



*System Impact Study Report  
PID 205  
60 MW Plant  
Port Hudson*

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# Objective:

This System Impact Study is the second step of the interconnection process and is based on PID-205 request for interconnection on Entergy's transmission system at Repapco 138 kV substation. This report is organized in two sections, namely, Section – A, Energy Resource Interconnection Service (ERIS) and Section – B, Network Resource Interconnection Service (NRIS – Section B).

Scope for the ERIS section (Section – A) includes load flow (steady state) analysis, transient stability analysis and short circuit analysis as defined in FERC orders 2003, 2003A and 2003B. The NRIS section (Section – B) contains details of load flow (steady state) analysis only, however, transient stability analysis and short circuit analysis of Section – A are also applicable to Section – B. Additional information on scope for NRIS study can be found in Section – B.

Requestor for PID-195 did request ERIS, however it was determined that a load flow (steady state) analysis was not required because the generator would not be exporting power.

PID-205 intends to install a Pet coke boiler, with a maximum capacity of 70.5 MVA. The scheduled gross power output of the plant is 60 MW. With existing Unit #1 (67 MW) the total generation would be 127 MW. An auxiliary/host load of approximately 131.6 MW is also expected at this site. PID-205 anticipates absorbing approximately 3.9 MW from the Entergy transmission system.

The proposed in-service date for this facility is April 30, 2007

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# I. Introduction

This Energy Resource Interconnection Service (ERIS) is based on PID-205 (**60 MW**) request for interconnection on Entergy's transmission system at Repapco 138 kV substation. The objective of this study is to assess the reliability impact of the new facility on the Entergy transmission system with respect to the steady state and transient stability performance of the system as well as its effects on the system's existing short circuit current capability. It is also intended to determine whether the transmission system meets standards established by NERC Reliability Standards and Entergy's planning criteria and guidelines when the plant is connected to Entergy's transmission system. If not, transmission improvements will be identified.

A short circuit analysis is performed to determine whether the generation would cause the available fault current to surpass the fault duty of existing equipment within the Entergy transmission system. A transient stability analysis was conducted to determine whether the new units would cause a stability problem on the Entergy system.

This ERIS System Impact Study was based on information provided by PID-205 and assumptions made by Southwest Power Pool, Independent Coordinator of Transmission (SPP ICT). All supplied information and assumptions are documented in this report. If the actual equipment installed is different from the supplied information or the assumptions made, the results outlined in this report are subject to change.

The load flow results from the ERIS study are for information only. ERIS does not in and of itself convey any transmission service.

## **II. Short Circuit Analysis/ Breaker Rating Analysis**

### **A. Model Information**

The short circuit analysis was performed on the Entergy system short circuit model using ASPEN software. This model includes all generators interconnected to the Entergy system or interconnected to an adjacent system and having an impact on this interconnection request, IPP's with signed IOAs, and approved future transmission projects on the Entergy transmission system including the proposed PID-205 unit.

### **B. Short Circuit Analysis**

The method used to determine if any short circuit problems would be caused by the addition of the PID-205 generation is as follows:

1. Three phase and single phase to ground faults were simulated on the Entergy base case short circuit model and the worst case short circuit level was determined at each station. The PID-205 generator was then modeled in the base case to generate a revised short circuit model. The base case short circuit results were then compared with the results from the revised model to identify any breakers that were under-rated as a result of additional short circuit contribution from PID-205 generation. The breakers identified to be upgraded through this comparison are *mandatory* upgrades.

### **C. Analysis Results**

The results of the short circuit analysis, including priors PID's 195, 197, 198, 203, and 205 indicates that the additional generation due to PID-205 generators does not cause an increase in short circuit current such that they exceed the fault interrupting capability of the high voltage circuit breakers within the vicinity of the proposed generation. Also, when studied with no

generation interconnection queue priors in service, there were no breakers identified as being underrated due to the added fault current from the PID-205 generator.

#### **D. Problem Resolution**

There were no problems identified for this part of the study that were a result of the additional PID-205 generation.

*The results of the short circuit analysis are subject to change. They are based upon the current configuration of the Entergy transmission system and Generation Interconnection Study Queue.*

### **III. Transient Stability Analysis**

#### **A. Model Information**

The dynamic database representing the 2007 summer peak was used in this analysis. The new PID-205 generation and load were also added to the model at the Repapco 138 kV substation. The resulting one-line diagram of the area of the Entergy system considered for stability studies is shown in Figure III-1.

The stability studies were conducted to assess the impact of PID-205 on Entergy's system. The loads in the Entergy system were represented as follows: for the active part, 100% was modeled with a constant current model; all of the reactive part, on the other hand, was modeled with a constant impedance model. The simulations were conducted with the PID-205 unit generating 60 MW and the total plant absorbing approximately 3.9 MW net from the Entergy System.

PID-205 provided dynamic models of their generation equipment for use in this study. The generators were modeled using the standard PSS/E **GENROU** model. PID-205 also provided data for the excitation and Automatic Voltage Regulator (AVR) systems. The data for PID-205 represents a Basler DECS excitation system, and was modeled using the PSS/E **ESAC8B** model.

No turbine-governor and PSS data was provided by PID-205 at the time of study.

In the dynamics data provided by PID-205, the following data was missing:

**Unit #1**

**Generator**

Open Circuit Transient Time constant ( $T_{q0}$ )

Open Circuit Sub-transient Time constant ( $T_{q0''}$ )

Unsaturated Synchronous Reactance ( $X_q$ )

Unsaturated Transient Reactance ( $X_d'$  &  $X_q'$ )

Leakage Reactance ( $X_l$ )

Exciter (Basler DECS Type)

The PID gains  $K_p$ ,  $K_i$  and  $K_D$  are not provided.

**Unit #2 PID-205**

**Generator**

Unsaturated Transient Reactance ( $X_q'$ )

Saturation constants [ $s(1.0)$  and  $s(1.2)$ ]

The inertia provided for the Unit #1 was 1.12 kW-sec/kVA, much lower than a typical value.

Hence, the coupling and turbine mass was added and the combined inertia for turbine and

generator for the Unit #1 is calculated as 2.59 kW-sec/kVA. For the missing generator and exciter

data typical values were assumed. The data used for the proposed PID-205 generator and exciter

models are shown in **Appendix A-A**.

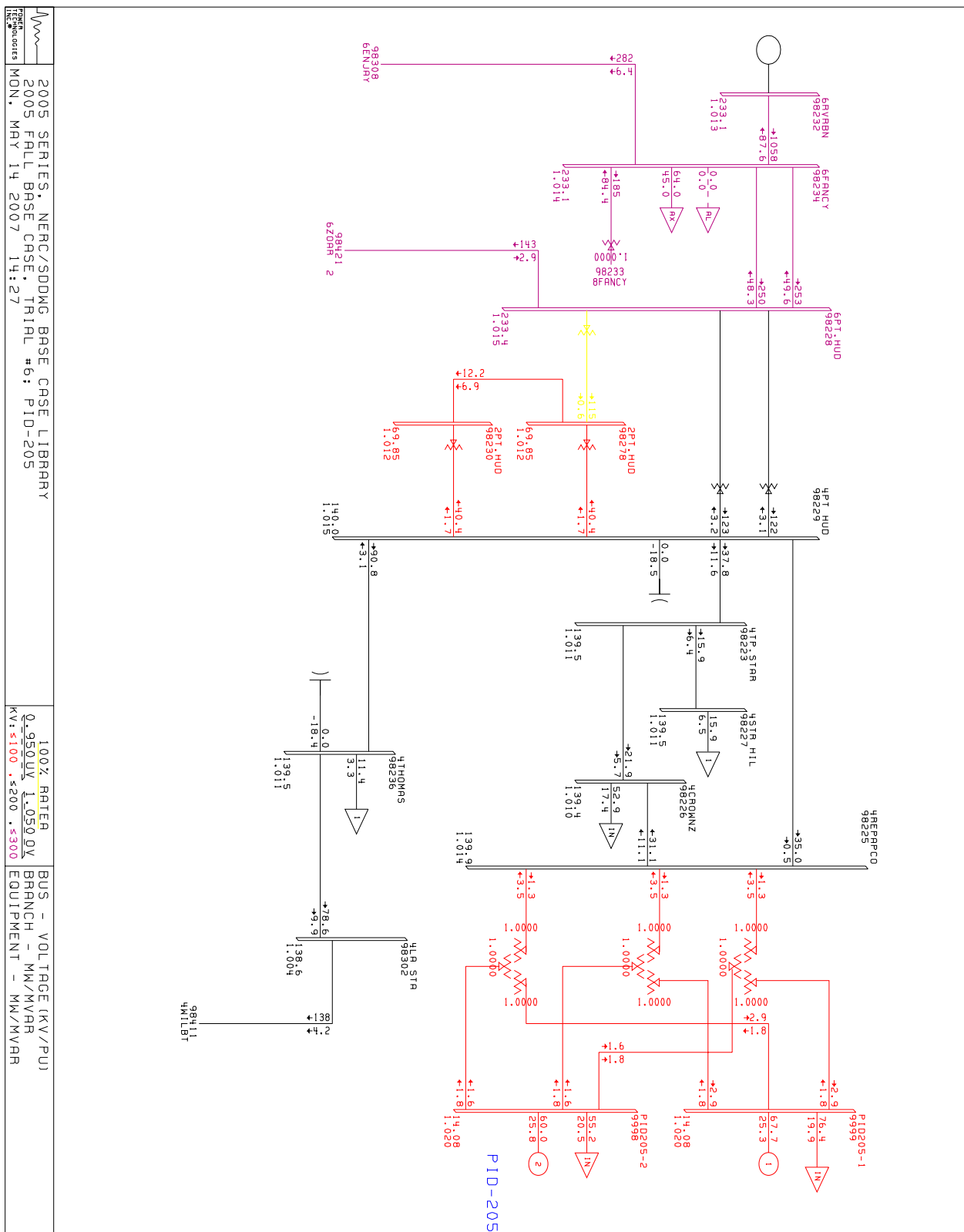


Figure III-1. Single Line Diagram of the Stability Study Area of Focus with PID-205



## B. Transient Stability Analysis

Stability simulations were run to examine the transient behavior of the PID-205 generator and its effect on the Entergy system. The stability analysis was performed using the following procedure. First, three-phase faults with three-phase breaker failure were simulated on the transmission lines connected to the Repapco 138 kV station and on key remote stations. The analysis was carried out on the power flow case without the upgrades identified in the study to determine whether the system could be worse from a stability point of view without the upgrades. If a three phase fault with three phase breaker failure was found to be unstable, only then were single phase fault followed with breaker failure conditions and normally cleared three phase fault studied. This procedure is being followed because when the units are stable for a more severe fault (such as three phase fault with three phase breaker failure), the need to study stability for a less severe fault (such as single-phase fault with breaker failure and normally cleared three phase) does not arise. The stability analysis was performed using the PSS/E dynamics program. The fault clearing times used for the simulations are given in **Table III-1**.

**Table III-1 Fault Clearing Times**

<b>Contingency at kV level</b>	<b>Fault Type</b>	<b>Normal Clearing</b>	<b>Delayed Clearing</b>
138	3 PH	6 cycles	6+9 cycles
138	1 PH	6 cycles	6+11 cycles

The breaker failure scenario was simulated with the following sequence of events:

- 1) At the normal clearing time for the primary breakers, the faulted line is tripped at the far end from the fault by normal breaker opening.
- 2) The fault remains in place for three-phase stuck-breakers. For single-phase faults, the fault is appropriately adjusted to account for the line trip of step 1).

3) The fault is then cleared by back-up clearing. If the system is shown to be unstable for this condition, then stability of the system without the PID-205 needs to be verified.

All line trips are assumed to be permanent (i.e. no high speed re-closure).

The stability analysis was performed using the PSS/E dynamics program. The PSS/E dynamics program only simulates the positive sequence network. Unbalanced faults involve the positive, negative, and zero sequence networks. For unbalanced faults, the equivalent fault admittance must be inserted in the PSS/E positive sequence model between the faulted bus and ground to simulate the effect of the negative and zero sequence networks. For a single-line-to-ground (SLG) fault, the fault admittance equals the inverse of the sum of the positive, negative and zero sequence Thevenin impedances at the faulted bus. Since PSS/E inherently models the positive sequence fault impedance, the sum of the negative and zero sequence Thevenin impedances needs to be added and entered as the fault impedance at the faulted bus.

For three-phase faults, a fault admittance of  $-j2E9$  is used (essentially infinite admittance or zero impedance).

Table III-2A and Table III-2B list all the fault cases that were simulated in this study. Fault scenarios were formulated by examining the system configuration shown in Figure III-2 and Figure III-3.

Faults 1 through 7 represent the normal clearing 3-phase faults. Faults 1a through 6b represent the three-phase (3PH) stuck breaker faults with the appropriate delayed back-up clearing times. Fault -1a-SLG, Fault-2a-SLG and Fault-6b-SLG represent the delayed single-line-to-ground faults.

Fault -1a, Fault-2a, Fault 6a and Fault-6b were all repeated on the case WITHOUT PID-205. These were performed with the same operational sequence followed as in the corresponding faults

WITH PID-205 in order to verify whether or not the impact on the system was due to the PID-205 generator.

For all cases analyzed, the initial disturbance was applied at  $t = 0.1$  seconds. The breaker clearing was applied at the appropriate time following this fault inception.

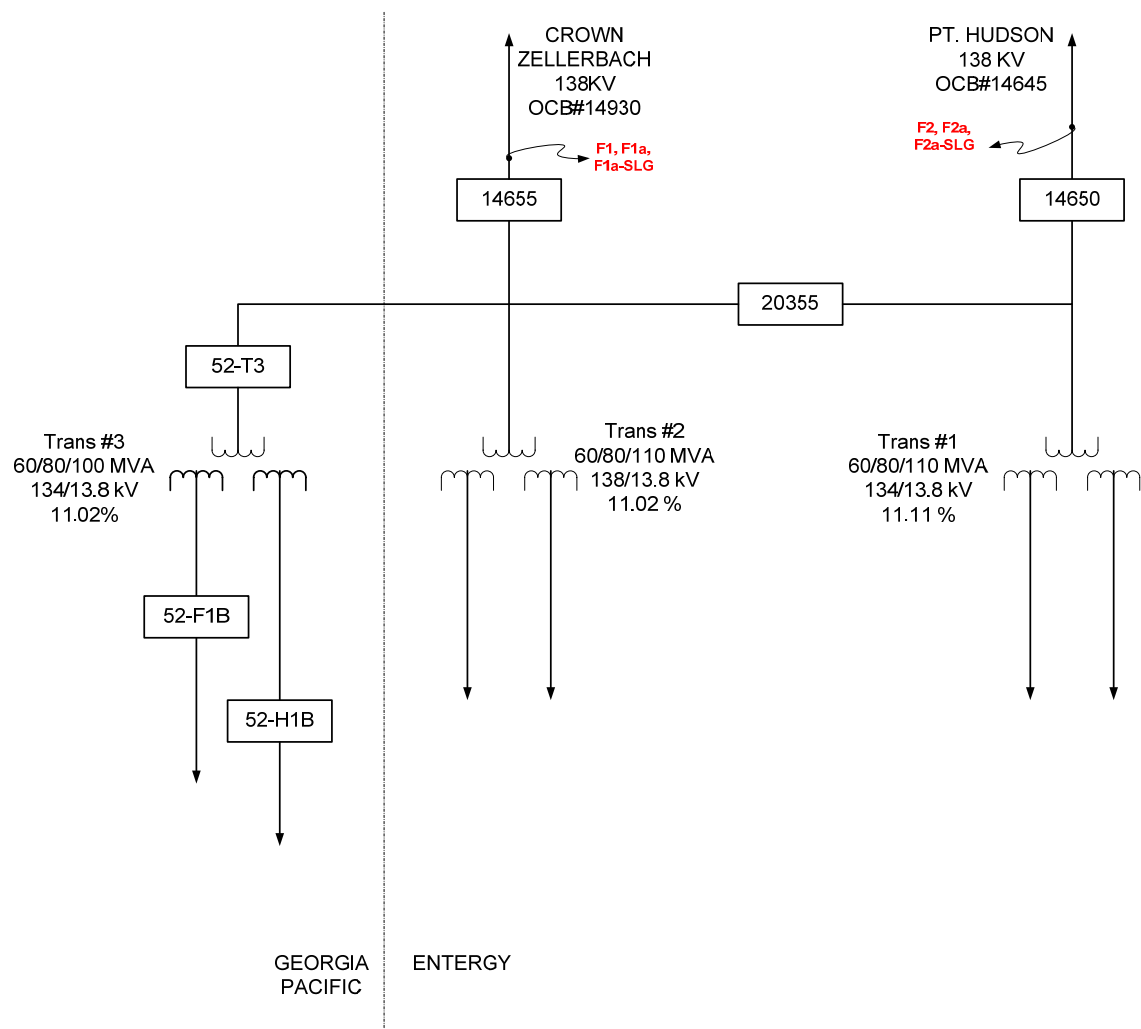
**Table III-2A Fault Cases Simulated in this Study: 3 phase faults with normal clearing**

CASE	LOCATION	TYPE	CLEARING TIME (cycles)	BRK TRIP #	TRIPPED FACILITIES	Stable ?	Acceptable Voltages ?
Fault-1	Repapco - Crown Zellerbach 138 kV	3 PH	6	OCB#14930, 14655	Repapco - Crown Zellerbach 138 kV	YES	YES
Fault-2	Repapco - PT. Hudson 138 kV	3 PH	6	OCB#14645, 14650	Repapco - PT. Hudson 138 kV	YES	YES
Fault-3	PT. Hudson - Crown Zellerbach 138 kV	3 PH	6	14275, OCB#14285	PT. Hudson - Crown Zellerbach 138 kV	YES	YES
Fault-4	PT. Hudson - LA Station 138 kV	3 PH	6	14270, OCB#19070, OCB#19075	PT. Hudson - LA Station 138 kV	YES	YES
Fault-5	PT. Hudson 230/138 kV transformer #5	3 PH	6	20235, 20225, 20220	PT. Hudson 230/138 kV transformer #5	YES	YES
Fault-6	PT. Hudson 138/69 kV transformer #2	3 PH	6	14665, Xmer Low side BRK, 20140, 14565	PT. Hudson 138/69 kV transformer #2, PT. Hudson 230/138 kV Transformer #4, PT. Hudson - Repapco 138 kV, 21.6 MVAR Cap Bank	YES	YES
Fault-7	PT. Hudson 138/69 kV transformer #3	3 PH	6	14665, 14275, 20235, 14270	PT. Hudson 138/69 kV transformer #3, Pt. Hudson Crown Zellerbach 138 kV, PT. Hudson - LA Station 138 kV, Pt. Hudson 230/138 kV Transformer #5	YES	YES

**Table III-2B Fault Cases Simulated in this Study: faults with stuck breaker**

CASE	LOCATION	TYPE	CLEARING TIME (cycles)		SLG FAULT IMP (MVA)	STUCK BRK #	PRIMARY BRK TRIP #	SECONDARY BRK TRIP	TRIPPED FACILITIES	Stable ?	Acceptable Voltages ?
			PRIM-ARY	Back-up							
Fault-1a	Repapco - Crown Zellerbach 138 kV	3 PH	6	9	--	14655	OCB#149 30	52-T3, 20335, Xmer #2 Low Side BRK	Repapco - Crown Zellerbach 138 kV, 138/13.8/13.8 Transformer #2 & #3	NO	NO
Fault-1a-SLG	Repapco - Crown Zellerbach 138 kV	1PH	6	11	278.97 - j1423.19	14655	OCB#149 30	52-T3, 20335, Xmer #2 Low Side BRK	Repapco - Crown Zellerbach 138 kV, 138/13.8/13.8 Transformer #2 & #3	YES	YES
Fault-2a	Repapco - PT. Hudson 138 kV	3 PH	6	9	--	14650	OCB#146 45	20335, Xmer #1 Low side BRK	Repapco - PT. Hudson 138 kV, 138/13.8/13.8 kV Transformer #1	NO	NO
Fault-2a-SLG	Repapco - PT. Hudson 138 kV	1PH	6	11	97.25 - j444.61	14650	OCB#146 45	20335, Xmer #1 Low side BRK	Repapco - PT. Hudson 138 kV, 138/13.8/13.8 kV Transformer #1	YES	YES
Fault-3a	PT. Hudson - Crown Zellerbach 138 kV	3 PH	6	9	--	14275	OCB#142 85	14665, 20235, 14270, Xmer #3 Low Side BRK	PT. Hudson - Crown Zellerbach 138 kV, PT. Hudson - LA Station 138 kV, PT. Hudson 230/138 kV Xmer #5, PT. Hudson 138/69 kV Transformer #3	YES	YES
Fault-4a	PT. Hudson - LA Station 138 kV	3 PH	6	9	--	14270	OCB#190 70, OCB#190 75	14275, 14665, 20235, Xmer #3 Low Side BRK	PT. Hudson - LA Station 138 kV, PT. Hudson - Crown Zellerbach 138 kV, PT. Hudson 230/138 kV Xmer #5, PT. Hudson 138/69 kV Transformer #3	YES	YES
Fault-5a	PT. Hudson 230/138 kV transformer #5	3 PH	6	9	--	20235	20225, 20220	14275, 14665, 14270, Xmer #3 Low Side BRK	PT. Hudson 230/138 kV transformer #5, PT. Hudson - LA Station 138 kV, PT. Hudson - Crown Zellerbach 138 kV, PT. Hudson 138/69 kV Transformer #3	YES	YES

CASE	LOCATION	TYPE	CLEARING TIME (cycles)		SLG FAULT IMP (MVA)	STUCK BRK #	PRIMARY BRK TRIP #	SECONDARY BRK TRIP	TRIPPED FACILITIES	Stable ?	Acceptable Voltages ?
			PRIM-ARY	Back-up							
Fault-5b	PT. Hudson 230/138 kV transformer #4	3 PH	6	9	--	14565	20850, 20230	20140, Xmer #2 Low Side BRK, 14645, 14665	PT. Hudson 230/138 kV transformer #4, PT. Hudson 138/69 kV Transformer #2, PT. Hudson - Repapco 138 kV, 21.6 Mvar Cap Bank	YES	YES
Fault-6a	PT. Hudson 138/69 kV transformer #2	3 PH	6	9	--	14665	Xmer #2 Low side BRK, 20140, 14645, 14565	20235, 14270, 14275, Xmer #3 Low side BRK	PT. Hudson 138/69 kV Transformer #2, PT. Hudson 230/138 kV Transformer #4, 21.6 MVAR Cap Bank, PT. Hudson - Repapco 138 kV, PT. Hudson - Crown Zellerbach 138 kV, PT. Hudson - LA Station 138 kV, PT. Hudson 230/138 kV Transformer #5, PT. Hudson 138/69 kV Transformer #3	NO	NO
Fault-6b	PT. Hudson 138/69 kV transformer #2	3 PH	6	9	--	14645	Xmer Low side BRK #2, 20140, 14665, 14565	OCB#14650	PT. Hudson 138/69 kV Transformer #2, PT. Hudson 230/138 kV Transformer #4, 21.6 MVAR Cap Bank, PT. Hudson - Repapco 138 kV	NO	NO
Fault-6b-SLG	PT. Hudson 138/69 kV transformer #2	1PH	6	11	258.45 - j2380.55	14645	Xmer Low side BRK #2, 20140, 14665, 14565	OCB#14650	PT. Hudson 138/69 kV Transformer #2, PT. Hudson 230/138 kV Transformer #4, 21.6 MVAR Cap Bank, PT. Hudson - Repapco 138 kV	YES	YES



**Figure III-2. Bus/Breaker Configuration of the Repapco 138 kV Station**

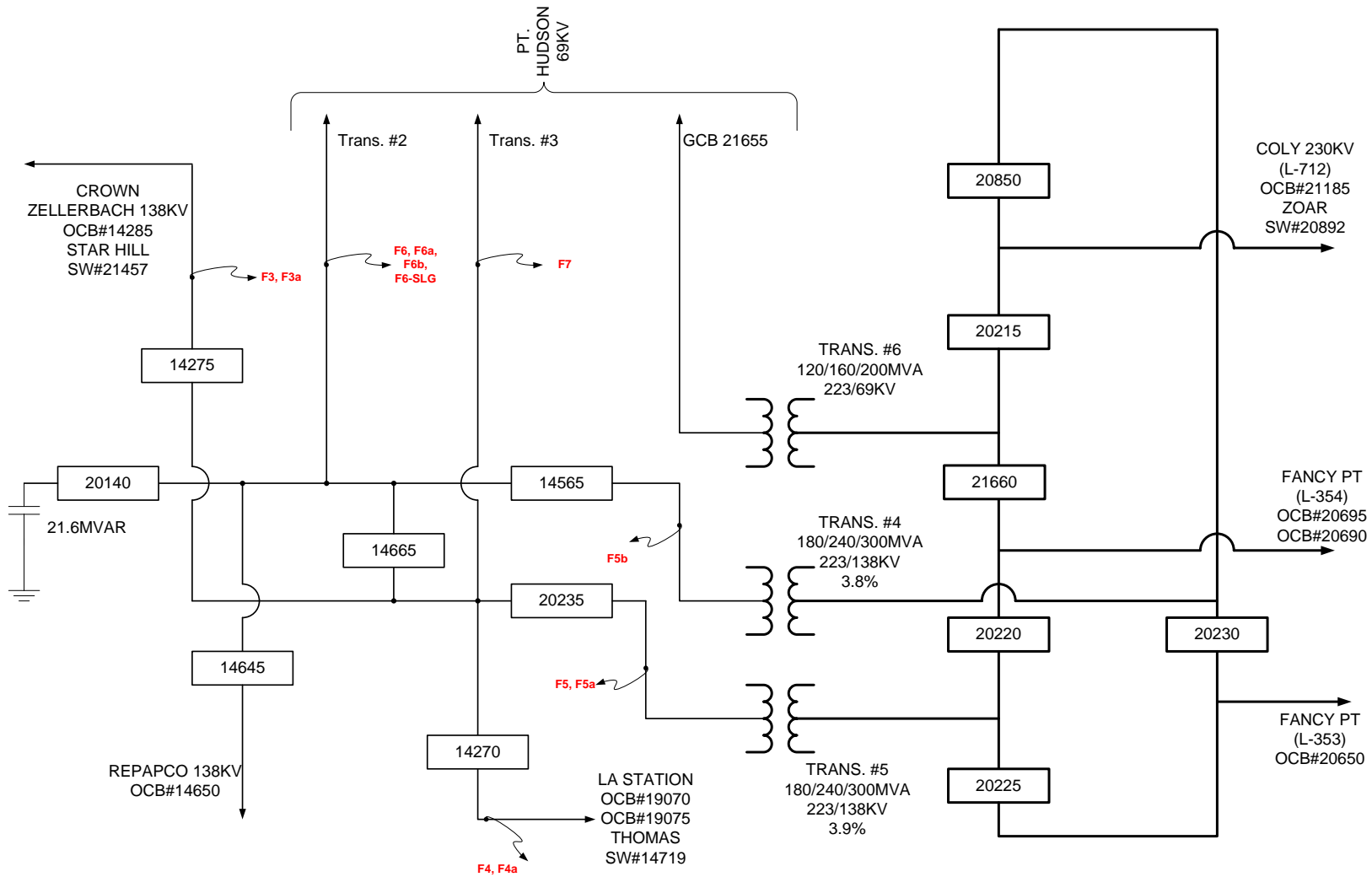


Figure III-3. Bus/Breaker Configuration of the PT. Hudson 138/230 kV Station



### C. Analysis Results

All of the normally-cleared, three-phase faults simulated were found to be stable. Four (4) three-phase stuck-breaker faults (Fault-1a, 2a, 6a and 6b) were found to be unstable in both WITH and WITHOUT PID-205.

PID-205 and the existing Unit #1 were found to be unstable following Fault-6a. The stuck-breaker Fault-6a results in the loss of complete PT. Hudson 138 kV bus-section (bus section 4 and 5), which results in islanding of the PID-205 and the existing Unit #1 at Repapco 138 kV station. No details about the turbine speed governor model, load frequency dependence and possible load shedding were available at the time of study. Hence, the instability of the PID-205 and Unit #1 was not further investigated. The instability is limited to the Requestor's facility and it is their responsibility to investigate further and add any necessary protection equipment. It should be noted that the system condition leading to the islanding of unit(s) at Repapco 138 kV already exists even before interconnection of PID-205, so the instability of the Units at Repapco 138 kV is not attributable to interconnection of PID-205.

As the remaining three (3) faults (Fault-1a, 2a and 6b) were unstable in both, WITH and WITHOUT PID-205, the delayed clearing single-line-to-ground faults (Fault-1a-SLG, 2a-SLG, and 6b-SLG) were simulated instead of three-phase stuck-breaker faults. The delayed single-line-to-ground faults were found to be stable with PID-205. Figure III-4 through Figure III-6 shows the plots for Fault-1a-SLG, Fault-2a-SLG, and Fault-6b-SLG respectively.

In addition to criteria for the stability of the machines, Entergy has evaluation criteria for the transient voltage dip as follows:

- 3-phase fault or single-line-ground fault with normal clearing resulting in the loss of a single component (generator, transmission circuit or transformer) or a loss of a single component without fault:

Not to exceed 20% for more than 20 cycles at any bus

Not to exceed 25% at any bus

- 3-phase faults with normal clearing resulting in the loss of two or more components (generator, transmission circuit or transformer)
- SLG fault with delayed clearing resulted in the loss of one or more components:

Not to exceed 20% for more than 40 cycles at any bus

Not to exceed 30% at any bus

The duration of the transient voltage dip excludes the duration of the fault. The transient voltage dip criteria may not be applied to three-phase faults followed by stuck breaker conditions unless the determined impact is extremely widespread.

The voltages at all of the buses shown in Figure III-1 were monitored during each of the fault cases as appropriate.

No violations of the transient voltage dip criteria were observed among stable faults.

Plots of relevant parameters are shown in Appendix A-H.



2005 SERIES, NERC/SDDWG BASE CASE LIBRARY  
2005 FALL BASE CASE, TRIAL #6; PID-205  
6+11CY SLG REPAPCO - CROWN ZELLERBACH 138 KV  
REPAPCO - CROWN ZELLERBACH 138 KV, 138/13.8/13.8 XMER#2&#3  
FILE: FAULT-1A-SLG.OUT

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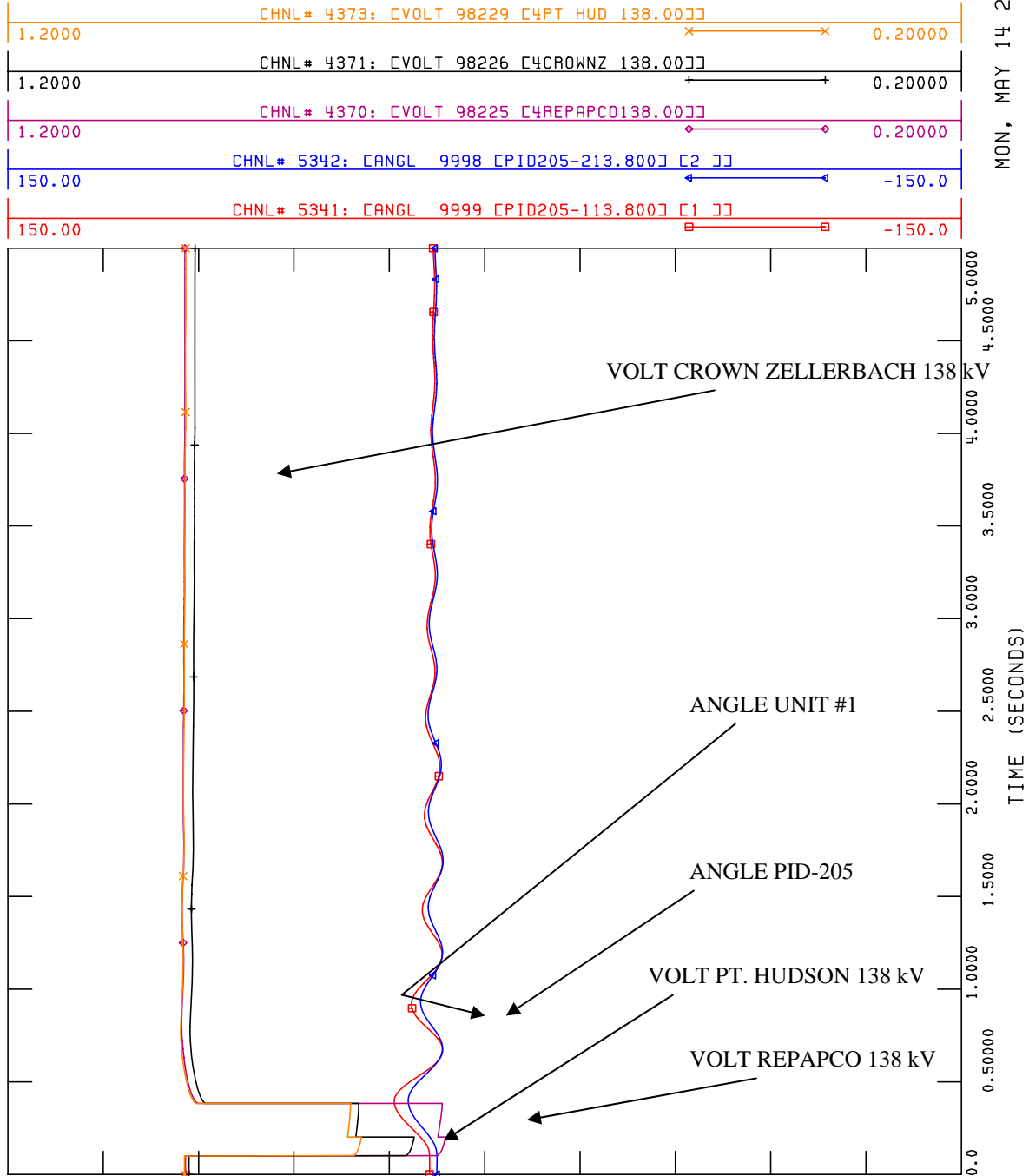


Figure III-4. Fault-1a-SLG WITH PID-205



2005 SERIES, NERC/SDDWG BASE CASE LIBRARY  
2005 FALL BASE CASE, TRIAL #6; PID-205  
6+11CY SLG REPAPCO - PT. HUDSON 138 KV  
REPAPCO - PT. HUDSON 138 KV, 138/13.8/13.8 KV TRANSFORMER #1  
FILE: FAULT-2A-SLG.OUT

