Impact Study
For
Generation Interconnection
Request
GEN-2006-035

SPP Tariff Studies

(#GEN-2006-035)

July 2007

Executive Summary

<OMITTED TEXT> (Customer) has requested an Impact Study under the Southwest Power Pool Open Access Transmission Tariff (OATT) for interconnection of 222MW of wind generation within the control area of American Electric Power West (AEPW) in Roger Mills County, Oklahoma. The wind powered generation facility was studied with one hundred forty eight (148) individual General Electric (GE) 1.5 MW wind turbines. The requested in-service date for the 222MW facility is December 1, 2008. This Impact study addresses the dynamic stability effects of interconnecting the plant to the rest of the AEPW transmission system as well as addressing the need for reactive compensation required by the wind farm because of the use of the GE turbines.

The requirements to interconnect the 222MW of generation at the new switching station on the Elk City – Grapevine 230kV line will consist of building a new 230kV ring bus substation that would be used to interconnect both GEN-2006-002 and this request. The method to interconnect one of the requests would consist of a three breaker ring bus substation with terminals to Elk City, Grapevine, and the generating facility. If both this request and GEN- 2006-002 interconnect into the station, a fourth ring bus terminal will be required. The total minimum cost for building the three breaker 230kV ring bus substation required for stand alone interconnection is $3,500,000. If the prior queued request signs an Interconnection Agreement, the cost for the incremental interconnection facilities for this request is $500,000.

From the new switching station, the Customer will build a 230 kV line to its 230/34.5 kV collector substation. The customer substation will provide terminations for the wind turbine collection circuits.

Two seasonal base cases were used in the study to analyze the stability impacts of the proposed generation facility. The cases studied were the 2008 winter peak and 2012 summer peak. Each case was modified to include prior queued projects that are listed in the body of the report. Seventeen contingencies were simulated in each case. The GE 1.5s wind turbines were modeled using information provided by the manufacturer.

Due to the reactive power losses on the collector system including the substation transformer, the Customer will be required to install in its substation a total of 46 Mvar’s of capacitor banks on the 34.5 kV bus. With the addition of the capacitor banks, the reactive capability of the GE turbines allows the wind farm to operate at unity power factor and have reactive reserve for fault recovery.

Stability Study results show that with the Customer requested GE wind turbines, the transmission system remains stable for all simulated contingencies studied. If the Customer changes the manufacturer or type of wind turbines from the GE 1.5 MW, an Impact re-study will be required.

Further Stability study results show that in order for the wind farm to meet FERC Order #661A’s Low Voltage Ride Through (LVRT) provisions, the Customer shall purchase the GE turbines with the LVRT II low voltage ride through package available from the manufacturer. Using the GE turbines, a dynamic reactive source (SVC or STATCOM) is not required. Again, if the Customer changes from the GE turbine, this need will be re-evaluated in an Impact re-study.

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 222MW of wind generation within the control area of American Electric Power West (AEPW) in Roger Mills County, Oklahoma. The wind powered generation facility was studied with one hundred forty eight (148) individual General Electric (GE) 1.5 MW wind turbines. The requested in-service date for the 222MW facility is December 1, 2008. This Impact study addresses the dynamic stability effects of interconnecting the plant to the rest of the AEPW transmission system as well as addressing the need for reactive compensation required by the wind farm because of the use of the GE turbines.

2.0 Purpose

The purpose of the Interconnection System Impact Study is to evaluate the impact of the proposed interconnection on the reliability of the Transmission System. The Impact Study 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 Interconnection System Impact Study 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; 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 148 GE 1.5s wind turbines. The nameplate rating of each turbine is 1.5MW (1500kW) with a machine base of 1667 kVA. The turbine output voltage is 575V. The GE turbines utilize a doubly fed induction-generator with a wound rotor and slip rings. The generator synchronous speed is 1200 rpm, and a variable frequency power converter tied to the generator rotor allows the generator to operate at speeds ranging from 800 rpm to 1600 rpm. Nominal speed at 1.5MW power output is 1440 rpm and the maximum allowable non-operating rotational speed is 1680 rpm. The power converter allows the generator to produce power at a power factor of 0.9 lagging to 0.95 leading. The power factor is settable at each WTG or by the Plant SCADA system.

This study was performed using the latest GE Standard Voltage and Frequency Settings with Fault Ride Through modeling stability package available from PTI. These settings are shown in Table 5.

Each wind turbine will feed into a 0.575/34.5 kV GSU rated at 1750 kVA. Impedance for the GSU is 5.75%.

The 148 wind turbines are divided among eight (8) collector circuits that feed into two (2) 34.5/230 kV transformers in the customer's substation. The first four collector circuits consist of 21, 21, 17, and 18 wind turbines, respectively and feed into one of the 34.5/230 kV transformers. The second four collector circuits consist of 18, 17, 18, and 18 wind turbines, respectively and feed into the other 34.5/230 kV transformer.

The impedance for each of the 34.5/230 kV transformers is 7.5% on a 79 MVA OA Base with a top rating of 129 MVA.

Figure 1shows the one-line modeling of the generation facility. Please note in the figure that not all 148 wind turbines are shown. Each wind turbine symbol has a number that shows the total turbines represented by that element. Section 4.0 discusses the aggregation of wind turbines to simplify the stability analysis.

3.2 <u>Interconnection Facility</u>

The Customer has proposed the point of interconnection (POI) to be the AEPW transmission system via a new substation located in northwest Beckham County, Oklahoma on the existing Elk City – Grapevine 230 kV line. See Figure 2 for one-line diagram of the interconnection facility.

The requirements to interconnect the 222MW of generation at the new switching station on the Elk City – Grapevine 230kV line will consist of building a new 230kV ring bus substation that would be used to interconnect both GEN-2006-002 and this request. The method to interconnect one of the requests would consist of a three breaker ring bus substation with terminals to Elk City, Grapevine, and the generating facility. If both this request and GEN- 2006-002 interconnect into the station, a fourth ring bus terminal will be required. The total minimum cost for building the three breaker 230kV ring bus substation required for stand alone interconnection is $3,500,000. If the prior queued request signs an Interconnection Agreement, the cost for the incremental interconnection facilities for this request is $500,000. These costs are shown in Table 1, Table 2 and Table 3.

From the new switching station, the Customer will build a 230 kV line to its 230/34.5 kV collector substation. The customer substation will provide terminations for the wind turbine collection circuits.

Analysis of the reactive compensation requirements of the wind farm indicated the need for a 34.5 kV, 24 Mvar capacitor bank to be located on the secondary side of the first substation transformer and for a 34.5 kV, 22 Mvar capacitor bank to be located on the secondary side of the second substation transformer (see Figure 1). These capacitor banks are necessary for reactive compensation for the wind farm (turbine and collector system losses). Because of the reactive capability of the GE turbines, the reactive compensation does not need to be dynamic (SVC).

Table 1: Direct Assignment Facilities

FACILITY	ESTIMATED COST (2007 DOLLARS)
Customer – 230/34.5 kV Substation facilities.	*
Customer – 230kV transmission line facilities between Customer facilities and AEPW 230kV switching station.	*
Customer - Right-of-Way for Customer facilities.	*
Customer – 34.5 kV, 46 Mvar capacitor bank(s) in Customer substation.	*
Total	*

Note: * Estimates of cost to be determined by Customer.

Table 2: Required Interconnection Network Upgrade Facilities (Assuming prior queued project withdraws)

FACILITY	ESTIMATED COST (2007 DOLLARS)
AEPW – Build 230kV, 3-breaker ring bus switching station. Station to include breakers, switches, control relaying, high speed communications, all structures, and metering and other related equipment.	$3,500,000
Total	**$3,500,000**

Table 3: Required Interconnection Network Upgrade Facilities (Assuming prior queued project stays in the queue)

FACILITY	ESTIMATED COST (2007 DOLLARS)
AEPW – Add 230kV line and breaker terminal to the ring bus switching station built initially for request GEN-2006-002.	$500,000
Total	**$500,000**

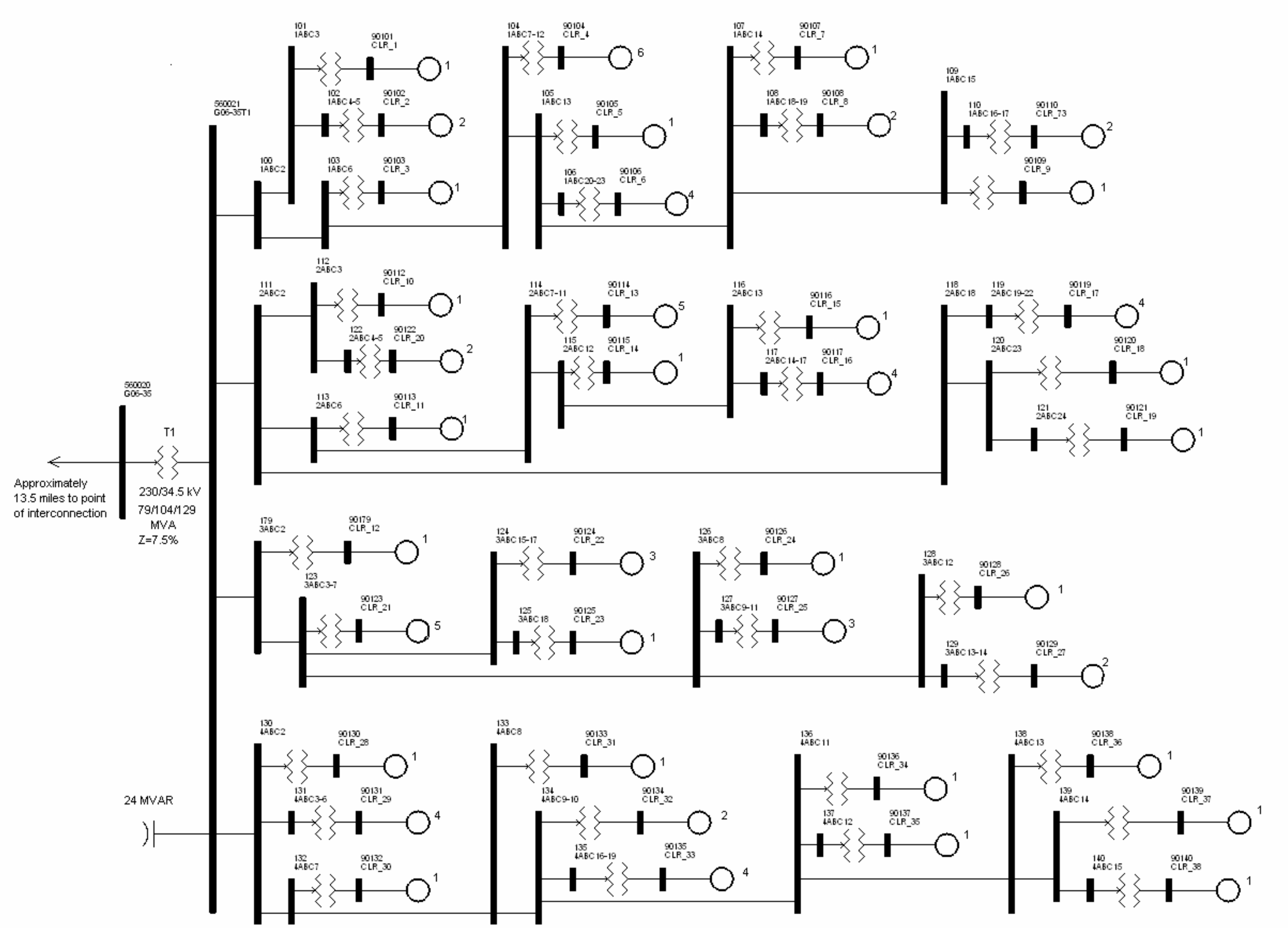


Figure 1: One-Line Drawing of the GEN-2006-035 Facility

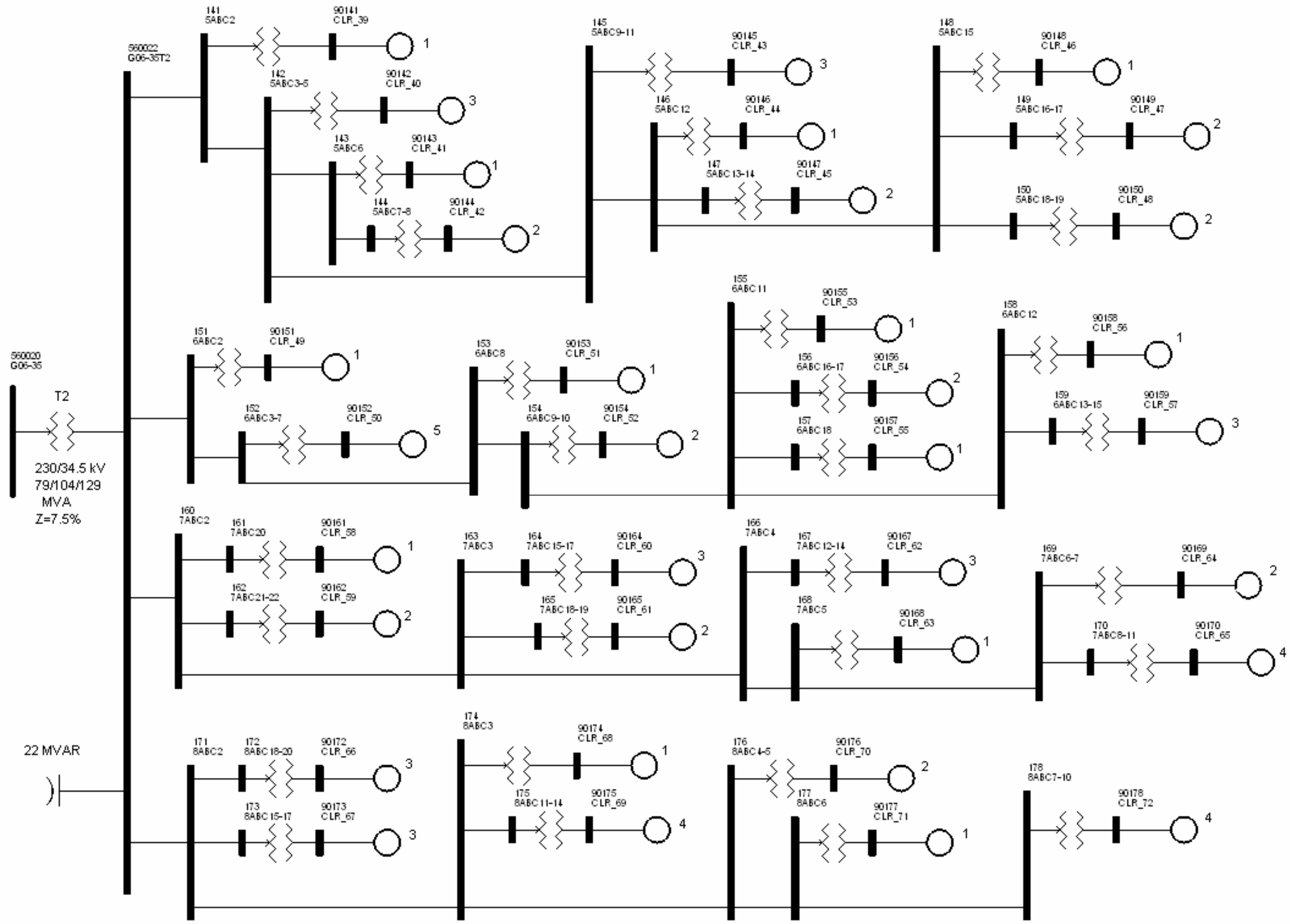


Figure 1: One-Line Drawing of the GEN-2006-035 Facility (continued)

