Southwest Power Pool

Expedited Impact Study Generation Interconnection Request GEN-2006-015

SPP Tariff Studies

(#GEN-2006-015)

June 2006

1 Executive Summary

<OMITTED TEXT> (Customer) has requested the Southwest Power Pool (SPP) to conduct a Feasibility Study and Impact Study through the SPP Tariff for a new Frame-7 170 MW combustion turbine (CT) connected to the existing Mustang substation as shown in Figure 1. The Mustang substation is located within the control area of Southwestern Public Service Company (SPS) (d/b/a Xcel Enerrgy, Inc.) The proposed in-service date is June 1, 2007.

For the Feasibility Study:

Powerflow analysis has indicated that for the powerflow cases studied, it is possible to interconnect the 170MW of generation with transmission system reinforcements within the local transmission system. Powerflow analysis was conducted with and without the study project to identify the proposed generator's impact on the local area. Five seasonal models were studied, the 2007 summer peak, 2007 winter peak, 2011 summer peak, 2011 winter peak, and the 2016 summer peak. For the contingency tests, SWPS was monitored for overloads that are greater than base case overloads + 3% and voltage below 0.9 pu and have a drop greater than 3% of the base case.

The minimum cost of interconnecting the Customer project is estimated at $0 for SPS's interconnection Network Upgrade facilities listed in Table 1. At this time, the cost estimates for the Direct Assignment facilities have not been defined by the Customer. These interconnection costs do not include any cost that may be associated with short circuit analysis. These costs likewise do not include all costs associated with the deliverability of the energy to final customers. Such costs are determined by separate studies if the Customer requests transmission service through SPP's OASIS.

For the Impact Study:

Twenty (20) contingencies were considered for the transient stability simulations which included three phase faults as well as single phase line faults on the 115 kV and 230 kV substations nearby the study project. 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. Three seasonal models were studied, the 2007 summer peak, 2007 winter peak, and the 2011 summer peak.

Table 5 shows the list of simulated contingencies. The table also shows the fault clearing time and the time delay before re-closing for all the study contingencies. The stability simulation shows that the study plant would not degrade the stability performance of the system.

The impact study finds that the study project addition shows stable performance of the SPP system for the contingencies tested on the supplied base cases.

2 Introduction

<OMITTED TEXT> (Customer) has requested the Southwest Power Pool (SPP) to conduct a generator interconnection feasibility and impact study through the SPP Tariff for new Frame-7 170 MW combustion turbine (CT) connected to the existing Mustang substation as shown in Figure 1. This CT will be interconnected using a set of new 230 kV breakers and switches in accordance with the proposed one-line. The existing substation is owned by SWPS (d/b/a Xcel Energy). The customer has asked for a load flow and Impact study case of 100% MW.

For the Feasibility study, five base cases were used in the study: 2007 summer peak, 2007 winter, 2011 summer peak, 2011 winter peak, and 2016 summer Peak. For the Impact Study, three base cases were used, 2007 summer peak, 2007 winter peak, and the 2011 summer peak.

3 Feasibility Study

3.1 Interconnection Facilities

The Feasibility Study assesses the practicality and costs involved to incorporate the study project into the SPP Transmission System. The analysis is limited to load flow analysis of the more probable contingencies within the Transmission Owner's control area and key adjacent areas.

The Feasibility Study is intended to identify attachment facilities and other direct assignment facilities needed to accept power into the grid at the interconnection receipt point. GEN-2006-015 will be interconnected to the Mustang 230 kV substation owned by SWPS (d/b/a Xcel Energy).

Table 1: Direct Assignment Facilities

Facility	Estimated Cost to Customer
Customer – Add the following at Mustang substation:	
• Step-up transformer 18/230 kV, 115/213.8 MVA	*
• 230 kV PTs	*
• Auxiliary service transformer 230/4.16 kV, 12/16/20 MVA	*
Total	*

*Note: * Estimate of cost to be determined by Customer*

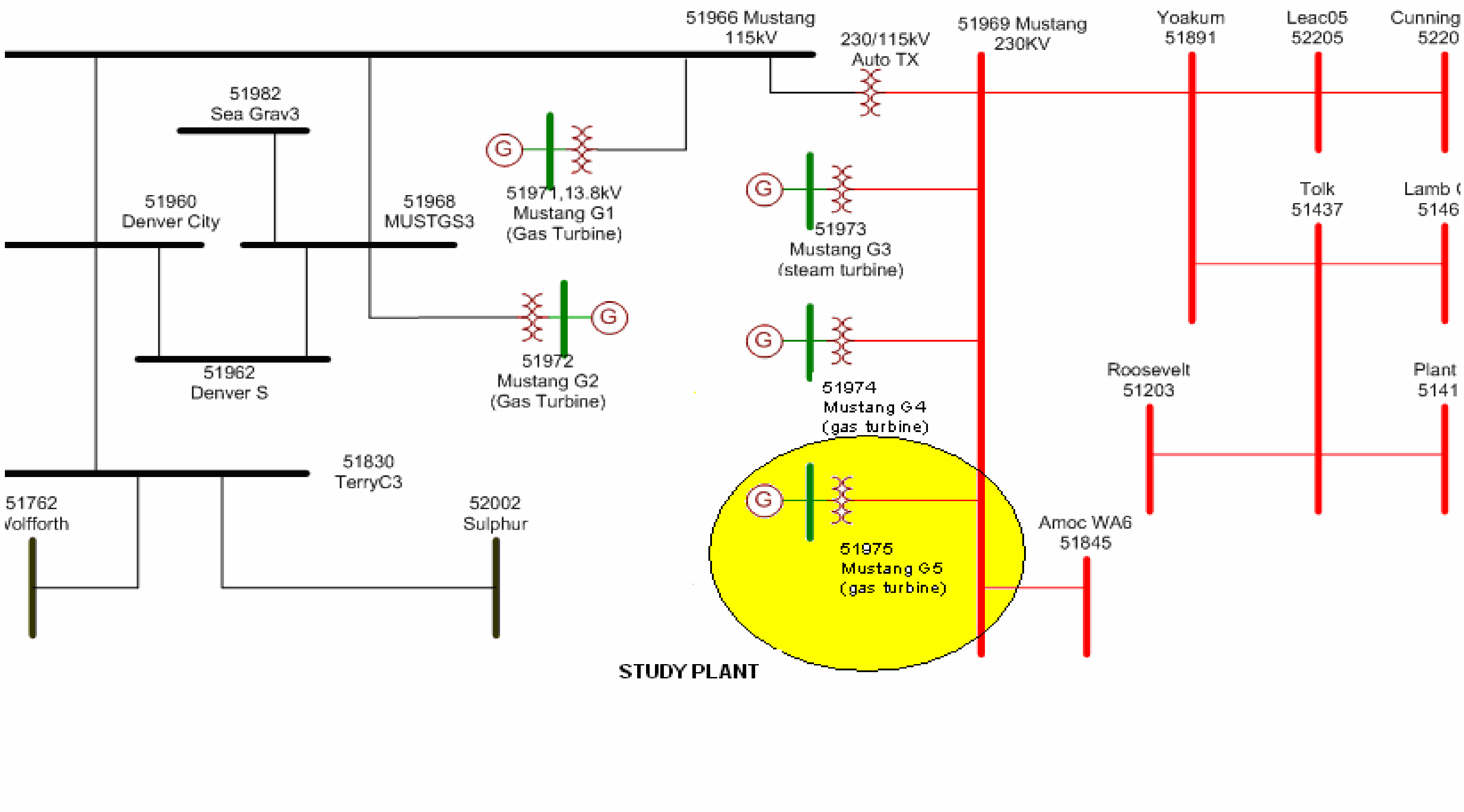


Figure 1 One Line Diagrams Showing the 170 MW Study Plant and the Nearby Substations