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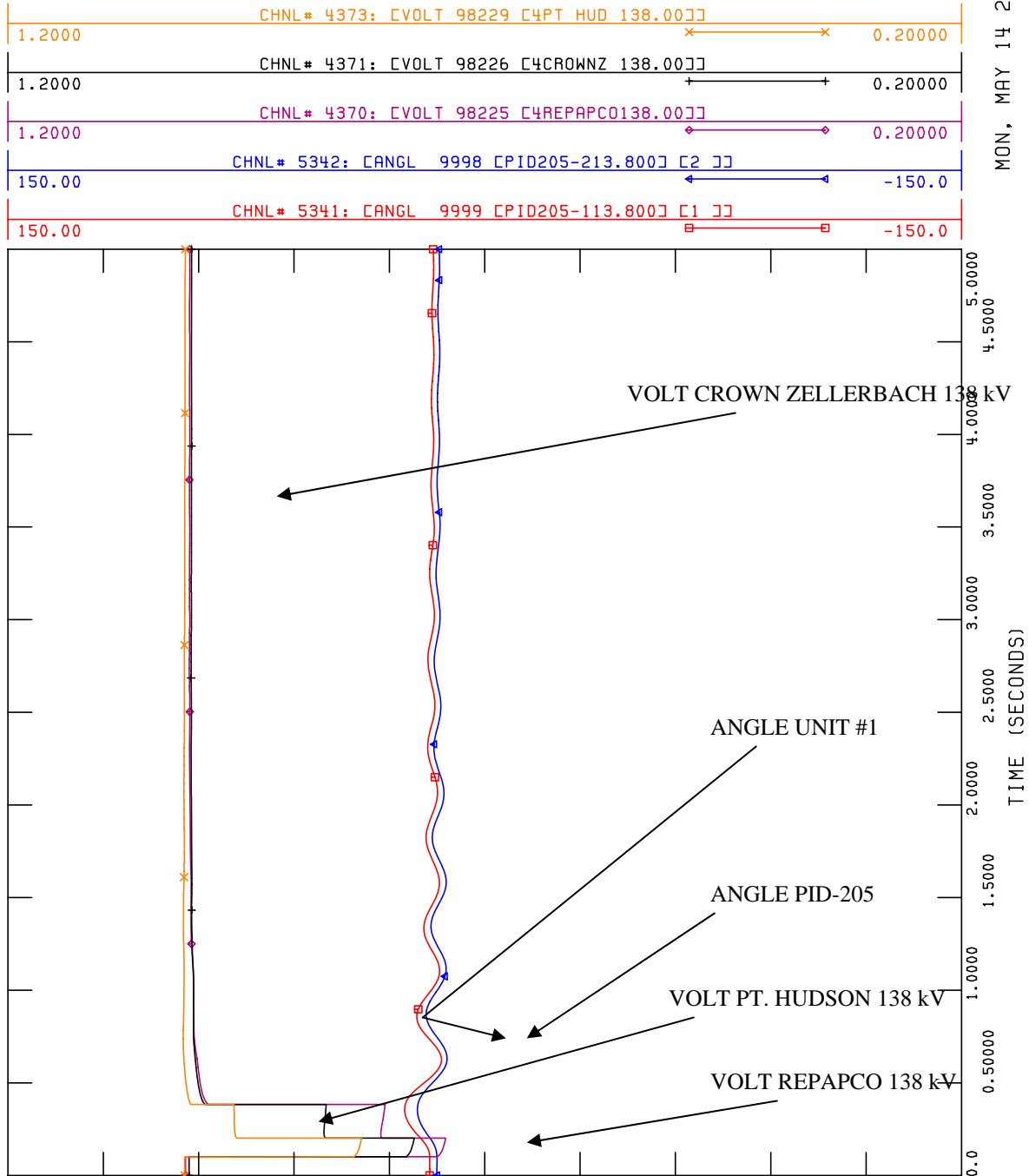


Figure III-5. Fault-2a-SLG WITH PID-205



2005 SERIES, NERC/SDDWG BASE CASE LIBRARY  
2005 FALL BASE CASE, TRIAL #6; PID-205  
6+11CY SLG PT. HUDSON 138/69 KV TRANSFORMER #2  
PT. HUDSON 138 KV BUS SECTION #4  
FILE: FAULT-6B-SLG.OUT

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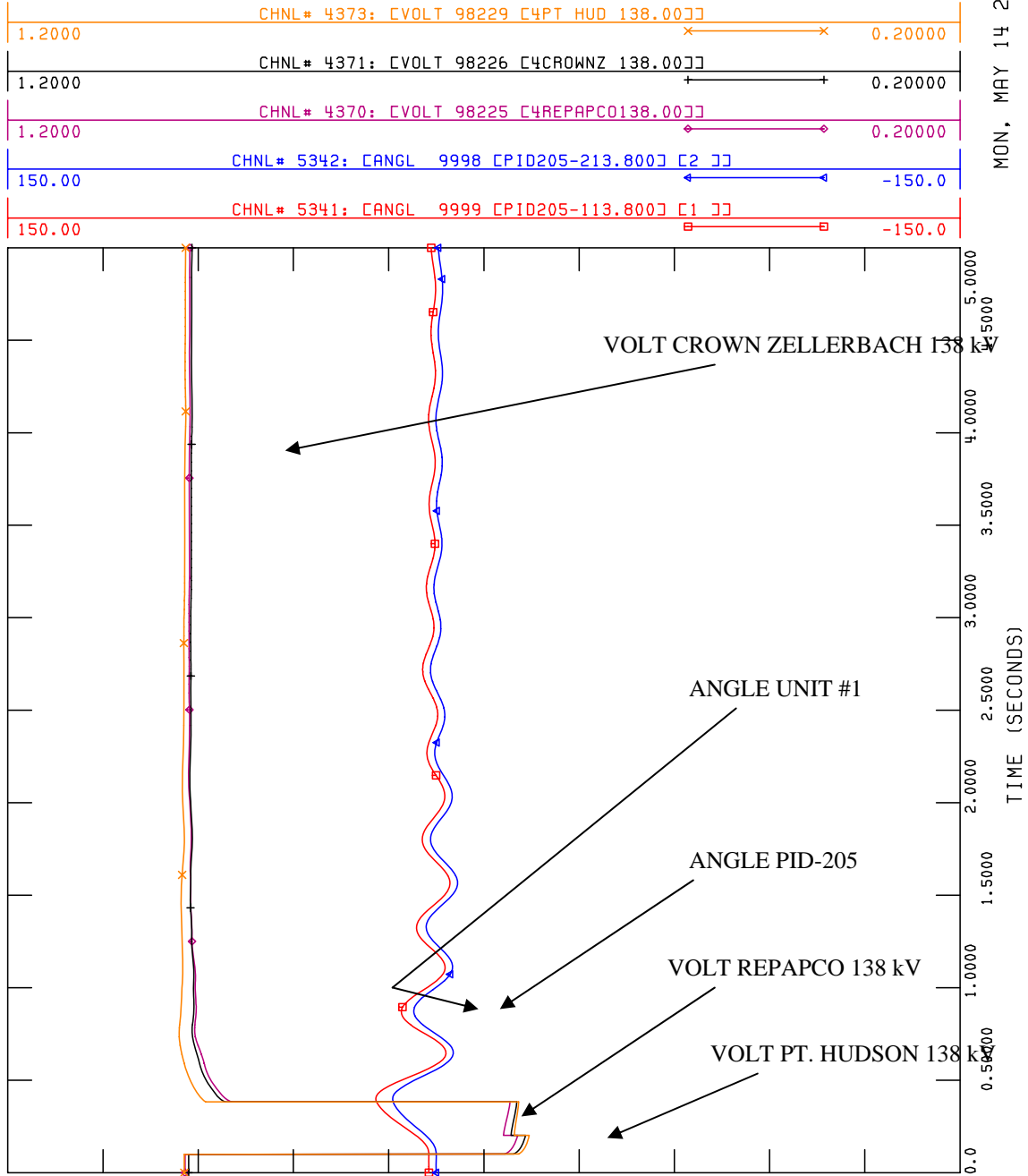


Figure III-6. Fault-6b-SLG WITH PID-205

In summary, the PID-205 (60 MW) generation at the Repapco 138 kV bus, meets Entergy's performance criteria.

Due to restructuring of the utility industry, there has been a large increase of merchant generation activity on the Entergy system. These generators are equipped with modern exciters that have a high gain and a fast response to enhance transient stability. However, these fast response exciters, if used without stabilizers, can lead to oscillatory instability affecting local or regional reliability. This problem is exacerbated particularly in areas where there is a large amount of generation with limited transmission available for exporting power.

Stability studies carried out at Entergy have validated this concern. Furthermore, based on the understanding of operational problems experienced in the WSCC area over the last several years and the opinion of leading experts in the stability area, Power System Stabilizers (PSS) are an effective and a low cost means of mitigating dynamic stability problems. In particular, PSS cost can be low if it is included in power plant procurement specifications.

Therefore, as a pre-emptive measure, Entergy requires all merchant generation intending to interconnect to its transmission system to install PSS on their respective units.

Please refer to Appendix A-I for Entergy's Policy Statement on PSS Requirements.

## APPENDIX A.A DATA SUPPLIED BY CUSTOMER

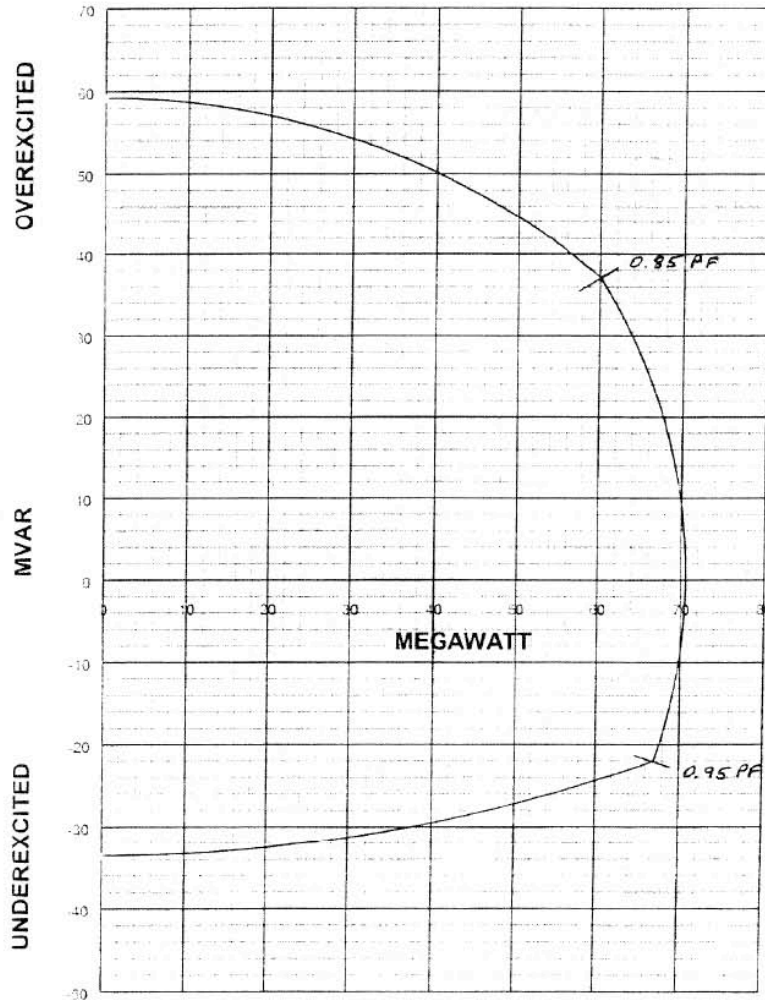
Customer:	
User:	
Proposal Number:	
Model	120B
KVA	70588
KW	60000
Power Factor	0.85
Temp. Total Class B Stator/Field Deg. C	110/125
Frequency	60
Phases	3
Voltage	13800
RPM	3600
Rated Armature Amps	2953
Voltage Regulation, Inherent at Rated P.F. (%)	35
Nominal Voltage Range % +/-	5
Short Circuit Ratio	0.48
Efficiency (Includes Bearings and Excitation)	
Full Load (Expected values, For guaranteed)	98.4
3/4 Load (values, refer to factory)	98.3
1/2 Load	97.9
1/4 Load	96.5
Reactance Data: Per Unit	
	Direct Axis
Saturated Synchronous - (Xdv)	2.17
Unsaturated Synchronous - (Xdi)	2.35
Saturated Transient - (X'dv)	0.22
Unsaturated Transient - (X'di)	0.25
Saturated Subtransient - (X''dv)	0.16
Unsaturated Subtransient - (X''di)	0.19
Saturated Negative Sequence - (X2v)	0.16
Unsaturated Negative Sequence - (X2i)	0.19
Saturated Zero Sequence - (X0v)	0.08
Unsaturated Zero Sequence - (X0i)	0.08
Leakage Reactance - (XLM, OEX)	0.14
	(XLM, UEX)
	0.14
	Quadrature Axis
Saturated Synchronous - (Xqv)	2.09
Unsaturated Synchronous - (Xqi)	2.27
Saturated Transient - (X'qv)	0.22
Saturated Subtransient - (X''qv)	0.16
Unsaturated Subtransient - (X''qi)	0.19
Field Time Constant Data - (Sec. @ 75C)	
	Direct Axis
Open Circuit - (T'do)	5.84
Three Phase Short Circuit Transient - (T'd3)	0.59
Line to Line Short Circuit Transient - (T'd2)	0.66
Line to Neutral Short Circuit Transient - (T'd1)	1.13
Short Circuit Subtransient - (T'd)	0.04
Open Circuit Subtransient - (T''do)	0.05

Customer:	
User:	
Proposal Number:	
70588 KVA - 13800 VOLT - 0.85 PF - 60 HZ	
Open Circuit Transient - (T"qo)	Quadrature Axis 1.28
Three Phase Short Circuit Transient - (T"q)	0.12
Short Circuit Subtransient - (T"q)	0.03
Open Circuit Subtransient - (T"qo)	0.47
<b>Armature D-C Component Time</b>	
Constant Data - (Sec. @ 75C)	
Three Phase Short Circuit - (Ta3)	0.32
Line to Line Short Circuit - (Ta2)	0.32
Line to Neutral Short Circuit - (Ta1)	0.27
<b>Per Unit Armature Winding Sequence Resistance Data:</b>	
Positive - (R1)	0.0039
Negative - (R2)	0.0156
Rotor Short Time Thermal Capacity - ((I2^2)t)	
	30
Armature Winding Capacitance Microfarads per Phase	
	0.165
Armature Winding D-C Resistance - (Per Phase) Ohms @ 75C	
	0.004
<b>Main Generator Field Data:</b>	
Field Winding D-C Resistance Ohms @ 75C	0.48
Field Current at Rated Load/Voltage/P.F. Amps	620
Field Voltage at Rated Load/Voltage/P.F. Volts	298
Field Current at No Load/Rated Voltage Amps	197
Field Voltage at No Load/ Rated Voltage Volts	95
Field Current at Rated KVA/Voltage/ 0 P.F. Amps	686
Field Current at 2.0 Per Unit Short Circuit Armature Current	330
Nominal Rated Field Voltage	330
Exciter Rated KW/Volts/Amps	210/330/640
Exciter Field Current at No Load/Rated Voltage DC Amp	4.0
Exciter Field Voltage at No Load/ Rated Voltage DC Volt	18
Exciter Field Current at Rated Load/Voltage/P.F. DC Amp	12.8
Exciter Field Voltage at Rated Load/Voltage/P.F. DC Volt	60
<b>PMG Nominal Ratings</b>	
KVA	1.6
Voltage (AC Volt)	125
Power Factor	0.9
Frequency (Hertz) / Phase	360 / 1



REACTIVE CAPABILITY CURVES FOR MODEL 120B - EM 05-1504-01  
 70588 KVA 13800 VOLT 2953 AMP 3 PH 60 HZ 3600 RPM 0.85 PF

Customer / User: [REDACTED]



**Loadflow Data used in Stability Model**

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0, 100.00 / PSS/E-29.4 TUE, MAY 15 2007 9:07
2005 SERIES, NERC/SDDWG BASE CASE LIBRARY
2005 FALL BASE CASE, TRIAL #6; PID-205
9998,'PID205-2', 13.8000,2, 0.000, 0.000, 151, 110,1.02000, -8.2723, 1
9999,'PID205-1', 13.8000,2, 0.000, 0.000, 151, 110,1.02000, -9.0425, 1
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9998,'IN',1, 151, 110, 55.200, 20.500, 0.000, 0.000, 0.000, 0.000,
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9999,'IN',1, 151, 110, 76.400, 19.900, 0.000, 0.000, 0.000, 0.000,
1
0 / END OF LOAD DATA, BEGIN GENERATOR DATA
9998,'2 ', 60.000, 25.799, 37.500, -24.000,1.02000, 0, 70.588,
0.00000, 0.19000, 0.00000, 0.00000,1.00000,1, 100.0, 69.047, 0.000,
1,1.0000
9999,'1 ', 67.670, 25.288, 30.000, -30.000,1.02000, 0, 73.555,
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1,1.0000
    
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0 / END OF GENERATOR DATA, BEGIN BRANCH DATA
0 / END OF BRANCH DATA, BEGIN TRANSFORMER DATA
98225, 9999, 9998, '3 ', 1, 2, 1, 0.00000, 0.00000, 2, ' ', 1, 1, 1.0000
0.00000, 0.09840, 30.00, 0.00000, 0.18540, 30.00, 0.00000, 0.09950,
30.00, 1.01463, -8.5476
1.00000, 0.000, 0.000, 100.00, 0.00, 0.00, 0, 0, 1.10000, 0.90000,
1.10000, 0.90000, 33, 0, 0.00000, 0.00000
1.00000, 0.000, 0.000, 50.00, 0.00, 0.00
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1.10000, 0.90000, 33, 0, 0.00000, 0.00000
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1.10000, 0.90000, 33, 0, 0.00000, 0.00000
1.00000, 0.000, 0.000, 50.00, 0.00, 0.00
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0 / END OF TWO-TERMINAL DC DATA, BEGIN VSC DC LINE DATA
0 / END OF VSC DC LINE DATA, BEGIN SWITCHED SHUNT DATA
0 / END OF SWITCHED SHUNT DATA, BEGIN IMPEDANCE CORRECTION DATA
0 / END OF IMPEDANCE CORRECTION DATA, BEGIN MULTI-TERMINAL DC DATA
0 / END OF MULTI-TERMINAL DC DATA, BEGIN MULTI-SECTION LINE DATA
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0 / END OF OWNER DATA, BEGIN FACTS DEVICE DATA
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## Dynamics Data used in Stability Model

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PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E TUE, MAY 15 2007 9:08
2005 SERIES, NERC/SDDWG BASE CASE LIBRARY
2005 FALL BASE CASE, TRIAL #6; PID-205

```

PLANT MODELS

REPORT FOR ALL MODELS BUS 9998 [PID205-213.800] MODELS

```

** GENROU ** BUS X-- NAME --X BASEKV MC C O N S S T A T E S
          9998 PID205-2 13.800 2 80982-80995 31039-31044

          MBASE Z S O R C E X T R A N GENTAP
          70.6 0.00000+J 0.19000 0.00000+J 0.00000 1.00000

T'D0 T''D0 T'Q0 T''Q0 H DAMP XD XQ X'D X'Q X''D XL
5.84 0.050 1.28 0.470 2.66 0.00 2.3500 2.2700 0.2500 0.3099 0.1900 0.1400

          S(1.0) S(1.2)
          0.1428 0.3714

```

```

** ESAC8B ** BUS X-- NAME --X BASEKV MC C O N S S T A T E S VAR
          9998 PID205-2 13.800 2 81010-81024 31051-31055 5586

