ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY STUDY FINAL REPORT

GPA-RFP-13-007

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Ref: **ENERGY STORAGE FEASIBILITY STUDY – FINAL REPORT, ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY, OPERATIONS AND SYSTEM IMPACT STUDIES, GPA-RFP-13-007**

Dear Lorraine,

In accordance with our contract for the above-referenced project, TG Engineers, PC (TGE) is pleased to submit the final report of the Feasibility Study on schedule per the revised schedule that was agreed on August 08, 2014.

This final draft submittal consists of the following:

- Seven (7) Feasibility Study Report copies
- Four (4) CD Electronic copies - Feasibility Study Report

We appreciate the assistance GPA personnel have provided with our work on this report.

Should you have any questions, please feel free to contact Andrew Layson or myself at 647-0808.

Si Yu'os Ma'ase,
TG Engineers, PC

Tor Gudmundsen, PE
President

EXECUTIVE SUMMARY

1 Executive Summary

Guam Power Authority (GPA) contracted with TG Engineers, PC (TGE) to supply Engineering and Technical Services for an Energy Storage Feasibility Study (Study). Additionally, TGE has sub-contracted with Electric Power Systems (EPS) to provide electrical engineering services for the scope of work as described in the request for proposal (RFP) by GPA, number GPA-RFP-13-007.

To determine the feasibility of adding an energy storage system (ESS), the performance of the GPA system with an ESS and the costs of an ESS were assessed. EPS worked with GPA to identify a balance between system reliability, the expected costs and specifications of the ESS, and generation unit commitment and production related costs. Various levels of renewable energy sources were studied to determine the effects on the system in conjunction with an ESS. The final results, conclusions, and recommendations found in this report include the findings of updates made to the Draft Feasibility Study and the Final Operations Study Report.

The major recommendations and conclusions of the Study are listed below:

- Feasibility – The addition of a 40 MW, 10 MWh ESS is technically feasible with few exceptions found to the under-frequency load shedding (UFLS) performance criterion. These exceptions occur with increased levels of renewables and 35 kV faults. Extended renewable energy source ride-through characteristics have been assumed.
- Storage Technology – Based on lifecycle cost analysis, a battery-based ESS is recommended. The type of battery technology recommended at this time is lithium-ion or advanced lead-acid.
- Project Cost – The estimated budgetary project cost for a battery-based ESS located at Agaña Substation is $49.6 Million. This estimate assumes the renovation and use of the existing power plant building.
- Siting – Based on technical studies, site evaluations, and estimated costs, the preferred site at this stage of the project is Agaña Substation with the ESS connected at the 115 kV voltage level. Agaña holds an advantage over Harmon Substation and Marbo Substation based on the available space. The budgetary project costs are similar.
- Renewable Ride-through – The frequency and voltage ride-through characteristics of the renewable energy sources must be evaluated. Improving the ride-through characteristics to levels similar to conventional generation and beyond IEEE 1547 is recommended.
- RFP – Broad specifications are recommended to be included in the RFP for the acquisition of the ESS. This approach will allow GPA to evaluate more alternatives and and choose the best storage technology and system that best meets GPA's requirements.

Summary of Changes

Revision	Revision Date	Revision Description
0	October 31, 2013	Draft Submittal to GPA
1	June 27, 2014	Final Draft Submittal to GPA
2	August 29, 2014	Final Submittal to GPA

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2 Introduction

2.1 Project Description

Guam Power Authority has contracted with TG Engineers, PC to supply Engineering and Technical Services for an Energy Storage Feasibility Study. Additionally, TGE has sub-contracted with Electric Power Systems to provide electrical engineering services for the scope of work as described in the request for proposal by GPA, number GPA-RFP-13-007.

GPA solicited engineering and technical services to provide three studies, namely an Energy Storage Feasibility Study, an Operations Study, and a System Impact Study. GPA awarded a contract to TGE and has currently authorized the Energy Storage Feasibility Study and Energy Storage Operations Study.

GPA is a public utility corporation that provides electric service to the island of Guam, with a rated generation capacity of approximately 550 MW.

GPA plans to add renewable energy generation to its system by 2014, consisting of approximately 25 MW of centralized solar generation and 10 MW of wind generation. GPA also intends to acquire an additional estimated 40 MW of renewable generation by 2015 under the Renewable Acquisition Phase 2 project.

This Study analyzed the feasibility of adding an ESS to the GPA grid in order to accommodate the renewable generation growth, meet GPA's long term strategic goals, and to provide ESS recommendations. The primary function of the ESS is for a spinning reserve application. In addition, the study considered various options to determine suitable locations for the proposed energy storage facility.

This report includes updates to the findings described in the initial revision of the Feasibility Study Report. The initial report included a broad range of performance and operating criteria in order to help determine final performance criteria developed during and presented in the Operations Study. This Report includes the final performance criteria, major assumptions, study results, conclusions, and recommendations generated in the Final Operations Study Report.

2.2 Project Objectives & Methodology

The Study results, recommendations, and conclusions were used to determine the feasibility of adding an energy storage system to the GPA grid as renewable energy generation is integrated into the system. The plan to integrate renewable generation is expected to help GPA meet their strategic goals of improving the affordability of GPA energy services by increasing the amount of cost-effective renewable energy generation. The addition of an ESS is anticipated to help meet these strategic goals.

GPA requested that the study be conducted to aid in meeting GPA's strategic goals to (1) improve the affordability of GPA energy, (2) decrease the frequency and duration of customer outages, (3) improve power quality, and (4) increase the penetration of cost-effective renewable generation. The addition of an ESS is an integral component in GPA's efforts to meet these strategic goals.

The GPA system performance requirements were developed in consultation with GPA, during both the Feasibility Study and the Operations Study. As such, the performance criteria evolved during both studies, with the final performance criteria used to revisit, revise, and complete both studies. Thus, the results, recommendations, and conclusions made in this report are a combination of the findings in both reports.

The transient stability studies found in the Operations Study, and presented in this report, represent a detailed and complete assessment of the system's response with a 40 MW ESS using the final performance criteria, anticipated generation mix, and modeling information. As stated in the initial draft of the Feasibility Report, the Final Feasibility Report will reflect the results of the Operations Study.

The transient stability study methodology used in the initial draft of the Feasibility Report was revisited and is also presented in this report. The initial draft methodology used a range of operating criteria in order to show the impact that the operating criteria could have on the final recommendations. Because of the evolution of the performance criteria and the anticipated generation mix for the Operations Study and the Feasibility Study, the revisited Feasibility Studies are primarily presented for completeness and draft report continuity. The system models used for the Operations Study and Feasibility Study are the same. The differences in analysis are found in the commitments, dispatches, and methodology.

The key updates to the Feasibility Study focus on the other aspects of evaluating and assessing the addition of an ESS to the GPA system. The initial draft Feasibility Study did not conclude with a final size recommendation. Thus the siting, cost, and other project related evaluations could not be detailed. The target ESS size of 40 MW was based on GPA's reliability analysis completed after the initial draft report. EPS' budgetary ESS cost estimates and Spin/ESS Sizing Analysis Report were used in the reliability analysis. Prior to the completion of the reliability analysis, single unit contingencies with no load shedding was the UFLS performance criterion.

To achieve all of the project objectives and other supporting information requested by GPA, the following evaluations and assessments were conducted:

- Transient Stability Studies – Transient stability studies were used to help determine the technical feasibility of adding an ESS to the system. The simulation results were evaluated based on the performance criteria using the generation and loading scenarios provided by GPA. A 40 MW rating was used for the final power specification for the ESS.
- Other Technical Evaluations – Other technical evaluations were completed including ESS control strategies, protection, and power quality.
- Economic Generation Production Evaluation – A high level generation production cost evaluation was completed for the initial Feasibility Study. The final evaluation was performed by GPA to determine the UFLS performance criteria and the anticipated generation unit commitment, in order to achieve the best economic balance of cost versus the GPA strategic goals.
- Energy Storage Technology Evaluation – Various technologies were evaluated based on the state of the technology, application applicability, safety, environmental impacts, and cost. The most viable technologies, batteries and flywheels, were the focus of the evaluation.
- Preliminary Siting Evaluation – The siting evaluation consisted of detailed analysis for three potential project sites. The evaluation included detailed costs estimates for each site.
- Budgetary ESS Lifecycle Analysis – A budgetary lifecycle analysis was performed for the viable storage technologies in order to compare the costs for each unique system.
- Budgetary Project Cost Estimates – A budgetary project cost estimate was completed for each storage technology.

- Estimated Project Schedules – Estimated project schedules for each technology were completed detailing all phases on the ESS project.

3 Technical Feasibility Studies

Initial power system studies were conducted to evaluate the impact on the electrical system of increasing levels of renewable generation. The approach and direction of these studies preceded the draft and final revisions of the Operations Study Report. The Operations Study included refinements to the study approach and performance criteria. A summary of the Operations Study can be found in Section 3.2.

3.1 Initial Power Flow and Stability Studies

Energy storage systems were evaluated to mitigate any negative impacts associated with the integration of the renewable generation. The initial system studies included power flow and stability simulations, high level production simulations, protection and power quality evaluations, and selection of suitable energy storage options.

3.1.1 Introduction

The initial studies included an extensive evaluation of the current and future electric system to identify the grid performance under normal and transient conditions. The performance for different load levels and for variations in the generation mix was quantified and evaluated in conjunction with the benefits of different levels of energy storage sizes and options. The initial study results have been updated for this revision of the report for completeness. The updates include the use of the most current UFLS scheme, FIDVR modeling, updates to the future generation configurations, updates to unit dispatch, and various modeling improvements.

The study also investigated the impact of the ESS control design and the improvement in system performance achievable as a function of control settings, power ratings, and energy ratings for the storage system.

The transient stability limitations associated with the performance of the GPA grid during disturbances translate into maximum power rating requirements for the energy storage systems under consideration. The dominant issues associated with the transient response of the system are associated with the frequency response due to loss of generation or due to line faults and the resulting increased load caused by Fault Induced Delayed Voltage Recovery (FIDVR).

The transient stability simulations also evaluated possible low inertia issues associated with proposed changes in the generation fleet, namely the transition to aero-derivative type combustion turbines. Lower generator inertia will result in a faster rate of decay of grid frequency during a unit trip event.

3.1.2 Major Assumptions

The performance criteria and other major assumptions used for the Feasibility Study and Operations Study are summarized below.

1. ESS Size / Control / Location – The size of the ESS is limited to 40 MW. A basic over / under-frequency droop characteristic is used to control the output of the ESS. The under-frequency droop is set for full output when the frequency reaches 59.3 Hz or lower. This provides for a 0.2 Hz margin above the first stage of UFLS. A frequency deadband of 59.9-60.1 Hz has been assumed. The ESS is assumed to be connected to a 13.8 kV bus and stepped up to 115 kV. The Agaña Substation location for the ESS was used for this Study. The Final Operations Study included detailed analysis with the

ESS located at Agaña, Harmon, and Marbo Substations and indicated minor differences in results.

2. Load Shedding / Frequency – One stage of load shedding is acceptable for the purposes of this Study. Reaching stage 2 frequency or lower results in an exception to the criteria. The details associated with the existing UFLS are listed below. The MW values listed are the amount of load shed at peak loading conditions. The frequency was monitored in all cases for stability.

   - Stage 1 – 59.1 Hz, 25.0 MW
   - Stage 2 – 58.8 Hz, 23.2 MW
   - Stage 3 – 58.5 Hz, 24.8 MW
   - Stage 4 – 58.3 Hz, 24.4 MW
   - Stage 5 - 58.0 Hz, 26.3 MW

3. Voltage – The assumed voltage criterion focused on stability and recovery to an acceptable nominal level. Key system voltages were monitored in all cases.

4. Renewable Voltage Ride-through – The under-voltage trip settings for the PV and wind renewable energy sources are assumed to be equivalent to the specifications found in IEEE 1547 unless other settings have been provided (see below). No over-voltage tripping has been modeled. Additional discussion related to these settings is included in the results and conclusions of this study.

   - Solaron (20 MVA) – Under-voltage setting #1 0.88 pu, timing 5.0 sec, Under-voltage setting #2 0.5 pu, timing 1.1 sec

5. Renewable Frequency Ride-through - The frequency trip settings for the PV and wind renewable energy sources are assumed to be similar to conventional generation. Therefore, the under-frequency trip settings need to be lower than the under-frequency load shedding settings, and definitely lower than the UFLS settings in the performance criterion. Over/under-frequency tripping is not modeled for any generation sources. Additional discussion related to these settings is included in the results and conclusions of this study.

6. PV/Wind Modeling - The plant and distributed PV and wind generation sources were all modeled as constant current generation sources. The locations and capacities for the distributed PV modeled are based on the information contained in the file "Net Metering Listing.xls" provided by GPA. All distributed PV levels were created in proportion to the stated capacities. All plant PV was modeled in the Talofofo area.

7. Fault Induced Delayed Voltage Recovery – A FIDVR conversion factor of 0.2436 has been assumed based on detailed disturbance recordings provided by GPA for the 4/12/2012 Agaña-Anigua 35 kV fault. This factor represents the amount of constant power load (24.36%) that is converted to have the FIDVR characteristics. The other parameters associated with the FIDVR model have been set to industry accepted typical values. A FIDVR load model has been applied to all loads except those associated with power plant auxiliary loads.

8. System Modeling/Benchmarking – It is assumed that the dynamic performance of the existing generation units and overall system response has not substantially changed

from when unit testing and dynamic models were developed for the GPA system. The dynamic models used for this study have the same modeling parameters established in the unit testing and tuning project that was performed by TGE/EPS from 2010 to 2013. A portion of that project included benchmarking the performance of the majority of conventional generation units. The benchmarking model tuning included generator models and load models.

9. Talofofo Area Line Capacity – For the power flow cases that included high levels of renewables in the Talofofo area, additional 35 kV lines were added to support the increased generation in the area. The lines were added between the renewable generation locations, Apra, and Pulantat.

3.1.3 Power Flow Base Cases

Power flow base cases were constructed to represent variations in load level, generation unit commitment, generation unit dispatch, renewable generation, spinning reserves, and ESS size. The cases were selected in such a way as to try to find the limiting conditions for the transient response, based on variations in load, generation, renewables, PV, ESS, etc.

The load levels, generation commitment, and renewable levels were taken from GPA's John Benavente report entitled "Task 8. Impact on Spinning Reserve by Solar PV", submitted to the Consolidated Commission on Utilities, dated September 6, 2013 (Benavente report). Based on the report, the following renewable generation levels were evaluated (see Table 3-1). Note that the GPA wind resource was not included in the dispatches in the report, but was included in all future simulation cases.

Case	GPA Solar	NEM Solar	Total Solar	GPA Wind	Total Renewables
1	-	-	-	-	-
2	25	-	25	10	35
3	25	45	70	10	80
4	75	45	120	10	130

Table 3-1 Renewable Generation Levels (MW)

The GPA Solar represents centralized solar plants, owned and operated by GPA. The NEM Solar represents "net energy metering" customers such as rooftop PV installations. The GPA Wind represents a centralized wind plant, owned and operated by GPA.

The Benavente report presented a typical peak load day over a full 24 hour period, with a peak net generation of 250 MW. The report included generation production costs for the renewable generation levels in Table 3-1, for both the existing GPA generation fleet and for a proposed future generation fleet that includes the retirement of Cabras 1 and 2 and Tanguisson 1 and 2, with the addition of a new combined cycle combustion turbine, LNG based plant with a capacity of 80 MW (updated to 220 MW). The Benavente report evaluated cases 1 through 4 in Table 3-1 for the existing generation fleet, and cases 3 and 4 with the future combined cycle generation in place.

This study included power flow base cases constructed to approximate the same six generation scenarios presented in the Benavente report. It is important to note that the six generation cases use a minimum spinning reserve requirement of 10-15 MW. This reflects a relatively recent change in operating practice for the GPA system from a traditional higher level of spinning reserve to a much lower level of spinning reserve. This change represents a shift to accept a higher risk of consumer outages in order to lower the operating costs of the system. However, another benefit of the addition of an ESS to the GPA system is the ESS can restore the system reliability back to levels that existed with higher spinning reserves, while maintaining the lower operating costs.

Base Cases – 0 MW Solar

The 0 MW Solar base cases represent the existing system unit commitment and dispatch practices, with a spinning reserve requirement of 10-15 MW. Load levels were selected to reflect four times during a typical day, namely 4 AM, 10 AM, 4 PM, and 8 PM. The 4 AM time period was chosen to represent a minimum daily load level. The load level selected represents an annual minimum load, not the minimum load expected during a peak load day. Typically, an early morning minimum case represents a time when the minimum number of generating units are online. The 10 AM time was chosen to represent a near maximum expected level of PV generation combined with the lowest expected load, such that the PV to total load ratio was largest. This scenario was expected to possibly exhibit the worst case response due to the high PV to load ratio. The 4 PM case was chosen to roughly represent the near maximum PV condition with the maximum load level. The 8 PM case was chosen to represent the expected maximum system load, with no solar generation, and typically with minimum spinning reserve.

Each of the load cases were chosen to roughly represent typical system conditions and may not represent a precise load and generation condition at exactly 4 AM, 10 AM, 4 PM, or 8 PM. The generation for the four base cases with 0 MW of Solar is shown in Table 3-2. For the daytime cases, no solar or wind generation was online, but solar and wind generation is online in subsequent cases discussed later.

Time of Day			4 AM	10 AM	4 PM	8 PM
Gen/Load Case ID			1100	1200	1300	1400
Demand			149	175	245	257
PV			-	-	-	-
Wind			-	-	-	-
Generation to Dispatch			149	175	245	257
Generation Units	Pmax	Pmin				
Cabras 1	66.0	31.0	31.0	31.0	57.0	57.0
Cabras 2	66.0	31.0	-	-	-	-
Cabras 3	38.6	22.0	22.0	24.0	37.0	38.0
Cabras 4	38.6	22.0	22.0	24.0	37.0	38.0
MEC 8	43.8	22.0	32.0	43.0	43.0	43.0
MEC 9	43.8	22.0	32.0	43.0	43.0	43.0
Tango 1	25.0	6.4	10.0	10.0	24.0	22.0
Tenjo 1	4.3	2.2	-	-	4.0	4.0
Tenjo 2	4.3	2.2	-	-	-	4.0
Tenjo 3	4.3	2.2	-	-	-	4.0
Tenjo 4	4.3	2.2	-	-	-	4.0
Tenjo 5	4.3	2.2	-	-	-	-
Tenjo 6	4.3	2.2	-	-	-	-
Talofofo 1	4.3	2.1	-	-	-	-
Talofofo 2	4.3	2.1	-	-	-	-
New CC 1	55.0	16.5	-	-	-	-
New CC 2	55.0	16.5	-	-	-	-
New CC 3	55.0	16.5	-	-	-	-
New CC 4	55.0	16.5	-	-	-	-
Total Gen			149	175	245	257
Capacity			256	256	260	273
Up Regulation			79	53	15	16
Down Regulation			24	50	117	123

Table 3-2 0 MW Solar Cases, Generation (MW)

In the 0 MW Solar cases, note that the assumed unit commitment is Cabras 1, Cabras 3, Cabras 4, MEC 8, MEC 9, and Tanguisson 1 in all 4 cases. The minimum up regulation (spinning reserve) is 15 MW, and diesels are committed during the late afternoon and during the evening peak to cover the peak load condition. This unit commitment aligns with the commitment presented in the Benavente report. Unit trip events were simulated for the loss of Cabras 1 and for the loss of MEC 8 for all cases, with the results discussed later.

Base Cases – 25 MW Solar

The 25 MW Solar base cases represent the GPA unit commitment and dispatch practices outlined in the Benavente Report, with Tanguisson retired, and with a spinning reserve requirement of 10-15 MW. Load levels were selected to reflect the two daytime periods with solar PV generation online, namely 10 AM and 4 PM. As discussed before, the 10 AM time was chosen to represent a near maximum expected level of PV generation combined with the lowest expected load, such that the PV to total load ratio was largest. The 4 PM case was chosen to roughly represent the near maximum PV condition with the maximum load level. The nighttime conditions with no solar are expected to be essentially equivalent to the 0 MW nighttime cases previously described.

The generation for the two base cases with 25 MW of Solar is shown in Table 3-3.

Time of Day			10 AM	4 PM
Gen/Load Case ID			1500	1600
Demand			175	245
PV			25	25
Wind			10	10
Generation to Dispatch			140	210
Generation Units	Pmax	Pmin		
Cabras 1	66.0	31.0	31.0	48.0
Cabras 2	66.0	31.0	-	-
Cabras 3	38.6	22.0	22.0	38.0
Cabras 4	38.6	22.0	22.0	38.0
MEC 8	43.8	22.0	32.5	43.0
MEC 9	43.8	22.0	32.5	43.0
Tango 1	25.0	6.4	-	-
Tenjo 1	4.3	2.2	-	-
Tenjo 2	4.3	2.2	-	-
Tenjo 3	4.3	2.2	-	-
Tenjo 4	4.3	2.2	-	-
Tenjo 5	4.3	2.2	-	-
Tenjo 6	4.3	2.2	-	-
Talofofo 1	4.3	2.1	-	-
Talofofo 2	4.3	2.1	-	-
New CC 1	55.0	16.5	-	-
New CC 2	55.0	16.5	-	-
New CC 3	55.0	16.5	-	-
New CC 4	55.0	16.5	-	-
Total Gen			140	210
Capacity			231	231
Up Regulation			63	21
Down Regulation			21	91

Table 3-3 25 MW Solar Cases, Generation (MW)

In the 25 MW Solar cases, note that the assumed unit commitment is Cabras 1, Cabras 3, Cabras 4, MEC 8, and MEC 9, in all cases. The minimum up regulation (spinning reserve) is 21 MW in these cases. This unit commitment aligns with the commitment presented in the Benavente report. Unit trip events were simulated for the loss of Cabras 1 and for the loss of MEC 8 for all cases, with the results discussed later.

Base Cases – 70 MW Solar, Existing Generation

The 70 MW Solar, Existing Generation cases represent the existing system unit commitment and dispatch practices, with Tanguisson retired, and with a spinning reserve requirement of 10-

15 MW. The 70 MW of solar comprises 25 MW of centralized GPA solar plus 45 MW of NEM solar, per the Benavente report. Additionally, 10 MW of GPA wind generation was included in the Talofofo area. Unit dispatches were selected to reflect the same four time periods as before. Load levels were increased by 2.5% to represent the future estimates.

The generation for the four base cases with 70 MW of Solar is shown in Table 3-4.

Time of Day			4 AM	10 AM	4 PM	8 PM
Gen/Load Case ID			2100	2200	2300	2400
Demand			153	179	251	263
PV			-	70	70	-
Wind			10	10	10	10
Generation to Dispatch			143	99	171	253
Generation Units	Pmax	Pmin				
Cabras 1	66.0	31.0	31.0	31.0	31.0	58.0
Cabras 2	66.0	31.0	-	-	-	-
Cabras 3	38.6	22.0	22.0	-	27.0	38.0
Cabras 4	38.6	22.0	22.0	22.0	27.0	38.0
MEC 8	43.8	22.0	34.0	23.2	43.0	43.0
MEC 9	43.8	22.0	33.7	23.2	43.0	43.0
Tango 1	25.0	6.4	-	-	-	-
Tenjo 1	4.3	2.2	-	-	-	4.3
Tenjo 2	4.3	2.2	-	-	-	4.3
Tenjo 3	4.3	2.2	-	-	-	4.3
Tenjo 4	4.3	2.2	-	-	-	4.3
Tenjo 5	4.3	2.2	-	-	-	4.3
Tenjo 6	4.3	2.2	-	-	-	4.3
Talofofo 1	4.3	2.1	-	-	-	4.3
Talofofo 2	4.3	2.1	-	-	-	4.3
New CC 1	55.0	16.5	-	-	-	-
New CC 2	55.0	16.5	-	-	-	-
New CC 3	55.0	16.5	-	-	-	-
New CC 4	55.0	16.5	-	-	-	-
Total Gen			143	99	171	254
Capacity			231	192	231	265
Up Regulation			60	65	32	11
Down Regulation			24	2	52	118

Table 3-4 70 MW Solar Cases, Existing Generation (MW)

In the 70 MW Solar cases, with the existing generation fleet, the unit commitment consists of Cabras 1, Cabras 3, Cabras 4, MEC 8, and MEC 9, in all cases, with diesels used to meet the daily load peak. Note that Cabras 3 was taken offline in the 10 AM case in order to meet the minimum unit generation output ratings. The minimum up regulation (spinning reserve) is 11 MW. This unit commitment aligns with the commitment presented in the Benavente report. Unit trip events were simulated for the loss of Cabras 1 and for the loss of MEC 8 for all cases, with the results discussed later.

Base Cases – 70 MW Solar, New Generation

The 70 MW Solar, New Generation cases represent the proposed system unit commitment and dispatch practices, with Cabras and Tanguisson retired, with a new 220 MW combined cycle gas fired plant added. The 70 MW of solar is comprised of 25 MW of centralized GPA solar plus 45 MW of NEM solar, per the Benavente report. Additionally, 10 MW of GPA wind generation was included in the Talofofo area. Load levels and unit dispatches were selected to reflect the same four time periods as the previous 70 MW solar cases.

The generation for the four base cases with 70 MW of Solar, with the new combined cycle generation is shown in Table 3-5. The combined cycle plant is assumed to be a four 1x1 combination with 1 combustion turbines and 1 heat recovery steam generator (HRSG) for each set.

Time of Day			4 AM	10 AM	4 PM	8 PM
Gen/Load Case ID			3100	3200	3300	3400
Demand			153	179	251	263
PV			-	70	70	-
Wind			10	10	10	10
Generation to Dispatch			143	99	171	253
Generation Units	Pmax	Pmin				
Cabras 1	66.0	31.0	-	-	-	-
Cabras 2	66.0	31.0	-	-	-	-
Cabras 3	38.6	22.0	-	-	-	-
Cabras 4	38.6	22.0	-	-	-	-
MEC 8	43.8	22.0	-	-	-	43.0
MEC 9	43.8	22.0	-	-	-	-
Tango 1	25.0	6.4	-	-	-	-
Tenjo 1	4.3	2.2	-	-	-	4.3
Tenjo 2	4.3	2.2	-	-	-	4.3
Tenjo 3	4.3	2.2	-	-	-	-
Tenjo 4	4.3	2.2	-	-	-	-
Tenjo 5	4.3	2.2	-	-	-	-
Tenjo 6	4.3	2.2	-	-	-	-
Talofofo 1	4.3	2.1	-	-	-	-
Talofofo 2	4.3	2.1	-	-	-	-
New CC 1	55.0	16.5	47.6	33.1	42.8	50.5
New CC 2	55.0	16.5	47.6	33.1	42.8	50.5
New CC 3	55.0	16.5	47.6	33.1	42.8	50.5
New CC 4	55.0	16.5	-	-	42.8	50.5
Total Gen			143	99	171	253
Capacity			165	165	220	272
Up Regulation			22	66	49	19
Down Regulation			93	50	105	161

Table 3-5 70 MW Solar Cases, New Generation (MW)

With the new combined cycle generation, the unit commitment consists of the new combined cycle plant as base units, with diesels and MEC 8 brought online to meet the daily load peak.

The minimum up regulation (spinning reserve) is maintained at 19 MW. Unit trip events were simulated for the loss of New CC 1 and for the loss of MEC 8 for all cases, with the results discussed later.

3.1.4 Description of Transient Stability Simulations

Transient stability simulations were constructed for unit trip events consisting of the loss of Cabras 1, MEC 8 or a new CC unit. These unit trip events result in the worst case under-frequency conditions and under-frequency load shedding. The UFLS is required to stabilize the system for the loss of a large generator, especially with only 10-15 MW of spinning reserve.

Transient stability cases for line fault and trip cases were also constructed for a number of 115 kV and 34.5 kV lines. A selected set of line faults simulations were performed to provide an indication of system stability. The complete and final line fault analysis was performed in the Operations Study and is presented later in this report.

The line faults are known to possibly result in a condition known as “fault induced delayed voltage recovery” (FIDVR). FIDVR is a known phenomenon most likely to occur in areas with significant air conditioning loads. FIDVR results in larger real and reactive power demand for several seconds or tens of seconds after a line fault event, as compared to the real and reactive demand of the system immediately prior to the fault. This is due to compressors stalling during the low voltage conditions during the fault and the resulting voltage depression and simultaneously re-starting at the time of fault clearing. The topology of the GPA system results in system-wide voltage depression for many 115 kV and 34.5 kV faults, triggering FIDVR across the entire system as opposed to localizing it on selected areas. GPA has high speed data recordings for line faults that clearly shown the FIDVR effects for the GPA system, where a load increase of approximately 30 MW has occurred.

The transient stability cases were simulated both with and without an ESS in service, for several different ESS sizes. The ESS was evaluated at Agaña Substation with a 115 kV connection to the transmission system. The cases with an ESS were evaluated primarily based on the amount of reduction in load shedding.

All the transient simulations were evaluated in terms of overall stability, voltage sag, and amount of load shedding. The simulation scenarios are listed in Table 3-6 below.

Description	Unit Trip	115 kV Line Trip	35 kV Line Trip	ID
Cabras 1	X			c1
MEC 8	X			m8
New CT/CC	X			cc1
Tamuning/Harmon		X		lf1
Harmon/Piti		X		lf2
Agana/Tamuning		X		lf3
Cabras/Agana		X		lf4
Talofofo/Apra			X	lf11
Barrigada/Agana			X	lf12
Andersen/Yigo			X	lf13
Piti/Agana			X	lf14
Agana/Tamuning			X	lf15
Harmon/Tumon			X	lf16
Agana/Anigua			X	lf17
Harmon/Macheche			X	lf18
Plant PV/Wind	X			pvw1
Alt. 3 Plant PV/Wind	X			pvw3

Table 3-6 Transient Stability Simulations

3.1.5 Transient Stability Results – Voltage Issues

The initial Feasibility Report simulation results showed a number of problems associated with a prolonged voltage dip, typically for most of the line faults, and also for the trip of Cabras 1. Both the 115 kV line faults and the 34.5 kV line faults exhibited sustained low voltages and load increases associated with the FIDVR load effects. These cases were further investigated for the Operations Study and the results are included in this report. The updated unit commitments found in the Operations Study showed much less sensitivity to voltage issues.

For completeness, this Final Feasibility Study includes the revisited initial report cases and results. Although the Operations Study findings offer a final and more complete system evaluation, the Final Feasibility Study results do provide some addition information related to the feasibility of adding an ESS, potential system improvements, and future generation additions.

Some of the cases repeated for this Final Feasibility Study indicate insufficient spinning reserves and/or the need for additional voltage support. This can be seen by the number of stages of load shedding and the system voltage response. The loss of the Cabras 1 unit exhibited some sustained low voltage conditions for the unit commitment cases with low levels of spinning reserve and lower number of units online. These results are related to the refined FIDVR modeling used for all cases found in this Feasibility Study and the Operations Study. To be clear, the results shown in this Report for the Final Feasibility Study have primarily been been superseded by the Final Operations Study.

3.1.6 Transient Stability Results – 0 MW Solar Cases

The 0 MW solar cases (base cases 1100, 1200, 1300, 1400) were evaluated for the loss of Cabras 1 or MEC 8. All cases were stable with load shedding required to stabilize the frequency. The cases were run with no ESS in place, and then again for several different sizes of ESS, typically in an attempt to remove all the load shedding. Table 3-7 lists the load shedding stages for the 0 MW solar cases, for the loss of Cabras 1. Detailed simulation result plots for all Agaña 115 kV ESS unit trip cases are provided in Appendix B.

Cabras 1 Unit Trip Load Shedding Stages								
ESS (MW)	0	15	20	25	30	35	40	45
Base Case	ref	1a	1b	1c	1d	1e	1f	1g
1100	1	-	-	-	-	-	-	-
1200	1	-	-	-	-	-	-	-
1300	4	3	2	2	2	1	1	1
1400	3	2	2	2	2	1	1	1

Table 3-7 Load Shedding, 0 MW Solar Cases, Trip Cabras 1

The column for 0 MW of ESS represents the results for the system currently without renewables and without an ESS. Note that base case 1400 is the maximum load case with 16 MW of spin. For this unit commitment, with Cabras 2 offline and diesels used to meet the peak load, 3 stages of load shedding occur for the loss of Cabras 1. This is directly related to the minimum amount of spinning reserve for this unit commitment.

Table 3-8 lists the load shedding stages for the 0 MW solar cases, for the loss of MEC 8.

MEC 8 Unit Trip Load Shedding Stages								
ESS (MW)	0	15	20	25	30	35	40	45
Base Case	ref	1a	1b	1c	1d	1e	1f	1g
1100	1	-	-	-	-	-	-	-
1200	2	1	1	-	-	-	-	-
1300	2	1	1	1	1	-	-	-
1400	2	1	1	1	1	-	-	-

Table 3-8 Load Shedding, 0 MW Solar Cases, Trip MEC 8

The cases with no ESS, in the column labeled 0, represent the response of the current system for the loss of MEC 8 with 16 MW of spin. For 3 of the cases, 2 stages of load shedding occur without as ESS. As before, this is a direct result of the amount of spinning reserve.

From the results in Table 3-7 and Table 3-8, an ESS size can be selected based on a desired amount of load shedding for the loss of either unit. For example, if operating criteria such as allowing one stage of load shedding for the loss of Cabras 1, and no load shedding for the loss of MEC 8 is adopted, then from Table 3-7 and Table 3-8 one can determine that an ESS of 35 MW is required to meet this criteria. If a criterion such as allowing two stages of UFLS for the loss of Cabras 1, and only one stage of UFLS for the loss of MEC 8 is adopted, then the required ESS size is 20 MW. This is the approach to interpreting and using the stability results for the loss of generation.

These results illustrate the significant impact that the operating criteria associated with unit trips, load shedding, and reliability has on the results of this study, especially in terms of selecting a required size for the ESS. The amount of allowable load shedding is a reliability issue.

3.1.7 Transient Stability Results – 25 MW Solar Cases

The 25 MW solar cases (base cases 1500, 1600) were evaluated for the loss of Cabras 1 or MEC 8. All cases were stable with load shedding required to stabilize the frequency. However, sustained low voltage conditions were found in Case 1600. The cases were run with no ESS in place, and then again for several different sizes of ESS. Table 3-9 lists the load shedding stages for the 25 MW solar cases, for the loss of Cabras 1.

Cabras 1 Unit Trip Load shedding Stages								
ESS (MW)	0	15	20	25	30	35	40	45
Base Case	ref	1a	1b	1c	1d	1e	1f	1g
1500	1	-	-	-	-	-	-	-
1600	5	5	5	5	5	5	5	4

Table 3-9 Load Shedding, 25 MW Solar Cases, Trip Cabras 1

The 0 MW ESS column represents the results for the system without an ESS. Note that base case 1600 is the combination of maximum load case when maximum or near maximum solar generation might occur, and with 21 MW of spin. For this unit commitment, with Cabras 2 offline, 5 stages of load shedding occur for the loss of Cabras 1. As before, this is directly related to the minimum amount of spinning reserve for this unit commitment. Cases analyzed in the Operations Study with updated unit commitments do not exceed the UFLS performance criterion.

Table 3-10 lists the load shedding stages for the 25 MW solar cases, for the loss of MEC 8.

MEC 8 Unit Trip Load shedding Stages								
ESS (MW)	0	15	20	25	30	35	40	45
Base Case	ref	1a	1b	1c	1d	1e	1f	1g
1500	1	-	-	-	-	-	-	-
1600	3	2	1	1	1	-	-	-

Table 3-10 Load Shedding, 25 MW Solar Cases, Trip MEC 8

The cases with no ESS represent the response of the system for the loss of MEC 8 with Case 1600 having 21 MW of spin and no ESS. For the afternoon case (1600), 3 stages of load shedding occur. As before, this is a direct result of the amount of spinning reserve.

From the results found in Table 3-9 for a Cabras 1 trip and the sustained low voltages for each ESS size, the system configuration is not appropriate for this case. The unit commitment and spinning reserve levels must be changed in order for this case to yield satisfactory results. Again, the cases analyzed in the Feasibility Study with updated unit commitments do not indicate a large number of stages shed or poor voltage conditions.

3.1.8 Transient Stability Results – 70 MW Solar Cases, Existing Generation

The 70 MW solar cases for the existing generation fleet (base cases 2100, 2200, 2300, 2400) were evaluated for the loss of Cabras 1 and MEC 8. All cases were stable with load shedding required to stabilize the frequency. However similar to Case 1600 above, sustained low voltage conditions were found in Cases 2300 and 2400. The cases were run with no ESS in place, and then again for several different sizes of ESS. Table 3-11 lists the load shedding stages for the 70 MW Solar, Existing Generation cases, for the loss of Cabras 1.

Cabras 1 Unit Trip Load Shedding Stages								
ESS (MW)	0	15	20	25	30	35	40	45
Base Case	ref	1a	1b	1c	1d	1e	1f	1g
2100	1	-	-	-	-	-	-	-
2200	2	1	-	-	-	-	-	-
2300	5	5	5	5	-	-	-	-
2400	5	5	5	5	5	4	4	4

Table 3-11 Load Shedding, 70 MW Solar, Existing Generation Cases, Trip Cabras 1

Base case 2400 is the maximum night time peak load case with no solar generation online, and with 11 MW of spin. Note that in Cases 2300 and 2400, sustained low voltages are found. Case 2300 shows recovery from the voltage collapse as the ESS is increased in size from 25 MW to 30 MW. Case 2400 has low voltage conditions for all ESS sizes studied. The 4 AM and 10 AM cases show a minimum number of stages shed and acceptable voltage conditions.

Table 3-12 lists the load shedding stages for the 70 MW Solar, Existing Generation cases, for the loss of MEC 8.

MEC 8 Unit Trip Load Shedding Stages								
ESS (MW)	0	15	20	25	30	35	40	45
Base Case	ref	1a	1b	1c	1d	1e	1f	1g
2100	2	-	-	-	-	-	-	-
2200	2	-	-	-	-	-	-	-
2300	3	1	1	1	-	-	-	-
2400	2	2	1	1	1	1	-	-

Table 3-12 Load Shedding, 70 MW Solar, Existing Generation Cases, Trip MEC 8

The results indicate that Case 2400 requires additional spinning reserves and/or voltage support. The Case 2300 results also indicate this, but to a lessor degree. The Case 2300 results are not as severe because of the lower load level and Cabras 1 dispatch. Again, similar to the Case 1600 results, the cases analyzed in the Operations Study with updated unit commitments do not exceed the UFLS performance criterion.

3.1.9 Transient Stability Results – 70 MW Solar Cases, New Generation

The 70 MW solar cases for the proposed new generation fleet (combined cycle plant, base cases 3100, 3200, 3300, 3400) were evaluated for the loss of MEC 8 and the loss of one of the combined cycle combustion turbines. All cases were stable with load shedding required to stabilize the frequency. The cases were run with no ESS in place, and then again for several different sizes of ESS. Table 3-13 lists the load shedding stages for the 70 MW Solar, New Generation cases, for the loss of one of the combined cycle combustion turbines.

New CC Unit Trip Load shedding Stages								
ESS (MW)	0	15	20	25	30	35	40	45
Base Case	ref	1a	1b	1c	1d	1e	1f	1g
3100	4	2	1	1	-	-	-	-
3200	3	1	-	-	-	-	-	-
3300	2	1	-	-	-	-	-	-
3400	2	1	1	1	-	-	-	-

Table 3-13 Load Shedding, 70 MW Solar, New Generation Cases, Trip CT

Table 3-14 lists the load shedding stages for the 70 MW Solar, New Generation cases, for the loss of MEC 8.

MEC 8 Unit Trip Load Shedding Stages								
ESS (MW)	0	15	20	25	30	35	40	45
Base Case	ref	1a	1b	1c	1d	1e	1f	1g
3100	-	-	-	-	-	-	-	-
3200	-	-	-	-	-	-	-	-
3300	-	-	-	-	-	-	-	-
3400	3	2	1	1	1	-	-	-

Table 3-14 Load Shedding, 70 MW Solar, New Generation Cases, Trip MEC 8

From these tables, a size for the ESS can be selected based on acceptable operating criteria. For one stage of load shedding for the loss of a CT and MEC 8, then the required ESS size is 35 MW. For two stages of UFLS, then a 20 MW ESS is required.

These generation cases represent the lower inertia cases due to the addition of lighter inertia aero-derivative type combustion turbines that replace heavy steam units. No frequency related issues were found in part because the heavy steam units (Cabras 1 and 2) were also the largest contingencies, and we have assumed that the combined cycle CT units will be LM6000 type units. This assumption is based on the proposal to add a 220 MW combined cycle plant. It is clear that the addition of CTs such as LM6000 units that are in the range of 50 MW may result in more significant issues related to the light inertia and larger size of a typical LM6000 CT.

3.1.10 Transient Stability Results – 120 MW Solar Cases

For the initial Feasibility Study Report, several base cases were created with 120 MW of solar generation, consisting of 75 MW of centralized GPA solar and 45 MW of NEM distributed solar. The transient stability results for all of these cases were found to be problematic. The Final Operations Study addressed the higher levels of renewables and determined the approximate maximum limits. Because of this, an evaluation of 120 MW solar cases was not included in the Final Feasibility Study analysis.

3.2 Final 40 MW ESS Power Flow and Stability Studies

As a follow-up to the initial Feasibility Report, the Operations Study included and built upon the findings discovered in the initial Feasibility Report. With the final Operations Study Report now complete, the following highlights the findings and recommendations found in the Operations Report. These results and findings represent the transient stability assessment using a 40 MW

ESS as determined by GPA. These results offer a final and more complete evaluation of the system than the results presented in the initial cases used in the Feasibility Report and presented above.

3.2.1 Introduction

The objectives of this study were to explore the performance of the GPA system with the addition of an ESS and with a modification to the minimum spinning reserve requirement. EPS worked with GPA to identify a balance between the expected cost of the ESS, the production costs associated with spinning reserve changes, the impact on cost of expected generation commitments, and the desired system performance during transients.

Ultimately, the study evaluated the system performance with the following assumptions:

- addition of a 40 MW ESS, evaluated at 3 locations
- adoption of a 15 MW minimum spinning reserve requirement, at peak load
- no daily unit cycling
- no more than one stage of under-frequency load shedding allowed for all unit trip events and 115 kV and 35 kV line fault and trip events

The study was completed in two parts. The preliminary part consisted of an evaluation of the size of ESS required based on varying spinning reserve levels and a performance criterion of no load shedding allowed. The simulations were performed with unit trip disturbances. This analysis resulted in the updated performance criteria and assumptions listed above.

The second part of the study included detailed system analysis using the 40 MW ESS and other assumptions. The analysis incorporated the major assumptions described and used for the initial Feasibility Study results found in this report. The simulations included an exhaustive listing of unit trip and line fault disturbances, three different ESS locations, and FIDVR modelling. The results of this part of the study were used to determine the recommendations and issues associated with the installation of a 40 MW ESS.

The study also included detailed analysis and conclusions regarding FIDVR, and a discussion and examples of renewable ramp rate data. An in-depth discussion was also provided for the simulation issues associated with using a fixed large unit commitment, system load levels, system benchmarking, and unit response.

3.2.2 Cases

GPA provided specific unit commitments and dispatches and system load demand totals for use in this Study. The unit commitments in combination with the system demands define the amount of spinning reserve/regulation to be used in this Study. The unit commitments provided did not include daily unit cycling. Thus as renewable output levels increase, the spinning reserve/regulation also increases providing 100% regulation for the renewables. Also, the future combined cycle units are not included in the generation portfolio.

The cases varied in types and capacities of renewable energy sources. Wind varied from 0-10 MW, Plant PV varied from 0-70 MW, and distributed PV varied from 0-62 MW. Estimated plant and distributed PV maximum limits determined.

Scenario			***Scenario 1***		***Scenario 2***		***Scenario 3***	
PV/Wind Addition			None		35 MW		97 MW	
Loading			Existing Monthly Peak		Existing Monthly Peak		Existing Monthly Peak	
Retire/Add Generation			Existing, Retire Tango		Existing, Retire Tango		Existing, Retire Tango	
Months			Mar/Oct	Nov/Feb	Mar/Oct	Nov/Feb	Mar/Oct	Nov/Feb
Gen/Load Case ID			1400	2400	1410	2410	1420	2420
Generation Source	Pmax	Pmin						
Wind			-	-	10.0	10.0	10.0	10.0
Plant PV			-	-	25.0	25.0	25.0	25.0
Distributed PV			-	-	-	-	62.0	62.0
ESS	40.0	(40.0)	-	-	-	-	-	-
Cabras 1	66.0	31.0	52.0	56.0	32.0	31.0	31.0	31.0
Cabras 2	66.0	31.0	47.0	-	32.0	-	31.0	-
Cabras 3	38.6	22.0	37.0	37.3	37.0	36.6	22.0	22.0
Cabras 4	38.6	22.0	37.0	37.2	37.0	36.6	22.0	22.0
MEC 8	43.8	22.0	42.0	43.7	42.0	43.7	27.0	27.0
MEC 9	43.8	22.0	42.0	43.8	42.4	43.8	25.3	26.0
Tenjo 1	4.3	-	-	4.0	-	-	-	-
Tenjo 2	4.3	-	-	4.0	-	-	-	-
Total Generation			257.0	226.0	257.4	226.7	255.3	225.0
Up Regulation			39.8	13.3	74.4	39.1	138.5	102.8
Down Regulation			107.0	107.0	72.4	72.7	8.3	9.0

Table 3-15 Main Base Cases

Scenario			***Scenario 4***		***Scenario 5***	
PV/Wind Addition			45 MW		55 MW	
Loading			Existing Monthly Peak		Existing Monthly Peak	
Retire/Add Generation			Existing, Retire Tango		Existing, Retire Tango	
Months			Mar/Oct	Nov/Feb	Mar/Oct	Nov/Feb
Gen/Load Case ID			1421	2421	1422	2422
Generation Source	Pmax	Pmin				
Wind			10.0	10.0	10.0	10.0
Plant PV			25.0	25.0	25.0	25.0
Distributed PV			10.0	10.0	20.0	20.0
ESS	40.0	(40.0)	-	-	-	-
Cabras 1	66.0	31.0	31.0	31.0	31.0	31.0
Cabras 2	66.0	31.0	31.0	-	31.0	-
Cabras 3	38.6	22.0	33.0	31.4	27.9	26.3
Cabras 4	38.6	22.0	33.0	31.4	27.9	26.3
MEC 8	43.8	22.0	42.0	43.8	41.9	43.8
MEC 9	43.8	22.0	42.0	43.8	42.0	43.8
Tenjo 1	4.3	-	-	-	-	-
Tenjo 2	4.3	-	-	-	-	-
Total Generation			257.0	226.4	256.7	226.2
Up Regulation			84.8	49.4	95.1	59.6
Down Regulation			62.0	62.4	51.7	52.2

Table 3-16 Alternative Base Cases (Distributed PV)

Scenario			***Scenario 6***	
PV/Wind Addition			80 MW	
Loading			Existing Monthly Peak	
Retire/Add Generation			Existing, Retire Tango	
Months				
Gen/Load Case ID			1433	2433
Generation Source	Pmax	Pmin		
Wind	-	-	10.0	10.0
Plant PV	-	-	70.0	70.0
Distributed PV	-	-	-	-
ESS	40.0	(40.0)	-	-
Cabras 1	66.0	31.0	31.0	31.0
Cabras 2	66.0	31.0	31.0	-
Cabras 3	38.6	22.0	22.0	22.0
Cabras 4	38.6	22.0	22.0	22.0
MEC 8	43.8	22.0	36.5	37.0
MEC 9	43.8	22.0	37.0	37.0
Tenjo 1	4.3	-	-	-
Tenjo 2	4.3	-	-	-
Total Generation			259.5	229.0
Up Regulation			117.3	81.8
Down Regulation			29.5	30.0

Table 3-17 Alternative Base Cases (Plant PV)

3.2.3 Results & Conclusions

The results of the analysis show that several conclusions can be made from the case and simulation variations performed. Overall, the 40 MW ESS performs well given the study parameters. The overall reliability of the system will improve while easing the transition to higher renewable penetration levels. Relatively minor exceptions to the load shedding performance criterion do exist. A summary of the conclusions is listed below.

- ESS Location – The physical location of the ESS is less critical than the voltage level that the ESS is placed. 115 kV interconnections at Agaña and Harmon show very similar results. Although the number of exceptions to the performance criteria due to the disturbances are similar between the 115 kV and 35 kV locations, less total load shedding is likely to occur when the ESS is placed on the 115 kV system. EPS recommends that the ESS be placed on the 115 kV system.
- Stage 1 UFLS Exceptions – The performance criterion exceptions that do occur with the 40 MW ESS are limited to 35 kV faults with higher levels of renewables. The exceptions are highly sensitive to ride-through characteristics of the renewable energy sources. This issue is discussed in more detail below.
- Estimated Maximum Renewable Limits – The estimated maximum renewable limits are less than 10 MW for distributed PV and less than 45 MW for plant PV. These values are separate and in addition to the phase 1 renewable capacity of 35 MW (10 MW wind, 25 MW plant PV.) The key difference between the two limits is based on the assumed under-voltage ride-through capabilities of the renewables.

- Existing System Comparison – A comparison set of cases was made to provide a rough comparison between the GPA system with and without an ESS. The system with the ESS showed a relatively large improvement over the existing system.
- Renewable Ride-through Characteristics – The study assumptions related to the ride-through characteristics of the renewable energy sources play a large role in the results. Ideally, all renewables will have characteristics similar to conventional generation. However, renewables are often very sensitive to frequency and voltage fluctuations and trip offline. IEEE 1547 ratings are sensitive and frequently found with renewables. This issue is common for isolated or islanded utilities. It should be noted that as renewable levels increase, and if the ride-through characteristics are not extended, renewable generation could become the largest single contingency on Guam.

4 Other Technical and Production Considerations

In addition to the power flow and transient stability studies performed, other technical topics relating to the addition of an ESS and the integration of renewables are provided below.

4.1 Spinning Reserve & Regulation Observations

The minimum spinning reserve policy of 15 MW was used to establish the unit commitment of the majority of power flow base cases. The 15 MW of spin represents only a small portion of the largest contingency (currently Cabras 1 or 2). Therefore, substantial UFLS is required to stabilize the system under unit trip conditions. Using the ESS to mitigate some of the UFLS that will occur for unit trips will require the size of the ESS to increase when smaller amounts of spinning reserve are being carried on the system. The spinning reserve approach used in the Operations Study was dictated by the unit commitments and load levels. The 15 MW spinning reserve policy was targeted at peak conditions with no renewables. As renewables increase, the spinning reserve also increases with no unit cycling.

It is common practice for islanded utilities with significant amounts of renewable generation to carry additional regulating/spinning reserve as a function of the amount of real time renewable generation, if units are cycled offline when the renewable energy is available. The additional spinning reserve is carried to provide regulation during variations in renewable generation output. In some of the cases created for the Feasibility Study, no additional spinning reserve was allocated due to the renewables, and the renewables were studied at full output levels. However, in cases where no units were cycled offline, additional spinning reserve equal to 100% of the renewables was carried. The Operations Study cases did not cycle units except for two diesel units in Case 2400. If the regulation required for the renewables is to be provided by the ESS, then the size of the ESS likely will be influenced and increased by the regulation requirement, especially if no regulation for the renewables is assigned to the conventional generation fleet.

If location specific renewable generation estimates are not available, a typical estimate for the amount of additional regulation needed as renewables are placed online can be made. One rule of thumb is that output fluctuations typically do not exceed 25% of the total capacity of the renewables. So for renewable output levels between 0% and 25% of the total capacity, a one for one power output relationship is made. In other words, for a renewable output of 8 MW (20% of 40 MW), then 8 MW of additional regulation is suggested. For 10 MW (25% of 40 MW) and higher, a value of 10 MW is suggested. For planning purposes and to add margin, we have at times used a value of 33% of the total capacity for regulation.

4.2 ESS Control Strategies

Within the transient stability simulations, variations in control strategy were evaluated. The final control strategy selected was a simple droop characteristic, with a dead band of 0.1 Hz (output from the ESS begins for frequency below 59.9 Hz), and the droop set such that the full rated output of the ESS occurs at 59.3 Hz (just above the first stage of load shedding, currently set to 59.1 Hz).

The simulations showed only minor variations in results for other control strategies. This is related to the small amount of spinning reserve. For example, if a unit trip occurs at 60 MW, and 15 MW of spinning reserve is online, then the difference, 45 MW must be made up of load shedding and any ESS response. If the first stage of load shedding is allowed to trip, and has say 25 MW on it, then the ESS must be at least 20 MW. However, this would require every last MW of spin to respond. In this example, an upper bound to the ESS exists at 40 MW (60 MW trip minus 20 MW UFLS). Therefore, in order to get only one stage of UFLS, the ESS must be sized between 25 and 40 MW. A "slow response" from the ESS results in a faster frequency decay and less of the spinning reserve responding before we get enough UFLS to arrest the frequency decay. A "fast response" from the ESS results in a slower frequency decay and more time for the spinning reserve to respond. However, with only 15 MW of spinning reserve online, the difference between "more" or "less" response from the spinning reserve becomes negligible. Therefore, the simple droop response for the ESS was selected.

It may be desirable to implement a direct auto-scheduling of the ESS based on unit trip detection via breaker status. This has been done in practice for another isolated utility using a battery energy storage system. The scheme requires some dedicated communication infrastructure and resulting cost but may decrease the ESS size somewhat. With a spinning reserve level of 15 MW for GPA, the auto-scheduling scheme is unlikely to reduce the required ESS size needed to obtain the desired levels of UFLS for unit trip events.

4.3 Protection and Power Quality Evaluation

In islanded power systems with limited voltage support and fault current, the implementation of variable, renewable generation can have a dramatic impact on the required protection system of the core transmission and subtransmission systems and to a certain extent, the protection of distribution systems. ESS and variable generators supply significantly less fault current than conventional generation. For instance, typical fault currents supplied by a 65 MVA units such as Cabras 1 approach 1600 amps at the 115 kV bus level. Typical fault currents provided by variable generation range from 350 – 500 amps, significantly less than the current system. The transmission protection employed at GPA, as in most utility systems depends on a large difference between fault current and load current to properly detect and clear faults on its system.

In addition to significantly more fault current, conventional generators provide a fault current with a known and measurable shift in angle between the voltage and current provided by the generator. Fault current provided by variable generation does not have a known shift or characteristic between the voltage and current. The angle between the two electrical quantities (voltage and current) varies based on the time of the fault inception and clearing, pre-loading of the device etc.

The unknown fault angle and the lower magnitude of the currents provided by the variable generators can preclude the use of conventional system protection, if sufficient fault current is not provided by conventional generation. With smaller amounts of PV/Wind generation, it is not anticipated that GPA will incur any protection problems or require protection improvements that are not also required to mitigate the impacts of FIDVR without consideration of renewable/variable generation.

For the larger amounts of renewable generation, it is likely that GPA will require line current differential relaying on all 34.5 kV and 115 kV transmission and subtransmission lines in order to protect the system against faults in those systems. The requirement is highly dependent on the locations and the frequency and voltage ride-through characteristics of the renewables.

4.4 High Level Production Simulations

The initial production simulation analysis provided by EPS in the draft Feasibility Report is detailed below. The key information gained from this analysis is a rough estimation of the additional daily cost required to attain a similar level of reliability for each case. Subsequent economic analysis was performed by GPA with the outcome integrated into the Operations Study Report. The final conclusions and recommendations provided in this report are based on the GPA economic and reliability analysis. Note that the results below reflect the future 80 MW combined cycle unit sizing originally provided by GPA.

The economic value of the energy storage system will be evaluated by comparing the expected daily production cost for the system with the ESS in service versus the expected daily production cost with no ESS but with more units online. The two comparison cases are required to have the same reliability in terms of load shedding for the loss of any generating unit. Therefore the case with an ESS in place will have fewer units online versus the case with no ESS, in order to achieve the same load shedding results.

Based on the load shedding results with an ESS in service, presented earlier, additional power flow cases were created. The additional cases had no ESS online but committed additional units, in order to increase the online spinning reserve, and therefore to achieve the same amount of load shedding for comparable unit trip events.

Using the same methodology as was presented in the Benavente report, the daily production cost was computed for the case with an ESS and compared to the same production computation for the same daily load curve, with no ESS online but with additional units online. The ESS case always has the lower production cost because fewer units are online versus the case with more units online. The difference represents the cost benefit of the ESS.

Table 4-1 illustrates the high level production cost case comparisons. Four comparisons are shown using the established levels of renewable energy and the existing/future generation scenarios. Each “a” case represents the results for the unit commitments found in the Benavente report (reference cases). Each “b” case includes additional units online in order to provide an appropriate comparison of the system with and without the ESS. Typically, a second Cabras unit was placed online to achieve the additional reliability. In certain cases, smaller diesel units were also added during the evening hours. Some solar curtailment was also used in order to satisfy unit minimums. The performance criteria used for the comparison was two stages of load shedding for a Cabras 1/2 trip a one stage for a MEC 8/9 unit trip.

Note that the exact fuel cost and heat rate curve information used in the Benavente report is not known. The values used in the analysis have been taken from other GPA correspondence and are believed to be similar, and produce similar costs. The heat rate curve for the new combined cycle units was estimated. An economic dispatch was performed for each operating hour based on the heat rate curves, fuel cost, and each committed unit’s minimum/maximum output.

Table 4-1 clearly shows the daily cost benefit of the ESS. The comparison increases with the level of renewable energy added to the system for comparable generation scenarios. The future system with the existing unit conversions and new combined cycle units show a reduced difference primarily due to the size of the largest unit contingency.

	1 a	1 b	2 a	2 b	3 a	3 b	4 a	4 b
Generation Scenario	Existing Generation						LNG Conv., New CC	
Renewable Energy Level	0 MW Solar		25 MW Solar		70 MW Solar			
Total Energy MWh	5,034	5,034	4,795	4,795	4,369	4,499	4,369	4,369
Renewable Energy MWh	-	-	239	239	665	535	665	665
Daily Cost	$ 808,706	$ 828,711	$ 756,564	$ 803,809	$ 688,341	$ 736,518	$ 532,436	$ 544,955
Daily Cost Increase		2.5%		6.2%		7.0%		2.4%
$/MWh	$ 160.60	$ 164.60	$ 157.80	$ 167.60	$ 157.60	$ 163.70	$ 121.90	$ 124.70

Table 4-1 Production Cost Comparison

5 Energy Storage System Technologies

The energy storage options under consideration included the commercially available battery technologies and flywheel technologies. The performance criteria for each storage option focused on spinning reserve applications. Also included were considerations of system dynamic performance, fault current levels, and power and energy ratings. The storage options were also assessed on the basis of expected capital costs. Pumped hydro and compressed air storage technologies were not investigated. These technologies are highly location specific and may not provide the type of response necessary for spinning reserve applications.

5.1 Energy Storage Systems Considerations

As ESS options are considered for near-term design and construction, several key attributes of the system must be identified and understood. The ultimate goal, as final recommendations are evaluated, is to match the performance and cost characteristics of the ESS with the GPA system's needs. The following attributes must be evaluated to achieve this goal.

- Application – The specific application for GPA is spinning reserve. The ESS will primarily function in a quiescent state until an over/under frequency event causes the ESS to respond. This type of event is most likely to be caused by a unit outage or a line fault and outage. The ESS will rapidly respond with a high power output capability, replacing the need for additional conventional spinning reserves. By limiting the need for the conventional spinning reserves, cost is reduced and reliability is improved by reducing the amount of load shed for these types of system disturbances. The number of events per year has been estimated at 50 by GPA as discussed in a meeting on 01/17/2014.
- Currently Available Technologies/Systems – There are many types of ESS technologies in development that may offer improved performance and cost in the future. There are far fewer that meet the specifications required for this application, are commercially available, and cost effective. Other factors may also reduce the available options such as siting and environmental restrictions. Careful consideration must be made in the RFP and acquisition process in order to select the optimum system.
- Cost – To a large extent, the cost of the ESS has been limited by GPA's budgetary analysis, ESS specifications, anticipated use of battery technology, and the system performance criteria and analysis results. GPA anticipates that the performance of the initial system installed and future system changes may warrant an expansion of the initial facility or an additional ESS. The initial ESS goal is to get the most "bang for the buck". One potential cost savings and/or performance enhancing tactic may be to carefully evaluate the energy needs of the ESS. Reducing the amount of

energy required (replacement unit start time) may open up other available technology options, while accepting higher levels may add functionality (frequency regulation) to the system.

5.2 Battery Technologies Overview

5.2.1 Lead Acid Batteries

The lead-acid battery is the most mature battery technology with well over 100 years of service. Currently, there are three types of lead-acid batteries. The first of which is the flooded cell lead-acid battery. This technology is the most common form of the lead-acid battery. This technology uses lead/lead alloy plates that will react with a sulfuric acid electrolyte to produce the movement of charge.

The flooded cell lead-acid battery has the advantage of being the lowest cost battery option with excellent shelf life and good efficiency. The main problems with the flooded cell lead-acid battery are the numerous environmental concerns and the low cycle life (only a couple hundred cycles). Since a spinning reserve application may require hundreds of cycles over the lifetime of the ESS and other lead-acid battery types are more advantageous, the flooded cell lead-acid battery should not be considered for spinning reserves.

The second type of lead acid battery is the valve regulated lead-acid battery (VRLA). The VRLA battery was designed to reduce some of the maintenance concerns with the flooded cell lead-acid battery. Unfortunately, the changes required to reduce the maintenance further reduce the cycle life of the VRLA battery. Therefore, this battery should not be considered for spinning reserves.

The third type of lead-acid battery is the advanced lead acid type. Due to continuing research into the lead-acid technology, some breakthroughs in the electrode materials have resulted in drastically improved battery cycle life. With the cycle life improvement, the advanced lead-acid batteries could be a potential solution for providing spinning reserves and for fast acting frequency recovery and should be considered a viable option. Several competing companies using advanced lead-acid batteries exist including Xtreme Power. The Xtreme Power dynamic power resource (DPR) has been used in conjunction with several wind farm applications in Hawaii, and has recently been proposed as the battery technology to provide 36 MW, 24 MWh in conjunction with a large wind farm in Texas. This Texas installation represents one of the largest battery installations in the world, and may be on the same scale as would be required for spinning reserves on Guam.

Figure 5-1 Example Advanced Lead-Acid Battery (Xtreme Power)

5.2.2 Nickel-Cadmium Batteries

The nickel-cadmium battery was a favored alternative to the traditional lead-acid batteries due to the following advantages:

- Greater depth of discharge
- Greater tolerance of extreme temperature variation
- Greater tolerance to over/under charging

Although the nickel-cadmium battery is superior to the lead-acid battery in performance, it does have a higher rate of self-discharge and requires continuous charge maintenance. Due to the limited cycle life of nickel-cadmium batteries and the maturation of the nickel metal hydride battery, this technology should not be considered for a spinning reserve application.

5.2.3 Nickel Metal Hydride Batteries

The Nickel Metal Hydride battery (NiMH) has basically displaced the nickel cadmium battery since it has better energy density and no heavy metals (fewer environmental concerns). This battery technology was used in the early Toyota Prius Hybrid vehicles (the newest plug-in model uses Lithium Ion). Due to the use in the plug-in hybrid market, these batteries are among the most field-tested solutions.

Currently, there are no large format NiMH batteries which would be better suited to a large-scale stationary battery system for utility use. The NiMH battery has largely been replaced by the lithium-ion technologies in consumer electronics, and does not have the same level of investment that it once had. Due to these factors, the Nickel Metal Hydride battery would not be a good selection for the spinning reserve application.

5.2.4 Lithium-Ion Batteries

The lithium ion battery technology has rapidly taken over the consumer electronics industry due to its energy density advantage over the nickel metal hydride battery technology. This battery technology comes in several flavors based on the specific chemistry of the cathode. The different types include lithium-ion cobalt, lithium-ion manganese, lithium-ion phosphate, and lithium-ion titanate. The different chemistries offer differing specific power (charge/discharge rate), safety characteristics, and cycle life.

The Chevrolet Volt and the newest Toyota Prius vehicles use lithium-ion battery packs. The selection of the lithium ion technology for the transportation sector suggests that the regulation market might be an acceptable utility application for this technology since the frequent battery usage associated with a hybrid vehicle is similar usage seen in utility regulation applications. Additionally, the new manufacturing capacity required by the electric vehicle industry will have a price reduction effect due to economies of scale.

The lithium-ion batteries have several desirable characteristics such as long-cycle lives, good energy density, and high power density. The lithium-ion batteries have been more expensive than many of the competing battery technologies, but with improvements in cost, their superior performance, and particularly the good cycle life, this battery technology should be considered for a spinning reserve application.

Figure 5-2 Example Lithium-Ion Battery (Saft)

5.2.5 Sodium-Sulfur Batteries

The sodium sulfur battery is currently the most widely used utility-scale battery technology. It has been heavily used in Japan by TEPCO (Tokyo Electric Power Company) and is produced by NGK. There are several installations in the United States.

The sodium-sulfur battery must maintain high operating temperatures (> 250°C). As such, the batteries must be heavily insulated to maintain the temperature, and when the batteries are not providing power, must be heated via resistor banks. These batteries are primarily used for uninterruptible power supplies in Japan, but are beginning to see high energy applications such as load shifting and wind smoothing in the United States.

The sodium-sulfur batteries advantages are that the technology has a high round-trip efficiency. It has good energy density and cycle life. There was a sodium sulfur battery fire on September 21, 2011 which has brought some scrutiny toward the battery safety. The cause has not been identified, and the production of these batteries has been put on hold until the safety concerns are resolved. The sodium-sulfur technology is a potential option for spinning reserve applications. However, due to the high cost and environmental and safety concerns, sodium-sulfur systems are not recommended at this time.

5.2.6 Sodium-Nickel-Chloride Batteries

Sodium-nickel-chloride (NaNiCl2, ZEBRA) battery technology is somewhat similar to sodium-sulfur technology. The operating temperature is high but self-discharge rates and molten metal issues have been improved over the sodium-sulfur batteries. The technology also offers improve efficiency. The ZEBRA battery improvements make the technology a more viable option, but primarily due to the current high costs, ZEBRA battery technology is not recommended at this time.

5.2.7 Vanadium & Zinc Redox (Flow) Batteries

The Redox battery is a flow type battery. Flow batteries store their energy in liquid electrolytes, and pump the liquid to the fuel cell where the electro-chemical reactions occur. The redox battery basically stores the energy in different ionic forms of Vanadium or Zinc and use abundant, inexpensive construction materials. One of the advantages of this flow battery system is that the energy capacity (MWh) and the power capability (MW) can be sized separately based on the application. For example, if more energy is needed, simply adding electrolyte storage tanks will increase the battery energy. This is a desirable attribute for matching a battery to an application that may require additional capacity at a later date.

The redox battery technology is being developed by several different manufacturers including Prudent Energy, UniEnergy Technologies, and ViZn Energy. The redox battery has decent AC-to-AC efficiency of 70% to 75%, good cycle life, and good reliability. The redox battery historically has some disadvantages such as high cost, low energy density, and a limited number of installations in the field. Although the technology is rapidly improving, the power and energy levels currently provided with these systems do not meet GPA's needs. Due to these disadvantages, the redox battery technology is not recommended.

5.2.8 Zinc Bromine Batteries

The zinc bromine battery is also a flow type battery. This technology has a significant promise, but has very limited field applications. During charging, metallic zinc is plated from the electrolyte onto the negative electrode and bromide is converted to bromine at the positive electrode. During discharge, the metallic zinc dissolves into the electrolyte. The zinc bromine technology has several advantages over the vanadium redox battery. Zinc bromine batteries have better energy density, lower cost, and fewer environmental concerns since zinc bromine technology does not use toxic materials. However, the zinc bromine batteries do not have independent sizing like the vanadium redox battery. Also, the power capacity of the zinc bromine battery is low which limits the charge/discharge rate.

The zinc bromine battery technology is being developed and manufactured by ZBB Energy Corp. and Premium Power Corp. ZBB Energy has more utility scale projects online, but still has limited experience in the utility sector. The battery maintenance requires "stripping". Stripping is performed by discharging the battery cell down to zero volts. This will remove all zinc from the negative electrode. This process is performed to increase efficiency, and ensure consistent operation of all battery cells. Due to the poor power capability of this technology, a 50 MW system would require at least 150 MWh of storage. This would add to the cost of such a system compared to other technologies that could have a 40 MW / 10 MWh configuration. Zinc bromine batteries are not recommended.

5.3 Flywheel Technologies Overview

Flywheels convert the electrical energy from the grid and convert it into rotating kinetic energy. The advanced flywheels spin at high speeds. In order to reduce the frictional losses, these flywheels operate with magnetic assistance in a vacuum. In order to maintain structural integrity at high rotational speeds, these flywheels are made of high-tech composite materials.

These advanced flywheels can charge and discharge without performance degradation which makes them ideally suited all ESS applications. Unfortunately, the advanced flywheel systems typically come with a higher installation cost than most viable battery technology options. There are several flywheel manufacturers, but only Beacon Power is marketing to larger scale utility applications. All the other companies are marketing toward lower energy applications such as uninterruptible power supplies.

Beacon Power has a 20 MW, 5 MWh flywheel system used for the New York regulation market. This project cost a reported $43 million. Beacon Power is currently finding their position in the storage market and being more aggressive in their pricing. If the required energy rating is large, such as greater than 15 minutes, the flywheel option becomes much less cost effective compared to other alternatives.

The future for flywheel systems may be in a hybrid form. Coupling a higher energy storage source, such as a battery system, with a flywheel system can add the high cycling qualities with the lower cost, higher energy qualities of the battery system. Typically, smaller frequency fluctuations would be handled solely by the flywheels. Larger frequency fluctuations would use both systems with the flywheel system rapidly losing charge leaving the battery system to supply the remaining amount of power and energy. For a disturbance such as a large unit trip, the increased power and energy available from both systems will help to minimize the frequency dip while the battery system will allow enough time to restore generation. Two hybrid systems are currently in the design/construction phase in Alaska.

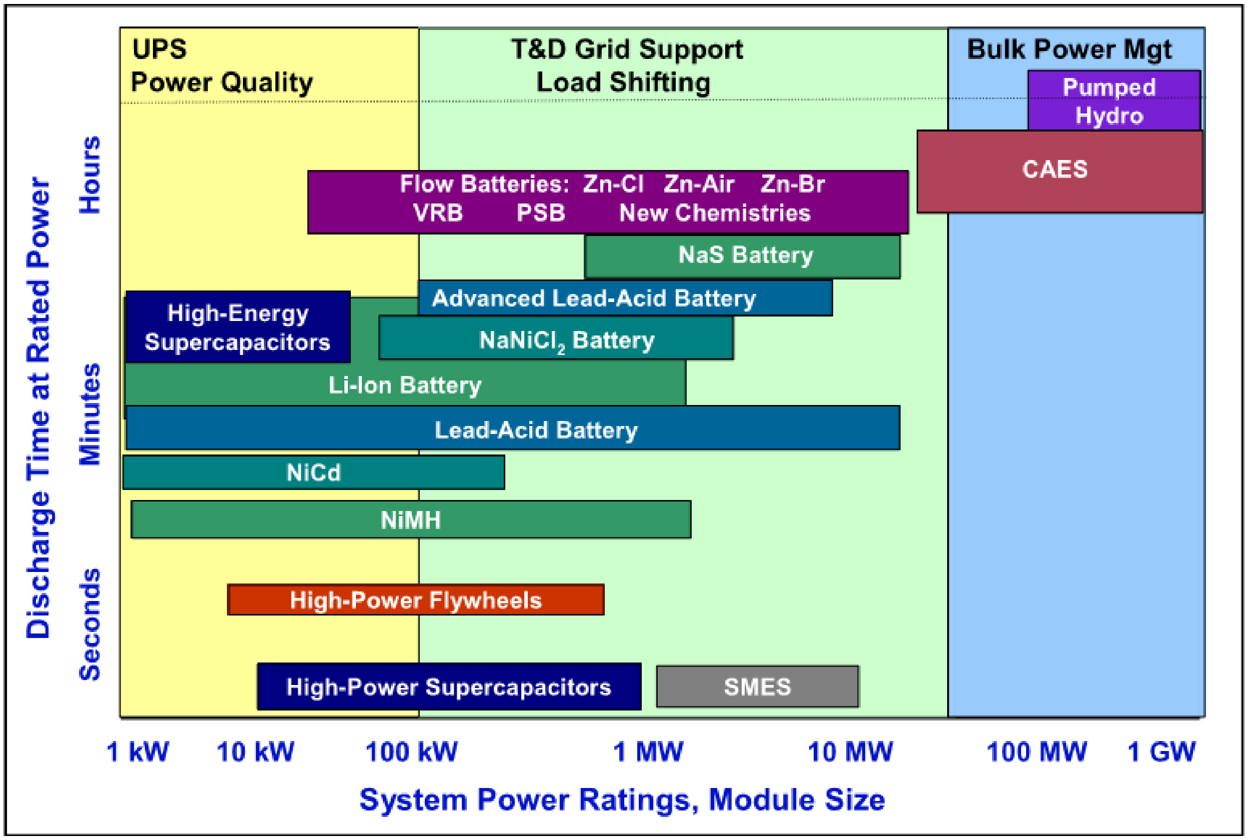
5.4 High Level Cost Considerations

The Sandia National Laboratories has published an Energy Storage Systems Cost report. This report compared the different storage technologies and application types. The energy storage types studied included lead-acid batteries, sodium-sulfur (NaS), sodium-nickel-chloride (NaNiCl2), zinc bromine (ZnBr), vanadium redox (V-redox), Lithium ion, compressed air (CAES), Pumped Hydro, High-speed flywheels, and super capacitors. The analysis studied the 10-year ownership of the storage device using the following factors:

- Efficiency
- Cycle Life
- Initial Capital Costs
- Operations and Maintenance
- Storage-device Replacement

The storage system cycle life, and replacement costs are highly dependent on the application. Figure 5-3 below provides a general guideline for the power and energy ratings for the different storage technologies. The GPA spinning reserve application requires roughly 15 minutes of storage with a power capability of approximately 40 MW (25 MW system are also provided). High level installed cost estimates for battery systems also provided below.

Figure 5-3 Positioning of Energy Storage Technologies



The Sandia National Labs has recently updated their Energy Storage Handbook in July of 2013. This handbook provides excellent information regarding the storage technology selection process, the storage technology characteristics, and the costs for the different storage applications. It is assumed that the battery system will provide multiple services including the frequency response to large system events, as well as some regulation or renewable following. Using the Sandia report as a primary source, the initial installation cost of a lithium-ion battery system is shown in Table 5-1 below. The cells highlighted grey represent the 40 MW size while the white cells represent the 25 MW size.

	Li-ion 1	Li-ion 2	Li-ion 3	Li-ion 4
MW	25	25	25	25
MWh	6.25	6.25	12.5	6.25
$ (Million)	$25.20	$25.40	$36.90	$27.50
	Li-ion 5	Li-ion 6	Li-ion 7	Li-ion 8
MW	40	40	40	40
MWh	10	10	20	10
$ (Million)	$40.40	$40.70	$59.00	$43.90

Table 5-1 Lithium Ion Installation Cost – 25 and 40 MW Sizes

The different options represent different manufacturers and sizes. Because the data has different battery sizes, the battery costs were determined by scaling the cost of each battery to a 25 MW and a 40 MW option using the $/kW and $/kWh provided in the Sandia report. A 25 MW li-ion battery with 15 minutes of storage would cost approximately $25 million to $27.5 million. Doubling the energy content could increase the cost of the system approximately $10 million as seen in Li-ion 3 column.

Similar analysis was performed for the advanced lead-acid battery technology with the results shown in Table 5-2 below.

	Lead Acid 1	Lead Acid 2	Lead Acid 3	Lead Acid 4
MW	25	25	25	25
MWh	6.25	12.5	10	10
$ (Million)	$ 29.40	$ 42.40	$ 42.30	$ 41.60
	Lead Acid 5	Lead Acid 6	Lead Acid 7	Lead Acid 8
MW	40	40	40	40
MWh	10	20	16	16
$ (Million)	$ 47.00	$ 67.80	$ 67.70	$ 66.50

Table 5-2 Lead Acid Installation Cost – 25 and 40 MW Sizes

A lead-acid battery with 25 MW and 15 minutes of energy would cost approximately $29 million. However, using data from a few recent Xtreme Power projects, the cost could be lower than the estimates provided by Sandia. The Notrees battery project in Texas has 32 MW and 24 MWh and was partially funded by a DOE grant for a project total cost of $43.8 million.

The only other battery technologies that have been installed in the size range recommended for the Guam system is sodium-sulfur (NaS) and sodium-nickel-chloride (NaNiCl2, ZEBRA). The NaS battery technology is only being manufactured by one Japanese company, and is better suited to an arbitrage application, but some costs are shown below. The NaS cells are only manufactured with 6-7 hour storage, so the costs are significantly higher, but so is the energy content. These systems are cheaper on a MWh basis compared to the lead-acid and li-ion batteries. The existing ZEBRA systems costs are also for higher energy applications.

	NaS 1	NaS 2	NaS 3	NaS 4
MW	25	25	25	25
MWh	150	180	180	180
$ (Million)	$ 76.80	$ 79.20	$ 85.90	$ 78.80
	NaS 5	NaS 6	NaS 7	NaS 8
MW	40	40	40	40
MWh	240	288	288	288
$ (Million)	$ 122.80	$ 126.70	$ 137.40	$ 126.10

Table 5-3 Sodium-Sulfur Installation Cost – 25 and 40 MW Sizes

	NaNiCl2 1	NaNiCl2 2	NaNiCl2 3
MW	25	25	25
MWh	125	125	125
$ (Million)	$ 133.25	$ 107.64	$ 70.50
	NaNiCl2 5	NaNiCl2 5	NaNiCl2 6
MW	40	40	40
MWh	200	200	200
$ (Million)	$ 213.21	$ 172.23	$ 112.80

Table 5-4 Sodium-Nickel-Cloride (NaNiCl2) Installation Cost – 25 and 40 MW Sizes

Lastly, the best option for a battery system that has not yet been proven in the field at the necessary size is the zinc-bromine battery system. The ZnBr 1 and ZnBr 4 options installation costs are less than a similarly sized lithium-ion or lead-acid battery.

	ZnBr 1	ZnBr 2	ZnBr 3
MW	25	25	25
MWh	25	125	125
$ (Million)	36.6	45.6	45.1
	ZnBr 4	ZnBr 5	ZnBr 6
MW	40	40	40
MWh	40	200	200
$ (Million)	58.5	72.9	72.2

Table 5-5 Zinc Bromine Installation Cost – 25 and 40 MW Sizes

5.5 Battery & Flywheel Technologies Comparison

The characteristics of the battery and flywheel technologies are discussed below. The flywheel information is specific to Beacon Power since they are the only manufacture available for utility scale applications. The battery technologies are grouped together and generally represent advanced lead-acid or lithium-ion technologies.

5.5.1 Power/Energy Specifications

The power and energy specifications must be met by the ESS in order for the system to have the type of dynamic and steady state performance required. Based on the spinning reserve application, a relatively high power output is required. This output aids in replacing any generation lost in a disturbance and stabilizes the system frequency. Based on recent cost and performance analysis, GPA has determined the ESS power rating to be approximately 40 MW. This amount generally allows for the ESS and the first stage of load shedding to cover for a large unit outage.

The amount of energy required is based on the length of time it takes to bring additional conventional generation online to replace the amount of generation initially lost in the disturbance. This time period has been estimated to be 15 minutes by GPA. Given a 40 MW ESS, the total minimum amount of energy required would be 10 MWh. Although this amount of energy could be considered large compared to what is necessary for transient disturbances, it is not sufficient for bulk energy applications that include shifting energy. Also, the state of charge for this application must be very high (maximum for cost effectiveness) in anticipation of a large amount of discharge for an underfrequency condition. Other smoothing applications require a lower state of charge in order to smooth by charging and discharging.

The power to energy ratio (MW/MWh) varies between available systems. The MW/MWh ratio for the GPA system is 4.0 based on a 40 MW output needed for 15 minutes.

5.5.1.1 Batteries

Battery based storage systems power to energy ratios can vary greatly depending in the technology. Typically, certain technologies favor higher or lower energy applications. For spinning reserve applications, the energy levels are low to medium. However, they are much higher than what would be necessary for a transient type disturbance (seconds to a few minutes).

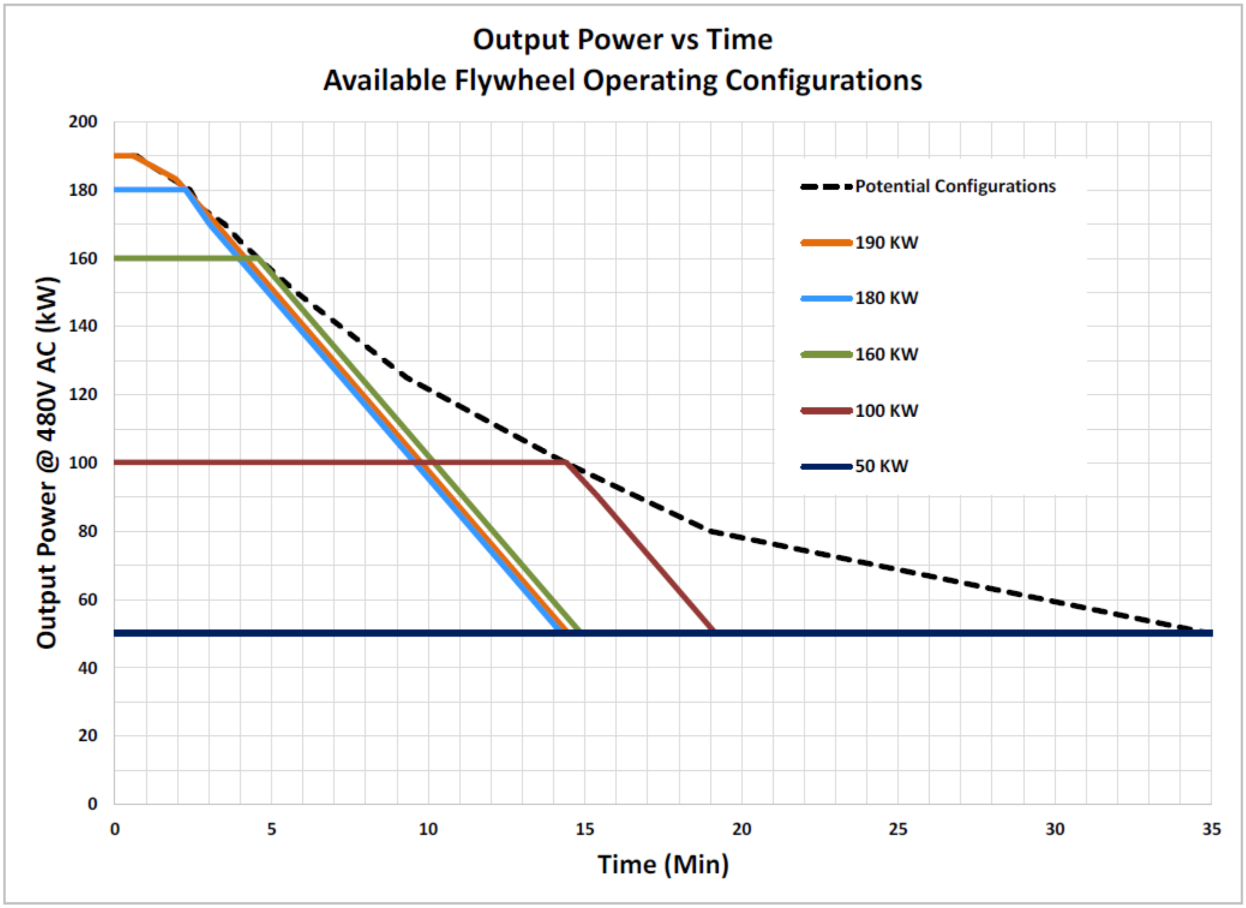
Advanced lead-acid and Lithium-ion technologies tend to offer low to high energy levels with the main differences relating to the ESS application and battery lifetime. Both technologies are appropriate for spinning reserve applications based on the available power and energy specifications.

5.5.1.2 Flywheels

The flywheel based systems can offer a variety of power and energy configurations. From a cost perspective, the flywheels improve as the the power to energy ratio increases. Based on the most current product information, flywheels start to be more competitive with battery technologies when they have a ratio of roughly 8.0. For the GPA system, this would reduce the time necessary to start a unit to roughly five minutes.

Figure 5-4 illustrates the available output power as a function of time, clearly showing the power and energy characteristics. Although this figure is representative for the current Beacon Power flywheels, this is only representative of the characteristics proposed for future projects.

Figure 5-4 Example Flywheel Output Power vs Time Characteristics



5.5.2 Charging/Cycling/Efficiency

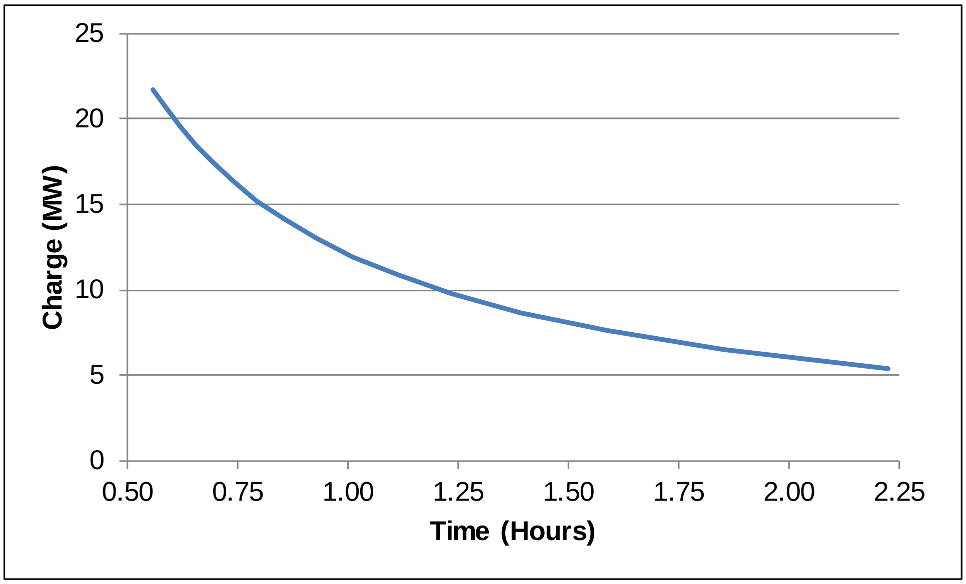
The charging, discharging, and cycling capabilities of the ESS technology are perhaps the most critical characteristics to achieve a proper match with the spinning reserve application and cost. The application requires relatively few cycles considering a 20-year system and fifty cycles per year. This totals an estimated 1,000 cycles over the lifetime of the system.

The type of cycling required is termed deep cycling where the majority of the energy capacity of the system is used for each event. Deep cycling, or near 100% Depth of Discharge (DOD) has a negative impact on most battery technologies.

The technology efficiency is an important consideration. For the battery and flywheel technologies considered, published AC-AC round trip efficiencies (RTE) range around 85-90%. The RTE decreases over time and may be reduced by roughly 5% at the end of its life. The RTE includes both discharging and charging. The charging efficiency for Saft Lithium-ion batteries, for instance, is roughly 2-3% higher than the discharging efficiency (43.5 MWh at 92%). Figure 5-5 illustrates an example of what the charging characteristics of an ESS over time using an efficiency of 92%. The limits associated with the charging levels and the efficiencies at each level vary between ESS technologies.

Note that these published RTE values are an indication of the system efficiency, but do not include all of the efficiency or loss related components that must be considered for a proper lifecycle evaluation. The lifecycle cost section of this report, Section 7.2, details these cost considerations.

Figure 5-5 Example Charging Characteristics

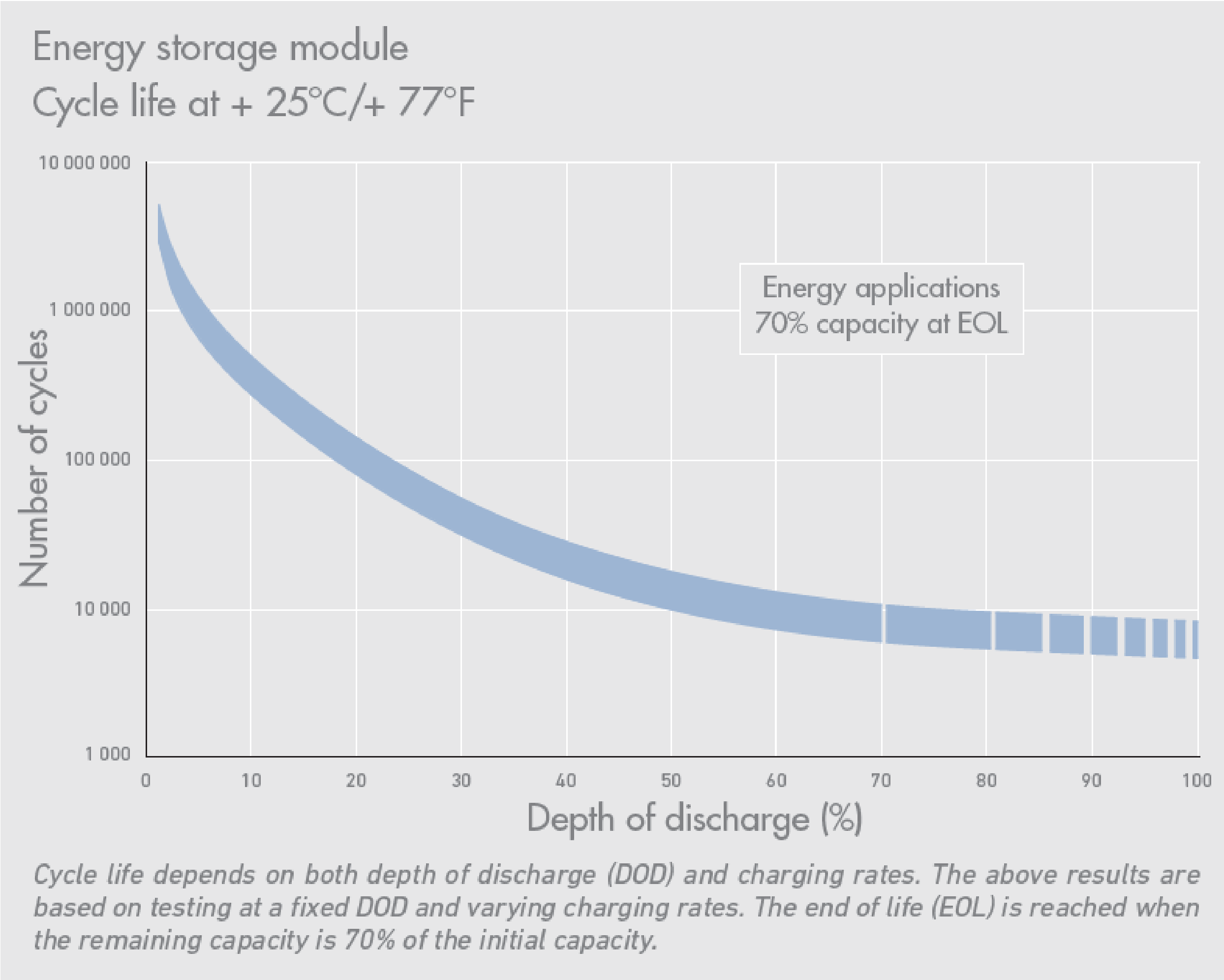


5.5.2.1 Batteries

Lithium-ion and advanced lead-acid technologies offer deep cycling capabilities for spinning reserve applications. Figure 5-6 illustrates the estimated number of cycles in the life of a system with varying DOD. The figure clearly shows the cycling limitations as the DOD is increased.

If frequency regulation applications are included, the battery lifetime may be affected enough to impact O&M costs (primarily battery replacement). A fixed 20-year lifetime of a battery system may include the replacement of batteries based on the anticipated cycling and DOD.

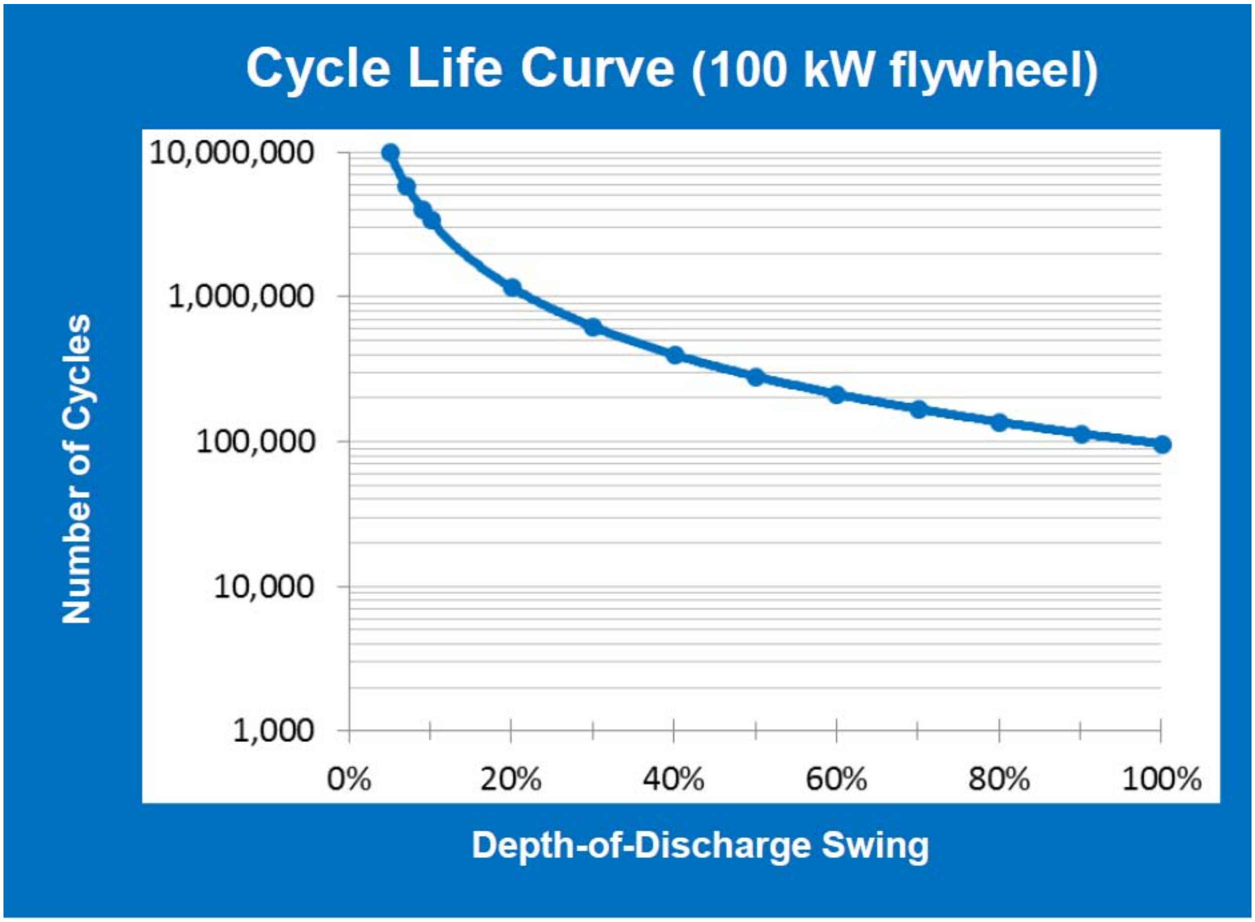
Figure 5-6 Example Lithium-ion Cycling/Depth of Discharge Characteristics



5.5.2.2 Flywheels

Flywheel cycling and DOD characteristics are much better than battery technologies. Figure 5-7 illustrates this fact. Even at 100% DOD, the flywheels can withstand almost 100,000 cycles in a 20-year lifetime. These large numbers of cycles and DOD values makes the flywheels ideally suited for all storage applications. This includes adding frequency regulation functionality to the primary spinning reserve application with little or no affect.

Figure 5-7 Example Flywheel Cycling/Depth of Discharge Characteristics



5.5.3 Site/Building/Space Requirements

The site requirements associated with the ESS are an important consideration. The available land, ownership of the land, and the existing electrical and building infrastructure on or near the land plays a critical role. From strictly an electrical perspective, placing the ESS on the 115 kV system is not a difficult requirement to meet. Anywhere on the system will suffice.

Most battery and flywheel systems are designed and supplied with a flexible and modularized approach. The majority of the equipment is placed in environmentally controlled containers not requiring a building for protection. The individual battery or flywheel systems are coupled in size with additional power electronics containers or enclosures and step-up transformers. Larger utility sized systems are often found including many 2 MW subsystems. The use of these containerized systems makes the use of existing buildings and infrastructure more complex.

5.5.3.1 Batteries

Battery based systems can be found as building or containerized type installations. The requirements for each are very different and require special assessment. There are benefits to both types of installations. Ultimately, the cost and site options must be weighed. Typically, above a certain size, a building approach becomes more cost effective.

Currently, many systems are supplied with a containerized approach. The basic components including the batteries, power electronics, and controls are all provided in environmentally controlled containers or enclosures. The remaining basic component is a step-up transformer meant for outdoor usage. The main benefits of the container approach is that much of the installation and commissioning work can be completed at the factory, the equipment is made to ship, and no additional building related infrastructure is required. See Figure 5-8 below as an example for a small scale installation showing all of the components.

For building based systems, a building and all of the environmental controls must be included. The building would mainly house the batteries, power electronics, and controls. The step-up transformers would likely be located outdoors. All equipment located in the building may require separation, primarily separation from the batteries. Further, the batteries in a 40 MW system may be segmented in four separate fire-walled areas requiring individual environmental controls and fire suppression systems.

Figure 5-8 Small Scale Container Installation (Lithium-Ion)

5.5.3.2 Flywheels

The flywheel systems are located on open land. Roughly 1.33 acres of land is required for a 40 MW/10 MWh installation. Additional land will be required for the utility infrastructure needed to connect the flywheel system to the 115 kV system.

The site construction is very different than battery based ESS'. The individual flywheels are buried under ground and the other equipment is placed above ground near the flywheels. The site is typically excavated and backfilled once the flywheels are in place. The flywheels are encased in a round storm drain type of cement structure. Figure 5-9 and Figure 5-10 below illustrate a typical flywheel installation and final site layout. All of the equipment is protected from the weather, not requiring any building structure. Environmentally controlled containers and enclosures, and other cooling equipment is included as part of the flywheel system.

Figure 5-9 Below Ground Flywheel Installation

Figure 5-10 Example Final Site Installation

5.5.4 Environmental & Safety

The environmental and safety issues for battery and flywheel technologies are summarized below. The specific characteristics of each proposal in the acquisition process must be assessed for the impacts including costs. Although the environmental and safety impacts normally focus on the storage technology, there can be some safety concerns with the power electronic components of the systems. These concerns are fire related and are common to both technologies.

5.5.4.1 Batteries

Storage systems using battery technologies use an electro-chemical process that typically has environmental and safety concerns. Many of these concerns go hand in hand because of the chemicals and material properties of the batteries. The transportation, handling, operations and maintenance, and disposal of the battery components must be properly dealt with in order to avoid both environmental and safety incidents.

The safety concerns include exposure to chemicals and gases as well as arcing, fire, and explosive events. No battery is inherently safe. Battery installations have thermal and safety management systems as well as smoke detection and fire suppression equipment.

The specific environmental and safety concerns for lithium-ion and advanced lead-acid batteries vary by manufacture. Lithium-ion batteries have a history of fires including smaller scale batteries such as the Sony laptop battery recall and the Boeing Dreamliner 787 incidents. One large scale fire at a renewable energy storage facility in Hawaii was suspected to be caused by the batteries, however the final cause was traced to capacitor in the power electronics.

5.5.4.2 Flywheels

The environmental and safety characteristics of the flywheel technology are much less impactful than other storage technologies. The environmental effects are limited to the ground disturbance of the excavation and underground installation of the flywheels. Being a mechanical system with a large mass rotating at a very high speed, the underground installation makes the flywheels more safety conscious. If a flywheel were to have a mechanical malfunction, the “explosion” would be largely controlled by the ground and concrete casing surrounding the flywheel. The containment of the malfunction would likely not have a large impact on the remainder of the flywheel system.

5.5.5 Modularity & Scalability

As previously discussed, the flywheel and battery systems typically are designed to be flexible and modular. There appears to be no large advantage or disadvantage between the two technologies in that regard. Sizing a system and/or adding to a system at a later time will require planning for the space requirements and the utility interconnection capacity. Several considerations must and are listed below.

- Developing Technologies – The fact that all storage system technologies are continually evolving is a deterrent to the expansion of an existing system. This evolution includes the energy source as well as the power electronic components of the system. It is difficult to anticipate the types of improvements that will be made in the future and how they may impact an existing facility. Advancements in safety, environmental, and other technical aspects may provide for better options in the future. It’s a bit of a semantics issue, but adding a new ESS to an existing facility is perhaps a better way to characterize expanding an ESS.
- Utility Interconnection – The size of transformer and/or number of transformers/breakers required must be assessed. Regarding transformer capacity, a transformer properly sized for the initial ESS is recommended assuming that future expansions are relatively large. Estimating the future required capacity and over-sizing the transformer from the initial ESS project requirements will result in increased installation costs and no-load losses. Any gain will only be realized if the ESS is expanded. Also, a single transformer

remains a single contingency for the entire ESS. A breaker/transformer combination for each phase of ESS is recommended for reliability purposes, again assuming future expansions are relatively large.

- Multiple Sites – In place of expanding an existing ESS, consideration should be given to adding an ESS at a different location. Having distributed ESS' is not required at this time, but two would likely better serve the system. If ESS voltage regulation functionality is used, two locations would be preferred.
- Site Planning – Aside from the obvious additional space requirements needed for a expansion project, the initial site preparation should be considered in the initial ESS project. For instance, a flywheel based system requires a considerable amount of excavation. It may be advantages to complete the bulk of work in preparation for the expansion. Other considerations include the overall layout of the site, cable routing for the collector systems, and utility interconnection requirements.

5.5.6 Dynamic Performance and Additional Functionality

EPS anticipates that all available technology options will have similar dynamic response and control functionality. Typically response times are less than 100 ms (6 cycles). Although there may be some minor control differences between ESS options, the energy storage component of the system is largely decoupled from the electrical output (power electronics and controls) of the ESS. The available control functionality for each proposed system received in the acquisition process needs to be assessed including the how flexible the controls are for custom applications and how control changes are administered.

Depending on the final power and energy specifications and technology characteristics of the ESS, the system may be able to perform additional functions such as frequency and voltage regulation. If the amount of energy available is higher than the minimum specification required for spinning reserves, the ESS may be able to regulate smaller frequency fluctuations while still allowing time to start replacement units. A larger number of cycles for the lifetime of the system is required for this application. Flywheels and some battery technologies offer this characteristic. The basic difference between the frequency regulation function and spinning reserve function of an ESS is that frequency regulation is meant to continually smooth out smaller frequency variations where spinning reserve provides a large amount of response for large frequency dips usually associated with the loss of generation.

Voltage regulation is a function often found in storage systems. If voltage regulation can be performed without sacrificing the required performance of the system for spinning reserve, then voltage regulation can be an added benefit. If the system is installed and/or expanded with more than one ESS location, the benefits of voltage regulation will be increased.

6 Preliminary Site Selection

6.1 Methodology

6.1.1 Preliminary Site Selection

Based on discussions with GPA, a preliminary list of properties was developed based on the following criteria:

- Property Size = 50,000 square feet = 1.15 Acres (preliminary estimate for the proposed facility consisting of an area approximately 200 feet by 200 feet and 10,000 square feet for the structure).
- Property Zones: Properties belonging to the following zoning classification were considered for the study: M-1, M-2, C, R-1/C Mixed Use, PF (Public Facility, a new zone classification), Military.
- Property owner to be categorized as being GPA-owned (land previously owned by the military will be marked with asterisk), GovGuam-owned, or Private. GWA-owned properties will also be considered.

GPA provided TGE/EPS a spreadsheet listing the properties based on the above criteria on September 17th, 2013. The spreadsheet divided the properties into five (5) categories: GPA, Chamorro Land Trust Commission (CLTC), Guam Ancestral Land Commission (GALC), Private, and Military Lands.

6.1.2 Site Selection – 3 Sites

Of the properties in the spreadsheet received from GPA, TGE prioritized the six (6) GPA-owned properties. If three (3) candidate sites could not be picked from the GPA properties, the order of the property categories by decreasing preference would be the following: CLTC, Military, Private, and GALC.

Preliminary site observations included the following criteria:

- Space Availability. Although the properties exceed 50,000 SF in size, a portion of the property is either being currently used (e.g. Marbo Substation) and/or planned for development (e.g. Fadian Property – Future GPA/GWA Office).
- Vulnerability to Flooding based on FEMA Flood Insurance Rate Map (FIRM).
- Proximity to Wetlands based on GIS provided by Bureau of Statistics and Plans (BSP).
- Existing Condition such as presence of access roads, utilities, buildings, and vegetation as well as proximity to existing electrical transmission lines and GPA grid.

Site visits to the GPA properties were performed during September-October 2013 and the disadvantages and advantages of each property were tabulated to aid in the selection of the three (3) properties that would be subjected to further evaluation.

Once the top three (3) sites were selected, TGE performed Preliminary Environmental Assessments on the three (3) sites per the scope of work. Preliminary Environmental Assessments incorporated the Council on Environmental Quality (CEQ) regulations for implementing the NEPA, federal statutes and laws designed to protect the Nation's resources. Additional records such as as-built drawings were requested. Also, further evaluation of the existing structures and infrastructure was conducted.

6.2 Qualitative Comparison of Sites

6.2.1 Selection of 3 Sites

TGE conducted site visits to the Marbo and Agaña Substations on September 12th, 2013. The perimeter around the decommissioned Agaña Power Plant was accessible, but the building itself was closed. As for Marbo Substation, the facility was closed and photos were taken from the chain link fence around the perimeter of the facility. Site visits to the four (4) remaining GPA sites were performed on September 19th.

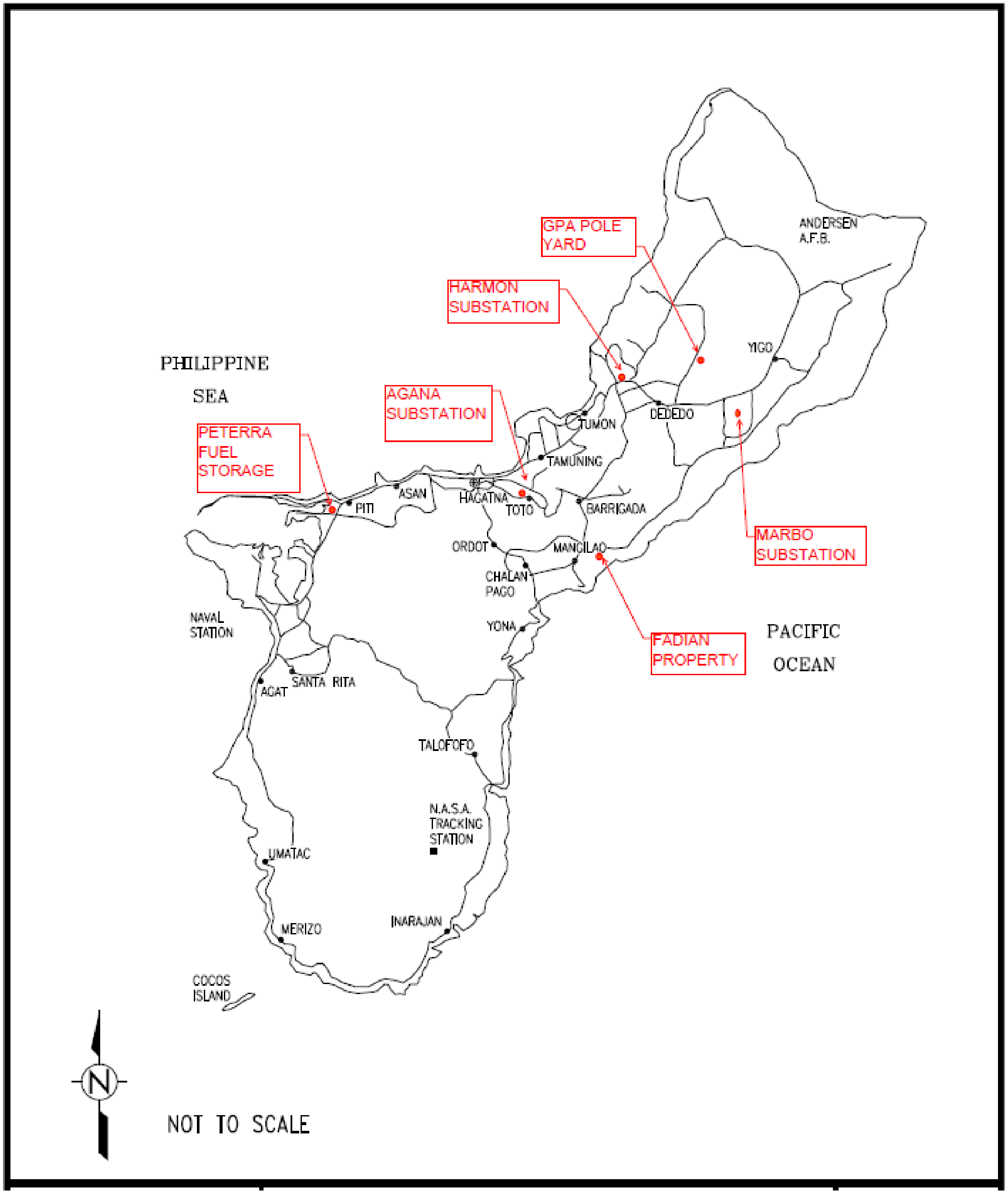
Table 6-1 summarizes the site observations based on the site visits and research of the FEMA Flood Insurance Rate Maps (FIRM) and a wetland map provided by the Bureau of Statistics and Plans. Figure 6-1 shows the approximate locations of the GPA properties. Table 6-2 and Table 6-3 list the properties selected for further evaluation and the properties eliminated based on the site observations completed.

Site	Space Availability	Flood Vulnerability	Wetland Proximity	Existing Condition
Peterra Fuel Storage	Approx. 18.5 AC of 30 AC	Potential Area in FEMA Floodplain	Two (2) Wetlands within Undeveloped Area	Access Road (Minor Road from Route 18) Two (2) Existing Fuel Tanks Area adjacent to the fuel tanks appear to be heavily vegetated Nearby Transmission line available as site is close to a Power Plant
GPA Pole Yard	Approx. 1.5 AC of 3.3 AC	Not in FEMA Floodplain	No Wetlands within Property Boundary	Access Road (on Route 28) Concrete Power Poles Storage Grass, Shrubs and some trees observed Nearest transmission line is by Dededo Substation about two (2) miles away.
Harmon Substation	Approx. 1.5 AC of 4.46 AC	Not in FEMA Floodplain	No Wetlands within Property Boundary	Access Road (on Route 1) Active Substation Grass observed Transmission lines in close proximity
Marbo Substation	Approx. 2.4 AC of 3.12 AC	Not in FEMA Floodplain	No Wetlands within Property Boundary	Access Road (Minor Road from Route 1) Active Substation Existing Soon-to-be-decommissioned Power Plant Grass observed throughout the property Transmission lines in close proximity

Agaña Substation	Approx 3.75 of the 6.29 AC	Not in FEMA Floodplain	No Wetlands within Property Boundary	Access Road (on Sergeant Roy T. Damian Jr. Street) Active Substation Decommissioned Power Plant Grass observed throughout the property Transmission lines in close proximity
GPA Consolidated Office – Fadian Property	Future Site of GPA/GWA Office According to RIM Architects, undeveloped areas north of existing road (approximately 70,000 SF) will be devoted to tree plantings per agreement with Dept. of Agriculture.	Not in FEMA Floodplain	No Wetlands within Property Boundary	Access Road (on Route 15). Grading and Construction have commenced at the future GPA/GWA Office southwest of the existing road Sections Northeast of the Existing Road appear heavily vegetated. No nearby transmission lines observed.

Table 6-1 Preliminary Site Observation - GPA Properties

Figure 6-1 Location Map - GPA Properties



Potential environmental and/or archeological issues, as well as proximity to existing GPA infrastructure were main reasons for eliminating three (3) of the six (6) GPA sites. The Peterra Fuel Storage site was discarded due to potential flood risks, possible wetland mitigation requirements and archeological issues. The Fadian Property was not further evaluated based on discussions during a site visit on September 19th with Rim Architects, the prime consultant for an ongoing project on the property. According to the consultant, the property will be used for the new GWA/GPA Offices, which will be situated towards the area south and west of an existing road that traverses the property. North of the road, approximately 70,000 square feet have been designated for tree planting to mitigate impacts of the office project per agreement with the Department of Agriculture. If the energy storage facility were to be constructed on the property, negotiations would need to be conducted with Department of Agriculture. As for the GPA pole yard, the absence of a nearby transmission line was considered to be the critical factor as the site would require approximately two (2) miles of transmission lines to the nearest substation. Per GPA correspondence on October 1st, 2013, transmission lines cost between $400,000 and $600,000 per mile.

The three (3) selected sites are active substations, and the proximity to existing transmission lines and availability of possible connection points were major factors in their selection. Agaña Substation has an existing structure which if deemed structurally sound, could be used to house the energy storage units. Marbo Substation also has existing steel structures that could possibly be reused/renovated to store the energy storage units. Harmon Substation does not have an existing structure, but its location along Marine Corps Drive was considered as an advantage over the other sites for ease of access.

Site	Pros	Cons
Marbo Substation	Wide space for the facility Property has been disturbed and archeological issues is unlikely Proximity to existing transmission lines	Potentially high demolition and clean-up costs of existing power plant(power plant expected to be decommissioned in the next few years).
Harmon Substation	Proximity to Route 1, Guam's major artery road. Easy access for maintenance Property has been disturbed and archeological issues is unlikely Proximity to existing transmission lines.	Space is limited, approximately 53,000 SF and changes in facility size. Could not fit a square facility if required by design. A rectangular facility would be required.
Agaña Substation	Lower costs due to existing Structure area is greater than 10,000 SF(estimate for the structure) Property has been disturbed and archeological issues is unlikely Proximity to existing transmission lines	Clean-up costs may be high, but some clean-up has probably been conducted considering the power plant has been shut down for more than a decade. If building is structurally unsafe, potentially high demolition costs

Table 6-2 GPA Properties selected for further evaluation

Site	Pros	Cons
GPA Pole Yard	Environmental Issues are unlikely from pole storage Property has been disturbed and archeological issues is unlikely	Space for poles would be reduced, some poles may need to be relocated Potentially high costs to construct transmission lines (length approximately 2 miles)
GPA Consolidated Office – Fadian Property	Wide space for the facility (more than 70,000 SF)* if Dept. of Agriculture agrees to plant trees in other locations	Potential archeological site due to heavy vegetation and apparently minimal disturbance of area Need to negotiate with Dept. of Agriculture about acquisition of property for project.
Peterra Fuel Storage	Wide Area for the facility (approximately 13.4 AC of site is undeveloped) Proximity to existing transmission lines/power plant	Two (2) Wetlands Identified within property of boundary Area for proposed facility is in a FEMA floodplain. Potential archeological site due to heavy vegetation and apparently minimal disturbance of area.

Table 6-3 GPA Properties eliminated based on Preliminary Site Observation

6.2.2 Comparison of 3 Sites

Once selected, the three (3) sites were subjected to preliminary environmental assessments and further evaluation. As part of the assessment, site visits were conducted together with GPA personnel. An executive summary of the preliminary findings is included as Appendix D to this report. The following sections detail some of the highlights from the assessment, as well as results from evaluation

6.2.3 Agaña Substation

The Agaña Substation was constructed in 1949 and initially served as a power plant. Power generation ceased in 1995, and generation and auxiliary equipment has gradually been removed from the existing building. The facility currently consists of the abandoned power plant at the center of the property, and active 115kV substations to the north and east of the existing structure. Adjoining properties are currently designated for residential and light industrial use. The property has frontage on Route 33, Sergeant Roy T. Damien Jr. Street. Refer to Figure 6-1.

The Preliminary Environmental Assessment found historical documents indicating that the property has undergone environmental cleanup. Per a 2013 Environmental Condition of Property (ECP) conducted by NAVFAC, land-use controls are in effect for two (2) areas east of the building. No records of lead-based paint surveys have been found. Therefore, presence of the aforementioned substances in the existing structures is possible. As noted in the 2013 ECP, an investigation found asbestos-containing material in the structure and subsequent removal of the materials, particularly friable asbestos, was performed. However, some traces of asbestos may be left and the ECP notes that the transferee “shall be responsible for management of any asbestos in accordance with applicable laws”. Based on the information provided by the assessment, TGE determined that the property is suitable for the construction of the proposed facility with appropriate additional studies and Hazmat Management Procedures.

A preliminary structural evaluation of the existing concrete structure determined that the building is generally in good condition and minor renovations and retrofits is likely needed for the structure to meet current building codes. The concrete structure has an approximate area of 17,500 square feet.

A preliminary review of the Guam Waterworks Authority (GWA) system indicates that existing water and sewer lines are present approximately 200 feet and 500 feet south of the property along Route 33.

6.2.4 Harmon Substation

The existing facility is located along Marine Corps Drive and across from Micronesia Mall. Refer to Figure 6-1. A power plant was constructed in the 1940s but demolished during either the 1960s or 1972. The facility currently consists of a 115kV substation covering the southern half of the property. Adjoining properties have been known to be used for military purposes.

The Preliminary Environmental Assessment found historical documents indicating that the property has undergone environmental cleanup. The cleanup was conducted based on a time critical removal action (TCRA) document dated October 2007. No records of lead-based paint surveys or asbestos containing material surveys have been found. Therefore, presence of the aforementioned substances in the existing structures is possible. The property does not have an existing building that could be potentially used as part of the proposed facility. Based on the information provided by the assessment, TGE determined that the property is suitable for the construction of the proposed facility.

A preliminary review of the Guam Waterworks Authority (GWA) system indicates that an existing water line is present under Marine Corps Drive approximately 300 feet from the center of the property and there is an existing sewer line approximately 900 north of the property.

6.2.5 Marbo Substation

The existing facility is located in Yigo and can be accessed by a road branching approximately 0.5 mile south from Marine Corps Drive. Refer to Figure 6-1. The facility currently consists of a 34.5 kV substation on the northwestern portion of the property and a power plant facility in the center of the property. The power plant is a diesel-fueled turbine completed in the 1990s and is schedule to be decommissioned within the next few years per discussion with GPA. Three (3) steel structures comprise the power plant. Adjoining properties have been known to be used for military purposes.

The Preliminary Environmental Assessment found historical documents indicating that the property has undergone environmental cleanup. The cleanup was conducted based on a time critical removal action (TCRA) document dated October 2007. Land-use controls (LUC) are currently in effect in three (3) areas. The affected areas are situated west of the power plant, the northern half of the power plant, and northwest corner of the property. No records of lead-based paint surveys or asbestos containing material surveys have been found. Therefore, presence of the aforementioned substances in the property is possible. Based on the information provided, TGE determined that the property is suitable for the construction of the proposed facility except for LUC areas.

A preliminary structural evaluation of the existing steel structures indicates that the three (3) structures need major renovations to meet current building codes. Furthermore, the structures need to be expanded to provide the needed space for the energy storage units. When combined, the steel structures have areas of approximately 1,750 square feet, 250 square feet, and 1,000 square feet for a total combined area of 3,000 square feet.

A preliminary review of the Guam Waterworks Authority (GWA) system indicates that an existing water line is present under Marine Corps Drive approximately 2,800 feet from the center of the property and there is an existing sewer line approximately 2,500 feet from the property. It was observed during the site visit that the property currently has two (2) existing fire hydrants (FH). It is suspected that the FH lines currently connect to military-owned water lines.

7 Cost/Benefit Evaluation & Scheduling

7.1 Site Comparison

7.1.1 Methodology

Once the three (3) sites were determined from the criteria listed in Section 6.1.2, a preliminary cost analysis to construct an ESS facility was conducted for each property. The findings from preliminary structural evaluations, environmental assessments and additional research were used as the basis of the estimates. The cost estimates include the following variables:

- Erosion Control
- Demolition of Existing Structures, and/or Infrastructure (Roadway, Water, Sewer, Stormwater Management, Electrical)
- Environmental/Archeological-related Activities (e.g. Clean up)
- Clearing/Grubbing
- Disposal
- Construction of Supporting Infrastructure and Utility connections
- Construction/Renovation of Structures and Infrastructure
- ESS Construction, Shipping, and Installation

The costs to construct the proposed facility on each of the three (3) sites were obtained by evaluation of these variables. Along with other factors such as space availability and electrical connections, the cost estimates were used to determine the recommended site for the proposed facility.

As discussed in Section 3.2.1, a 40 MW ESS was determined to be the optimal size based on the Operations Study findings and discussions with GPA. In addition, two (2) ESS technologies are being considered: a battery-based and flywheel-based system. A battery-based system may be installed inside a building or containerized. On the other hand, a flywheel system is containerized. Based on preliminary estimates received from ESS manufacturer (shown in Table 7-3), 5-minute and 15-minute systems were considered. Approximate spatial requirements for the battery and flywheel alternatives are as follows:

Energy Storage System Type	Total Required Area including Battery/Flywheel Equipment and Auxiliary Electrical Equipment*
Flywheel-based – Containerized – 40 MW, 15-min	63,200 SF
Flywheel-based – Containerized – 40 MW, 5-min	29,000 SF
Battery-based- Building Installation	27,000 SF
Battery-based – Containerized	30,000 SF

*Areas as shown in the table are based on information received from ESS manufacturers and are considered preliminary and may be subject to change.

Table 7-1 Rough Spatial Requirements for ESS Alternatives

The above figures only account for the footprint of the ESS itself and take into consideration size of the control building (for Building-based Battery ESS), the sizes of the ESS units, the spacing between storage units and access paths between rows/columns. However, they do not account for the supporting infrastructure required at each site such as bays, transformers, switchgear and access roads. Together with the values listed in Table 7-1, the following estimated spatial requirements for the supporting infrastructure should be considered:

- 50 feet by 75 feet for the Bay
- 30 feet by 30 feet for the Transformer
- 20 feet by 36 feet for the Switchgear
- 24-feet wide access road around the structure.

Of the costs mentioned above, Construction/Renovation of Structures, Environmental Cleanup, Demolition of Existing Structures, and Utility Connections are expected to vary significantly when comparing the three (3) sites. The other variables are not expected to be major factors in the comparison as the footprint of the facility is similar for the properties being considered.

As mentioned in Section 6.2.2, Agaña and Marbo Substations have existing structures. The concrete structure at the Agaña Substation was found to exceed the space requirement for the control building with an area of approximately 17,500 square feet. It was found to be generally in good condition and suitable for reuse after minor renovation and retrofit. Reuse of the building is dependent on the ESS alternative being considered and associated upgrade costs are included as part of the lifecycle analysis in Section 7.2. At Marbo, major renovations and expansion of the structures would be required. To avoid potential problems involved with connecting existing and new segments of the structure, demolition of existing structures on the concrete slab and the construction of a new storage building was deemed to be a safer and simpler course of action.

For environmental cleanup activities, the values were determined based on the presence of existing structures in areas where the facility is being proposed and whether the structures have been examined for the presence of lead-based paint (LBP) and asbestos-containing material (ACM). If a site does not have an existing structure, it is concluded that environmental cleanup is not needed. If a site has an existing structure and no prior investigation of LBP or ACM was found, it is assumed that the entire structure has to be subjected to clean up. If a site has historical documentation of ACM or LBP and a corresponding cleanup was conducted, some cleanup may be assumed depending on the assessment after the cleanup. Based on this criteria and findings as described in Sections 6.2.3 - 6.2.5, the following are the quantities of the expected cleanup used for the estimates:

Site	Lead-based Paint Removal	Asbestos Removal
Agaña Substation	17,500 SF (approximate area of Bldg. 2100) No historical documentation found	3,500 SF (20% approximate area of Bldg. 2100) 2013 ECP indicates Asbestos detection and subsequent removal of friable asbestos. Some asbestos may be present.
Harmon Substation	No existing building, so cleanup is not expected	No existing building, so cleanup is not expected
Marbo Substation	3,000 SF (approximate total area of structures on concrete slab)	3,000 SF (approximate total area of structures on concrete slab)

Table 7-2 Environmental Cleanup Quantities

The proximity of utility connections particularly sewer and water were found to vary across the three (3) properties being considered. The length of the water and sewer laterals could be determined based on the approximate distance of the nearest lines to the properties.

Storm drainage, erosion control, and the length of the access roads are expected to be similar across the three (3) sites. The following values are used in the estimate:

- Length of Access Road – 900 feet
- Storm Drainage consisting of Perimeter Swales and Culverts (same value used for erosion control) – 1,000 feet

Although the distance to the electrical connection point is expected to be comparable for the three (3) properties, the interconnecting voltages and equipment varies. Based on system performance, the preferred voltage level is 115 kV and is available at the Agaña and Harmon Substations. A breaker, transformer, switchgear, and bus related equipment is required at these two locations. The transformer will likely be rated at 35/115 kV and 40 MVA. The 35 kV switchgear will facilitate the connection between the 40 MVA transformer and the high voltage connections from each ESS power module step-up transformer. Marbo Substation's high voltage is 35 kV. There is an existing 35 kV breaker that can be utilized at this site, thus reducing the total grid interconnection cost.

7.2 Lifecycle Cost Evaluations

The purpose of the lifecycle cost evaluations were to provide budgetary level estimates for cost comparison purposes. The results of the evaluations were used by TGE/EPS to make final recommendations. The results will also aid GPA in the acquisition of the ESS. In particular, the results can provide insight into the various specifications and characteristics of the ESS that will be included in the RFP/bid package.

EPS has contacted ESS suppliers and included specific information in addition to utilizing industry publications containing detailed budgetary cost information. It is important to note that obtaining detailed equipment and cost information from suppliers is difficult until an RFP or bid package is produced and proposals are received. Two of the main suppliers that were contacted, and adequately supplied information, were unable to provide published marketing information for their systems. The main reason for this is that the systems being offered are in an ever-changing state. One supplier provided updated lifecycle cost information two days before the printing of the Report. This information was very different than the previously updated information provided two weeks prior. Another supplier would not provide cost information without a non-disclosure agreement.

EPS assumes that the RFP or bid package will be broad enough in scope and technical specifications that a number of proposals will be provided and the types of storage technologies will vary. The final and most critical ESS evaluation will be based on the actual costs and other system requirements that will be provided in the ESS proposals. EPS believes that, in addition to the costs, the various storage technology capabilities, available options, and the delivery schedules will play a large role in selecting the final ESS.

The costs included in the lifecycle analysis are intended to be budgetary, yet be accurate enough so that large differences are avoided when firm proposals are provided. Since there is only one viable flywheel technology manufacture/provider, the bulk of the lifecycle information for flywheels has been provided directly by the one manufacturer. Since many battery technologies exist, the lifecycle costs for battery technology are more generic with a focus on lithium-ion and advanced lead-acid technologies.

The lifecycle cost evaluations for the ESS alternatives are provided for two battery based systems and two flywheel based systems. The two battery systems assume an installation at the Agaña Substation and show the variance between a building and containerized installation. The two flywheel installations are also assumed to be located at the Agaña Substation and feature a 15 minute and 5 minute energy specification. The differences in lifecycle costs between the use of Agaña Substation and Harmon Substation do not have a significant impact on lifecycle analysis results.

In addition to the quantitative lifecycle cost evaluations, a discussion and comparison of the technologies is also provided including the advantages/disadvantages, environmental impacts, and other important comparison qualities.

7.2.1 Lifecycle Cost Parameters

The following items are included in the lifecycle cost analysis. The final value used for comparison between storage technologies is the Net Present Value (NPV) of the ESS related costs. Common costs for both technologies are excluded from the analysis, but included in the project costs estimates. The common costs include the utility interconnection costs and some of the construction related costs. Note that the lifecycle costs do not include any cash inflows related to the ESS. Any cash inflows are expected to be similar for the purposes of this analysis. Table 7-3 and Table 7-4 show the onetime construction and annual costs used for the analysis.

- ESS Equipment
- ESS Construction
- ESS Shipping
- ESS Building
- Fixed O&M
- Plant Load - Parasitic and auxiliary loads
- Energy Charging – 50 charges per year
- Lifetime – 20 Years
- Rate of Return – 5%
- Energy Costs – $0.30/kW

The lifecycle costs for the flywheel technology systems are divided into two parts for comparison purposes. The reasoning behind the comparison is the system meeting the 40 MW, 10 MWh specification is clearly not cost competitive with other storage system options. A lifecycle analysis of a system with 3.33 MWh (5 minute) shows that it is much more cost competitive, but does not meet the current GPA system requirements.

ESS			Construction		
Technology	Power Rating	Energy Rating	Equipment	Installation	Shipping
Battery/Container	40 MW	10-19 MWh, 15 min	$ 32,000,000	$ 2,900,000	$ 1,312,200
Battery/Building	40 MW	10-19 MWh, 15 min	$ 28,000,000	$ 3,932,500	$ 1,093,500
Flywheel	40 MW	10 MWh, 15 min	$ 67,000,000	$ 12,500,000	$ 1,117,800
Flywheel	40 MW	3.33 MWh, 5 min	$ 30,800,000	$ 7,500,000	$ 546,750

Table 7-3 ESS Lifecycle Construction Cost Variables

ESS			Annual		
Technology	Power Rating	Energy Rating	Fixed O&M	Plant Load	Energy
Battery/Container	40 MW	10-19 MWh, 15 min	$ 640,000	$ 543,120	$ 166,667
Battery/Building	40 MW	10-19 MWh, 15 min	$ 560,000	$ 543,120	$ 166,667
Flywheel	40 MW	10 MWh, 15 min	$ 563,200	$ 5,275,710	$ 176,471
Flywheel	40 MW	3.33 MWh, 5 min	$ 256,000	$ 2,381,625	$ 58,824

Table 7-4 ESS Lifecycle Annual Cost Variables

7.2.2 Lifecycle Cost Results

The net present values for the lifecycle cost analysis can be found below in Table 7-5. The battery based technology ESS, building or containerized installation, shows a clear cost advantage over the the flywheel system with roughly similar specifications. As expected, the reduced energy flywheel system has a much lower NPV compared to the 15 minute system, though it is still significantly higher than the battery-based systems.

ESS			Net Present
Technology	Power Rating	Energy Rating	Value
Battery/Container	40 MW	10-19 MWh, 15 min	$ 51,309,135
Battery/Building	40 MW	10-19 MWh, 15 min	$ 47,277,682
Flywheel	40 MW	10 MWh, 15 min	$ 151,743,795
Flywheel	40 MW	3.33 MWh, 5 min	$ 70,600,614

Table 7-5 ESS Lifecycle Cost Results

Because the NPV difference is large between comparable 15 minute battery and flywheel systems, the following discussion will only focus on the 5 minute flywheel system. The key difference, aside from the NPV, is the energy rating. The total project cost estimates found in the Section 7.3.1 also do not include the 15 minute flywheel system.

7.2.2.1 Cost Differences

The major cost difference between the battery and flywheel (5 minute) systems is found in the estimated costs for installation and the plant load or station service load. The flywheel system is roughly $23.3M more than the NPV of the battery/building system. The NPV difference between the two battery-based systems is roughly $4.0M with the building approach being the most cost effective.

The estimated plant load for an individual flywheel is an average of 7.3 kW. For 125 flywheels at 906 kW, this totals 7,939 MWh per year. The cost of this amount of energy is significant. In comparison, the battery-based system is estimated roughly 210 kW. EPS anticipates that a refined plant load total for a battery system may be higher when suppliers are providing firm quotes in the RFP process. However, changes in this value are not likely to impact the recommendations found in this Report due to the major difference in energy ratings. The energy rate (0.30 $/kWh) has no material impact on the NPV comparisons because the rate is the same for each system.

The costs associated with charging the system after an event are not comparable given the differences in energy capacity. The relative difference in costs is due to the technology's round trip efficiency. The battery technology is expected to be 90% and 85% for the flywheels.

7.2.2.2 Energy

The reasoning for the difference in energy capacity has been discussed. However, two important aspects of the energy ratings are important to consider. First, if five minutes of time is sufficient to start the generation replacement units, then the flywheel option is worthy of consideration. The system would provide for a technically feasible, but costly option.

Second, the costs used for the basis of the battery-based estimate offer a maximum energy capacity of 19 MWh or roughly 28 minutes. For GPA's spinning reserve application, this capacity is more than sufficient. The potential use of this excess capacity is considered below. EPS anticipates that other battery-based systems are available with lower energy capacities and therefore may offer additional cost savings.

7.2.2.3 Additional Functionality

Given the energy capacity of the flywheel system, the system does not offer any other functionality other than potentially voltage regulation. However, the battery-based system does offer additional functionality beyond the core spinning reserve function and voltage regulation. With the excess energy capacity available, some frequency regulation functionality could be used. The target state of charge for the system would be lowered to allow for frequent charging and discharging within a programmed energy deadband. Minor frequency deviations would be smoothed out and potentially providing some power system-wide benefit. Outside of this frequency regulation deadband would be enough dedicated energy storage capacity to provide for roughly 15 minutes of spinning reserve capacity.

7.2.2.4 System Lifetime

The lifetimes of both systems are expected to be roughly 20 years. The flywheel systems appear to be fairly robust and may have a longer life. The battery system's lifetime can vary greatly depending on how the system is used and how it is maintained. Using a battery system exclusively for GPA's spinning reserve application should provide for a 20+ year system. The estimated number of deep cycles is not large enough to have an impact on the batteries. It is possible that other system equipment such as the inverters may reach the end of their lifetime first.

7.2.2.5 Maintenance & Environmental

The maintenance requirements for the battery systems are higher from an annual cost perspective than the flywheels. The flywheels require little maintenance but other ancillary equipment such as cooling systems and the power modules also require some maintenance. The battery system maintenance costs are based on maintenance provided by the manufacture.

The maintenance for battery-based systems can vary greatly. As previously discussed, the estimated number of deep cycles is relatively low. The main advantage to this is that there is reduced maintenance and likelihood for battery replacement. No replacement costs are included in the maintenance costs. The more a battery is used (cycled), the more its life expectancy is reduced and requires more maintenance. Some systems require battery replacement programs to maintain a sufficient level of performance.

For this spinning reserve application, no battery replacement is anticipated with the use of lithium-ion or advanced lead-acid battery technologies. The use of lithium-ion batteries opens up the potential for other functionality such as frequency regulation as previously discussed. It is likely that most advanced lead-acid technologies would not allow for additional functionality unless a battery replacement program was in place.

From an environmental impact standpoint, neither of the systems are a major concern. The flywheels pose very little potential impact compared to the electro-chemical-based battery systems. Since the batteries are not expected to need replacement, large-scale disposal costs only need to be accounted for at the end of the lifetime of the system. With a battery-based system, a maintenance agreement with the manufacturer should be considered. This helps to place the onus for any environmental waste and disposal, as well as for the performance of the system on the manufacturer.

7.2.2.6 Space Requirements

The space requirements can vary quite a bit between battery-based and flywheel-based systems. The difference is mostly found in the type of installation. Battery systems can be partially indoor or completely outdoor systems. Flywheel systems are practically limited to outdoor installations. The space requirements for outdoor systems are fairly comparable using containerized battery systems. If a building is utilized for a battery installation, then the total footprint can be reduced. However, additional costs are incurred related to the building and its requirements.

7.3 Project Cost Estimates & Scheduling

7.3.1 Project Cost Estimates

Table 7-6 below provides the summary of building either a building battery-based battery system, containerized battery system or a 5-minute flywheel system at each of the three (3) proposed locations: Agaña Substation, Harmon Substation, and Marbo Substation. It can be seen that the least-cost ESS configuration is a building-based battery system in Agaña Substation. For the containerized battery and flywheel configurations, Marbo Substation is the least-cost location, while Agaña Substation is the highest cost due to the costs associated with the demolition and environmental cleanup of the existing building. When comparing the type of ESS, building-based battery systems are consistently the least-cost, while a 5-minute flywheel system is the highest cost.

	Type of ESS		
Location	Battery – Building Based	Battery – Containerized	Flywheel – 5-Minute System
Agaña Substation	$49.6 Million	$54.1 Million	$57.6 Million
Harmon Substation	$50.8 Million	$53.2 Million	$56.7 Million
Marbo Substation	$50.6 Million	$52.9 Million	$56.5 Million

Table 7-6 Cost Estimate Summary – Type of ESS and Location

Table 7-7 provides a glimpse of the relative cost magnitudes of elements associated with building an energy storage facility on the three (3) sites. As can be seen in the table below, direct ESS costs which include the equipment, shipping, and installation are the highest regardless of the location dwarfing the rest of the project elements whose total cost is less than $5 million.

The Environmental Cleanup costs on the sites are comparable for both Agaña and Marbo, while Harmon is not expected to require cleanup because of the absence of existing structures. The relatively high utility connection cost at Marbo is due to the distance of the existing GWA water and sewer lines to the facility. This cost could be lowered if active water and sewer lines could be found within the facility. If so, the lines will probably be military-owned since properties adjacent to Marbo substation are military-owned and permission from the military may be required before connecting to those lines. The high electrical connection costs for Harmon is due to the need for the installation of a circuit breaker in a vacant slot in the existing substation.

Detailed budgetary cost estimates for the three (3) properties with the three (3) ESS configurations are attached as Appendix E to this report.

	Sites		
Item	**Agana Substation**	**Harmon Substation**	**Marbo Substation**
Pre-Construction (Mobilization, Site Preparation, Erosion Control)	$ 379,476	$391,569	$388,662
Environmental Cleanup	$350,000	$0	$204,000
Energy Storage System	$ 33,026,000 - $ 38,846,750	$ 34,238,500 - $38,346,750	$34,238,500 - $38,346,750
Utility Connection – Sewer and Water	$ 62,600	$ 108,000	$ 453,400
Electrical Connection to GPA Grid	$ 2,960,000	$ 2,960,000	$ 2,310,000
Other Utilities and Items (e.g. Access Road, Chain Link Fence, Storm Drainage	$ 407,658	$ 543,550	$ 367,485

Table 7-7 Cost Estimate Breakdown Summary

7.3.2 Scheduling

TGE/EPS has prepared project schedules for a battery-based and flywheel-based system. Although the schedules assumes a facility that is constructed in Agaña Substation, the overall project duration to build the proposed facility at either Harmon Substation or Marbo Substation is not expected to vary significantly since the long-lead items are related to ESS production and delivery to the site. Comparing the schedules, it can be seen that a battery-based system is estimated to take approximately 15 months to complete from Notice to Proceed (NTP) while 19 months is needed to complete the flywheel-based system from NTP. The difference is mainly due to the longer production times of the flywheels as compared to the batteries.

Project schedules are included as Appendix F.

8 Recommendations and Conclusions

8.1 Energy Storage Technology

Based on the required ESS specifications, results of the lifecycle cost analysis, and other technical characteristics, a battery based ESS is recommended. The lifecycle cost comparison to a reduced energy flywheel system indicates a NPV difference of $23.3 M. This is a large difference and shows that, at this time, flywheel systems do not compete with battery based systems.

Lithium-ion or advanced lead-acid technologies are expected to be the most viable battery options at this time, for this spinning reserve application. Both technologies have a relatively long history, proven track record, and large number of installed systems compared to other technologies. The costs presented in this report are believed to be representative of all the available cost competitive battery technologies.

EPS recommends that the RFP created for GPA's ESS project will be broad enough in scope and technical specifications that a number of proposals will be provided. This will allow for all serious and competitive suppliers, regardless of specific energy storage technology, to respond and offer their best system considering cost, performance, and availability. Given the evolving storage technologies available and in development, especially battery chemistries, it would not be prudent to target a specific battery technology, or even to rule out a flywheel based system.

The final and most critical ESS evaluation will be based on the costs and other information provided in the proposals in response to the RFP. The proposals will reveal more accurate equipment pricing, delivery schedules, and system installation requirements. Additional insight will be given specific to the state of each technology and other information which may have an impact on the lifecycle costs such as parasitic loads, maintenance schedules, and supplier provided maintenance agreements.

EPS also recommends that the energy requirements of the ESS be confirmed and/or re-evaluated. The transient studies clearly show that the power specification of 40 MW is sufficient for the system given the current study assumptions. However, the energy requirements are solely based on the time it takes to start additional generation. It is critical, going into the RFP process, to have a firm understanding of the minimum energy requirements. It is also important to know that if additional energy is available for proposed systems, what value this energy has to the GPA system. EPS anticipates that some proposed systems may have energy rating above the minimum requirement. Depending on the type of storage technology, this excess energy could be used for frequency regulation and be of value to the GPA system.

8.2 Energy Storage Siting

Based on the project siting analysis, Agaña Substation appears to have the edge over Harmon and Marbo Substations for the proposed ESS facility. The difference in costs between the three locations is negligible given the budgetary nature of the cost estimates. This conclusion also considers the cost differences between the building-based and container-based systems.

The advantage Agaña has over Harmon and Marbo is more usable space and a potential in cost savings if a building-based system is ultimately preferred. The extra space could potentially allow for more installation options and accommodate future expansion of the facility. From a performance standpoint, Agaña or Harmon Substation locations are preferred over other locations that provide ESS connections to the 35 kV system. Based on the aforementioned reasons, the use of Agaña Substation is recommended for the ESS.

Siting the ESS at Agaña Substation has the potential to take advantage of an existing structure to house the system. The existing structure, formerly a power plant, could be retrofitted and renovated to house some of the system components. The use of this structure is highly dependent on the space requirements and type of storage technology chosen for acquisition. Many technologies are supplied in environmentally controlled modules prepared for shipping and installation and do not require a building. Some technologies also have specific installation requirements such as below ground flywheels and battery chemical storage.

The utilization of any existing structure must take into account the complete cost and benefit of the use. Battery-based systems not utilizing containers or modules will require additional attention. The building requirements may vary by battery chemistry, but will likely require sophisticated HVAC and fire detection and suppression systems. Portions of the system may be divided up with fire walls to limit equipment damage and increase safety.

Other siting considerations include the potential for ESS expansion and dividing the ESS into multiple locations. Expanding an ESS is possible and, if planned for, may be an effective approach as opposed to adding a new ESS at a different location. As previously discussed, many systems are provided in containers forming an inherent modular design. Based on the spatial requirements listed in Section 7.1.1, a 40 MW facility could be expected to require an approximate area of 57,000 SF. That translates to approximately 1,425 SF/MW. Based on evaluation of the three (3) sites, the table provides an estimate of the potential for expansion based on the remaining available area after the construction of the 40 MW facility:

Location	**Available Area (SF)**	**Additional MW Capacity = Available Area /1,425**
Agaña Substation	53,000	37
Harmon Substation	13,000	9
Marbo Substation	25,500	18

Table 8-1 Potential Expansion of ESS Capacity for Three Sites

Depending on the timing of a potential expansion and the state of storage technology, it may or may not be prudent to integrate a new system into the initial system. It may be more beneficial to treat an expansion as a new ESS, even if co-located. Considerations including transformer capacity and the number of transformers and breakers must be made for the utility connection in order to account for loss and reliability issues. An evaluation of the cost estimates for the three (3) locations indicate that on average, it would cost $1.26 Million/MW for a building-based battery ESS, $1.34 Million/MW for a containerized battery ESS, and $1.42 Million/MW for a 5-minute flywheel system.

Dividing the initial ESS into two locations has some merit and should be considered. The main disadvantage to this approach is increased cost, plus there is no technical requirement for multiple locations. Some of the installation related benefits include alleviating space constraints at existing properties and allowing for staged construction. Staging the construction could decrease the time required to complete the initial portion of the system at one site allowing an ESS to contribute to the performance and reliability of the system sooner. Following the initial portion and location of construction, the second stage of construction would be completed providing all of the required ESS capacity.

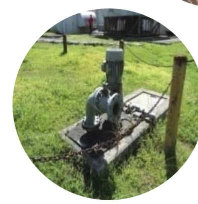
From a technical standpoint, the benefits of two ESS locations would provide for increased system performance and may impact future generation requirements. Using an ESS for voltage regulation will improve the system voltage profile and multiple locations will provide for further improvement and a reduction in losses. Using voltage regulation may be useful as GPA transitions to a different generation mix including the retirement of existing units, changing fuel sources, and adding new units. It's possible that the additional voltage regulation capabilities of the ESS will allow for additional unit cycling and aid in the prevention of voltage collapse.

8.3 Other Recommendations and Conclusions

The transient study results and conclusions found in the Feasibility Study and Operations Study are sensitive to the renewable energy frequency and voltage ride-through characteristics assumed for the studies. The need for improving the ride-through characteristics of renewables to levels similar to conventional generation and beyond the IEEE 1547 restrictive specifications is a known issue for islanded or isolated utilities. It is important for GPA to have a clear understanding of the ride-through characteristics of the existing and future renewable energy sources found within the system.

Past studies and discussions have indicated some potential need for additional voltage support for the system. Based on the unit commitment and dispatch levels, UFLS scheme, and performance criteria used for the Feasibility and Operations Studies, it does not appear that any additional voltage support is necessary. Additional support may become necessary if the number of units online is reduced, such as during unit cycling at times with high renewable output, and / or if the system power factor is reduced by a relatively large amount.

APPENDICES



APPENDIX A – PHOTOS

Agana Substation Photos

Agana Power Plant - Southern End Looking West

Agana Power Plant - Southern Portion Looking East

TG ENGINEERS, PC
CIVIL ENGINEERING, PLANNING, CONSTRUCTION MANAGEMENT & LAND SURVEYING

Email: torg@tg-engr.com
Tel: (671) 647-0808/28/33
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SHEET TITLE: AGANA SUBSTATION PHOTOGRAPHS

PREPARED BY: AJ

PROJECT TITLE: ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY STUDY

Agana Power Plant - Eastern End Looking West

Agana Power Plant - Northern Portion Looking West

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SHEET TITLE: **AGANA SUBSTATION PHOTOGRAPHS**

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PROJECT TITLE: **ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY STUDY**

Agana Power Plant - Western End Looking East

Southern End of the Building - Outside

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SHEET TITLE: **AGANA SUBSTATION PHOTOGRAPHS**

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Existing Substation East of Building

Eastern End of Building - Outside

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34-5 kV Substation East of Building

115kV Substation and Existing Fuel Tanks

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SHEET TITLE: **AGANA SUBSTATION PHOTOGRAPHS**

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Northern End of Building - Outside

Isometric View -Taken from Northwest of Building

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SHEET TITLE: **AGANA SUBSTATION PHOTOGRAPHS**

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Western End of Building - Outside

TG ENGINEERS, PC CIVIL ENGINEERING, PLANNING, CONSTRUCTION MANAGEMENT & LAND SURVEYING	SHEET TITLE: **AGANA SUBSTATION PHOTOGRAPHS**	PREPARED BY: AJ
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Harmon Substation Photos

Eastern End Looking South

Eastern End Looking North

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SHEET TITLE: HARMON SUBSTATION PHOTOGRAPHS		PREPARED BY: AJ
PROJECT TITLE: ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY STUDY		SHEET NO. 1 OF 3

Eastern End Looking West - Existing Substation

Eastern End Looking Northwest

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SHEET TITLE: **HARMON SUBSTATION PHOTOGRAPHS**

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PROJECT TITLE: **ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY STUDY**

Northern End Looking South - Existing Substation

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SHEET TITLE: HARMON SUBSTATION PHOTOGRAPHS

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PROJECT TITLE: ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY STUDY

Marbo Substation Photos

Northern End Looking South

Western End Outside

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SHEET TITLE: **MARBO SUBSTATION PHOTOGRAPHS**

PREPARED BY: AJ

PROJECT TITLE: **ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY STUDY**

Southern End Looking North

Southern End of Structure

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SHEET TITLE: **MARBO SUBSTATION PHOTOGRAPHS**

PREPARED BY: AJ

PROJECT TITLE: **ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY STUDY**

Isometric - Taken Southeast of Structures

Eastern End

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SHEET TITLE: **MARBO SUBSTATION PHOTOGRAPHS**

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PROJECT TITLE: **ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY STUDY**

Eastern End Looking West

Interior Southern Building

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Email: torg@tg-engr.com
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SHEET TITLE: **MARBO SUBSTATION PHOTOGRAPHS**

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PROJECT TITLE: **ENGINEERING & TECHNICAL SERVICES FOR ENERGY STORAGE FEASIBILITY STUDY**

APPENDIX B – MODELING & SIMULATION RESULTS

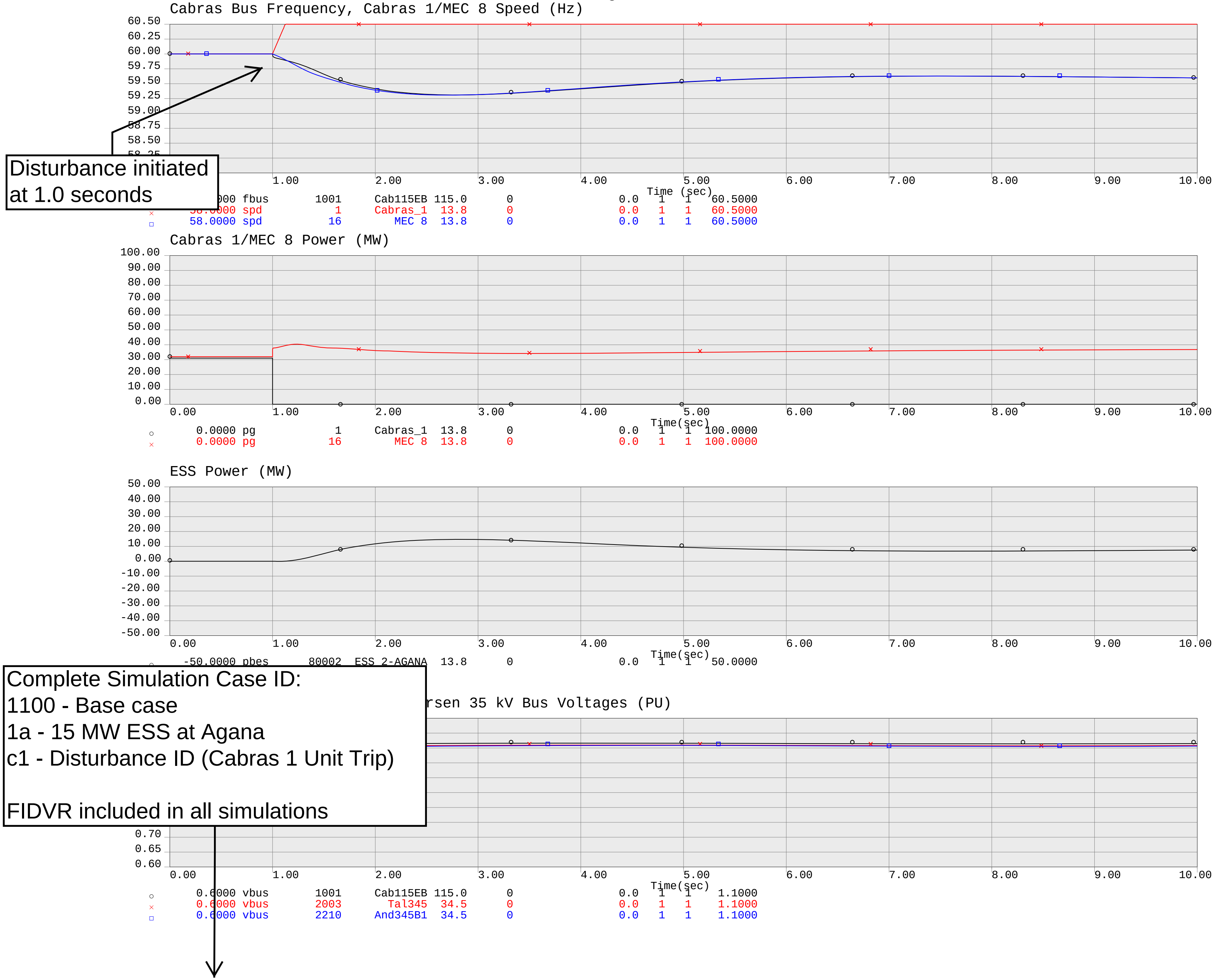
B.1 FEASIBILITY SIMULATION PLOTS, EXISTING UNITS

B.2 FEASIBILITY SIMULATION PLOTS, NEW UNITS

B.3 OPERATIONS STUDY SUMMARY RESULTS

B.4 OPERATIONS STUDY SIMULATION PLOTS

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



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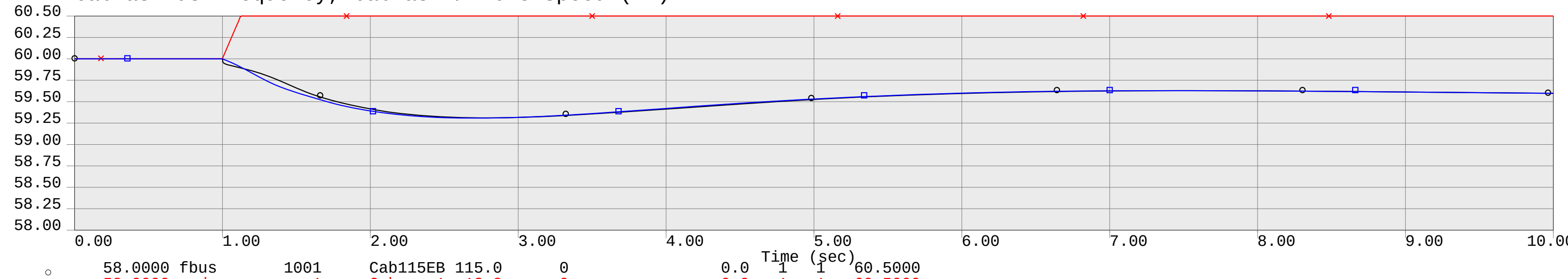
Fri May 23 10:22:17 2014

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



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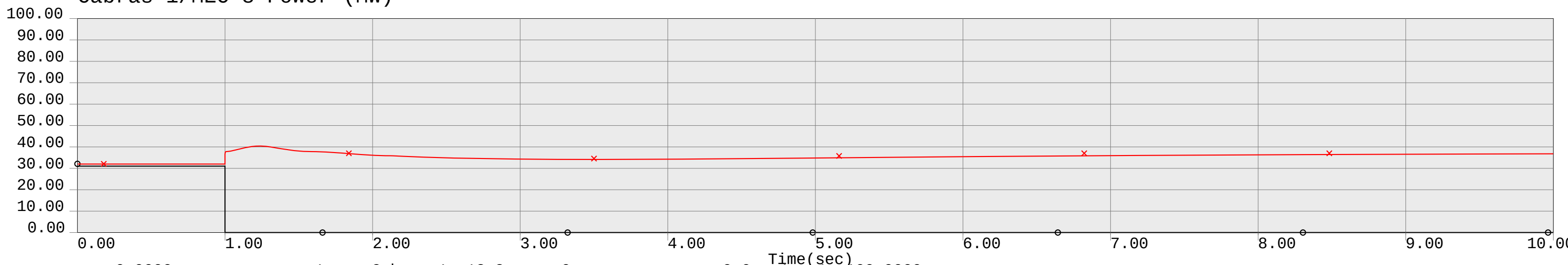
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



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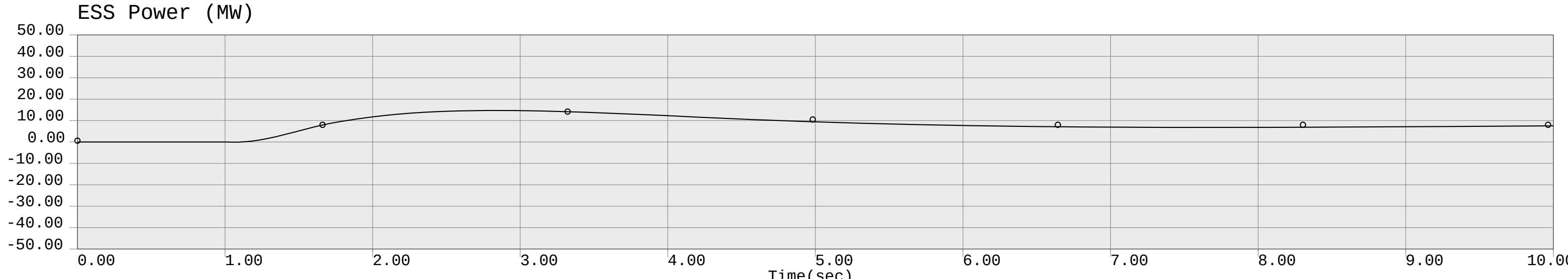
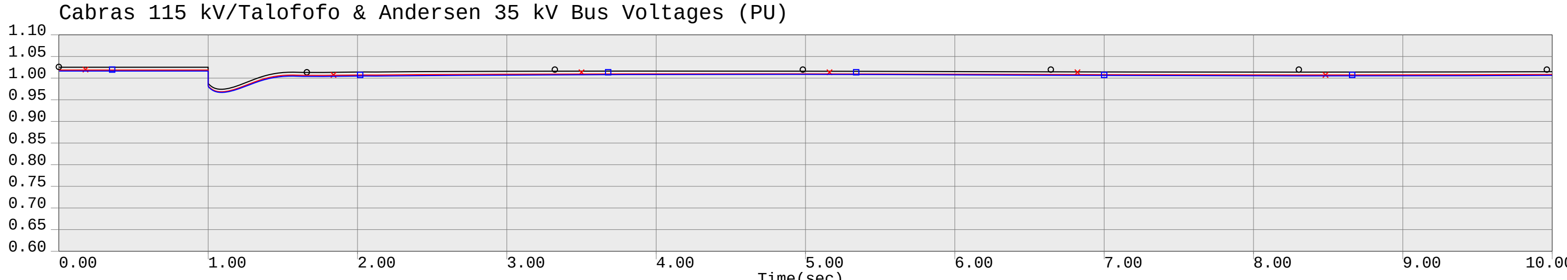
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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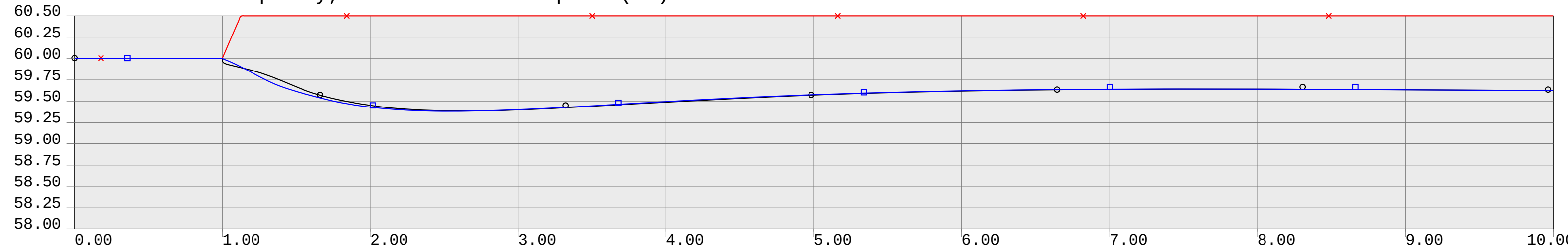
Fri May 23 10:22:17 2014

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



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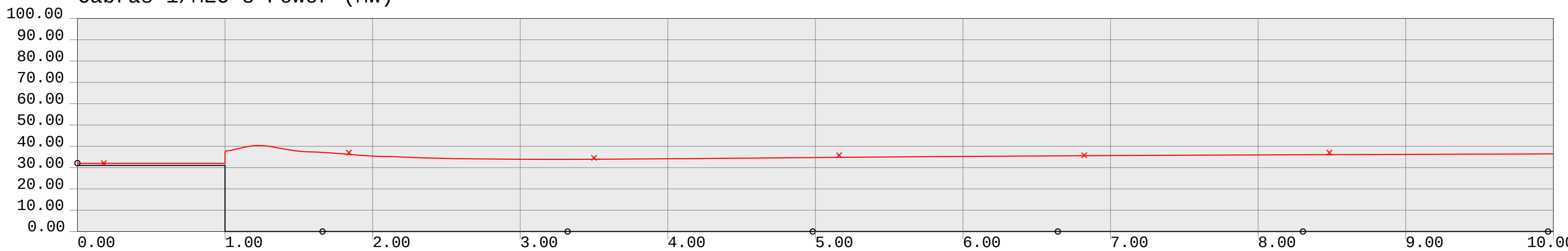
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



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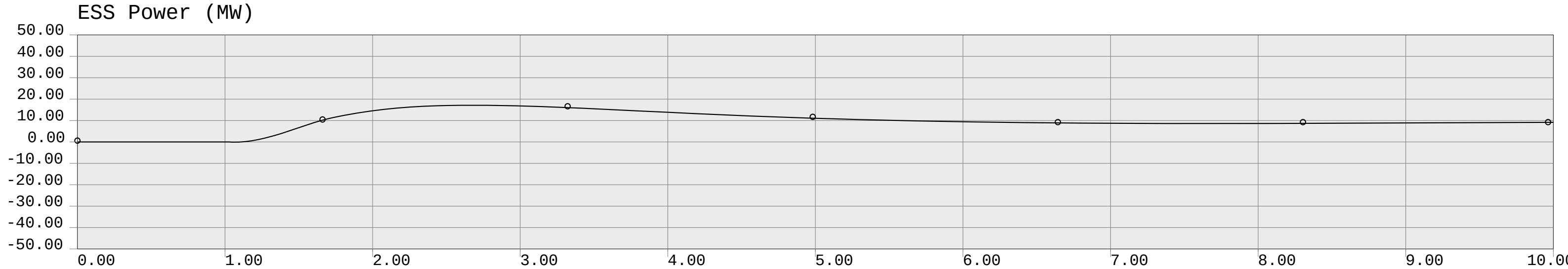
ESS Power (MW)



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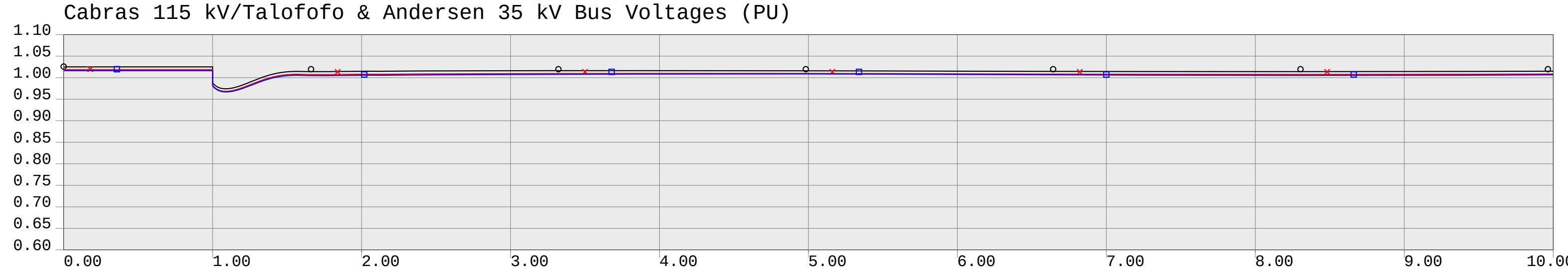
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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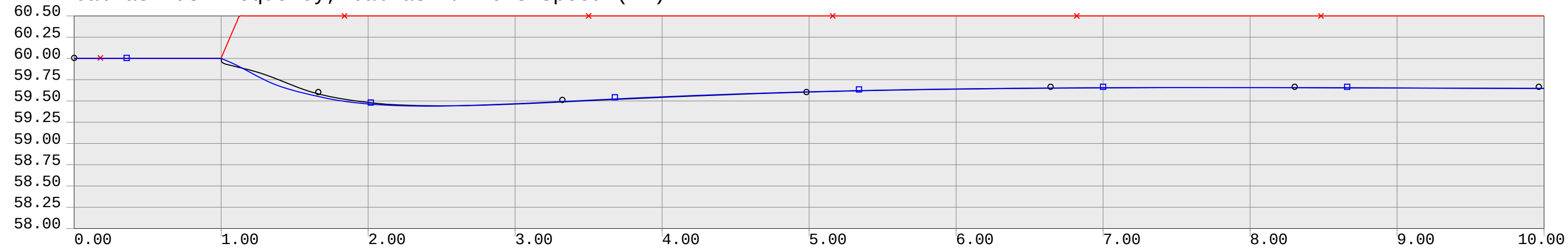
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

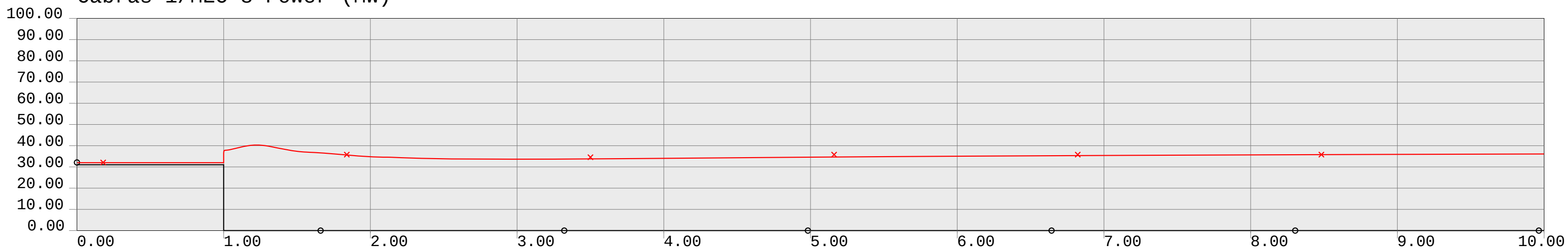
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



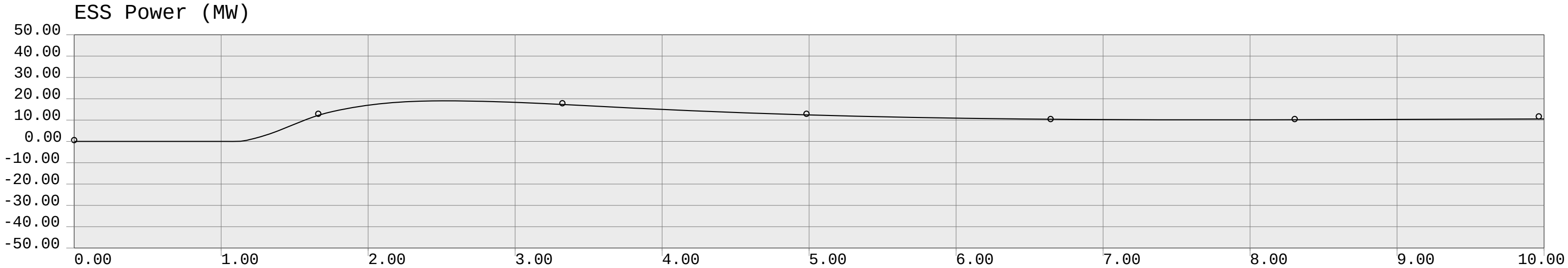
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



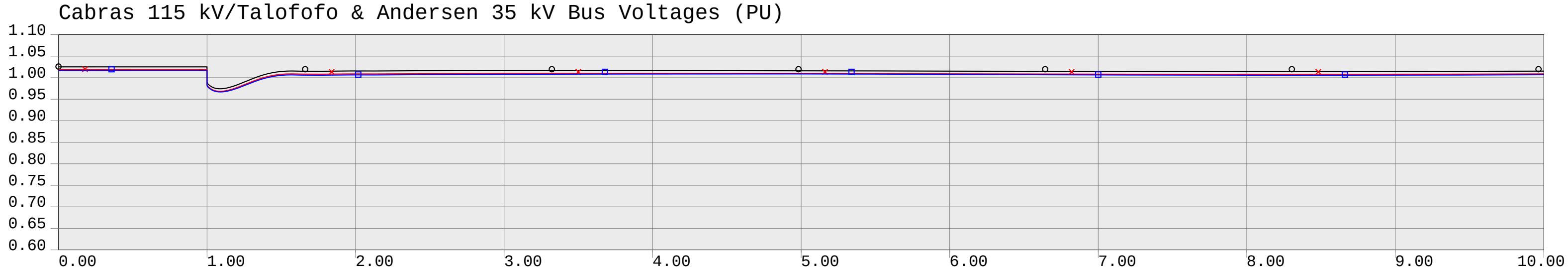
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

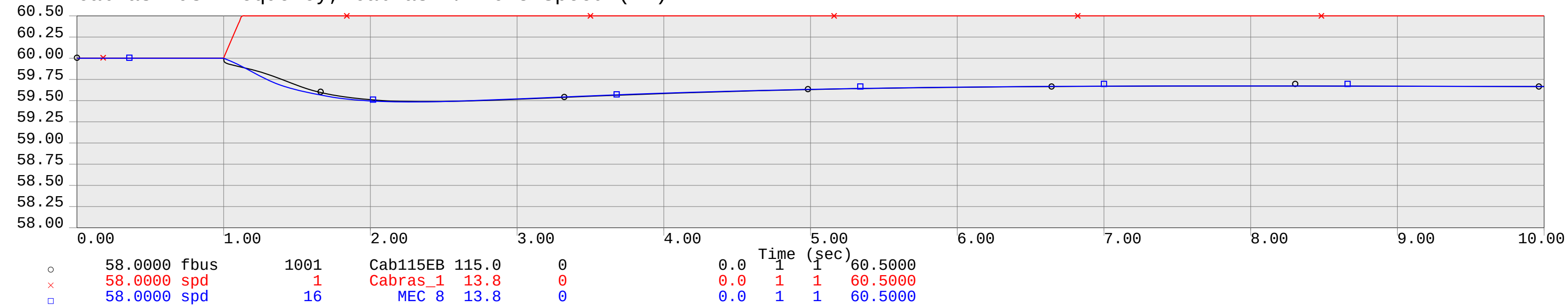
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



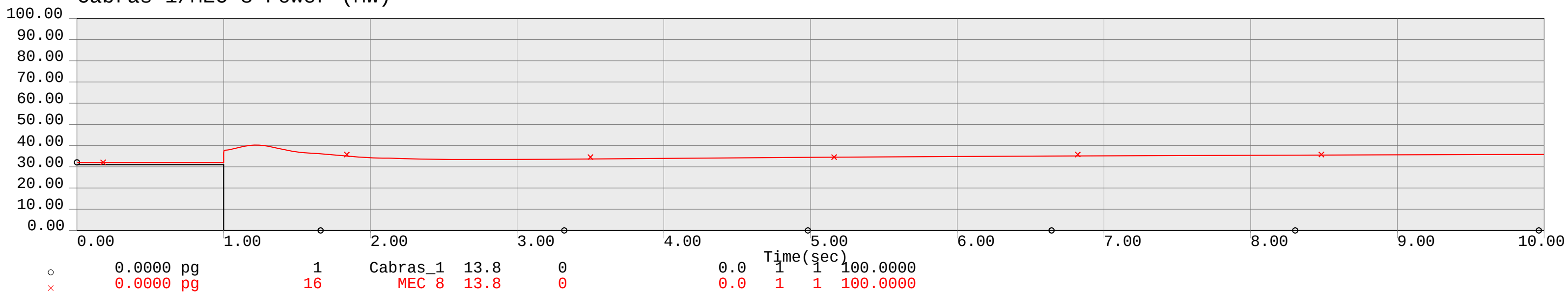
○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

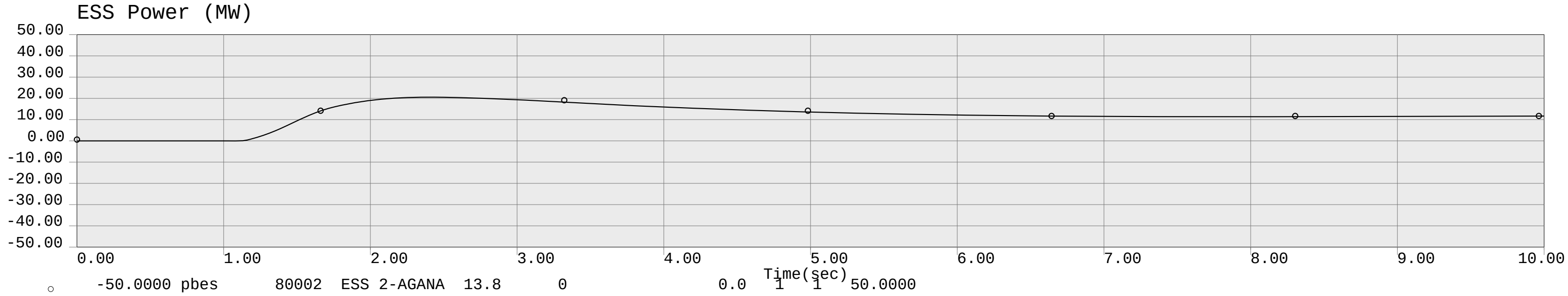
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



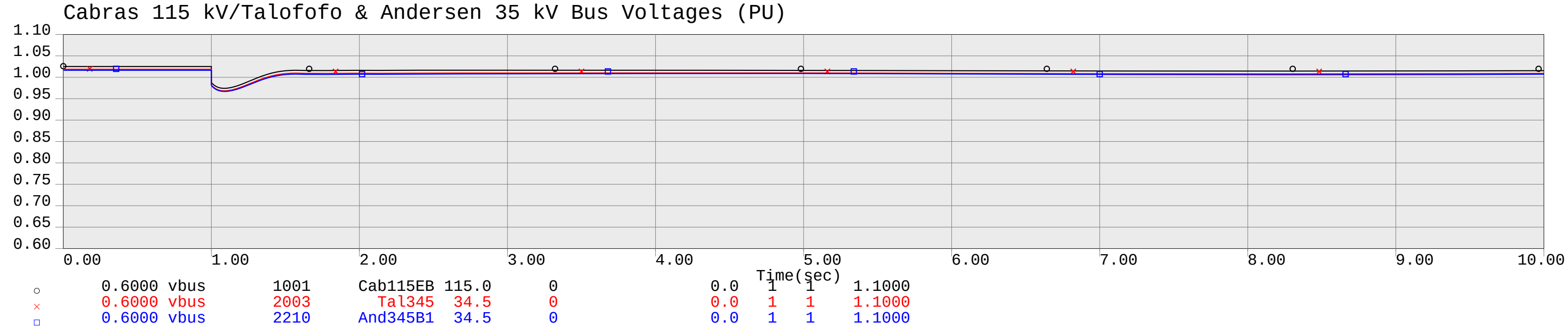
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)

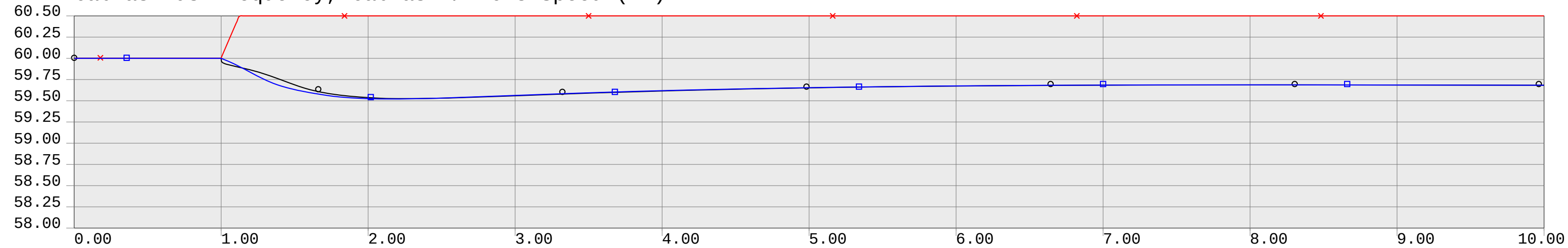


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



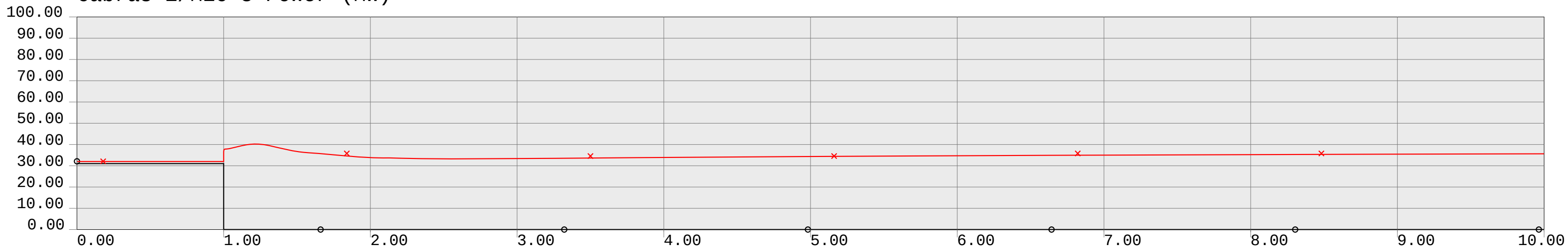
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



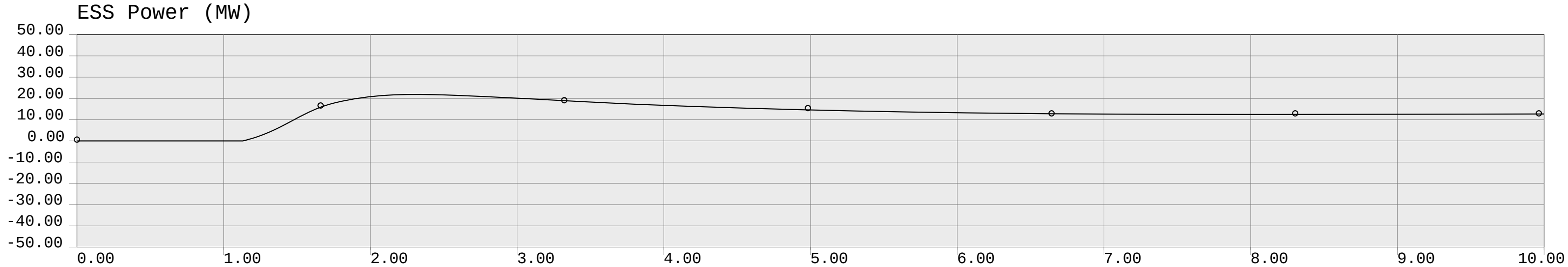
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



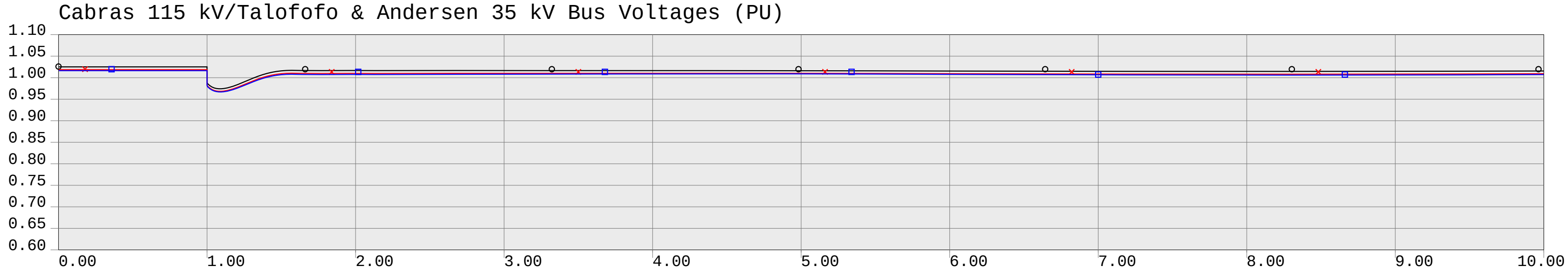
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

Guam Power Authority - EPS Energy Storage Analysis
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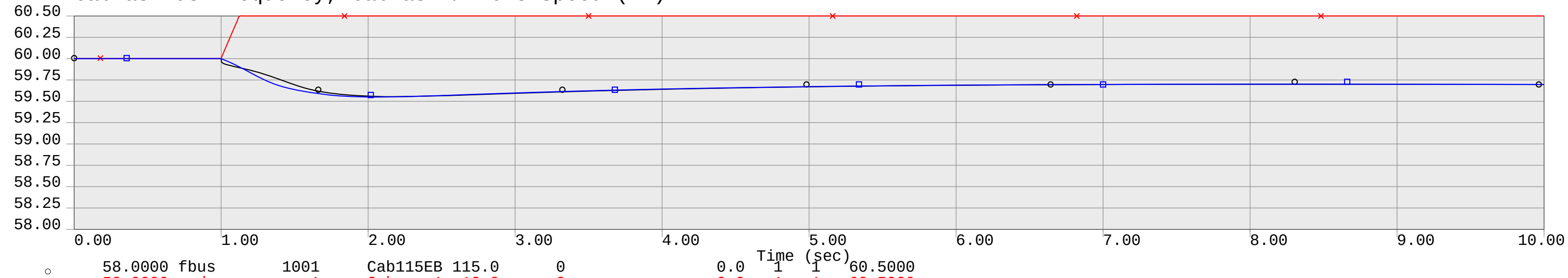
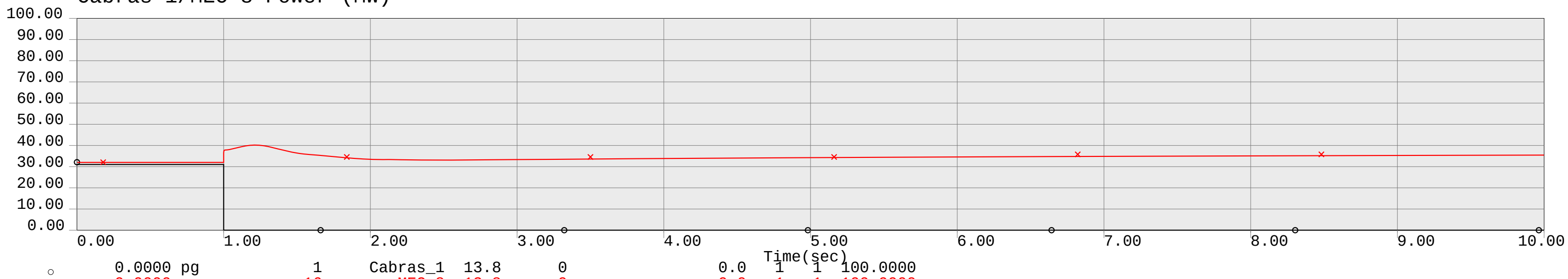
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



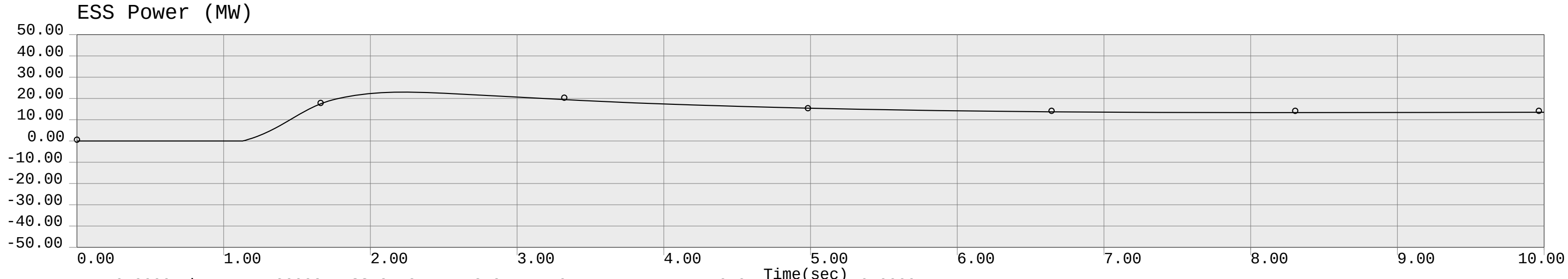
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



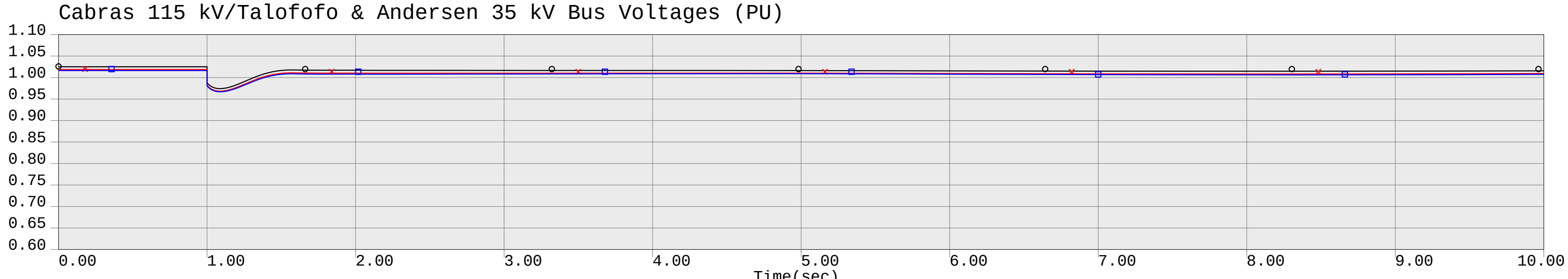
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

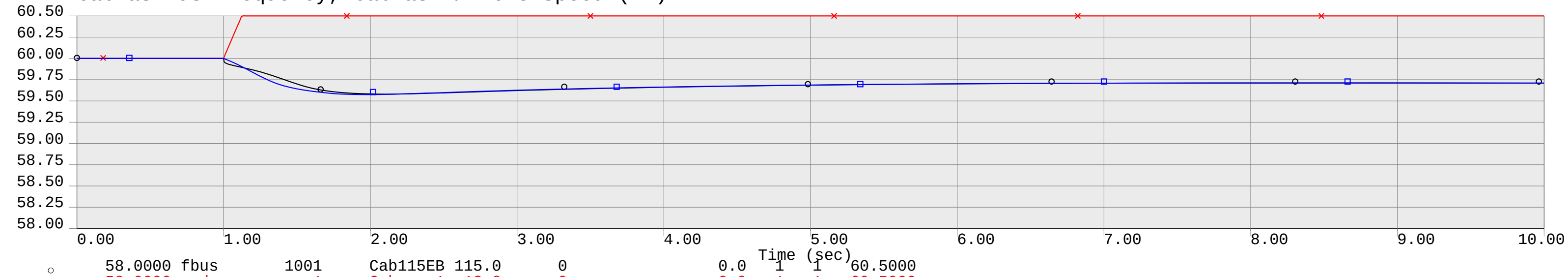
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

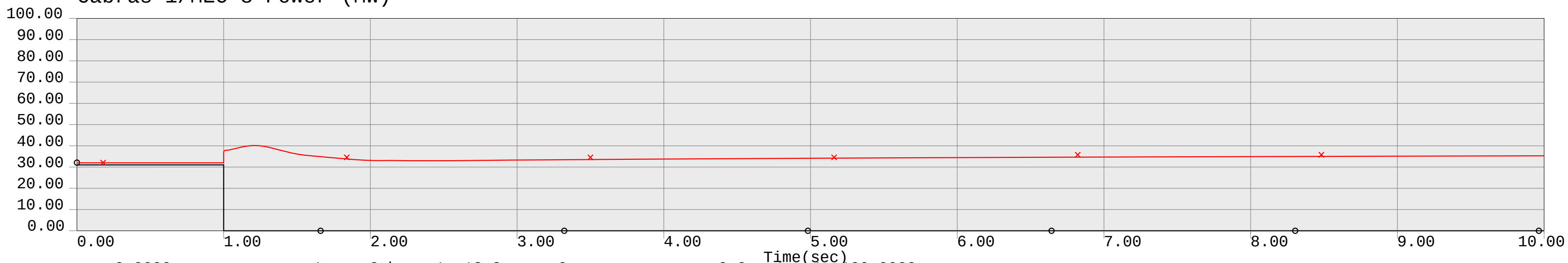
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



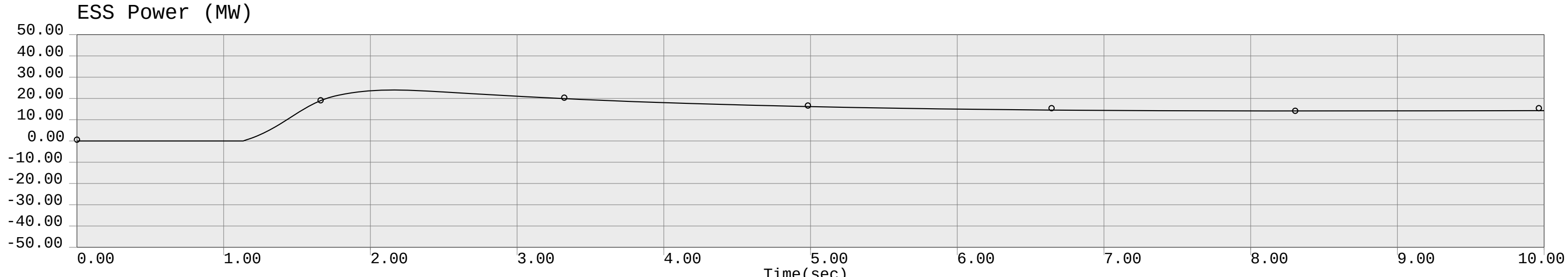
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



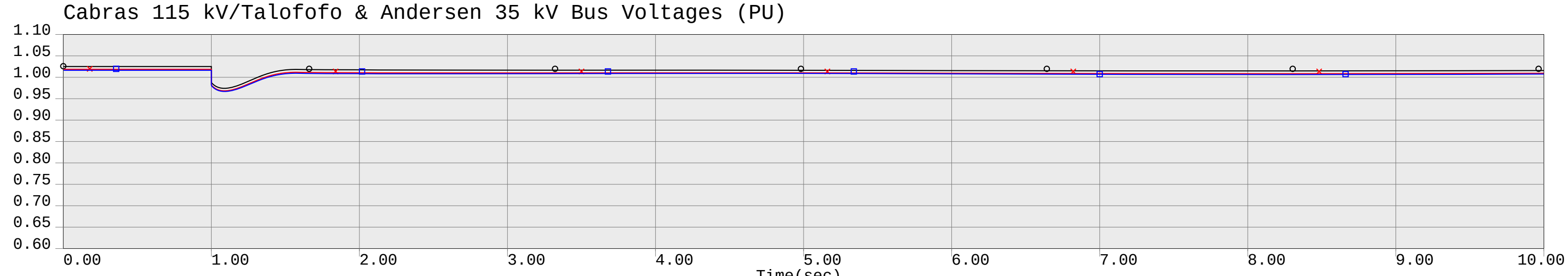
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

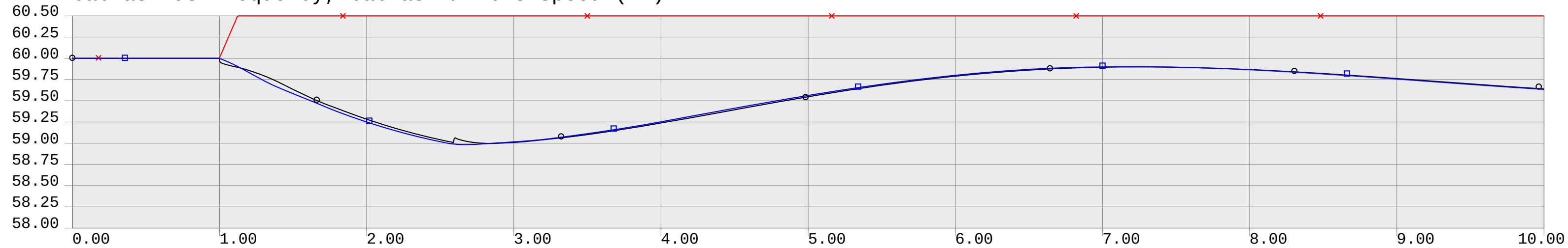
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

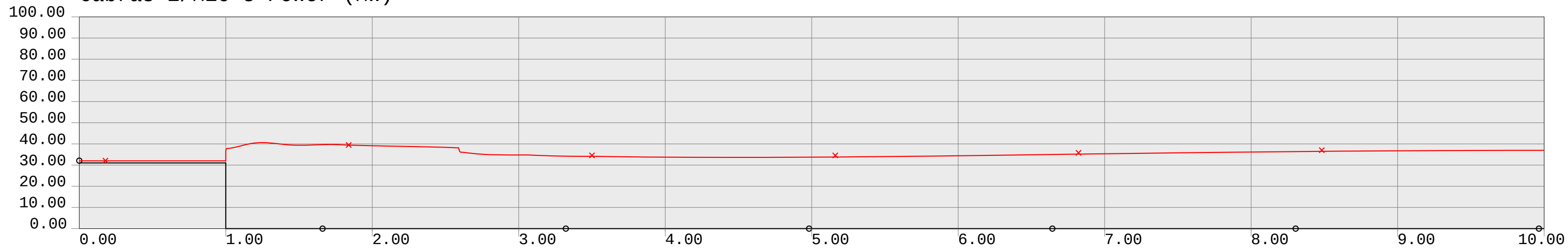
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



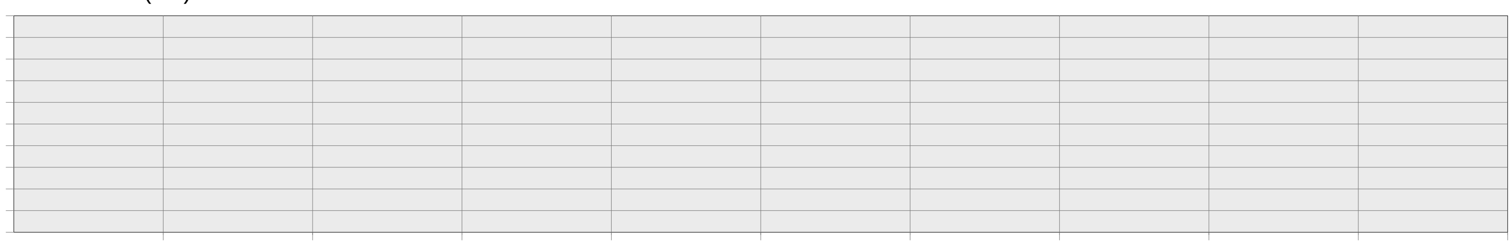
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)

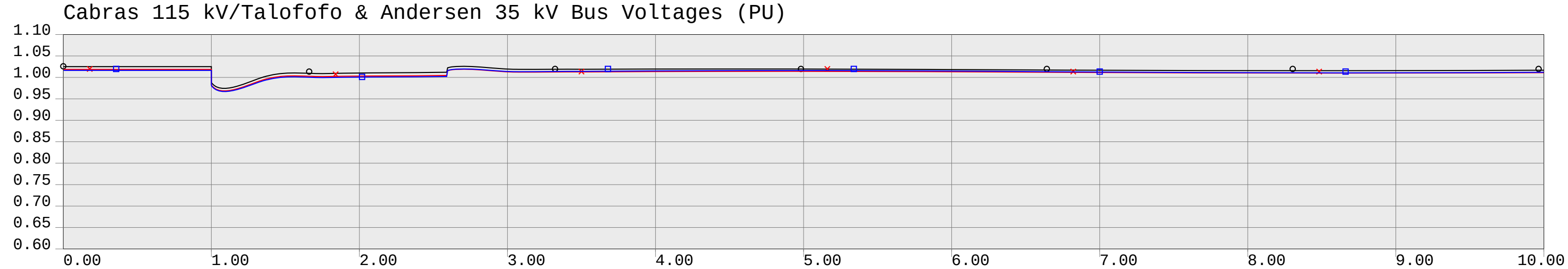


0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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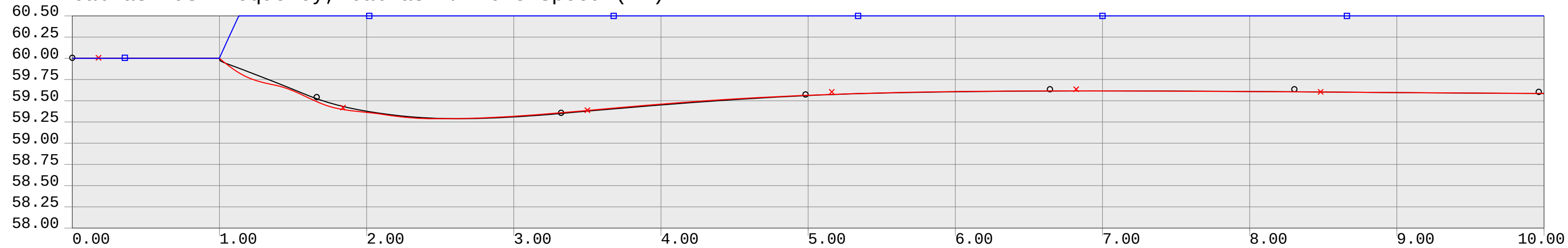
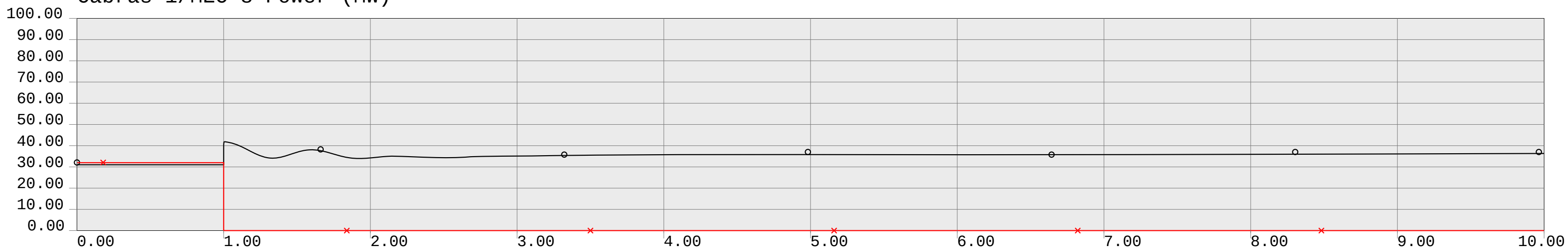
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



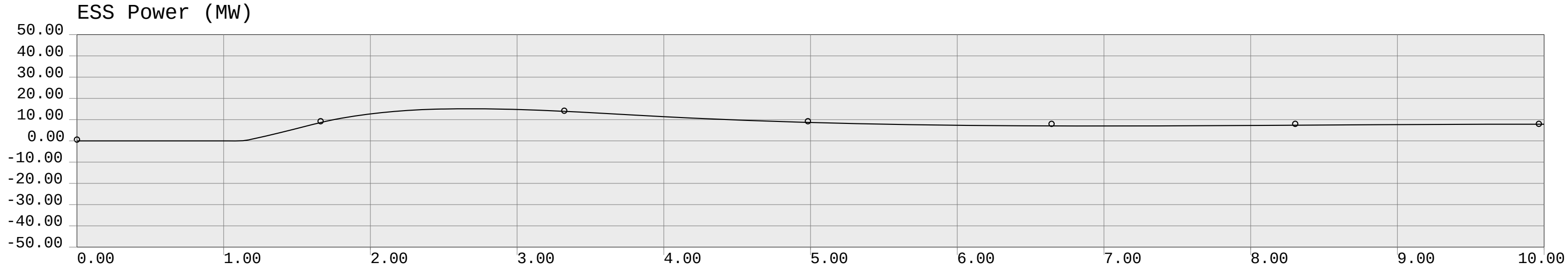
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



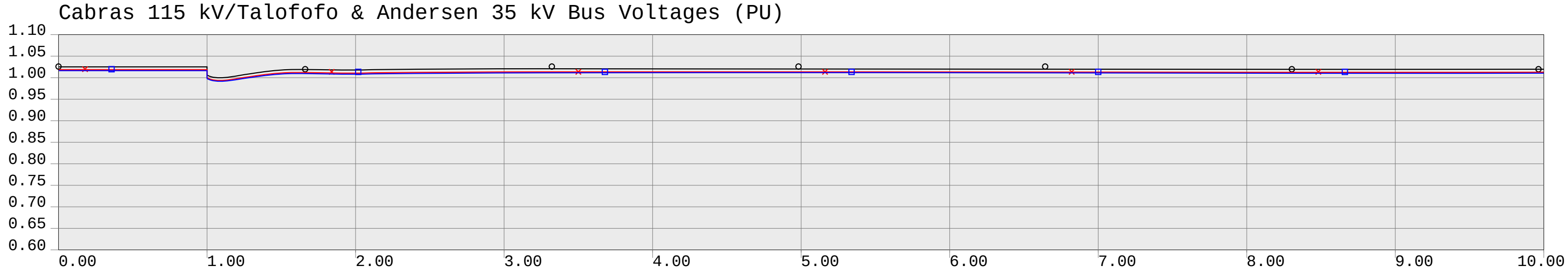
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

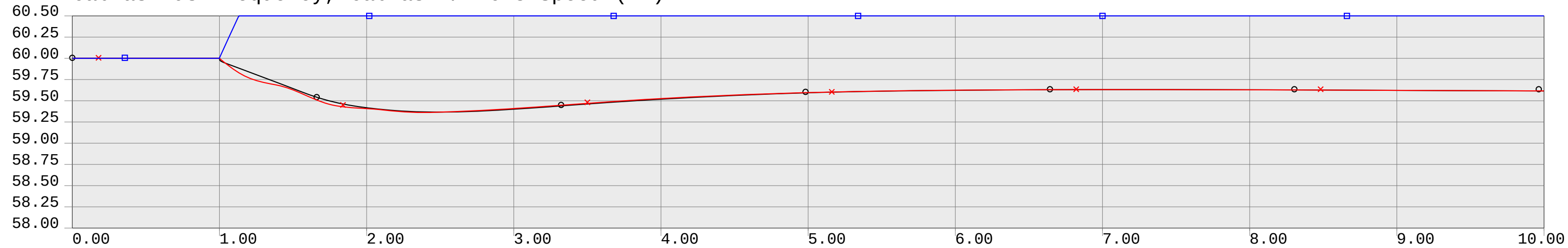
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

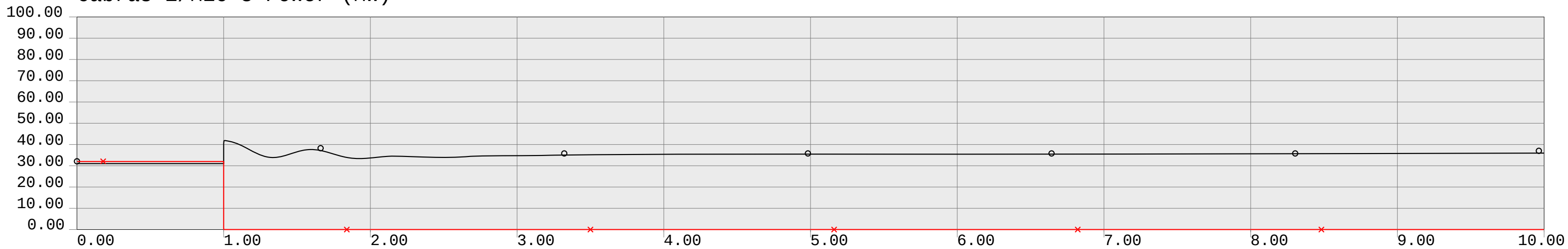
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



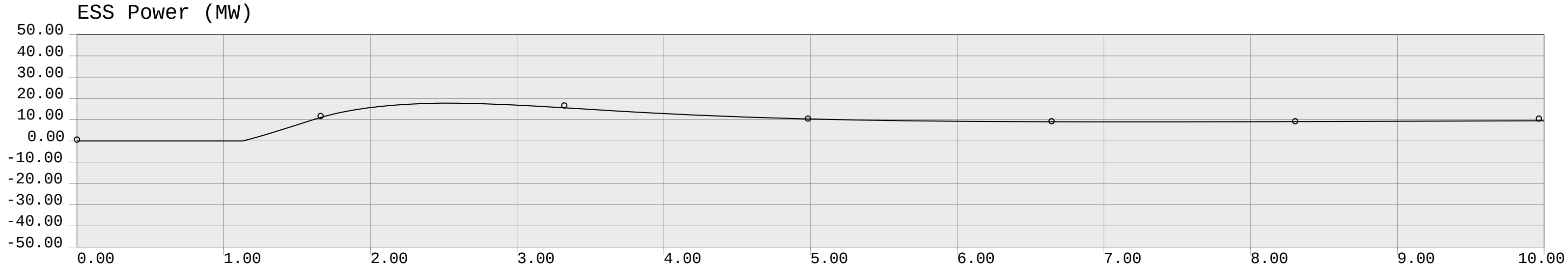
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



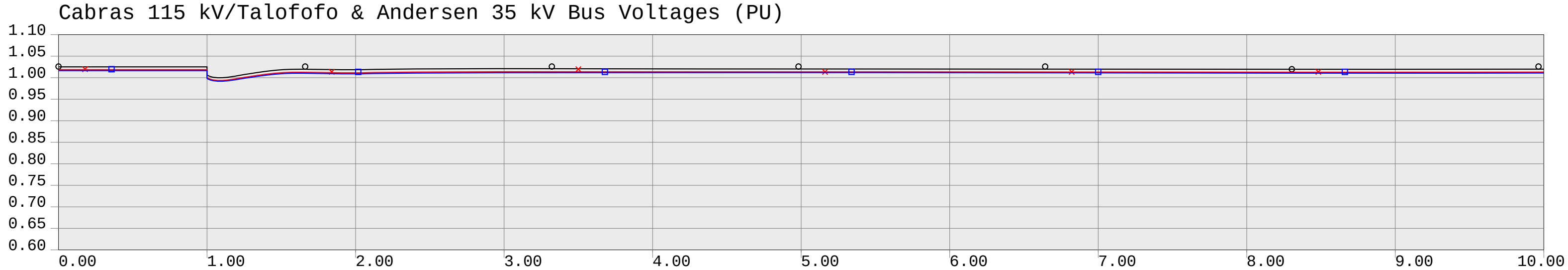
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

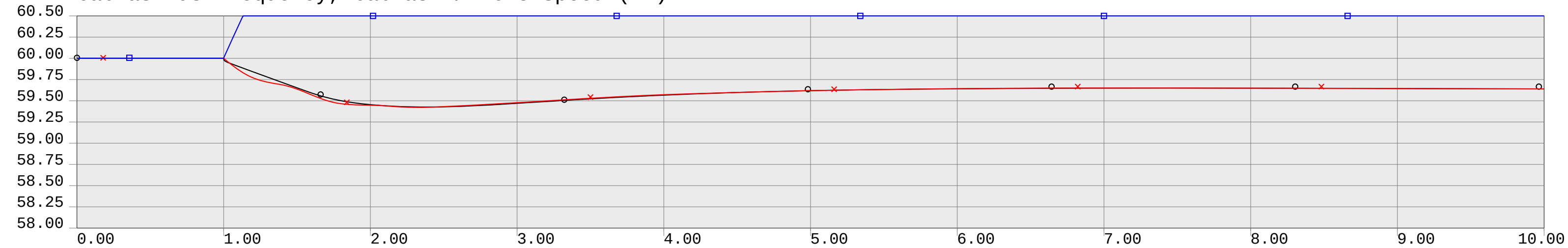
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

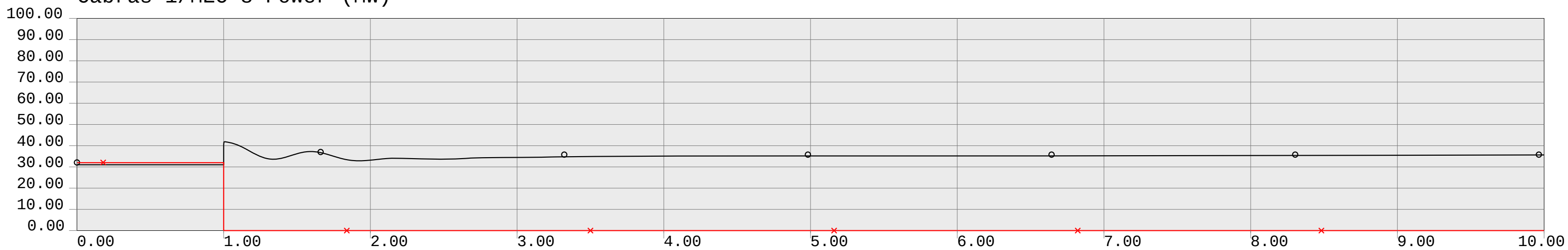
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



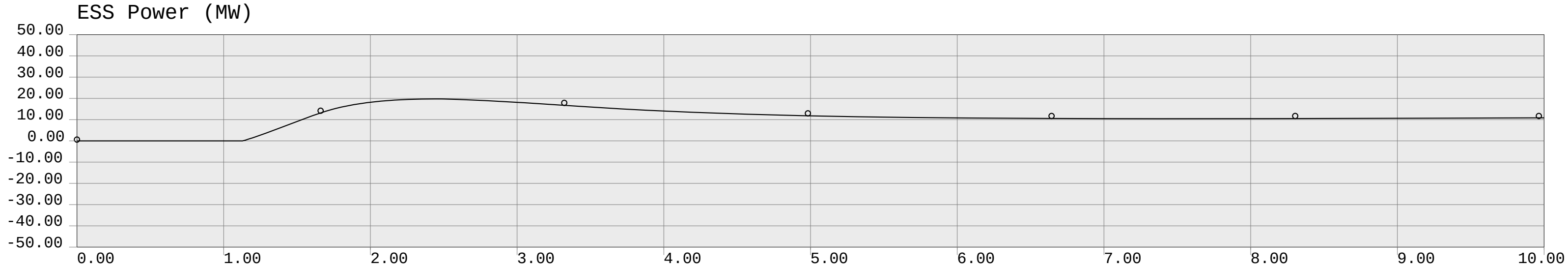
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



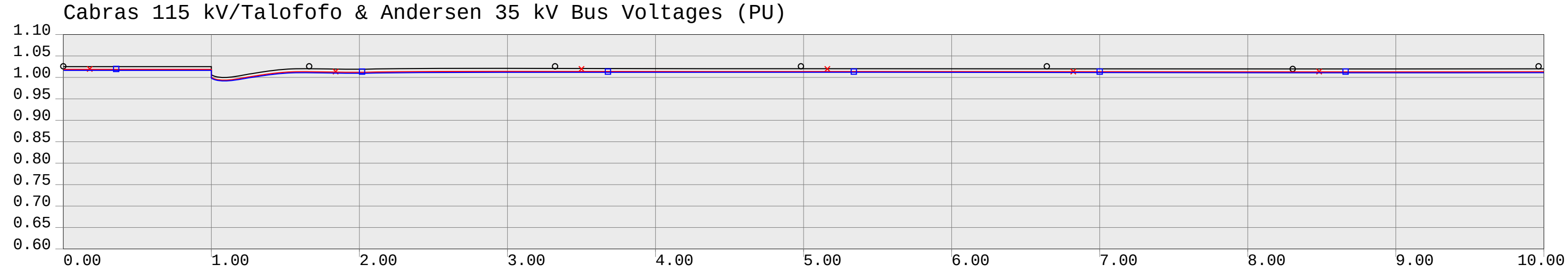
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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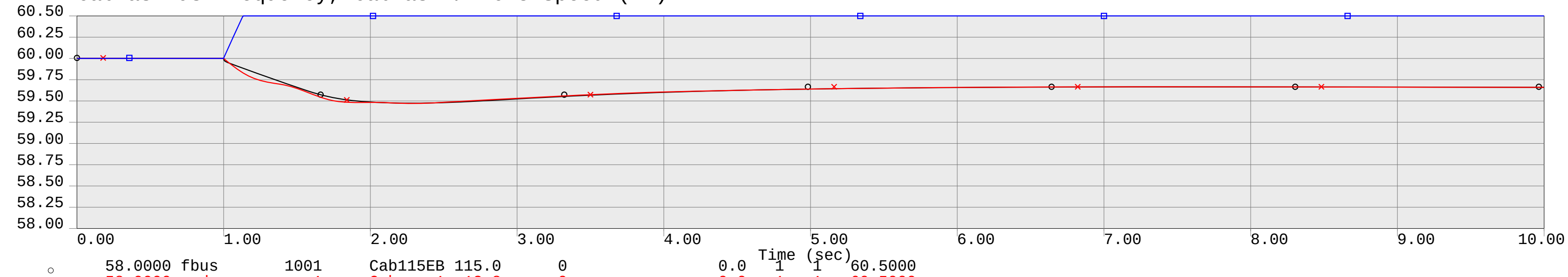
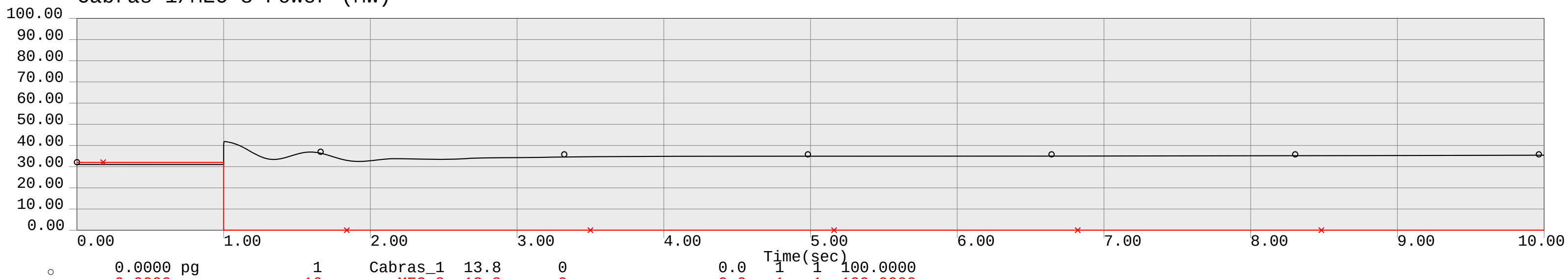
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



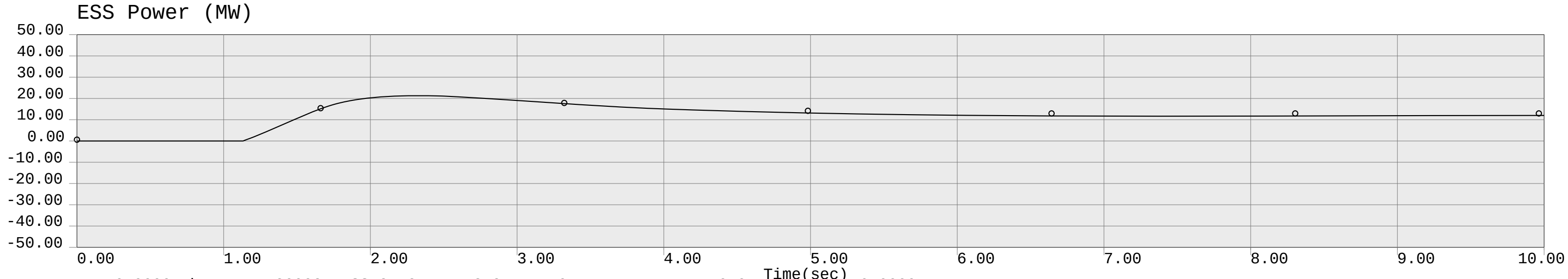
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



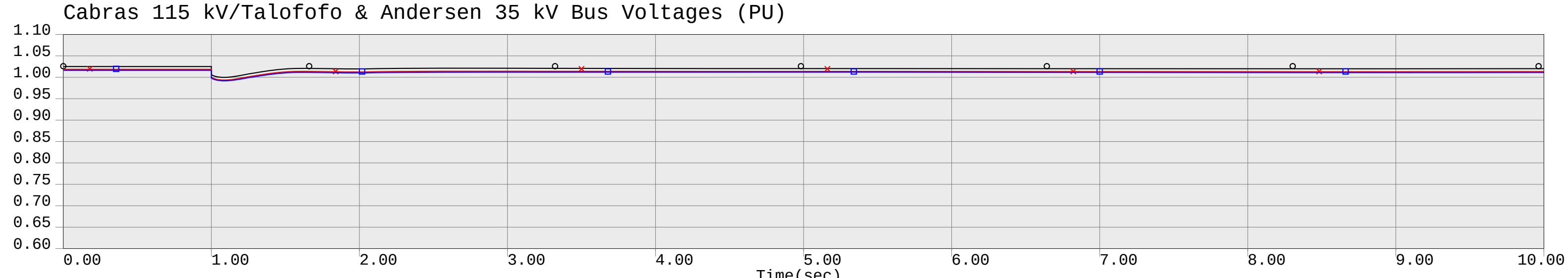
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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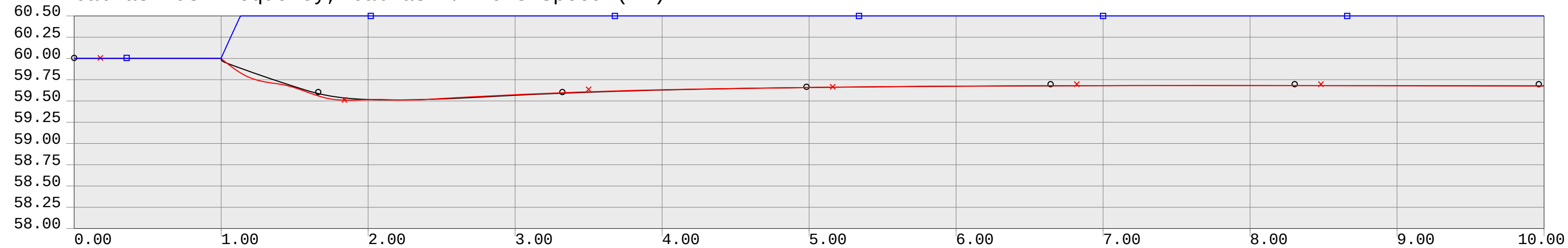
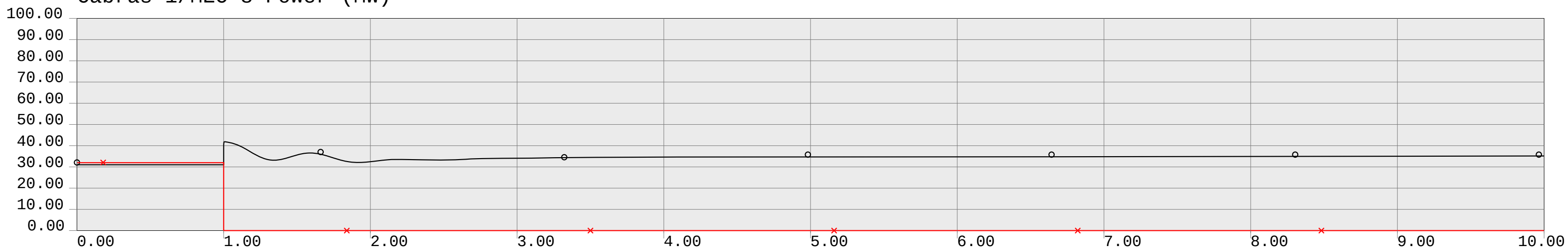
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



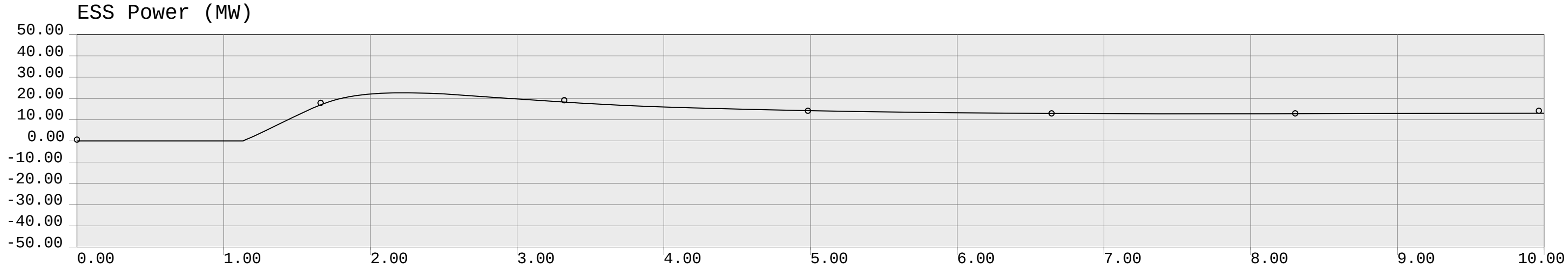
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



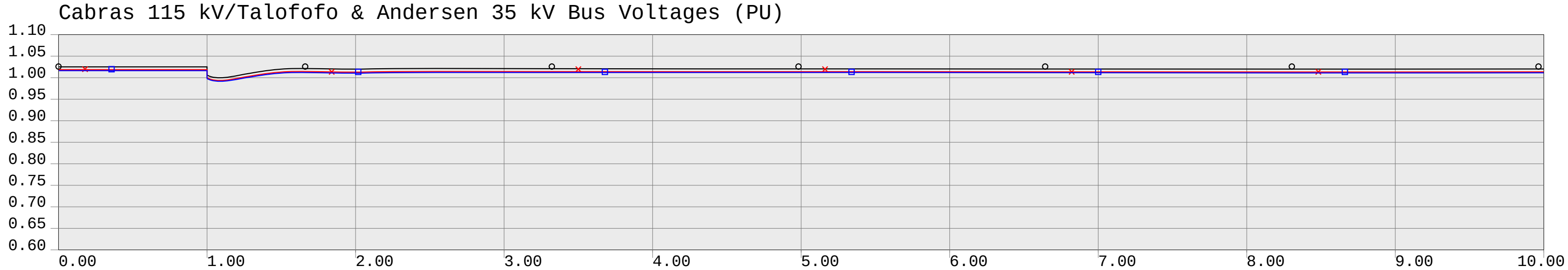
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1100-m8-1e.chf

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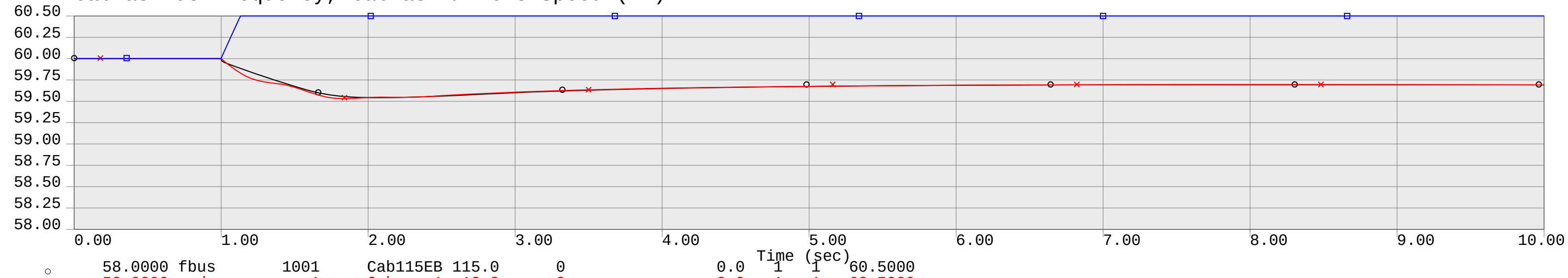
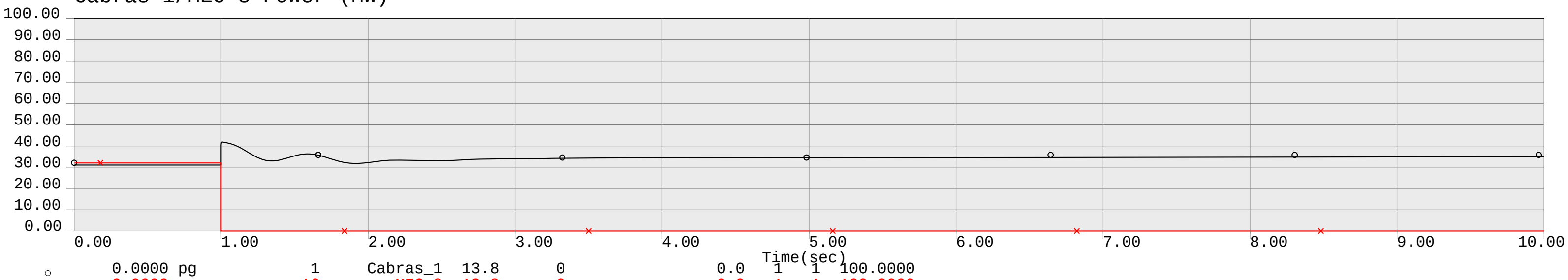
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



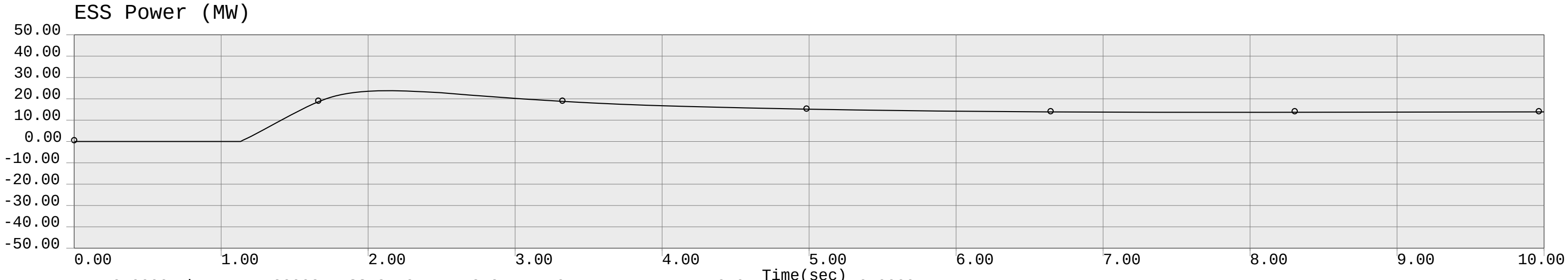
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



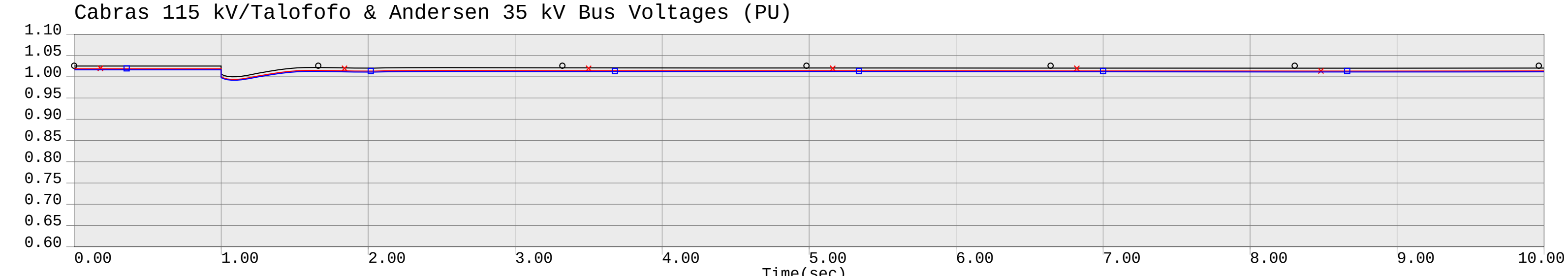
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

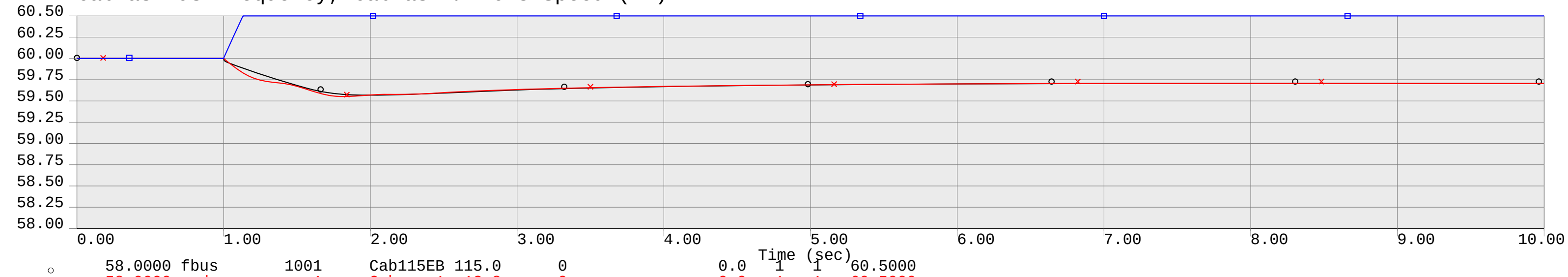
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

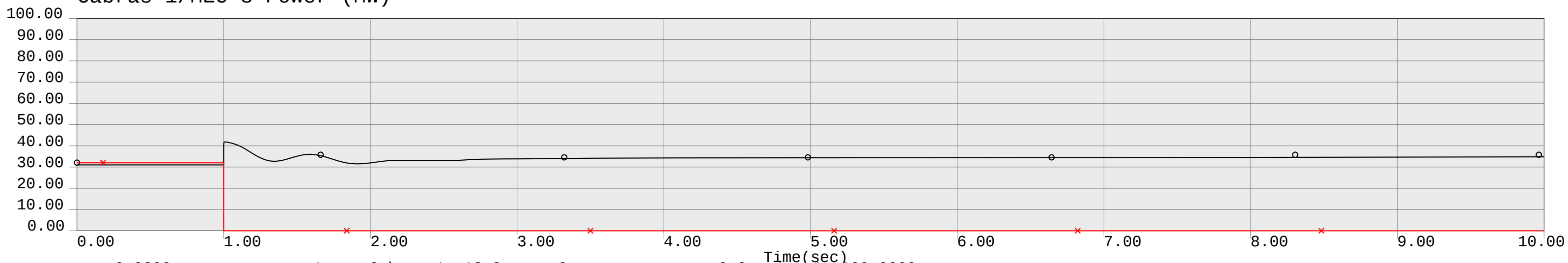
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



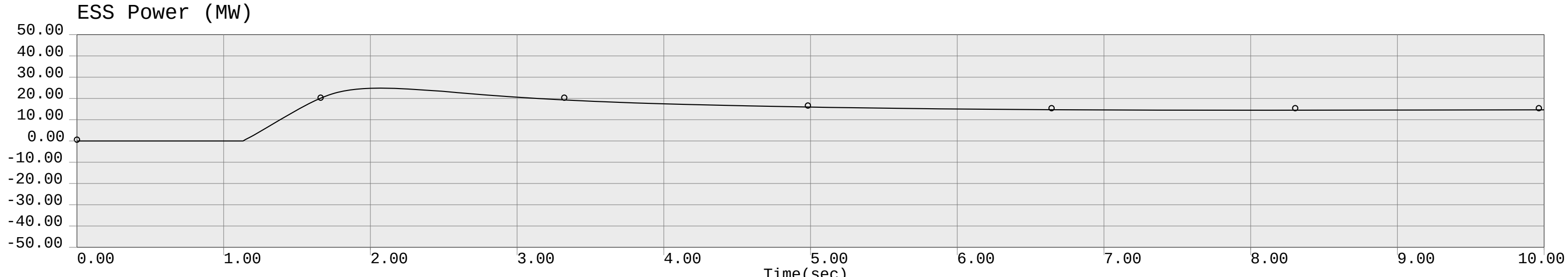
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



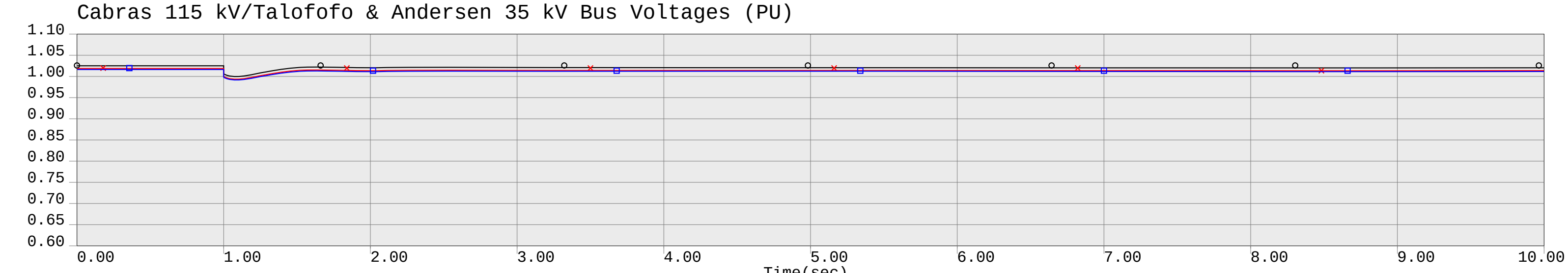
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

chans/1100-m8-1g.chf

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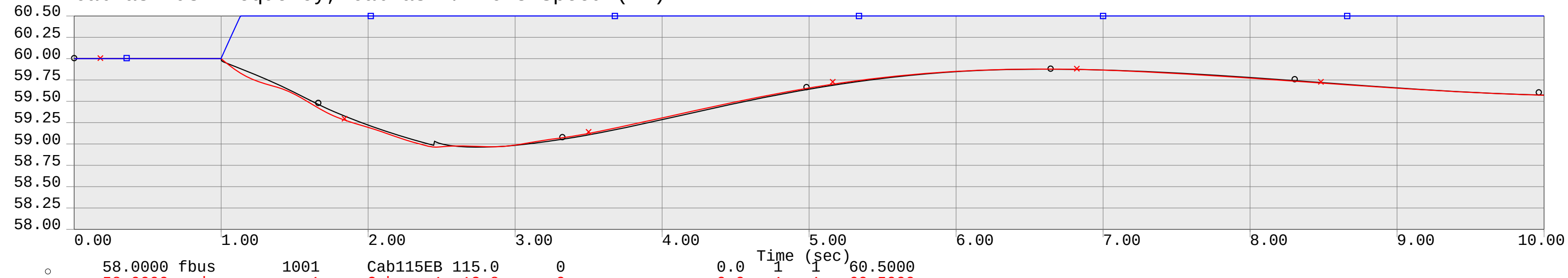
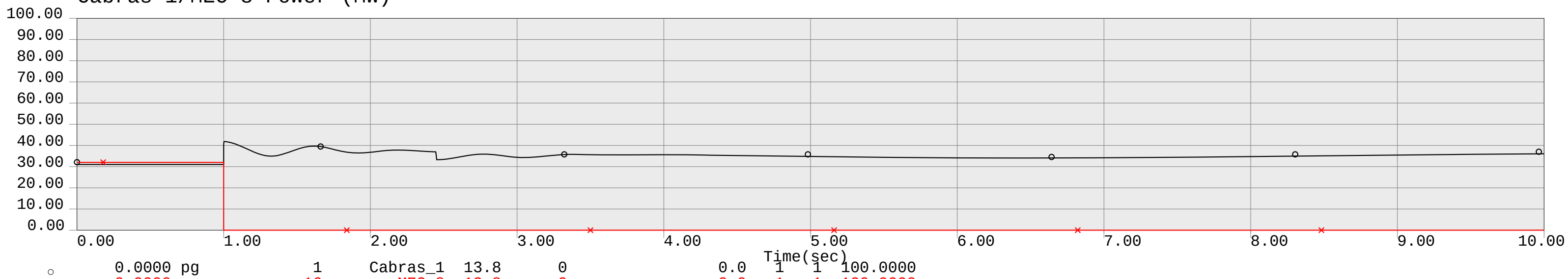
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



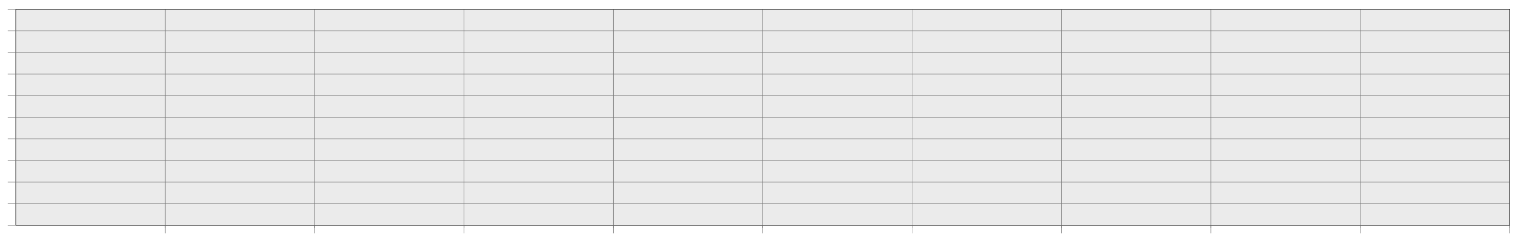
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)

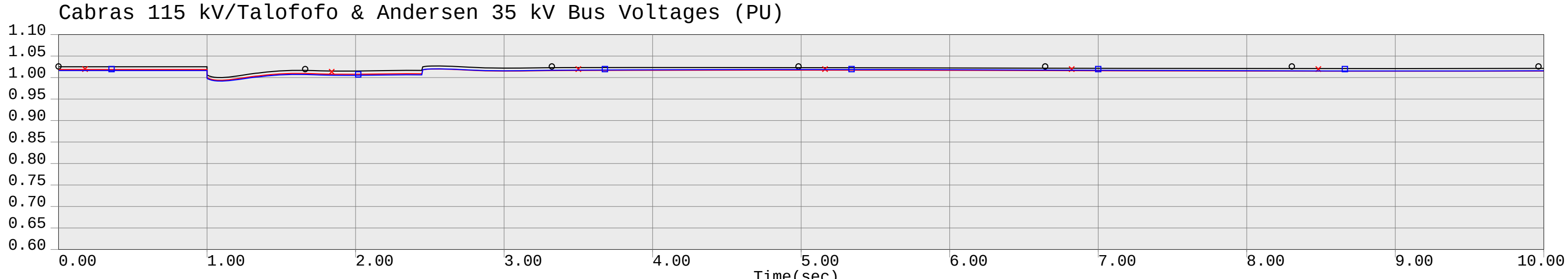


0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1100-m8-ref.chf

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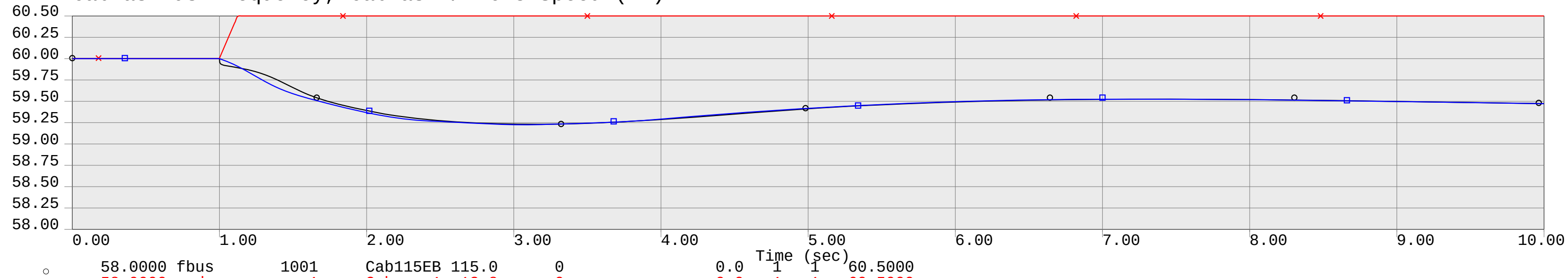
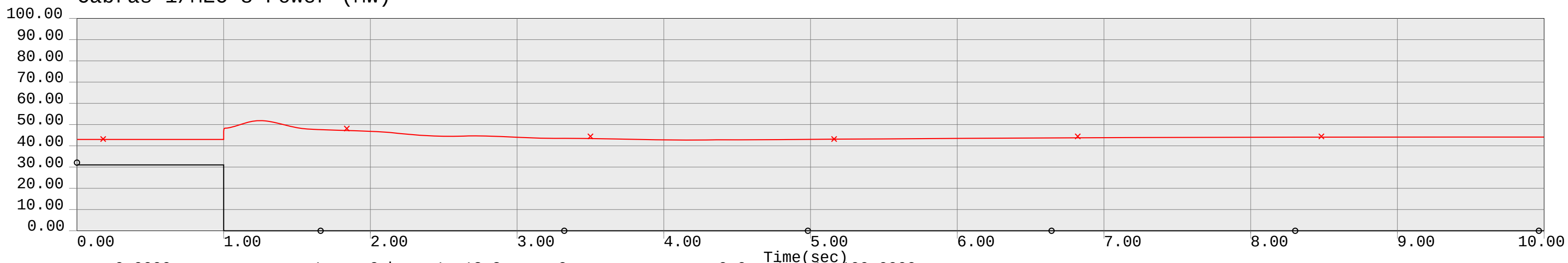
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



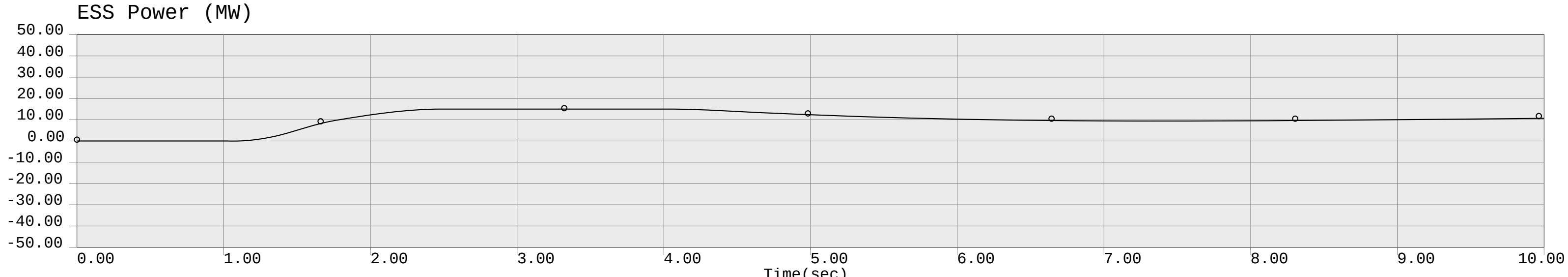
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



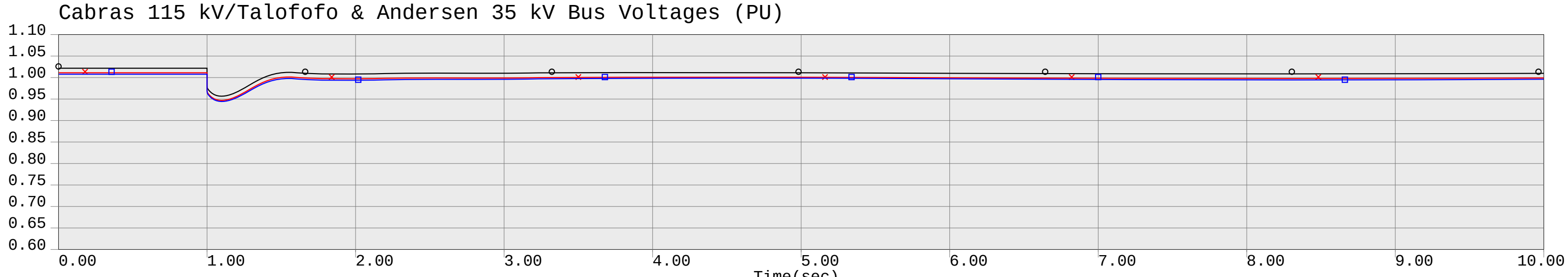
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1200-c1-1a.chf

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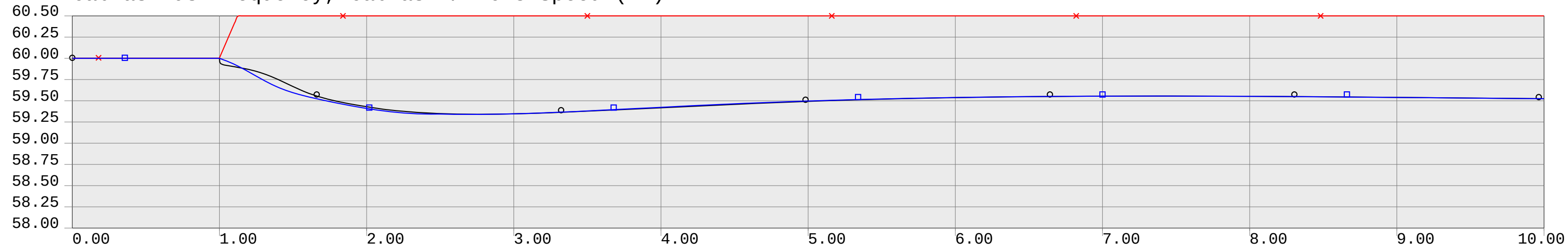
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)

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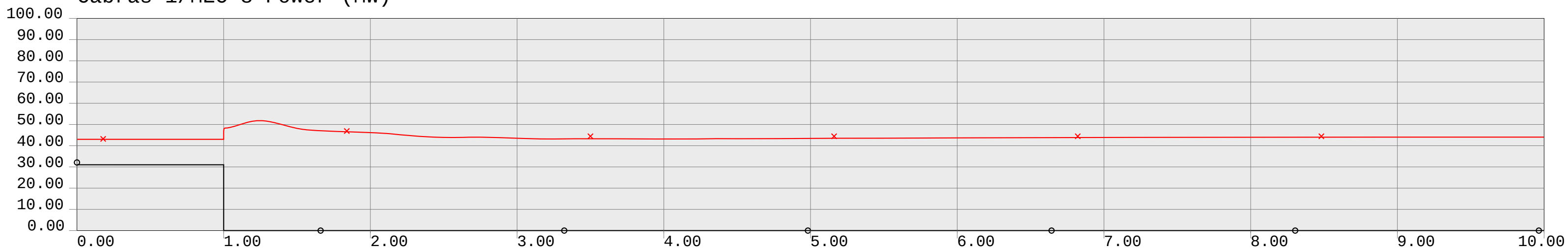
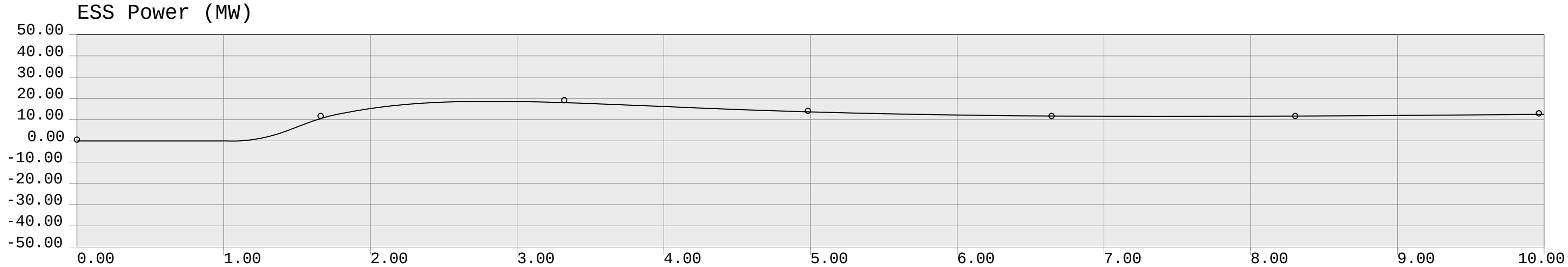
○ 58.0000 fbus   1001  Cab115EB 115.0  0   0.0  1  1  60.5000
× 58.0000 spd       1  Cabras_1  13.8  0   0.0  1  1  60.5000
□ 58.0000 spd      16     MEC 8  13.8  0   0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)




```
○ 0.0000 pg   1  Cabras_1  13.8  0   0.0  1  1  100.0000
× 0.0000 pg  16     MEC 8  13.8  0   0.0  1  1  100.0000
```

ESS Power (MW)

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○ -50.0000 pbes  80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
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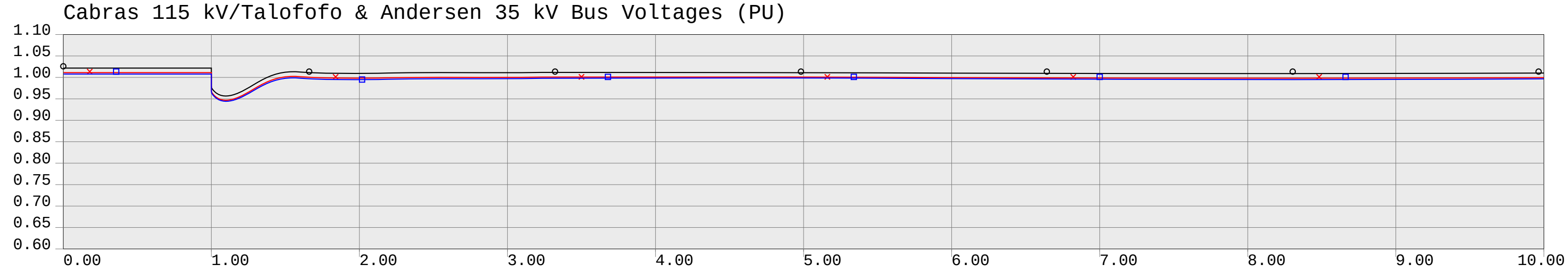
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○ 0.6000 vbus  1001  Cab115EB 115.0  0   0.0  1  1  1.1000
× 0.6000 vbus  2003    Tal345  34.5  0   0.0  1  1  1.1000
□ 0.6000 vbus  2210  And345B1  34.5  0   0.0  1  1  1.1000
```


chans/1200-c1-1b.chf

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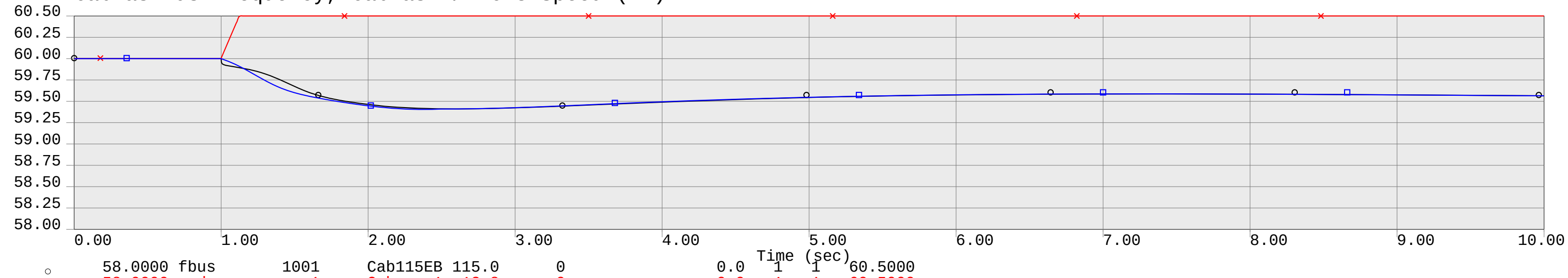
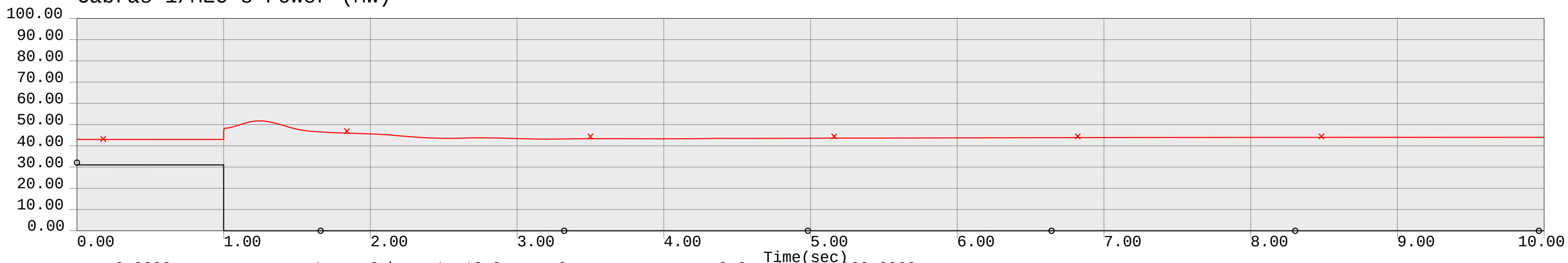
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



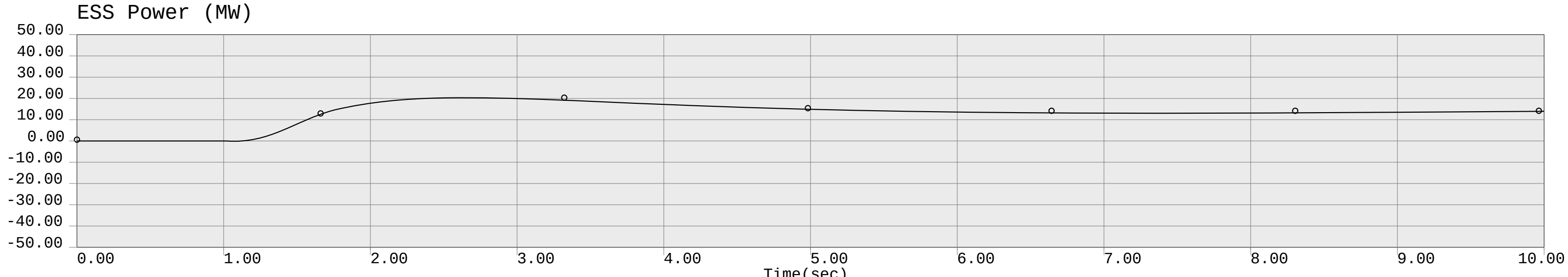
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



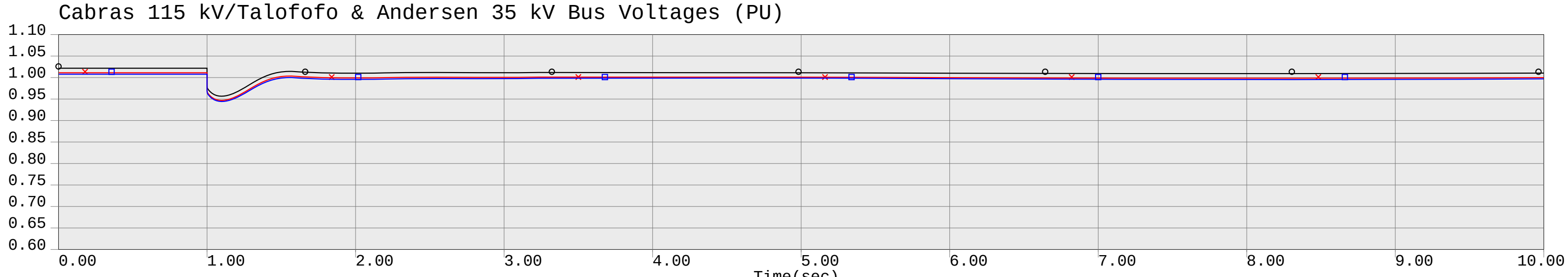
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1200-c1-1c.chf

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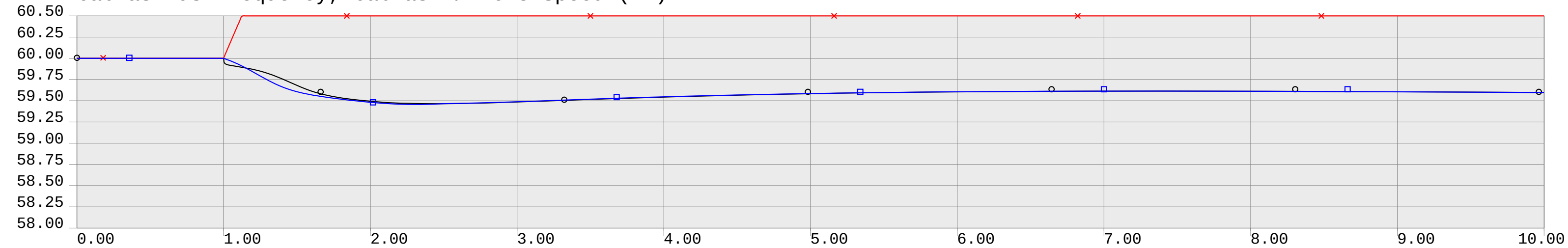
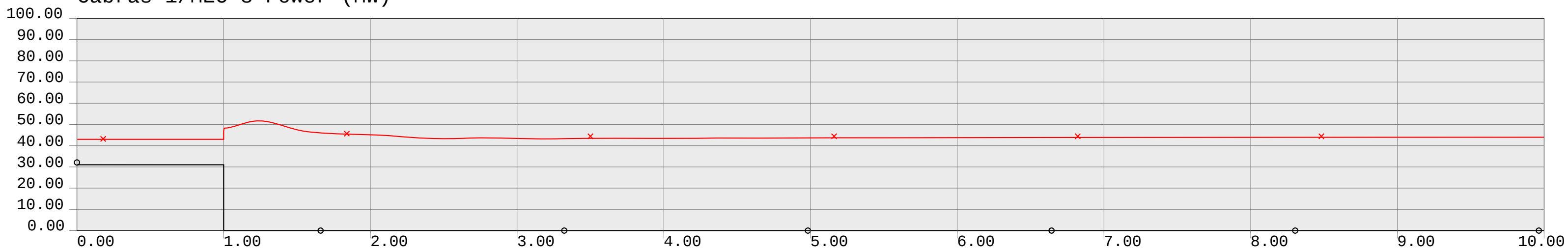
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



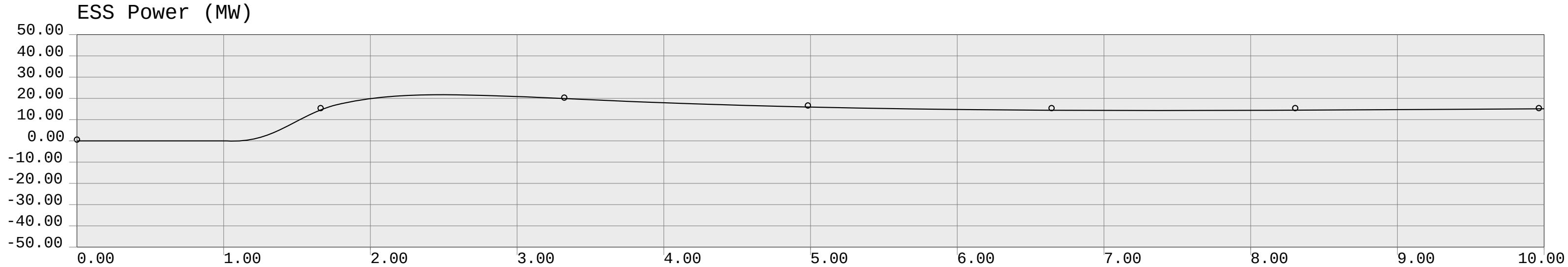
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



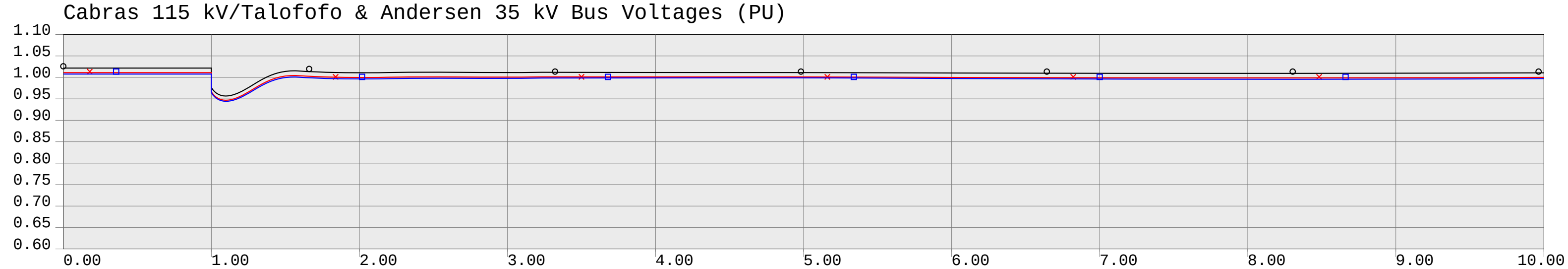
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
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0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1200-c1-1d.chf

asibility_Study\rev_2\sim

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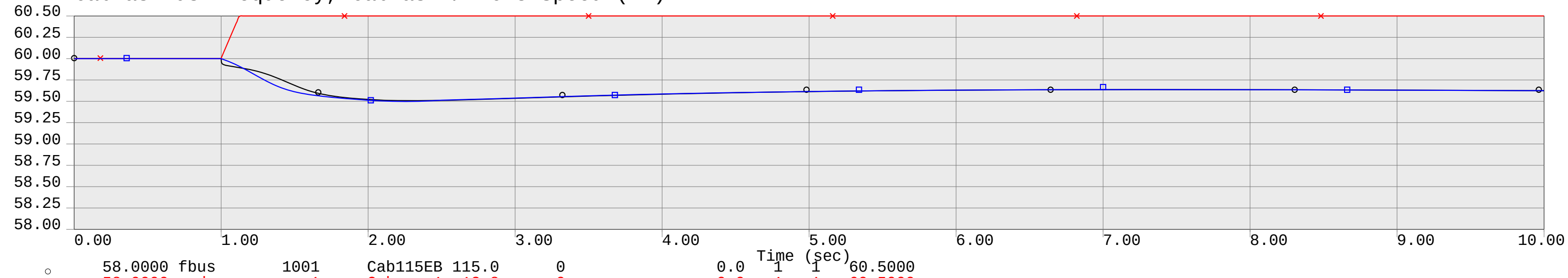
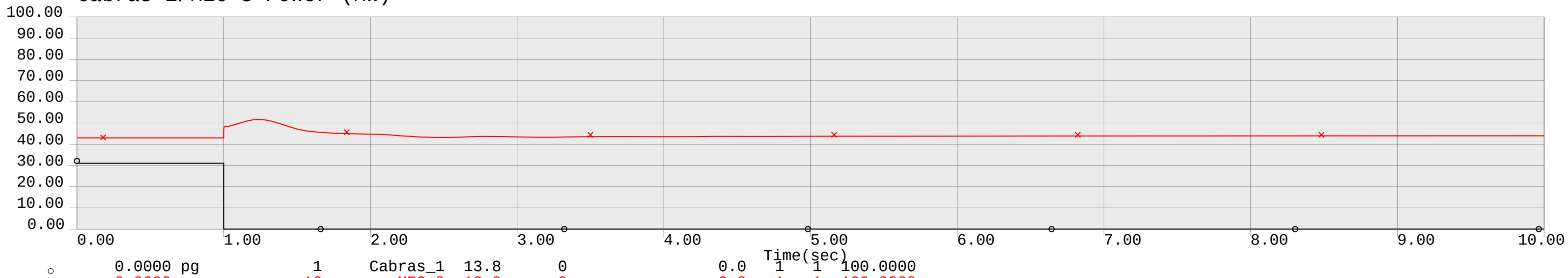
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



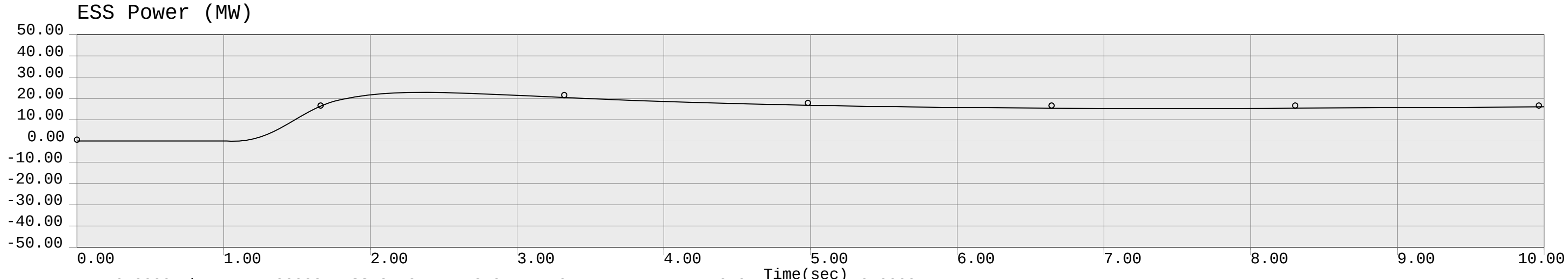
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



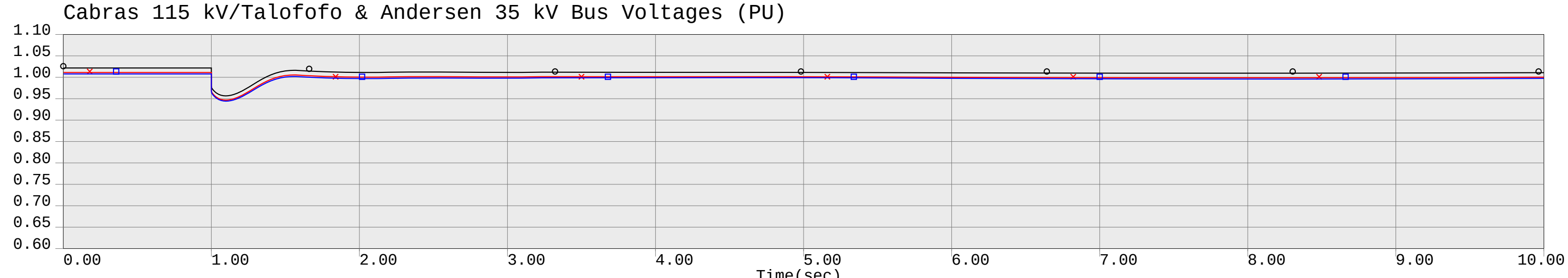
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1200-c1-1e.chf

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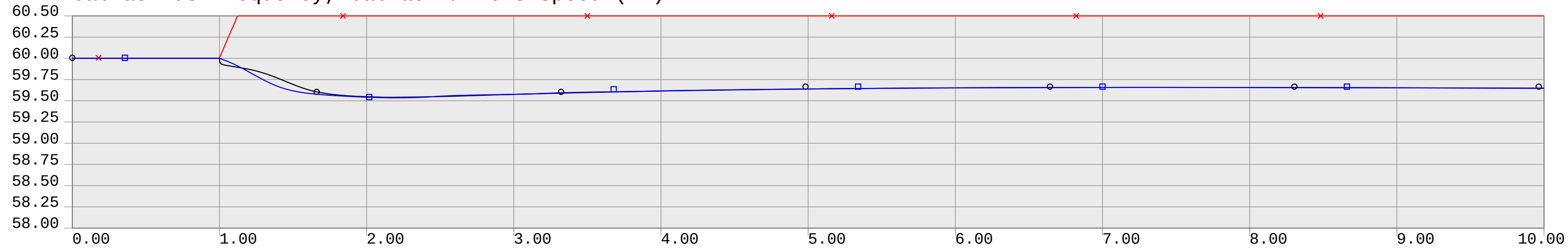
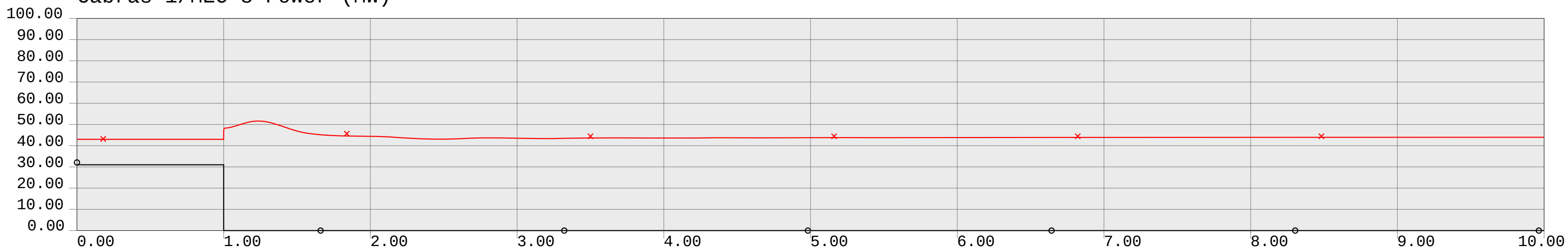
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



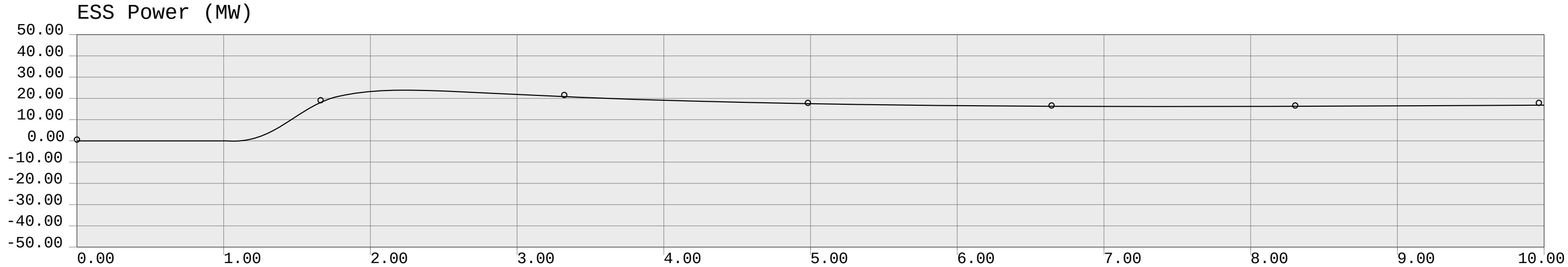
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



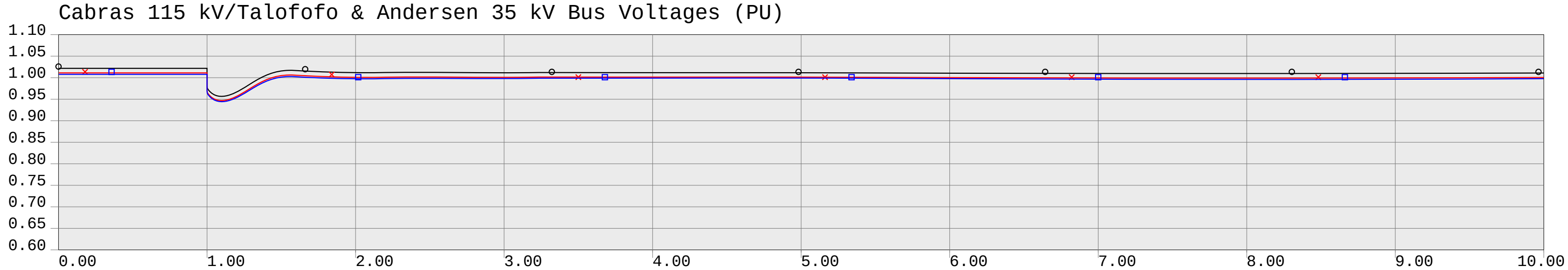
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1200-c1-1f.chf

asibility_Study\rev_2\sim

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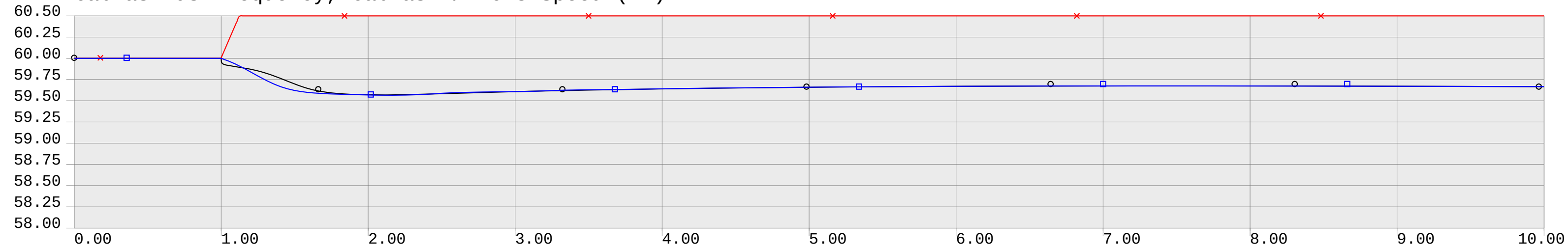
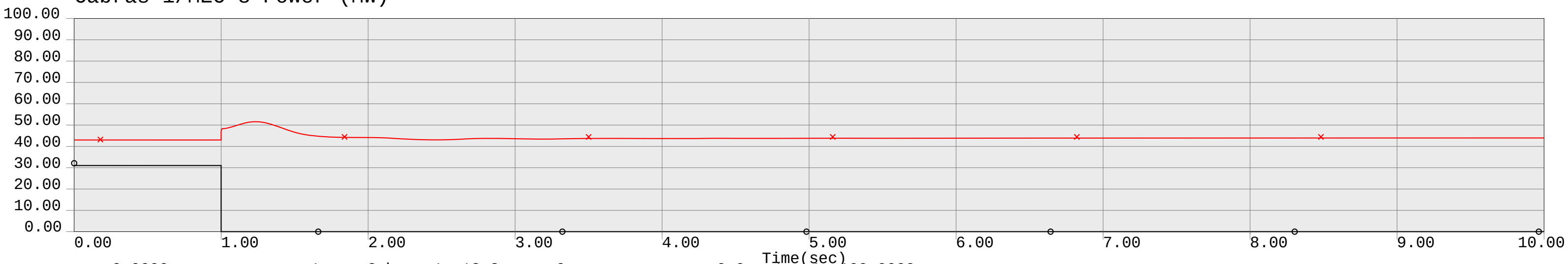
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



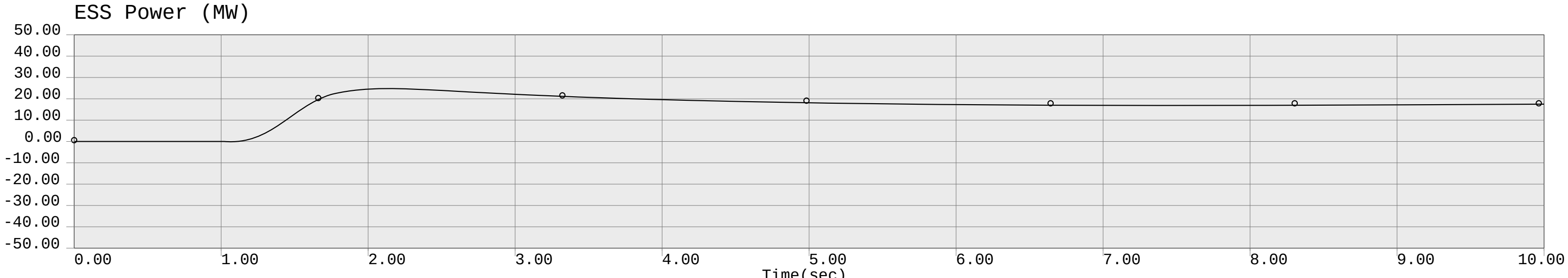
○	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



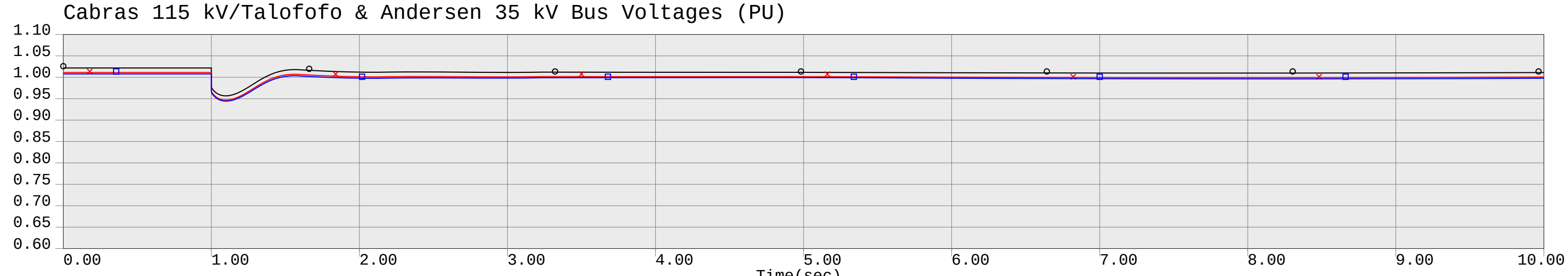
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1200-c1-1g.chf

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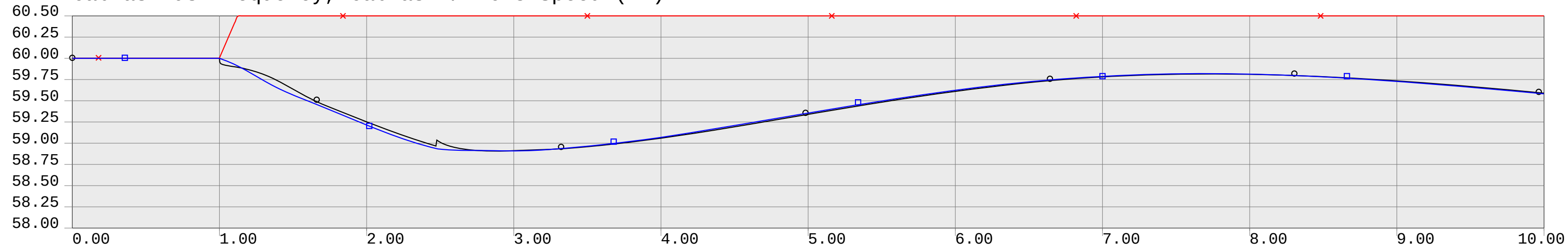
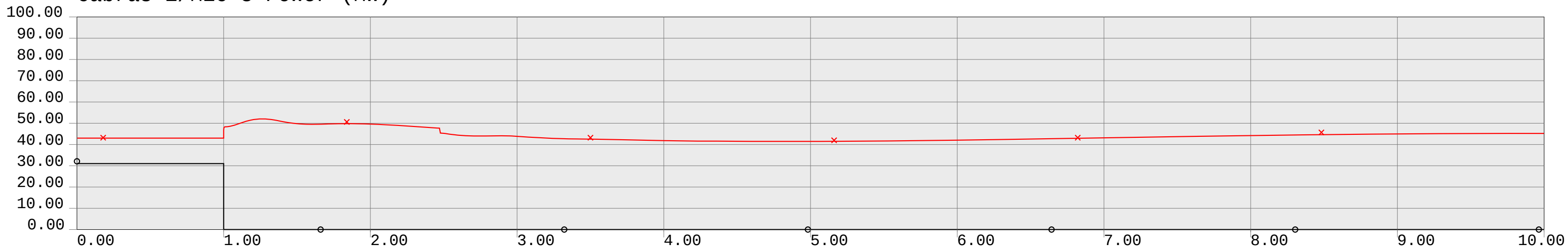
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



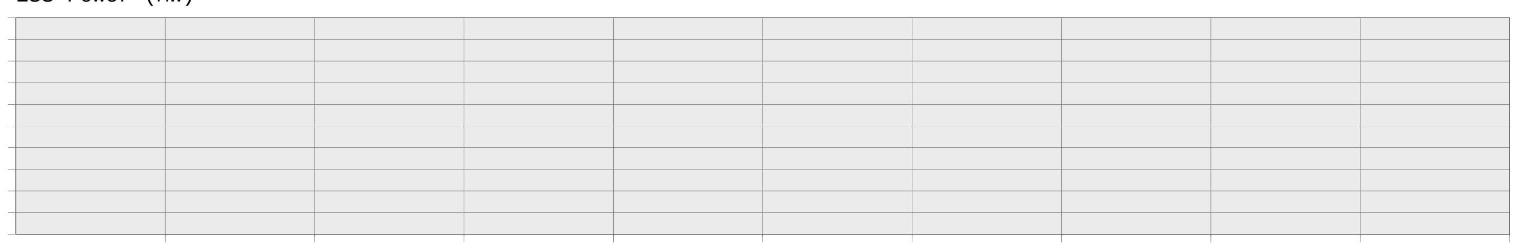
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)

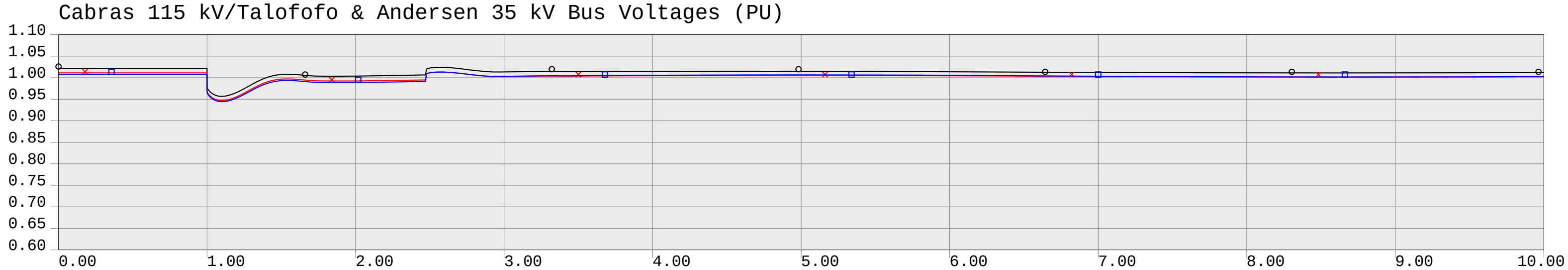


○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



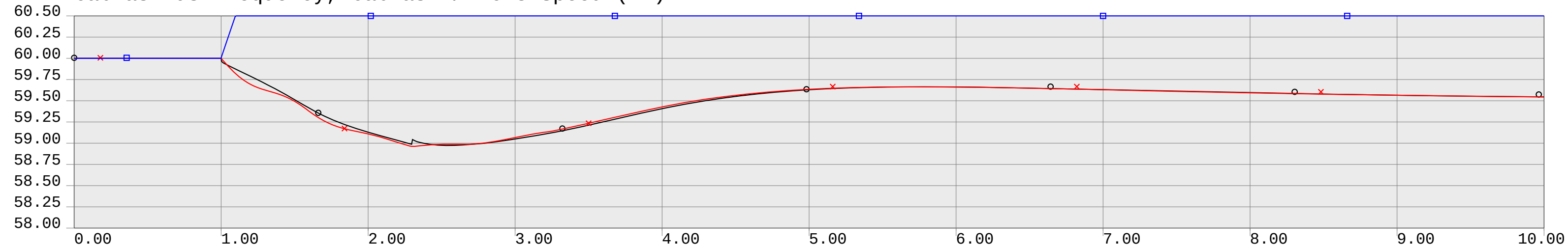
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

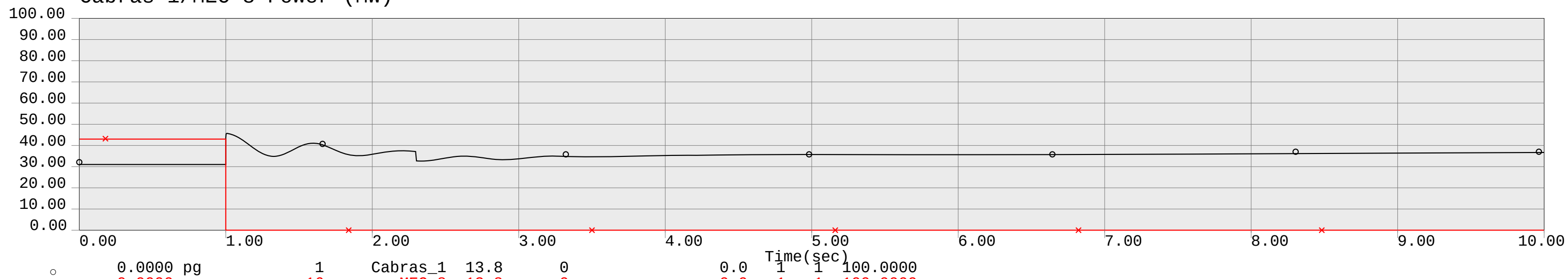
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



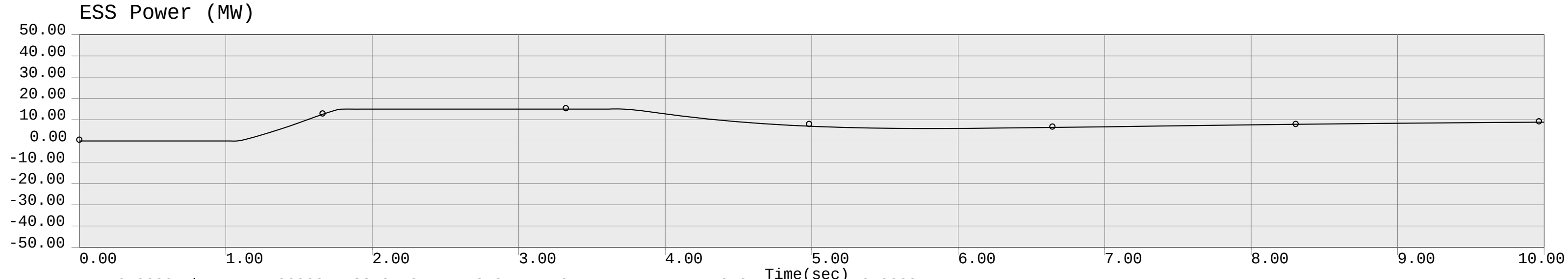
○	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



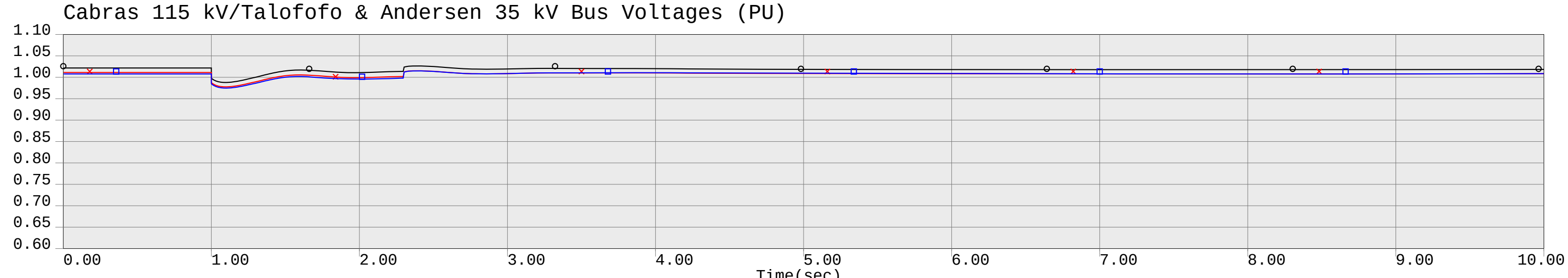
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

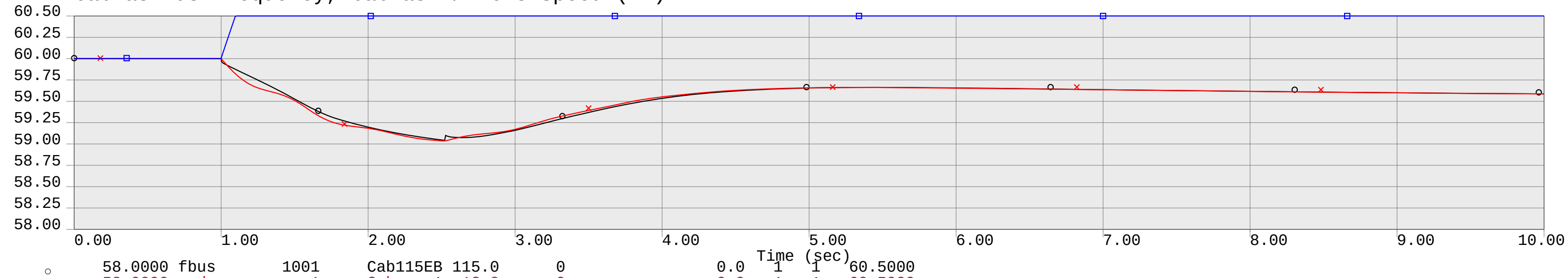
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)

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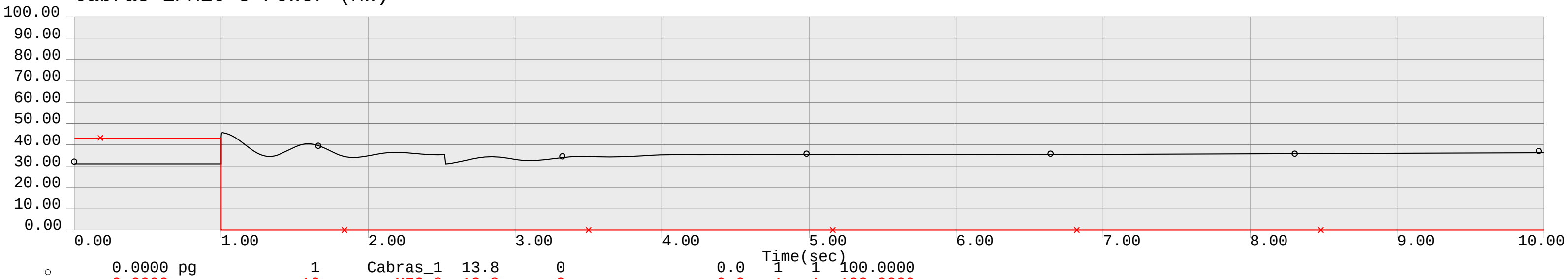
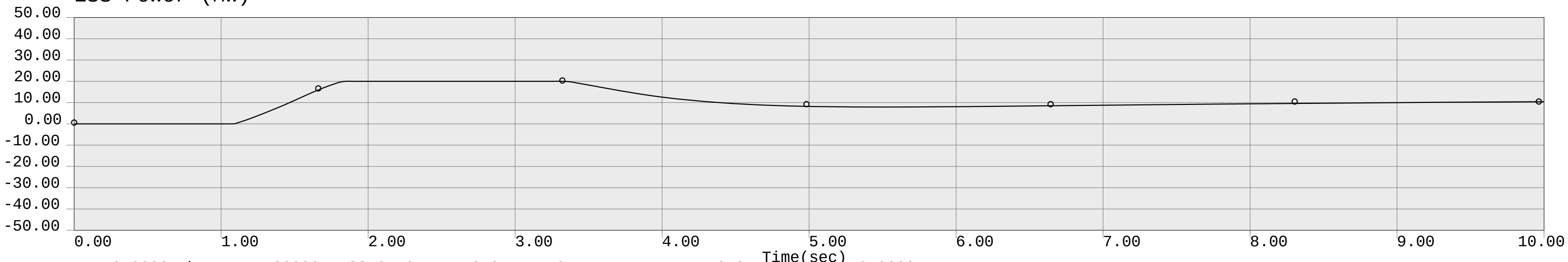
○  58.0000 fbus    1001   Cab115EB 115.0   0     0.0  1  1  60.5000
×  58.0000 spd        1   Cabras_1  13.8   0     0.0  1  1  60.5000
□  58.0000 spd       16      MEC 8  13.8   0     0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)




```
○   0.0000 pg         1   Cabras_1  13.8   0     0.0  1  1  100.0000
×   0.0000 pg        16      MEC 8  13.8   0     0.0  1  1  100.0000
```

ESS Power (MW)




