Preliminary System Planning Study for 2011
10 MW Generation Expansion at Craig Unit 1

June 30, 2008
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Executive Summary

The existing Craig Generating Station in northwestern Colorado consists of three coal-fired generating units. It has been proposed that a new turbine rotor be installed at Craig Unit 1 to increase the Craig Unit 1 generating capacity by 10 MW in the spring of 2011. Craig Unit 1 currently has a net generating capacity of 428 MW and the net capacity of this generating unit will increase to 438 MW after the proposed generation expansion project is completed. The purpose of this study is to investigate whether the project will result in any transmission problems.

Prior to any generation expansion at Craig Unit 1, the net generating capacity of the Craig Generating Station in 2011 will be 1,304 MW. This capacity will increase to 1,314 MW after the proposed generation expansion project. Using the modified Western Electricity Coordinating Council (WECC) 2013 heavy winter case, an additional 10 MW of generation capacity was added at Craig Unit 1. Both the steady-state power flow/contingency analysis study and the transient stability study showed that there were no planning criteria violations caused by the proposed 10 MW addition of generating capacity to Craig Unit 1. Based on the system conditions simulated in this study, the conclusion of this report is that the existing system can adequately support the proposed 10 MW generation expansion at Craig Unit 1. This conclusion does not assess or address ownership or capacity rights in the transmission system of western Colorado. Since this generation project is not expected to require any system reinforcements, a facilities study is not necessary.

Objective
The purpose of this study is to investigate the impact which the proposed addition of 10 MW of generating capacity to Craig Unit 1 will have on the surrounding bulk electric system. The unit generation for the existing Craig Generating Station is tabulated below: With 10 MW of new generation capacity added, Craig Unit 1 will have a new net generating capacity of 438 MW. This study was performed assuming that the Craig Unit 3 generation expansion will successfully be able to add 30 MW to the generating capacity of Craig Unit 3 in the spring of 2009.

Unit Name	2008 Net Generating Capacity (MW)	2011 Net Generating Capacity (MW)
Craig Unit 1	**428**	**438**
Craig Unit 2	**428**	**428**
Craig Unit 3	**418**	**448**
Total	**1274**	**1314**

The total net generating capacity for Craig will increase to 1,314 MW upon the completion of the Craig Unit 1 generation expansion.

Planning Criteria

Tri-State's system planning criteria are consistent with the Western Electricity Coordinating Council (WECC) and the North American Electric Reliability Council (NERC) system reliability criteria.

System normal study criteria require bus voltages to be within a range of 0.95 to 1.05 per unit. Transmission line flows must not exceed 80 percent of the stated continuous rating of the line, and transformer flows must not exceed 100 percent of its maximum nameplate rating. System adjustments including shunt capacitor and reactor switching, generator voltage regulation, transformer tap and phase shifter adjustments, and area interchanges were allowed to be changed automatically by power system modeling software.

Single contingency outage criteria require that bus voltages be within a range of 0.90 and 1.10 per unit. Furthermore, the voltage magnitude at a bus during a single contingency outage cannot drop by more than 0.05 per unit from the system normal condition. Transmission lines and transformers flows must not exceed 100 percent of their continuous ratings. System adjustments including shunt capacitor and reactor switching, generator voltage regulation, transformer tap and phase shifter adjustments, and area interchanges were allowed to be changed automatically by power system modeling software.

Study Methodology

The WECC 2013 heavy winter case (2013HW1A) was selected to perform the study. To stress the system, the case was modified to maximize the generation output at both the Craig and Hayden Generation Stations. The Laramie River swing generator was adjusted to offset the generation increase from Craig and Hayden. The added 10 MW generation at Craig Unit 1 was absorbed by scaling up 10 MW of load in eastern Colorado.
In addition to a system normal analysis, a contingency analysis and transient stability analysis were completed for selected single line outages in the study area. These analyses identify any transmission overload, low voltage, or stability problems that do not satisfy reliability criteria. The analyses were performed with the GE PSLF version 16.08 positive sequence load flow and positive sequence dynamic simulation functions.

Base Case Modifications

The base case steady state power flow file was modified to reflect the addition of 10 MW of generating capacity to Craig Unit 1. The base case dynamics file was modified to represent a new exciter model (exst4b) for Craig Unit 3 and the generator MVA base was adjusted to reflect the 40 MW Craig Unit 3 capacity increase scheduled for the spring of 2009. The Craig Unit 3 dynamic model was then updated using the exciter test report provided by GE for Craig Unit 3.

Power Flow Results

The modified 2013 heavy winter case with 10 MW of generation added at Craig Unit 1 was simulated under system normal conditions. With all generators at the Craig and Hayden stations set to their maximum power output level, the step-up transformers for Craig Unit 1, Craig Unit 2, and Craig Unit 3 showed overloads of 104.6 percent, 102.4 percent, and 107.3 respectively. These overloads are based on the 55° C temperature rise ratings for Craig Unit 1, Craig Unit 2, and Craig Unit 3 which are 420 MVA, 420 MVA, and 420 MVA respectively. Craig Unit 1, Craig Unit 2, and Craig Unit 3 have 65° C temperature rise ratings of 470 MVA, 470 MVA, and 470 MVA respectively, and when the 65° C temperature rise ratings are used the Craig step-up transformers are not overloaded.

Contingency Analysis

The contingency analysis included the following 11 single line outages:

1) Craig - Bear Ears - Bonanza 345 kV

2) Craig - Ault 345 kV

3) Craig - Rifle 345 kV

4) Craig – Rifle 230 kV

5) Craig - Hayden #1 230 kV

6) Hayden - Archer 230 kV

7) Hayden - Wolcott 230 kV

8) Hayden - Gore Pass 230 kV

9) Hayden - Artesia 138 kV

10) Hayden - Gore Pass 138 kV

11) Hayden - Axial Basin 138 kV

All contingencies from the selected list were applied individually to the system, and the results analyzed. After each contingency was applied to the system, the PSLF voltage limit reporting function (VoltLimitRept) and the overload reporting function (OverLoadRept) were both initiated to explicitly report violations of planning criteria which are specified in the PSLF limit-checking parameter file.

None of the contingencies applied to the system resulted in planning criteria voltage violations.

When the Hayden-Wolcott 230 kV line is taken out of service, the Rifle 115/69 kV transformer is loaded to 108.9 percent of its full-load rating. Additionally, the Hopkins-Basalt 115 kV transmission line is loaded to 115.3 percent of its full-load rating. These overloads are present when the contingency is applied to the unmodified WECC 2013 heavy winter base case and are not caused by the 10 MW increase of the Craig Unit 1 generating capacity. Further study will be required to investigate the overloads which occur in the unmodified 2013 heavy winter case during N-1 contingency conditions.

Transient Stability Analysis

The transient stability analysis study included the following 13 simulations with the respective resulting plots included:

Plot 1: 3-φ Craig 345 kV Fault and Loss of the Craig - Ault 345 kV Line

Plot 2:3-φ Craig 345 kV Fault and Loss of the Craig - Bear Ears-Bonanza 345 kV Line

Plot 3: 3-φ Bonanza 345 kV Fault and Loss of the Craig-Bear Ears-Bonanza 345 kV Line

Plot 4: 3-φ Craig 345 kV Fault and Loss of the Craig - Rifle 345 kV Line

Plot 5: 3-φ Craig 230 kV Fault and Loss of the Craig - Rifle 230 kV Line

Plot 6: 3-φ Craig 230 kV Fault and Loss of the Craig - Hayden #1 230 kV Line

Plot 7: 3-φ Hayden 230 kV Fault and Loss of the Craig - Hayden #1 230 kV Line

Plot 8: 3-φ Hayden 230 kV Fault and Loss of the Hayden - Archer 230 kV Line

Plot 9: 3-φ Hayden 230 kV Fault and Loss of the Hayden - Gore Pass 230 kV Line

Plot 10: 3-φ Hayden 230 kV Fault and Loss of the Hayden - Wolcott 230 kV Line

Plot 11: 3-φ Hayden 138 kV Fault and Loss of the Hayden - Artesia 138 kV Line

Plot 12: 3-φ Hayden 138 kV Fault and Loss of the Hayden - Gore Pass 138 kV Line

Plot 13: 3-φ Hayden 138 kV Fault and Loss of the Hayden - Axial Basin 138 kV Line

All plots include the generator per unit terminal voltage, generator bus frequency, and the generator rotor angle for the monitored generators and the per unit bus voltage for monitored load buses. The transient stability results exhibit adequate damping and no oscillatory or stability problems. The graphical results of the transient stability study are located in Appendix A.

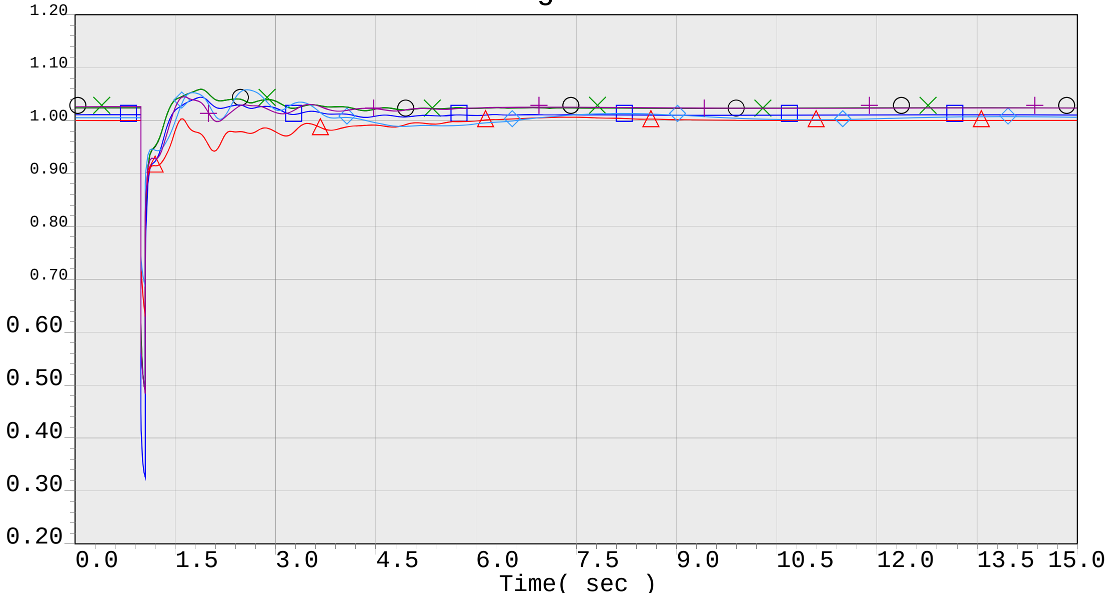
Conclusion and Recommendation

Based on the modified WECC 2013 heavy winter case with 10 MW of generating capacity added to Craig Unit 1 there are no transmission problems associated with the proposed generation expansion project. The Craig Unit 1, Craig Unit 2, and Craig Unit 3 step-up transformers are not overloaded when the 470 MVA 65 ° C temperature rise ratings are used in lieu of the corresponding 55 ° C temperature rise ratings for the units. The steady state power flow, contingency analysis, and transient stability analysis show no planning criteria violations caused by the proposed Craig Unit 1 10 MW generation expansion project. Thus it is concluded that the existing system can adequately support the proposed 10 MW generation expansion at Craig Unit 1. This conclusion does not assess or address ownership or capacity rights in the transmission system of western Colorado. Since this generation project is not expected to require any system reinforcements, a facilities study is not required.

Appendix A: Transient Stability Study Results

PLOT 1a:
Fault on Craig 345 kV Bus and Loss of Craig-Ault 345 kV Line

Generator Terminal Voltage



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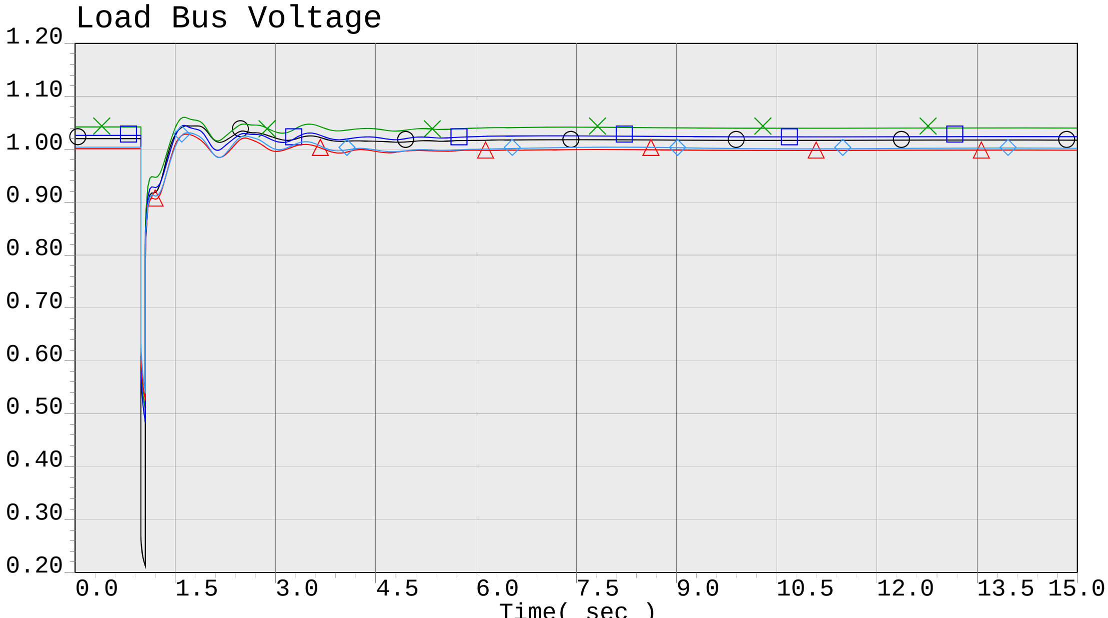
×	0.2000 vt	79016	CRAIG 2	22.0	0	0.0	1	1	1.2000
□	0.2000 vt	79017	CRAIG 3	22.0	0	0.0	1	1	1.2000
△	0.2000 vt	79040	HAYDEN1	18.0	0	0.0	1	1	1.2000
◇	0.2000 vt	65191	BONANZA	13.8	0	0.0	1	1	1.2000
+	0.2000 vt	79065	STEAMBT	230.0	0	0.0	YV	1	1.2000

Load Bus Voltage



○	0.2000 vbul	79013	CRAIG	230.0	0	0.0	1	1	1.2000
×	0.2000 vbul	79038	HAYDEN	138.0	0	0.0	1	1	1.2000
□	0.2000 vbul	79065	STEAMBT	230.0	0	0.0	1	1	1.2000
△	0.2000 vbul	79056	RIFLE CU	138.0	0	0.0	1	1	1.2000
◇	0.2000 vbul	79046	MEEKER	138.0	0	0.0	1	1	1.2000

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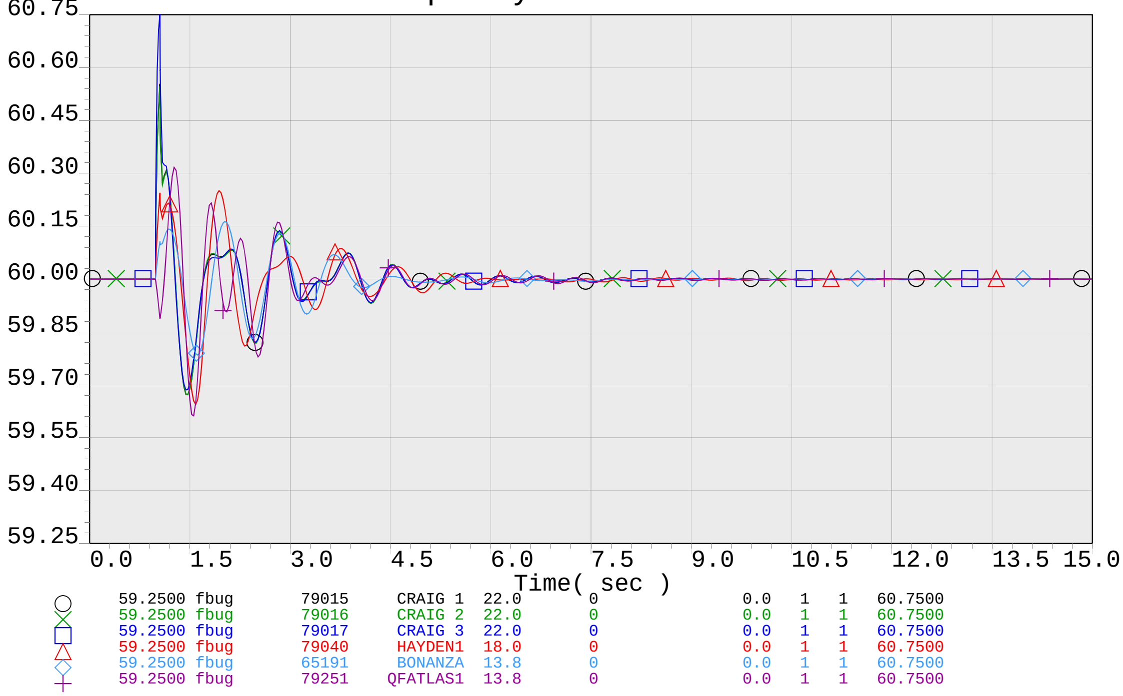
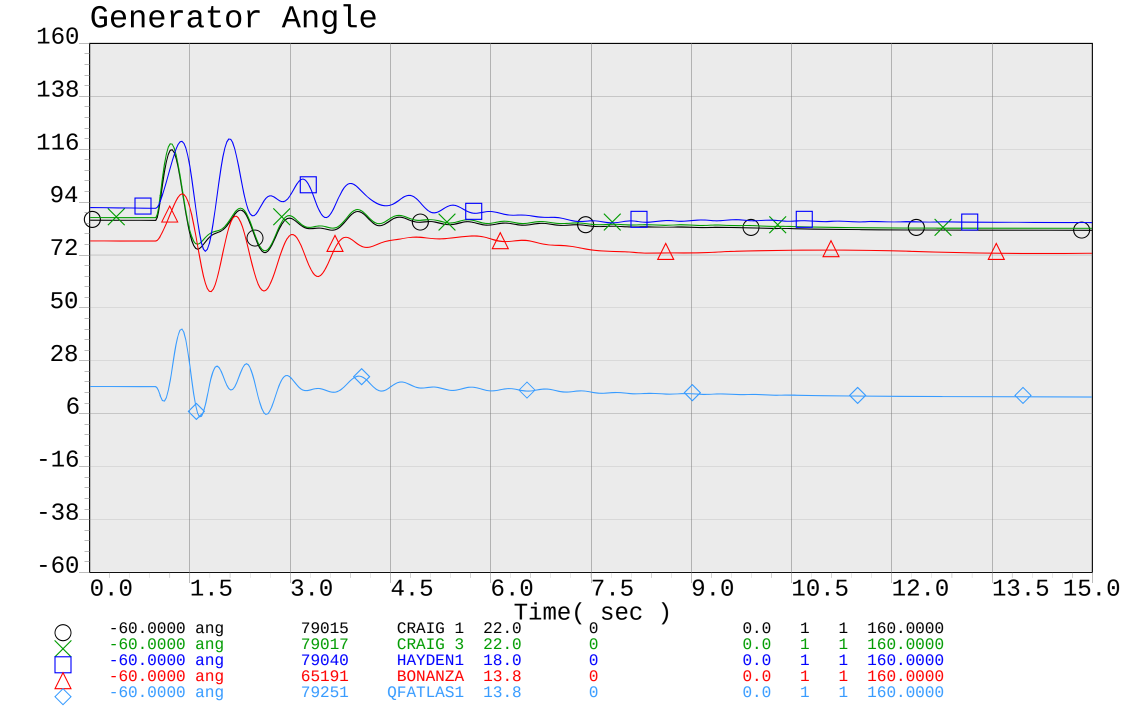
PLOT 1b:
Fault on Craig 345 kV Bus and
Loss of Craig-Ault 345 kV Line

