



**Interconnection System Impact Study Report
Request # GI-2010-08
Preliminary 2010 Summer Results
Revision 1**

Comanche Unit 3 100 MW Uprate
Pueblo, Colorado

Public Service Company of Colorado
Transmission Planning
August 25, 2010

Executive Summary

Public Service Company of Colorado (PSCo) received an interconnection request (GI-2010-08) for a 100 MW increase in Comanche Unit 3 generation output. Comanche Unit 3 is currently a 750 MWnet unit connected to the transmission system at Comanche 345 kV substation located at Pueblo, Colorado (see Figure 1 below). The request was for 850 MWnet. The requested in-service date was June 15, 2010.

This request was studied as a Network Resource. These investigations included steady-state power flow and dynamic analyses. The request was studied as a stand-alone project only, with no evaluations made of other potential new generation requests that may exist in the Large Generator Interconnection Request (LGIR) queue, other than the generation projects that are already approved and planned to be in service by summer 2010. The main purpose of this System Impact Study was to evaluate the potential impact on the PSCo transmission infrastructure as well as that of neighboring utilities when injecting the additional 100 MW of generation at the Comanche 345 kV substation, and delivering the additional generation to native PSCo loads.

Network Resource

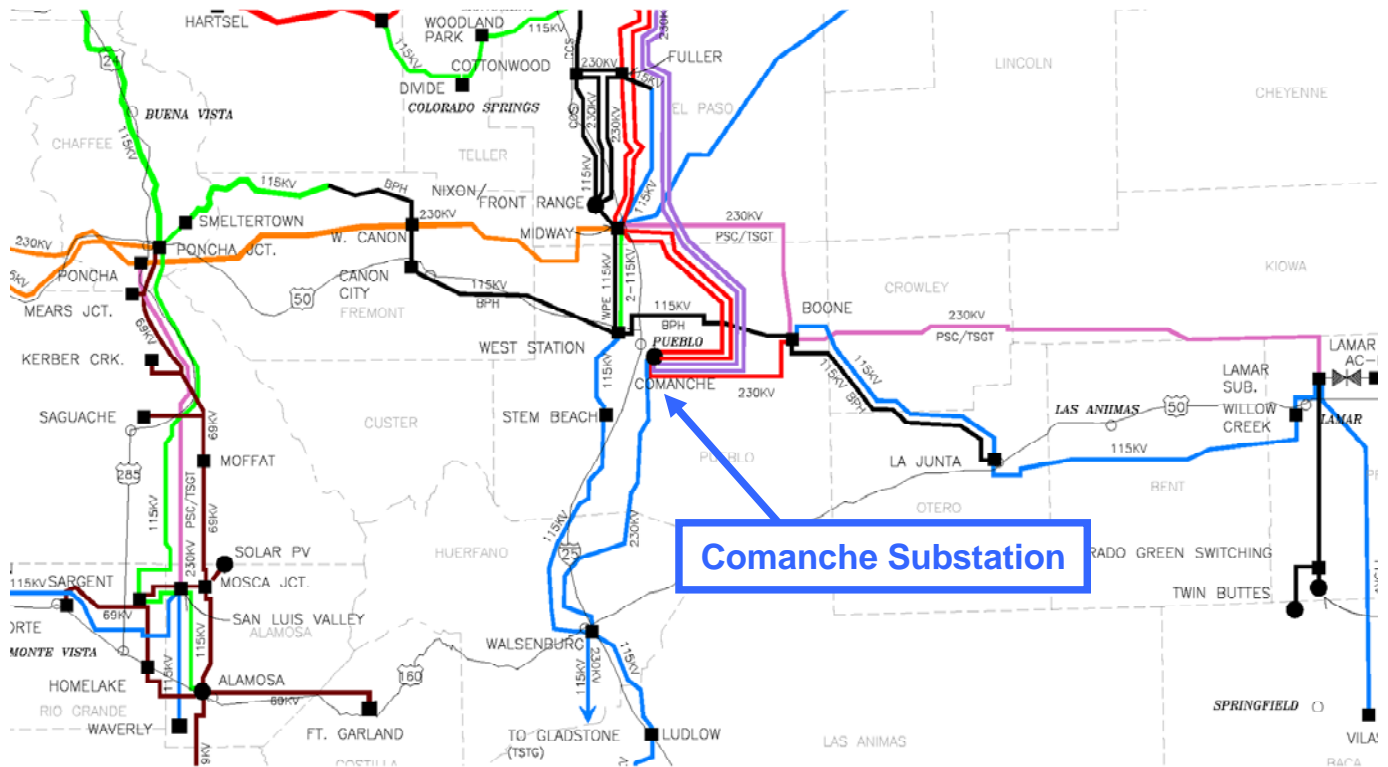
The results of the study for 2010 summer analyses showed increases in previously existing overloads on facilities in the PSCo, BHE, and TSG&T systems. However, the overload increases were less than 5%, which is not significant. A new overload was found on the BHE system, Burnt Mill-Freemary 115 kV circuit for the loss of Pueblo Plant-Reader 115 kV circuit. However, the studies showed that BHE load 22 MW below the system peak in the case would relieve the overload. As of this writing, BHE is past the system peak. Therefore, this overload should not be a problem for the remainder of 2010. For 2011, the studies showed that installation of the new Airport Tap-West Station double circuits relieved the loading on the Burnt Mill-Freemary 115 kV circuit. Therefore, 2011 should also not be a concern.



The transient stability performance of the system with the additional generation at Comanche Unit 3 was satisfactory, with the exception of one NERC Category C disturbance that was positively damped but not well damped. This will be studied further after receipt of WECC testing data.

Therefore, the Network Resource analysis indicates that the customer can provide 100 MW of additional generation from Comanche Unit 3 during 2010 without the need for network upgrades. Also, since there are no area system changes expected that would adversely affect system performance, the additional generation should be okay for 2011 as well. However, additional studies are required to examine system performance with the planned BHE Airport generation, which is due in service by the end of 2011. The coordinating affects of the new Midway-Waterton 345 kV line will also be included. These studies will be performed for 2012 summer conditions.

Figure 1 Comanche Substation and Surrounding Transmission System





Introduction

Public Service Company of Colorado (PSCo) received an interconnection request (GI-2010-08) for a 100 MW increase in Comanche Unit 3 generation output. The interconnection request was received May 14, 2010. Comanche Unit 3 is currently a 750 MWnet unit connected to the transmission system at Comanche 345 kV substation located at Pueblo, Colorado. The request was originally for 840 MWnet. However, on May 26, 2010, the customer requested an increase to 850 MWnet. The requested in-service date was June 15, 2010.

Study Scope and Analysis

The System Impact Study evaluated the transmission impacts associated with the proposed generation increase. It consisted of power flow and dynamic analyses. The power flow analysis identified any thermal or voltage limit violations resulting from the uprate and an identification of network upgrades required to deliver the proposed generation to PSCo loads. The dynamic analysis identified any transient and oscillatory stability impacts due to addition of the new generation.

PSCo adheres to NERC & WECC Reliability Criteria, as well as internal Company criteria for planning studies. During system intact conditions, criteria are to maintain transmission system bus voltages between 0.95 and 1.05 per unit of nominal, and steady-state power flows below the thermal ratings of all facilities. Operationally, PSCo tries to maintain a transmission system voltage profile ranging from 1.02 per unit or higher at regulating (generation) buses to 1.0 per unit or higher at transmission load buses. Following a single contingency, transmission system steady state bus voltages must remain within 0.90 per unit to 1.10 per unit, and power flows within 100% of the facilities' continuous thermal ratings. Also, voltage deviations should not exceed 5%.

Transient stability criteria require that all generating machines remain in synchronism and all power swings should be well damped. Also, transient voltage performance should meet the following criteria:

- Following fault clearing for Category B contingencies, voltage may not dip more than 25% of the pre-fault voltage at load buses, more than 30% at non-load buses, or more than 20% for more than 20 cycles at load buses.
- Following fault clearing for Category C contingencies, voltage may not dip more than 30% of the pre-fault voltage at any bus or more than 20% for more than 40 cycles at load buses.

In addition, transient frequency performance should meet the following criteria:

- Following fault clearing for Category B contingencies, frequency should not dip below 59.6 Hz for 6 cycles or more at a load bus.



- Following fault clearing for Category C contingencies, frequency should not dip below 59.0 Hz for 6 cycles or more at a load bus.

Note that load buses include generating unit auxiliary loads.

This project was studied as a Network Resource. Network Resource Interconnection Service shall mean an Interconnection Service that allows the Interconnection Customer to integrate its Large Generating Facility with the Transmission Provider's Transmission System (1) in a manner comparable to that in which the Transmission Provider integrates its generating facilities to serve native load customers; or (2) in an RTO or ISO with market based congestion management, in the same manner as all other Network Resources. Network Resource Interconnection Service in and of itself does not convey transmission service.

For this project, potential affected parties include Tri-State Generation & Transmission (TSG&T), Black Hills Energy (BHE), Colorado Springs Utilities (CSU), and Western Area Power Administration (WAPA).

Power Flow Study Models

The power flow and dynamic studies for 2010 summer were based on the WECC approved 10HS3BP case. PSCo loads in the case were adjusted to reflect the most recent (April 2010) PSCo load forecast. IREA load was also adjusted to reflect IREA's 2010 load forecast. The topology was also updated to reflect current project plans. Updates were included for the PSCo, CSU, WAPA, and BHE systems. TSG&T indicated their system model was satisfactory in the case. The PSCo updates included the addition of the Midway-Daniels Park 230 kV circuit, addition of the Comanche and Daniels Park 345 kV 40 Mvar reactors, correction of the Comanche-Reader 115 kV circuit 1 & 2 ratings, and correction of the Comanche Unit 1 & 2 GSU transformer primary rated voltages.

The Comanche Unit 3 model was adjusted to reflect current available data. The Unit 3 GSU impedance and ratings were corrected per the manufacturer test reports. This transformer consists of 3 single phase units rated $345.0/\sqrt{3} / 27.0$ kV 336 MVA. The 3 phase impedance was $0.00162 + j 0.11087$ pu on 1008 MVA. The reactive capability of the generator was adjusted to reflect the machine D-Curve and the MEL settings. The new reactive capability at 792 MW gross was 560 Mvar to -80 Mvar. The machine impedances, time constants, and ratings were updated to reflect the manufacturer's data. In particular, the machine rated voltage was adjusted to 27.0 kV. Also, Z Source in the load flow generator data was set to $0.002 + j 0.266$ pu on 1008 MVA. And the unit auxiliary load was adjusted to $42.6 + j 32.6$ MVA to reflect levels measured near maximum output. In the WECC load flow case, Comanche Unit 3 was modeled with a maximum output of 750 MW gross. This was adjusted to reflect 750 MW net and 850 MW net.



For the 2010 heavy summer case, two main power flow generation dispatch scenarios were evaluated. One was created as a reference scenario and the other was created with the additional generation. To assess the impact of the additional generation on the transmission system between Comanche Unit 3 and the Denver load centers, the power flow models were modified to simulate higher flows from southern Colorado to the north. To accomplish this, generation in south-central Colorado was dispatched to maximum output to increase flows to the north. Generation increases were implemented at Comanche Units 1 & 2, Fountain Valley Units 1-6, and the Lamar DC Tie. Generation at Manchief Units 1 & 2, Fort St Vrain Units 1-6, Valmont Units 6-8, Arapahoe Units 5-7, Spruce Units 1-2, and RMEC Units 1-3 was used as a sink for the dispatch changes. PSCo control area (Area 70) wind generation facilities were dispatched to 12.5%.

For the transient stability studies, there were a number of small generation adjustments required to address dynamic simulation initialization problems. In particular, Comanche Units 1 & 2 had to be backed down to 345 MW, each. This was offset with generation at Fort St. Vrain. Also, the Front Range Units 1 & 2 also had to be reduced 5 MW, each. This was offset with generation in Wyoming. In addition, a unit in PG&E also had to be reduced 5 MW. This was offset with other generation in PG&E. During the initial dynamic runs, a stability problem was found with the two large synchronous motors at TSG&T's Rosebud 115 kV bus in the New Mexico system model for faults at the Comanche 230 kV and 345 kV buses. Since these machines are smaller and electrically far away from Comanche Substation, they were taken out of service with the load reduction compensated for by reducing generation in New Mexico.

Power Flow Study Process

Contingency power flow studies were completed on the reference model and the model with the proposed generation increase using PTI's PSSE Ver. 30.3.2 program. Results from the two cases were compared and new overloads or overloads that increased significantly in the new generation case were noted. Voltage criteria violations were also recorded. PSSE's ACCC activity was used to perform the load flow contingency analysis.

Contingency dynamic stability studies were also completed using PSSE Ver. 30.3.2. The fault durations that were used for 3 phase faults were 4 cycles for Comanche 345 kV substation and 5 cycles for Comanche 230 kV substation. The total fault duration of 1 phase faults with breaker failure at Comanche 345 kV substation was 16 cycles. At Comanche 230 kV substation, the total fault duration of 1 phase faults with breaker failure was 17 cycles. Recorded results included generator relative rotor angle, bus voltage, and bus frequency plots, minimum bus voltages and maximum frequency deviation.