Table 2: Required Interconnection Network Upgrade Facilities

Facility	Estimated Cost
None	$0

Table 3: Network Constraints

Facility
SWPS – Mustang 230/115kV auto, 51966-51969
SWPS – Yoakum 230/115kV auto, 58190-51891
SWPS – Denver N-Mustang 115kV, 51960-51966
SWPS – Denver S-Mustang 115kV, 51962-51968

Table 4: Contingency Analysis Results

Facility	Model and Contingency	Facility Loading (% Rate B; first season)	ATC (MW) (2007sp only)	Date Required
Mustang 230/115kV autotransformer, 51966 – 51969	07sp, 11sp, 16sp / Yoakum 230/115kV transformer , 51890 - 51891	125.5	18	6/1/2007
Yoakum 230/115kV autotransformer, 51890 – 51891	07sp, 11sp, 16sp / Mustang 230/115kV auto 51966 - 51969	107.9	93	6/1/2007
Denver N-Mustang 115kV, 51960-51966	07sp, 11sp, 16sp / Denver S-Mustang 115kV, 51962-51968	102.2	114	6/1/2007
Denver S-Mustang 115kV, 51962-51968	11sp, 16sp / Denver N-Mustang 115kV, 51960-51966	101.1	128	6/1/2007

Note: When transmission service associated with this interconnection is evaluated, the loading of the facilities listed in this table may be greater due to higher priority reservations. If the loading of a facility is higher, the level of ATC will be lower.

3.2 Powerflow Analysis

Powerflow Analysis was conducted with and without the study project to identify the study project's impact on the local area. In the power flow, the 160 MW study plant was added to the base case as a new source delivering to the Mustang 230 kV bus.

The results of load flow analysis include power flow and voltage magnitudes under probable contingency conditions. The results of the load flow study are used to identify equipment overloads and voltage impacts that may be encountered due to the addition of new generation. Probable contingencies comprise of single contingencies in the study area and their impact on transmission elements in the monitored area.

Five base cases were used in the study: 2007 summer peak, 2007 winter peak, 2011 summer peak, 2011 winter peak, and 2016 summer peak. There is one prior queued project, the previously studied Mustang 4 CT unit. The study project is dispatched only into SPP member SWPS. Half of the output was accounted for by adjusting load in the model while the other half was accounted for by redispatching SWPS generation. For the contingency tests, SWPS is monitored. Overloads that are greater than base case overloads + 3% and voltage below 0.9 pu and have a drop greater than 3% of the base case, are checked in the results.

3.3 Methodology

The SPP criteria applied to the Feasibility Study states that: "The transmission system of the SPP region shall be planned and constructed so that the contingencies as set forth in the Criteria will meet the applicable NERC Planning Standards for System Adequacy and Security – Transmission System Table 1, and its applicable standards and measurements."

The analysis was conducted by assessing single contingencies in SWPS using power flows. This is consistent with the more probable contingency testing criteria mandated by NERC and the SPP.

3.4 Conclusion

The minimum cost of interconnecting the Customer project is estimated at $0 for SWPS's interconnection Network Upgrade facilities listed in Table 1. At this time, the cost estimates for the Direct Assignment facilities have not been defined by the Customer.

These interconnection costs do not include any cost that may be associated with short circuit analysis. The required interconnection costs listed in Table 1 and other upgrades associated with Network Constraints listed in Table 3 do not include all 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 SPP's OASIS.

4 Impact Study

4.1 Objective

The objective of the impact study is to determine the impact on system stability of connecting the proposed GEN-2006-015 combustion turbine to SPP's 230 kV transmission system. Three base cases were provided by SPP for the stability simulations: 2007 Summer Peak, 2007 Winter, and 2011 Summer Peak.

4.2 The Study Plant Model

The customer provided generator data of the study plant. This data was converted into a PTI compatible *.dyr file as shown in Appendix A. The Customer supplied data for the generator and exciter. A generic model was used for the governor. The plant was dispatched against the existing plant in the system maintaining current area interchange totals.

4.3 Contingencies Simulated

Twenty (20) contingencies were considered for the transient stability simulations which included three phase faults as well as Single-phase line faults on the 115 kV and 230 kV substations nearby the study project. 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.

Table 5 shows the list of simulated contingencies. The table also shows the fault clearing time and the time delay before re-closing for all the study contingencies.

The 20 second "no fault" runs were performed prior to running the contingencies listed in Table 5, and the results shows flat machines angle performance.

4.4 Impact Study Results

The stability simulation shows that the study plant would not degrade the stability performance of the system. The impact study finds that the study project addition shows stable performance of the SPP system for the contingencies tested on the supplied base cases.

Table 5 List of Contingencies and Results Summary for Impact Study

Legend:
-- : System shows stable performance
S : Stability issues encountered
UV : Tripped due to low voltage

Cont .No.	***Cont.Name***	***Description***	***<u>Case-1:</u> 2007 Summer Peak***	***<u>Case-2:</u> 2007 Winter Case***	***<u>Casse-3:</u> 2011 Summer Peak***
1	FLT13PH	3-phase fault on the Cunningham (52209) to Yoakum (51891) 230 kV line near Cunningham. a. Apply Fault at the Cunningham bus (52209) b. Clear Fault after 5 cycles by removing the line from Cunningham (52209) to Yoakum (51891). c. Wait 30 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 Tolk (51437) to Yoakum (51891) 230 kV line near Tolk a. Fault on the Tolk (51437) to Yoakum (51891) 230 kV line near Tolk b. Apply fault at the Tolk bus (51437). c. Clear fault after 5 cycles by removing the 230 kV line from Tolk (51437) to Yoakum (51891). d. Wait 30 cycles, and then re-close the line in (b) into the fault. e. 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*	--	--	--