Generator Bus Frequency



Generator Angle



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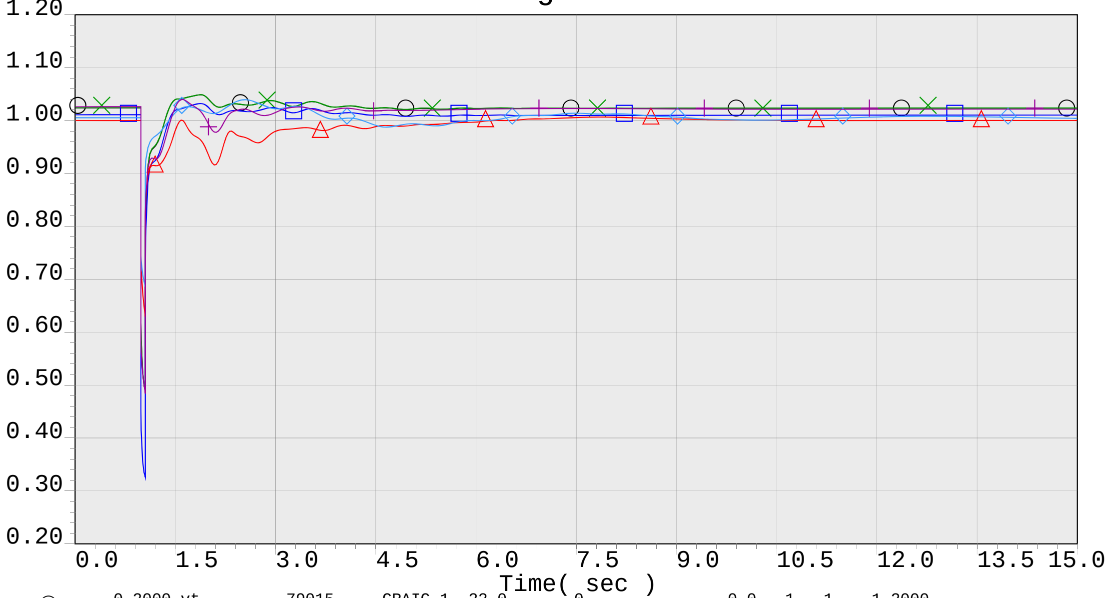
PLOT 2a:
Fault on Craig 345 kV Bus and
Loss of Craig-Bears Ears-Bonanza 345 kV Line

Generator Terminal Voltage



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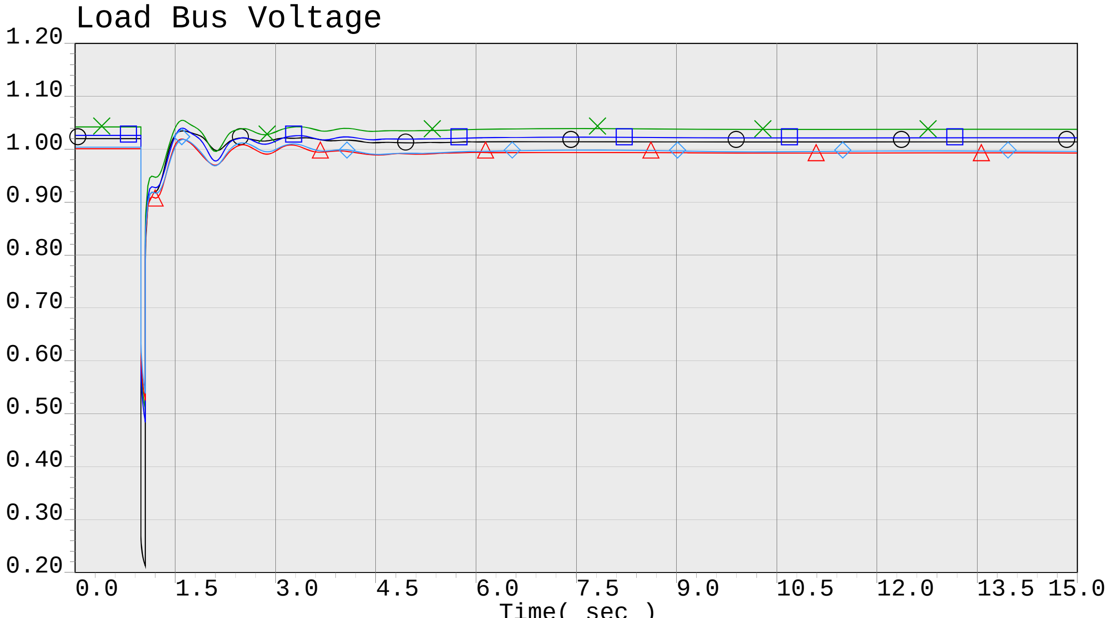
0.2000 vt	79017	CRAIG 3	22.0	0	0.0	1	1	1.2000
0.2000 vt	79040	HAYDEN1	18.0	0	0.0	1	1	1.2000
0.2000 vt	65191	BONANZA	13.8	0	0.0	1	1	1.2000
0.2000 vt	79065	STEAMBT	230.0	0	0.0	YV	1	1.2000

Load Bus Voltage



0.2000 vbul	79013	CRAIG	230.0	0	0.0	1	1	1.2000
0.2000 vbul	79038	HAYDEN	138.0	0	0.0	1	1	1.2000
0.2000 vbul	79065	STEAMBT	230.0	0	0.0	1	1	1.2000
0.2000 vbul	79056	RIFLE CU	138.0	0	0.0	1	1	1.2000
0.2000 vbul	79046	MEEKER	138.0	0	0.0	1	1	1.2000

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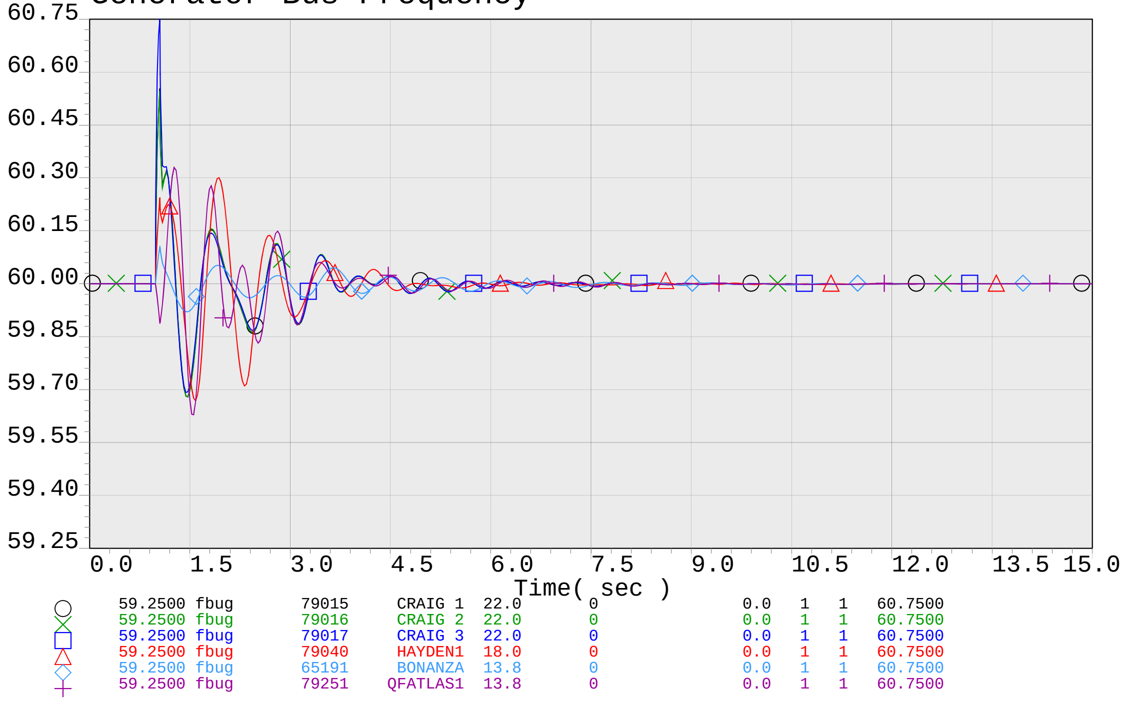
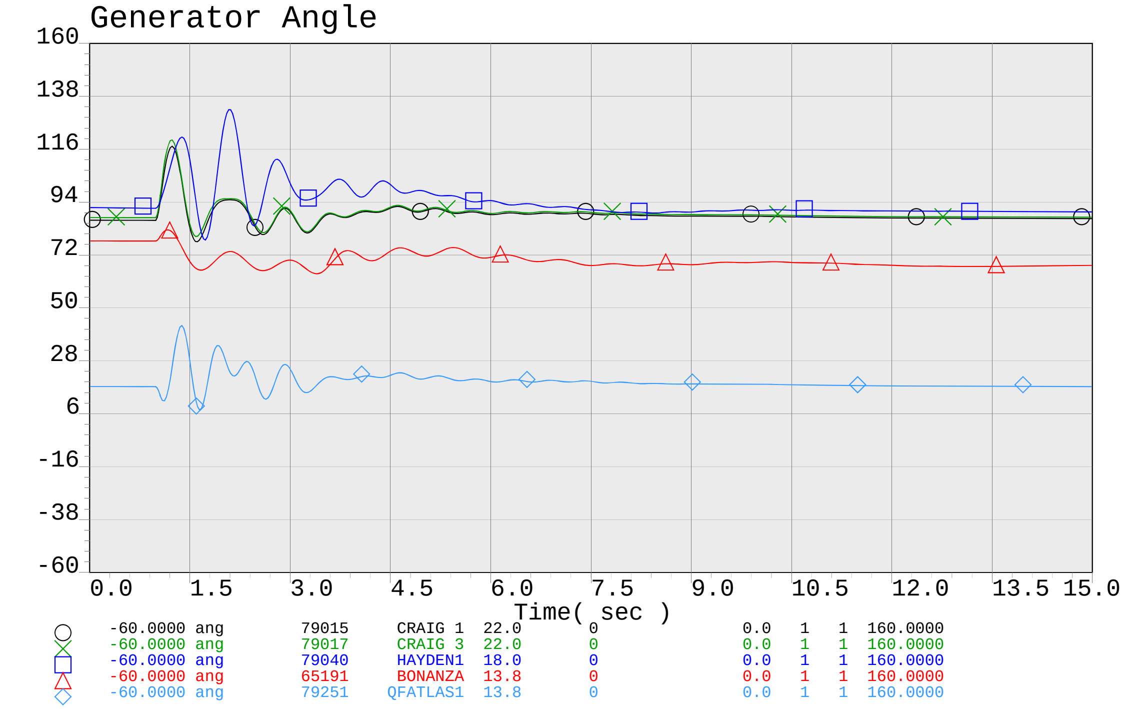
PLOT 2b:
Fault on Craig 345 kV Bus and
Loss of Craig-Bears Ears-Bonanza 345 kV Line

Generator Bus Frequency



Generator Angle



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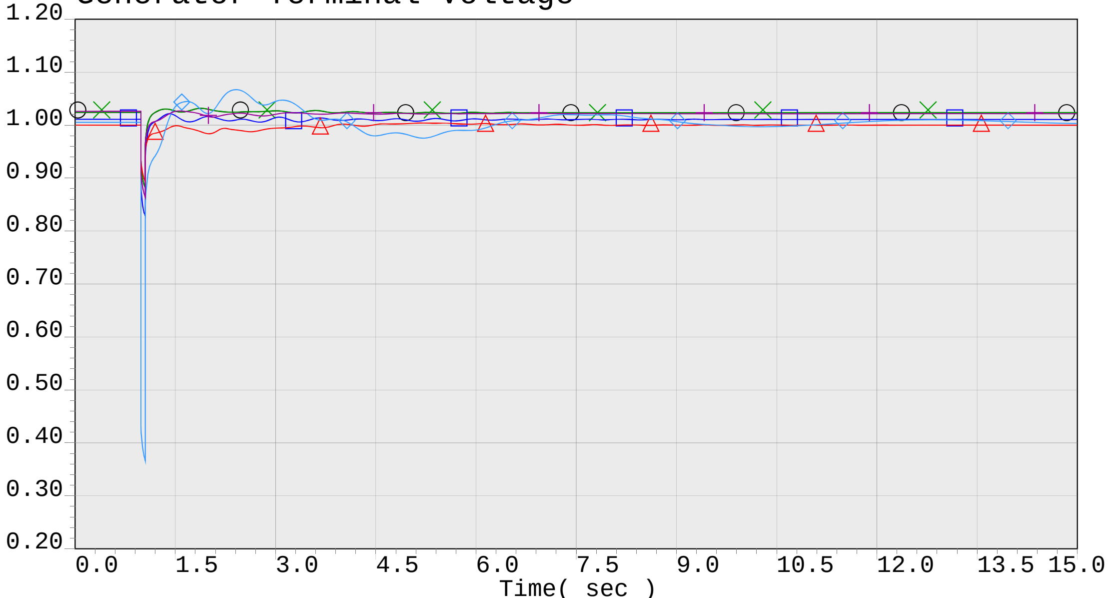
PLOT 3a:
Fault on Bonanza 345 kV Bus and
Loss of Craig-Bears Ears-Bonanza 345 kV Line

Generator Terminal Voltage



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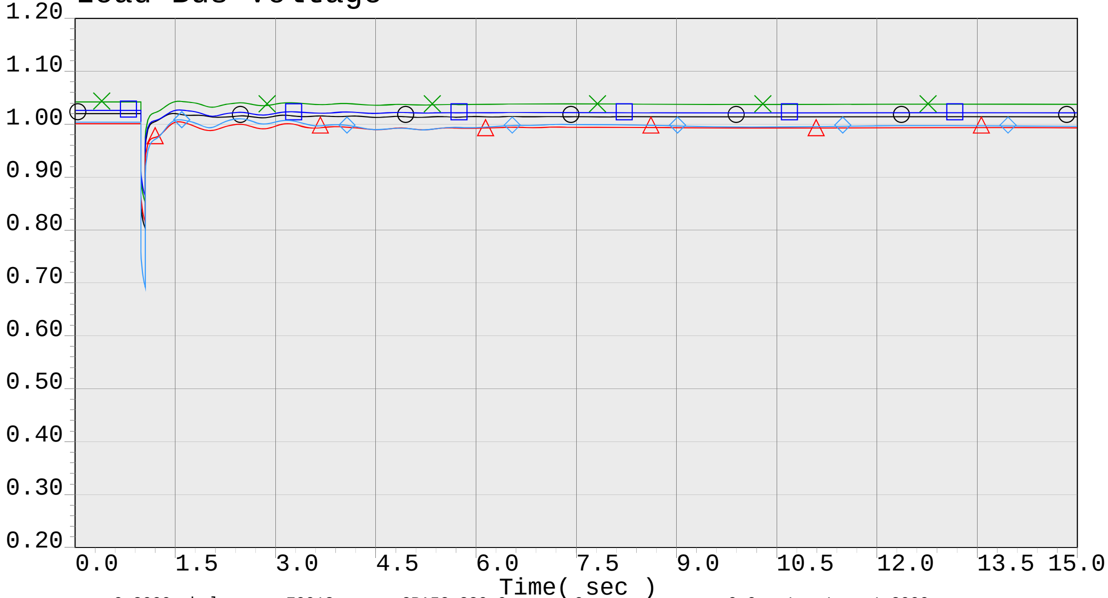
0.2000	vt	79016	CRAIG 2	22.0	0	0.0	1	1	1.2000
0.2000	vt	79017	CRAIG 3	22.0	0	0.0	1	1	1.2000
0.2000	vt	79040	HAYDEN1	18.0	0	0.0	1	1	1.2000
0.2000	vt	65191	BONANZA	13.8	0	0.0	1	1	1.2000
0.2000	vt	79065	STEAMBT	230.0	0	0.0	YV	1	1.2000

Load Bus Voltage



0.2000	vbul	79013	CRAIG	230.0	0	0.0	1	1	1.2000
0.2000	vbul	79038	HAYDEN	138.0	0	0.0	1	1	1.2000
0.2000	vbul	79065	STEAMBT	230.0	0	0.0	1	1	1.2000
0.2000	vbul	79056	RIFLE CU	138.0	0	0.0	1	1	1.2000
0.2000	vbul	79046	MEEKER	138.0	0	0.0	1	1	1.2000

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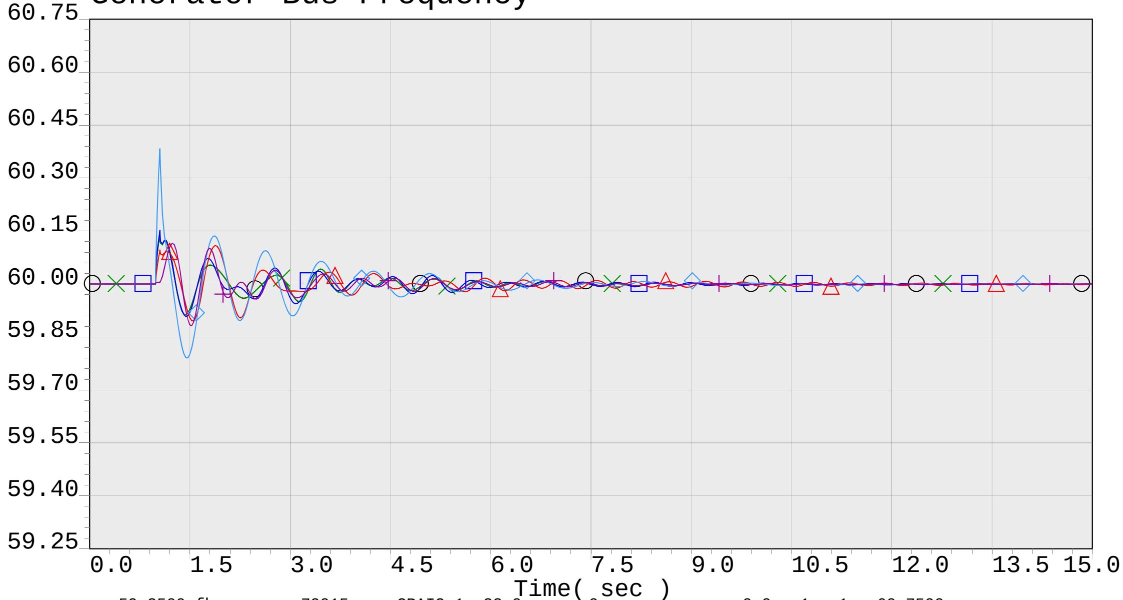
PLOT 3b:
Fault on Bonanza 345 kV Bus and
Loss of Craig-Bears Ears-Bonanza 345 kV Line