Power Flow Results

2010 Heavy Summer Case:

Using this case, contingency analysis was performed to assess system performance under 2010 heavy summer conditions. The results are included in Table 1 in the Appendix. Overloads due to the proposed generation increase were noted on PSCo, TSG&T, and BHE facilities. However, with one exception, all of these facilities were also overloaded in the benchmark case.

Overloads on the PSCo system included the Comanche 230/115 kV transformer #1 due to the loss of Comanche 230/115 kV T2, and the Comanche-Reader 115 kV #1 circuit due to the loss of Comanche-Reader 115 kV #2. Comanche 230/115 kV T1 was overloaded 139.0% in the benchmark case and 142.1% with the new generation for an increase of 3.1%. This transformer is scheduled to be replaced in December 2010. Comanche-Reader 115 kV #1 was overloaded 116.32% in the benchmark case versus 119.4% in the case with the new generation for an increase of 3.1%. This circuit is limited by terminal equipment at the Comanche Substation. The limiting terminal equipment is scheduled to be upgraded by June 30, 2010 resulting in a rating of 1600 A due to the circuit breaker at Comanche 115 kV. Since the overloads are pre-existing, and the overload change is less than 5% they should not represent a limitation to the proposed generation increase.

There were eleven contingency overloads noted on the BHE system. However, in most cases, the facilities were overloaded in the benchmark case, as well as with the proposed generation increase. Therefore, these overloads should not present a limit to the proposed upgrade. However, the Burnt Mill-Freemary 115 kV circuit was contingency loaded 99% in the benchmark case and 102.0% in the case with the proposed uprate for an increase of 3%. The contingency was the loss of the Pueblo Plant-Reader 115 kV circuit. For the 2010 summer season, as of the writing of this report, the 2010 summer peak is already past. Load flow studies show that lowering the BHE load by 22 MW to 379 MW lowered the overload to 100% of rating. Since we are past the summer peak, this overload should not be a problem for 2010.

BHE reports that they are installing a new 115 kV double circuit from West Station to Airport Tap. These two circuits are due in service April-May 2011. With these two circuits in service, the Burnt Mill-Freemary 115 kV circuit is no longer overloaded. Therefore, in the 2011 summer season, this overload should not present a limitation to the proposed uprate.

The remaining four overloads were on the TSG&T system. The first TSG&T overload was the Comanche-Walsenburg 230 kV circuit for the loss of Pueblo Tap-West Station 115 kV. This circuit was overloaded in the benchmark case as well as the case with the proposed generation increase. Comanche-Walsenburg 230 kV is overloaded 129.2% in the benchmark case and 130.8% in the case with the new generation for an increase of



1.6%. Note that there are no breakers at Pueblo Tap. Therefore faults on this line section would also open Pueblo Tap-Stem Beach. With the loss of both line sections, Comanche-Walsenburg 230 kV is overloaded 105.9% in the benchmark case and 107.2% in the case with the new generation for an increase of 1.3%. Since the overload of the Comanche-Walsenburg 230 kV circuit is a pre-existing condition and the overload increase is less than 5%, this should not be a limitation to the proposed generation increase.

Another TSG&T overload was Stem Beach-Walsenburg 115 kV circuit for the loss of Comanche-Walsenburg 230 kV. This circuit was overloaded in the benchmark case as well as the case with the proposed generation increase. Stem Beach-Walsenburg 115 kV is overloaded 163.5% in the benchmark case and 165.0% in the case with the new generation for an increase of 1.5%. This overload did not include the RAS scheme. With the RAS scheme, the overload does not exist. Therefore, this should not be a concern.

A third TSG&T overload was Pueblo Tap-Stem Beach 115 kV for the loss of Comanche-Walsenburg 230 kV. This circuit was overloaded in the benchmark case as well as the case with the proposed generation increase. Pueblo Tap-Stem Beach 115 kV is overloaded 215.5% in the benchmark case and 217.4% in the case with the new generation for an increase of 1.9%. The associated outage did not include the Comanche-Walsenburg 230 kV RAS scheme. With the RAS scheme there is no overload. Therefore, this should not be a concern.

A fourth TSG&T overload is Pueblo Tap-West Station 115 kV for the loss of Comanche-Walsenburg 230 kV both with and without the RAS scheme. This circuit was overloaded in the benchmark case as well as the case with the proposed generation increase. Without the RAS scheme, Pueblo Tap-West Station 115 kV is overloaded 271.4% in the benchmark case and 273.4% in the case with the new generation for an increase of 2.0%. With the RAS scheme, the circuit is overloaded 136.9% in the benchmark case and 137.0% in the case with the new generation for an increase of 0.1% with the RAS scheme. Since this is a preexisting overload and the overload increase is significantly less than 5%, this should not represent a limitation to the proposed generation increase.

Dynamic Stability Results

2010 Heavy Summer Case:

Using this case, contingency analysis was performed to assess the transient stability system performance under 2010 heavy summer conditions. The examined disturbances are provided in Table 2. The list of evaluated contingencies was limited to that necessary to adequately assess the transient stability performance of the system with the proposed increase in Comanche Unit 3 generation. The extent of the breaker failure contingencies was determined by the substation configuration and the relative



short circuit strengths of each circuit at the substation of interest. To perform the analyses, plots of generator rotor angle and bus voltage were produced for each disturbance. Minimum transient bus voltage dips and maximum transient frequency deviations were also determined. The results can be found in Table 3 in the Appendix. Plots of rotor angles, bus voltages, and bus frequency can be found in Section D in the Appendix.

The results indicate that with the proposed increase in generation, Comanche Unit 3 and nearby units are stable with satisfactory damping for most modeled disturbances. Case #200 with a double-circuit tower 3 phase fault on the Comanche-Daniels Park 345 kV was positively damped but not well damped. This situation will be studied further after the modeling results are received from WECC testing. The transient voltage dip results show that the system response is well within WECC transient voltage dip criteria. The lowest voltage dip among the disturbances was to 83.0% at the Walsenburg 69 kV bus. In addition, the maximum transient frequency deviation was to 59.57 Hz at the City of Lamar 14.4 kV bus. This is below the 59.6 Hz WECC threshold but it was below the threshold for less than the 6 cycle minimum time requirement.

Network Resource (NR)

The results of the study for 2010 summer analyses showed increases in previously existing overloads on facilities in the PSCo, BHE, and TSG&T systems. However, the overload increases were less than 5%, which is not significant. A new overload was found on the BHE system, Burnt Mill-Freemary 115 kV circuit for the loss of Pueblo Plant-Reader 115 kV circuit. However, the studies showed that BHE load 22 MW below the system peak in the case would relieve the overload. As of this writing, BHE is past the system peak. Therefore, this overload should not be a problem for the remainder of 2010. For 2011, the studies showed that installation of the new Airport Tap-West Station double circuits relieved the loading on the Burnt Mill-Freemary 115 kV circuit. Therefore, 2011 should also not be a concern.

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Therefore, the Network Resource analysis indicates that the customer can provide 100 MW of additional generation from Comanche Unit 3 during 2010 without the need for network upgrades. Also, since there are no area system changes expected that would adversely affect system performance, the additional generation should be okay for 2011 as well. However, additional studies are required to examine system performance with the planned BHE Airport generation, which is due in service by the end of 2011. The coordinating affects of the new Midway-Waterton 345 kV line will also be included. These studies will be performed for 2012 summer conditions.



NR = 850 MWnet (2010-2011)



GI-2010-08

A. Load Flow Thermal Results (2010 Summer) – Revised 7/30/10

Table 1 – Summary Listing of Differentially Overloaded Facilities¹

				Branch N-1 Loading Without GI-2010-08		Branch N-1 Loading With GI-2010-08			
Monitored Facility (Line or Transformer)	Type	Line Owner	Branch Rating MVA	N-1 Flow in MVA	N-1 Flow in % of Rating	N-1 Flow in MVA	N-1 Flow in % of Rating	% Change	N-1 Contingency Outage
Comanche 230/115 kV T1	TR	PSCo	176	244.6	139.0	250.1	142.1	3.1	Comanche 230/115 kV T2
Comanche - Reader 115 kV 1	LN	PSCo	239	282.6	116.3	289.8	119.4	3.1	Comanche - Reader 115 kV 2
Burnt Mill – Freemary 115 kV	LN	BHE	122	121.0	99.0	124.4	102.0	3.0	Pueblo Plant – Reader 115 kV
Burnt Mill – West Station 115 kV	LN	BHE	100	106.9	108.9	112.6	112.6	3.7	Pueblo Plant – Reader 115 kV
Freemary – Reader 115 kV	LN	BHE	122	135.3	109.1	138.7	112.1	3.0	Pueblo Plant – Reader 115 kV
Boone 115/69 kV T1	TR	BHE	33	45.6	138.1	45.8	138.8	0.7	Boone – La Junta W 115 kV
Boone – Boone Tap 69 kV	LN	BHE	24	42.8	190.6	43.0	191.9	1.3	Boone – La Junta W 115 kV
Hyde Park – Pueblo Plant 115 kV	LN	BHE	120	146.3	126.0	149.9	129.4	3.4	Comanche - Walsenburg 230 kV
Hyde Park – West Station 115 kV	LN	BHE	120	128.7	111.8	132.2	115.2	3.4	Comanche - Walsenburg 230 kV
Pueblo Plant – Reader 115 kV	LN	BHE	159	172.4	110.7	176.0	113.3	2.6	Comanche - Walsenburg 230 kV
Reader 115/69 kV T1	TR	BHE	42	54.1	128.8	54.5	129.6	0.8	Reader 115/69 kV T2
Reader 115/69 kV T2	TR	BHE	42	54.6	130.0	54.9	130.8	0.8	Reader 115/69 kV T1
Rockford – S_FWL_TP 69 kV	LN	BHE	24	34.1	181.6	34.2	182.9	1.3	Boone – La Junta W 115 kV

¹ Newly overloaded elements, or delta overloads > 0.3% of rating, due to proposed 100 MW generation increase at POI.



				Branch N-1 Loading Without GI-2010-08		Branch N-1 Loading With GI-2010-08			
Monitored Facility (Line or Transformer)	Type	Line Owner	Branch Rating MVA	N-1 Flow in MVA	N-1 Flow in % of Rating	N-1 Flow in MVA	N-1 Flow in % of Rating	% Change	N-1 Contingency Outage
Comanche - Walsenburg 230 kV	LN	TSGT	239	290.5	129.2	292.7	130.8	1.6	Pueblo Tap – West Station 115 kV
Comanche - Walsenburg 230 kV	LN	TSGT	239	255.0	105.9	257.6	107.2	1.3	Pueblo Tap – West Station 115 kV and Pueblo Tap - Stem Beach 115 kV
Pueblo Tap - Stem Beach 115 kV	LN	TSGT	95	181.1	215.7	182.2	218.3	2.6	Comanche - Walsenburg 230 kV
Stem Beach - Walsenburg 115 kV	LN	TSGT	95	137.4	163.7	138.3	165.7	2.0	Comanche - Walsenburg 230 kV
Pueblo Tap – West Station 115 kV	LN	TSGT	95	245.5	271.7	247.3	274.5	2.8	Comanche - Walsenburg 230 kV
Pueblo Tap – West Station 115 kV w/ RAS	LN	TSGT	95	128.2	137.1	128.2	137.4	0.3	Comanche - Walsenburg 230 kV and Walsenburg – Gladstone 230 kV



B. Dynamic Stability Disturbances

Table 2
Listing of Transient Stability Study Contingency Scenarios

Disturbance Scenario #	Fault Type	Fault Location	Tripped Facilities	Facility Tripped due to Breaker Failure
100	3ph	Comanche 345 kV	Comanche – Daniels Pk. 345 kV #1	N/A
101	3ph	Comanche 345 kV	Comanche 345/230 kV T3	N/A
102	3ph	Comanche 345 kV	Comanche Unit 3	N/A
110	3ph	Comanche 230 kV	Comanche 345/230 kV T3	N/A
111	3ph	Comanche 230 kV	Comanche – Midway 230 kV #1	N/A
112	3ph	Comanche 230 kV	Comanche – Boone 230 kV	N/A
113	3ph	Comanche 230 kV	Comanche – Walsenburg 230 kV	N/A
114	3ph	Comanche 230 kV	Comanche Unit 1	N/A
115	3ph	Comanche 230 kV	Comanche Unit 2	N/A
120	3ph	Midway 230 kV	Midway-Jackson Fuller 230 kV	N/A
121	3ph	Midway 230 kV	Midway-Comanche 230 kV #1	N/A
122	3ph	Midway 230 kV	Midway-Nixon 230 kV	N/A
123	3ph	Midway 230 kV	Midway-Fountain Valley 230 kV	N/A
200	3ph	Comanche 345 kV	Comanche – Daniels Pk. 345 kV #1 Comanche – Daniels Pk. 345 kV #2	N/A
201	slg w/ BF	Comanche 345 kV	Comanche 345/230 kV T4	Comanche – Daniels Pk. 345 kV #1
210	slg w/ BF	Comanche 230 kV	Comanche 345/230 kV T3	Comanche 230/115 kV T2
211	slg w/ BF	Comanche 230 kV	Comanche – Midway 230 kV #1	Comanche-Furnace 230 kV
212	slg w/ BF	Comanche 230 kV	Comanche – Midway 230 kV #2	Comanche – Walsenburg 230 kV
220	slg w/ BF	Midway 230 kV	Midway-Comanche 230 kV #2	Midway-Fountain Valley 230 kV
221	slg w/ BF	Midway 230 kV	Midway- Daniels Park 230 kV	Midway-Comanche 230 kV #1
222	slg w/ BF	Midway 230 kV	Midway-Nixon 230 kV	MidwayPS-MidwayWAPA 230 kV Midway-Lincoln 230 kV Midway-Canon West 230 kV Midway 230/115 kV #T2