Cont .No.	***Cont.Name***	***Description***	***<u>Case-1:</u> 2007 Summer Peak***	***<u>Case-2:</u> 2007 Winter Case***	***<u>Casse-3:</u> 2011 Summer Peak***
5	FLT53PH	3-phase fault on the Roosevelt (51203) to Tolk (51437) 230 kV line near Roosevelt. a. Apply Fault at the Roosevelt bus (51203). b. Trip the line after 5 cycles by removing the line from Roosevelt (51203) to Tolk (51437. c. Wait 30 cycles, and then re-close the line in (b) 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 Lamb Co. bus (51467) to Tolk (51437) 230 kV line, near Lamb Co. a. Apply fault at the Lamb Co. bus (51467). b. Clear fault after 5 cycles by tripping the line from Lamb Co. bus (51467) to Tolk (51437). c. Wait 30 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	FLT81PH	*Single phase fault and sequence like Cont. No. 7*	--	--	--
9	FLT93PH	3-phase fault on the Tolk (51437) to Plant X (51419) 230 kV line, near Plant X. a. Apply fault at the Plant X bus (51419). b. Clear fault after 5 cycles by tripping the line from Tolk (51437) to Plant X (51419). 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*	--	--	--

Cont .No.	*Cont.Name*	*Description*	***<u>Case-1:</u> 2007 Summer Peak***	***<u>Case-2:</u> 2007 Winter Case***	***<u>Casse-3:</u> 2011 Summer Peak***
11	FLT113PH	3-phase fault on the Denver S. (51962) to Denver City (51960) 115 kV line, near Denver S. a. Apply fault at the Denver S. bus (51962). b. Clear fault after 5 cycles by tripping the line Denver S. (51962) to Denver City (51960). c. Wait 20 cycles, and then re-close 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 Denver City (51960) to Terry Co. (51830) 115 kV line, near Terry Co. a. Apply fault at the Terry Co. bus (51830). b. Clear fault after 5 cycles by tripping the line from Denver City (51960) to Terry Co. (51830). c. Wait 20 cycles, and then re-close line in (b) back into the fault. d. Leave fault on for 5 cycles, then trip the line in (b) and remove fault.	--	--	--
14	FLT141PH	*Single phase fault and sequence like Cont. No. 13*	--	--	--
15	FLT153PH	3-phase fault on the Terry Co. (51830) to Wolfforth (51762) 115 kV line, near Wolfforth. a. Apply fault at the Wolfforth bus (51762). b. Clear fault after 5 cycles by tripping the line from Terry Co. (51830) to Wolfforth (51762). 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*	--	--	--

Cont .No.	*Cont.Name*	*Description*	***<u>Case-1:</u>* 2007 Summer Peak**	***<u>Case-2:</u>* 2007 Winter Case**	***<u>Casse-3:</u>* 2011 Summer Peak**
17	FLT173PH	3-phase Fault on the Terry Co. (51830) to Sulphur Springs (52002) 115 kV line near Sulphur Springs. a. Apply fault at the Sulphur Springs bus (52002). b. Clear fault after 5 cycles by tripping the line from Terry Co. (51830) to Sulphur Springs (52002). 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.	--	--	--
18	FLT181PH	*Single phase fault and sequence like Cont. No. 17*	--	--	--
19	FLT193PH	3-phase Fault on Yoakum 230 kV bus (51891) to Mustang (51969) a. Apply fault at the Yoakum 230 kV bus (51891) b. Clear fault after 5 cycles by tripping the 230kV line from Yoakum (51891) to Mustang (51969). 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.	--	--	--
20	FLT201PH	*Single phase fault and sequence like Cont. No. 19*	--	--	--

5 Conclusion

The Direct Assignment Facility cost of interconnecting the Customer project is approximately $0. This figure does not address the Customer Interconnection Facilities within their own substation. Network constraints exist on the SWPS system and are listed in Table 3 and Table 4.

No stability concerns presently exist for the GEN-2006-015 interconnection request consisting of the 170 MW CT. Twenty (20) contingencies were studied and the system remained stable for all contingencies studied.

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

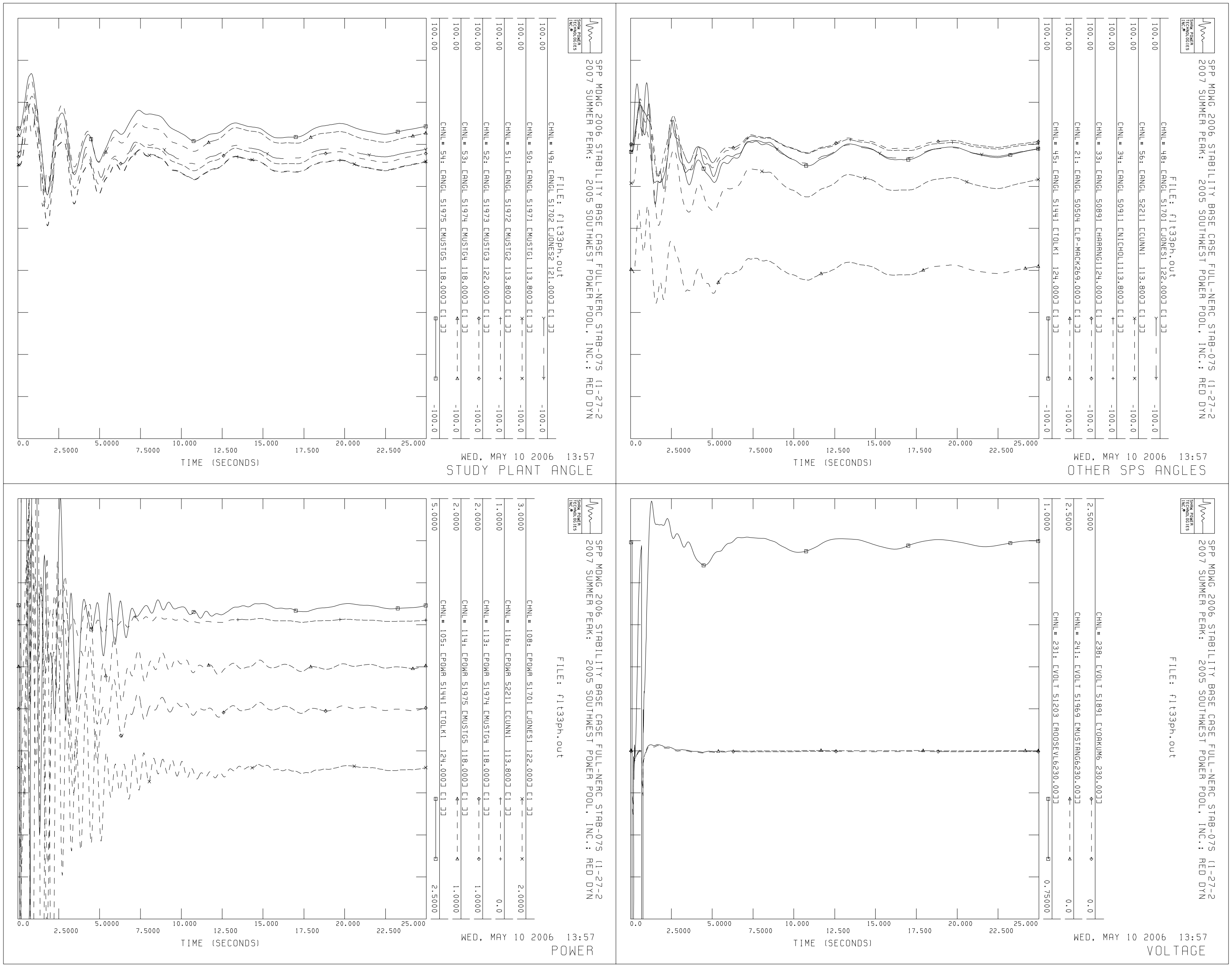
PTI compatible file for generator – generated from manufacturer data sheets provided by Customer