Generator Bus Frequency



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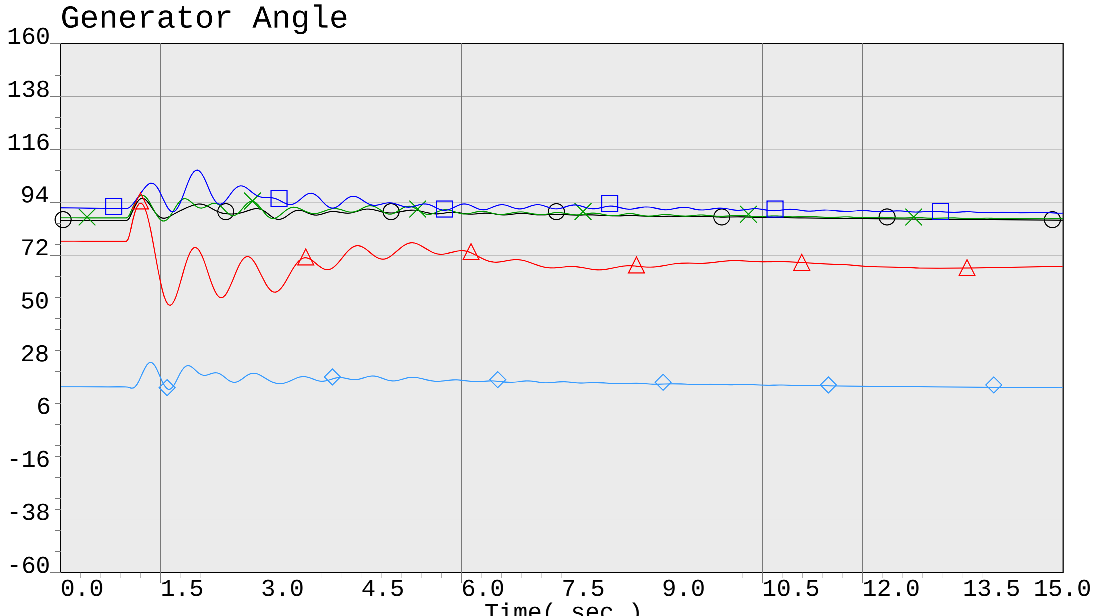
□	59.2500 fbug	79017	CRAIG 3	22.0	0	0.0	1	1	60.7500
△	59.2500 fbug	79040	HAYDEN1	18.0	0	0.0	1	1	60.7500
◇	59.2500 fbug	65191	BONANZA	13.8	0	0.0	1	1	60.7500
+	59.2500 fbug	79251	QFATLAS1	13.8	0	0.0	1	1	60.7500

Generator Angle



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×	-60.0000 ang	79017	CRAIG 3	22.0	0	0.0	1	1	160.0000
□	-60.0000 ang	79040	HAYDEN1	18.0	0	0.0	1	1	160.0000
△	-60.0000 ang	65191	BONANZA	13.8	0	0.0	1	1	160.0000
◇	-60.0000 ang	79251	QFATLAS1	13.8	0	0.0	1	1	160.0000

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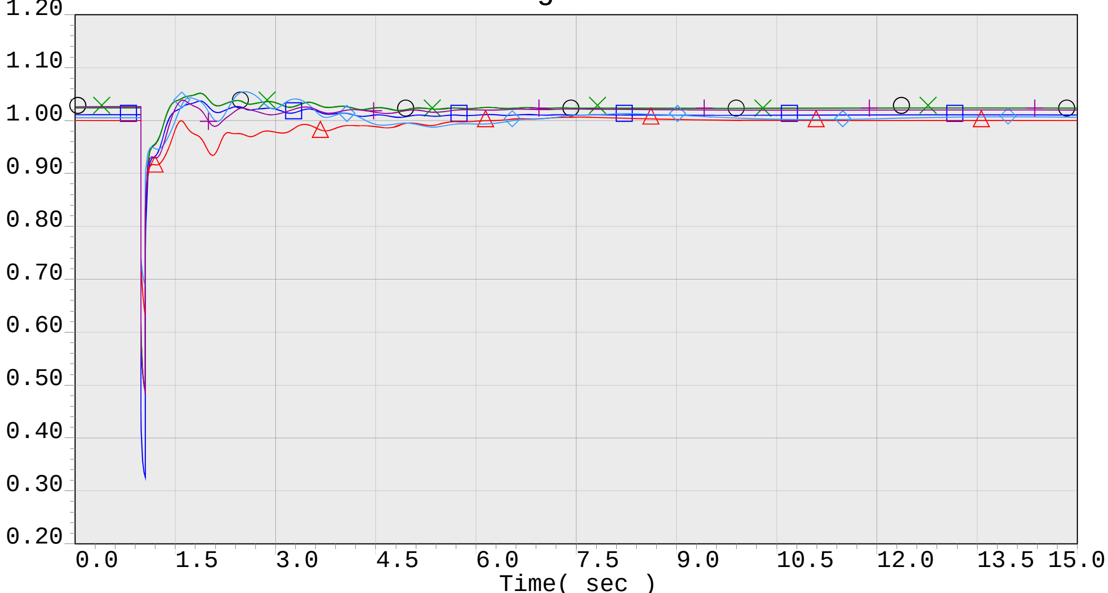
PLOT 4a:
Fault on Craig 345 kV Bus and
Loss of Craig-Rifle 345 kV Line

Generator Terminal Voltage



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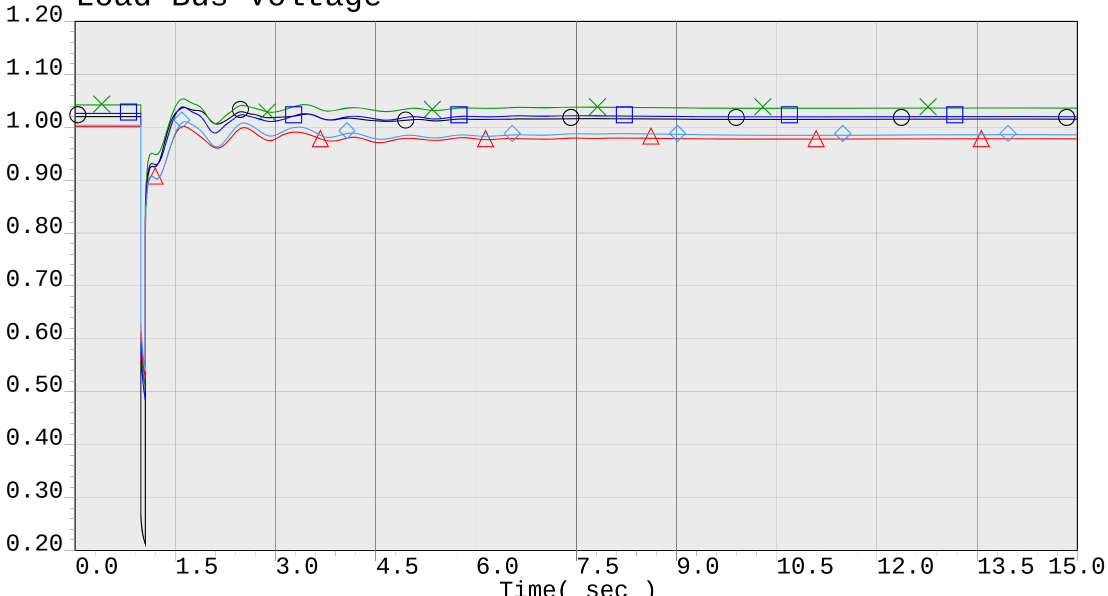
□	0.2000 vt	79017	CRAIG 3 22.0	0	0.0	1	1	1.2000
△	0.2000 vt	79040	HAYDEN1 18.0	0	0.0	1	1	1.2000
◇	0.2000 vt	65191	BONANZA 13.8	0	0.0	1	1	1.2000
+	0.2000 vt	79065	STEAMBT 230.0	0	0.0	YV	1	1.2000

Load Bus Voltage



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□	0.2000 vbul	79065	STEAMBT 230.0	0	0.0	1	1	1.2000
△	0.2000 vbul	79056	RIFLE CU 138.0	0	0.0	1	1	1.2000
◇	0.2000 vbul	79046	MEEKER 138.0	0	0.0	1	1	1.2000

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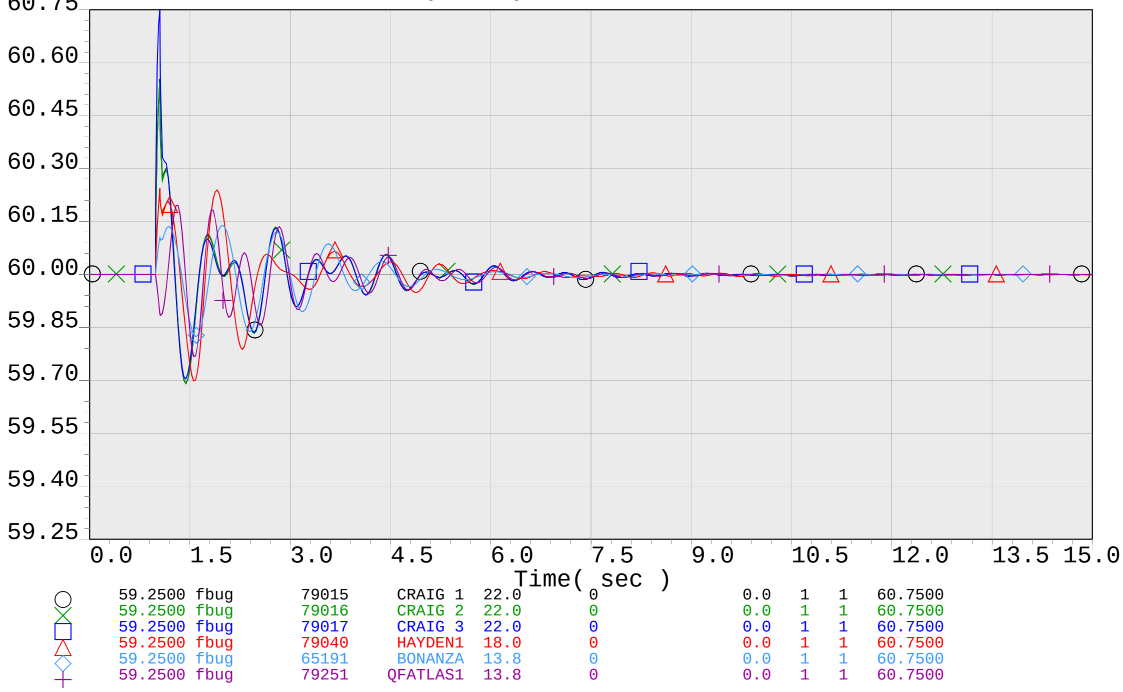
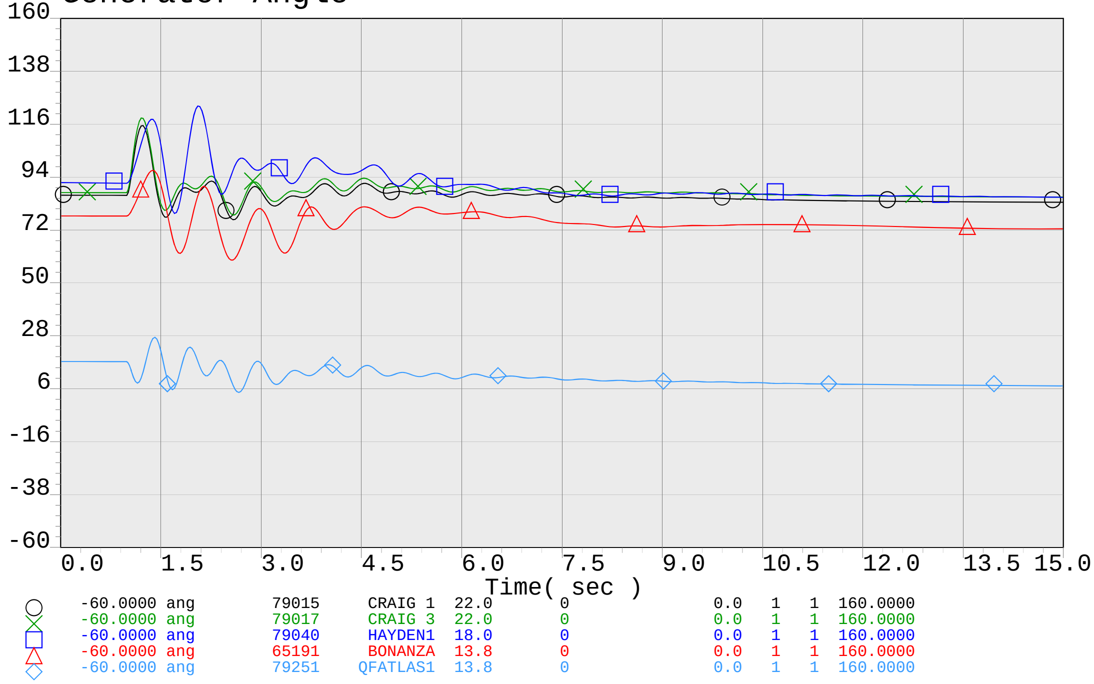
PLOT 4b:
Fault on Craig 345 kV Bus and
Loss of Craig-Rifle 345 kV Line

Generator Bus Frequency



Generator Angle



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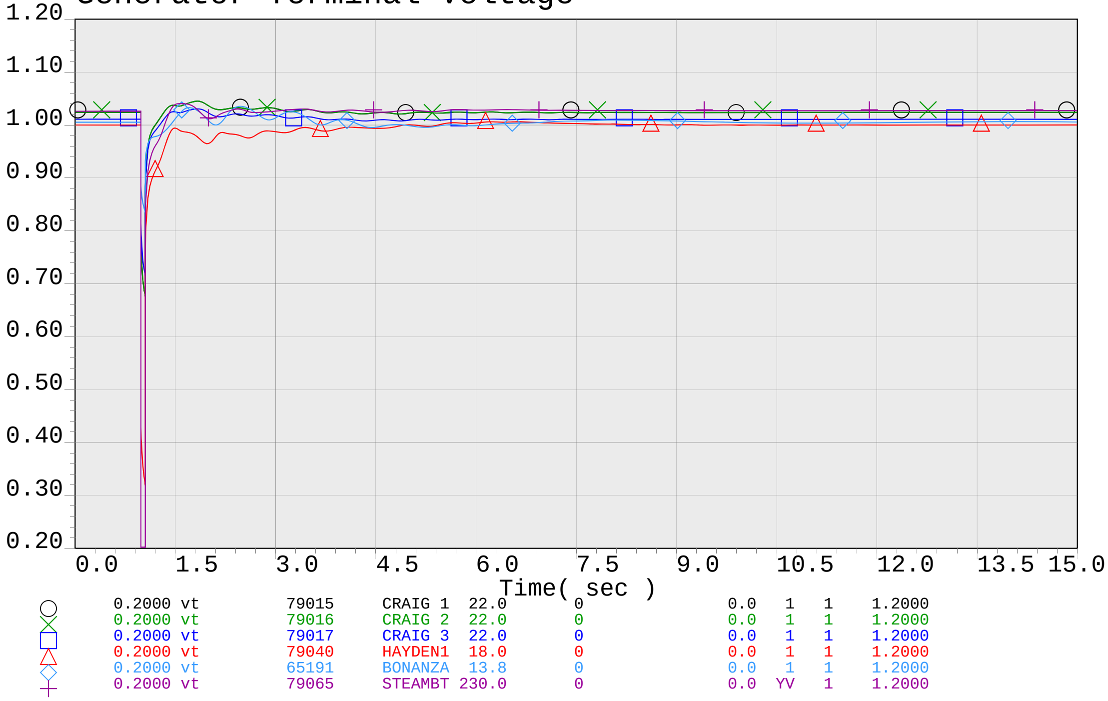
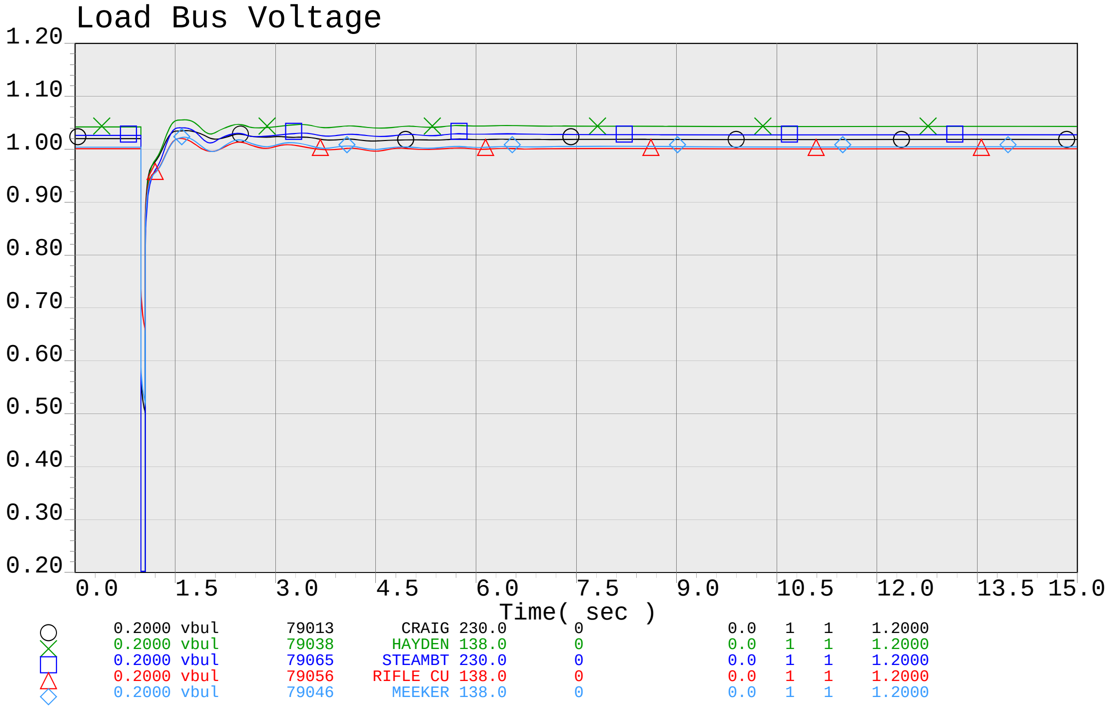
PLOT 5a:
Fault on Craig 230 kV Bus and
Loss of Craig-Rifle 230 kV Line