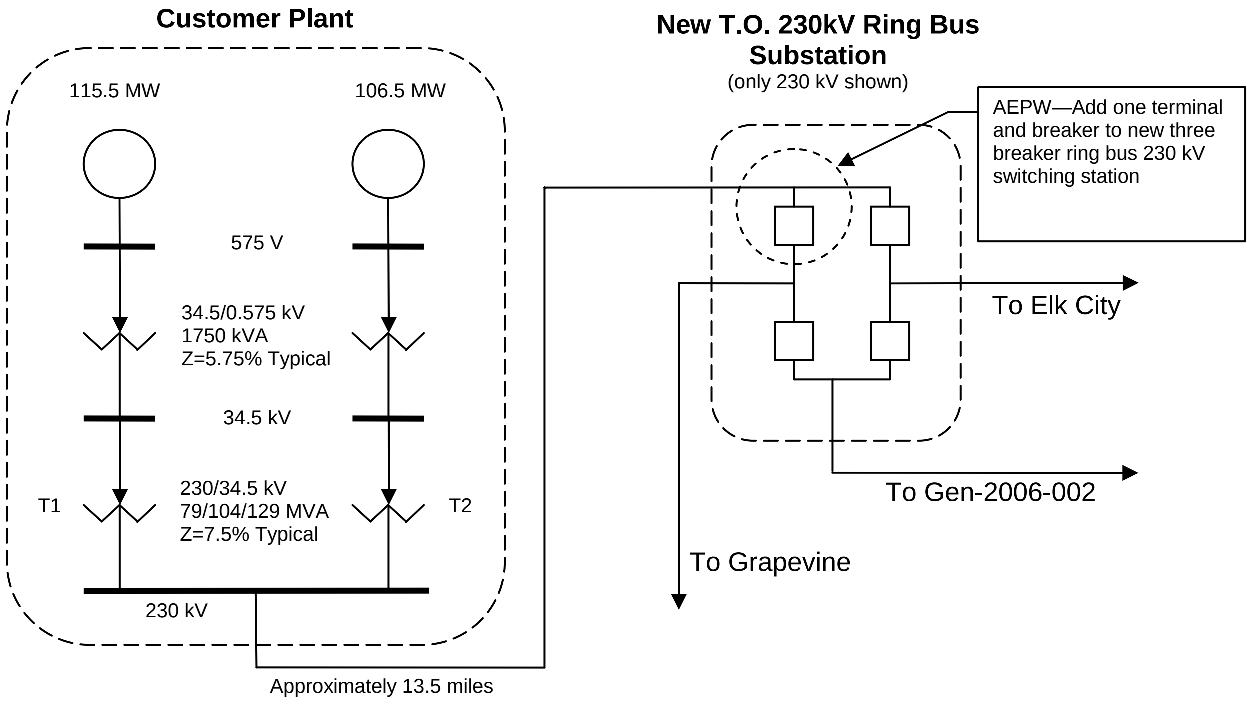


Figure 2: Proposed Interconnection Configuration

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 connected to the same 34.5 kV collector lines were aggregated into several equivalent units (see Figure 1). The number next to the generator symbol shows how many turbines and associated impedances were combined. The 148 wind turbines were reduced to 73 equivalent units.

4.2 Modeling of the Wind Turbines in Dynamics

The GE 1.5s wind turbine generators utilize a doubly fed induction-generator with a wound rotor and slip rings. The generator synchronous speed is 1200 rpm, and a variable frequency power converter tied to the generator rotor allows the generator to operate at speeds ranging from 800 rpm to 1600 rpm. Nominal speed at 1.5MW power output is 1440 rpm and the maximum allowable non-operating rotational speed is 1680 rpm. The power converter allows the generator to produce power at a power factor of 0.9 lagging to 0.95 leading. The power factor is settable at each WTG or by the Plant SCADA system.

Power Technologies Inc. (PTI) has produced a GE 1.5s turbine model package for use on their PSS/E simulation software. This package was obtained from PTI and was used exclusively in modeling this wind farm. The GE stability model package used was released by Siemens PTI in July, 2005. The generator data used by the stability model is shown in Table 4.

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 1.0 unity power factor.

Description	Value
Stator resistance, Ra	0.00706 pu
Stator inductance, La	0.1714 pu
Mutual inductance, Lm	2.904 pu
Rotor resistance	0.005 pu
Rotor inductance	0.1563 pu
Drive train inertia	0.64 sec
Shaft damping	0.73 pu
Shaft stiffness	0.6286 pu
Generator rotor inertia	0.57 sec
Number of generator pole pairs	3
Gear box ratio	72.0

Table 4: GE 1.5 MW Wind Turbine Generator Parameters

4.2.1 Turbine Protection Schemes

The GE 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.

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 (in this case, the 230 kV bus at the AEP switching station) that draw the voltage down at the POI to 0.0 pu.

In order to meet Order #661A, GE provides three different LVRT packages. The voltage settings for the three packages are shown in Table 5. For this study, the wind turbines were determined to need the LVRT II package.

Voltage	Time Limit
1.3000pu +	1.2 cycles (0.02s)
1.1500pu -- 1.299pu	6 cycles (0.1s)
1.1499pu – 1.1000pu	60 cycles (1.0s)
1.0999pu – 0.8501pu	Continuous Operation
0.8500pu -- 0.7501pu	600 cycles (10.0s)
0.7500pu – 0.7001pu	60 cycles (1.0s)
0.7000pu – 0.3001pu	6 cycles (0.1s)
0.3000pu – 0.0000pu	6 cycles (LVRT I)
0.3000pu – 0.1500pu	37.5 cycles (0.625s) (LVRT II)
0.1500pu – 0.0000pu	6 cycles (LVRT II)
0.0000pu	60 cycles (1 s) (LVRT III)

Table 5: G.E. 1.5s Turbine Voltage Protection

The frequency protection scheme for the GE turbines is outlined in Table 6 below:

Frequency	Time Limit
62.5000Hz +	1.2 cycles (0.02s)
62.4999Hz -- 61.500Hz	1800 cycles (30.0s)
61.4999Hz -- 57.5001Hz	Continuous Operation
57.5000Hz – 56.5001Hz	600 cycles (10.0s)
56.5000Hz – 0.0000Hz	1.2 cycles (0.02s)

Table 6: G.E. Turbine Frequency Protection

4.3 Contingencies Simulated

Seventeen (17) contingencies were considered for the transient stability simulations. These contingencies included three phase faults, single phase line faults, and a breaker failure fault 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 7.

Table 7: Contingencies Evaluated

Cont. No.	*Cont. Name*	*Description*
1	FLT13PH	3 phase fault on the Wind Farm (560112) to Grapevine (523771) 230 kV line, near the Wind Farm. a. Apply fault at the Wind Farm 230kV bus. b. Clear fault after 5 cycles by tripping the line from the Wind Farm-Grapevine. 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	FLT21PH	*Single phase fault and sequence like Cont. No. 1*
3	FLT33PH	3 phase fault on the Wind Farm (560112) to Elk City (511490) 230 kV line, near the Wind Farm. a. Apply fault at the Wind Farm 230kV bus. b. Clear fault after 5 cycles by tripping the line from the Wind Farm-Grapevine. 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.
4	FLT41PH	*Single phase fault and sequence like Cont. No. 3*
5	FLT53PH	3 phase fault on the Clinton Jct (511485) – Elk City (511458) 138kV line, near Clinton Jct. a. Apply fault at the Clinton Jct 138kV bus. b. Clear fault after 5 cycles by tripping the line from the Elk City – Clinton Jct. 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	FLT61PH	*Single phase fault and sequence like Cont. No. 5*
7	FLT73PH	3 phase fault on the G02-05 (560000) – Morewood (521001) 138kV line, near Morewood. a. Apply fault at the Morewood 138kV bus. b. Clear fault after 5 cycles by tripping the line from the Elk City – G02-05 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.

Cont. No.	Cont. Name	Description
8	FLT81PH	*Single phase fault and sequence like Cont. No.7*
9	FLT93PH	3 phase fault on the Hobart Jct (511446) – Elk City (511458) 138kV line, near Elk City. a. Apply fault at the Elk City 138kV bus. b. Clear fault after 5 cycles by tripping the line from the Elk City – Clinton AFB (511446) - Hobart Jct 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	FLT101PH	*Single phase fault and sequence like Cont. No.9*
11	FLT113PH	3 phase fault on the Grapevine (523771) – Nichols (524044) 230kV line near Grapevine. a. Apply fault at the Grapevine bus. b. Clear fault after 5 cycles by tripping the line Grapevine-Nichols 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	FLT121PH	*Single phase fault and sequence like Cont. No.11*
13	FLT133PH	3 phase fault on the Grapevine 230/115kV autotransformer on the 230kV bus a. Apply fault at the Grapevine 230kV bus. b. Clear fault after 5 cycles by tripping the autotransformer c. No reclose
14	FLT141PH	*Single phase fault and sequence like Cont. No.13*
15	FLT153PH	3 phase fault on the Conway (524079)-Yarnell (524072) –Nichols (524072) 115kV line near Nichols a. Apply fault at the Nichols bus. b. Clear fault after 5 cycles by tripping the line Conway-Yarnell-Nichols 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	FLT161PH	*Single phase fault and sequence like Cont. No.15*
17	FLT17BF	Breaker failure fault at Elk City 138 kV (511458) a. Apply 1 phase fault at Elk City 138 kV b. After 3.5 cycles, trip line to Hobart (but do not clear fault) c. Run with fault for 11.5 more cycles d. Clear fault e. Open 230 kV line to wind farm

Table 7: Contingencies Evaluated (continued)

4.4 Further Model Preparation

The two base cases contain prior queued projects as shown in Table 8.

The wind farm generation from the study customer and previously queued customers is 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-2001-026	74
GEN-2002-005	114
GEN-2003-004 GEN-2004-023 GEN-2005-003	151
GEN-2003-020	160
GEN-2003-022 GEN-2004-020	147.5
GEN-2004-003	240
GEN-2005-021	85.5
GEN-2006-002	150

Table 8: Prior Queued Projects

5.0 Results

Results of the stability analysis are summarized in Table 9. The results indicate that for all contingencies, the transmission system remains stable. It was noted that for contingency seven (FLT73PH) that prior queued project GEN-2002-005 was found to trip in both seasons. The project also tripped in the base case.

Selected stability plots for the two seasons are in Appendix A and Appendix B. All plots are available on request.

The wind farm was modeled using the GE LVRT II package. The LVRT II package is required for the wind farm to meet FERC Order #661A Low Voltage Ride Through Requirements. If the Customer changes the wind turbines to be used for this request at any time, an Impact re-study will be required.

.

Table 9: Summary of Fault Simulation Results

Cont. No.	*Cont. Name*	*Description*	2008 Winter Peak	2012 Summer Peak
1	FLT13PH	3 phase fault on the Wind Farm (560112) to Grapevine (523771) 230 kV line, near the Wind Farm. a. Apply fault at the Wind Farm 230kV bus. b. Clear fault after 5 cycles by tripping the line from the Wind Farm-Grapevine. 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**
2	FLT21PH	*Single phase fault and sequence like Cont. No. 1*	**STABLE**	**STABLE**
3	FLT33PH	3 phase fault on the Wind Farm (560112) to Elk City (511490) 230 kV line, near the Wind Farm. a. Apply fault at the Wind Farm 230kV bus. b. Clear fault after 5 cycles by tripping the line from the Wind Farm-Grapevine. 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**
4	FLT41PH	*Single phase fault and sequence like Cont. No. 3*	**STABLE**	**STABLE**
5	FLT53PH	3 phase fault on the Clinton Jct (511485) – Elk City (511458) 138kV line, near Clinton Jct. a. Apply fault at the Clinton Jct 138kV bus. b. Clear fault after 5 cycles by tripping the line from the Elk City – Clinton Jct. 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**
6	FLT61PH	*Single phase fault and sequence like Cont. No. 5*	**STABLE**	**STABLE**
7	FLT73PH	3 phase fault on the G02-05 (560000) – Morewood (521001) 138kV line, near Morewood. a. Apply fault at the Morewood 138kV bus. b. Clear fault after 5 cycles by tripping the line from the Elk City – G02-05 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***
8	FLT81PH	*Single phase fault and sequence like Cont. No.7*	**STABLE**	**STABLE**
9	FLT93PH	3 phase fault on the Hobart Jct (511446) – Elk City (511458) 138kV line, near Elk City. a. Apply fault at the Elk City 138kV bus. b. Clear fault after 5 cycles by tripping the line from the Elk City – Clinton AFB (511446) - Hobart Jct. 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**
10	FLT101PH	*Single phase fault and sequence like Cont. No.9*	**STABLE**	**STABLE**

Cont. No.	*Cont. Name*	*Description*	**2008 Winter Peak**	**2012 Summer Peak**
11	FLT113PH	3 phase fault on the Grapevine (523771) – Nichols (524044) 230kV line near Grapevine. a. Apply fault at the Grapevine bus. b. Clear fault after 5 cycles by tripping the line Grapevine-Nichols 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**
12	FLT121PH	*Single phase fault and sequence like Cont. No.11*	**STABLE**	**STABLE**
13	FLT133PH	3 phase fault on the Grapevine 230/115kV autotransformer on the 230kV bus a. Apply fault at the Grapevine 230kV bus. b. Clear fault after 5 cycles by tripping the autotransformer c. No reclose	**STABLE**	**STABLE**
14	FLT141PH	*Single phase fault and sequence like Cont. No.13*	**STABLE**	**STABLE**
15	FLT153PH	3 phase fault on the Conway (524079)-Yarnell (524072) –Nichols (524072) 115kV line near Nichols a. Apply fault at the Nichols bus. b. Clear fault after 5 cycles by tripping the line Conway-Yarnell-Nichols 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**
16	FLT161PH	*Single phase fault and sequence like Cont. No.15*	**STABLE**	**STABLE**
17	FLT17BF	Breaker fault at Elk City 138 kV (511458) a. Apply 1 phase fault at Elk City 138 kV b. After 3.5 cycles, trip line to Hobart (but do not clear fault) c. Run with fault for 11.5 more cycles d. Clear fault e. Open 230 kV line to wind farm	**STABLE**	**STABLE**

*** Prior queued project GEN-2002-005 was found to trip in both seasons. The project also tripped in the base case.**

Table 9: Summary of Fault Simulation Results (continued)

6.0 Conclusion

No stability concerns presently exist for the GEN-2006-035 wind farm as proposed and studied using one hundred forty eight (148) GE 1.5 MW wind turbines. The wind farm and the transmission system remain stable for all contingencies studied. A change in wind turbine type or manufacturer will require an Impact re-study to confirm system stability.

The total minimum network upgrade cost for building the three breaker 230kV ring bus substation required for stand alone interconnection is $3,500,000. If the prior queued request signs an Interconnection Agreement, the cost for the incremental interconnection facilities for this request is $500,000. These figures do not address the cost of the Customer substation, the Customer 34.5 kV, 46 Mvar capacitor banks, or the transmission line between the Customer substation and the proposed AEPW switching substation located on the Grapevine – Elk City 230 kV line.

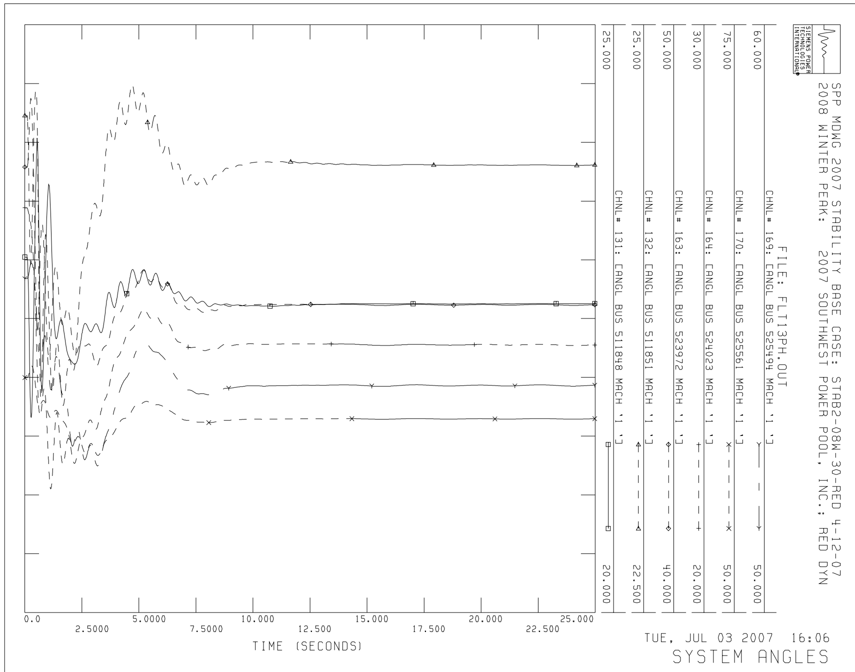
In order for the wind farm to meet the LVRT provisions of FERC Order #661A, the Customer will be required to purchase the GE turbines with the LVRT II low voltage ride through package offered by the manufacturer.