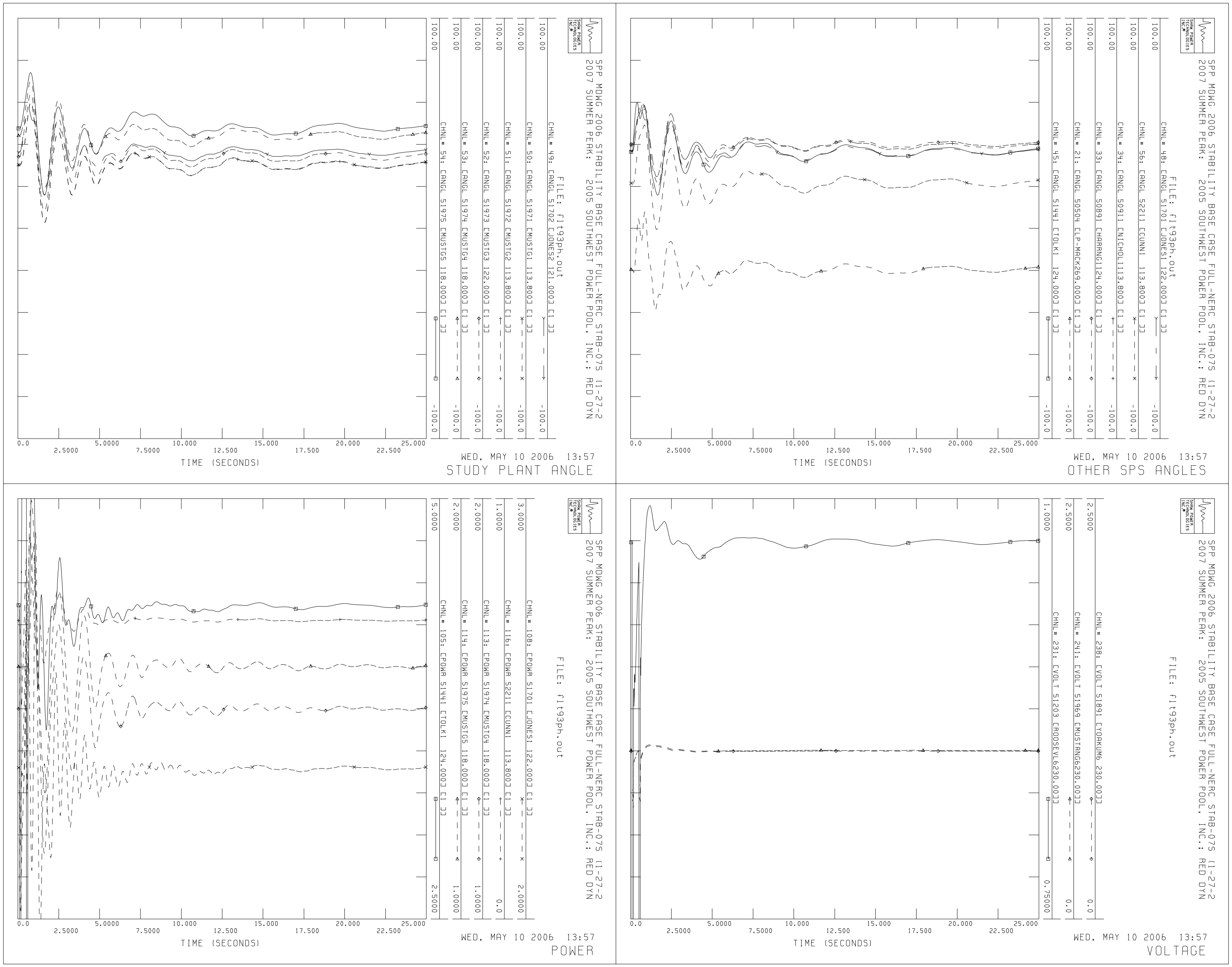
```
/****MUSTANG 5***Bus #51975
  51975 'GENROU' 1     7.0000      0.40000E-01  0.52000      0.84000E-01
       6.270      0.0000      1.6500      1.5600      0.20500
      0.39000      0.15500      0.11500      0.68000E-01  0.58060    /
  51975 'IEEEX1' 1     0.0000      50.000      0.70000E-01   1.0000
       1.0000      2.1000      -2.1000     -0.65000      0.20000
      0.75000E-01  0.60000      0.0000      2.4700      0.35000E-01
       4.5000      0.47000    /
  51975 'GAST'   1    0.50000E-01  0.40000      0.10000      3.0000
       1.0000      4.0000      1.0000      0.0000      0.45000    /
```