Generator Terminal Voltage



Load Bus Voltage



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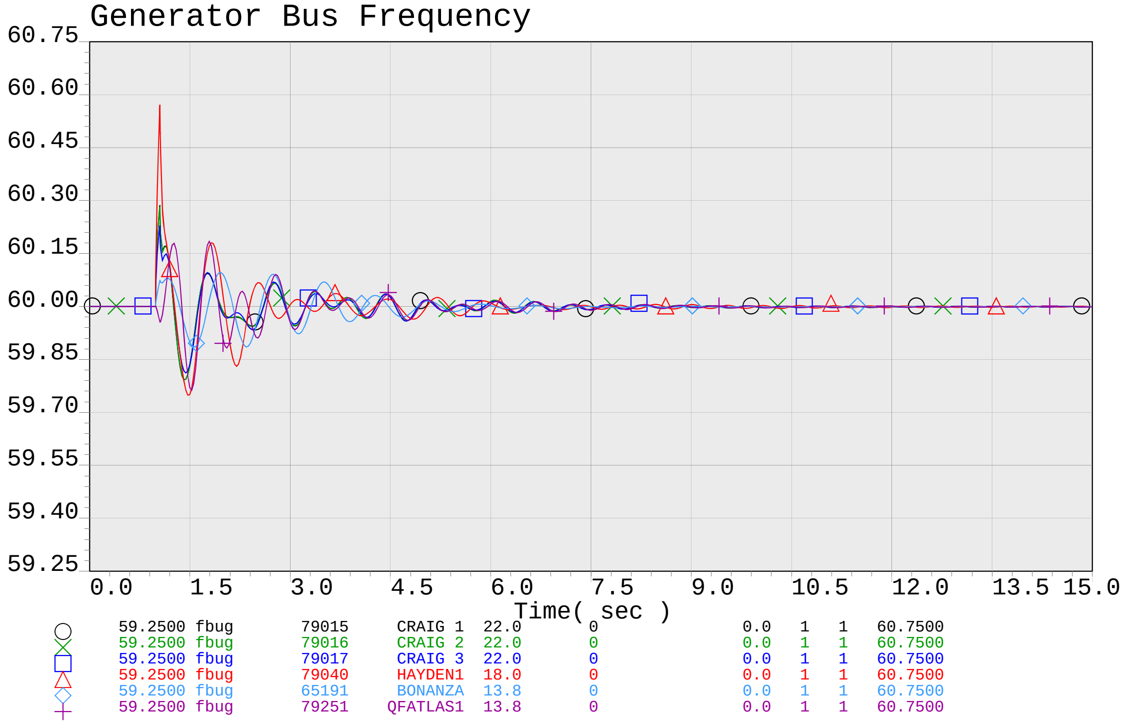
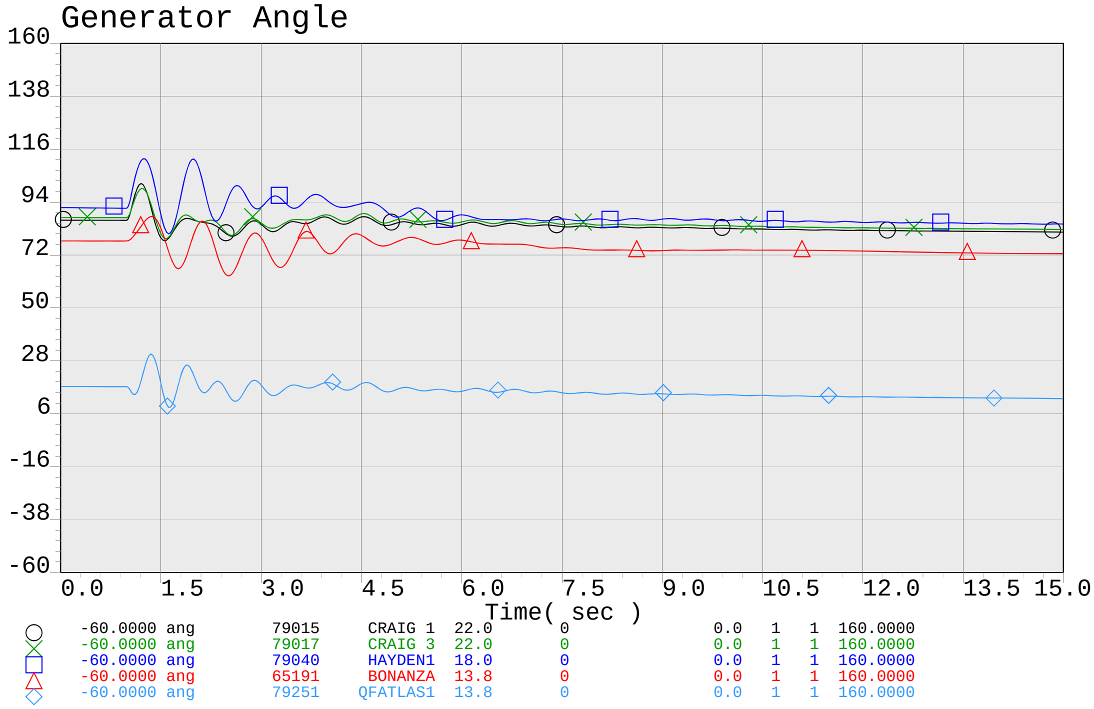
PLOT 5b:
Fault on Craig 230 kV Bus and
Loss of Craig-Rifle 230 kV Line

Generator Bus Frequency



Generator Angle



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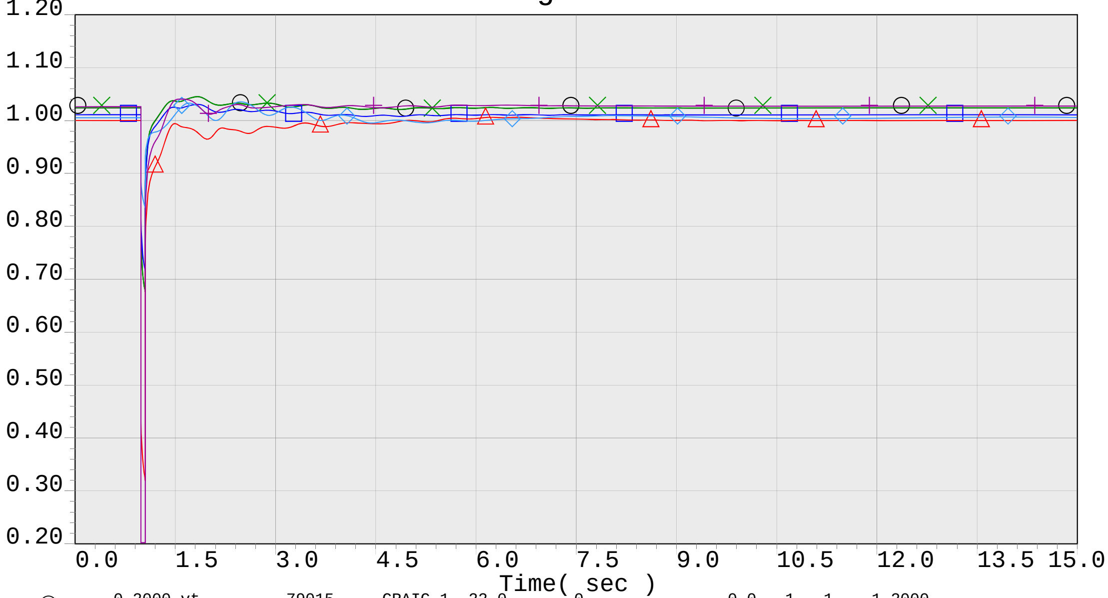
PLOT 6a:
Fault on Hayden 230 kV Bus and Loss of Craig-Hayden 230 kV Line

Generator Terminal Voltage



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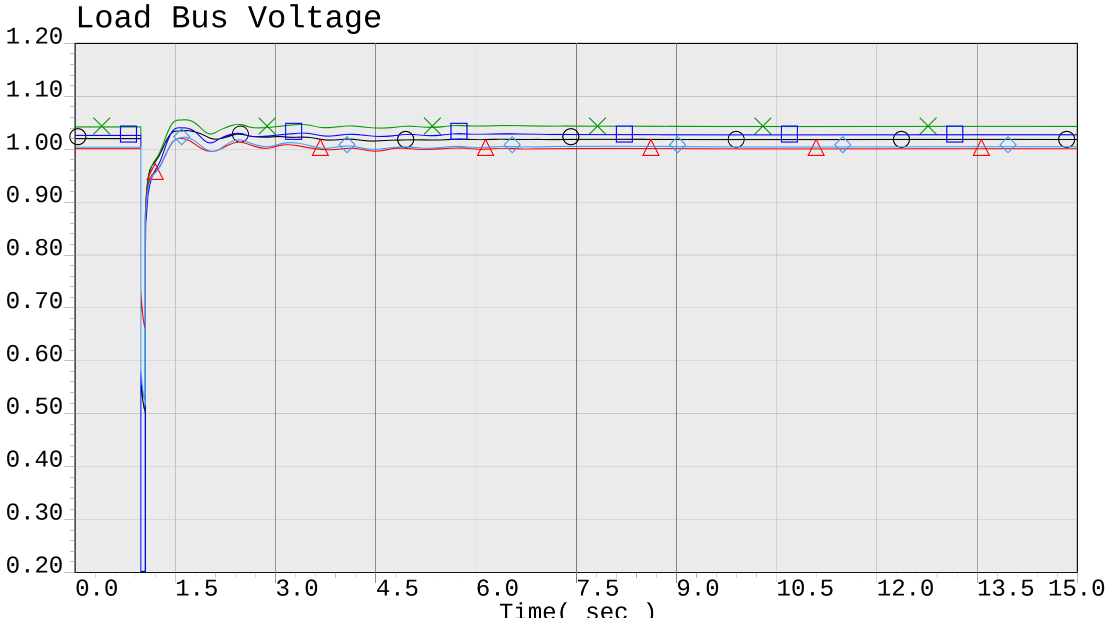
0.2000	vt	79017	CRAIG 3	22.0	0	0.0	1	1	1.2000
0.2000	vt	79040	HAYDEN1	18.0	0	0.0	1	1	1.2000
0.2000	vt	65191	BONANZA	13.8	0	0.0	1	1	1.2000
0.2000	vt	79065	STEAMBT	230.0	0	0.0	YV	1	1.2000

Load Bus Voltage



0.2000	vbul	79013	CRAIG	230.0	0	0.0	1	1	1.2000
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0.2000	vbul	79065	STEAMBT	230.0	0	0.0	1	1	1.2000
0.2000	vbul	79056	RIFLE CU	138.0	0	0.0	1	1	1.2000
0.2000	vbul	79046	MEEKER	138.0	0	0.0	1	1	1.2000

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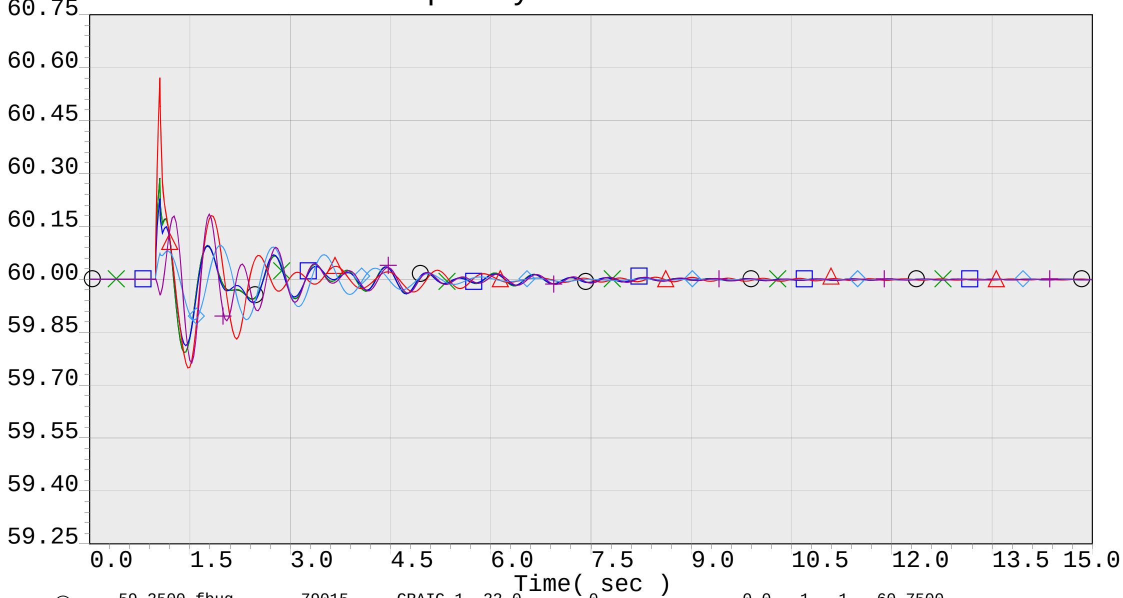
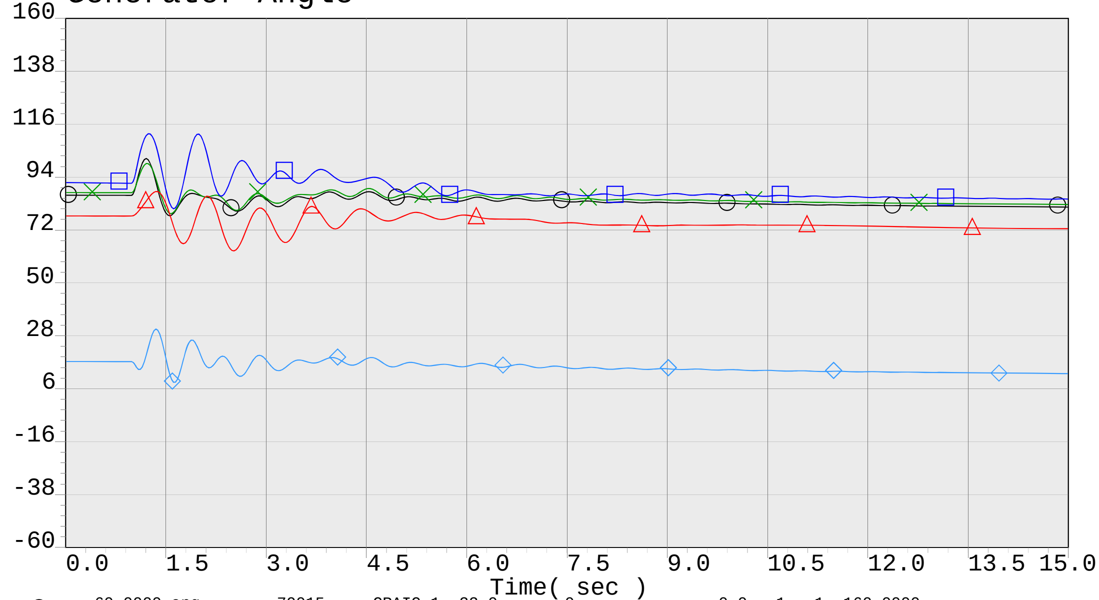
PLOT 6b:
Fault on Hayden 230 kV Bus and
Loss of Craig-Hayden 230 kV Line

Generator Bus Frequency



○	59.2500 fbug	79015	CRAIG 1	22.0	0	0.0	1	1	60.7500
×	59.2500 fbug	79016	CRAIG 2	22.0	0	0.0	1	1	60.7500
□	59.2500 fbug	79017	CRAIG 3	22.0	0	0.0	1	1	60.7500
△	59.2500 fbug	79040	HAYDEN1	18.0	0	0.0	1	1	60.7500
◇	59.2500 fbug	65191	BONANZA	13.8	0	0.0	1	1	60.7500
+	59.2500 fbug	79251	QFATLAS1	13.8	0	0.0	1	1	60.7500

Generator Angle



○	-60.0000 ang	79015	CRAIG 1	22.0	0	0.0	1	1	160.0000
×	-60.0000 ang	79017	CRAIG 3	22.0	0	0.0	1	1	160.0000
□	-60.0000 ang	79040	HAYDEN1	18.0	0	0.0	1	1	160.0000
△	-60.0000 ang	65191	BONANZA	13.8	0	0.0	1	1	160.0000
◇	-60.0000 ang	79251	QFATLAS1	13.8	0	0.0	1	1	160.0000