          TR KP KI KD TD KA TA VRMAX VRMIN TE KE
          0.005 43.00 11.00 11.00 0.030 0.005 0.000 12.000 0.000 0.550 1.000

```

E1	S(E1)	E2	S(E2)	KE VAR
0.7500	1.6000	1.0000	1.7000	0.0000

PTI INTERACTIVE POWER SYSTEM SIMULATOR--PSS/E      TUE, MAY 15 2007    9:08  
 2005 SERIES, NERC/SDDWG BASE CASE LIBRARY  
 2005 FALL BASE CASE, TRIAL #6; PID-205

PLANT MODELS

REPORT FOR ALL MODELS

BUS 9999 [PID205-113.800] MODELS

\*\* GENROU \*\*    BUS X-- NAME --X BASEKV MC    C O N S    S T A T E S  
                  9999        PID205-1 13.800 1    80996-81009    31045-31050

MBASE	Z S O R C E	X T R A N	GENTAP
73.6	0.00000+J 0.19000	0.00000+J 0.00000	1.00000

T'D0	T''D0	T'Q0	T''Q0	H	DAMP	XD	XQ	X'D	X'Q	X''D	XL
4.10	0.012	1.28	0.470	2.59	0.00	2.4200	2.2700	0.2500	0.3099	0.1900	0.1400

S(1.0)	S(1.2)
0.1428	0.3714

\*\* ESAC8B \*\*    BUS X-- NAME --X BASEKV MC    C O N S    S T A T E S    VAR  
                  9999        PID205-1 13.800 1    81025-81039    31056-31060    5587

TR	KP	KI	KD	TD	KA	TA	VRMAX	VRMIN	TE	KE
0.005	43.00	11.00	11.00	0.030	0.005	0.000	12.000	0.000	0.550	0.000

E1	S(E1)	E2	S(E2)	KE VAR
0.7500	1.6000	1.0000	1.7000	0.0000

## **APPENDIX A.B Stability Issues in the Western Region of the Entergy System Due to Independent Power Generation**

### **Introduction**

The WOTAB (West of the Atchafalaya Basin) Area is defined as Entergy's systems in Southwestern Louisiana, and Southeastern Texas. The WOTAB area is a major load center for the Entergy System. The load to generation ratio requires a significant amount of power to be imported into the WOTAB area. However, because of the influx of new generating projects proposed for the area, it is likely that by the year 2003 this area may turn into a significant exporter of power. There have been a significant number of requests for interconnection studies to evaluate the potential interconnection of new generating facilities in the WOTAB area. It is anticipated that by 2003 there may be approximately 4000 – 6000 MW of new merchant generation within the WOTAB area.

Entergy's transmission system was planned, designed and built to serve approximately 5000 – 6000 MW of native and network loads in the WOTAB area. The addition of a significant amount of merchant generation will result in the export of power out of the WOTAB area. A high level of export power has the potential to create major problems, such as voltage and dynamic stability. The main objective of this study is to establish an estimated power export limit for the WOTAB area based on stability criteria.

Signing an interconnection agreement provides the generator the right to interconnection to the transmission system, but does not provide it any right to move its power onto or over the transmission system. The right to use the transmission system to transmit power can only be obtained by submitting a transmission request for service pursuant to Entergy's FERC-approved transmission tariff. Solutions to stability problems to increase export limits, such as construction of 500 kV line, have very long lead-times and tend to be very expensive.

Entergy believes that it is important to post this study publicly on its OASIS site so that entities that have already executed interconnection agreements, as well as entities that are proposing to site new generation within the WOTAB area, can incorporate this information into their decision-making process.

## **Analysis**

In order to establish stability limits from the WOTAB area, all merchant generating that have signed an interconnection agreement were dispatched at their maximum capability along with the native generation in the area. In order to accommodate this export and simulate a worst case scenario, generation was reduced in the northern part of the Entergy System.

In this analysis the export limits were determined without the addition of any Power System Stabilizers (PSSs). However, sensitivity studies were conducted to determine the impact of stabilizers. If voltage stability limits were found to be lower than the dynamic stability limits, they were captured in this analysis.

*One important assumption made in this study was to ignore thermal limitations. Thermal issues will be addressed as part of Transmission Service Request as they are based on source to sink information and generation dispatch within the WOTAB area.*

The two cases analyzed in this study are as follows:

1. Base case with no merchant generation
2. Base case with merchant generation

Voltage stability analysis was performed for the pre-contingency condition and contingencies on four critical lines: Hartburg-Mt. Olive 500 kV, Richard-Webre 500 kV, Nelson-Richard 500 kV, and Grimes-Crockett 345 kV lines. As part of the voltage stability analysis, PV curves were developed in order to determine the maximum power that can be exported from the WOTAB area without experiencing voltage decline or voltage collapse. Entergy's guideline on voltage decline states that voltage at any station should not fall below 0.92 pu of nominal system voltage on single contingency.