```
○  -50.0000 pbes   80002  ESS 2-AGANA  13.8   0     0.0  1  1  50.0000
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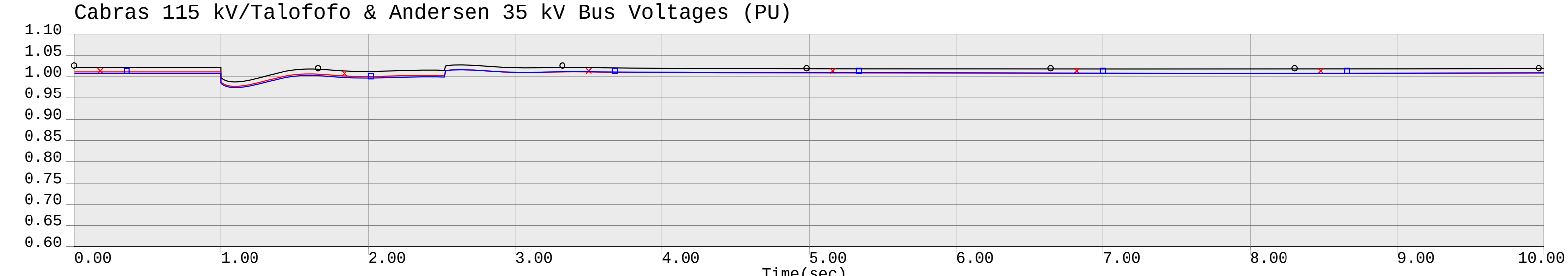
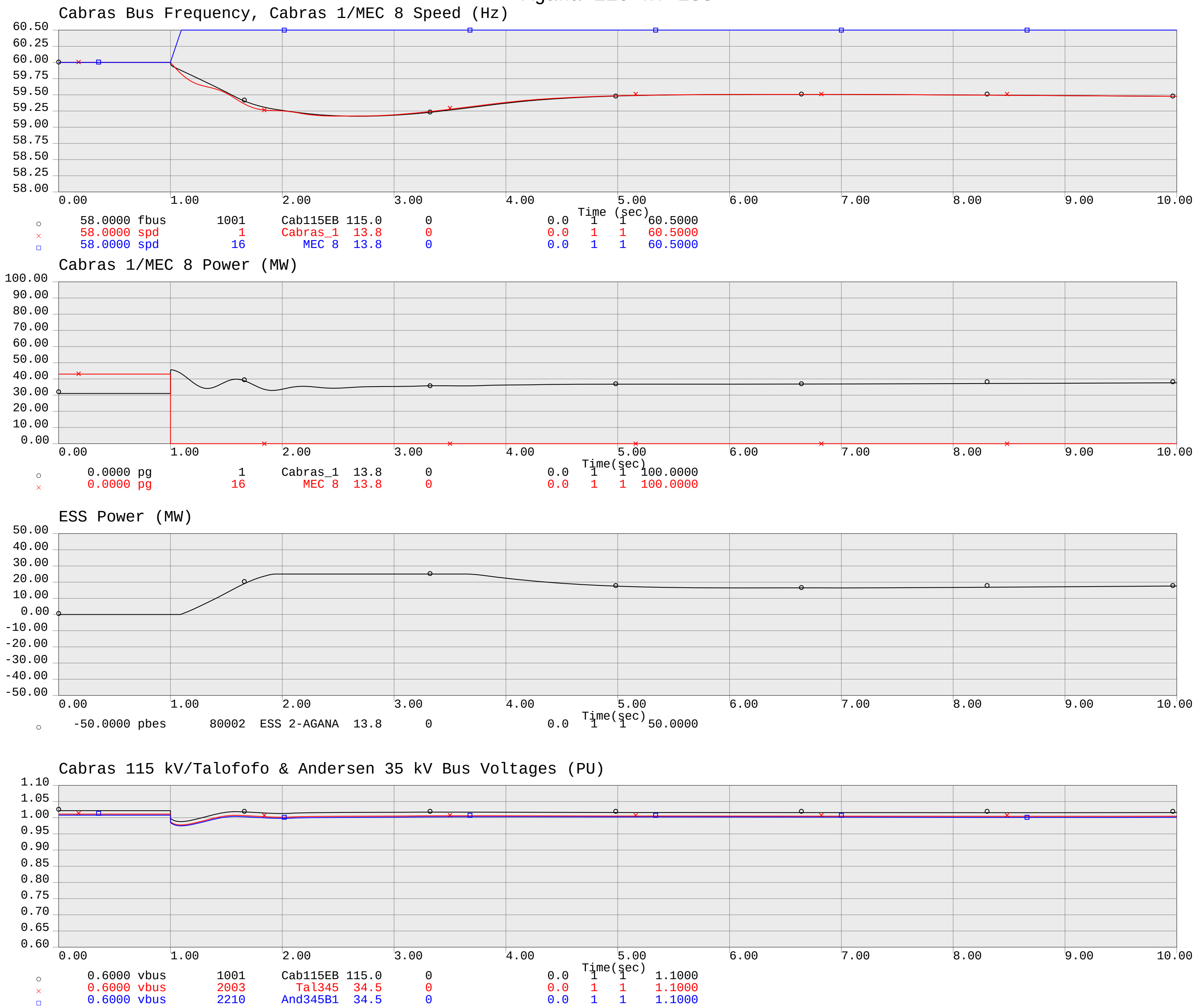
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○   0.6000 vbus    1001   Cab115EB 115.0   0     0.0  1  1  1.1000
×   0.6000 vbus    2003     Tal345  34.5   0     0.0  1  1  1.1000
□   0.6000 vbus    2210   And345B1  34.5   0     0.0  1  1  1.1000
```

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



chans/1200-m8-1c.chf

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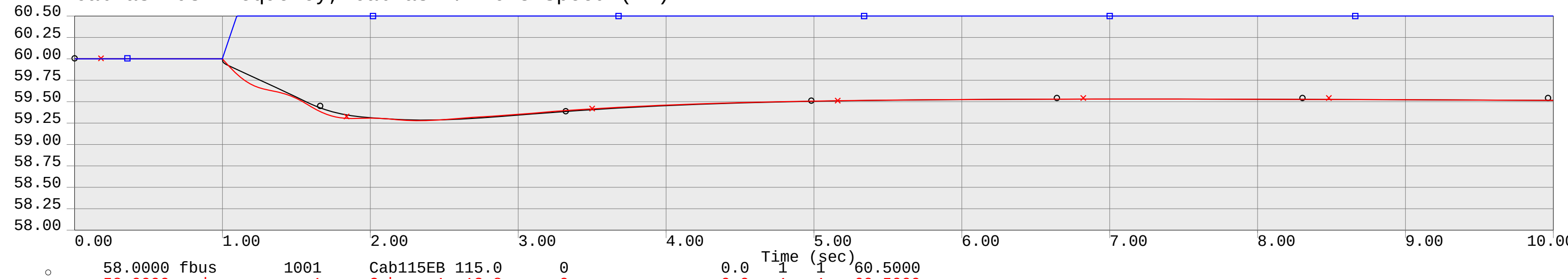
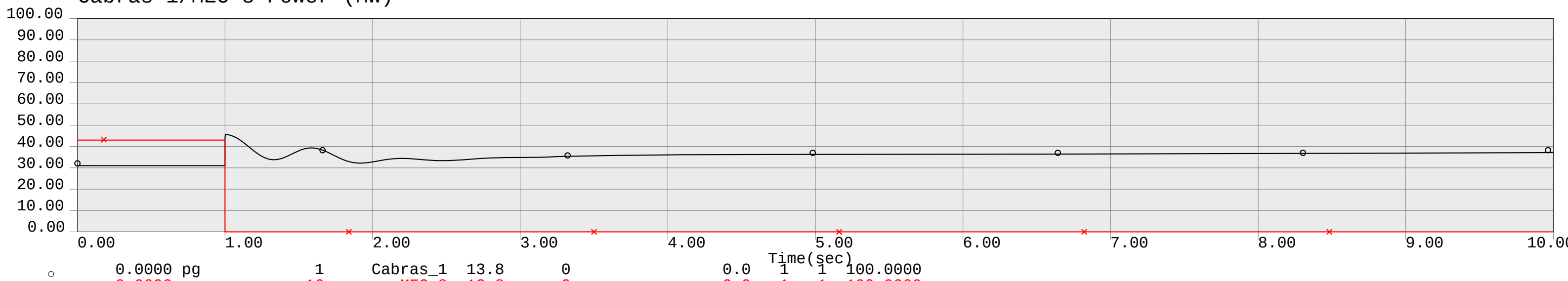
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



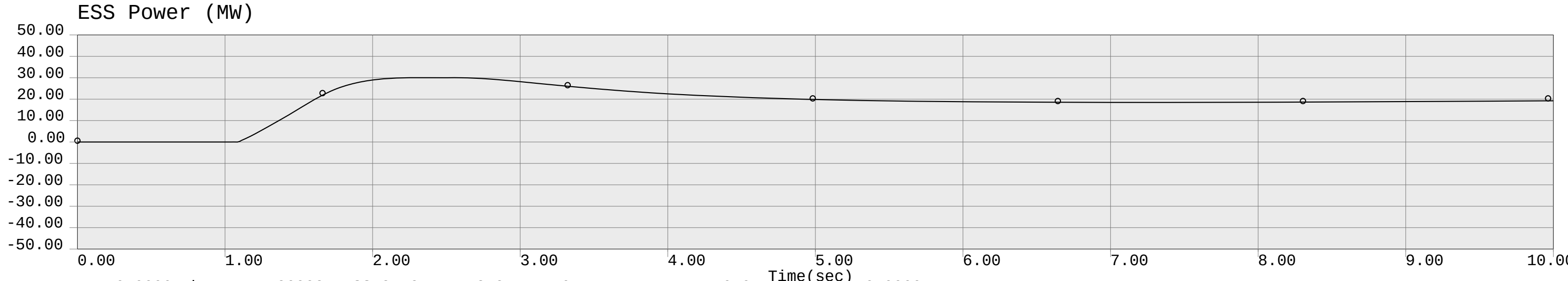
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



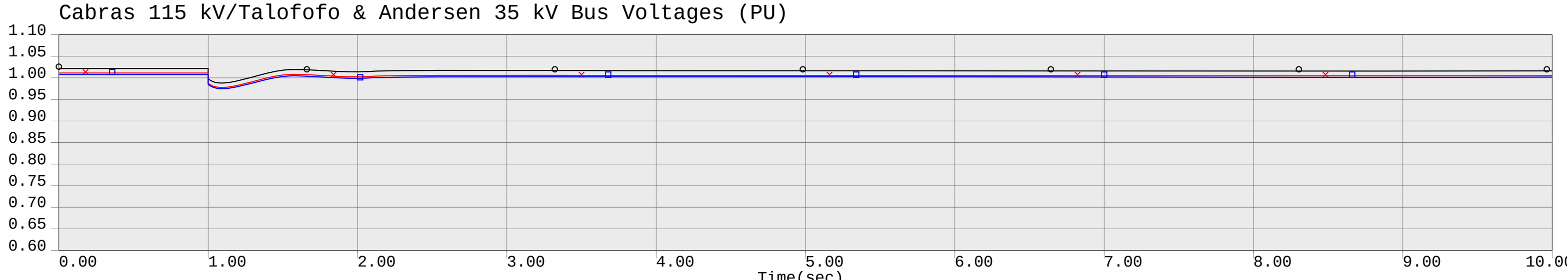
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1200-m8-1d.chf

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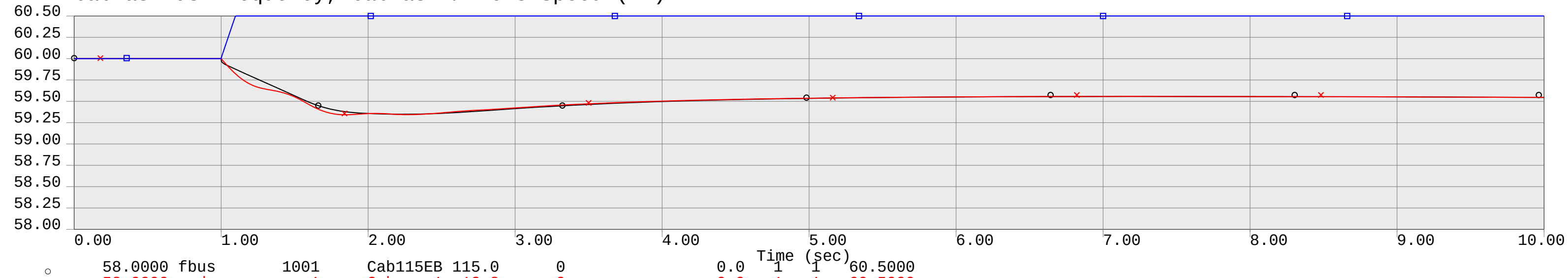
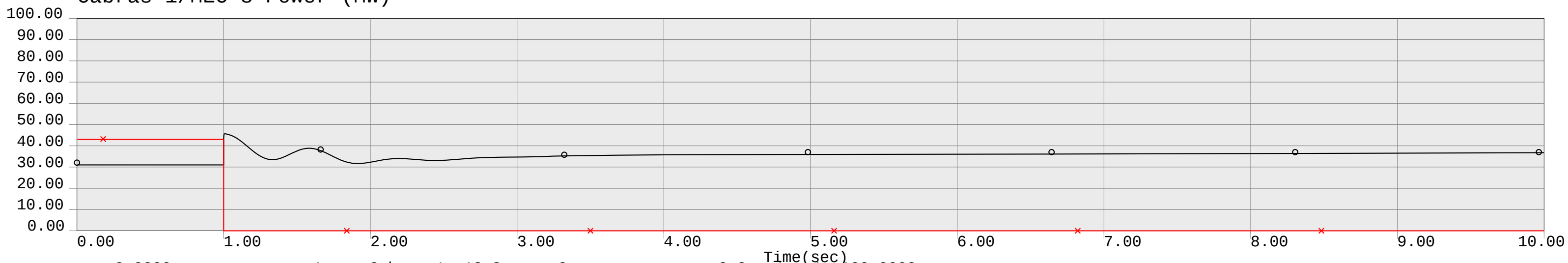
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



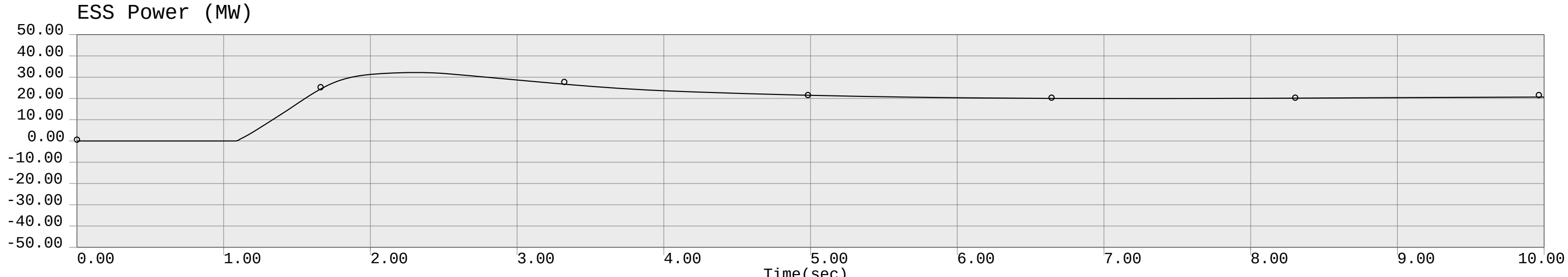
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



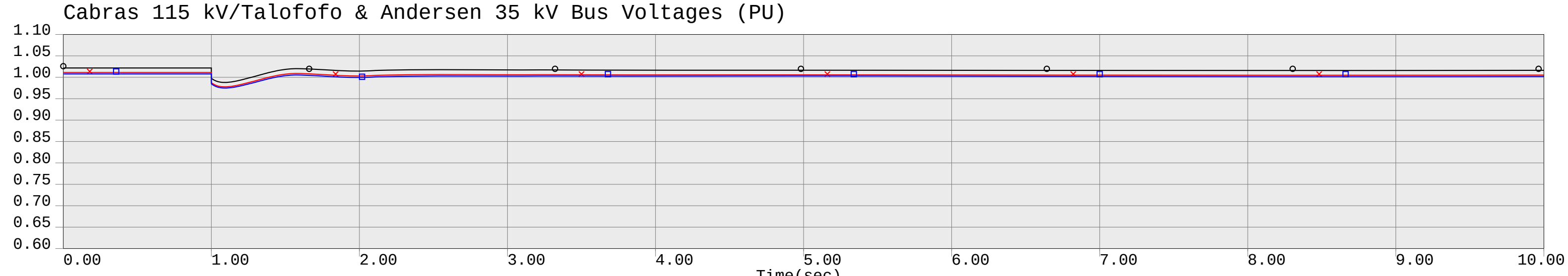
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1200-m8-1e.chf

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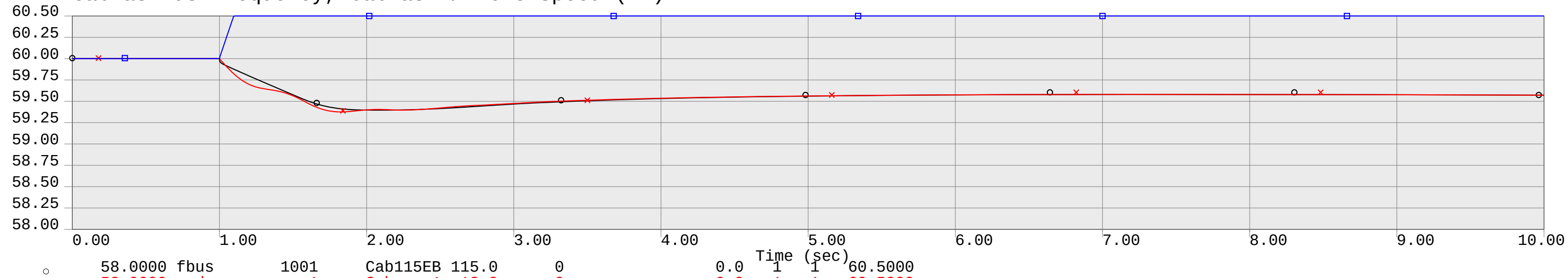
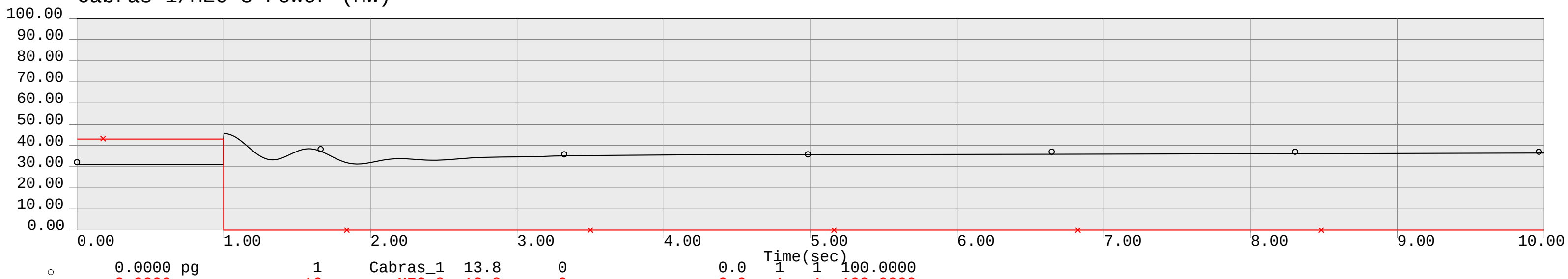
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



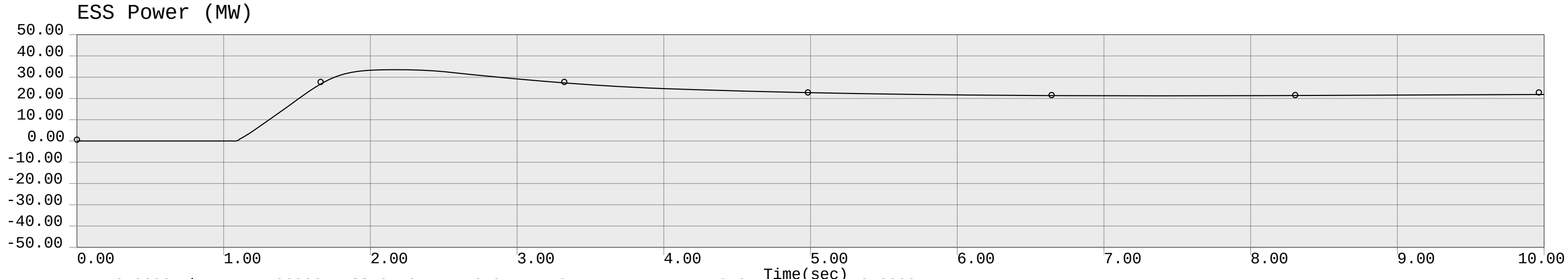
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



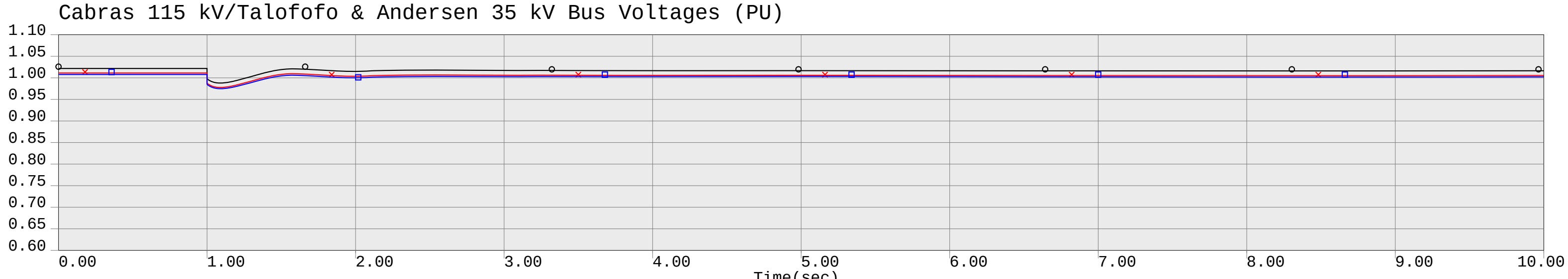
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

chans/1200-m8-1f.chf

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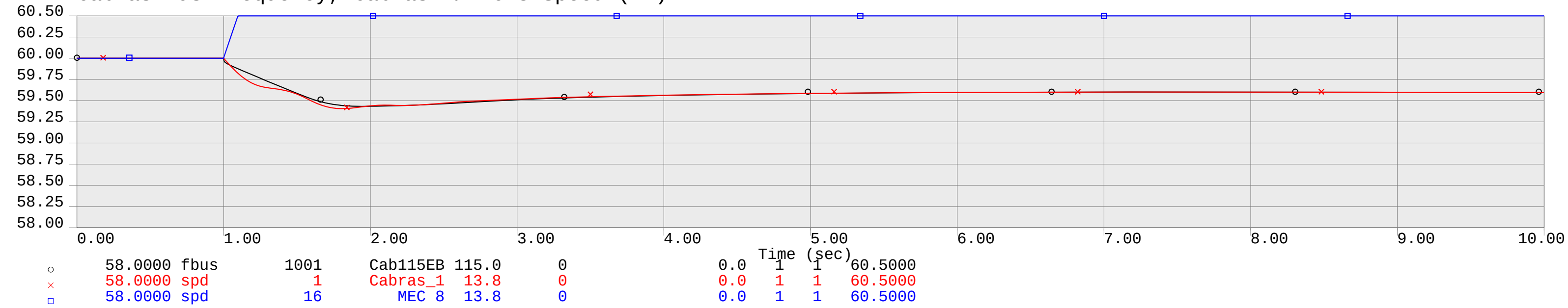
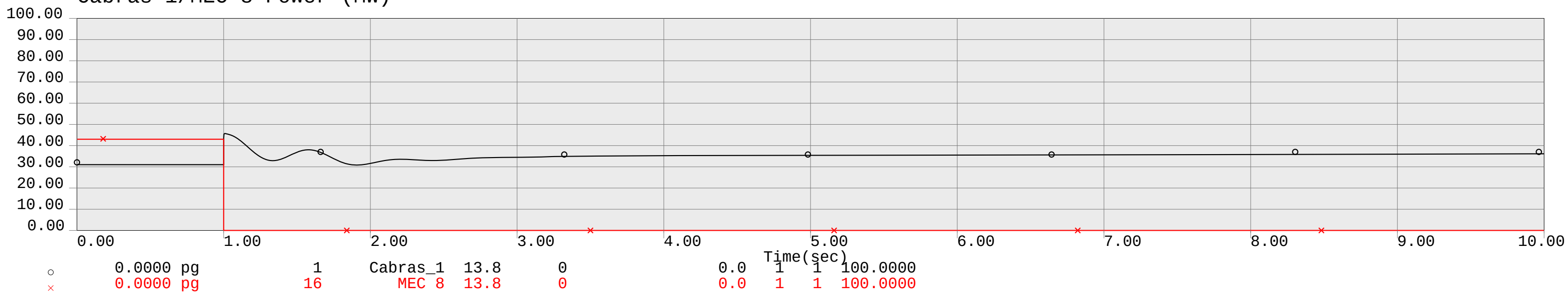
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

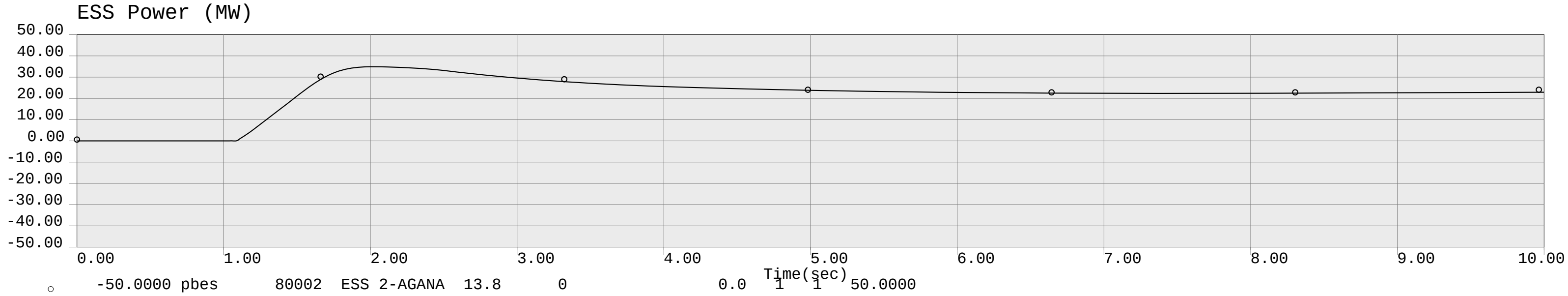
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



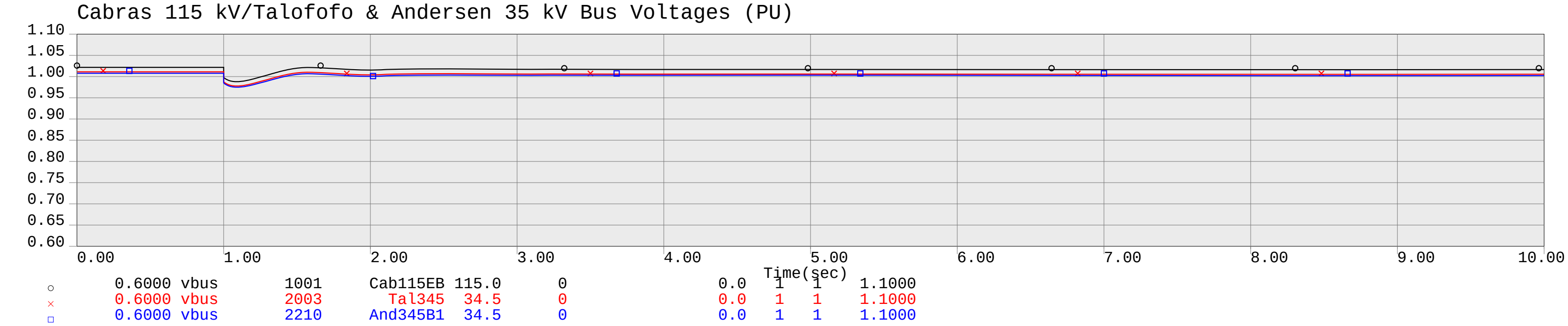
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



chans/1200-m8-1g.chf

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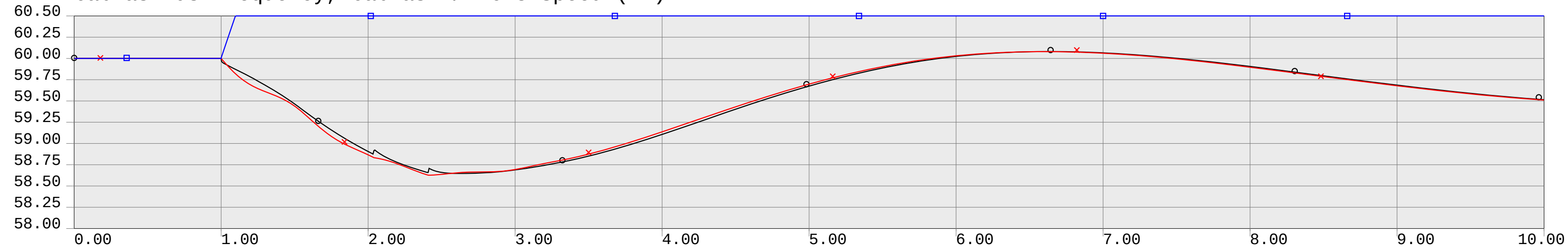
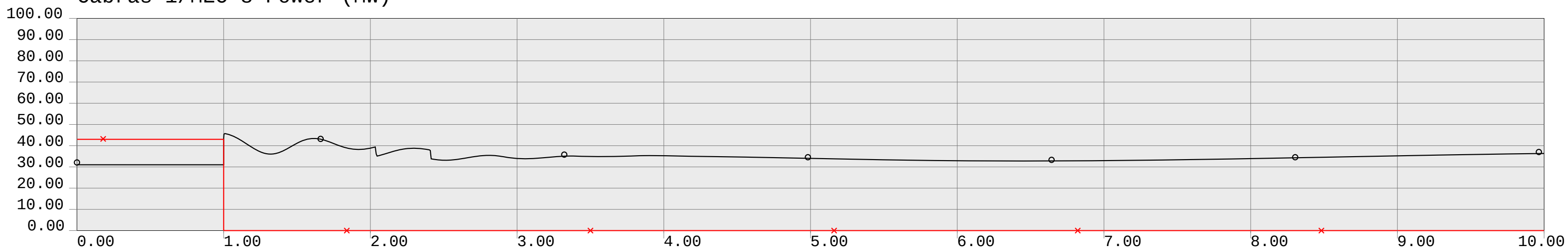
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



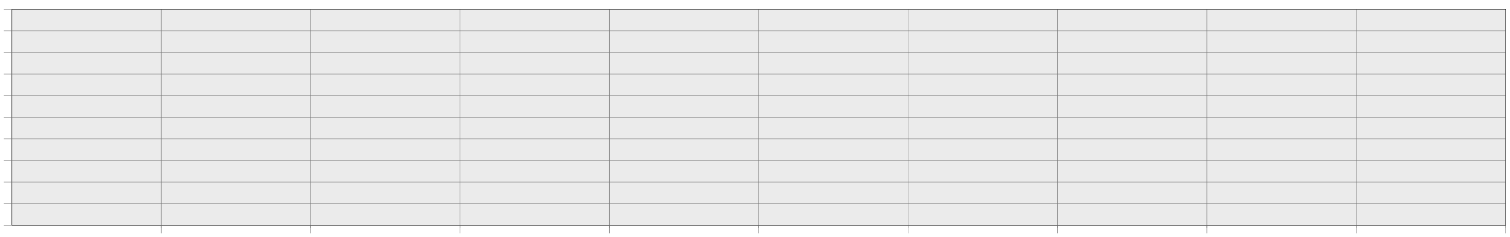
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)

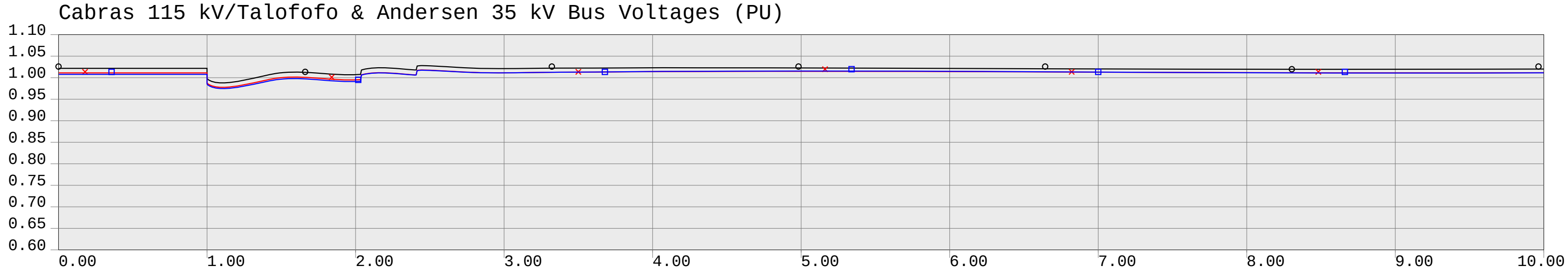


○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

chans/1200-m8-ref.chf

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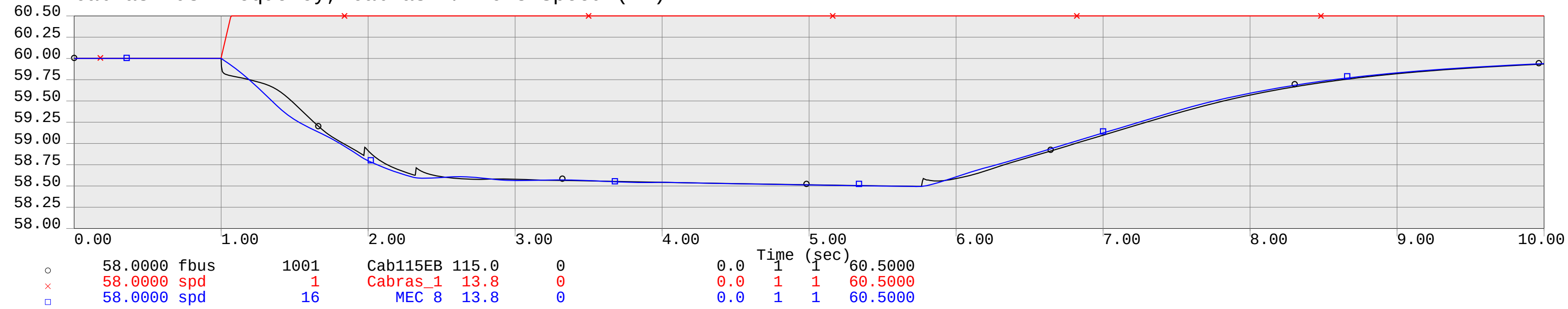
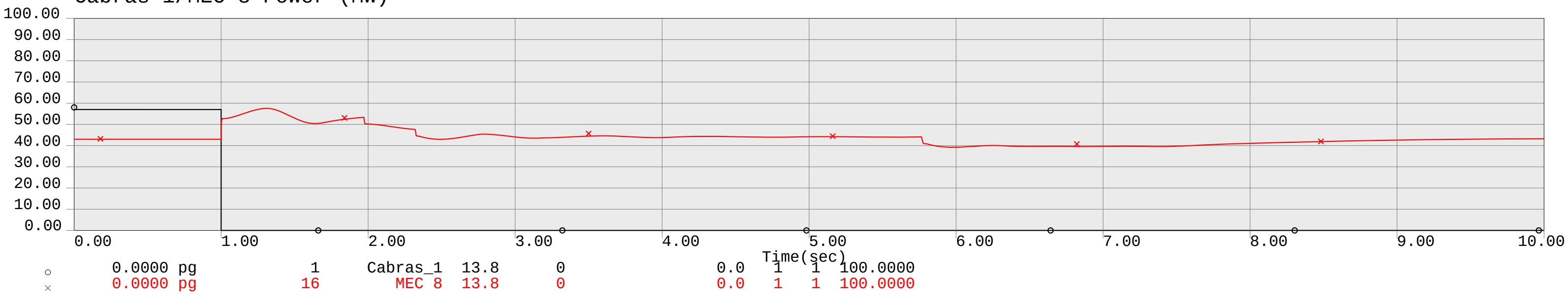
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

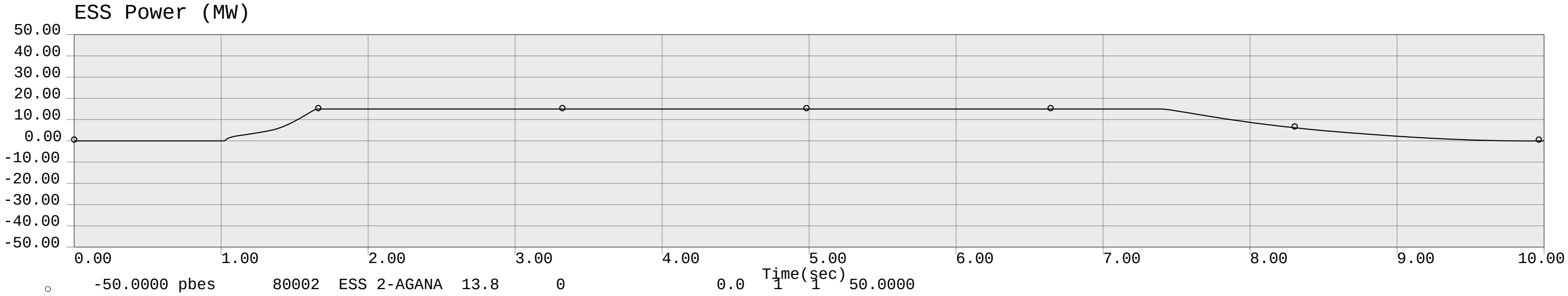
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



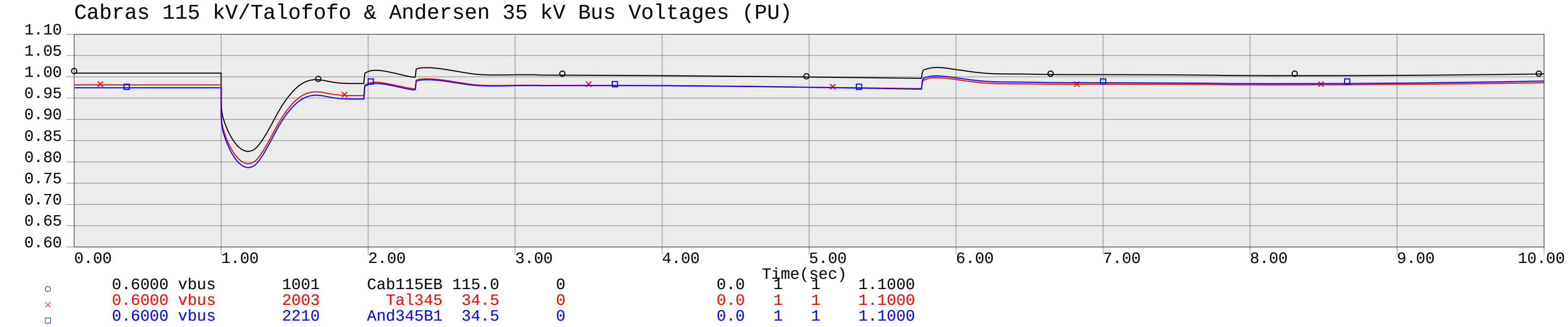
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



chans/1300-c1-1a.chf

asibility_Study\rev_2\sim

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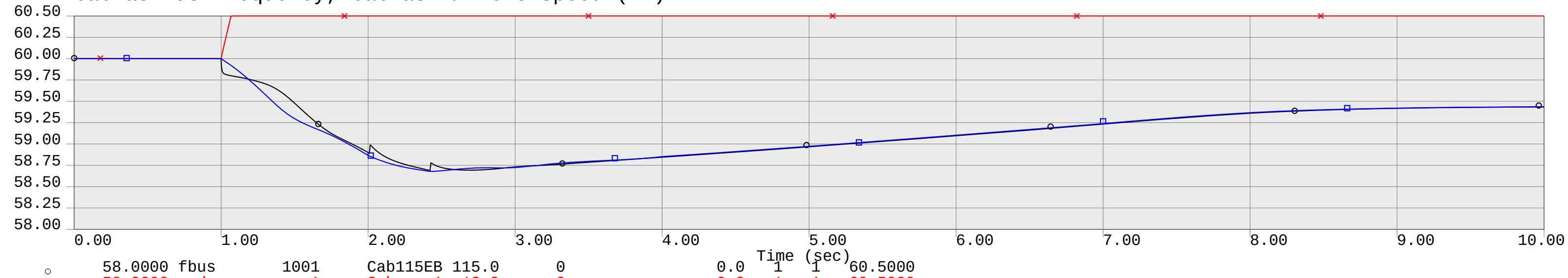
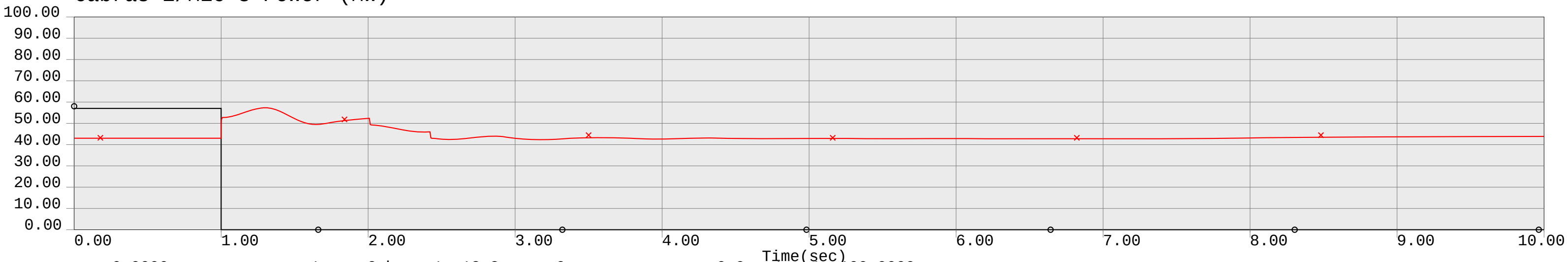
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



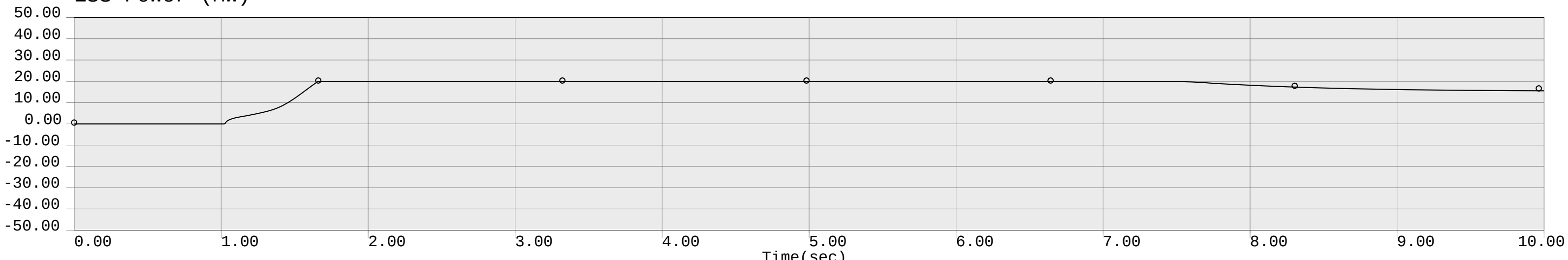
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



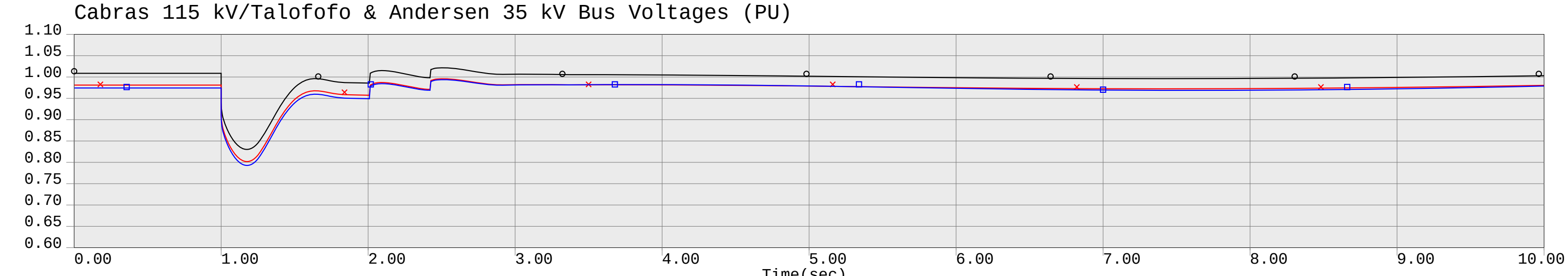
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1300-c1-1b.chf

asibility_Study\rev_2\sim

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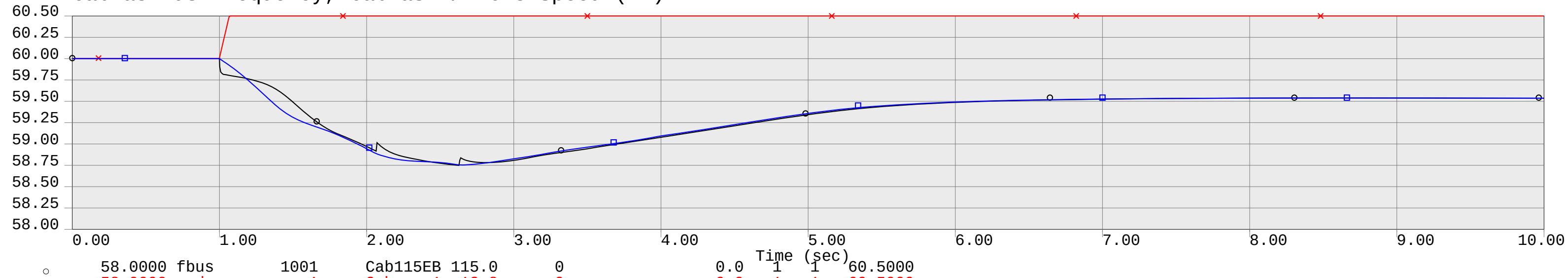
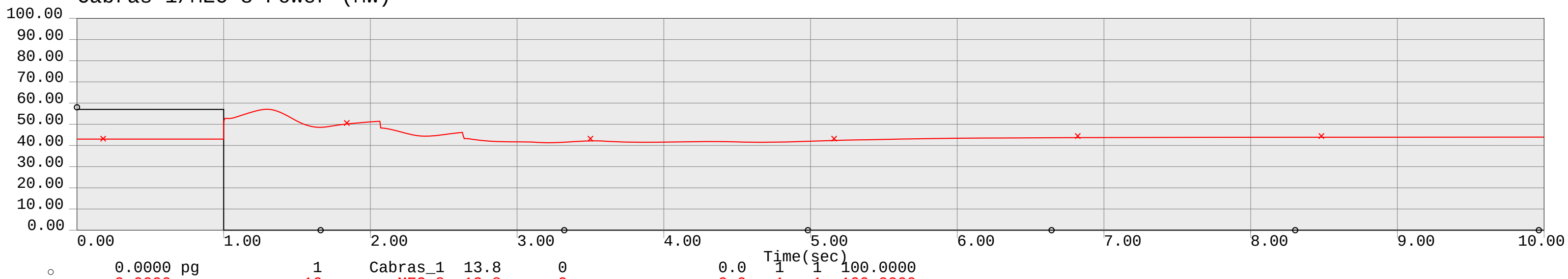
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



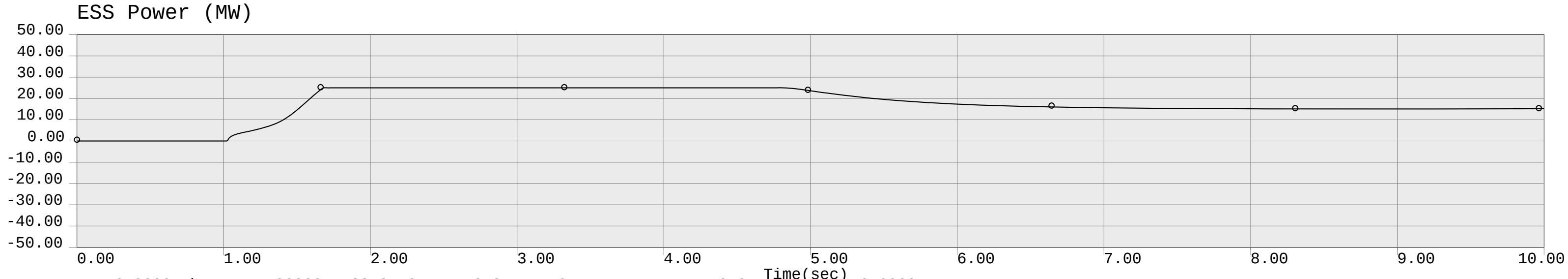
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



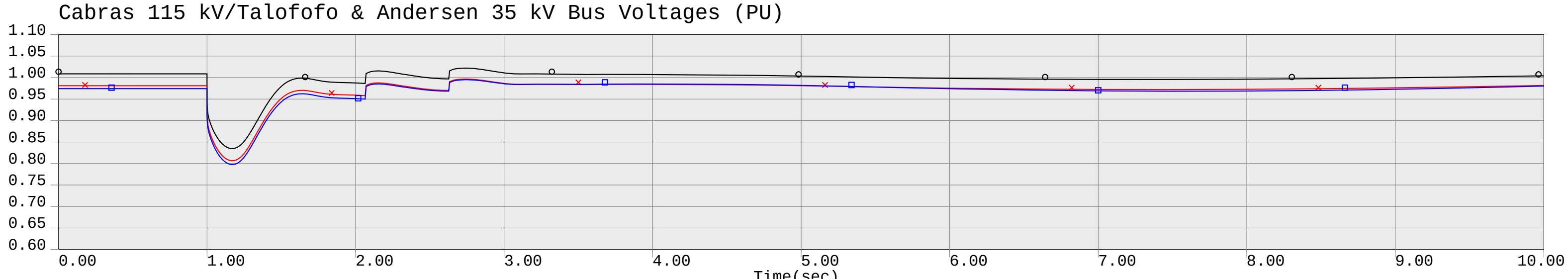
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

chans/1300-c1-1c.chf

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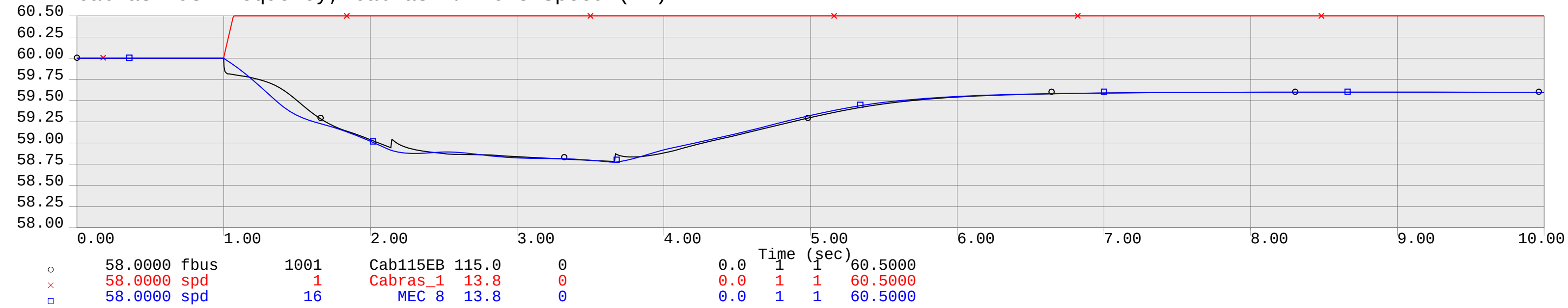
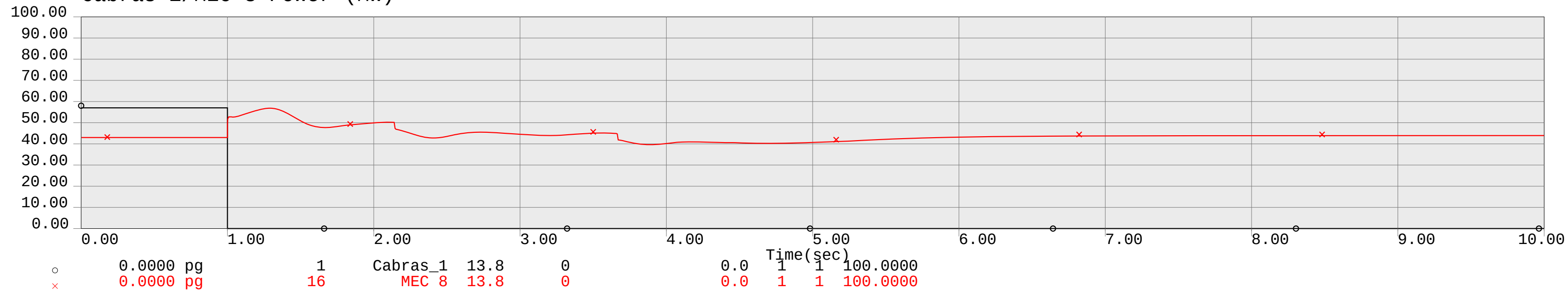
Agana 115 kV ESS

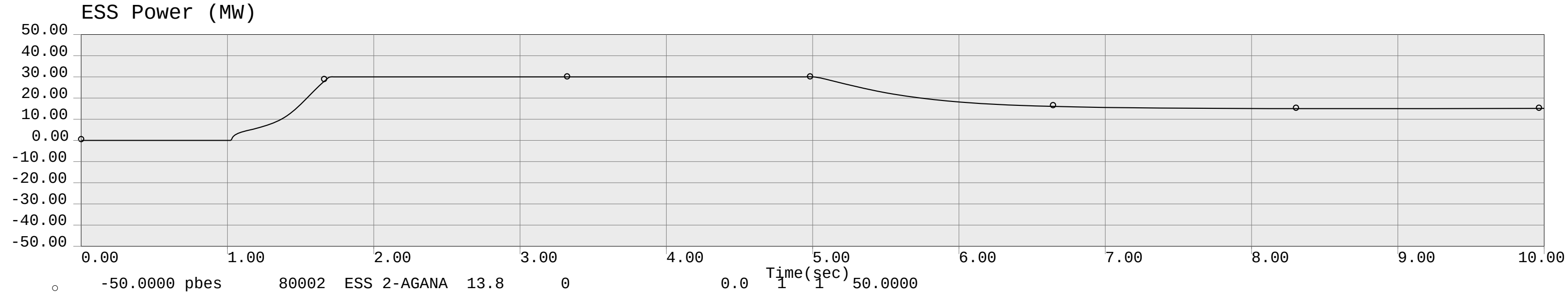
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



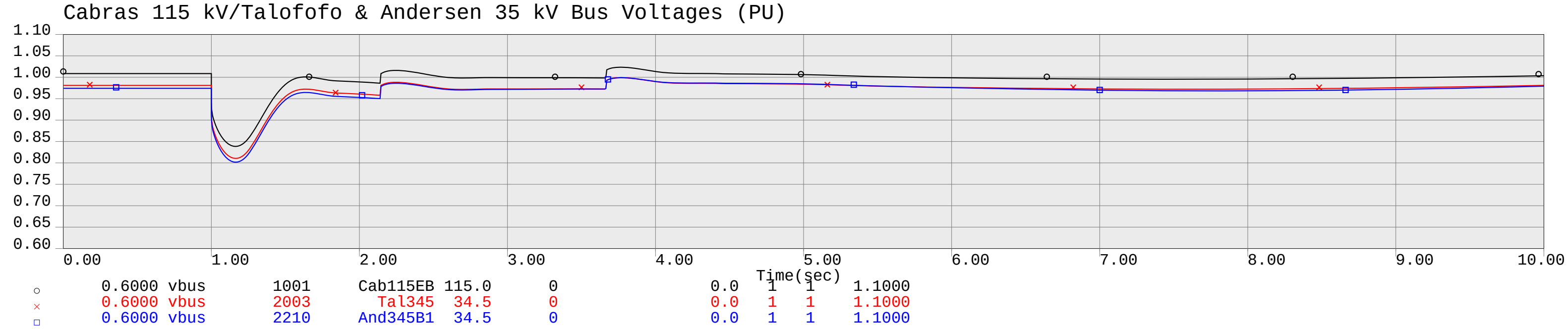
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)

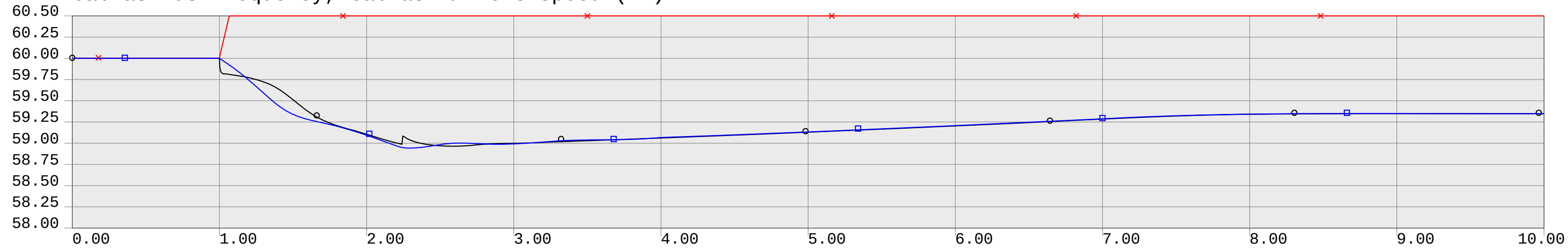


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



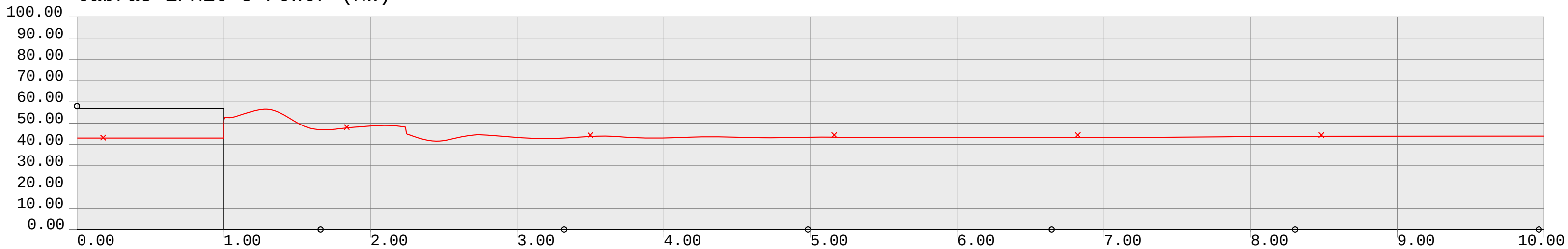
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



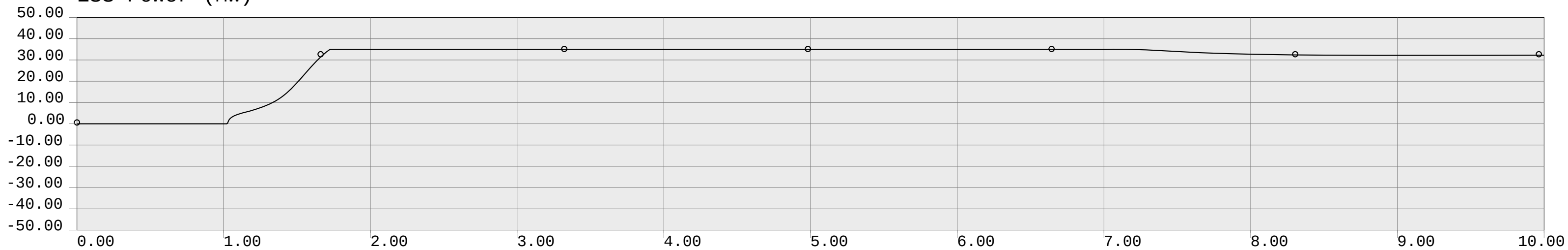
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



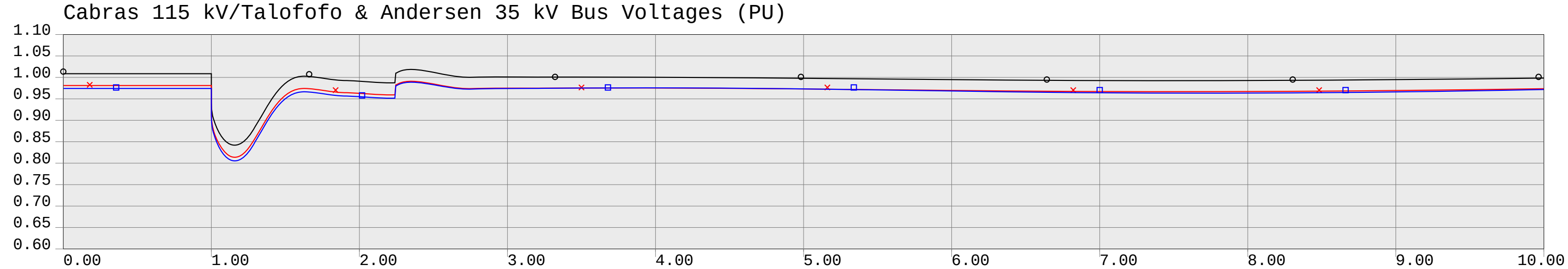
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

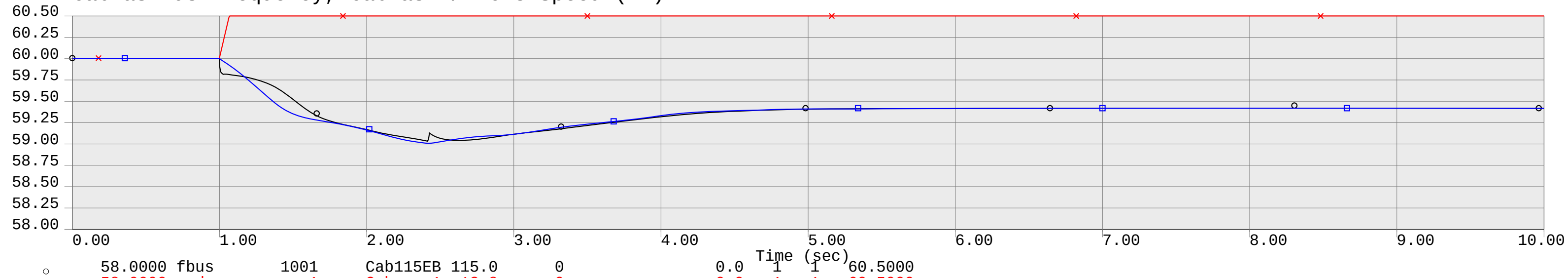
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

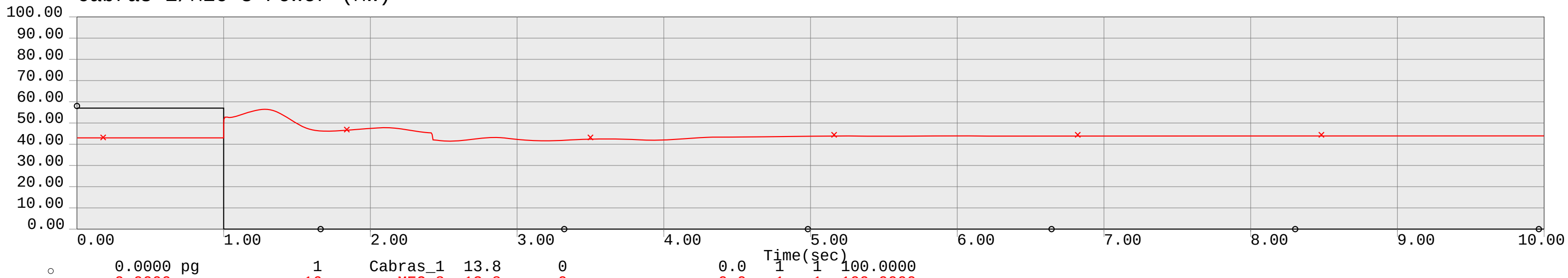
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



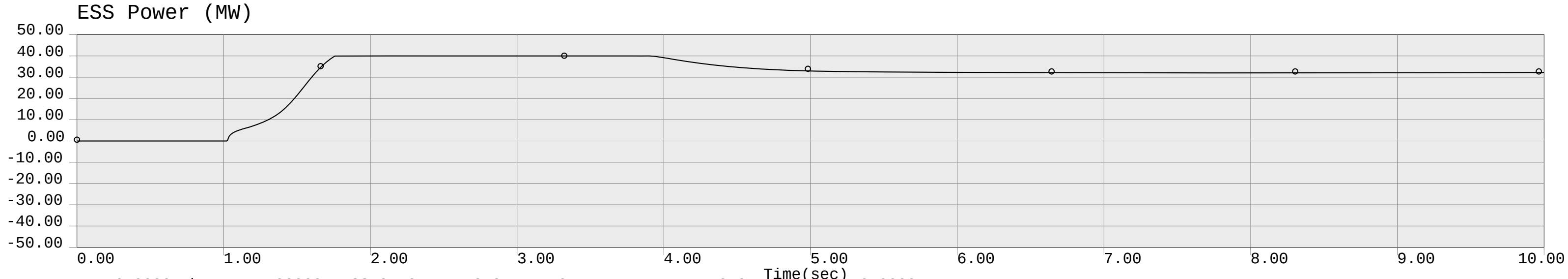
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



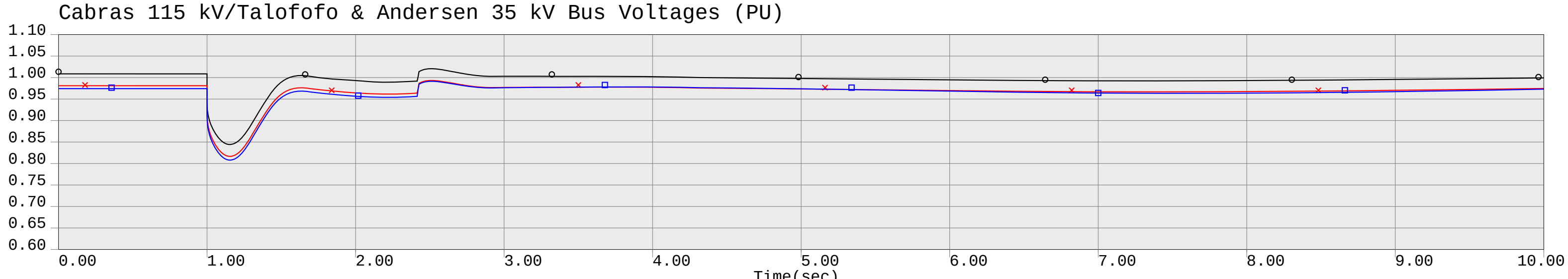
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

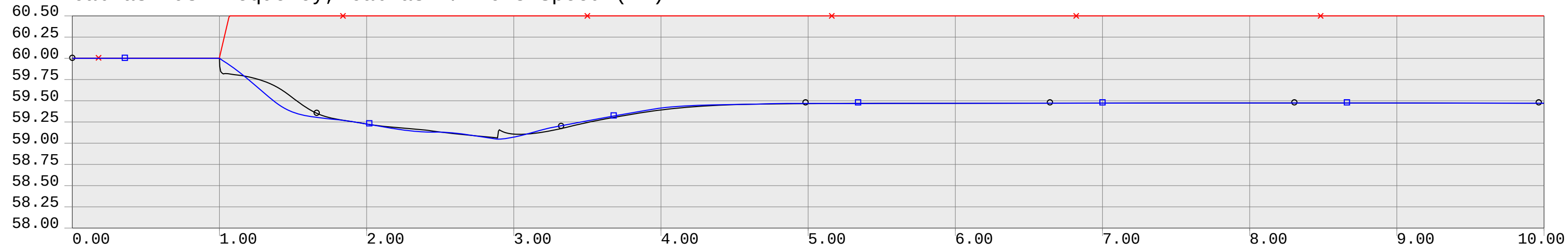
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

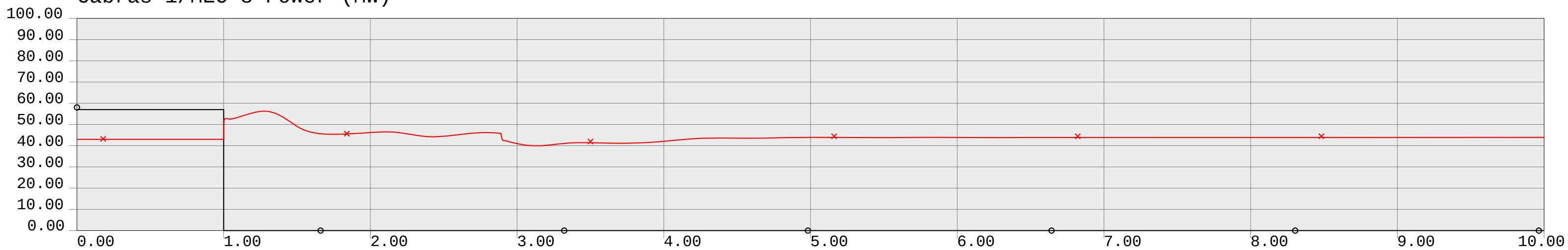
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



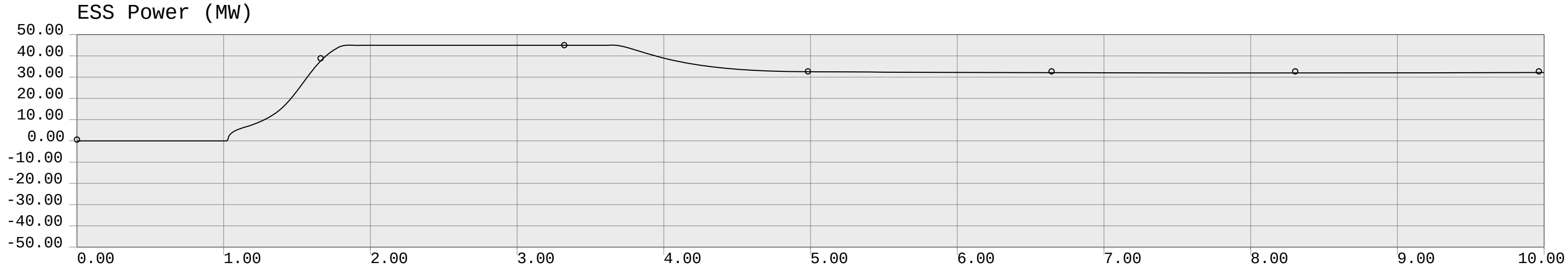
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



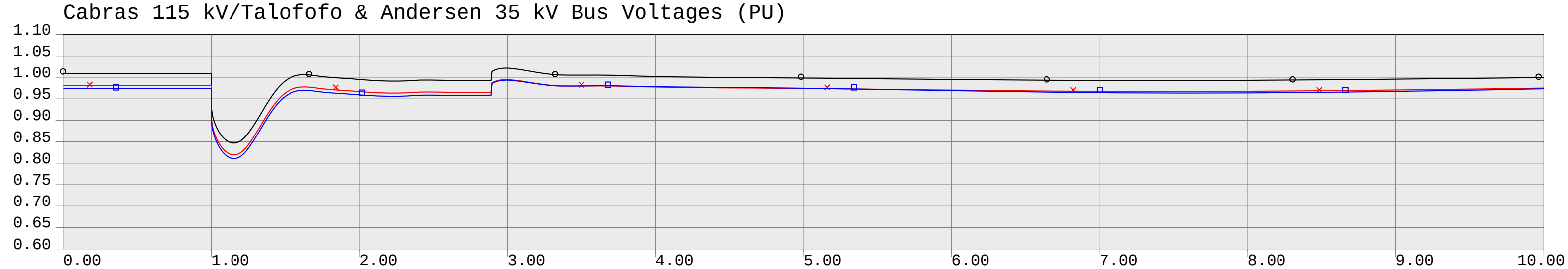
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

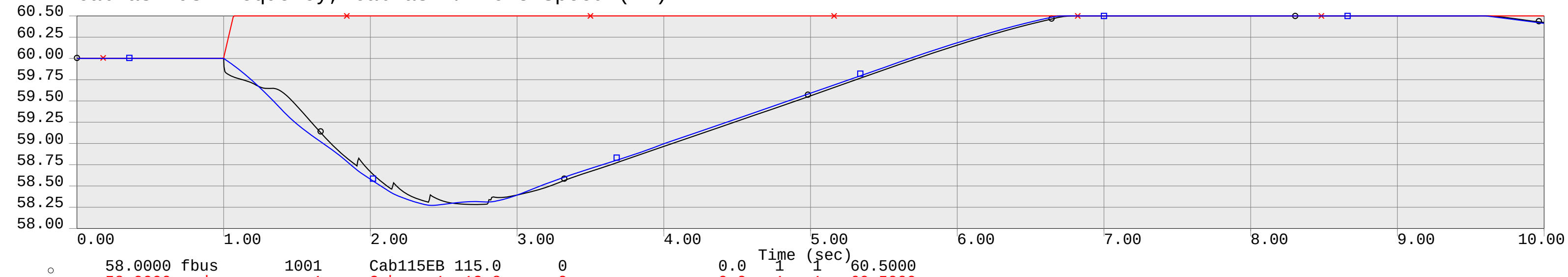
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

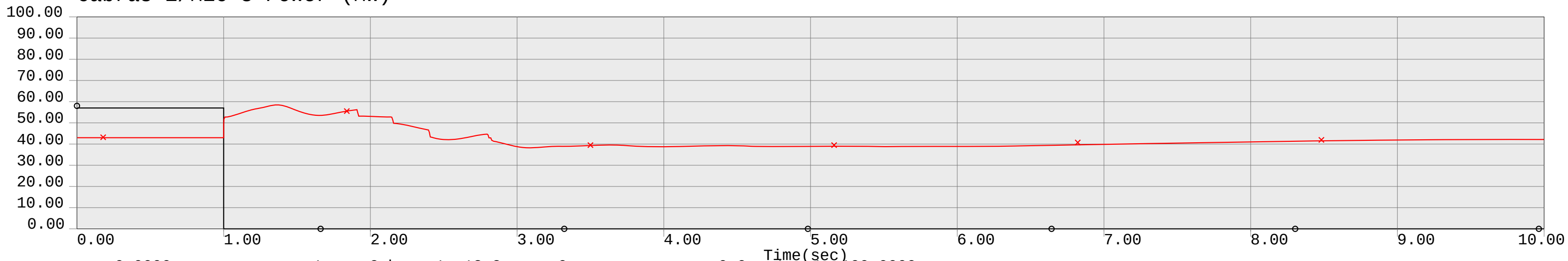
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



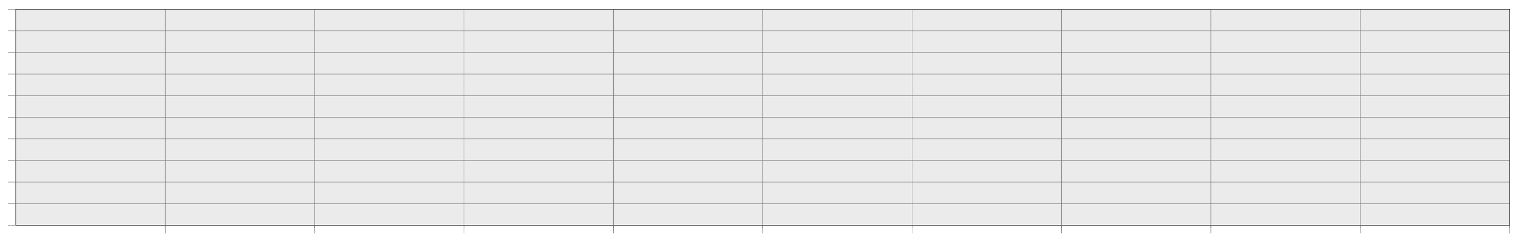
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)

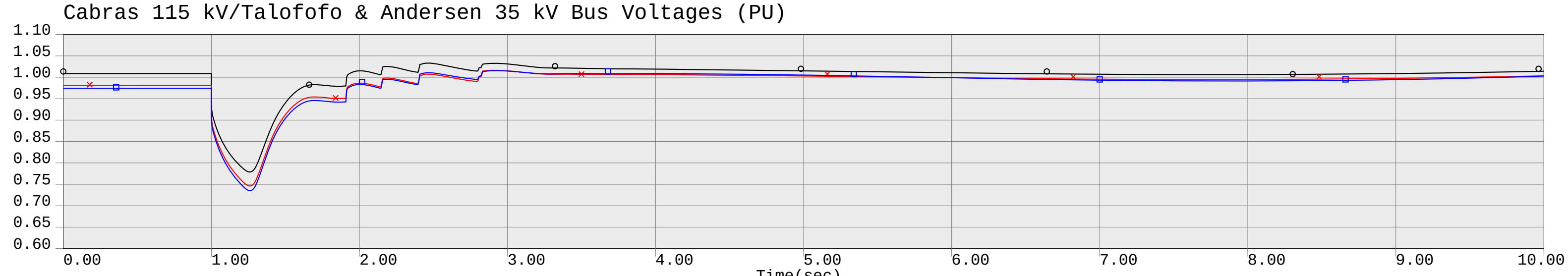


○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



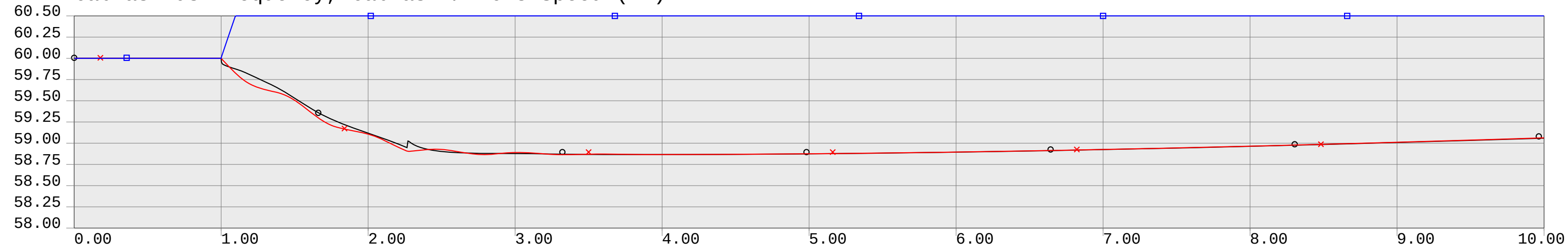
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

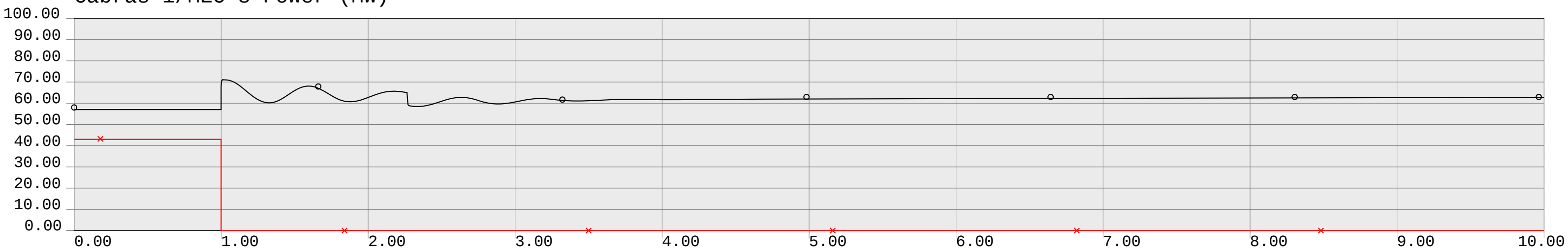
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



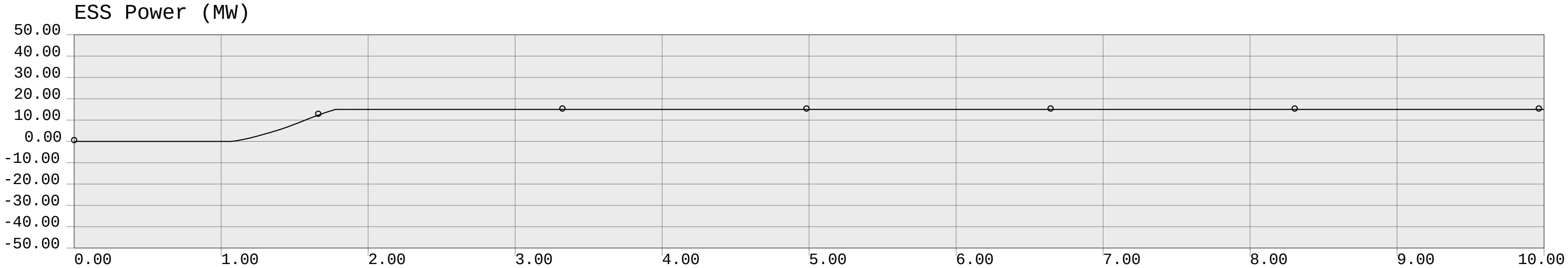
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



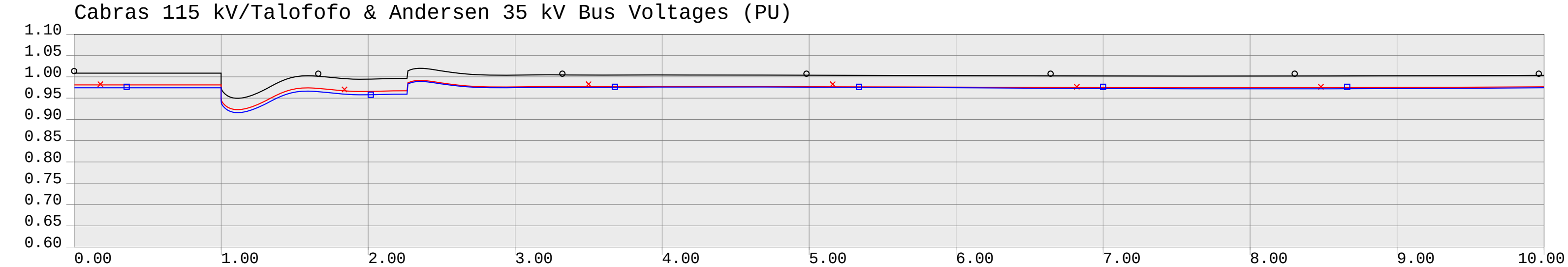
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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Guam Power Authority - EPS Energy Storage Analysis
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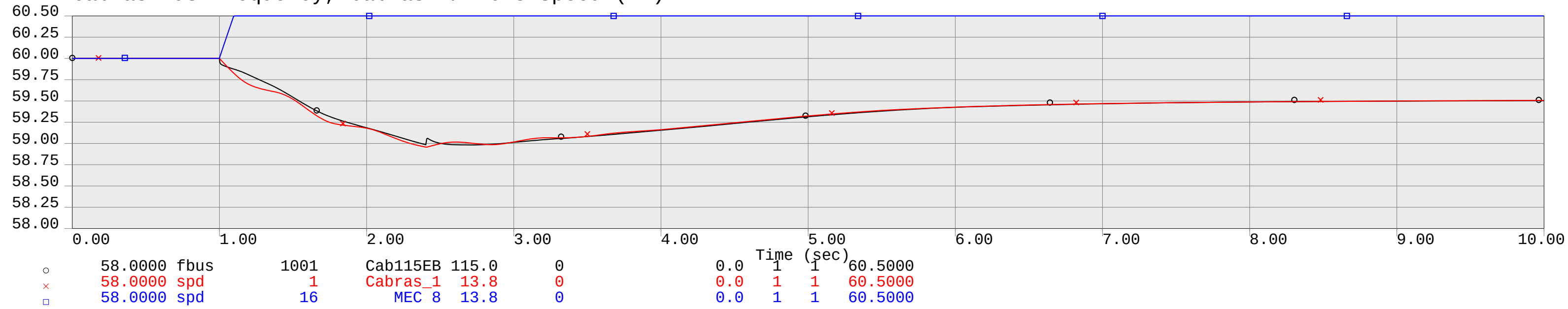
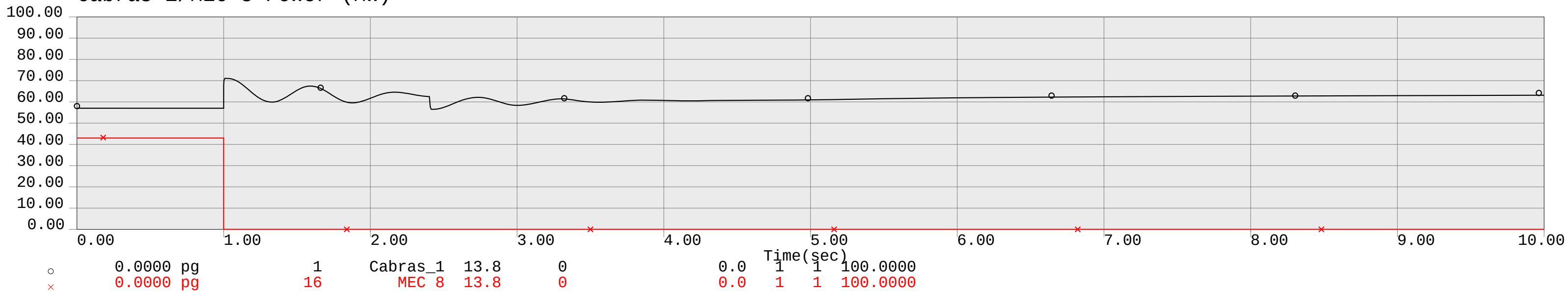
Agana 115 kV ESS

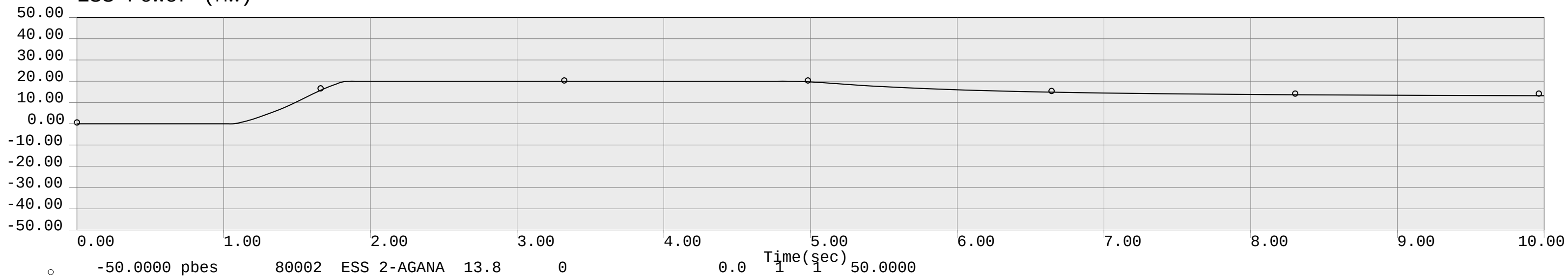
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



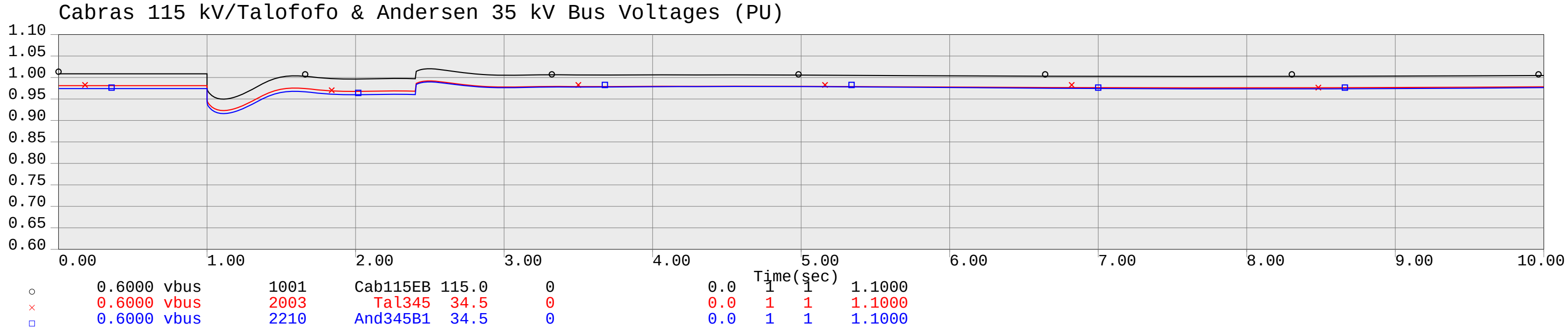
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)

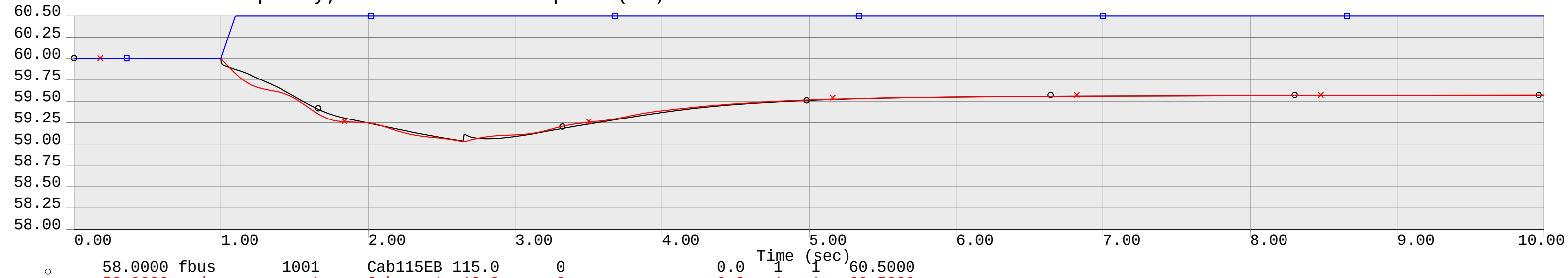


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



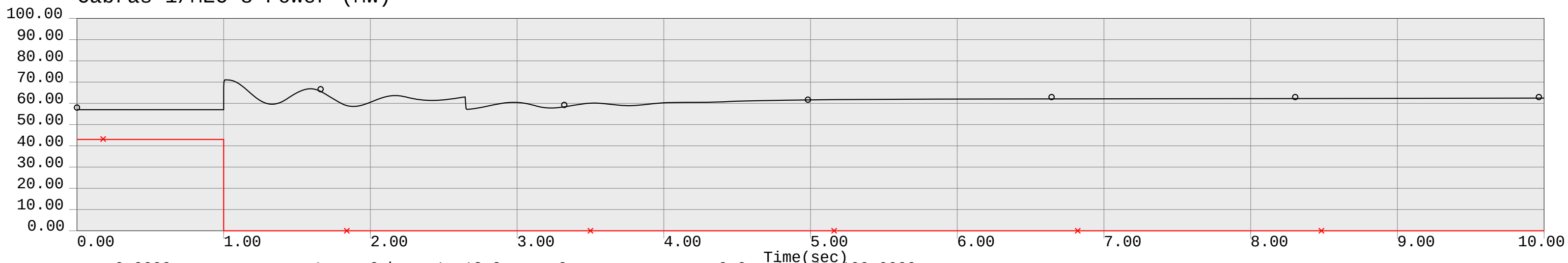
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



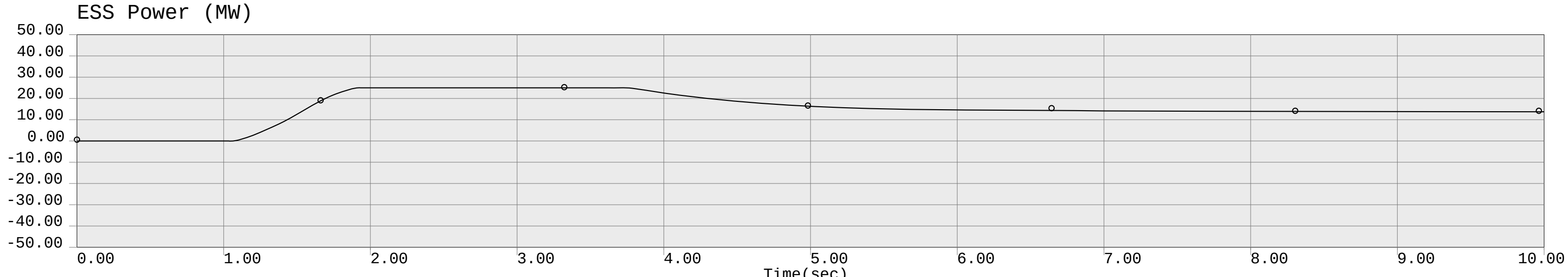
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



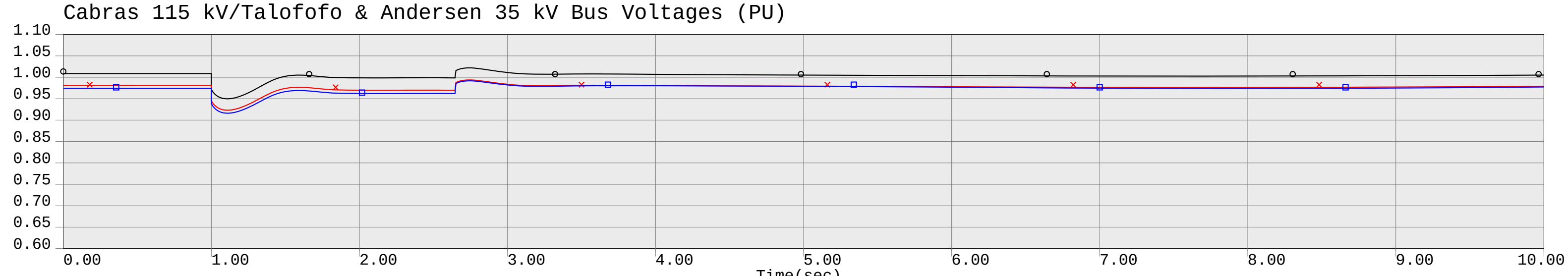
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

chans/1300-m8-1c.chf

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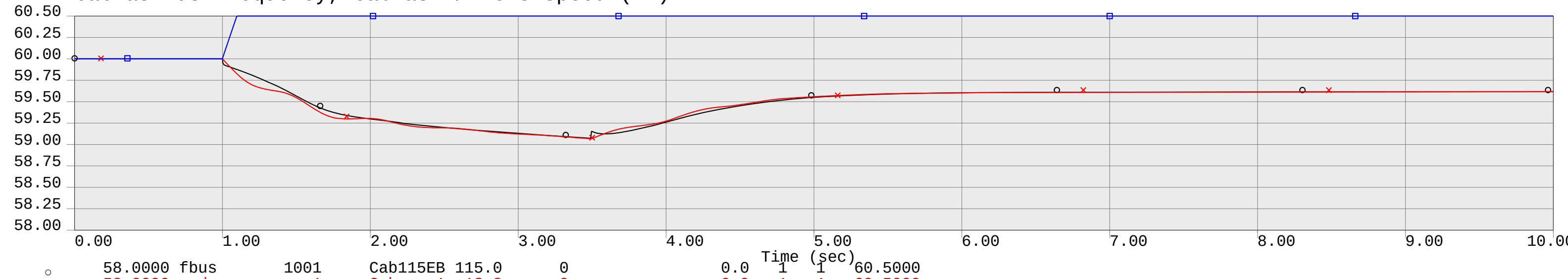
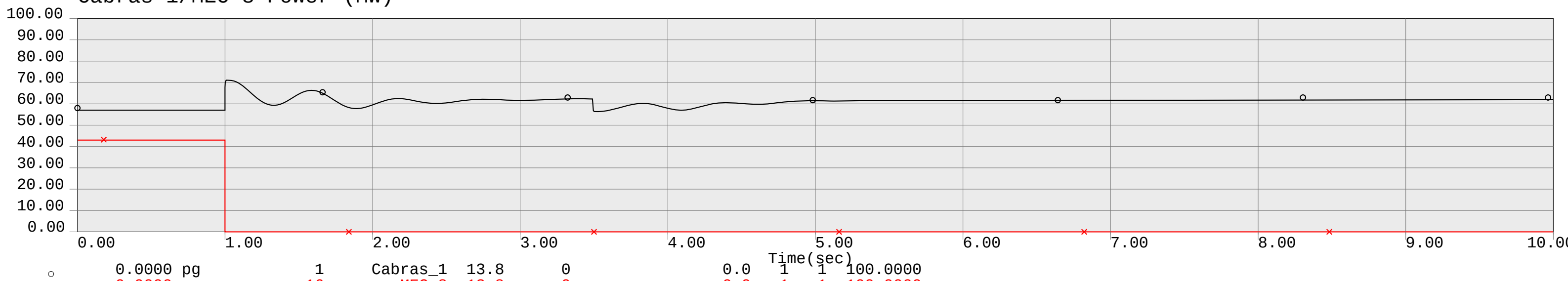
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



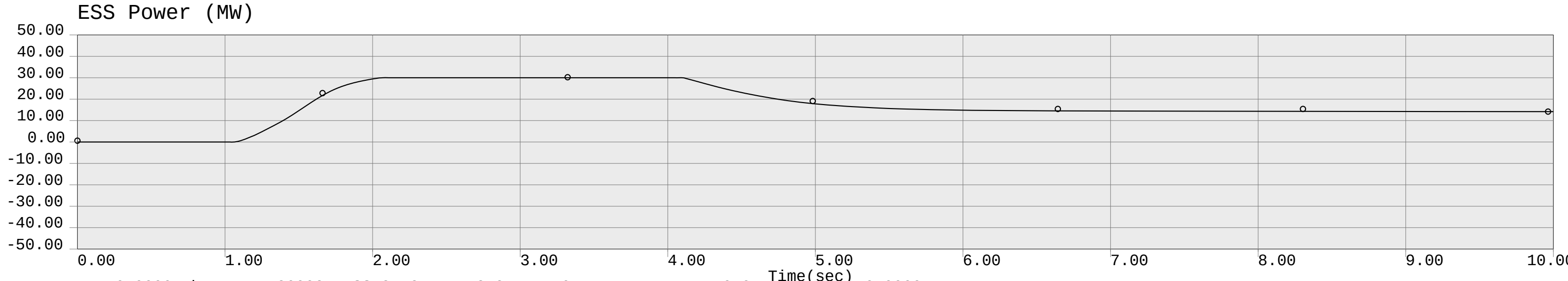
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



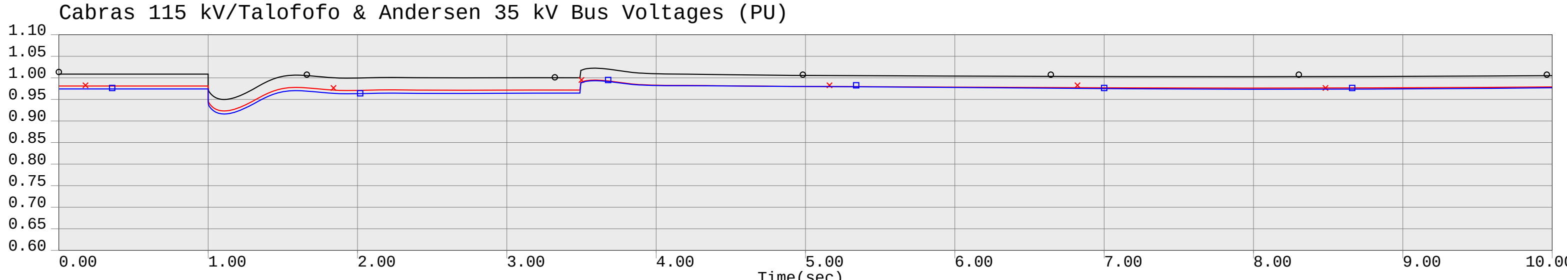
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

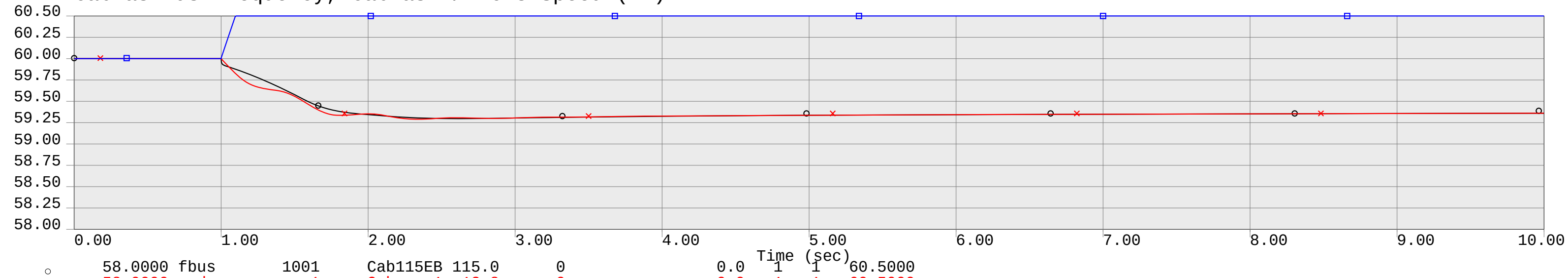
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

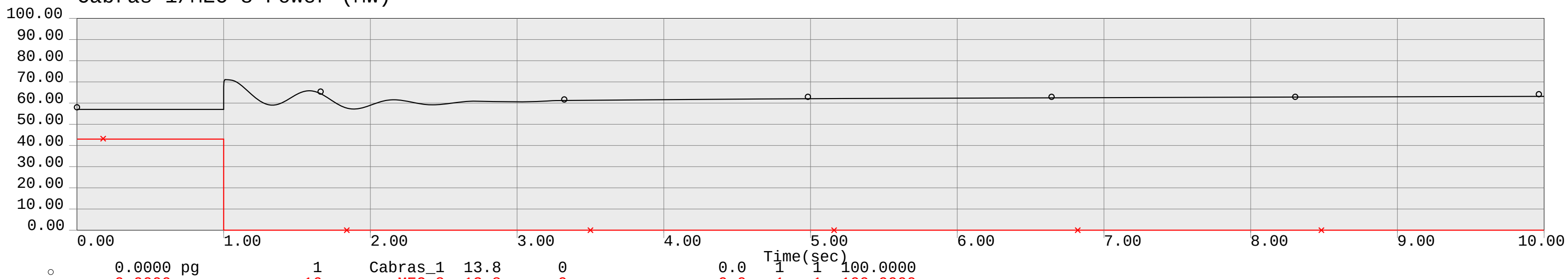
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



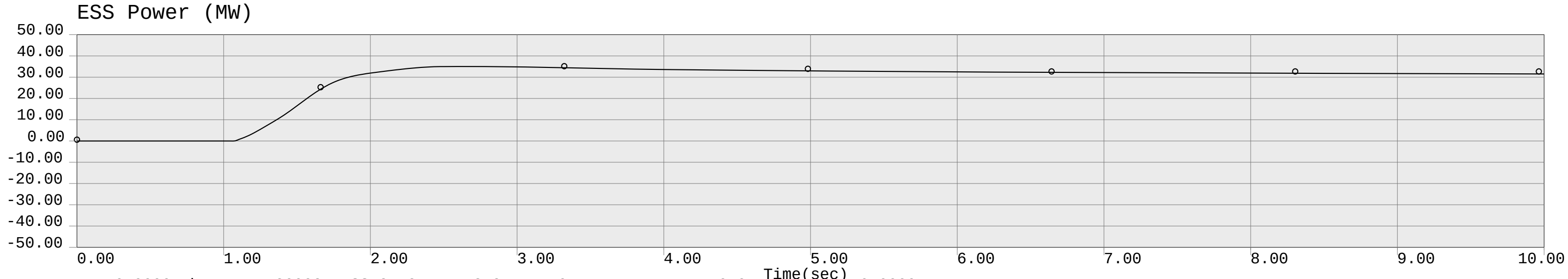
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



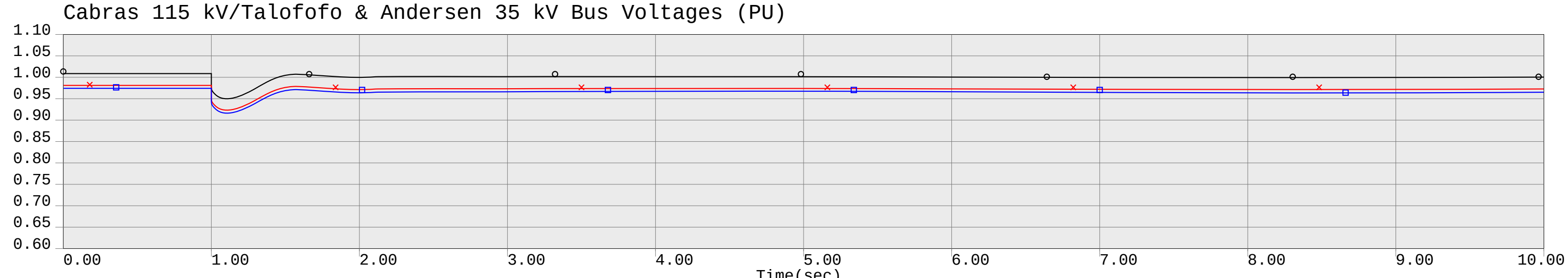
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
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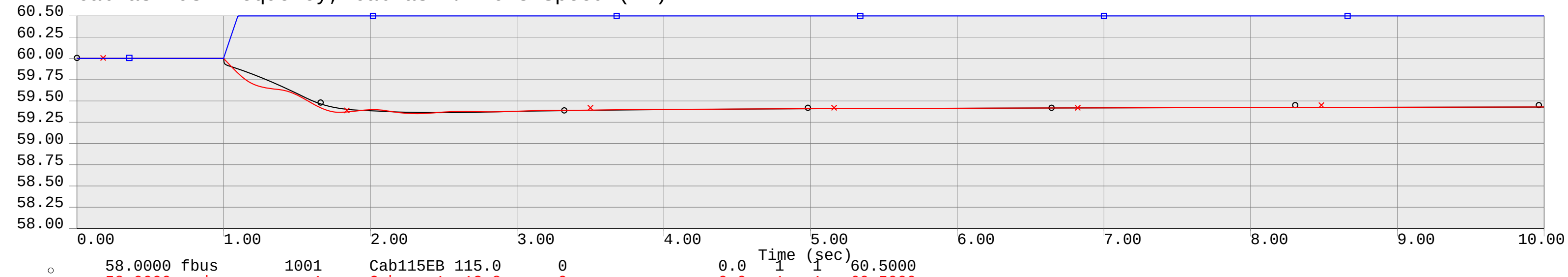
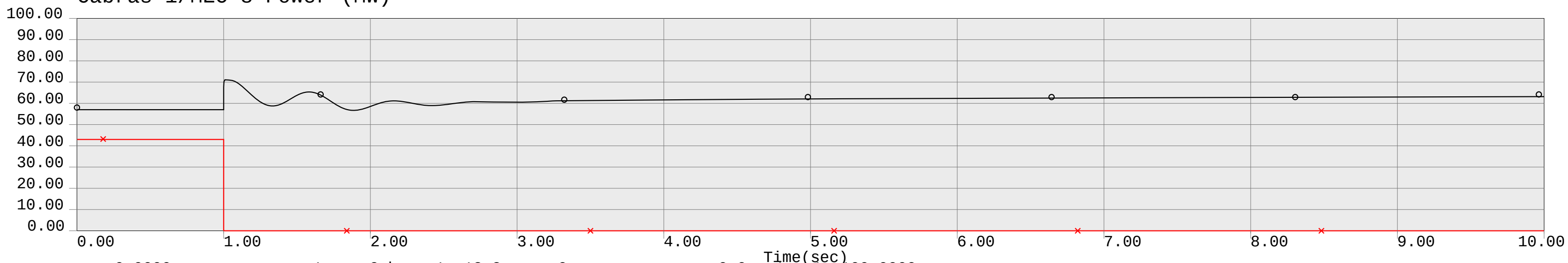
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



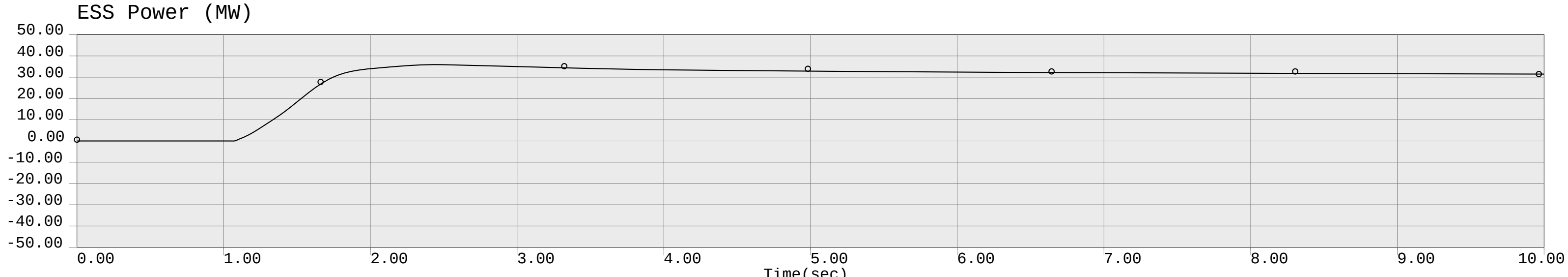
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



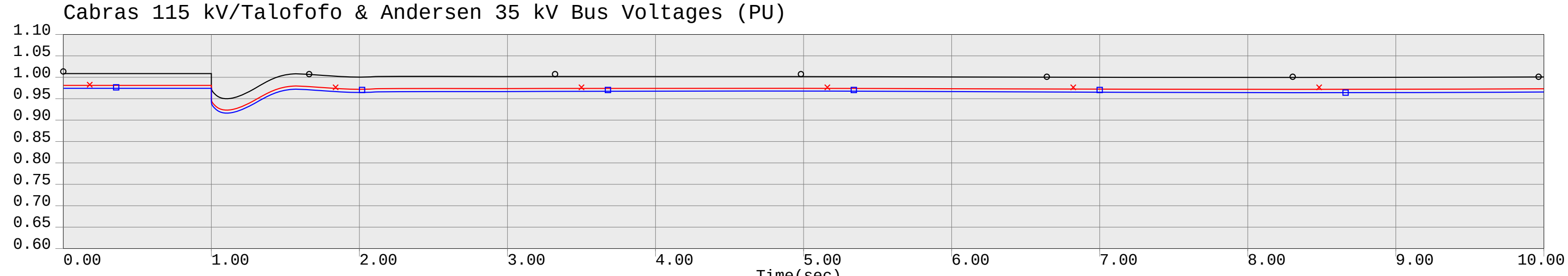
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1300-m8-1f.chf

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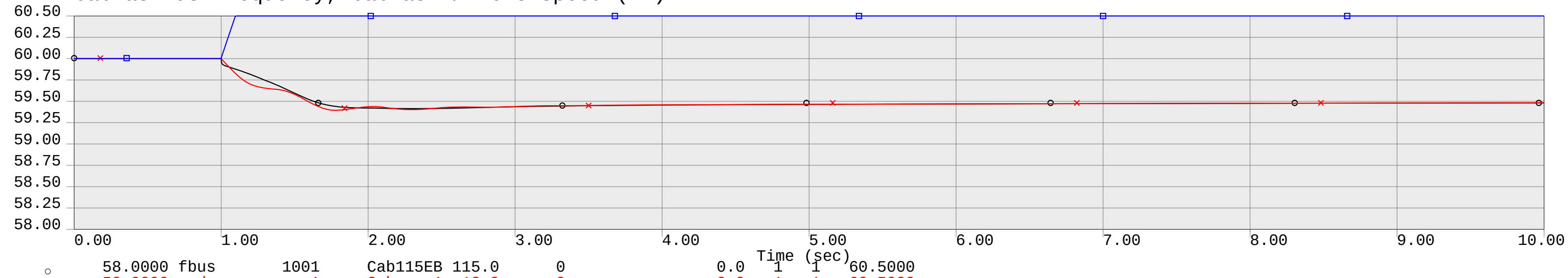
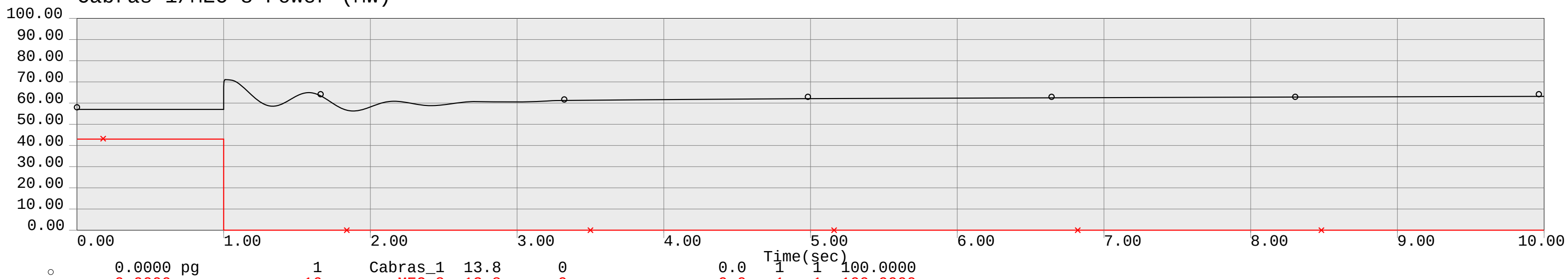
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



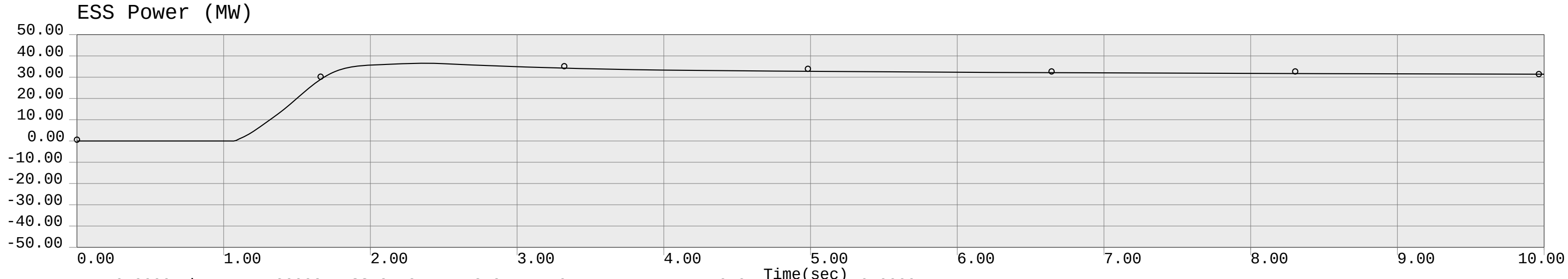

```
○ 58.0000 fbus    1001  Cab115EB 115.0  0   0.0  1  1  60.5000
× 58.0000 spd        1  Cabras_1  13.8  0   0.0  1  1  60.5000
□ 58.0000 spd       16     MEC 8  13.8  0   0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)



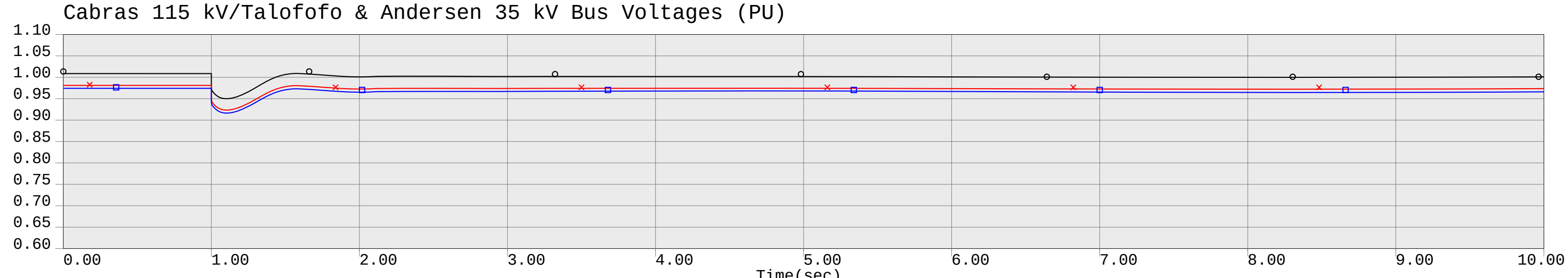

```
○ 0.0000 pg     1  Cabras_1  13.8  0   0.0  1  1  100.0000
× 0.0000 pg    16     MEC 8  13.8  0   0.0  1  1  100.0000
```

ESS Power (MW)




```
○ -50.0000 pbes   80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○ 0.6000 vbus   1001  Cab115EB 115.0  0   0.0  1  1  1.1000
× 0.6000 vbus   2003    Tal345  34.5  0   0.0  1  1  1.1000
□ 0.6000 vbus   2210  And345B1  34.5  0   0.0  1  1  1.1000
```


chans/1300-m8-1g.chf

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Guam Power Authority - EPS Energy Storage Analysis
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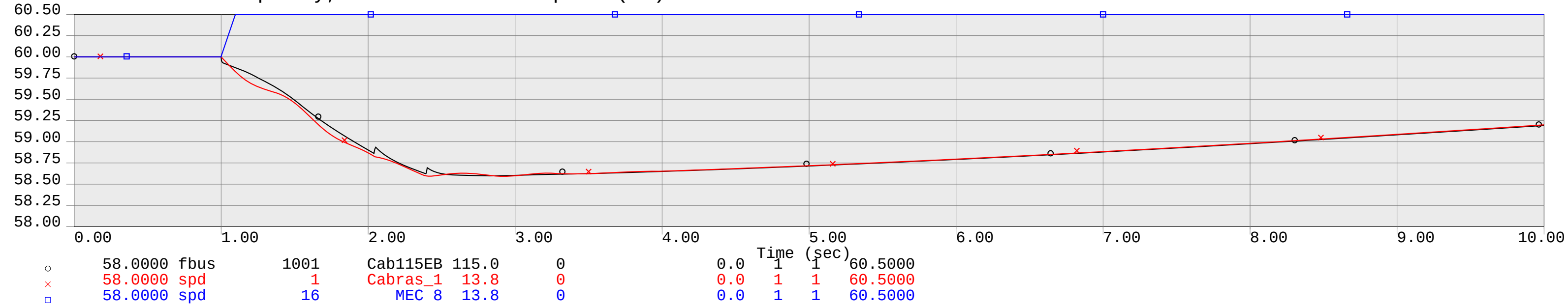
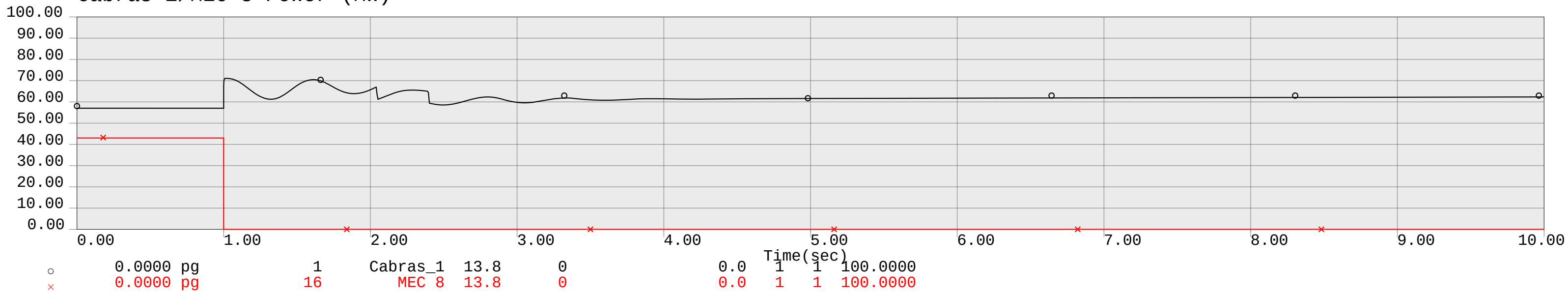
Agana 115 kV ESS

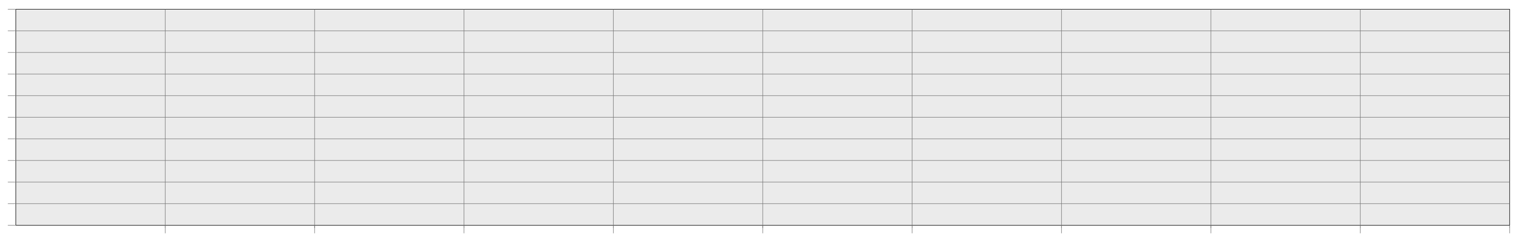
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



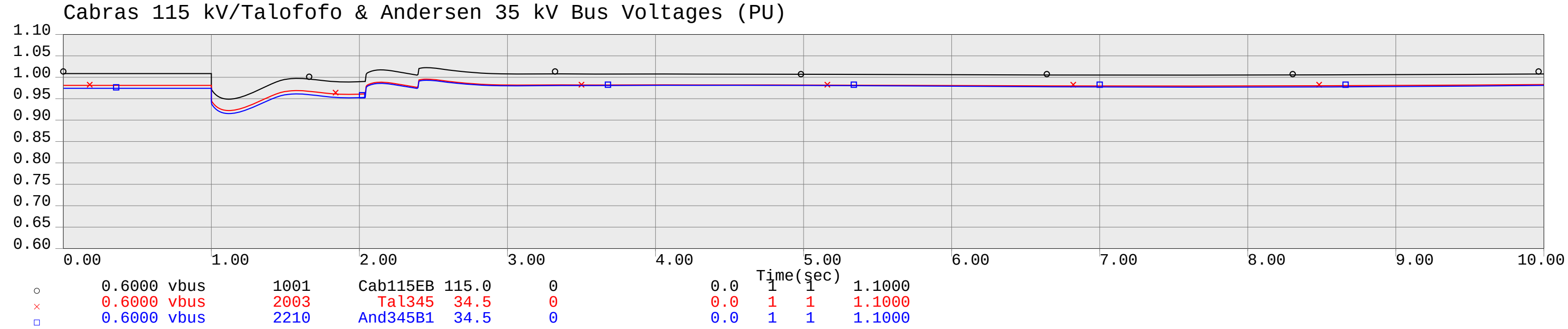
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



chans/1300-m8-ref.chf

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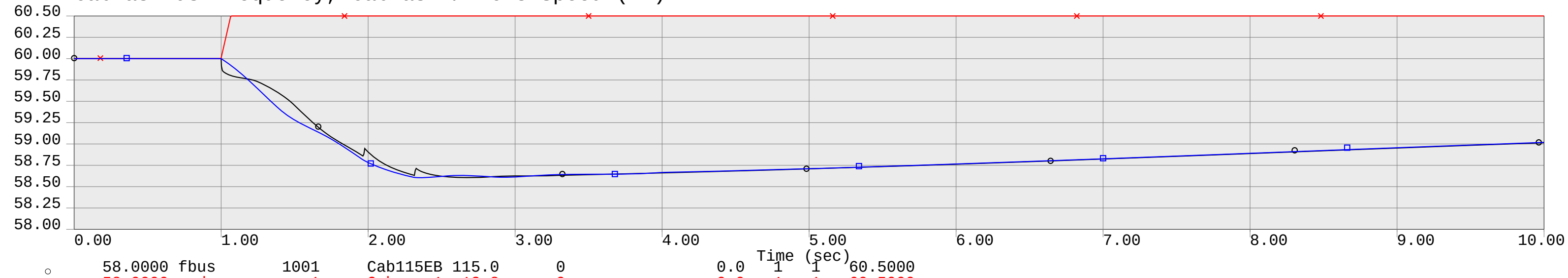
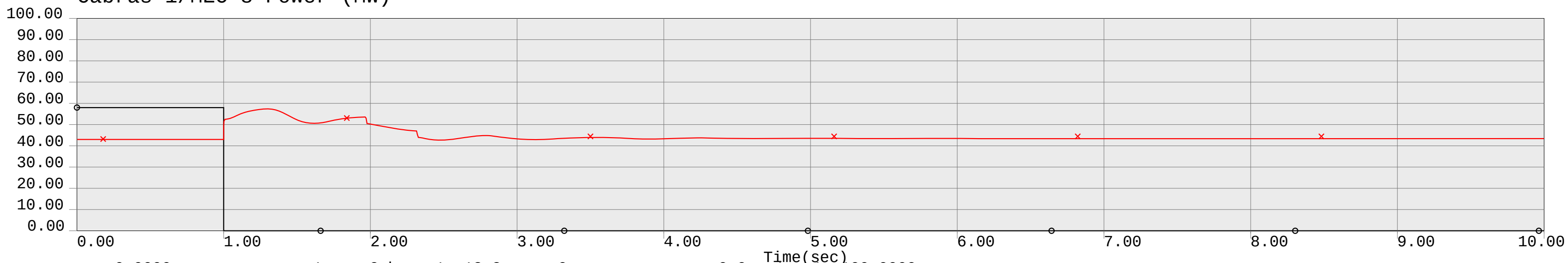
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



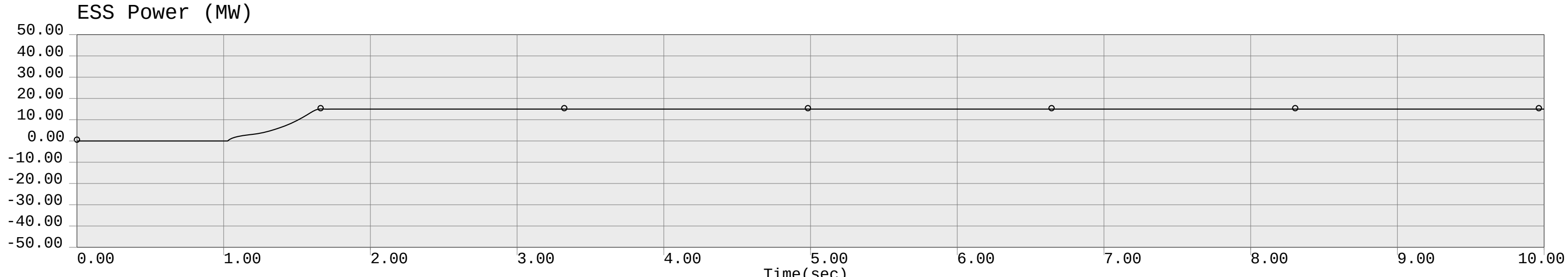

```
○  58.0000 fbus     1001   Cab115EB 115.0   0    0.0  1  1   60.5000
×  58.0000 spd         1   Cabras_1  13.8   0    0.0  1  1   60.5000
□  58.0000 spd        16      MEC 8  13.8   0    0.0  1  1   60.5000
```

Cabras 1/MEC 8 Power (MW)




```
○   0.0000 pg          1   Cabras_1  13.8   0    0.0  1  1  100.0000
×   0.0000 pg         16      MEC 8  13.8   0    0.0  1  1  100.0000
```

ESS Power (MW)




```
○ -50.0000 pbes    80002 ESS 2-AGANA 13.8   0    0.0  1  1   50.0000
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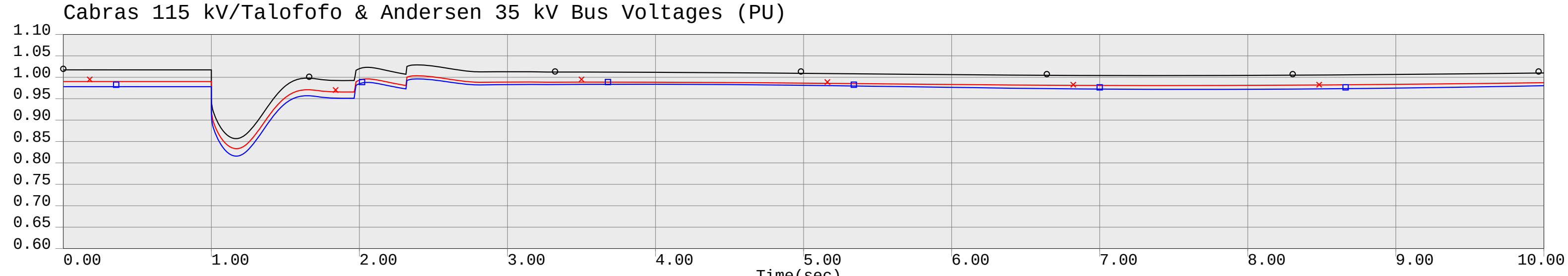
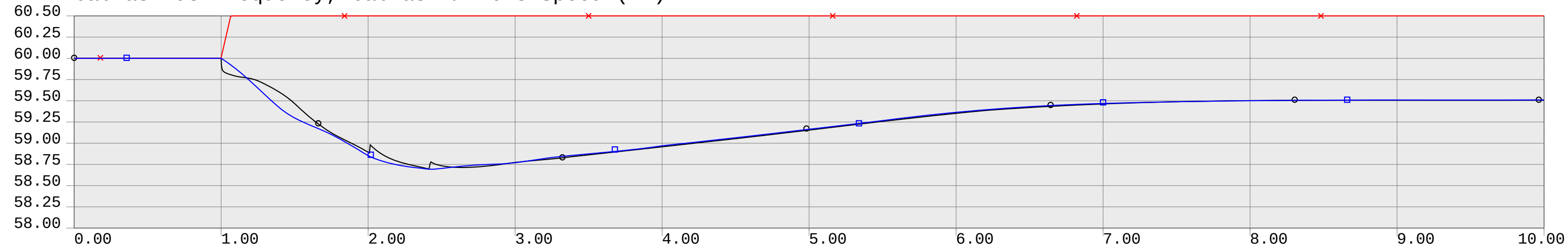
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○   0.6000 vbus     1001   Cab115EB 115.0   0    0.0  1  1    1.1000
×   0.6000 vbus     2003     Tal345  34.5   0    0.0  1  1    1.1000
□   0.6000 vbus     2210   And345B1  34.5   0    0.0  1  1    1.1000
```

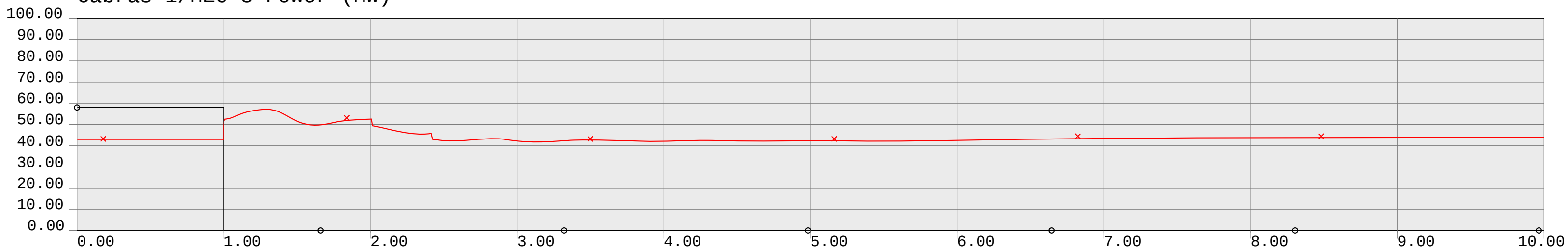
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



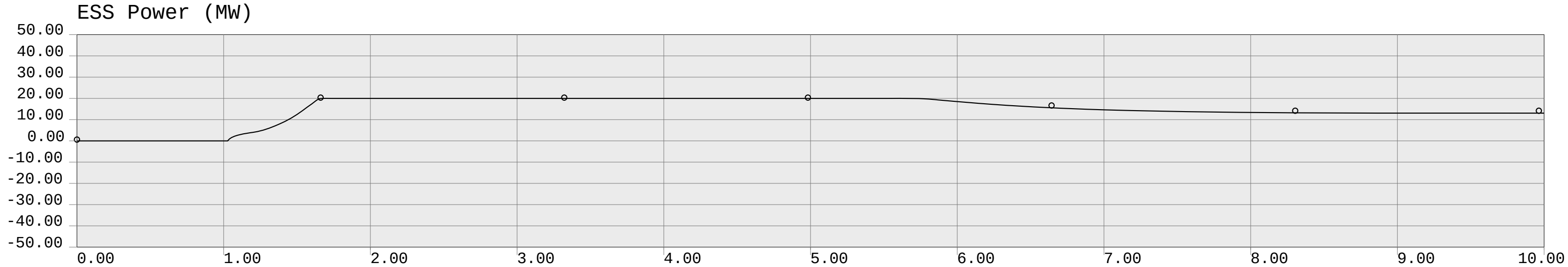
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



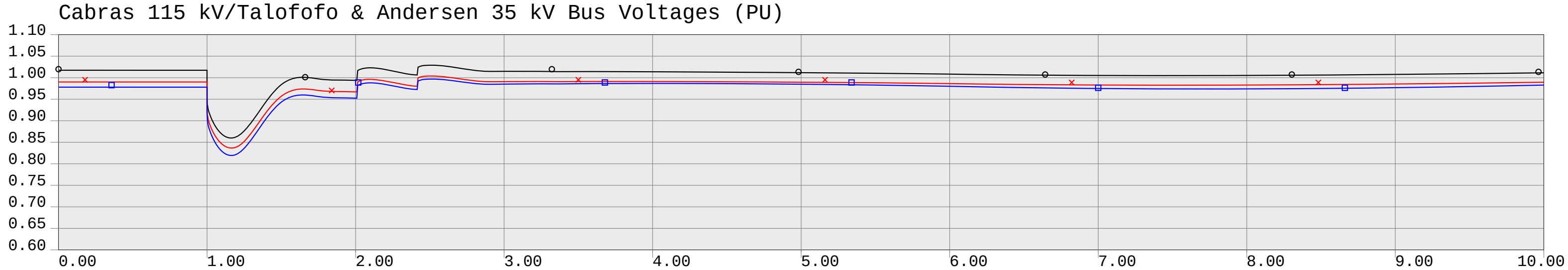
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1400-c1-1b.chf

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Guam Power Authority - EPS Energy Storage Analysis
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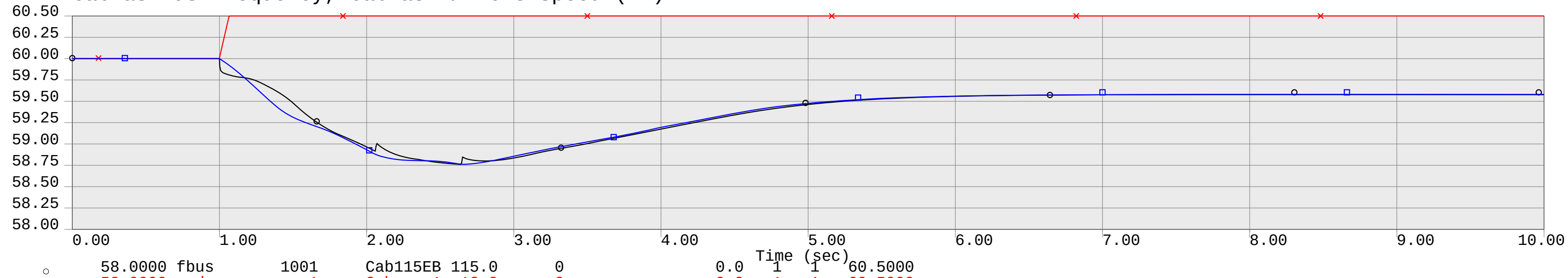
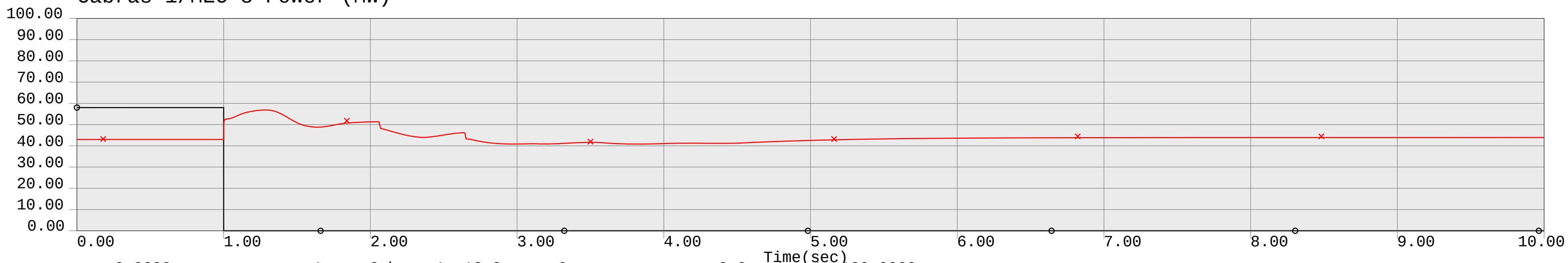
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



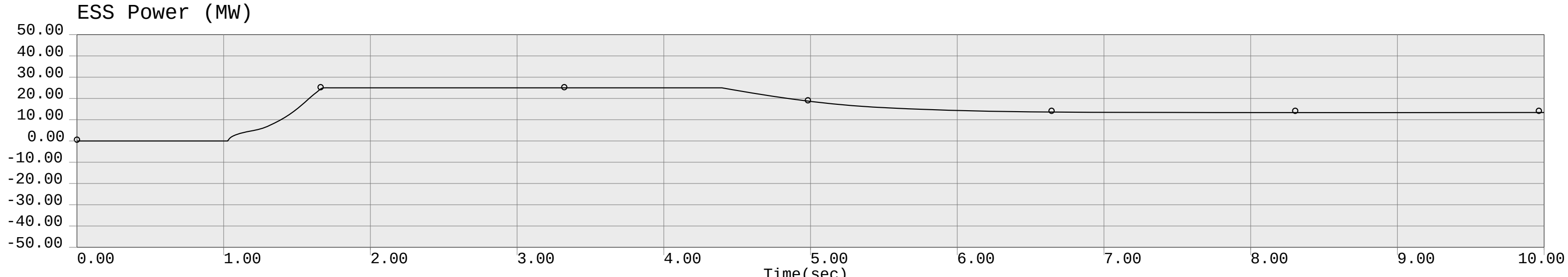
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



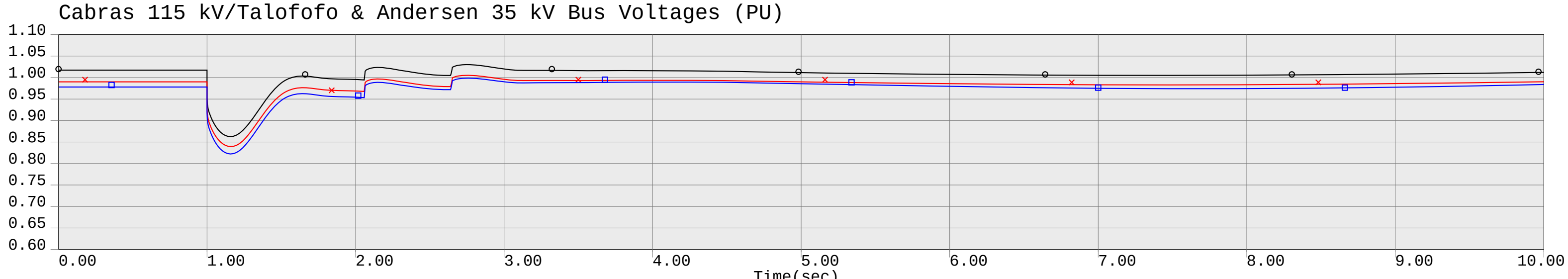
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

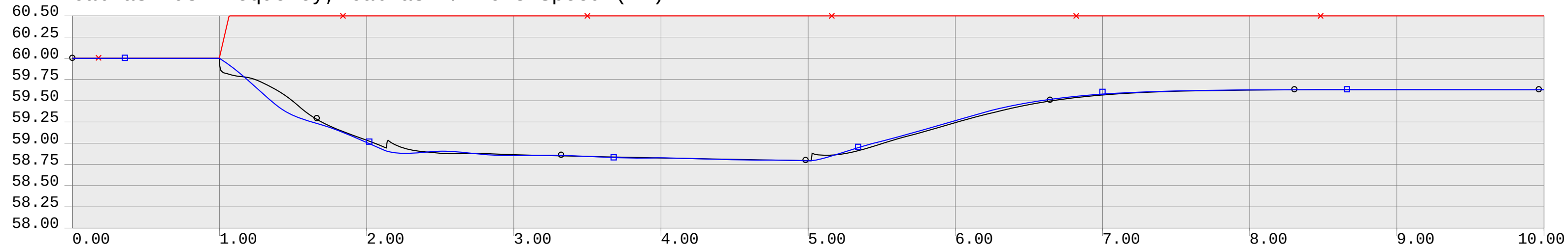
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

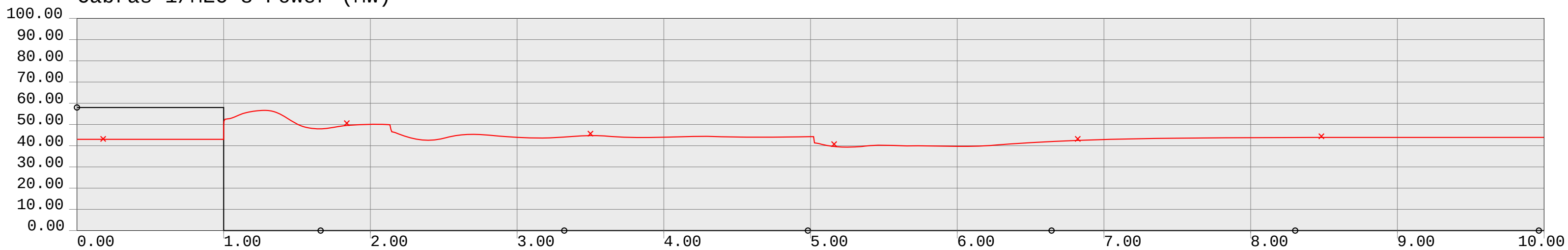
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



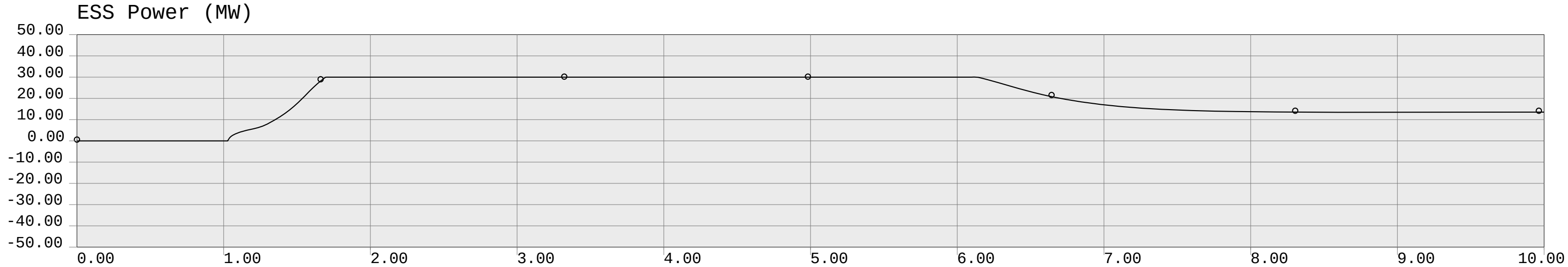
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



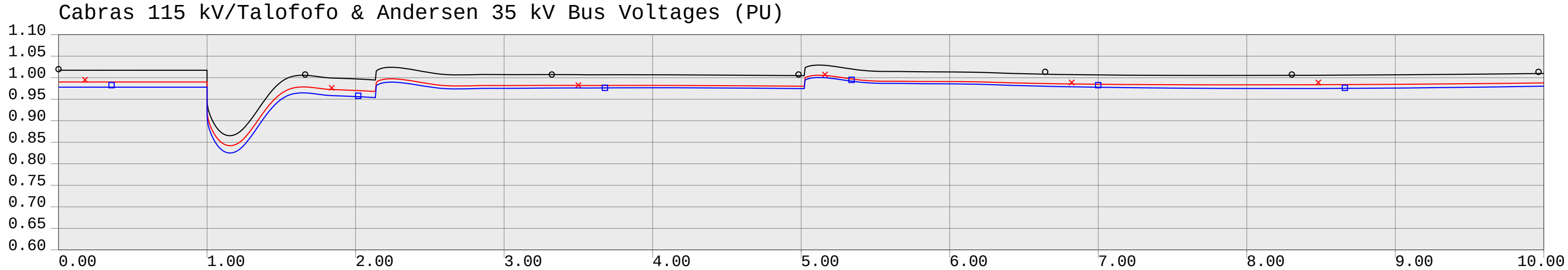
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

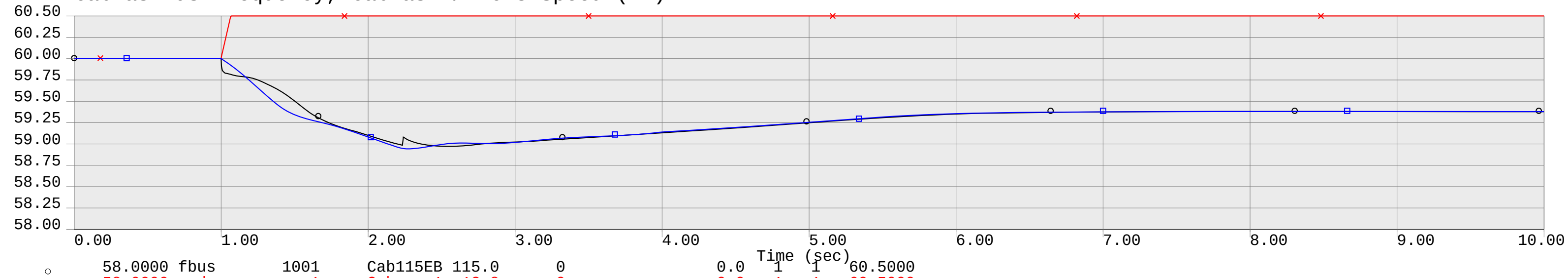
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

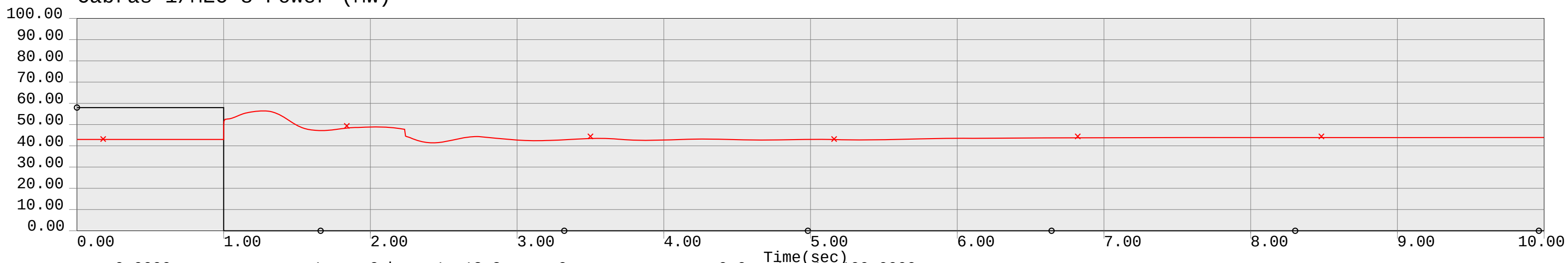
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



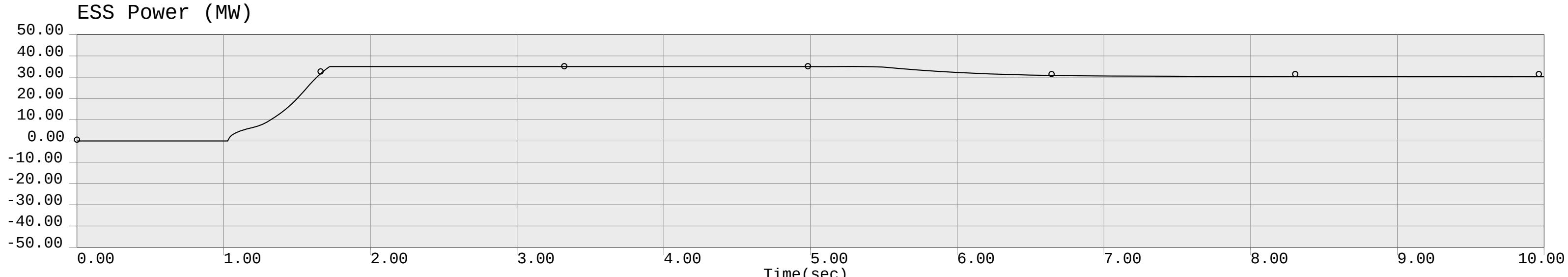
○ 58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
× 58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□ 58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



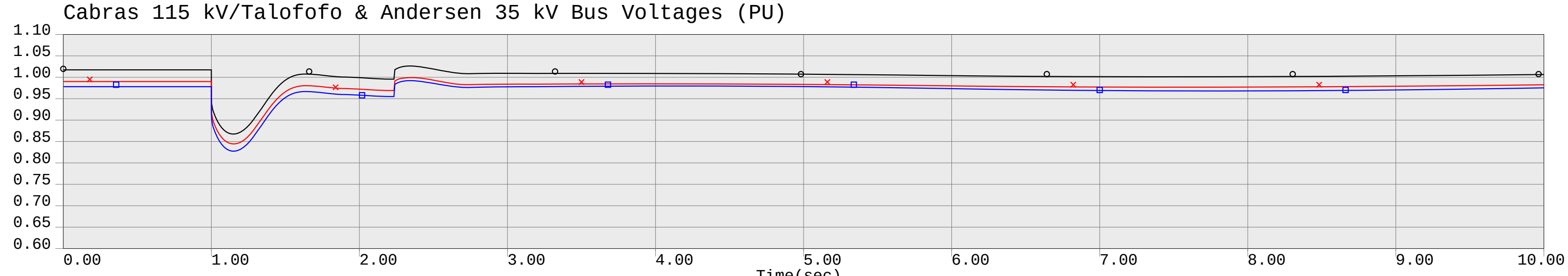
○ 0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
× 0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○ -50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
× 0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□ 0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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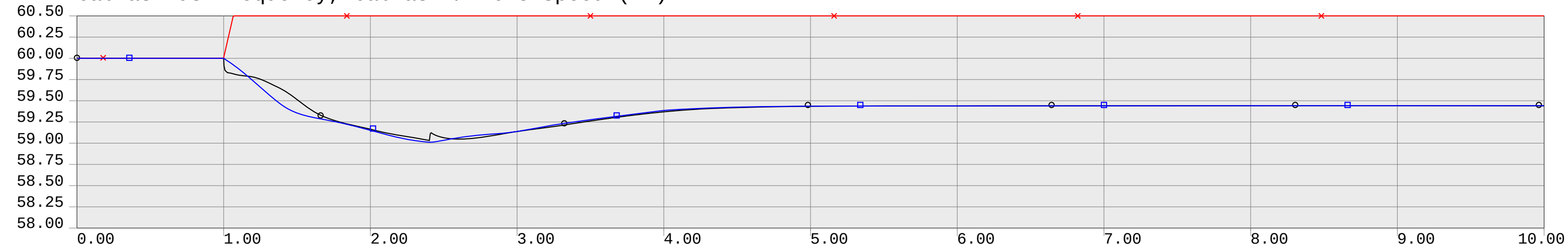
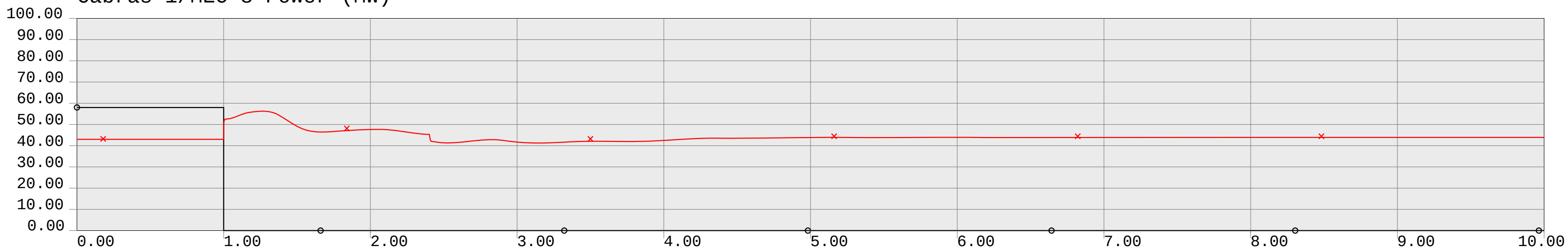
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



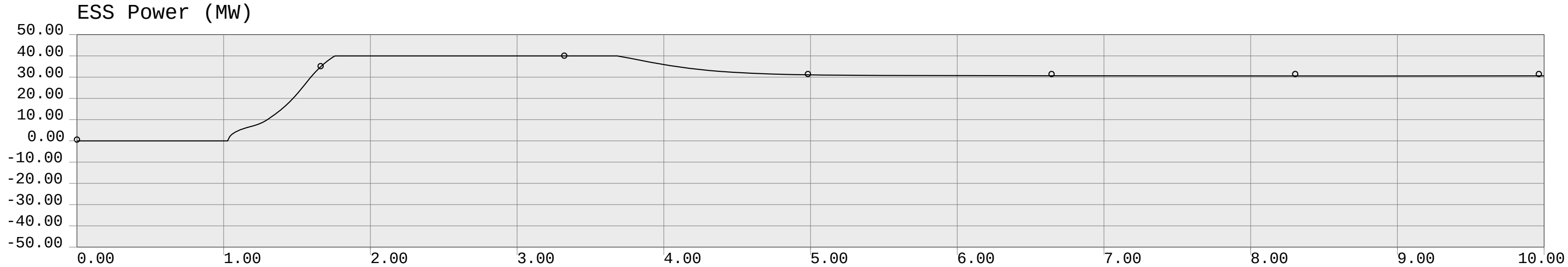
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



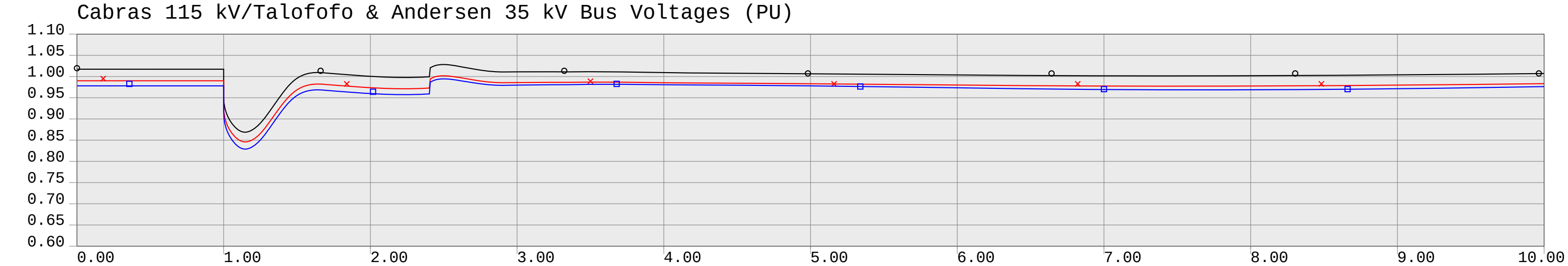
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1400-c1-1f.chf

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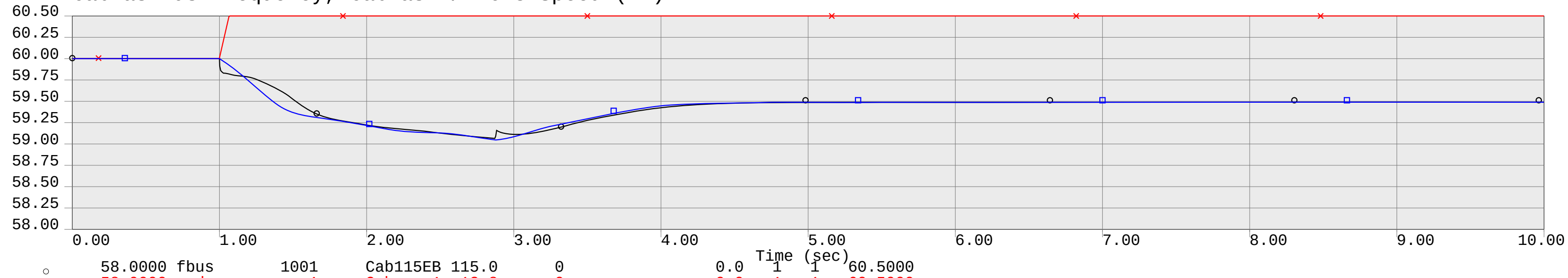
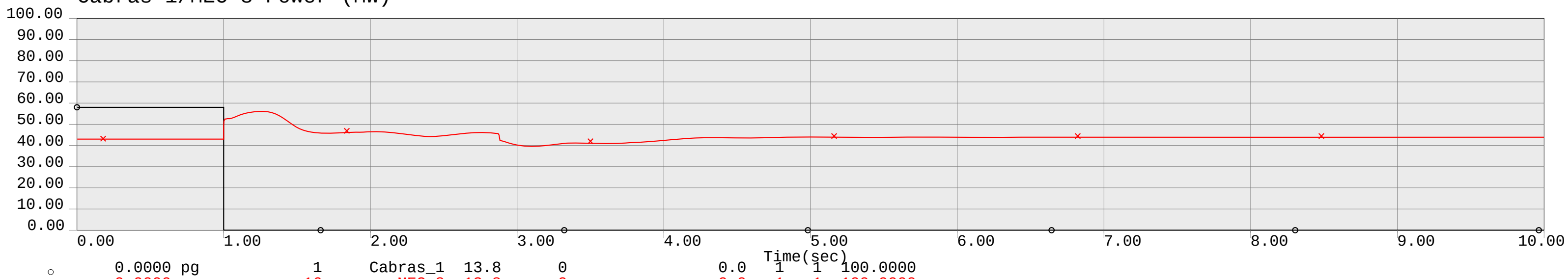
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



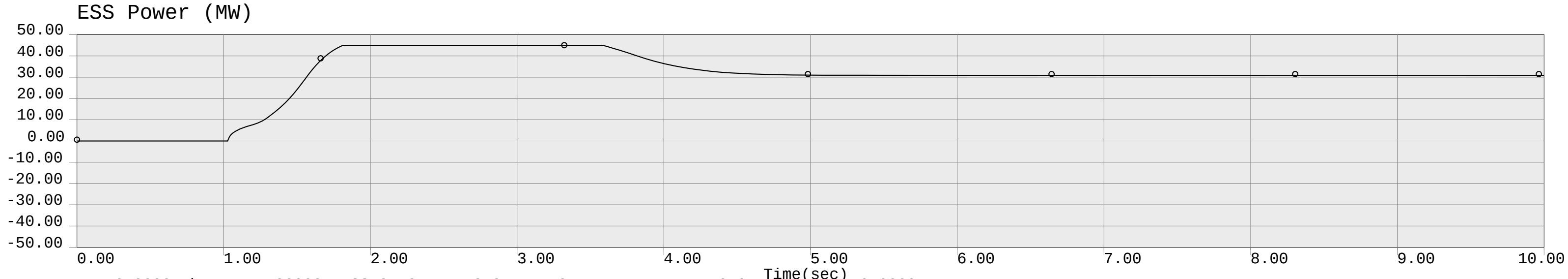
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



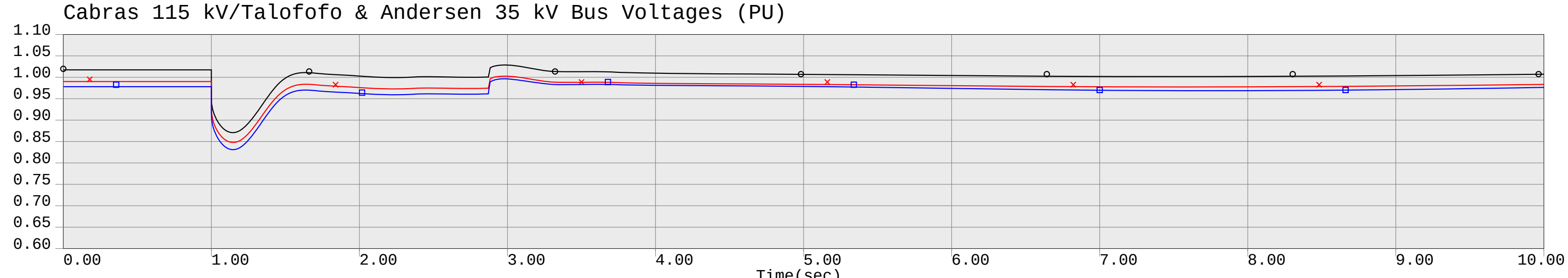
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1400-c1-1g.chf

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Guam Power Authority - EPS Energy Storage Analysis
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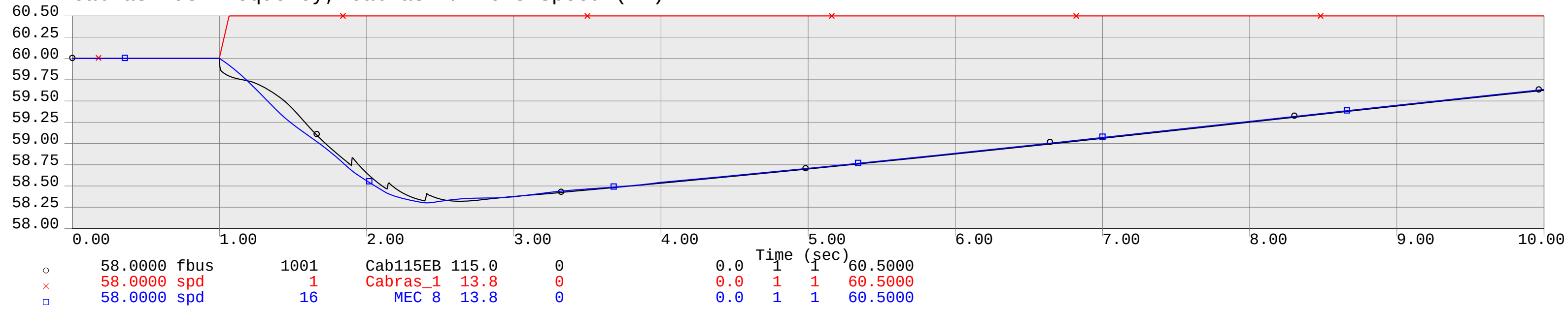
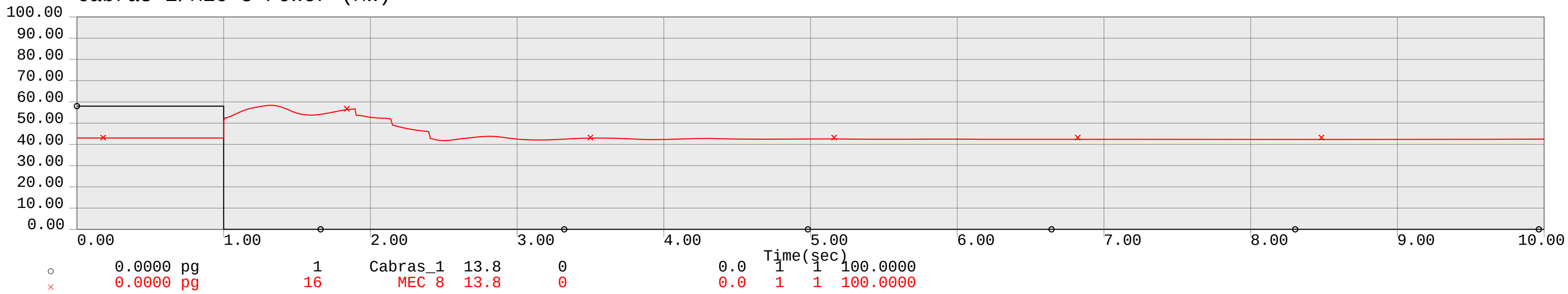
Agana 115 kV ESS

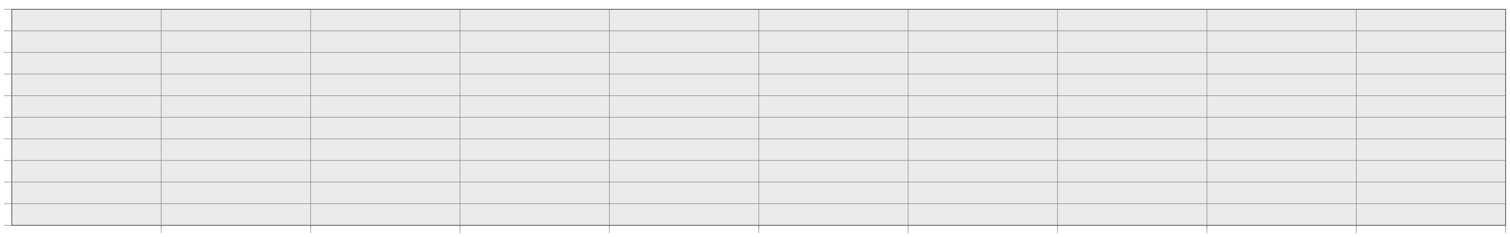
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



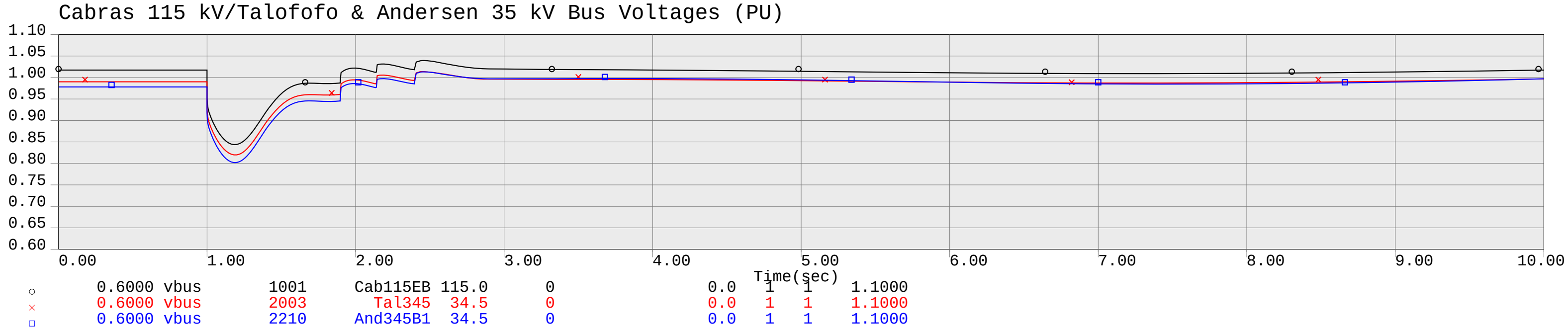
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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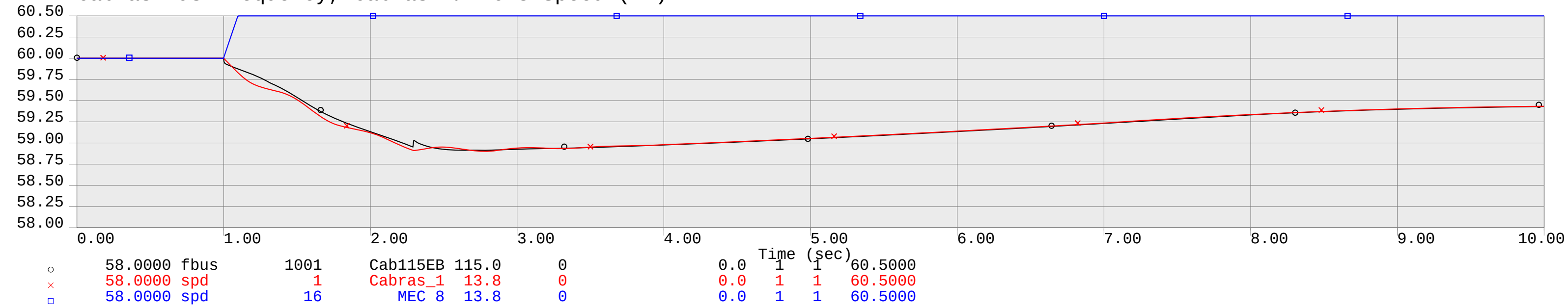
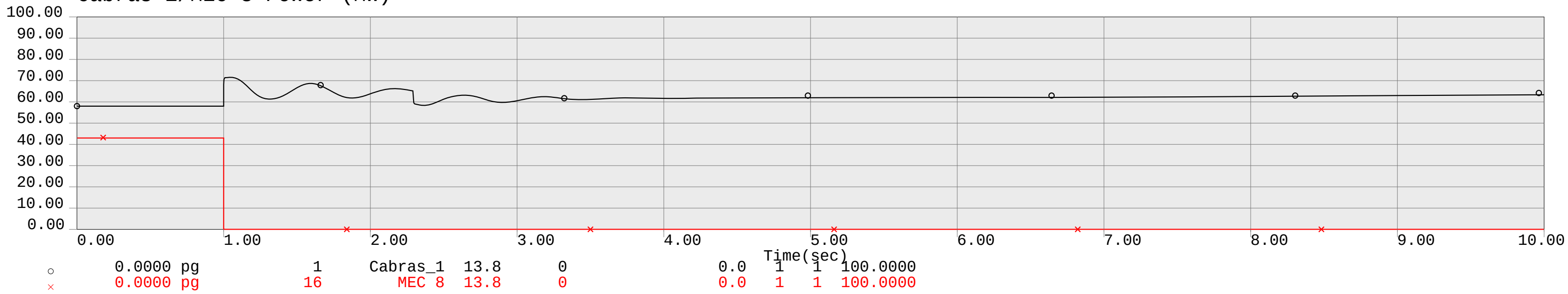
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

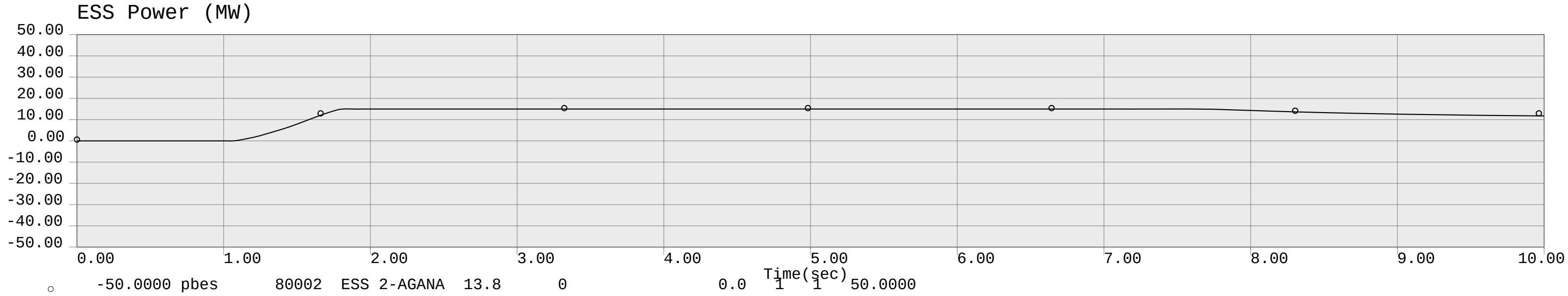
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



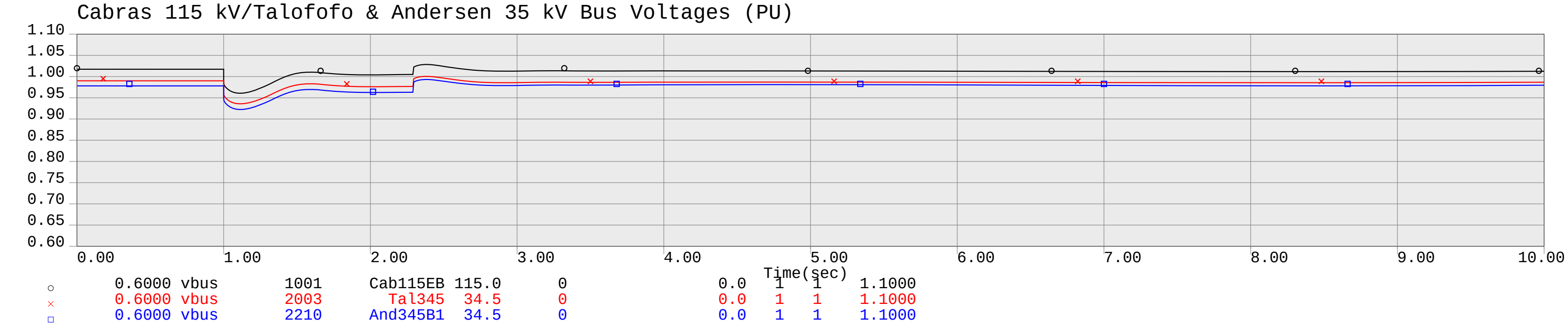
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)

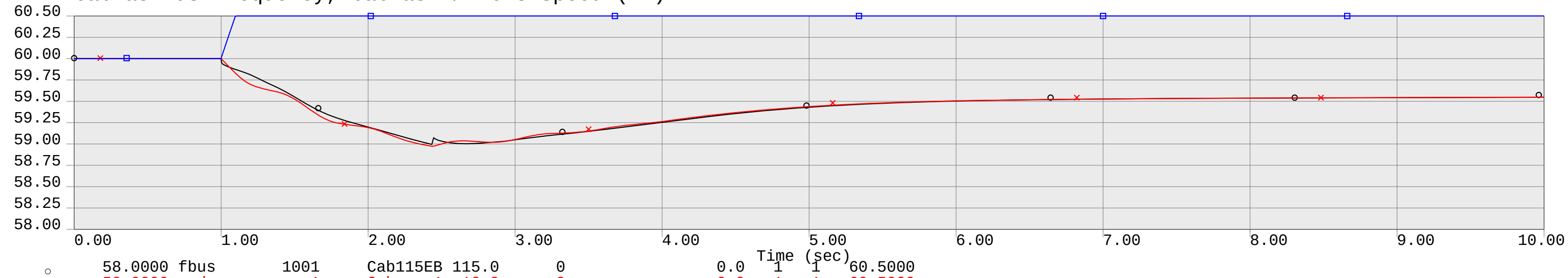


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



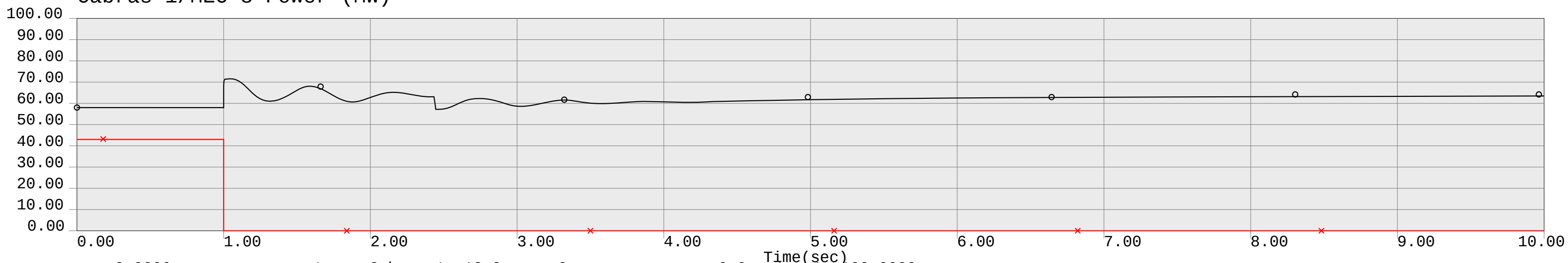
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



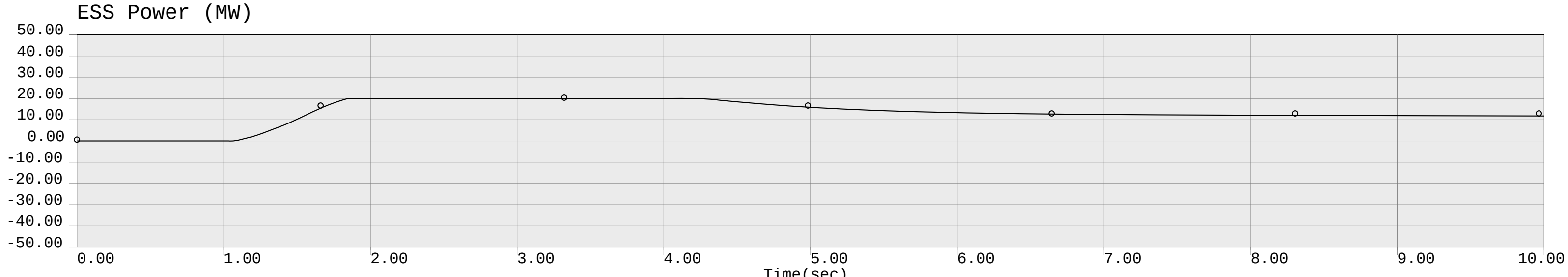
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



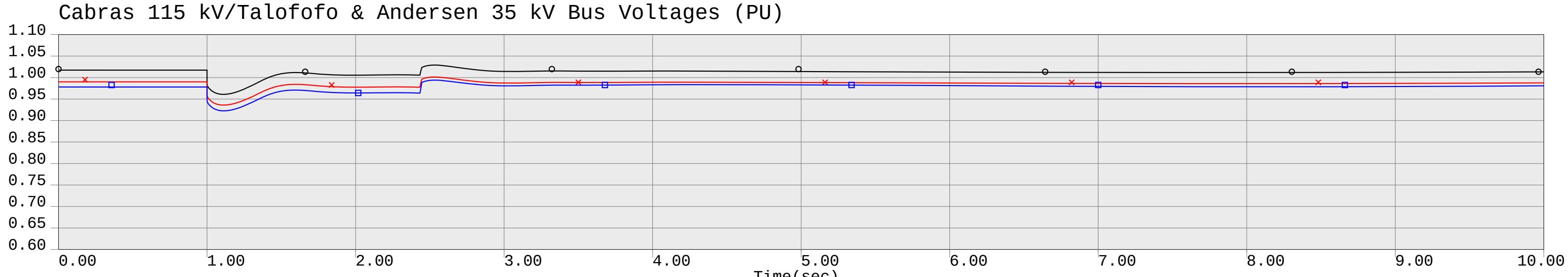
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

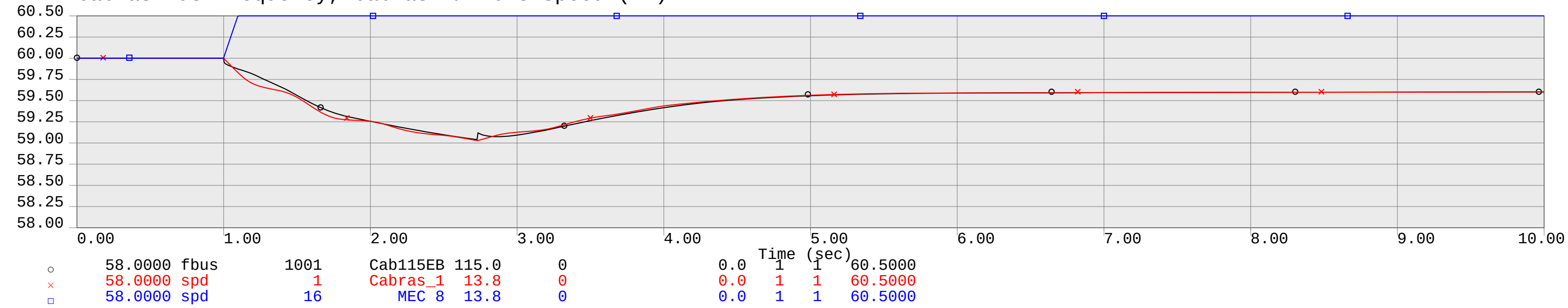
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



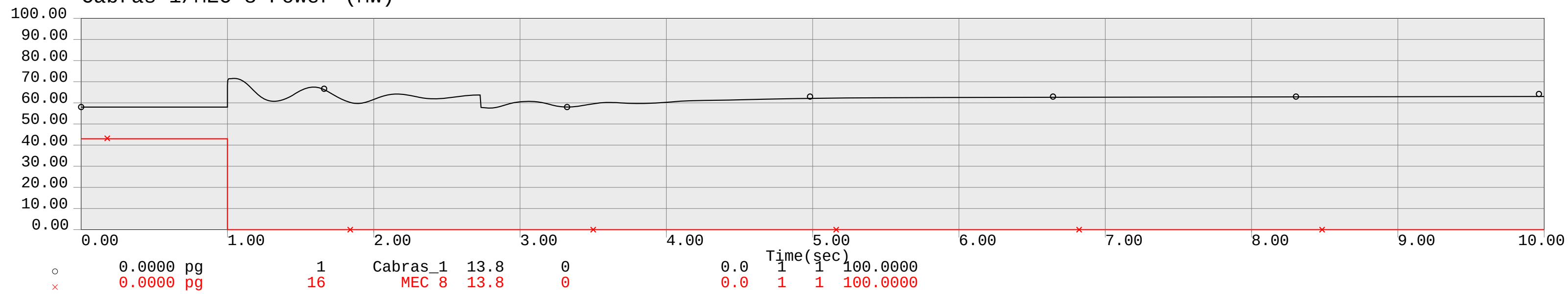
○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

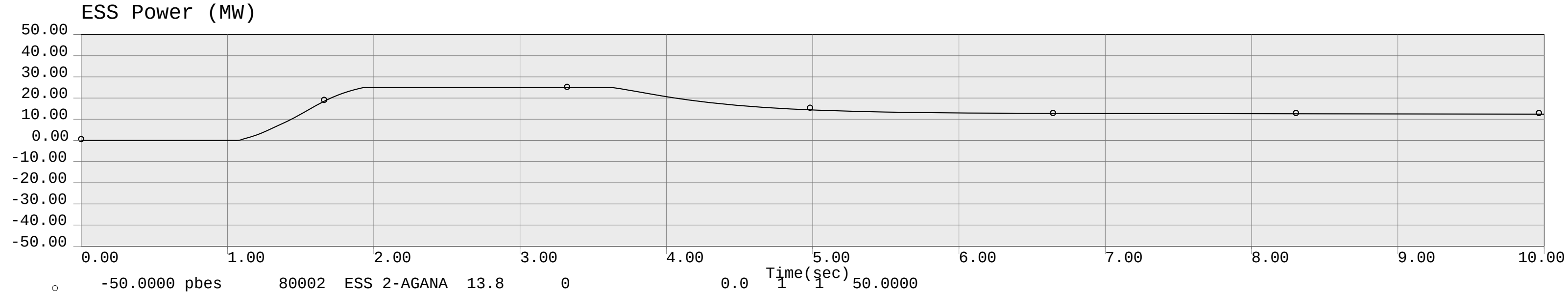
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



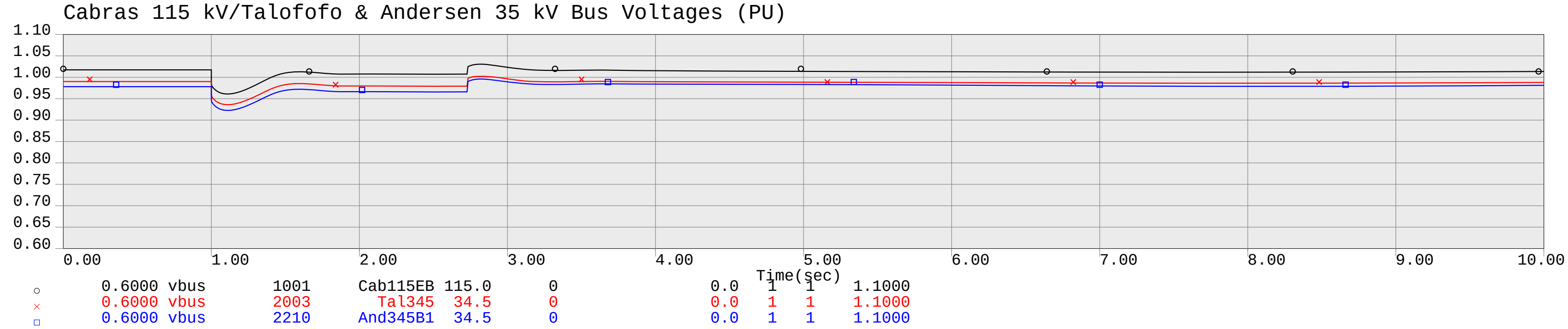
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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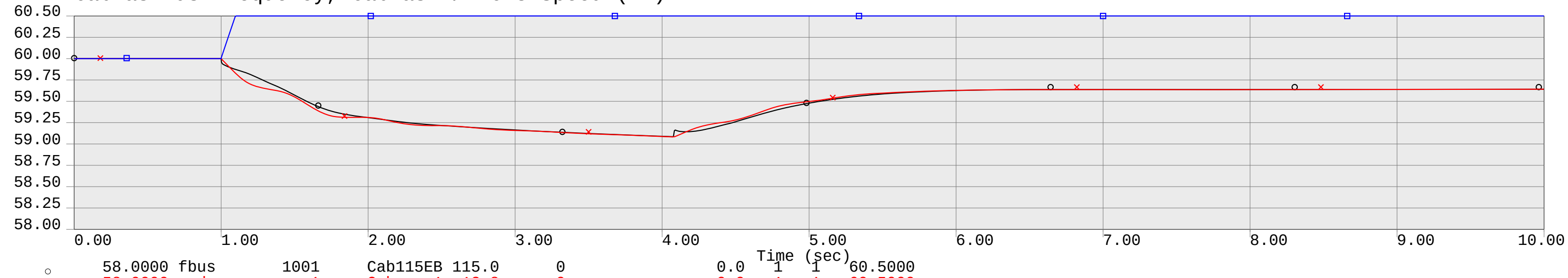
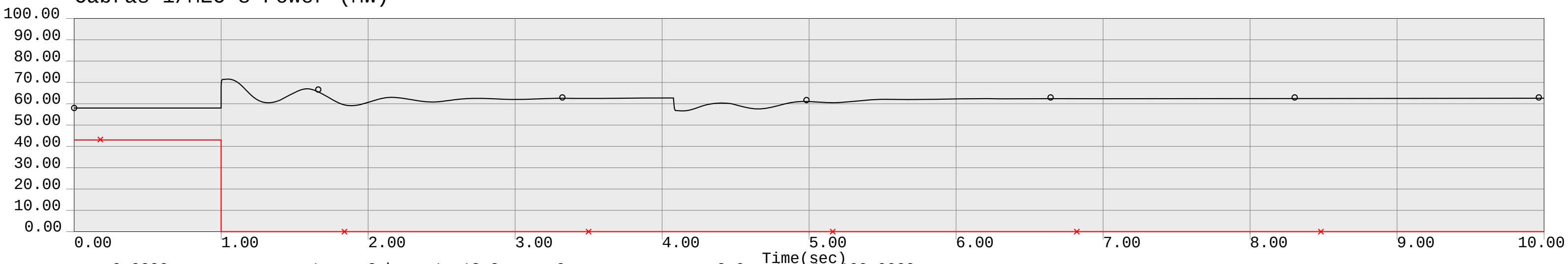
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



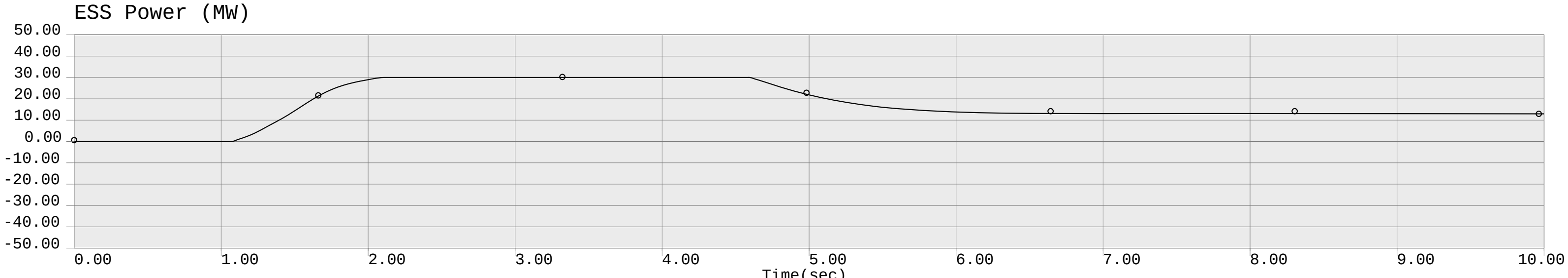
○	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



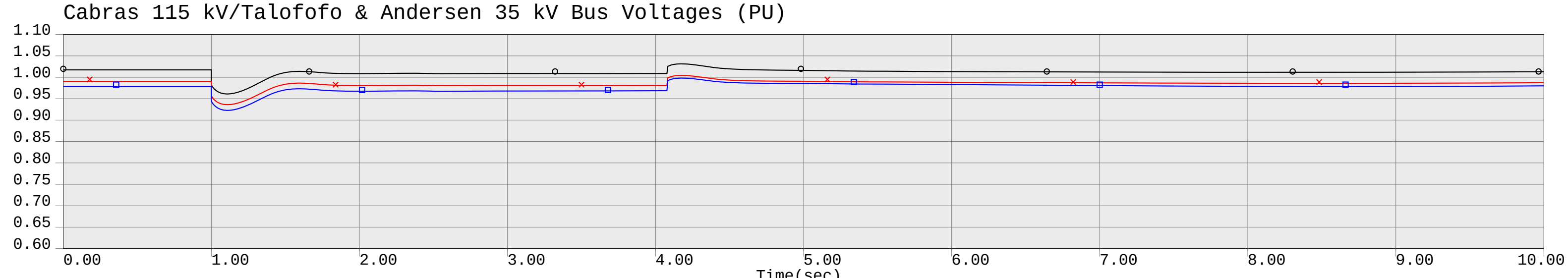
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

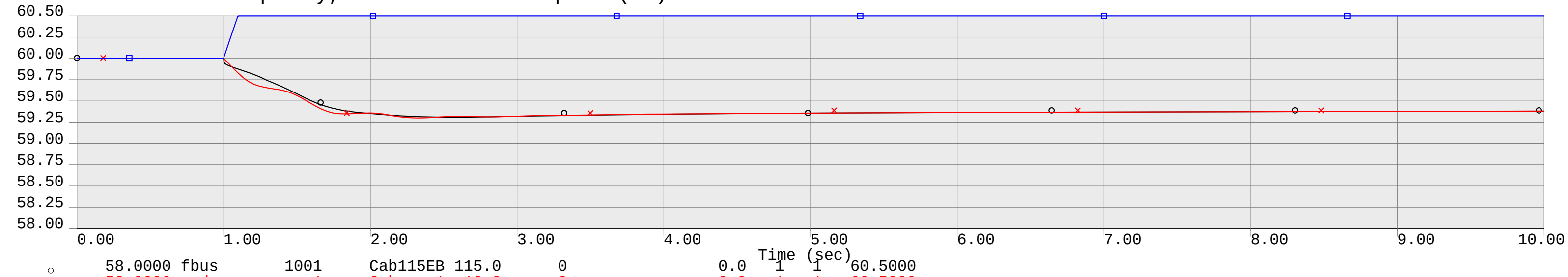
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

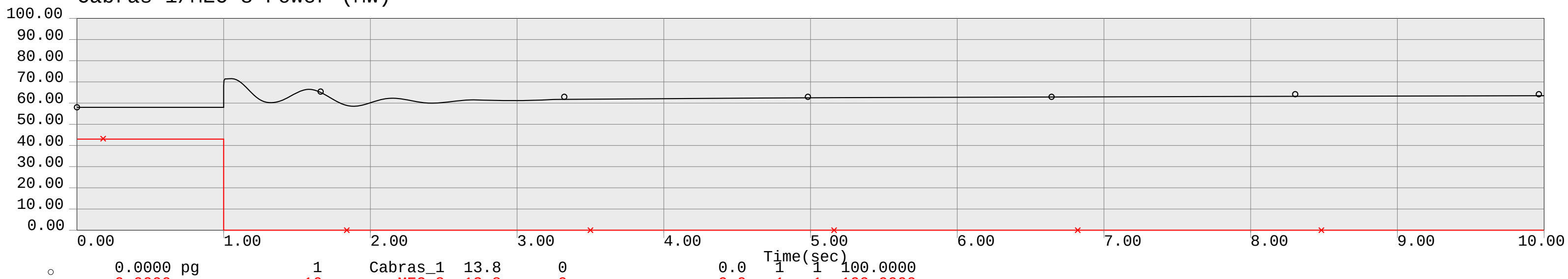
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



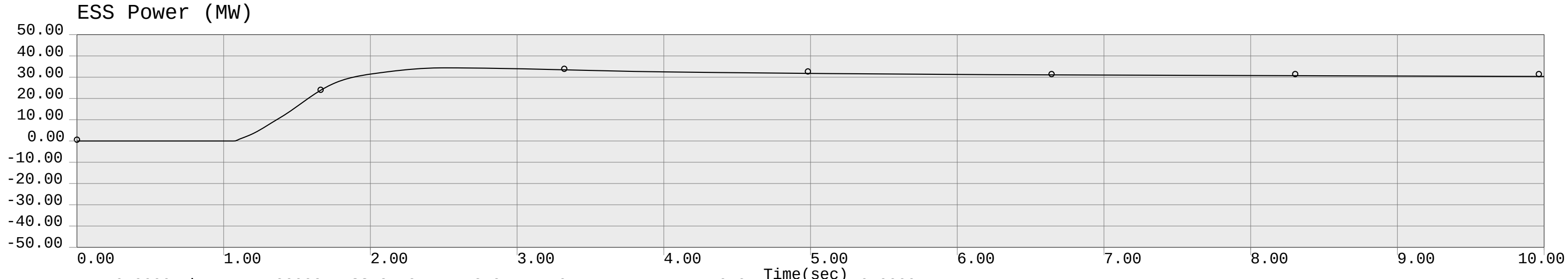
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



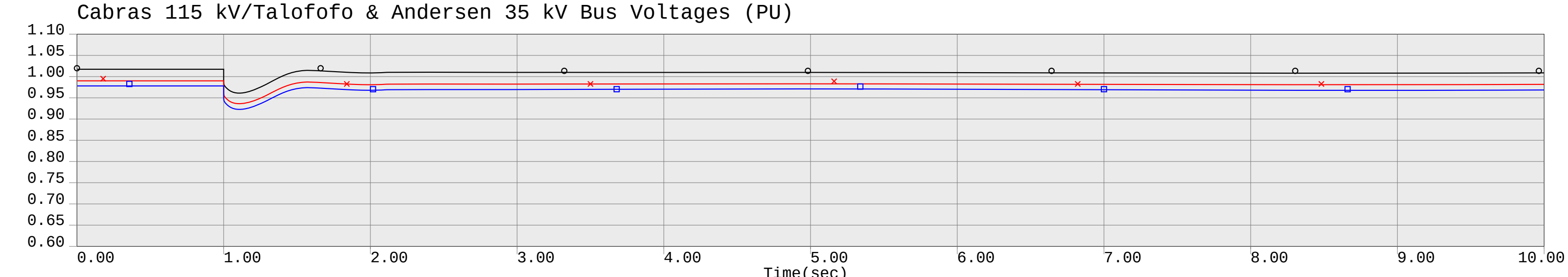
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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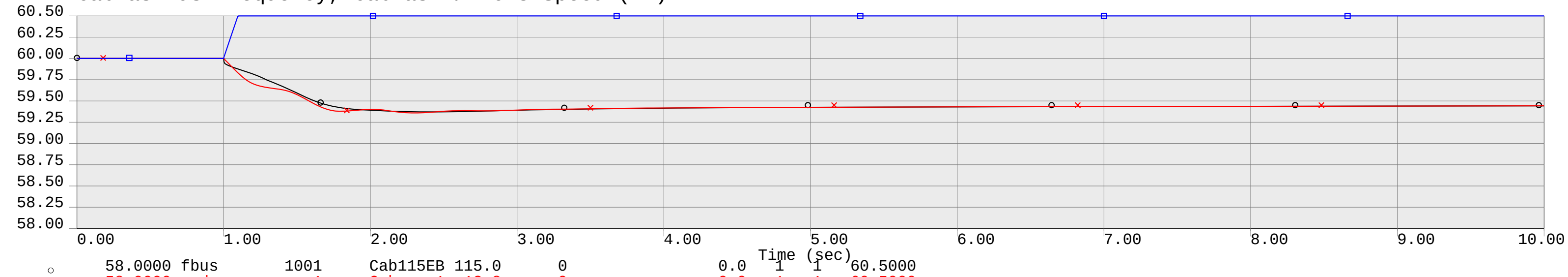
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)

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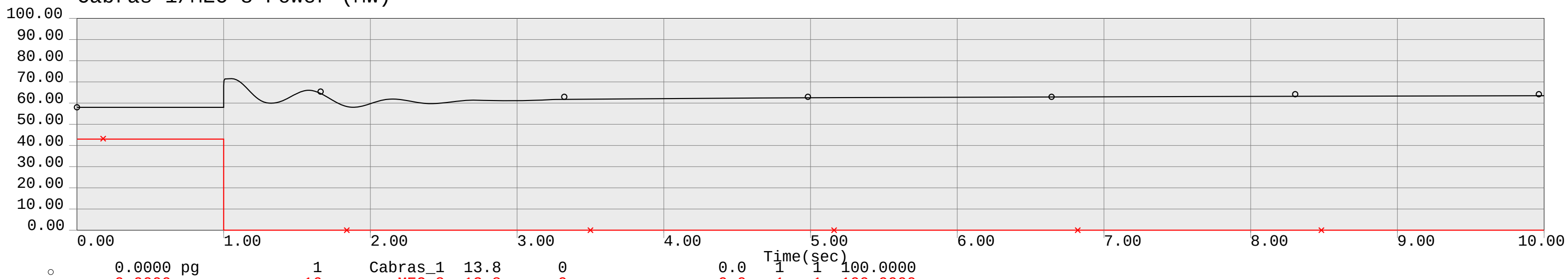
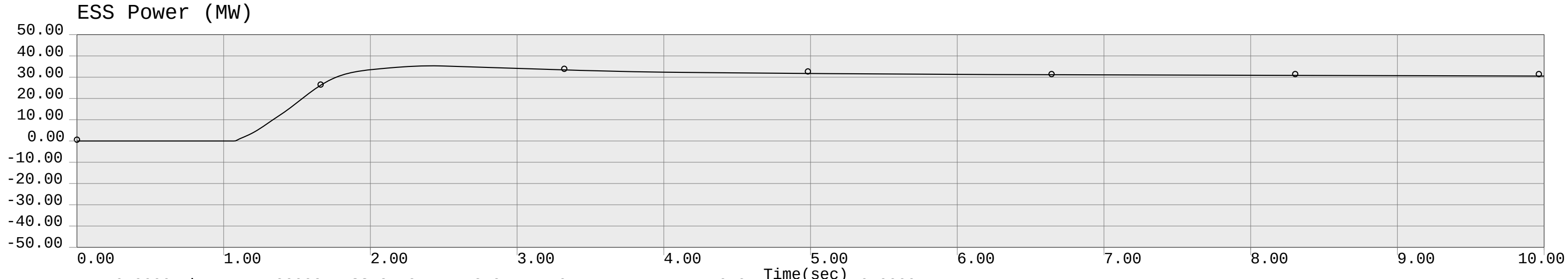
○  58.0000 fbus    1001   Cab115EB 115.0   0    0.0  1  1  60.5000
×  58.0000 spd        1   Cabras_1  13.8   0    0.0  1  1  60.5000
□  58.0000 spd       16      MEC 8  13.8   0    0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)




```
○   0.0000 pg         1   Cabras_1  13.8   0    0.0  1  1  100.0000
×   0.0000 pg        16      MEC 8  13.8   0    0.0  1  1  100.0000
```

ESS Power (MW)




```
○  -50.0000 pbes  80002  ESS 2-AGANA  13.8   0    0.0  1  1  50.0000
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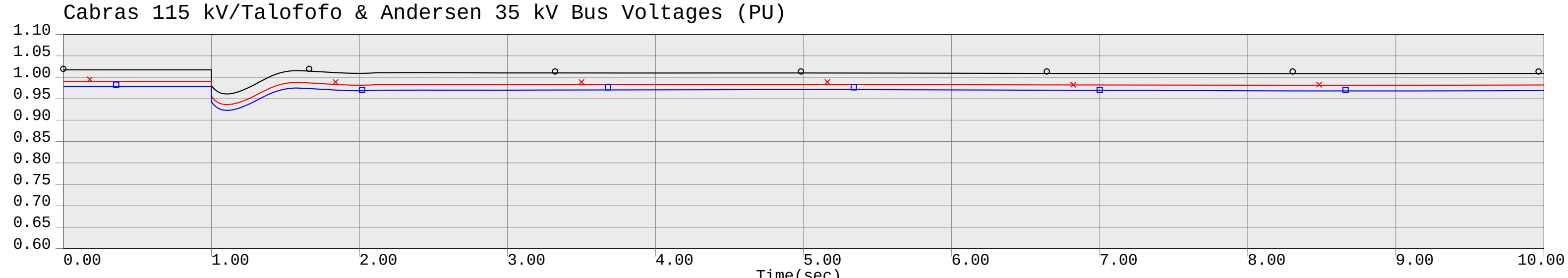
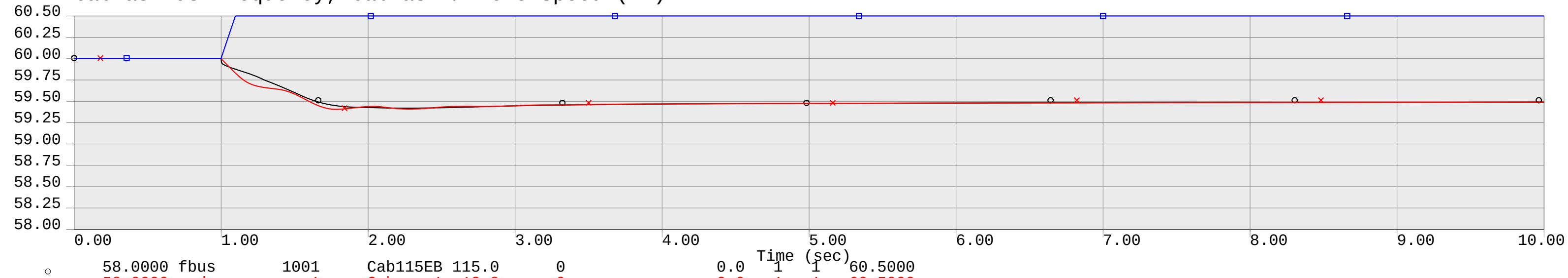
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○   0.6000 vbus    1001   Cab115EB 115.0   0    0.0  1  1  1.1000
×   0.6000 vbus    2003     Tal345  34.5   0    0.0  1  1  1.1000
□   0.6000 vbus    2210   And345B1  34.5   0    0.0  1  1  1.1000
```

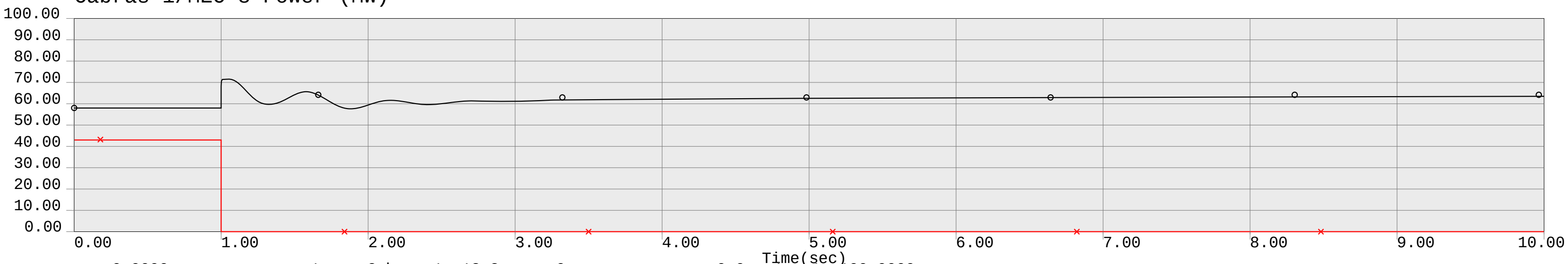
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



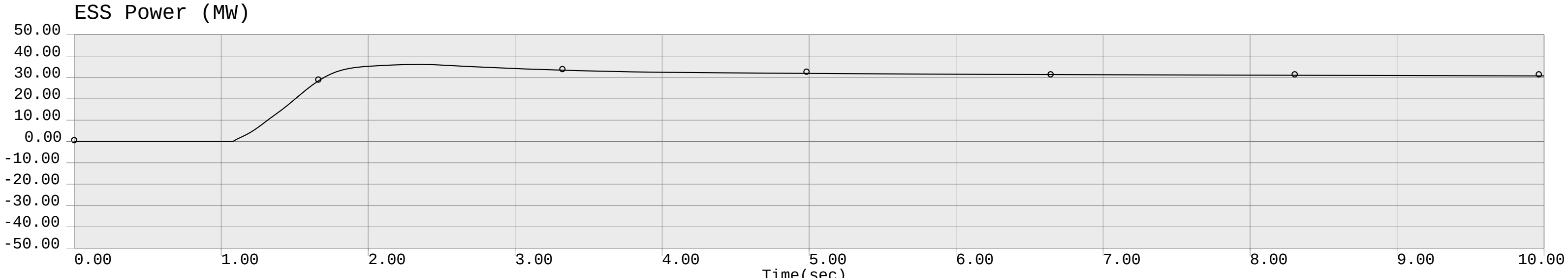
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



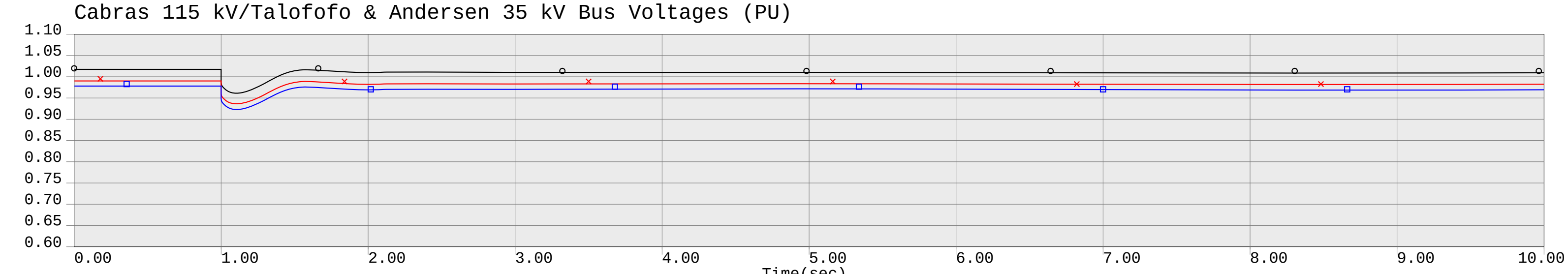
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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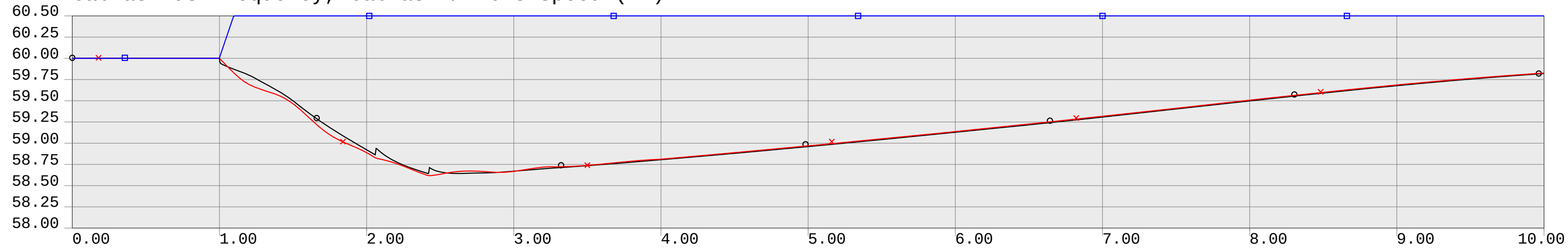
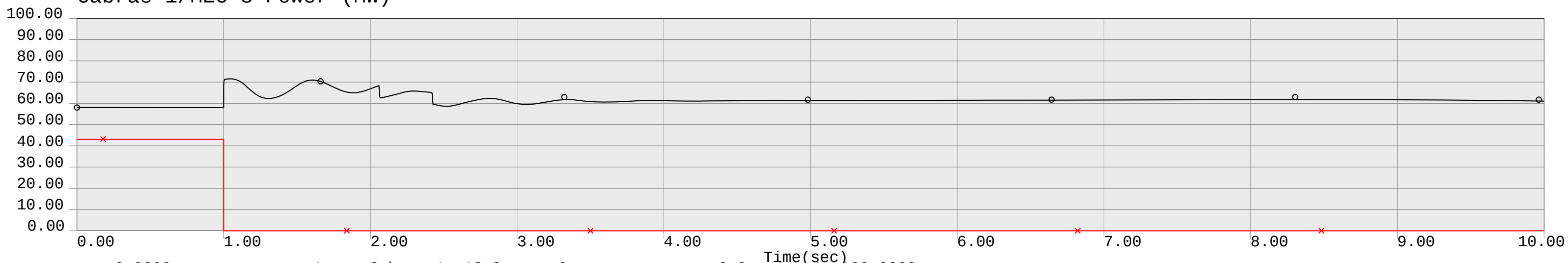
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



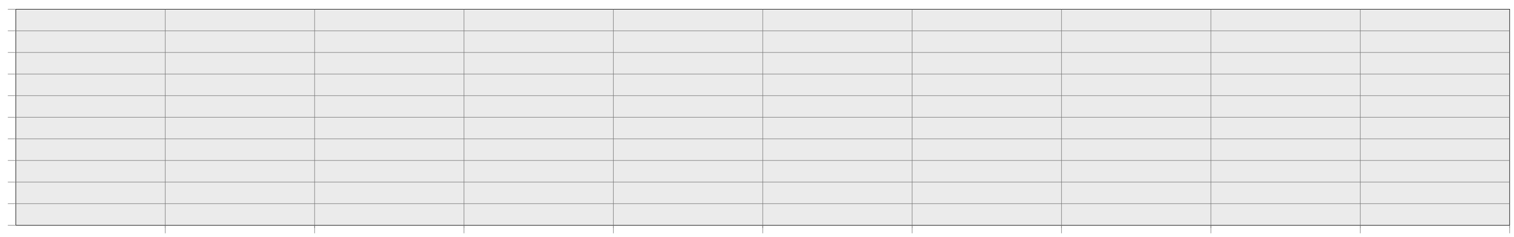
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)

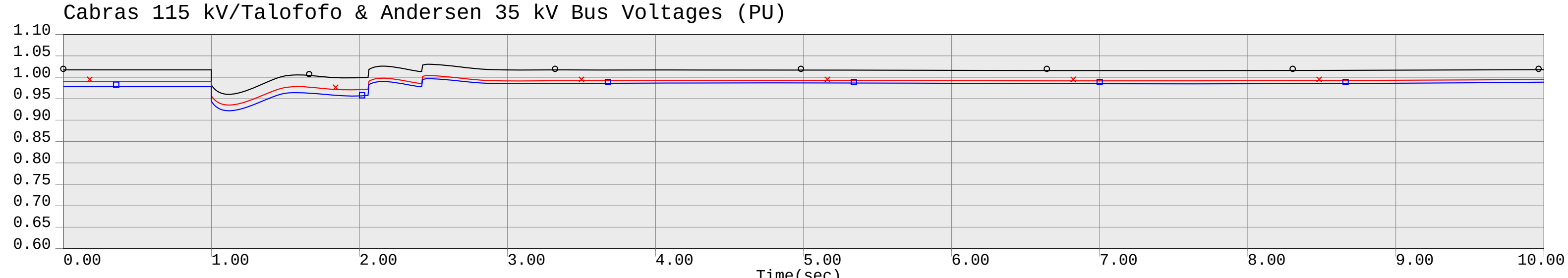


○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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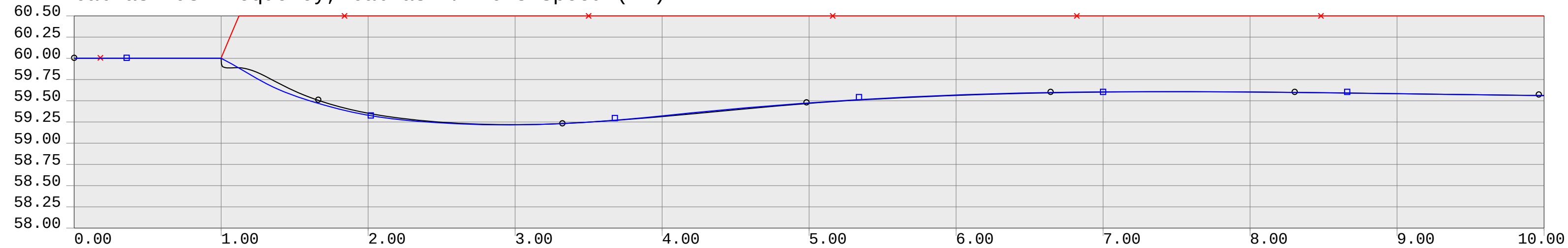
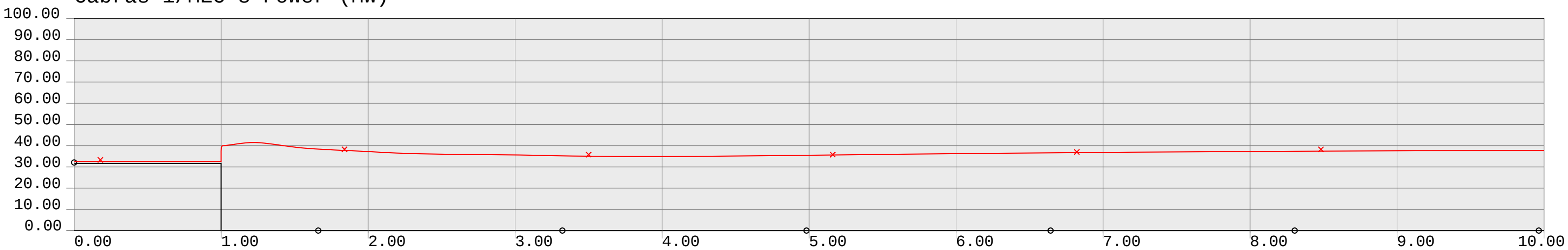
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



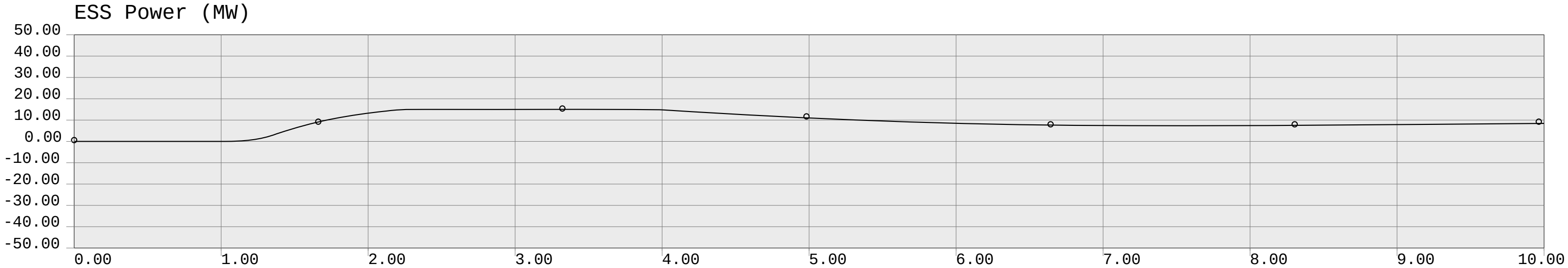
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



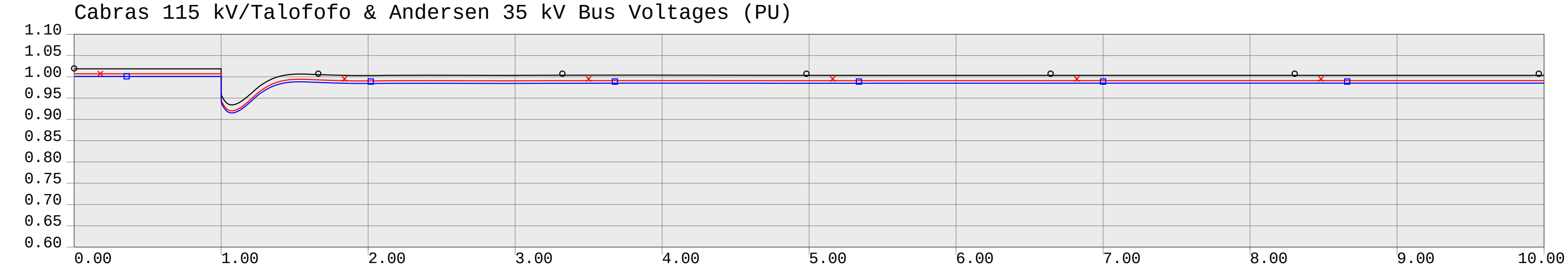
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

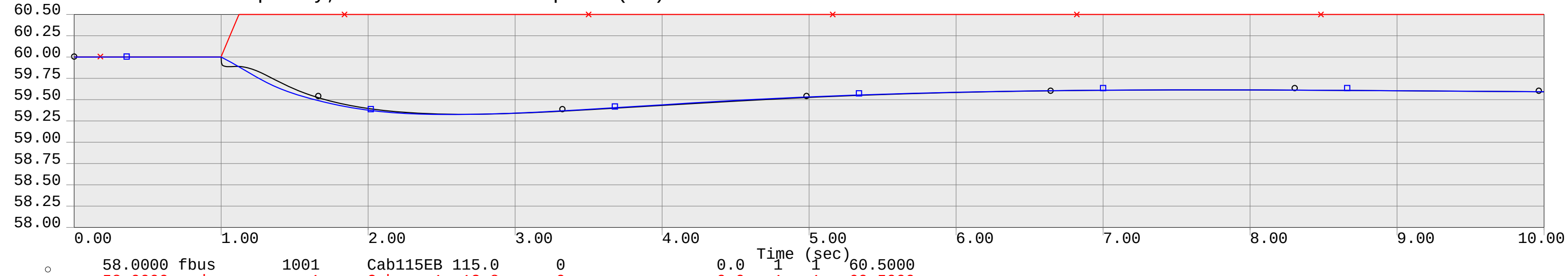
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

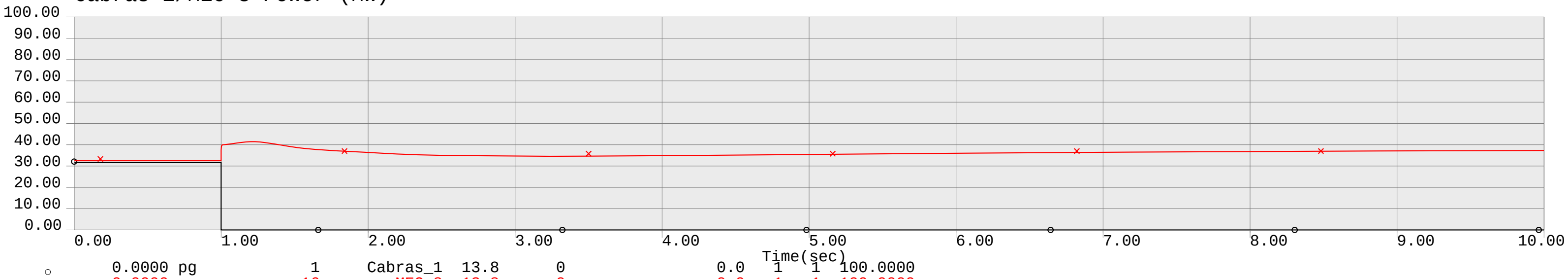
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



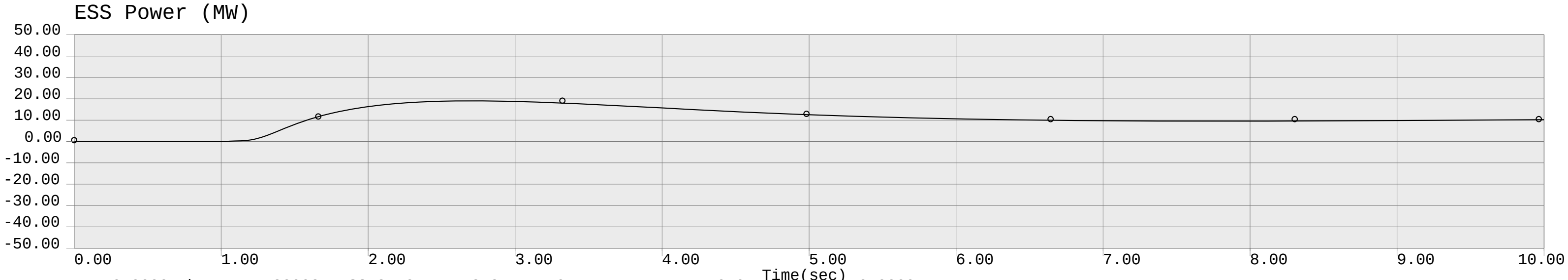
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



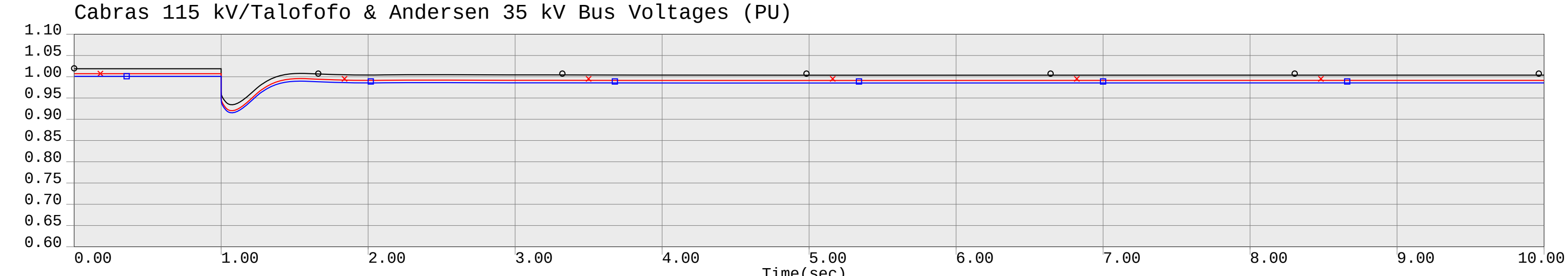
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

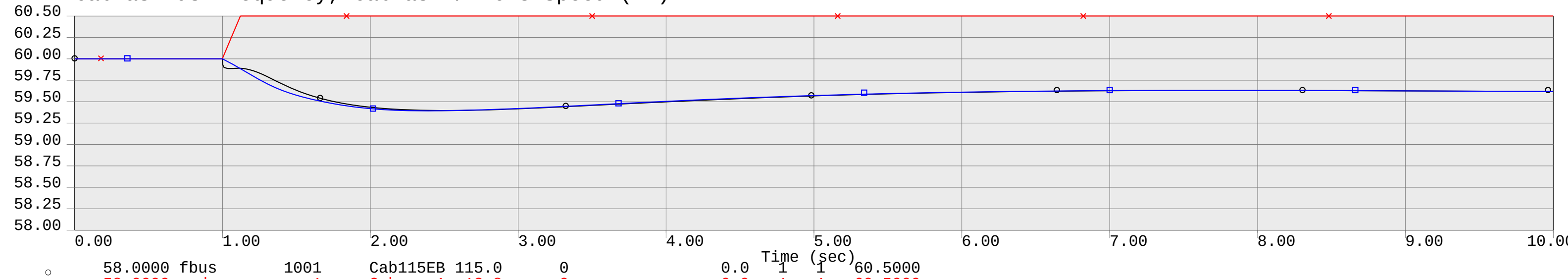
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

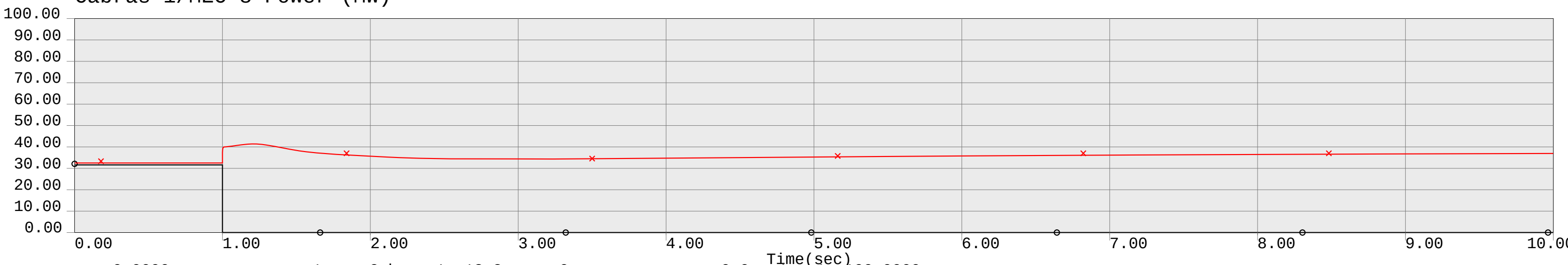
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



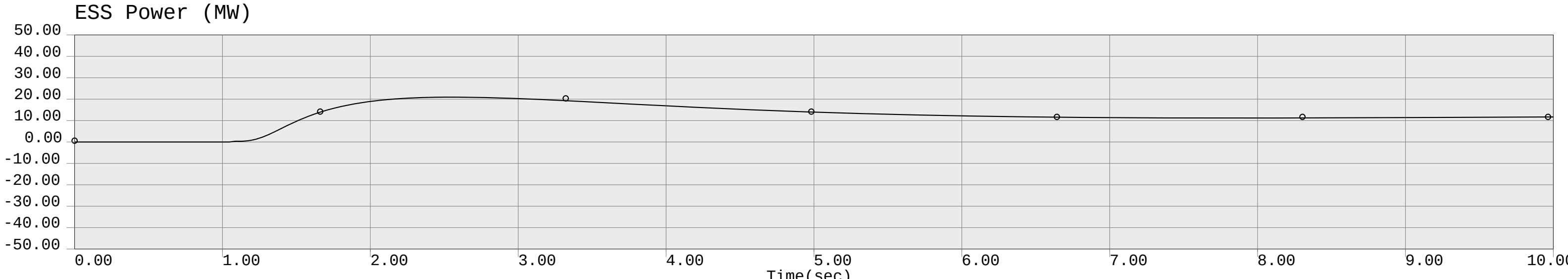
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



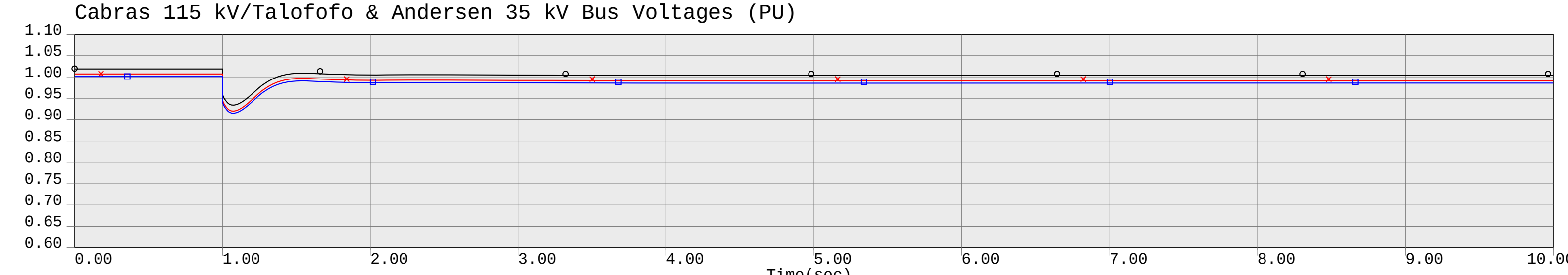
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

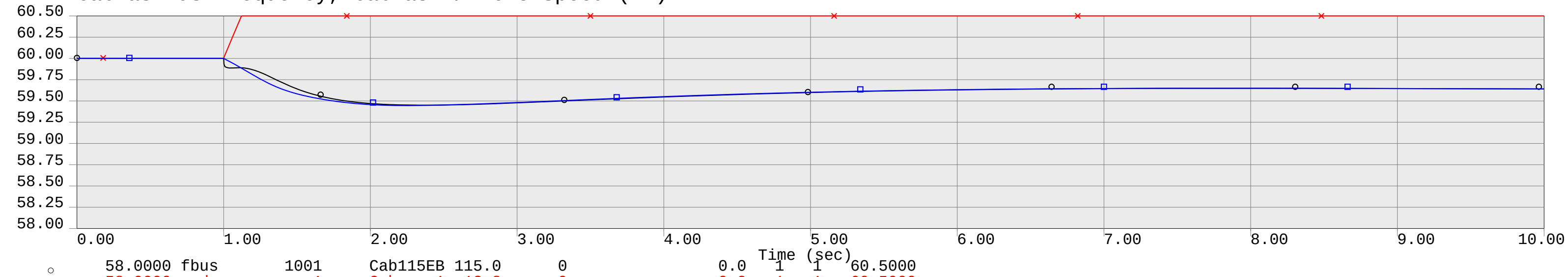
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

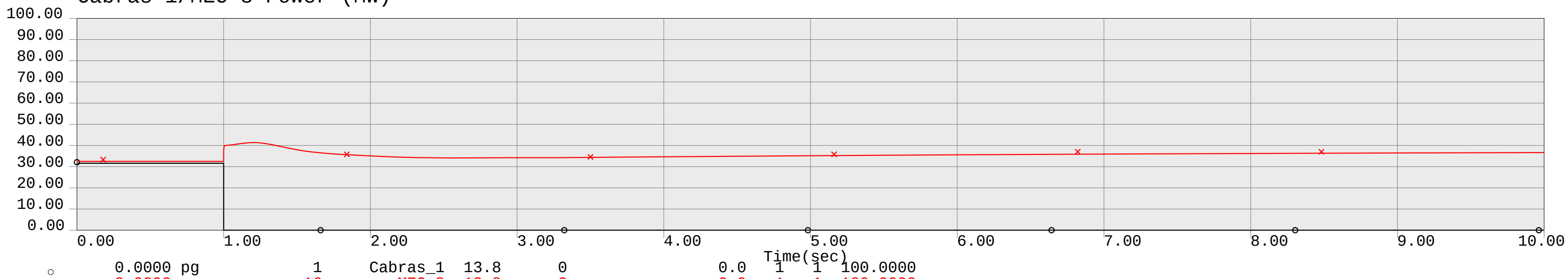
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



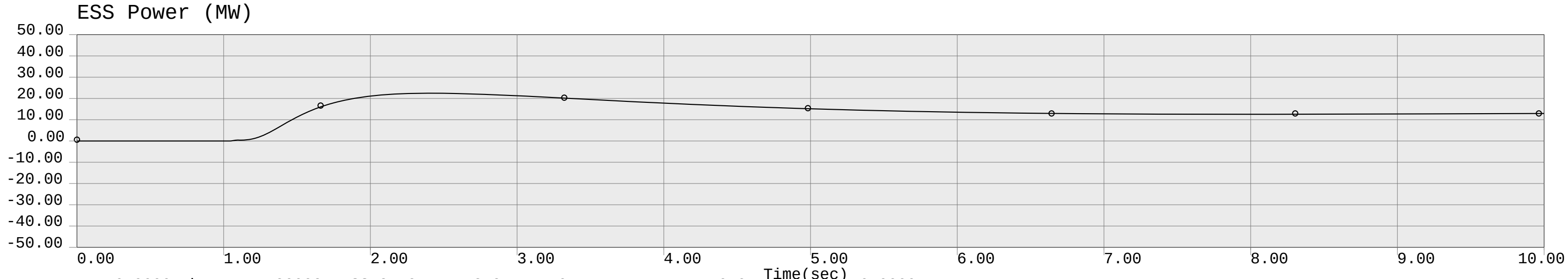
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



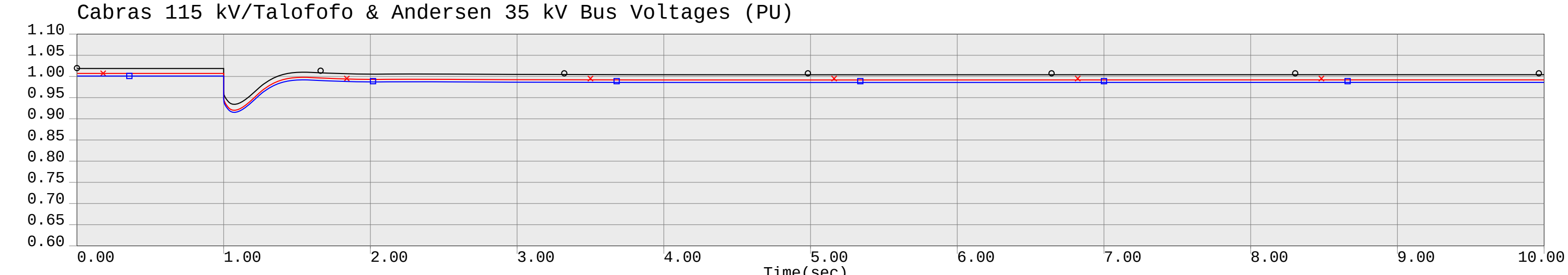
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

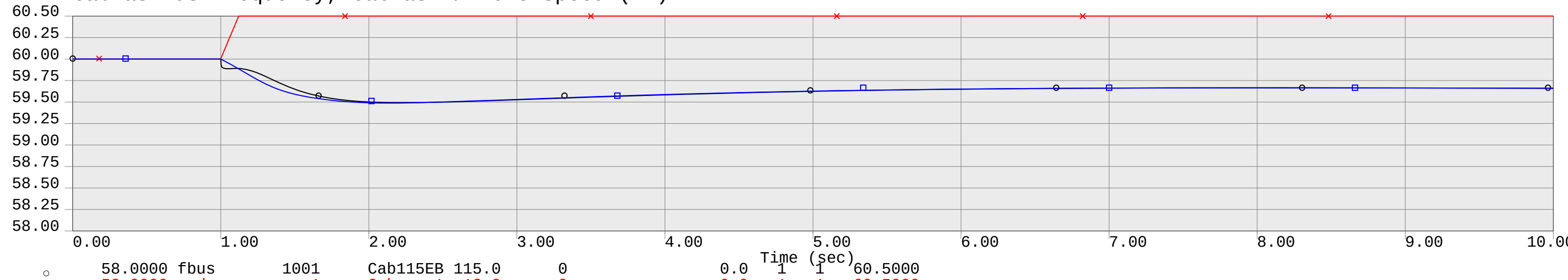
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

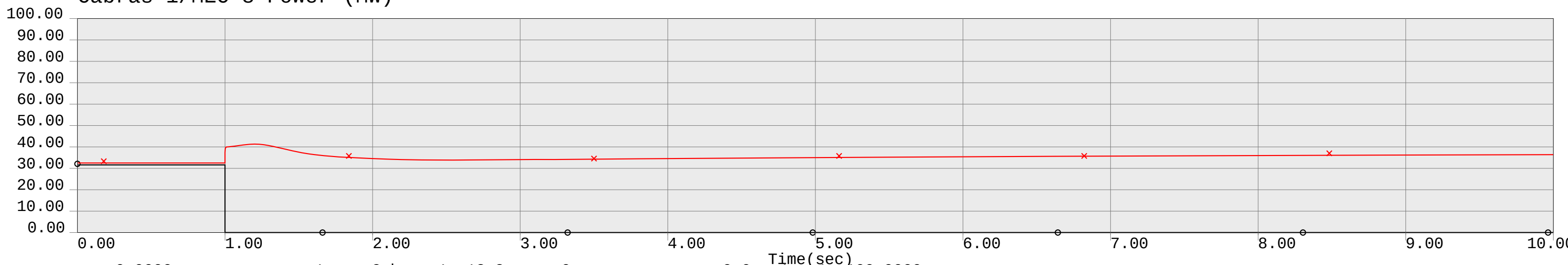
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



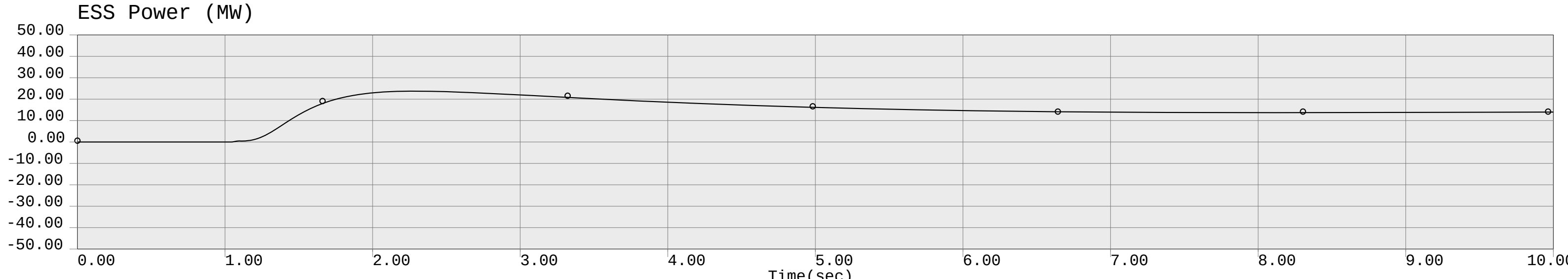
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



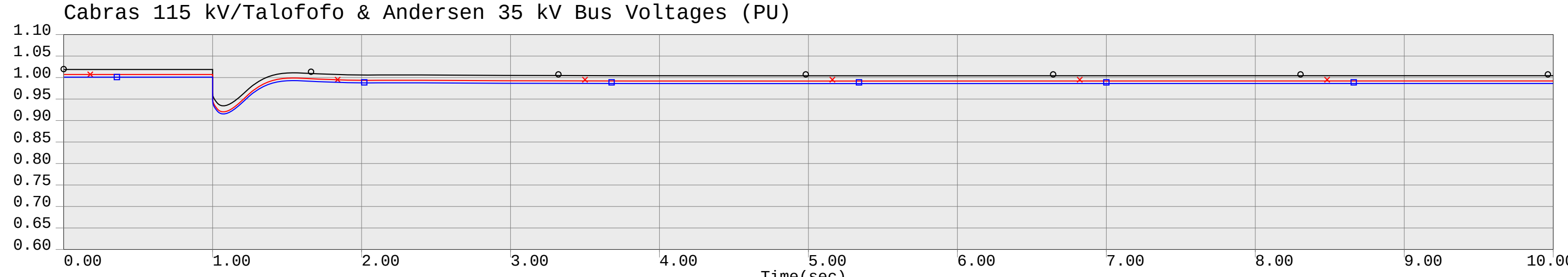
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1500-c1-1e.chf

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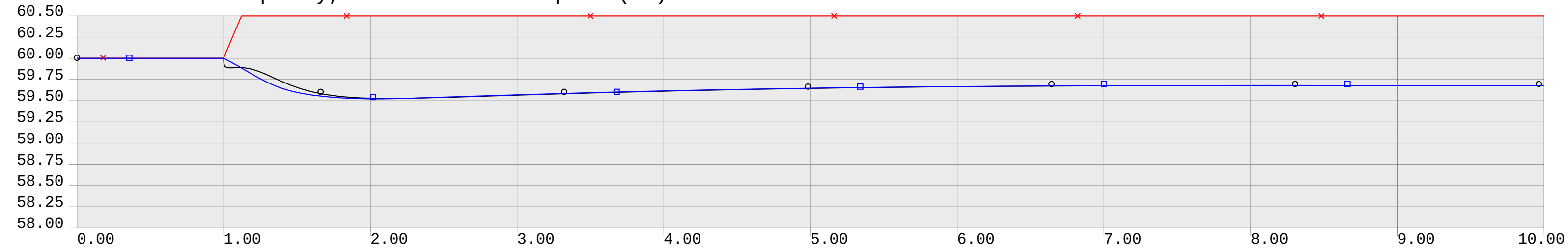
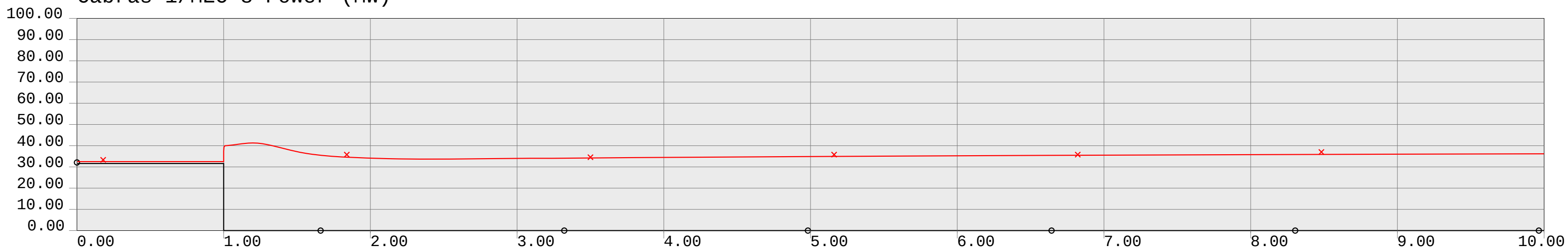
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



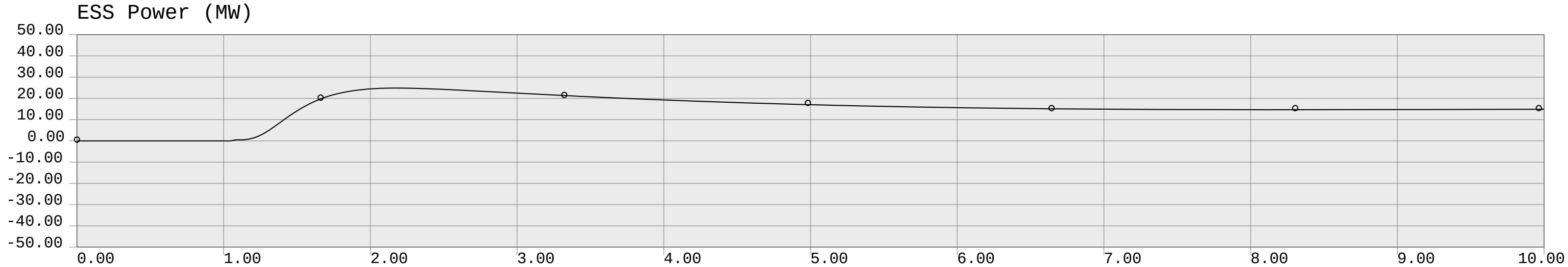
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



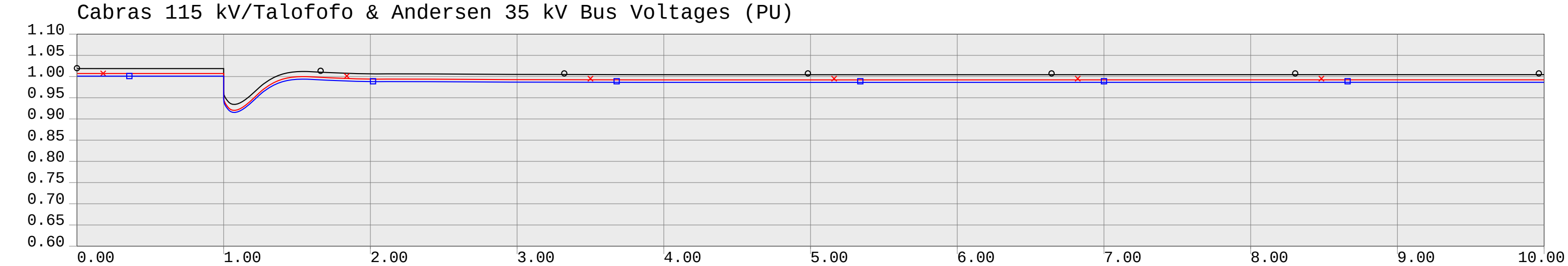
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1500-c1-1f.chf

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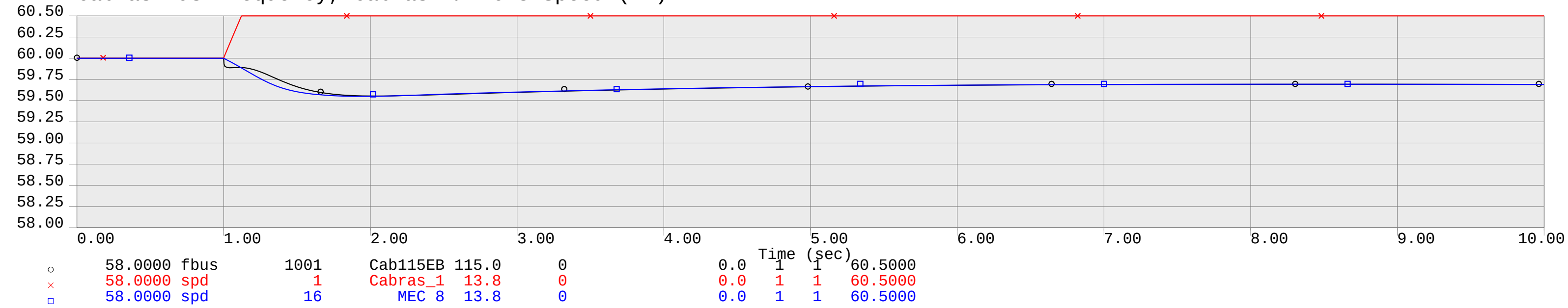
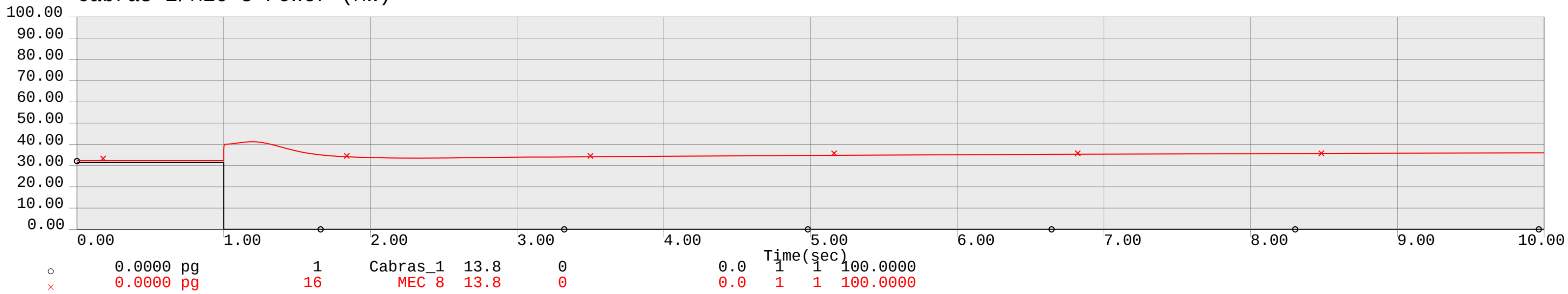
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

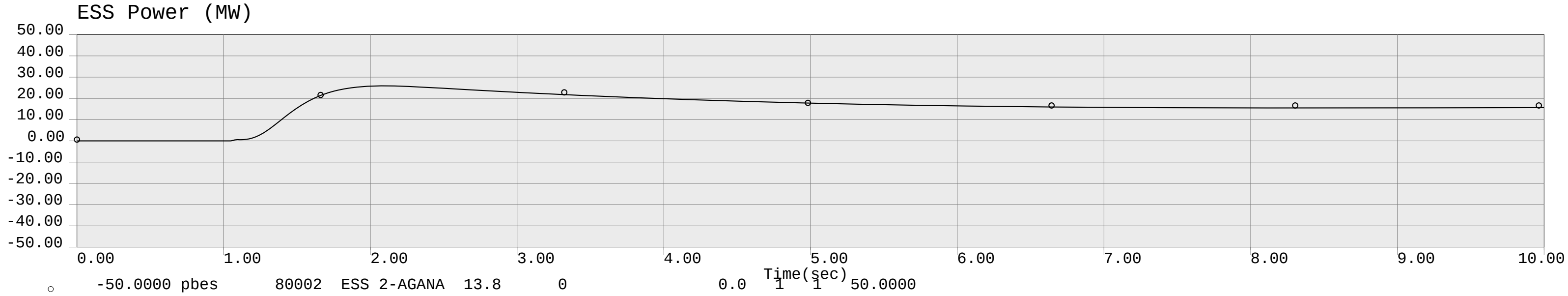
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



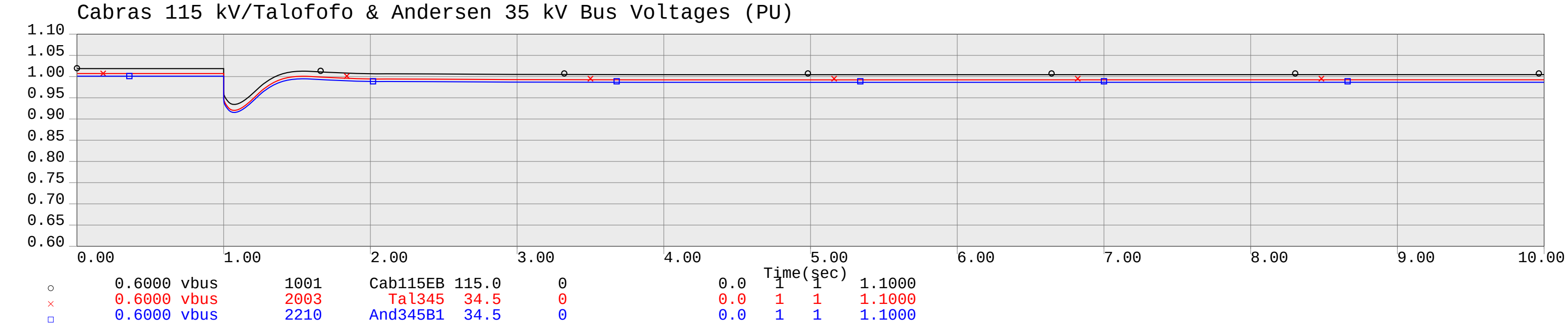
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)

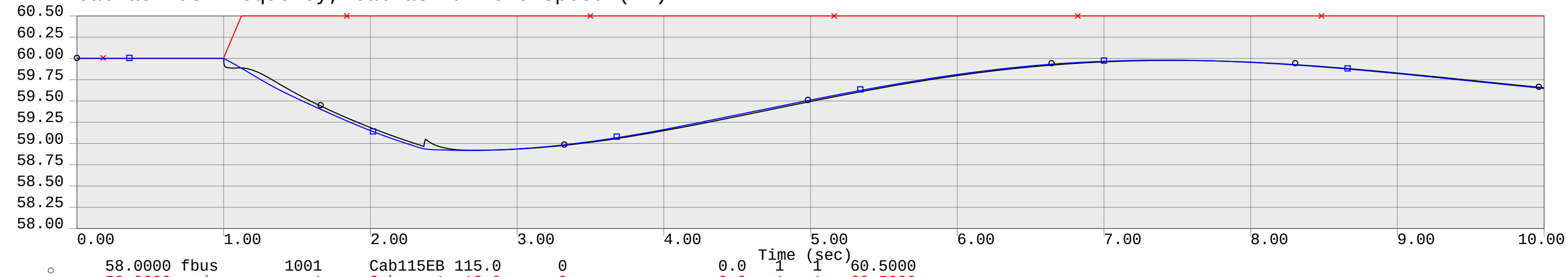


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



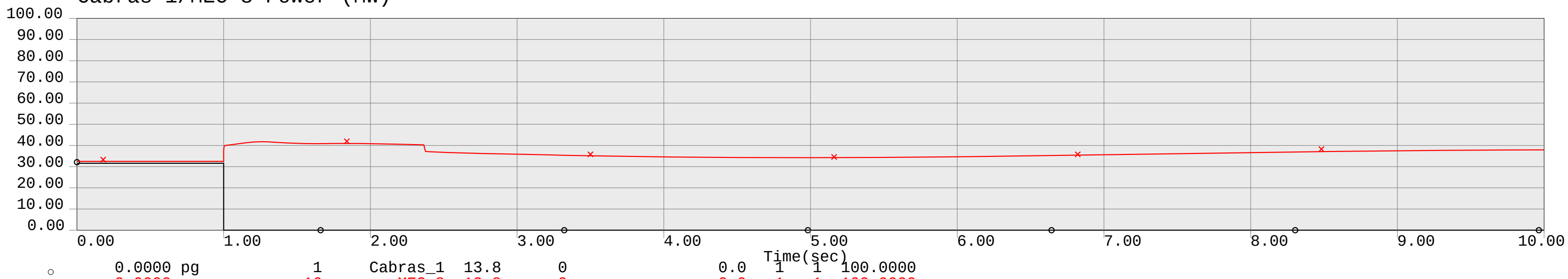
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



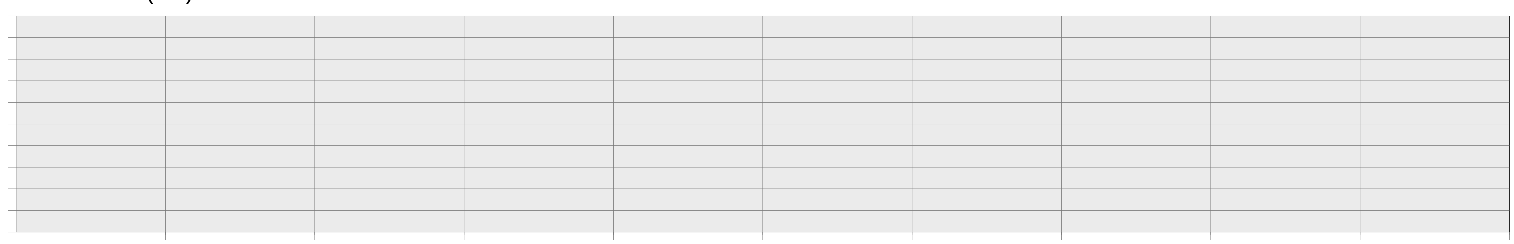
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)

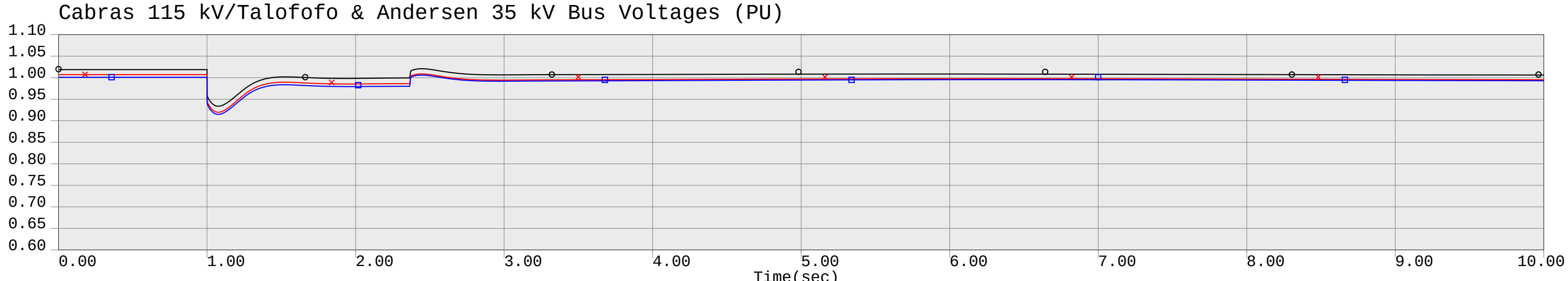


○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

chans/1500-c1-ref.chf

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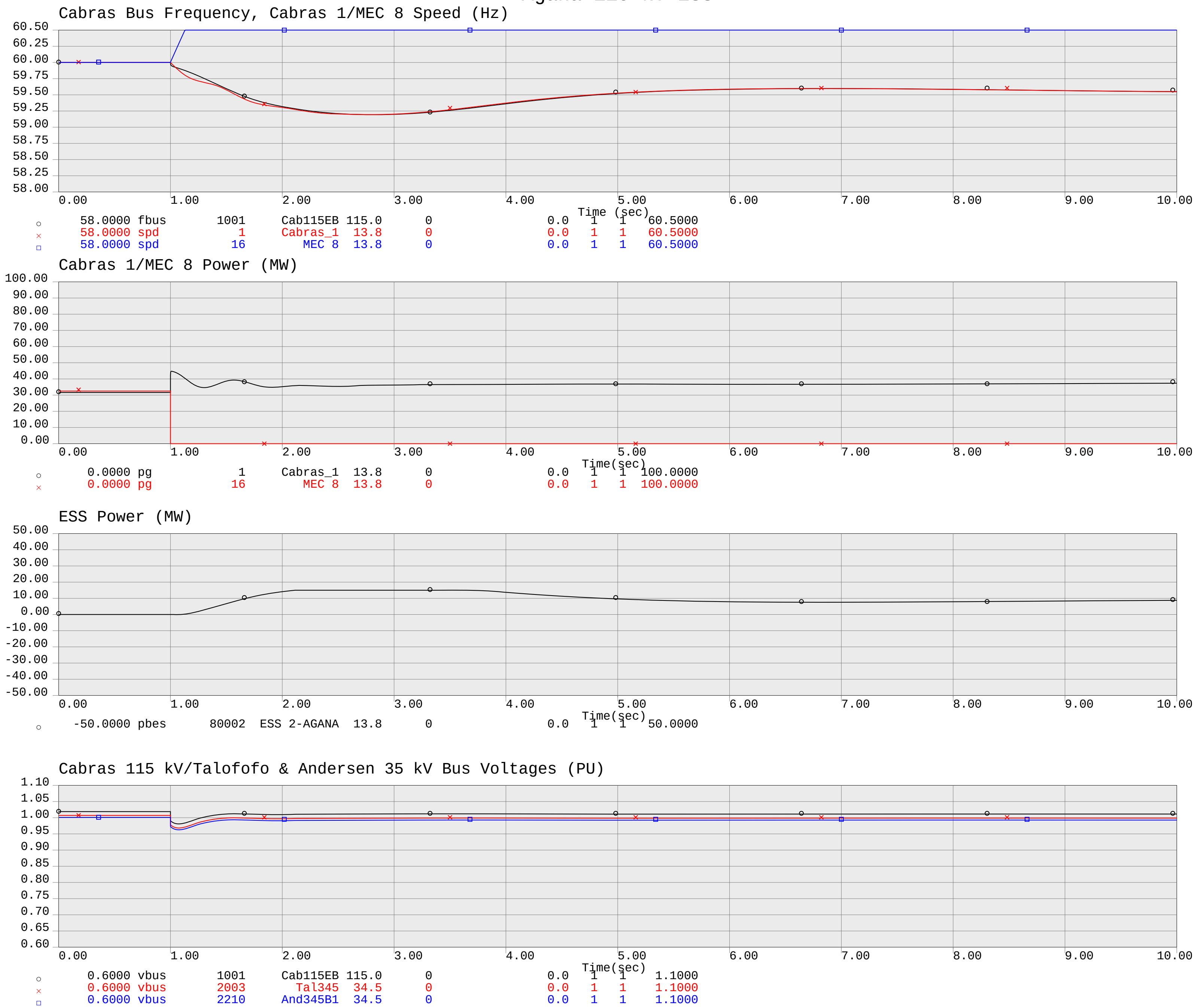
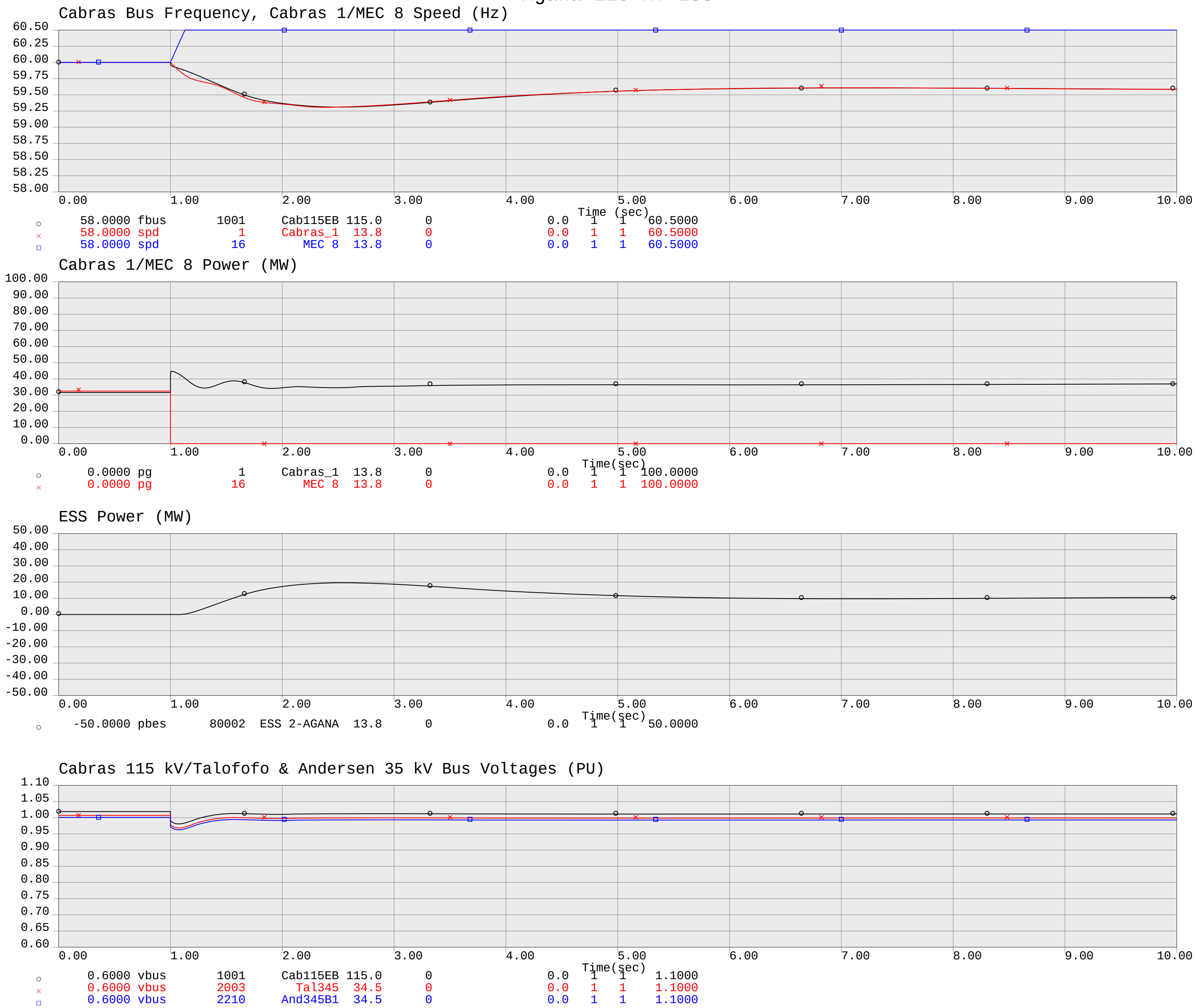
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



chans/1500-m8-1b.chf

asibility_Study\rev_2\sim

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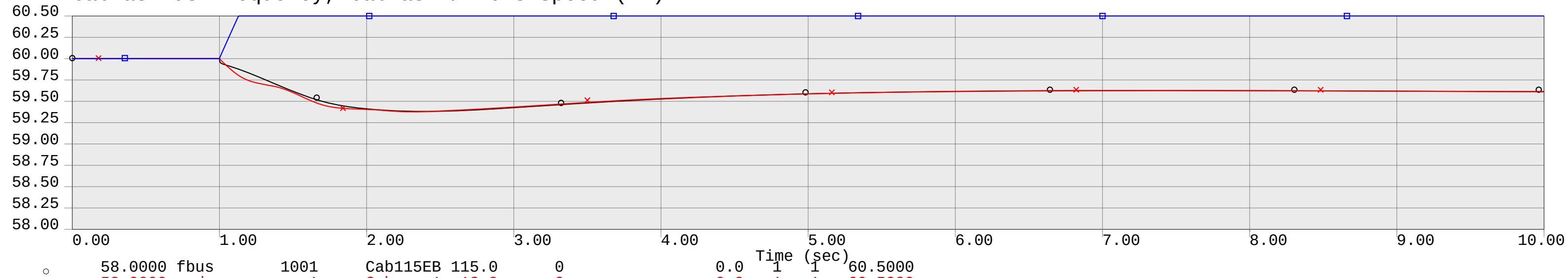
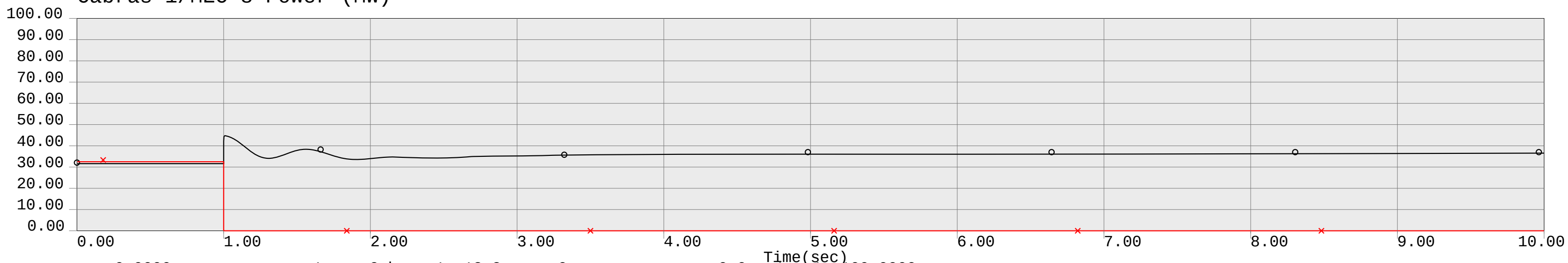
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



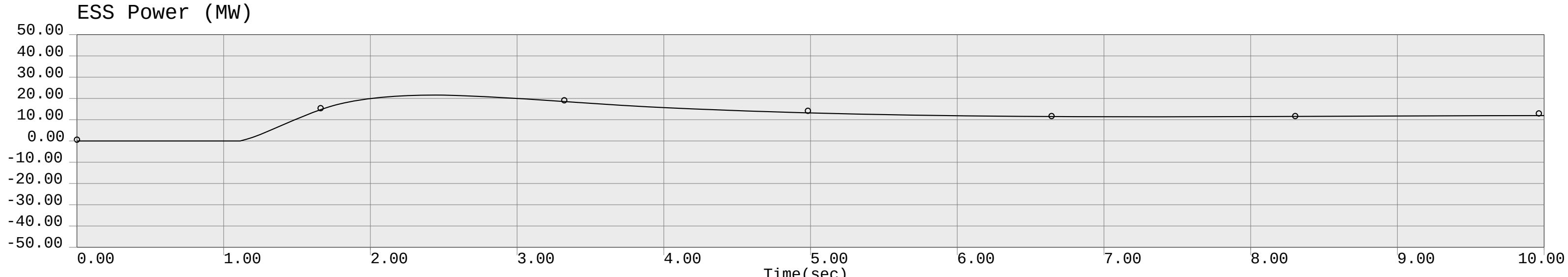
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



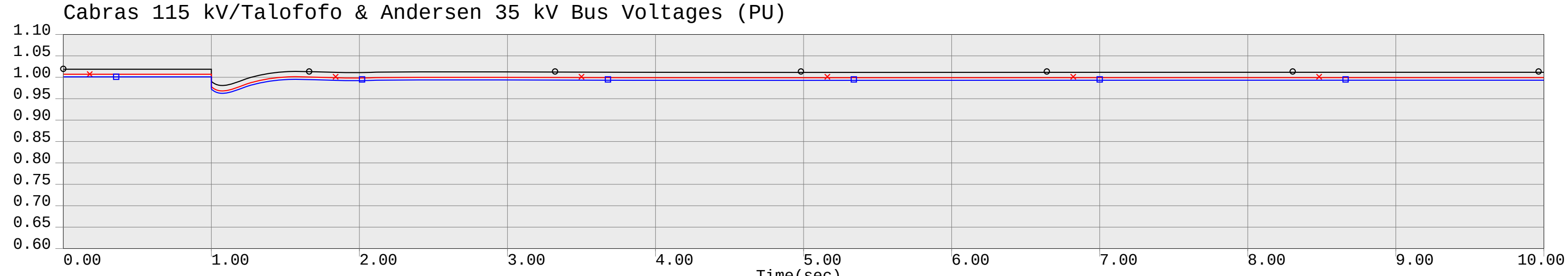
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1500-m8-1c.chf

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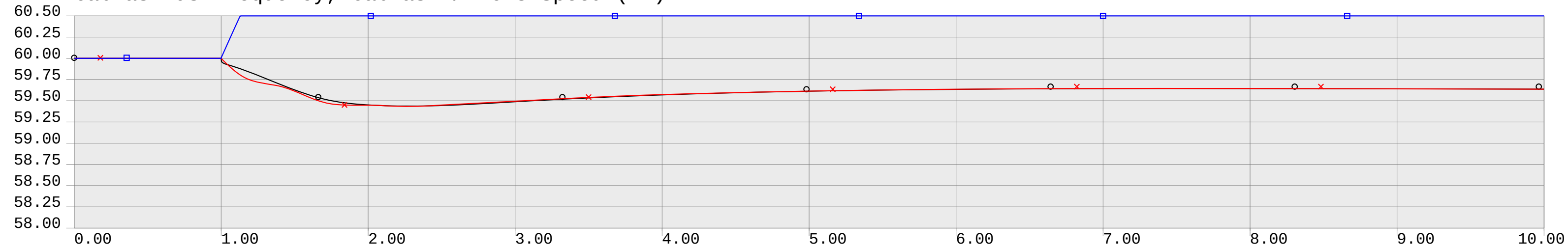
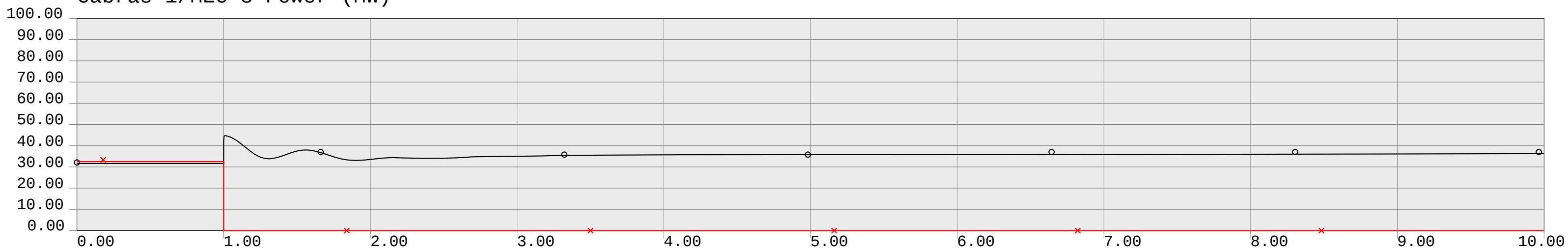
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



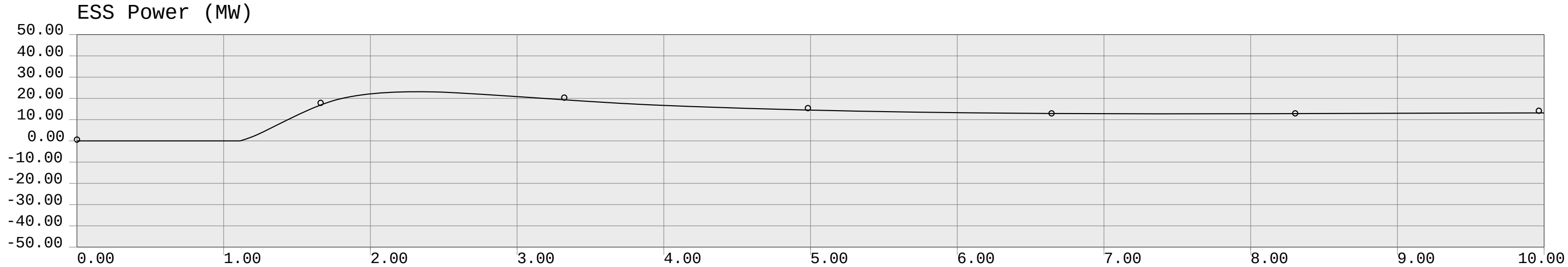
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



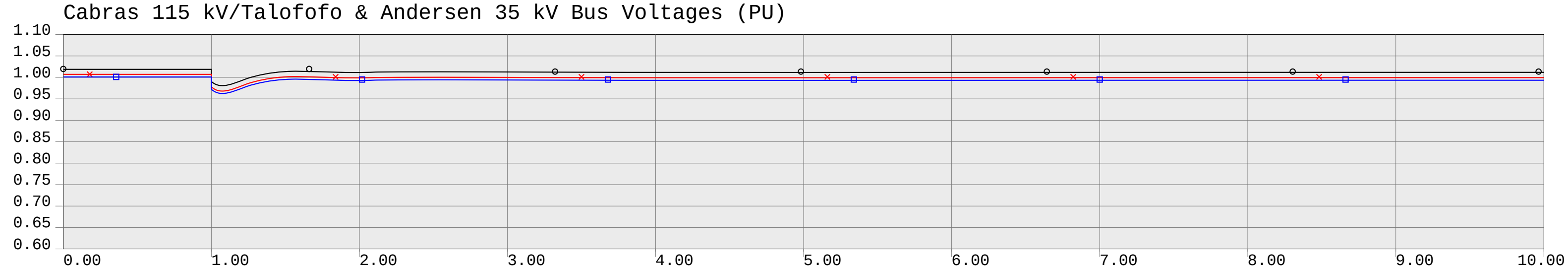
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

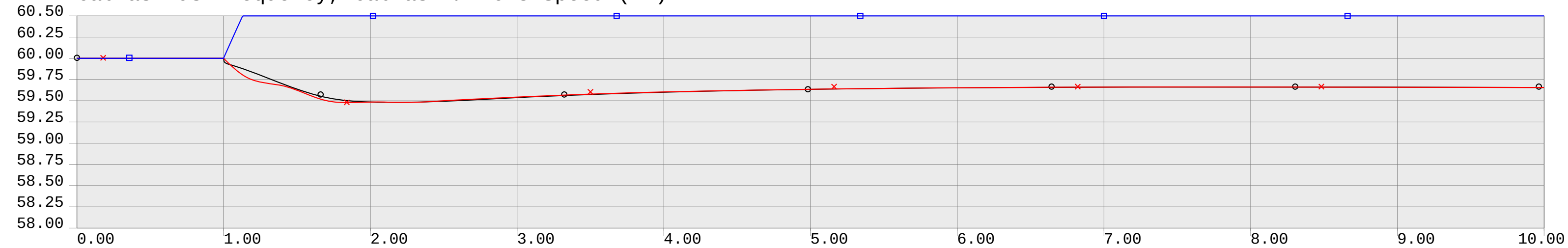
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

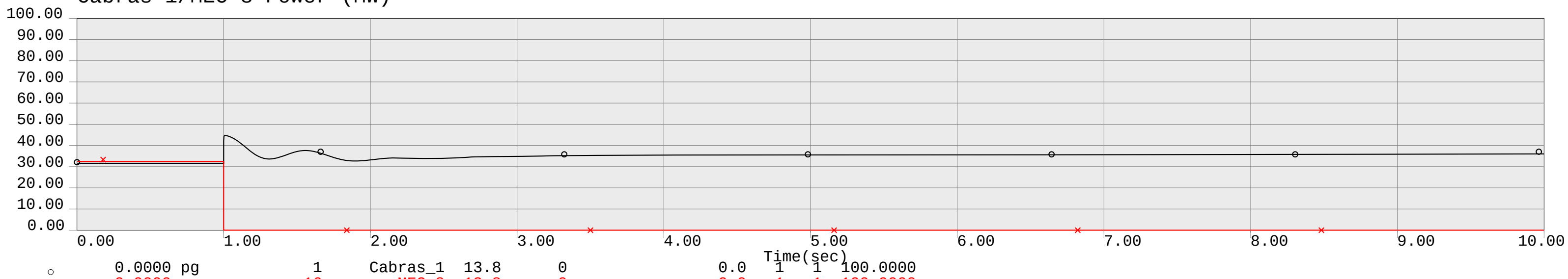
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



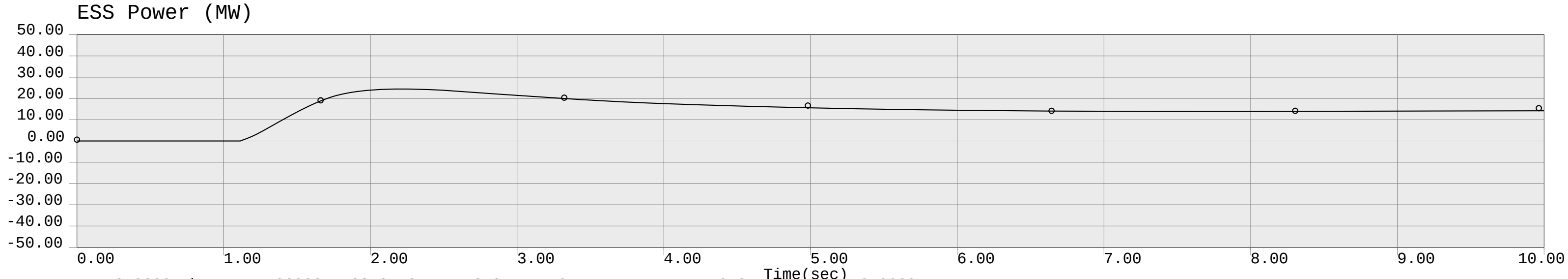

```
o 58.0000 fbus   1001  Cab115EB  115.0  0   0.0  1  1  60.5000
x 58.0000 spd       1  Cabras_1   13.8  0   0.0  1  1  60.5000
□ 58.0000 spd      16     MEC 8   13.8  0   0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)




```
o 0.0000 pg    1  Cabras_1  13.8  0   0.0  1  1  100.0000
x 0.0000 pg   16     MEC 8  13.8  0   0.0  1  1  100.0000
```

ESS Power (MW)




```
o -50.0000 pbes   80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
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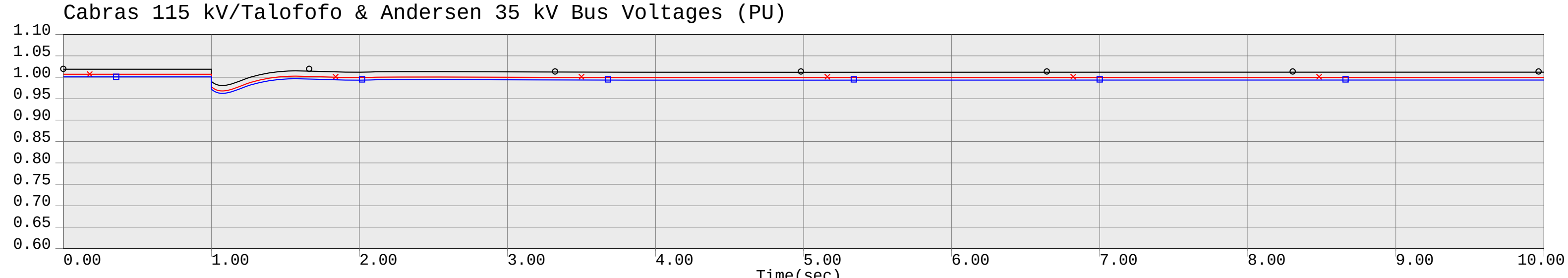
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
o 0.6000 vbus   1001  Cab115EB  115.0  0   0.0  1  1  1.1000
x 0.6000 vbus   2003    Tal345   34.5  0   0.0  1  1  1.1000
□ 0.6000 vbus   2210  And345B1   34.5  0   0.0  1  1  1.1000
```


chans/1500-m8-1e.chf

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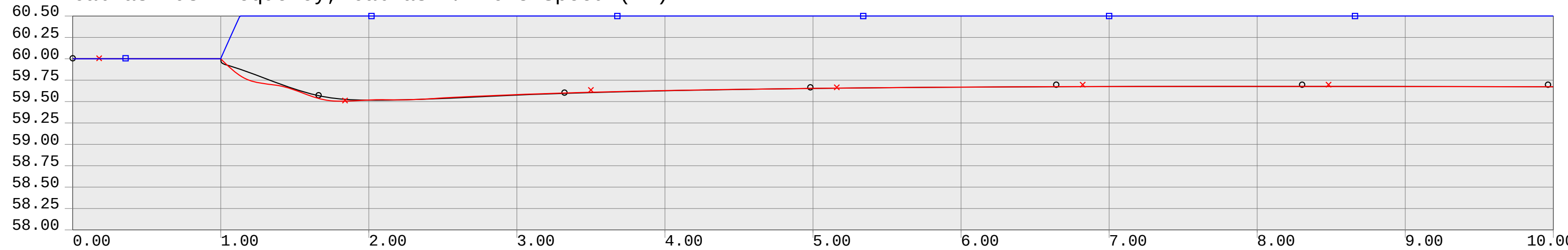
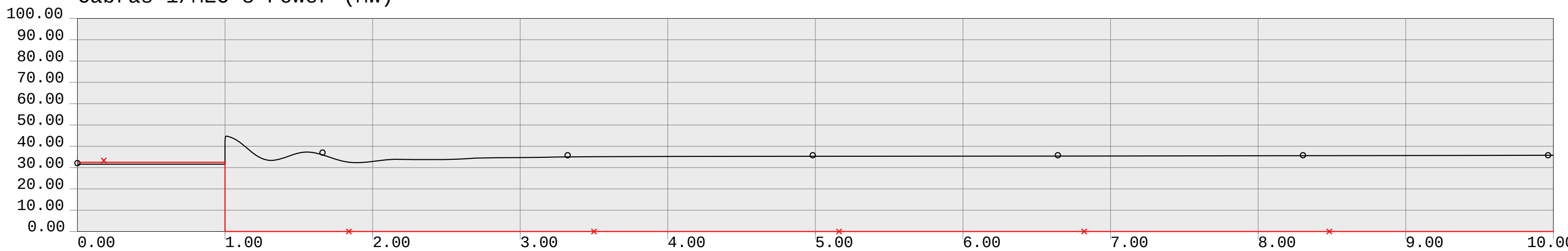
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



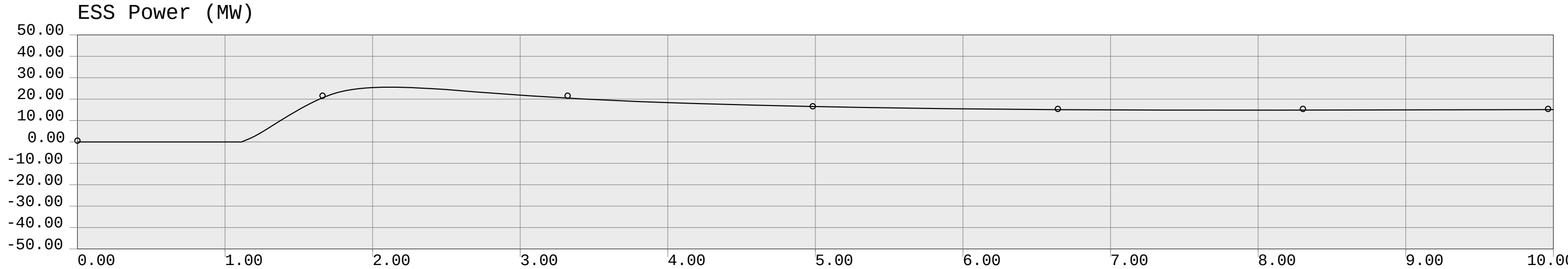
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



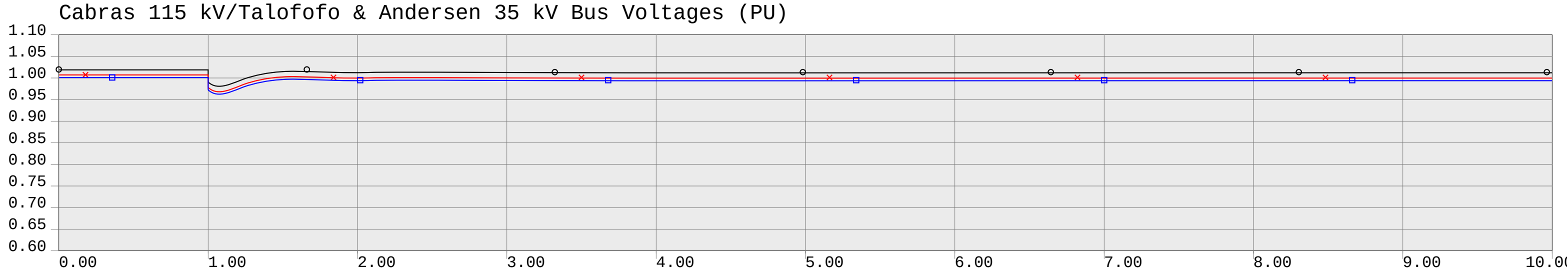
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

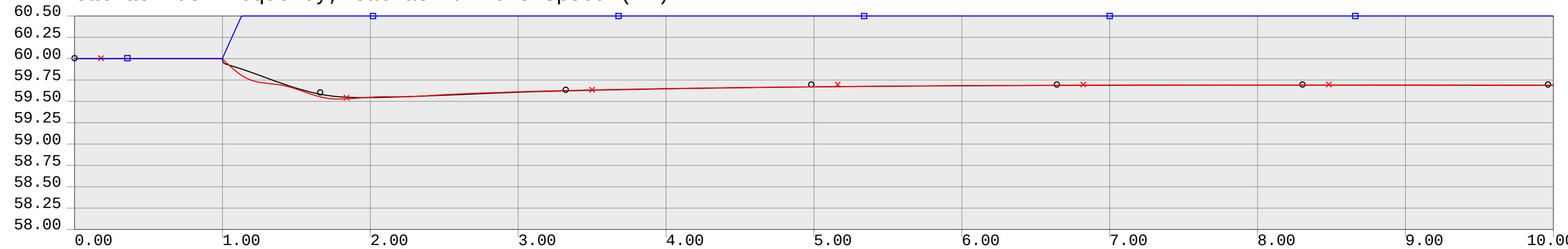
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

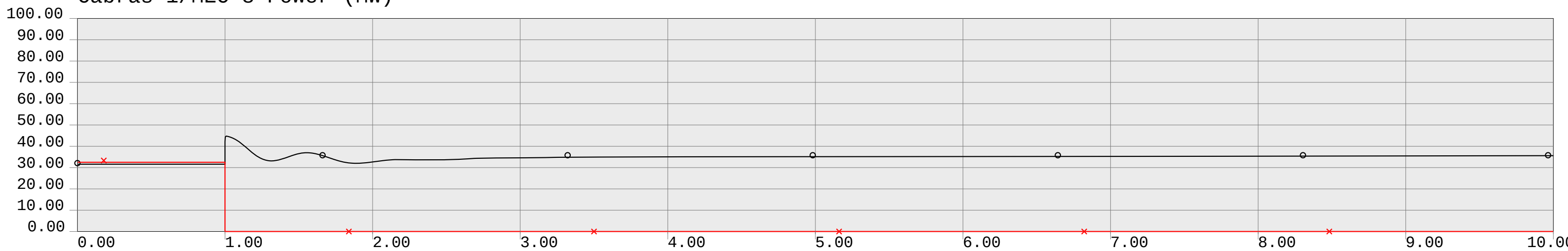
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



Time (sec)

○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

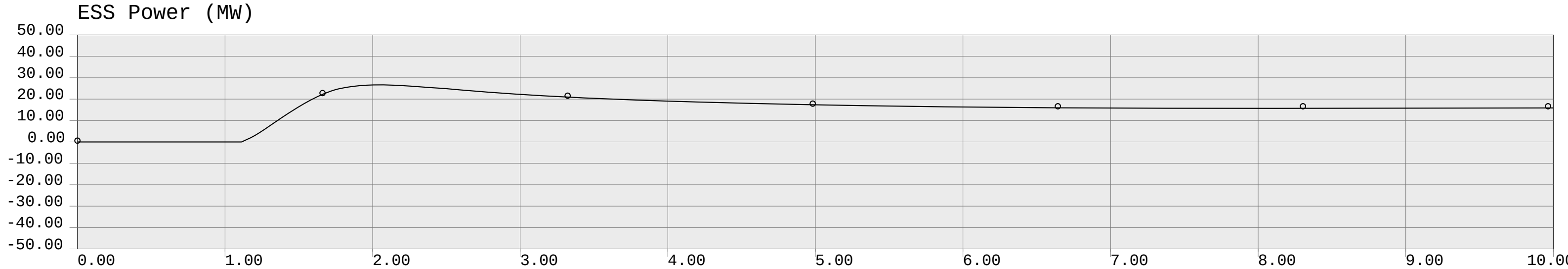
Cabras 1/MEC 8 Power (MW)



Time(sec)

○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

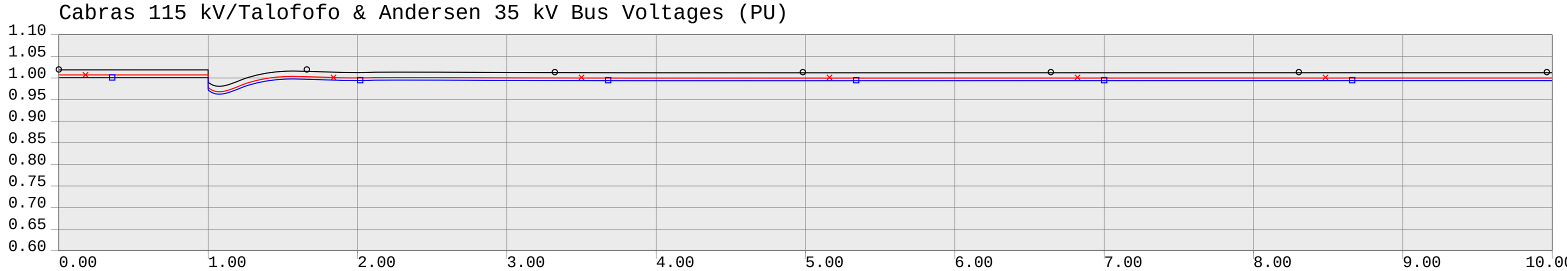
ESS Power (MW)



Time(sec)

○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



Time(sec)

○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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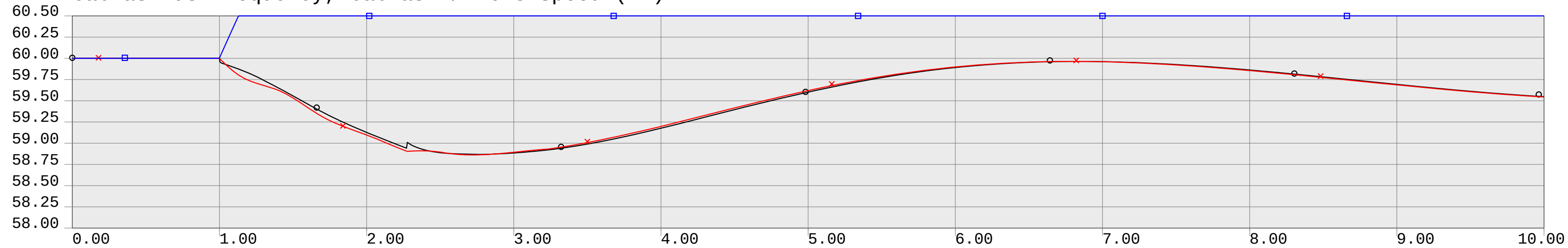
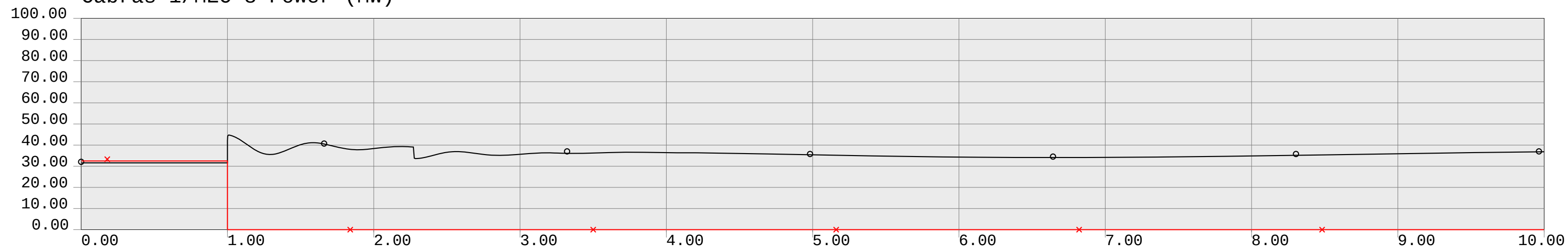
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



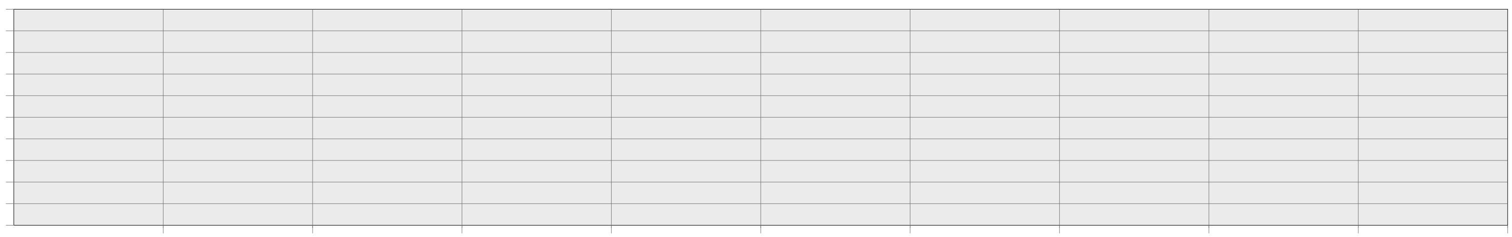
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)

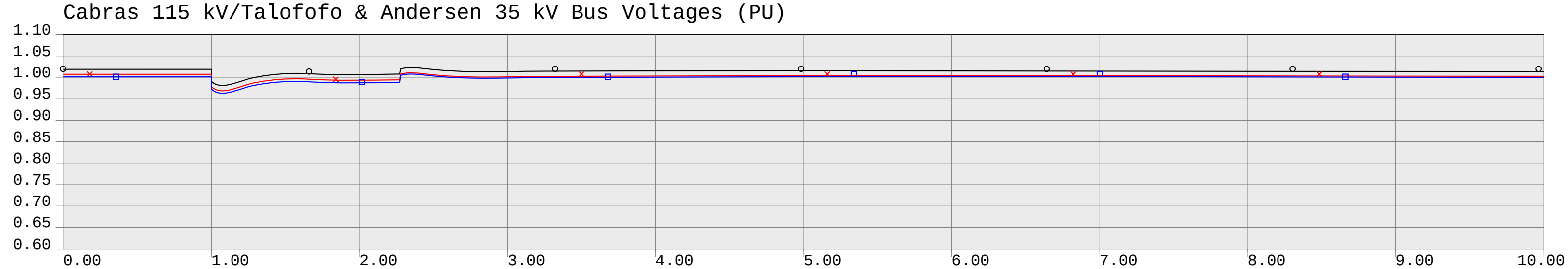


0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1500-m8-ref.chf

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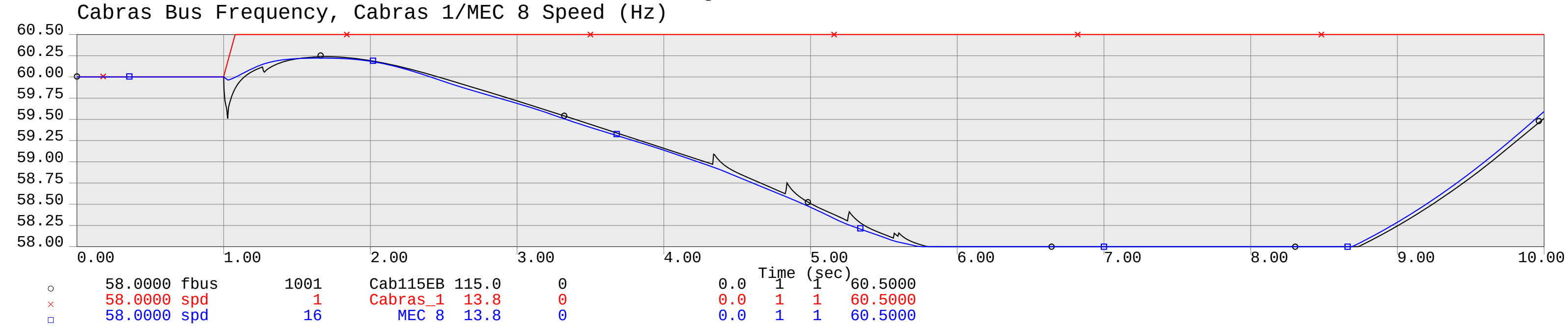
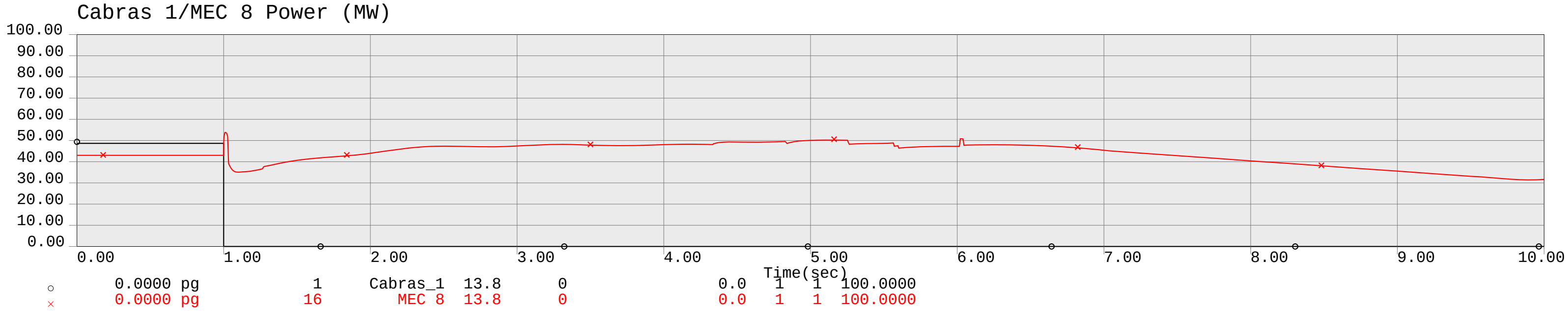
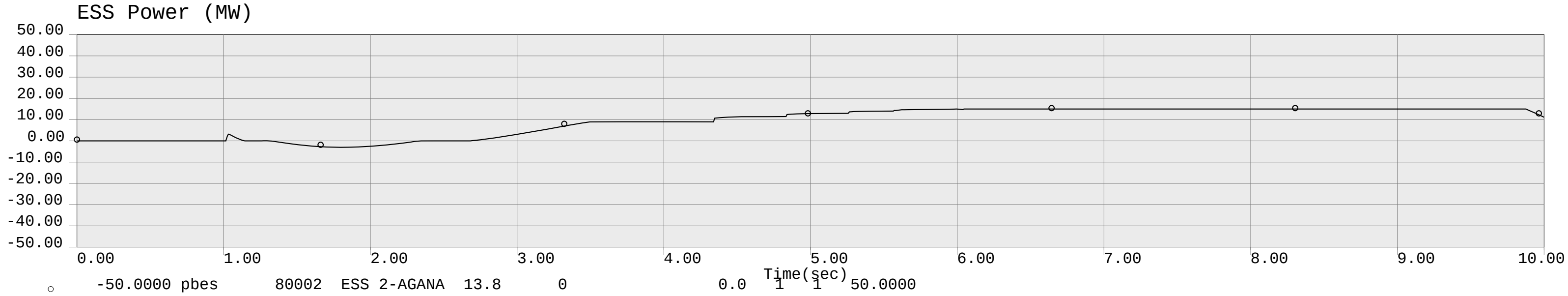
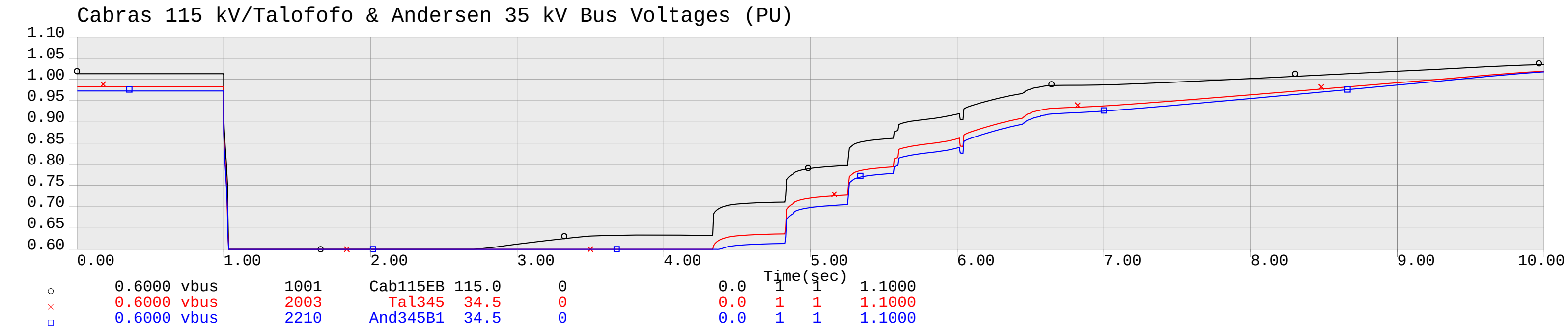
Simulation Summary Results 5/2014
Agana 115 kV ESS









chans/1600-c1-1a.chf

asibility_Study\rev_2\sim

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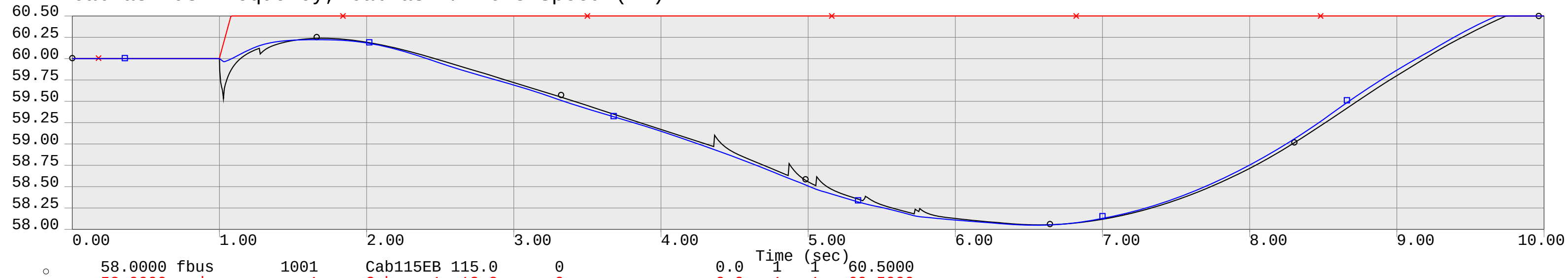
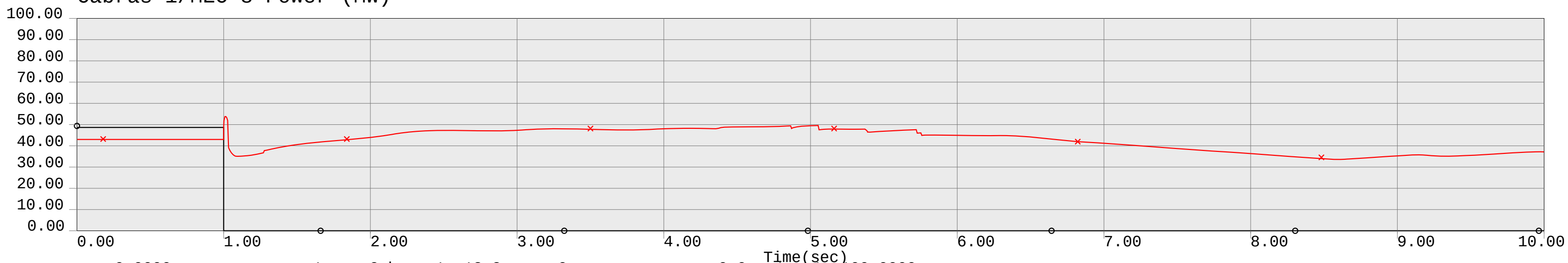
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



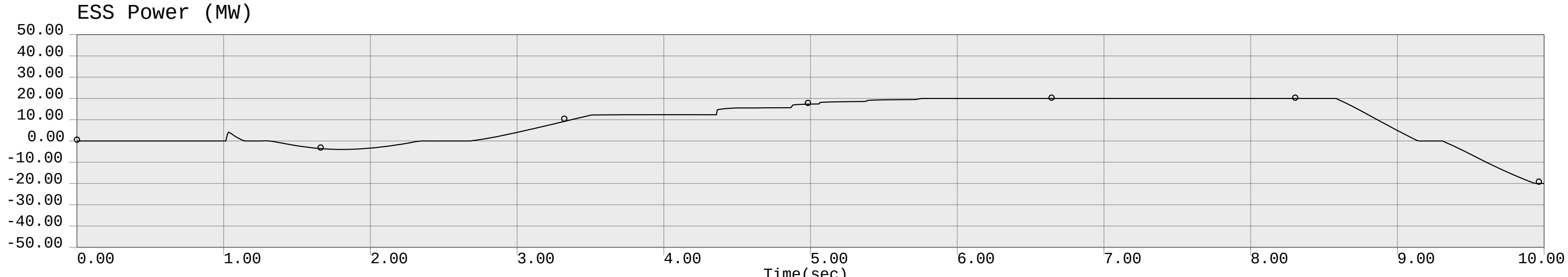
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



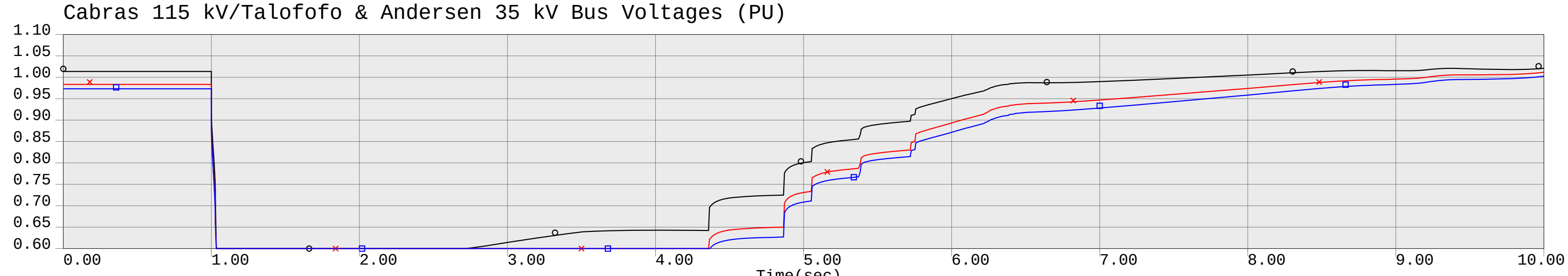
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1600-c1-1b.chf

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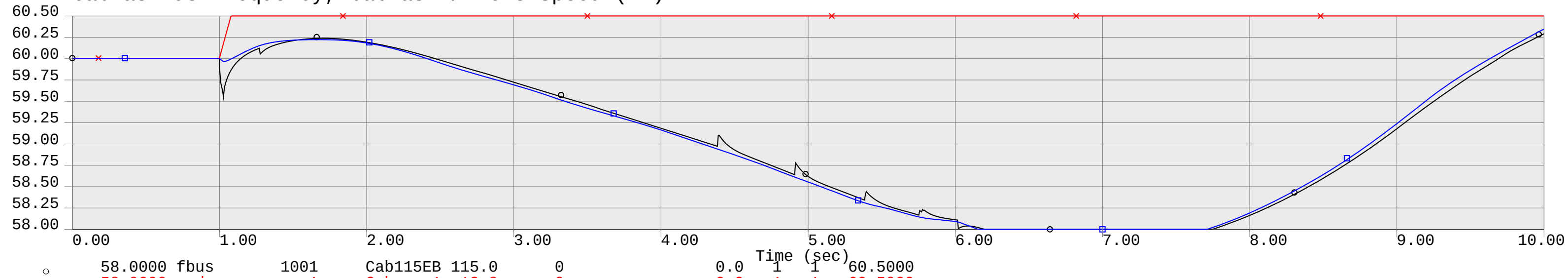
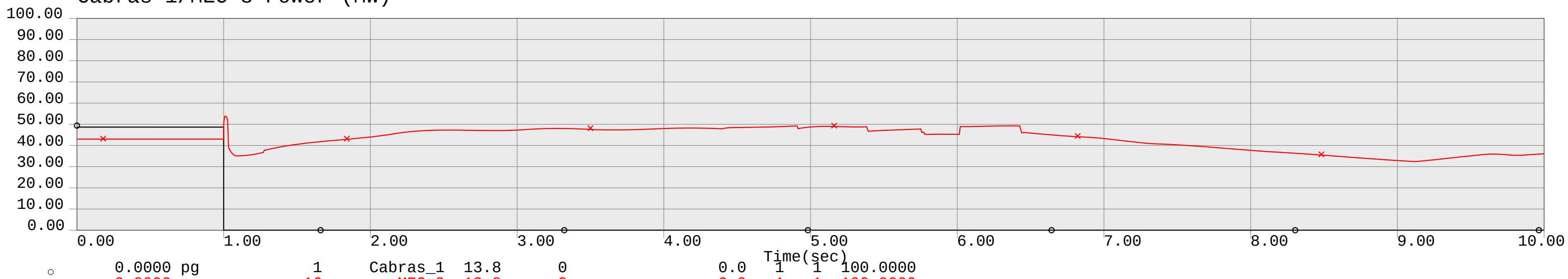
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



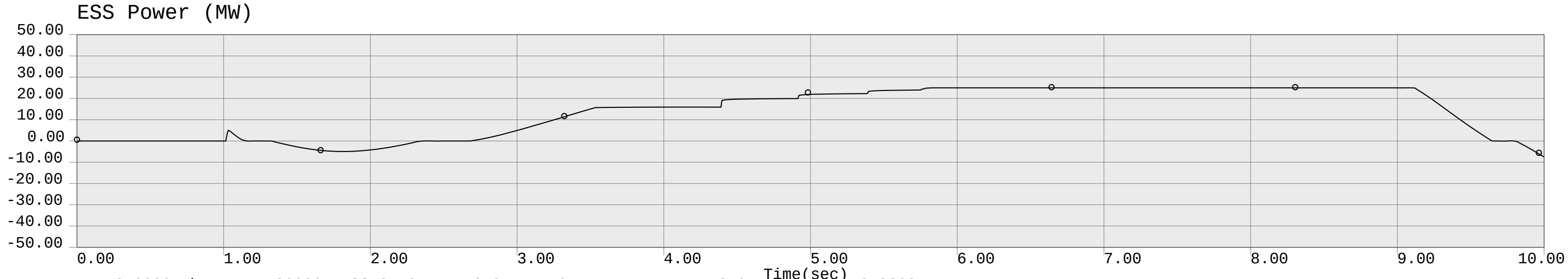

```
58.0000 fbus     1001   Cab115EB 115.0   0     0.0  1  1  60.5000
58.0000 spd         1   Cabras_1  13.8   0     0.0  1  1  60.5000
58.0000 spd        16      MEC 8  13.8   0     0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)



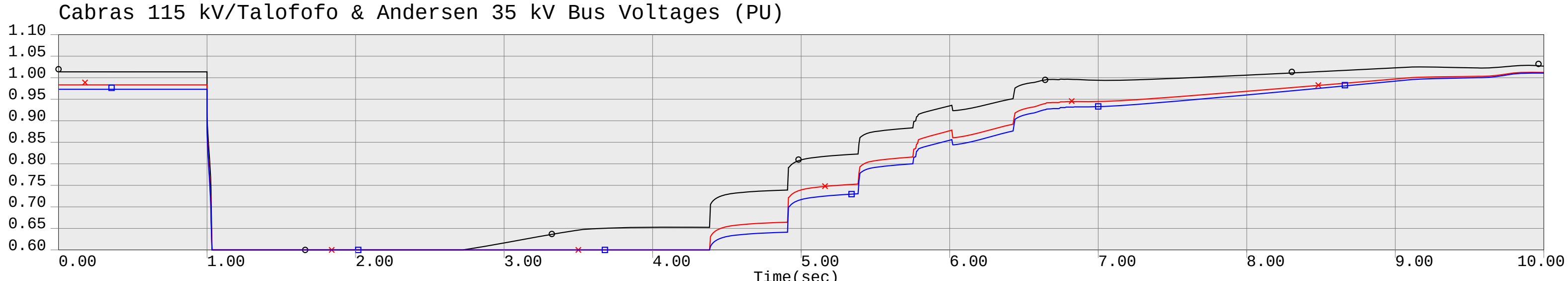

```
0.0000 pg           1   Cabras_1  13.8   0     0.0  1  1 100.0000
0.0000 pg          16      MEC 8  13.8   0     0.0  1  1 100.0000
```

ESS Power (MW)




```
-50.0000 pbes   80002  ESS 2-AGANA  13.8   0     0.0  1  1  50.0000
```

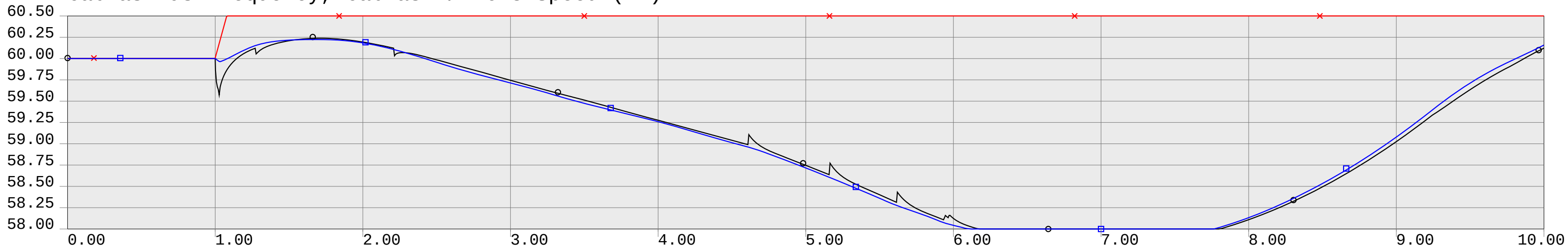
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.6000 vbus      1001   Cab115EB 115.0   0     0.0  1  1  1.1000
0.6000 vbus      2003     Tal345  34.5   0     0.0  1  1  1.1000
0.6000 vbus      2210   And345B1  34.5   0     0.0  1  1  1.1000
```

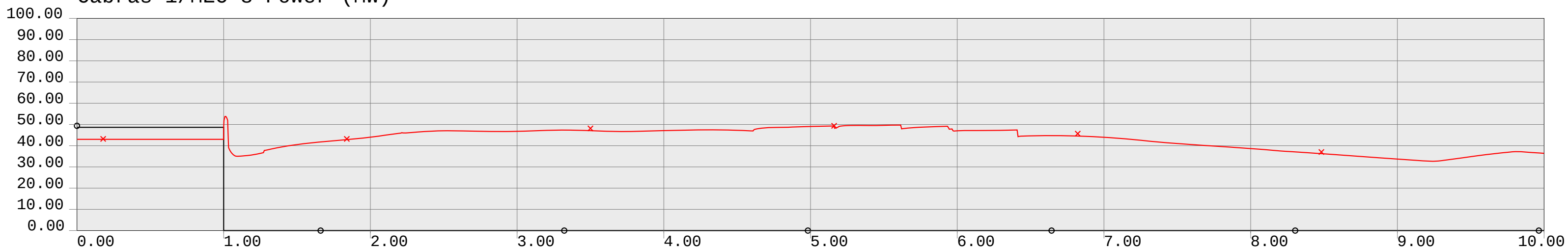
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



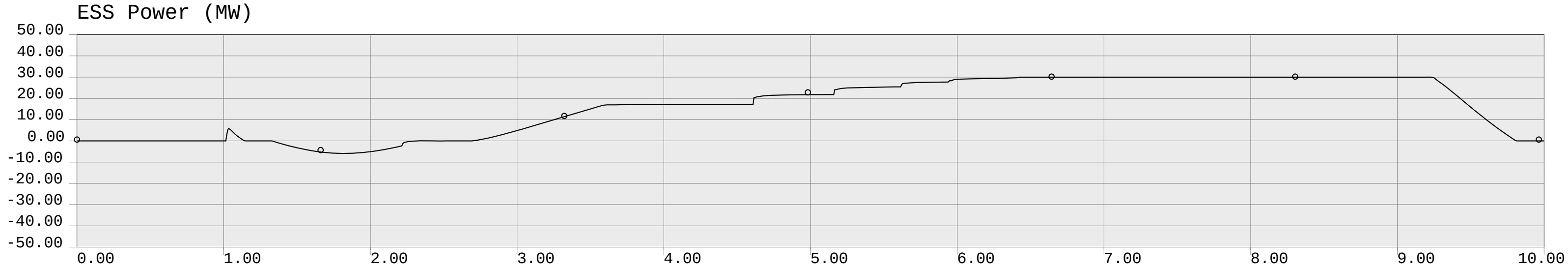

```
○  58.0000 fbus    1001  Cab115EB 115.0  0   0.0  1  1  60.5000
×  58.0000 spd        1  Cabras_1  13.8  0   0.0  1  1  60.5000
□  58.0000 spd       16     MEC 8  13.8  0   0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)



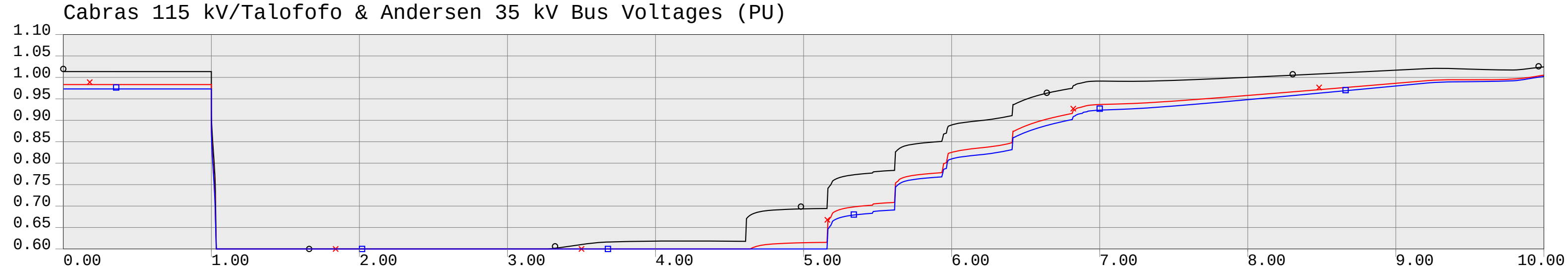

```
○   0.0000 pg         1  Cabras_1  13.8  0   0.0  1  1  100.0000
×   0.0000 pg        16     MEC 8  13.8  0   0.0  1  1  100.0000
```

ESS Power (MW)




```
○  -50.0000 pbes    80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
```

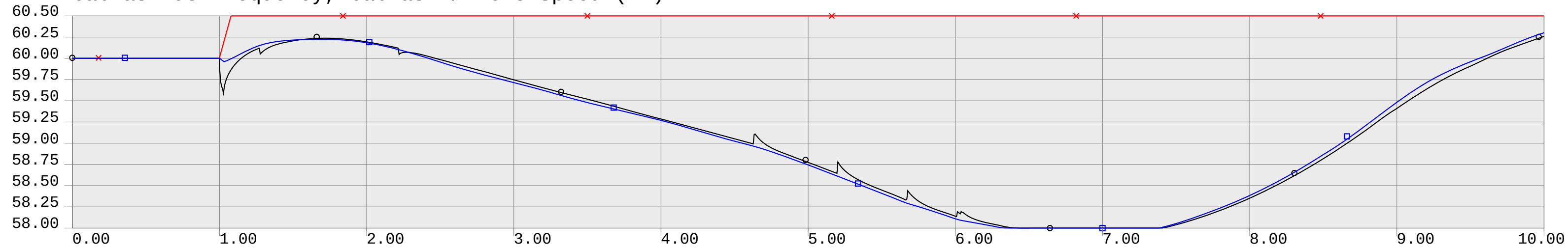
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○   0.6000 vbus    1001  Cab115EB 115.0  0   0.0  1  1  1.1000
×   0.6000 vbus    2003    Tal345  34.5  0   0.0  1  1  1.1000
□   0.6000 vbus    2210  And345B1  34.5  0   0.0  1  1  1.1000
```

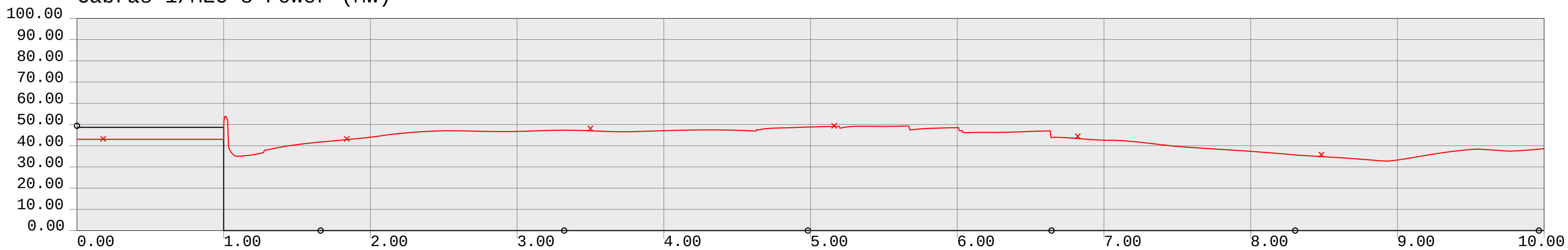
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



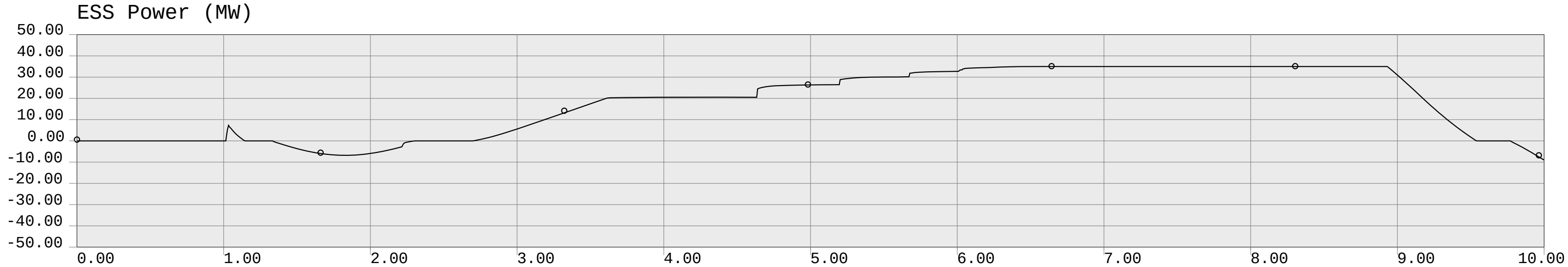
○	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



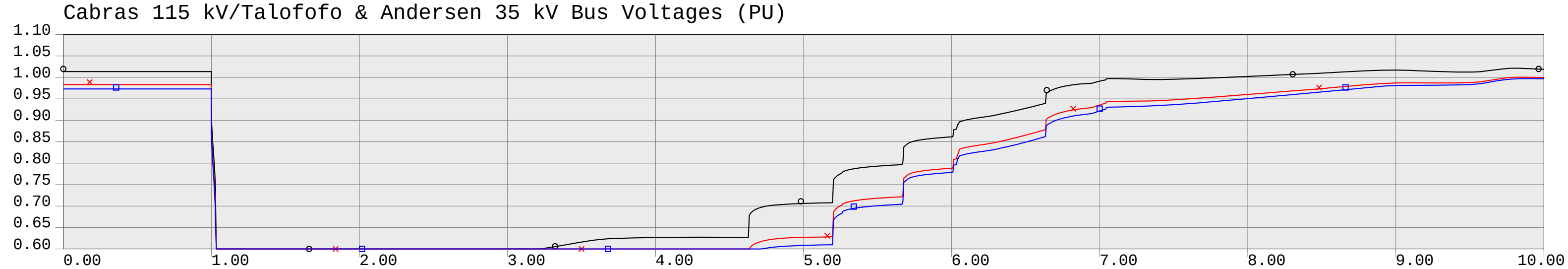
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

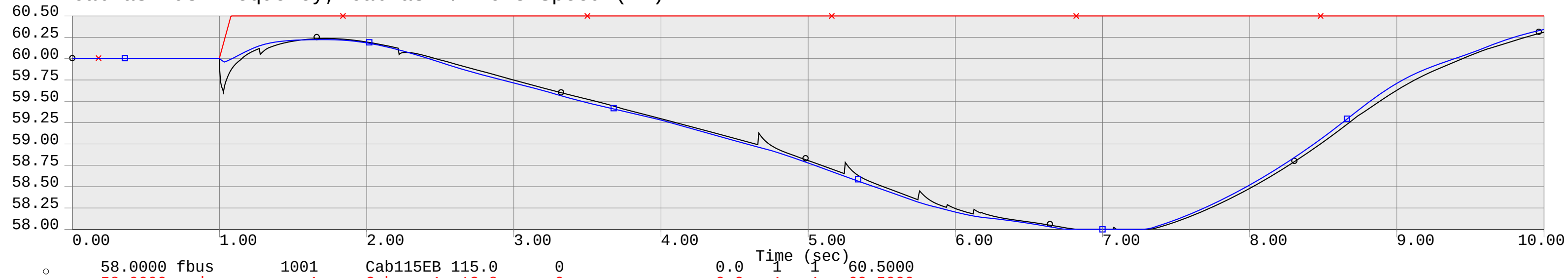
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

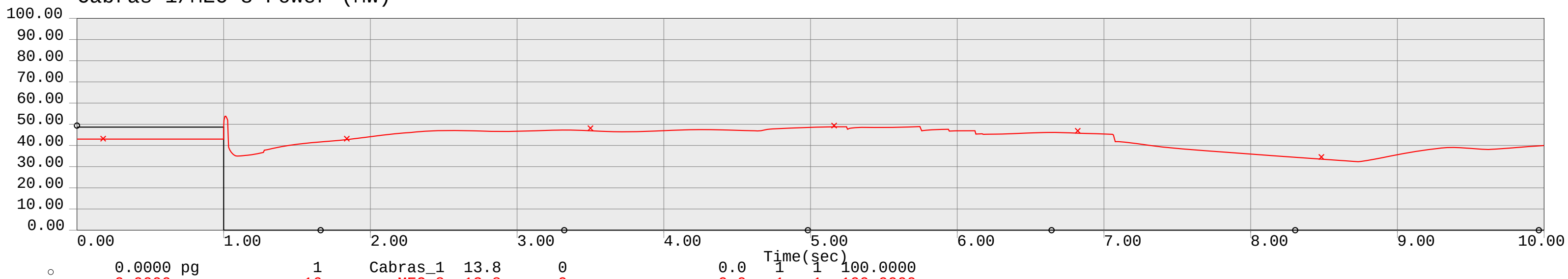
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



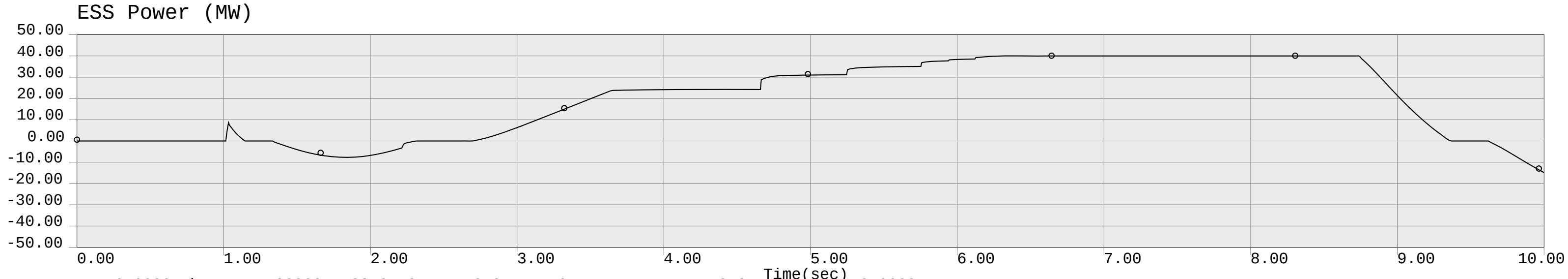
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



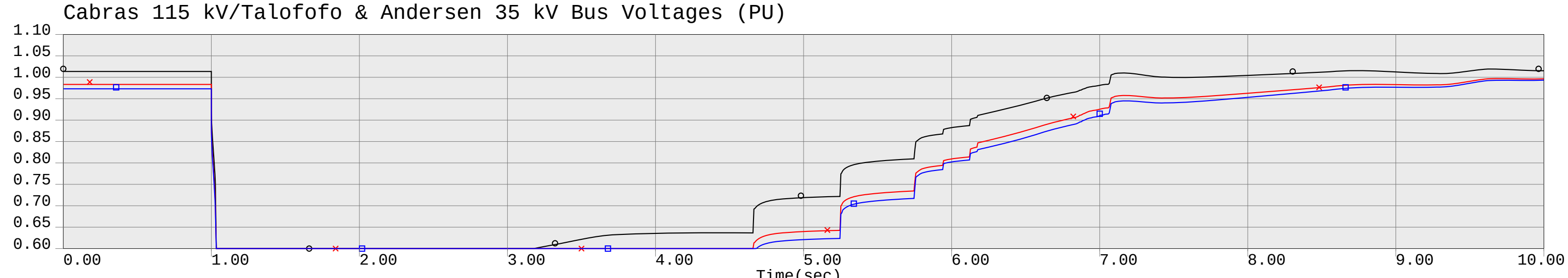
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1600-c1-1f.chf

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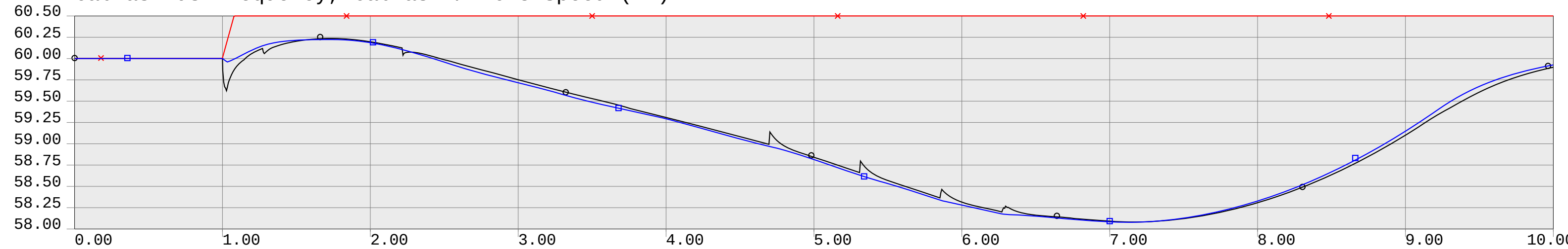
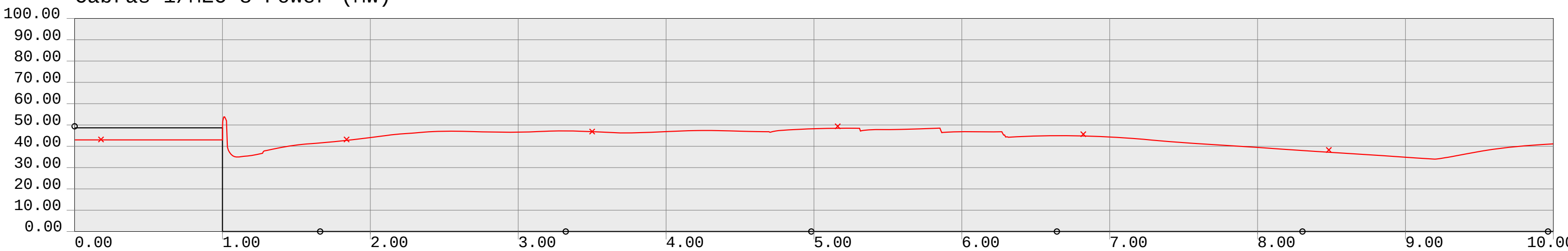
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



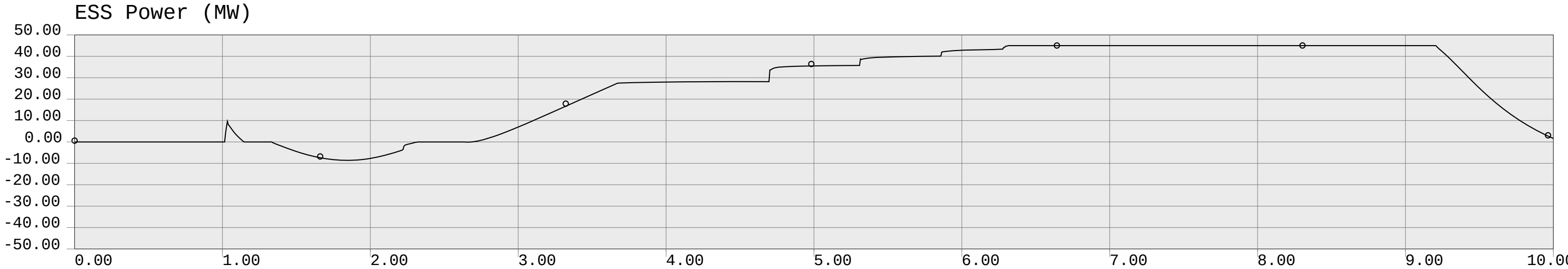
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



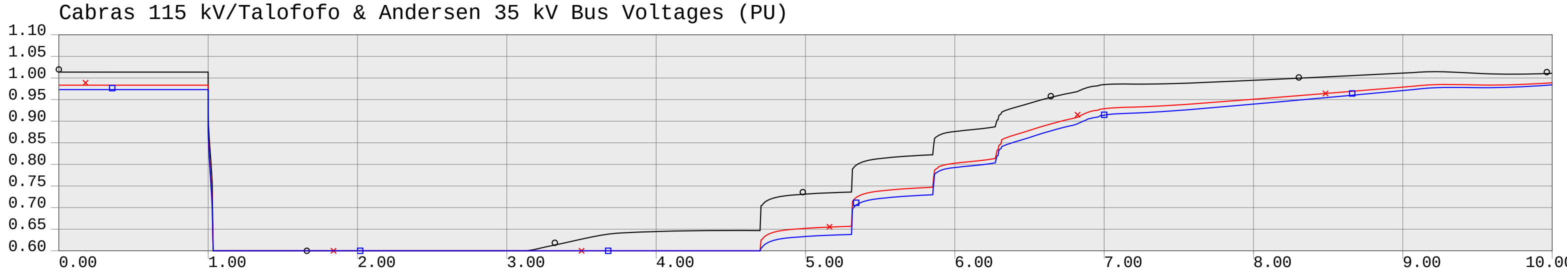
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1600-c1-1g.chf

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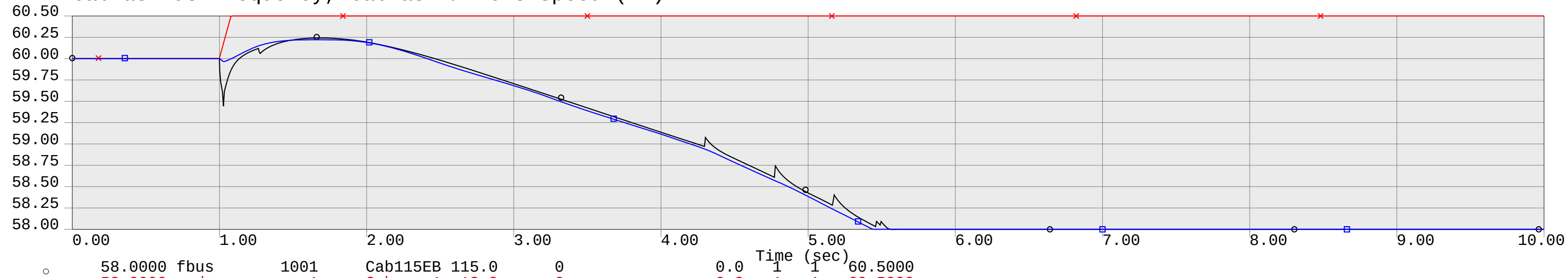
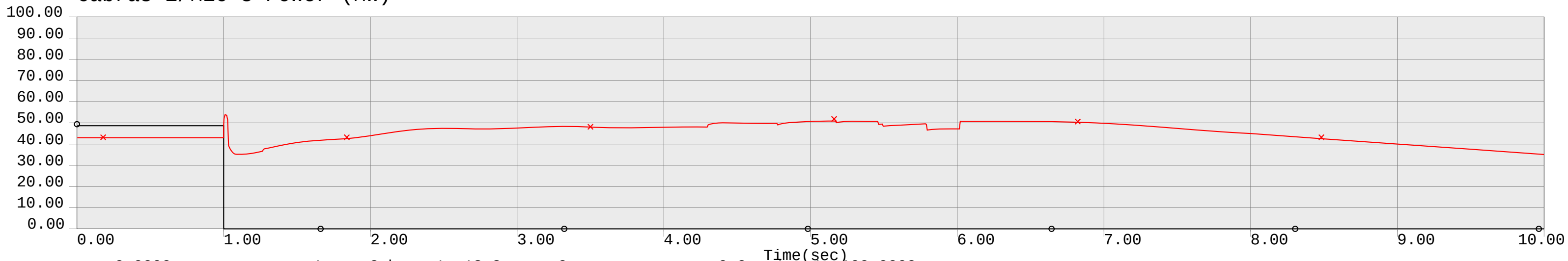
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



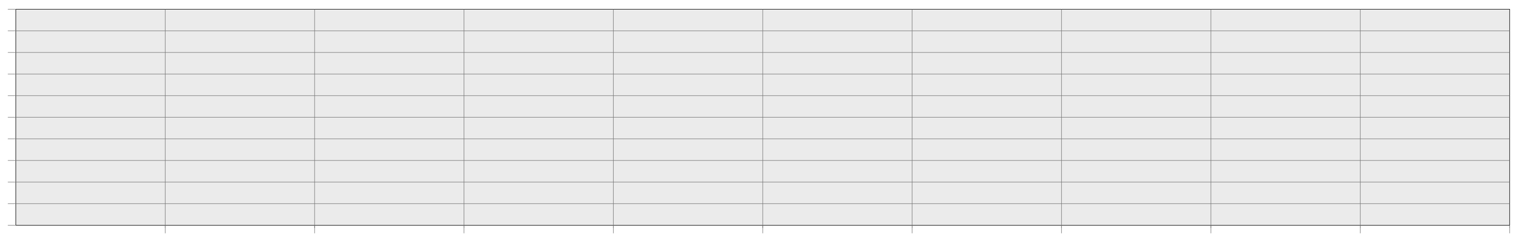
58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)

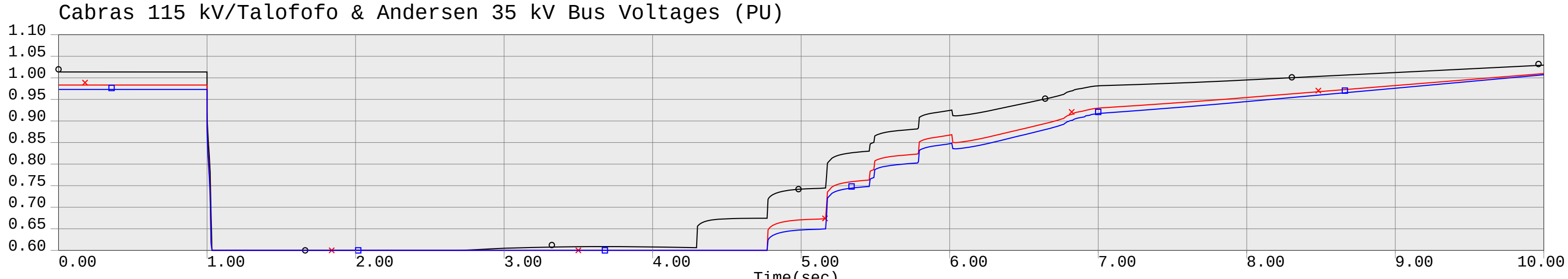


0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



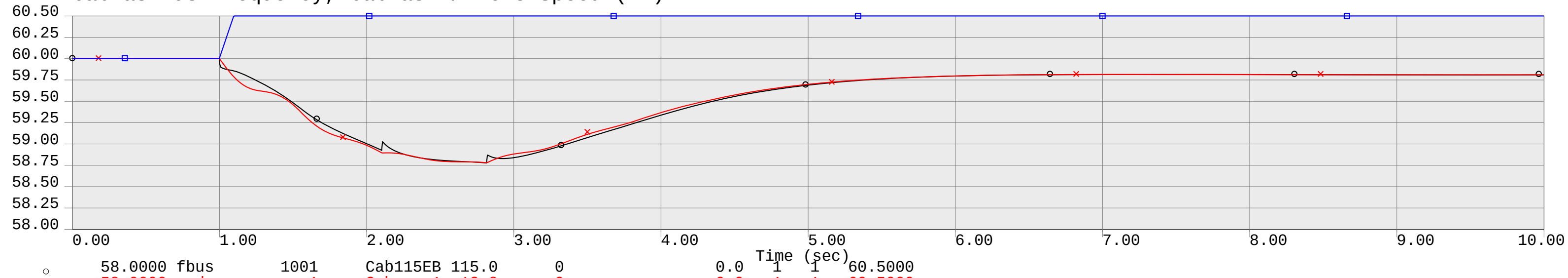
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



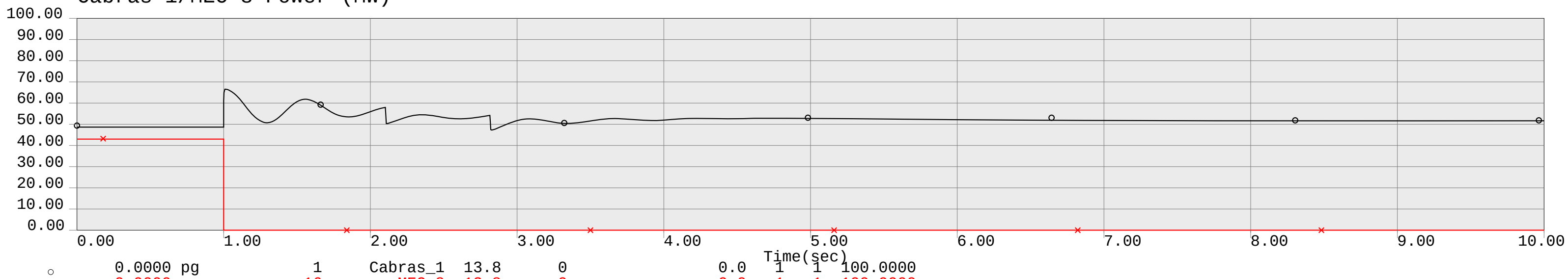
0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

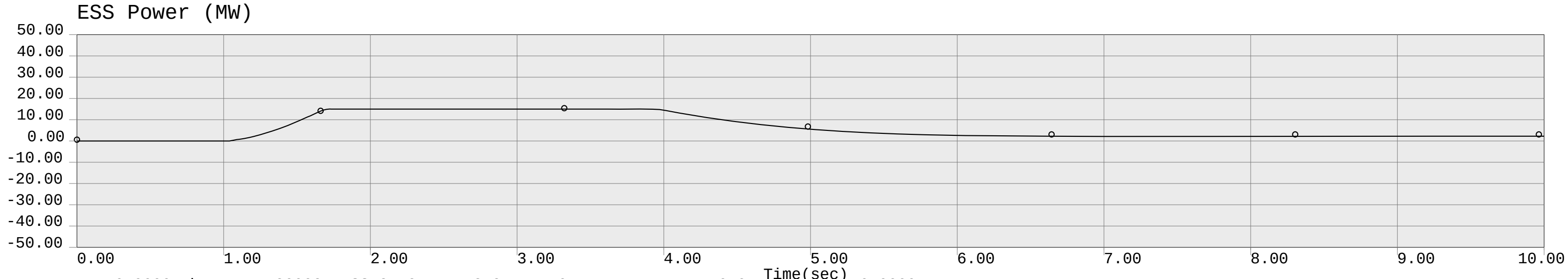
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



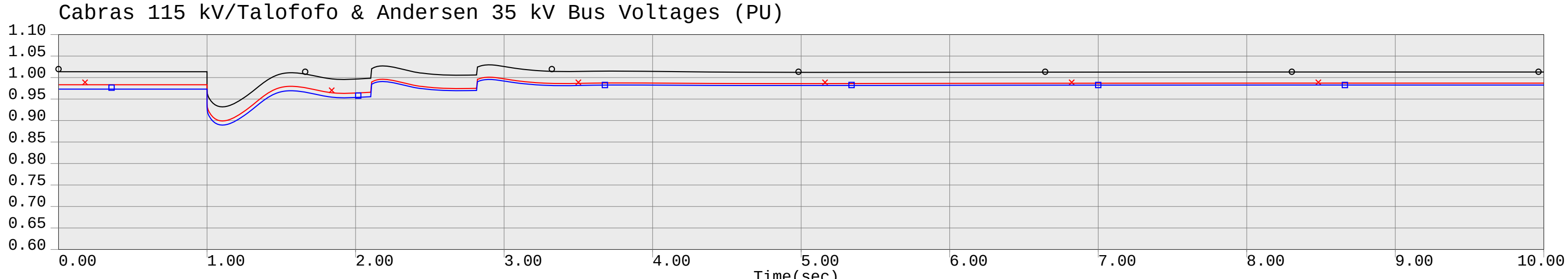
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



chans/1600-m8-1a.chf

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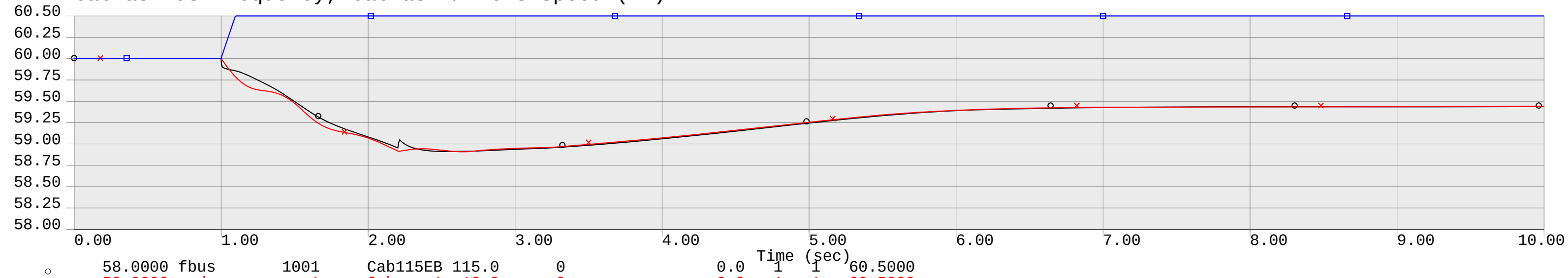
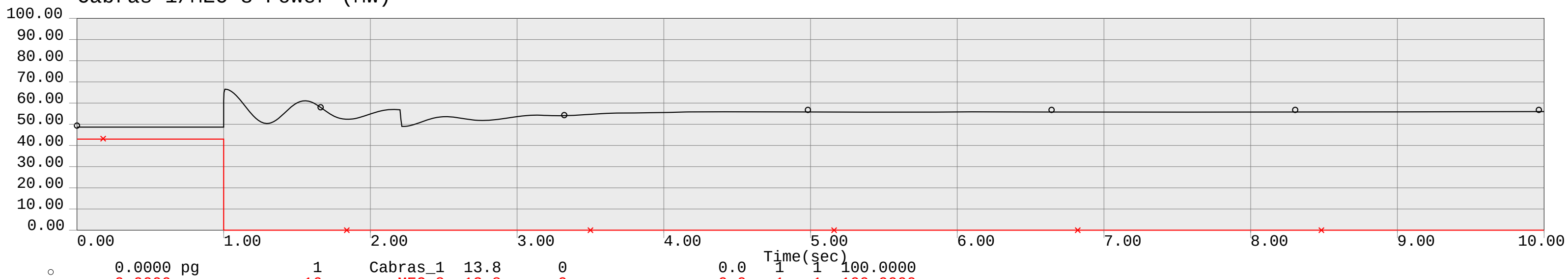
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



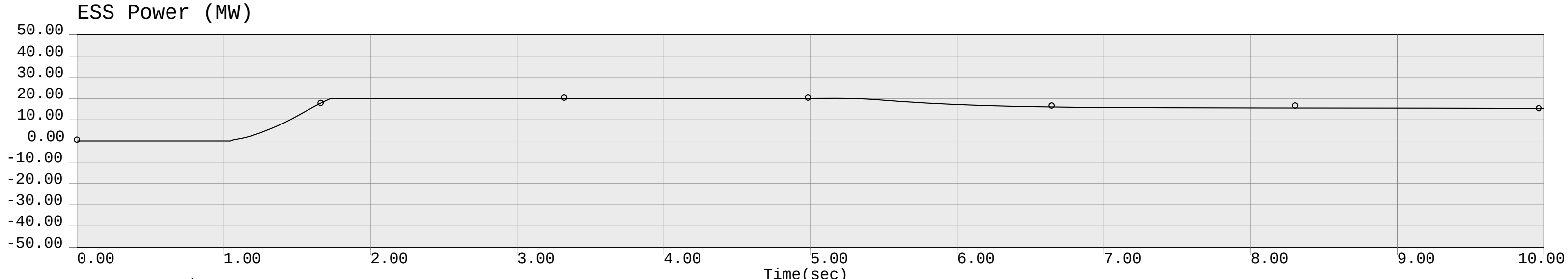
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



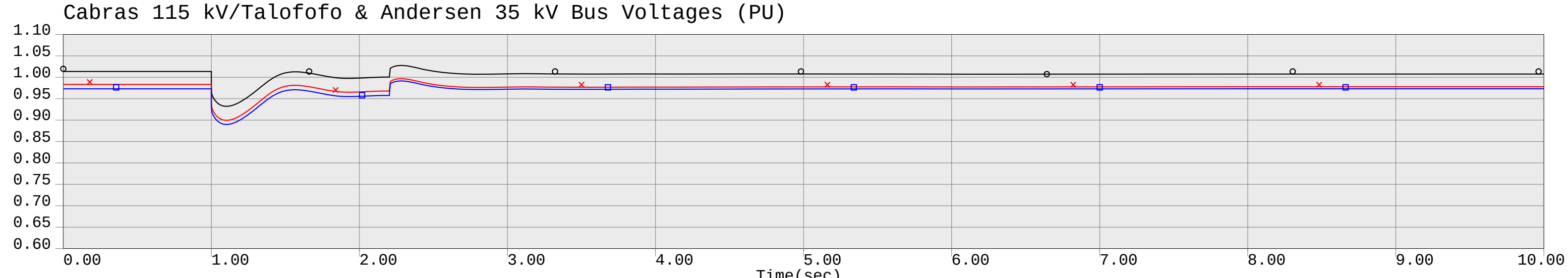
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

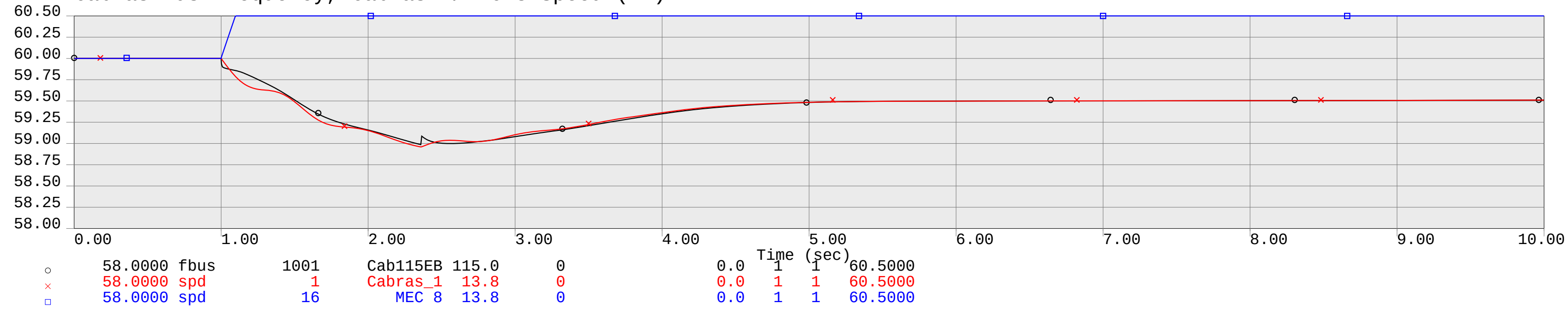
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



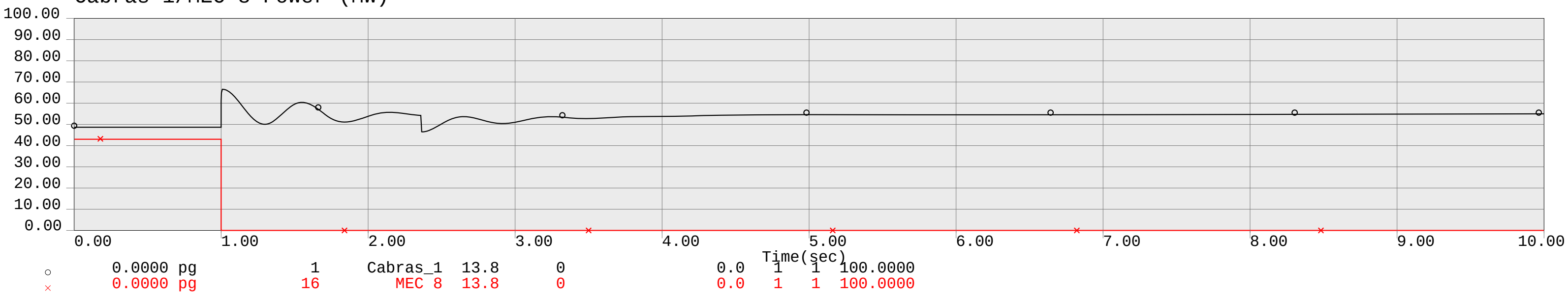
○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

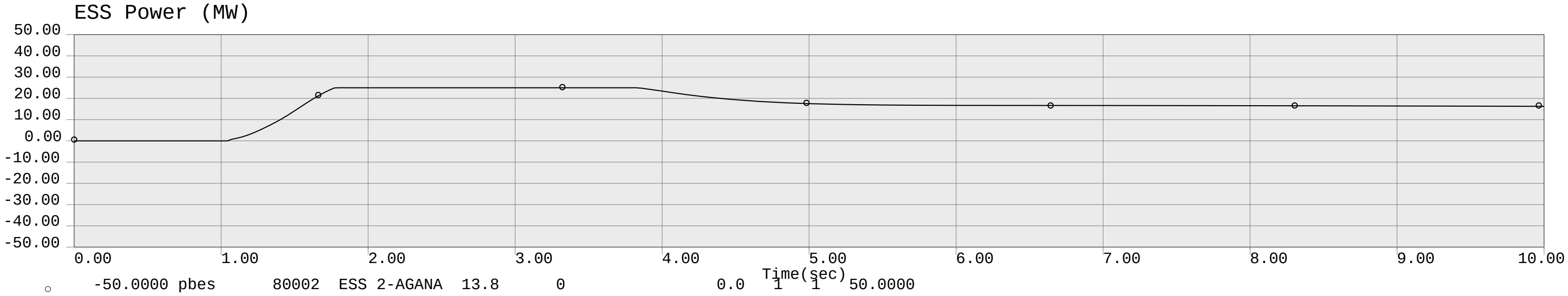
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



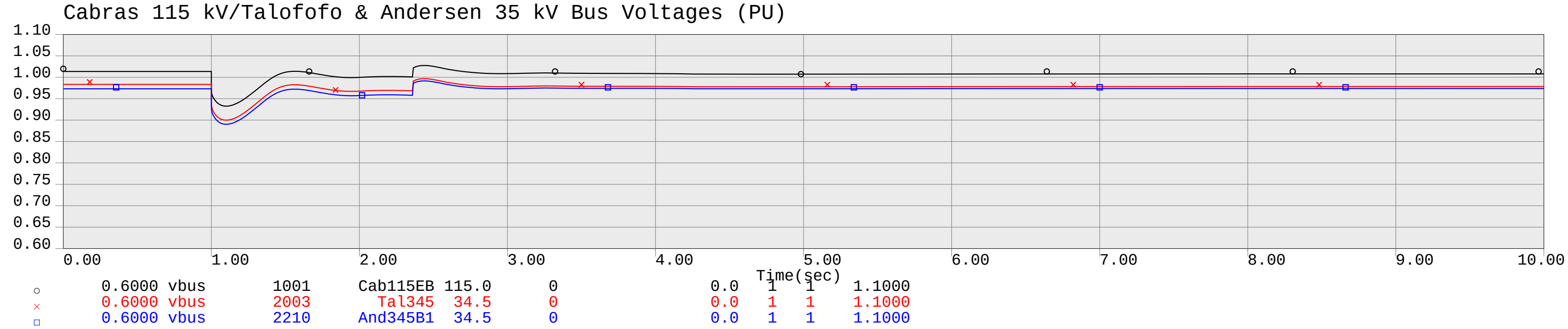
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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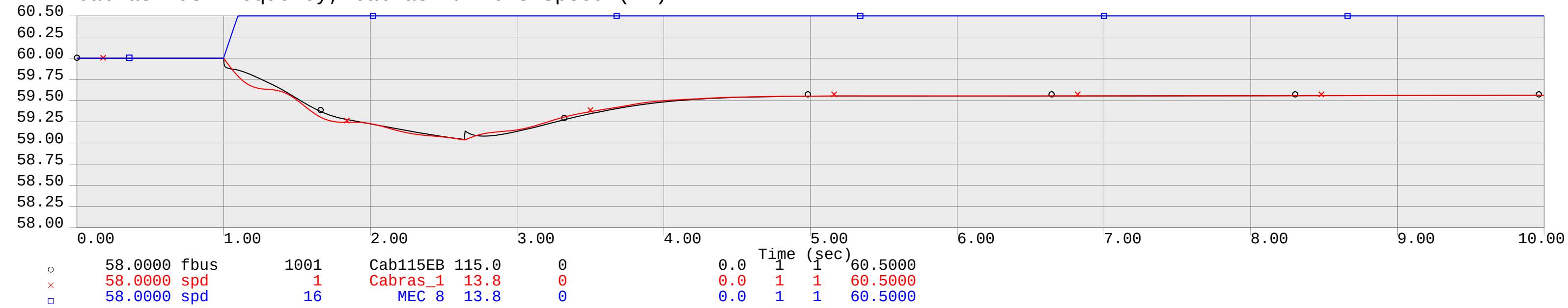
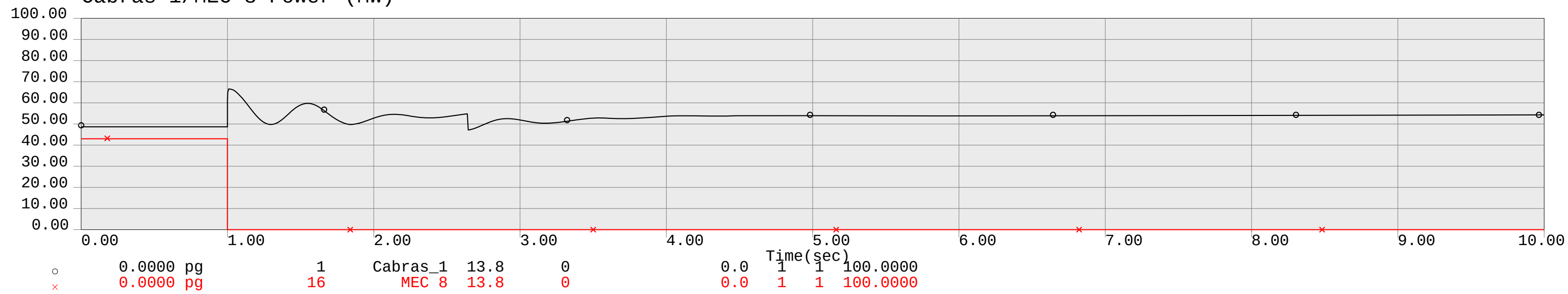
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

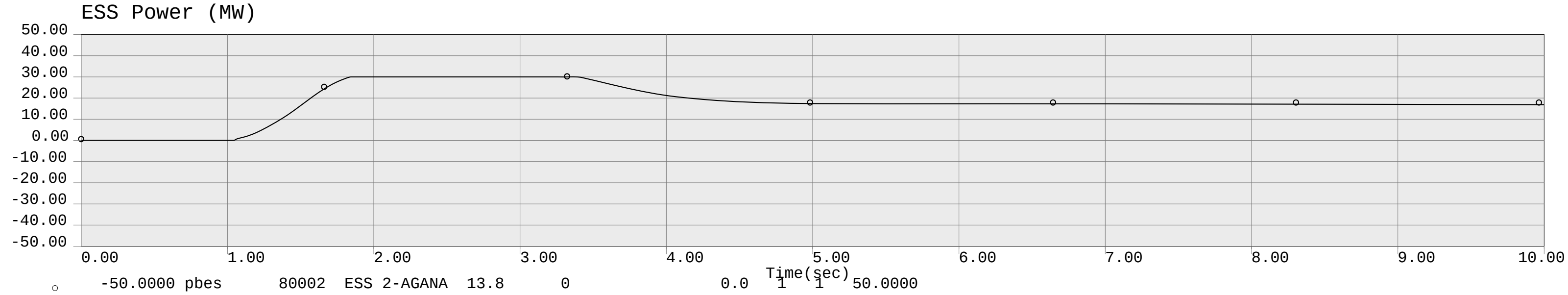
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



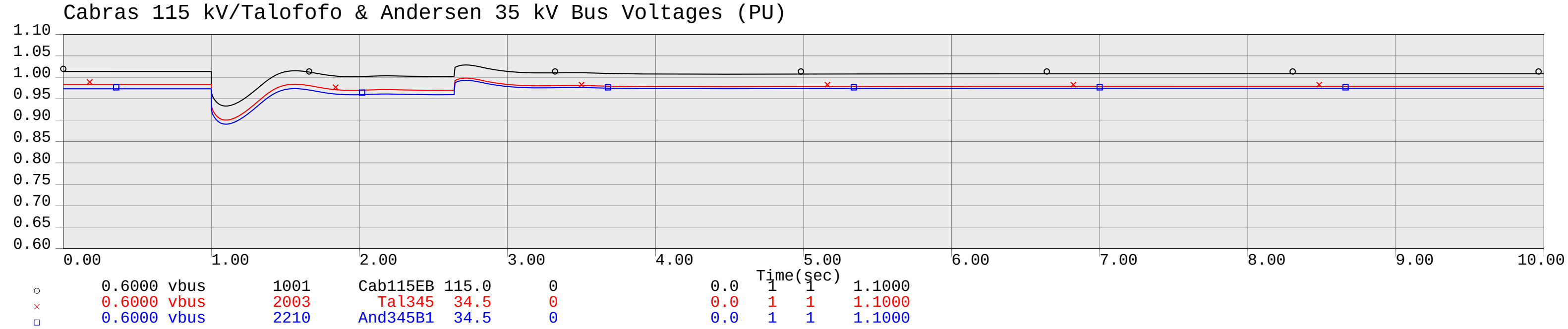
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)

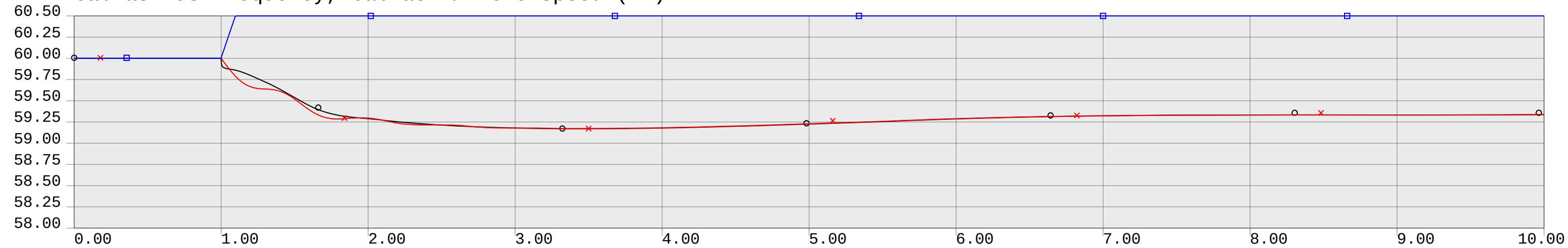


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



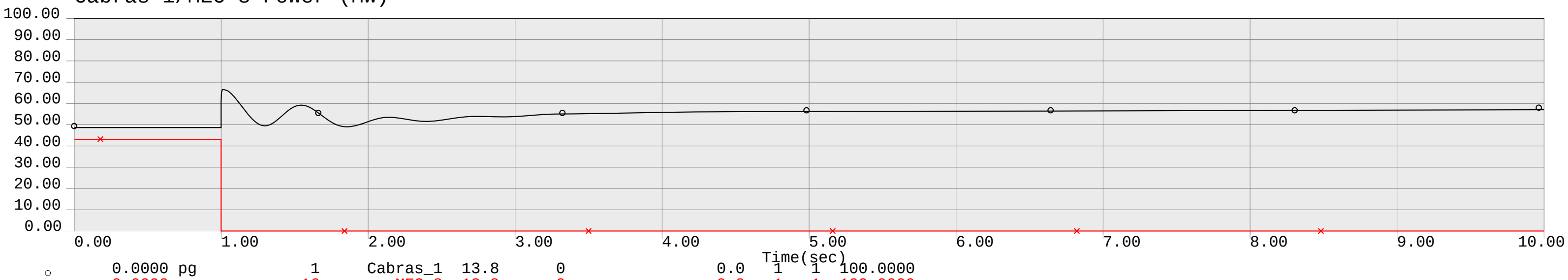
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



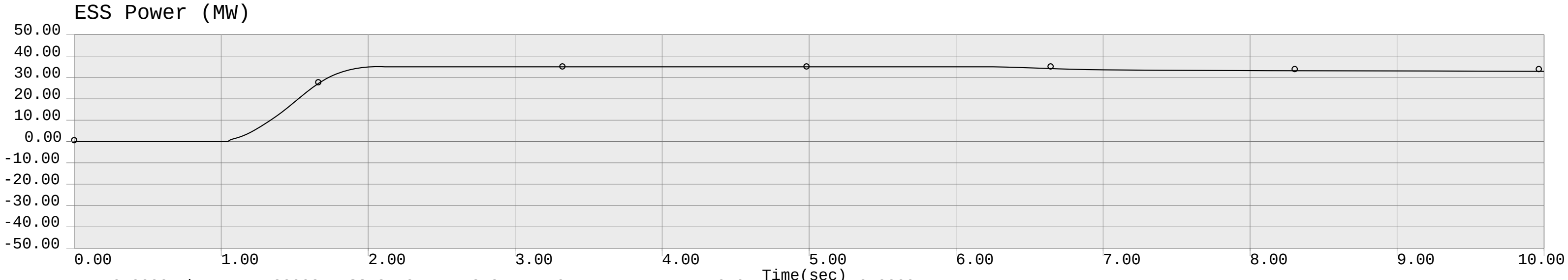

