Southwest Power Pool

Interim Operational Impact Study For Generation Interconnection Request GEN-2008-003

SPP Tariff Studies

(#GEN-2008-003)

May 2009

Executive Summary

<OMITTED TEXT> (Customer) has requested an Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of 101.2 MW of wind generation within the control area of Oklahoma Gas and Electric (OKGE) in Woodward County, Oklahoma. SPP expects to complete the Impact Study as part of the cluster study ICS-2008-001. SPP will not be able to complete all interconnection studies required under the OATT in time for the Customer's requested in-service date of August 1, 2009. Therefore, Customer has requested this Interim Operation Impact Study (IOIS) to determine the impacts of interconnecting its generating facility to the transmission system before all required Network Upgrades identified in the Feasibility Cluster Study (FCS-2008-001) posted on December 18, 2008 can be placed into service. SPP announced it would conduct interim operation impact studies for interested interconnection customers in an OASIS posting on March 6, 2009.

This study is intended only as an Interim Operation Study that will be used in order to tender an Interim Interconnection Agreement to the Customer for Interim Interconnection Service. If an Interim Interconnection Agreement is not executed with the Customer, this study will be inapplicable. If an Interim Interconnection Agreement is executed with the Customer, this study will be considered inapplicable upon termination of such Interim Interconnection Agreement.

This study assumed that only the higher queued projects identified in Table 6 or Table 7 of this study might go into service before the completion of all Network Upgrades identified in FCS-2008-001. If any additional generation projects not identified in Table 6 or Table 7 but with queue priority over GEN-2008-003 request to go into commercial operation before all Network Upgrades identified through the Cluster Interconnection Study process as required, then this study must be conducted again to determine whether sufficient interim interconnection capacity exists to interconnect the GEN-2008-003 interconnection request in addition to all higher priority requests in operation or pending operation.

The wind powered generation facility was studied with forty two (42) individual Siemens SMK-2.3-93 2.3 MW wind turbines. The requested in-service date for the 101.2 MW facility is August 1, 2009. This Impact study addresses the dynamic stability effects of interconnecting the plant to the rest of the OKGE transmission system for two system conditions. The first condition (Scenario 1) is the transmission system as it will exist on August 1, 2009. The second condition (Scenario 2) is the transmission system as it will exist on January 1, 2010 after Oklahoma Gas and Electric completes the construction and places into service the Woodward – Northwest 345kV transmission line.

Two seasonal base cases were used in the study to analyze the stability impacts of the proposed generation facility. The cases studied were a modified 2010 summer peak and 2010 winter peak that were adjusted to meet the system conditions stated above. Each case was modified to include prior queued projects that are listed in the body of the report. Forty-two (42) contingencies were identified for use in this study. The Siemens SMK-2.3-93 2.3 MW wind turbines were modeled using information provided by the manufacturer.

The stability study results show that with the Customer requested Siemens wind turbines the transmission system remains stable for all simulated contingencies and both system conditions studied. If the Customer does not use the Siemens SMK-2.3-93 2.3 MW, this IOIS will be considered invalid and the Customer will not be allowed to interconnect on an interim basis. The study results show that, with the Siemens turbines, the wind farm will meet FERC Order #661A's Low Voltage Ride Through (LVRT) provisions. The Customer's windfarm is required to maintain +/- 0.95 power factor at the point of interconnection (POI) for any system condition.

The estimates of costs for network upgrades and the interconnection facilities for interim operation will be estimated by the Transmission Owner on an expedited basis to meet the Customer's in service date. The Customer will also be required to provide security in the amount of $10,852,000 per the Feasibility Cluster Study (FCS-2008-001). This amount of security will be adjusted as the GEN-2008-003 interconnection request advances through the Cluster interconnection process as stated in SPP's OASIS posting.

Nothing in this study should be construed as a guarantee of transmission service. If the customer wishes to sell power from the facility, a separate request for transmission service shall be requested on Southwest Power Pool's OASIS by the Customer.

1.0 Introduction

<OMITTED TEXT> (Customer) has requested an Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of 101.2 MW of wind generation within the control area of Oklahoma Gas and Electric (OKGE) in Woodward County, Oklahoma. As the interconnection studies for this request cannot be completed before the August 1, 2009 in service date of the generating facility, the Customer has requested that SPP conduct an Interim Operational Impact Study (IOIS) to determine if the generating facility can be interconnected in an interim manner before all Network Upgrades identified in the Feasibility Cluster Study (FCS-2008-001) are placed in service. SPP announced it would conduct such studies for interested interconnection customers in an OASIS posting on March 6, 2009.

The wind powered generation facility was studied with forty-two (42) individual Siemens SMK-2.3-93 2.3 MW wind turbines. The requested in-service date for the 101.2 MW facility is August 1, 2009. This Impact study addresses the dynamic stability effects of interconnecting the plant to the rest of the OKGE transmission system for two system conditions. The first condition (Scenario 1) is the transmission system as it will exist on August 1, 2009. The second condition (Scenario 2) is the transmission system as it will exist on January 1, 2010 after Oklahoma Gas and Electric completes the construction and places into service the Woodward – Northwest 345kV transmission line.

Two seasonal base cases were used in the study to analyze the stability impacts of the proposed generation facility. The cases studied were modified versions of the 2010 summer peak and 2010 winter peak to reflect the system conditions stated above. Each case was modified to include prior queued projects that are listed in the body of the report. Forty-two (42) contingencies were identified for this study. The Siemens SMK-2.3-93 2.3 MW wind turbines were modeled using information provided by the manufacturer.

2.0 Purpose

The purpose of this Interim Operational Impact Study (IOIS) is to evaluate the impact of the proposed interconnection on the reliability of the Transmission System. The IOIS considers the Base Case as well as all Generating Facilities (and with respect to (b) below, any identified Network Upgrades associated with such higher queued interconnection) that, on the date the IOIS is commenced:

a) are directly interconnected to the Transmission System;
b) are interconnected to Affected Systems and may have an impact on the Interconnection Request;
c) have a pending higher queued Interconnection Request to interconnect to the Transmission System listed in Table 6 or Table 7; or
d) have no Queue Position but have executed an LGIA or requested that an unexecuted LGIA be filed with FERC.

Any changes to these assumptions, for example, one or more of the previously queued projects not included in this study signing an interconnection agreement, may require a re-study of this request at the expense of the customer.

Nothing in this System Impact Study constitutes a request for transmission service or confers upon the Interconnection Customer any right to receive transmission service.

3.0 Facilities

3.1 Generating Facility

The generating facility was studied with the assumption that it would be using forty-two (42) individual Siemens SMK-2.3-93 2.3 MW wind turbines. The nameplate rating of each turbine is 2.3 MW (2300 kW) with a machine base of 2.3 kVA. The turbine output voltage is 690V.

Each wind turbine will feed into a 0.690/34.5 kV GSU rated at 2500 kVA. Impedance for the GSU is 5.75%.

The 44 wind turbines are distributed among four collector circuits that feed into a 34.5/138 kV transformer in the customer's substation. The impedance for the substation transformer is 8.8% on an 84 MVA OA Base with a top rating of 140 MVA.

Figure 1 shows the one-line modeling of the generation facility.

3.2 Interconnection Facility

The point of interconnection (POI) will be at the new OKGE 138 kV switching station located just west of the existing Woodward 138 kV District Substation. Figure 1 shows the proposed POI. OKGE is currently building the new Woodward EHV 138kV substation as part of its construction plans. Customer intends to interconnect into the new Woodward EHV 138kV substation.

Cost to interconnect on an Interim basis is estimated at **$1,250,000**.

Customer's latest estimate for cost responsibility for Interconnection Service is given in the Feasibility Cluster Study (FCS-2008-001) at **$10,852,000**. The Customer will be required to provide security in this amount to move forward into an Interim Interconnection Agreement.

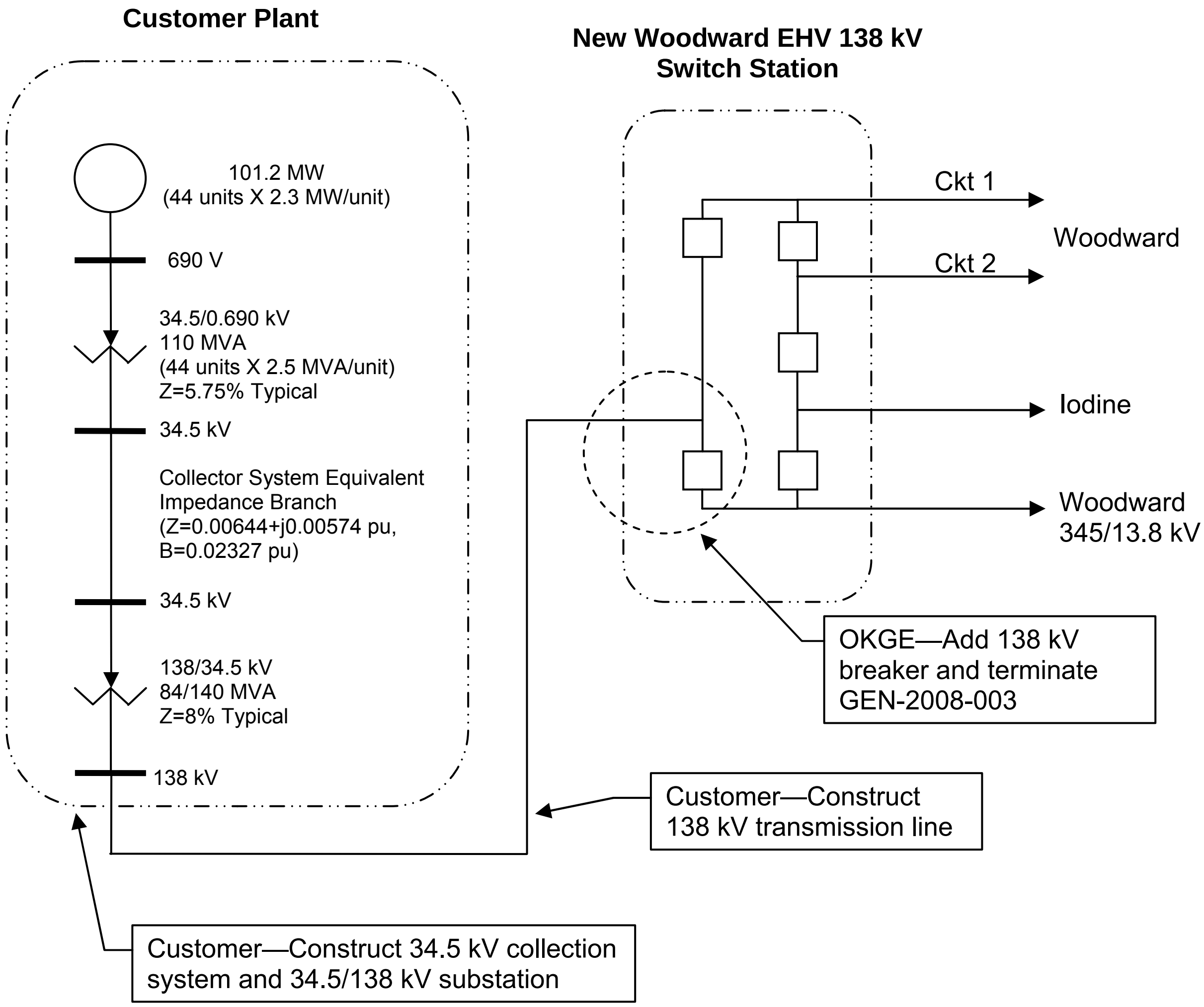


Figure 1: GEN-2008-003 Facility and Proposed Interconnection Configuration

3.3 Power Factor Requirements

The Siemens SMK-2.3-93 2.3 MW turbines have a reactive capability of +/- 0.90 (lead/lag) power factor at the generator terminals. An analysis was conducted to determine whether the wind turbines are sufficient to meet the power factor criteria for the wind farm.

The interconnection generators were set to hold a voltage schedule at the POI at the system intact voltage level. The most stringent contingencies for each season were used to determine the windfarm power factor at the POI. The resulting power factors are shown in Table 1.

The Customer's windfarm is required to maintain +/- 0.95 power factor at the POI for any system condition.

SEASON	CONTINGENCY	Voltage @POI (pu)	PF @POI	PF	MW @POI	Mvars @POI
10SP SC1	NONE	1.01673	0.985	Lag	100.1	-17.5
10SP SC1	Woodward EHV – Woodward	1.01673	0.986	Lag	100.1	-17.2
10SP SC1	Woodward EHV – Iodine	1.01673	0.963	Lag	100.1	-28.1
10SP SC2	NONE (System intact)	1.00875	0.991	Lag	100.1	-13.3
10SP SC2	Woodward EHV (POI) – Woodward	1.00875	0.992	Lag	100.1	-13.1
10SP SC2	Woodward EHV – Iodine	1.00875	0.998	Lag	100.1	-5.0
10SP SC2	Woodward EHV – Woodward 345 kV Autotransformer	1.00875	0.925	Lag	100.0	-41.1
10WP SC1	NONE	1.00806	0.992	Lag	100.1	-12.9
10WP SC1	Woodward EHV – Woodward	1.00806	0.992	Lag	100.1	-12.8
10WP SC1	Woodward EHV – Iodine	1.00806	0.979	Lag	1001.	-20.9
10WP SC2	NONE	0.99687	0.997	Lag	100.1	-7.1
10WP SC2	Woodward EHV – Woodward	0.99687	0.998	Lag	100.1	-6.9
10WP SC2	Woodward EHV – Iodine	0.99687	0.998	Lead	100.1	5.9
10WP SC2	Woodward EHV – Woodward 345 kV Autotransformer	0.99687	0.929	Lag	100.0	-39.9

Note: SC1 – Scenario 1, SC2 – Scenario 2

Table 1: Power Factor at the Point of Interconnection

4.0 Stability Analysis

4.1 Modeling of the Wind Turbines in the Power Flow

In order to simplify the model of the wind farm while capturing the effect of the different impedances of cables (due to change of the conductor size and length), the wind turbines and associated impedances on the collector circuit were modeled by an equivalent circuit as shown in Figure 1.

4.2 Modeling of the Wind Turbines in Dynamics

Siemens SMK203-V1.1, User Information for PSS/E Simulation Package for Siemens Wind Power SWT-2.3-93 60Hz Wind Turbine model was used for this study. This package is available from the manufacturer. The generator data used by the stability model is shown in Table 2.

For the simulations, the wind farm was dispatched directly by the user to the level specified (100% rated power). It was assumed the turbines would operate at +/- 0.90 power factor as per the unit capabilities.

Description	Value
Machine active power rating (MW)	2.30
Stator voltage rating (kV)	0.690
Rated network frequency (Hz)	60
Unit transformer rating (MVA)	2.6

Table 2: SMK-2.3-93 2.3 MW Wind Turbine Generator Parameters

4.2.1 Turbine Protection Schemes

The Siemens SMK-2.3-93 2.3 MW wind turbines utilize an undervoltage/overvoltage protection scheme and an underfrequency/overfrequency protection scheme. The various protection schemes are designed to protect the wind turbines in the case of system disturbances that can cause damage to the mechanical systems or power electronics on board the turbine. Generally, the protection schemes will disconnect the generator from the electric grid if the sampled frequency or voltage is outside of a specified band for a specified amount of time. The voltage protection limits are shown in Table 3, and the frequency protection limits are shown in Table 4.

FERC Order #661A places specific requirements on wind farms through its Low Voltage Ride Through (LVRT) provisions. For Interconnection Agreements signed after December 31, 2006, wind farms shall stay on line for faults at the POI that draw the voltage down at the POI to 0.0 pu. For this study, the wind turbines were determined to comply with FERC Order #661A.