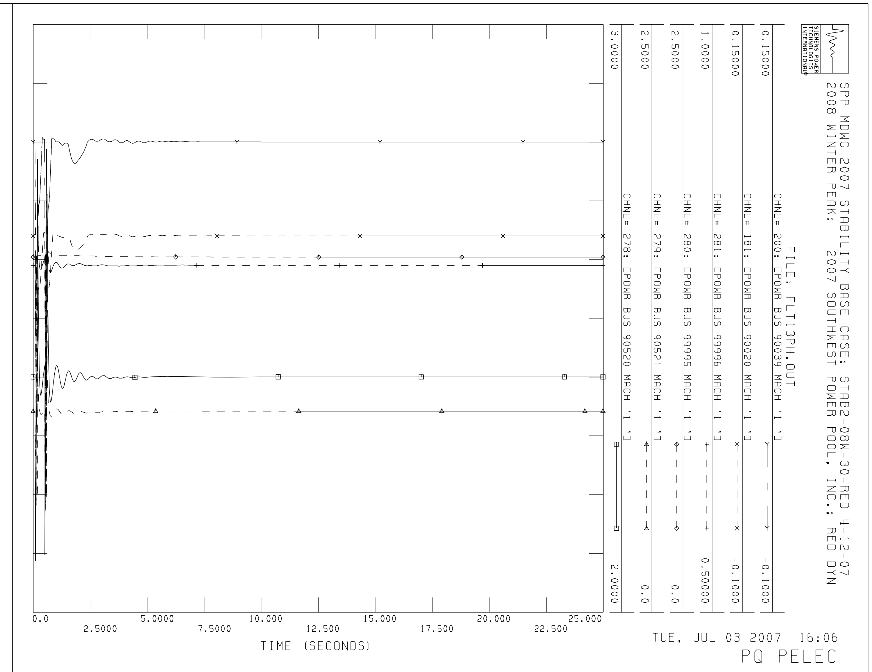
The costs do not include any costs associated with the deliverability of the energy to final customers. These costs are determined by separate studies if the Customer requests transmission service through Southwest Power Pool's OASIS. It should be noted that the models used for simulation do not contain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

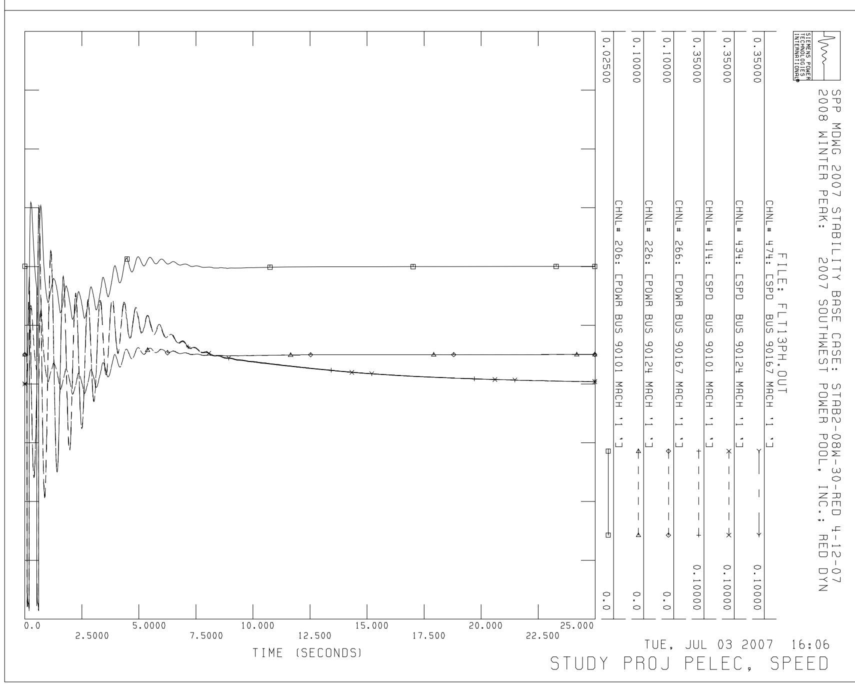
APPENDIX A.

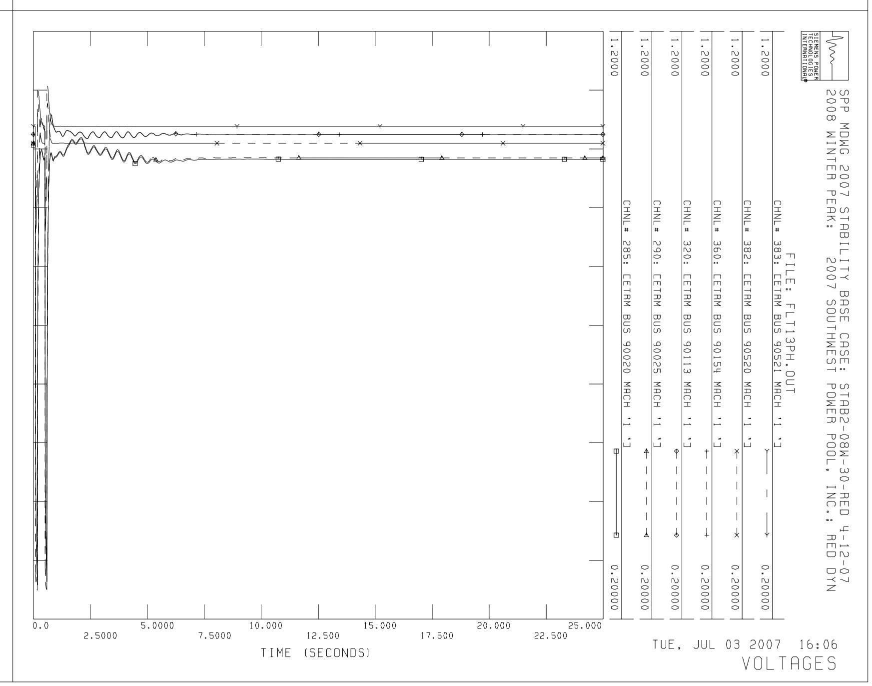
SELECTED STABILITY PLOTS -- 2008 WINTER PEAK

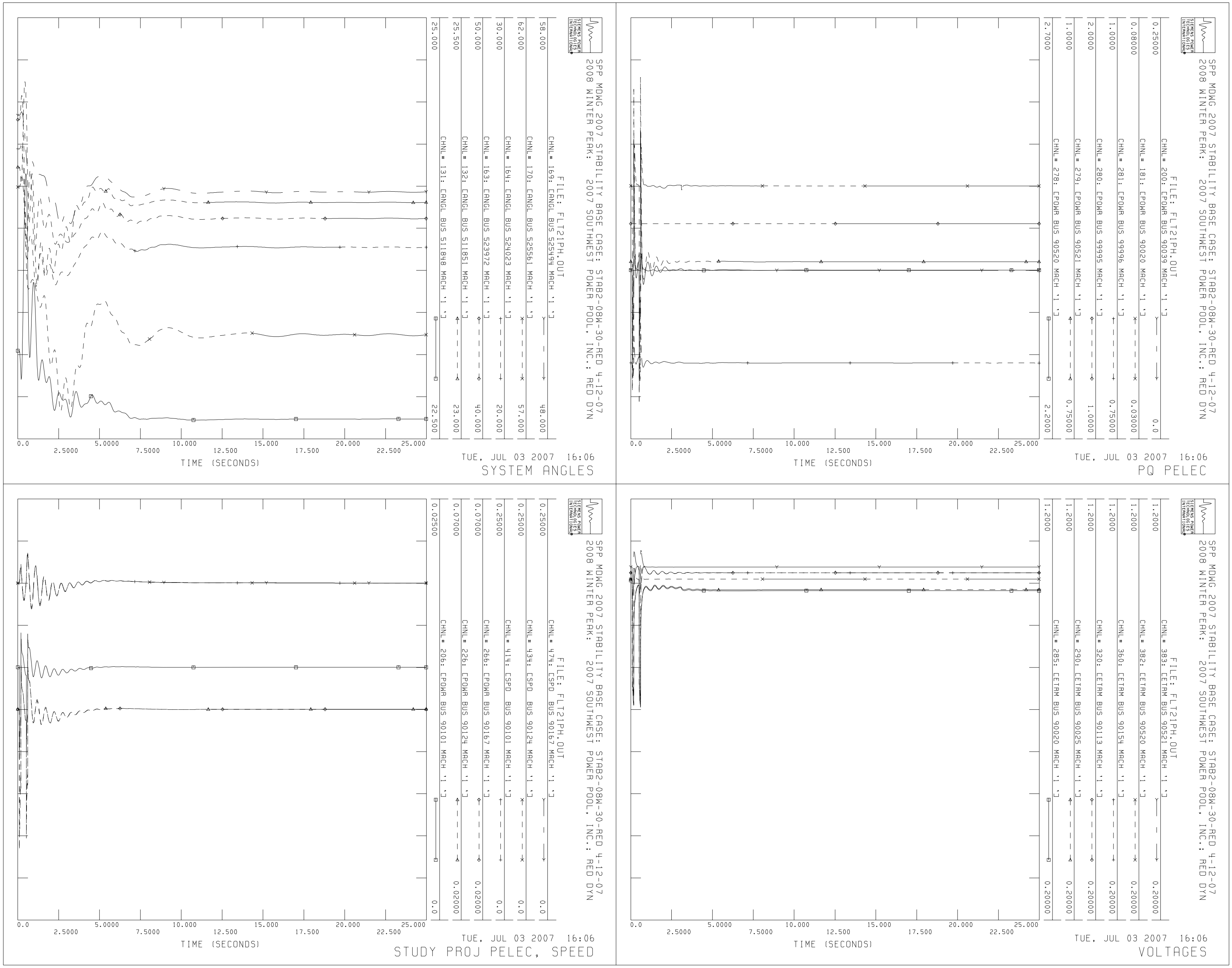
All plots available on request.

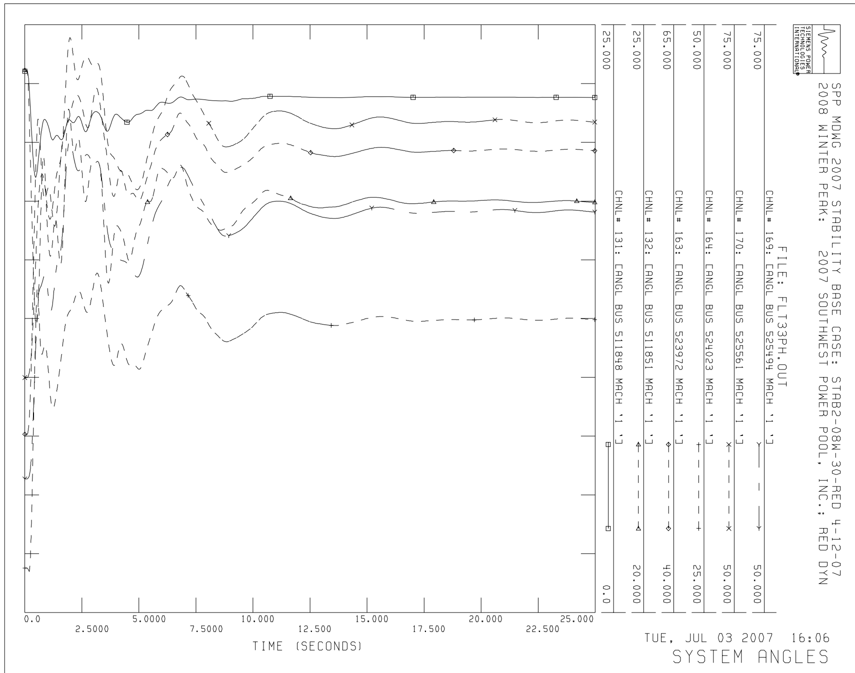

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT13PH.OUT
CHNL# 169: CANGL BUS 525494 MACH '1 '
CHNL# 170: CANGL BUS 525561 MACH '1 '
CHNL# 164: CANGL BUS 524023 MACH '1 '
CHNL# 163: CANGL BUS 523972 MACH '1 '
CHNL# 132: CANGL BUS 511851 MACH '1 '
CHNL# 131: CANGL BUS 511848 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
SYSTEM ANGLES

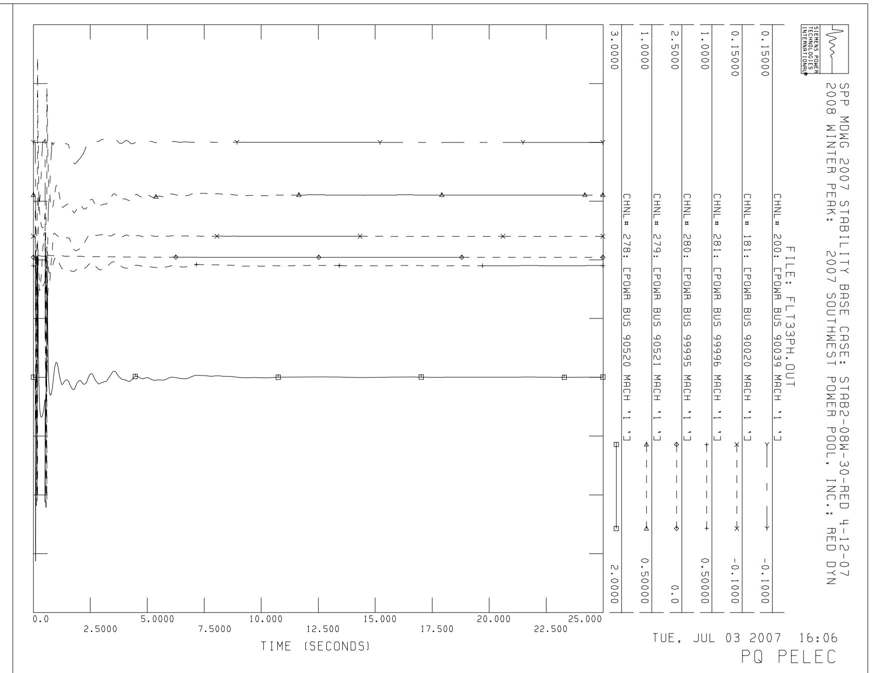

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT13PH.OUT
CHNL# 200: CPOWR BUS 90039 MACH '1 '
CHNL# 181: CPOWR BUS 90020 MACH '1 '
CHNL# 281: CPOWR BUS 99996 MACH '1 '
CHNL# 280: CPOWR BUS 99995 MACH '1 '
CHNL# 279: CPOWR BUS 90521 MACH '1 '
CHNL# 278: CPOWR BUS 90520 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
PQ PELEC