Transient stability analysis was performed by applying a 3 phase to ground fault on the lines mentioned earlier. The fault clearing time was assumed to be 5 cycles for 500 kV and 345 kV lines and 6 cycles for the 230 kV lines. The transient stability plots show the machine angle as a function of time and indicate whether machine is stable and well damped, transiently unstable or dynamically unstable. A three percent damping criteria was used to screen the damping problem.

## **Results**

### **Case 1 – Base Case with no Merchant Generation**

No voltage stability problems were identified in this case. The transient stability plots in Figures 1 and 2 for a three-phase fault on the Hartburg – Mt.Olive 500 kV and Richard – Webre 500 kV lines show that the machines are stable and well damped.

### **Case 2 – Base case with Merchant Generation**

#### **A. Voltage Stability Analysis**

The voltage stability plot or PV Curve for this case is shown in Figure 3. The X-axis of this plot is the power export level from the WOTAB area corresponding to the pre-contingency condition and the contingency of the four critical lines described earlier. The Y-axis represents the voltage at the Cane River 115 kV bus in the North Louisiana area. This station is representative of the voltage collapse occurring in that area. From the PV plot it can be observed that the most limiting contingency from the point of view of export from the area is the Hartburg – Mt. Olive 500 kV line. Based on the voltage decline guideline, the export limit from the area on the contingency of Hartburg-Mt. Olive line is 2100 MW. Figure 3 also shows that voltage collapse will eventually occur at about 3300 MW.

## B. Transient/Dynamic Stability Analysis

The transient stability simulations were performed with the assumption that there are no Power System Stabilizers (PSS) installed on the proposed merchant generating units. The maximum export under this condition where the units are marginally damped was determined to be approximately 2700 MW. The stability plot for this simulation is shown in Figure 4. It was determined that export limits can be improved by adding PSS to the merchant generation. Henceforth, it will be a requirement that all new units in the area be equipped with stabilizers.

### Conclusions:

The West of the Atchafalaya Basin (WOTAB) area can experience a voltage and dynamic stability problem if a significant amount of new merchant generation is operating in the area by year 2003. The export limit from this area is determined to be 2700 MW based on dynamic stability and 2100 MW based on voltage decline. As this area can experience dynamic problems beyond a certain export limit it will be mandatory for all IPPs in the area to install PSS on their units. Any *further* increase in the export level may require major upgrades, such as construction of 500 kV transmission lines.

The thermal limits were not evaluated in this study because they are source and sink specific and based on the generation dispatch. These limits will be evaluated when transmission service is requested and a System Impact Study is conducted.

# **APPENDIX A.C POLICY STATEMENT/GUIDELINES FOR POWER SYSTEM STABILIZER ON THE ENTERGY SYSTEM**

Background:

A Power System Stabilizer (PSS) is an electronic feedback control that is a part of the excitation system control for generating units. The PSS acts to modulate the generator field voltage to damp the Power System oscillation.

Due to restructuring of the utility industry, there has been a significant amount of merchant generation activity on the Entergy system. These generators are typically equipped with modern exciters that have a high gain and a fast response to enhance transient stability. However, these fast response exciters, if used without stabilizers, can lead to oscillatory instability affecting local or regional reliability. This problem is exacerbated particularly in areas where there is a large amount of generation with limited transmission available for exporting power.

Stability studies carried out at Entergy have validated this concern. Furthermore, based on the understanding of operational problems experienced in the WSCC area over the last several years and the opinion of leading experts in the stability area, PSS are an effective and a low cost means of mitigating dynamic stability problems. In particular, PSS cost can be low if it is included in power plant procurement specifications.

Therefore, as a pre-emptive measure, Entergy requires all new generation (including affiliates and qualifying facilities) intending to interconnect to its transmission system to install PSS on their respective units.

The following guidelines shall be followed for PSS installation:

- PSS shall be installed on all new synchronous generators (50 MVA and larger) connecting to the transmission system that were put into service after January 1, 2000.