Voltage (V)	Time Limit
V > 1.2 pu	0.2 sec
V > 1.1 pu	1.0 sec
1.1 pu ≥ V ≥ 0.9 pu	Continuous Operation
V < 0.9 pu	3.0 sec
V < 0.5 pu	1.735 sec
V < 0.15 pu	0.625 sec

Table 3: Siemens SMK-2.3-93 2.3 MW Wind Turbine Generator Voltage Protection

Frequency (F)	Time Limit
F > 62.4 Hz	0.1 sec
62.0 Hz ≥F ≥ 57.0Hz	Continuous Operation
57.0 Hz > F ≥ 56.4 Hz	10.0 sec
F < 56.4 Hz	0.1 sec

Table 4: Siemens SMK-2.3-93 2.3 MW Wind Turbine Generator Frequency Protection

4.3 Contingencies Simulated

Forty-two (42) contingencies were considered for the transient stability simulations. These contingencies included three phase faults and single phase line faults at locations defined by SPP. Single-phase line faults were simulated by applying a fault impedance to the positive sequence network at the fault location to represent the effect of the negative and zero sequence networks on the positive sequence network. The fault impedance was computed to give a positive sequence voltage at the specified fault location of approximately 60% of pre-fault voltage. This method is in agreement with SPP current practice.

The faults that were defined and simulated are listed in Table 5.

Table 5: Contingencies Evaluated

Cont. No.	Cont. Name	Description
1	FLT01-3PH	3 phase fault on one of the Woodward (515375) to Northwest (514880) 345kV lines, near Woodward. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
2	FLT02-1PH	Single phase fault and sequence like previous
3	FLT03-3PH	3 phase fault on the Woodward 345kV (515375) to 138kV (515376) transformer, near the 345 kV bus. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
4	FLT04-1PH	Single phase fault and sequence like previous
5	FLT05-3PH	3 phase fault on the Wichita (532796) to Woodring (514715) 345kV line, near Wichita. a. Apply fault at the Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
6	FLT06-1PH	Single phase fault and sequence like previous
7	FLT07-3PH	3 phase fault on the Woodring (514715) to Sooner (514803) 345kV line, near Woodring. a. Apply fault at the Woodring 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
8	FLT08-1PH	Single phase fault and sequence like previous
9	FLT09-3PH	3 phase fault on the Cimarron (514901) to Draper (514934) 345kV line, near Cimarron. a. Apply fault at the Cimarron 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
10	FLT10-1PH	Single phase fault and sequence like previous
11	FLT11-3PH	3 phase fault on the Northwest (514880) to Arcadia (514908) 345kV line, near Northwest. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
12	FLT12-1PH	Single phase fault and sequence like previous
13	FLT13-3PH	3 phase fault on the Northwest (514880) to Spring Creek (514881) 345kV line, near Northwest. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
14	FLT14-1PH	Single phase fault and sequence like previous
15	FLT15-3PH	3 phase fault on the Northwest (514880) to Cimarron (514901) 345kV line, near Northwest. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
16	FLT16-1PH	Single phase fault and sequence like previous

Table 5: Contingencies Evaluated

17	FLT17-3PH	3 phase fault on Northwest 345kV (514880) to 138kV (514879) transformer T2, near the 345 kV bus. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
18	FLT18-1PH	Single phase fault and sequence like previous
19	FLT19-3PH	3 phase fault on the Woodward 138kV (515376) to 345kV (515375) transformer, near the 138kV bus. a. Apply fault at the Woodward 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
20	FLT20-1PH	Single phase fault and sequence like previous
21	FLT21-3PH	3 phase fault on the Woodward EHV (515376) to Iodine (514796) 138kV line, near Woodward EHV. a. Apply fault at the Woodward EHV 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
22	FLT22-1PH	Single phase fault and sequence like previous
23	FLT23-3PH	3 phase fault on the Woodward (514785) to GEN-2001-037 (515785) 138kV line, near Woodward. a. Apply fault at the Woodward 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
24	FLT24-1PH	Single phase fault and sequence like previous
25	FLT25-3PH	3 phase fault on the GEN-2001-037 (515785) to Woodward (514785) 138kV line, near GEN-2001-037. a. Apply fault at the GEN-2001-037 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
26	FLT26-1PH	Single phase fault and sequence like previous
27	FLT29-3PH	3 phase fault on the Mooreland (520999) to Glass Mountain (514788) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
28	FLT30-1PH	Single phase fault and sequence like previous
29	FLT31-3PH	3 phase fault on the Mooreland (520999) to Cedardale (520848) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
30	FLT32-1PH	Single phase fault and sequence like previous
31	FLT33-3PH	3 phase fault on the Mooreland (520999) to Morewood (521001) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
32	FLT34-1PH	Single phase fault and sequence like previous

Table 5: Contingencies Evaluated

33	FLT35-3PH	3 phase fault on the Mooreland (520999) to Taloga (521065) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
34	FLT36-1PH	Single phase fault and sequence like previous
35	FLT37-3PH	3 phase fault on the Taloga 138kV (521065) to 69kV (521064) transformer, near the 138kV bus. a. Apply fault at the Taloga 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.
36	FLT38-1PH	Single phase fault and sequence like previous
37	FLT39-3PH	3 phase fault on the Dewey (514787) to Taloga (521065) 138kV line, near Dewey. a. Apply fault at the Dewey 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
38	FLT40-1PH	Single phase fault and sequence like previous
39	FLT41-3PH	3 phase fault on the Dewey (514787) to Southard (514822) 138kV line, near Dewey. a. Apply fault at the Dewey 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
40	FLT42-1PH	Single phase fault and sequence like previous
41	FLT43-3PH	3 phase fault on El Reno (514819) to Roman Nose (514823) 138kV line, near El Reno. a. Apply fault at the El Reno 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.
42	FLT44-1PH	Single phase fault and sequence like previous

4.4 Further Model Preparation

The two base cases contain prior queued projects as shown in Table 6 for August 1, 2009 operation (Scenario 1) and in Table 7 for January 1, 2010 operation (Scenario 2).

For the Scenario 2 model, the Northwest – Woodward 345kV transmission line schedule for January 1, 2010 in service was included in the model.

The wind farm generation from the study customer and previously queued customers were dispatched into the SPP footprint.

Initial simulation were carried out on both base cases and cases with the added generation for a no-disturbance run of 20 seconds to verify the numerical stability of the model. All cases were confirmed to be stable.

Project	MW
GEN-2001-014	96
GEN-2001-037	102
GEN-2002-005	120
GEN-2005-008	130

Table 6: Prior Queued Projects for August 1, 2009 Operation (Scenario 1)

Project	MW
GEN-2001-014	96
GEN-2001-037	102
GEN-2002-005	120
GEN-2005-008	130
GEN-2006-046	130
GEN-2007-006	160

Table 7: Prior Queued Projects for January 1, 2010 Operation (Scenario 2)

5.0 Results

Results of the stability analysis are summarized in Table 8. The results indicate that for all contingencies studied the transmission system remains stable.

Selected stability plots for the simulations are in Appendices A, B, C, and D. All plots are available on request.

Table 8: Results of Simulated Contingencies

Cont. No.	Cont. Name	Description	2010SP Scenario 1	2010SP Scenario 2	2010WP Scenario 1	2010WP Scenario 2
1	FLT01-3PH	3 phase fault on one of the Woodward (515375) to Northwest (514880) 345kV lines, near Woodward. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
2	FLT02-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
3	FLT03-3PH	3 phase fault on the Woodward 345kV (515375) to 138kV (515376) transformer, near the 345 kV bus. a. Apply fault at the Woodward 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
4	FLT04-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
5	FLT05-3PH	3 phase fault on the Wichita (532796) to Woodring (514715) 345kV line, near Wichita. a. Apply fault at the Wichita 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
6	FLT06-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
7	FLT07-3PH	3 phase fault on the Woodring (514715) to Sooner (514803) 345kV line, near Woodring. a. Apply fault at the Woodring 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
8	FLT08-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**

Table 8: Results of Simulated Contingencies

Cont. No.	Cont. Name	Description	2010SP Scenario 1	2010SP Scenario 2	2010WP Scenario 1	2010WP Scenario 2
9	FLT09-3PH	3 phase fault on the Cimarron (514901) to Draper (514934) 345kV line, near Cimarron. a. Apply fault at the Cimarron 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
10	FLT10-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
11	FLT11-3PH	3 phase fault on the Northwest (514880) to Arcadia (514908) 345kV line, near Northwest. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
12	FLT12-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
13	FLT13-3PH	3 phase fault on the Northwest (514880) to Spring Creek (514881) 345kV line, near Northwest. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
14	FLT14-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
15	FLT15-3PH	3 phase fault on the Northwest (514880) to Cimarron (514901) 345kV line, near Northwest. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
16	FLT16-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**

Table 8: Results of Simulated Contingencies

Cont. No.	Cont. Name	Description	2010SP Scenario 1	2010SP Scenario 2	2010WP Scenario 1	2010WP Scenario 2
17	FLT17-3PH	3 phase fault on Northwest 345kV (514880) to 138kV (514879) transformer T2, near the 345 kV bus. a. Apply fault at the Northwest 345kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
18	FLT18-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
19	FLT19-3PH	3 phase fault on the Woodward 138kV (515376) to 345kV (515375) transformer, near the 138kV bus. a. Apply fault at the Woodward 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
20	FLT20-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
21	FLT21-3PH	3 phase fault on the Woodward EHV (515376) to Iodine (514796) 138kV line, near Woodward EHV. a. Apply fault at the Woodward EHV 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
22	FLT22-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
23	FLT23-3PH	3 phase fault on the Woodward (514785) to GEN-2001-037 (515785) 138kV line, near Woodward. a. Apply fault at the Woodward 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
24	FLT24-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
25	FLT25-3PH	3 phase fault on the GEN-2001-037 (515785) to Woodward (514785) 138kV line, near GEN-2001-037. a. Apply fault at the GEN-2001-037 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
26	FLT26-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**

Table 8: Results of Simulated Contingencies

Cont. No.	Cont. Name	Description	2010SP Scenario 1	2010SP Scenario 2	2010WP Scenario 1	2010WP Scenario 2
27	FLT29-3PH	3 phase fault on the Mooreland (520999) to Glass Mountain (514788) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
28	FLT30-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
29	FLT31-3PH	3 phase fault on the Mooreland (520999) to Cedardale (520848) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
30	FLT32-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
31	FLT33-3PH	3 phase fault on the Mooreland (520999) to Morewood (521001) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
32	FLT34-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
33	FLT35-3PH	3 phase fault on the Mooreland (520999) to Taloga (521065) 138kV line, near Mooreland. a. Apply fault at the Mooreland 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
34	FLT36-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**

Table 8: Results of Simulated Contingencies

Cont. No.	Cont. Name	Description	2010SP Scenario 1	2010SP Scenario 2	2010WP Scenario 1	2010WP Scenario 2
35	FLT37-3PH	3 phase fault on the Taloga 138kV (521065) to 69kV (521064) transformer, near the 138kV bus. a. Apply fault at the Taloga 138kV bus. b. Clear fault after 5 cycles by tripping the faulted transformer.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
36	FLT38-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
37	FLT39-3PH	3 phase fault on the Dewey (514787) to Taloga (521065) 138kV line, near Dewey. a. Apply fault at the Dewey 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
38	FLT40-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
39	FLT41-3PH	3 phase fault on the Dewey (514787) to Southard (514822) 138kV line, near Dewey. a. Apply fault at the Dewey 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
40	FLT42-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**
41	FLT43-3PH	3 phase fault on El Reno (514819) to Roman Nose (514823) 138kV line, near El Reno. a. Apply fault at the El Reno 138kV bus. b. Clear fault after 5 cycles by tripping the faulted line. c. Wait 20 cycles, and then re-close the line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	**STABLE**	**STABLE**	**STABLE**	**STABLE**
42	FLT44-1PH	Single phase fault and sequence like previous	**STABLE**	**STABLE**	**STABLE**	**STABLE**

6.0 Conclusion

<OMITTED TEXT> (Customer) has requested an Interim Operation Impact Study for interim interconnection service of 101.2 MW of wind generation within the control area of Oklahoma Gas and Electric (OKGE) in Woodward County, Oklahoma, in accordance with the OASIS posting made by SPP on March 6, 2009. The wind powered generation facility was studied with forty-two (42) individual Siemens SMK-2.3-93 2.3 MW wind turbines

The results of this study show that the wind farm and the transmission system remain stable for all contingencies studied. The Customer's windfarm is required to maintain +/-0.95 power factor at the POI. Additionally, the stability study results show that the wind farm will meet FERC Order #661A's Low Voltage Ride Through (LVRT) provisions.

The estimates of costs for network upgrades and the interconnection facilities are found in the Feasibility Cluster Study, FCS-2008-001, posted December 19, 2008. The Customer is required to provide security in the amount of $10,852,000 to move forward into an Interim Interconnection Agreement. Failure by the Customer to provide the security in this amount in accordance with the Interim Interconnection will cause this Interim Operation Impact Study and the Interim Interconnection Agreement to become invalid

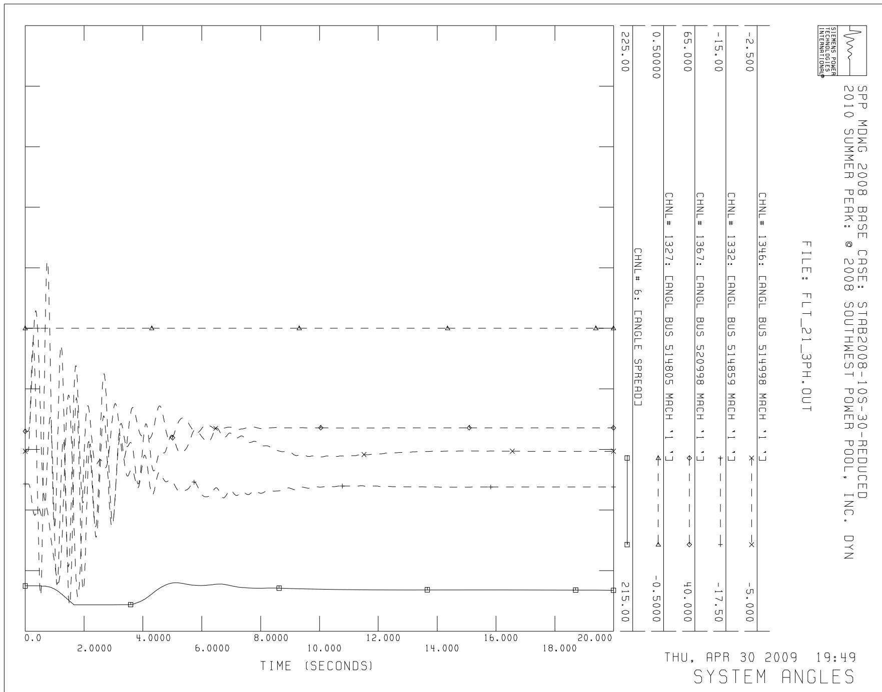
The estimates do not include any costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer requests transmission service through Southwest Power Pool's OASIS. It should be noted that the models used for simulation do not contain all SPP transmission service.

APPENDIX A.