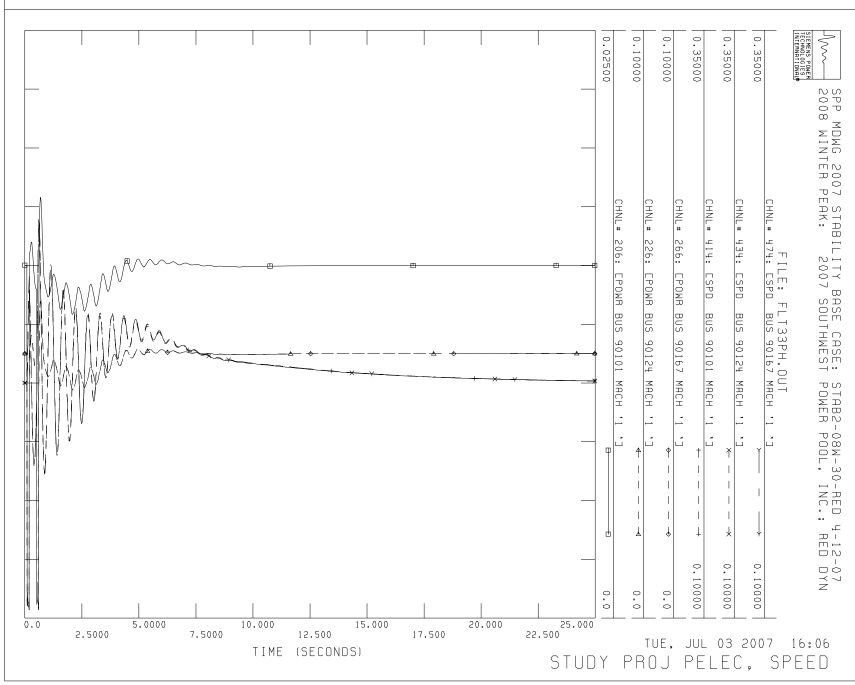

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT13PH.OUT
CHNL# 474: CSPD BUS 90167 MACH '1 '
CHNL# 434: CSPD BUS 90124 MACH '1 '
CHNL# 414: CSPD BUS 90101 MACH '1 '
CHNL# 266: CPOWR BUS 90167 MACH '1 '
CHNL# 226: CPOWR BUS 90124 MACH '1 '
CHNL# 206: CPOWR BUS 90101 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
STUDY PROJ PELEC, SPEED

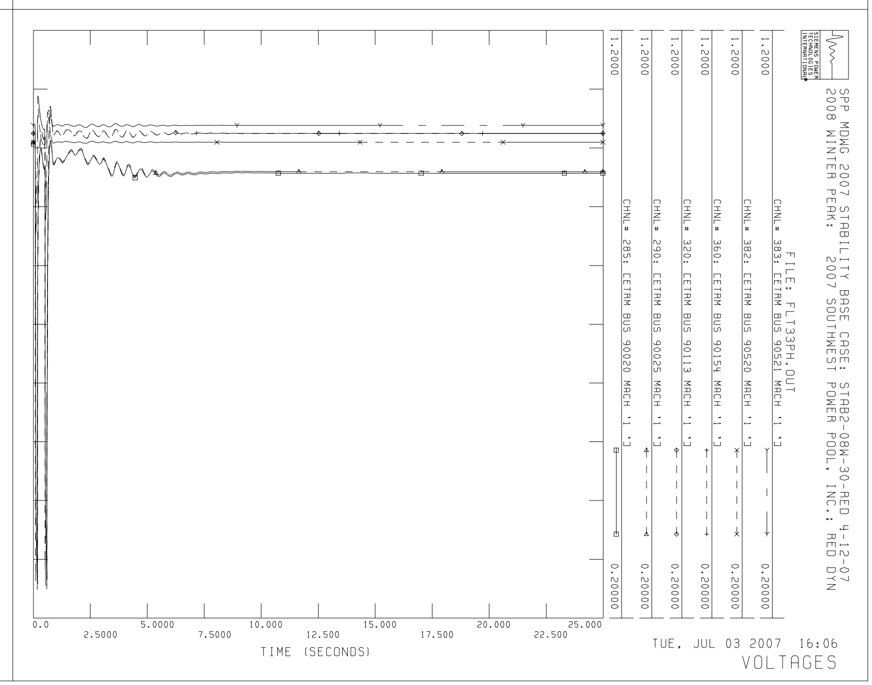

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT13PH.OUT
CHNL# 383: CETRM BUS 90521 MACH '1 '
CHNL# 382: CETRM BUS 90520 MACH '1 '
CHNL# 360: CETRM BUS 90154 MACH '1 '
CHNL# 320: CETRM BUS 90113 MACH '1 '
CHNL# 290: CETRM BUS 90025 MACH '1 '
CHNL# 285: CETRM BUS 90020 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
VOLTAGES

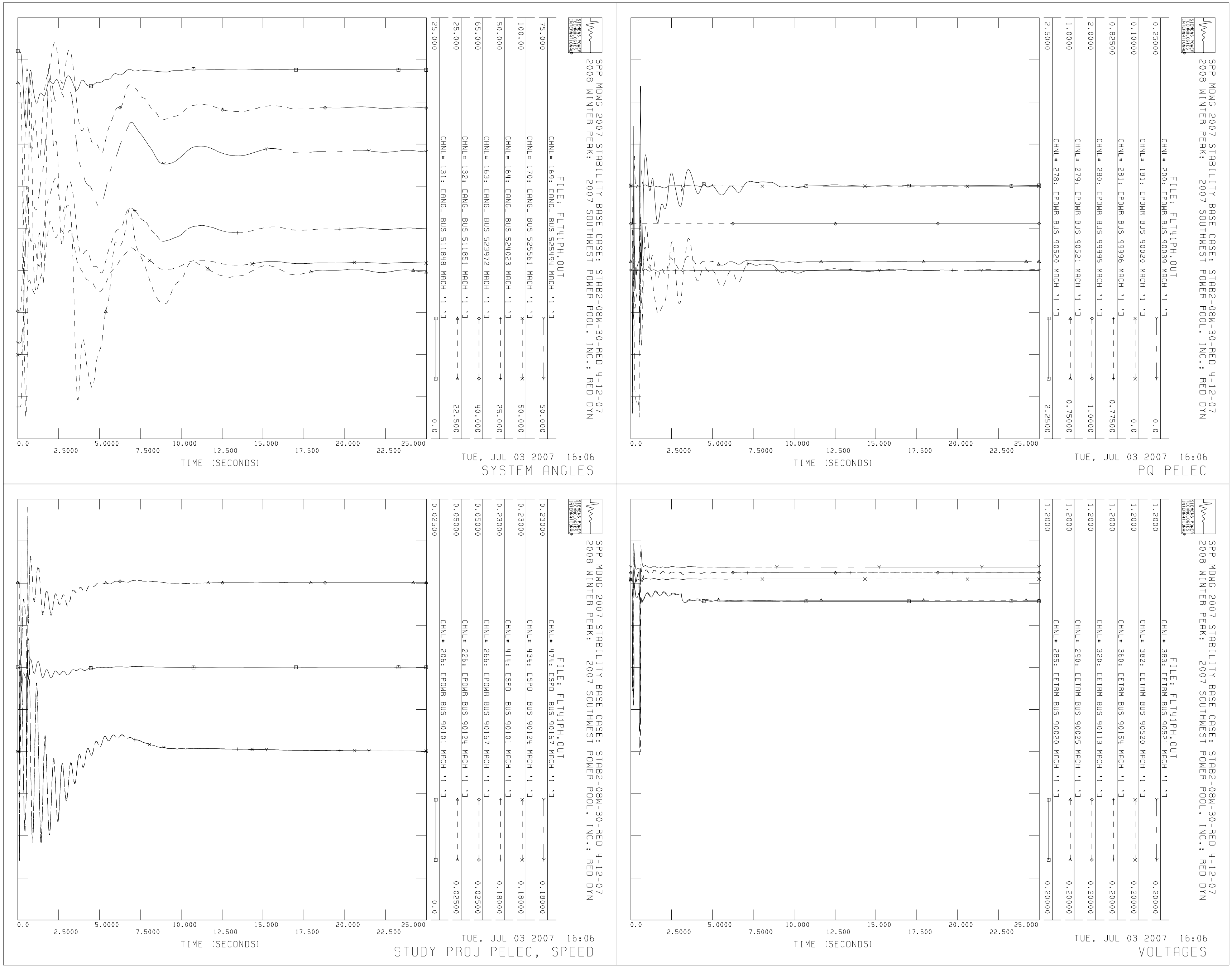

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT21PH.OUT
CHNL# 169: [ANGL BUS 525494 MACH '1 ']
CHNL# 170: [ANGL BUS 525561 MACH '1 ']
CHNL# 164: [ANGL BUS 524023 MACH '1 ']
CHNL# 163: [ANGL BUS 523972 MACH '1 ']
CHNL# 132: [ANGL BUS 511851 MACH '1 ']
CHNL# 131: [ANGL BUS 511848 MACH '1 ']
TIME (SECONDS)
TUE, JUL 03 2007 16:06
SYSTEM ANGLES
CHNL# 200: [POWR BUS 90039 MACH '1 ']
CHNL# 181: [POWR BUS 90020 MACH '1 ']
CHNL# 281: [POWR BUS 99996 MACH '1 ']
CHNL# 280: [POWR BUS 99995 MACH '1 ']
CHNL# 279: [POWR BUS 90521 MACH '1 ']
CHNL# 278: [POWR BUS 90520 MACH '1 ']
PQ PELEC
CHNL# 474: [SPD BUS 90167 MACH '1 ']
CHNL# 434: [SPD BUS 90124 MACH '1 ']
CHNL# 414: [SPD BUS 90101 MACH '1 ']
CHNL# 266: [POWR BUS 90167 MACH '1 ']
CHNL# 226: [POWR BUS 90124 MACH '1 ']
CHNL# 206: [POWR BUS 90101 MACH '1 ']
STUDY PROJ PELEC, SPEED
CHNL# 383: [ETRM BUS 90521 MACH '1 ']
CHNL# 382: [ETRM BUS 90520 MACH '1 ']
CHNL# 360: [ETRM BUS 90154 MACH '1 ']
CHNL# 320: [ETRM BUS 90113 MACH '1 ']
CHNL# 290: [ETRM BUS 90025 MACH '1 ']
CHNL# 285: [ETRM BUS 90020 MACH '1 ']
VOLTAGES

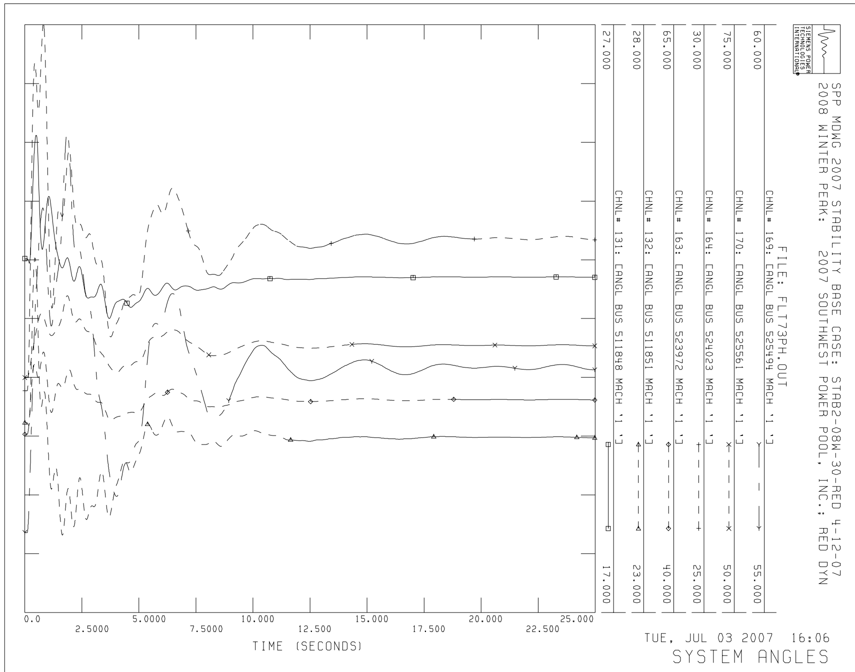

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT33PH.OUT
CHNL# 169: [ANGL BUS 525494 MACH '1 '] 75.000 50.000
CHNL# 170: [ANGL BUS 525561 MACH '1 '] 75.000 50.000
CHNL# 164: [ANGL BUS 524023 MACH '1 '] 50.000 25.000
CHNL# 163: [ANGL BUS 523972 MACH '1 '] 65.000 40.000
CHNL# 132: [ANGL BUS 511851 MACH '1 '] 25.000 20.000
CHNL# 131: [ANGL BUS 511848 MACH '1 '] 25.000 0.0
TIME (SECONDS)
TUE, JUL 03 2007 16:06
SYSTEM ANGLES

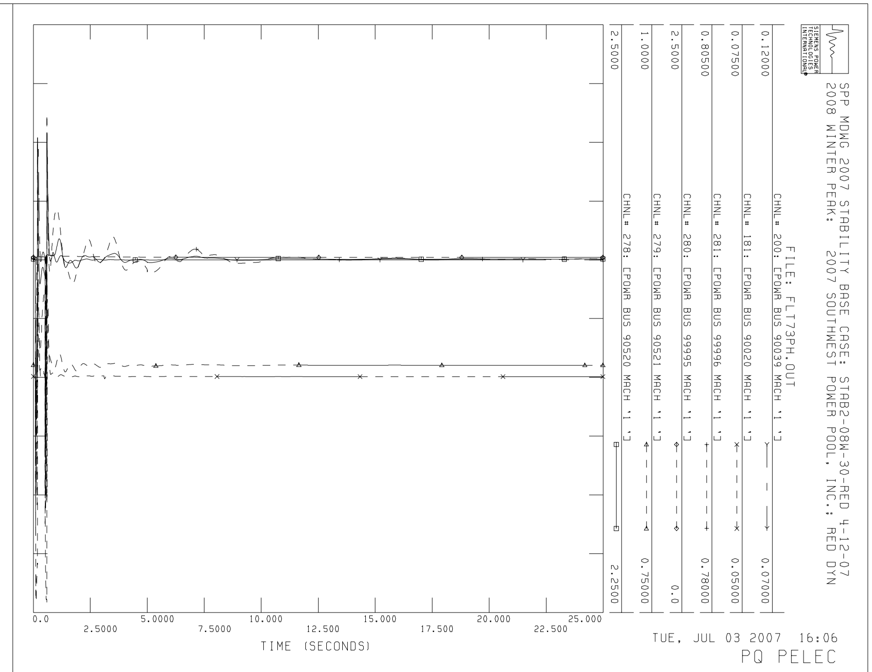

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT33PH.OUT
CHNL# 200: [POWR BUS 90039 MACH '1 '] 0.15000 -0.1000
CHNL# 181: [POWR BUS 90020 MACH '1 '] 0.15000 -0.1000
CHNL# 281: [POWR BUS 99996 MACH '1 '] 1.0000 0.50000
CHNL# 280: [POWR BUS 99995 MACH '1 '] 2.5000 0.0
CHNL# 279: [POWR BUS 90521 MACH '1 '] 1.0000 0.50000
CHNL# 278: [POWR BUS 90520 MACH '1 '] 3.0000 2.0000
TIME (SECONDS)
TUE, JUL 03 2007 16:06
PQ PELEC