C. Dynamic Stability Results

**Table 3
Transient Stability Study Results**

Disturbance Scenario #	Transient Voltage Dip		Minimum Transient Frequency		
	Bus	Minimum Voltage Dip pu	Bus	Minimum Frequency Hz	Time at or Below WECC Limit sec.
100	Ordway 69.0 kV	0.9408	Comanche #3 27.0 kV	59.69	0
101	Comanche #2 24.0 kV	0.9494	Comanche #3 27.0 kV	59.67	0
102	Comanche #2 24.0 kV	0.9538	City Lamar 14.0 kV	59.68	0
110	Comanche #2 24.0 kV	0.9492	City Lamar 14.0 kV	59.64	0
111	Comanche #2 24.0 kV	0.9465	City Lamar 14.0 kV	59.64	0
112	Comanche #2 24.0 kV	0.9477	City Lamar 14.0 kV	59.65	0
113	Walsenburg 69.0 kV	0.8608	City Lamar 14.0 kV	59.65	0
114	Comanche #1 24.0 kV	0.9136	City Lamar 14.0 kV	59.58	0.0466
115	Comanche #2 24.0 kV	0.9134	City Lamar 14.0 kV	59.57	0.0500
120	Comanche #2 24.0 kV	0.9473	Fountain Val 13.8 kV 5&6	59.66	0
121	Comanche #2 24.0 kV	0.9449	Fountain Val 13.8 kV 5&6	59.63	0
122	Comanche #2 24.0 kV	0.9448	Fountain Val 13.8 kV 5&6	59.64	0
123	Comanche #2 24.0 kV	0.9483	City Lamar 14.0 kV	59.65	0
200	Ordway 69.0 kV	0.8727	Comanche #3 27.0 kV	59.61	0
201	Ordway 69.0 kV	0.9374	Comanche #3 27.0 kV	59.51	0
210	Comanche #1 24.0 kV	0.9437	Comanche #3 27.0 kV	59.56	0
211	Comanche #1 24.0 kV	0.9385	Comanche #3 27.0 kV	59.53	0
212	Walsenburg 69.0 kV	0.8300	Comanche #3 27.0 kV	59.53	0
220	Ordway 69.0 kV	0.9405	Comanche #3 27.0 kV	59.73	0
221	Comanche #1 24.0 kV	0.9440	Fountain Val 13.8 kV 5&6	59.72	0
222	Comanche #1 24.0 kV	0.9436	Fountain Val 13.8 kV 5&6	59.62	0

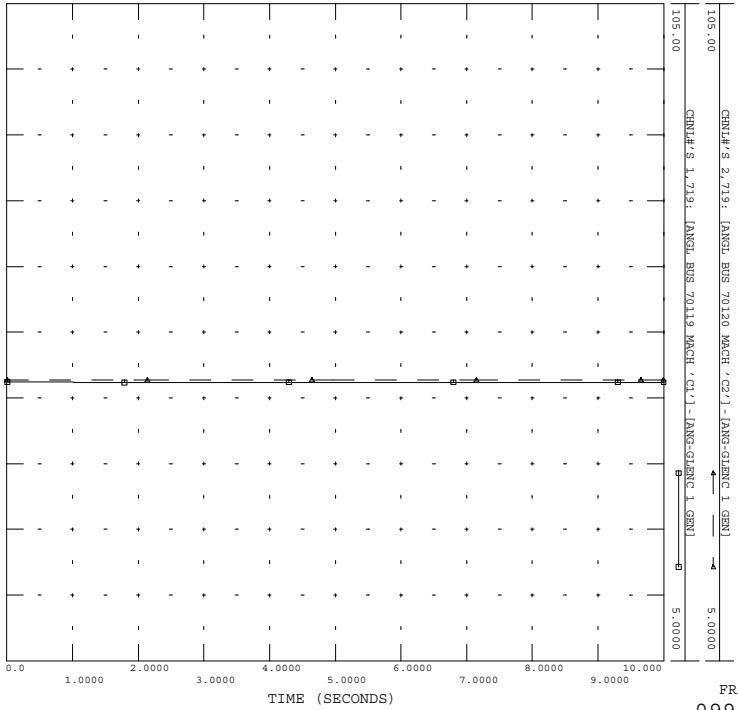


D. Dynamic Stability Plots

Stability Plots on Following Pages.

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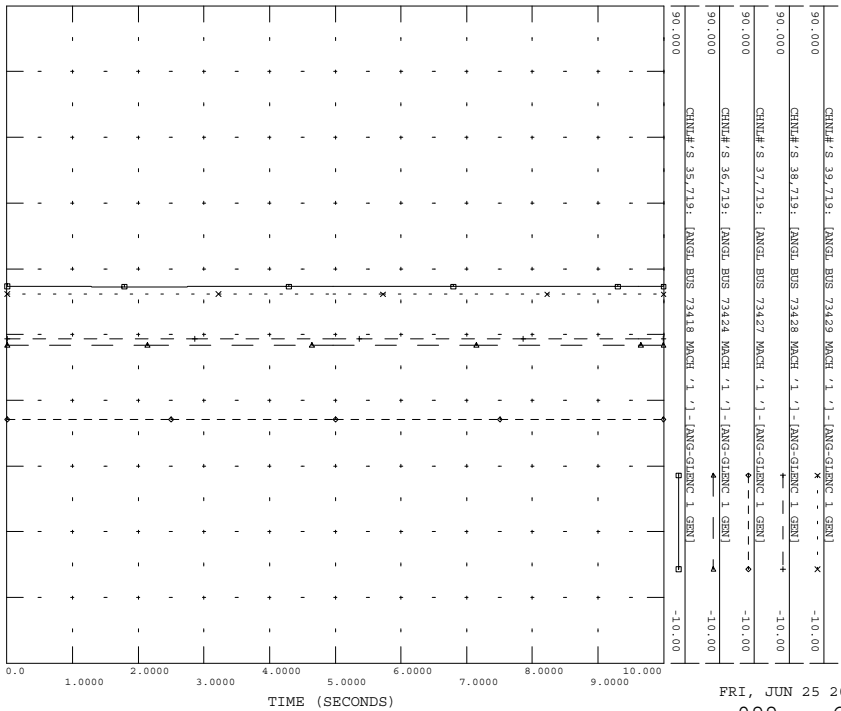
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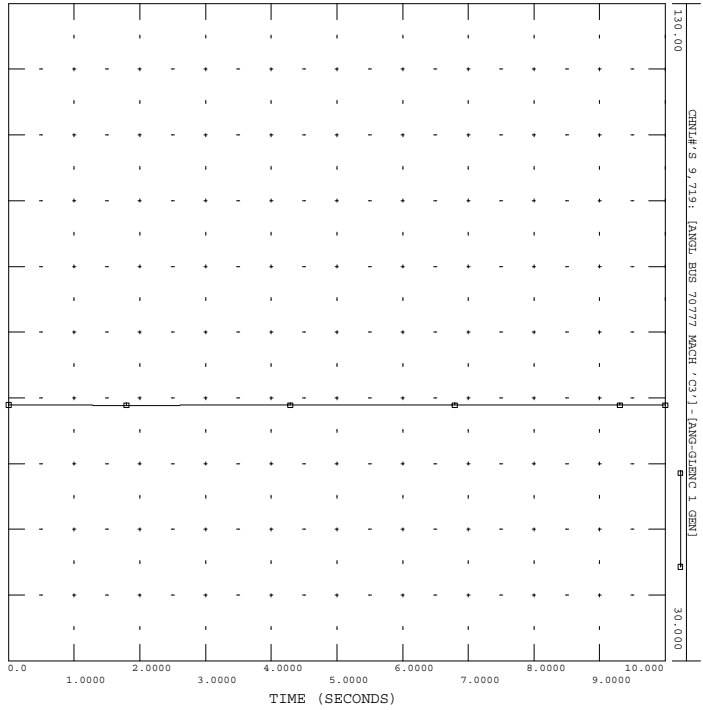
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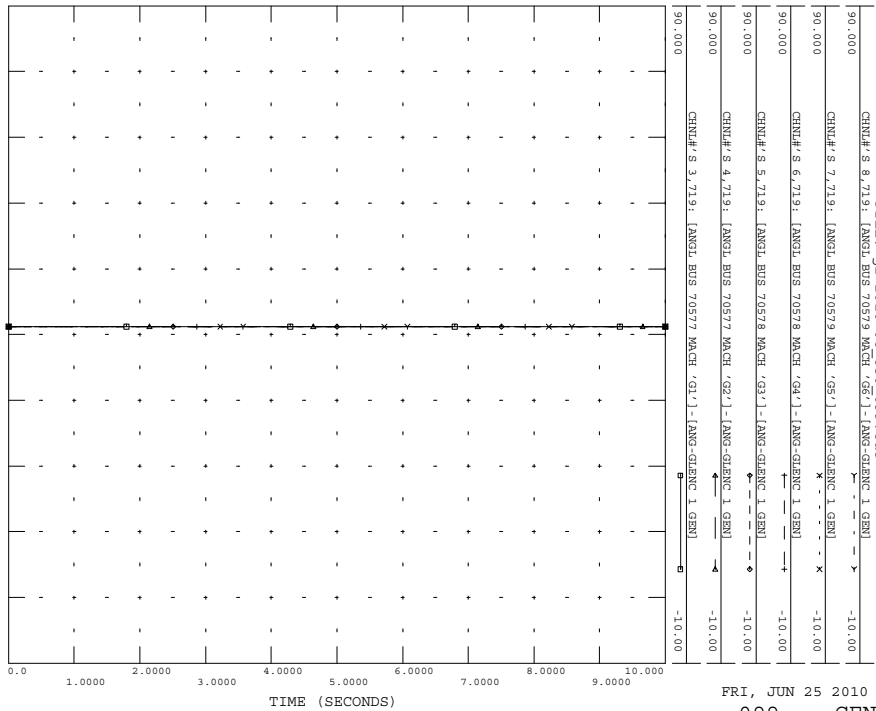
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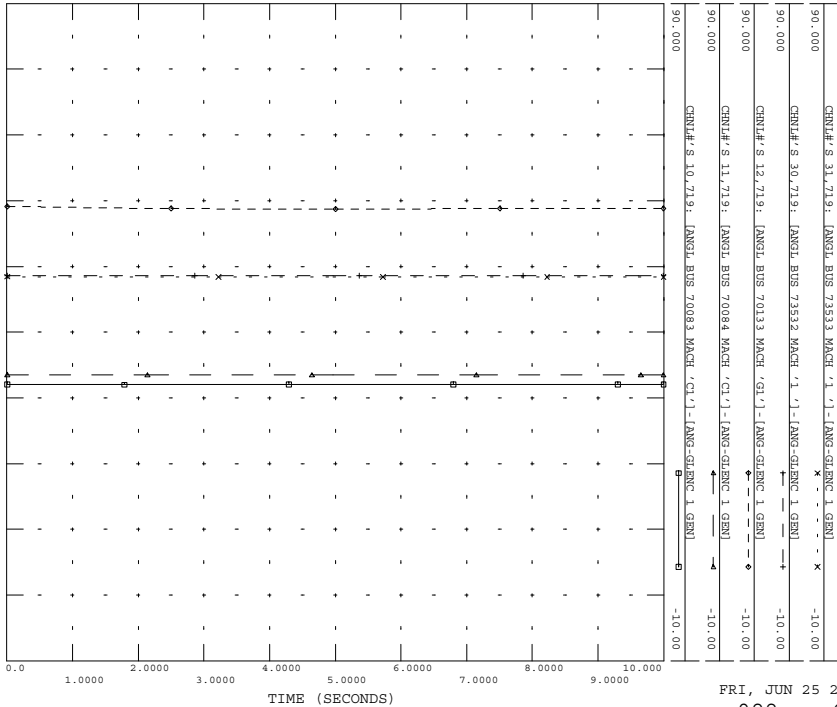