SELECTED STABILITY PLOTS

2010 SUMMER PEAK – SCENARIO 1

All plots available on request.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2010 SUMMER PEAK: @ 2008 SOUTHWEST POWER POOL, INC. DYN
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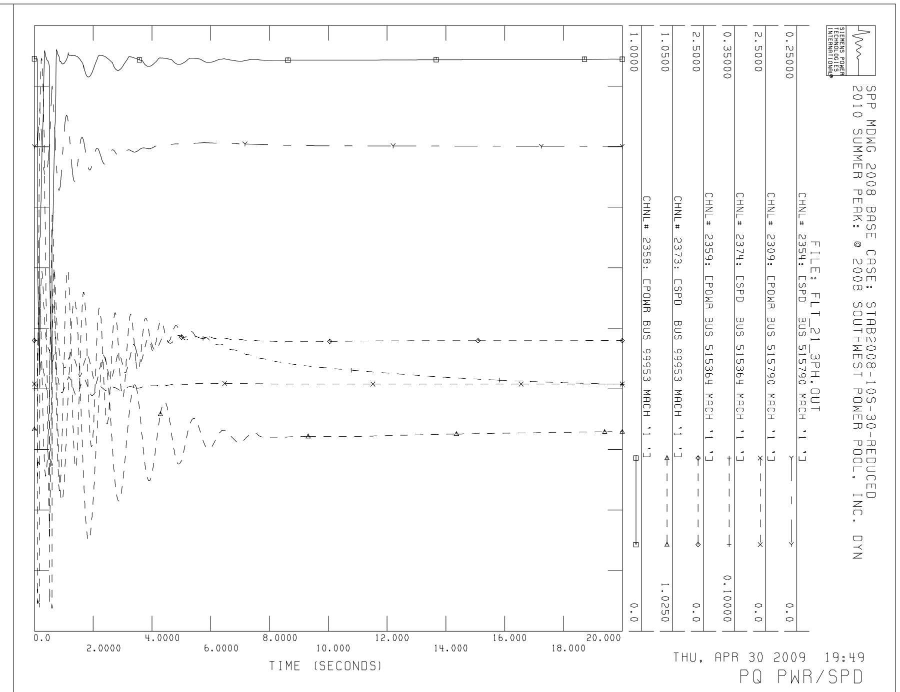
CHNL# 1346: [ANGL BUS 514998 MACH '1 ']
CHNL# 1332: [ANGL BUS 514859 MACH '1 ']
CHNL# 1367: [ANGL BUS 520998 MACH '1 ']
CHNL# 1327: [ANGL BUS 514805 MACH '1 ']
CHNL# 6: [ANGLE SPREAD]
TIME (SECONDS)
THU, APR 30 2009 19:49
SYSTEM ANGLES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2010 SUMMER PEAK: @ 2008 SOUTHWEST POWER POOL, INC. DYN
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CHNL# 2354: [SPD BUS 515790 MACH '1 ']
CHNL# 2309: [POWR BUS 515790 MACH '1 ']
CHNL# 2374: [SPD BUS 515364 MACH '1 ']
CHNL# 2359: [POWR BUS 515364 MACH '1 ']
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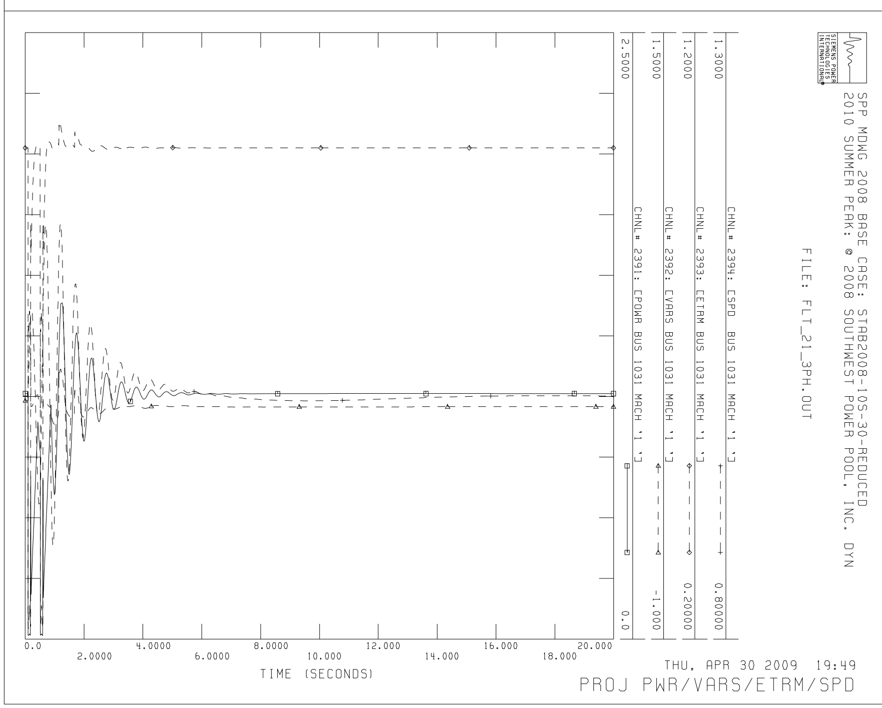
THU, APR 30 2009 19:49
PQ PWR/SPD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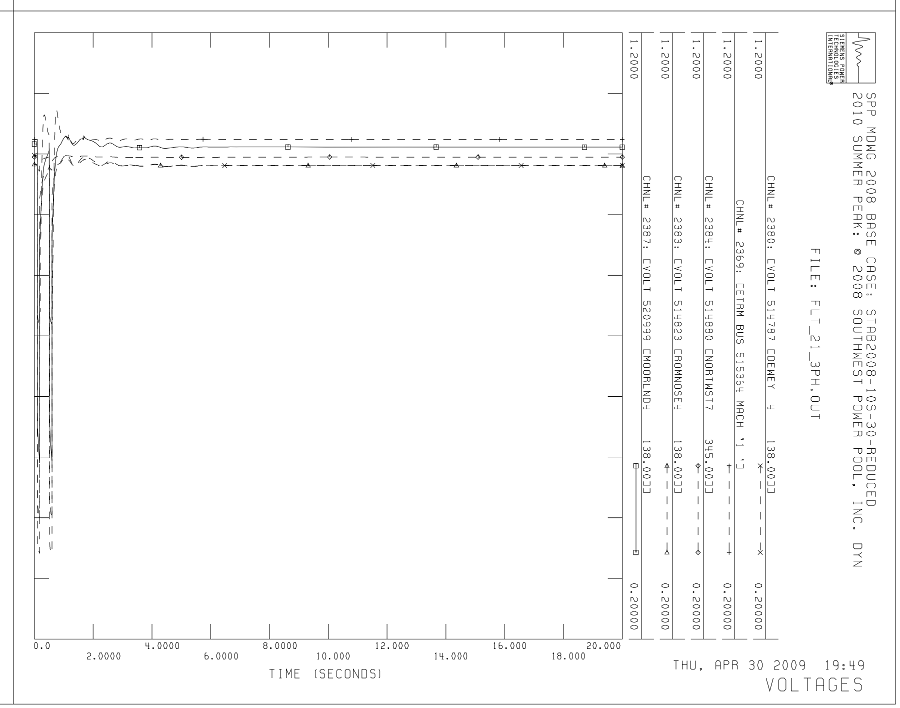
CHNL# 2393: [ETRM BUS 1031 MACH '1 ']
CHNL# 2392: [VARS BUS 1031 MACH '1 ']
CHNL# 2391: [POWR BUS 1031 MACH '1 ']
TIME (SECONDS)
THU, APR 30 2009 19:49
PROJ PWR/VARS/ETRM/SPD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2010 SUMMER PEAK: @ 2008 SOUTHWEST POWER POOL, INC. DYN
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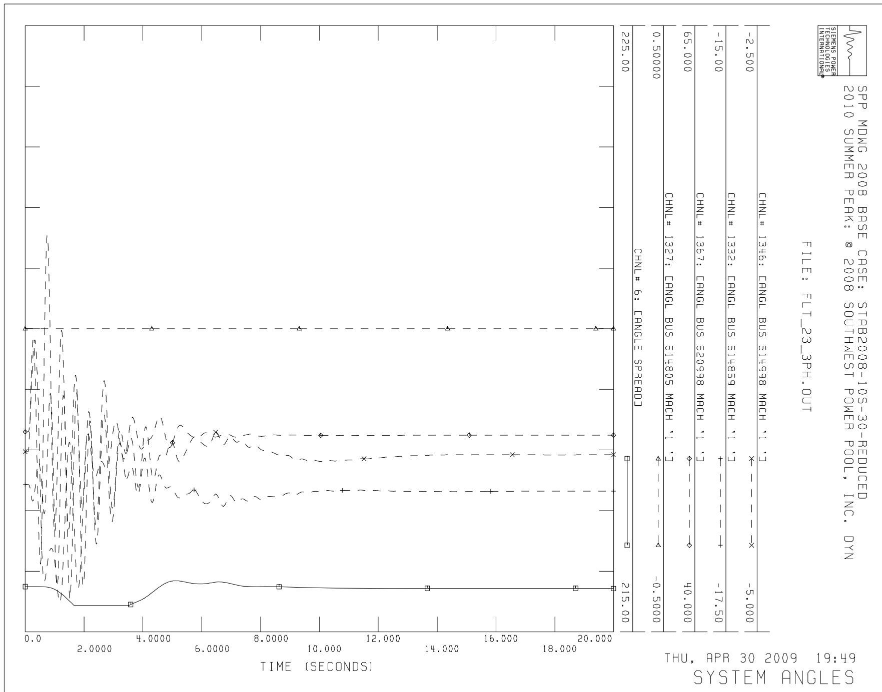
CHNL# 2369: [ETRM BUS 515364 MACH '1 ']
CHNL# 2384: [VOLT 514880 [NORTWST7 345.00]]
CHNL# 2383: [VOLT 514823 [ROMNOSE4 138.00]]
CHNL# 2387: [VOLT 520999 [MOORLND4 138.00]]
TIME (SECONDS)
THU, APR 30 2009 19:49
VOLTAGES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2010 SUMMER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
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CHNL# 1332: [ANGL BUS 514859 MACH '1 ']
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TIME (SECONDS)
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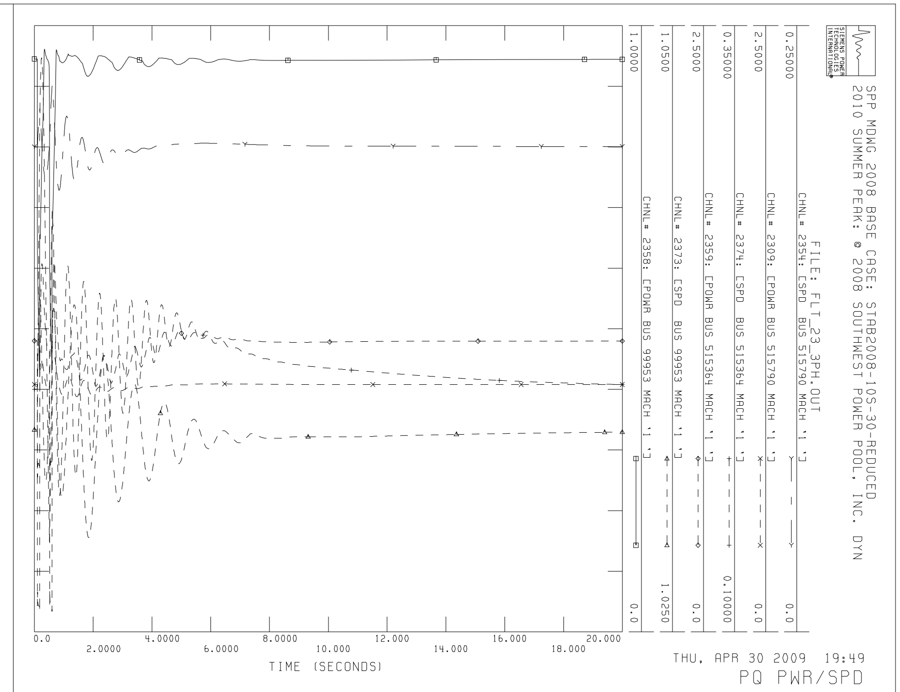
SYSTEM ANGLES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2010 SUMMER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
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CHNL# 2309: [POWR BUS 515790 MACH '1 ']
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CHNL# 2359: [POWR BUS 515364 MACH '1 ']
CHNL# 2373: [SPD BUS 99953 MACH '1 ']
CHNL# 2358: [POWR BUS 99953 MACH '1 ']
TIME (SECONDS)
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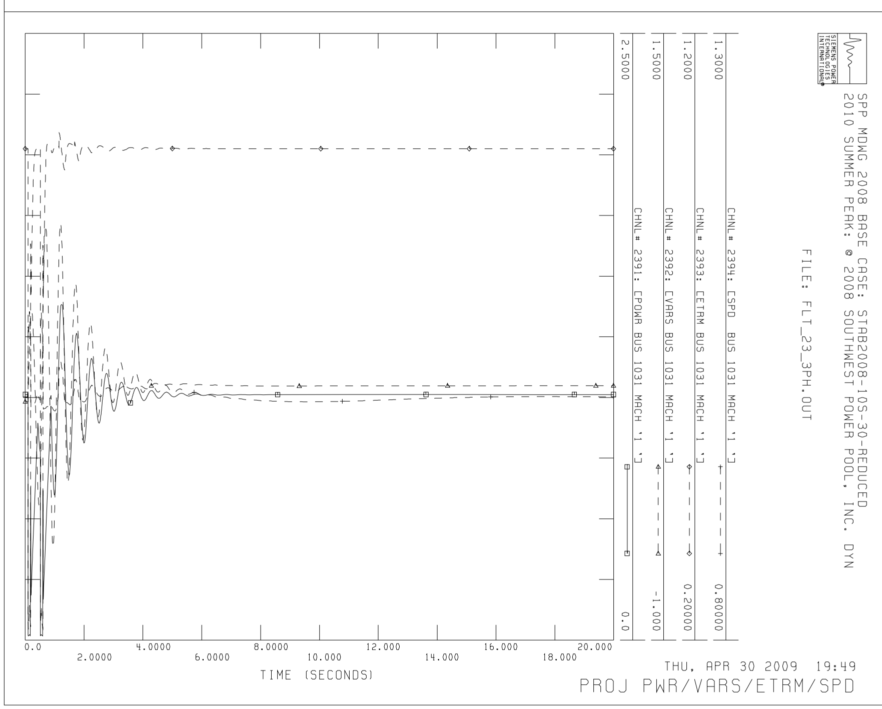
PQ PWR/SPD