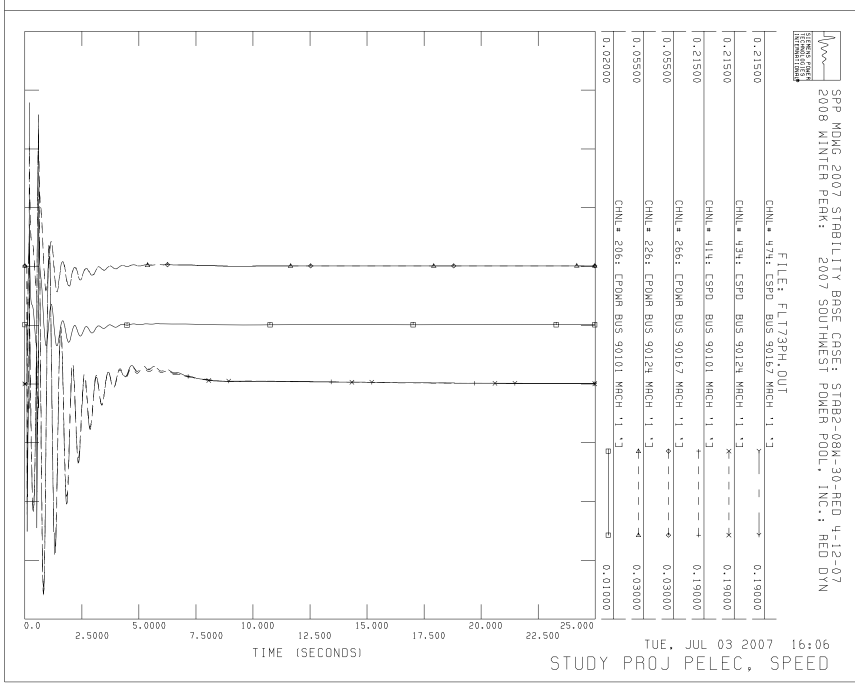

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT33PH.OUT
CHNL# 474: [SPD BUS 90167 MACH '1 '] 0.35000 0.10000
CHNL# 434: [SPD BUS 90124 MACH '1 '] 0.35000 0.10000
CHNL# 414: [SPD BUS 90101 MACH '1 '] 0.35000 0.10000
CHNL# 266: [POWR BUS 90167 MACH '1 '] 0.10000 0.0
CHNL# 226: [POWR BUS 90124 MACH '1 '] 0.10000 0.0
CHNL# 206: [POWR BUS 90101 MACH '1 '] 0.02500 0.0
TIME (SECONDS)
TUE, JUL 03 2007 16:06
STUDY PROJ PELEC, SPEED

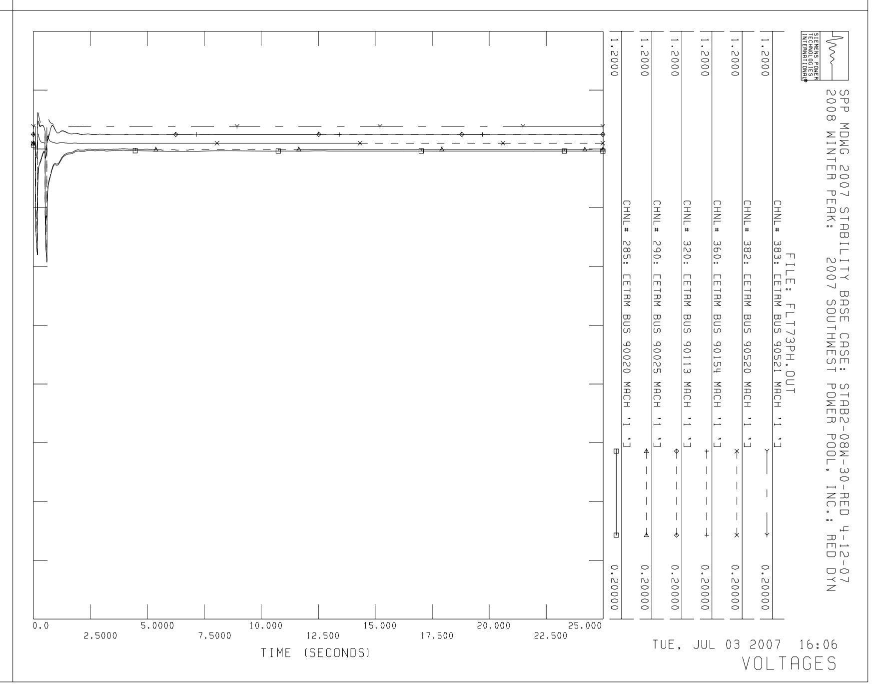

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT33PH.OUT
CHNL# 383: [ETRM BUS 90521 MACH '1 '] 1.2000 0.20000
CHNL# 382: [ETRM BUS 90520 MACH '1 '] 1.2000 0.20000
CHNL# 360: [ETRM BUS 90154 MACH '1 '] 1.2000 0.20000
CHNL# 320: [ETRM BUS 90113 MACH '1 '] 1.2000 0.20000
CHNL# 290: [ETRM BUS 90025 MACH '1 '] 1.2000 0.20000
CHNL# 285: [ETRM BUS 90020 MACH '1 '] 1.2000 0.20000
TIME (SECONDS)
TUE, JUL 03 2007 16:06
VOLTAGES

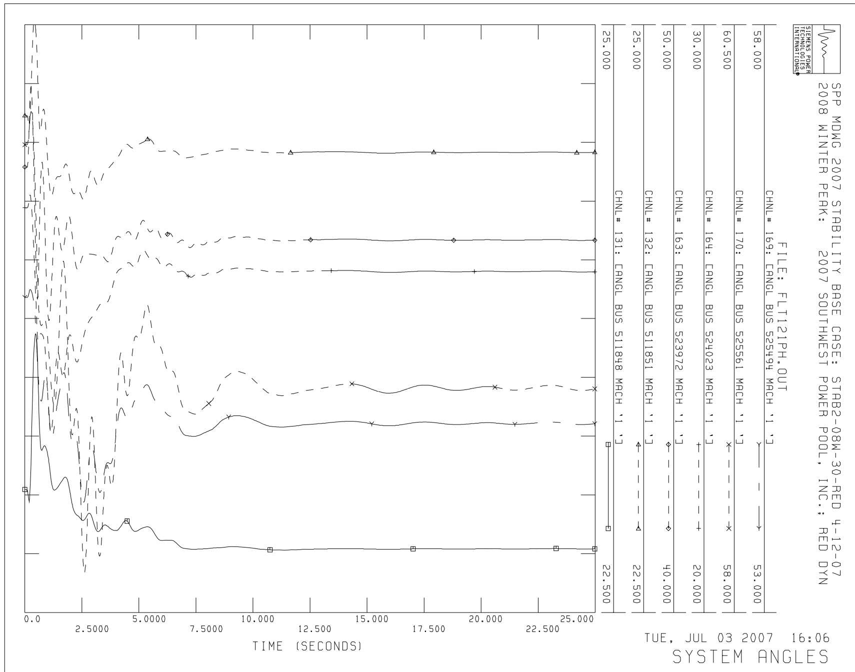
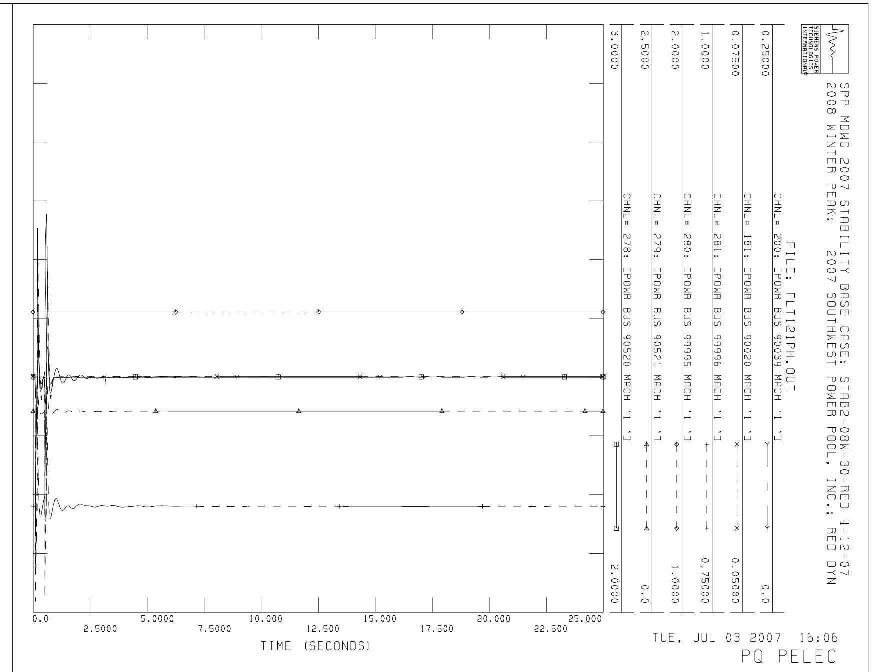
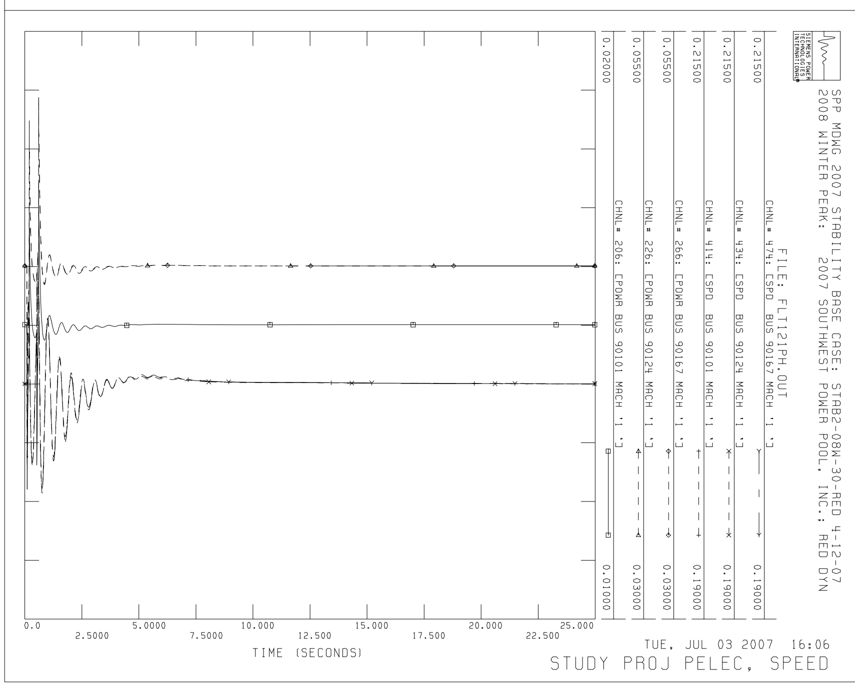
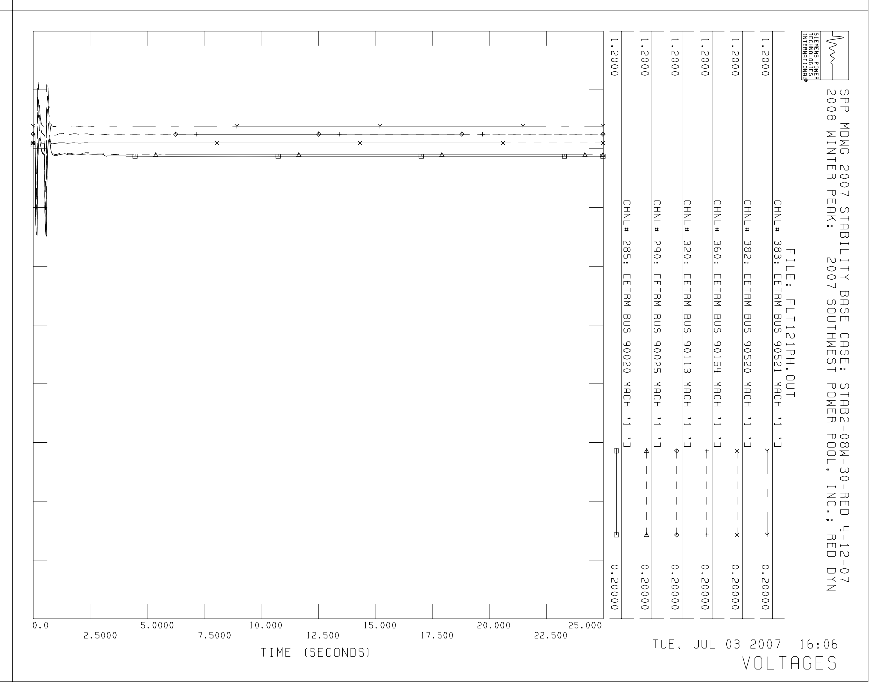

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT41PH.OUT
CHNL# 169: [ANGL BUS 525494 MACH '1 ']
CHNL# 170: [ANGL BUS 525561 MACH '1 ']
CHNL# 164: [ANGL BUS 524023 MACH '1 ']
CHNL# 163: [ANGL BUS 523972 MACH '1 ']
CHNL# 132: [ANGL BUS 511851 MACH '1 ']
CHNL# 131: [ANGL BUS 511848 MACH '1 ']
TIME (SECONDS)
TUE, JUL 03 2007 16:06
SYSTEM ANGLES
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT41PH.OUT
CHNL# 200: [POWR BUS 90039 MACH '1 ']
CHNL# 181: [POWR BUS 90020 MACH '1 ']
CHNL# 281: [POWR BUS 99996 MACH '1 ']
CHNL# 280: [POWR BUS 99995 MACH '1 ']
CHNL# 279: [POWR BUS 90521 MACH '1 ']
CHNL# 278: [POWR BUS 90520 MACH '1 ']
TIME (SECONDS)
TUE, JUL 03 2007 16:06
PQ PELEC
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT41PH.OUT
CHNL# 474: [SPD BUS 90167 MACH '1 ']
CHNL# 434: [SPD BUS 90124 MACH '1 ']
CHNL# 414: [SPD BUS 90101 MACH '1 ']
CHNL# 266: [POWR BUS 90167 MACH '1 ']
CHNL# 226: [POWR BUS 90124 MACH '1 ']
CHNL# 206: [POWR BUS 90101 MACH '1 ']
TIME (SECONDS)
TUE, JUL 03 2007 16:06
STUDY PROJ PELEC, SPEED
SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT41PH.OUT
CHNL# 383: [ETRM BUS 90521 MACH '1 ']
CHNL# 382: [ETRM BUS 90520 MACH '1 ']
CHNL# 360: [ETRM BUS 90154 MACH '1 ']
CHNL# 320: [ETRM BUS 90113 MACH '1 ']
CHNL# 290: [ETRM BUS 90025 MACH '1 ']
CHNL# 285: [ETRM BUS 90020 MACH '1 ']
TIME (SECONDS)
TUE, JUL 03 2007 16:06
VOLTAGES


SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT73PH.OUT
CHNL# 169: CANGL BUS 525494 MACH '1 '
CHNL# 170: CANGL BUS 525561 MACH '1 '
CHNL# 164: CANGL BUS 524023 MACH '1 '
CHNL# 163: CANGL BUS 523972 MACH '1 '
CHNL# 132: CANGL BUS 511851 MACH '1 '
CHNL# 131: CANGL BUS 511848 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
SYSTEM ANGLES


SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT73PH.OUT
CHNL# 200: CPOWR BUS 90039 MACH '1 '
CHNL# 181: CPOWR BUS 90020 MACH '1 '
CHNL# 281: CPOWR BUS 99996 MACH '1 '
CHNL# 280: CPOWR BUS 99995 MACH '1 '
CHNL# 279: CPOWR BUS 90521 MACH '1 '
CHNL# 278: CPOWR BUS 90520 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
PQ PELEC


SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT73PH.OUT
CHNL# 474: CSPD BUS 90167 MACH '1 '
CHNL# 434: CSPD BUS 90124 MACH '1 '
CHNL# 414: CSPD BUS 90101 MACH '1 '
CHNL# 266: CPOWR BUS 90167 MACH '1 '
CHNL# 226: CPOWR BUS 90124 MACH '1 '
CHNL# 206: CPOWR BUS 90101 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
STUDY PROJ PELEC, SPEED