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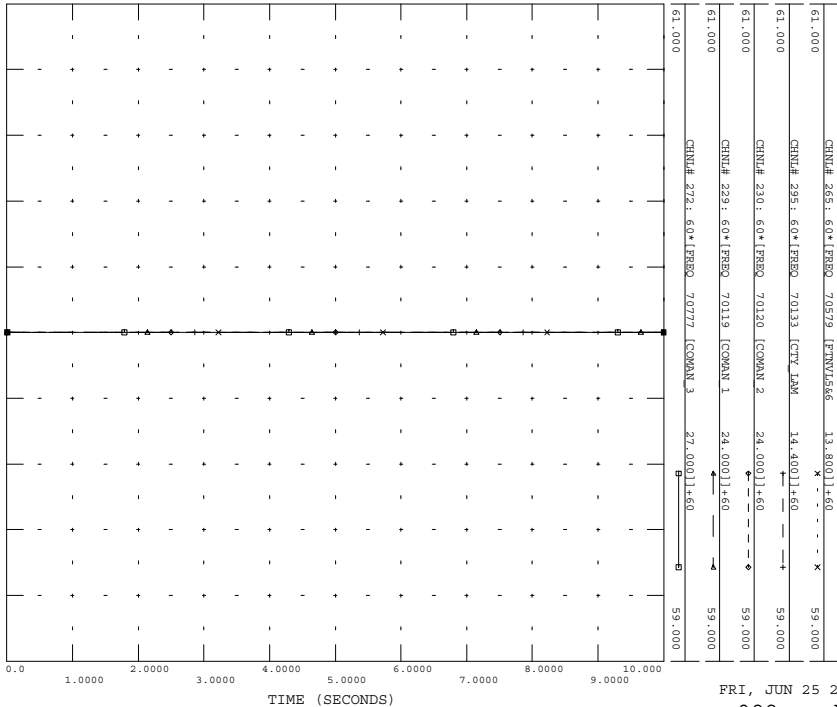
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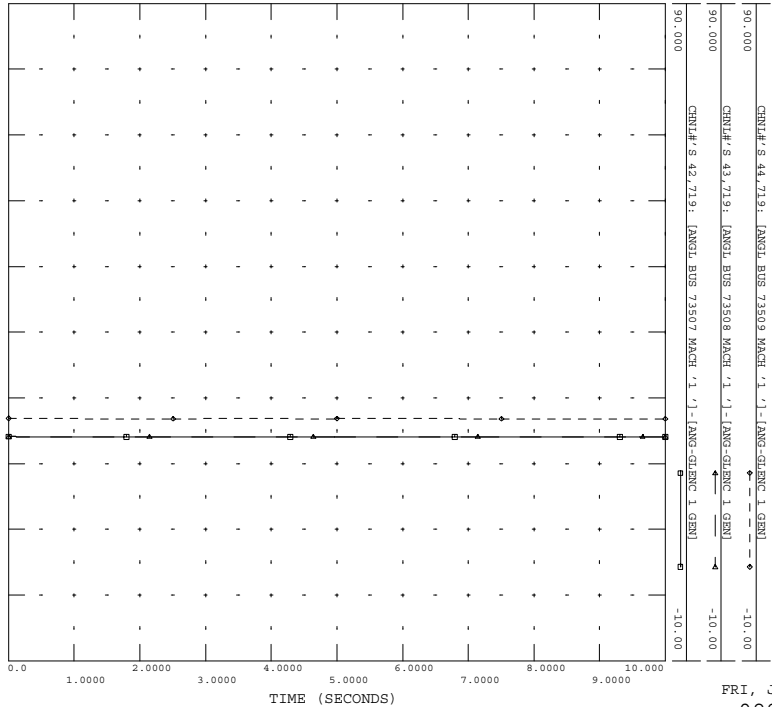
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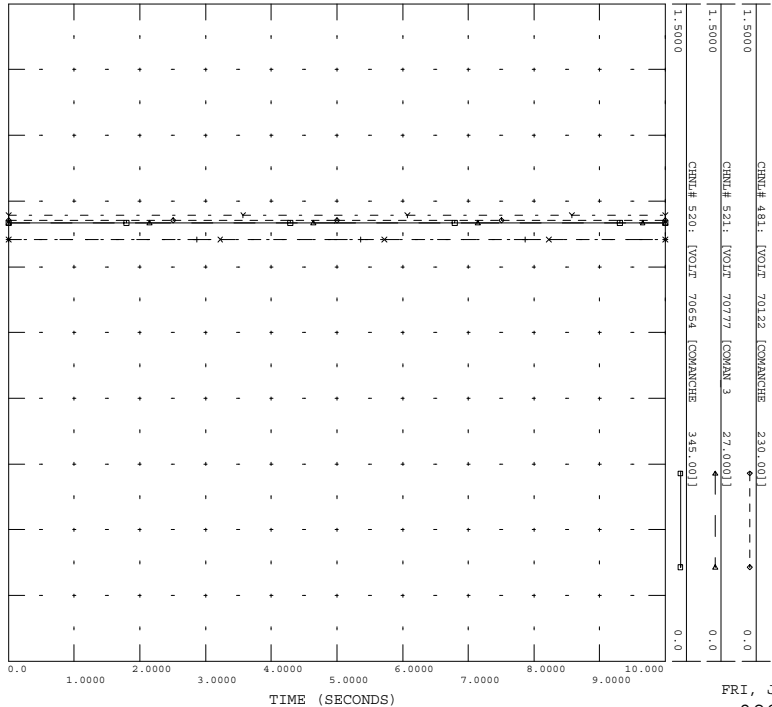
GI-2010-08_850_099 --> JUN 10
NO DISTURBANCE

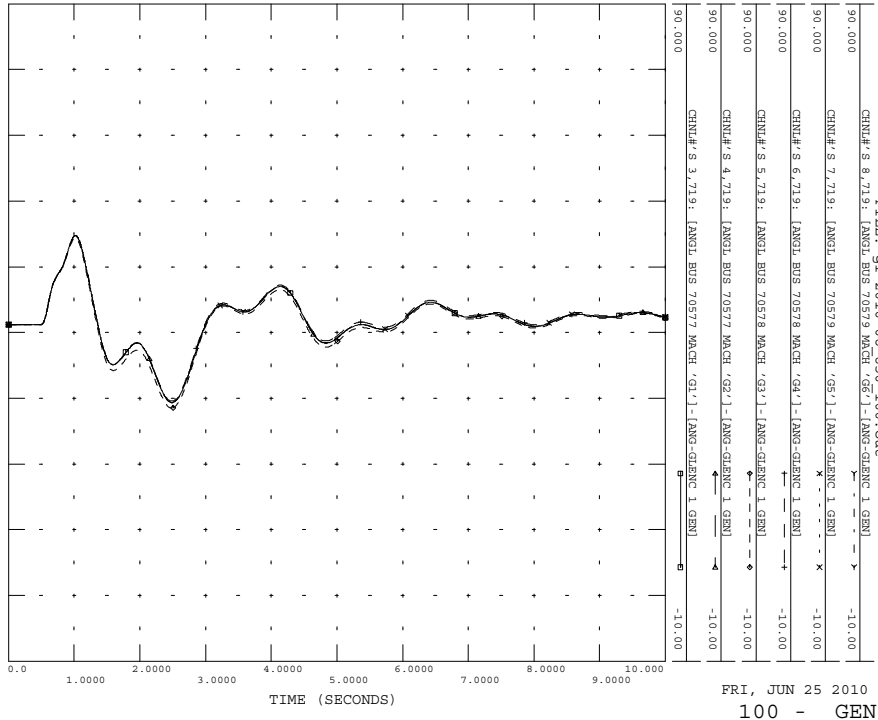
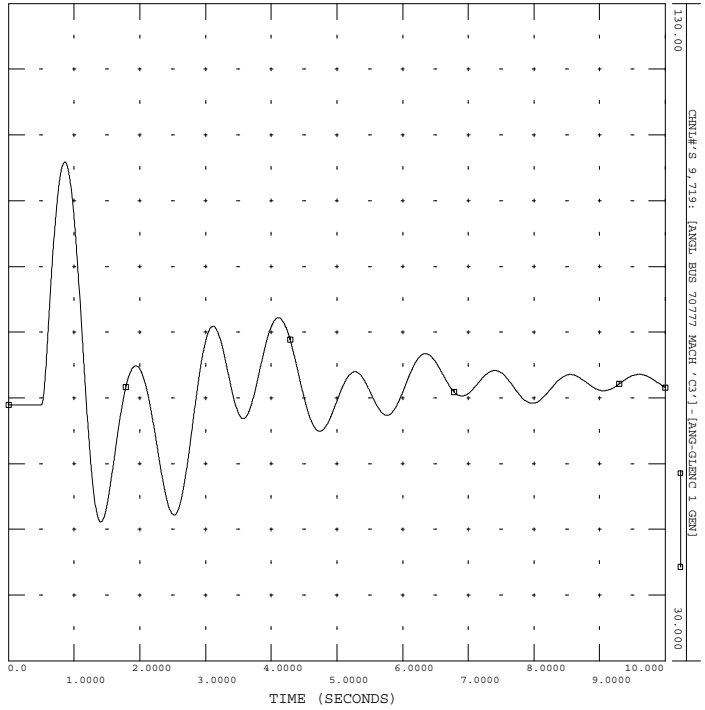
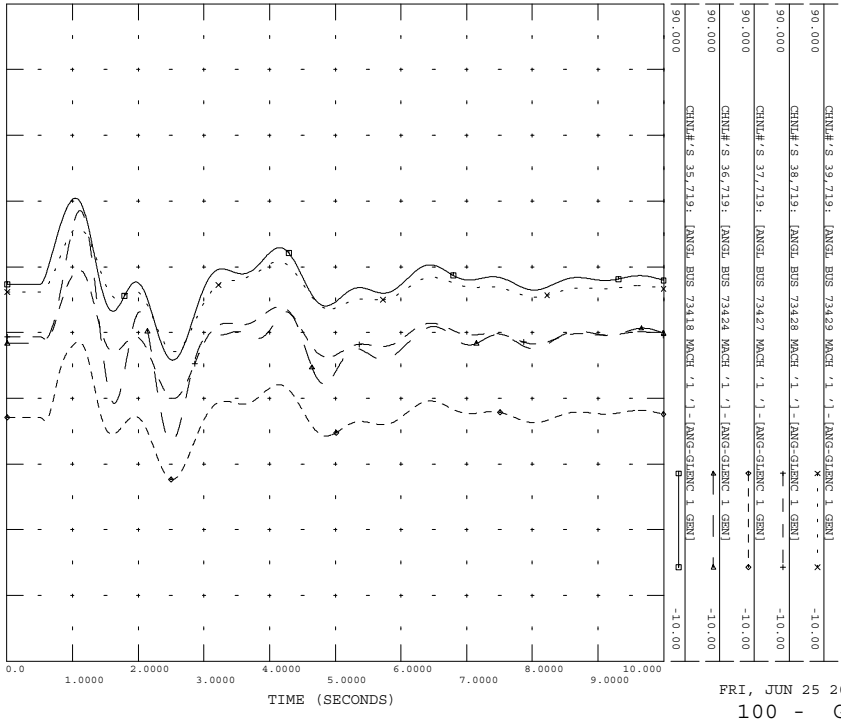
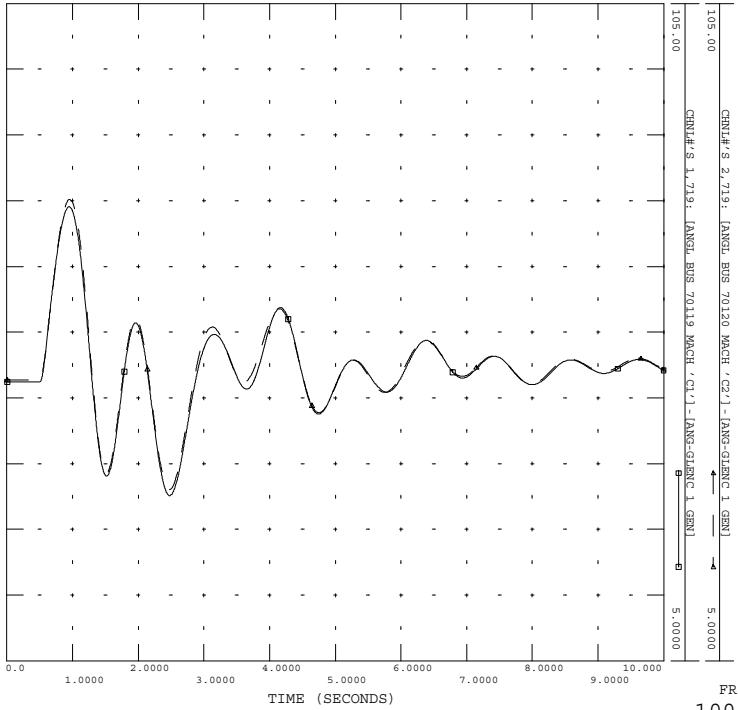
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GI-2010-08_850_099 --> JUN 10
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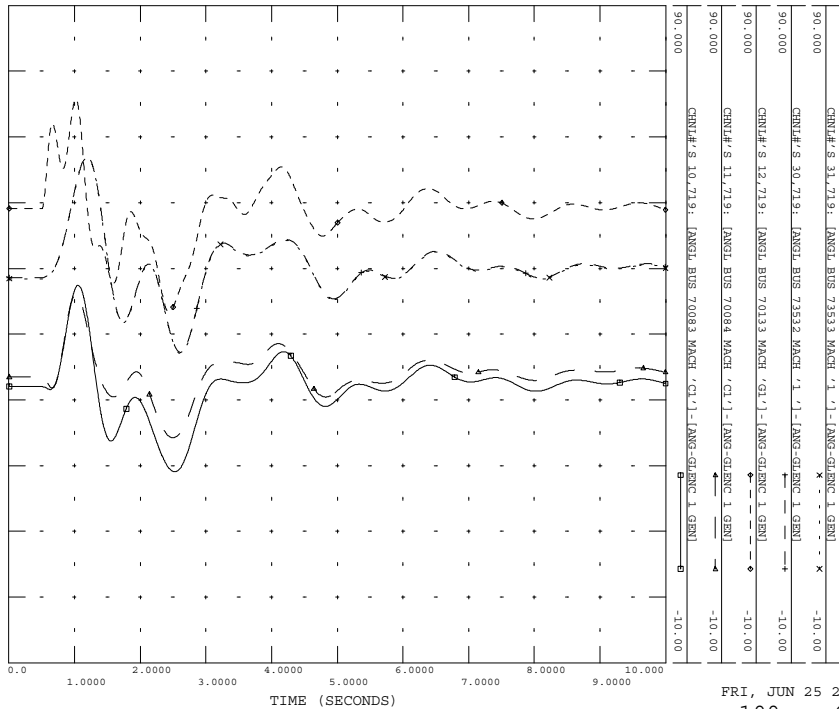