```
58.0000 fbus   1001  Cab115EB 115.0  0  0.0  1  1  60.5000
58.0000 spd       1  Cabras_1  13.8  0  0.0  1  1  60.5000
58.0000 spd      16     MEC 8  13.8  0  0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)




```
0.0000 pg    1  Cabras_1  13.8  0  0.0  1  1  100.0000
0.0000 pg   16     MEC 8  13.8  0  0.0  1  1  100.0000
```

ESS Power (MW)




```
-50.0000 pbes  80002  ESS 2-AGANA  13.8  0  0.0  1  1  50.0000
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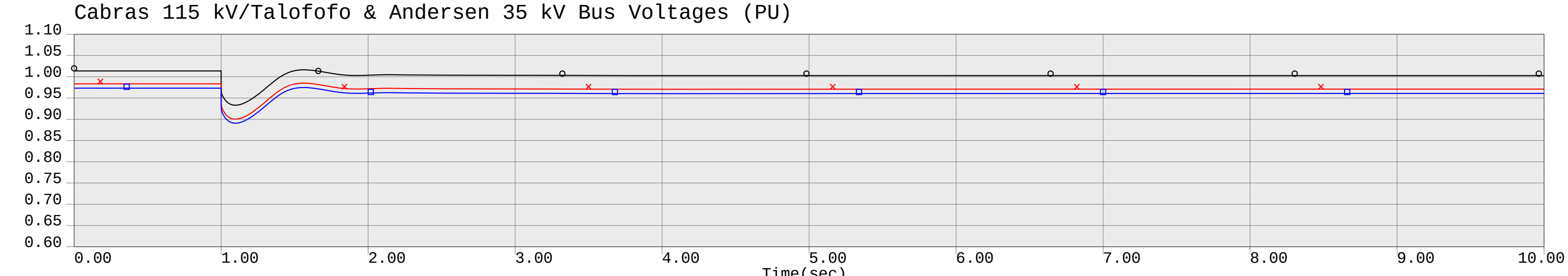
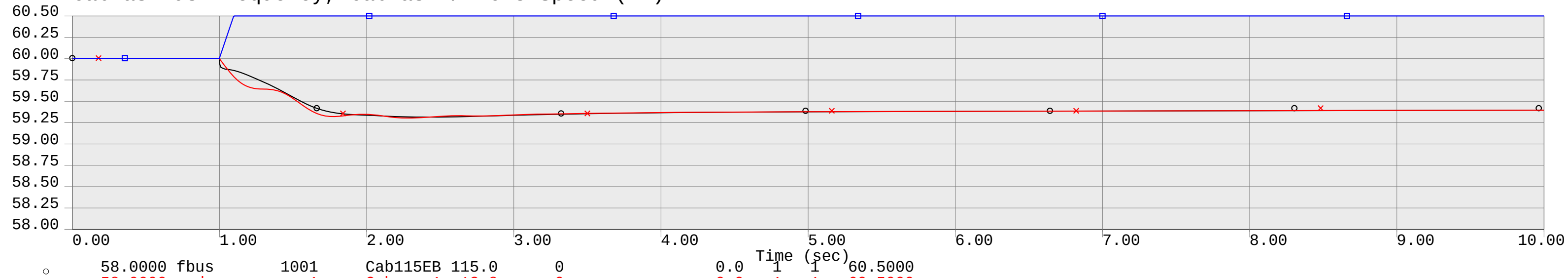
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.6000 vbus  1001  Cab115EB 115.0  0  0.0  1  1  1.1000
0.6000 vbus  2003    Tal345  34.5  0  0.0  1  1  1.1000
0.6000 vbus  2210  And345B1  34.5  0  0.0  1  1  1.1000
```

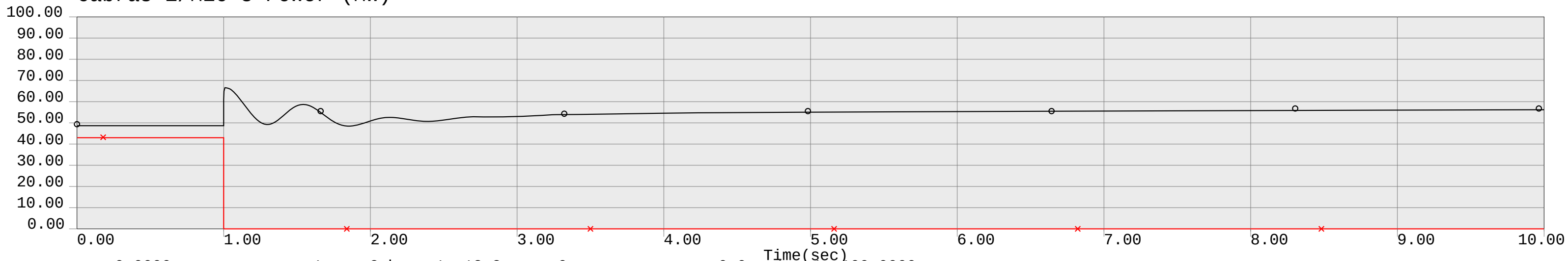
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



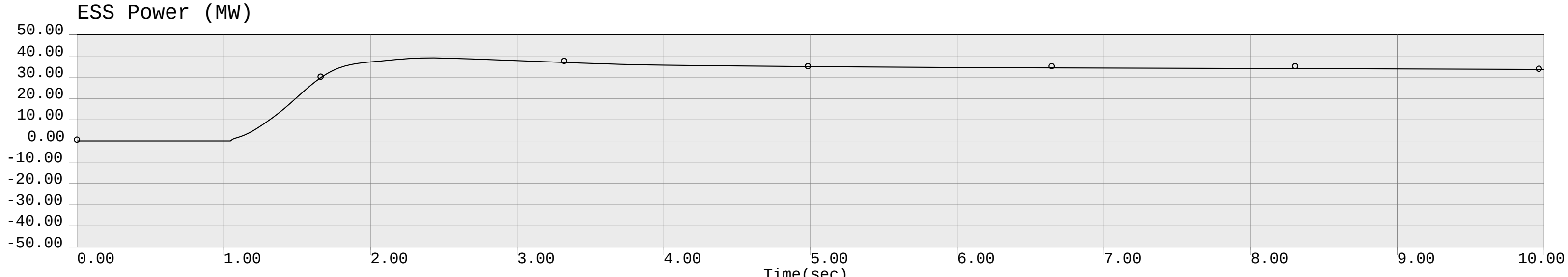
○ 58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
× 58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□ 58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



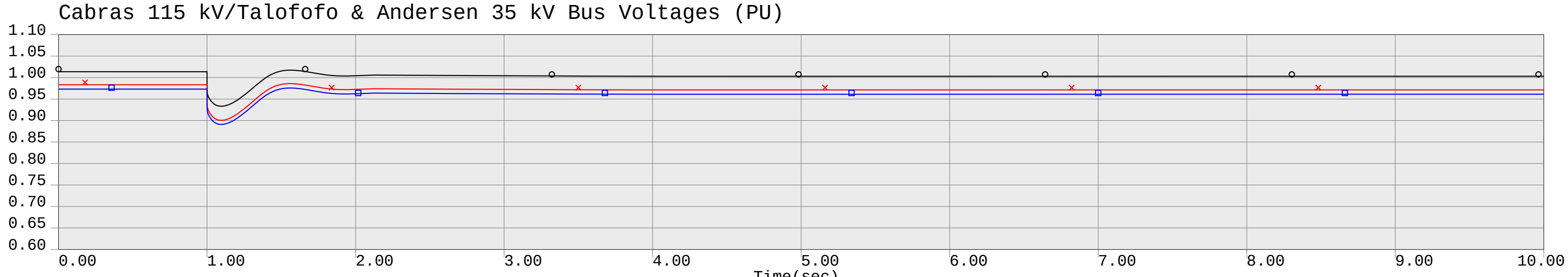
○ 0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
× 0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○ -50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
× 0.6000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□ 0.6000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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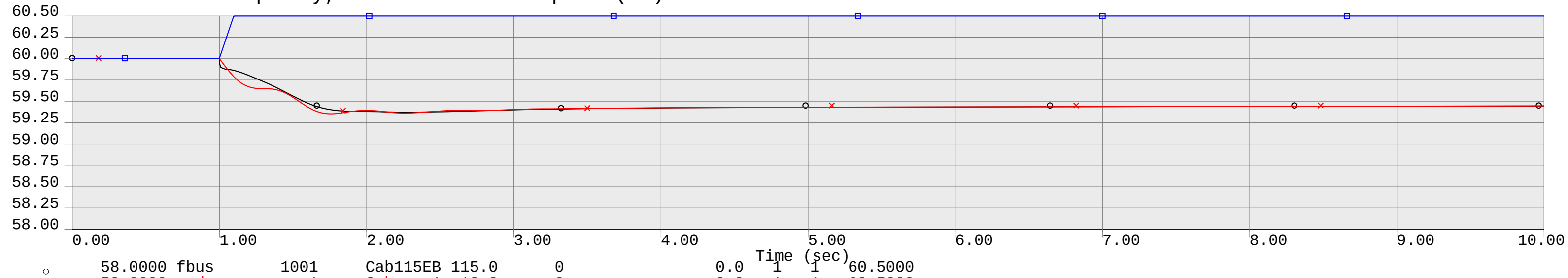
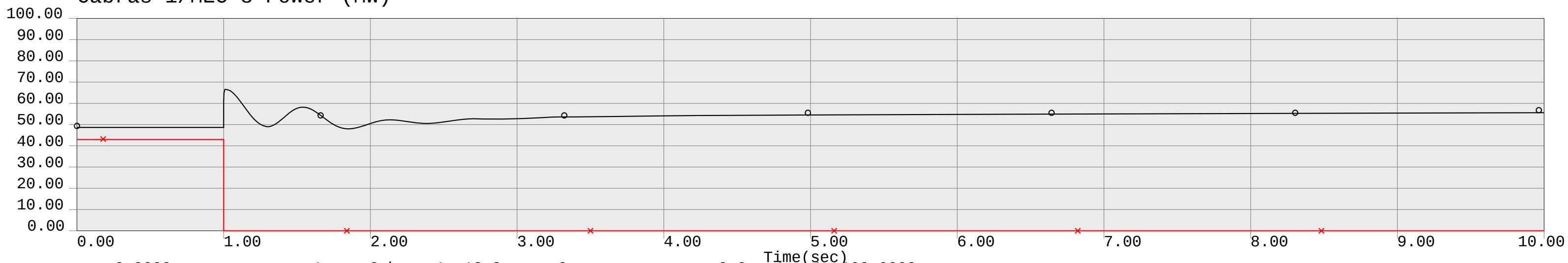
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



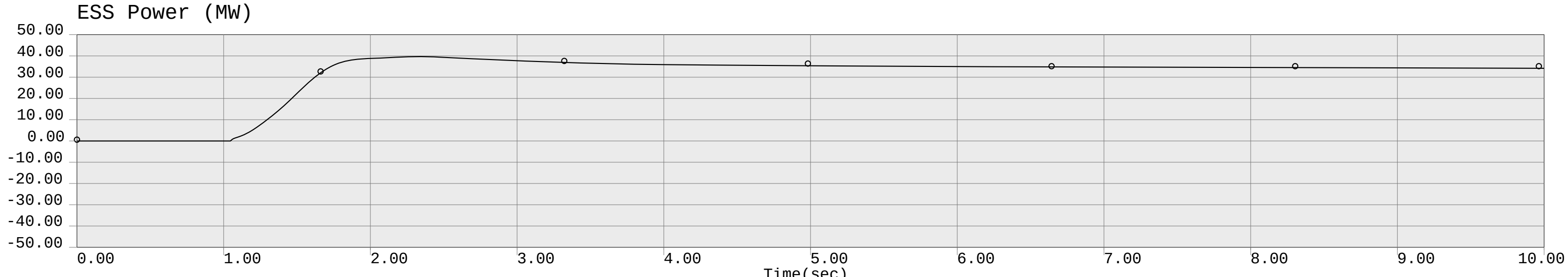
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



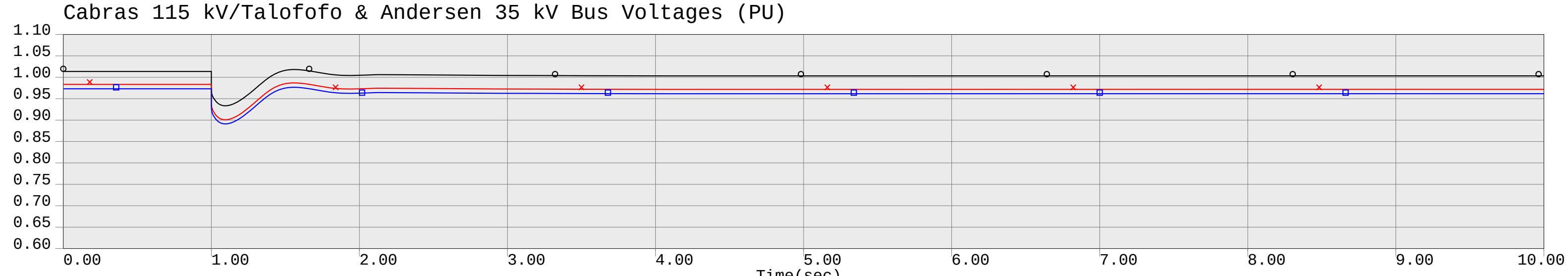
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1600-m8-1g.chf

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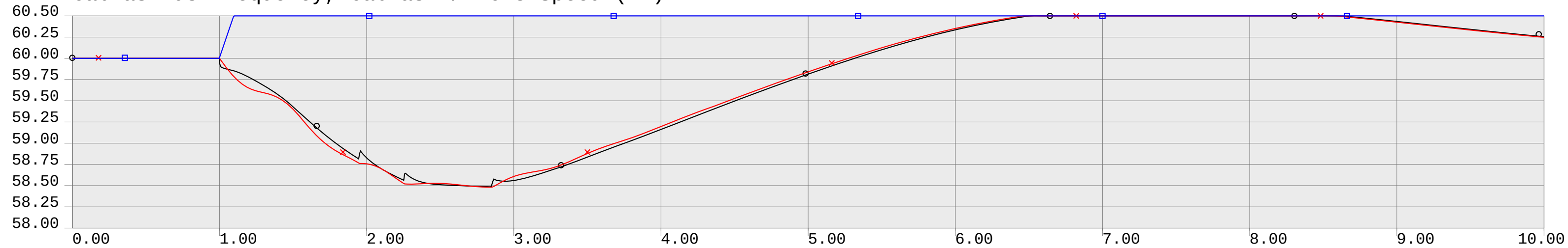
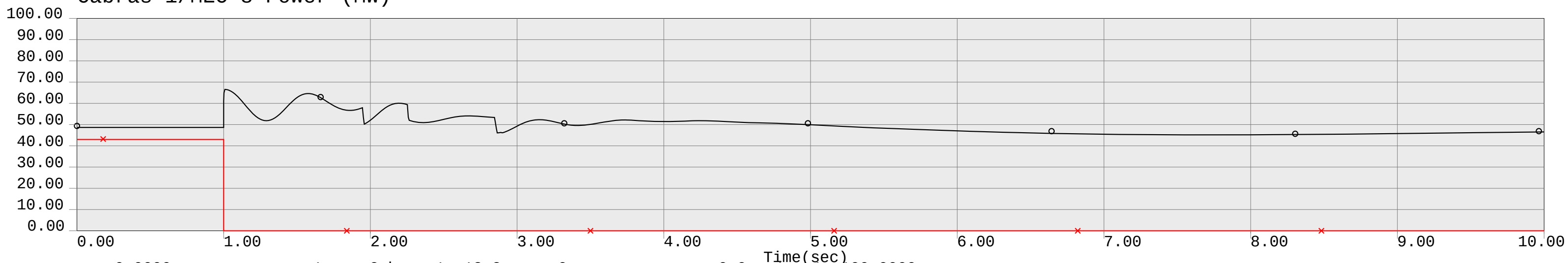
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



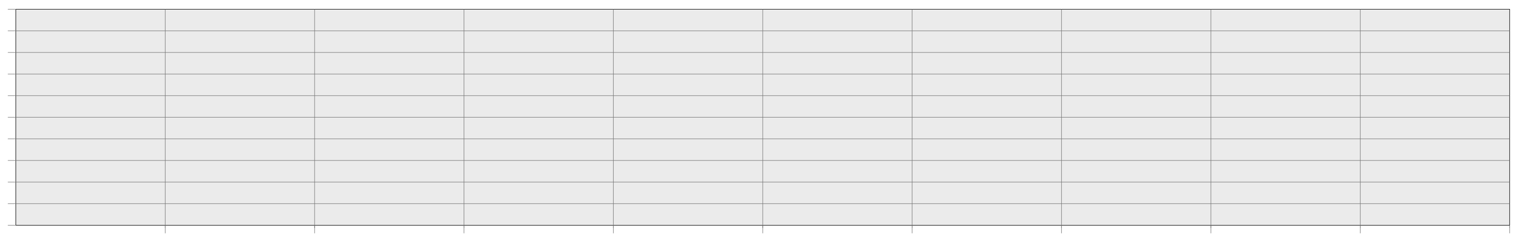

```
○  58.0000 fbus      1001   Cab115EB 115.0   0       0.0  1  1  60.5000
×  58.0000 spd          1   Cabras_1  13.8   0       0.0  1  1  60.5000
□  58.0000 spd         16      MEC 8  13.8   0       0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)

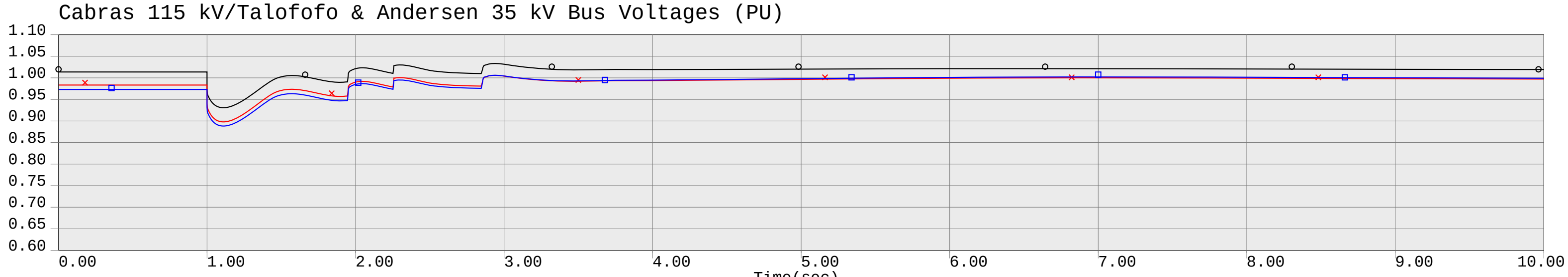



```
○   0.0000 pg           1   Cabras_1  13.8   0       0.0  1  1  100.0000
×   0.0000 pg          16      MEC 8  13.8   0       0.0  1  1  100.0000
```

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○   0.6000 vbus      1001   Cab115EB 115.0   0       0.0  1  1  1.1000
×   0.6000 vbus      2003     Tal345  34.5   0       0.0  1  1  1.1000
□   0.6000 vbus      2210   And345B1  34.5   0       0.0  1  1  1.1000
```


chans/1600-m8-ref.chf

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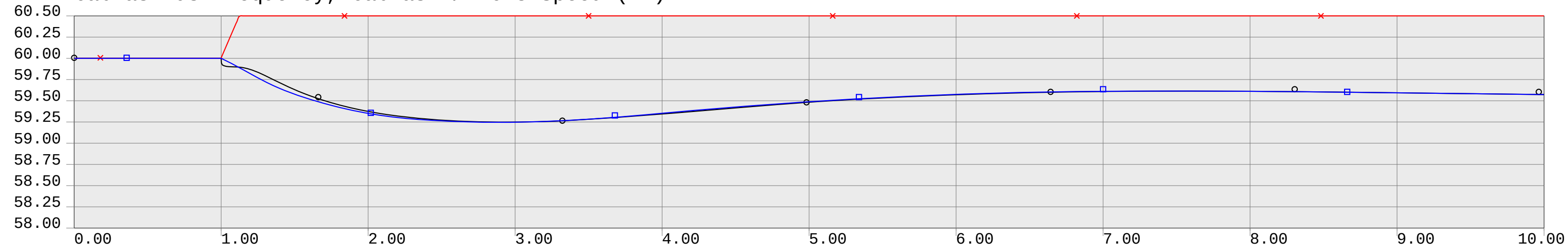
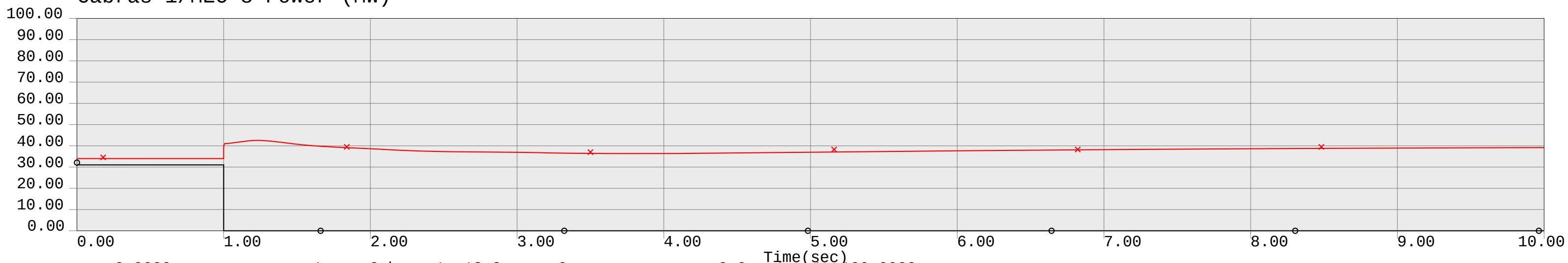
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



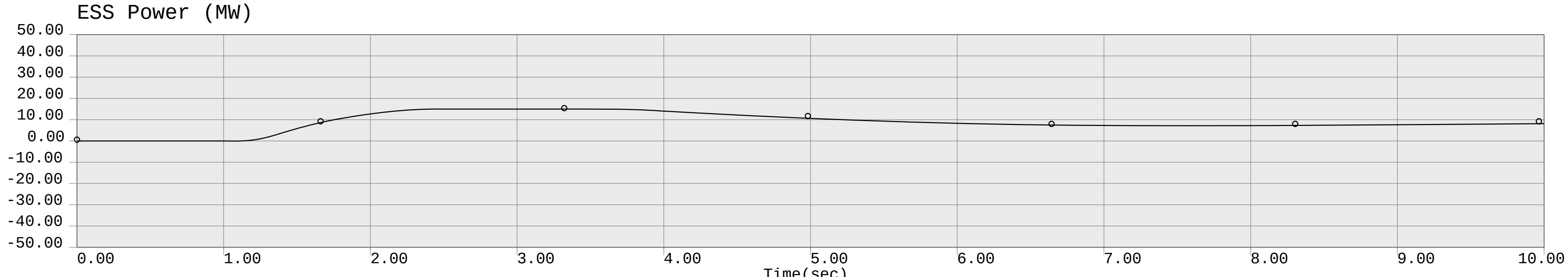
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



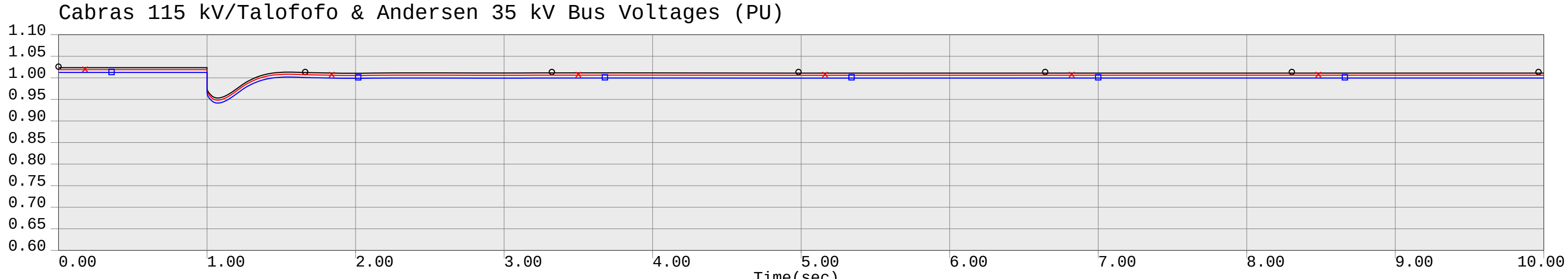
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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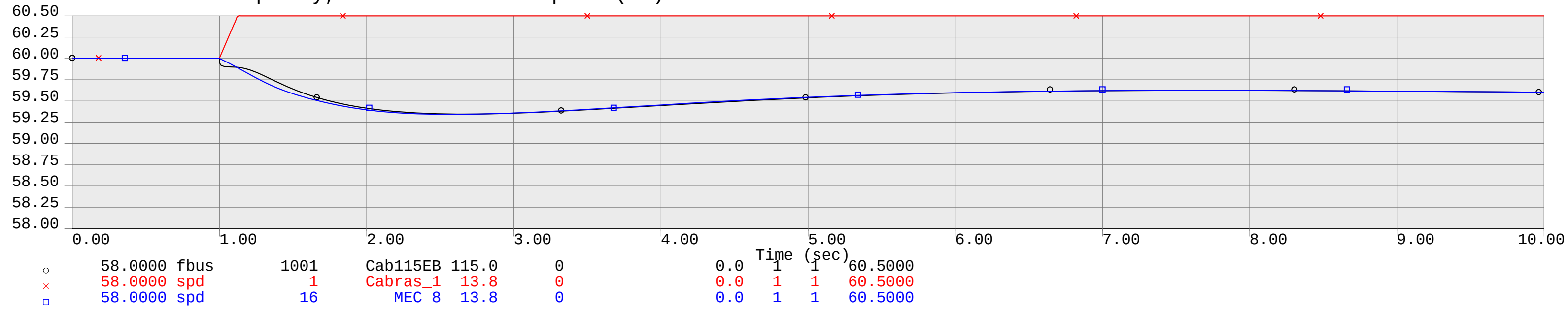
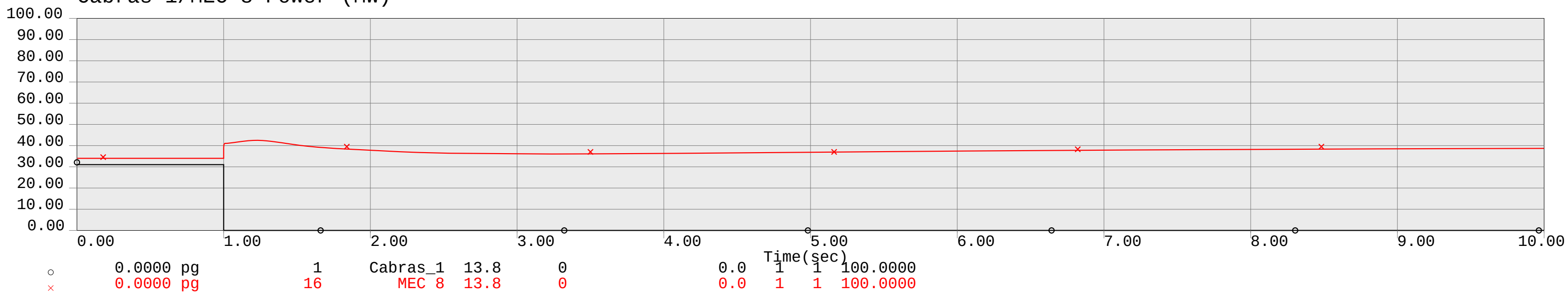
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

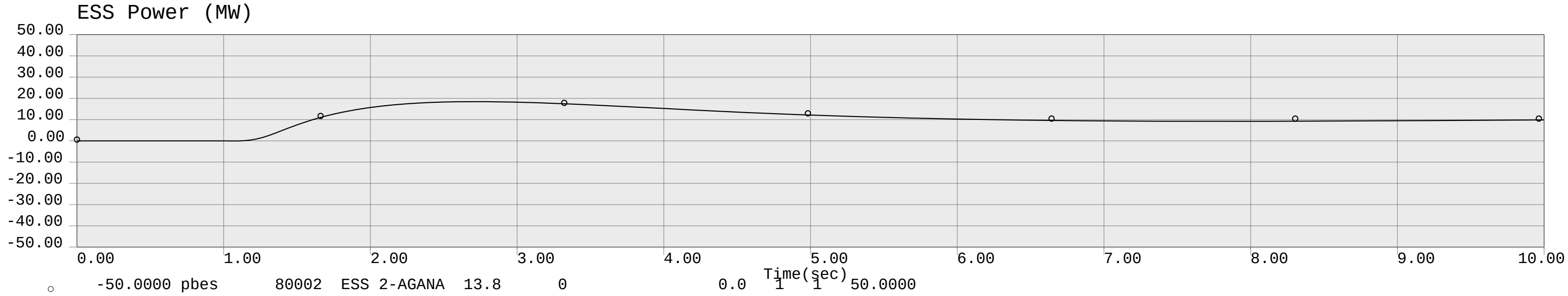
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



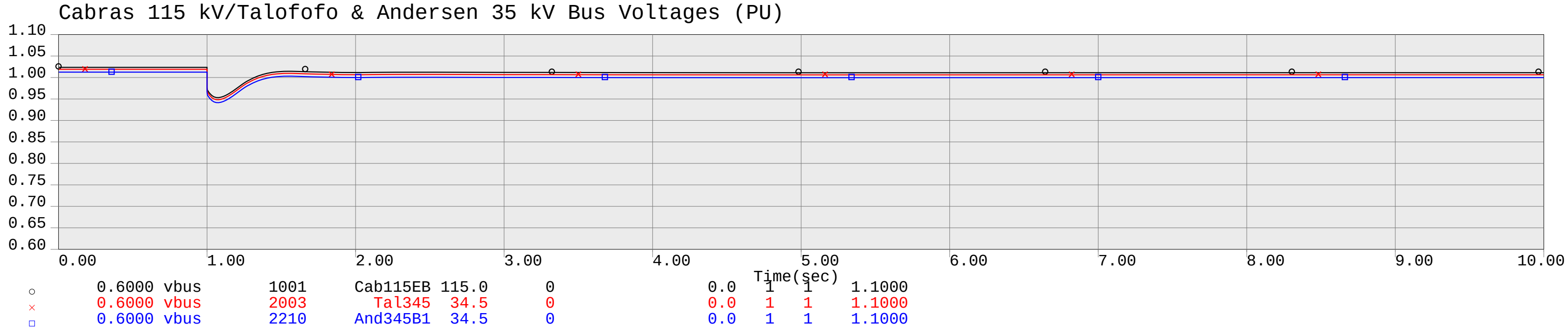
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)

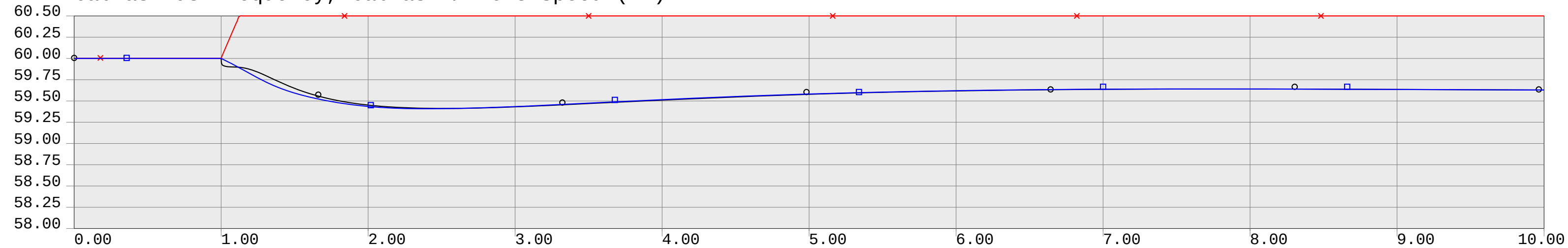


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



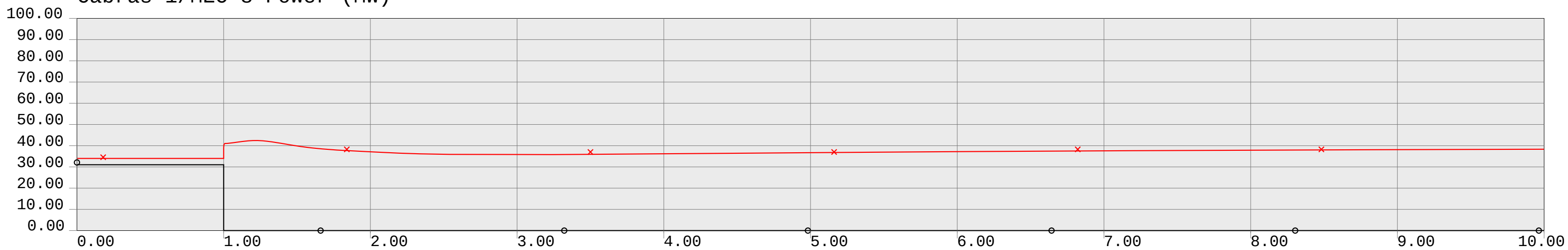
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



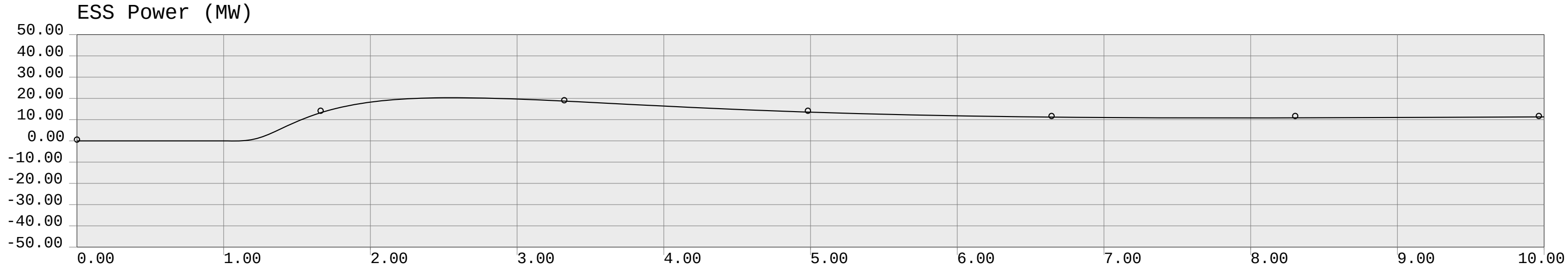
○	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



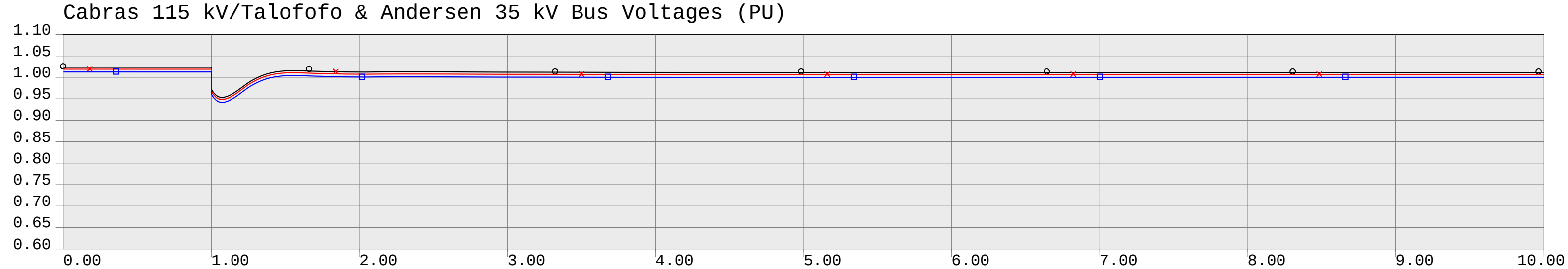
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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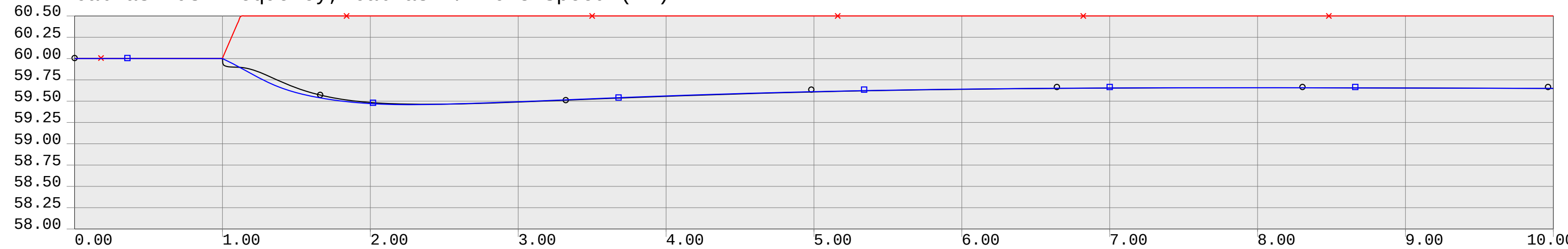
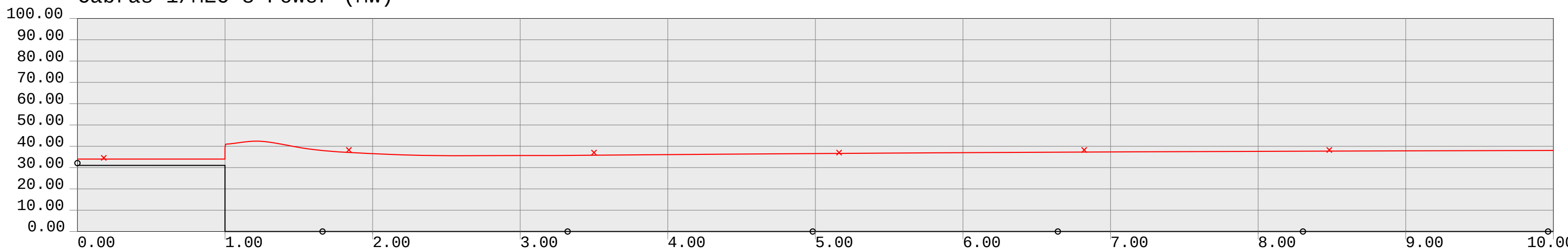
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



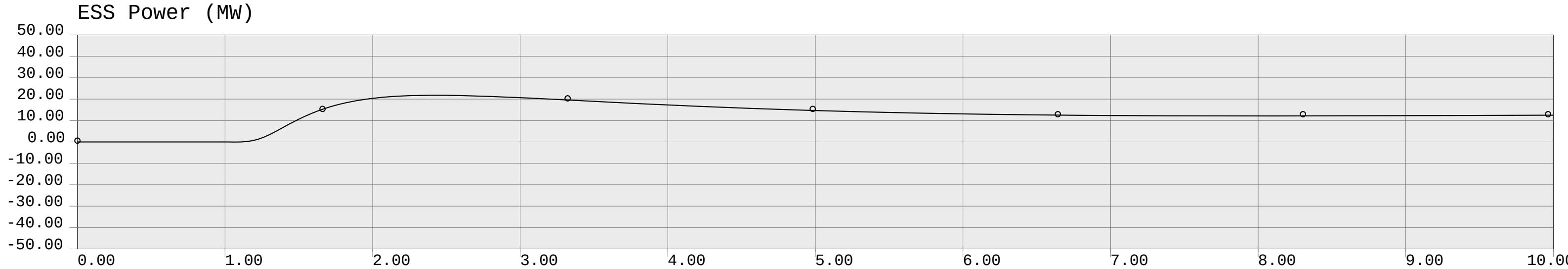

```
○  58.0000 fbus   1001  Cab115EB 115.0  0   0.0  1  1  60.5000
×  58.0000 spd       1  Cabras_1  13.8  0   0.0  1  1  60.5000
□  58.0000 spd      16     MEC 8  13.8  0   0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)



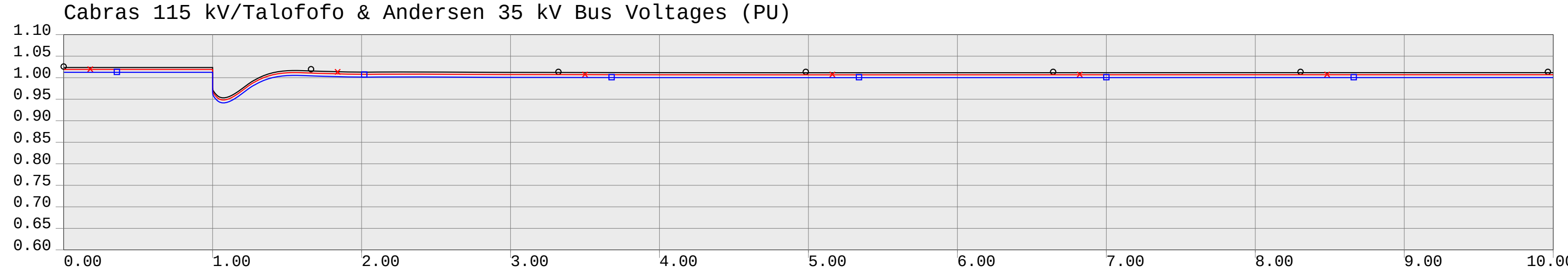

```
○   0.0000 pg        1  Cabras_1  13.8  0   0.0  1  1  100.0000
×   0.0000 pg       16     MEC 8  13.8  0   0.0  1  1  100.0000
```

ESS Power (MW)




```
○  -50.0000 pbes   80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
```

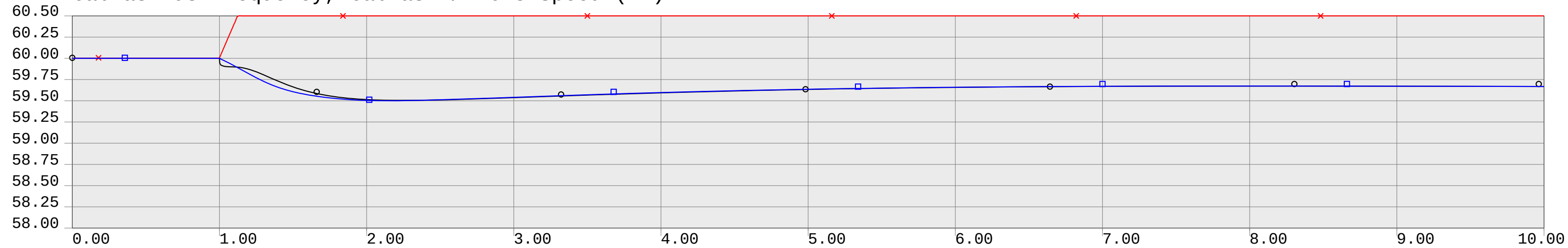
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○   0.6000 vbus   1001  Cab115EB 115.0  0   0.0  1  1  1.1000
×   0.6000 vbus   2003    Tal345  34.5  0   0.0  1  1  1.1000
□   0.6000 vbus   2210  And345B1  34.5  0   0.0  1  1  1.1000
```

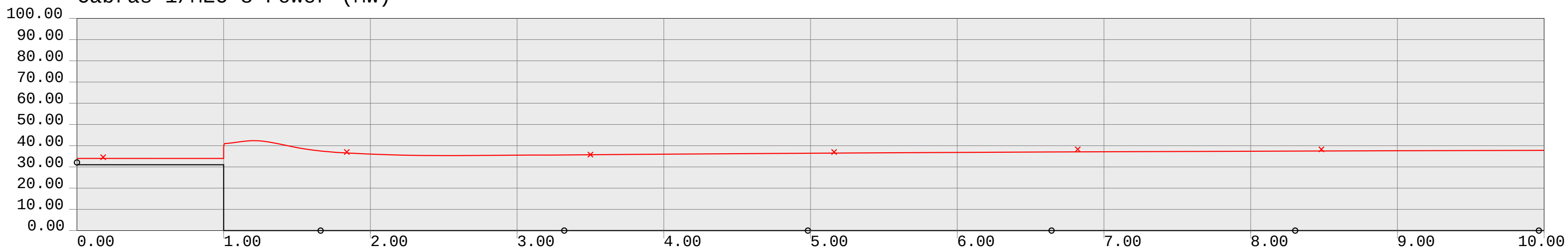
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



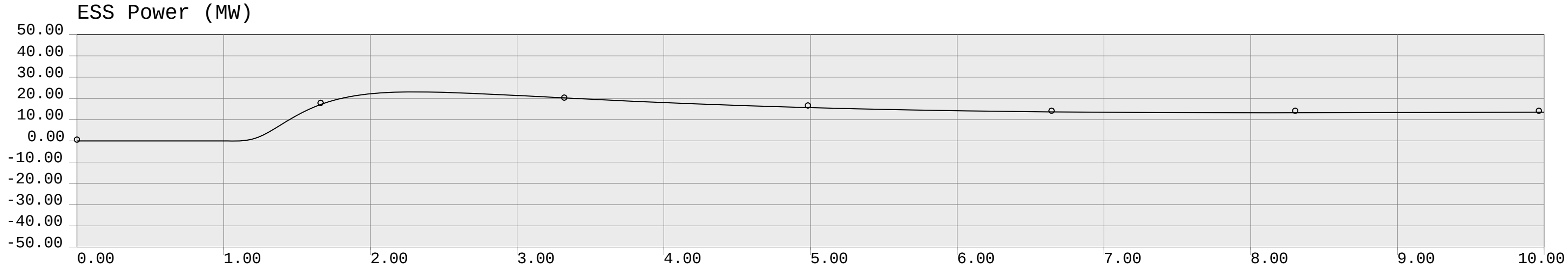
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



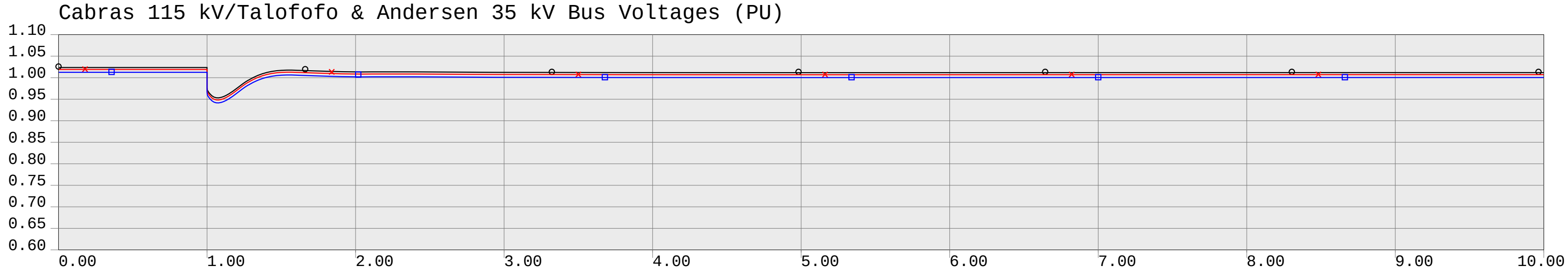
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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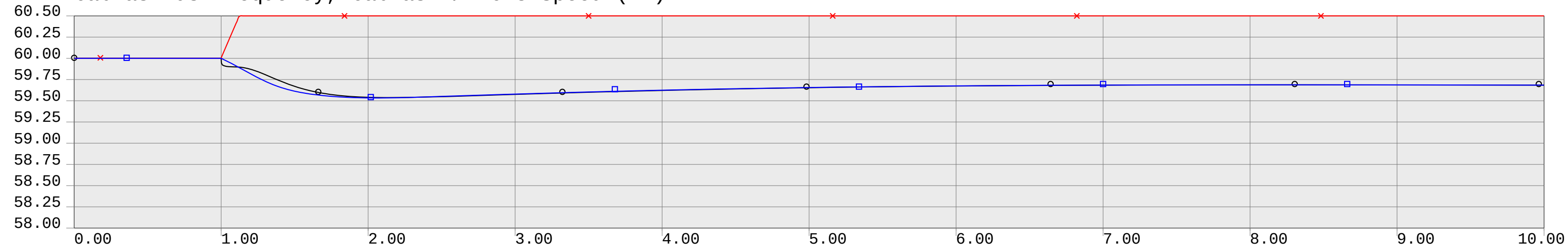
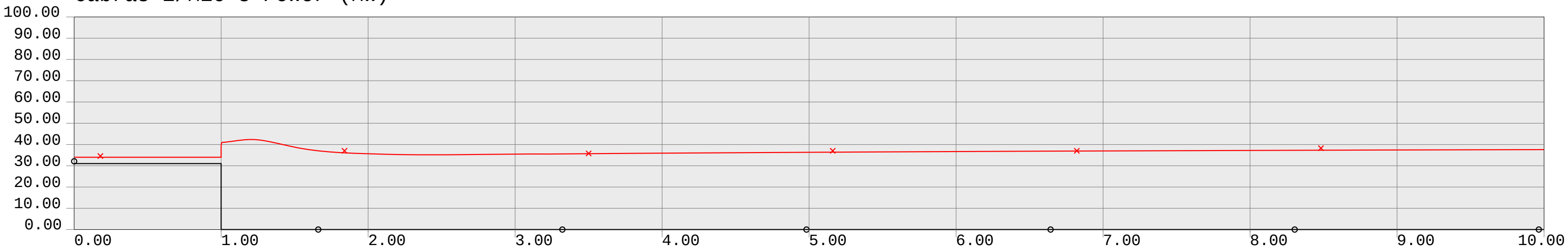
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



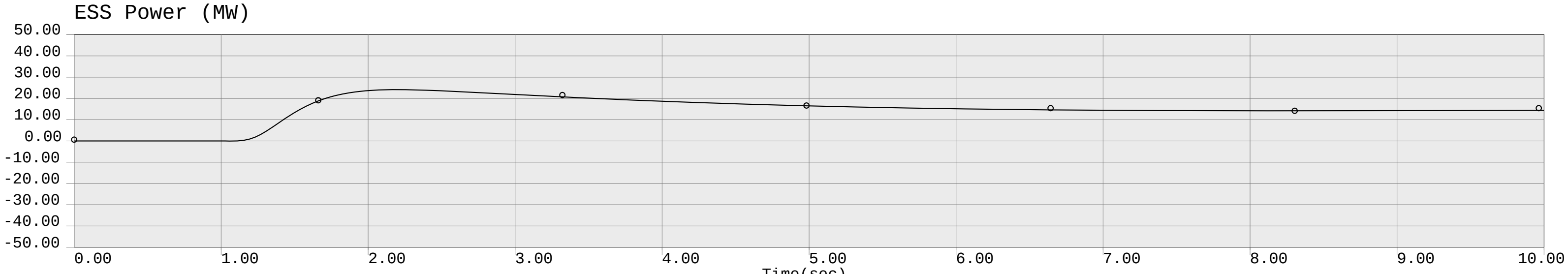
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



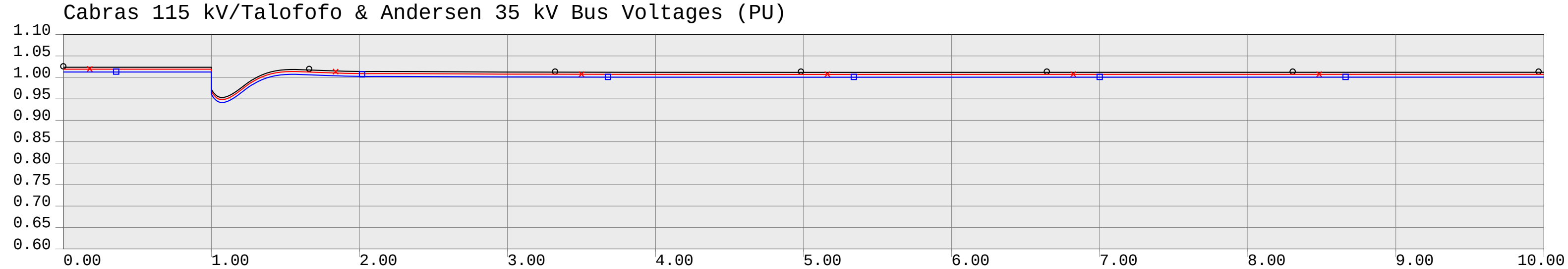
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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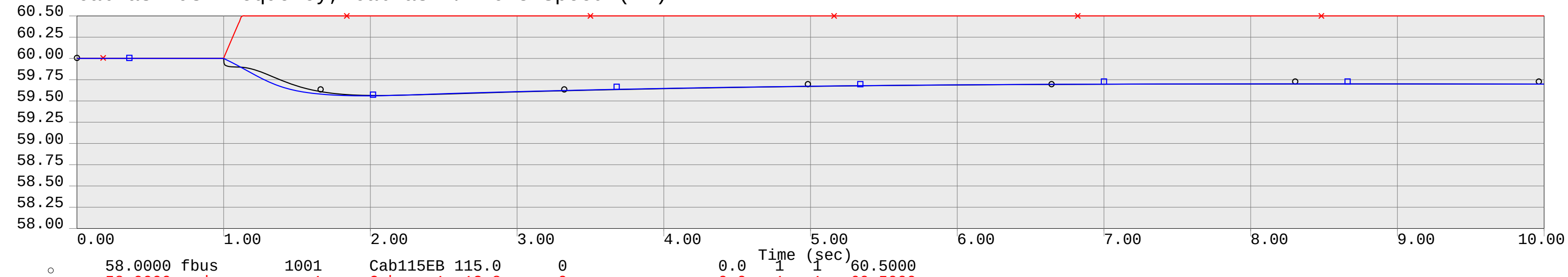
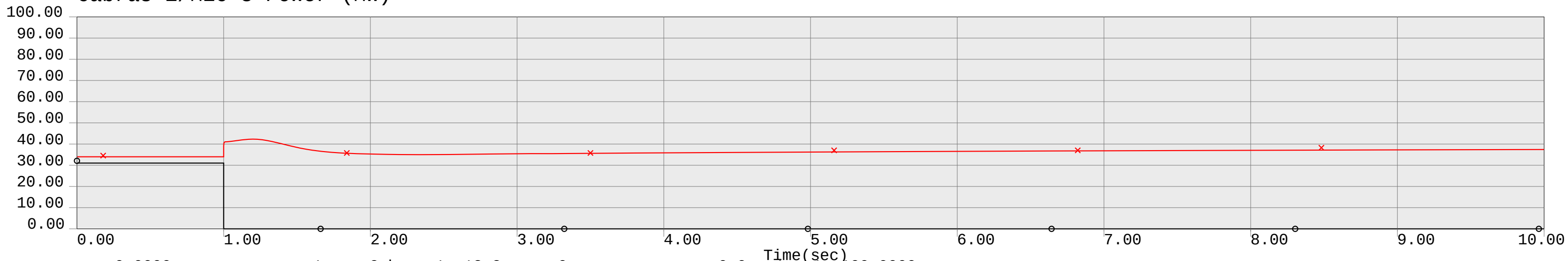
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



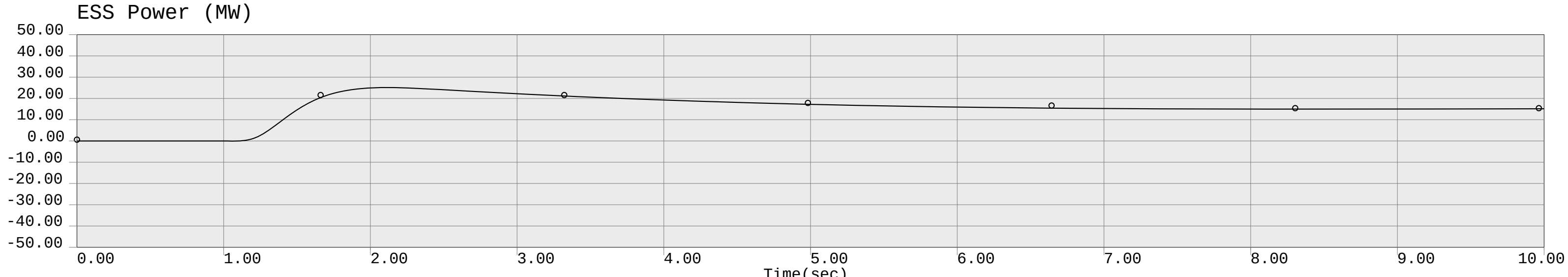
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



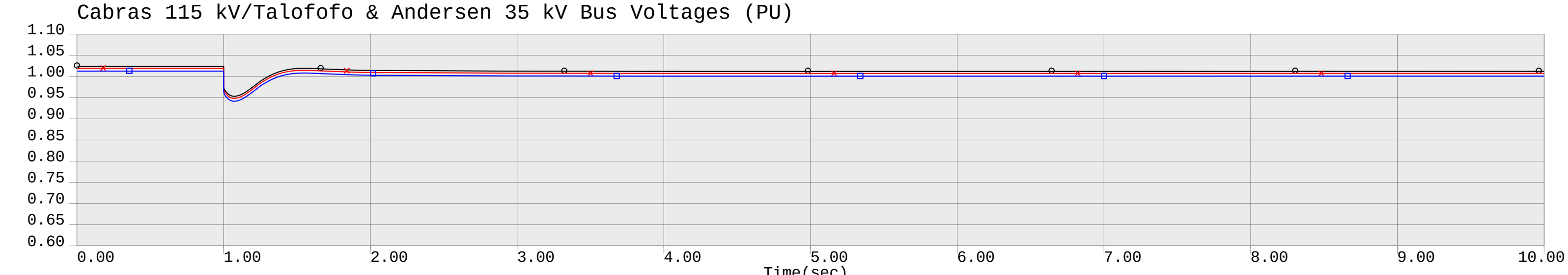
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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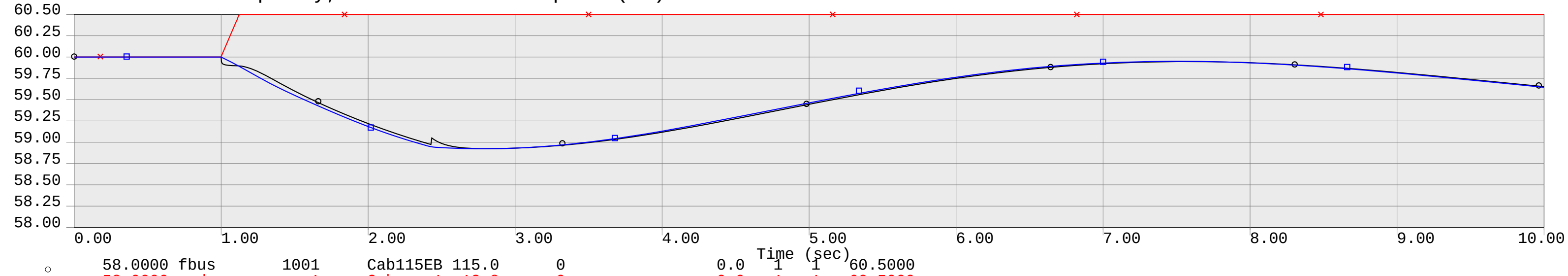
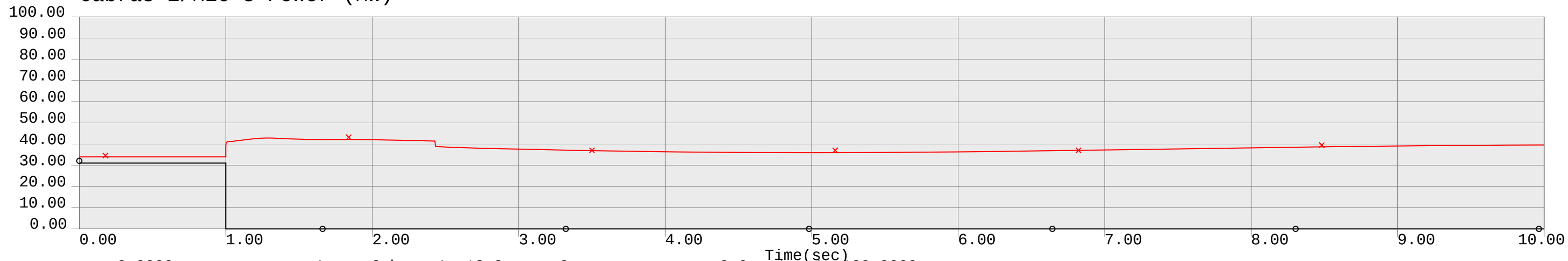
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



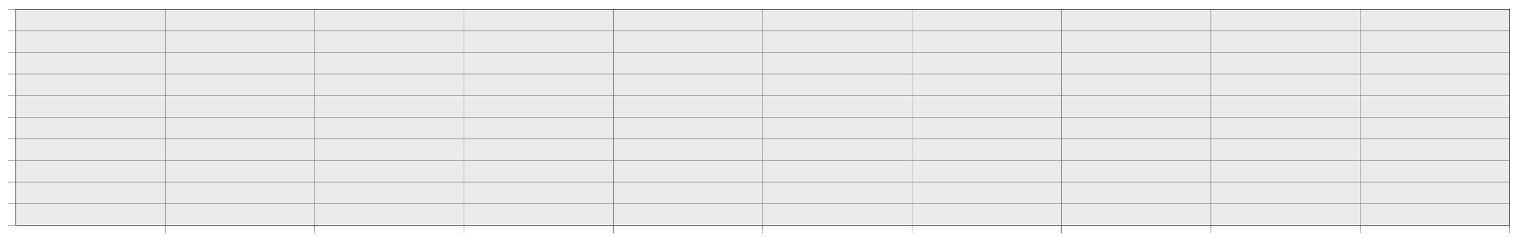
○ 58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
× 58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□ 58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)

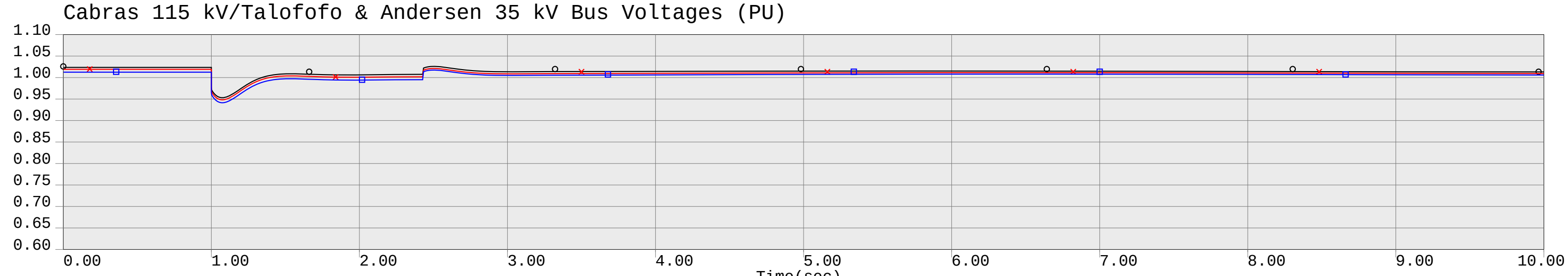


○ 0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
× 0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
× 0.6000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□ 0.6000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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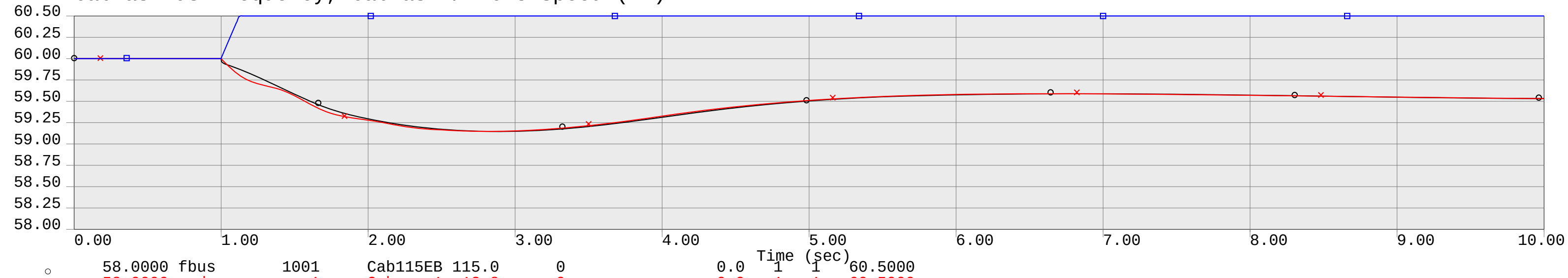
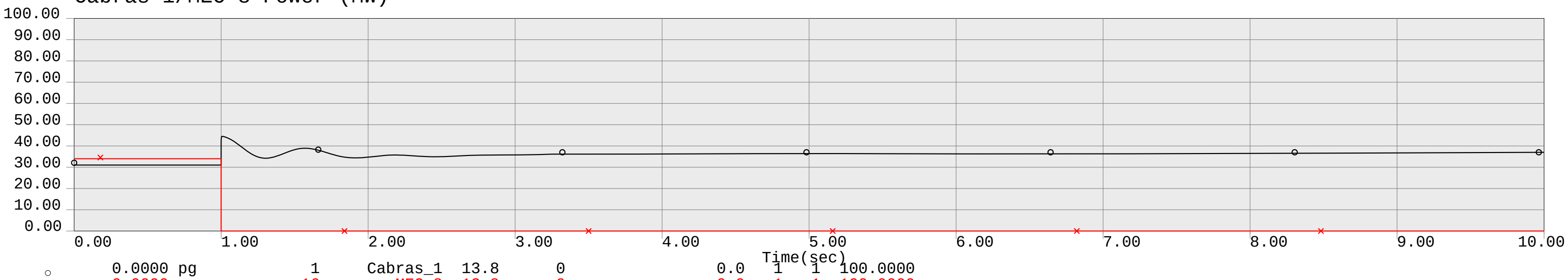
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



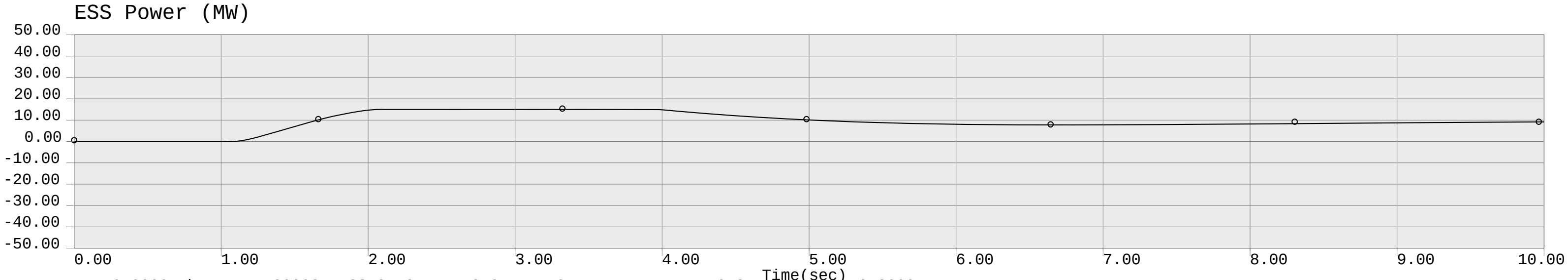
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



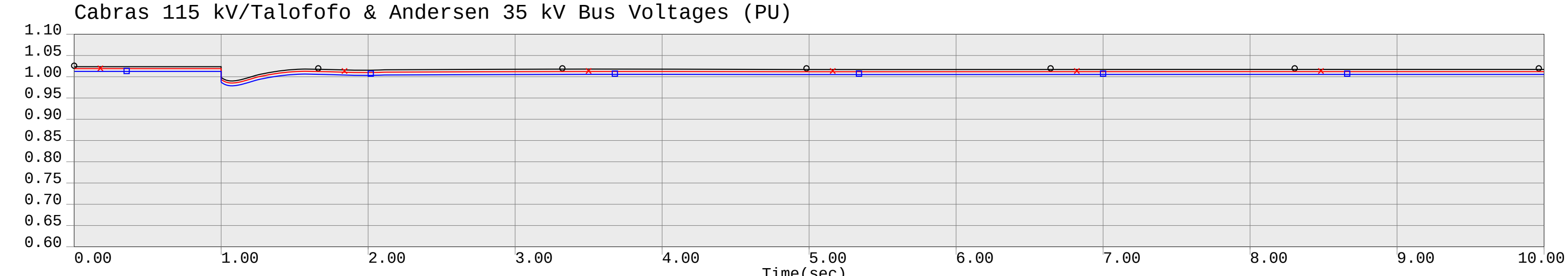
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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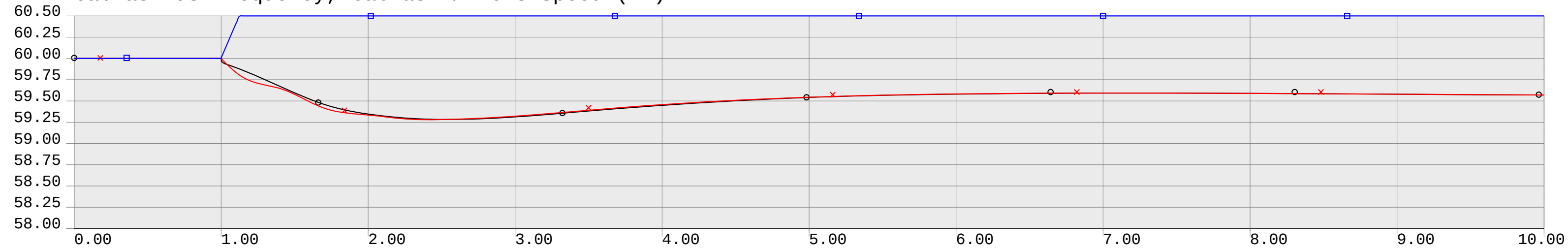
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



Time (sec)

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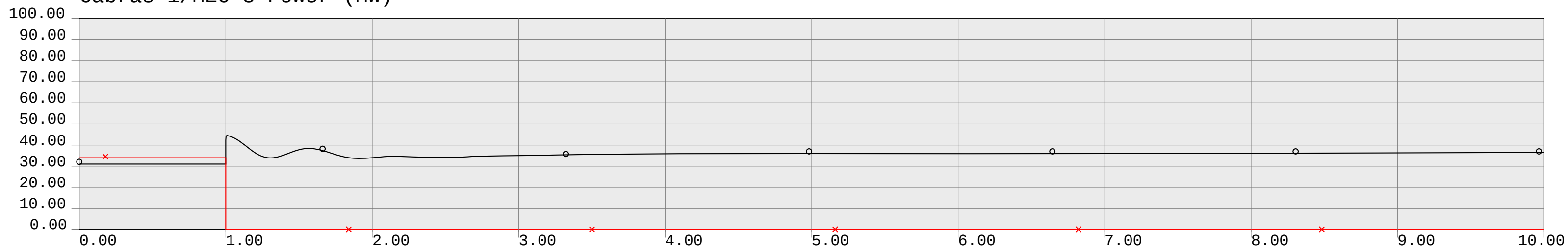
o  58.0000 fbus     1001   Cab115EB 115.0   0     0.0  1  1  60.5000
x  58.0000 spd         1   Cabras_1  13.8   0     0.0  1  1  60.5000
□  58.0000 spd        16      MEC 8  13.8   0     0.0  1  1  60.5000
```

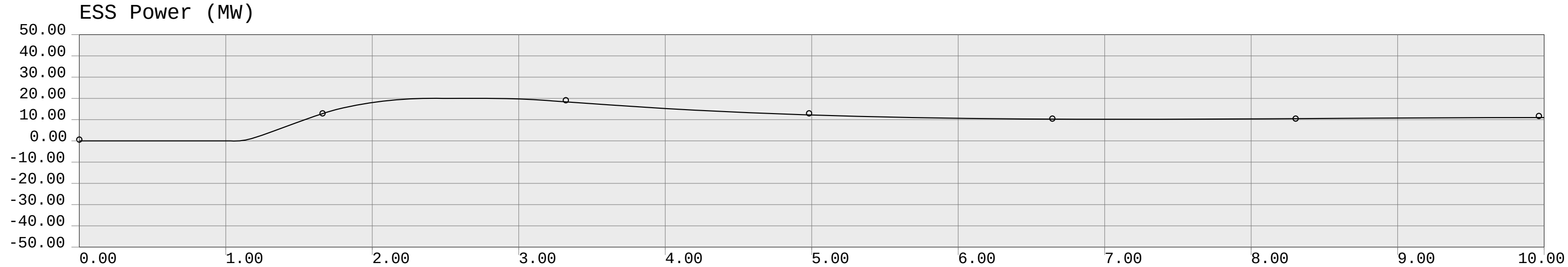
Cabras 1/MEC 8 Power (MW)



Time(sec)

```
o   0.0000 pg          1   Cabras_1  13.8   0     0.0  1  1  100.0000
x   0.0000 pg         16      MEC 8  13.8   0     0.0  1  1  100.0000
```

ESS Power (MW)



Time(sec)

```
o  -50.0000 pbes   80002  ESS 2-AGANA  13.8   0     0.0  1  1  50.0000
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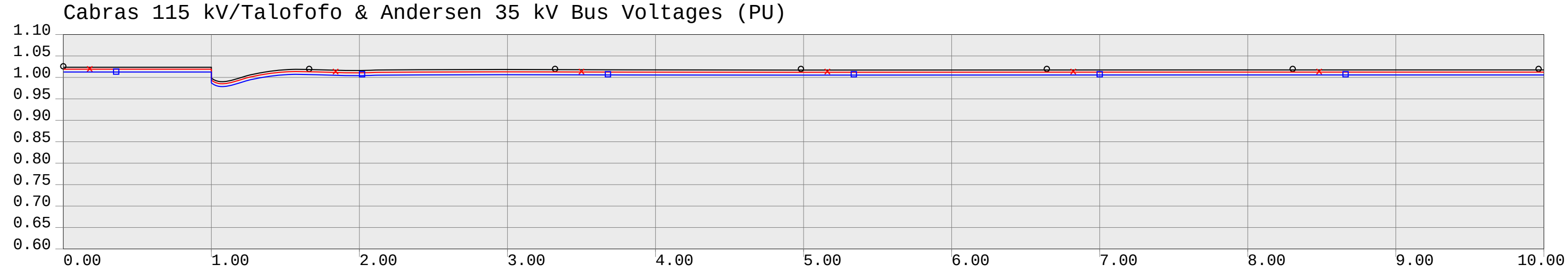
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

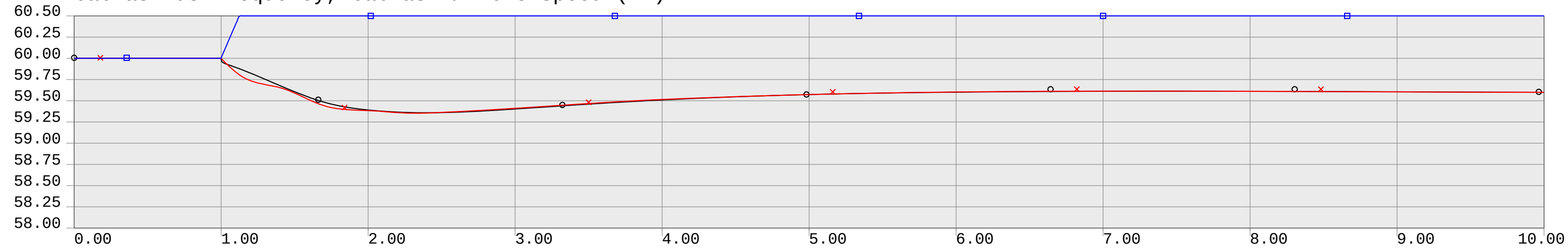


Time(sec)

```
o   0.6000 vbus     1001   Cab115EB 115.0   0     0.0  1  1  1.1000
x   0.6000 vbus     2003     Tal345  34.5   0     0.0  1  1  1.1000
□   0.6000 vbus     2210   And345B1  34.5   0     0.0  1  1  1.1000
```

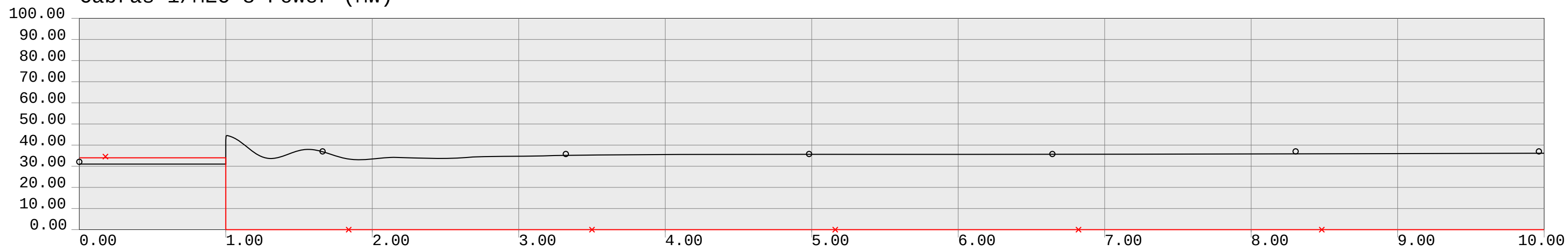
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



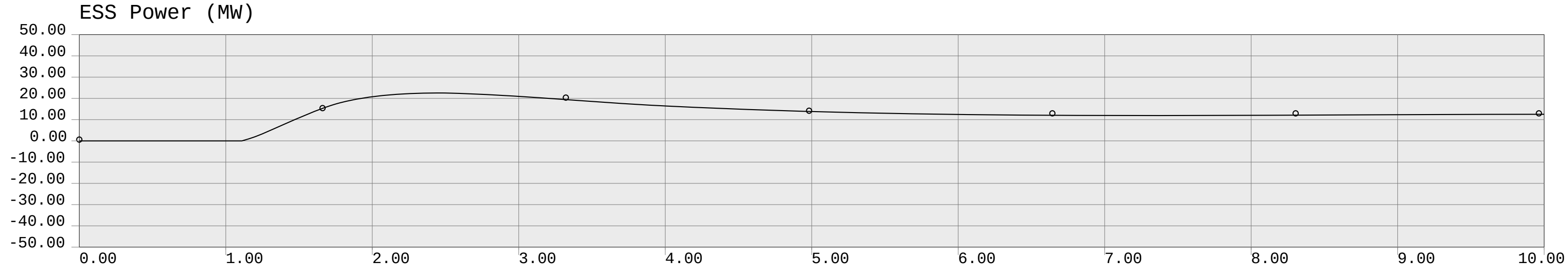
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



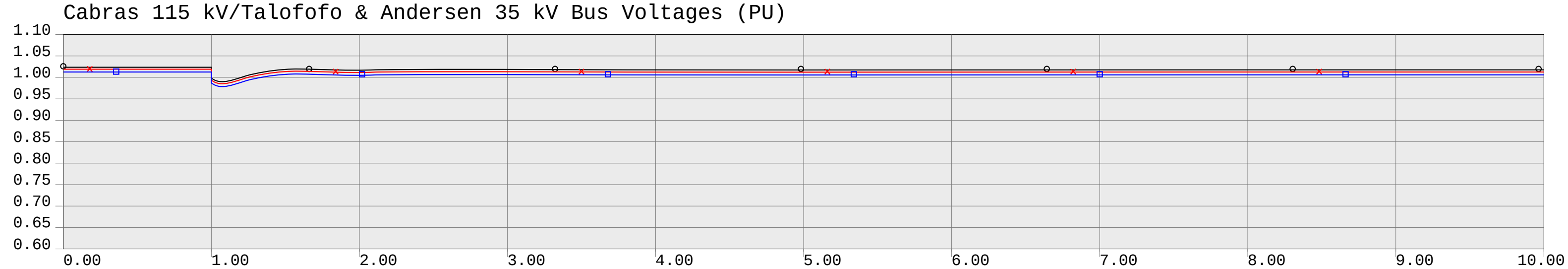
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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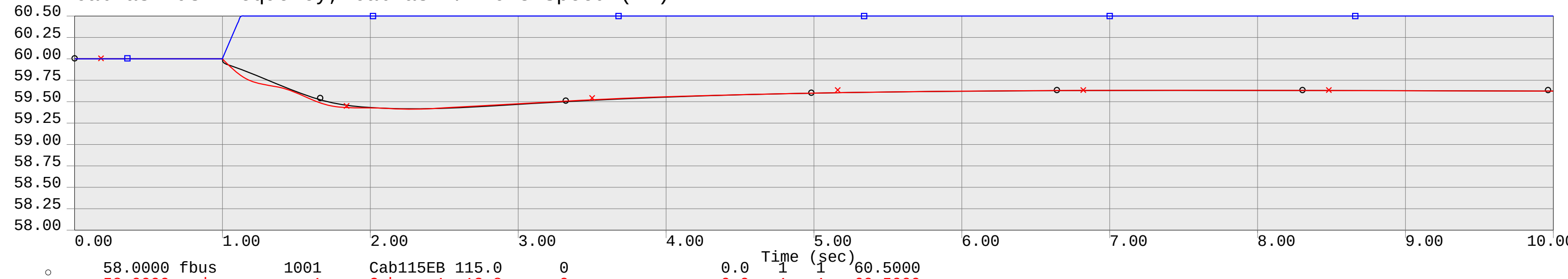
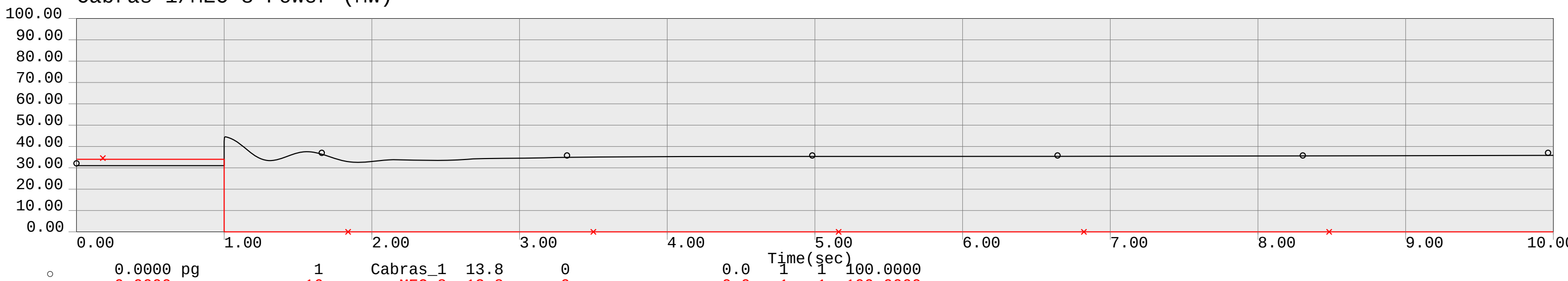
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



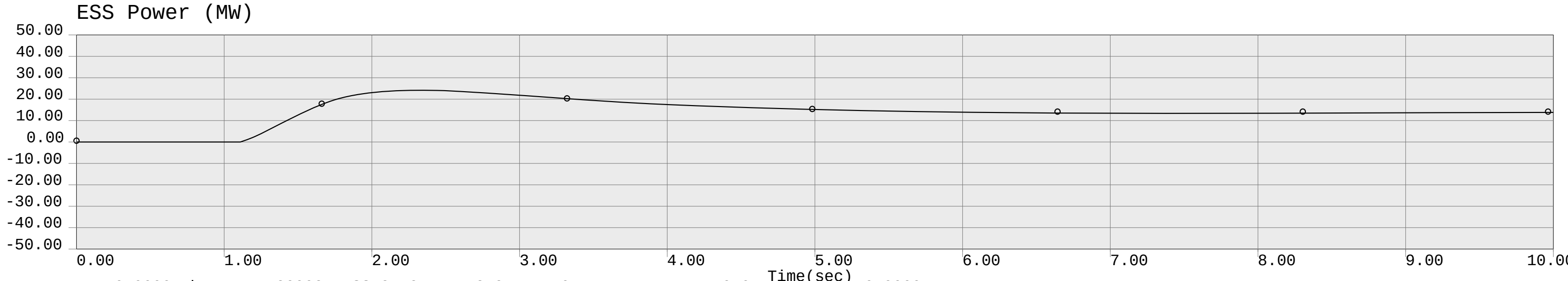
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



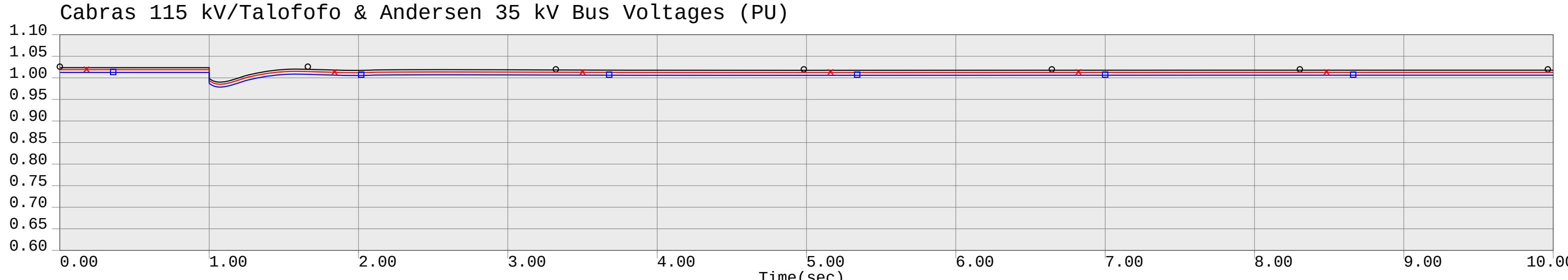
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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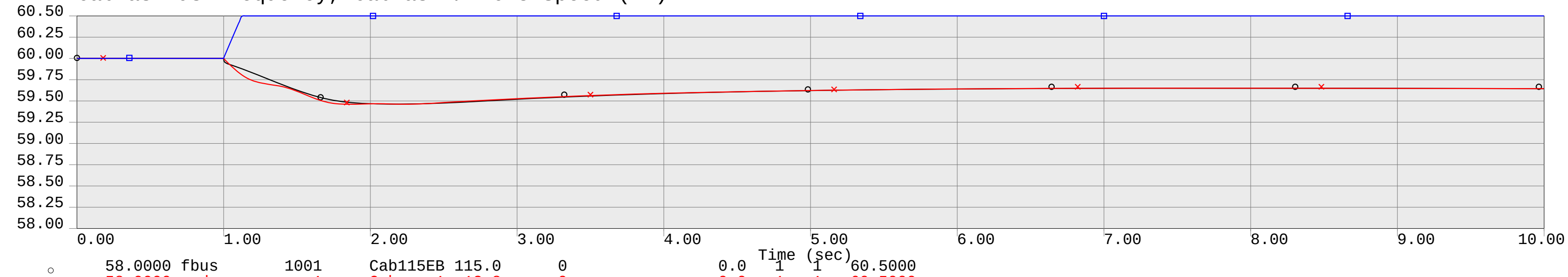
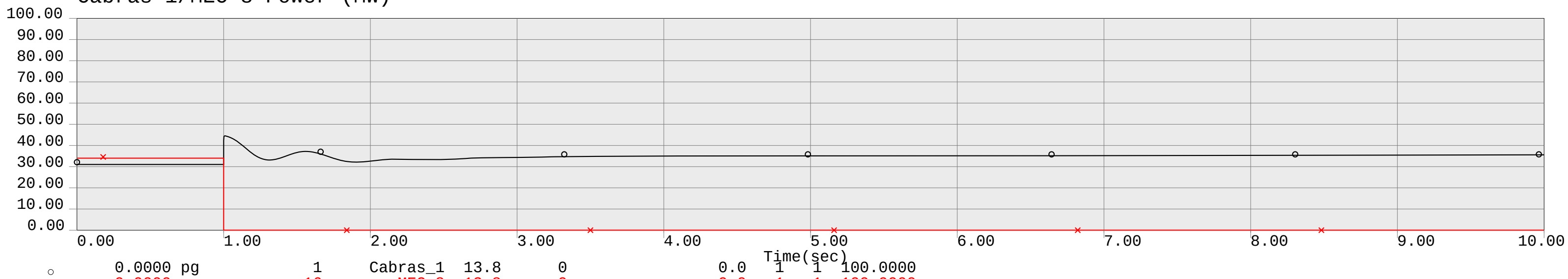
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



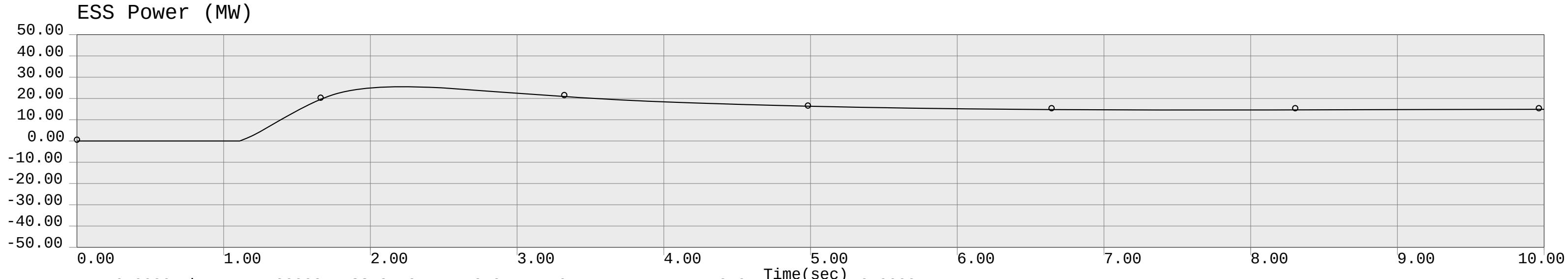
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



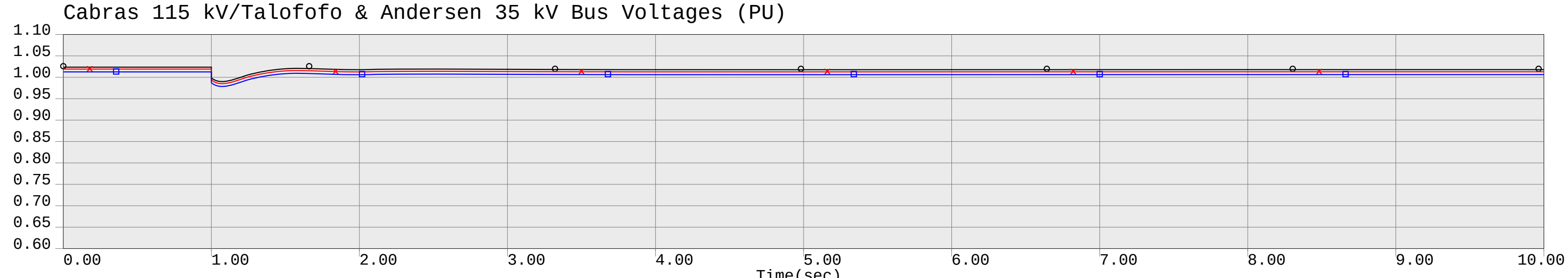
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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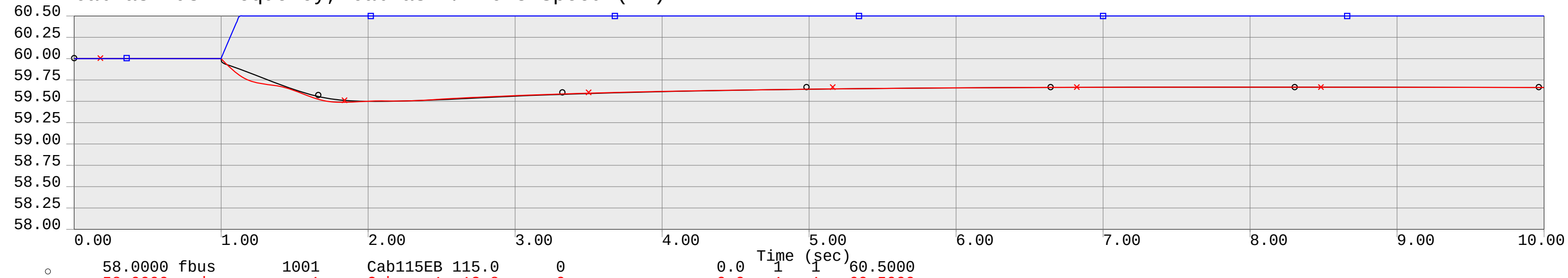
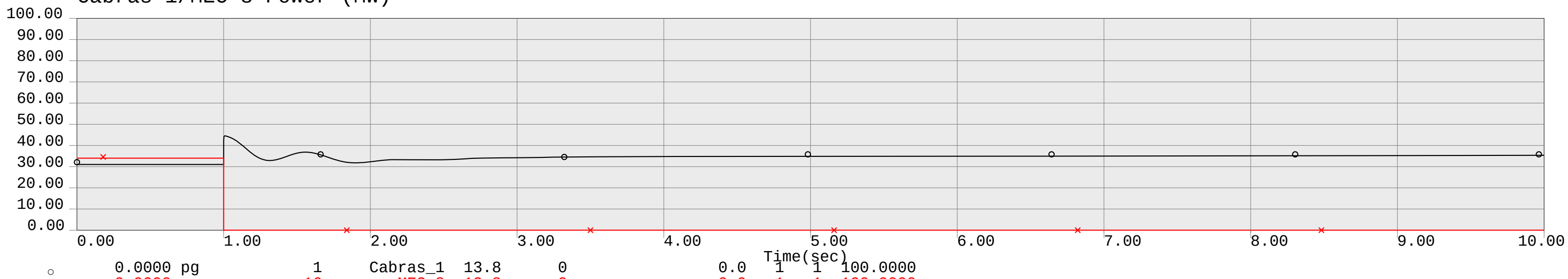
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



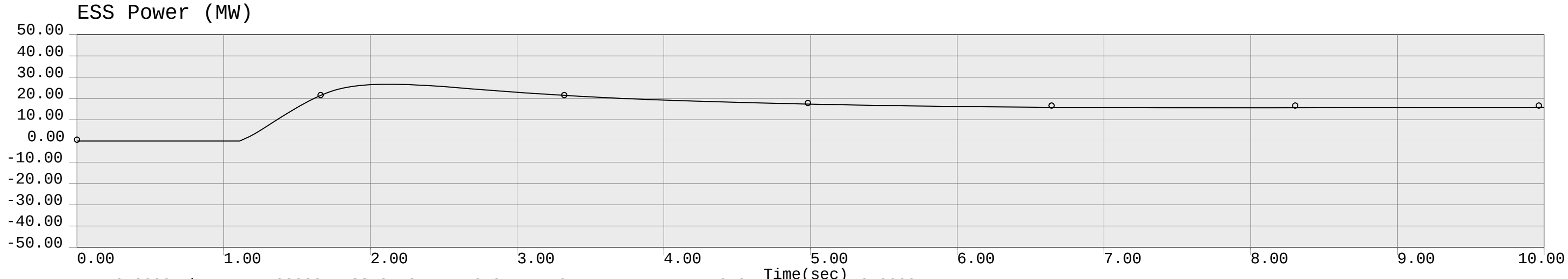
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



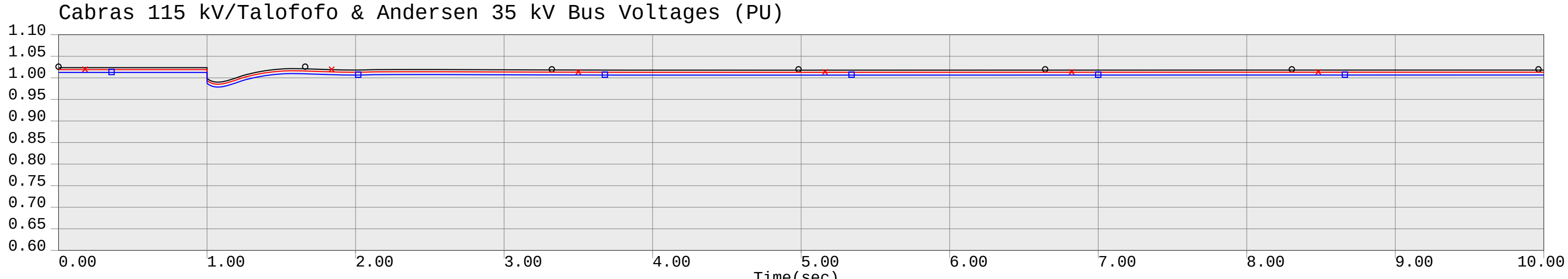
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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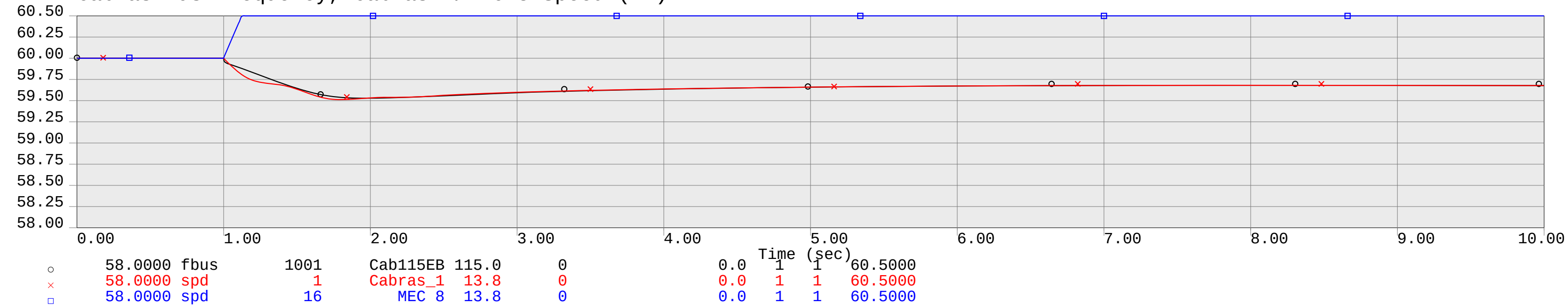
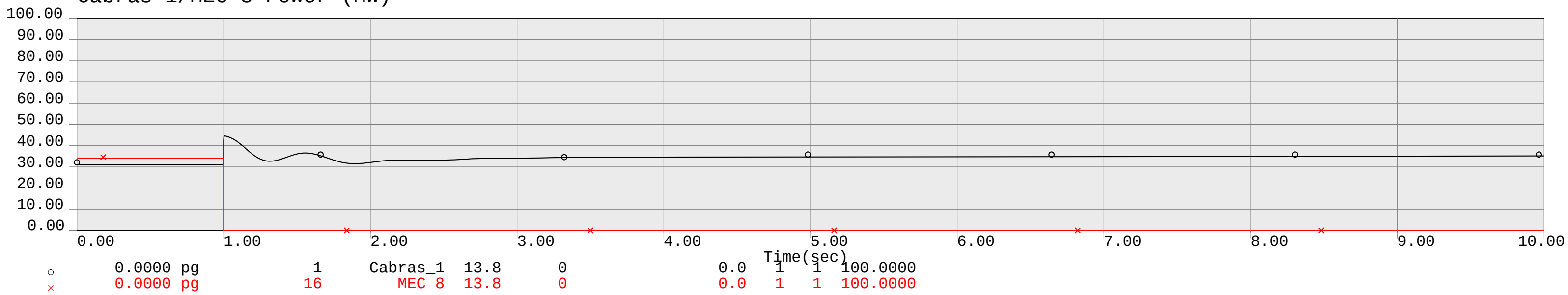
Agana 115 kV ESS

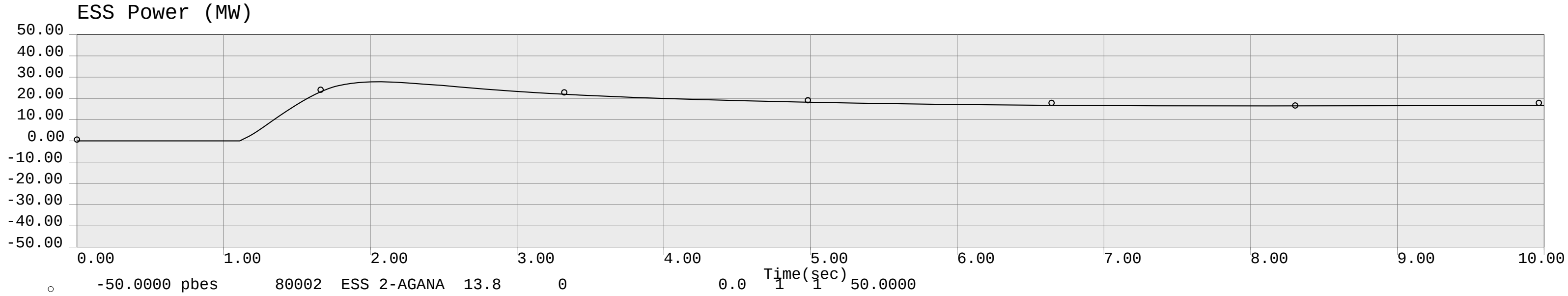
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



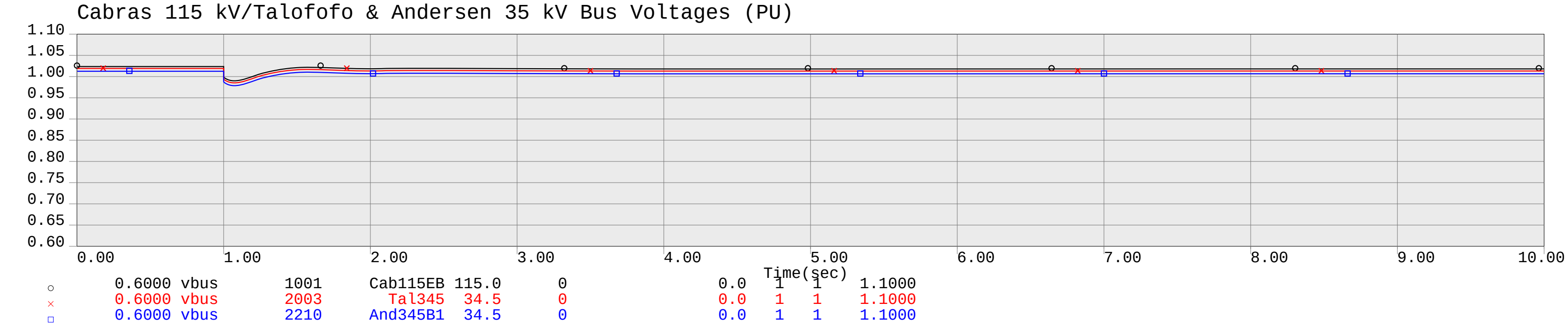
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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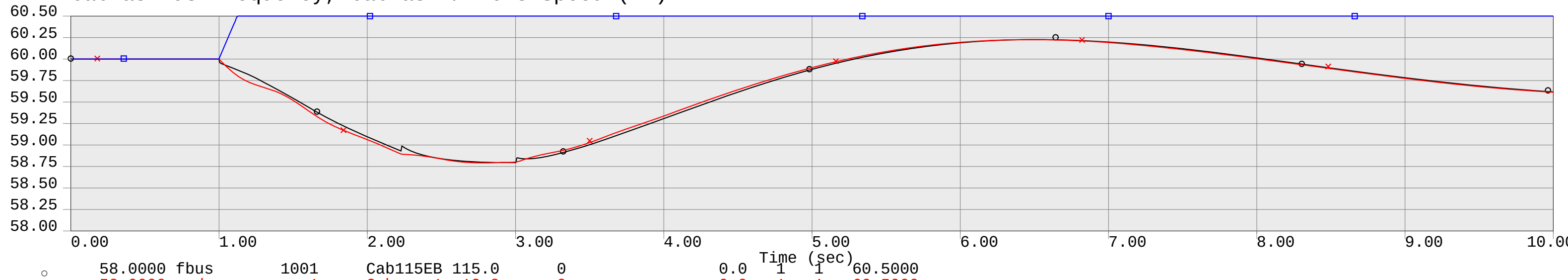
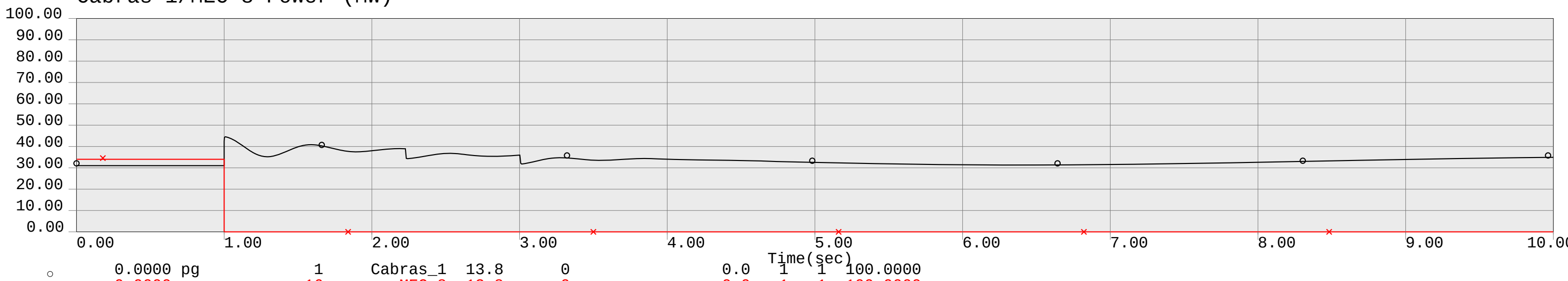
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



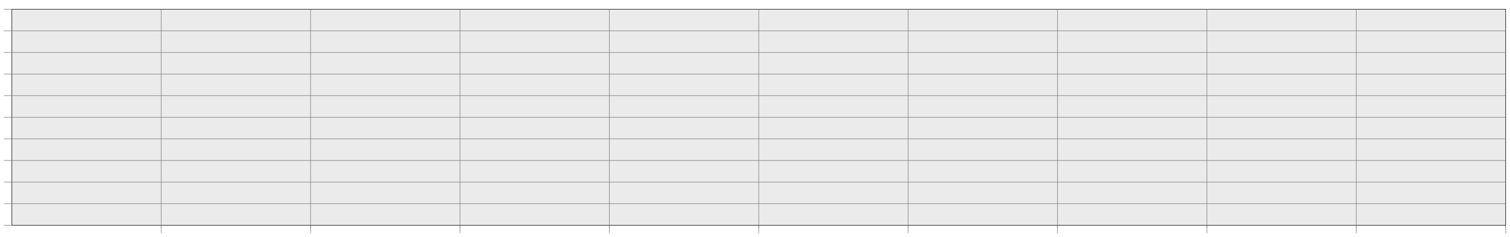
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)

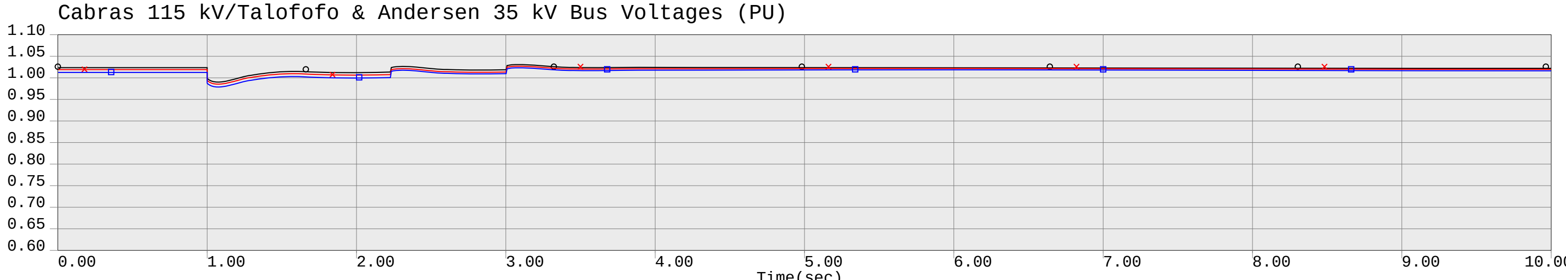


0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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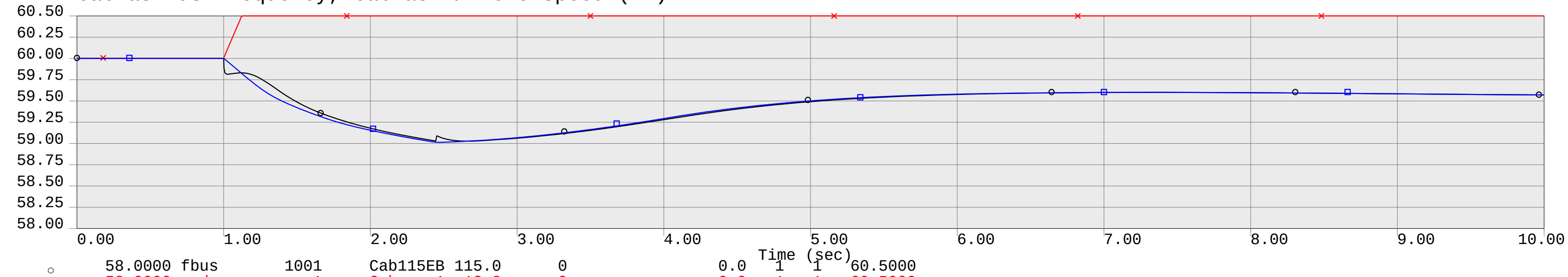
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
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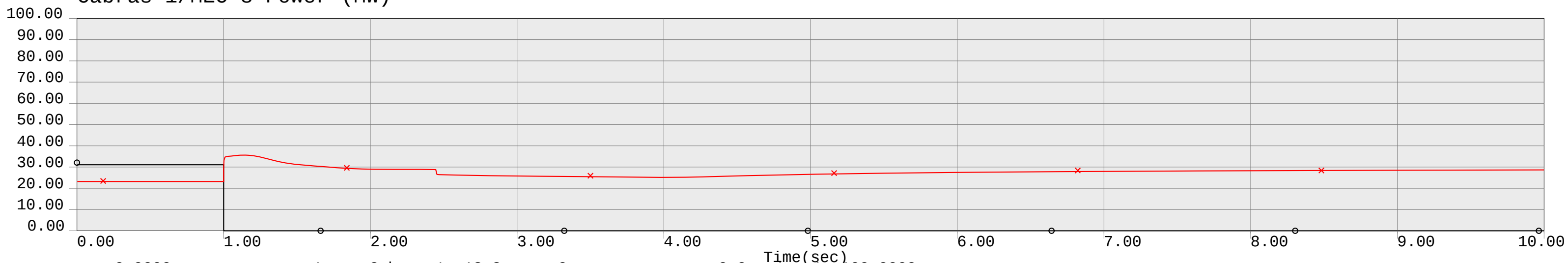
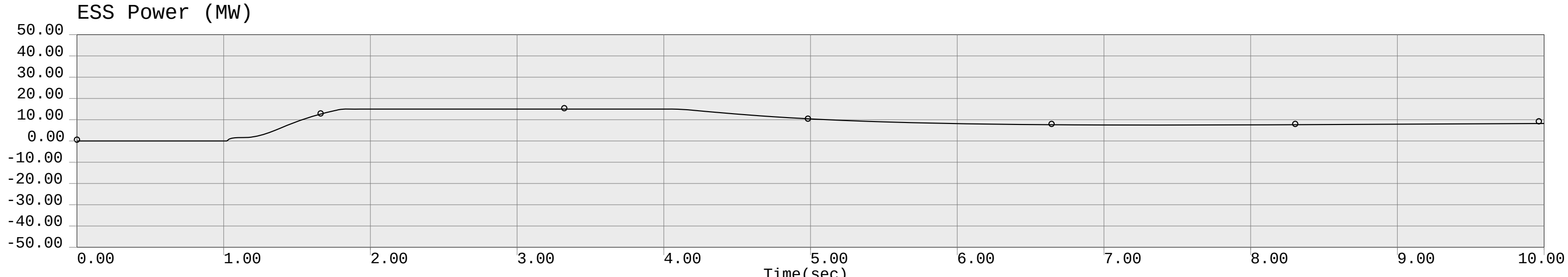
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



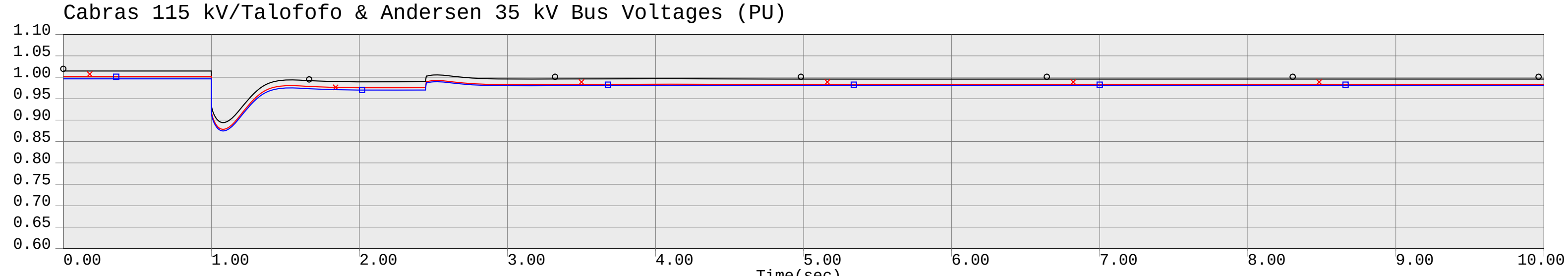
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2200-c1-1a.chf

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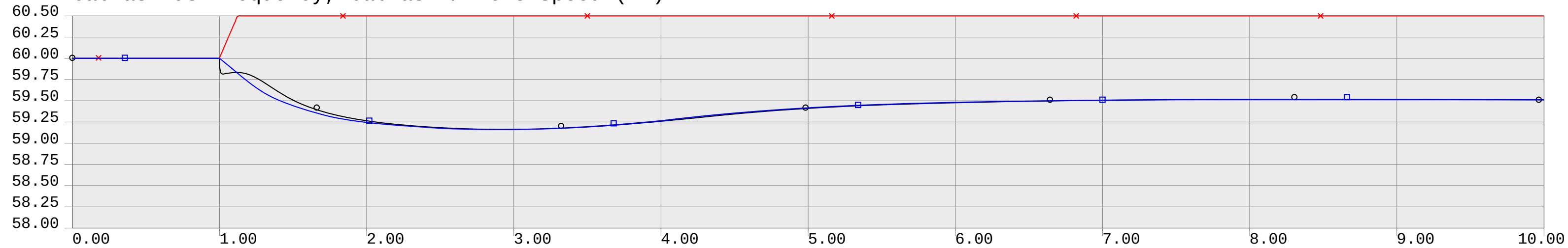
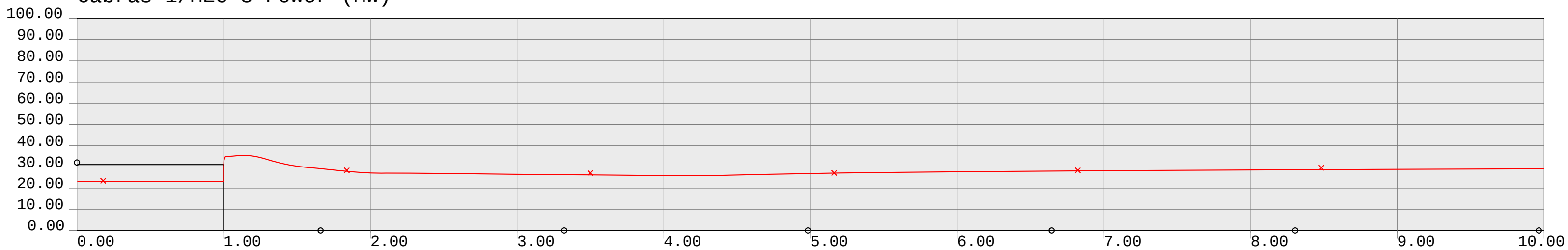
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



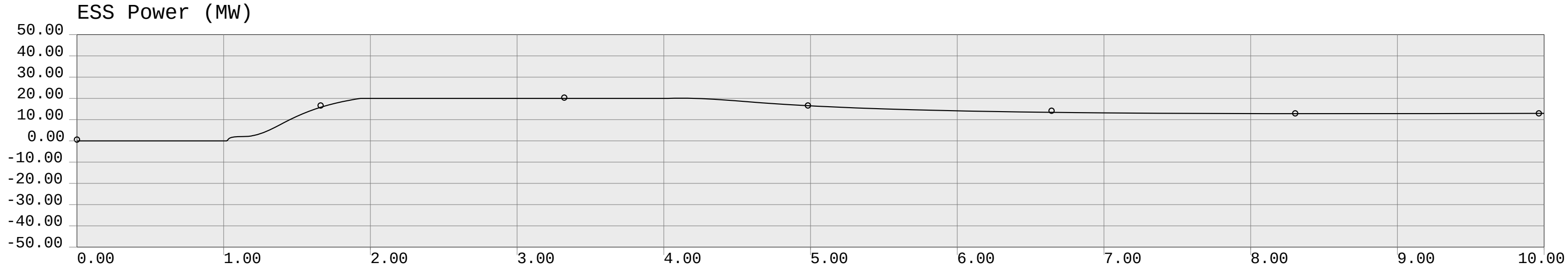
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



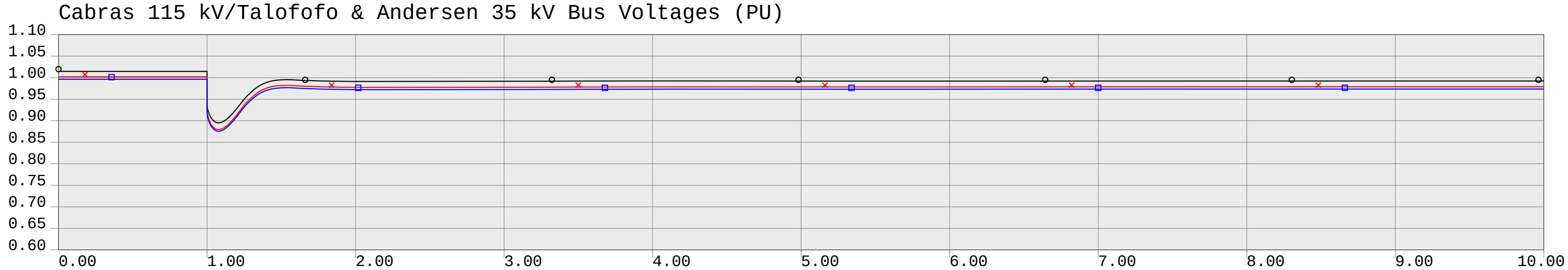
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

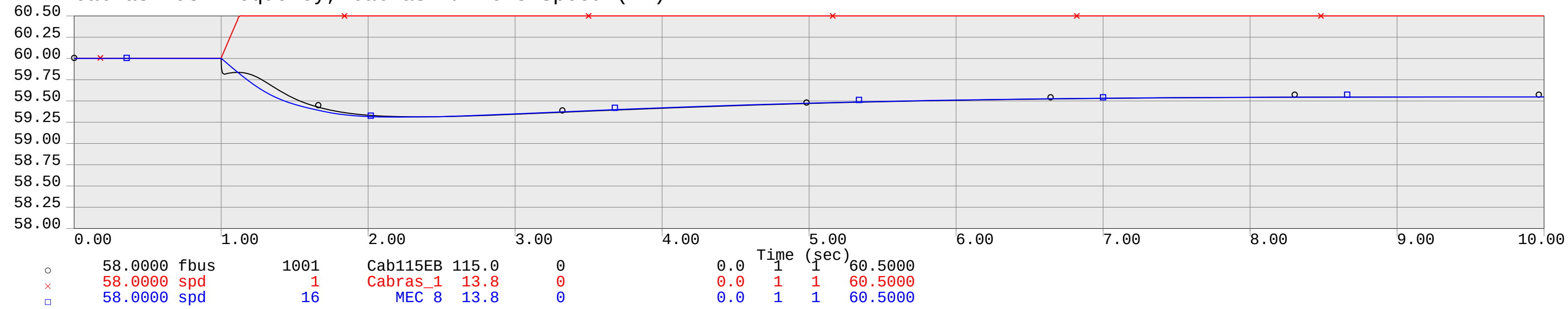
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



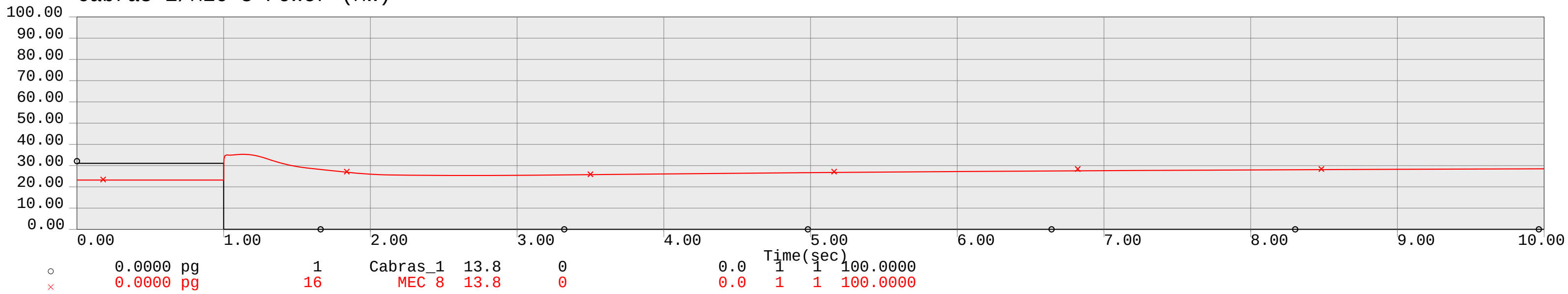
0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

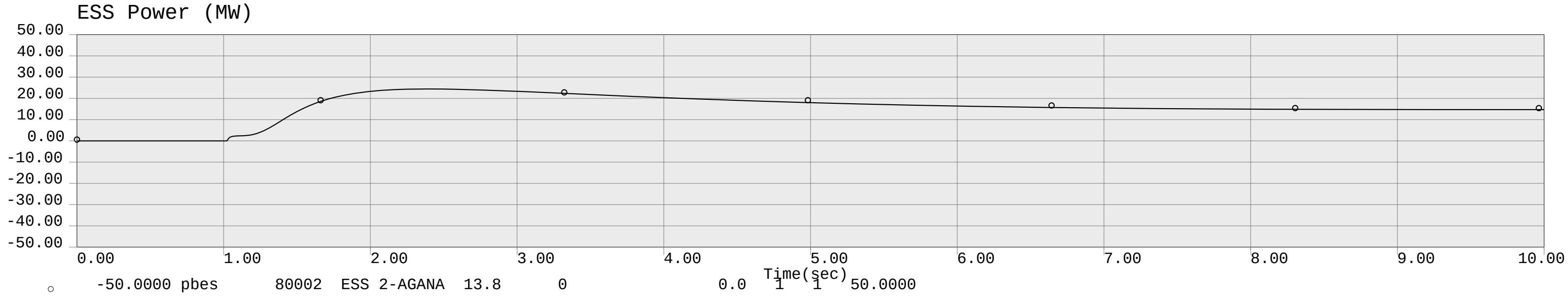
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



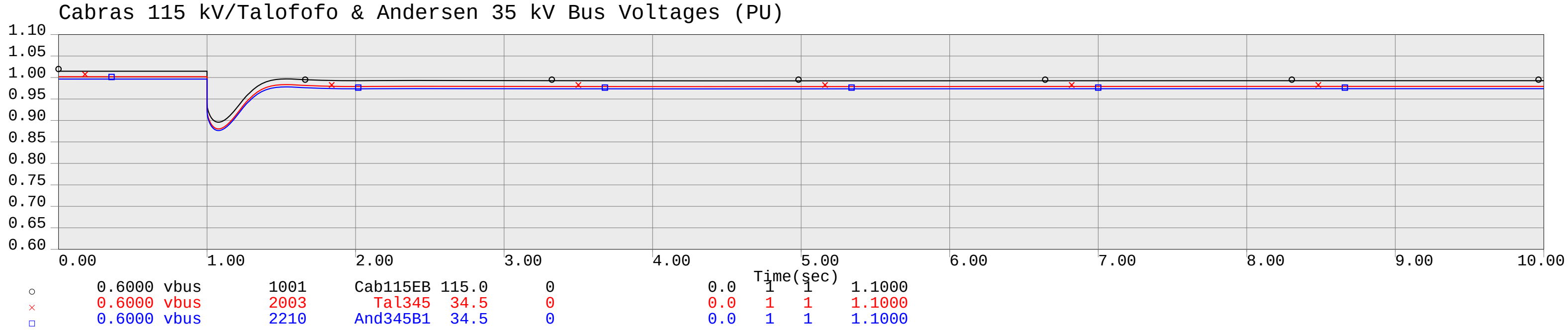
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)

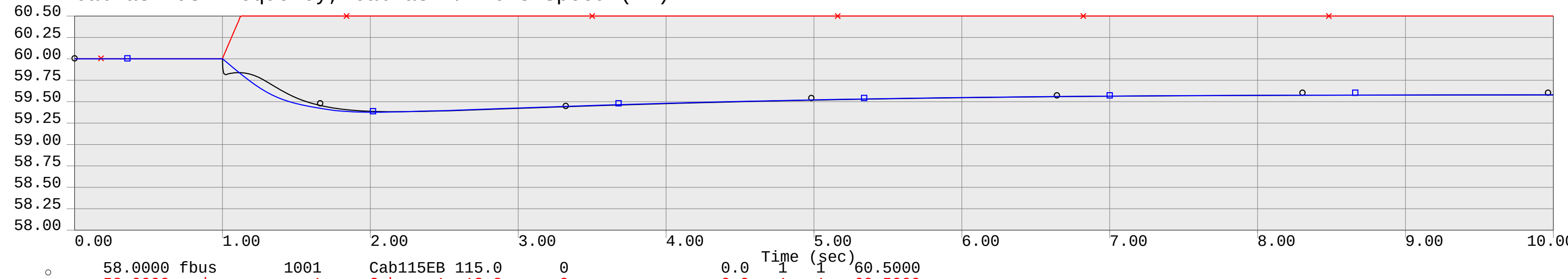


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



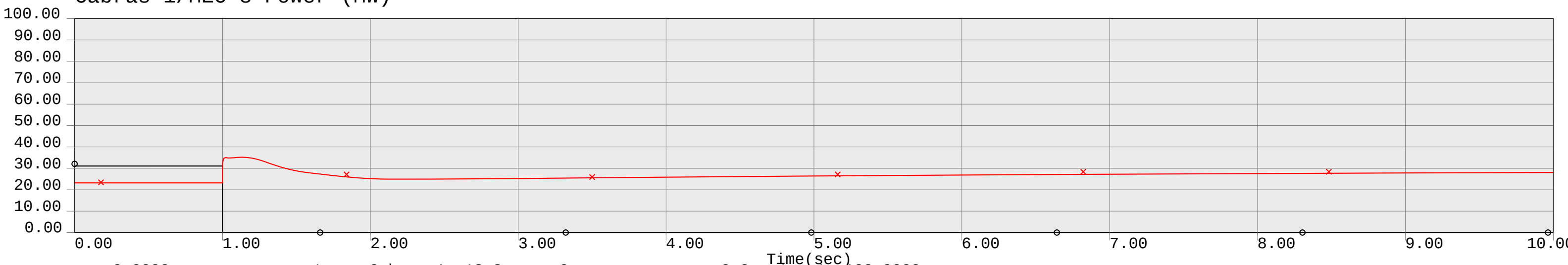
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



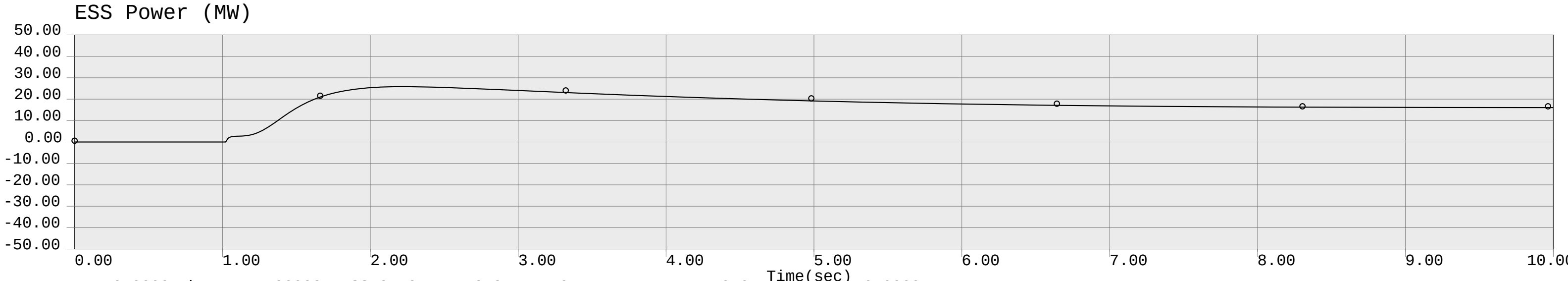
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



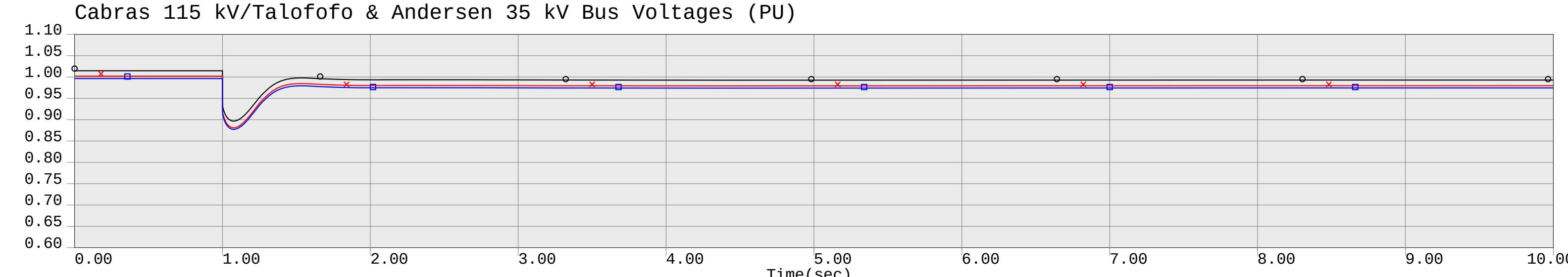
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2200-c1-1d.chf

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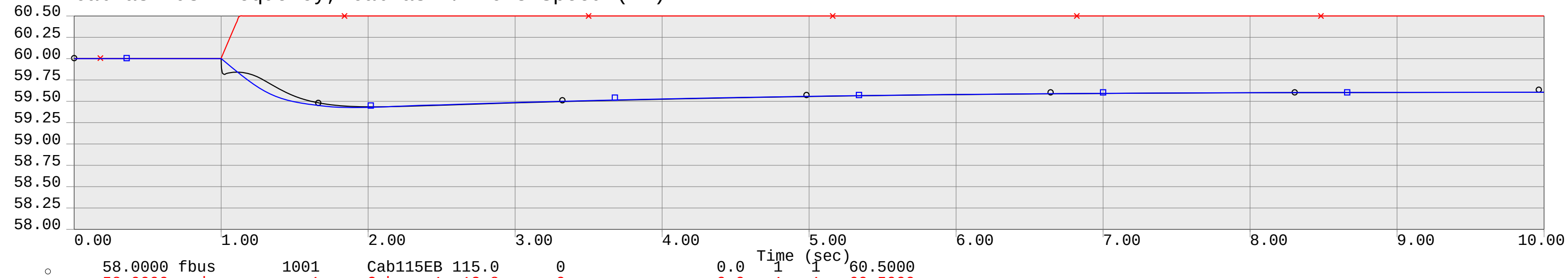
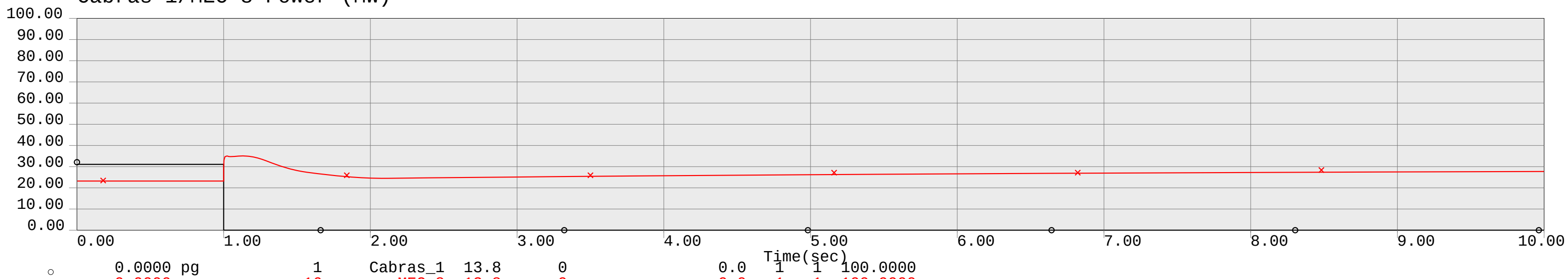
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



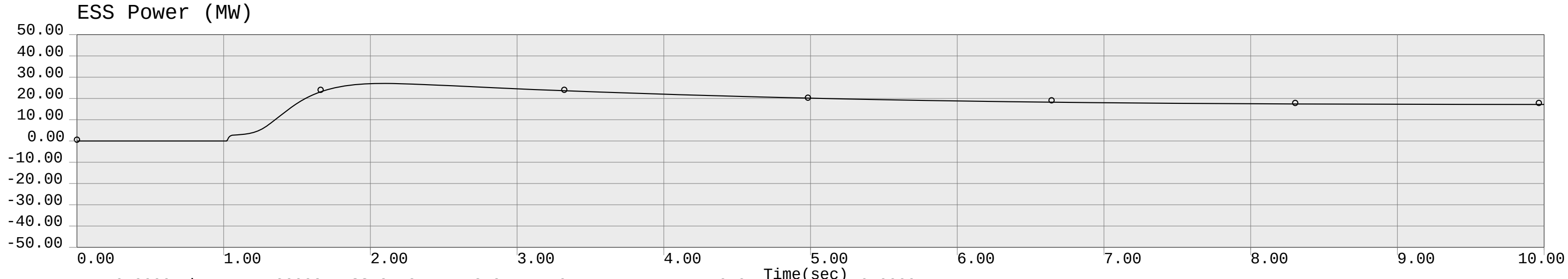
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



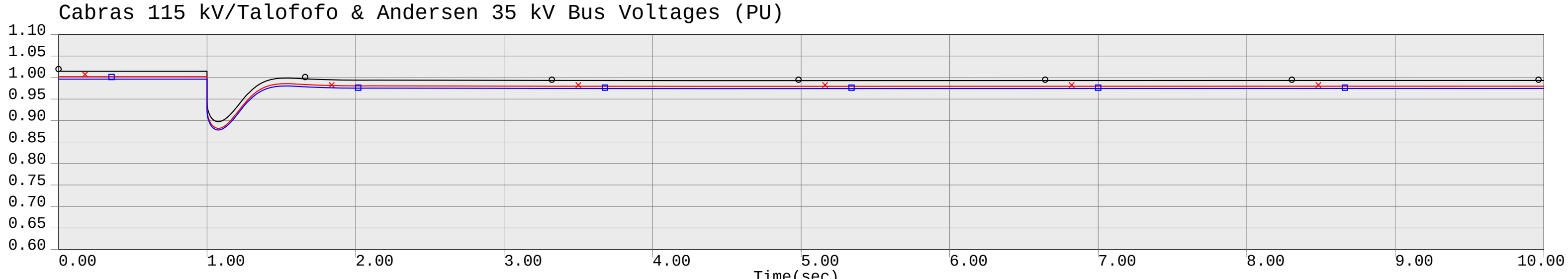
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2200-c1-1e.chf

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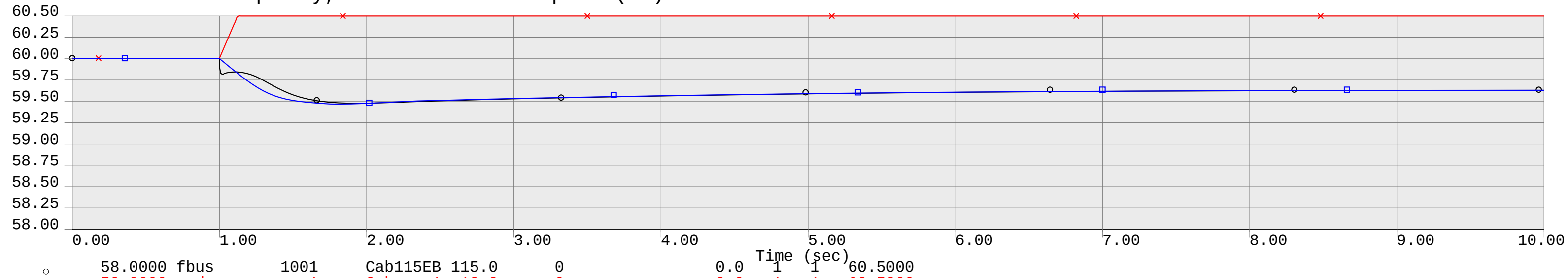
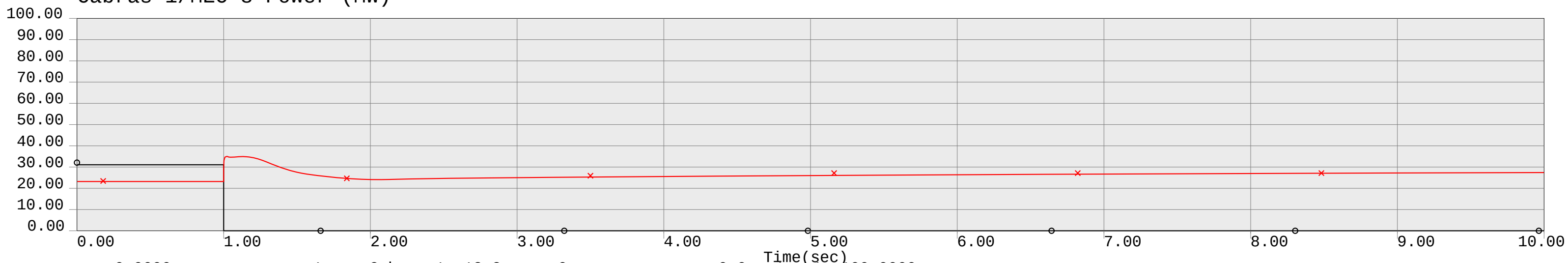
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



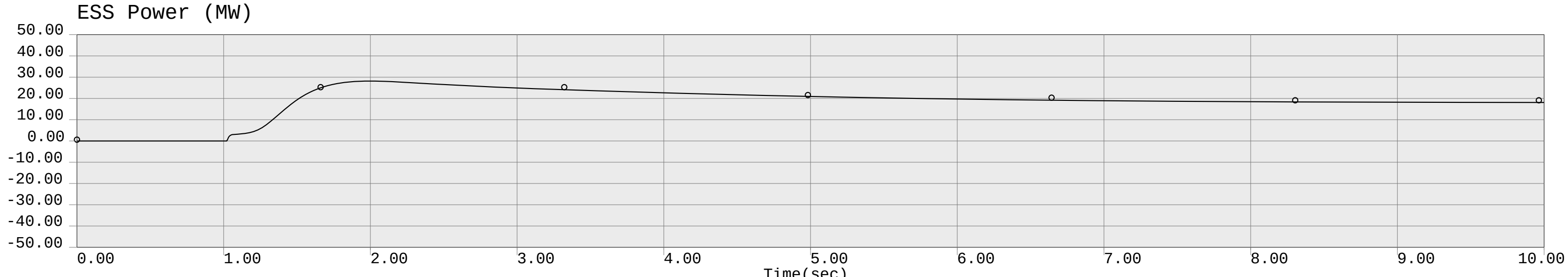
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



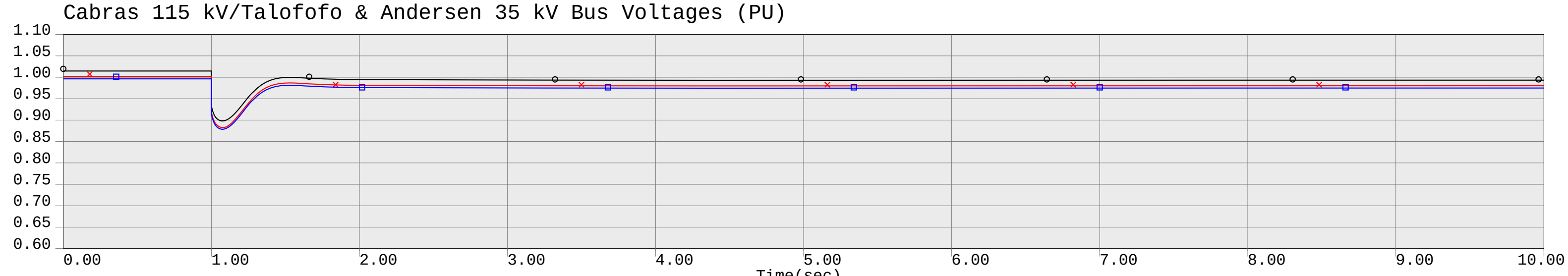
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

chans/2200-c1-1f.chf

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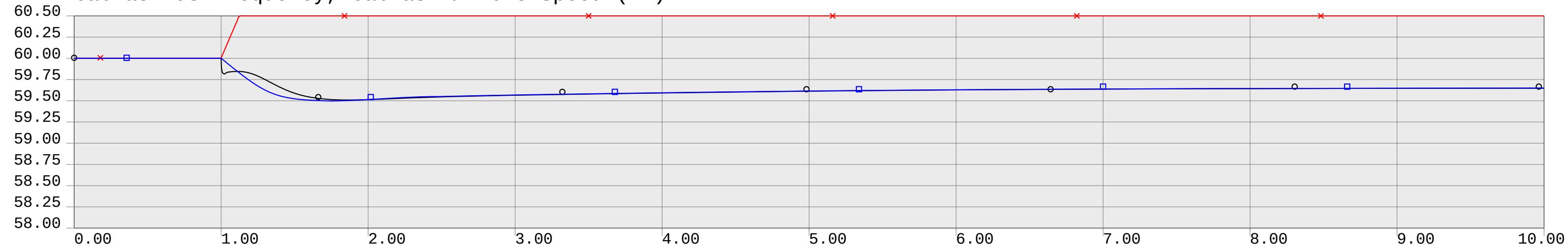
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)

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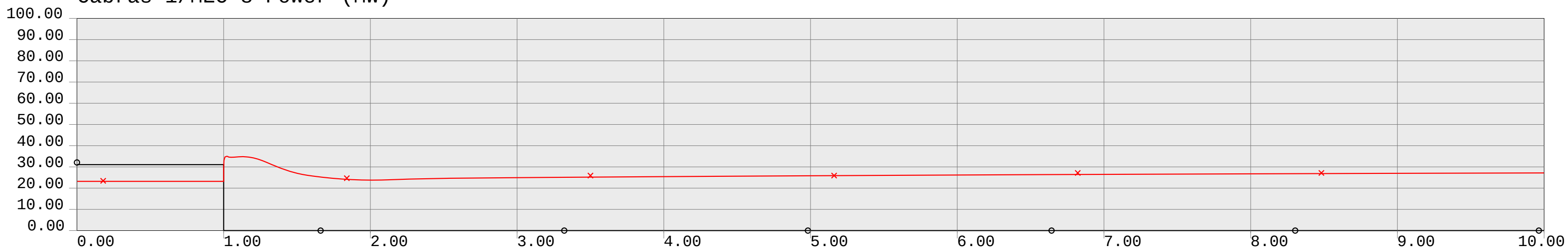
×  58.0000 spd       1  Cabras_1  13.8  0  0.0  1  1  60.5000
□  58.0000 spd      16     MEC 8  13.8  0  0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)




```
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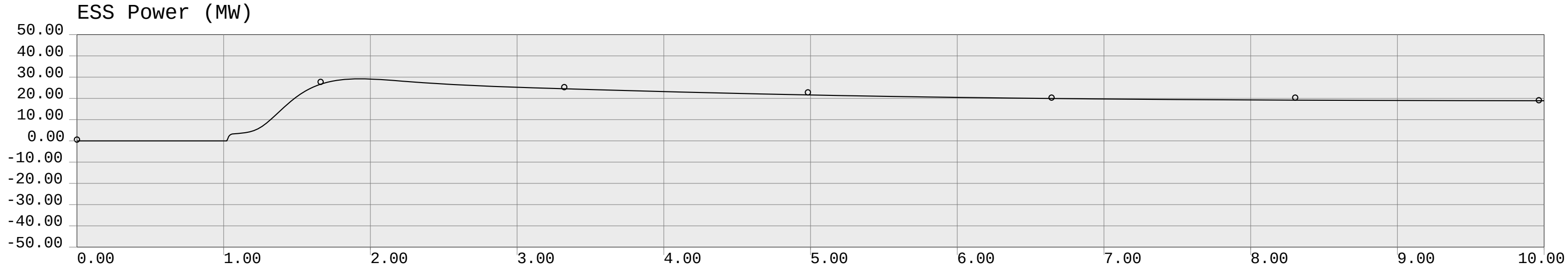
×  0.0000 pg   16     MEC 8  13.8  0  0.0  1  1  100.0000
```

ESS Power (MW)

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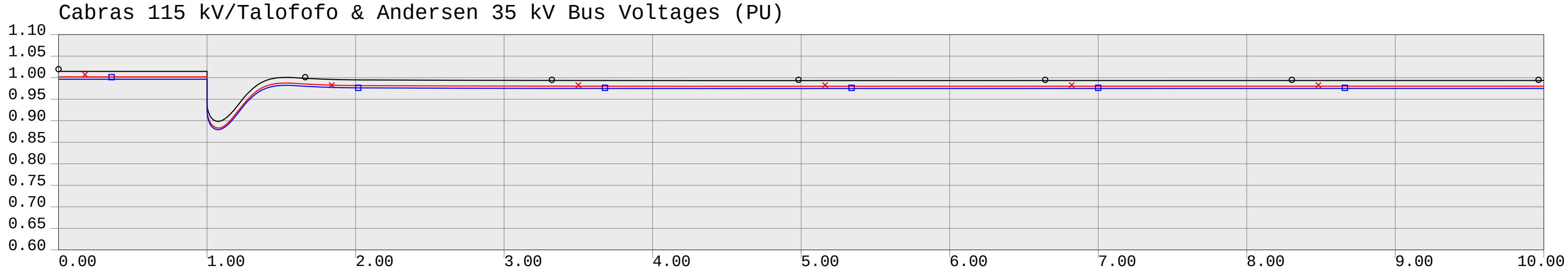
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
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×  0.6000 vbus   2003    Tal345  34.5  0  0.0  1  1  1.1000
□  0.6000 vbus   2210  And345B1  34.5  0  0.0  1  1  1.1000
```


chans/2200-c1-1g.chf

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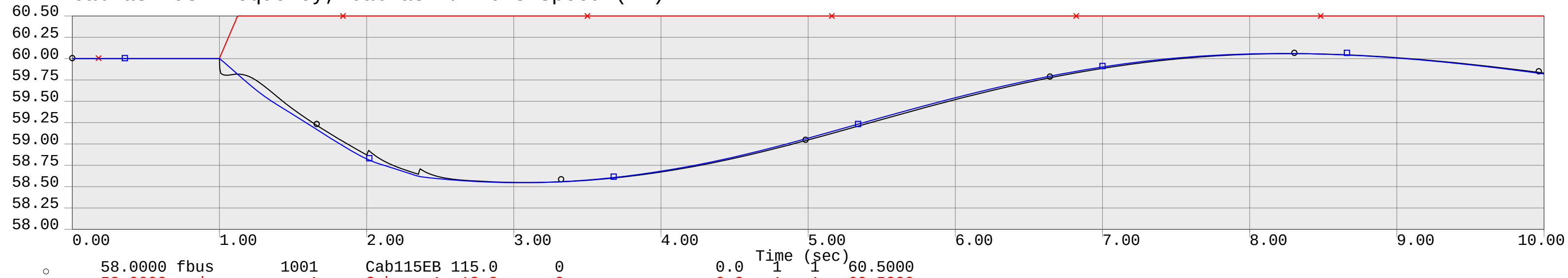
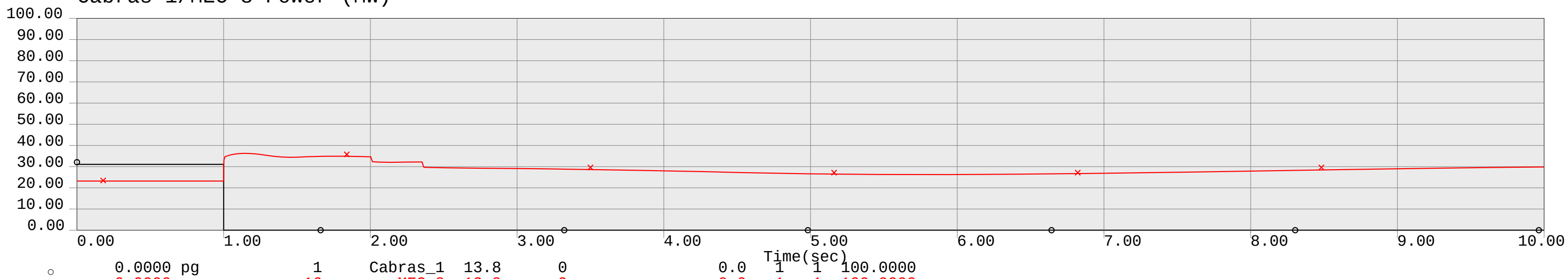
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



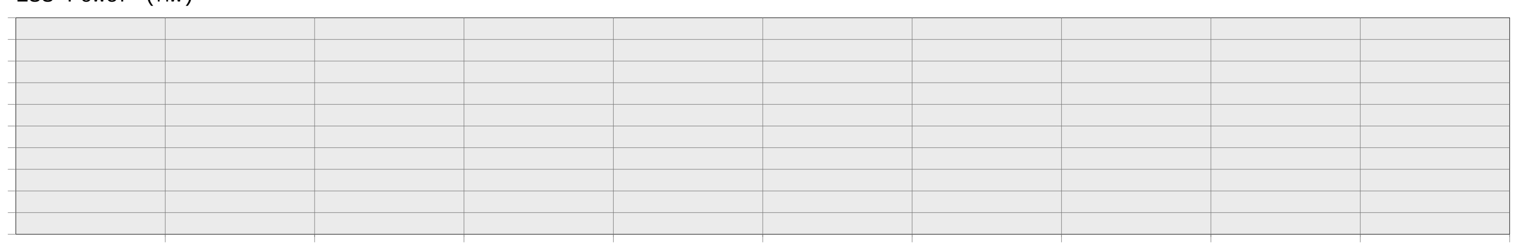
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)

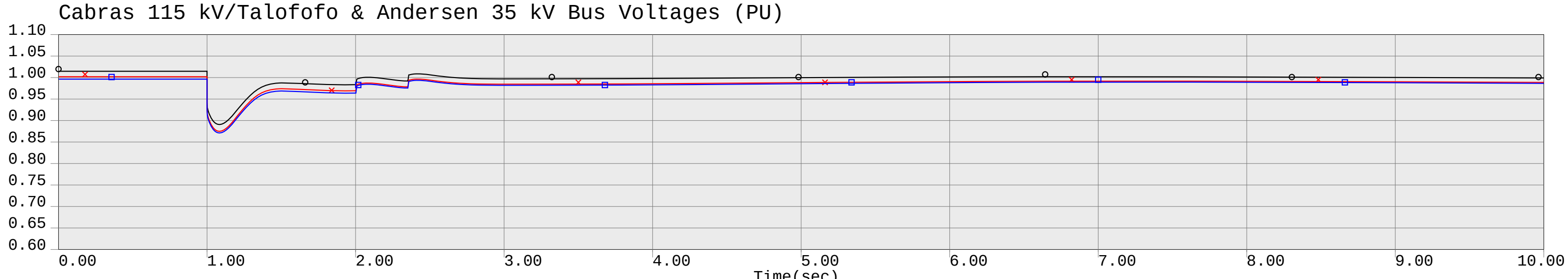


○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2200-c1-ref.chf

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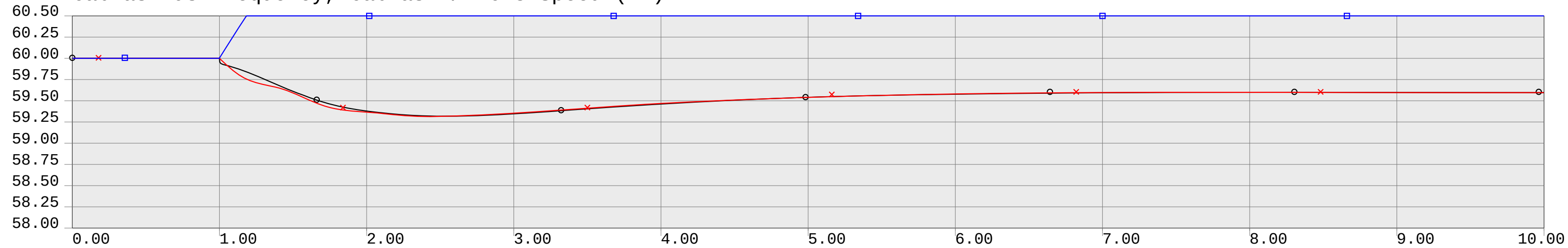
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



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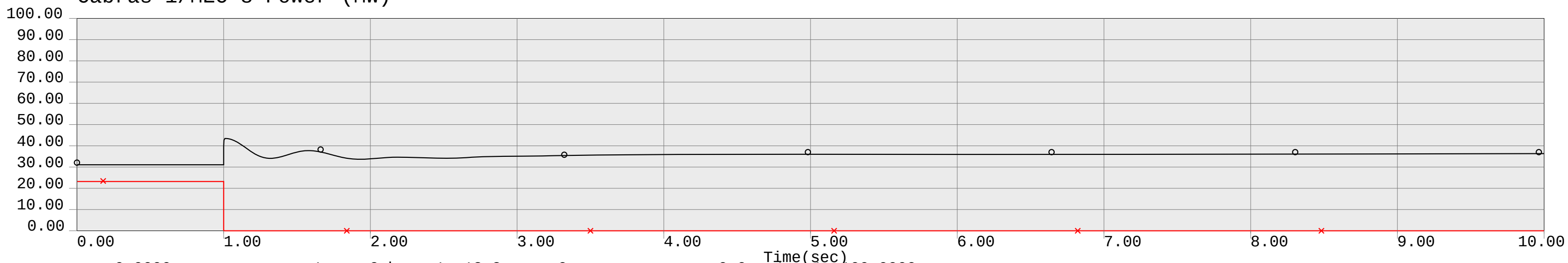
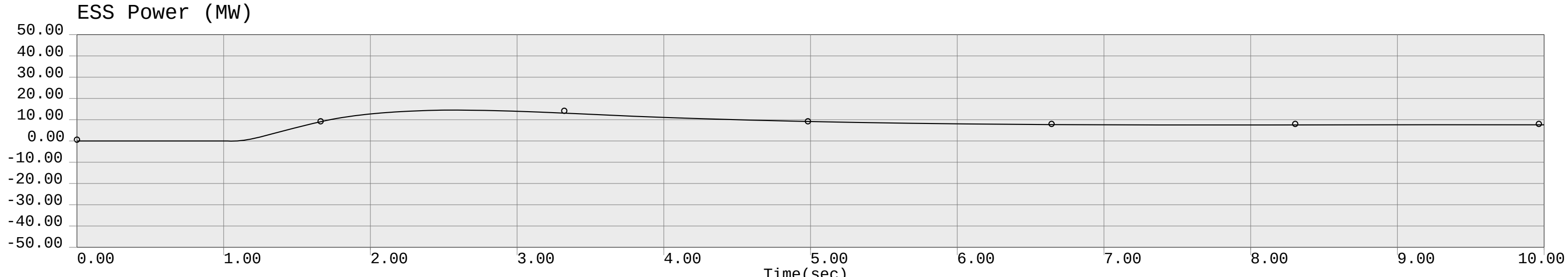
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



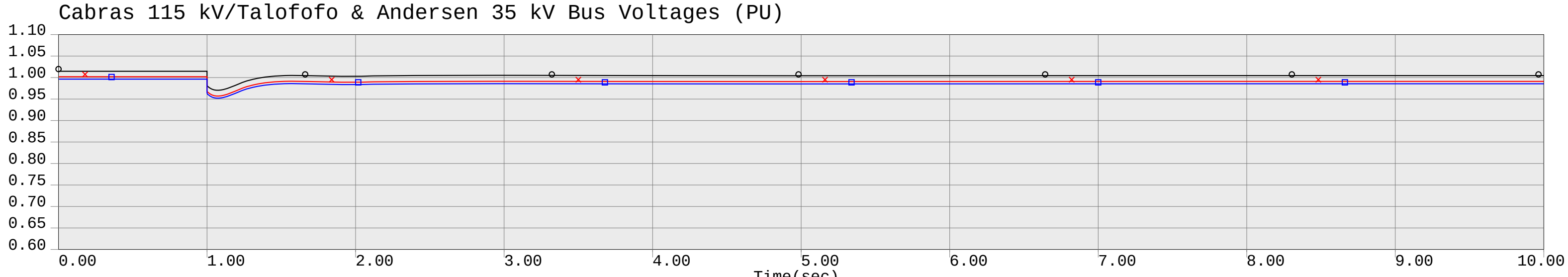
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

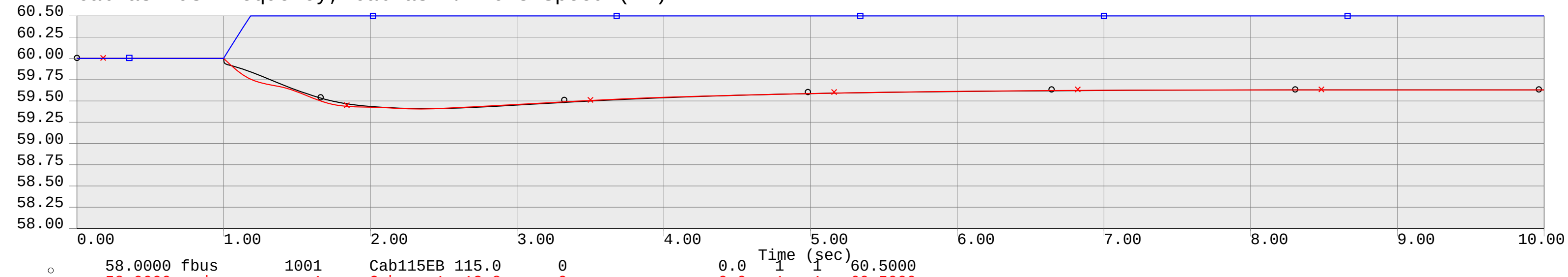
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

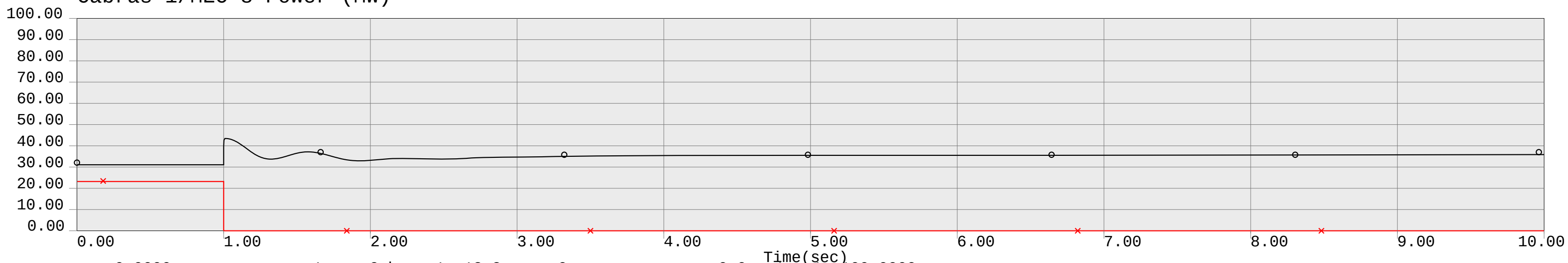
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



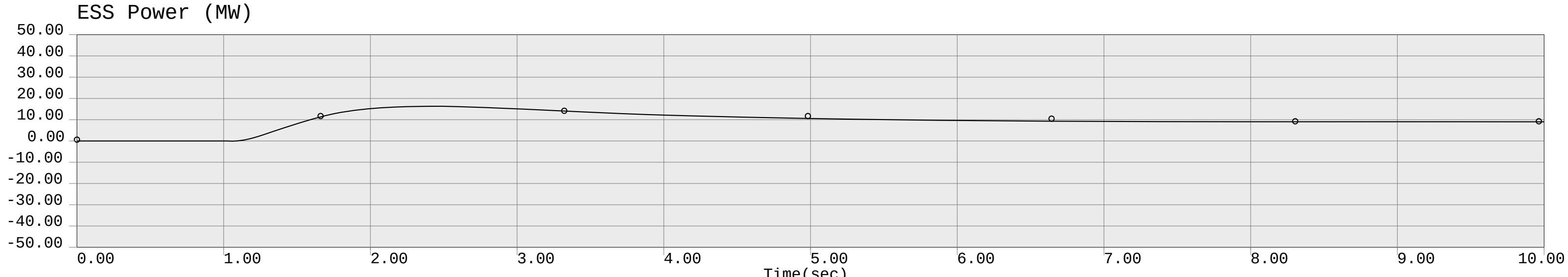
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



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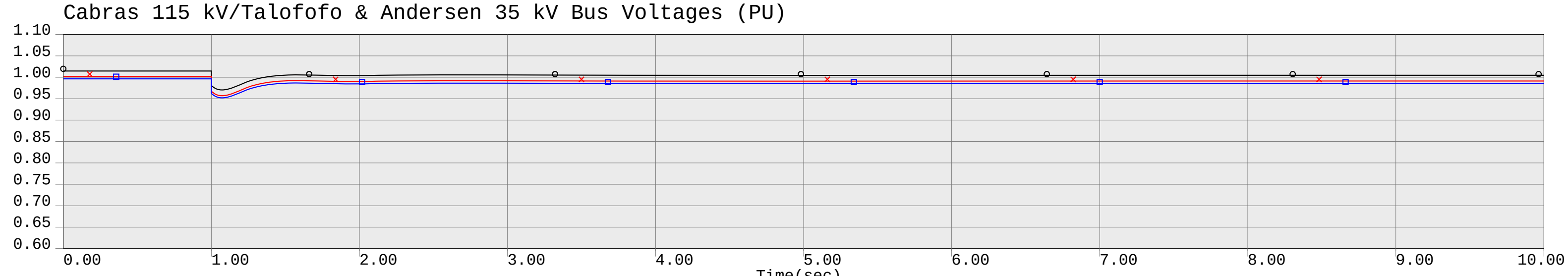
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2200-m8-1b.chf

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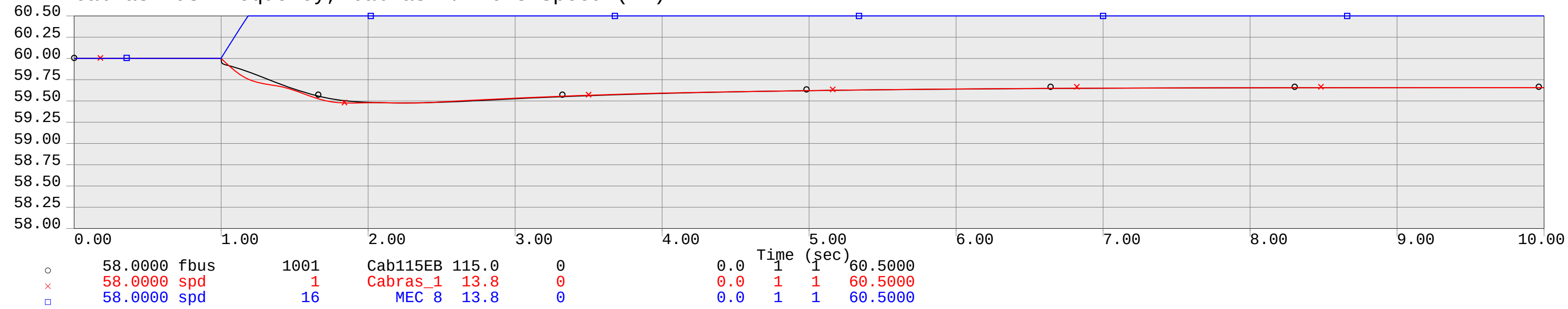
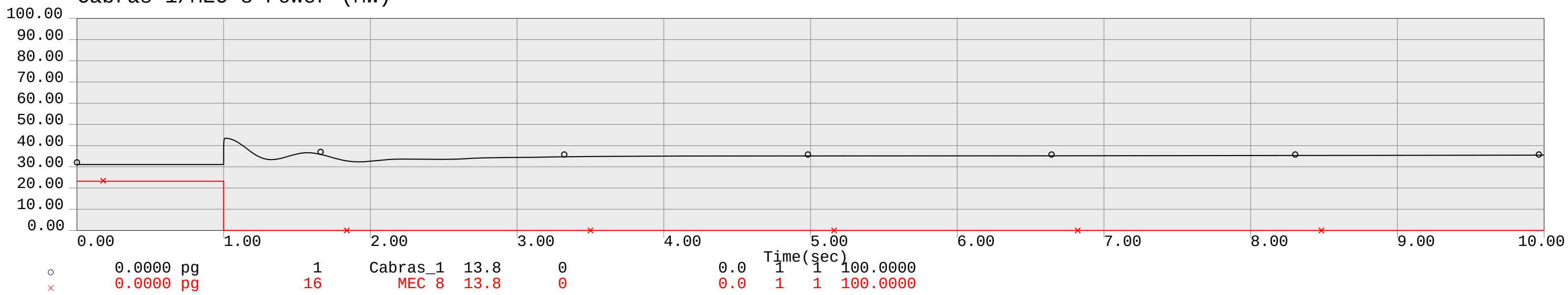
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

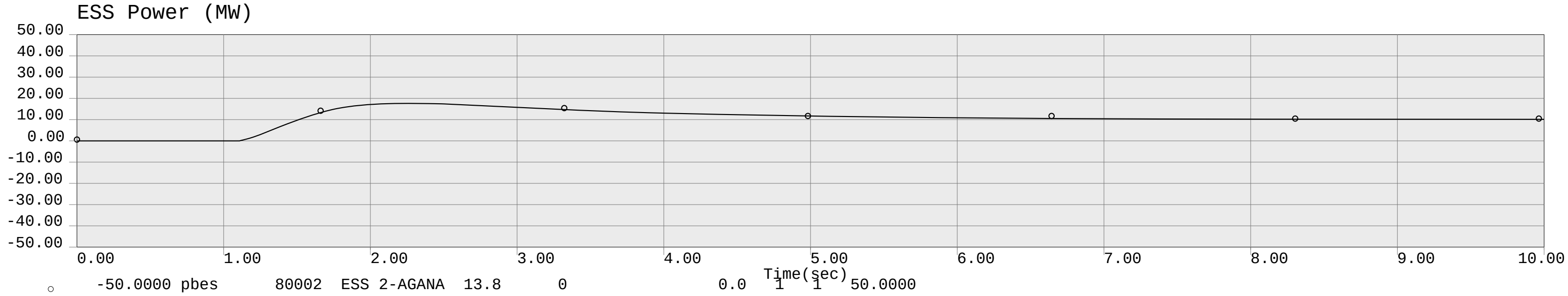
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



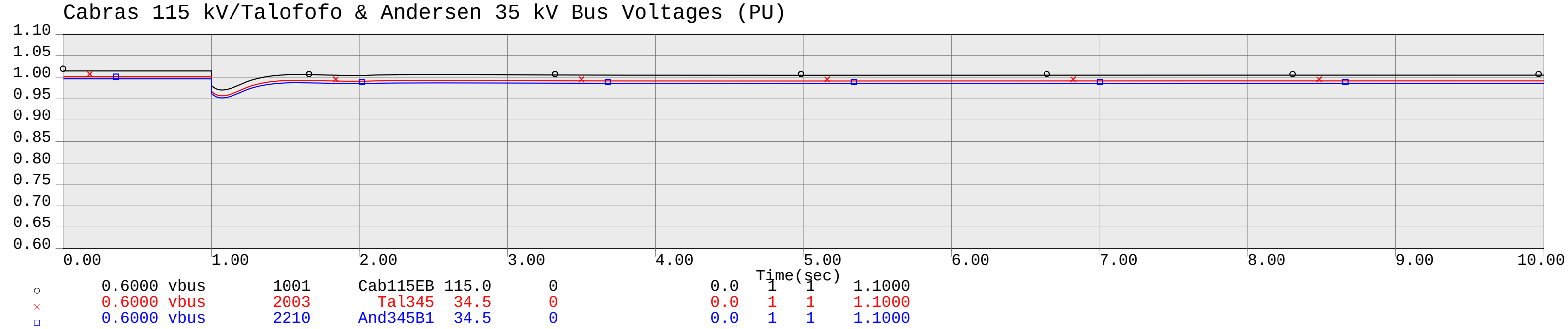
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



chans/2200-m8-1c.chf

asibility_Study\rev_2\sim

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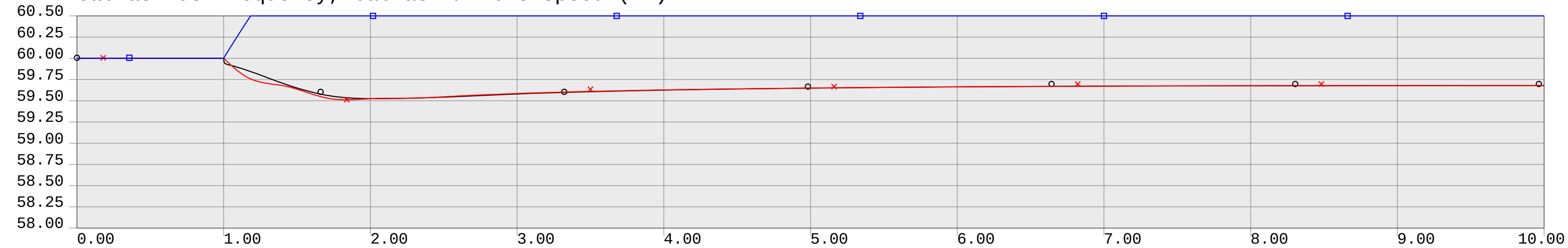
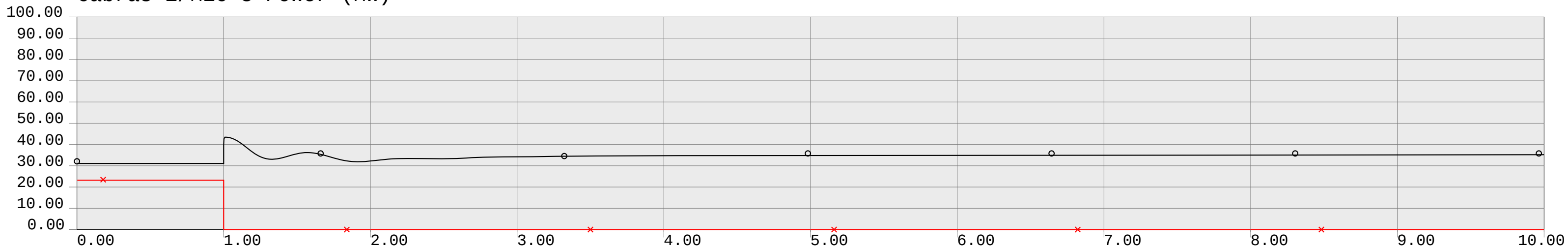
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



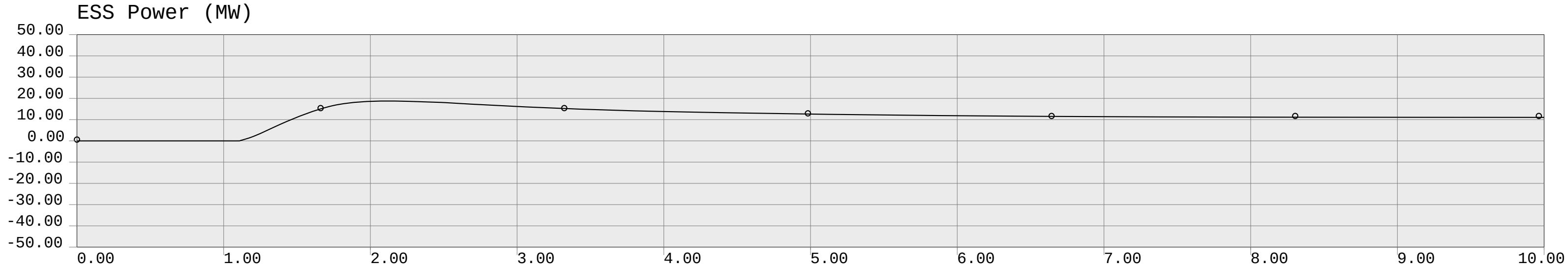
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



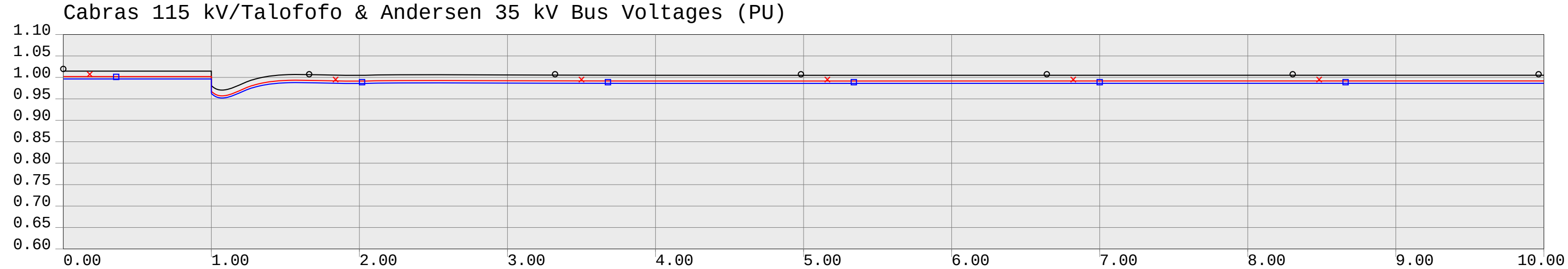
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

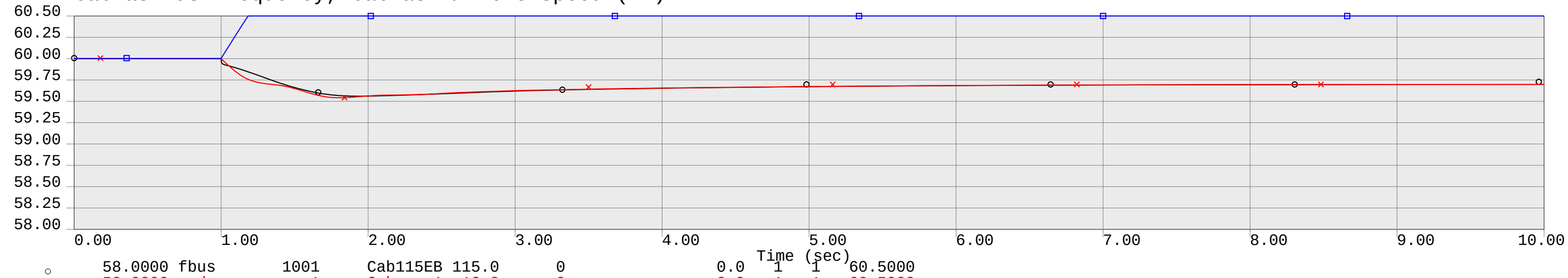
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

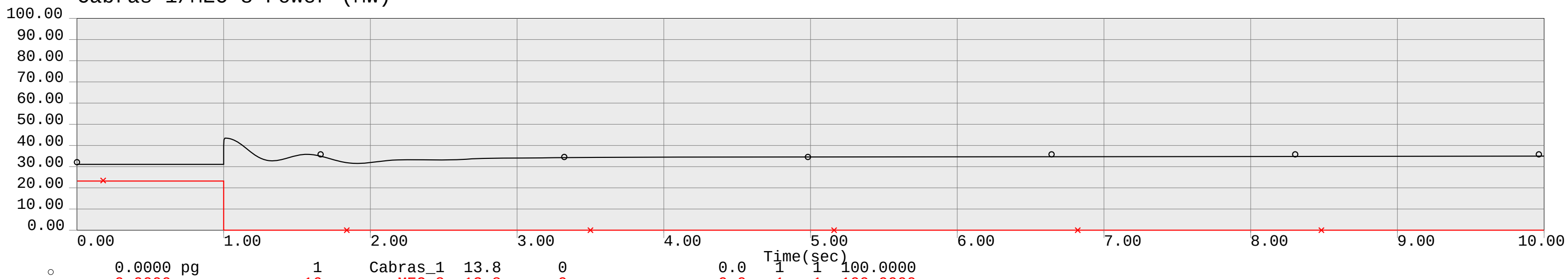
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



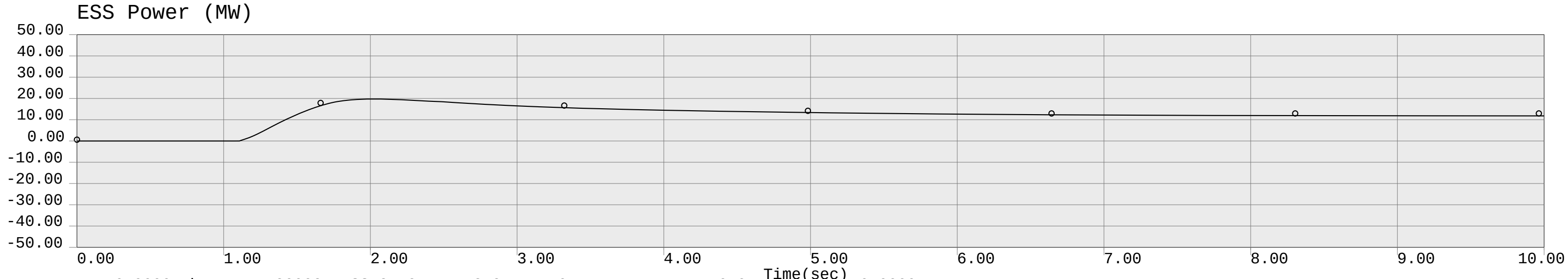
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



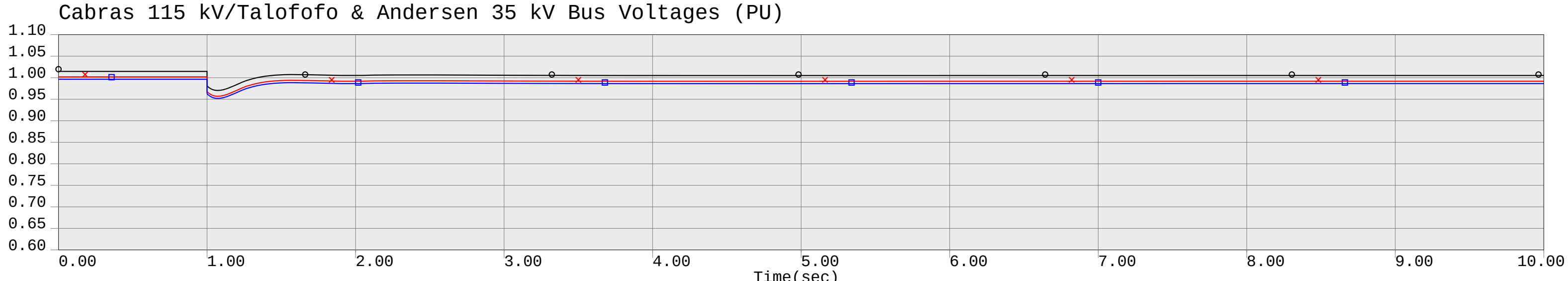
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2200-m8-1e.chf

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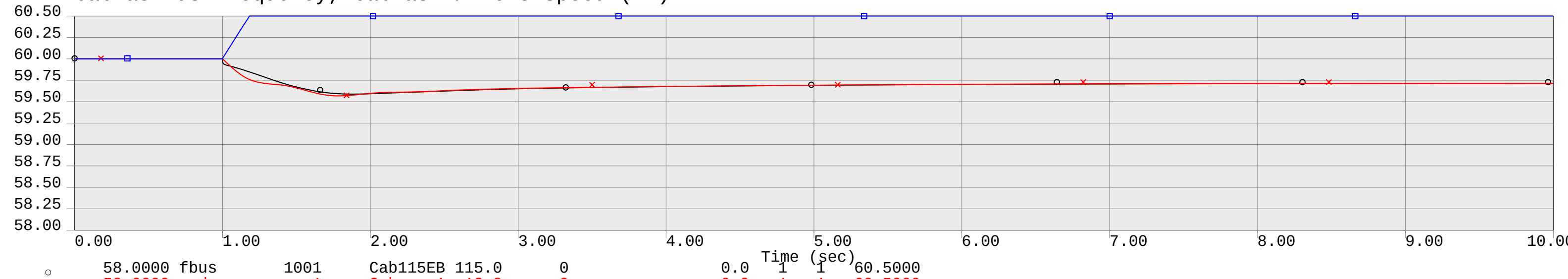
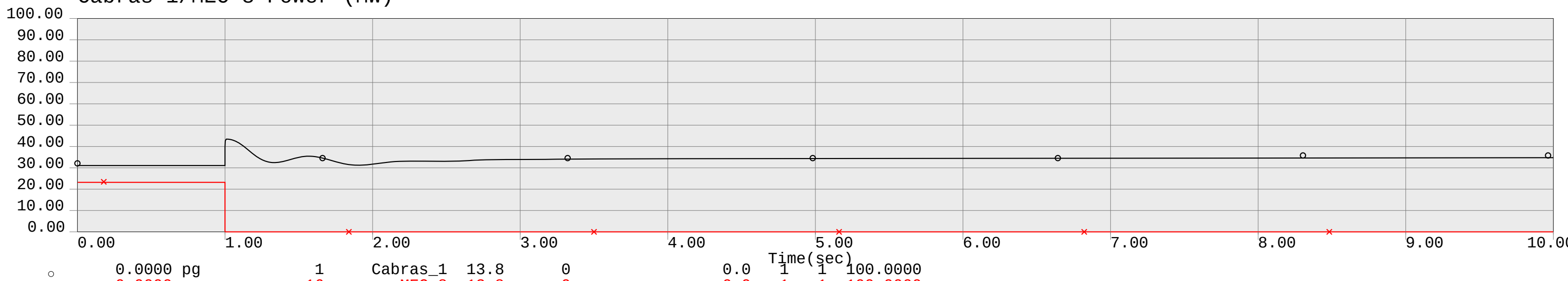
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



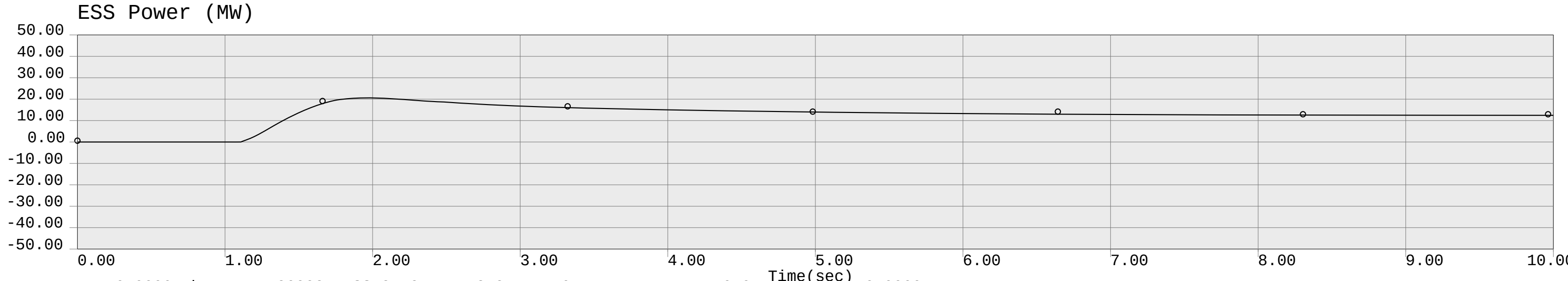
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



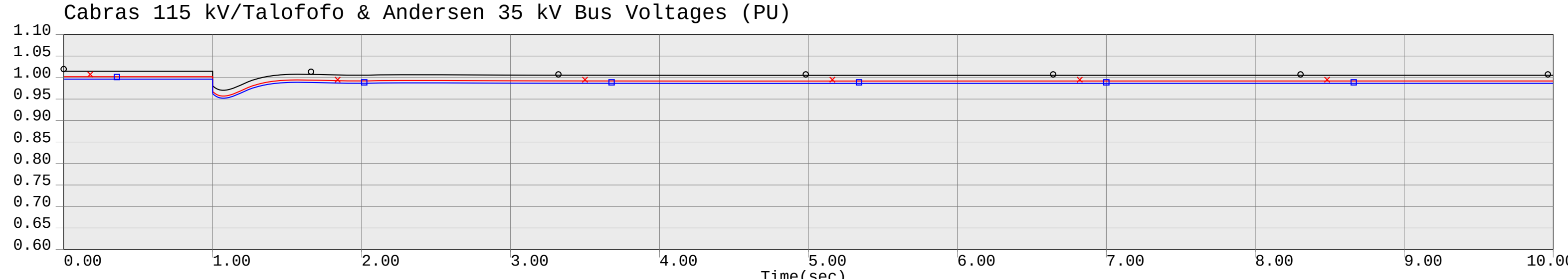
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

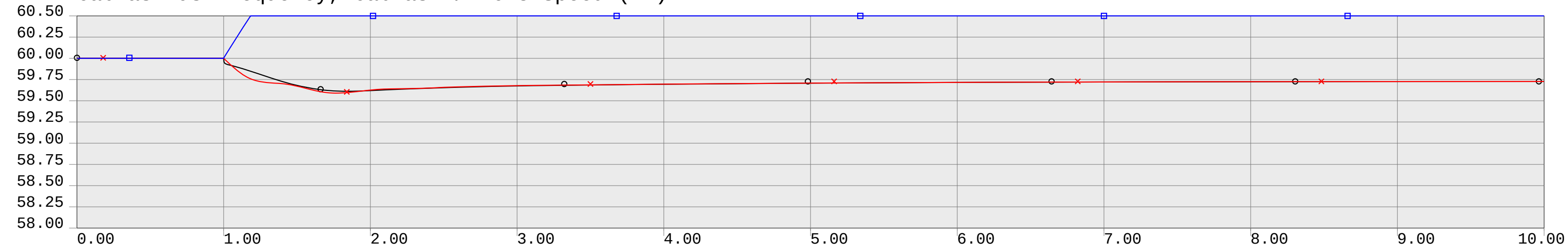
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

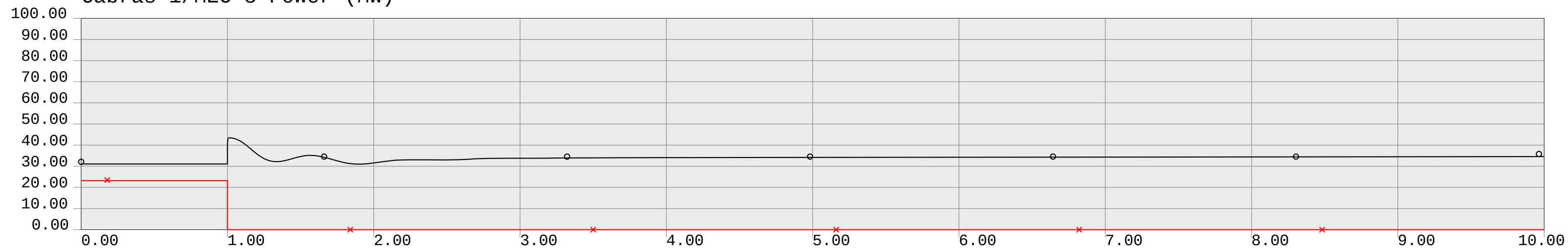
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



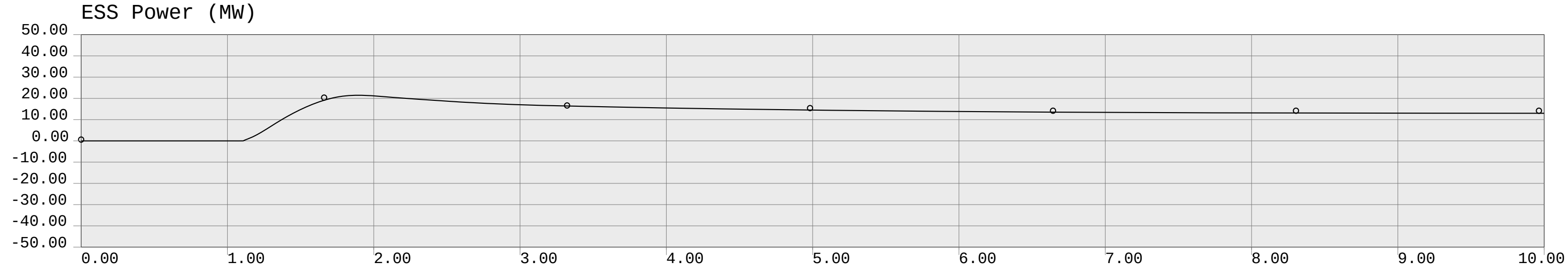
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



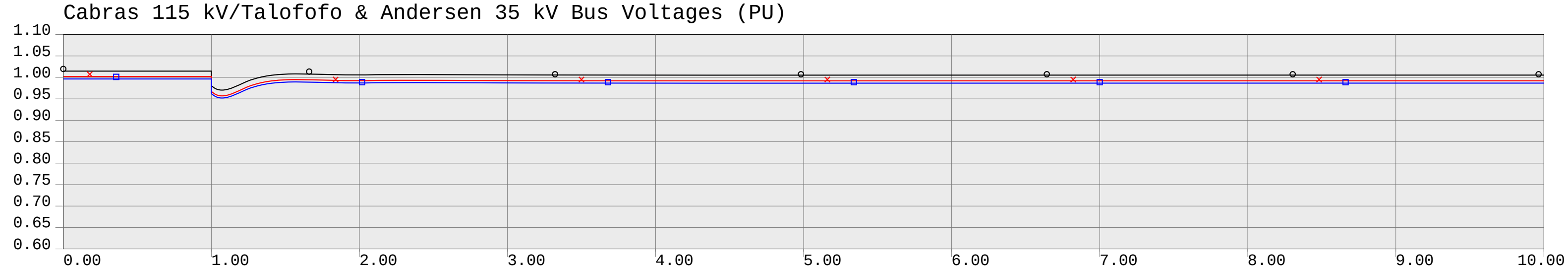
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2200-m8-1g.chf

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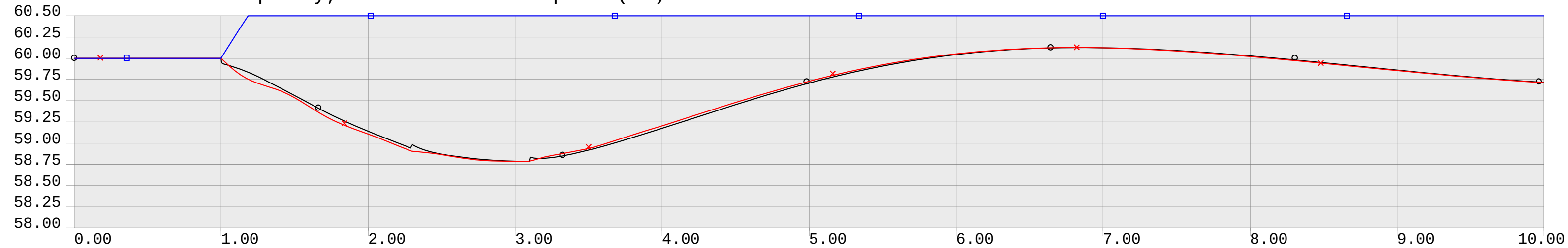
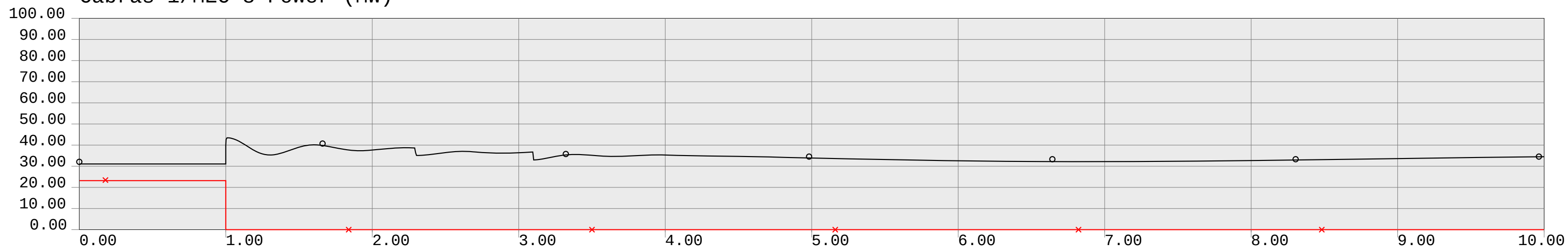
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



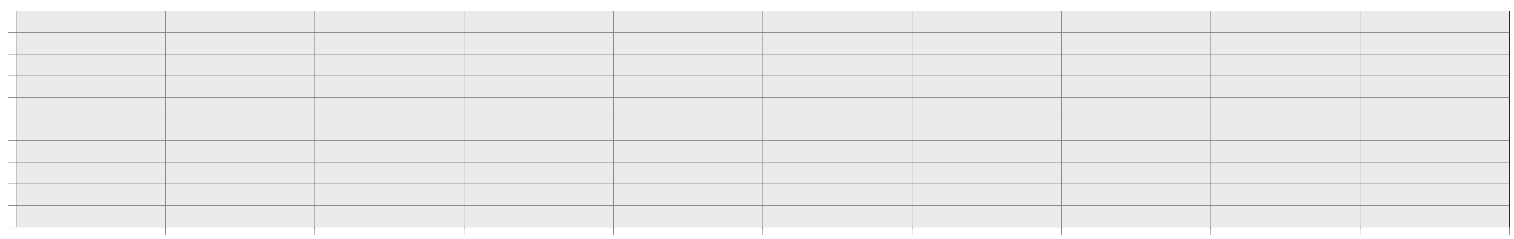
○	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)

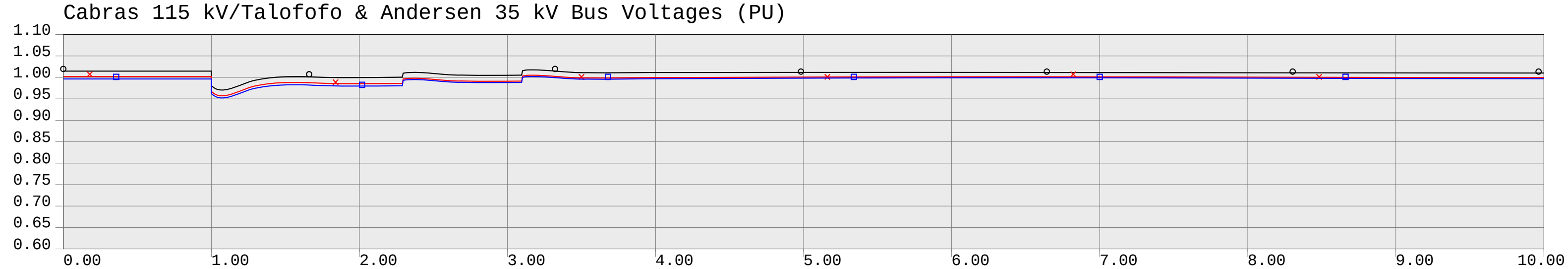


○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2200-m8-ref.chf

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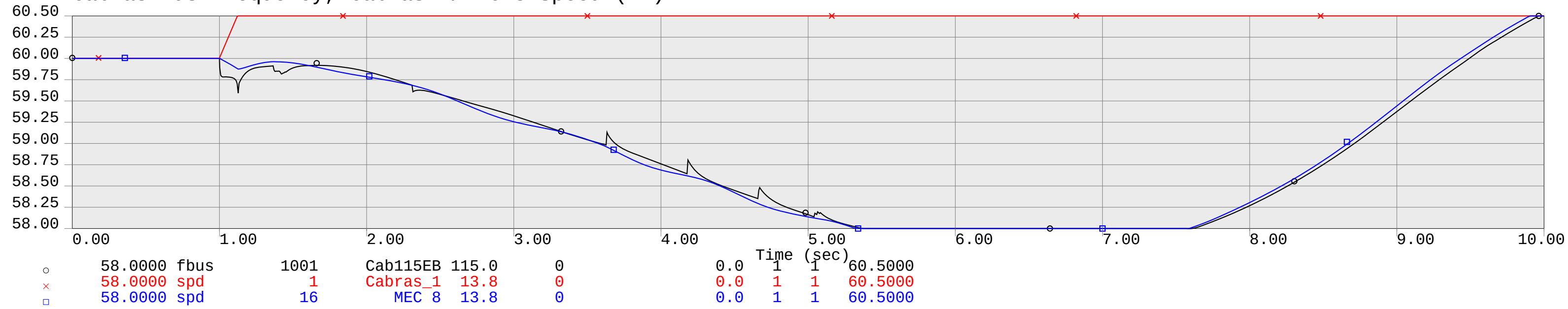
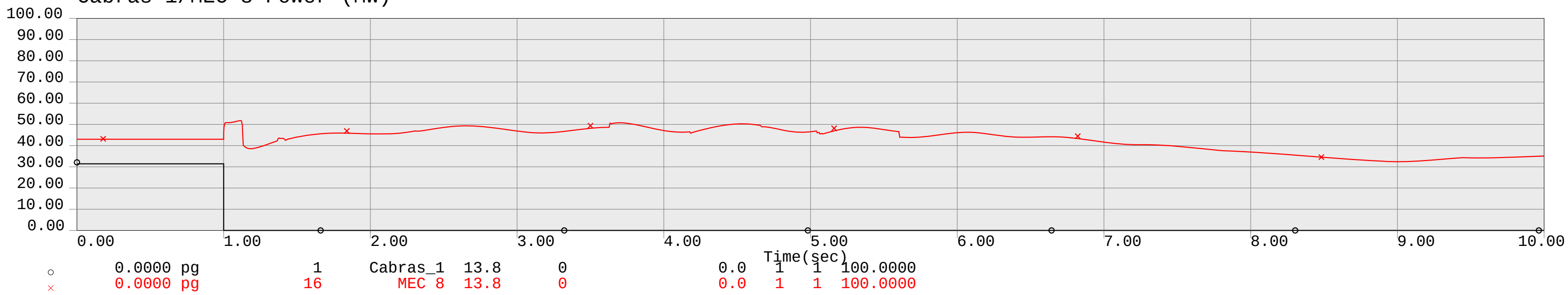
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

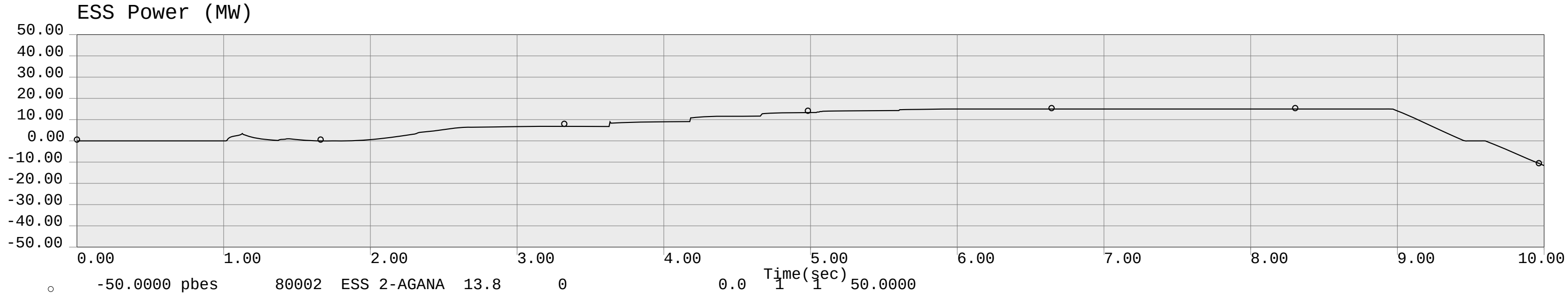
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



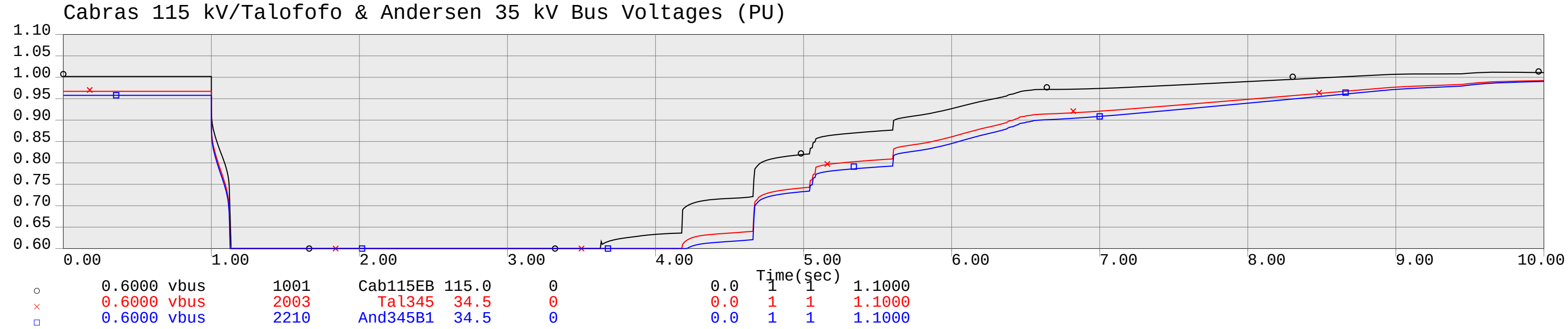
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)

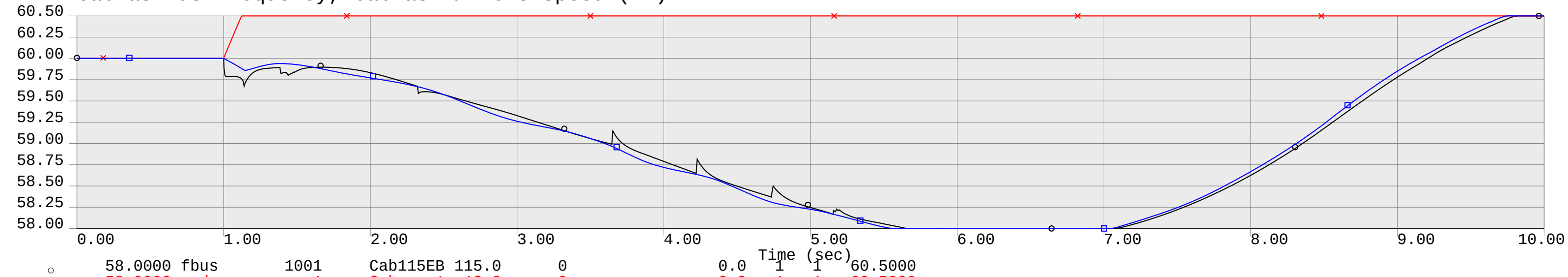


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



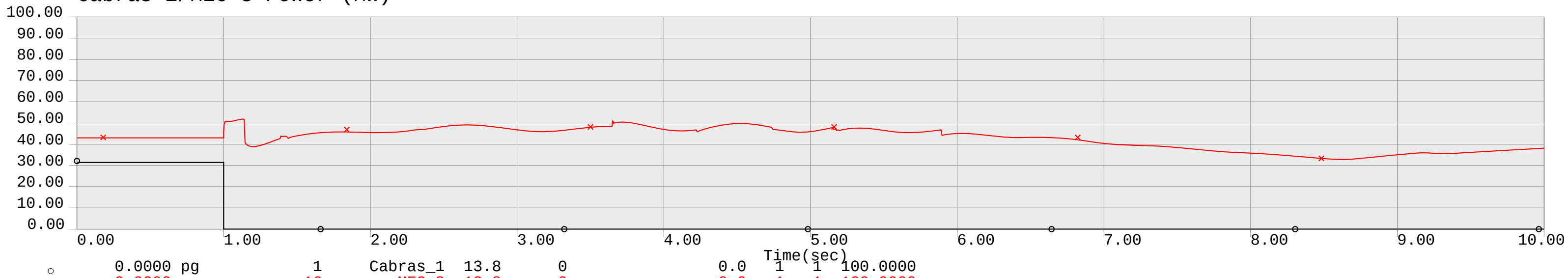
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



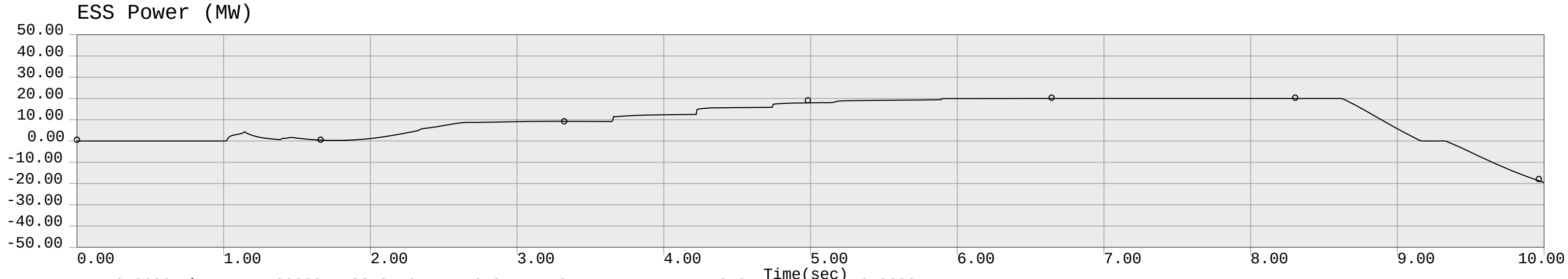
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



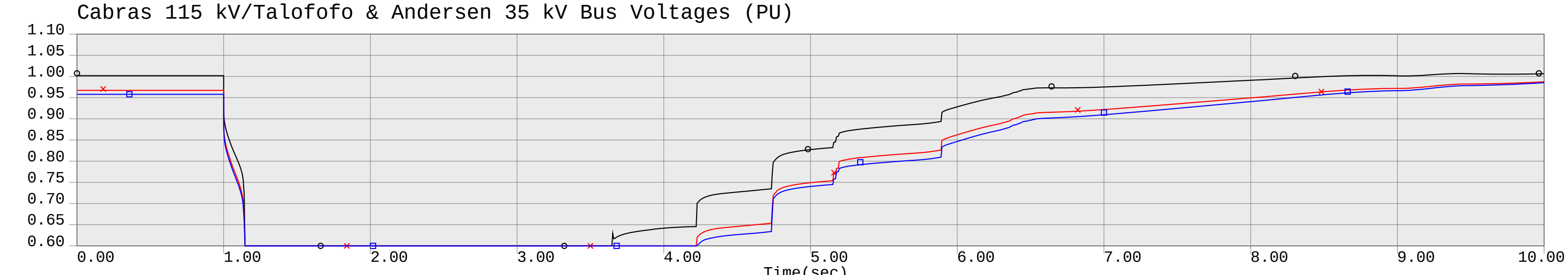
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2300-c1-1b.chf

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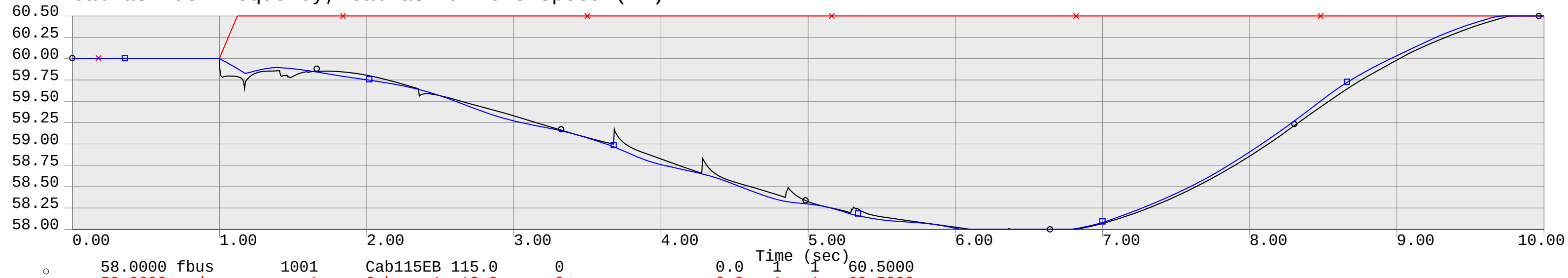
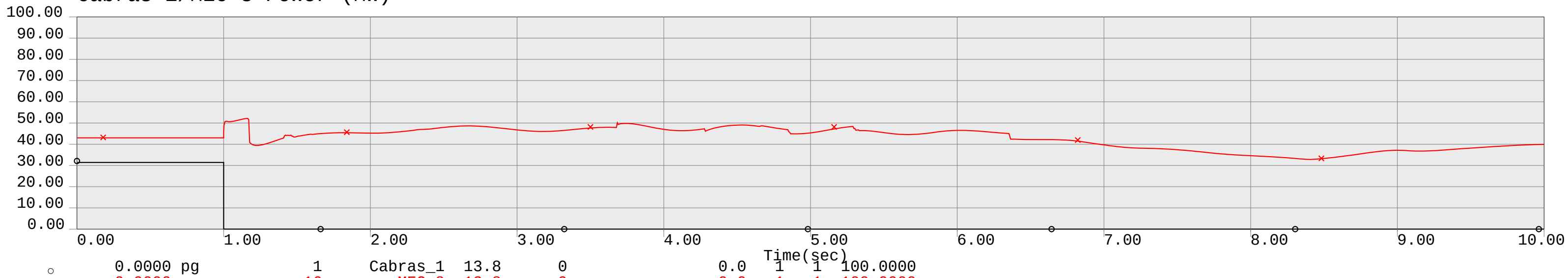
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



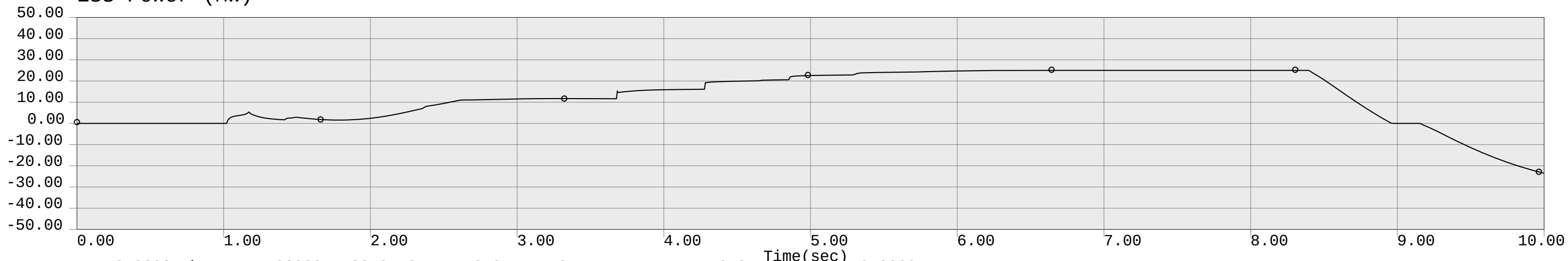
○	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



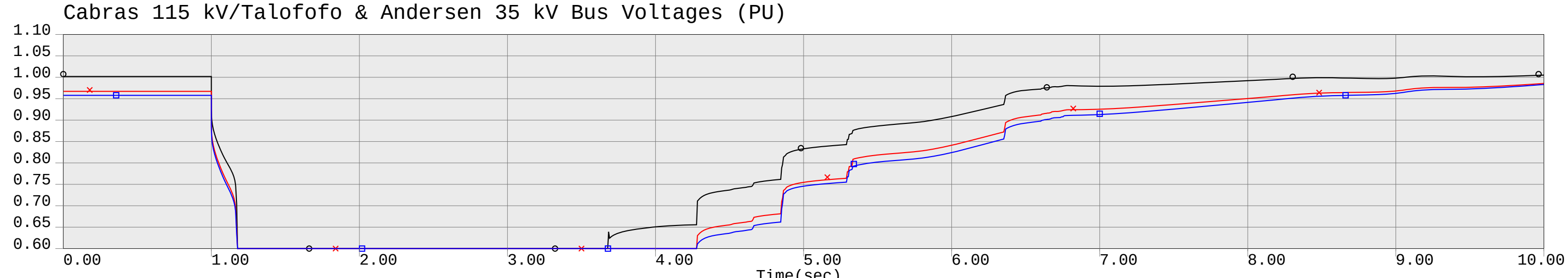
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2300-c1-1c.chf

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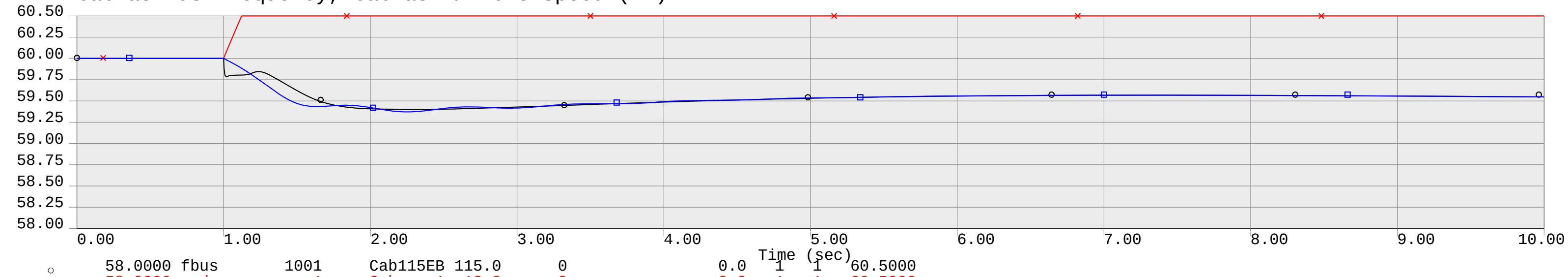
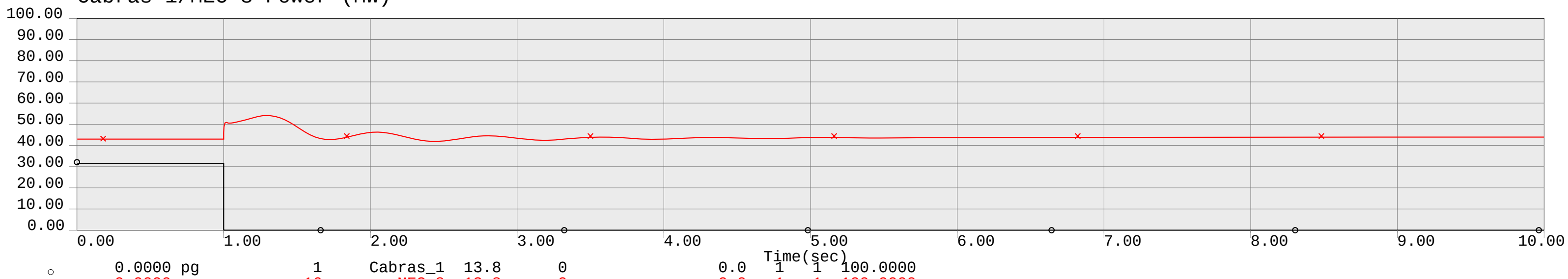
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



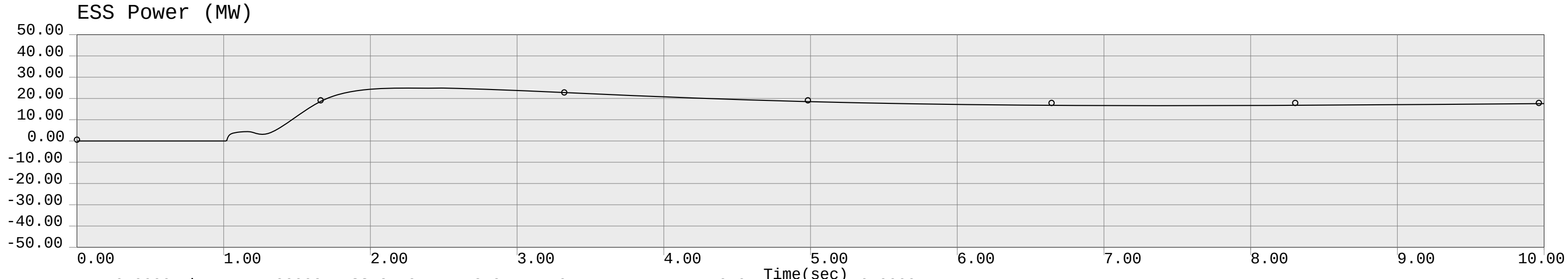

```
○ 58.0000 fbus   1001  Cab115EB 115.0  0   0.0  1  1  60.5000
× 58.0000 spd       1  Cabras_1  13.8  0   0.0  1  1  60.5000
□ 58.0000 spd      16     MEC 8  13.8  0   0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)




```
○ 0.0000 pg   1  Cabras_1  13.8  0   0.0  1  1  100.0000
× 0.0000 pg  16     MEC 8  13.8  0   0.0  1  1  100.0000
```

ESS Power (MW)

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○ -50.0000 pbes  80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
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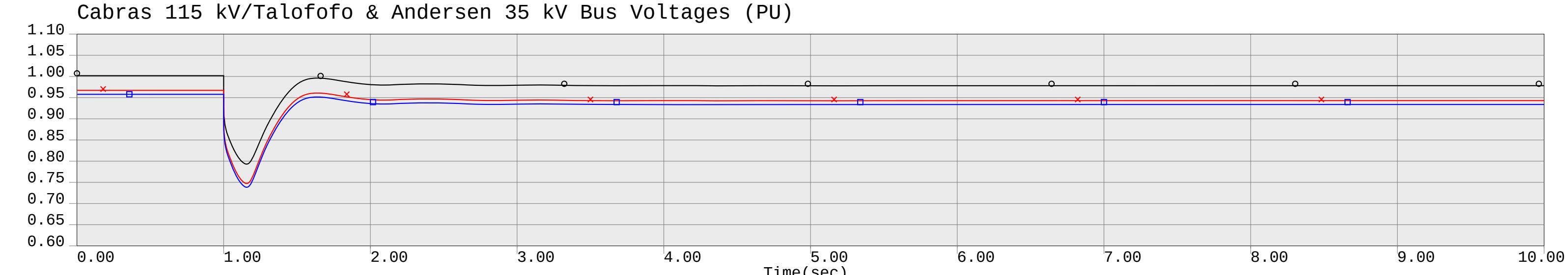
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○ 0.6000 vbus  1001  Cab115EB 115.0  0   0.0  1  1  1.1000
× 0.6000 vbus  2003    Tal345  34.5  0   0.0  1  1  1.1000
□ 0.6000 vbus  2210  And345B1  34.5  0   0.0  1  1  1.1000
```


chans/2300-c1-1d.chf

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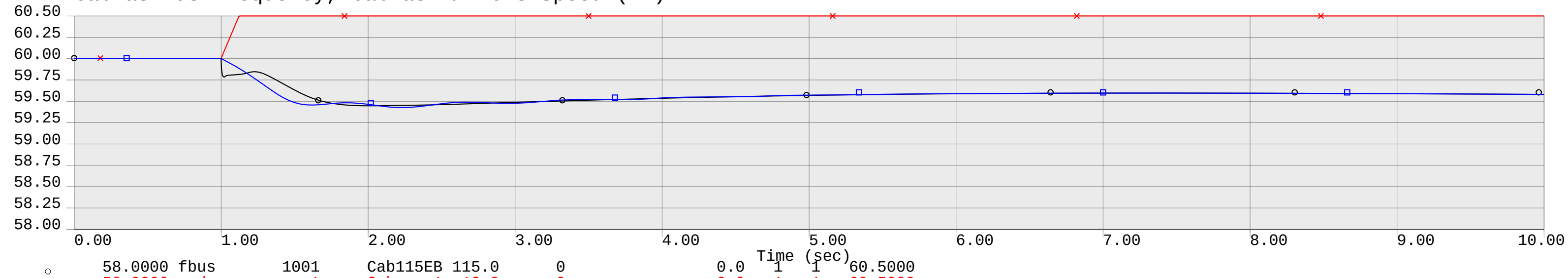
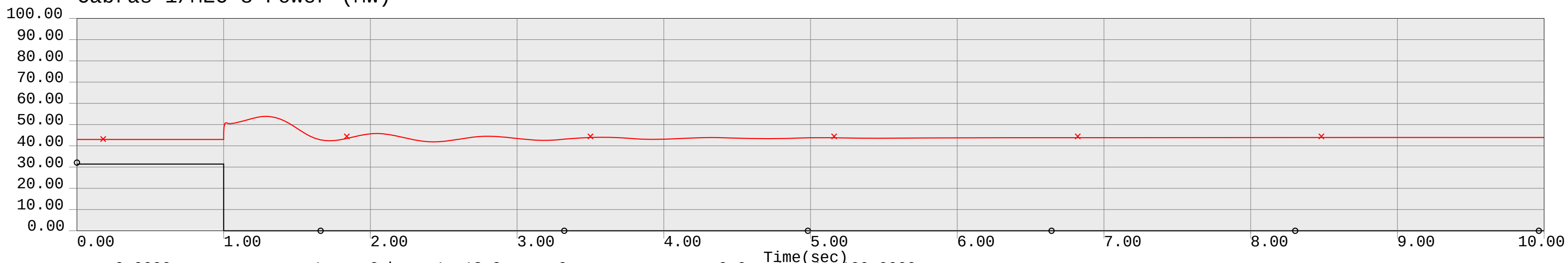
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



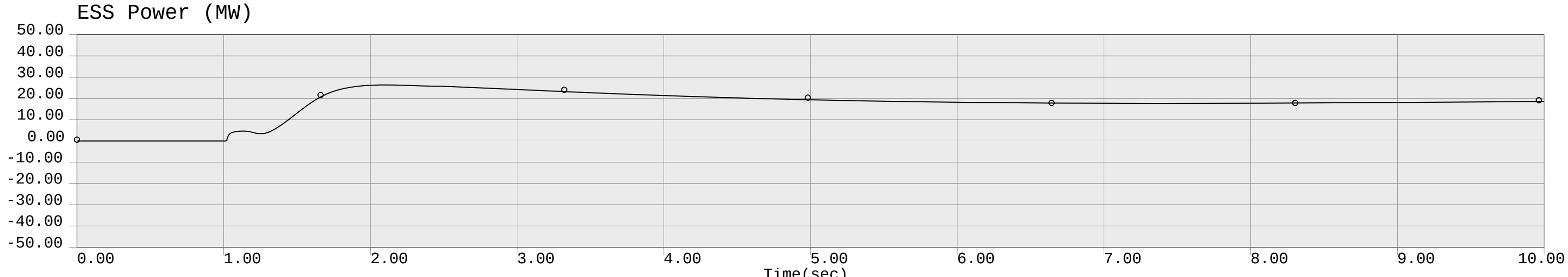
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



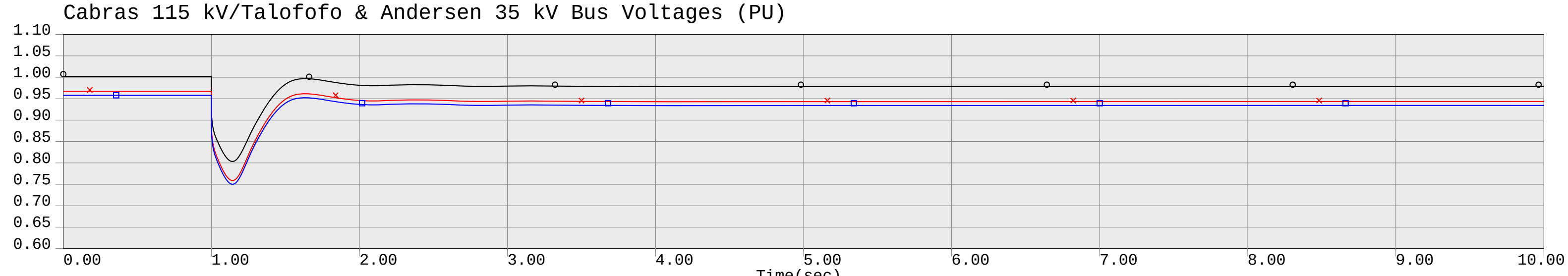
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

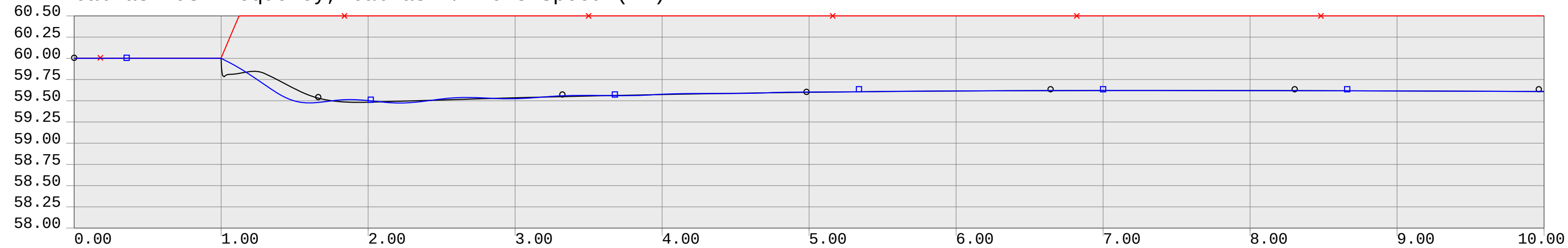
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

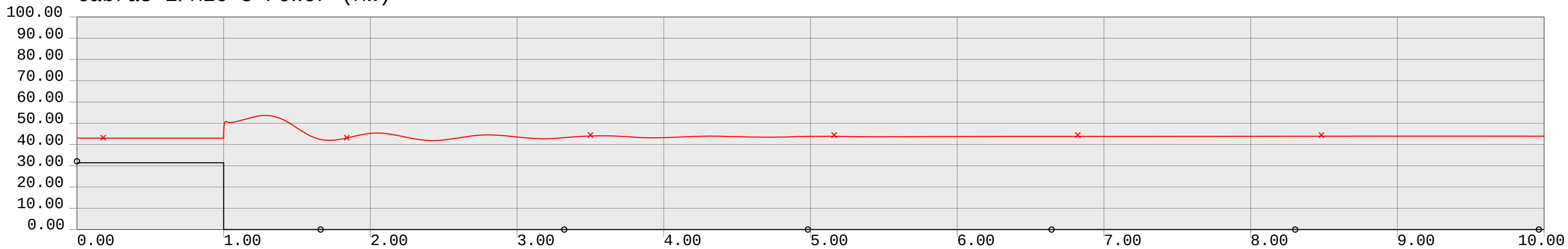
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



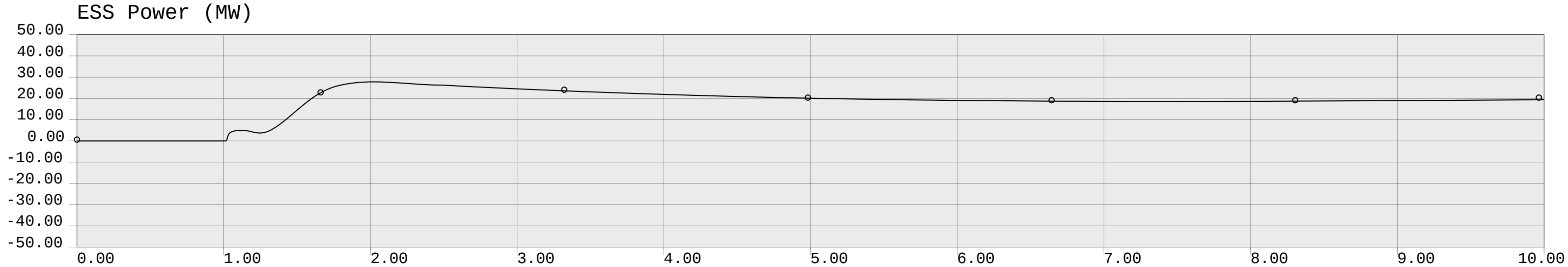
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



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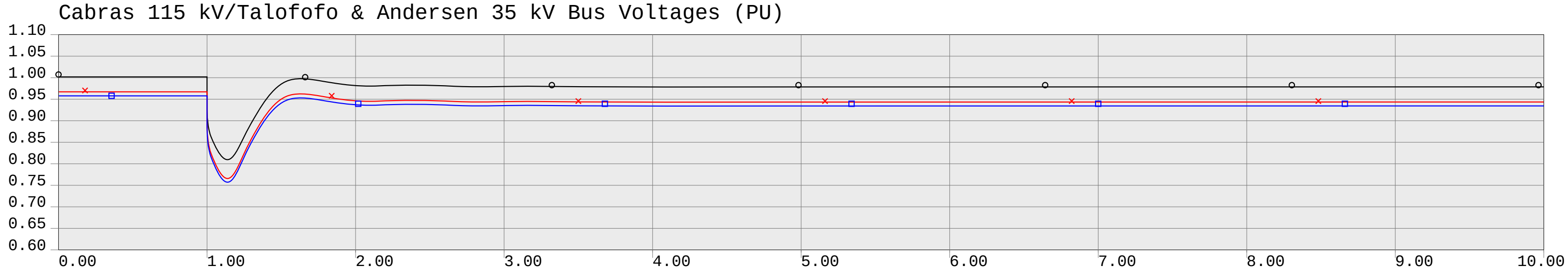
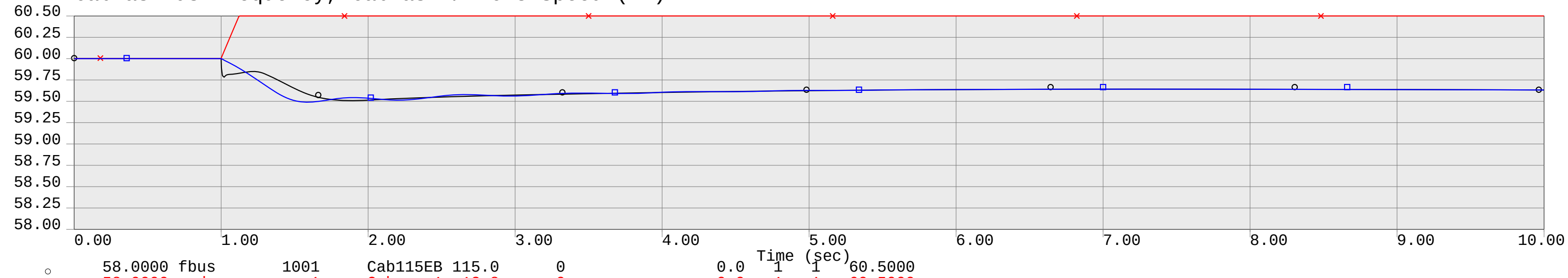
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

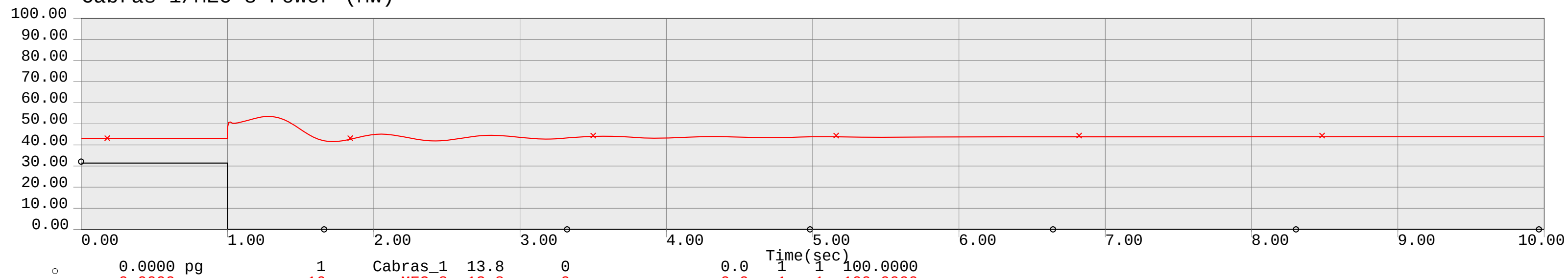
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



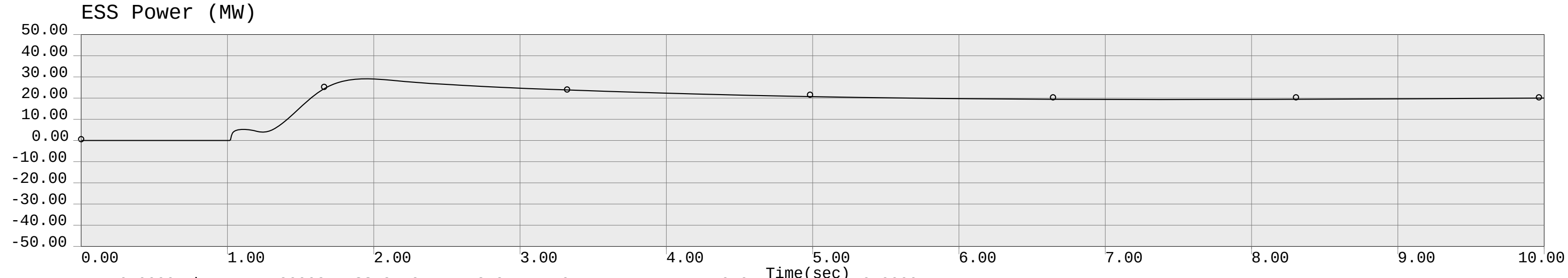
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



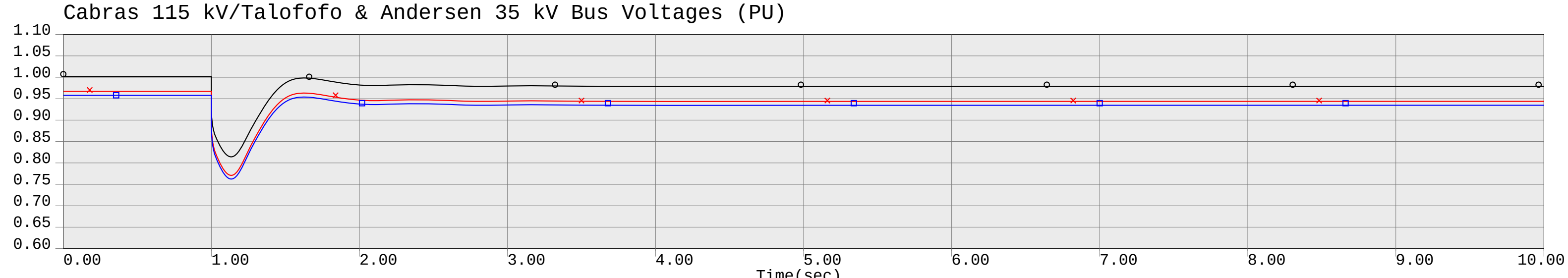
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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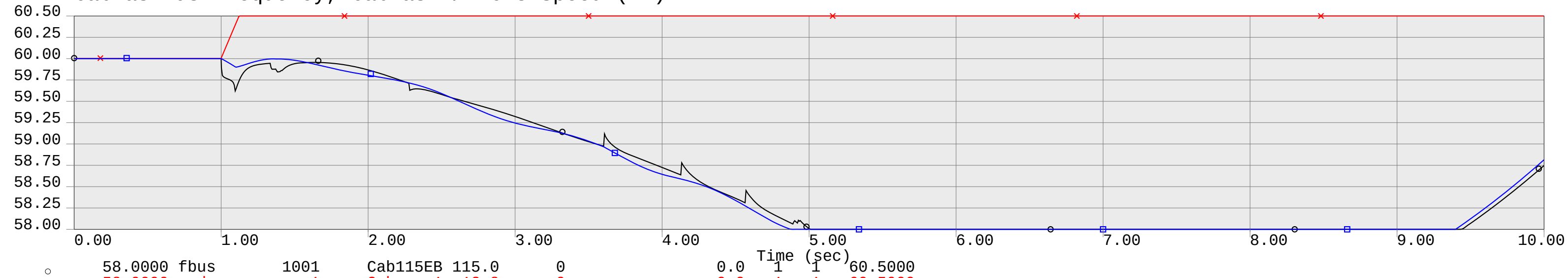
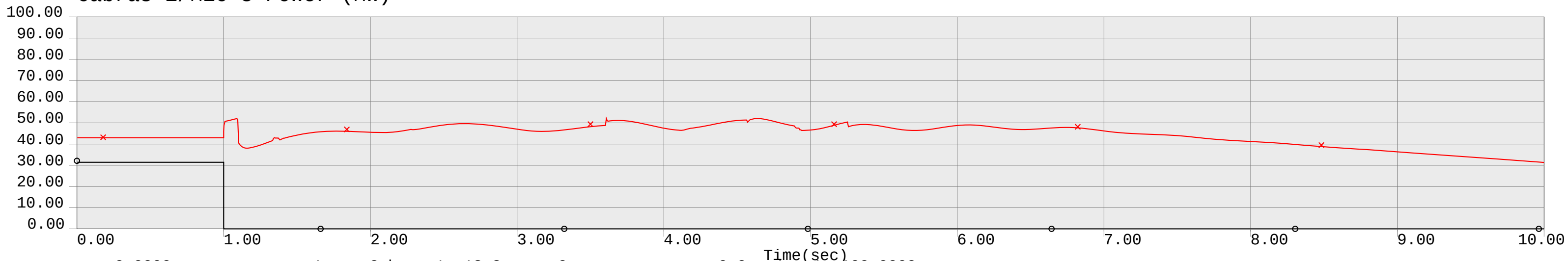
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



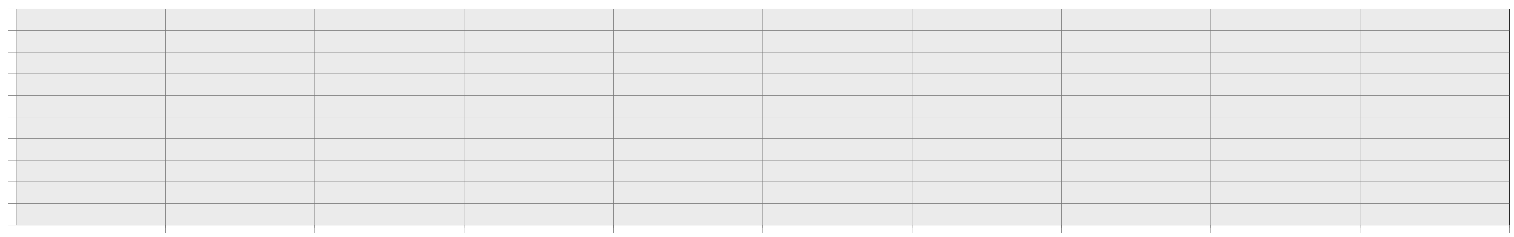
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)

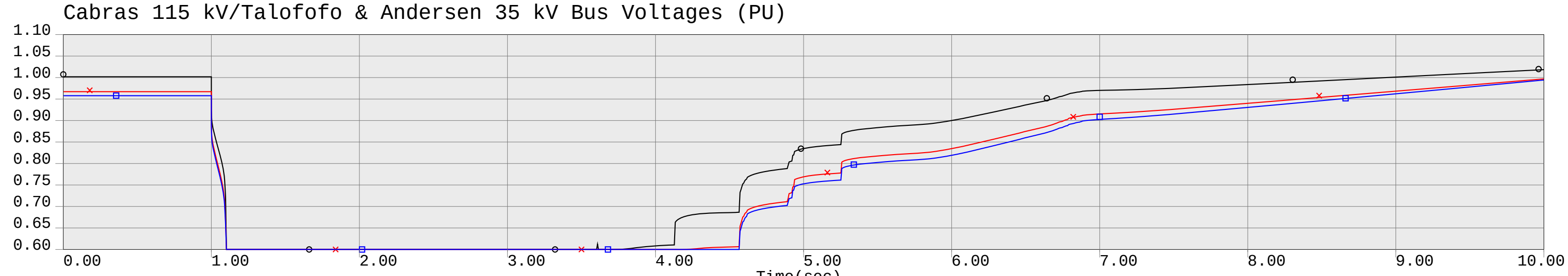


0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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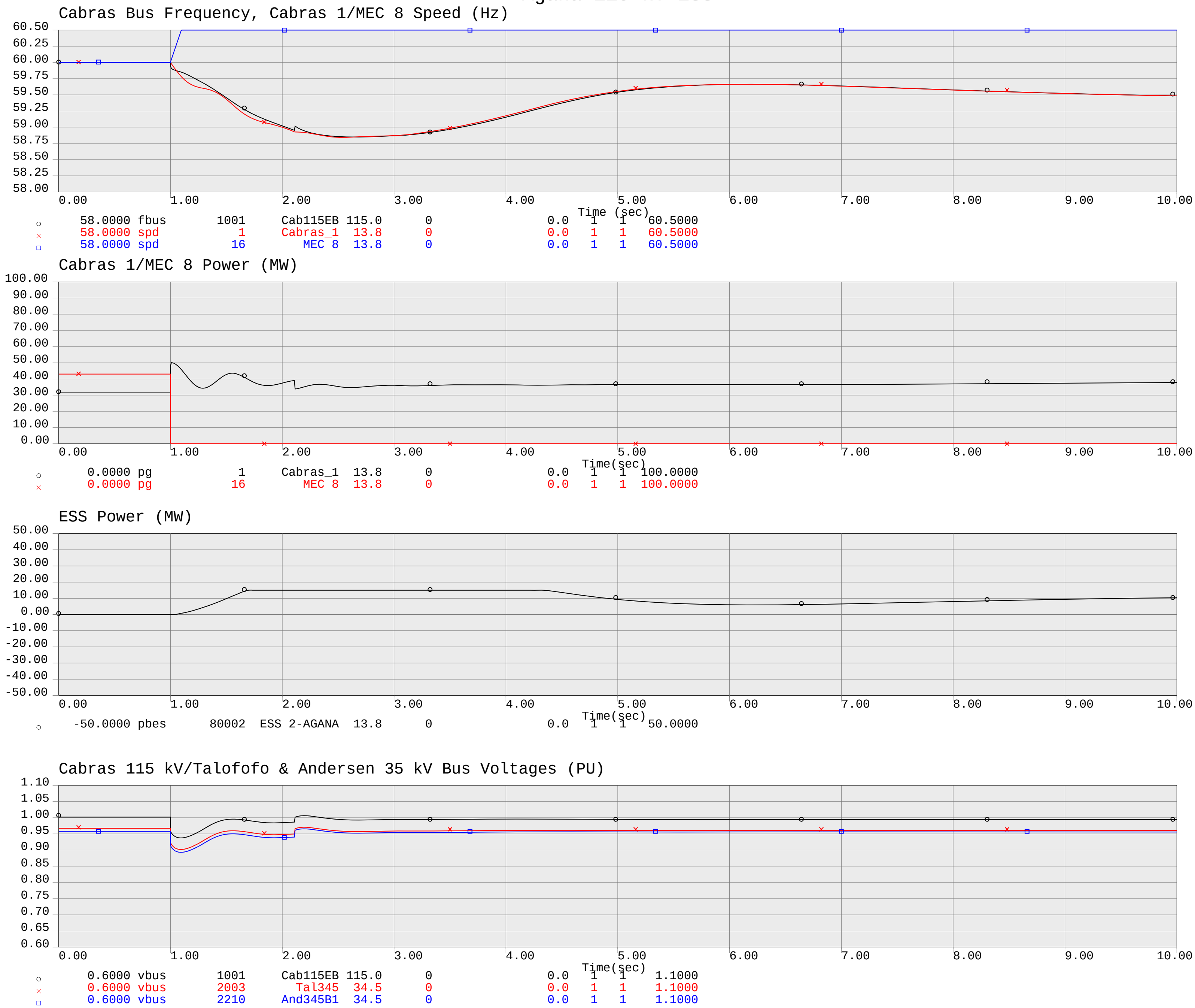
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



chans/2300-m8-1a.chf

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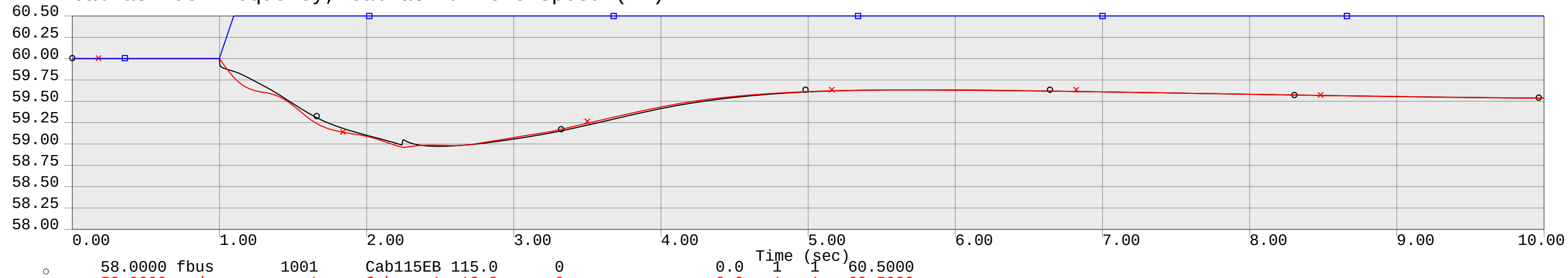
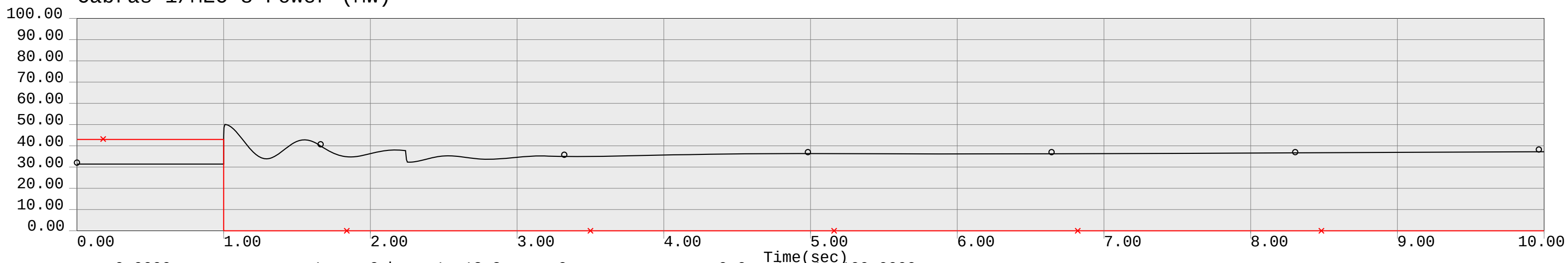
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



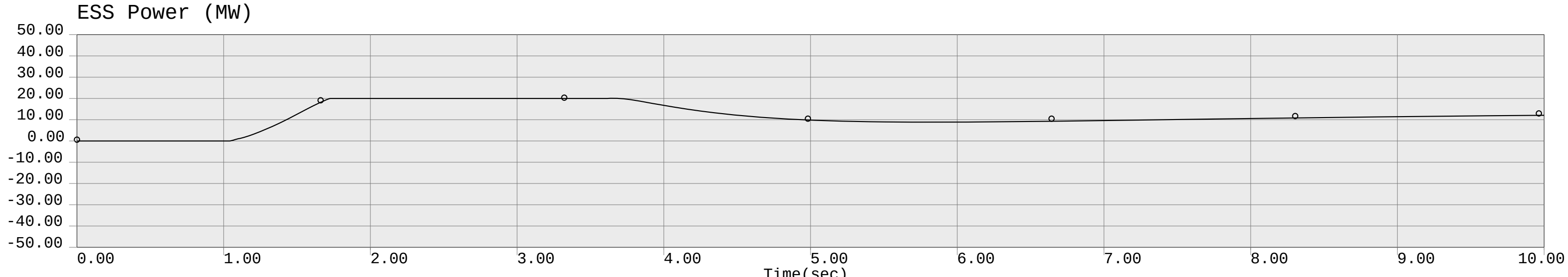
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



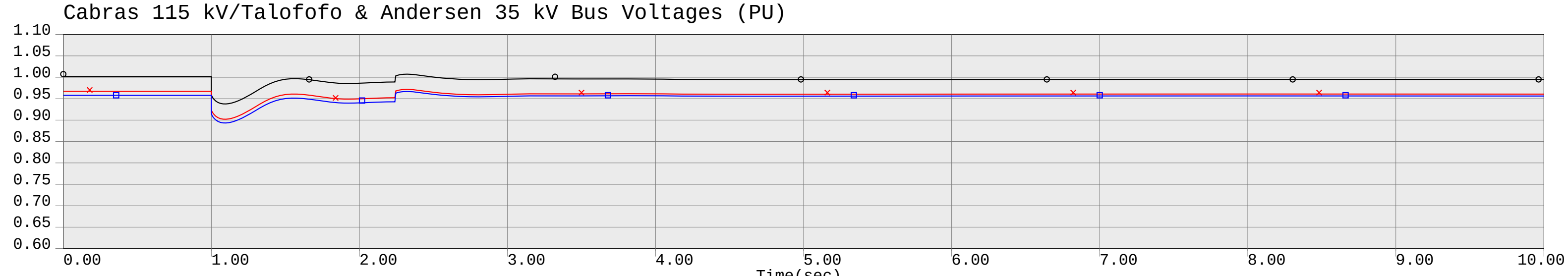
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

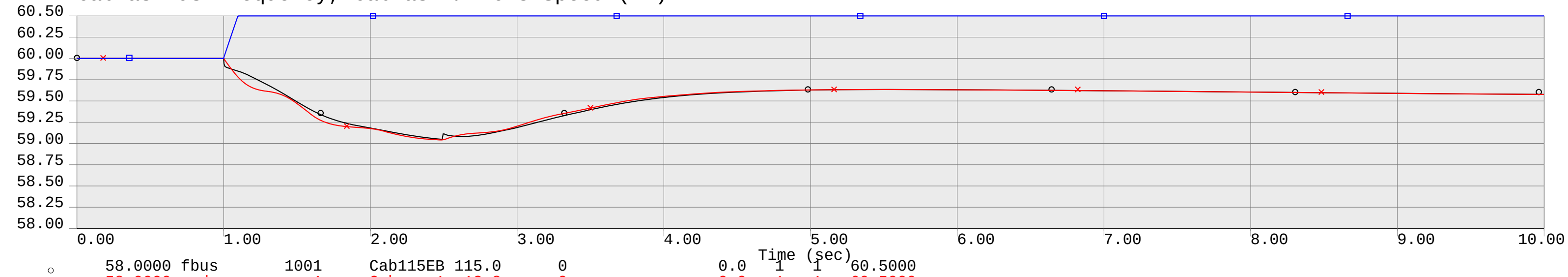
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

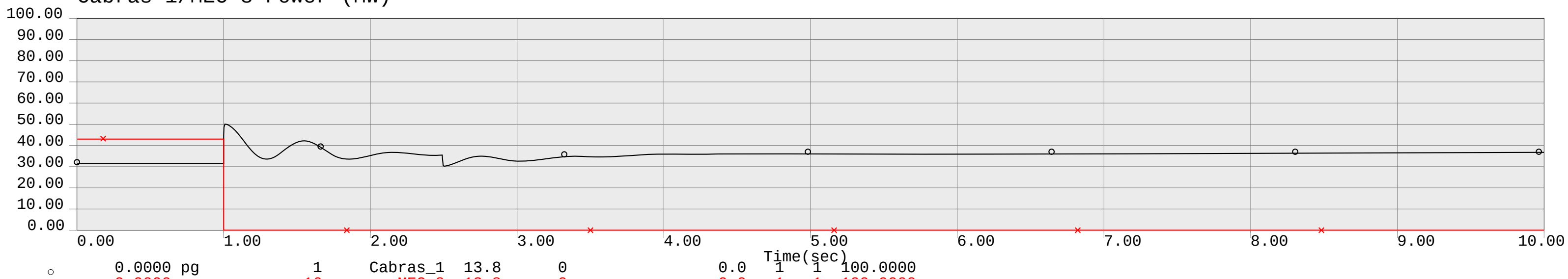
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



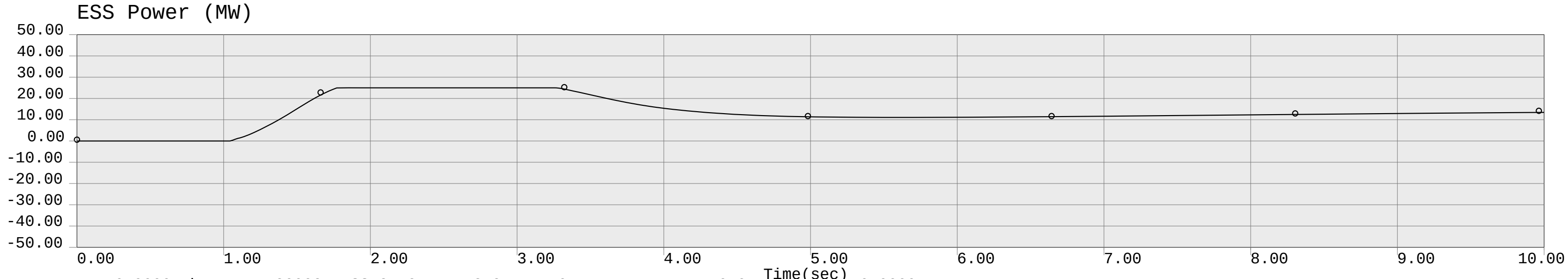
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



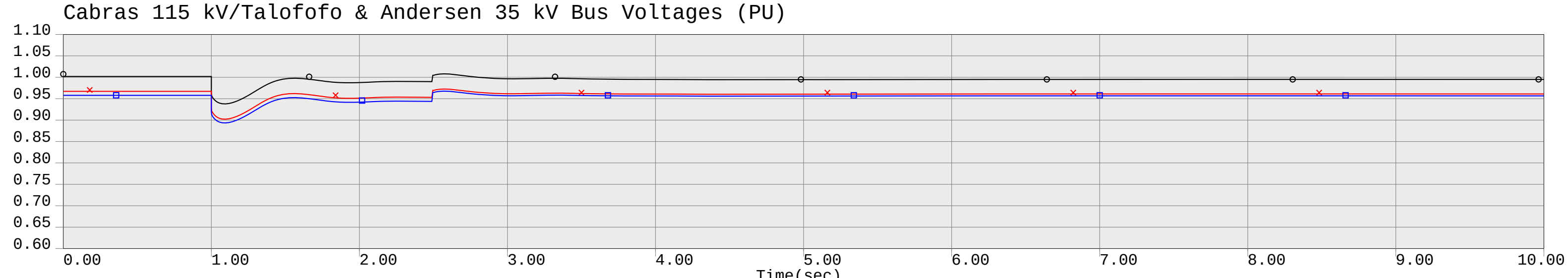
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

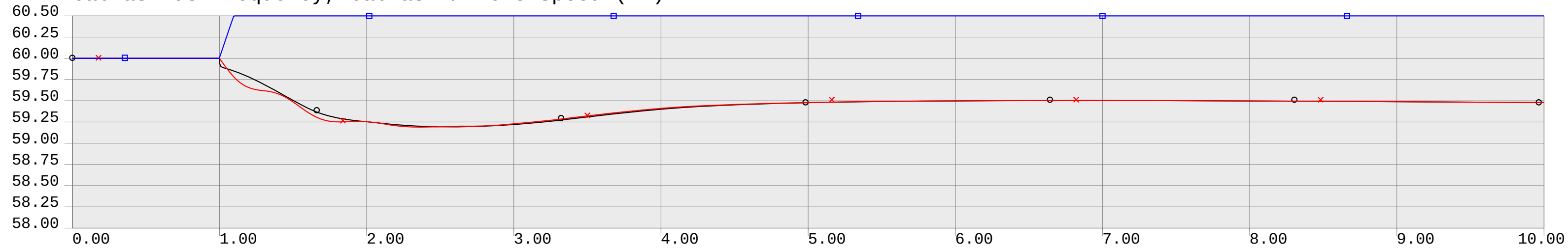
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

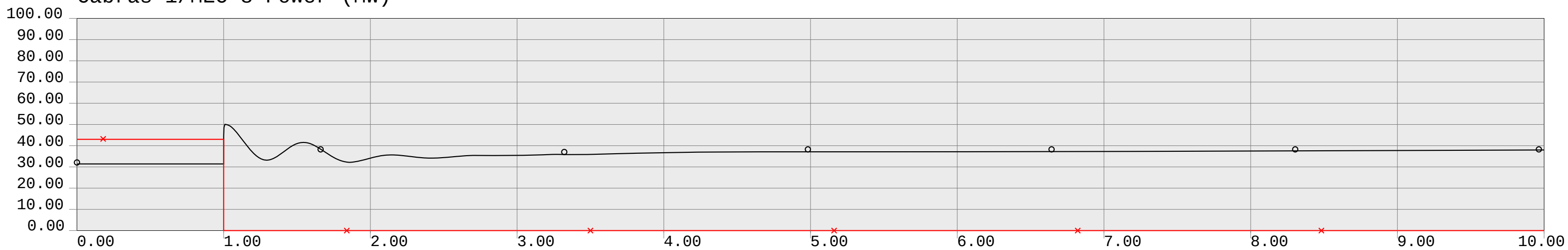
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



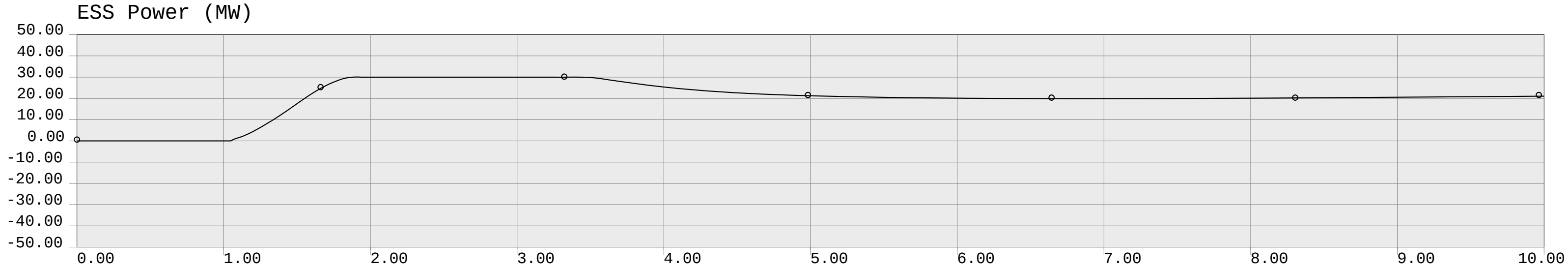
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



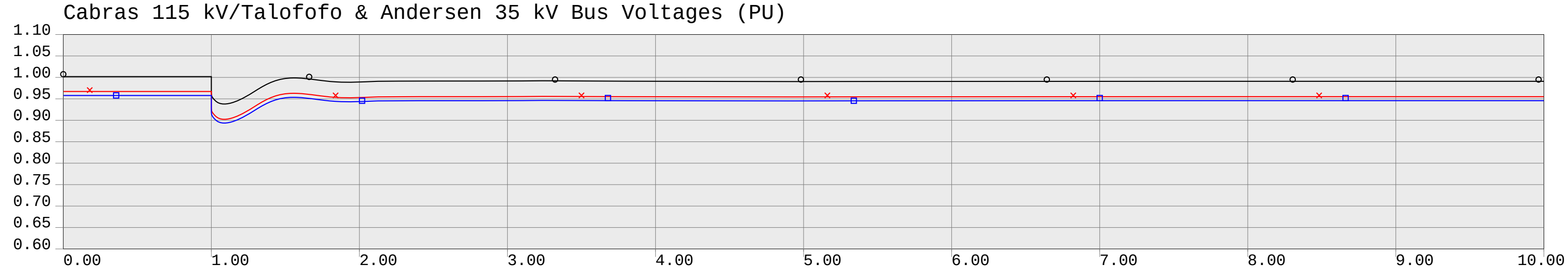
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

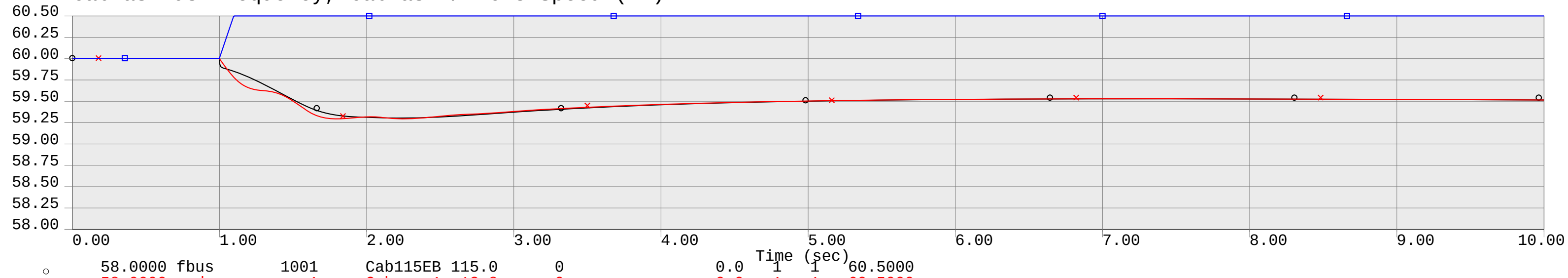
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

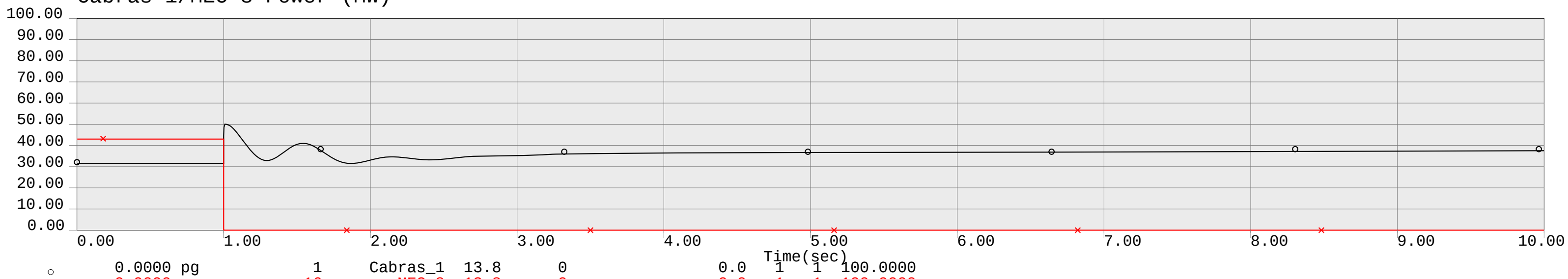
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



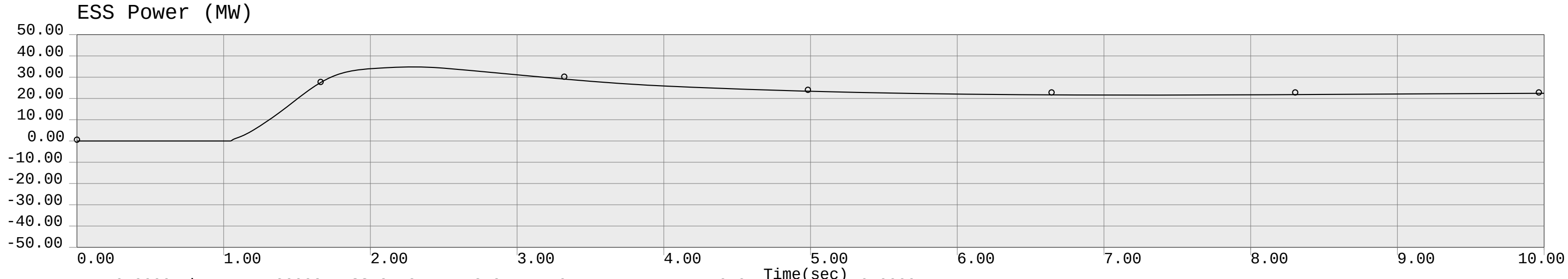
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



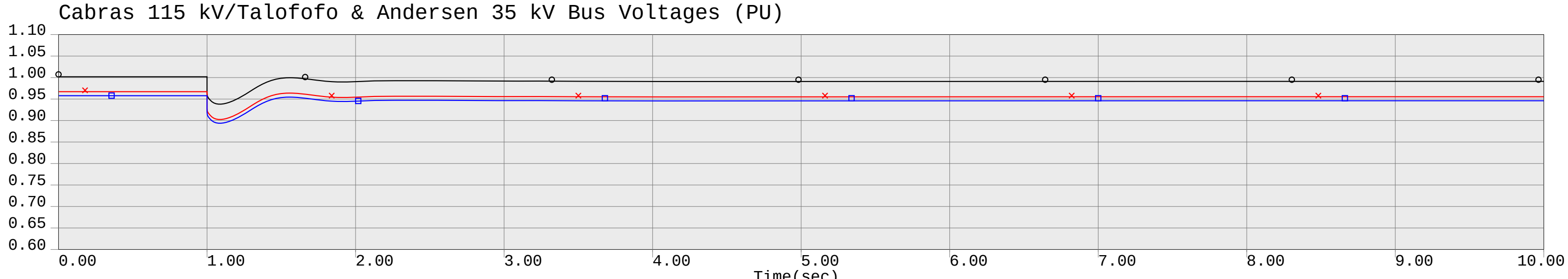
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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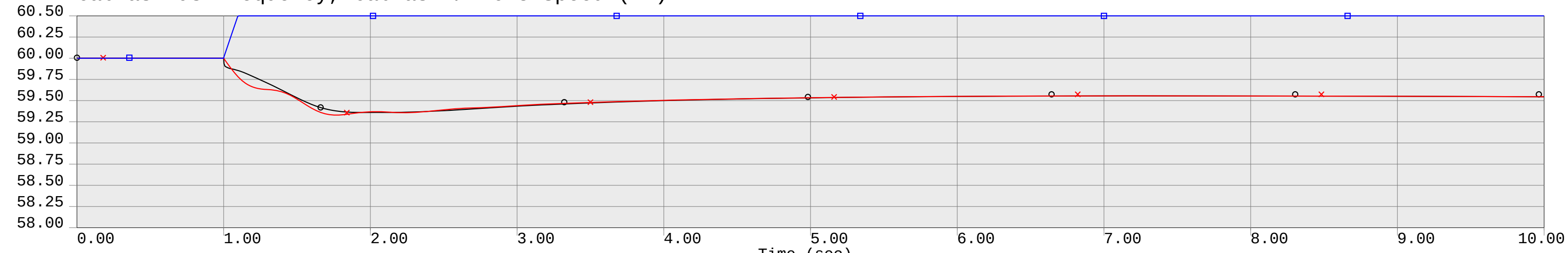
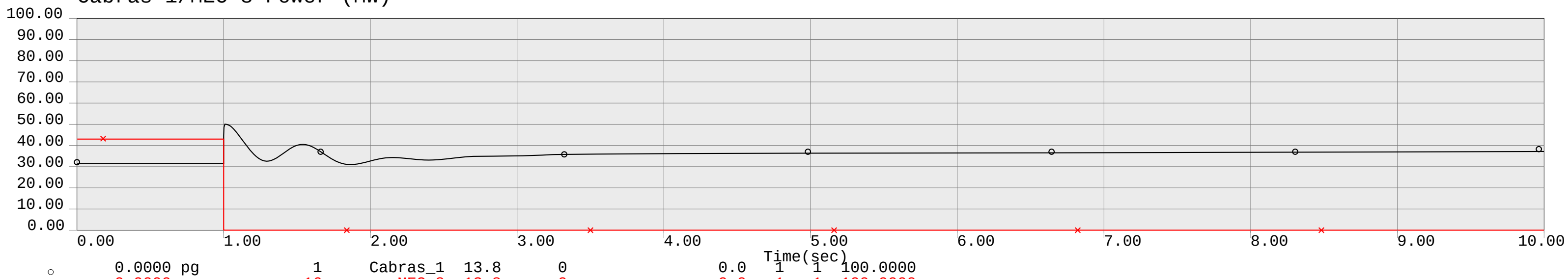
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



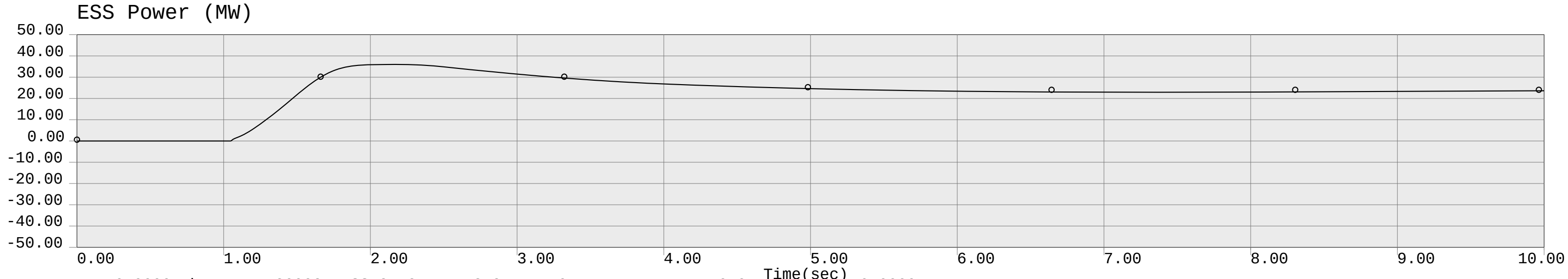
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



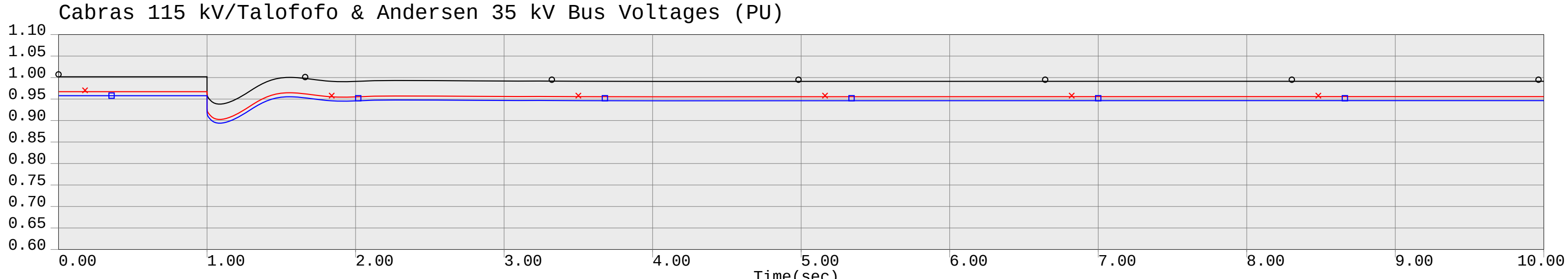
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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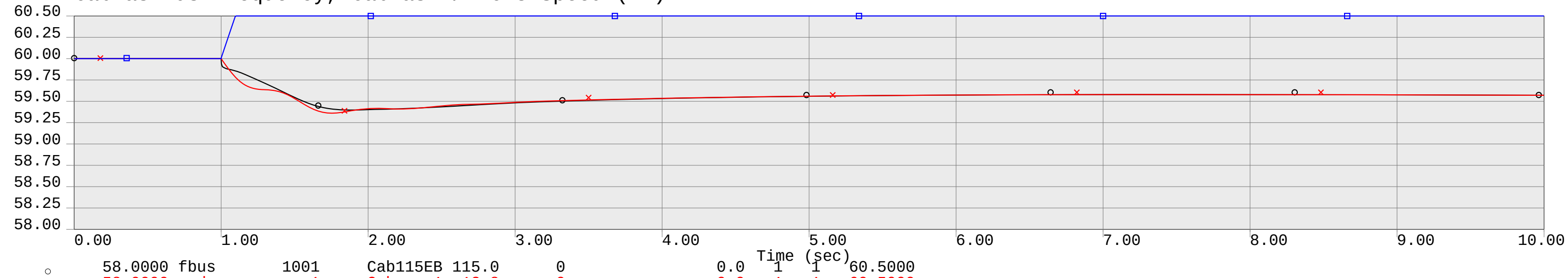
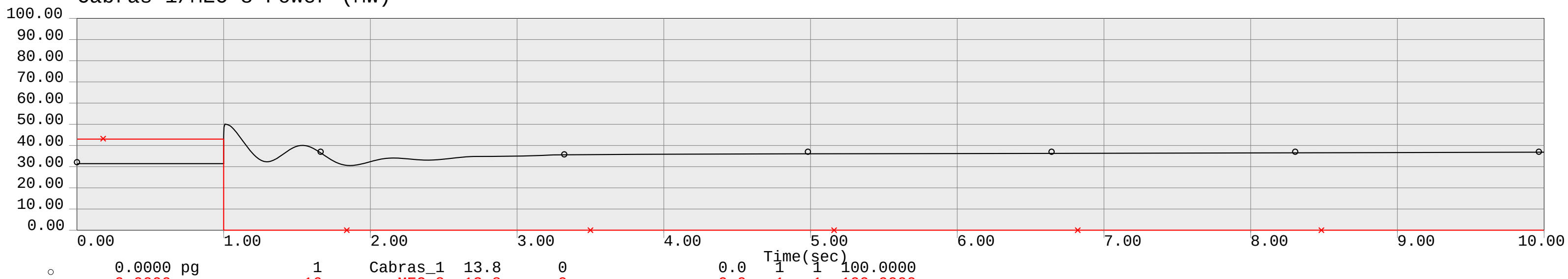
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



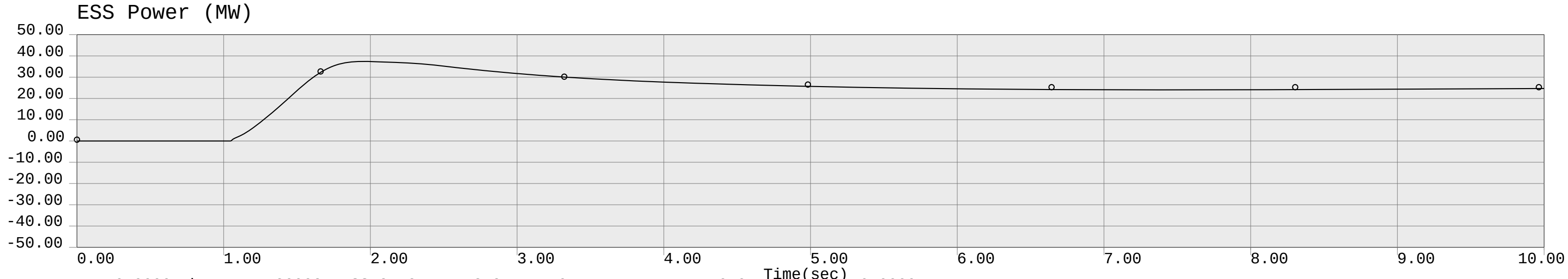
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



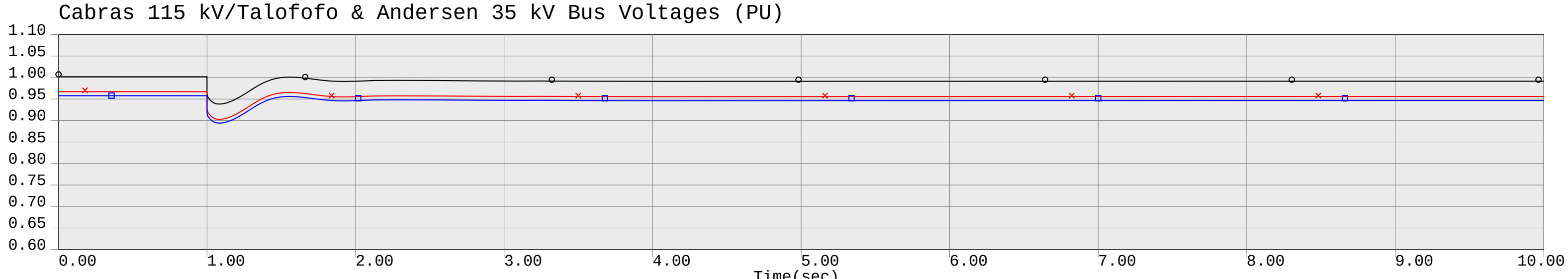
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

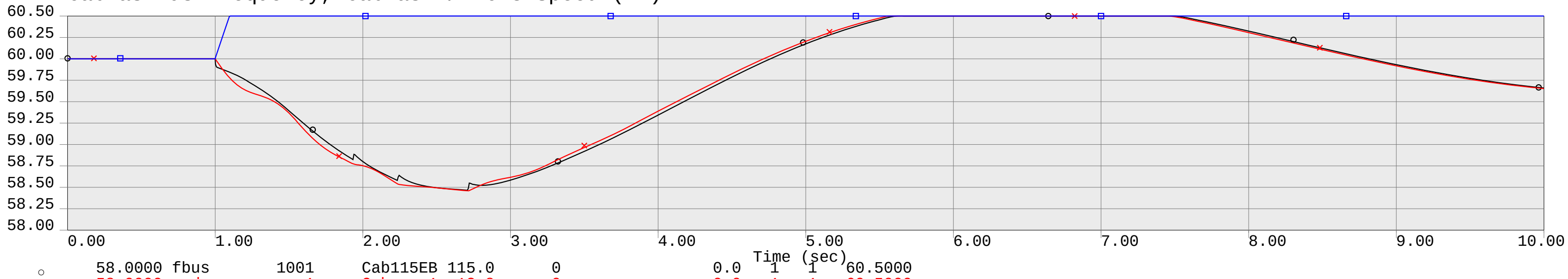
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)

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○  58.0000 fbus      1001   Cab115EB 115.0    0        0.0  1   1  60.5000
×  58.0000 spd          1   Cabras_1  13.8    0        0.0  1   1  60.5000
□  58.0000 spd         16      MEC 8  13.8    0        0.0  1   1  60.5000
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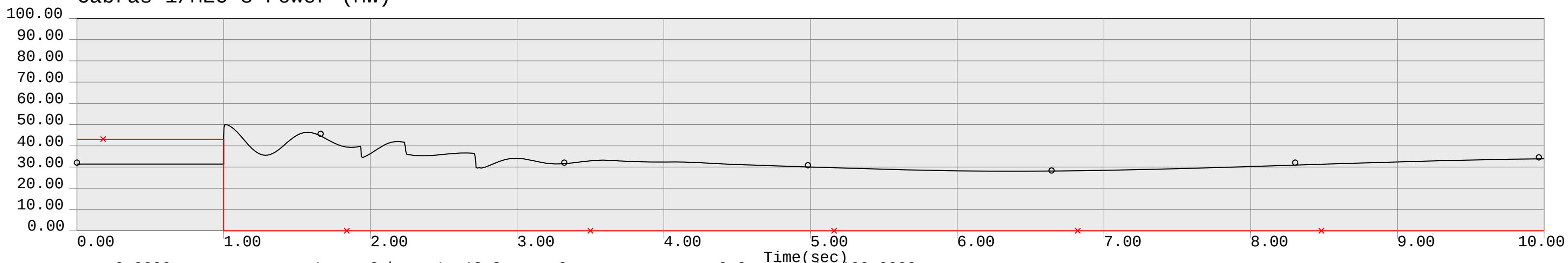
Cabras 1/MEC 8 Power (MW)

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○    0.0000 pg          1   Cabras_1  13.8    0        0.0  1   1 100.0000
×    0.0000 pg         16      MEC 8  13.8    0        0.0  1   1 100.0000
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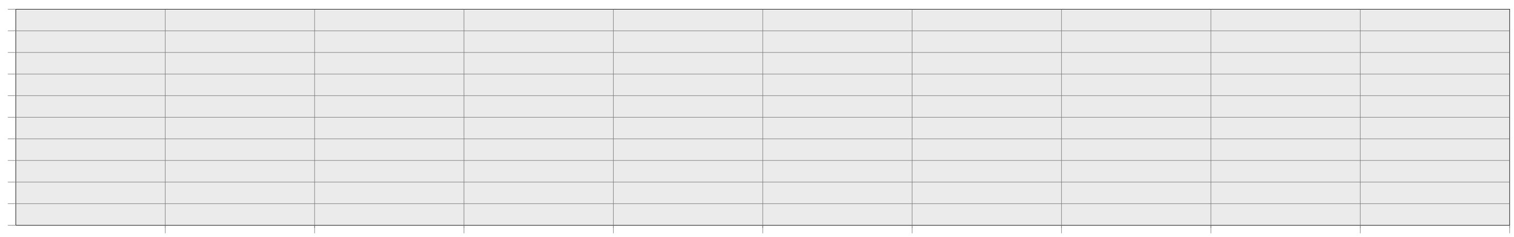
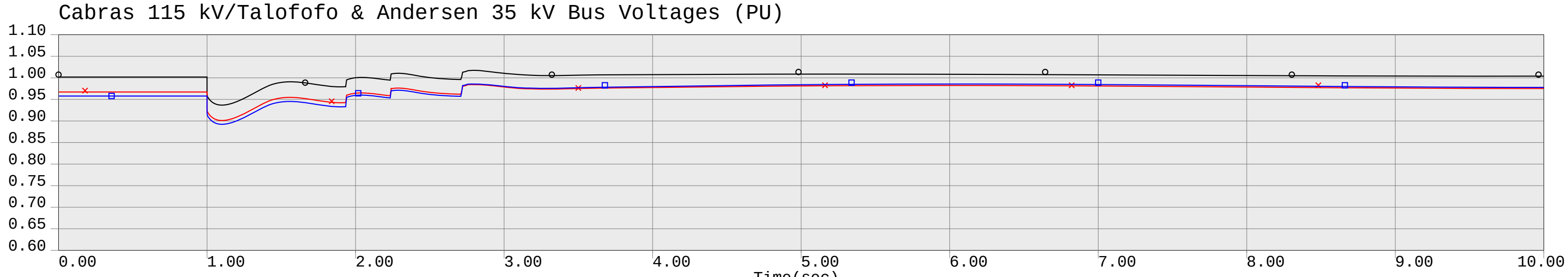
ESS Power (MW)



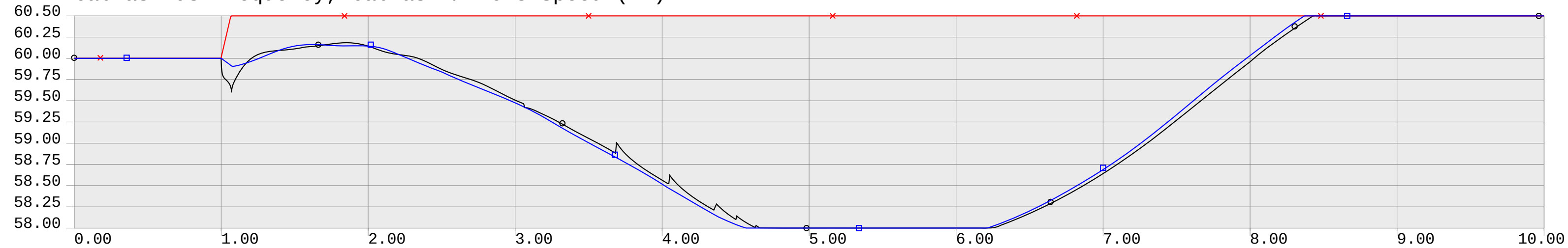
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○    0.6000 vbus     1001   Cab115EB 115.0    0        0.0  1   1   1.1000
×    0.6000 vbus     2003     Tal345  34.5    0        0.0  1   1   1.1000
□    0.6000 vbus     2210   And345B1  34.5    0        0.0  1   1   1.1000
```

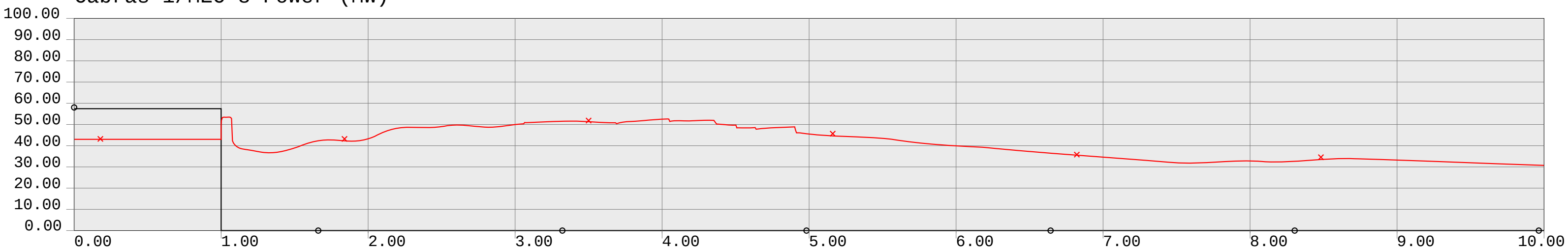
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



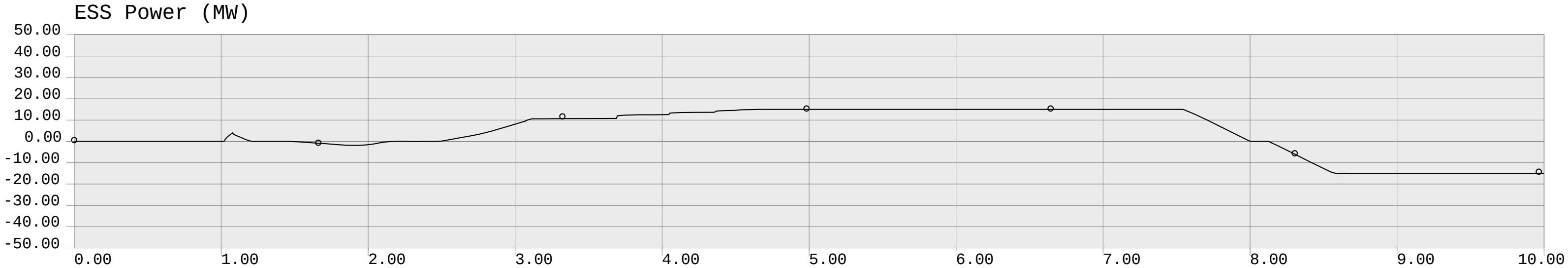
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



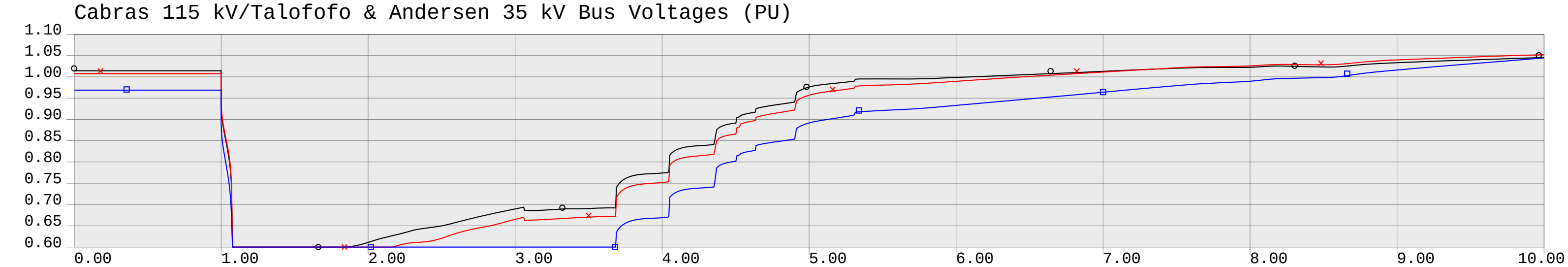
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

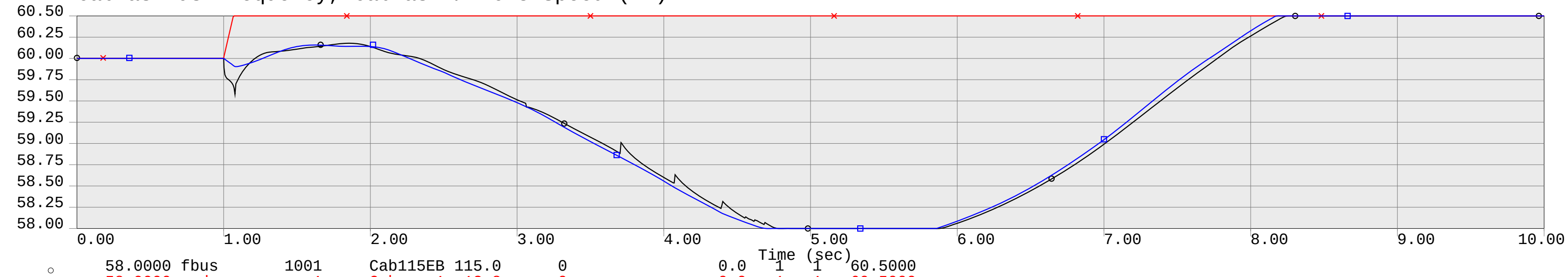
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

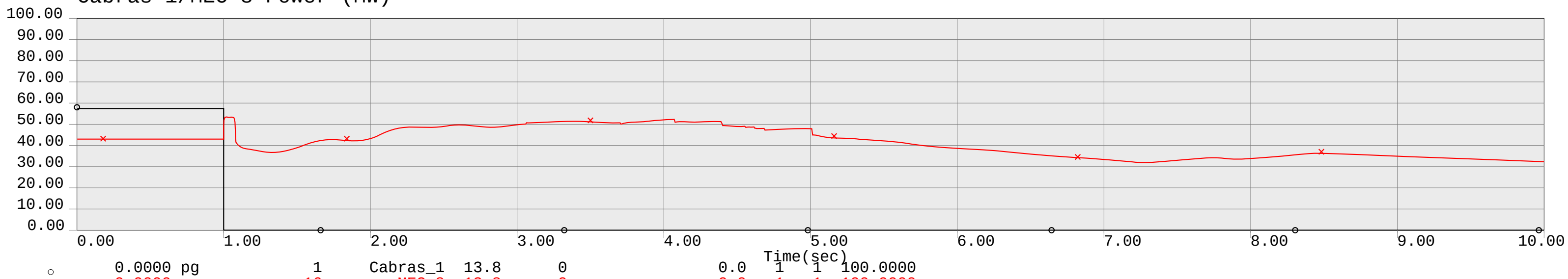
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



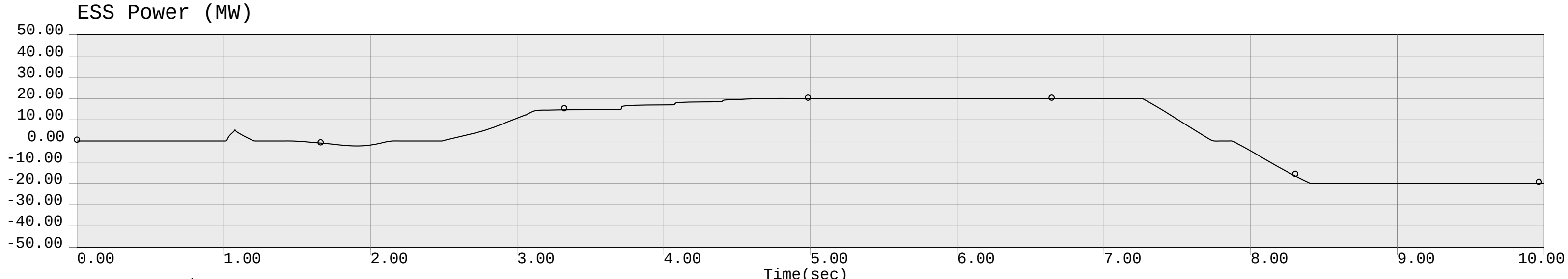
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



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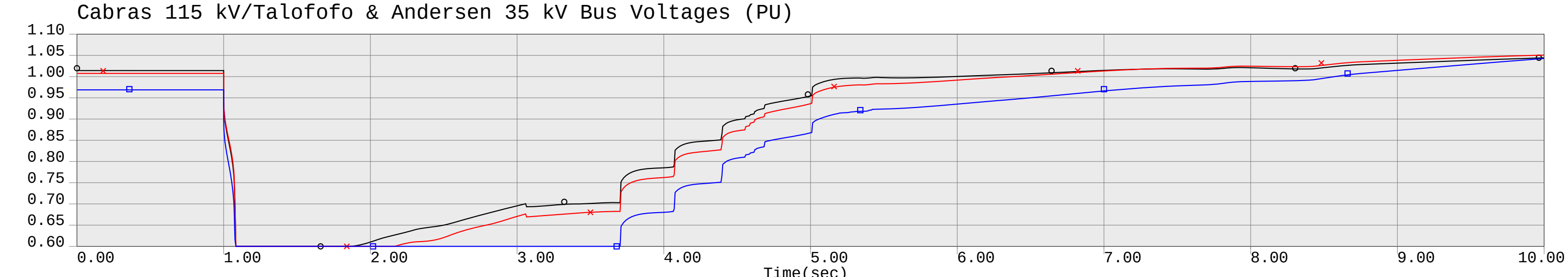
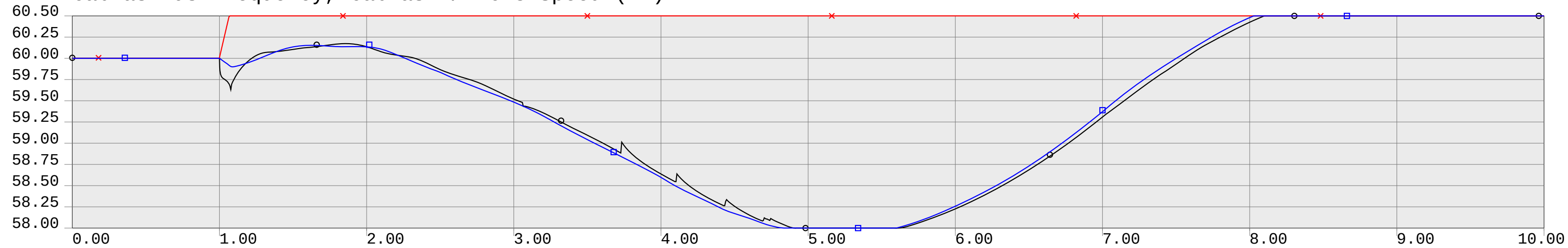
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

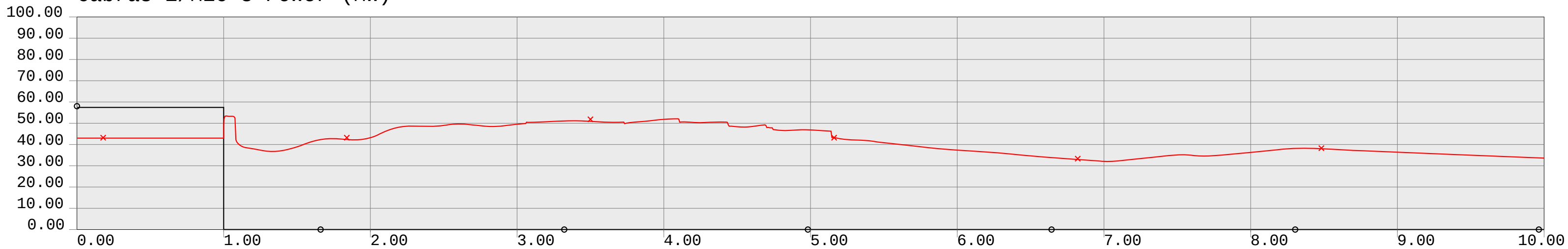
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



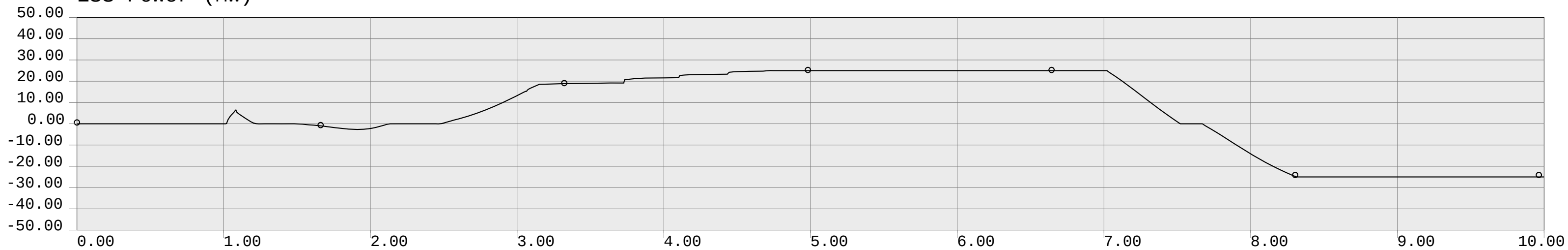

```
○ 58.0000 fbus   1001 Cab115EB 115.0 0   0.0 1 1 60.5000
× 58.0000 spd       1 Cabras_1  13.8 0   0.0 1 1 60.5000
□ 58.0000 spd      16    MEC 8  13.8 0   0.0 1 1 60.5000
```

Cabras 1/MEC 8 Power (MW)




```
○ 0.0000 pg       1 Cabras_1  13.8 0   0.0 1 1 100.0000
× 0.0000 pg      16    MEC 8  13.8 0   0.0 1 1 100.0000
```

ESS Power (MW)




```
○ -50.0000 pbes  80002 ESS 2-AGANA 13.8 0   0.0 1 1 50.0000
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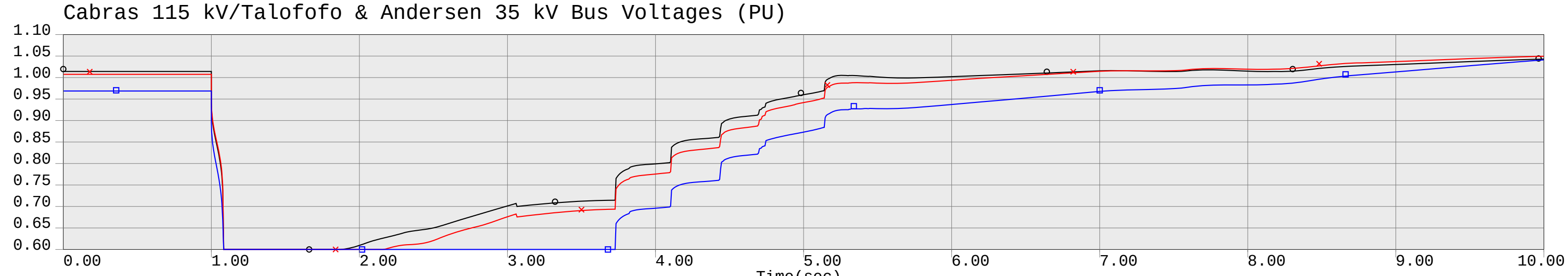
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○ 0.6000 vbus   1001 Cab115EB 115.0 0   0.0 1 1 1.1000
× 0.6000 vbus   2003   Tal345  34.5 0   0.0 1 1 1.1000
□ 0.6000 vbus   2210 And345B1  34.5 0   0.0 1 1 1.1000
```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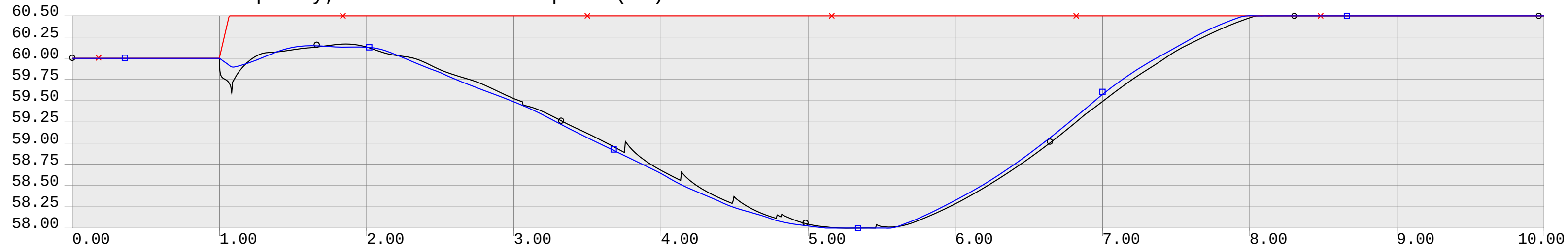
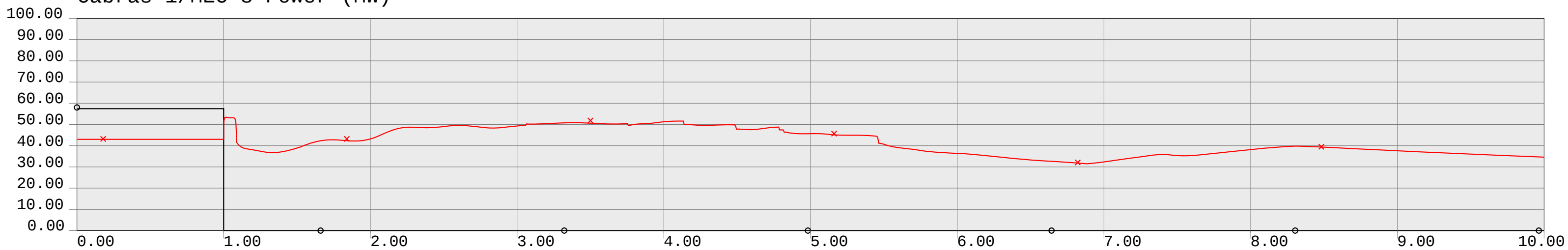
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



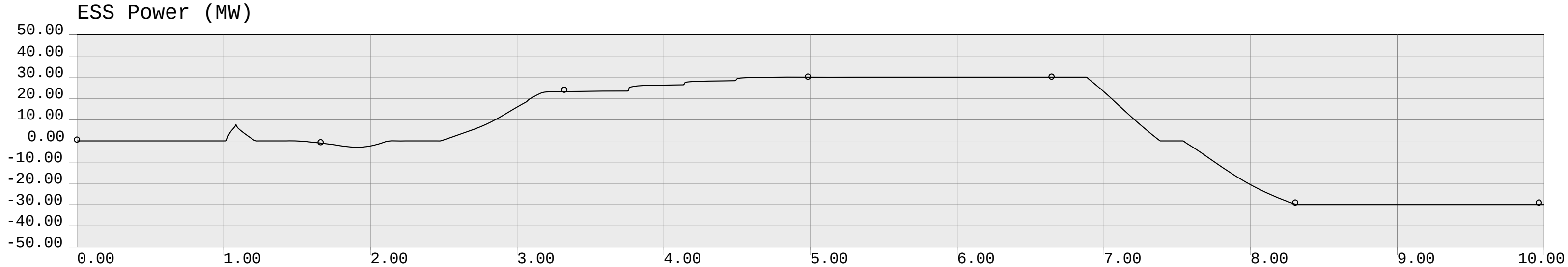
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



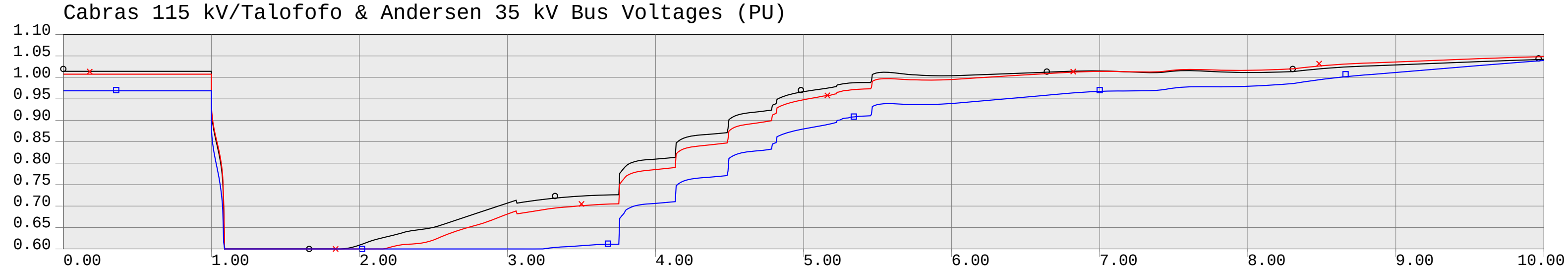
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

chans/2400-c1-1d.chf

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Guam Power Authority - EPS Energy Storage Analysis
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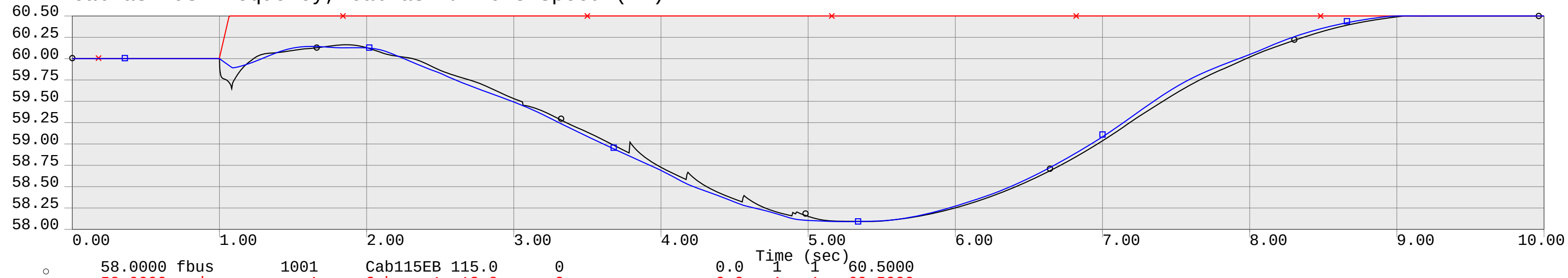
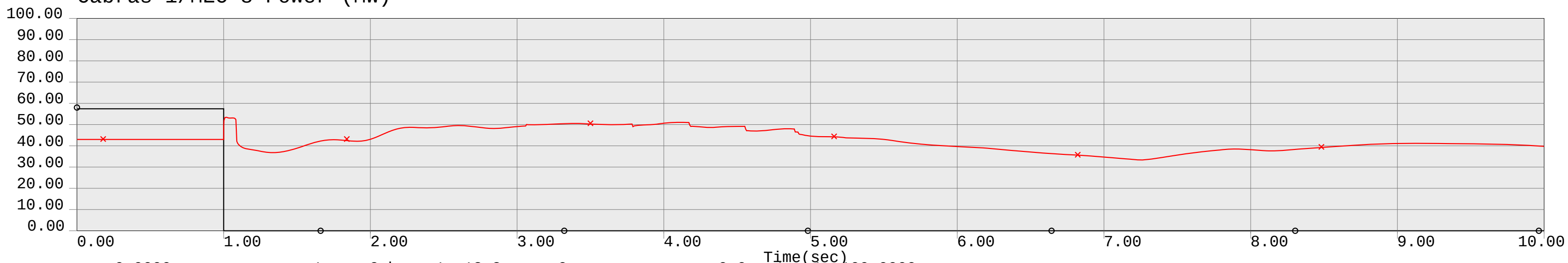
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