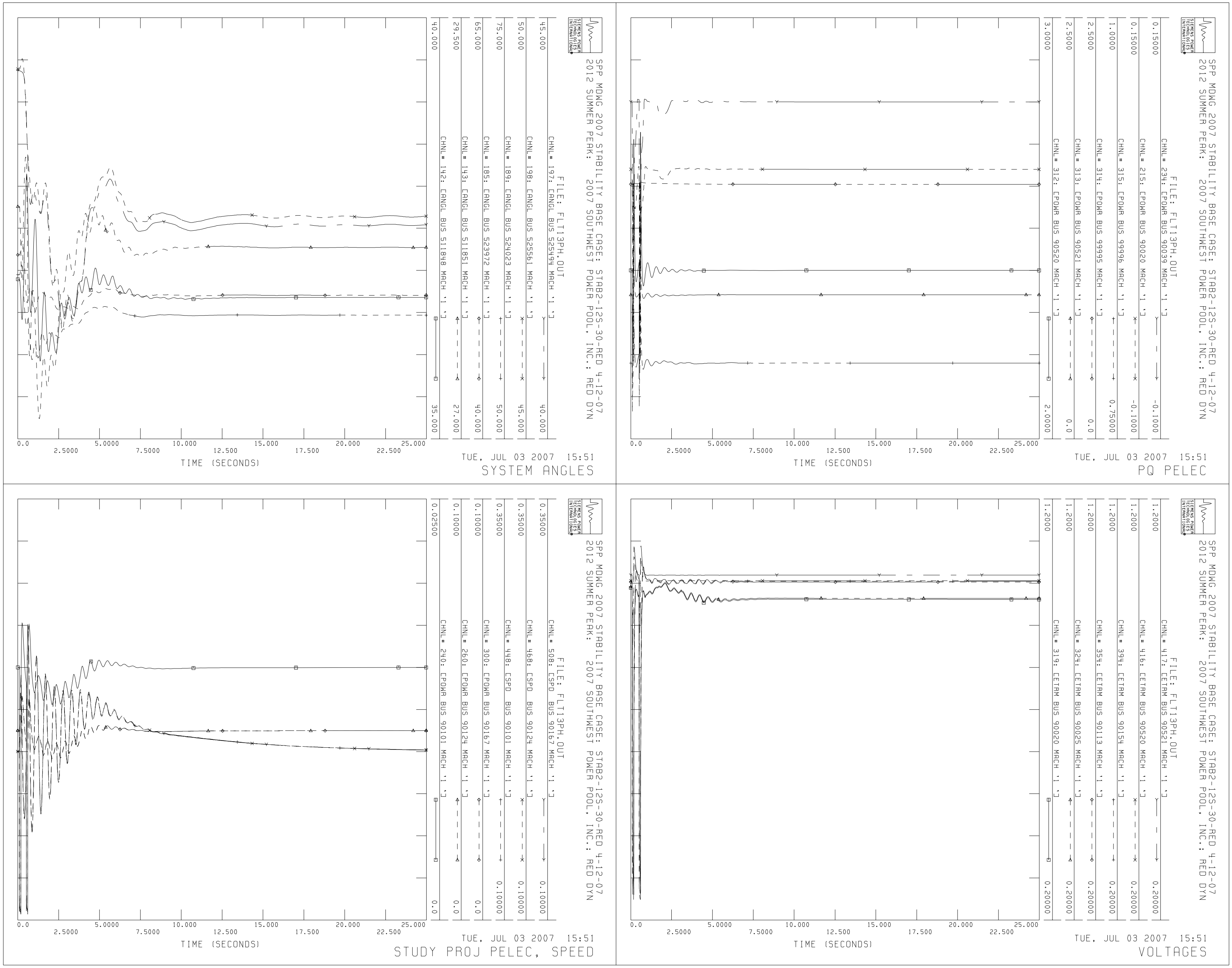

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT73PH.OUT
CHNL# 383: CETRM BUS 90521 MACH '1 '
CHNL# 382: CETRM BUS 90520 MACH '1 '
CHNL# 360: CETRM BUS 90154 MACH '1 '
CHNL# 320: CETRM BUS 90113 MACH '1 '
CHNL# 290: CETRM BUS 90025 MACH '1 '
CHNL# 285: CETRM BUS 90020 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
VOLTAGES


SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT12IPH.OUT
CHNL# 169: CANGL BUS 525494 MACH '1 '
CHNL# 170: CANGL BUS 525561 MACH '1 '
CHNL# 164: CANGL BUS 524023 MACH '1 '
CHNL# 163: CANGL BUS 523972 MACH '1 '
CHNL# 132: CANGL BUS 511851 MACH '1 '
CHNL# 131: CANGL BUS 511848 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
SYSTEM ANGLES

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT12IPH.OUT
CHNL# 200: CPOWR BUS 90039 MACH '1 '
CHNL# 181: CPOWR BUS 90020 MACH '1 '
CHNL# 281: CPOWR BUS 99996 MACH '1 '
CHNL# 280: CPOWR BUS 99995 MACH '1 '
CHNL# 279: CPOWR BUS 90521 MACH '1 '
CHNL# 278: CPOWR BUS 90520 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
PQ PELEC

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT12IPH.OUT
CHNL# 474: CSPD BUS 90167 MACH '1 '
CHNL# 434: CSPD BUS 90124 MACH '1 '
CHNL# 414: CSPD BUS 90101 MACH '1 '
CHNL# 266: CPOWR BUS 90167 MACH '1 '
CHNL# 226: CPOWR BUS 90124 MACH '1 '
CHNL# 206: CPOWR BUS 90101 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
STUDY PROJ PELEC, SPEED

SPP MDWG 2007 STABILITY BASE CASE: STAB2-08W-30-RED 4-12-07
2008 WINTER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT12IPH.OUT
CHNL# 383: CETRM BUS 90521 MACH '1 '
CHNL# 382: CETRM BUS 90520 MACH '1 '
CHNL# 360: CETRM BUS 90154 MACH '1 '
CHNL# 320: CETRM BUS 90113 MACH '1 '
CHNL# 290: CETRM BUS 90025 MACH '1 '
CHNL# 285: CETRM BUS 90020 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 16:06
VOLTAGES

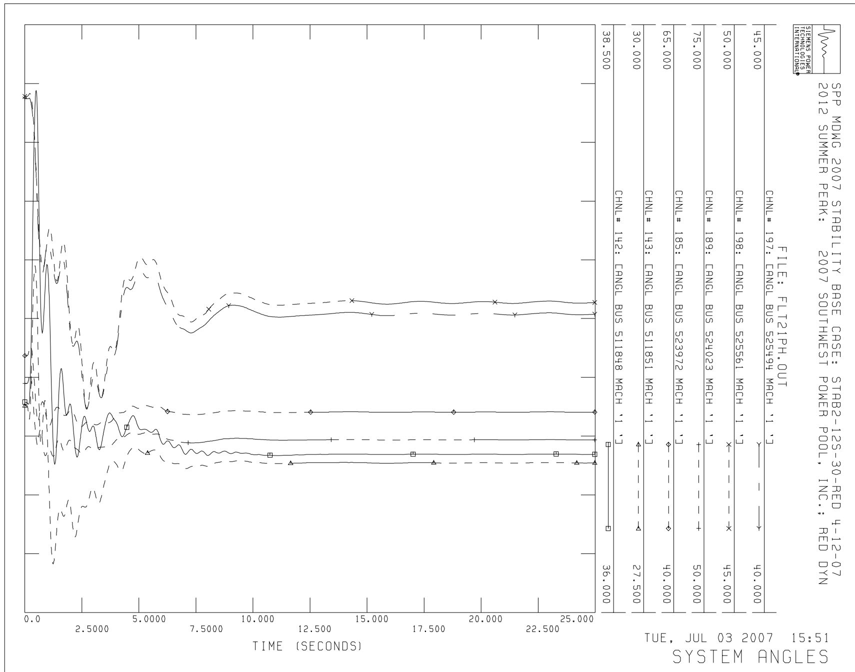
APPENDIX B.

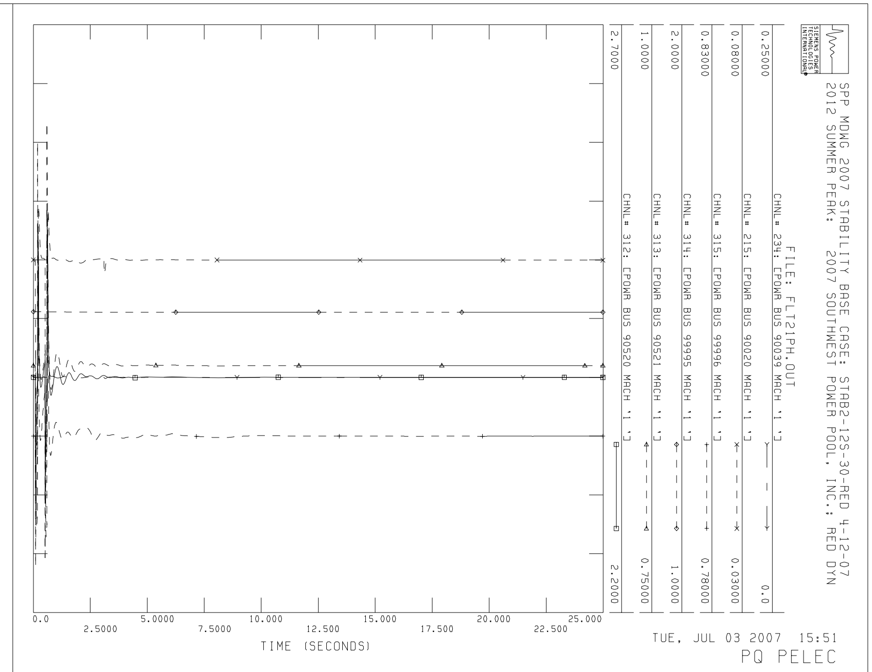
SELECTED STABILITY PLOTS -- 2012 SUMMER PEAK

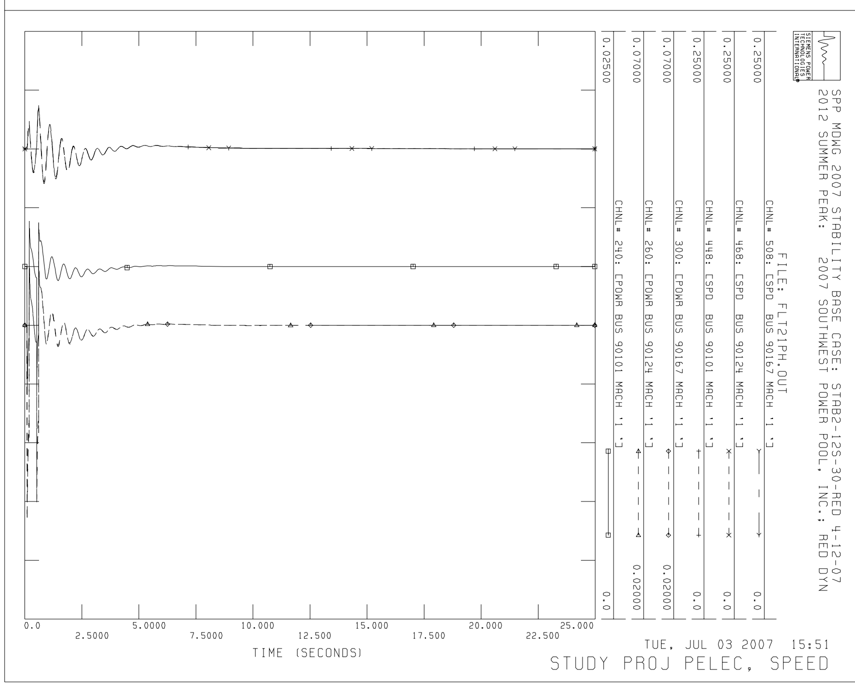
All plots available on request.

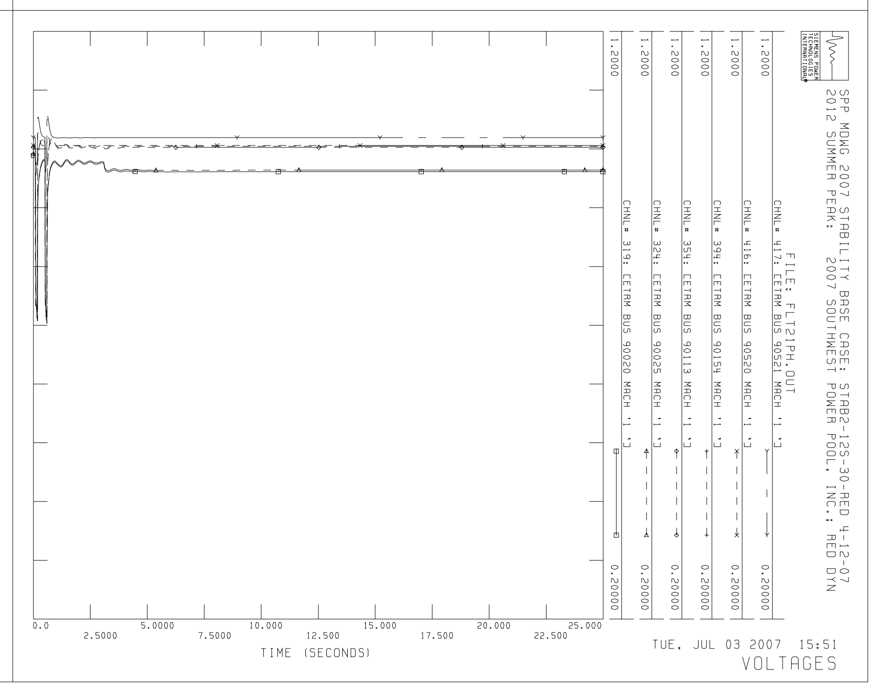


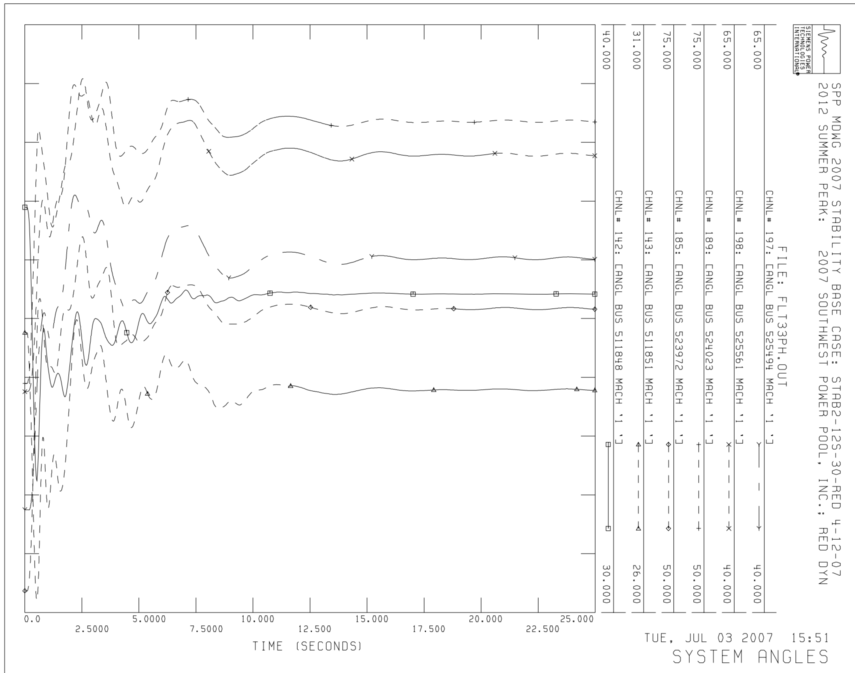
SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT13PH.OUT
CHNL# 197: CANGL BUS 525494 MACH '1 '
CHNL# 198: CANGL BUS 525561 MACH '1 '
CHNL# 189: CANGL BUS 524023 MACH '1 '
CHNL# 185: CANGL BUS 523972 MACH '1 '
CHNL# 143: CANGL BUS 511851 MACH '1 '
CHNL# 142: CANGL BUS 511848 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 15:51
SYSTEM ANGLES
CHNL# 234: CPOWR BUS 90039 MACH '1 '
CHNL# 215: CPOWR BUS 90020 MACH '1 '
CHNL# 315: CPOWR BUS 99996 MACH '1 '
CHNL# 314: CPOWR BUS 99995 MACH '1 '
CHNL# 313: CPOWR BUS 90521 MACH '1 '
CHNL# 312: CPOWR BUS 90520 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 15:51
PQ PELEC
CHNL# 508: CSPD BUS 90167 MACH '1 '
CHNL# 468: CSPD BUS 90124 MACH '1 '
CHNL# 448: CSPD BUS 90101 MACH '1 '
CHNL# 300: CPOWR BUS 90167 MACH '1 '
CHNL# 260: CPOWR BUS 90124 MACH '1 '
CHNL# 240: CPOWR BUS 90101 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 15:51
STUDY PROJ PELEC, SPEED
CHNL# 417: CETRM BUS 90521 MACH '1 '
CHNL# 416: CETRM BUS 90520 MACH '1 '
CHNL# 394: CETRM BUS 90154 MACH '1 '
CHNL# 354: CETRM BUS 90113 MACH '1 '
CHNL# 324: CETRM BUS 90025 MACH '1 '
CHNL# 319: CETRM BUS 90020 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 15:51
VOLTAGES