- PSS shall be installed on synchronous generators (50 MVA and larger) installed before January 1, 2000 subject to confirmation by Entergy that these units are good candidates for PSS and installing PSS on these units will enhance stability in the region. The decision to install PSS on a specific unit will be based on the effectiveness of the PSS in controlling oscillations, the suitability of the excitation system, and cost of retrofitting.
- In areas where a dynamic stability problem has not been explicitly identified, all synchronous generators (50 MVA and larger) will still be required to install stabilizers. However, in such cases the tuning will not be required and the stabilizer may remain disconnected until further advised by Entergy.
- Need for testing and tuning of PSS on units requesting transmission service from areas where stability problem has not been explicitly identified will be determined on an as-needed basis as part of transmission service study.
- The plants are responsible for testing and tuning of exciter and stabilizer controls for optimum performance and providing PSS model and data for use with PSS/E stability program.
- PSS equipment shall be tested and calibrated in conjunction with automatic voltage regulation (AVR) testing and calibration at-least every five years in accordance with the NERC Compliance Criteria on Generator Testing. PSS re-calibration must be performed if AVR parameters are modified.
- The PSS equipment to be installed is required to be of the Delta-P-omega type.

References:

WOTAB Area Stability Study for the Entergy System

WSCC Draft Policy Statement on Power System Stabilizers

PSEC Application Notes: Power System Stabilizer helps need plant stability margins for Simple Cycle and Combined Cycle Power Plants



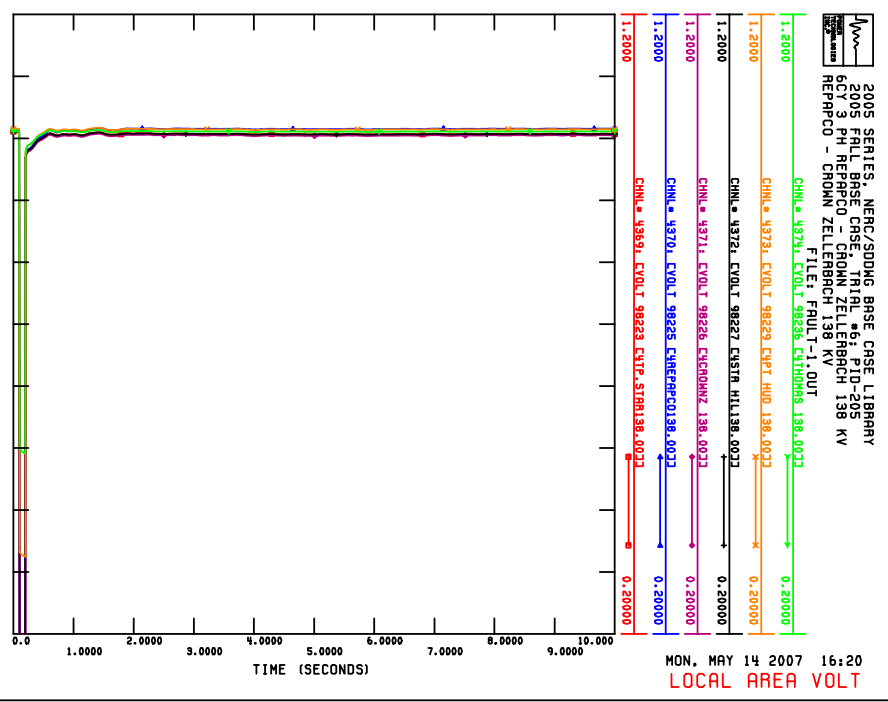
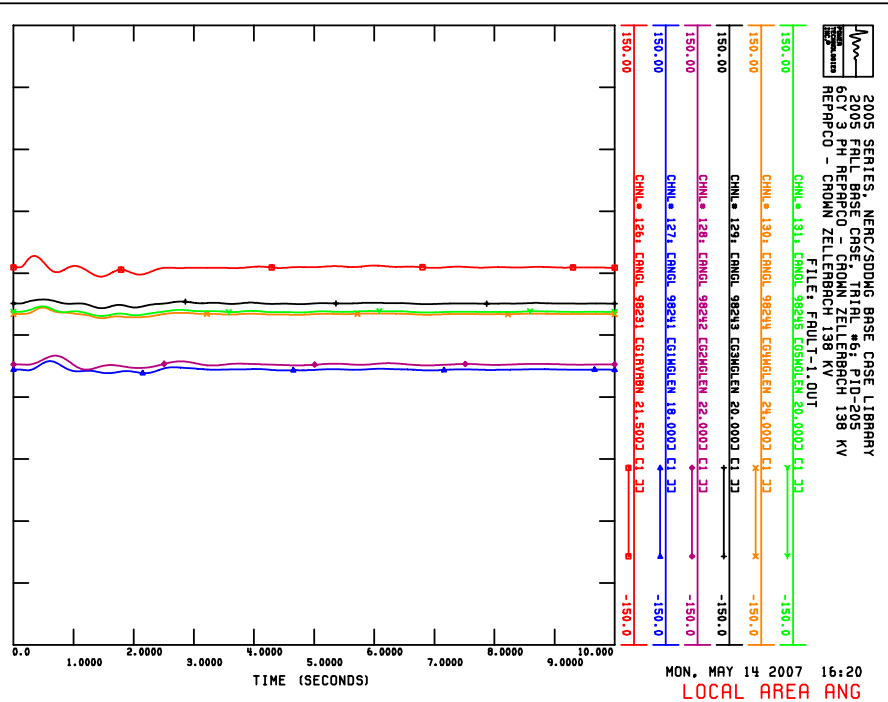
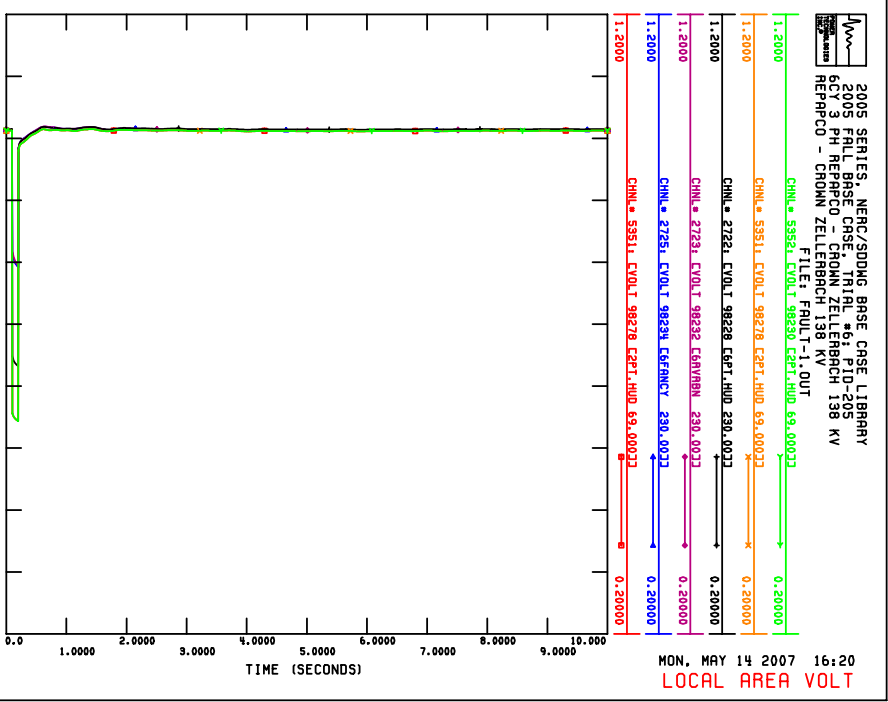
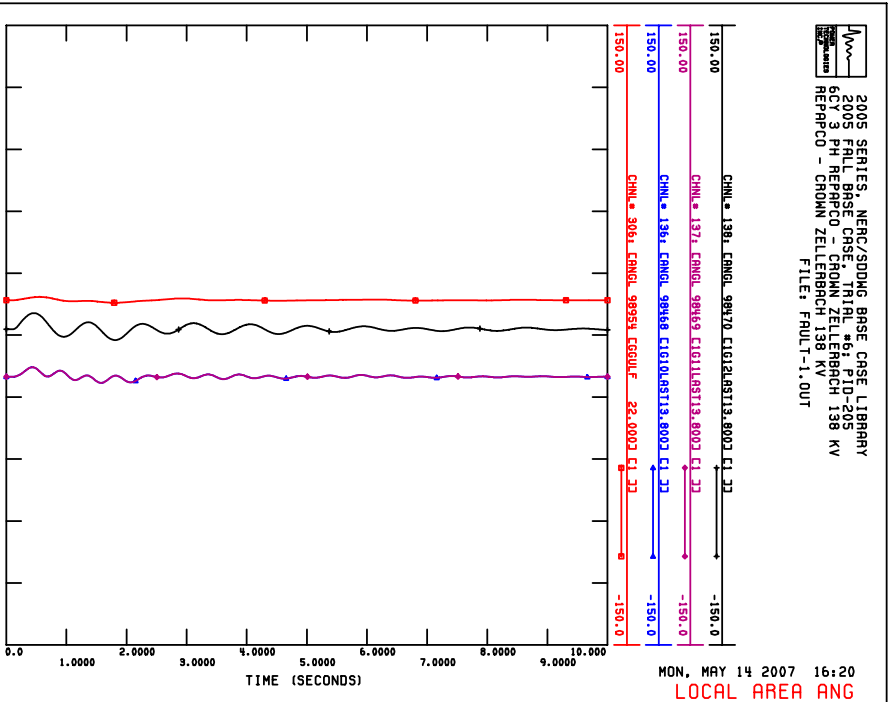
## **APPENDIX A.D Transient Stability Data and Plots**

Plots illustrating the results from the simulated cases have been provided. For all cases, bus voltages and angles of the nearby generators in the vicinity of the proposed PID 205 unit are included in the plots.

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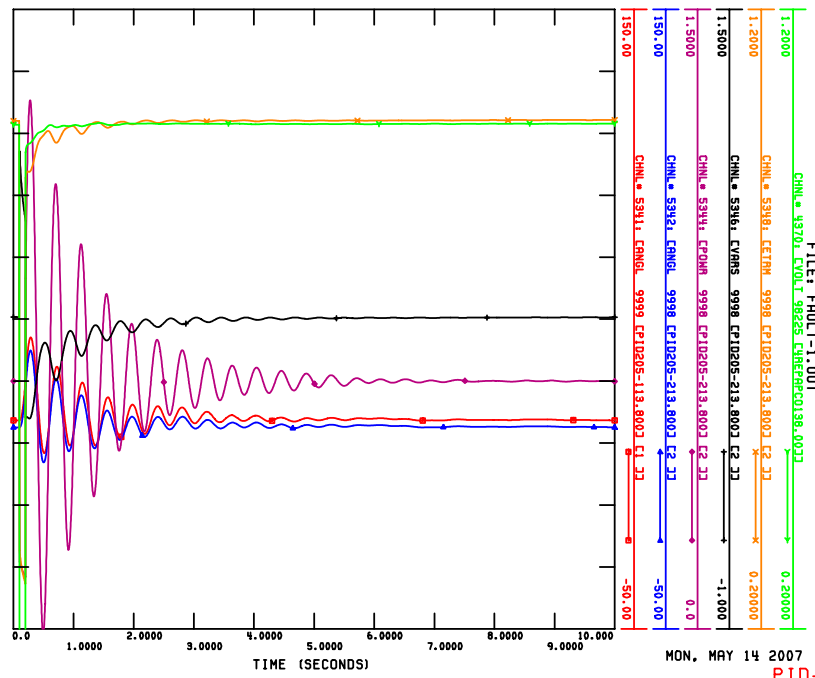
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**REPAPCO - CROWN ZELLERBACH 138 KV**





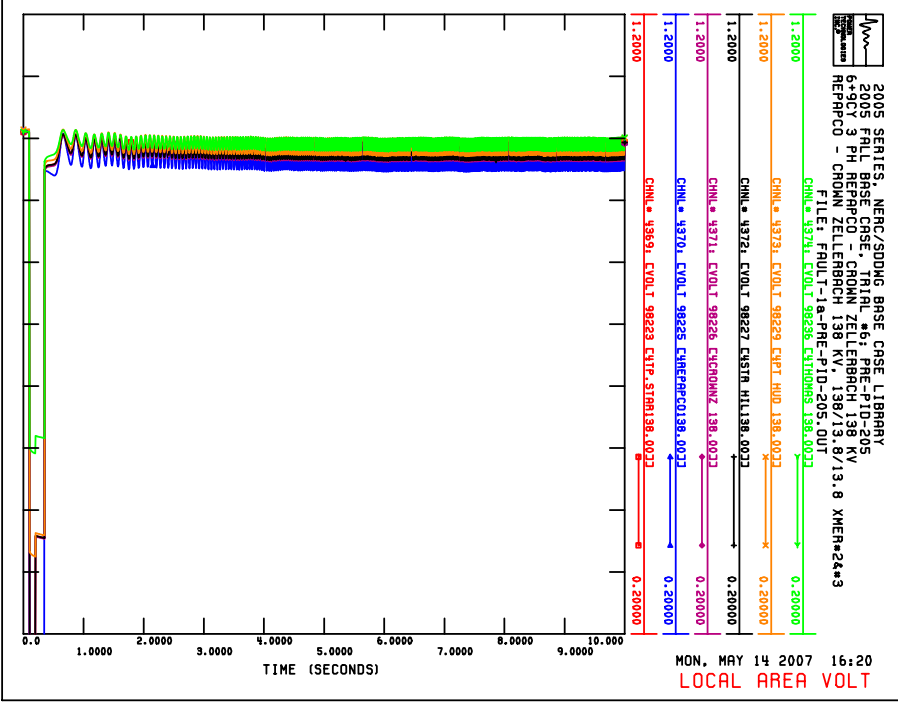
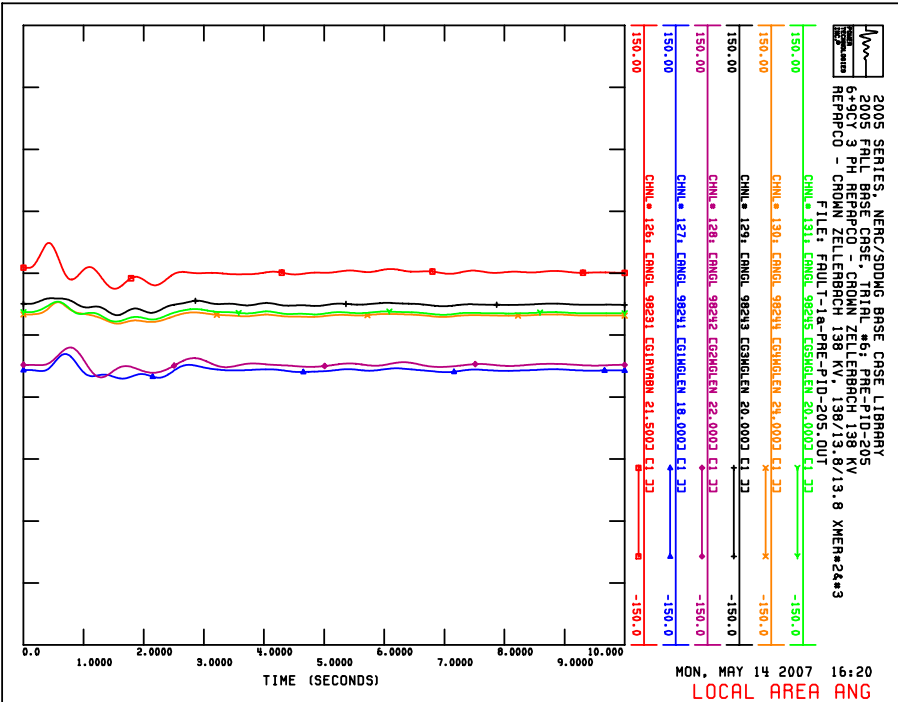
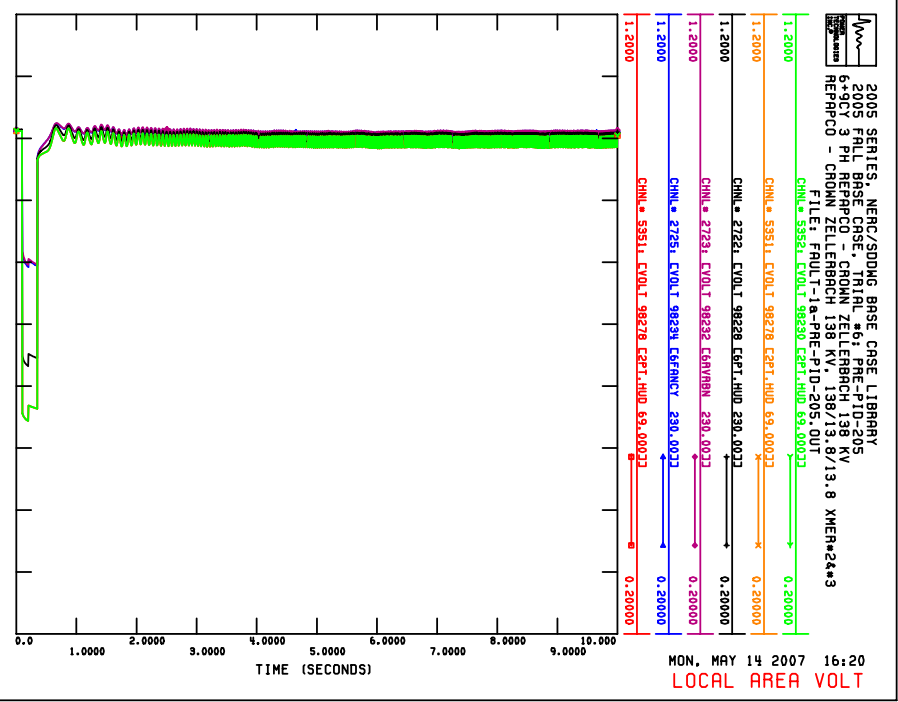
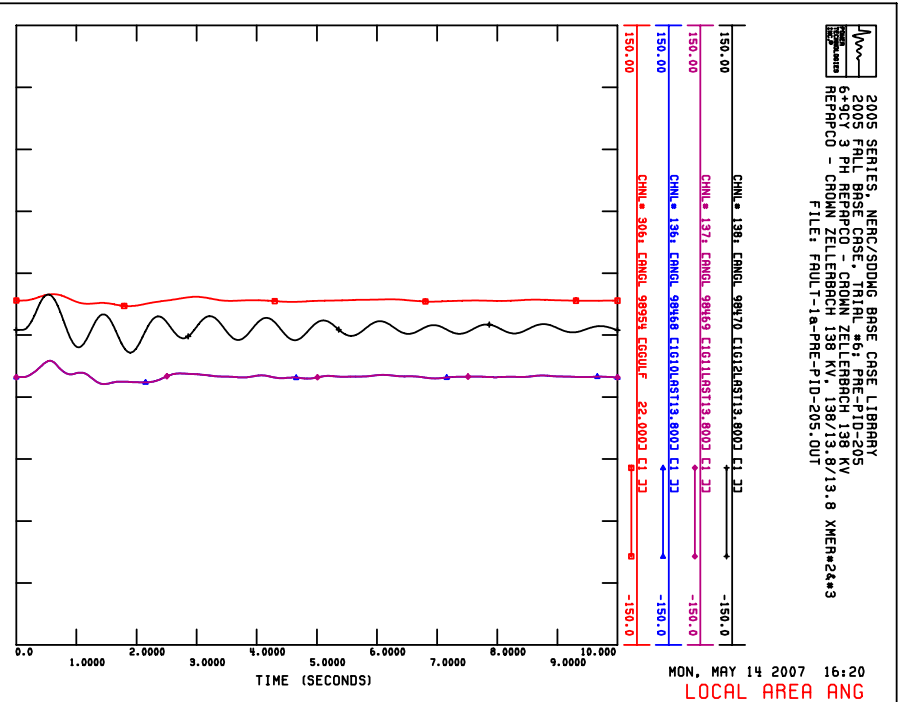
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 REPAIRCO - CROWN ZELLEBRICH 138 KV  
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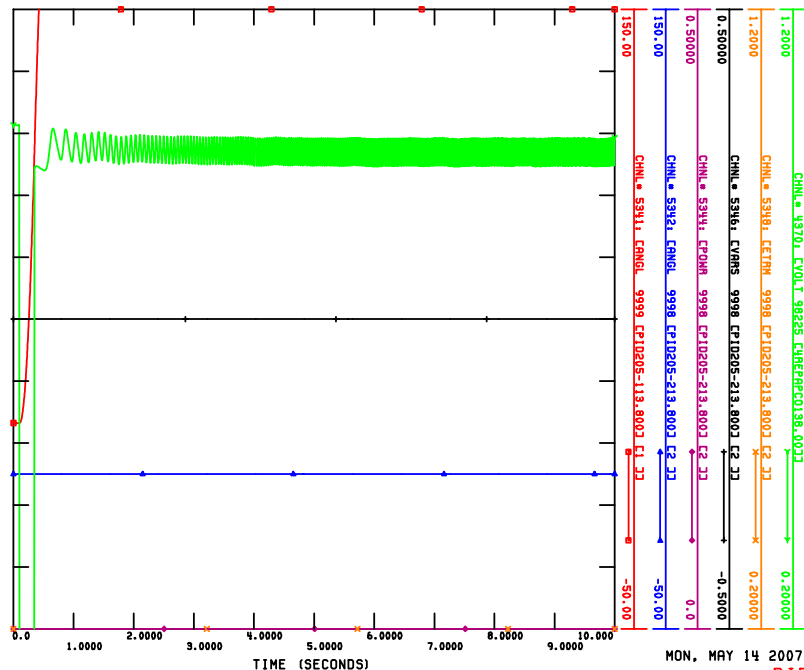
**FAULT-1a WITHOUT PID-205**

**6+9CY 3 PH REPAPCO - CROWN ZELLERBACH 138 KV**

**Repapco - Crown Zellerbach 138 kV, 138/13.8/13.8 xmer#2&#3**



2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
2005 FAULT BASE CASE, TRIPL #6, PRE-PID-205  
6+9C1 3 PH REPPCO - CROWN ZELLEBRICH 138 KV  
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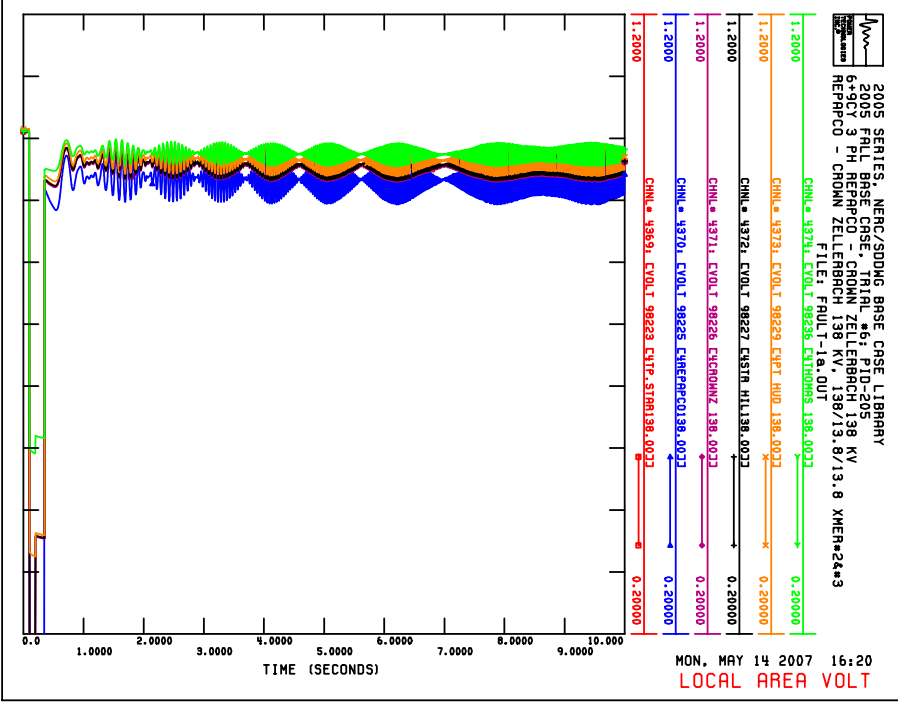
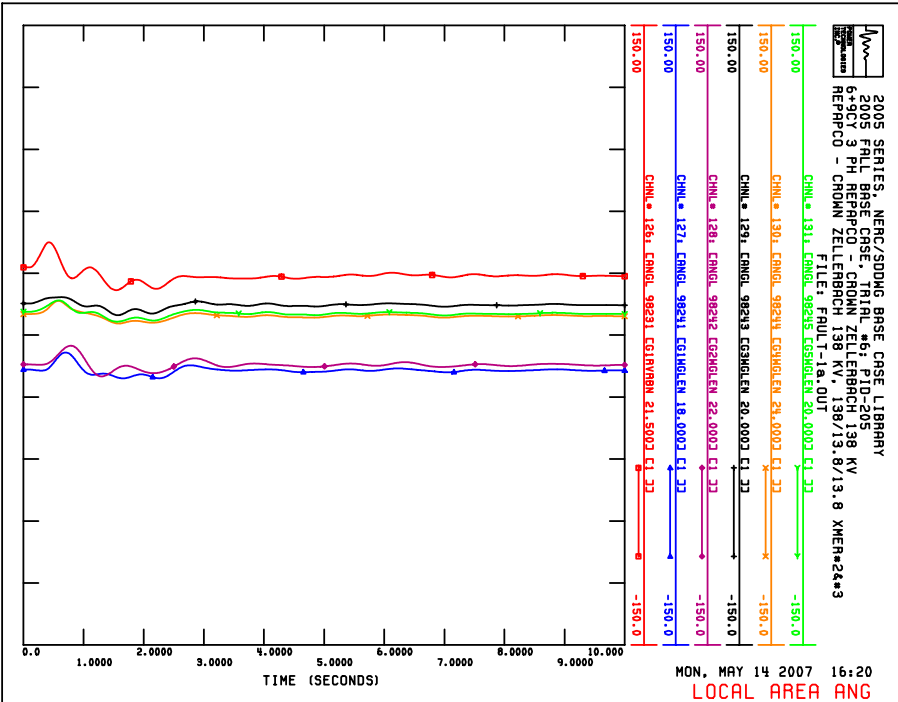
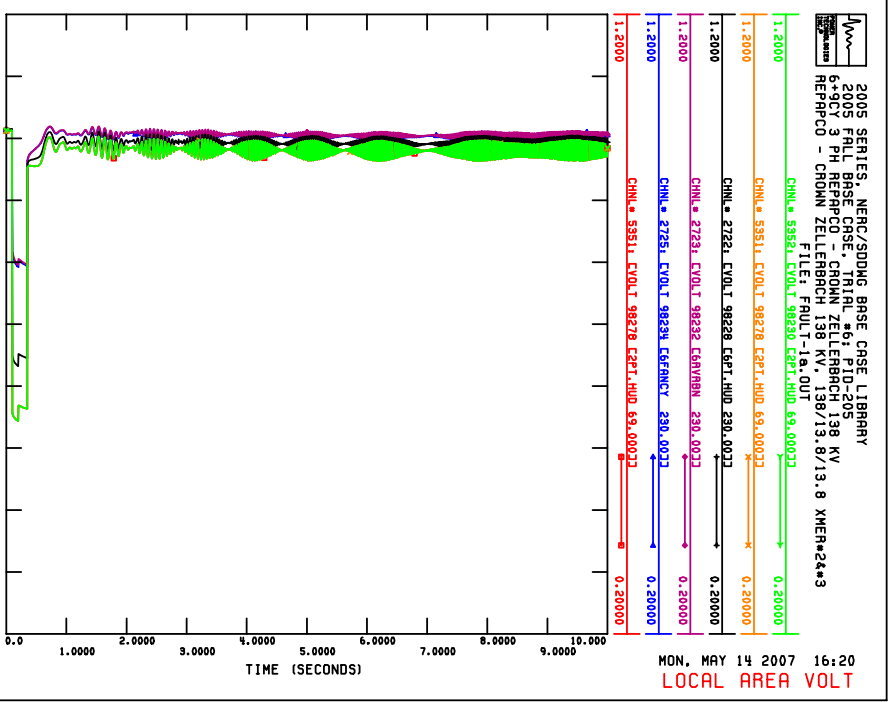
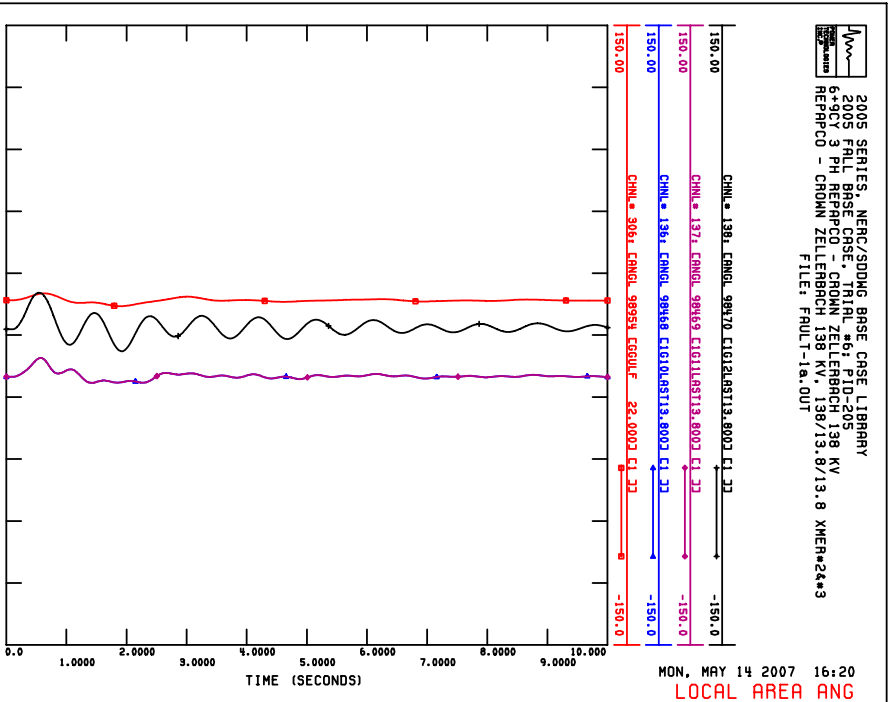


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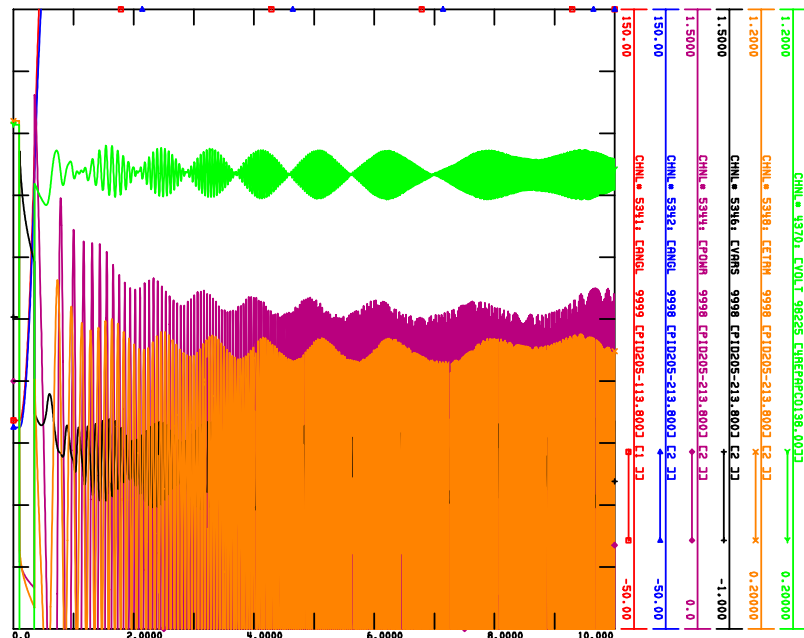
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**Repapco - Crown Zellerbach 138 kV, 138/13.8/13.8 xmer#2&#3**





2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FAULT BASE CASE, TRIPL #6, PID-205  
 6+9CY 3 PH REPPCO - CROWN ZELLEBRICH 138 KV, 138/13.8/13.8 XMER#24#3  
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TIME (SECONDS)

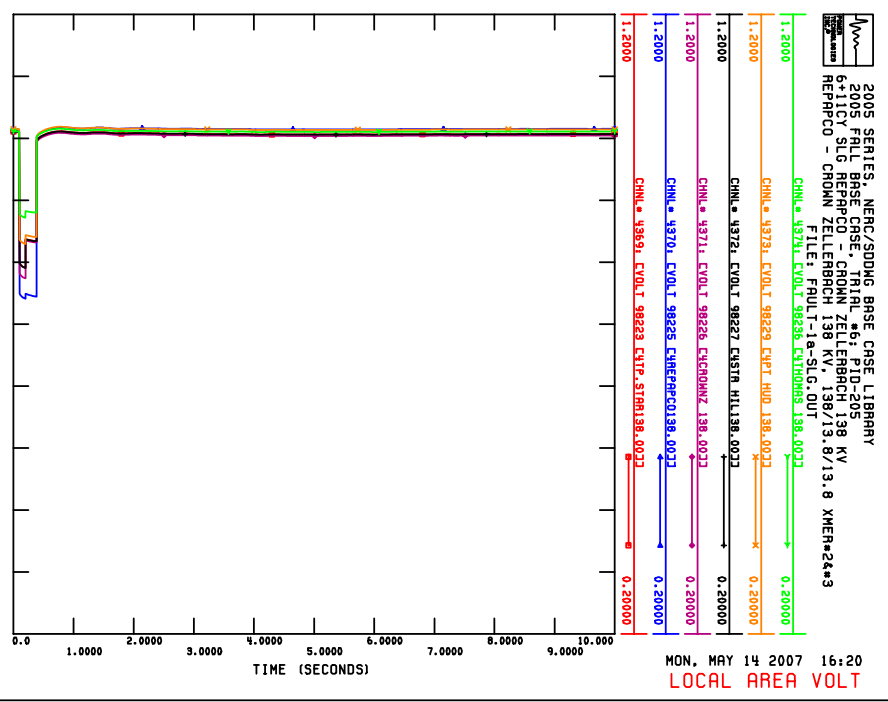
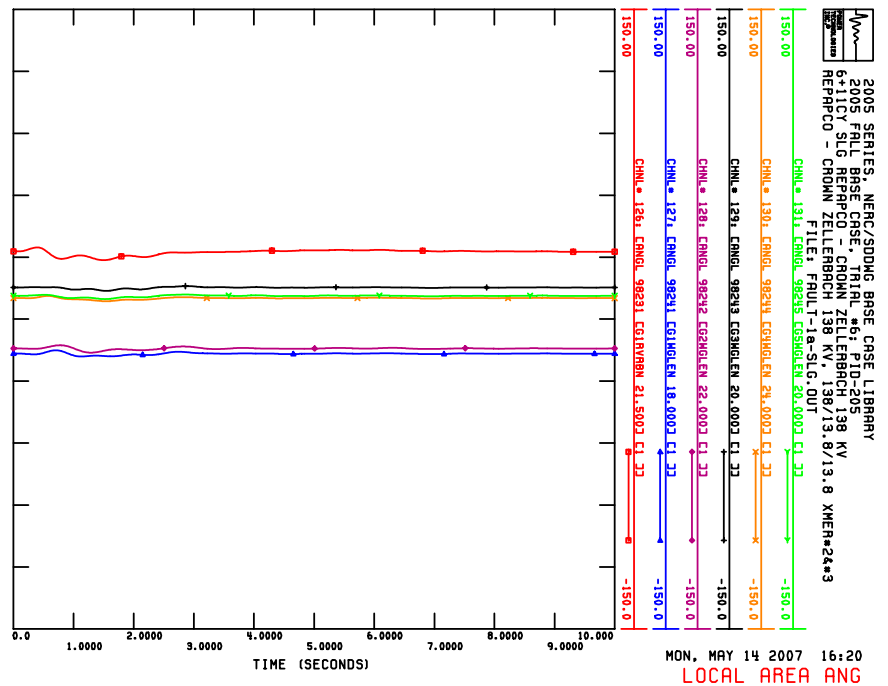
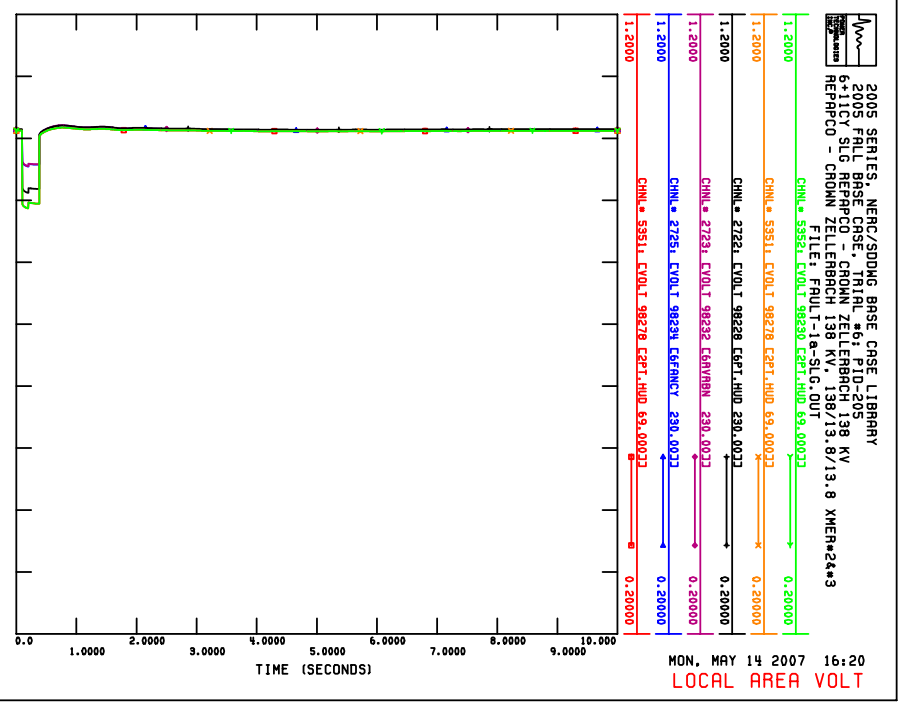
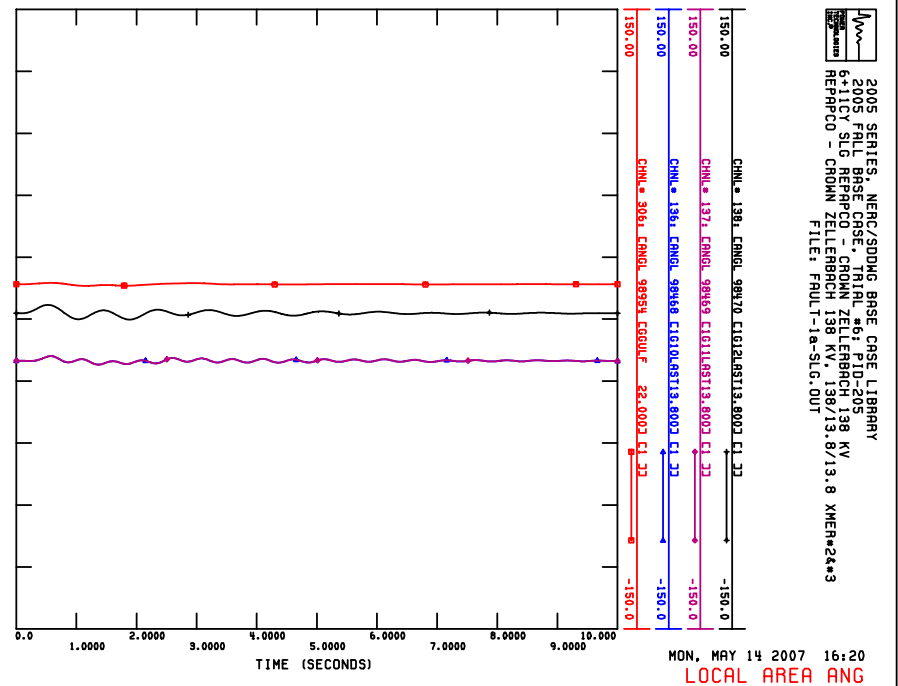
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PID-205

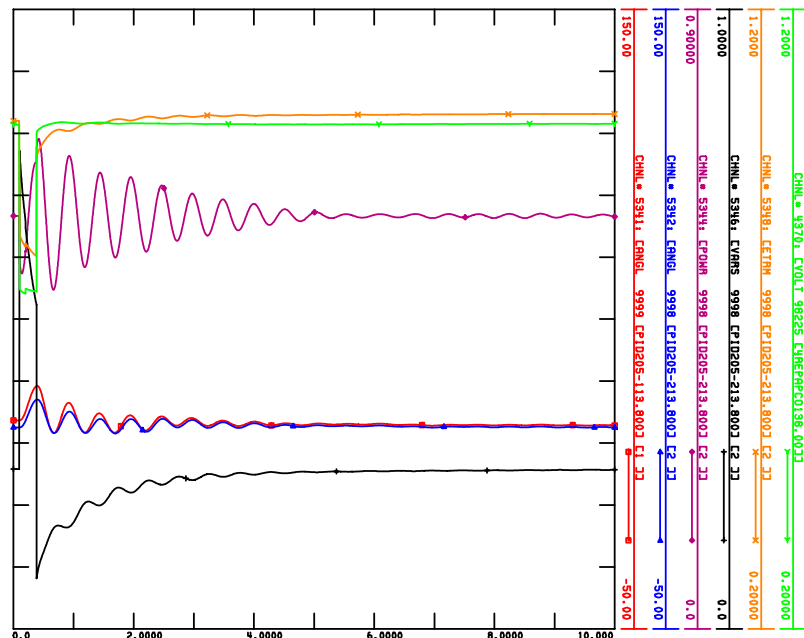
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**6+11CY SLG REPAPCO - CROWN ZELLERBACH 138 KV**

**Repapco - Crown Zellerbach 138 kV, 138/13.8/13.8 xmer#2&#3**



2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FULL BASE CASE, TRIRL #6, PID-205  
 6+11CY SLG REPPCO - CROWN ZELLEBRICH 138 KV  
 REPPCO - CROWN ZELLEBRICH 138 KV, 138/13.8/13.8 XMER#24#3  
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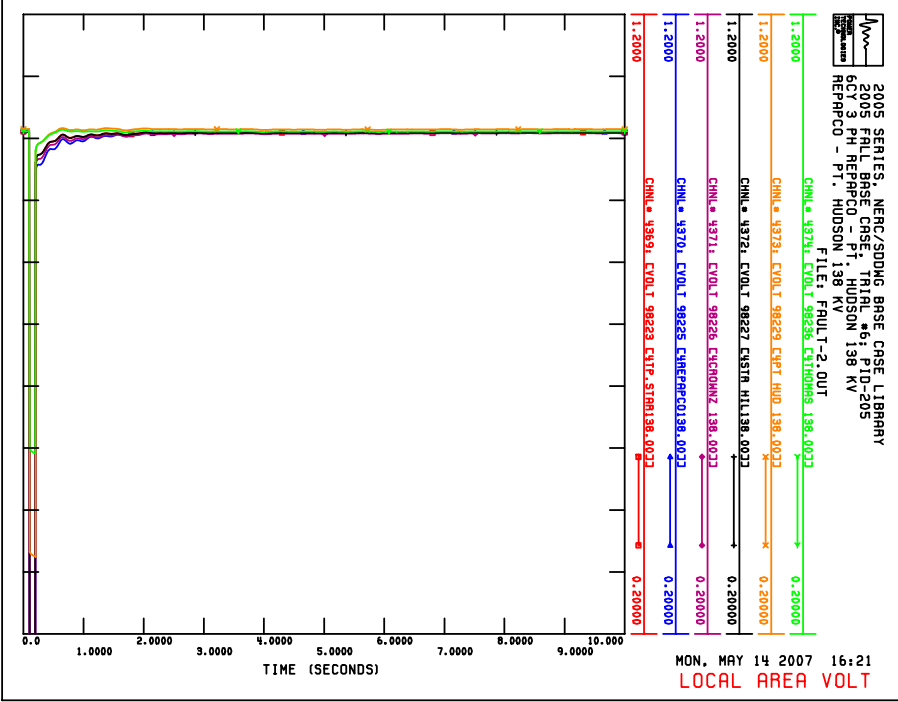
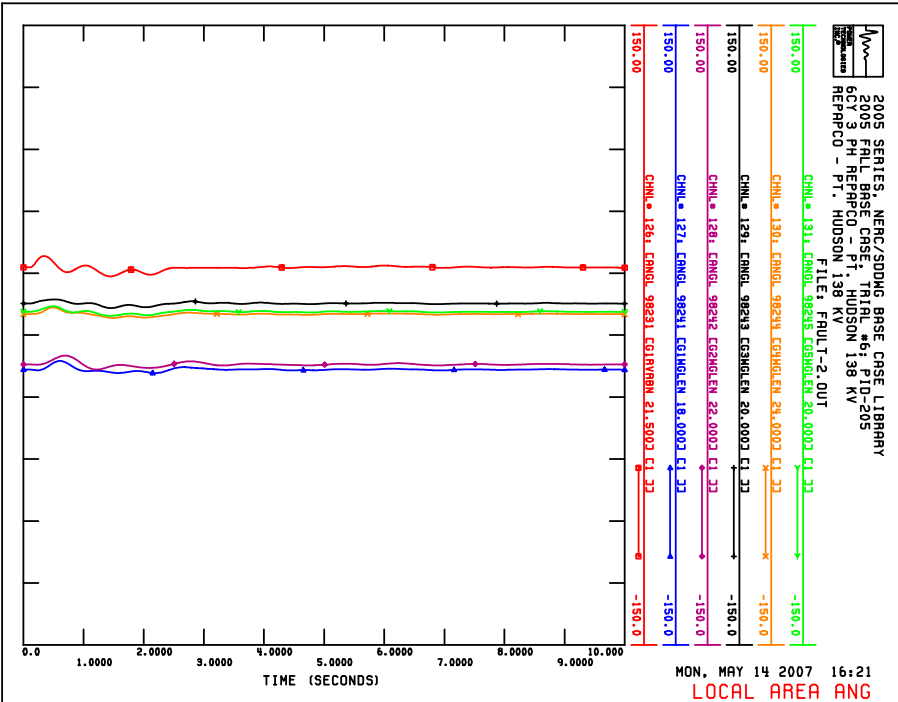
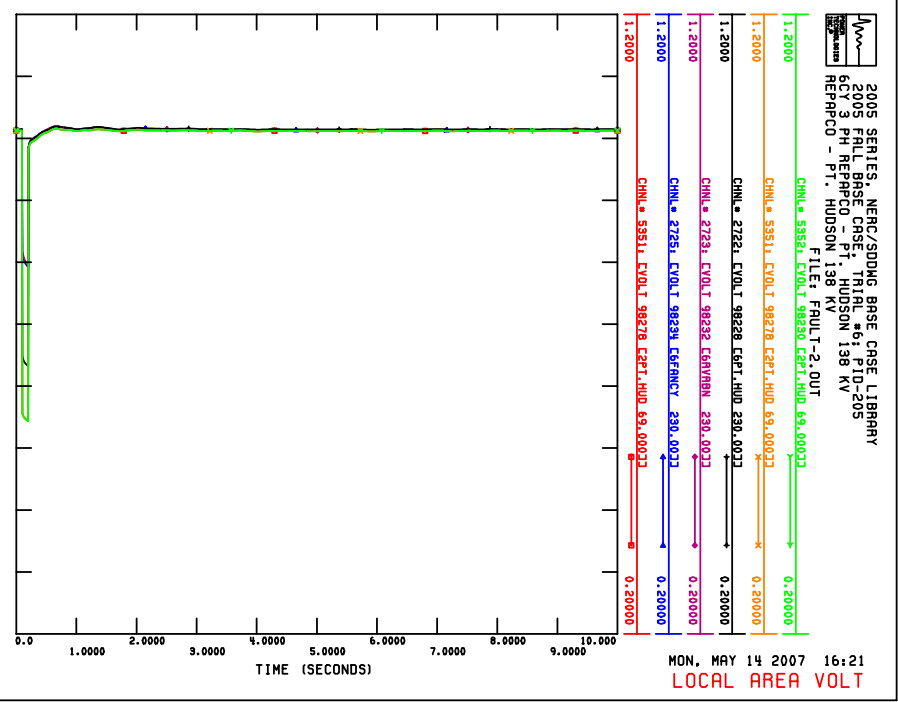
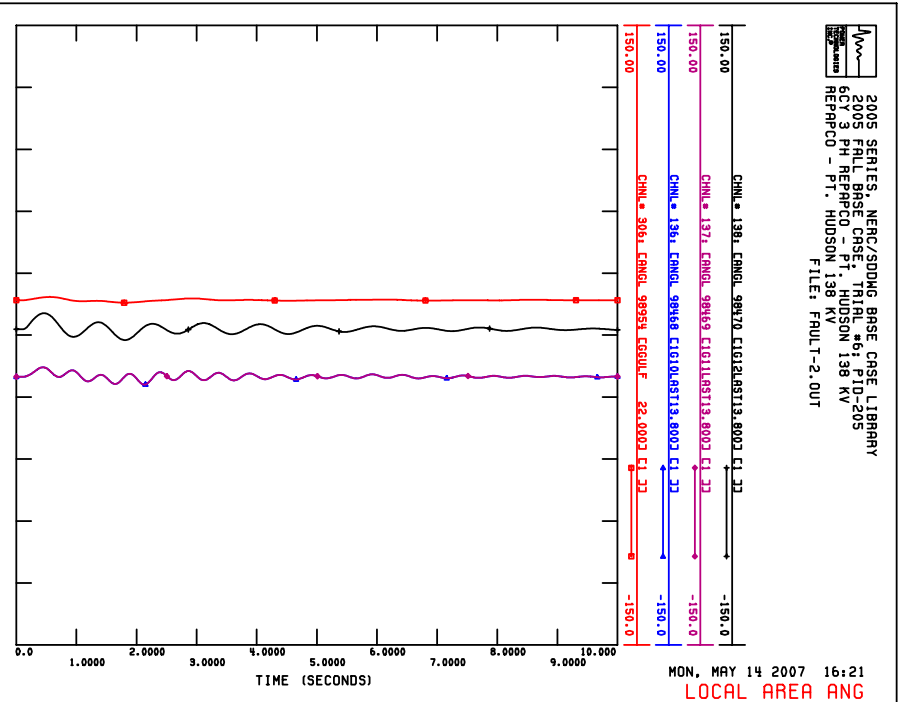


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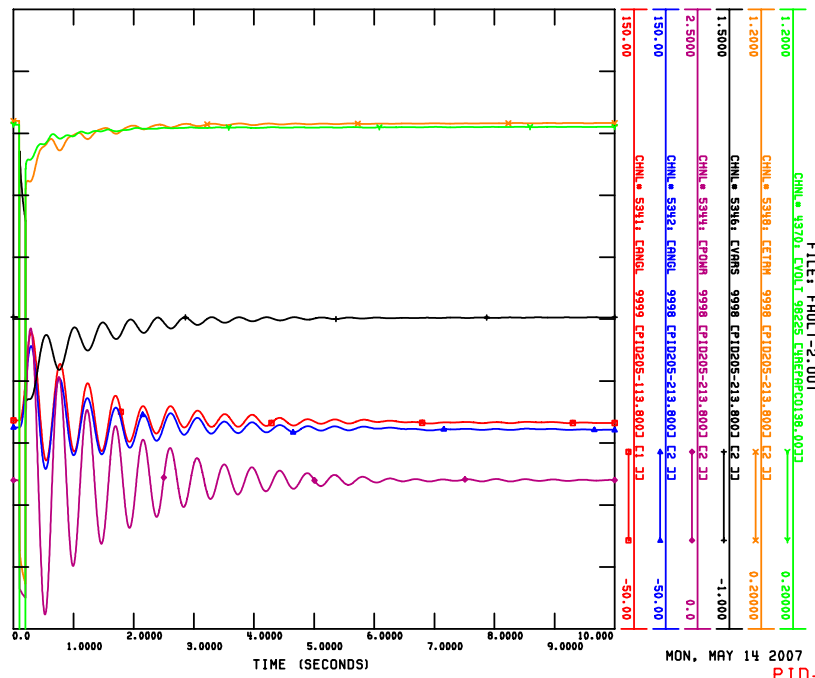
**6CY 3 PH REPAPCO - PT. HUDSON 138 KV**

**REPAPCO - PT. HUDSON 138 KV**





2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
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6CY 3 PH REPAIRCO - PT. HUDSON 138 KV  