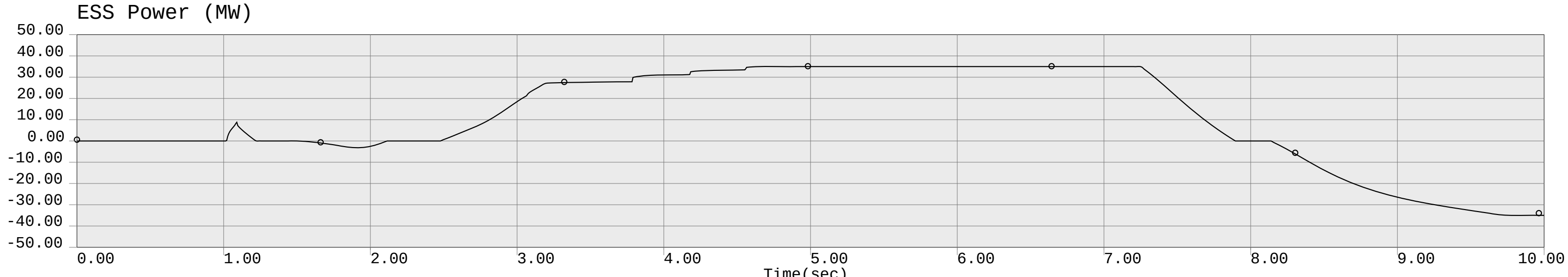
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



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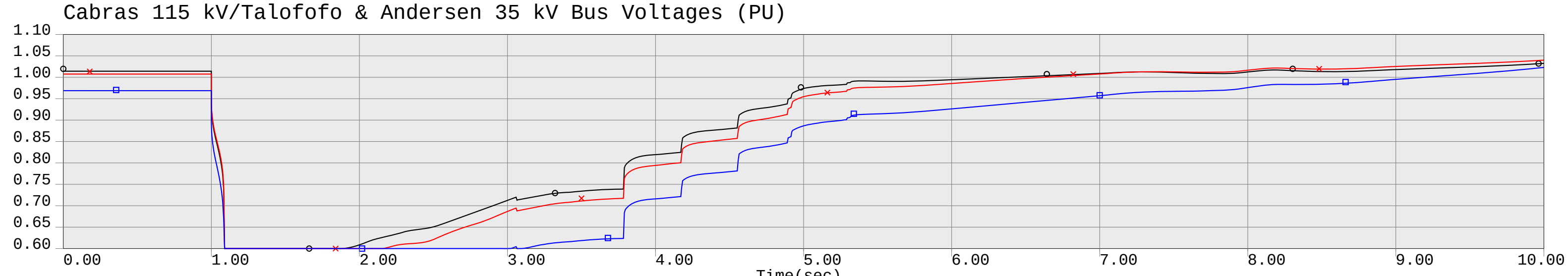
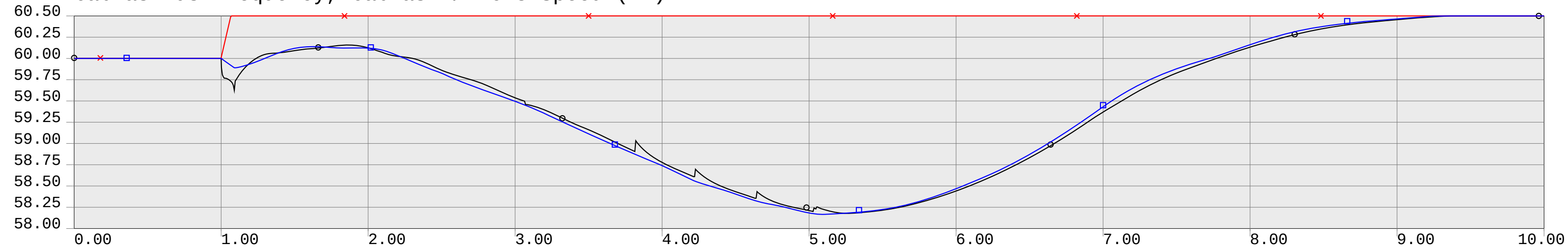
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
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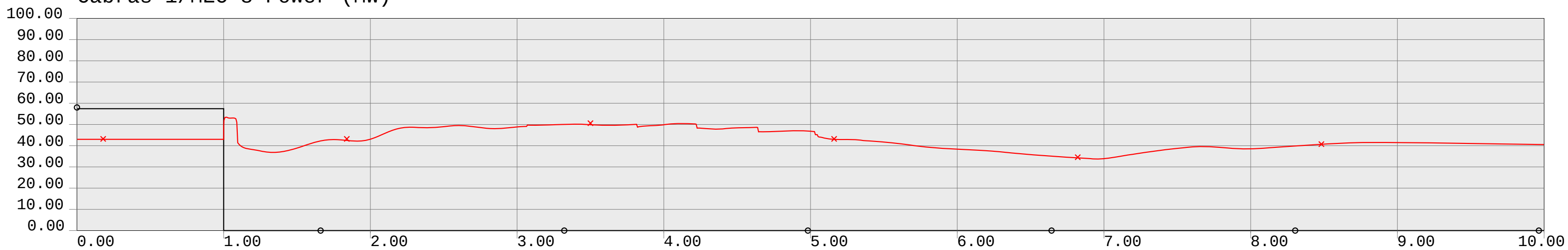
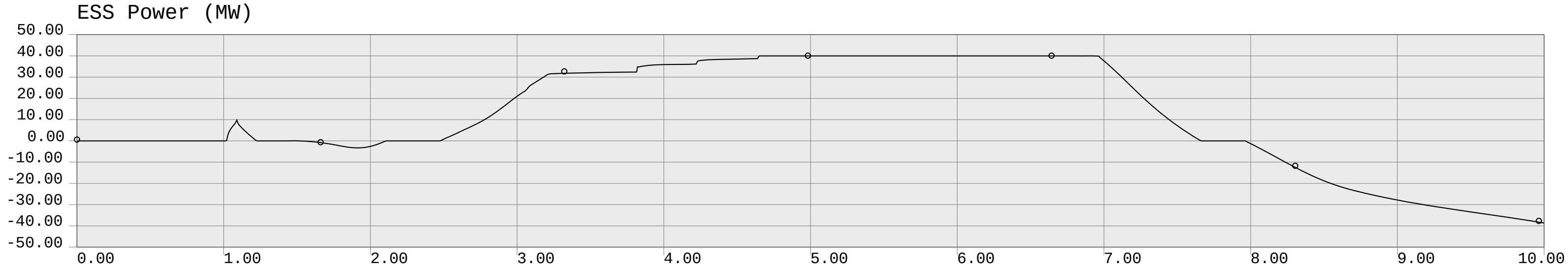
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



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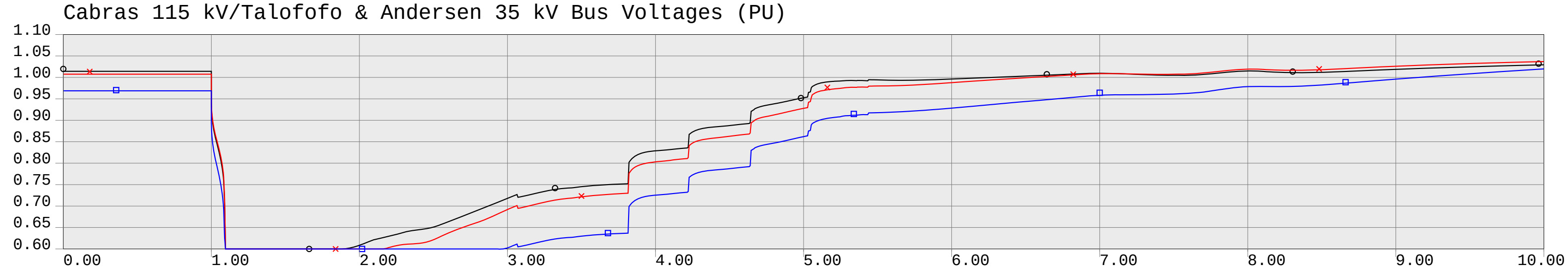
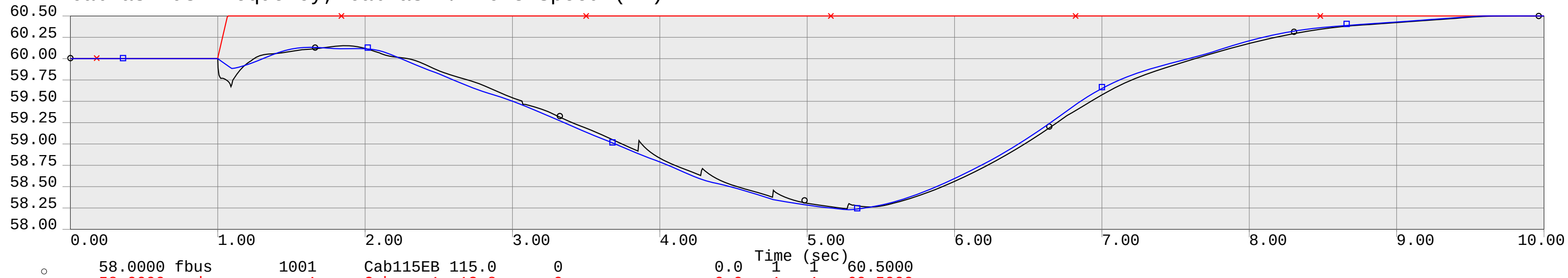
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

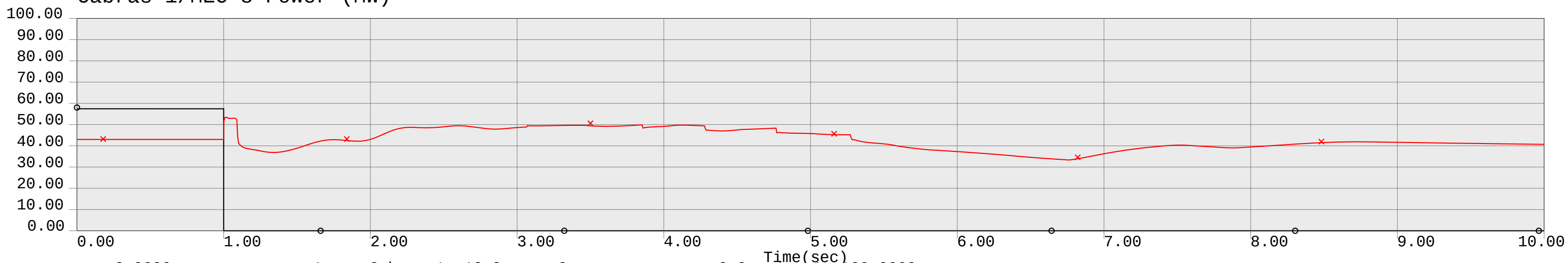
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



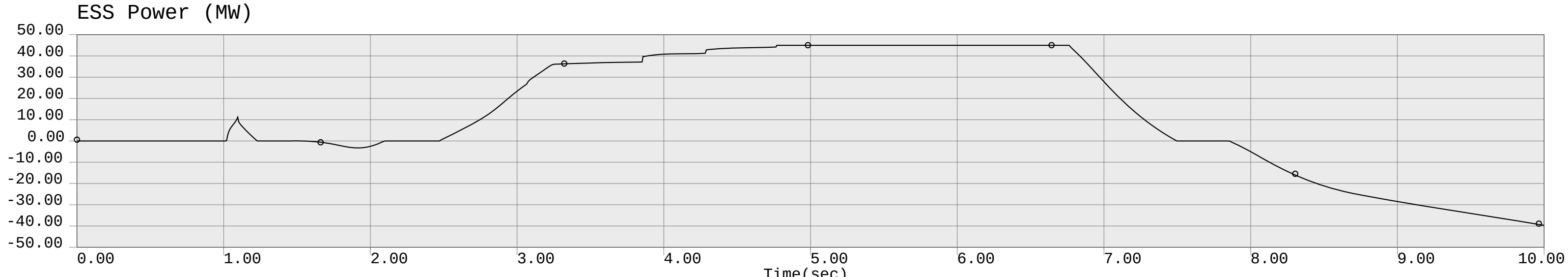
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



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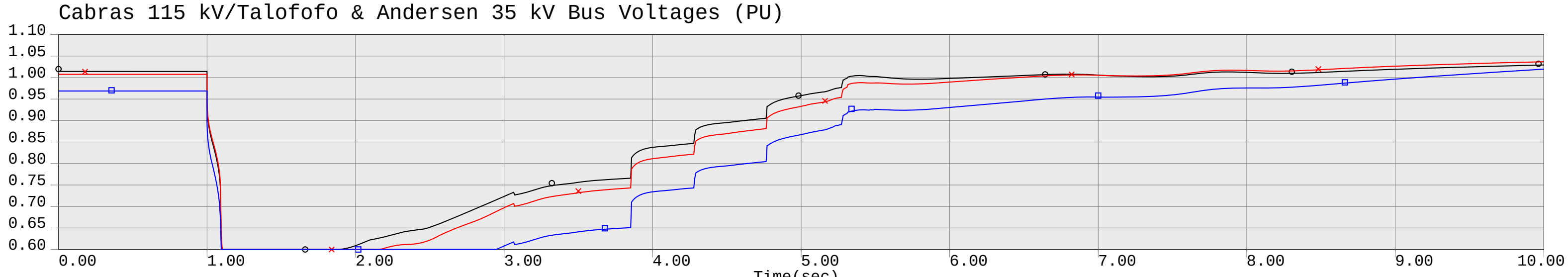
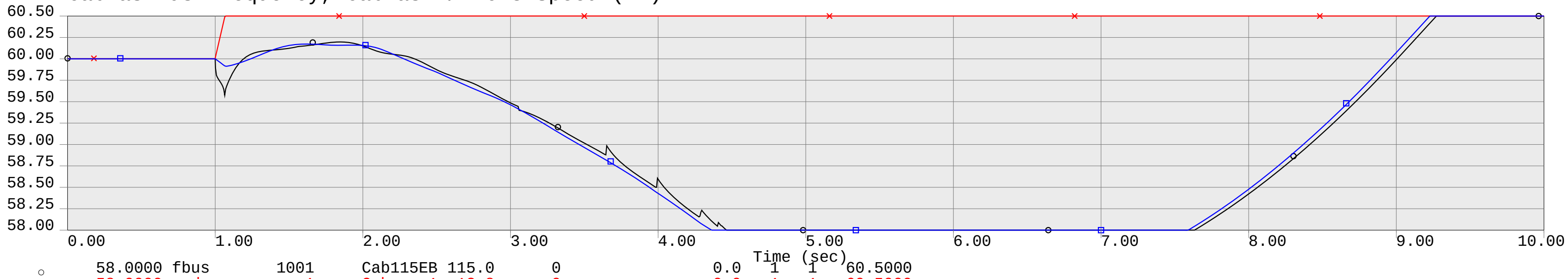
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

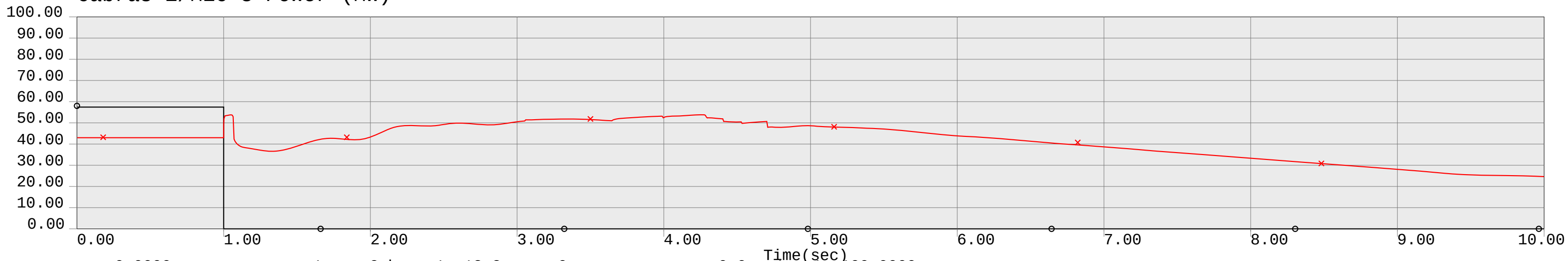
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



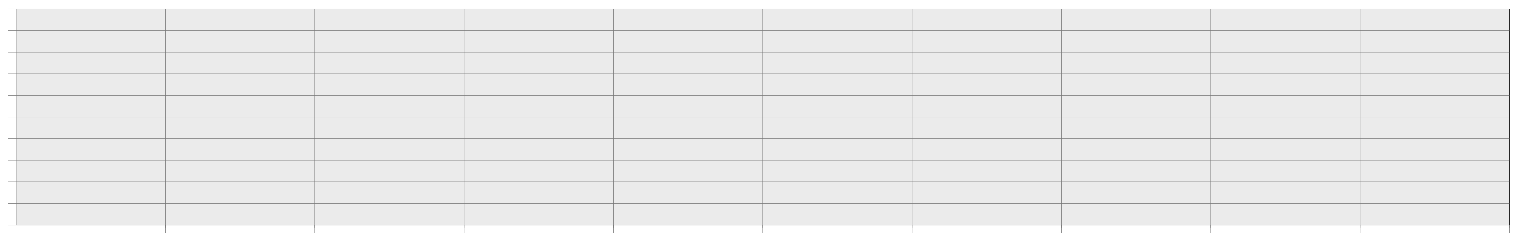
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)

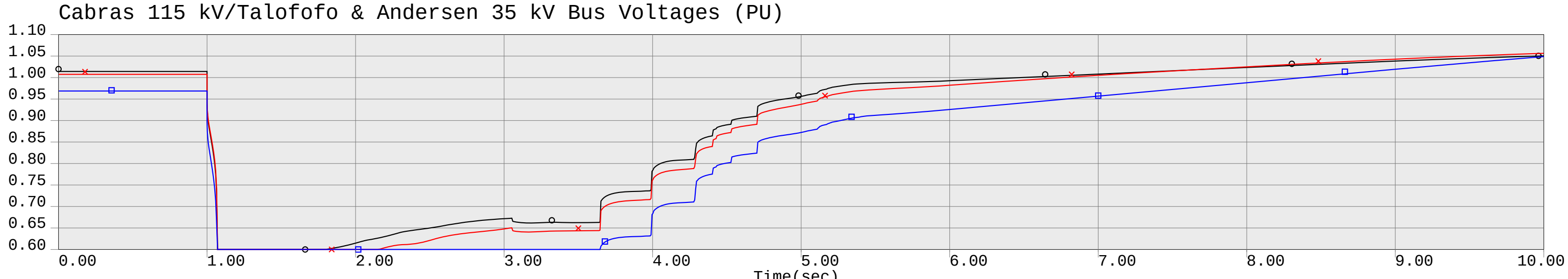


0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)

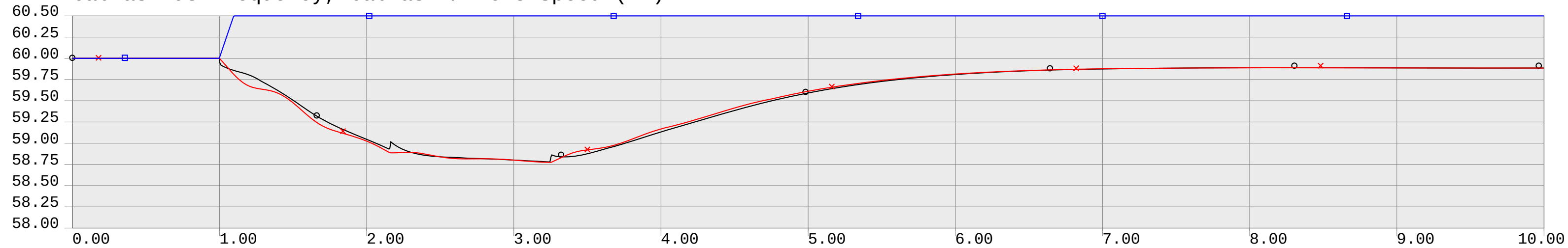


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



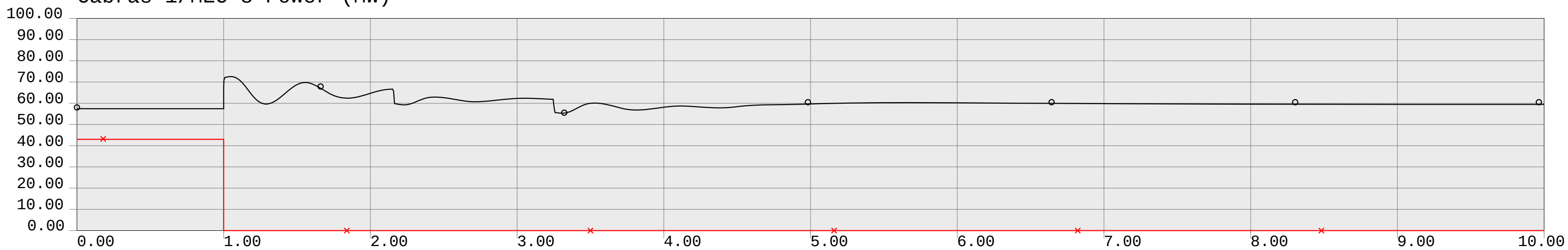
0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



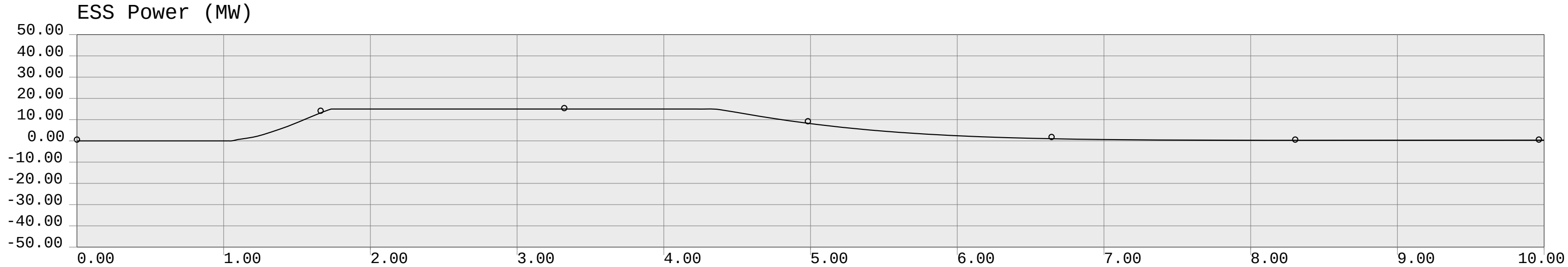
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



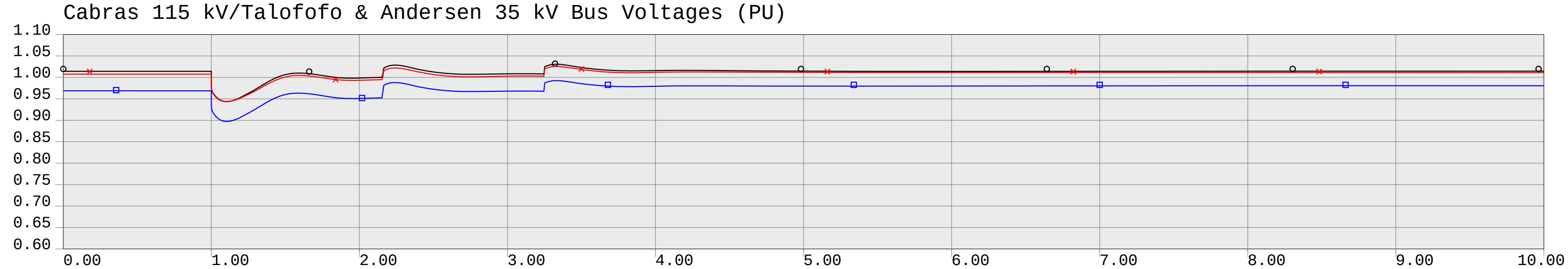
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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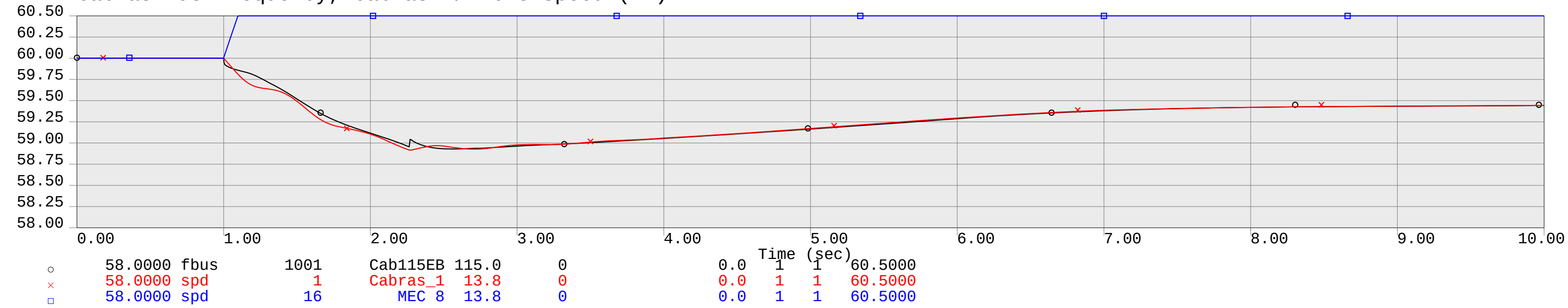
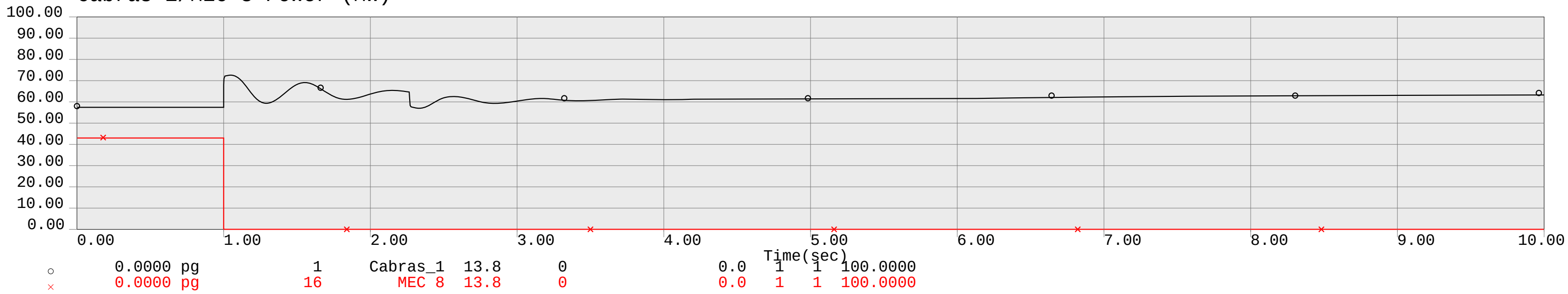
Agana 115 kV ESS

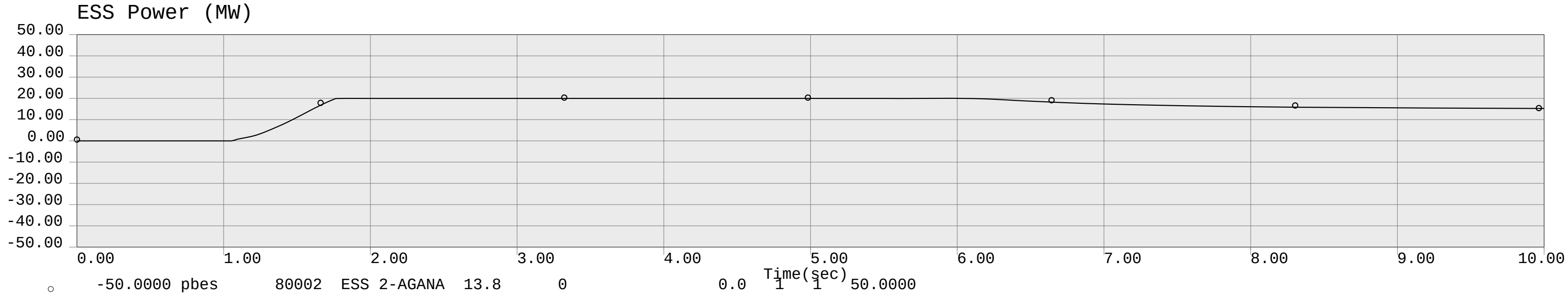
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



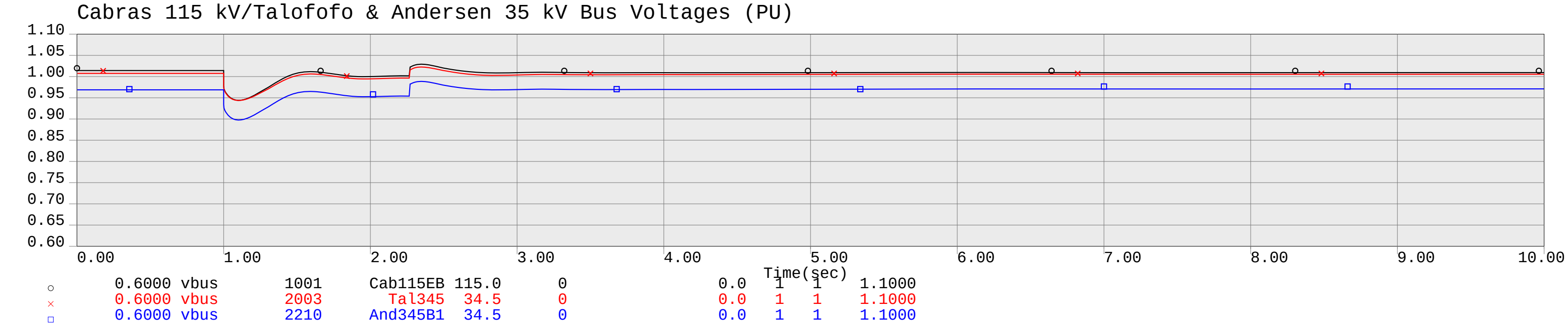
Cabras 1/MEC 8 Power (MW)



ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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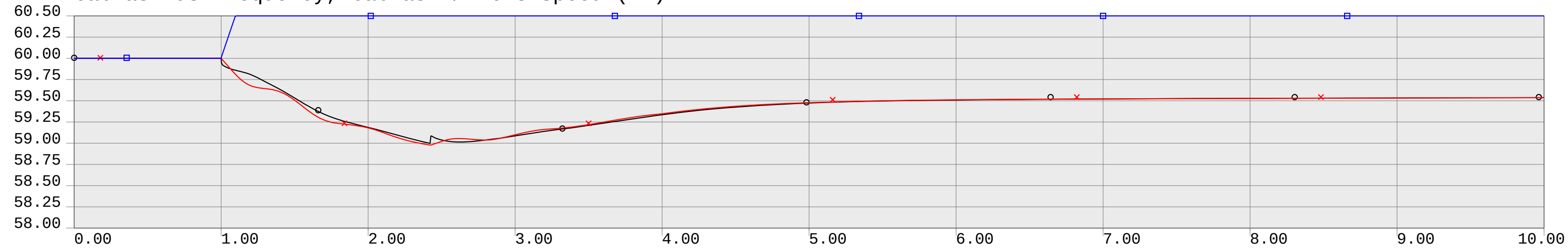
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)




```
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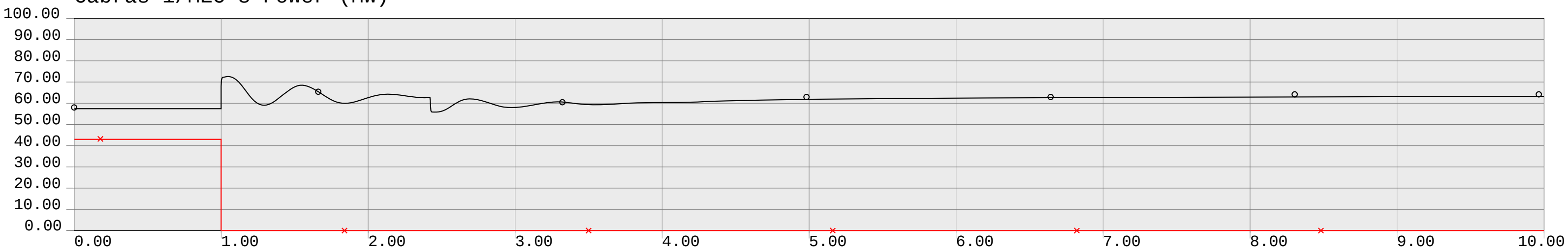
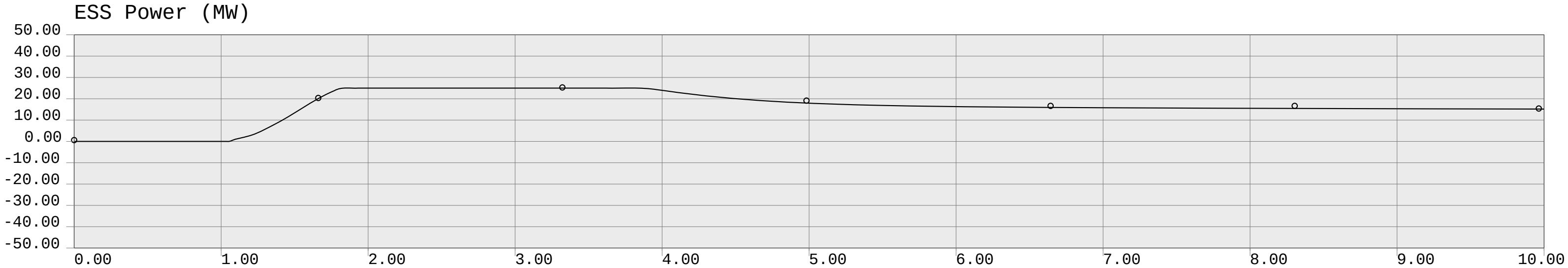
x  58.0000 spd        1  Cabras_1  13.8  0   0.0  1  1  60.5000
□  58.0000 spd       16     MEC 8  13.8  0   0.0  1  1  60.5000
```

Cabras 1/MEC 8 Power (MW)



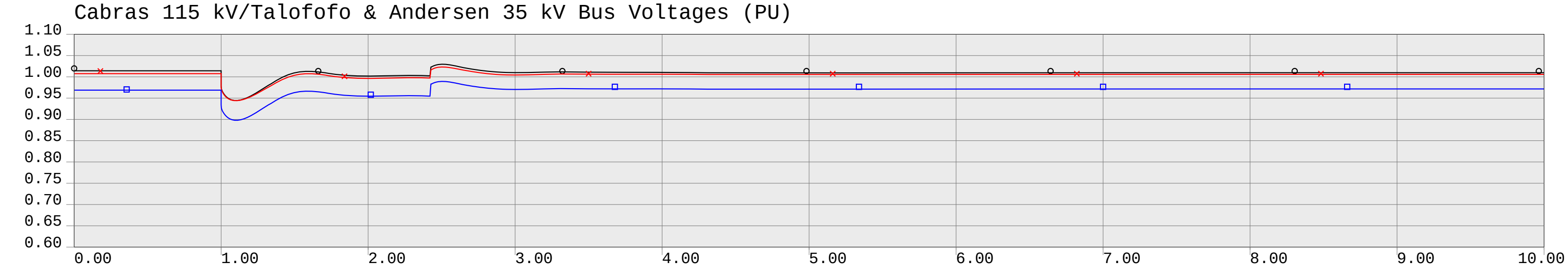

```
o  0.0000 pg     1  Cabras_1  13.8  0   0.0  1  1  100.0000
x  0.0000 pg    16     MEC 8  13.8  0   0.0  1  1  100.0000
```

ESS Power (MW)




```
o  -50.0000 pbes   80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
```

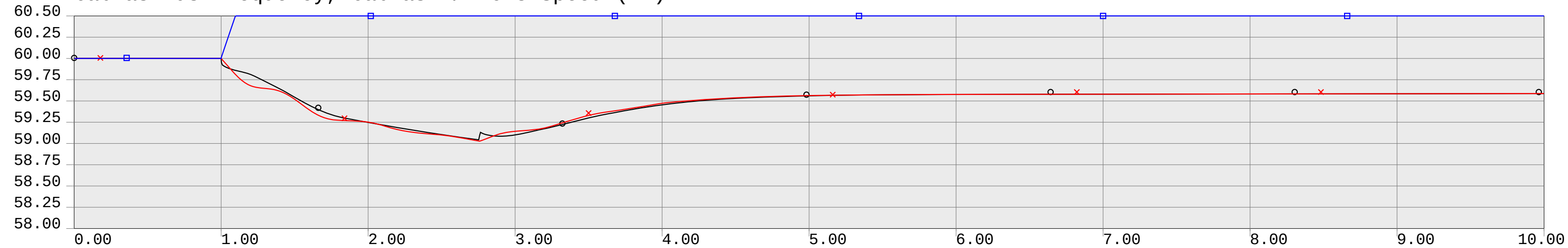
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
o  0.6000 vbus   1001  Cab115EB  115.0  0   0.0  1  1  1.1000
x  0.6000 vbus   2003    Tal345   34.5  0   0.0  1  1  1.1000
□  0.6000 vbus   2210  And345B1   34.5  0   0.0  1  1  1.1000
```

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

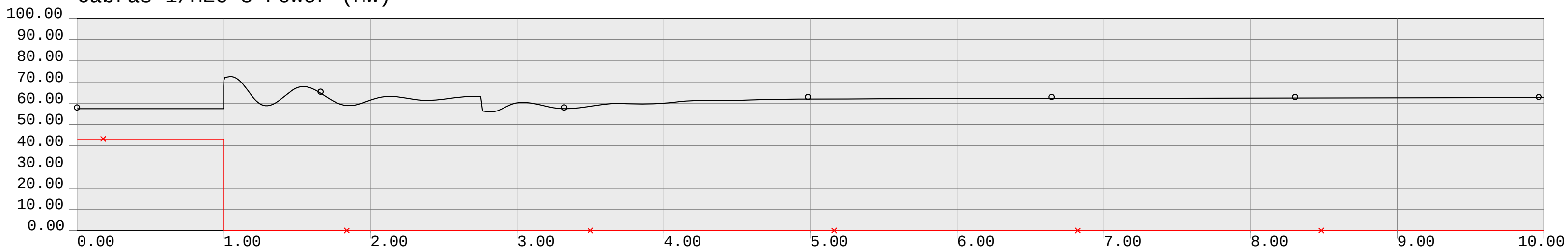
Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



Time (sec)

```
○ 58.0000 fbus    1001  Cab115EB 115.0  0   0.0  1  1  60.5000
× 58.0000 spd        1  Cabras_1  13.8  0   0.0  1  1  60.5000
□ 58.0000 spd       16     MEC 8  13.8  0   0.0  1  1  60.5000
```

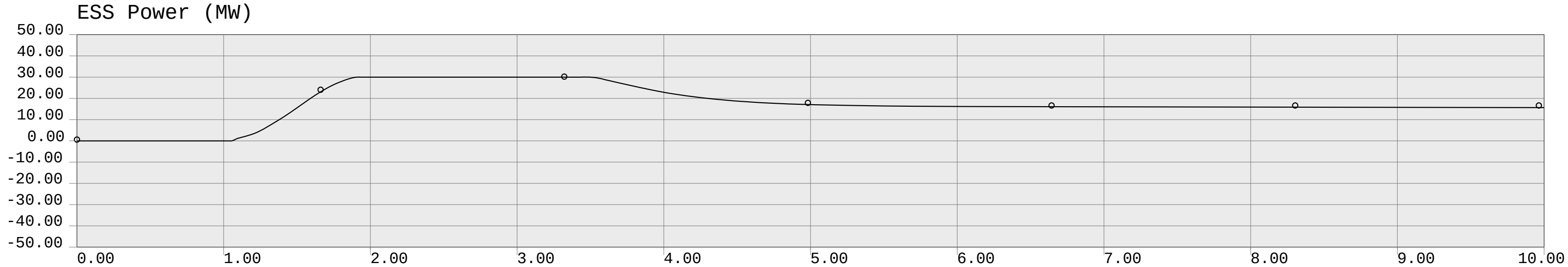
Cabras 1/MEC 8 Power (MW)



Time(sec)

```
○ 0.0000 pg     1  Cabras_1  13.8  0   0.0  1  1  100.0000
× 0.0000 pg    16     MEC 8  13.8  0   0.0  1  1  100.0000
```

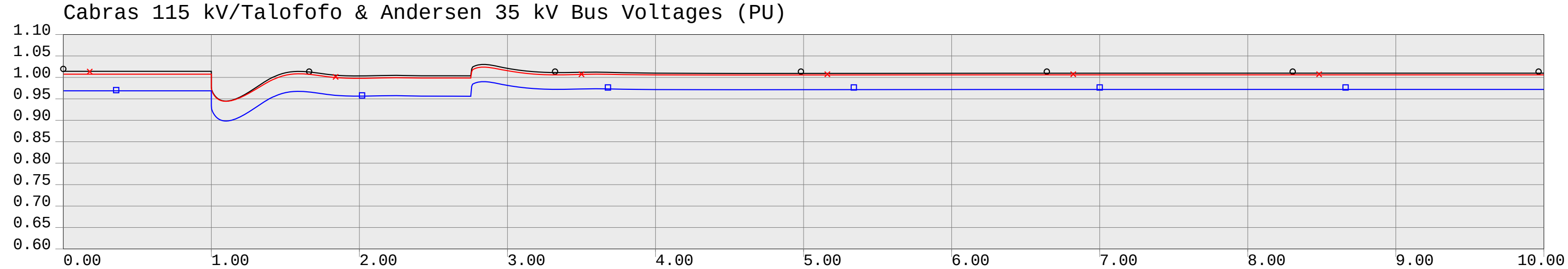
ESS Power (MW)



Time(sec)

```
○ -50.0000 pbes  80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

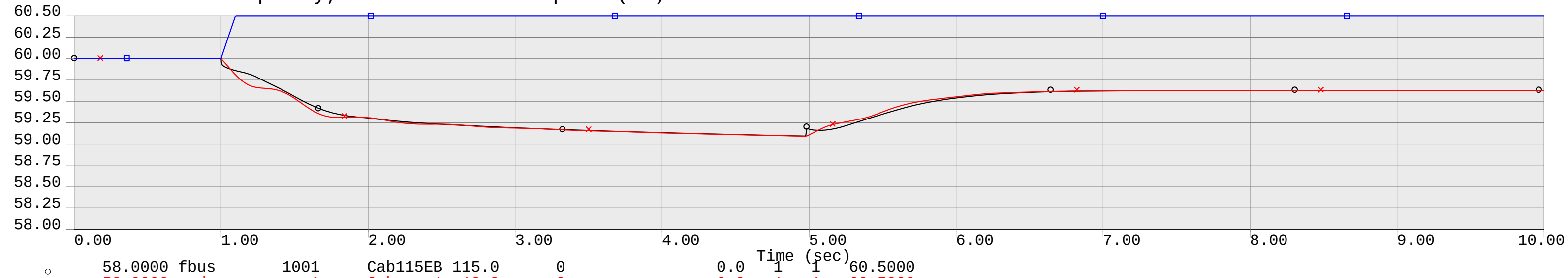


Time(sec)

```
○ 0.6000 vbus  1001  Cab115EB 115.0  0   0.0  1  1  1.1000
× 0.6000 vbus  2003    Tal345  34.5  0   0.0  1  1  1.1000
□ 0.6000 vbus  2210  And345B1  34.5  0   0.0  1  1  1.1000
```

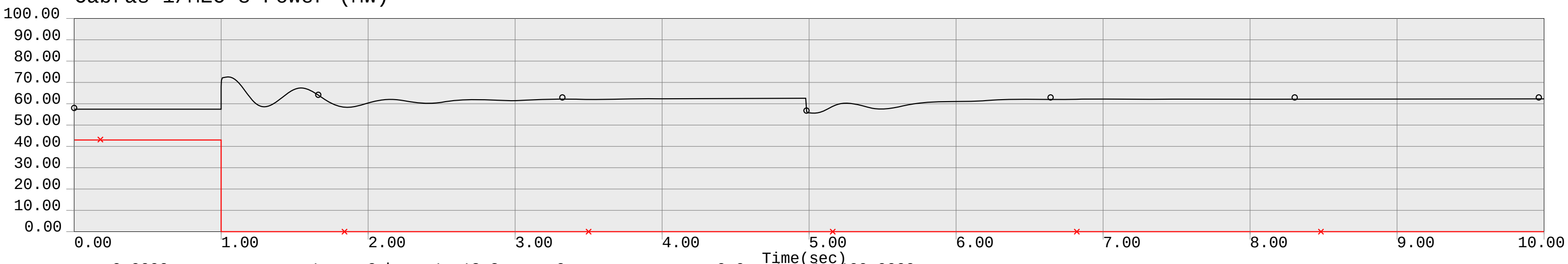
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



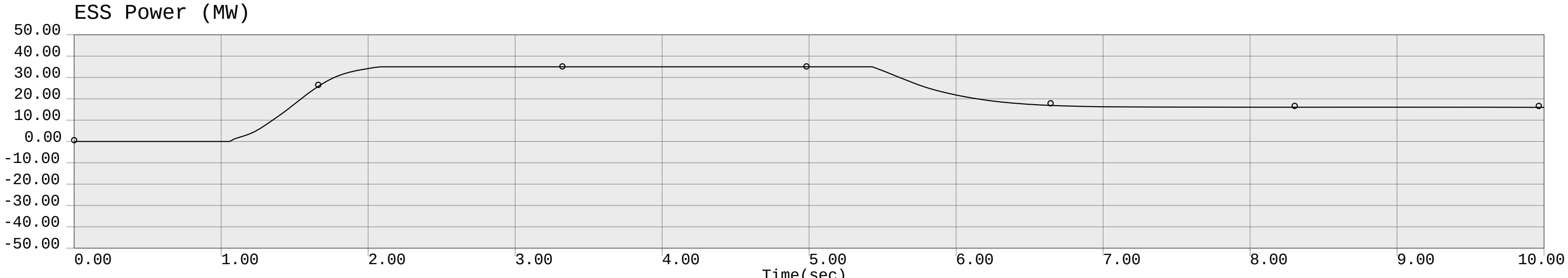
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)



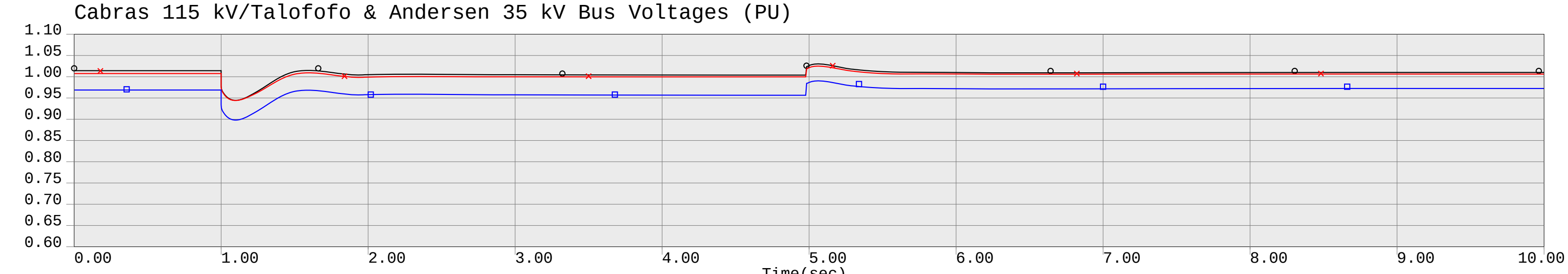
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

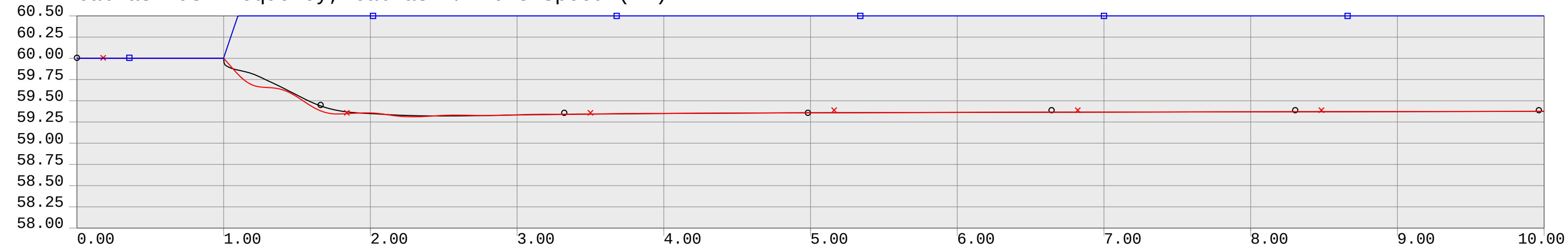
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

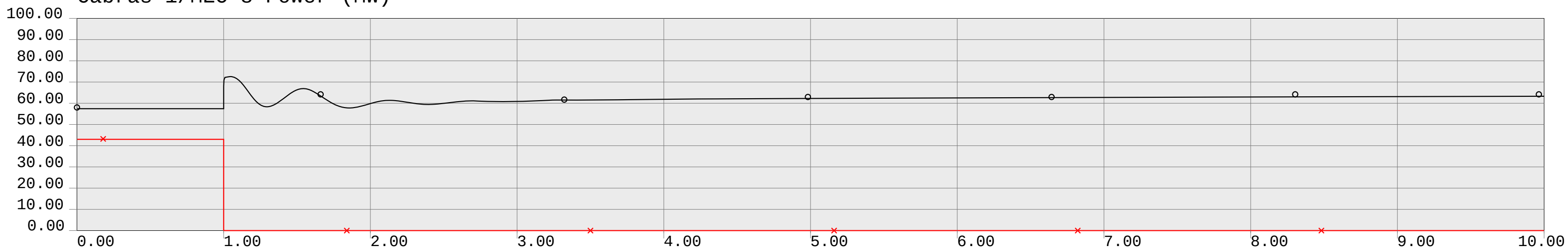
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



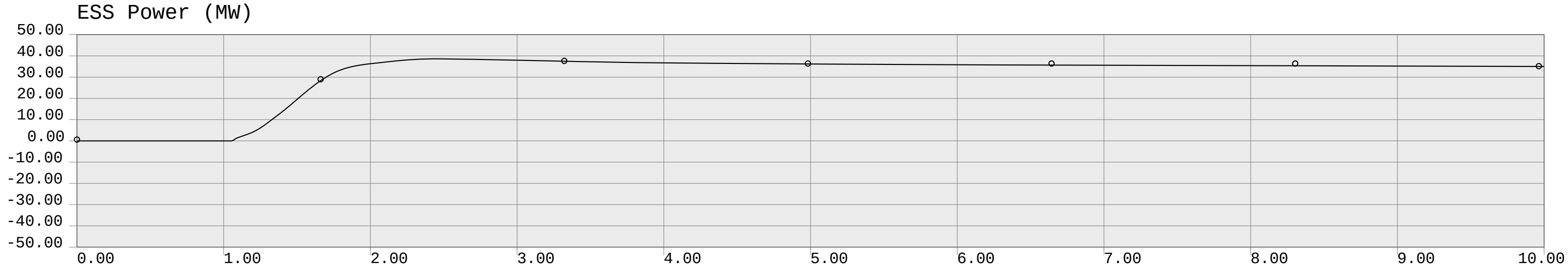
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



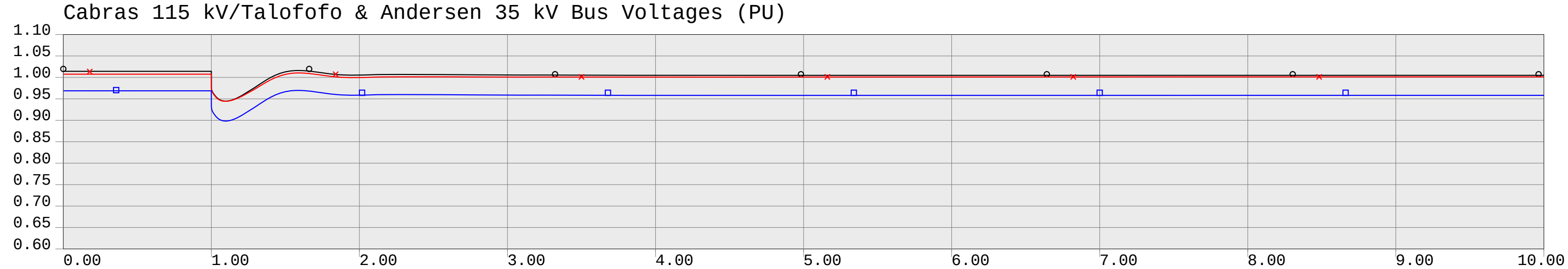
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2400-m8-1f.chf

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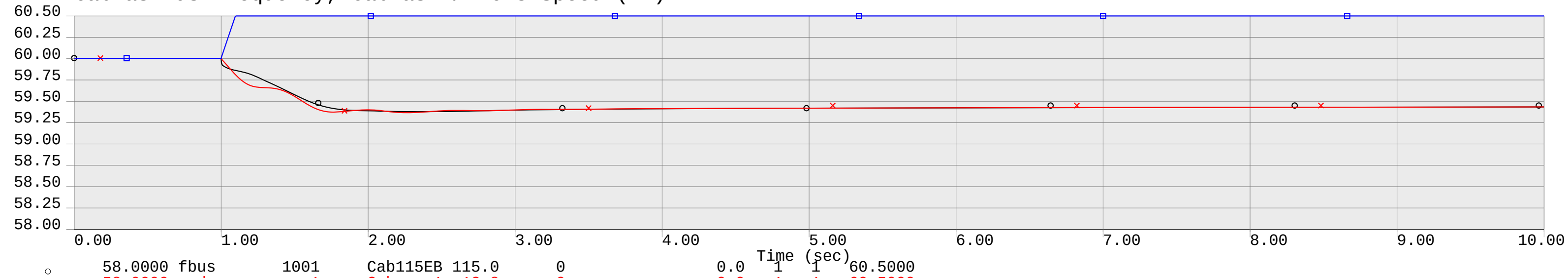
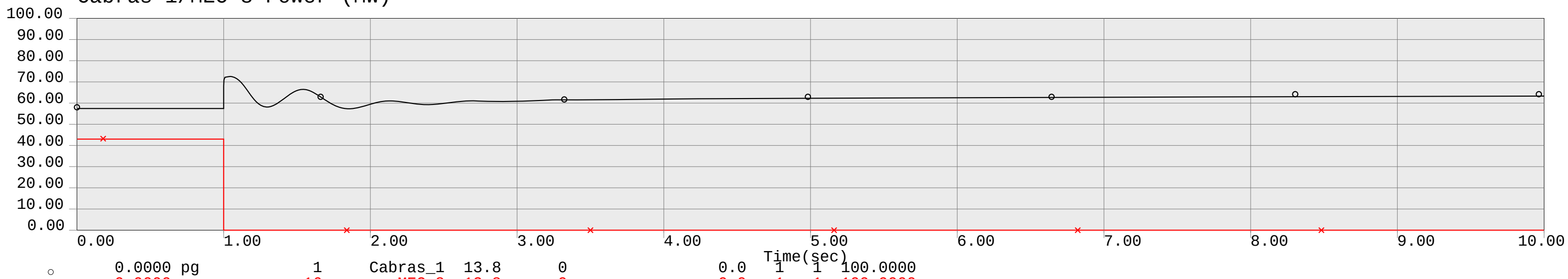
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



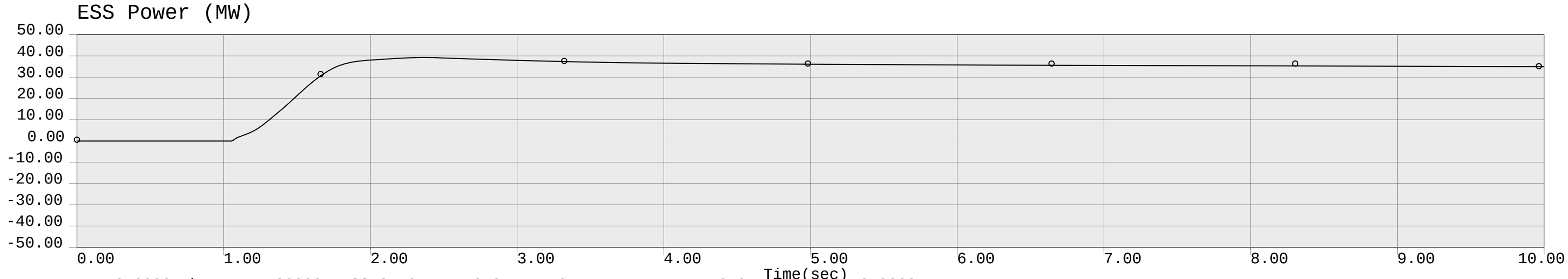
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

Cabras 1/MEC 8 Power (MW)



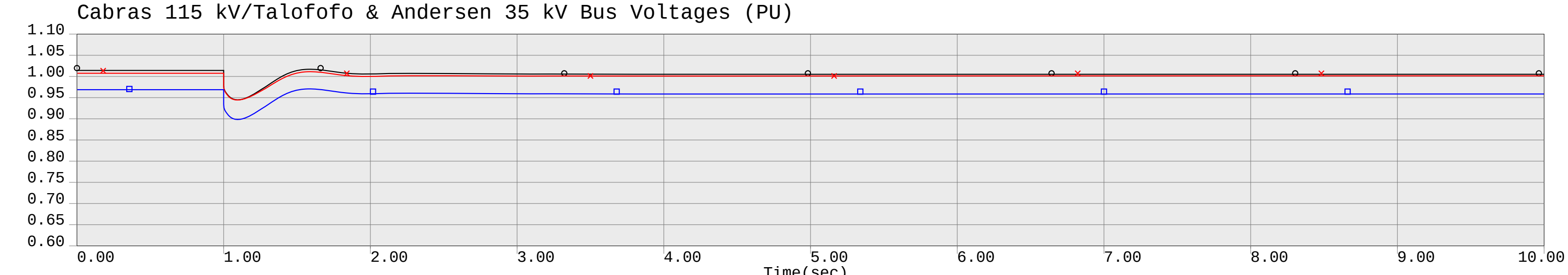
○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
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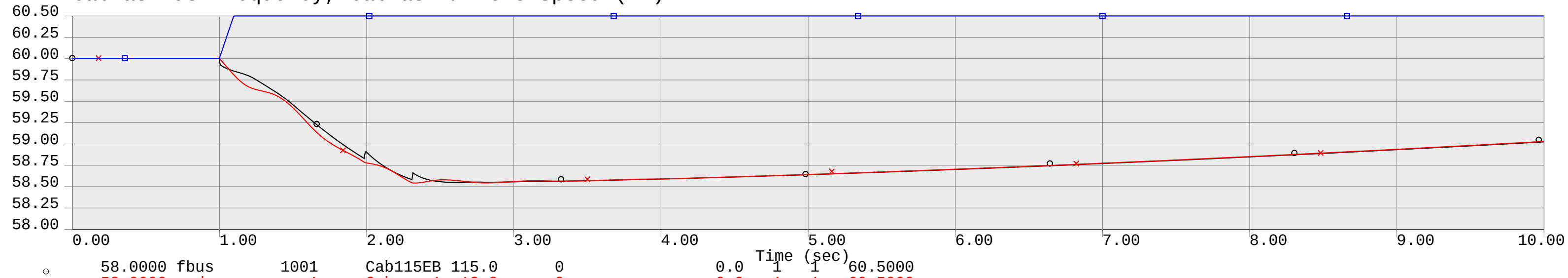
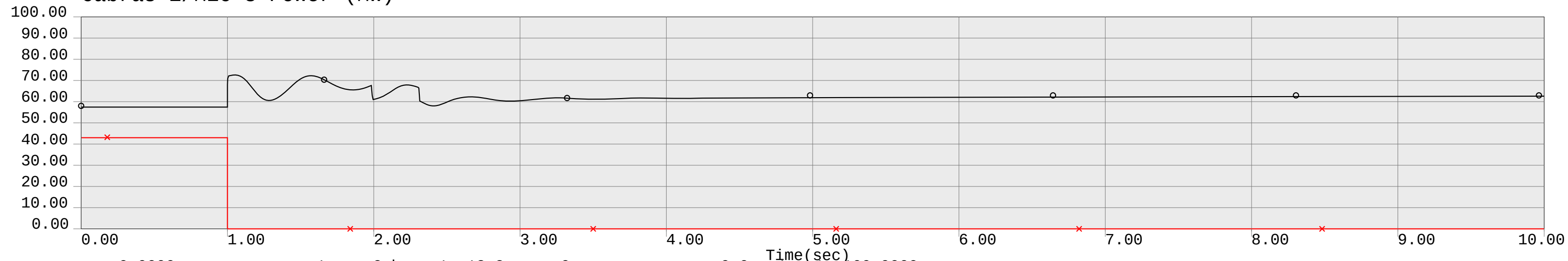
Agana 115 kV ESS

Cabras Bus Frequency, Cabras 1/MEC 8 Speed (Hz)



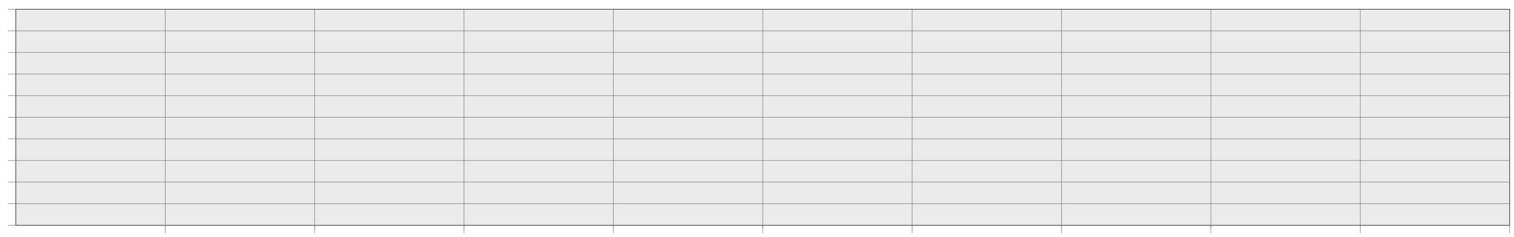
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

Cabras 1/MEC 8 Power (MW)

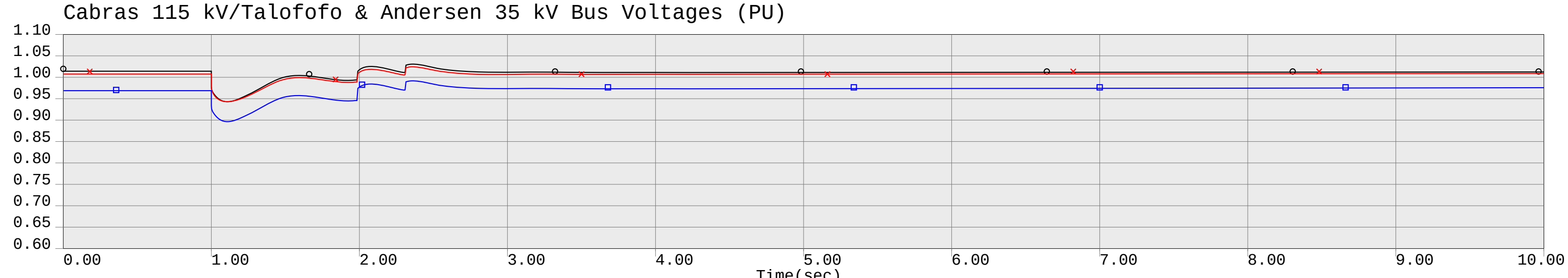


0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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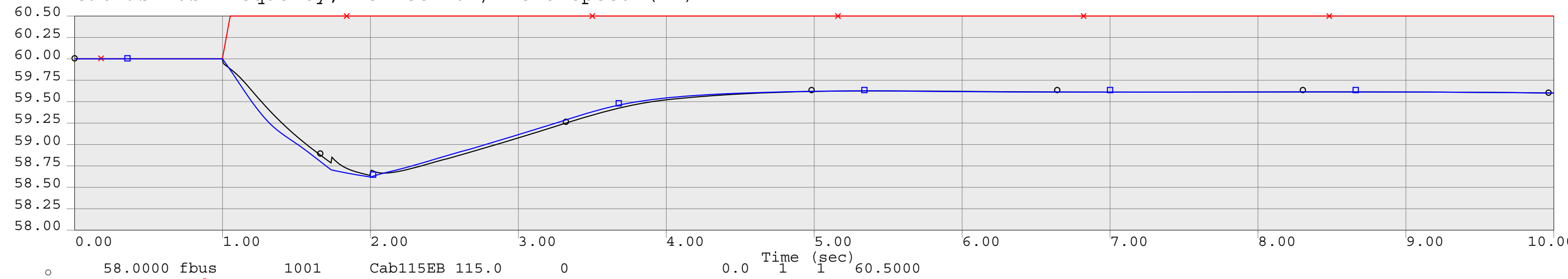
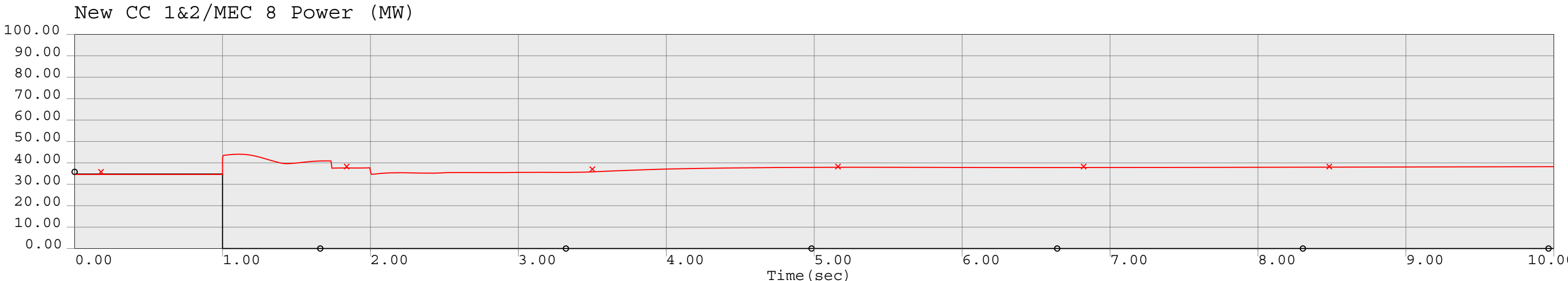
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



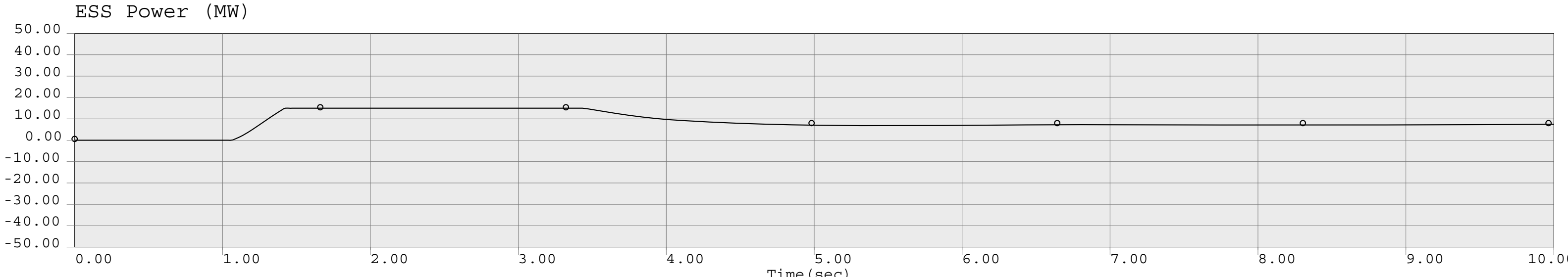
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



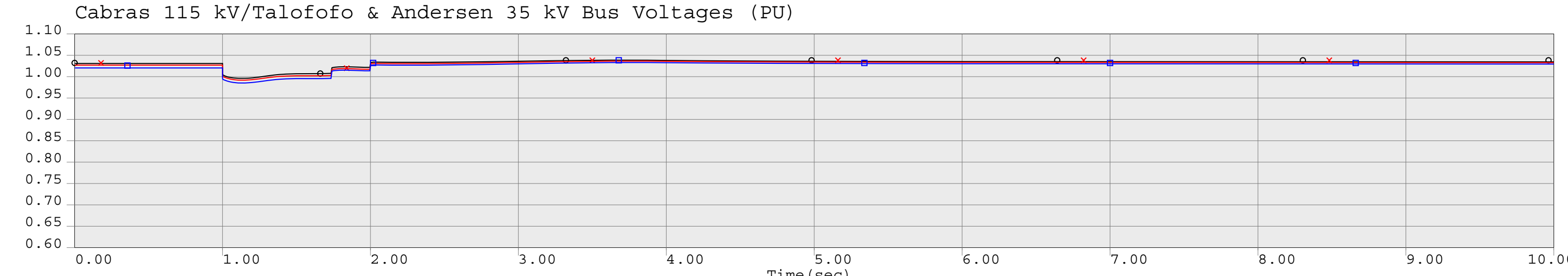
0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/3100-cc1-1a.chf

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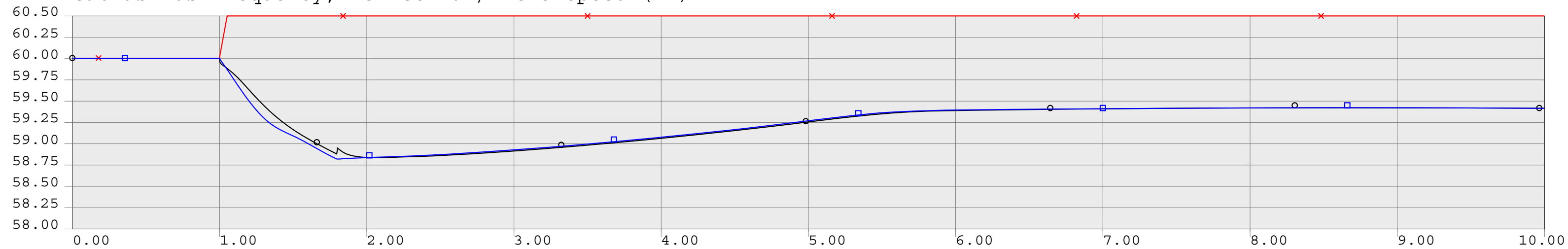
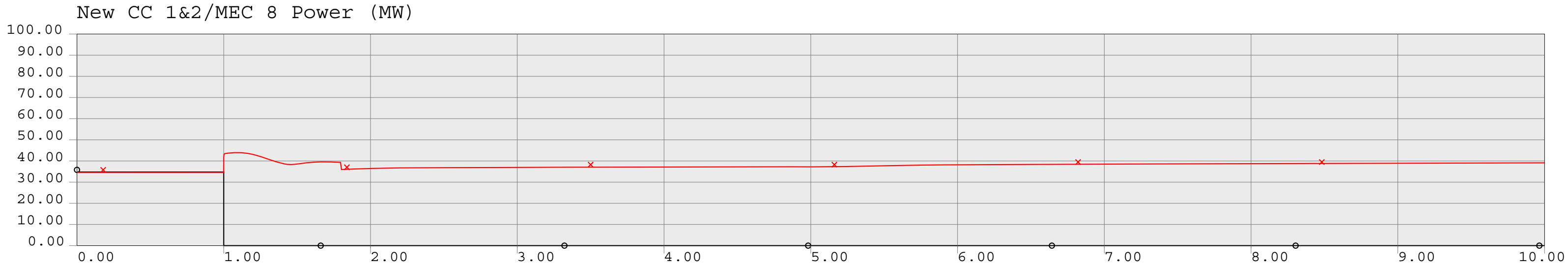
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



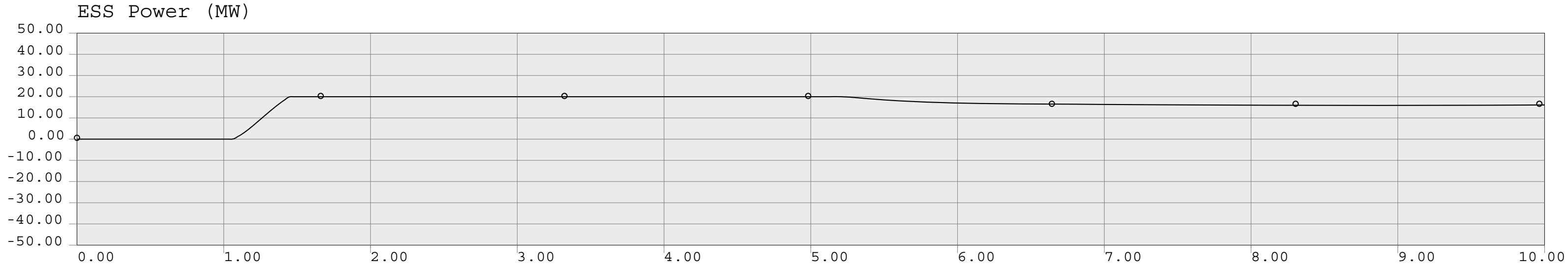
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



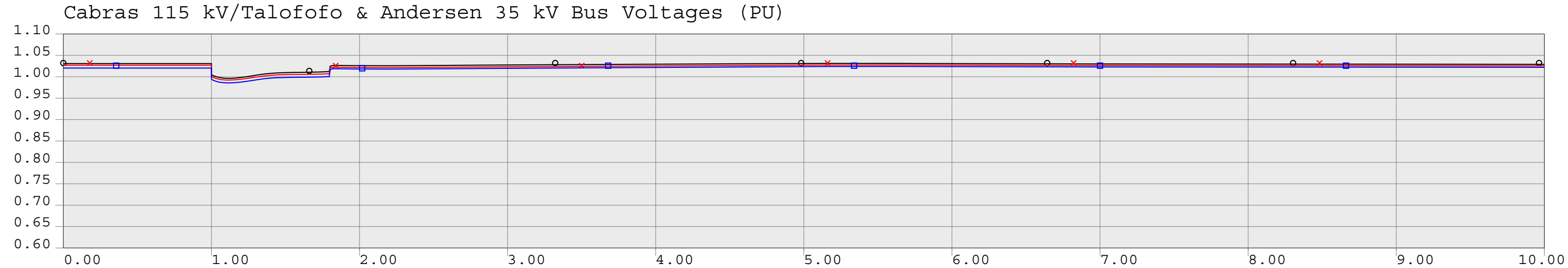
○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

chans/3100-cc1-1b.chf

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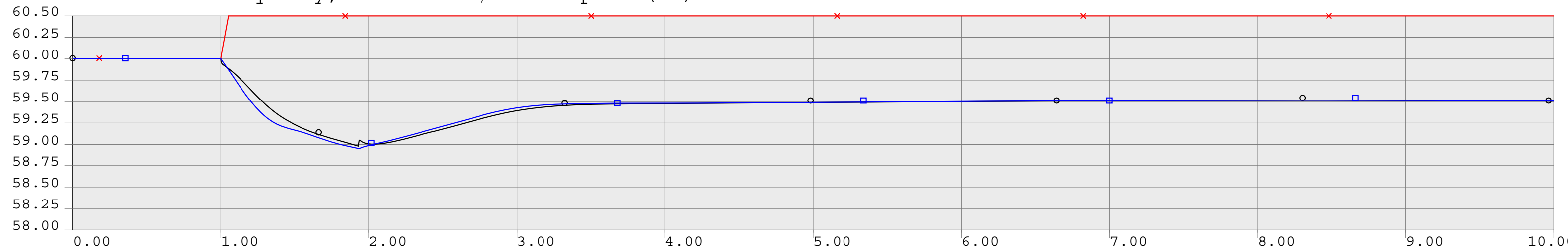
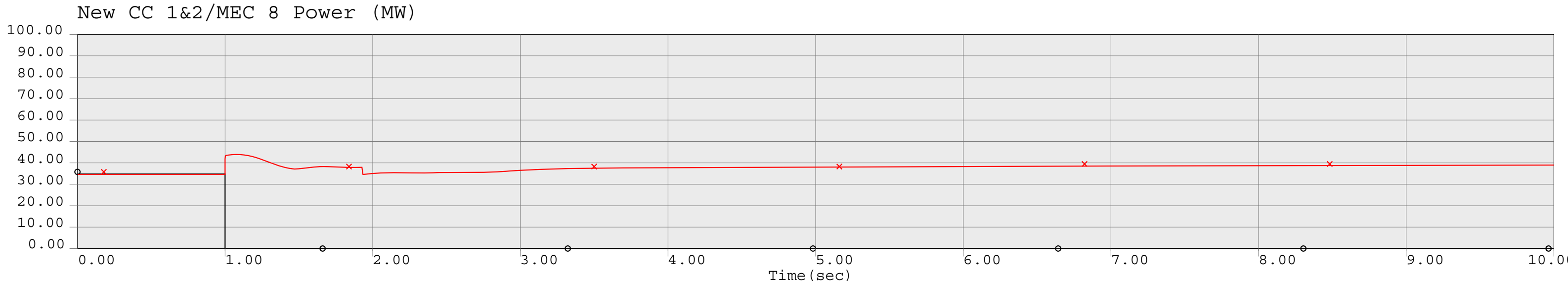
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



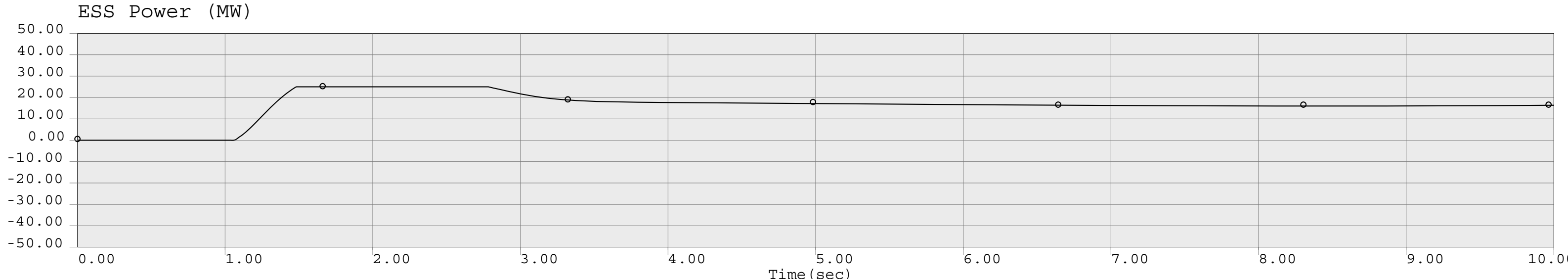
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



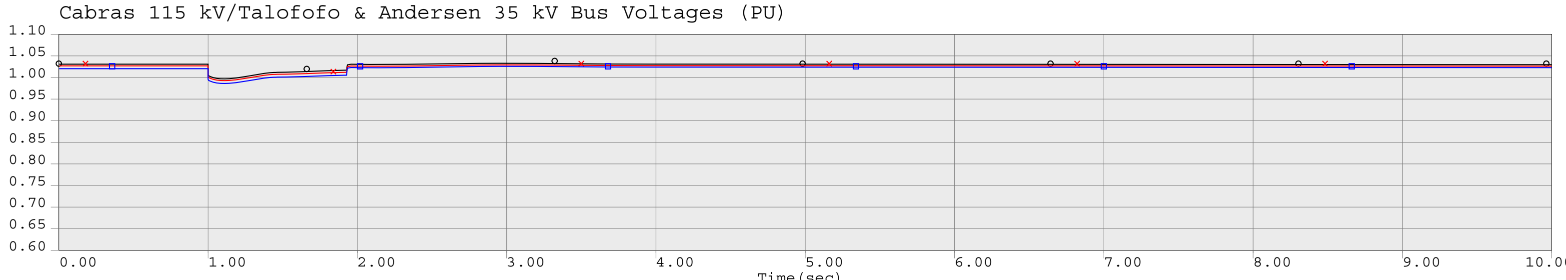
○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

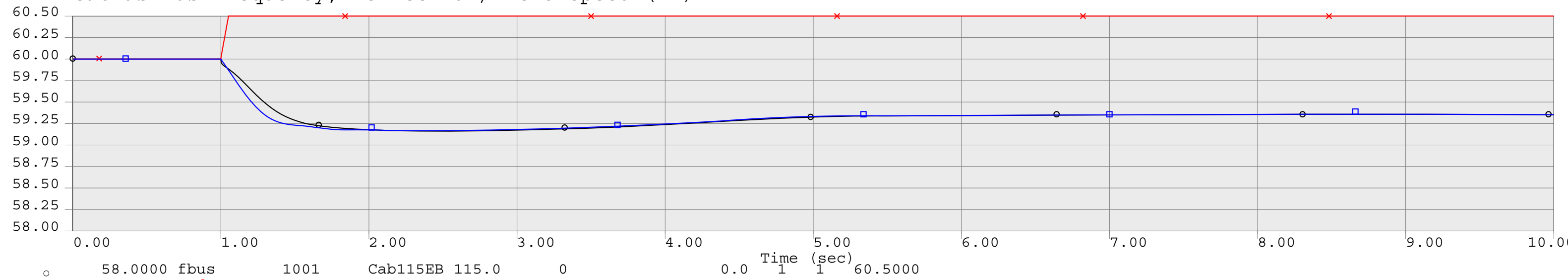
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

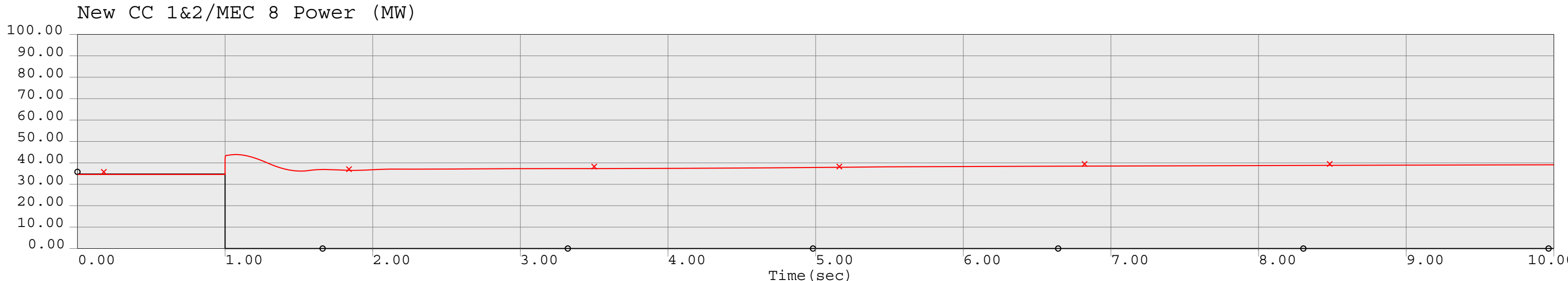
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



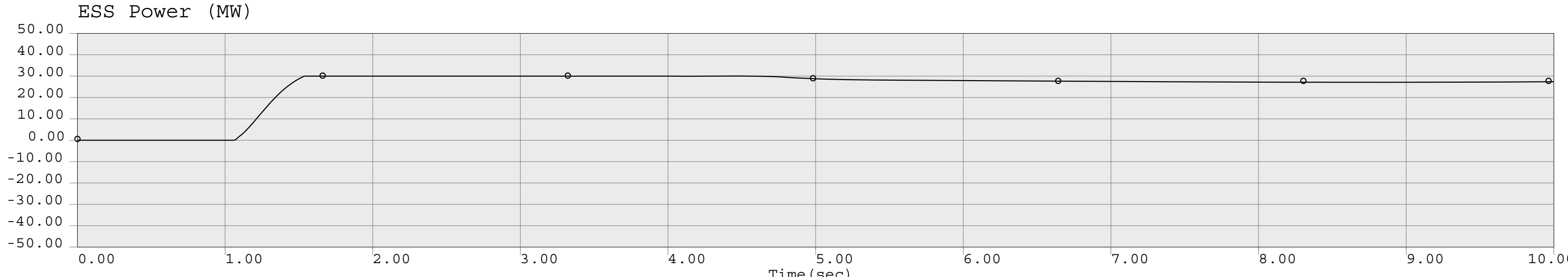
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



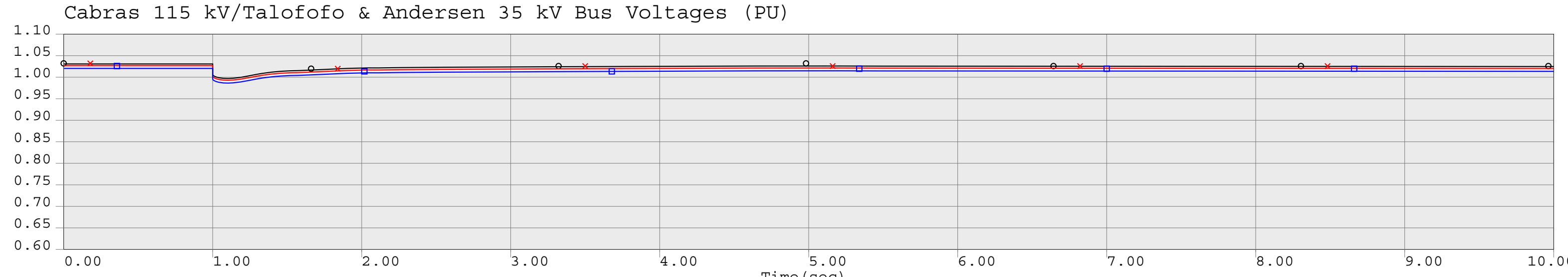
0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

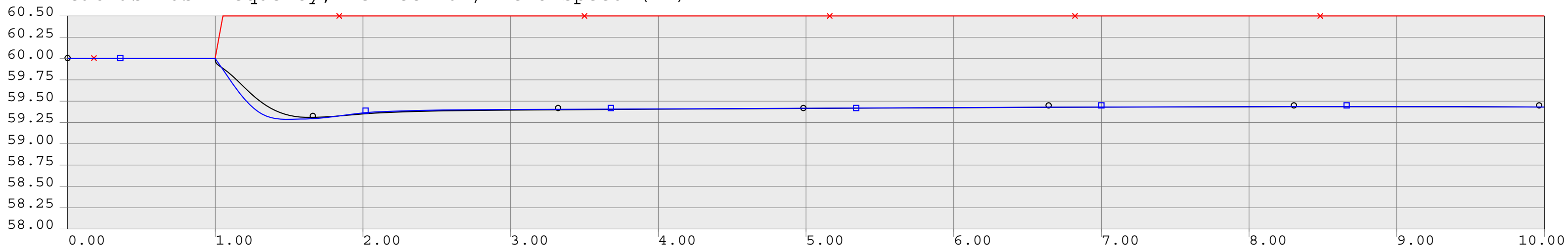
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

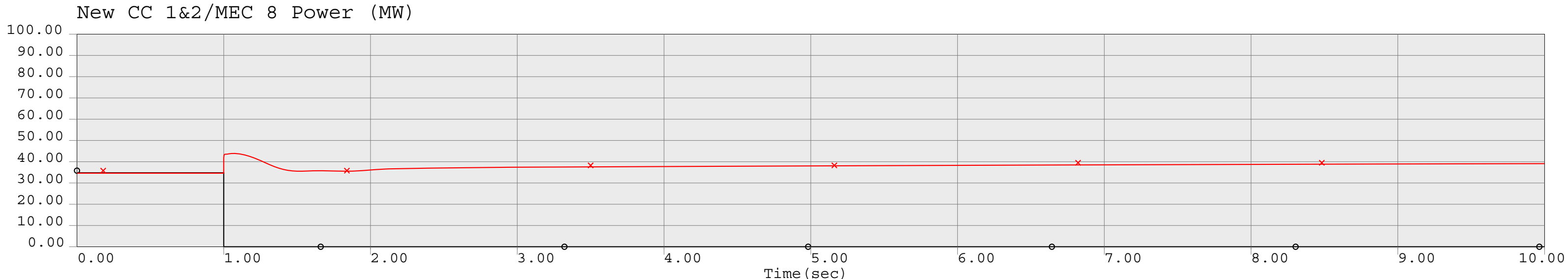
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



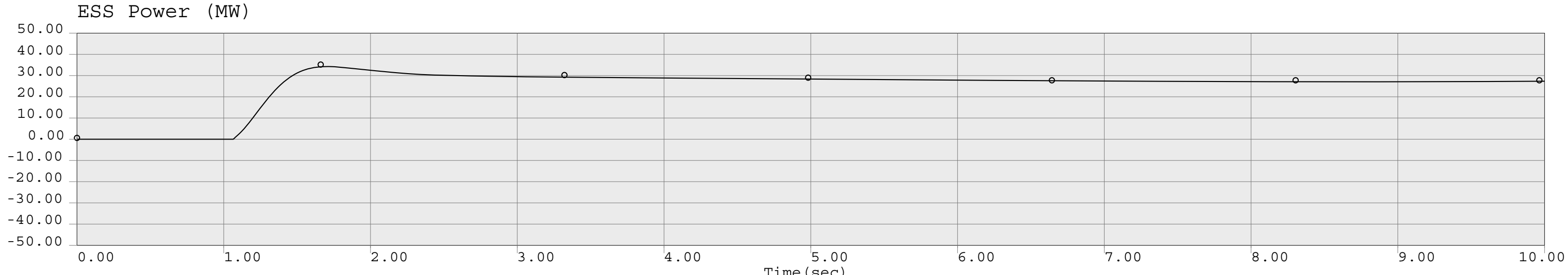
o	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
x	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



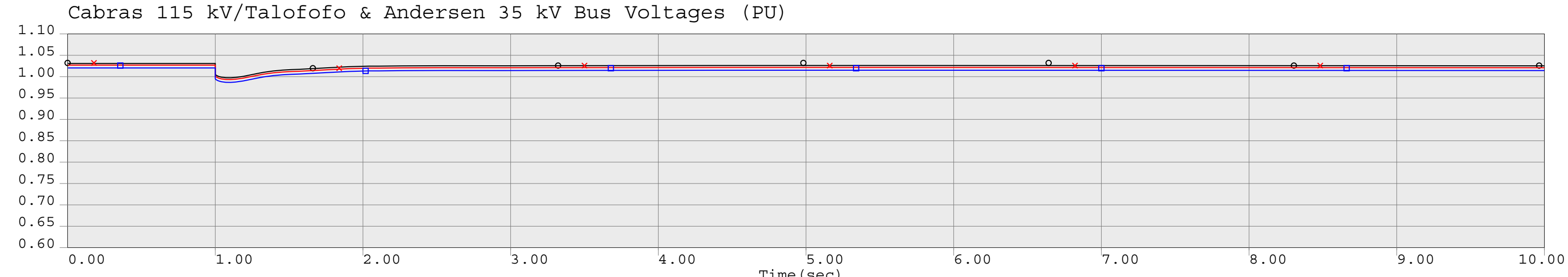
o	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
x	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



o	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

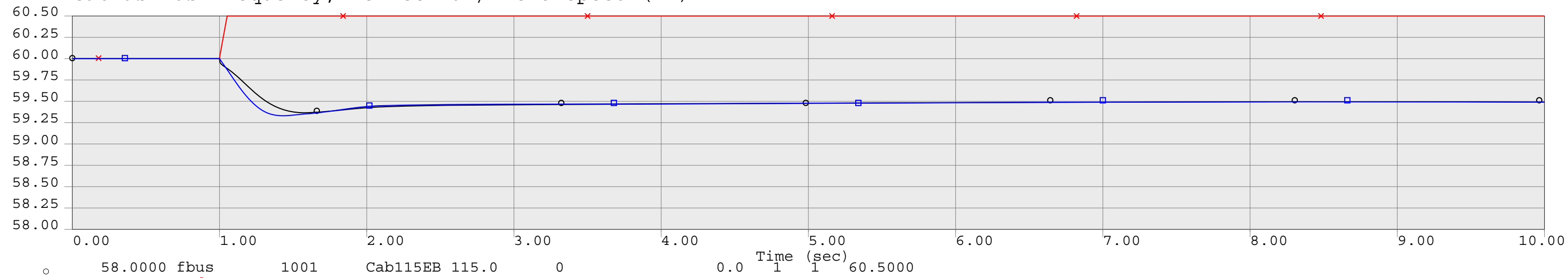
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



o	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
x	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

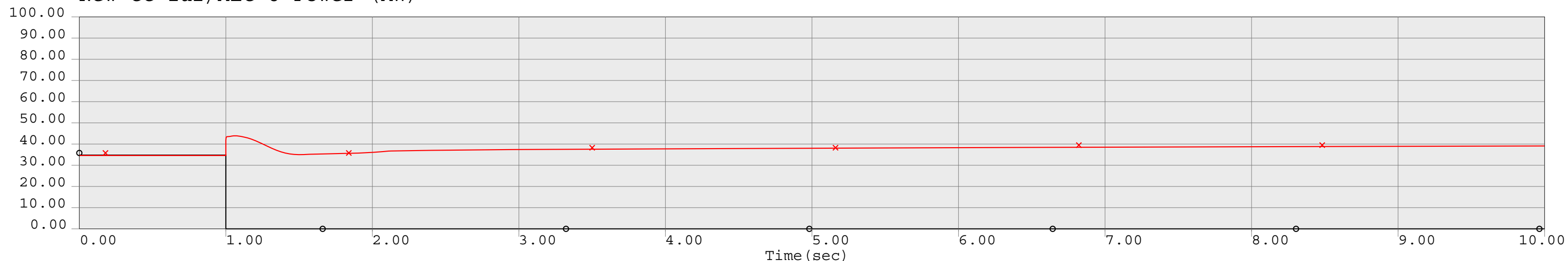
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



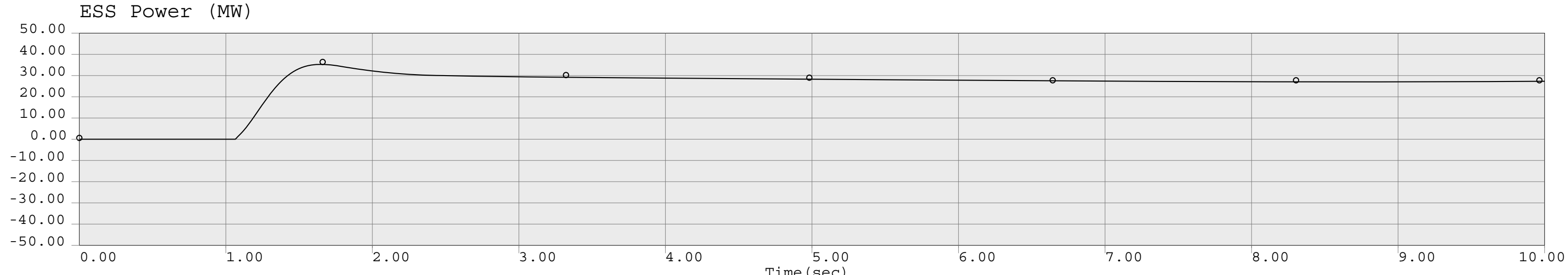
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



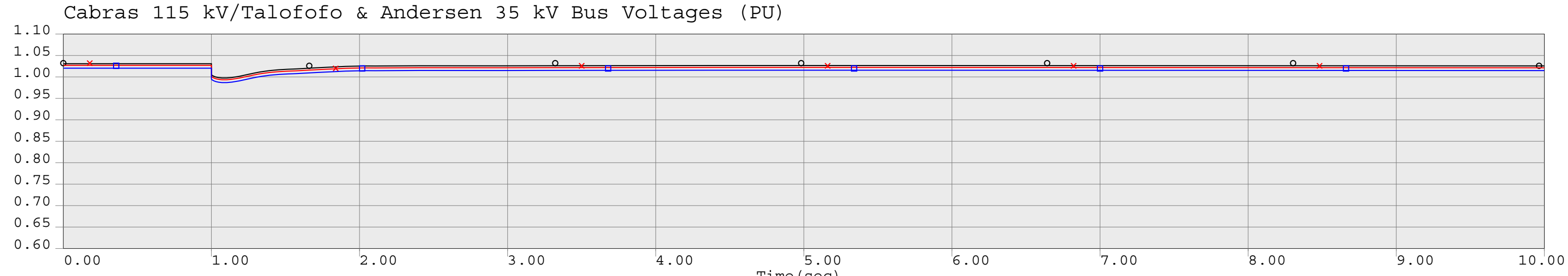
○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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Guam Power Authority - EPS Energy Storage Analysis
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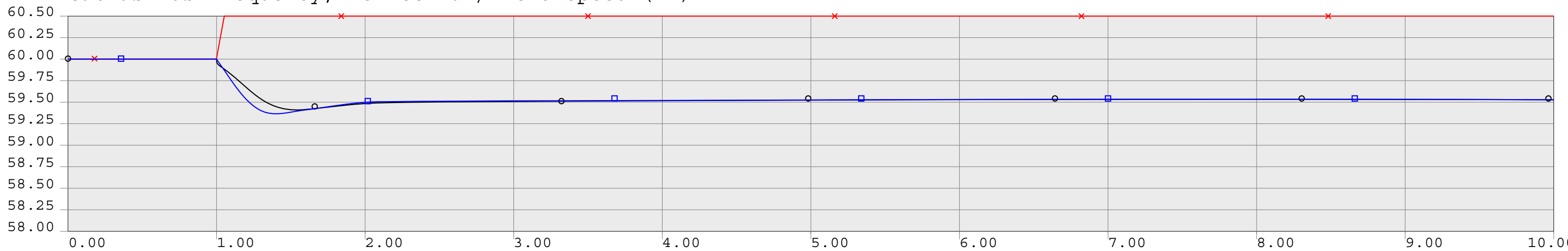
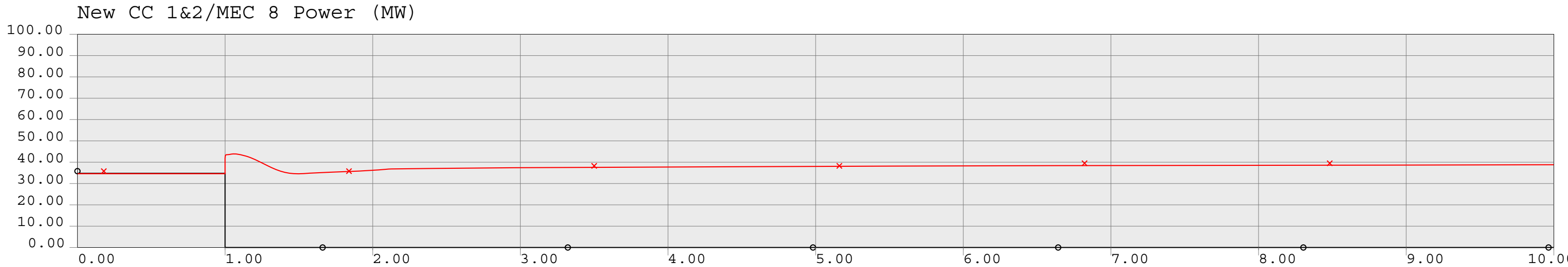
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



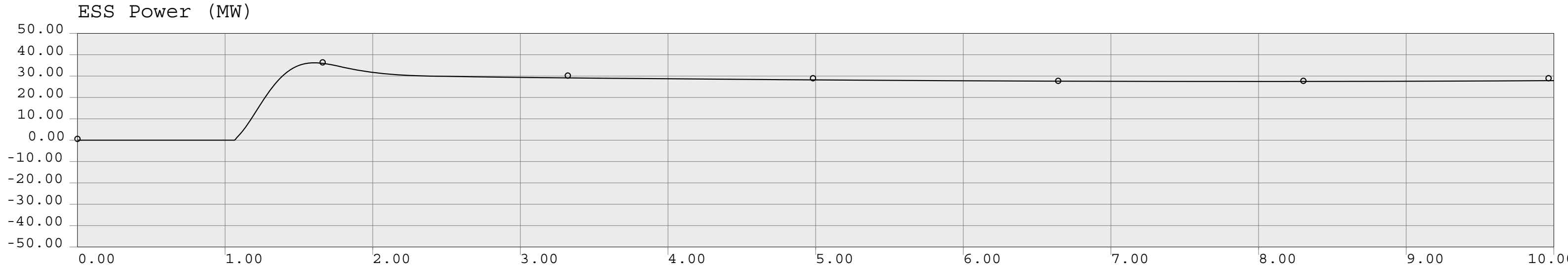
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



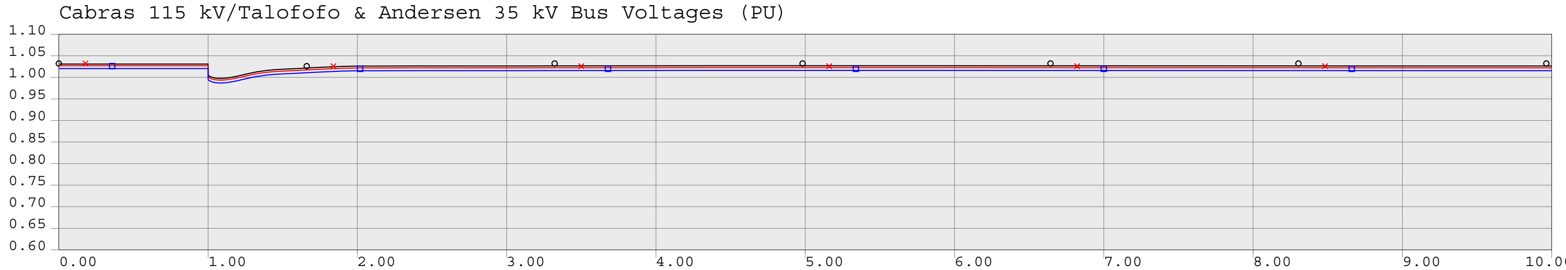
○ 0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/3100-cc1-1g.chf

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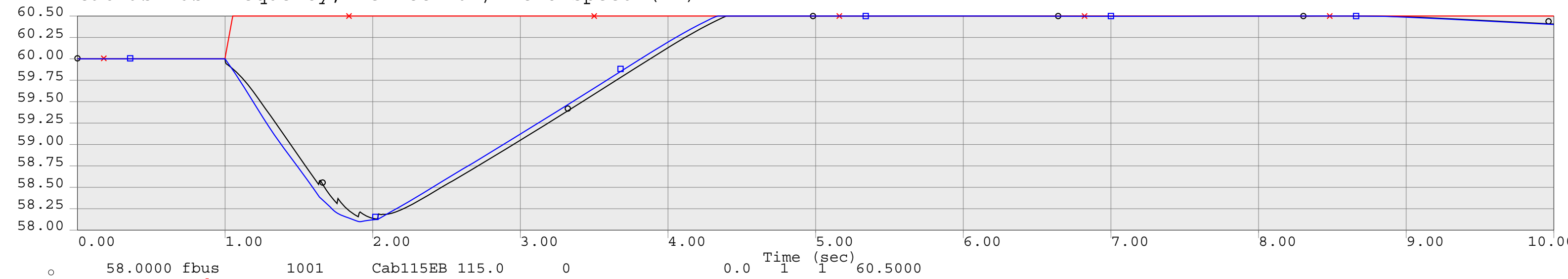
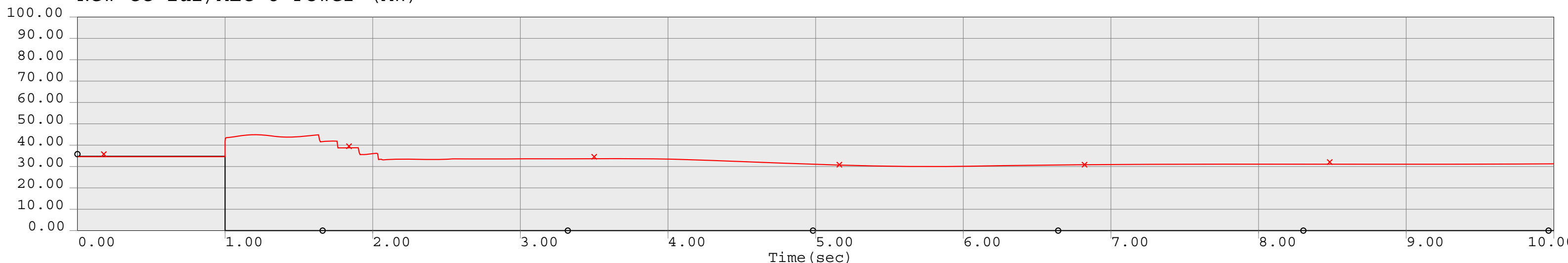
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



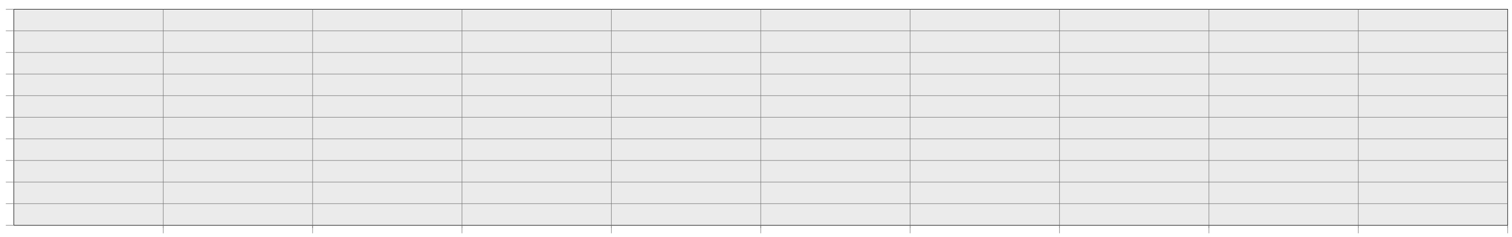

```
○ 58.0000 fbus  1001  Cab115EB 115.0  0    0.0  1  1  60.5000
× 58.0000 spd   7001  NEW CC 1  13.8  0    0.0  1  1  60.5000
□ 58.0000 spd   7002  NEW CC 2  13.8  0    0.0  1  1  60.5000
```

New CC 1&2/MEC 8 Power (MW)

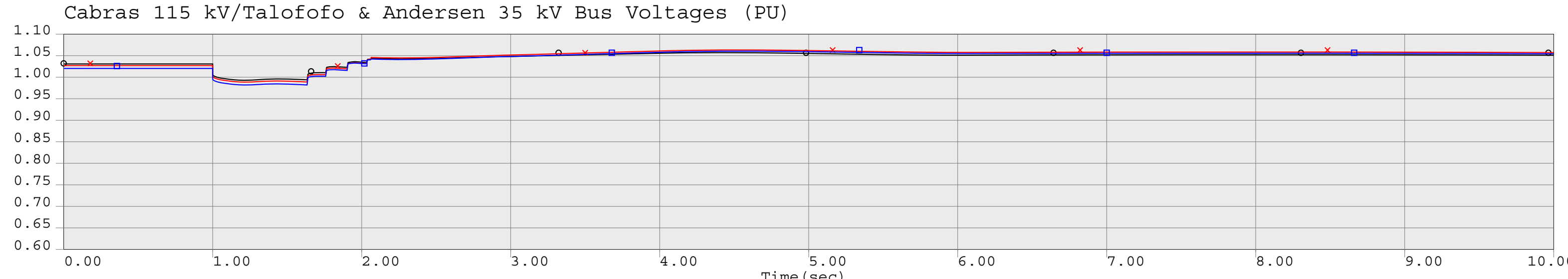



```
○ 0.0000 pg  7001  NEW CC 1  13.8  0    0.0  1  1  100.0000
× 0.0000 pg  7002  NEW CC 2  13.8  0    0.0  1  1  100.0000
```

ESS Power (MW)



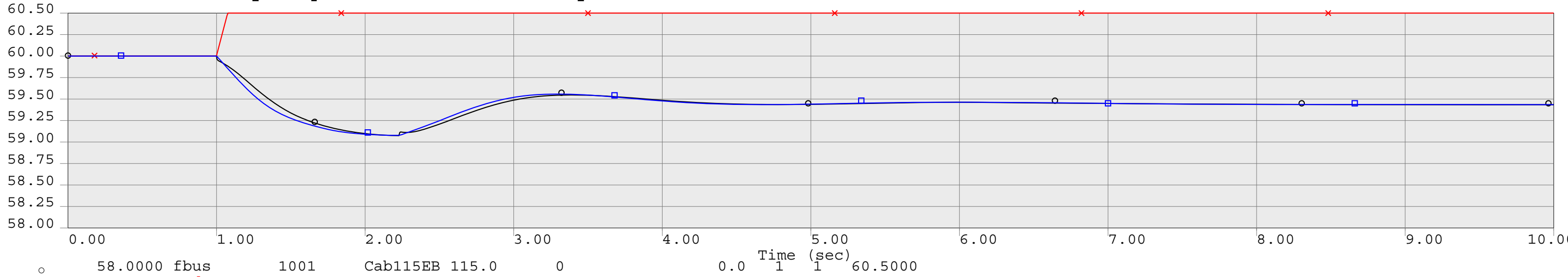
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○ 0.6000 vbus  1001  Cab115EB 115.0  0    0.0  1  1  1.1000
× 0.6000 vbus  2003    Tal345  34.5  0    0.0  1  1  1.1000
□ 0.6000 vbus  2210  And345B1  34.5  0    0.0  1  1  1.1000
```

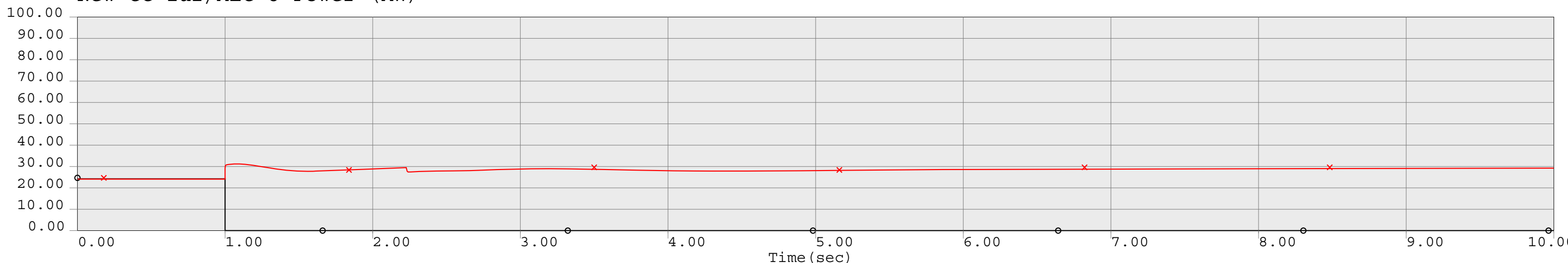
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



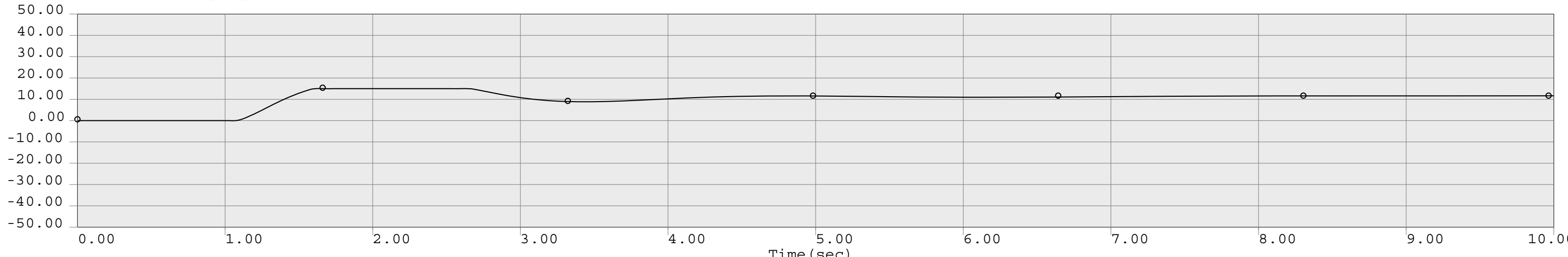
○ 58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
× 58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□ 58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



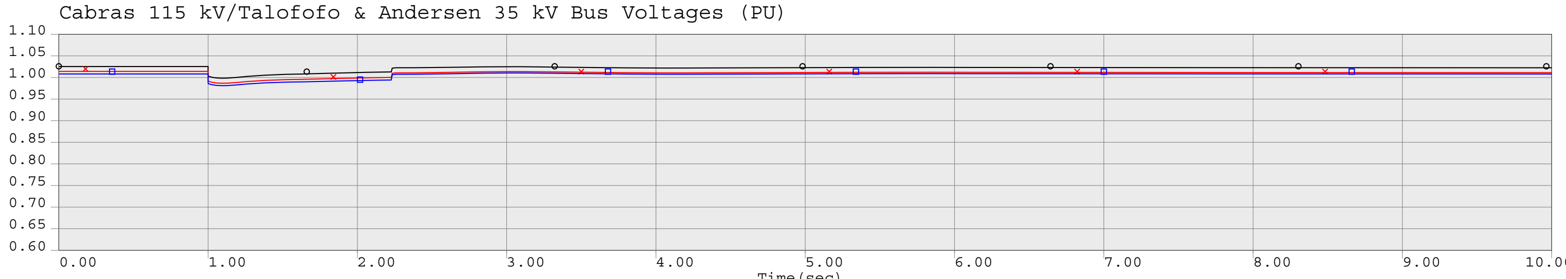
○ 0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
× 0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○ -50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

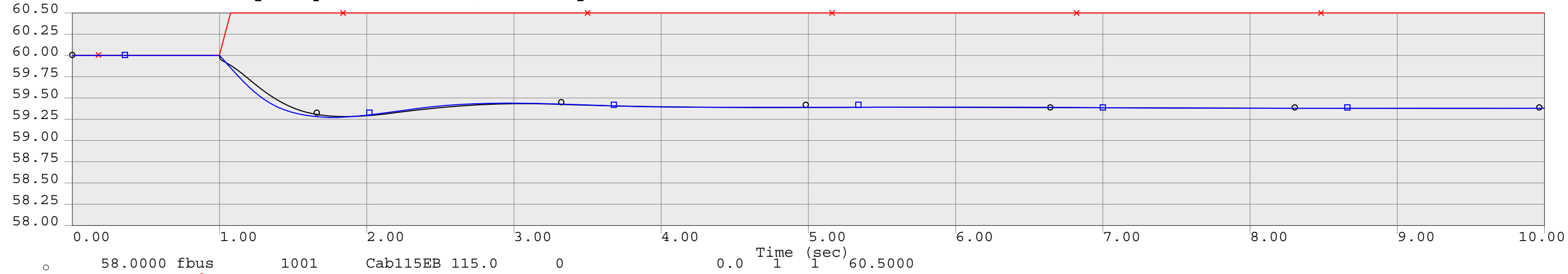
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
× 0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□ 0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

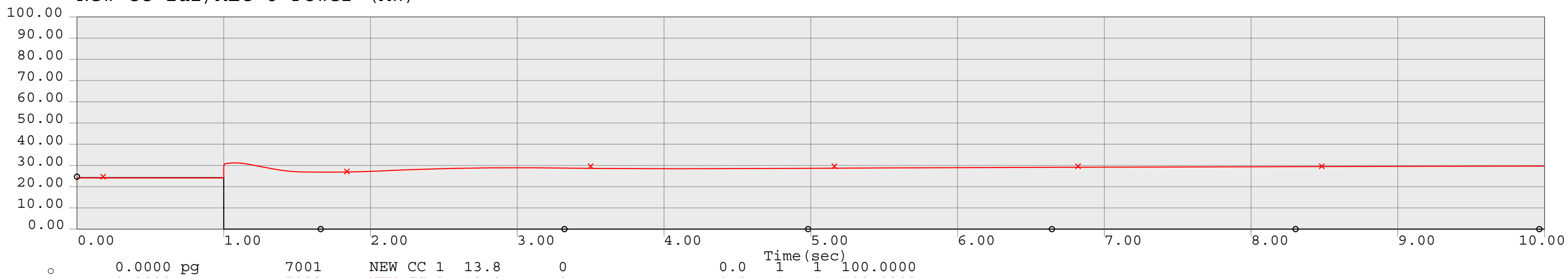
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



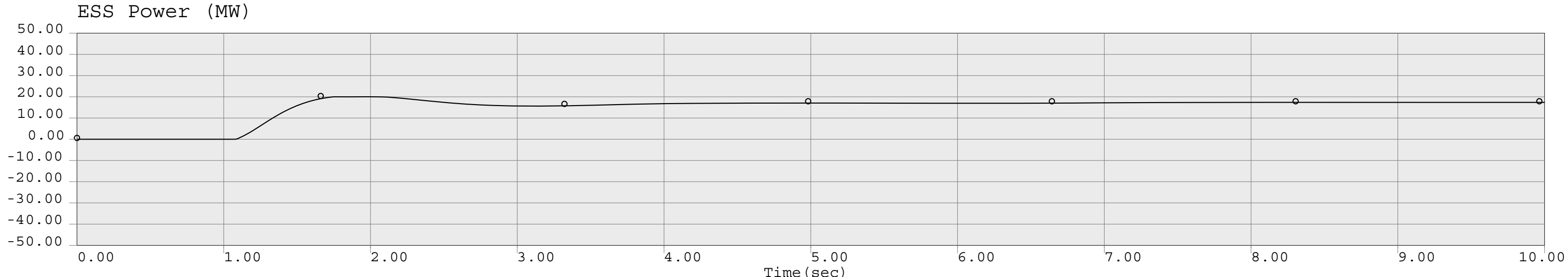
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



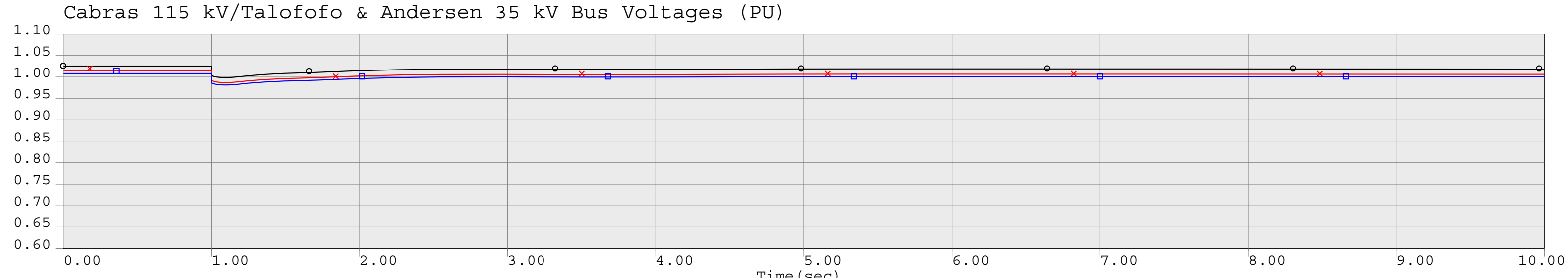
○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

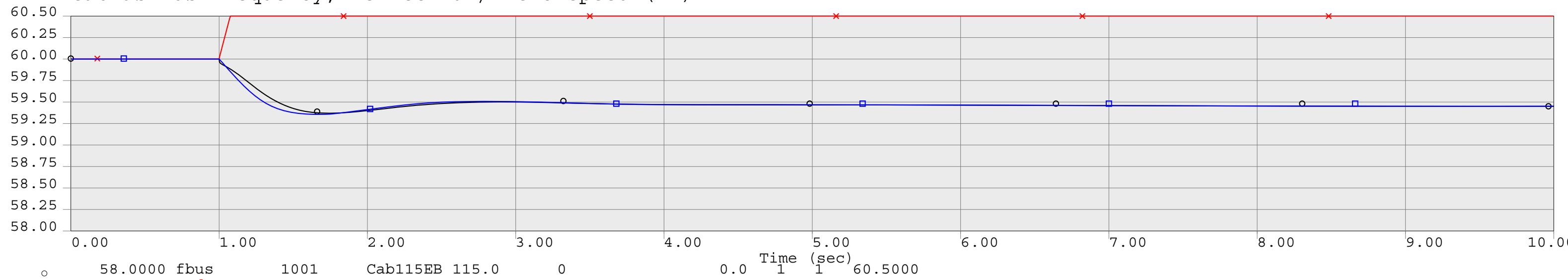
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

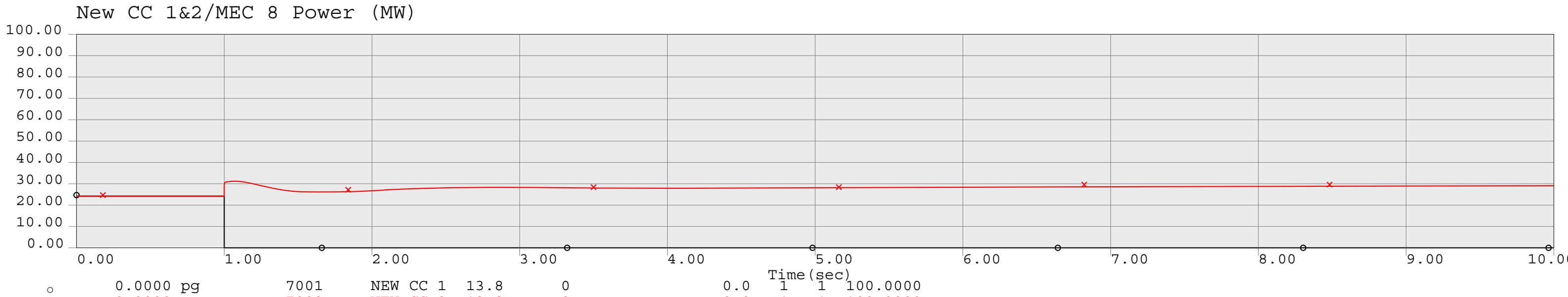
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



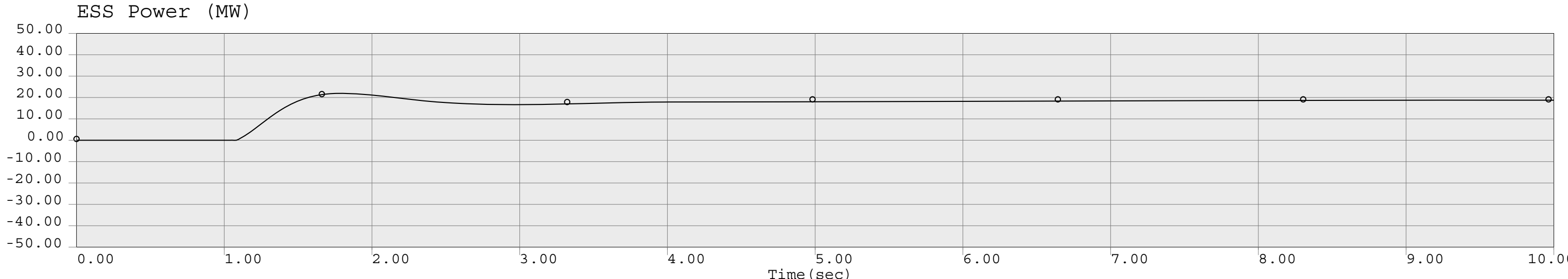
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



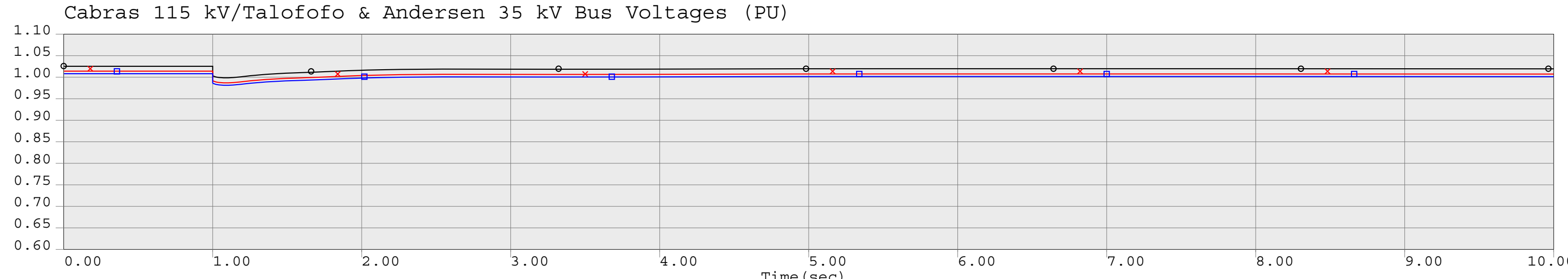
○ 0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

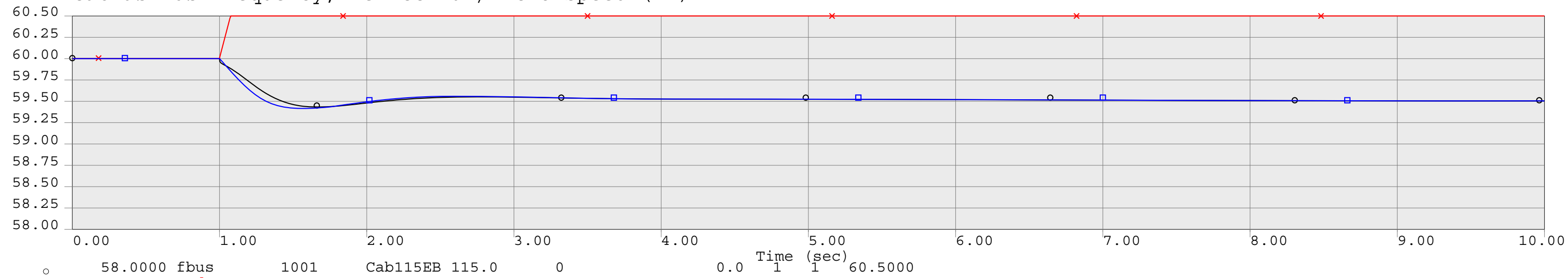
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

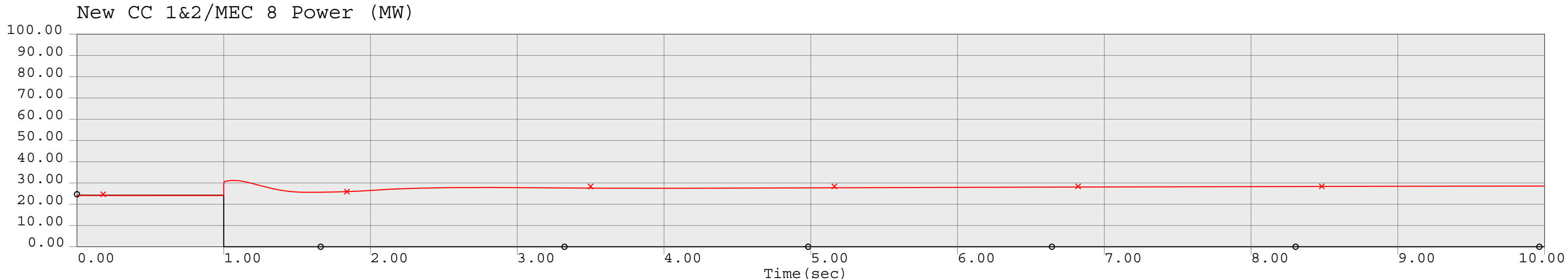
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



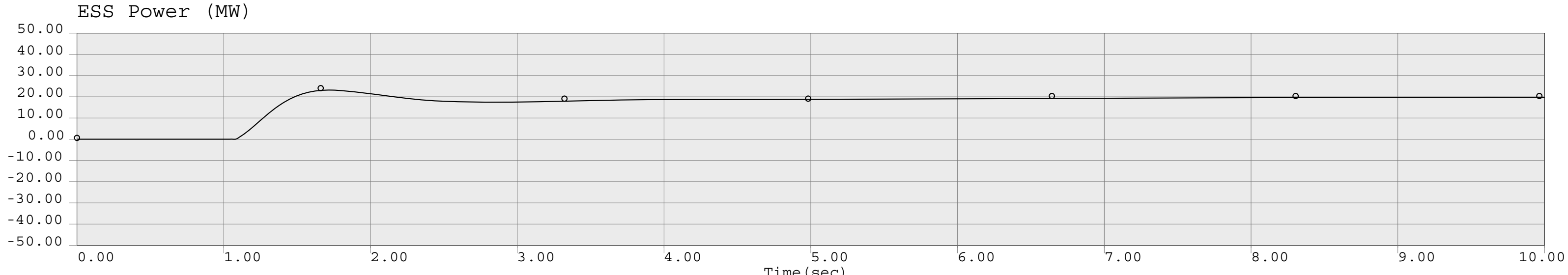
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



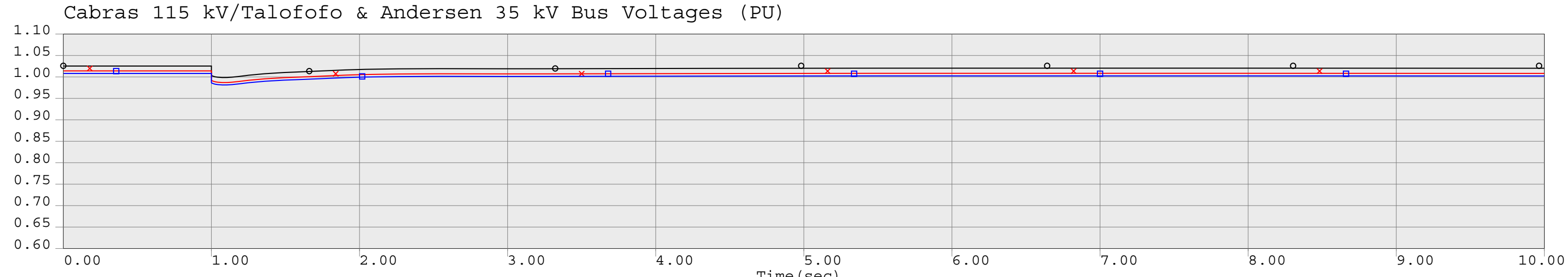
○ 0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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Guam Power Authority - EPS Energy Storage Analysis
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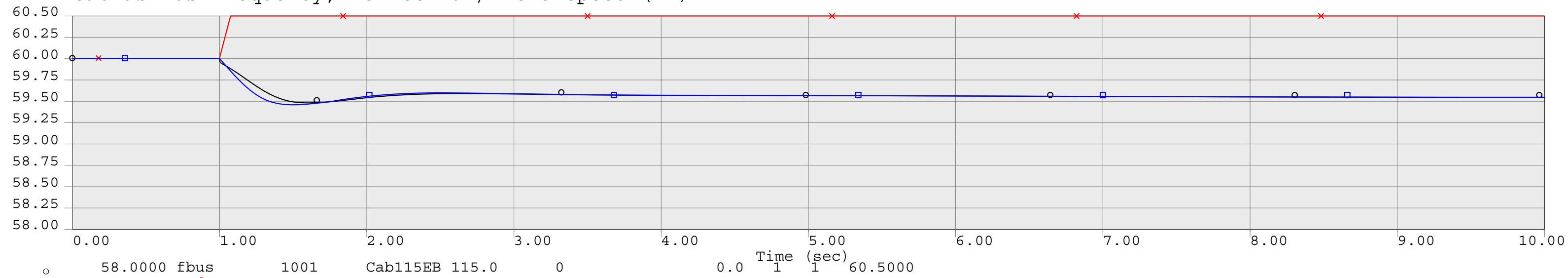
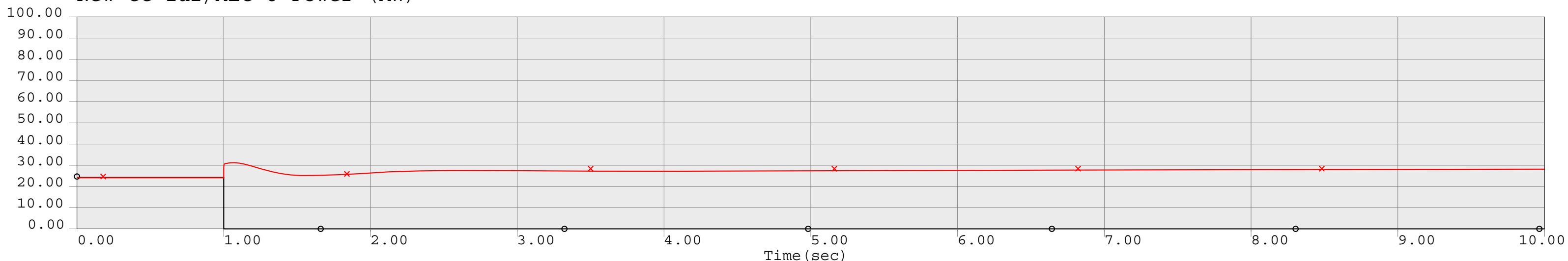
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



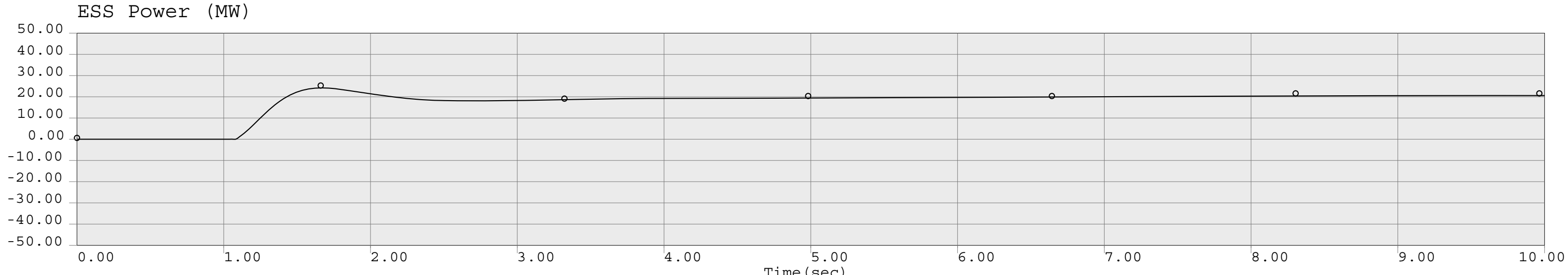
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



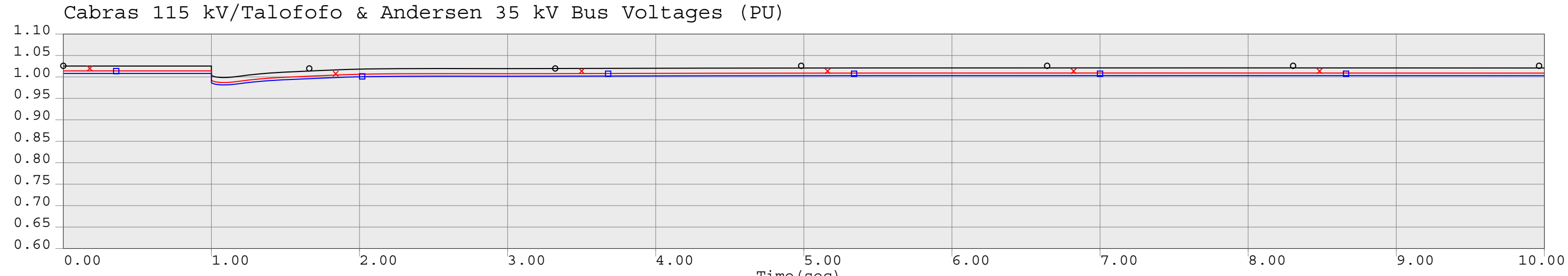
○ 0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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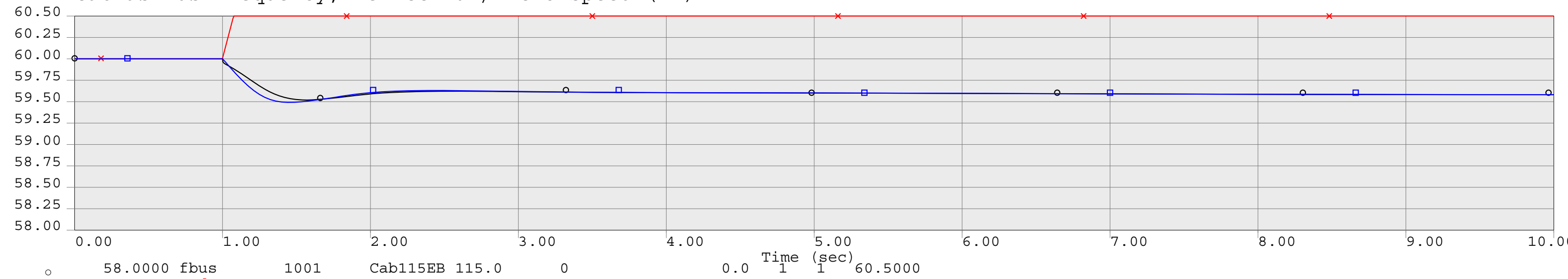
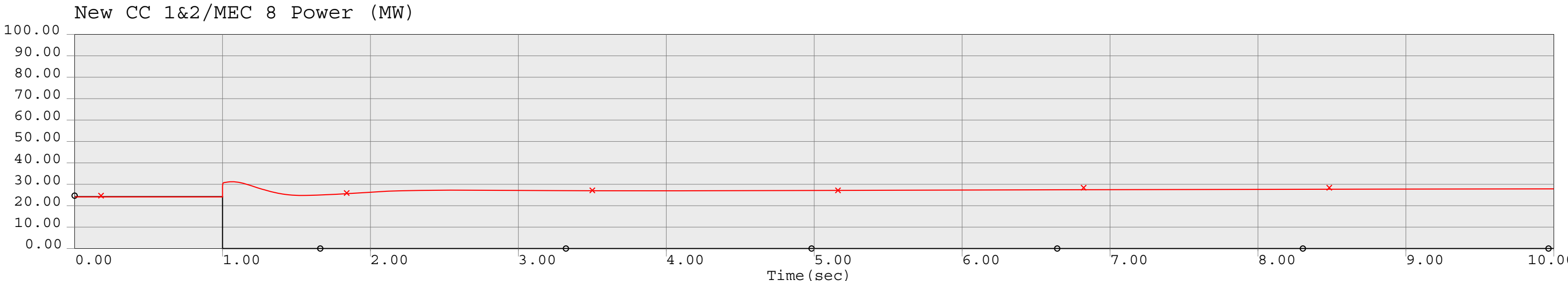
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



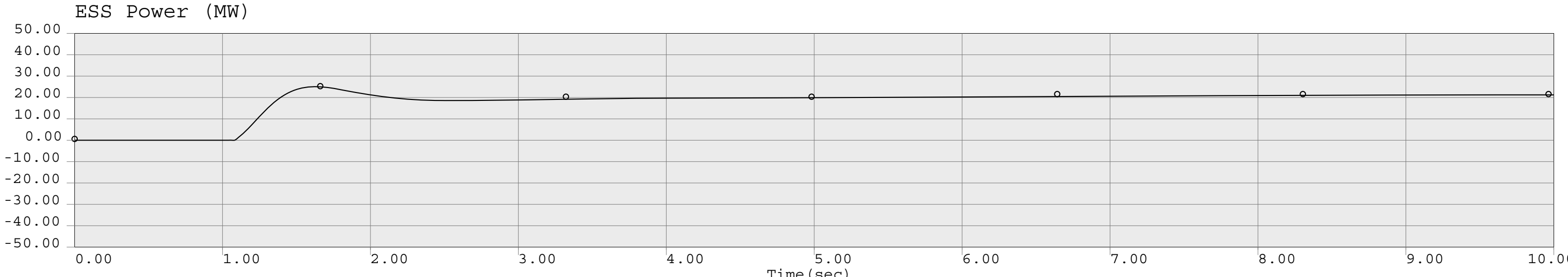
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



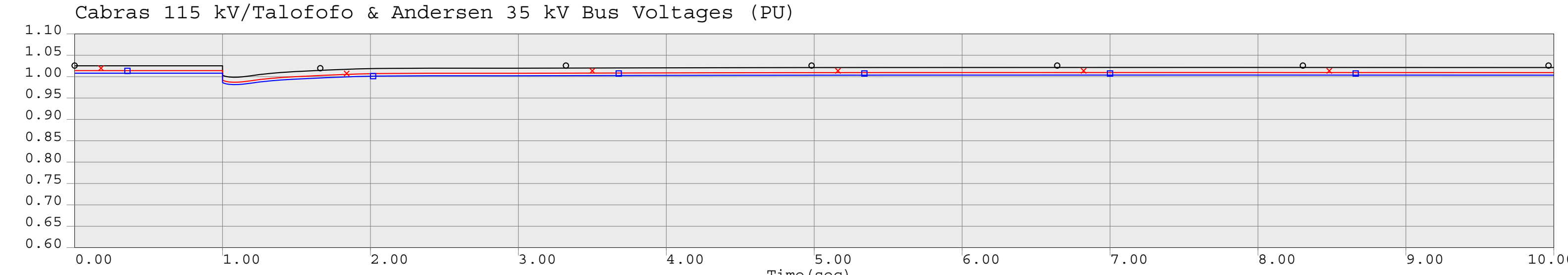
○ 0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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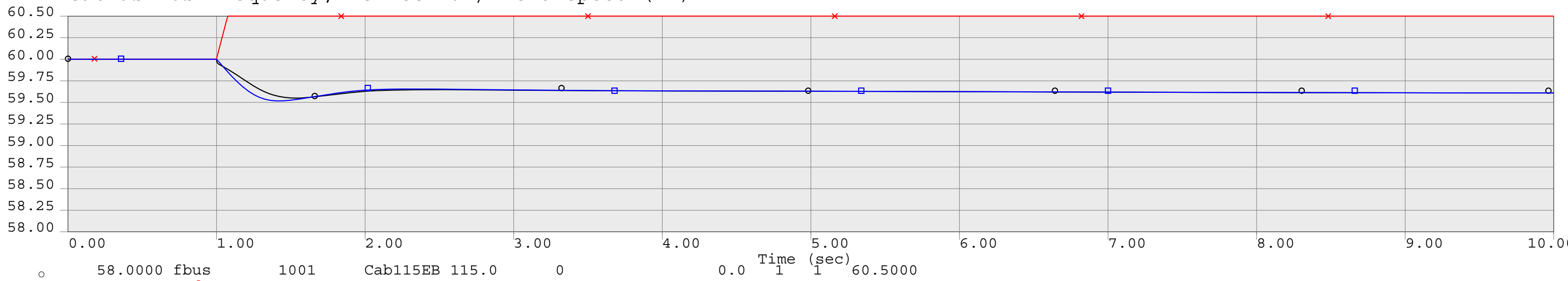
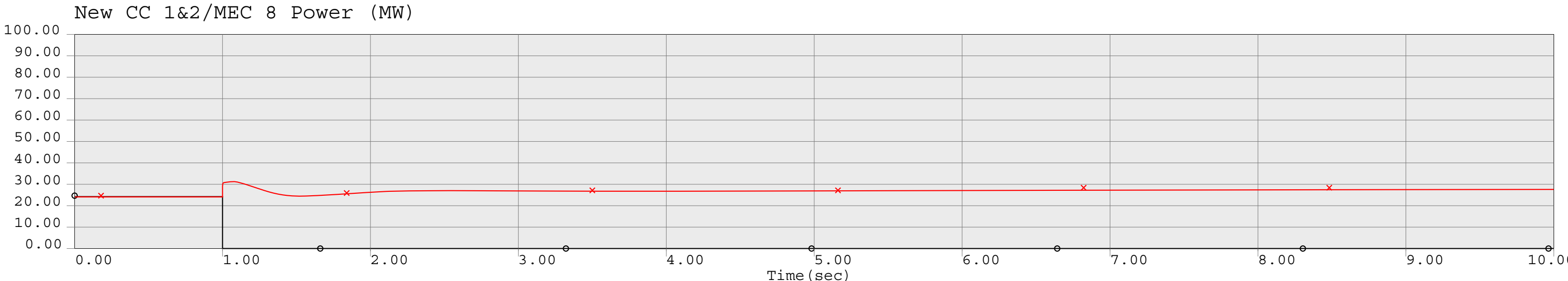
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)




```
o  58.0000 fbus   1001  Cab115EB 115.0  0   0.0  1  1  60.5000
x  58.0000 spd    7001  NEW CC 1  13.8  0   0.0  1  1  60.5000
□  58.0000 spd    7002  NEW CC 2  13.8  0   0.0  1  1  60.5000
```

New CC 1&2/MEC 8 Power (MW)




```
o  0.0000 pg   7001  NEW CC 1  13.8  0   0.0  1  1 100.0000
x  0.0000 pg   7002  NEW CC 2  13.8  0   0.0  1  1 100.0000
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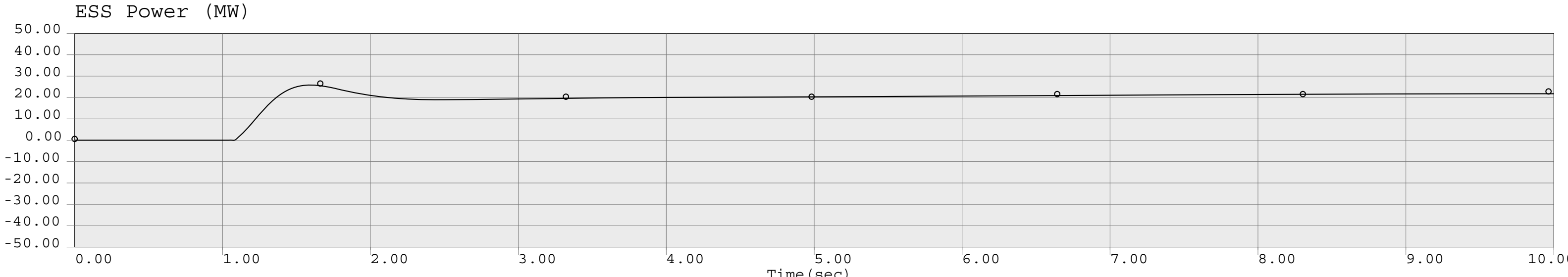
ESS Power (MW)

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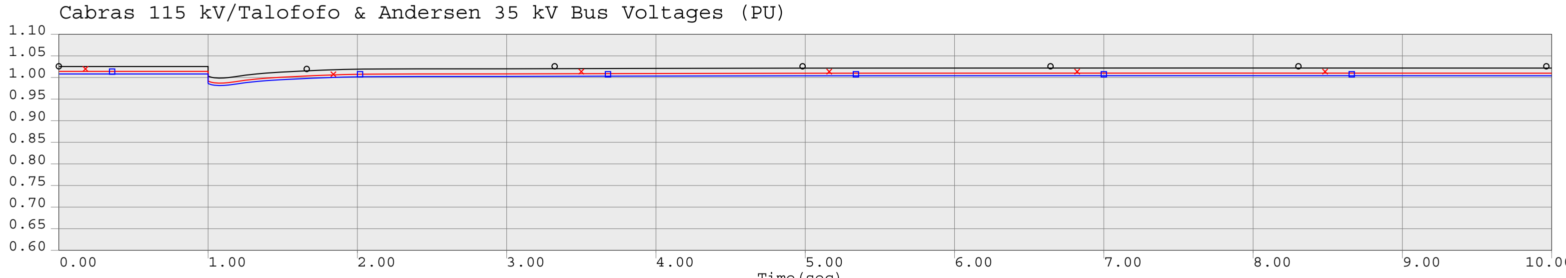
o  -50.0000 pbes   80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
```

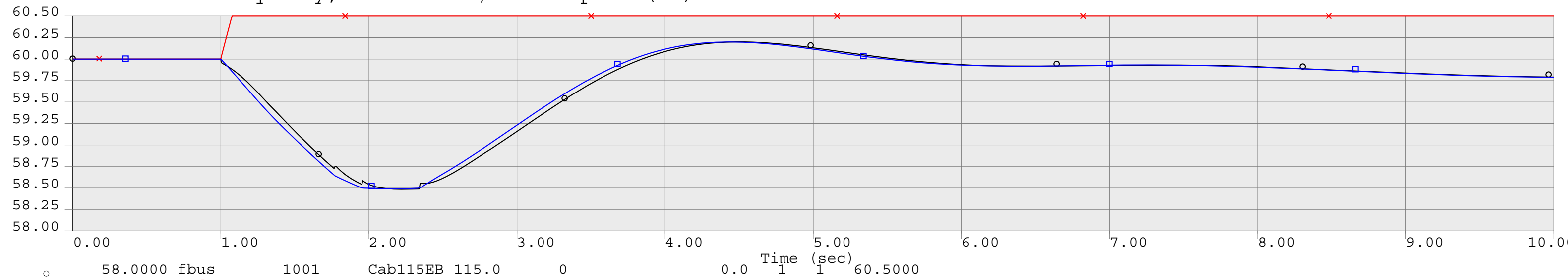
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
o  0.6000 vbus   1001  Cab115EB 115.0  0   0.0  1  1  1.1000
x  0.6000 vbus   2003    Tal345  34.5  0   0.0  1  1  1.1000
□  0.6000 vbus   2210  And345B1  34.5  0   0.0  1  1  1.1000
```

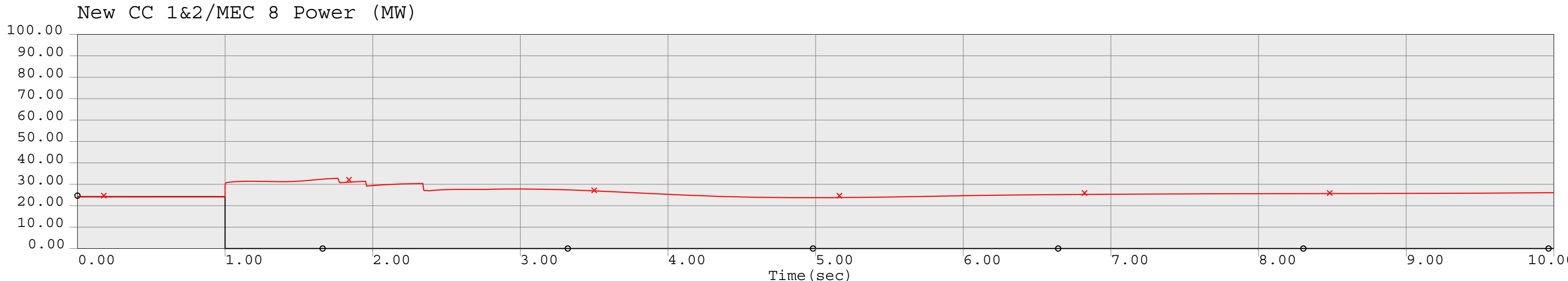
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



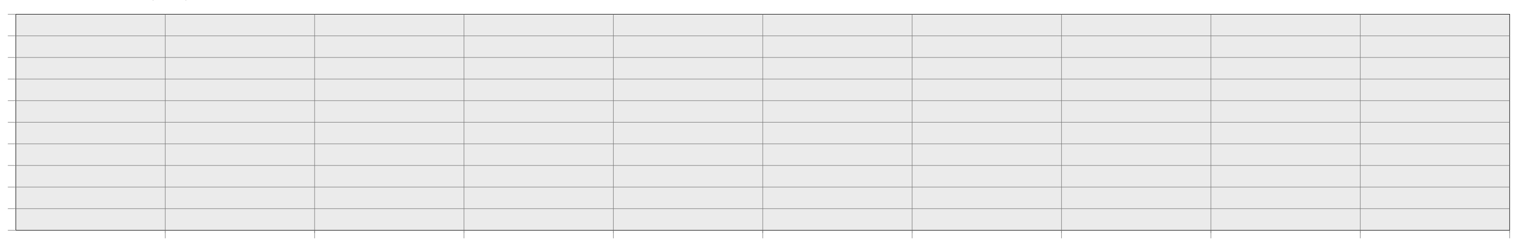
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)

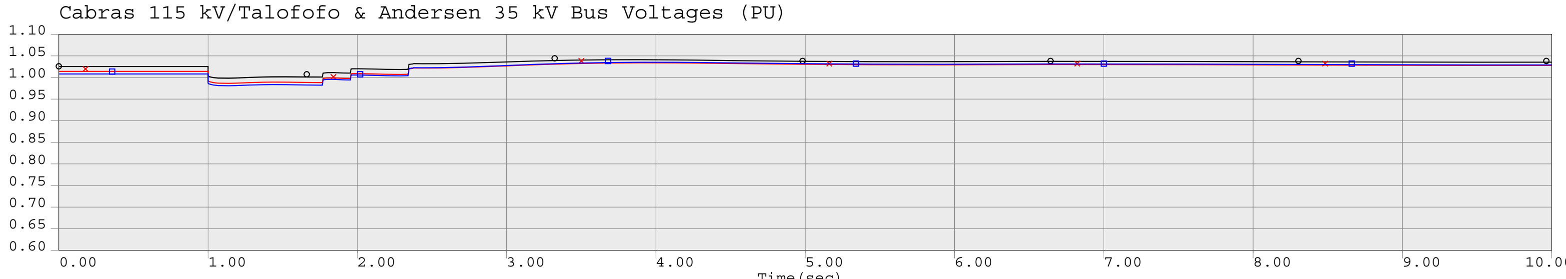


○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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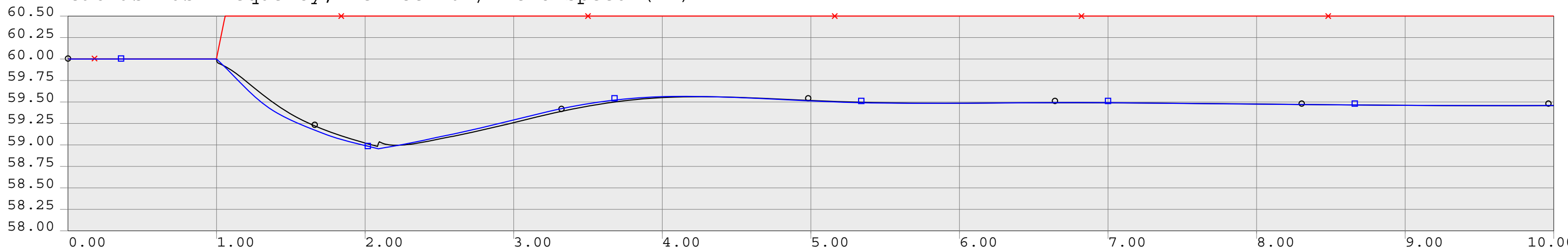
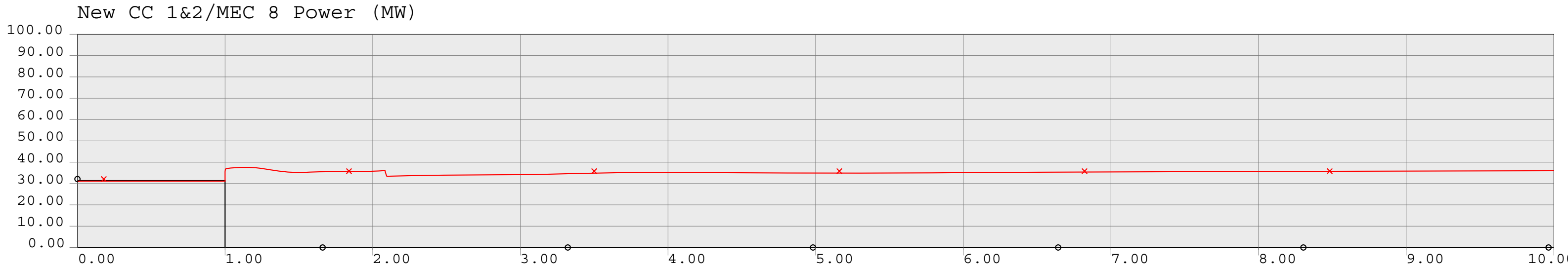
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



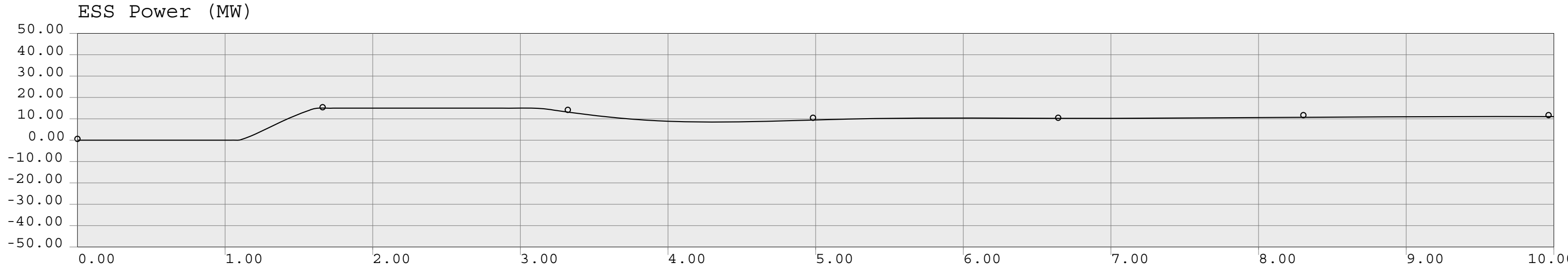
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



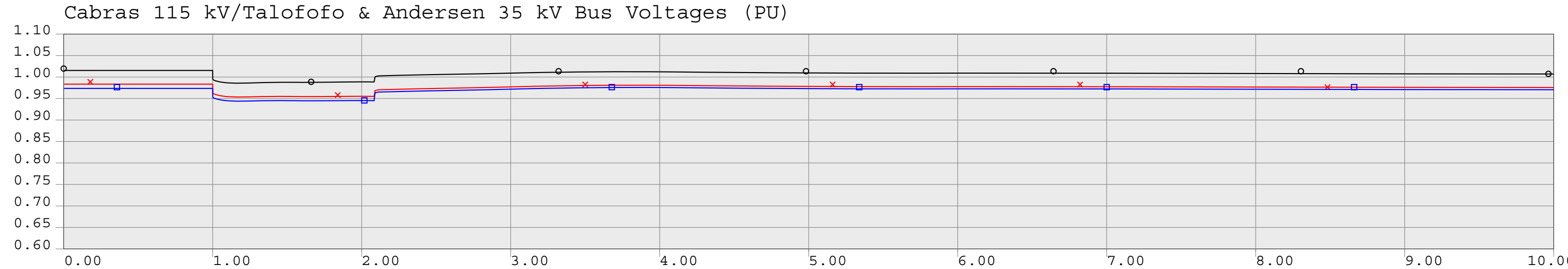
○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

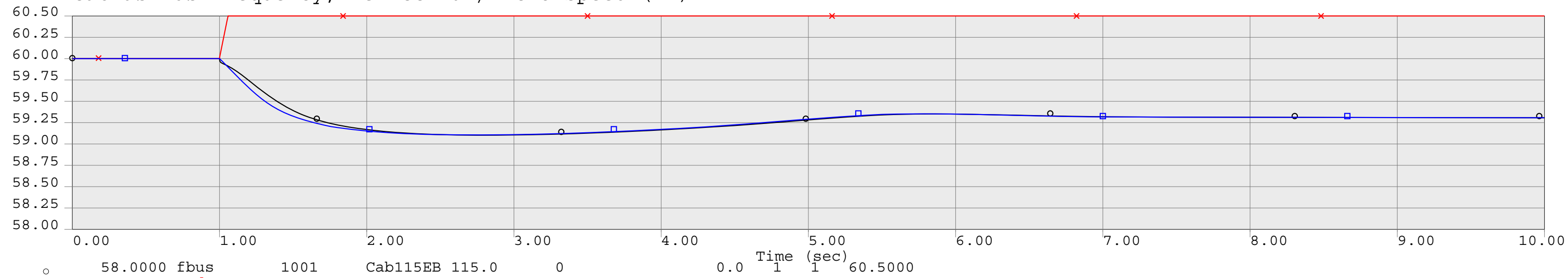
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

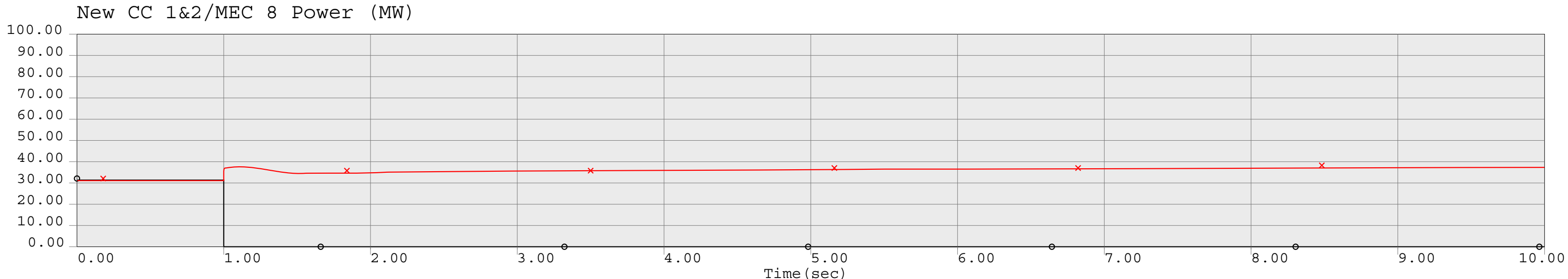
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



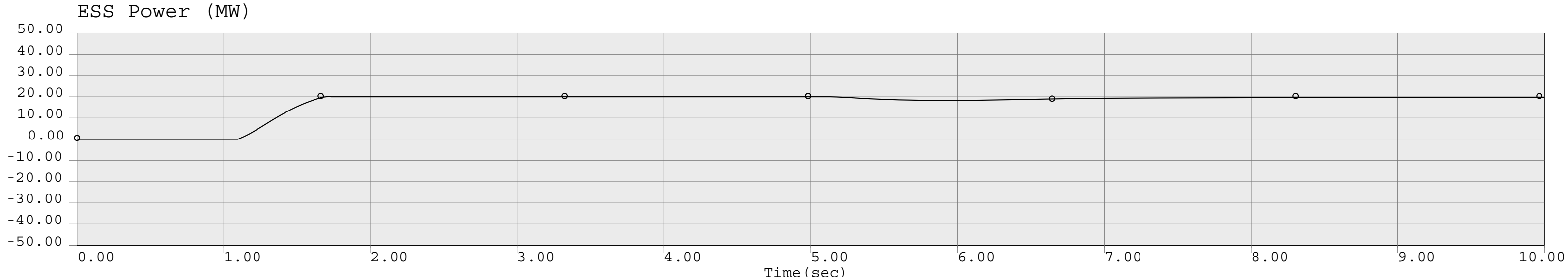
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



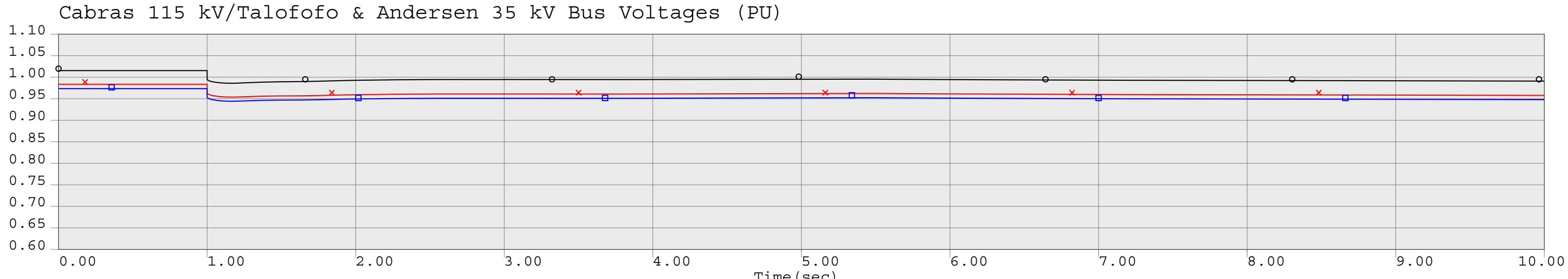
○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

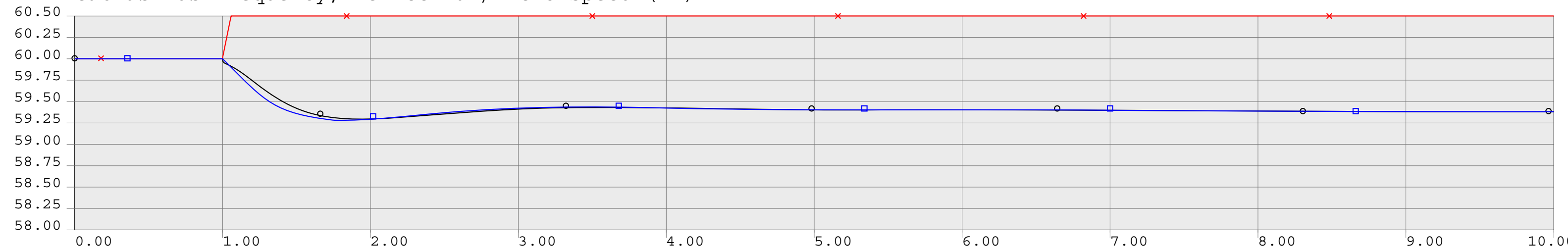
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

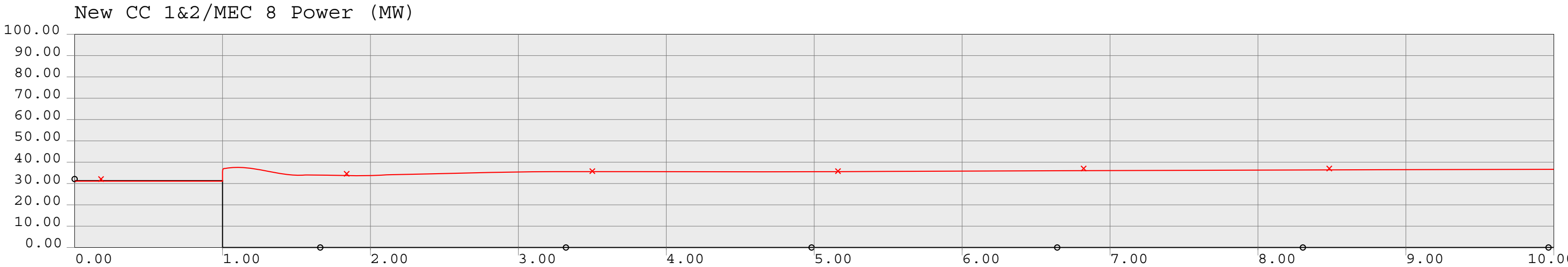
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



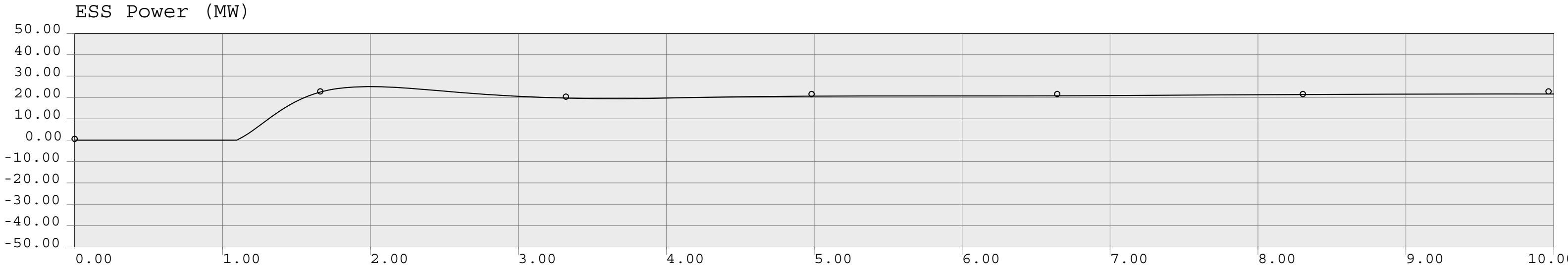
○ 58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
× 58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□ 58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



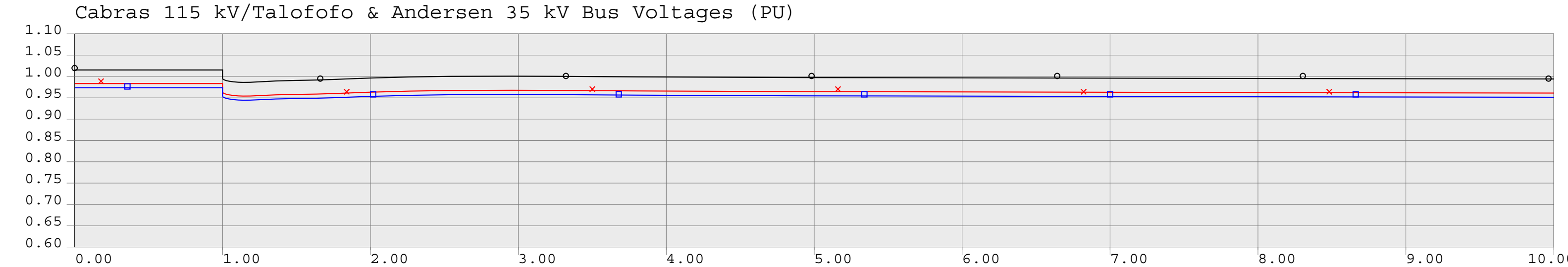
○ 0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
× 0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○ -50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

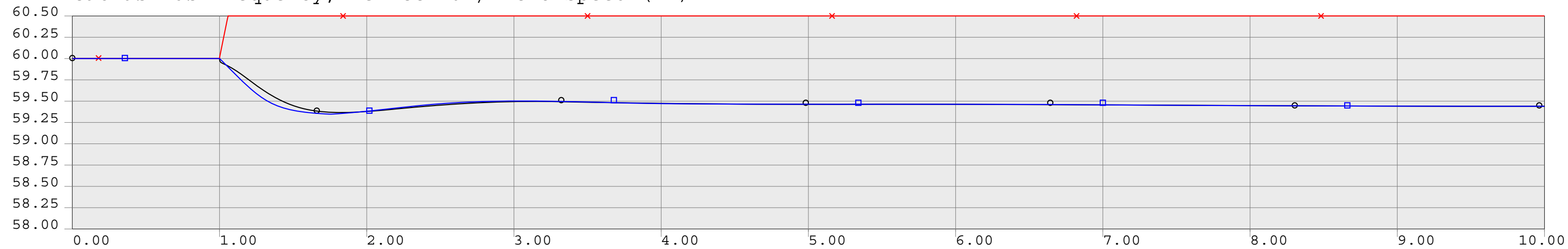
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
× 0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□ 0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

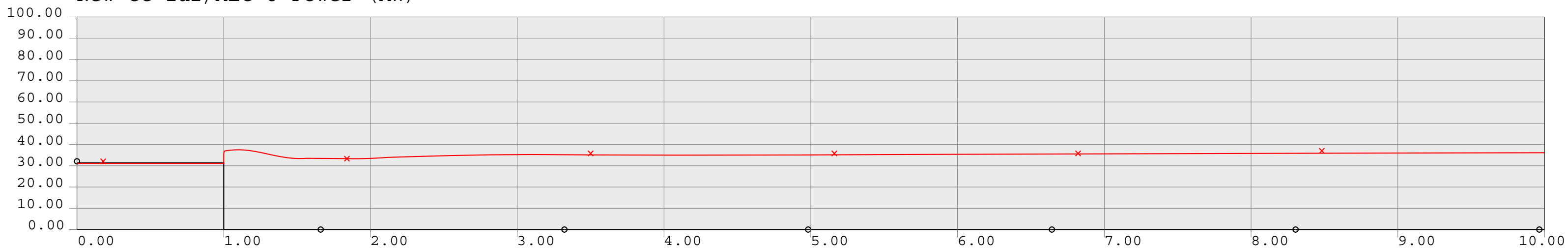
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



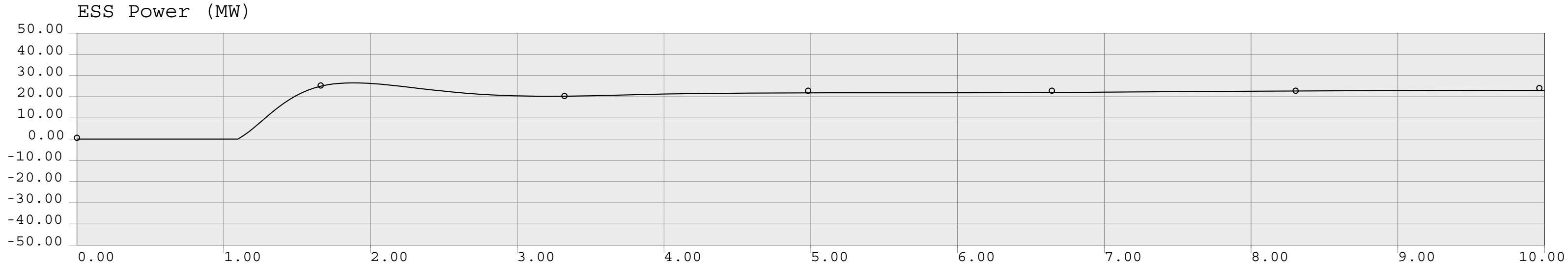
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



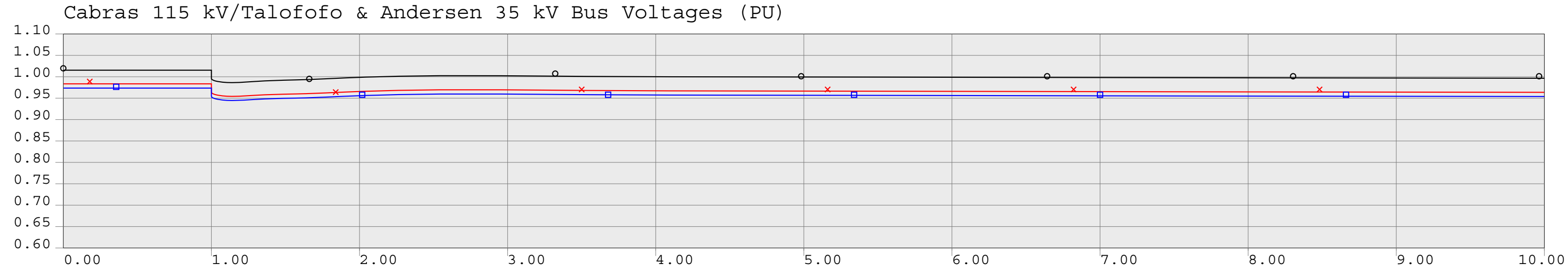
○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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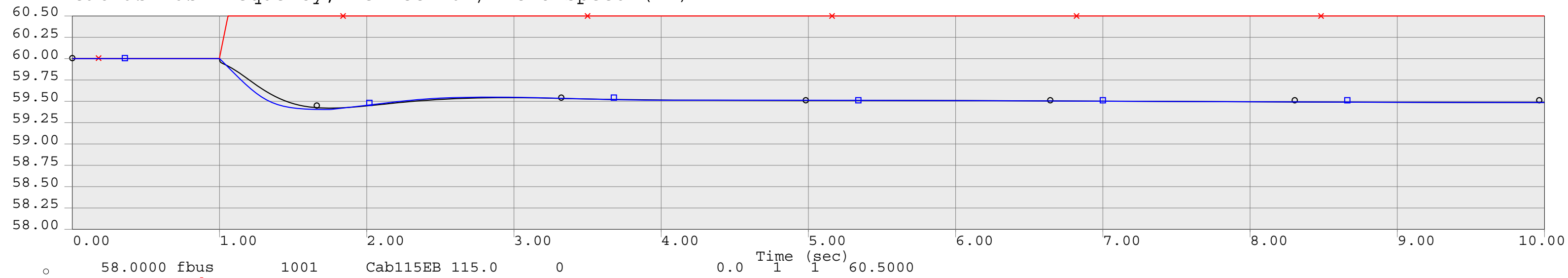
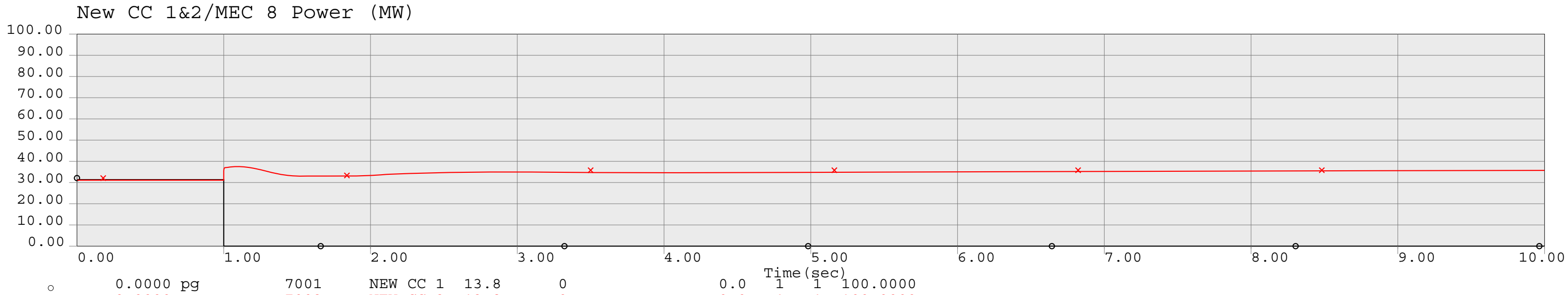
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



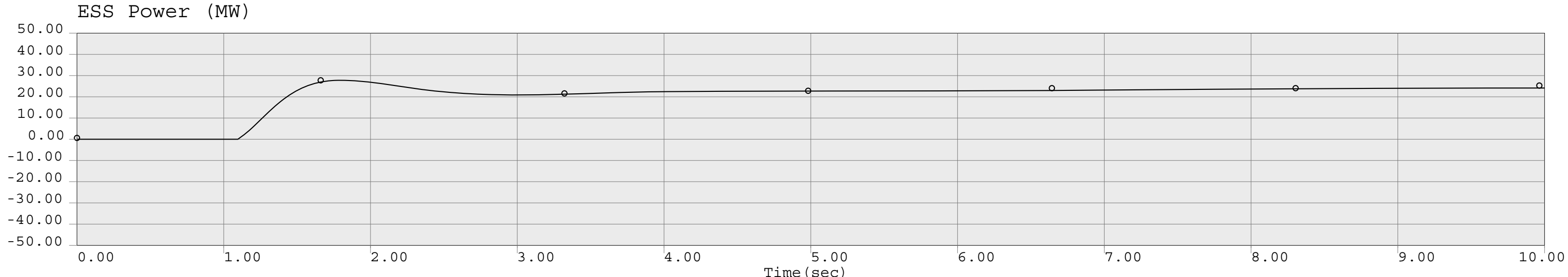
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



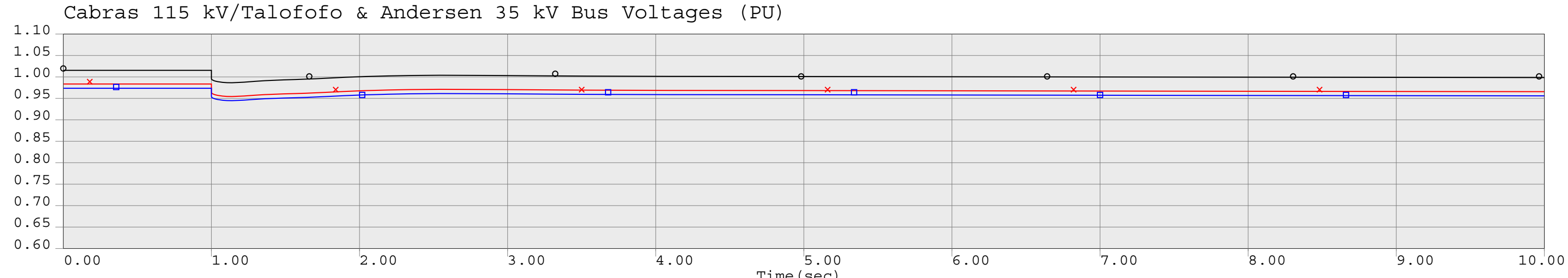
○ 0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/3300-cc1-1e.chf

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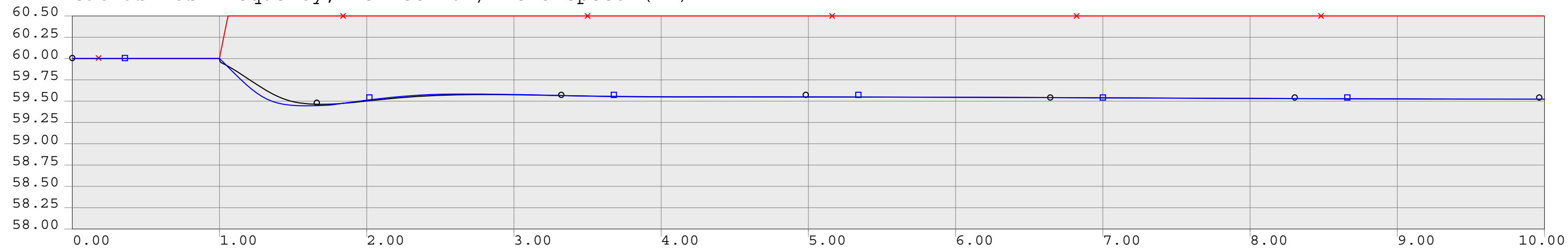
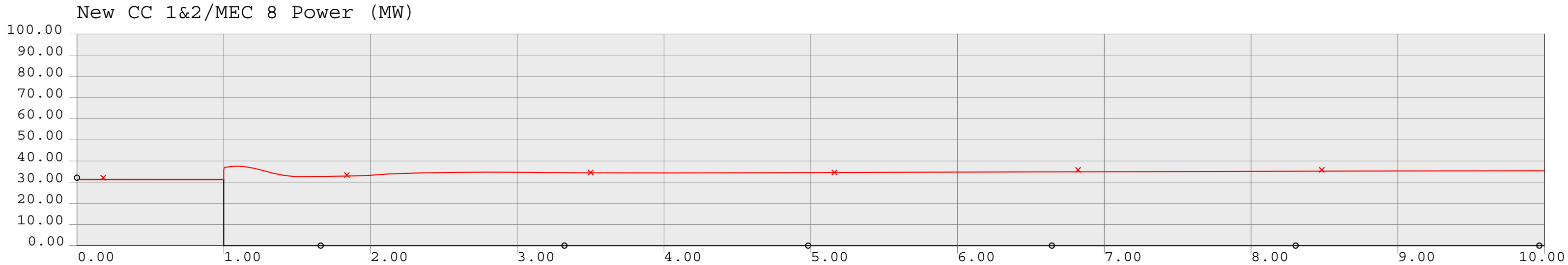
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



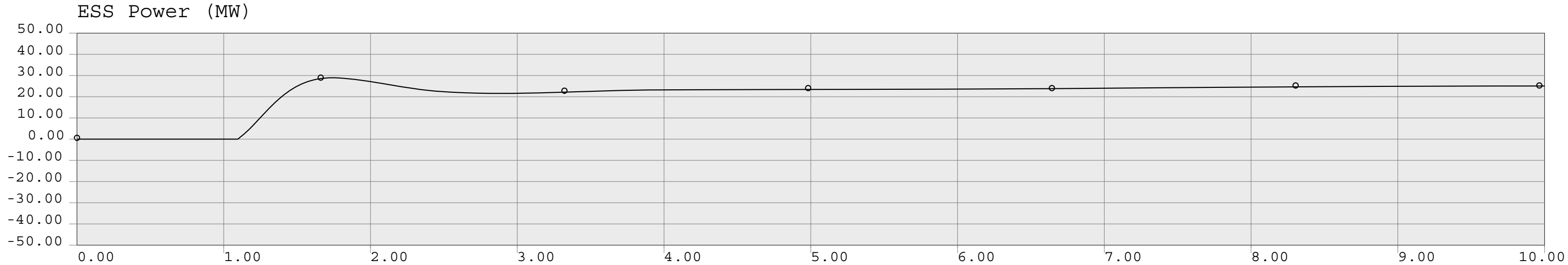
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



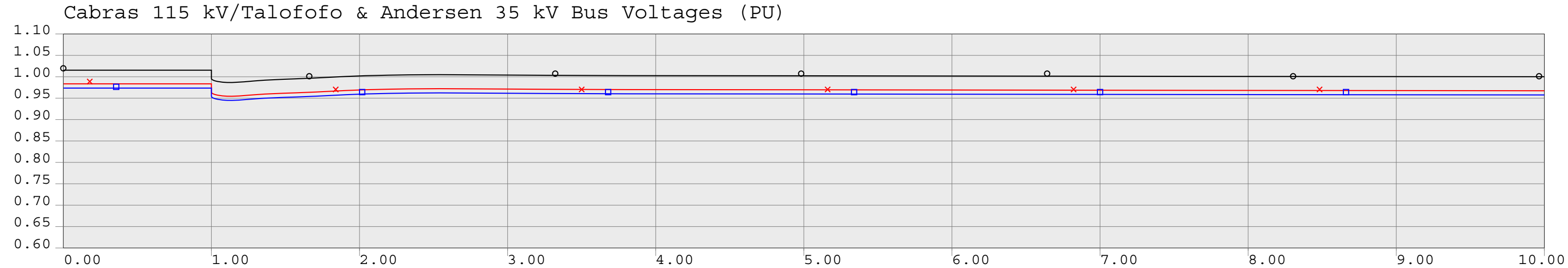
○ 0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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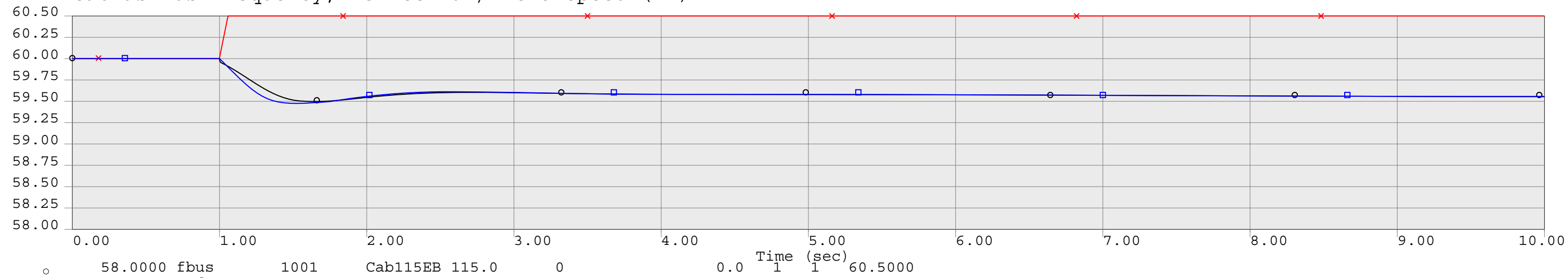
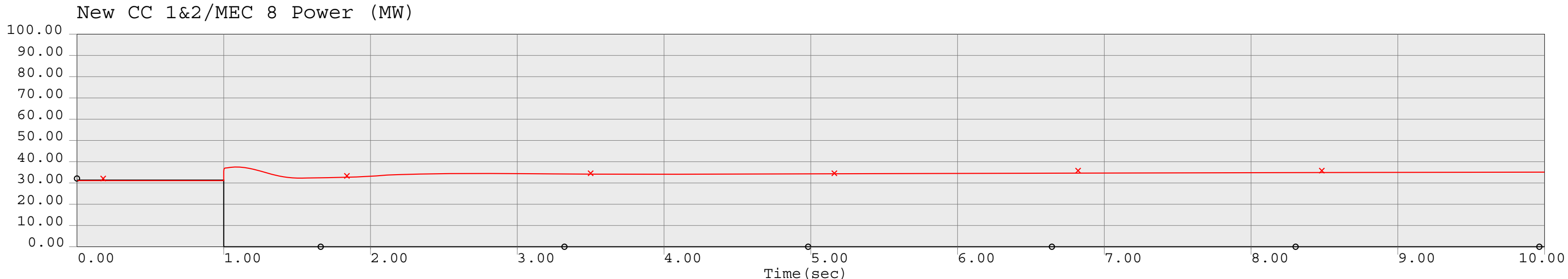
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



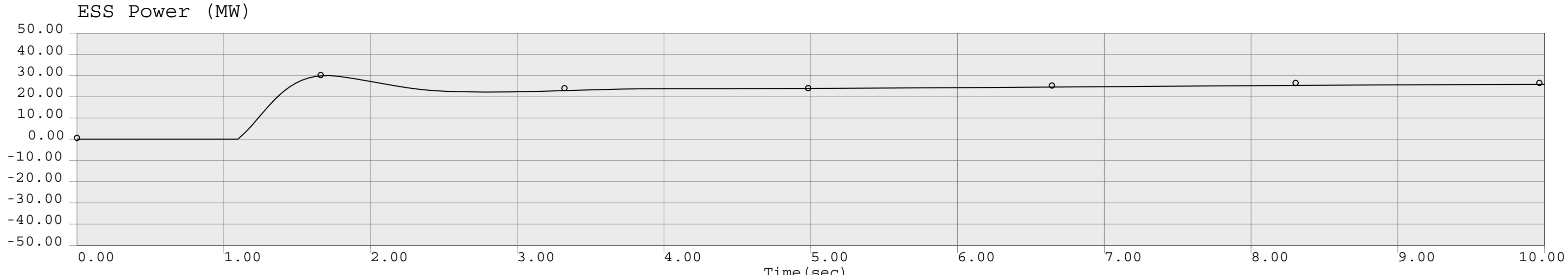
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



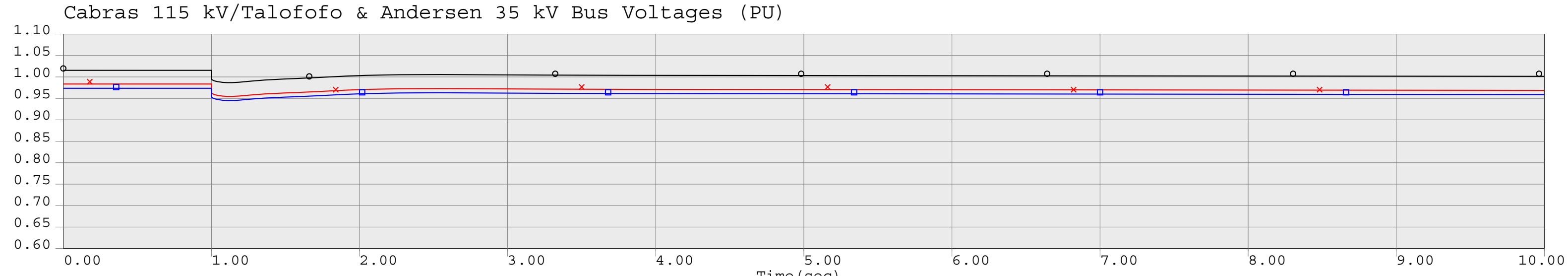
○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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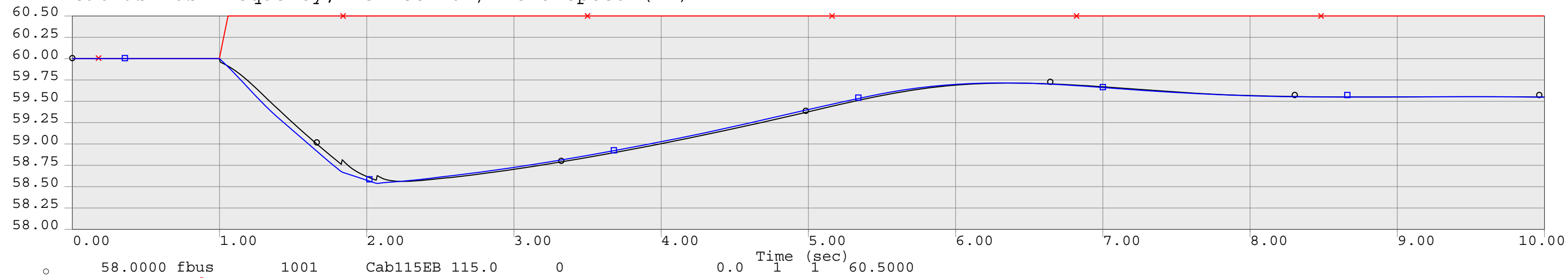
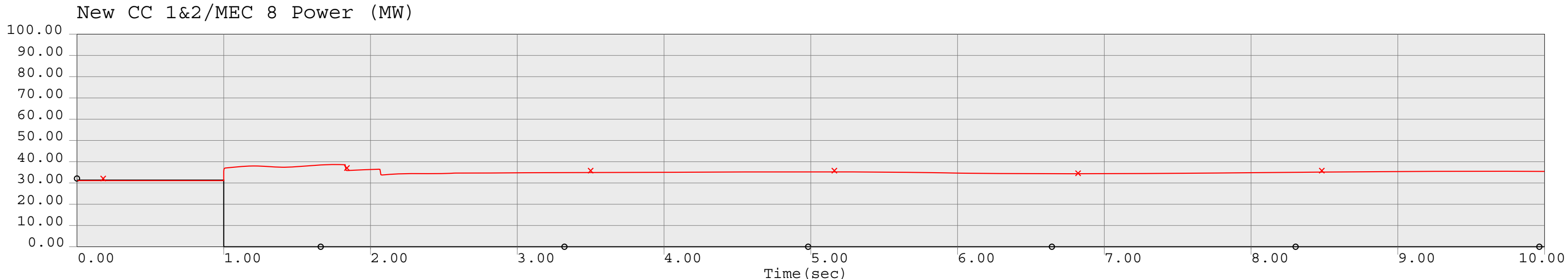
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



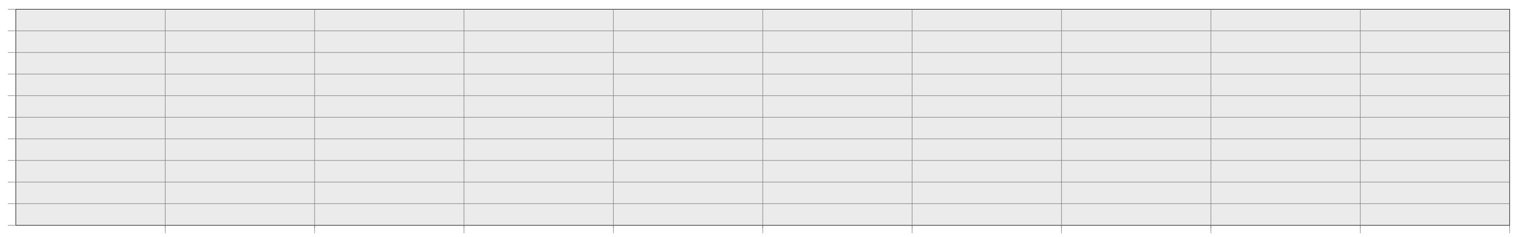
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)

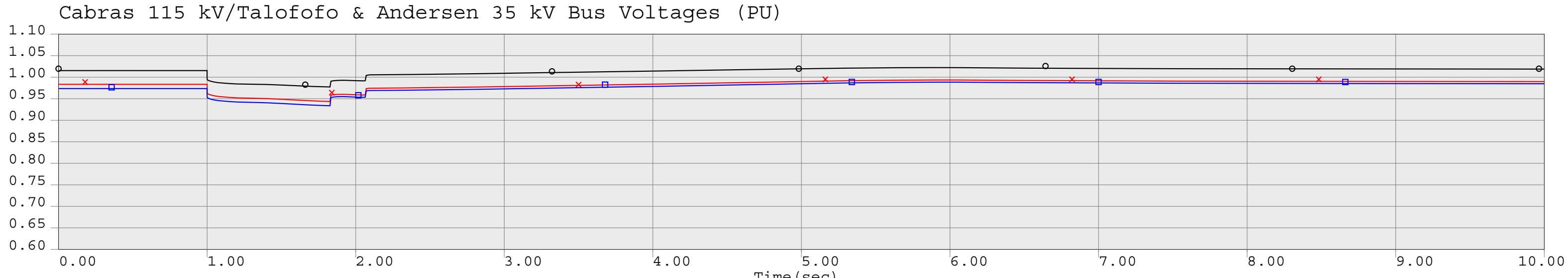


○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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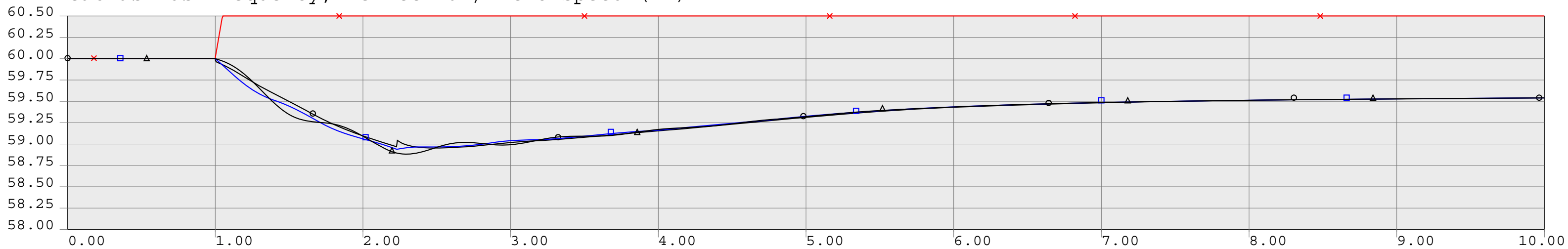
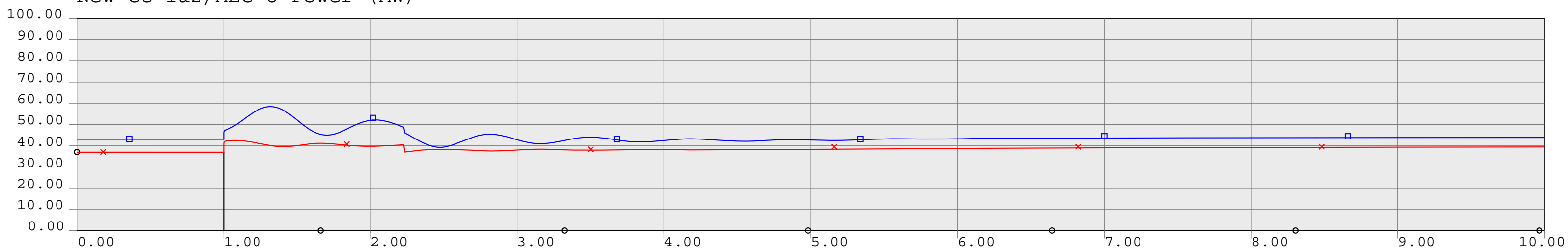
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



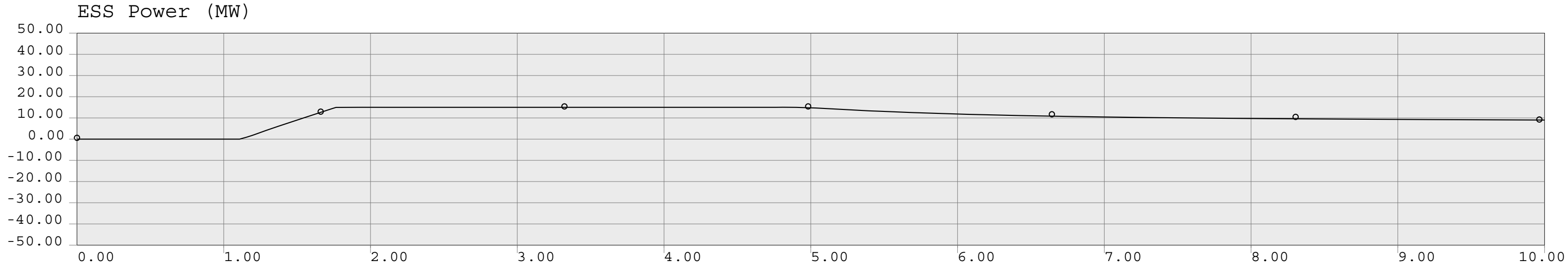
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	7001	NEW CC 1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	7002	NEW CC 2	13.8	0	0.0	1	1	60.5000
△	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



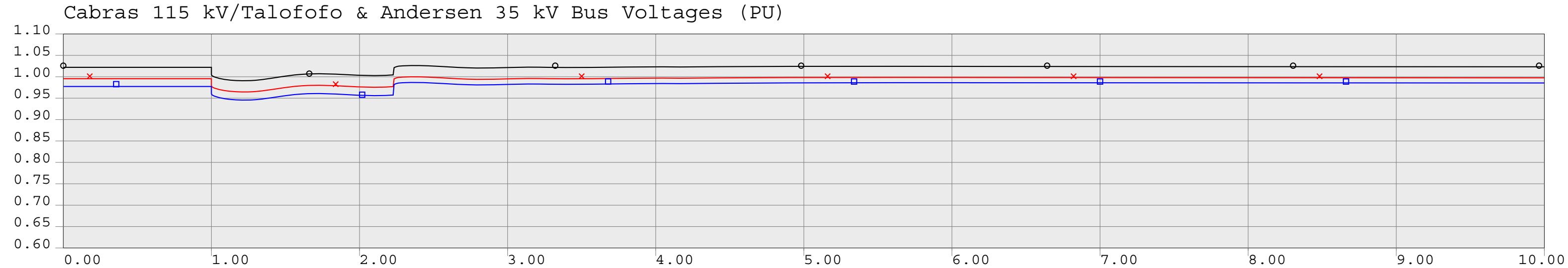
○	0.0000	pg	7001	NEW CC 1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	7002	NEW CC 2	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
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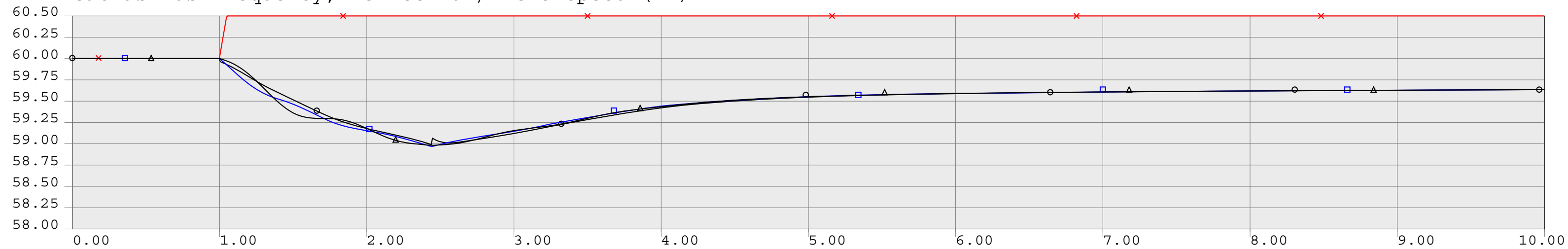
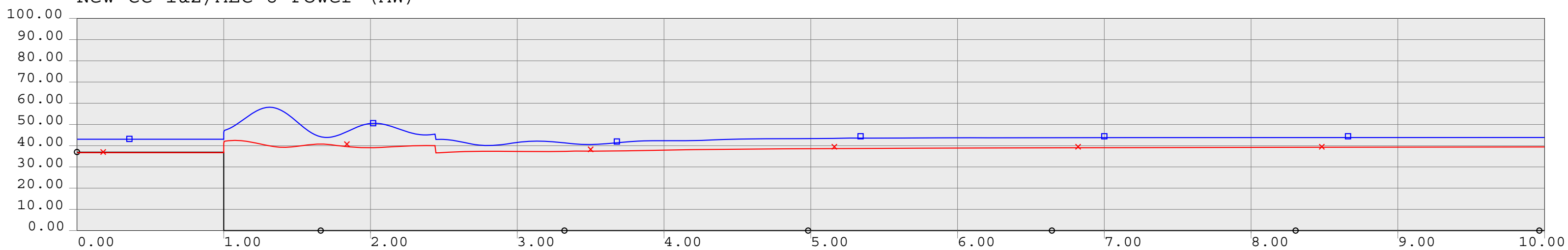
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



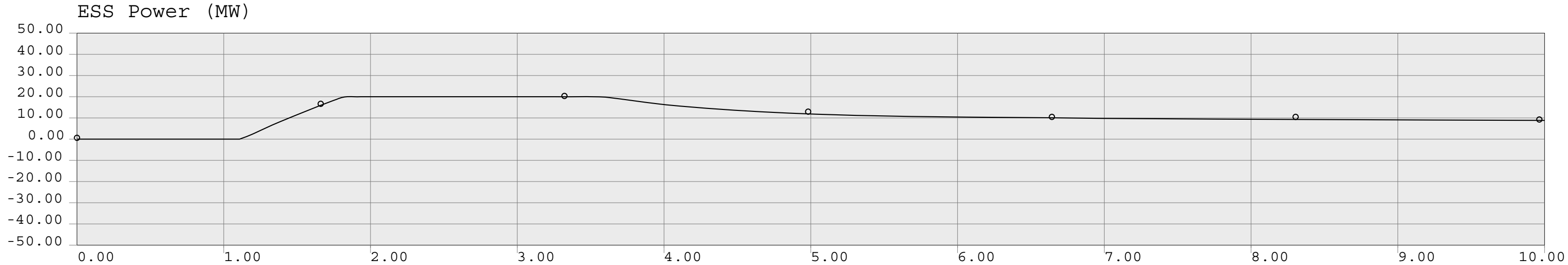

```
o  58.0000 fbus   1001  Cab115EB 115.0  0   0.0  1  1  60.5000
x  58.0000 spd    7001  NEW CC 1  13.8  0   0.0  1  1  60.5000
□  58.0000 spd    7002  NEW CC 2  13.8  0   0.0  1  1  60.5000
△  58.0000 spd      16     MEC 8  13.8  0   0.0  1  1  60.5000
```

New CC 1&2/MEC 8 Power (MW)



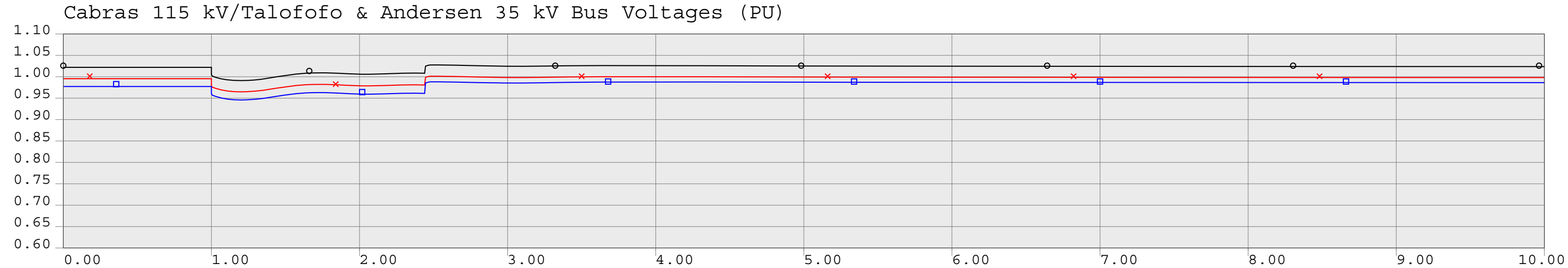

```
o  0.0000 pg   7001  NEW CC 1  13.8  0   0.0  1  1  100.0000
x  0.0000 pg   7002  NEW CC 2  13.8  0   0.0  1  1  100.0000
□  0.0000 pg     16     MEC 8  13.8  0   0.0  1  1  100.0000
```

ESS Power (MW)




```
o  -50.0000 pbes   80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
o  0.6000 vbus   1001  Cab115EB 115.0  0   0.0  1  1  1.1000
x  0.6000 vbus   2003    Tal345  34.5  0   0.0  1  1  1.1000
□  0.6000 vbus   2210  And345B1  34.5  0   0.0  1  1  1.1000
```


chans/3400-cc1-1b.chf

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Guam Power Authority - EPS Energy Storage Analysis
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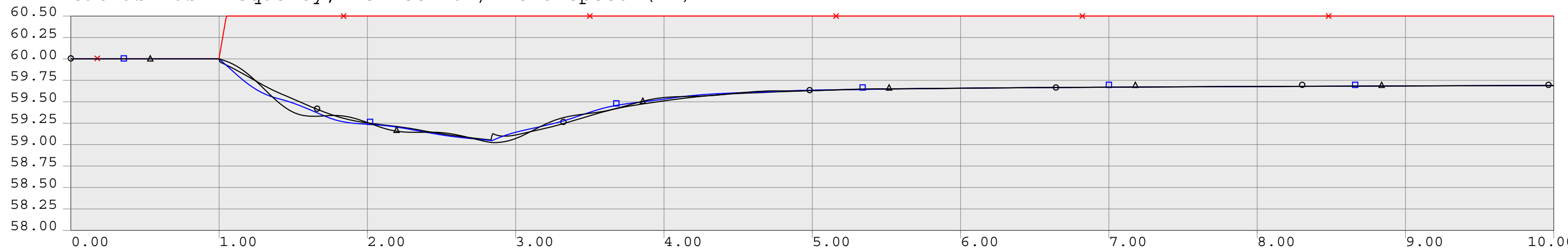
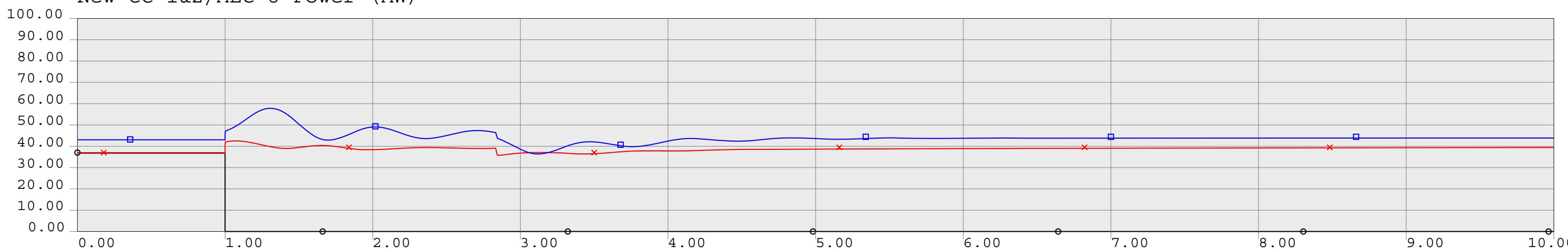
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



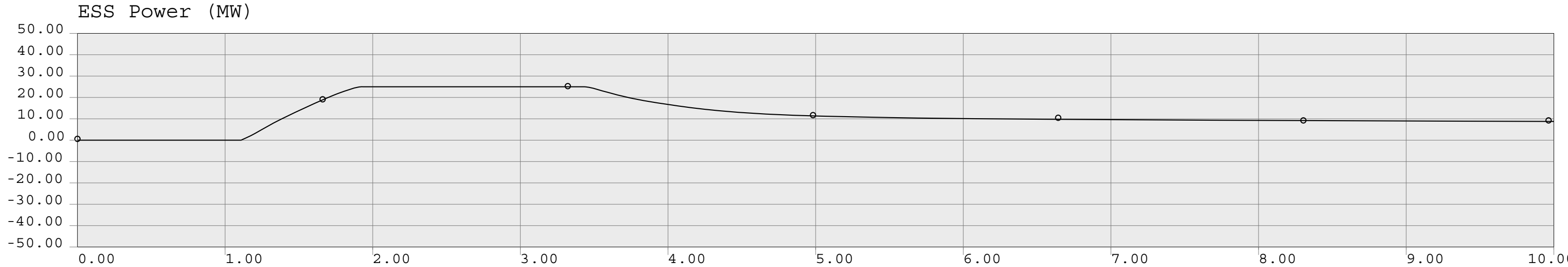
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000
△ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



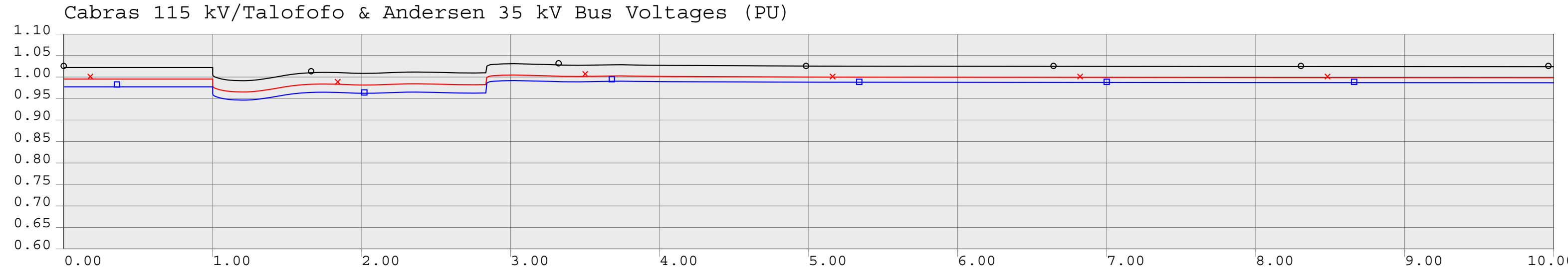
○ 0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000
□ 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/3400-cc1-1c.chf

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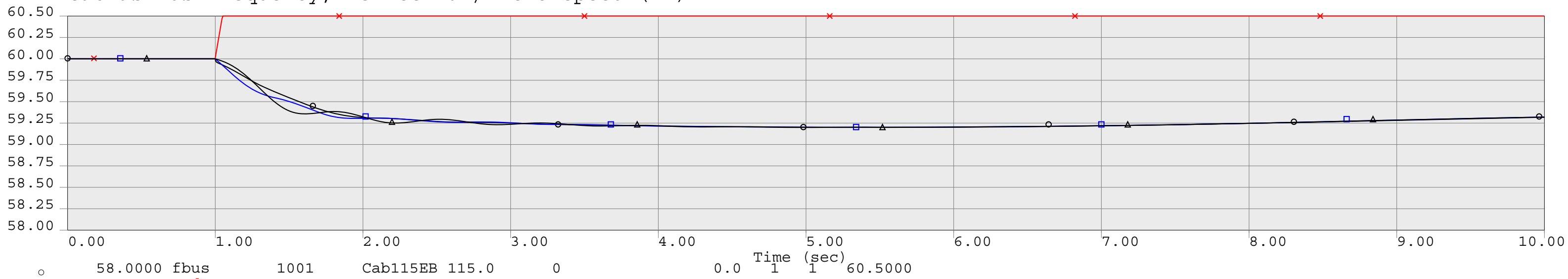
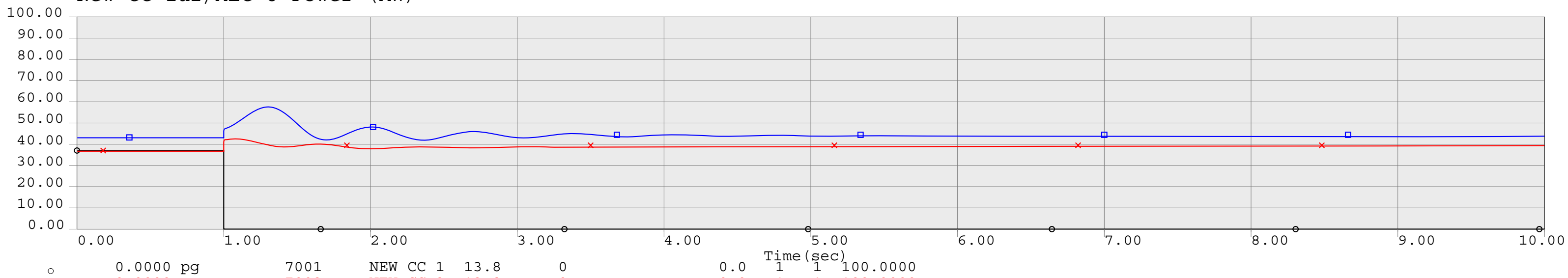
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



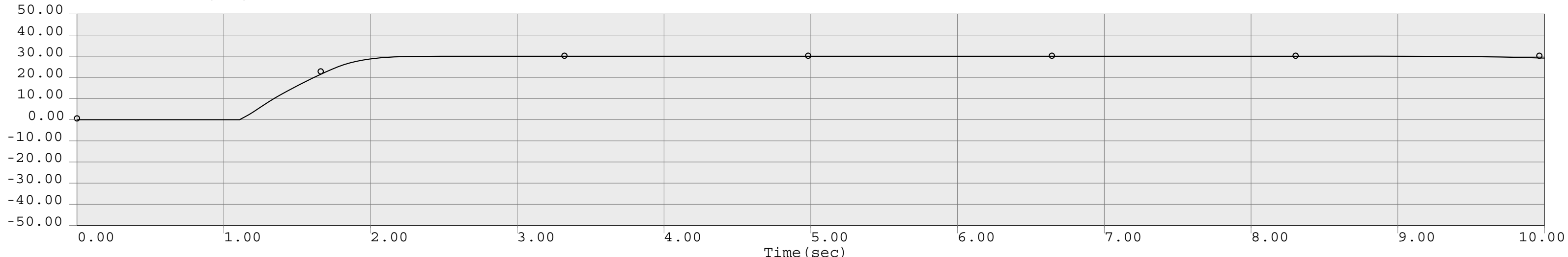
○ 58.0000	fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
× 58.0000	spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□ 58.0000	spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000
△ 58.0000	spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



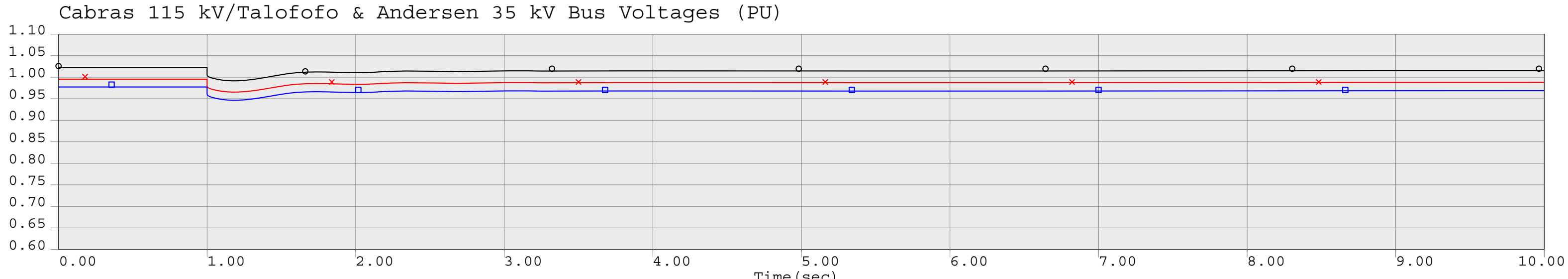
○ 0.0000	pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
× 0.0000	pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000
□ 0.0000	pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○ -50.0000	pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000	vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
× 0.6000	vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□ 0.6000	vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

chans/3400-cc1-1d.chf

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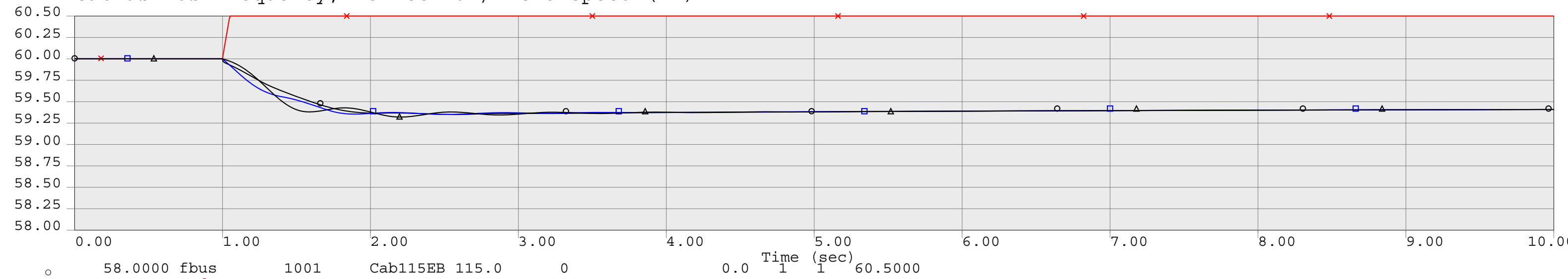
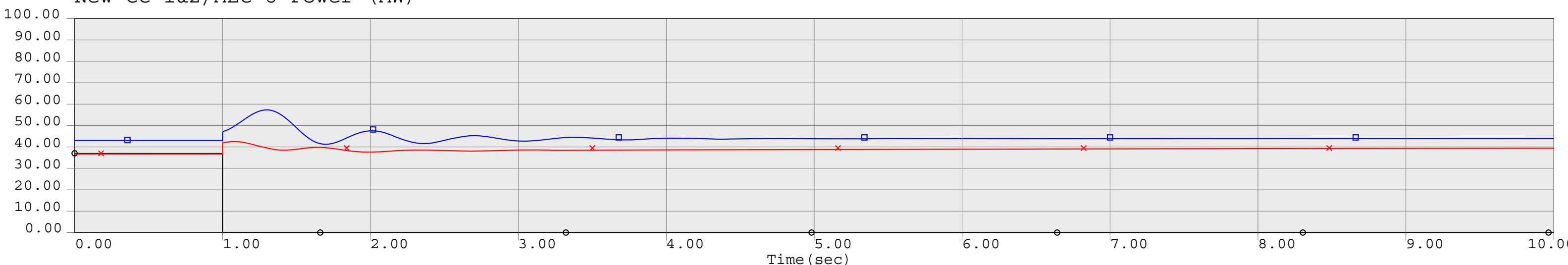
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



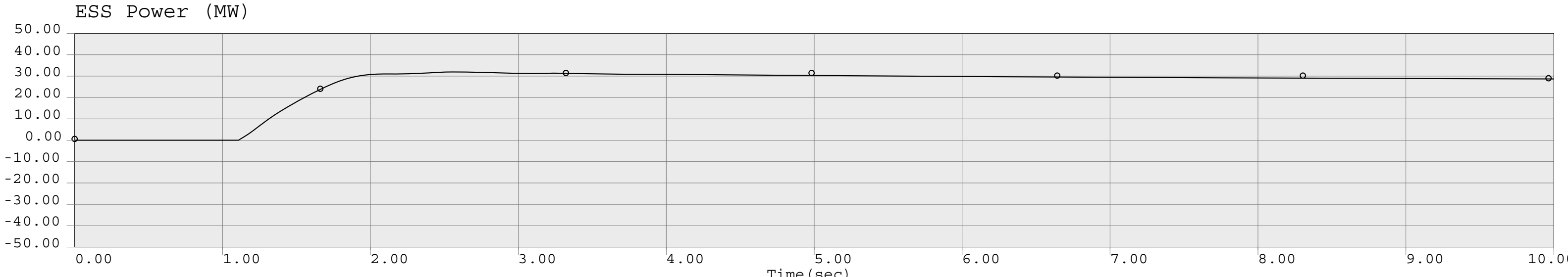
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000
△	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



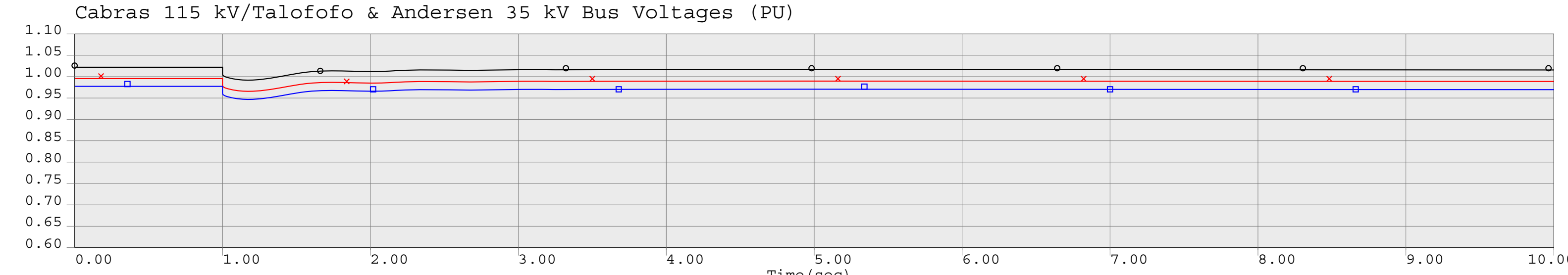
○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000
□	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

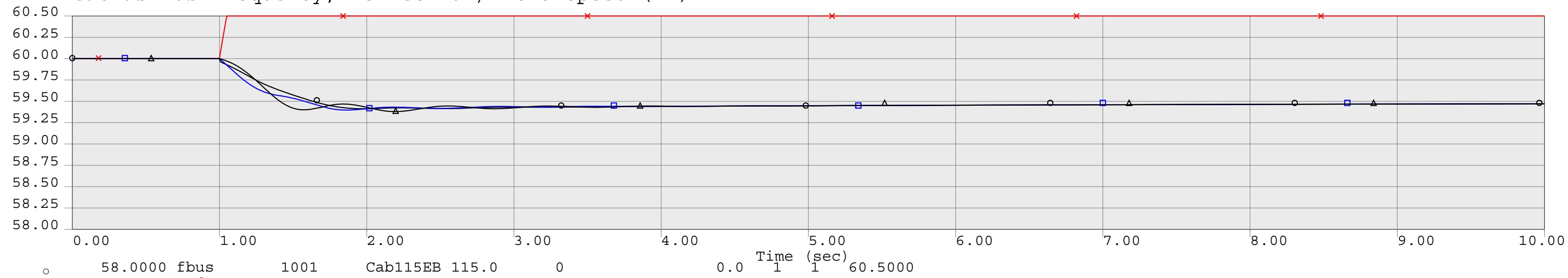
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

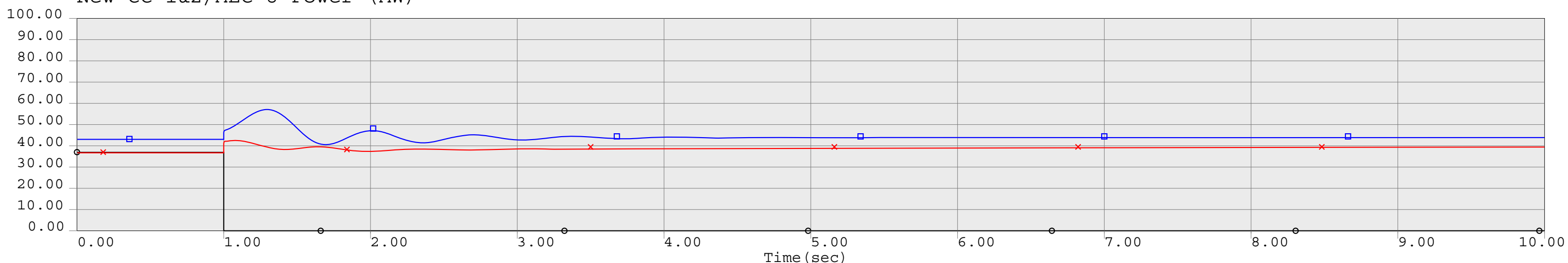
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



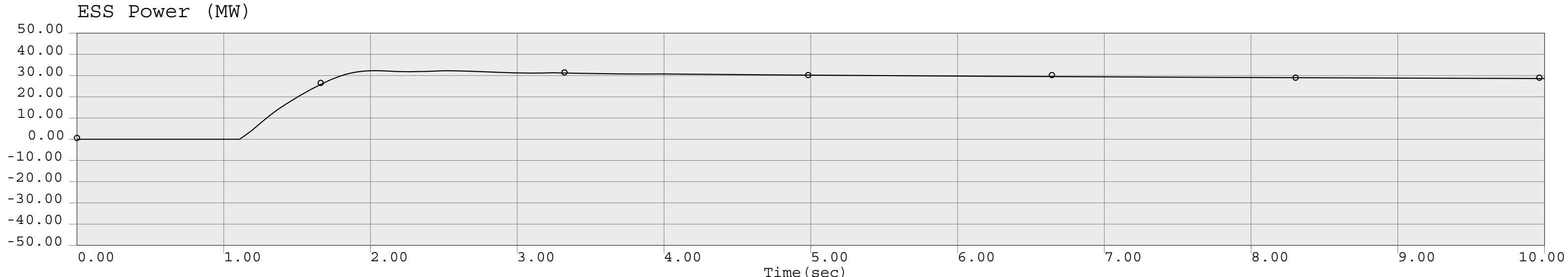
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



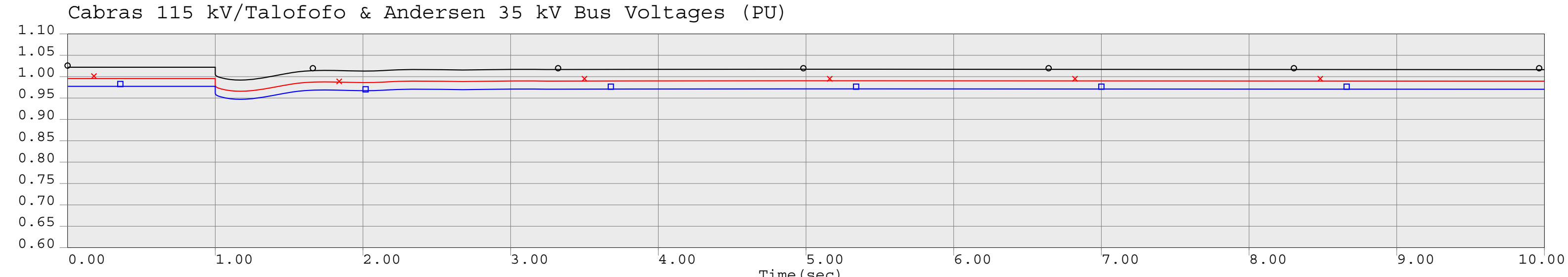
0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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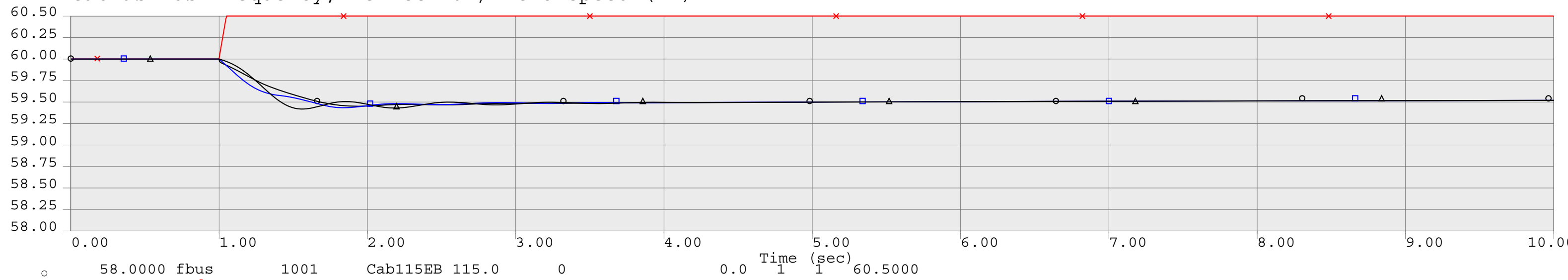
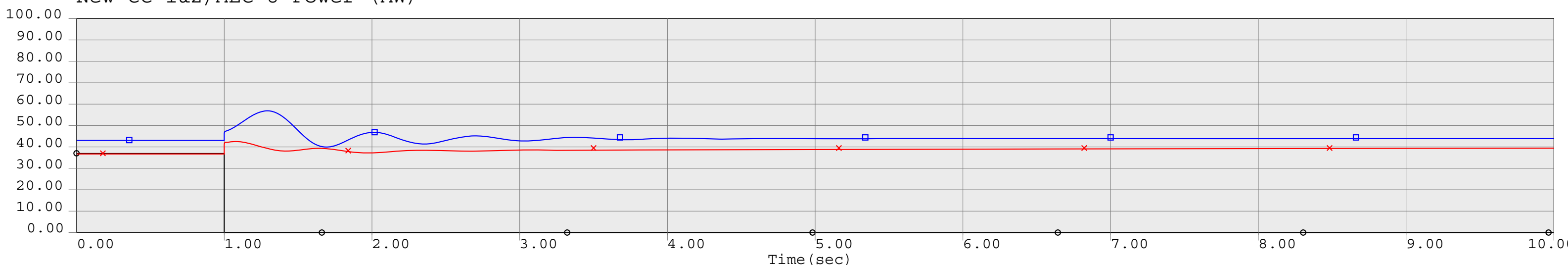
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



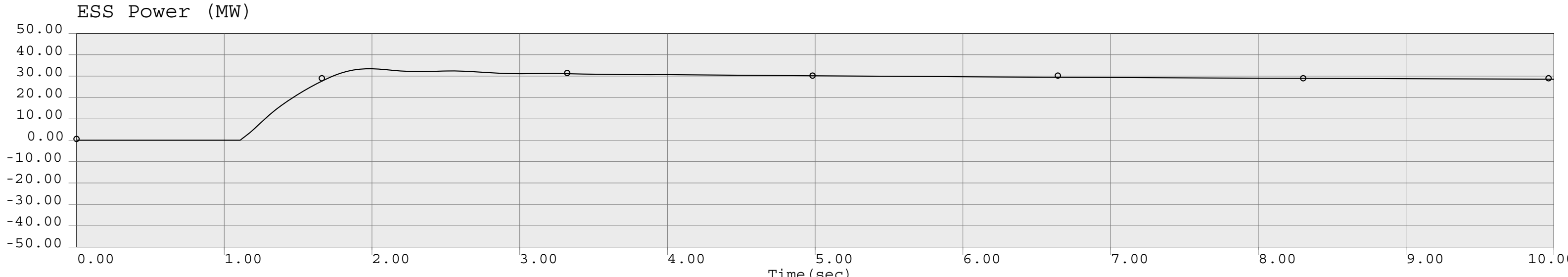
○ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
× 58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
□ 58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000
△ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



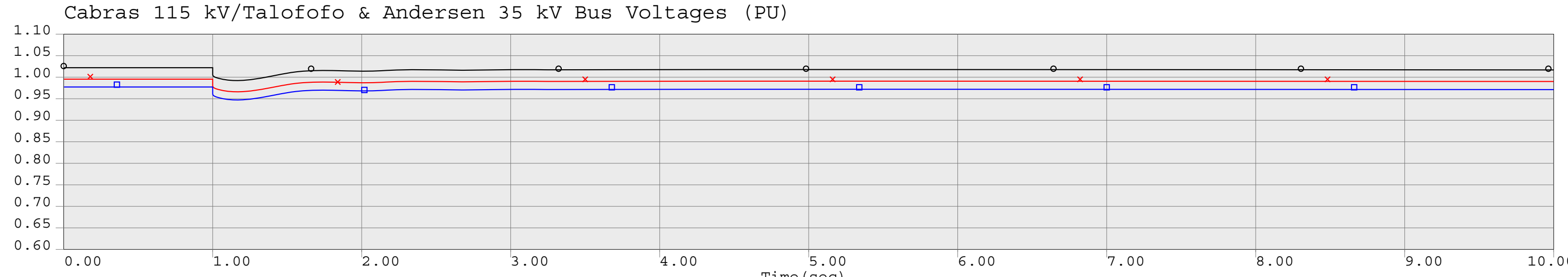
○ 0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000
□ 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/3400-cc1-1g.chf

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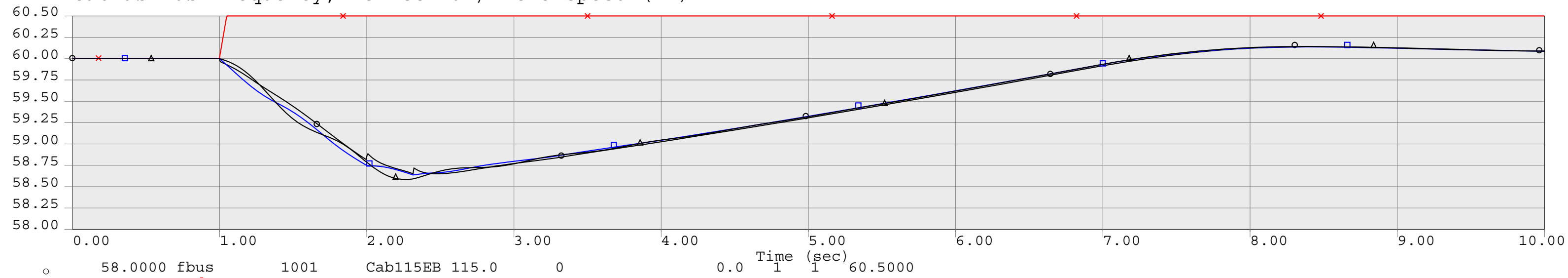
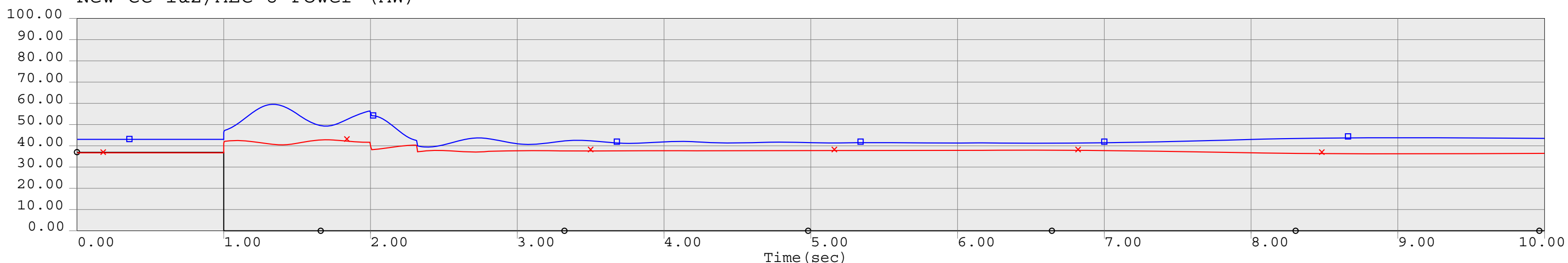
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



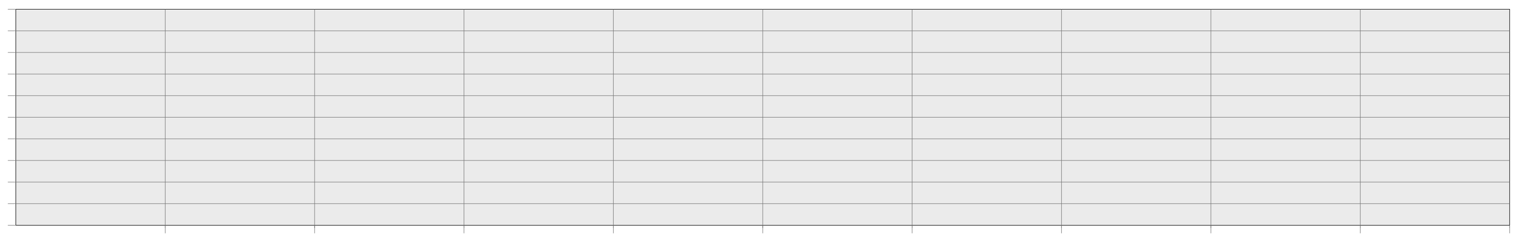
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)

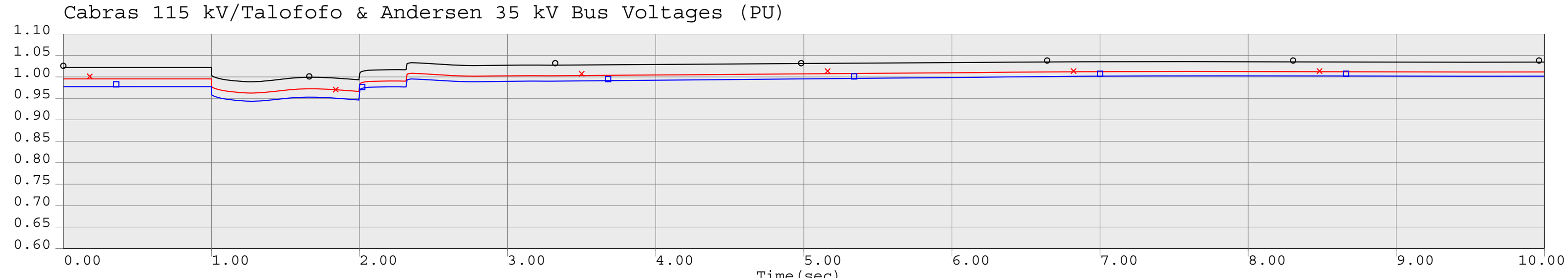


0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/3400-cc1-ref.chf

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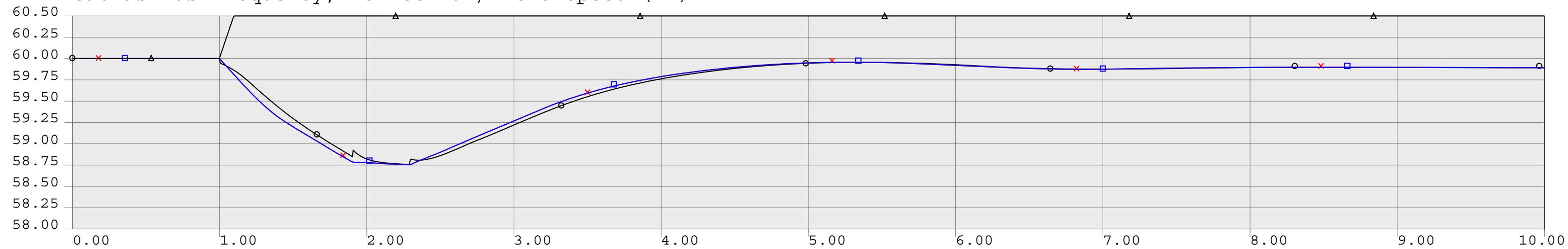
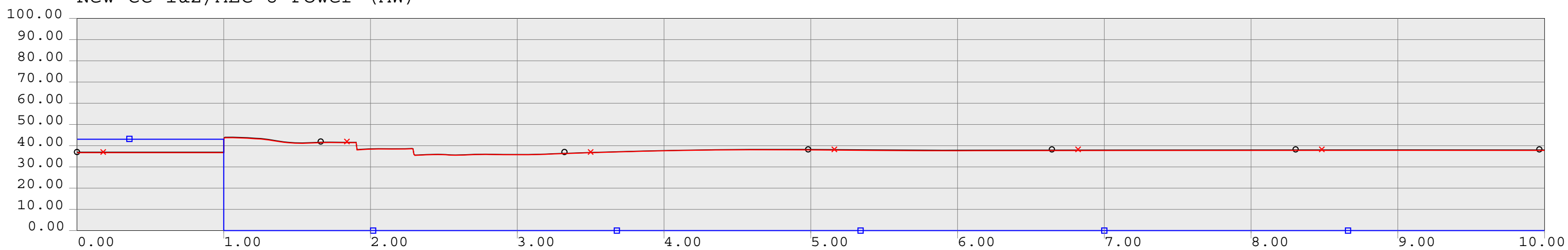
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



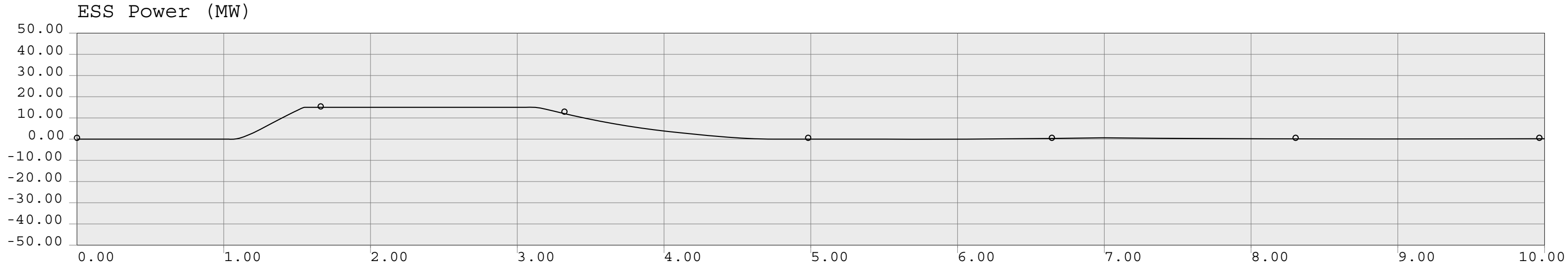
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



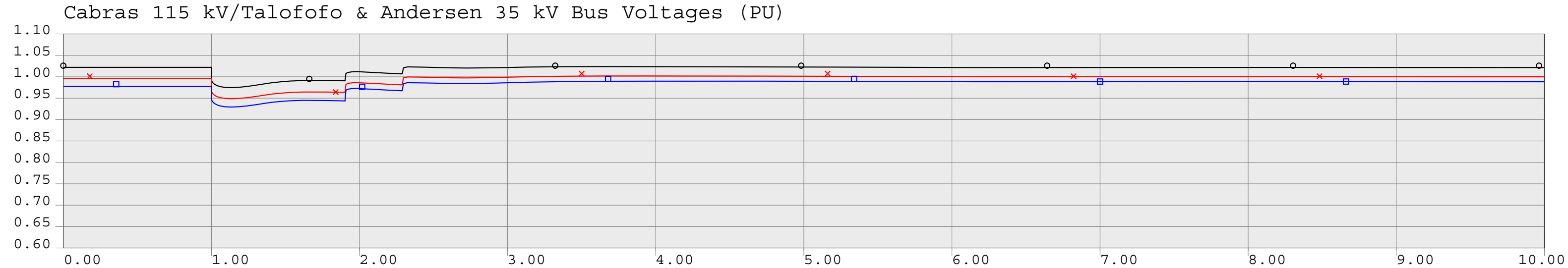
0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/3400-m8-1a.chf

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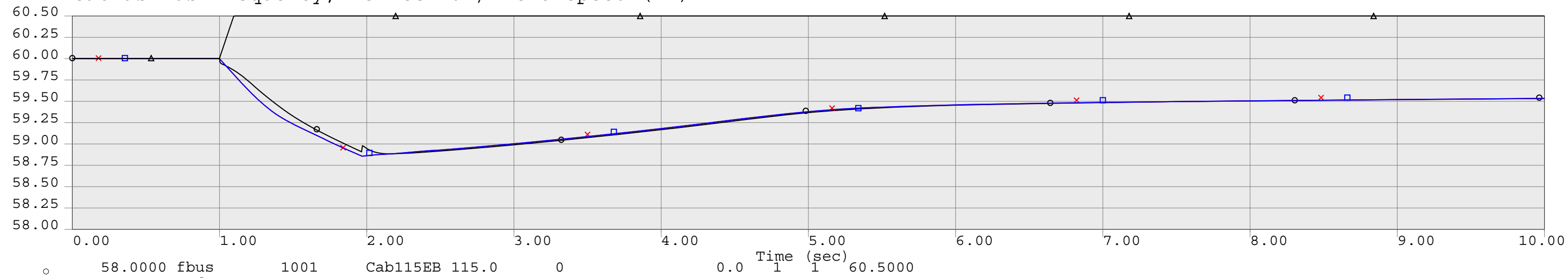
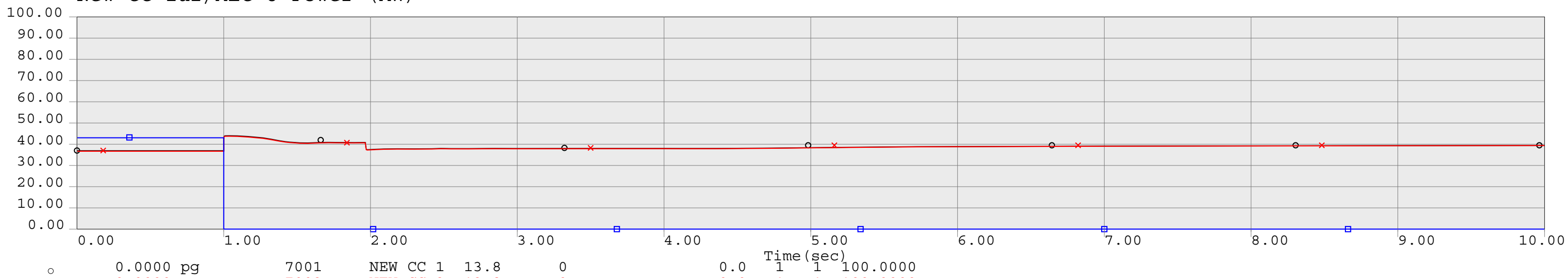
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



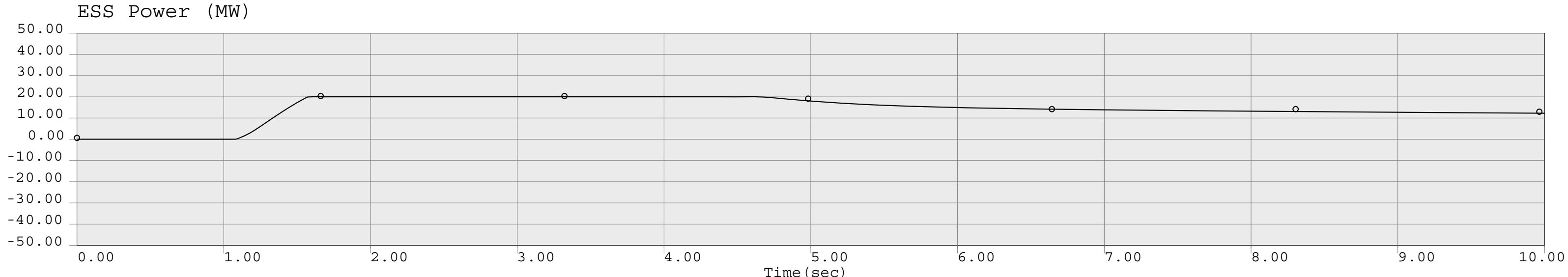
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



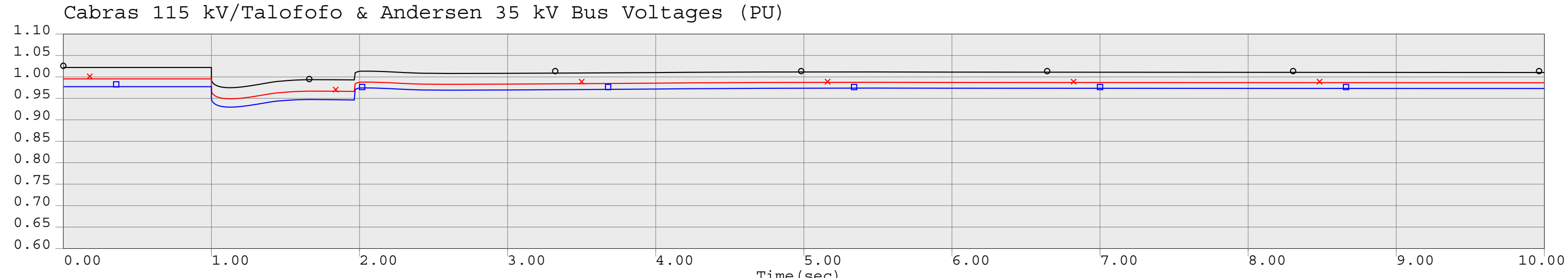
0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/3400-m8-1b.chf

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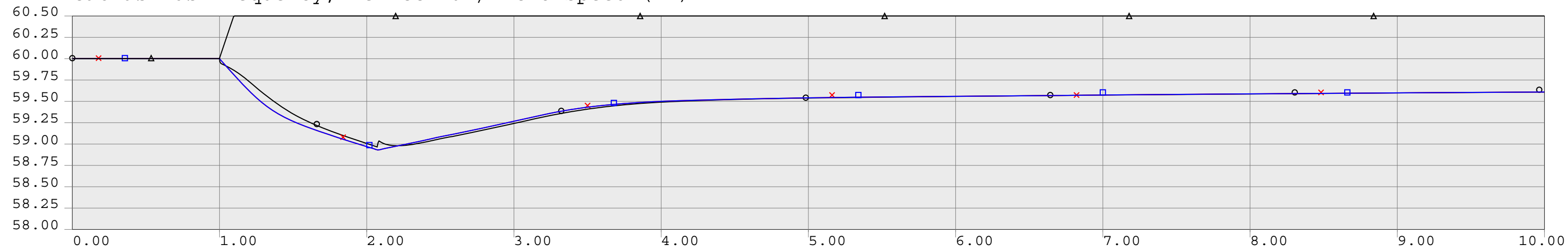
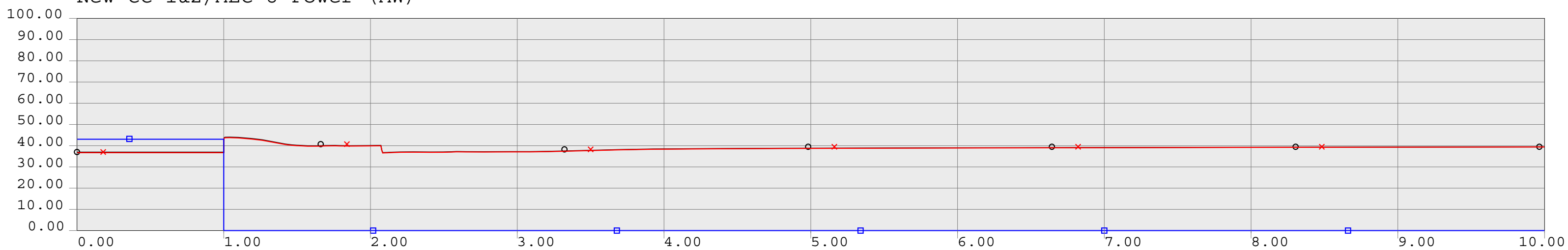
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



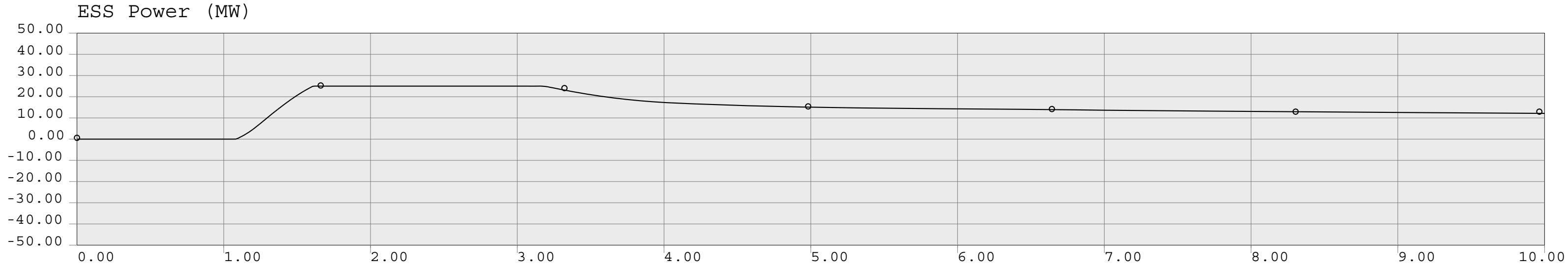
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	7001	NEW CC 1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	7002	NEW CC 2	13.8	0	0.0	1	1	60.5000
△	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



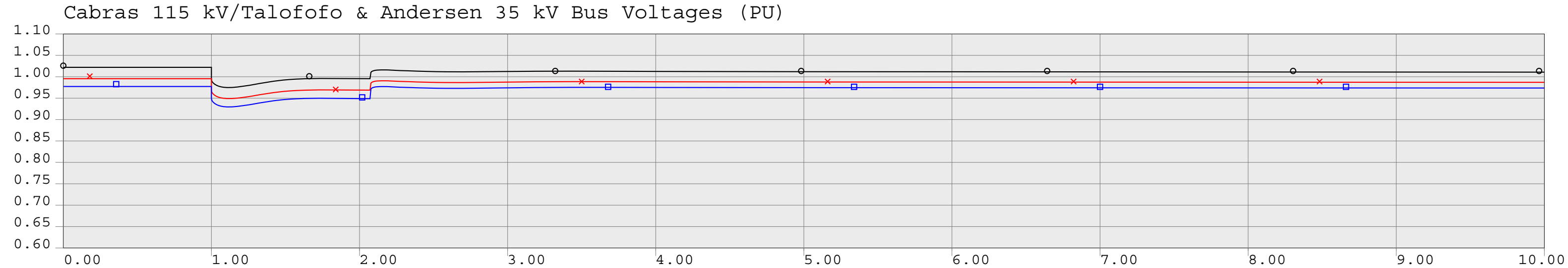
○	0.0000	pg	7001	NEW CC 1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	7002	NEW CC 2	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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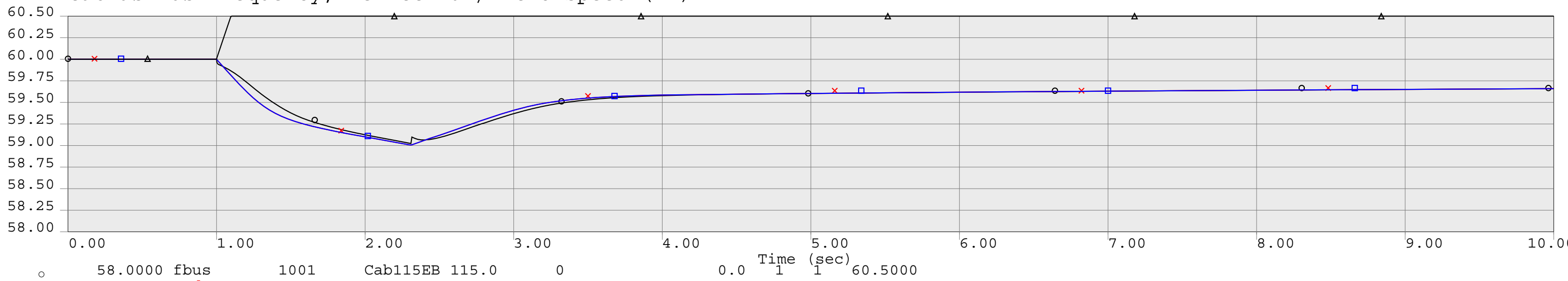
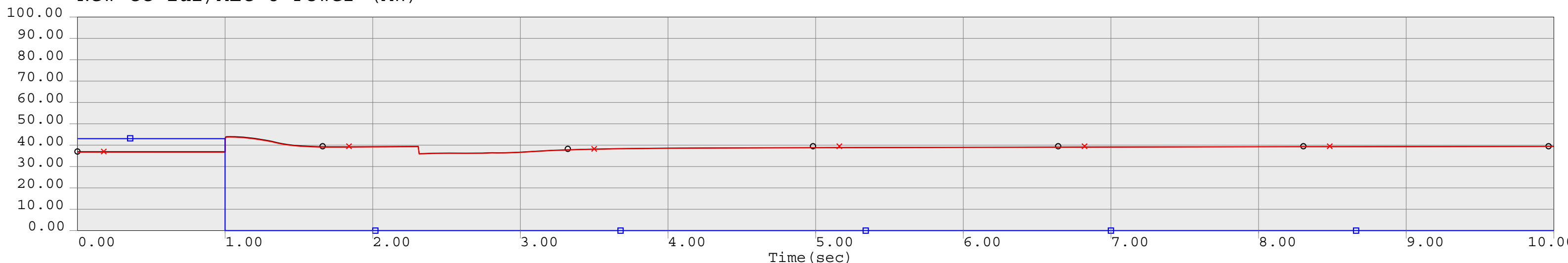
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



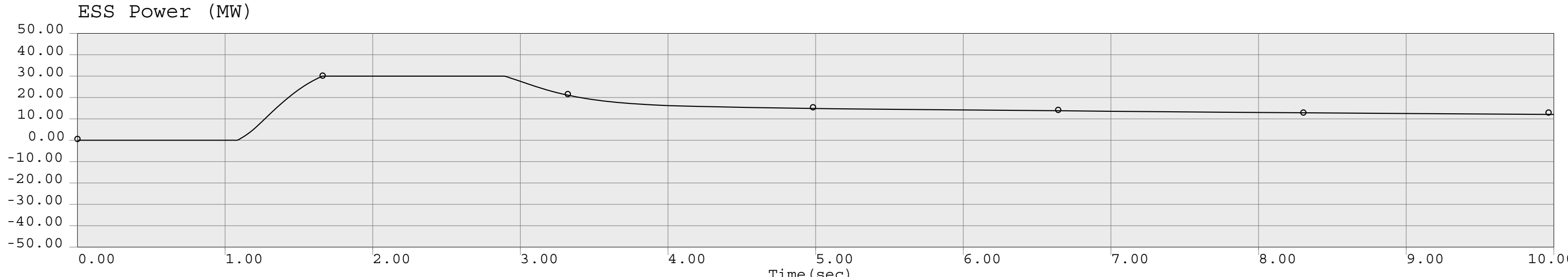
58.0000	fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
58.0000	spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
58.0000	spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000
58.0000	spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



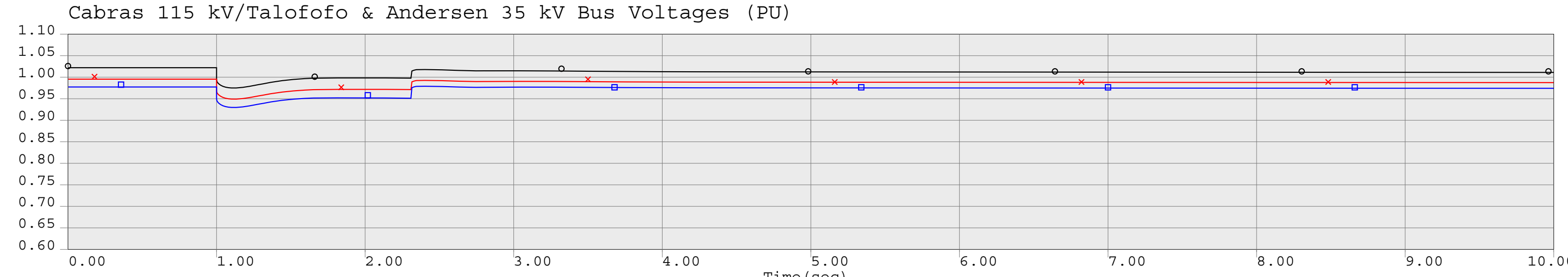
0.0000	pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
0.0000	pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



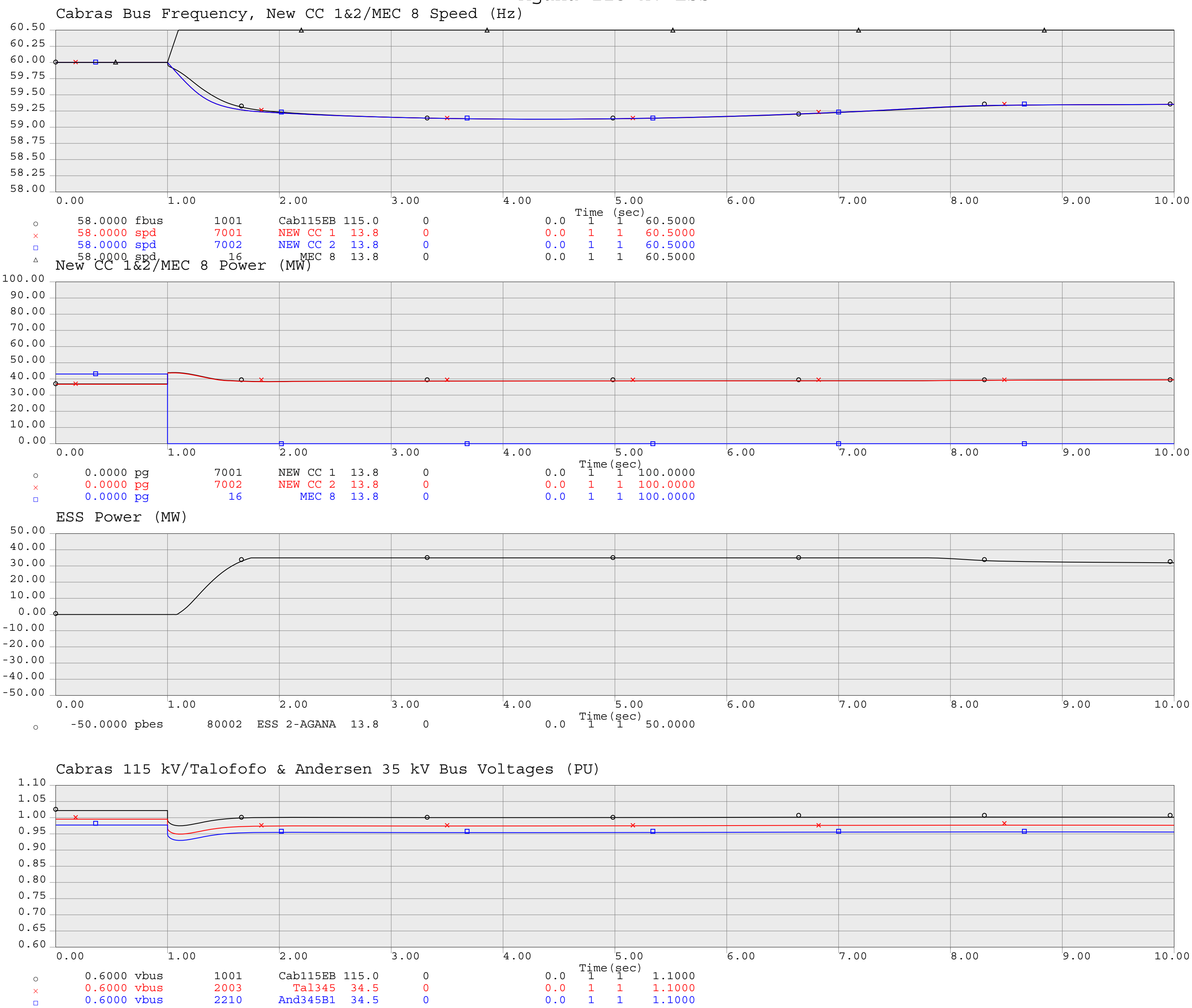
-50.0000	pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000	vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
0.6000	vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
0.6000	vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



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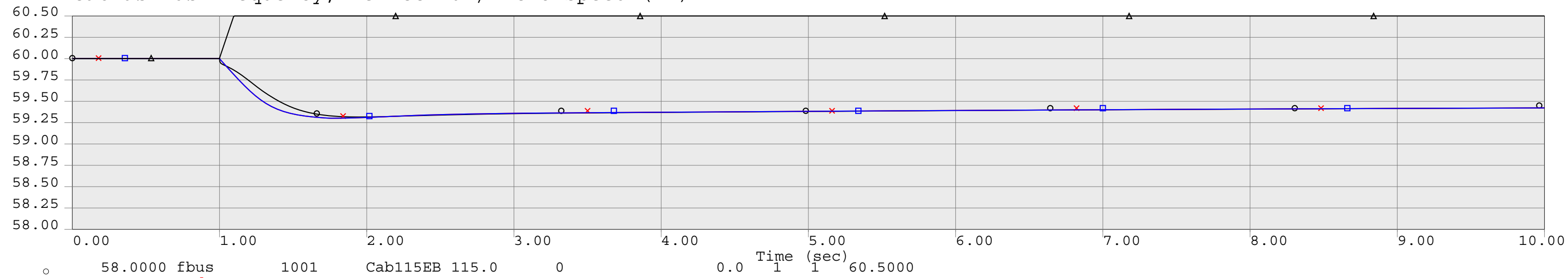
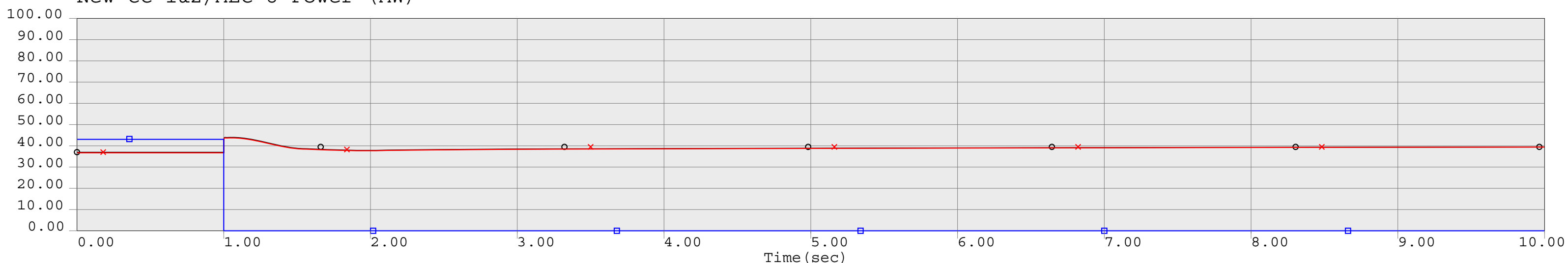
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



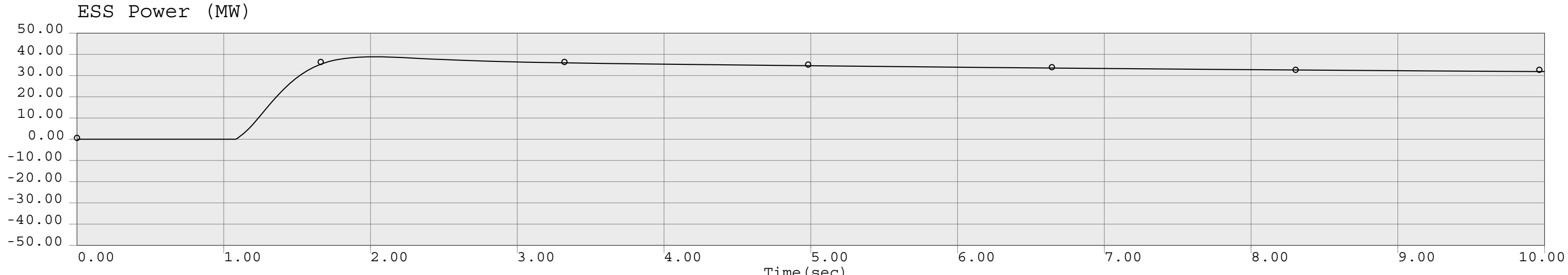
○	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	60.5000
×	58.0000	spd	7001	NEW CC 1	13.8	0	0.0	1	1	60.5000
□	58.0000	spd	7002	NEW CC 2	13.8	0	0.0	1	1	60.5000
△	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)



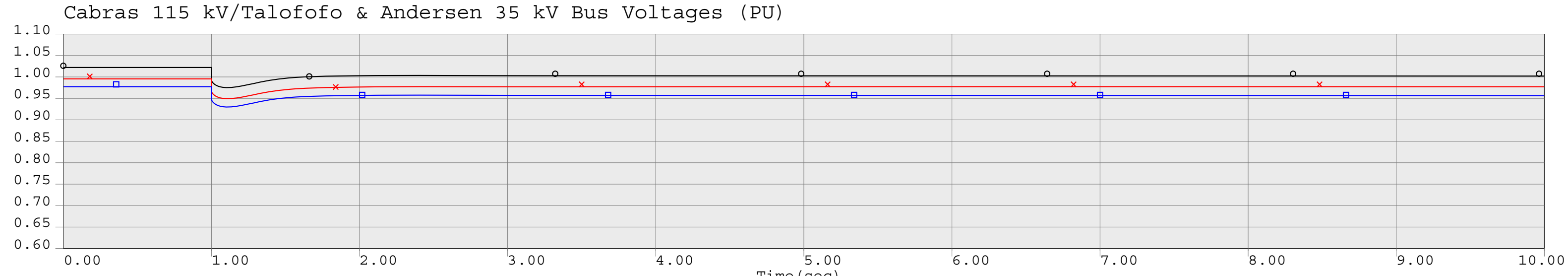
○	0.0000	pg	7001	NEW CC 1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	7002	NEW CC 2	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000

ESS Power (MW)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

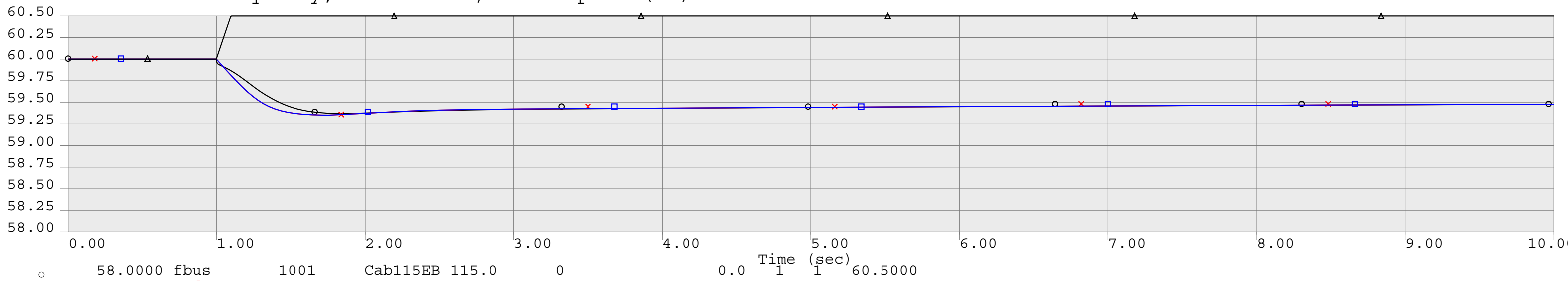
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.6000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.6000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

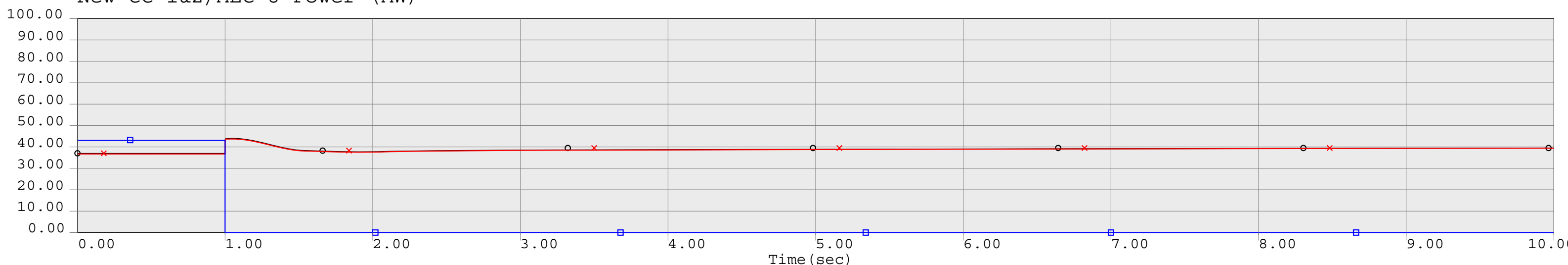
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



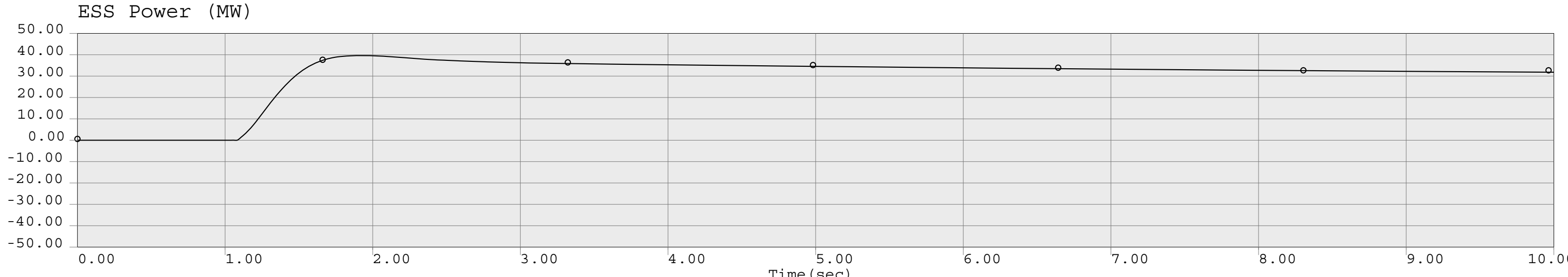
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 60.5000
58.0000 spd 7001 NEW CC 1 13.8 0 0.0 1 1 60.5000
58.0000 spd 7002 NEW CC 2 13.8 0 0.0 1 1 60.5000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 60.5000

New CC 1&2/MEC 8 Power (MW)



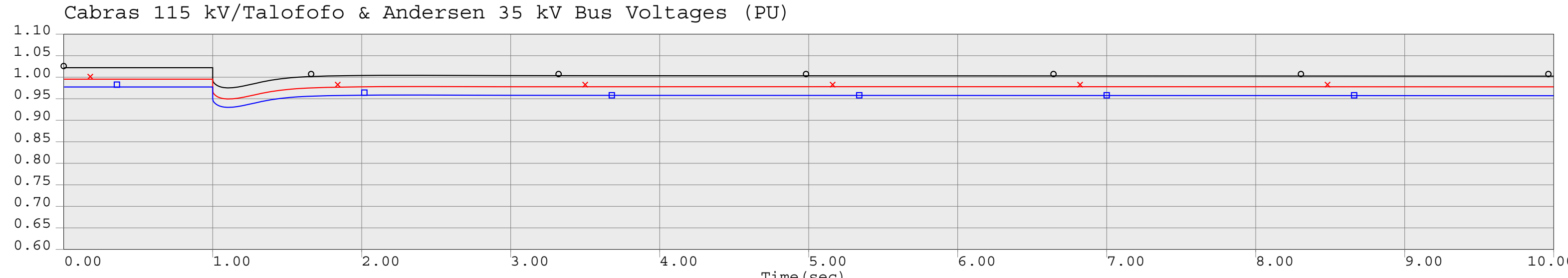
0.0000 pg 7001 NEW CC 1 13.8 0 0.0 1 1 100.0000
0.0000 pg 7002 NEW CC 2 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000

ESS Power (MW)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.6000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.6000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.6000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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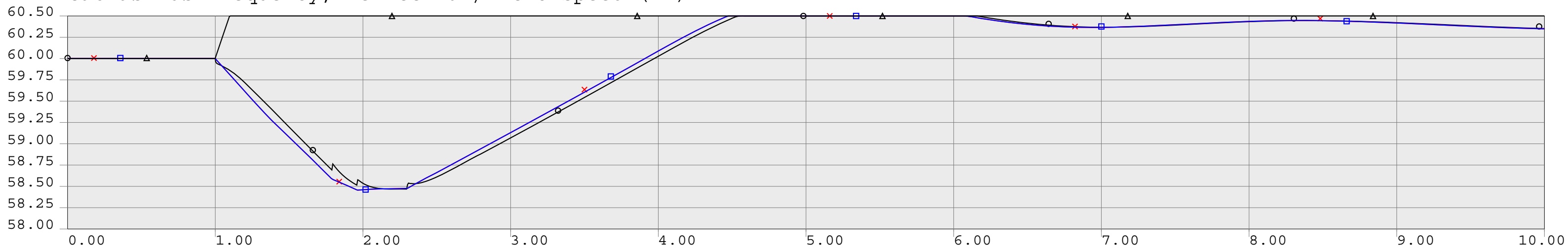
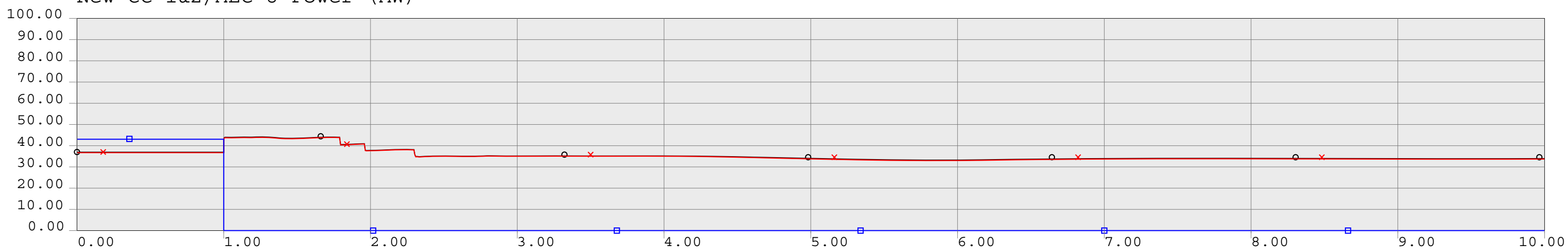
Agana 115 kV ESS

Cabras Bus Frequency, New CC 1&2/MEC 8 Speed (Hz)



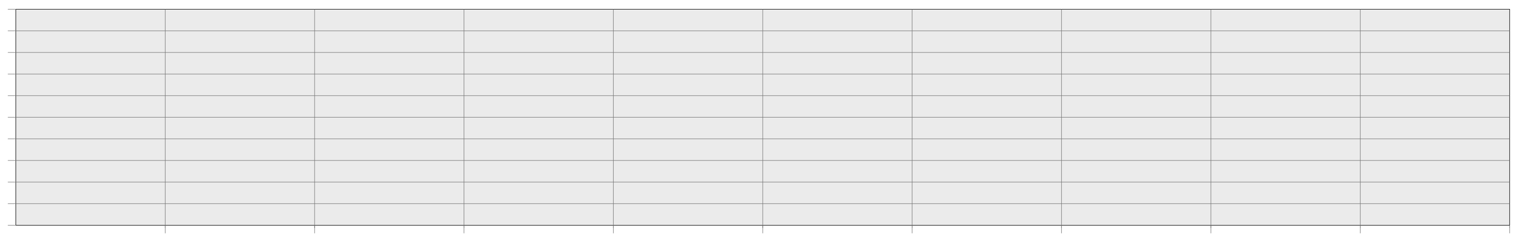
○	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	60.5000
×	58.0000 spd	7001	NEW CC 1 13.8	0	0.0	1	1	60.5000
□	58.0000 spd	7002	NEW CC 2 13.8	0	0.0	1	1	60.5000
△	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	60.5000

New CC 1&2/MEC 8 Power (MW)

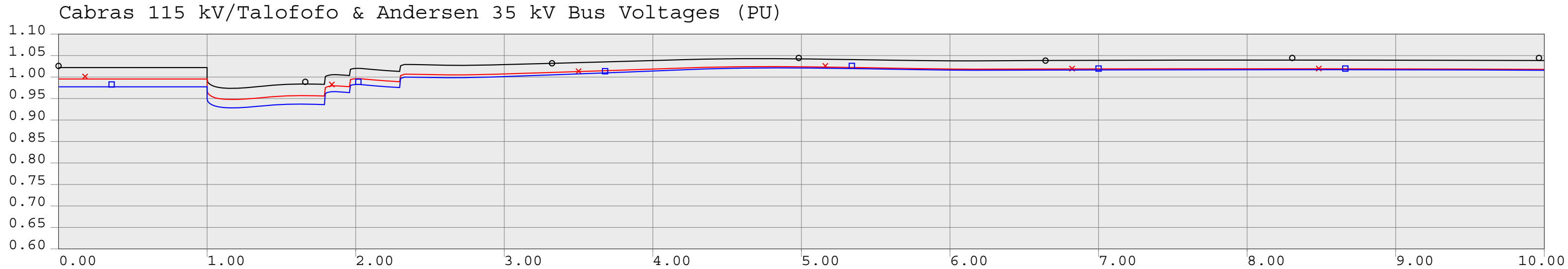


○	0.0000 pg	7001	NEW CC 1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	7002	NEW CC 2 13.8	0	0.0	1	1	100.0000
□	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000

ESS Power (MW)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.6000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.6000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.6000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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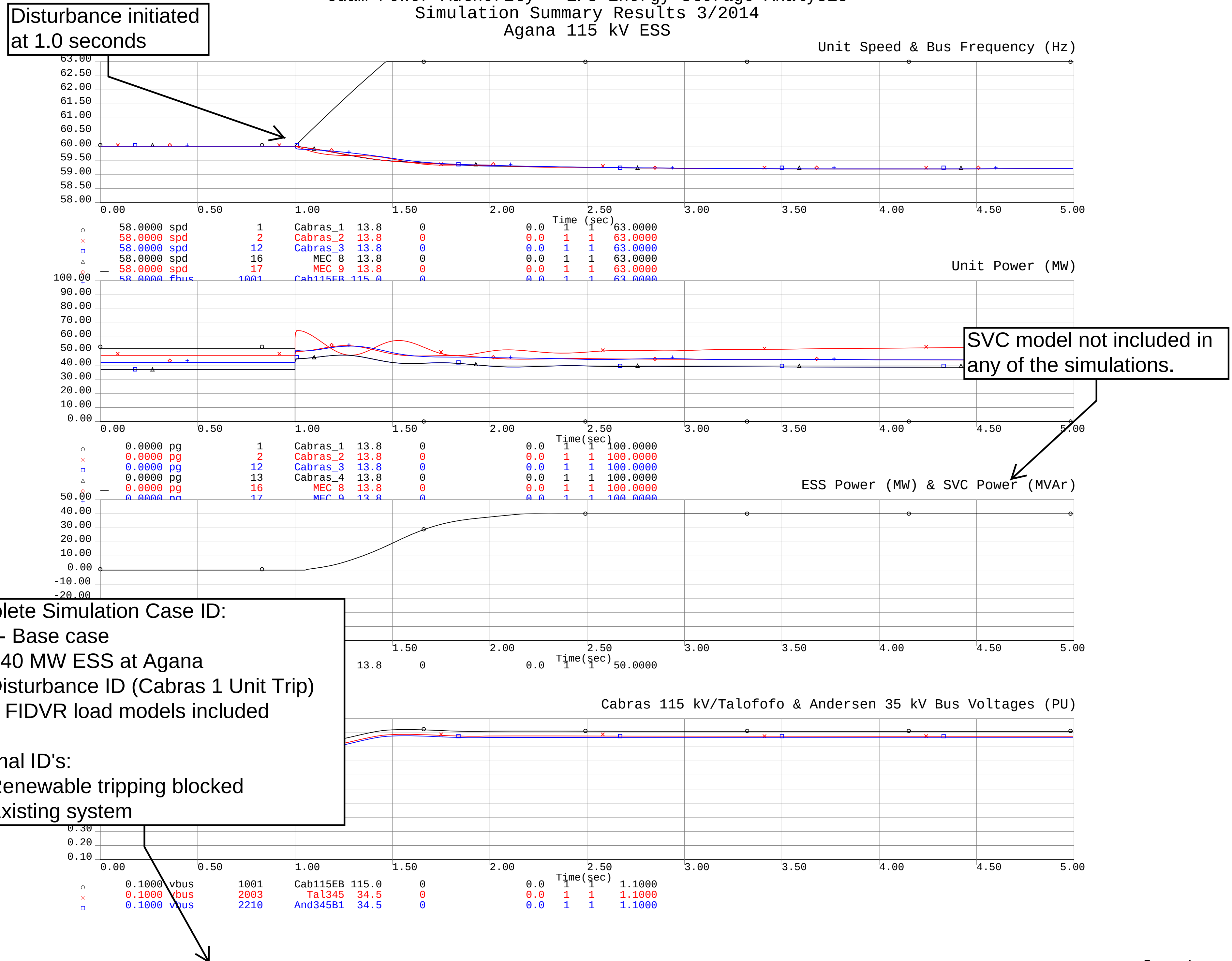
Case ID	Disturbance	Block Renewable Tripping	Agana ESS Stage	Agana ESS Min Freq	Harmon ESS Stage	Harmon ESS Min Freq	Marbo ESS Stage	Marbo ESS Min Freq
1400	Cabras 1		-	59.19	-	59.20	-	59.20
1410			-	59.54	-	59.54	-	59.54
1420			-	59.55	-	59.56	-	59.56
1433			-	59.55	-	59.55	-	59.55
2400			1	59.00	1	59.00	1	59.01
2410			-	59.49	-	59.49	-	59.49
2420			-	59.52	-	59.52	-	59.52
2433			-	59.52	-	59.52	-	59.52
1400	MEC 8		-	59.41	-	59.41	-	59.41
1410			-	59.40	-	59.40	-	59.40
1420			-	59.61	-	59.61	-	59.61
1433			-	59.49	-	59.49	-	59.49
2400			-	59.32	-	59.32	-	59.32
2410			-	59.32	-	59.33	-	59.32
2420			-	59.58	-	59.58	-	59.58
2433			-	59.45	-	59.45	-	59.45
1410	PV/Wind		-	59.54	-	59.54	-	59.54
1420			-	59.56	-	59.56	-	59.56
1433			1	58.97	1	58.98	1	58.98
2410			-	59.49	-	59.49	-	59.49
2420			-	59.54	-	59.54	-	59.54
2433			1	58.89	1	58.89	1	58.89
1400	Tamuning/Harmon 115 kV		-	59.33	-	59.33	-	59.31
1410			-	59.30	-	59.30	-	59.28
1420			-	59.25	-	59.25	-	59.24
1433			-	59.30	-	59.30	-	59.29
2400			-	59.32	-	59.31	-	59.29
2410			-	59.31	-	59.30	-	59.29
2420			-	59.29	-	59.29	-	59.28
2433			-	59.33	-	59.33	-	59.32
1400	Harmon/Piti 115 kV		-	59.36	-	59.35	-	59.33
1410			-	59.32	-	59.32	-	59.30
1420			-	59.27	-	59.27	-	59.26
1433			-	59.32	-	59.32	-	59.31
2400			-	59.34	-	59.33	-	59.31
2410			-	59.32	-	59.32	-	59.31
2420			-	59.30	-	59.30	-	59.29
2433			-	59.35	-	59.35	-	59.33
1400	Agana/Tamuning 115 kV		-	59.36	-	59.35	-	59.33
1410			-	59.32	-	59.32	-	59.30
1420			-	59.24	-	59.25	-	59.26
1433			-	59.32	-	59.32	-	59.31
2400			-	59.34	-	59.33	-	59.31
2410			-	59.32	-	59.32	-	59.31
2420			-	59.30	-	59.30	-	59.29
2433			-	59.35	-	59.35	-	59.34
1400	Cabras/Agana 115 kV		-	59.33	-	59.33	-	59.31
1410			-	59.30	-	59.30	-	59.28
1420			-	58.90	-	58.90	-	58.90
1433			-	59.08	-	59.08	-	59.08
2400			-	59.32	-	59.32	-	59.29
2410			-	59.31	-	59.31	-	59.29
2420			-	58.85	-	58.85	-	58.85
2433			-	59.04	-	59.04	-	59.04

Case ID	Disturbance	Block Renewable Tripping	Agana ESS		Harmon ESS		Marbo ESS	
			Stage	Min Freq	Stage	Min Freq	Stage	Min Freq
1400	Talofofo/Apra 35 kV		-	59.31	-	59.31	-	59.28
1410			1	58.99	1	58.99	1	58.98
1420			1	58.85	1	58.85	1	58.83
1433			1	58.84	1	58.84	1	58.82
2400			-	59.30	-	59.29	-	59.26
2410			1	58.97	1	58.97	1	58.95
2420			1	58.84	1	58.84	1	58.82
2433			1	58.83	1	58.83	1	58.82
1400	Barrigada/Agana 35 kV		-	59.16	-	59.15	1	59.08
1410			1	58.90	1	58.90	1	58.87
1420			2	N/A	2	N/A	2	N/A
1420		Yes	-	59.14	-	59.14	-	59.11
1421			2	N/A	2	N/A	2	N/A
1421		Yes	-	59.17	-	59.17	-	59.12
1422			2	N/A	2	N/A	2	N/A
1422		Yes	-	59.15	-	59.15	-	59.11
1433			1	58.81	1	58.81	2	58.78
1433		Yes	-	59.17	-	59.16	-	59.13
2400			-	59.16	-	59.15	1	59.06
2410			1	58.89	1	58.89	1	58.85
2420			2	N/A	2	N/A	2	N/A
2420		Yes	-	59.20	-	59.20	-	59.17
2421			2	N/A	2	N/A	2	N/A
2421		Yes	-	59.16	-	59.16	-	59.11
2422			2	N/A	2	N/A	2	N/A
2422		Yes	-	59.13	-	59.13	1	59.08
2433			1	58.82	1	58.82	2	58.79
2433		Yes	-	59.23	-	59.22	-	59.19
1400	Andersen/Yigo 35 kV		-	59.31	-	59.31	-	59.28
1410			-	59.27	-	59.27	-	59.25
1420			-	59.14	-	59.14	-	59.13
1433			-	59.28	-	59.28	-	59.27
2400			-	59.30	-	59.29	-	59.26
2410			-	59.28	-	59.28	-	59.25
2420			-	59.18	-	59.18	-	59.17
2433			-	59.31	-	59.31	-	59.30
1400	Piti/Agana 35 kV		-	59.20	-	59.20	-	59.14
1410			1	58.92	1	58.91	1	58.88
1420			1	58.89	1	58.89	1	58.87
1433			-	59.10	-	59.10	1	59.07
2400			-	59.20	-	59.19	-	59.10
2410			1	58.91	1	58.90	1	58.87
2420			2	N/A	2	N/A	2	N/A
2420		Yes	-	59.22	-	59.22	-	59.19
2421			1	58.86	1	58.85	1	58.81
2422			2	N/A	2	N/A	2	N/A
2422		Yes	-	59.16	-	59.16	-	59.11
2433			1	58.85	1	58.84	1	58.82

Case ID	Disturbance	Block Renewable Tripping	Agana ESS Stage	Agana ESS Min Freq	Harmon ESS Stage	Harmon ESS Min Freq	Marbo ESS Stage	Marbo ESS Min Freq
1400			-	59.11	-	59.10	1	59.05
1410			1	58.87	1	58.86	1	58.82
1420			2	N/A	2	N/A	2	N/A
1420		Yes	-	59.11	-	59.11	1	59.08
1421			2	N/A	2	N/A	2	N/A
1421		Yes	-	59.13	-	59.12	1	59.07
1422			2	N/A	2	N/A	2	N/A
1422		Yes	-	59.11	-	59.11	1	59.06
1433			2	58.78	2	58.77	2	58.75
1433	Agana/Tamuning 35 kV	Yes	-	59.14	-	59.14	-	59.10
2400			-	59.12	-	59.10	1	59.04
2410			1	58.86	1	58.86	1	58.81
2420			2	N/A	2	N/A	2	N/A
2420		Yes	-	59.18	-	59.18	-	59.15
2421			2	N/A	2	N/A	2	N/A
2421		Yes	-	59.13	-	59.13	1	59.07
2422			2	N/A	2	N/A	2	N/A
2422		Yes	-	59.11	-	59.10	1	59.06
2433			1	58.80	1	58.80	2	58.77
2433		Yes	-	59.21	-	59.21	-	59.17
1400			-	59.16	-	59.15	1	59.08
1410			1	58.90	1	58.90	1	58.87
1420			2	N/A	2	N/A	2	N/A
1420		Yes	-	59.16	-	59.16	-	59.14
1421			2	N/A	2	N/A	2	N/A
1421		Yes	-	59.18	-	59.17	-	59.13
1422			2	N/A	2	N/A	2	N/A
1422		Yes	-	59.16	-	59.16	-	59.12
1433			1	58.82	1	58.82	2	58.80
1433	Harmon/Tumon 35 kV	Yes	-	59.19	-	59.19	-	59.16
2400			-	59.16	-	59.15	1	59.06
2410			1	58.89	1	58.89	1	58.85
2420			2	N/A	2	N/A	2	N/A
2420		Yes	-	59.22	-	59.22	-	59.20
2421			2	N/A	2	N/A	2	N/A
2421		Yes	-	59.17	-	59.17	-	59.12
2422			2	N/A	2	N/A	2	N/A
2422		Yes	-	59.14	-	59.14	1	59.09
2433			1	58.84	1	58.84	1	58.81
1400			-	59.21	-	59.21	-	59.15
1410			1	58.92	1	58.92	1	58.90
1420			1	58.81	1	58.81	2	N/A
1433			-	59.21	-	59.20	-	59.18
2400			-	59.21	-	59.21	-	59.12
2410	Agana/Aniga 35 kV		1	58.91	1	58.91	1	58.88
2420			2	N/A	2	N/A	2	N/A
2420		Yes	-	59.23	-	59.23	-	59.20
2421			1	58.87	1	58.87	1	58.83
2422			2	N/A	2	N/A	2	N/A
2422		Yes	-	59.17	-	59.16	-	59.12
2433			1	58.85	1	58.85	1	58.83

Case ID	Disturbance	Block Renewable Tripping	Agana ESS		Harmon ESS		Marbo ESS	
			Stage	Min Freq	Stage	Min Freq	Stage	Min Freq
1400	Harmon/Macheche 35 kV		-	59.13	-	59.12	1	59.06
1410			1	58.89	1	58.89	1	58.85
1420			2	N/A	2	N/A	2	N/A
1420		Yes	-	59.13	-	59.13	-	59.11
1421			2	N/A	2	N/A	2	N/A
1421		Yes	-	59.15	-	59.15	-	59.10
1422			2	N/A	2	N/A	2	N/A
1422		Yes	-	59.14	-	59.13	1	59.09
1433			1	58.81	1	58.80	2	58.78
1433		Yes	-	59.17	-	59.16	-	59.13
2400			-	59.14	-	59.13	1	59.05
2410			1	58.88	1	58.88	1	58.83
2420			2	N/A	2	N/A	2	N/A
2420		Yes	-	59.20	-	59.20	-	59.18
2421			2	N/A	2	N/A	2	N/A
2421		Yes	-	59.16	-	59.15	1	59.09
2422			2	N/A	2	N/A	2	N/A
2422		Yes	-	59.13	-	59.12	1	59.08
2433			1	58.83	1	58.82	2	58.79
2433		Yes	-	59.23	-	59.23	-	59.20

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/1400_40a_c1_fidvr.chf

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Simulation Plot Listing - Main Base Cases

Base Case	ESS Configuration	Disturbance ID	FIDVR	Renewable Block Trip	Complete Case ID
1400	40a	c1	fidvr		1400_40a_c1_fidvr
1410	40a	c1	fidvr		1410_40a_c1_fidvr
1420	40a	c1	fidvr		1420_40a_c1_fidvr
2400	40a	c1	fidvr		2400_40a_c1_fidvr
2410	40a	c1	fidvr		2410_40a_c1_fidvr
2420	40a	c1	fidvr		2420_40a_c1_fidvr
1400	40a	m8	fidvr		1400_40a_m8_fidvr
1410	40a	m8	fidvr		1410_40a_m8_fidvr
1420	40a	m8	fidvr		1420_40a_m8_fidvr
2400	40a	m8	fidvr		2400_40a_m8_fidvr
2410	40a	m8	fidvr		2410_40a_m8_fidvr
2420	40a	m8	fidvr		2420_40a_m8_fidvr
1410	40a	pvw1	fidvr		1410_40a_pvw1_fidvr
1420	40a	pvw1	fidvr		1420_40a_pvw1_fidvr
2410	40a	pvw1	fidvr		2410_40a_pvw1_fidvr
2420	40a	pvw1	fidvr		2420_40a_pvw1_fidvr
1400	40a	lf1	fidvr		1400_40a_lf1_fidvr
1410	40a	lf1	fidvr		1410_40a_lf1_fidvr
1420	40a	lf1	fidvr		1420_40a_lf1_fidvr
2400	40a	lf1	fidvr		2400_40a_lf1_fidvr
2410	40a	lf1	fidvr		2410_40a_lf1_fidvr
2420	40a	lf1	fidvr		2420_40a_lf1_fidvr
1400	40a	lf2	fidvr		1400_40a_lf2_fidvr
1410	40a	lf2	fidvr		1410_40a_lf2_fidvr
1420	40a	lf2	fidvr		1420_40a_lf2_fidvr
2400	40a	lf2	fidvr		2400_40a_lf2_fidvr
2410	40a	lf2	fidvr		2410_40a_lf2_fidvr
2420	40a	lf2	fidvr		2420_40a_lf2_fidvr
1400	40a	lf3	fidvr		1400_40a_lf3_fidvr
1410	40a	lf3	fidvr		1410_40a_lf3_fidvr
1420	40a	lf3	fidvr		1420_40a_lf3_fidvr
2400	40a	lf3	fidvr		2400_40a_lf3_fidvr
2410	40a	lf3	fidvr		2410_40a_lf3_fidvr
2420	40a	lf3	fidvr		2420_40a_lf3_fidvr
1400	40a	lf4	fidvr		1400_40a_lf4_fidvr
1410	40a	lf4	fidvr		1410_40a_lf4_fidvr
1420	40a	lf4	fidvr		1420_40a_lf4_fidvr
2400	40a	lf4	fidvr		2400_40a_lf4_fidvr
2410	40a	lf4	fidvr		2410_40a_lf4_fidvr
2420	40a	lf4	fidvr		2420_40a_lf4_fidvr
1400	40a	lf11	fidvr		1400_40a_lf11_fidvr
1410	40a	lf11	fidvr		1410_40a_lf11_fidvr
1420	40a	lf11	fidvr		1420_40a_lf11_fidvr
2400	40a	lf11	fidvr		2400_40a_lf11_fidvr

Simulation Plot Listing - Main Base Cases

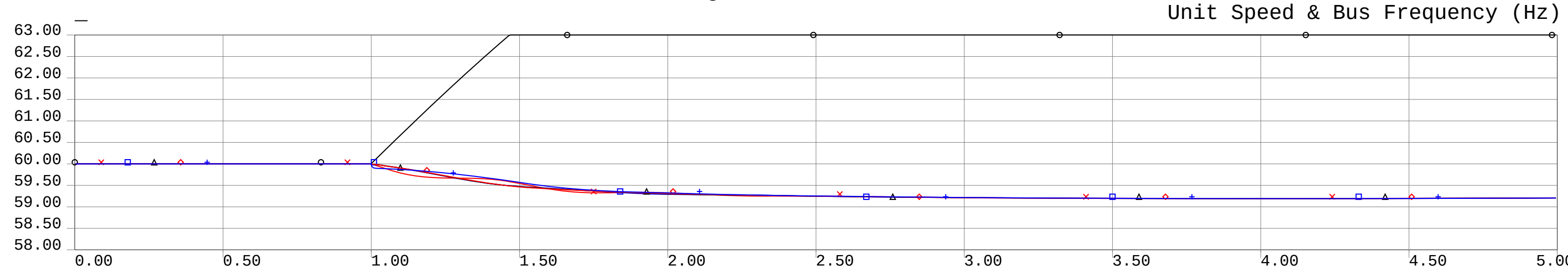
Base Case	ESS Configuration	Disturbance ID	FIDVR	Renewable Block Trip	Complete Case ID
2410	40a	lf11	fidvr		2410_40a_lf11_fidvr
2420	40a	lf11	fidvr		2420_40a_lf11_fidvr
1400	40a	lf12	fidvr		1400_40a_lf12_fidvr
1410	40a	lf12	fidvr		1410_40a_lf12_fidvr
1420	40a	lf12	fidvr		1420_40a_lf12_fidvr
1420	40a	lf12	fidvr	pv	1420_40a_lf12_fidvr_pv
2400	40a	lf12	fidvr		2400_40a_lf12_fidvr
2410	40a	lf12	fidvr		2410_40a_lf12_fidvr
2420	40a	lf12	fidvr		2420_40a_lf12_fidvr
2420	40a	lf12	fidvr	pv	2420_40a_lf12_fidvr_pv
1400	40a	lf13	fidvr		1400_40a_lf13_fidvr
1410	40a	lf13	fidvr		1410_40a_lf13_fidvr
1420	40a	lf13	fidvr		1420_40a_lf13_fidvr
2400	40a	lf13	fidvr		2400_40a_lf13_fidvr
2410	40a	lf13	fidvr		2410_40a_lf13_fidvr
2420	40a	lf13	fidvr		2420_40a_lf13_fidvr
1400	40a	lf14	fidvr		1400_40a_lf14_fidvr
1410	40a	lf14	fidvr		1410_40a_lf14_fidvr
1420	40a	lf14	fidvr		1420_40a_lf14_fidvr
2400	40a	lf14	fidvr		2400_40a_lf14_fidvr
2410	40a	lf14	fidvr		2410_40a_lf14_fidvr
2420	40a	lf14	fidvr		2420_40a_lf14_fidvr
2420	40a	lf14	fidvr	pv	2420_40a_lf14_fidvr_pv
1400	40a	lf15	fidvr		1400_40a_lf15_fidvr
1410	40a	lf15	fidvr		1410_40a_lf15_fidvr
1420	40a	lf15	fidvr		1420_40a_lf15_fidvr
1420	40a	lf15	fidvr	pv	1420_40a_lf15_fidvr_pv
2400	40a	lf15	fidvr		2400_40a_lf15_fidvr
2410	40a	lf15	fidvr		2410_40a_lf15_fidvr
2420	40a	lf15	fidvr		2420_40a_lf15_fidvr
2420	40a	lf15	fidvr	pv	2420_40a_lf15_fidvr_pv
1400	40a	lf16	fidvr		1400_40a_lf16_fidvr
1410	40a	lf16	fidvr		1410_40a_lf16_fidvr
1420	40a	lf16	fidvr		1420_40a_lf16_fidvr
1420	40a	lf16	fidvr	pv	1420_40a_lf16_fidvr_pv
2400	40a	lf16	fidvr		2400_40a_lf16_fidvr
2410	40a	lf16	fidvr		2410_40a_lf16_fidvr
2420	40a	lf16	fidvr		2420_40a_lf16_fidvr
2420	40a	lf16	fidvr	pv	2420_40a_lf16_fidvr_pv
1400	40a	lf17	fidvr		1400_40a_lf17_fidvr
1410	40a	lf17	fidvr		1410_40a_lf17_fidvr
1420	40a	lf17	fidvr		1420_40a_lf17_fidvr
2400	40a	lf17	fidvr		2400_40a_lf17_fidvr
2410	40a	lf17	fidvr		2410_40a_lf17_fidvr

Simulation Plot Listing - Main Base Cases

Base Case	ESS Configuration	Disturbance ID	FIDVR	Renewable Block Trip	Complete Case ID
2420	40a	lf17	fidvr		2420_40a_lf17_fidvr
2420	40a	lf17	fidvr	pv	2420_40a_lf17_fidvr_pv
1400	40a	lf18	fidvr		1400_40a_lf18_fidvr
1410	40a	lf18	fidvr		1410_40a_lf18_fidvr
1420	40a	lf18	fidvr		1420_40a_lf18_fidvr
1420	40a	lf18	fidvr	pv	1420_40a_lf18_fidvr_pv
2400	40a	lf18	fidvr		2400_40a_lf18_fidvr
2410	40a	lf18	fidvr		2410_40a_lf18_fidvr
2420	40a	lf18	fidvr		2420_40a_lf18_fidvr
2420	40a	lf18	fidvr	pv	2420_40a_lf18_fidvr_pv

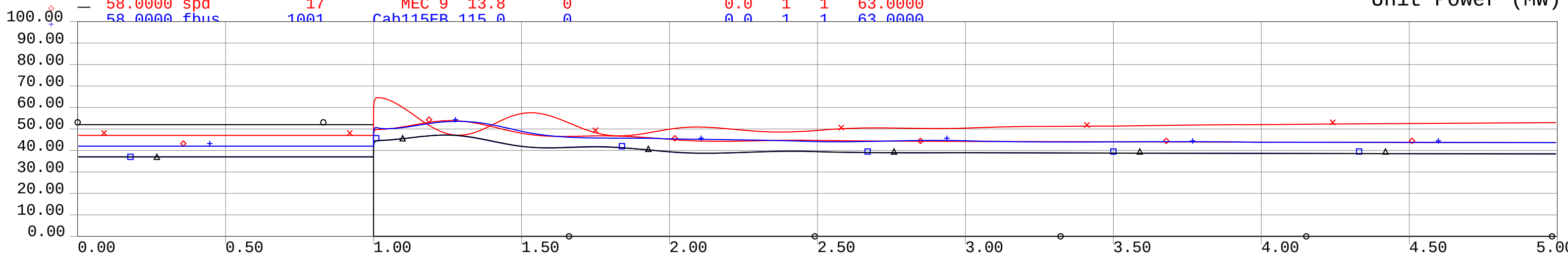
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



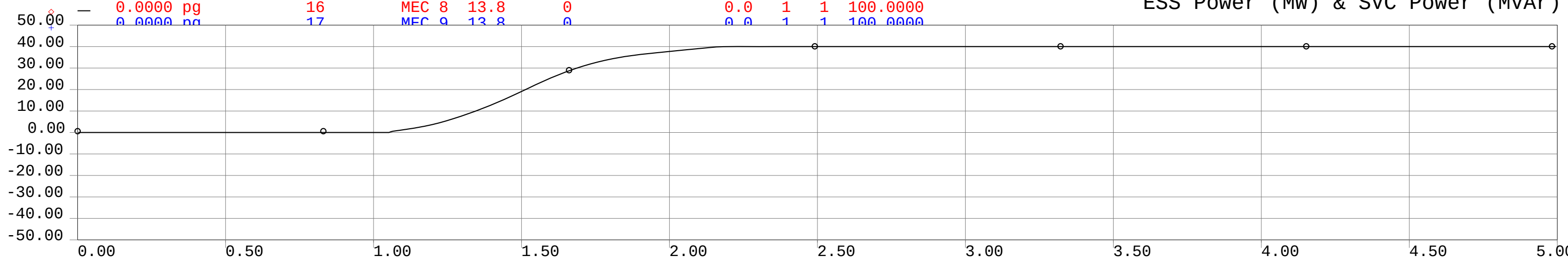
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



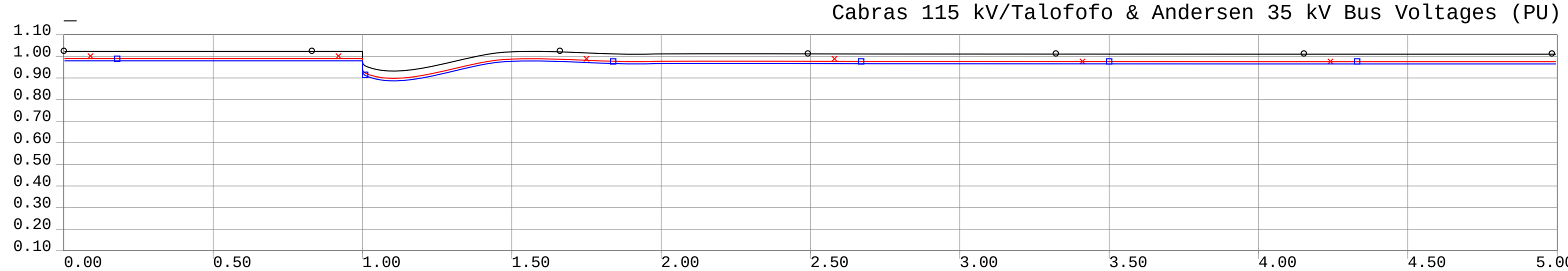
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1400_40a_c1_fidvr.chf

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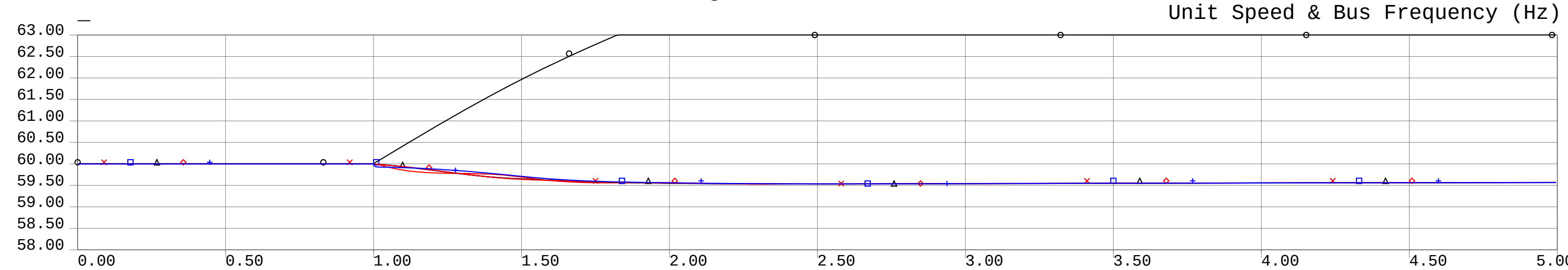
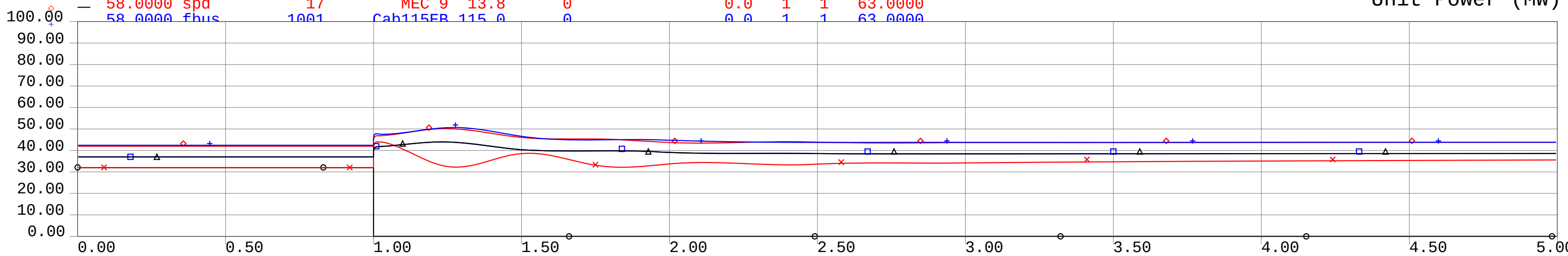
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



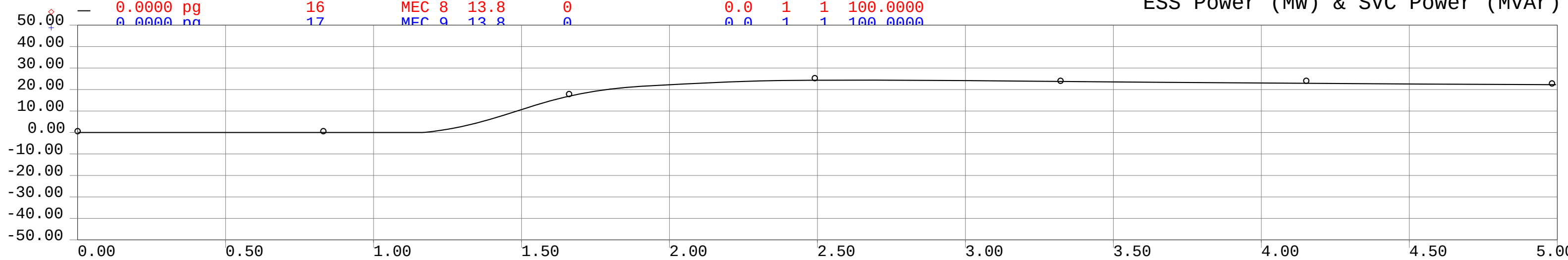
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



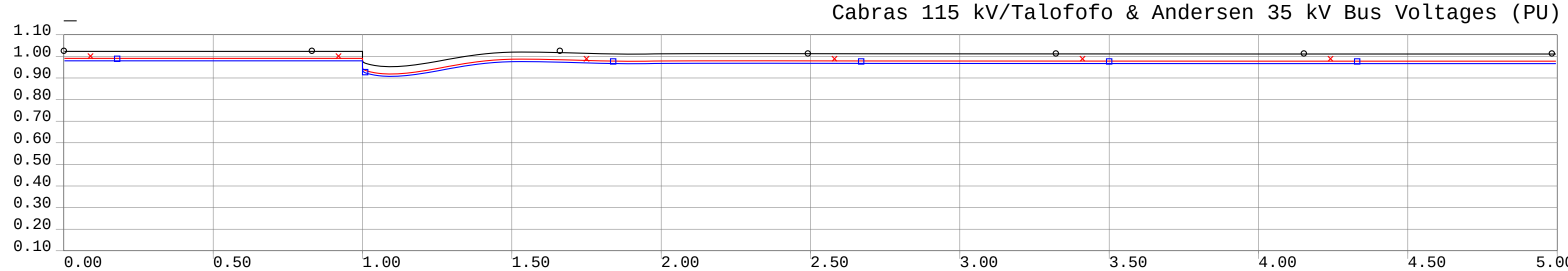
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1410_40a_c1_fidvr.chf

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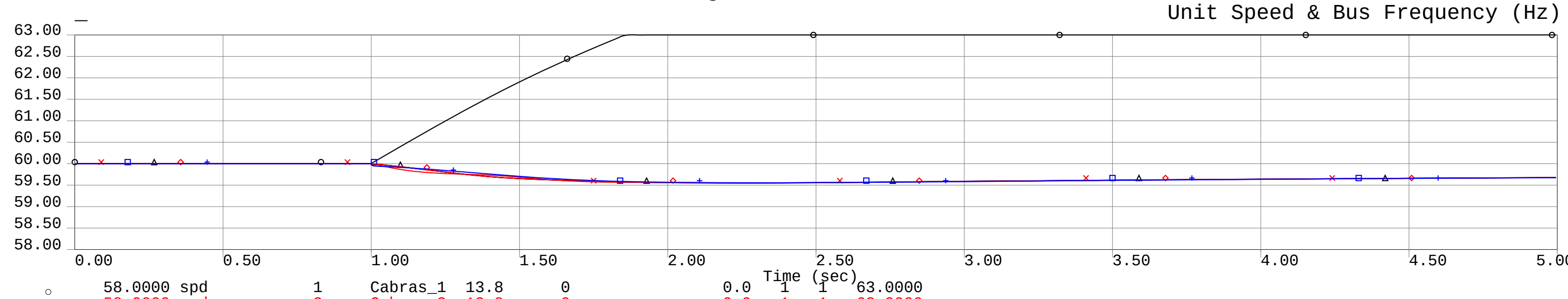
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



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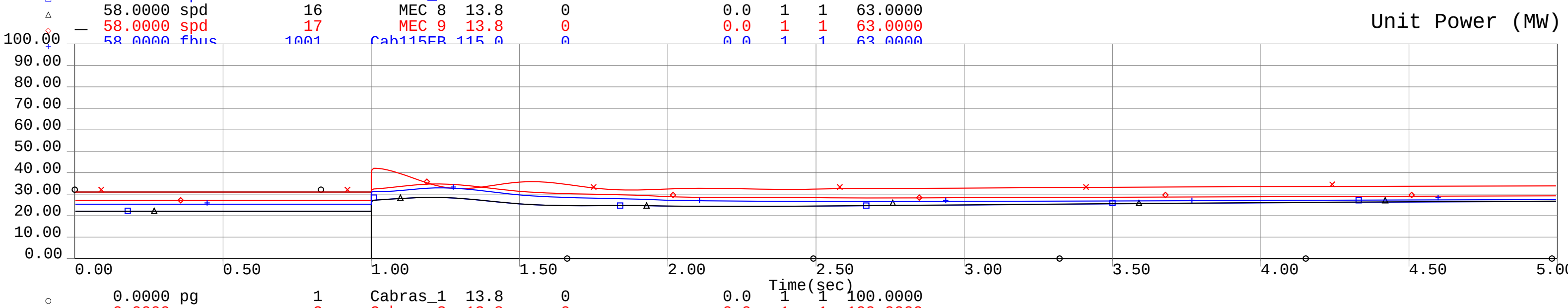
58.0000 spd      1     Cabras_1  13.8   0    0.0  1  1  63.0000
58.0000 spd      2     Cabras_2  13.8   0    0.0  1  1  63.0000
58.0000 spd     12     Cabras_3  13.8   0    0.0  1  1  63.0000
58.0000 spd     16       MEC 8   13.8   0    0.0  1  1  63.0000
58.0000 spd     17       MEC 9   13.8   0    0.0  1  1  63.0000
58.0000 fbus  1001     Cab115EB 115.0   0    0.0  1  1  63.0000
```

Unit Power (MW)



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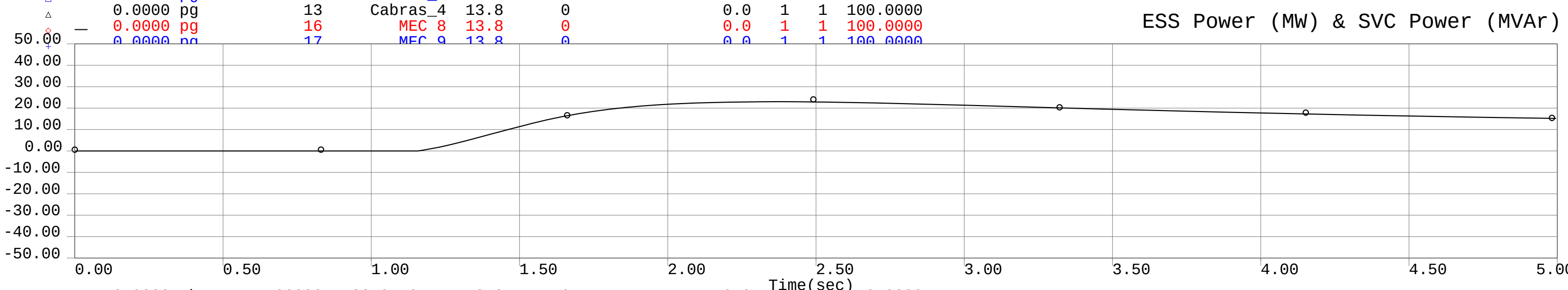
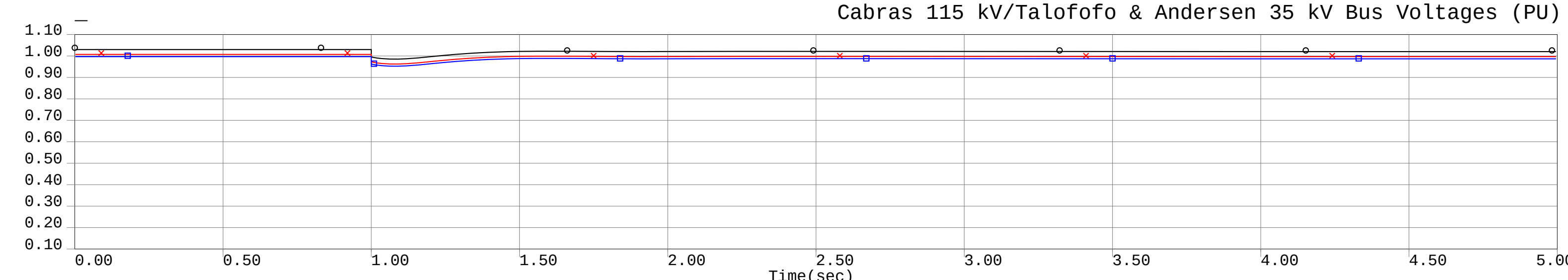
0.0000 pg      1   Cabras_1  13.8   0    0.0  1  1  100.0000
0.0000 pg      2   Cabras_2  13.8   0    0.0  1  1  100.0000
0.0000 pg     12   Cabras_3  13.8   0    0.0  1  1  100.0000
0.0000 pg     13   Cabras_4  13.8   0    0.0  1  1  100.0000
0.0000 pg     16     MEC 8   13.8   0    0.0  1  1  100.0000
0.0000 pg     17     MEC 9   13.8   0    0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)