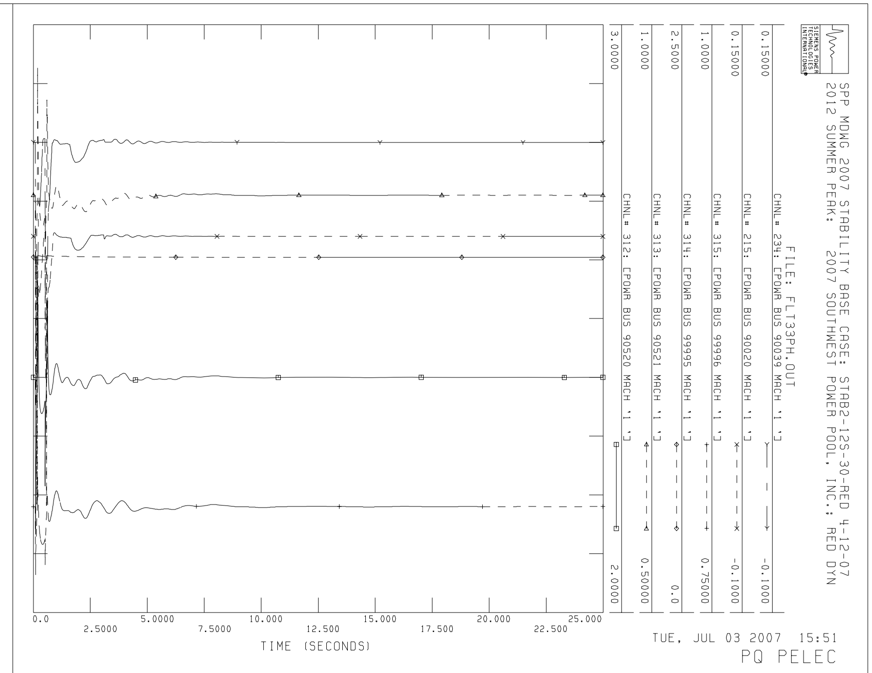

SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT21PH.OUT
CHNL# 197: CANGL BUS 525499 MACH '1 ' 45.000 40.000
CHNL# 198: CANGL BUS 525561 MACH '1 ' 50.000 45.000
CHNL# 189: CANGL BUS 524023 MACH '1 ' 75.000 50.000
CHNL# 185: CANGL BUS 523972 MACH '1 ' 65.000 40.000
CHNL# 143: CANGL BUS 511851 MACH '1 ' 30.000 27.500
CHNL# 142: CANGL BUS 511848 MACH '1 ' 38.500 36.000
TIME (SECONDS)
TUE, JUL 03 2007 15:51
SYSTEM ANGLES

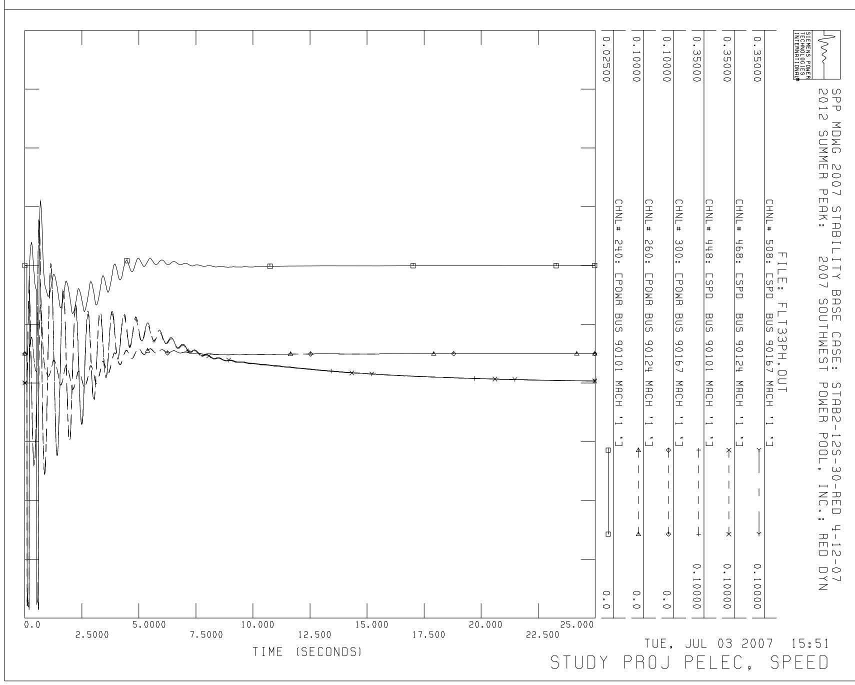

SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT21PH.OUT
CHNL# 234: CPOWR BUS 90039 MACH '1 ' 0.25000 0.0
CHNL# 215: CPOWR BUS 90020 MACH '1 ' 0.08000 0.03000
CHNL# 315: CPOWR BUS 99996 MACH '1 ' 0.83000 0.78000
CHNL# 314: CPOWR BUS 99995 MACH '1 ' 2.0000 1.0000
CHNL# 313: CPOWR BUS 90521 MACH '1 ' 1.0000 0.75000
CHNL# 312: CPOWR BUS 90520 MACH '1 ' 2.7000 2.2000
TIME (SECONDS)
TUE, JUL 03 2007 15:51
PQ PELEC

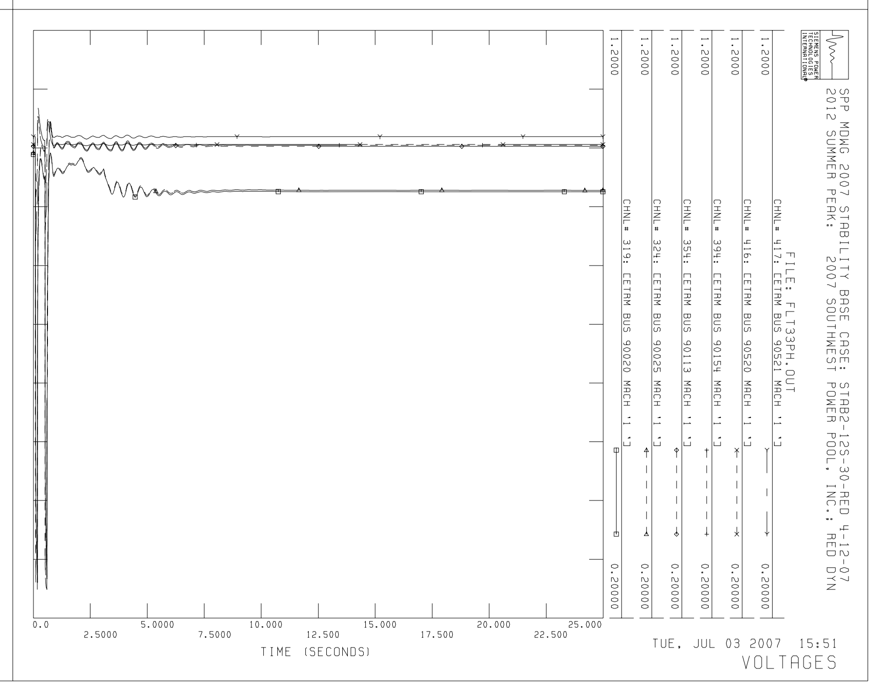

SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT21PH.OUT
CHNL# 508: CSPD BUS 90167 MACH '1 ' 0.25000 0.0
CHNL# 468: CSPD BUS 90124 MACH '1 ' 0.25000 0.0
CHNL# 448: CSPD BUS 90101 MACH '1 ' 0.25000 0.0
CHNL# 300: CPOWR BUS 90167 MACH '1 ' 0.07000 0.02000
CHNL# 260: CPOWR BUS 90124 MACH '1 ' 0.07000 0.02000
CHNL# 240: CPOWR BUS 90101 MACH '1 ' 0.02500 0.0
TIME (SECONDS)
TUE, JUL 03 2007 15:51
STUDY PROJ PELEC, SPEED

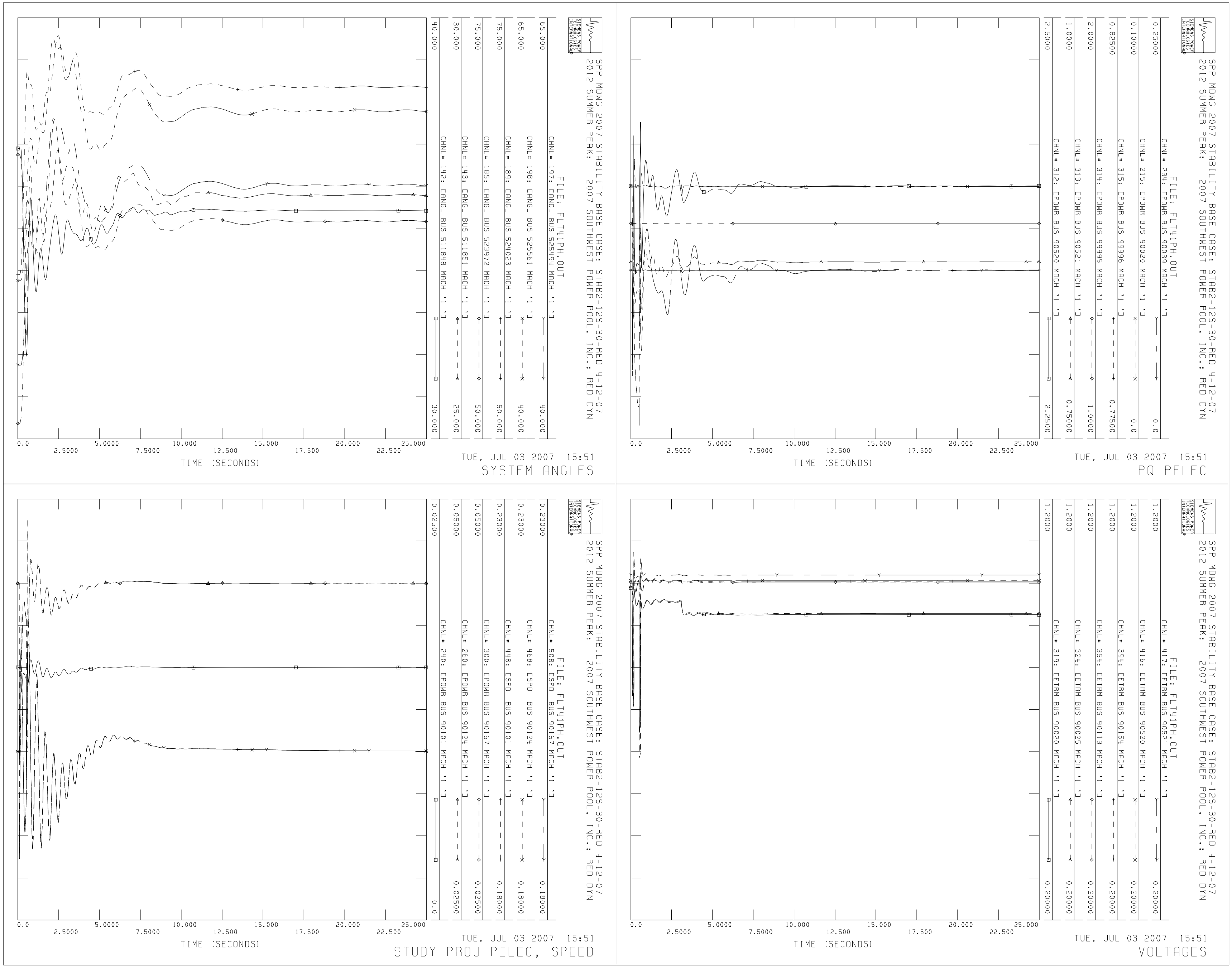

SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT21PH.OUT
CHNL# 417: CETRM BUS 90521 MACH '1 ' 1.2000 0.20000
CHNL# 416: CETRM BUS 90520 MACH '1 ' 1.2000 0.20000
CHNL# 394: CETRM BUS 90154 MACH '1 ' 1.2000 0.20000
CHNL# 354: CETRM BUS 90113 MACH '1 ' 1.2000 0.20000
CHNL# 324: CETRM BUS 90025 MACH '1 ' 1.2000 0.20000
CHNL# 319: CETRM BUS 90020 MACH '1 ' 1.2000 0.20000
TIME (SECONDS)
TUE, JUL 03 2007 15:51
VOLTAGES