SPP MDWG 2008 BASE CASE: STAB2008-10S-30-REDUCED
2010 SUMMER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
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CHNL# 2393: [ETRM BUS 1031 MACH '1 ']
CHNL# 2392: [VARS BUS 1031 MACH '1 ']
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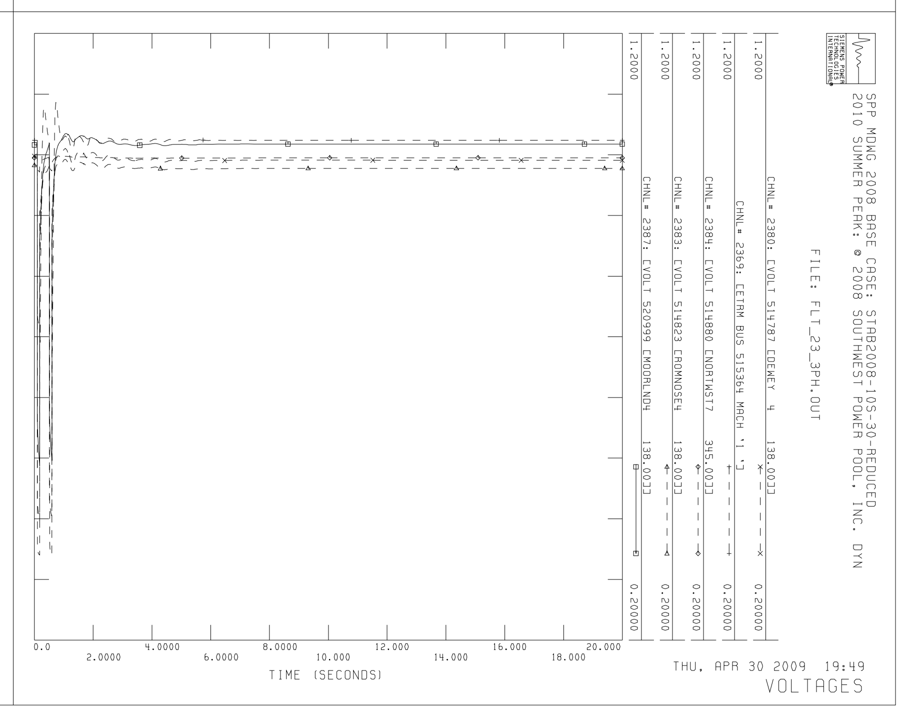
PROJ PWR/VARS/ETRM/SPD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2010 SUMMER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
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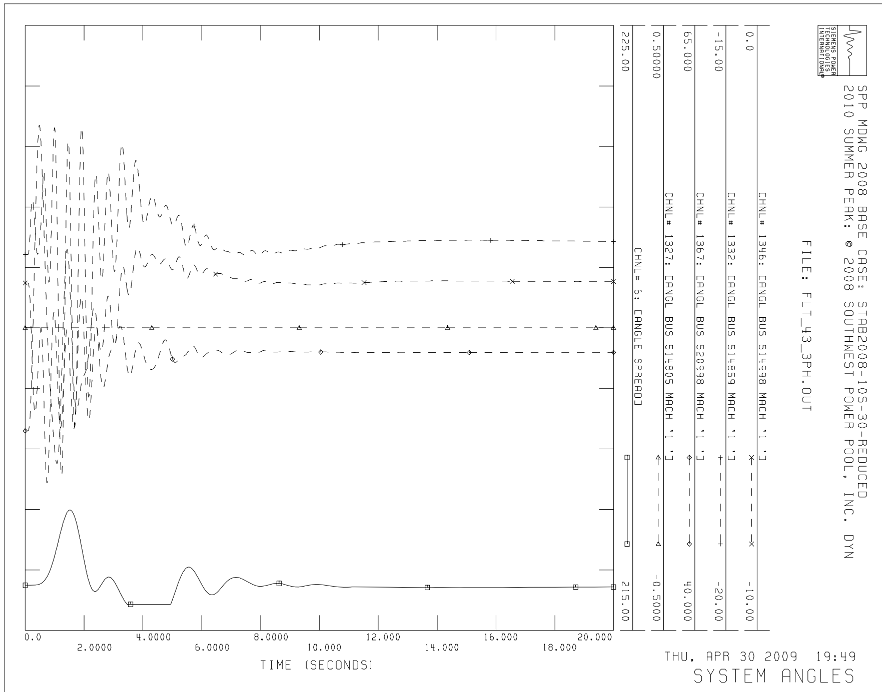
CHNL# 2380: [VOLT 514787 [DEWEY 4 138.00]]
CHNL# 2369: [ETRM BUS 515364 MACH '1 ']
CHNL# 2384: [VOLT 514880 [NORTWST7 345.00]]
CHNL# 2383: [VOLT 514823 [ROMNOSE4 138.00]]
CHNL# 2387: [VOLT 520999 [MOORLND4 138.00]]
TIME (SECONDS)
THU, APR 30 2009 19:49
VOLTAGES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2010 SUMMER PEAK; © 2008 SOUTHWEST POWER POOL, INC. DYN
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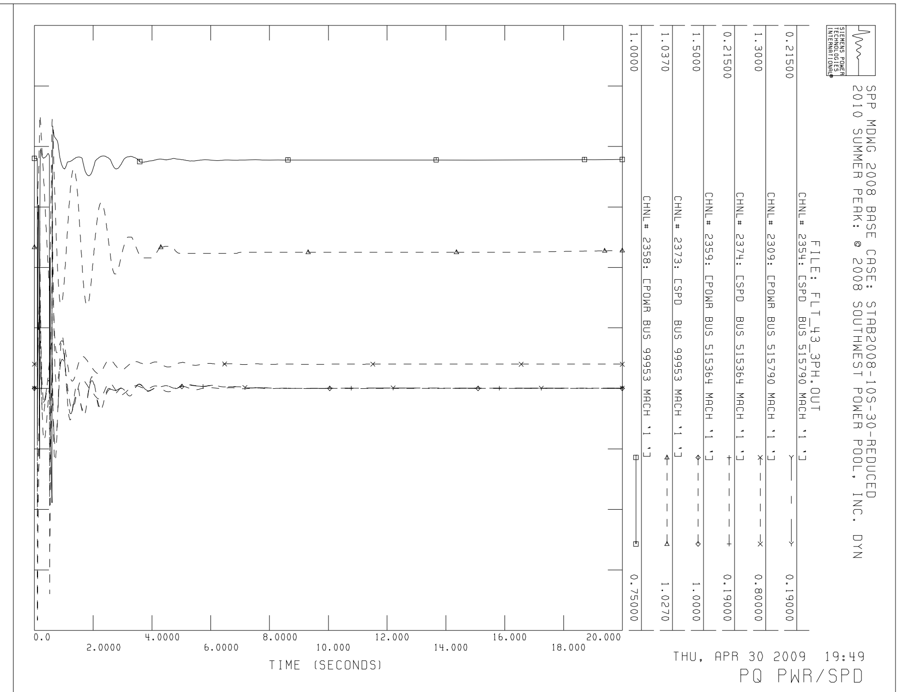
CHNL# 1332: [ANGL BUS 514859 MACH '1 ']
CHNL# 1367: [ANGL BUS 520998 MACH '1 ']
CHNL# 1327: [ANGL BUS 514805 MACH '1 ']
CHNL# 6: [ANGLE SPREAD]
TIME (SECONDS)
THU, APR 30 2009 19:49
SYSTEM ANGLES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2010 SUMMER PEAK; © 2008 SOUTHWEST POWER POOL, INC. DYN
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CHNL# 2354: [SPD BUS 515790 MACH '1 ']
CHNL# 2309: [POWR BUS 515790 MACH '1 ']
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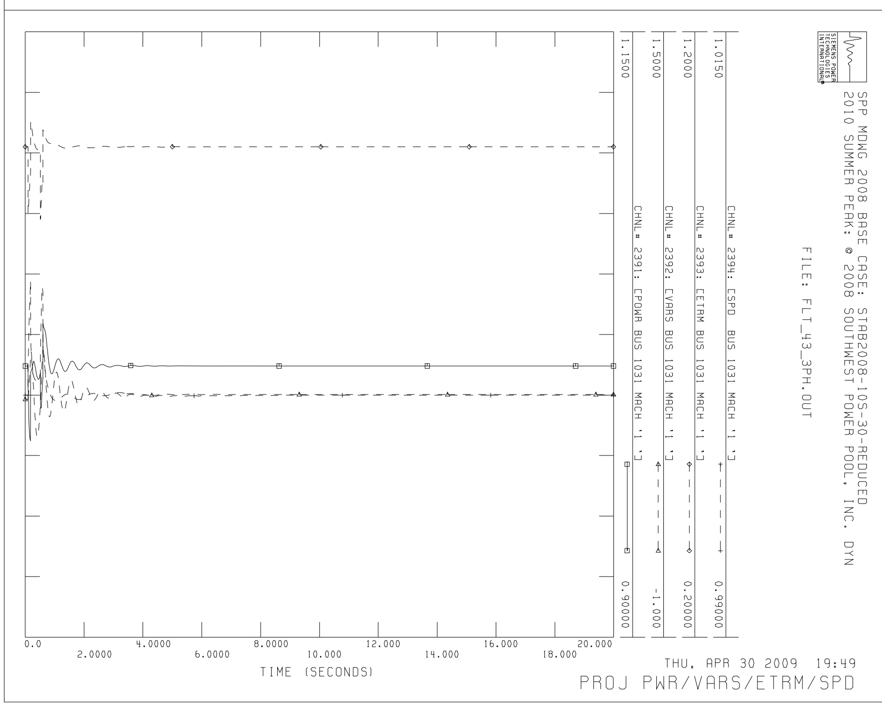
CHNL# 2359: [POWR BUS 515364 MACH '1 ']
CHNL# 2373: [SPD BUS 99953 MACH '1 ']
CHNL# 2358: [POWR BUS 99953 MACH '1 ']
TIME (SECONDS)
THU, APR 30 2009 19:49
PQ PWR/SPD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2010 SUMMER PEAK; © 2008 SOUTHWEST POWER POOL, INC. DYN
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CHNL# 2393: [ETRM BUS 1031 MACH '1 ']
CHNL# 2392: [VARS BUS 1031 MACH '1 ']
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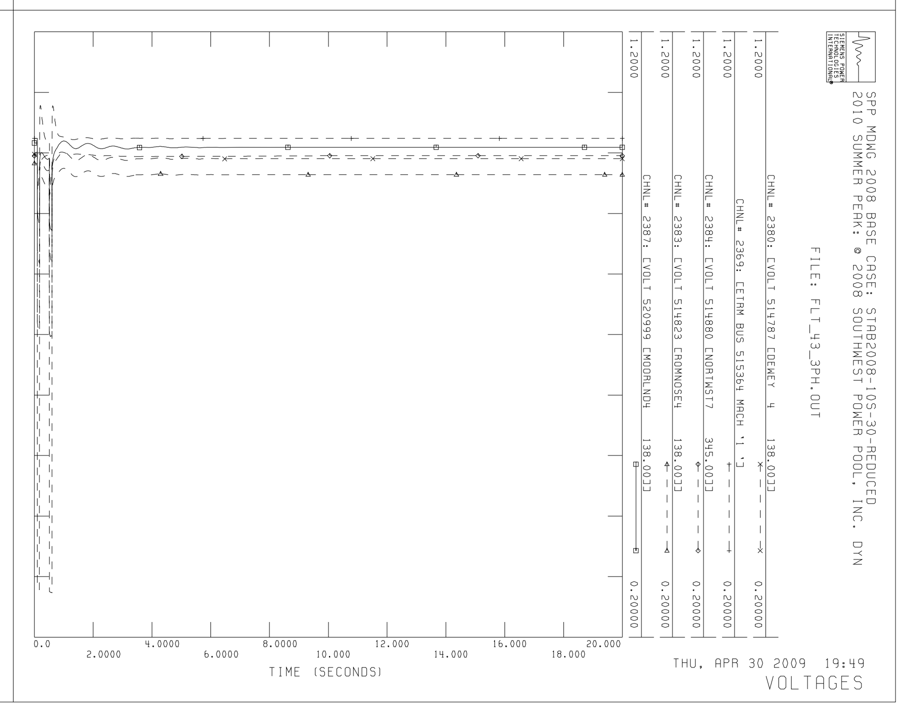
TIME (SECONDS)
THU, APR 30 2009 19:49
PROJ PWR/VARS/ETRM/SPD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2010 SUMMER PEAK; © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 2380: [VOLT 514787 [DEWEY 4 138.00]]
CHNL# 2369: [ETRM BUS 515364 MACH '1 ']
CHNL# 2384: [VOLT 514880 [NORTWST7 345.00]]
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CHNL# 2387: [VOLT 520999 [MOORLND4 138.00]]
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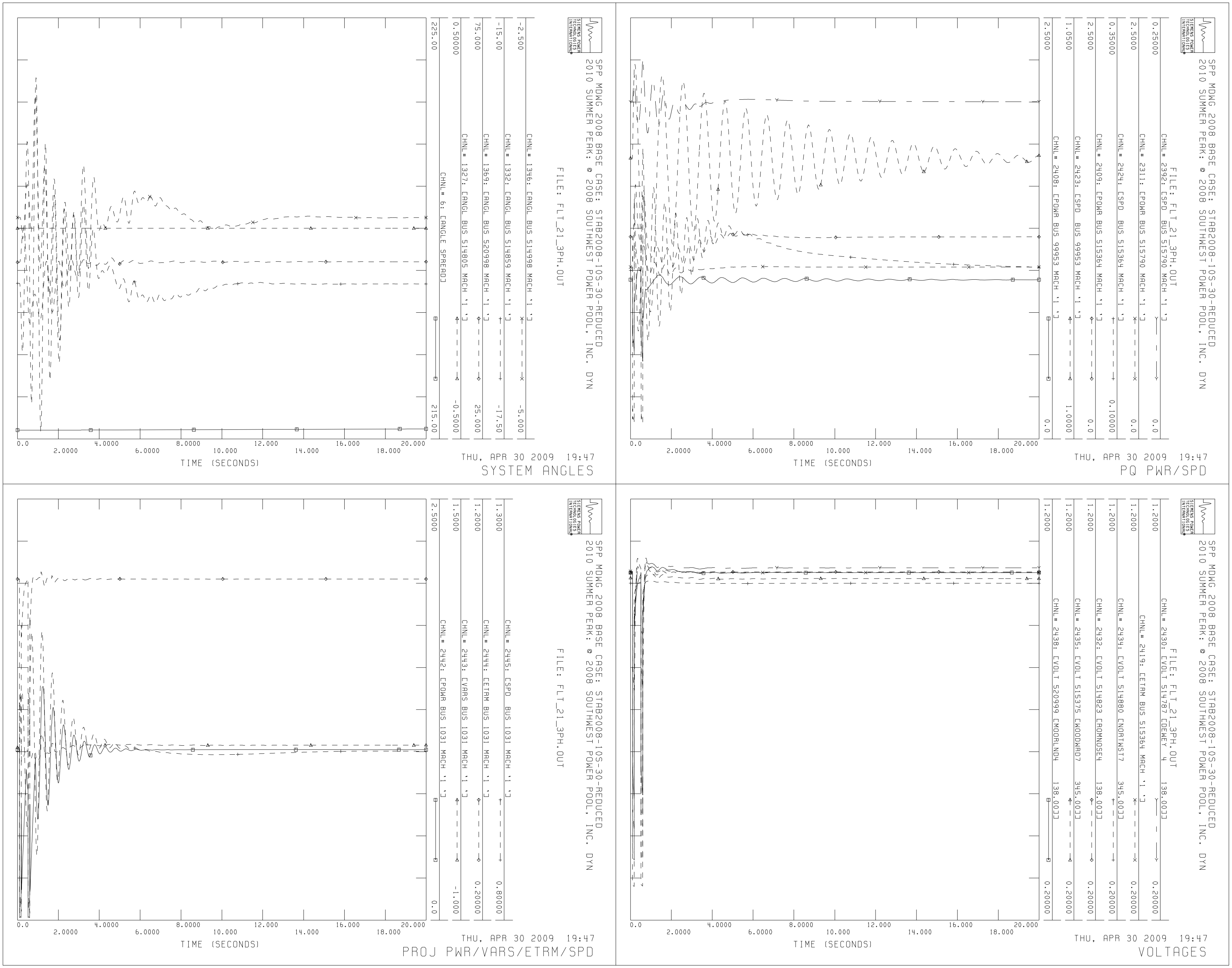
VOLTAGES

APPENDIX B.