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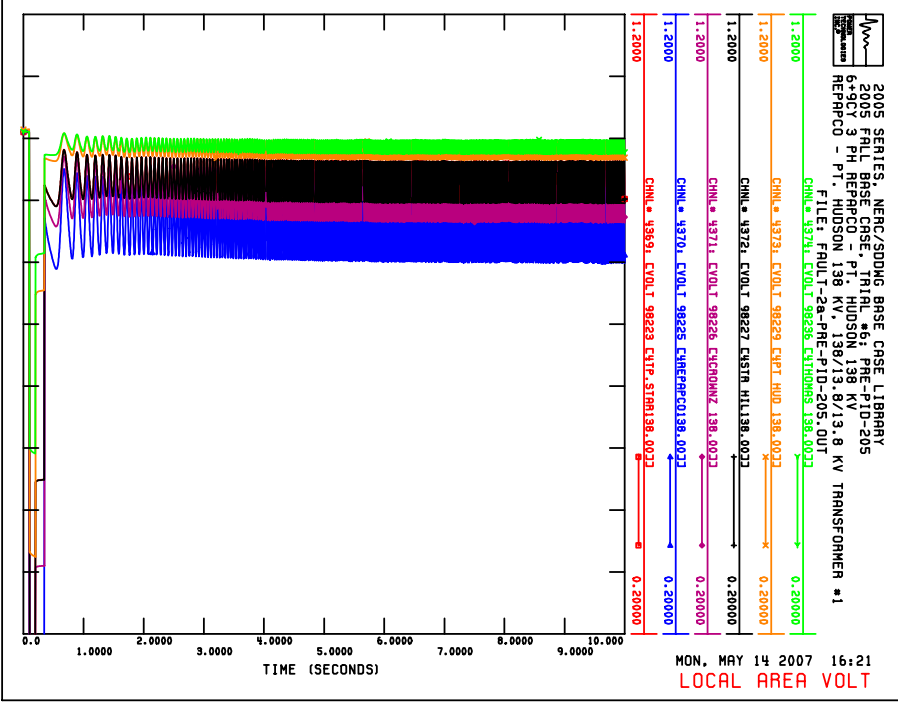
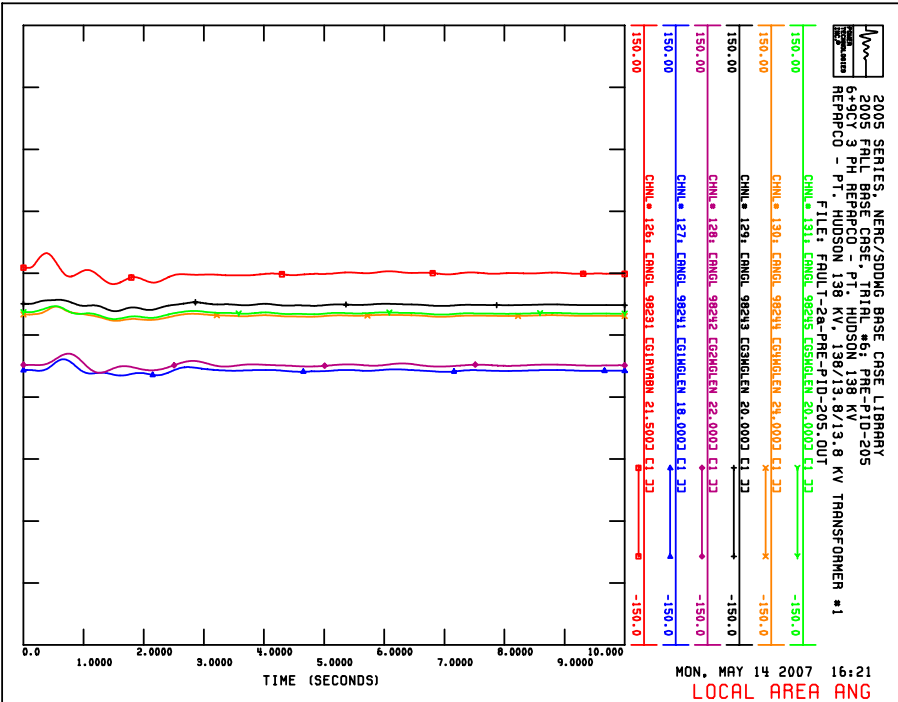
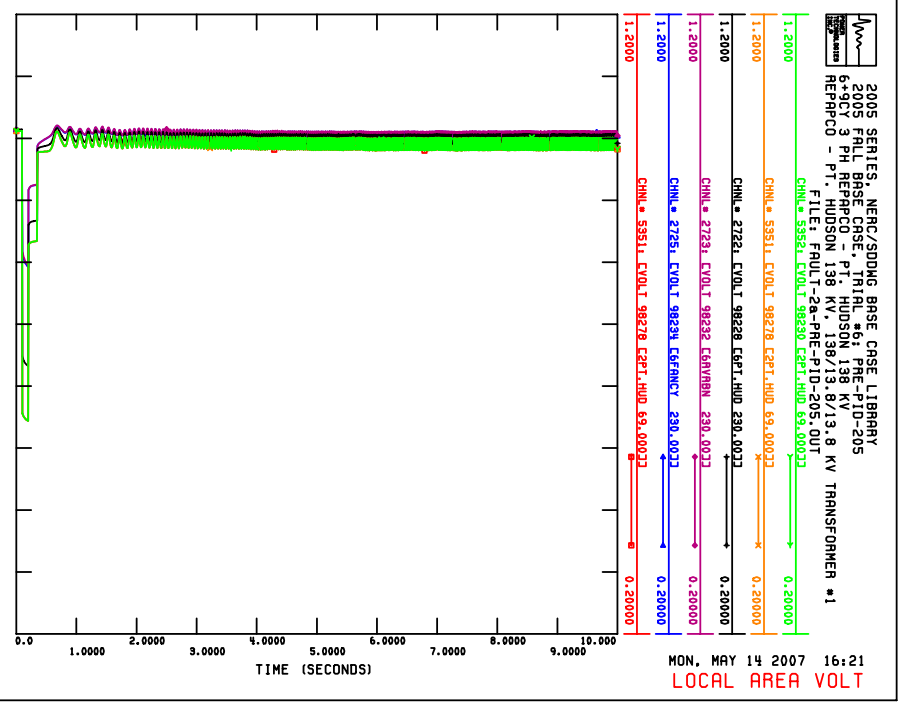
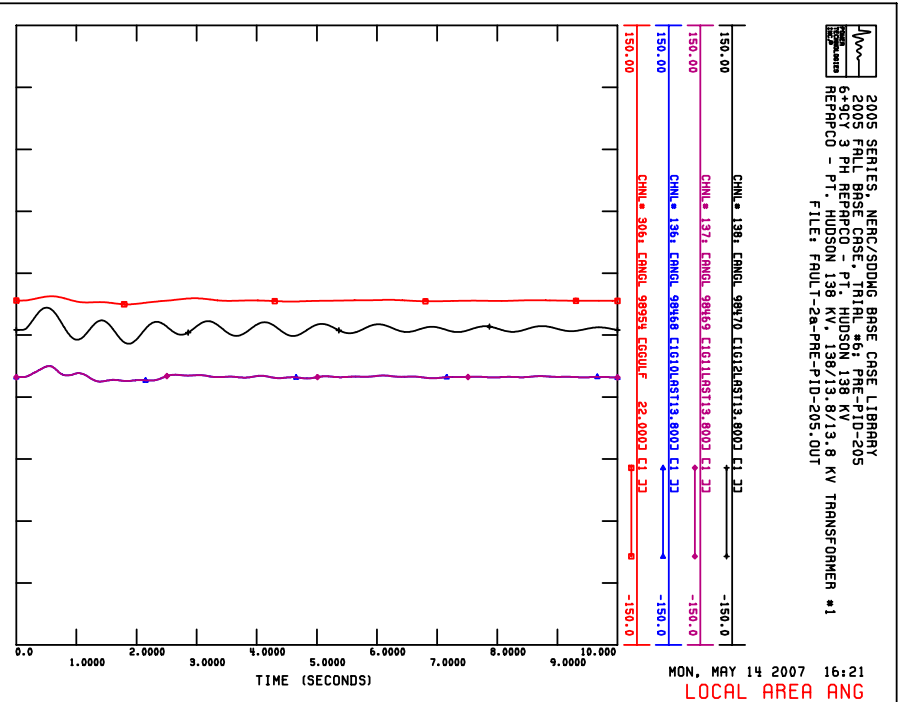
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PID-205



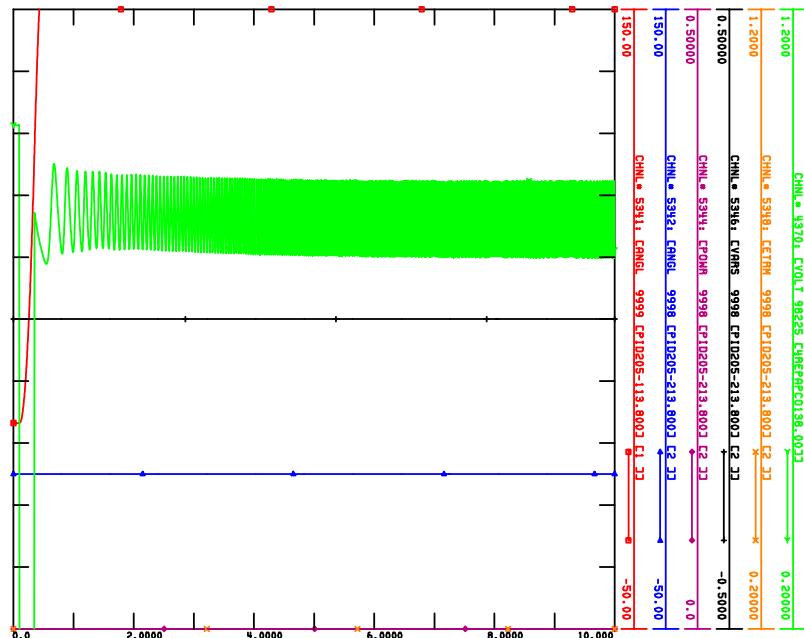
**FAULT-2a WITHOUT PID-205**

**6+9CY 3 PH REPAPCO - PT. HUDSON 138 KV**

**Repapco - PT. Hudson 138 kV, 138/13.8/13.8 kV Transformer #1**



2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
2005 FALL BRSE CRSE, TRIRL #6, PRE-PID-205  
6+9C1 3 PH REPPPCO - PT, HUDSON 138 KV  
REPPPCO - PT, HUDSON 138 KV, 138/13.8/13.8 KV TRANSFORMER #1  
FILE: FAULT-2a-PRE-PID-205.OUT  
CHN1 = 13701 CVOLT 98225 CHREPPPCO138\_0001  
CHN2 = 53981 CETERM 9998 CP10205-213\_8001 C2 31  
CHN3 = 53961 CVARS 9998 CP10205-213\_8001 C2 31  
CHN4 = 53941 CPGMR 9998 CP10205-213\_8001 C2 31  
CHN5 = 53921 CANNL 9998 CP10205-213\_8001 C2 31  
CHN6 = 53911 CANNL 9999 CP10205-113\_8001 C1 31

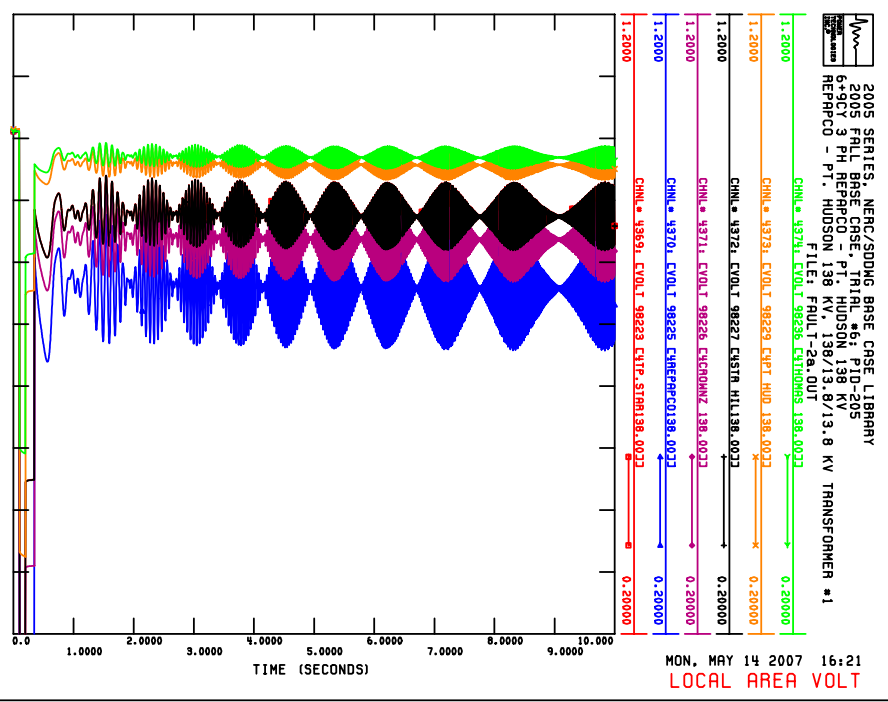
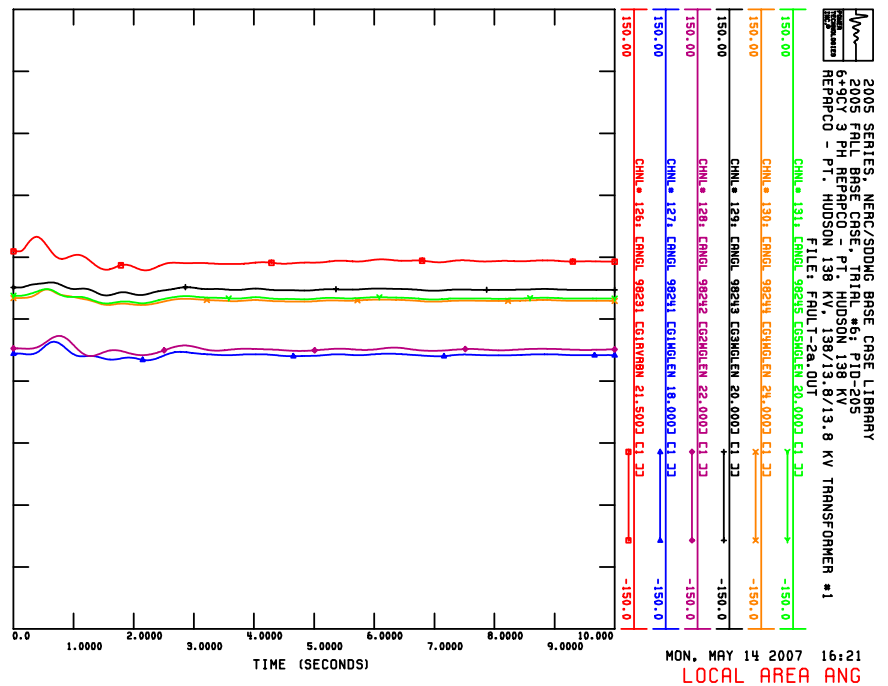
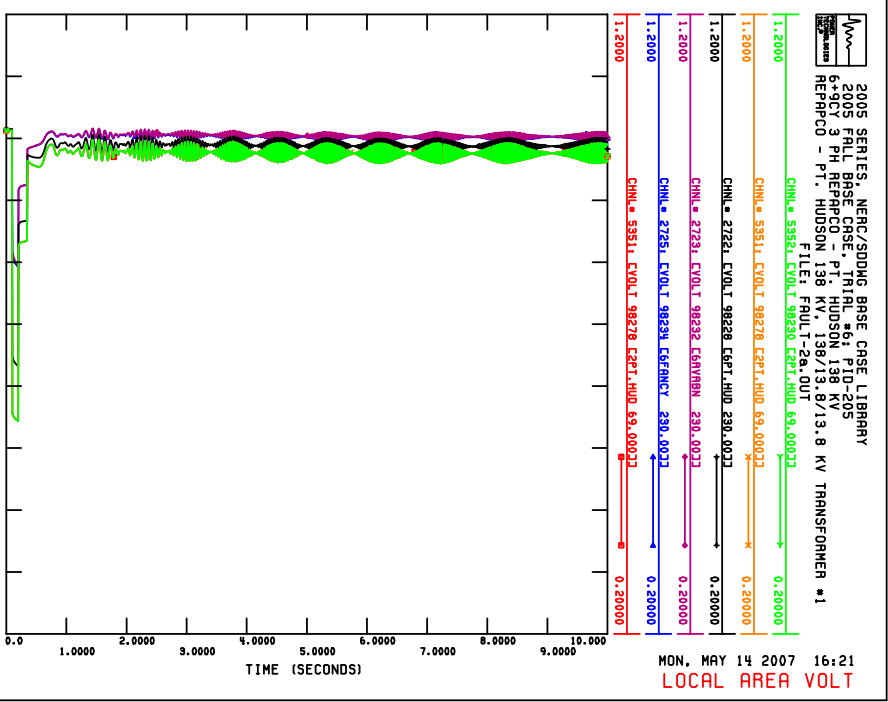
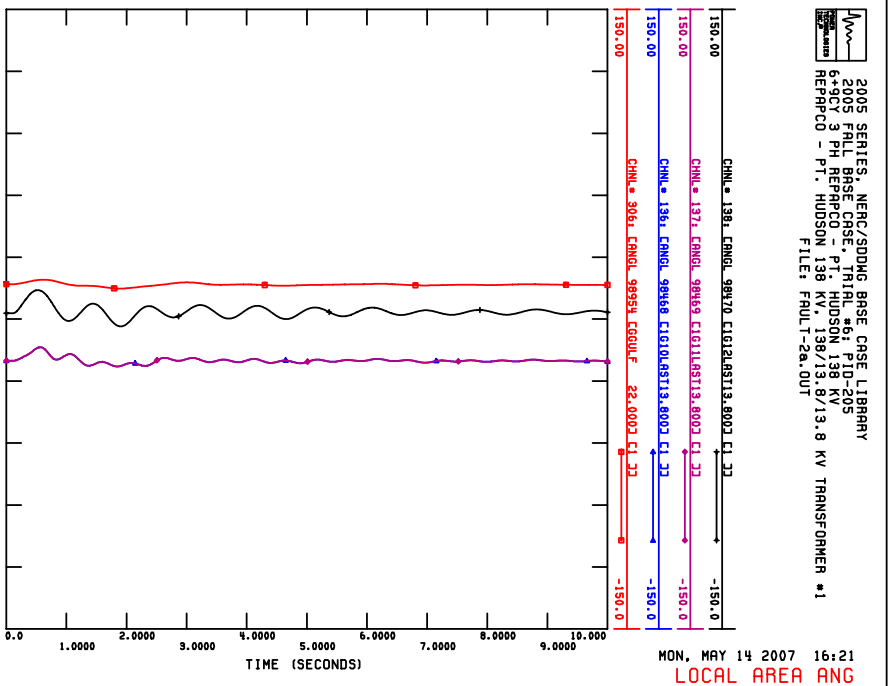


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PID-205

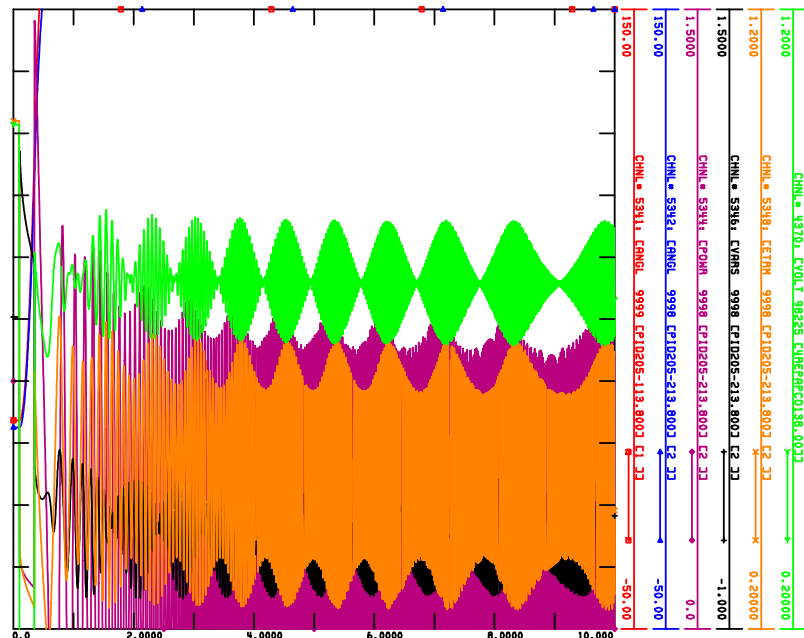
**FAULT-2a WITH PID-205**

**6+9CY 3 PH REPAPCO - PT. HUDSON 138 KV**

**Repapco - PT. Hudson 138 kV, 138/13.8/13.8 kV Transformer #1**



2005 SERIES, NERC/SDDNG BASE CASE LIBRARY  
2005 FAULT BASE CASE TRIPL #6: PID-205  
6+9C1 3 PH REPPPCO - PT. HUDSON 138 KV  
REPPPCO - PT. HUDSON 138 KV, 138/13.8/13.8 KV TRANSFORMER #1  
FILE: FAULT\_2a.OUT



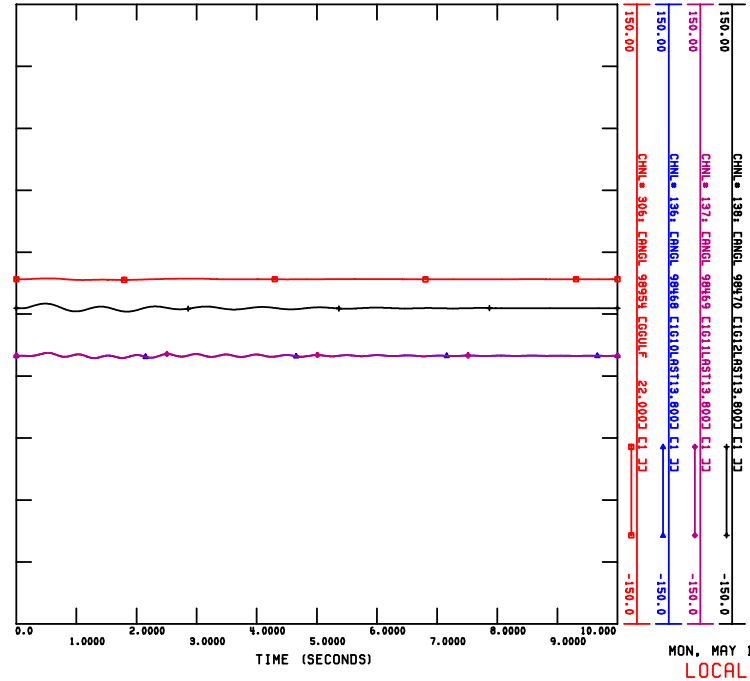
MON, MAY 14 2007 16:21  
PID-205

**FAULT-2a-SLG WITH PID-205**

**6+11CY SLG REPAPCO - PT. HUDSON 138 KV**

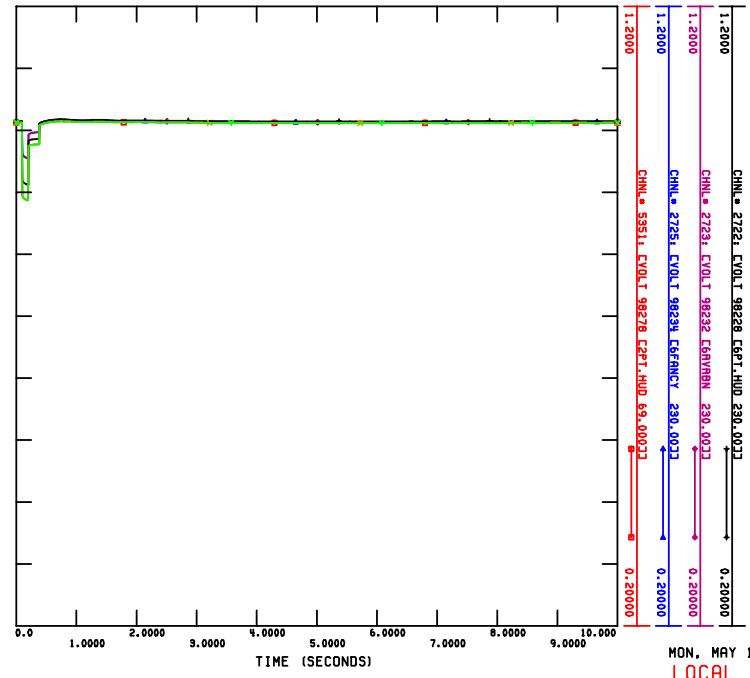
**Repapco - PT. Hudson 138 kV, 138/13.8/13.8 kV Transformer #1**

2005 SERIES, NERC/SDMG BASE CASE LIBRARY  
2005 FALL BASE CASE, TRIAL #6, PID-205  
6+11CY SLG REPPCO - PT. HUDSON 138 KV  
REPPCO - PT. HUDSON 138 KV, 138/13.8/13.8 KV TRANSFORMER #1  
FILE: FAULT-2a-SLG.OUT



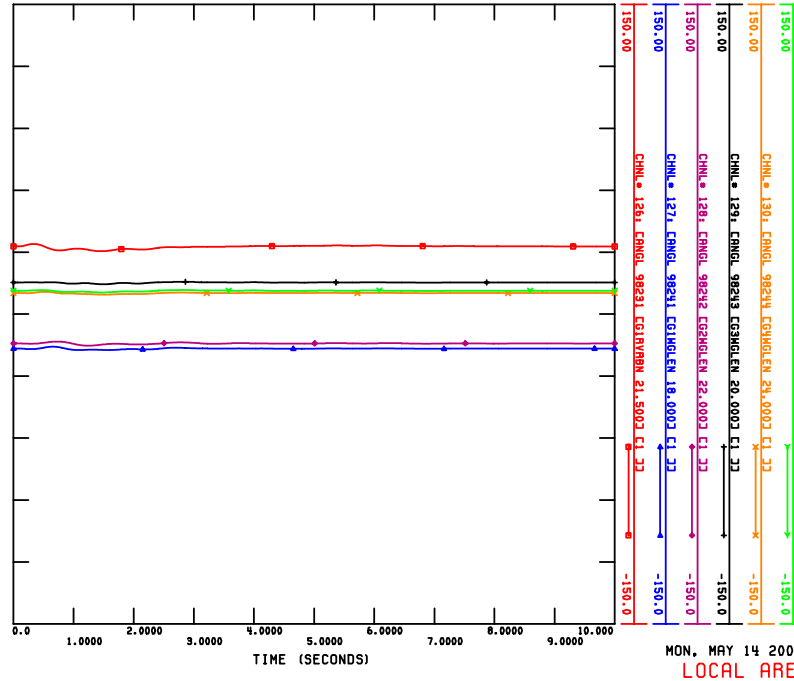
MON, MAY 14 2007 16:21  
LOCAL AREA ANG

2005 SERIES, NERC/SDMG BASE CASE LIBRARY  
2005 FALL BASE CASE, TRIAL #6, PID-205  
6+11CY SLG REPPCO - PT. HUDSON 138 KV  
REPPCO - PT. HUDSON 138 KV, 138/13.8/13.8 KV TRANSFORMER #1  
FILE: FAULT-2a-SLG.OUT



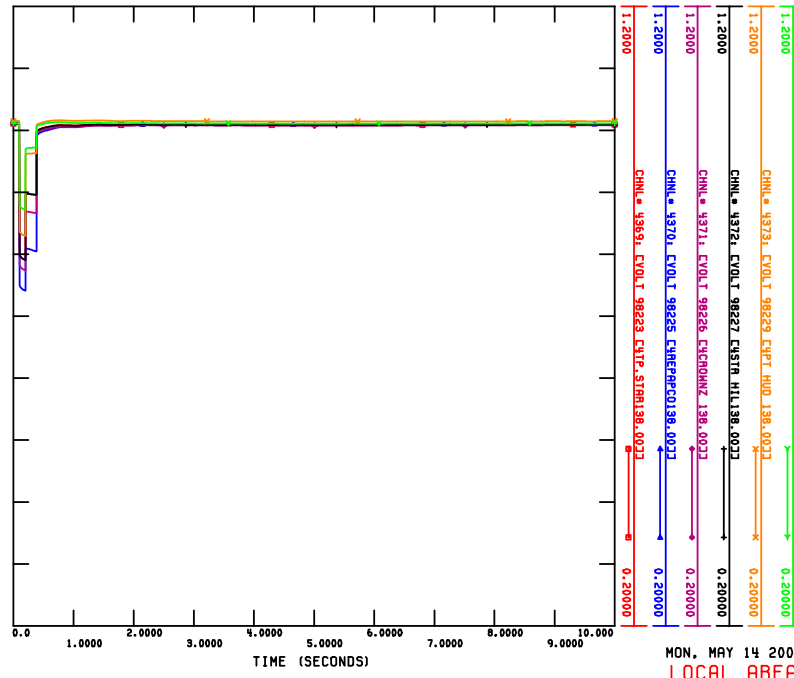
MON, MAY 14 2007 16:21  
LOCAL AREA VOLT

2005 SERIES, NERC/SDMG BASE CASE LIBRARY  
2005 FALL BASE CASE, TRIAL #6, PID-205  
6+11CY SLG REPPCO - PT. HUDSON 138 KV  
REPPCO - PT. HUDSON 138 KV, 138/13.8/13.8 KV TRANSFORMER #1  
FILE: FAULT-2a-SLG.OUT



MON, MAY 14 2007 16:21  
LOCAL AREA ANG

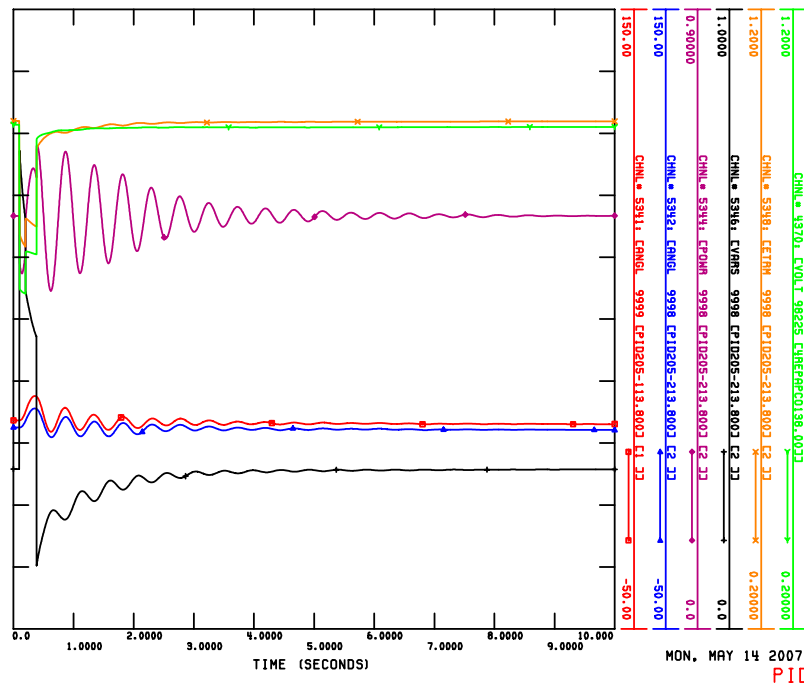
2005 SERIES, NERC/SDMG BASE CASE LIBRARY  
2005 FALL BASE CASE, TRIAL #6, PID-205  
6+11CY SLG REPPCO - PT. HUDSON 138 KV  
REPPCO - PT. HUDSON 138 KV, 138/13.8/13.8 KV TRANSFORMER #1  
FILE: FAULT-2a-SLG.OUT



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LOCAL AREA VOLT



2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE TRIRL #6: PID-205  
 6+11CY SLG REPPCO - PT. HUDSON 138 KV  
 REPPCO - PT. HUDSON 138 KV, 138/13.8/13.8 KV TRANSFORMER #1  
 FILE: FAULT-2a-SLG.OUT  
 FILE: 93701.VOLT.98225.CHEPPCO.3B.0001

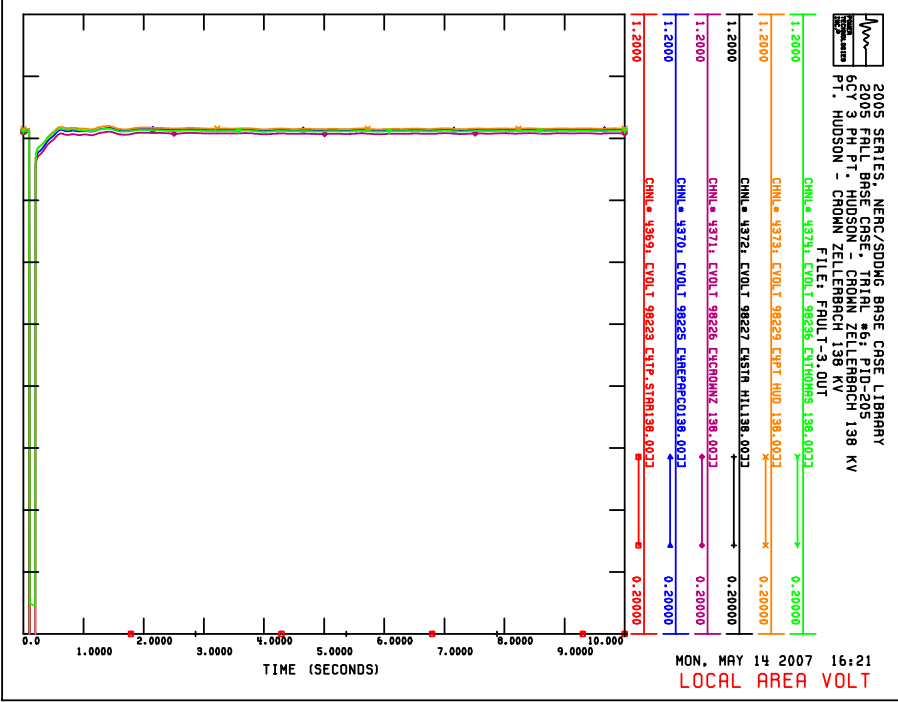
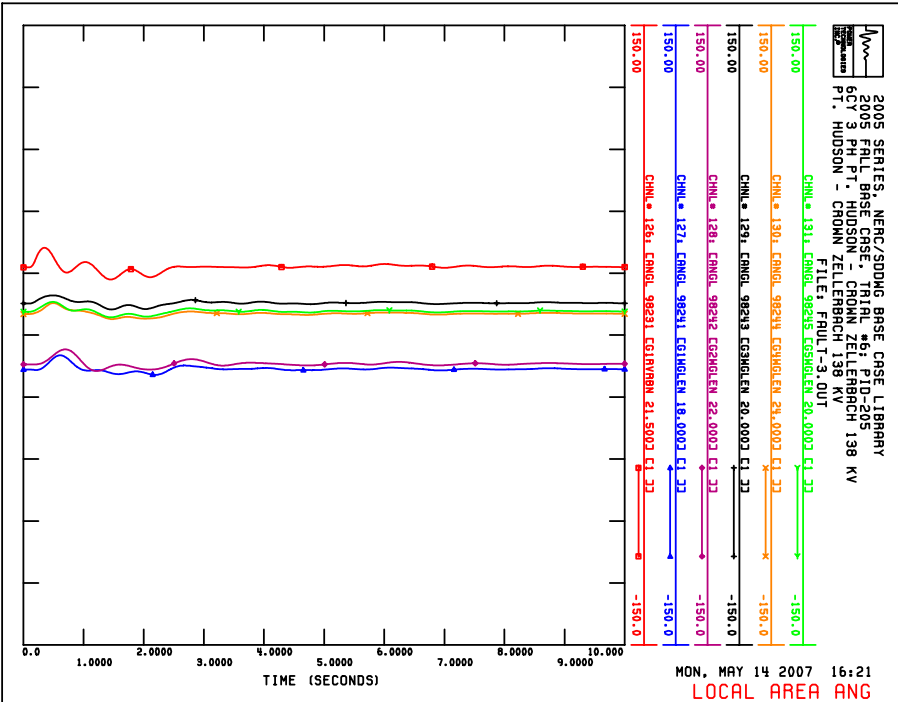
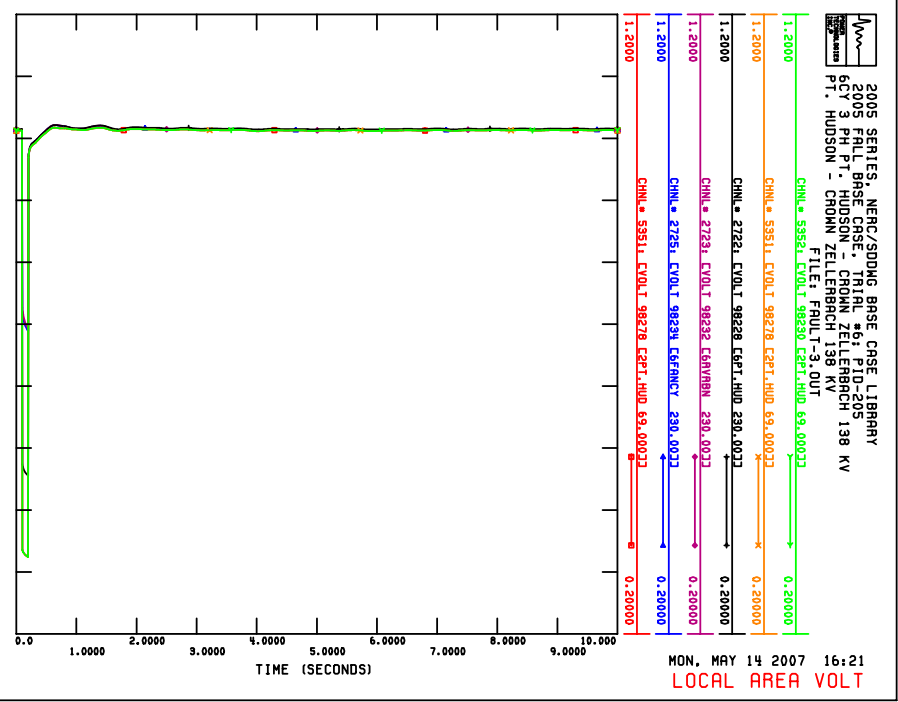
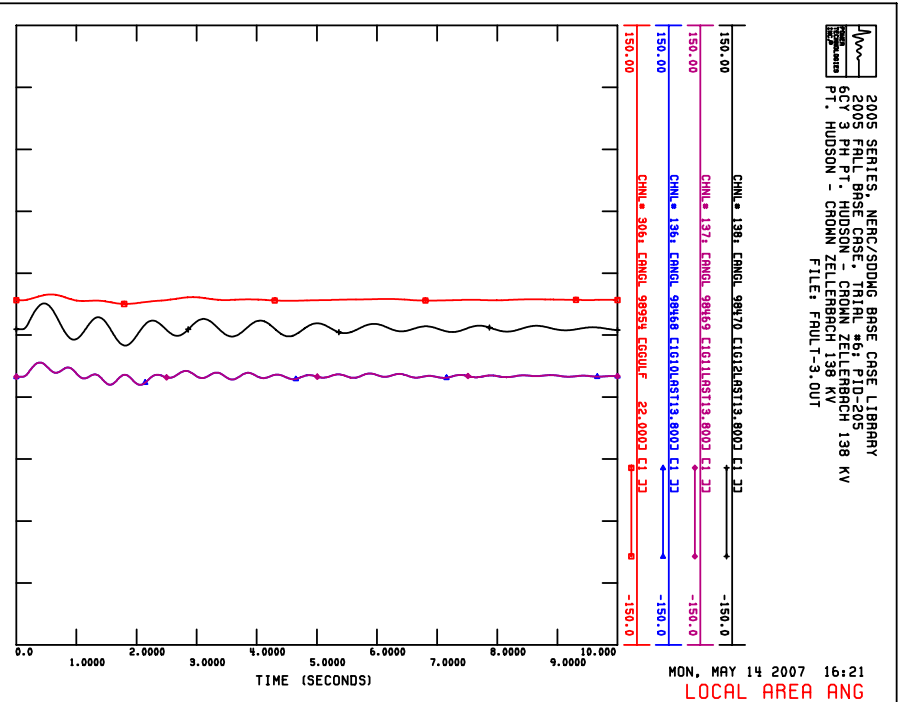


MON, MAY 14 2007 16:21  
 PID-205

## **FAULT-3**

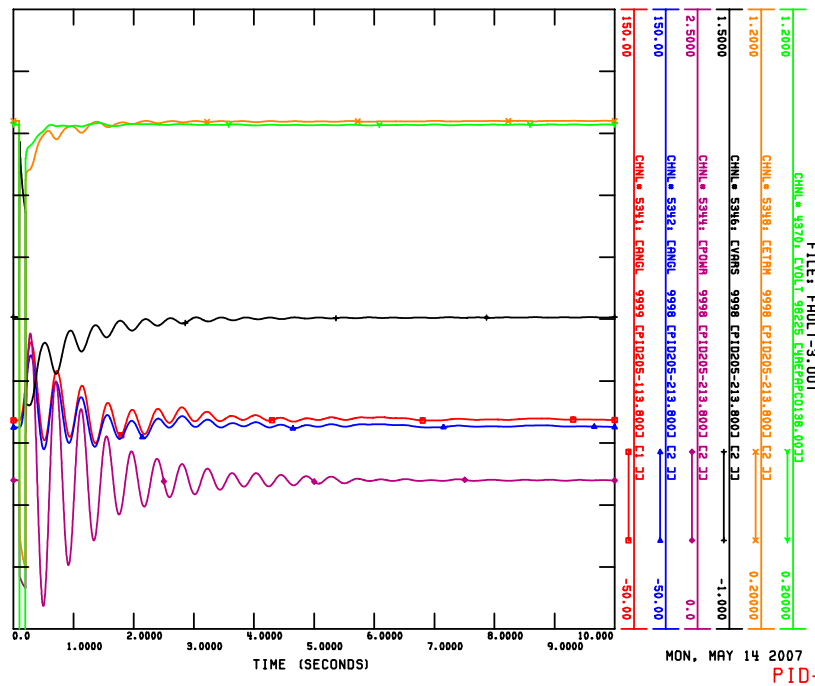
**6CY 3 PH PT. HUDSON - CROWN ZELLERBACH 138 KV**

**PT. HUDSON - CROWN ZELLERBACH 138 KV**



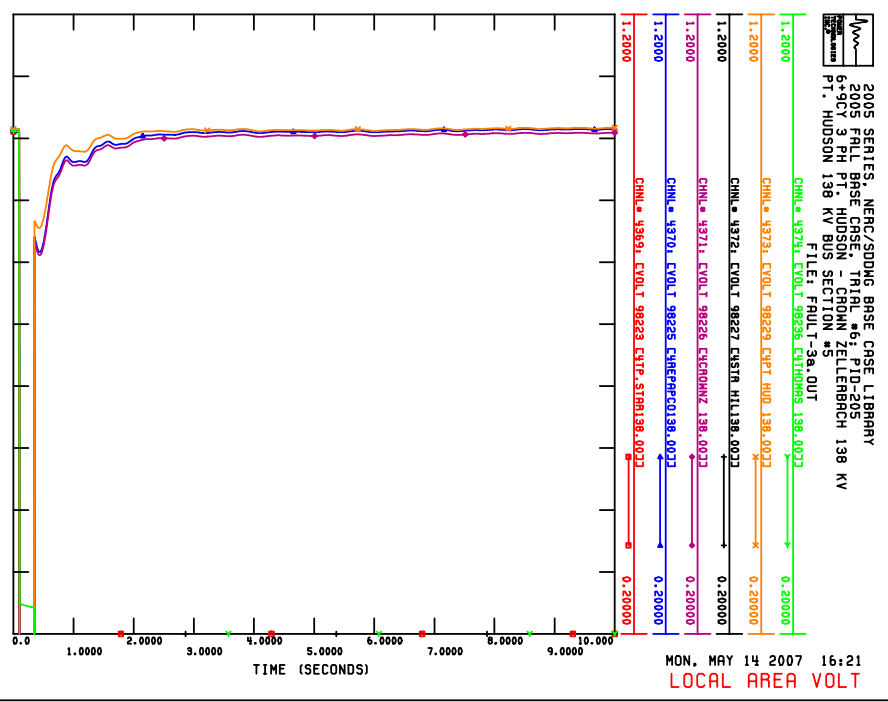
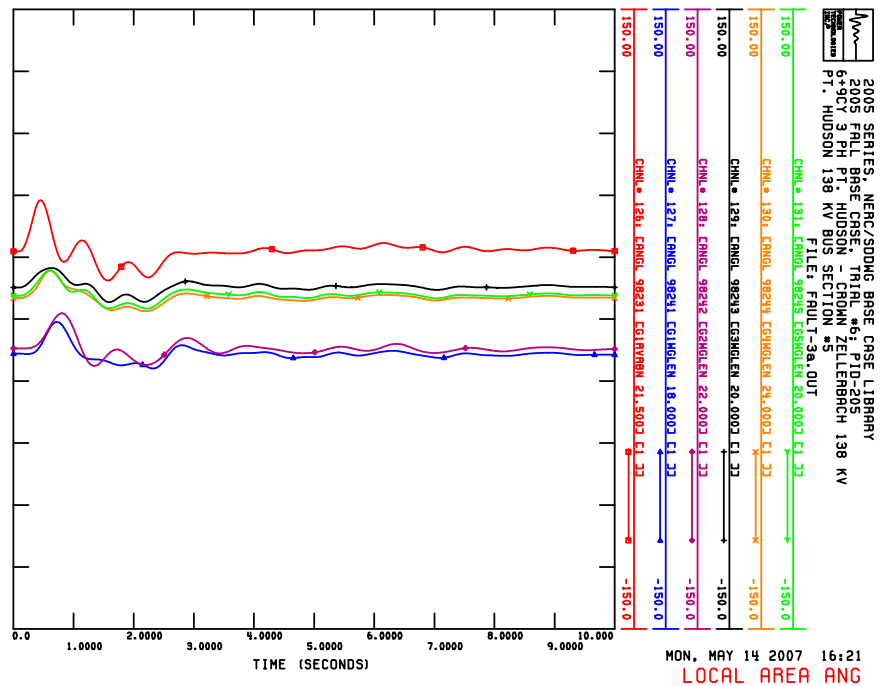
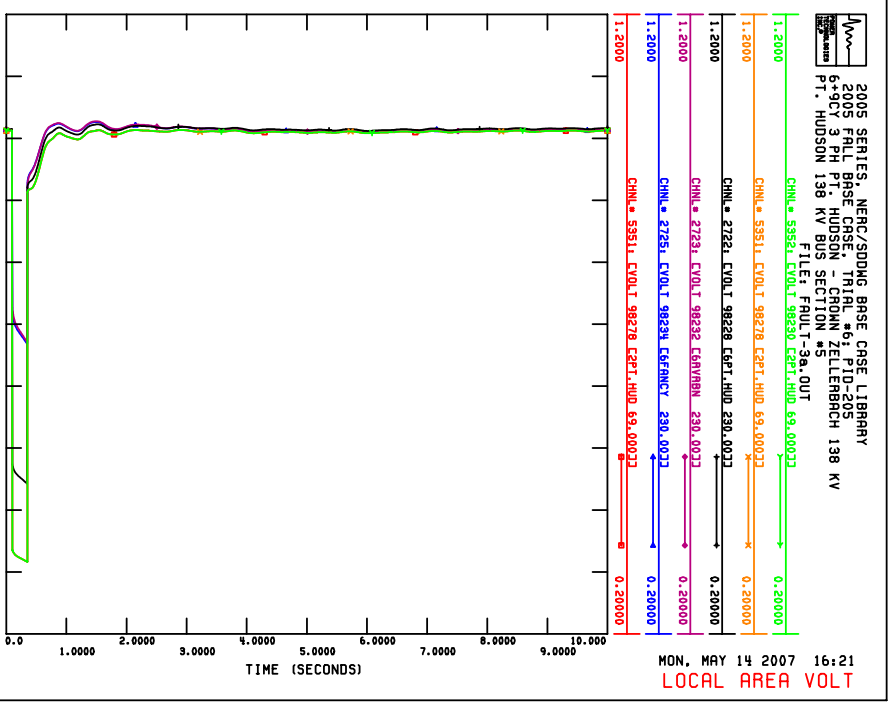
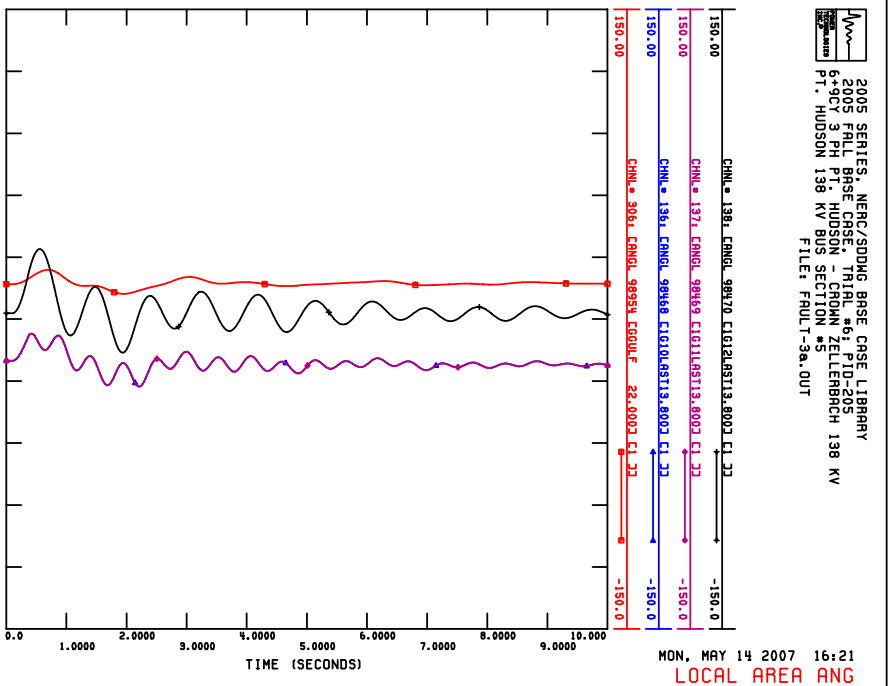


2005 SERIES, NERC/SDDNG BASE CASE LIBRARY  
 2005 FAULT BASE CASE TRIPL #6, PID-205  
 6CY 3 PH PT. HUDSON - CROWN ZELLERBACH 138 KV  
 PT. HUDSON - CROWN ZELLERBACH 138 KV  
 FILE: FAULT-3.0UT

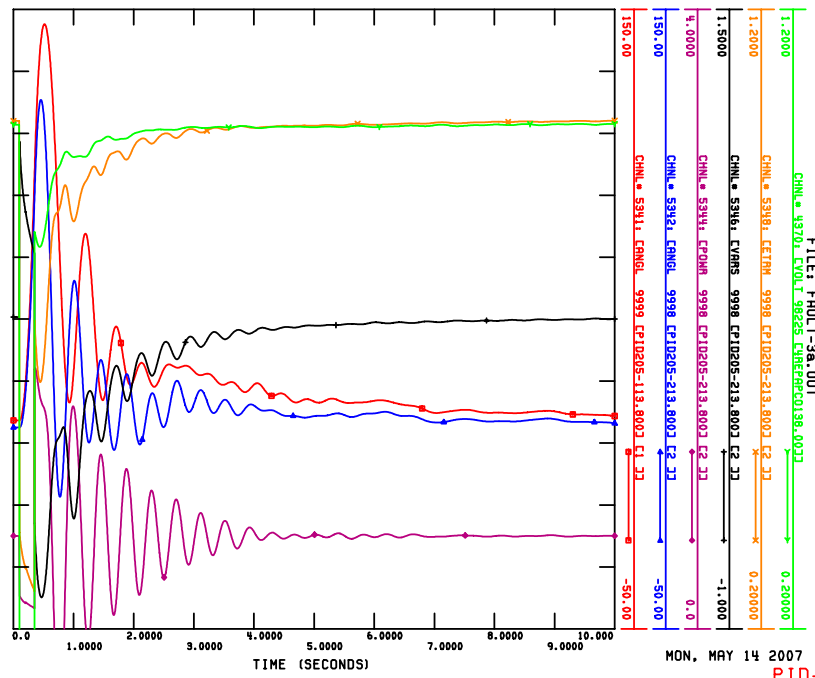


**FAULT-3a**

**6+9CY 3 PH PT. HUDSON - CROWN ZELLERBACH 138 KV  
PT. HUDSON 138 KV BUS SECTION #5**



2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE TRIPL #5, PID-205  
 6+9C 3 PH PT. HUDSON - CHODN ZELLEBRACH 138 KV  
 PT. HUDSON 138 KV BUS SECTION #5  
 FILE: FAULT-38.OUT



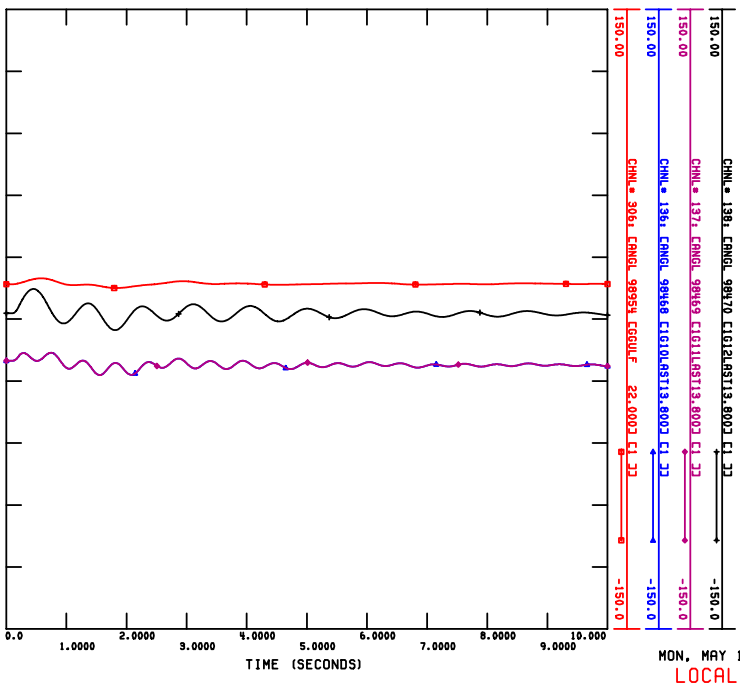
**FAULT-4**

**6CY 3 PH PT. HUDSON - LA STATION 138 KV**

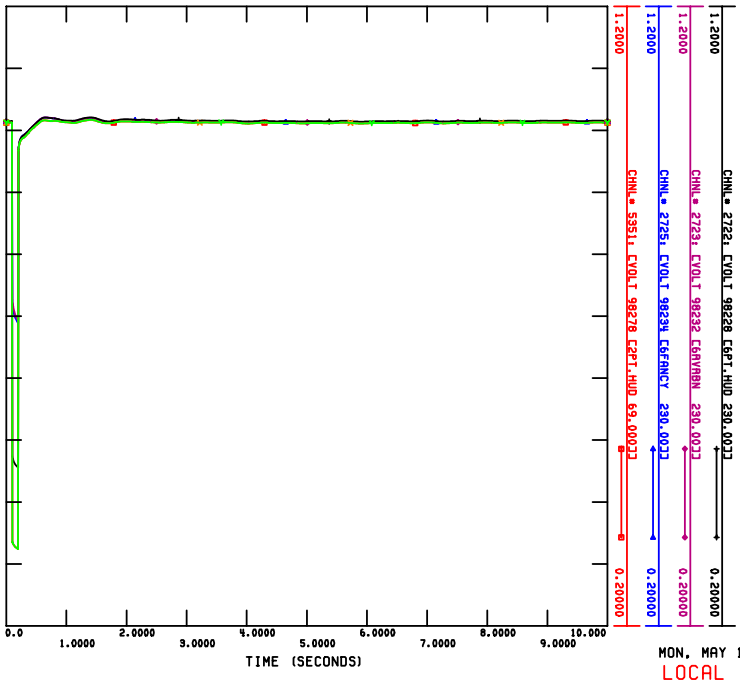
**PT. HUDSON - LA STATION 138 KV**



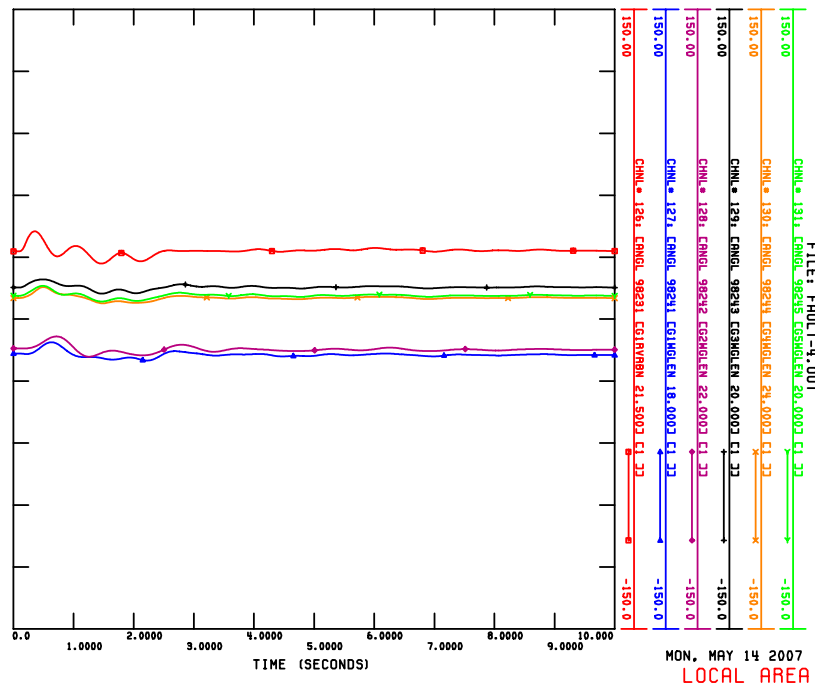
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE, TRAIL #6, PID-205  
 6CY 3 PH PT, HUDSON - LA STATION 198 KV  
 PT, HUDSON - LA STATION 198 KV  
 FILE: FAULT-4.OUT



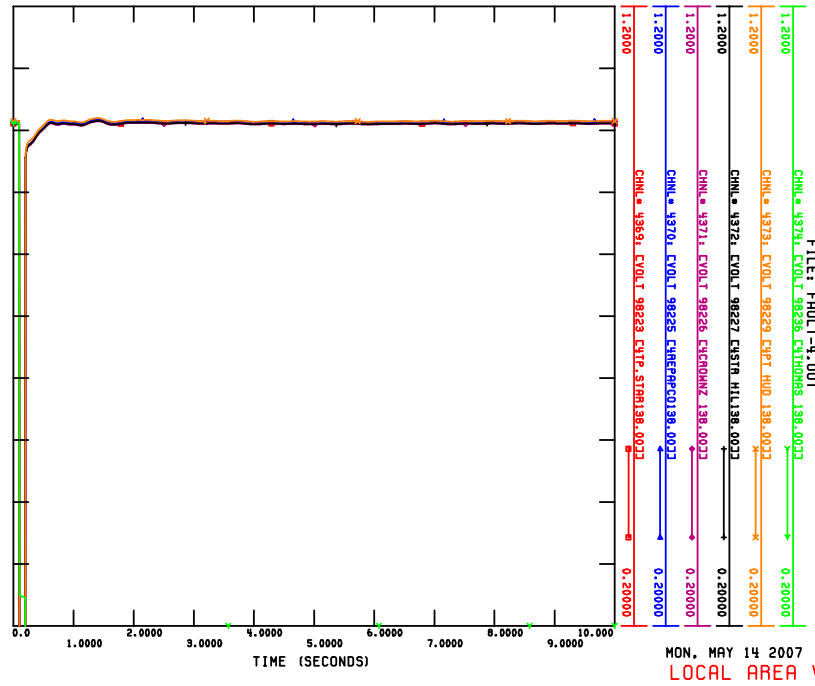
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE, TRAIL #6, PID-205  
 6CY 3 PH PT, HUDSON - LA STATION 198 KV  
 PT, HUDSON - LA STATION 198 KV  
 FILE: FAULT-4.OUT



2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE, TRAIL #6, PID-205  