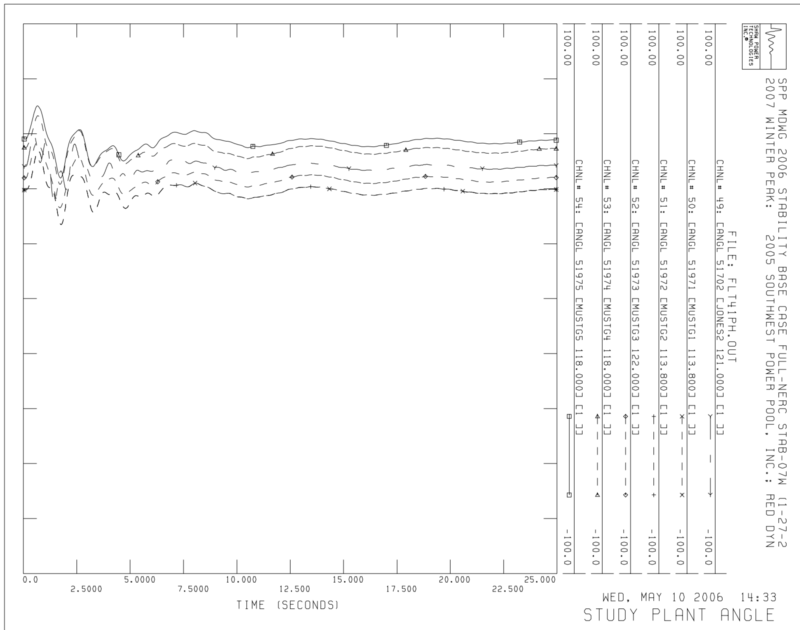
Appendix B

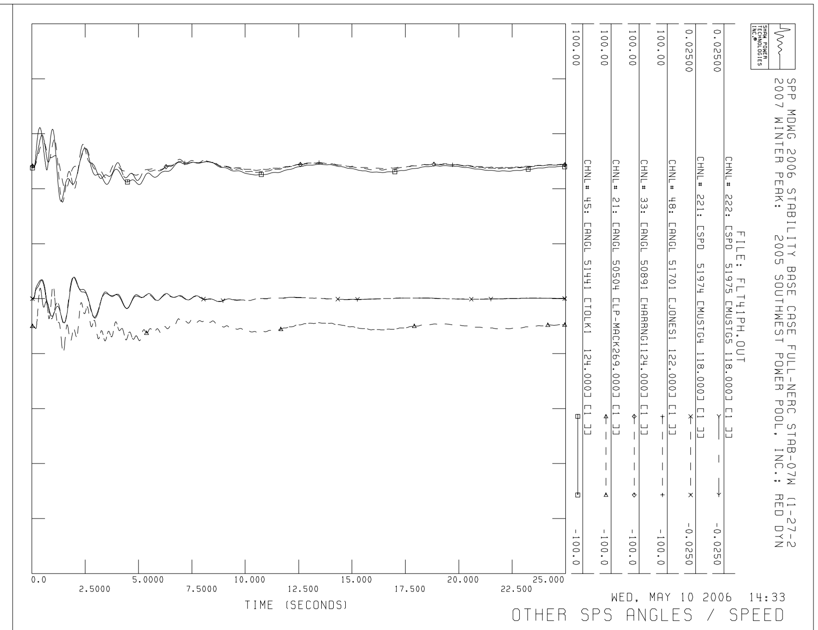
The following plots are included for sample only, the complete plots for all contingencies listed in Table 5 are provided in on request

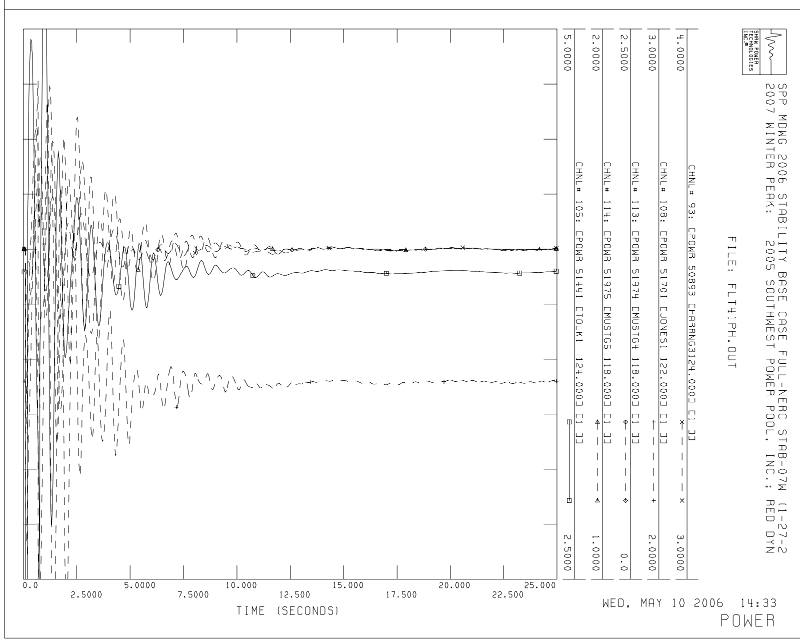
- *2007 Summer Peak Plot, Contingency # 3, 3-phase fault.*
- *2007 Summer Peak Plot, Contingency #9, 3-phase fault*
- *2007 Winter Peak Plot, Contingency #4, Single phase fault.*
- *2007 Winter Peak Plot, Contingency #9, 3- phase fault.*
- *2011 Summer Peak Plot, Contingency #3, , 3-phase fault*

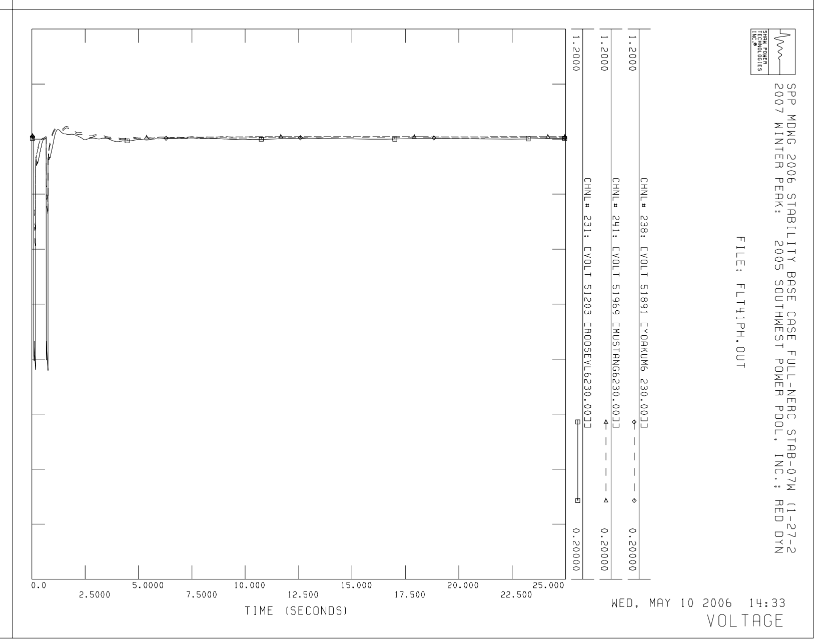

SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07S (1-27-2
2007 SUMMER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: flt33ph.out
CHNL# 49: [ANGL 51702 [JONES2 121.00]] [1]
CHNL# 50: [ANGL 51971 [MUSTG1 13.800]] [1]
CHNL# 51: [ANGL 51972 [MUSTG2 13.800]] [1]
CHNL# 52: [ANGL 51973 [MUSTG3 22.000]] [1]
CHNL# 53: [ANGL 51974 [MUSTG4 18.000]] [1]
CHNL# 54: [ANGL 51975 [MUSTG5 18.000]] [1]
TIME (SECONDS)
WED, MAY 10 2006 13:57
STUDY PLANT ANGLE
CHNL# 48: [ANGL 51701 [JONES1 22.000]] [1]
CHNL# 56: [ANGL 52211 [CUNNI 13.800]] [1]
CHNL# 34: [ANGL 50911 [NICHOL1 13.800]] [1]
CHNL# 33: [ANGL 50891 [HARRNG1 24.000]] [1]
CHNL# 21: [ANGL 50504 [LP-MACK269.00]] [1]
CHNL# 45: [ANGL 51441 [TOLK1 24.000]] [1]
WED, MAY 10 2006 13:57
OTHER SPS ANGLES
CHNL# 108: [POWR 51701 [JONES1 22.000]] [1]
CHNL# 116: [POWR 52211 [CUNNI 13.800]] [1]
CHNL# 113: [POWR 51974 [MUSTG4 18.000]] [1]
CHNL# 114: [POWR 51975 [MUSTG5 18.000]] [1]
CHNL# 105: [POWR 51441 [TOLK1 24.000]] [1]
WED, MAY 10 2006 13:57
POWER
CHNL# 238: [VOLT 51891 [YORKUM6 230.00]]
CHNL# 241: [VOLT 51969 [MUSTANG6230.00]]
CHNL# 231: [VOLT 51203 [ROOSEVL6230.00]]
WED, MAY 10 2006 13:57
VOLTAGE