SELECTED STABILITY PLOTS

2010 SUMMER PEAK – SCENARIO 2

All plots available on request.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2010 SUMMER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
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CHNL# 1346: [ANGL BUS 514998 MACH '1 ']
CHNL# 1332: [ANGL BUS 514859 MACH '1 ']
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CHNL# 1327: [ANGL BUS 514805 MACH '1 ']
CHNL# 6: [ANGLE SPREAD]
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THU, APR 30 2009 19:47
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CHNL# 2408: [POWR BUS 99953 MACH '1 ']
PQ PWR/SPD
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CHNL# 2444: [ETRM BUS 1031 MACH '1 ']
CHNL# 2443: [VARS BUS 1031 MACH '1 ']
CHNL# 2442: [POWR BUS 1031 MACH '1 ']
PROJ PWR/VARS/ETRM/SPD
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CHNL# 2419: [ETRM BUS 515364 MACH '1 ']
CHNL# 2434: [VOLT 514880 [NORTWST7 345.00]]
CHNL# 2432: [VOLT 514823 [ROMNOSE4 138.00]]
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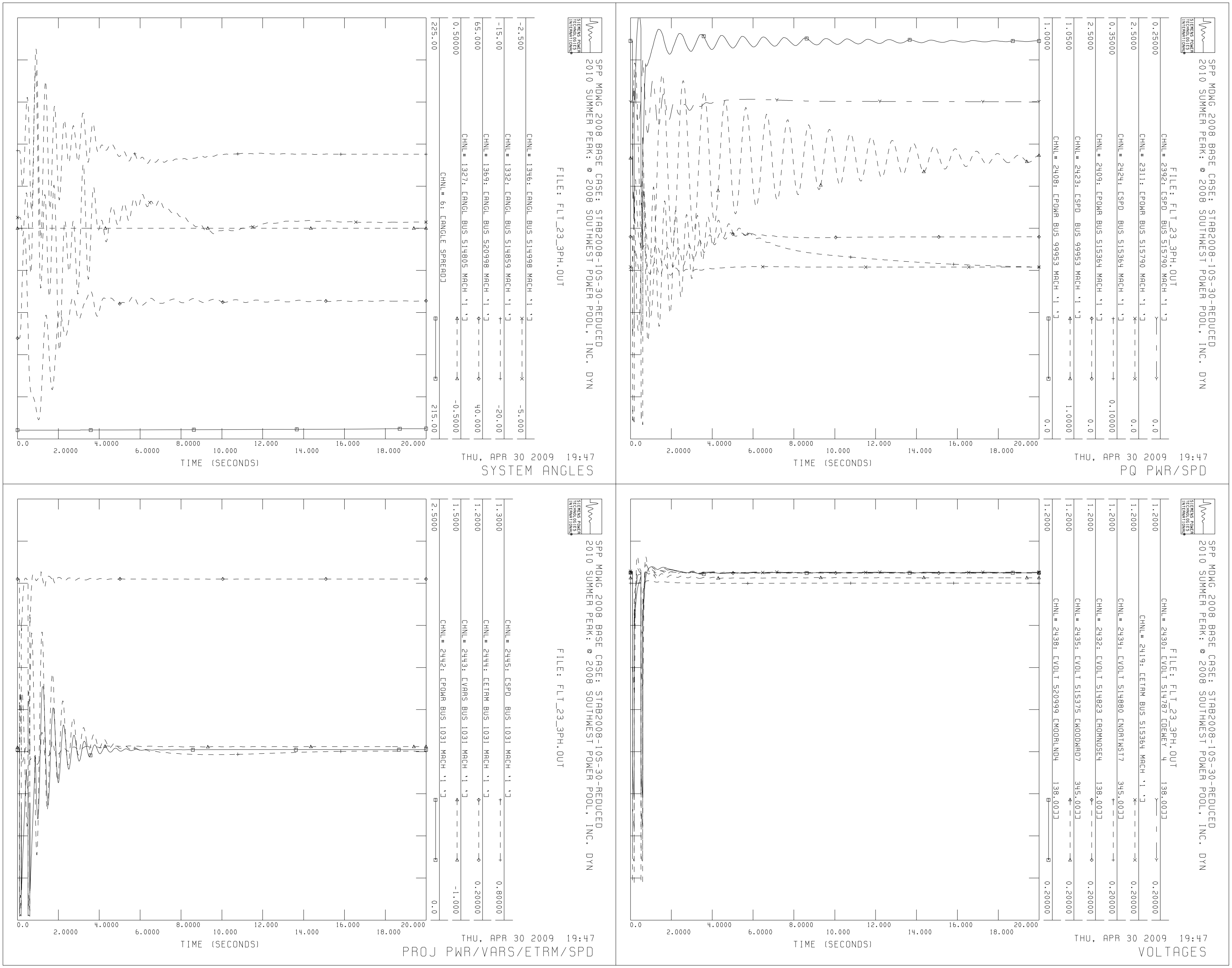
VOLTAGES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2010 SUMMER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
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CHNL# 1332: [ANGL BUS 514859 MACH '1 ']
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TIME (SECONDS)
THU, APR 30 2009 19:47
SYSTEM ANGLES
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CHNL# 2311: [POWR BUS 515790 MACH '1 ']
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CHNL# 2408: [POWR BUS 99953 MACH '1 ']
PQ PWR/SPD
CHNL# 2445: [SPD BUS 1031 MACH '1 ']
CHNL# 2444: [ETRM BUS 1031 MACH '1 ']
CHNL# 2443: [VARS BUS 1031 MACH '1 ']
CHNL# 2442: [POWR BUS 1031 MACH '1 ']
PROJ PWR/VARS/ETRM/SPD
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CHNL# 2434: [VOLT 514880 [NORTWST7 345.00]]
CHNL# 2432: [VOLT 514823 [ROMNOSE4 138.00]]
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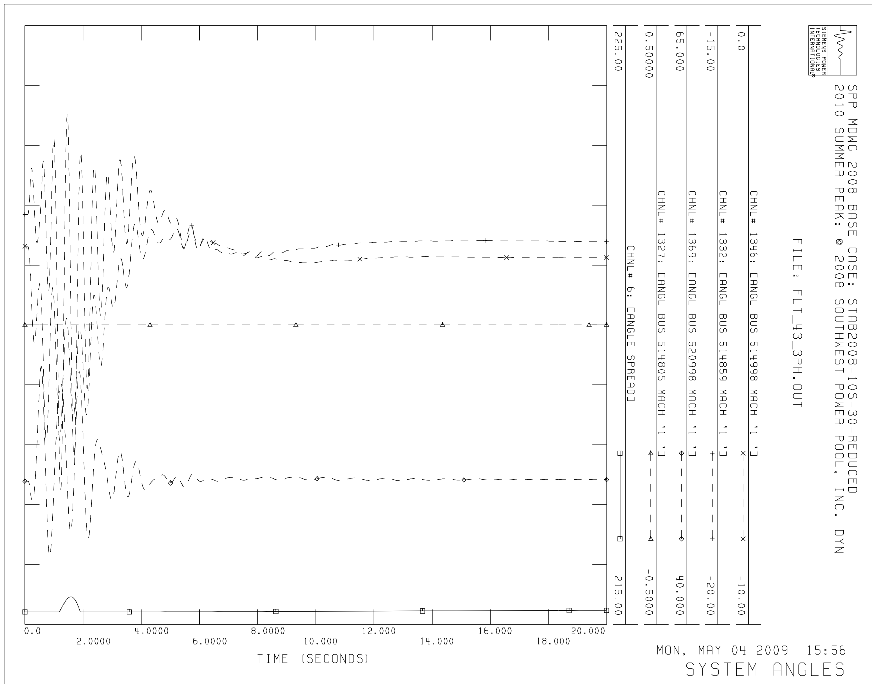
VOLTAGES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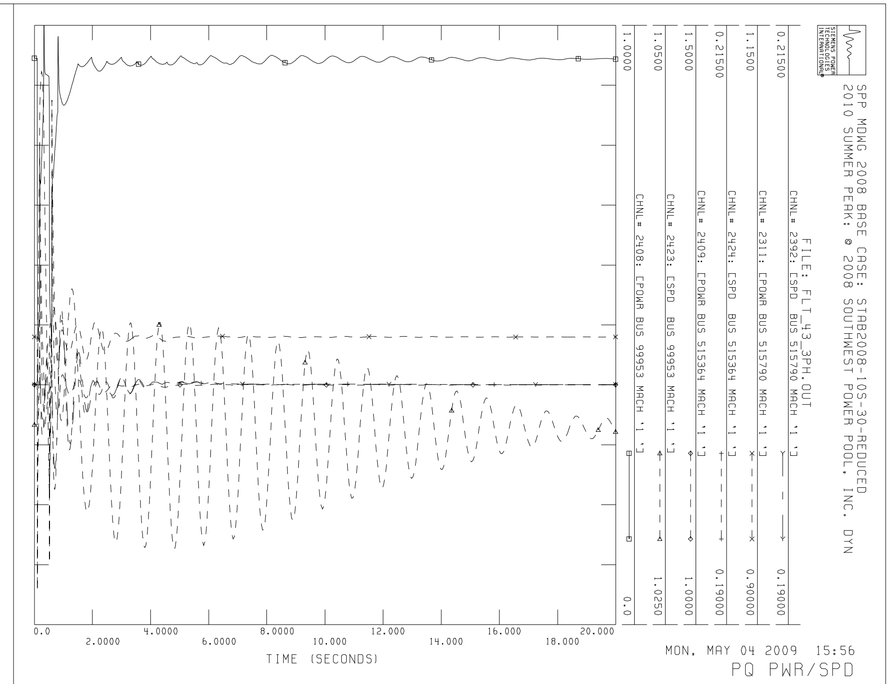
2010 SUMMER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 1346: CANGL BUS 514998 MACH '1 '
CHNL# 1332: CANGL BUS 514859 MACH '1 '
CHNL# 1369: CANGL BUS 520998 MACH '1 '
CHNL# 1327: CANGL BUS 514805 MACH '1 '
CHNL# 6: [ANGLE SPREAD]
TIME (SECONDS)
MON, MAY 04 2009 15:56
SYSTEM ANGLES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2010 SUMMER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
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CHNL# 2311: CPOWR BUS 515790 MACH '1 '
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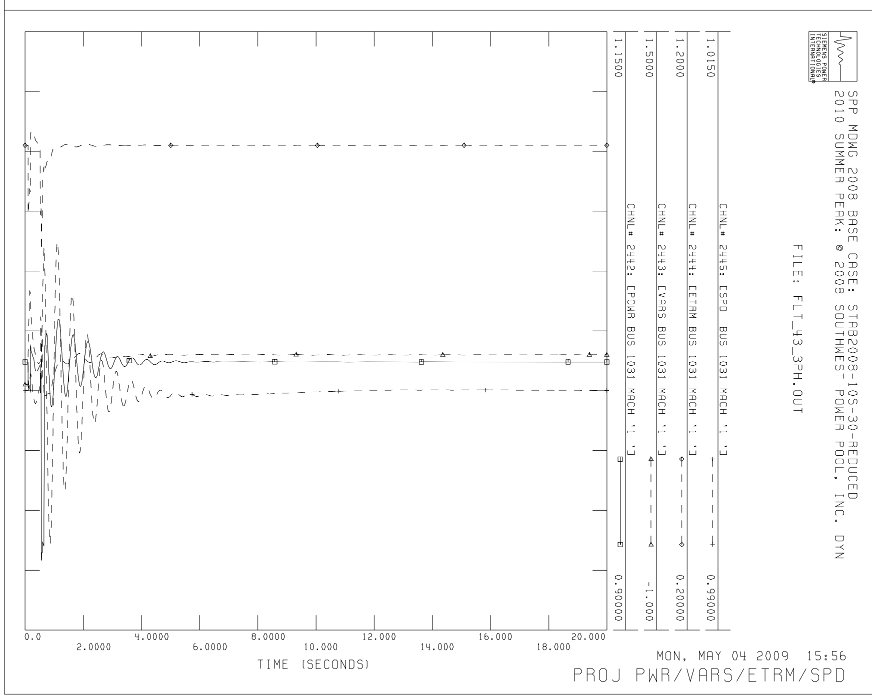
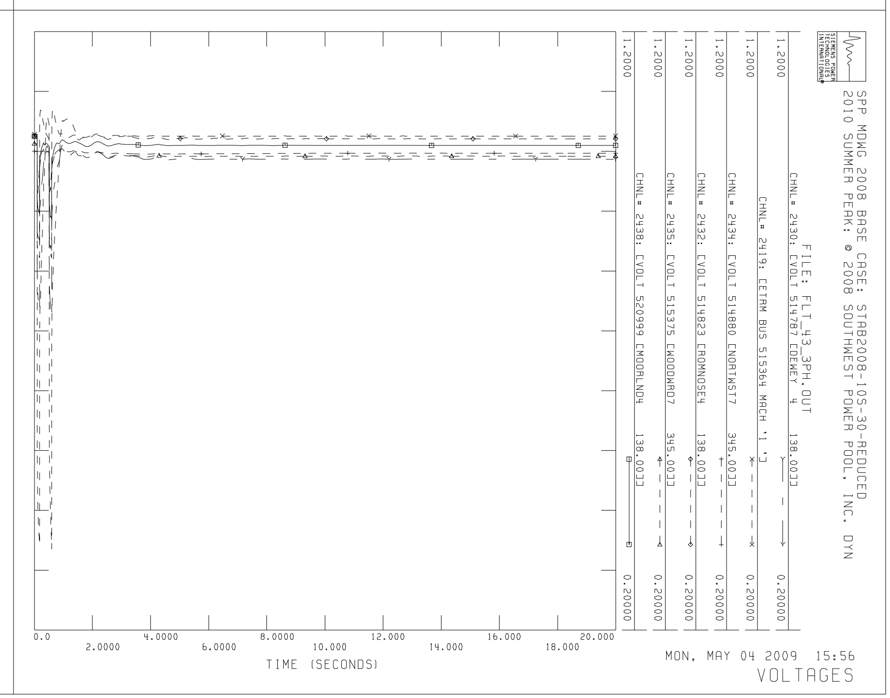
TIME (SECONDS)
MON, MAY 04 2009 15:56
PQ PWR/SPD


SPP MDWG 2008 BASE CASE: STAB2008-10S-30-REDUCED
2010 SUMMER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 2445: CSPD BUS 1031 MACH '1 '
CHNL# 2444: CETRM BUS 1031 MACH '1 '
CHNL# 2443: CVARS BUS 1031 MACH '1 '
CHNL# 2442: CPOWR BUS 1031 MACH '1 '
TIME (SECONDS)
MON, MAY 04 2009 15:56
PROJ PWR/VARS/ETRM/SPD