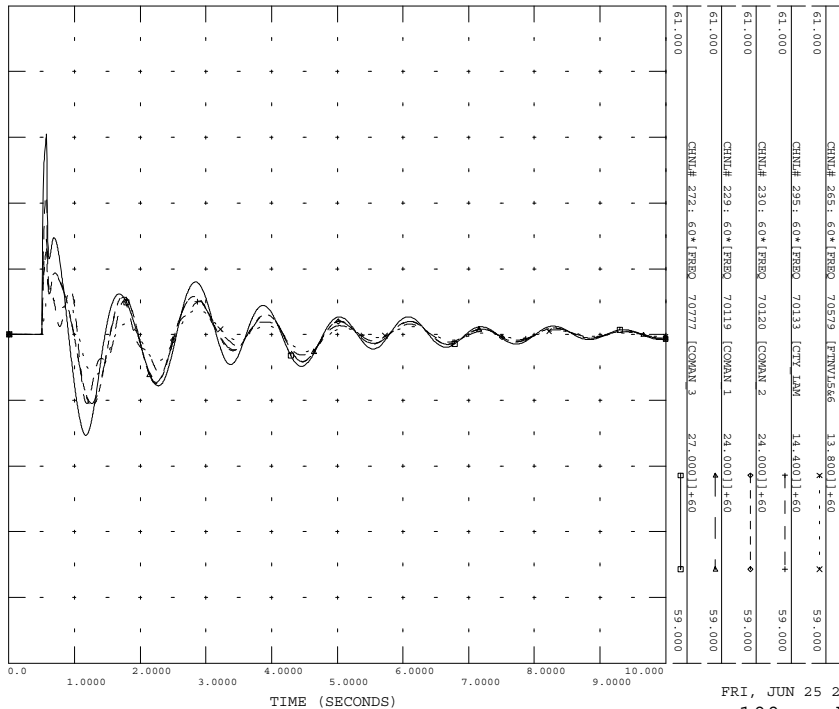
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FILE: gi-2010-08_850_100.out



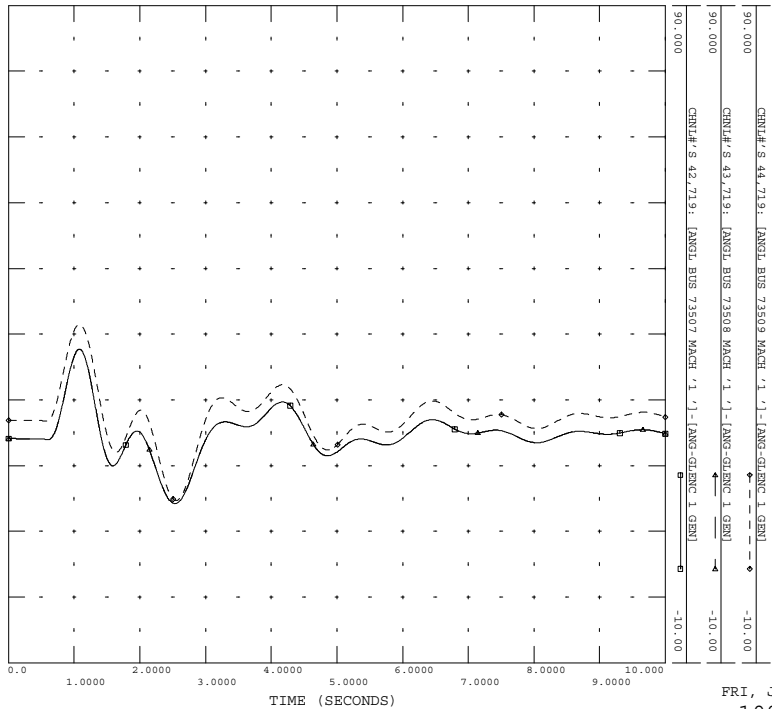
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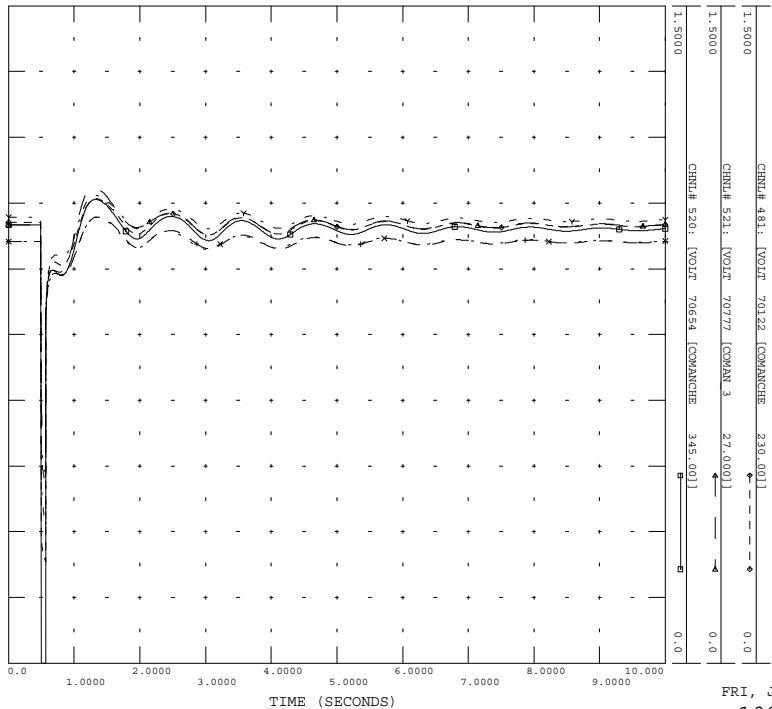
GI-2010-08_850_100 --> JUN 10
3PH FLT COM-DP_1

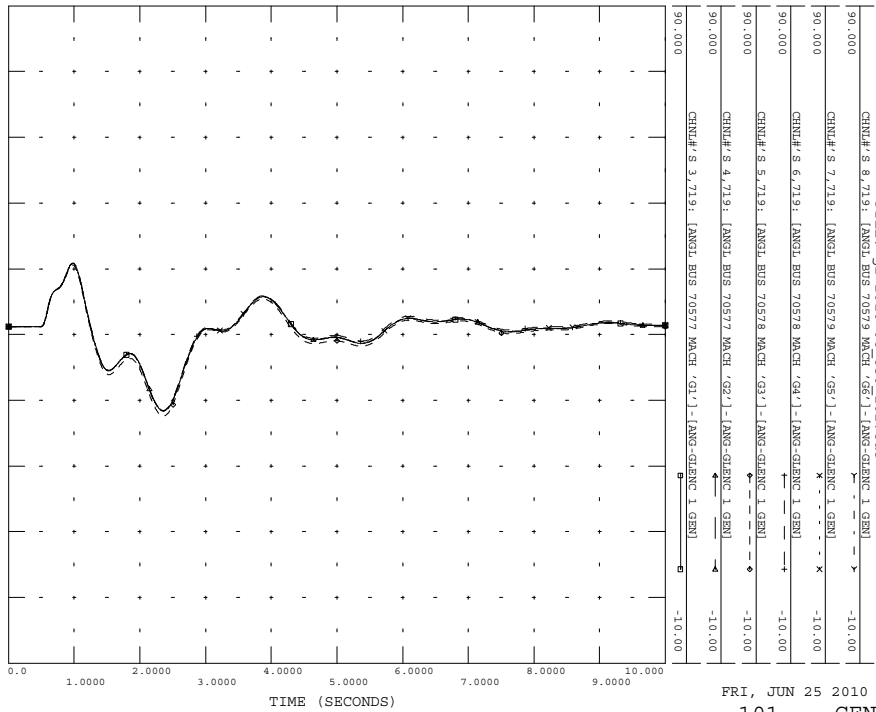
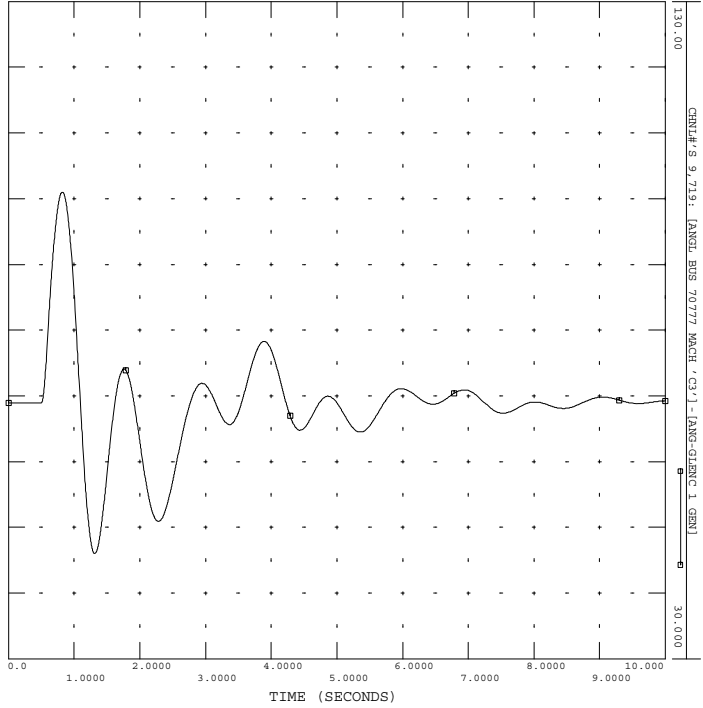
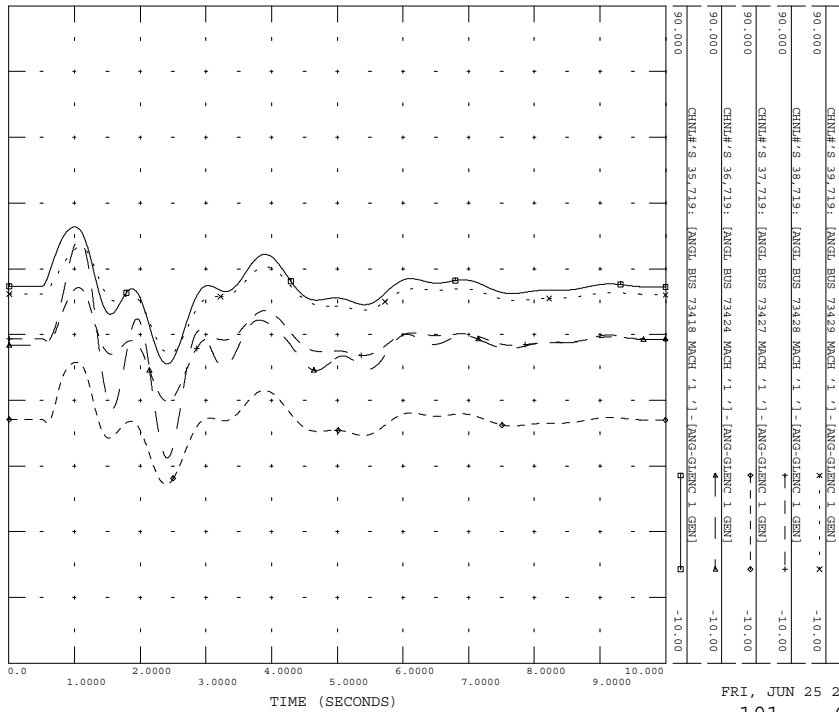
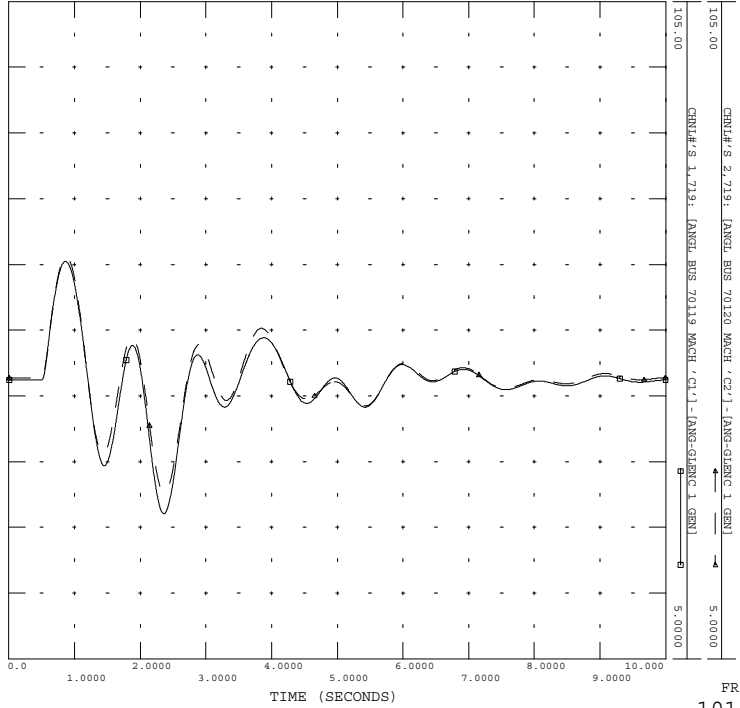
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GI-2010-08_850_100 --> JUN 10
3PH FLT COM-DP_1