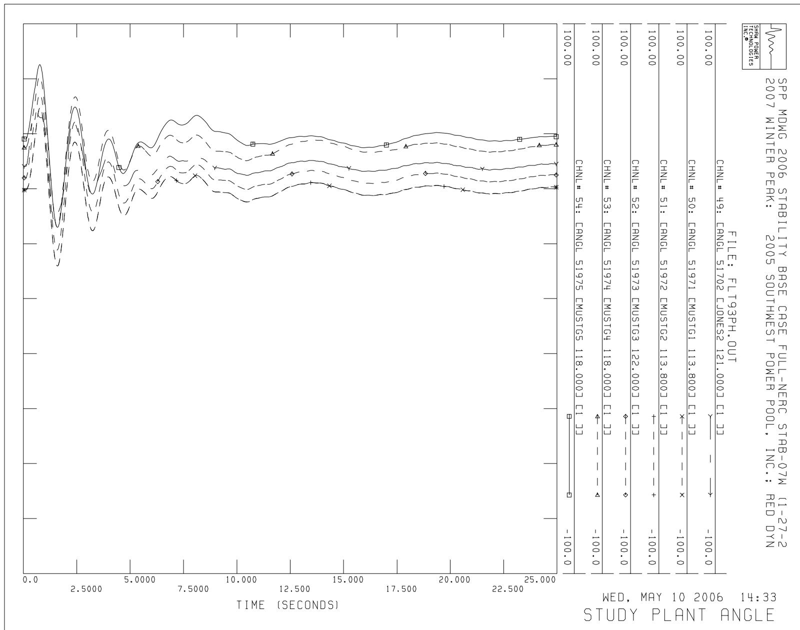

SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07S (1-27-2
2007 SUMMER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: flt93ph.out
CHNL# 49: [ANGL 51702 [JONES2 121.00] [1]
CHNL# 50: [ANGL 51971 [MUSTG1 13.800] [1]
CHNL# 51: [ANGL 51972 [MUSTG2 13.800] [1]
CHNL# 52: [ANGL 51973 [MUSTG3 22.000] [1]
CHNL# 53: [ANGL 51974 [MUSTG4 118.00] [1]
CHNL# 54: [ANGL 51975 [MUSTG5 118.00] [1]
WED, MAY 10 2006 13:57
STUDY PLANT ANGLE
TIME (SECONDS)
SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07S (1-27-2
2007 SUMMER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: flt93ph.out
CHNL# 48: [ANGL 51701 [JONES1 122.00] [1]
CHNL# 56: [ANGL 52211 [CUNN1 113.80] [1]
CHNL# 34: [ANGL 50911 [NICHOL1 13.80] [1]
CHNL# 33: [ANGL 50891 [HARRNG1 24.00] [1]
CHNL# 21: [ANGL 50504 [LP-MACK269.00] [1]
CHNL# 45: [ANGL 51441 [TOLK1 124.00] [1]
WED, MAY 10 2006 13:57
OTHER SPS ANGLES
TIME (SECONDS)
SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07S (1-27-2
2007 SUMMER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: flt93ph.out
CHNL# 108: [POWR 51701 [JONES1 122.00] [1]
CHNL# 116: [POWR 52211 [CUNN1 113.80] [1]
CHNL# 113: [POWR 51974 [MUSTG4 118.00] [1]
CHNL# 114: [POWR 51975 [MUSTG5 118.00] [1]
CHNL# 105: [POWR 51441 [TOLK1 124.00] [1]
WED, MAY 10 2006 13:57
POWER
TIME (SECONDS)
SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07S (1-27-2
2007 SUMMER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: flt93ph.out
CHNL# 238: [VOLT 51891 [YOAKUM6 230.00]]
CHNL# 241: [VOLT 51969 [MUSTANG6230.00]]
CHNL# 231: [VOLT 51203 [ROOSEVL6230.00]]
WED, MAY 10 2006 13:57
VOLTAGE
TIME (SECONDS)

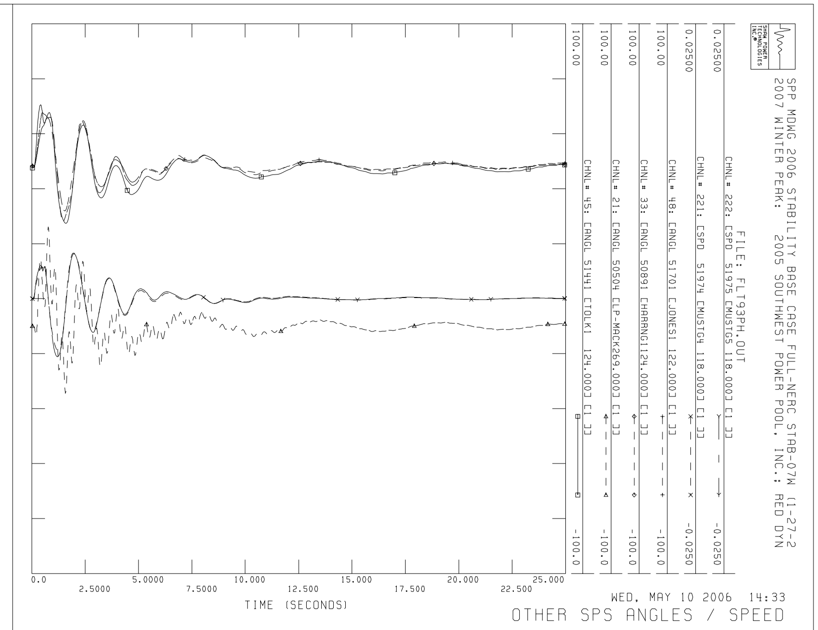

SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07W (1-27-2
2007 WINTER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT41PH.OUT
CHNL# 49: [ANGL 51702 [JONES2 121.00] [1]] 100.00 -100.0
CHNL# 50: [ANGL 51971 [MUSTG1 113.80] [1]] 100.00 -100.0
CHNL# 51: [ANGL 51972 [MUSTG2 113.80] [1]] 100.00 -100.0
CHNL# 52: [ANGL 51973 [MUSTG3 122.00] [1]] 100.00 -100.0
CHNL# 53: [ANGL 51974 [MUSTG4 118.00] [1]] 100.00 -100.0
CHNL# 54: [ANGL 51975 [MUSTG5 118.00] [1]] 100.00 -100.0
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
TIME (SECONDS)
WED, MAY 10 2006 14:33
STUDY PLANT ANGLE