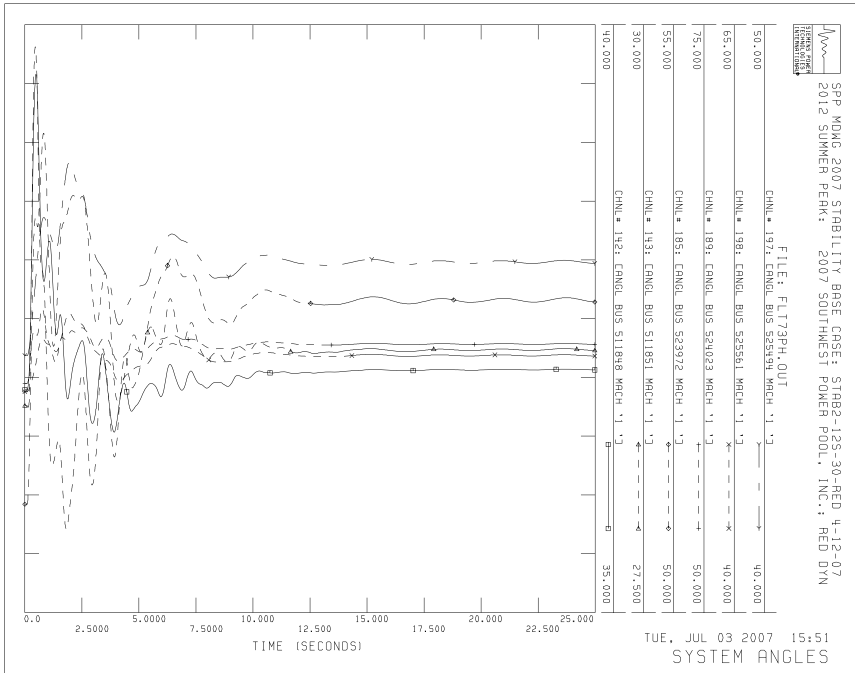
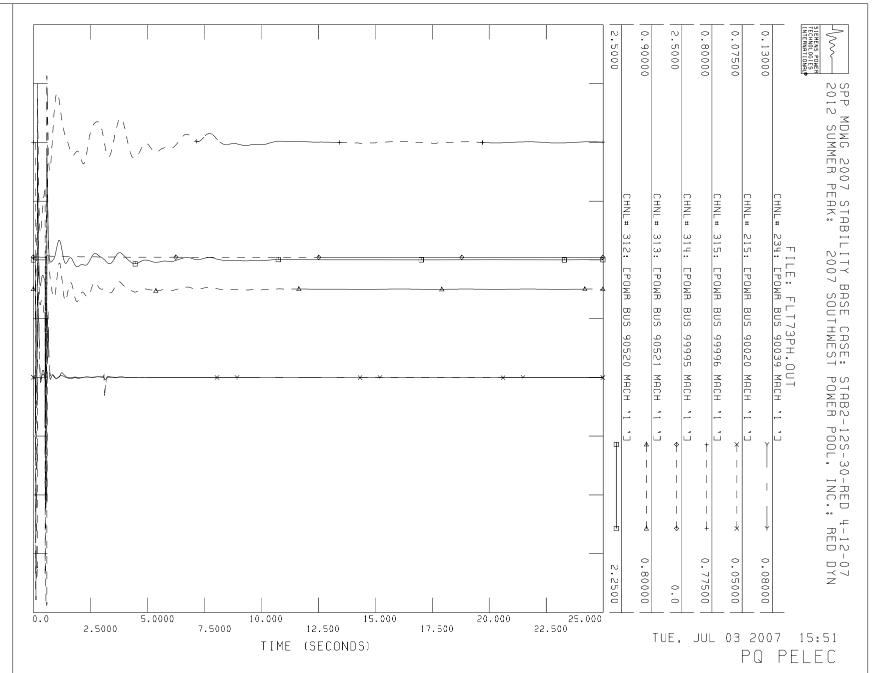
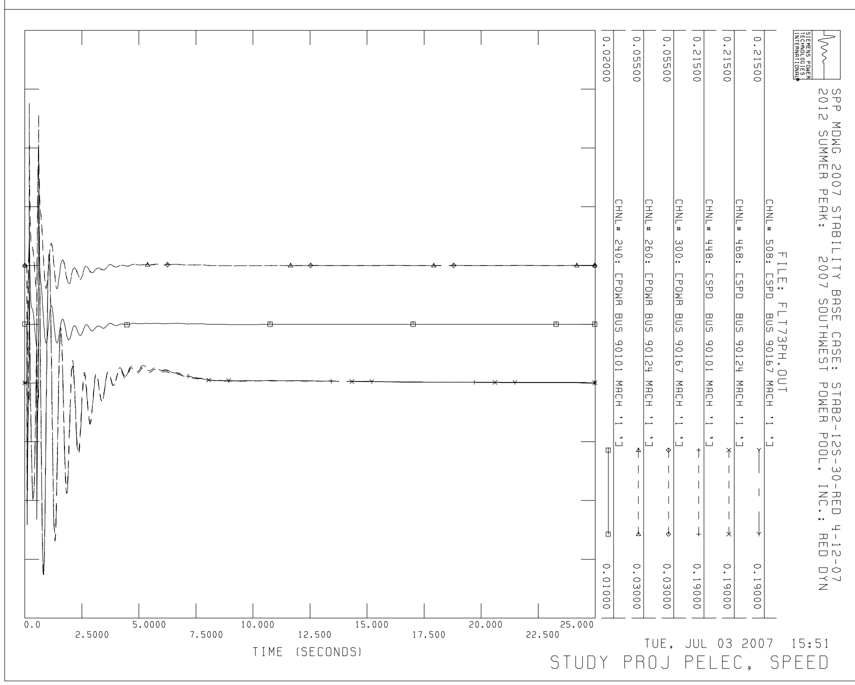
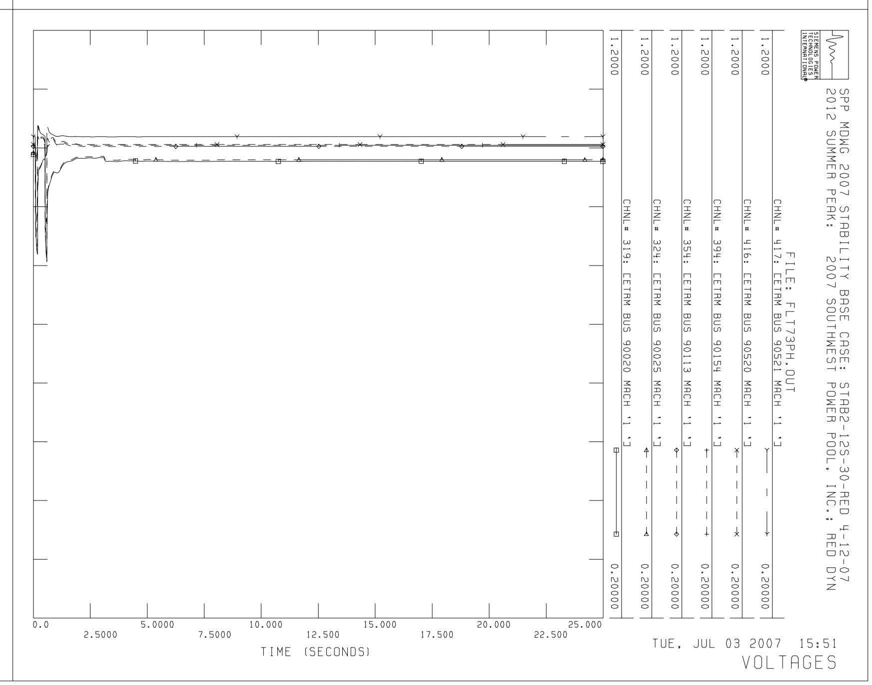

SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT33PH.OUT
CHNL# 197: CANGL BUS 525494 MACH '1 ' 65.000 40.000
CHNL# 198: CANGL BUS 525561 MACH '1 ' 65.000 40.000
CHNL# 189: CANGL BUS 524023 MACH '1 ' 75.000 50.000
CHNL# 185: CANGL BUS 523972 MACH '1 ' 75.000 50.000
CHNL# 143: CANGL BUS 511851 MACH '1 ' 31.000 26.000
CHNL# 142: CANGL BUS 511848 MACH '1 ' 40.000 30.000
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
TIME (SECONDS)
TUE, JUL 03 2007 15:51
SYSTEM ANGLES

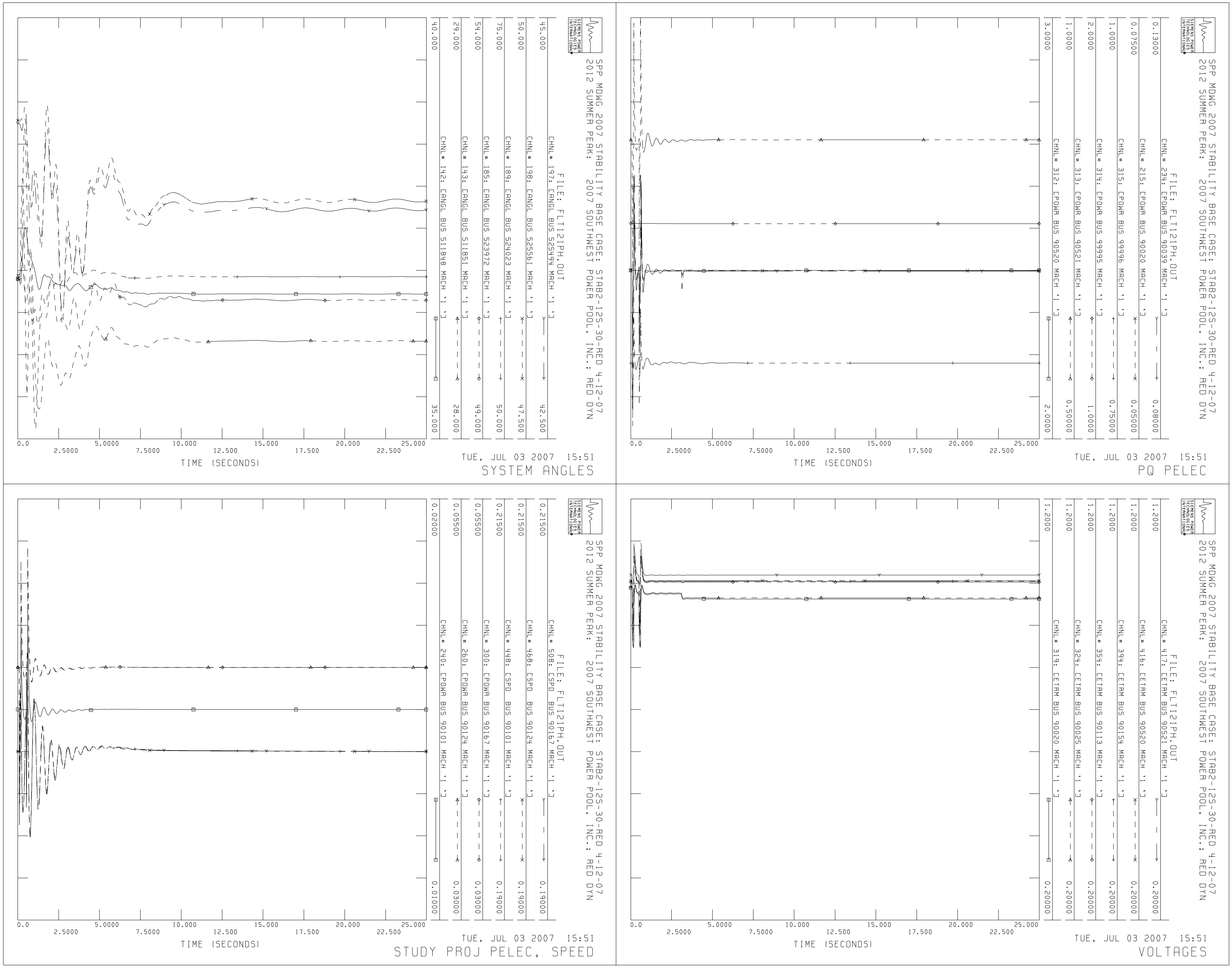

SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT33PH.OUT
CHNL# 234: CPOWR BUS 90039 MACH '1 ' 0.15000 -0.1000
CHNL# 215: CPOWR BUS 90020 MACH '1 ' 0.15000 -0.1000
CHNL# 315: CPOWR BUS 99996 MACH '1 ' 1.0000 0.75000
CHNL# 314: CPOWR BUS 99995 MACH '1 ' 2.5000 0.0
CHNL# 313: CPOWR BUS 90521 MACH '1 ' 1.0000 0.50000
CHNL# 312: CPOWR BUS 90520 MACH '1 ' 3.0000 2.0000
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
TIME (SECONDS)
TUE, JUL 03 2007 15:51
PQ PELEC


SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT33PH.OUT
CHNL# 508: CSPD BUS 90167 MACH '1 ' 0.35000 0.10000
CHNL# 468: CSPD BUS 90124 MACH '1 ' 0.35000 0.10000
CHNL# 448: CSPD BUS 90101 MACH '1 ' 0.35000 0.10000
CHNL# 300: CPOWR BUS 90167 MACH '1 ' 0.10000 0.0
CHNL# 260: CPOWR BUS 90124 MACH '1 ' 0.10000 0.0
CHNL# 240: CPOWR BUS 90101 MACH '1 ' 0.02500 0.0
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
TIME (SECONDS)
TUE, JUL 03 2007 15:51
STUDY PROJ PELEC, SPEED


SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT33PH.OUT
CHNL# 417: CETRM BUS 90521 MACH '1 ' 1.2000 0.20000
CHNL# 416: CETRM BUS 90520 MACH '1 ' 1.2000 0.20000
CHNL# 394: CETRM BUS 90154 MACH '1 ' 1.2000 0.20000
CHNL# 354: CETRM BUS 90113 MACH '1 ' 1.2000 0.20000
CHNL# 324: CETRM BUS 90025 MACH '1 ' 1.2000 0.20000
CHNL# 319: CETRM BUS 90020 MACH '1 ' 1.2000 0.20000
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
TIME (SECONDS)
TUE, JUL 03 2007 15:51
VOLTAGES


SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT41PH.OUT
TIME (SECONDS)
TUE, JUL 03 2007 15:51
SYSTEM ANGLES
PQ PELEC
STUDY PROJ PELEC, SPEED
VOLTAGES


SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT73PH.OUT
CHNL# 197: CANGL BUS 525494 MACH '1 ' 50.000 40.000
CHNL# 198: CANGL BUS 525561 MACH '1 ' 65.000 40.000
CHNL# 189: CANGL BUS 524023 MACH '1 ' 75.000 50.000
CHNL# 185: CANGL BUS 523972 MACH '1 ' 55.000 50.000
CHNL# 143: CANGL BUS 511851 MACH '1 ' 30.000 27.500
CHNL# 142: CANGL BUS 511848 MACH '1 ' 40.000 35.000
TIME (SECONDS)
TUE, JUL 03 2007 15:51
SYSTEM ANGLES

SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT73PH.OUT
CHNL# 234: CPOWR BUS 90039 MACH '1 ' 0.13000 0.08000
CHNL# 215: CPOWR BUS 90020 MACH '1 ' 0.07500 0.05000
CHNL# 315: CPOWR BUS 99996 MACH '1 ' 0.80000 0.77500
CHNL# 314: CPOWR BUS 99995 MACH '1 ' 2.5000 0.0
CHNL# 313: CPOWR BUS 90521 MACH '1 ' 0.90000 0.80000
CHNL# 312: CPOWR BUS 90520 MACH '1 ' 2.5000 2.2500
TIME (SECONDS)
TUE, JUL 03 2007 15:51
PQ PELEC

SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT73PH.OUT
CHNL# 508: CSPD BUS 90167 MACH '1 ' 0.21500 0.19000
CHNL# 468: CSPD BUS 90124 MACH '1 ' 0.21500 0.19000
CHNL# 448: CSPD BUS 90101 MACH '1 ' 0.21500 0.19000
CHNL# 300: CPOWR BUS 90167 MACH '1 ' 0.05500 0.03000
CHNL# 260: CPOWR BUS 90124 MACH '1 ' 0.05500 0.03000
CHNL# 240: CPOWR BUS 90101 MACH '1 ' 0.02000 0.01000
TIME (SECONDS)
TUE, JUL 03 2007 15:51
STUDY PROJ PELEC, SPEED

SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT73PH.OUT
CHNL# 417: CETRM BUS 90521 MACH '1 ' 1.2000 0.20000
CHNL# 416: CETRM BUS 90520 MACH '1 ' 1.2000 0.20000
CHNL# 394: CETRM BUS 90154 MACH '1 ' 1.2000 0.20000
CHNL# 354: CETRM BUS 90113 MACH '1 ' 1.2000 0.20000
CHNL# 324: CETRM BUS 90025 MACH '1 ' 1.2000 0.20000
CHNL# 319: CETRM BUS 90020 MACH '1 ' 1.2000 0.20000
TIME (SECONDS)
TUE, JUL 03 2007 15:51
VOLTAGES


SPP MDWG 2007 STABILITY BASE CASE: STAB2-12S-30-RED 4-12-07
2012 SUMMER PEAK: 2007 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT121PH.OUT
CHNL# 197: CANGL BUS 525494 MACH '1 '
CHNL# 198: CANGL BUS 525561 MACH '1 '
CHNL# 189: CANGL BUS 524023 MACH '1 '
CHNL# 185: CANGL BUS 523972 MACH '1 '
CHNL# 143: CANGL BUS 511851 MACH '1 '
CHNL# 142: CANGL BUS 511848 MACH '1 '
TIME (SECONDS)
TUE, JUL 03 2007 15:51
SYSTEM ANGLES
CHNL# 234: CPOWR BUS 90039 MACH '1 '
CHNL# 215: CPOWR BUS 90020 MACH '1 '
CHNL# 315: CPOWR BUS 99996 MACH '1 '
CHNL# 314: CPOWR BUS 99995 MACH '1 '
CHNL# 313: CPOWR BUS 90521 MACH '1 '
CHNL# 312: CPOWR BUS 90520 MACH '1 '
PQ PELEC
CHNL# 508: CSPD BUS 90167 MACH '1 '
CHNL# 468: CSPD BUS 90124 MACH '1 '
CHNL# 448: CSPD BUS 90101 MACH '1 '
CHNL# 300: CPOWR BUS 90167 MACH '1 '
CHNL# 260: CPOWR BUS 90124 MACH '1 '
CHNL# 240: CPOWR BUS 90101 MACH '1 '
STUDY PROJ PELEC, SPEED
CHNL# 417: CETRM BUS 90521 MACH '1 '
CHNL# 416: CETRM BUS 90520 MACH '1 '
CHNL# 394: CETRM BUS 90154 MACH '1 '
CHNL# 354: CETRM BUS 90113 MACH '1 '
CHNL# 324: CETRM BUS 90025 MACH '1 '
CHNL# 319: CETRM BUS 90020 MACH '1 '
VOLTAGES