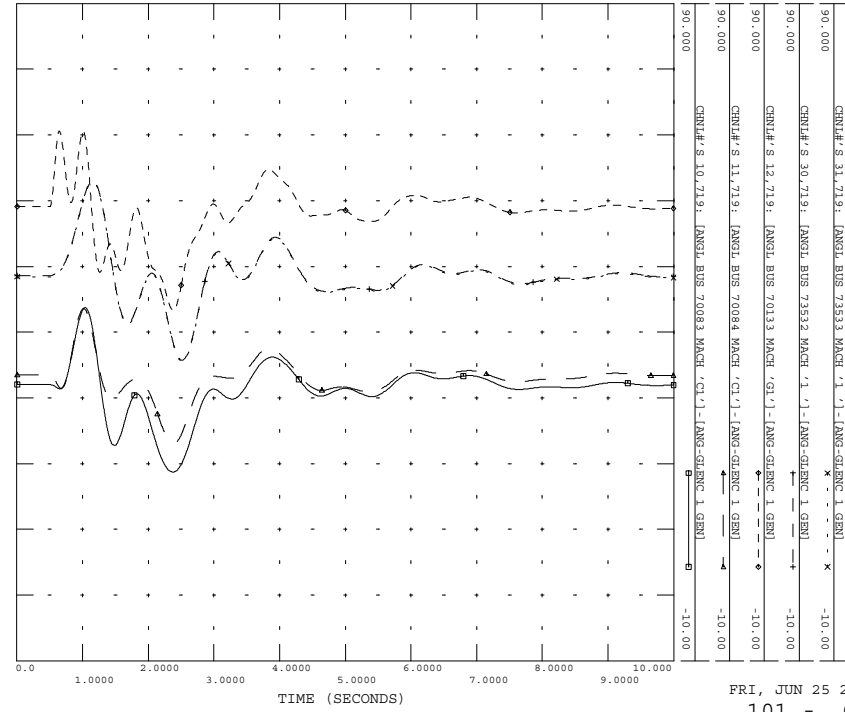
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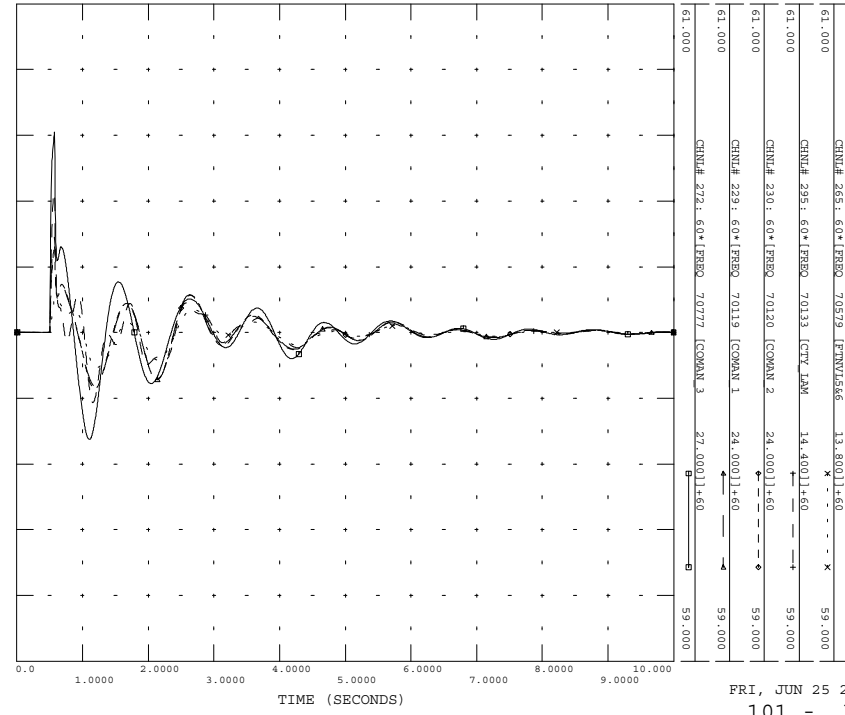
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3PH FLT COM 3/2 T3

FILE: gi-2010-08_850_101.out



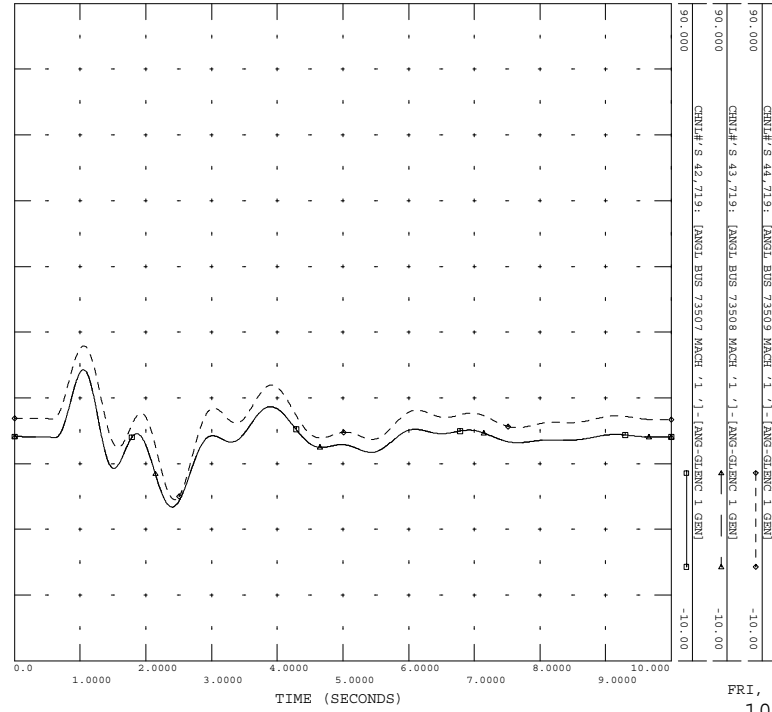
GI-2010-08_850_101 --> JUN 10
3PH FLT COM 3/2 T3

FILE: gi-2010-08_850_101.out



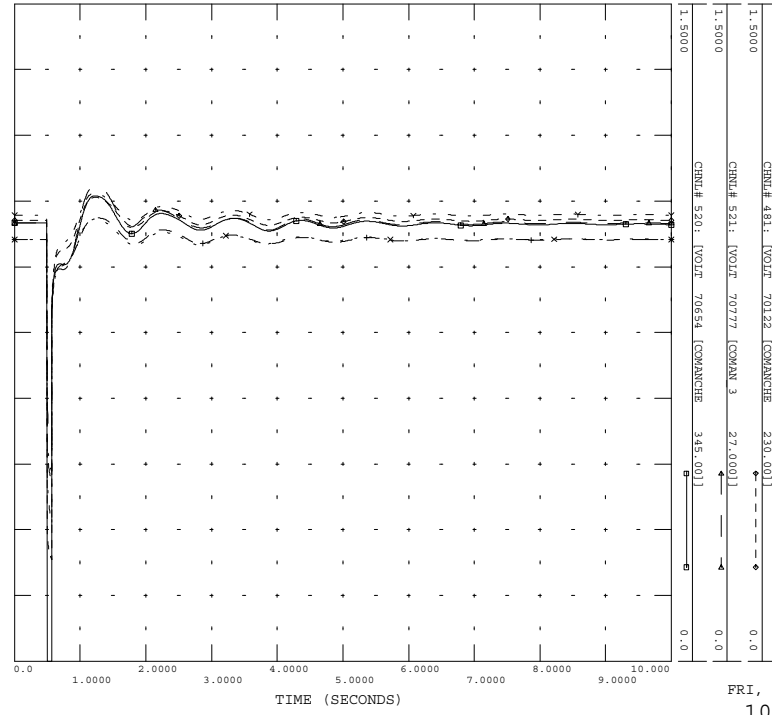
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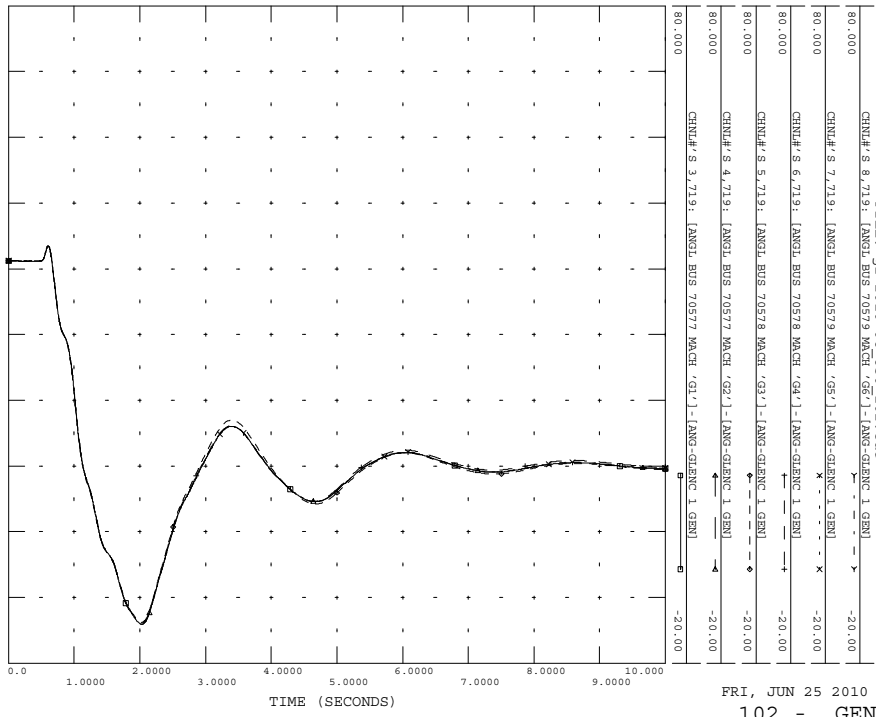
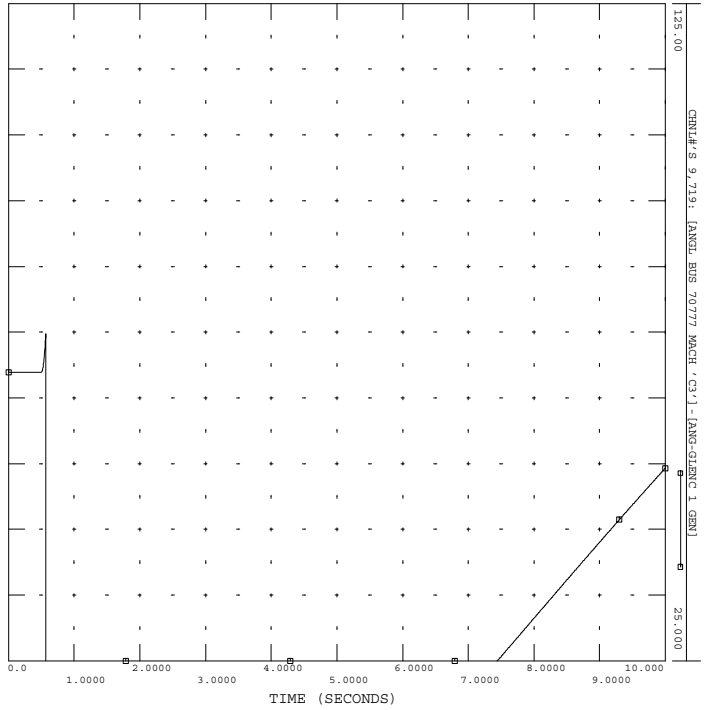
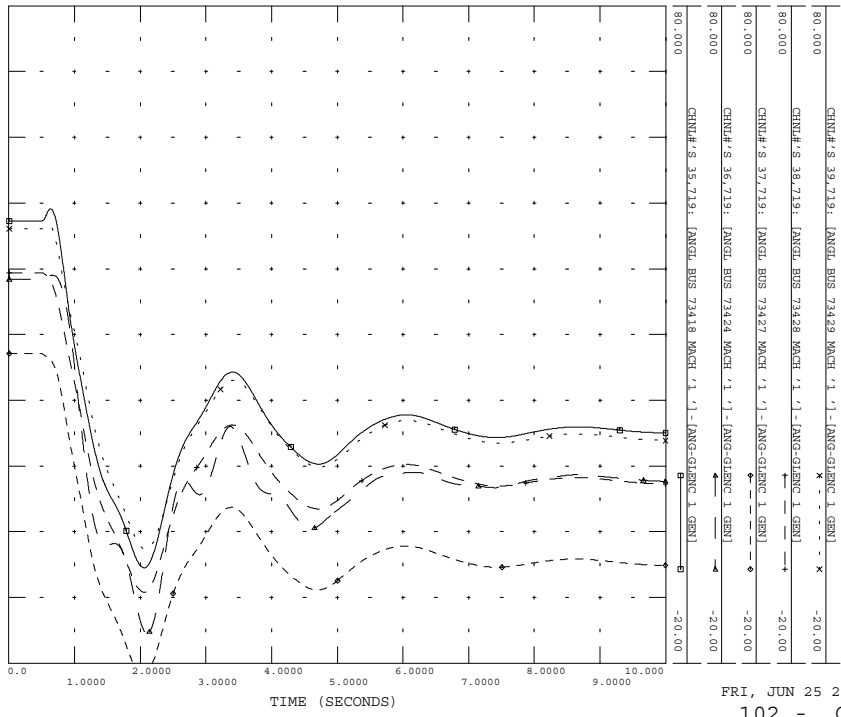
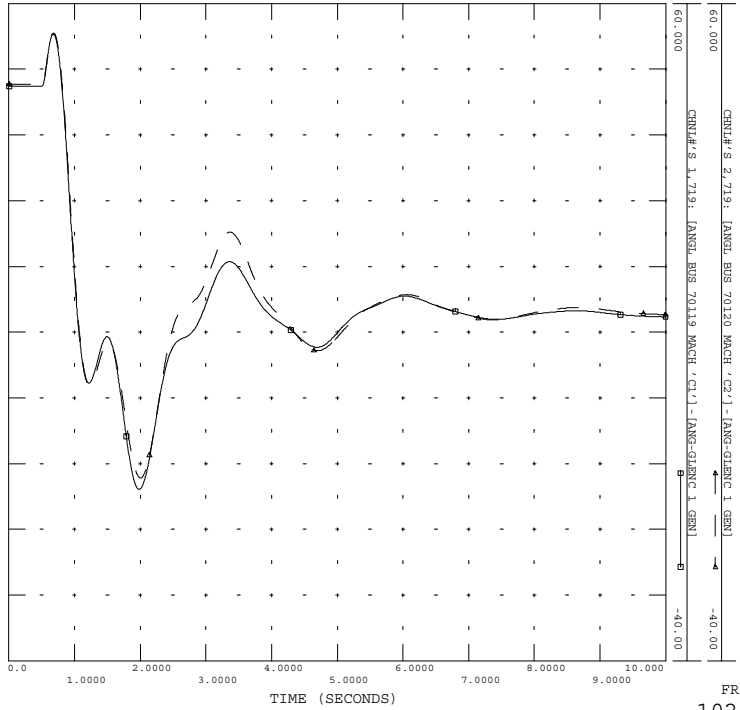
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GI-2010-08_850_101 --> JUN 10
3PH FLT COM 3/2 T3