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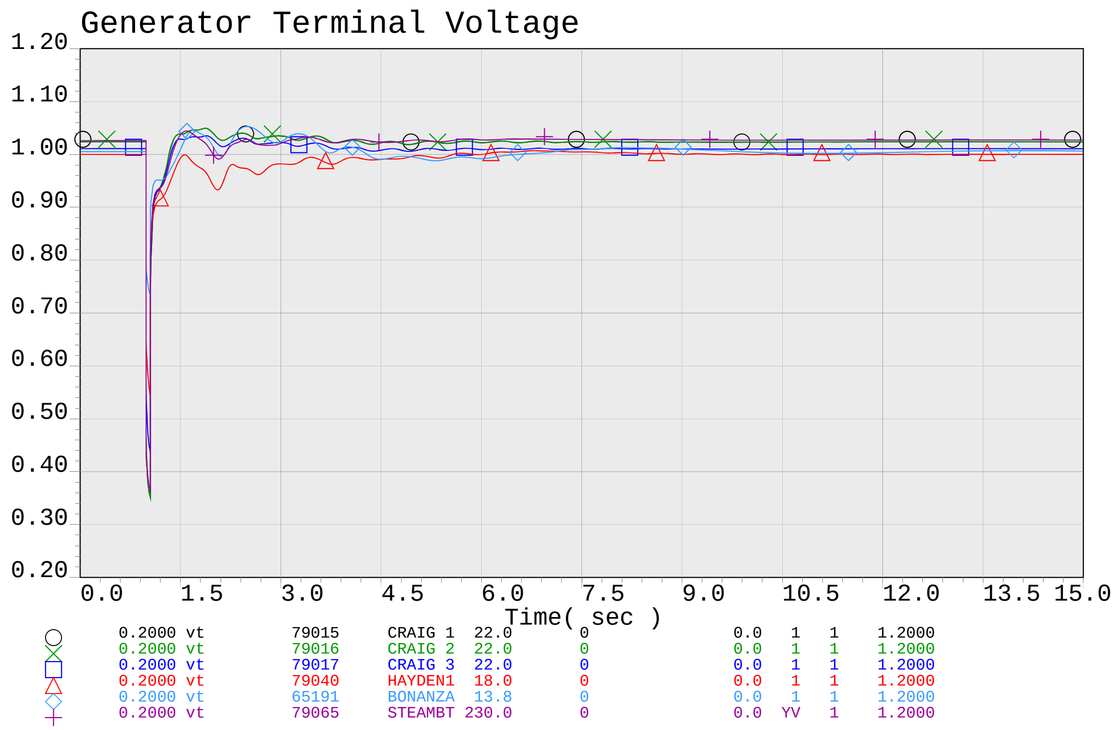
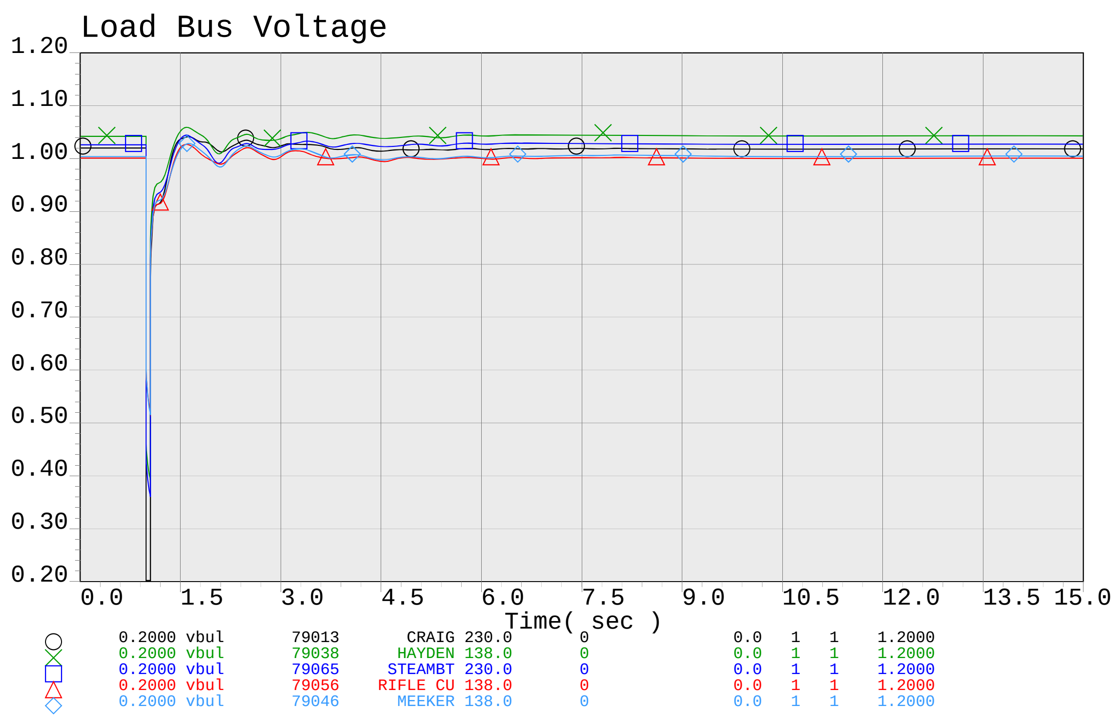
PLOT 7a:
Fault on Craig 230 kV Bus and Loss of Craig-Hayden 230 kV Line





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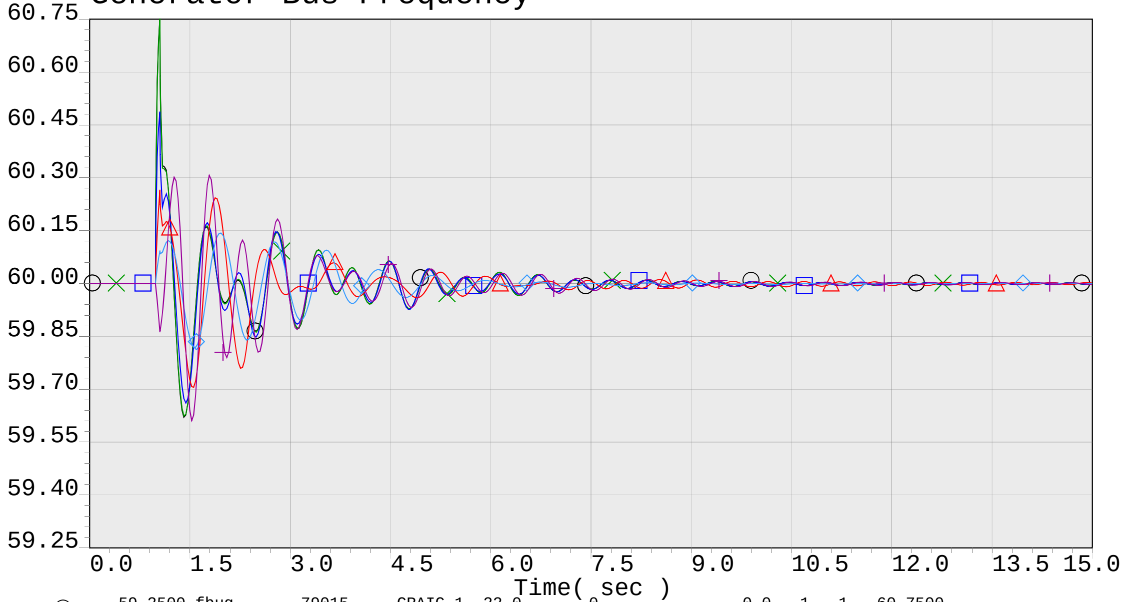
Thu Jun 26 16:58:59 2008

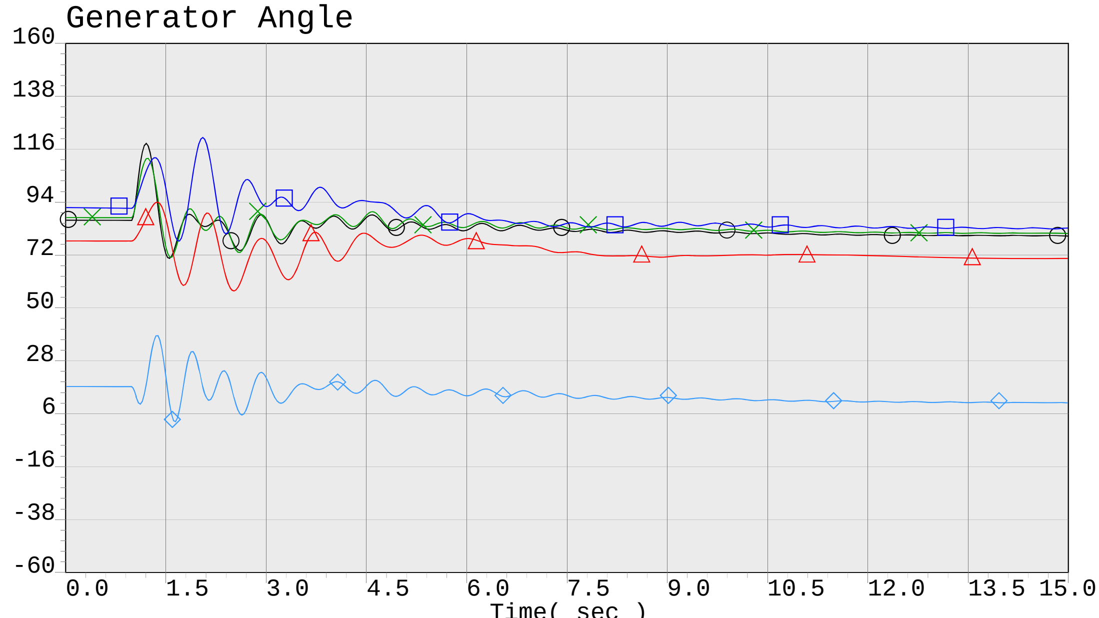
PLOT 7b:
Fault on Craig 230 kV Bus and Loss of Craig-Hayden 230 kV Line

Generator Bus Frequency



59.2500	fbug	79015	CRAIG 1	22.0	0	0.0	1	1	60.7500
59.2500	fbug	79016	CRAIG 2	22.0	0	0.0	1	1	60.7500
59.2500	fbug	79017	CRAIG 3	22.0	0	0.0	1	1	60.7500
59.2500	fbug	79040	HAYDEN1	18.0	0	0.0	1	1	60.7500
59.2500	fbug	65191	BONANZA	13.8	0	0.0	1	1	60.7500
59.2500	fbug	79251	QFATLAS1	13.8	0	0.0	1	1	60.7500

Generator Angle



-60.0000	ang	79015	CRAIG 1	22.0	0	0.0	1	1	160.0000
-60.0000	ang	79017	CRAIG 3	22.0	0	0.0	1	1	160.0000
-60.0000	ang	79040	HAYDEN1	18.0	0	0.0	1	1	160.0000
-60.0000	ang	65191	BONANZA	13.8	0	0.0	1	1	160.0000
-60.0000	ang	79251	QFATLAS1	13.8	0	0.0	1	1	160.0000

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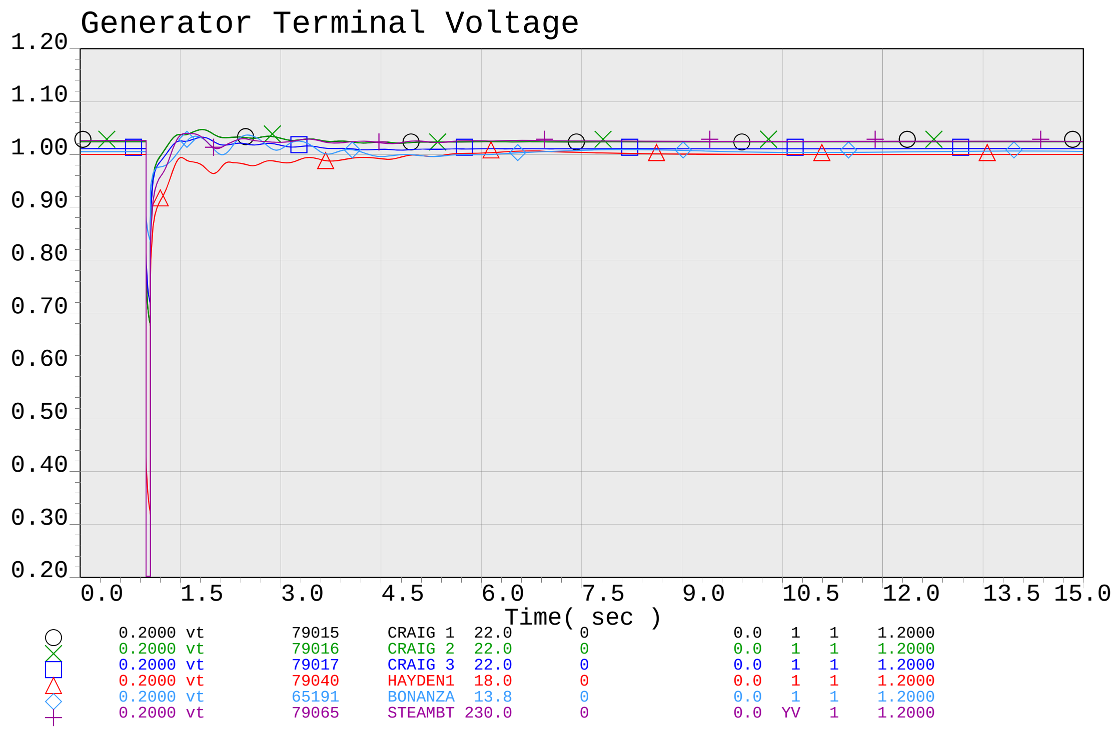
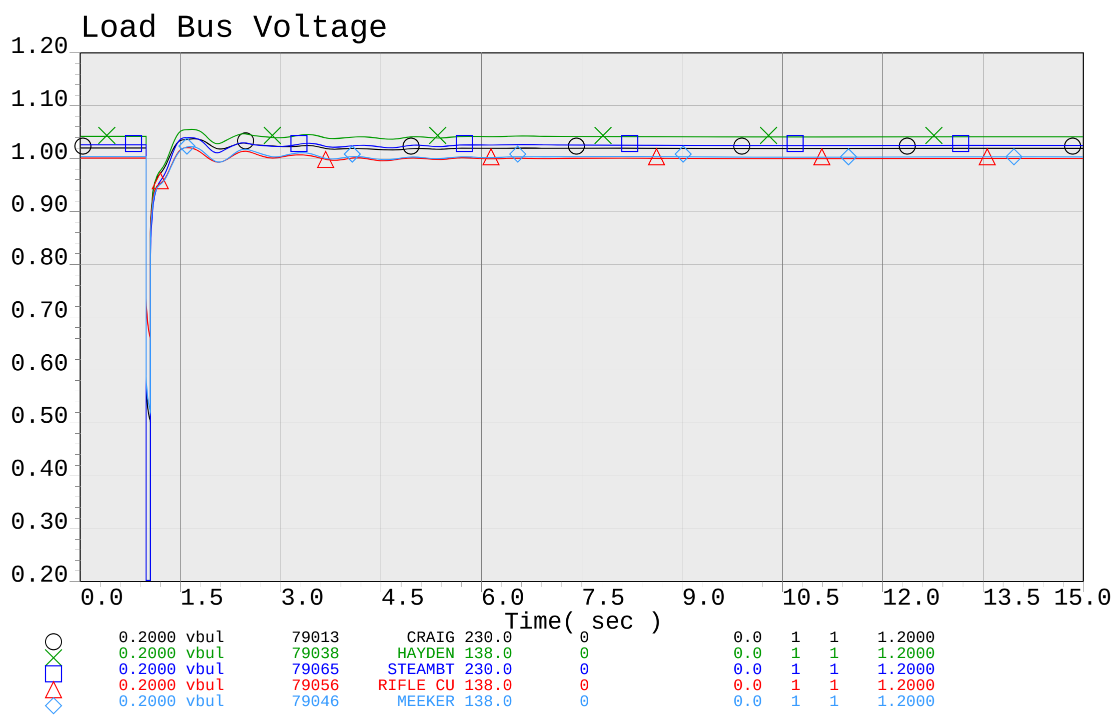
PLOT 8a:
Fault on Hayden 230 kV Bus and Loss of Hayden-Archer 230 kV Line





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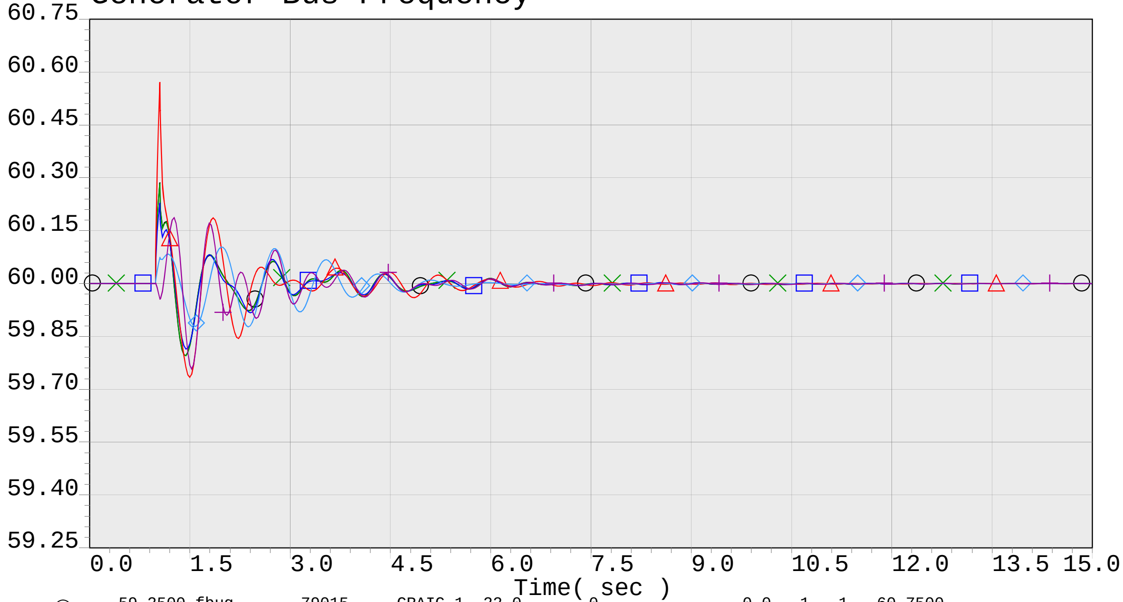
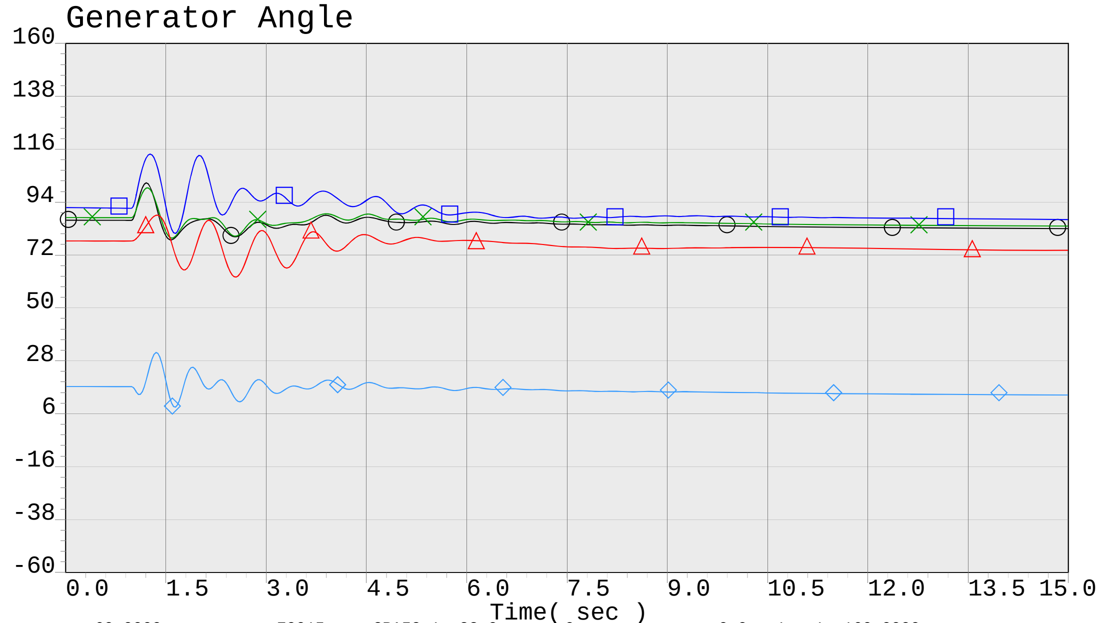
PLOT 8b:
Fault on Hayden 230 kV Bus and
Loss of Hayden-Archer 230 kV Line