 6CY 3 PH PT, HUDSON - LA STATION 198 KV  
 PT, HUDSON - LA STATION 198 KV  
 FILE: FAULT-4.OUT

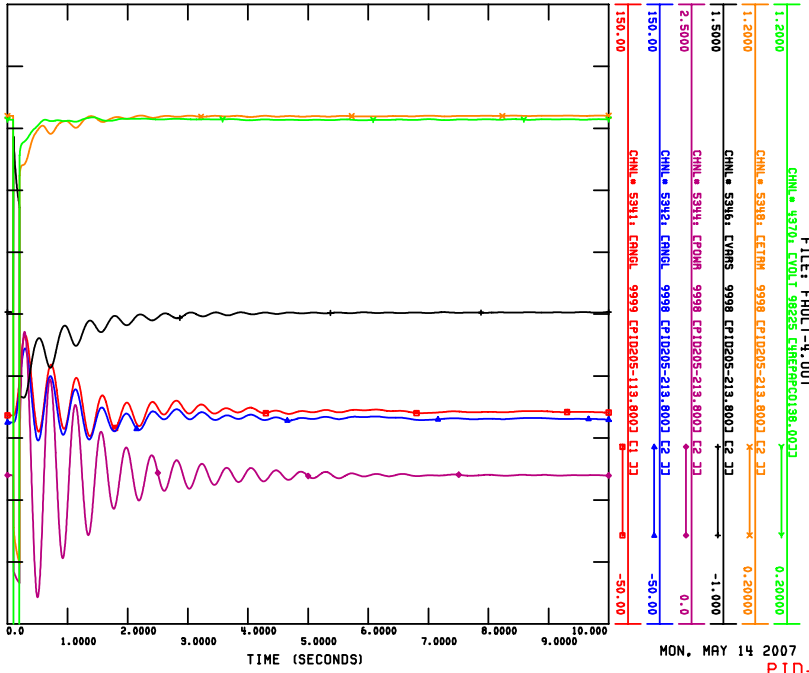


2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE, TRAIL #6, PID-205  
 6CY 3 PH PT, HUDSON - LA STATION 198 KV  
 PT, HUDSON - LA STATION 198 KV  
 FILE: FAULT-4.OUT





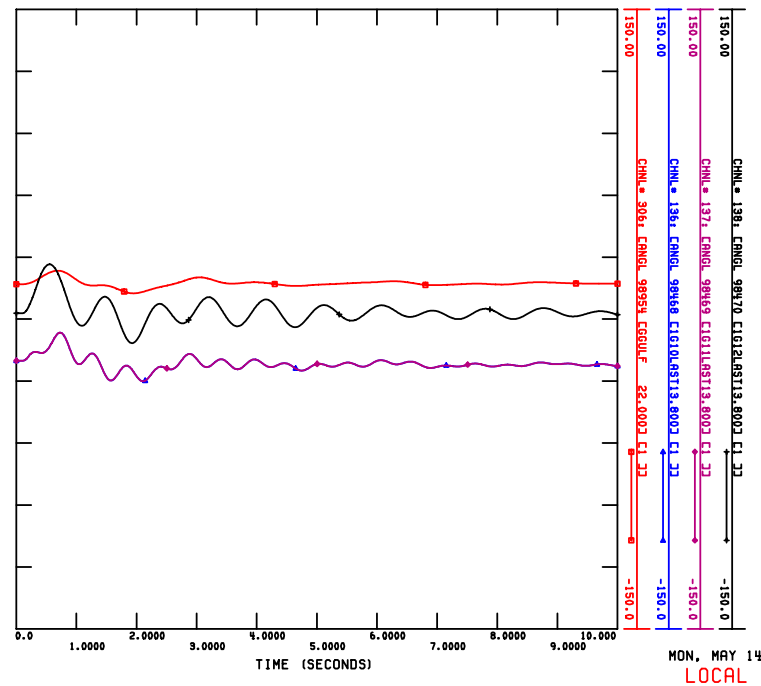
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
2005 FAULT BASE CASE TRIPL #6, PID-205  
6CY 3 PH PT. HUDSON - LA STATION 198 KV  
PT. HUDSON - LA STATION 198 KV  
FILE: FAULT-4\_OUT



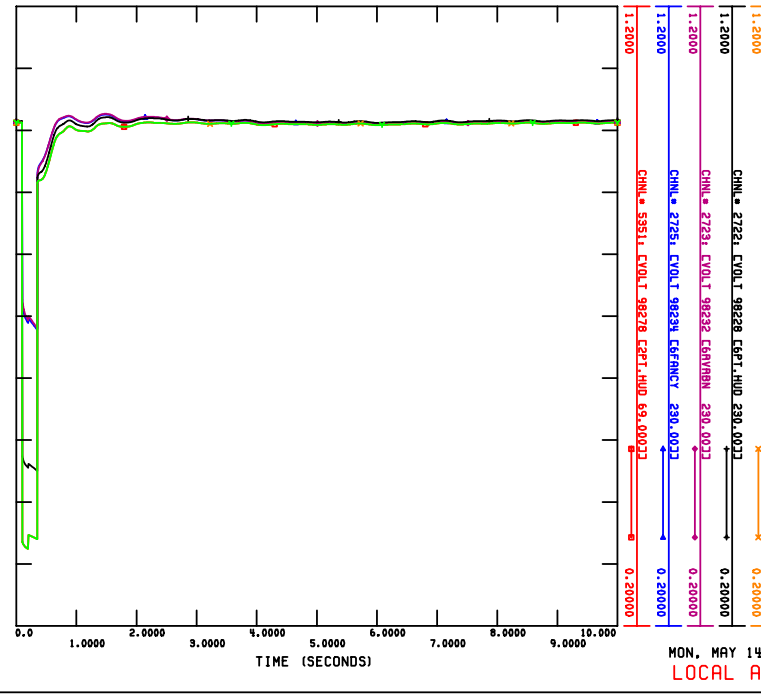
**FAULT-4a**

**6+9CY 3 PH PT. HUDSON - LA STATION 138 KV  
PT. HUDSON 138 KV BUS SECTION #5**

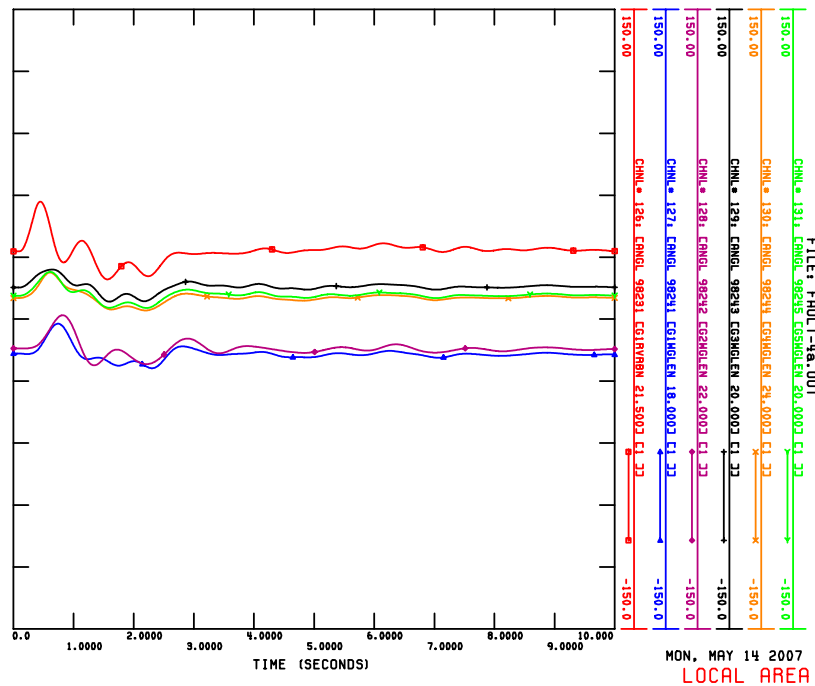
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BRSE CRSE, TRIRL #61, PID-205  
 6+9CY 3 PH PT. HUDSON - LA STATION 138 KV  
 PT. HUDSON 138 KV BUS SECTION #5  
 FILE: FAULT-4a.OUT



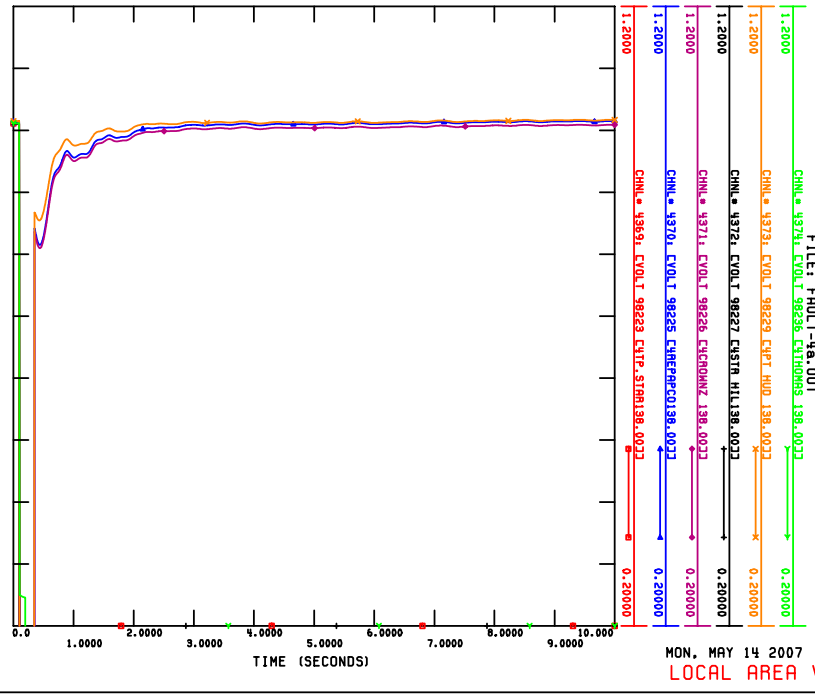
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BRSE CRSE, TRIRL #61, PID-205  
 6+9CY 3 PH PT. HUDSON - LA STATION 138 KV  
 PT. HUDSON 138 KV BUS SECTION #5  
 FILE: FAULT-4a.OUT



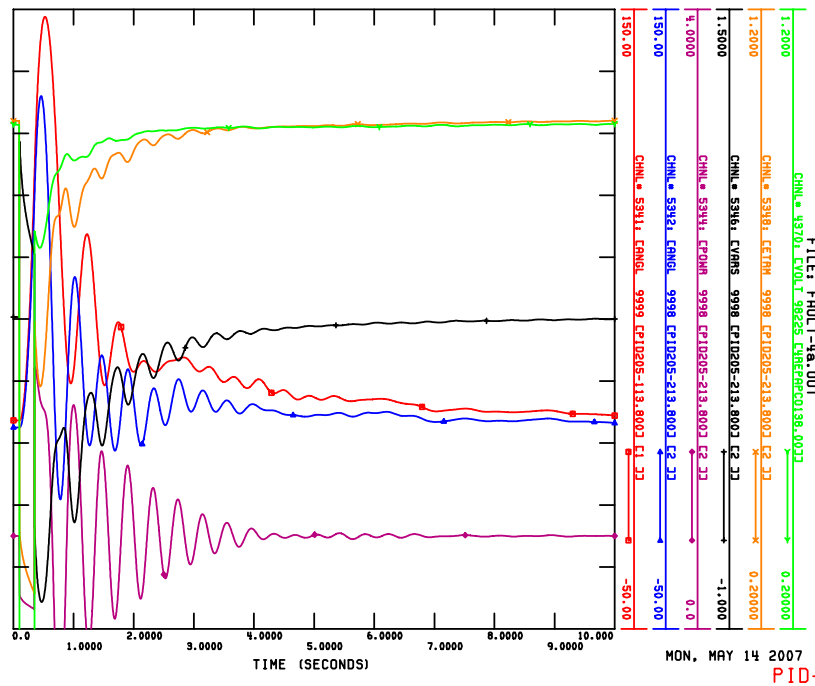
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BRSE CRSE, TRIRL #61, PID-205  
 6+9CY 3 PH PT. HUDSON - LA STATION 138 KV  
 PT. HUDSON 138 KV BUS SECTION #5  
 FILE: FAULT-4a.OUT



2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BRSE CRSE, TRIRL #61, PID-205  
 6+9CY 3 PH PT. HUDSON - LA STATION 138 KV  
 PT. HUDSON 138 KV BUS SECTION #5  
 FILE: FAULT-4a.OUT



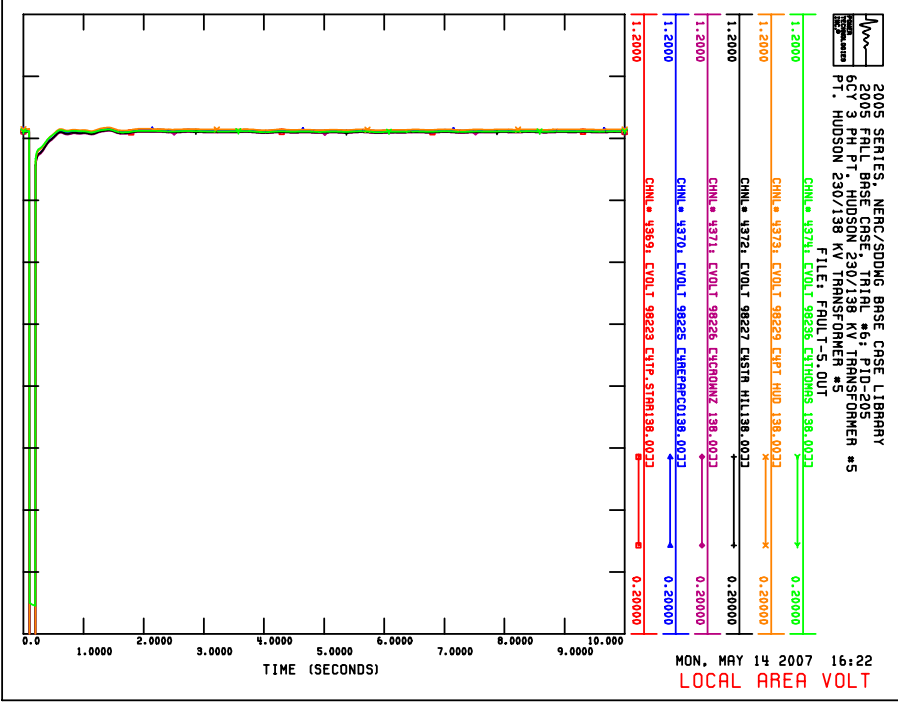
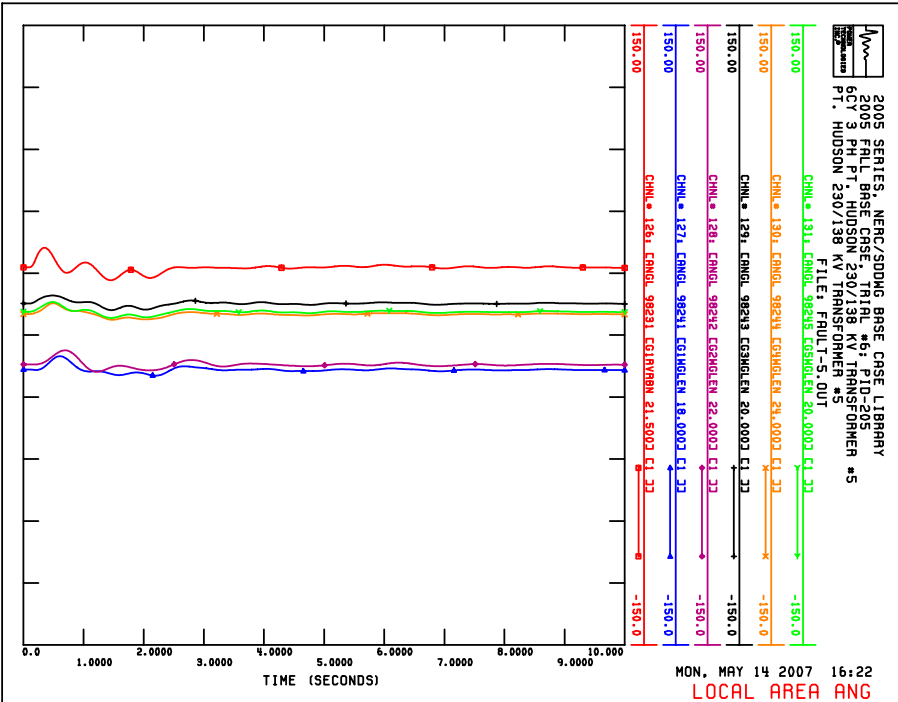
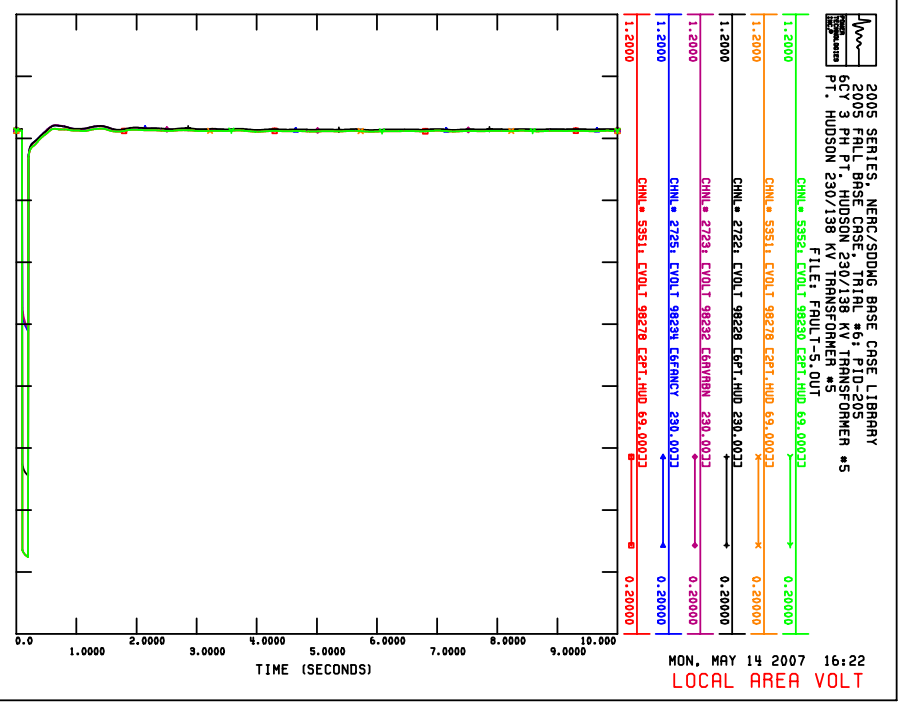
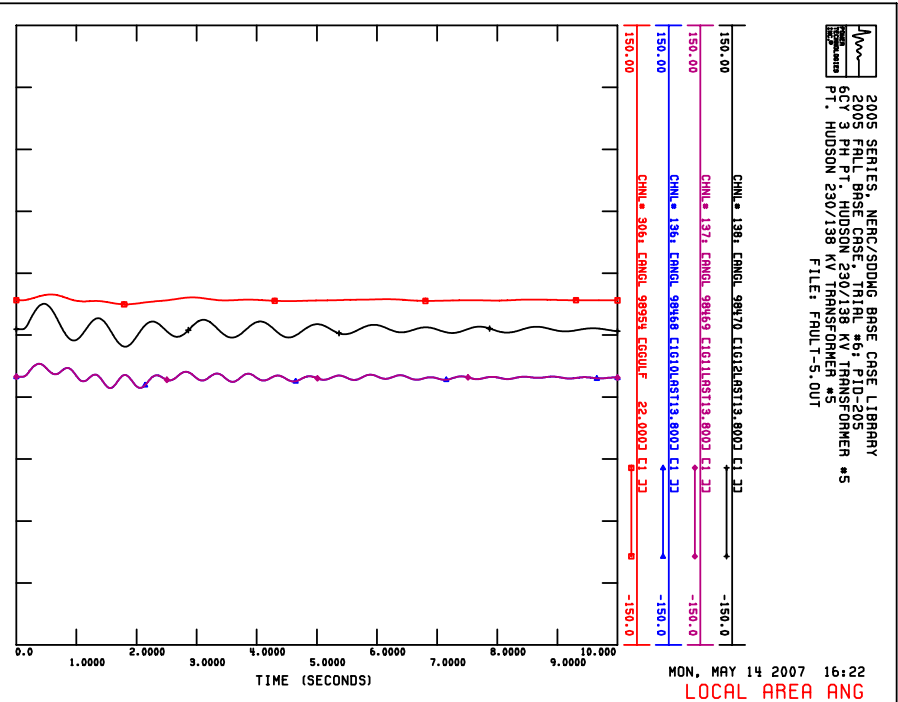
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE TRIPL #6, PID-205  
 6+9C 3 PH PT. HUDSON - LR STATION #5  
 PT. HUDSON 138 KV BUS SECTION #5  
 FILE: FAULT-4a.OUT



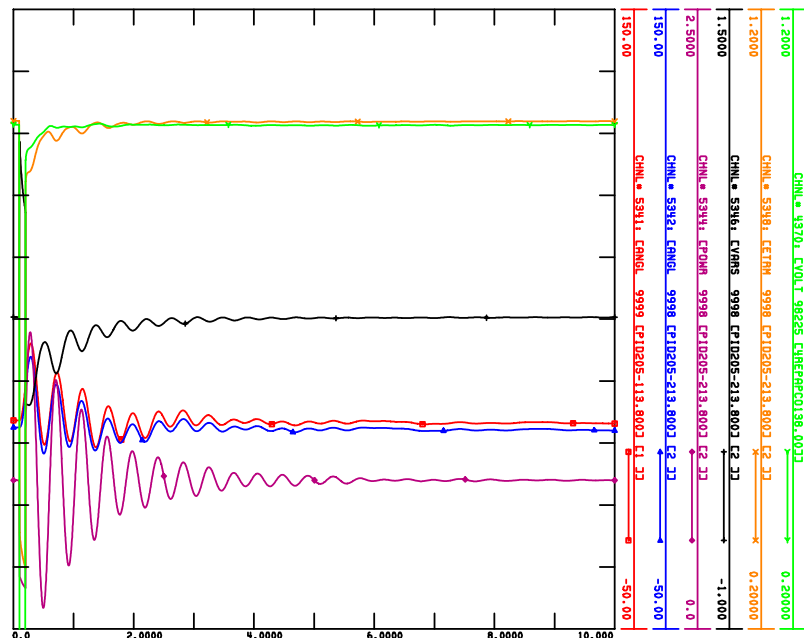
**FAULT-5**

**6CY 3 PH PT. HUDSON 230/138 KV TRANSFORMER #5**

**PT. HUDSON 230/138 KV TRANSFORMER #5**



2005 SERIES, MFRC/SDDNG BASE CASE LIBRARY  
 2005 FAULT BASE CASE TRIRL #6: PID-205  
 6CY 3 PH PT. HUDSON 230/138 KV TRANSFORMER #5  
 PT. HUDSON 230/138 KV TRANSFORMER #5  
 FILE: FAULT-5\_OUT



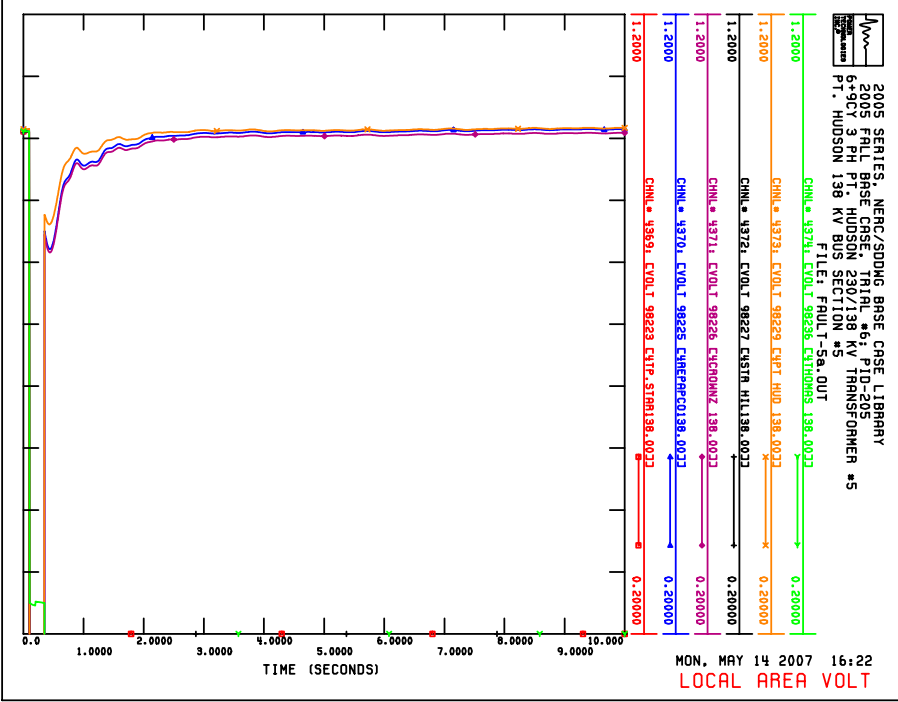
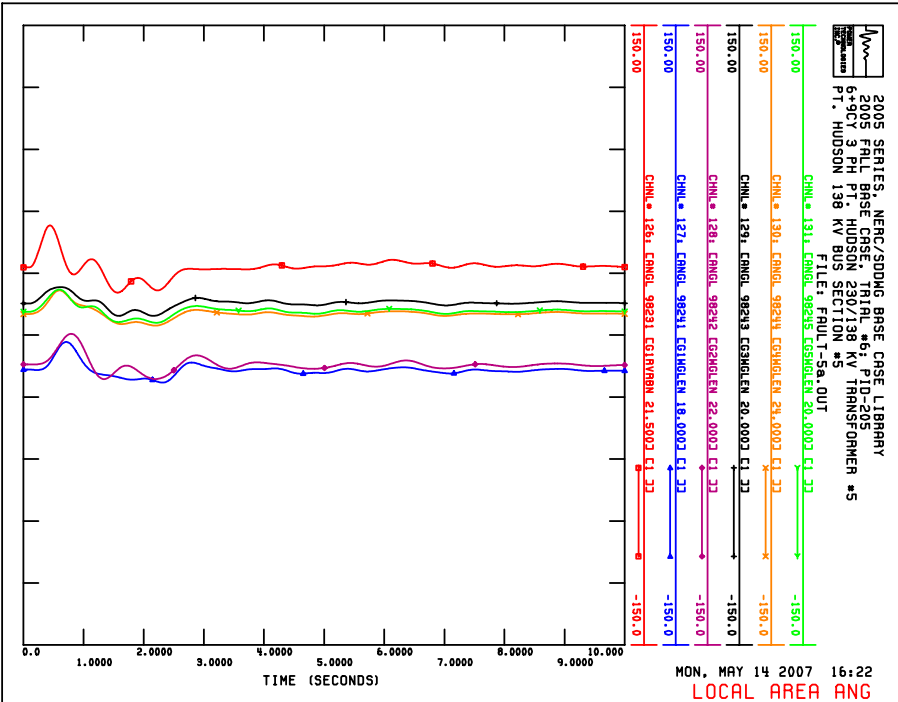
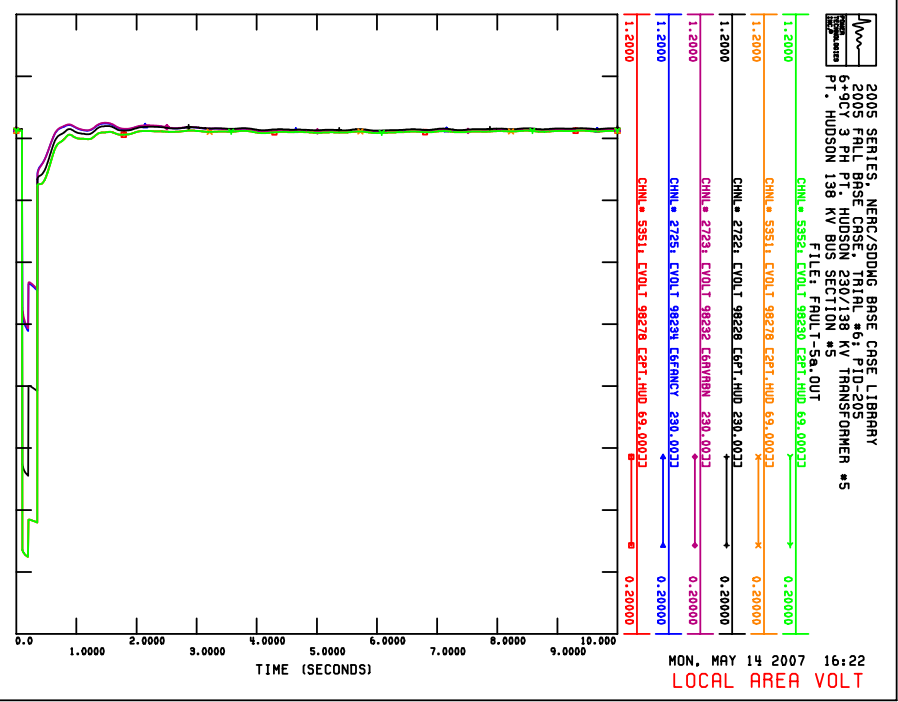
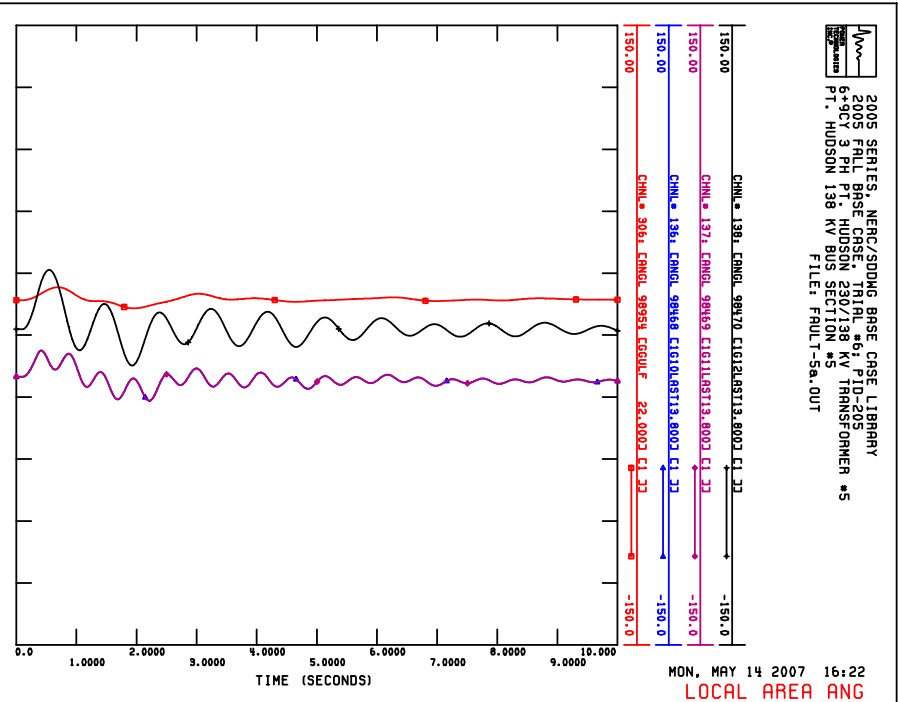
MON, MAY 14 2007 16:22  
 PID-205

TIME (SECONDS)



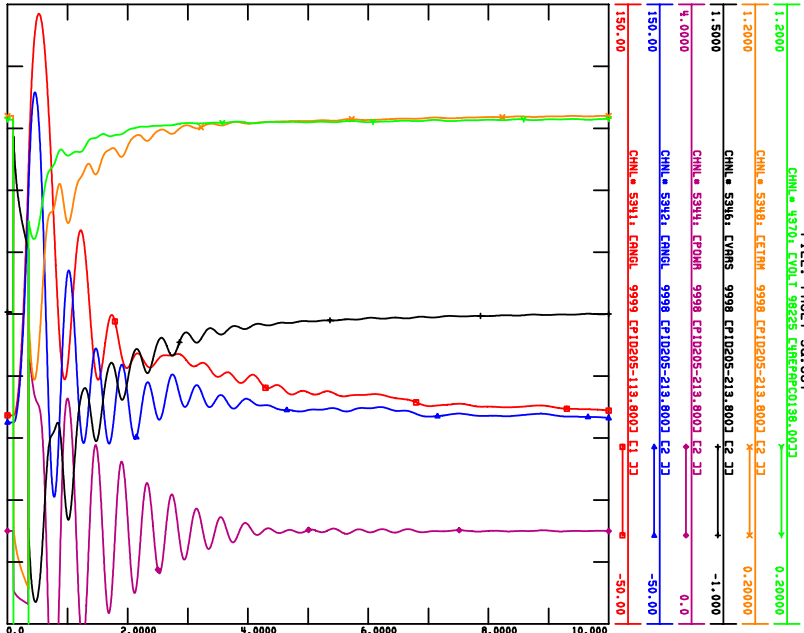
**FAULT-5a**

**6+9CY 3 PH PT. HUDSON 230/138 KV TRANSFORMER #5  
PT. HUDSON 138 KV BUS SECTION #5**





2005 SERIES, NERC/SODDNG BASE CASE LIBRARY  
2005 FAULT BASE CASE TRIP# 65, PID-205  
6+9C 3 PH PT. HUDSON 230/138 KV TRANSFORMER #5  
PT. HUDSON 138 KV BUS SECTION #5  
FILE: FAULT-5a.OUT



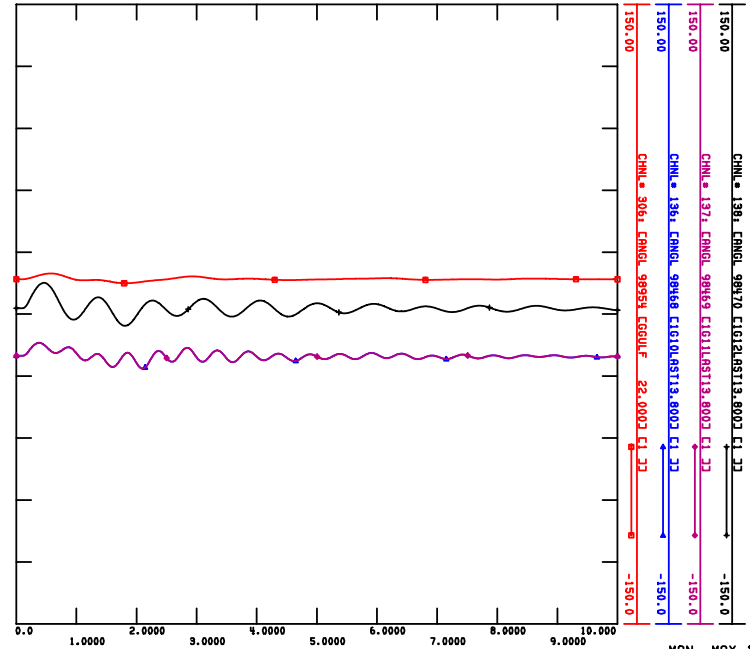
MON, MAY 14 2007 16:22

PID-205

**FAULT-5b**

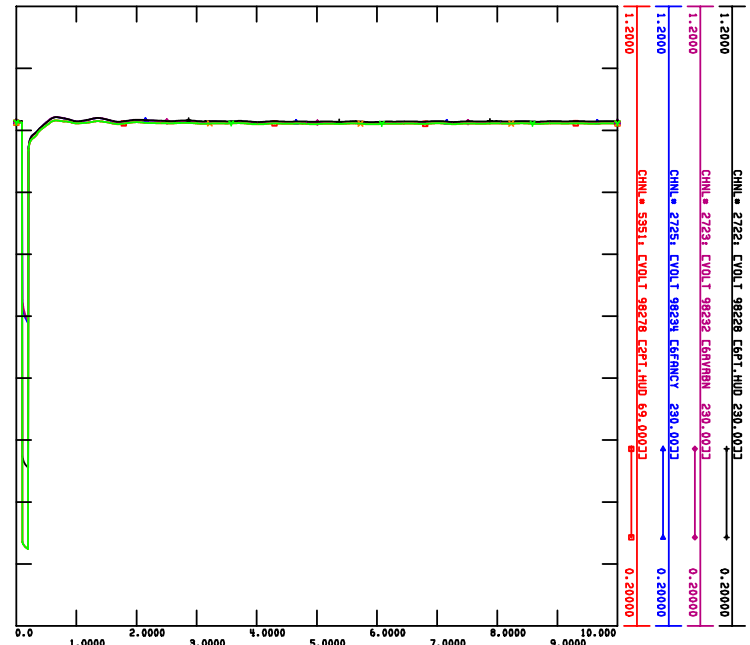
**6+9CY 3 PH PT. HUDSON 230/138 KV TRANSFORMER #4  
PT. HUDSON 138 KV BUS SECTION #4**

2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BRSE CRSE, TRIRL #6, PID-205  
 6+9CY 3 PH PT. HUDSON 230/138 KV TRANSFORMER #4  
 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FAULT-5b.OUT



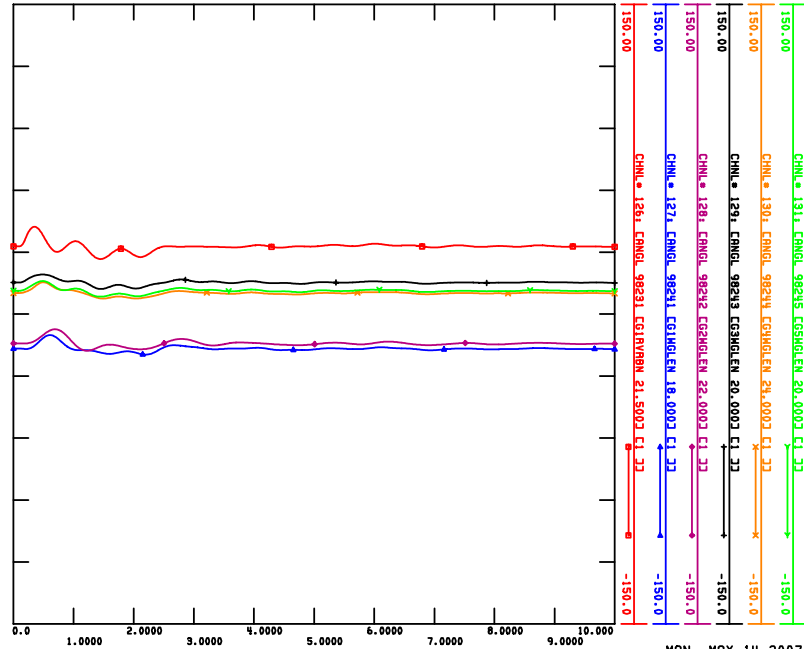
MON, MAY 14 2007 16:22  
 LOCAL AREA ANG

2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BRSE CRSE, TRIRL #6, PID-205  
 6+9CY 3 PH PT. HUDSON 230/138 KV TRANSFORMER #4  
 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FAULT-5b.OUT



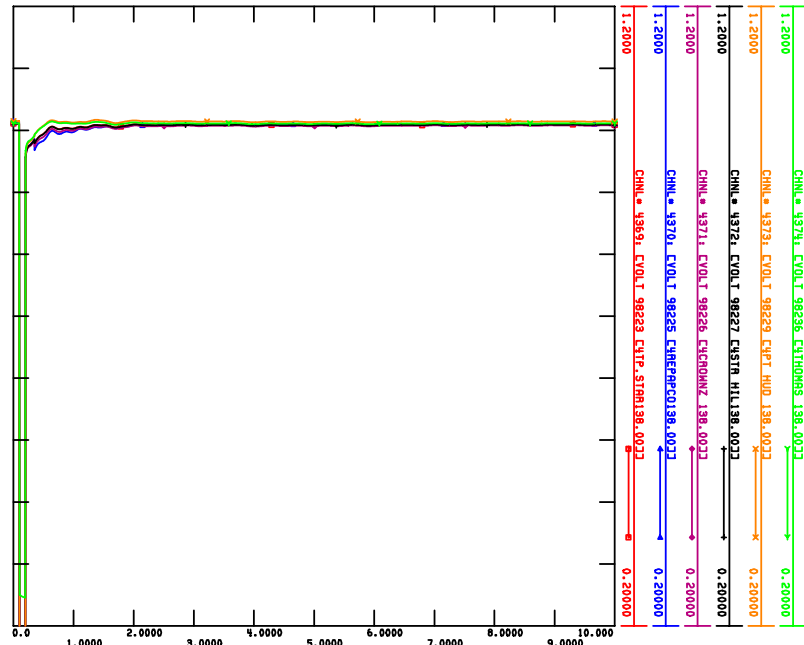
MON, MAY 14 2007 16:22  
 LOCAL AREA VOLT

2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BRSE CRSE, TRIRL #6, PID-205  
 6+9CY 3 PH PT. HUDSON 230/138 KV TRANSFORMER #4  
 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FAULT-5b.OUT



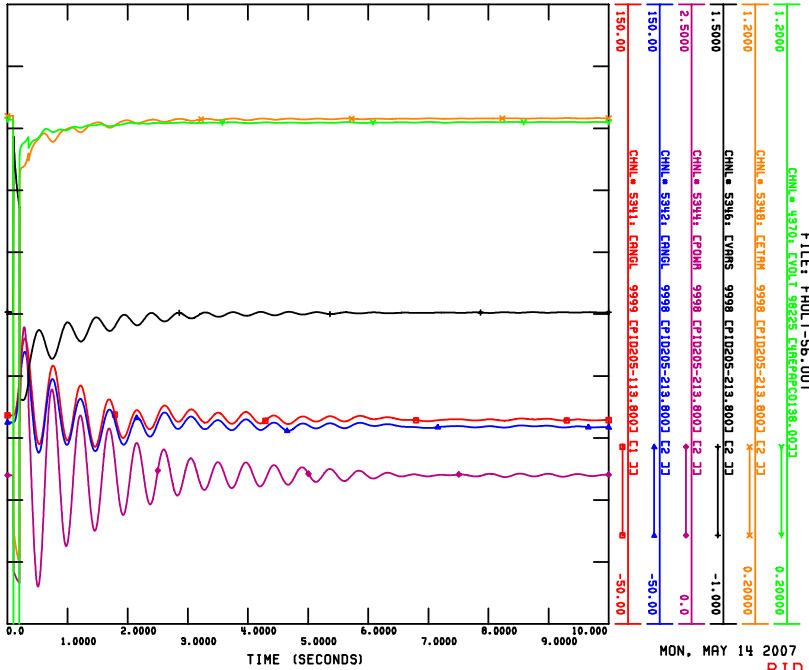
MON, MAY 14 2007 16:22  
 LOCAL AREA ANG

2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BRSE CRSE, TRIRL #6, PID-205  
 6+9CY 3 PH PT. HUDSON 230/138 KV TRANSFORMER #4  
 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FAULT-5b.OUT



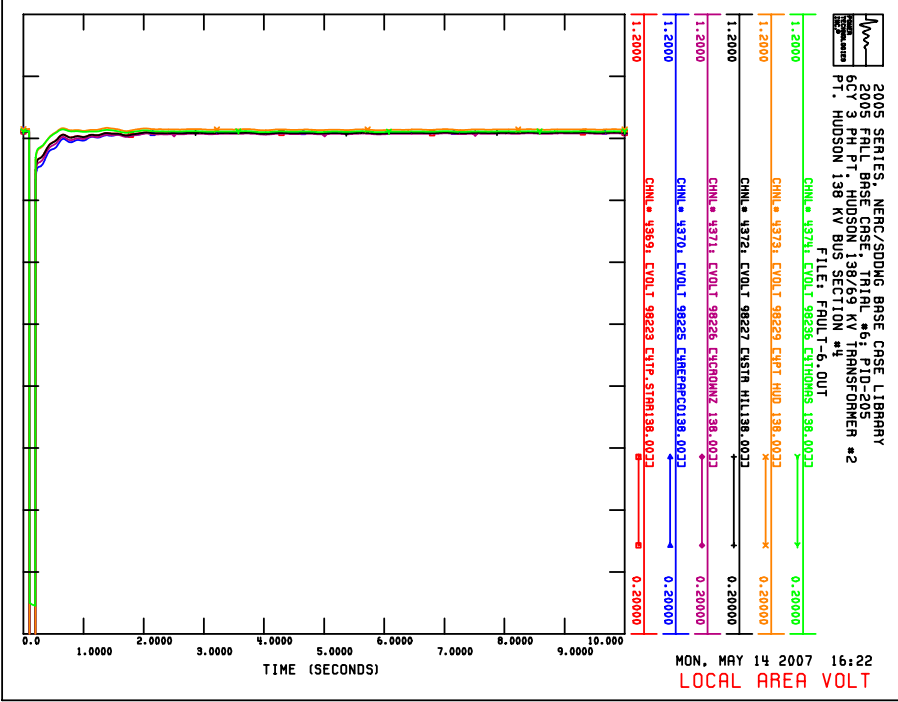
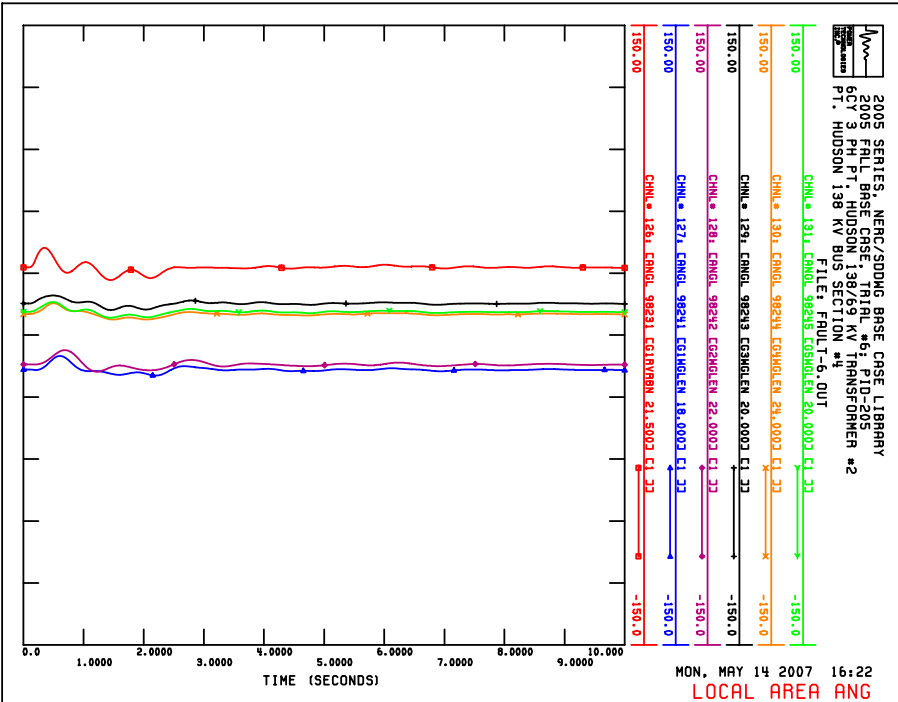
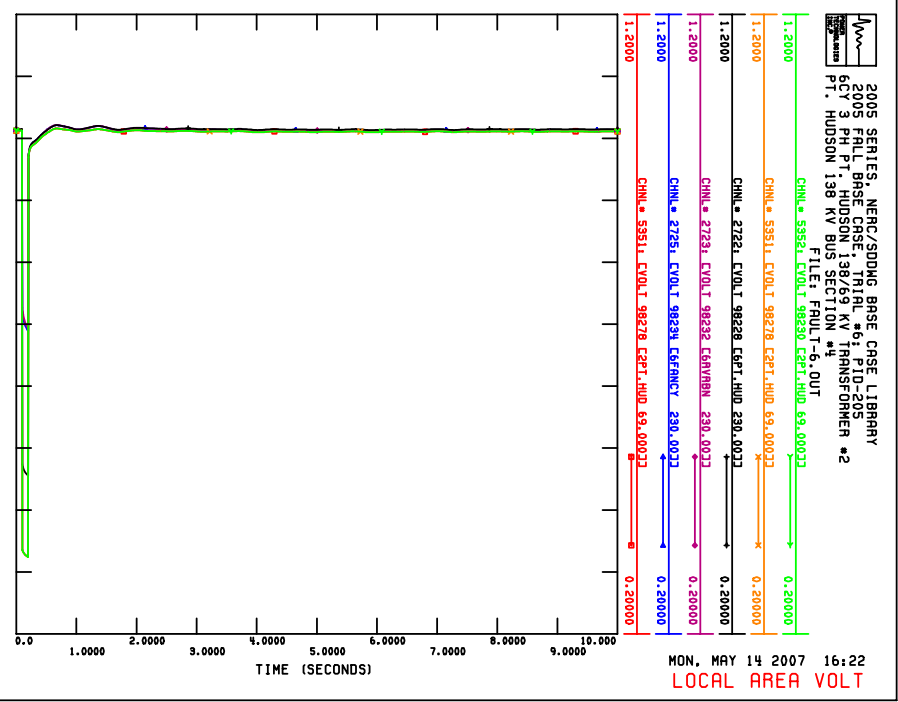
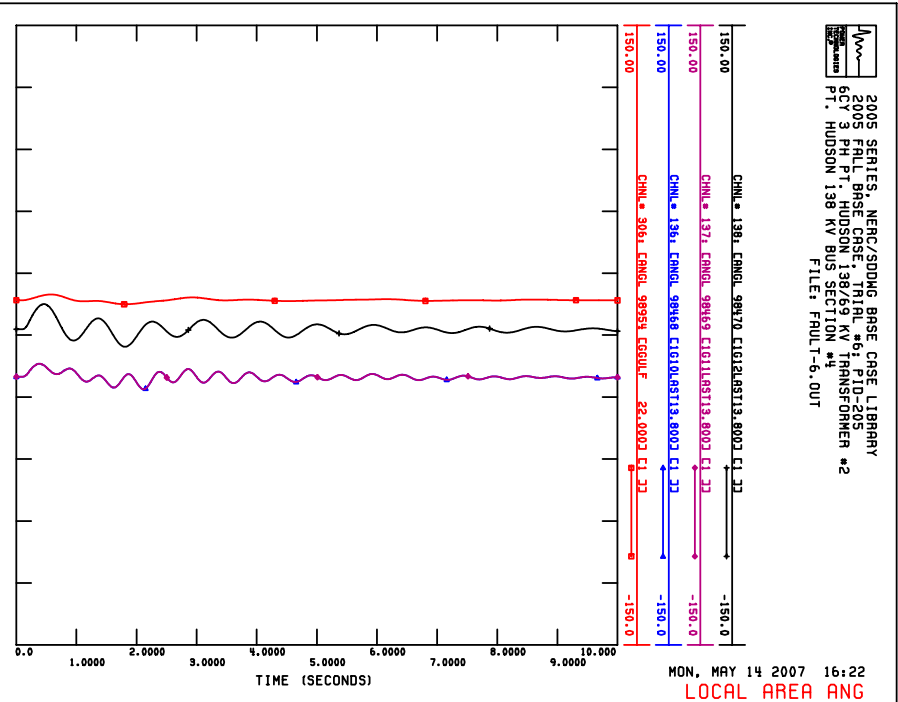
MON, MAY 14 2007 16:22  
 LOCAL AREA VOLT

2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
2005 FAULT BASE CASE TRIP# 65, PID-205  
6+9C 3 PH PT - HUDSON 230/138 KV TRANSFORMER #4  
PT - HUDSON 138 KV BUS SECTION #4  
FILE: FAULT-5b.OUT



**FAULT-6**

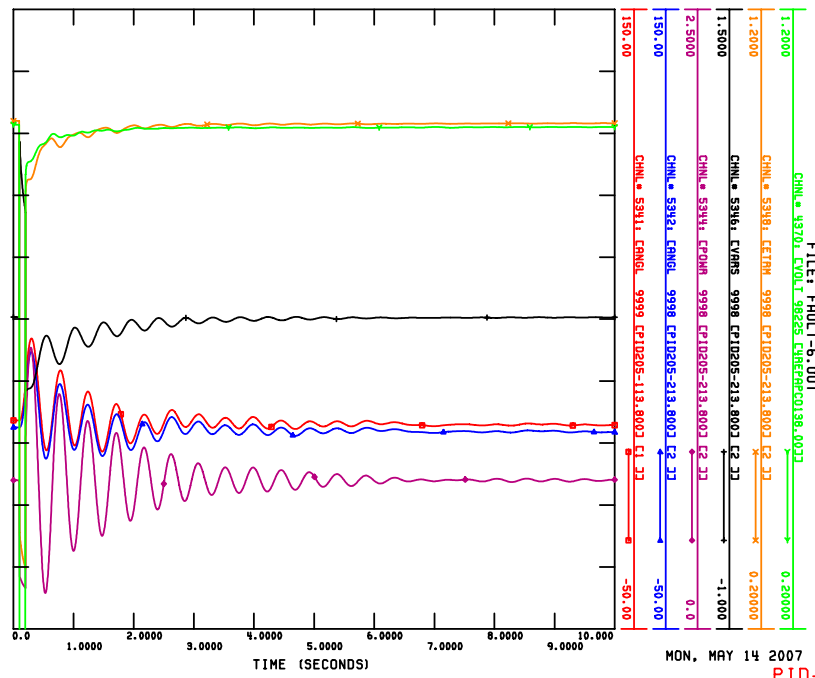
**6CY 3 PH PT. HUDSON 138/69 KV TRANSFORMER #2  
PT. HUDSON 138 KV BUS SECTION #4**





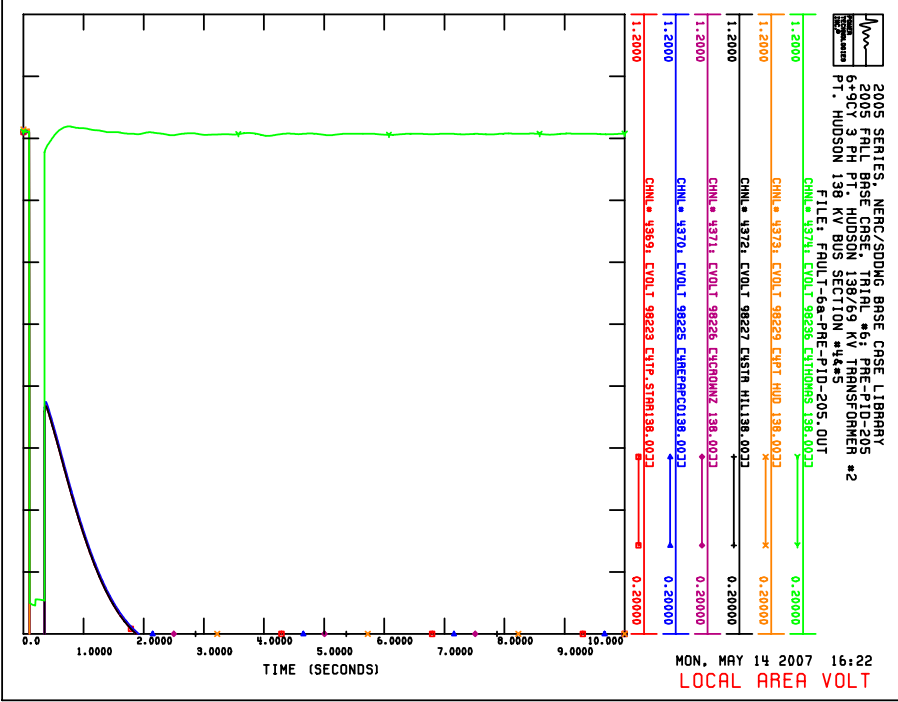
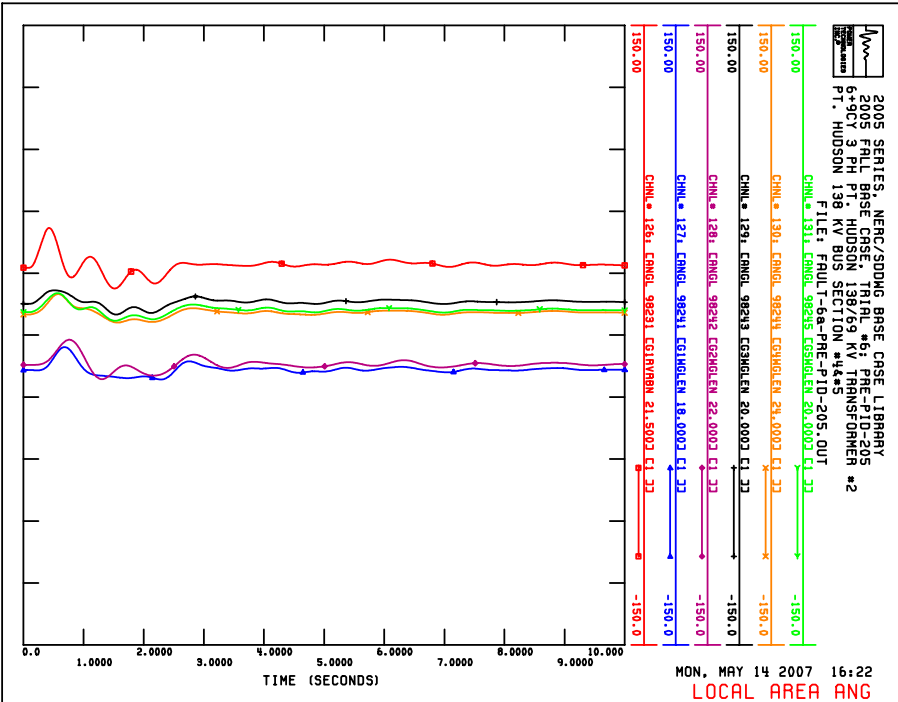
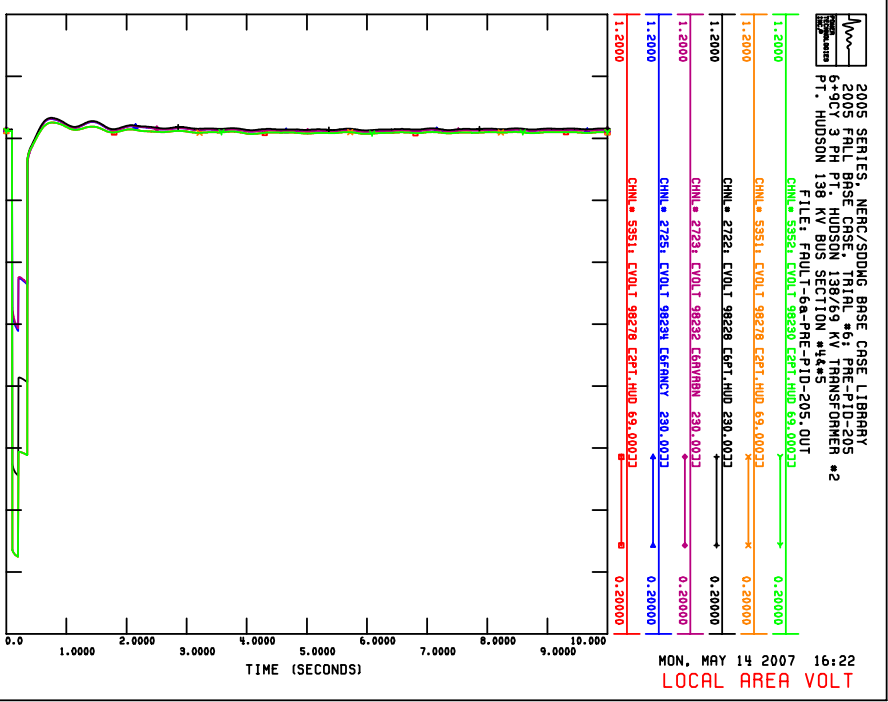
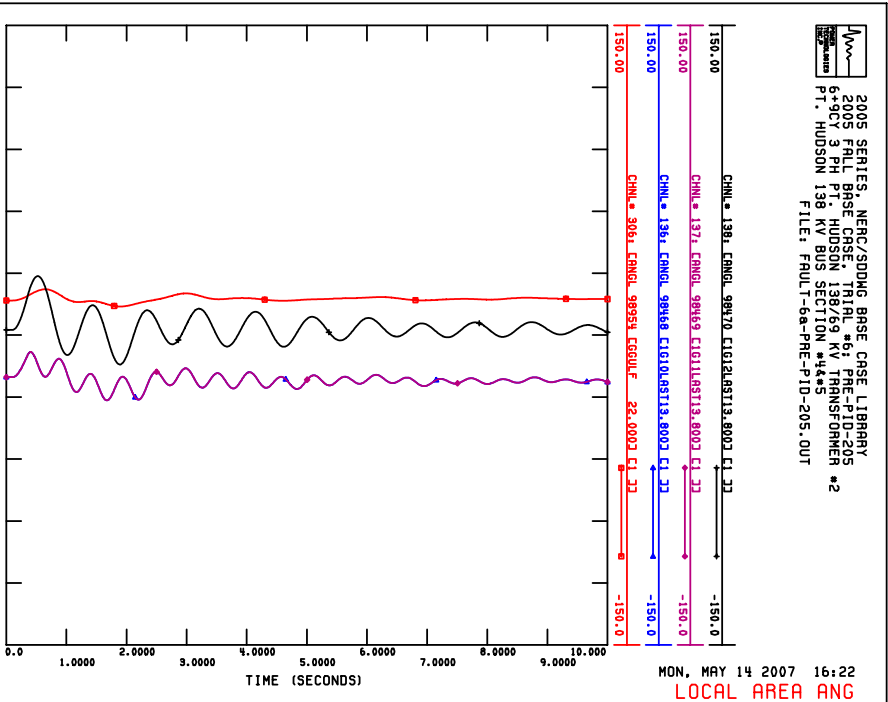


2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FAULT BASE CASE TRIRL #6, PID-205  
 6CY 3 PH PT. HUDSON 138/69 KV TRANSFORMER #2  
 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FAULT-6\_OUT