```
-50.0000 pbes   80002  ESS 2-AGANA  13.8   0    0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



```
0.1000 vbus   1001   Cab115EB 115.0   0    0.0  1  1  1.1000
0.1000 vbus   2003     Tal345  34.5   0    0.0  1  1  1.1000
0.1000 vbus   2210   And345B1  34.5   0    0.0  1  1  1.1000
```


chans/1420_40a_c1_fidvr.chf

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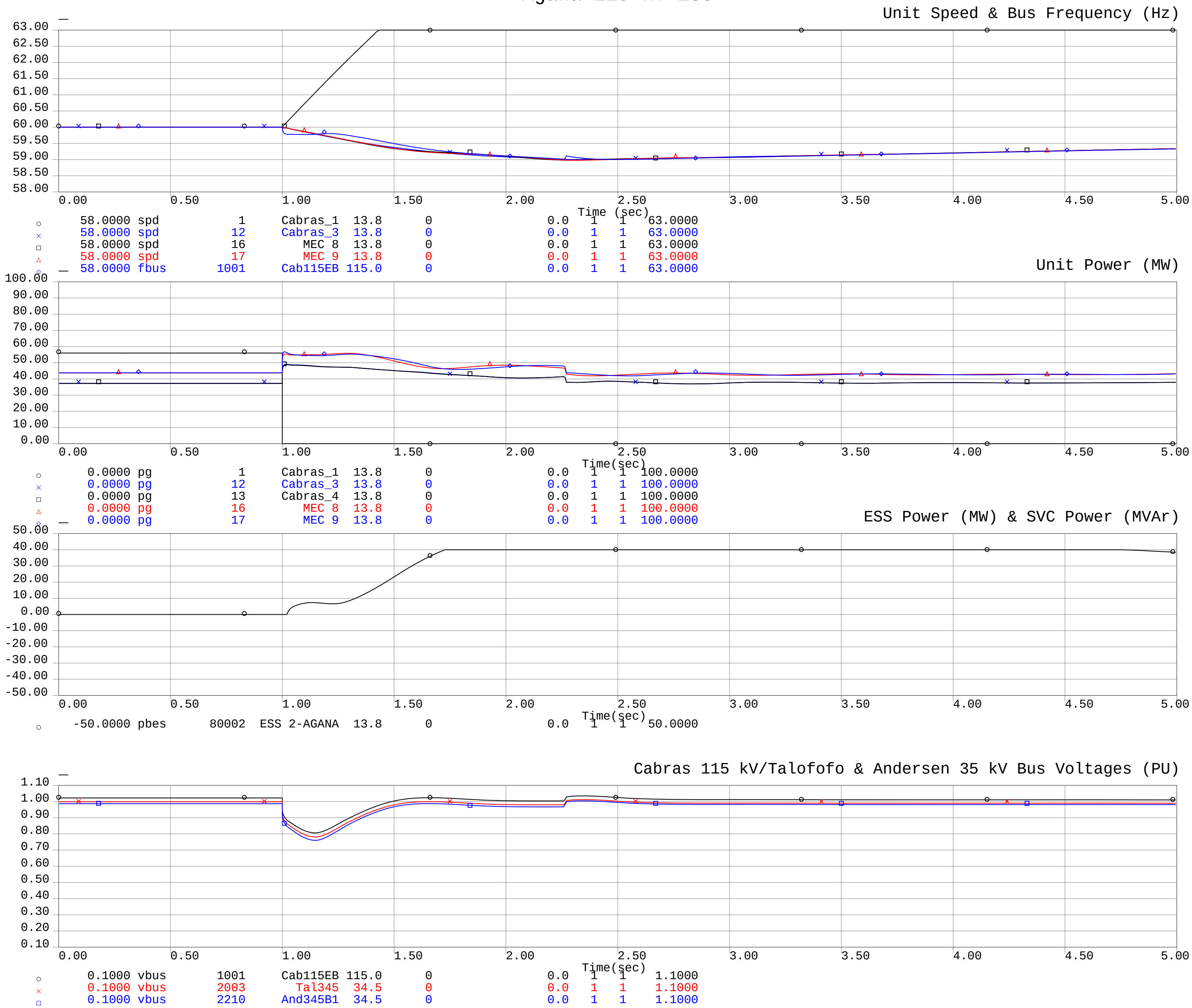
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/2400_40a_c1_fidvr.chf

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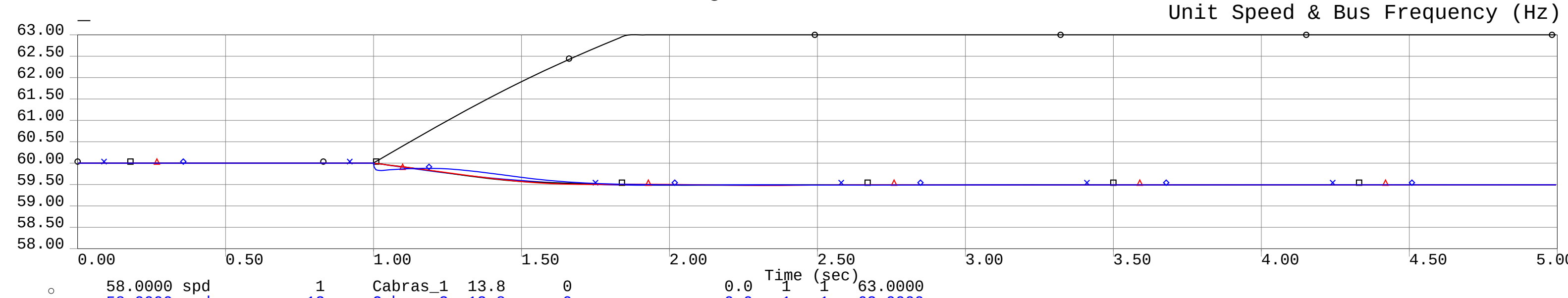
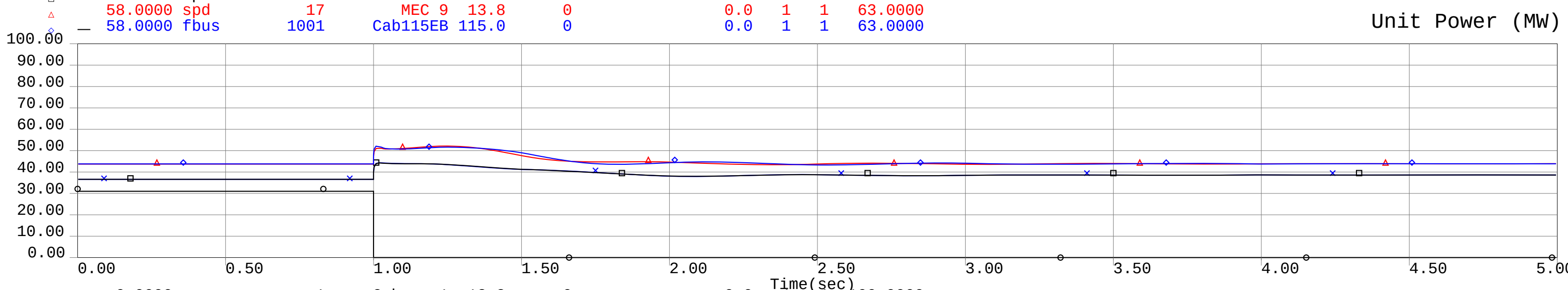
Thu Mar 27 12:30:19 2014

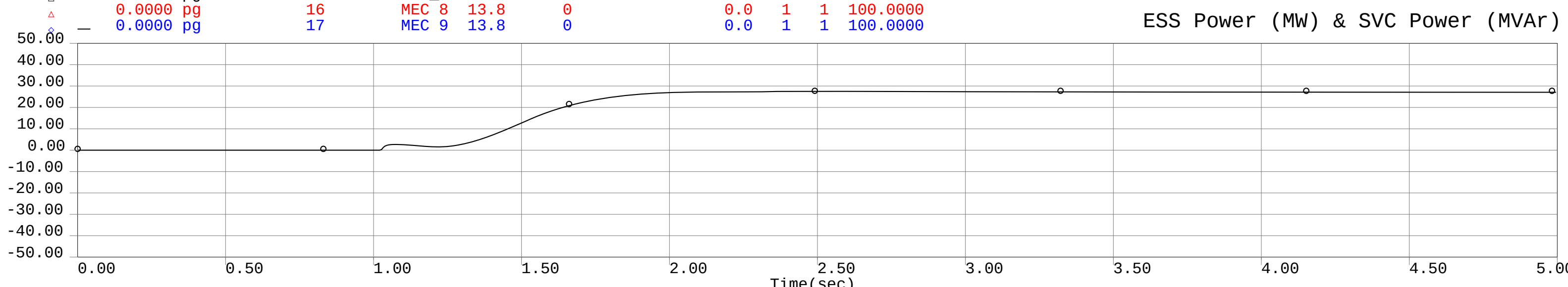
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS




```
○ 58.0000 spd      1    Cabras_1  13.8   0   0.0  1  1  63.0000
× 58.0000 spd     12    Cabras_3  13.8   0   0.0  1  1  63.0000
□ 58.0000 spd     16       MEC 8  13.8   0   0.0  1  1  63.0000
△ 58.0000 spd     17       MEC 9  13.8   0   0.0  1  1  63.0000
◇ 58.0000 fbus  1001    Cab115EB 115.0   0   0.0  1  1  63.0000
```




```
○ 0.0000 pg    1    Cabras_1  13.8   0   0.0  1  1  100.0000
× 0.0000 pg   12    Cabras_3  13.8   0   0.0  1  1  100.0000
□ 0.0000 pg   13    Cabras_4  13.8   0   0.0  1  1  100.0000
△ 0.0000 pg   16       MEC 8  13.8   0   0.0  1  1  100.0000
◇ 0.0000 pg   17       MEC 9  13.8   0   0.0  1  1  100.0000
```




```
○ -50.0000 pbes  80002  ESS 2-AGANA  13.8   0   0.0  1  1  50.0000
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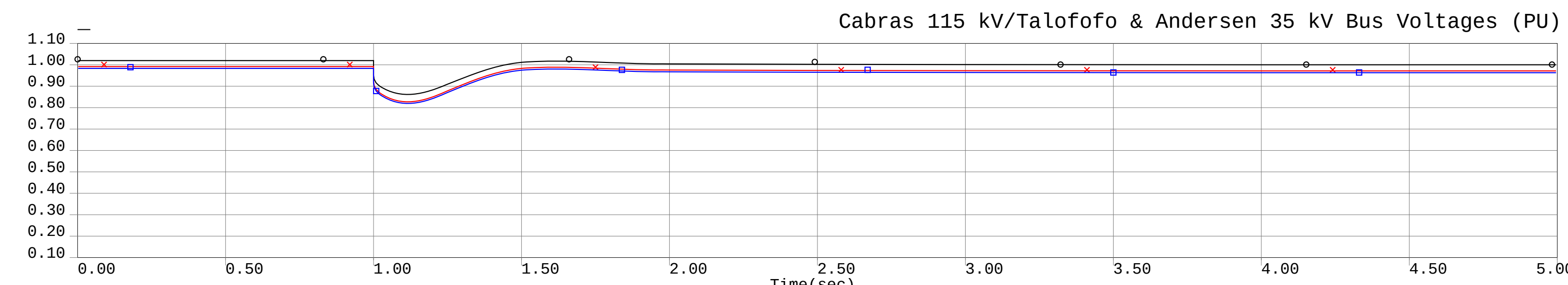


```
○ 0.1000 vbus  1001   Cab115EB 115.0   0   0.0  1  1  1.1000
× 0.1000 vbus  2003     Tal345  34.5   0   0.0  1  1  1.1000
□ 0.1000 vbus  2210   And345B1  34.5   0   0.0  1  1  1.1000
```


chans/2410_40a_c1_fidvr.chf

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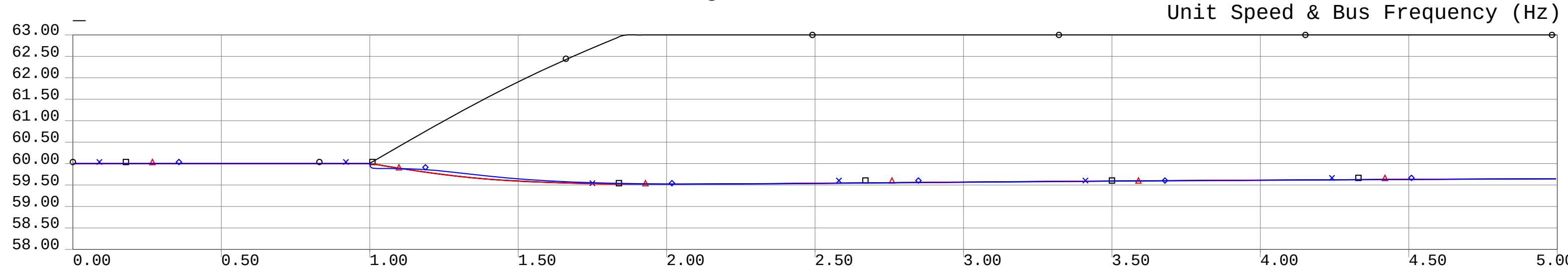
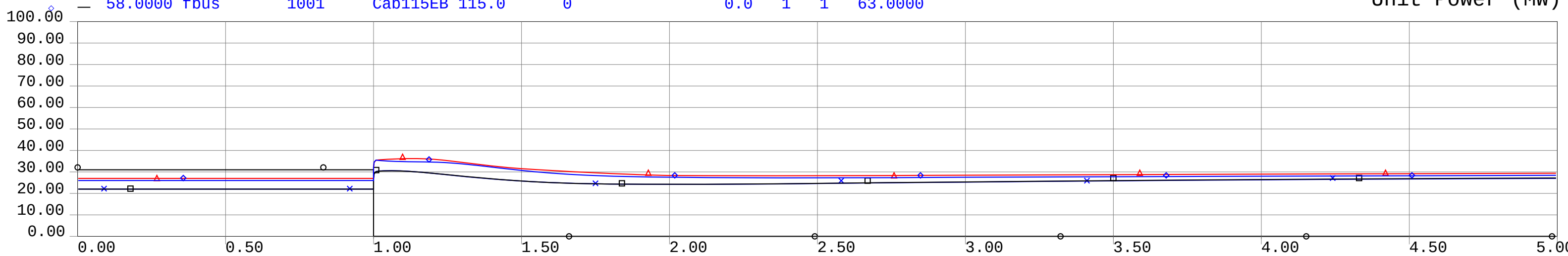
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



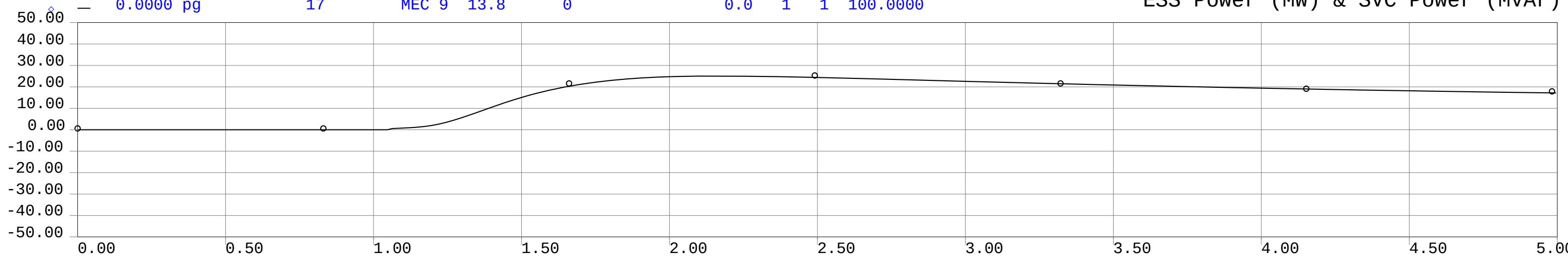
○ 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
× 58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
△ 58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
◇ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



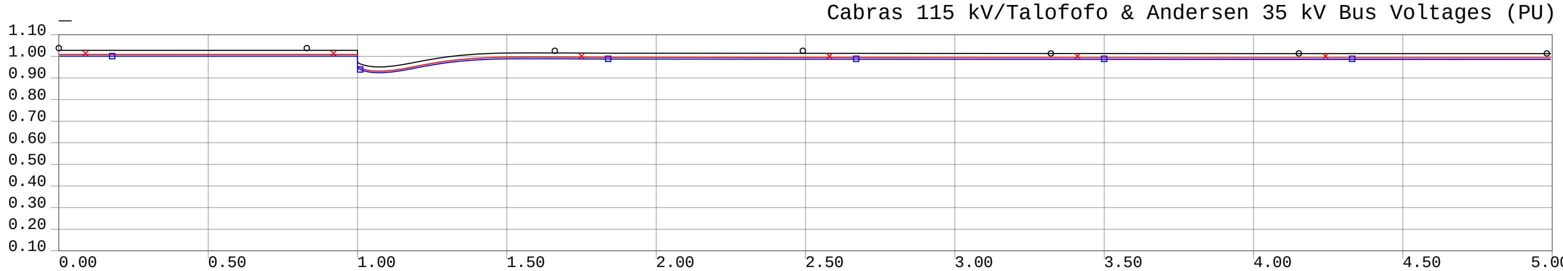
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
□ 0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
△ 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
◇ 0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2420_40a_c1_fidvr.chf

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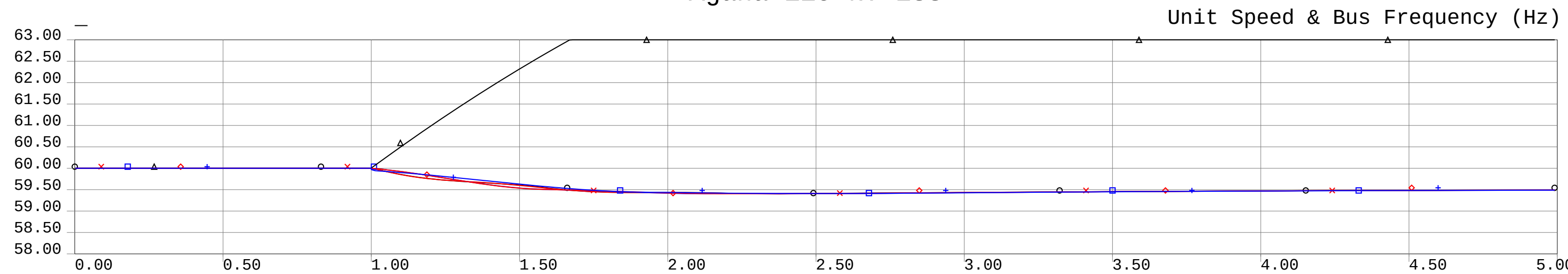
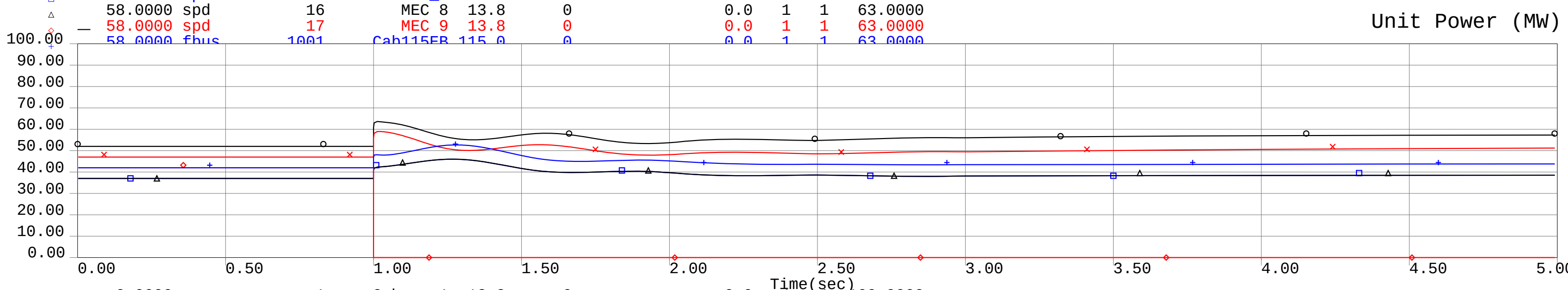
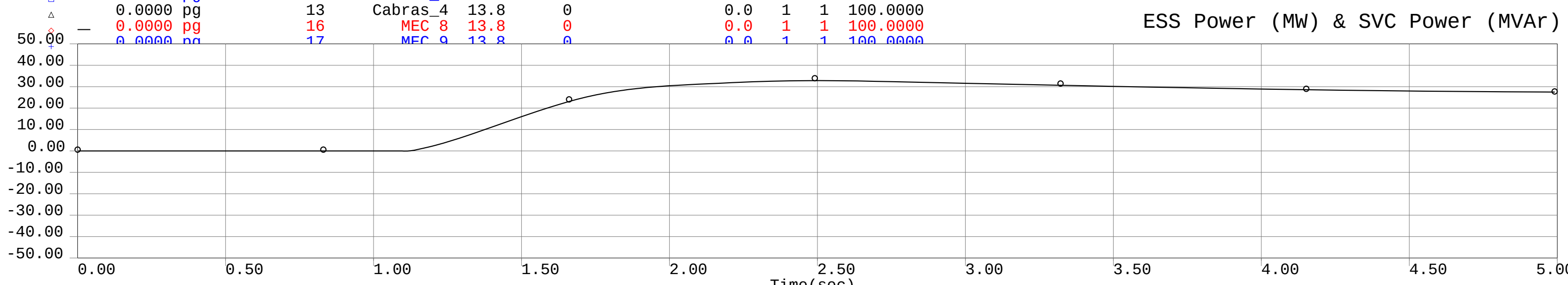
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



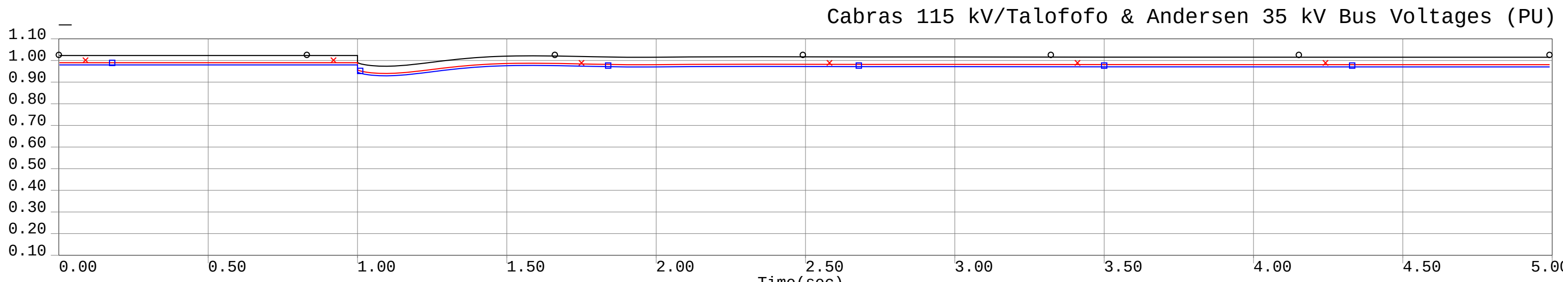
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000



0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1400_40a_m8_fidvr.chf

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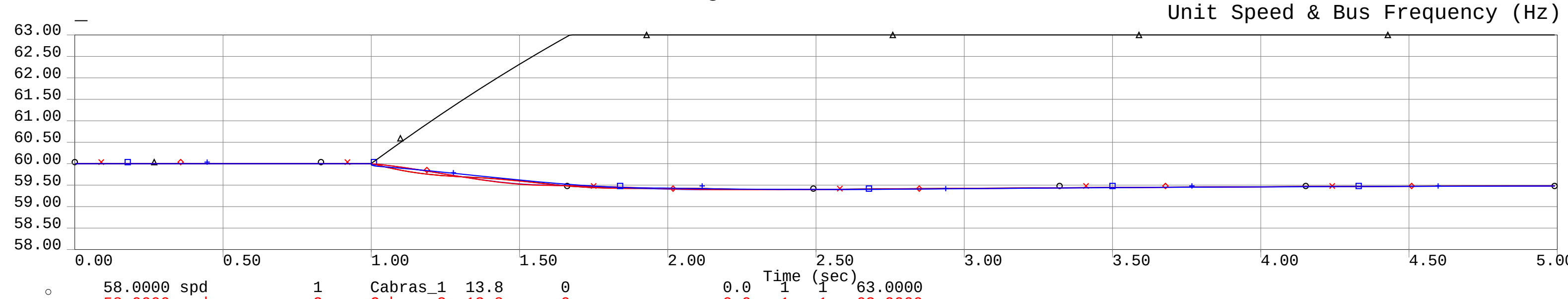
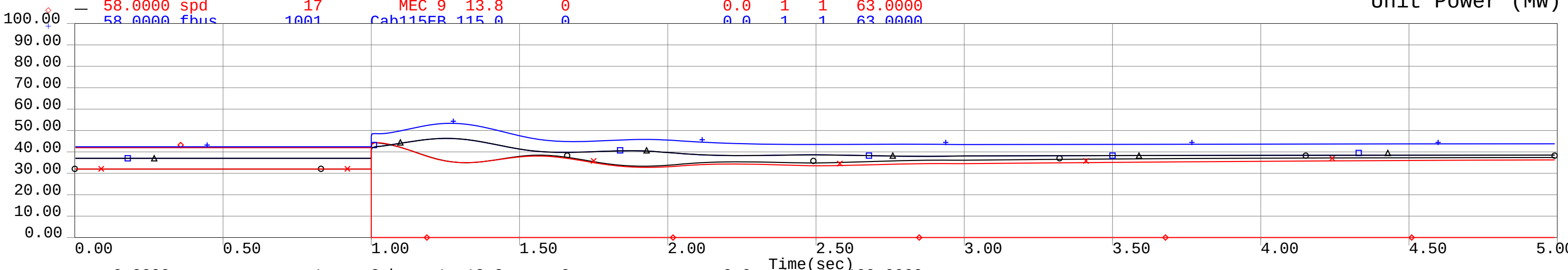
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



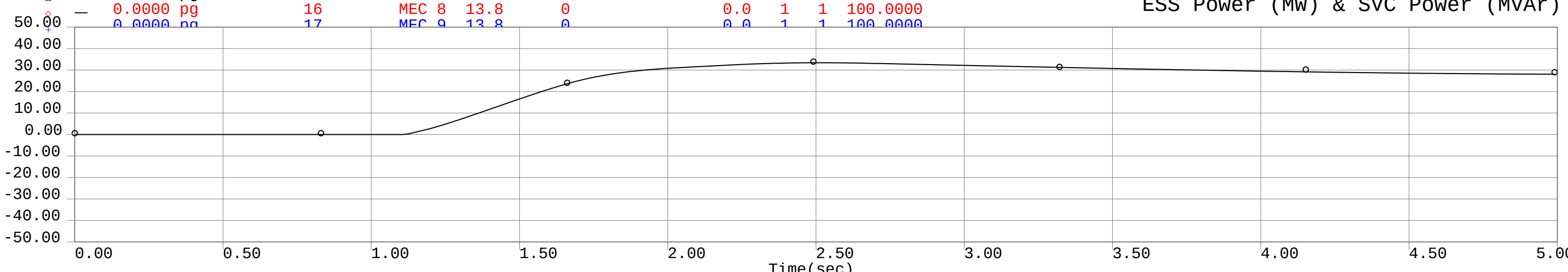
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



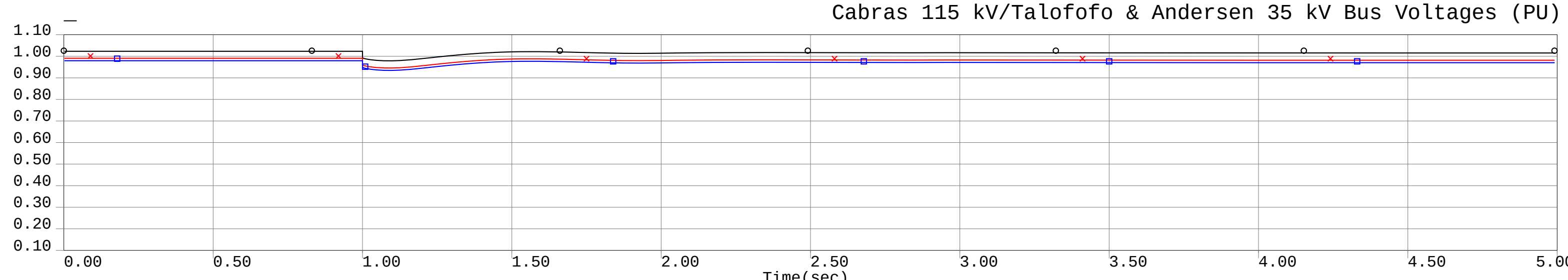
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1410_40a_m8_fidvr.chf

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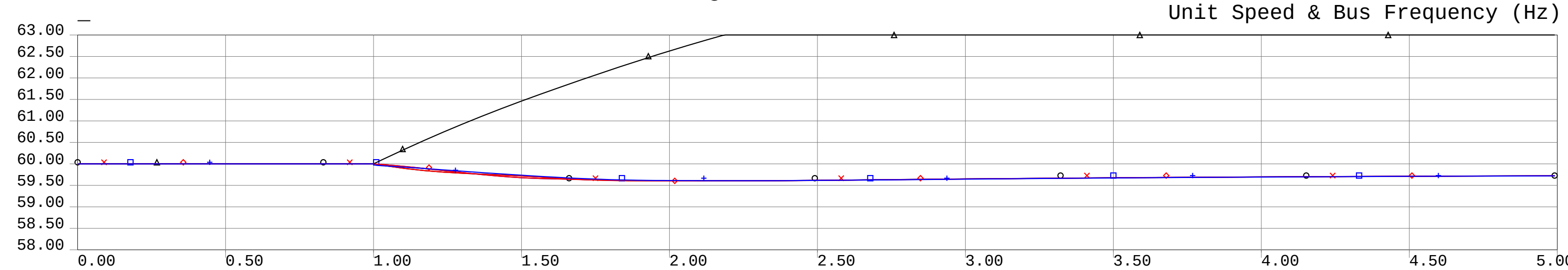
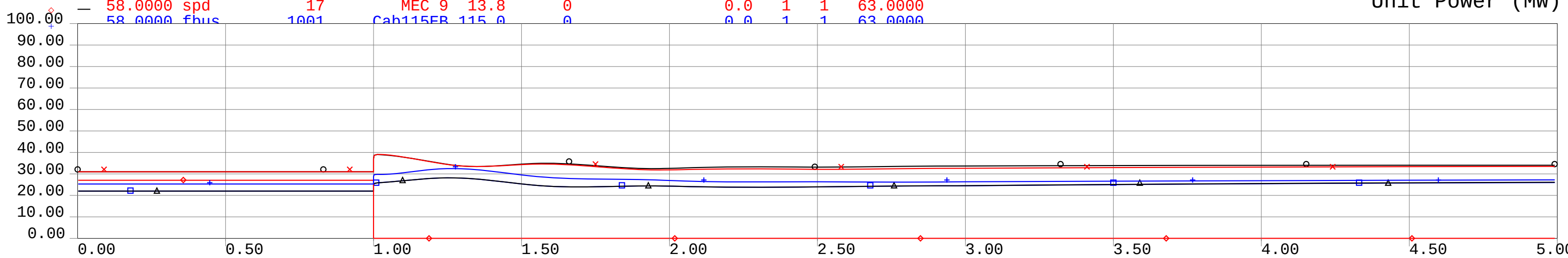
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



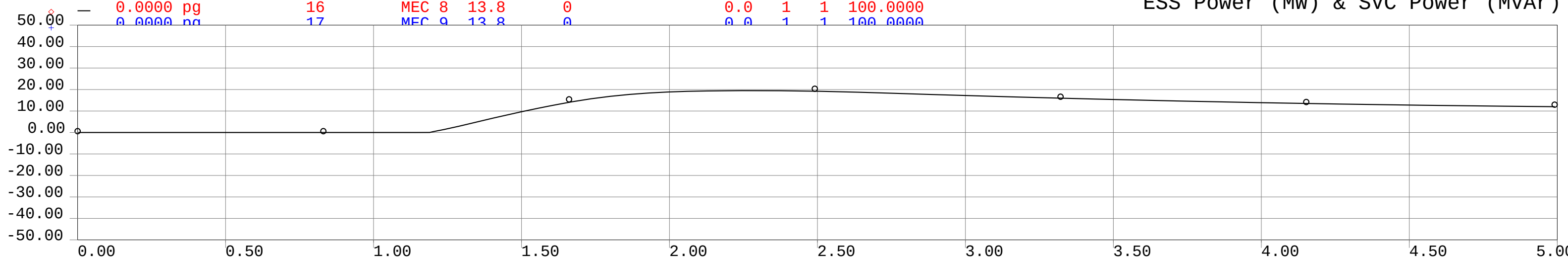
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



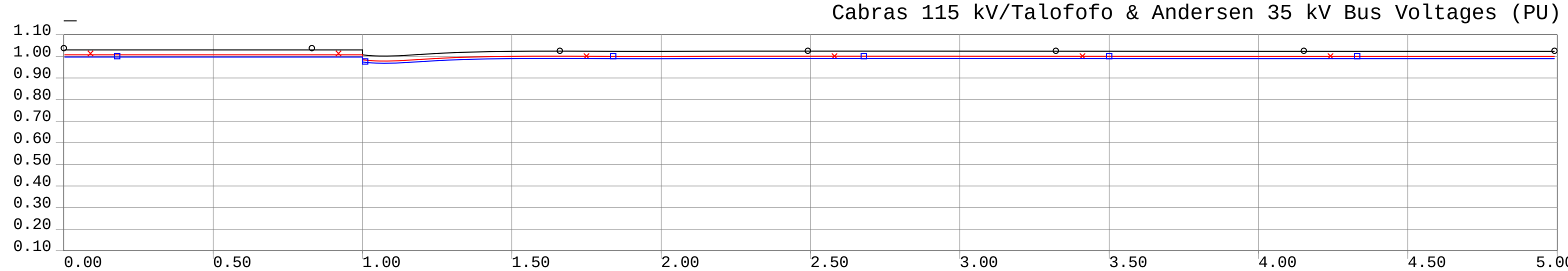
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1420_40a_m8_fidvr.chf

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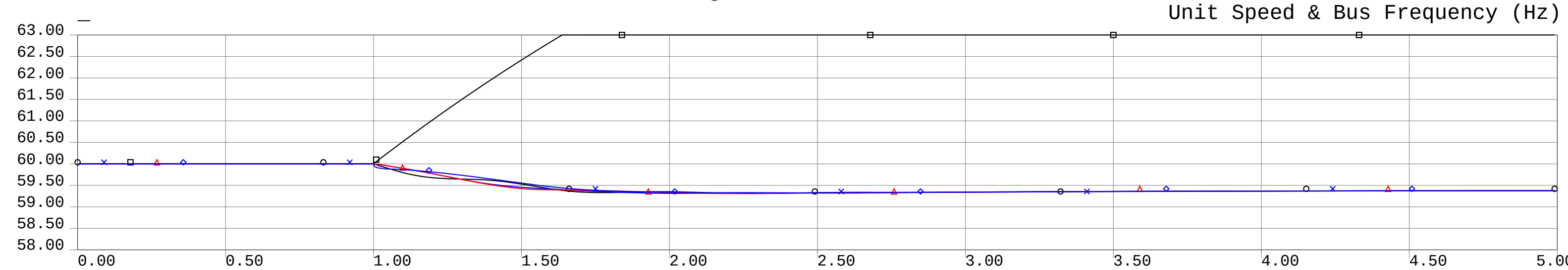
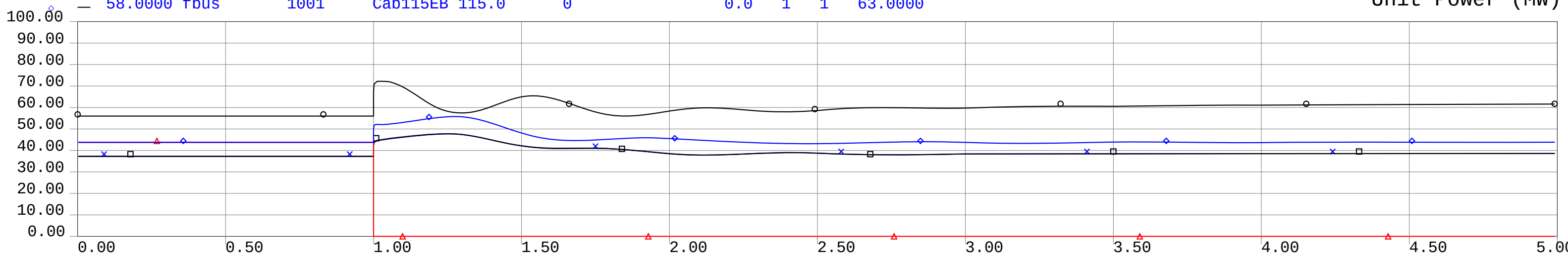
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



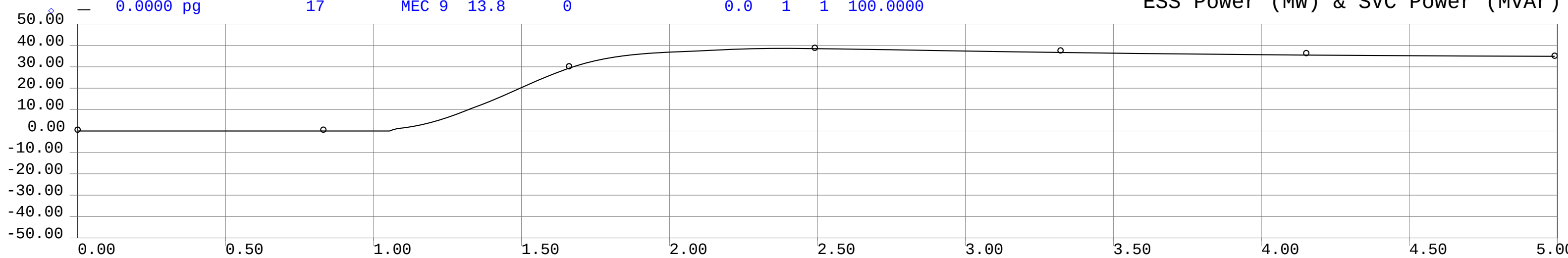
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



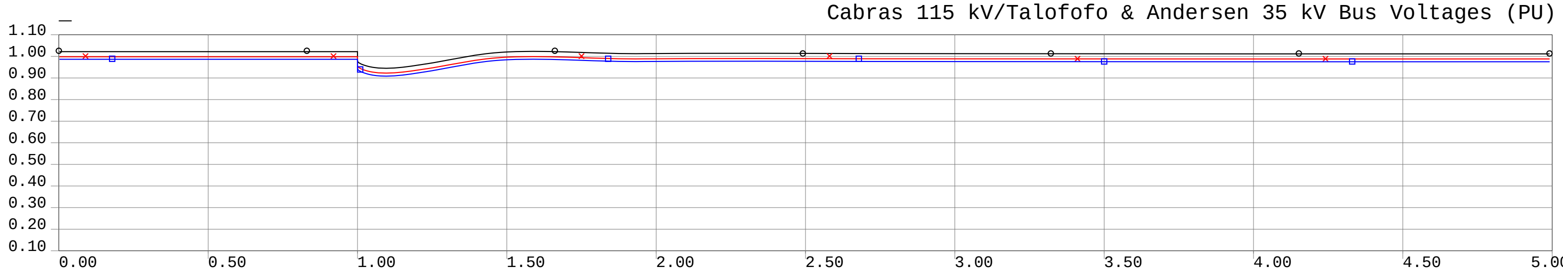
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2400_40a_m8_fidvr.chf

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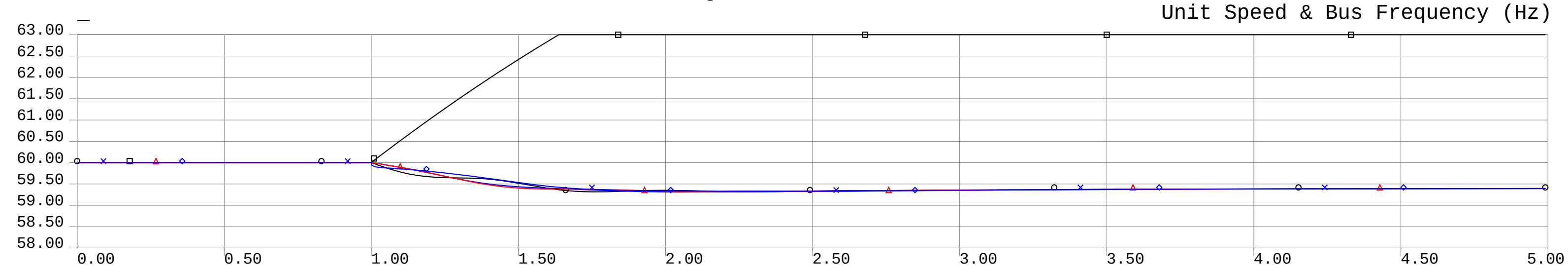
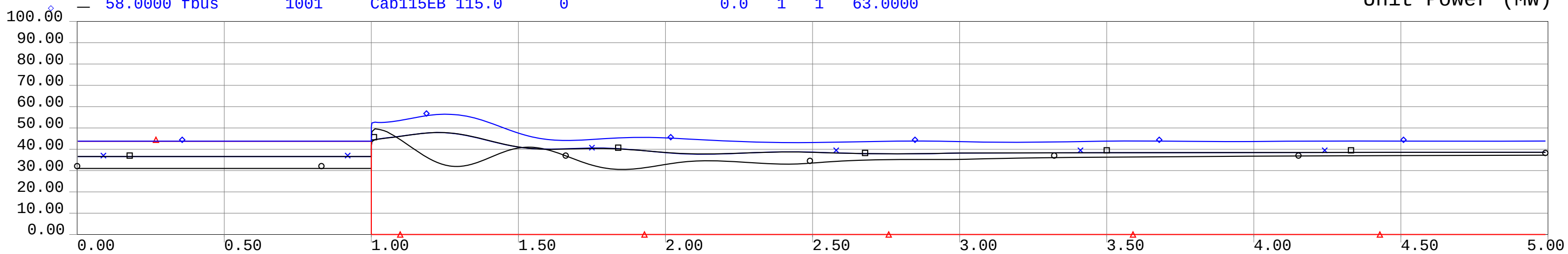
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



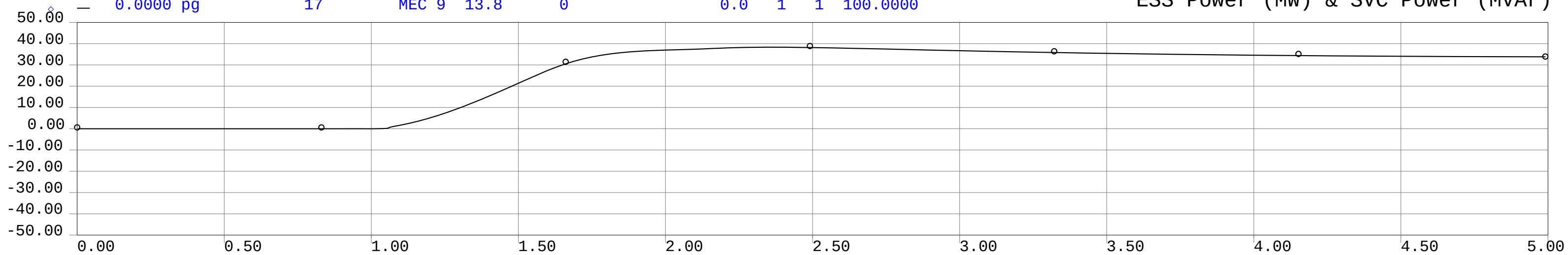
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



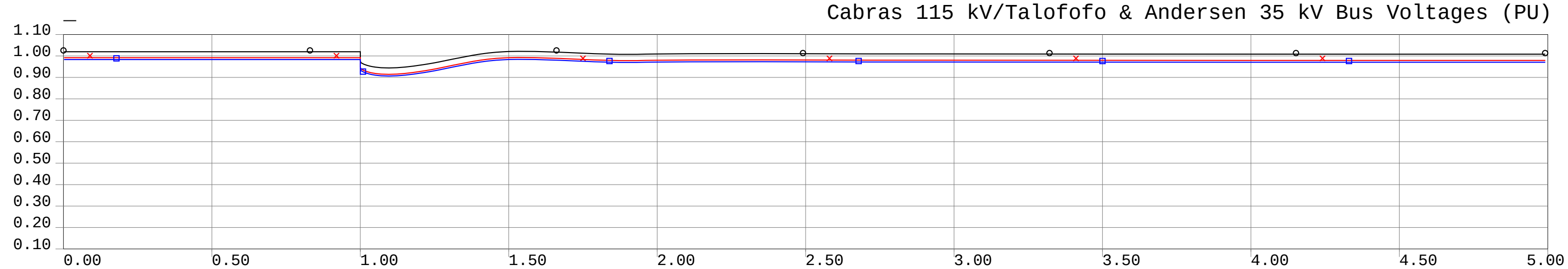
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2410_40a_m8_fidvr.chf

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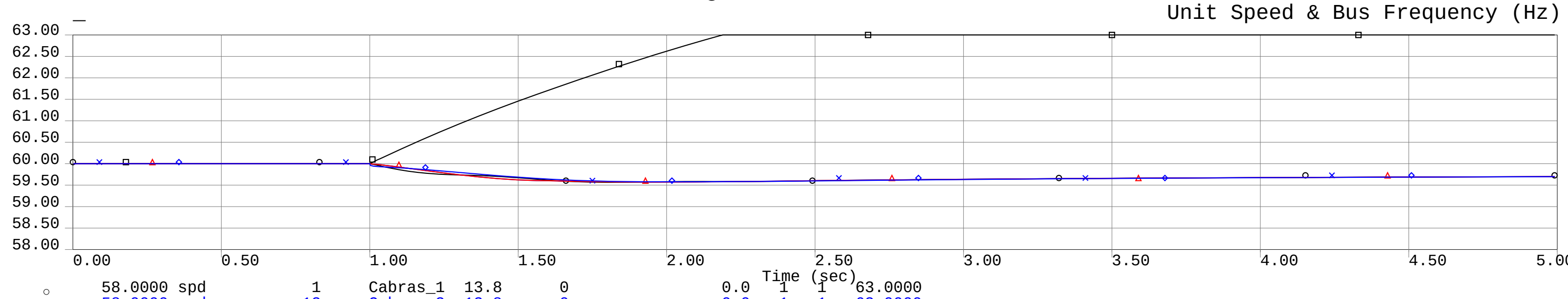
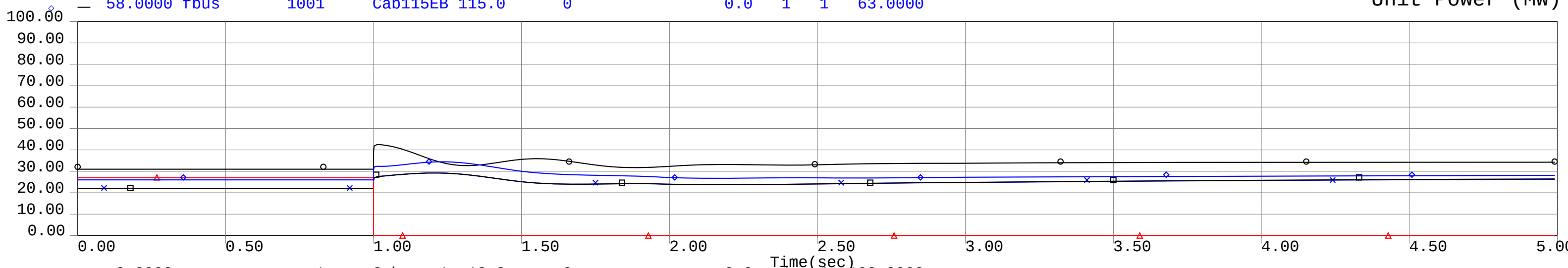
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



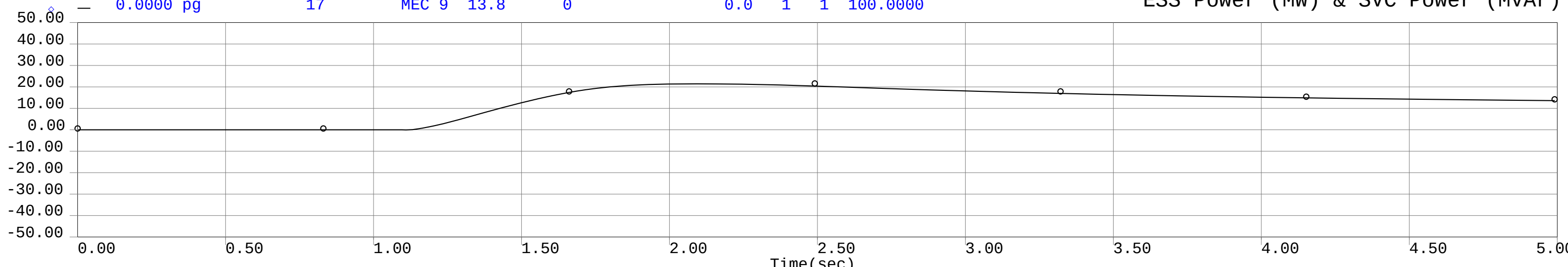
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



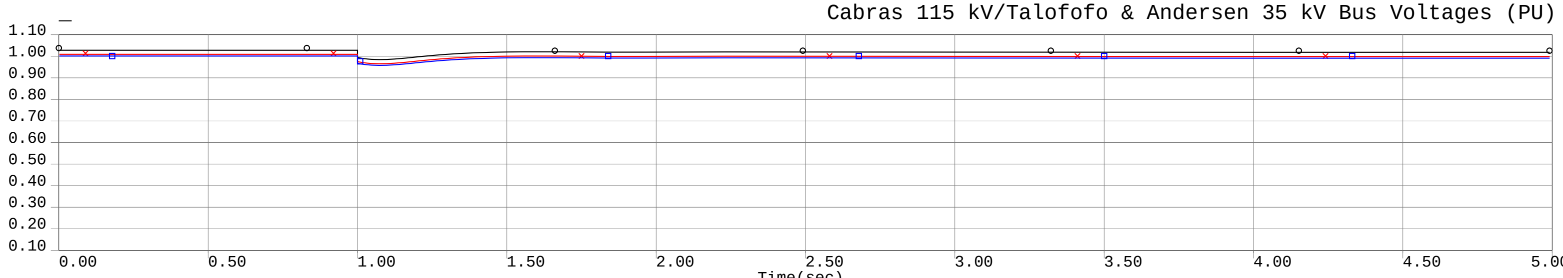
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



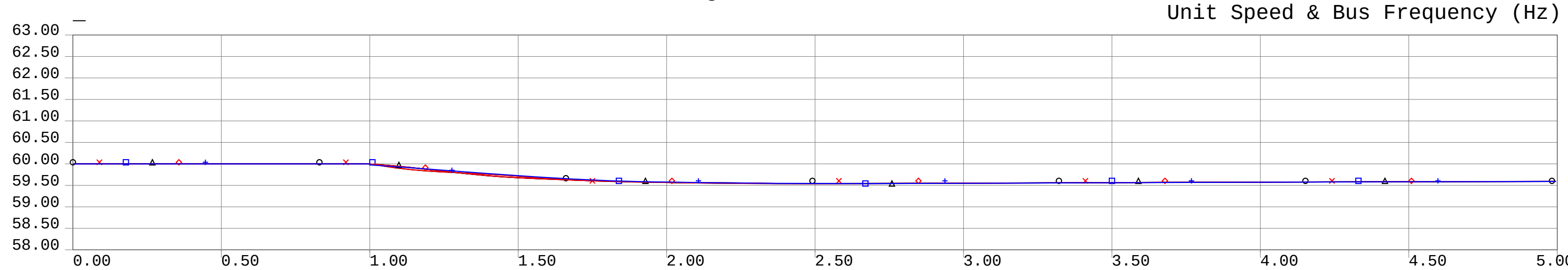
○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

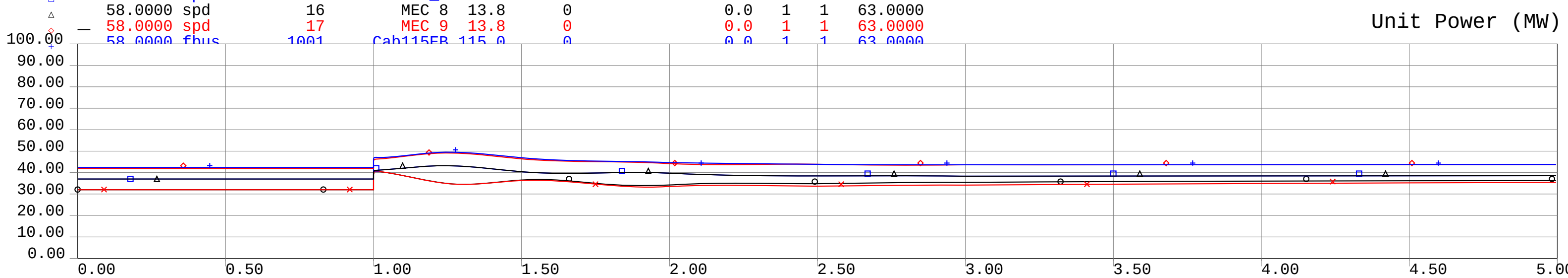


○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

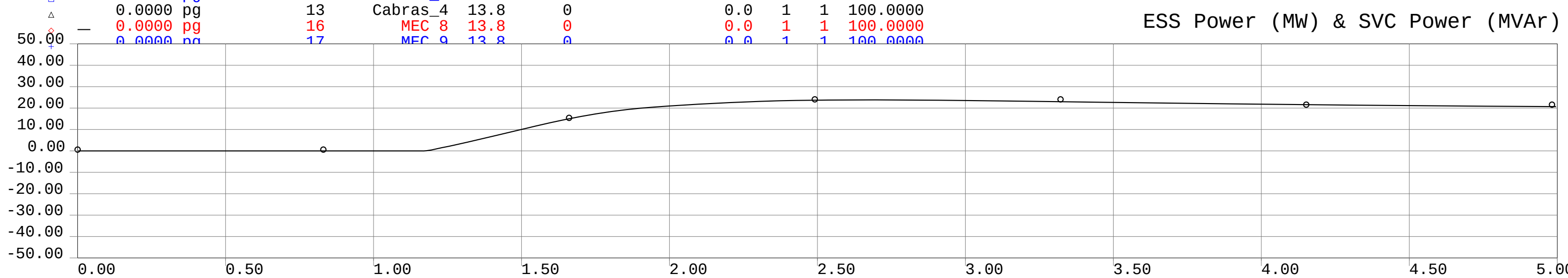
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



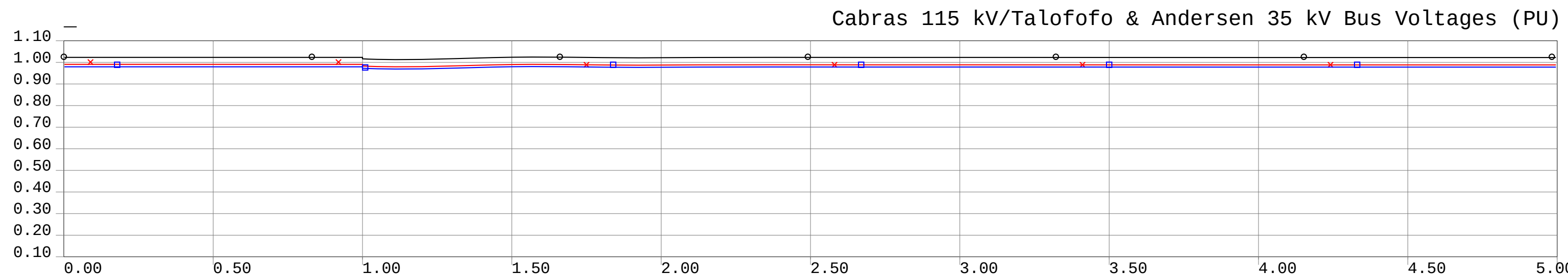
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000



0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1410_40a_pvw1_fidvr.chf

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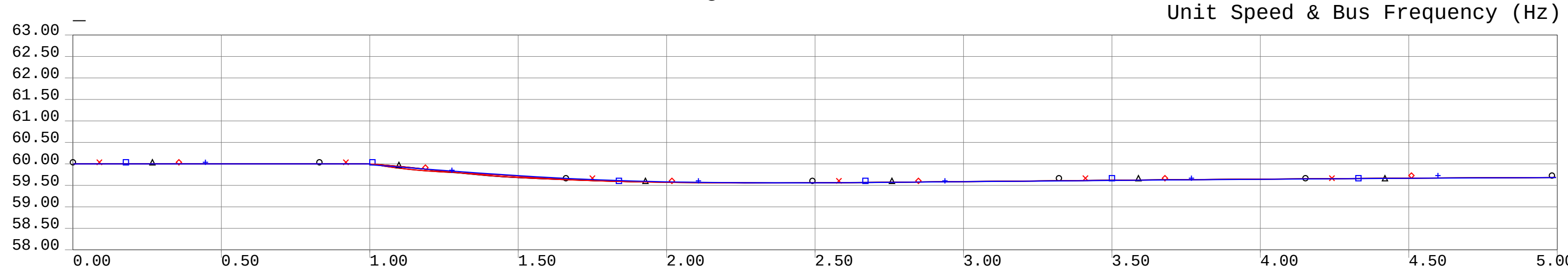
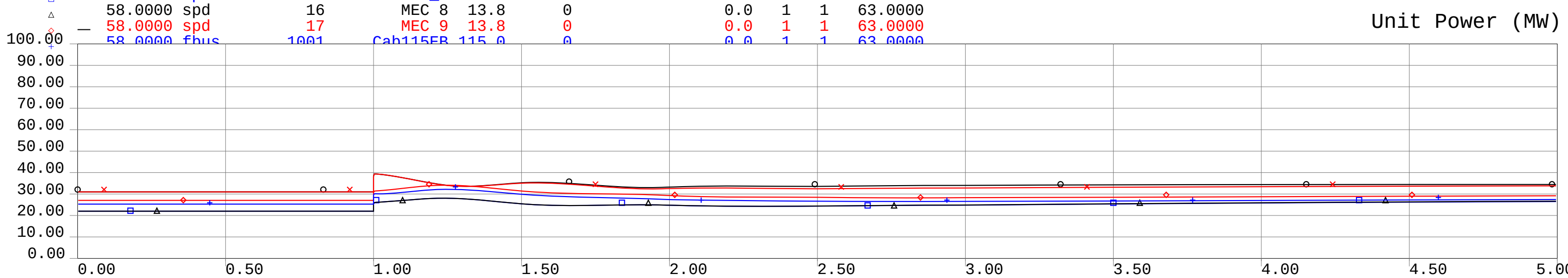
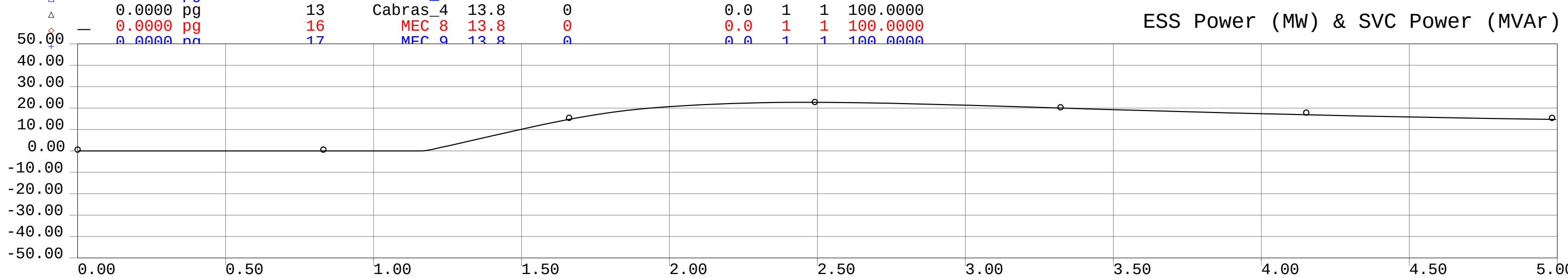
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



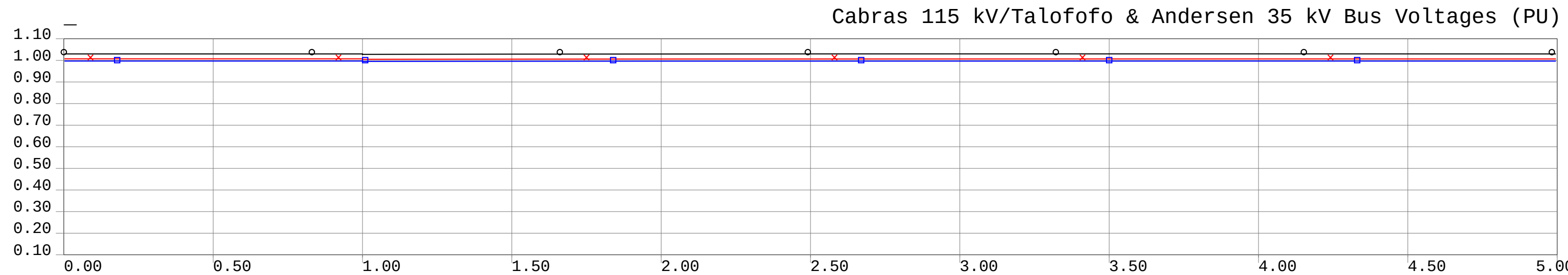
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000



0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1420_40a_pvw1_fidvr.chf

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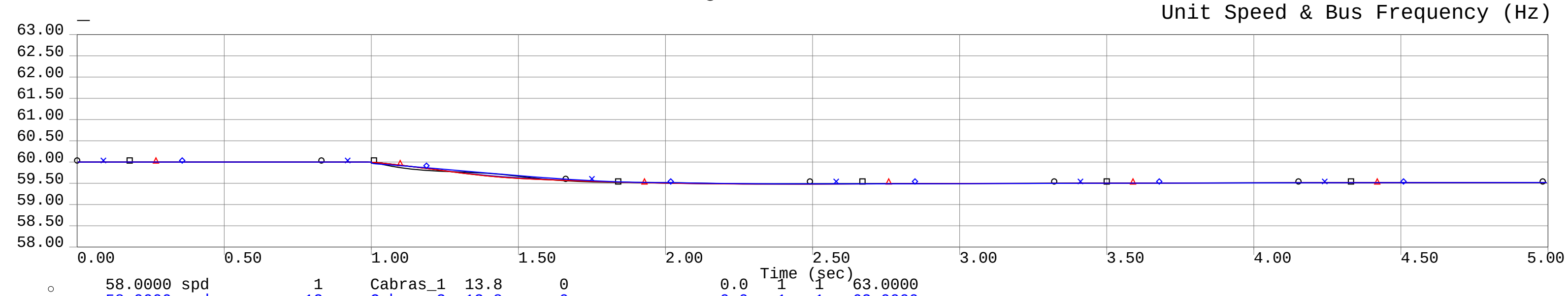
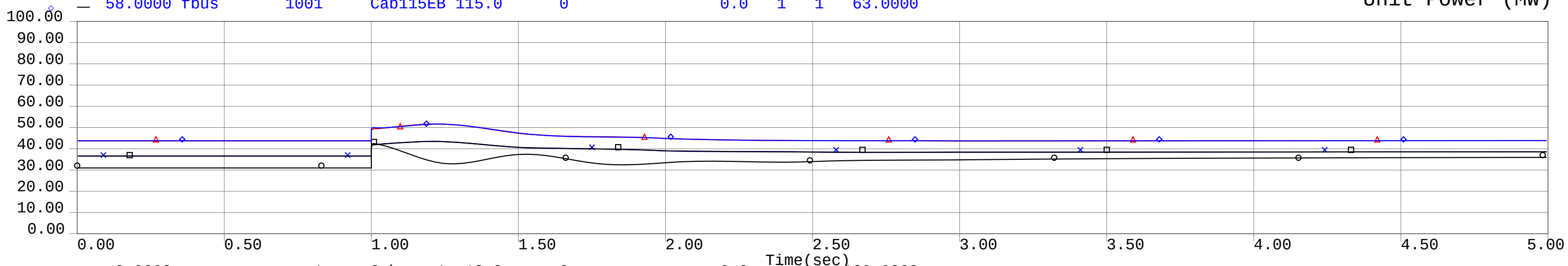
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



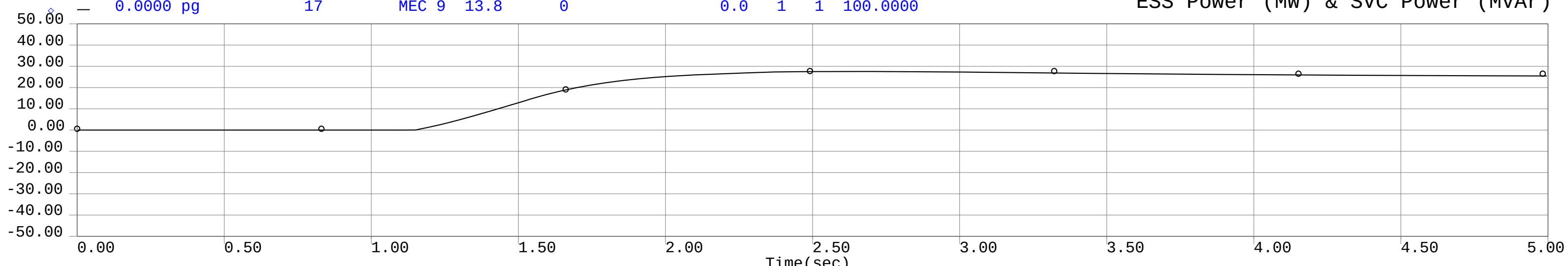
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



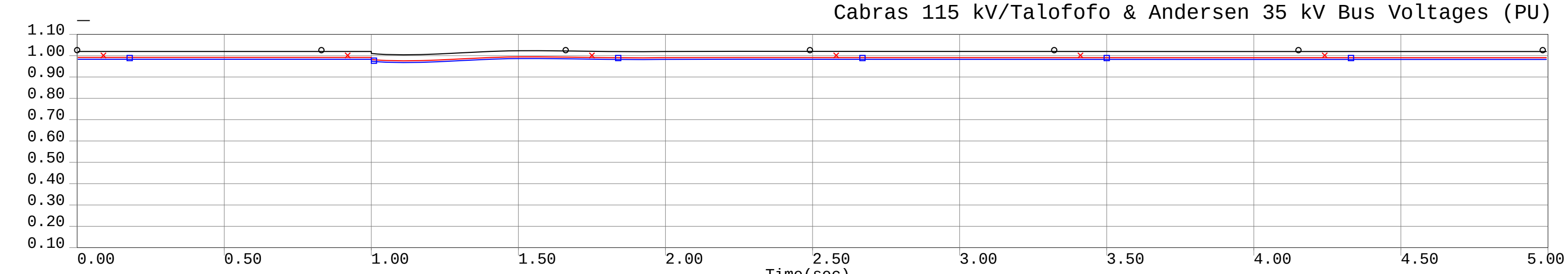
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2410_40a_pvw1_fidvr.chf

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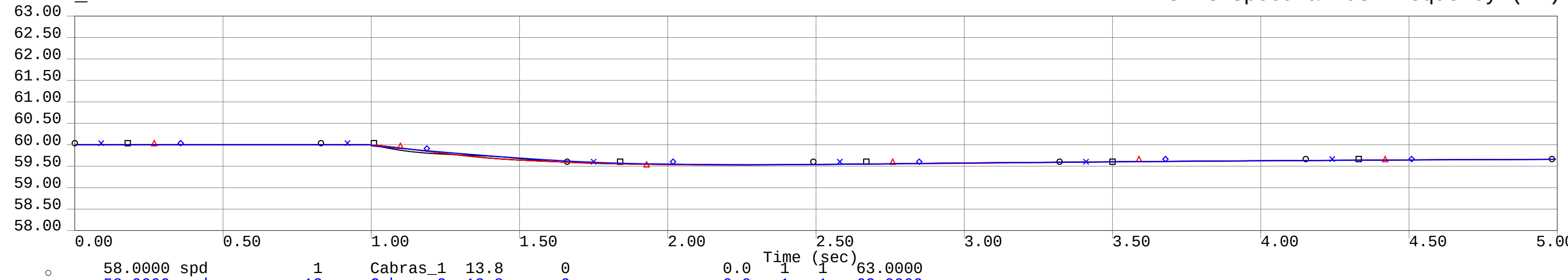
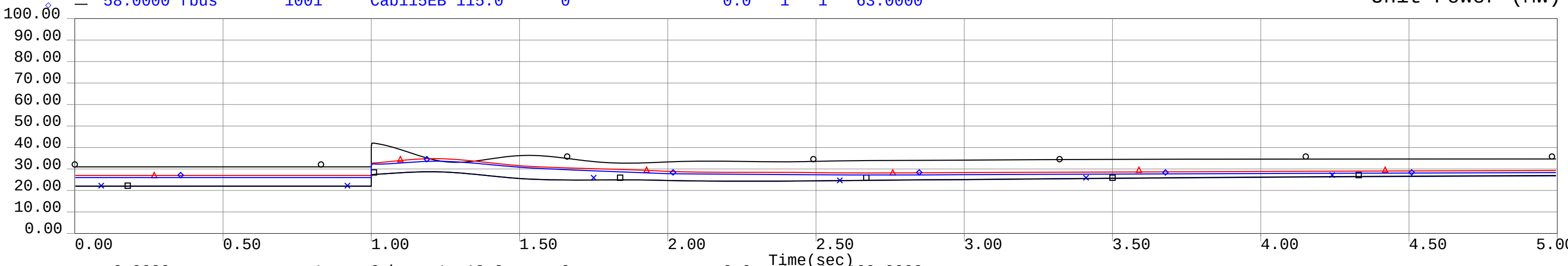
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



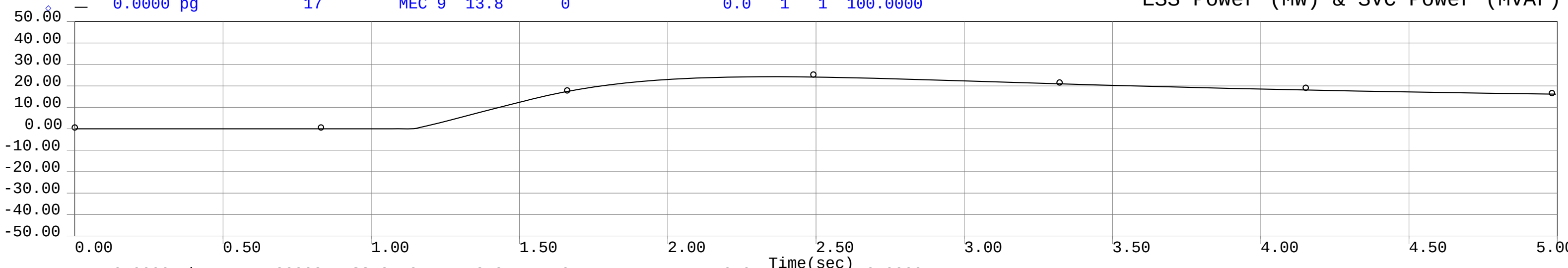
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



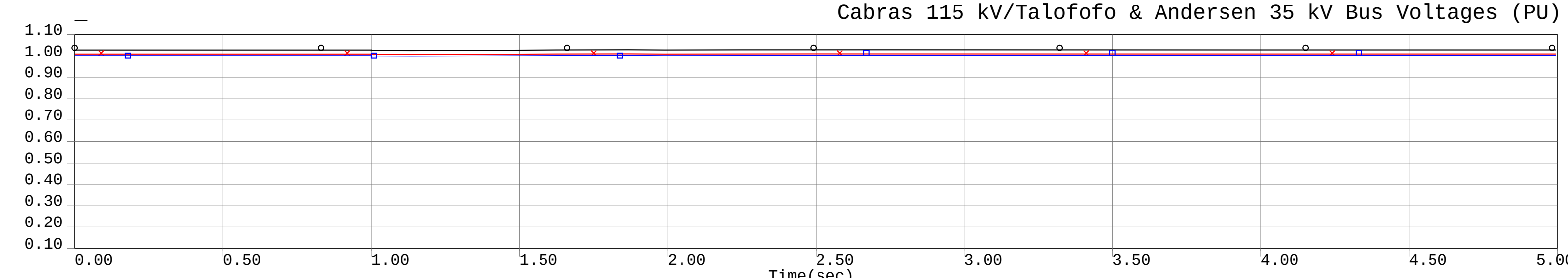
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2420_40a_pvw1_fidvr.chf

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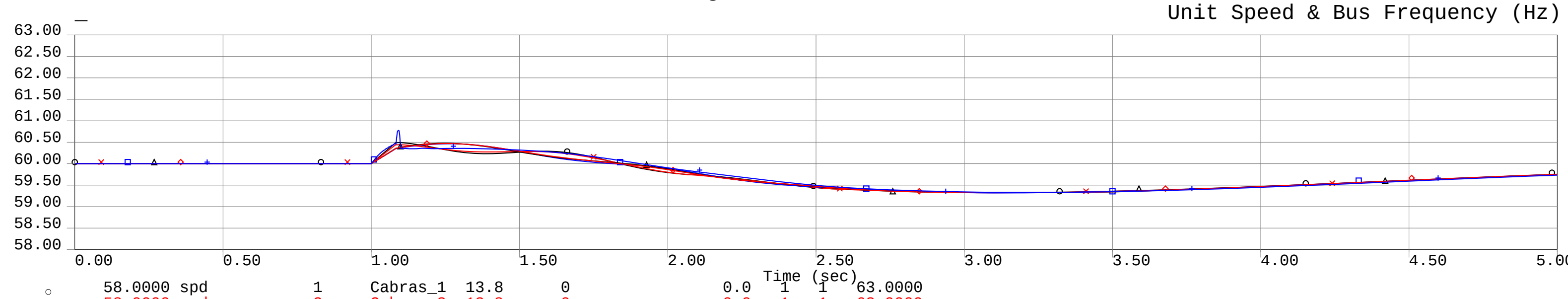
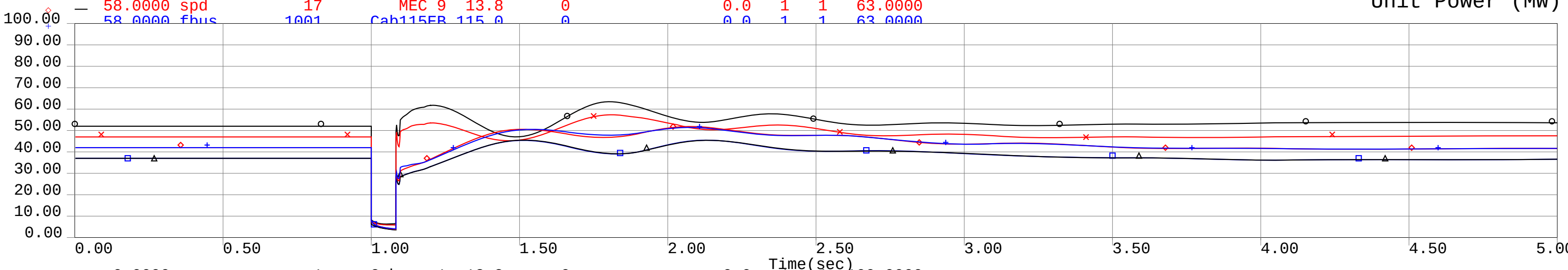
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



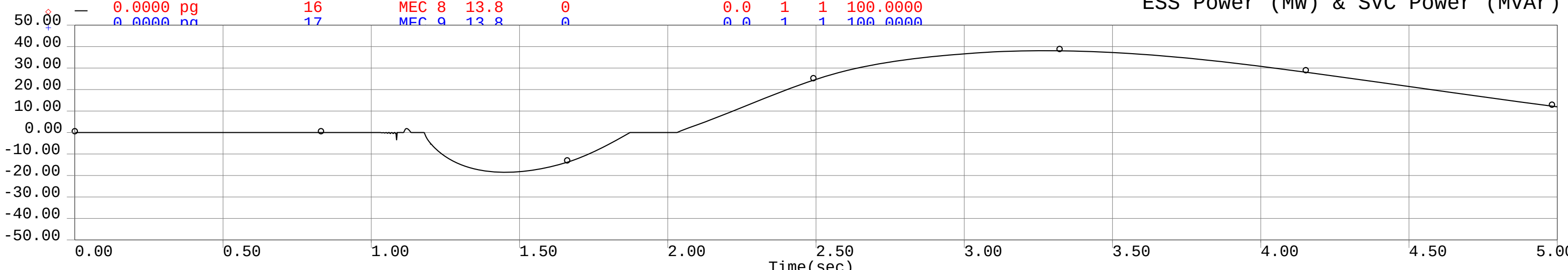
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



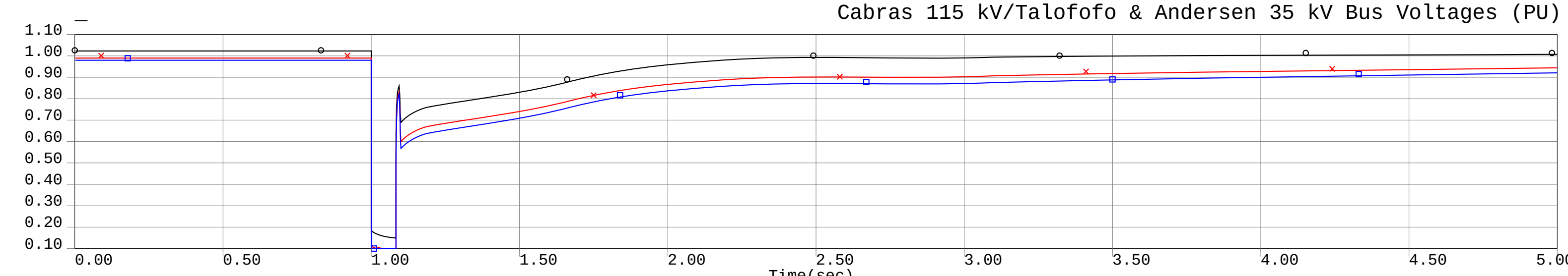
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1400_40a_lf1_fidvr.chf

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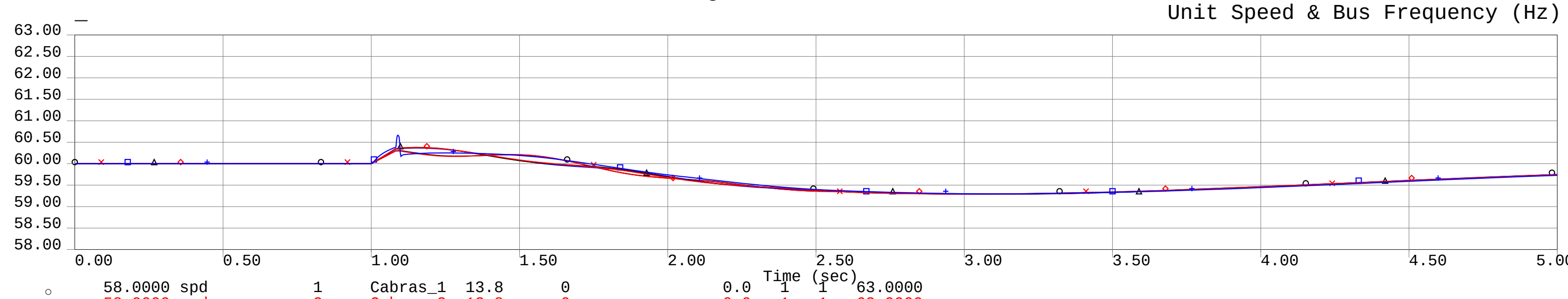
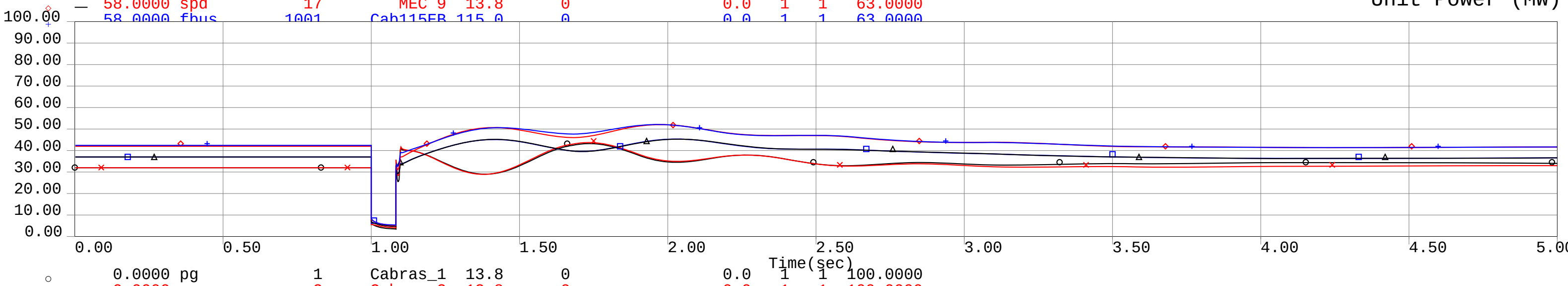
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



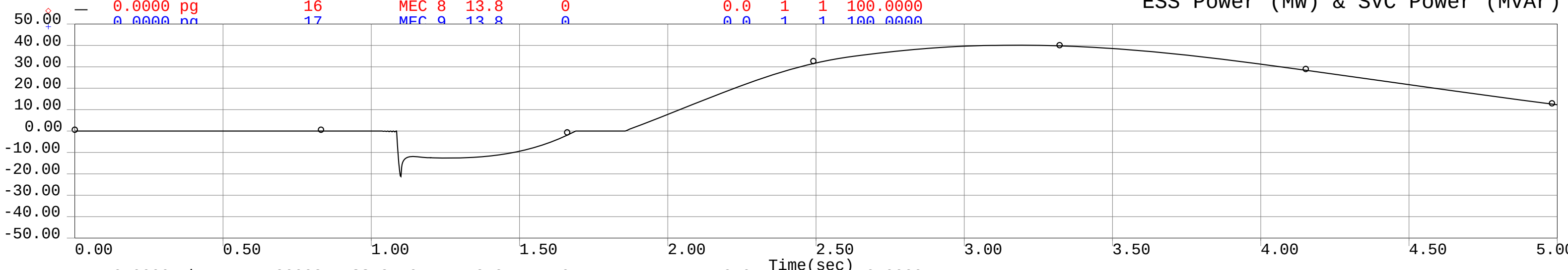
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



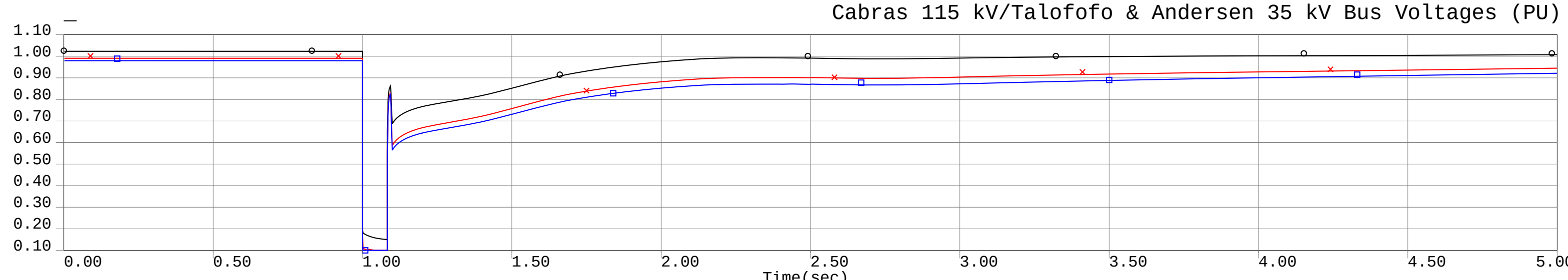
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1410_40a_lf1_fidvr.chf

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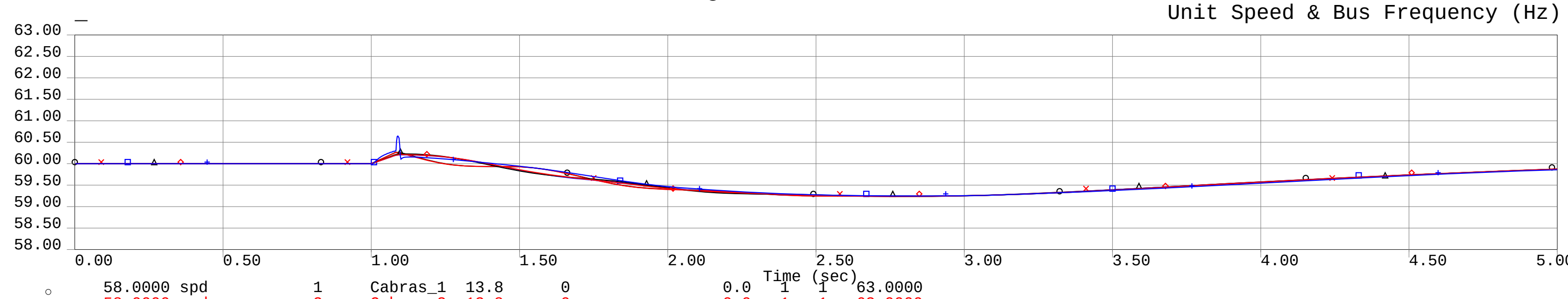
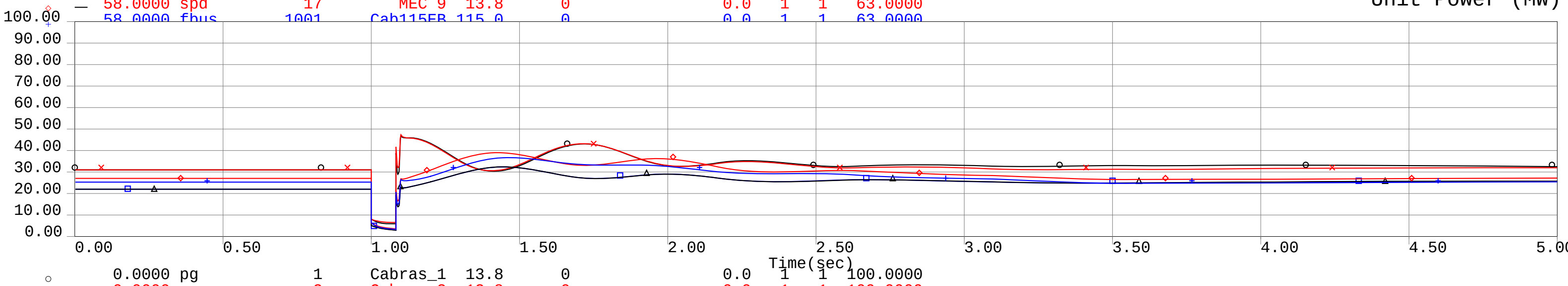
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



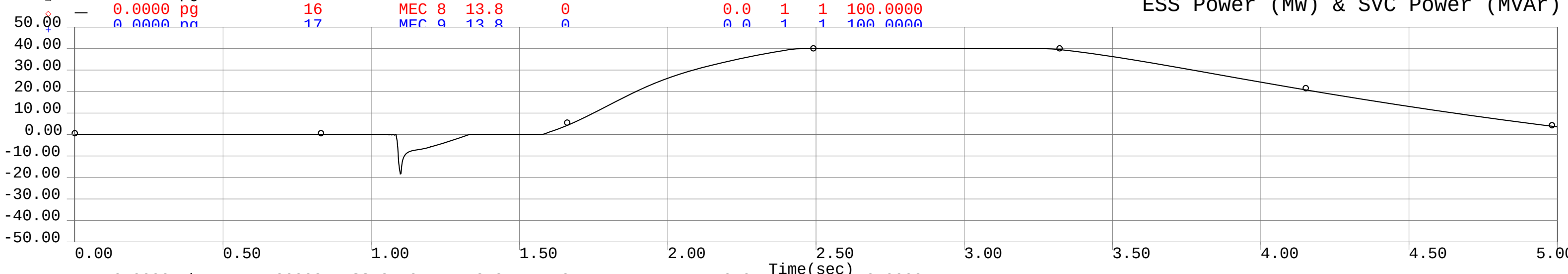
```
58.0000 spd       1   Cabras_1  13.8    0        0.0  1  1  63.0000
58.0000 spd       2   Cabras_2  13.8    0        0.0  1  1  63.0000
58.0000 spd      12   Cabras_3  13.8    0        0.0  1  1  63.0000
58.0000 spd      16      MEC 8  13.8    0        0.0  1  1  63.0000
58.0000 spd      17      MEC 9  13.8    0        0.0  1  1  63.0000
58.0000 fbus   1001   Cab115EB 115.0    0        0.0  1  1  63.0000
```

Unit Power (MW)



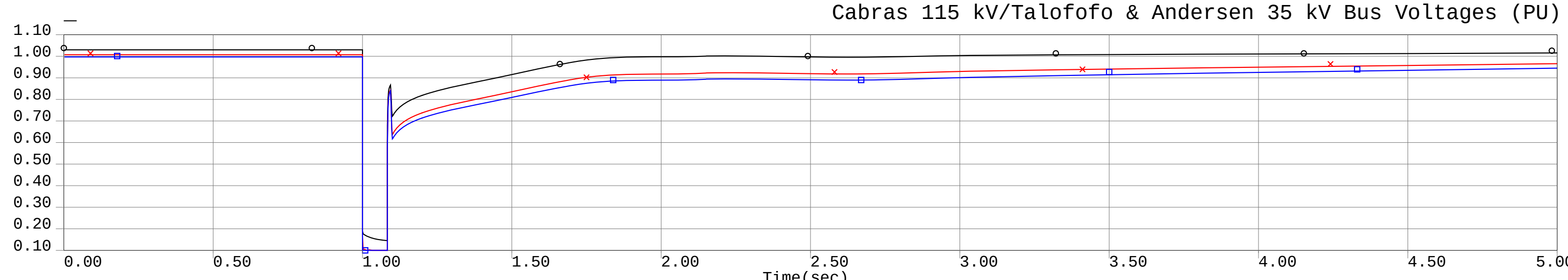
```
0.0000 pg       1   Cabras_1  13.8    0        0.0  1  1  100.0000
0.0000 pg       2   Cabras_2  13.8    0        0.0  1  1  100.0000
0.0000 pg      12   Cabras_3  13.8    0        0.0  1  1  100.0000
0.0000 pg      13   Cabras_4  13.8    0        0.0  1  1  100.0000
0.0000 pg      16      MEC 8  13.8    0        0.0  1  1  100.0000
0.0000 pg      17      MEC 9  13.8    0        0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)



```
-50.0000 pbes     80002  ESS 2-AGANA  13.8    0        0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



```
0.1000 vbus    1001   Cab115EB 115.0    0        0.0  1  1  1.1000
0.1000 vbus    2003     Tal345  34.5    0        0.0  1  1  1.1000
0.1000 vbus    2210   And345B1  34.5    0        0.0  1  1  1.1000
```


chans/1420_40a_lf1_fidvr.chf

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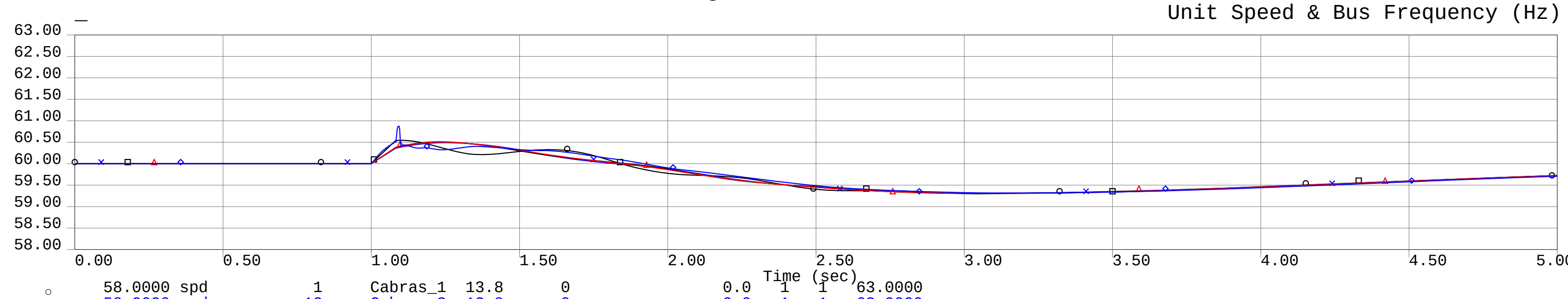
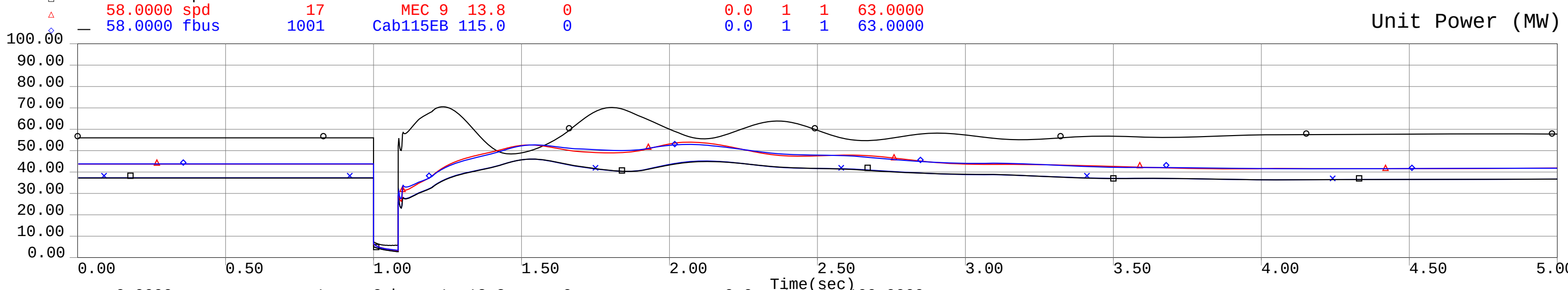
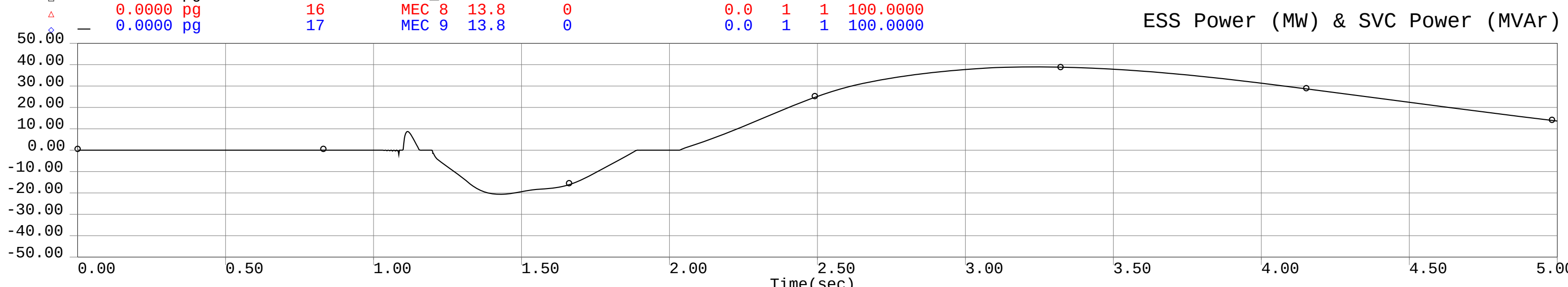
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



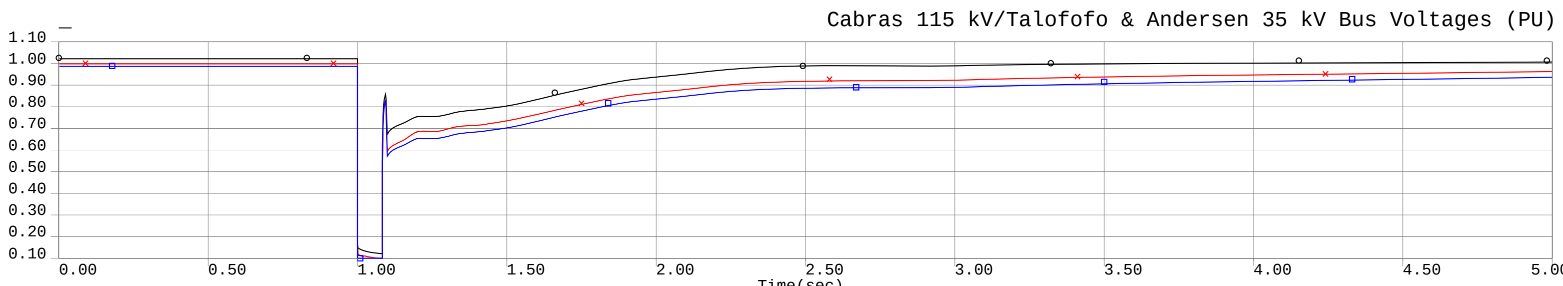
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000



0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2400_40a_lf1_fidvr.chf

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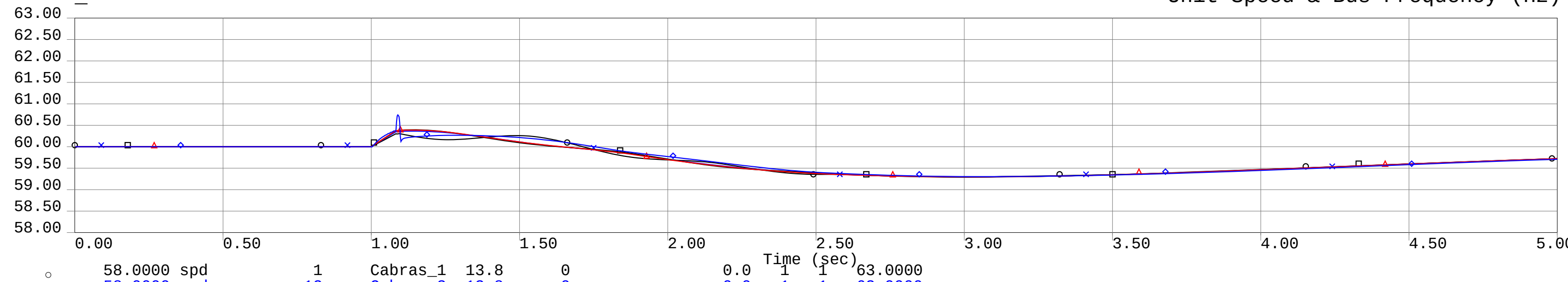
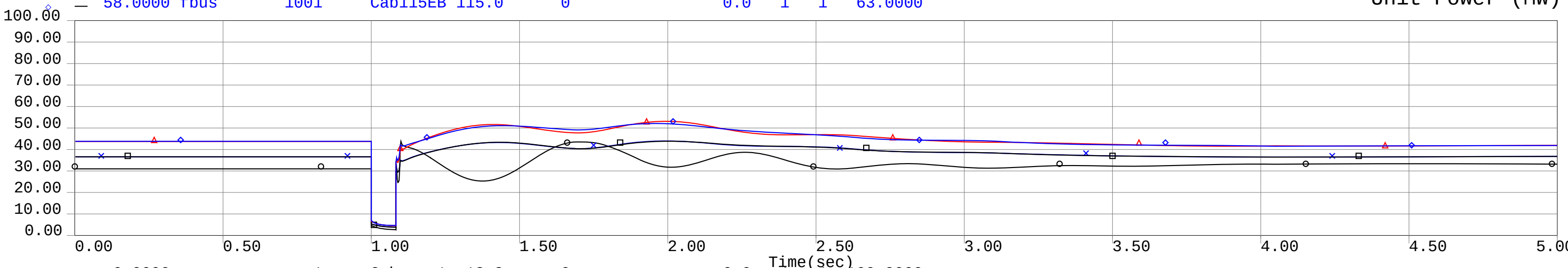
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



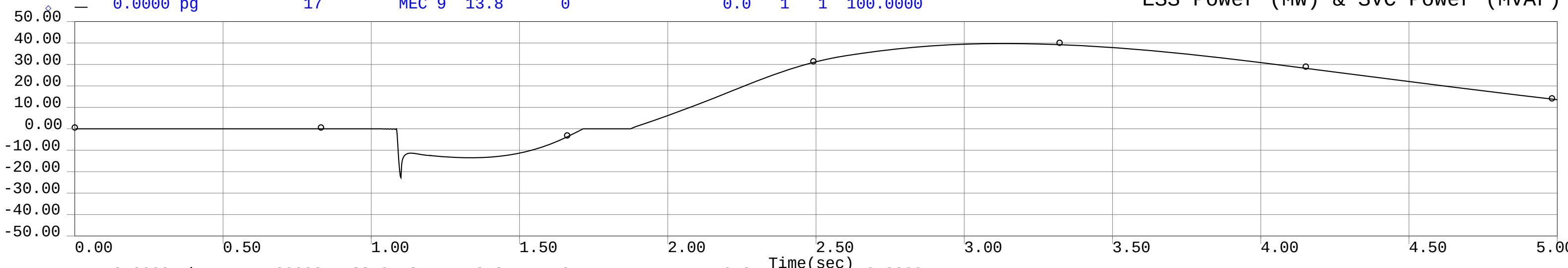

```
○  58.0000 spd      1     Cabras_1  13.8   0   0.0  1  1  63.0000
×  58.0000 spd     12     Cabras_3  13.8   0   0.0  1  1  63.0000
□  58.0000 spd     16        MEC 8  13.8   0   0.0  1  1  63.0000
△  58.0000 spd     17        MEC 9  13.8   0   0.0  1  1  63.0000
◇  58.0000 fbus  1001    Cab115EB 115.0   0   0.0  1  1  63.0000
```

Unit Power (MW)



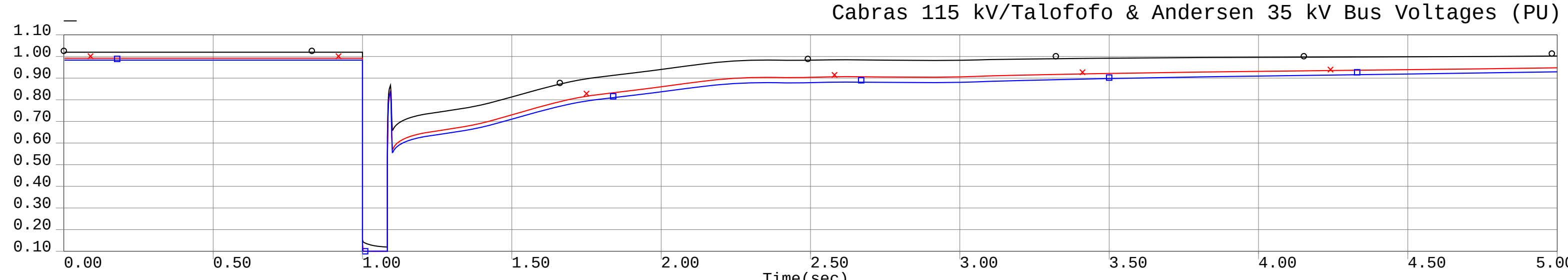

```
○  0.0000 pg      1   Cabras_1  13.8   0   0.0  1  1  100.0000
×  0.0000 pg     12   Cabras_3  13.8   0   0.0  1  1  100.0000
□  0.0000 pg     13   Cabras_4  13.8   0   0.0  1  1  100.0000
△  0.0000 pg     16      MEC 8  13.8   0   0.0  1  1  100.0000
◇  0.0000 pg     17      MEC 9  13.8   0   0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
○  -50.0000 pbes   80002  ESS 2-AGANA  13.8   0   0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○  0.1000 vbus   1001   Cab115EB 115.0   0   0.0  1  1  1.1000
×  0.1000 vbus   2003     Tal345  34.5   0   0.0  1  1  1.1000
□  0.1000 vbus   2210   And345B1  34.5   0   0.0  1  1  1.1000
```


chans/2410_40a_lf1_fidvr.chf

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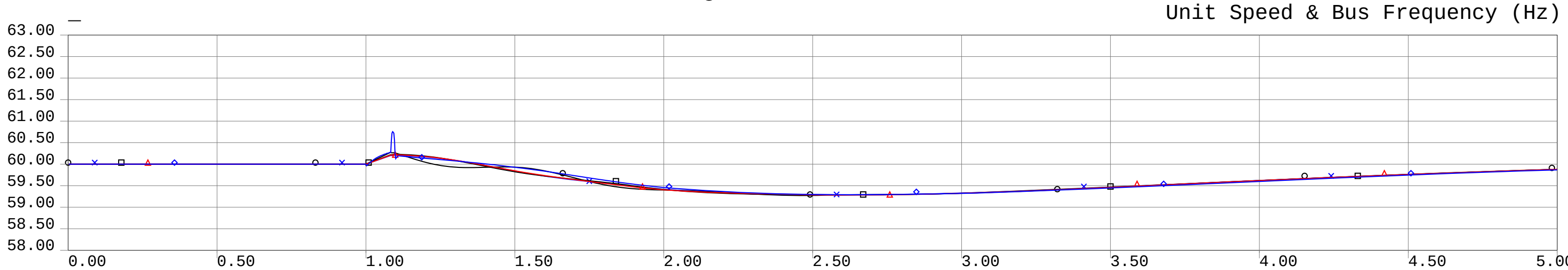
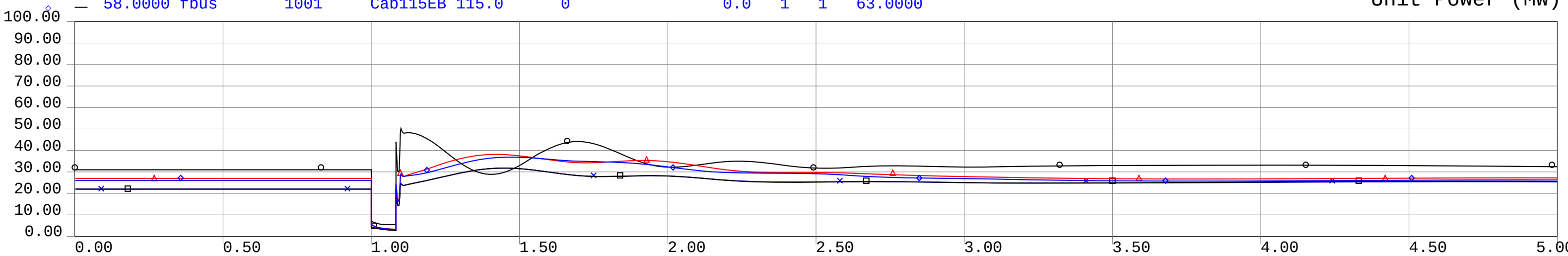
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



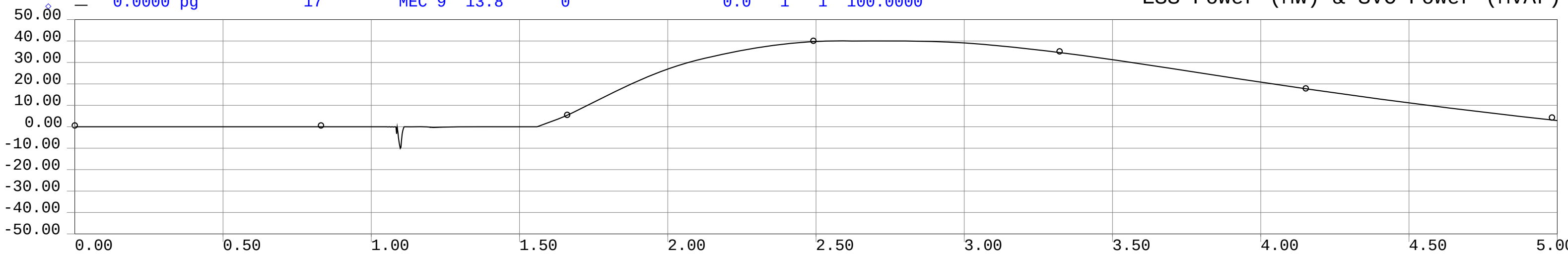
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



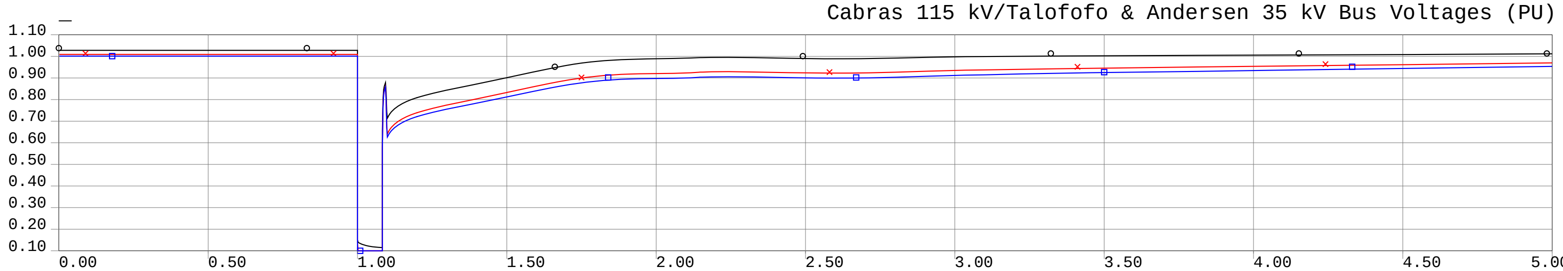
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



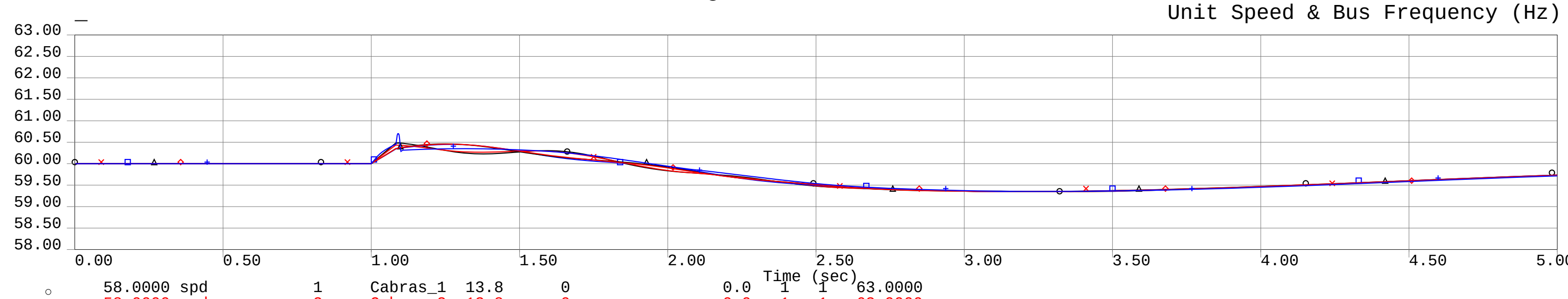
○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

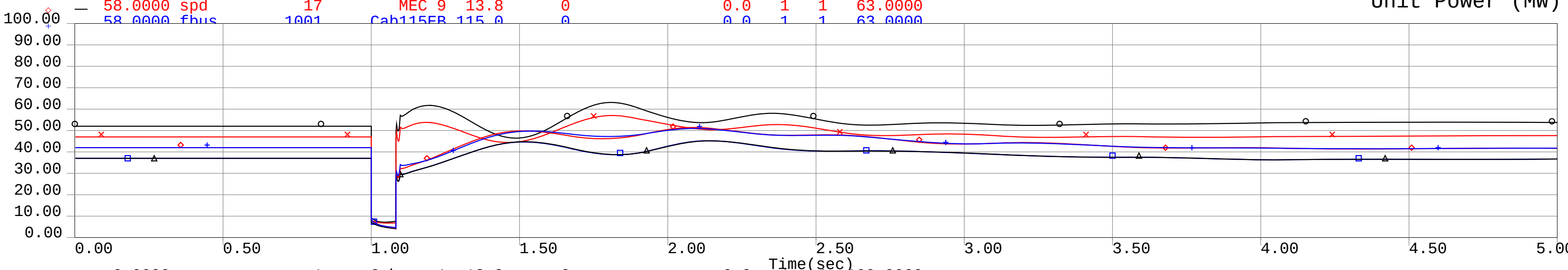


○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

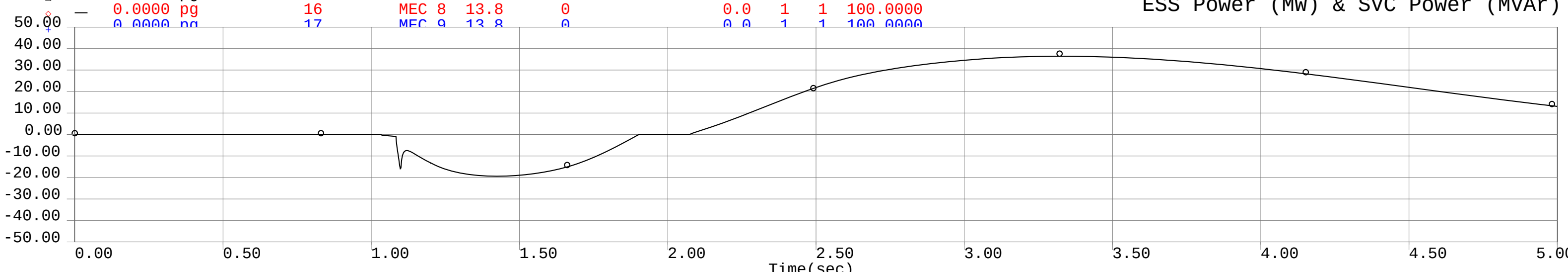
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



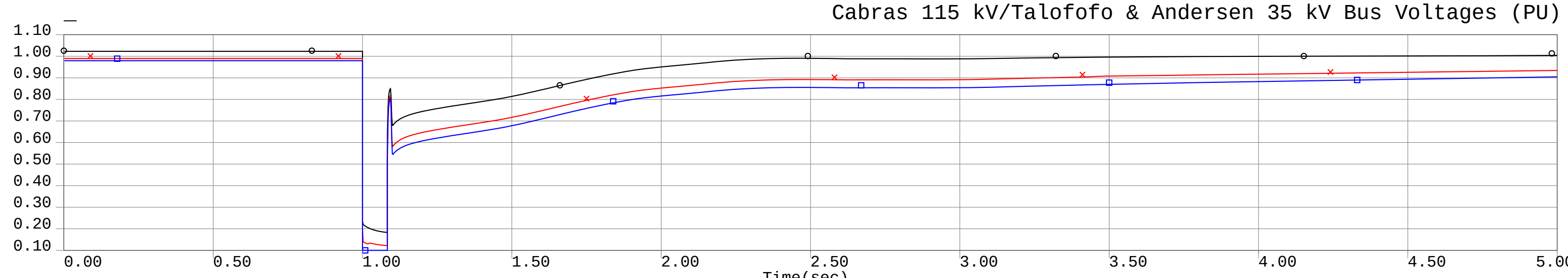
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000



0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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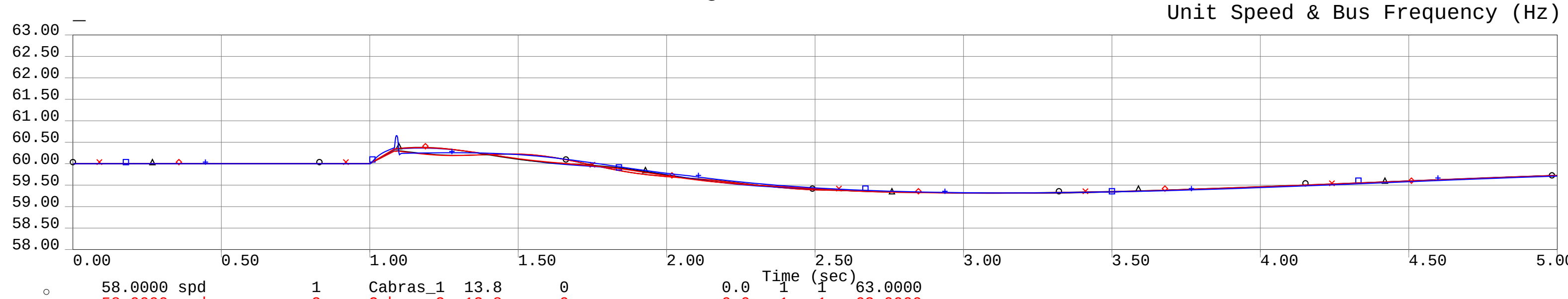
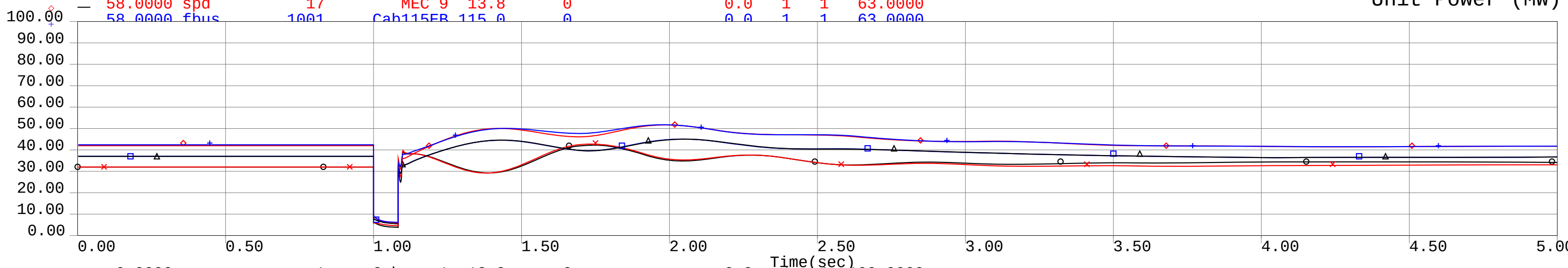
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



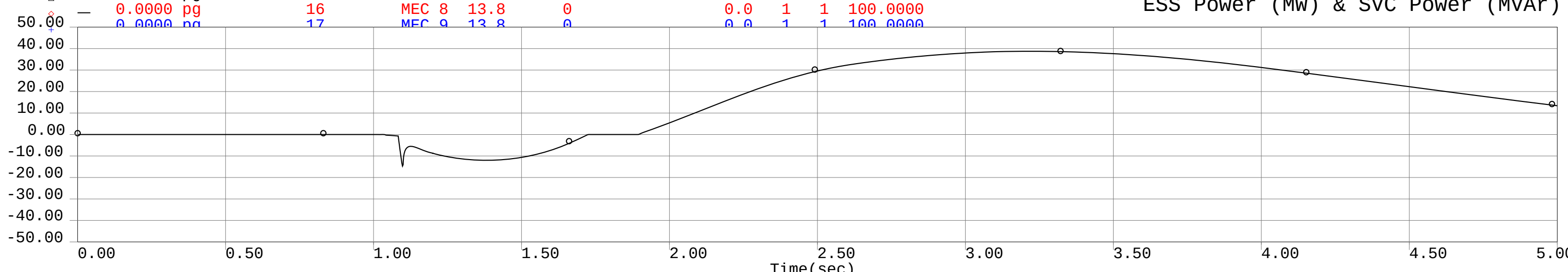
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



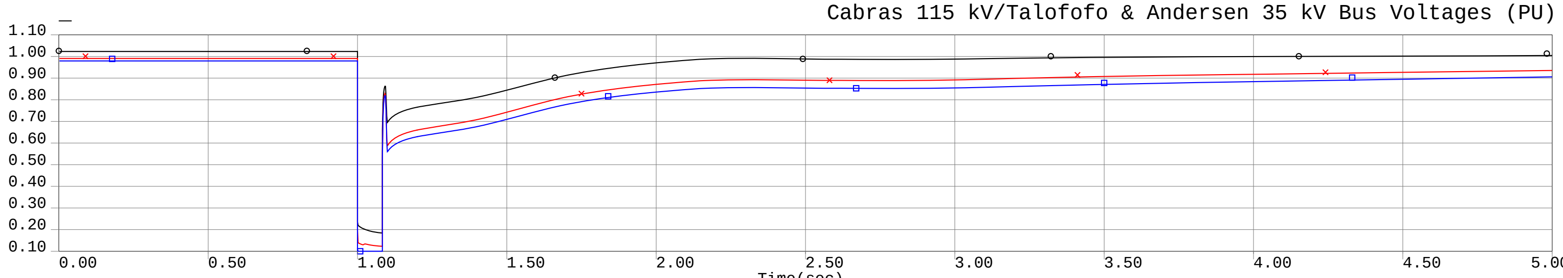
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

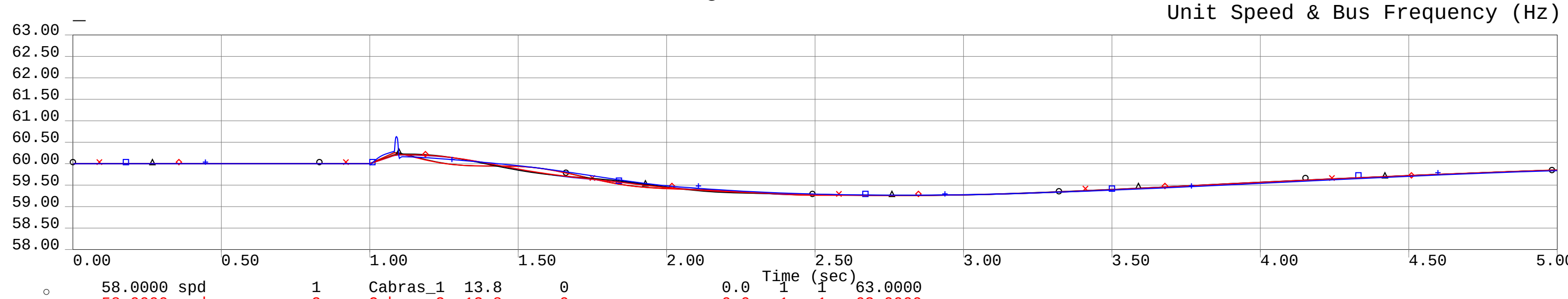
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

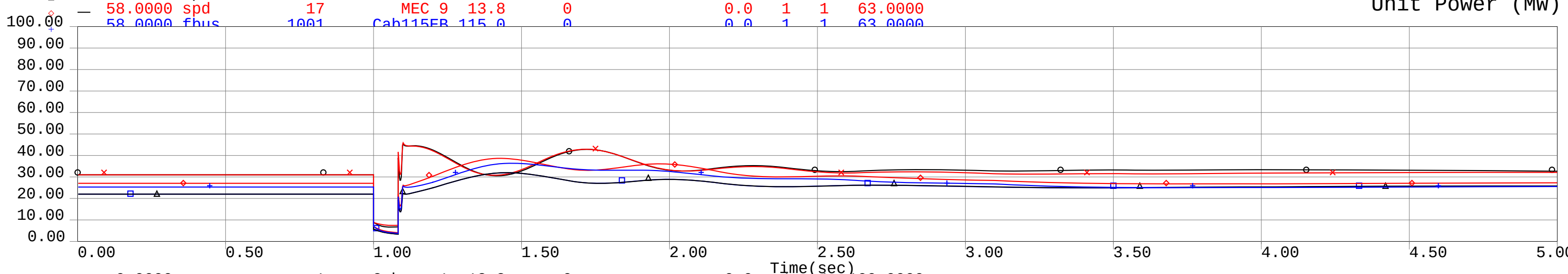
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



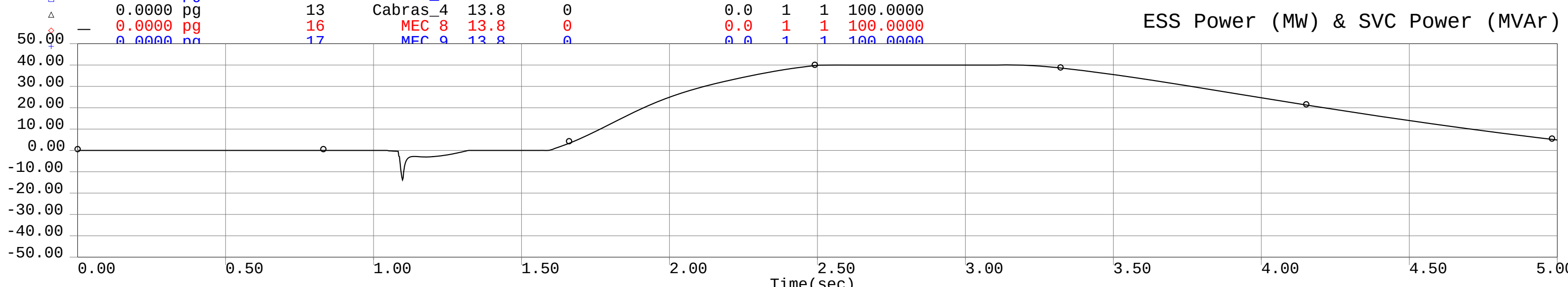
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



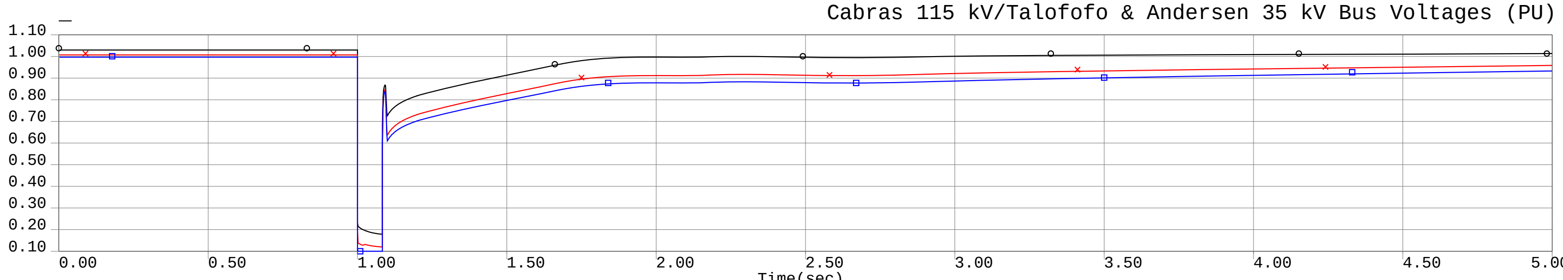
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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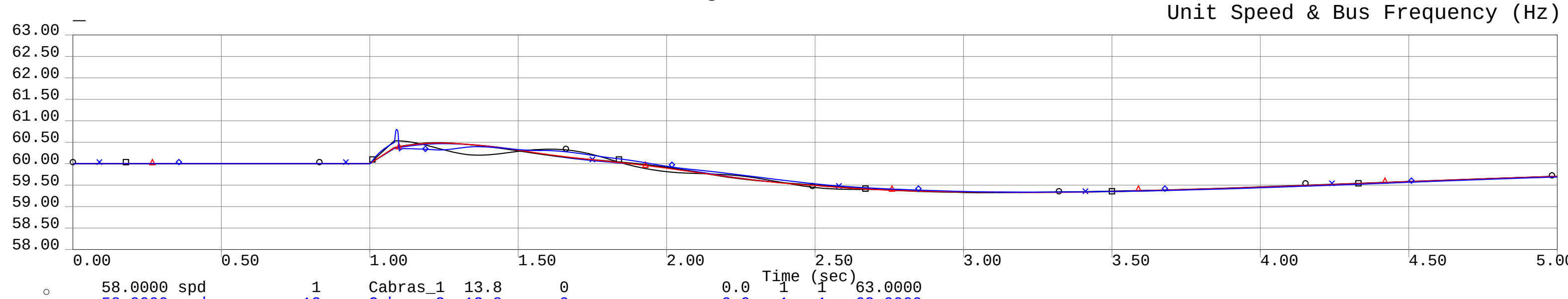
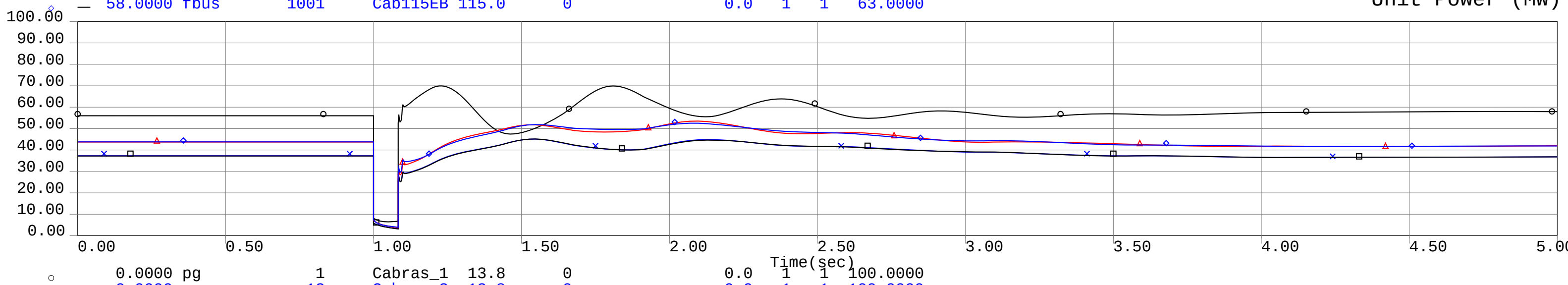
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



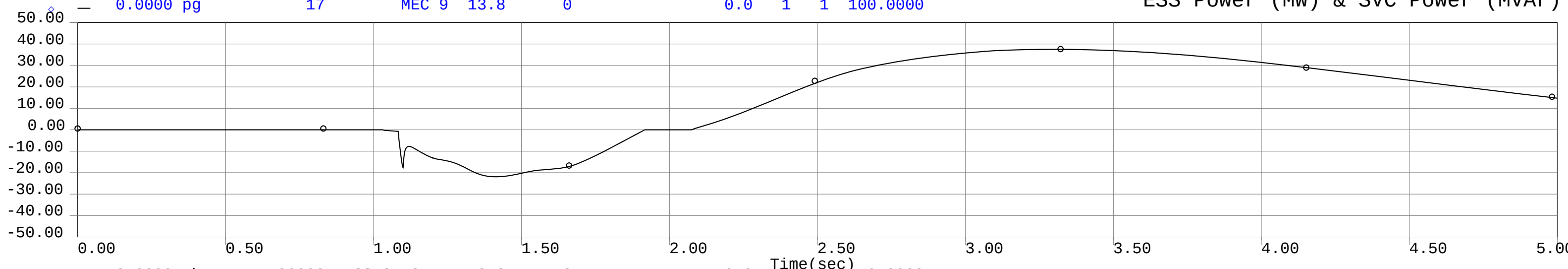
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



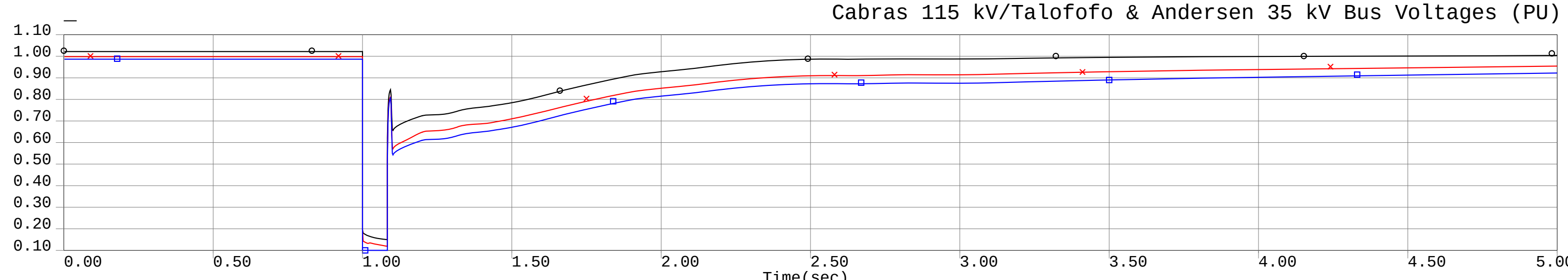
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

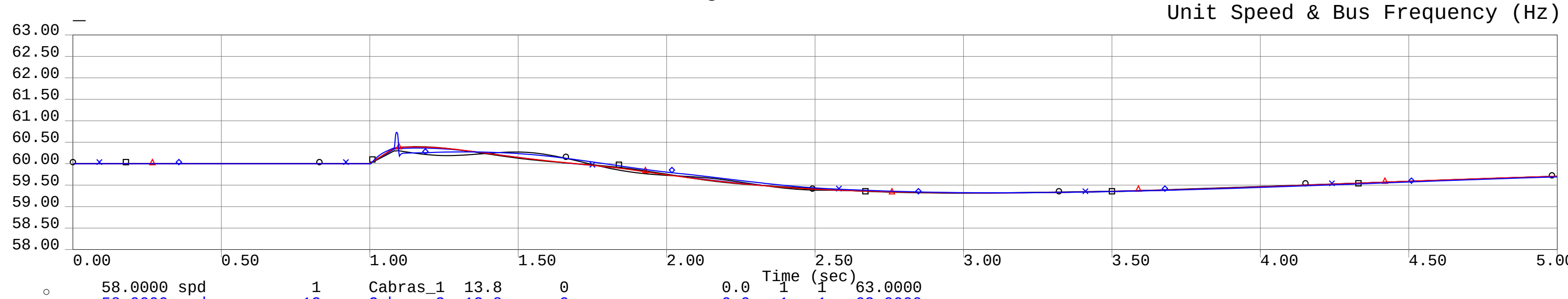
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

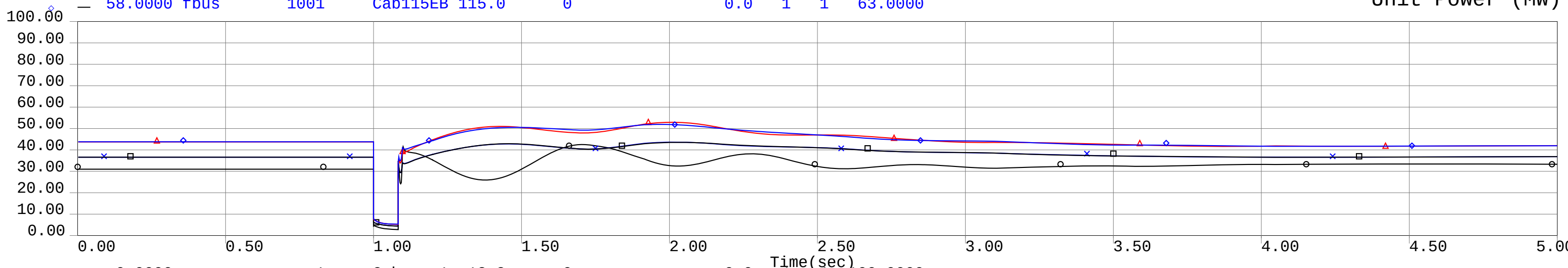
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



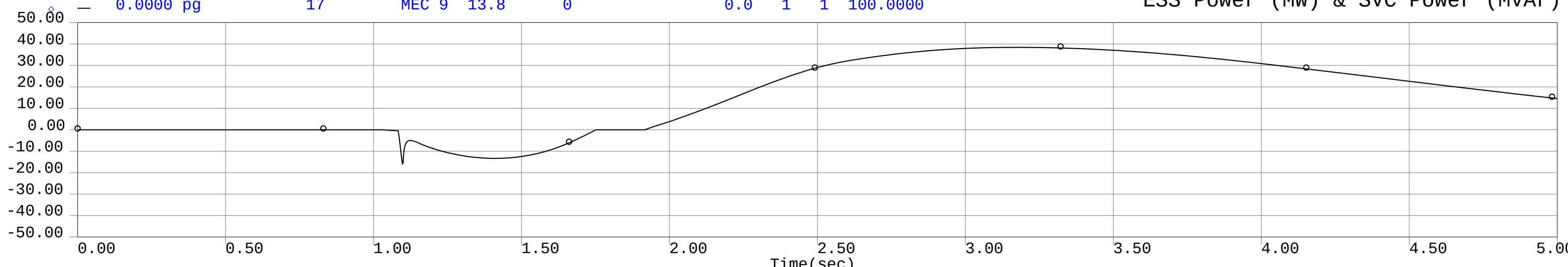
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



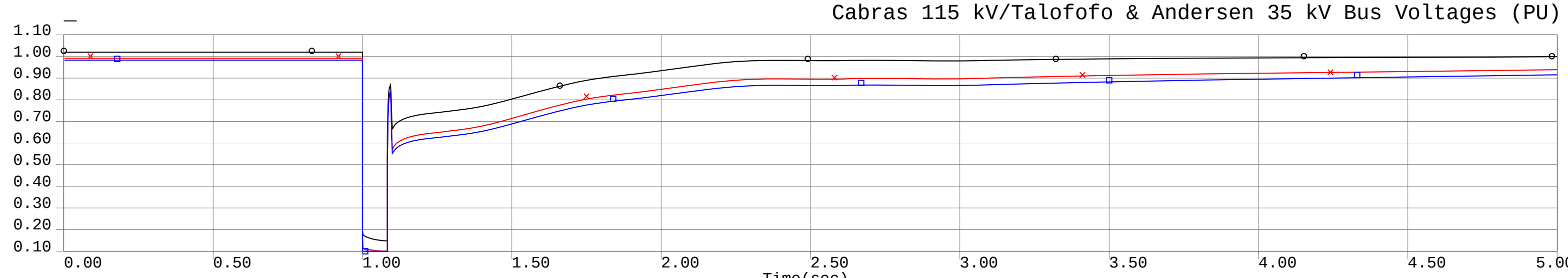
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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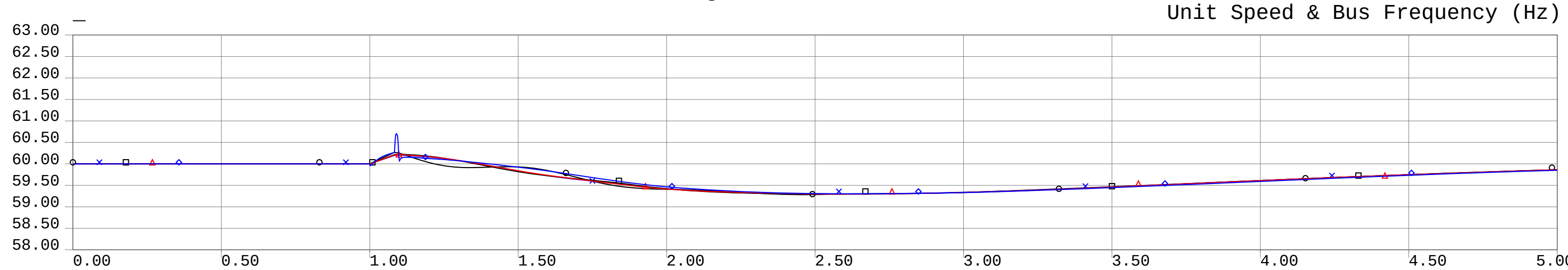
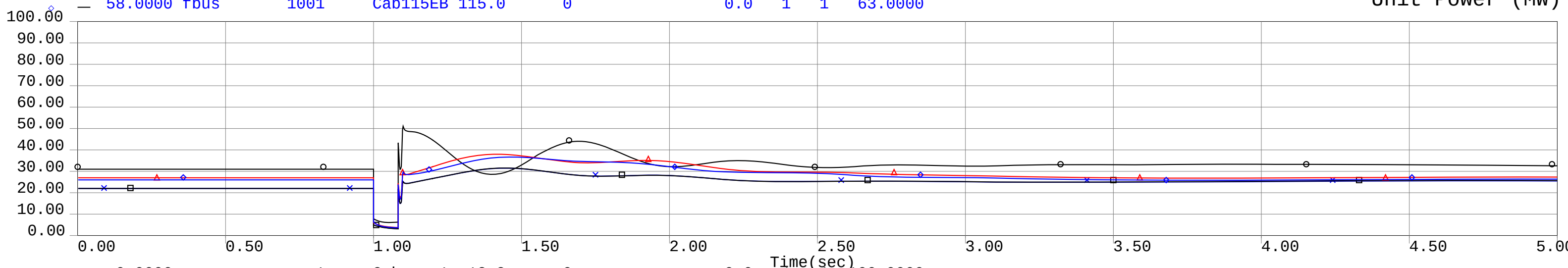
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



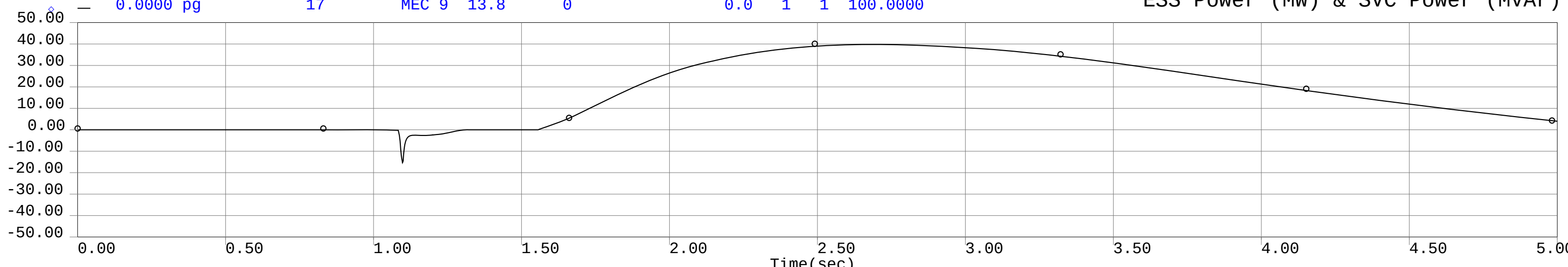
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



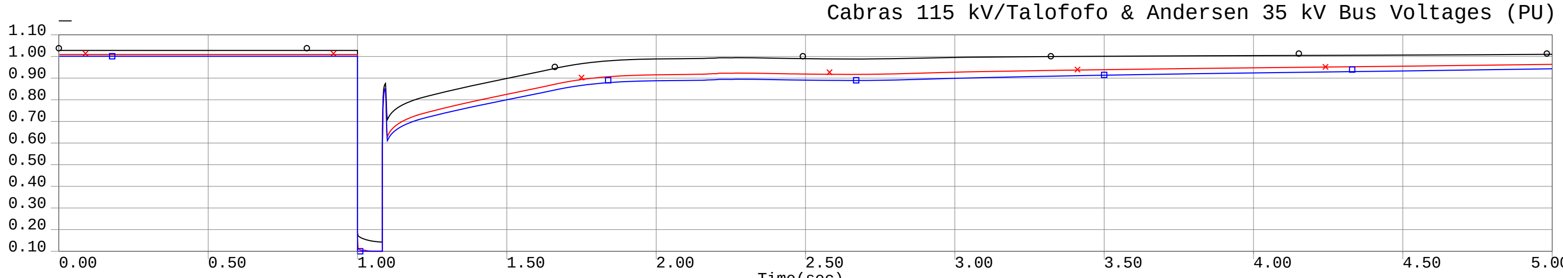
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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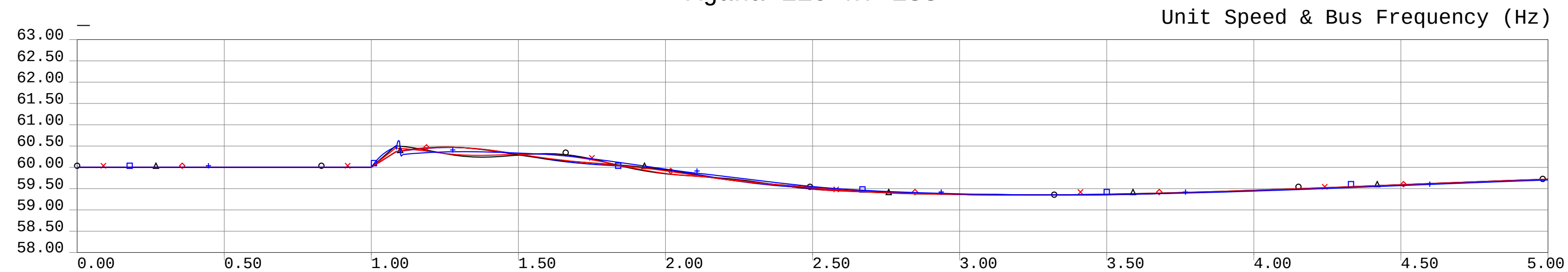
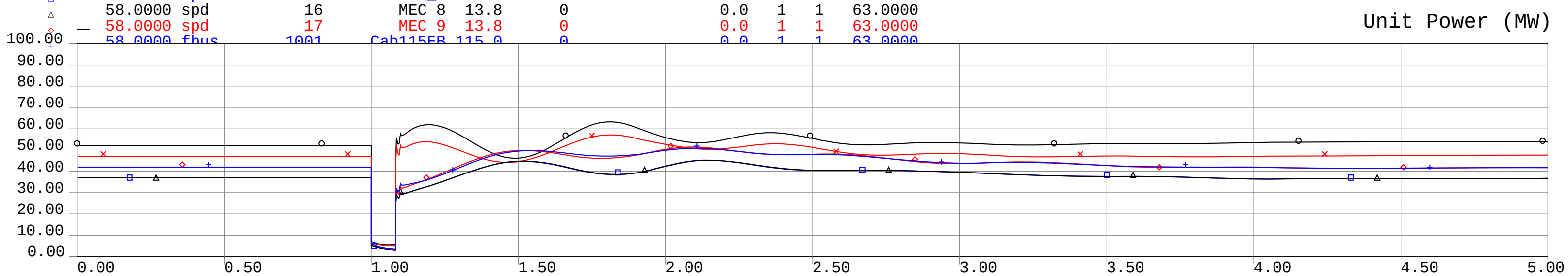
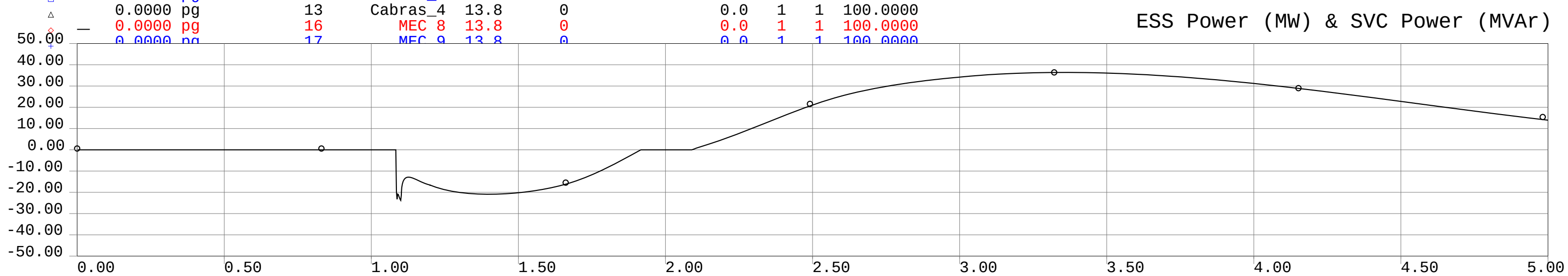
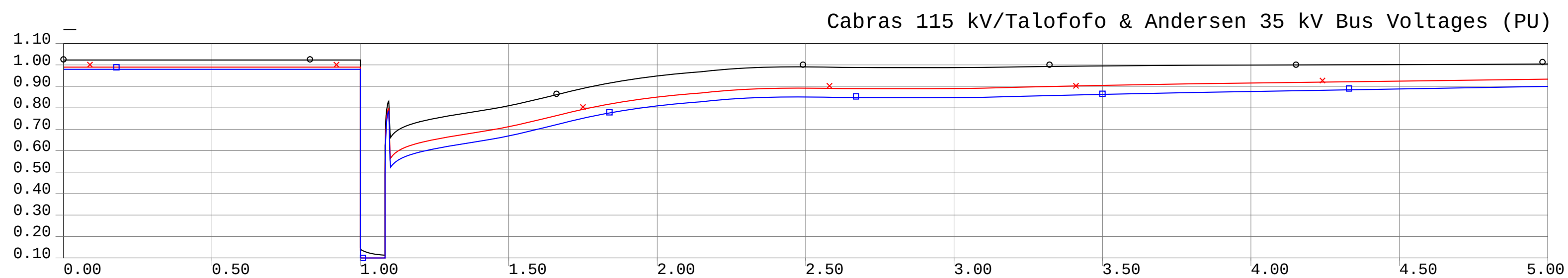
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS









chans/1400_40a_lf3_fidvr.chf

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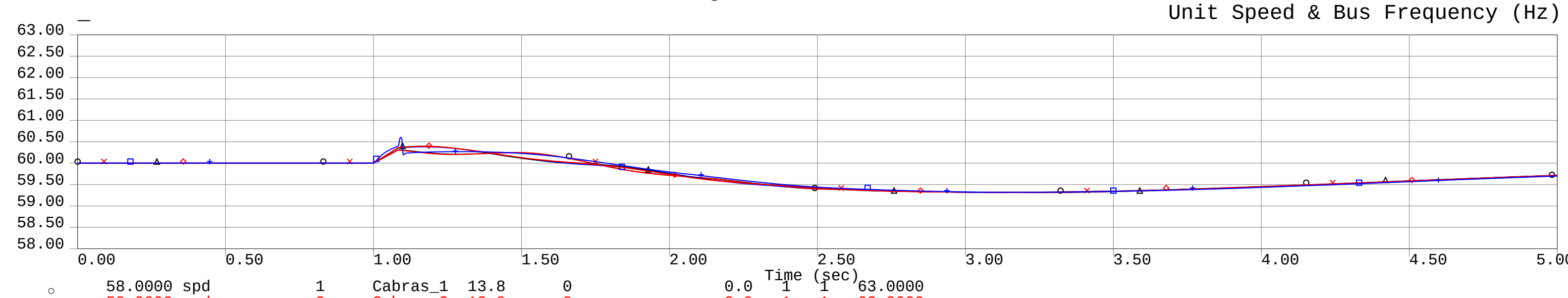
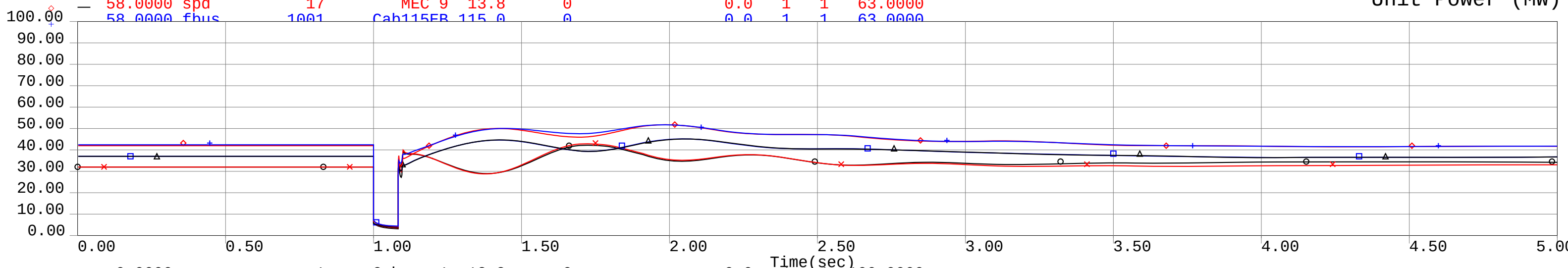
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



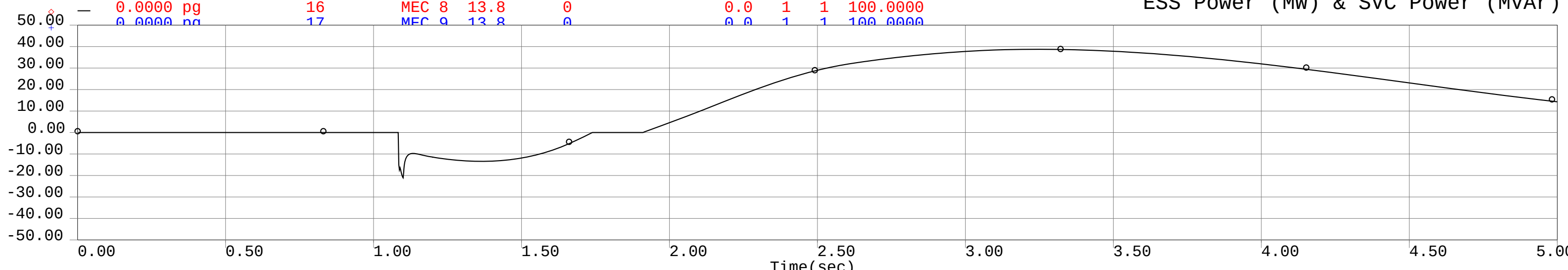
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



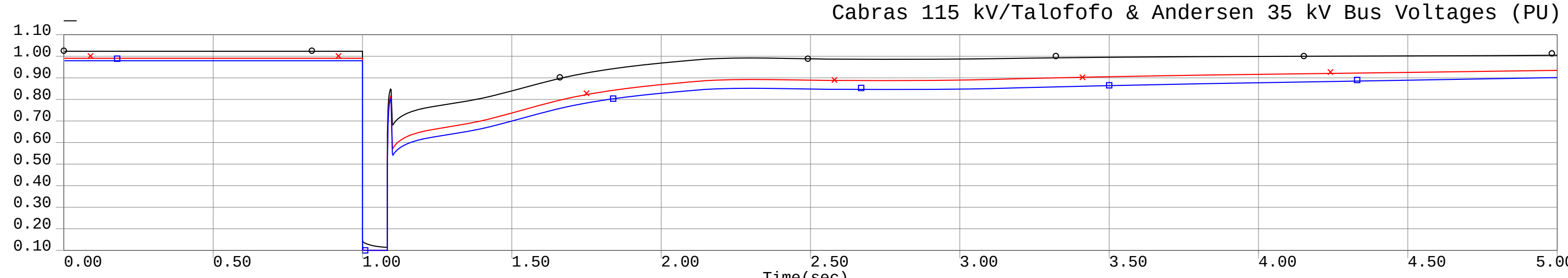
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



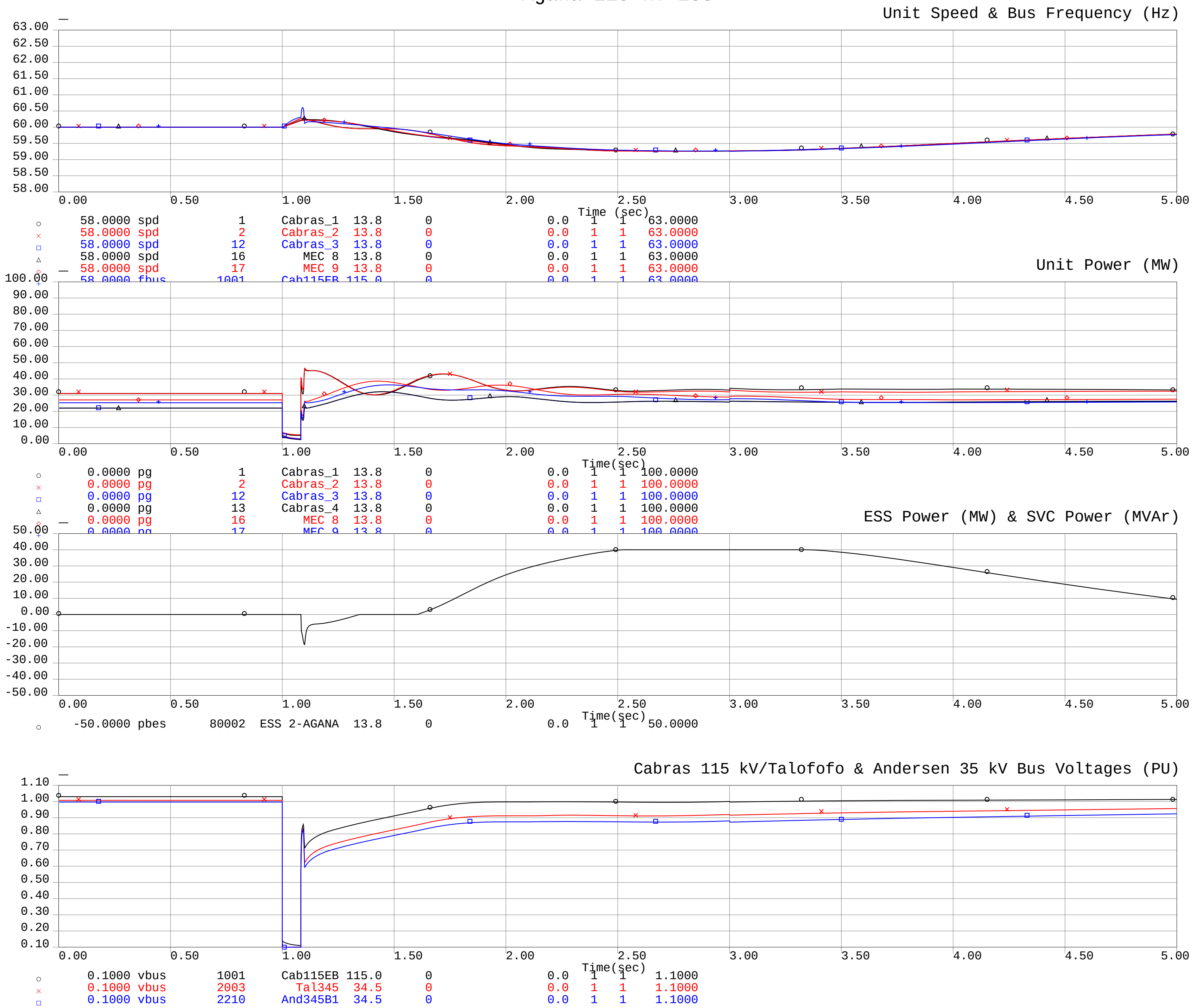
-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



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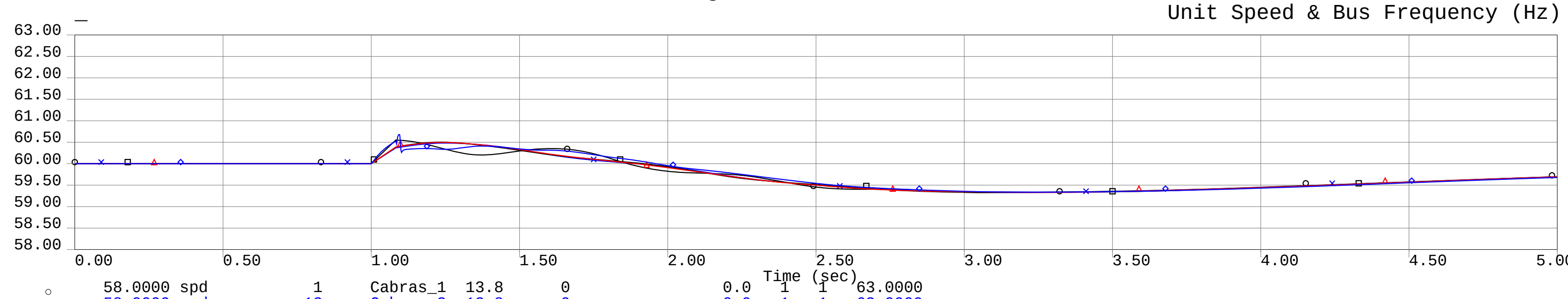
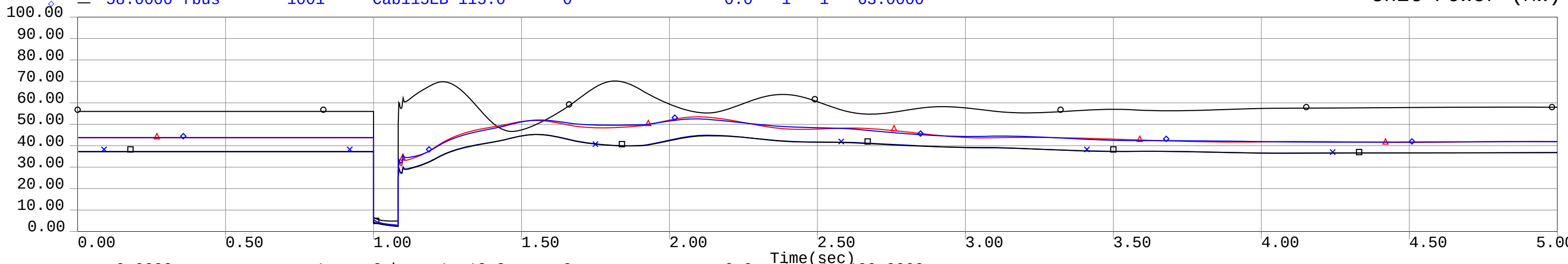
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



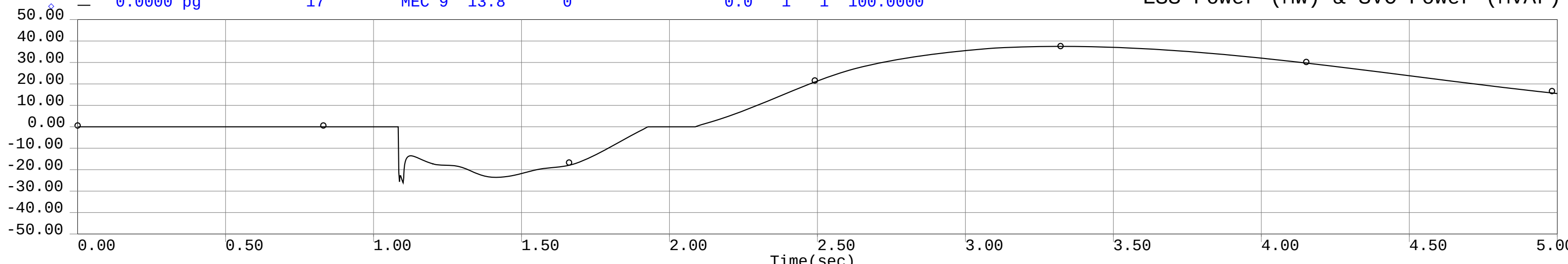
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



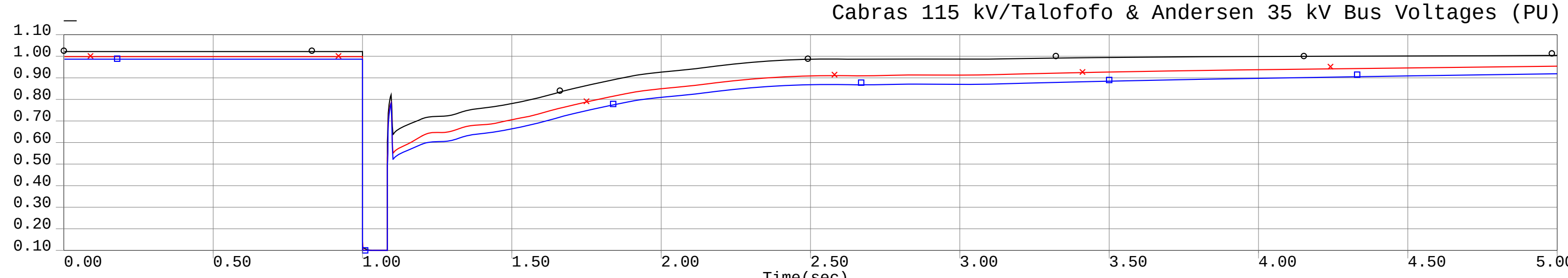
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

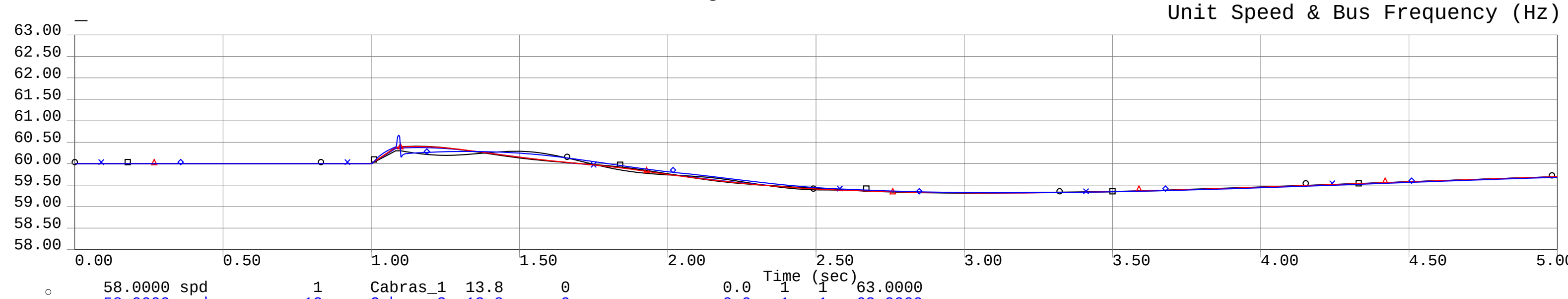
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

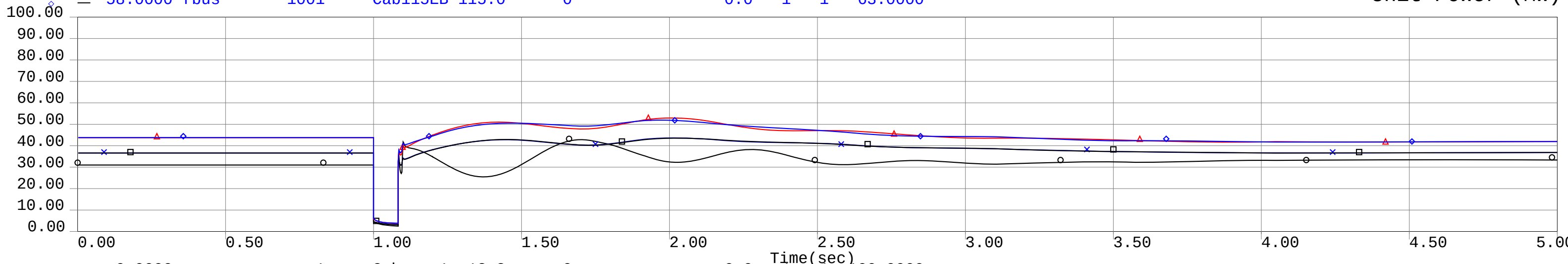
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



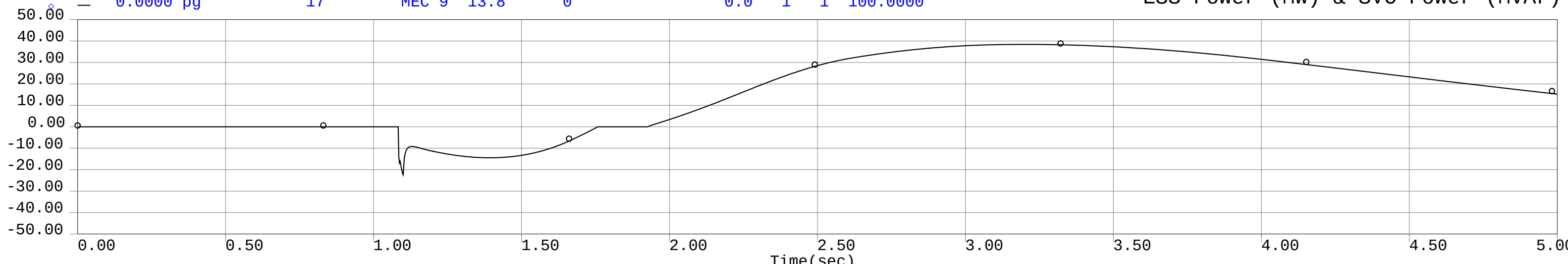
58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



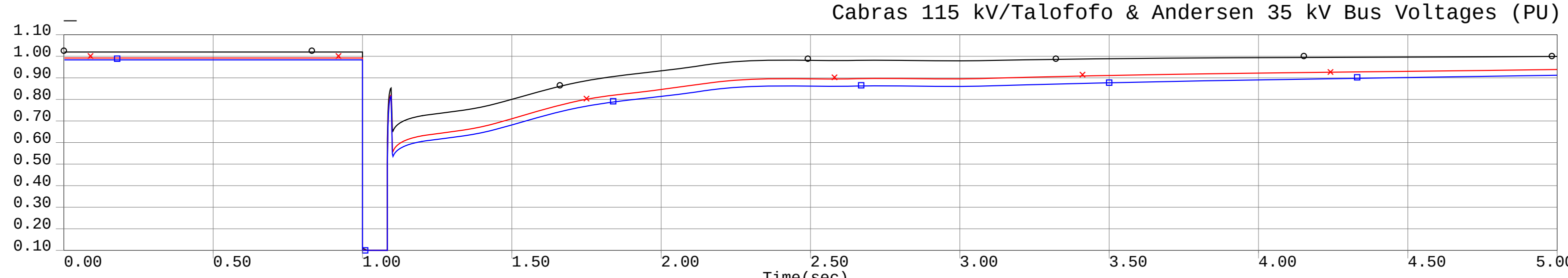
0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2410_40a_lf3_fidvr.chf

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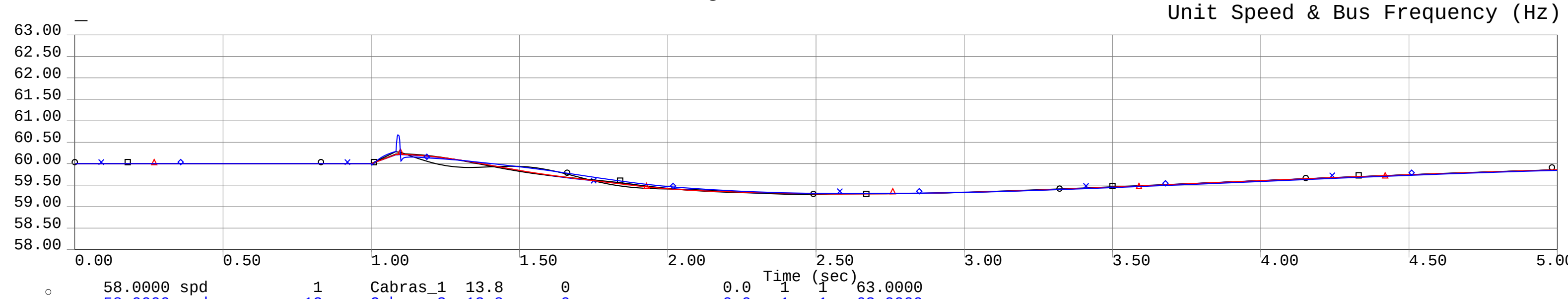
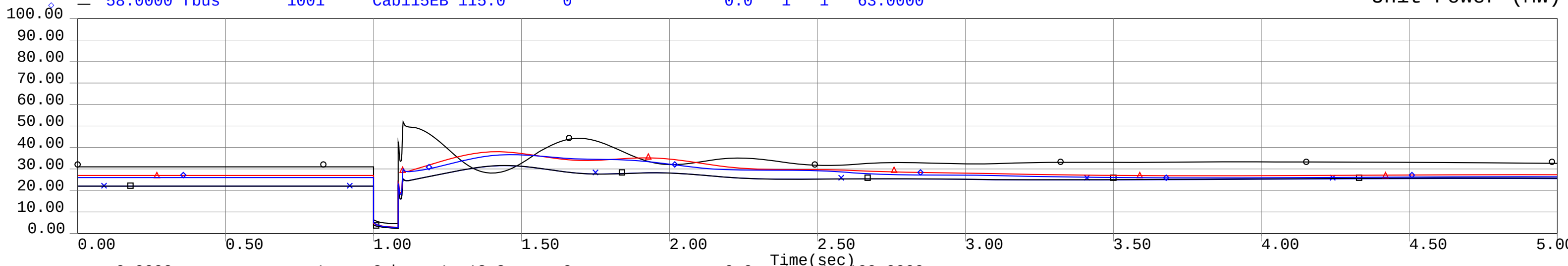
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

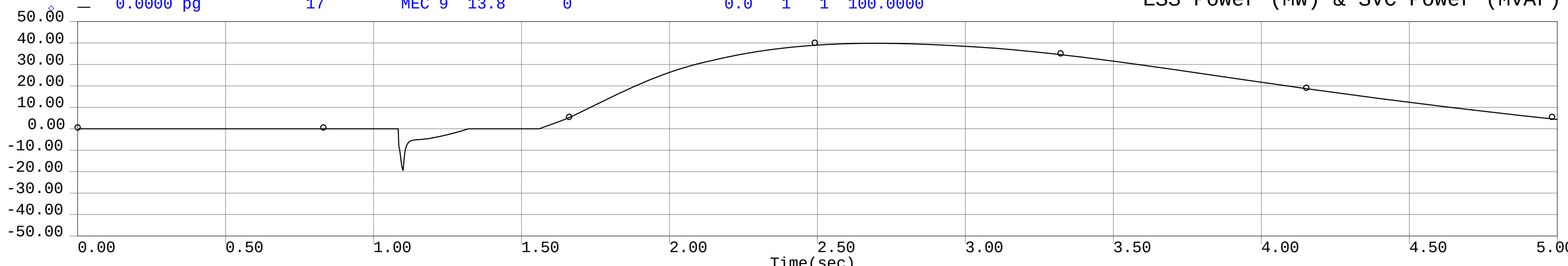
Unit Speed & Bus Frequency (Hz)



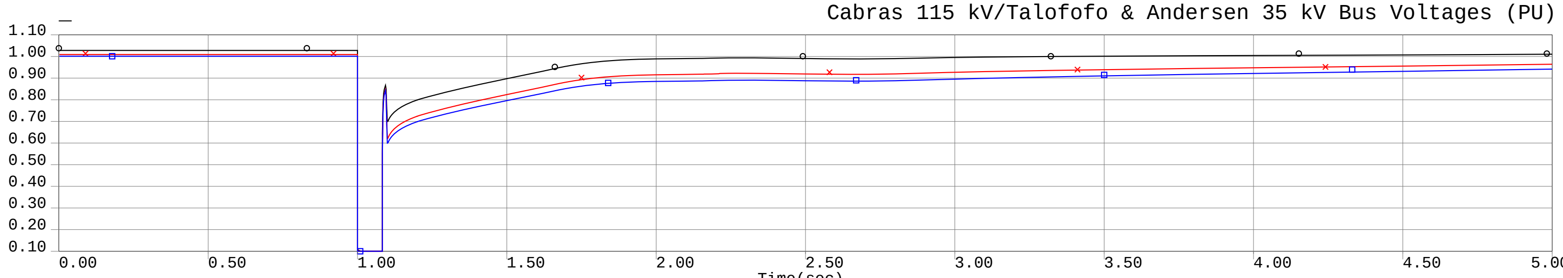
Unit Power (MW)



ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



chans/2420_40a_lf3_fidvr.chf

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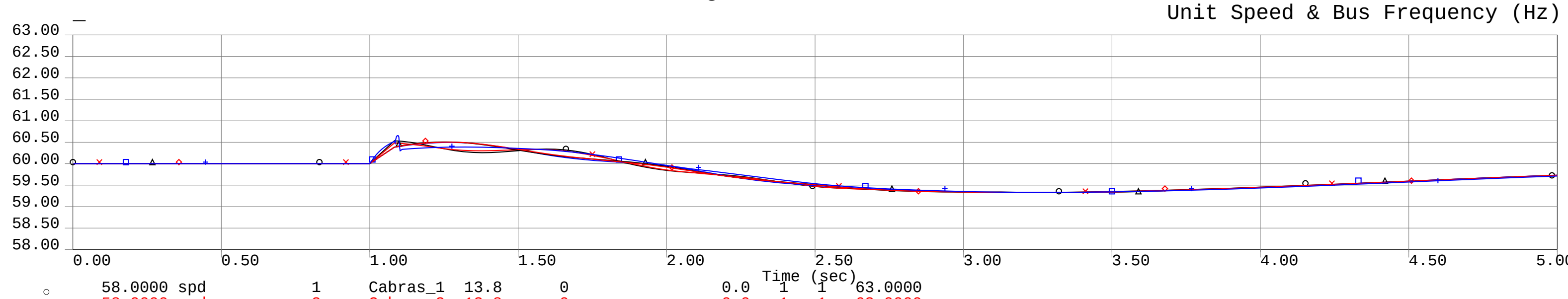
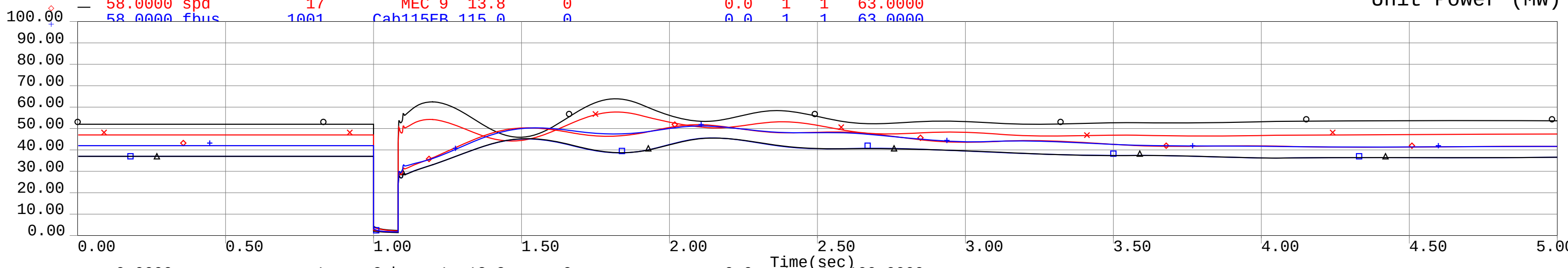
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

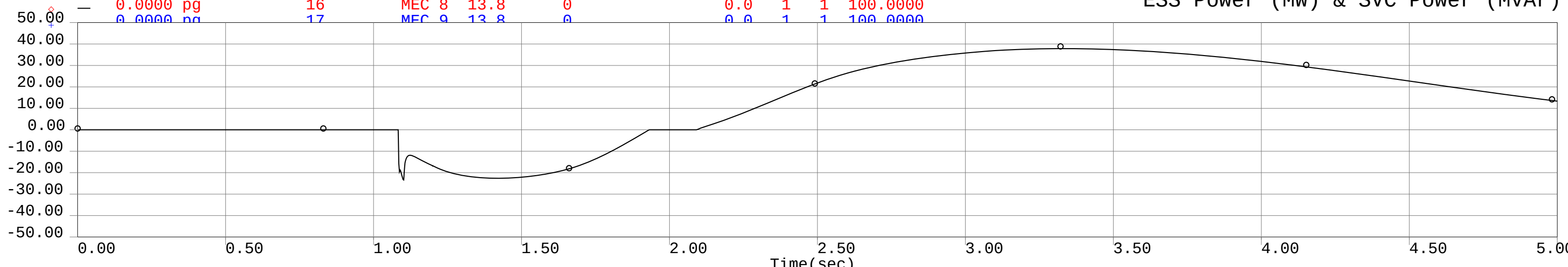
Unit Speed & Bus Frequency (Hz)



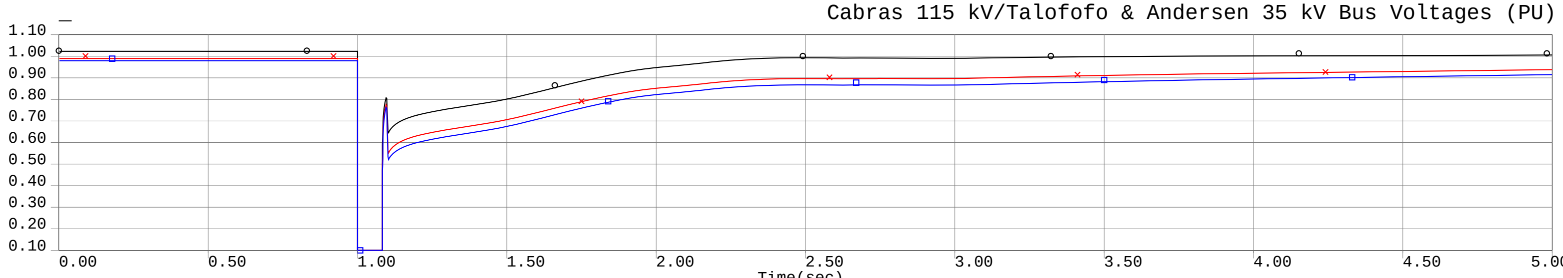
Unit Power (MW)



ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



chans/1400_40a_lf4_fidvr.chf

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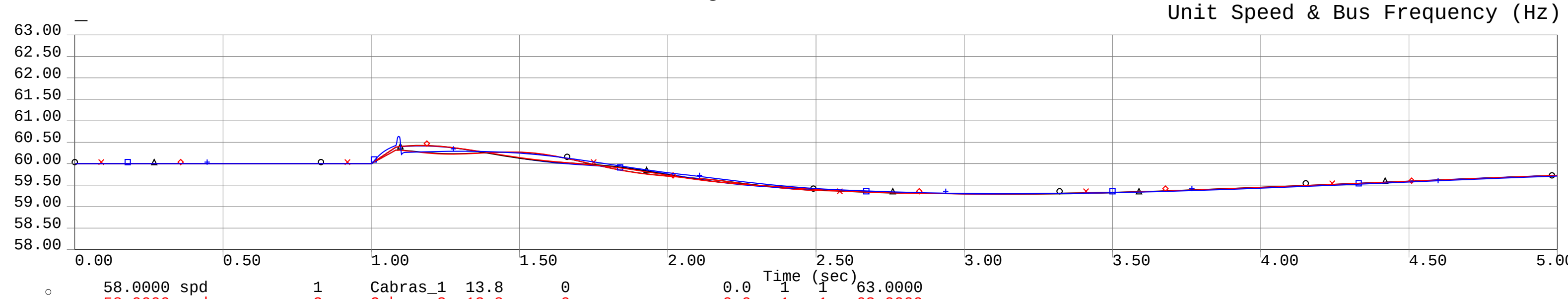
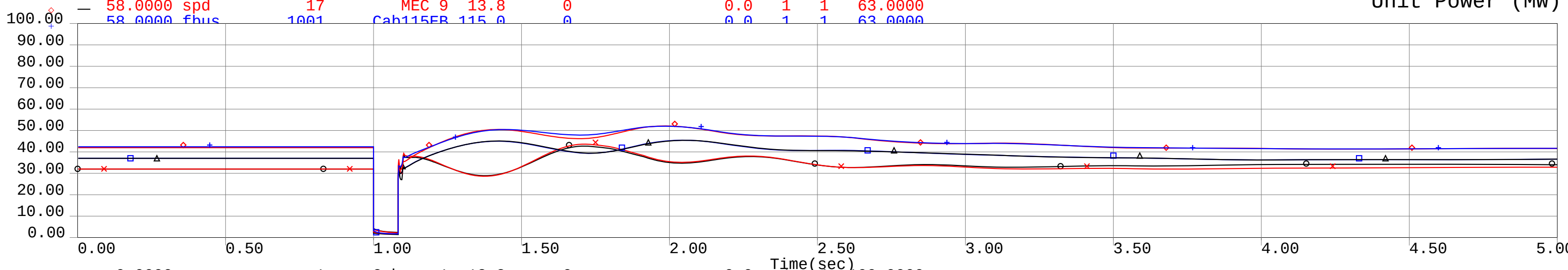
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



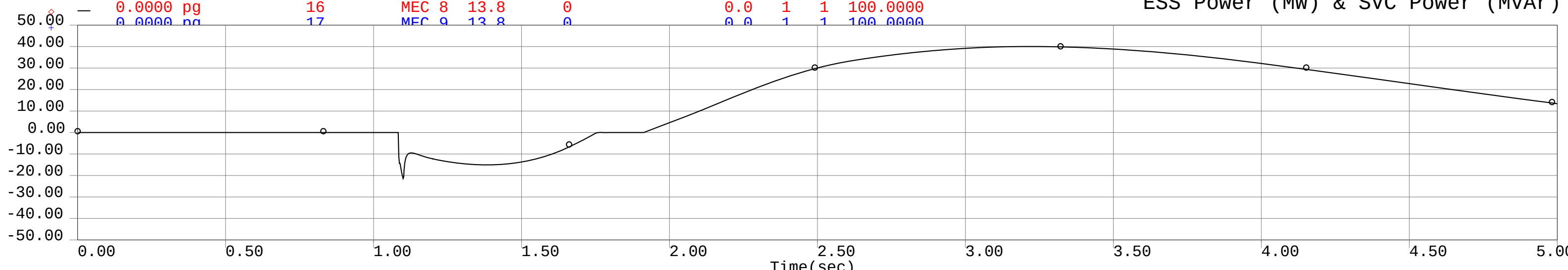
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



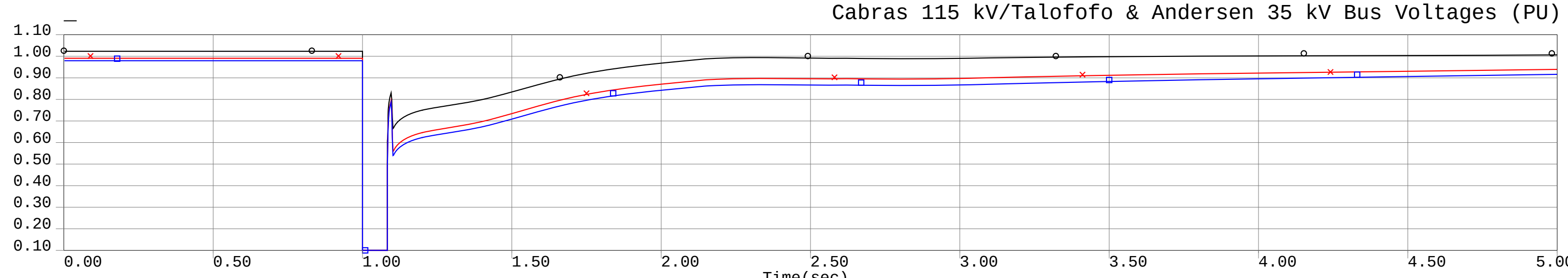
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1410_40a_lf4_fidvr.chf

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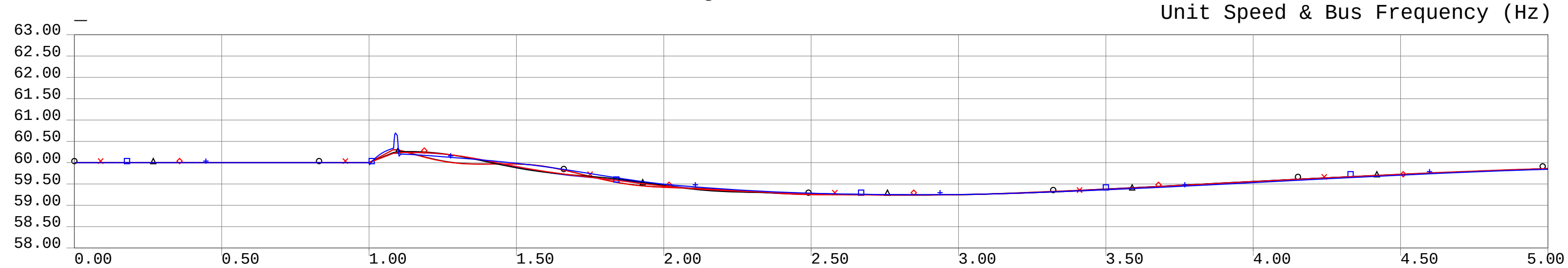
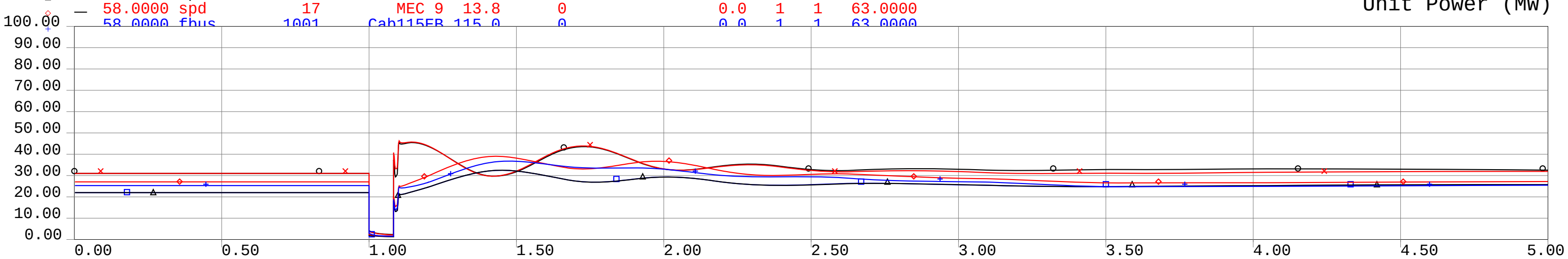
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



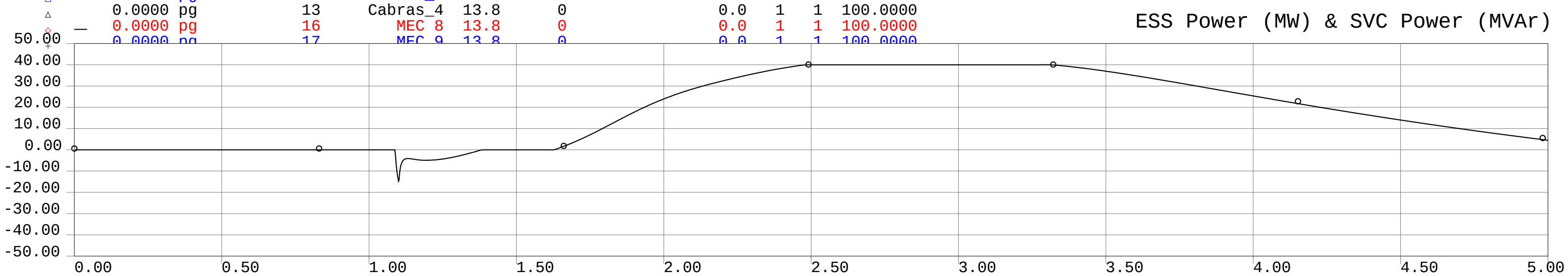

```
○  58.0000 spd     1     Cabras_1  13.8   0    0.0  1  1  63.0000
×  58.0000 spd     2     Cabras_2  13.8   0    0.0  1  1  63.0000
□  58.0000 spd     12    Cabras_3  13.8   0    0.0  1  1  63.0000
△  58.0000 spd     16    MEC 8     13.8   0    0.0  1  1  63.0000
◇  58.0000 spd     17    MEC 9     13.8   0    0.0  1  1  63.0000
+  58.0000 fbus    1001  Cab115EB  115.0  0    0.0  1  1  63.0000
```

Unit Power (MW)



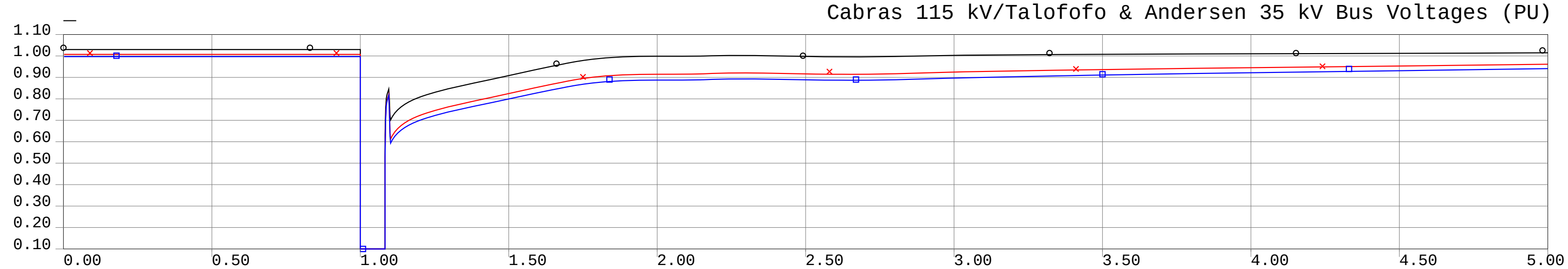

```
○  0.0000 pg   1    Cabras_1  13.8   0    0.0  1  1  100.0000
×  0.0000 pg   2    Cabras_2  13.8   0    0.0  1  1  100.0000
□  0.0000 pg   12   Cabras_3  13.8   0    0.0  1  1  100.0000
△  0.0000 pg   13   Cabras_4  13.8   0    0.0  1  1  100.0000
◇  0.0000 pg   16   MEC 8     13.8   0    0.0  1  1  100.0000
+  0.0000 pg   17   MEC 9     13.8   0    0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
○  -50.0000 pbes   80002  ESS 2-AGANA  13.8   0    0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○  0.1000 vbus   1001  Cab115EB  115.0  0    0.0  1  1  1.1000
×  0.1000 vbus   2003  Tal345    34.5   0    0.0  1  1  1.1000
□  0.1000 vbus   2210  And345B1  34.5   0    0.0  1  1  1.1000
```


chans/1420_40a_lf4_fidvr.chf

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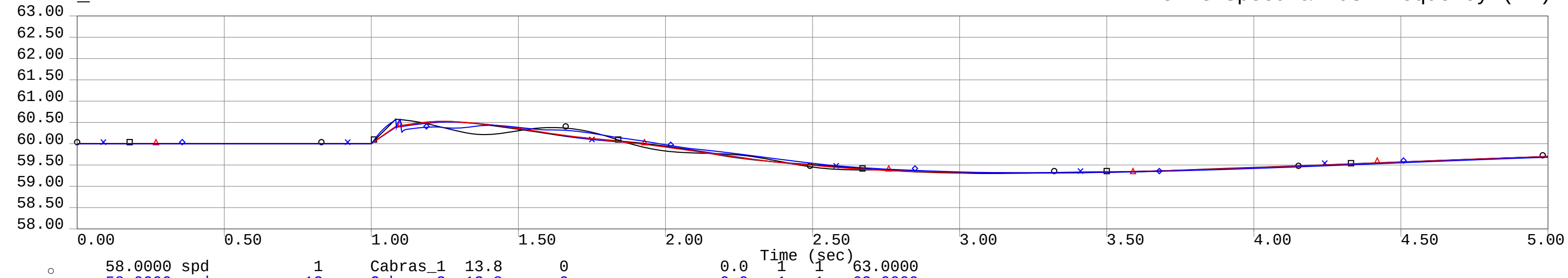
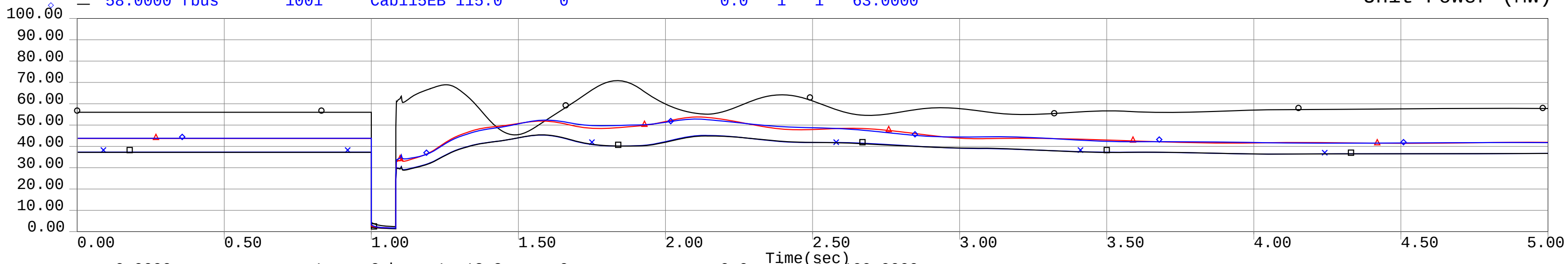
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



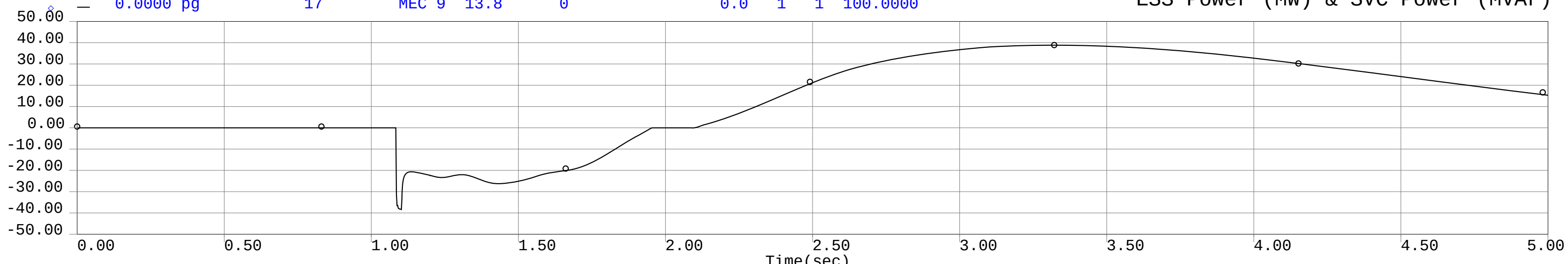
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



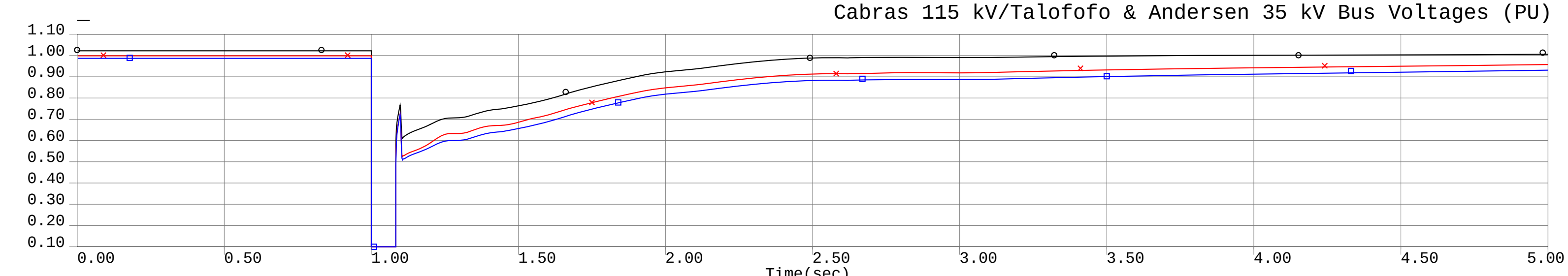
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2400_40a_lf4_fidvr.chf

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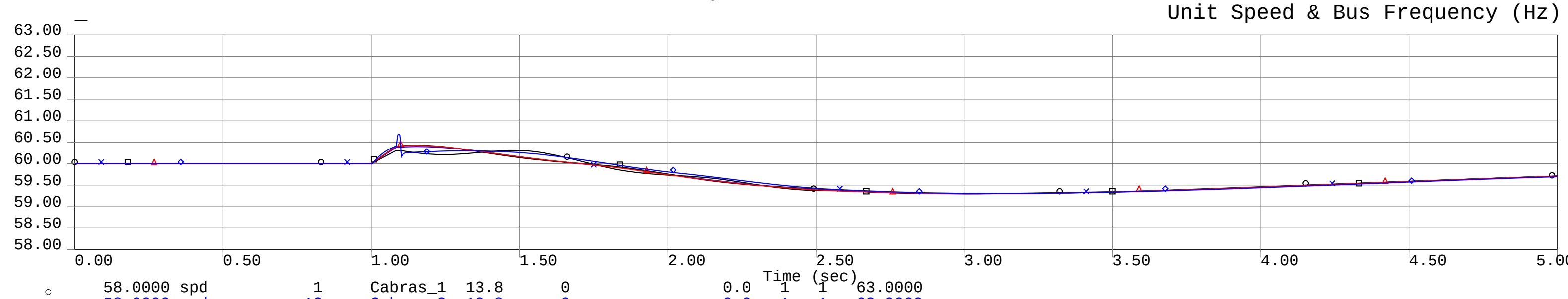
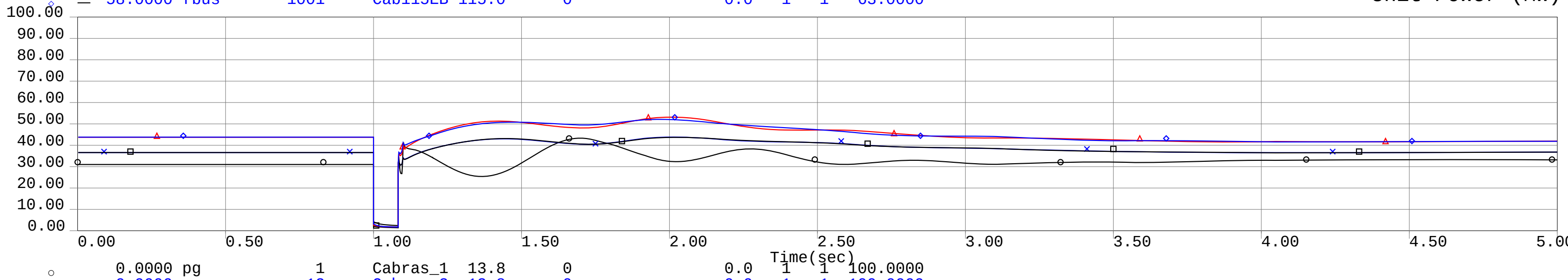
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



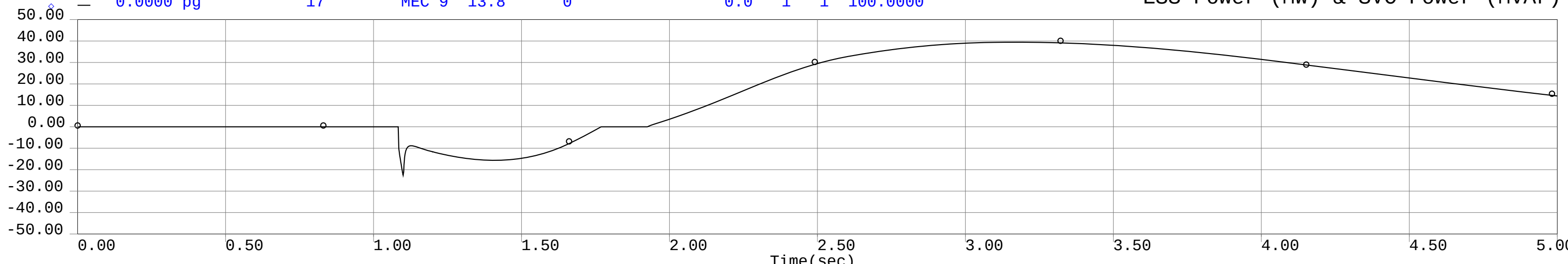
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



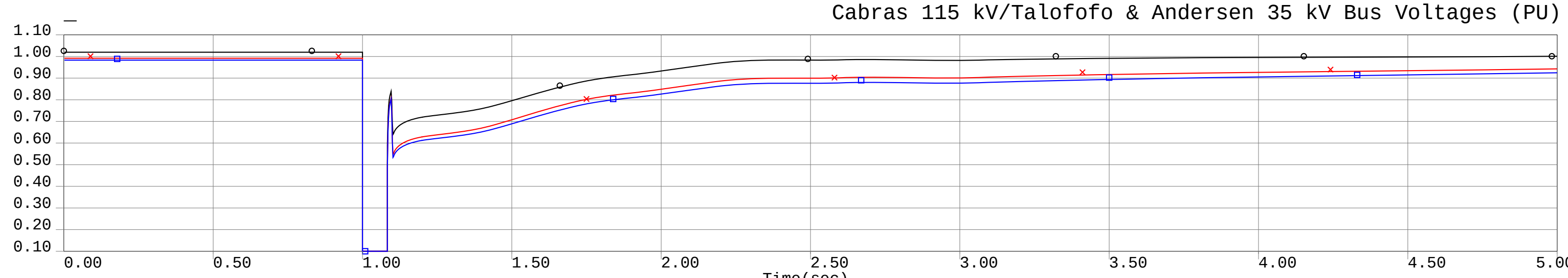
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2410_40a_lf4_fidvr.chf

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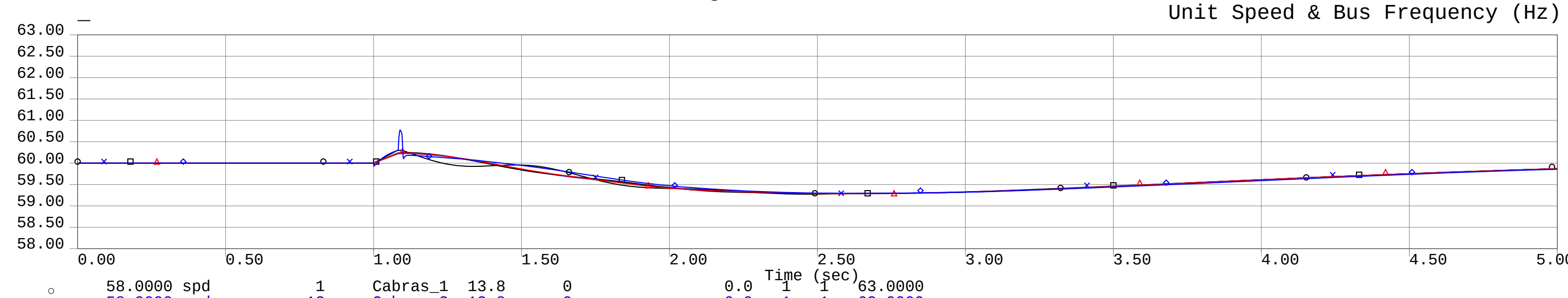
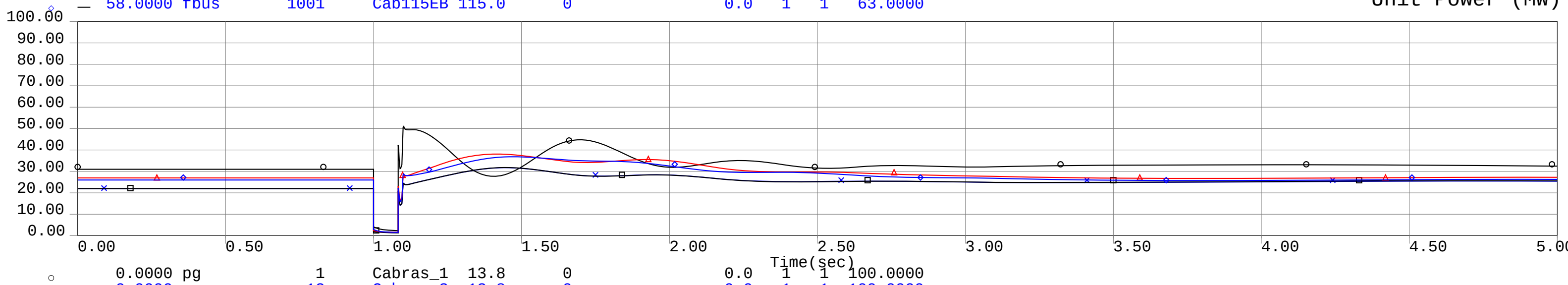
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



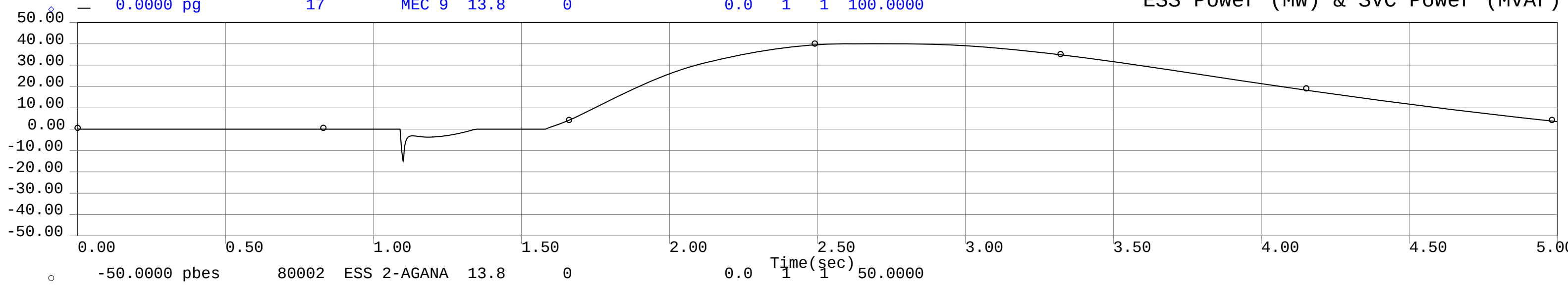
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



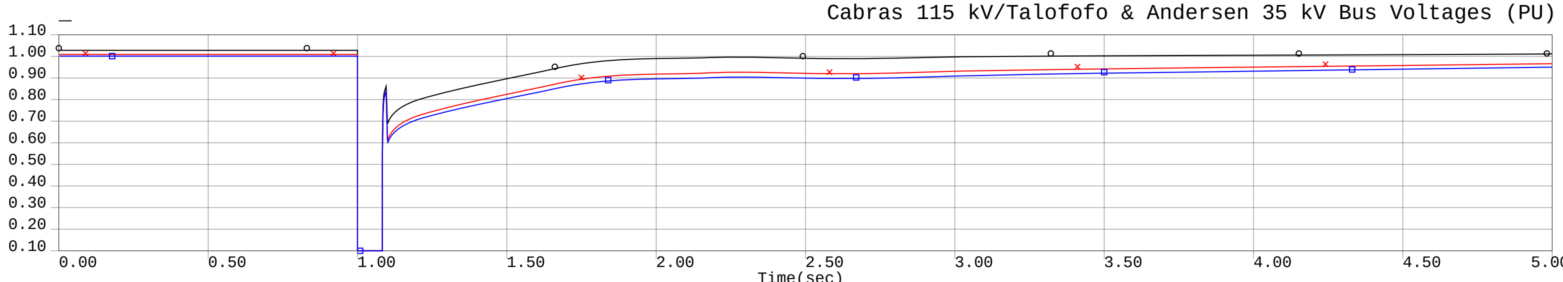
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

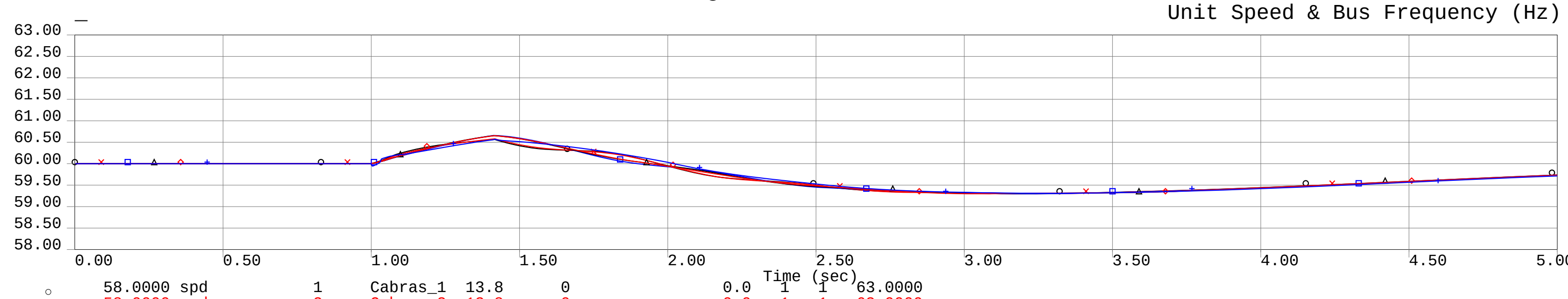
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

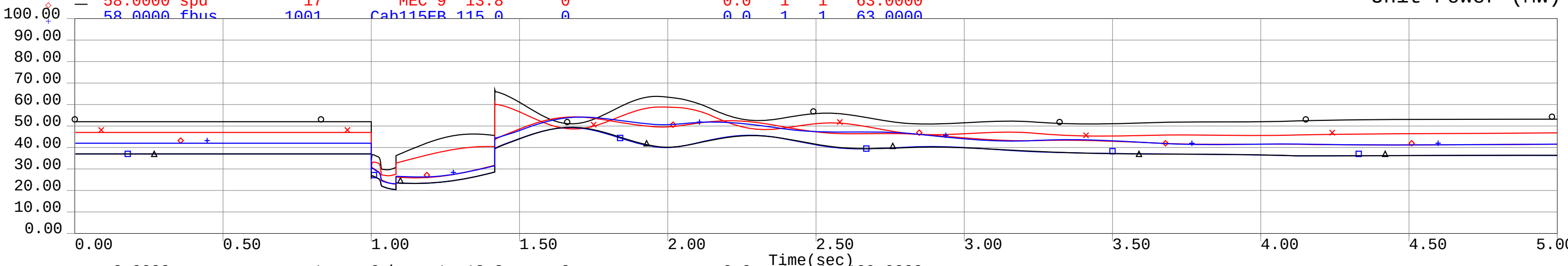
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



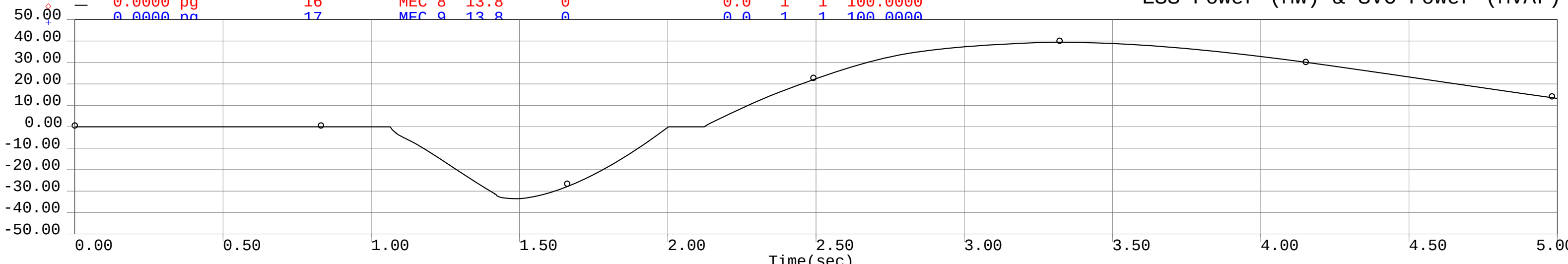
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



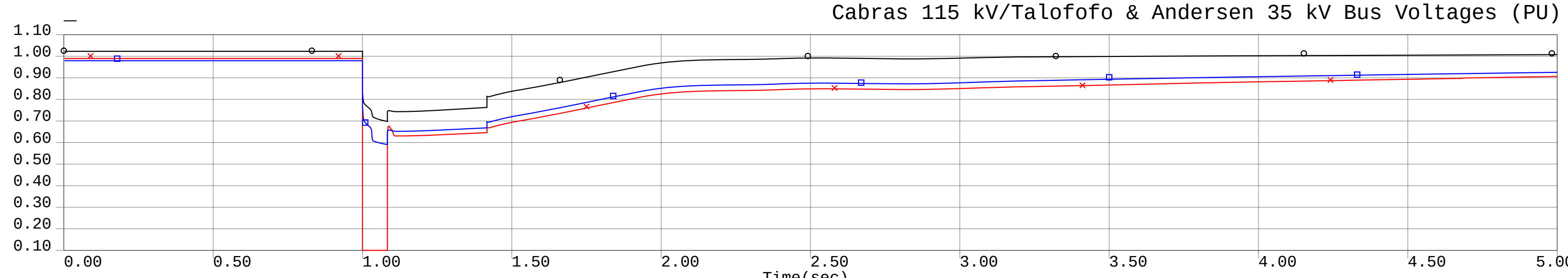
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1400_40a_lf11_fidvr.chf

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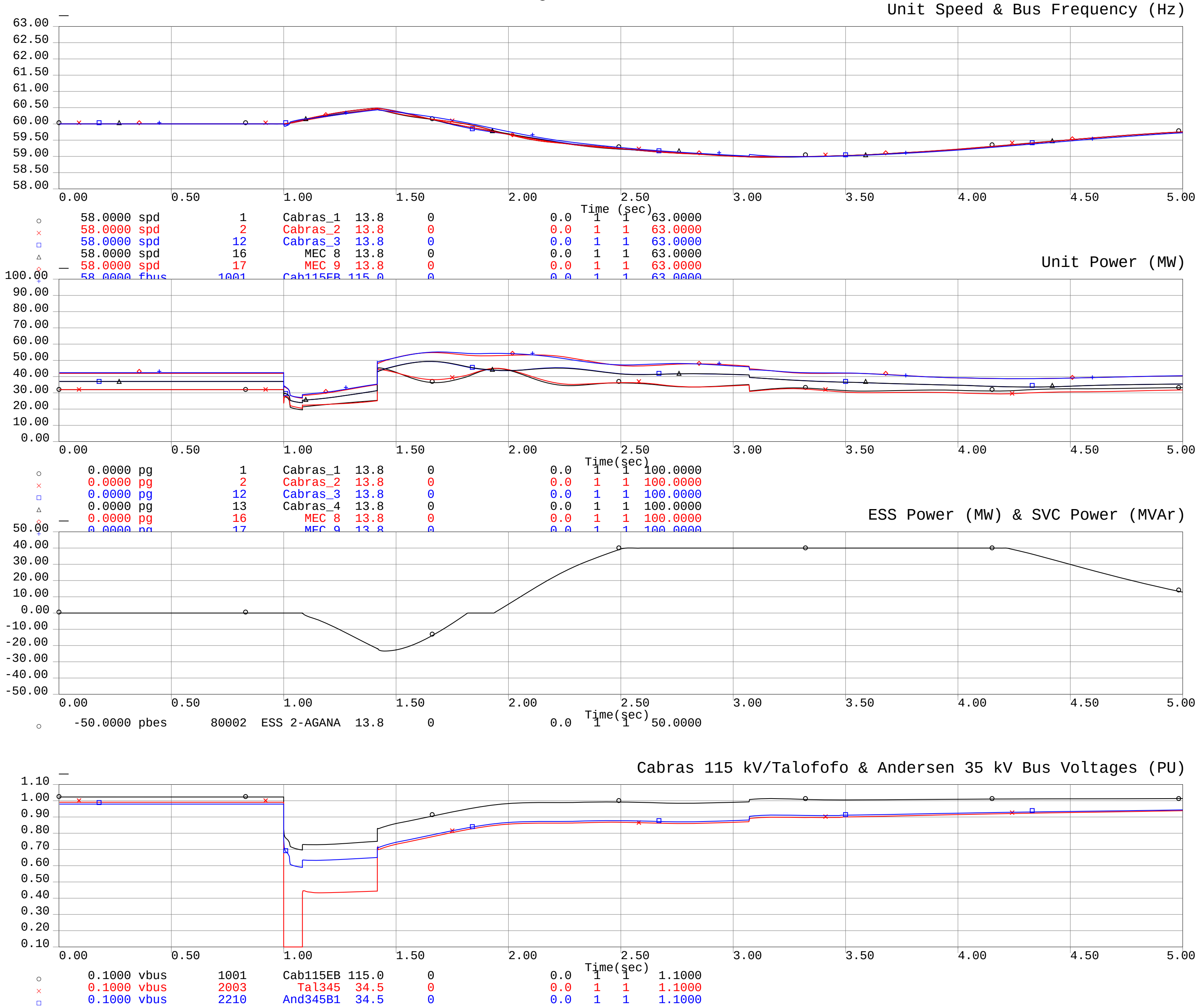
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/1410_40a_lf11_fidvr.chf

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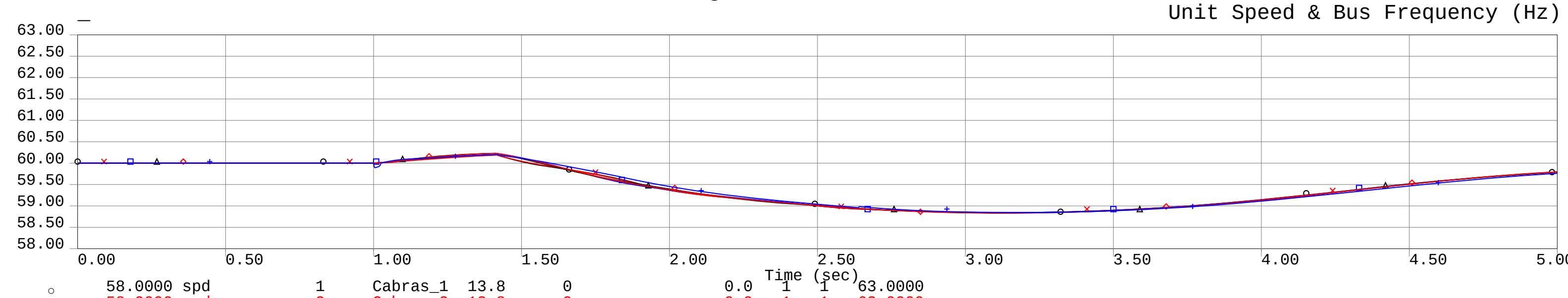
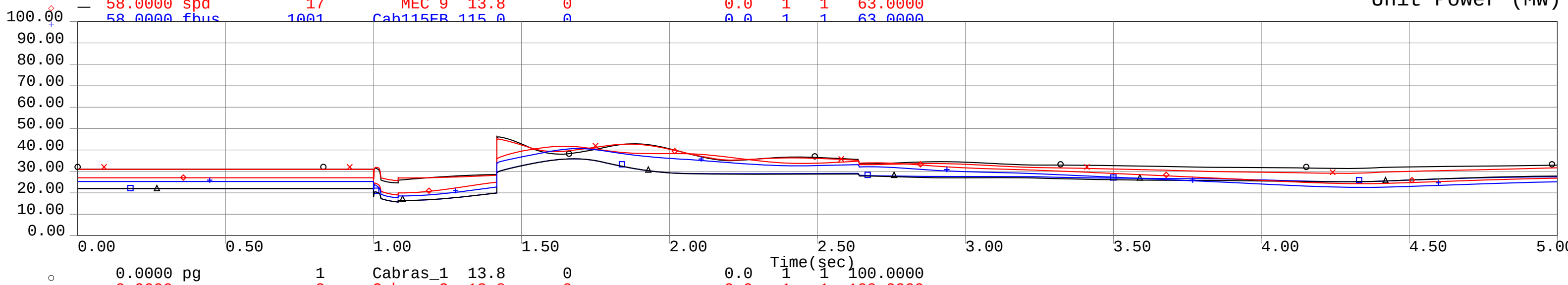
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



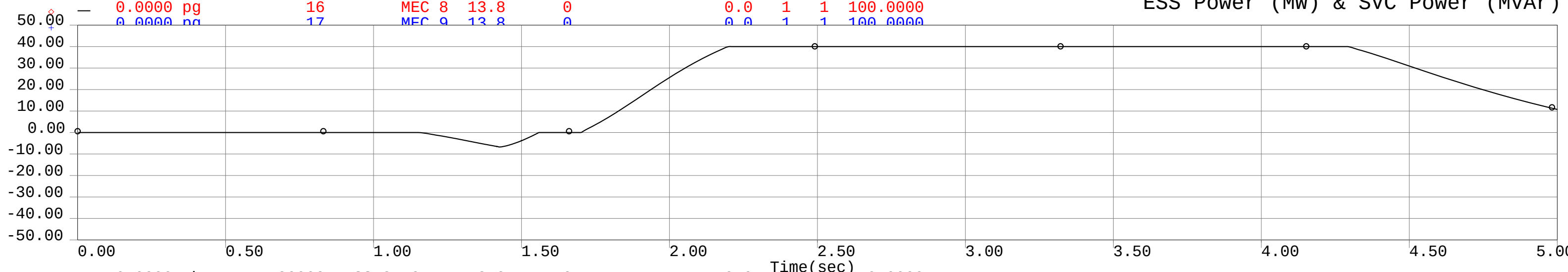
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



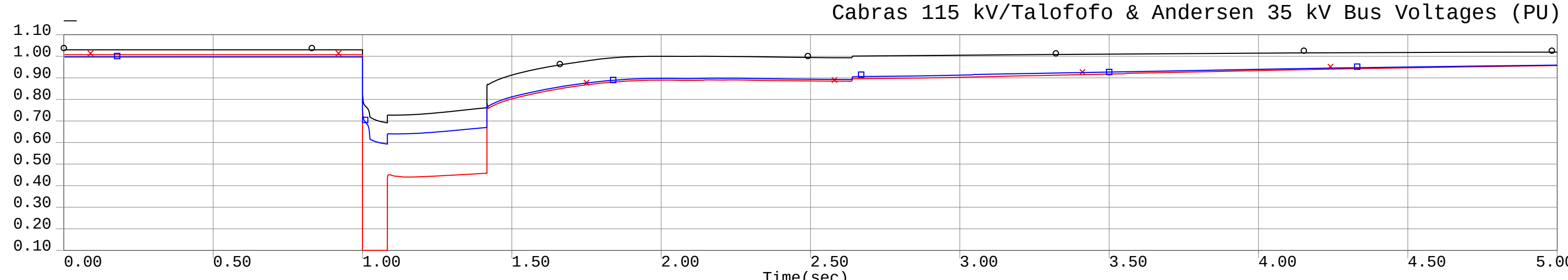
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1420_40a_lf11_fidvr.chf

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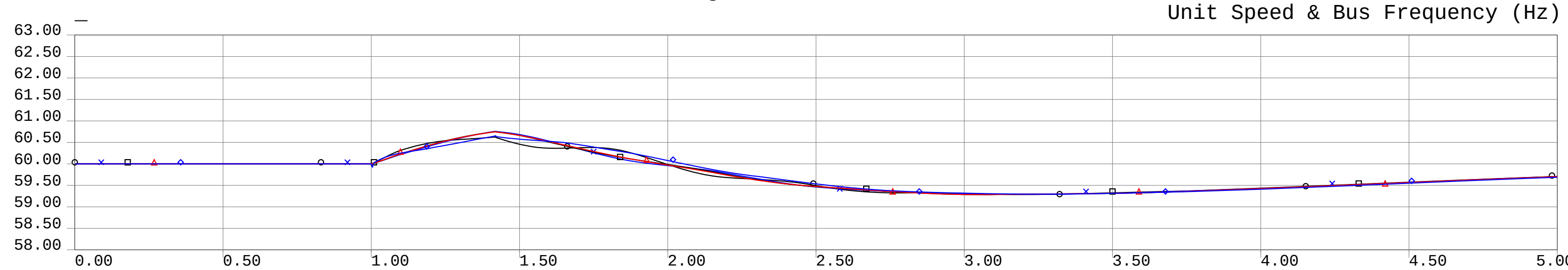
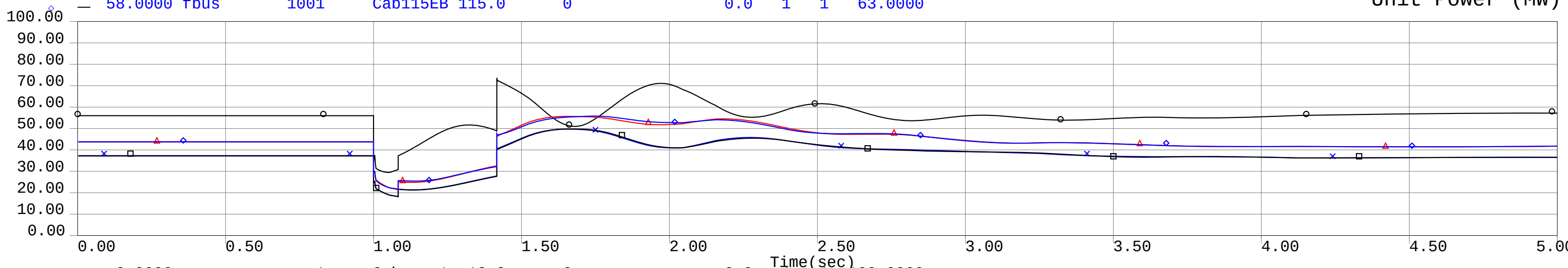
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



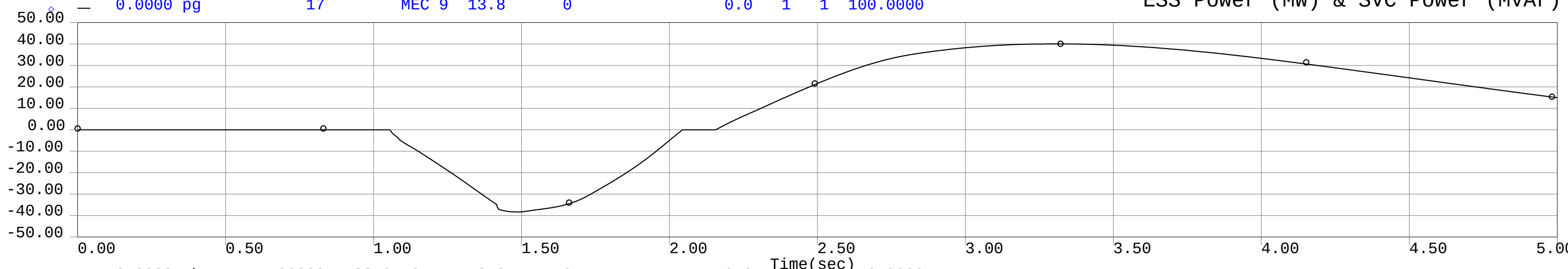
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



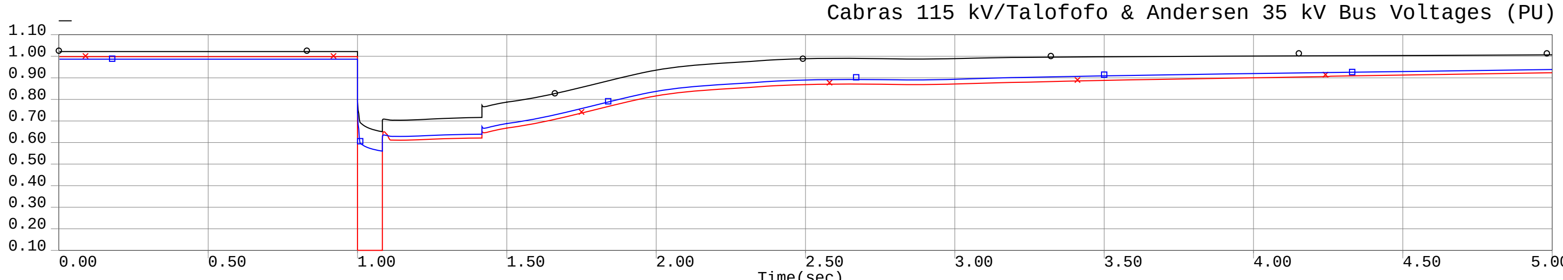
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

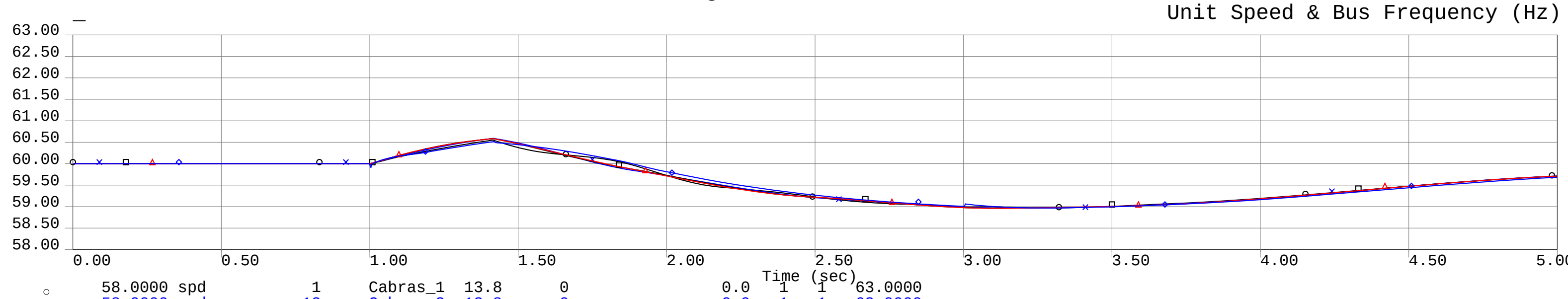
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

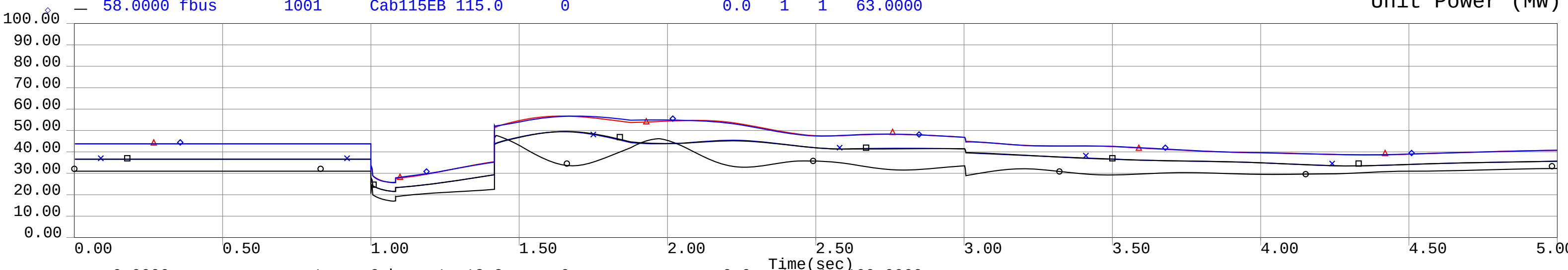
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



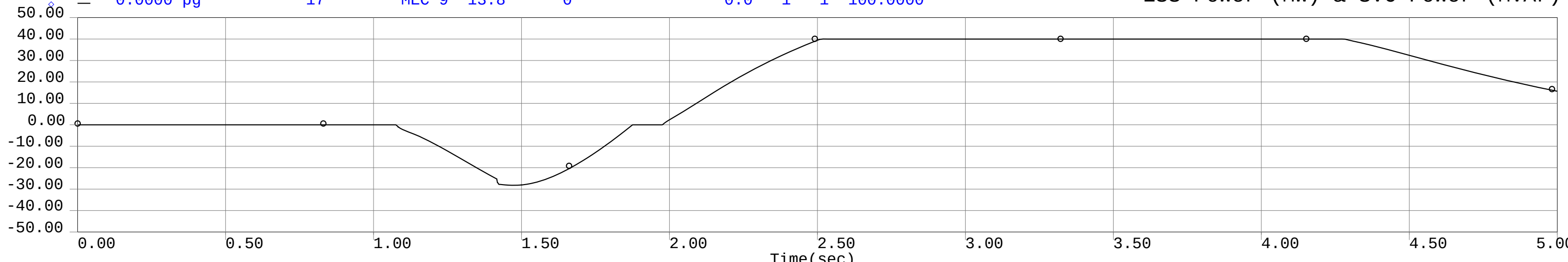
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



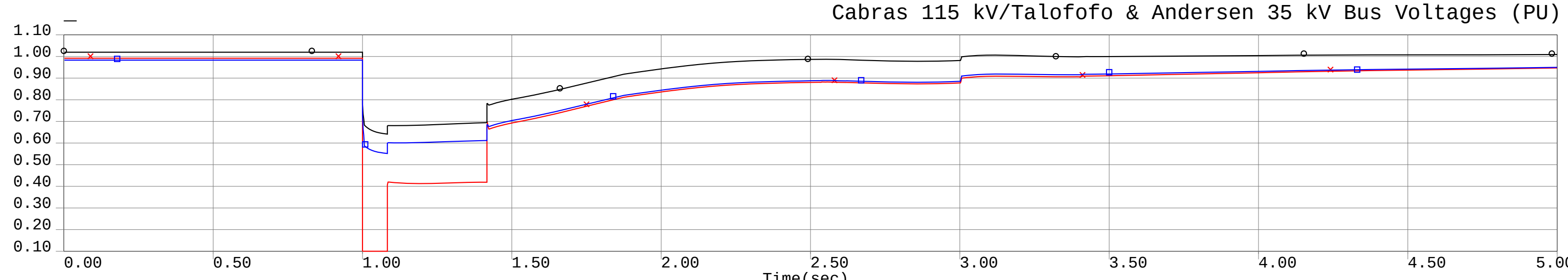
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



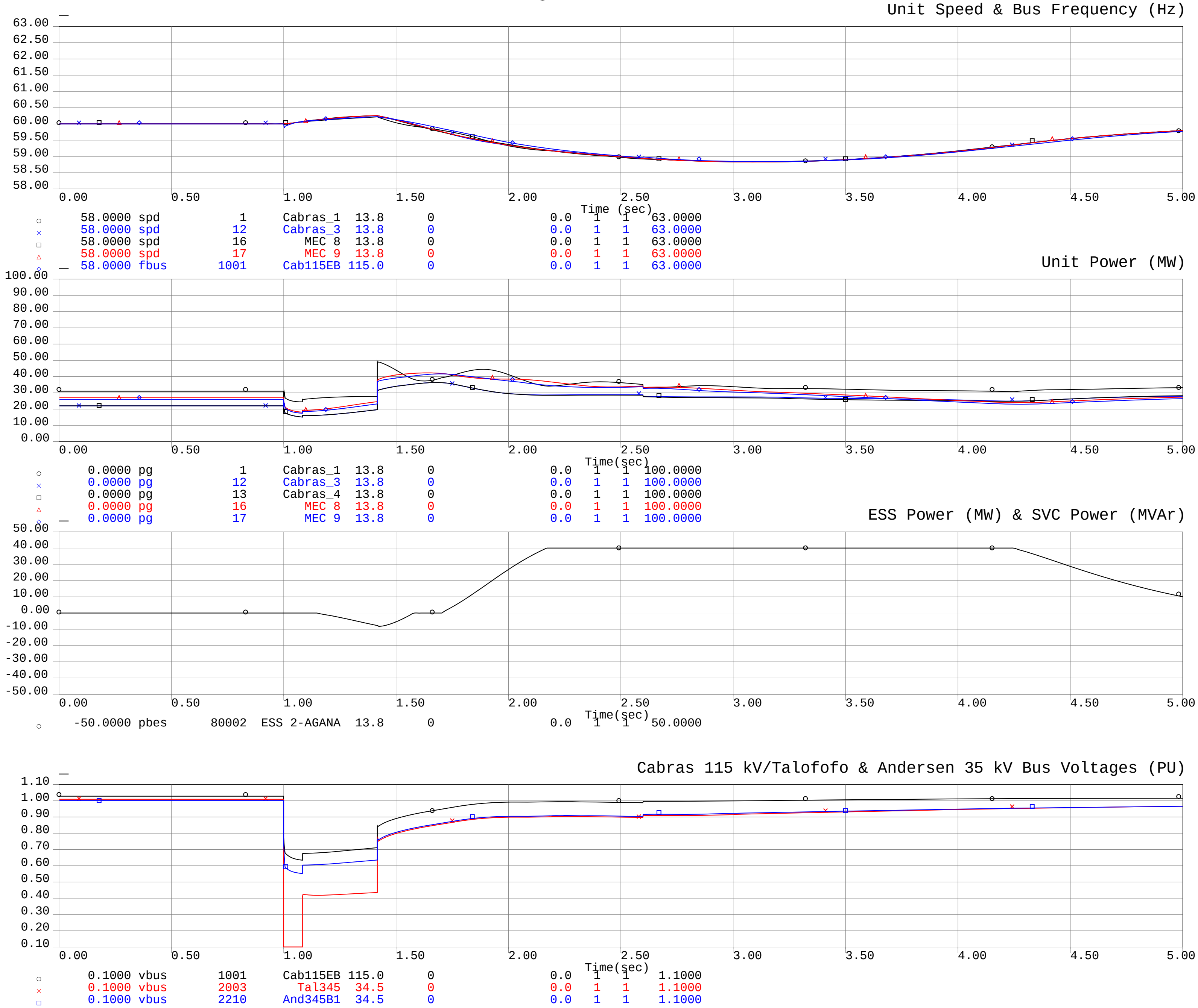
○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/2420_40a_lf11_fidvr.chf

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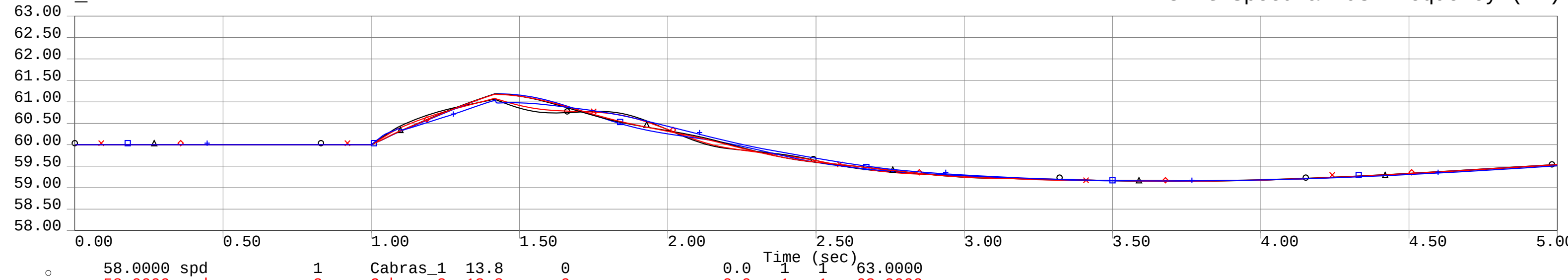
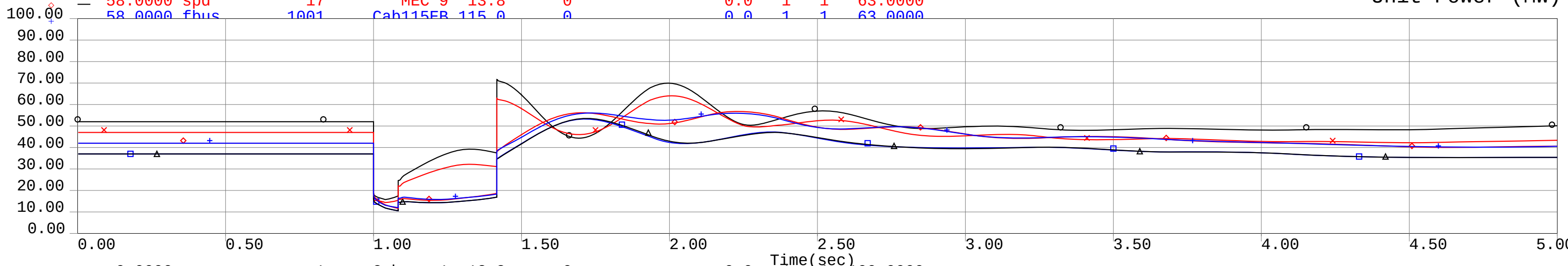
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



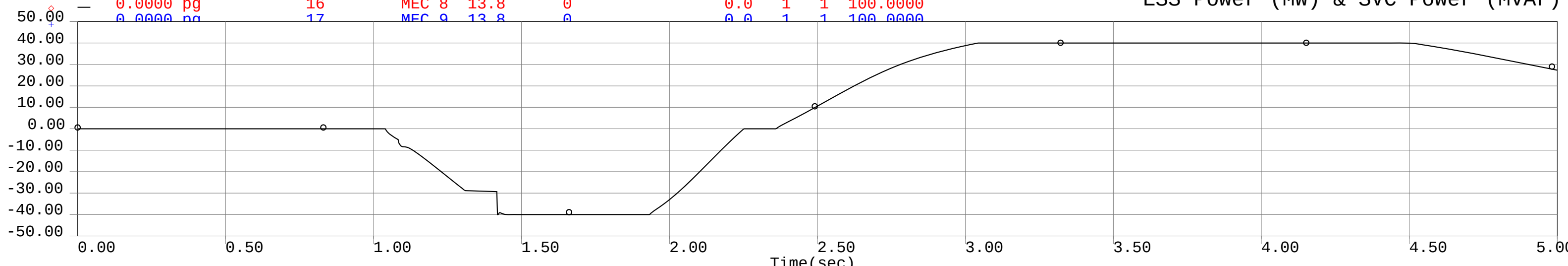
○ 58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
× 58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□ 58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△ 58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇ 58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+ 58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



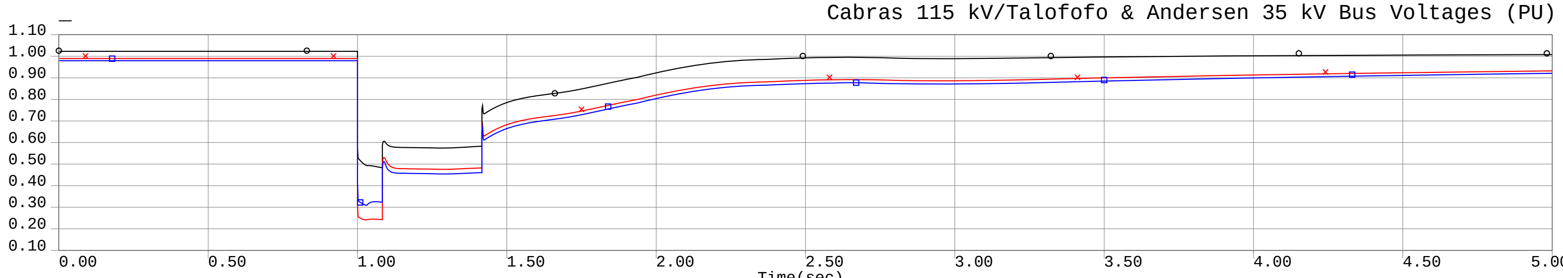
○ 0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
× 0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
□ 0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△ 0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇ 0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+ 0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○ -50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
× 0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□ 0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1400_40a_lf12_fidvr.chf

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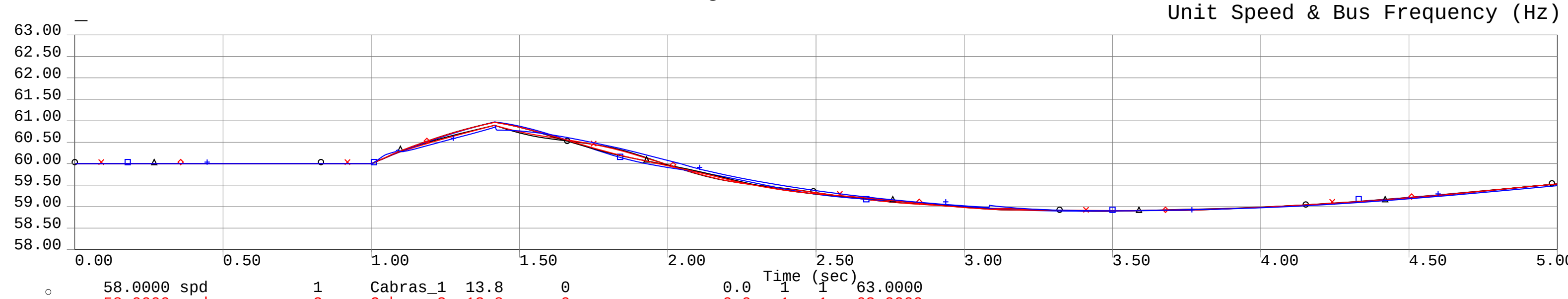
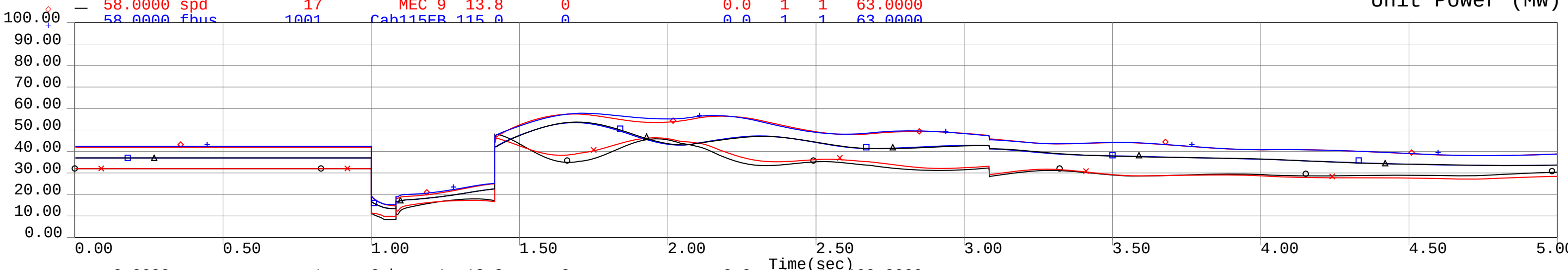
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



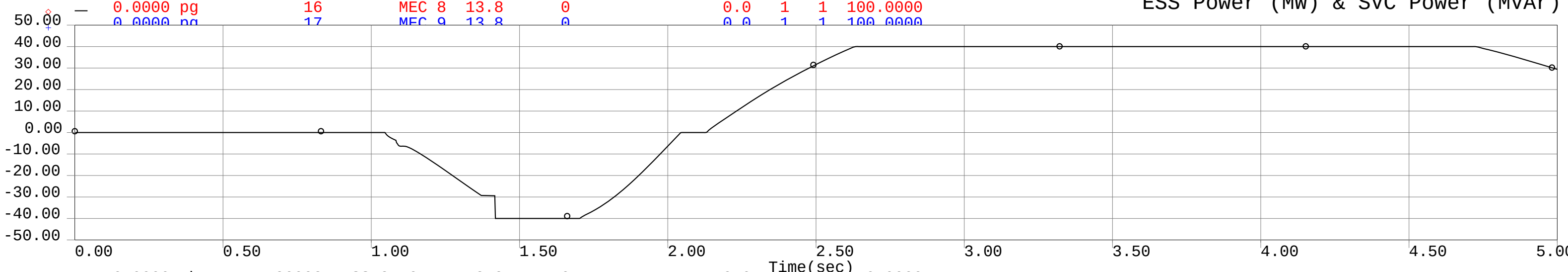
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



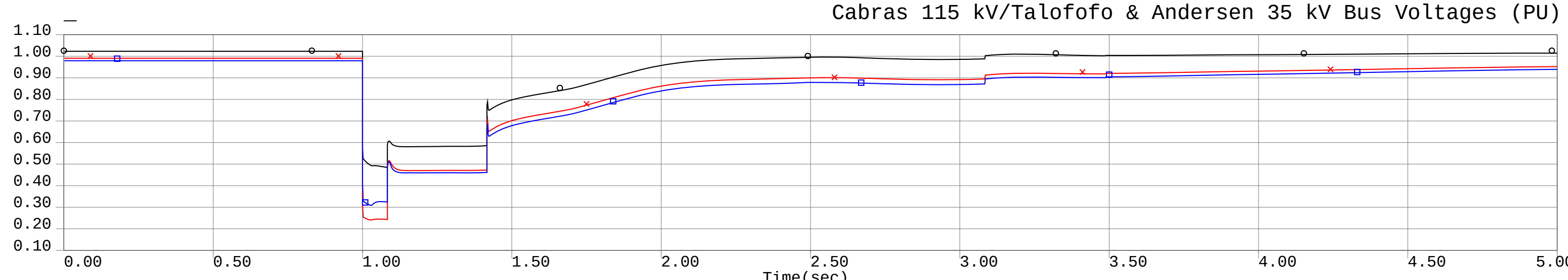
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1410_40a_lf12_fidvr.chf

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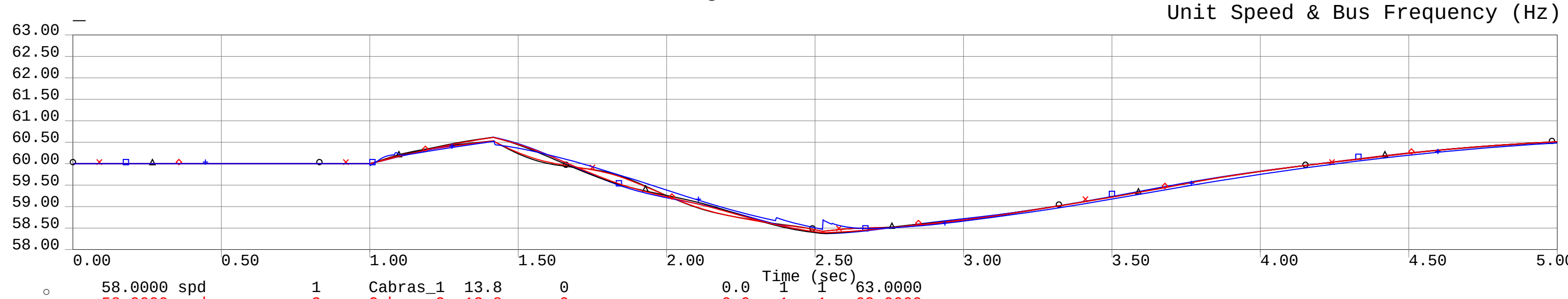
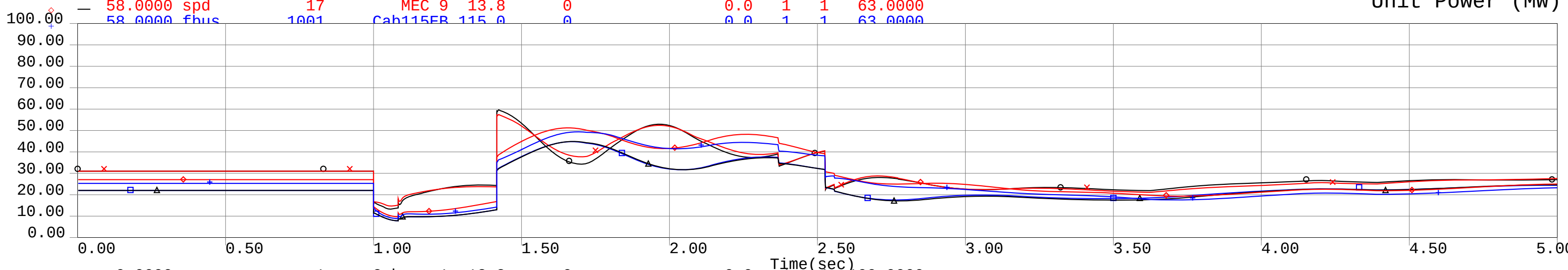
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



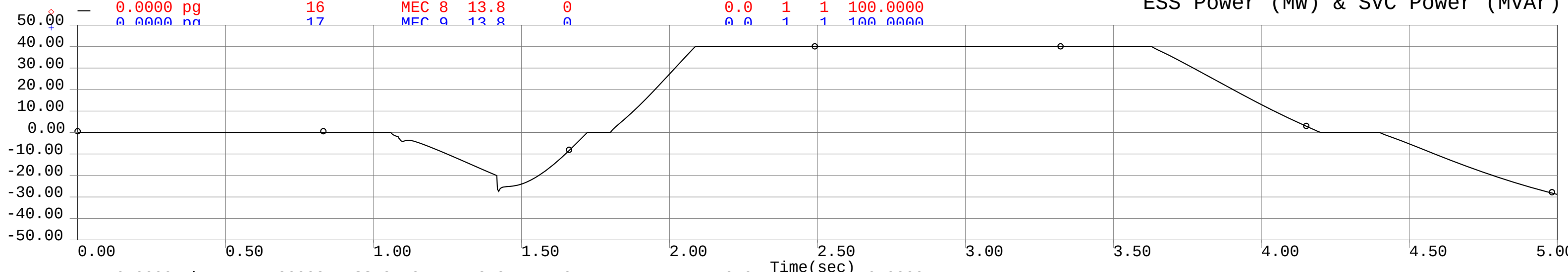

```
○ 58.0000 spd        1     Cabras_1  13.8    0      0.0  1  1  63.0000
× 58.0000 spd        2     Cabras_2  13.8    0      0.0  1  1  63.0000
□ 58.0000 spd       12     Cabras_3  13.8    0      0.0  1  1  63.0000
△ 58.0000 spd       16       MEC 8   13.8    0      0.0  1  1  63.0000
◇ 58.0000 spd       17       MEC 9   13.8    0      0.0  1  1  63.0000
+ 58.0000 fbus    1001     Cab115EB 115.0    0      0.0  1  1  63.0000
```

Unit Power (MW)




```
○ 0.0000 pg          1     Cabras_1  13.8    0      0.0  1  1  100.0000
× 0.0000 pg          2     Cabras_2  13.8    0      0.0  1  1  100.0000
□ 0.0000 pg         12     Cabras_3  13.8    0      0.0  1  1  100.0000
△ 0.0000 pg         13     Cabras_4  13.8    0      0.0  1  1  100.0000
◇ 0.0000 pg         16       MEC 8   13.8    0      0.0  1  1  100.0000
+ 0.0000 pg         17       MEC 9   13.8    0      0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
○ -50.0000 pbes  80002  ESS 2-AGANA  13.8    0      0.0  1  1  50.0000
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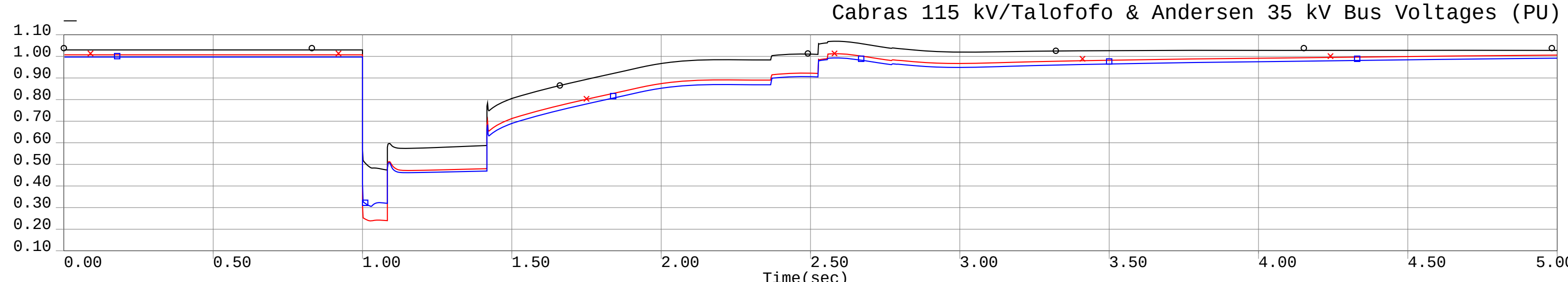
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○ 0.1000 vbus     1001     Cab115EB 115.0    0      0.0  1  1  1.1000
× 0.1000 vbus     2003       Tal345  34.5    0      0.0  1  1  1.1000
□ 0.1000 vbus     2210     And345B1  34.5    0      0.0  1  1  1.1000
```


chans/1420_40a_lf12_fidvr.chf

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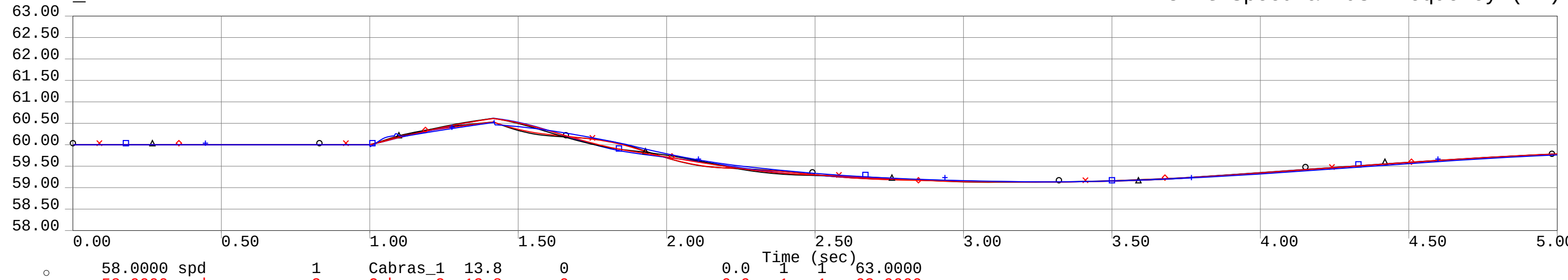
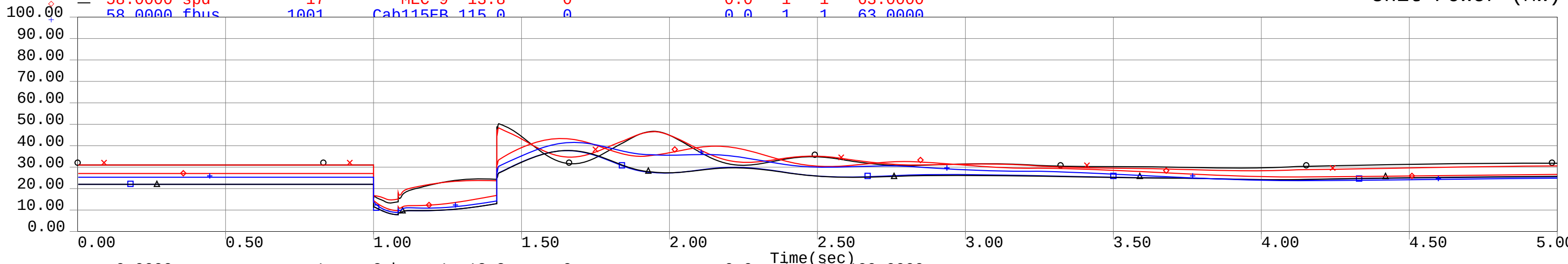
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



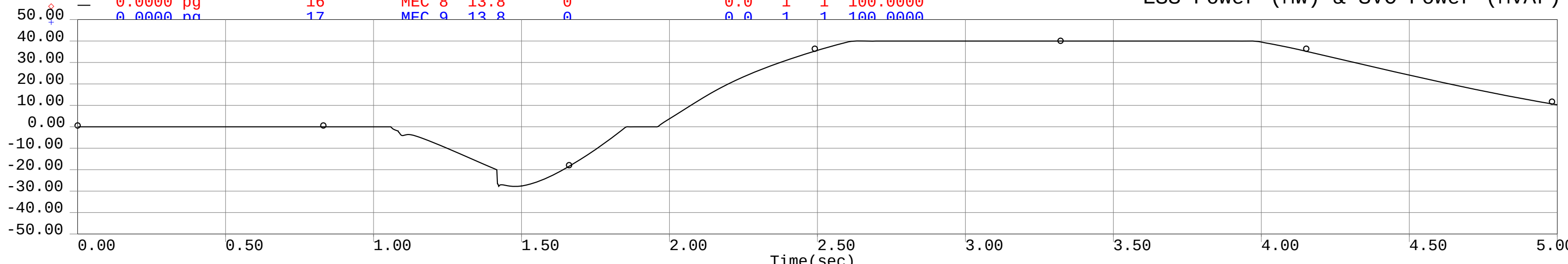
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



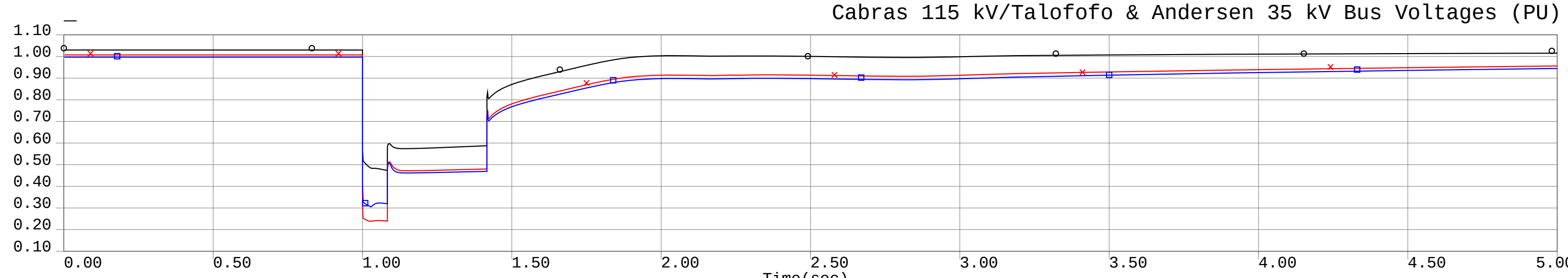
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



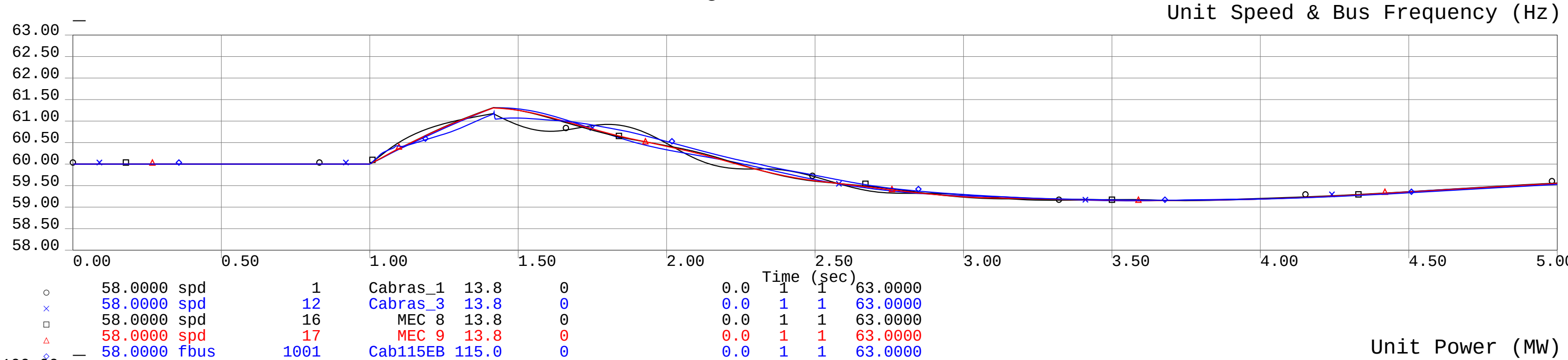
-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

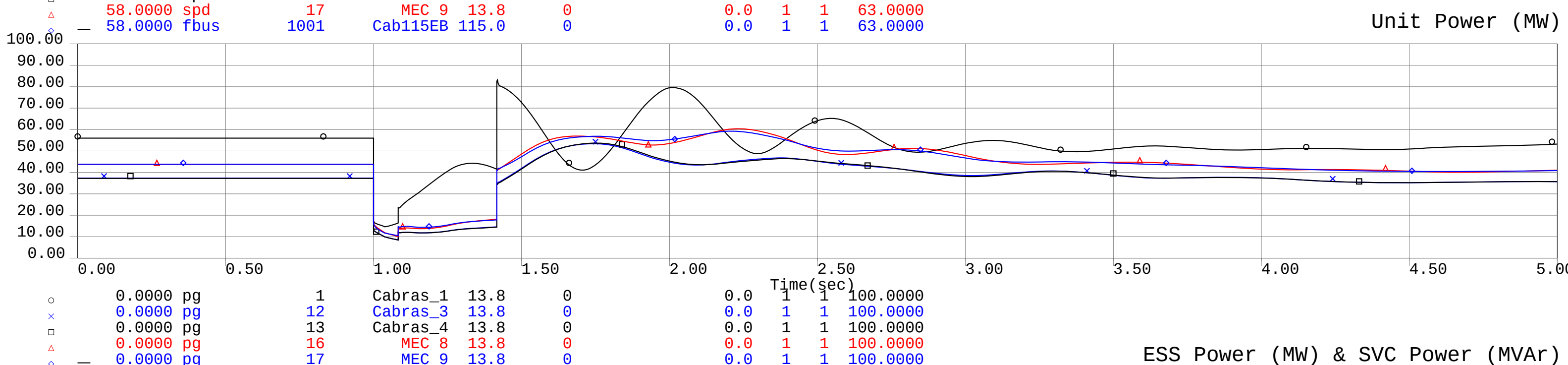
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

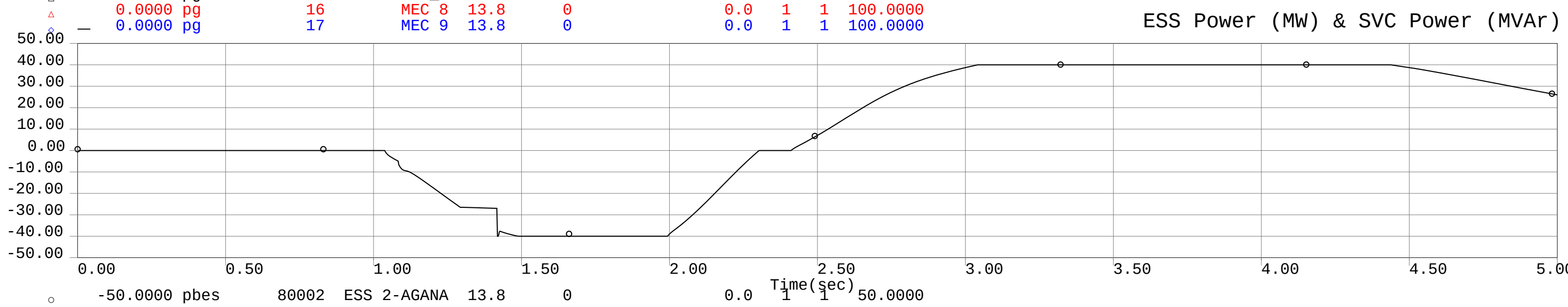


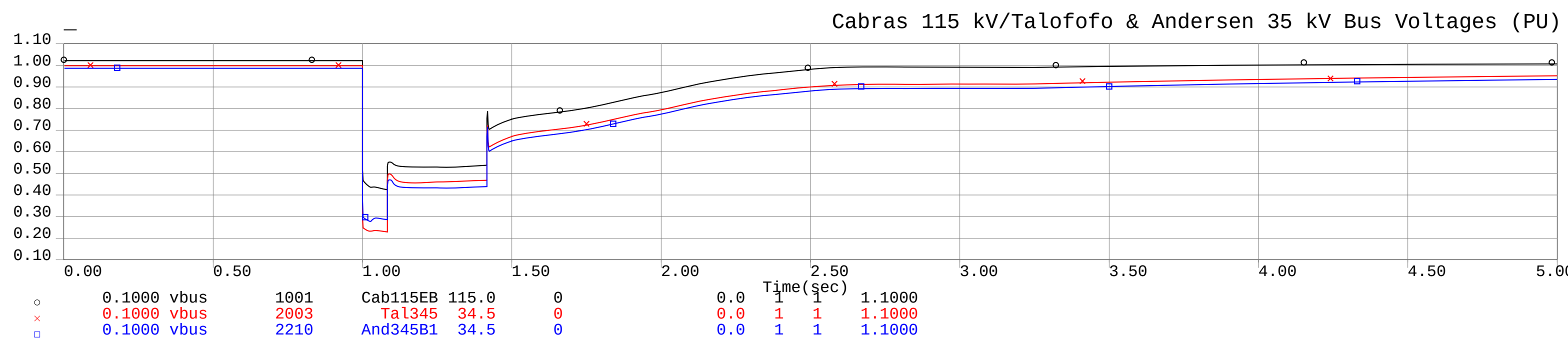
0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS









chans/2400_40a_lf12_fidvr.chf
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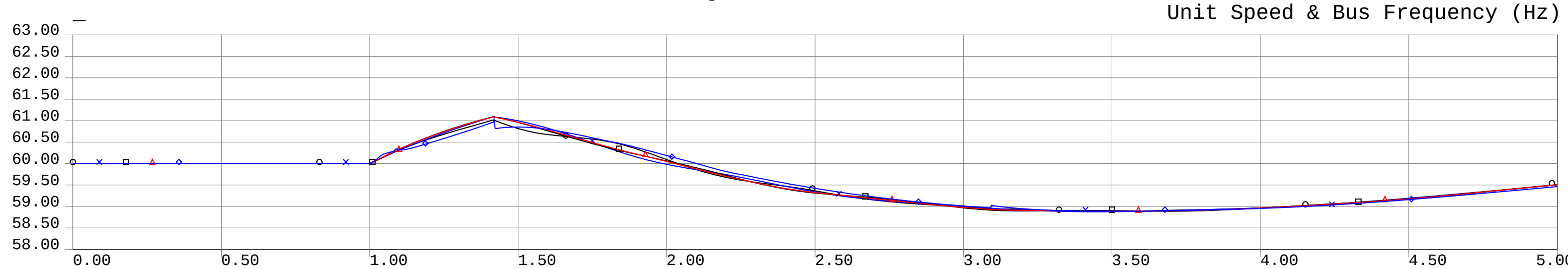
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

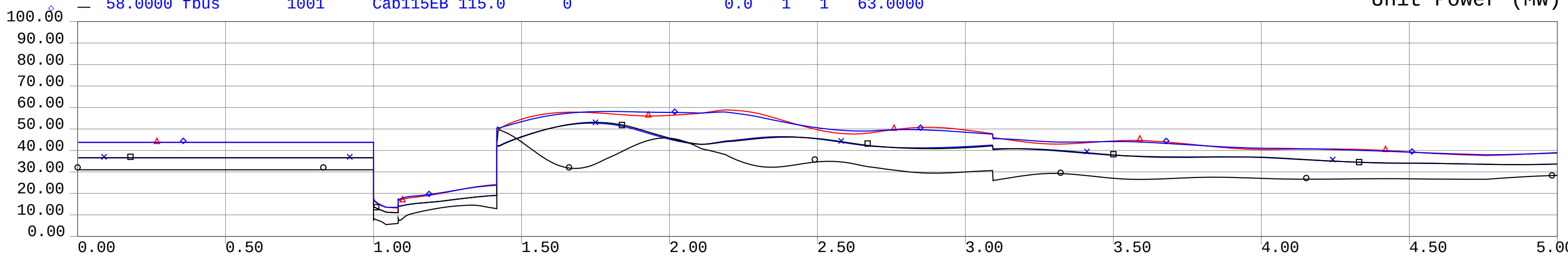
Unit Speed & Bus Frequency (Hz)



Time (sec)

```
58.0000 spd     1     Cabras_1  13.8   0   0.0  1  1  63.0000
58.0000 spd    12     Cabras_3  13.8   0   0.0  1  1  63.0000
58.0000 spd    16        MEC 8  13.8   0   0.0  1  1  63.0000
58.0000 spd    17        MEC 9  13.8   0   0.0  1  1  63.0000
58.0000 fbus 1001     Cab115EB 115.0   0   0.0  1  1  63.0000
```

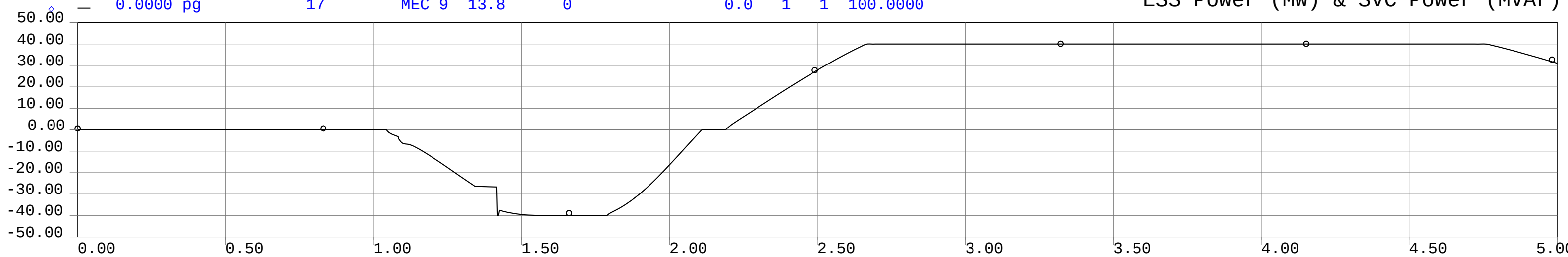
Unit Power (MW)



Time(sec)

```
0.0000 pg     1     Cabras_1  13.8   0   0.0  1  1  100.0000
0.0000 pg    12     Cabras_3  13.8   0   0.0  1  1  100.0000
0.0000 pg    13     Cabras_4  13.8   0   0.0  1  1  100.0000
0.0000 pg    16        MEC 8  13.8   0   0.0  1  1  100.0000
0.0000 pg    17        MEC 9  13.8   0   0.0  1  1  100.0000
```

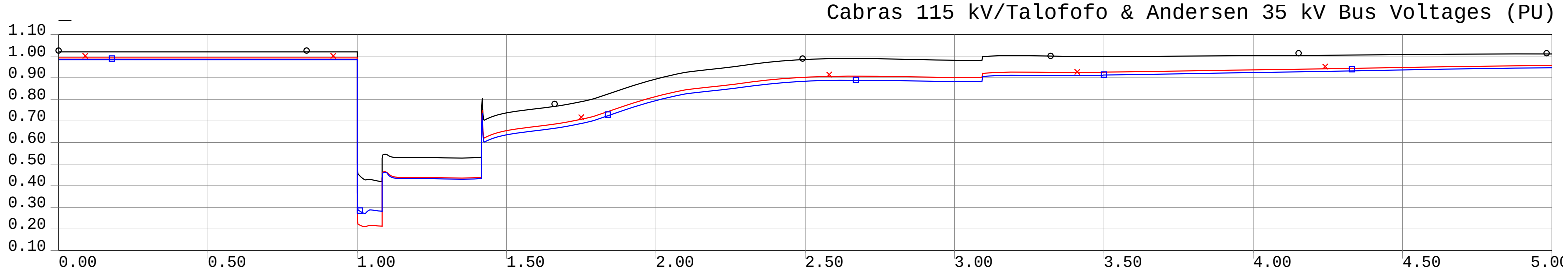
ESS Power (MW) & SVC Power (MVAr)



Time(sec)

```
-50.0000 pbes  80002  ESS 2-AGANA  13.8   0   0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



Time(sec)

```
0.1000 vbus  1001   Cab115EB 115.0   0   0.0  1  1  1.1000
0.1000 vbus  2003     Tal345  34.5   0   0.0  1  1  1.1000
0.1000 vbus  2210   And345B1  34.5   0   0.0  1  1  1.1000
```


chans/2410_40a_lf12_fidvr.chf

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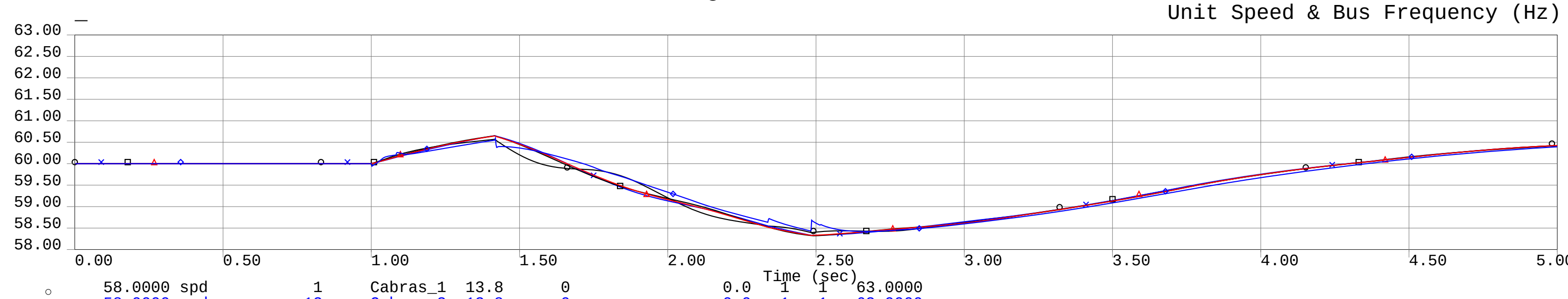
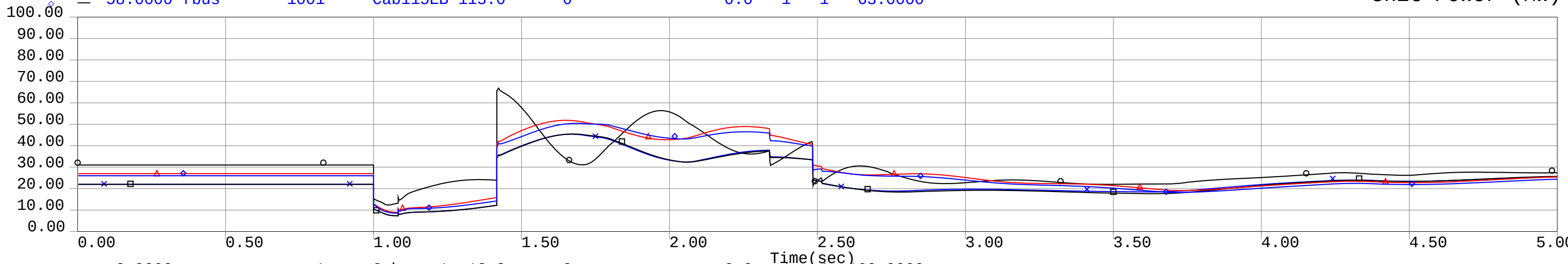
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



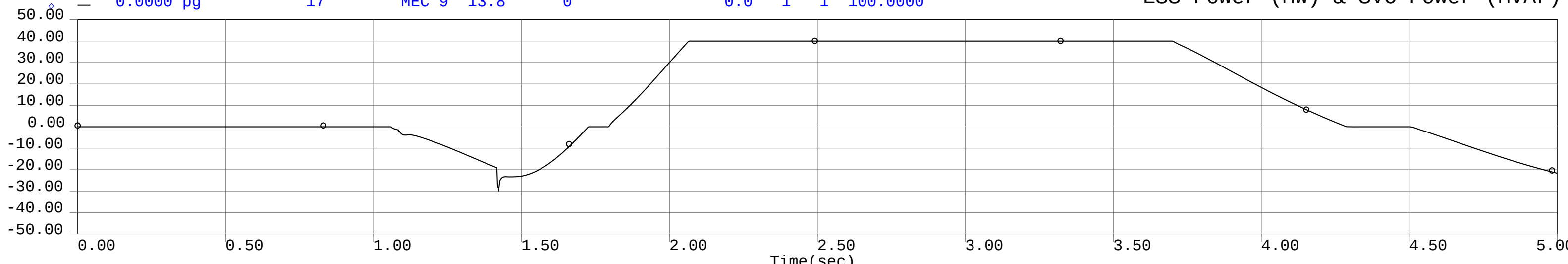
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



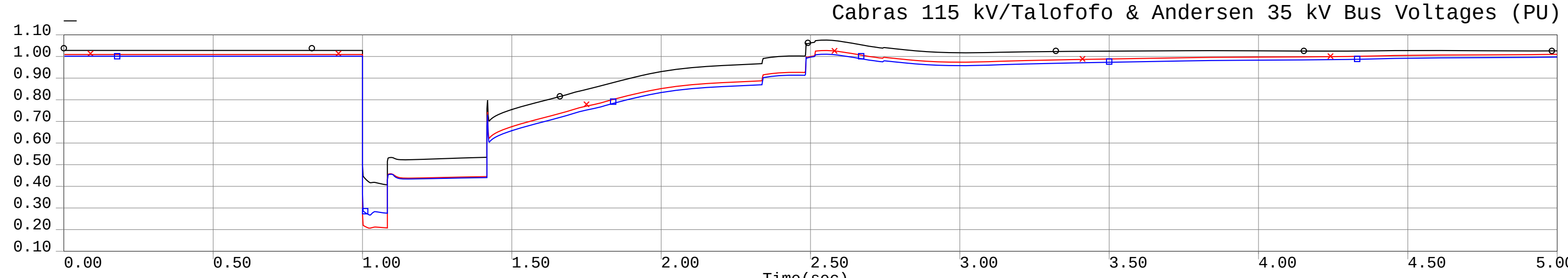
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2420_40a_lf12_fidvr.chf

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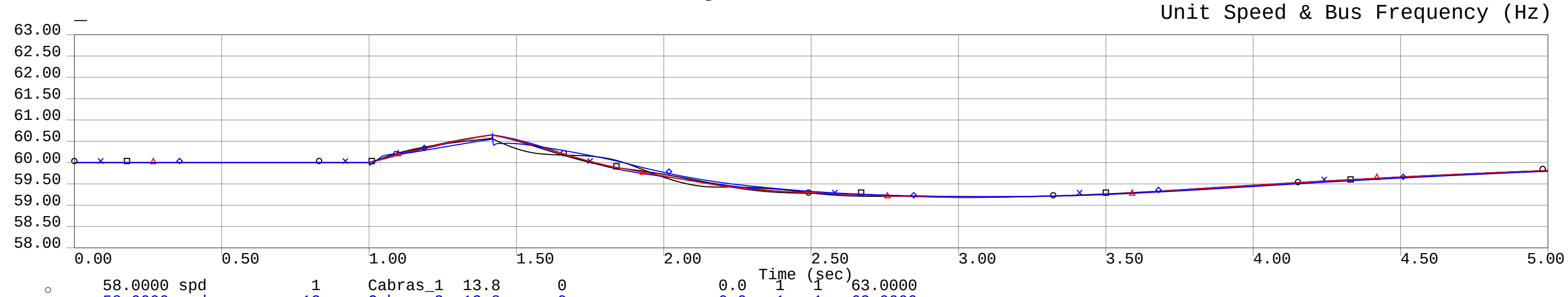
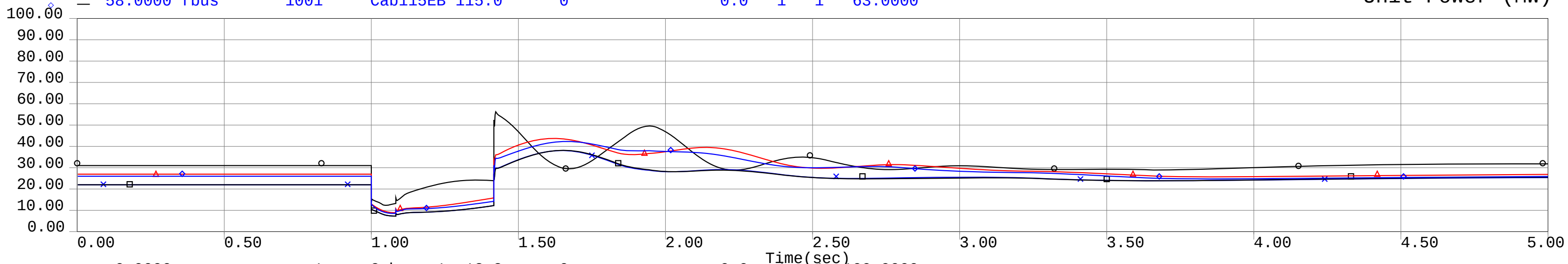
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



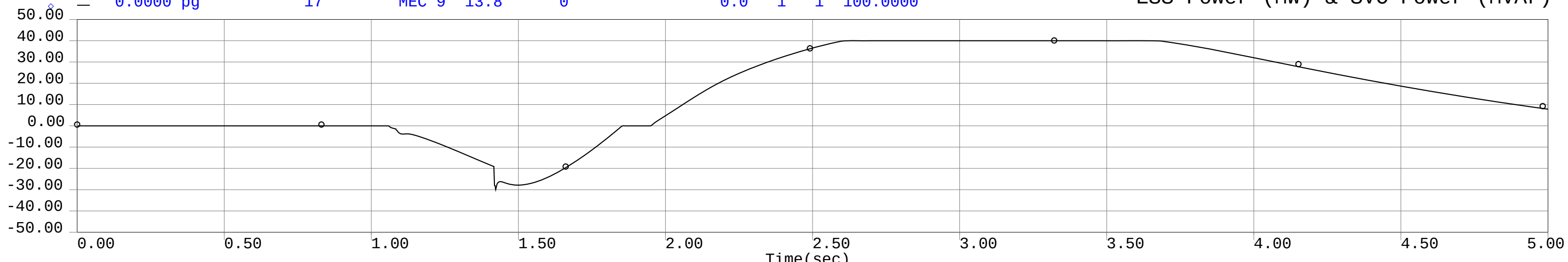
○ 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
× 58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
△ 58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
◇ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



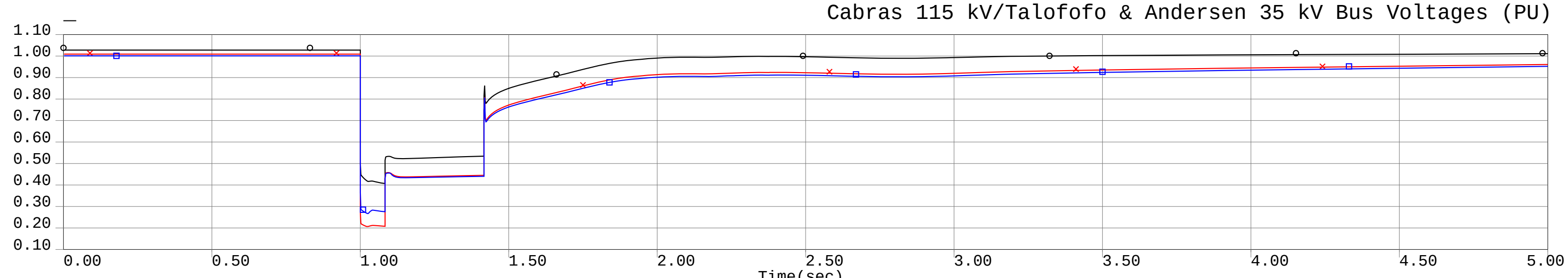
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
□ 0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
△ 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
◇ 0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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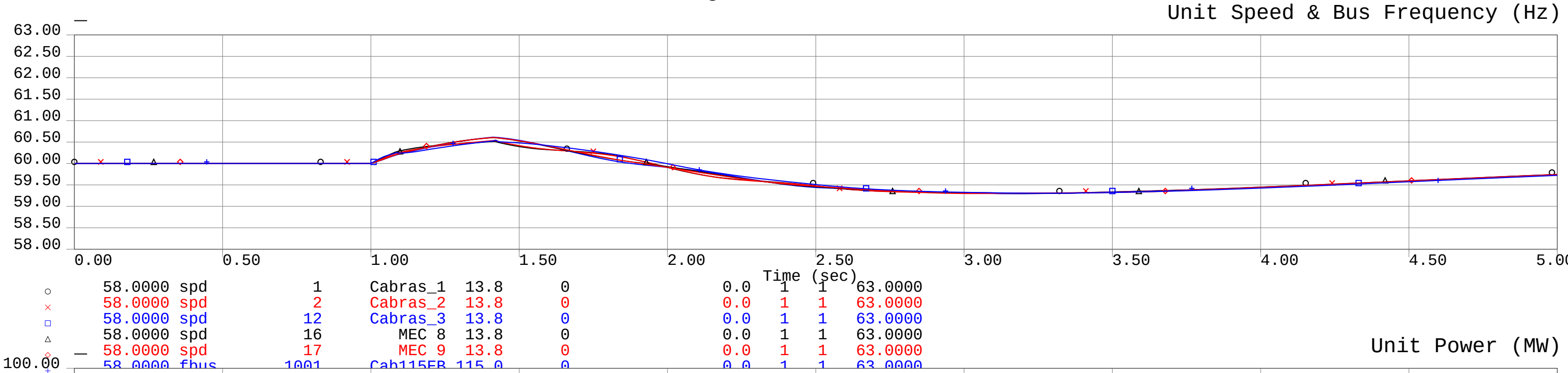
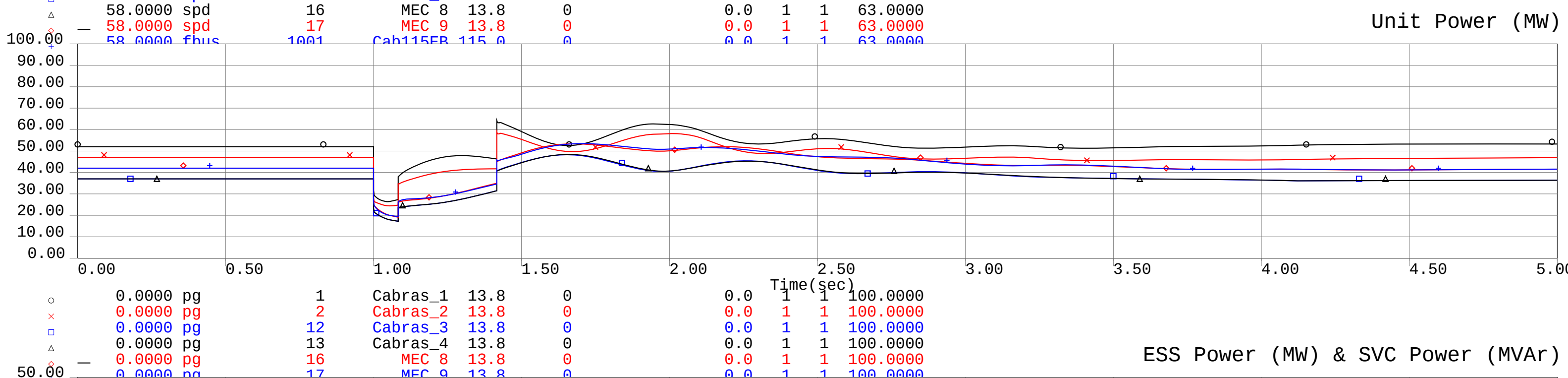
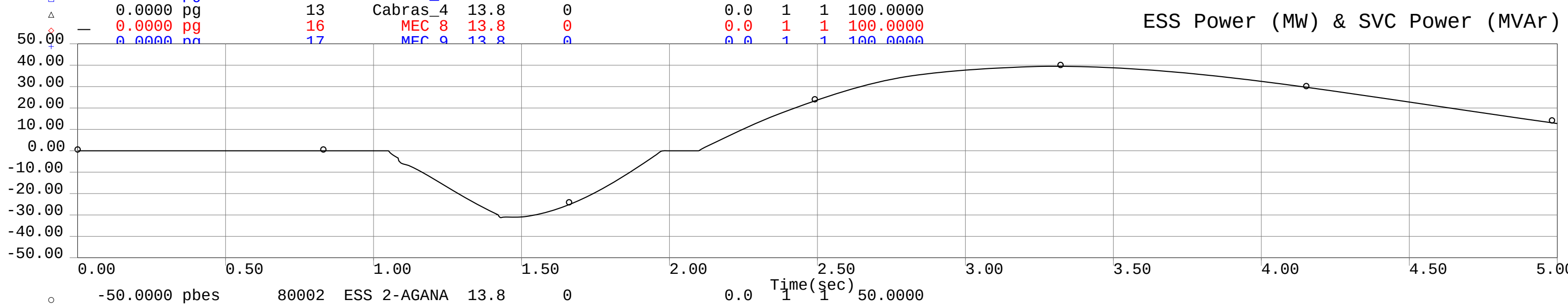
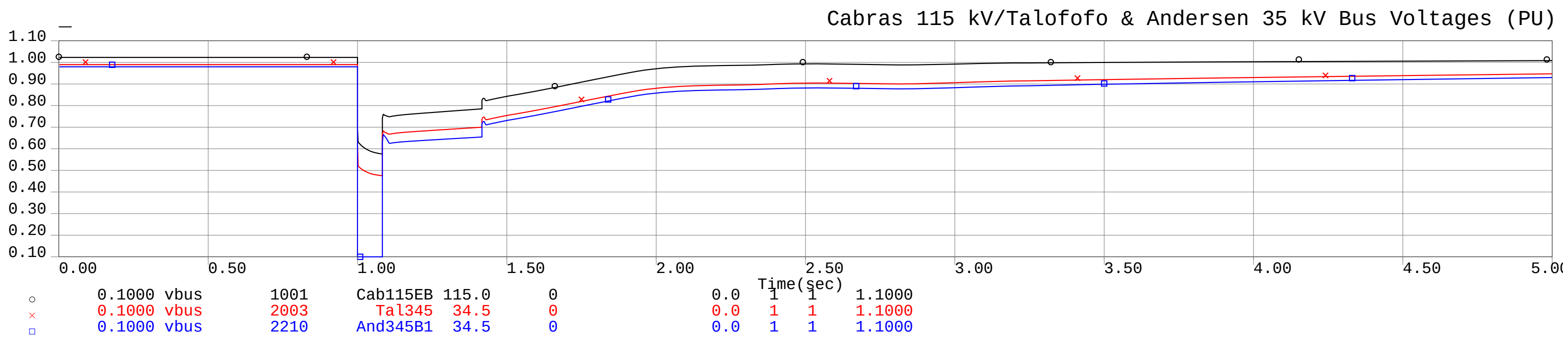
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS









chans/1400_40a_lf13_fidvr.chf

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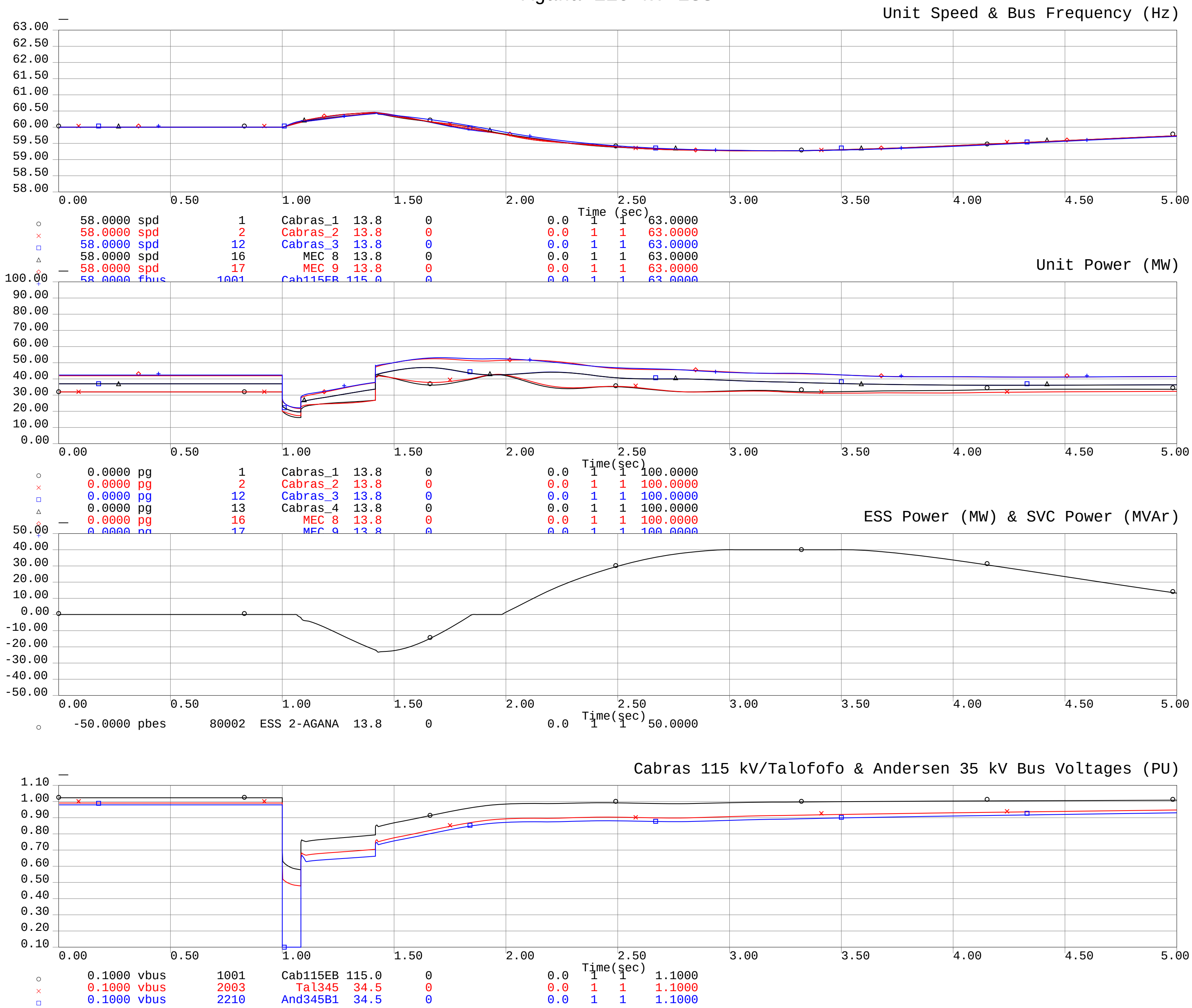
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/1410_40a_lf13_fidvr.chf

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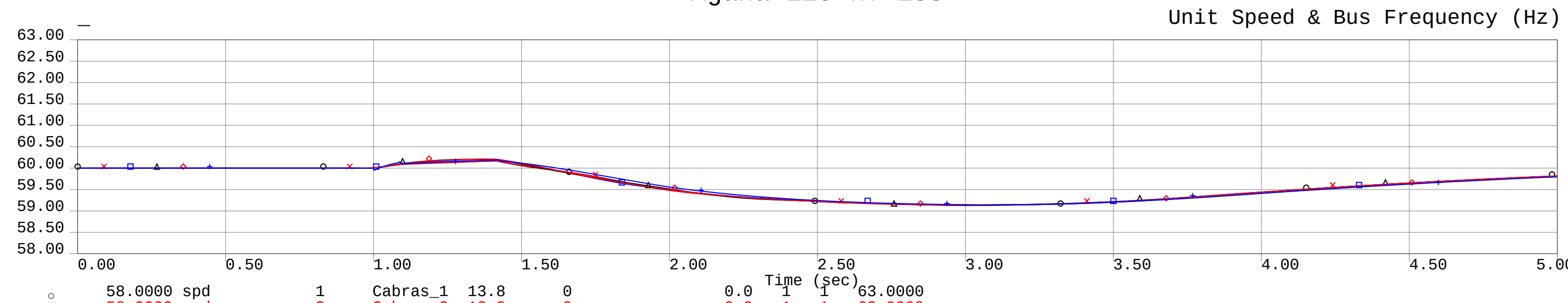
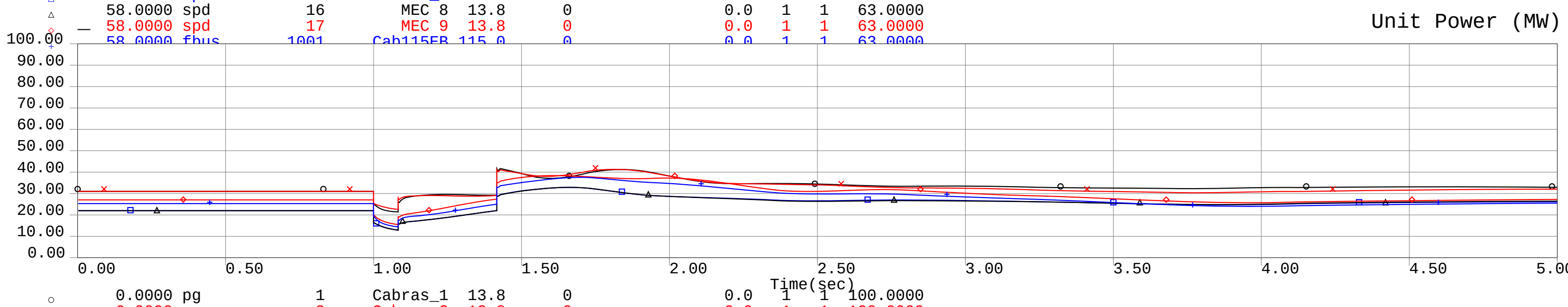
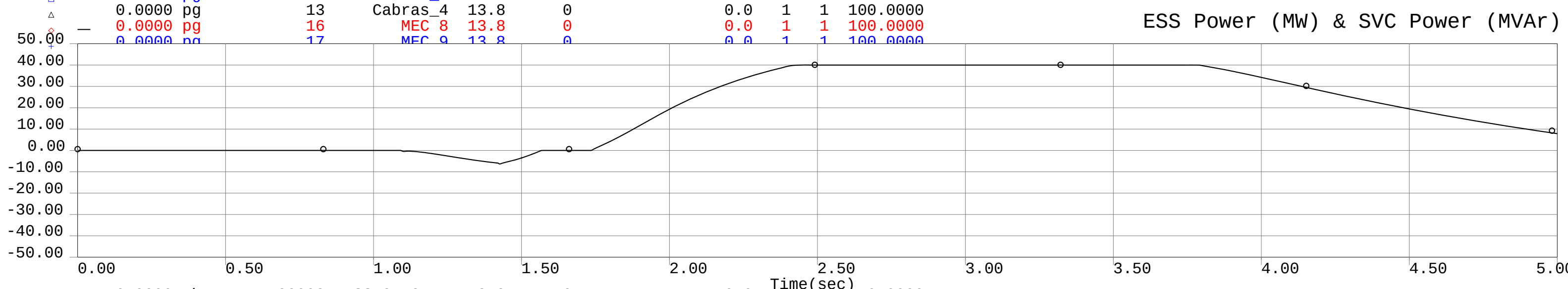
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



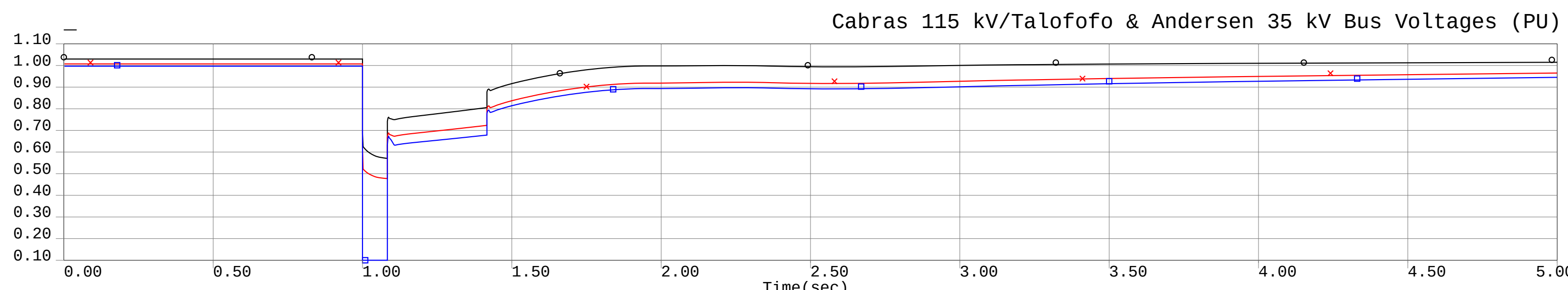
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000



0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1420_40a_lf13_fidvr.chf

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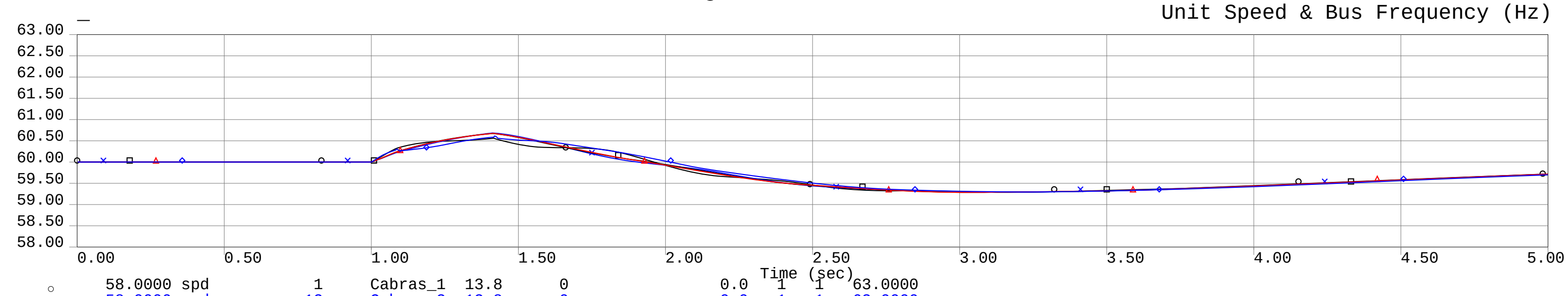
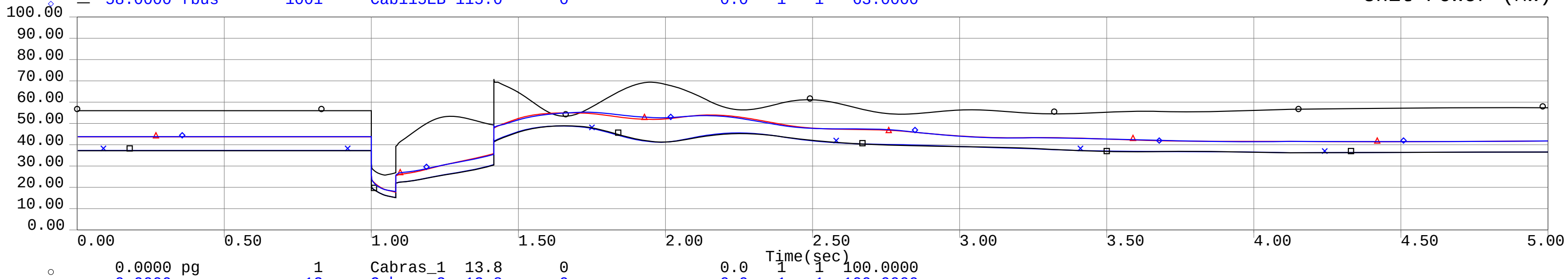
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



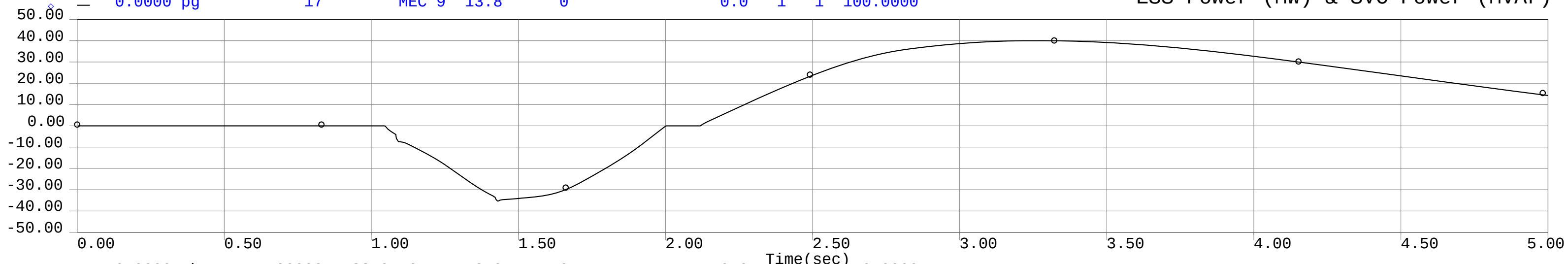
Min	Channel	Bus	Name	kV					Max
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



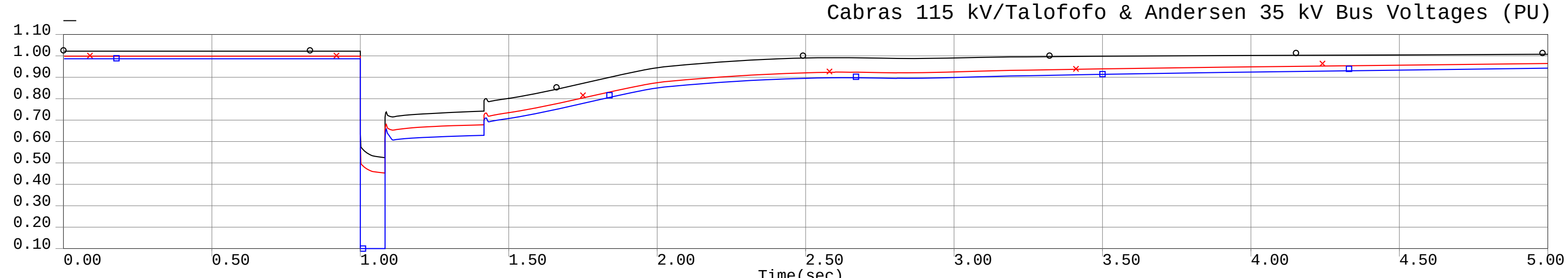
Min	Channel	Bus	Name	kV					Max
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Min	Channel	Bus	Name	kV					Max
-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



Min	Channel	Bus	Name	kV					Max
0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2400_40a_lf13_fidvr.chf

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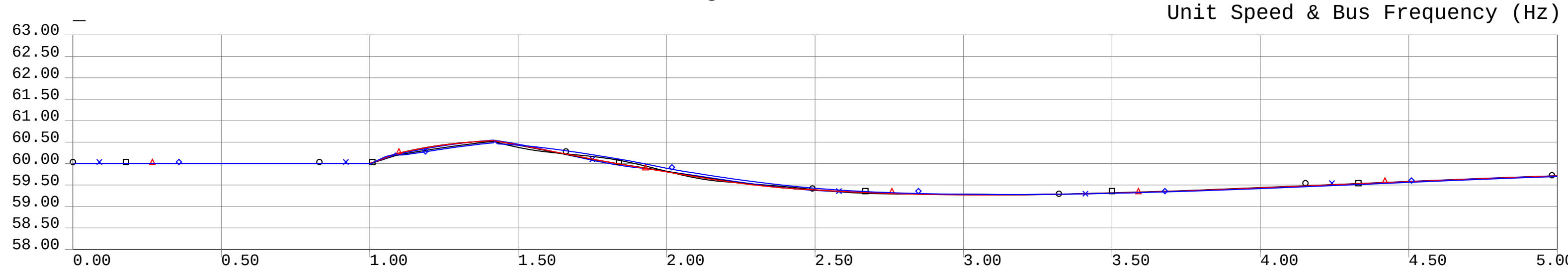
Thu Mar 27 12:31:00 2014

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

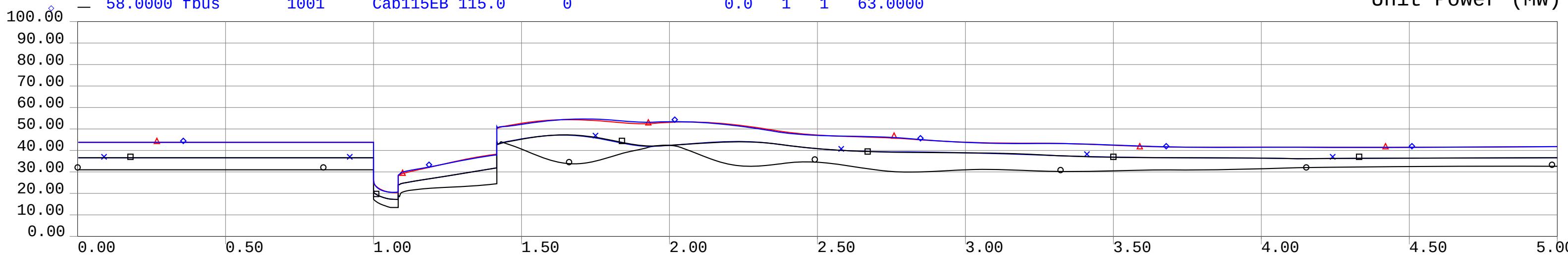
Unit Speed & Bus Frequency (Hz)



Time (sec)

○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

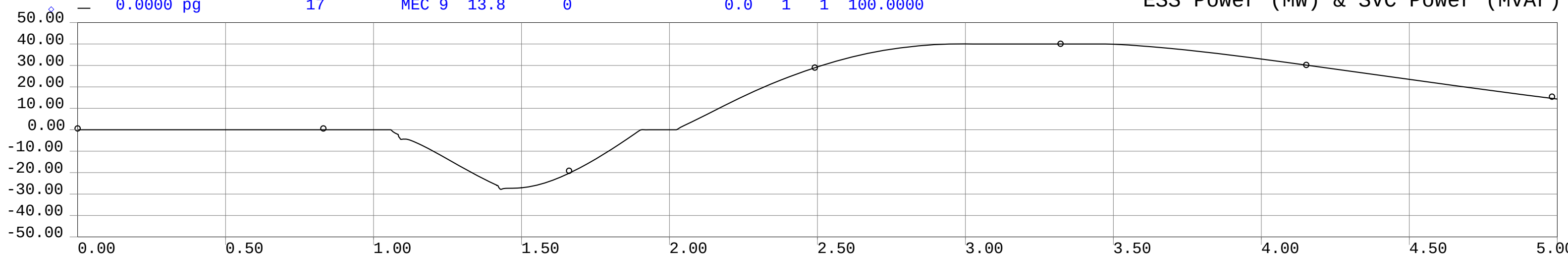
Unit Power (MW)



Time(sec)

○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

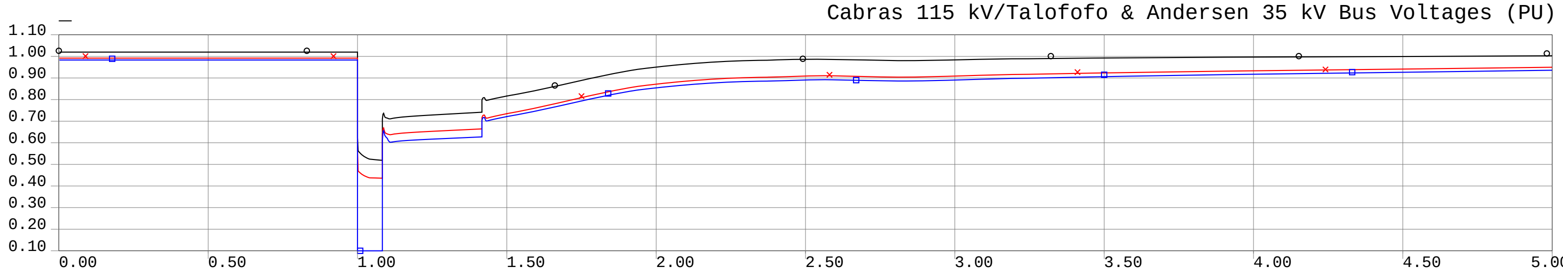
ESS Power (MW) & SVC Power (MVAr)



Time(sec)

○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



Time(sec)

○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2410_40a_lf13_fidvr.chf

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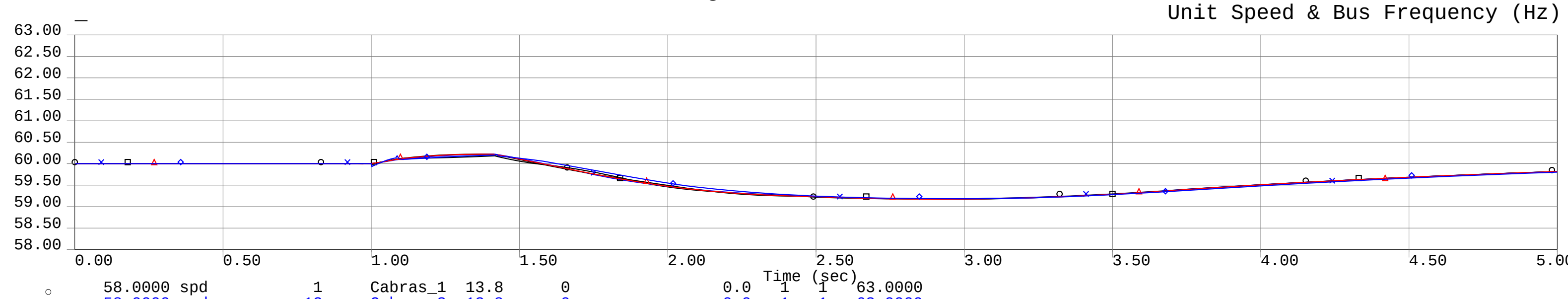
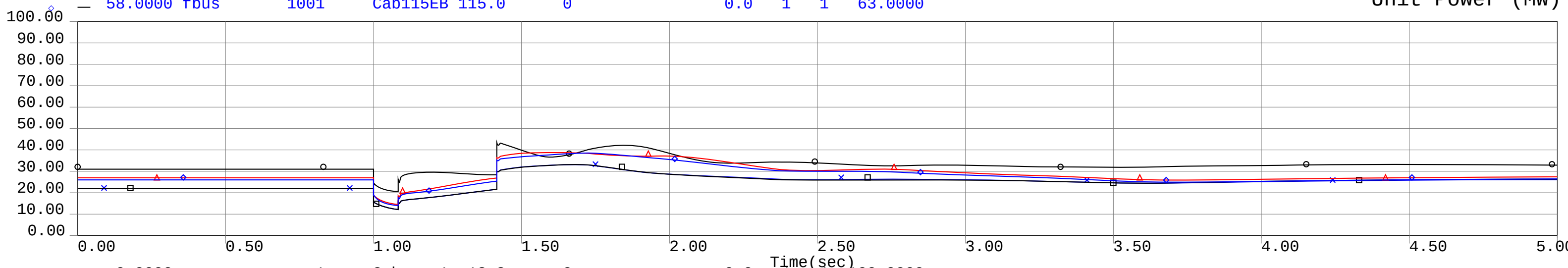
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



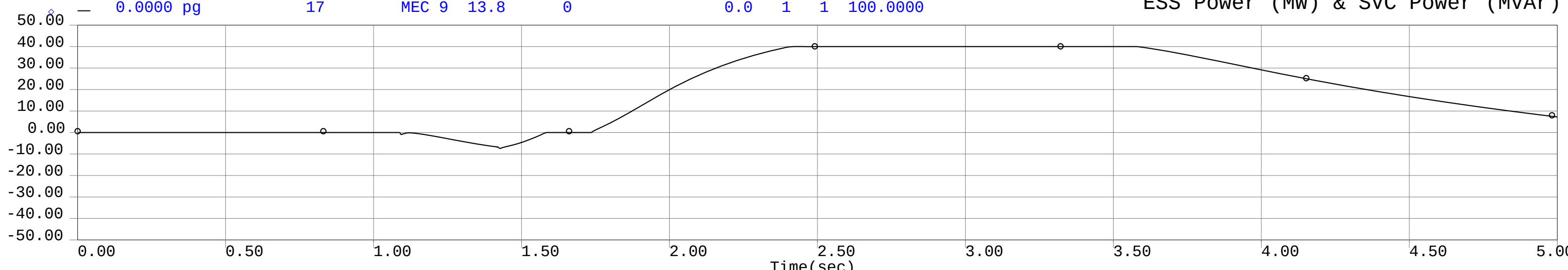
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