Generator Bus Frequency



59.2500 fbug	79015	CRAIG 1	22.0	0	0.0	1	1	60.7500
59.2500 fbug	79016	CRAIG 2	22.0	0	0.0	1	1	60.7500
59.2500 fbug	79017	CRAIG 3	22.0	0	0.0	1	1	60.7500
59.2500 fbug	79040	HAYDEN1	18.0	0	0.0	1	1	60.7500
59.2500 fbug	65191	BONANZA	13.8	0	0.0	1	1	60.7500
59.2500 fbug	79251	QFATLAS1	13.8	0	0.0	1	1	60.7500

Generator Angle



-60.0000 ang	79015	CRAIG 1	22.0	0	0.0	1	1	160.0000
-60.0000 ang	79017	CRAIG 3	22.0	0	0.0	1	1	160.0000
-60.0000 ang	79040	HAYDEN1	18.0	0	0.0	1	1	160.0000
-60.0000 ang	65191	BONANZA	13.8	0	0.0	1	1	160.0000
-60.0000 ang	79251	QFATLAS1	13.8	0	0.0	1	1	160.0000

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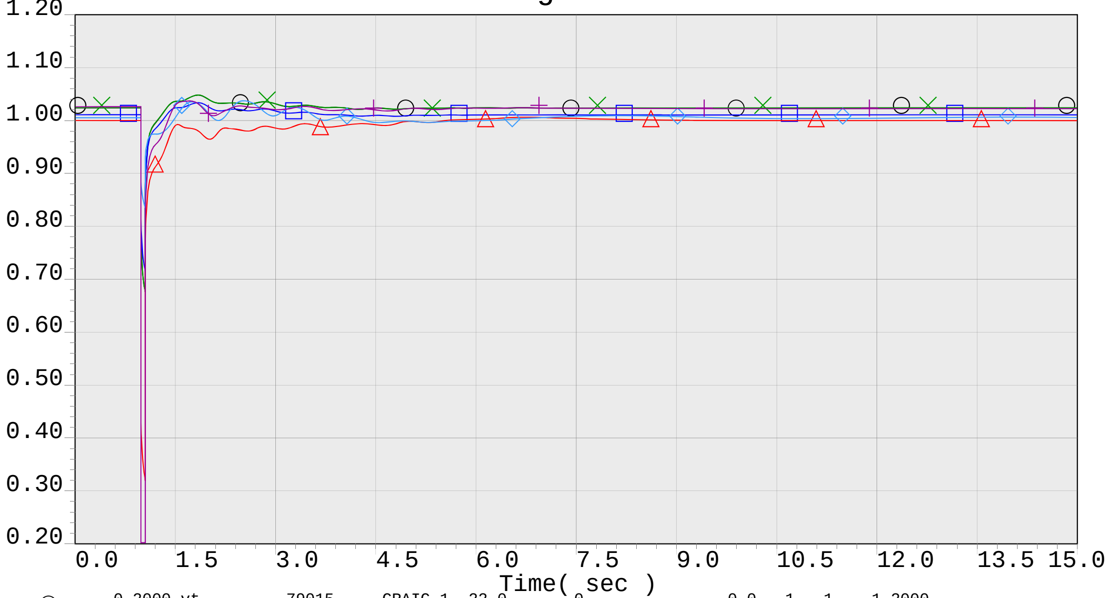
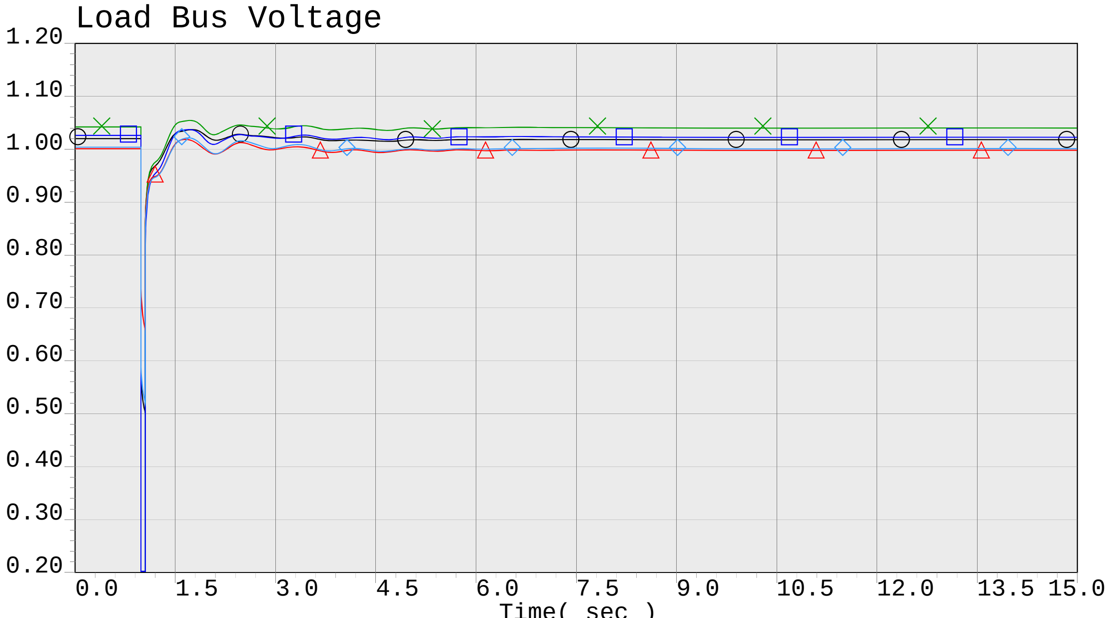
PLOT 9a:
Fault on Hayden 230 kV Bus and Loss of Hayden-Gore Pass 230 kV Line

Generator Terminal Voltage



○	0.2000	vt	79015	CRAIG 1	22.0	0	0.0	1	1	1.2000
×	0.2000	vt	79016	CRAIG 2	22.0	0	0.0	1	1	1.2000
□	0.2000	vt	79017	CRAIG 3	22.0	0	0.0	1	1	1.2000
△	0.2000	vt	79040	HAYDEN1	18.0	0	0.0	1	1	1.2000
◇	0.2000	vt	65191	BONANZA	13.8	0	0.0	1	1	1.2000
+	0.2000	vt	79065	STEAMBT	230.0	0	0.0	YV	1	1.2000

Load Bus Voltage



○	0.2000	vbul	79013	CRAIG	230.0	0	0.0	1	1	1.2000
×	0.2000	vbul	79038	HAYDEN	138.0	0	0.0	1	1	1.2000
□	0.2000	vbul	79065	STEAMBT	230.0	0	0.0	1	1	1.2000
△	0.2000	vbul	79056	RIFLE CU	138.0	0	0.0	1	1	1.2000
◇	0.2000	vbul	79046	MEEKER	138.0	0	0.0	1	1	1.2000

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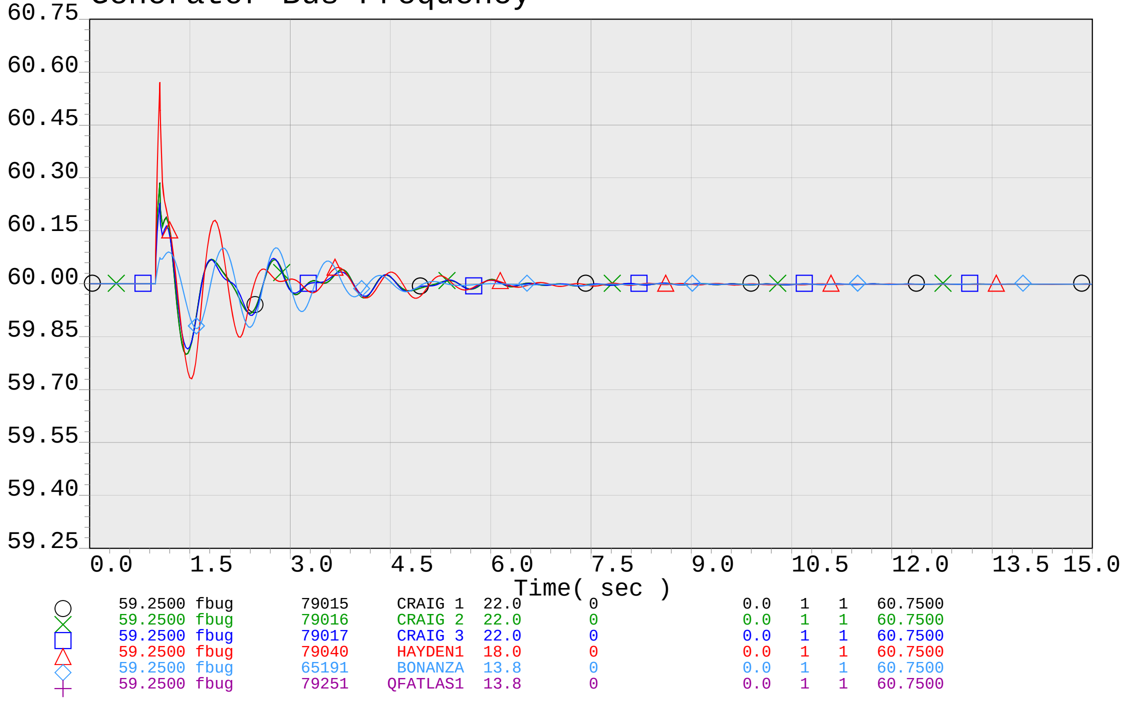
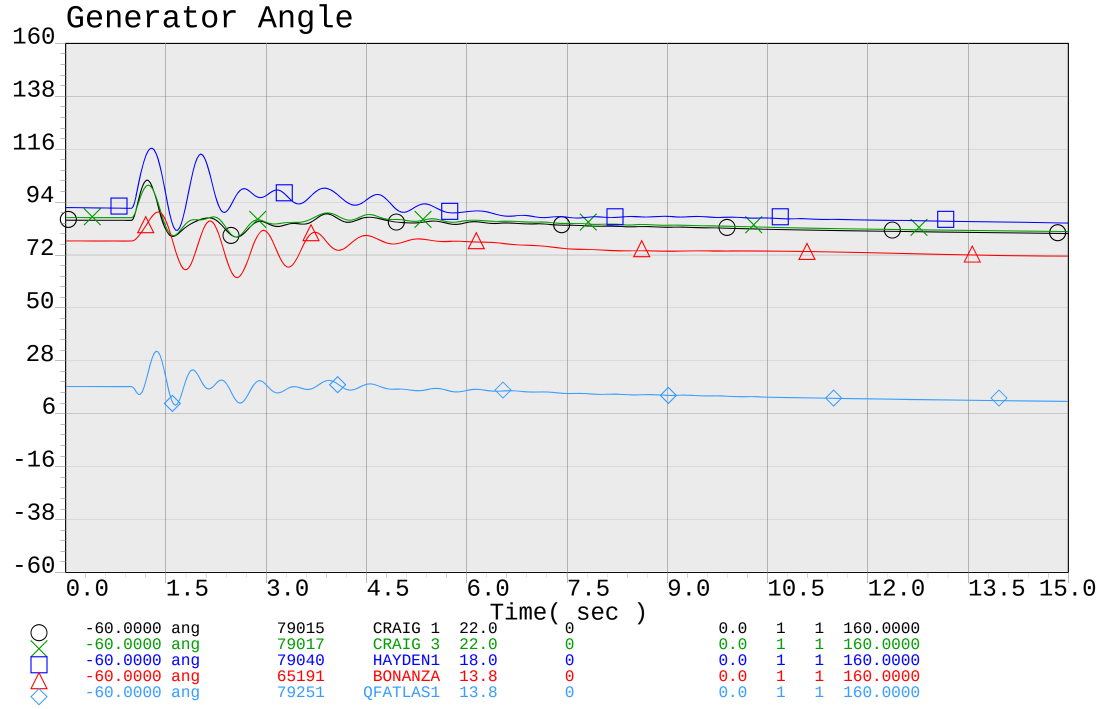
PLOT 9b:
Fault on Hayden 230 kV Bus and Loss of Hayden-Gore Pass 230 kV Line

Generator Bus Frequency



Generator Angle



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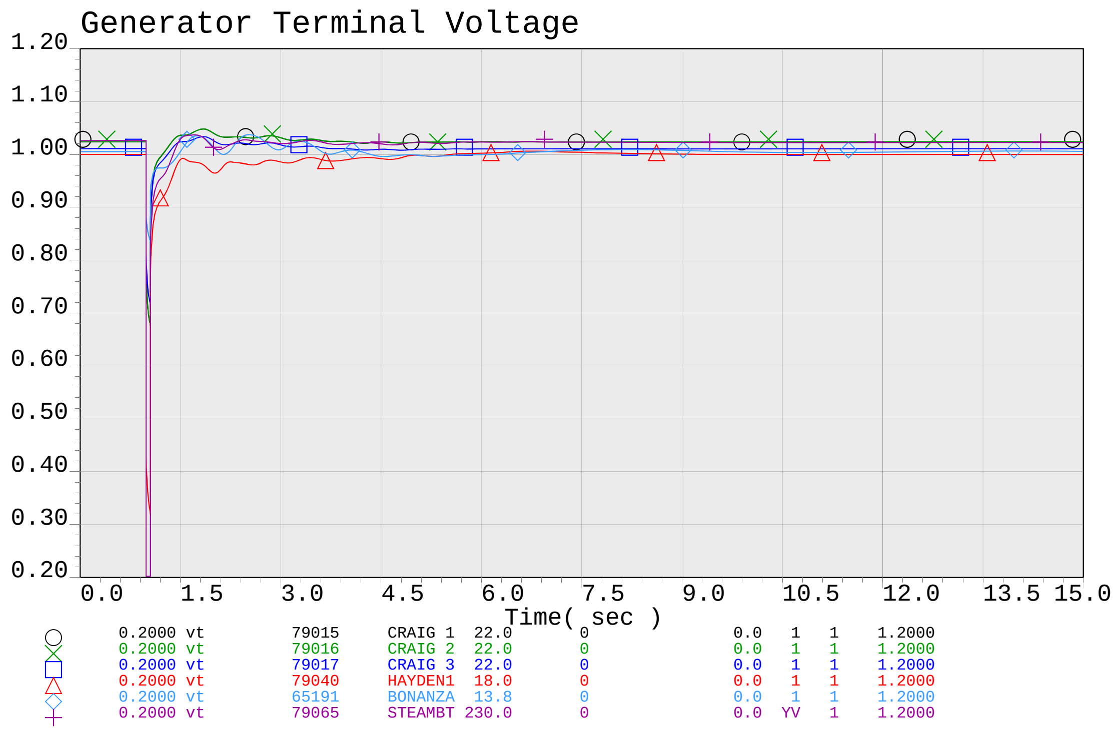
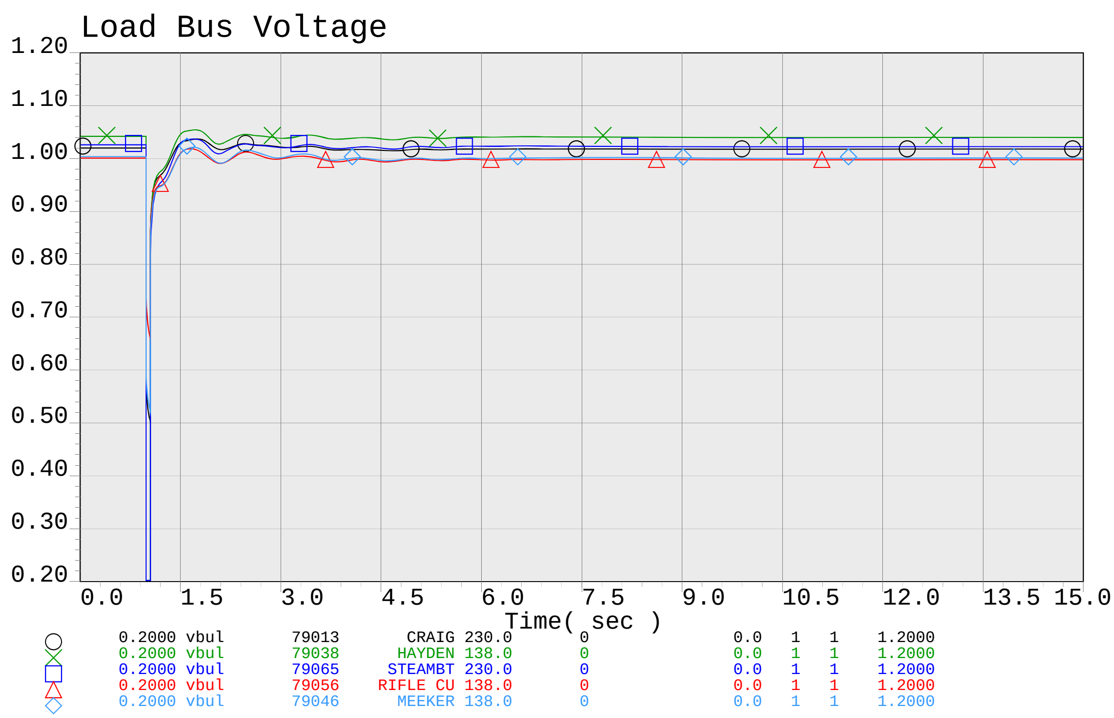
PLOT 10a:
Fault on Hayden 230 kV Bus and
Loss of Hayden-Wolcott 230 kV Line