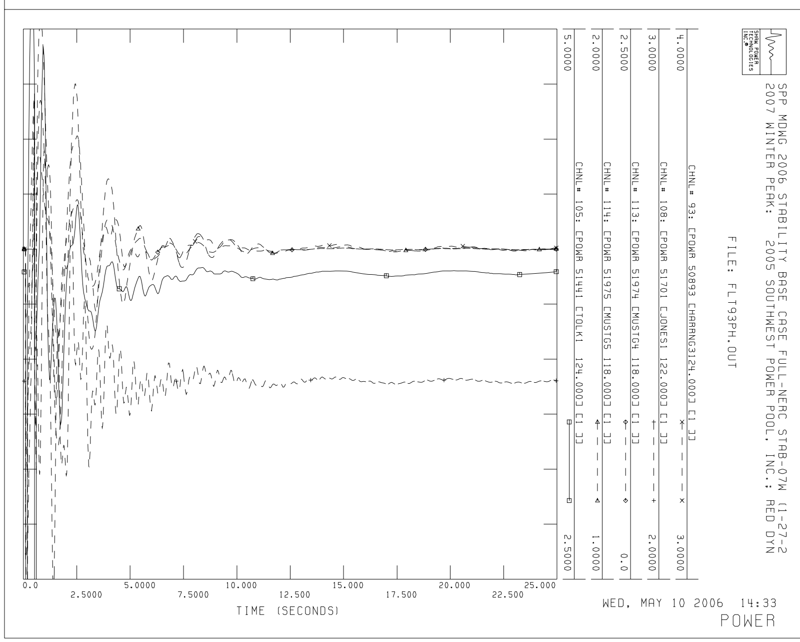

SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07W (1-27-2
2007 WINTER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT41PH.OUT
CHNL# 222: [SPD 51975 [MUSTG5 118.00] [1]] 0.02500 -0.0250
CHNL# 221: [SPD 51974 [MUSTG4 118.00] [1]] 0.02500 -0.0250
CHNL# 48: [ANGL 51701 [JONES1 122.00] [1]] 100.00 -100.0
CHNL# 33: [ANGL 50891 [HARRNG1 24.000] [1]] 100.00 -100.0
CHNL# 21: [ANGL 50504 [LP-MACK269.00] [1]] 100.00 -100.0
CHNL# 45: [ANGL 51441 [TOLK1 24.000] [1]] 100.00 -100.0
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
TIME (SECONDS)
WED, MAY 10 2006 14:33
OTHER SPS ANGLES / SPEED

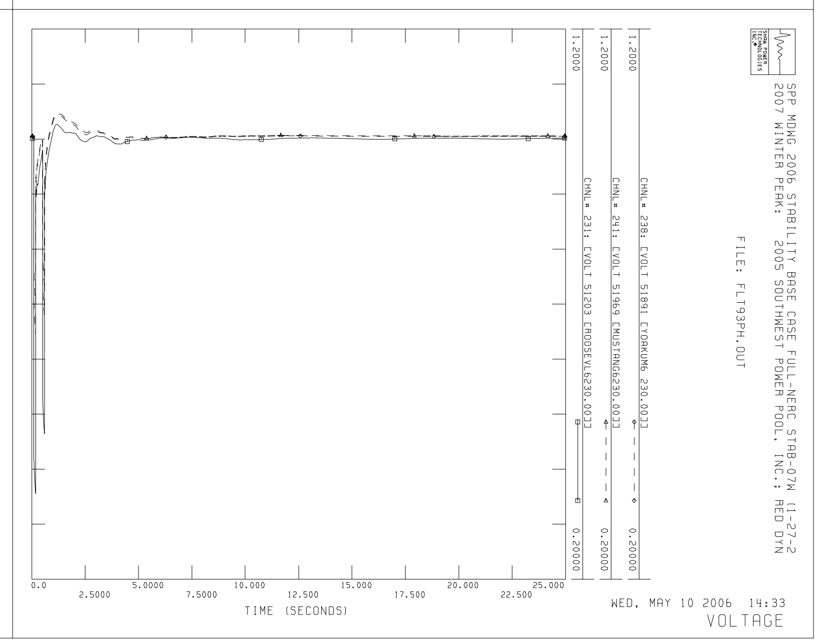

SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07W (1-27-2
2007 WINTER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT41PH.OUT
CHNL# 93: [POWR 50893 [HARRNG3 24.000] [1]] 4.0000 3.0000
CHNL# 108: [POWR 51701 [JONES1 122.00] [1]] 3.0000 2.0000
CHNL# 113: [POWR 51974 [MUSTG4 118.00] [1]] 2.5000 0.0
CHNL# 114: [POWR 51975 [MUSTG5 118.00] [1]] 2.0000 1.0000
CHNL# 105: [POWR 51441 [TOLK1 24.000] [1]] 5.0000 2.5000
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
TIME (SECONDS)
WED, MAY 10 2006 14:33
POWER