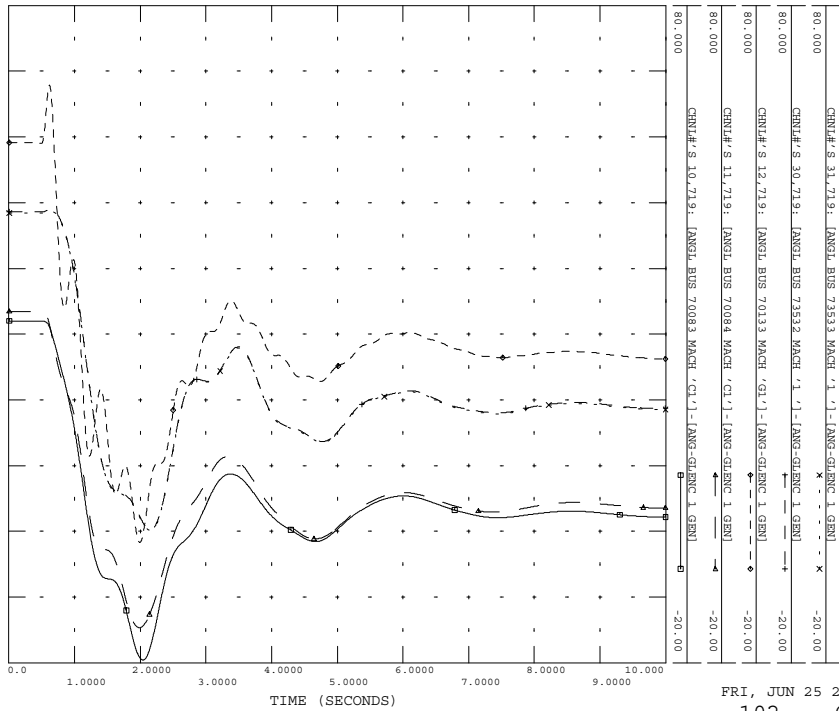
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GI-2010-08_850_102 --> JUN 10
3PH FLT COM U3 GSU

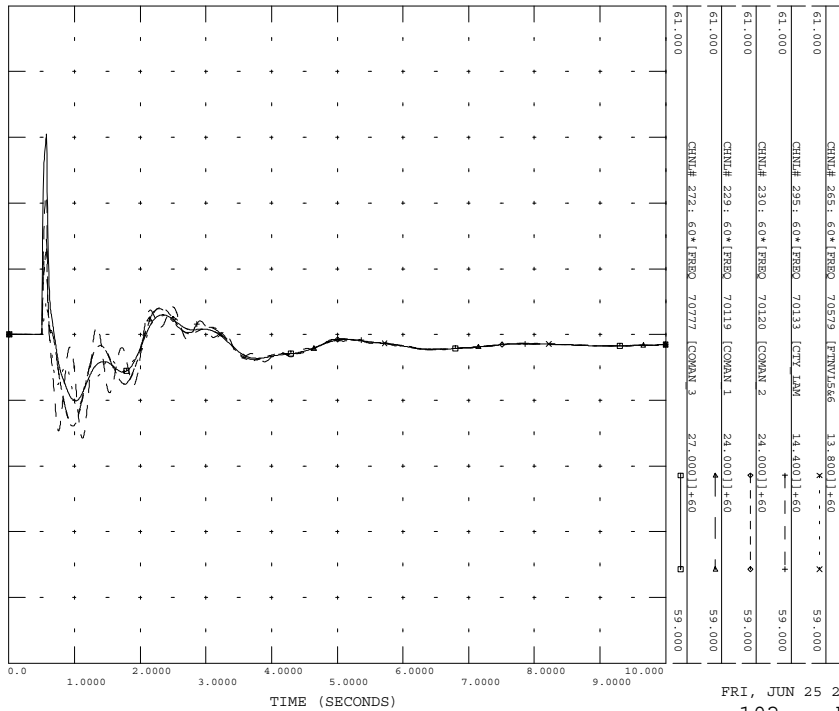
FILE: gi-2010-08_850_102.out



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102 - GEN ANG

GI-2010-08_850_102 --> JUN 10
3PH FLT COM U3 GSU

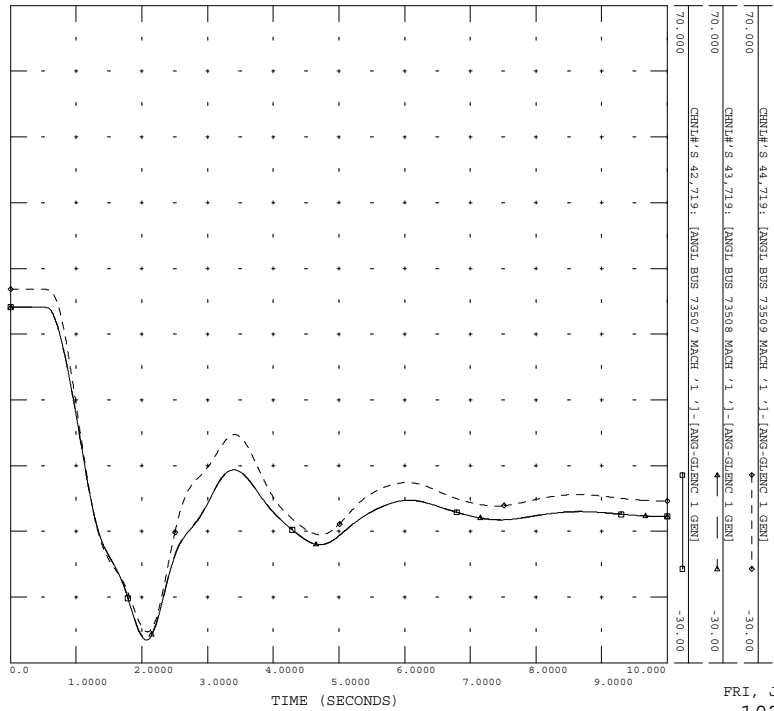
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FRI, JUN 25 2010 16:14
102 - BUS FRQ