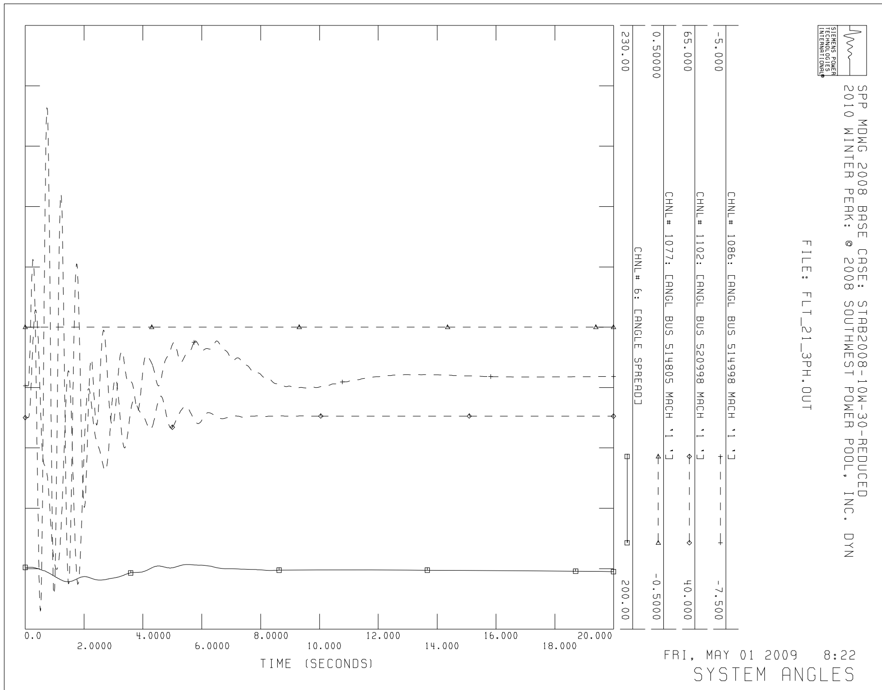

SPP MDWG 2008 BASE CASE: STAB2008-10S-30-REDUCED
2010 SUMMER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 2430: CVOLT 514787 [DEWEY 4 138.00]
CHNL# 2419: CETRM BUS 515364 MACH '1 '
CHNL# 2434: CVOLT 514880 [NORTWST7 345.00]
CHNL# 2432: CVOLT 514823 [ROMNOSE4 138.00]
CHNL# 2435: CVOLT 515375 [WOODWRD7 345.00]
CHNL# 2438: CVOLT 520999 [MOORLND4 138.00]
TIME (SECONDS)
MON, MAY 04 2009 15:56
VOLTAGES

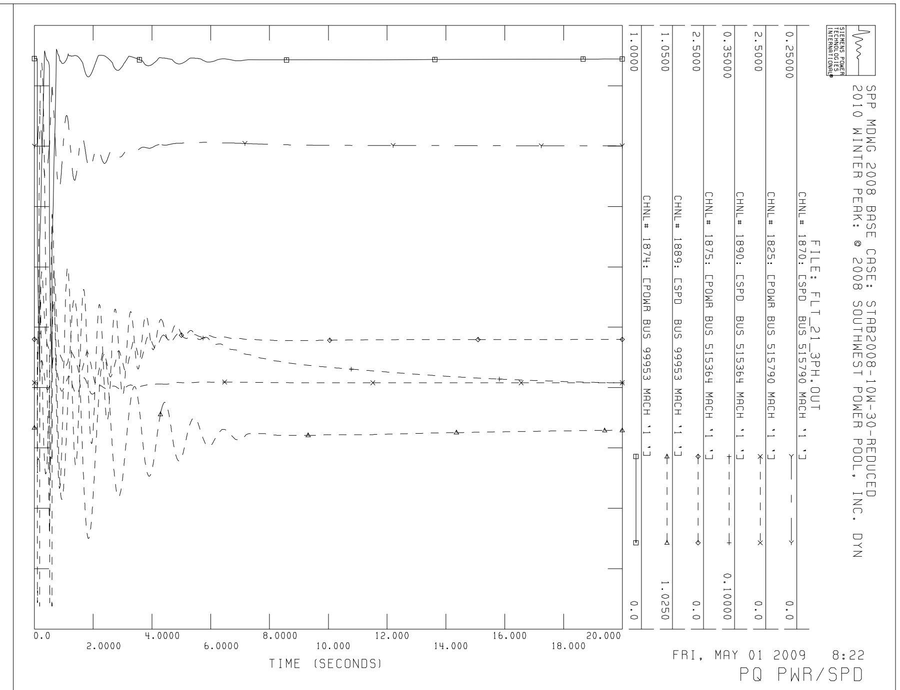
APPENDIX C.

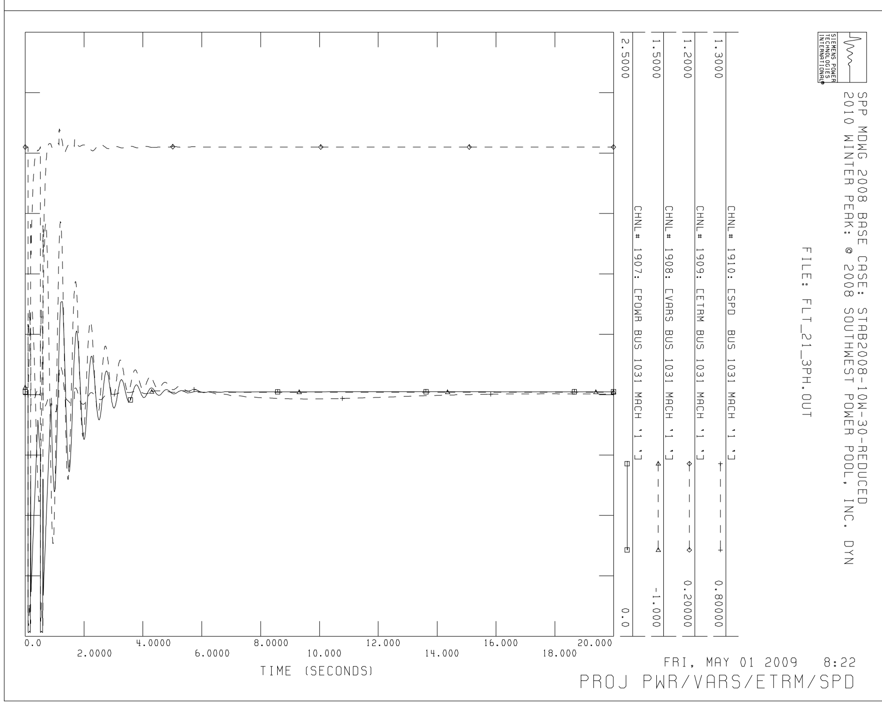
SELECTED STABILITY PLOTS

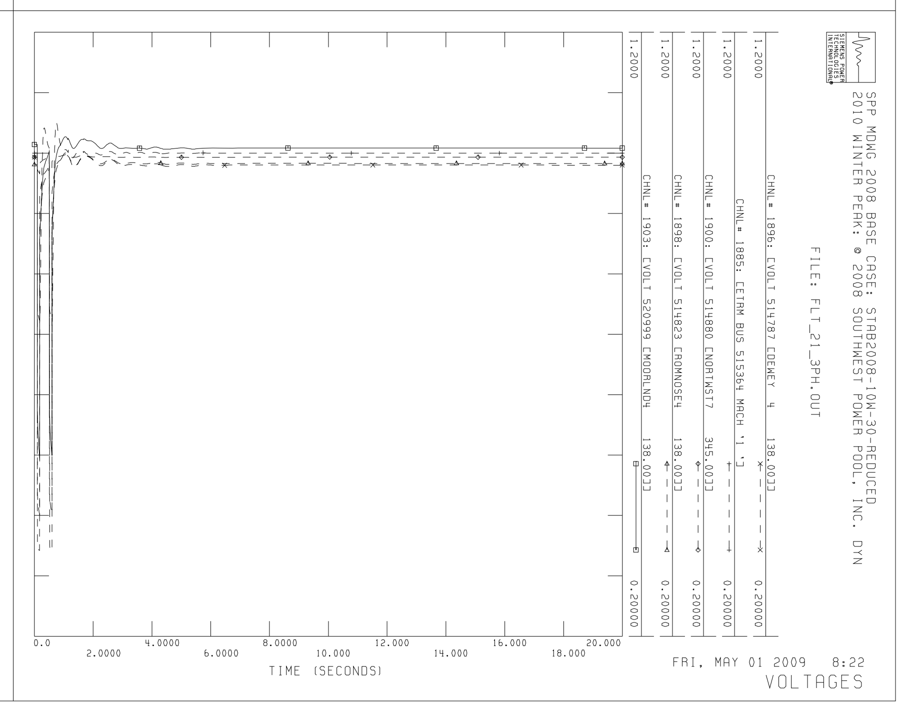
2010 WINTER PEAK – SCENARIO 1

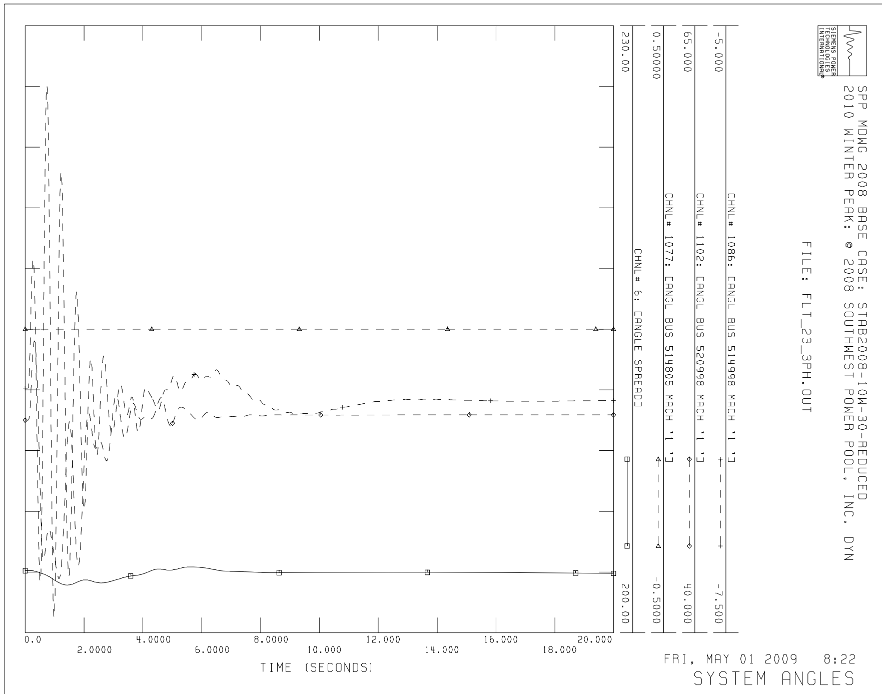
All plots available on request.

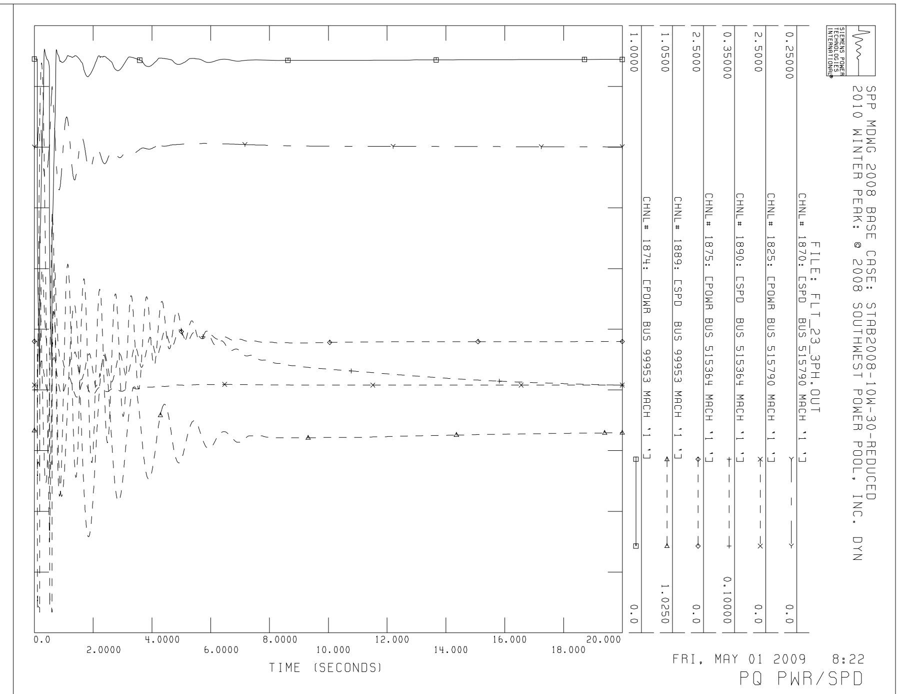

SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_21_3PH.OUT
CHNL# 1086: [ANGL BUS 514998 MACH '1 ']
CHNL# 1102: [ANGL BUS 520998 MACH '1 ']
CHNL# 1077: [ANGL BUS 514805 MACH '1 ']
CHNL# 6: [ANGLE SPREAD]
TIME (SECONDS)
FRI, MAY 01 2009 8:22
SYSTEM ANGLES

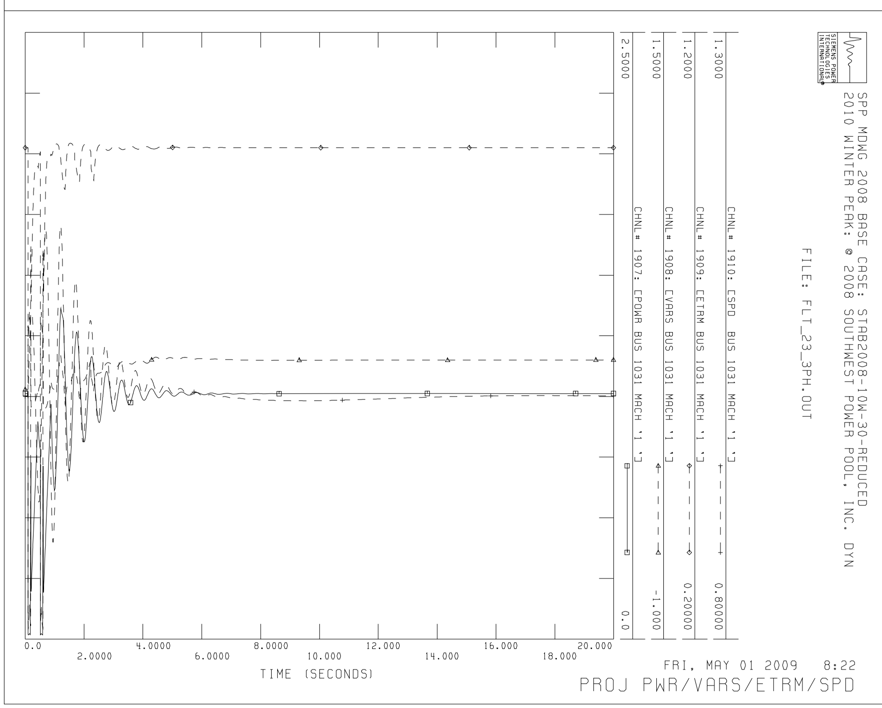

SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_21_3PH.OUT
CHNL# 1870: [SPD BUS 515790 MACH '1 ']
CHNL# 1825: [POWR BUS 515790 MACH '1 ']
CHNL# 1890: [SPD BUS 515364 MACH '1 ']
CHNL# 1875: [POWR BUS 515364 MACH '1 ']
CHNL# 1889: [SPD BUS 99953 MACH '1 ']
CHNL# 1874: [POWR BUS 99953 MACH '1 ']
TIME (SECONDS)
FRI, MAY 01 2009 8:22
PQ PWR/SPD


SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_21_3PH.OUT
CHNL# 1910: [SPD BUS 1031 MACH '1 ']
CHNL# 1909: [ETRM BUS 1031 MACH '1 ']
CHNL# 1908: [VARS BUS 1031 MACH '1 ']
CHNL# 1907: [POWR BUS 1031 MACH '1 ']
TIME (SECONDS)
FRI, MAY 01 2009 8:22
PROJ PWR/VARS/ETRM/SPD


SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_21_3PH.OUT
CHNL# 1896: [VOLT 514787 [DEWEY 4 138.00]]
CHNL# 1885: [ETRM BUS 515364 MACH '1 ']
CHNL# 1900: [VOLT 514880 [NORTWST7 345.00]]
CHNL# 1898: [VOLT 514823 [ROMNOSE4 138.00]]
CHNL# 1903: [VOLT 520999 [MOORLND4 138.00]]
TIME (SECONDS)
FRI, MAY 01 2009 8:22
VOLTAGES


SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_23_3PH.OUT
CHNL# 1086: [ANGL BUS 514998 MACH '1 ']
CHNL# 1102: [ANGL BUS 520998 MACH '1 ']
CHNL# 1077: [ANGL BUS 514805 MACH '1 ']
CHNL# 6: [ANGLE SPREAD]
TIME (SECONDS)
FRI, MAY 01 2009 8:22
SYSTEM ANGLES


SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_23_3PH.OUT
CHNL# 1870: [SPD BUS 515790 MACH '1 ']
CHNL# 1825: [POWR BUS 515790 MACH '1 ']
CHNL# 1890: [SPD BUS 515364 MACH '1 ']
CHNL# 1875: [POWR BUS 515364 MACH '1 ']
CHNL# 1889: [SPD BUS 99953 MACH '1 ']
CHNL# 1874: [POWR BUS 99953 MACH '1 ']
TIME (SECONDS)
FRI, MAY 01 2009 8:22
PQ PWR/SPD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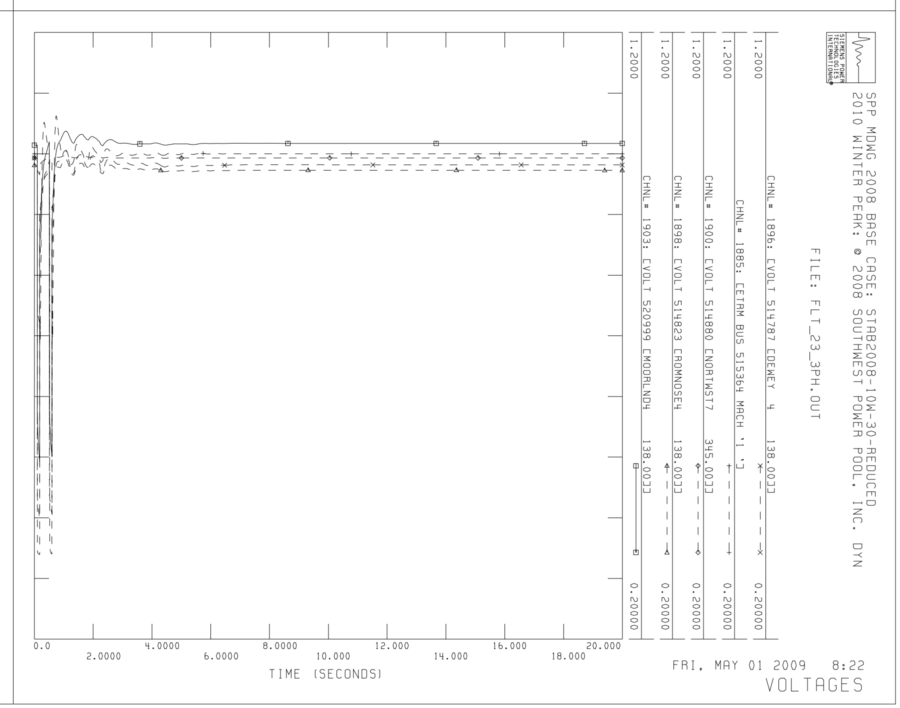
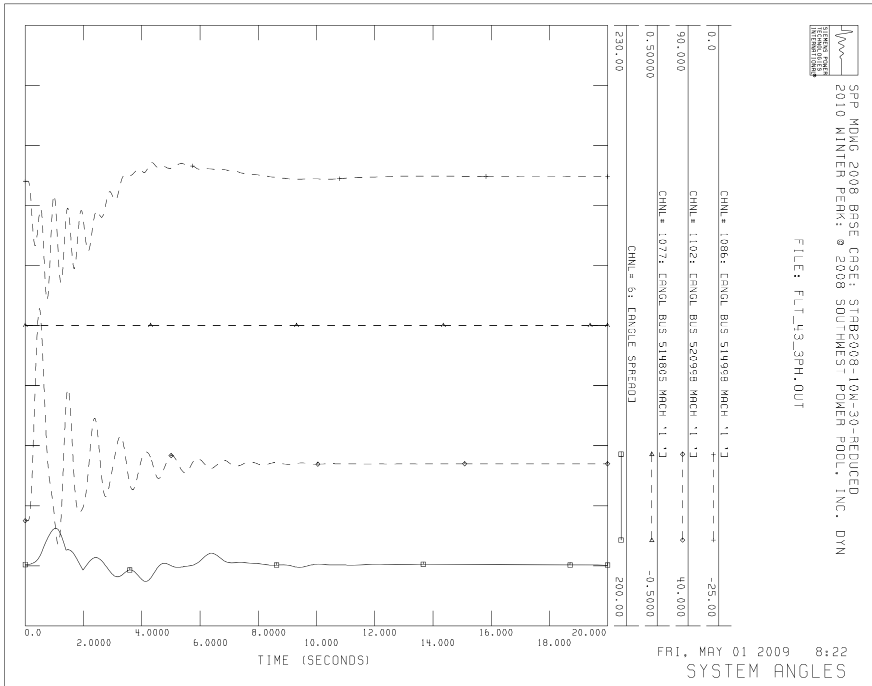
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_23_3PH.OUT
CHNL# 1910: [SPD BUS 1031 MACH '1 ']
CHNL# 1909: [ETRM BUS 1031 MACH '1 ']
CHNL# 1908: [VARS BUS 1031 MACH '1 ']
CHNL# 1907: [POWR BUS 1031 MACH '1 ']
TIME (SECONDS)
FRI, MAY 01 2009 8:22
PROJ PWR/VARS/ETRM/SPD


SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_23_3PH.OUT
CHNL# 1896: [VOLT 514787 [DEWEY 4 138.00]]
CHNL# 1885: [ETRM BUS 515364 MACH '1 ']
CHNL# 1900: [VOLT 514880 [NORTWST7 345.00]]
CHNL# 1898: [VOLT 514823 [ROMNOSE4 138.00]]
CHNL# 1903: [VOLT 520999 [MOORLND4 138.00]]
TIME (SECONDS)
FRI, MAY 01 2009 8:22
VOLTAGES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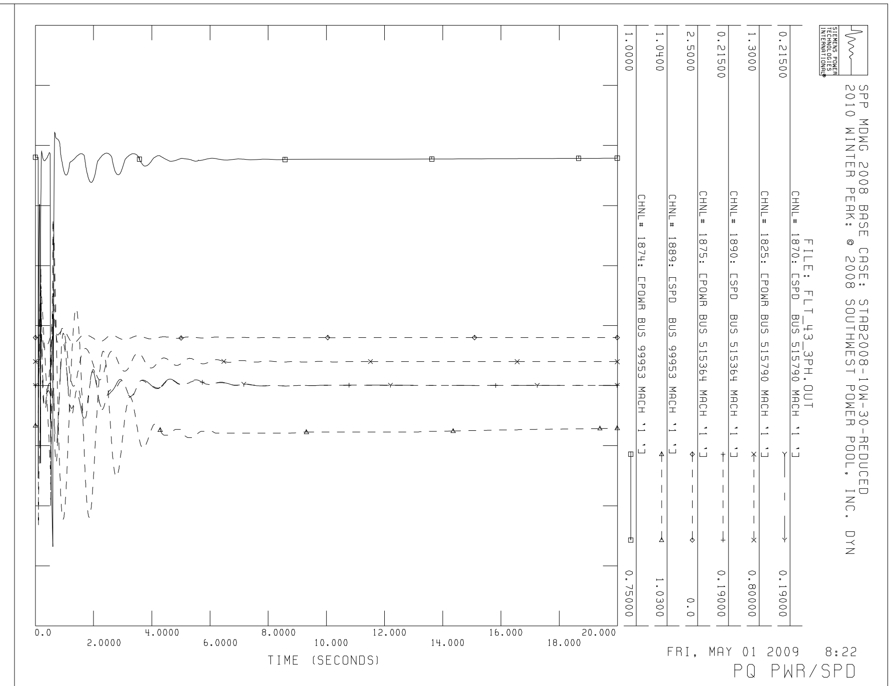
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 1086: [ANGL BUS 514998 MACH '1 ']
CHNL# 1102: [ANGL BUS 520998 MACH '1 ']
CHNL# 1077: [ANGL BUS 514805 MACH '1 ']
CHNL# 6: [ANGLE SPREAD]
TIME (SECONDS)
FRI, MAY 01 2009 8:22
SYSTEM ANGLES

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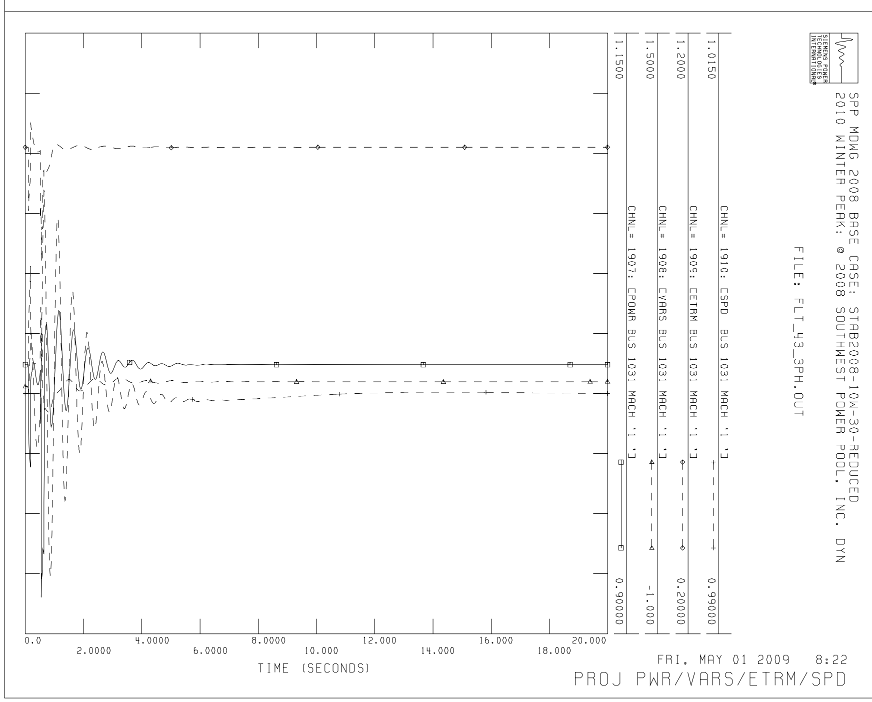
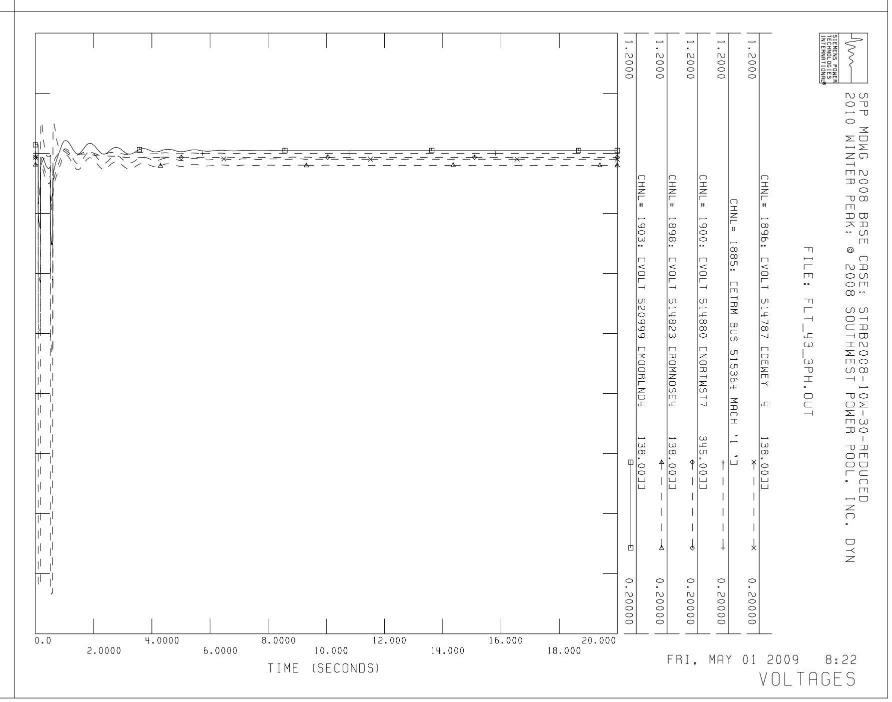
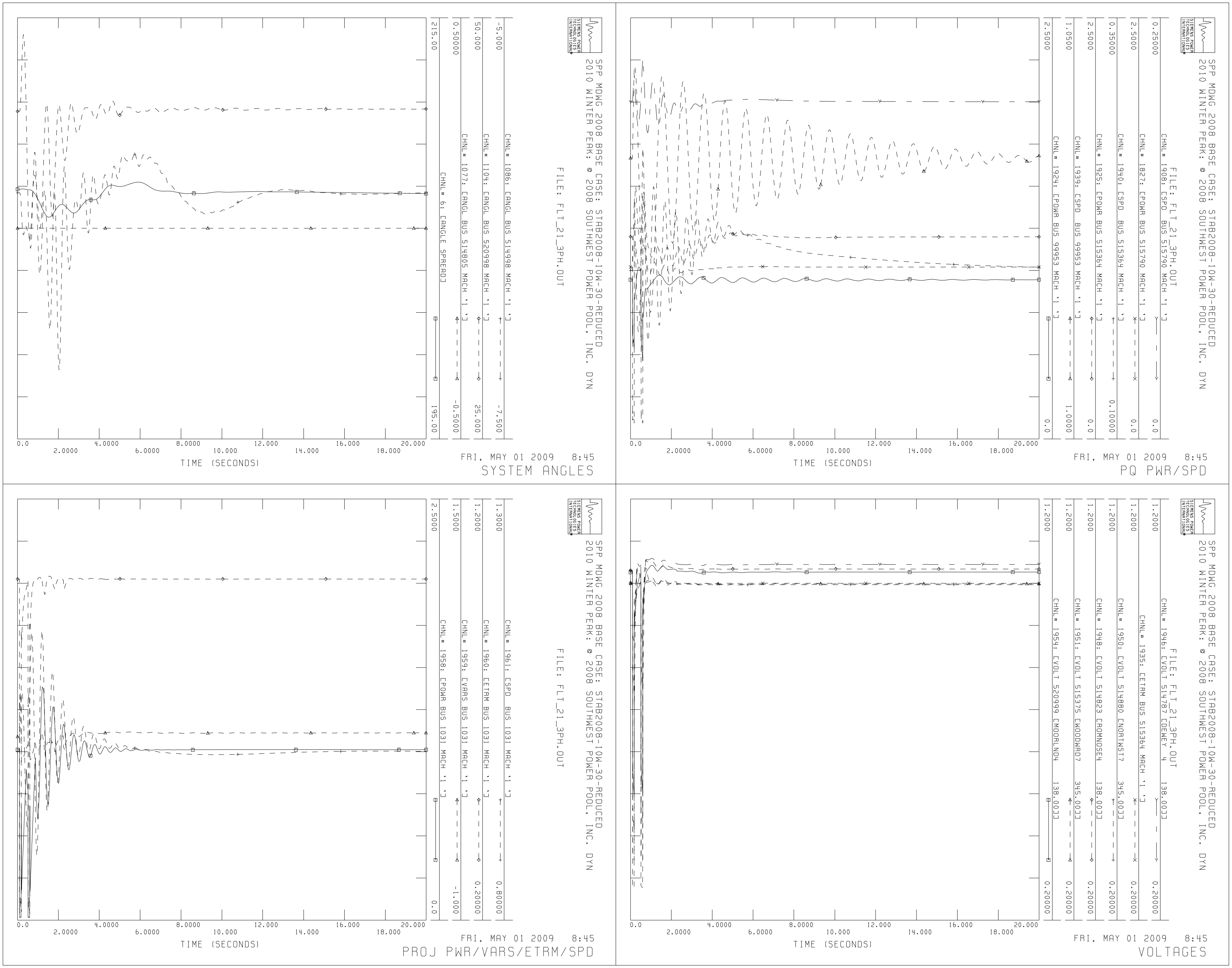
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 1870: [SPD BUS 515790 MACH '1 ']
CHNL# 1825: [POWR BUS 515790 MACH '1 ']
CHNL# 1890: [SPD BUS 515364 MACH '1 ']
CHNL# 1875: [POWR BUS 515364 MACH '1 ']
CHNL# 1889: [SPD BUS 99953 MACH '1 ']
CHNL# 1874: [POWR BUS 99953 MACH '1 ']
TIME (SECONDS)
FRI, MAY 01 2009 8:22
PQ PWR/SPD

SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 1910: [SPD BUS 1031 MACH '1 ']
CHNL# 1909: [ETRM BUS 1031 MACH '1 ']
CHNL# 1908: [VARS BUS 1031 MACH '1 ']
CHNL# 1907: [POWR BUS 1031 MACH '1 ']
TIME (SECONDS)
FRI, MAY 01 2009 8:22
PROJ PWR/VARS/ETRM/SPD

SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 1896: [VOLT 514787 [DEWEY 4 138.00]]
CHNL# 1885: [ETRM BUS 515364 MACH '1 ']
CHNL# 1900: [VOLT 514880 [NORTWST7 345.00]]
CHNL# 1898: [VOLT 514823 [ROMNOSE4 138.00]]
CHNL# 1903: [VOLT 520999 [MOORLND4 138.00]]
TIME (SECONDS)
FRI, MAY 01 2009 8:22
VOLTAGES

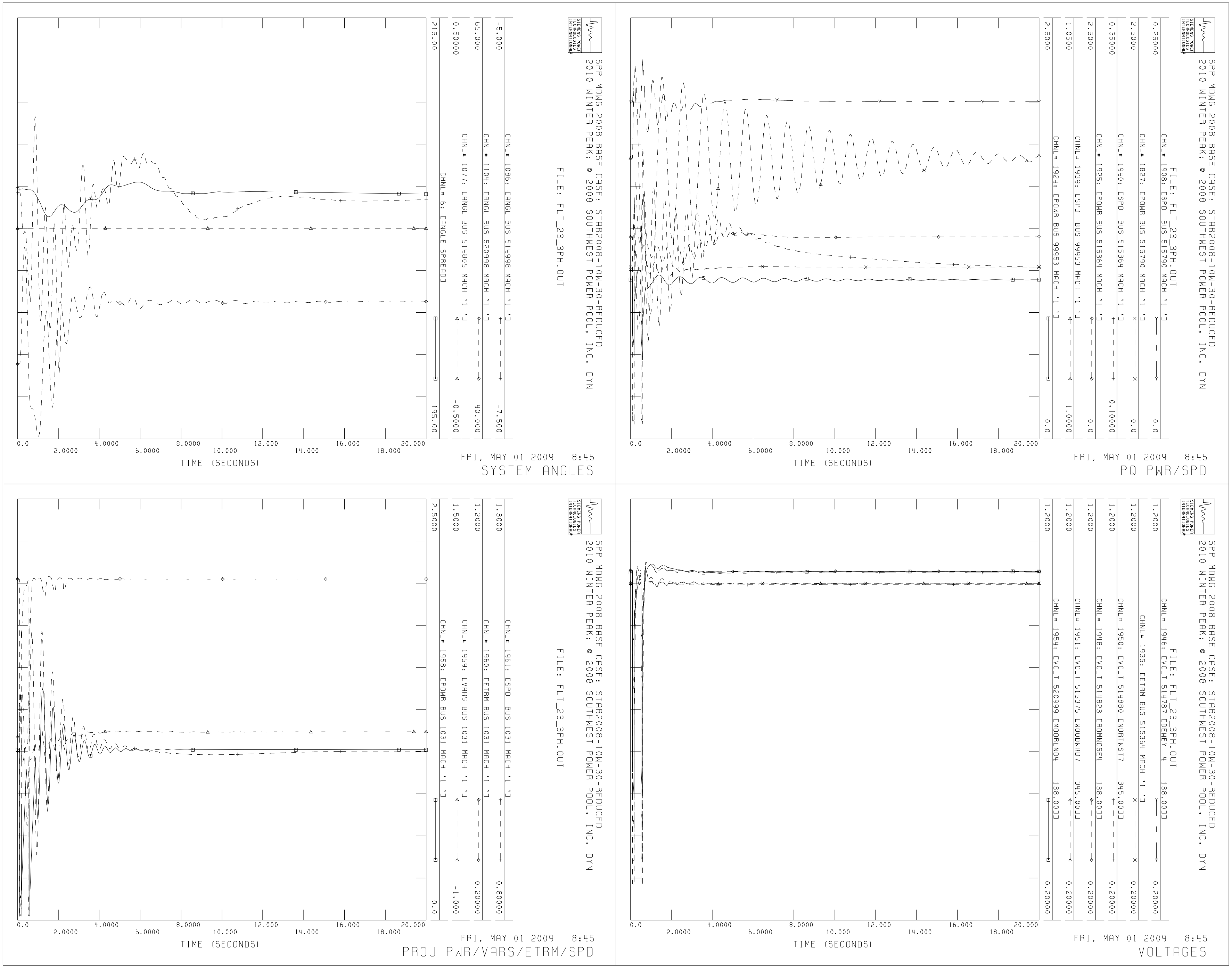
APPENDIX D.

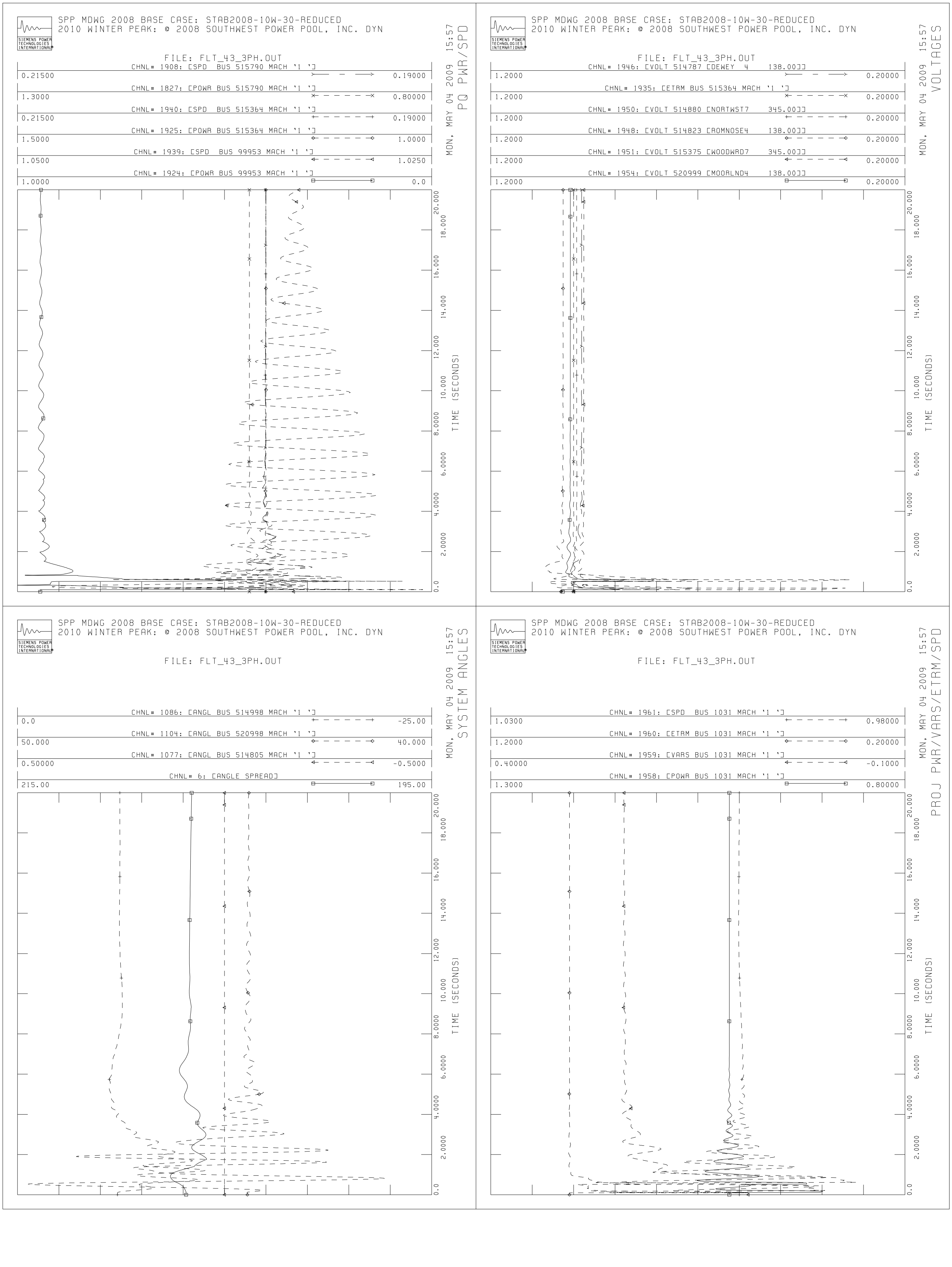
SELECTED STABILITY PLOTS

2010 WINTER PEAK – SCENARIO 2

All plots available on request.


SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_21_3PH.OUT
CHNL# 1086: CANGL BUS 514998 MACH '1 ']
CHNL# 1104: CANGL BUS 520998 MACH '1 ']
CHNL# 1077: CANGL BUS 514805 MACH '1 ']
CHNL# 6: CANGLE SPREAD]
FRI, MAY 01 2009 8:45
SYSTEM ANGLES
TIME (SECONDS)
CHNL# 1908: CSPD BUS 515790 MACH '1 ']
CHNL# 1827: CPOWR BUS 515790 MACH '1 ']
CHNL# 1940: CSPD BUS 515364 MACH '1 ']
CHNL# 1925: CPOWR BUS 515364 MACH '1 ']
CHNL# 1939: CSPD BUS 99953 MACH '1 ']
CHNL# 1924: CPOWR BUS 99953 MACH '1 ']
PQ PWR/SPD
CHNL# 1961: CSPD BUS 1031 MACH '1 ']
CHNL# 1960: CETRM BUS 1031 MACH '1 ']
CHNL# 1959: CVARS BUS 1031 MACH '1 ']
CHNL# 1958: CPOWR BUS 1031 MACH '1 ']
PROJ PWR/VARS/ETRM/SPD
CHNL# 1946: CVOLT 514787 CDEWEY 4 138.0]
CHNL# 1935: CETRM BUS 515364 MACH '1 ']
CHNL# 1950: CVOLT 514880 CNORTWST7 345.0]
CHNL# 1948: CVOLT 514823 CROMNOSE4 138.0]
CHNL# 1951: CVOLT 515375 CWOODWRD7 345.0]
CHNL# 1954: CVOLT 520999 CMOORLND4 138.0]
VOLTAGES


SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_23_3PH.OUT
CHNL# 1086: [ANGL BUS 514998 MACH '1 ']
CHNL# 1104: [ANGL BUS 520998 MACH '1 ']
CHNL# 1077: [ANGL BUS 514805 MACH '1 ']
CHNL# 6: [ANGLE SPREAD]
TIME (SECONDS)
FRI, MAY 01 2009 8:45
SYSTEM ANGLES
CHNL# 1908: [SPD BUS 515790 MACH '1 ']
CHNL# 1827: [POWR BUS 515790 MACH '1 ']
CHNL# 1940: [SPD BUS 515364 MACH '1 ']
CHNL# 1925: [POWR BUS 515364 MACH '1 ']
CHNL# 1939: [SPD BUS 99953 MACH '1 ']
CHNL# 1924: [POWR BUS 99953 MACH '1 ']
PQ PWR/SPD
CHNL# 1961: [SPD BUS 1031 MACH '1 ']
CHNL# 1960: [ETRM BUS 1031 MACH '1 ']
CHNL# 1959: [VARS BUS 1031 MACH '1 ']
CHNL# 1958: [POWR BUS 1031 MACH '1 ']
PROJ PWR/VARS/ETRM/SPD
CHNL# 1946: [VOLT 514787 [DEWEY 4 138.00]]
CHNL# 1935: [ETRM BUS 515364 MACH '1 ']
CHNL# 1950: [VOLT 514880 [NORTWST7 345.00]]
CHNL# 1948: [VOLT 514823 [ROMNOSE4 138.00]]
CHNL# 1951: [VOLT 515375 [WOODWRD7 345.00]]
CHNL# 1954: [VOLT 520999 [MOORLND4 138.00]]
VOLTAGES


SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 1908: [SPD BUS 515790 MACH '1 '] 0.21500 0.19000
CHNL# 1827: [POWR BUS 515790 MACH '1 '] 1.3000 0.80000
CHNL# 1940: [SPD BUS 515364 MACH '1 '] 0.21500 0.19000
CHNL# 1925: [POWR BUS 515364 MACH '1 '] 1.5000 1.0000
CHNL# 1939: [SPD BUS 99953 MACH '1 '] 1.0500 1.0250
CHNL# 1924: [POWR BUS 99953 MACH '1 '] 1.0000 0.0
TIME (SECONDS)
MON, MAY 04 2009 15:57
PQ PWR/SPD
SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 1946: [VOLT 514787 [DEWEY 4 138.00]] 1.2000 0.20000
CHNL# 1935: [ETRM BUS 515364 MACH '1 '] 1.2000 0.20000
CHNL# 1950: [VOLT 514880 [NORTWST7 345.00]] 1.2000 0.20000
CHNL# 1948: [VOLT 514823 [ROMNOSE4 138.00]] 1.2000 0.20000
CHNL# 1951: [VOLT 515375 [WOODWRD7 345.00]] 1.2000 0.20000
CHNL# 1954: [VOLT 520999 [MOORLND4 138.00]] 1.2000 0.20000
TIME (SECONDS)
MON, MAY 04 2009 15:57
VOLTAGES
SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 1086: [ANGL BUS 514998 MACH '1 '] 0.0 -25.00
CHNL# 1104: [ANGL BUS 520998 MACH '1 '] 50.000 40.000
CHNL# 1077: [ANGL BUS 514805 MACH '1 '] 0.50000 -0.5000
CHNL# 6: [ANGLE SPREAD] 215.00 195.00
TIME (SECONDS)
MON, MAY 04 2009 15:57
SYSTEM ANGLES
SPP MDWG 2008 BASE CASE: STAB2008-10W-30-REDUCED
2010 WINTER PEAK: © 2008 SOUTHWEST POWER POOL, INC. DYN
FILE: FLT_43_3PH.OUT
CHNL# 1961: [SPD BUS 1031 MACH '1 '] 1.0300 0.98000
CHNL# 1960: [ETRM BUS 1031 MACH '1 '] 1.2000 0.20000
CHNL# 1959: [VARS BUS 1031 MACH '1 '] 0.40000 -0.1000
CHNL# 1958: [POWR BUS 1031 MACH '1 '] 1.3000 0.80000
TIME (SECONDS)
MON, MAY 04 2009 15:57
PROJ PWR/VARS/ETRM/SPD