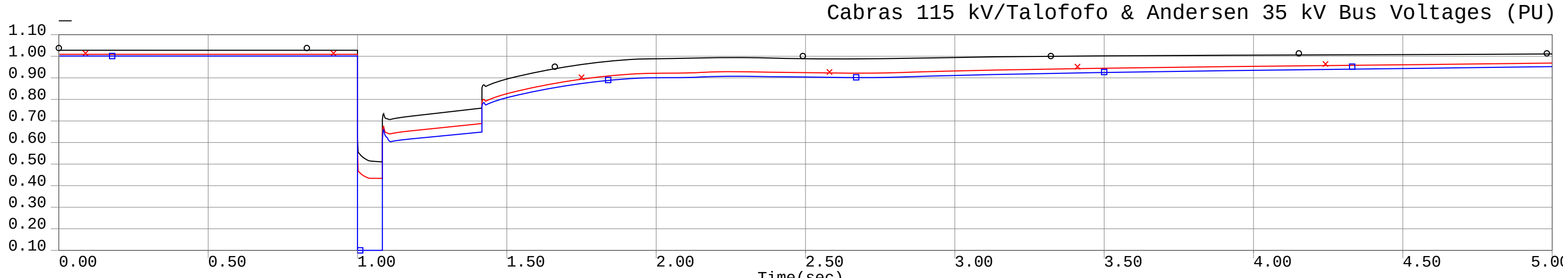
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2420_40a_lf13_fidvr.chf

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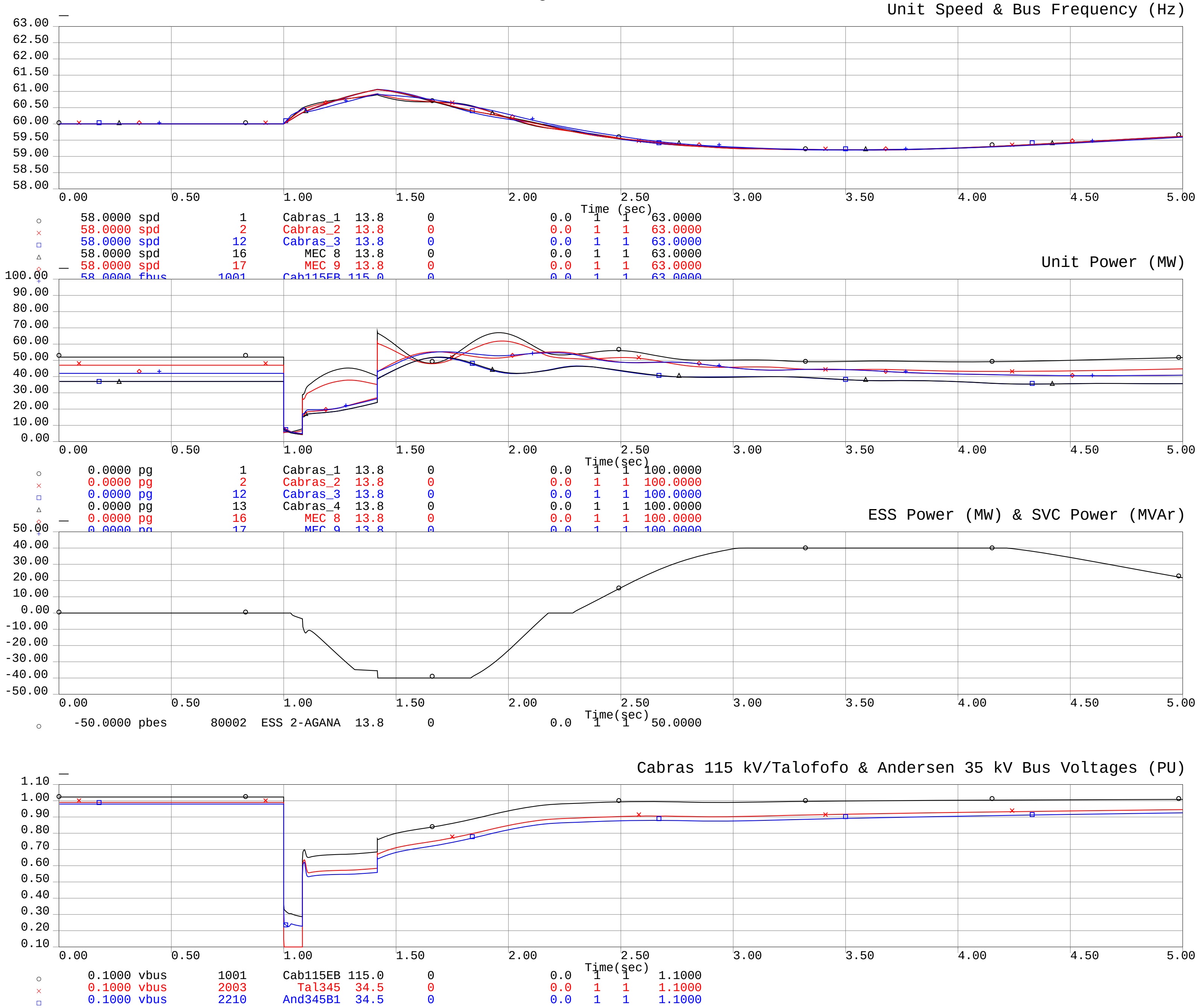
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/1400_40a_lf14_fidvr.chf

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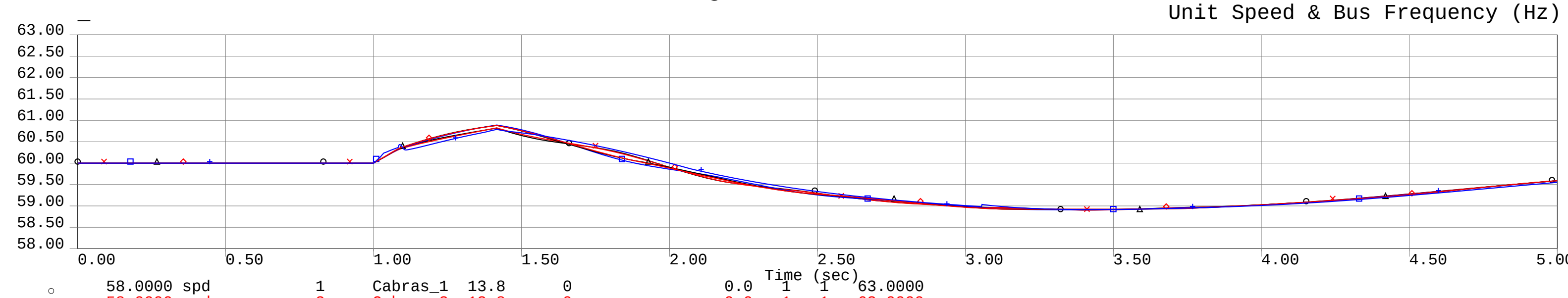
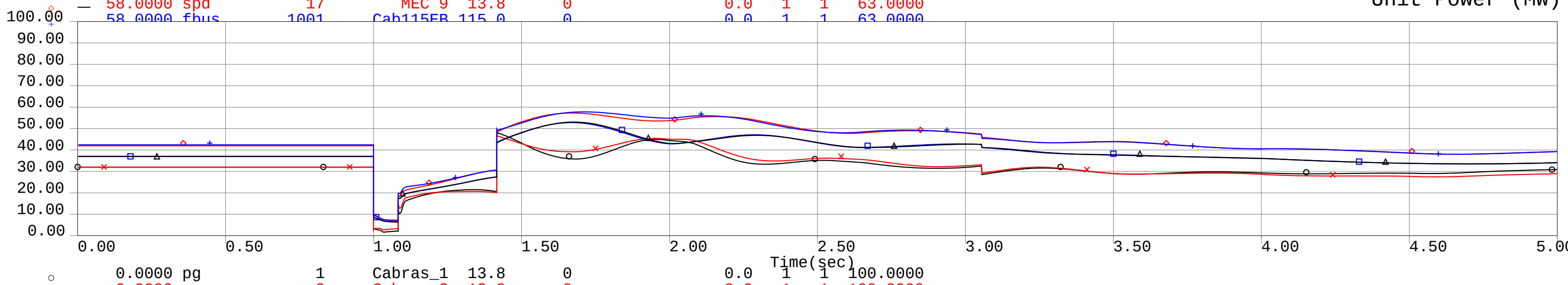
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



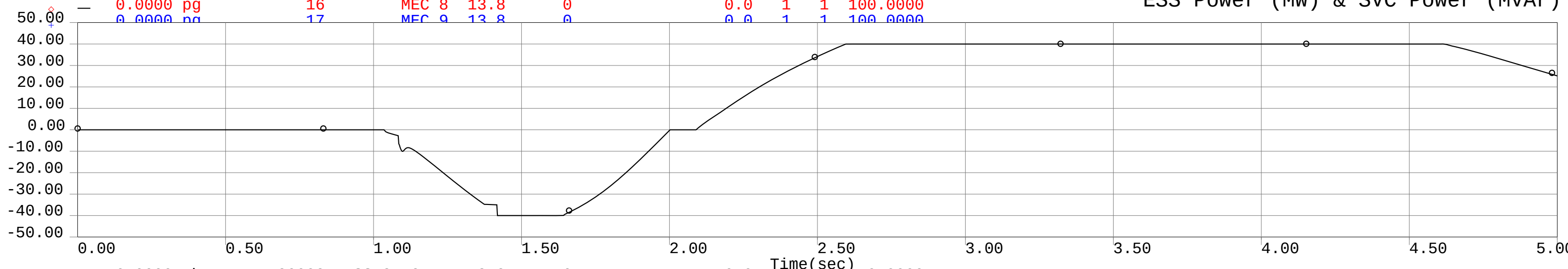
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



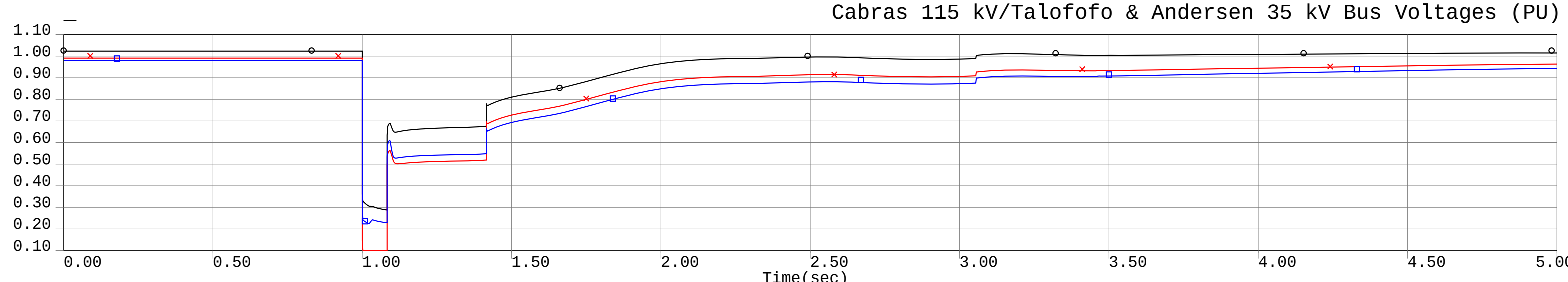
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

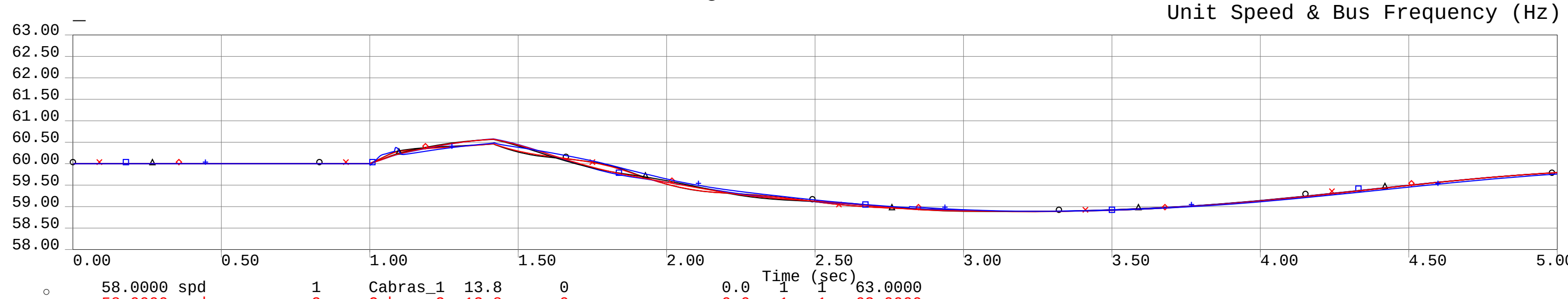
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

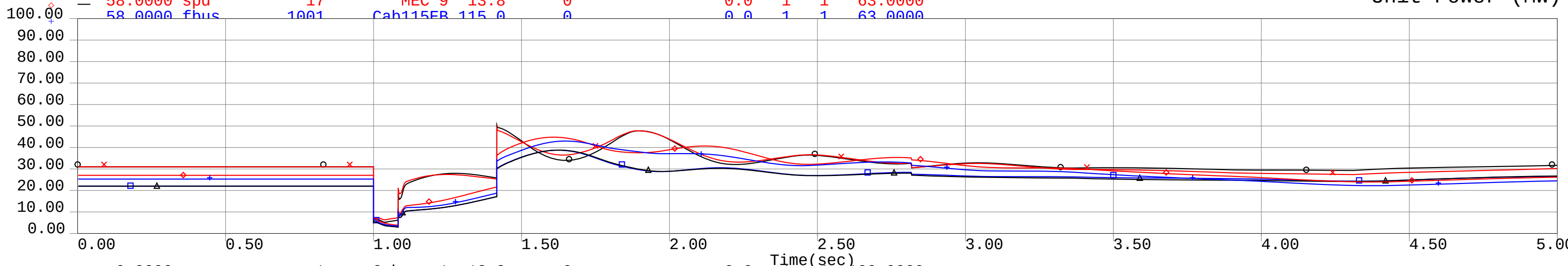
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



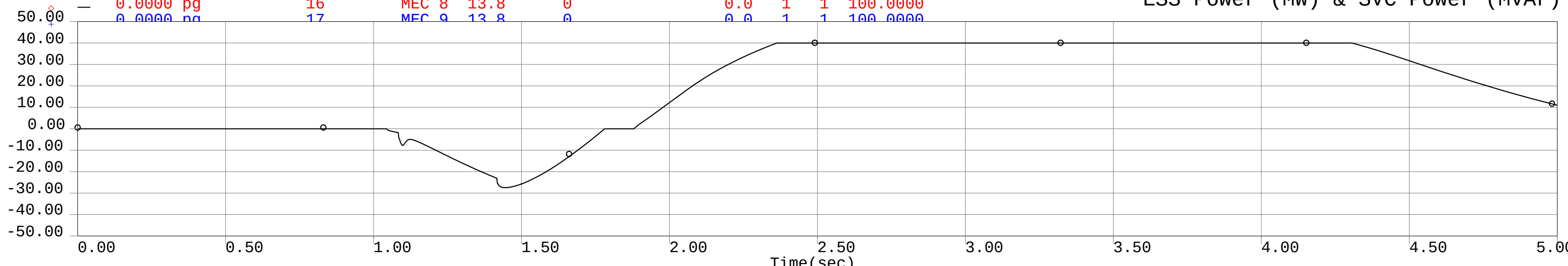
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



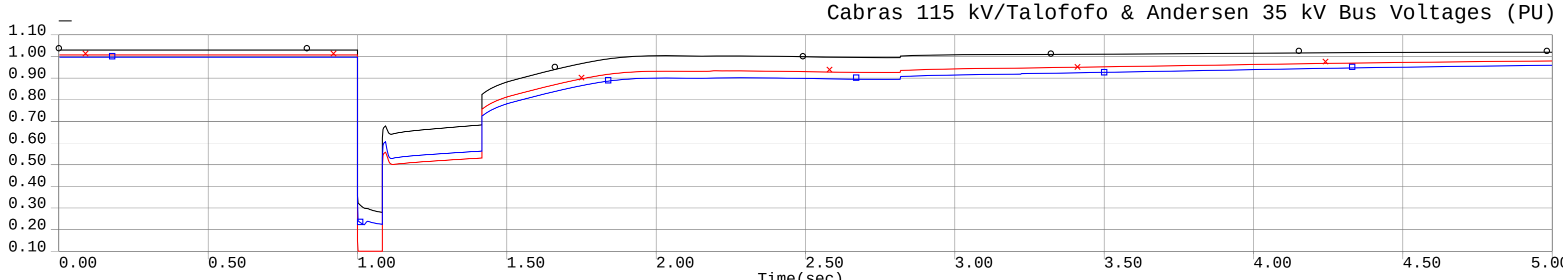
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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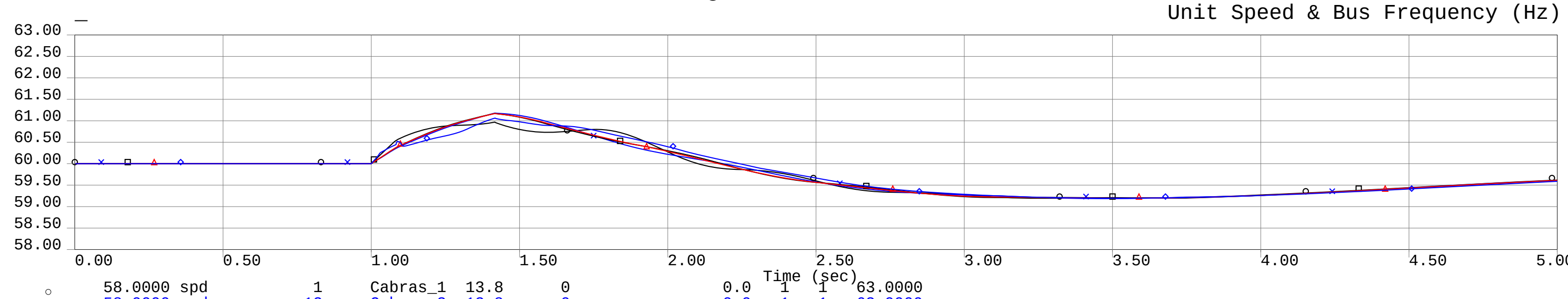
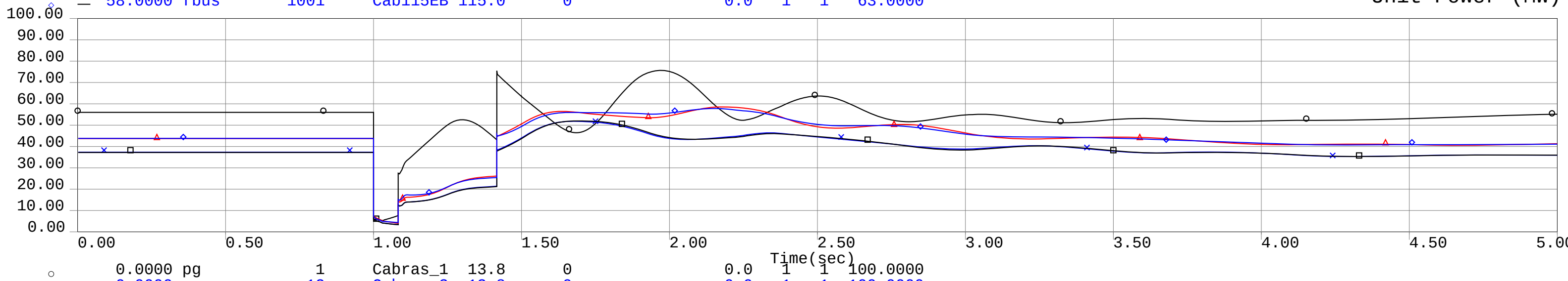
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



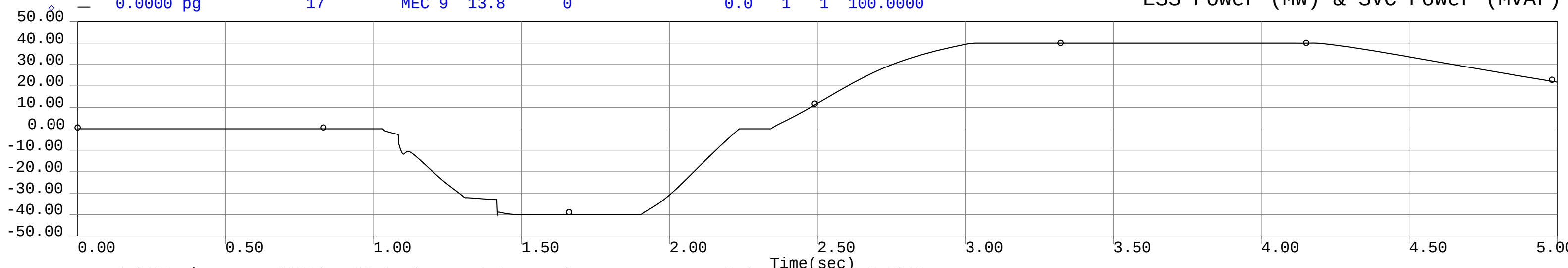
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



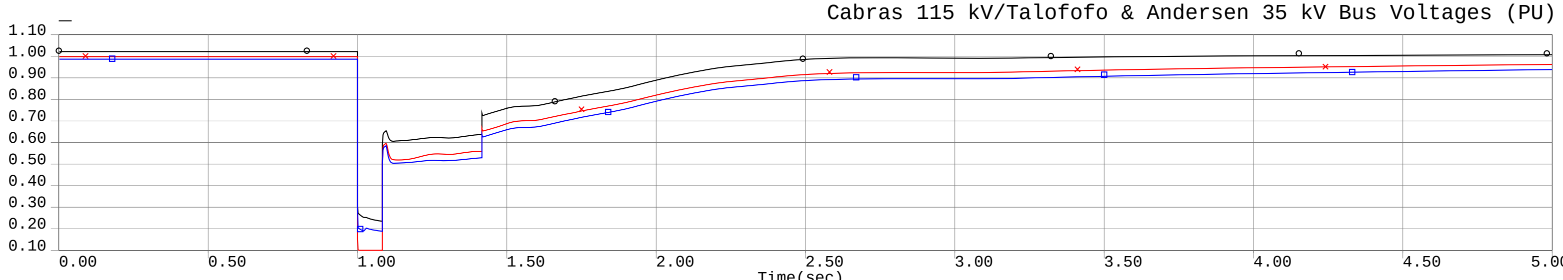
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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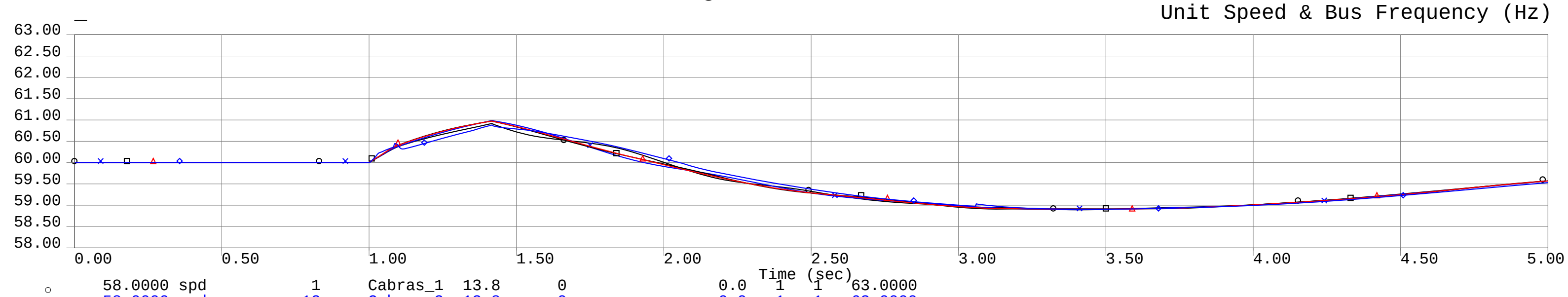
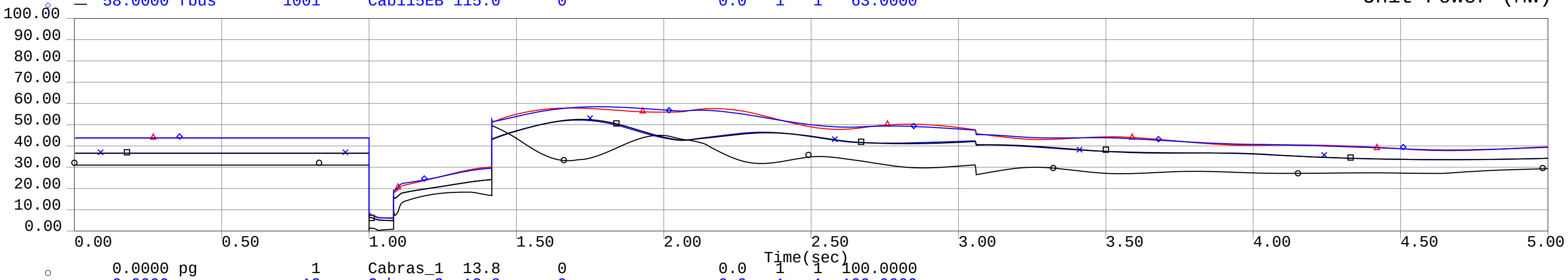
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



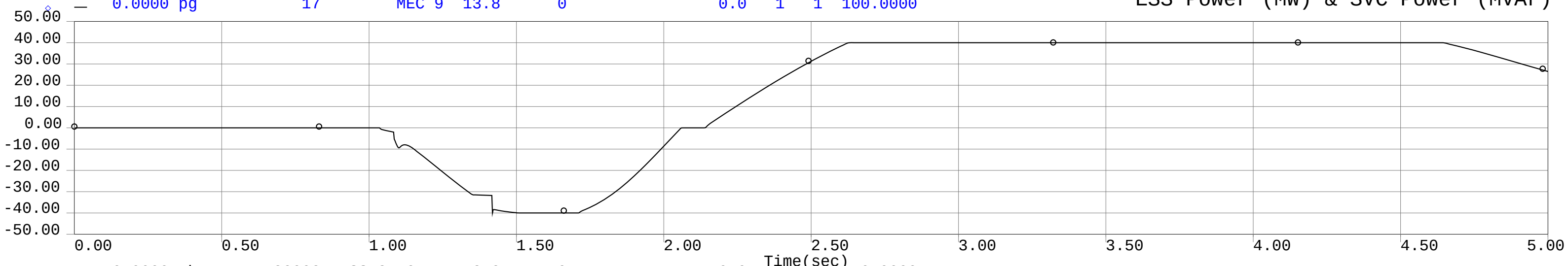
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



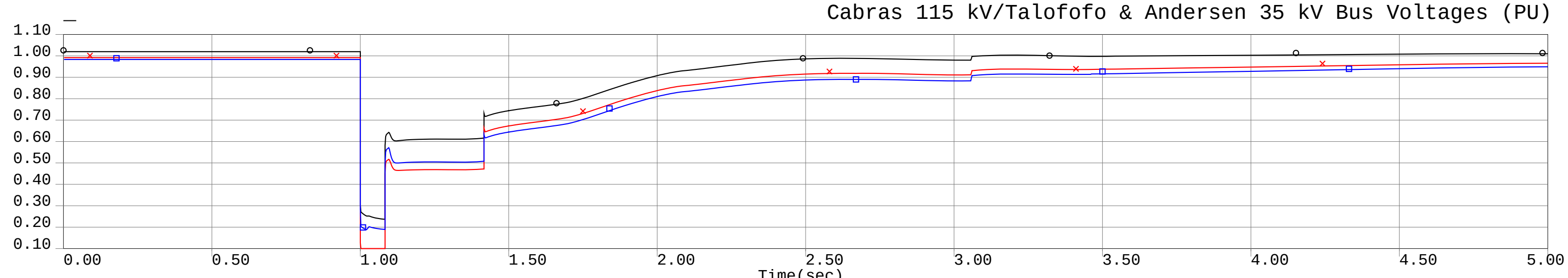
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2410_40a_lf14_fidvr.chf

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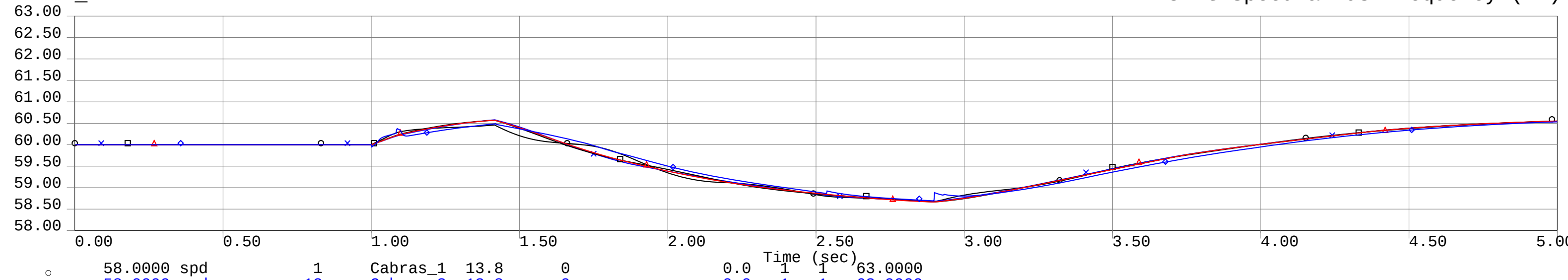
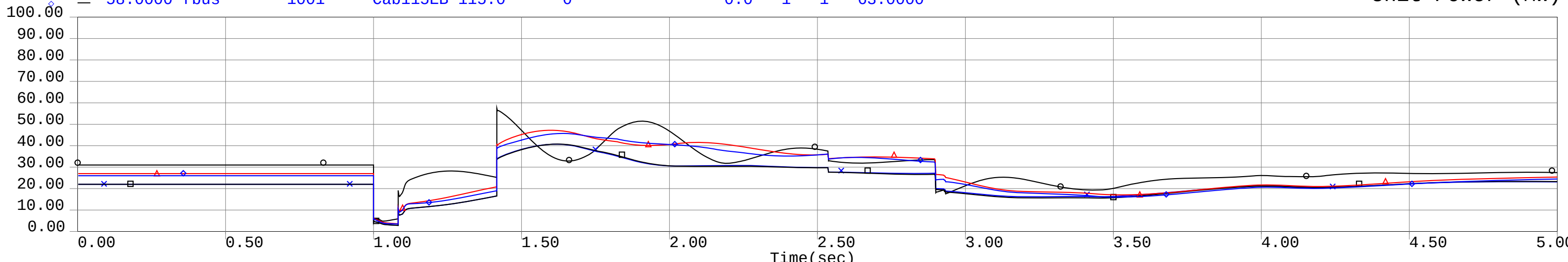
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



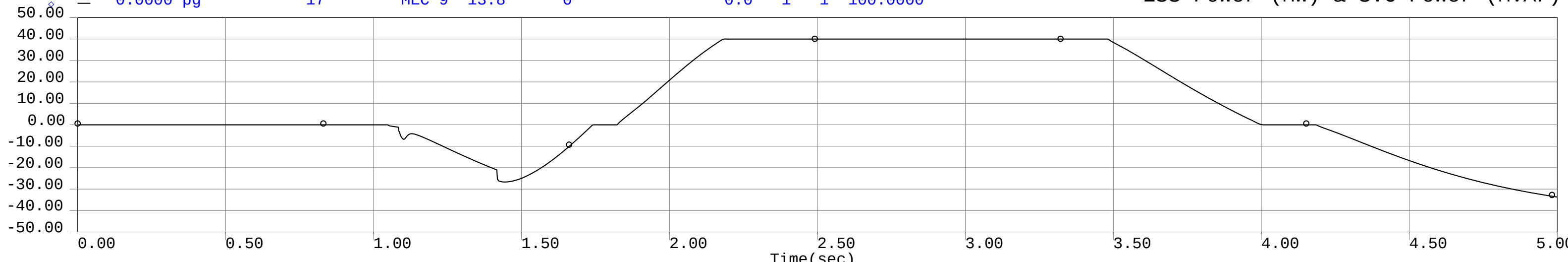
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



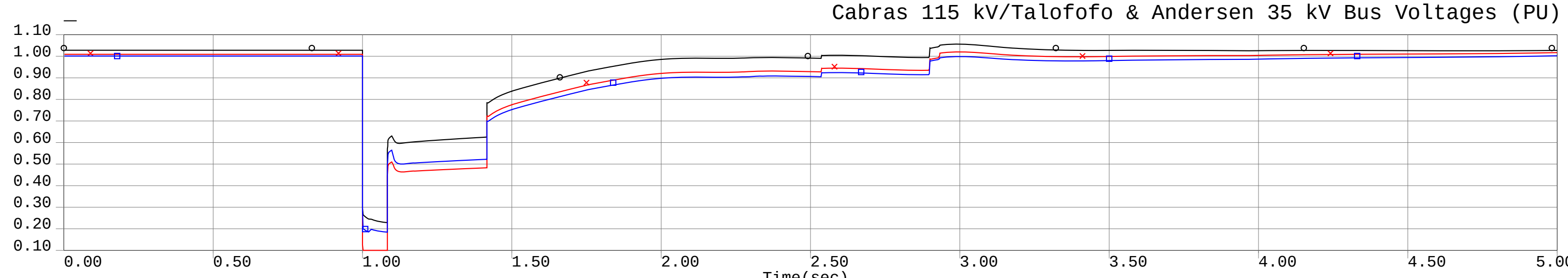
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

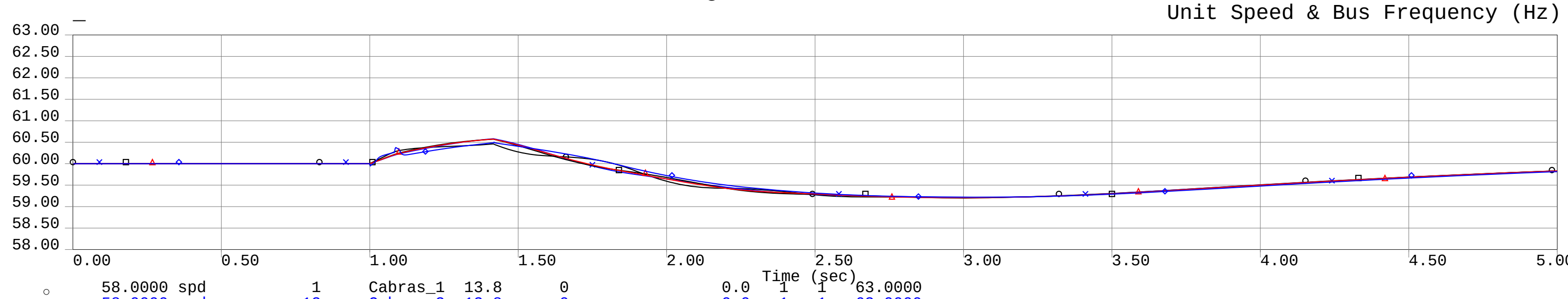
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

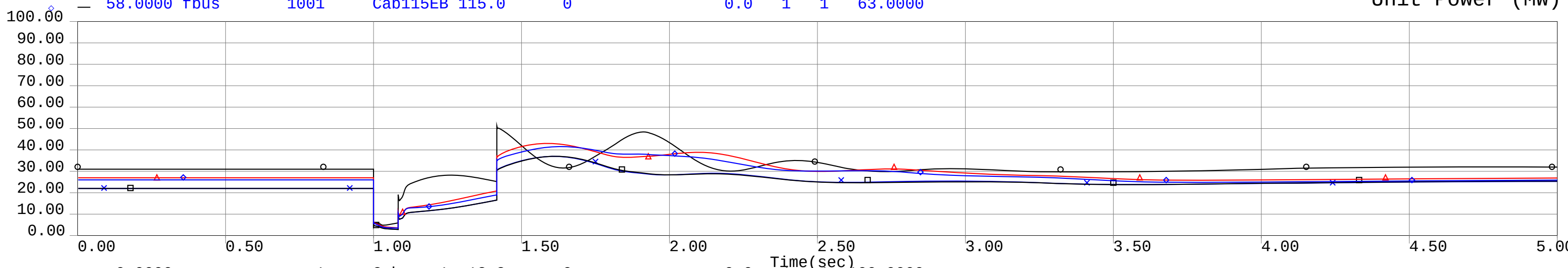
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



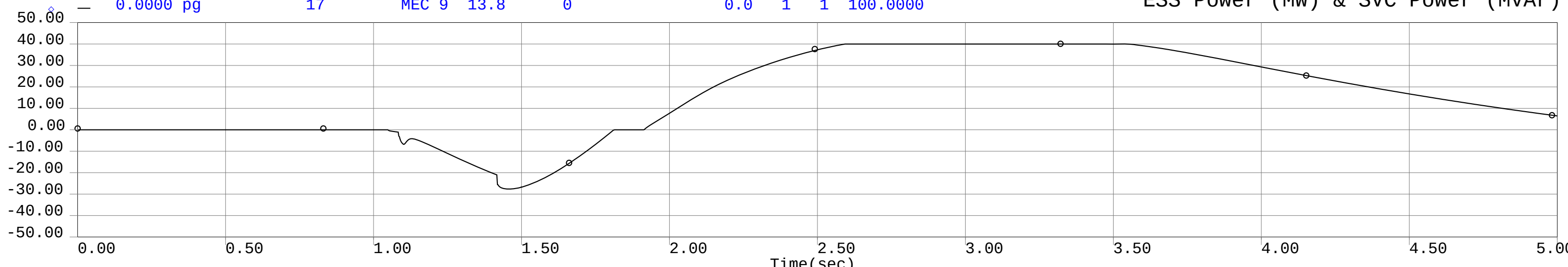
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



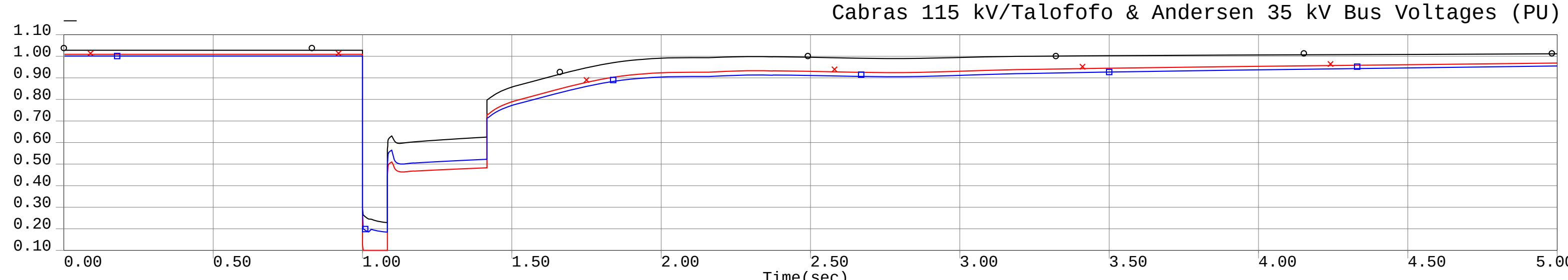
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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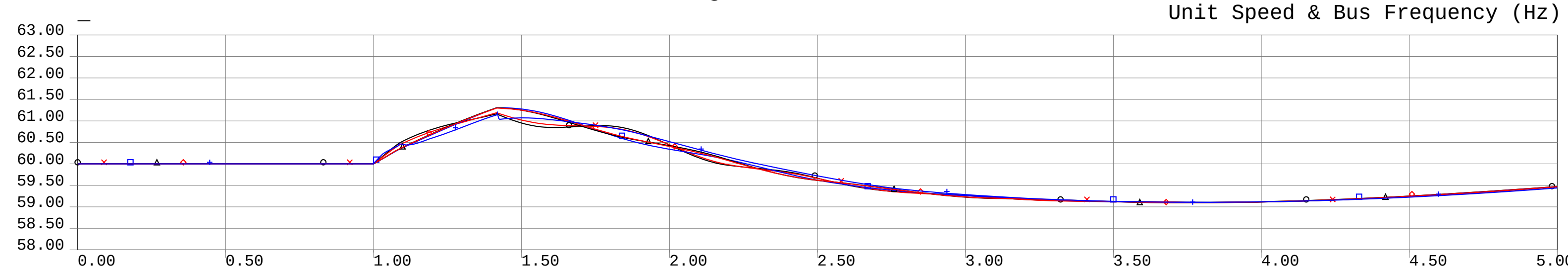
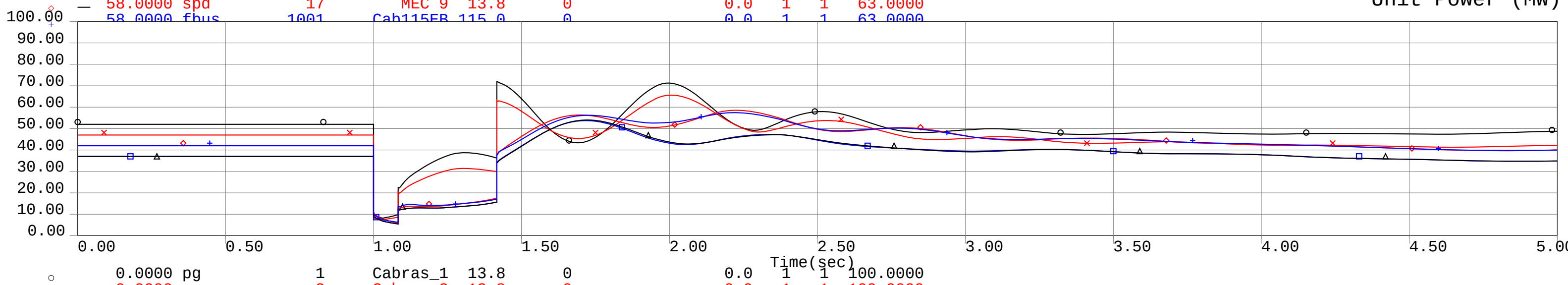
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



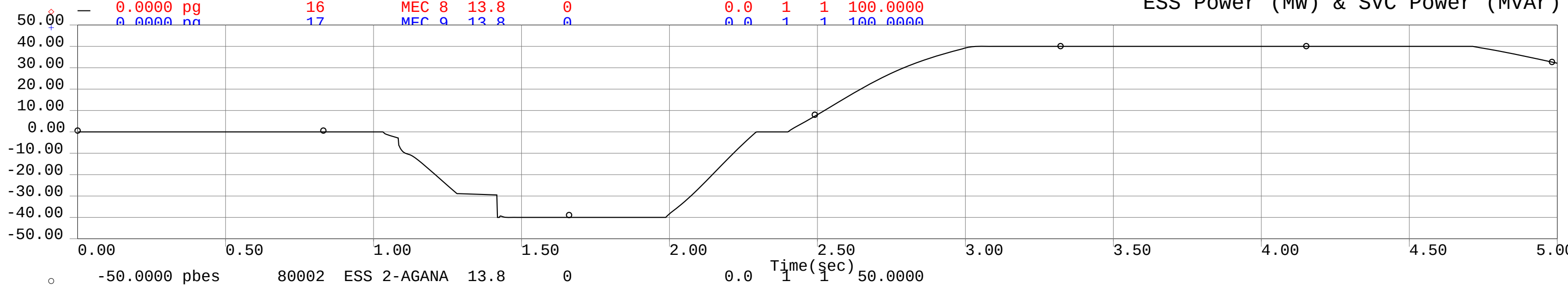
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



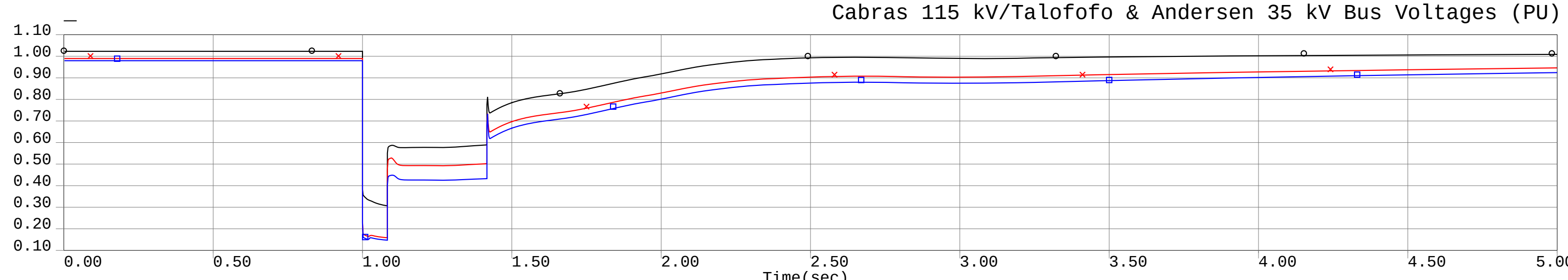
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1400_40a_lf15_fidvr.chf

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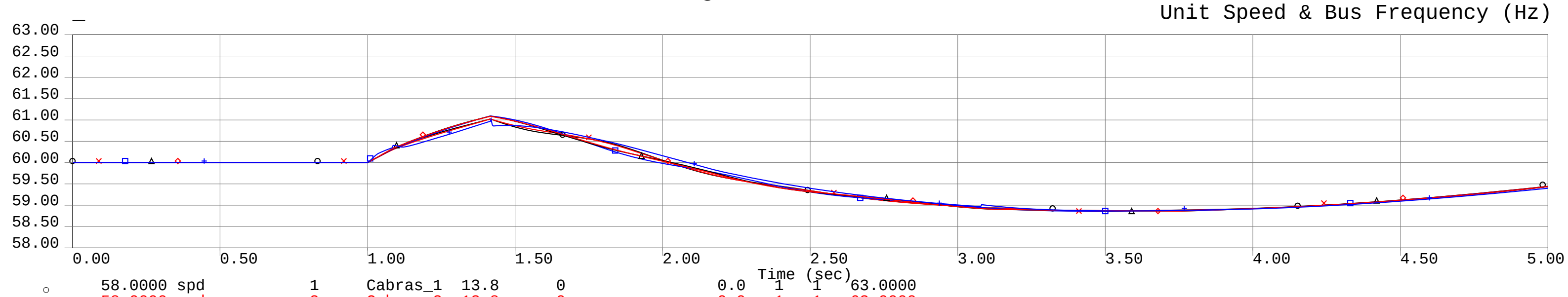
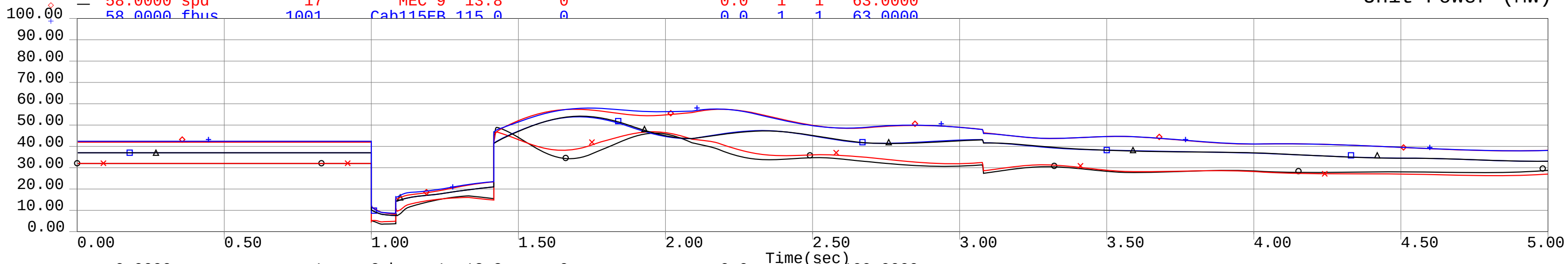
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



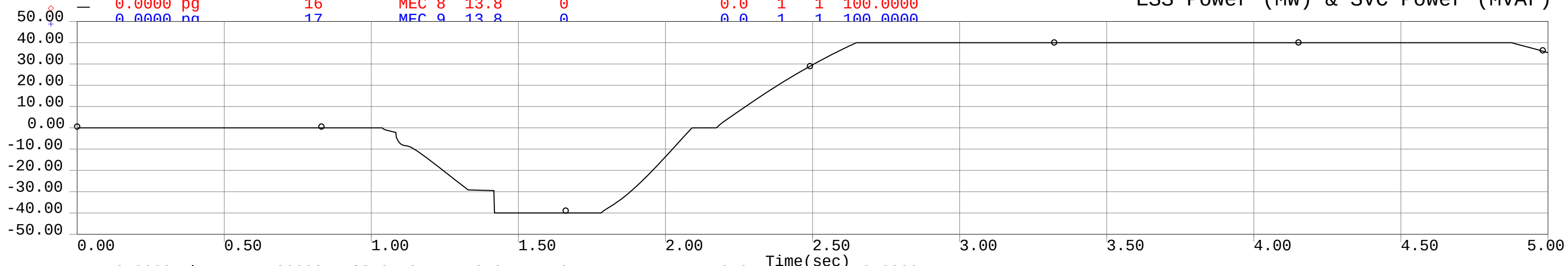
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



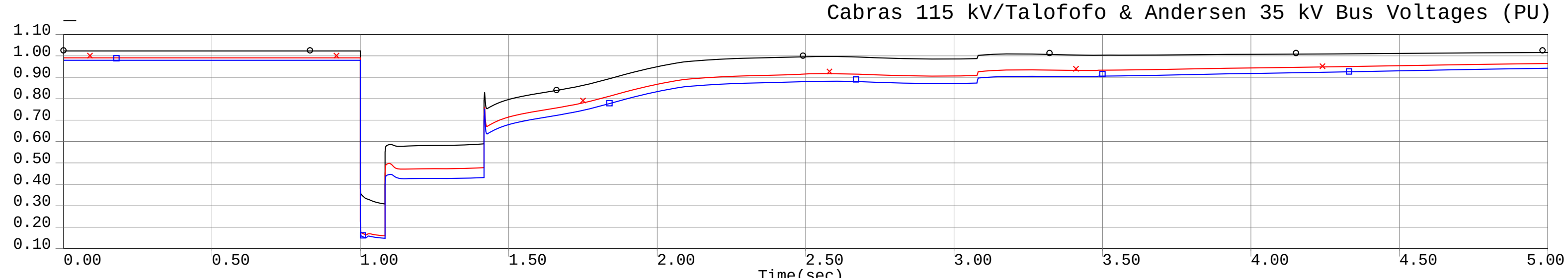
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1410_40a_lf15_fidvr.chf

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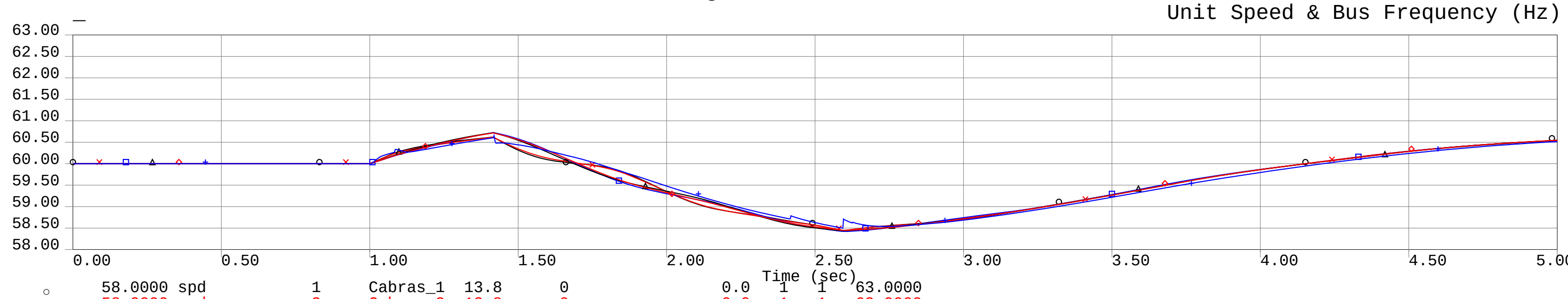
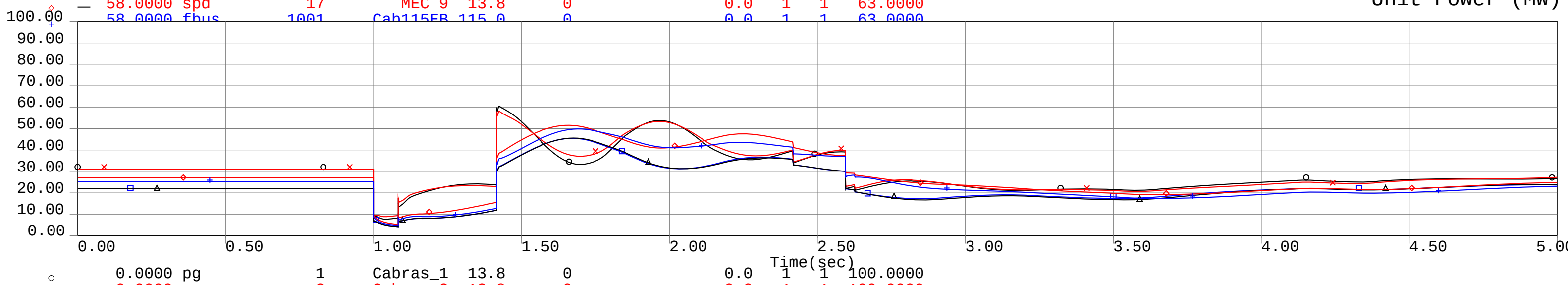
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



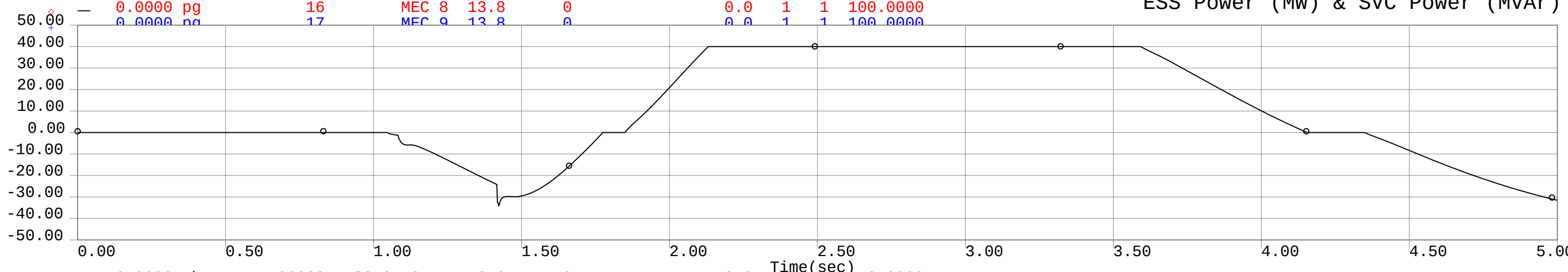
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



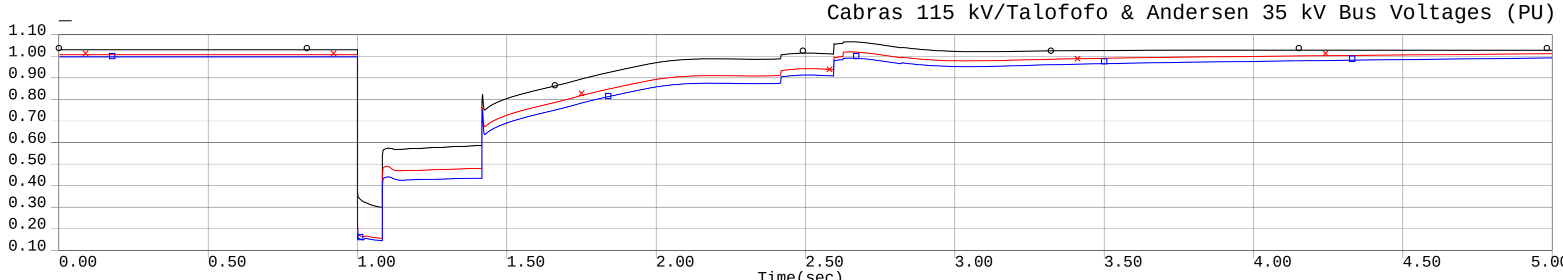
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

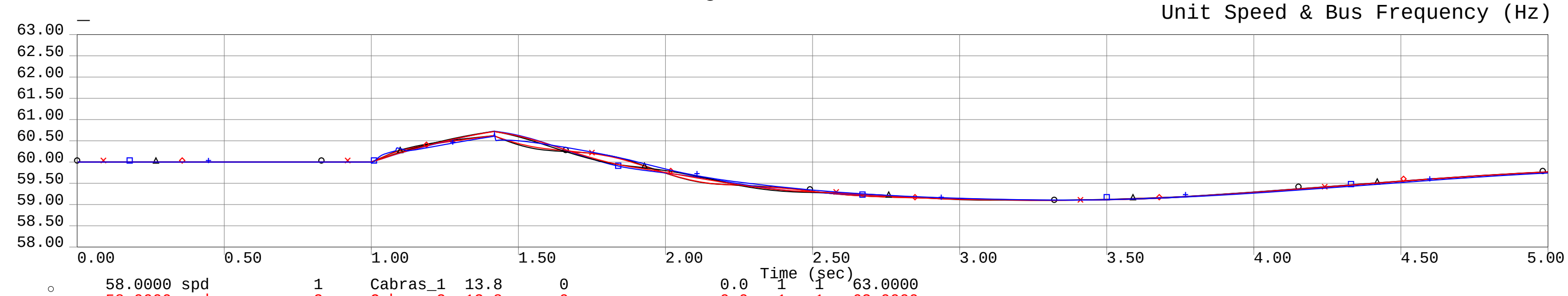
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



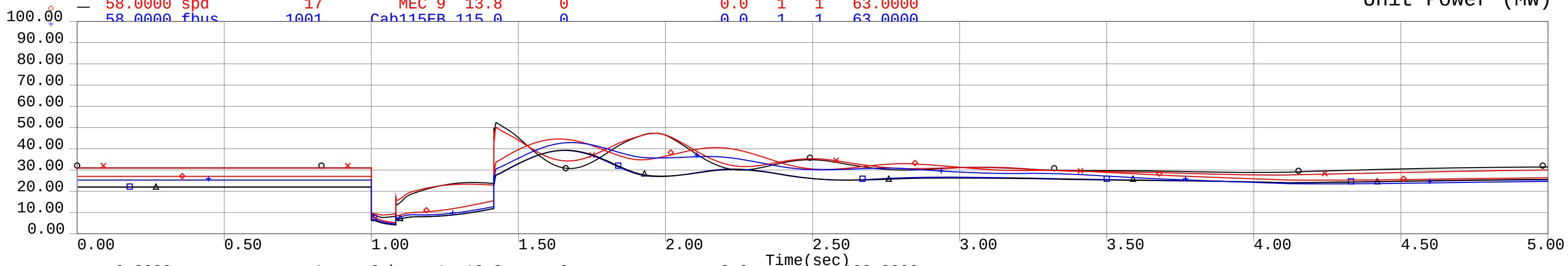
0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

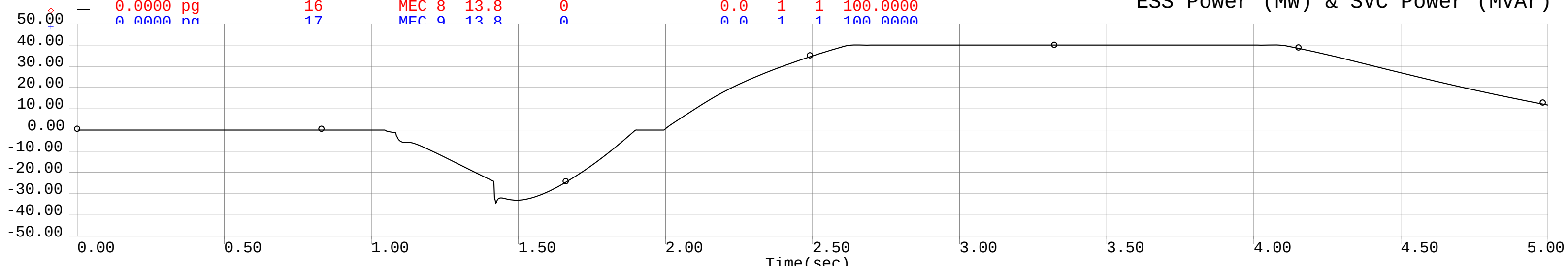
Unit Speed & Bus Frequency (Hz)



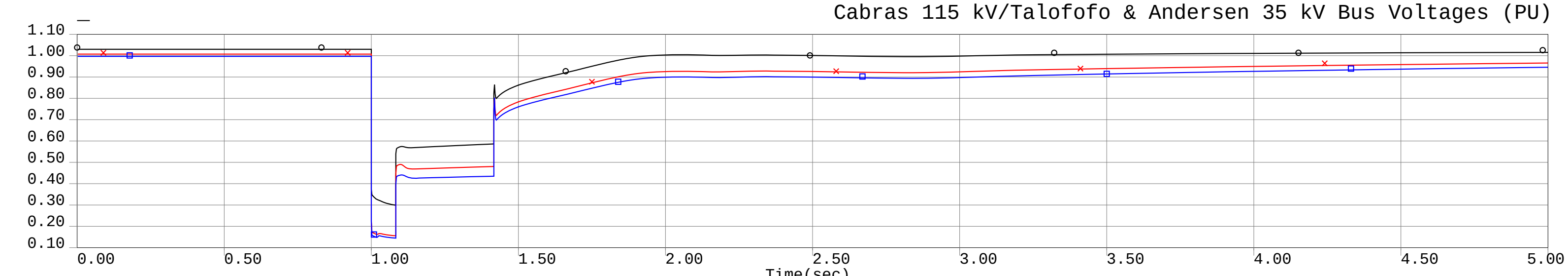
Unit Power (MW)



ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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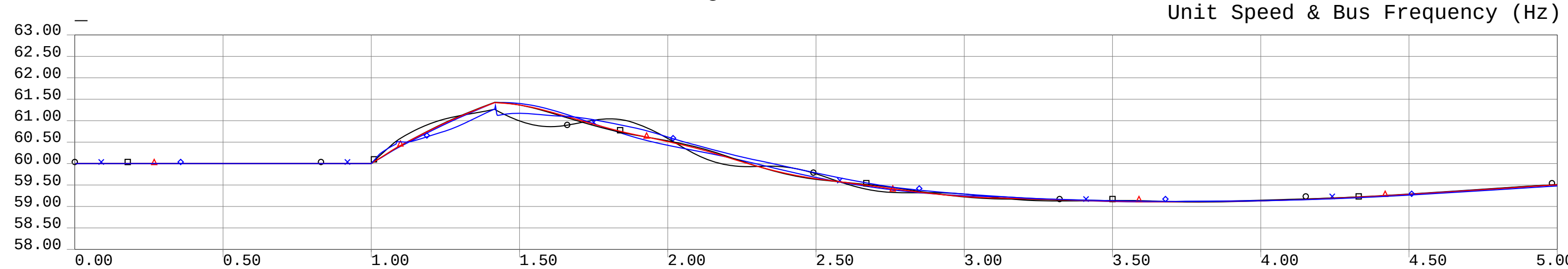
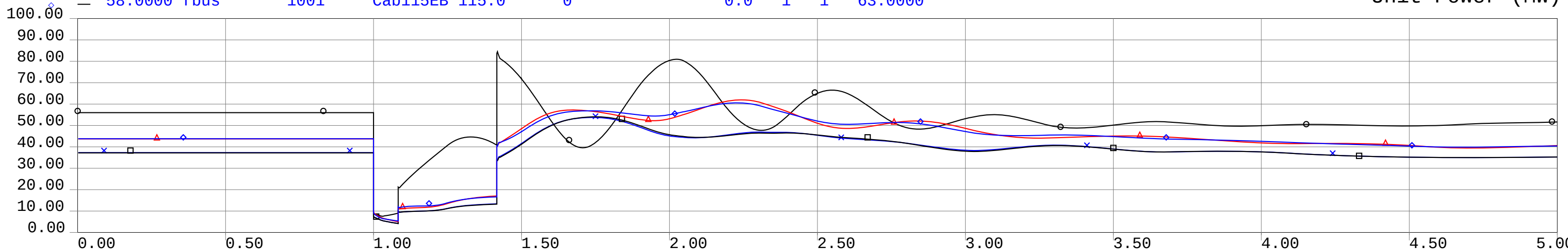
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



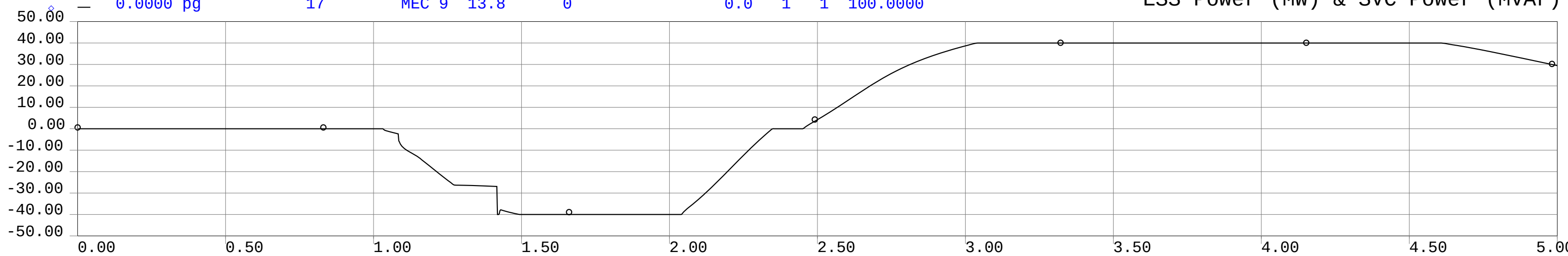
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



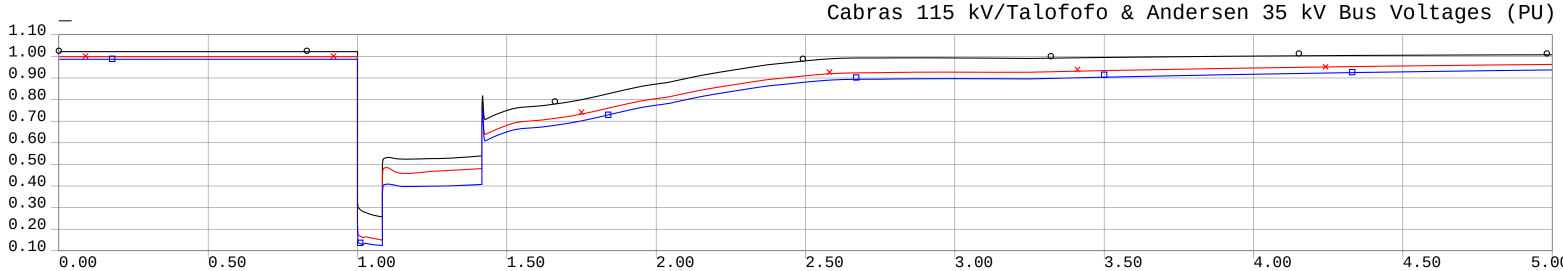
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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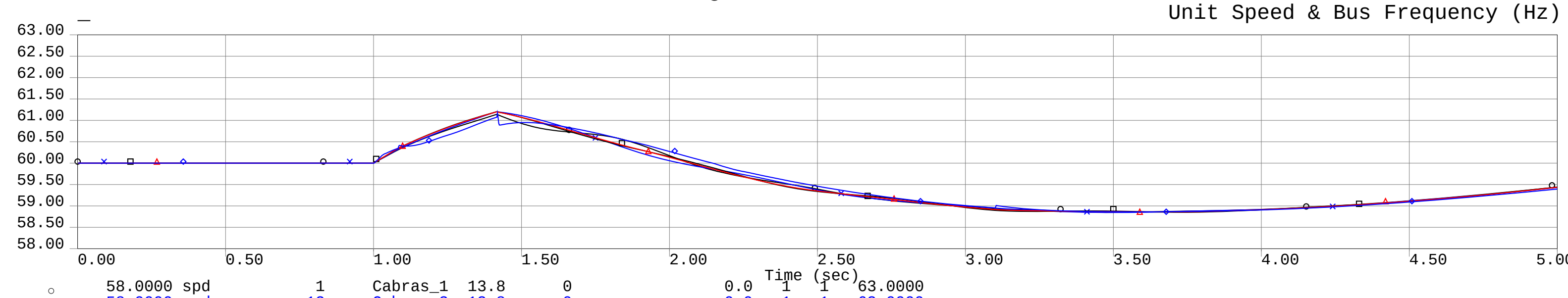
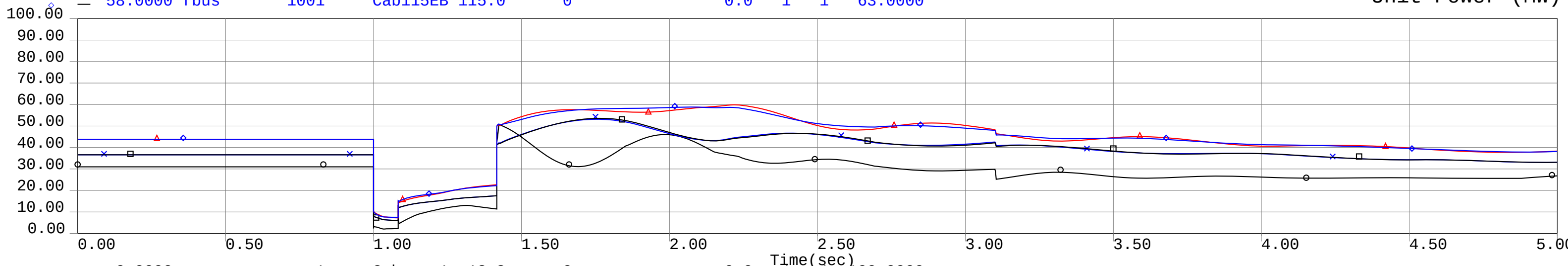
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



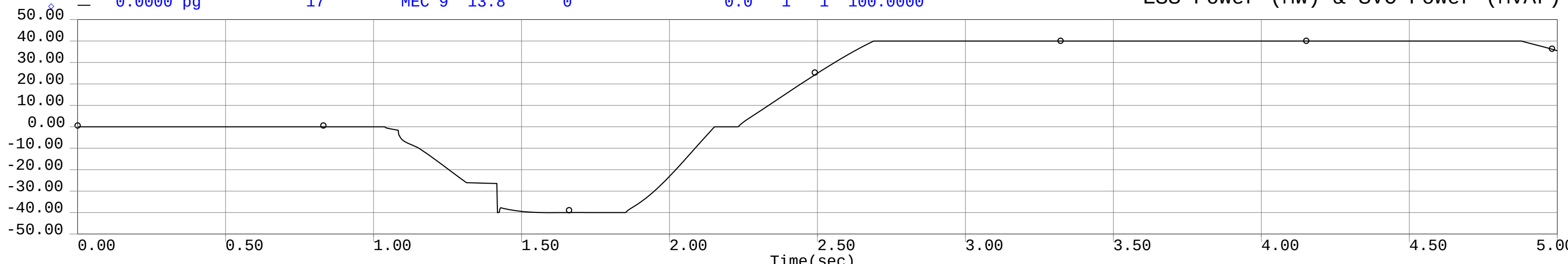
○ 58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
× 58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□ 58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△ 58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇ 58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



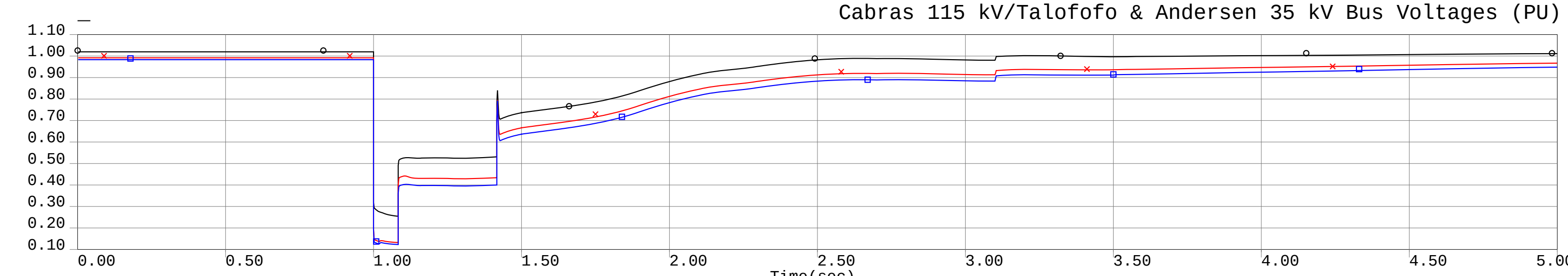
○ 0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
× 0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□ 0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△ 0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇ 0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○ -50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

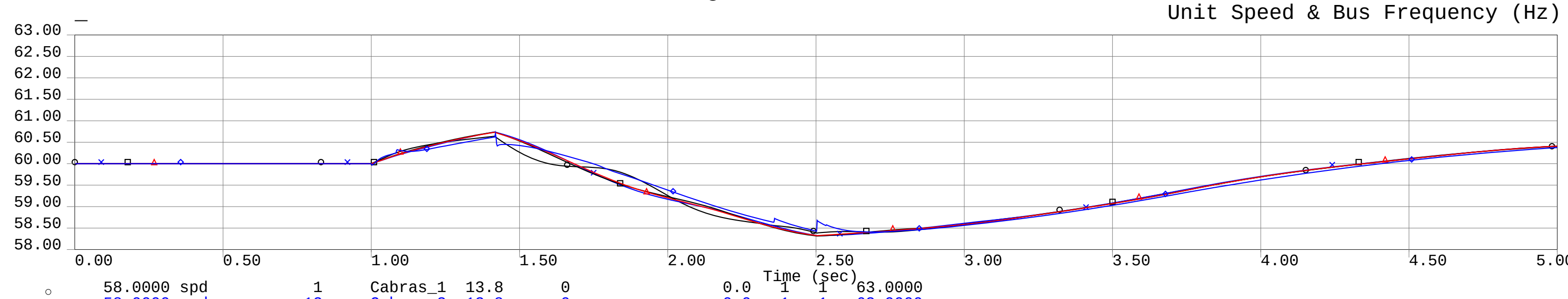
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
× 0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□ 0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

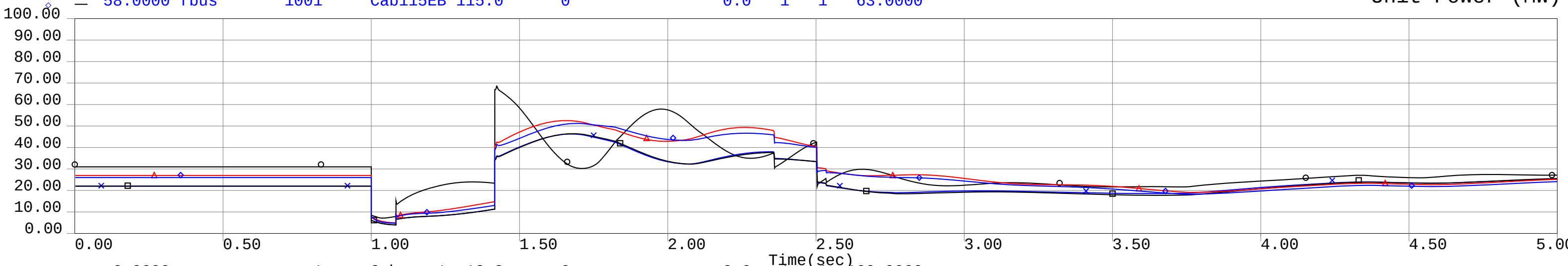
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



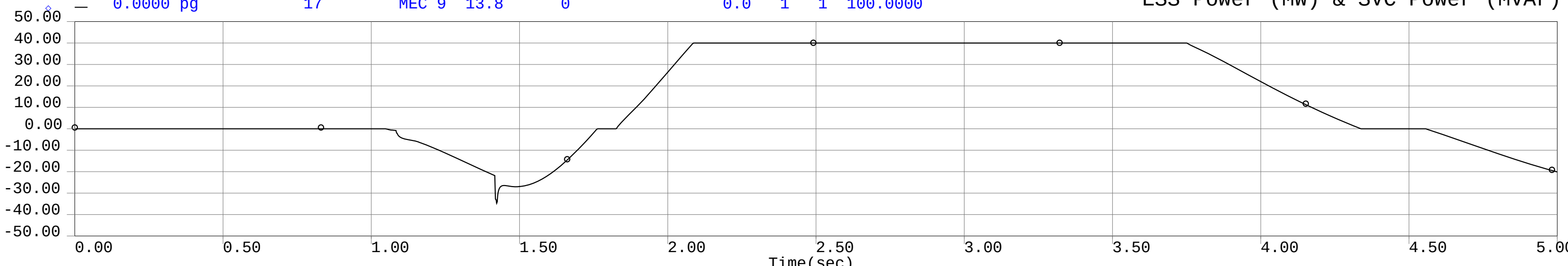
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



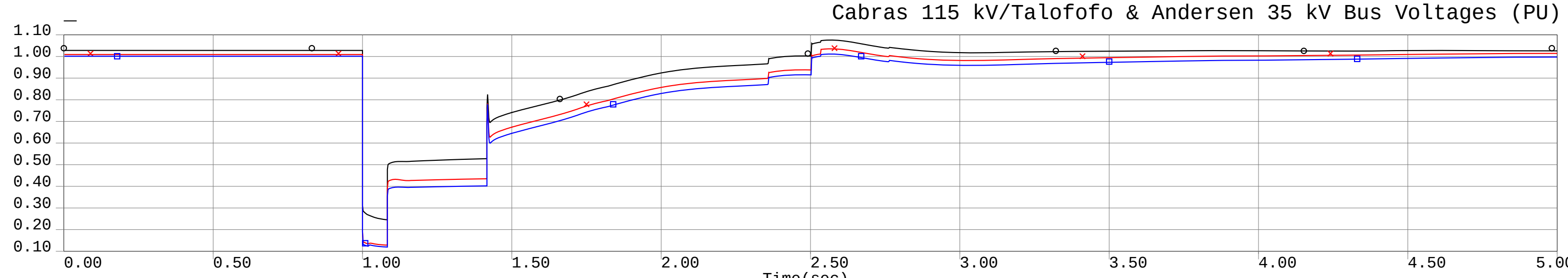
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

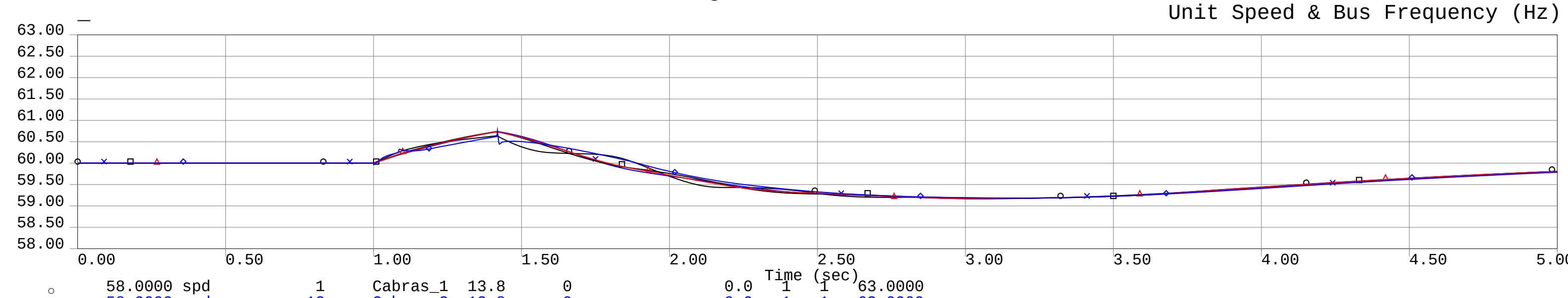
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

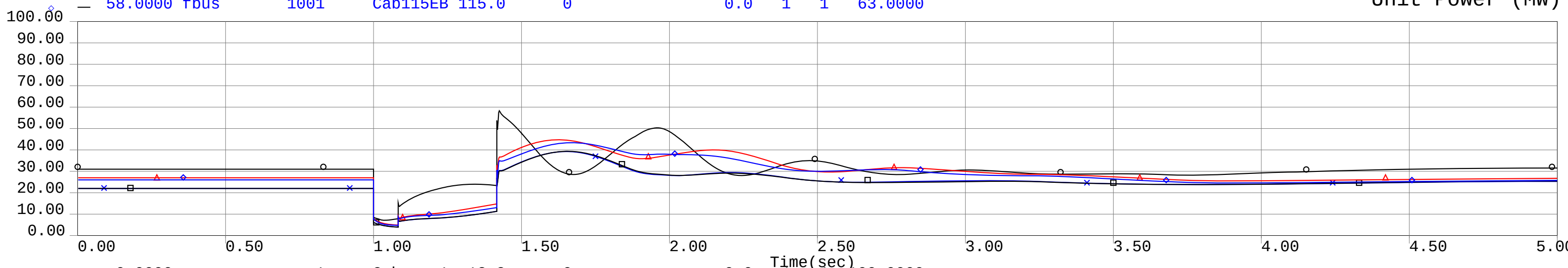
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



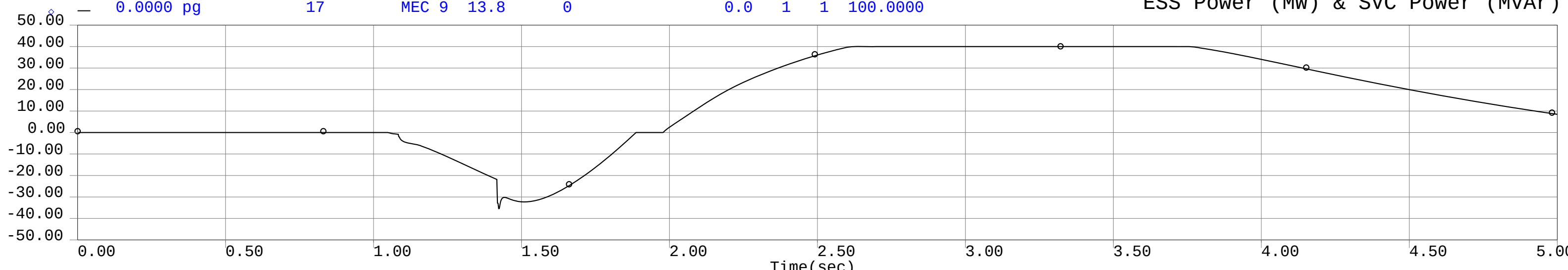
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



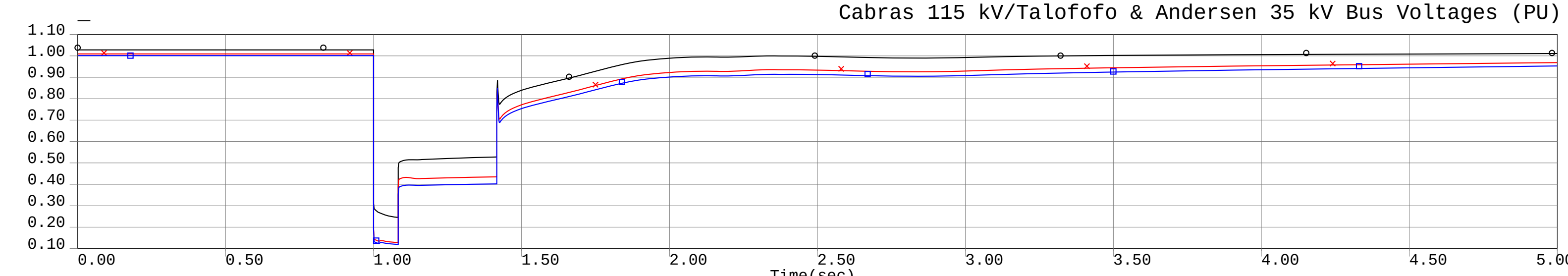
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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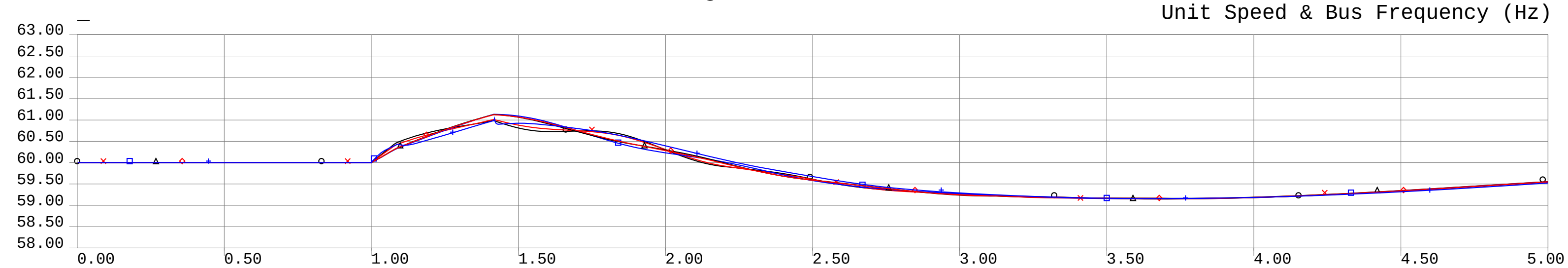
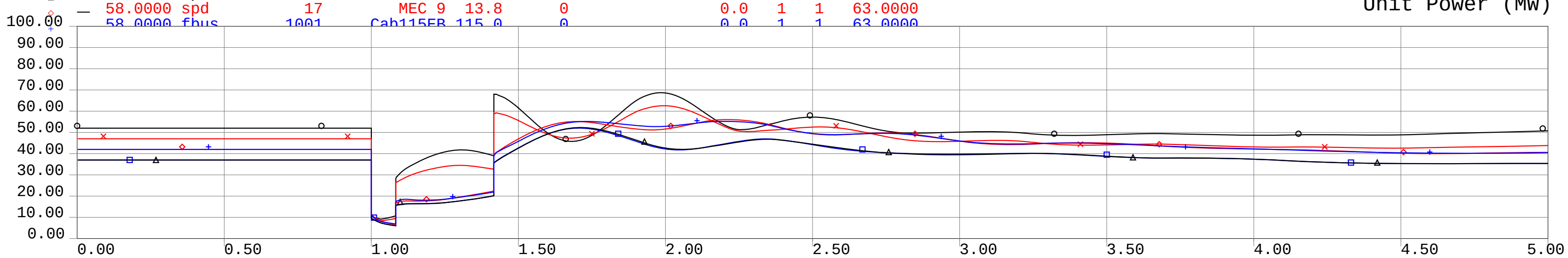
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



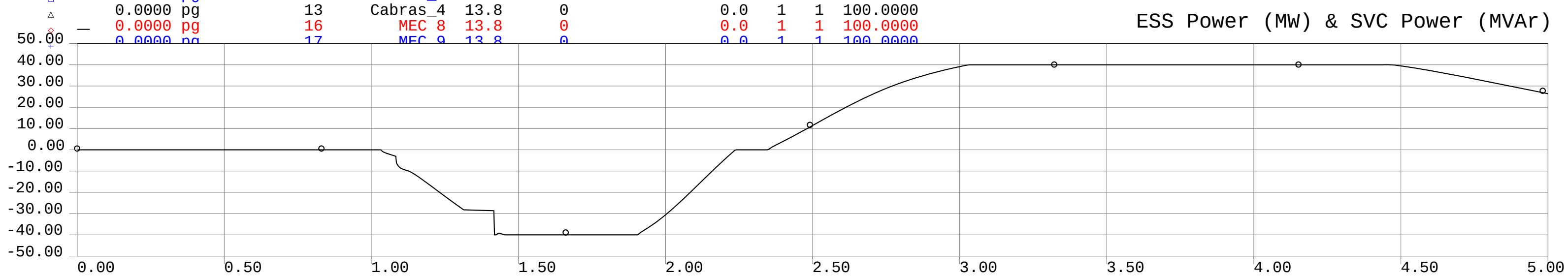

```
58.0000 spd       1   Cabras_1  13.8   0    0.0  1  1  63.0000
58.0000 spd       2   Cabras_2  13.8   0    0.0  1  1  63.0000
58.0000 spd      12   Cabras_3  13.8   0    0.0  1  1  63.0000
58.0000 spd      16      MEC 8  13.8   0    0.0  1  1  63.0000
58.0000 spd      17      MEC 9  13.8   0    0.0  1  1  63.0000
58.0000 fbus   1001  Cab115EB 115.0    0    0.0  1  1  63.0000
```

Unit Power (MW)




```
0.0000 pg       1   Cabras_1  13.8   0    0.0  1  1  100.0000
0.0000 pg       2   Cabras_2  13.8   0    0.0  1  1  100.0000
0.0000 pg      12   Cabras_3  13.8   0    0.0  1  1  100.0000
0.0000 pg      13   Cabras_4  13.8   0    0.0  1  1  100.0000
0.0000 pg      16      MEC 8  13.8   0    0.0  1  1  100.0000
0.0000 pg      17      MEC 9  13.8   0    0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
-50.0000 pbes   80002  ESS 2-AGANA  13.8   0    0.0  1  1  50.0000
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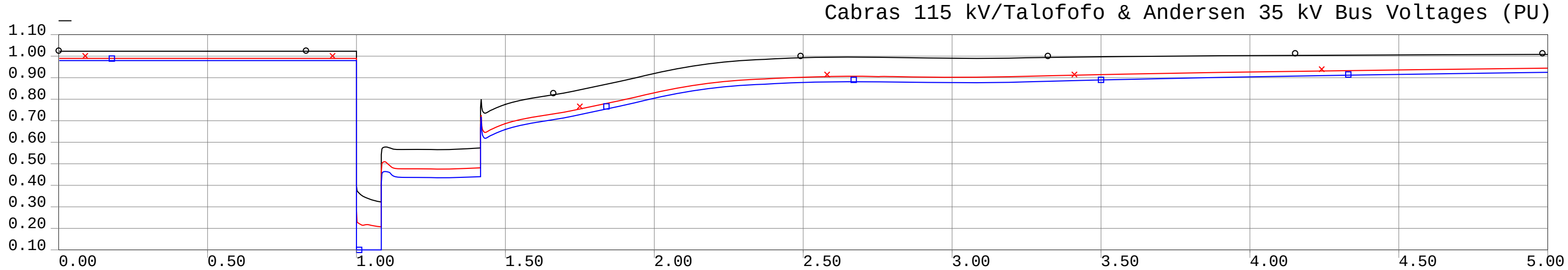
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.1000 vbus   1001  Cab115EB 115.0   0    0.0  1  1  1.1000
0.1000 vbus   2003    Tal345  34.5   0    0.0  1  1  1.1000
0.1000 vbus   2210  And345B1  34.5   0    0.0  1  1  1.1000
```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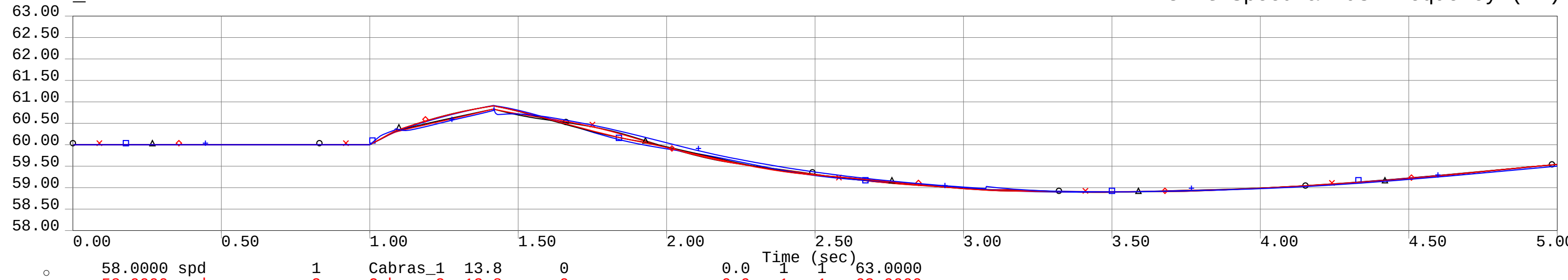
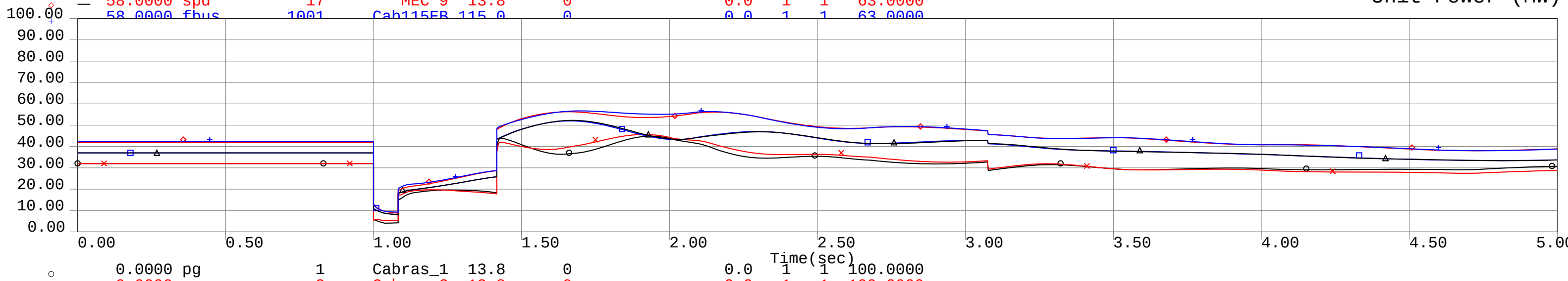
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



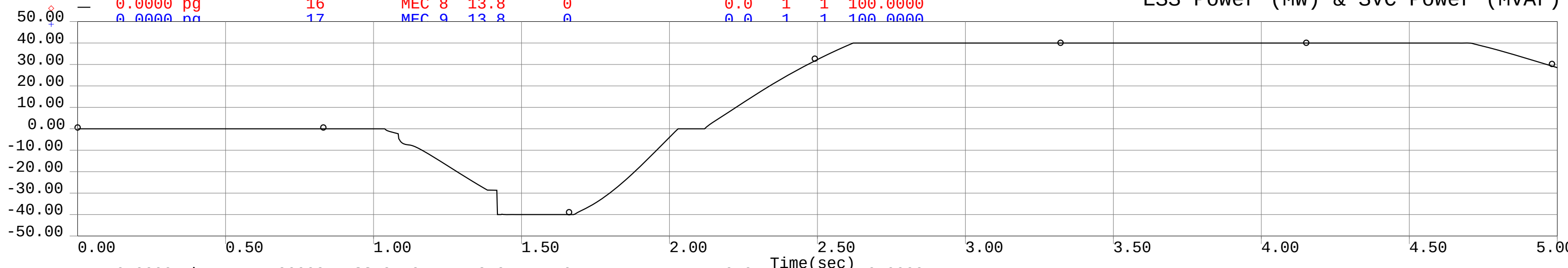
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



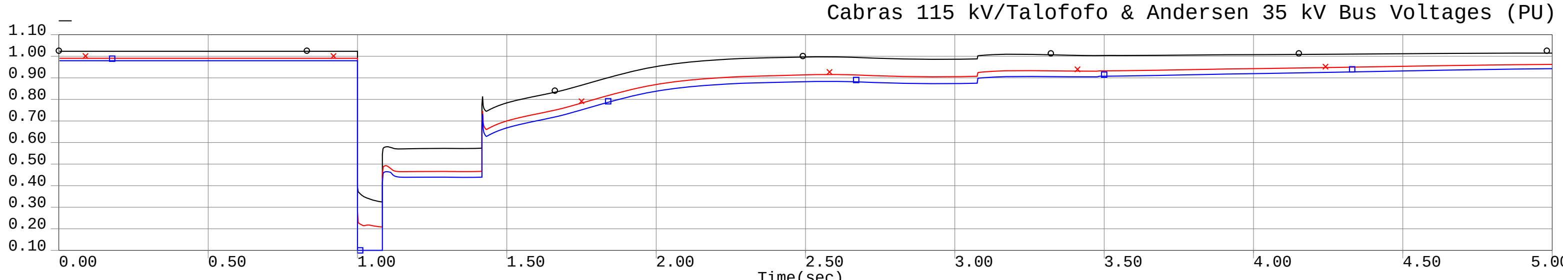
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

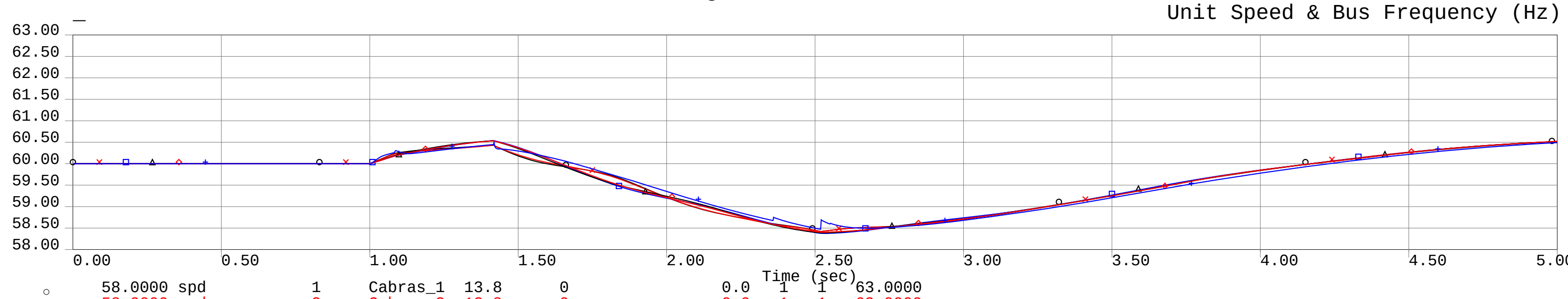
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

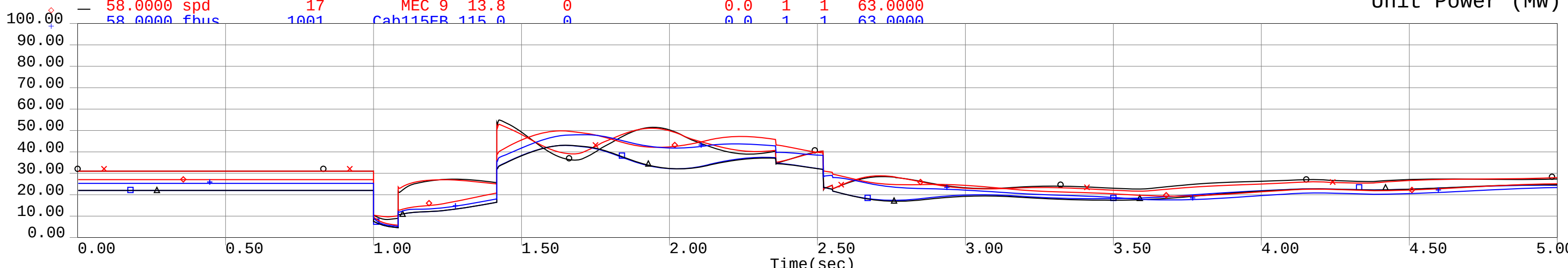
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



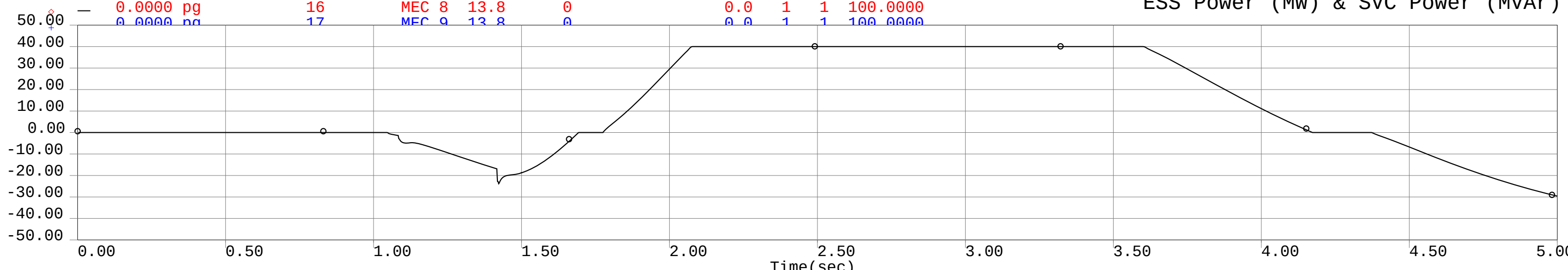

```
○  58.0000 spd       1  Cabras_1  13.8   0   0.0  1  1  63.0000
×  58.0000 spd       2  Cabras_2  13.8   0   0.0  1  1  63.0000
□  58.0000 spd      12  Cabras_3  13.8   0   0.0  1  1  63.0000
△  58.0000 spd      16     MEC 8  13.8   0   0.0  1  1  63.0000
◇  58.0000 spd      17     MEC 9  13.8   0   0.0  1  1  63.0000
+  58.0000 fbus   1001  Cab115EB 115.0   0   0.0  1  1  63.0000
```

Unit Power (MW)



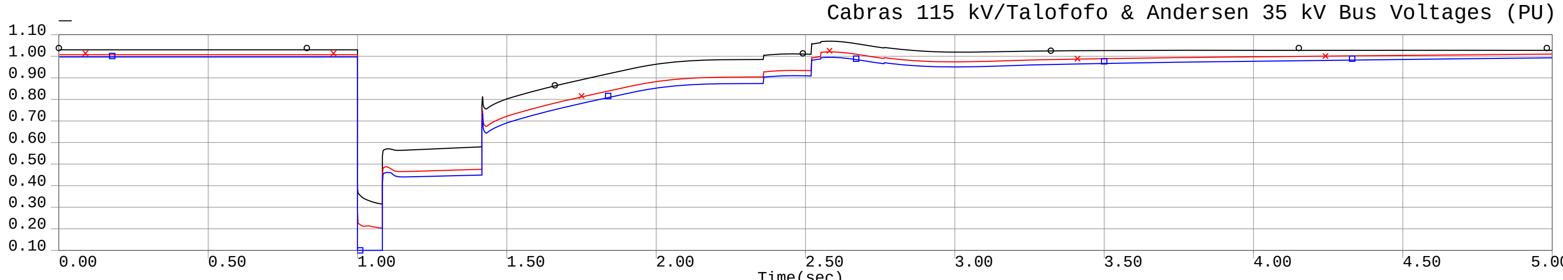

```
○  0.0000 pg        1  Cabras_1  13.8   0   0.0  1  1  100.0000
×  0.0000 pg        2  Cabras_2  13.8   0   0.0  1  1  100.0000
□  0.0000 pg       12  Cabras_3  13.8   0   0.0  1  1  100.0000
△  0.0000 pg       13  Cabras_4  13.8   0   0.0  1  1  100.0000
◇  0.0000 pg       16     MEC 8  13.8   0   0.0  1  1  100.0000
+  0.0000 pg       17     MEC 9  13.8   0   0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
○  -50.0000 pbes   80002  ESS 2-AGANA  13.8   0   0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○  0.1000 vbus   1001  Cab115EB 115.0   0   0.0  1  1  1.1000
×  0.1000 vbus   2003    Tal345  34.5   0   0.0  1  1  1.1000
□  0.1000 vbus   2210  And345B1  34.5   0   0.0  1  1  1.1000
```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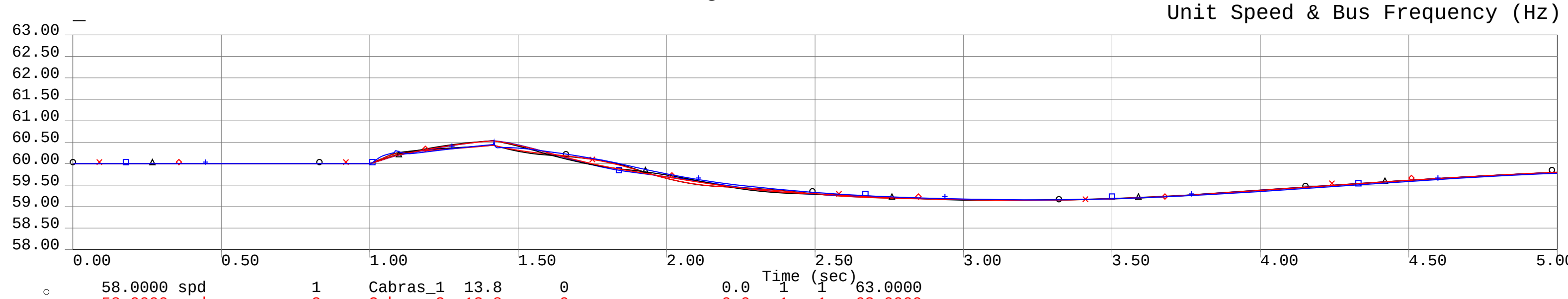
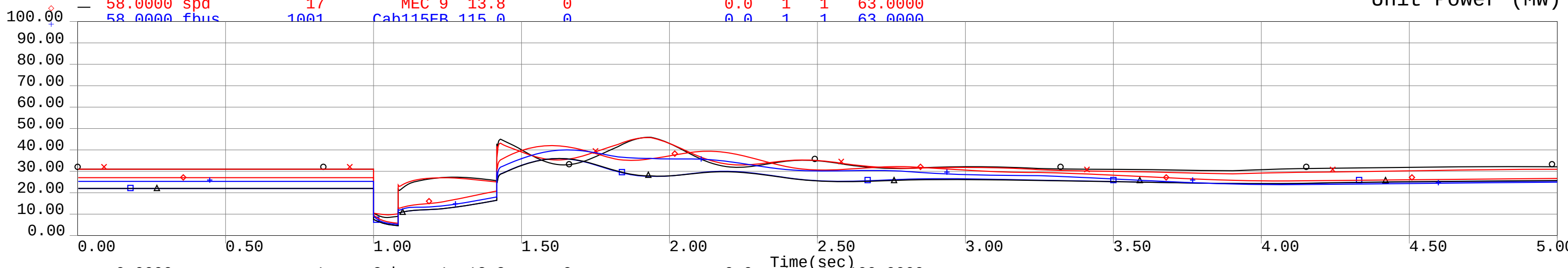
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



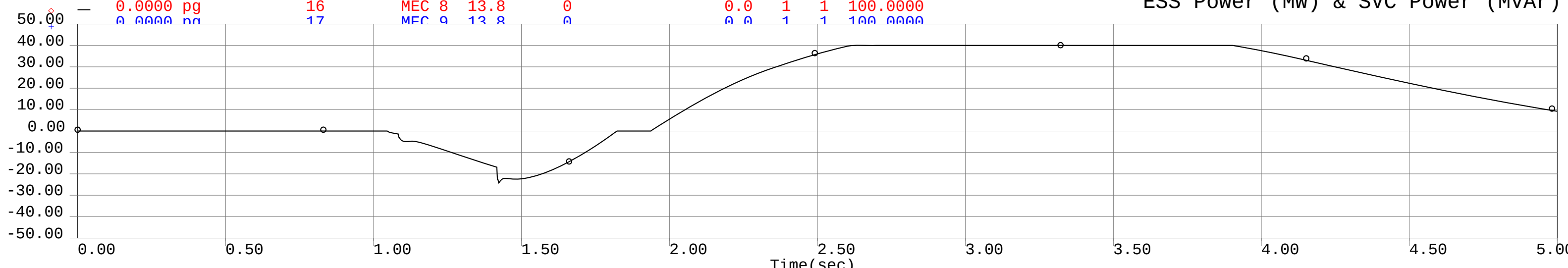
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



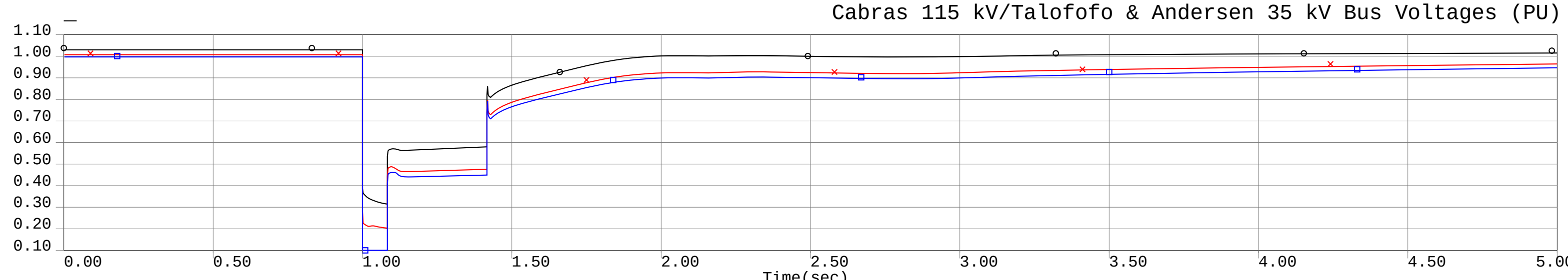
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1420_40a_lf16_fidvr_pv.chf

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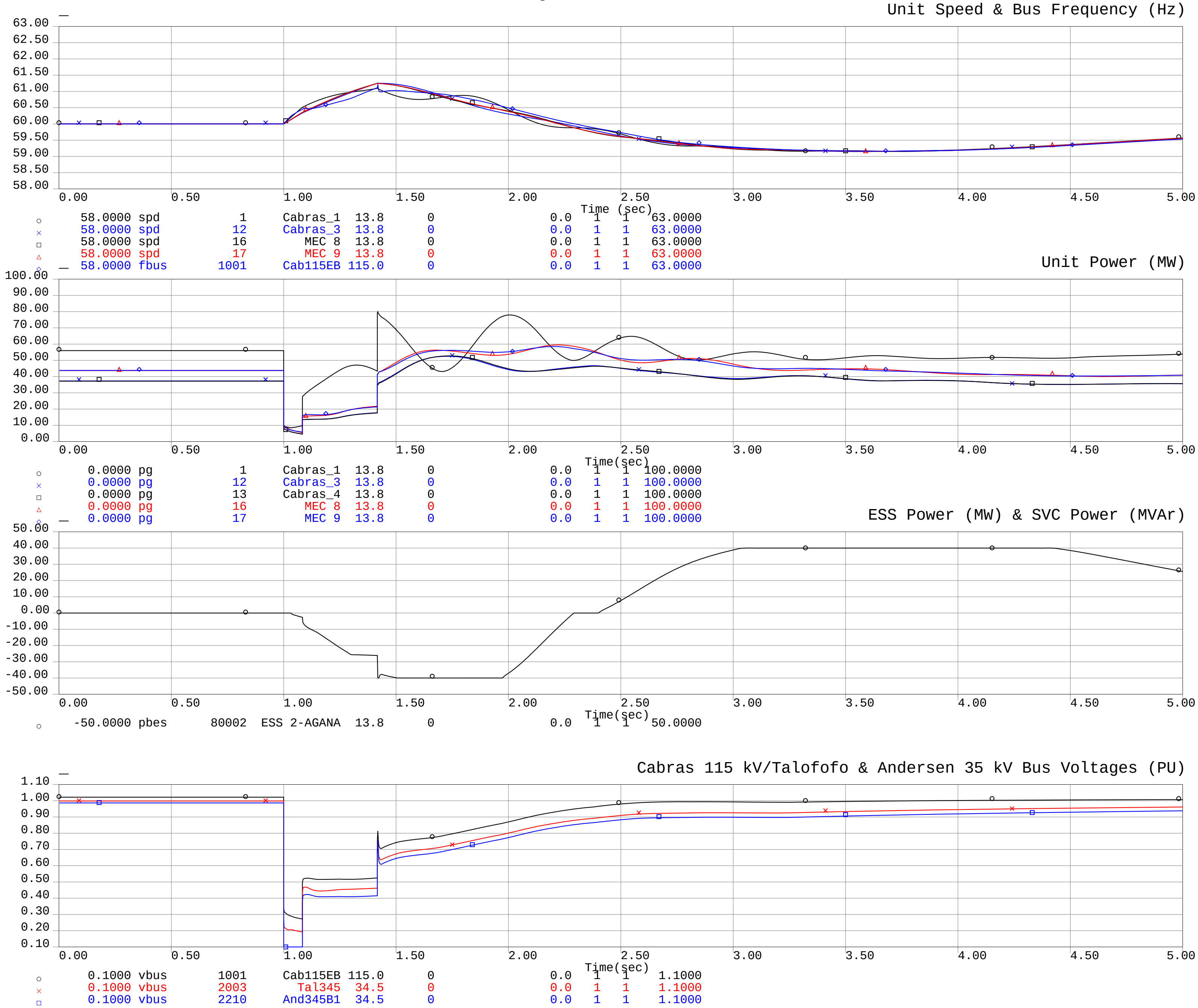
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/2400_40a_lf16_fidvr.chf
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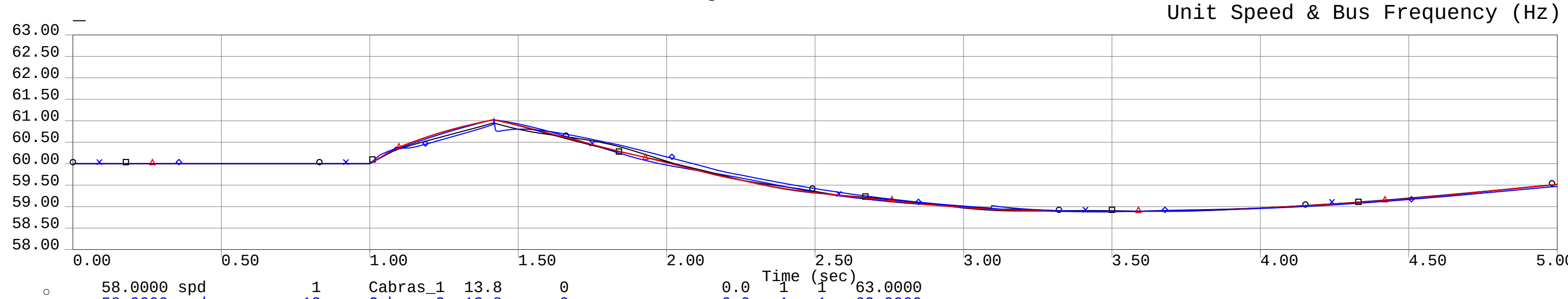
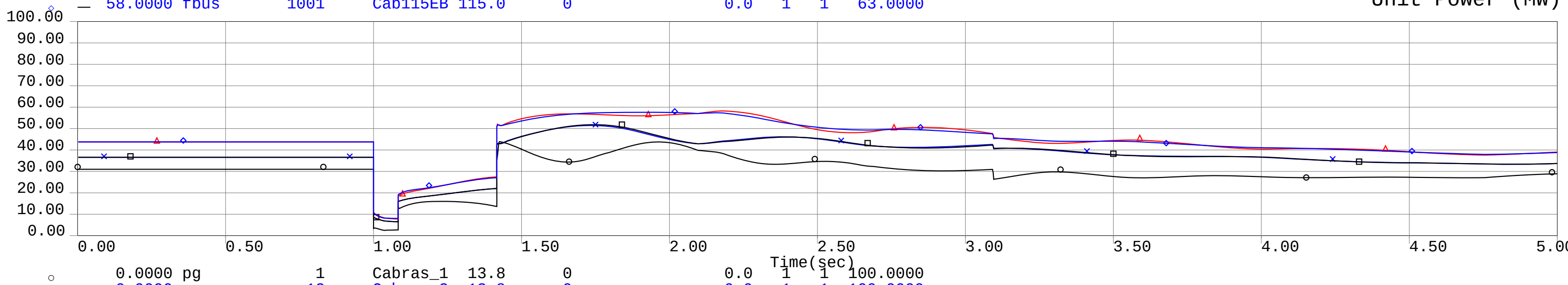
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



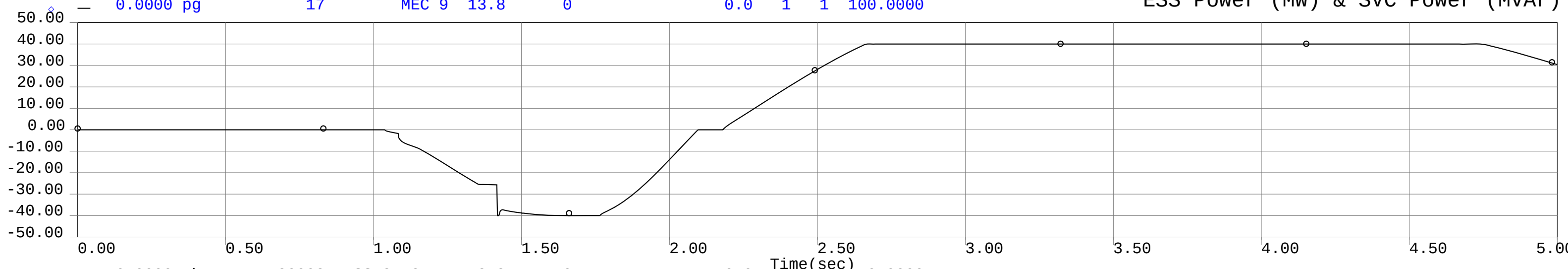
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



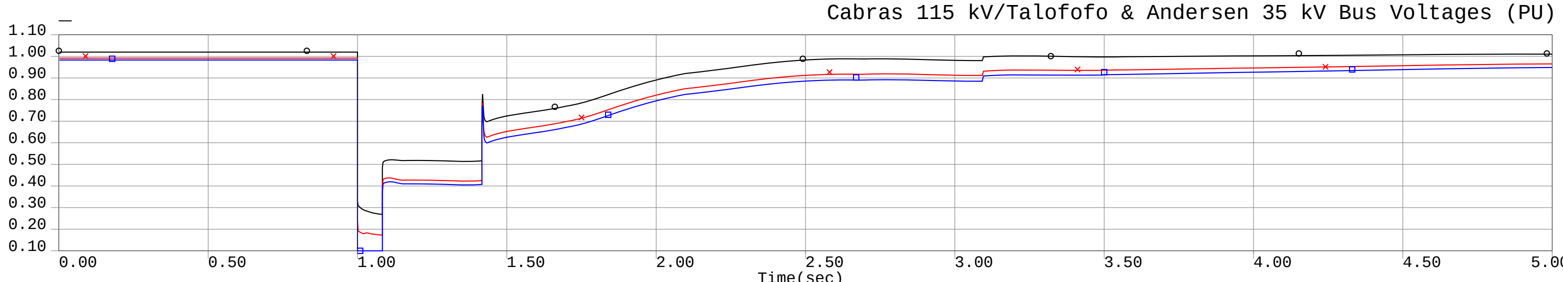
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

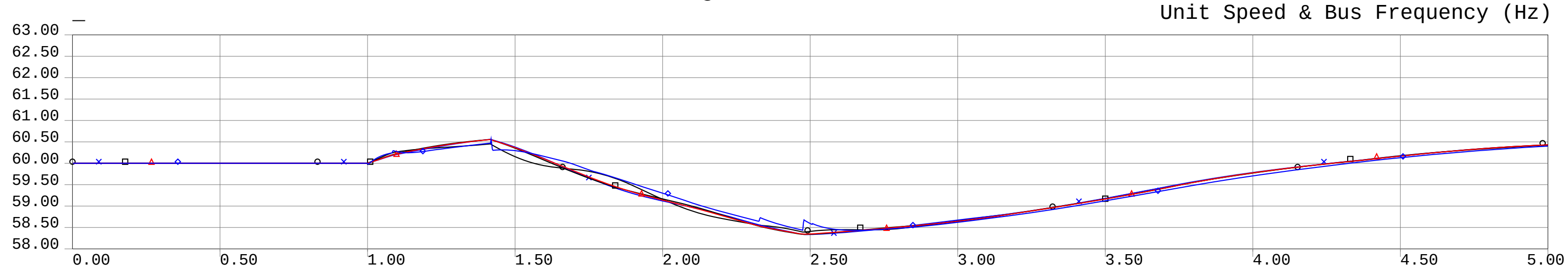
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

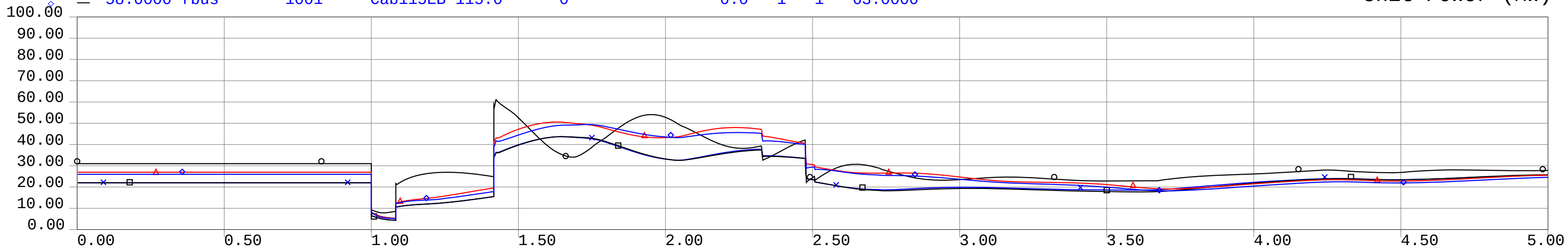
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



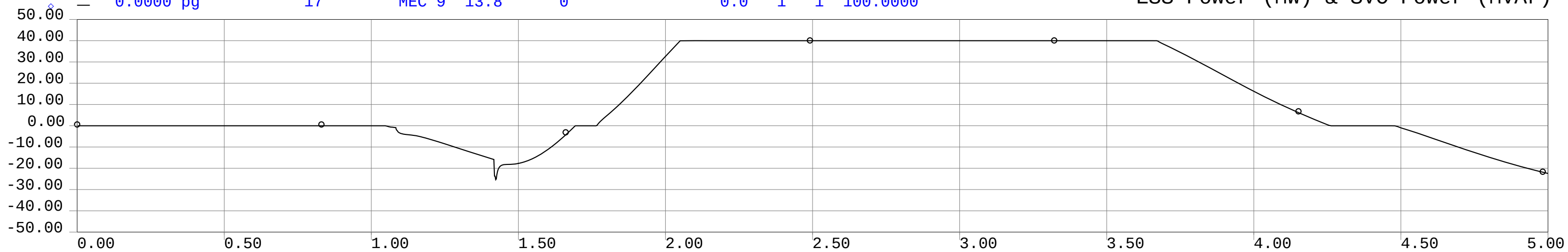
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



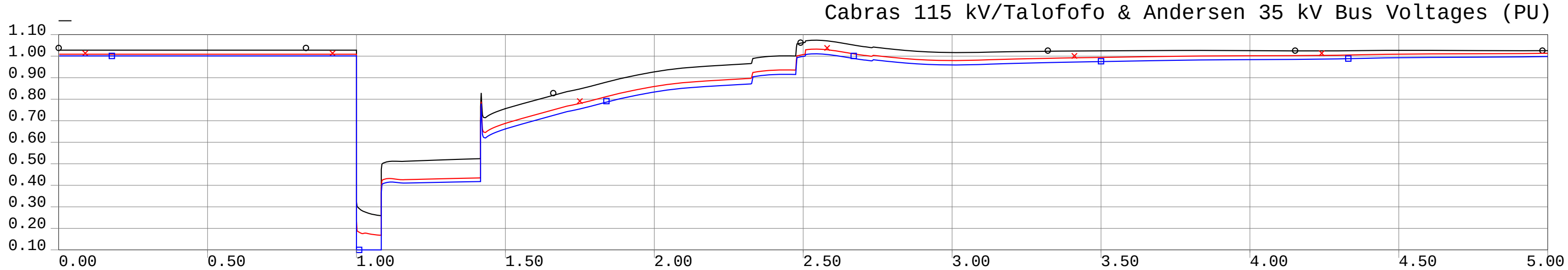
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

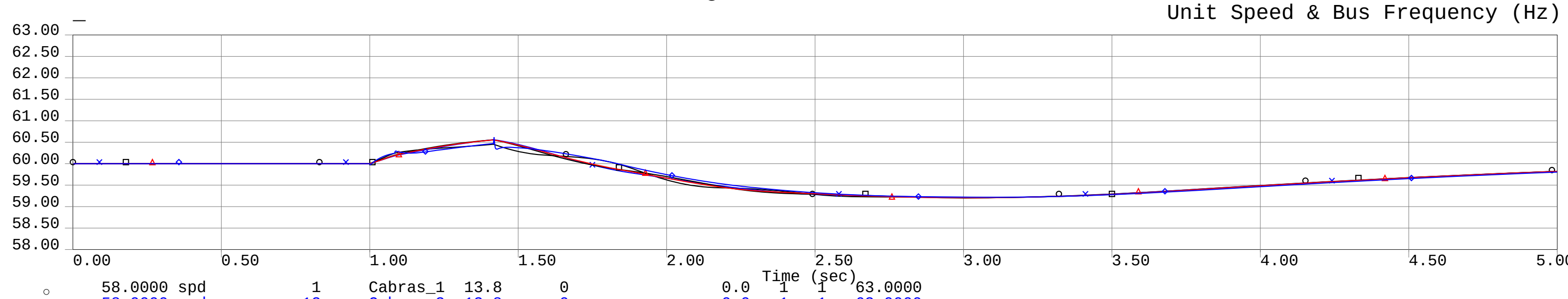
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

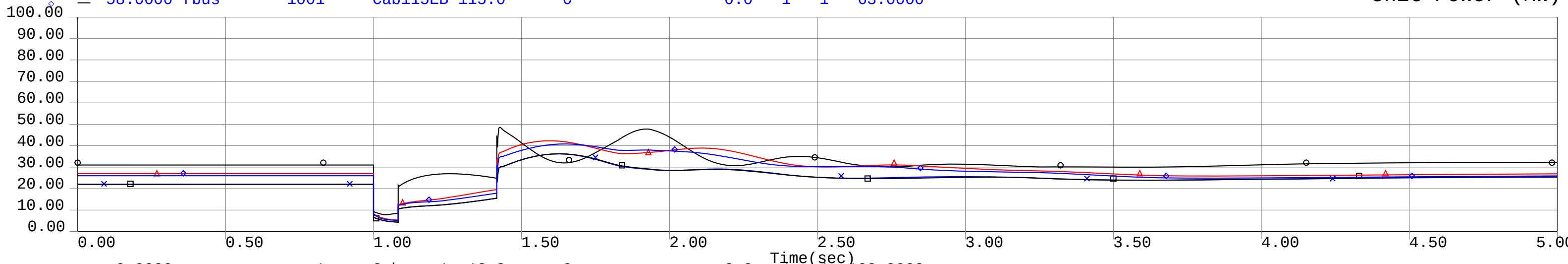
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



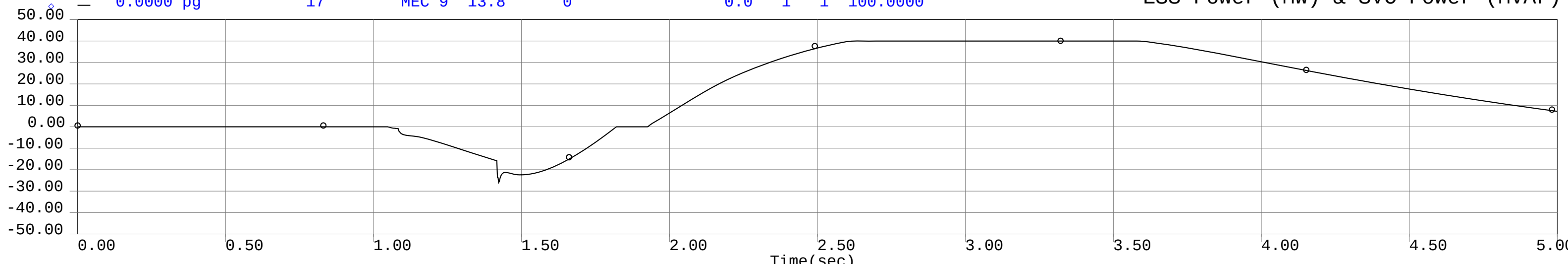
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



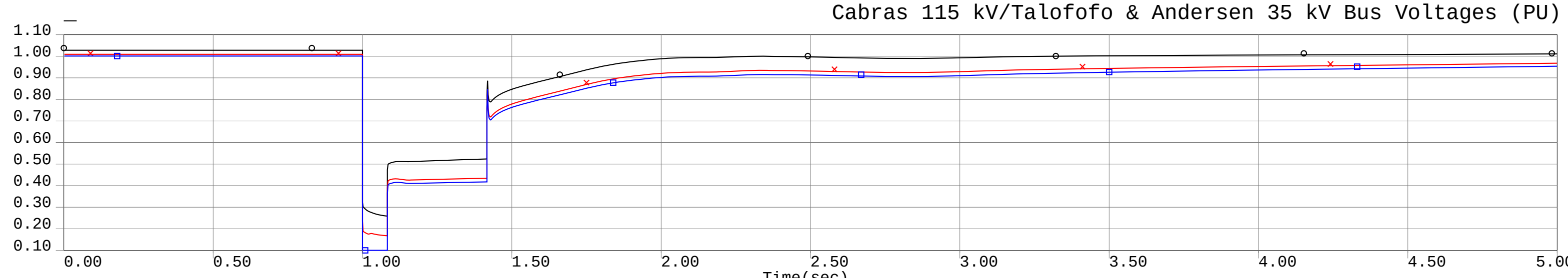
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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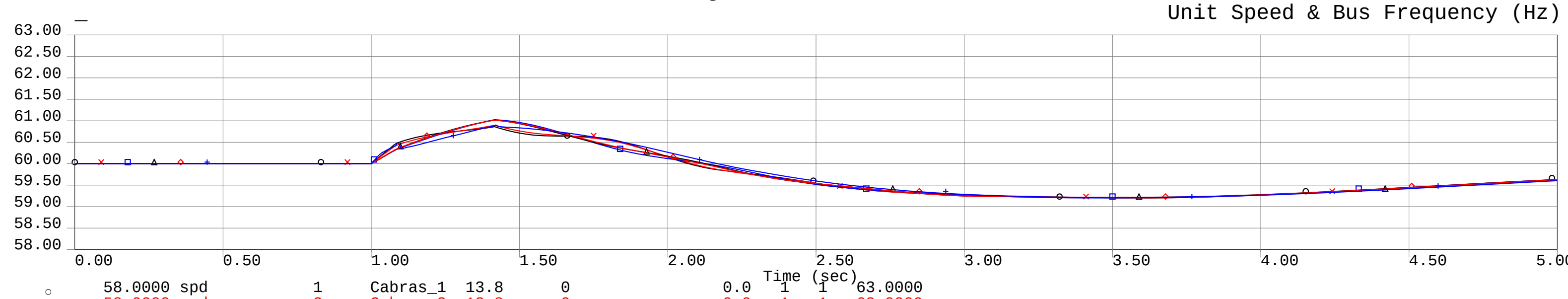
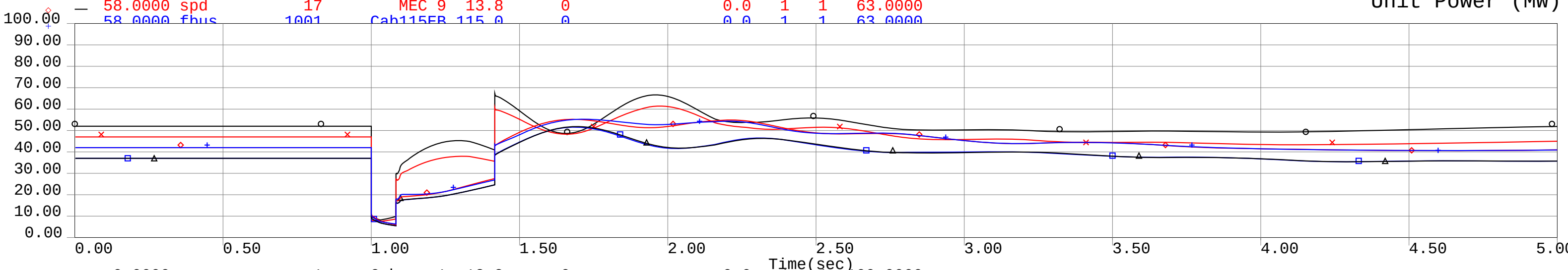
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



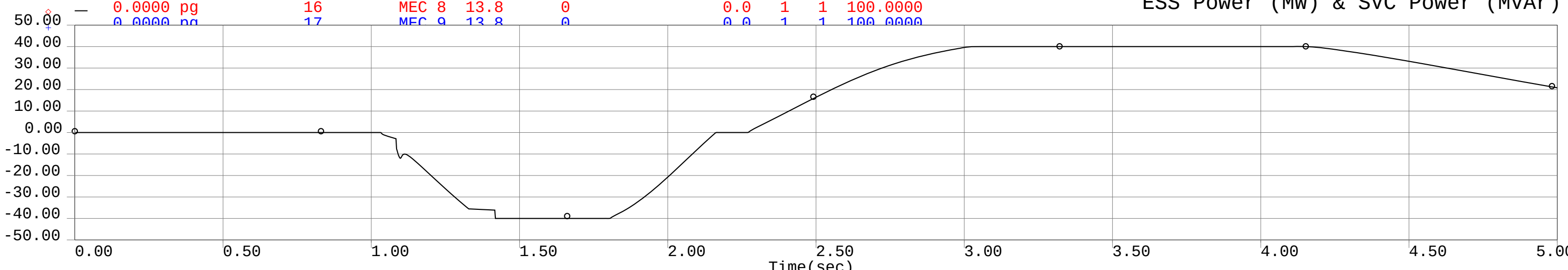

```
58.0000 spd        1   Cabras_1  13.8   0   0.0  1  1  63.0000
58.0000 spd        2   Cabras_2  13.8   0   0.0  1  1  63.0000
58.0000 spd       12   Cabras_3  13.8   0   0.0  1  1  63.0000
58.0000 spd       16      MEC 8  13.8   0   0.0  1  1  63.0000
58.0000 spd       17      MEC 9  13.8   0   0.0  1  1  63.0000
58.0000 fbus    1001  Cab115EB 115.0    0   0.0  1  1  63.0000
```

Unit Power (MW)



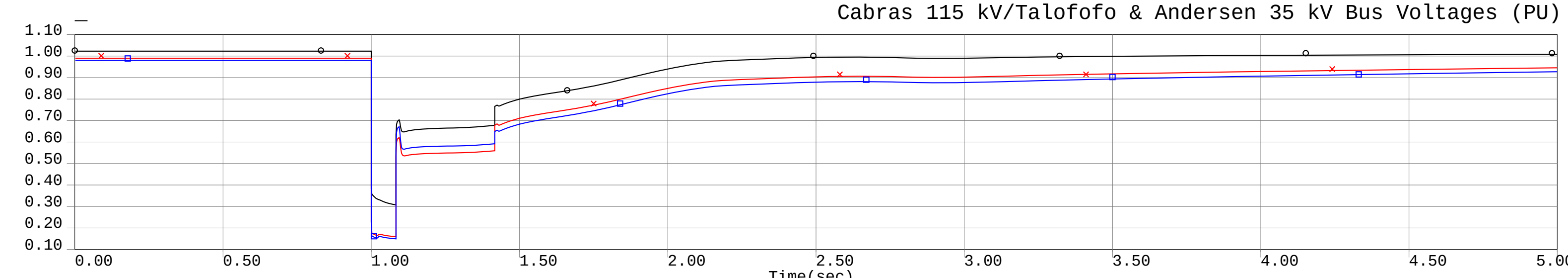

```
0.0000 pg    1   Cabras_1  13.8   0   0.0  1  1  100.0000
0.0000 pg    2   Cabras_2  13.8   0   0.0  1  1  100.0000
0.0000 pg   12   Cabras_3  13.8   0   0.0  1  1  100.0000
0.0000 pg   13   Cabras_4  13.8   0   0.0  1  1  100.0000
0.0000 pg   16      MEC 8  13.8   0   0.0  1  1  100.0000
0.0000 pg   17      MEC 9  13.8   0   0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)



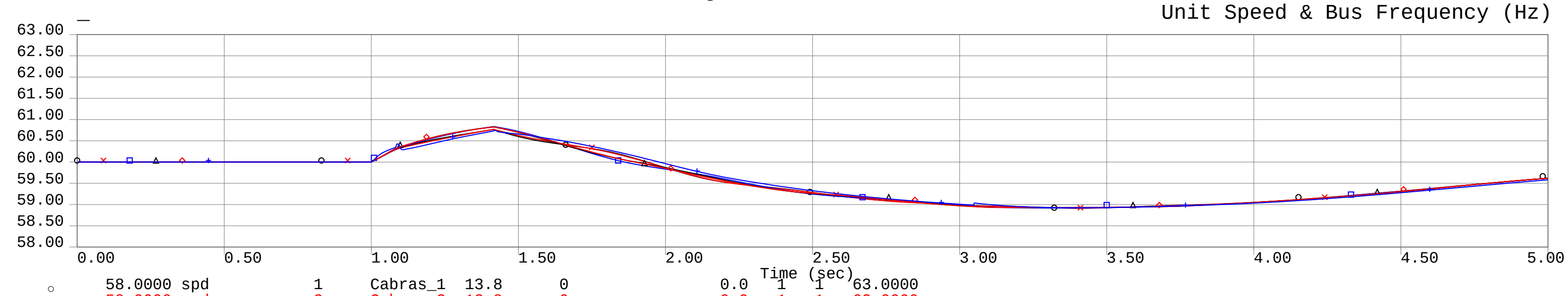

```
-50.0000 pbes   80002  ESS 2-AGANA  13.8   0   0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

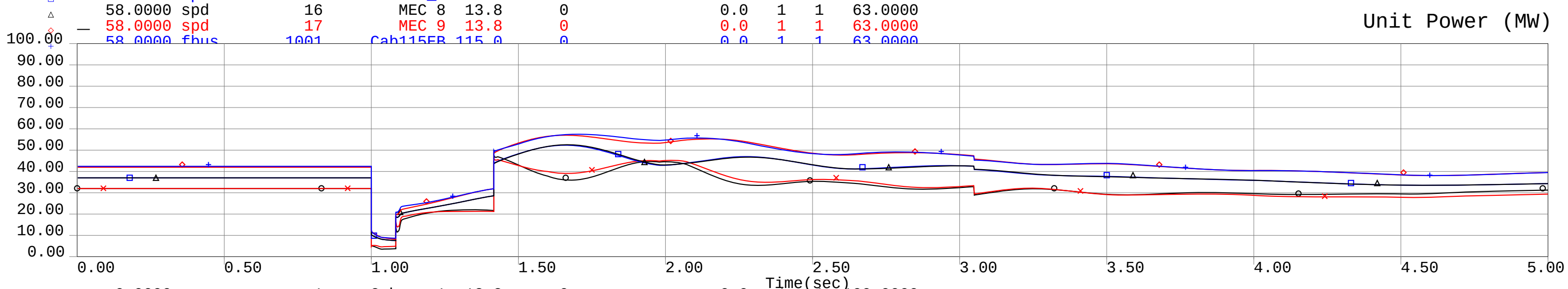



```
0.1000 vbus   1001  Cab115EB 115.0   0   0.0  1  1  1.1000
0.1000 vbus   2003    Tal345  34.5   0   0.0  1  1  1.1000
0.1000 vbus   2210  And345B1  34.5   0   0.0  1  1  1.1000
```

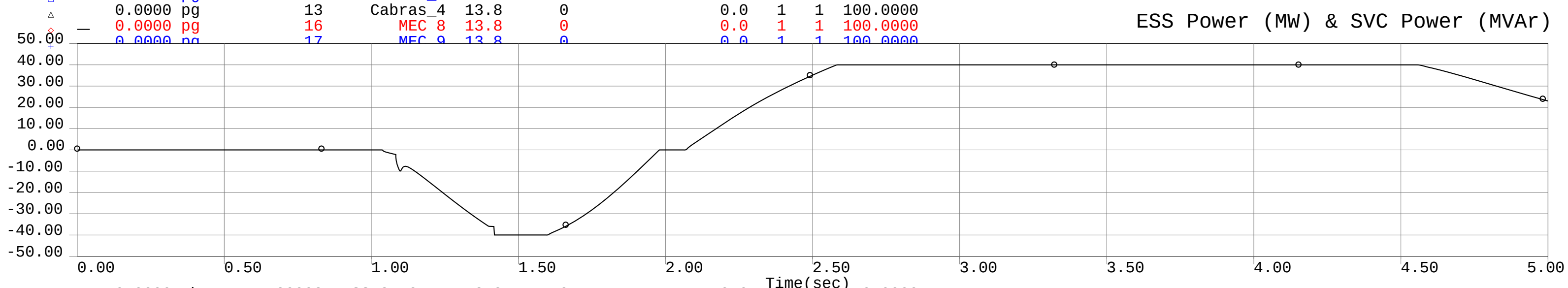
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



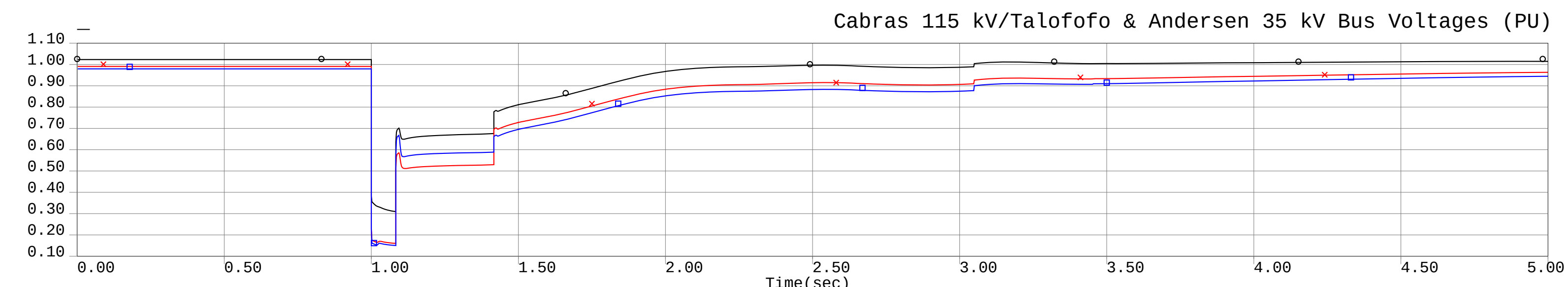
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000



0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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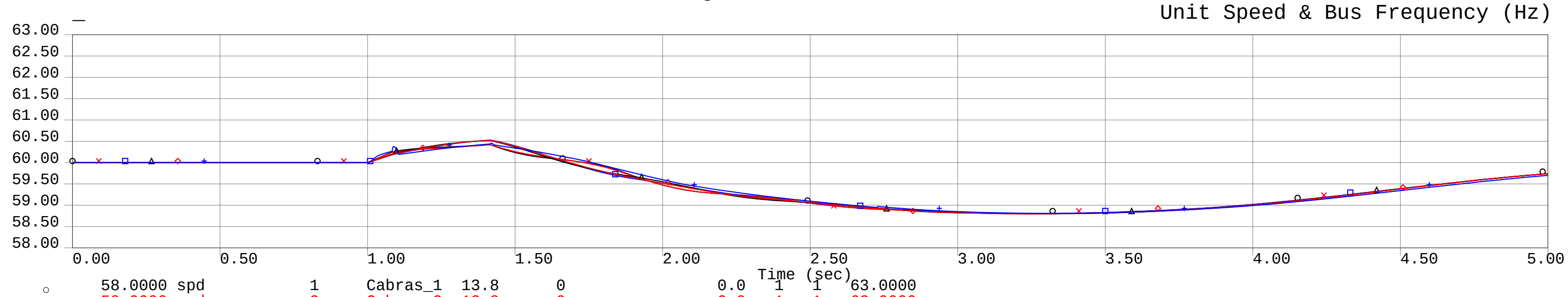
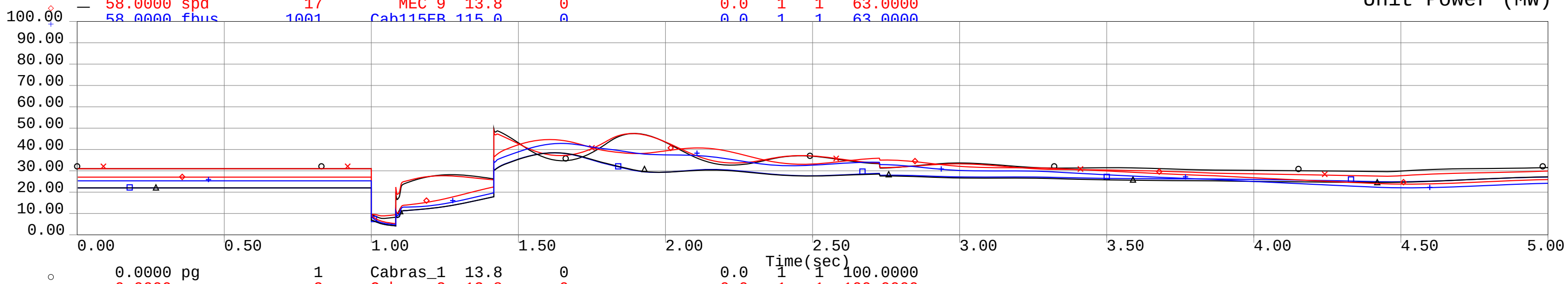
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



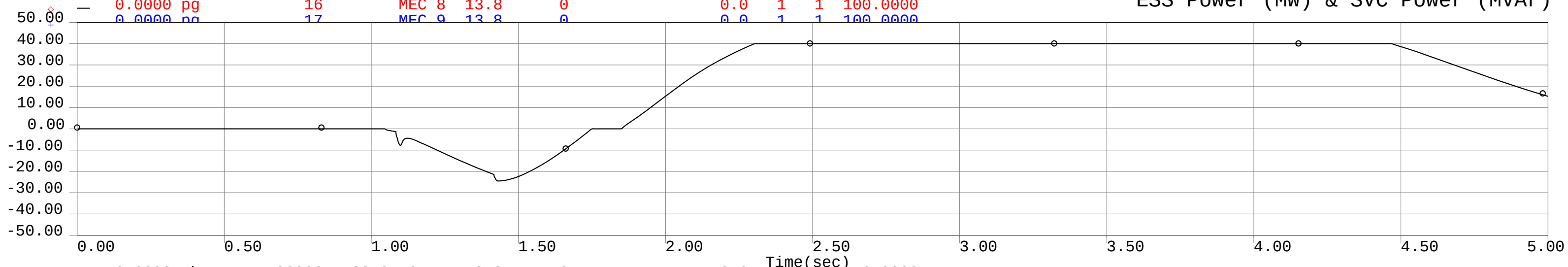

```
58.0000 spd     1     Cabras_1  13.8  0   0.0  1  1  63.0000
58.0000 spd     2     Cabras_2  13.8  0   0.0  1  1  63.0000
58.0000 spd     12    Cabras_3  13.8  0   0.0  1  1  63.0000
58.0000 spd     16    MEC 8     13.8  0   0.0  1  1  63.0000
58.0000 spd     17    MEC 9     13.8  0   0.0  1  1  63.0000
58.0000 fbus    1001  Cab115EB  115.0 0   0.0  1  1  63.0000
```

Unit Power (MW)



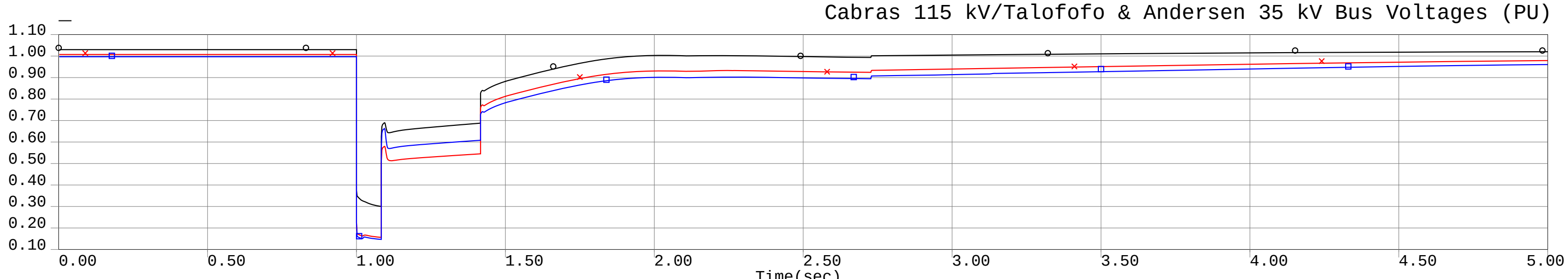

```
0.0000 pg   1    Cabras_1  13.8  0   0.0  1  1  100.0000
0.0000 pg   2    Cabras_2  13.8  0   0.0  1  1  100.0000
0.0000 pg   12   Cabras_3  13.8  0   0.0  1  1  100.0000
0.0000 pg   13   Cabras_4  13.8  0   0.0  1  1  100.0000
0.0000 pg   16   MEC 8     13.8  0   0.0  1  1  100.0000
0.0000 pg   17   MEC 9     13.8  0   0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
-50.0000 pbes   80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.1000 vbus  1001  Cab115EB  115.0  0   0.0  1  1  1.1000
0.1000 vbus  2003  Tal345    34.5   0   0.0  1  1  1.1000
0.1000 vbus  2210  And345B1  34.5   0   0.0  1  1  1.1000
```


chans/1420_40a_lf17_fidvr.chf

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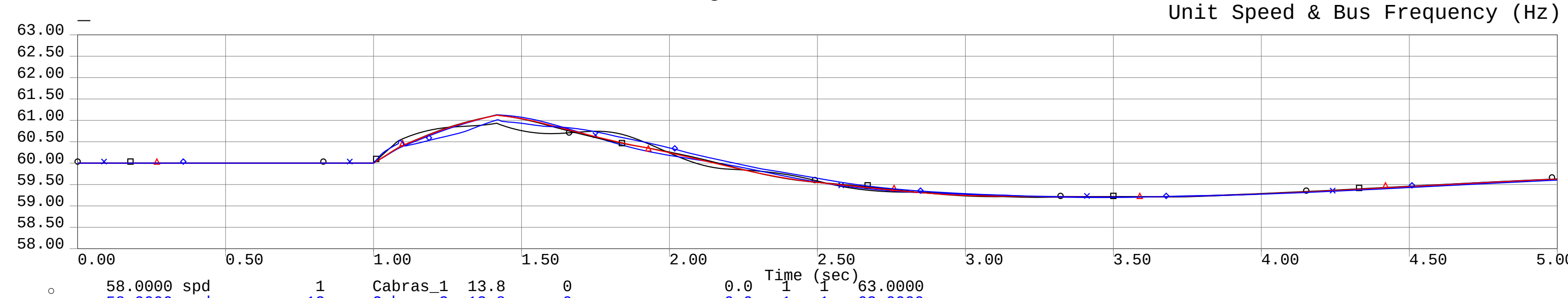
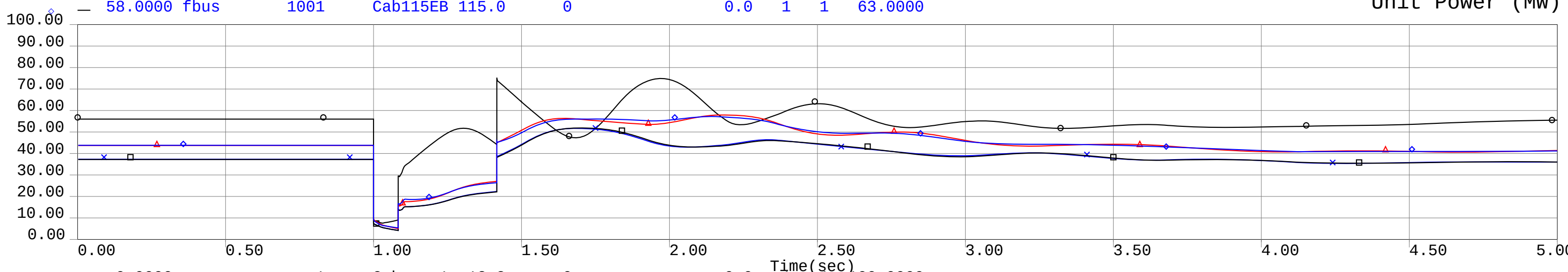
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



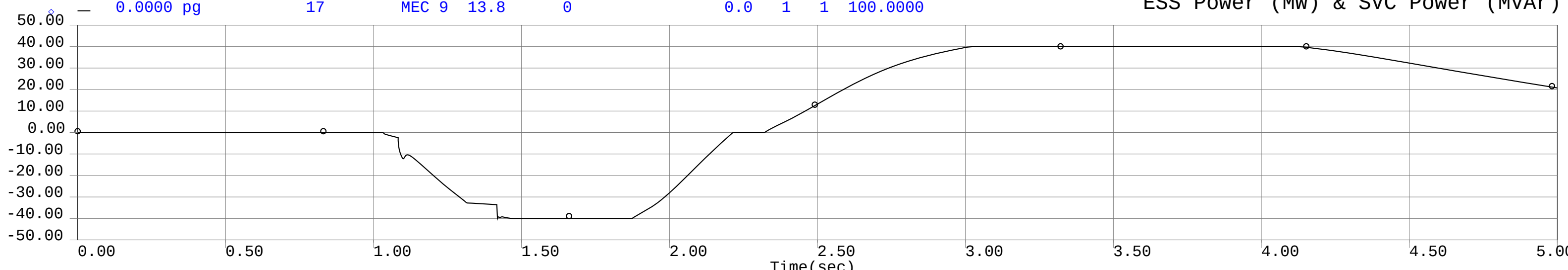
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



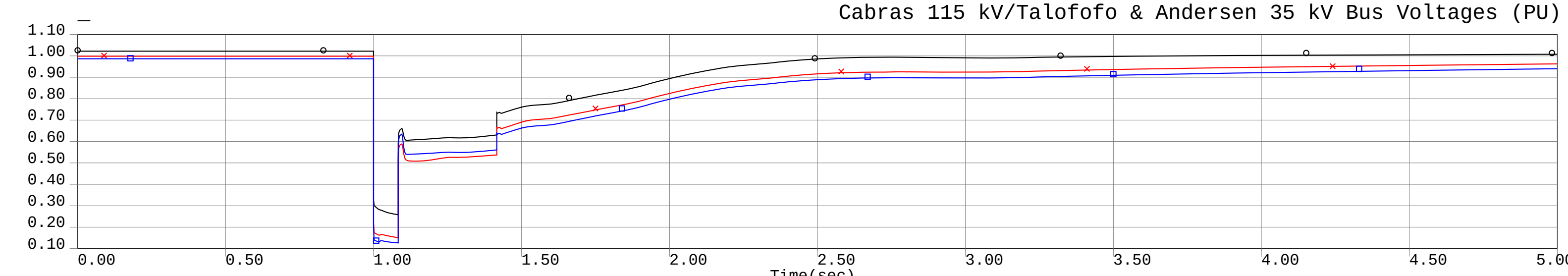
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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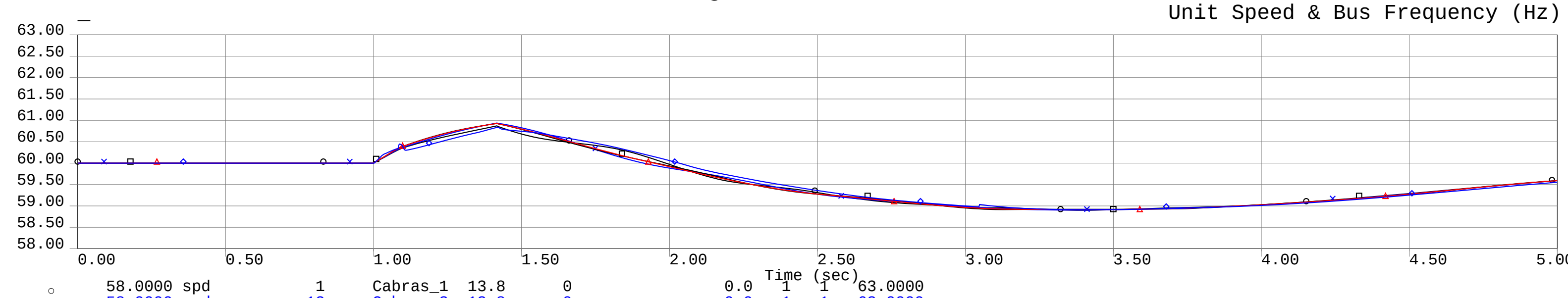
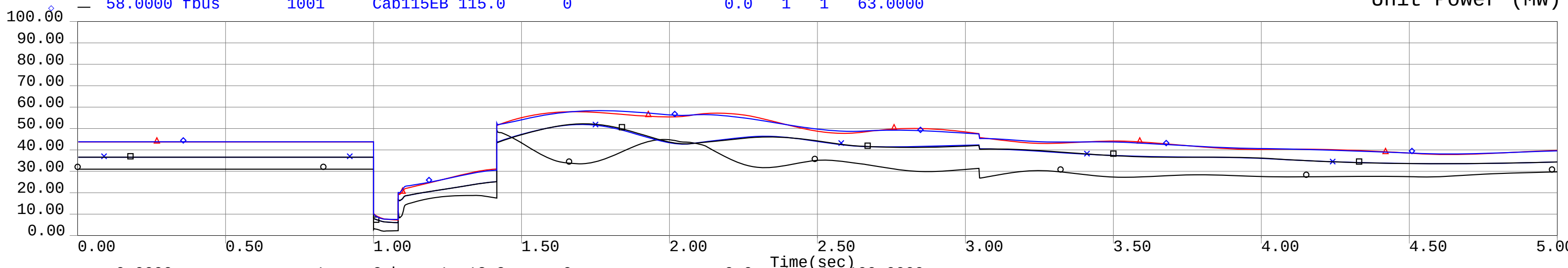
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



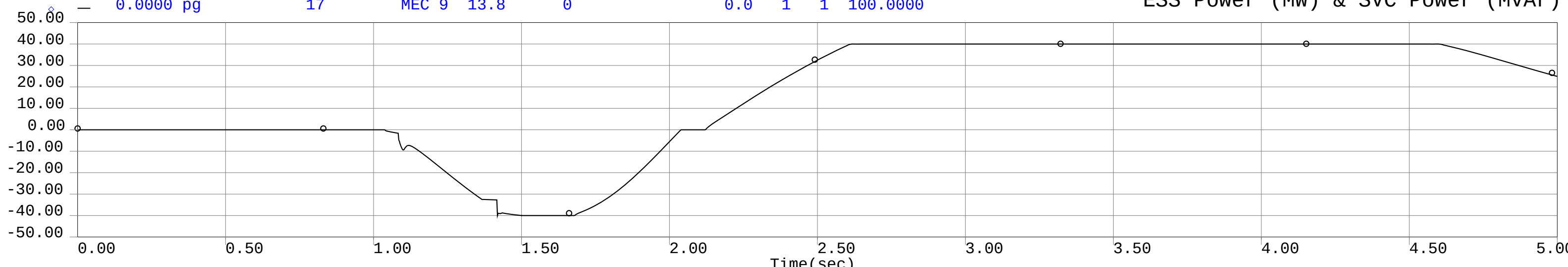
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



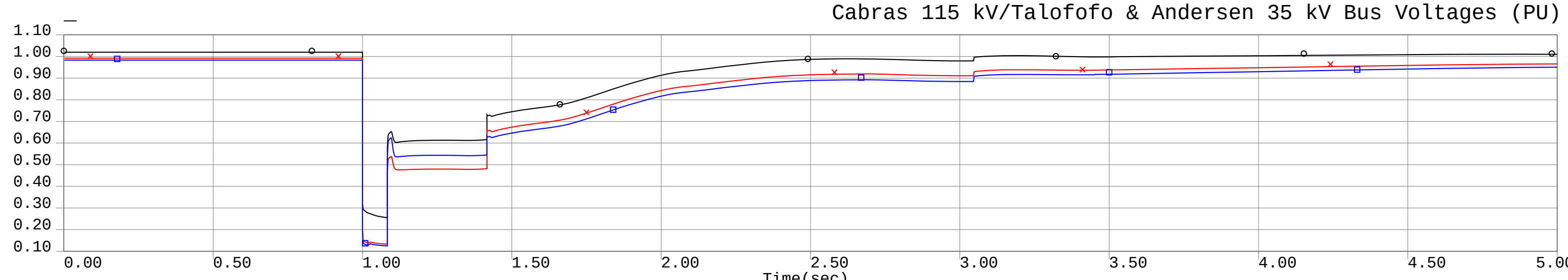
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

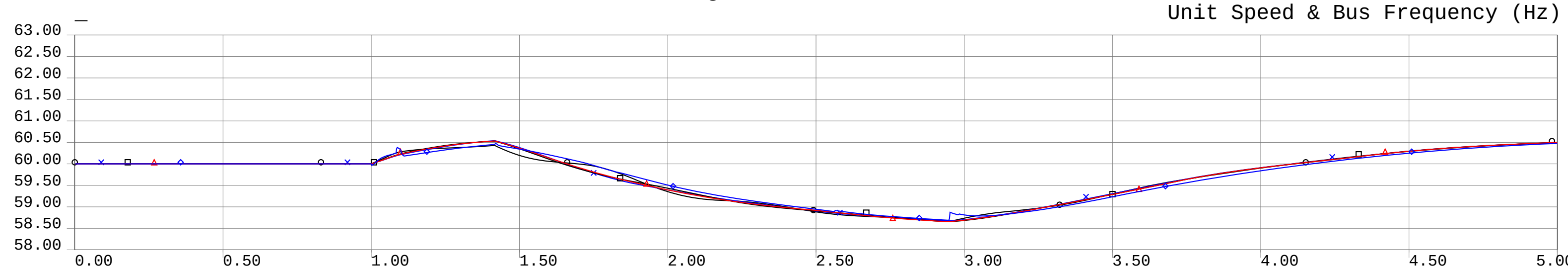
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

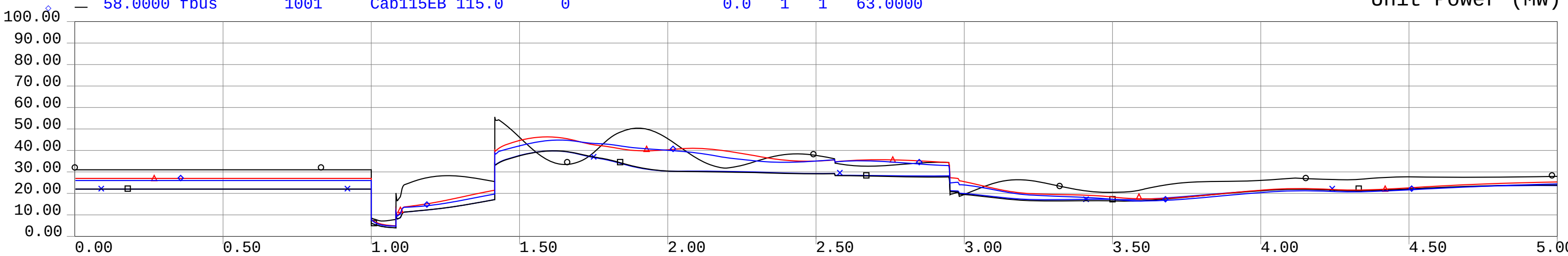
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



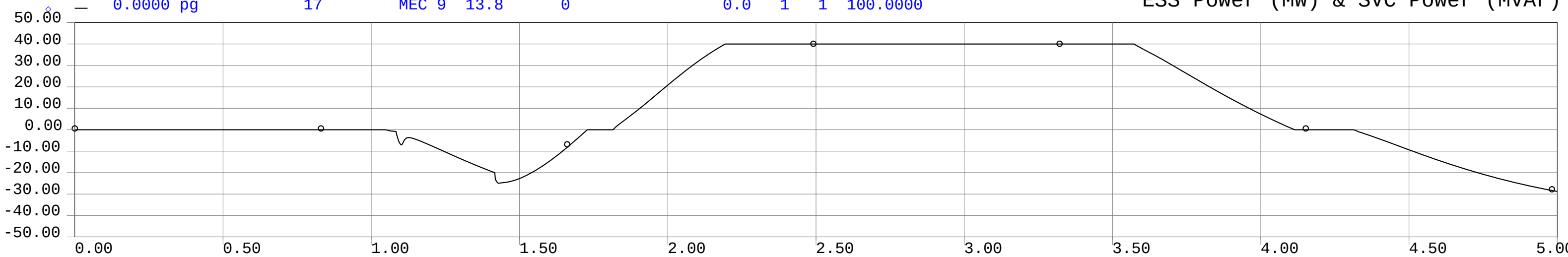
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



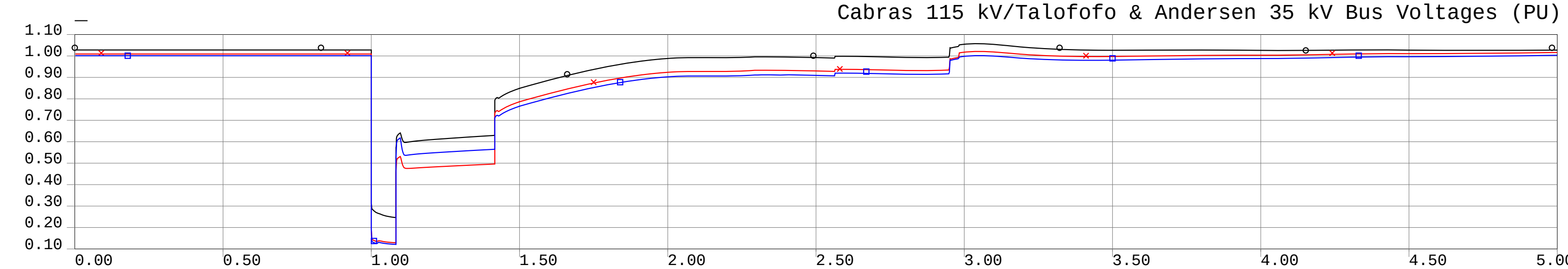
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

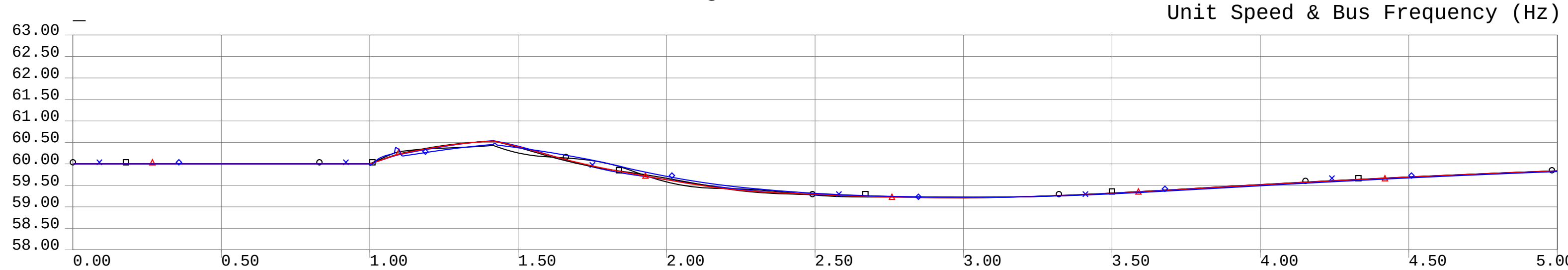
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)

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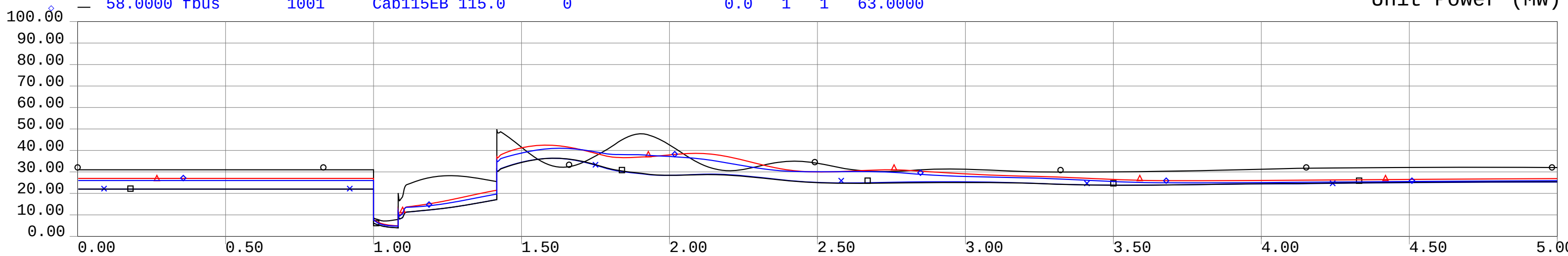
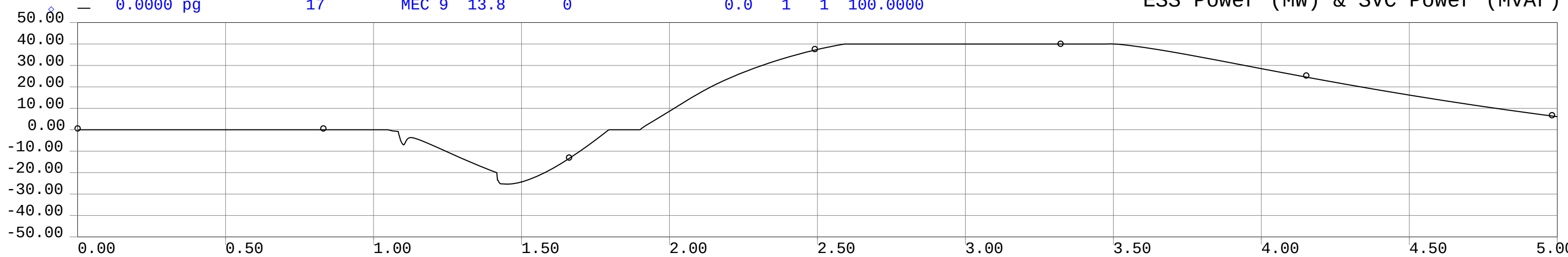
58.0000 spd       1    Cabras_1  13.8   0   0.0  1  1  63.0000
58.0000 spd      12    Cabras_3  13.8   0   0.0  1  1  63.0000
58.0000 spd      16       MEC 8  13.8   0   0.0  1  1  63.0000
58.0000 spd      17       MEC 9  13.8   0   0.0  1  1  63.0000
58.0000 fbus   1001    Cab115EB 115.0   0   0.0  1  1  63.0000
```

Unit Power (MW)




```
0.0000 pg       1    Cabras_1  13.8   0   0.0  1  1  100.0000
0.0000 pg      12    Cabras_3  13.8   0   0.0  1  1  100.0000
0.0000 pg      13    Cabras_4  13.8   0   0.0  1  1  100.0000
0.0000 pg      16       MEC 8  13.8   0   0.0  1  1  100.0000
0.0000 pg      17       MEC 9  13.8   0   0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)

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-50.0000 pbes   80002  ESS 2-AGANA  13.8   0   0.0  1  1  50.0000
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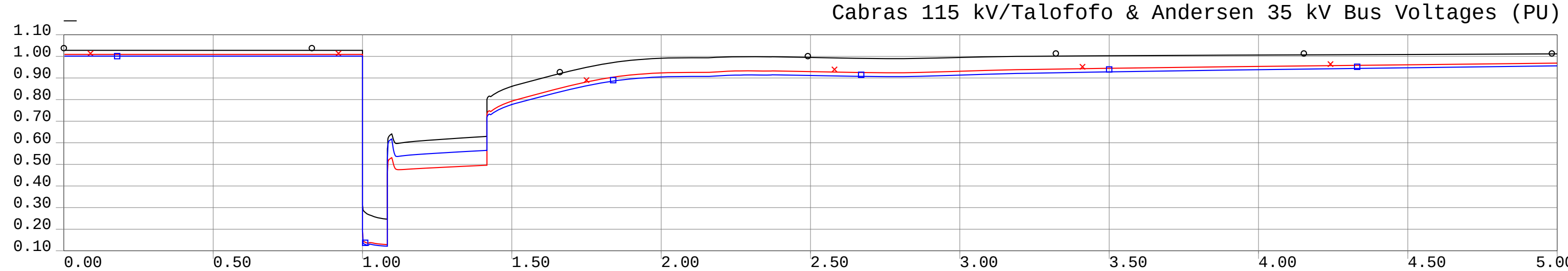
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.1000 vbus   1001   Cab115EB 115.0   0   0.0  1  1  1.1000
0.1000 vbus   2003     Tal345  34.5   0   0.0  1  1  1.1000
0.1000 vbus   2210   And345B1  34.5   0   0.0  1  1  1.1000
```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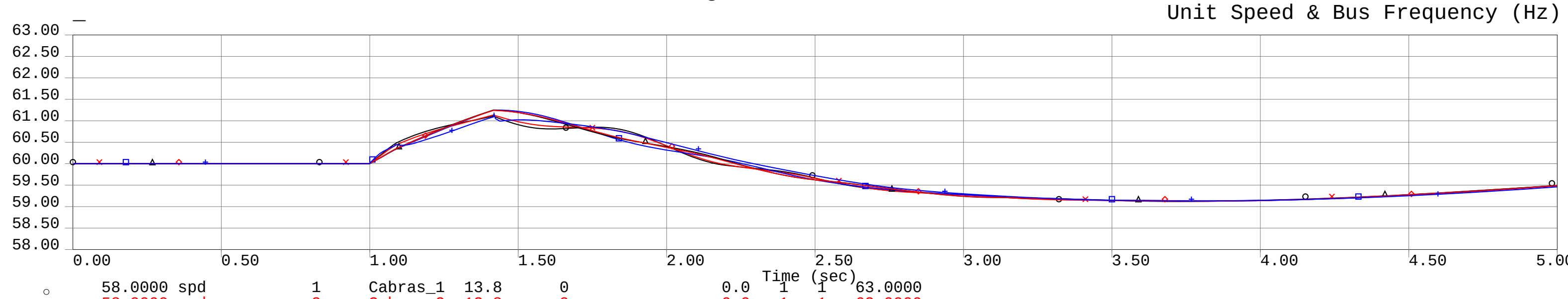
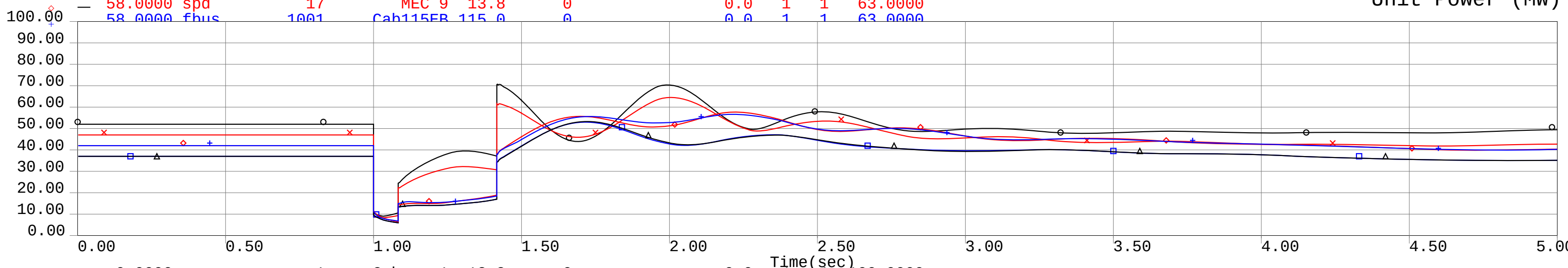
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



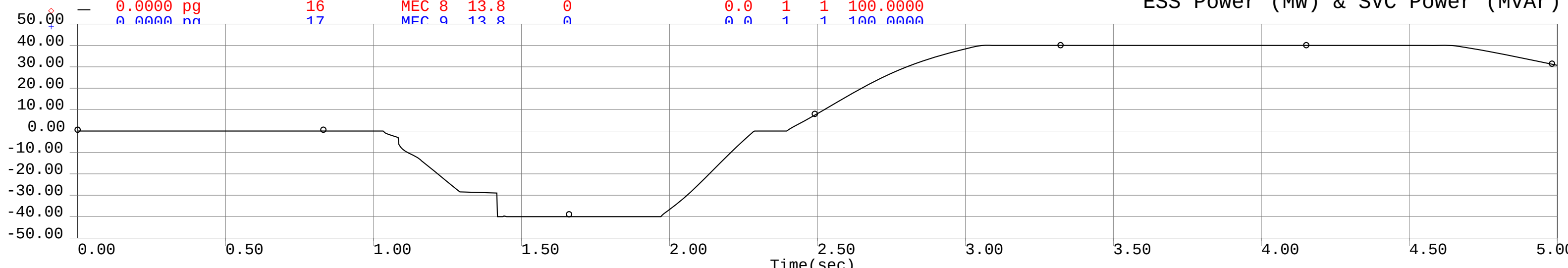
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



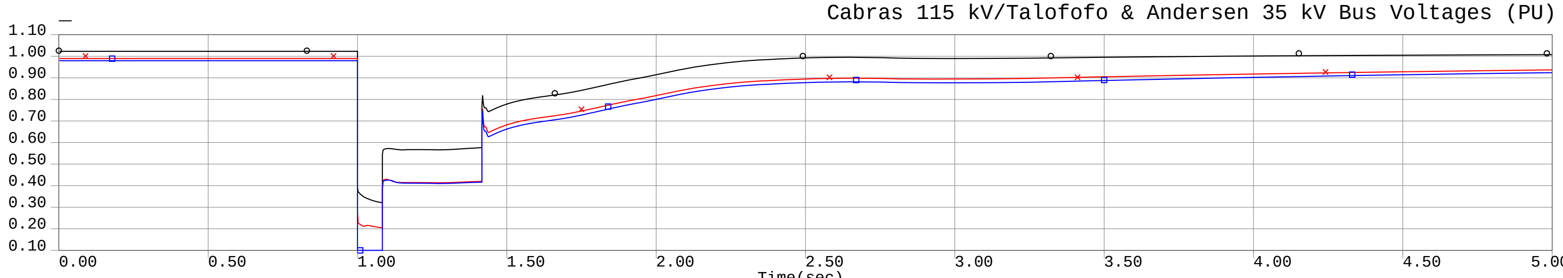
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

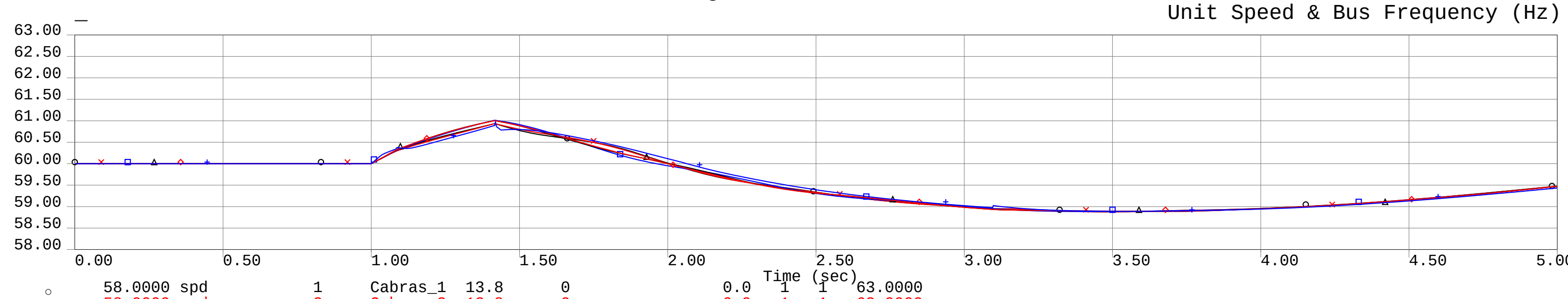
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



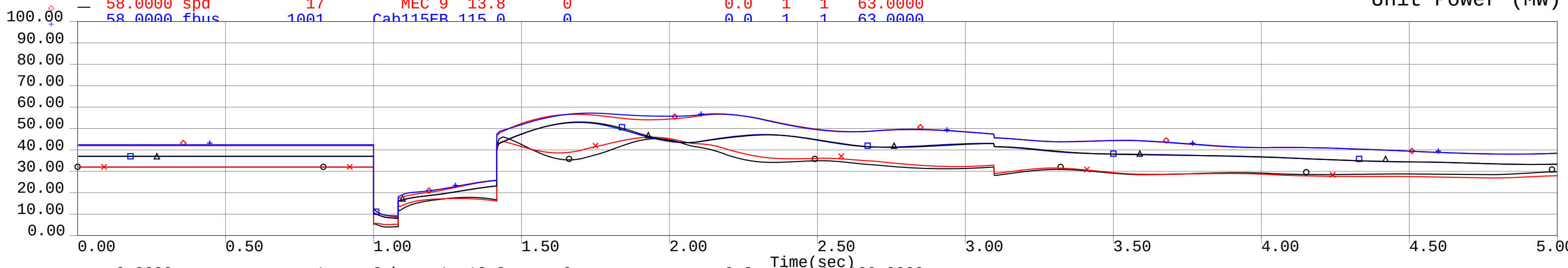
○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

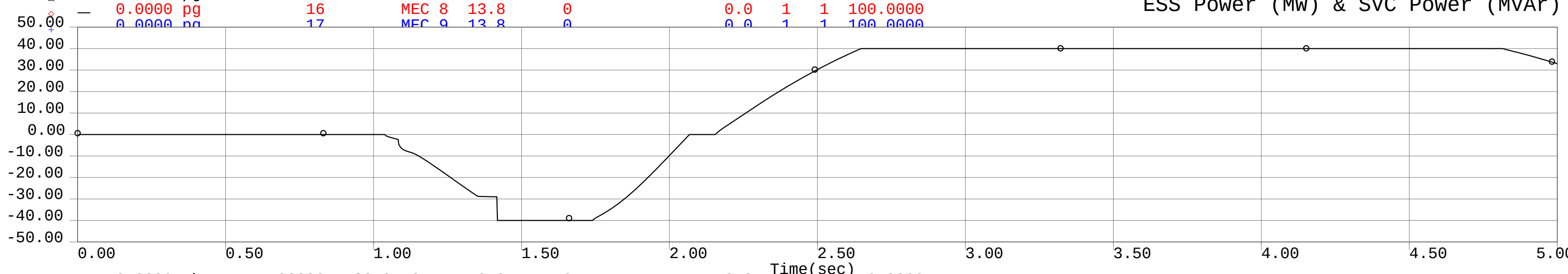
Unit Speed & Bus Frequency (Hz)



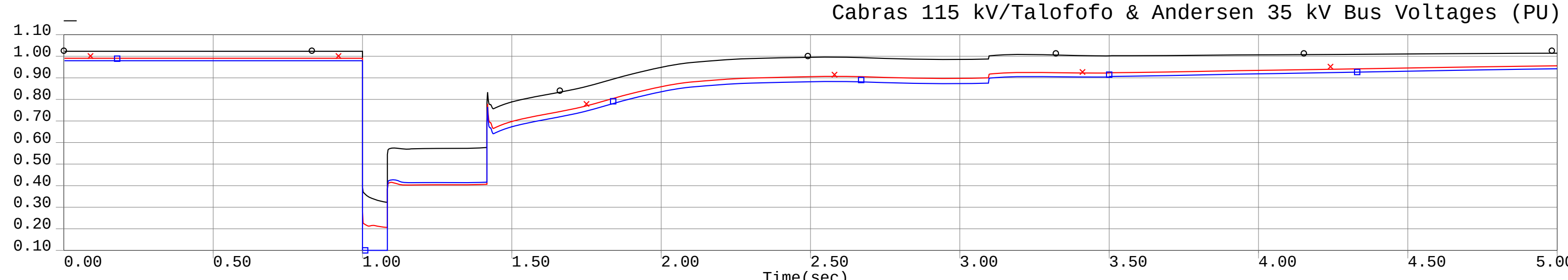
Unit Power (MW)



ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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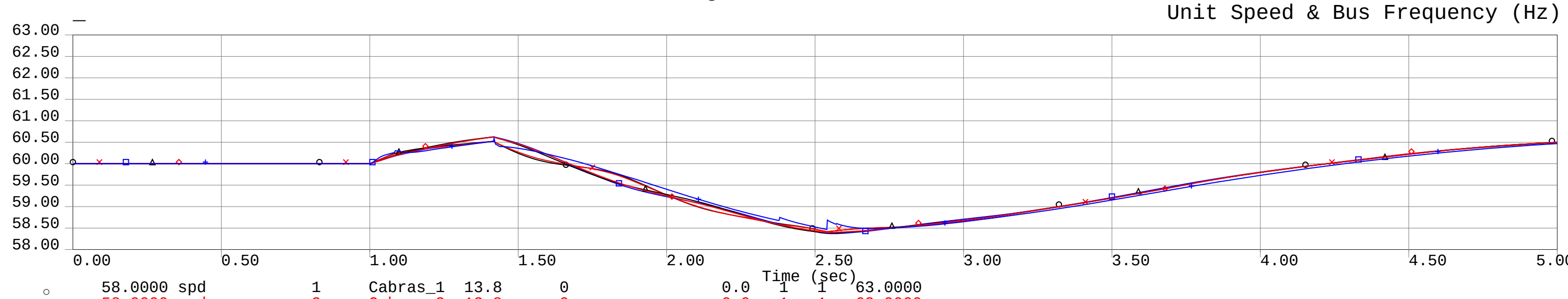
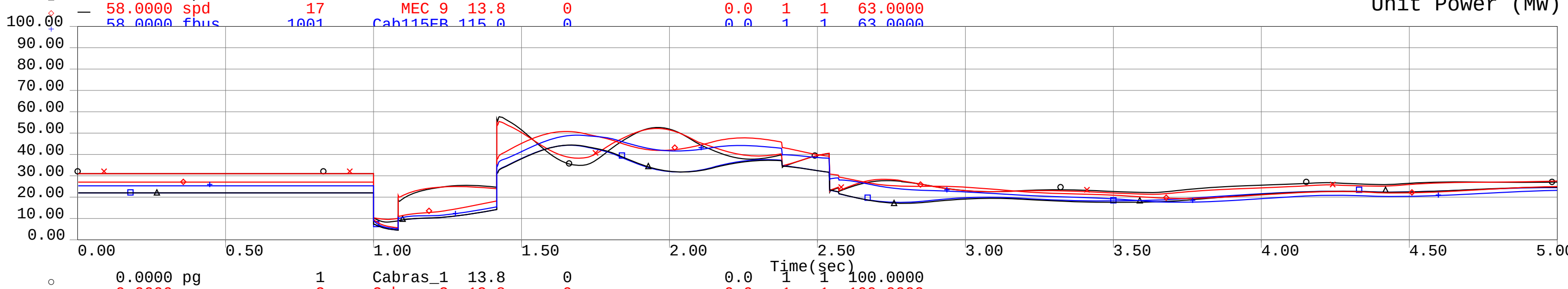
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



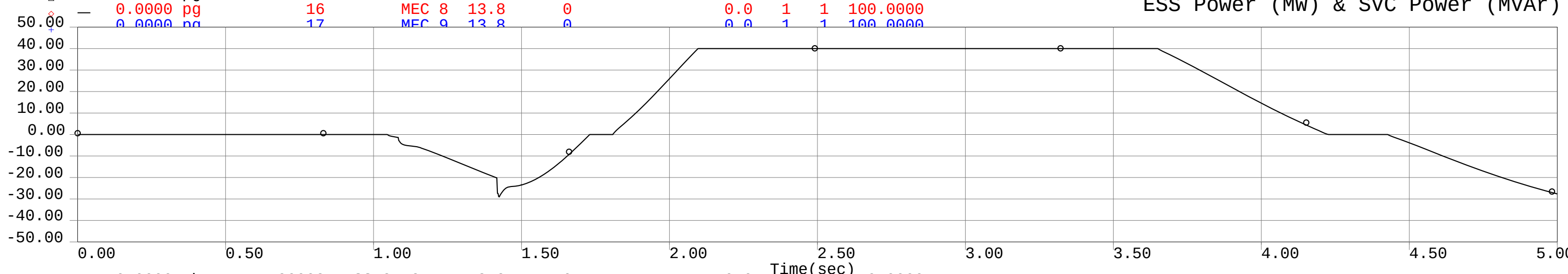
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



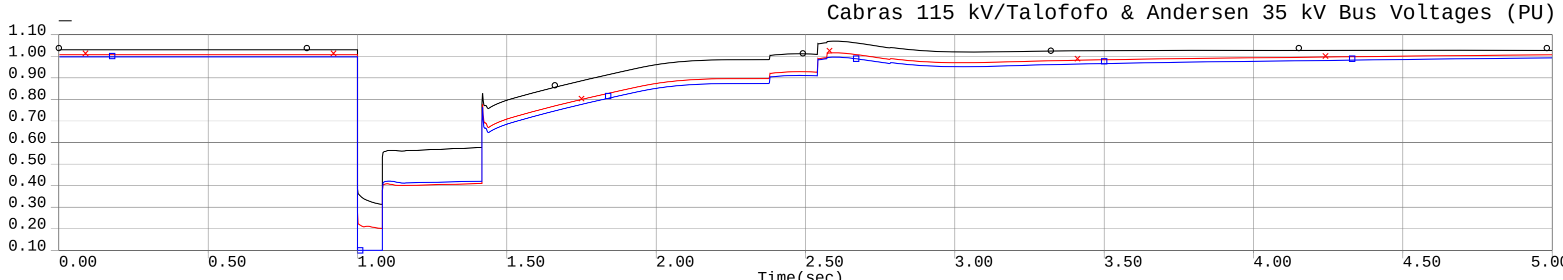
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

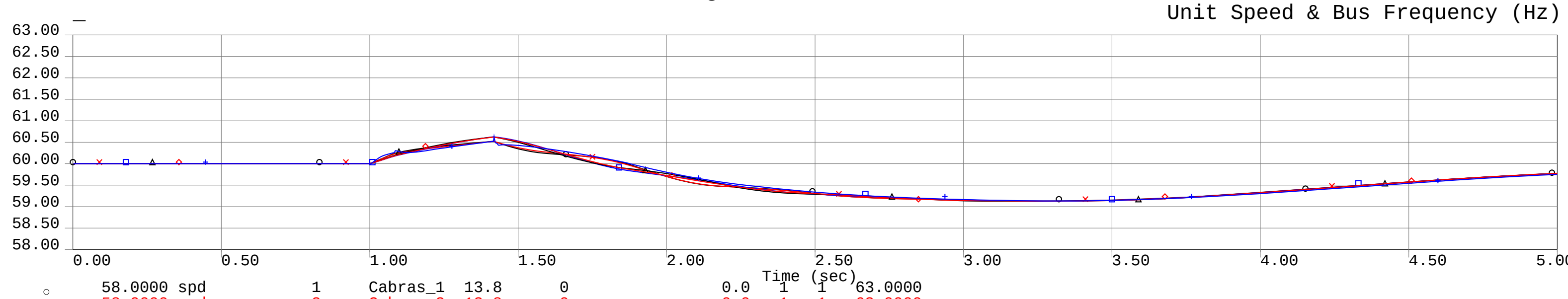
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

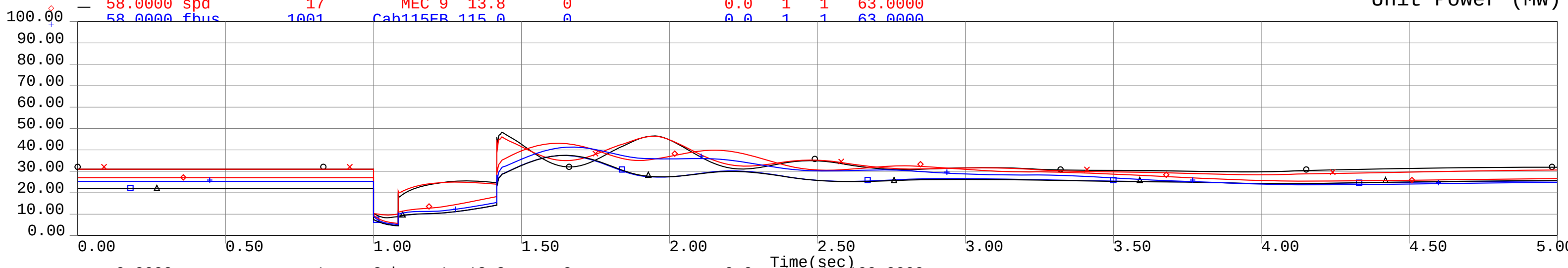
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



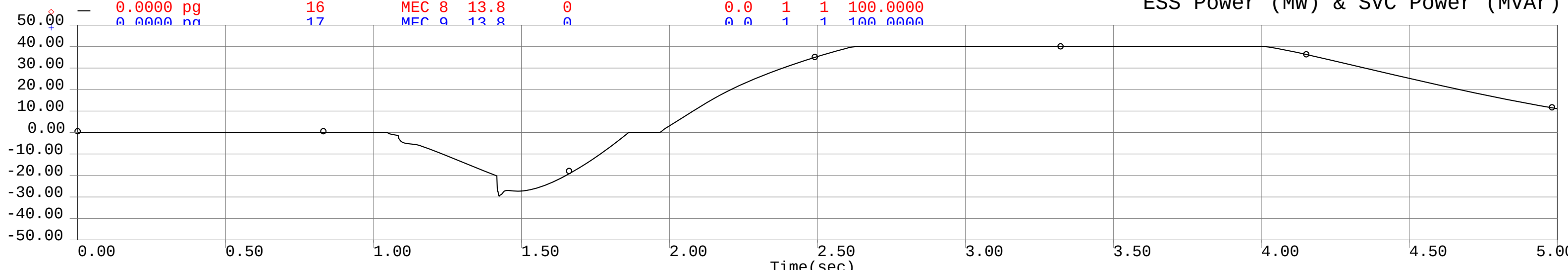
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



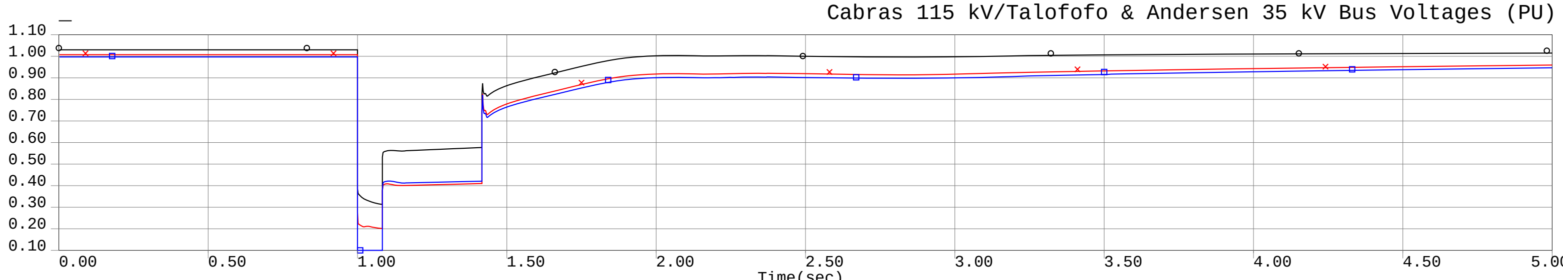
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

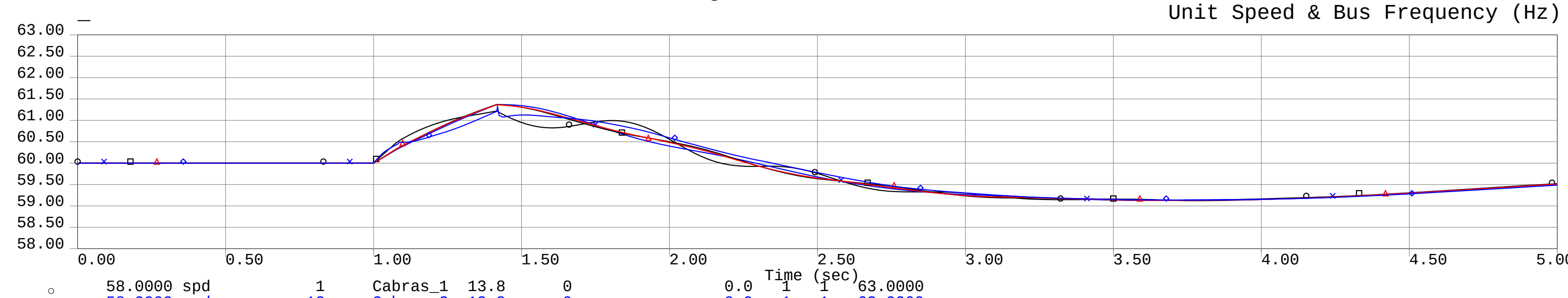
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

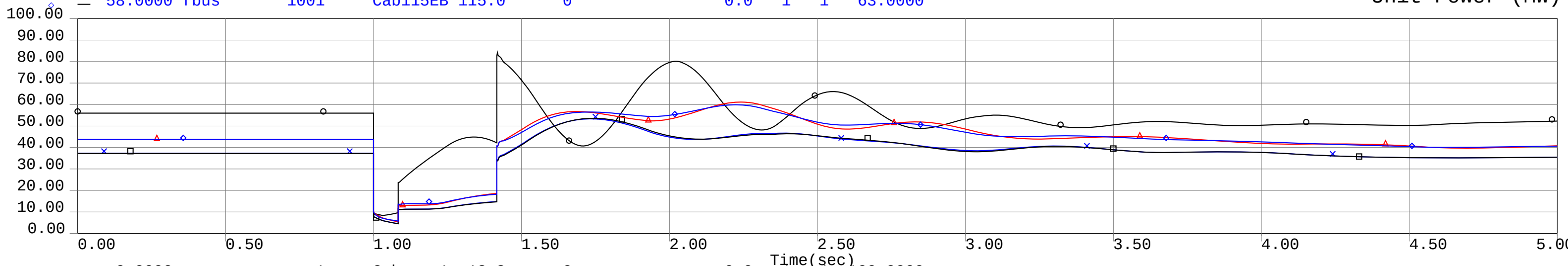
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



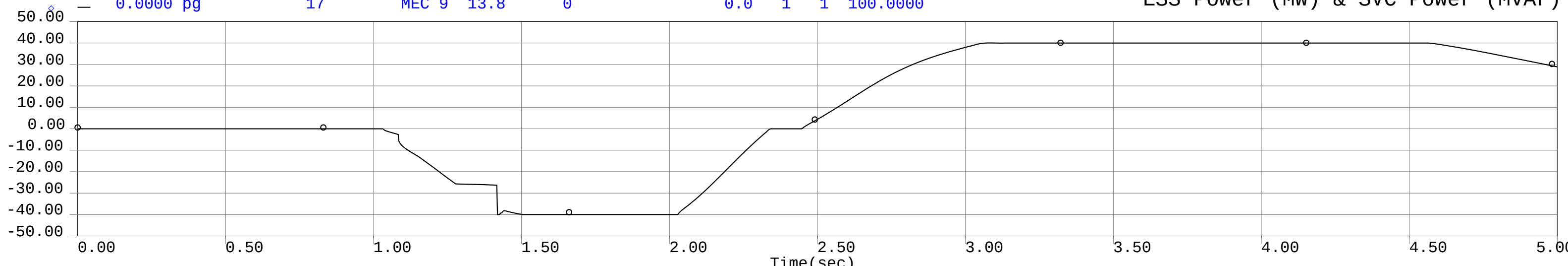
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



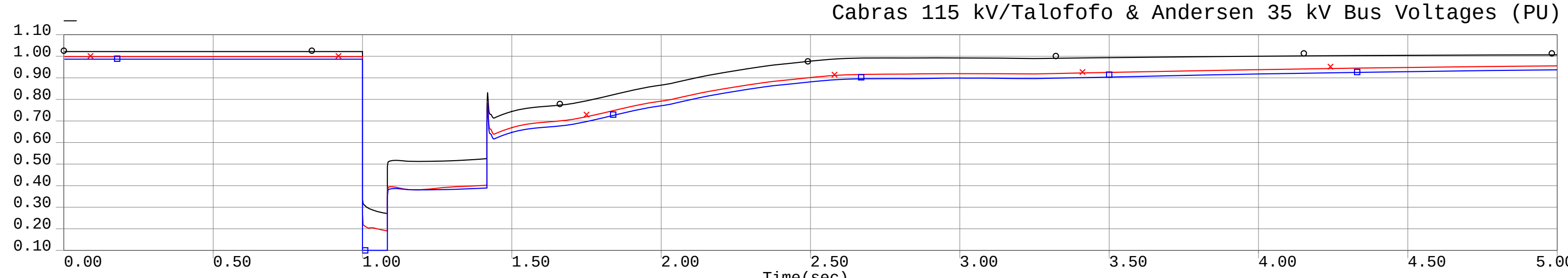
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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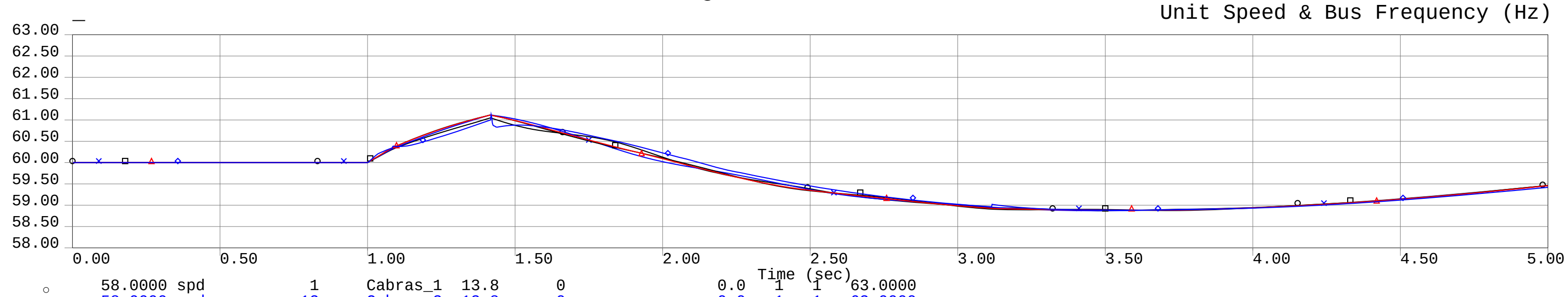
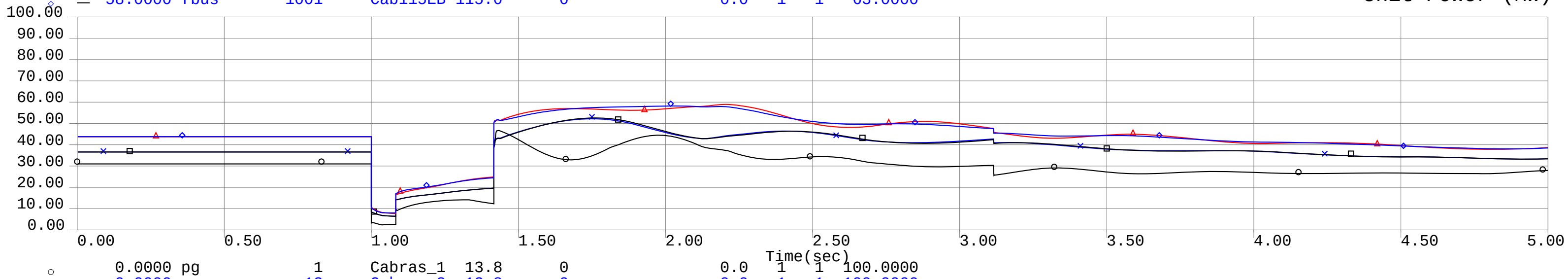
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



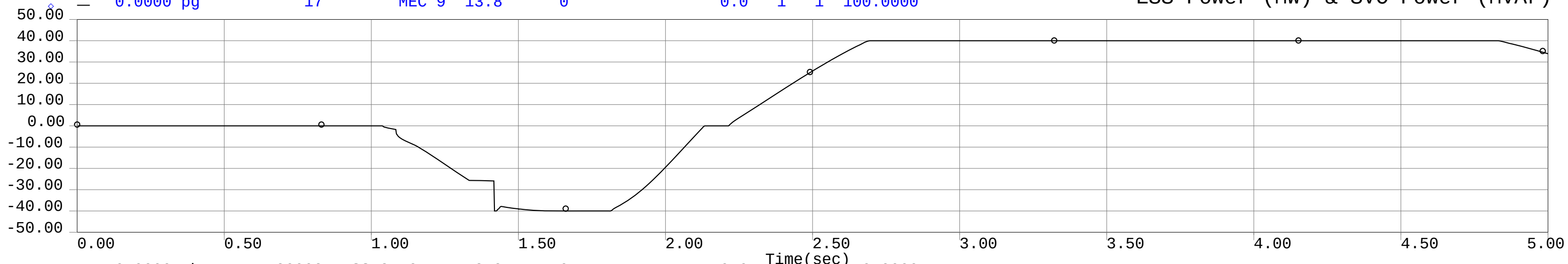
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



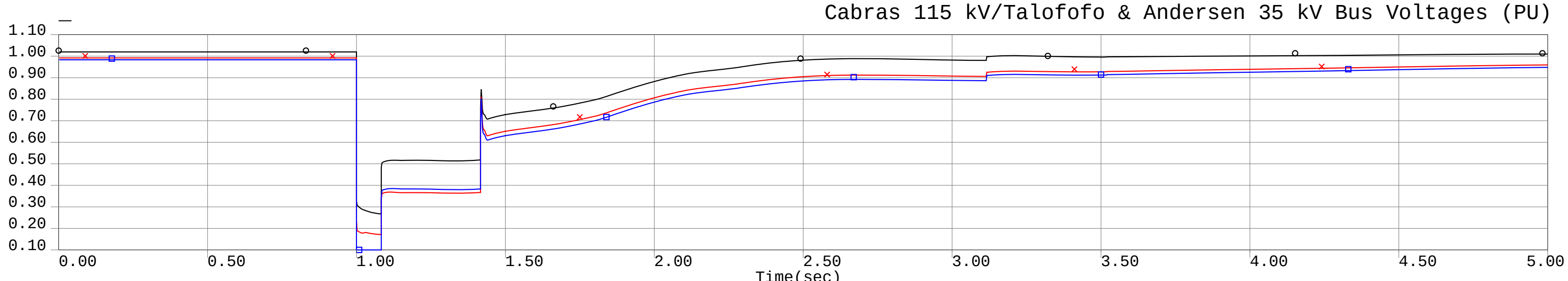
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



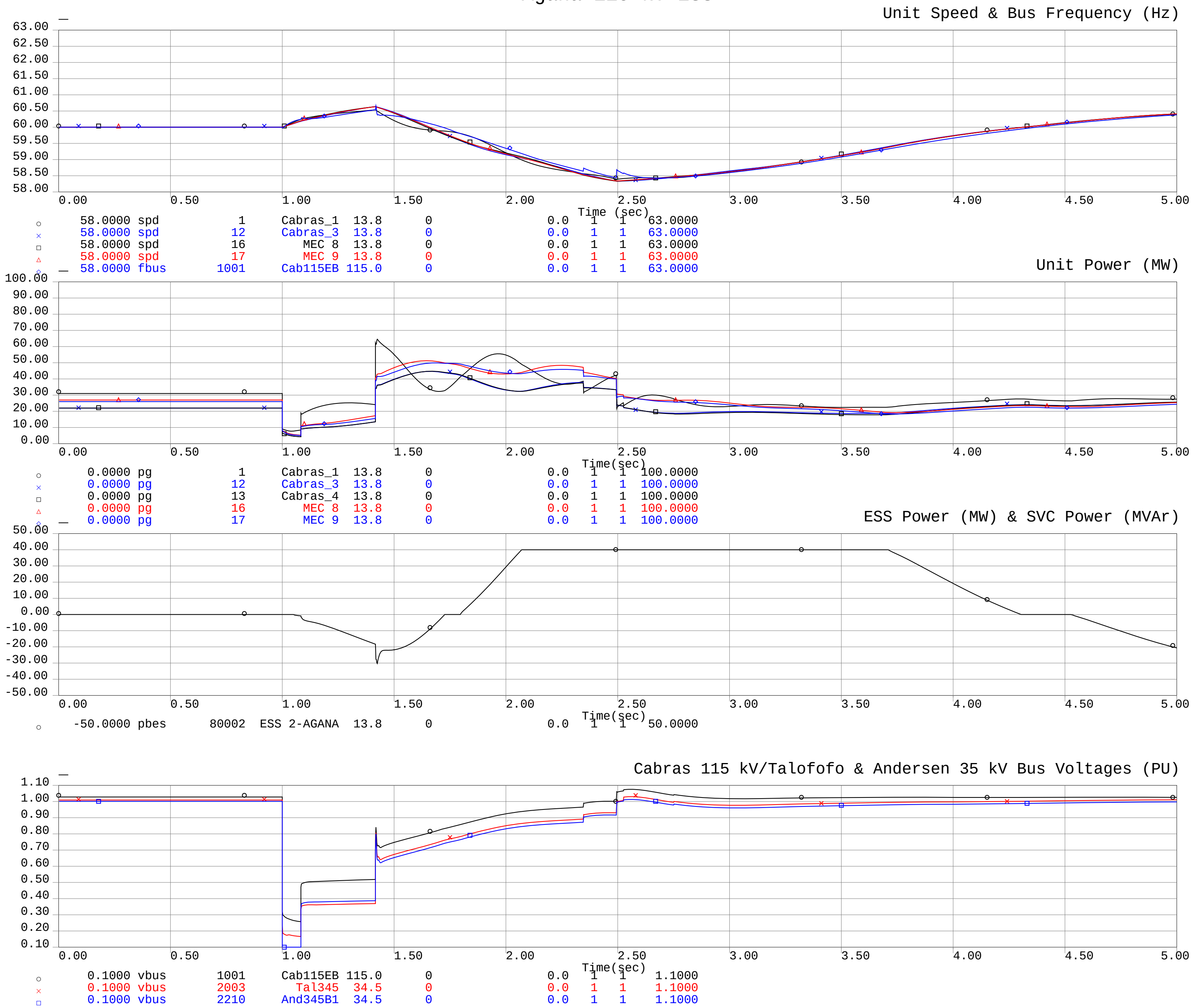
○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/2420_40a_lf18_fidvr.chf

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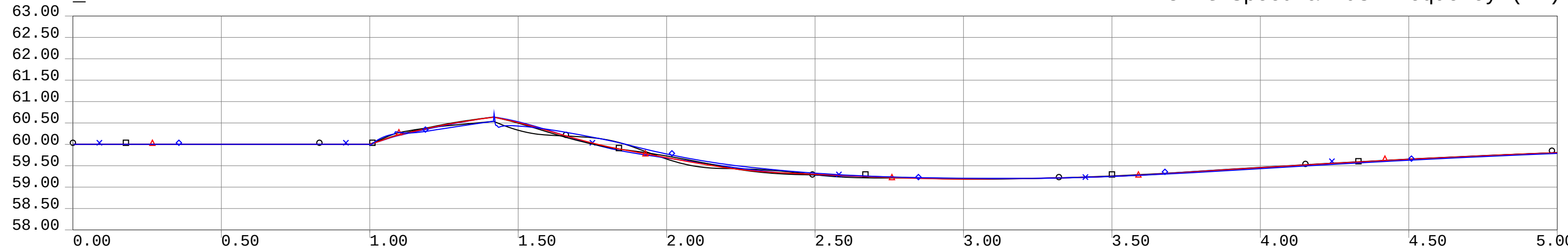
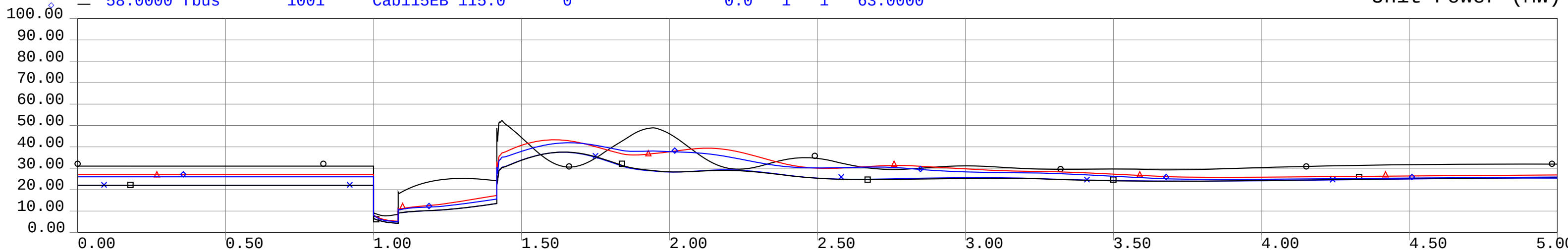
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



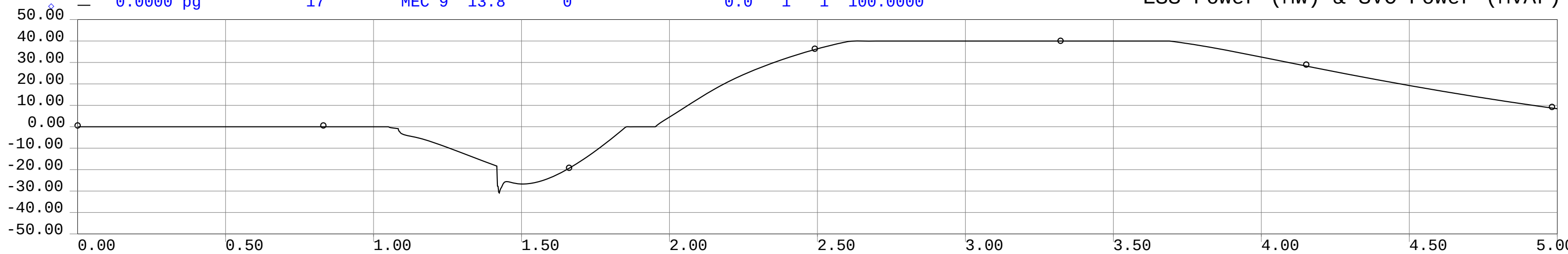
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



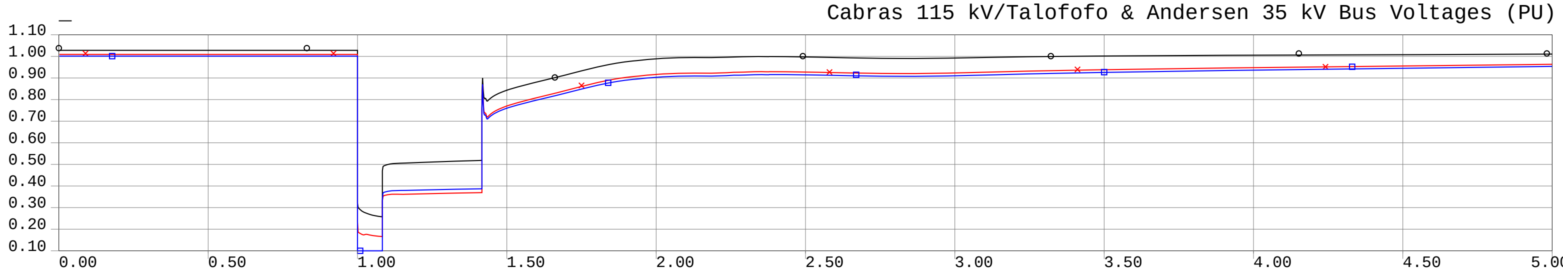
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2420_40a_lf18_fidvr_pv.chf

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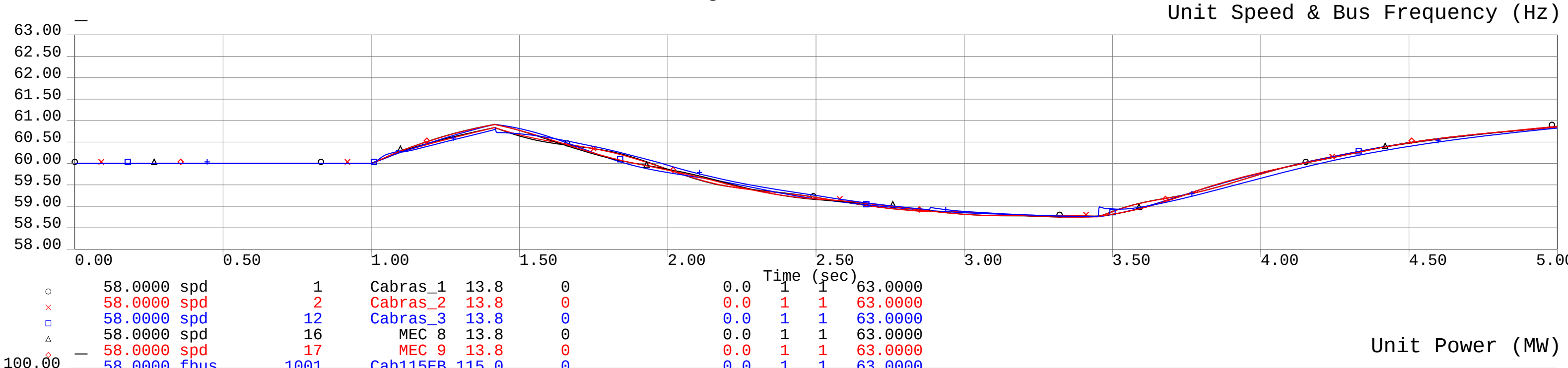
Simulation Plot Listing - Alternative Base Cases (only exceptions)

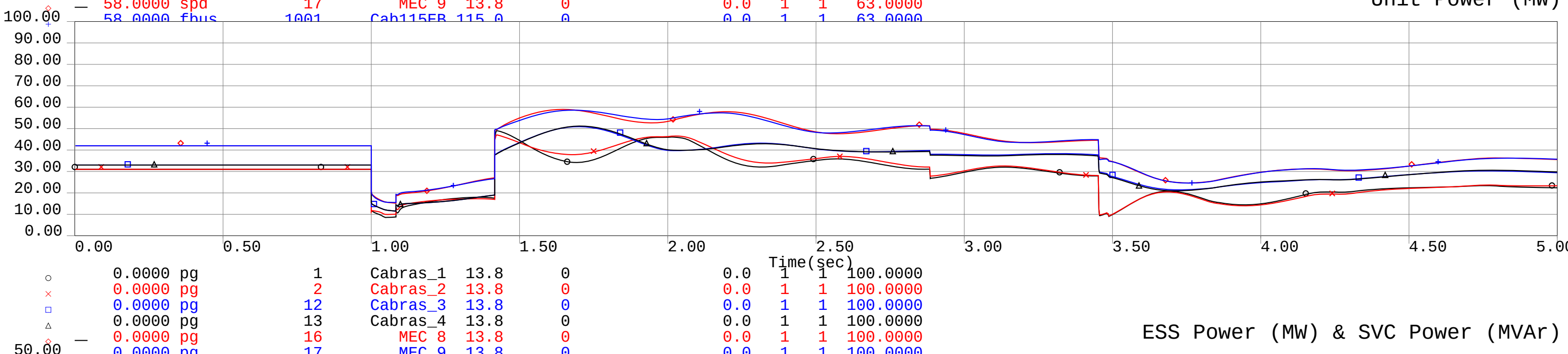
Base Case	ESS Configuration	Disturbance ID	FIDVR	Renewable Block Trip	Complete Case ID
1421	40a	lf12	fidvr		1421_40a_lf12_fidvr
1421	40a	lf12	fidvr	pv	1421_40a_lf12_fidvr_pv
1422	40a	lf12	fidvr		1422_40a_lf12_fidvr
1422	40a	lf12	fidvr	pv	1422_40a_lf12_fidvr_pv
2421	40a	lf12	fidvr		2421_40a_lf12_fidvr
2421	40a	lf12	fidvr	pv	2421_40a_lf12_fidvr_pv
2422	40a	lf12	fidvr		2422_40a_lf12_fidvr
2422	40a	lf12	fidvr	pv	2422_40a_lf12_fidvr_pv
2421	40a	lf14	fidvr		2421_40a_lf14_fidvr
2422	40a	lf14	fidvr		2422_40a_lf14_fidvr
2422	40a	lf14	fidvr	pv	2422_40a_lf14_fidvr_pv
1421	40a	lf15	fidvr		1421_40a_lf15_fidvr
1421	40a	lf15	fidvr	pv	1421_40a_lf15_fidvr_pv
1422	40a	lf15	fidvr		1422_40a_lf15_fidvr
1422	40a	lf15	fidvr	pv	1422_40a_lf15_fidvr_pv
2421	40a	lf15	fidvr		2421_40a_lf15_fidvr
2421	40a	lf15	fidvr	pv	2421_40a_lf15_fidvr_pv
2422	40a	lf15	fidvr		2422_40a_lf15_fidvr
2422	40a	lf15	fidvr	pv	2422_40a_lf15_fidvr_pv
1421	40a	lf16	fidvr		1421_40a_lf16_fidvr
1421	40a	lf16	fidvr	pv	1421_40a_lf16_fidvr_pv
1422	40a	lf16	fidvr		1422_40a_lf16_fidvr
1422	40a	lf16	fidvr	pv	1422_40a_lf16_fidvr_pv
2421	40a	lf16	fidvr		2421_40a_lf16_fidvr
2421	40a	lf16	fidvr	pv	2421_40a_lf16_fidvr_pv
2422	40a	lf16	fidvr		2422_40a_lf16_fidvr
2422	40a	lf16	fidvr	pv	2422_40a_lf16_fidvr_pv
2421	40a	lf17	fidvr		2421_40a_lf17_fidvr
2422	40a	lf17	fidvr		2422_40a_lf17_fidvr
2422	40a	lf17	fidvr	pv	2422_40a_lf17_fidvr_pv
1421	40a	lf18	fidvr		1421_40a_lf18_fidvr
1421	40a	lf18	fidvr	pv	1421_40a_lf18_fidvr_pv
1422	40a	lf18	fidvr		1422_40a_lf18_fidvr
1422	40a	lf18	fidvr	pv	1422_40a_lf18_fidvr_pv
2421	40a	lf18	fidvr		2421_40a_lf18_fidvr
2421	40a	lf18	fidvr	pv	2421_40a_lf18_fidvr_pv
2422	40a	lf18	fidvr		2422_40a_lf18_fidvr
2422	40a	lf18	fidvr	pv	2422_40a_lf18_fidvr_pv

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

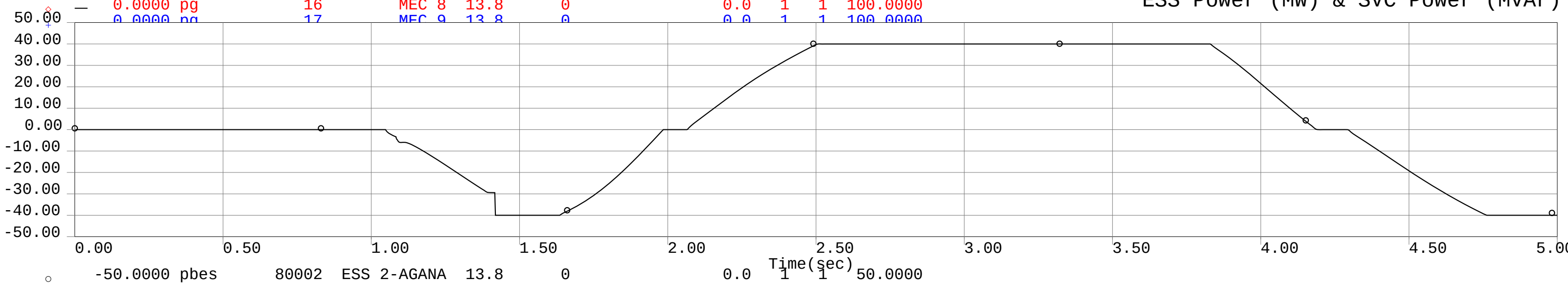
Unit Speed & Bus Frequency (Hz)



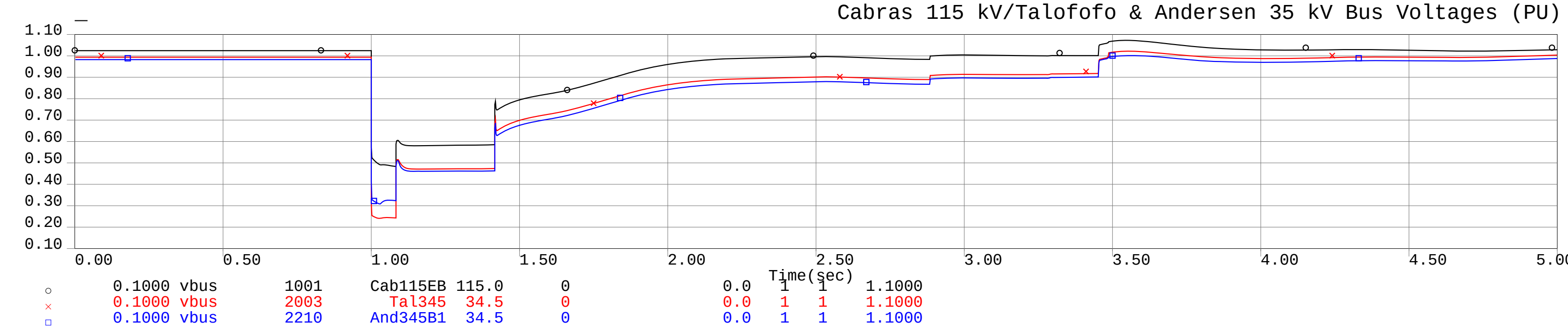
Unit Power (MW)



ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



chans/1421_40a_lf12_fidvr.chf

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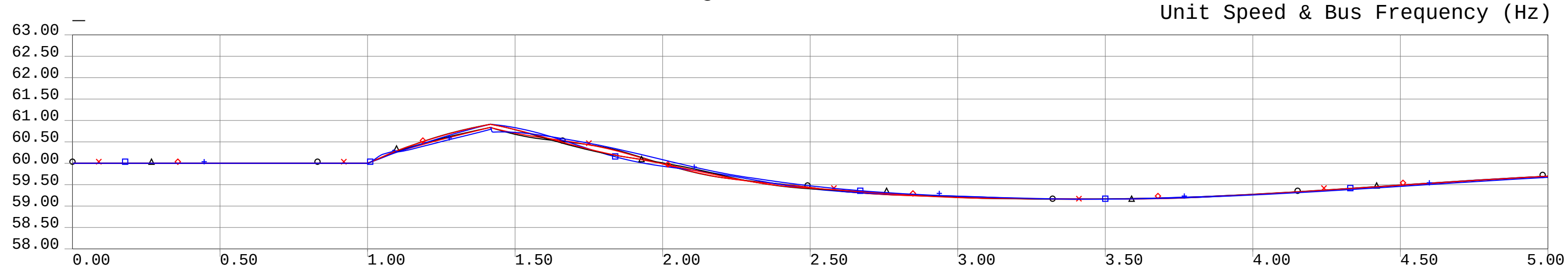
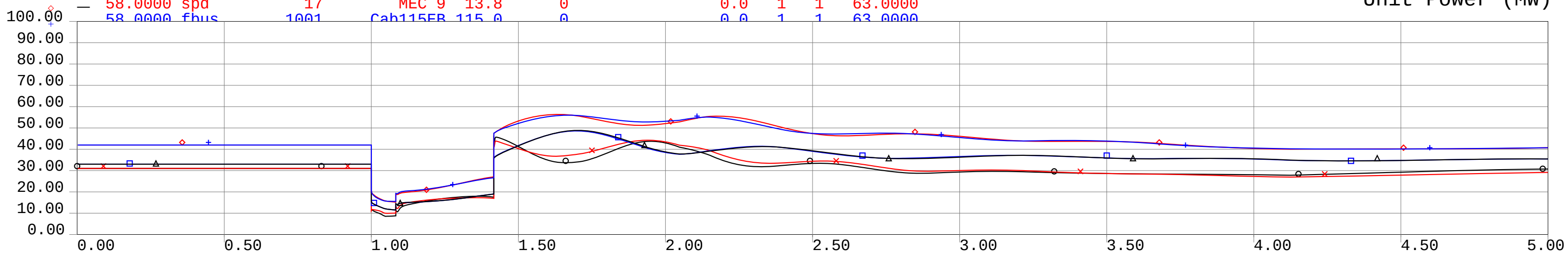
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



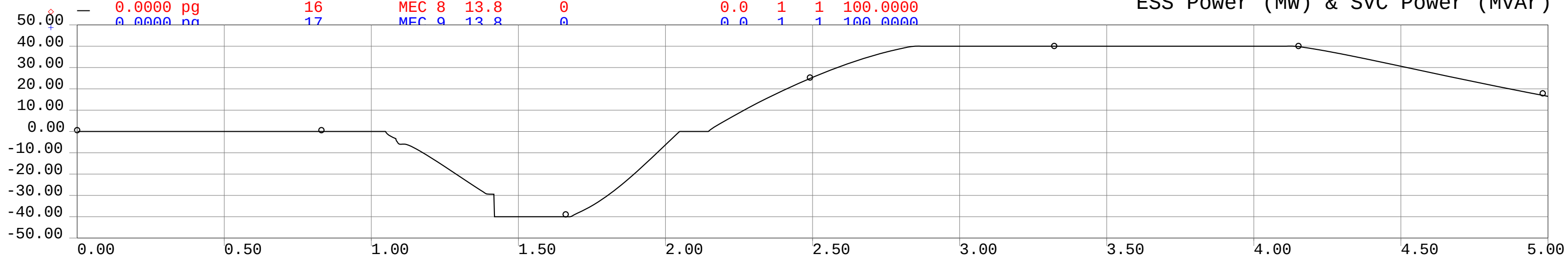
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



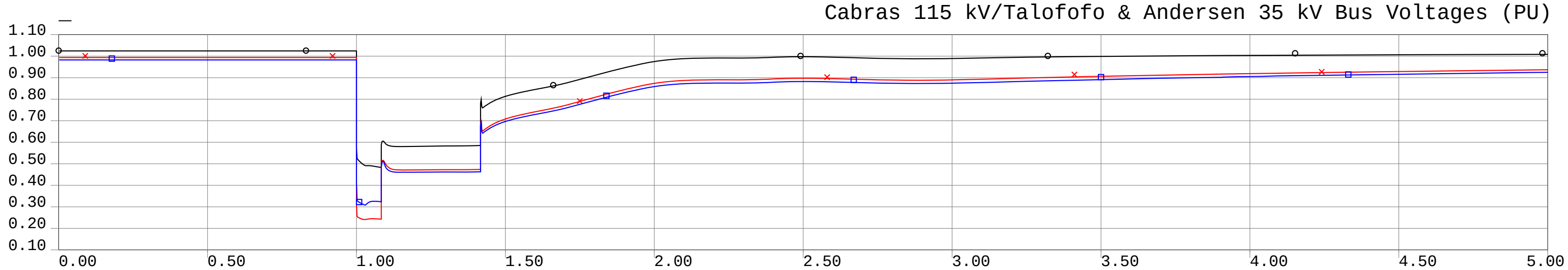
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1421_40a_lf12_fidvr_pv.chf

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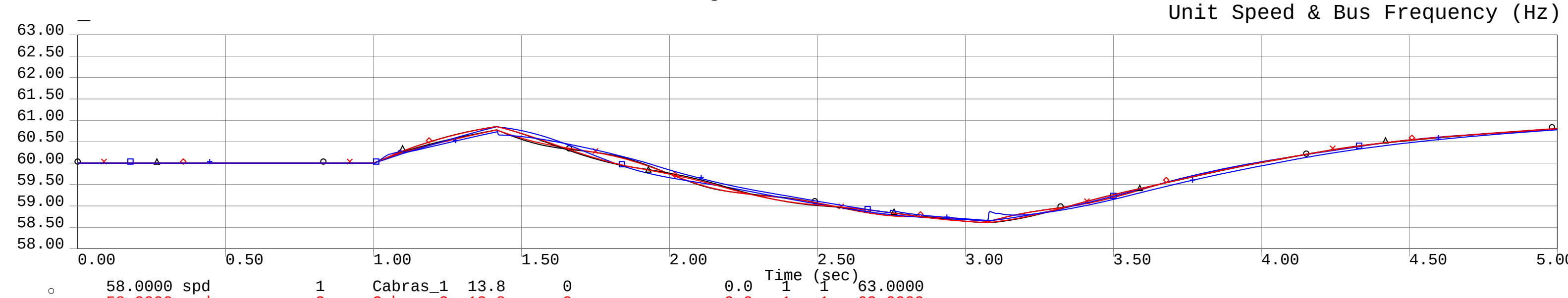
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

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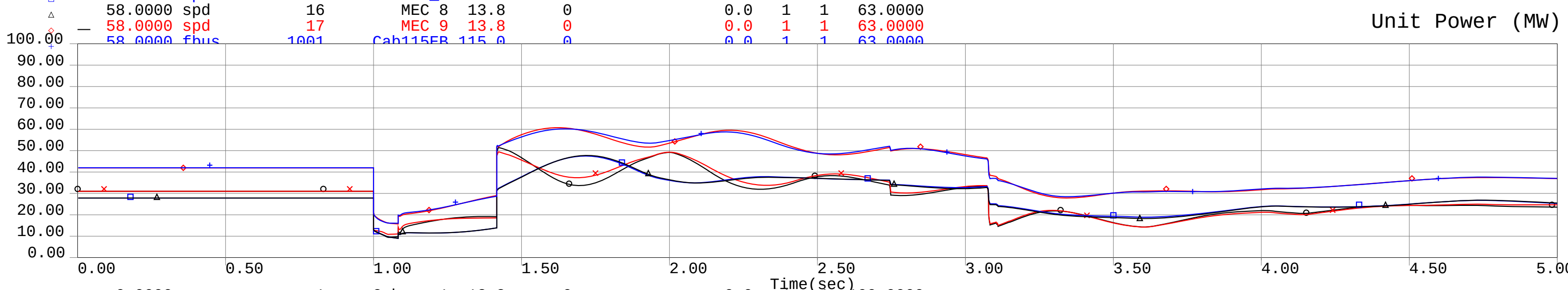
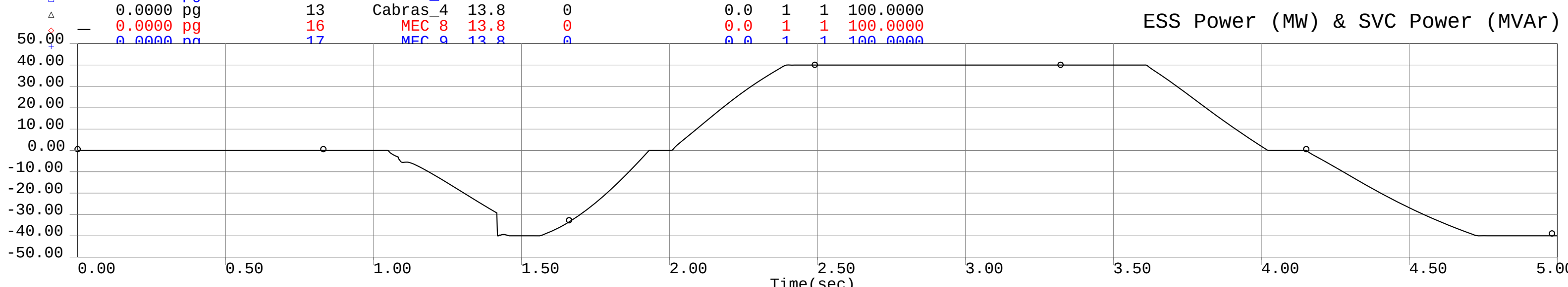
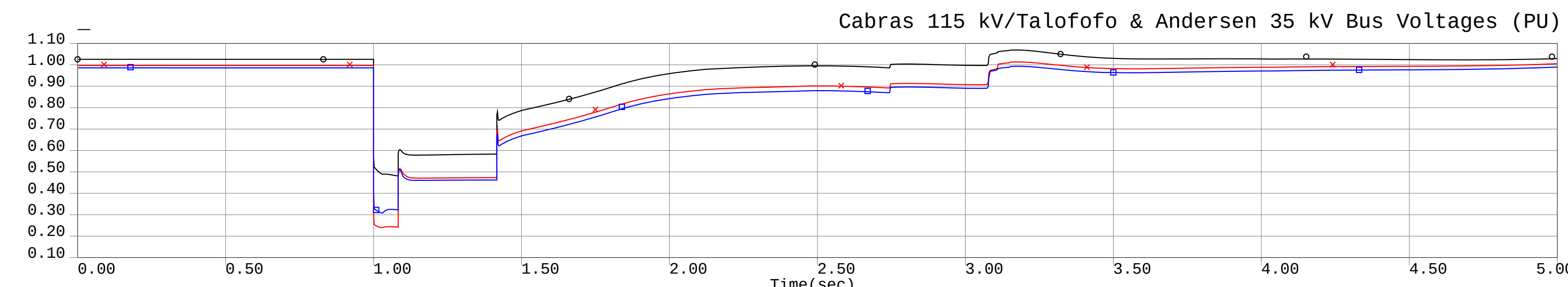
58.0000 spd       1   Cabras_1  13.8   0   0.0  1  1  63.0000
58.0000 spd       2   Cabras_2  13.8   0   0.0  1  1  63.0000
58.0000 spd      12   Cabras_3  13.8   0   0.0  1  1  63.0000
58.0000 spd      16      MEC 8  13.8   0   0.0  1  1  63.0000
58.0000 spd      17      MEC 9  13.8   0   0.0  1  1  63.0000
58.0000 fbus   1001   Cab115EB 115.0   0   0.0  1  1  63.0000
```




```
0.0000 pg         1   Cabras_1  13.8   0   0.0  1  1  100.0000
0.0000 pg         2   Cabras_2  13.8   0   0.0  1  1  100.0000
0.0000 pg        12   Cabras_3  13.8   0   0.0  1  1  100.0000
0.0000 pg        13   Cabras_4  13.8   0   0.0  1  1  100.0000
0.0000 pg        16      MEC 8  13.8   0   0.0  1  1  100.0000
0.0000 pg        17      MEC 9  13.8   0   0.0  1  1  100.0000
```




```
-50.0000 pbes    80002 ESS 2-AGANA  13.8   0   0.0  1  1  50.0000
```




```
0.1000 vbus    1001   Cab115EB 115.0   0   0.0  1  1  1.1000
0.1000 vbus    2003     Tal345  34.5   0   0.0  1  1  1.1000
0.1000 vbus    2210   And345B1  34.5   0   0.0  1  1  1.1000
```


chans/1422_40a_lf12_fidvr.chf

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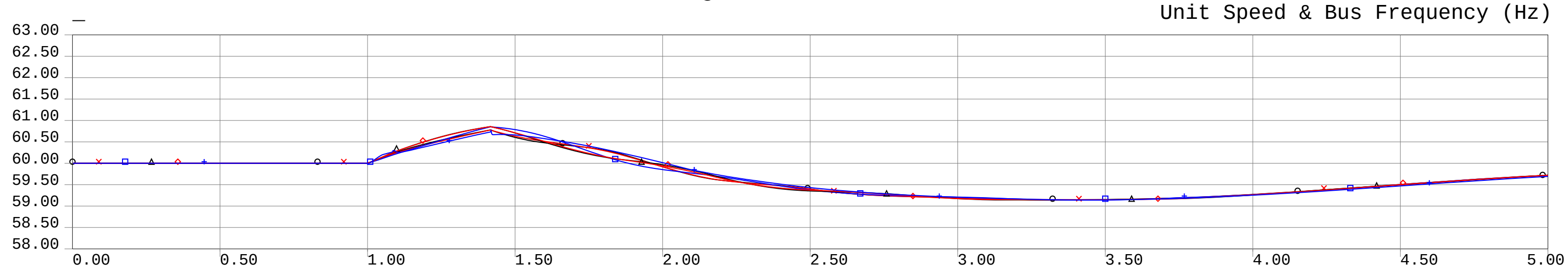
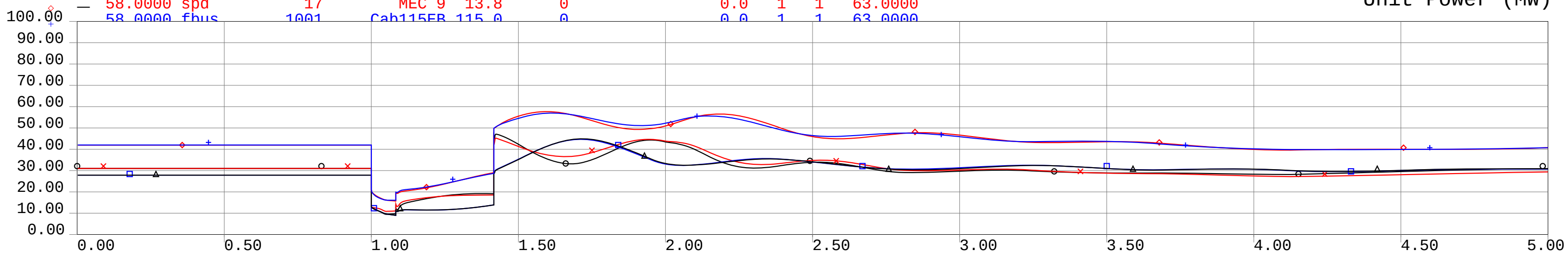
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



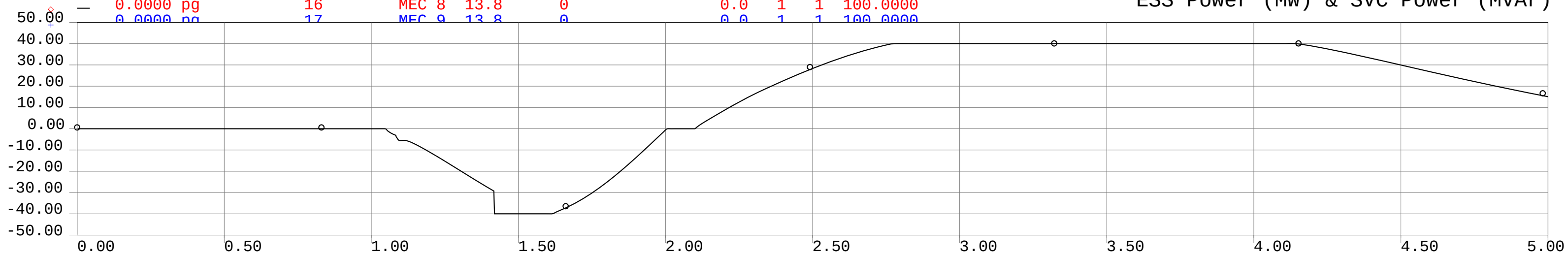
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



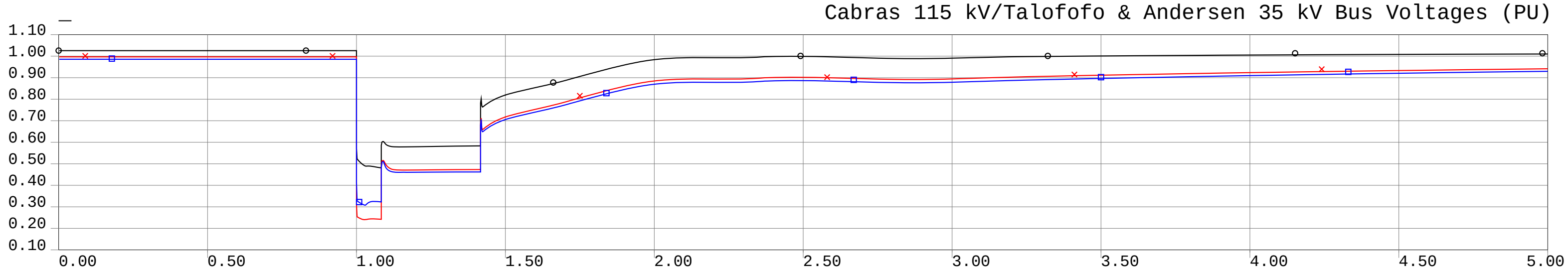
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1422_40a_lf12_fidvr_pv.chf

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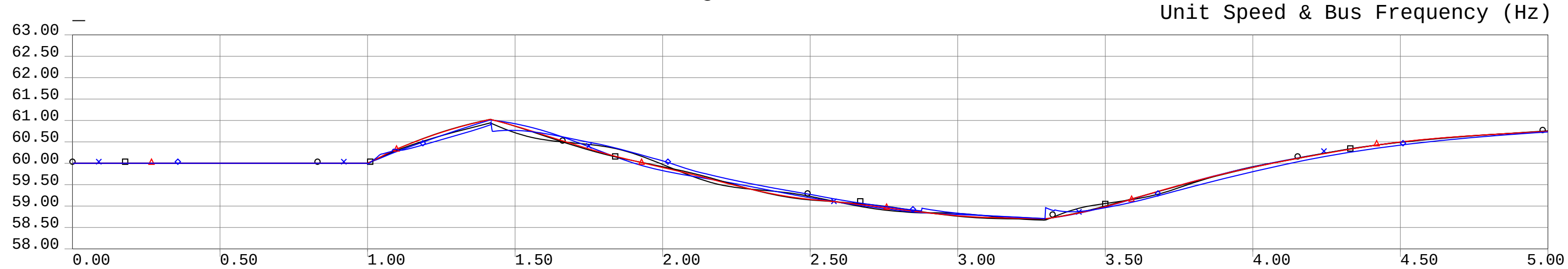
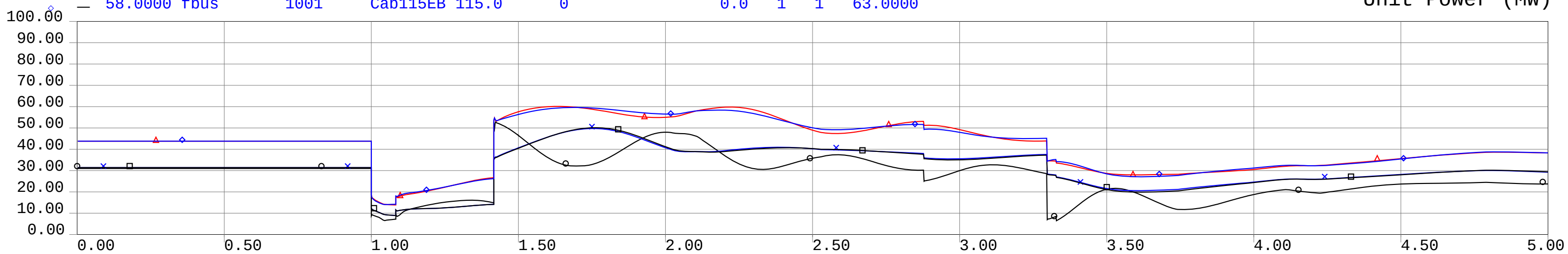
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



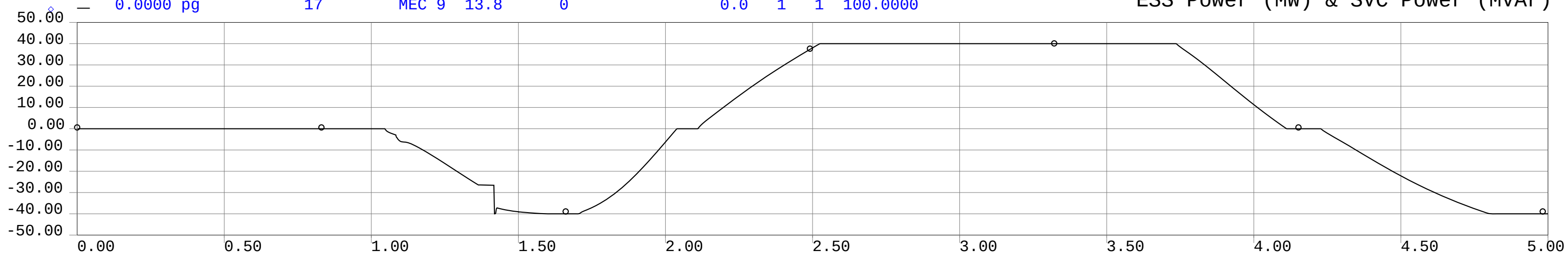
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



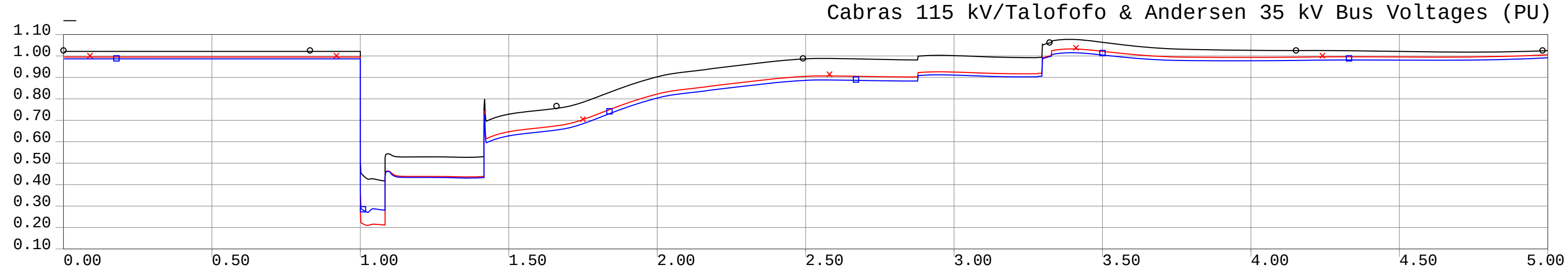
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2421_40a_lf12_fidvr.chf

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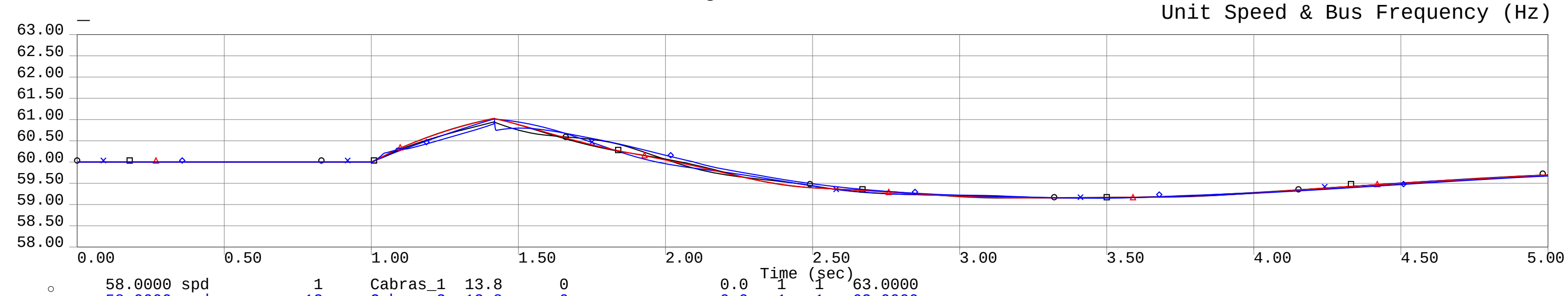
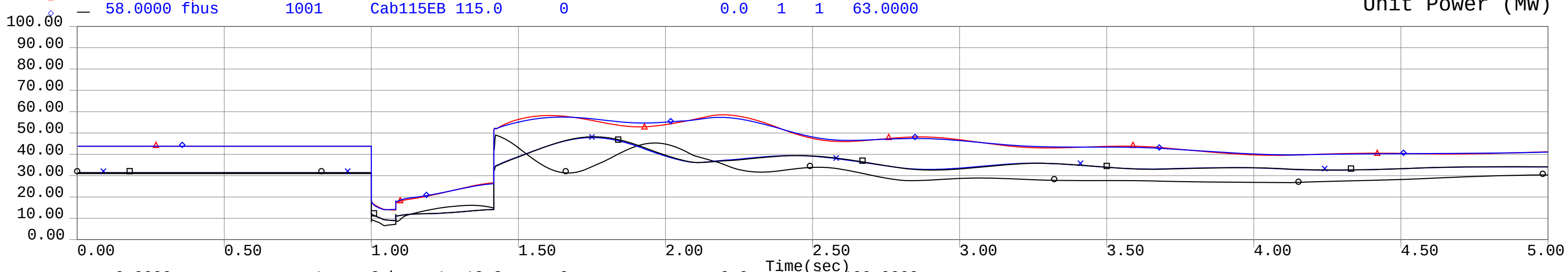
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



```
○  58.0000 spd        1   Cabras_1  13.8   0    0.0  1  1  63.0000
×  58.0000 spd       12   Cabras_3  13.8   0    0.0  1  1  63.0000
□  58.0000 spd       16      MEC 8  13.8   0    0.0  1  1  63.0000
△  58.0000 spd       17      MEC 9  13.8   0    0.0  1  1  63.0000
◇  58.0000 fbus    1001   Cab115EB 115.0   0    0.0  1  1  63.0000
```

Unit Power (MW)



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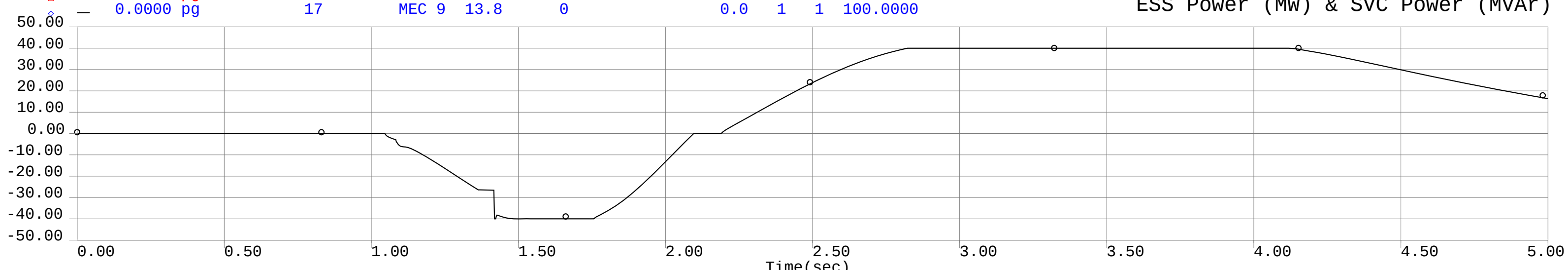
○  0.0000 pg          1   Cabras_1  13.8   0    0.0  1  1  100.0000
×  0.0000 pg         12   Cabras_3  13.8   0    0.0  1  1  100.0000
□  0.0000 pg         13   Cabras_4  13.8   0    0.0  1  1  100.0000
△  0.0000 pg         16      MEC 8  13.8   0    0.0  1  1  100.0000
◇  0.0000 pg         17      MEC 9  13.8   0    0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)



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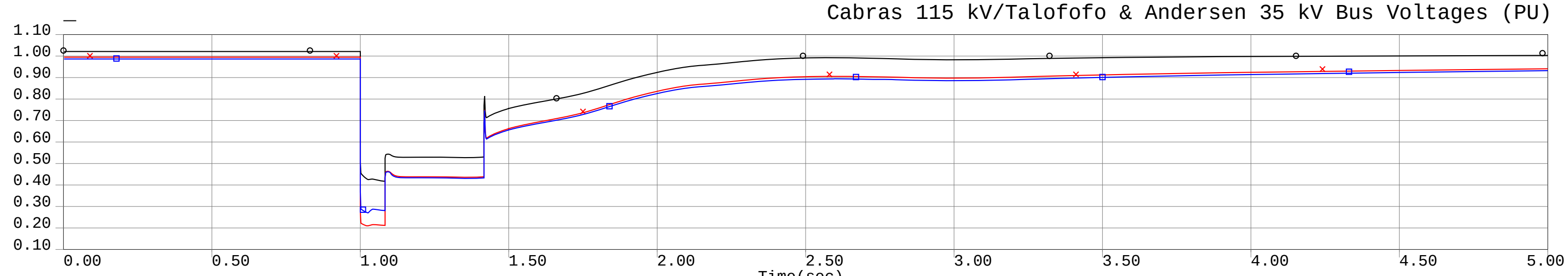
○  -50.0000 pbes  80002  ESS 2-AGANA  13.8   0    0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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○  0.1000 vbus     1001   Cab115EB 115.0   0    0.0  1  1  1.1000
×  0.1000 vbus     2003     Tal345  34.5   0    0.0  1  1  1.1000
□  0.1000 vbus     2210   And345B1  34.5   0    0.0  1  1  1.1000
```


chans/2421_40a_lf12_fidvr_pv.chf

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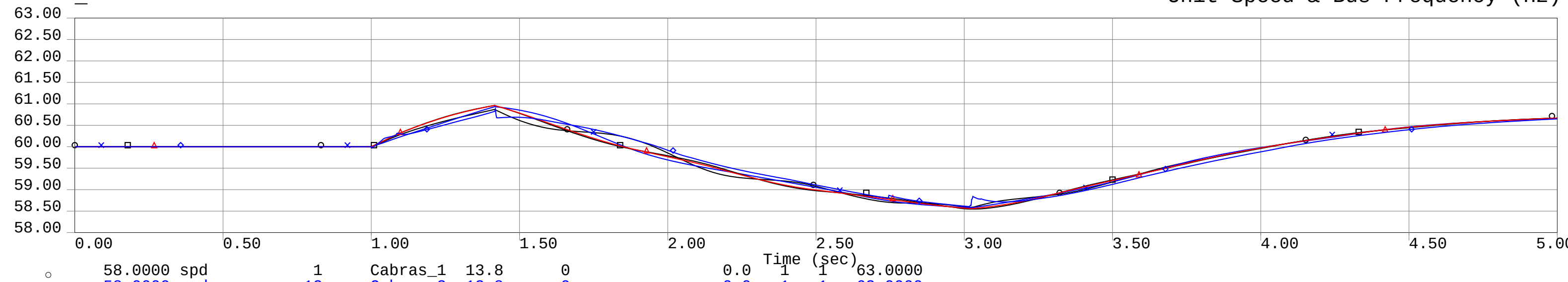
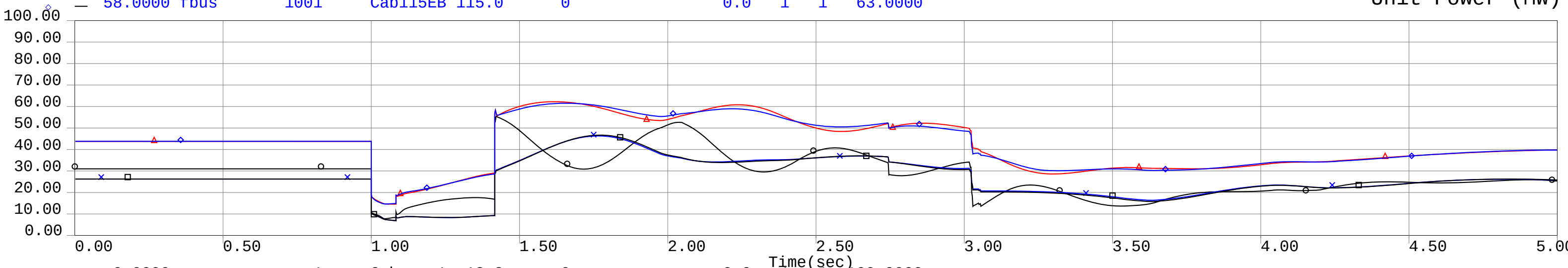
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



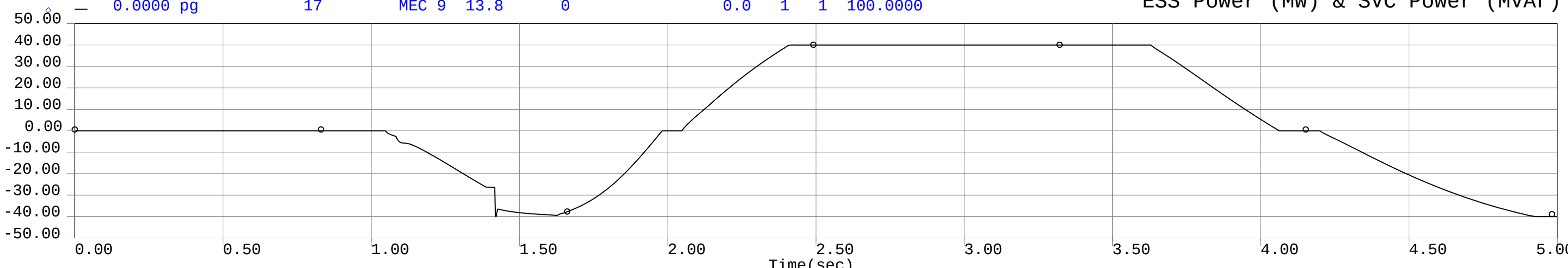
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



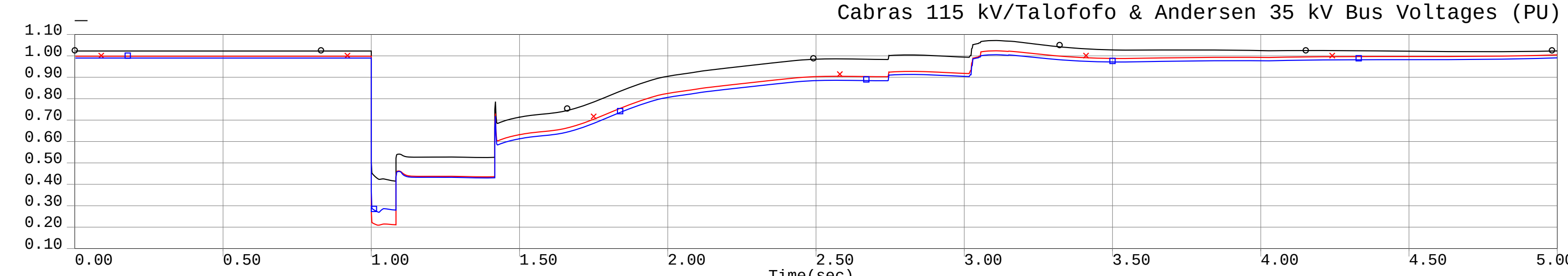
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2422_40a_lf12_fidvr.chf

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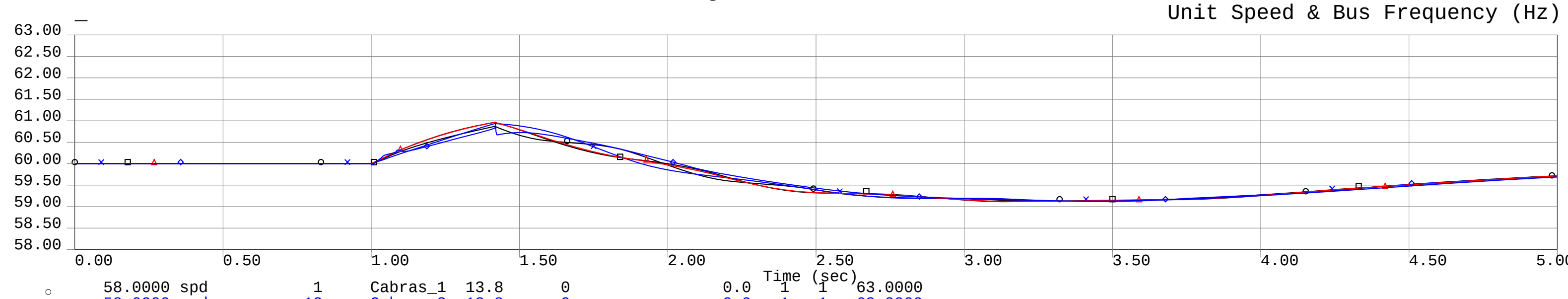
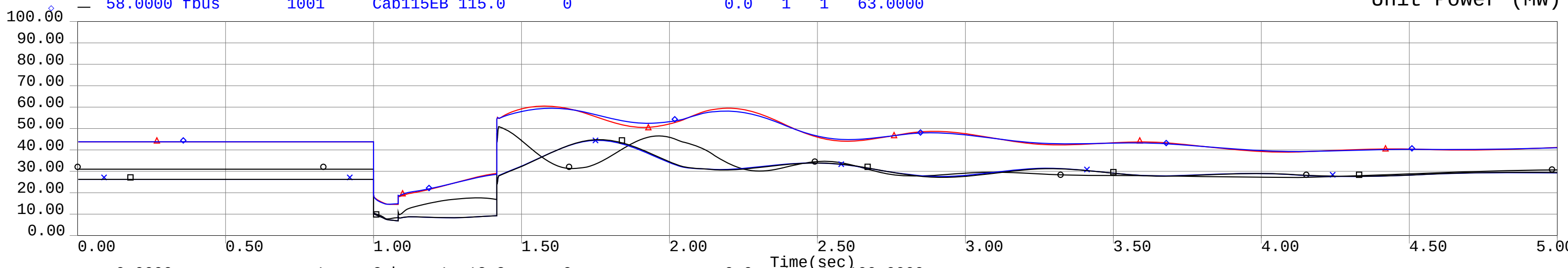
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



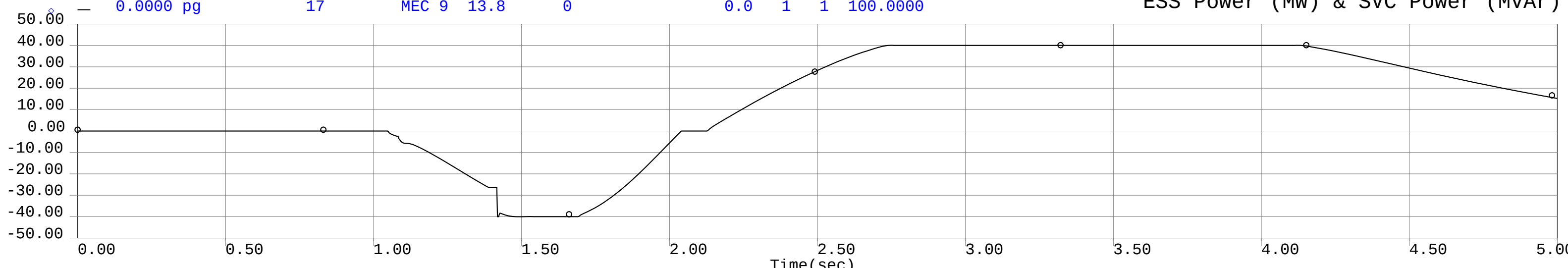
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



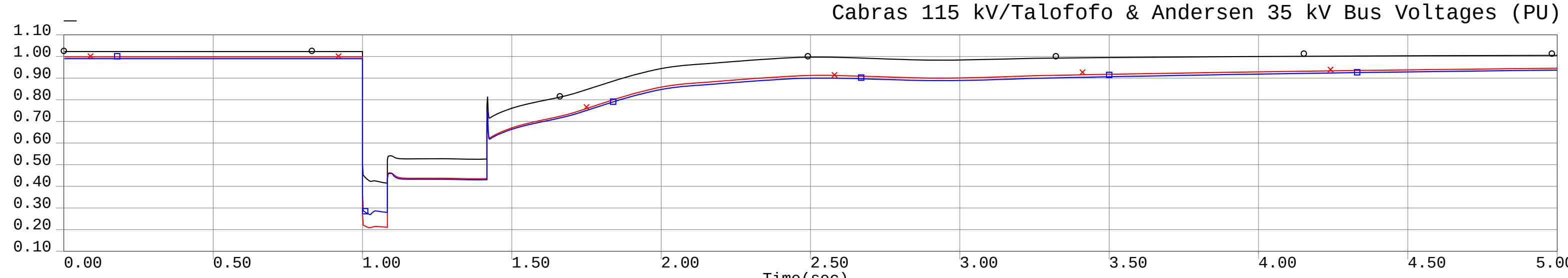
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2422_40a_lf12_fidvr_pv.chf

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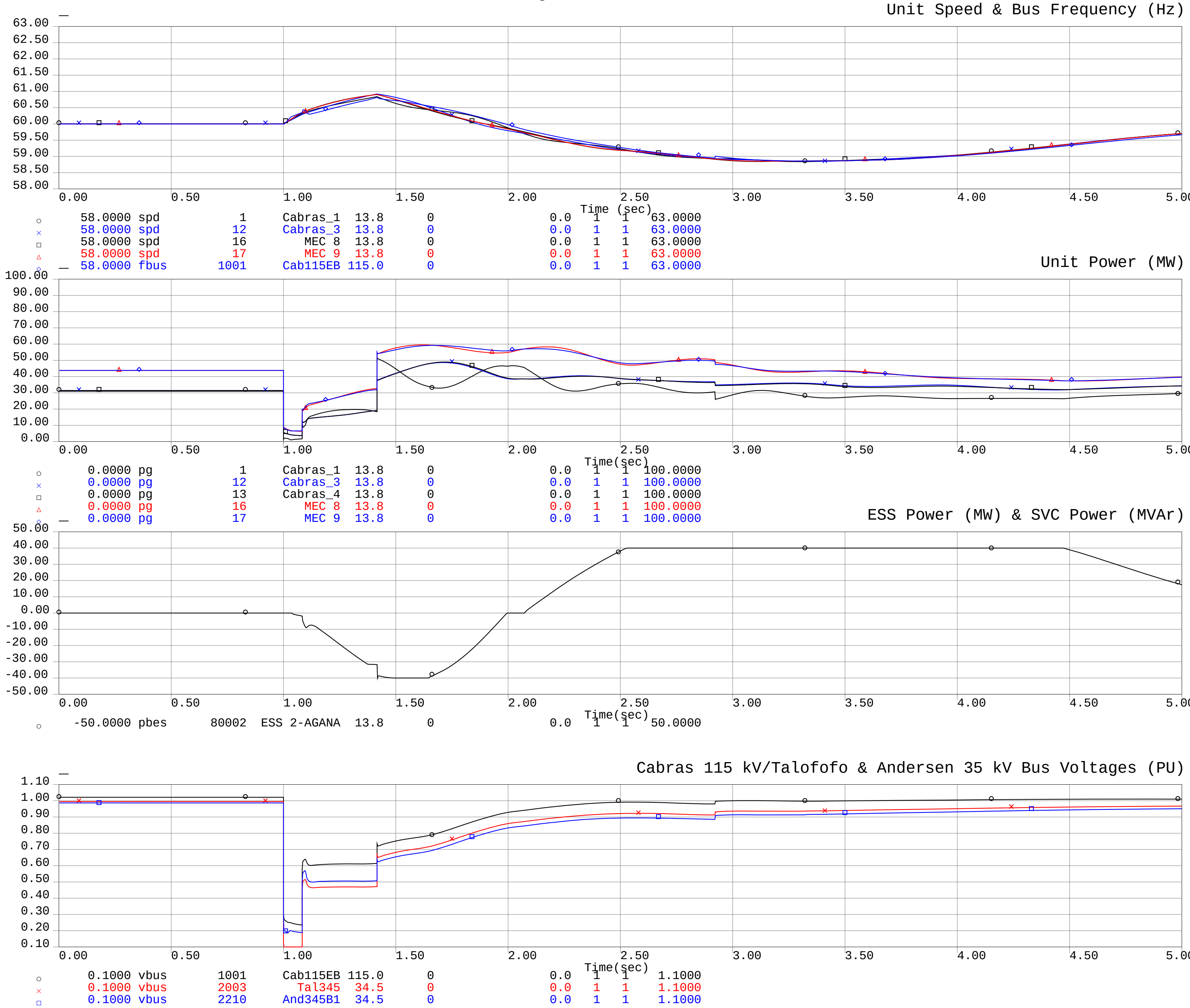
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/2421_40a_lf14_fidvr.chf

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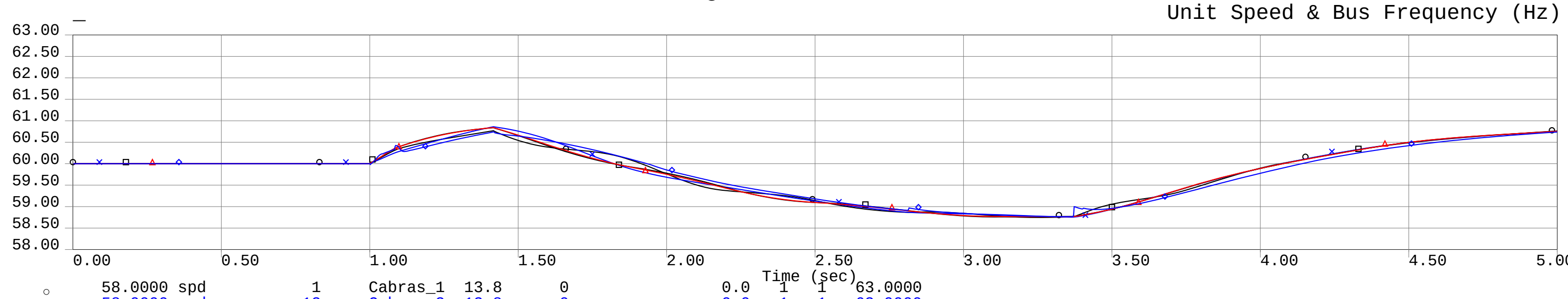
Thu Mar 27 12:39:16 2014

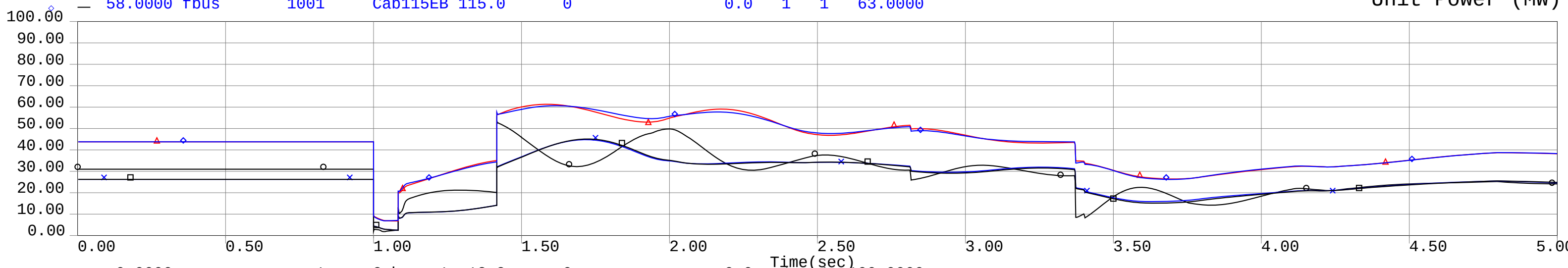
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



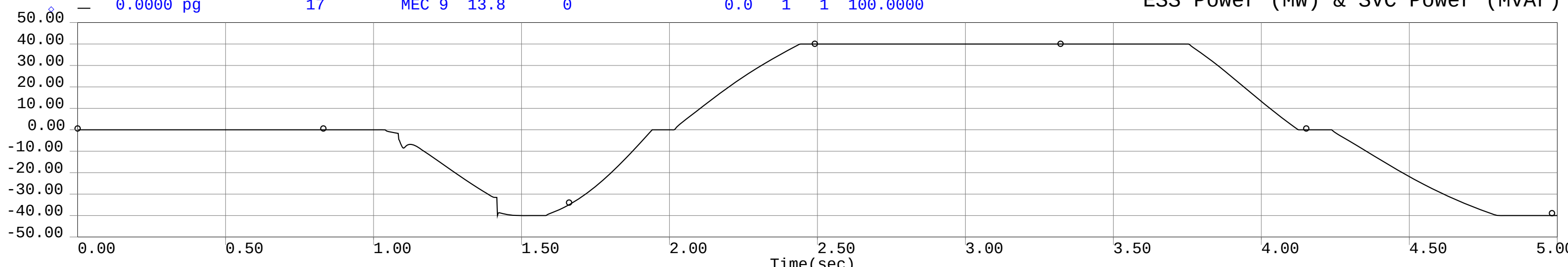
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



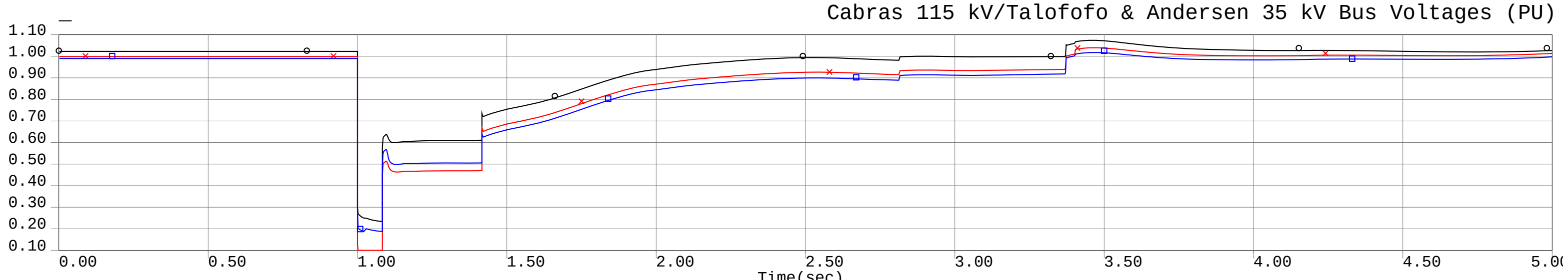
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

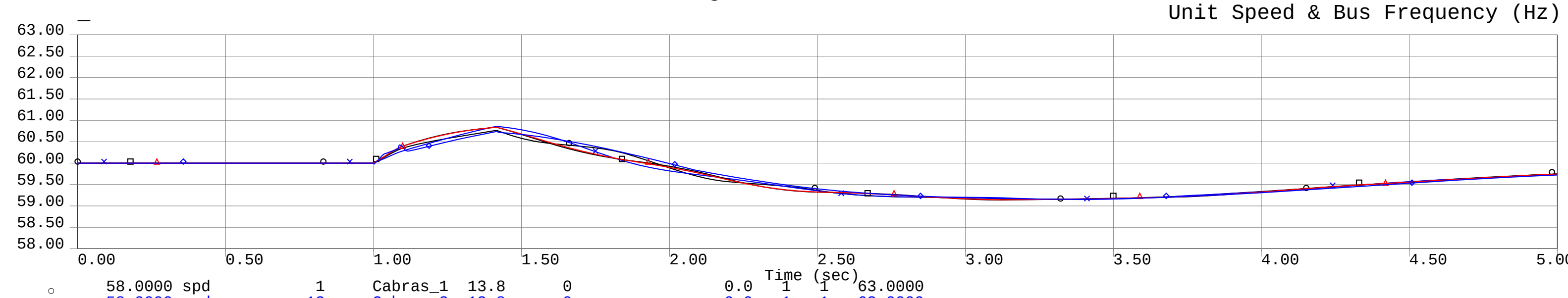
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

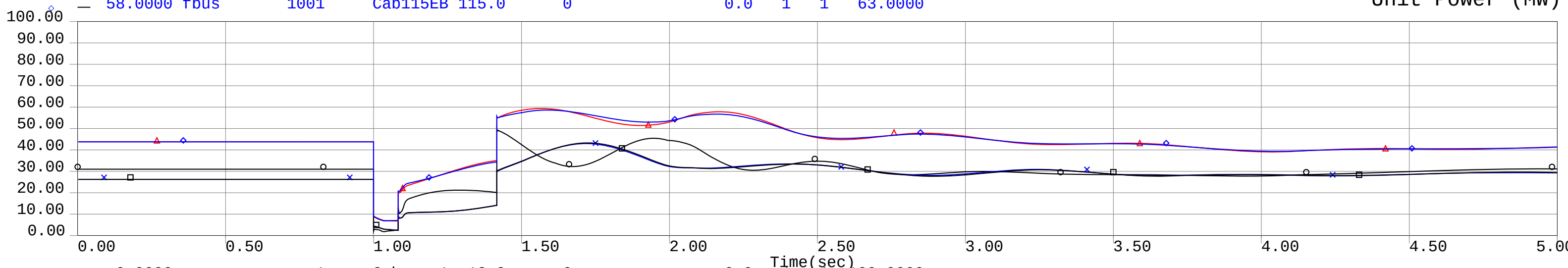
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



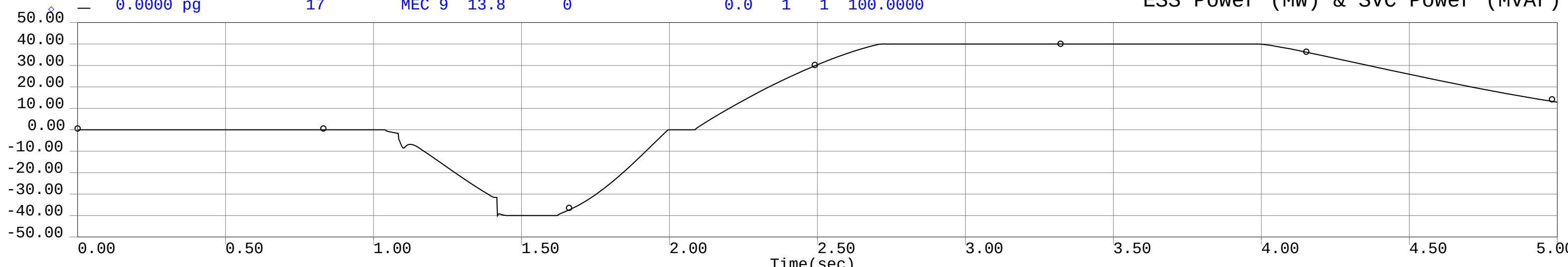
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



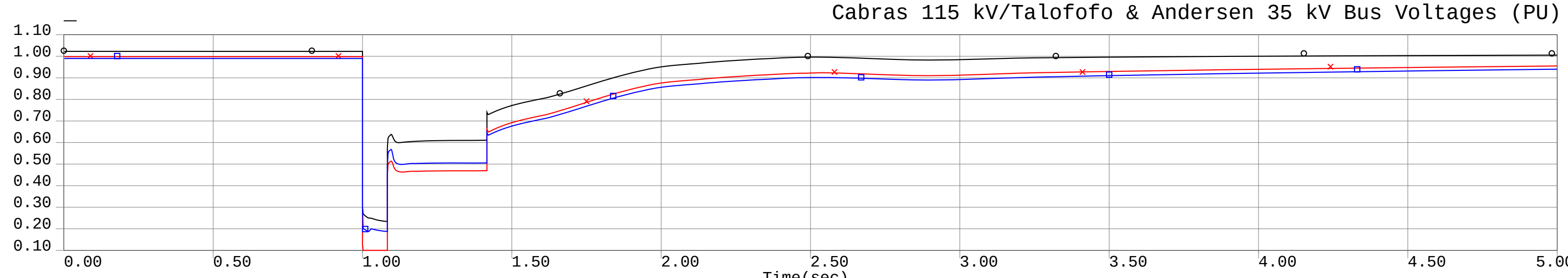
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2422_40a_lf14_fidvr_pv.chf

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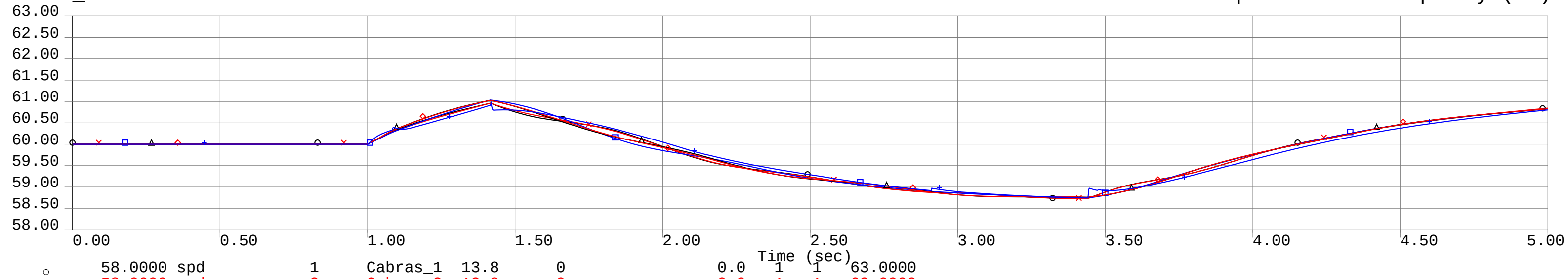
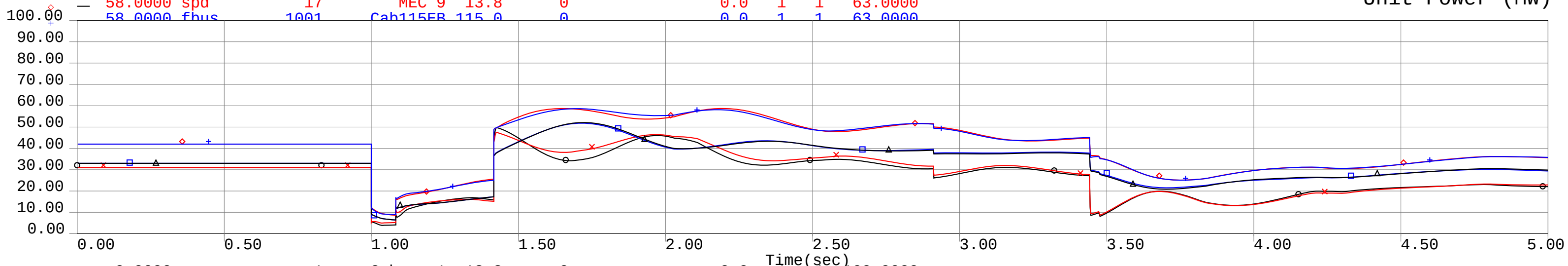
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



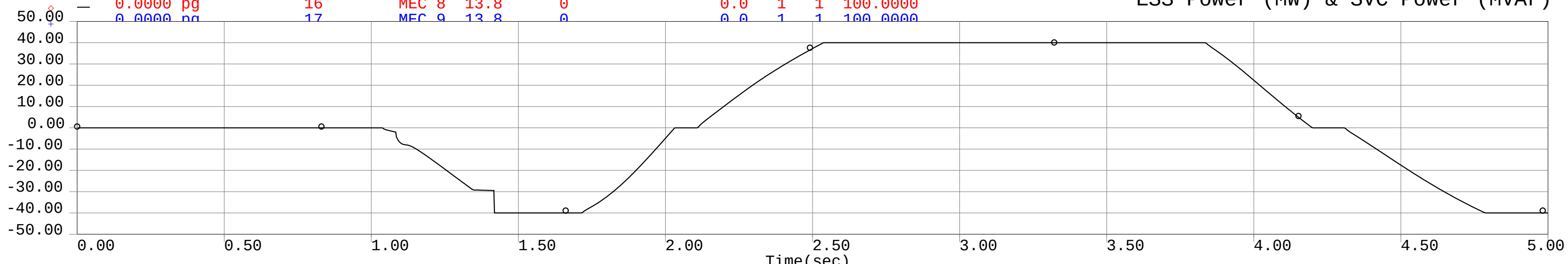
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



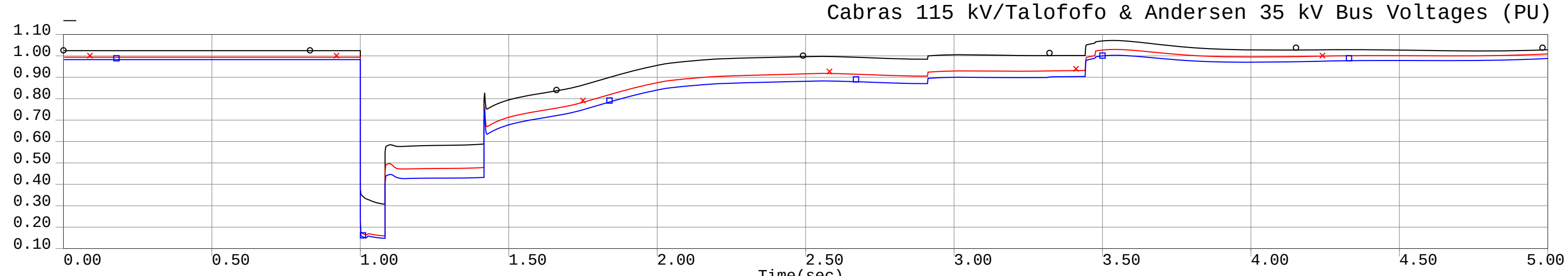
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1421_40a_lf15_fidvr.chf

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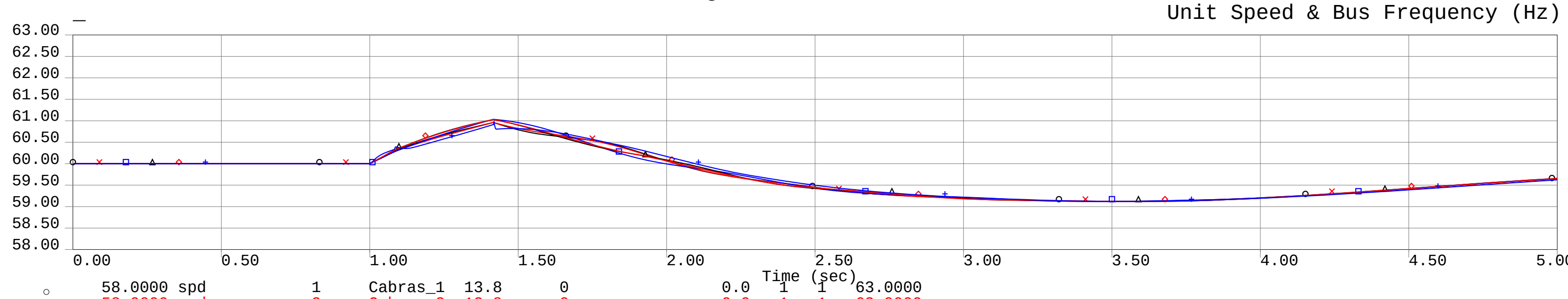
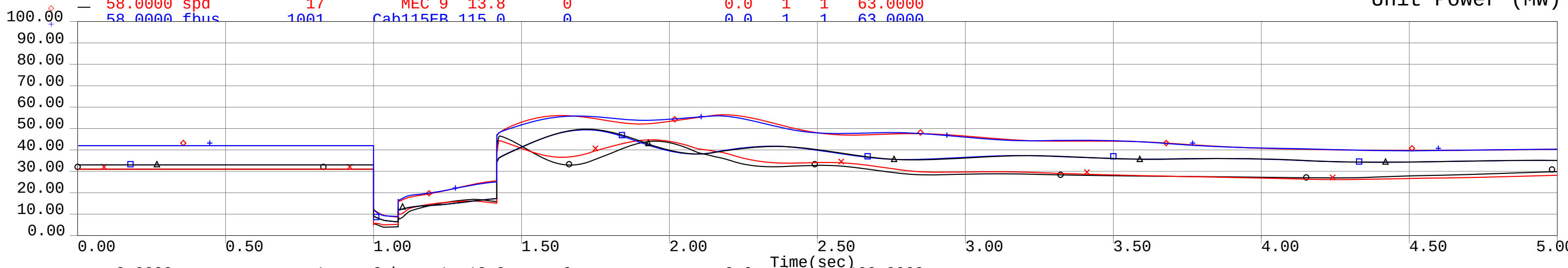
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



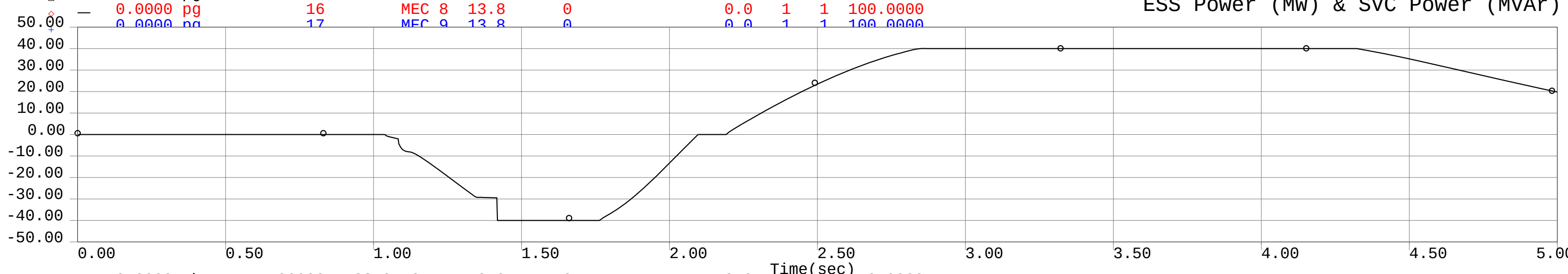
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



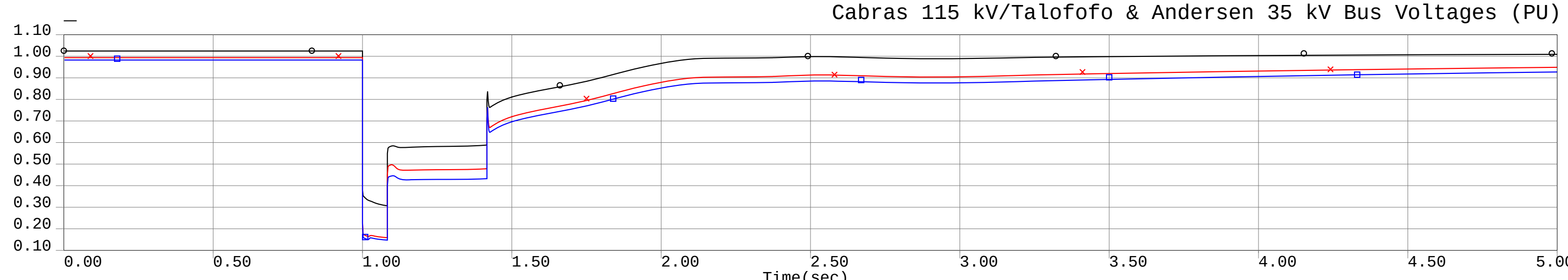
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1421_40a_lf15_fidvr_pv.chf

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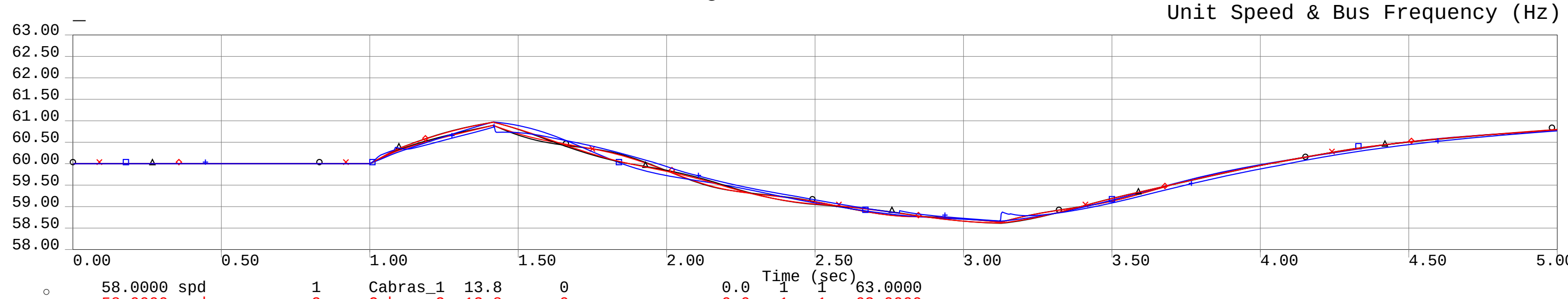
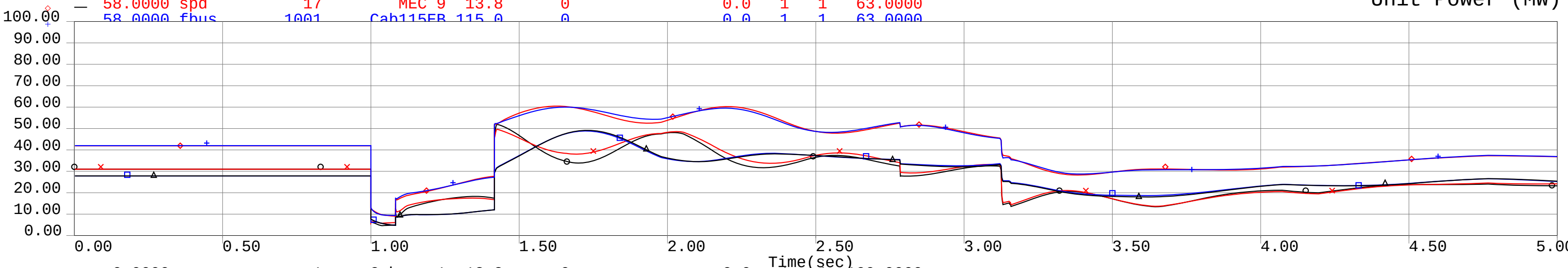
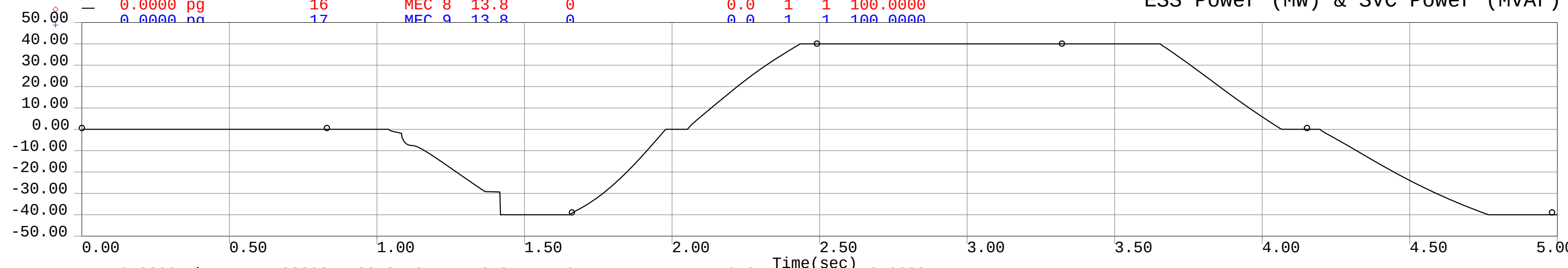
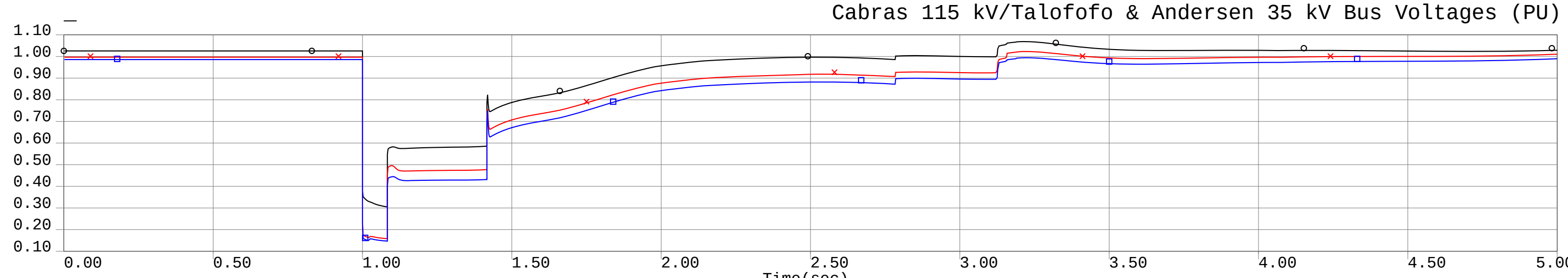
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS









chans/1422_40a_lf15_fidvr.chf

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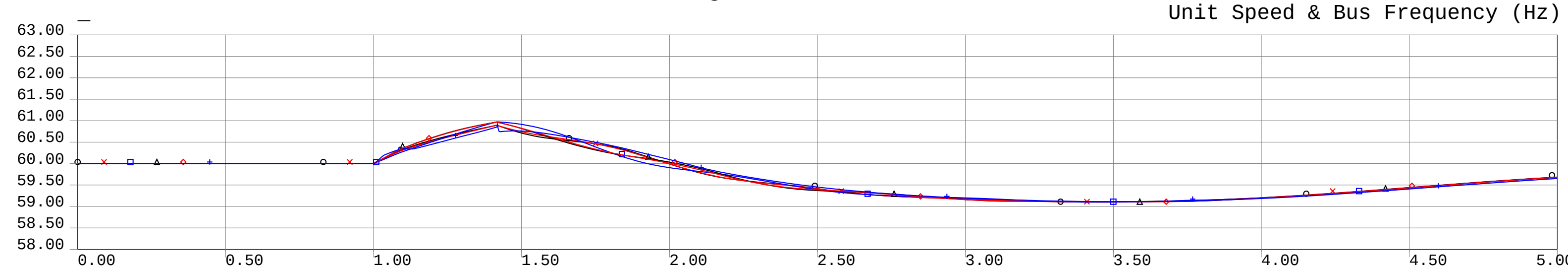
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

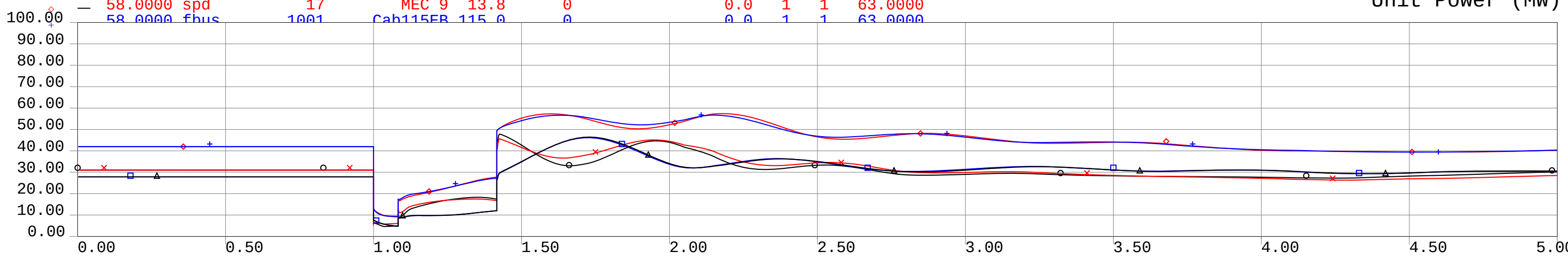
Unit Speed & Bus Frequency (Hz)



Time (sec)

58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

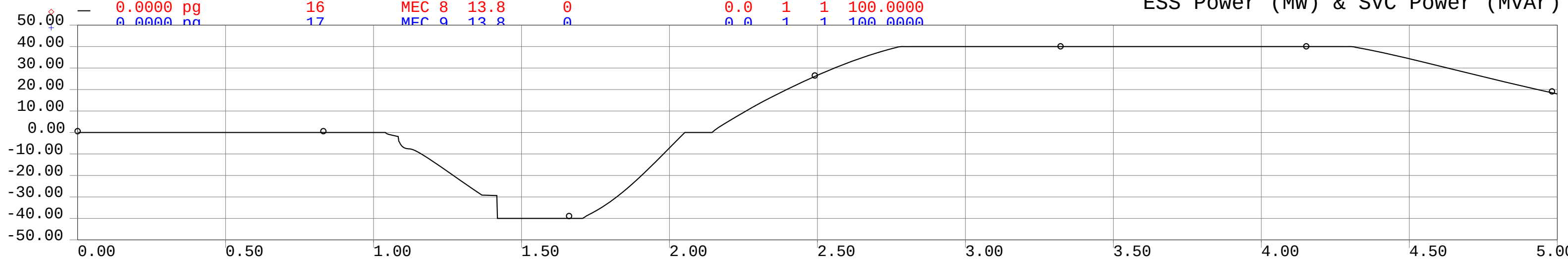
Unit Power (MW)



Time(sec)

0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

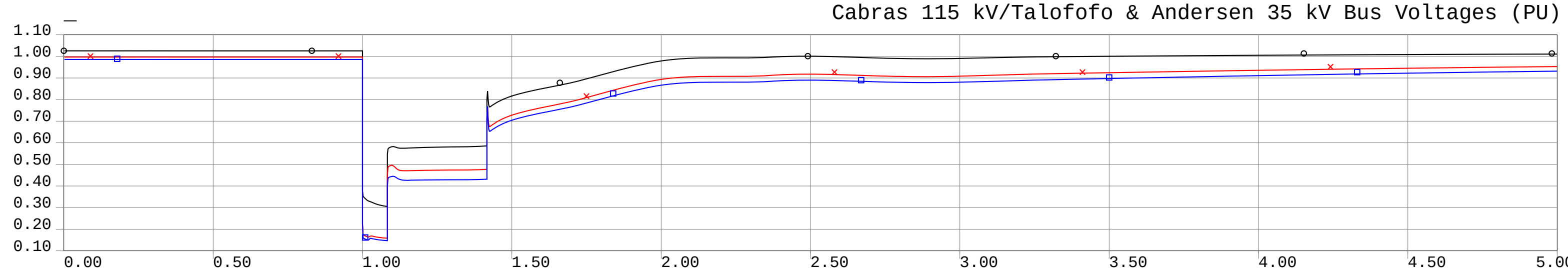
ESS Power (MW) & SVC Power (MVAr)



Time(sec)

-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

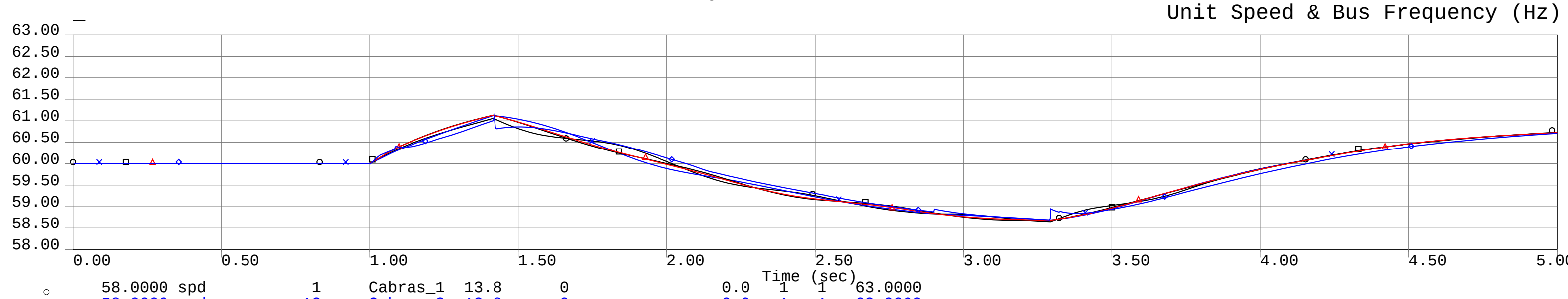


Time(sec)

0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

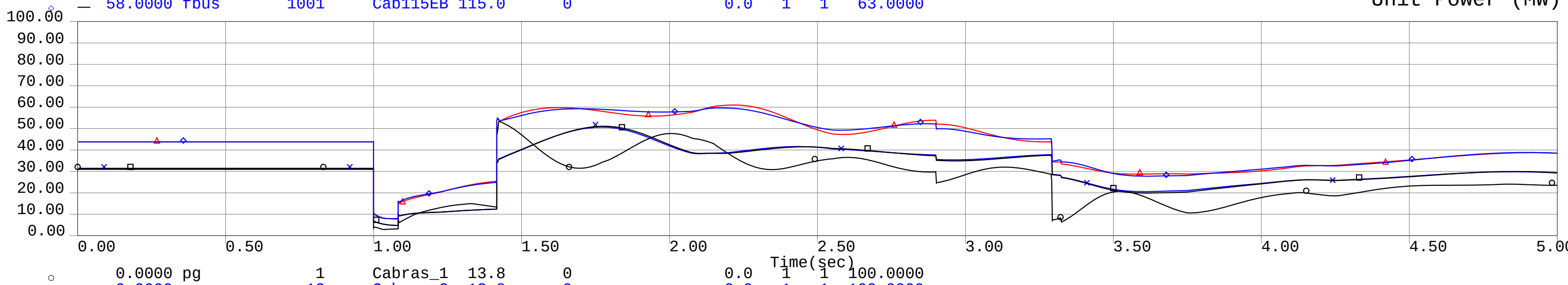
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



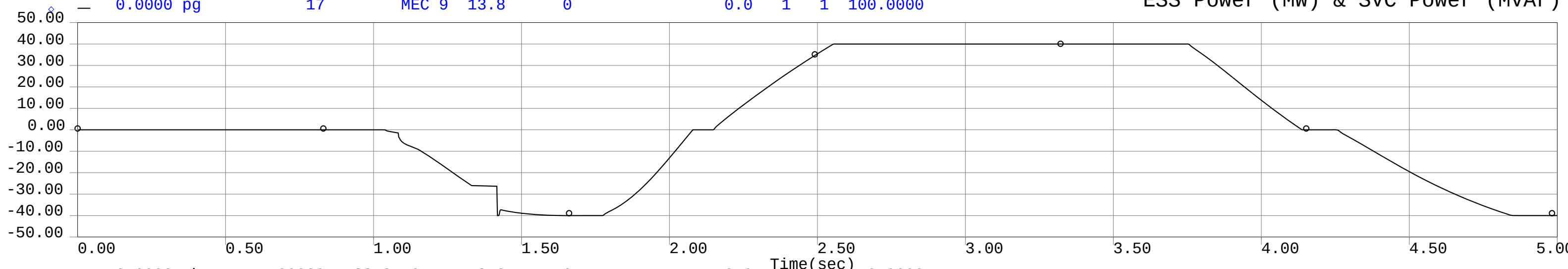

```
○ 58.0000 spd      1   Cabras_1 13.8  0   0.0 1 1 63.0000
× 58.0000 spd     12   Cabras_3 13.8  0   0.0 1 1 63.0000
□ 58.0000 spd     16      MEC 8 13.8  0   0.0 1 1 63.0000
△ 58.0000 spd     17      MEC 9 13.8  0   0.0 1 1 63.0000
◇ 58.0000 fbus  1001  Cab115EB 115.0  0   0.0 1 1 63.0000
```

Unit Power (MW)




```
○ 0.0000 pg   1   Cabras_1 13.8  0   0.0 1 1 100.0000
× 0.0000 pg  12   Cabras_3 13.8  0   0.0 1 1 100.0000
□ 0.0000 pg  13   Cabras_4 13.8  0   0.0 1 1 100.0000
△ 0.0000 pg  16      MEC 8 13.8  0   0.0 1 1 100.0000
◇ 0.0000 pg  17      MEC 9 13.8  0   0.0 1 1 100.0000
```

ESS Power (MW) & SVC Power (MVAr)

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○ -50.0000 pbes  80002  ESS 2-AGANA 13.8  0   0.0 1 1 50.0000
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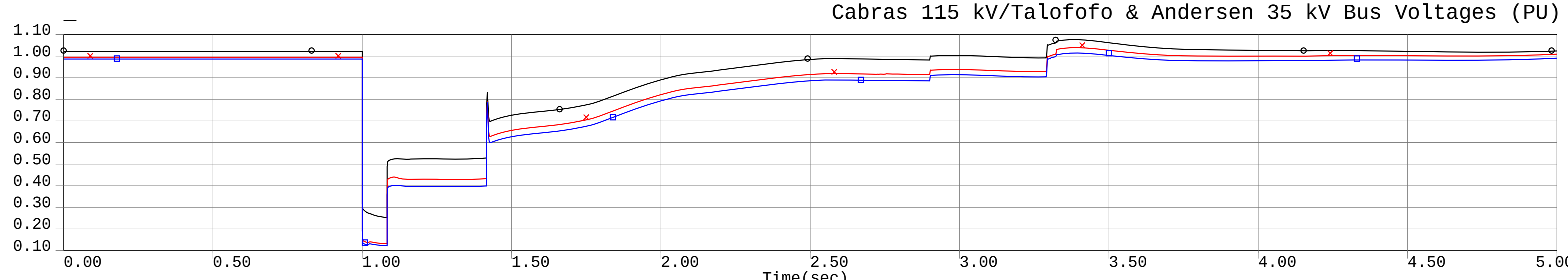
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○ 0.1000 vbus  1001  Cab115EB 115.0  0   0.0 1 1 1.1000
× 0.1000 vbus  2003    Tal345  34.5  0   0.0 1 1 1.1000
□ 0.1000 vbus  2210  And345B1  34.5  0   0.0 1 1 1.1000
```


chans/2421_40a_lf15_fidvr.chf

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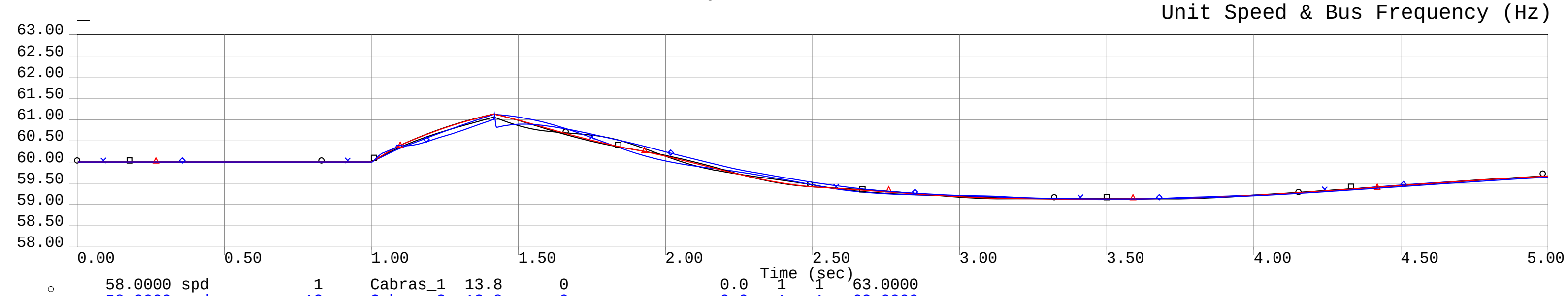
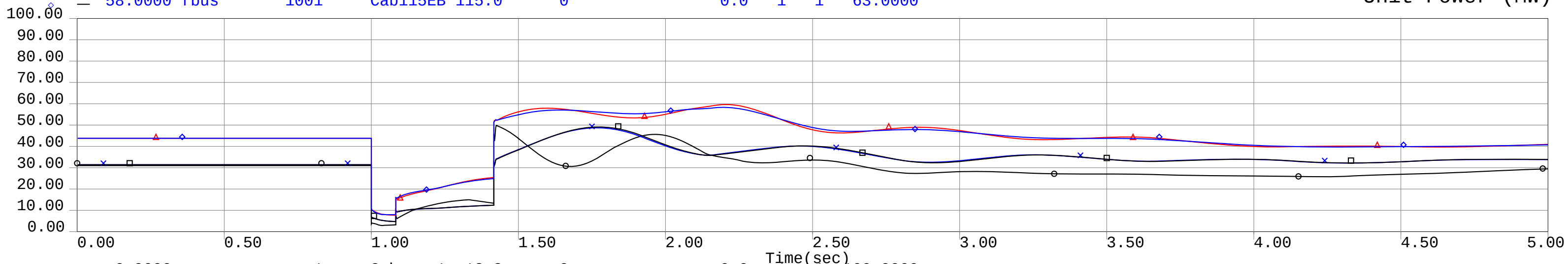
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



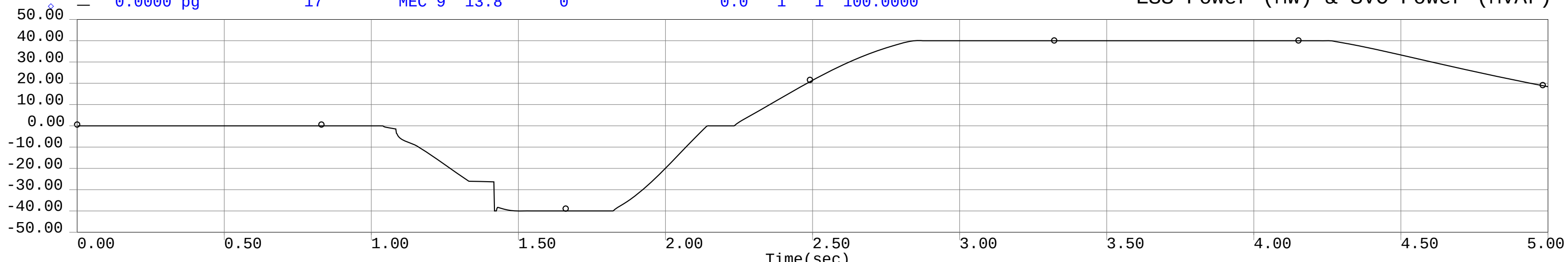
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



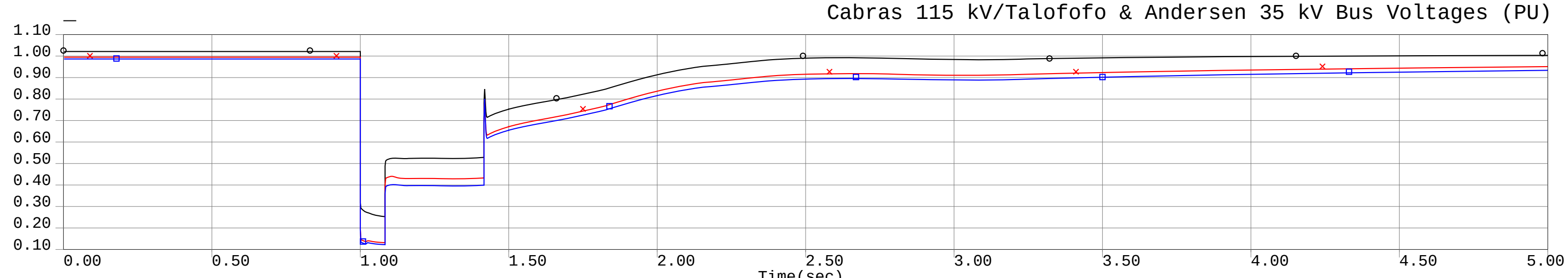
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2421_40a_lf15_fidvr_pv.chf

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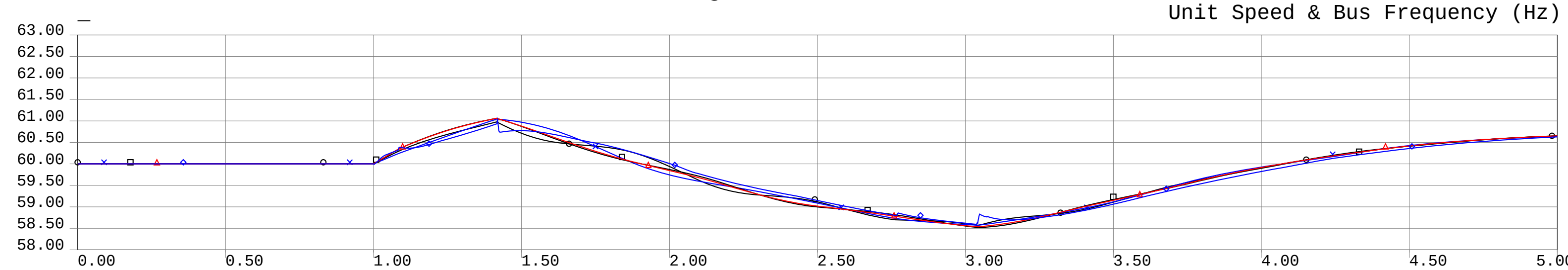
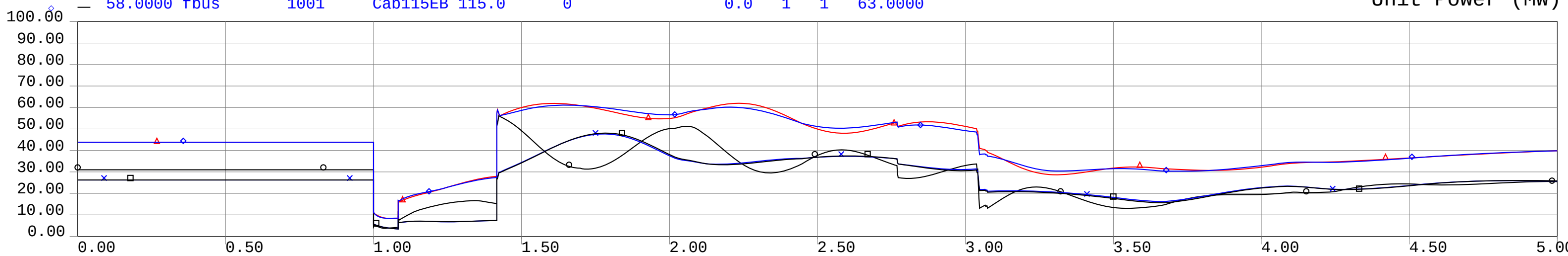
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



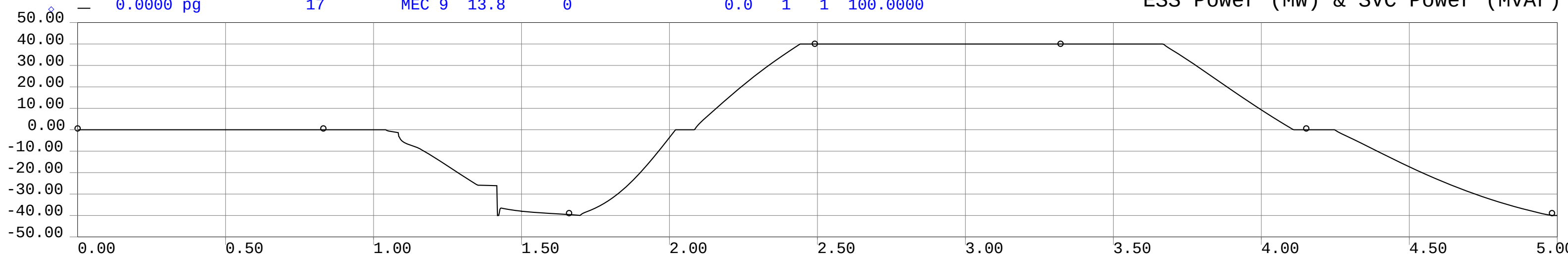
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



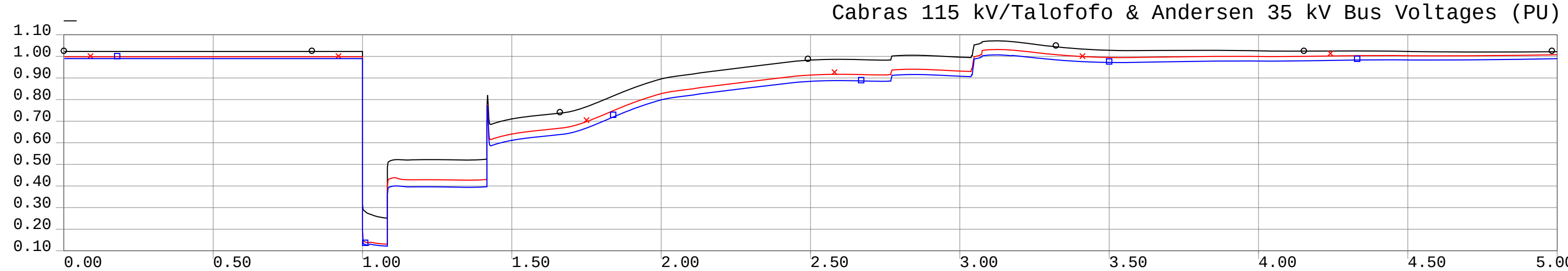
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