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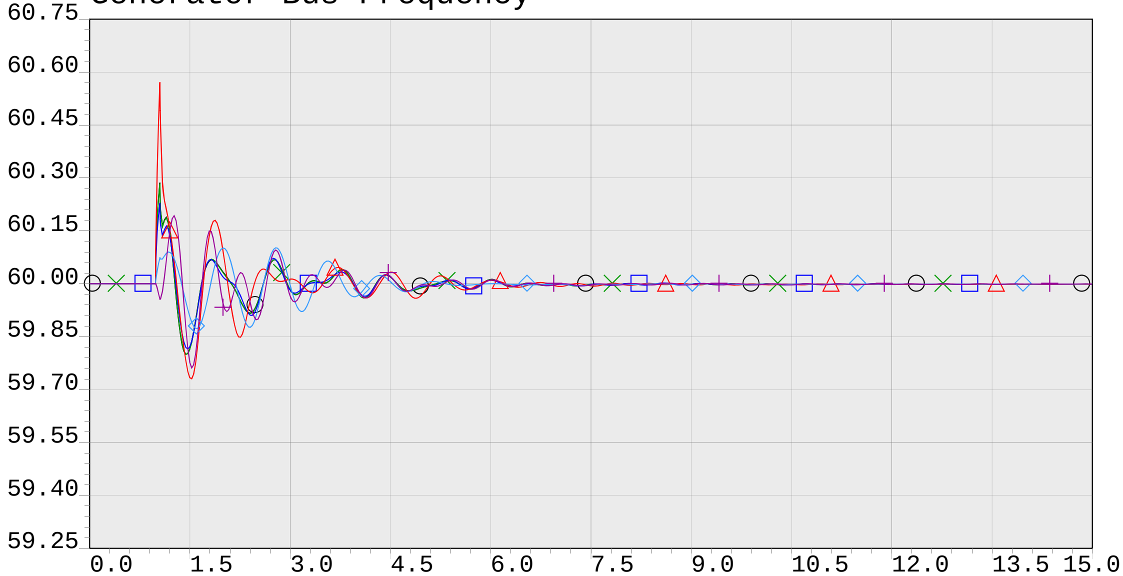
Fri Jun 27 08:01:49 2008

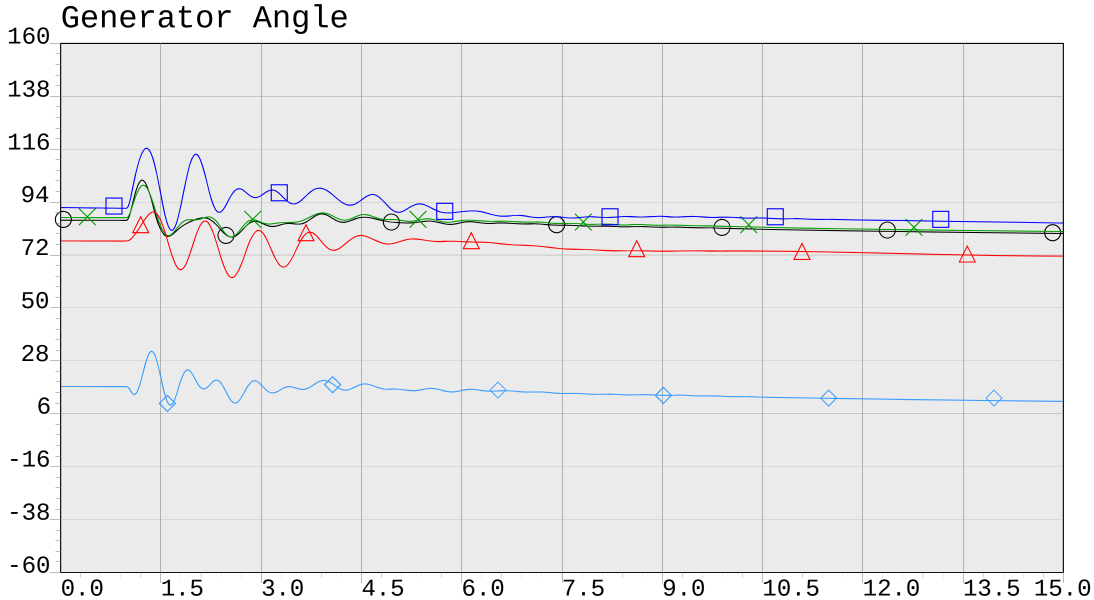
PLOT 10b:
Fault on Hayden 230 kV Bus and
Loss of Hayden-Wolcott 230 kV Line

Generator Bus Frequency



○	59.2500	fbug	79015	CRAIG 1	22.0	0	0.0	1	1	60.7500
×	59.2500	fbug	79016	CRAIG 2	22.0	0	0.0	1	1	60.7500
□	59.2500	fbug	79017	CRAIG 3	22.0	0	0.0	1	1	60.7500
△	59.2500	fbug	79040	HAYDEN1	18.0	0	0.0	1	1	60.7500
◇	59.2500	fbug	65191	BONANZA	13.8	0	0.0	1	1	60.7500
+	59.2500	fbug	79251	QFATLAS1	13.8	0	0.0	1	1	60.7500

Generator Angle



○	-60.0000	ang	79015	CRAIG 1	22.0	0	0.0	1	1	160.0000
×	-60.0000	ang	79017	CRAIG 3	22.0	0	0.0	1	1	160.0000
□	-60.0000	ang	79040	HAYDEN1	18.0	0	0.0	1	1	160.0000
△	-60.0000	ang	65191	BONANZA	13.8	0	0.0	1	1	160.0000
◇	-60.0000	ang	79251	QFATLAS1	13.8	0	0.0	1	1	160.0000

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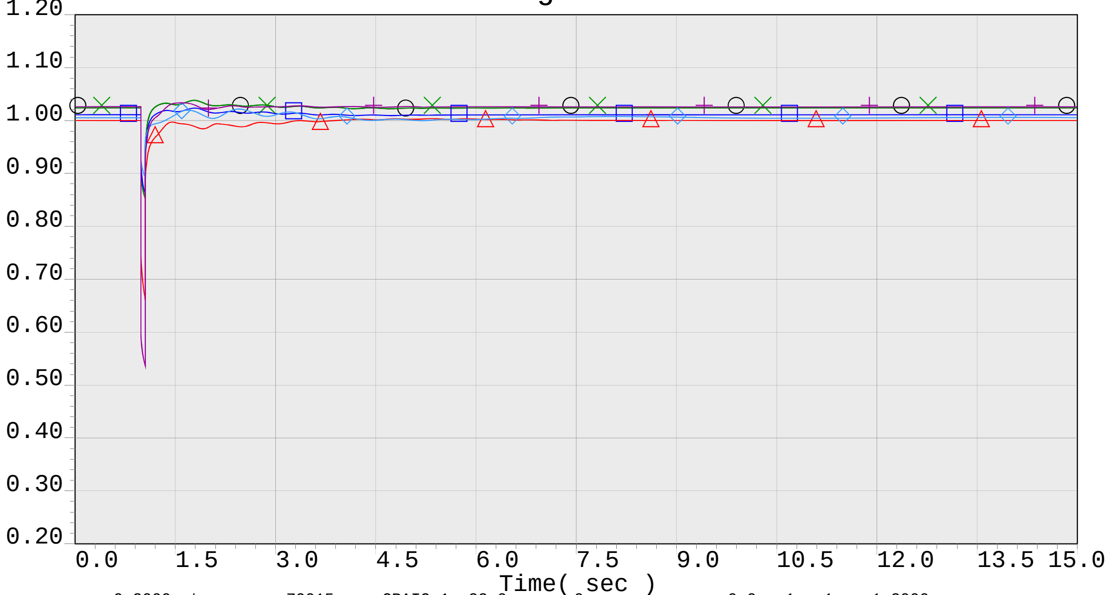
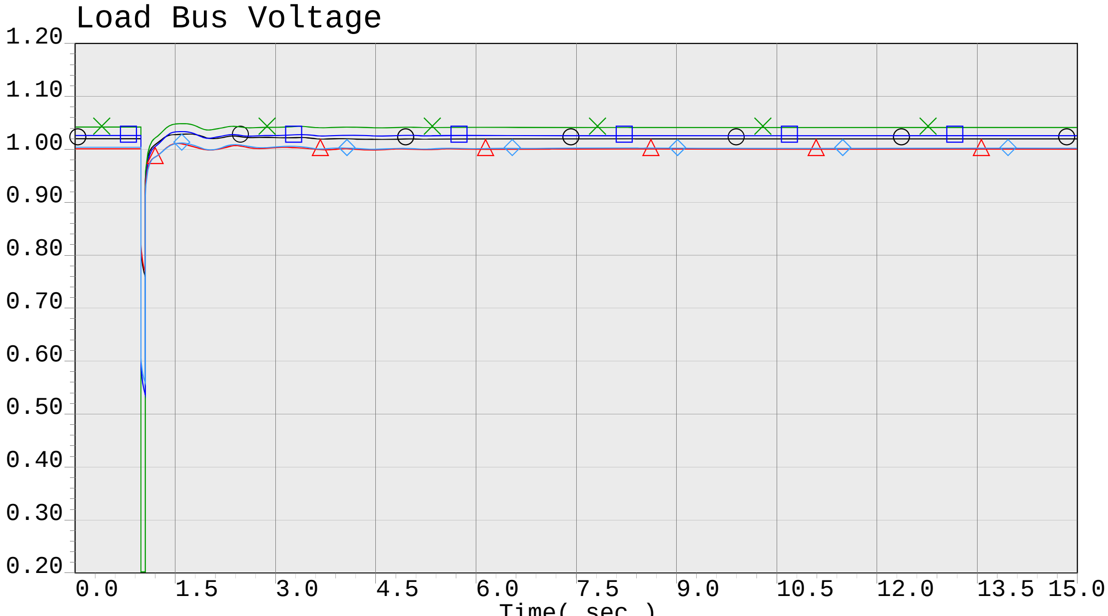
PLOT 11a:
Fault on Hayden 138 kV Bus and
Loss of Hayden-Artesia 138 kV Line

Generator Terminal Voltage



○	0.2000	vt	79015	CRAIG 1	22.0	0	0.0	1	1	1.2000
×	0.2000	vt	79016	CRAIG 2	22.0	0	0.0	1	1	1.2000
□	0.2000	vt	79017	CRAIG 3	22.0	0	0.0	1	1	1.2000
△	0.2000	vt	79040	HAYDEN1	18.0	0	0.0	1	1	1.2000
◇	0.2000	vt	65191	BONANZA	13.8	0	0.0	1	1	1.2000
+	0.2000	vt	79065	STEAMBT	230.0	0	0.0	YV	1	1.2000

Load Bus Voltage



○	0.2000	vbul	79013	CRAIG	230.0	0	0.0	1	1	1.2000
×	0.2000	vbul	79038	HAYDEN	138.0	0	0.0	1	1	1.2000
□	0.2000	vbul	79065	STEAMBT	230.0	0	0.0	1	1	1.2000
△	0.2000	vbul	79056	RIFLE CU	138.0	0	0.0	1	1	1.2000
◇	0.2000	vbul	79046	MEEKER	138.0	0	0.0	1	1	1.2000

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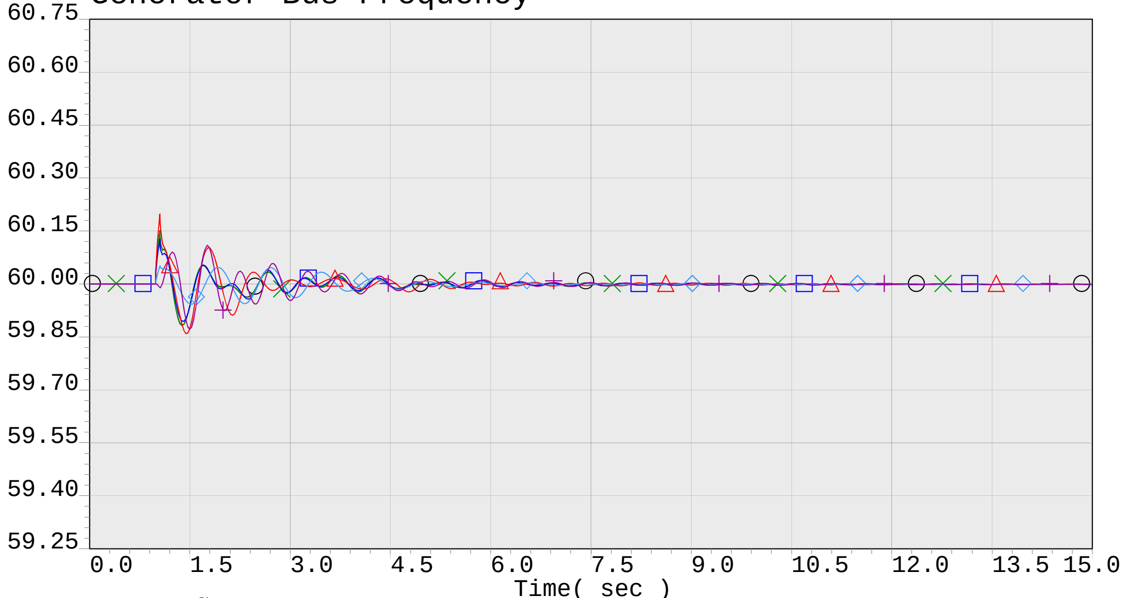
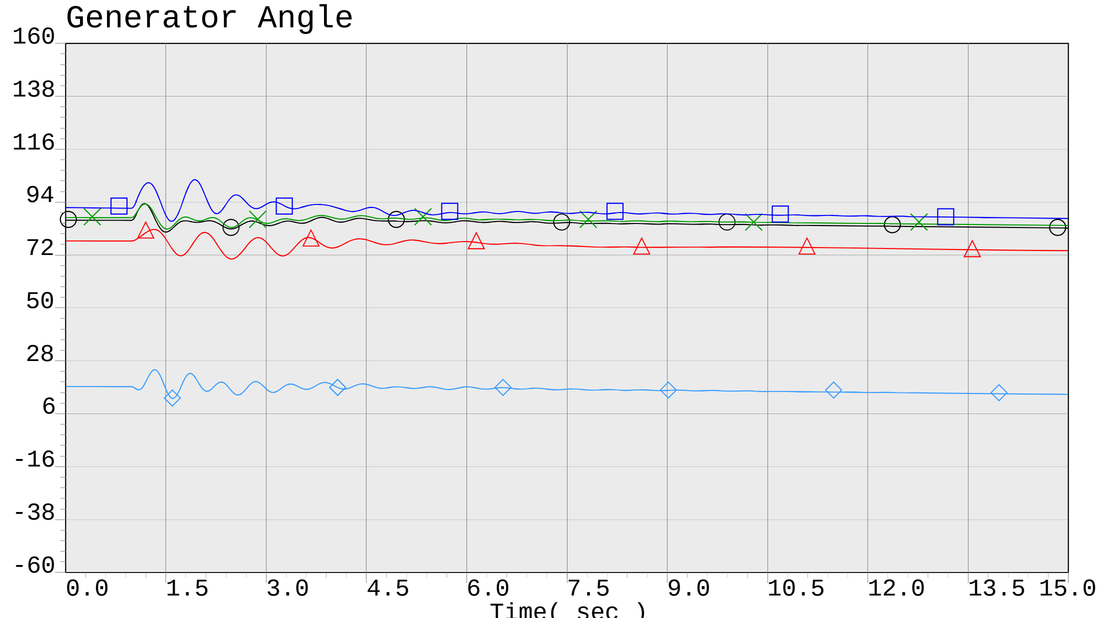
PLOT 11b:
Fault on Hayden 138 kV Bus and
Loss of Hayden-Artesia 138 kV Line

Generator Bus Frequency



○	59.2500	fbug	79015	CRAIG 1	22.0	0	0.0	1	1	60.7500
X	59.2500	fbug	79016	CRAIG 2	22.0	0	0.0	1	1	60.7500
□	59.2500	fbug	79017	CRAIG 3	22.0	0	0.0	1	1	60.7500
△	59.2500	fbug	79040	HAYDEN1	18.0	0	0.0	1	1	60.7500
◇	59.2500	fbug	65191	BONANZA	13.8	0	0.0	1	1	60.7500
+	59.2500	fbug	79251	QFATLAS1	13.8	0	0.0	1	1	60.7500

Generator Angle



○	-60.0000	ang	79015	CRAIG 1	22.0	0	0.0	1	1	160.0000
X	-60.0000	ang	79017	CRAIG 3	22.0	0	0.0	1	1	160.0000
□	-60.0000	ang	79040	HAYDEN1	18.0	0	0.0	1	1	160.0000
△	-60.0000	ang	65191	BONANZA	13.8	0	0.0	1	1	160.0000
◇	-60.0000	ang	79251	QFATLAS1	13.8	0	0.0	1	1	160.0000

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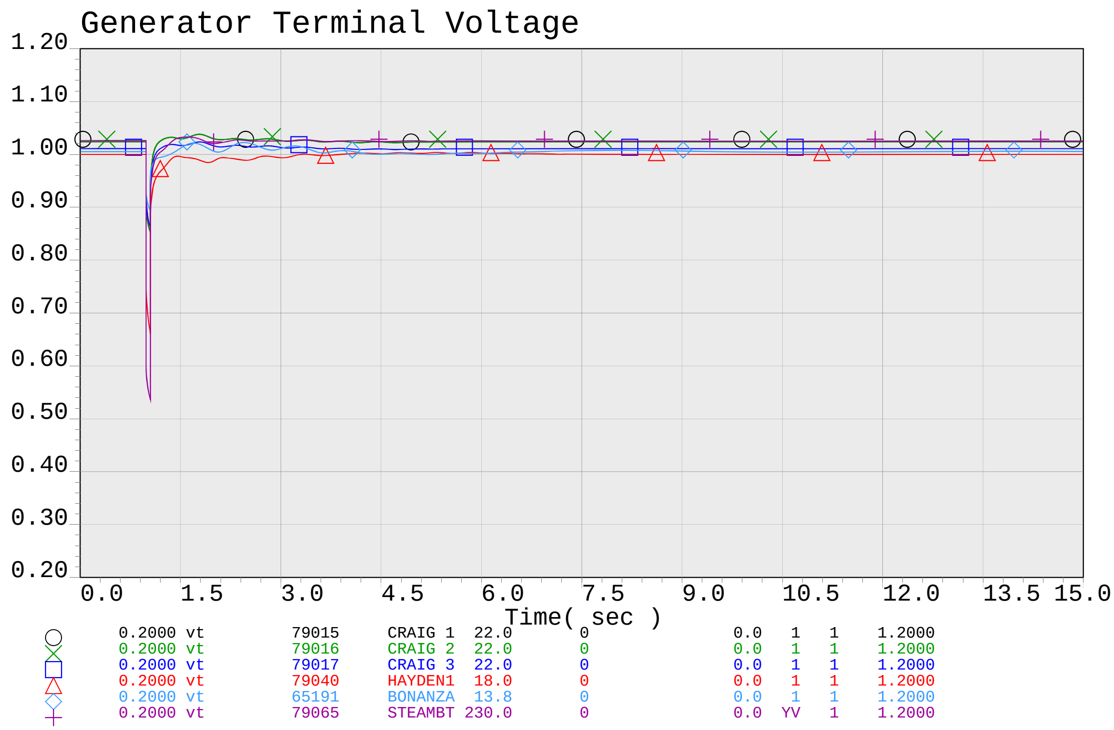
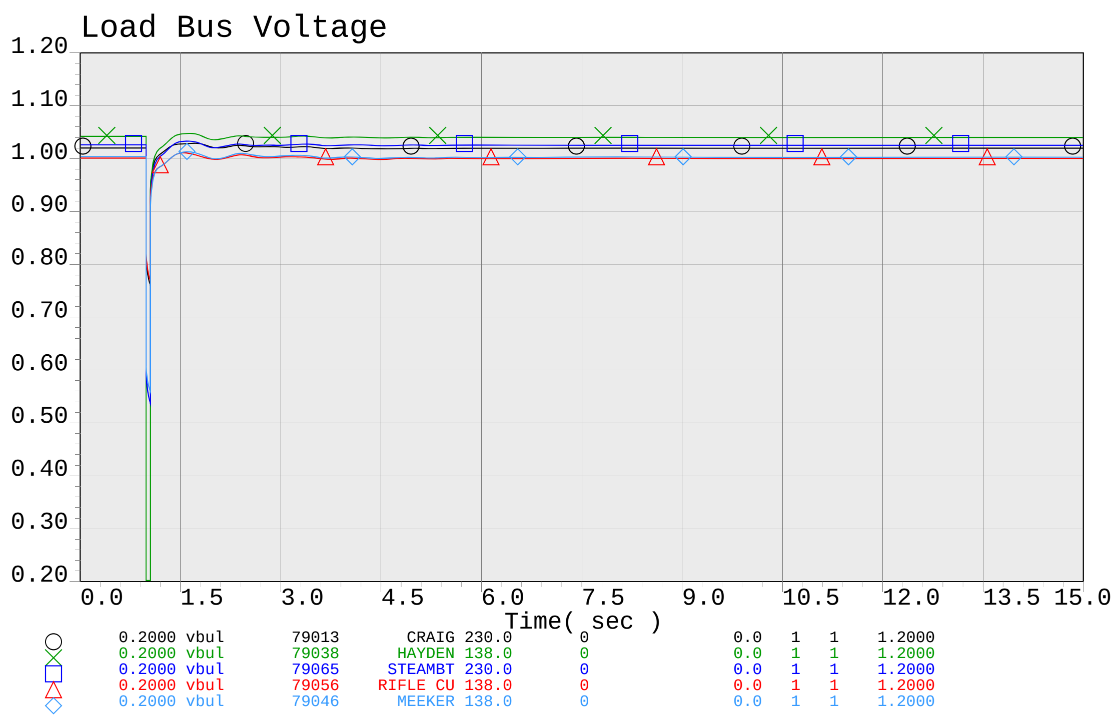
PLOT 12a:
Fault on Hayden 138 kV Bus and Loss of Hayden-Gore Pass 138 kV Line