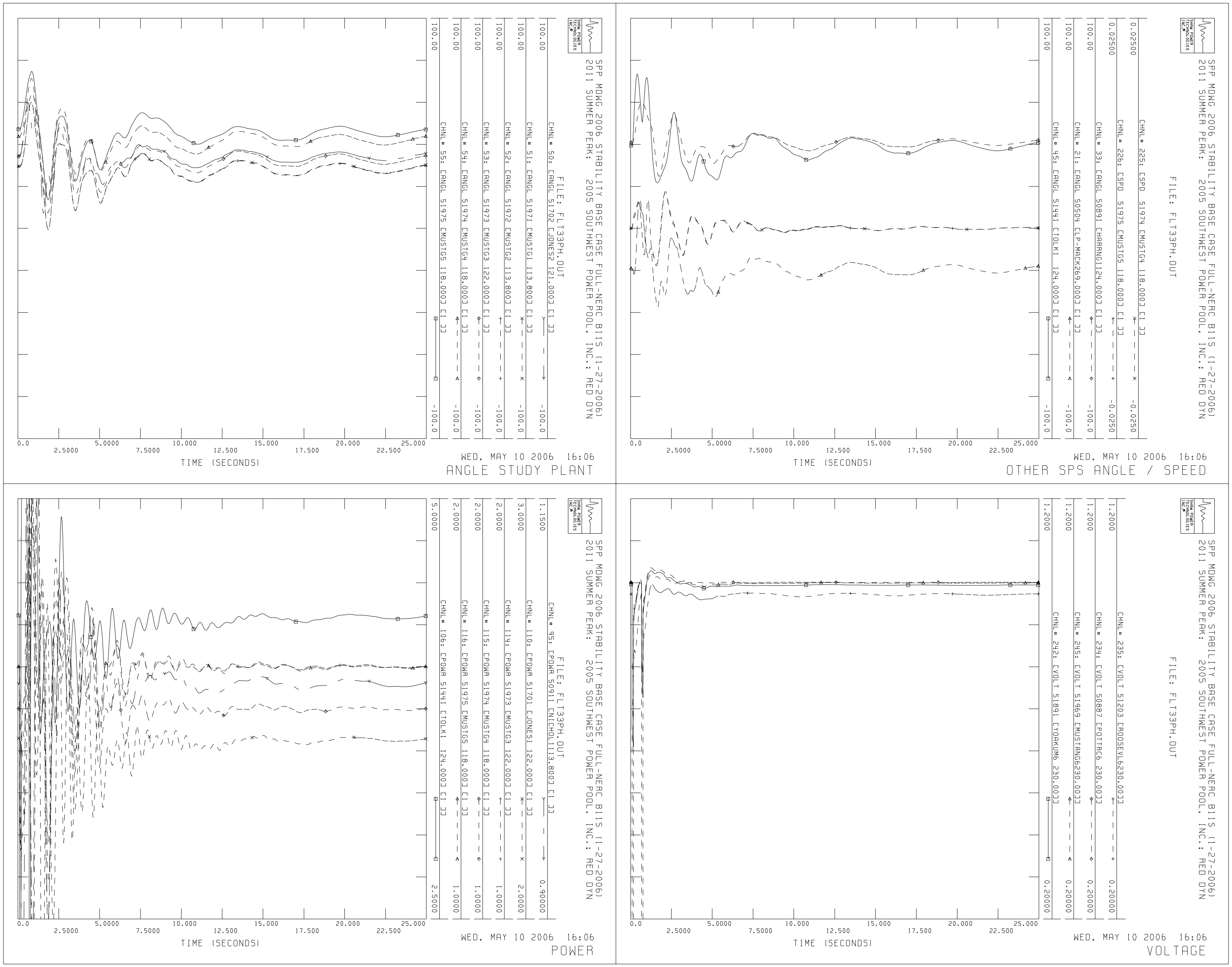

SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07W (1-27-2
2007 WINTER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT41PH.OUT
CHNL# 238: [VOLT 51891 [YORKUM6 230.00]] 1.2000 0.20000
CHNL# 241: [VOLT 51969 [MUSTANG6230.00]] 1.2000 0.20000
CHNL# 231: [VOLT 51203 [ROOSEVL6230.00]] 1.2000 0.20000
0.0 2.5000 5.0000 7.5000 10.000 12.500 15.000 17.500 20.000 22.500 25.000
TIME (SECONDS)
WED, MAY 10 2006 14:33
VOLTAGE


SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07W (1-27-2
2007 WINTER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT93PH.OUT
CHNL# 49: [ANGL 51702 [JONES2 121.00] [1]]
CHNL# 50: [ANGL 51971 [MUSTG1 13.800] [1]]
CHNL# 51: [ANGL 51972 [MUSTG2 13.800] [1]]
CHNL# 52: [ANGL 51973 [MUSTG3 22.000] [1]]
CHNL# 53: [ANGL 51974 [MUSTG4 18.000] [1]]
CHNL# 54: [ANGL 51975 [MUSTG5 18.000] [1]]
TIME (SECONDS)
WED, MAY 10 2006 14:33
STUDY PLANT ANGLE


SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07W (1-27-2
2007 WINTER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT93PH.OUT
CHNL# 222: [SPD 51975 [MUSTG5 18.000] [1]]
CHNL# 221: [SPD 51974 [MUSTG4 18.000] [1]]
CHNL# 48: [ANGL 51701 [JONES1 22.000] [1]]
CHNL# 33: [ANGL 50891 [HARRNG1 24.000] [1]]
CHNL# 21: [ANGL 50504 [LP-MACK 269.00] [1]]
CHNL# 45: [ANGL 51441 [TOLK1 24.000] [1]]
TIME (SECONDS)
WED, MAY 10 2006 14:33
OTHER SPS ANGLES / SPEED


SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07W (1-27-2
2007 WINTER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT93PH.OUT
CHNL# 93: [POWR 50893 [HARRNG3 24.000] [1]]
CHNL# 108: [POWR 51701 [JONES1 22.000] [1]]
CHNL# 113: [POWR 51974 [MUSTG4 18.000] [1]]
CHNL# 114: [POWR 51975 [MUSTG5 18.000] [1]]
CHNL# 105: [POWR 51441 [TOLK1 24.000] [1]]
TIME (SECONDS)
WED, MAY 10 2006 14:33
POWER


SPP MDWG 2006 STABILITY BASE CASE FULL-NERC STAB-07W (1-27-2
2007 WINTER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT93PH.OUT
CHNL# 238: [VOLT 51891 [YOAKUM6 230.00]]
CHNL# 241: [VOLT 51969 [MUSTANG6 230.00]]
CHNL# 231: [VOLT 51203 [ROOSEVL6 230.00]]
TIME (SECONDS)
WED, MAY 10 2006 14:33
VOLTAGE


SPP MDWG 2006 STABILITY BASE CASE FULL-NERC B11S (1-27-2006)
2011 SUMMER PEAK: 2005 SOUTHWEST POWER POOL, INC.; RED DYN
FILE: FLT33PH.OUT
CHNL# 50: [ANGL 51702 [JONES2 121.00] [1]]
CHNL# 51: [ANGL 51971 [MUSTG1 113.80] [1]]
CHNL# 52: [ANGL 51972 [MUSTG2 113.80] [1]]
CHNL# 53: [ANGL 51973 [MUSTG3 122.00] [1]]
CHNL# 54: [ANGL 51974 [MUSTG4 118.00] [1]]
CHNL# 55: [ANGL 51975 [MUSTG5 118.00] [1]]
TIME (SECONDS)
WED, MAY 10 2006 16:06
ANGLE STUDY PLANT
CHNL# 225: [SPD 51974 [MUSTG4 118.00] [1]]
CHNL# 226: [SPD 51975 [MUSTG5 118.00] [1]]
CHNL# 33: [ANGL 50891 [HARRNG1 24.000] [1]]
CHNL# 21: [ANGL 50504 [LP-MACK269.00] [1]]
CHNL# 45: [ANGL 51441 [TOLK1 24.000] [1]]
OTHER SPS ANGLE / SPEED
CHNL# 95: [POWR 50911 [NICHOL1 13.800] [1]]
CHNL# 110: [POWR 51701 [JONES1 22.000] [1]]
CHNL# 114: [POWR 51973 [MUSTG3 122.000] [1]]
CHNL# 115: [POWR 51974 [MUSTG4 118.00] [1]]
CHNL# 116: [POWR 51975 [MUSTG5 118.00] [1]]
CHNL# 106: [POWR 51441 [TOLK1 24.000] [1]]
POWER
CHNL# 235: [VOLT 51203 [ROOSEVL6230.00]]
CHNL# 234: [VOLT 50887 [POTTER6 230.00]]
CHNL# 245: [VOLT 51969 [MUSTANG6230.00]]
CHNL# 242: [VOLT 51891 [YORKUM6 230.00]]
VOLTAGE