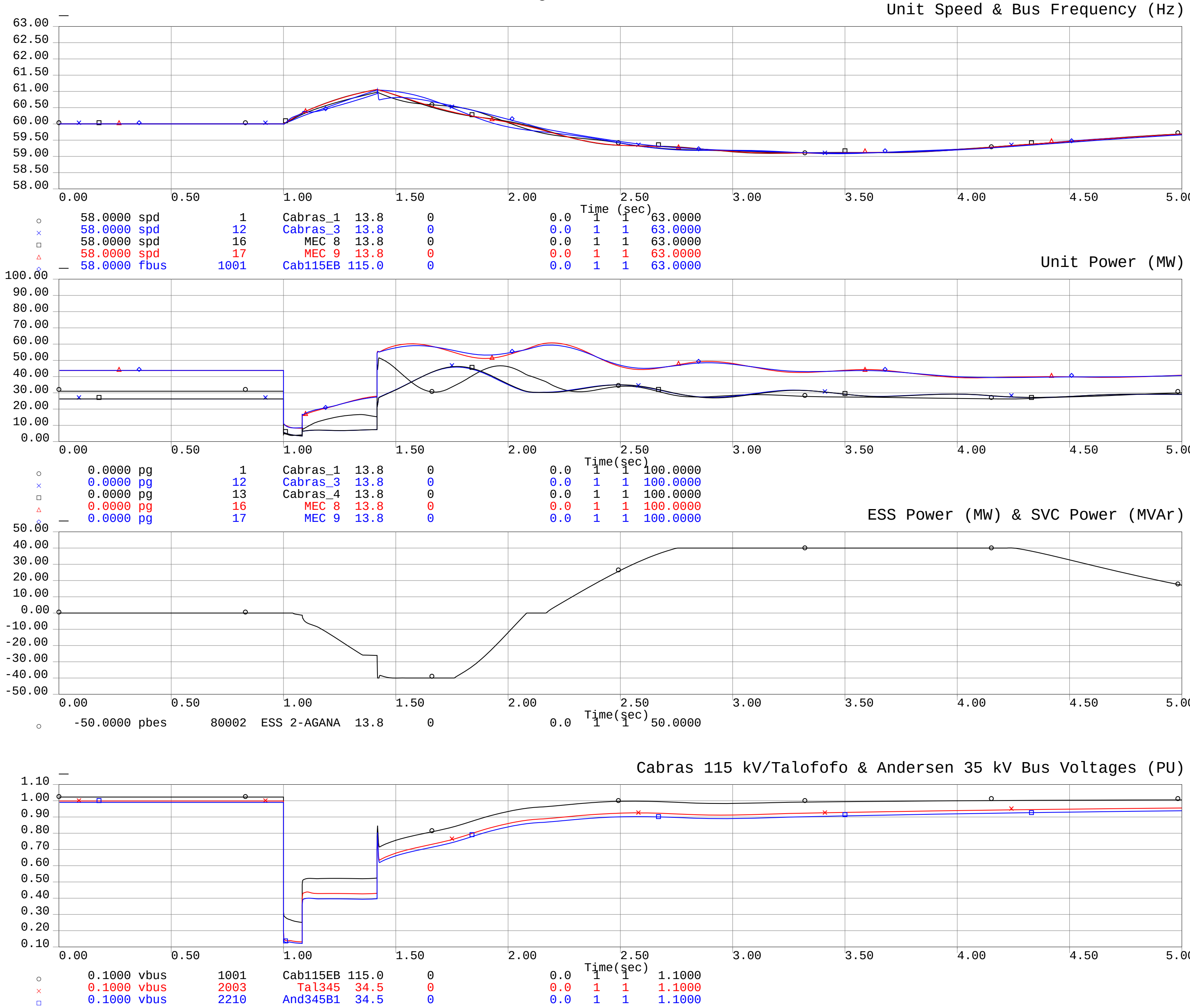
○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/2422_40a_lf15_fidvr_pv.chf

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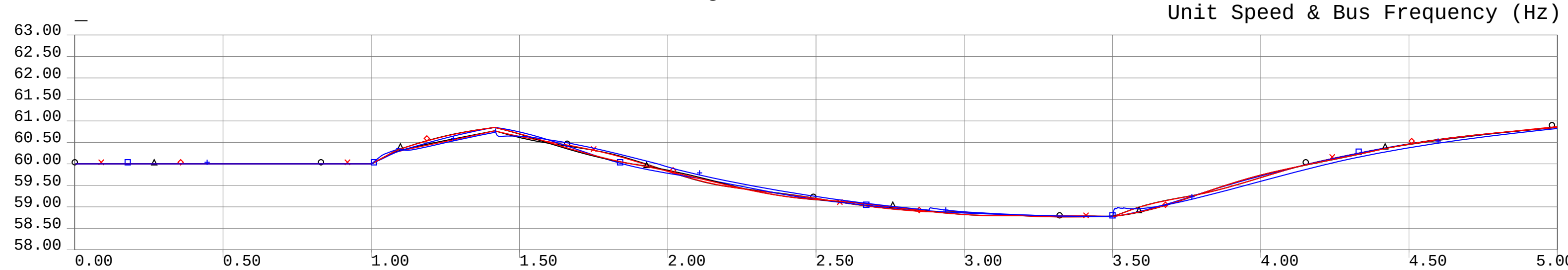
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

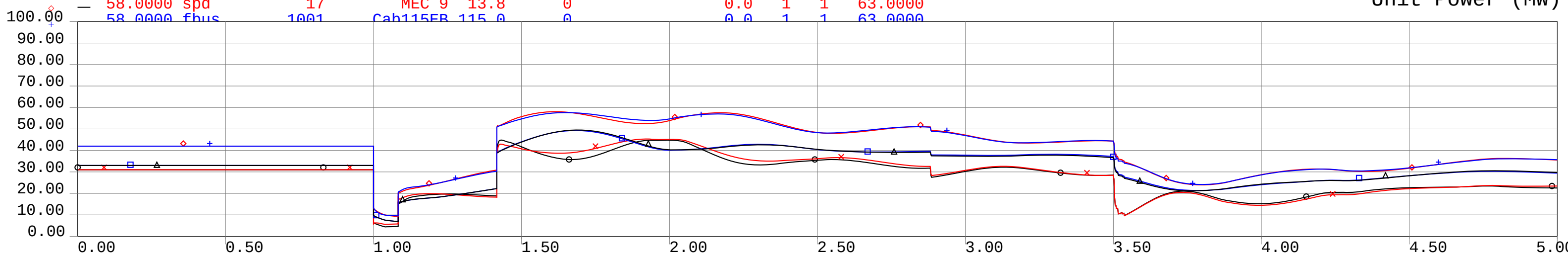
Unit Speed & Bus Frequency (Hz)



Time (sec)

○	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	63.0000
×	58.0000 spd	2	Cabras_2 13.8	0	0.0	1	1	63.0000
□	58.0000 spd	12	Cabras_3 13.8	0	0.0	1	1	63.0000
△	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	63.0000
◇	58.0000 spd	17	MEC 9 13.8	0	0.0	1	1	63.0000
+	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	63.0000

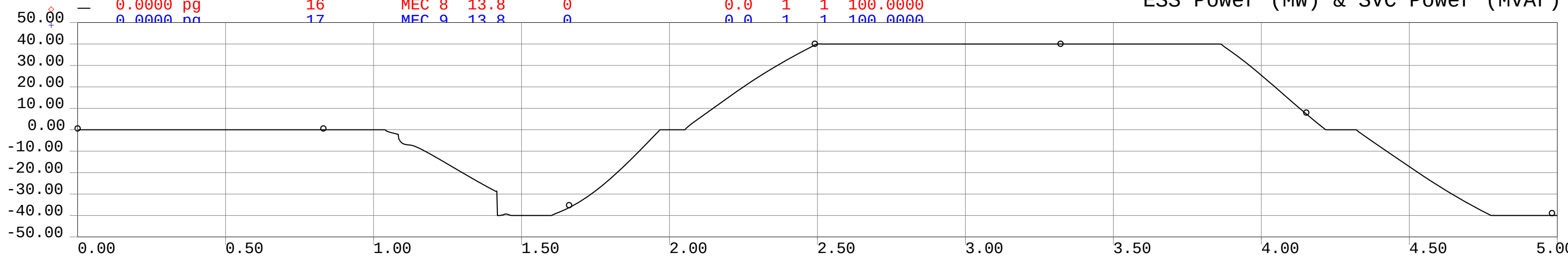
Unit Power (MW)



Time(sec)

○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	2	Cabras_2 13.8	0	0.0	1	1	100.0000
□	0.0000 pg	12	Cabras_3 13.8	0	0.0	1	1	100.0000
△	0.0000 pg	13	Cabras_4 13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000
+	0.0000 pg	17	MEC 9 13.8	0	0.0	1	1	100.0000

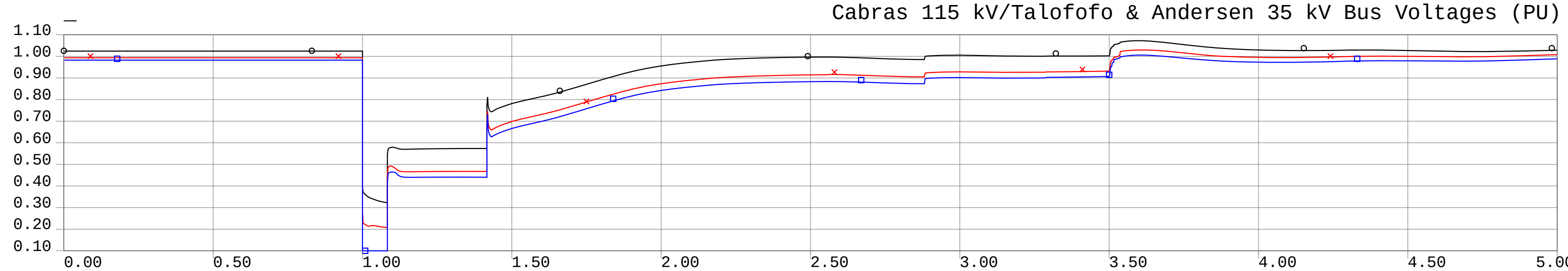
ESS Power (MW) & SVC Power (MVAr)



Time(sec)

○	-50.0000 pbes	80002	ESS 2-AGANA 13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

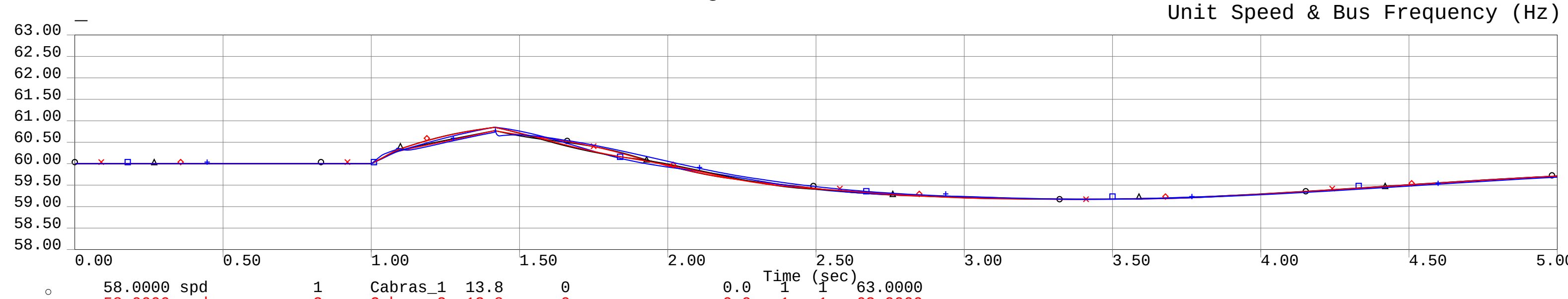


Time(sec)

○	0.1000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

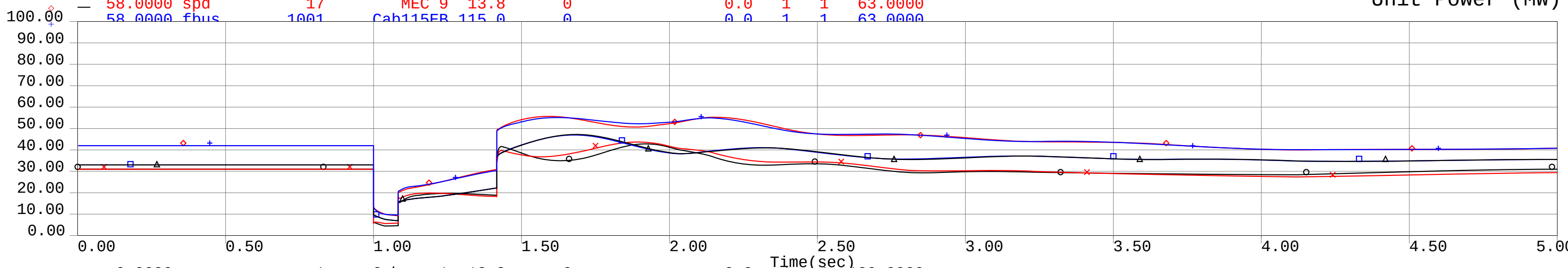
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



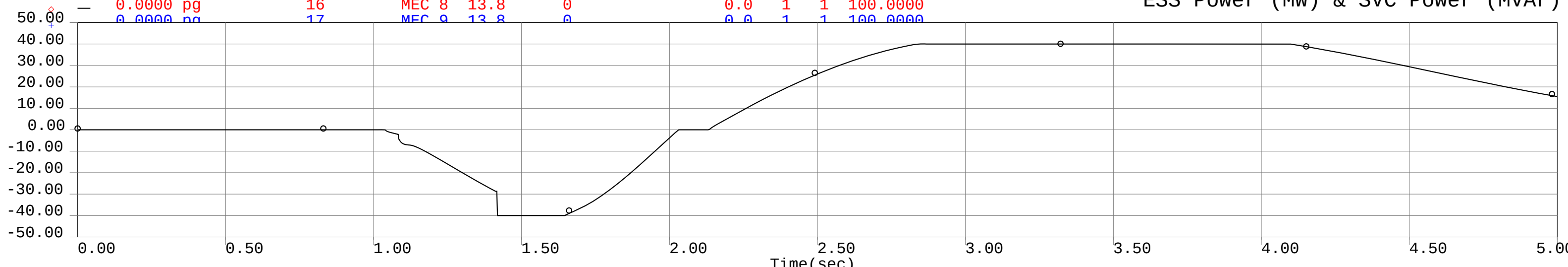
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



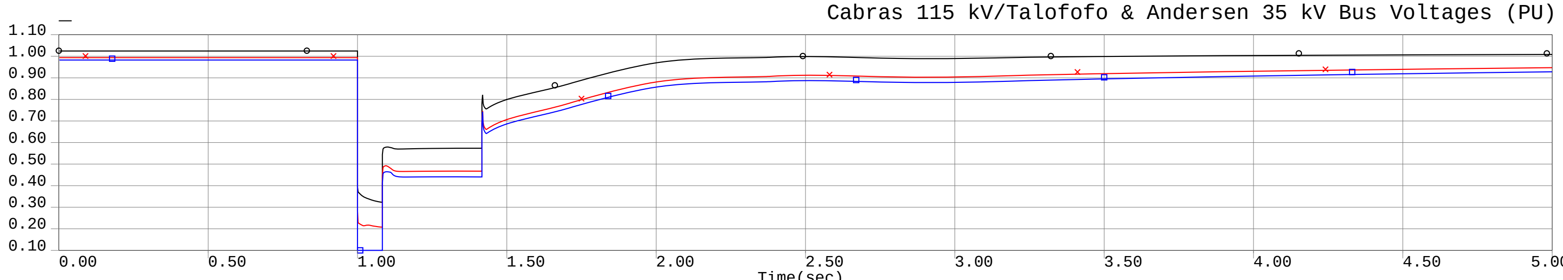
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1421_40a_lf16_fidvr_pv.chf

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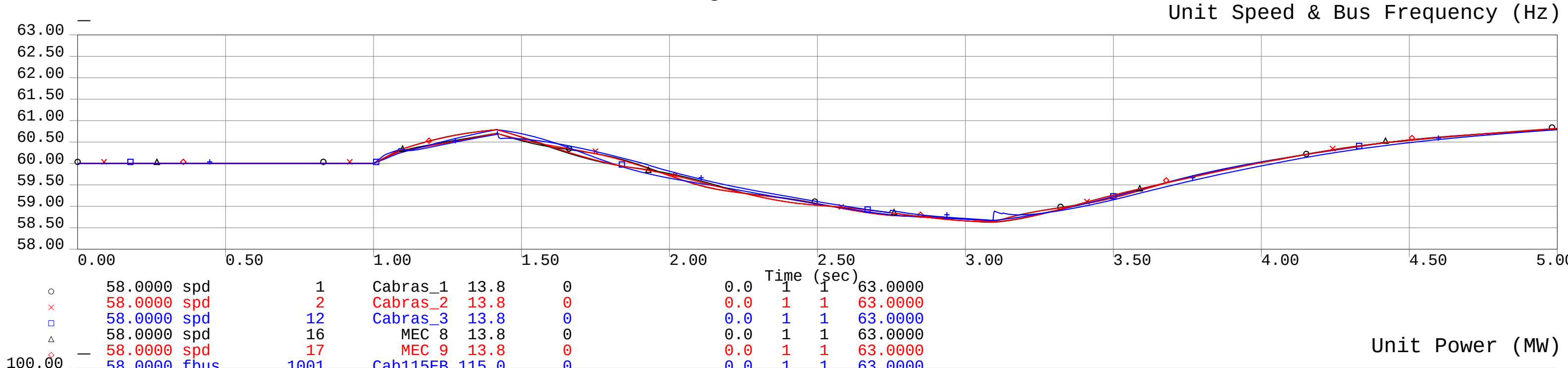
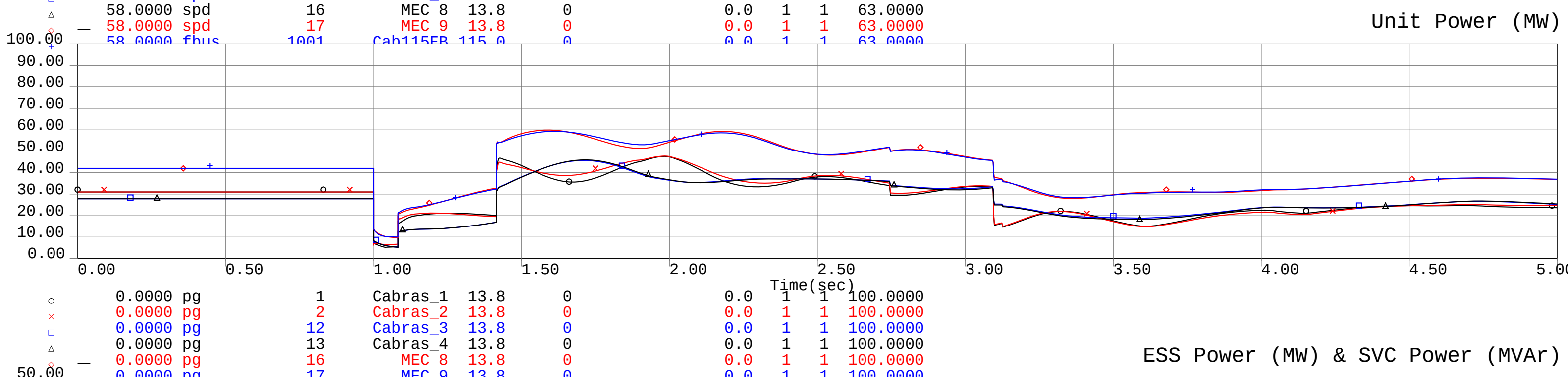
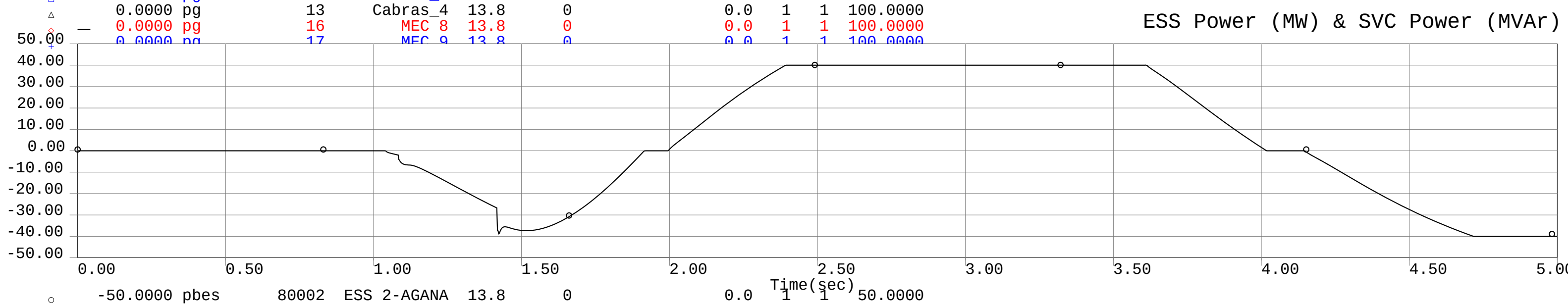
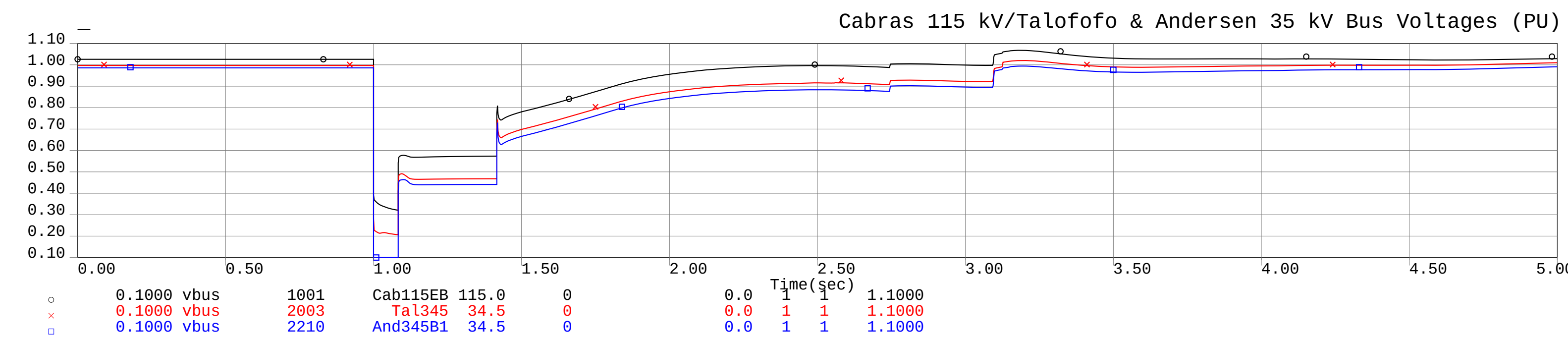
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS









chans/1422_40a_lf16_fidvr.chf

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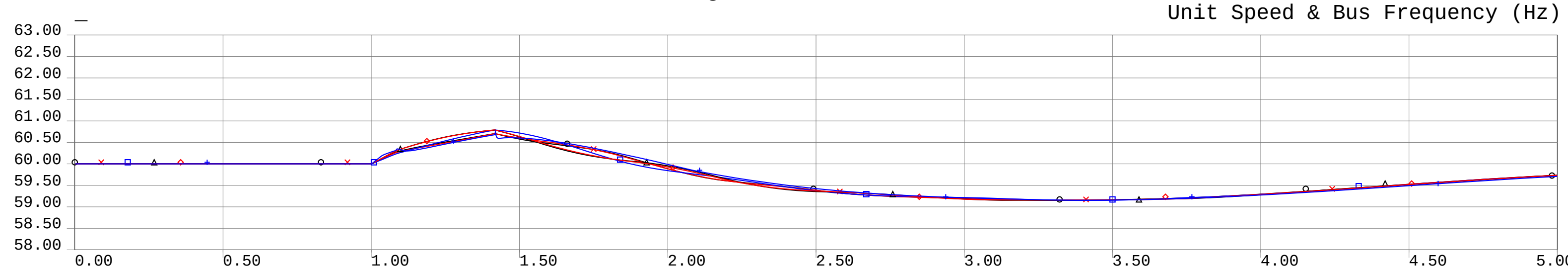
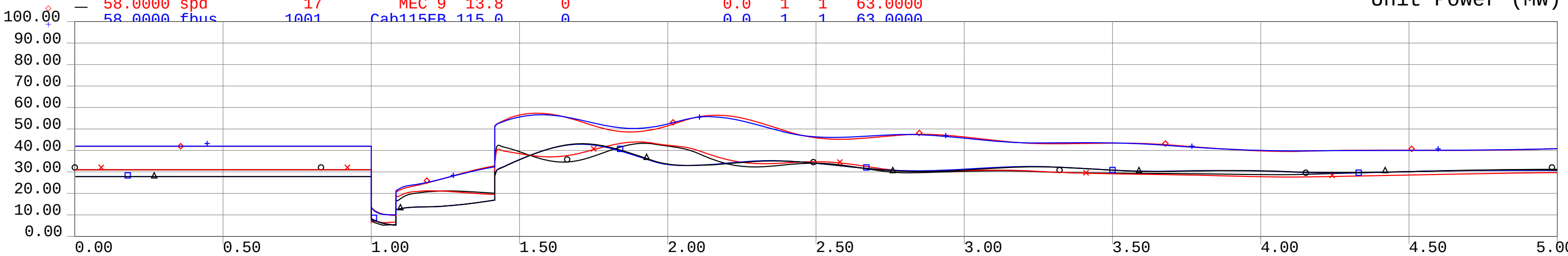
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



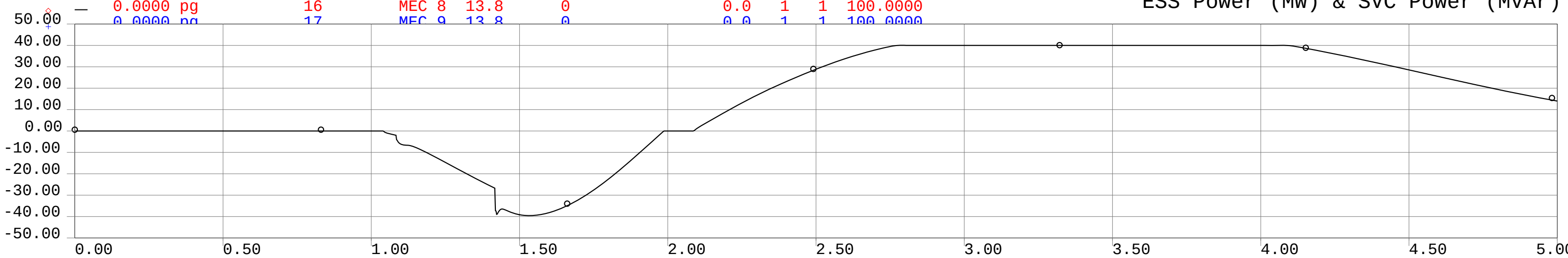
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



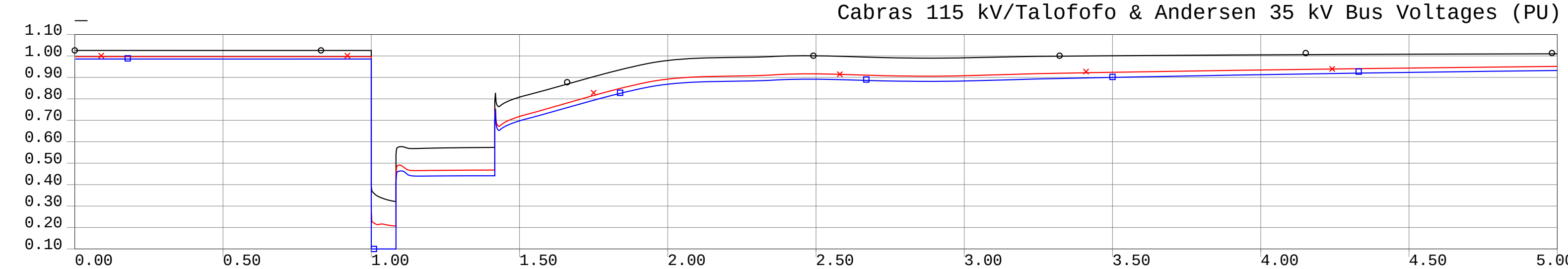
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1422_40a_lf16_fidvr_pv.chf

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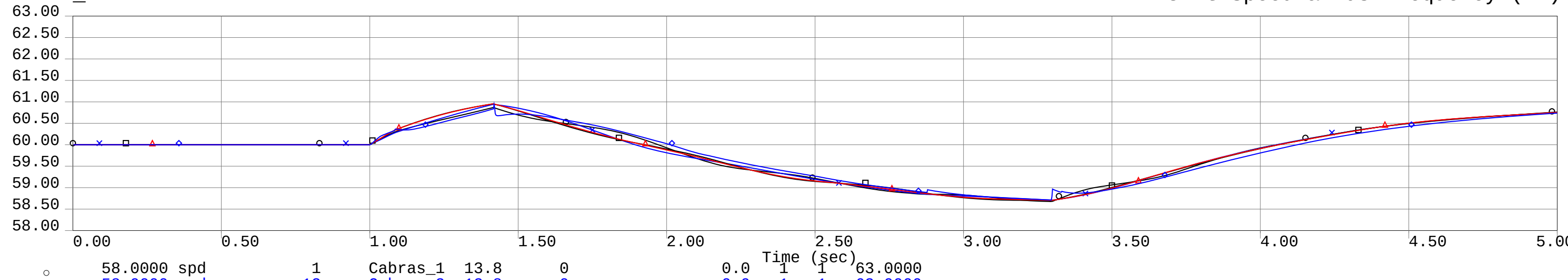
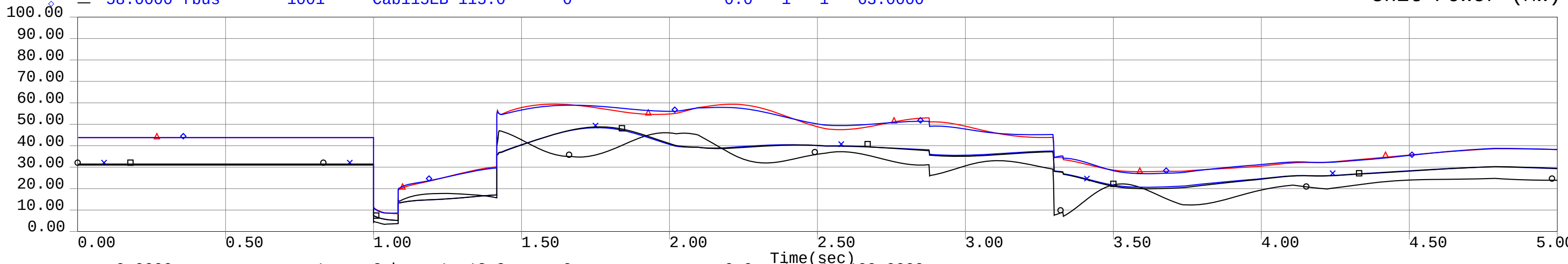
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

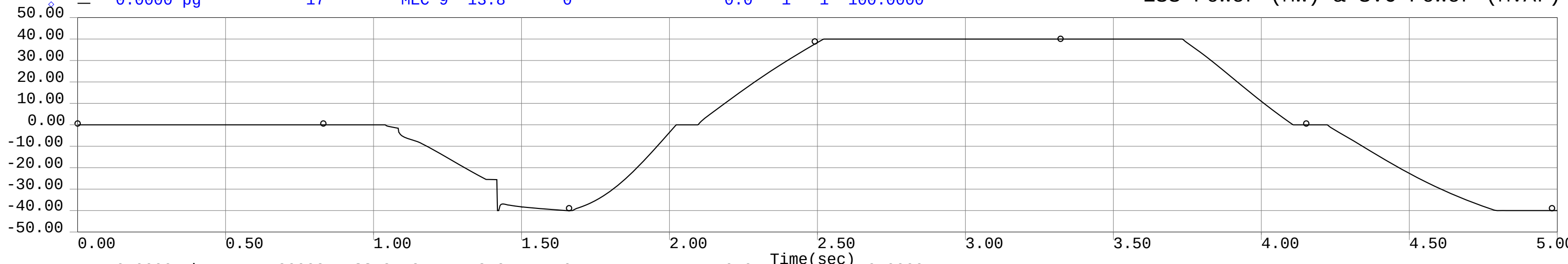
Unit Speed & Bus Frequency (Hz)



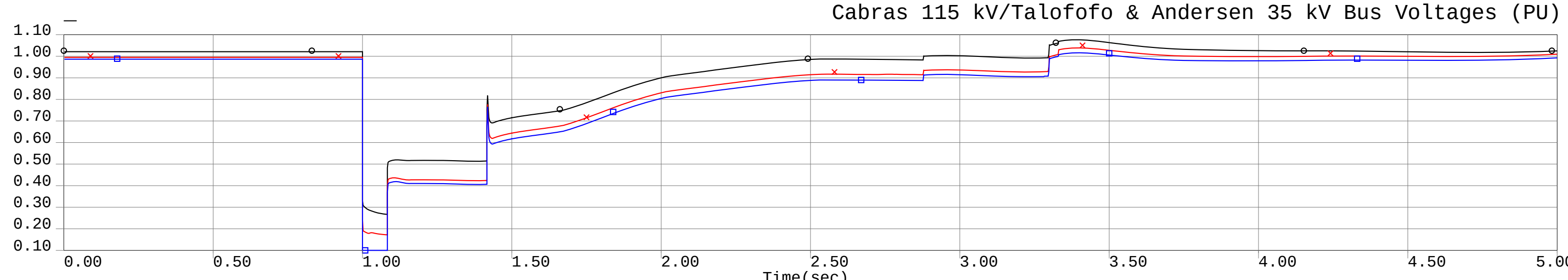
Unit Power (MW)



ESS Power (MW) & SVC Power (MVAr)

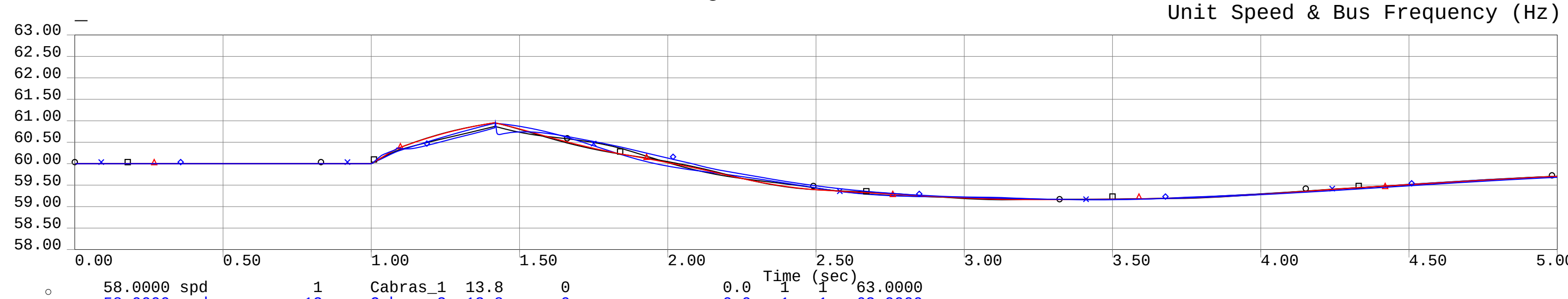


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



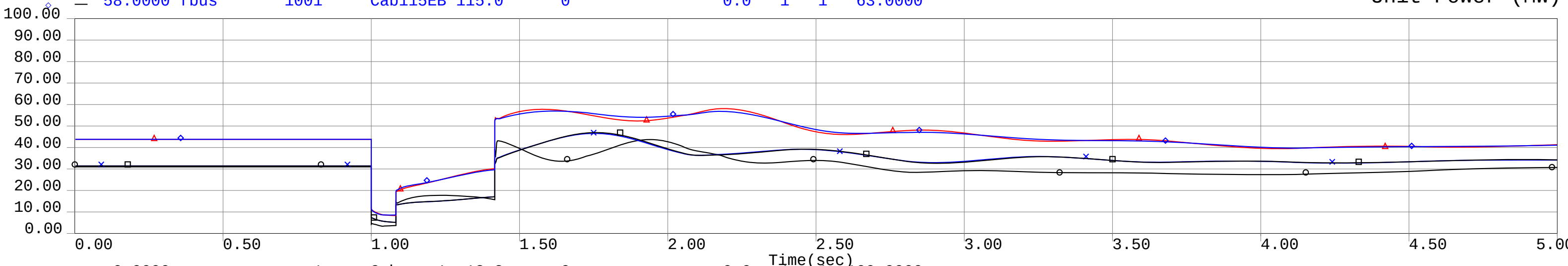
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



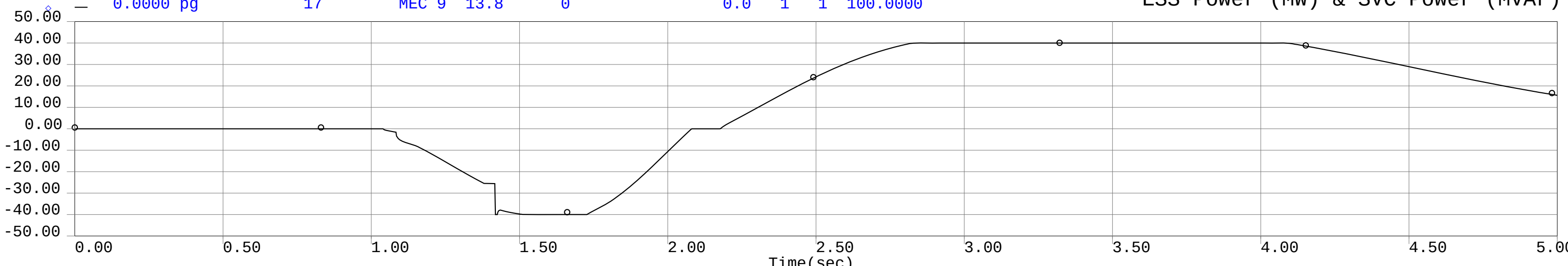
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



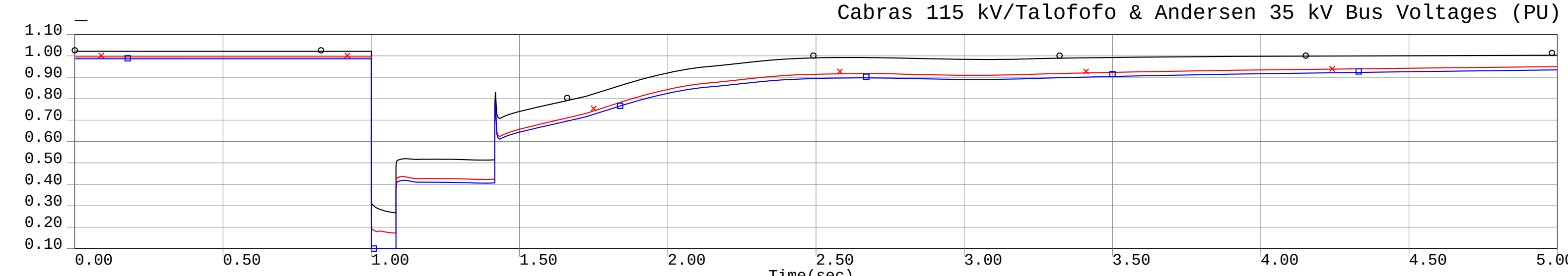
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

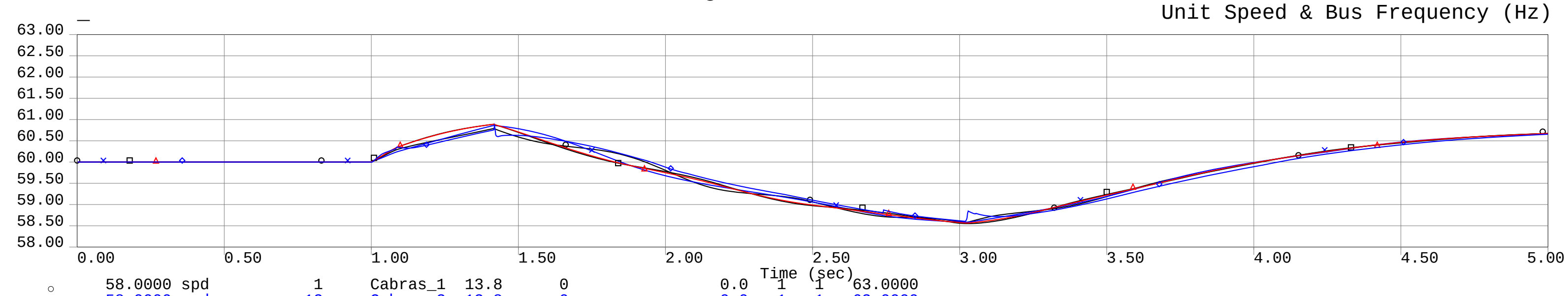
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

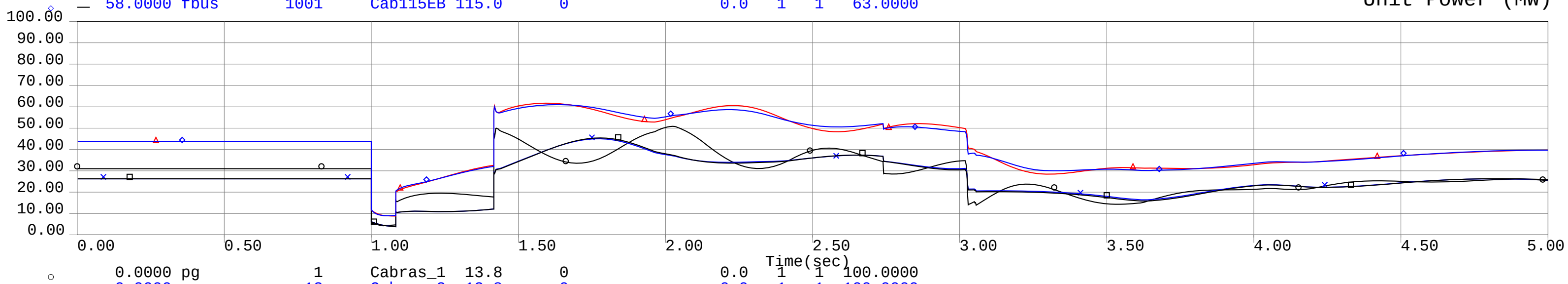
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



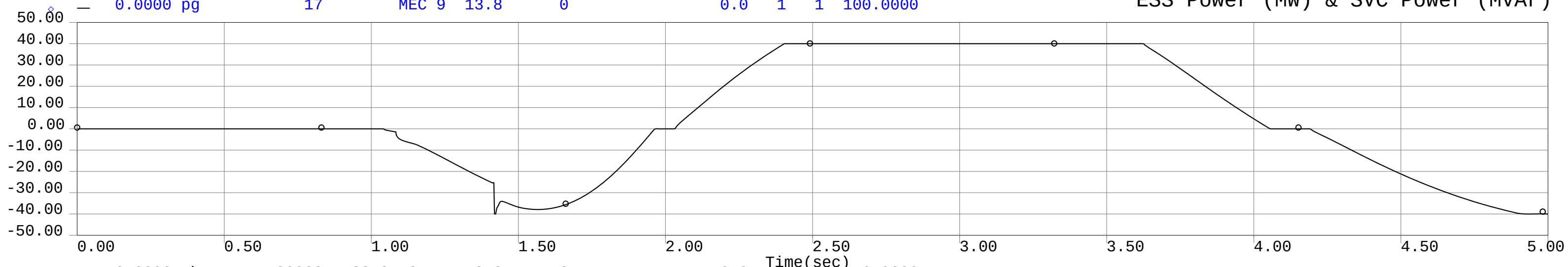
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



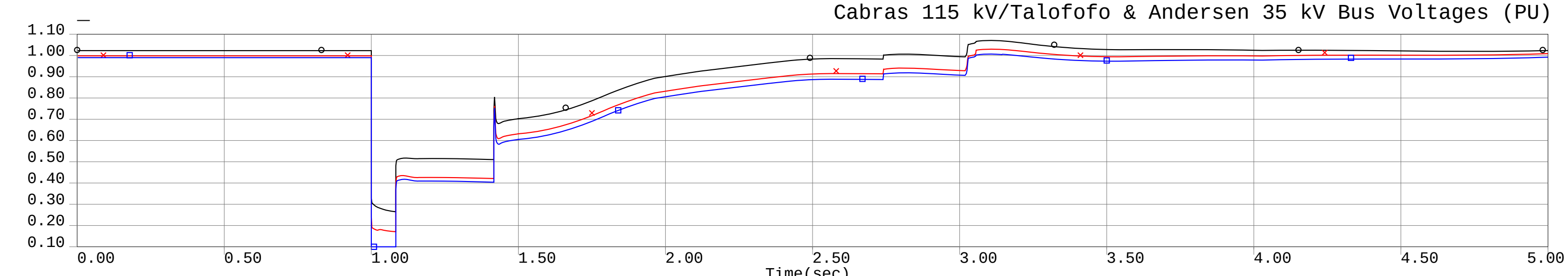
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2422_40a_lf16_fidvr.chf

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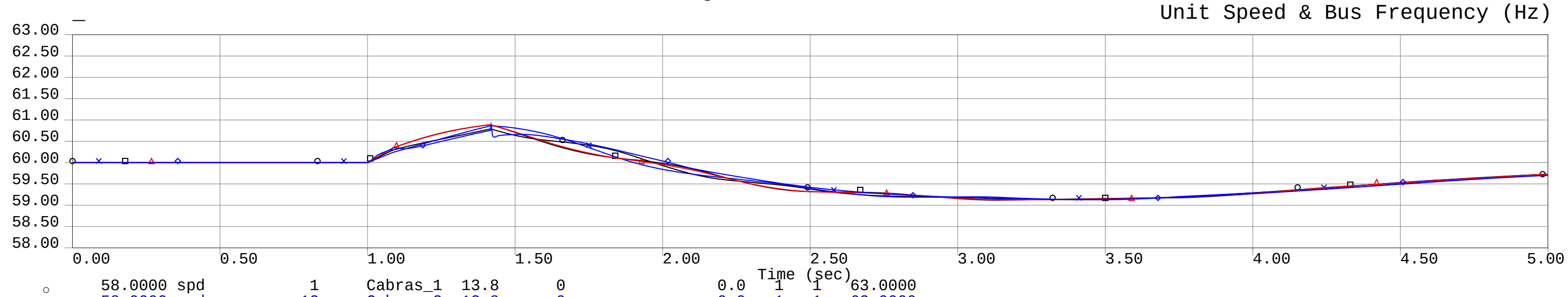
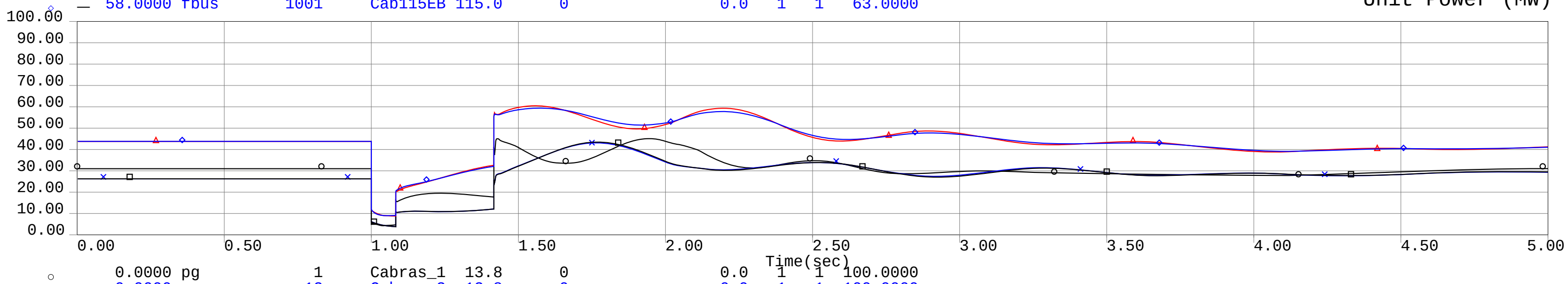
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



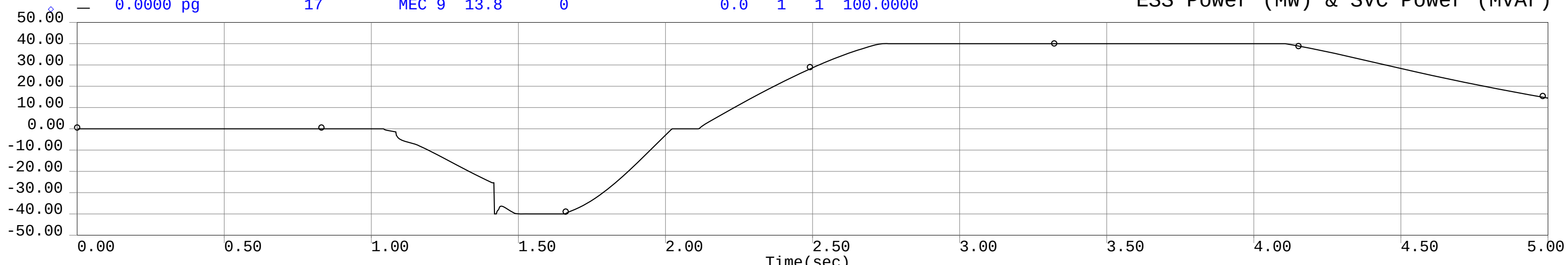
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



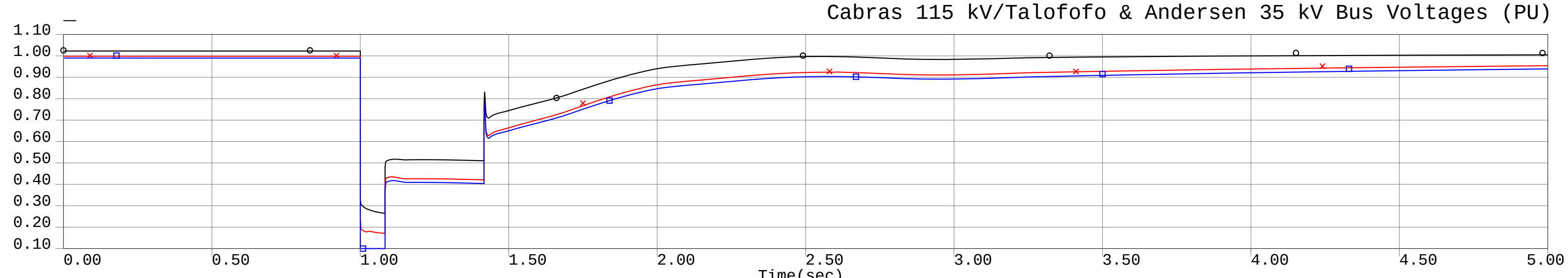
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2422_40a_lf16_fidvr_pv.chf

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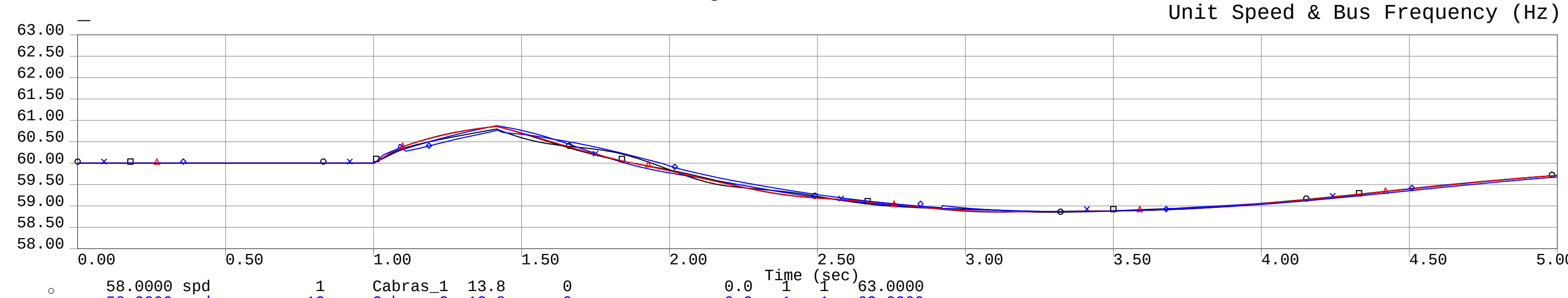
Thu Mar 27 12:39:30 2014

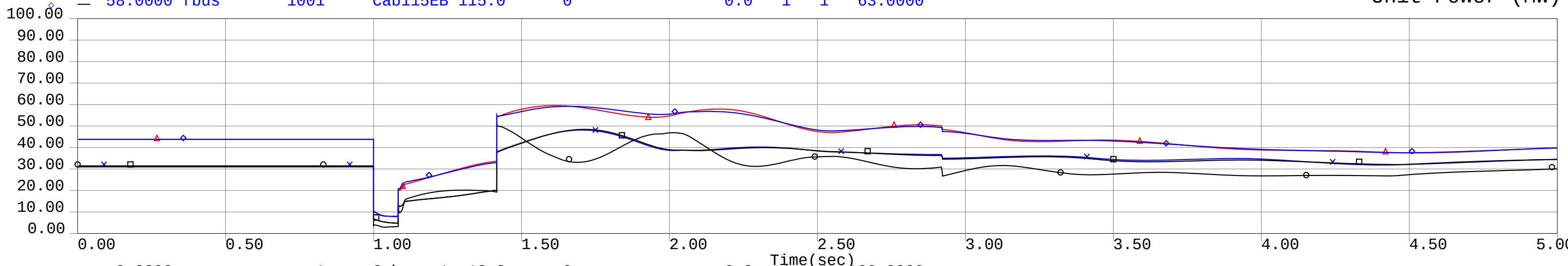
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



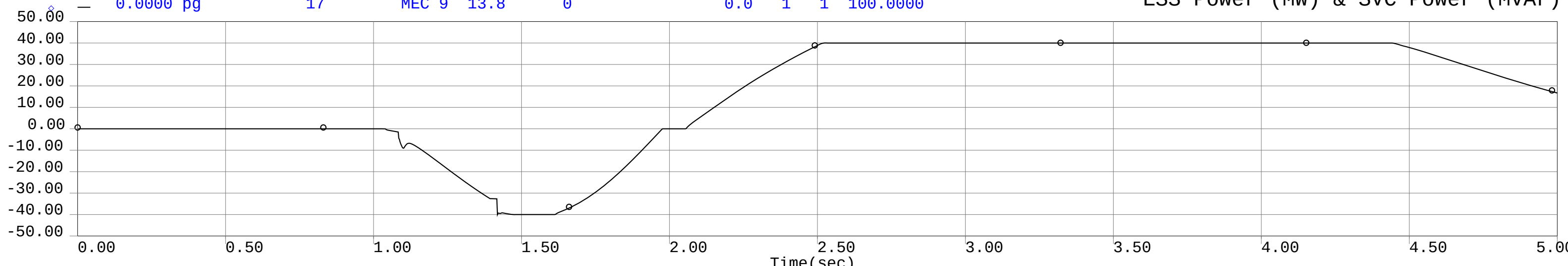
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



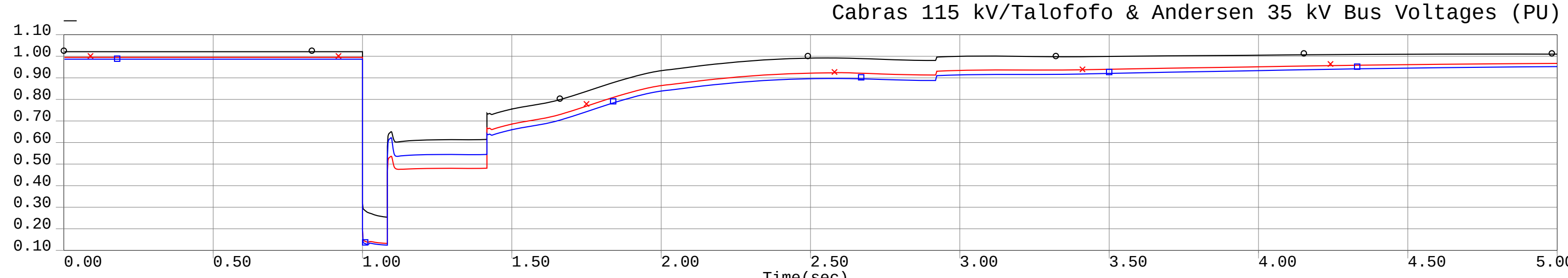
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2421_40a_lf17_fidvr.chf

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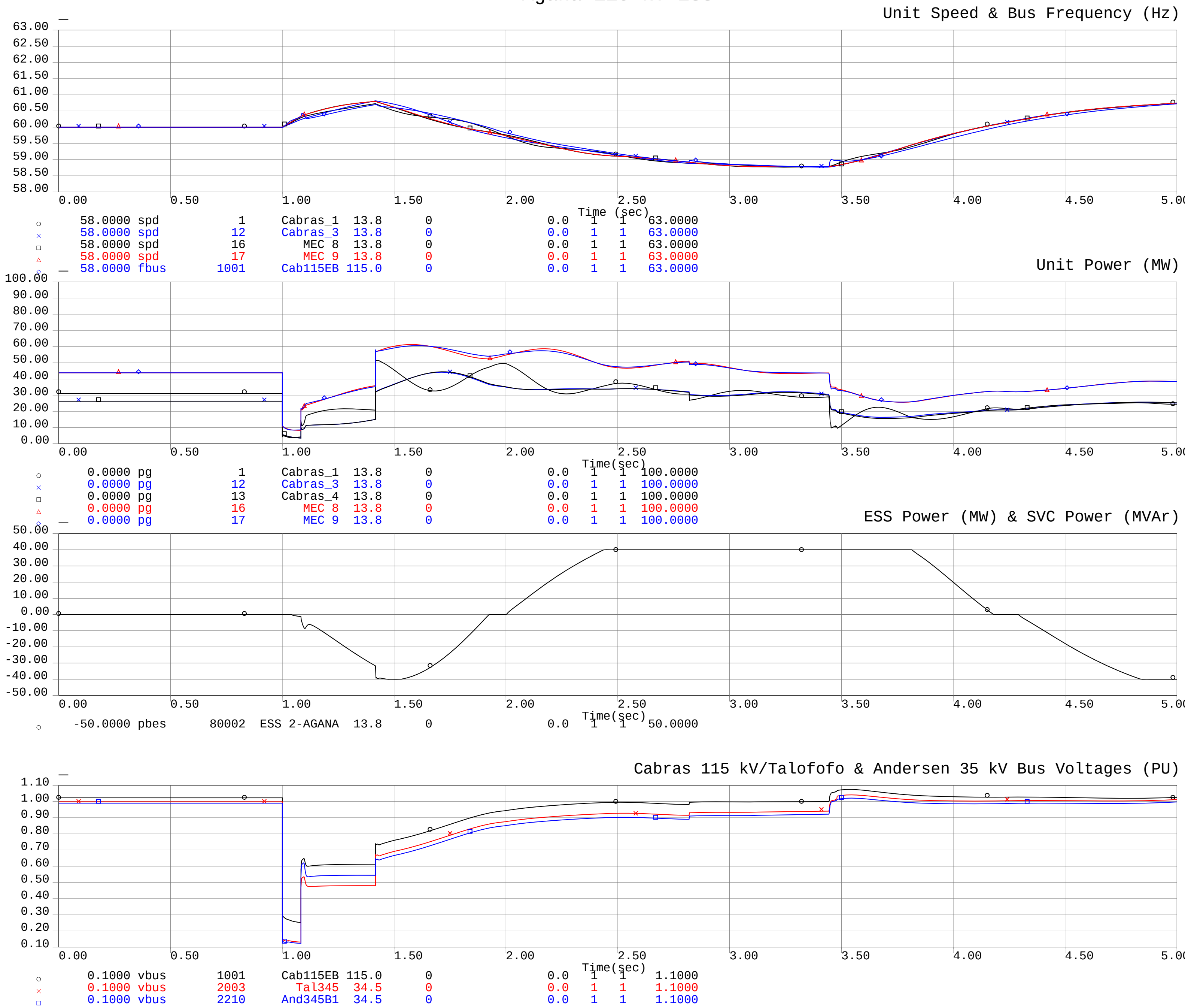
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/2422_40a_lf17_fidvr.chf

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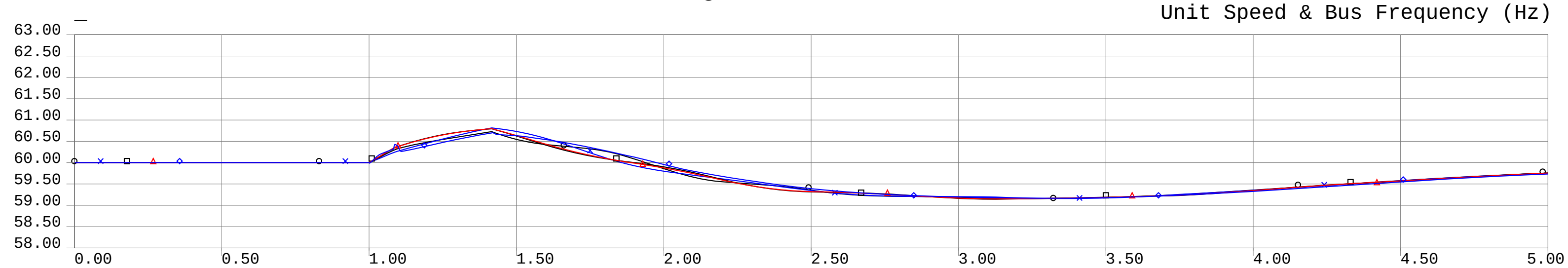
Thu Mar 27 12:39:31 2014

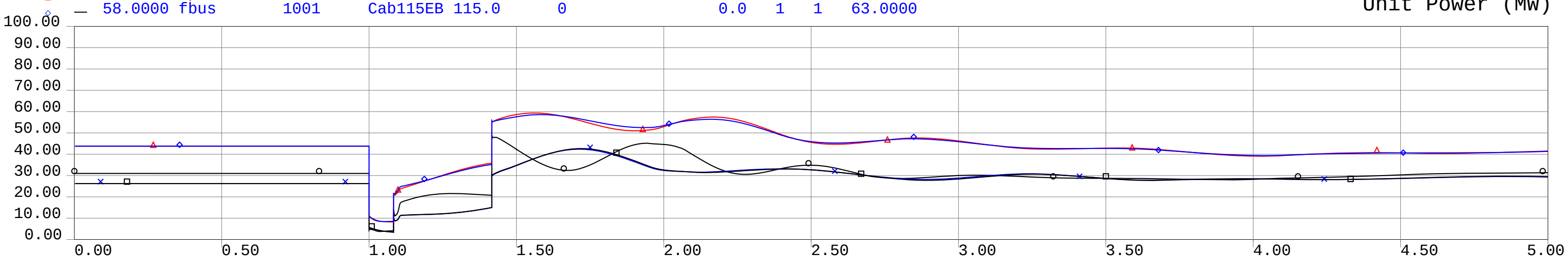
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



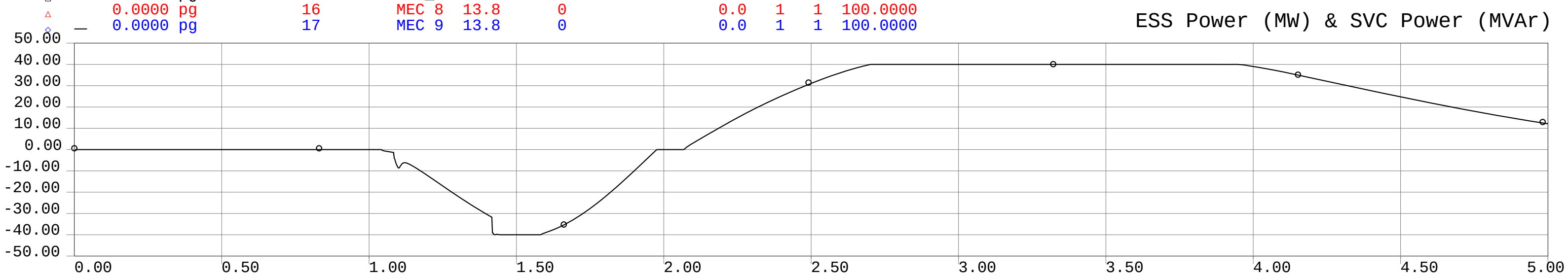

```
58.0000 spd      1     Cabras_1  13.8   0      0.0  1  1  63.0000
58.0000 spd     12     Cabras_3  13.8   0      0.0  1  1  63.0000
58.0000 spd     16        MEC 8  13.8   0      0.0  1  1  63.0000
58.0000 spd     17        MEC 9  13.8   0      0.0  1  1  63.0000
58.0000 fbus  1001     Cab115EB 115.0   0      0.0  1  1  63.0000
```

Unit Power (MW)



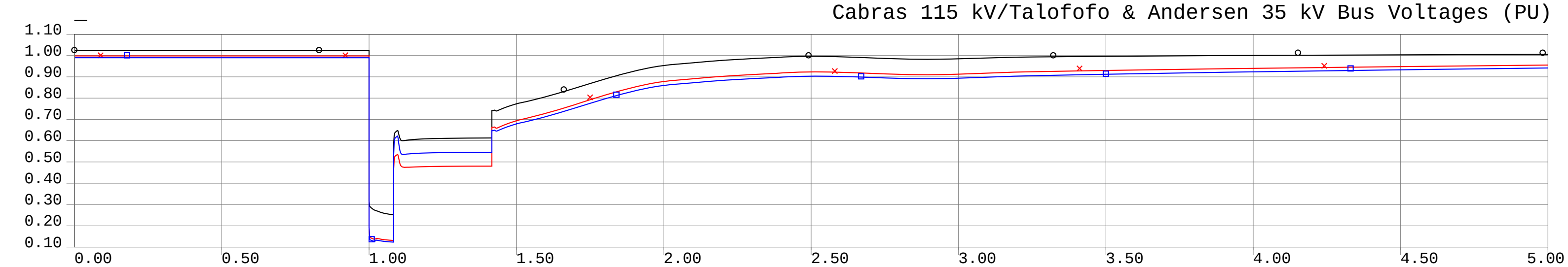

```
0.0000 pg      1     Cabras_1  13.8   0      0.0  1  1  100.0000
0.0000 pg     12     Cabras_3  13.8   0      0.0  1  1  100.0000
0.0000 pg     13     Cabras_4  13.8   0      0.0  1  1  100.0000
0.0000 pg     16        MEC 8  13.8   0      0.0  1  1  100.0000
0.0000 pg     17        MEC 9  13.8   0      0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
-50.0000 pbes   80002  ESS 2-AGANA  13.8   0      0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.1000 vbus   1001   Cab115EB 115.0   0      0.0  1  1  1.1000
0.1000 vbus   2003     Tal345  34.5   0      0.0  1  1  1.1000
0.1000 vbus   2210   And345B1  34.5   0      0.0  1  1  1.1000
```


chans/2422_40a_lf17_fidvr_pv.chf

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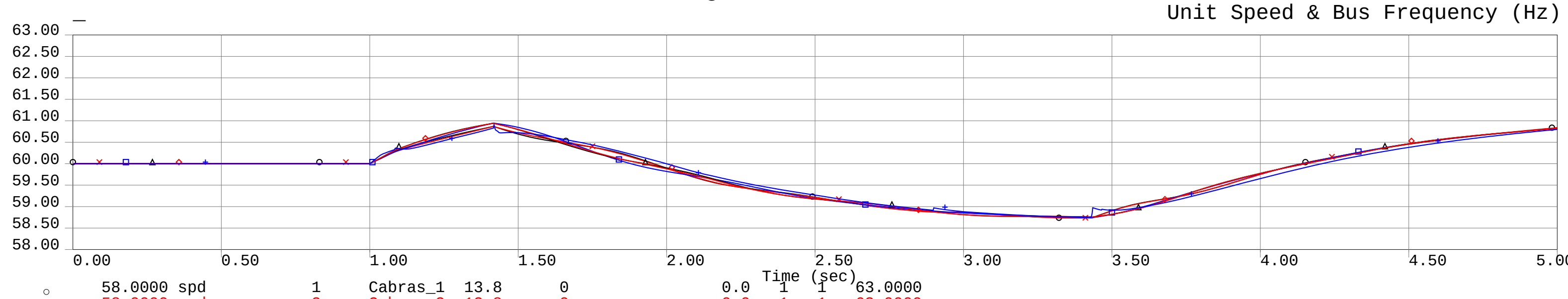
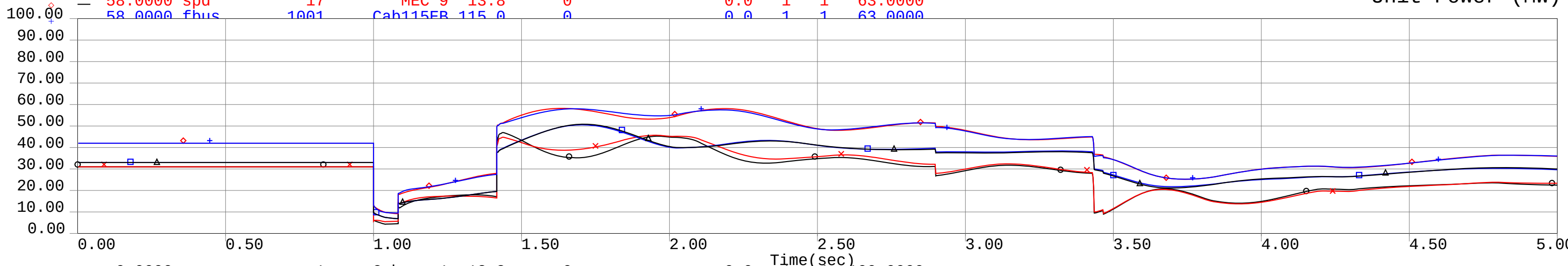
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



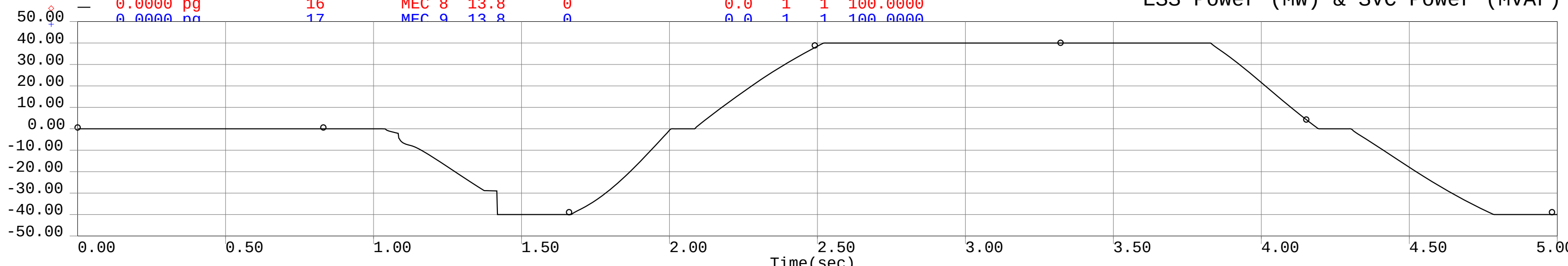
```
58.0000 spd       1   Cabras_1  13.8   0    0.0  1  1  63.0000
58.0000 spd       2   Cabras_2  13.8   0    0.0  1  1  63.0000
58.0000 spd      12   Cabras_3  13.8   0    0.0  1  1  63.0000
58.0000 spd      16      MEC 8  13.8   0    0.0  1  1  63.0000
58.0000 spd      17      MEC 9  13.8   0    0.0  1  1  63.0000
58.0000 fbus   1001   Cab115EB 115.0   0    0.0  1  1  63.0000
```

Unit Power (MW)



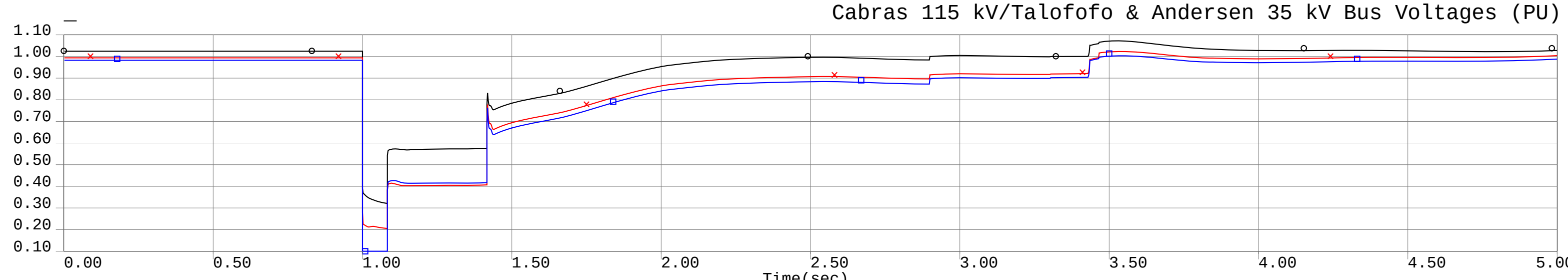
```
0.0000 pg         1   Cabras_1  13.8   0    0.0  1  1  100.0000
0.0000 pg         2   Cabras_2  13.8   0    0.0  1  1  100.0000
0.0000 pg        12   Cabras_3  13.8   0    0.0  1  1  100.0000
0.0000 pg        13   Cabras_4  13.8   0    0.0  1  1  100.0000
0.0000 pg        16      MEC 8  13.8   0    0.0  1  1  100.0000
0.0000 pg        17      MEC 9  13.8   0    0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)



```
-50.0000 pbes    80002  ESS 2-AGANA  13.8   0    0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



```
0.1000 vbus    1001   Cab115EB 115.0   0    0.0  1  1  1.1000
0.1000 vbus    2003     Tal345  34.5   0    0.0  1  1  1.1000
0.1000 vbus    2210   And345B1  34.5   0    0.0  1  1  1.1000
```


chans/1421_40a_lf18_fidvr.chf

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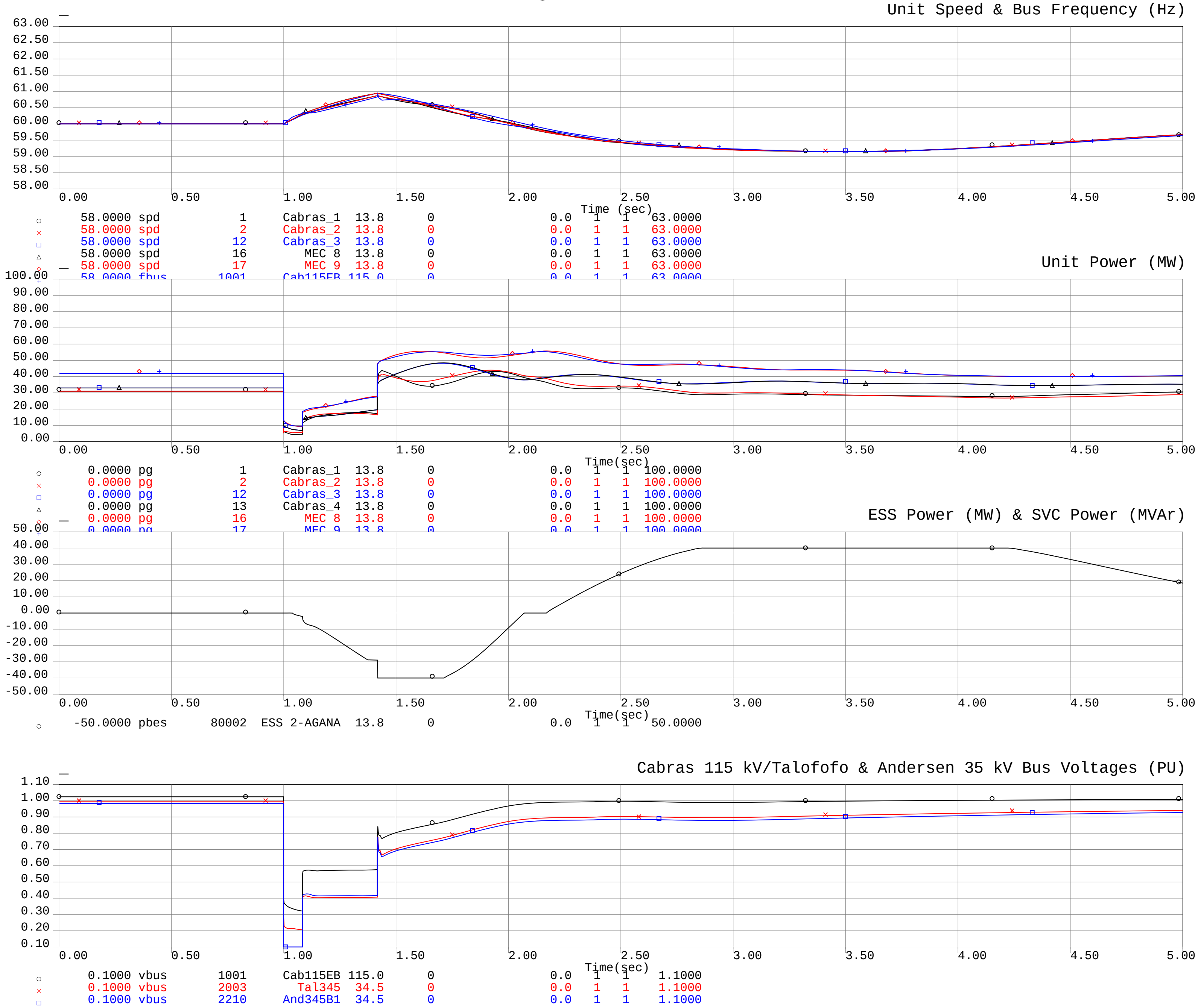
Thu Mar 27 12:39:33 2014

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/1421_40a_lf18_fidvr_pv.chf

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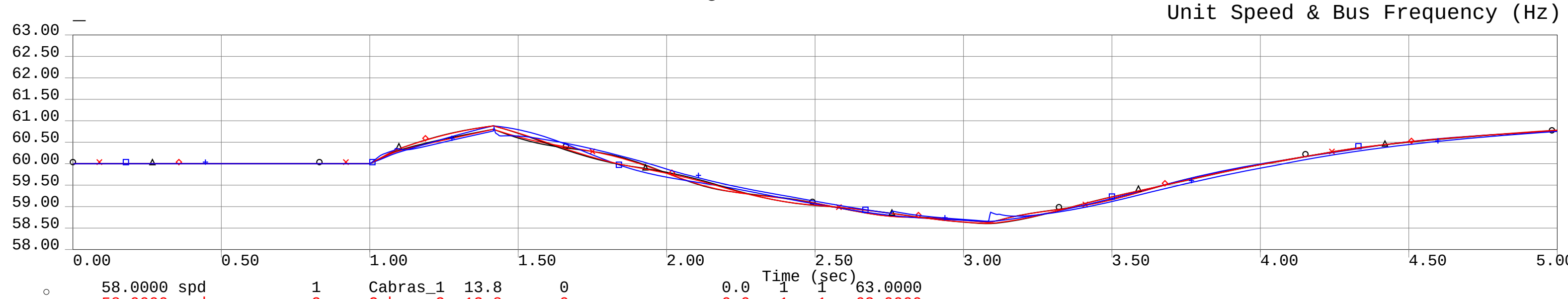
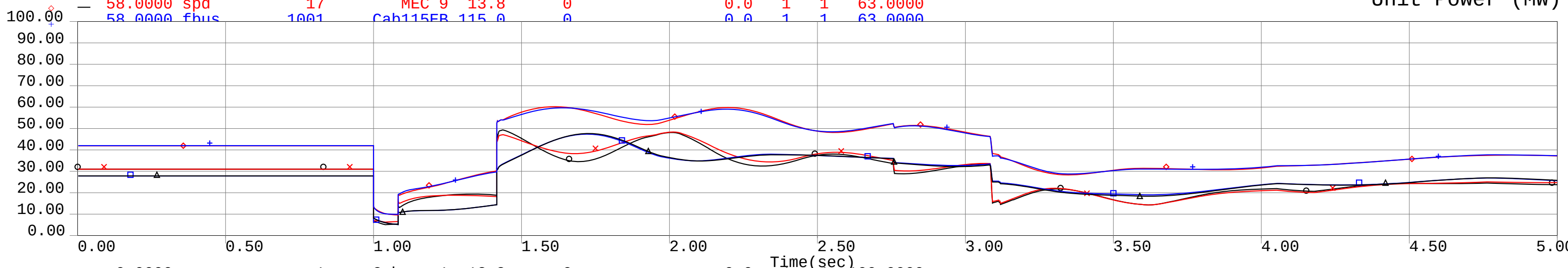
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



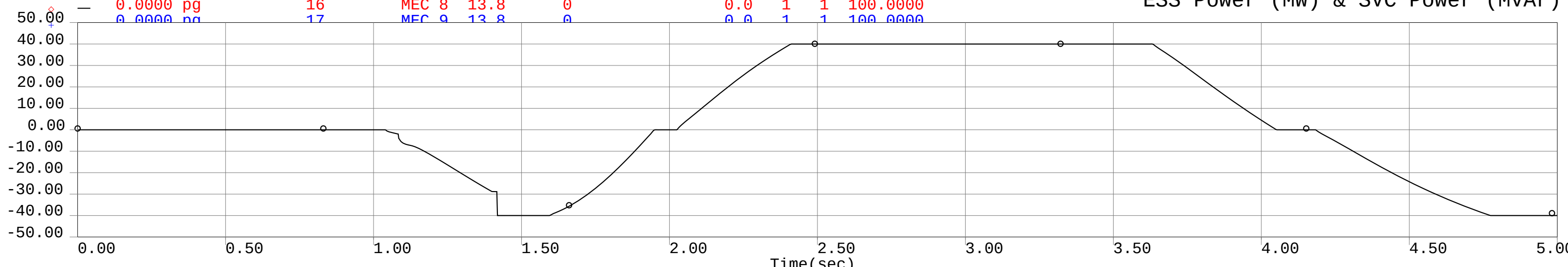
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



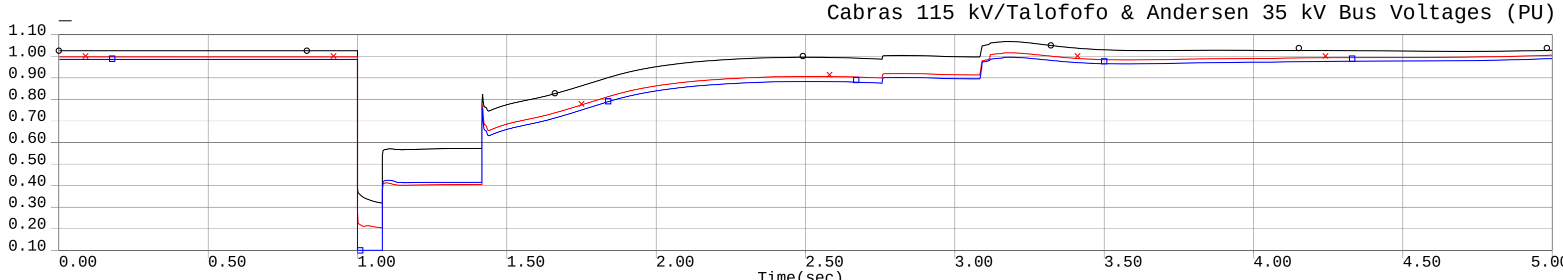
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

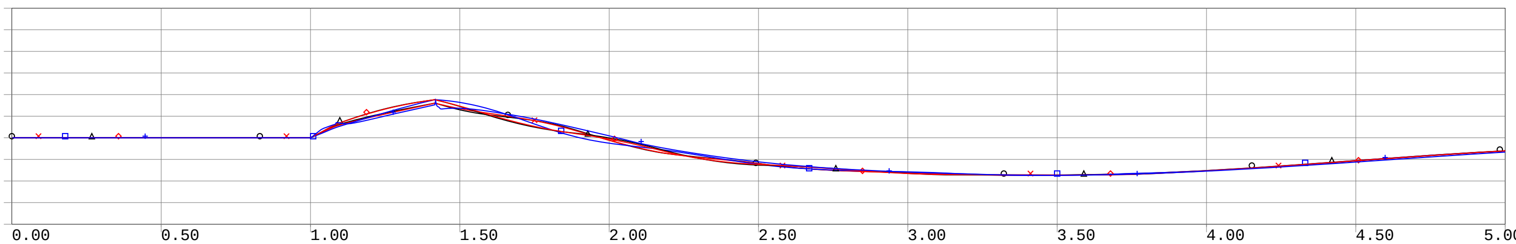
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

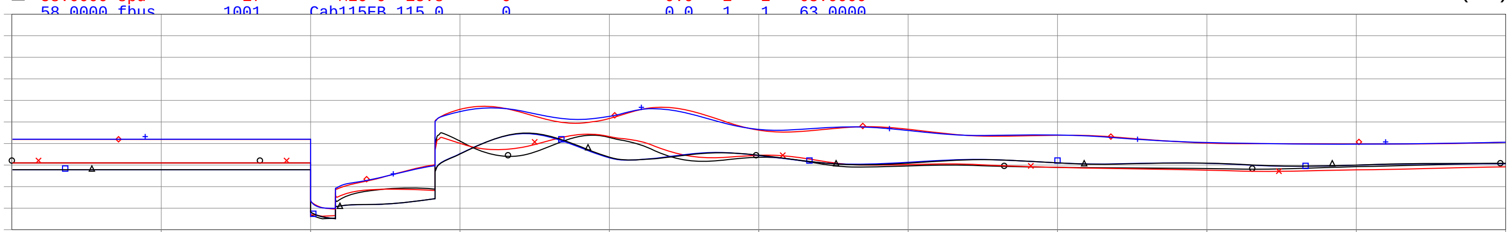
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



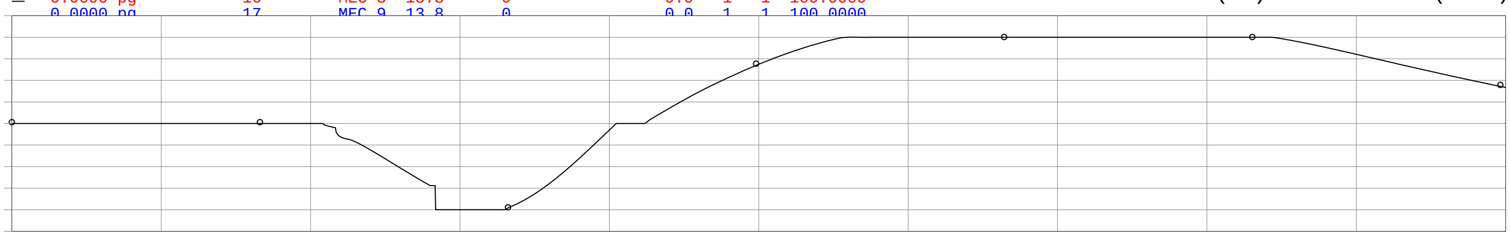
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



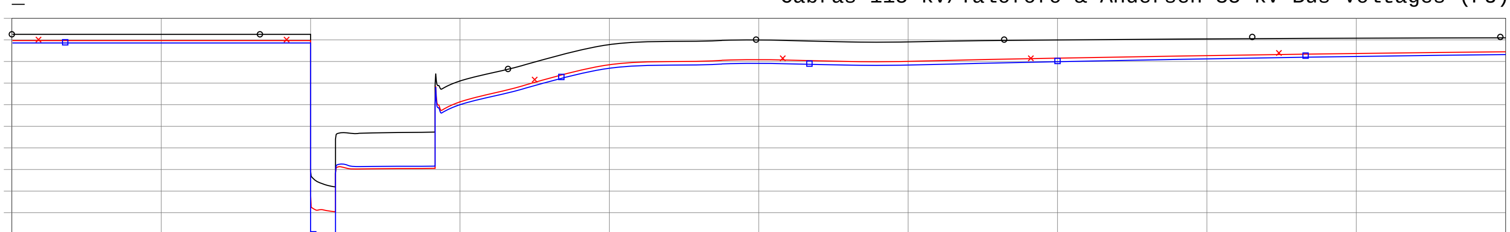
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1422_40a_lf18_fidvr_pv.chf

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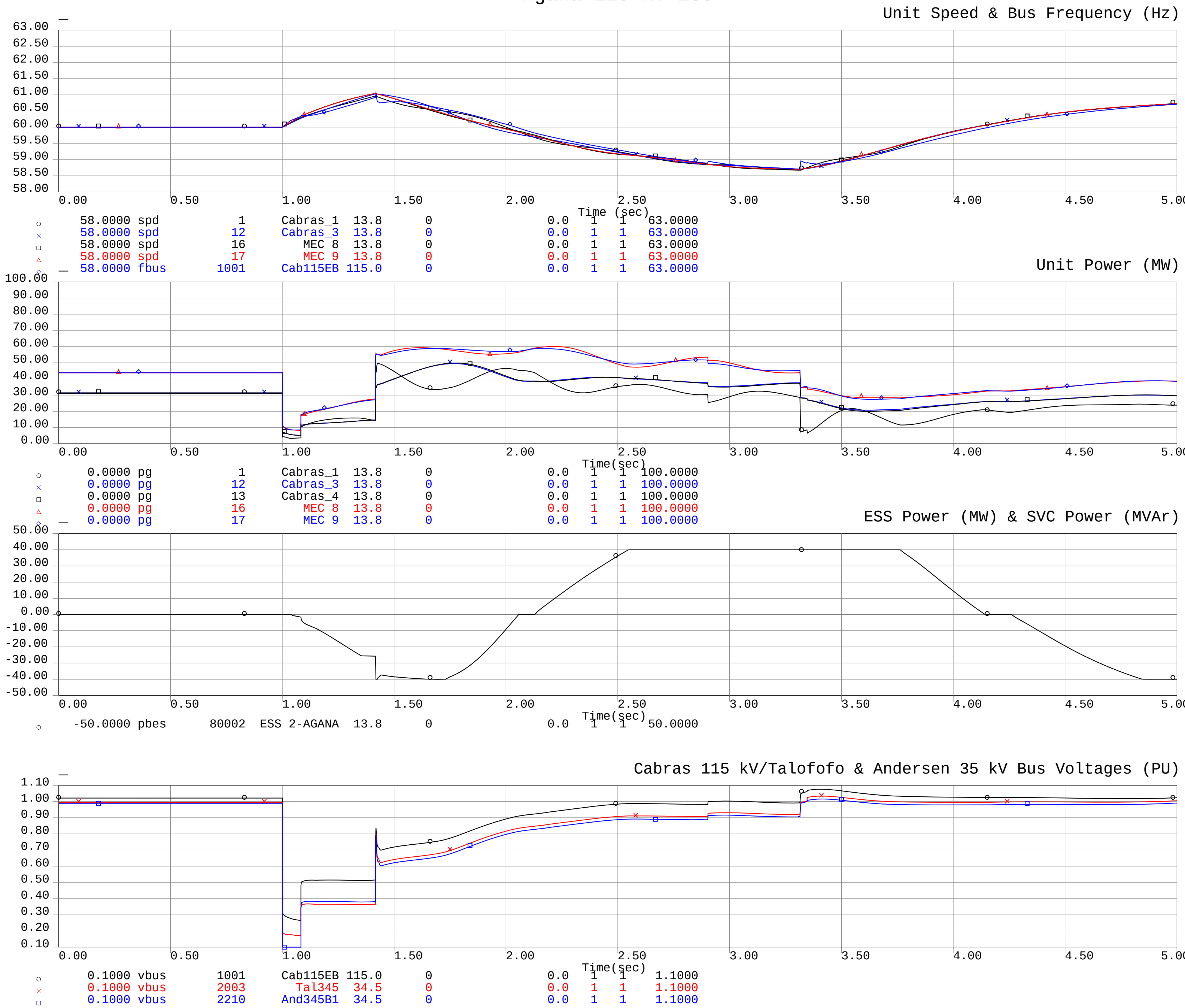
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/2421_40a_lf18_fidvr.chf

age\operating_study\sim_9

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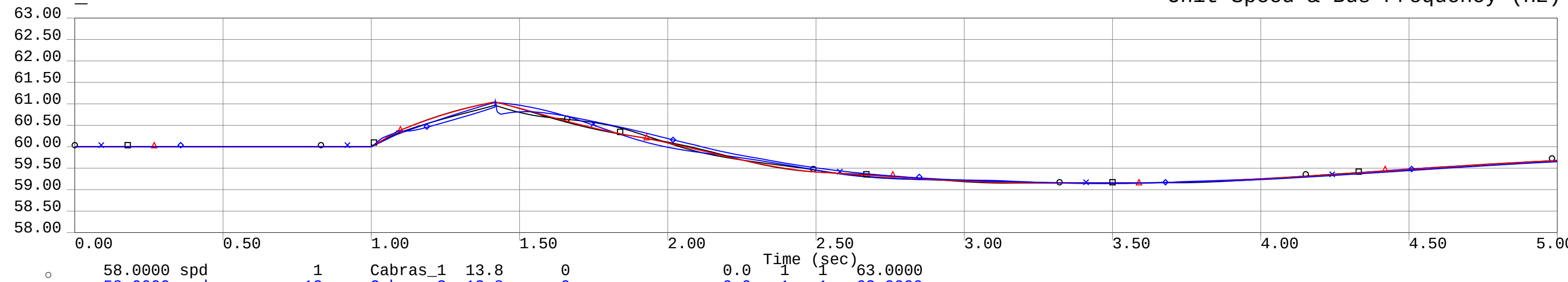
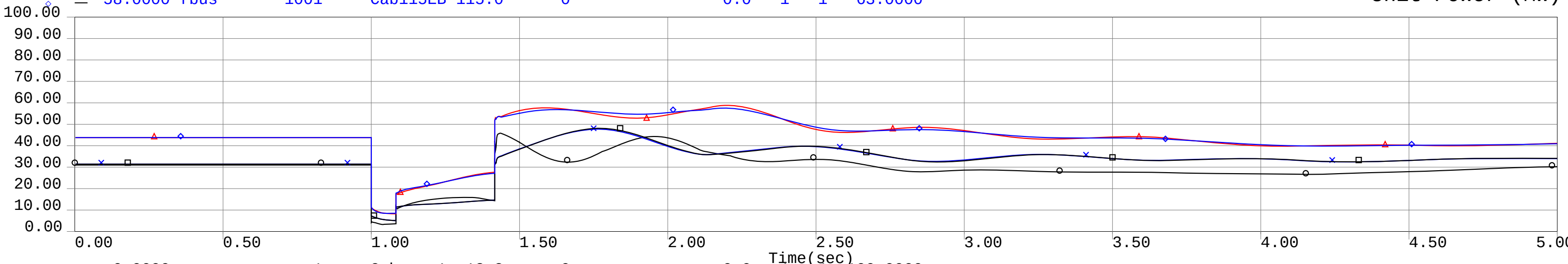
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



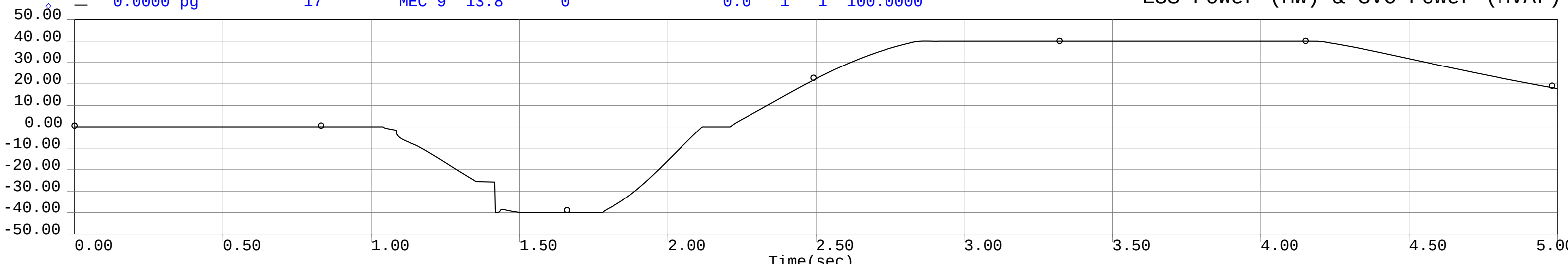
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



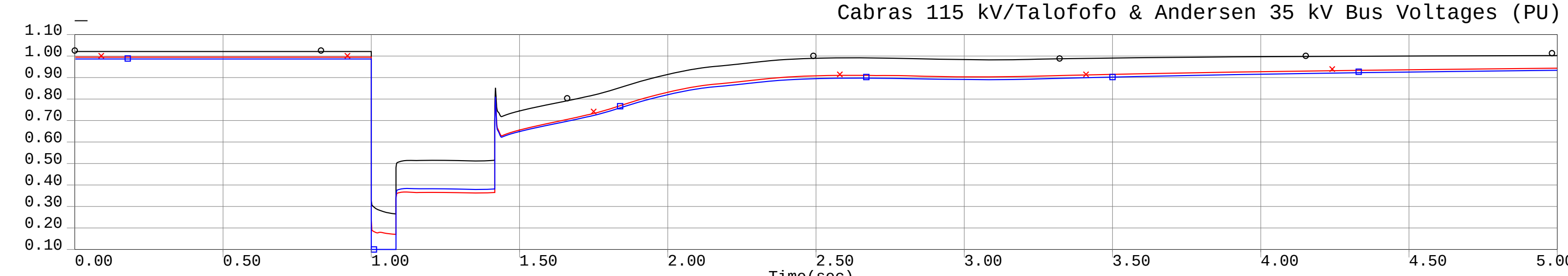
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2421_40a_lf18_fidvr_pv.chf

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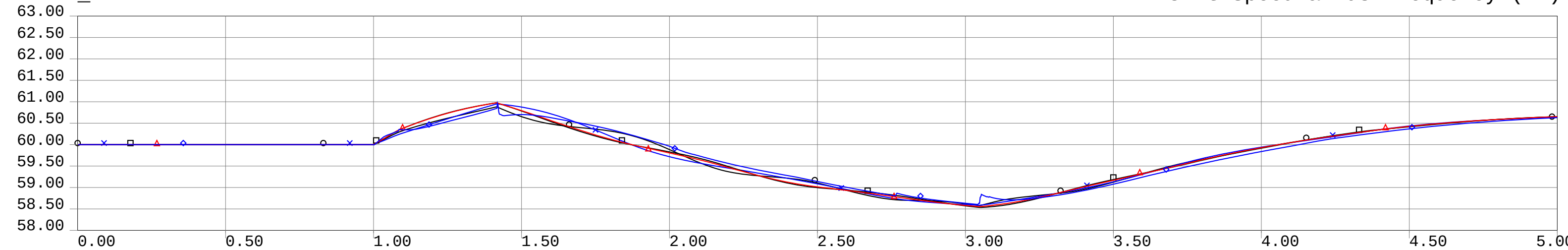
Thu Mar 27 12:39:37 2014

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

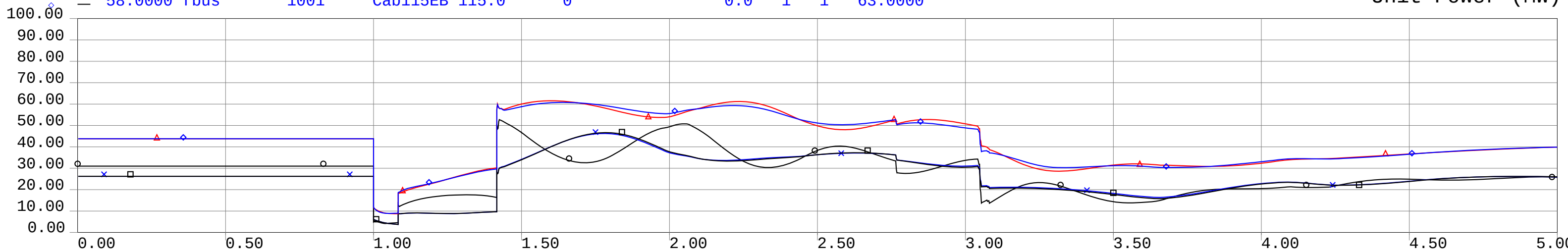
Unit Speed & Bus Frequency (Hz)



Time (sec)

○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

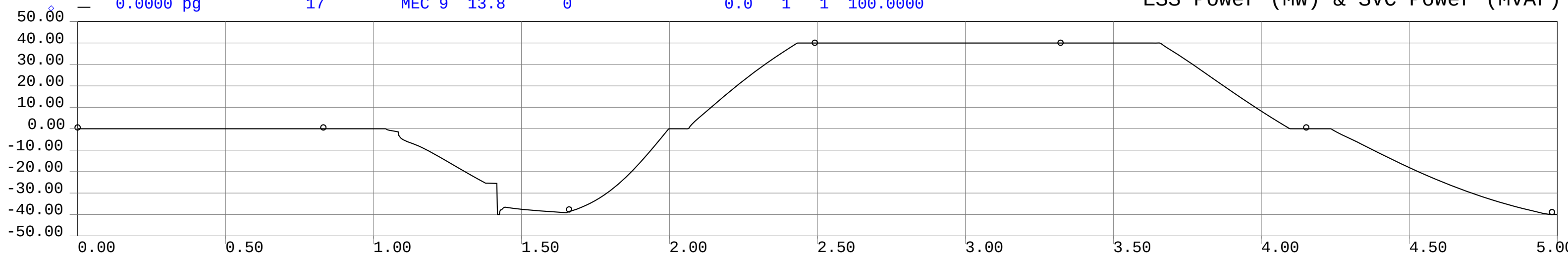
Unit Power (MW)



Time(sec)

○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

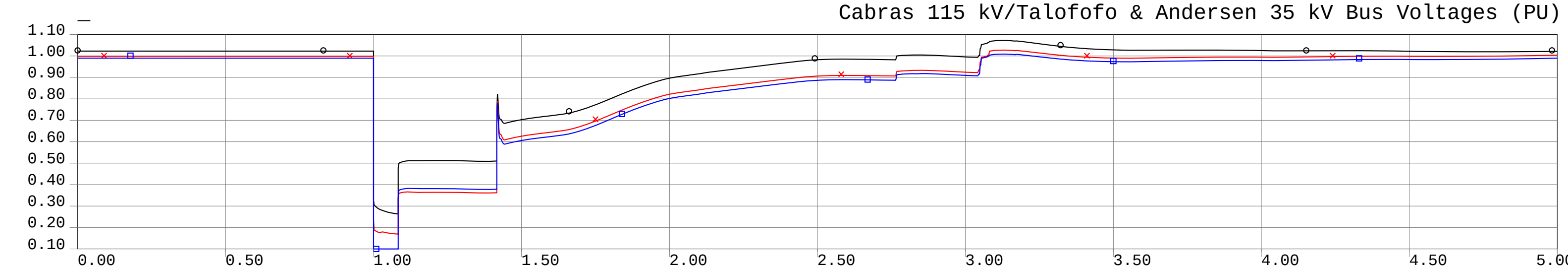
ESS Power (MW) & SVC Power (MVAr)



Time(sec)

○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



Time(sec)

○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2422_40a_lf18_fidvr.chf

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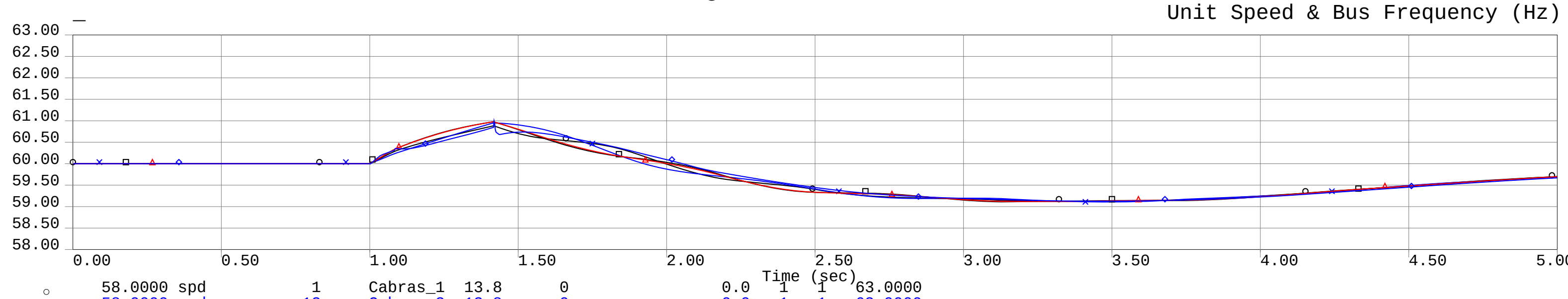
Thu Mar 27 12:39:38 2014

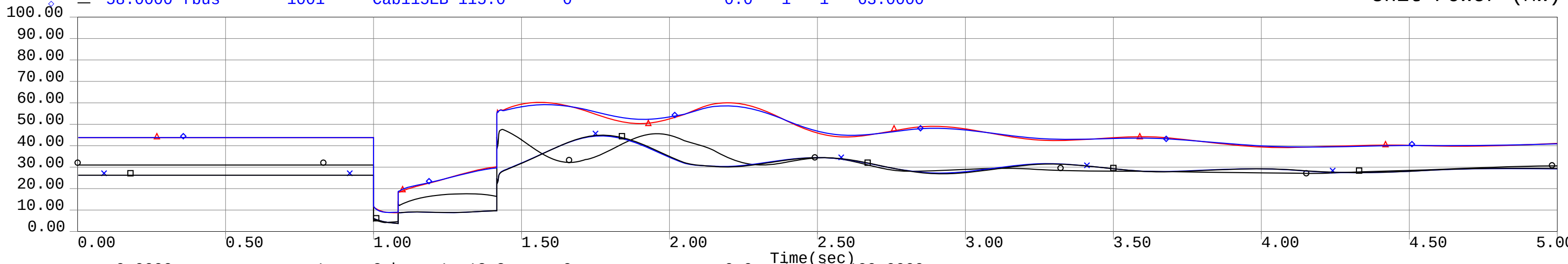
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



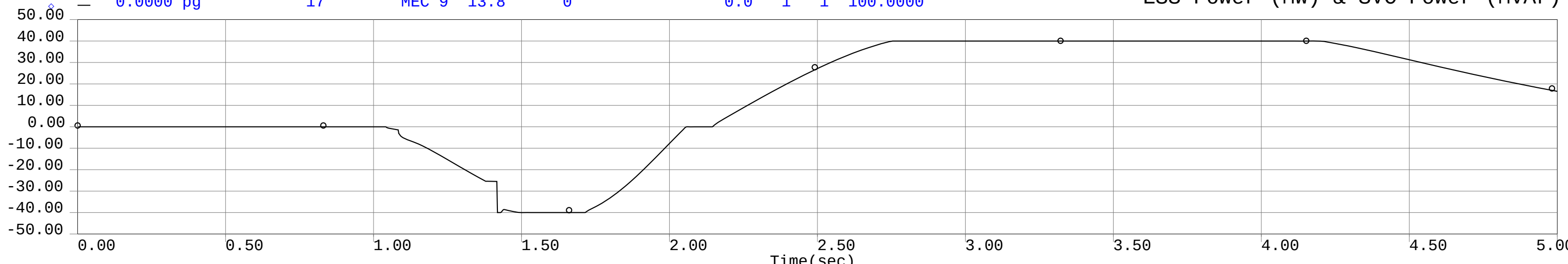

```
○ 58.0000 spd      1    Cabras_1  13.8   0    0.0  1  1  63.0000
× 58.0000 spd     12    Cabras_3  13.8   0    0.0  1  1  63.0000
□ 58.0000 spd     16       MEC 8  13.8   0    0.0  1  1  63.0000
△ 58.0000 spd     17       MEC 9  13.8   0    0.0  1  1  63.0000
◇ 58.0000 fbus  1001    Cab115EB 115.0   0    0.0  1  1  63.0000
```

Unit Power (MW)



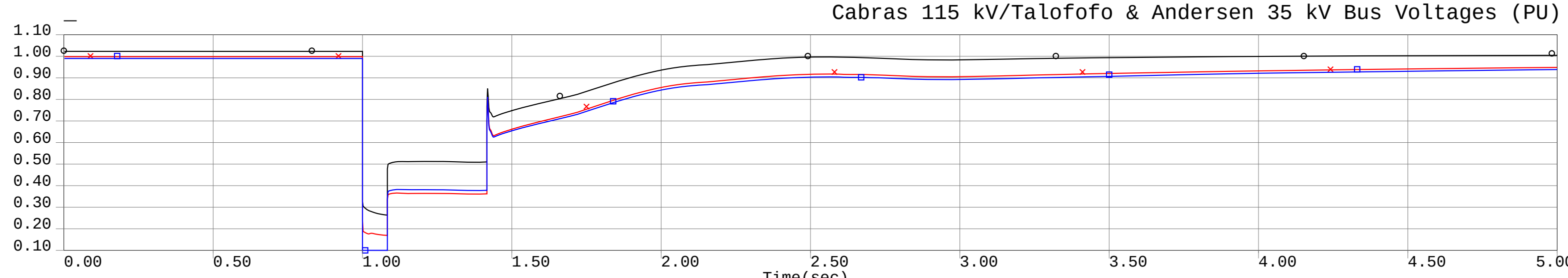

```
○ 0.0000 pg    1   Cabras_1  13.8   0    0.0  1  1  100.0000
× 0.0000 pg   12   Cabras_3  13.8   0    0.0  1  1  100.0000
□ 0.0000 pg   13   Cabras_4  13.8   0    0.0  1  1  100.0000
△ 0.0000 pg   16      MEC 8  13.8   0    0.0  1  1  100.0000
◇ 0.0000 pg   17      MEC 9  13.8   0    0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
○ -50.0000 pbes   80002  ESS 2-AGANA  13.8   0    0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



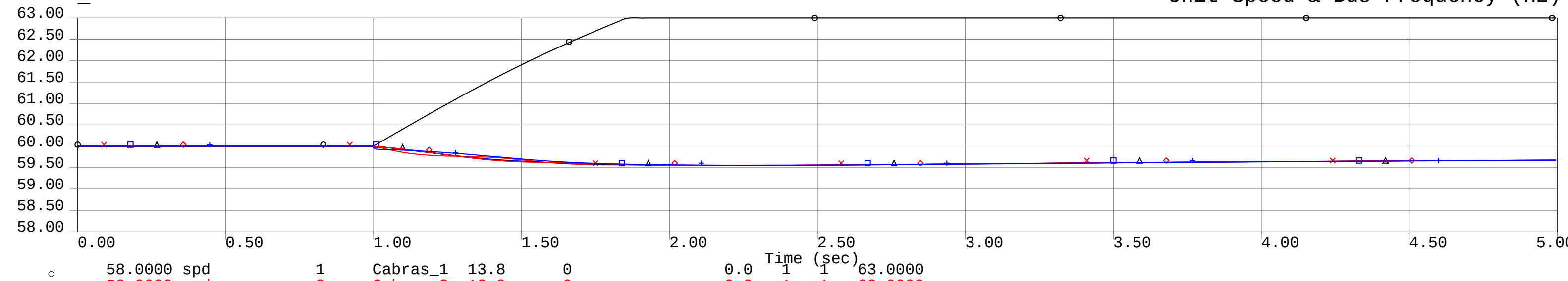

```
○ 0.1000 vbus  1001  Cab115EB 115.0   0    0.0  1  1  1.1000
× 0.1000 vbus  2003    Tal345  34.5   0    0.0  1  1  1.1000
□ 0.1000 vbus  2210  And345B1  34.5   0    0.0  1  1  1.1000
```

Simulation Plot Listing - Alternative Base Cases (plant PV)

Base Case	ESS Configuration	Disturbance ID	FIDVR	Renewable Block Trip	Complete Case ID
1433	40a	c1	fidvr		1433_40a_c1_fidvr
2433	40a	c1	fidvr		2433_40a_c1_fidvr
1433	40a	m8	fidvr		1433_40a_m8_fidvr
2433	40a	m8	fidvr		2433_40a_m8_fidvr
1433	40a	pvw3	fidvr		1433_40a_pvw3_fidvr
2433	40a	pvw3	fidvr		2433_40a_pvw3_fidvr
1433	40a	lf1	fidvr		1433_40a_lf1_fidvr
2433	40a	lf1	fidvr		2433_40a_lf1_fidvr
1433	40a	lf2	fidvr		1433_40a_lf2_fidvr
2433	40a	lf2	fidvr		2433_40a_lf2_fidvr
1433	40a	lf3	fidvr		1433_40a_lf3_fidvr
2433	40a	lf3	fidvr		2433_40a_lf3_fidvr
1433	40a	lf4	fidvr		1433_40a_lf4_fidvr
2433	40a	lf4	fidvr		2433_40a_lf4_fidvr
1433	40a	lf11	fidvr		1433_40a_lf11_fidvr
2433	40a	lf11	fidvr		2433_40a_lf11_fidvr
1433	40a	lf12	fidvr		1433_40a_lf12_fidvr
1433	40a	lf12	fidvr	pv	1433_40a_lf12_fidvr_pv
2433	40a	lf12	fidvr		2433_40a_lf12_fidvr
2433	40a	lf12	fidvr	pv	2433_40a_lf12_fidvr_pv
1433	40a	lf13	fidvr		1433_40a_lf13_fidvr
2433	40a	lf13	fidvr		2433_40a_lf13_fidvr
1433	40a	lf14	fidvr		1433_40a_lf14_fidvr
2433	40a	lf14	fidvr		2433_40a_lf14_fidvr
1433	40a	lf15	fidvr		1433_40a_lf15_fidvr
1433	40a	lf15	fidvr	pv	1433_40a_lf15_fidvr_pv
2433	40a	lf15	fidvr		2433_40a_lf15_fidvr
2433	40a	lf15	fidvr	pv	2433_40a_lf15_fidvr_pv
1433	40a	lf16	fidvr		1433_40a_lf16_fidvr
1433	40a	lf16	fidvr	pv	1433_40a_lf16_fidvr_pv
2433	40a	lf16	fidvr		2433_40a_lf16_fidvr
1433	40a	lf17	fidvr		1433_40a_lf17_fidvr
2433	40a	lf17	fidvr		2433_40a_lf17_fidvr
1433	40a	lf18	fidvr		1433_40a_lf18_fidvr
1433	40a	lf18	fidvr	pv	1433_40a_lf18_fidvr_pv
2433	40a	lf18	fidvr		2433_40a_lf18_fidvr
2433	40a	lf18	fidvr	pv	2433_40a_lf18_fidvr_pv

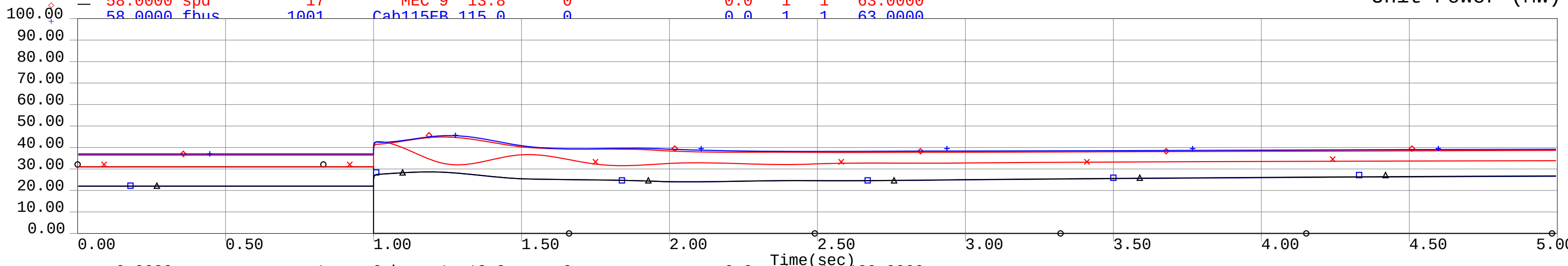
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



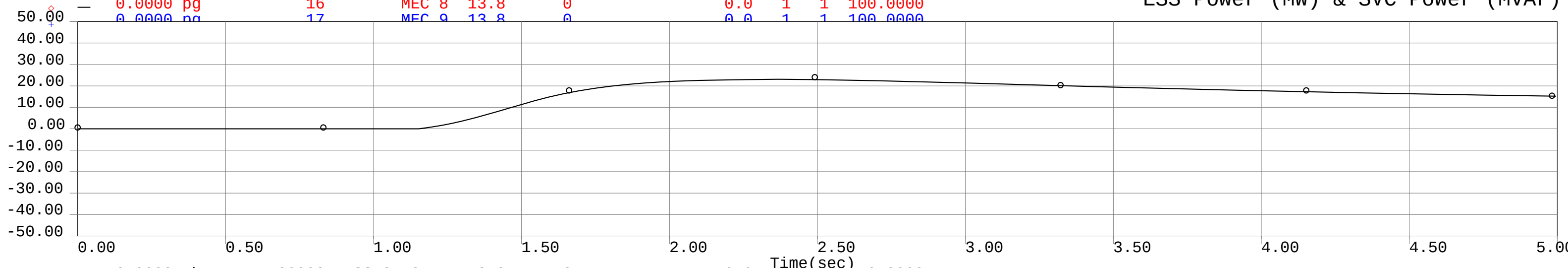
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



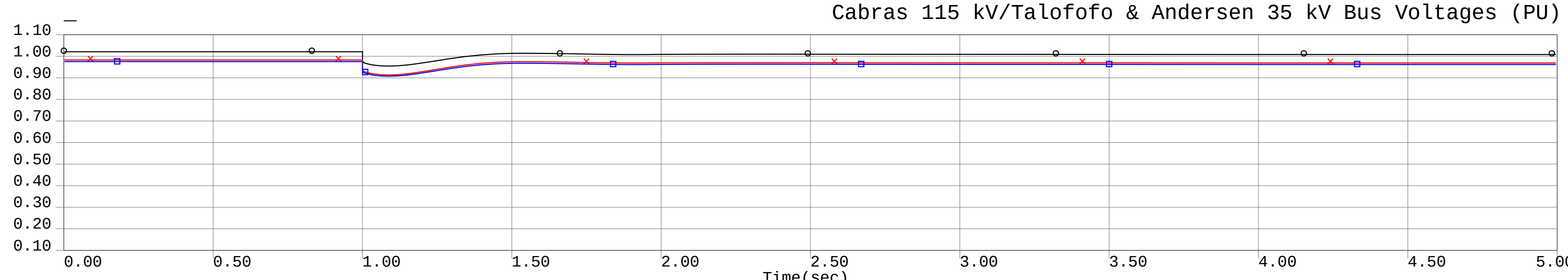
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1433_40a_c1_fidvr.chf

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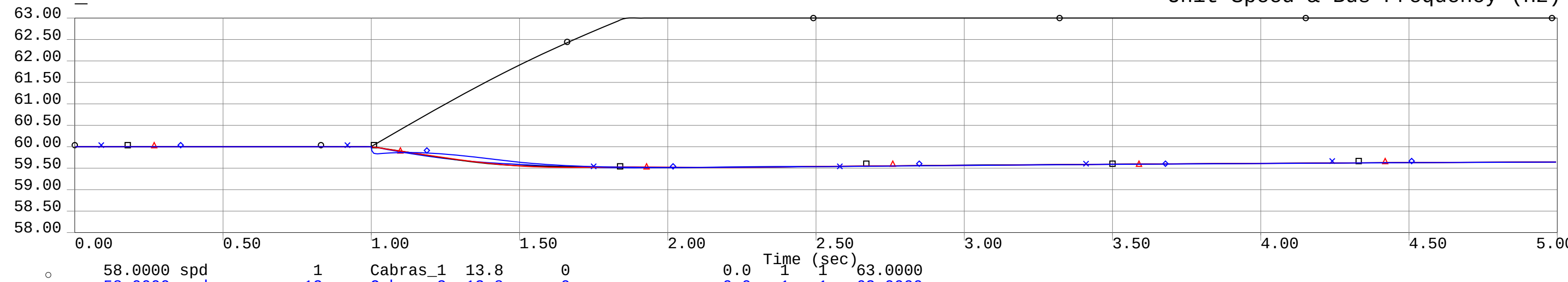
Wed May 07 16:08:01 2014

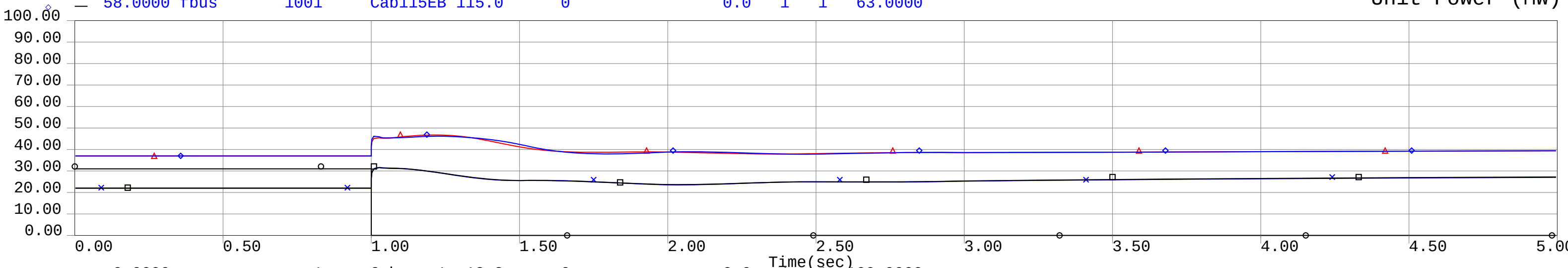
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



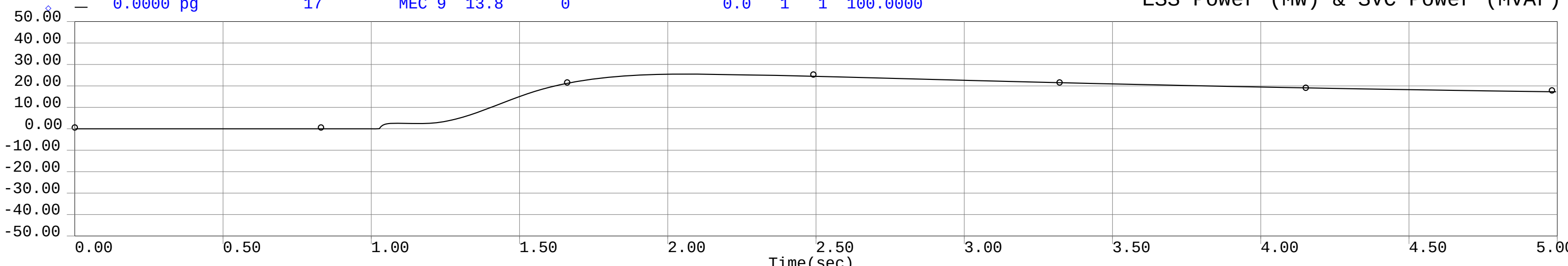

```
○  58.0000 spd        1     Cabras_1  13.8    0        0.0  1  1  63.0000
×  58.0000 spd       12     Cabras_3  13.8    0        0.0  1  1  63.0000
□  58.0000 spd       16        MEC 8  13.8    0        0.0  1  1  63.0000
△  58.0000 spd       17        MEC 9  13.8    0        0.0  1  1  63.0000
◇  58.0000 fbus    1001     Cab115EB 115.0    0        0.0  1  1  63.0000
```

Unit Power (MW)



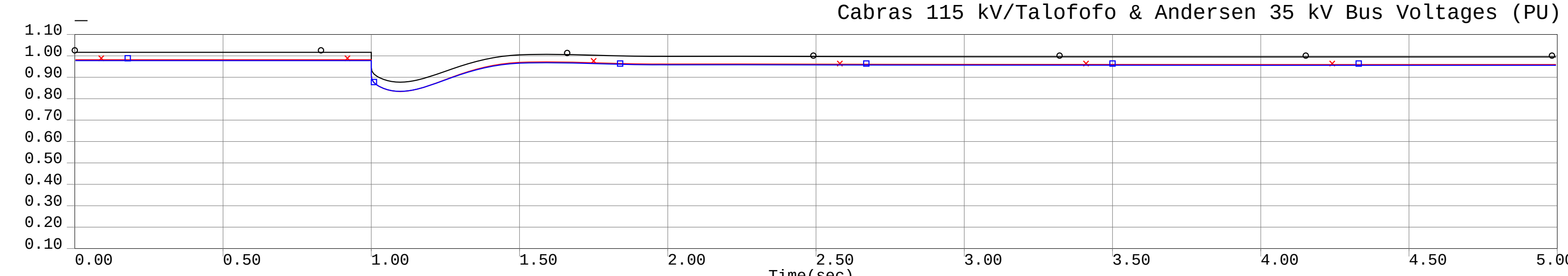

```
○  0.0000 pg          1     Cabras_1  13.8    0        0.0  1  1  100.0000
×  0.0000 pg         12     Cabras_3  13.8    0        0.0  1  1  100.0000
□  0.0000 pg         13     Cabras_4  13.8    0        0.0  1  1  100.0000
△  0.0000 pg         16        MEC 8  13.8    0        0.0  1  1  100.0000
◇  0.0000 pg         17        MEC 9  13.8    0        0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
○  -50.0000 pbes    80002  ESS 2-AGANA  13.8    0        0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
○  0.1000 vbus     1001     Cab115EB 115.0    0        0.0  1  1  1.1000
×  0.1000 vbus     2003       Tal345  34.5    0        0.0  1  1  1.1000
□  0.1000 vbus     2210     And345B1  34.5    0        0.0  1  1  1.1000
```


chans/2433_40a_c1_fidvr.chf

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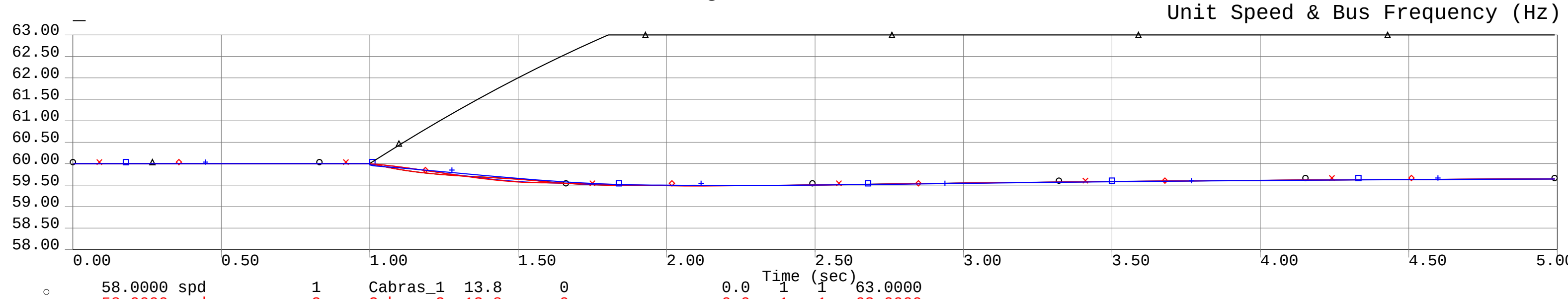
Wed May 07 16:08:02 2014

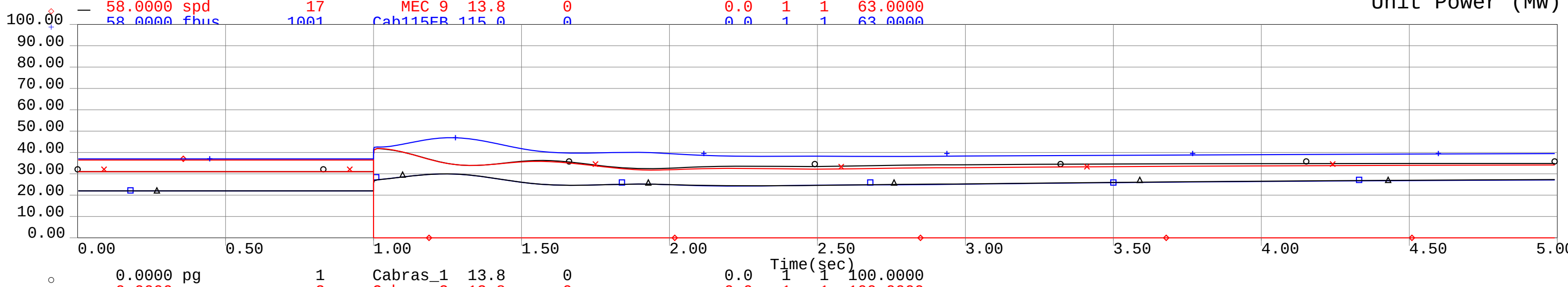
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



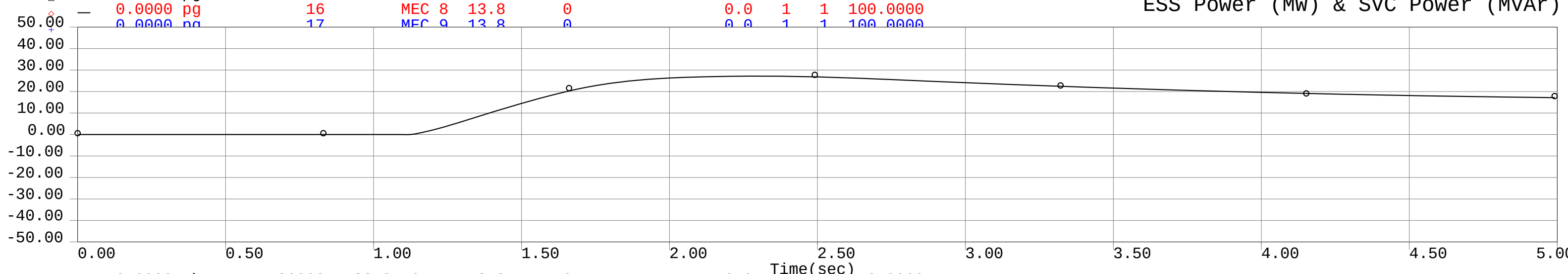

```
58.0000 spd      1     Cabras_1  13.8   0    0.0  1  1  63.0000
58.0000 spd      2     Cabras_2  13.8   0    0.0  1  1  63.0000
58.0000 spd     12     Cabras_3  13.8   0    0.0  1  1  63.0000
58.0000 spd     16       MEC 8   13.8   0    0.0  1  1  63.0000
58.0000 spd     17       MEC 9   13.8   0    0.0  1  1  63.0000
58.0000 fbus  1001     Cab115EB 115.0   0    0.0  1  1  63.0000
```

Unit Power (MW)



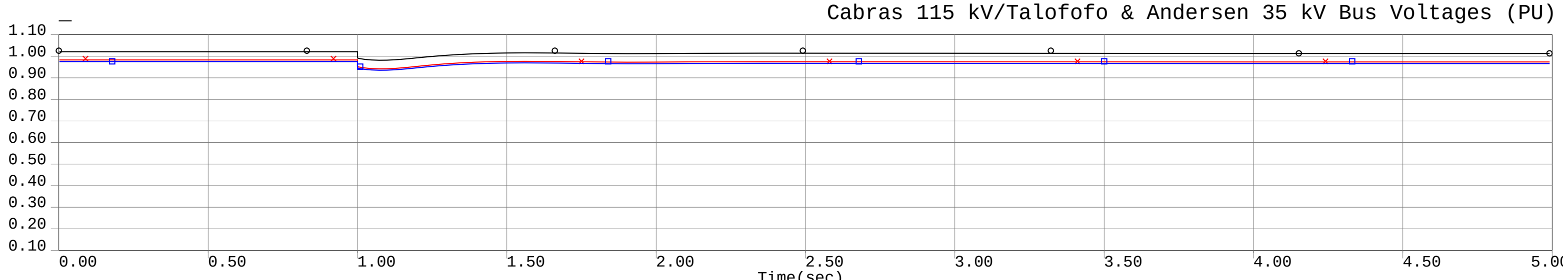

```
0.0000 pg      1     Cabras_1  13.8   0    0.0  1  1  100.0000
0.0000 pg      2     Cabras_2  13.8   0    0.0  1  1  100.0000
0.0000 pg     12     Cabras_3  13.8   0    0.0  1  1  100.0000
0.0000 pg     13     Cabras_4  13.8   0    0.0  1  1  100.0000
0.0000 pg     16       MEC 8   13.8   0    0.0  1  1  100.0000
0.0000 pg     17       MEC 9   13.8   0    0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
-50.0000 pbes   80002  ESS 2-AGANA  13.8   0    0.0  1  1  50.0000
```

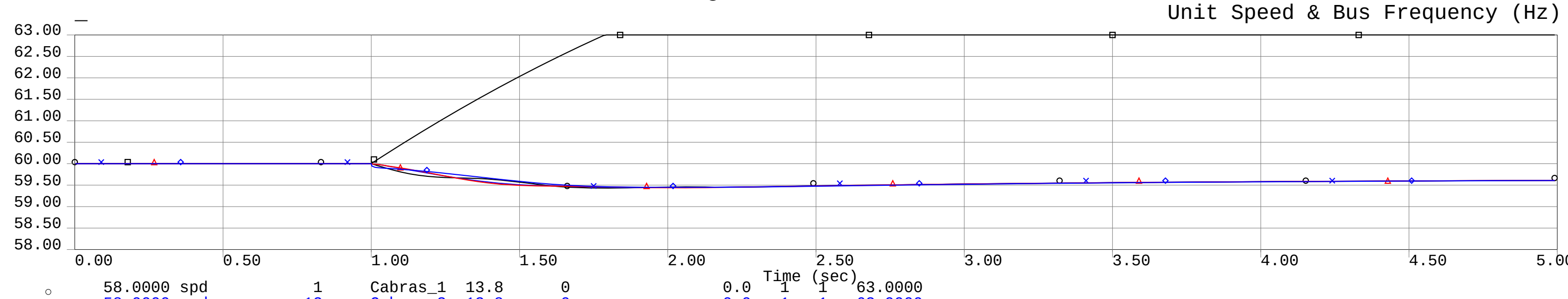
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.1000 vbus   1001   Cab115EB 115.0   0    0.0  1  1  1.1000
0.1000 vbus   2003     Tal345  34.5   0    0.0  1  1  1.1000
0.1000 vbus   2210   And345B1  34.5   0    0.0  1  1  1.1000
```

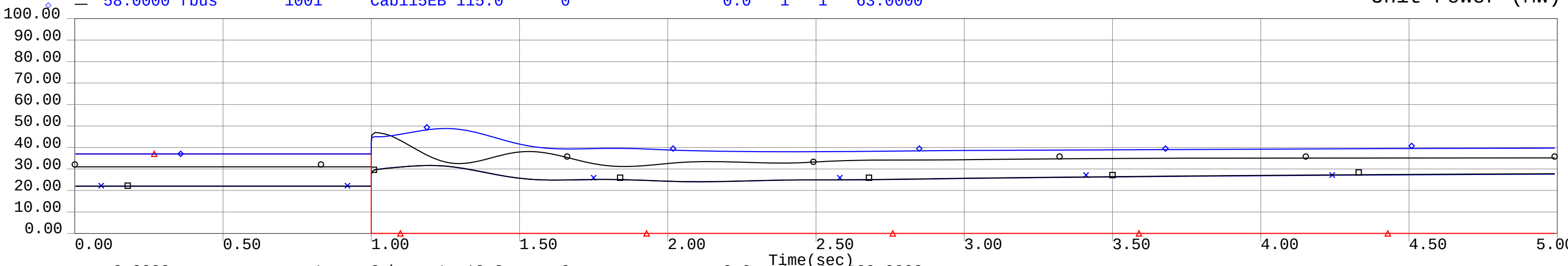
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



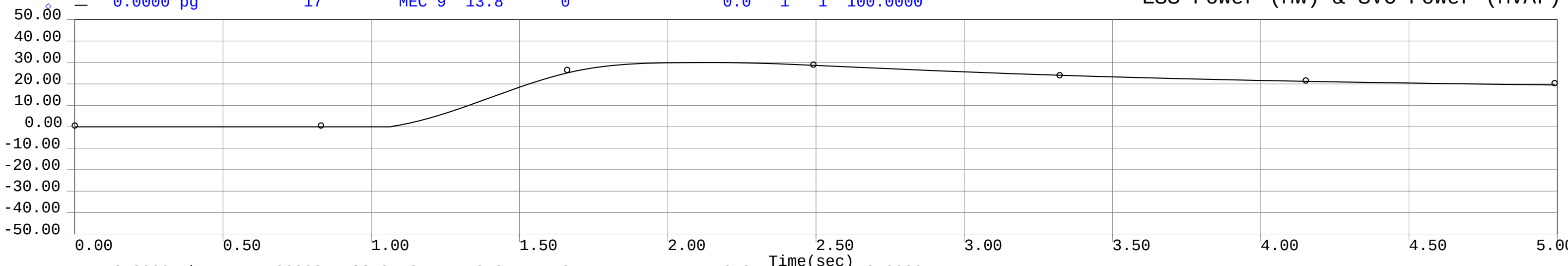

```
58.0000 spd       1  Cabras_1  13.8  0  0.0  1  1  63.0000
58.0000 spd      12  Cabras_3  13.8  0  0.0  1  1  63.0000
58.0000 spd      16     MEC 8  13.8  0  0.0  1  1  63.0000
58.0000 spd      17     MEC 9  13.8  0  0.0  1  1  63.0000
58.0000 fbus   1001  Cab115EB 115.0  0  0.0  1  1  63.0000
```

Unit Power (MW)



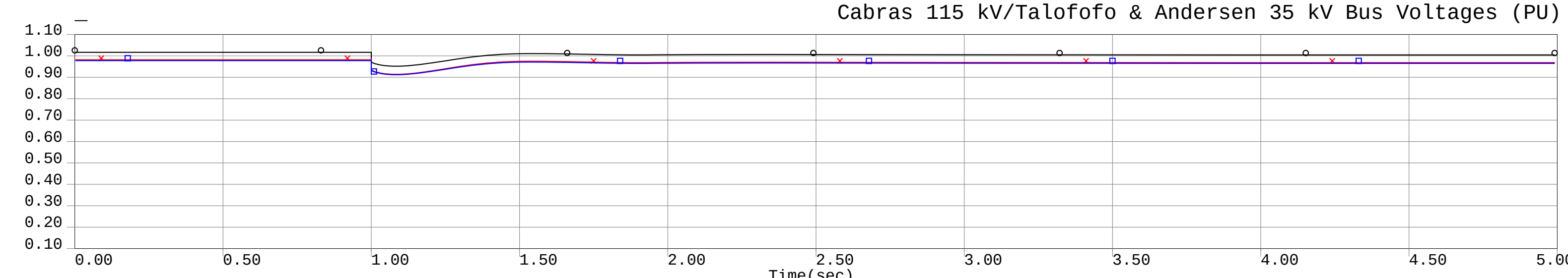

```
0.0000 pg       1  Cabras_1  13.8  0  0.0  1  1  100.0000
0.0000 pg      12  Cabras_3  13.8  0  0.0  1  1  100.0000
0.0000 pg      13  Cabras_4  13.8  0  0.0  1  1  100.0000
0.0000 pg      16     MEC 8  13.8  0  0.0  1  1  100.0000
0.0000 pg      17     MEC 9  13.8  0  0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
-50.0000 pbes   80002  ESS 2-AGANA  13.8  0  0.0  1  1  50.0000
```

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.1000 vbus   1001  Cab115EB 115.0  0  0.0  1  1  1.1000
0.1000 vbus   2003    Tal345  34.5  0  0.0  1  1  1.1000
0.1000 vbus   2210  And345B1  34.5  0  0.0  1  1  1.1000
```


chans/2433_40a_m8_fidvr.chf

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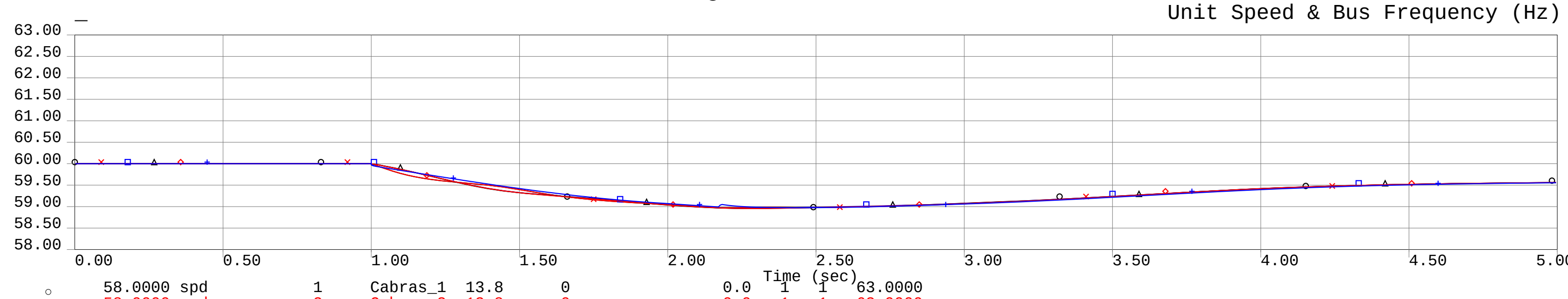
Wed May 07 16:08:03 2014

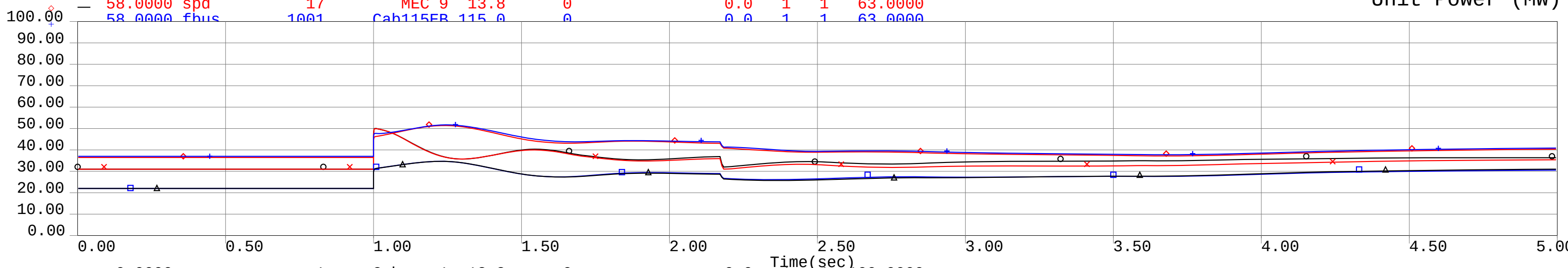
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



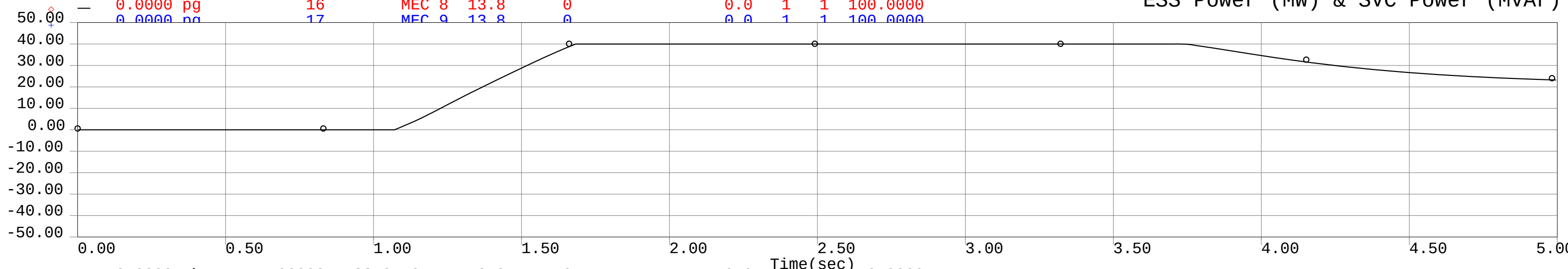
58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



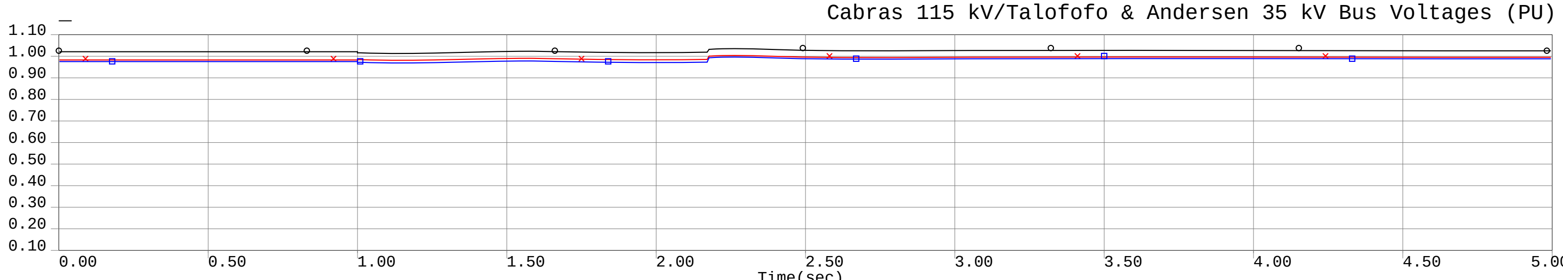
0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

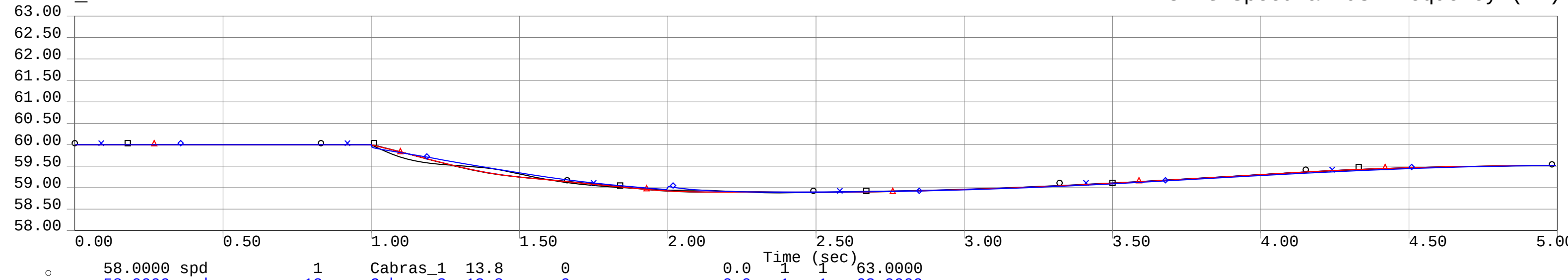
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

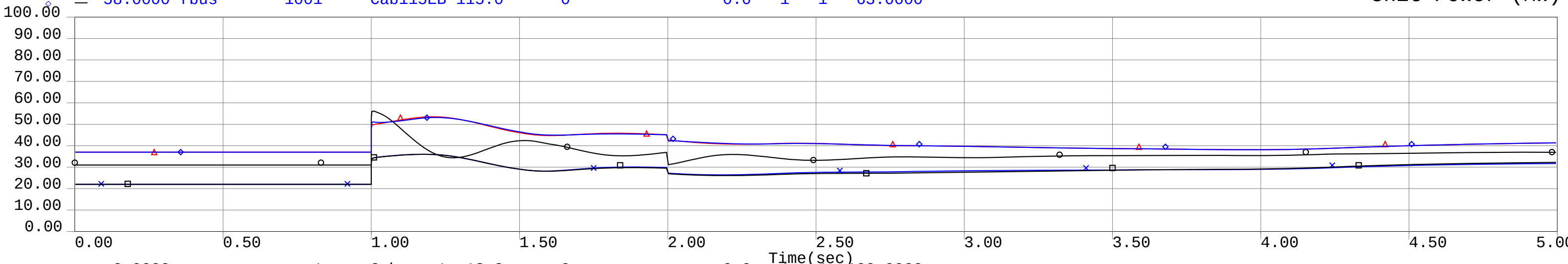
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



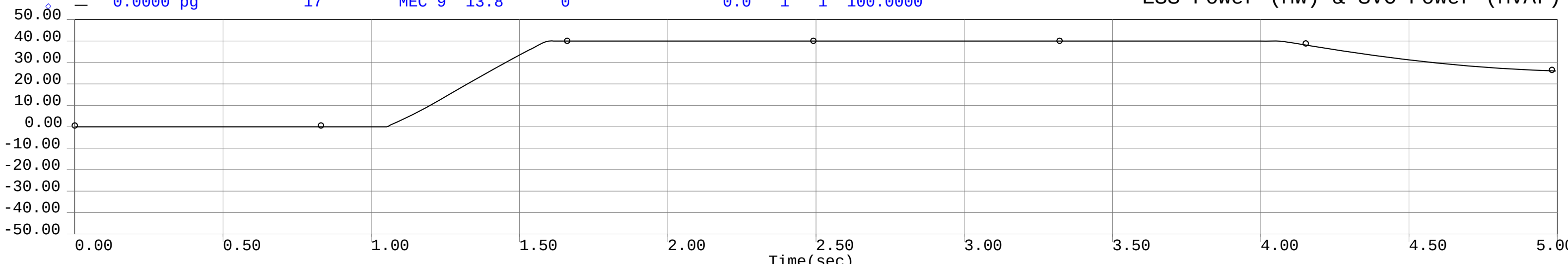
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



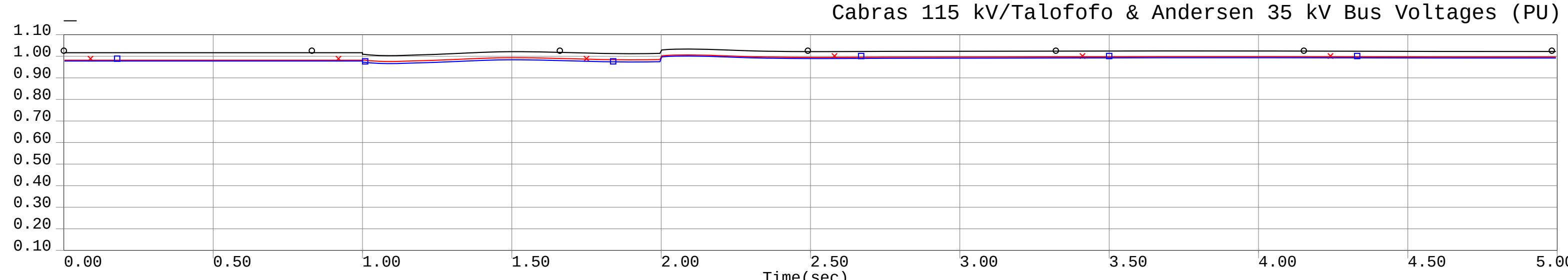
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

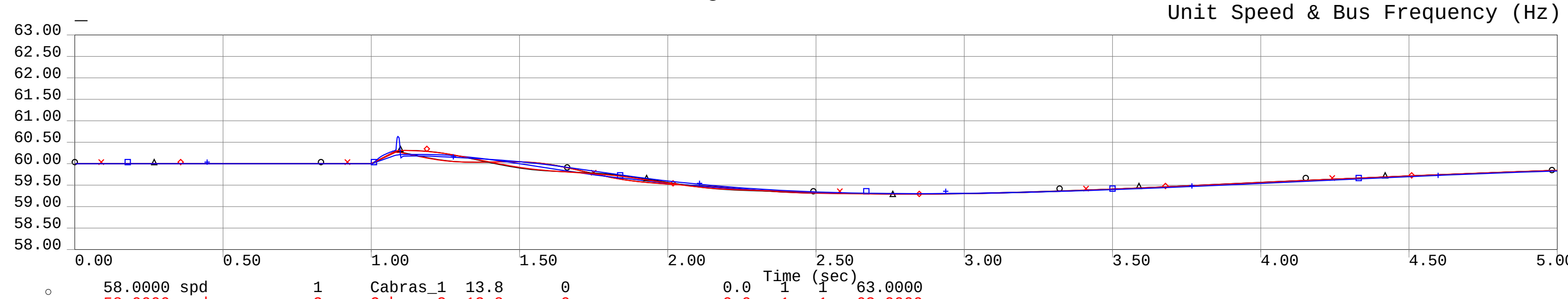
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

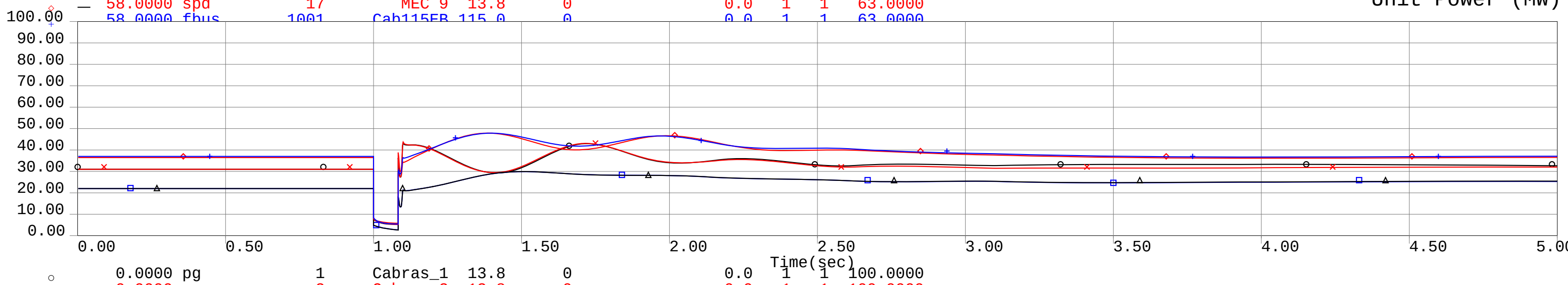
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



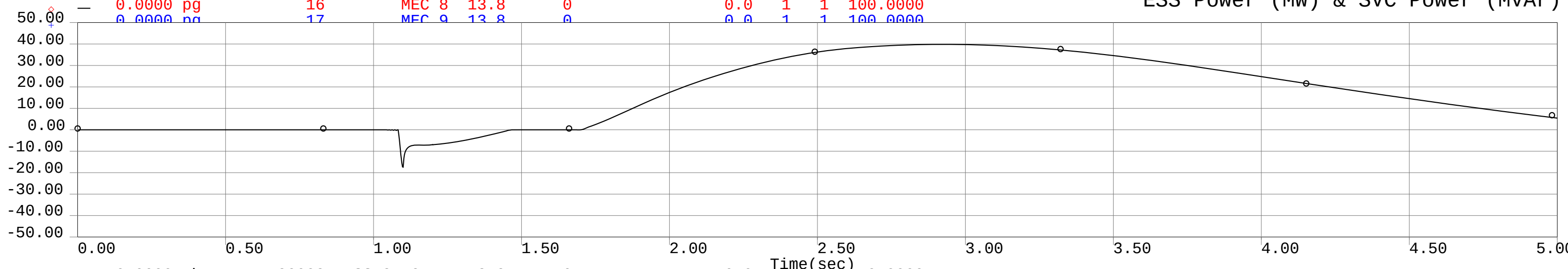

```
58.0000 spd        1   Cabras_1  13.8   0     0.0  1  1  63.0000
58.0000 spd        2   Cabras_2  13.8   0     0.0  1  1  63.0000
58.0000 spd       12   Cabras_3  13.8   0     0.0  1  1  63.0000
58.0000 spd       16      MEC 8  13.8   0     0.0  1  1  63.0000
58.0000 spd       17      MEC 9  13.8   0     0.0  1  1  63.0000
58.0000 fbus    1001  Cab115EB 115.0   0     0.0  1  1  63.0000
```

Unit Power (MW)



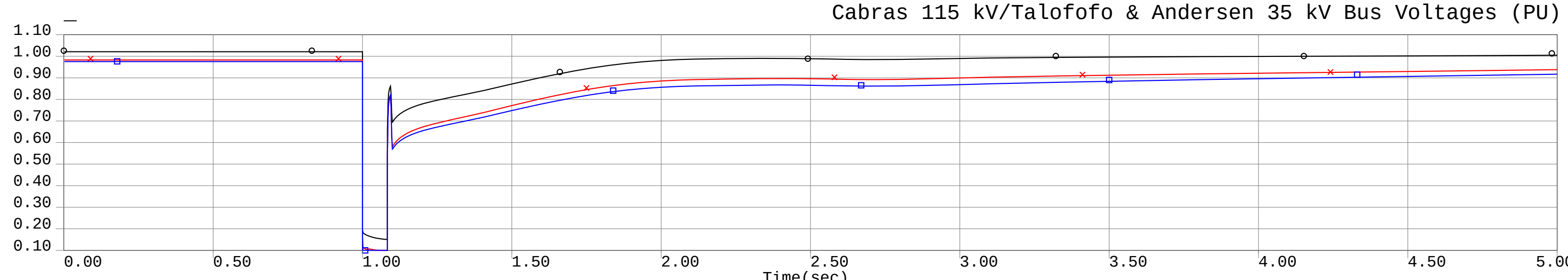

```
0.0000 pg        1   Cabras_1  13.8   0     0.0  1  1  100.0000
0.0000 pg        2   Cabras_2  13.8   0     0.0  1  1  100.0000
0.0000 pg       12   Cabras_3  13.8   0     0.0  1  1  100.0000
0.0000 pg       13   Cabras_4  13.8   0     0.0  1  1  100.0000
0.0000 pg       16      MEC 8  13.8   0     0.0  1  1  100.0000
0.0000 pg       17      MEC 9  13.8   0     0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)




```
-50.0000 pbes    80002  ESS 2-AGANA  13.8   0     0.0  1  1  50.0000
```

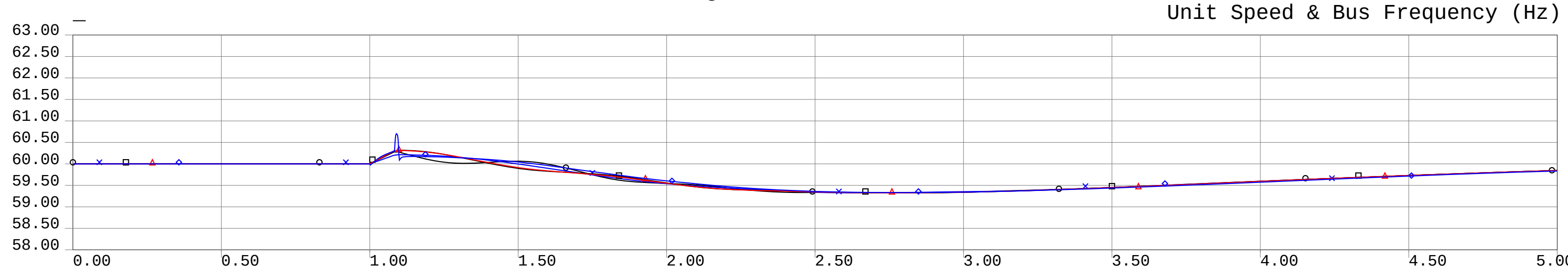
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.1000 vbus    1001   Cab115EB 115.0   0     0.0  1  1  1.1000
0.1000 vbus    2003     Tal345  34.5   0     0.0  1  1  1.1000
0.1000 vbus    2210   And345B1  34.5   0     0.0  1  1  1.1000
```

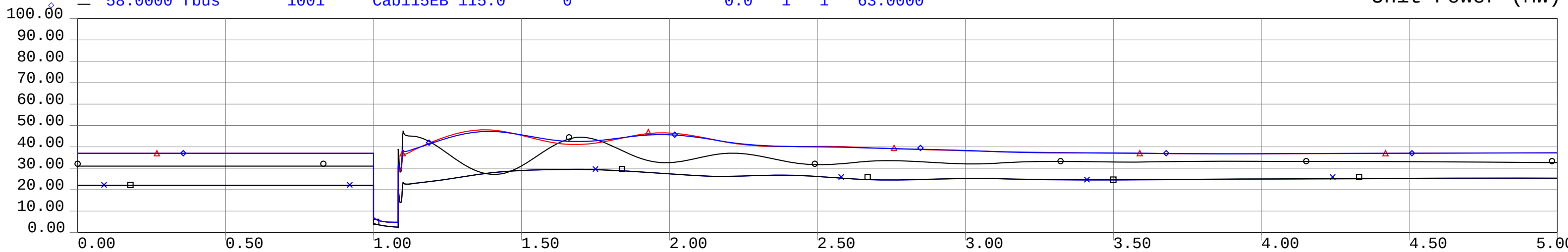
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



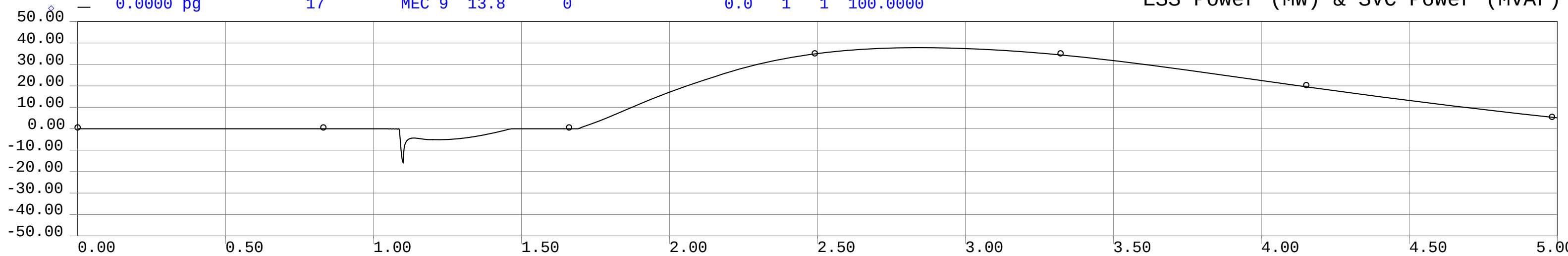
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



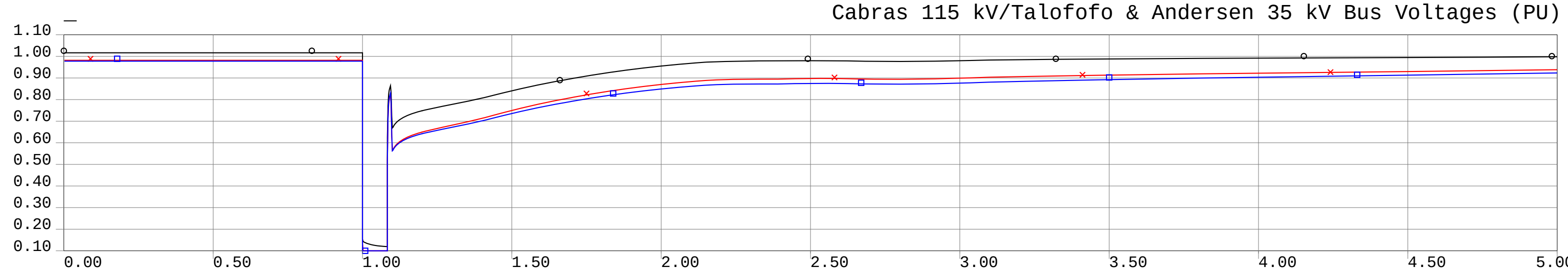
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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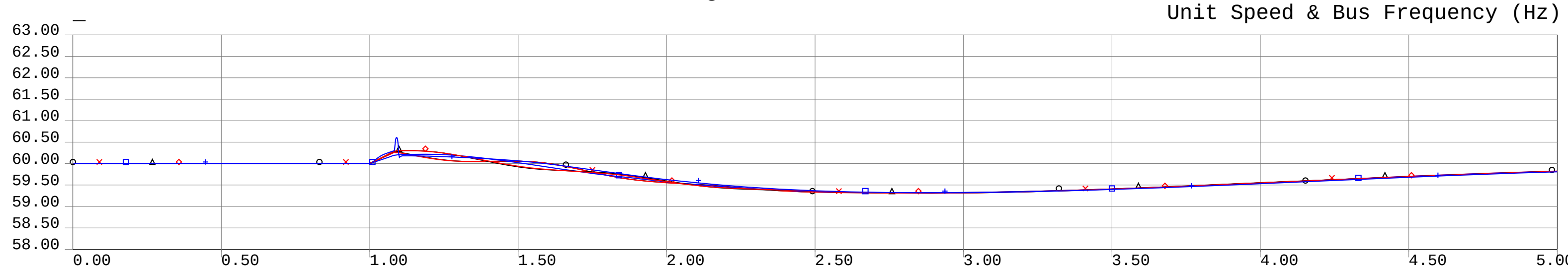
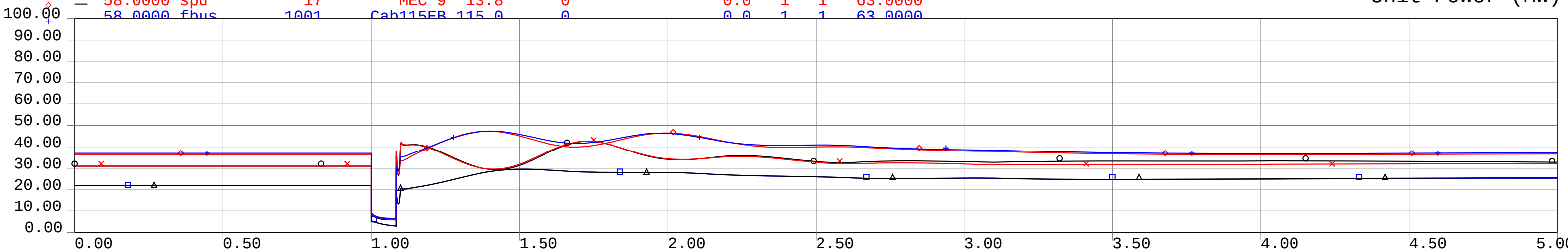
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



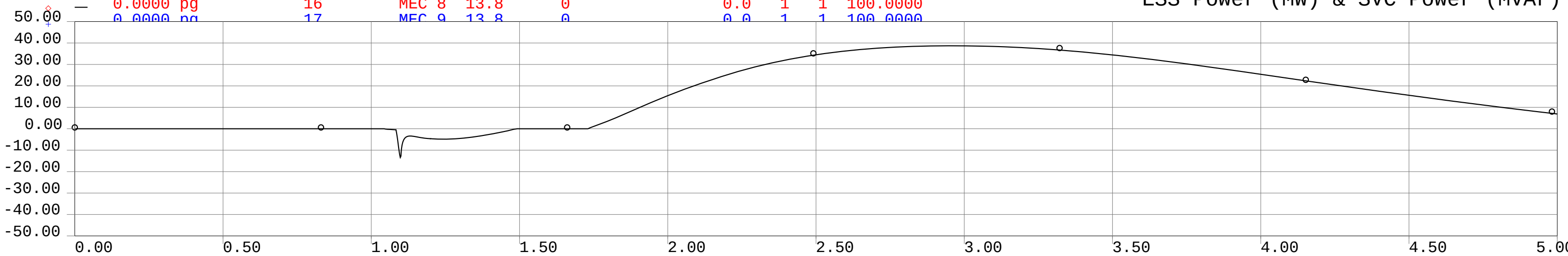
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



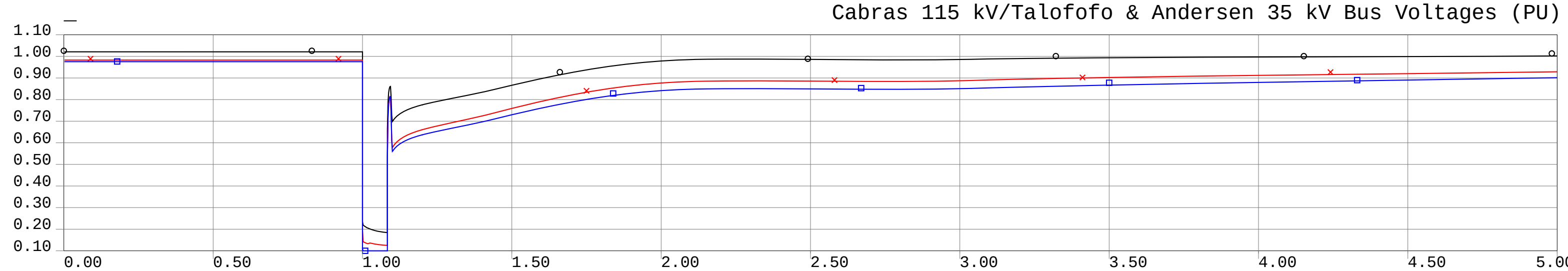
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



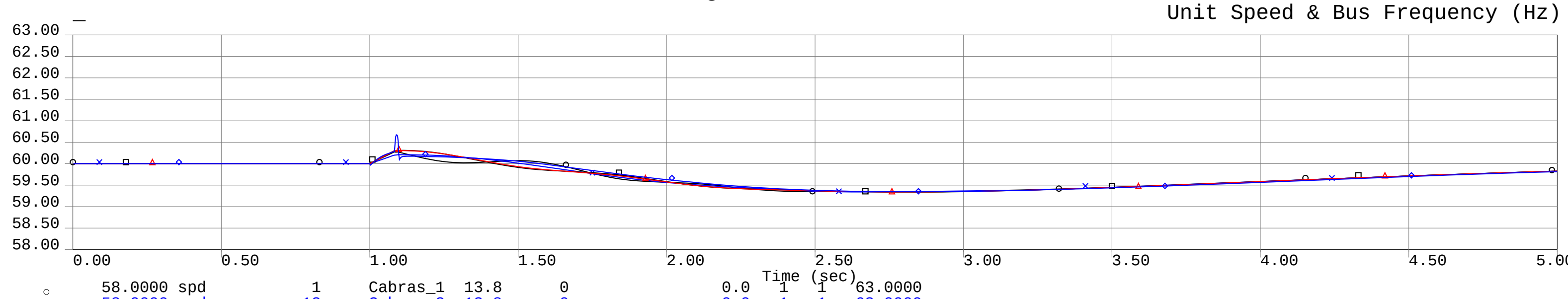
-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

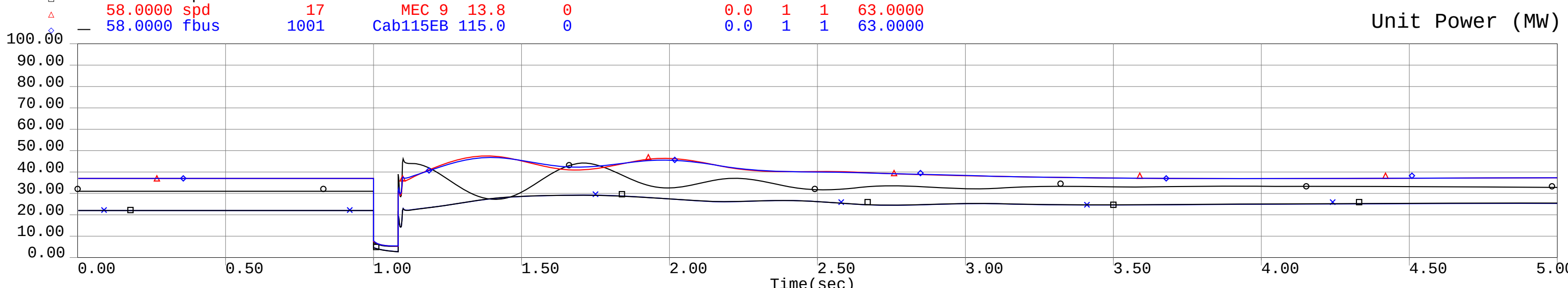


0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

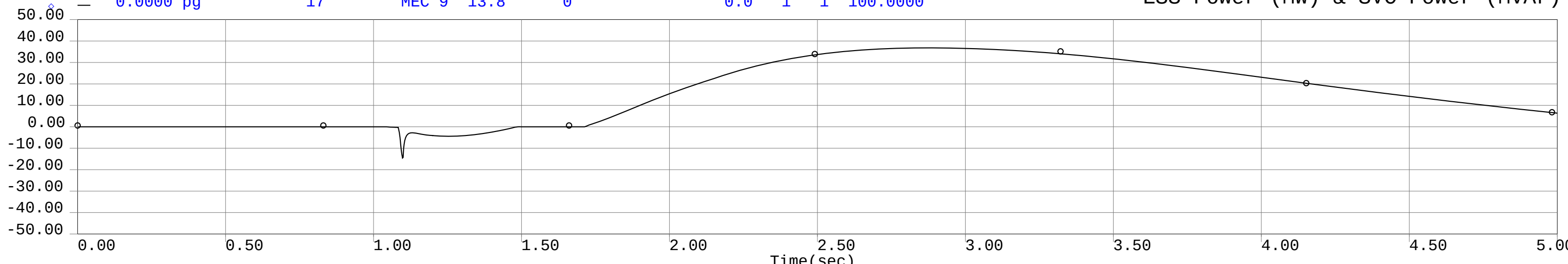
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



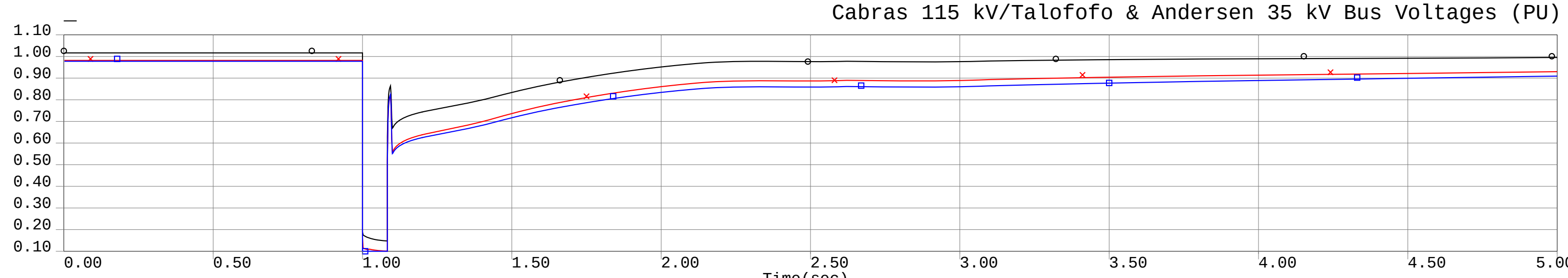

```
58.0000 spd      1     Cabras_1  13.8   0   0.0  1  1  63.0000
58.0000 spd      12    Cabras_3  13.8   0   0.0  1  1  63.0000
58.0000 spd      16    MEC 8     13.8   0   0.0  1  1  63.0000
58.0000 spd      17    MEC 9     13.8   0   0.0  1  1  63.0000
58.0000 fbus     1001  Cab115EB  115.0  0   0.0  1  1  63.0000
```




```
0.0000 pg   1    Cabras_1  13.8  0   0.0  1  1  100.0000
0.0000 pg   12   Cabras_3  13.8  0   0.0  1  1  100.0000
0.0000 pg   13   Cabras_4  13.8  0   0.0  1  1  100.0000
0.0000 pg   16   MEC 8     13.8  0   0.0  1  1  100.0000
0.0000 pg   17   MEC 9     13.8  0   0.0  1  1  100.0000
```




```
-50.0000 pbes   80002  ESS 2-AGANA  13.8  0   0.0  1  1  50.0000
```




```
0.1000 vbus   1001  Cab115EB  115.0  0   0.0  1  1  1.1000
0.1000 vbus   2003  Tal345    34.5   0   0.0  1  1  1.1000
0.1000 vbus   2210  And345B1  34.5   0   0.0  1  1  1.1000
```


chans/2433_40a_lf2_fidvr.chf

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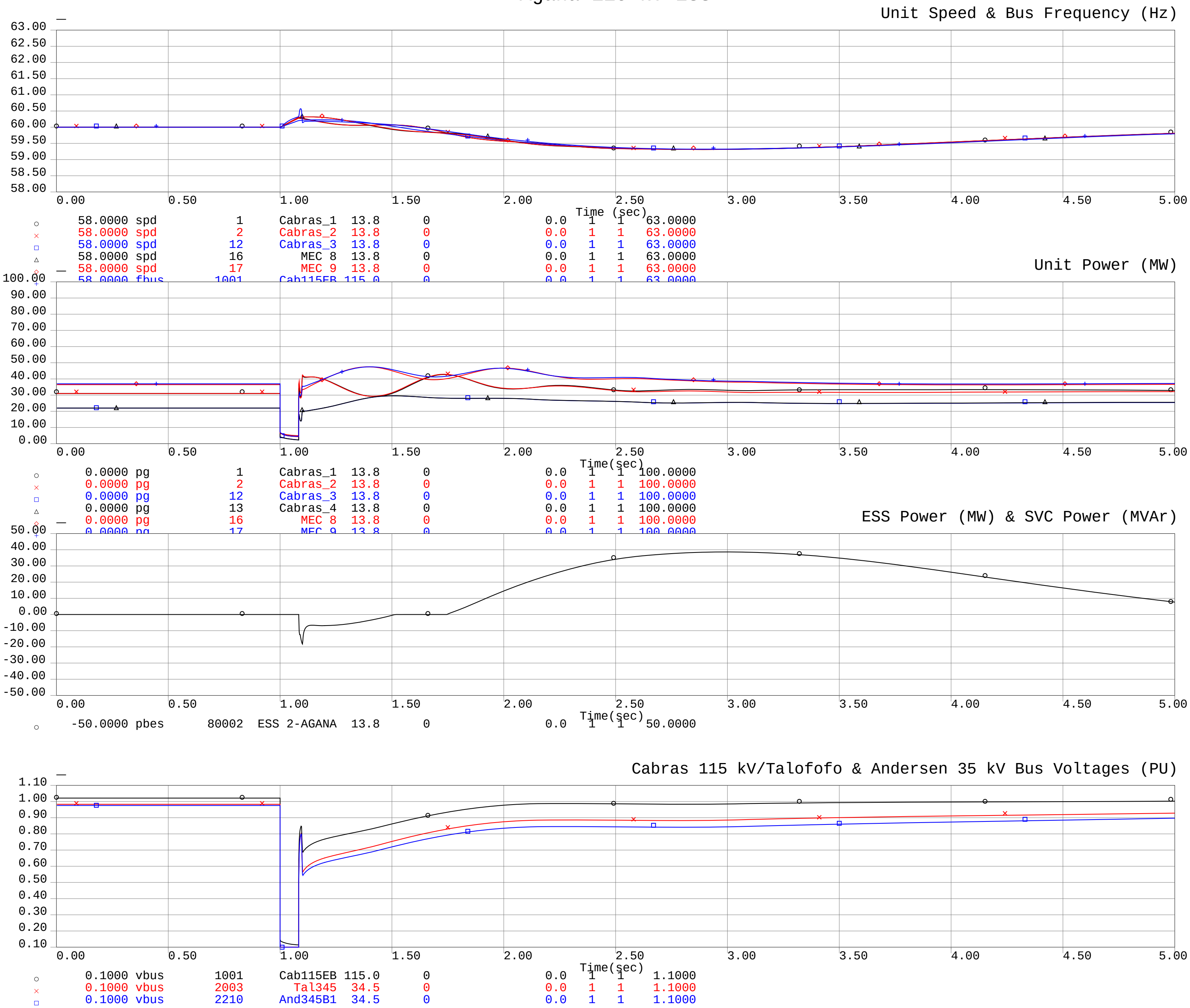
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



chans/1433_40a_lf3_fidvr.chf

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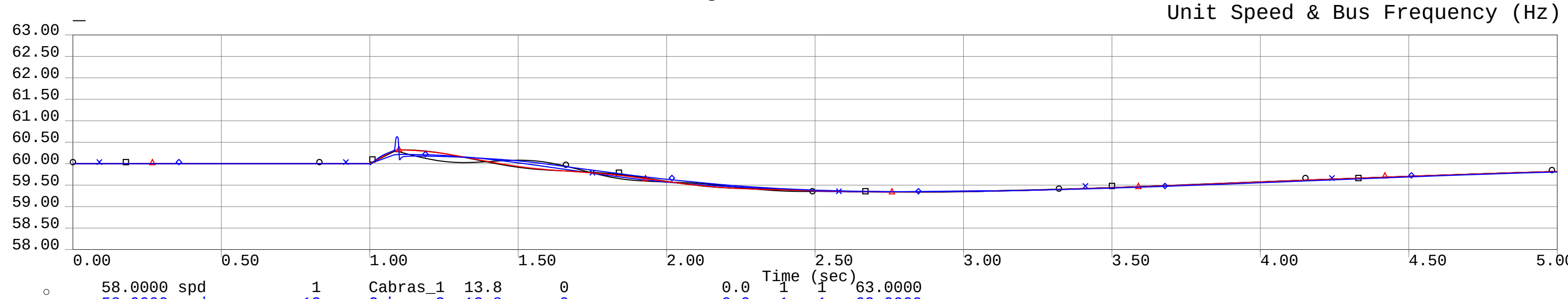
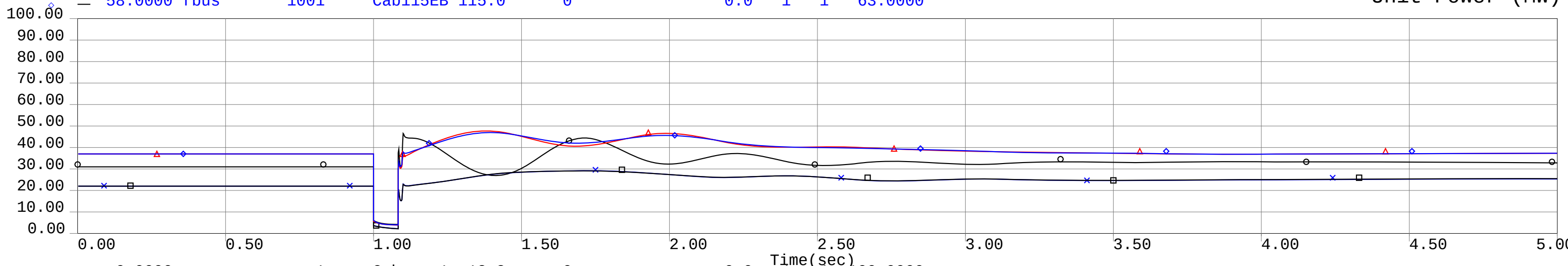
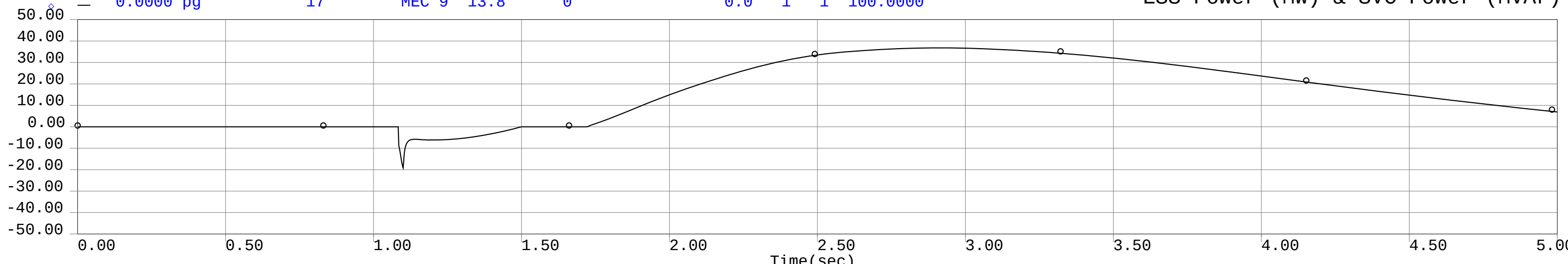
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS




```
58.0000 spd      1     Cabras_1  13.8   0    0.0  1  1  63.0000
58.0000 spd      12    Cabras_3  13.8   0    0.0  1  1  63.0000
58.0000 spd      16       MEC 8  13.8   0    0.0  1  1  63.0000
58.0000 spd      17       MEC 9  13.8   0    0.0  1  1  63.0000
58.0000 fbus     1001  Cab115EB 115.0   0    0.0  1  1  63.0000
```




```
0.0000 pg   1     Cabras_1  13.8   0    0.0  1  1  100.0000
0.0000 pg   12    Cabras_3  13.8   0    0.0  1  1  100.0000
0.0000 pg   13    Cabras_4  13.8   0    0.0  1  1  100.0000
0.0000 pg   16       MEC 8  13.8   0    0.0  1  1  100.0000
0.0000 pg   17       MEC 9  13.8   0    0.0  1  1  100.0000
```

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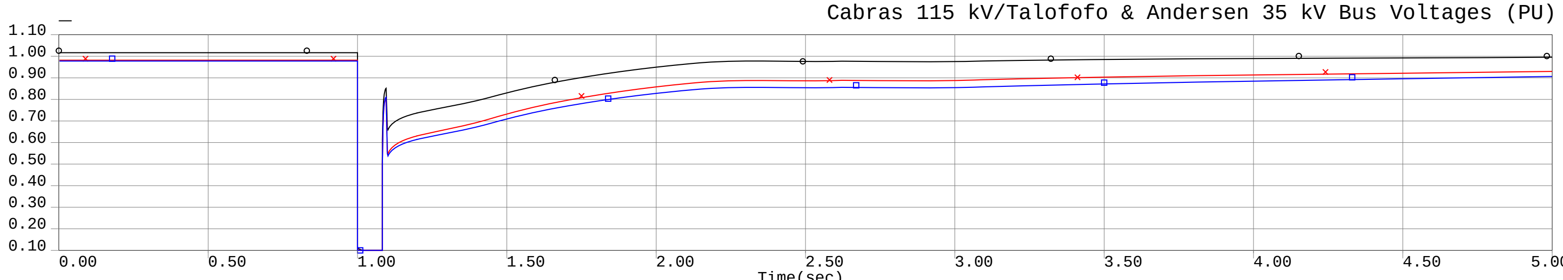
-50.0000 pbes   80002  ESS 2-AGANA  13.8   0    0.0  1  1  50.0000
```




```
0.1000 vbus   1001  Cab115EB 115.0   0    0.0  1  1  1.1000
0.1000 vbus   2003    Tal345  34.5   0    0.0  1  1  1.1000
0.1000 vbus   2210  And345B1  34.5   0    0.0  1  1  1.1000
```


chans/2433_40a_lf3_fidvr.chf

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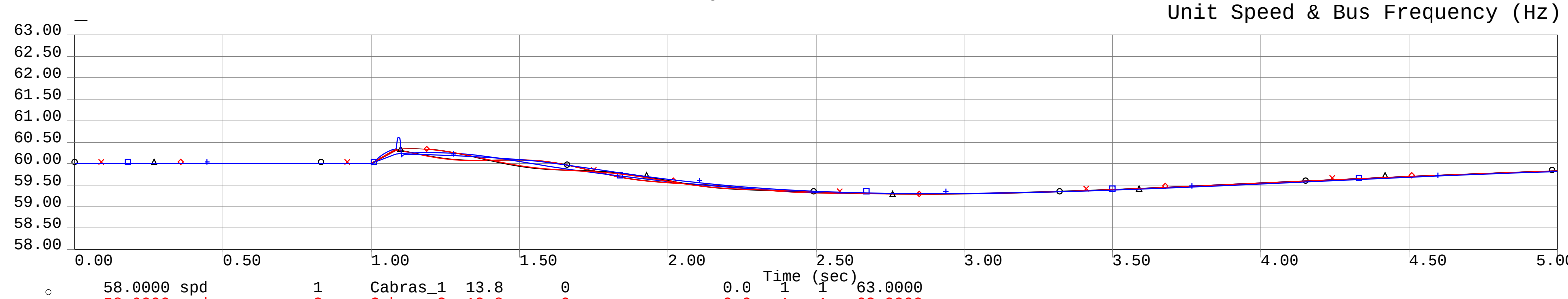
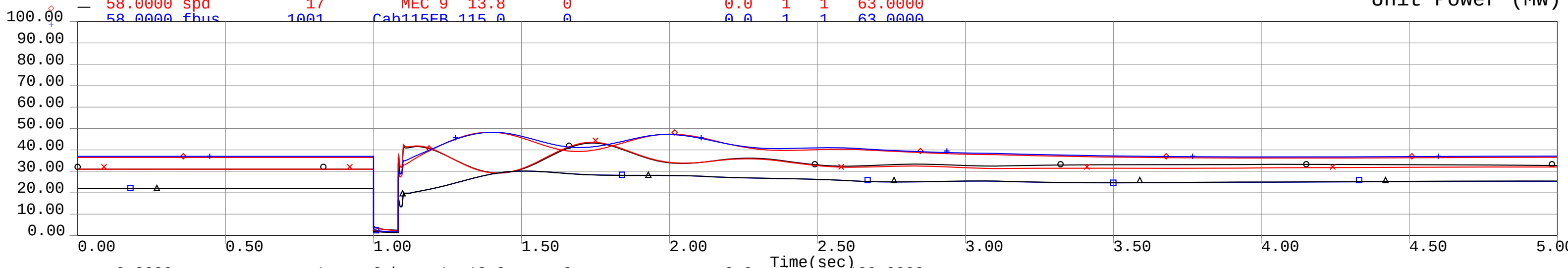
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



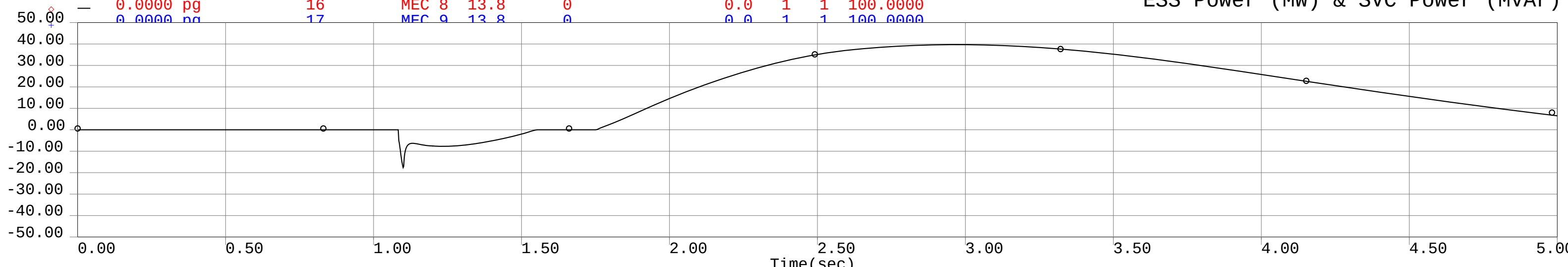
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



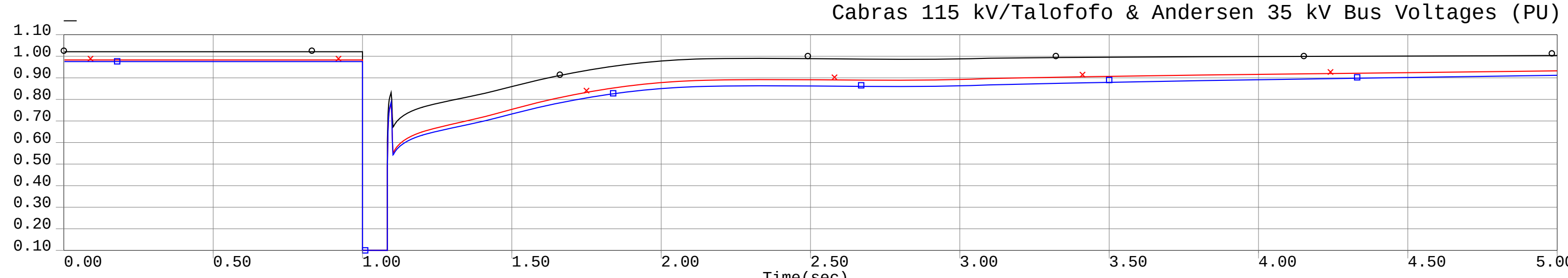
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1433_40a_lf4_fidvr.chf

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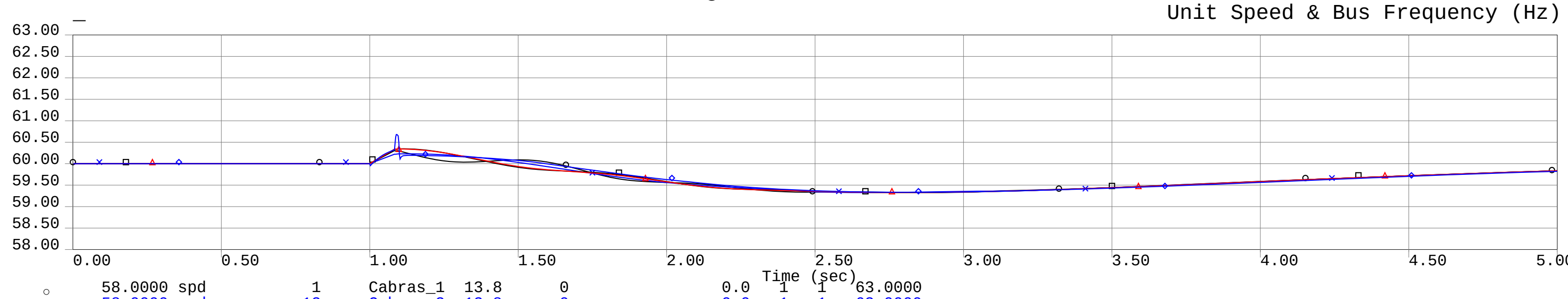
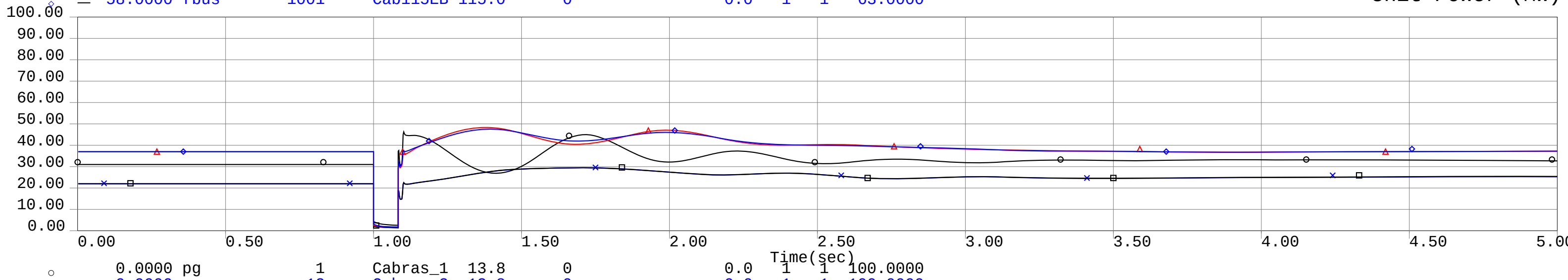
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



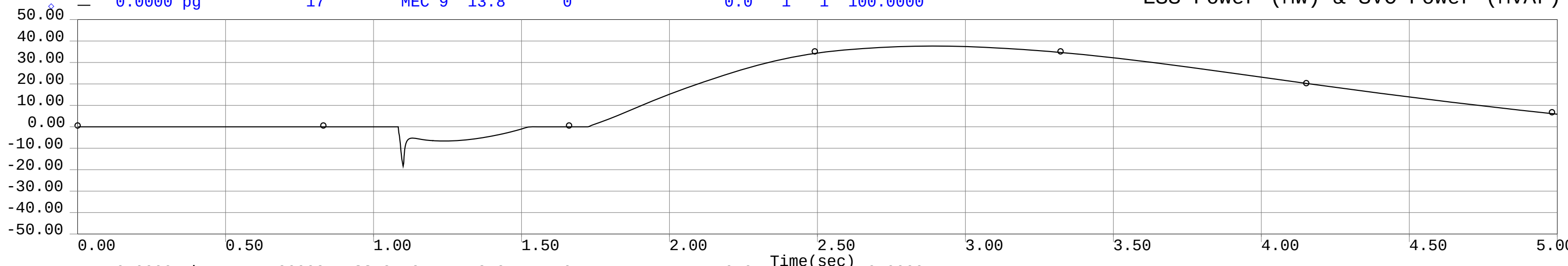
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



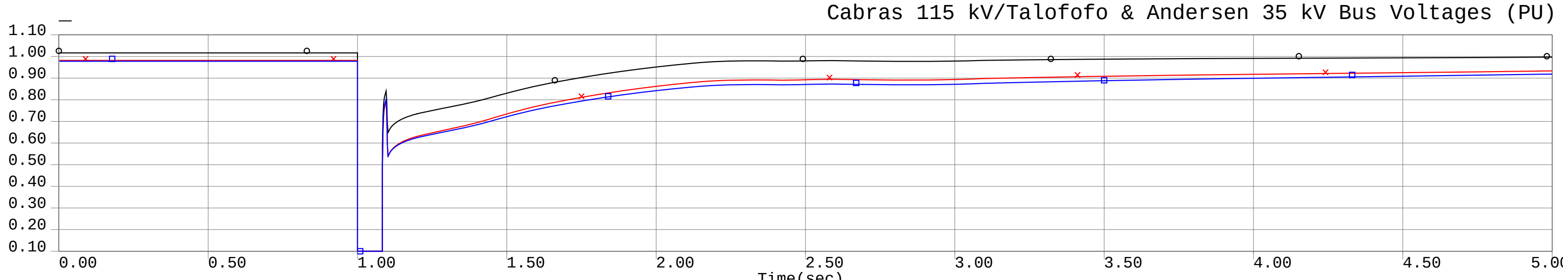
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2433_40a_lf4_fidvr.chf

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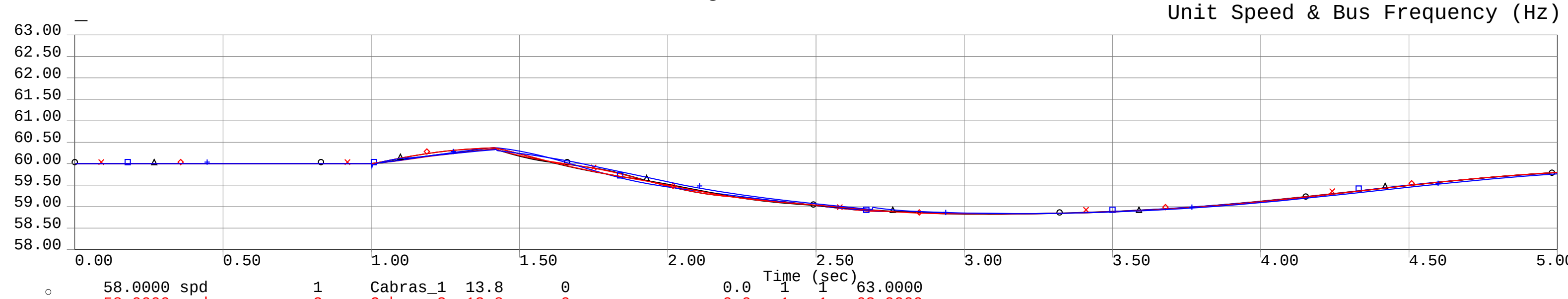
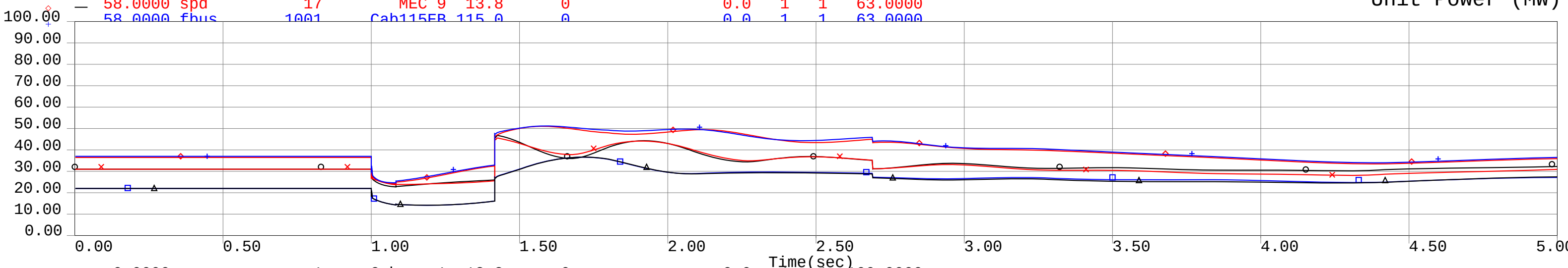
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



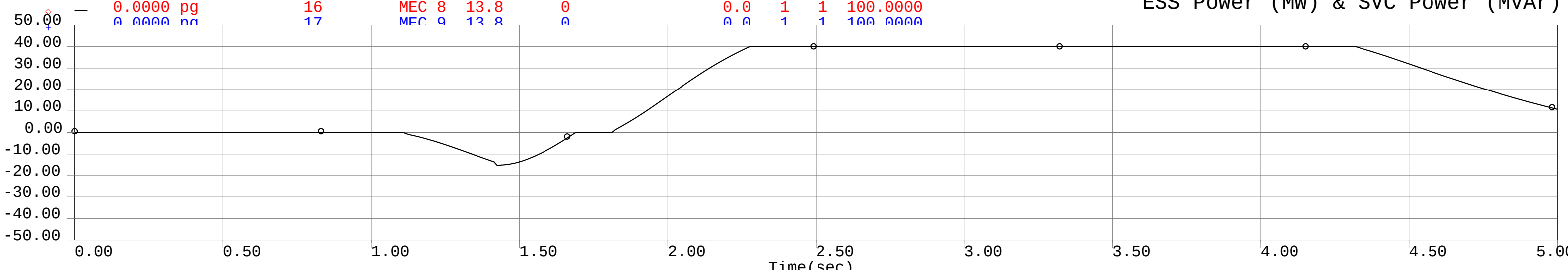
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



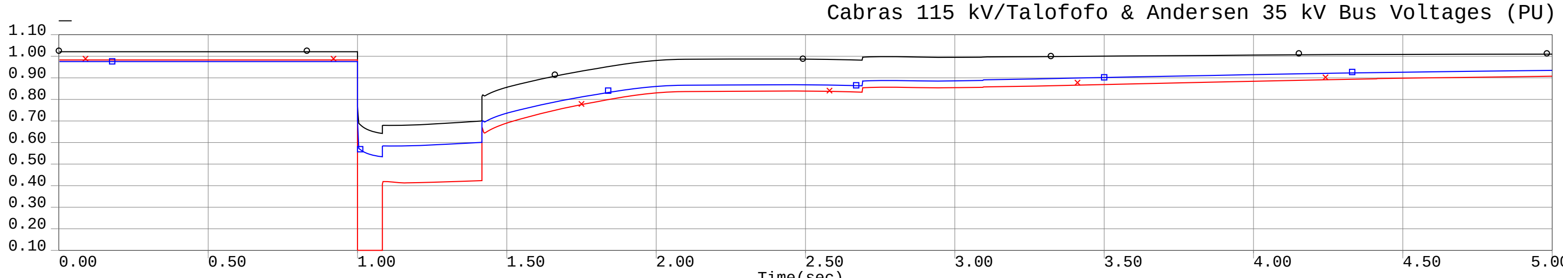
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1433_40a_lf11_fidvr.chf

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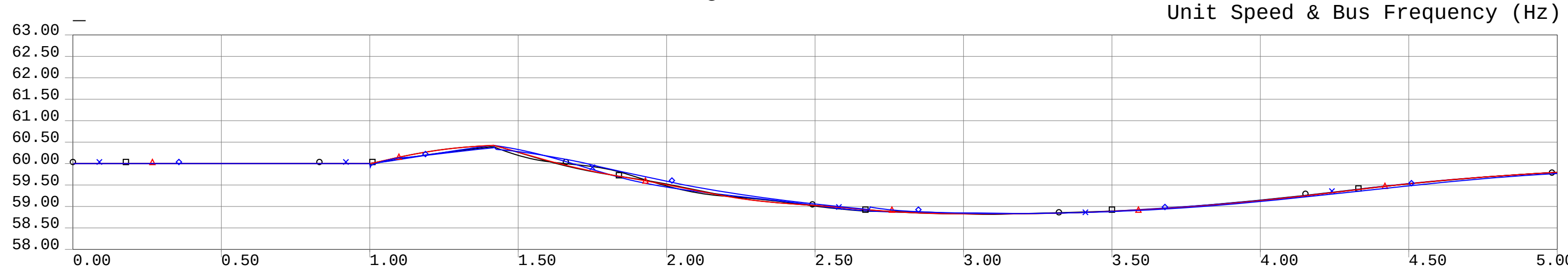
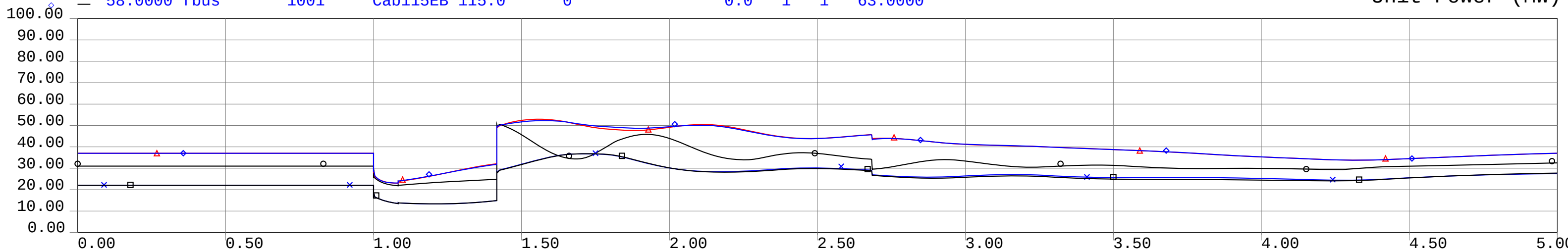
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



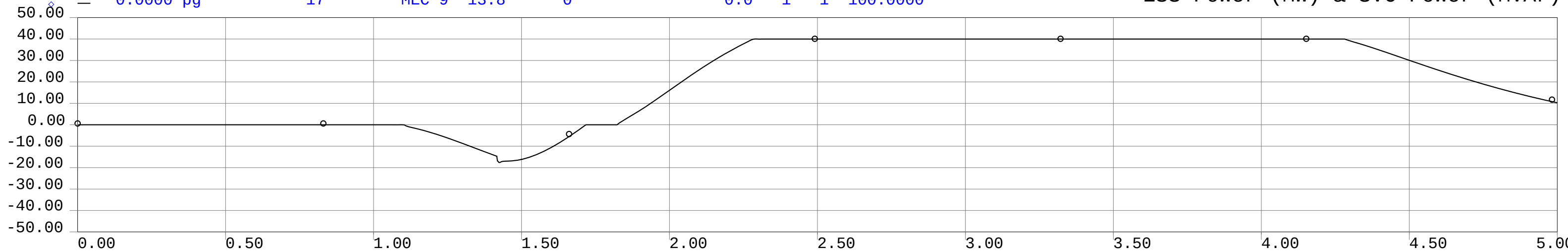
○ 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
× 58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
△ 58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
◇ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



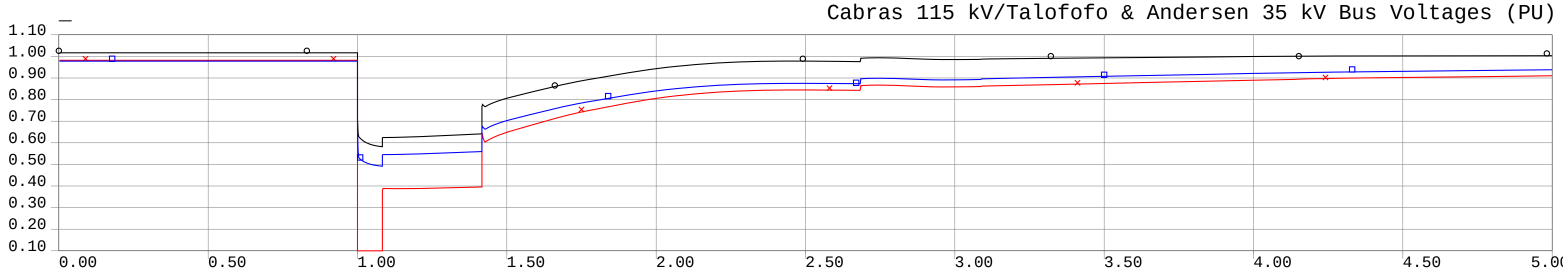
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
□ 0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
△ 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
◇ 0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2433_40a_lf11_fidvr.chf

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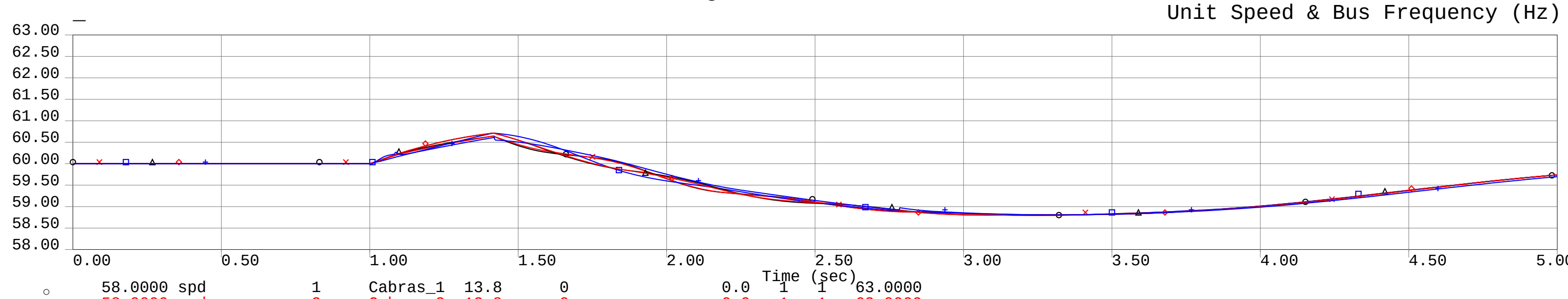
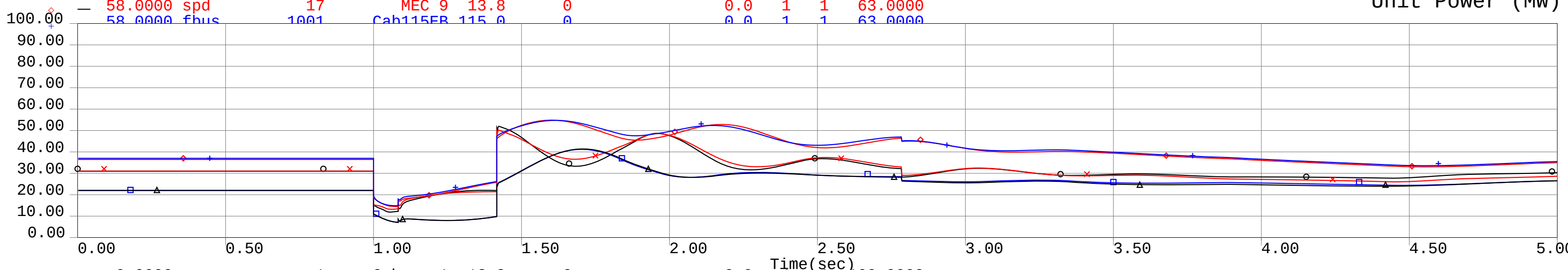
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



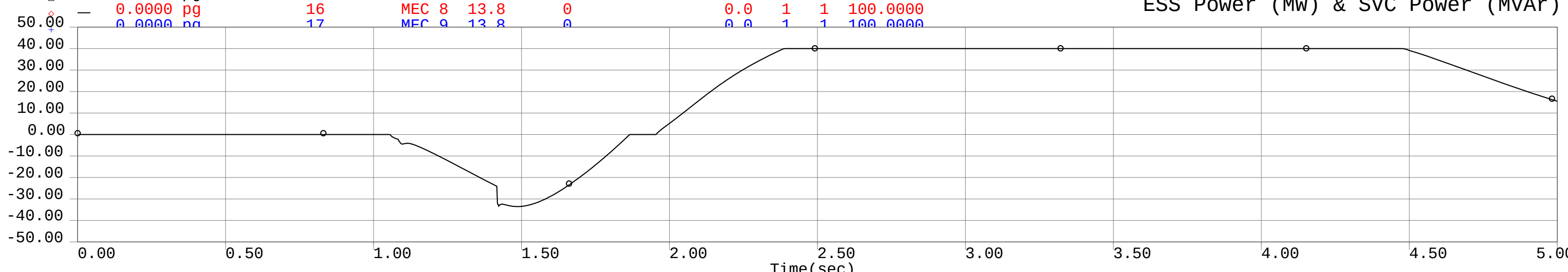
58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



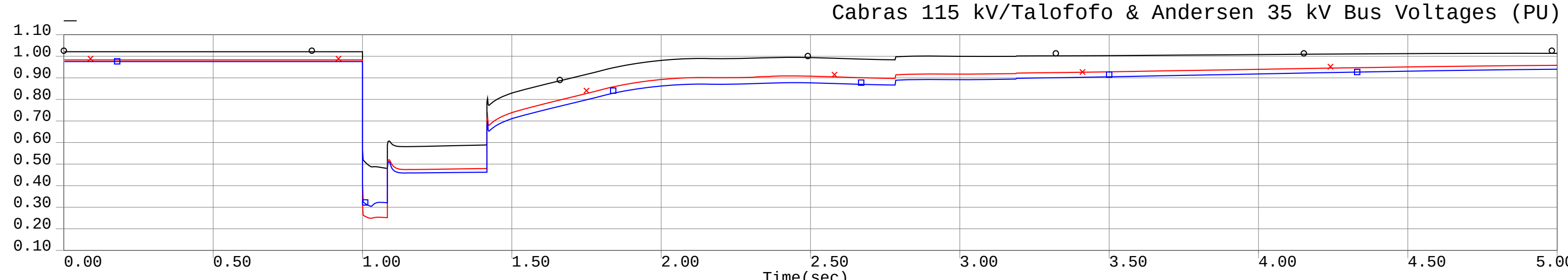
0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1433_40a_lf12_fidvr.chf

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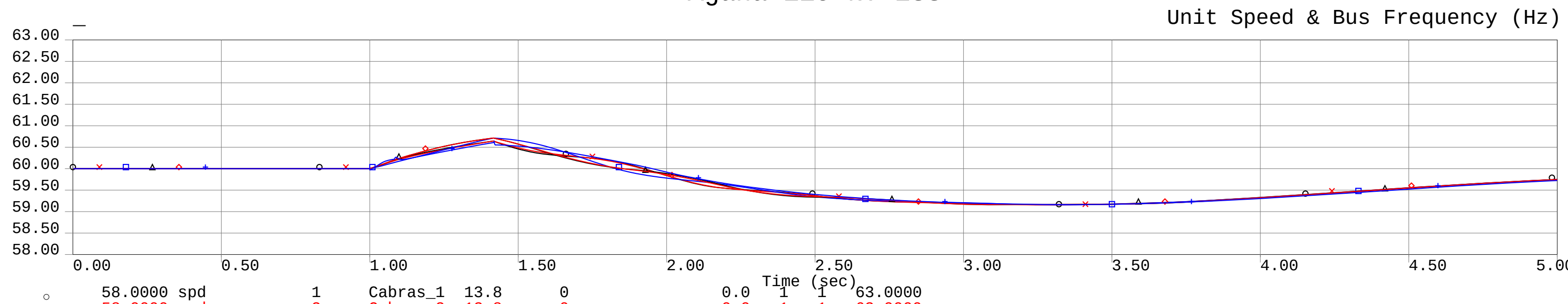
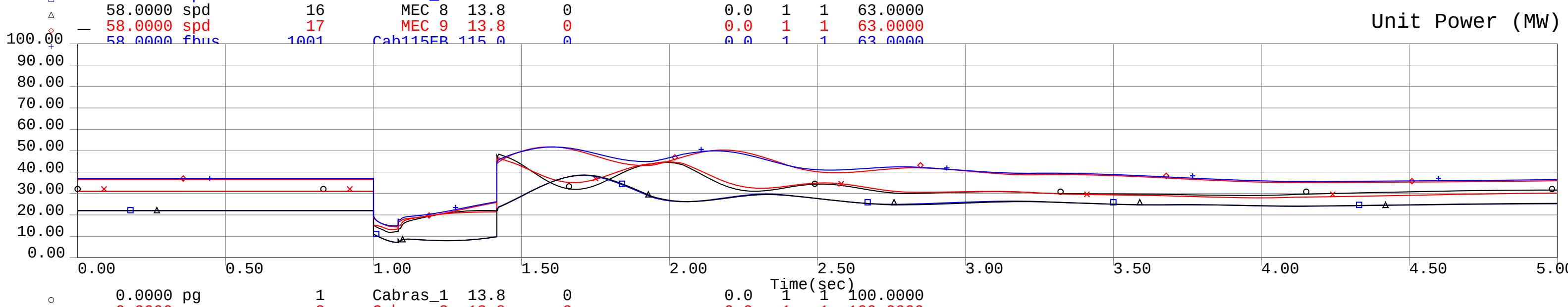
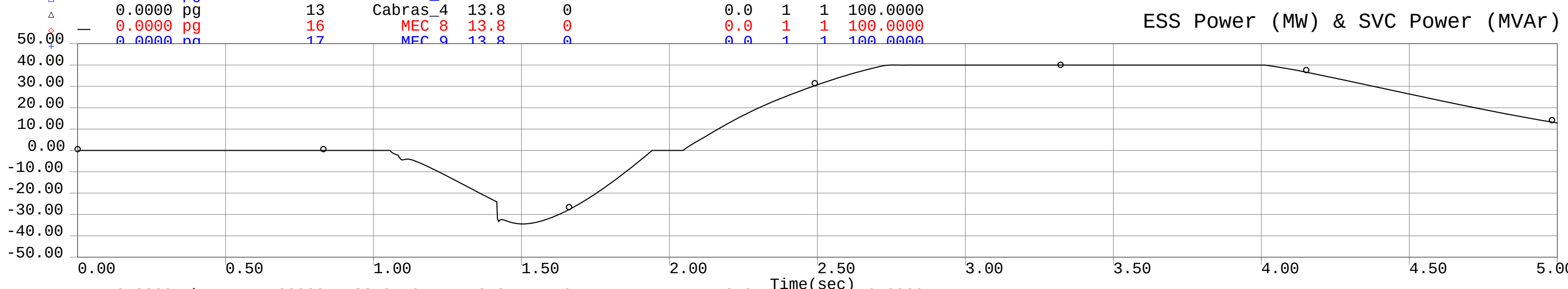
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



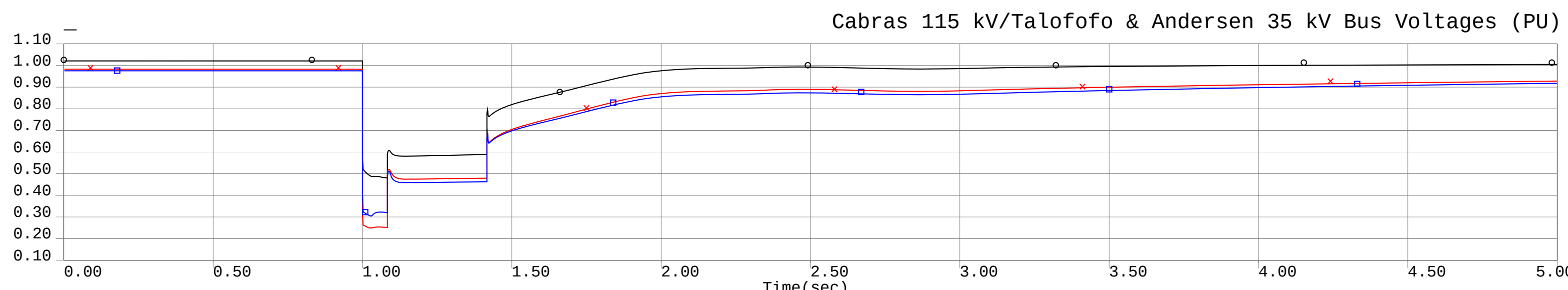
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000



○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1433_40a_lf12_fidvr_pv.chf

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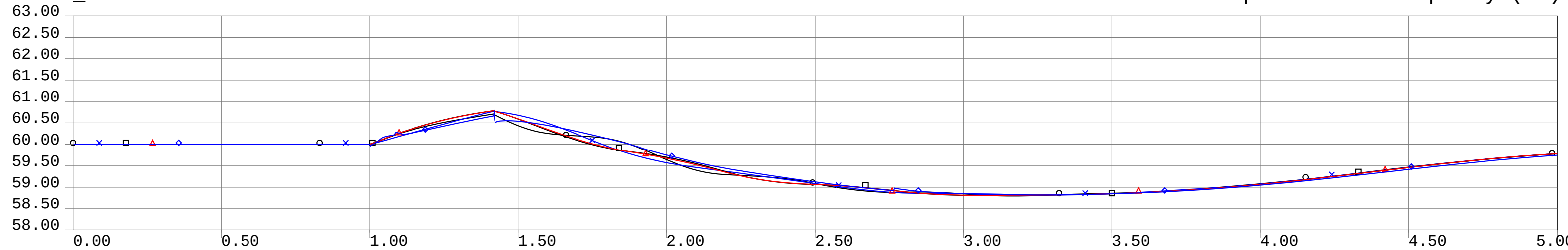
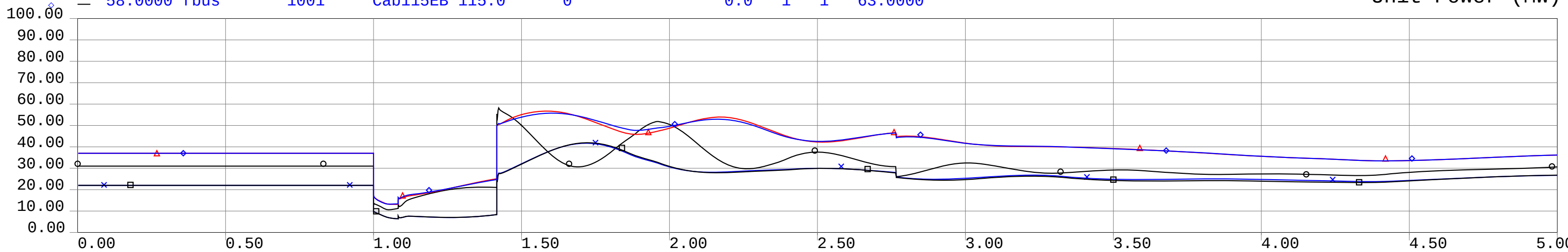
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



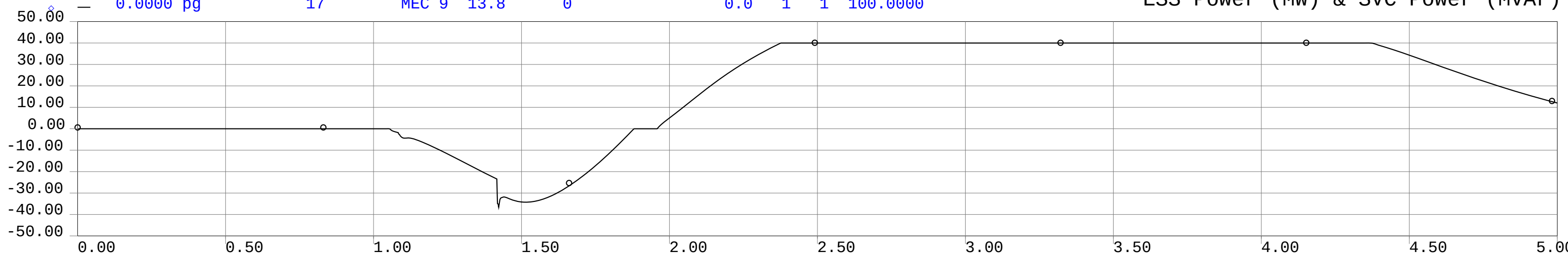
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



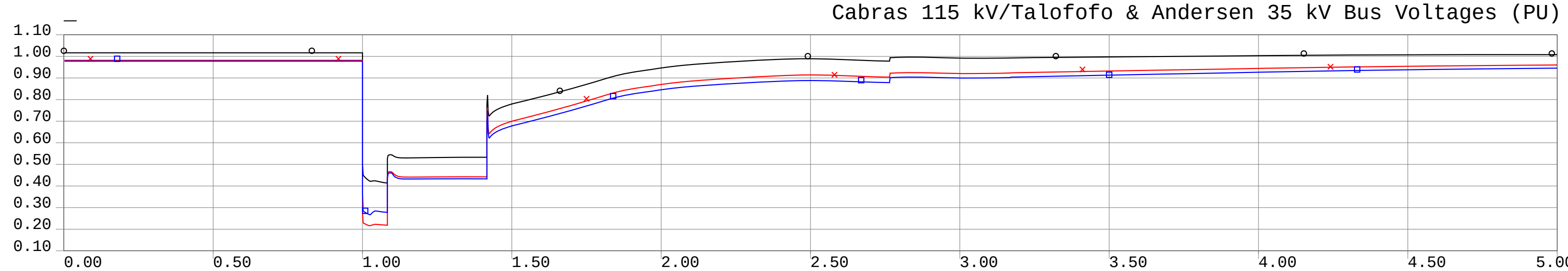
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2433_40a_lf12_fidvr.chf

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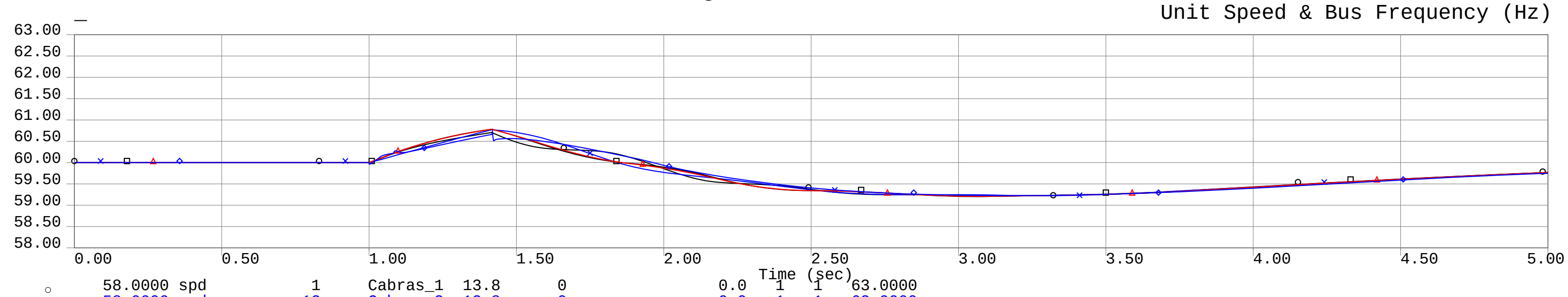
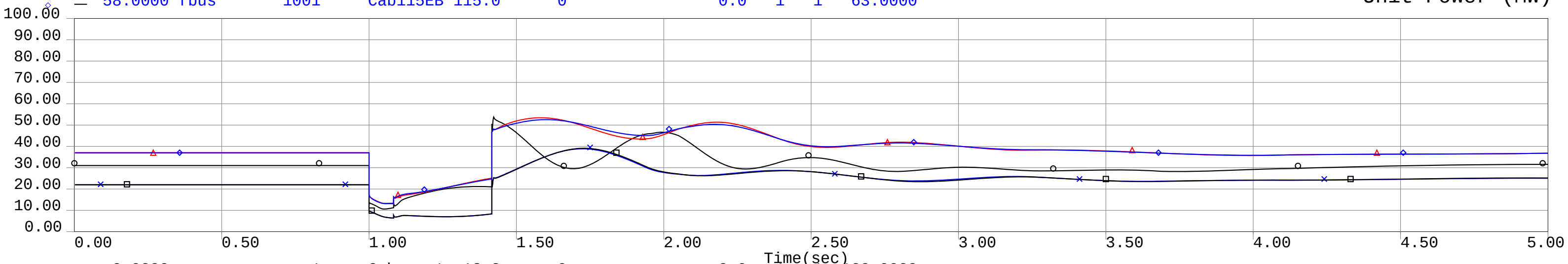
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



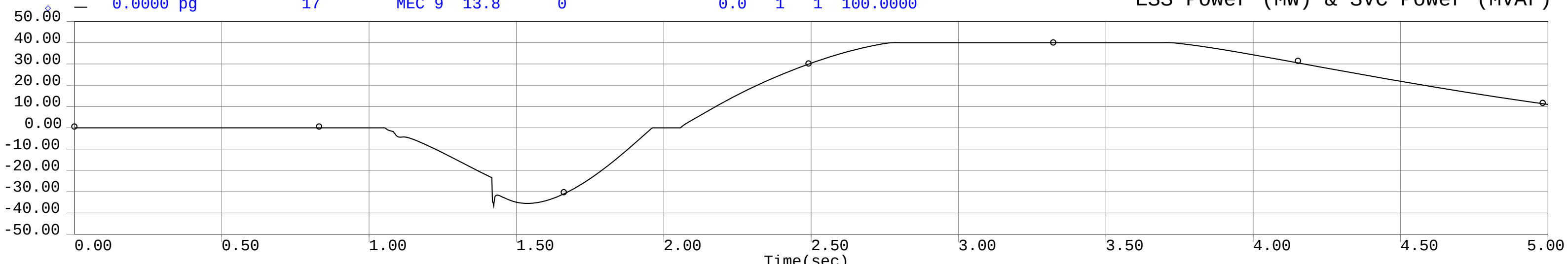
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



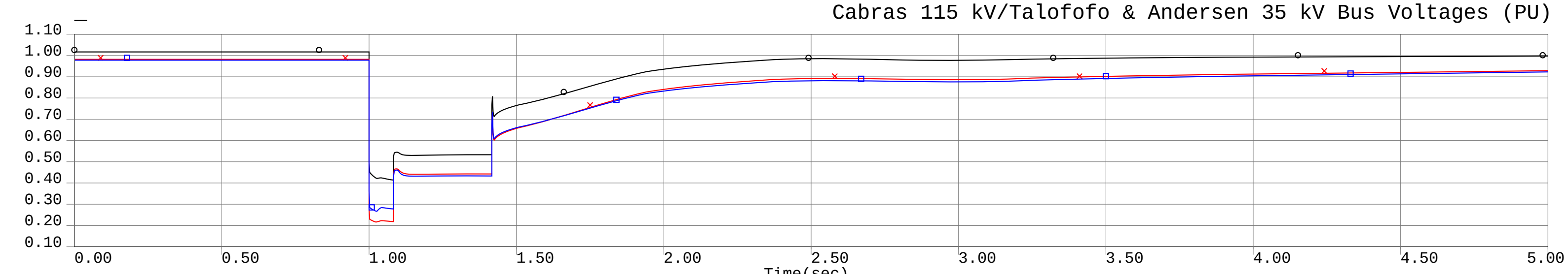
0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2433_40a_lf12_fidvr_pv.chf

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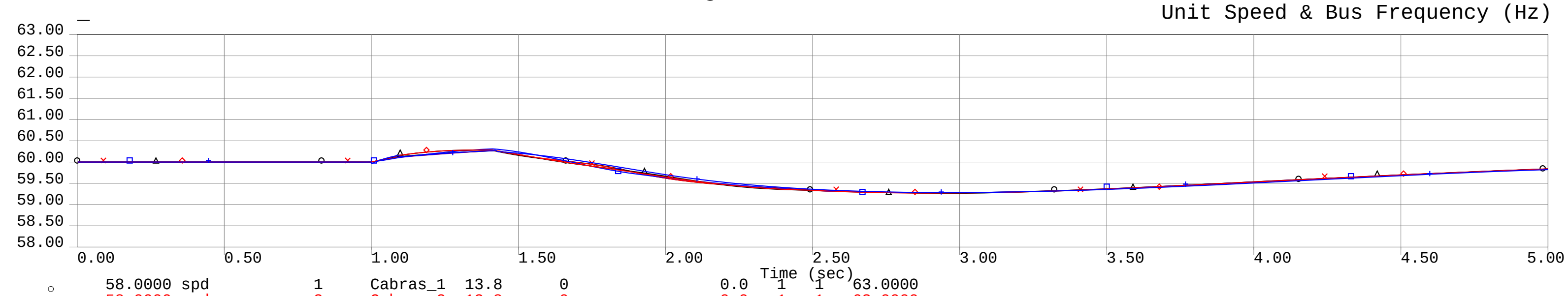
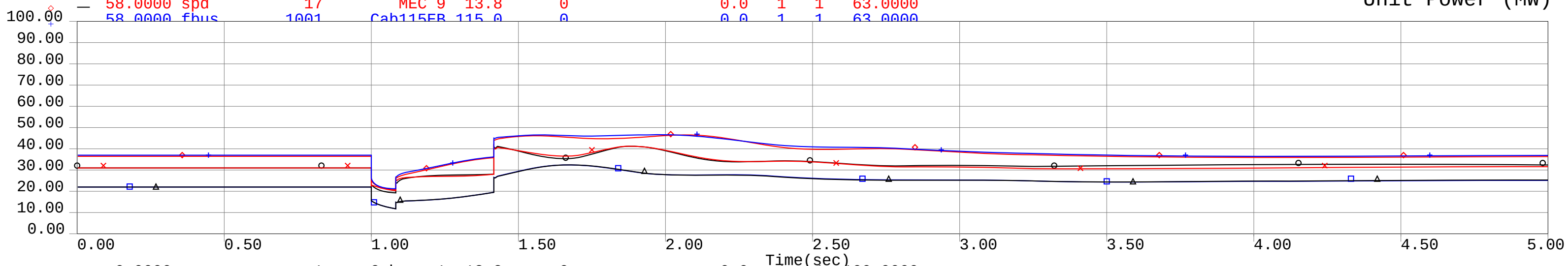
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



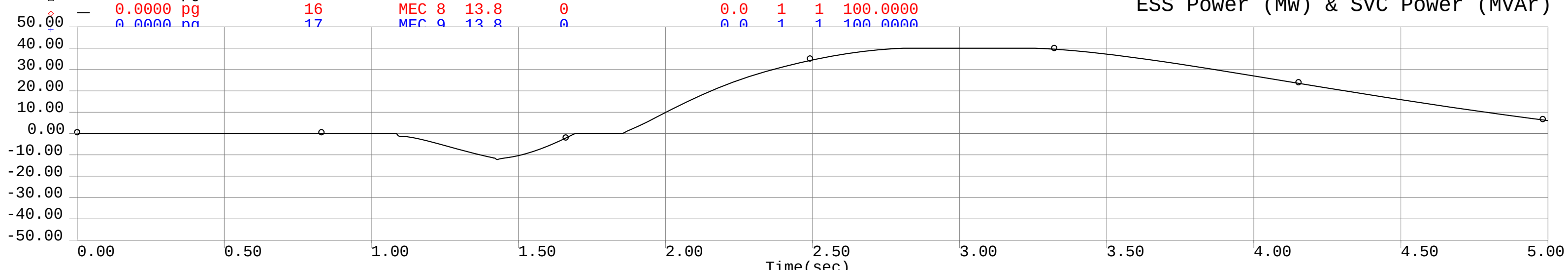
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



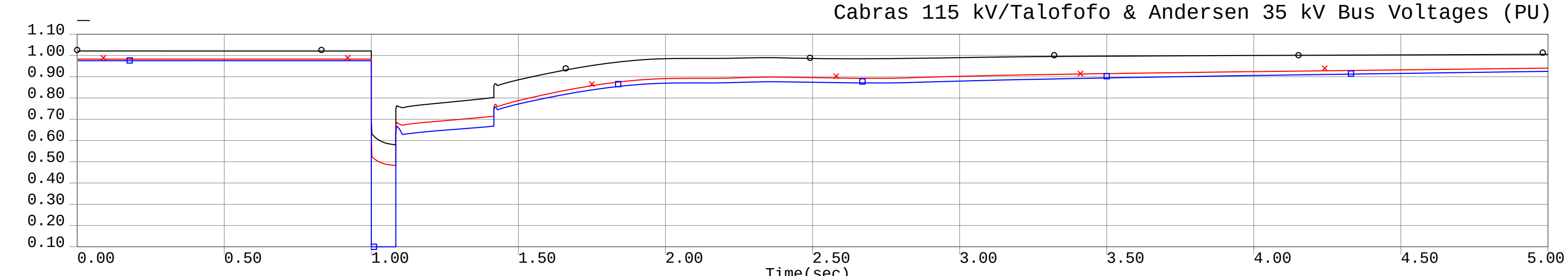
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1433_40a_lf13_fidvr.chf

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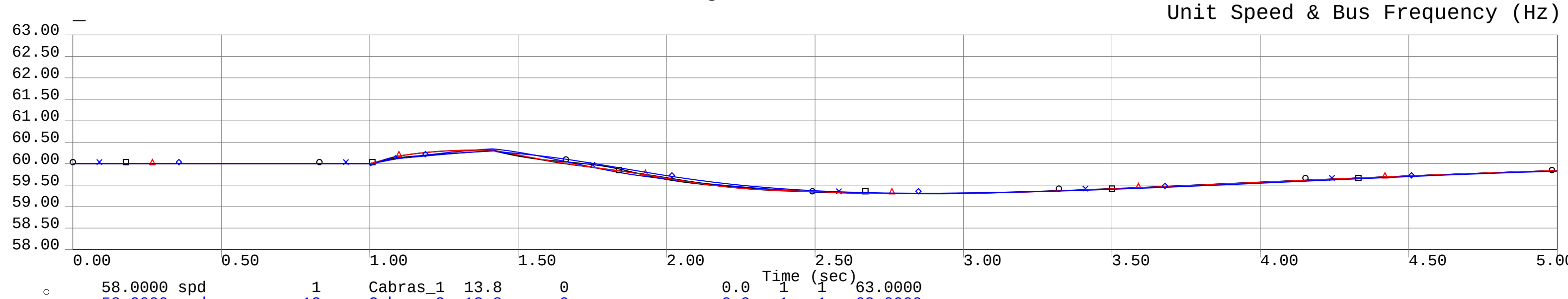
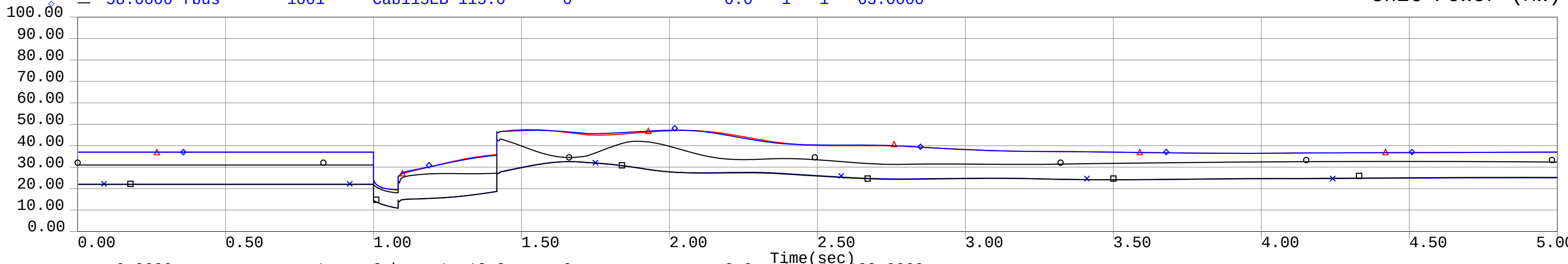
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



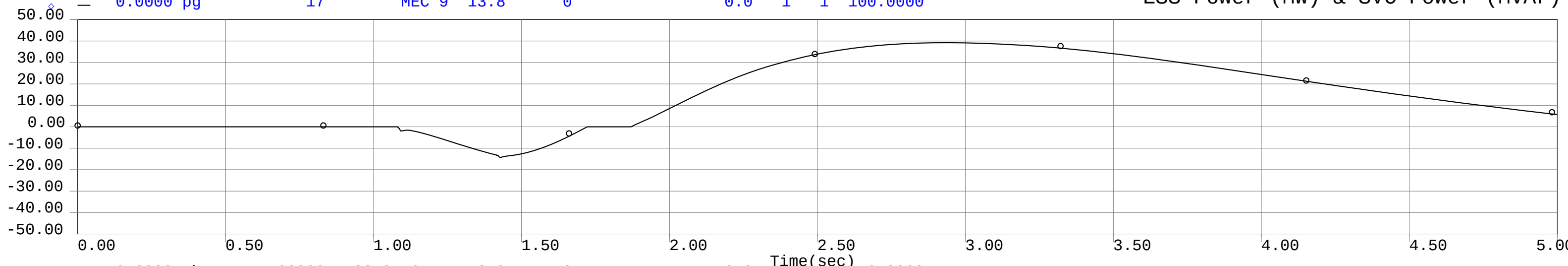
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



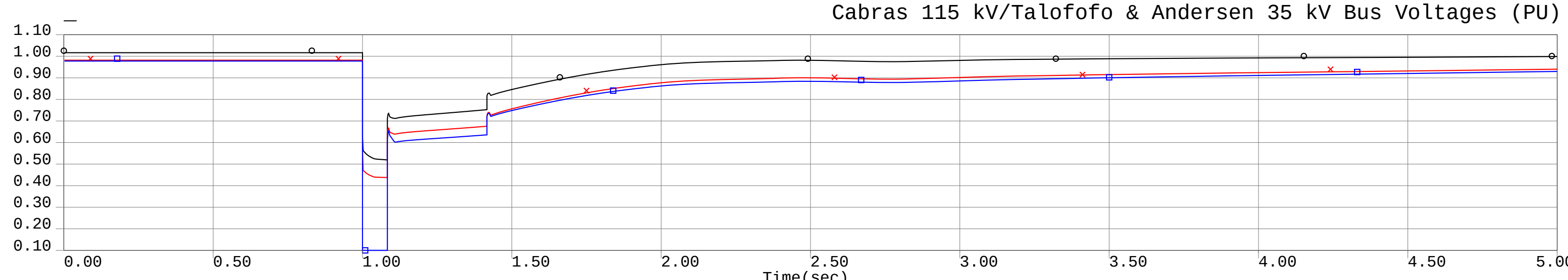
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2433_40a_lf13_fidvr.chf

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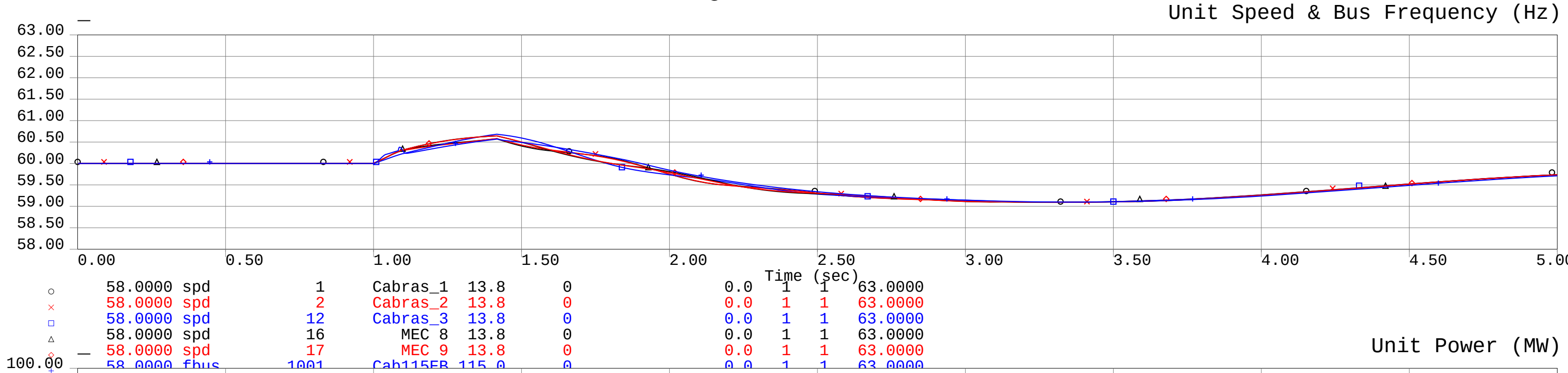
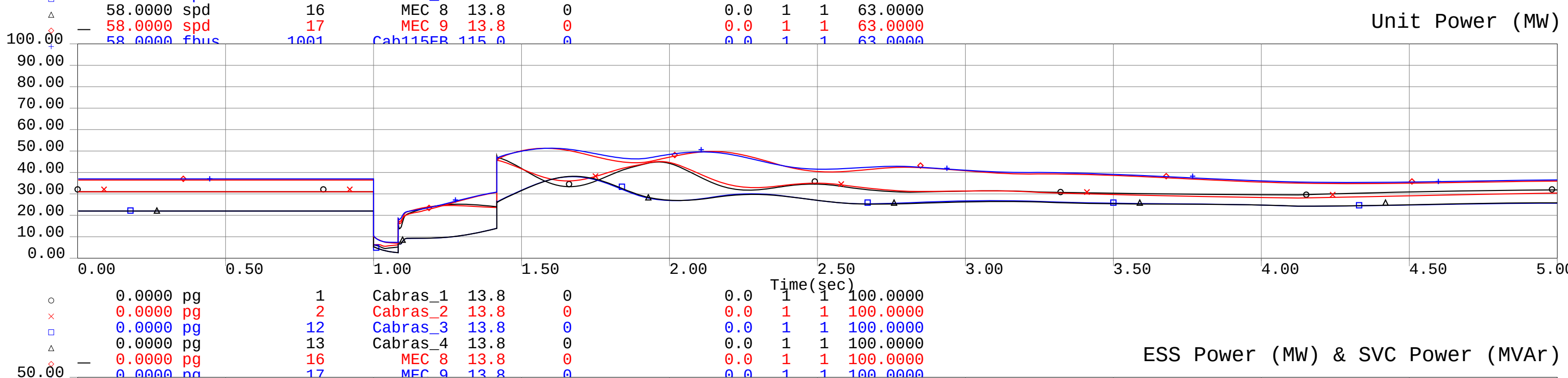
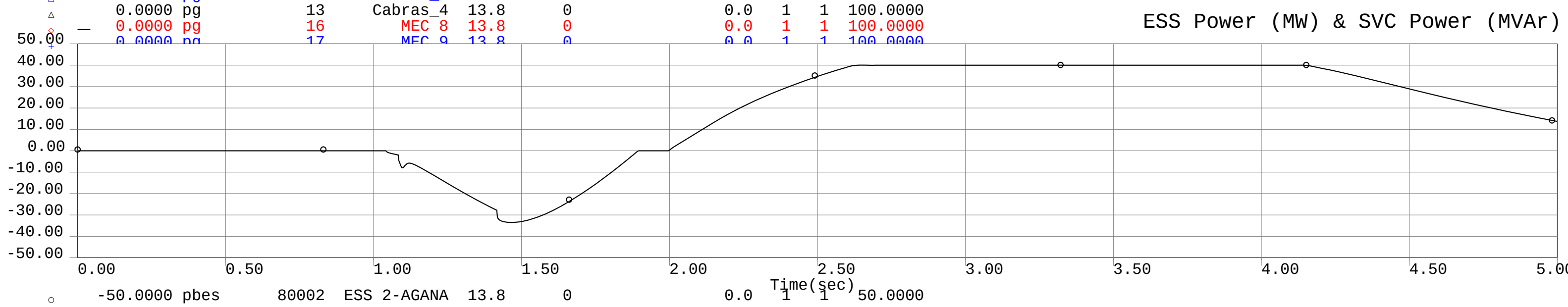
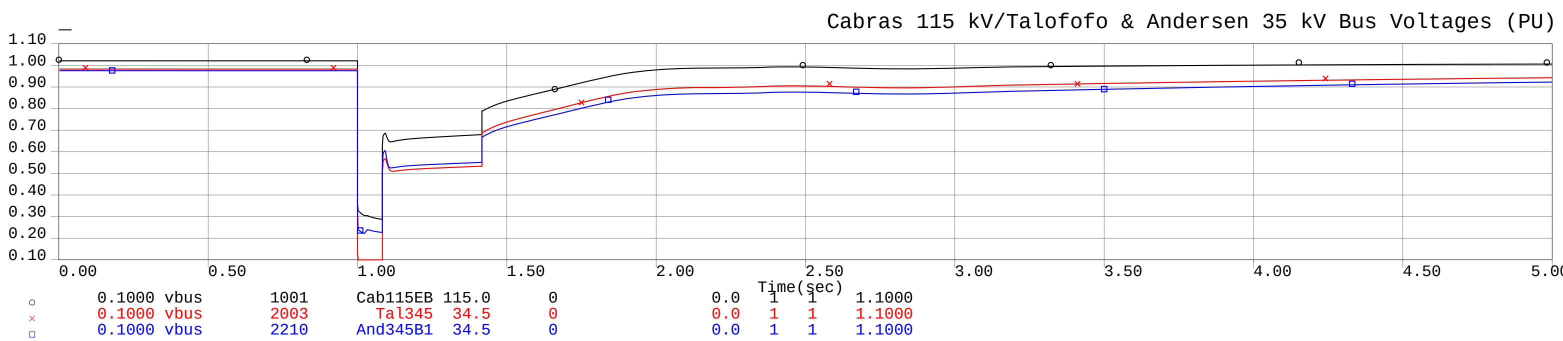
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS









chans/1433_40a_lf14_fidvr.chf
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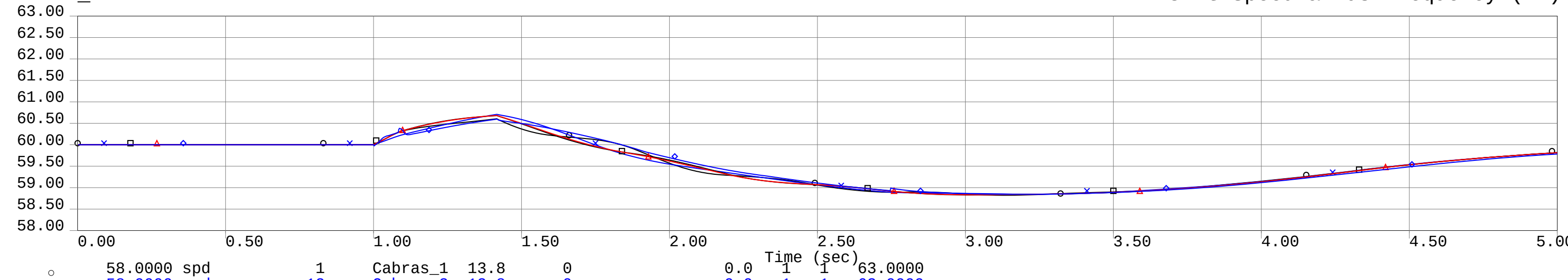
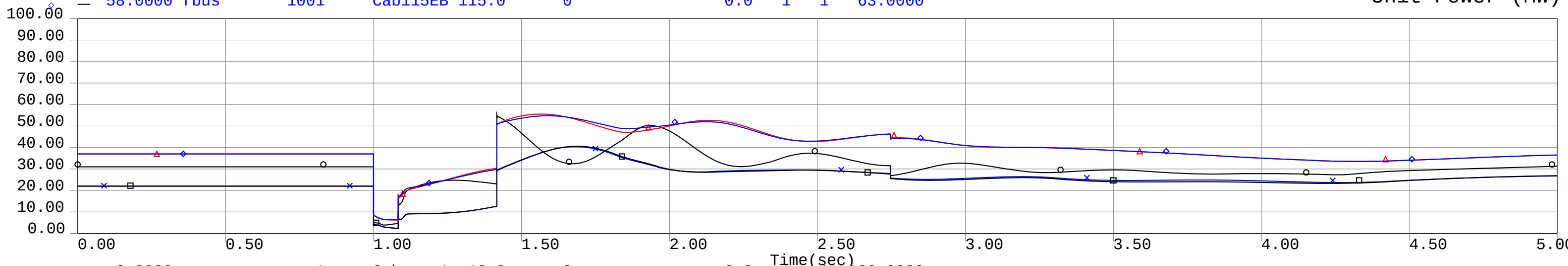
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



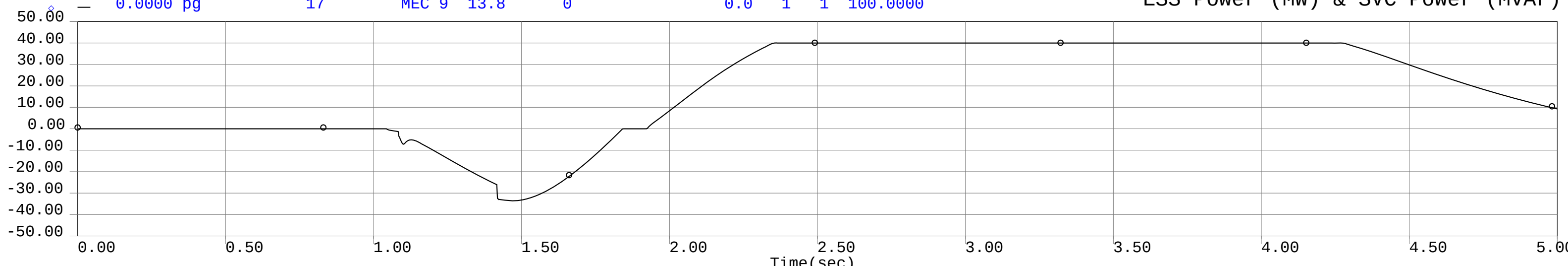
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



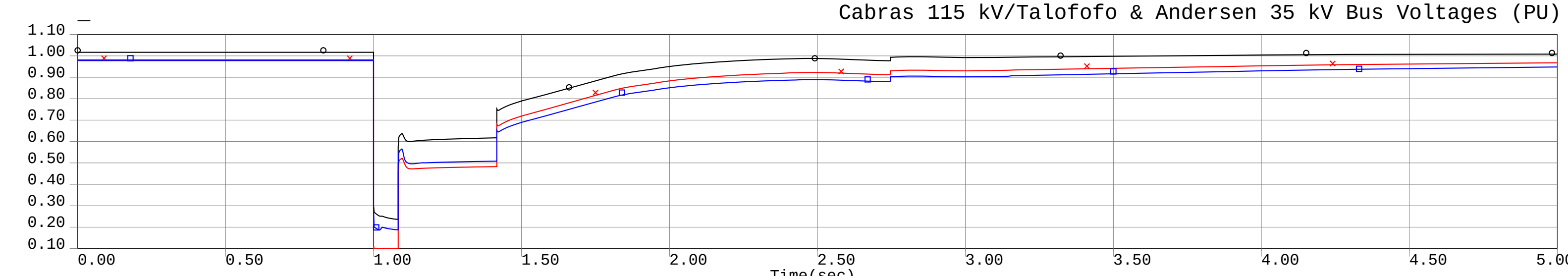
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2433_40a_lf14_fidvr.chf

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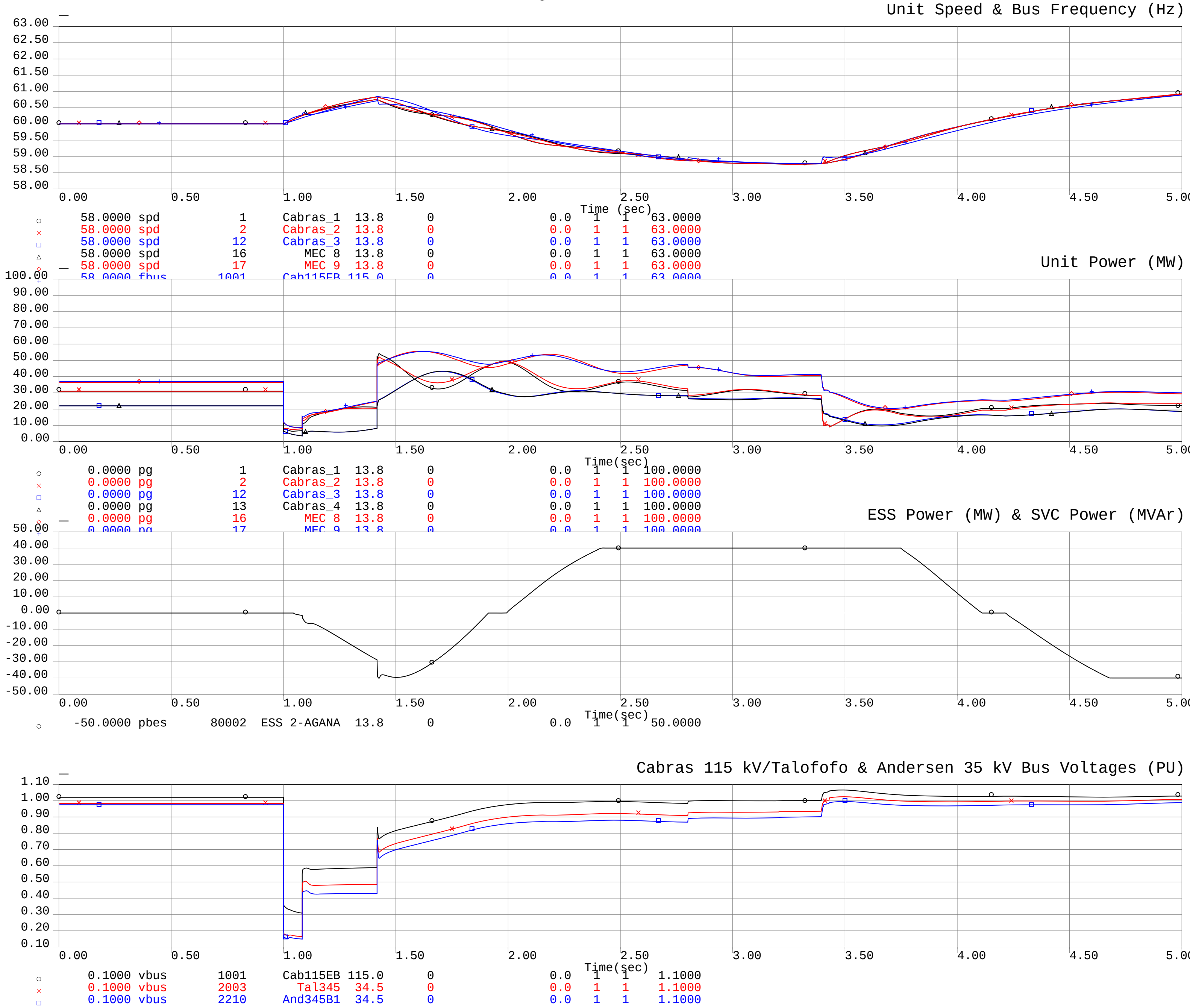
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



chans/1433_40a_lf15_fidvr.chf

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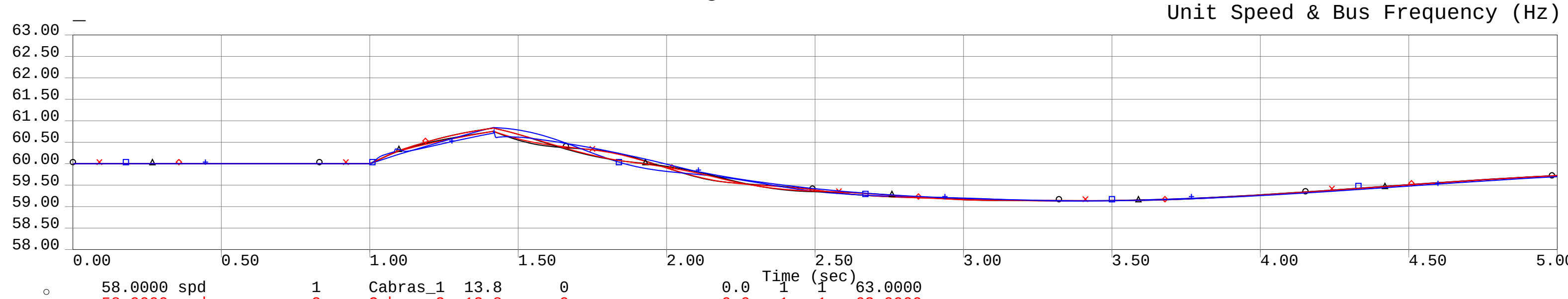
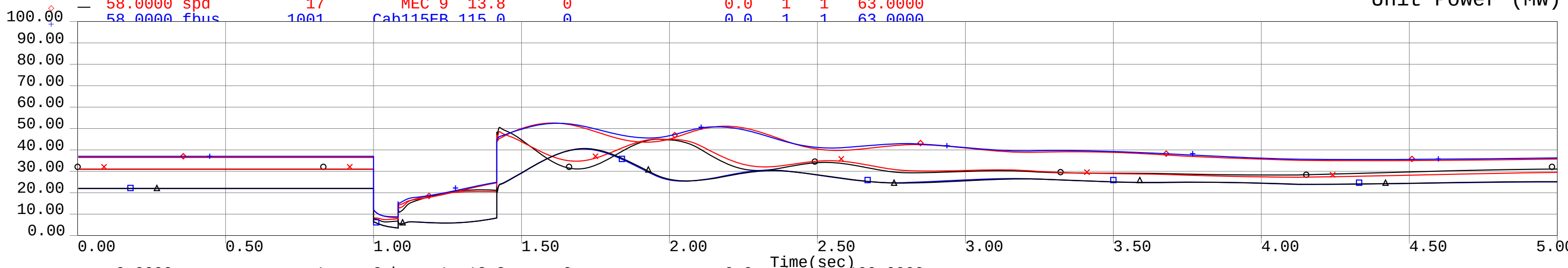
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



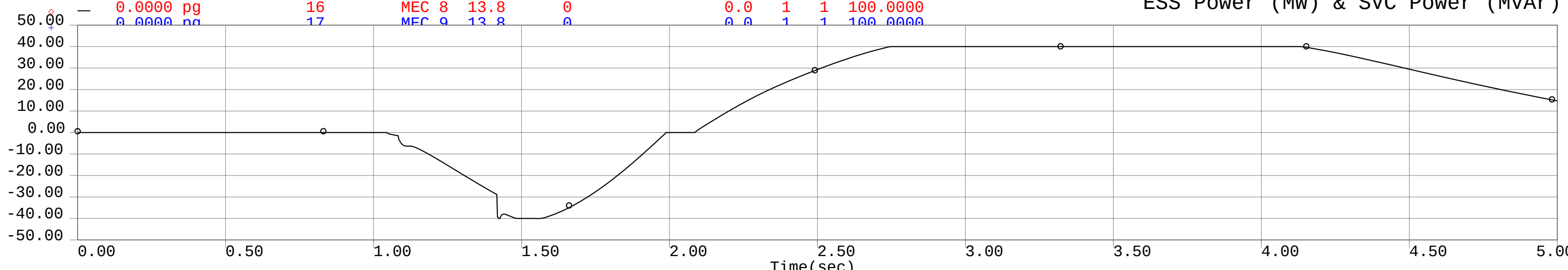
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



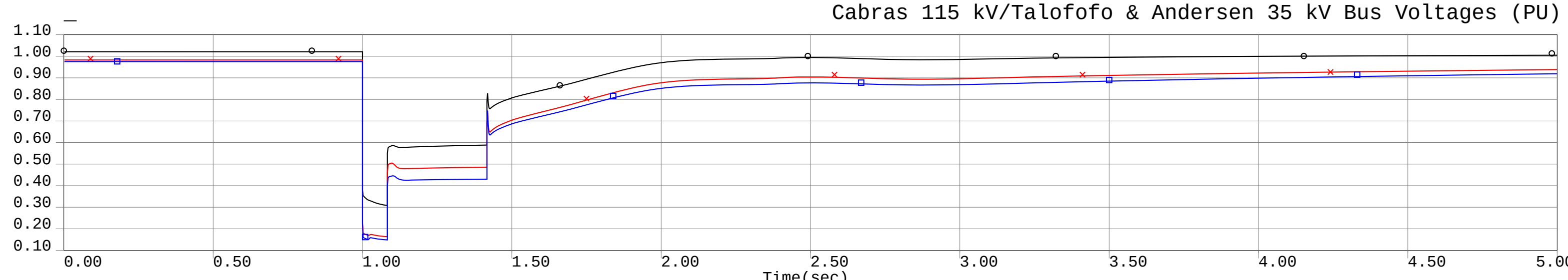
0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/1433_40a_lf15_fidvr_pv.chf

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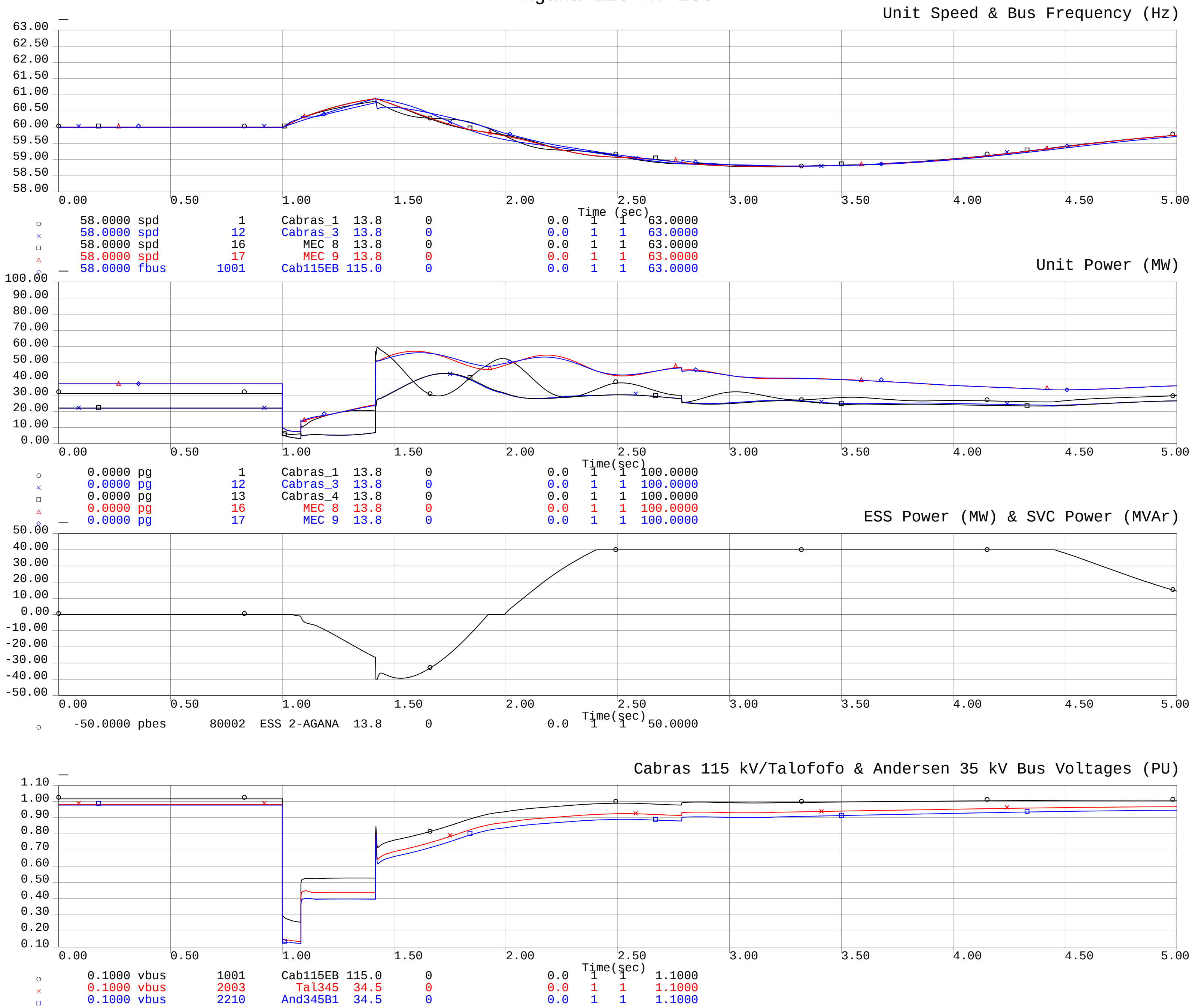
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS



chans/2433_40a_lf15_fidvr.chf

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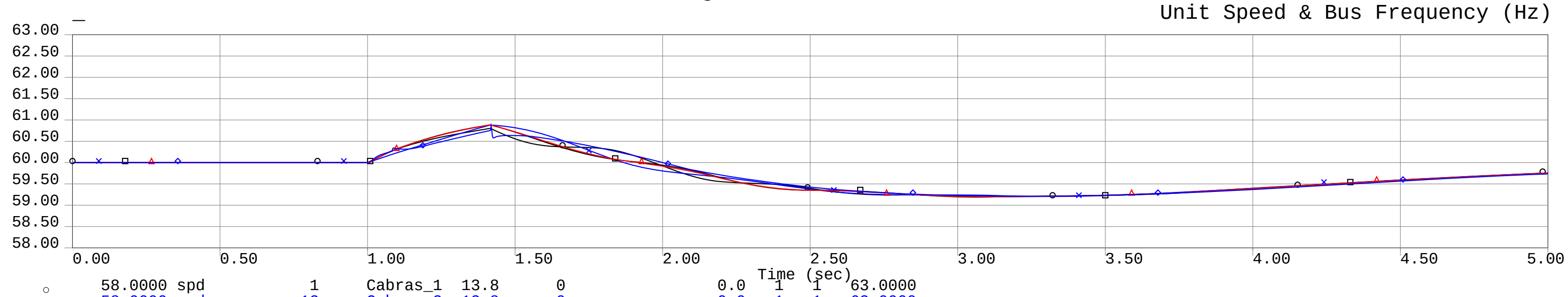
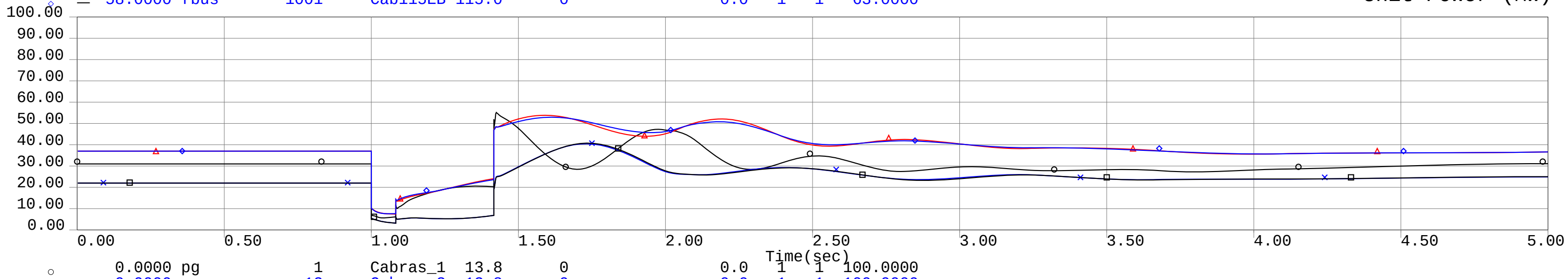
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

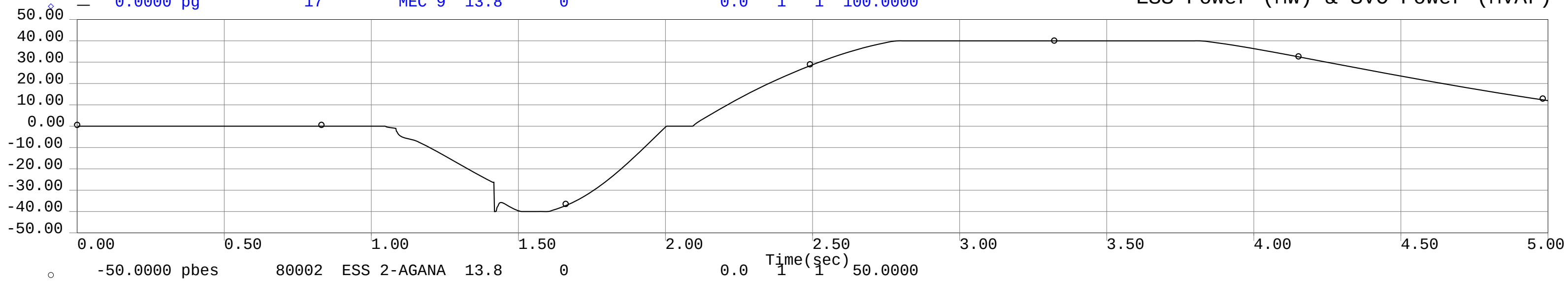
Unit Speed & Bus Frequency (Hz)



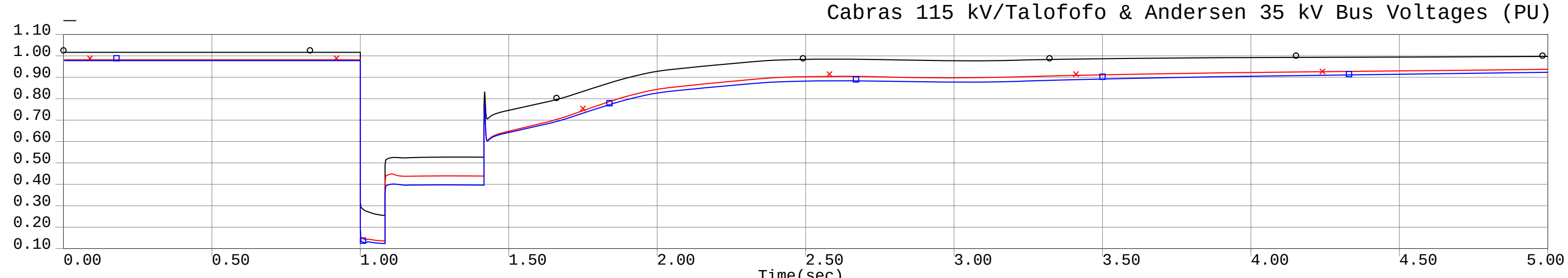
Unit Power (MW)



ESS Power (MW) & SVC Power (MVAr)

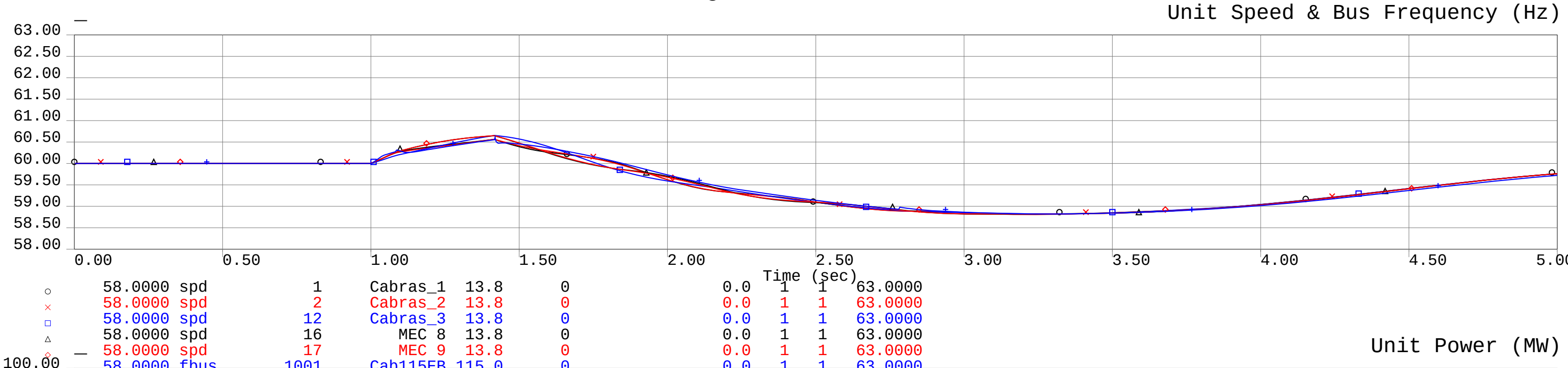


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

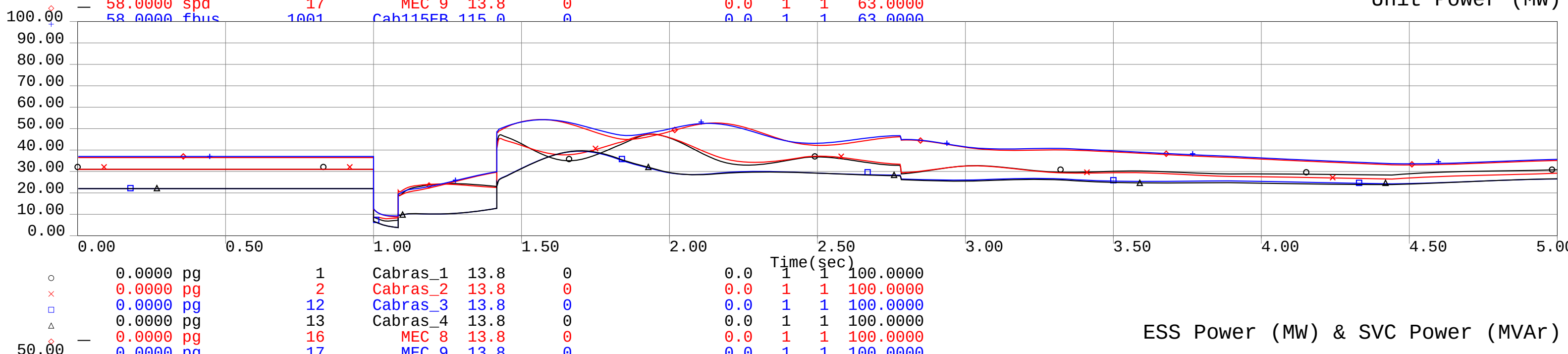


Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

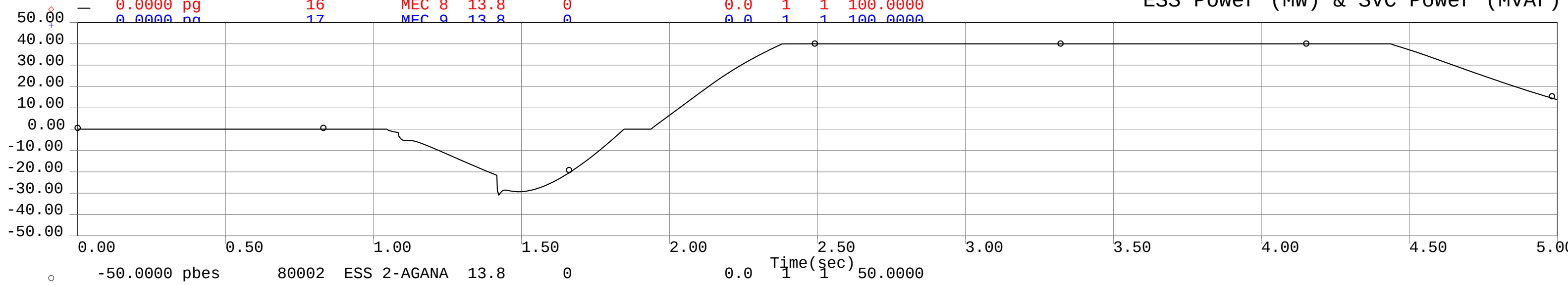
Unit Speed & Bus Frequency (Hz)



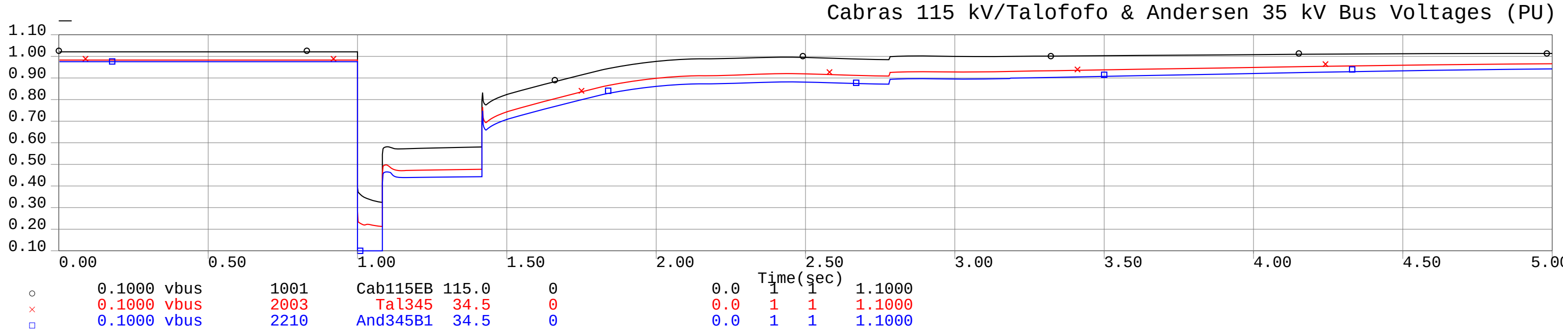
Unit Power (MW)



ESS Power (MW) & SVC Power (MVAr)

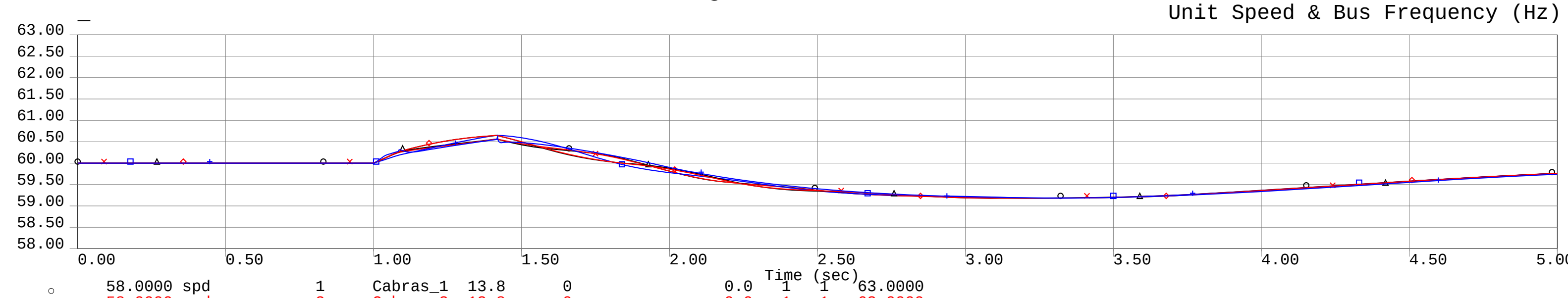


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



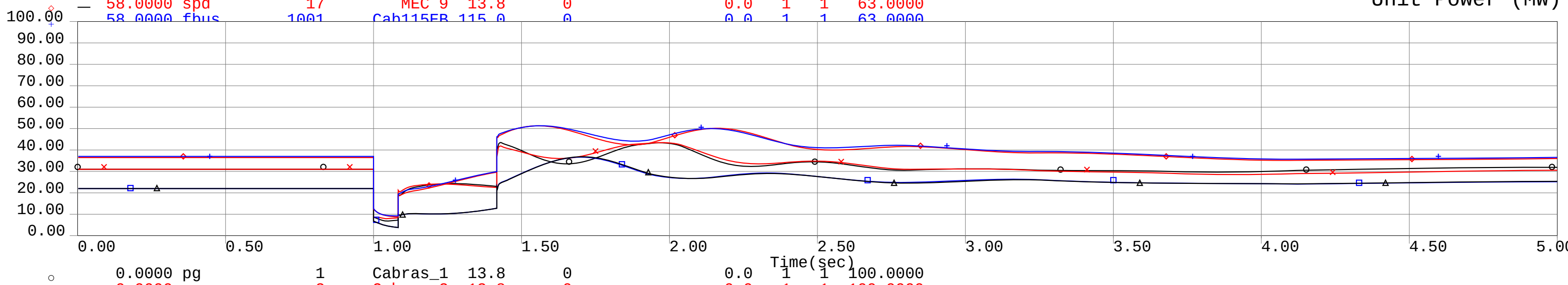
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



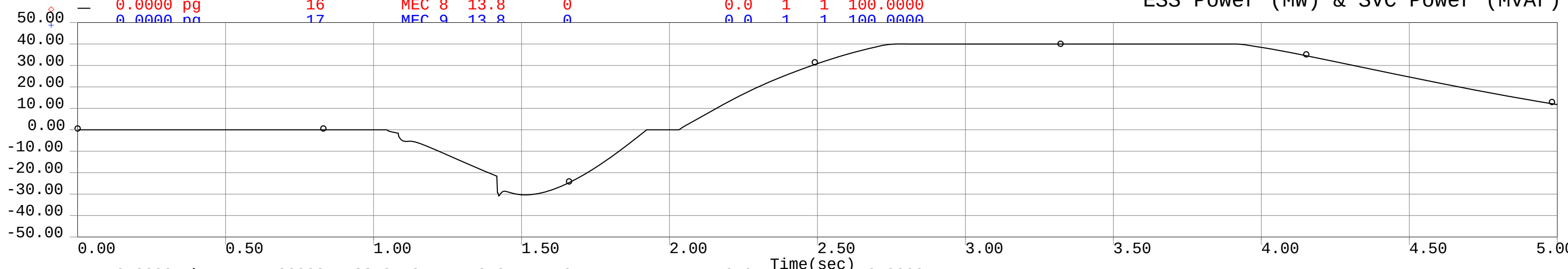
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



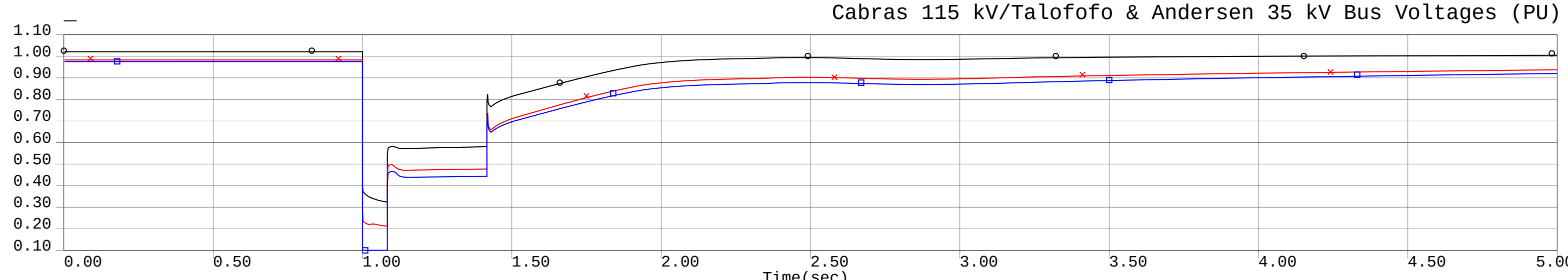
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1433_40a_lf16_fidvr_pv.chf

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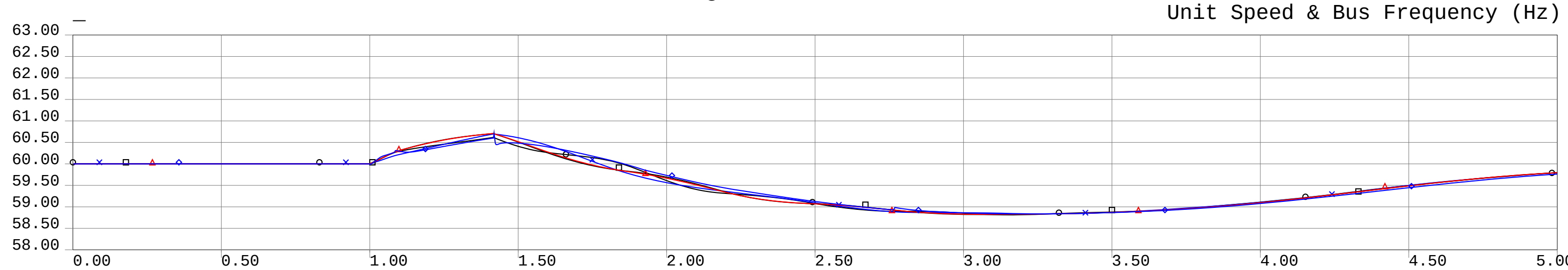
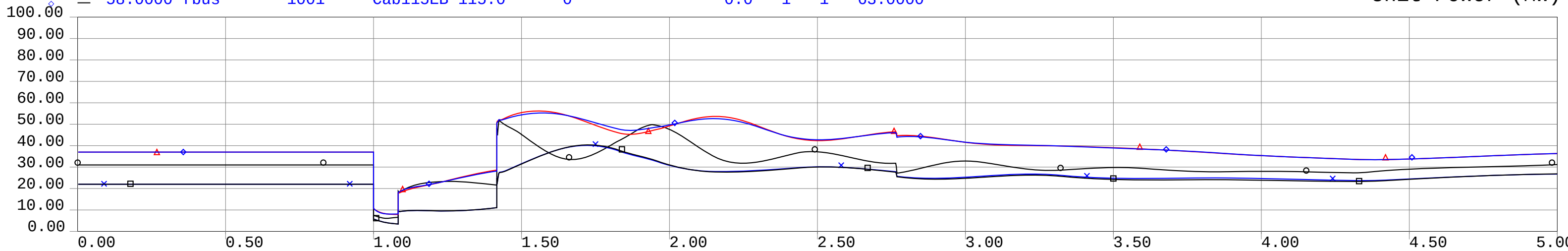
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



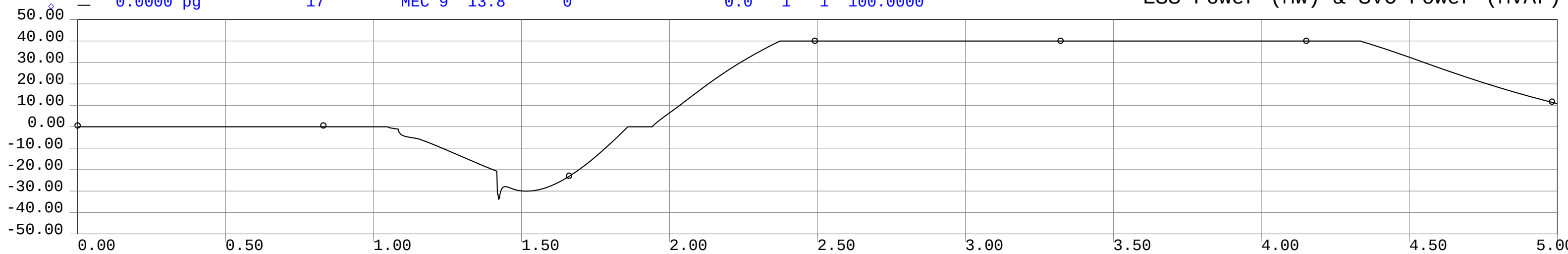
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



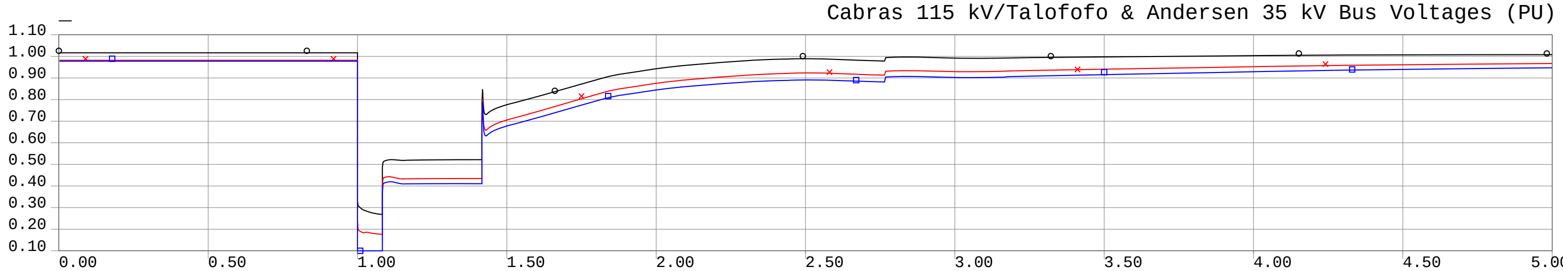
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

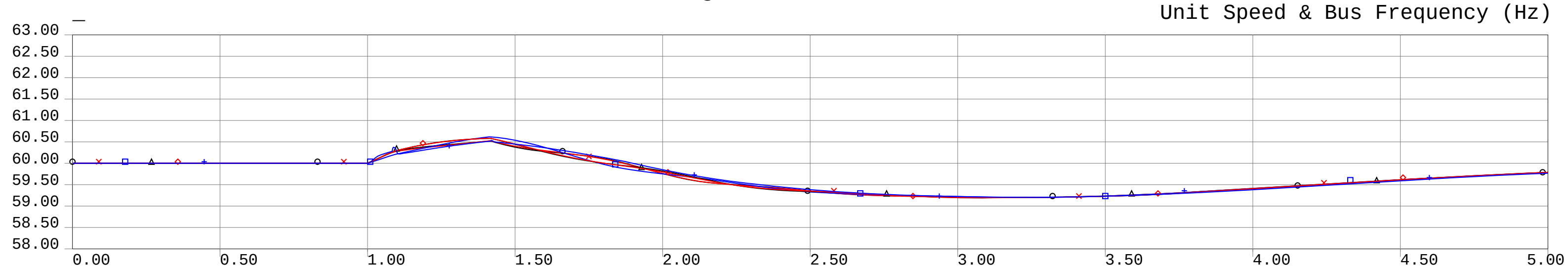
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)

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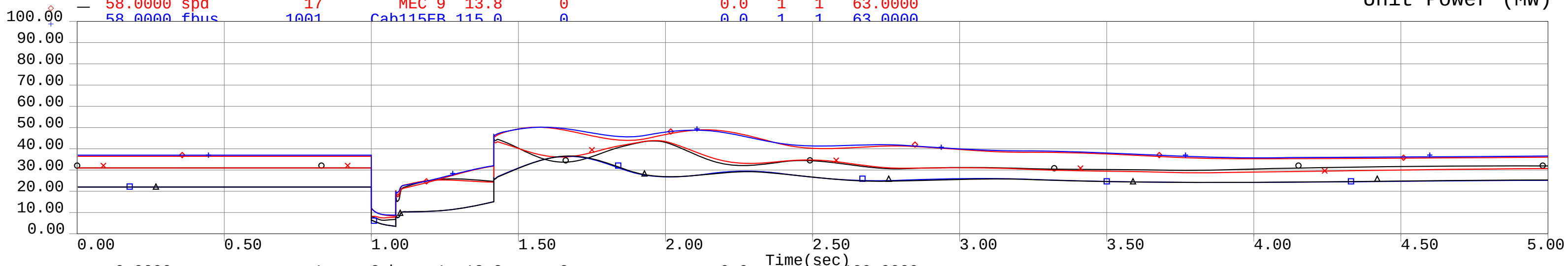
58.0000 spd       1     Cabras_1  13.8   0       0.0  1  1  63.0000
58.0000 spd       2     Cabras_2  13.8   0       0.0  1  1  63.0000
58.0000 spd      12     Cabras_3  13.8   0       0.0  1  1  63.0000
58.0000 spd      16        MEC 8  13.8   0       0.0  1  1  63.0000
58.0000 spd      17        MEC 9  13.8   0       0.0  1  1  63.0000
58.0000 fbus   1001     Cab115EB 115.0   0       0.0  1  1  63.0000
```

Unit Power (MW)

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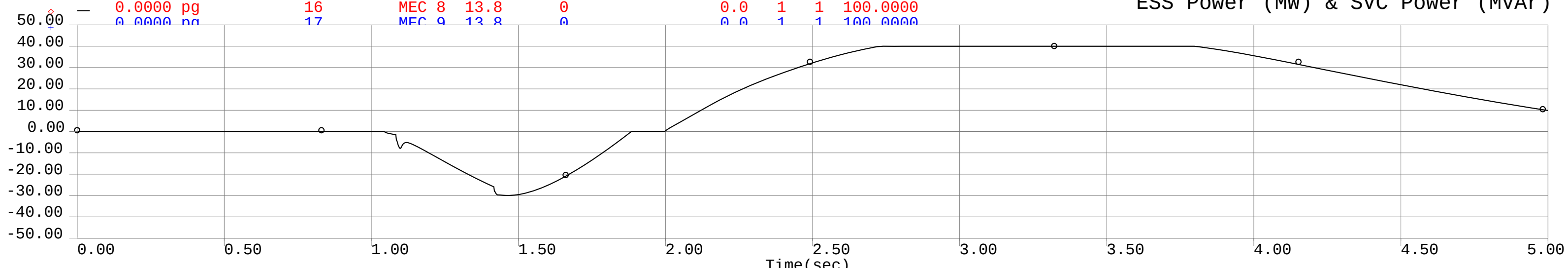
0.0000 pg       1     Cabras_1  13.8   0       0.0  1  1  100.0000
0.0000 pg       2     Cabras_2  13.8   0       0.0  1  1  100.0000
0.0000 pg      12     Cabras_3  13.8   0       0.0  1  1  100.0000
0.0000 pg      13     Cabras_4  13.8   0       0.0  1  1  100.0000
0.0000 pg      16        MEC 8  13.8   0       0.0  1  1  100.0000
0.0000 pg      17        MEC 9  13.8   0       0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)

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-50.0000 pbes     80002  ESS 2-AGANA  13.8   0       0.0  1  1  50.0000
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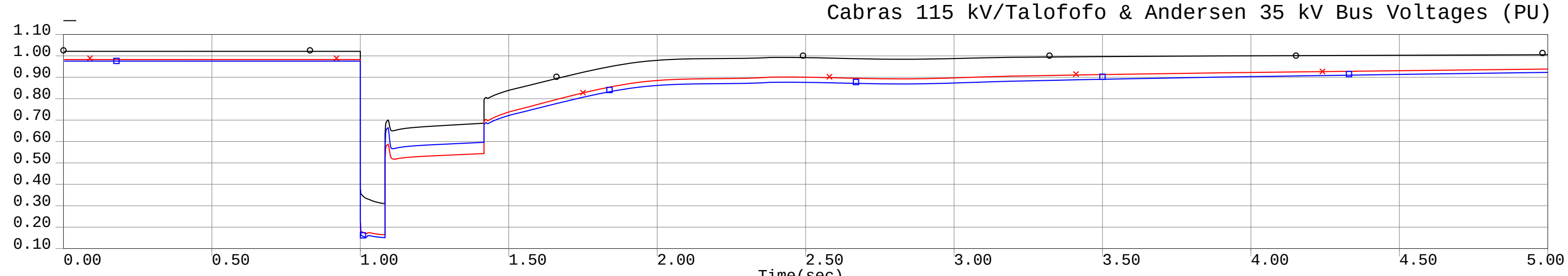
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.1000 vbus    1001   Cab115EB 115.0   0       0.0  1  1  1.1000
0.1000 vbus    2003     Tal345  34.5   0       0.0  1  1  1.1000
0.1000 vbus    2210   And345B1  34.5   0       0.0  1  1  1.1000
```


chans/1433_40a_lf17_fidvr.chf

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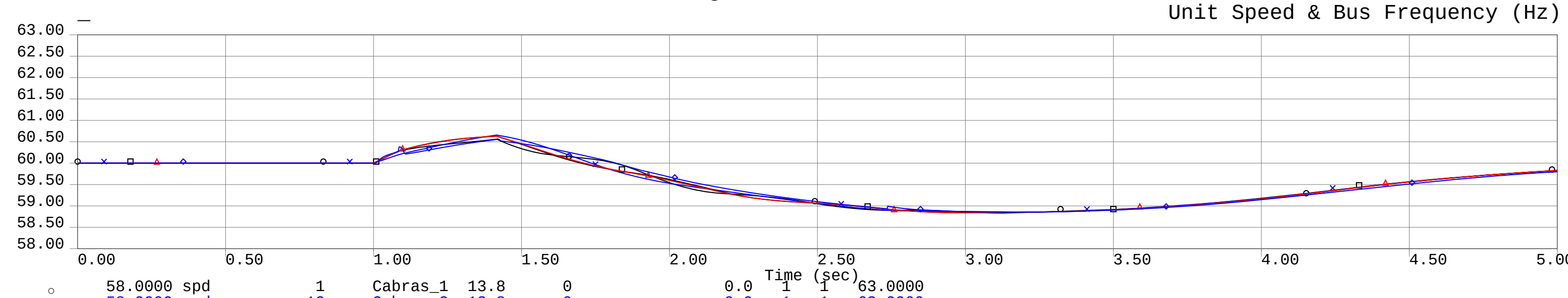
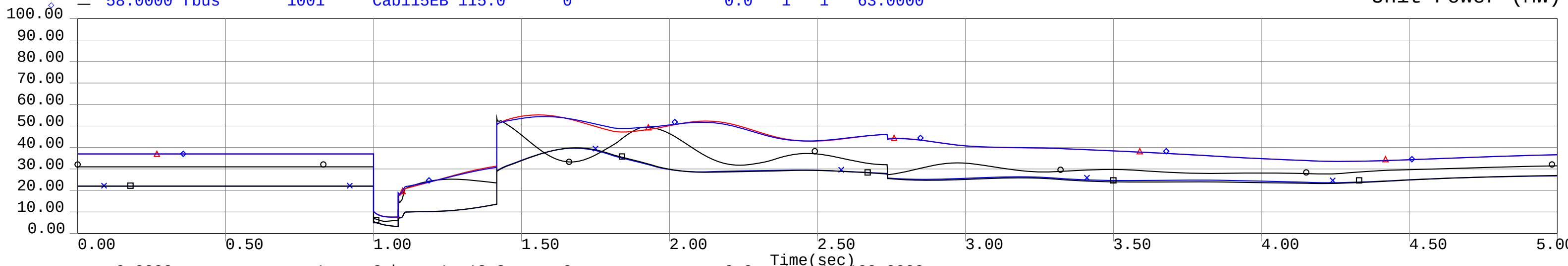
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



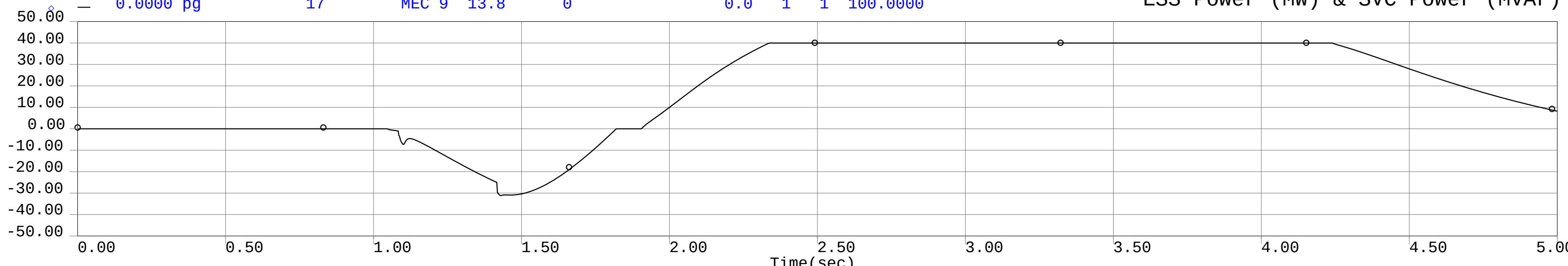
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



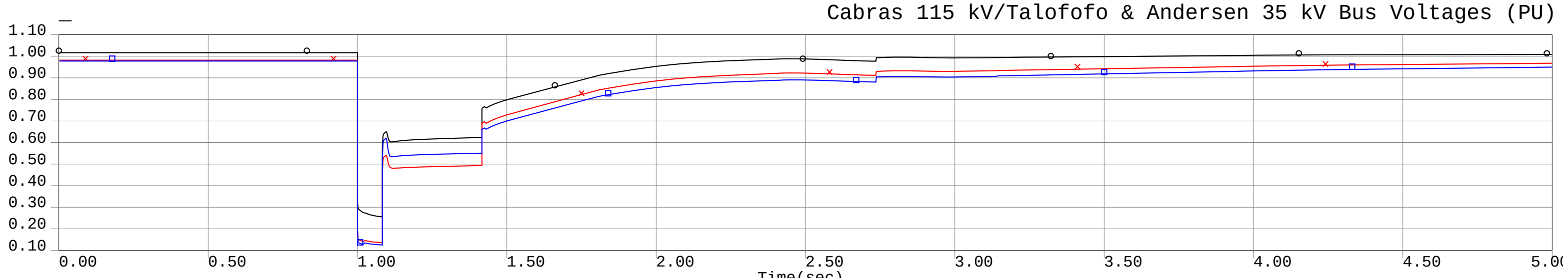
○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000	pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2433_40a_lf17_fidvr.chf

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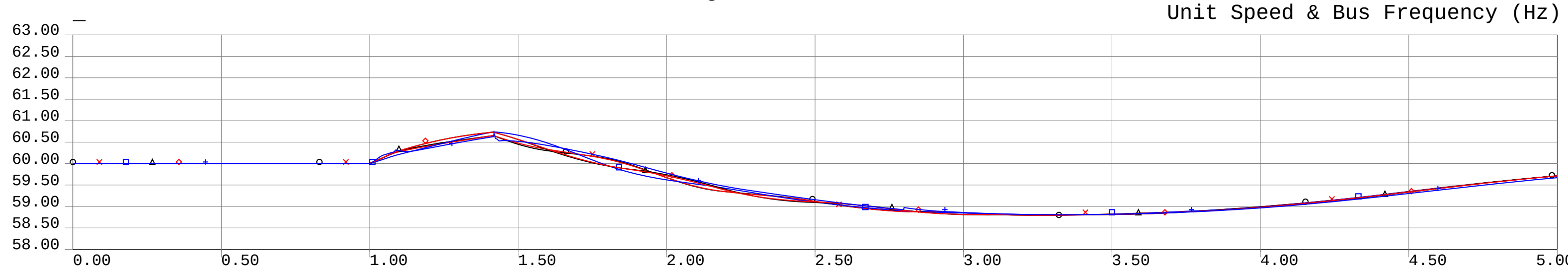
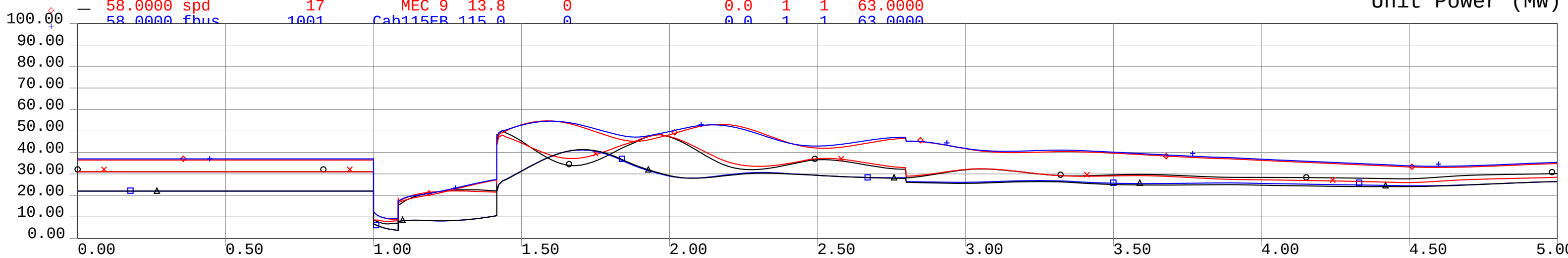
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



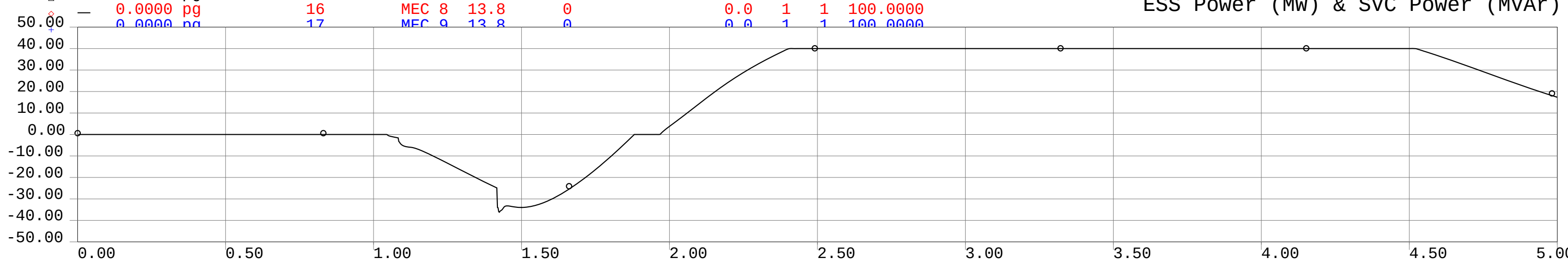
58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



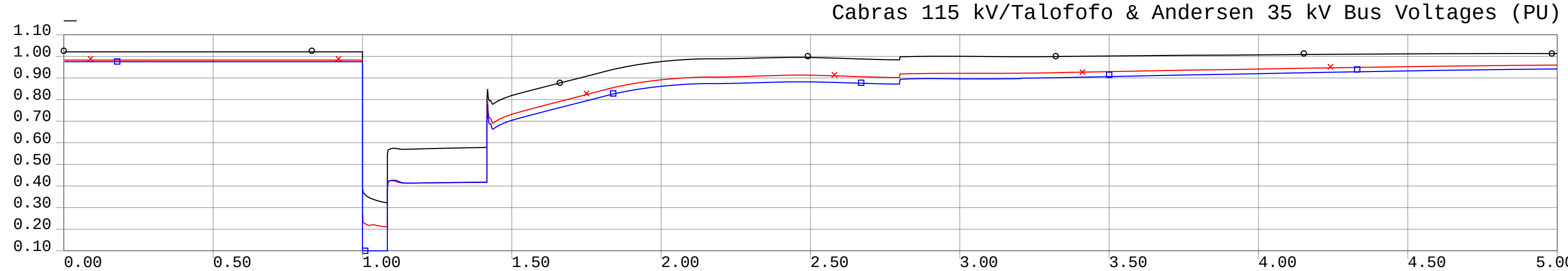
0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1433_40a_lf18_fidvr.chf

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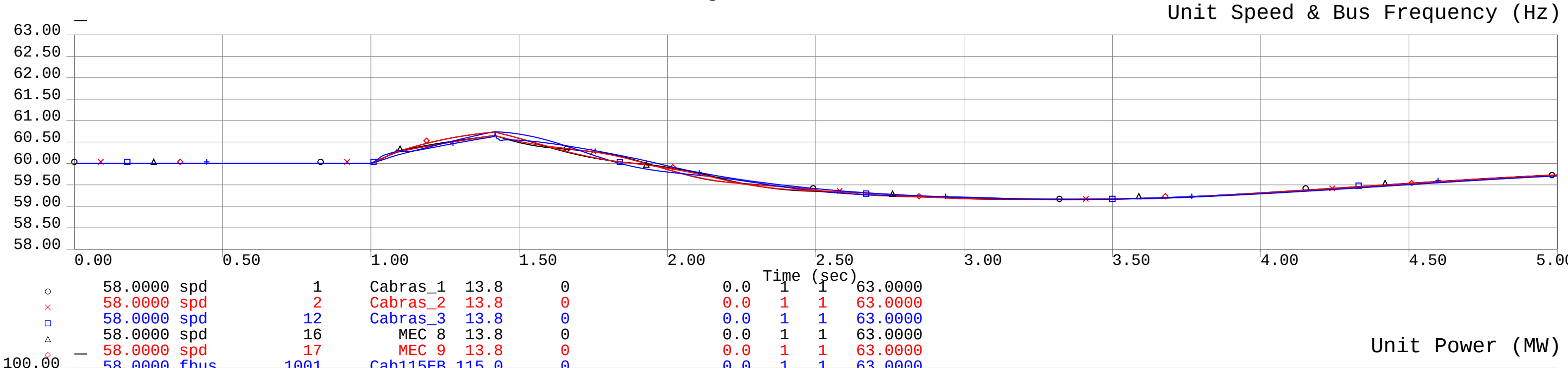
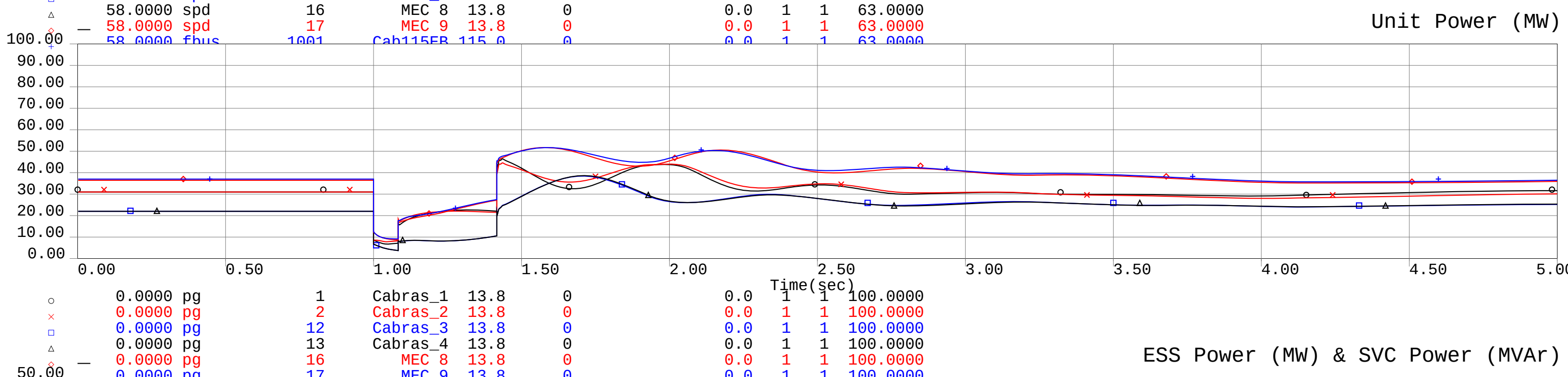
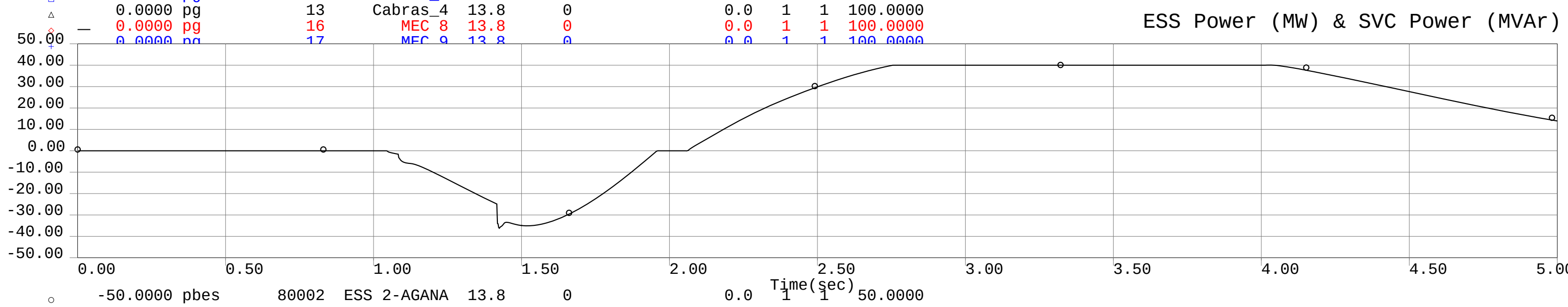
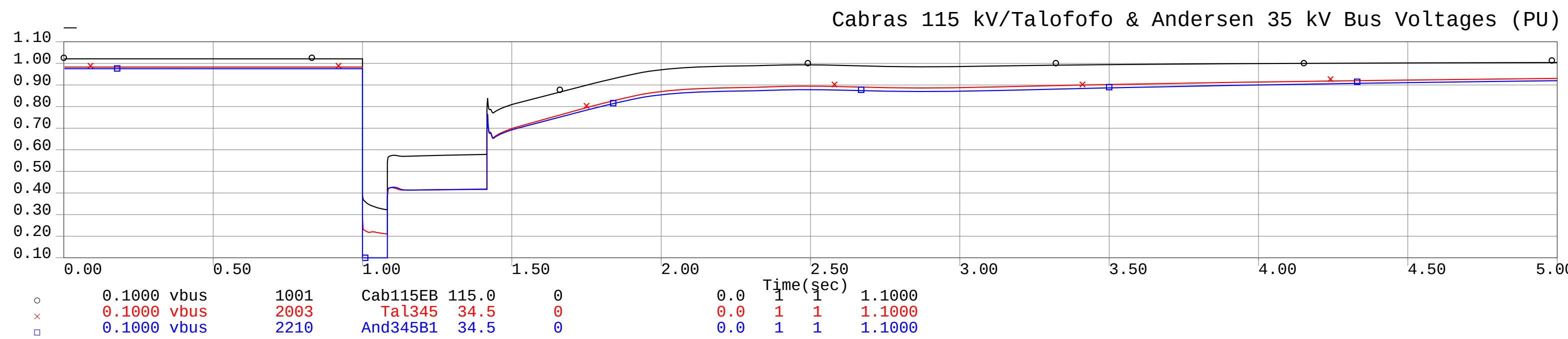
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS









chans/1433_40a_lf18_fidvr_pv.chf

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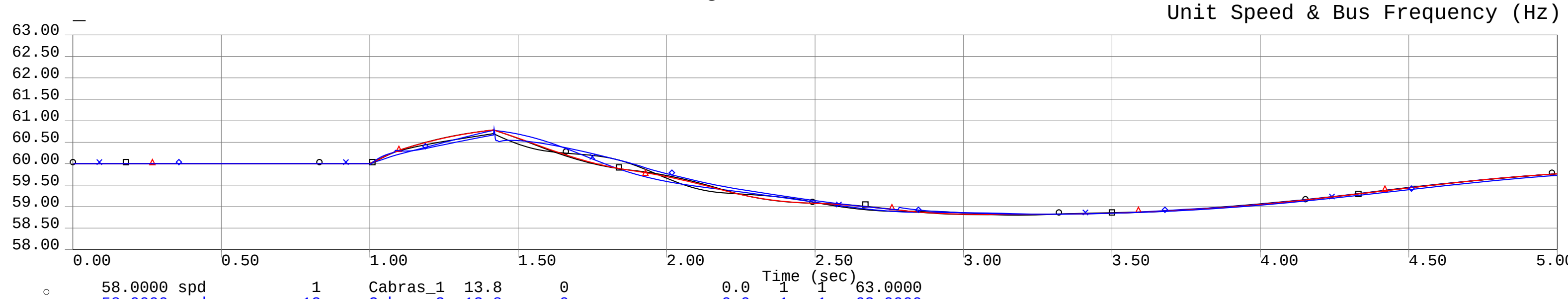
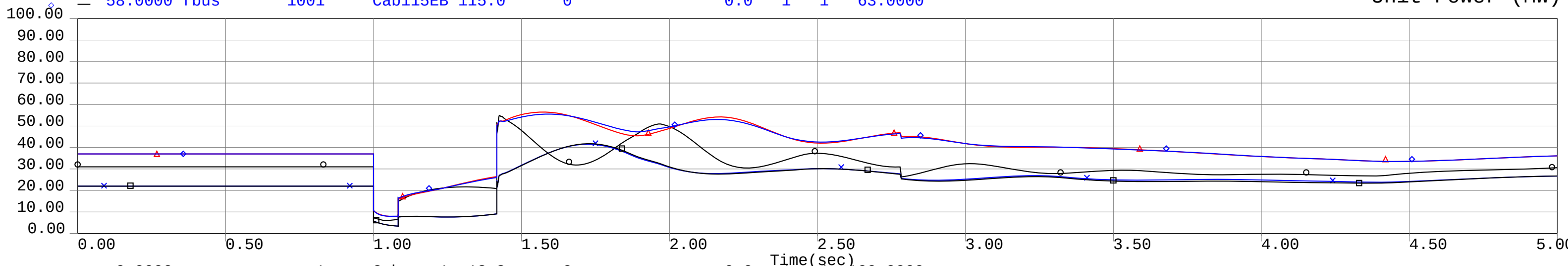
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



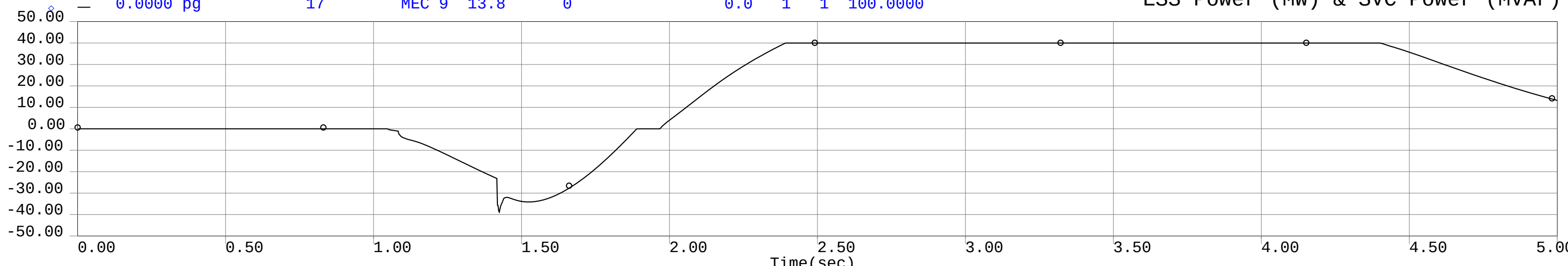
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



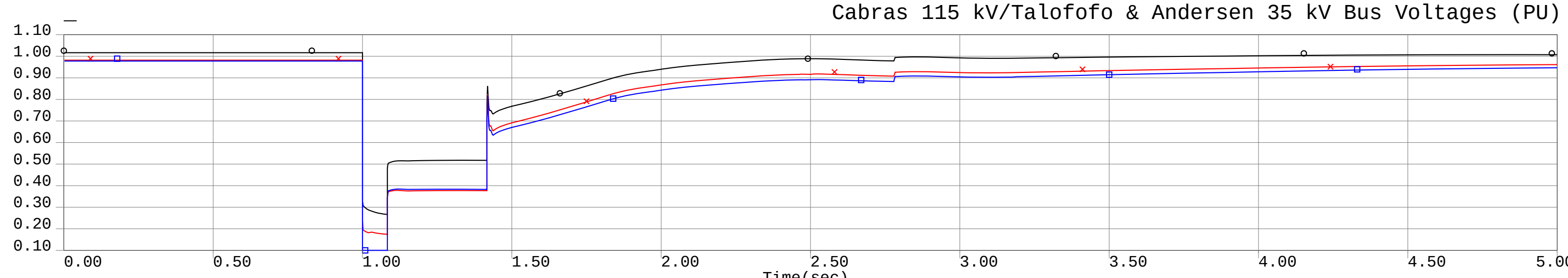
○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