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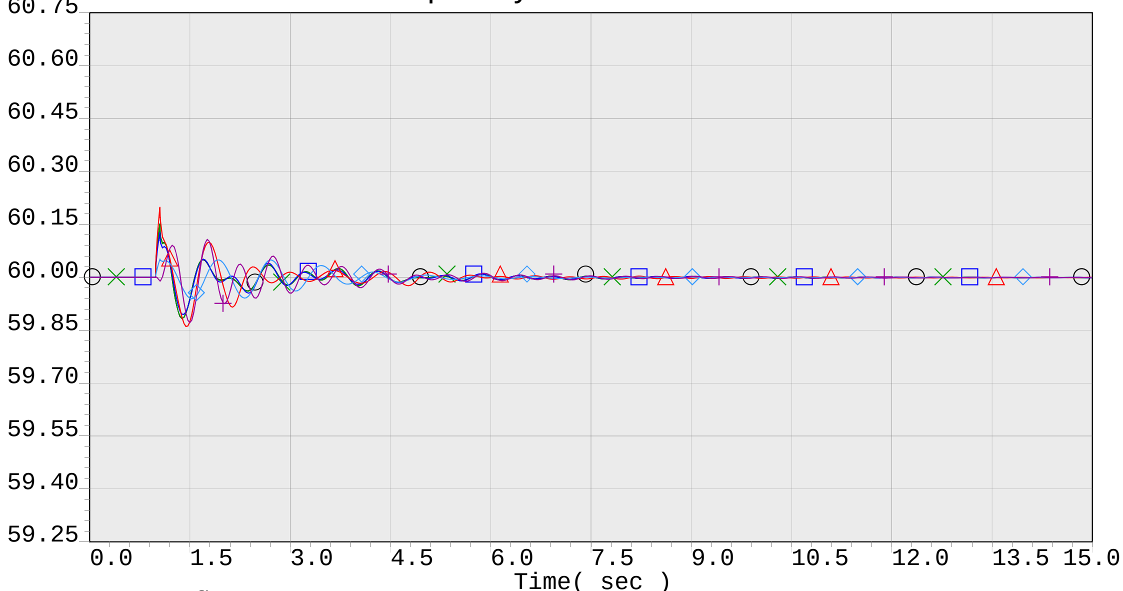
Fri Jun 27 08:20:14 2008

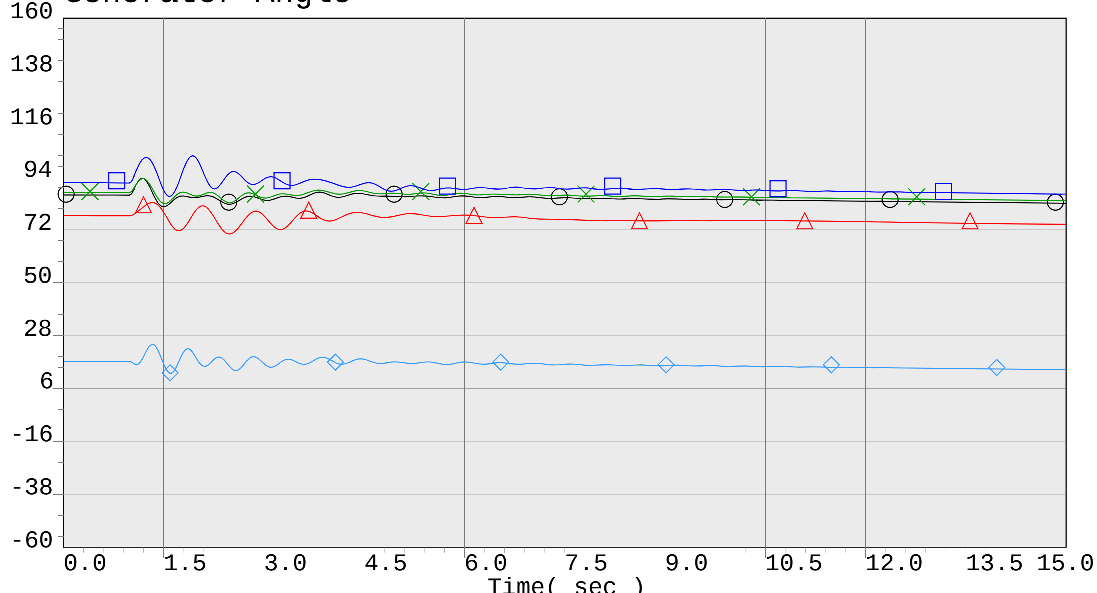
PLOT 12b:
Fault on Hayden 138 kV Bus and Loss of Hayden-Gore Pass 138 kV Line

Generator Bus Frequency



59.2500	fbug	79015	CRAIG 1	22.0	0	0.0	1	1	60.7500
59.2500	fbug	79016	CRAIG 2	22.0	0	0.0	1	1	60.7500
59.2500	fbug	79017	CRAIG 3	22.0	0	0.0	1	1	60.7500
59.2500	fbug	79040	HAYDEN1	18.0	0	0.0	1	1	60.7500
59.2500	fbug	65191	BONANZA	13.8	0	0.0	1	1	60.7500
59.2500	fbug	79251	QFATLAS1	13.8	0	0.0	1	1	60.7500

Generator Angle



-60.0000	ang	79015	CRAIG 1	22.0	0	0.0	1	1	160.0000
-60.0000	ang	79017	CRAIG 3	22.0	0	0.0	1	1	160.0000
-60.0000	ang	79040	HAYDEN1	18.0	0	0.0	1	1	160.0000
-60.0000	ang	65191	BONANZA	13.8	0	0.0	1	1	160.0000
-60.0000	ang	79251	QFATLAS1	13.8	0	0.0	1	1	160.0000

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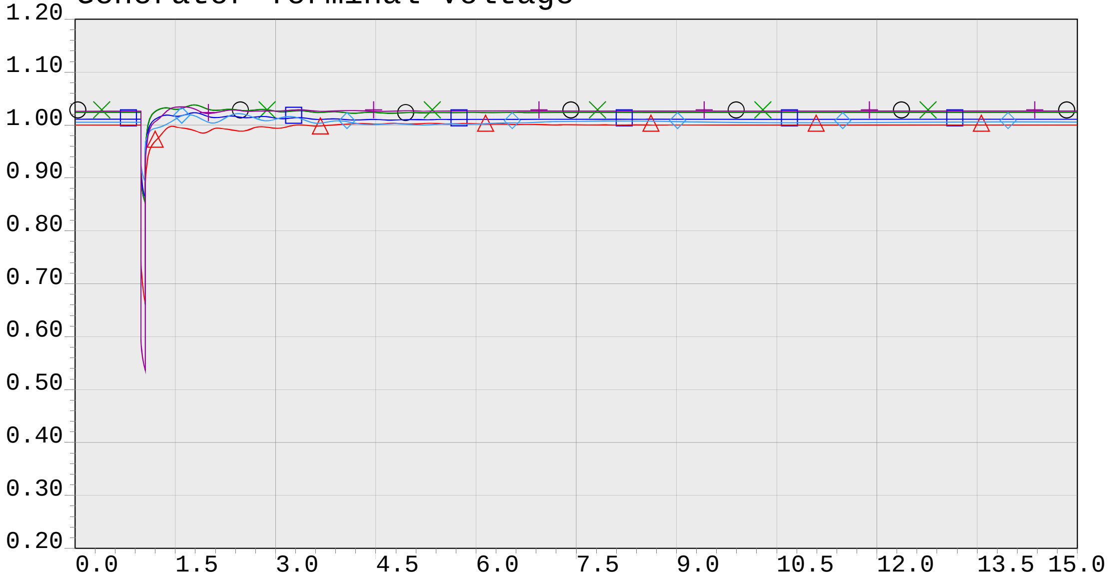
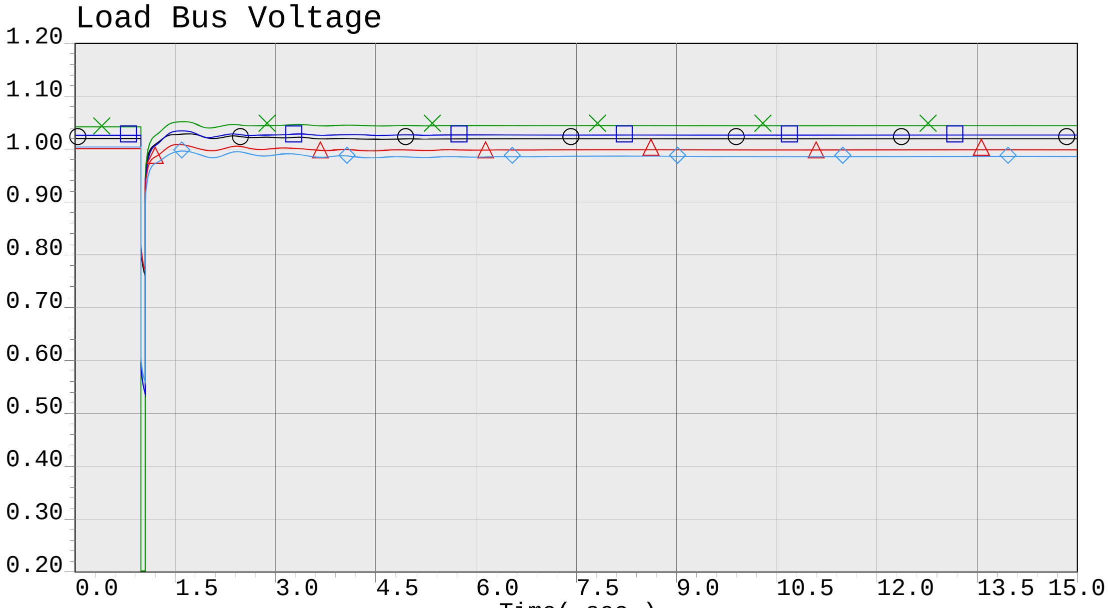
PLOT 13a:
Fault on Hayden 138 kV Bus and
Loss of Hayden-Axial Basin 138 kV Line

Generator Terminal Voltage



○	0.2000 vt	79015	CRAIG 1	22.0	0	0.0	1	1	1.2000
×	0.2000 vt	79016	CRAIG 2	22.0	0	0.0	1	1	1.2000
□	0.2000 vt	79017	CRAIG 3	22.0	0	0.0	1	1	1.2000
△	0.2000 vt	79040	HAYDEN1	18.0	0	0.0	1	1	1.2000
◇	0.2000 vt	65191	BONANZA	13.8	0	0.0	1	1	1.2000
+	0.2000 vt	79065	STEAMBT	230.0	0	0.0	YV	1	1.2000

Load Bus Voltage



○	0.2000 vbul	79013	CRAIG	230.0	0	0.0	1	1	1.2000
×	0.2000 vbul	79038	HAYDEN	138.0	0	0.0	1	1	1.2000
□	0.2000 vbul	79065	STEAMBT	230.0	0	0.0	1	1	1.2000
△	0.2000 vbul	79056	RIFLE CU	138.0	0	0.0	1	1	1.2000
◇	0.2000 vbul	79046	MEEKER	138.0	0	0.0	1	1	1.2000

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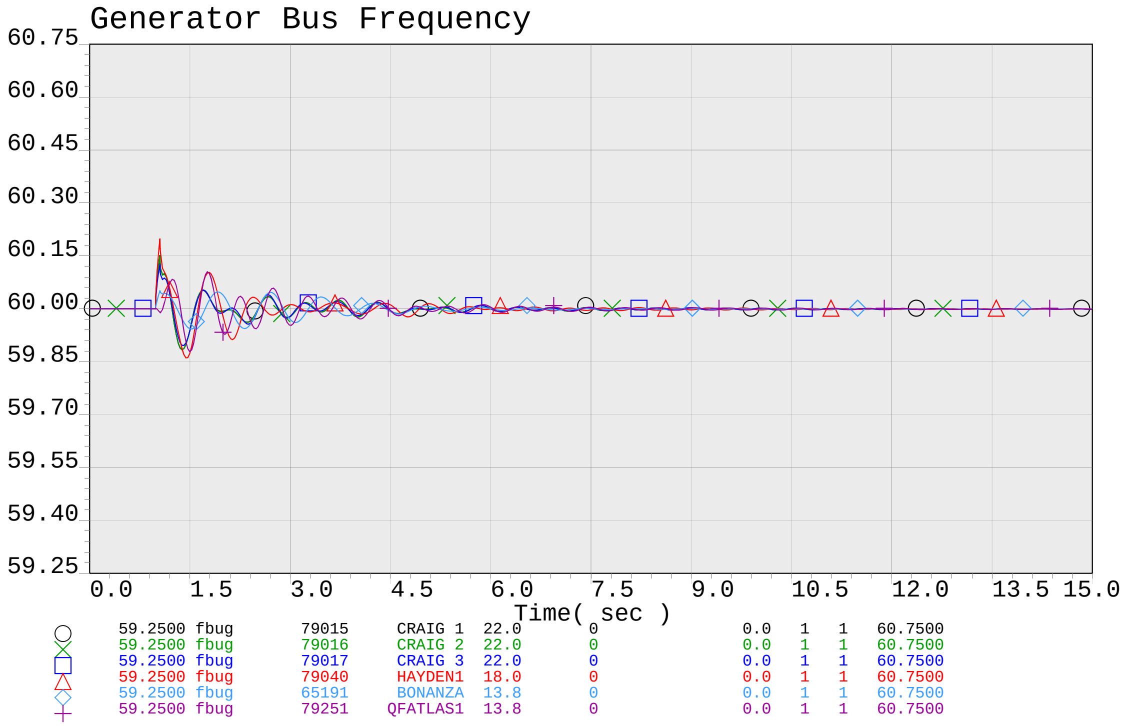
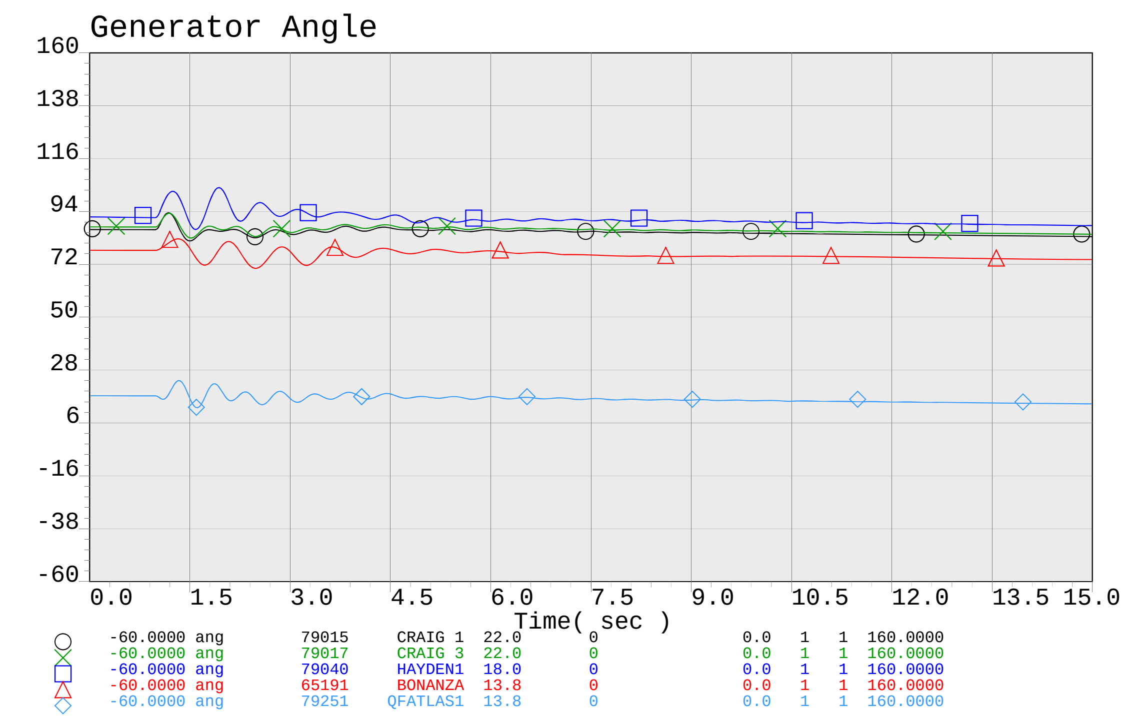
PLOT 13b:
Fault on Hayden 138 kV Bus and Loss of Hayden-Axial Basin 138 kV Line





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