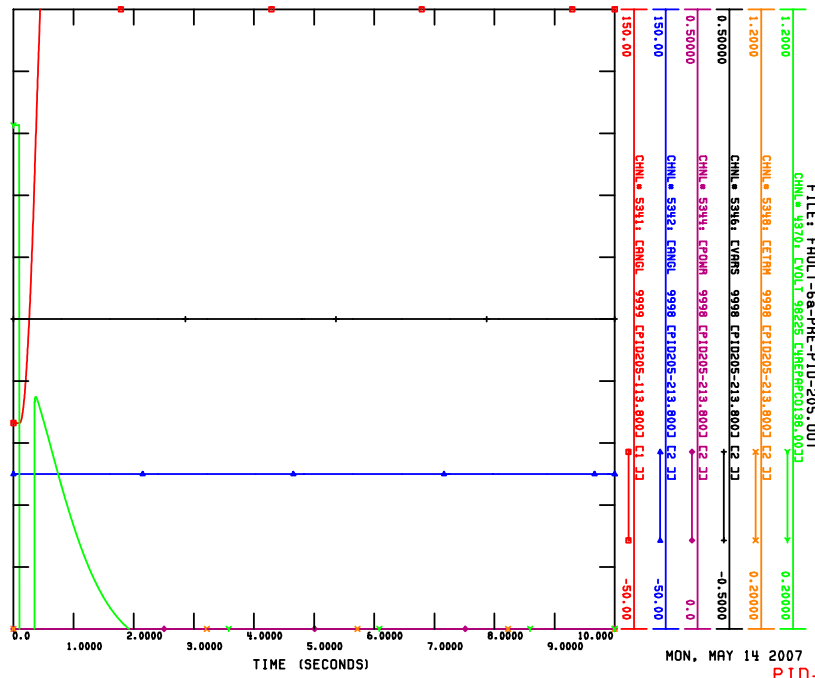
**FAULT-6a WITHOUT PID-205**

**6+9CY 3 PH PT. HUDSON 138/69 KV TRANSFORMER #2  
PT. HUDSON 138 KV BUS SECTION #4&#5**





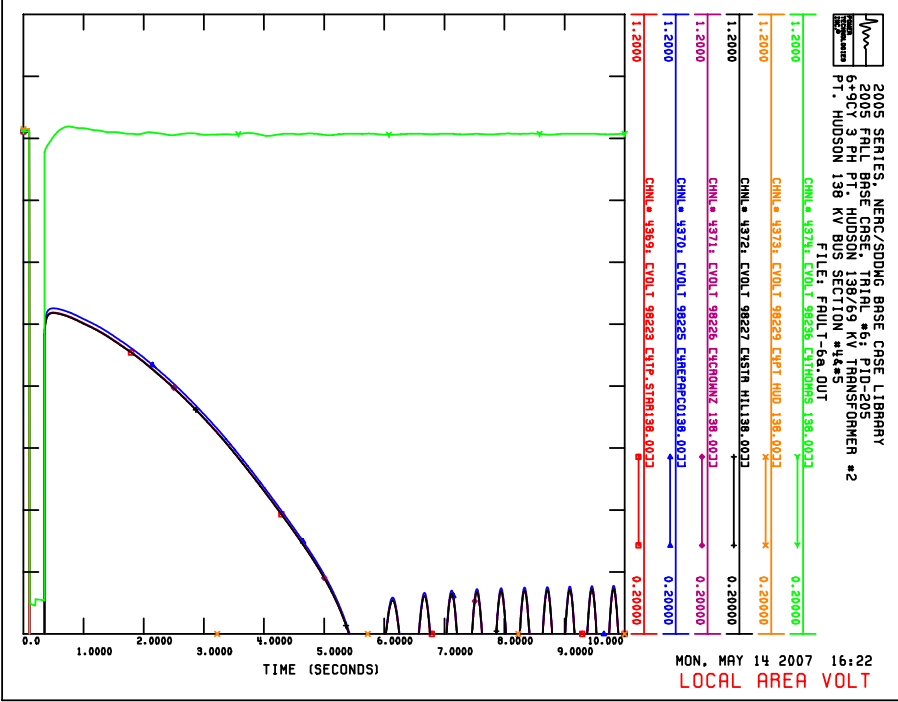
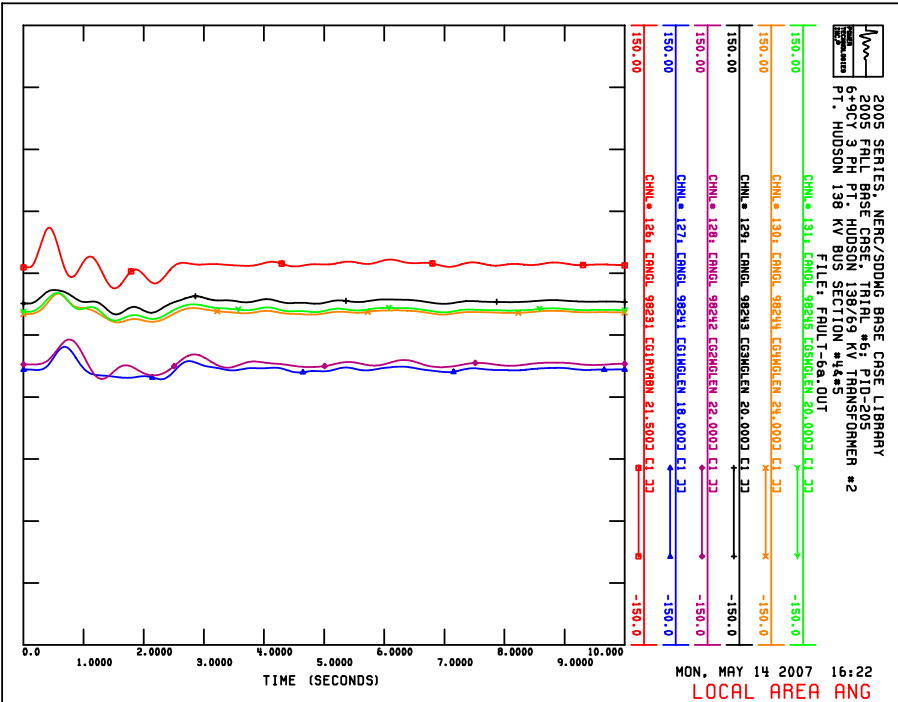
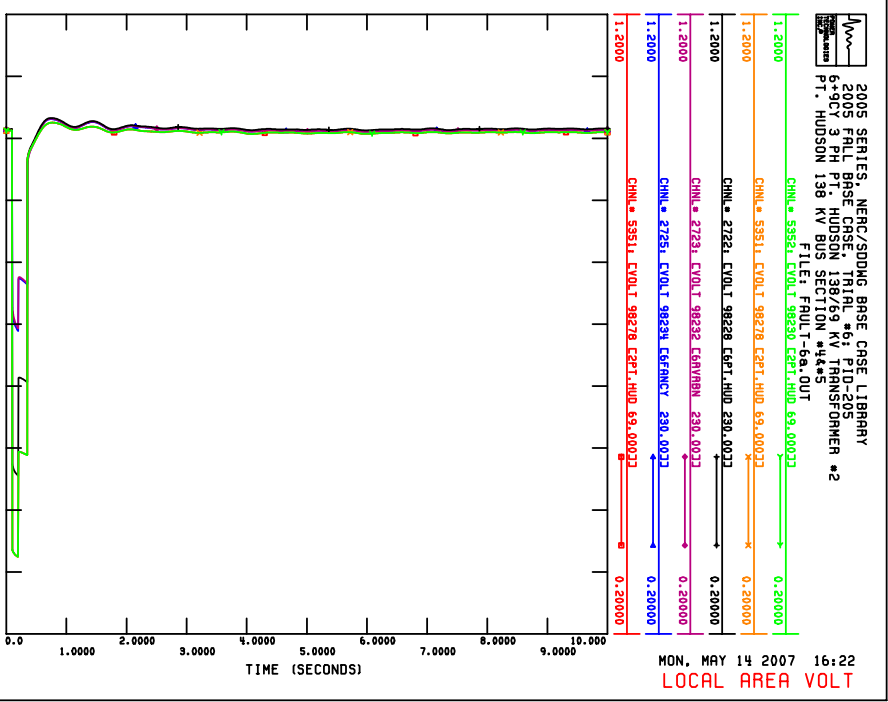
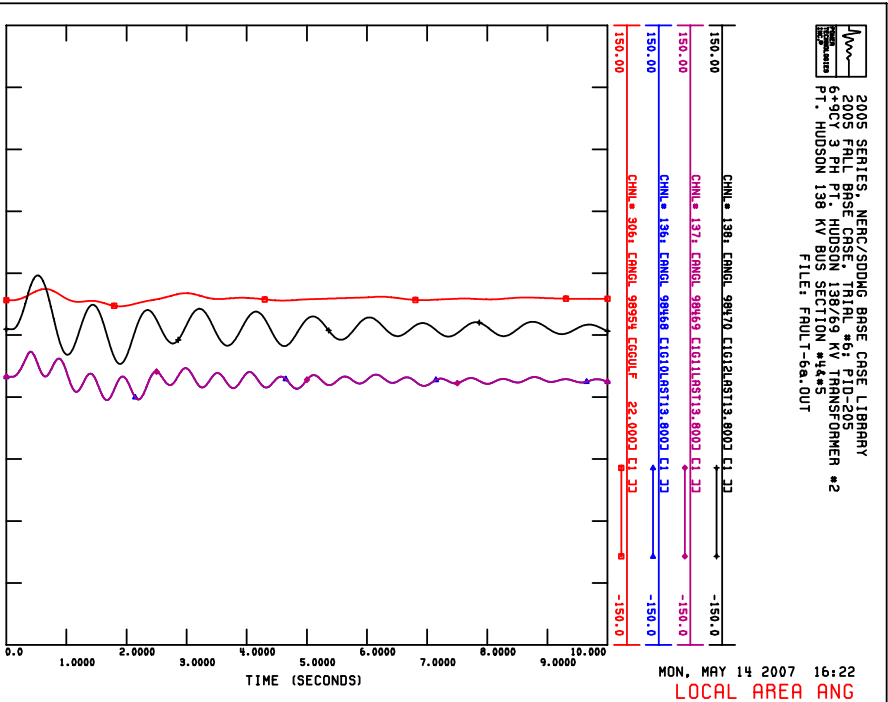
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
2005 FALL BASE CASE TRIPL #6: PRE-PID-205  
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PT. HUDSON 138 KV BUS SECTION #4#5  
FILE: FAULT-6a-PRE-PID-205.OUT  
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MON, MAY 14 2007 16:22  
PID-205

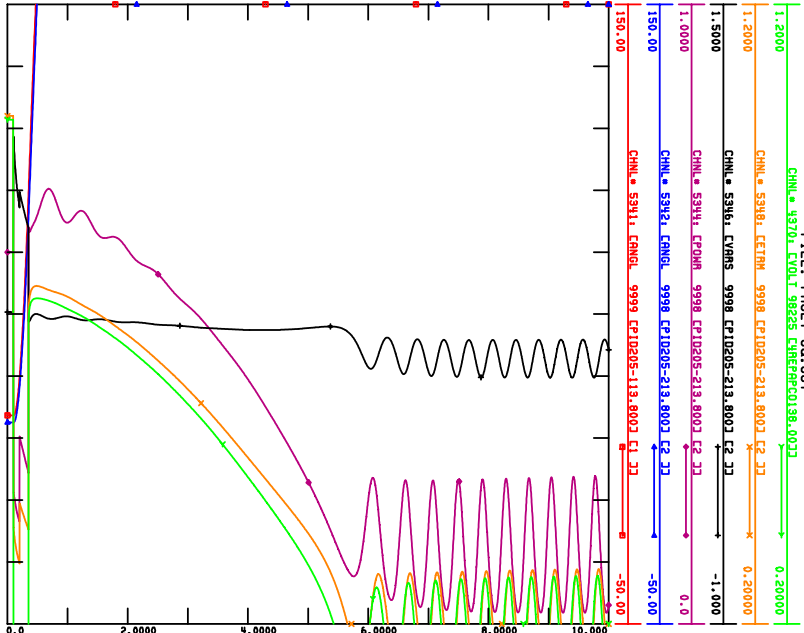
**FAULT-6a WITH PID-205**

**6+9CY 3 PH PT. HUDSON 138/69 KV TRANSFORMER #2  
PT. HUDSON 138 KV BUS SECTION #4&#5**





2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
2005 FALL BASE CASE TRIPL #6; PID-205  
6+9C 3 PH PT. HUDSON 138/69 KV TRANSFORMER #2  
PT. HUDSON 138 KV BUS SECTION #4#5  
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TIME (SECONDS)

MON, MAY 14 2007 16:22

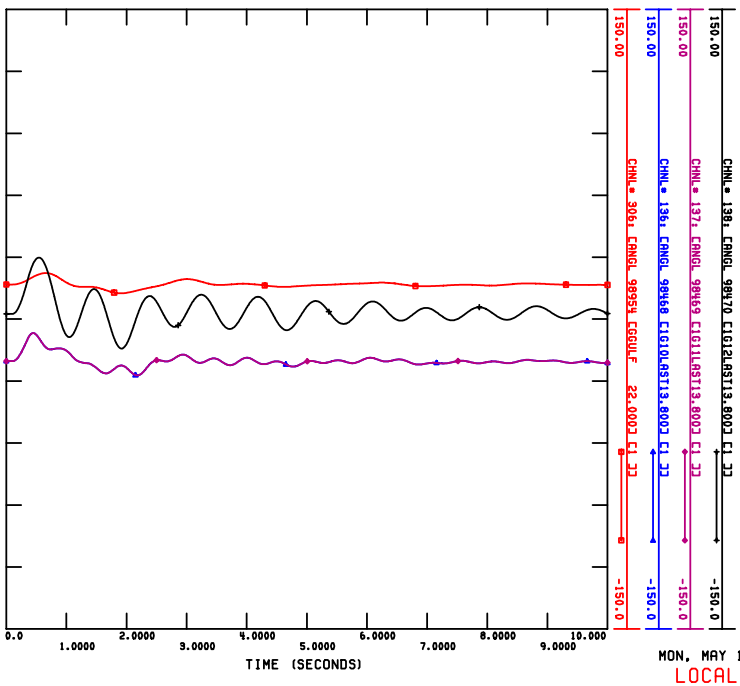
PID-205

**FAULT-6b WITHOUT PID-205**

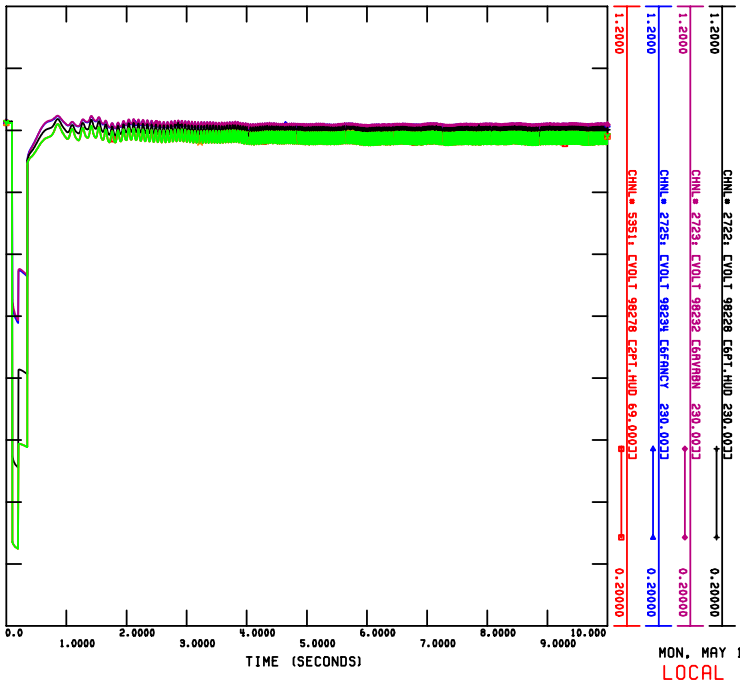
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PT. HUDSON 138 KV BUS SECTION #4**



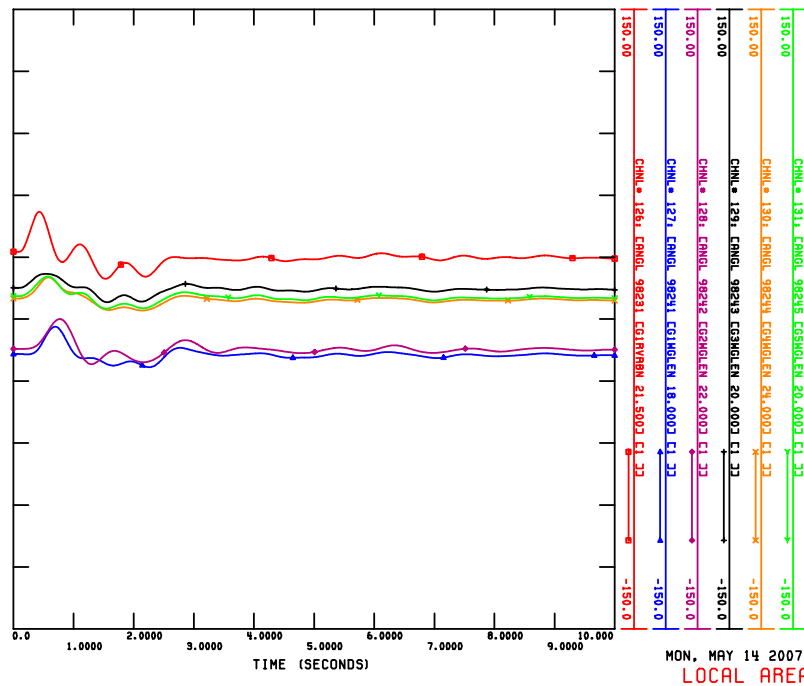
2005 SERIES, NERC/SDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE, TRIPL #6, PRE-PTD-205  
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 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FAULT-66-PTD-205\_OUT



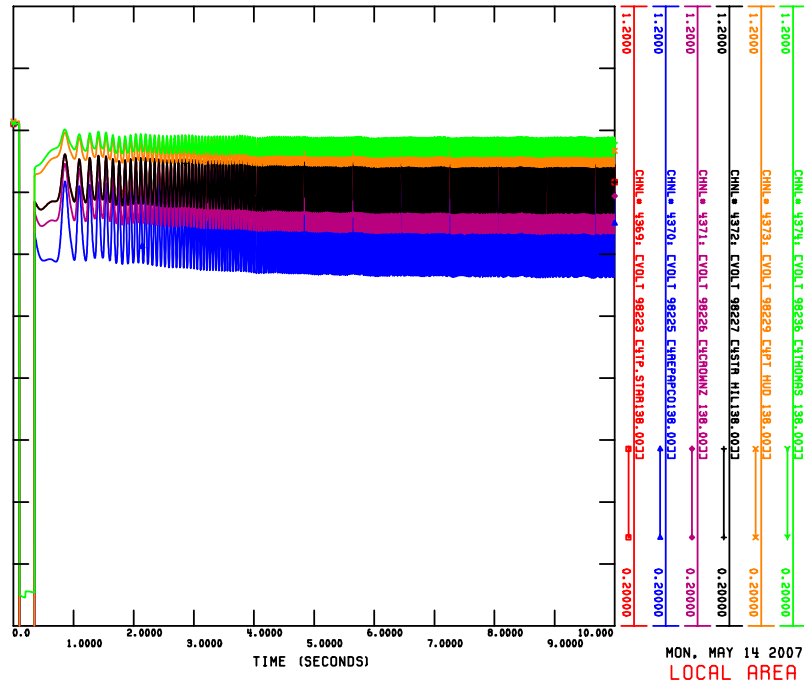
2005 SERIES, NERC/SDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE, TRIPL #6, PRE-PTD-205  
 6+9CY 3 PH PT. HUDSON 138/69 KV TRANSFORMER #2  
 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FAULT-66-PTD-205\_OUT



2005 SERIES, NERC/SDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE, TRIPL #6, PRE-PTD-205  
 6+9CY 3 PH PT. HUDSON 138/69 KV TRANSFORMER #2  
 PT. HUDSON 138 KV BUS SECTION #4  
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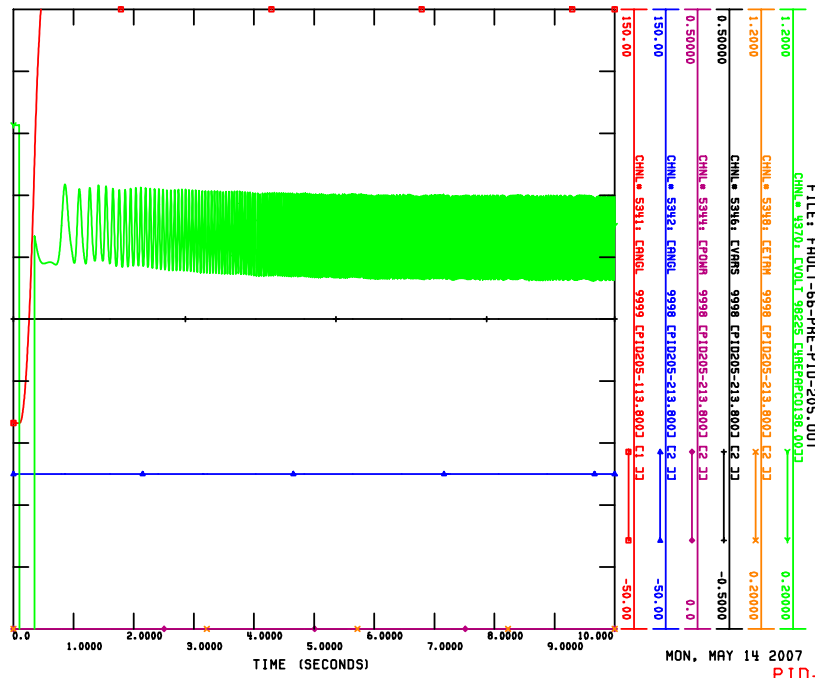


2005 SERIES, NERC/SDMG BASE CASE LIBRARY  
 2005 FALL BASE CASE, TRIPL #6, PRE-PTD-205  
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 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FAULT-66-PTD-205\_OUT



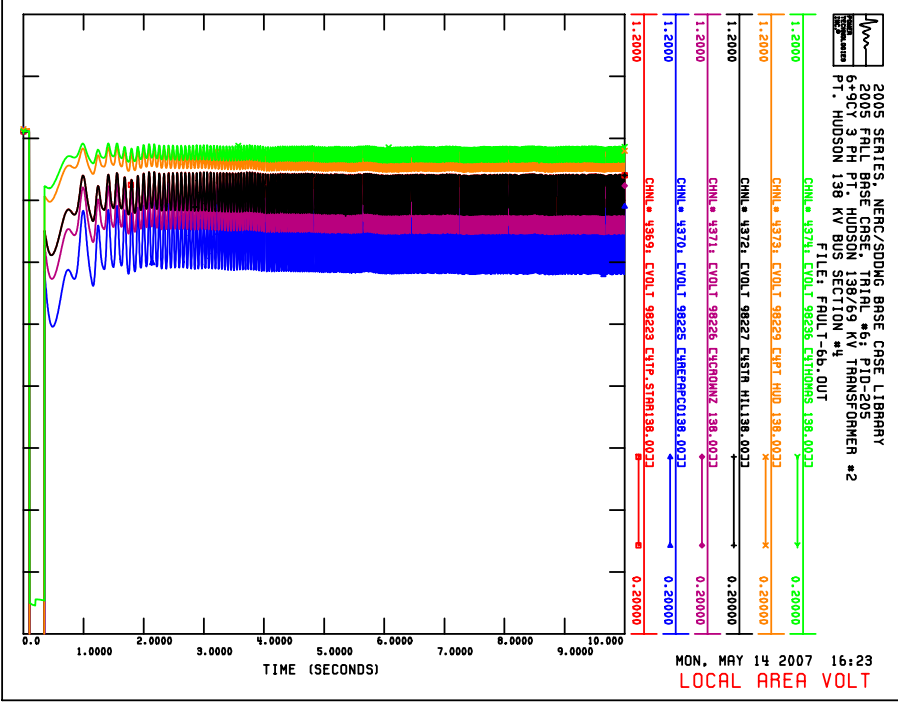
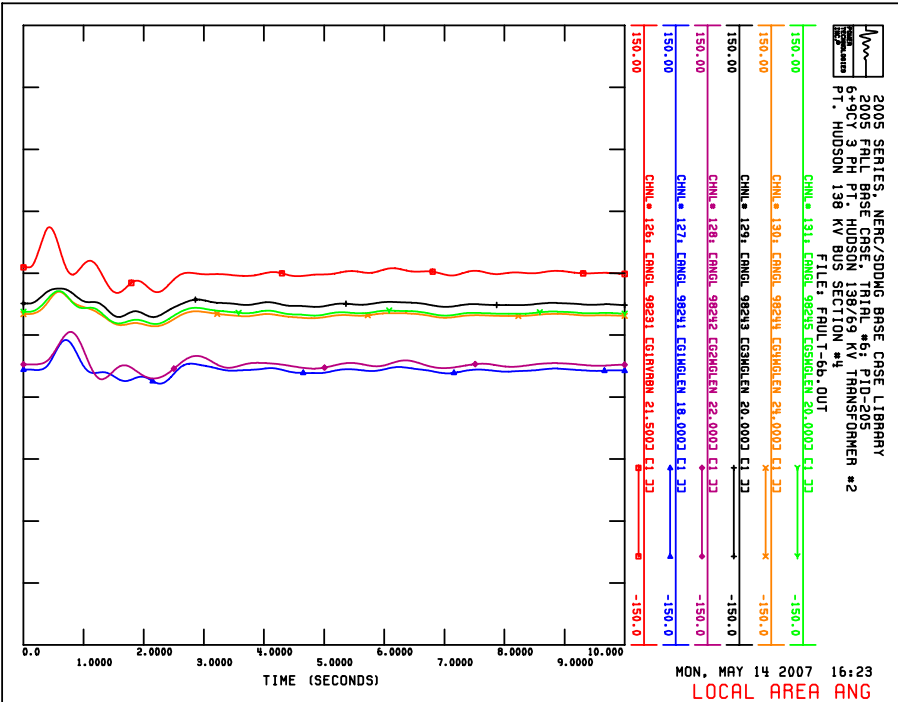
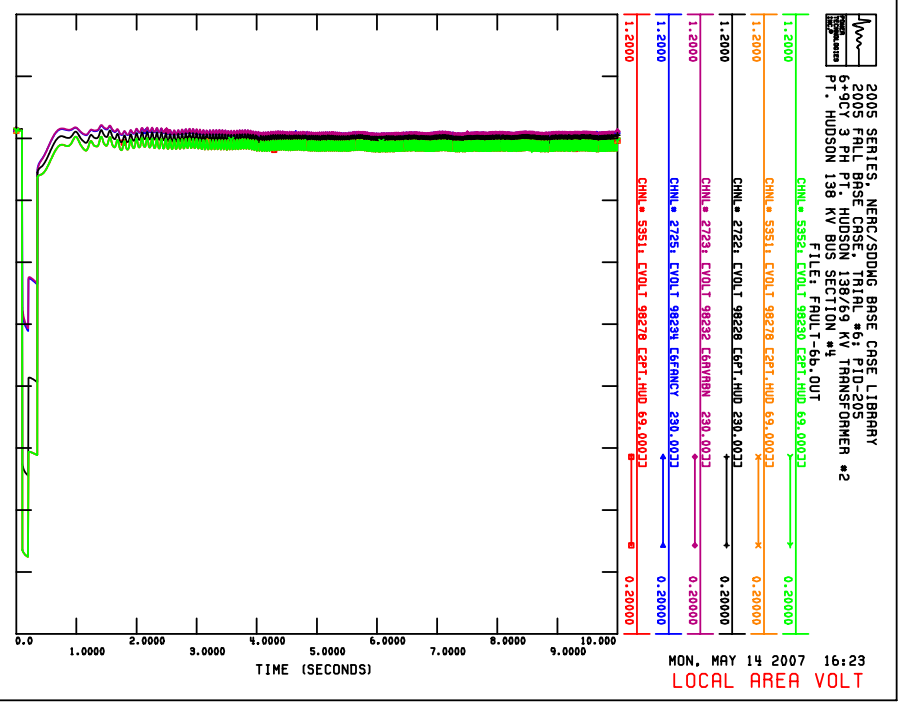
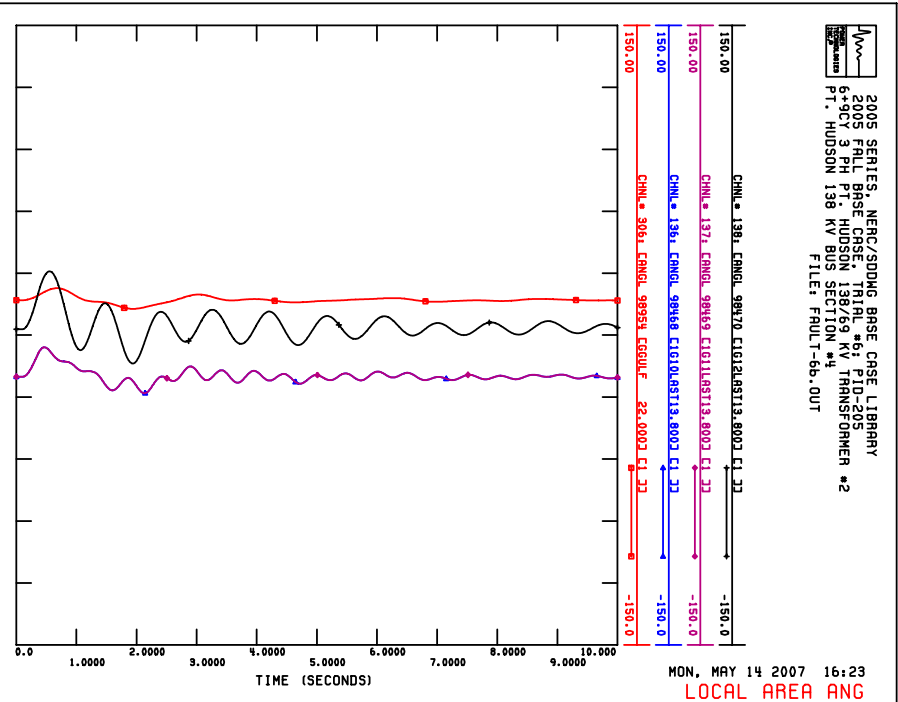


2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
2005 FALL BASE CASE TRIBL #6, PRE-PID-205  
6+9C 3 PH PT, HUDSON 138/69 KV TRANSFORMER #2  
PT, HUDSON 138 KV BUS SECTION #4  
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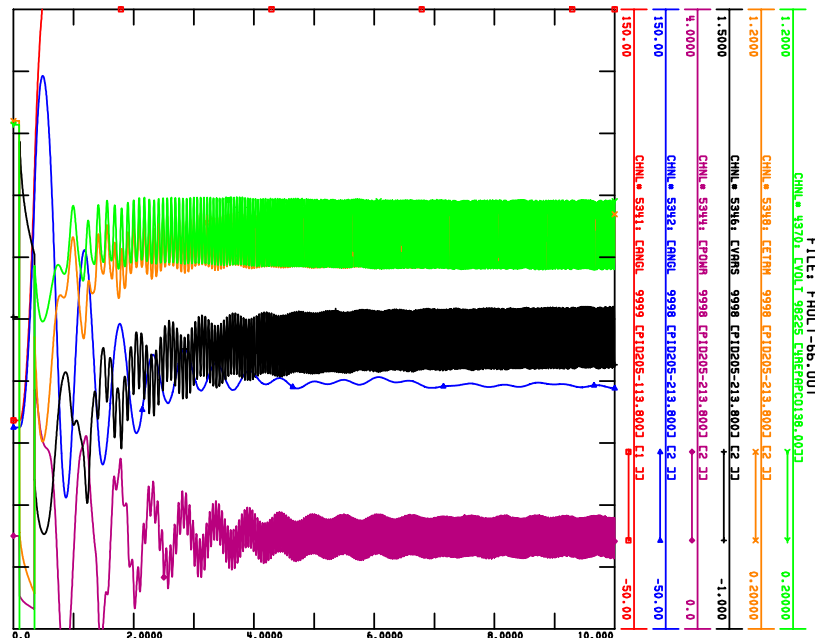


**FAULT-6b WITH PID-205**

**6+9CY 3 PH PT. HUDSON 138/69 KV TRANSFORMER #2  
PT. HUDSON 138 KV BUS SECTION #4**



2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
2005 FALL BASE CASE TRIBL #6, PID-205  
6+9C 3 PH PT. HUDSON 138/69 KV TRANSFORMER #2  
PT. HUDSON 138 KV BUS SECTION #4  
FILE: FAULT-6b.OUT



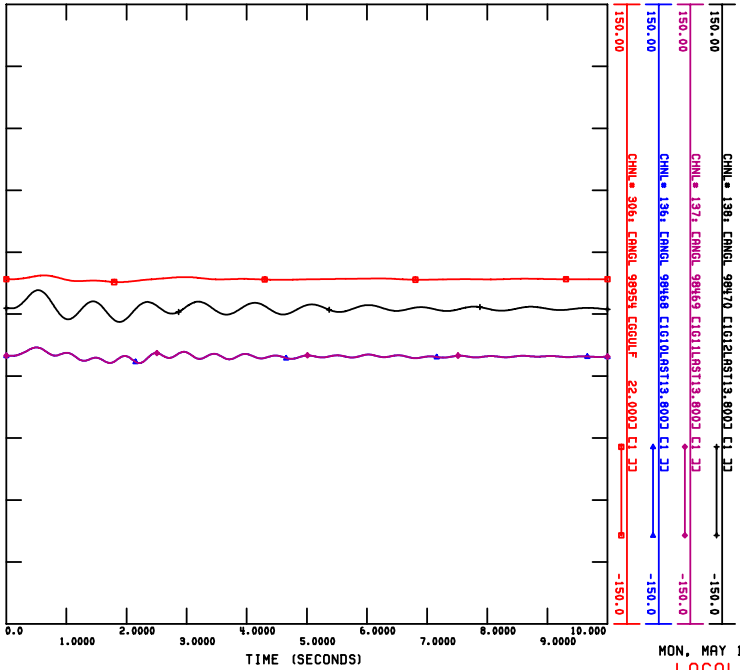
MON, MAY 14 2007 16:23  
PID-205

**FAULT-6b-SLG WITH PID-205**

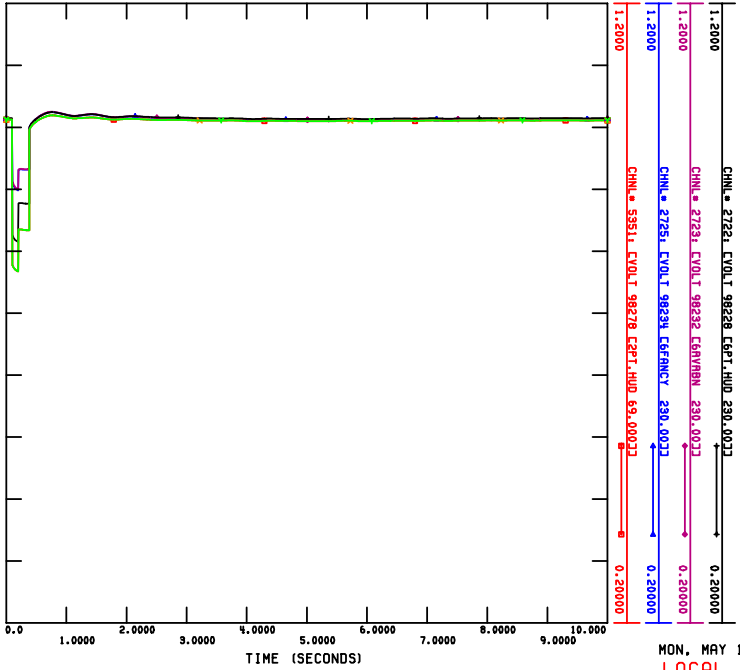
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**PT. HUDSON 138 KV BUS SECTION #4**

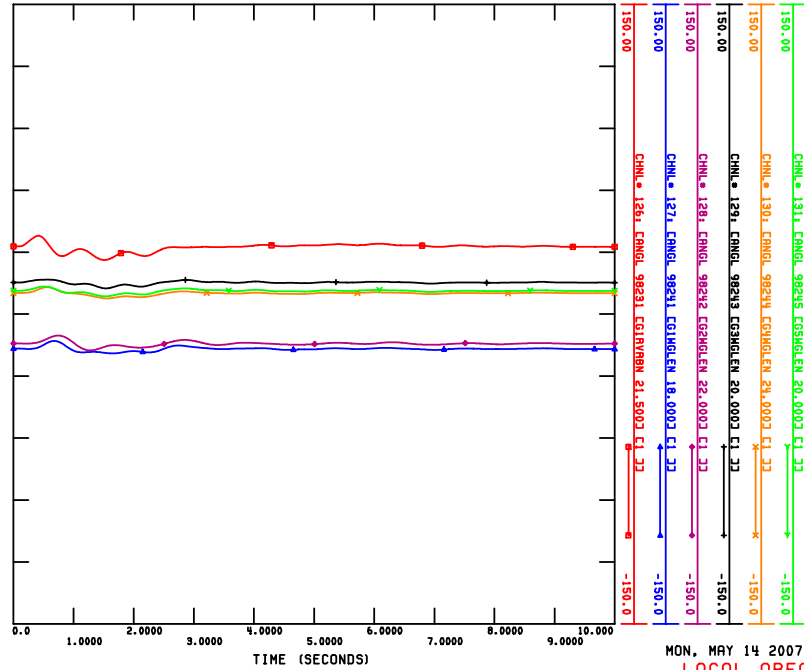
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
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 PT. HUDSON 138 KV BUS SECTION #4  
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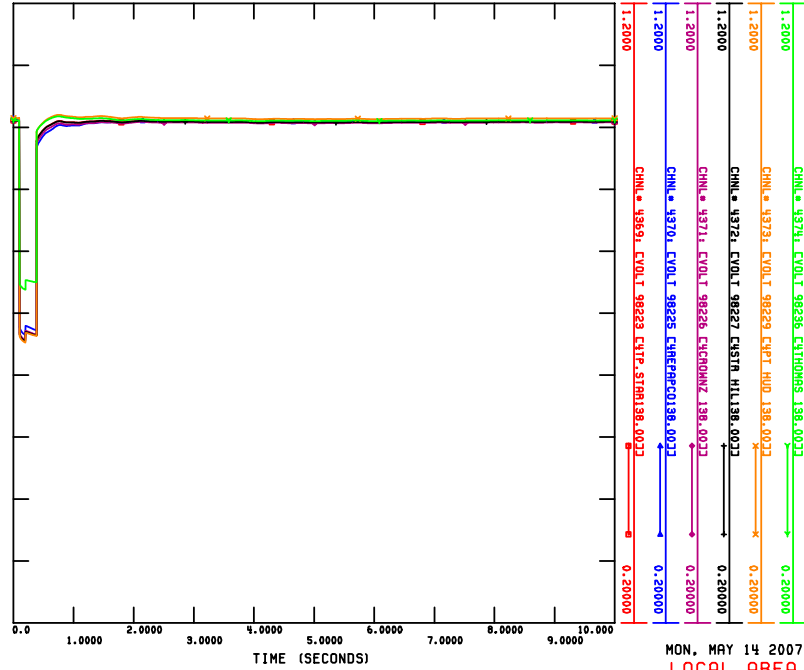
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
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 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FAULT-66-SLG.OUT



2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BRSE CRSE, TRIRL #6, PID-205  
 6+11CY SLG PT. HUDSON 138/69 KV TRANSFORMER #2  
 PT. HUDSON 138 KV BUS SECTION #4  
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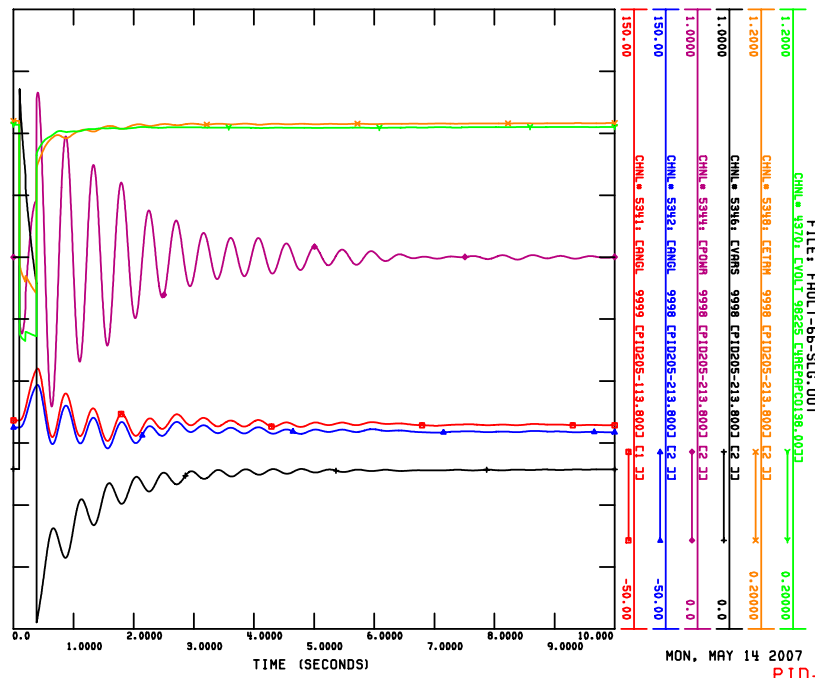


2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
 2005 FALL BRSE CRSE, TRIRL #6, PID-205  
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 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FAULT-66-SLG.OUT





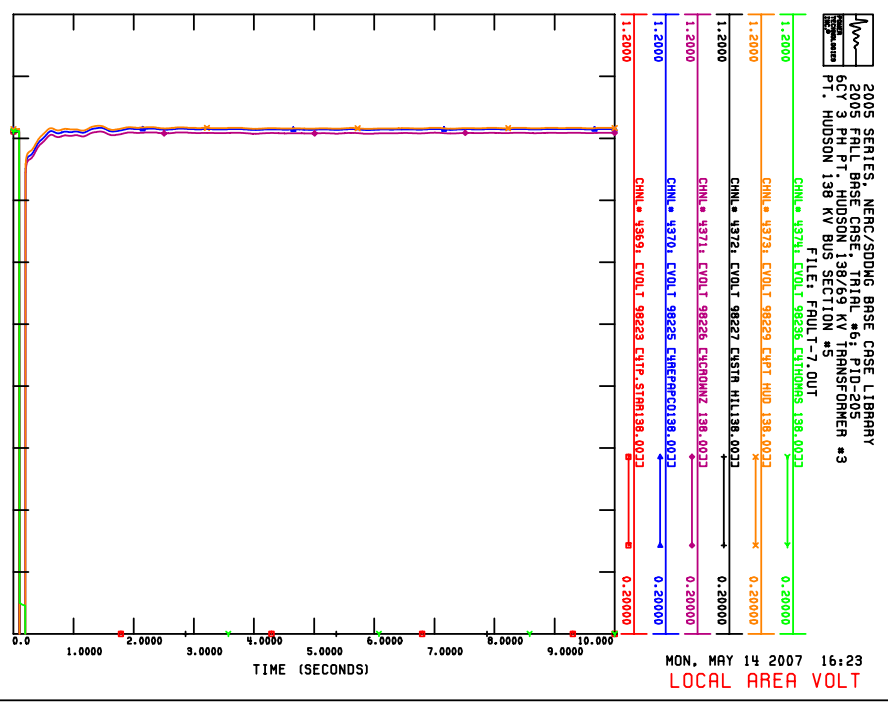
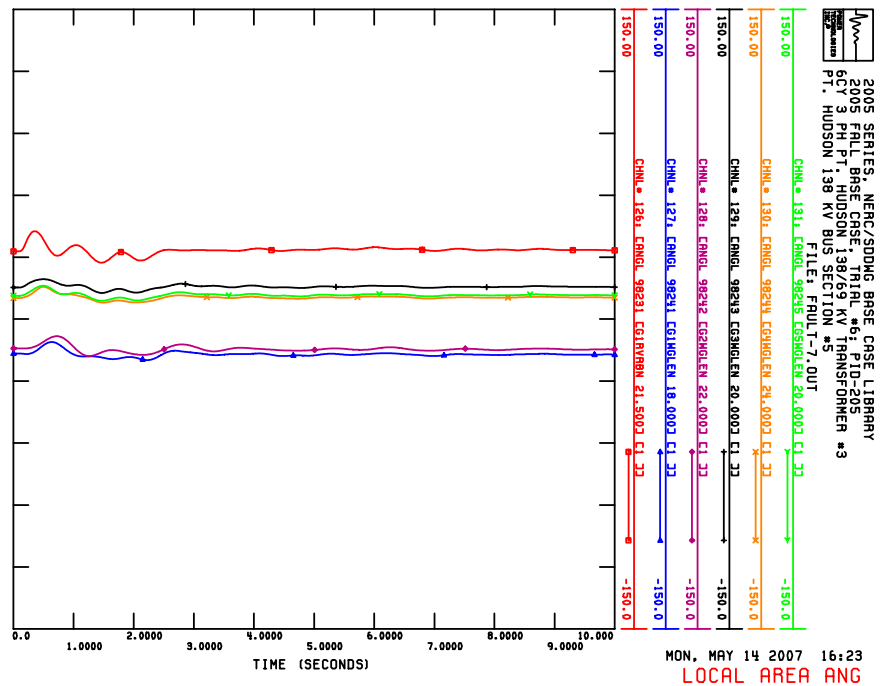
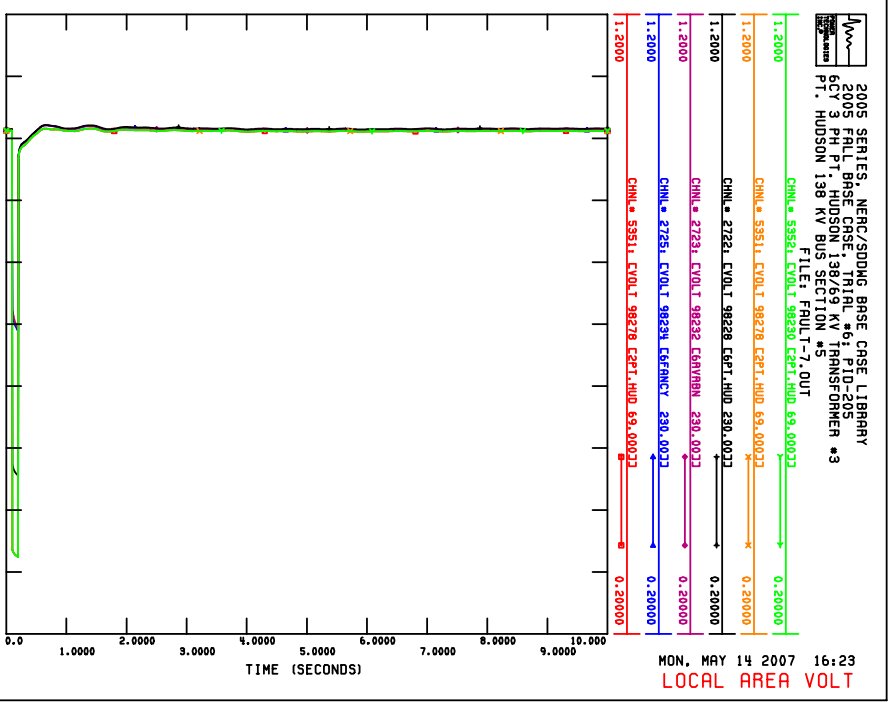
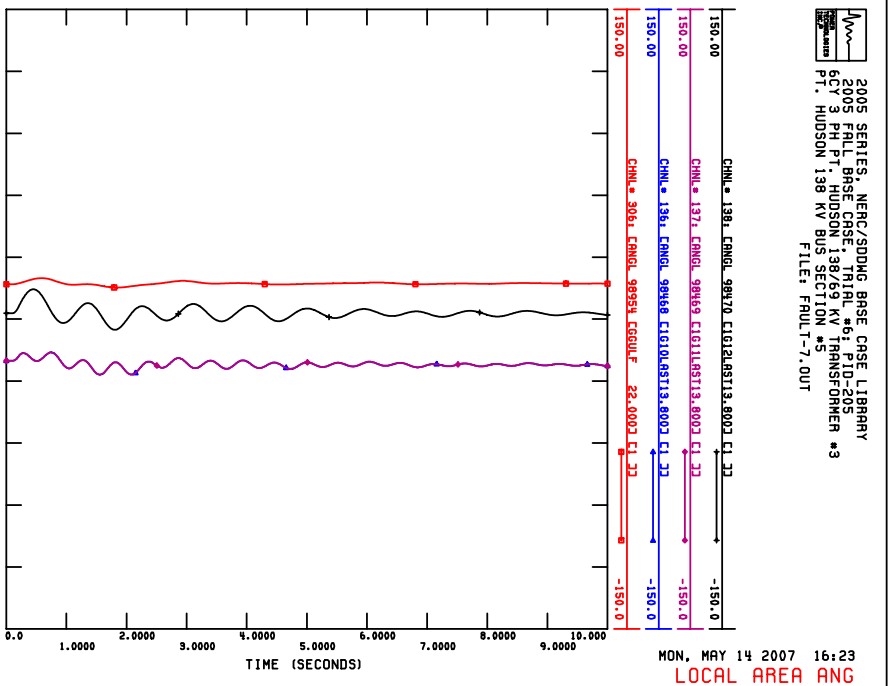
2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
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 PT. HUDSON 138 KV BUS SECTION #4  
 FILE: FULT-66-SLG.OUT  
 CHANNEL 1: 9370V, VOLT, 98225, CHREFFAC0138, 0001





**FAULT-7**

**6CY 3 PH PT. HUDSON 138/69 KV TRANSFORMER #3  
PT. HUDSON 138 KV BUS SECTION #5**





2005 SERIES, NERC/SDDMG BASE CASE LIBRARY  
2005 FULL BASE CASE TRIP# #5, PID-205  
6CY 3 PH PT. HUDSON 138/69 KV TRANSFORMER #3  
PT. HUDSON 138 KV BUS SECTION #5  
FILE: FAULT-7\_OUT