○	-50.0000 pbes	80002	ESS 2-AGANA	13.8	0	0.0	1	1	50.0000

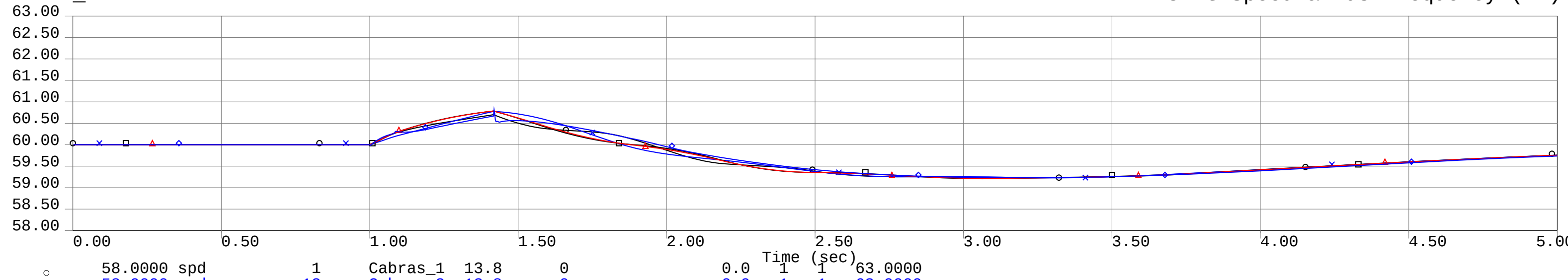
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

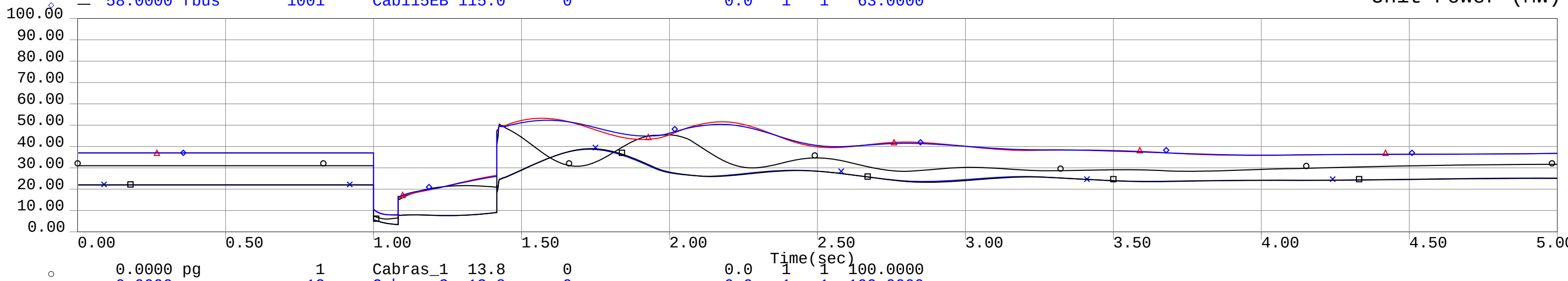
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 5/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



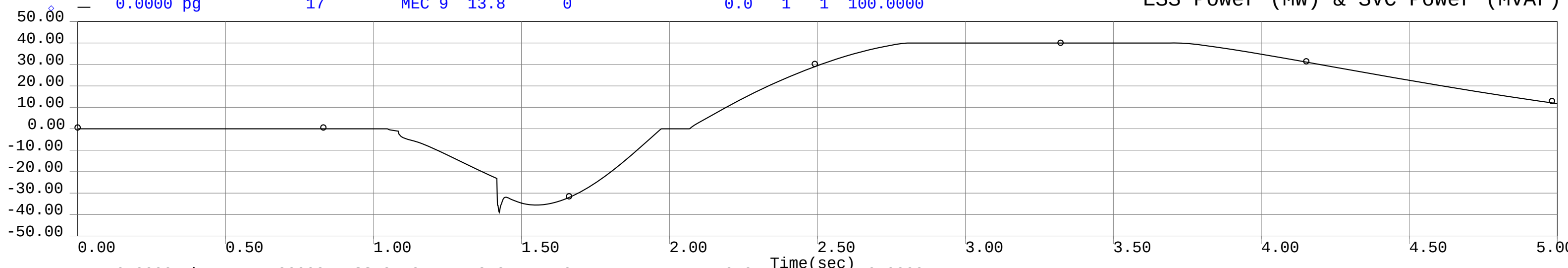
○ 58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
× 58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
□ 58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
△ 58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
◇ 58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)



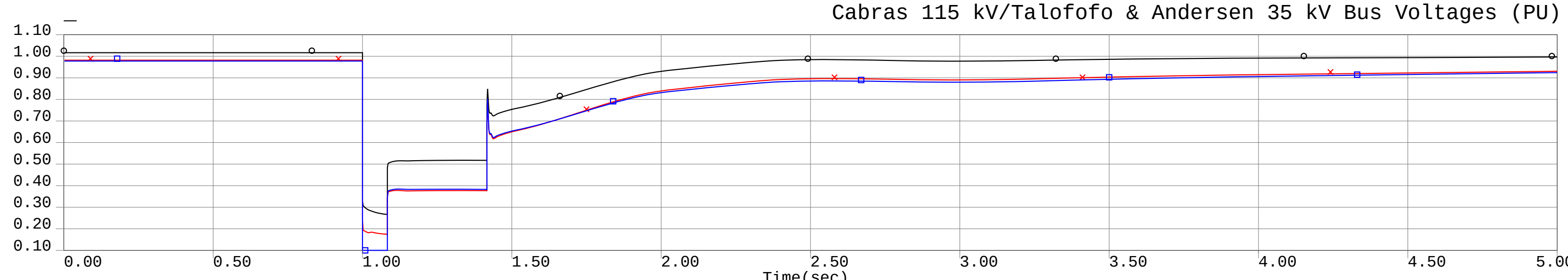
○ 0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
× 0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
□ 0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
△ 0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
◇ 0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



○ -50.0000 pbes 80002 ESS 2-AGANA 13.8 0 0.0 1 1 50.0000

Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○ 0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
× 0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
□ 0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

chans/2433_40a_lf18_fidvr_pv.chf

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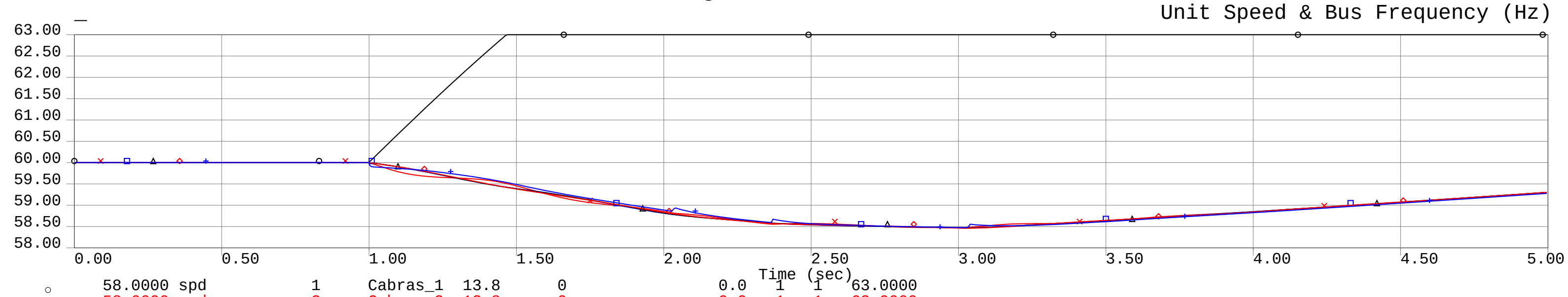
Simulation Plot Listing - Existing System Reference Cases

Base Case	ESS Configuration	Disturbance ID	FIDVR	Existing System	Complete Case ID
1400	40a	c1	fidvr	ex	1400_40a_c1_fidvr_ex
2400	40a	c1	fidvr	ex	2400_40a_c1_fidvr_ex
1400	40a	m8	fidvr	ex	1400_40a_m8_fidvr_ex
2400	40a	m8	fidvr	ex	2400_40a_m8_fidvr_ex
1400	40a	lf1	fidvr	ex	1400_40a_lf1_fidvr_ex
2400	40a	lf1	fidvr	ex	2400_40a_lf1_fidvr_ex
1400	40a	lf2	fidvr	ex	1400_40a_lf2_fidvr_ex
2400	40a	lf2	fidvr	ex	2400_40a_lf2_fidvr_ex
1400	40a	lf3	fidvr	ex	1400_40a_lf3_fidvr_ex
2400	40a	lf3	fidvr	ex	2400_40a_lf3_fidvr_ex
1400	40a	lf4	fidvr	ex	1400_40a_lf4_fidvr_ex
2400	40a	lf4	fidvr	ex	2400_40a_lf4_fidvr_ex
1400	40a	lf11	fidvr	ex	1400_40a_lf11_fidvr_ex
2400	40a	lf11	fidvr	ex	2400_40a_lf11_fidvr_ex
1400	40a	lf12	fidvr	ex	1400_40a_lf12_fidvr_ex
2400	40a	lf12	fidvr	ex	2400_40a_lf12_fidvr_ex
1400	40a	lf13	fidvr	ex	1400_40a_lf13_fidvr_ex
2400	40a	lf13	fidvr	ex	2400_40a_lf13_fidvr_ex
1400	40a	lf14	fidvr	ex	1400_40a_lf14_fidvr_ex
2400	40a	lf14	fidvr	ex	2400_40a_lf14_fidvr_ex
1400	40a	lf15	fidvr	ex	1400_40a_lf15_fidvr_ex
2400	40a	lf15	fidvr	ex	2400_40a_lf15_fidvr_ex
1400	40a	lf16	fidvr	ex	1400_40a_lf16_fidvr_ex
2400	40a	lf16	fidvr	ex	2400_40a_lf16_fidvr_ex
1400	40a	lf17	fidvr	ex	1400_40a_lf17_fidvr_ex
2400	40a	lf17	fidvr	ex	2400_40a_lf17_fidvr_ex
1400	40a	lf18	fidvr	ex	1400_40a_lf18_fidvr_ex
2400	40a	lf18	fidvr	ex	2400_40a_lf18_fidvr_ex

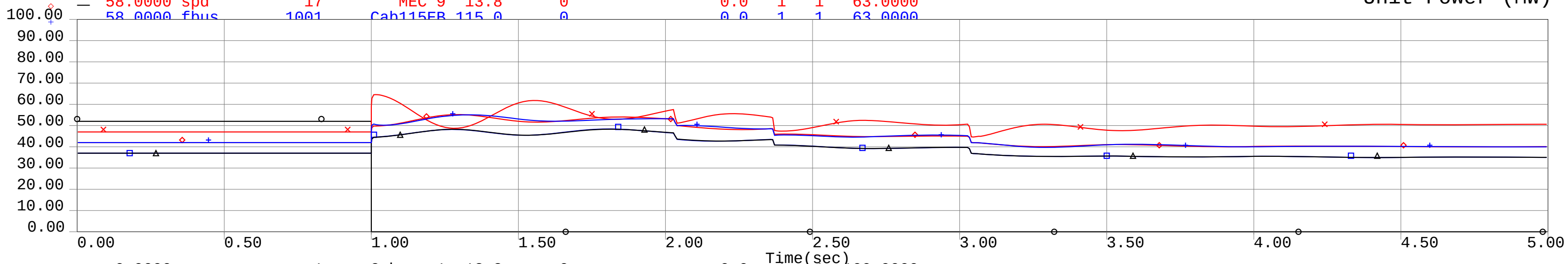
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



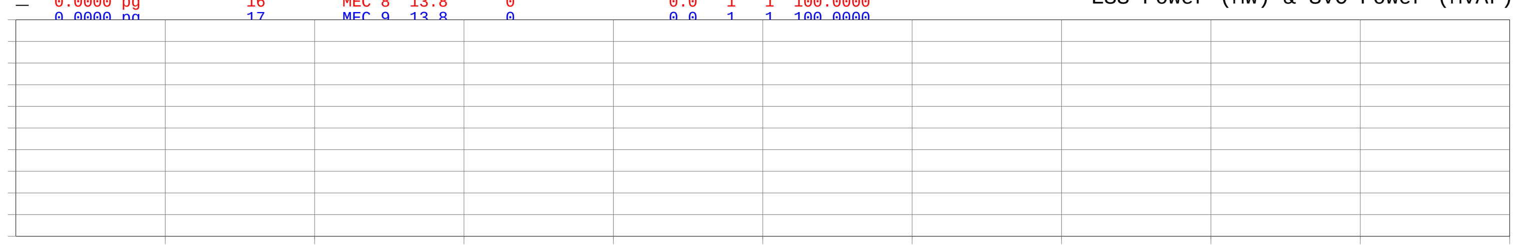
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)

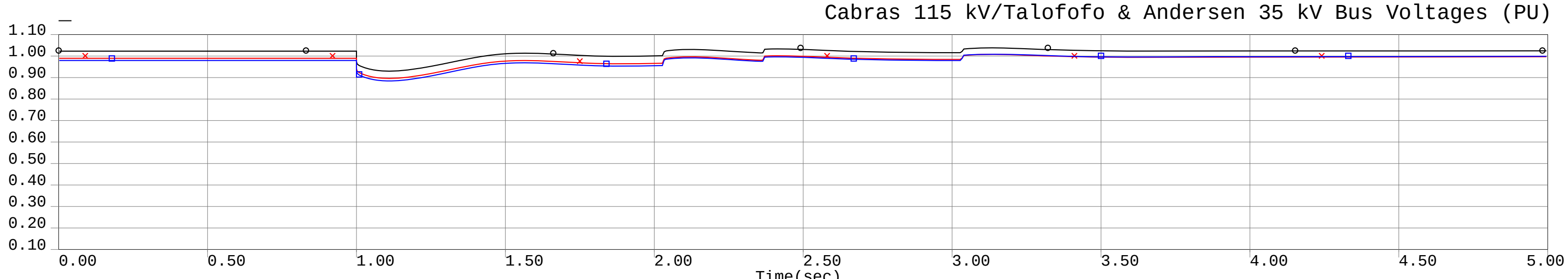


○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1400_40a_c1_fidvr_ex.chf

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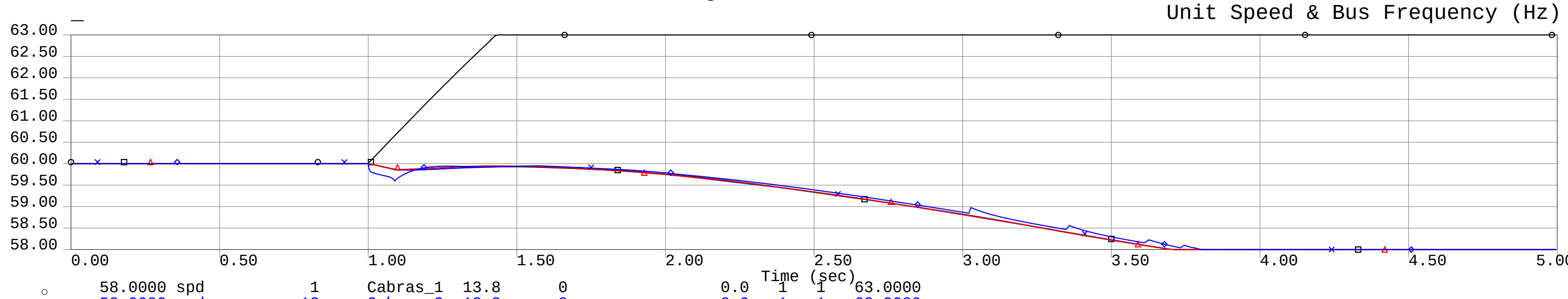
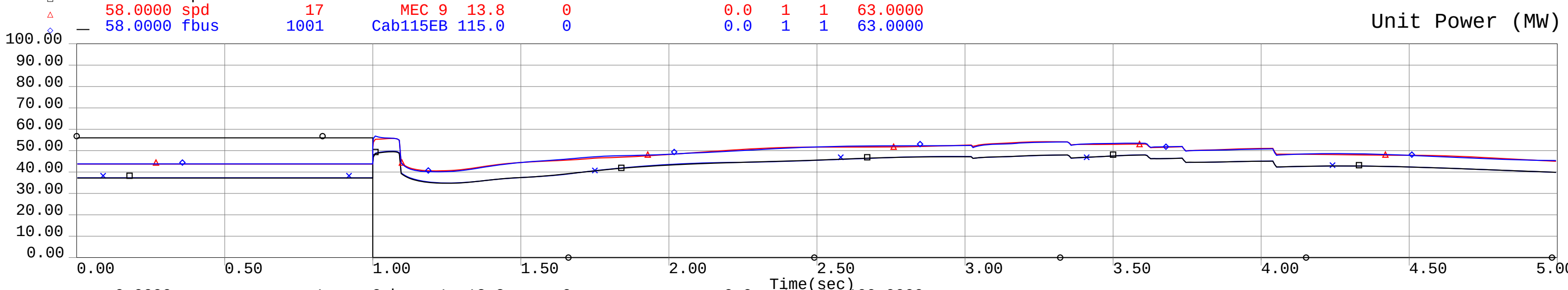
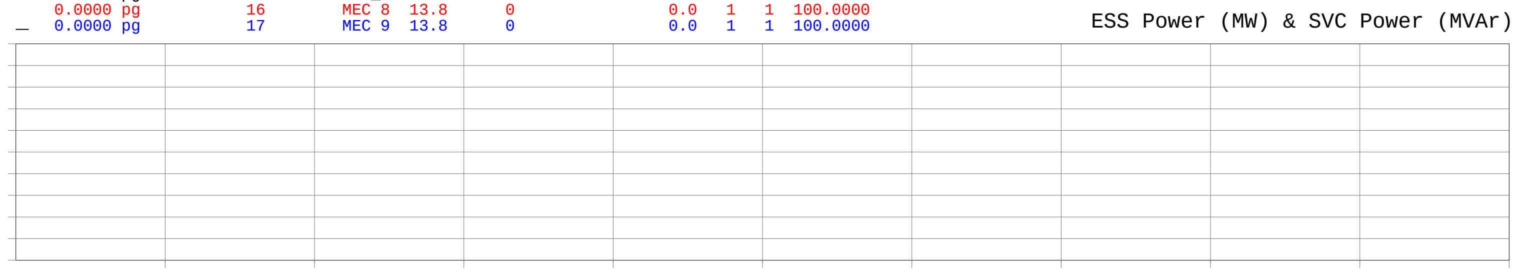
Simulation Summary Results 3/2014
Agana 115 kV ESS

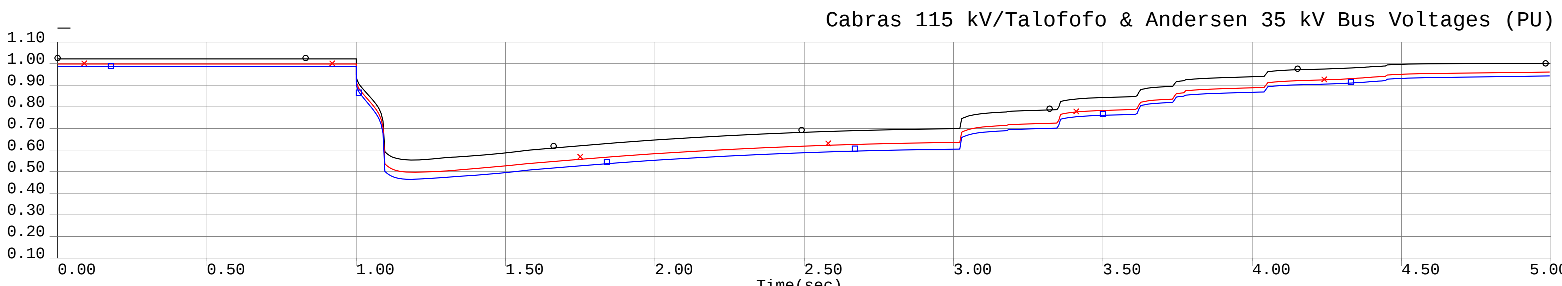


○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000



○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000





○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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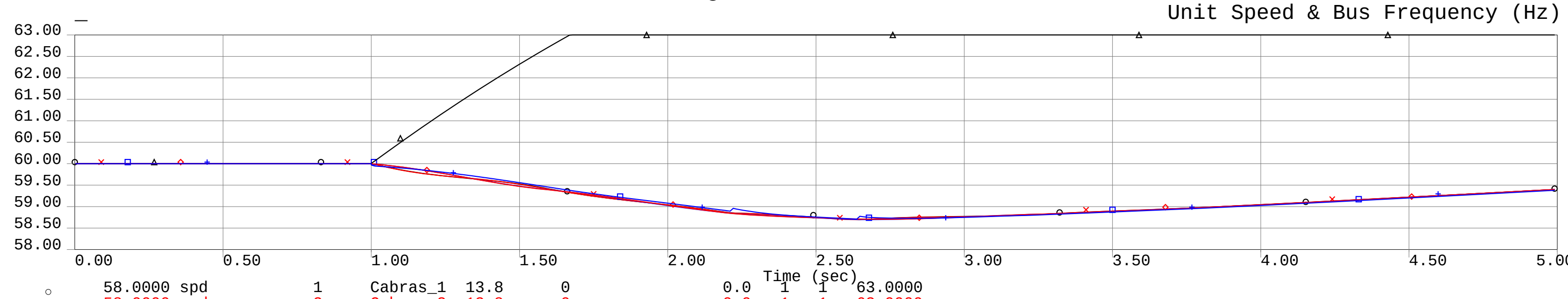
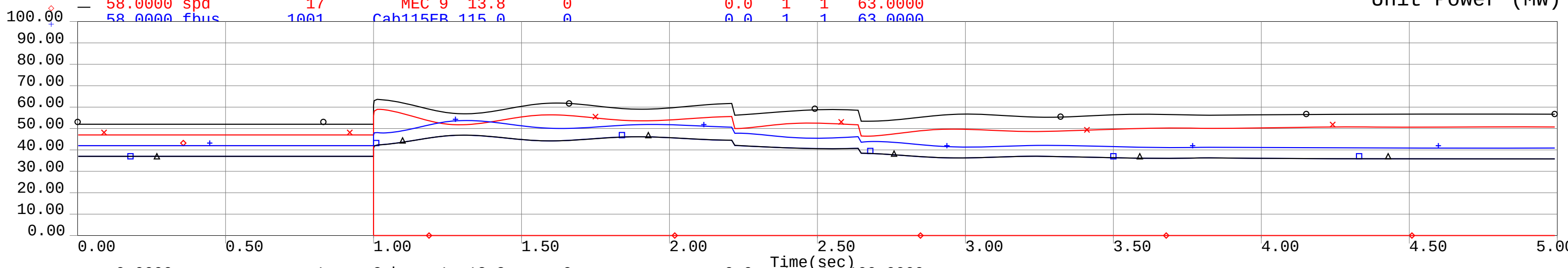
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



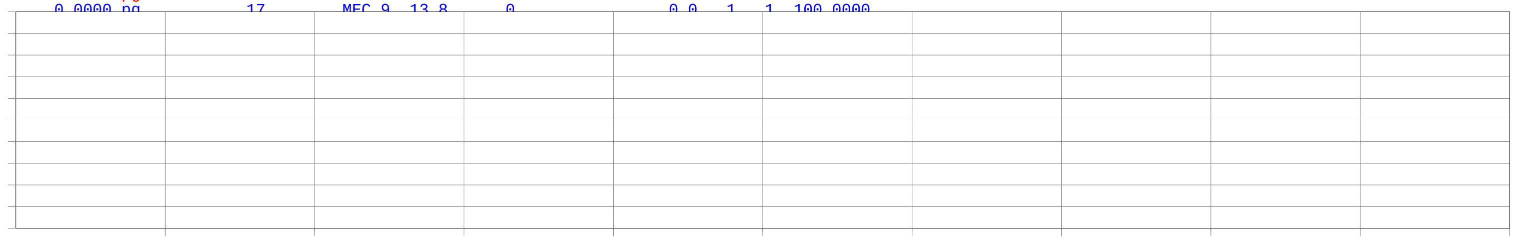
58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)

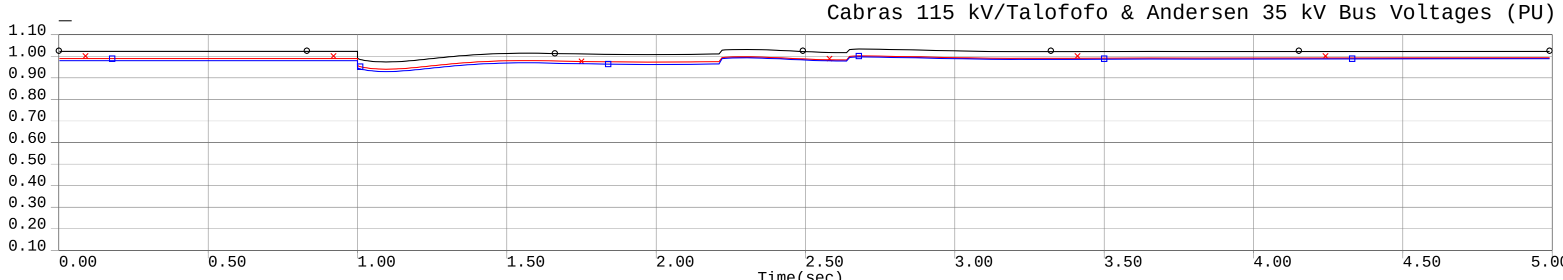


0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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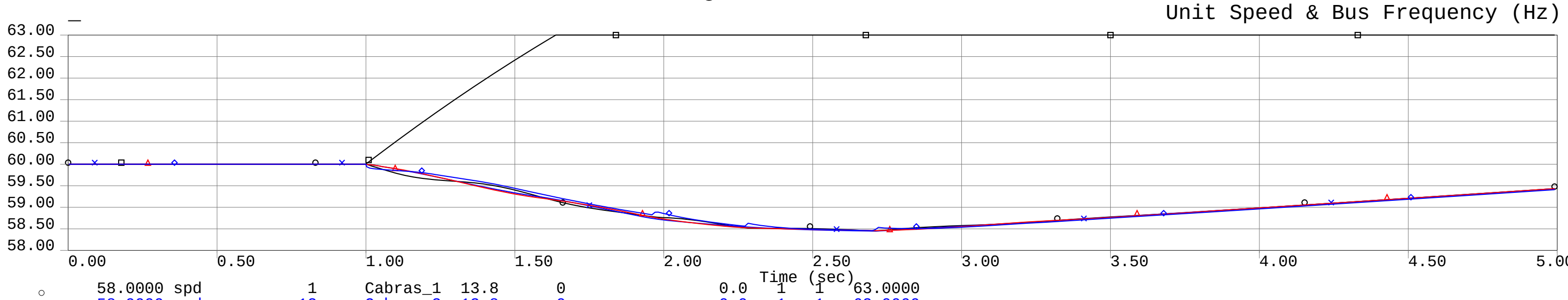
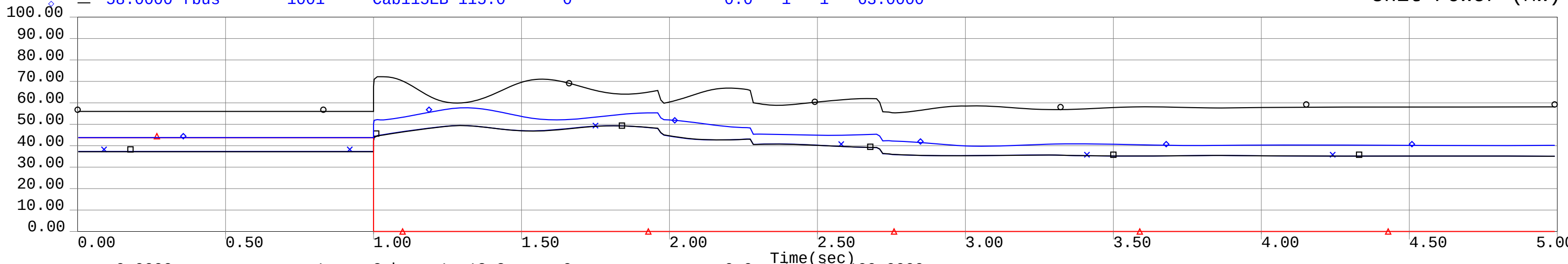
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



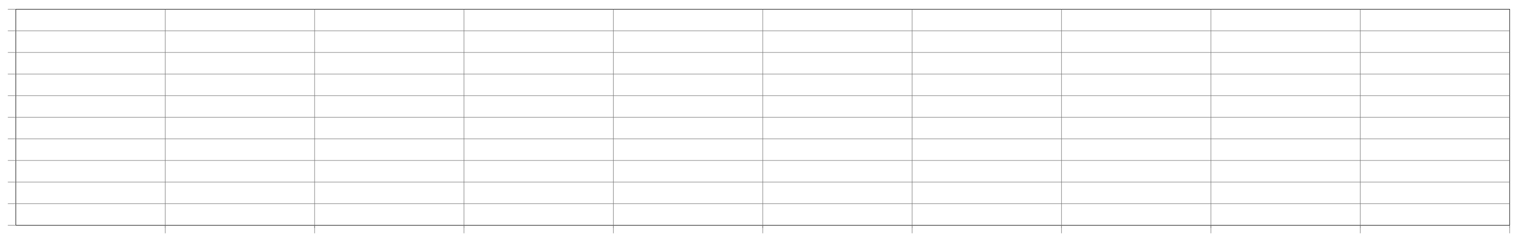
58.0000	spd	1	Cabras_1 13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3 13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8 13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9 13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB 115.0	0	0.0	1	1	63.0000

Unit Power (MW)

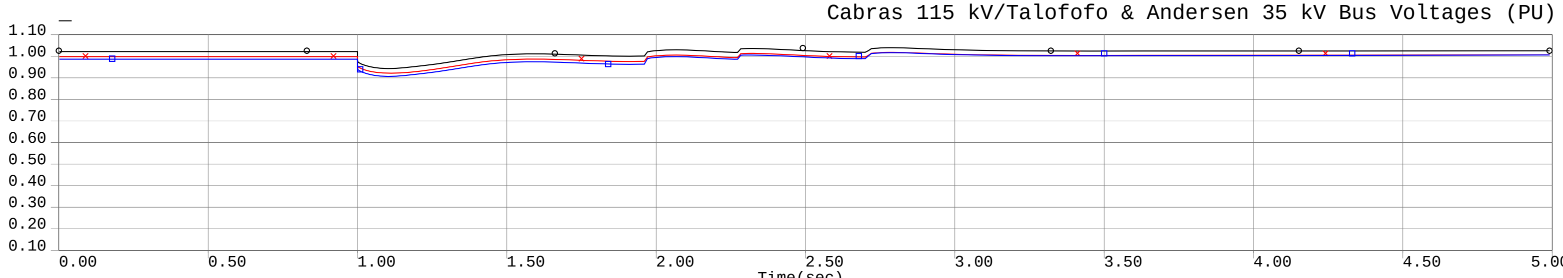


0.0000	pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3 13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4 13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8 13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9 13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)

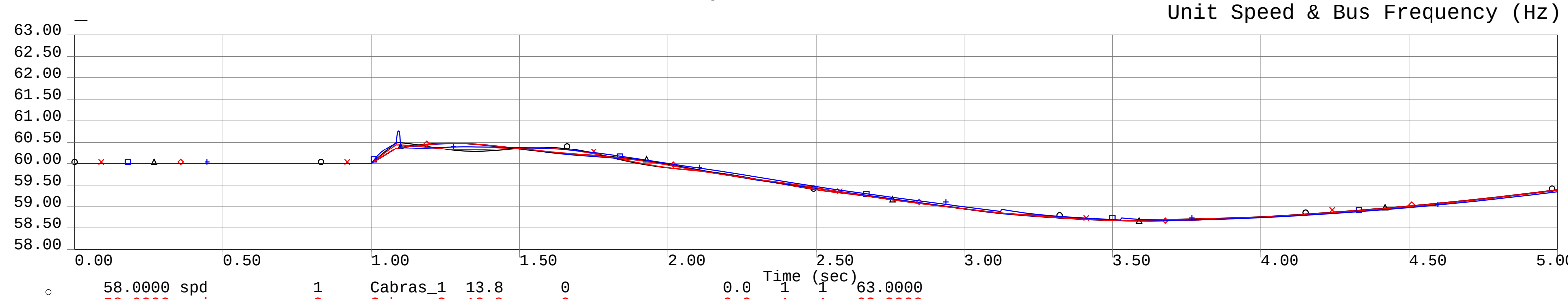


Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)

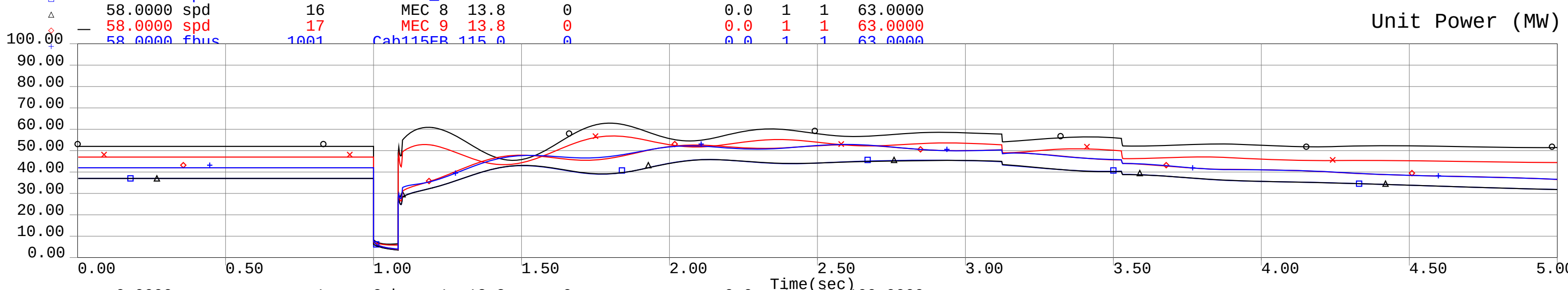


0.1000	vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

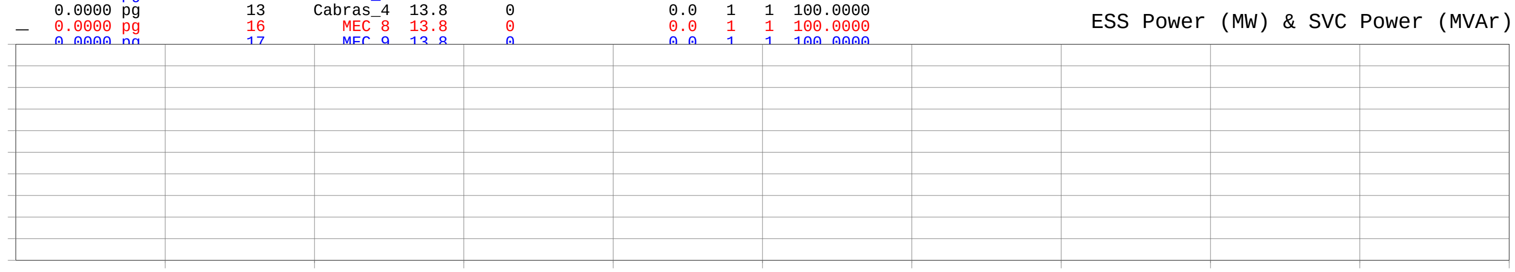
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

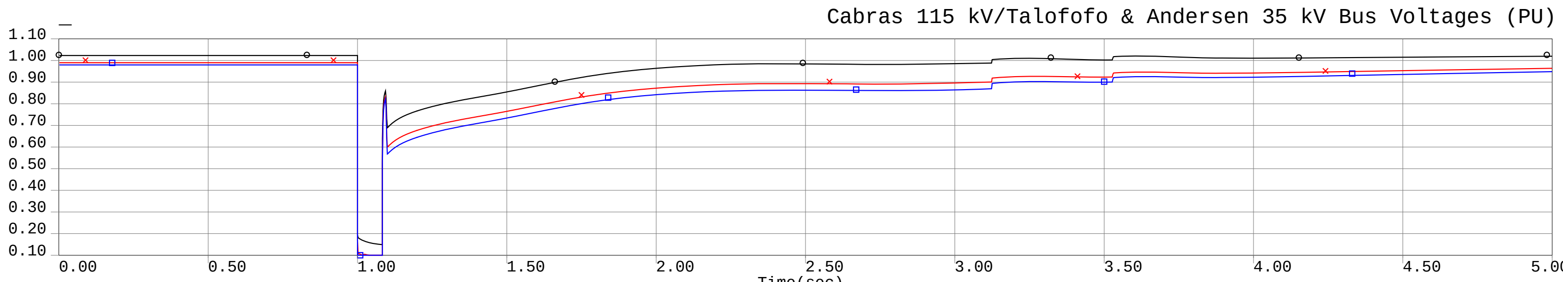


58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000



0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000





0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1400_40a_lf1_fidvr_ex.chf

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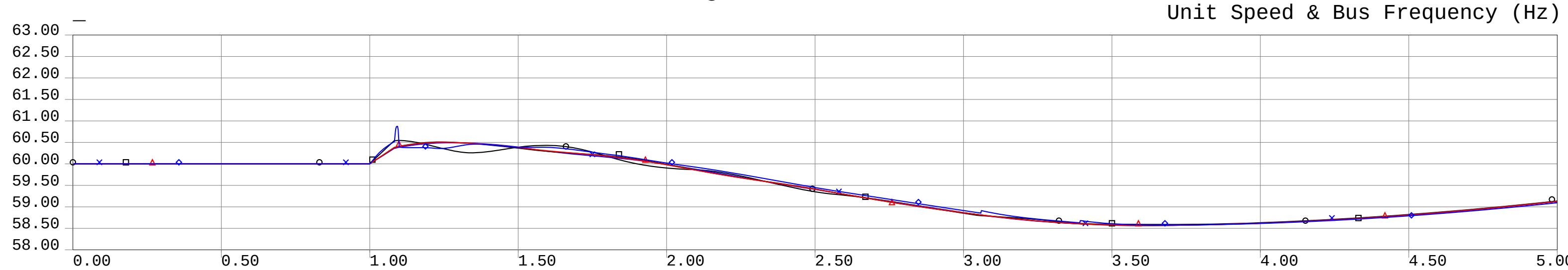
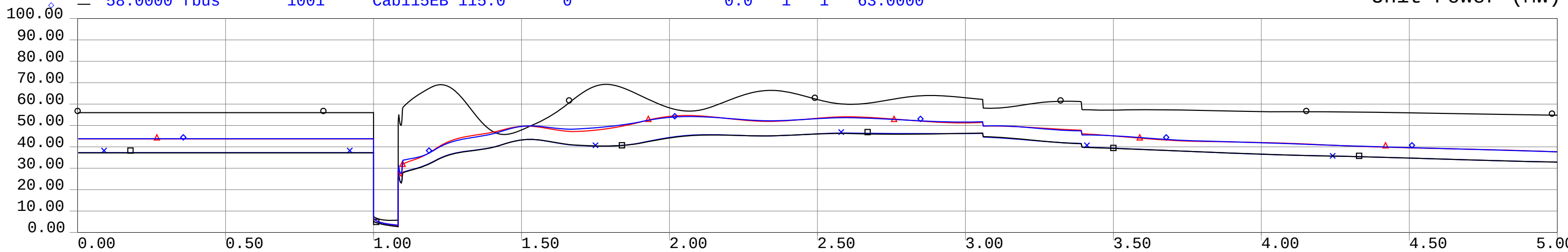
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



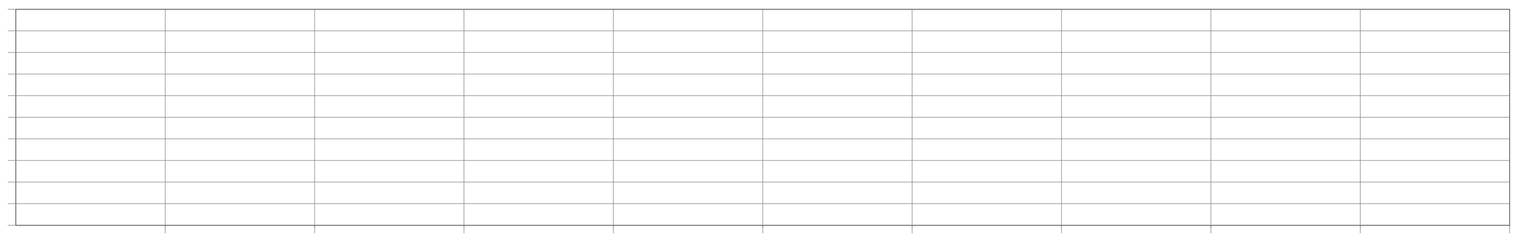

```
58.0000 spd        1   Cabras_1  13.8    0    0.0  1  1  63.0000
58.0000 spd       12   Cabras_3  13.8    0    0.0  1  1  63.0000
58.0000 spd       16      MEC 8  13.8    0    0.0  1  1  63.0000
58.0000 spd       17      MEC 9  13.8    0    0.0  1  1  63.0000
58.0000 fbus    1001   Cab115EB 115.0    0    0.0  1  1  63.0000
```

Unit Power (MW)

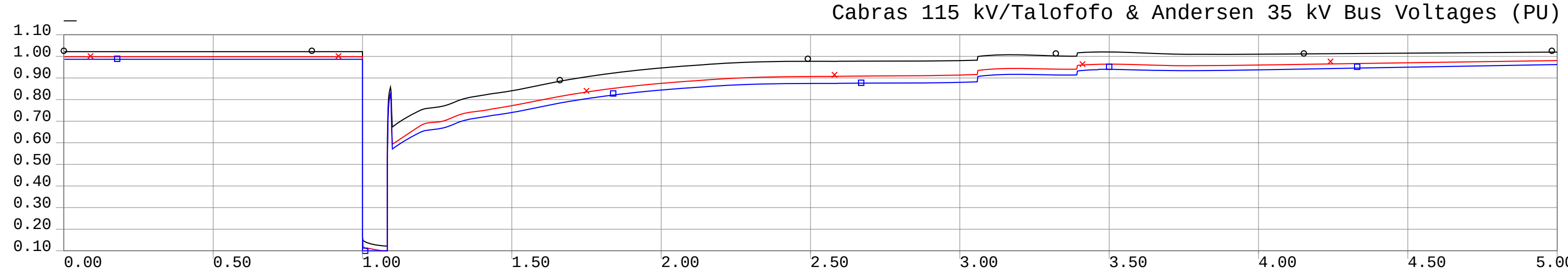



```
0.0000 pg          1   Cabras_1  13.8    0    0.0  1  1  100.0000
0.0000 pg         12   Cabras_3  13.8    0    0.0  1  1  100.0000
0.0000 pg         13   Cabras_4  13.8    0    0.0  1  1  100.0000
0.0000 pg         16      MEC 8  13.8    0    0.0  1  1  100.0000
0.0000 pg         17      MEC 9  13.8    0    0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.1000 vbus     1001   Cab115EB 115.0    0    0.0  1  1  1.1000
0.1000 vbus     2003     Tal345  34.5    0    0.0  1  1  1.1000
0.1000 vbus     2210   And345B1  34.5    0    0.0  1  1  1.1000
```


chans/2400_40a_lf1_fidvr_ex.chf

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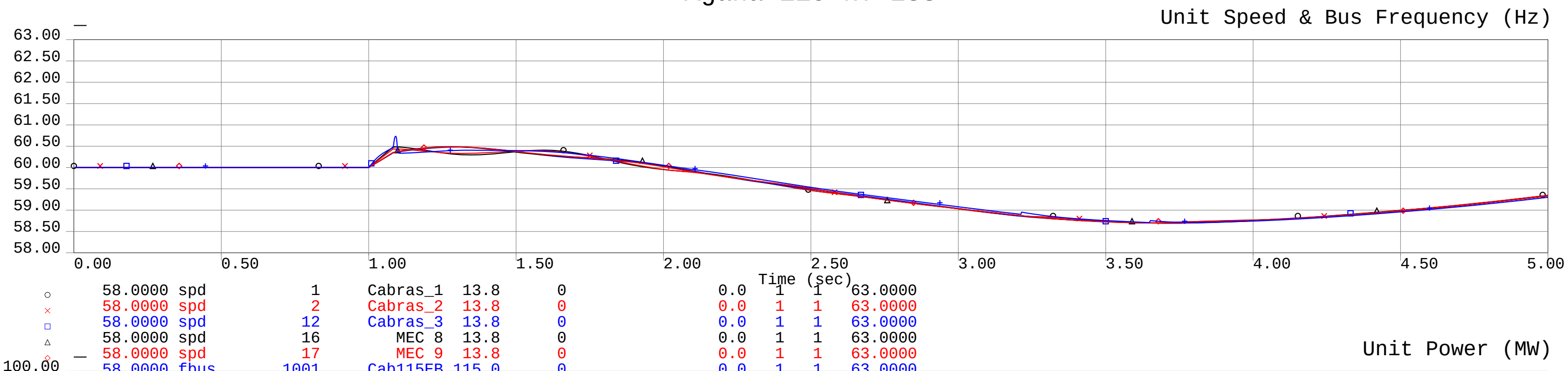
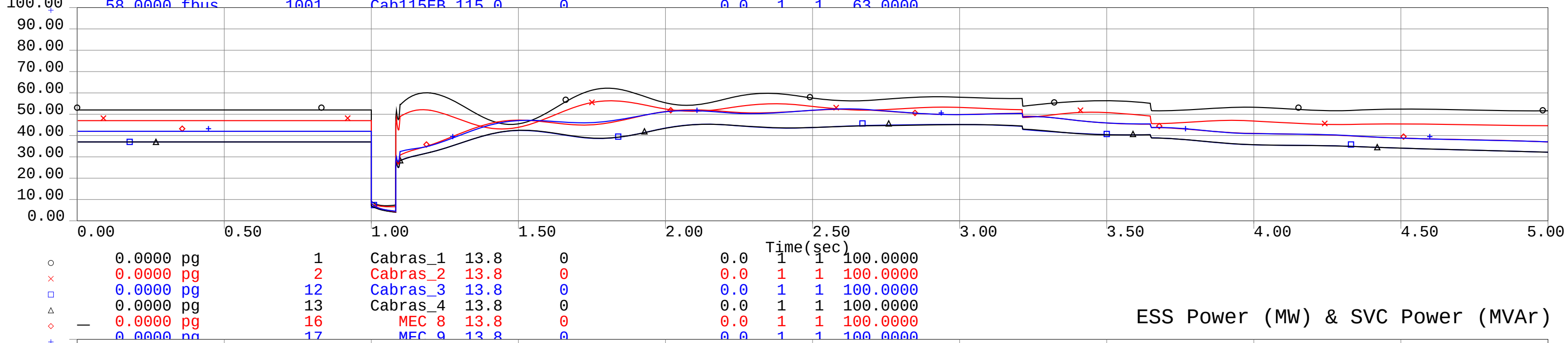
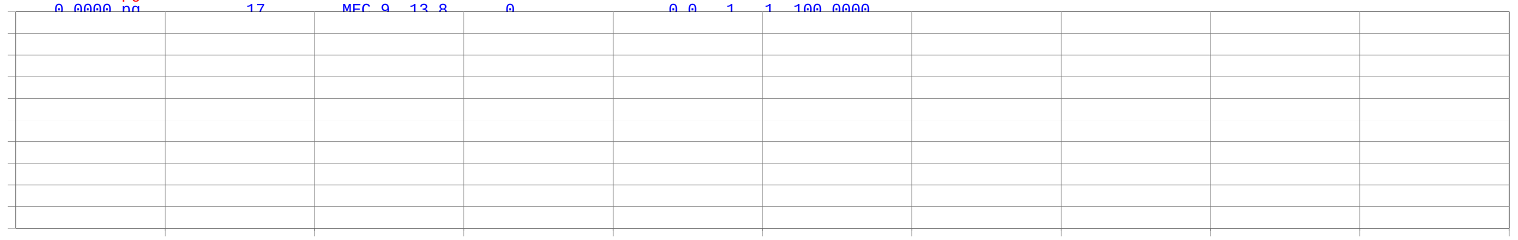
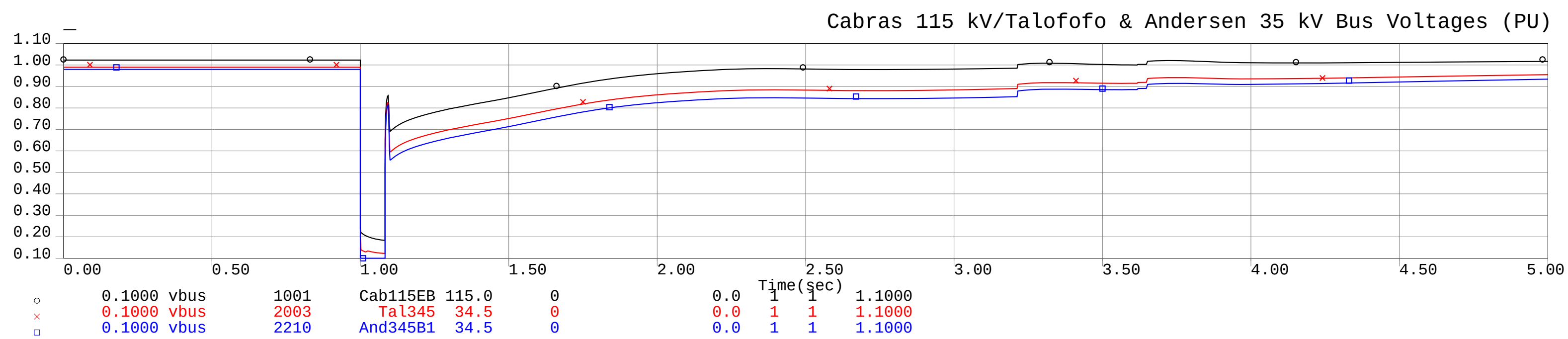
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS









chans/1400_40a_lf2_fidvr_ex.chf

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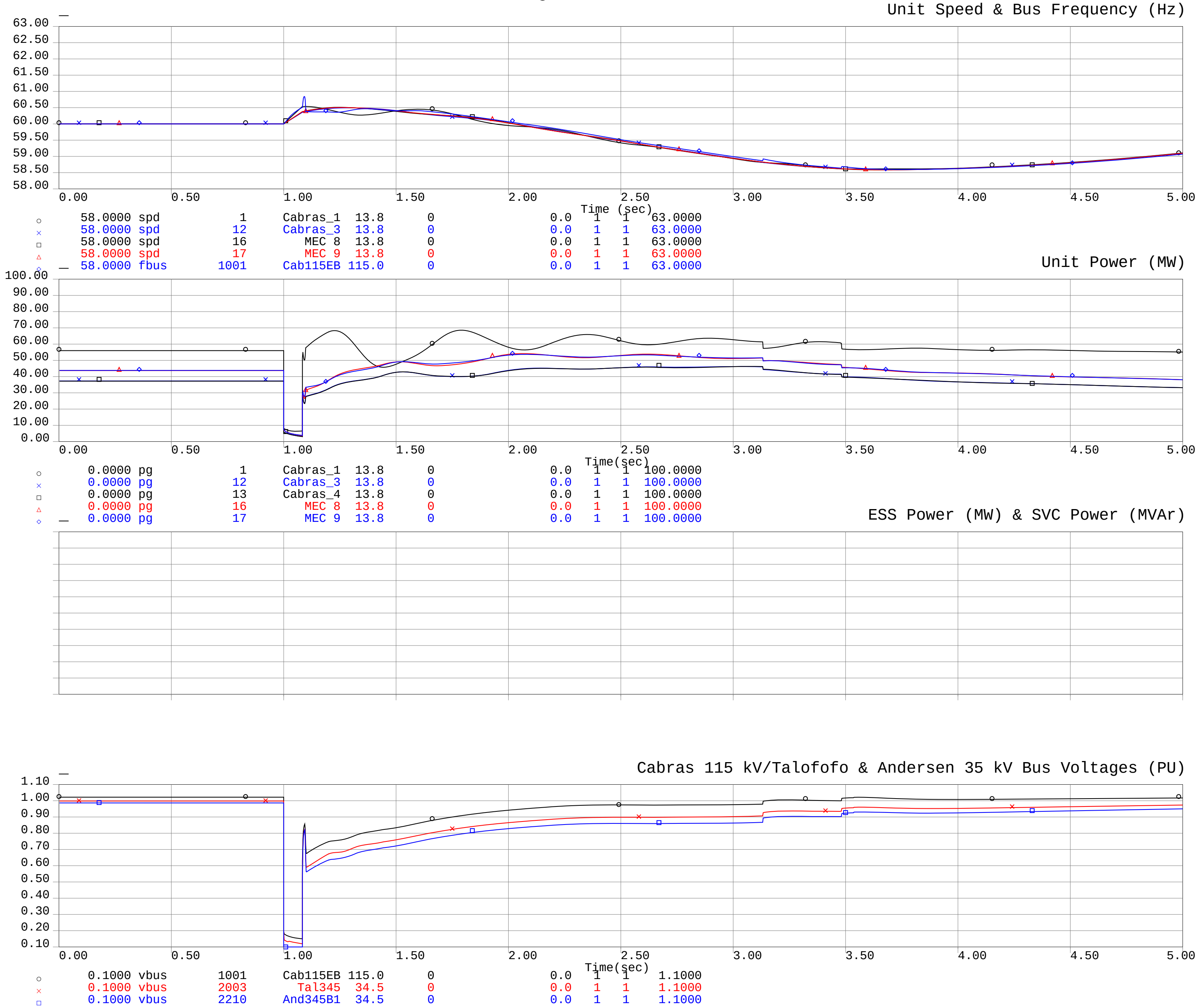
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/2400_40a_lf2_fidvr_ex.chf

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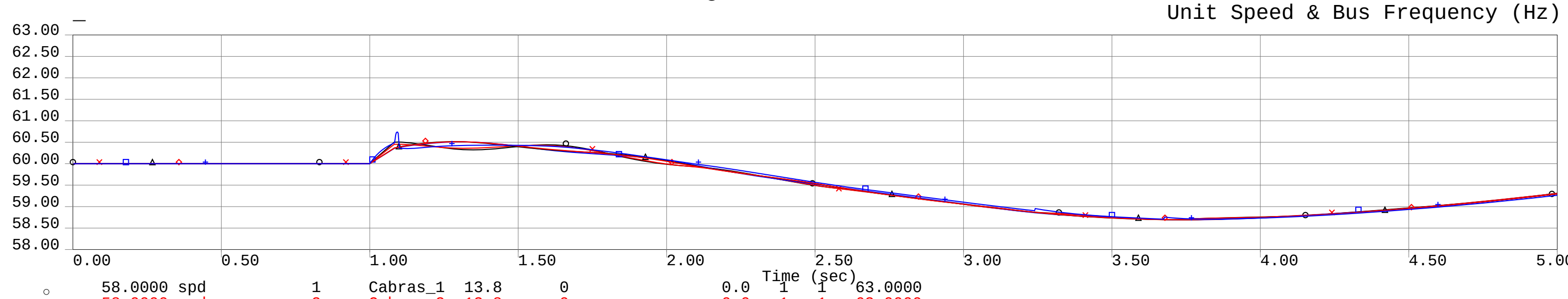
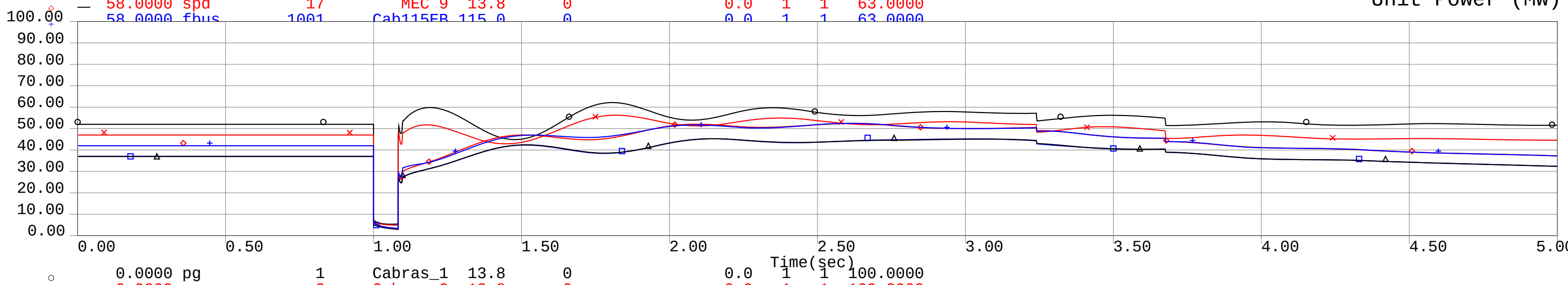
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



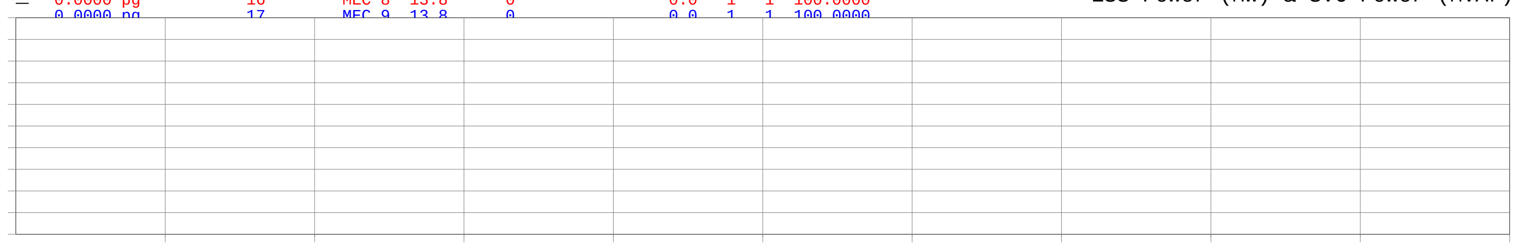
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)

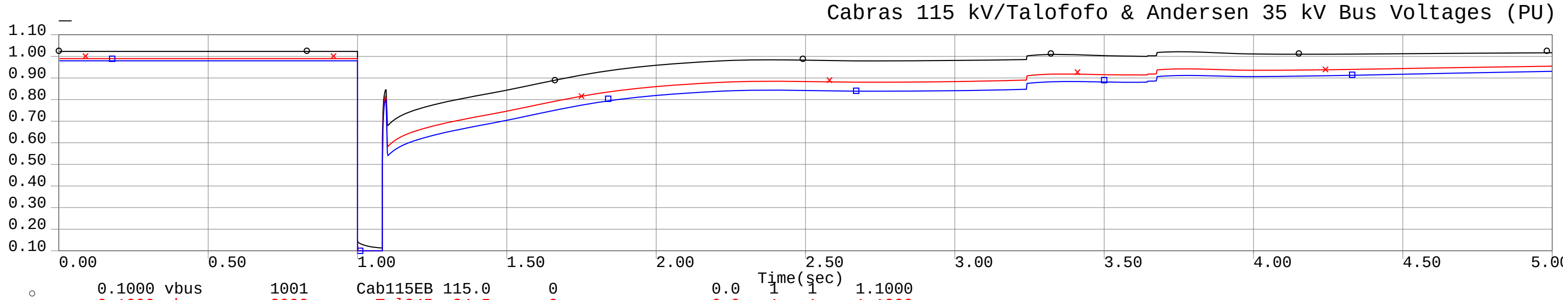


○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1400_40a_lf3_fidvr_ex.chf

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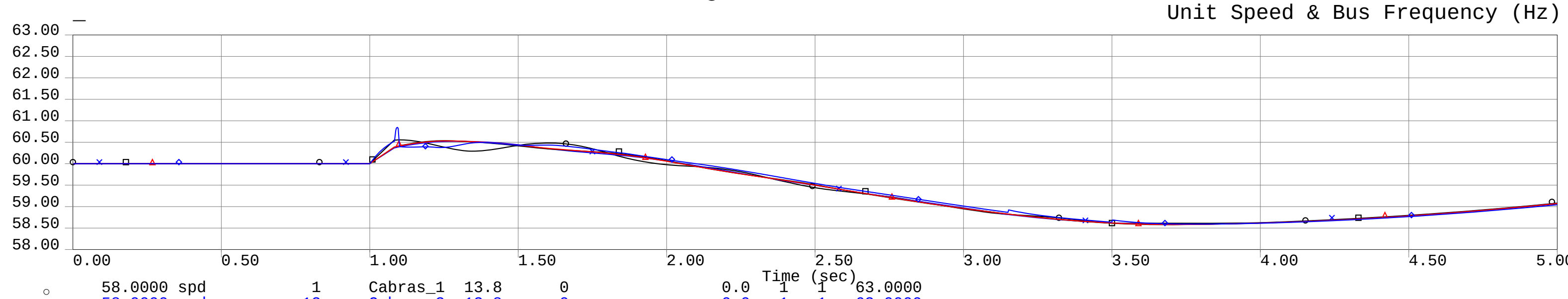
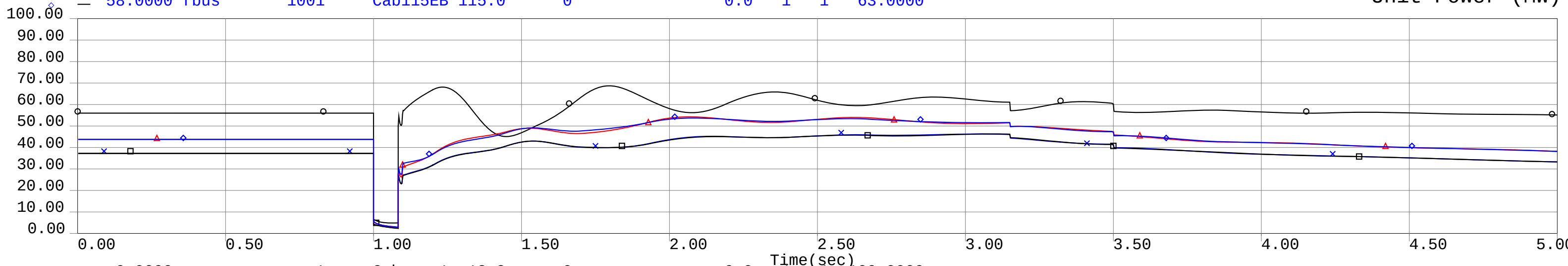
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



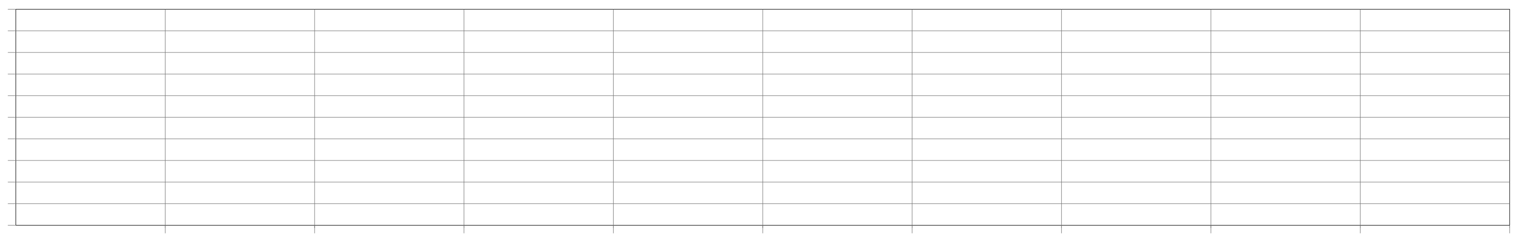
58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	63.0000
58.0000 spd	12	Cabras_3 13.8	0	0.0	1	1	63.0000
58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	63.0000
58.0000 spd	17	MEC 9 13.8	0	0.0	1	1	63.0000
58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	63.0000

Unit Power (MW)

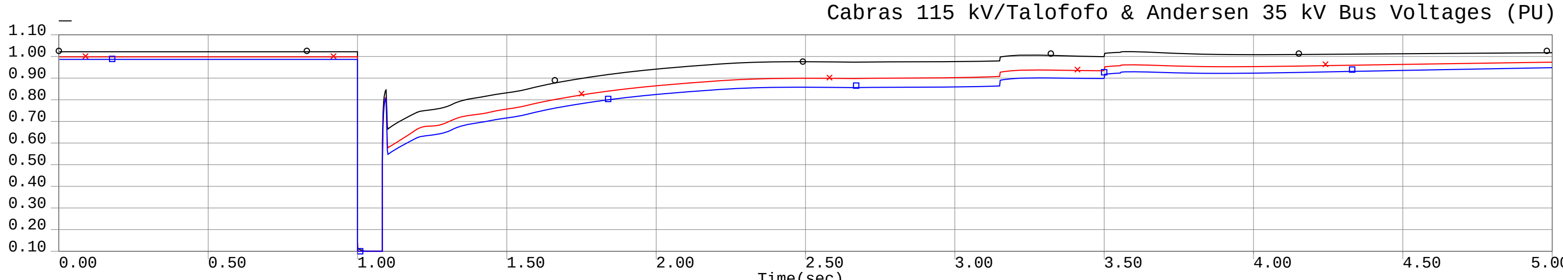


0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
0.0000 pg	12	Cabras_3 13.8	0	0.0	1	1	100.0000
0.0000 pg	13	Cabras_4 13.8	0	0.0	1	1	100.0000
0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000
0.0000 pg	17	MEC 9 13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



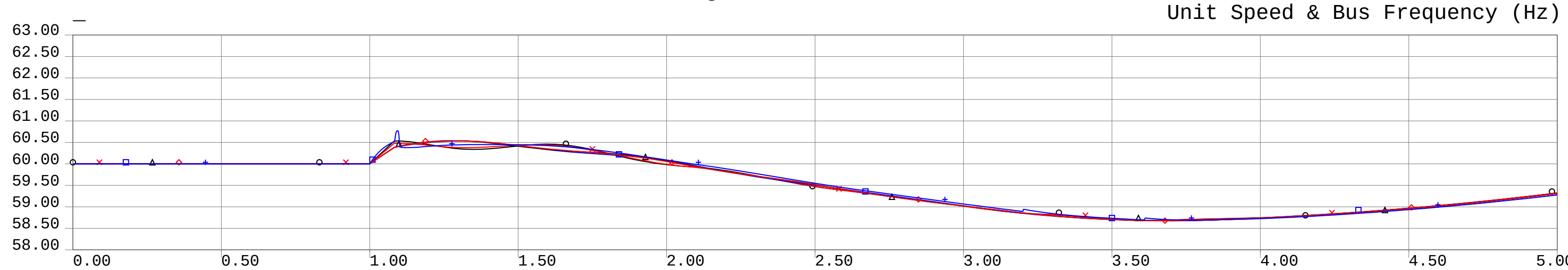
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
0.1000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
0.1000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

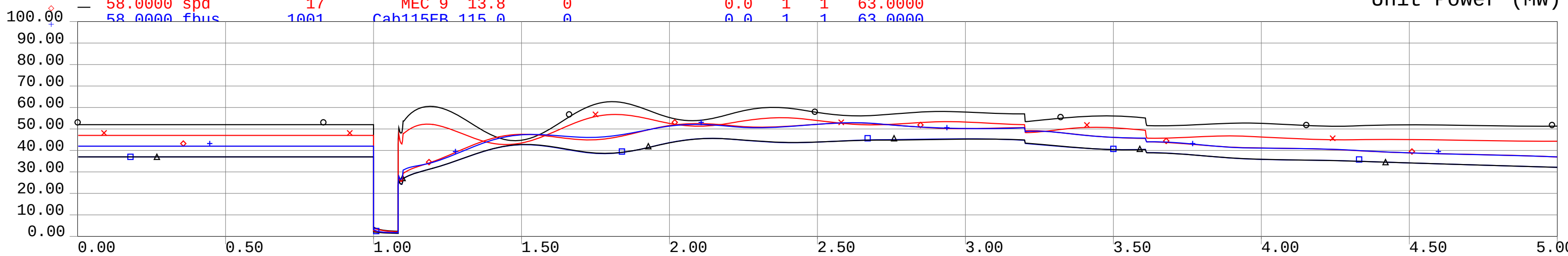
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



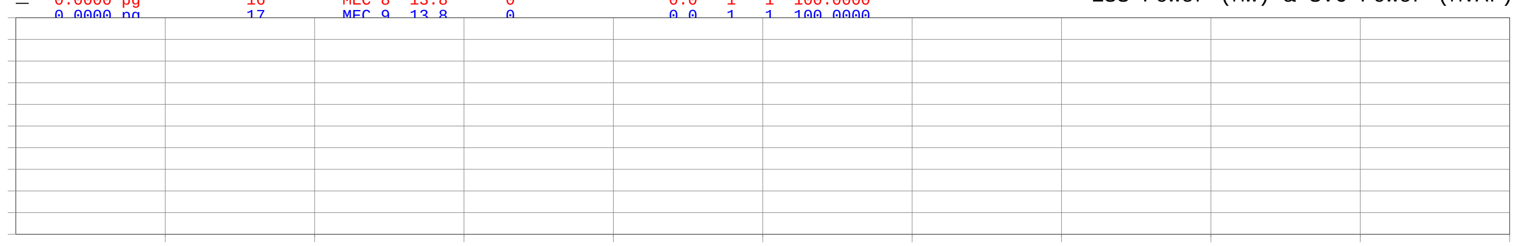
○	58.0000	spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000	spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□	58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△	58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇	58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+	58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)

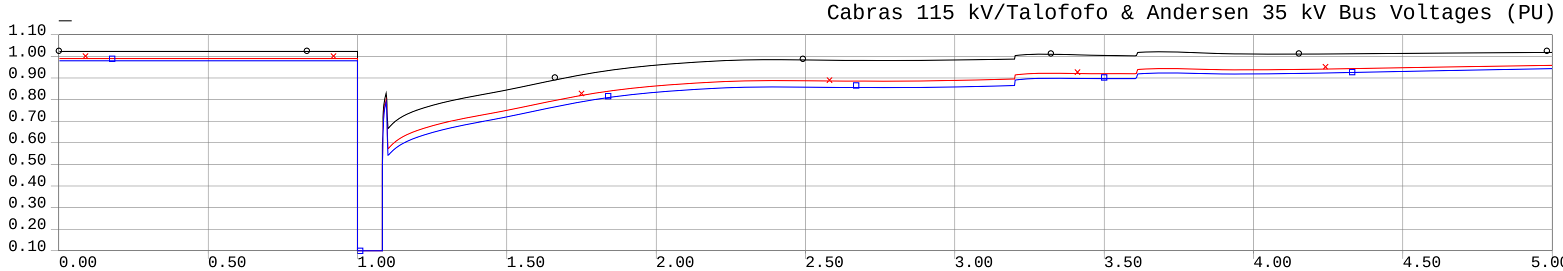


○	0.0000	pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000	pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
□	0.0000	pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△	0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇	0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+	0.0000	pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/1400_40a_lf4_fidvr_ex.chf

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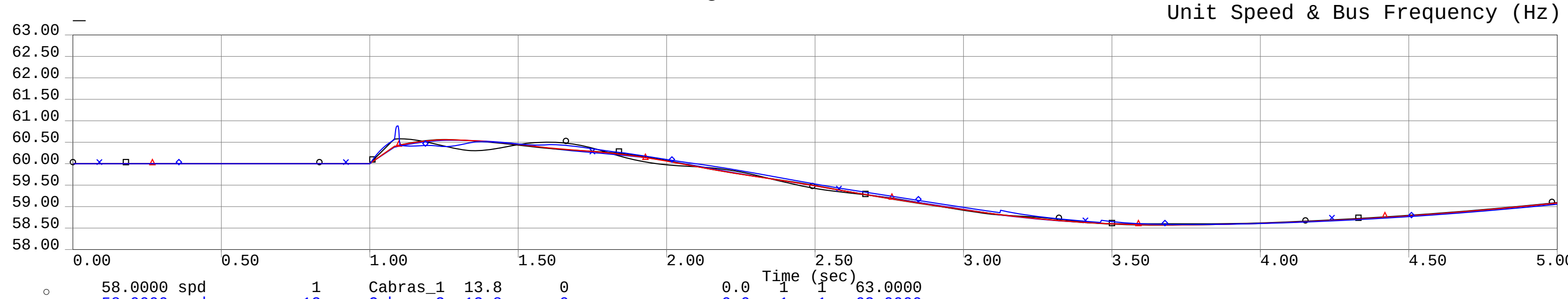
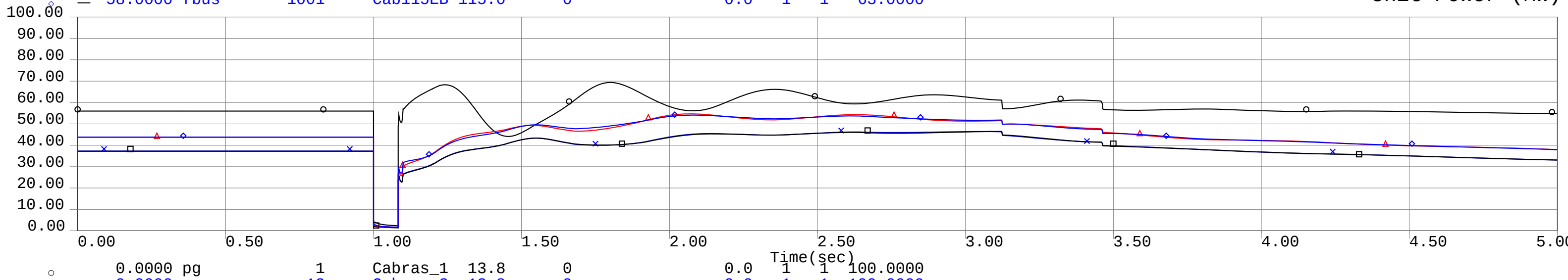
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



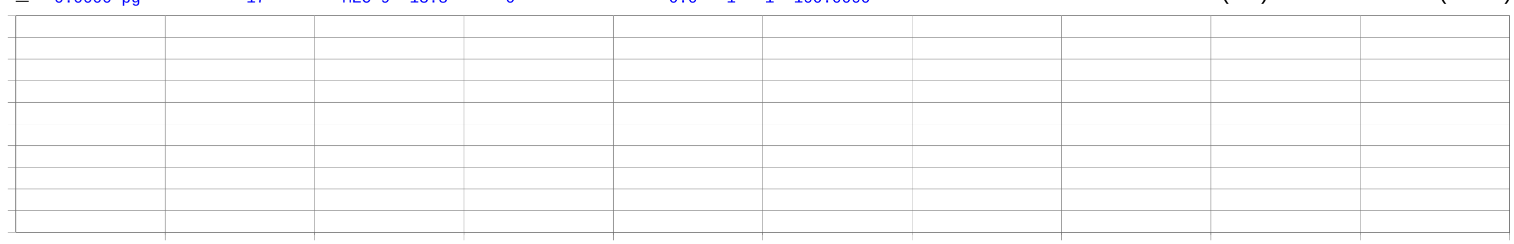
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)

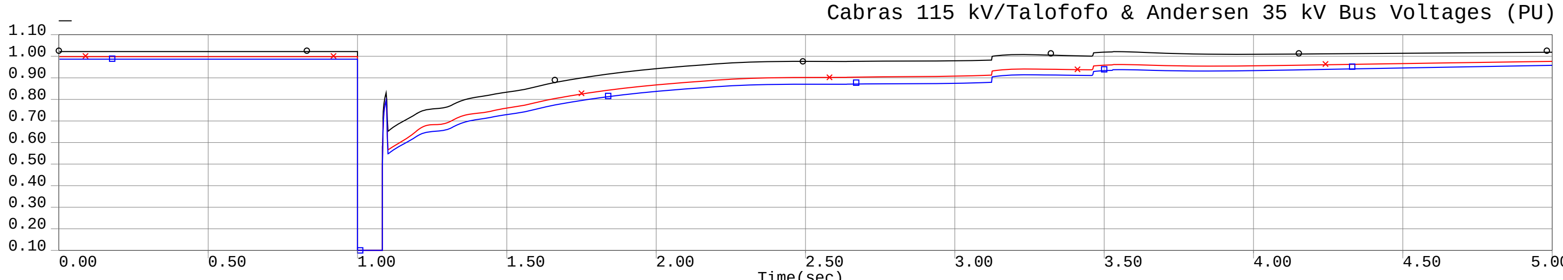


○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

chans/2400_40a_lf4_fidvr_ex.chf

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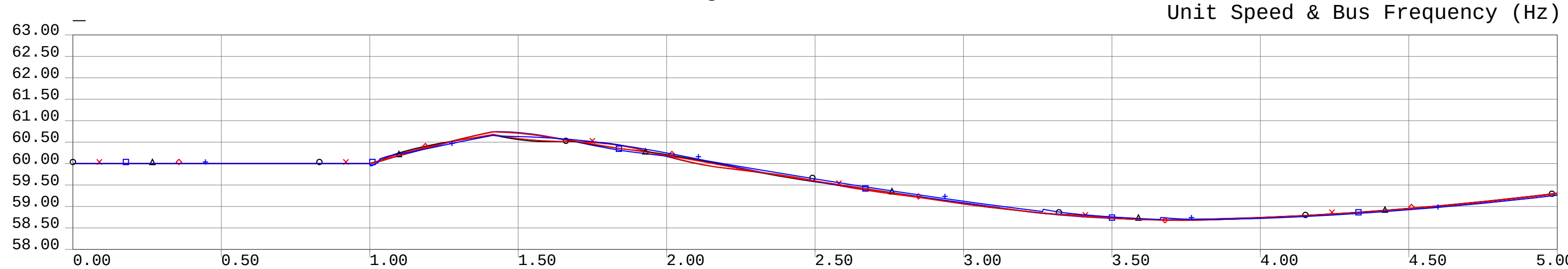
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

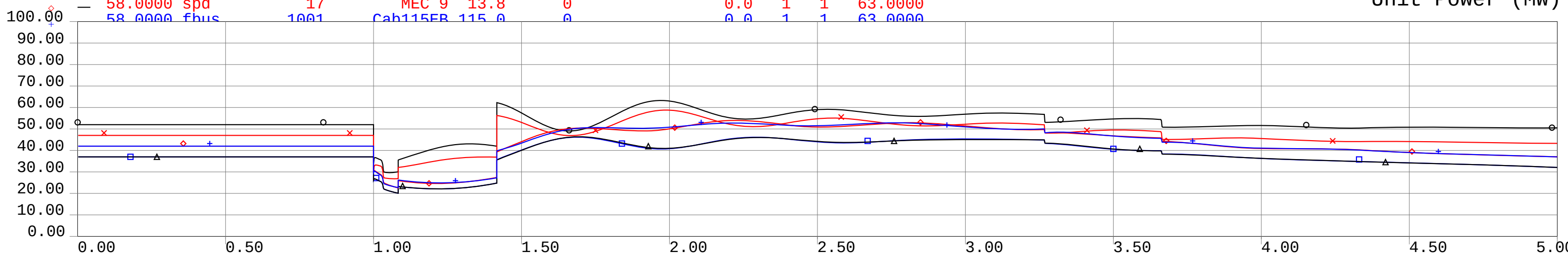
Unit Speed & Bus Frequency (Hz)



Time (sec)

58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

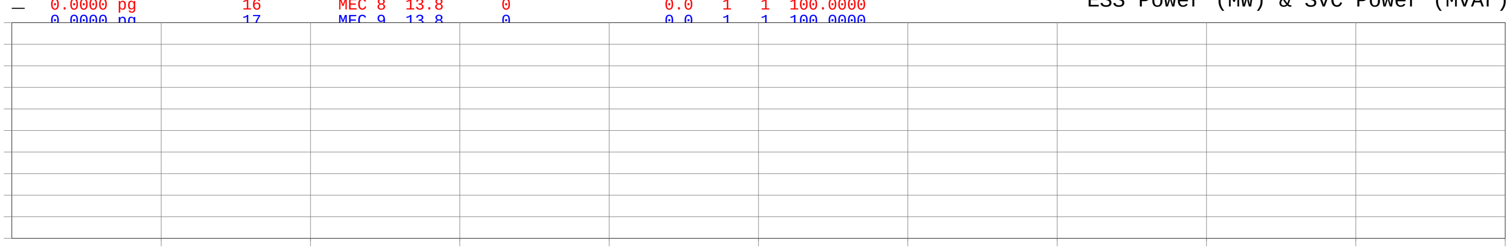
Unit Power (MW)



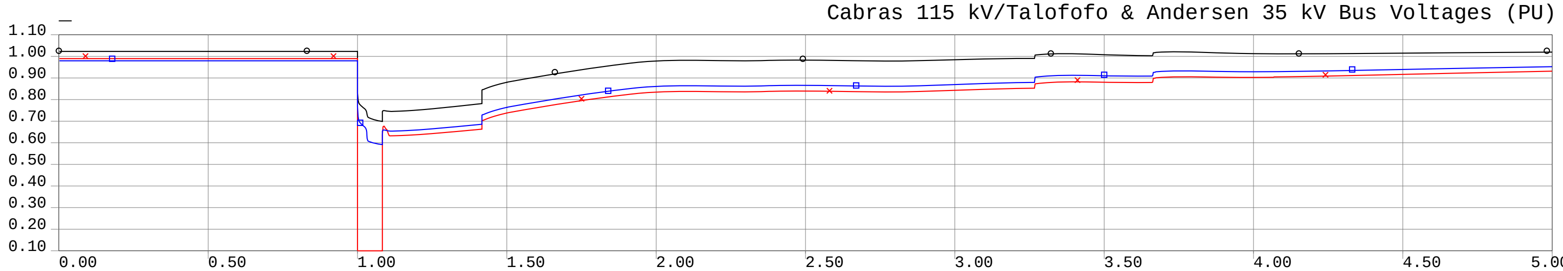
Time(sec)

0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



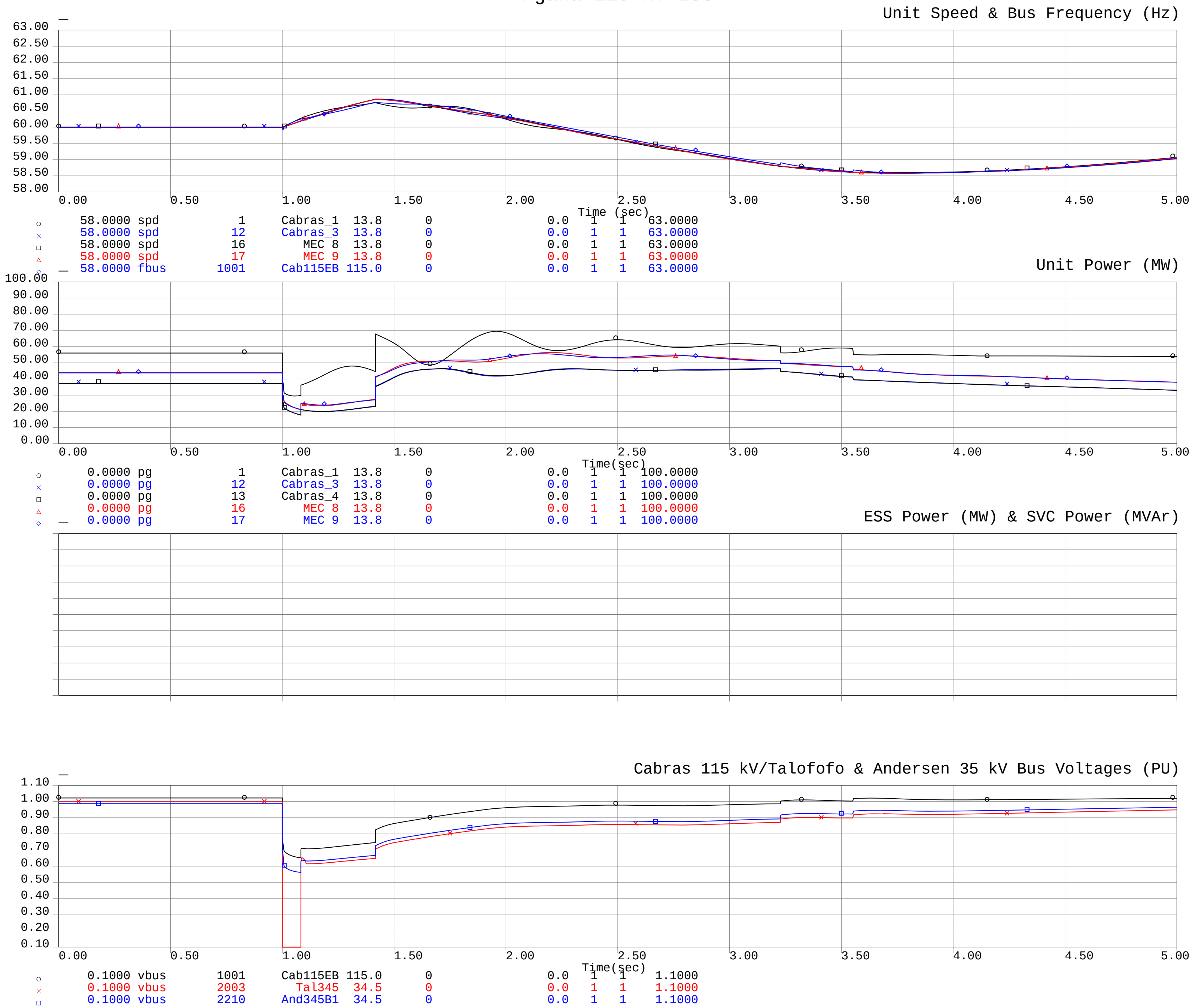
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



Time(sec)

0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



chans/2400_40a_lf11_fidvr_ex.chf

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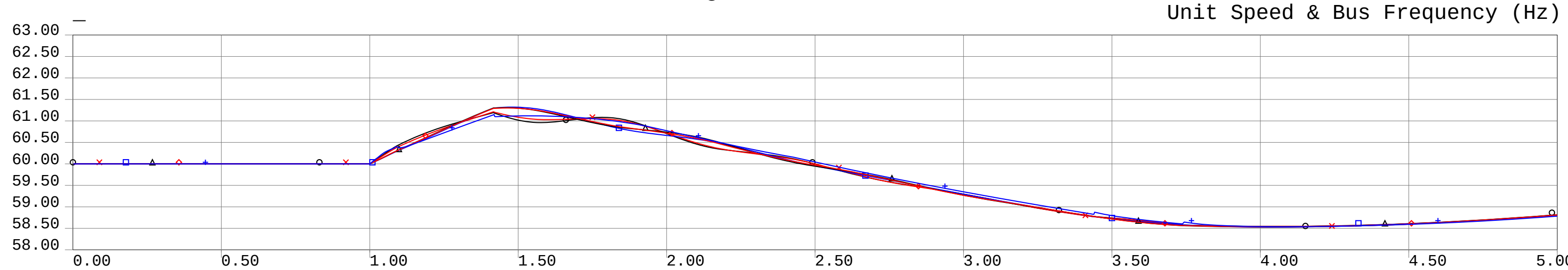
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)

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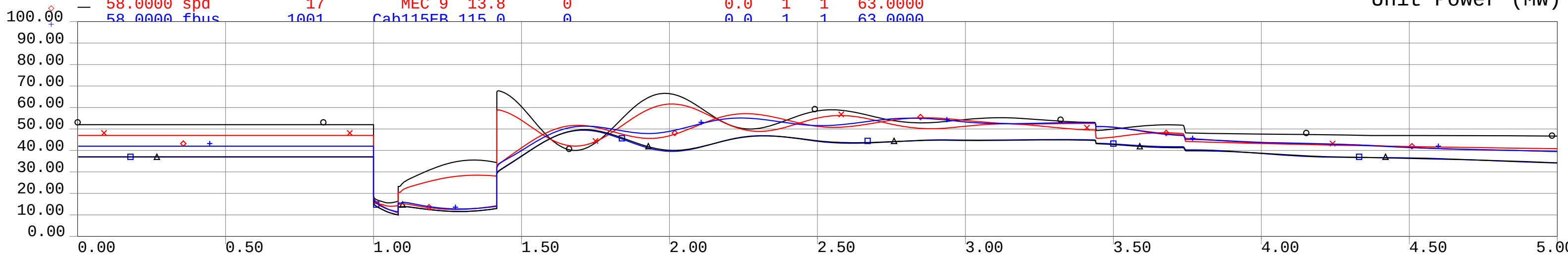
58.0000 spd      1    Cabras_1  13.8   0    0.0  1  1  63.0000
58.0000 spd      2    Cabras_2  13.8   0    0.0  1  1  63.0000
58.0000 spd     12    Cabras_3  13.8   0    0.0  1  1  63.0000
58.0000 spd     16       MEC 8  13.8   0    0.0  1  1  63.0000
58.0000 spd     17       MEC 9  13.8   0    0.0  1  1  63.0000
58.0000 fbus  1001    Cab115EB 115.0   0    0.0  1  1  63.0000
```

Unit Power (MW)

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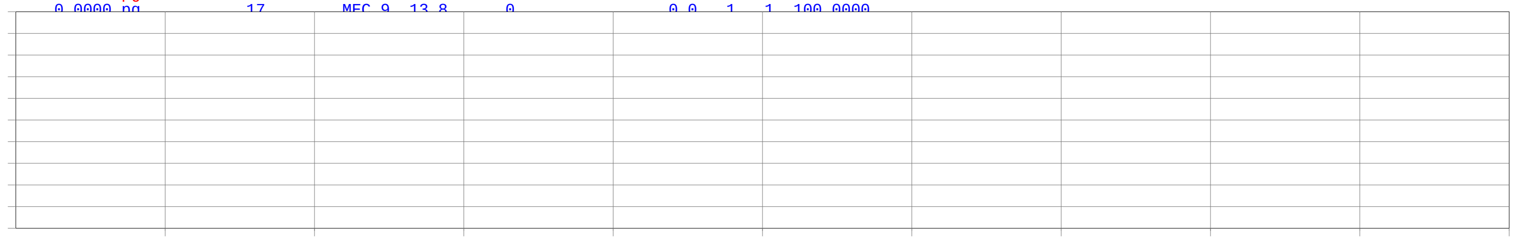
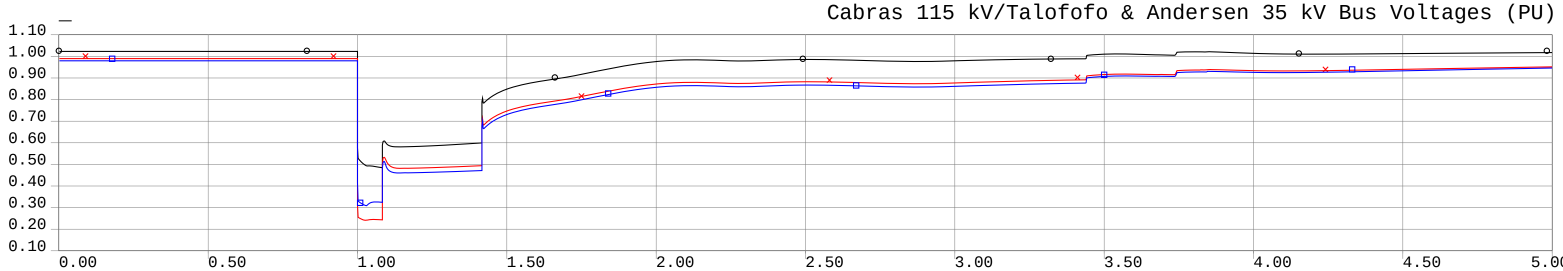
0.0000 pg      1    Cabras_1  13.8   0    0.0  1  1  100.0000
0.0000 pg      2    Cabras_2  13.8   0    0.0  1  1  100.0000
0.0000 pg     12    Cabras_3  13.8   0    0.0  1  1  100.0000
0.0000 pg     13    Cabras_4  13.8   0    0.0  1  1  100.0000
0.0000 pg     16       MEC 8  13.8   0    0.0  1  1  100.0000
0.0000 pg     17       MEC 9  13.8   0    0.0  1  1  100.0000
```

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)




```
0.1000 vbus  1001  Cab115EB 115.0   0    0.0  1  1  1.1000
0.1000 vbus  2003    Tal345  34.5   0    0.0  1  1  1.1000
0.1000 vbus  2210  And345B1  34.5   0    0.0  1  1  1.1000
```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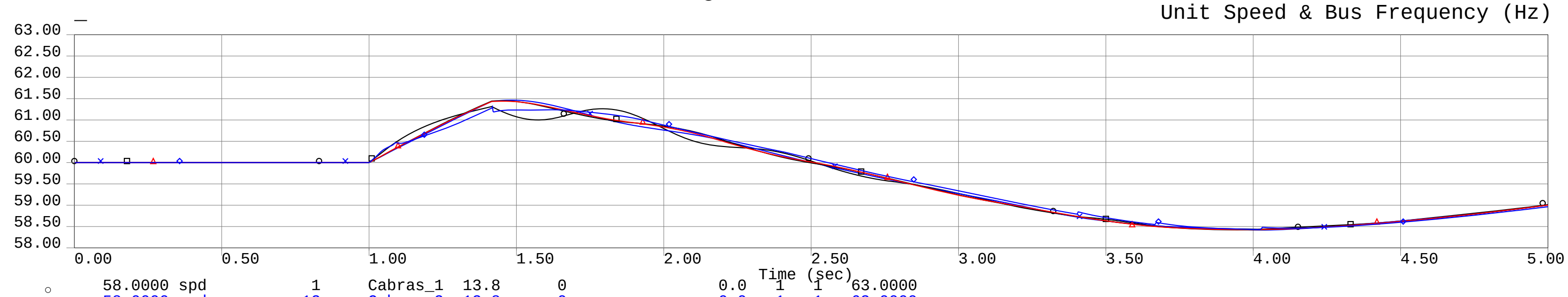
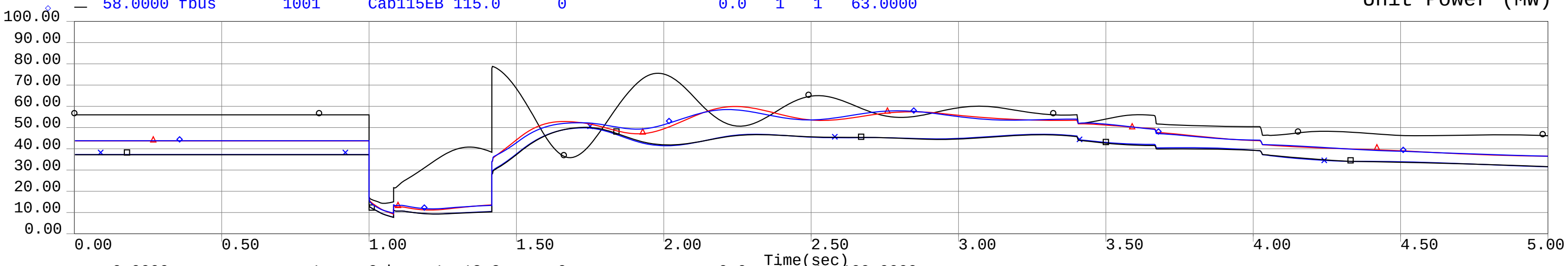
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



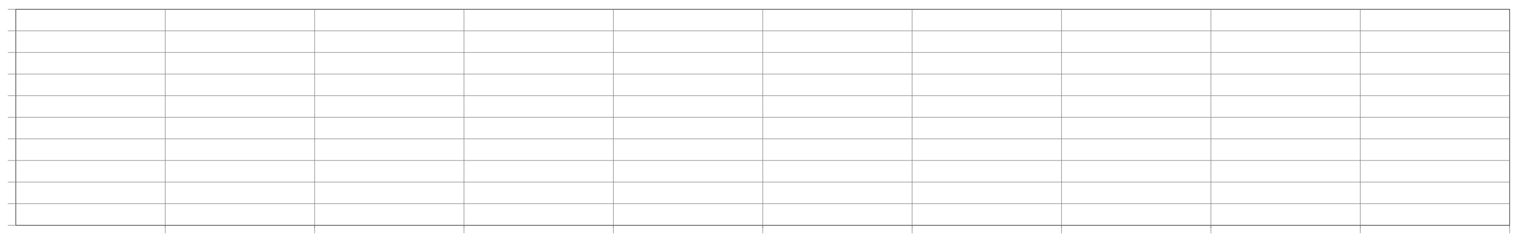
○	58.0000 spd	1	Cabras_1 13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3 13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8 13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9 13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB 115.0	0	0.0	1	1	63.0000

Unit Power (MW)

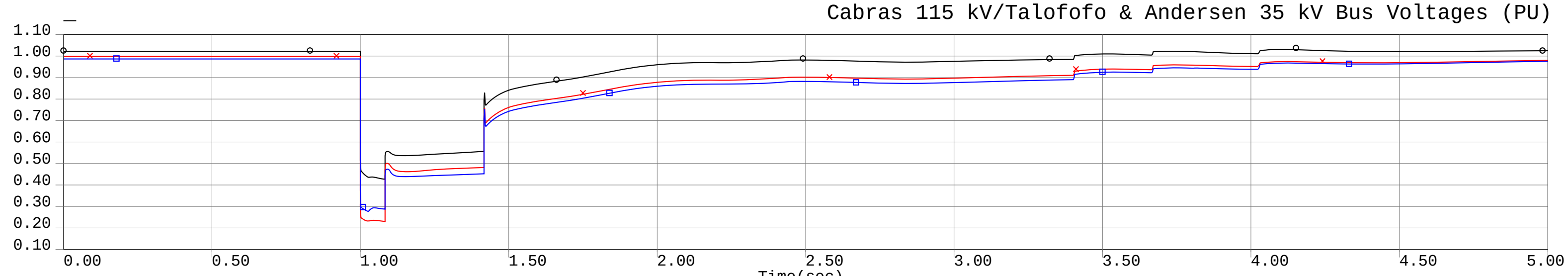


○	0.0000 pg	1	Cabras_1 13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3 13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4 13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8 13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9 13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB 115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345 34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1 34.5	0	0.0	1	1	1.1000

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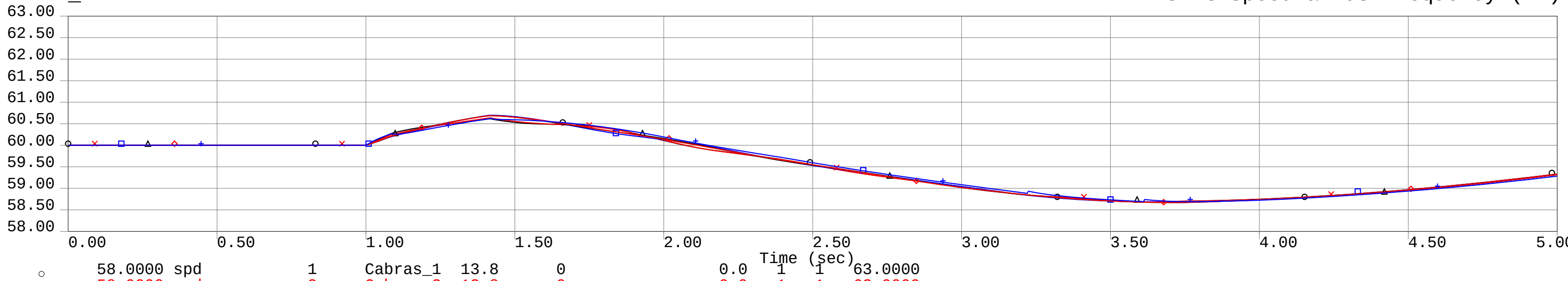
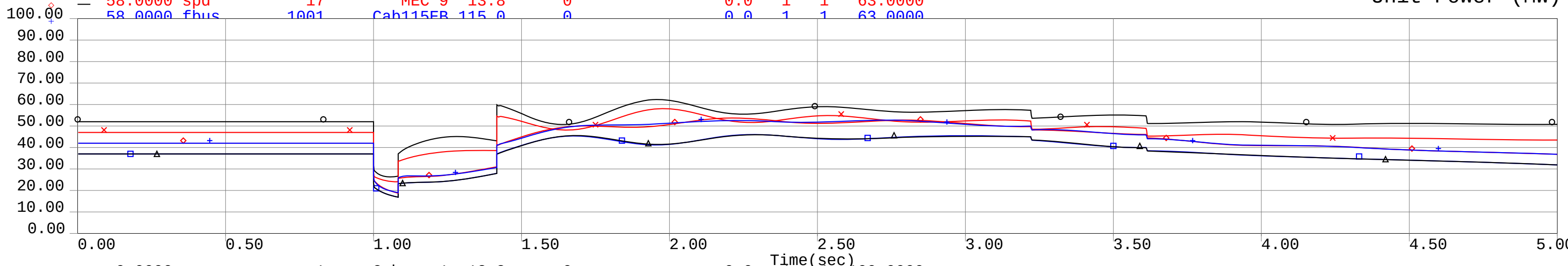
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



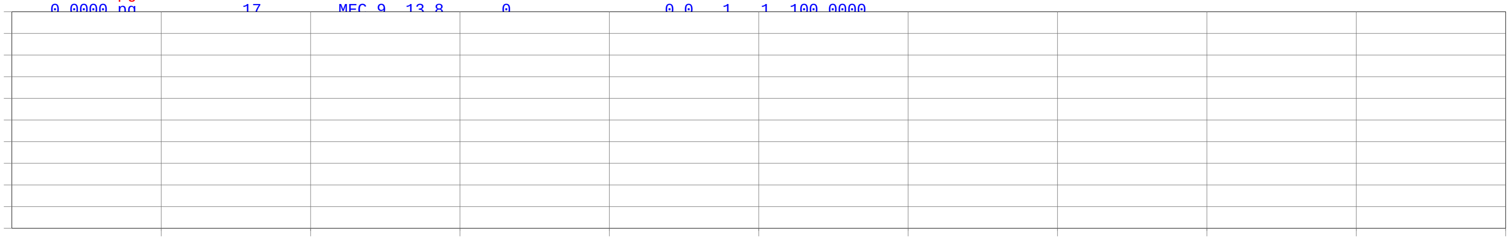
58.0000	spd	1	Cabras_1	13.8	0	0.0	1 1	63.0000
58.0000	spd	2	Cabras_2	13.8	0	0.0	1 1	63.0000
58.0000	spd	12	Cabras_3	13.8	0	0.0	1 1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1 1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1 1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1 1	63.0000

Unit Power (MW)

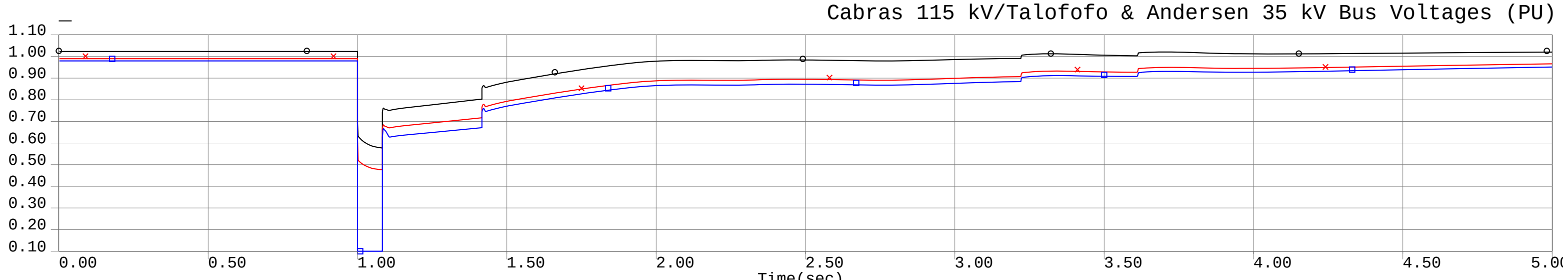


0.0000	pg	1	Cabras_1	13.8	0	0.0	1 1	100.0000
0.0000	pg	2	Cabras_2	13.8	0	0.0	1 1	100.0000
0.0000	pg	12	Cabras_3	13.8	0	0.0	1 1	100.0000
0.0000	pg	13	Cabras_4	13.8	0	0.0	1 1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1 1	100.0000
0.0000	pg	17	MEC 9	13.8	0	0.0	1 1	100.0000

ESS Power (MW) & SVC Power (MVAr)



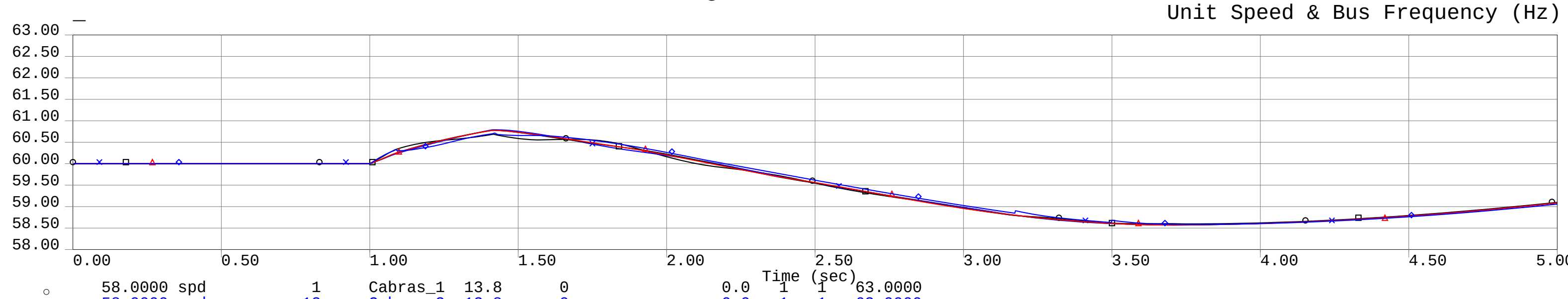
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000	vbus	1001	Cab115EB	115.0	0	0.0	1 1	1.1000
0.1000	vbus	2003	Tal345	34.5	0	0.0	1 1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1 1	1.1000

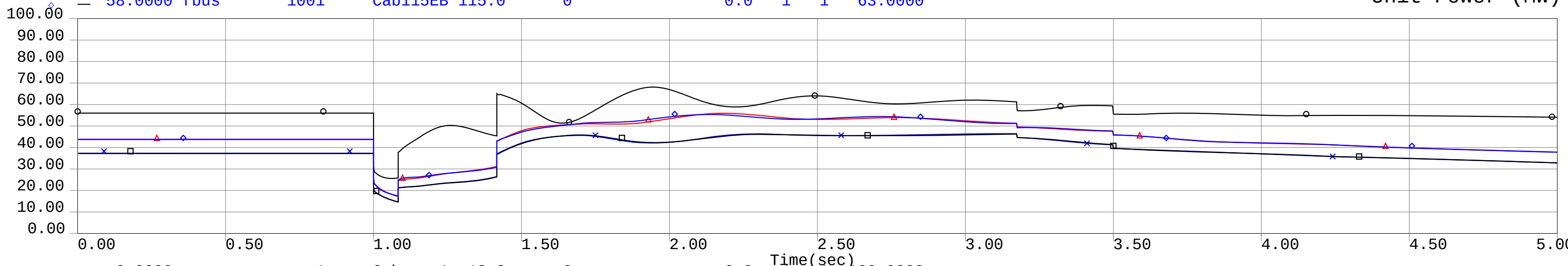
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



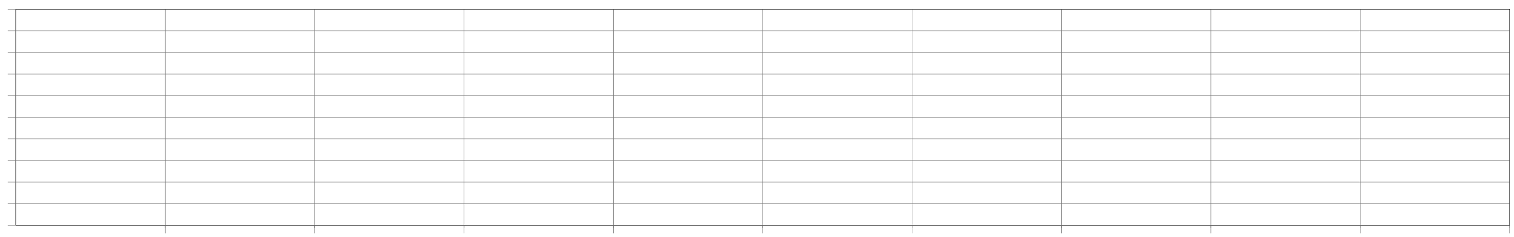
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)

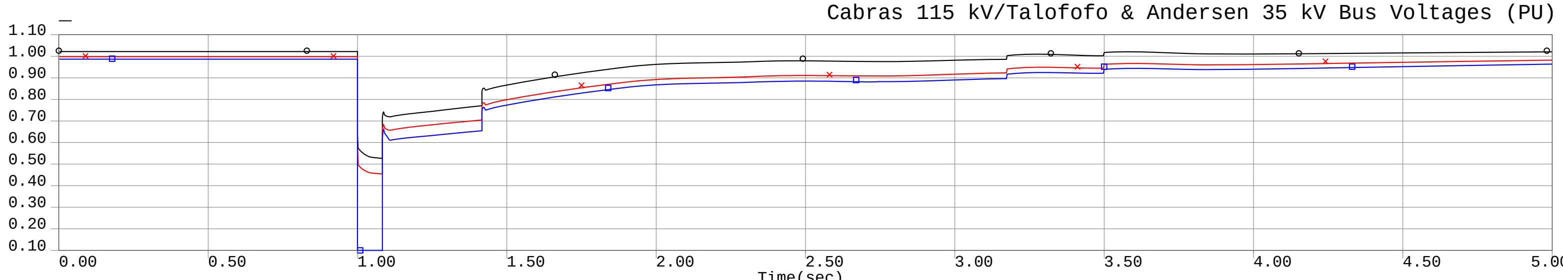


○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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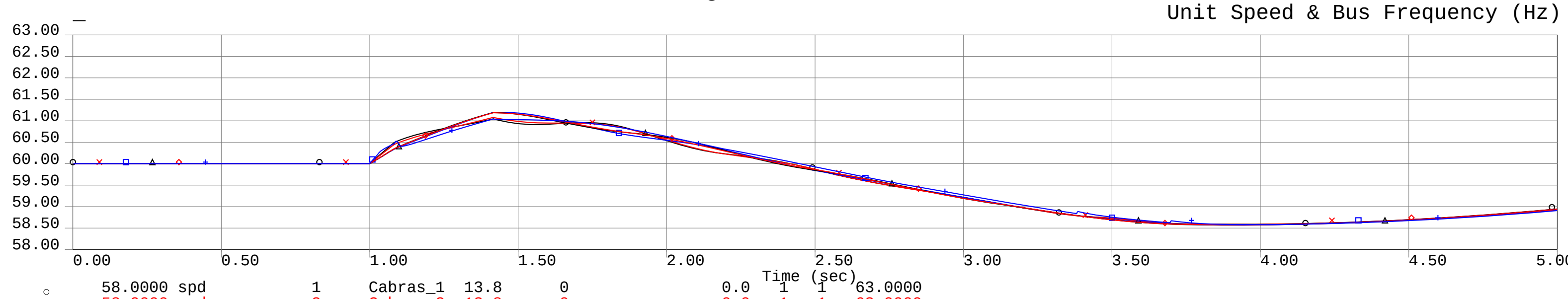
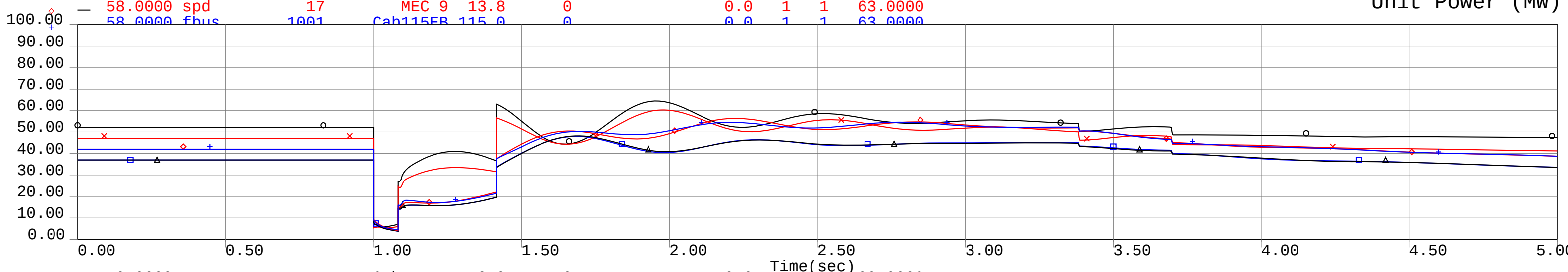
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



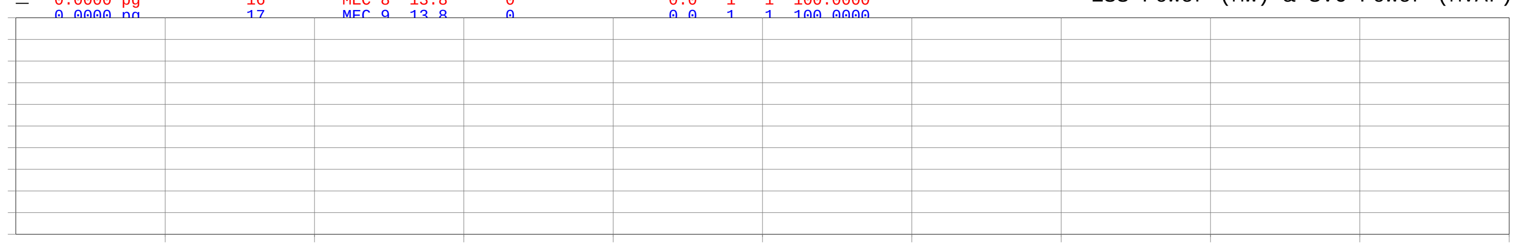
58.0000 spd 1 Cabras_1 13.8 0 0.0 1 1 63.0000
58.0000 spd 2 Cabras_2 13.8 0 0.0 1 1 63.0000
58.0000 spd 12 Cabras_3 13.8 0 0.0 1 1 63.0000
58.0000 spd 16 MEC 8 13.8 0 0.0 1 1 63.0000
58.0000 spd 17 MEC 9 13.8 0 0.0 1 1 63.0000
58.0000 fbus 1001 Cab115EB 115.0 0 0.0 1 1 63.0000

Unit Power (MW)

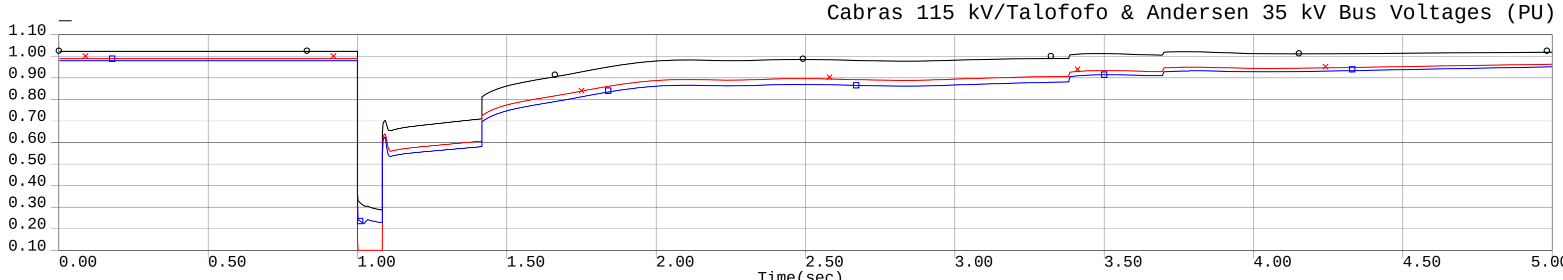


0.0000 pg 1 Cabras_1 13.8 0 0.0 1 1 100.0000
0.0000 pg 2 Cabras_2 13.8 0 0.0 1 1 100.0000
0.0000 pg 12 Cabras_3 13.8 0 0.0 1 1 100.0000
0.0000 pg 13 Cabras_4 13.8 0 0.0 1 1 100.0000
0.0000 pg 16 MEC 8 13.8 0 0.0 1 1 100.0000
0.0000 pg 17 MEC 9 13.8 0 0.0 1 1 100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus 1001 Cab115EB 115.0 0 0.0 1 1 1.1000
0.1000 vbus 2003 Tal345 34.5 0 0.0 1 1 1.1000
0.1000 vbus 2210 And345B1 34.5 0 0.0 1 1 1.1000

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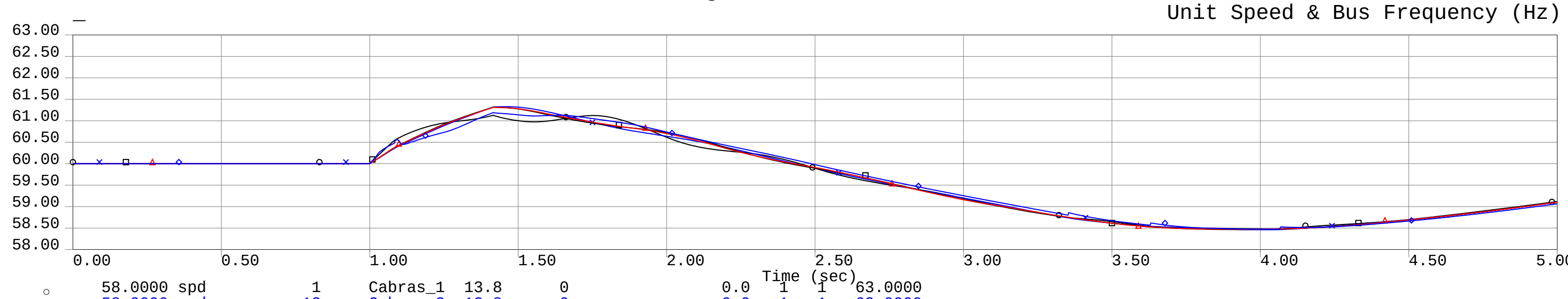
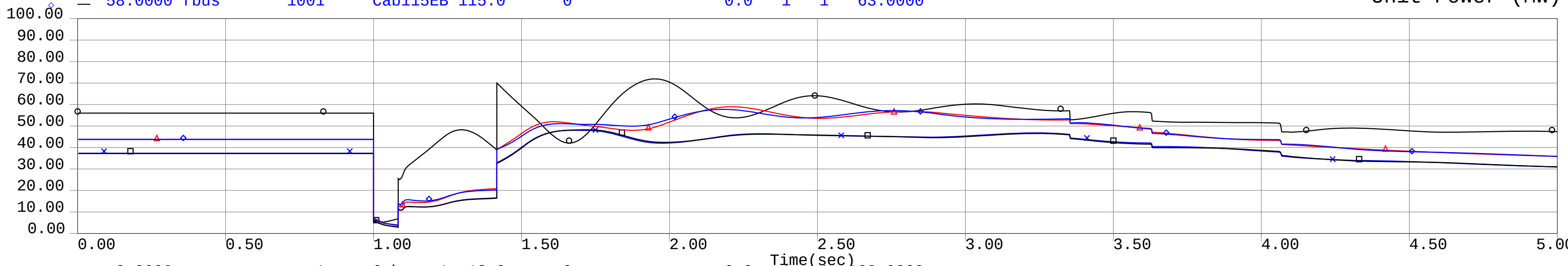
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



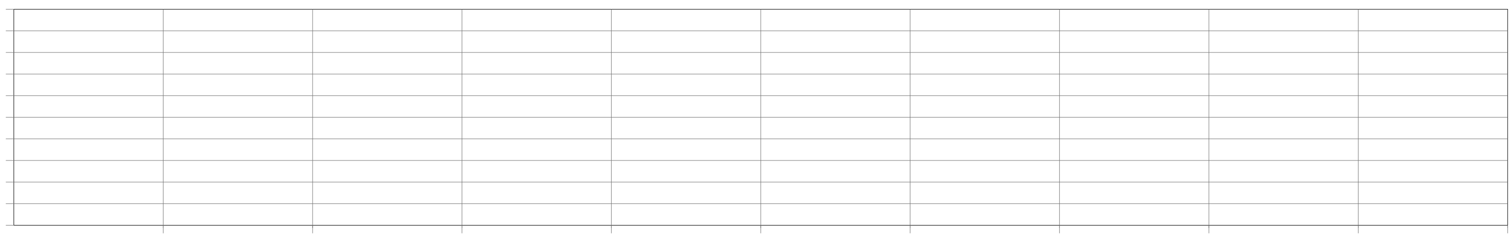
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)

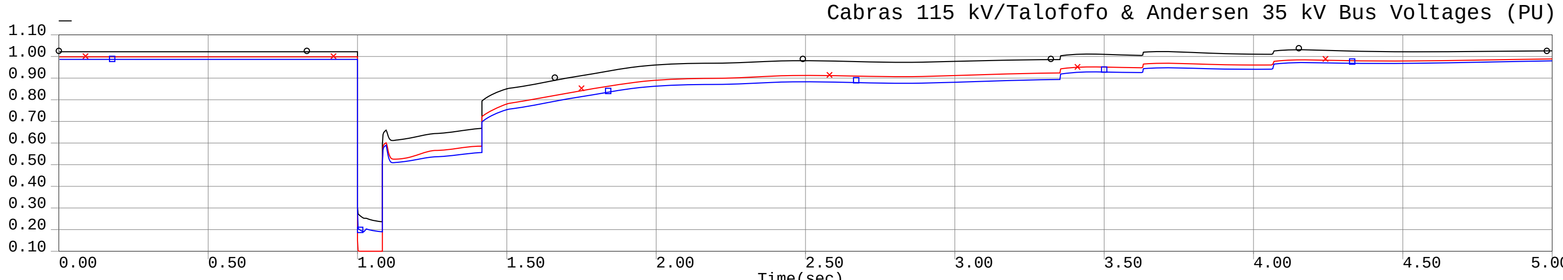


○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



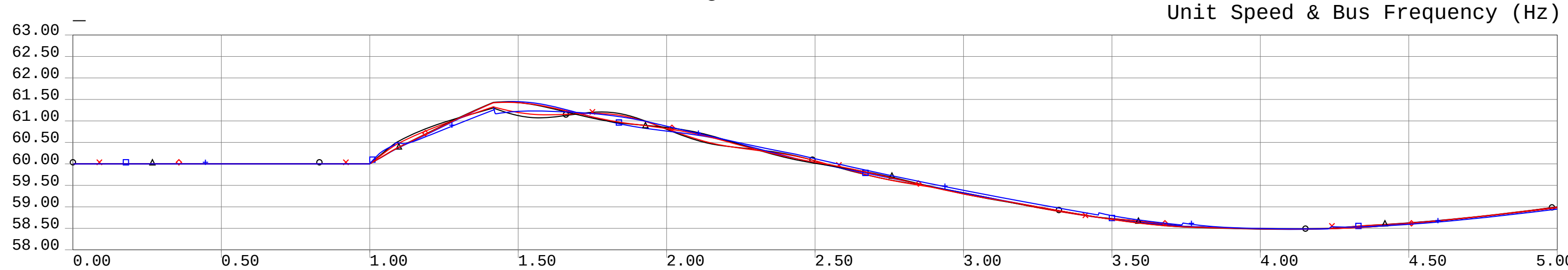
Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

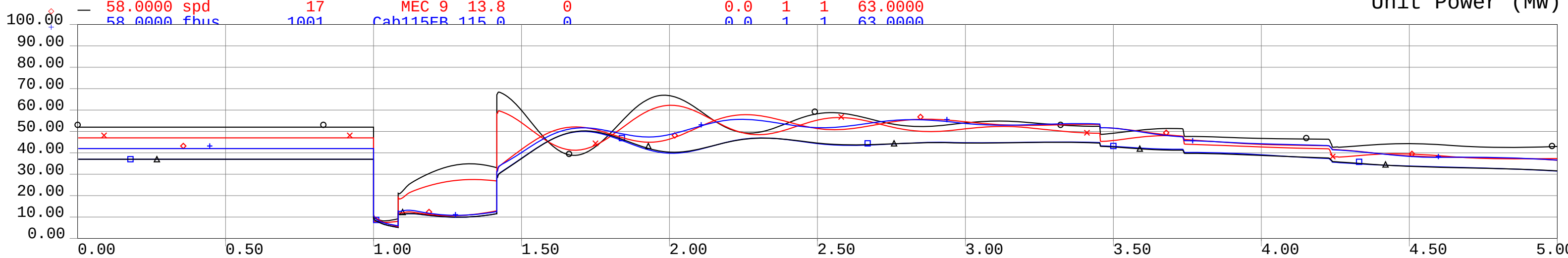
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



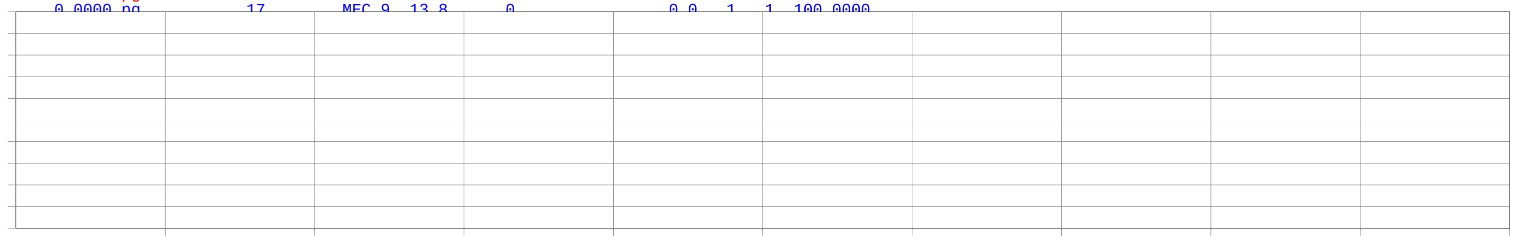
58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)

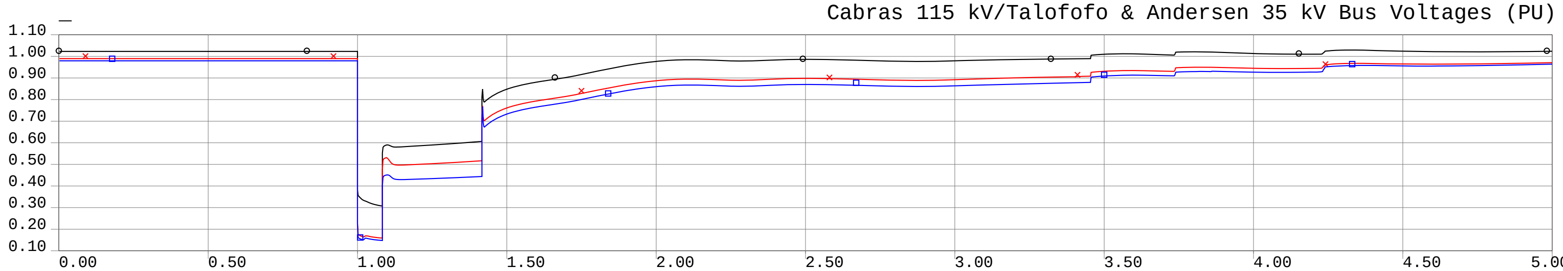


0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
0.0000 pg	2	Cabras_2	13.8	0	0.0	1	1	100.0000
0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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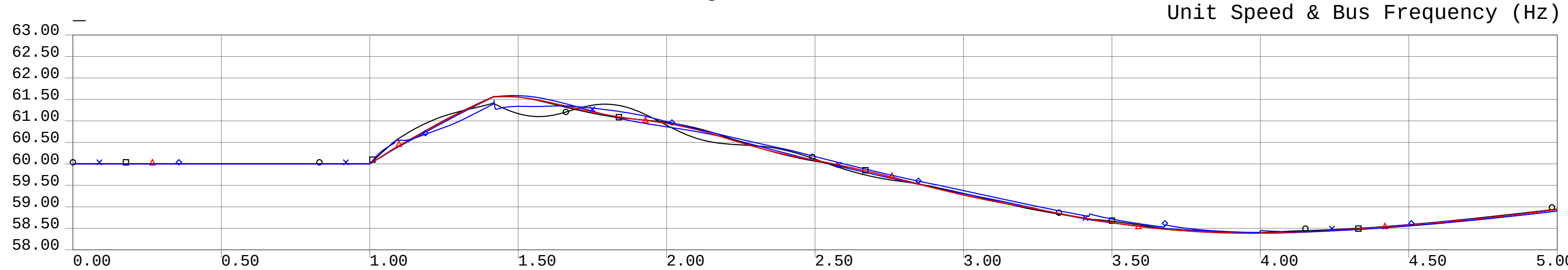
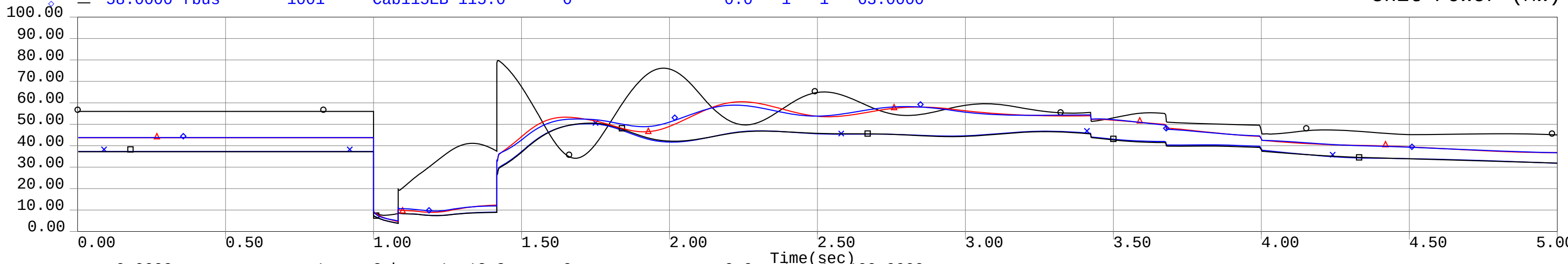
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



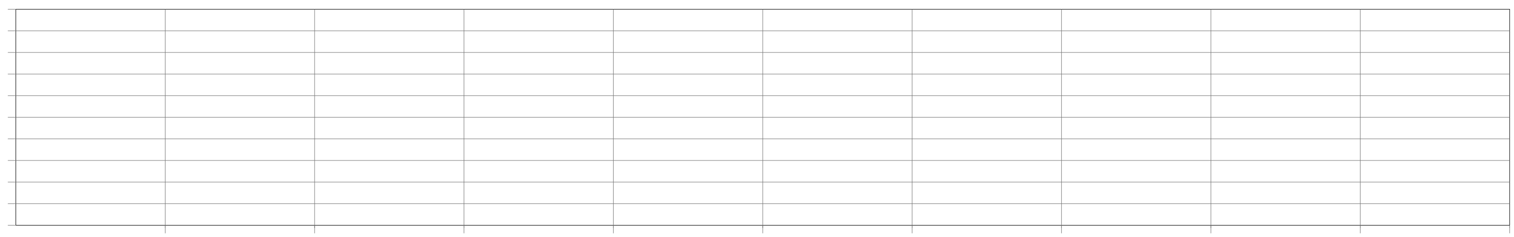
○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
◇	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)

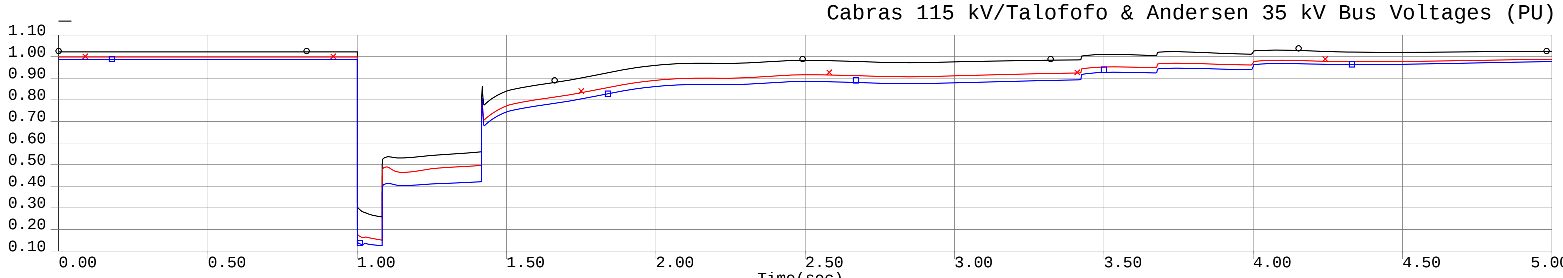


○	0.0000 pg	1	Cabras_1	13.8	0	0.0	1	1	100.0000
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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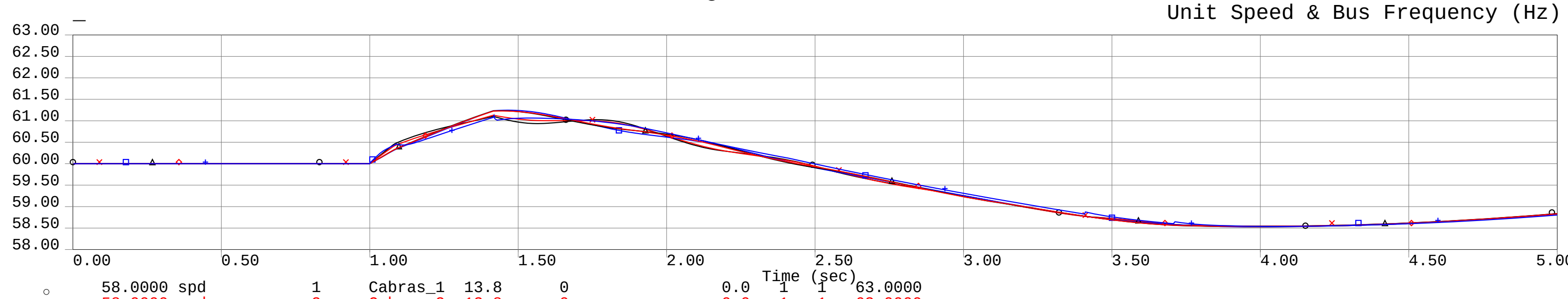
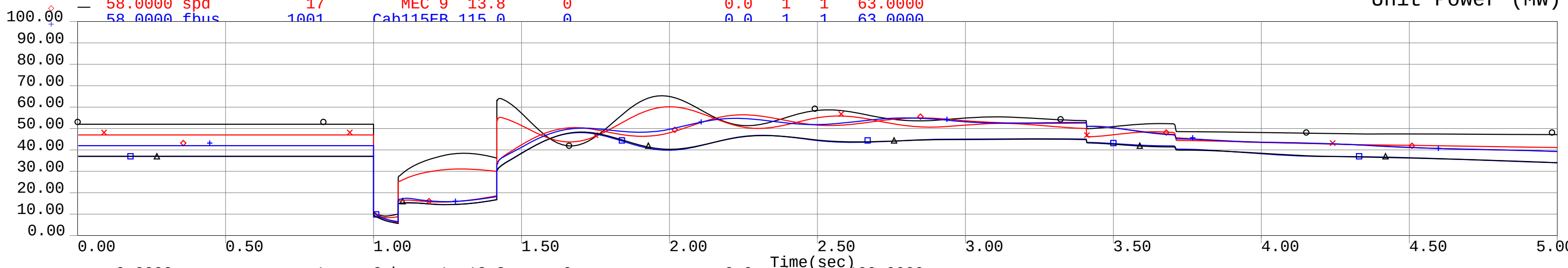
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



○	58.0000 spd	1	Cabras_1	13.8	0	0.0	1	1	63.0000
×	58.0000 spd	2	Cabras_2	13.8	0	0.0	1	1	63.0000
□	58.0000 spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
◇	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
+	58.0000 fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



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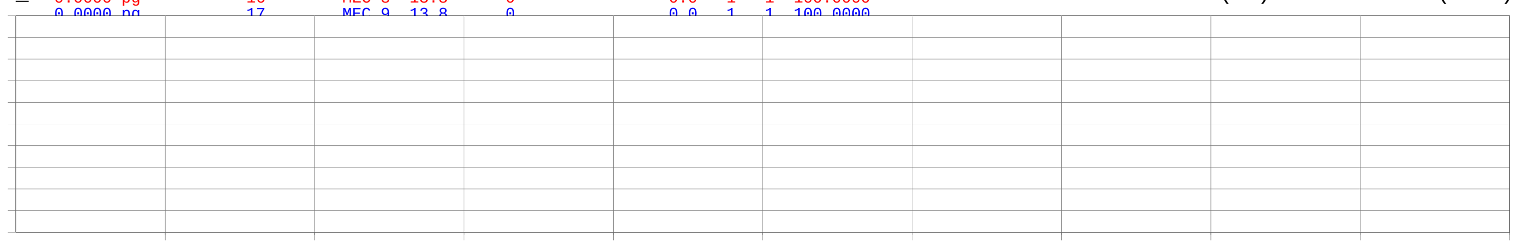
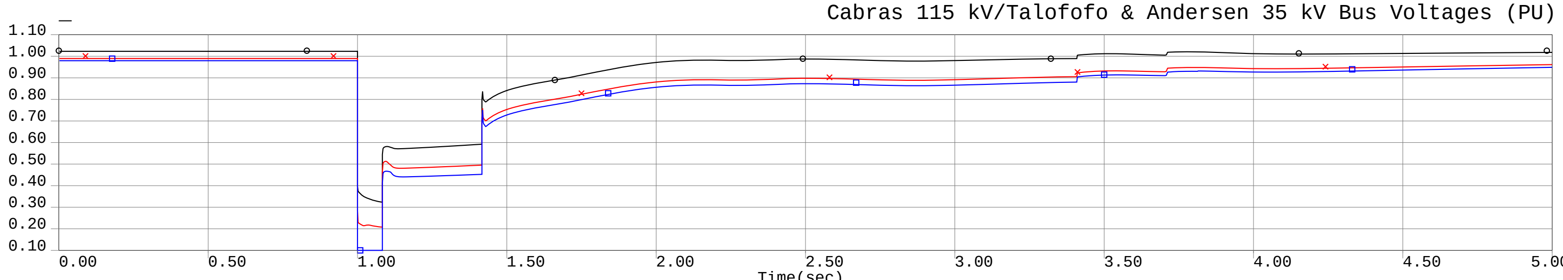
□	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
+	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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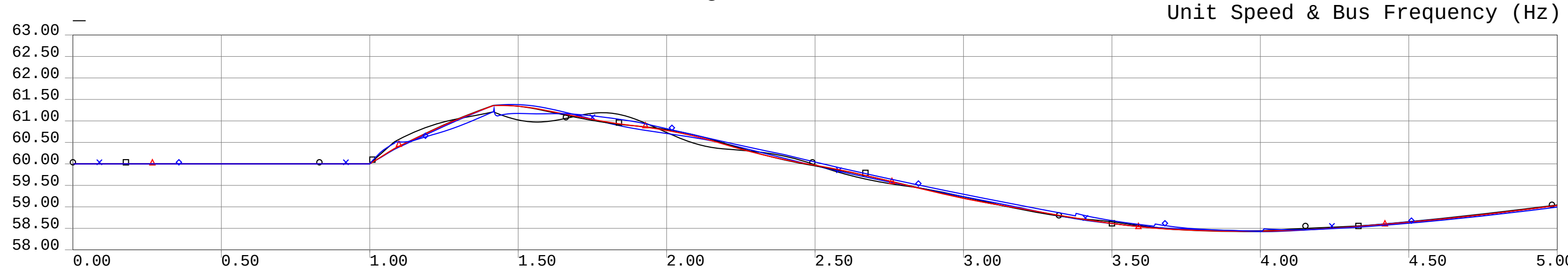
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



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58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
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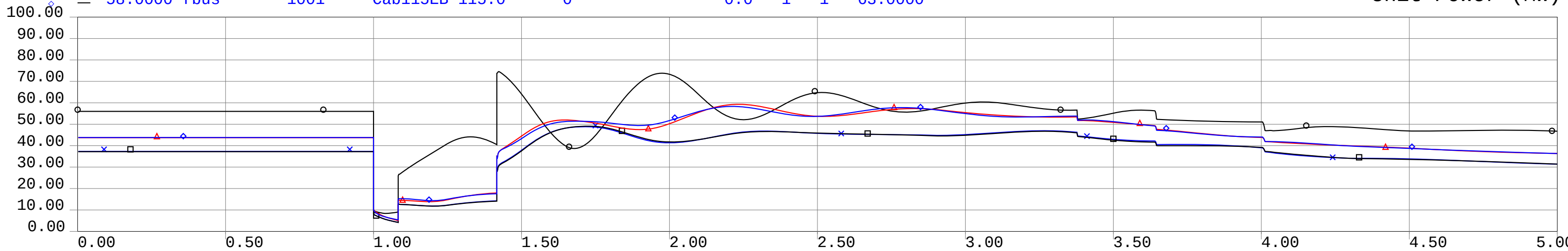

Min	Type	Bus	Name	kV					Max
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0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
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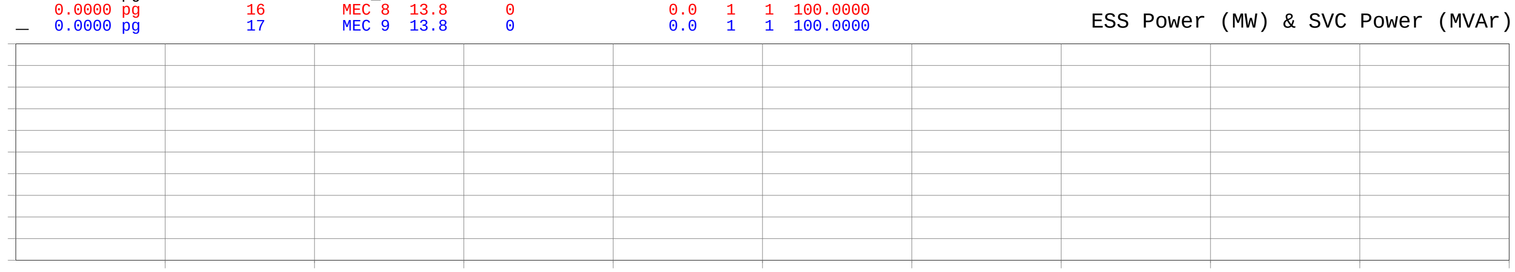

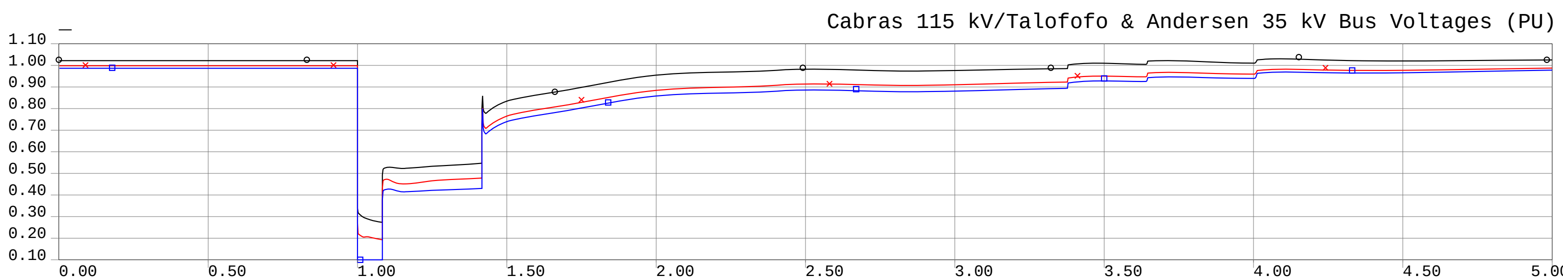

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0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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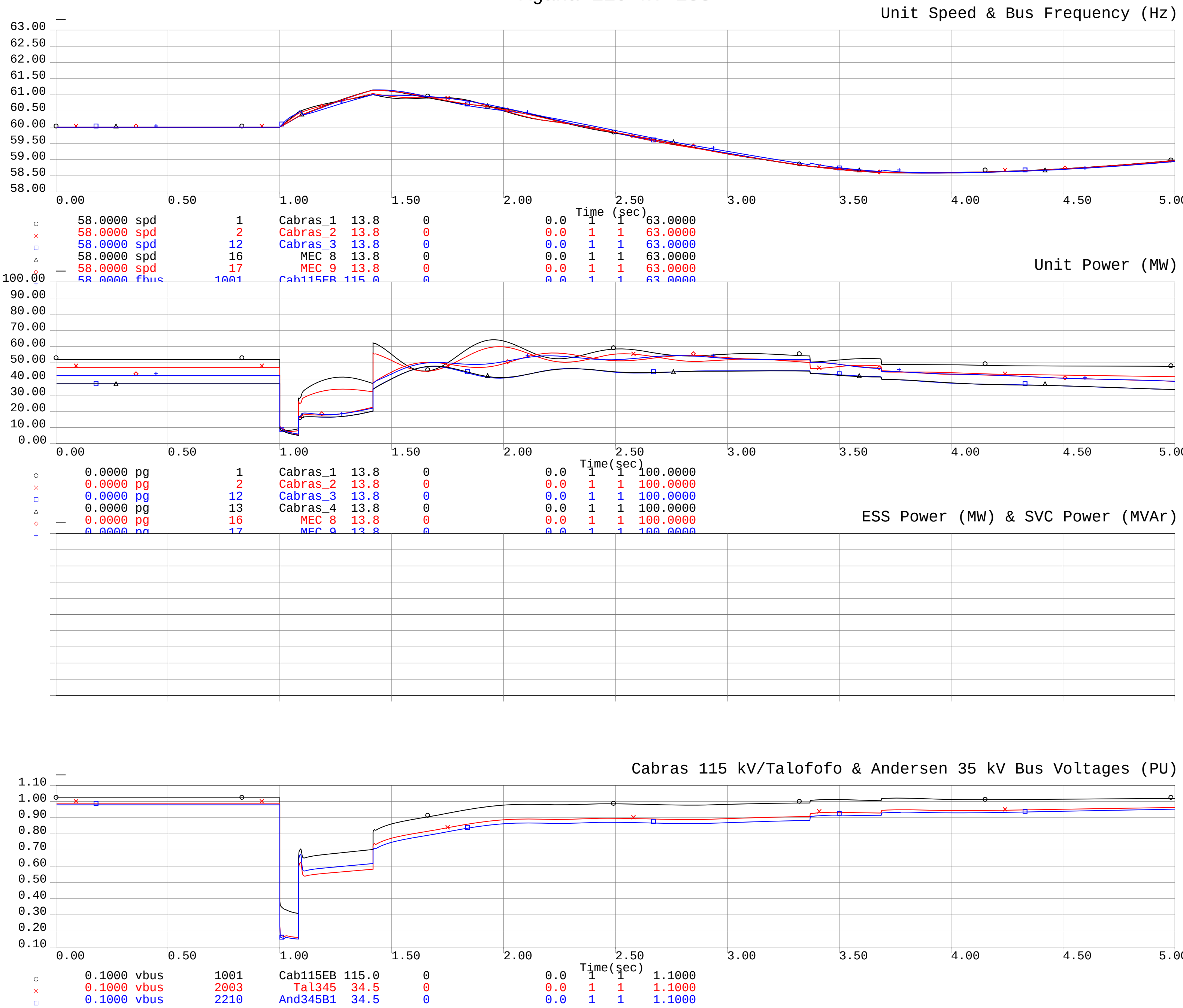
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS



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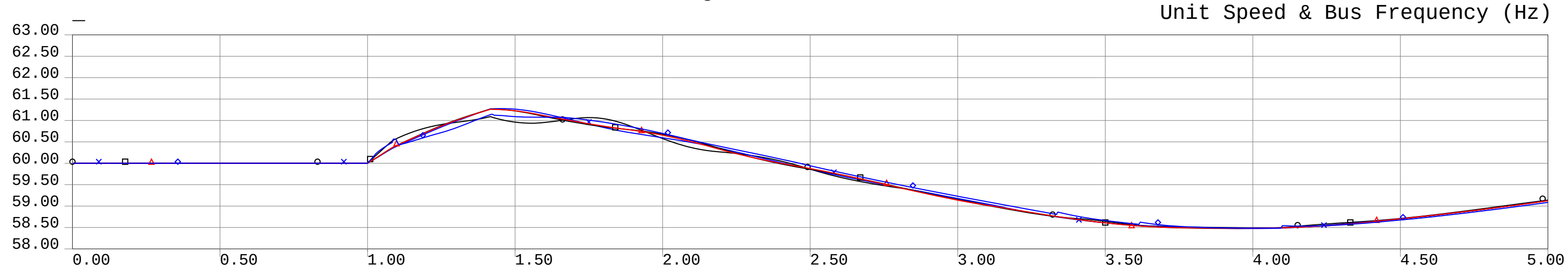
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



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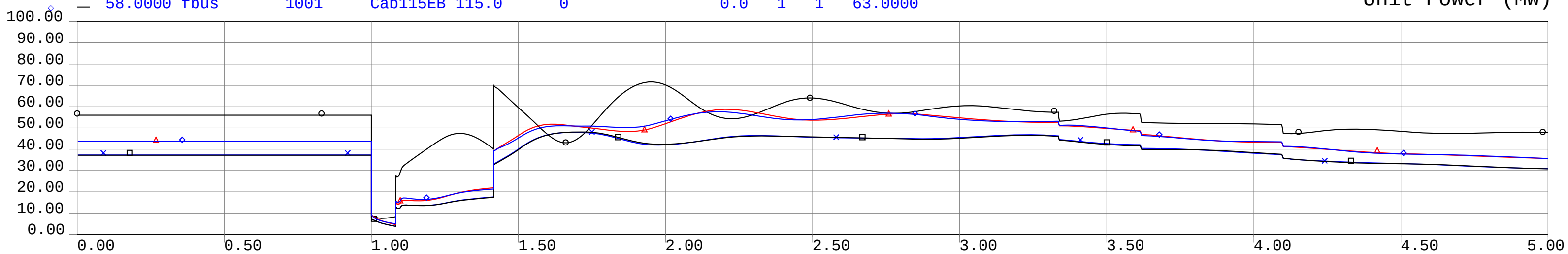
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



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0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
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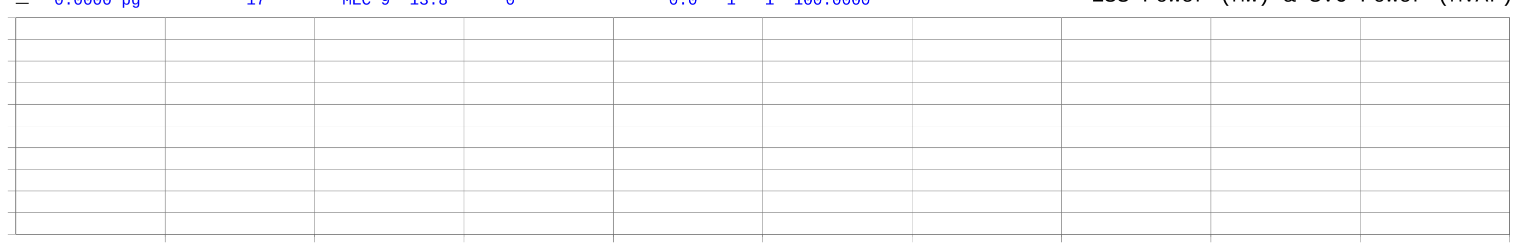
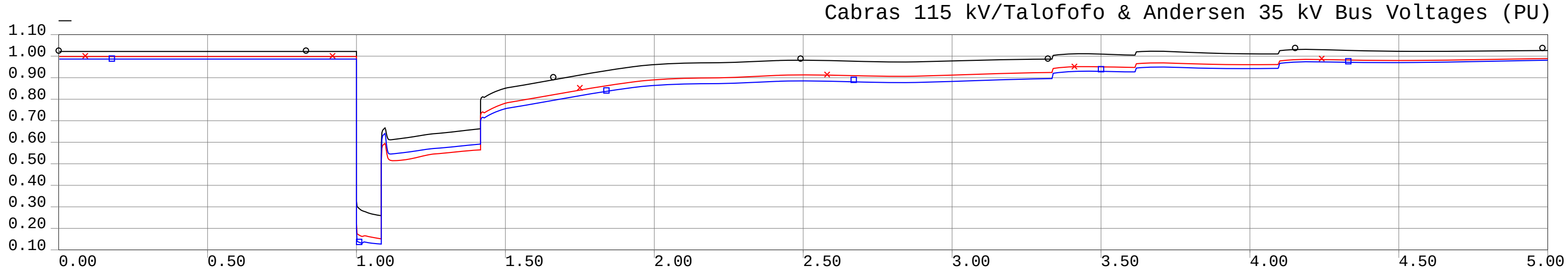
ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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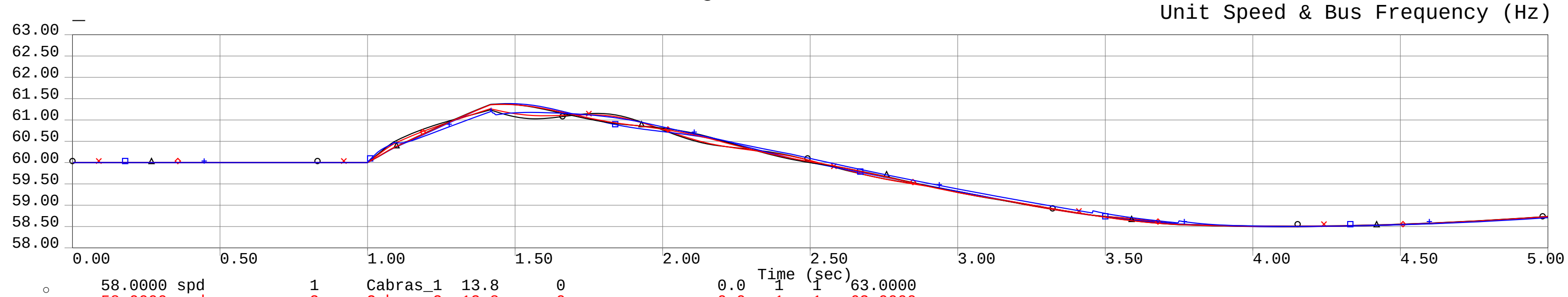
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



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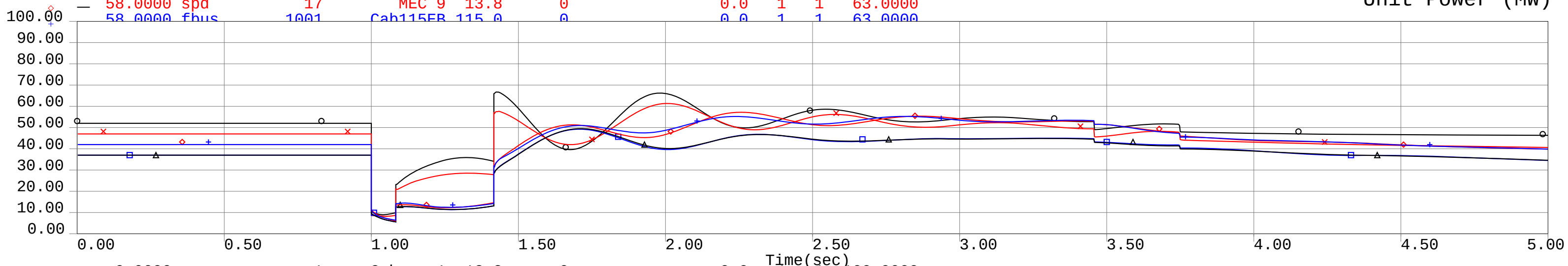
58.0000	spd	12	Cabras_3	13.8	0	0.0	1	1	63.0000
58.0000	spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
58.0000	spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
58.0000	fbus	1001	Cab115EB	115.0	0	0.0	1	1	63.0000

Unit Power (MW)



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0.0000	pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
0.0000	pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
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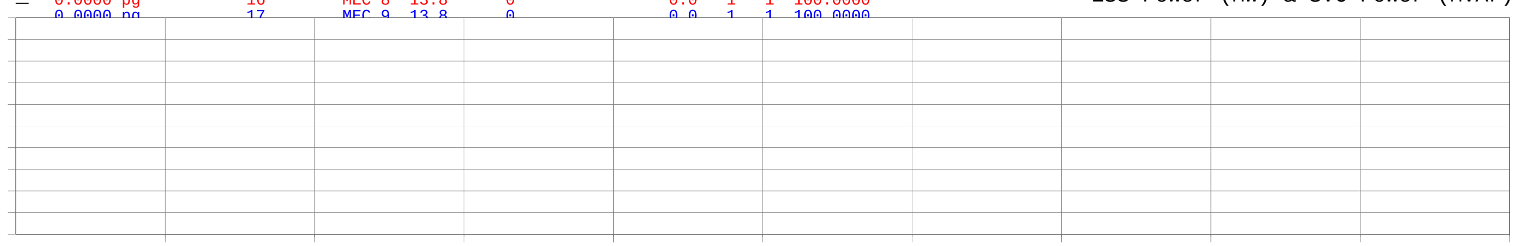
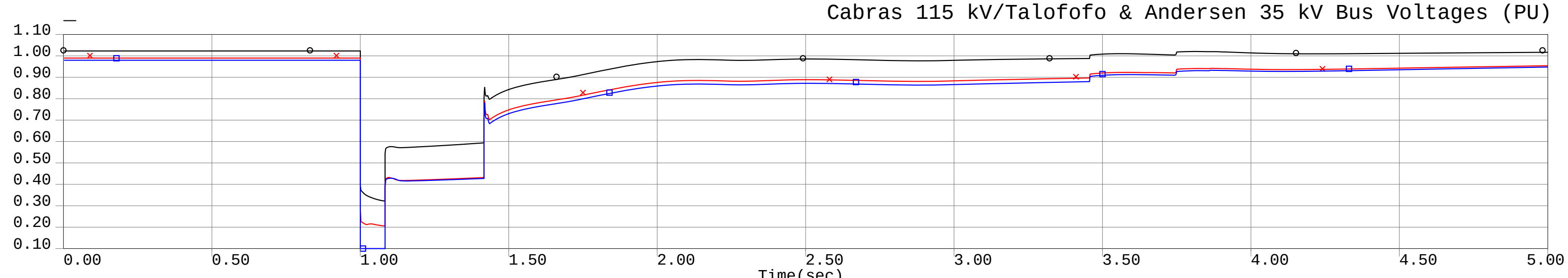
ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



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0.1000	vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
0.1000	vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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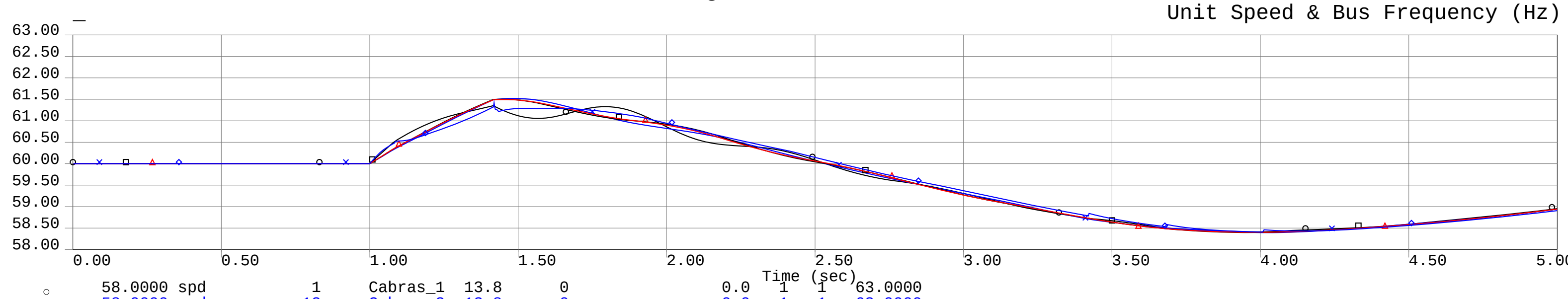
Guam Power Authority - EPS Energy Storage Analysis
Simulation Summary Results 3/2014
Agana 115 kV ESS

Unit Speed & Bus Frequency (Hz)



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□	58.0000 spd	16	MEC 8	13.8	0	0.0	1	1	63.0000
△	58.0000 spd	17	MEC 9	13.8	0	0.0	1	1	63.0000
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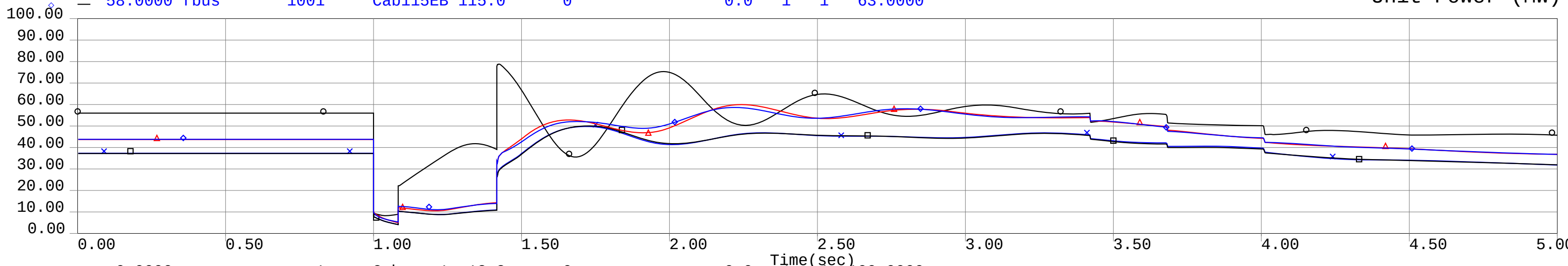
Unit Power (MW)



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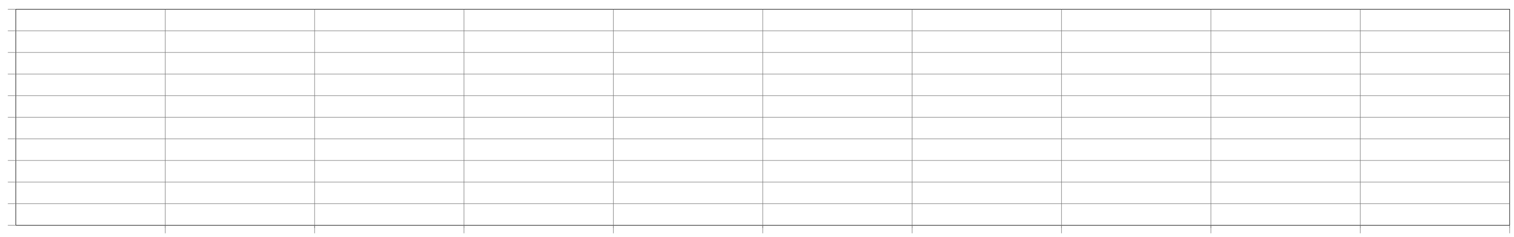
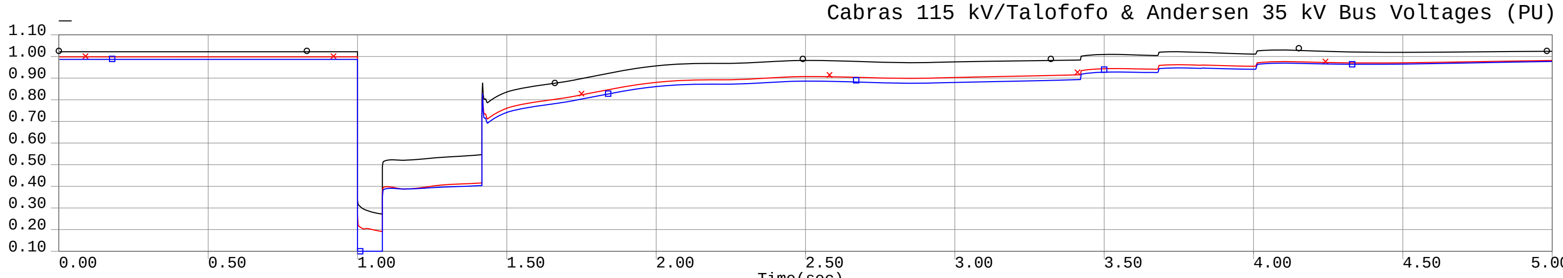
×	0.0000 pg	12	Cabras_3	13.8	0	0.0	1	1	100.0000
□	0.0000 pg	13	Cabras_4	13.8	0	0.0	1	1	100.0000
△	0.0000 pg	16	MEC 8	13.8	0	0.0	1	1	100.0000
◇	0.0000 pg	17	MEC 9	13.8	0	0.0	1	1	100.0000

ESS Power (MW) & SVC Power (MVAr)



Cabras 115 kV/Talofofo & Andersen 35 kV Bus Voltages (PU)



○	0.1000 vbus	1001	Cab115EB	115.0	0	0.0	1	1	1.1000
×	0.1000 vbus	2003	Tal345	34.5	0	0.0	1	1	1.1000
□	0.1000 vbus	2210	And345B1	34.5	0	0.0	1	1	1.1000

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APPENDIX C – PRELIMINARY ENVIRONMENTAL ASSESSMENT

Preliminary Environmental Assessment

Agana and MARBO Power Plants and Harmon Substation, Guam

Prepared for:

Guam Power Authority
1911 Rte 16
Harmon, Guam 96913

January 2014

PCR Environmental, Inc
111 East Sunset Blvd
Barrigada, Guam 96913
(671) 473-3560

EXECUTIVE SUMMARY

This Preliminary Environmental Assessment was prepared for the Guam Power Authority (GPA), through TG Engineers PC, and documents an investigation into known and potential environmental concerns at three (3) existing electrical facility sites on Guam. The scope of this investigation included a records search, site visits, and a review of past environmental reports. GPA is currently evaluating these three (3) sites for the future location a energy storage facilities associated with alternative power projects.

The subject properties include the Agana Power Plant, the MARBO Power Plant, and the Harmon Substation properties. The Agana Power Plant is located in Mongmong, and is approximately 6 acres in size fronting Serg. Roy T. Damian Jr Street. The Harmon Substation is located in Tamuning on Marine Corps Drive across from the Micronesia Mall. This property is 3.4 acres in size. The MARBO Power Plant property is located in Yigo, within the MARBO Annex of Andersen Air Force Base. This property is approximately 3 acres in size and is bordered to the west, south, and east by undeveloped land, and by an unnamed access road to the north.

This Preliminary Environmental Assessment has revealed the following environmental concerns:

Land use controls (LUCs) are present at the Agana Power Plant property because of remaining PCB soil contamination. The areas with contamination and LUC boundaries are identified as POI-4 East and POI-6 East.

LUCs are also present at the MARBO Power Plant property due to remaining PCB and Antimony soil contamination. The MARBO property has three (3) areas with land use controls.

For all three sites no documentation was available detailing lead based paint (LBP) surveys. Historical research indicates that all three (3) properties support structures built prior to 1978, when the use of LBP was phased out. If there are going to be any renovations or demolition of the subject structures, LBP surveys would be required to identify this occupational health and environmental concern.

There are no records of asbestos containing material (ACM) surveys for the Marbo Power Plant and Harmon Substation properties. Records were located that indicate that ACM is present at the Agana Power Plant property, of which only a portion has been removed. The use of facilities that have ACM will require an asbestos management plan and disclosure to employees. If there are going to be renovations or demolition of structures on the subject properties, asbestos surveys and waste management will be required.

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ACRONYMS AND ABBREVIATIONS

pCi/L	picocuries per liter
bgs	Below Ground Surface
AAFB	Anderson Air Force Base
ACM	Asbestos Containing Material
AHERA	Asbestos Hazard Emergency Response
AM	Action Memorandum
AST	Aboveground Storage Tanks
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	CERCLA Information System
DD	Decision Document
DU	Decision Units
EBS	Environmental Baseline Survey
ERNS	Emergency Response Notification System
FFA	Federal Facilities Agreement
FOIA	Freedom of Information Act
GEPA	Guam Environmental Protection Agency
GWA	Guam Waterworks Authority
HUD	Department of Housing and Development
kg	kilogram
LBP	Lead Based Paint
LQG	Large Quantity Generator
LUC	Land Use Control
LUCWP	Land Use Control Work Plan
MARBO	Marianas Bonins Command
MEC	Munitions and Explosives of Concern
mg	milligram
MSD	Minimum Search Distance
NFA	No Further Action
NFRAP	No Further Remedial Action Planned
NIOSH	National Institute for Occupational Safety and Health
NPL	National Priorities List
PEA	Preliminary Environmental Assessment
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PCR	PCR Environmental, Inc.
PL	Public Law
ppm	parts per million
PRE	Preliminary Risk Evaluation
RCRA	Resource Conservation and Recovery Act
RCRInfo	RCRA Information System
RI	Remedial Investigation
ROD	Record of Decision
RSE	Removal Site Evaluation
RVR	Remediation Verification Report
SPCC	Spill Prevention Control and Countermeasure
SQG	Small Quantity Generator
TCE	Trichloroethene

TCRA	Time-Critical Removal Action
TSCA	Toxic Substances and Control Act
TSD	Treatment, Storage & Disposal
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tanks
VOC	Volatile Organic Compound

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1 INTRODUCTION

This report summarizes the findings of a Preliminary Environmental Assessment (PEA) of known and potential environmental concerns at three (3) electrical facility sites on Guam. The investigation included a records search, site visits, and a review of past environmental reports. These three (3) sites are being evaluated for the future location of energy storage facilities associated with a solar power generation plant. All three (3) sites are currently owned by the U.S. Navy, but operated by GPA.

1.1 PREVIOUS REPORTS

Various environmental reports were reviewed during the completion of this PEA. Table 2-1 lists documents that were reviewed during the course of the assessment, and a brief summary of findings from them. Findings from these historical documents are discussed in more detail in the appropriate sections of the report.

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pcr environmental, inc.	Project: Preliminary Environmental Assessment for Agana and Marbo Power Plants and Harmon Substation, Guam	Figure 1-1
	Description: Site Locations Map	

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Table 1-1 Previous Reports

Investigation/Report (Author)	Date Reported	Findings
Environmental Baseline Survey (EBS) (Ogden)	1996	Review of historical records for various electrical utilities sites indicated onsite use and storage of Polychlorinated Biphenyls (PCBs), fuels, waste oils, and metals. Known releases were documented. Extent of contamination at sites not known.
Abbreviated Remedial Investigation (RI), PWC Guam, AOC 1, Marine Drive 2, Former Power Plant, Dededo, Guam (Earth Tech, Inc.)	October, 2000	Abbreviated RI for properties immediately adjacent to the Harmon Substation detected levels of pesticides, metals, and dioxins above screening criteria. Few samples exceeded screening criteria, and no further action was recommended.
Removal Site Evaluation (RSE), Various Electrical Utility Facilities COMNAVMAR, Guam (ECC)	January, 2008	The RSE report identified specific areas noted in the 1996 EBS to be addressed in a subsequent CERCLA Removal Action.
Action Memorandum (AM) For Time-Critical Removal Action Various Electrical Utility Facilities COMNAVMAR, Guam	December, 2008	The AM documents the decision by the Navy to undertake a time-critical removal action (TCRA) the MARBO Power Plant
Remediation Verification Report (RVR) Time Critical Removal Action Various Electrical Utility Sites Guam (ECC)	December, 2010	The RVR documents the TCRA activities conducted at six (6) sites, discusses the sites sampling results, and provides conclusions and recommendations with respect to each site's closure.
Decision Document (DD) No Further Action for Piti Power Plant, Harmon Substation, and Power Pole 141 Transmission Lines Site Guam (ETS)	September, 2011	The DD describes past site investigations, cleanup actions, and rationale for selecting No Further Action (NFA) as the final remedy for the Harmon Substation.
Land Use Control Work Plan (LUCWP) for Piti Substation, MARBO Power Plant, and Barrigada Substation (ETS)	September, 2011	The LUCWP recommends notice, monitoring, and enforcement mechanisms needed to ensure long-term effectiveness of LUCs at the sites, and identifies the roles and responsibilities of the Navy, Guam Environmental Protection Agency (GEPA), and subsequent property owners tasked with maintaining the LUCs.
Decision Document for Piti Substation, MARBO Power Plant, and Barrigada Substation Guam (ETS)	September, 2011	The DD presents the selected final remedy for contamination found at the MARBO Power Plant.

1.2 STANDARD ENVIRONMENTAL RECORD SOURCES

A review of data available from regulatory agencies can provide useful information regarding the potential for contamination at or near the subject properties. Records contained in Federal and local government databases were reviewed for relevant environmental information. Each subject property addressed in this PEA was evaluated for the following environmental indicators, which are expanded upon in the site-specific sections of this report.

1.2.1 Federal Environmental Data Base Records

Records were reviewed to help identify recognized environmental conditions in connection with the properties. Standard federal and local environmental record sources that were reasonably ascertainable, publicly available, and practically reviewable were evaluated. Attention was paid to the property itself, adjoining properties, and properties located within a minimum search distance (Table 1-2).

Table 1-2 Federal Databases, AMSD, and Version Date

Standard Environmental Record Sources (where available)	AMSD miles (kilometers)	Version Date
Federal NPL Site List	1.0 (1.6)	October 18, 2013
Federal CERCLIS List	0.5 (0.8)	October 18, 2013
Federal CERCLIS NFRAP List	0.5 (0.8)	October 18, 2013
Federal RCRA CORRACTS Facilities List	1.0 (1.6)	October 18, 2013
Federal RCRA TSD Facilities list (non-CORRACTS)	0.5 (0.8)	October 18, 2013
Federal RCRA generators list	Property and adjoining properties	October 18, 2013
Federal ERNS list	Property only	October 18, 2013

A review of federal databases included: the National Priorities List (NPL); the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) database, the Resource Conservation and Recovery Act (RCRA) Information (RCRAInfo) database, Enforcement & Compliance History Online (ECHO) Database, and the Federal Emergency Response Notification System (ERNS) list. A review of data available from regulatory agencies can provide useful information regarding the potential for contamination at or near the subject property.

Federal databases were searched exclusively online within established Federal environmental database websites, based on the location of the areas encompassing a pre-specified radius around the subject properties (Table 1-2). Sites were then identified within the approximate minimum search distance (MSD) for each individual site based on the comprehensive searches.

Federal databases are known to be incomplete and contain inaccuracies for properties on the island of Guam, with the result that all positive or negative findings are considered tentative and are subject to confirmation. The information in the databases searched is also updated on an irregular basis. The investigation has used the most recent update of each database, which were found to be publicly available, practically reviewable, and obtainable within a reasonable time and cost.

The databases searched for this PEA are discussed below.

1.2.2 National Priorities List (NPL) Database

The Federal NPL database contains a listing of contaminated sites that have been evaluated and found by the USEPA's Hazard Ranking System to present a demonstrated high risk to human health and the environment. The Unites States Environmental Protection Agency (USEPA) designates NPL sites as national priorities for cleanup.

1.2.3 Delisted National Priorities List (NPL) Database

The Federal Delisted NPL Database contains a listing of NPL sites that have been removed from the NPL List.

1.2.4 CERCLA Information System (CERCLIS) Database

The CERCLIS database is an inventory of hazardous and potentially hazardous waste sites being investigated or cleaned under CERCLA. The CERCLIS database provides site names, addresses and status of any investigation of cleanup.

1.2.5 CERCLA Information Systems (CERCLIS) NFRAP Database

CERCLIS No Further Remedial Action Planned (NFRAP) sites were reviewed through a search of archived sites using the Superfund Information Systems, Superfund Site Information Database. The 'Archived' designation indicates that a CERCLIS site has no further interest under the Federal Superfund Program based on available information and therefore, no further remedial action is currently planned.

1.2.6 RCRA Information (RCRAInfo) Database

RCRAInfo database is a compilation of data concerning hazardous waste activity, including the status of registrations, permits, reports, inspections, enforcement activities, and financial data for facilities regulated under RCRA. The database categorizes RCRA facilities by type (large or small quantity generator (LQG, SQG), conditionally exempt, transporter, treatment, storage and disposal (TSD) facility, and unspecified universe).

1.2.7 Enforcement & Compliance History Online (ECHO) Database

ECHO provides compliance and enforcement information for USEPA regulated facilities. The data covered by the ECHO database covers the past five years. For the purposes of this PEA, the ECHO database was used to identify RCRA facilities with corrective action activity within a specified search distance of the subject properties.

1.2.8 Federal Emergency Response Notification System (ERNS) List

The NRC is the sole national point of contact for reporting all oil, chemical, radiological, biological, and etiological discharges into the environment anywhere in the United States and its territories. The NRC provides all spill data reported to the center since 1990 in the ERNS List.

1.2.9 Local Environmental Records

In general there are no Internet accessible environmental databases for local government agencies. Research into local environmental records is conducted through personal interviews or through a formal Freedom of Information Act (FOIA) requests to agencies such as the Guam Environmental Protection Agency (GEPA). Generally, research was focused on the subject property and surrounding land areas adjacent to the subject property. However, research to identify the surrounding properties with documented releases of hazardous substances was expanded to encompass a half-mile radius from the subject property. As of the production time for this report, GEPA had not responded in full to a November 20, 2013, FOIA request.

1.2.9.1 Hazardous Waste Management

The GEPA has been authorized by the USEPA to administer a territorial hazardous waste management program, which closely follows the federal program. The Territorial Hazardous Waste Management Regulations adopt the federal regulations by reference, with some adjustments in stringency. Under Guam's regulations, major generators of hazardous waste are those who generate 100 kilograms (kg) or more of hazardous waste in any calendar month. Major generators, transporters, and facilities that store, treat or dispose of hazardous waste are required to notify GEPA and USEPA of their status. The regulations also require all hazardous waste handlers to submit an annual report on the types and quantities of hazardous waste generated or otherwise handled each year.

1.2.9.2 Solid Waste Management

The GEPA has promulgated regulations, which govern the management of solid waste. These statutes and regulations require the issuance of permits for land disposal of solid waste on any private, commercial, or government property. A minimum search radius of one-half mile from the subject property was used.

1.2.9.3 Asbestos Containing Material

Asbestos abatement is regulated under the Toxic Substances and Control Act (TSCA) Title II, Asbestos Hazard Emergency Response added by the Asbestos Hazard Emergency Response (AHERA) (Public Law (PL) 99-519). This regulation authorizes

USEPA to amend its TSCA regulations to impose more requirements on asbestos abatement.

ACM have in the past been used to insulate ceilings, pipes and ducts, or have been used as a fire-retardant. ACM has also been used in building materials including floor tiles, mastic and ceiling tiles. Asbestos use is much more limited in modern construction practices, however older buildings often have ACM.

1.2.9.4 PCBs

PCBs were previously used in electrical equipment, primarily capacitors and transformers, because they are electrically nonconductive and stable at high temperatures. PCBs present an environmental hazard because they persist in the environment, accumulate in living organisms, and concentrate in the food chain. The TSCA of 1976 banned the manufacture, processing, distribution, and use of PCBs. TSCA authorizes USEPA to secure information on all new and existing chemical substances and to control any of these substances that could cause an unreasonable risk to public health or the environment.

PCBs are regulated under Title 40 CFR 761. Title 40 CFR 761 establishes prohibitions of, and requirements for, the manufacture, processing, distribution in commerce, use, disposal, storage, and marking of PCBs and PCB items. The USEPA, under Title 40 guidelines, regulates the removal and disposal of all sources containing PCBs at concentrations of 50 parts per million (ppm) or more.

1.2.9.5 Lead Based Paint

The Residential Lead-Based Paint Hazard Reduction Act (Title X) developed a comprehensive federal strategy for reducing LBP hazard exposure to protect families from exposure to lead from paint, dust, and soil in homes. Section 1018 of this law directed US Department of Housing and Development (HUD) and USEPA to require the disclosure of known information on LBP hazards before the sale or lease of housing built before 1978.

1.2.9.6 Underground Storage Tanks (USTs)

UST systems are regulated under RCRA. Federal regulations codified under 40 CFR Part 280 mandate owners and operators of UST systems to notify the designated “state” agency whenever an UST system is removed from the ground to identify whether contamination has occurred.

USTs located on any of the subject properties or adjacent properties are discussed in the site-specific sections of this report.

1.2.9.7 Aboveground Storage Tanks (ASTs)

The federal Spill Prevention Control and Countermeasure (SPCC) regulations, codified under 40 CFR Part 112, require non-transportation related facilities having an aggregate aboveground storage capacity greater than 1,320 gallons, with a reasonable potential to discharge into nearby navigable waters, to be provided with secondary contaminant in the event of a major petroleum release. GEPA assists the USEPA in implementing this program by conducting physical inspections of those facilities, which are affected by these regulatory requirements.

In addition, GEPA, under its Water Quality Standards, requires all containers storing 55 gallons or more of petroleum products or hazardous materials to be provided with secondary contaminant, regardless of proximity to navigable waters. In addition, in the Water Quality Standards, GEPA has lowered the storage capacity threshold for the SPCC regulations, from 1,320 gallons to 666 gallons.

1.2.9.8 Radon

Radon gas is a colorless and odorless product of the radioactive decay of naturally occurring uranium (uranium decays to radium). Radon that is present in soil can enter a building through small spaces and openings and can accumulate in enclosed areas such as basements.

Radon levels on Guam correspond to the islands geology, and higher levels of radon are typically associated with areas underlain with limestone foundations. The only way to determine radon levels in a building are through testing. No radon tests were conducted during this PEA.

1.2.9.9 Pesticide Use

Under the Guam Pesticide Act and corresponding regulations, any person who imports pesticides into the Territory is required to notify GEPA of such action and the types of pesticides to be imported. In addition, all persons engaged in the sale, purchase, or direct application of restricted-use pesticides are required to be licensed by GEPA.

1.2.9.10 Industrial Wastewater Discharges

The Guam Waterworks Authority (GWA) has promulgated regulations under Sections 21206 and 21207 of the Government Code of Guam, which limit the types and concentrations of industrial wastewaters that may be discharged into the public sewer system. The GWA issues permits to industries for discharges into the government's wastewater treatment plants by way of the public sewer system.

Normally, GEPA identifies those industries preparing to discharge into the public sewer system as part of the building permit process. GEPA may prohibit industries from discharging wastewater into the sewer system because of toxic constituents or require pre-treatment prior to allowing discharges to occur.

1.3 SITE INSPECTIONS

Site inspections of all subject properties included in this PEA were completed to assess the physical conditions of each site. During the site inspections, the inspectors visually observed all areas that were generally accessible to identify visible evidence of potential environmental contamination including: stained surface soils or distressed vegetation; disturbed surface soils or reclaimed areas; pools of liquid, residues, and discarded containers; electrical equipment, ASTs, USTs, piping, sumps and other types of impoundment structures; abandoned structures and associated utilities; and drainage structures and direction of stormwater runoff.

1.4 PRELIMINARY ENVIRONMENTAL IMPACT EVALUATION

In additions to a preliminary assessment, a preliminary environmental impact evaluation was conducted. The evaluation did not foresee any negative environmental impacts related to the proposed project at any of the properties. For a complete review of the findings of the evaluation see Appendix D.

2 AGANA POWER PLANT

2.1 SITE LOCATION

The Agana Power Plant is located on Roy T. Damian Street in Mongmong Guam at approximately at 13°28′ North, 144°45′ East. The site is approximately 6 acres in size and is surrounded by a chain link fence. Land use adjacent to the site is residential. See figure 2-1 for a site map of the Agana Power Plant.

2.2 CURRENT USE OF THE PROPERTY

The property is currently used as an electrical Substation operated by GPA.

2.3 PAST USE AND OPERATIONS

The Agana Power Plant was built in 1949 as a diesel-fueled electricity-generating power plant by the U.S. Navy. The Power Plant provided electricity to Naval Air Station (NAS) Agana and Government of Guam (GovGuam) customers throughout the central and northern parts of Guam. The Power Plant was in operation until 1995 (NAVFAC 2013).

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NAVFAC Naval Facilities Engineering Command
NAVFAC MARIANAS

Project:	Preliminary Environmental Assessment for Agana and Marbo Power Plants and Harmon Substation, Guam
Description:	Site Map of Agana Power Plant

Figure 2-1

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2.3.1 USEPA – National Priorities List (NPL) Database.

The subject site was NOT FOUND in the NPL database.

The subject site was NOT FOUND in a search of sites delisted from the NPL.

A review found the following NPL facilities within an approximate minimum search distance of one mile of the subject property:

Table 2-1 Federal NPL Sites Within One Mile

Facility Name	Location	Direction
NONE FOUND	-	-

A review found the following delisted NPL facilities within an approximate minimum search distance of 0.5 miles of the subject property:

Table 2-2 Federal Delisted NPL Sites Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

2.3.2 USEPA – CERCLA Information System (CERCLIS) Database.

The subject site was NOT FOUND in the CERCLIS database.

A review found the following CERCLIS sites within an approximate minimum search distance of 0.5 miles of the subject property:

Table 2-3 Federal CERCLIS Sites Within 0.5 Miles

Facility Name	Location	Direction
Agana Springs PCB Site	Agana	South

2.3.3 USEPA – CERCLA Information System (CERCLIS) NFRAP Database.

The subject site was NOT FOUND in the Superfund Information Systems Archived Database.

A review found the following CERCLIS NFRAP sites within an approximate minimum search distance of 0.5 miles of the subject property:

Table 2-4 Federal CERCLIS NFRAP Sites Within 0.5 Miles

Facility Name	Location	Direction
Agana River And Paseo Site	Hagatna	Southwest

2.3.4 USEPA – RCRA Information System (RCRIS) Database.

The subject site was NOT FOUND in the RCRIS database as a small or large quantity generator.

A review found the following RCRA large quantity generators within an approximate search distance of 0.5 mile of the subject property:

Table 2-5 RCRIS Large Quantity Generators Within 0.5 Miles

Facility Name	Location	Direction
Global Laundry, Ltd.	Maite	East
Guam Public School System	Hagatna	West
Guam Public Transit	Hagatna	West

A review found the following RCRA small quantity generators within an approximate search distance of 0.5 mile of the subject property:

Table 2-6 RCRIS Small Quantity Generators Within 0.5 Miles

Facility Name	Location	Direction
Bank Of Guam	Hagatna	West
Graphic Center Inc.	Maite	East
Pacific Motors Corp	Hagatna	West

A review found the following RCRA non-CORRACTS TSD facilities within an approximate search distance of 0.5 mile of the subject property:

Table 2-7 RCRIS Conditionally Exempt Small Quantity Generators Facilities Within 0.5 Miles

Facility Name	Location	Direction
Archdiocese Of Agana	Hagatna	West
Pacific Daily News	Hagatna	West

Table 2-8 RCRIS Non-CORRACTS TSD Facilities Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

Table 2-9 RCRIS Transporter Facilities Within 0.5 Miles

Facility Name	Location	Direction
Allied Pacific Environmental Consulting Inc	Hagatna	West

Table 2-10 RCRIS Unspecified Universe Facilities Within 0.5 Miles

Facility Name	Location	Direction
Nissan Motors Corp Of Guam	Hagatna	West

2.3.5 USEPA – RCRIS Corrective Action Report (CORRACTS) Database.

The subject site was NOT FOUND in the CORRACTS database.

A review found the following CORRACTS facilities within an approximate minimum search distance of one mile of the subject property:

Table 2-11 RCRA CORRACTS Facilities Within One Mile

Facility Name	Location	Direction
NONE FOUND	-	-

2.3.6 Federal ERNS List

The subject site was NOT FOUND in a review of the Federal ERNS list

2.4 OTHER ENVIRONMENTAL RECORDS

2.4.1 Hazardous Waste Management

GEPA did not report any known hazardous waste management issues located within a half-mile of the subject property.

2.4.2 Solid Waste Management

GEPA indicated that solid waste violations in the general area consist of illegal dumping of municipal solid waste, green waste, overflowing trash bins and construction and demolition debris and tires. GEPA did not specify where or when these violations occurred.

2.4.3 Asbestos Containing Material (ACM)

The U.S. Navy conducted an asbestos survey of the main power plant building in 1991. Non-friable asbestos was detected in thermal insulation, gasket material, kitchen wall cement, and roof material (Ogden 1996).

Following removal and disposal of asbestos, including friable asbestos insulation on diesel exhaust stacks at the facility, independent visual inspection and air monitoring for asbestos was performed in 2010 to verify the adequacy of the abatement process. The measurement of airborne asbestos fiber concentrations by National Institute for Occupational Safety and Health (NIOSH) Method 7400 indicated that the final concentration in air inside the building was less than the current USEPA required level (0.01 fibers per cubic centimeter) for release of contractors from asbestos abatement projects at schools as outlined in the Federal Register 52, 210 [763.90](10-30-87) (NAVFAC 2013).

2.4.4 PCBs

Two (2) areas at the Agana Power Plant, POI-4 East and POI-6 East, are currently impacted by PCB contamination. Attempts to remediate the contamination were not completed because of the proximity of electrical equipment and structures. These areas have LUCs in place and are reviewed below.

2.4.4.1 POI-4 East

After initial sampling, PCB concentrations as high as 77 milligrams per kilogram (mg/kg) were detected in surface and subsurface soil. The Navy conducted a Time Critical Removal Action (TCRA) at POI-4 East in order to remove the elevated concentrations of PCBs. The TCRA was completed during two different events. The first event was carried out between February and March 1999, and aimed to remove soil with concentrations of PCBs greater than the low-occupancy cleanup level of 10 mg/kg. Excavation was advanced to 3.0 to 4.0 feet below ground surface (bgs). Elevated concentrations of PCBs remained at these lower depths; however, due to safety concerns regarding possible compromising of the integrity of concrete pads supporting electrical equipment, the excavation was stopped. PCB-containing soil remaining in place was covered with clean fill (NAVFAC 2013).

A second event was conducted at POI-4 in August 2000 to address surface soil containing concentrations of PCBs greater than the TSCA high-occupancy cleanup level of 1 mg/kg that could potentially be transported by surface water runoff and be deposited in the downgradient areas, including the Agana Swamp. Three (3) additional areas were addressed; however, not all surface soil with PCB detections above 1 mg/kg were removed due to the presence of nearby structures. Therefore, LUCs have been implemented at POI-4 East.

2.4.4.2 POI-6 East

The Agana Power Plant has two (2) stormwater outlets, which are concrete swales leading into outfalls on the southeast (POI-6 East) and southwest (POI-6 West) side of the site. PCBs in soil at POI-6 West were not detected at concentrations above 1 mg/kg.

In 1999, a TCRA (NAVFAC 2008) was conducted at POI-6 East to address PCBs in soil. Excavation at the site was advanced to 4 feet bgs and laterally to the extent possible. All surface soil samples above the 1 mg/kg cleanup level were removed. However, due to safety concerns regarding the stability of several active nearby utilities, excavation activities were discontinued before all subsurface soil could be removed. The excavation site was subsequently filled to the ground surface with 4 feet of clean fill. Therefore, LUCs have been implemented at POI-6 East.

2.4.5 Lead Based Paint

There are no records of LBP surveys for the subject property. Historical documentation indicates that the buildings on the subject property have been present before 1978, when the use of LBP was phased out. Therefore, it is possible that LBP may be present on the subject property.

2.4.6 Underground Storage Tanks (USTs)

According to a review of the GEPA UST registry, there are no registered USTs currently on the subject property. There is one (1) UST within 0.25 miles of the subject property. This UST, with a capacity of 8,000 gallons, is used for diesel storage and is located at the First Hawaiian Bank building north of the Agana Power Plant.

One (1) former UST at the Agana Power Plant was closed in place (NAVFAC 2013). This UST (UST No. PWC 38) was initially recommended for removal; however, due to nearby structural issues it was closed by filling it with an inert material after cleaning the tank, A subsequent Remedial Investigation determined that a subsurface soil-boring sample exceeded a Total Petroleum Hydrocarbons (TPH) lube oil range organics (LRO) cleanup level. However, no groundwater TPH contamination was detected in an adjacent monitoring well and a human health preliminary risk evaluation (PRE) did not indicate risks associated with TPH or its constituents.

2.4.7 Aboveground Storage Tanks (ASTs)

The 1996 EBS identified an AST Fueling Area with 11 ASTs. Two (2) aboveground waste oil tanks had been removed in 1995. There were documented releases from overfilling waste oil and diesel ASTs. Fuel pipelines associated with the ASTs are located both above and below ground at the power plant. There were no documented releases associated with these pipelines (Ogden 1996), A RI investigation of the ASTs determined that COPCs detected in surface and subsurface soil at concentrations exceeding GEPA guidance, were within the acceptable risk range for continued industrial use of the property without additional cleanup (NAVFAC 2013).

2.4.8 Radon

The subject property is located in an area designated as Zone 1, “High Radon Potential - probable indoor average concentration greater than 4 picocuries per liter (pCi/L). The actual level of radon exposure can only be determined through radon testing in buildings on the subject property (USEPA 1993).

2.4.9 Pesticide Use

GEPA provided no information related to pesticide use within the timeframe of this assessment, as requested in the November 20, 2013, FOIA request.

2.4.10 Industrial Wastewater Discharges

GEPA provided no information relative to industrial wastewater discharges from the property or surrounding property within the timeframe of this assessment. During the site reconnaissance, no wastewater discharges were observed on or from the subject property.

2.5 SITE VISIT

A site visit was conducted on October 2, 2013. Fencing surrounds the property with gated access along Sergeant Roy T. Damian Jr. Street, which fronts the facilty. The Agana power plant property consists of a large building that formerly housed power generation equipment, and several smaller substation buildings and electrical equipment, which are to the north and east of the larger building. The interior of the larger building is currently empty. Some staining was noted on the concrete floor of the building in areas where generators were formerly present.

Several transformers were observed in the substation area of the property. These transformers all reside within bermed secondary containments. No evidence of leaking was observed. Five (5) ASTs were observed on the property; two (2) north of the main building in the substation area, and three (3) in the northwest corner of the property. All were within berms and no evidence of releases were observed. Additionally, aboveground piping was observed leading both to and from the ASTs.

2.5.1 Adjacent Properties

The properties directly adjacent to the subject site were also evaluated and observed during the site inspection to see if any activities on these areas may have environmental impacts on the subject property. The immediately adjacent properties to the north, east and west are currently residential areas. An apartment building is west of the subject property and single-family houses are located to the north, east and south. No off site concerns were observed.

3 HARMON SUBSTATION

3.1 SITE LOCATION

This subject property is located in Tamuning, Guam, at approximately 144°49’9” East, 13°31’22” North. The property is 3.4 acres in size and fully fenced. Marine Corps Drive forms the southern property boundary; the remainder of the site is surrounded by vegetated undeveloped land. See figure 3-1 for a site map of the Substation.

3.2 CURRENT USE OF THE PROPERTY

The property is currently used as an electrical Substation, operated by GPA, and contains a diesel generation power plant owned by the US Navy. The site has been in the possession of the Navy since WWII.

3.3 PAST USE AND OPERATIONS

The property was undeveloped prior to the 1940’s, during which it was developed into an electrical utility facility. The subject property previously included a power plant, which included seven (7) diesel generators in a single building on a concrete pad. A cooling water pond was located east of the generator building. The power plant was on site until 1972 when it was demolished (Ogden 1996).

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Project: Preliminary Environmental Assessment for Agana and Marbo Power Plants and Harmon Substation, Guam

Description: Site Map of Harmon Substation

Figure 3-1

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3.4 FEDERAL ENVIRONMENTAL RECORDS

Table 3-1 Federal NPL Sites Within One Mile

Facility Name	Location	Direction
Andersen Air Force Base (AAFB), Harmon Annex	Dededo	West

AAFB was placed on the NPL in 1992. Contaminants have been identified throughout AAFB due to many small waste disposal sites and the presence of an unlined landfill. Groundwater testing has revealed wells contaminated with volatile organic compounds (VOCs) and soil testing has indicated the presences of VOCs, PCBs, fuels, metals and pesticides. Remediation efforts are underway and land use controls have been implemented to protect the public from exposure. The subject property is located immediately south of the Harmon Annex.

In 1993, the United States Air Force entered into a Federal Facilities Agreement (FFA) with the USEPA and GEPA. This FFA agreement provides the legal framework and schedule for the Air Force to perform remedial investigations and cleanup activities in accordance with CERCLA. Sources of hazardous substances at AAFB and its annexes include: landfills, drum storage and disposal areas, chemical storage areas, fire training areas, waste storage areas, a laundry facility and industrial and flight line operations. Substances known to be involved in AAFB operations included: solvents such as trichloroethene (TCE) and paint thinners; dry cleaning fluids and laundry products; fuels including JP-4 and gasoline; pesticides; antifreeze; aircraft cleaning compounds; and PCBs. Contaminated media at AAFB includes groundwater, soil, subsurface soil, and surface soil.

A review found the following delisted NPL facilities within an approximate minimum search distance of 0.5 miles of the subject property:

Table 3-2 Federal Delisted NPL Sites Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

3.4.1 USEPA – CERCLA Information System (CERCLIS) Database.

CERCLIS is an inventory of hazardous and potentially hazardous waste sites being investigated or cleaned under CERCLA. The CERCLIS database provides site names, addresses, and status of any investigation or cleanup.

The subject site was NOT FOUND in the CERCLIS database.

A review found the following CERCLIS sites within an approximate minimum search distance of 0.5 miles of the subject property:

Table 3-3 Federal CERCLIS Sites Within 0.5 Miles

Facility Name	Location	Direction
Guam Water Authority	Harmon Annex	North

3.4.2 USEPA – CERCLA Information System (CERCLIS) NFRAP Database.

CERCLIS NFRAP sites were reviewed through a search of archived sites using the Superfund Information Systems, Superfund Site Information Database. The Archived designation indicates that a CERCLIS site has no further interest under the Federal Superfund Program based on available information and therefore no further remedial action is currently planned.

The subject site was NOT FOUND in the Superfund Information Systems Archived Database.

A review found the following CERCLIS NFRAP sites within an approximate minimum search distance of 0.5 miles of the subject property:

Table 3-4 Federal CERCLIS NFRAP Sites Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

3.4.3 USEPA – RCRA Information System (RCRIS) Database.

RCRIS is a compilation of data concerning hazardous waste activity, including the status of registrations, permits, reports, inspections, enforcement activities, and financial data for facilities regulated under the RCRA. This database categorizes RCRA facilities by type (large or small generator, conditionally exempt, transporter and treatment, storage and disposal) and provides information on the existence of violations, corrective action requirements, and other details.

The subject site was NOT FOUND in the RCRIS database as a small or large quantity generator.

A review found the following RCRA large quantity generators within an approximate search distance of 0.5 mile of the subject property:

Table 3-5 RCRIS Large Quantity Generators Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

A review found the following RCRA small quantity generators within an approximate search distance of 0.5 mile of the subject property:

Table 3-6 RCRIS Small Quantity Generators Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-
United Technologies Otis Elevators	Dededo	South

A review found the following RCRA non-CORRACTS TSD facilities within an approximate search distance of 0.5 mile of the subject property:

Table 3-7 RCRIS Conditionally Exempt Small Quantity Generators Facilities Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

Table 3-8 RCRIS Non-CORRACTS TSD Facilities Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

Table 3-9 RCRIS Transporter Facilities Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

Table 3-10 RCRIS Unspecified Universe Facilities Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

3.4.4 USEPA – RCRIS Corrective Action Report (CORRACTS) Database.

CORRACTS is a compilation of data concerning hazardous waste corrective action activity for facilities regulated under the RCRA. This database categorizes RCRA facilities with corrective action activity.

The subject site was NOT FOUND in the CORRACTS database.

3.5 LOCAL ENVIRONMENTAL RECORDS

3.5.1 Hazardous Waste Management

GEPA did not report any known hazardous waste management issues located within a half-mile of the subject property.

3.5.2 Solid Waste Management

GEPA did not indicate the there have been any complaints of illegal dumping of solid waste in the area. GEPA indicated that the following waste management facilities are in the vicinity of Harmon Substation:

- Pyramid Recycling Inc.- Taitano Road/ Blas Road Harmon (scrap metal, tires, plastics, and e-waste)
- Xiong's Family Recycling- Harmon (scrap metal, white goods, ACs, and batteries)
- Triple Star Recycling- Harmon (scrap metals, ACs, and batteries)
- Viba Recycling- Harmon (scrap metal and batteries)

3.5.3 Asbestos Containing Material (ACM)

There is no information regarding asbestos surveys or abatement activities for the subject property. Historical documentation indicates that the buildings on the subject property were constructed before 1980, when the use of ACM was phased out. Therefore, it is possible that ACM may be present on the subject property.

3.5.4 PCBs

PCBs were previously used in electrical equipment at the Substation. According to GPA all PCB containing fluids have been removed from the site. Transformers that were not labeled as 'PCB free' were observed on the subject property during the site inspection performed for this PEA. The date of installation of these transformers is unknown. Possible spills were observed during a 1996 EBS. Testing performed in 2007 confirmed the presence of PCB contamination on the subject property. Soil in areas where contamination was observed was excavated, thermally treated, and reused as fill at the site and no further action is currently required for the site (ETS 2011a).

3.5.5 Lead Based Paint

There are no records of LBP surveys for the subject property. Historical documentation indicates that the buildings on the subject property were present before 1978, when the use of LBP was phased out. Therefore, it is possible that LBP may be present on the subject property.

3.5.6 Underground Storage Tanks (USTs)

According to a review of the GEPA UST registry, there are no registered USTs currently on the subject property. There are two (2) USTs within 0.25 miles of the subject property. These are both diesel fuel tanks located at the nearby Micronesia Mall shopping center. One (1) UST has a capacity of 10,000 gallons and the other a capacity of 4,000 gallons.

Previously, two (2) diesel fuel storage tanks, two lube oil storage tanks, two waste oil tanks and two concrete sumps were located at the exterior of the former Power Plant. It is not known if these tanks were ASTs or USTs; however, there are no documented releases from USTs on the subject property.

3.5.7 Aboveground Storage Tanks (ASTs)

No ASTs are located at the Harmon Substation. According to the 1996 EBS, two (2) diesel fuel storage tanks, two (2) lube oil storage tanks, two (2) waste oil tanks and two (2) concrete sumps were previously located at the exterior of the former Power Plant. It is unknown if these tanks were ASTs or USTs; however, there are no documented releases from ASTs on the subject property.

3.5.8 Radon

The subject property is located in an area designated as Zone 1, “High Radon Potential - probable indoor average concentration greater than 4 pCi/L.” The actual level of radon exposure can only be determined through radon testing in buildings on the subject property (USEPA 1993).

3.5.9 Pesticide Use

GEPA provided no information related to pesticide use within the timeframe of this assessment, as requested in the November 20, 2013 FOIA request.

3.5.10 Industrial Wastewater Discharges

GEPA provided no information relative to industrial wastewater discharges from the property or surrounding property within the timeframe of this assessment. During the site reconnaissance, no wastewater discharges were observed on or from the subject property.

3.6 SITE VISIT

3.6.1 On Site Observation

A site visit was conducted on October 3, 2013. The subject property is fully enclosed by a fence, with gated access provided via Route 1, which fronts the property. A control building and a battery building are both present on the property. Additionally, various equipment, such as transformers power lines and switches used for the distribution of power, are located on the property. Evidence of previous structures was noted, with concrete pads noted on the property in grassy areas.

3.6.2 Adjacent Properties

The properties directly adjacent to the subject site were also evaluated and observed during the site inspection to see if any activities on these areas may have environmental impacts on the subject property.

The immediately adjacent properties to the north, east and west are currently undeveloped. Access roads are located to the northwest and west of the site. The road to the northwest cuts through IRP Site 39 and terminates at a pipeline easement to the north of the IRP site. The road to the west terminates at Route 34.

4 MARBO POWER PLANT

4.1 SITE LOCATION

The MARBO Power Plant is located in Yigo, Guam, at approximately 13°30’45” North and 144°52’20” East. The property is several acres in size and is bordered to the west, south, and east by undeveloped land, and by an unnamed road to the north. See figure 4-1 for a site map of the Power Plant

4.2 CURRENT USE OF PROPERTY

The property is currently used as a diesel powered electrical generation facility operated by GPA. The DON turned over operations of the Power Plant to GPA in the 1990s. At the time this PEA was completed, the Power Plant was not in operation. The facility consists of a single diesel-powered turbine generator, four transformers, two (2) ASTs, and an active electrical substation (ETS 2011b).

4.3 PAST USE AND OPERATIONS

The site was undeveloped prior to being built as an electrical facility for the Navy. In the 1940’s six (6) diesel powered generators, multiple ASTs, and an electrical substation were installed, most of which were demolished in 1965 (ETS 2011b)

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Project:	Preliminary Environmental Assessment for Agana and Marbo Power Plants and Harmon Substation, Guam
Description:	Site Map of MARBO Power Plant

Figure 4-1

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4.4 FEDERAL ENVIRONMENTAL RECORDS

Table 4-1 Federal NPL Sites Within One Mile

Facility Name	Location	Direction
Andersen Air Force Base, MARBO Annex	Yigo	Adjacent

AAFB was designated as a NPL site in 1992. AAFB consists of several parcels of land in the northern half of Guam. The largest portion of AAFB property consists of the Main Base and Northwest Field. Additional AAFB properties include the MARBO Annex, located approximately three (3) miles south of the Main Base and the former Harmon Annex, located further south. The subject property is within the MARBO Annex.

In 1993, the United States Air Force entered into a Federal Facilities Agreement (FFA) with the USEPA and GEPA. This FFA agreement provides the legal framework and schedule for the Air Force to perform remedial investigations and cleanup activities in accordance with CERCLA. Sources of hazardous substances at AAFB and its annexes include: landfills, drum storage and disposal areas, chemical storage areas, fire training areas, waste storage areas, a laundry facility and industrial and flight line operations. Substances known to be involved in AAFB operations included: solvents such as trichloroethene (TCE) and paint thinners; dry cleaning fluids and laundry products; fuels including JP-4 and gasoline; pesticides; antifreeze; aircraft cleaning compounds; and PCBs. Contaminated media at AAFB includes groundwater, soil, subsurface soil, and surface soil.

At present, the final remedy for soil contamination at MARBO Annex has been completed by disposing of some hazardous soils off-island, moving some other less hazardous soils to the main base landfill, and by thermal treatment of PCB contaminated soils. USEPA and GEPA concurred that LUCs imposed on the subject site are protective of human health and the environment (ETS 2011c).

The Record of Decision (ROD) for MARBO Annex, signed in 1998, selected natural attenuation as the remedy for contaminated groundwater. In addition, property deeds pertaining to the installation of water supply wells on property affected by TCE and tetrachloroethene (PCE) impacted groundwater, are restricted. Long-term groundwater monitoring data has shown that neither physical (e.g. dilution) nor biological processes (e.g. reductive dehalogenation) have been working to significantly attenuate TCE and PCE in the deep part of the fresh water lens. The Air Force and USEPA amended the ROD in 2009 to propose a waiver for technical impracticability, since there is no practical way to implement another remedy. Cleaning the aquifer directly over the saltwater interface would cause an upwelling of saltwater into the drinking water portion of the aquifer. The ROD amendment implements institutional controls, and prohibiting the pumping of groundwater into the deep plume area.

A review found the following delisted NPL facilities within an approximate minimum search distance of 0.5 miles of the subject property:

Table 4-2 Federal Delisted NPL Sites Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

USEPA – CERCLA Information System (CERCLIS) Database.

CERCLIS is an inventory of hazardous and potentially hazardous waste sites being investigated or cleaned under CERCLA. The CERCLIS database provides site names, addresses, and status of any investigation or cleanup.

The subject site was NOT FOUND in the CERCLIS database.

A review found the following CERCLIS sites within an approximate minimum search distance of 0.5 miles of the subject property:

Table 4-3 Federal CERCLIS Sites Within 0.5 Miles

Facility Name	Location	Direction
Andersen Air Force Base – MARBO Annex	Yigo, Guam	Adjacent

USEPA – CERCLA Information System (CERCLIS) NFRAP Database.

CERCLIS No Further Remedial Action Planned (NFRAP) sites were reviewed through a search of archived sites using the Superfund Information Systems, Superfund Site Information Database. The Archived designation indicates that a CERCLIS site has no further interest under the Federal Superfund Program based on available information and therefore no further remedial action is currently planned.

The subject site was NOT FOUND in the Superfund Information Systems Archived Database.
A review found the following CERCLIS NFRAP sites within an approximate minimum search distance of 0.5 miles of the subject property:

Table 4-4 Federal CERCLIS NFRAP Sites Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

USEPA – RCRA Information System (RCRIS) Database.

RCRIS is a compilation of data concerning hazardous waste activity, including the status of registrations, permits, reports, inspections, enforcement activities, and financial data for facilities regulated under the RCRA. This database categorizes RCRA facilities by type (large or small generator, conditionally exempt, transporter and treatment, storage and disposal) and provides information on the existence of violations, corrective action requirements, and other details.

The subject site was NOT FOUND in the RCRIS database as a small or large quantity generator.

A review found the following RCRA large quantity generators within an approximate search distance of 0.5 mile of the subject property:

Table 4-5 RCRIS Large Quantity Generators Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

A review found the following RCRA small quantity generators within an approximate search distance of 0.5 miles of the subject property:

Table 4-6 RCRIS Small Quantity Generators Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

A review found the following RCRA non-CORRACTS TSD facilities within an approximate search distance of 0.5 miles of the subject property:

Table 4-7 RCRIS Conditionally Exempt Small Quantity Generators Facilities Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

Table 4-8 RCRIS Non-CORRACTS TSD Facilities Within 0.5 Mile

Facility Name	Location	Direction
NONE FOUND	-	-

Table 4-9 RCRIS Transporter Facilities Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

Table 4-10 RCRIS Unspecified Universe Facilities Within 0.5 Miles

Facility Name	Location	Direction
NONE FOUND	-	-

USEPA – RCRIS Corrective Action Report (CORRACTS) Database.

CORRACTS is a compilation of data concerning hazardous waste corrective action activity for facilities regulated under the RCRA. This database categorizes RCRA facilities with corrective action activity.

The subject site was NOT FOUND in the CORRACTS database.

4.5 LOCAL ENVIRONMENTAL RECORDS

4.5.1 Hazardous Waste Management

GEPA did not report any known hazardous waste management issues located within a half-mile of the subject property. Additionally, no hazardous waste generators were identified by the federal database search within the half-mile search radius and the area surrounding the subject property is primarily undeveloped.

4.5.2 Solid Waste Management

GEPA indicated that solid waste violations in the general area consist of illegal dumping of municipal solid waste, green waste, overflowing trash bins and construction and demolition debris and tires. GEPA did not specify where or when these violations have occurred.

4.5.3 Asbestos Containing Material (ACM)

There is no information regarding asbestos surveys or abatement activities for the subject property. Historical documentation indicates that the buildings on the subject property were present before 1980, when the use of ACM was phased out. Therefore, it is possible that ACM may be present of the subject property.

4.5.4 PCBs

According to the operator, GPA, none of the oil-filled equipment within the Substation yard currently contains PCB. A site inspection performed in 1996 (Ogden 1996) noted that numerous metal parts located outside the former Substation fencing were marked with yellow

PCB labels. These parts were thought to be associated with former electrical equipment located within the Substation site.

On July 16, 1990, approximately two (2) gallons of dielectric fluid, with a PCB concentration of 250 ppm, were discovered to have leaked from a weld joint of a transformer. Contaminated soil, a utility pole, and associated hardwires were removed as part of a remediation effort at the site for this release. The transformer may have been previously located within in the former substation area of the subject property.

Soil sampling conducted in 2008 during a RSE revealed the presence of PCBs above allowable limits at 21 soil decision units (DUs) and two concrete DUs. Approximately 4,470 cubic yards of PCB impacted soil and concrete was excavated and thermally treated offsite. Post-excavation revealed the presence of PCBs above cleanup goals at three (3) DUs. Further excavation was not conducted because of the proximity of contaminated areas to adjacent structures. Because further remediation was not possible at the site, and contamination persists at the site, LUCs were implemented at two (2) areas to prevent human exposure (ETS 2011c). The boundaries of these two (2) areas are identified in Appendix B.

4.5.5 Lead Based Paint

There are no records of LBP surveys for the subject property. Historical documentation indicates that the buildings on the subject property were built before 1978, when the use of LBP was phased out. Therefore, it is possible that LBP may be present on the subject property.

4.5.6 Underground Storage Tanks (USTs)

According to a review of the GEPA UST registry, there are no registered USTs currently on the subject property or within a 0.25-mile radius of the subject property.

4.5.7 Aboveground Storage Tanks (ASTs)

There is one (1) AST located on the subject property with a capacity of approximately 126,000 gallons. It is used to store diesel fuel. The tank is located in the southeast portion of the property, within a concrete berm, and is connected to the Power Plant via a subsurface pipeline that feeds diesel to the generator. The pipeline is enclosed in a concrete vault. A smaller 500 gallon AST containing diesel was previously located immediately to the north of the Power Plant building on a concrete slab but has been removed. Two (2) other 10,000 gallon ASTs were removed from the property in 1965 (Ogden 1996) without reported releases.

4.5.8 Radon

The subject property is located in an area designated as Zone 1, "High Radon Potential - probable indoor average concentration greater than 4 pCi/L." The actual level of radon exposure can only be determined through radon testing in buildings on the subject property (USEPA 1993).

4.5.9 Pesticide Use

GEPA provided no information related to pesticide use within the timeframe of this assessment, as requested in the November 20, 2013, FOIA request.

4.5.10 Industrial Wastewater Discharges

GEPA provided no information relative to industrial wastewater discharges from the property or surrounding property within the timeframe of this assessment. During the site reconnaissance, no wastewater discharges were observed on or from the subject property.

4.6 SITE VISIT

4.6.1 On Site Observation

A site visit was conducted on October 3, 2013. The MARBO Power Plant property is comprised of a power plant, located in the central portion of the property, and a substation found in the northwest corner. A fence surrounds the property and the substation is contained within additional fencing.

The Power Plant consists of a main generator building and three (3) smaller adjacent buildings. One (1) of the smaller buildings contains a single small generator. The other two (2) buildings were locked at the time of the site inspection and could not be inspected.

A large pad mounted transformer and smaller pad mounted transformer were observed 10 to 15 feet from the northwestern corner of the generator building.

An air intake is located near the northwest corner of the generator building. Large diameter pipes running into the air intake were noted. These pipes were labeled “lube oil in” and “lube oil out”. The pipes were painted white but the paint is flaking and spots of rust are showing through. No evidence of leaking was observed.

An AST is located in the southeastern portion of the subject property, within a concrete secondary containment. This AST is used to provide diesel fuel to the power generator when in use.

A control building, transformers, and various electrical equipment are located within the substation fence.

4.6.2 Adjacent Properties

The properties directly adjacent to the subject property were also evaluated and observed during the site inspection to see if any activities on these areas may have environmental impacts on the subject property.

The surrounding properties are currently undeveloped.

5 CONCLUSIONS

This Preliminary Environmental Assessment has revealed the following environmental concerns:

Land use controls (LUCs) are present at the Agana Power Plant property because of remaining PCB soil contamination. The areas with contamination and LUC boundaries are identified as POI-4 East and POI-6 East.

LUCs are also present at the MARBO Power Plant property due to remaining PCB and Antimony soil contamination. The MARBO property has three areas with land use controls.

For all three sites no documentation was available detailing lead based paint (LBP) surveys. Historical research indicates that all three (3) properties supported structures prior to 1978, when the use of LBP was phased out. If there are going to be any renovations or demolition of the subject structures, LBP surveys would be required to identify this occupational health and environmental concern.

There are no records of asbestos containing material (ACM) surveys for the Marbo Power Plant and Harmon Substation properties. Records were located and indicate that ACM is present at the Agana Power Plant property and that only a portion has been removed. The use of facilities that have ACM will require an asbestos management plan and disclosure to employees. If there are going to be renovations or demolition of structures on the subject properties, updated asbestos surveys will be required.

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6 REFERENCES

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Appendix A
Site Visit Photograph Log

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo A Interior view of Agana Power Plant

Photo B Exterior view of Agana Power Plant facing north/northwest

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo C View of electrical equipment present at Agana Power Plant

Photo D View of first substation building at Agana Power Plant

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo E View of second substation building at Agana Power Plant

Photo F View of electrical equipment present at Agana Power Plant

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo G View of AST present at Agana Power Plant

Photo H View of AST present at Agana Power Plant

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo I View of ASTs present at Agana Power Plant

Photo J View of AST Agana Power Plant looking southeast

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo K View of electrical equipemnt present at Agana Power Plant

Photo L View of fence line running north at Agana Power Plant

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo M View of MARBO Power Plant facing south

Photo N View of MARBO Power Plant facing south

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo O View of substation at MARBO Power Plant

Photo P View of first transformer at MARBO Power Plant

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo Q View of second transformer at MARBO Power Plant

Photo R View of western portion of MARBO Power Plant property facing north

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo S View of MARBO Power Plant facing north/northeast

Photo T View of AST at MARBO Power Plant

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo U View of MARBO Power Plant facing northwest

Photo V View of small generator at MARBO Power Plant

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo W View of interior of MARBO Power Plant

Photo X View of MARBO Power Plant facing southwest

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo Y View of Harmon Substation facing west

Photo Z View of Harmon Substation facing south

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo AA View of Harmon Substation facing southeast

Photo BB View of transformer at Harmon Substation

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo CC View of Harmon Substation control building facing southeast

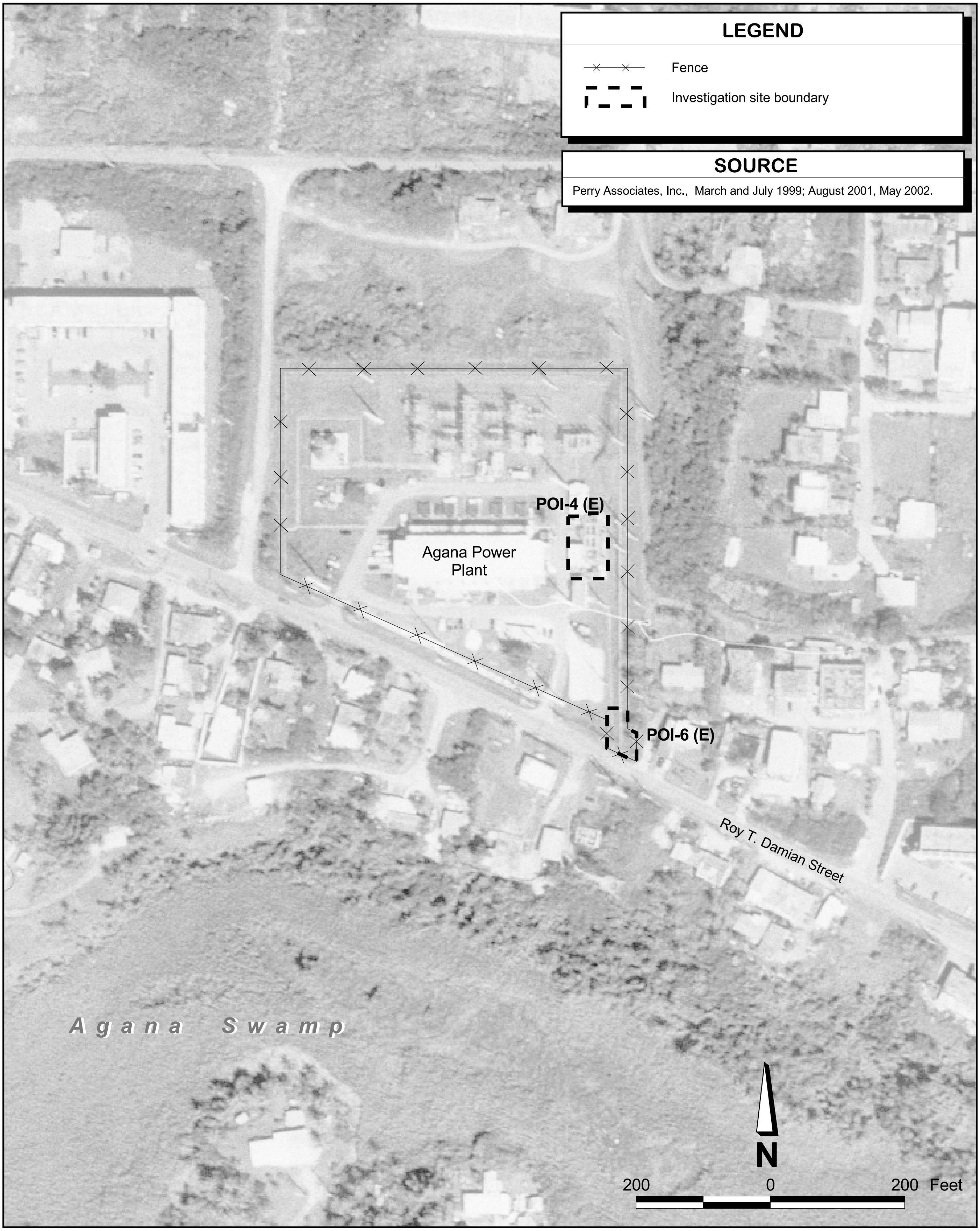
Photo DD View of transformer at Harmon Substation

APPENDIX A - SITE VISIT PHOTOGRAPHS: Agana Power Plant, Marbo Power Plant, and Harmon Substation

Photo EE View of transformer at Harmon Substation

Photo FF View of transformer at Harmon Substation

Appendix B
LUC Maps



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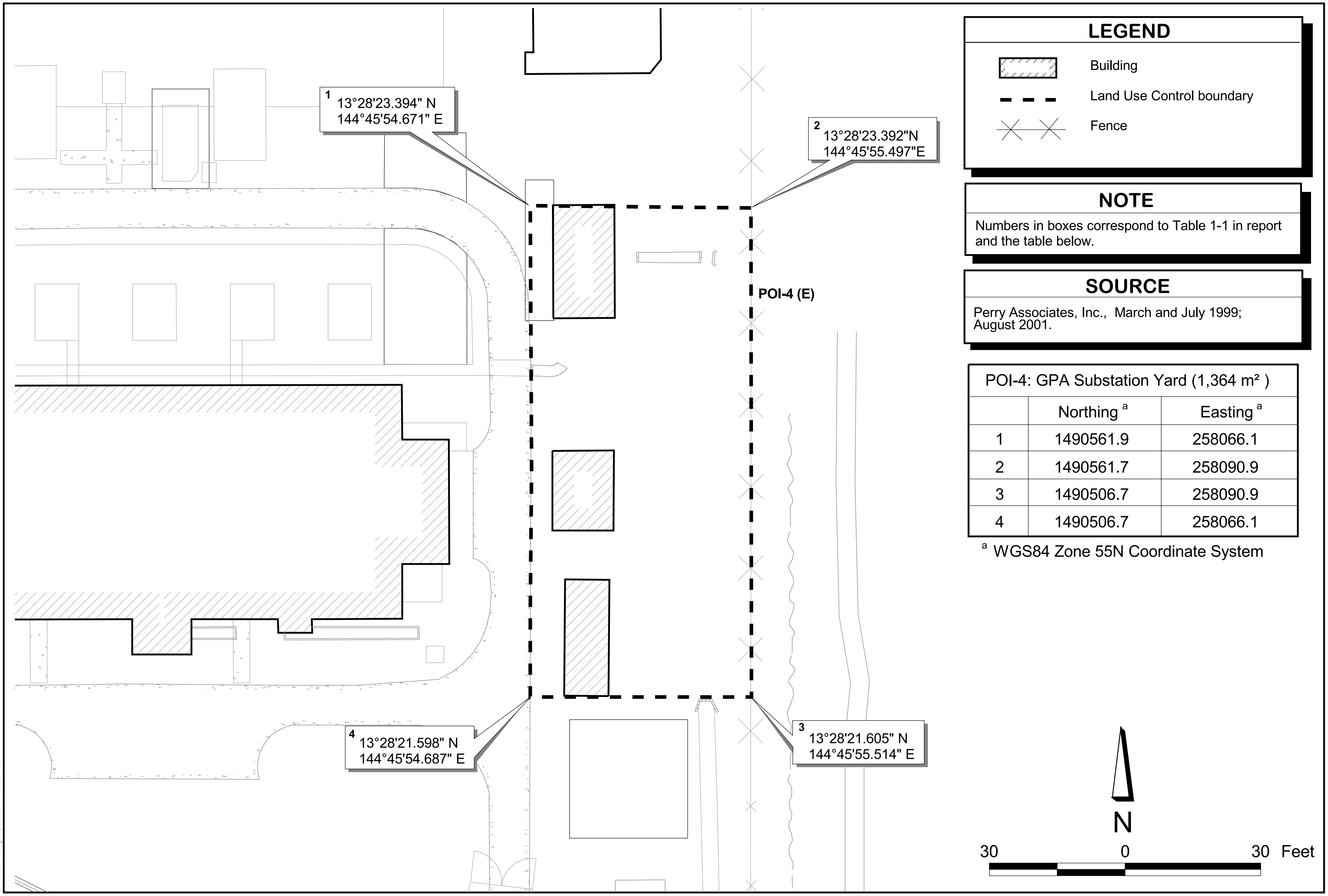
LAYOUT: L001_Fig1-2_POI4-6E
DATE: Apr 24, 2007 2:16 PM

Figure 1-2
POI-4 and POI-6 East
Land Use Control Work Plan
Agana Power Plant
Mongmong, Guam

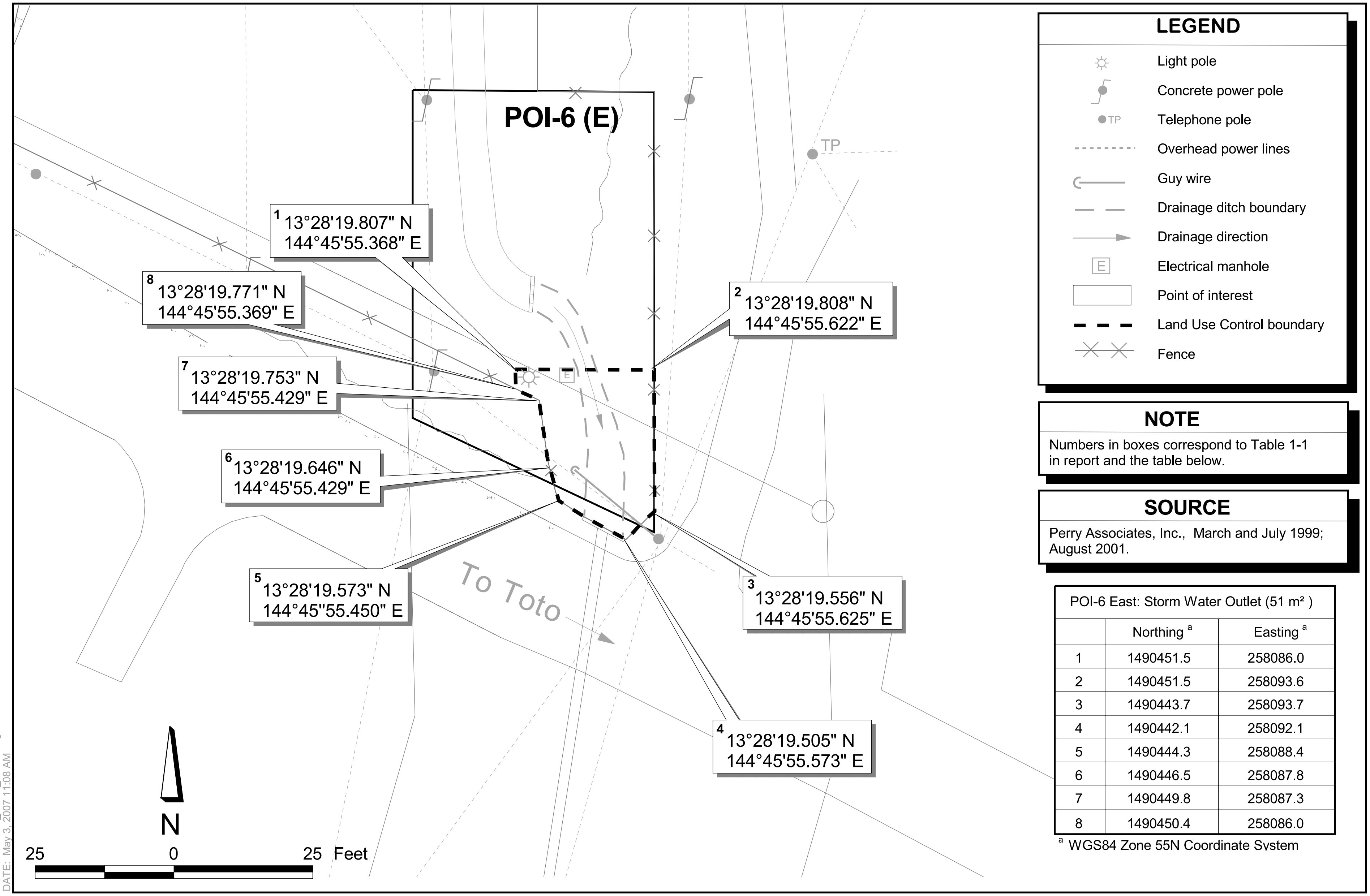


POI-4: GPA Substation Yard (1,364 m²)		
	Northing [a]	Easting [a]
1	1490561.9	258066.1
2	1490561.7	258090.9
3	1490506.7	258090.9
4	1490506.7	258066.1

[a] WGS84 Zone 55N Coordinate System

FILE REFERENCE: q:\clean iii\gis\cto 010-019\cto 017\av_project\luc_work-plan\luc_workplan.apr
LAYOUT: L002_POI-4_Coordinates
DATE: May 3, 2007 11:05 AM

Figure 1-4
Approximate Coordinates for Land Use Control Implementation at POI-4
Land Use Control Work Plan
Agana Power Plant
Mongmong, Guam



POI-6 East: Storm Water Outlet (51 m²)

	Northing [a]	Easting [a]
1	1490451.5	258086.0
2	1490451.5	258093.6
3	1490443.7	258093.7
4	1490442.1	258092.1
5	1490444.3	258088.4
6	1490446.5	258087.8
7	1490449.8	258087.3
8	1490450.4	258086.0

[a] WGS84 Zone 55N Coordinate System

FILE REFERENCE: q:\clean iii\gis\cto 010-019\cto 017\av_project\luc_work-plan\luc_workplan.apr
LAYOUT: L012_POI-6_Exceeding
DATE: May 3, 2007 11:08 AM

Figure 1-5
Approximate Coordinates for Land Use Control Implementataion at POI-6 East
Land Use Control Work-Plan
Agana Power Plant
Mongmong, Guam

DATE: JUNE 2011	PROJECT TITLE: DECISION DOCUMENT PITI SUBSTATION, MARBO POWER PLANT, AND BARRIGADA SUBSTATION, GUAM	
FIGURE TITLE: SITE MAP MARBO POWER PLANT, GUAM		FIGURE NO.: 3

Appendix C
Long Forms

Checklist to Support an Environmental Impact Evaluation	
This checklist documents consideration of environmental laws, regulations, and executive orders as they apply to Federal actions. It incorporates the Council on Environmental Quality (CEQ) regulations for implementing the NEPA, federal statutes and laws designed to protect the Nation's resources. The preparer of this checklist should have knowledge of the environmental features of the area and general potential impacts associated with the proposed development. Although some of the responses may be obtained from the preparer's own knowledge and observations, previous environmental documents and current agency correspondence should be cited.	
Project Name and Location	Proposed Energy Storage Facility, Yigo, Guam
Complete Project Description	MARBO Power Plant Property
Estimated Start Date	TBD

Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated?		Explanation
		Yes	No	
1.	**Air quality:** Will the project have the potential to increase landside or airside capacity, including an increase of surface vehicles? <u>Check all appropriate boxes</u> ☒ Project is not located within or adjacent to USEPA-defined Non-Attainment area ☐ Project is accounted for in State Implementation Plan ☒ Project air pollutant emissions do not exceed applicable *de minimis* levels as defined by General Conformity ☒ Project is listed on Presumed to Conform List		√	Project in not anticipated to create air emissions
2.	**Archaeological:** Will action have an effect on property included in or eligible for Federal, Tribal, State or local historical, archeological, or cultural significance? <u>Check all appropriate boxes</u> ☒ Project does not involve any disturbance of previously undisturbed ground. ☐ Project involves disturbance of previously undisturbed ground, SHPO coordination will need to be completed and "determination of no effect" ◆ The Project Sponsor shall ensure that construction specifications include conditions required by SHPO regarding unknown items found during construction.		√	Project will take place within the property bounds on an existing facility

Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated? Yes	Impact Anticipated? No	Explanation
3.	**Biotic communities:** Will the project impact plant communities and/or cause displacement of wildlife?		√	Project will take place within the property bounds on an existing facility
4.	**Coastal resources:** Will the project occur in, or impact a coastal zone as defined by the State's Coastal Zone Management Plan?	√		All of Guam is located within the CZMP
5.	**Compatible land use:** Will the project be consistent with plans, goals, policy, zoning or local controls that have been adopted for the area in which the project is located?	√		Current and surrounding zoning for Limited Industrial and Residential use will not be adversely impacted.
6.	**Construction impacts:** Will the project produce construction impacts, such as reducing local air quality, produce erosion or pollutant runoff, or disrupt local traffic patterns?		√	It is not anticipated that the project will have off site impacts
7.	**Endangered species:** Is there any impact on any Federally listed endangered, threatened, and candidate species (flora or fauna) or designated critical habitat? <u>Check all appropriate boxes</u> ☒ Project will not adversely affect the physical environment (land disturbance, vegetation removal, sedimentation, dust, noise/ waste/hazardous materials emission into the environment, etc.). ☐ Project will have an effect on the physical environment. USFWS documentation is required.		√	Project will take place within the property bounds on an existing facility
8.	**Energy supply and natural resources:** Will the project impact energy supply of natural resources?		√	The Project will have a beneficial impact by reducing dependence on oil/gas supplied power

Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated? Yes	Impact Anticipated? No	Explanation
9.	**Environmental justice:** Will the project cause any adverse and disproportionate impacts on minority and low-income populations? (Refer to Executive Order 12898.)		√	
10.	**Essential fish habitat:** Is project located in or cause adverse effects to a waterway, stream, or water body? Check all appropriate boxes ☒ Project is not within or near a waterway, stream, or other body of water. ☐ Project is within or near a waterway, stream, or other body of water: ◆ The Project Sponsor shall ensure that USFWS conditions/ requirements are included in Construction Specifications.		√	
11.	**Farmland:** Will action involve acquisition and conversion of farmland? Check all appropriate boxes ☒ Project does not involve new disturbance of farmland. ☐ U.S. Natural Resources Conservation Service consultation required		√	Subject property not presently used for farming or suitable for farm use.
12.	**Migratory Bird Treaty Act:** Will the project have the potential to adversely impact birds protected by the migratory bird treaty act?		√	
13.	**Floodplains:** Will project be located in, encroach upon or otherwise impact a floodplain? Check all appropriate boxes ☒ Project is not located in and does not impact floodplains ☐ Applicable FEMA Map is attached. ☐ Project is located in floodplain and will not negatively impact floodplains.		√	
14.	**Hazardous materials:** Does project involve or affect hazardous materials or involve construction in an area that contains hazardous materials and/or hazardous waste?		√	

Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated?		Explanation
		Yes	No	
15.	**Historic:** Will action have an effect on property included in or eligible for the National Register of Historic Places or other property of Federal, Tribal, State or local significance? <u>Check all appropriate boxes</u> ☒ Project does not involve any “Historic” Structures over 50 years old ☐Project involves “Historic” Structures over 50 years old, and attach State Historic Preservation Officer (SHPO) coordination completed and “determination of no effect” ☒ Project does not involve any property of Federal, Tribal, State or local significance ☐ Project does involve property of Federal, Tribal, State or local significance		√	
16.	**Light emissions:** Will the project produce significant light emission impacts to residential areas, schools, or hospitals?		√	
17.	**Natural resources:** Will action have significant impact on natural, ecological, cultural or scenic resources of national, state or local significance?		√	
18.	**Noise levels:** Will project have a significant impact (DNL 1.5 dB or greater) on noise levels over noise sensitive areas (residences, schools, churches, hospitals)?		√	
19.	**Parks, public lands, refuges and recreational resources:** Will project impact publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state or local significance, or land of a historic site with national, state or local significance? (DOT Section 4(f) [49 U.S.C. 303 (c)] impacts)		√	
20.	**Surface transportation:** Will project cause a significant increase in surface traffic congestion or cause a degradation of level of service?		√	Minimal to no construction phase impact to local traffic.

Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated? Yes	Impact Anticipated? No	Explanation
21.	**Water quality:** Will project have a significant impact to water quality to groundwater, surface water bodies, public water supply systems or violate Federal, state, or tribal water quality standards? <u>Check all appropriate boxes</u> ☒ Project <u>will not</u> produce water quality impacts or other modifications to groundwater, surface bodies, or public water supply systems. ☐ Project <u>will</u> produce water quality impacts or other modifications to groundwater, surface bodies, or public water supply systems. ◆ The Project Sponsor shall ensure that National Pollutant Discharge Elimination System (NPDES) permits are obtained as required for construction projects.		√	Impacts will be mitigated
22.	**Wetlands:** Will project impact any wetlands? Wetland Determinations must meet requirements of the U.S. Army Corps of Engineers (USCOE) 1987 Wetland Delineation Manual. <u>Check all appropriate boxes</u> ☒ Project <u>will not</u> involve dredging or disposal of dredged material, or excavation, bank stabilization, filling or other changes to wetlands ☐ Project <u>will</u> involve dredging or disposal of dredged material, or excavation, bank stabilization, filling or other changes to wetlands <u>Coordination with agencies</u> ☒ Consultation with U.S. National Resource Conservation Service and National Wetland Inventory (NWI) Maps required. ☐ Consultation with US Fish & Wildlife (USFWS) required. ☐ Consultation with USCOE required ☐ Other Consultation (EPA/State) required ☐ Wetland Delineation required		√	Based on NWI maps, no wetlands on or, or adjacent to the subject property. A freshwater emergent wetland is 0.07 miles south from, and down gradient of, the subject property.
23.	**Wild and Scenic Rivers:** Does action impact U.S. National Park Service-designated Wild or Scenic River?		√	
Other required environmental considerations				
24.	**Connected actions:** Are there other closely related actions that should be considered?		√	
25.	**Cumulative actions:** When viewed with other planned actions, are the project impacts significant?		√	
26.	**Cumulative impacts:** When considered together with other past, present, and reasonably foreseeable future development projects, regardless of funding source, would the proposed project produce a significant cumulative effect?		√	

Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated? Yes	Impact Anticipated? No	Explanation
27.	**Environmental laws:** Is project inconsistent with any other Federal, state, or local laws relating to environment?		√	
28.	**Highly controversial:** Is the proposed project likely to be highly controversial on environmental grounds? A proposed Federal action is considered highly controversial when an action is opposed on environmental grounds by a Federal, state, or local government, or by a substantial number of persons affected by such action.		√	Project will take place within the property bounds fn an existing facility that itself in not controversial
29.	**Community disruption:** Will project cause disruption of a community, disrupt planned development or be inconsistent with plans or goals of the community?		√	
30.	**Relocation housing:** Is the availability of adequate housing a highly controversial issue?		√	
31.	**Social impact:** Are residents or businesses being relocated?		√	
33.	**Similar actions:** Are there other similar Federal actions that would cause this project to be significant?		√	
34.	List additional comments/consultation to support findings. It is important to explain determinations in the space provided above for situations where "checked boxes" do not adequately explain the project-specific situation for this Assessment.			

pcr environmental, inc.

Preparer Certification

I hereby certify that the information I have provided is complete and accurate, to the best of my knowledge:

	October 4, 2013
Signature	Date
Scott E. Schimmel	PCR Environmental, Inc.
Printed Name and Title	Organization

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- ☐ The proposed project qualifies for a Categorical Exclusion.
- ☐ The proposed project appears to involve conditions that may require the preparation of an Environmental Assessment (EA), addressing:
- ☐ The following additional documentation is required to perform a complete environmental evaluation of the proposed project Cultural Resources Survey, Wetlands Survey, and Endangered Species Assessment.

Checklist to Support an Environmental Impact Evaluation	
This checklist documents consideration of environmental laws, regulations, and executive orders as they apply to Federal actions. It incorporates the Council on Environmental Quality (CEQ) regulations for implementing the NEPA, federal statutes and laws designed to protect the Nation's resources. The preparer of this checklist should have knowledge of the environmental features of the area and general potential impacts associated with the proposed development. Although some of the responses may be obtained from the preparer's own knowledge and observations, previous environmental documents and current agency correspondence should be cited.	
Project Name and Location	Proposed Energy Storage Facility, Yigo, Guam
Complete Project Description	Harmon Substation Property
Estimated Start Date	TBD

Environmental Resource Area Review for Potential Effects and Impacts		**Impact Anticipated?**		**Explanation**
		Yes	**No**	
1.	**Air quality:** Will the project have the potential to increase landside or airside capacity, including an increase of surface vehicles? <u>Check all appropriate boxes</u> ☒ Project is not located within or adjacent to USEPA-defined Non-Attainment area ☐ Project is accounted for in State Implementation Plan ☒ Project air pollutant emissions do not exceed applicable *de minimis* levels as defined by General Conformity ☒ Project is listed on Presumed to Conform List		√	Project in not anticipated to create air emissions
2.	**Archaeological:** Will action have an effect on property included in or eligible for Federal, Tribal, State or local historical, archeological, or cultural significance? <u>Check all appropriate boxes</u> ☒ Project does not involve any disturbance of previously undisturbed ground. ☐ Project involves disturbance of previously undisturbed ground, SHPO coordination will need to be completed and "determination of no effect" ◆ The Project Sponsor shall ensure that construction specifications include conditions required by SHPO regarding unknown items found during construction.		√	Project will take place within the property bounds on an existing facility

environmental, inc.

Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated? Yes	Impact Anticipated? No	Explanation
3.	**Biotic communities:** Will the project impact plant communities and/or cause displacement of wildlife?		√	Project will take place within the property bounds on an existing facility
4.	**Coastal resources:** Will the project occur in, or impact a coastal zone as defined by the State's Coastal Zone Management Plan?	√		All of Guam is located within the CZMP
5.	**Compatible land use:** Will the project be consistent with plans, goals, policy, zoning or local controls that have been adopted for the area in which the project is located?	√		Current and surrounding use will not be adversely impacted.
6.	**Construction impacts:** Will the project produce construction impacts, such as reducing local air quality, produce erosion or pollutant runoff, or disrupt local traffic patterns?		√	It is not anticipated that the project will have off site impacts
7.	**Endangered species:** Is there any impact on any Federally listed endangered, threatened, and candidate species (flora or fauna) or designated critical habitat? <u>Check all appropriate boxes</u> ☒ Project will not adversely affect the physical environment (land disturbance, vegetation removal, sedimentation, dust, noise/ waste/hazardous materials emission into the environment, etc.). ☐ Project will have an effect on the physical environment. USFWS documentation is required.		√	Project will take place within the property bounds on an existing facility
8.	**Energy supply and natural resources:** Will the project impact energy supply of natural resources?		√	The Project will have a beneficial impact by reducing dependence on oil/gas supplied power
9.	**Environmental justice:** Will the project cause any adverse and disproportionate impacts on minority and low-income populations? (Refer to Executive Order 12898.)		√	

Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated?		Explanation
		Yes	No	
10.	**Essential fish habitat:** Is project located in or cause adverse effects to a waterway, stream, or water body? <u>Check all appropriate boxes</u> ☒ Project is not within or near a waterway, stream, or other body of water. ☐ Project is within or near a waterway, stream, or other body of water: ◆ The Project Sponsor shall ensure that USFWS conditions/ requirements are included in Construction Specifications.		√	
11.	**Farmland:** Will action involve acquisition and conversion of farmland? <u>Check all appropriate boxes</u> ☒ Project does not involve new disturbance of farmland. ☐ U.S. Natural Resources Conservation Service consultation required		√	Subject property not presently used for farming or suitable for farm use.
12.	**Migratory Bird Treaty Act:** Will the project have the potential to adversely impact birds protected by the migratory bird treaty act?		√	
13.	**Floodplains:** Will project be located in, encroach upon or otherwise impact a floodplain? <u>Check all appropriate boxes</u> ☒ Project is not located in and does not impact floodplains ☐ Applicable FEMA Map is attached. ☐ Project is located in floodplain and will not negatively impact floodplains.		√	
14.	**Hazardous materials:** Does project involve or affect hazardous materials or involve construction in an area that contains hazardous materials and/or hazardous waste?		√	

Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated?		Explanation
		Yes	No	
15.	**Historic:** Will action have an effect on property included in or eligible for the National Register of Historic Places or other property of Federal, Tribal, State or local significance? <u>Check all appropriate boxes</u> ☒ Project does not involve any "Historic" Structures over 50 years old ☐ Project involves "Historic" Structures over 50 years old, and attach State Historic Preservation Officer (SHPO) coordination completed and "determination of no effect" ☒ Project does not involve any property of Federal, Tribal, State or local significance ☐ Project does involve property of Federal, Tribal, State or local significance		√	
16.	**Light emissions:** Will the project produce significant light emission impacts to residential areas, schools, or hospitals?		√	
17.	**Natural resources:** Will action have significant impact on natural, ecological, cultural or scenic resources of national, state or local significance?		√	
18.	**Noise levels:** Will project have a significant impact (DNL 1.5 dB or greater) on noise levels over noise sensitive areas (residences, schools, churches, hospitals)?		√	
19.	**Parks, public lands, refuges and recreational resources:** Will project impact publicly owned land from a public park, recreation area, or wildlife or waterfowl refuge of national, state or local significance, or land of a historic site with national, state or local significance? (DOT Section 4(f) [49 U.S.C. 303 (c)] impacts)		√	
20.	**Surface transportation:** Will project cause a significant increase in surface traffic congestion or cause a degradation of level of service?		√	Minimal to no construction phase impact to local traffic.

<table>
<tr><th colspan="2" rowspan="2">Environmental Resource Area Review for Potential Effects and Impacts</th><th colspan="2">Impact Anticipated?</th><th rowspan="2">Explanation</th></tr>
<tr><th>Yes</th><th>No</th></tr>
<tr><td>21.</td><td>Water quality: Will project have a significant impact to water quality to groundwater, surface water bodies, public water supply systems or violate Federal, state, or tribal water quality standards?

<u>Check all appropriate boxes</u>
☒ Project <u>will not</u> produce water quality impacts or other modifications to groundwater, surface bodies, or public water supply systems.
☐ Project <u>will</u> produce water quality impacts or other modifications to groundwater, surface bodies, or public water supply systems.

◆ The Project Sponsor shall ensure that National Pollutant Discharge Elimination System (NPDES) permits are obtained as required for construction projects.</td><td></td><td>√</td><td>Impacts will be mitigated</td></tr>
<tr><td>22.</td><td>Wetlands: Will project impact any wetlands? Wetland Determinations must meet requirements of the U.S. Army Corps of Engineers (USCOE) 1987 Wetland Delineation Manual.

<u>Check all appropriate boxes</u>
☒ Project <u>will not</u> involve dredging or disposal of dredged material, or excavation, bank stabilization, filling or other changes to wetlands
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<u>Coordination with agencies</u>
☒ Consultation with U.S. National Resource Conservation Service and National Wetland Inventory (NWI) Maps required.
☐ Consultation with US Fish & Wildlife (USFWS) required.
☐ Consultation with USCOE required
☐ Other Consultation (EPA/State) required
☐ Wetland Delineation required</td><td></td><td>√</td><td>Based on NWI maps, no wetlands on or, or adjacent to, the subject property</td></tr>
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<tr><td colspan="5">Other required environmental considerations</td></tr>
<tr><td>24.</td><td>Connected actions: Are there other closely related actions that should be considered?</td><td></td><td>√</td><td></td></tr>
<tr><td>25.</td><td>Cumulative actions: When viewed with other planned actions, are the project impacts significant?</td><td></td><td>√</td><td></td></tr>
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Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated?		Explanation
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pcr environmental, inc.

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Project Name and Location	Proposed Energy Storage Facility, Yigo, Guam
Complete Project Description	MARBO Power Plant Property
Estimated Start Date	TBD

Environmental Resource Area Review for Potential Effects and Impacts		**Impact Anticipated?**		**Explanation**
		Yes	**No**	
1.	**Air quality:** Will the project have the potential to increase landside or airside capacity, including an increase of surface vehicles? <u>Check all appropriate boxes</u> ☒ Project is not located within or adjacent to USEPA-defined Non-Attainment area ☐ Project is accounted for in State Implementation Plan ☒ Project air pollutant emissions do not exceed applicable *de minimis* levels as defined by General Conformity ☒ Project is listed on Presumed to Conform List		√	Project in not anticipated to create air emissions
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23.	**Wild and Scenic Rivers:** Does action impact U.S. National Park Service-designated Wild or Scenic River?		√	
Other required environmental considerations				
24.	**Connected actions:** Are there other closely related actions that should be considered?		√	
25.	**Cumulative actions:** When viewed with other planned actions, are the project impacts significant?		√	
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Environmental Resource Area Review for Potential Effects and Impacts		Impact Anticipated?		Explanation
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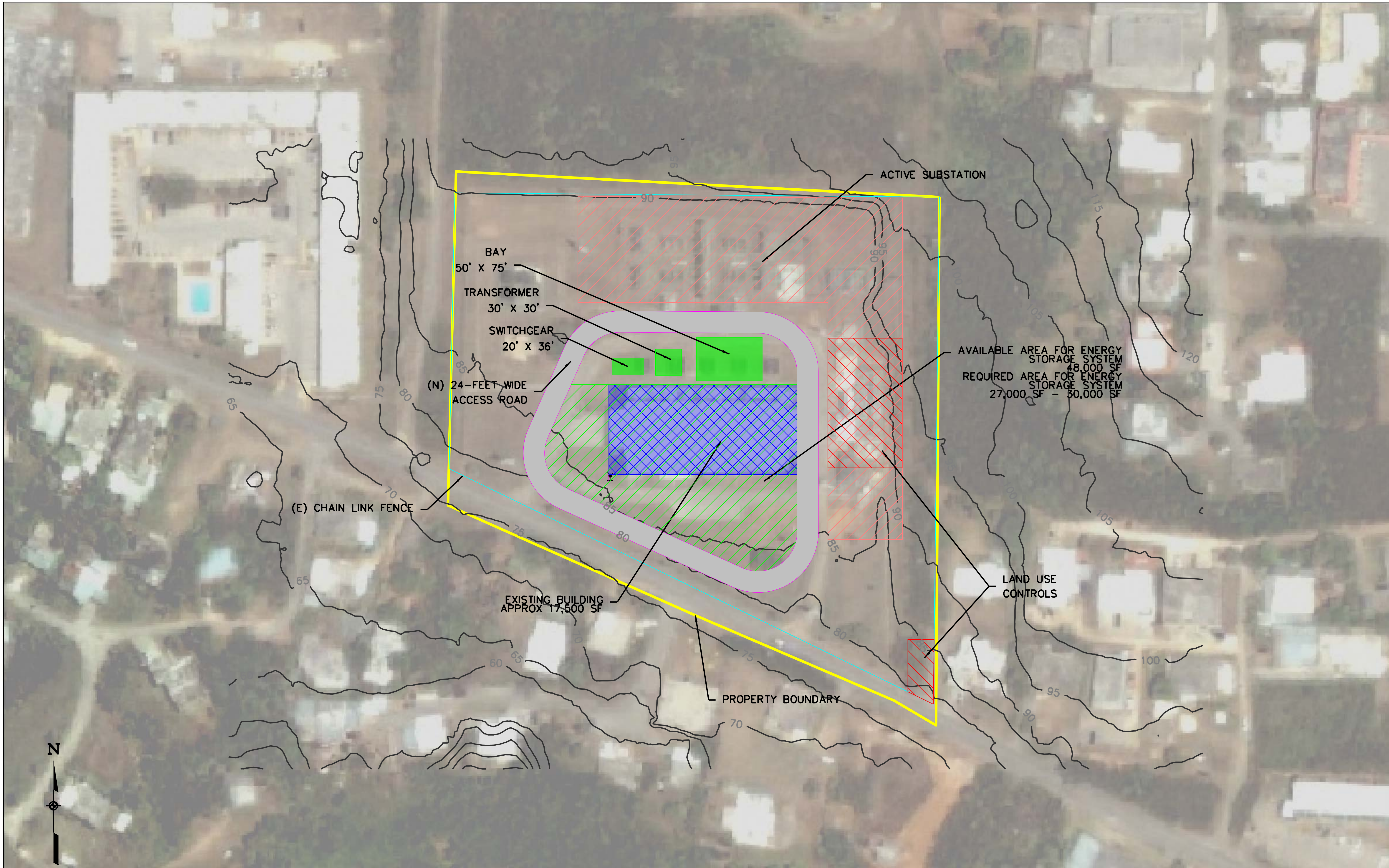
APPENDIX D – PRELIMINARY SITE LAYOUT

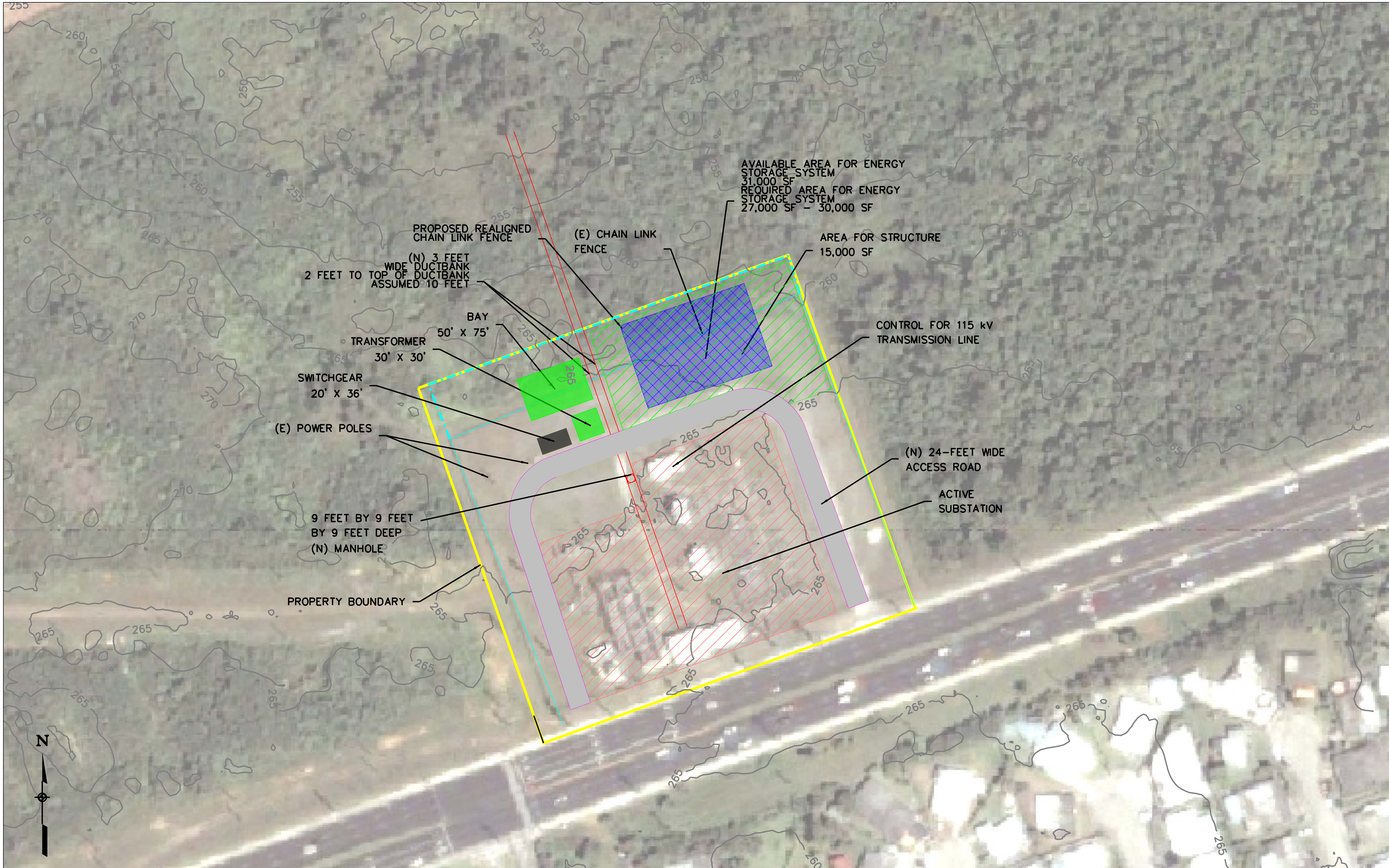


Note: Electrical equipment layout as shown is to demonstrate that the site has adequate space for the proposed ESS facility and does not reflect a specific site design.

AGANA SUBSTATION

GRAPHIC SCALE 1" = 100 FEET

0 100 200 300



Note: Electrical equipment layout as shown is to demonstrate that the site has adequate space for the proposed ESS facility and does not reflect a specific site design.

HARMON SUBSTATION

GRAPHIC SCALE 1" = 100 FEET

0 100 200 300

Note: Electrical equipment layout as shown is to demonstrate that the site has adequate space for the proposed ESS facility and does not reflect a specific site design.

MARBO SUBSTATION

GRAPHIC SCALE 1" = 100 FEET

0 100 200 300

APPENDIX E – COST ESTIMATE

BUDGETARY COST ESTIMATE

Guam Power Authority Energy Storage Facility
Feasibility Study

SITE 1 - AGANA -BATTERY - BUILDING-BASED								**August 29, 2014**	
Item Nos.	**Item Description**	**Quantity**		**Material Cost**		**Labor Cost**		**Engineering Estimate**	
		Number	**Unit**	**Unit Cost**	**Total**	**Unit Cost**	**Total**	**Unit Cost**	**Total Cost**
I	**SITE 1 - AGANA**								
1.0	**Mobilization**	ALL	LPSM					$ 399,091.47	$ 399,091.47
2.0	**Temporary Erosion & Sediment Control**								
2.1	Silt Fence	1000	LF					$ 4.50	$ 4,500.00
3.0	**Demolition**	-	SF						
3.1	Demolition of Existing Steel Structures	-	CF					$ 0.35	$ -
3.2	Disposal of Materials from Steel Structures Demolition	-	CY					$ 32.00	$ -
4.0	**Environmental Clean-up**								
4.1	Hazardous Materials Clean up - Lead Paint Removal	17,500	SF					$ 8.00	$ 140,000.00
3.2	Asbestos Removal and Disposal	3,500	SF					$ 60.00	$ 210,000.00
5.0	**Earthwork**								
5.1	Clearing and Grubbing	1.5	Acre					$ 6,800.00	$ 6,800.00
6.0	**Utility Connections**								
6.1	6" Water	200	LF					$ 78.00	$ 15,600.00
6.2	4" Sewer	500	LF					$ 94.00	$ 47,000.00
6.3	Electrical Connection to GPA Grid							$ 140.00	
6.3.1	Breaker[2]	ALL	LPSM					$ 436,400.00	$ 436,400.00
6.3.2	Bay/Bus[2]	ALL	LPSM					$ 545,500.00	$ 545,500.00
6.3.3	Transformer[2]	ALL	LPSM					$ 1,489,215.00	$ 1,489,215.00
6.3.4	Switchgear[2]	ALL	LPSM					$ 758,245.00	$ 758,245.00
6.4	Storm Drainage Consisting of Swales & Pipes	1,000	LF					$ 108.00	$ 108,000.00
7.0	**Energy Storage System**								
7.1	Upgrade Existing Structure	17,500	SF					$ 115.00	$ 2,012,500.00
7.2	Equipment[2]	ALL	LPSM					$ 30,548,000.00	$ 30,548,000.00
7.3	Installation[2]	ALL	LPSM					$ 2,094,720.00	$ 2,094,720.00
7.4	Shipping[2]	ALL	LPSM					$ 1,193,008.50	$ 1,193,008.50
8.0	**AC Pavement & Parking Space**								
8.1	AC Pavement								
8.1.1	Demolish Existing AC Pavement	2,100	SY					$ 12.00	$ 25,200.00
8.1.2	New Access Road	2,800	SY						
8.1.2.1	Subbase, 12" Thick	950	CY					$ 60.00	$ 57,000.00
8.1.2.2	Base Course,8" Thick	650	CY					$ 80.00	$ 52,000.00
8.1.2.3	Tack Coat	450	Gal					$ 12.50	$ 5,625.00
8.1.2.4	Asphalt, 3" Thick	2,800	SY					$ 45.00	$ 126,000.00
8.1.2.5	4" Wide Striping	4,200	LF					$ 2.50	$ 10,500.00
8.2	Parking Space	240	SY						
8.2.1	Demolish Existing AC Pavement & Disposal	194	SY					$ 12.00	$ 2,333.33
8.2.2	New Parking Space	240	SY						
8.2.2.1	Subbase, 12" Thick	80	CY					$ 60.00	$ 4,800.00
8.2.2.2	Base Course,8" Thick	55	CY					$ 80.00	$ 4,400.00
8.2.2.3	Tack Coat	40	Gal					$ 12.50	$ 500.00
8.2.2.4	Asphalt, 3" Thick	240	SY					$ 45.00	$ 10,800.00
8.2.2.5	4" Wide Striping	200	LF					$ 2.50	$ 500.00
9.0	**Reconfiguration of Chain Link Fence**								
9.1	Removal of Existing Chain Link Fence	-	LF					$ 10.00	$ -
9.2	Installation of New Chain Link Fence	-	LF					$ 45.00	$ -
10.0	**Technical Services**								
10.1	Site Survey and Surface Investigation	ALL	LPSM					$ 544,161.22	$ 544,161.22
10.2	Architect-Engineer Services	ALL	LPSM					$ 1,007,705.96	$ 1,007,705.96
10.3	Construction Management	ALL	LPSM					$ 1,410,788.34	$ 1,410,788.34
						Total Estimated Cost			**$ 43,270,893.82**
						Contingency[1], 10%			**$ 4,327,089.38**
						Sub-Total			**$ 47,597,983.20**
						GRT, 4.167%			**$ 1,983,407.96**
						Total Cost			**$ 49,581,391.16**
						Total Estimated Cost (Rounded)			**$ 49,581,000.00**

Notes:

1: 10% Contingency was added to cover items not evident at this level.

2: 9.1% was added to Items 6.3.1-6.3.4 and Items 7.2-7.4 to provide a total contingency of 20%

BUDGETARY COST ESTIMATE

Guam Power Authority Energy Storage Facility
Feasibility Study

SITE 1 - AGANA - BATTERY - CONTAINERIZED								August 29, 2014	
Item Nos.	Item Description	Quantity		Material Cost		Labor Cost		Engineering Estimate	
		Number	Unit	Unit Cost	Total	Unit Cost	Total	Unit Cost	Total Cost
I	**SITE 1 - AGANA**								
1.0	**Mobilization**	ALL	LPSM					$ 435,227.10	$ 435,227.10
2.0	**Temporary Erosion & Sediment Control**								
2.1	Silt Fence	1000	LF					$ 4.50	$ 4,500.00
3.0	**Demolition**	-	SF						
3.1	Demolition of Existing Steel Structures	-	CF					$ 0.35	$ -
3.2	Disposal of Materials from Steel Structures Demolition	-	CY					$ 32.00	$ -
4.0	**Environmental Clean-up**								
4.1	Hazardous Materials Clean up - Lead Paint Removal	17,500	SF					$ 8.00	$ 140,000.00
3.2	Asbestos Removal and Disposal	3,500	SF					$ 60.00	$ 210,000.00
5.0	**Earthwork**								
5.1	Clearing and Grubbing	1.5	Acre					$ 6,800.00	$ 6,800.00
6.0	**Utility Connections**								
6.1	6" Water	200	LF					$ 78.00	$ 15,600.00
6.2	4" Sewer	500	LF					$ 94.00	$ 47,000.00
6.3	Electrical Connection to GPA Grid							$ 140.00	
6.3.1	Breaker[2]	ALL	LPSM					$ 436,400.00	$ 436,400.00
6.3.2	Bay/Bus[2]	ALL	LPSM					$ 545,500.00	$ 545,500.00
6.3.3	Transformer[2]	ALL	LPSM					$ 1,489,215.00	$ 1,489,215.00
6.3.4	Switchgear[2]	ALL	LPSM					$ 758,245.00	$ 758,245.00
6.4	Storm Drainage Consisting of Swales & Pipes	1,000	LF					$ 108.00	$ 108,000.00
7.0	**Energy Storage System**								
7.1	Demolish Existing Structure	ALL	LPSM					$ 500,000.00	$ 500,000.00
7.2	Equipment[2]	ALL	LPSM					$ 34,912,000.00	$ 34,912,000.00
7.3	Installation[2]	ALL	LPSM					$ 2,618,400.00	$ 2,618,400.00
7.4	Shipping[2]	ALL	LPSM					$ 1,431,392.00	$ 1,431,392.00
8.0	**AC Pavement & Parking Space**								
8.1	AC Pavement								
8.1.1	Demolish Existing AC Pavement	2,100	SY					$ 12.00	$ 25,200.00
8.1.2	New Access Road	2,800	SY						
8.1.2.1	Subbase, 12" Thick	950	CY					$ 60.00	$ 57,000.00
8.1.2.2	Base Course,8" Thick	650	CY					$ 80.00	$ 52,000.00
8.1.2.3	Tack Coat	450	Gal					$ 12.50	$ 5,625.00
8.1.2.4	Asphalt, 3" Thick	2,800	SY					$ 45.00	$ 126,000.00
8.1.2.5	4" Wide Striping	4,200	LF					$ 2.50	$ 10,500.00
8.2	Parking Space	240	SY						
8.2.1	Demolish Existing AC Pavement & Disposal	194	SY					$ 12.00	$ 2,333.33
8.2.2	New Parking Space	240	SY						
8.2.2.1	Subbase, 12" Thick	80	CY					$ 60.00	$ 4,800.00
8.2.2.2	Base Course,8" Thick	55	CY					$ 80.00	$ 4,400.00
8.2.2.3	Tack Coat	40	Gal					$ 12.50	$ 500.00
8.2.2.4	Asphalt, 3" Thick	240	SY					$ 45.00	$ 10,800.00
8.2.2.5	4" Wide Striping	200	LF					$ 2.50	$ 500.00
9.0	**Reconfiguration of Chain Link Fence**								
9.1	Removal of Existing Chain Link Fence	-	LF					$ 10.00	$ -
9.2	Installation of New Chain Link Fence	-	LF					$ 45.00	$ -
10.0	**Technical Services**								
10.1	Site Survey and Surface Investigation	ALL	LPSM					$ 593,432.16	$ 593,432.16
10.2	Architect-Engineer Services	ALL	LPSM					$ 1,098,948.44	$ 1,098,948.44
10.3	Construction Management	ALL	LPSM					$ 1,538,527.81	$ 1,538,527.81
						Total Estimated Cost			**$ 47,188,845.84**
						Contingency[1], 10%			**$ 4,718,884.58**
						Sub-Total			**$ 51,907,730.42**
						GRT, 4.167%			**$ 2,162,995.13**
						Total Cost			**$ 54,070,725.55**
						Total Estimated Cost (Rounded)			**$ 54,071,000.00**

Notes:

1: 10% Contingency was added to cover items not evident at this level.

2: 9.1% was added to Items 6.3.1-6.3.4 and Items 7.2-7.4 to provide a total contingency of 20%

BUDGETARY COST ESTIMATE

Guam Power Authority Energy Storage Facility
Feasibility Study

SITE 1 - AGANA - FLYWHEEL 5-MINUTE								**August 29, 2014**	
Item Nos.	**Item Description**	**Quantity**		**Material Cost**		**Labor Cost**		**Engineering Estimate**	
		Number	**Unit**	**Unit Cost**	**Total**	**Unit Cost**	**Total**	**Unit Cost**	**Total Cost**
I	**SITE 1 - AGANA**								
1.0	**Mobilization**	ALL	LPSM					$ 463,972.23	$ 463,972.23
2.0	**Temporary Erosion & Sediment Control**								
2.1	Silt Fence	1000	LF					$ 4.50	$ 4,500.00
3.0	**Demolition**	-	SF						
3.1	Demolition of Existing Steel Structures	-	CF					$ 0.35	$ -
3.2	Disposal of Materials from Steel Structures Demolition	-	CY					$ 32.00	$ -
4.0	**Environmental Clean-up**								
4.1	Hazardous Materials Clean up - Lead Paint Removal	17,500	SF					$ 8.00	$ 140,000.00
3.2	Asbestos Removal and Disposal	3,500	SF					$ 60.00	$ 210,000.00
5.0	**Earthwork**								
5.1	Clearing and Grubbing	1.5	Acre					$ 6,800.00	$ 6,800.00
6.0	**Utility Connections**								
6.1	6" Water	200	LF					$ 78.00	$ 15,600.00
6.2	4" Sewer	500	LF					$ 94.00	$ 47,000.00
6.3	Electrical Connection to GPA Grid							$ 140.00	
6.3.1	Breaker[2]	ALL	LPSM					$ 436,400.00	$ 436,400.00
6.3.2	Bay/Bus[2]	ALL	LPSM					$ 545,500.00	$ 545,500.00
6.3.3	Transformer[2]	ALL	LPSM					$ 1,489,215.00	$ 1,489,215.00
6.3.4	Switchgear[2]	ALL	LPSM					$ 758,245.00	$ 758,245.00
6.4	Storm Drainage Consisting of Swales & Pipes	1,000	LF					$ 108.00	$ 108,000.00
7.0	**Energy Storage System**								
7.1	Demolish Existing Structure	ALL	LPSM					$ 500,000.00	$ 500,000.00
7.2	Equipment[2]	ALL	LPSM					$ 33,602,800.00	$ 33,602,800.00
7.3	Installation[2]	ALL	LPSM					$ 7,637,000.00	$ 7,637,000.00
7.4	Shipping[2]	ALL	LPSM					$ 596,504.25	$ 596,504.25
8.0	**AC Pavement & Parking Space**								
8.1	AC Pavement								
8.1.1	Demolish Existing AC Pavement	2,100	SY					$ 12.00	$ 25,200.00
8.1.2	New Access Road	2,800	SY						
8.1.2.1	Subbase, 12" Thick	950	CY					$ 60.00	$ 57,000.00
8.1.2.2	Base Course,8" Thick	650	CY					$ 80.00	$ 52,000.00
8.1.2.3	Tack Coat	450	Gal					$ 12.50	$ 5,625.00
8.1.2.4	Asphalt, 3" Thick	2,800	SY					$ 45.00	$ 126,000.00
8.1.2.5	4" Wide Striping	4,200	LF					$ 2.50	$ 10,500.00
8.2	Parking Space	240	SY						
8.2.1	Demolish Existing AC Pavement & Disposal	194	SY					$ 12.00	$ 2,333.33
8.2.2	New Parking Space	240	SY						
8.2.2.1	Subbase, 12" Thick	80	CY					$ 60.00	$ 4,800.00
8.2.2.2	Base Course,8" Thick	55	CY					$ 80.00	$ 4,400.00
8.2.2.3	Tack Coat	40	Gal					$ 12.50	$ 500.00
8.2.2.4	Asphalt, 3" Thick	240	SY					$ 45.00	$ 10,800.00
8.2.2.5	4" Wide Striping	200	LF					$ 2.50	$ 500.00
9.0	**Reconfiguration of Chain Link Fence**								
9.1	Removal of Existing Chain Link Fence	-	LF					$ 10.00	$ -
9.2	Installation of New Chain Link Fence	-	LF					$ 45.00	$ -
10.0	**Technical Services**								
10.1	Site Survey and Surface Investigation	ALL	LPSM					$ 632,626.13	$ 632,626.13
10.2	Architect-Engineer Services	ALL	LPSM					$ 1,171,529.87	$ 1,171,529.87
10.3	Construction Management	ALL	LPSM					$ 1,640,141.82	$ 1,640,141.82
						Total Estimated Cost			**$ 50,305,492.63**
						Contingency[1], 10%			**$ 5,030,549.26**
						Sub-Total			**$ 55,336,041.89**
						GRT, 4.167%			**$ 2,305,852.87**
						Total Cost			**$ 57,641,894.76**
						Total Estimated Cost (Rounded)			**$ 57,642,000.00**

Notes:
1: 10% Contingency was added to cover items not evident at this level.
2: 9.1% was added to Items 6.3.1-6.3.4 and Items 7.2-7.4 to provide a total contingency of 20%

BUDGETARY COST ESTIMATE

Guam Power Authority Energy Storage Facility
Feasibility Study

SITE 2 - HARMON - BATTERY - BUILDING-BASED									August 29, 2014
Item Nos.	Item Description	Quantity		Material Cost		Labor Cost		Engineering Estimate	
		Number	Unit	Unit Cost	Total	Unit Cost	Total	Unit Cost	Total Cost
I	**SITE 2 - HARMON**								
1.0	**Mobilization**	ALL	LPSM					$ 408,901.94	$ 408,901.94
2.0	**Temporary Erosion & Sediment Control**								
2.1	Silt Fence	1000	LF					$ 5.00	$ 5,000.00
3.0	**Demolition**		SF						
3.1	Demolition of Existing Steel Structures	-	CF					$ 0.35	$ -
3.2	Disposal of Materials from Demolition	-	CY					$ 32.00	$ -
4.0	**Environmental Clean-up**								
4.1	Hazardous Materials Clean up - Lead Paint Remova	-	SF					$ 8.00	$ -
4.2	Asbestos Removal and Disposal	-	SF					$ 60.00	$ -
5.0	**Earthwork**								
5.1	Clearing and Grubbing	1	Acre					$ 6,800.00	$ 6,800.00
6.0	**Utility Connections**								
6.1	6" Waterline	300	LF					$ 78.00	$ 23,400.00
6.2	4" Sewerline	900	LF					$ 94.00	$ 84,600.00
6.3	Electrical Connection to GPA Grid								$ -
6.3.1	Breaker[2]	ALL	LPSM					$ 436,400.00	$ 436,400.00
6.3.2	Bay/Bus[2]	ALL	LPSM					$ 545,500.00	$ 545,500.00
6.3.3	Transformer[2]	ALL	LPSM					$ 1,489,215.00	$ 1,489,215.00
6.3.4	Switchgear[2]	ALL	LPSM					$ 758,245.00	$ 695,000.00
6.4	Storm Drainage Consisting of Swales & Pipes	1,000	LF					$ 108.00	$ 108,000.00
7.0	**Energy Storage Structure**								
7.1	Construct Structure	15,000	SF					$ 215.00	$ 3,225,000.00
7.2	Equipment[2]	ALL	LPSM					$ 30,548,000.00	$ 30,548,000.00
7.3	Installation[2]	ALL	LPSM					$ 2,094,720.00	$ 2,094,720.00
7.4	Shipping[2]	ALL	LPSM					$ 1,193,008.50	$ 1,193,008.50
8.0	**AC Pavement & Parking Space**								
8.1	AC Pavement								
8.1.1	Demolish Existing AC Pavement	1,700	SY					$ 12.00	$ 20,400.00
8.1.2	New Access Road	4,100	SY						$ -
8.1.2.1	12" Thick Subbase	1,380	CY					$ 60.00	$ 82,800.00
8.1.2.2	8" Thick Base Course	920	CY					$ 80.00	$ 73,600.00
8.1.2.3	Tack Coat	620	Gal					$ 12.50	$ 7,750.00
8.1.2.4	Asphalt, 3" Thick	4,100	SY					$ 45.00	$ 184,500.00
8.1.2.5	4" Wide Striping	7,000	LF					$ 2.50	$ 17,500.00
8.2	Parking Space	240	SY						
8.2.1	Demolish Existing AC Pavement & Disposal	-	SY					$ 12.00	$ -
8.2.2	New Parking Space	240	SY						
8.2.2.1	Subbase, 12" Thick	80	CY					$ 60.00	$ 4,800.00
8.2.2.2	Base Course,8" Thick	55	CY					$ 80.00	$ 4,400.00
8.2.2.3	Asphalt, 3" Thick	240	SY					$ 45.00	$ 10,800.00
8.2.2.3	Tack Coat	50	Gal					$ 12.50	$ 625.00
8.2.2.5	4" Wide Striping	200	LF					$ 2.50	$ 500.00
9.0	**Reconfiguration of Chain Link Fence**								
9.1	Removal of Existing Chain Link Fence	425	LF					$ 10.00	$ 4,250.00
9.2	Installation of New Chain Link Fence	525	LF					$ 45.00	$ 23,625.00
10.0	**Technical Services**								
10.1	Site Survey and Surface Investigation	ALL	LPSM					$ 557,537.79	$ 557,537.79
10.2	Architect-Engineer Services	ALL	LPSM					$ 1,032,477.39	$ 1,032,477.39
10.3	Construction Management	ALL	LPSM					$ 1,445,468.34	$ 1,445,468.34
						Total Estimated Cost			**$ 44,334,578.95**
						Contingency[1], 10%			**$ 4,433,457.89**
						Sub-Total			**$ 48,768,036.84**
						GRT, 4.167%			**$ 2,032,164.10**
						Total Cost			**$ 50,800,200.94**
						Total Estimated Cost (Rounded)			**$ 50,800,000.00**

Notes:

1: 10% Contingency was added to cover items not evident at this level.

2: 9.1% was added to Items 6.3.1-6.3.4 and Items 7.2-7.4 to provide a total contingency of 20%

BUDGETARY COST ESTIMATE

Guam Power Authority Energy Storage Facility
Feasibility Study

SITE 2 - HARMON - BATTERY - CONTAINERIZED								August 29, 2014	
Item Nos.	Item Description	Quantity		Material Cost		Labor Cost		Engineering Estimate	
		Number	Unit	Unit Cost	Total	Unit Cost	Total	Unit Cost	Total Cost
I	**SITE 2 - HARMON**								
1.0	**Mobilization**	ALL	LPSM					$ 427,912.57	$ 427,912.57
2.0	**Temporary Erosion & Sediment Control**								
2.1	Silt Fence	1000	LF					$ 5.00	$ 5,000.00
3.0	**Demolition**		SF						
3.1	Demolition of Existing Steel Structures	-	CF					$ 0.35	$ -
3.2	Disposal of Materials from Demolition	-	CY					$ 32.00	$ -
4.0	**Environmental Clean-up**								
4.1	Hazardous Materials Clean up - Lead Paint Removal	-	SF					$ 8.00	$ -
4.2	Asbestos Removal and Disposal	-	SF					$ 60.00	$ -
5.0	**Earthwork**								
5.1	Clearing and Grubbing	1	Acre					$ 6,800.00	$ 6,800.00
6.0	**Utility Connections**								
6.1	6" Waterline	300	LF					$ 78.00	$ 23,400.00
6.2	4" Sewerline	900	LF					$ 94.00	$ 84,600.00
6.3	Electrical Connection to GPA Grid								$ -
6.3.1	Breaker[2]	ALL	LPSM					$ 436,400.00	$ 436,400.00
6.3.2	Bay/Bus[2]	ALL	LPSM					$ 545,500.00	$ 545,500.00
6.3.3	Transformer[2]	ALL	LPSM					$ 1,489,215.00	$ 1,489,215.00
6.3.4	Switchgear[2]	ALL	LPSM					$ 758,245.00	$ 695,000.00
6.4	Storm Drainage Consisting of Swales & Pipes	1,000	LF					$ 108.00	$ 108,000.00
7.0	**Energy Storage Structure**								
7.1	Construct Structure	-	SF					$ 215.00	$ -
7.2	Equipment[2]	ALL	LPSM					$ 34,912,000.00	$ 34,912,000.00
7.3	Installation[2]	ALL	LPSM					$ 2,618,400.00	$ 2,618,400.00
7.4	Shipping[2]	ALL	LPSM					$ 1,431,392.00	$ 1,431,392.00
8.0	**AC Pavement & Parking Space**								
8.1	AC Pavement								
8.1.1	Demolish Existing AC Pavement	1,700	SY					$ 12.00	$ 20,400.00
8.1.2	New Access Road	4,100	SY						$ -
8.1.2.1	12" Thick Subbase	1,380	CY					$ 60.00	$ 82,800.00
8.1.2.2	8" Thick Base Course	920	CY					$ 80.00	$ 73,600.00
8.1.2.3	Tack Coat	620	Gal					$ 12.50	$ 7,750.00
8.1.2.4	Asphalt, 3" Thick	4,100	SY					$ 45.00	$ 184,500.00
8.1.2.5	4" Wide Striping	7,000	LF					$ 2.50	$ 17,500.00
8.2	Parking Space	240	SY						
8.2.1	Demolish Existing AC Pavement & Disposal	-	SY					$ 12.00	$ -
8.2.2	New Parking Space	240	SY						
8.2.2.1	Subbase, 12" Thick	80	CY					$ 60.00	$ 4,800.00
8.2.2.2	Base Course,8" Thick	55	CY					$ 80.00	$ 4,400.00
8.2.2.3	Asphalt, 3" Thick	240	SY					$ 45.00	$ 10,800.00
8.2.2.3	Tack Coat	50	Gal					$ 12.50	$ 625.00
8.2.2.5	4" Wide Striping	200	LF					$ 2.50	$ 500.00
9.0	**Reconfiguration of Chain Link Fence**								
9.1	Removal of Existing Chain Link Fence	425	LF					$ 10.00	$ 4,250.00
9.2	Installation of New Chain Link Fence	525	LF					$ 45.00	$ 23,625.00
10.0	**Technical Services**								
10.1	Site Survey and Surface Investigation	ALL	LPSM					$ 583,458.79	$ 583,458.79
10.2	Architect-Engineer Services	ALL	LPSM					$ 1,080,479.24	$ 1,080,479.24
10.3	Construction Management	ALL	LPSM					$ 1,512,670.93	$ 1,512,670.93
						Total Estimated Cost			**$ 46,395,778.53**
						Contingency[1], 10%			**$ 4,639,577.85**
						Sub-Total			**$ 51,035,356.39**
						GRT, 4.167%			**$ 2,126,643.30**
						Total Cost			**$ 53,161,999.69**
						Total Estimated Cost (Rounded)			**$ 53,162,000.00**

Notes:

1: 10% Contingency was added to cover items not evident at this level.

2: 9.1% was added to Items 6.3.1-6.3.4 and Items 7.2-7.4 to provide a total contingency of 20%

BUDGETARY COST ESTIMATE

Guam Power Authority Energy Storage Facility
Feasibility Study

SITE 2 - HARMON - FLYWHEEL 5-MINUTE								August 29, 2014	
Item Nos.	Item Description	Quantity		Material Cost		Labor Cost		Engineering Estimate	
		Number	Unit	Unit Cost	Total	Unit Cost	Total	Unit Cost	Total Cost
I	**SITE 2 - HARMON**								
1.0	**Mobilization**	ALL	LPSM					$ 456,657.69	$ 456,657.69
2.0	**Temporary Erosion & Sediment Control**								
2.1	Silt Fence	1000	LF					$ 5.00	$ 5,000.00
3.0	**Demolition**		SF						
3.1	Demolition of Existing Steel Structures	-	CF					$ 0.35	$ -
3.2	Disposal of Materials from Demolition	-	CY					$ 32.00	$ -
4.0	**Environmental Clean-up**								
4.1	Hazardous Materials Clean up - Lead Paint Remova	-	SF					$ 8.00	$ -
4.2	Asbestos Removal and Disposal	-	SF					$ 60.00	$ -
5.0	**Earthwork**								
5.1	Clearing and Grubbing	1	Acre					$ 6,800.00	$ 6,800.00
6.0	**Utility Connections**								
6.1	6" Waterline	300	LF					$ 78.00	$ 23,400.00
6.2	4" Sewerline	900	LF					$ 94.00	$ 84,600.00
6.3	Electrical Connection to GPA Grid								$ -
6.3.1	Breaker[2]	ALL	LPSM					$ 436,400.00	$ 436,400.00
6.3.2	Bay/Bus[2]	ALL	LPSM					$ 545,500.00	$ 545,500.00
6.3.3	Transformer[2]	ALL	LPSM					$ 1,489,215.00	$ 1,489,215.00
6.3.4	Switchgear[2]	ALL	LPSM					$ 758,245.00	$ 695,000.00
6.4	Storm Drainage Consisting of Swales & Pipes	1,000	LF					$ 108.00	$ 108,000.00
7.0	**Energy Storage Structure**								
7.1	Construct Structure	-	SF					$ 215.00	$ -
7.2	Equipment[2]	ALL	LPSM					$ 33,602,800.00	$ 33,602,800.00
7.3	Installation[2]	ALL	LPSM					$ 7,637,000.00	$ 7,637,000.00
7.4	Shipping[2]	ALL	LPSM					$ 596,504.25	$ 596,504.25
8.0	**AC Pavement & Parking Space**								
8.1	AC Pavement								
8.1.1	Demolish Existing AC Pavement	1,700	SY					$ 12.00	$ 20,400.00
8.1.2	New Access Road	4,100	SY						$ -
8.1.2.1	12" Thick Subbase	1,380	CY					$ 60.00	$ 82,800.00
8.1.2.2	8" Thick Base Course	920	CY					$ 80.00	$ 73,600.00
8.1.2.3	Tack Coat	620	Gal					$ 12.50	$ 7,750.00
8.1.2.4	Asphalt, 3" Thick	4,100	SY					$ 45.00	$ 184,500.00
8.1.2.5	4" Wide Striping	7,000	LF					$ 2.50	$ 17,500.00
8.2	Parking Space	240	SY						
8.2.1	Demolish Existing AC Pavement & Disposal	-	SY					$ 12.00	$ -
8.2.2	New Parking Space	240	SY						
8.2.2.1	Subbase, 12" Thick	80	CY					$ 60.00	$ 4,800.00
8.2.2.2	Base Course,8" Thick	55	CY					$ 80.00	$ 4,400.00
8.2.2.3	Asphalt, 3" Thick	240	SY					$ 45.00	$ 10,800.00
8.2.2.3	Tack Coat	50	Gal					$ 12.50	$ 625.00
8.2.2.5	4" Wide Striping	200	LF					$ 2.50	$ 500.00
9.0	**Reconfiguration of Chain Link Fence**								
9.1	Removal of Existing Chain Link Fence	425	LF					$ 10.00	$ 4,250.00
9.2	Installation of New Chain Link Fence	525	LF					$ 45.00	$ 23,625.00
10.0	**Technical Services**								
10.1	Site Survey and Surface Investigation	ALL	LPSM					$ 622,652.76	$ 622,652.76
10.2	Architect-Engineer Services	ALL	LPSM					$ 1,153,060.67	$ 1,153,060.67
10.3	Construction Management	ALL	LPSM					$ 1,614,284.94	$ 1,614,284.94
						Total Estimated Cost			**$ 49,512,425.32**
						Contingency[1], 10%			**$ 4,951,242.53**
						Sub-Total			**$ 54,463,667.86**
						GRT, 4.167%			**$ 2,269,501.04**
						Total Cost			**$ 56,733,168.89**
						Total Estimated Cost (Rounded)			**$ 56,733,000.00**

Notes:

1: 10% Contingency was added to cover items not evident at this level.

2: 9.1% was added to Items 6.3.1-6.3.4 and Items 7.2-7.4 to provide a total contingency of 20%

BUDGETARY COST ESTIMATE

Guam Power Authority Energy Storage Facility
Feasibility Study

SITE 3 - MARBO - BATTERY - BUILDING-BASED								**August 29, 2014**	
Item Nos.	**Item Description**	**Quantity**		**Material Cost**		**Labor Cost**		**Engineering Estimate**	
		Number	**Unit**	**Unit Cost**	**Total**	**Unit Cost**	**Total**	**Unit Cost**	**Total Cost**
I	**SITE 3 - MARBO**								
1.0	**Mobilization**	ALL	LPSM					$ 407,186.24	$ 407,186.24
2.0	**Temporary Erosion & Sediment Control**								
2.1	Silt Fence	1000	LF					$ 5.00	$ 5,000.00
3.0	**Demolition**	3,000	SF						
3.1	Demolition of Existing Steel Structures	60,000	CF					$ 0.35	$ 21,000.00
3.2	Disposal of Materials from Steel Structures Demolition	2,500	CY					$ 32.00	$ 80,000.00
4.0	**Environmental Clean-up**								
4.1	Hazardous Materials Clean up - Lead Paint Removal	3,000	SF					$ 8.00	$ 24,000.00
4.2	Asbestos Removal and Disposal	3,000	SF					$ 60.00	$ 180,000.00
5.0	**Earthwork**								
5.1	Clearing and Grubbing	1	Acre					$ 6,800.00	$ 6,800.00
6.0	**Utility Connections**								
6.1	6" Waterline	2,800	LF					$ 78.00	$ 218,400.00
6.2	4" Sewerline	2,500	LF					$ 94.00	$ 235,000.00
6.3	Electrical Connection to GPA Grid								$ -
6.3.1	Breaker[2]	ALL	LPSM					$ -	$ -
6.3.2	Bay/Bus[2]	ALL	LPSM					$ 272,750.00	$ 272,750.00
6.3.3	Transformer[2]	ALL	LPSM					$ 1,489,215.00	$ 1,489,215.00
6.3.4	Switchgear[2]	ALL	LPSM					$ 758,245.00	$ 758,245.00
6.4	Storm Drainage Consisting of Swales & Pipes	1,000	LF					$ 108.00	$ 108,000.00
7.0	**Energy Storage Structure**								
7.1	Construct Structure	15,000	SF					$ 215.00	$ 3,225,000.00
7.2	Equipment[2]	ALL	LPSM					$ 30,548,000.00	$ 30,548,000.00
7.3	Installation[2]	ALL	LPSM					$ 2,094,720.00	$ 2,094,720.00
7.4	Shipping[2]	ALL	LPSM					$ 1,193,008.50	$ 1,193,008.50
8.0	**AC Pavement & Parking Space**								
8.1	AC Pavement								
8.1.1	Demolish Existing AC Pavement & Disposal	-	SY					$ 12.00	$ -
8.1.2	New Access Road	900	LF						
8.1.2.1	Subbase	800	CY					$ 60.00	$ 48,000.00
8.1.2.2	Base Course	550	CY					$ 80.00	$ 44,000.00
8.1.2.3	Tack Coat	400	Gal					$ 12.50	$ 5,000.00
8.1.2.4	Asphalt, 3" Thick	2,400	SY					$ 45.00	$ 108,000.00
8.1.2.5	4" Wide Striping	3,600	LF					$ 2.50	$ 9,000.00
8.2	Parking Space	2,000	SF						
8.2.1	Demolish Existing AC Pavement	-	SY					$ 12.00	$ -
8.2.2	New Parking Space	240	SY						
8.2.2.1	Subbase, 12" Thick	80	CY					$ 60.00	$ 4,800.00
8.2.2.2	Base Course,8" Thick	55	CY					$ 80.00	$ 4,400.00
8.2.2.3	Tack Coat	50	Gal					$ 12.50	$ 625.00
8.2.2.4	Asphalt, 3" Thick	240	SY					$ 45.00	$ 10,800.00
8.2.2.5	4" Wide Striping	200	LF					$ 2.50	$ 500.00
9.0	**Reconfiguration of Chain Link Fence**								
9.1	Removal of Existing Chain Link Fence	411	LF					$ 10.00	$ 4,110.00
9.2	Installation of New Chain Link Fence	450	LF					$ 45.00	$ 20,250.00
10.0	**Technical Services**								
10.1	Site Survey and Surface Investigation	ALL	LPSM					$ 555,198.43	$ 555,198.43
10.2	Architect-Engineer Services	ALL	LPSM					$ 1,028,145.24	$ 1,028,145.24
10.3	Construction Management	ALL	LPSM					$ 1,439,403.34	$ 1,439,403.34
						Total Estimated Cost			**$ 44,148,556.75**
						Contingency[1], 10%			**$ 4,414,855.68**
						Sub-Total			**$ 48,563,412.43**
						GRT, 4.167%			**$ 2,023,637.40**
						Total Cost			**$ 50,587,049.82**
						Total Estimated Cost (Rounded)			**$ 50,587,000.00**

Notes:

1: 10% Contingency was added to cover items not evident at this level.

2: 9.1% was added to Items 6.3.1-6.3.4 and Items 7.2-7.4 to provide a total contingency of 20%

BUDGETARY COST ESTIMATE

Guam Power Authority Energy Storage Facility
Feasibility Study

SITE 3 - MARBO - BATTERY - CONTAINERIZED								**August 29, 2014**	
Item Nos.	**Item Description**	**Quantity**		**Material Cost**		**Labor Cost**		**Engineering Estimate**	
		Number	**Unit**	**Unit Cost**	**Total**	**Unit Cost**	**Total**	**Unit Cost**	**Total Cost**
I	**SITE 3 - MARBO**								
1.0	**Mobilization**	ALL	LPSM					$ 426,196.87	$ 426,196.87
2.0	**Temporary Erosion & Sediment Control**								
2.1	Silt Fence	1000	LF					$ 5.00	$ 5,000.00
3.0	**Demolition**	3,000	SF						
3.1	Demolition of Existing Steel Structures	60,000	CF					$ 0.35	$ 21,000.00
3.2	Disposal of Materials from Steel Structures Demolition	2,500	CY					$ 32.00	$ 80,000.00
4.0	**Environmental Clean-up**								
4.1	Hazardous Materials Clean up - Lead Paint Removal	3,000	SF					$ 8.00	$ 24,000.00
4.2	Asbestos Removal and Disposal	3,000	SF					$ 60.00	$ 180,000.00
5.0	**Earthwork**								
5.1	Clearing and Grubbing	1	Acre					$ 6,800.00	$ 6,800.00
6.0	**Utility Connections**								
6.1	6" Waterline	2,800	LF					$ 78.00	$ 218,400.00
6.2	4" Sewerline	2,500	LF					$ 94.00	$ 235,000.00
6.3	Electrical Connection to GPA Grid								$ -
6.3.1	Breaker[2]	ALL	LPSM					$ -	$ -
6.3.2	Bay/Bus[2]	ALL	LPSM					$ 272,750.00	$ 272,750.00
6.3.3	Transformer[2]	ALL	LPSM					$ 1,489,215.00	$ 1,489,215.00
6.3.4	Switchgear[2]	ALL	LPSM					$ 758,245.00	$ 758,245.00
6.4	Storm Drainage Consisting of Swales & Pipes	1,000	LF					$ 108.00	$ 108,000.00
7.0	**Energy Storage Structure**								
7.1	Construct Structure	-	SF					$ 215.00	$ -
7.2	Equipment[2]	ALL	LPSM					$ 34,912,000.00	$ 34,912,000.00
7.3	Installation[2]	ALL	LPSM					$ 2,618,400.00	$ 2,618,400.00
7.4	Shipping[2]	ALL	LPSM					$ 1,431,392.00	$ 1,431,392.00
8.0	**AC Pavement & Parking Space**								
8.1	AC Pavement								
8.1.1	Demolish Existing AC Pavement & Disposal	-	SY					$ 12.00	$ -
8.1.2	New Access Road	900	LF						
8.1.2.1	Subbase	800	CY					$ 60.00	$ 48,000.00
8.1.2.2	Base Course	550	CY					$ 80.00	$ 44,000.00
8.1.2.3	Tack Coat	400	Gal					$ 12.50	$ 5,000.00
8.1.2.4	Asphalt, 3" Thick	2,400	SY					$ 45.00	$ 108,000.00
8.1.2.5	4" Wide Striping	3,600	LF					$ 2.50	$ 9,000.00
8.2	Parking Space	2,000	SF						
8.2.1	Demolish Existing AC Pavement	-	SY					$ 12.00	$ -
8.2.2	New Parking Space	240	SY						
8.2.2.1	Subbase, 12" Thick	80	CY					$ 60.00	$ 4,800.00
8.2.2.2	Base Course,8" Thick	55	CY					$ 80.00	$ 4,400.00
8.2.2.3	Tack Coat	50	Gal					$ 12.50	$ 625.00
8.2.2.4	Asphalt, 3" Thick	240	SY					$ 45.00	$ 10,800.00
8.2.2.5	4" Wide Striping	200	LF					$ 2.50	$ 500.00
9.0	**Reconfiguration of Chain Link Fence**								
9.1	Removal of Existing Chain Link Fence	411	LF					$ 10.00	$ 4,110.00
9.2	Installation of New Chain Link Fence	450	LF					$ 45.00	$ 20,250.00
10.0	**Technical Services**								
10.1	Site Survey and Surface Investigation	ALL	LPSM					$ 581,119.43	$ 581,119.43
10.2	Architect-Engineer Services	ALL	LPSM					$ 1,076,147.10	$ 1,076,147.10
10.3	Construction Management	ALL	LPSM					$ 1,506,605.94	$ 1,506,605.94
						Total Estimated Cost			**$ 46,209,756.33**
						Contingency[1], 10%			**$ 4,620,975.63**
						Sub-Total			**$ 50,830,731.97**
						GRT, 4.167%			**$ 2,118,116.60**
						Total Cost			**$ 52,948,848.57**
						Total Estimated Cost (Rounded)			**$ 52,949,000.00**

Notes:

1: 10% Contingency was added to cover items not evident at this level.

2: 9.1% was added to Items 6.3.1-6.3.4 and Items 7.2-7.4 to provide a total contingency of 20%

BUDGETARY COST ESTIMATE

Guam Power Authority Energy Storage Facility
Feasibility Study

SITE 3 - MARBO - FLYWHEEL 5-MINUTE								**August 29, 2014**	
Item Nos.	**Item Description**	**Quantity**		**Material Cost**		**Labor Cost**		**Engineering Estimate**	
		Number	**Unit**	**Unit Cost**	**Total**	**Unit Cost**	**Total**	**Unit Cost**	**Total Cost**
I	**SITE 3 - MARBO**								
1.0	**Mobilization**	ALL	LPSM					$ 454,941.99	$ 454,941.99
2.0	**Temporary Erosion & Sediment Control**								
2.1	Silt Fence	1000	LF					$ 5.00	$ 5,000.00
3.0	**Demolition**	3,000	SF						
3.1	Demolition of Existing Steel Structures	60,000	CF					$ 0.35	$ 21,000.00
3.2	Disposal of Materials from Steel Structures Demolition	2,500	CY					$ 32.00	$ 80,000.00
4.0	**Environmental Clean-up**								
4.1	Hazardous Materials Clean up - Lead Paint Removal	3,000	SF					$ 8.00	$ 24,000.00
4.2	Asbestos Removal and Disposal	3,000	SF					$ 60.00	$ 180,000.00
5.0	**Earthwork**								
5.1	Clearing and Grubbing	1	Acre					$ 6,800.00	$ 6,800.00
6.0	**Utility Connections**								
6.1	6" Waterline	2,800	LF					$ 78.00	$ 218,400.00
6.2	4" Sewerline	2,500	LF					$ 94.00	$ 235,000.00
6.3	Electrical Connection to GPA Grid								$ -
6.3.1	Breaker[2]	ALL	LPSM					$ -	$ -
6.3.2	Bay/Bus[2]	ALL	LPSM					$ 272,750.00	$ 272,750.00
6.3.3	Transformer[2]	ALL	LPSM					$ 1,489,215.00	$ 1,489,215.00
6.3.4	Switchgear[2]	ALL	LPSM					$ 758,245.00	$ 758,245.00
6.4	Storm Drainage Consisting of Swales & Pipes	1,000	LF					$ 108.00	$ 108,000.00
7.0	**Energy Storage Structure**								
7.1	Construct Structure	-	SF					$ 215.00	$ -
7.2	Equipment[2]	ALL	LPSM					$ 33,602,800.00	$ 33,602,800.00
7.3	Installation[2]	ALL	LPSM					$ 7,637,000.00	$ 7,637,000.00
7.4	Shipping[2]	ALL	LPSM					$ 596,504.25	$ 596,504.25
8.0	**AC Pavement & Parking Space**								
8.1	AC Pavement								
8.1.1	Demolish Existing AC Pavement & Disposal	-	SY					$ 12.00	$ -
8.1.2	New Access Road	900	LF						
8.1.2.1	Subbase	800	CY					$ 60.00	$ 48,000.00
8.1.2.2	Base Course	550	CY					$ 80.00	$ 44,000.00
8.1.2.3	Tack Coat	400	Gal					$ 12.50	$ 5,000.00
8.1.2.4	Asphalt, 3" Thick	2,400	SY					$ 45.00	$ 108,000.00
8.1.2.5	4" Wide Striping	3,600	LF					$ 2.50	$ 9,000.00
8.2	Parking Space	2,000	SF						
8.2.1	Demolish Existing AC Pavement	-	SY					$ 12.00	$ -
8.2.2	New Parking Space	240	SY						
8.2.2.1	Subbase, 12" Thick	80	CY					$ 60.00	$ 4,800.00
8.2.2.2	Base Course,8" Thick	55	CY					$ 80.00	$ 4,400.00
8.2.2.3	Tack Coat	50	Gal					$ 12.50	$ 625.00
8.2.2.4	Asphalt, 3" Thick	240	SY					$ 45.00	$ 10,800.00
8.2.2.5	4" Wide Striping	200	LF					$ 2.50	$ 500.00
9.0	**Reconfiguration of Chain Link Fence**								
9.1	Removal of Existing Chain Link Fence	411	LF					$ 10.00	$ 4,110.00
9.2	Installation of New Chain Link Fence	450	LF					$ 45.00	$ 20,250.00
10.0	**Technical Services**								
10.1	Site Survey and Surface Investigation	ALL	LPSM					$ 620,313.41	$ 620,313.41
10.2	Architect-Engineer Services	ALL	LPSM					$ 1,148,728.53	$ 1,148,728.53
10.3	Construction Management	ALL	LPSM					$ 1,608,219.94	$ 1,608,219.94
						Total Estimated Cost			**$ 49,326,403.12**
						Contingency[1], 10%			**$ 4,932,640.31**
						Sub-Total			**$ 54,259,043.44**
						GRT, 4.167%			**$ 2,260,974.34**
						Total Cost			**$ 56,520,017.78**
						Total Estimated Cost (Rounded)			**$ 56,520,000.00**

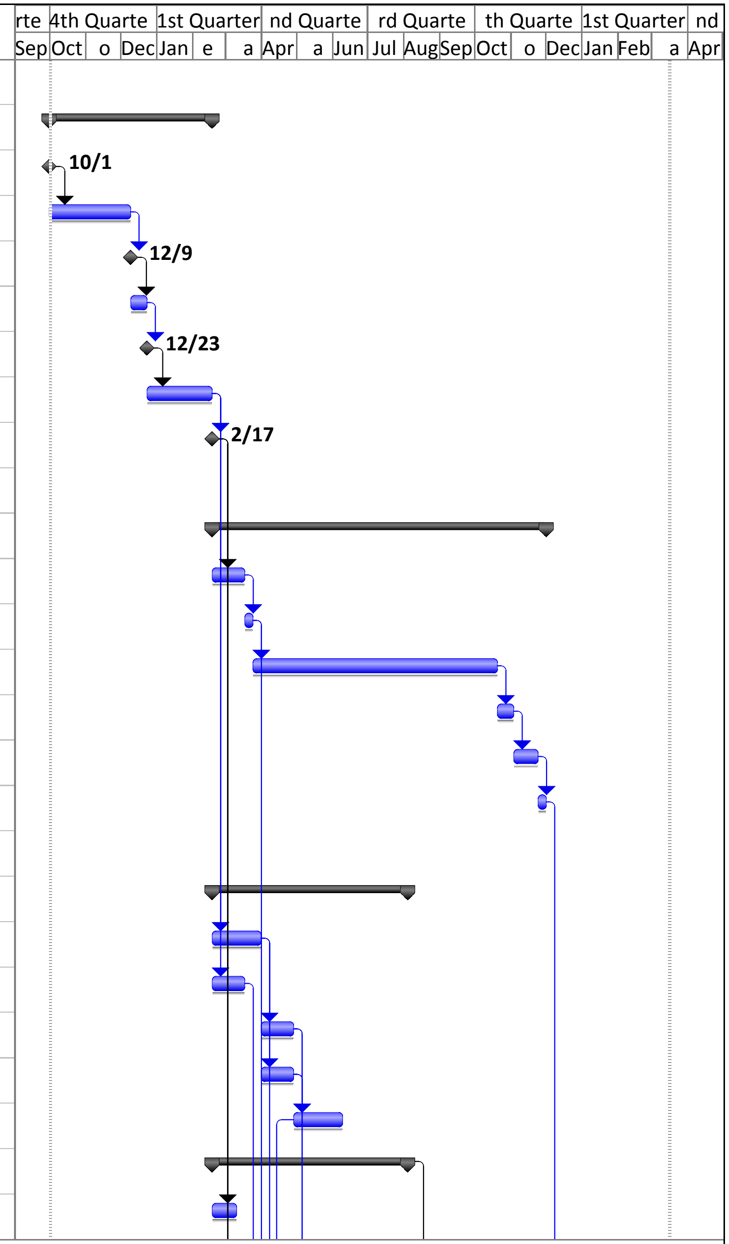
Notes:

1: 10% Contingency was added to cover items not evident at this level.

2: 9.1% was added to Items 6.3.1-6.3.4 and Items 7.2-7.4 to provide a total contingency of 20%

APPENDIX F – PRELIMINARY PROJECT SCHEDULES

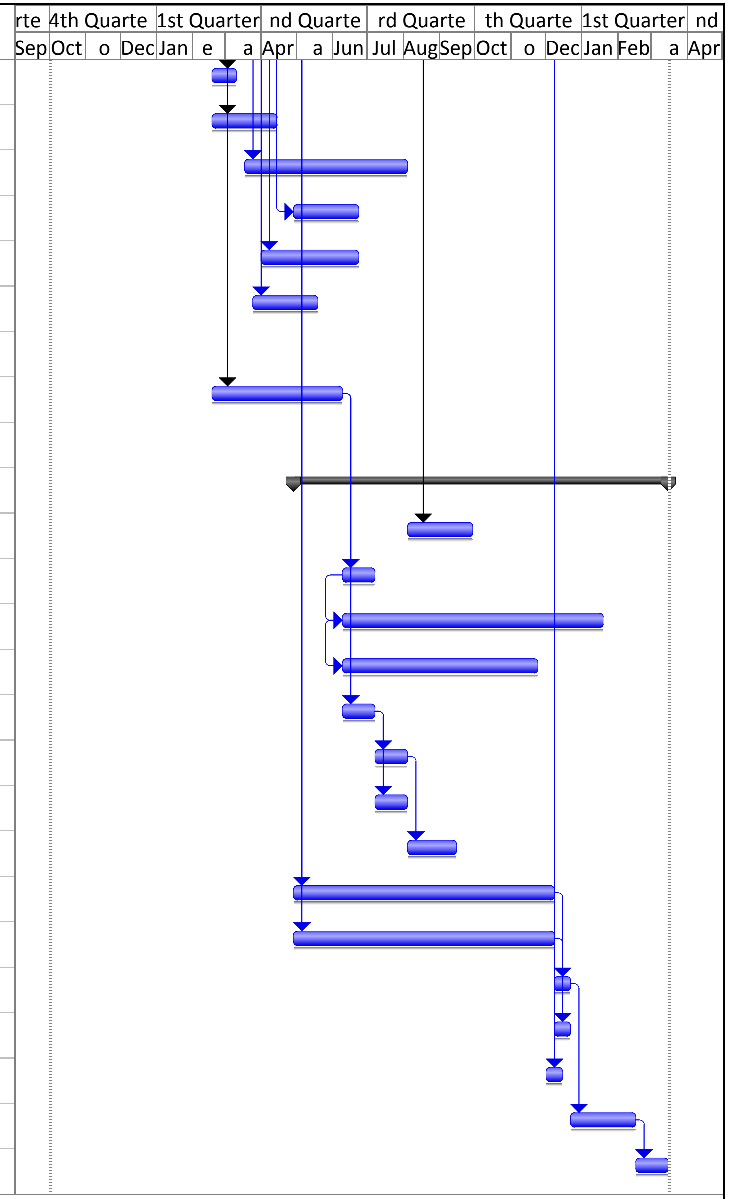
ID		Task Name	Duration	Start	Finish	Predecessors
1						
2		**ESS Acquisition**	**20 wks**	**Wed 10/1/14**	**Tue 2/17/15**	
3		Issue for Bid	0 wks	Wed 10/1/14	Wed 10/1/14	
4		Bid Period	10 wks	Wed 10/1/14	Tue 12/9/14	3
5		Bid Submittal	0 wks	Tue 12/9/14	Tue 12/9/14	4
6		Bid Evaluation	2 wks	Wed 12/10/14	Tue 12/23/14	5
7		Notice of Award	0 wks	Tue 12/23/14	Tue 12/23/14	6
8		Contract Administration	8 wks	Wed 12/24/14	Tue 2/17/15	7
9		Notice to Proceed	0 wks	Tue 2/17/15	Tue 2/17/15	8
10						
11		**ESS Production**	**41 wks**	**Wed 2/18/15**	**Tue 12/1/15**	
12		Preliminary Engineering	4 wks	Wed 2/18/15	Tue 3/17/15	9
13		Final Specifications	1 wk	Wed 3/18/15	Tue 3/24/15	12
14		Production	30 wks	Wed 3/25/15	Tue 10/20/15	13
15		Factory Acceptance Testing	2 wks	Wed 10/21/15	Tue 11/3/15	14
16		Shipping to Guam	3 wks	Wed 11/4/15	Tue 11/24/15	15
17		Site Delivery & Storage	1 wk	Wed 11/25/15	Tue 12/1/15	16
18						
19		**Site Design**	**24 wks**	**Wed 2/18/15**	**Tue 8/4/15**	
20		Preliminary Engineering	6 wks	Wed 2/18/15	Tue 3/31/15	8
21		Site Selection	4 wks	Wed 2/18/15	Tue 3/17/15	8
22		Transformer Specification	4 wks	Wed 4/1/15	Tue 4/28/15	20
23		Switchgear Specification	4 wks	Wed 4/1/15	Tue 4/28/15	20
24		Order Long Lead Items	6 wks	Wed 4/29/15	Tue 6/9/15	23,22
25		**Design**	**24 wks**	**Wed 2/18/15**	**Tue 8/4/15**	
26		Boundary Survey	3 wks	Wed 2/18/15	Tue 3/10/15	9



Project: Battery ESS
Date: Fri 6/27/14

Task		Summary		External Milestone	
Split		Project Summary		Deadline	
Milestone		External Tasks		Progress	

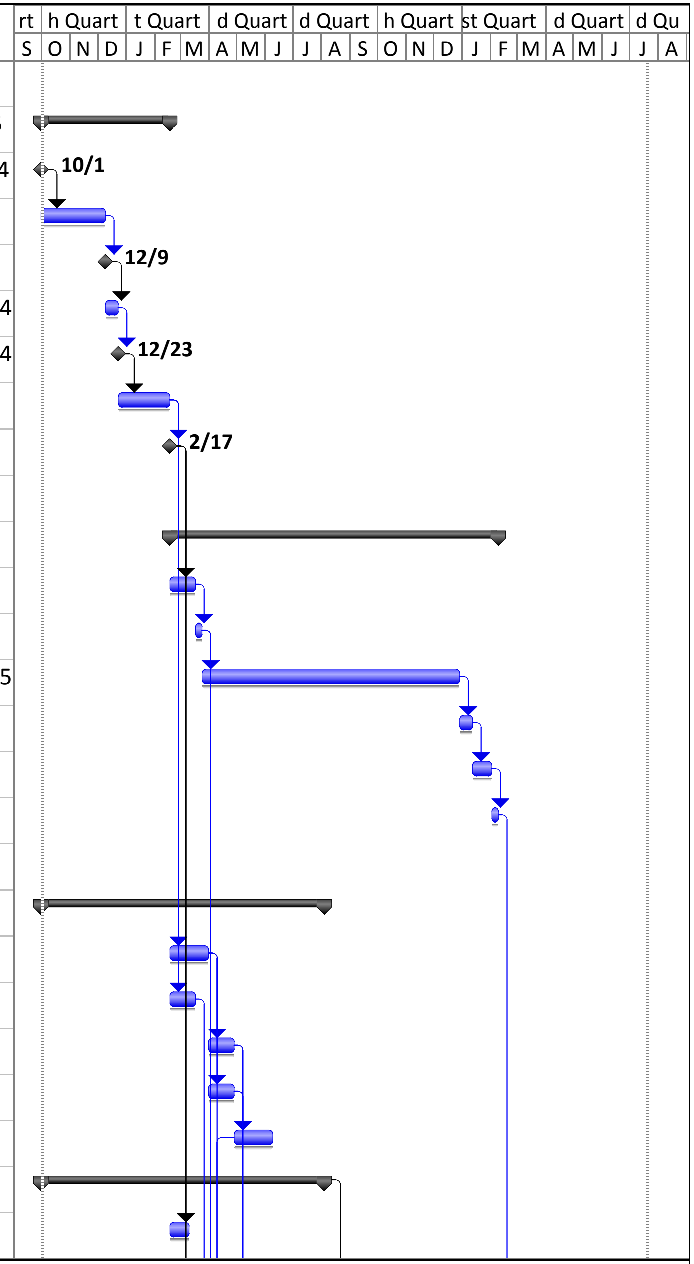
ID	ℹ	Task Name	Duration	Start	Finish	Predecessors
27		Topographic Survey	3 wks	Wed 2/18/15	Tue 3/10/15	9
28		Geotechnical Investigation & Report	8 wks	Wed 2/18/15	Tue 4/14/15	9
29		Civil/Structural	20 wks	Wed 3/18/15	Tue 8/4/15	21
30		Electrical Collector System	8 wks	Wed 4/29/15	Tue 6/23/15	24SS
31		Electrical Utility Tie	12 wks	Wed 4/1/15	Tue 6/23/15	20
32		Controls/SCADA	8 wks	Wed 3/25/15	Tue 5/19/15	13
33						
34		Permitting	16 wks	Wed 2/18/15	Tue 6/9/15	9
35						
36		**Site Construction**	**46 wks**	**Wed 4/29/15**	**Tue 3/15/16**	
37		Order Materials	8 wks	Wed 8/5/15	Tue 9/29/15	25
38		Demolition of Cooling Coils & Debris Disposal	4 wks	Wed 6/10/15	Tue 7/7/15	34
39		Building Upgrade	32 wks	Wed 6/10/15	Tue 1/19/16	38SS
40		Infrastructure Improvements	24 wks	Wed 6/10/15	Tue 11/24/15	39SS
41		Site Excavation	4 wks	Wed 6/10/15	Tue 7/7/15	34
42		Foundations	4 wks	Wed 7/8/15	Tue 8/4/15	41
43		Electrical Collector System	4 wks	Wed 7/8/15	Tue 8/4/15	41
44		Bus/Breaker	6 wks	Wed 8/5/15	Tue 9/15/15	42
45		Transformer Delivery	32 wks	Wed 4/29/15	Tue 12/8/15	22
46		Switchgear Delivery	32 wks	Wed 4/29/15	Tue 12/8/15	23
47		Transformer	2 wks	Wed 12/9/15	Tue 12/22/15	45
48		Switchgear	2 wks	Wed 12/9/15	Tue 12/22/15	46
49		Place ESS	2 wks	Wed 12/2/15	Tue 12/15/15	17
50		Electrical Interconnections	8 wks	Wed 12/23/15	Tue 2/16/16	47
51		Commissioning	4 wks	Wed 2/17/16	Tue 3/15/16	50



Project: Battery ESS
Date: Fri 6/27/14

Task		Summary		External Milestone	
Split		Project Summary		Deadline	
Milestone		External Tasks		Progress	

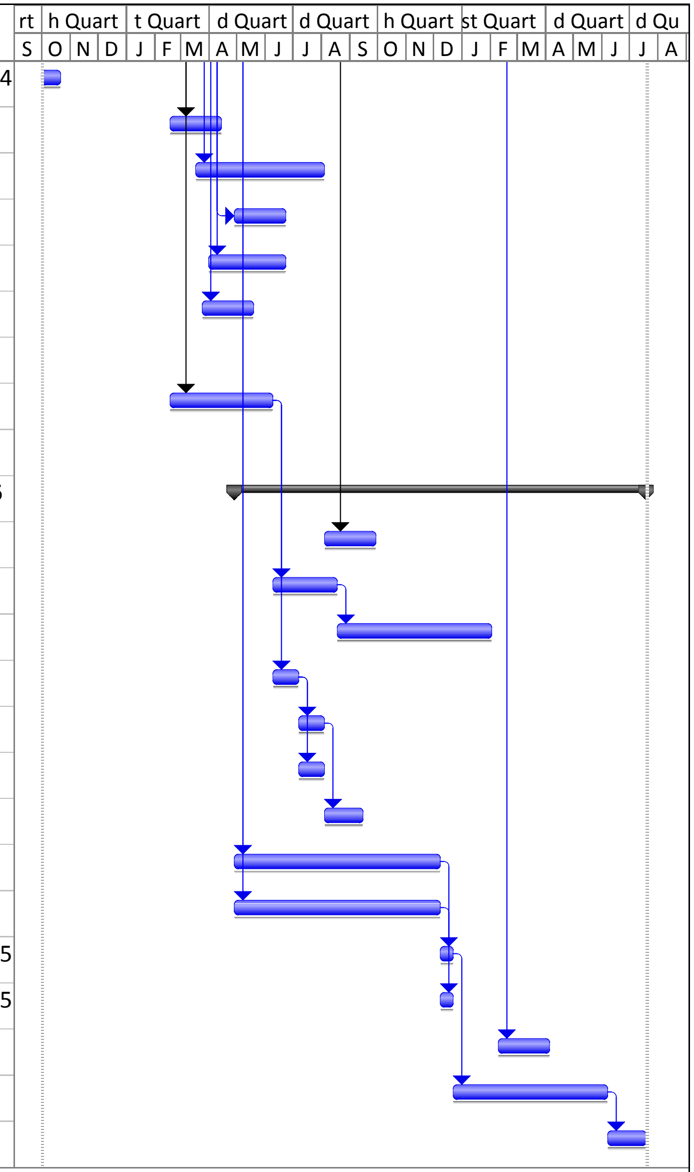
ID		Task Name	Duration	Start	Finish
1					
2		**ESS Acquisition**	**20 wks**	**Wed 10/1/14**	**Tue 2/17/15**
3		Issue for Bid	0 wks	Wed 10/1/14	Wed 10/1/14
4		Bid Period	10 wks	Wed 10/1/14	Tue 12/9/14
5		Bid Submittal	0 wks	Tue 12/9/14	Tue 12/9/14
6		Bid Evaluation	2 wks	Wed 12/10/14	Tue 12/23/14
7		Notice of Award	0 wks	Tue 12/23/14	Tue 12/23/14
8		Contract Administration	8 wks	Wed 12/24/14	Tue 2/17/15
9		Notice to Proceed	0 wks	Tue 2/17/15	Tue 2/17/15
10					
11		**ESS Production**	**51 wks**	**Wed 2/18/15**	**Tue 2/9/16**
12		Preliminary Engineering	4 wks	Wed 2/18/15	Tue 3/17/15
13		Final Specifications	1 wk	Wed 3/18/15	Tue 3/24/15
14		Production	40 wks	Wed 3/25/15	Tue 12/29/15
15		Factory Acceptance Testing	2 wks	Wed 12/30/15	Tue 1/12/16
16		Shipping to Guam	3 wks	Wed 1/13/16	Tue 2/2/16
17		Site Delivery & Storage	1 wk	Wed 2/3/16	Tue 2/9/16
18					
19		**Site Design**	**44 wks**	**Wed 10/1/14**	**Tue 8/4/15**
20		Preliminary Engineering	6 wks	Wed 2/18/15	Tue 3/31/15
21		Site Selection	4 wks	Wed 2/18/15	Tue 3/17/15
22		Transformer Specification	4 wks	Wed 4/1/15	Tue 4/28/15
23		Switchgear Specification	4 wks	Wed 4/1/15	Tue 4/28/15
24		Order Long Lead Items	6 wks	Wed 4/29/15	Tue 6/9/15
25		**Design**	**44 wks**	**Wed 10/1/14**	**Tue 8/4/15**
26		Boundary Survey	3 wks	Wed 2/18/15	Tue 3/10/15



Project: Flywheel ESS
Date: Fri 6/27/14

Task	Summary	External Milestone
Split	Project Summary	Deadline
Milestone	External Tasks	Progress

ID		Task Name	Duration	Start	Finish
27		Topographic Survey	3 wks	Wed 10/1/14	Tue 10/21/14
28		Surface / Geotechnical Investigation	8 wks	Wed 2/18/15	Tue 4/14/15
29		Civil/Structural	20 wks	Wed 3/18/15	Tue 8/4/15
30		Electrical Collector System	8 wks	Wed 4/29/15	Tue 6/23/15
31		Electrical Utility Tie	12 wks	Wed 4/1/15	Tue 6/23/15
32		Controls/SCADA	8 wks	Wed 3/25/15	Tue 5/19/15
33					
34		Permitting	16 wks	Wed 2/18/15	Tue 6/9/15
35					
36		**Site Construction**	**64 wks**	**Wed 4/29/15**	**Tue 7/19/16**
37		Order Materials	8 wks	Wed 8/5/15	Tue 9/29/15
38		Demolition of (E) Building, Cooling Coils & Debris Disposal	10 wks	Wed 6/10/15	Tue 8/18/15
39		Infrastructure Improvements	24 wks	Wed 8/19/15	Tue 2/2/16
40		Site Excavation	4 wks	Wed 6/10/15	Tue 7/7/15
41		Foundations	4 wks	Wed 7/8/15	Tue 8/4/15
42		Electrical Collector System	4 wks	Wed 7/8/15	Tue 8/4/15
43		Bus/Breaker	6 wks	Wed 8/5/15	Tue 9/15/15
44		Transformer Delivery	32 wks	Wed 4/29/15	Tue 12/8/15
45		Switchgear Delivery	32 wks	Wed 4/29/15	Tue 12/8/15
46		Transformer	2 wks	Wed 12/9/15	Tue 12/22/15
47		Switchgear	2 wks	Wed 12/9/15	Tue 12/22/15
48		Place ESS	8 wks	Wed 2/10/16	Tue 4/5/16
49		Electrical Interconnections	24 wks	Wed 12/23/15	Tue 6/7/16
50		Commissioning	6 wks	Wed 6/8/16	Tue 7/19/16



Project: Flywheel ESS
Date: Fri 6/27/14

Task	Summary	External Milestone
Split	Project Summary	Deadline
Milestone	External Tasks	Progress