GI-2010-08_850_102 --> JUN 10
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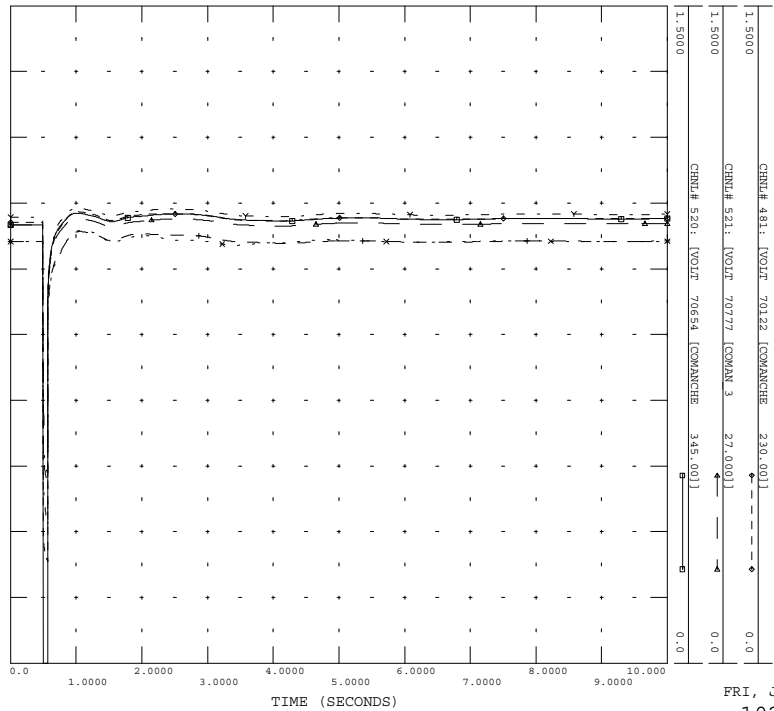
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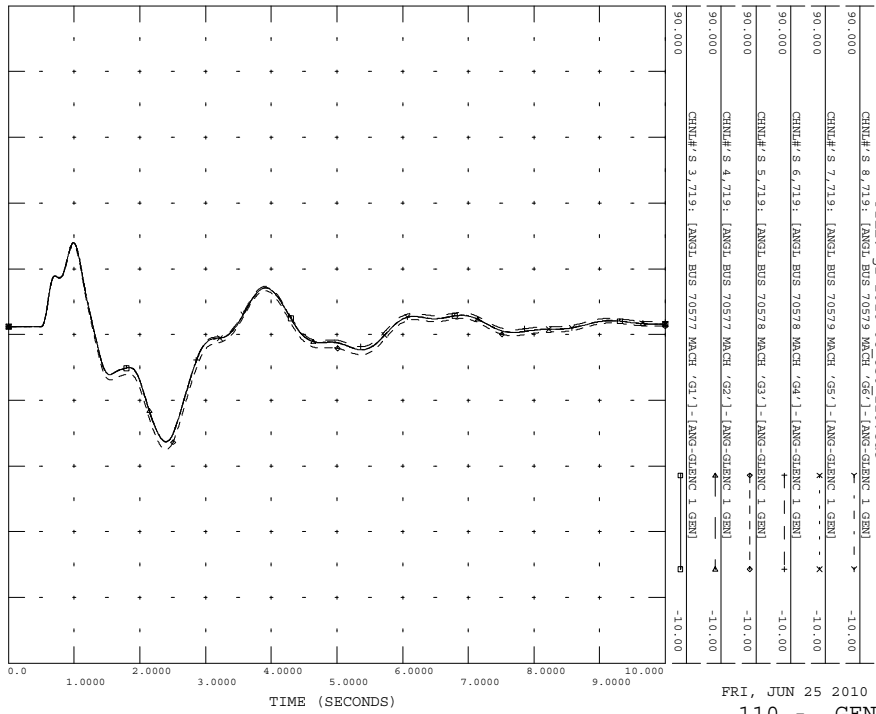
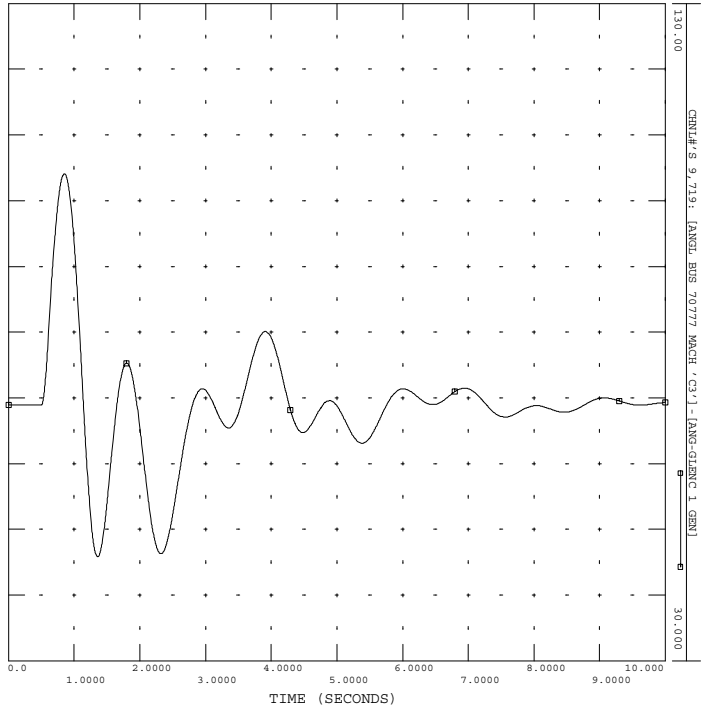
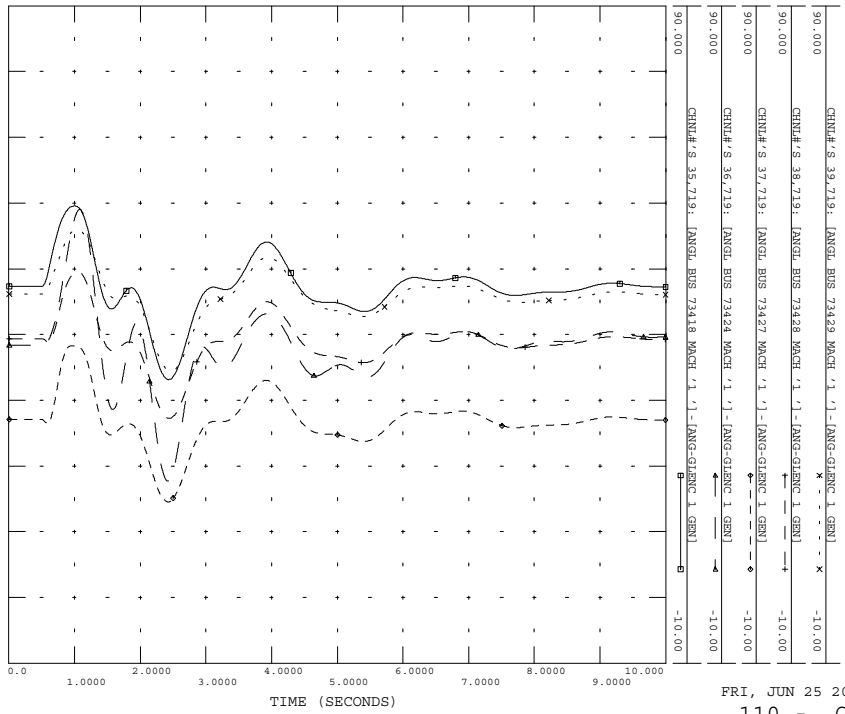
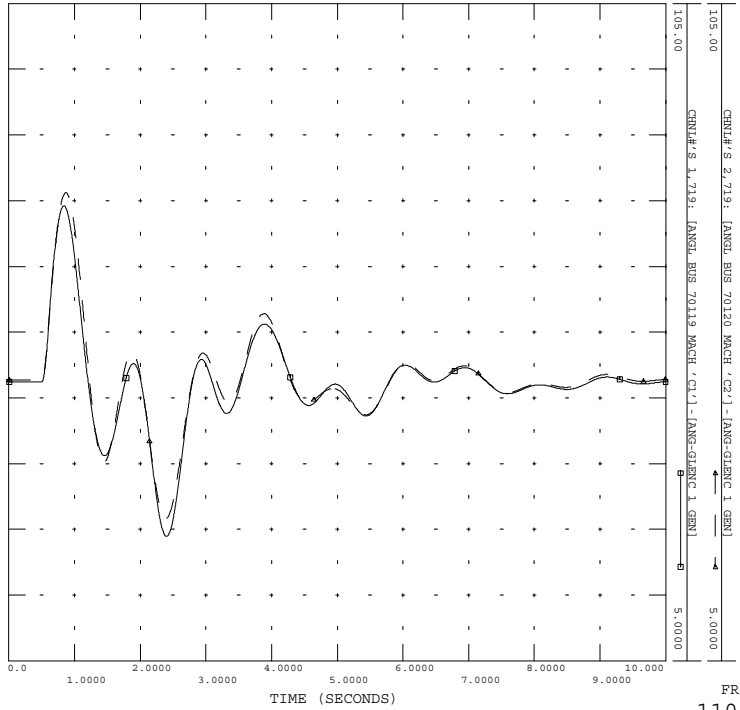
FRI, JUN 25 2010 16:14
102 - GEN ANG

GI-2010-08_850_102 --> JUN 10
3PH FLT COM U3 GSU

FILE: gi-2010-08_850_102.out



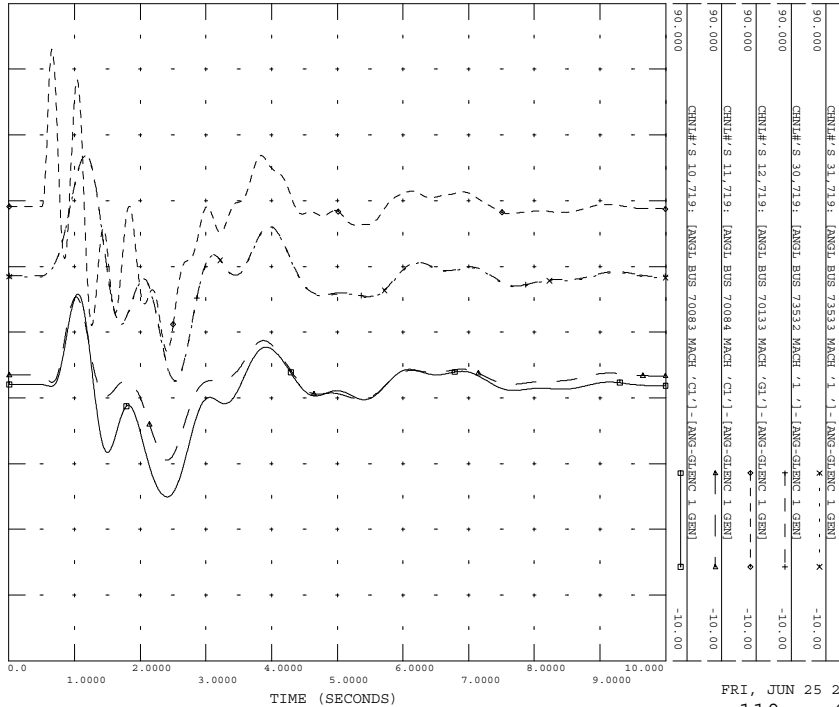
FRI, JUN 25 2010 16:14
102 - COM VLT





GI-2010-08_850_110 --> JUN 10
3PH FLT COM 2/3 T3

FILE: gi-2010-08_850_110.out

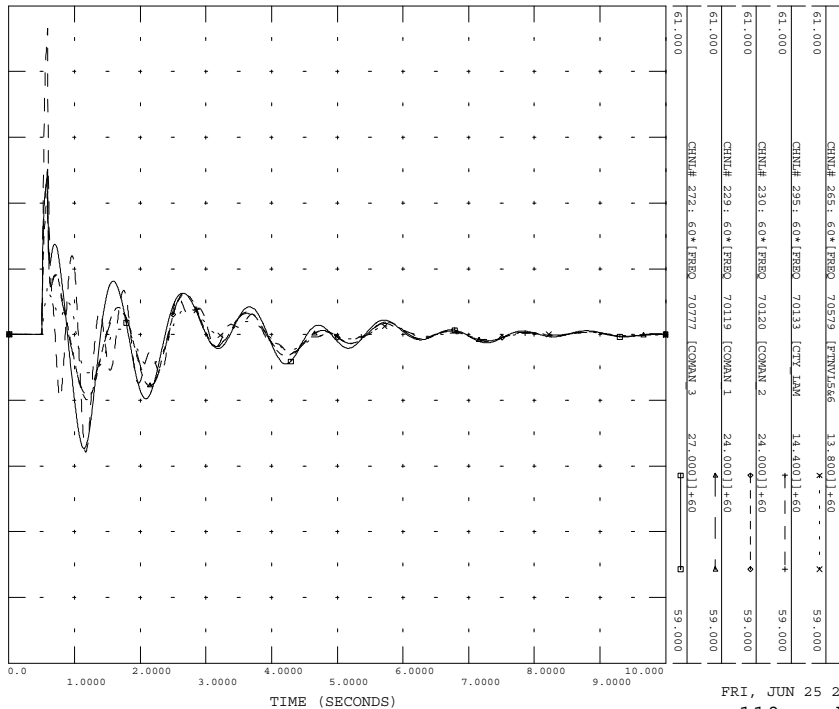


FRI, JUN 25 2010 16:14
110 - GEN ANG



GI-2010-08_850_110 --> JUN 10
3PH FLT COM 2/3 T3

FILE: gi-2010-08_850_110.out

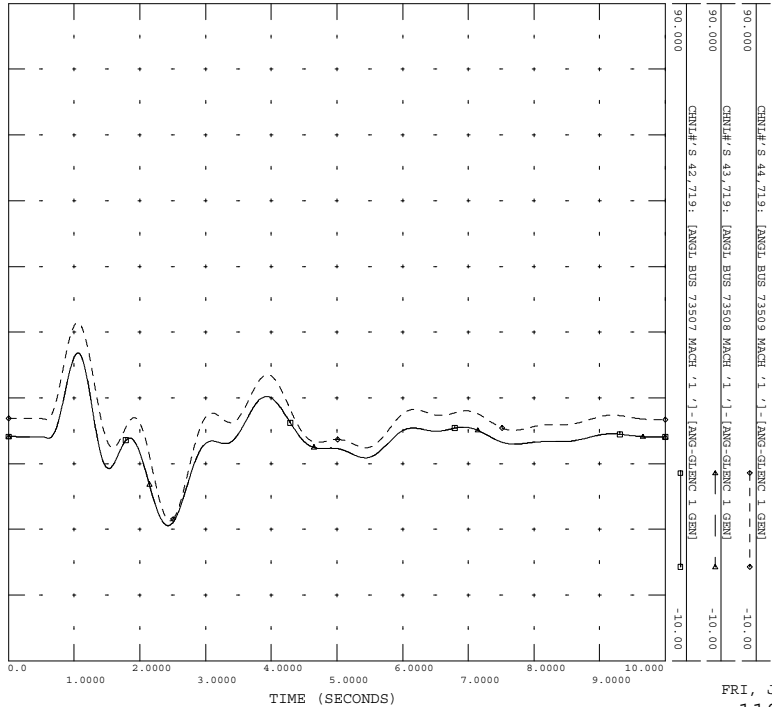


FRI, JUN 25 2010 16:14
110 - BUS FRQ



GI-2010-08_850_110 --> JUN 10
3PH FLT COM 2/3 T3

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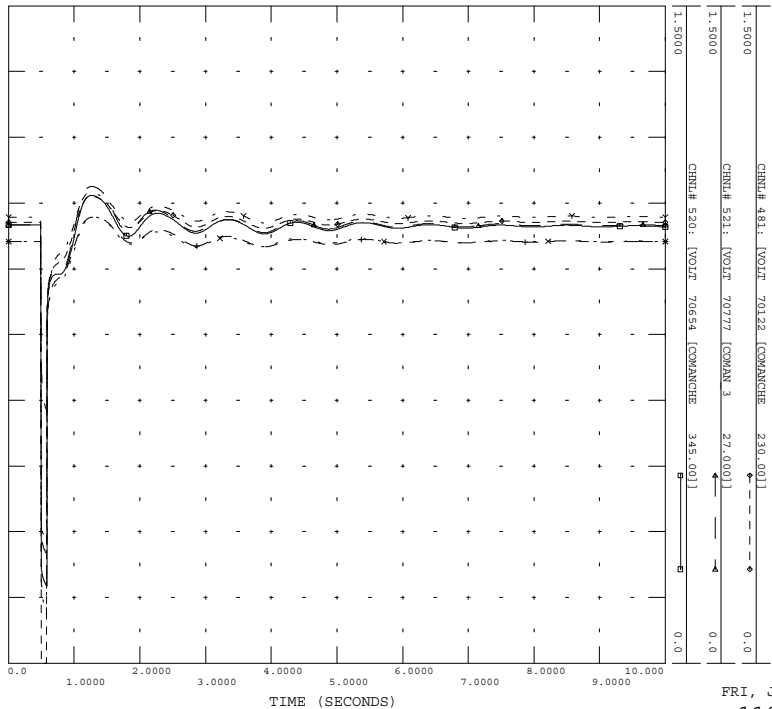


FRI, JUN 25 2010 16:14
110 - GEN ANG

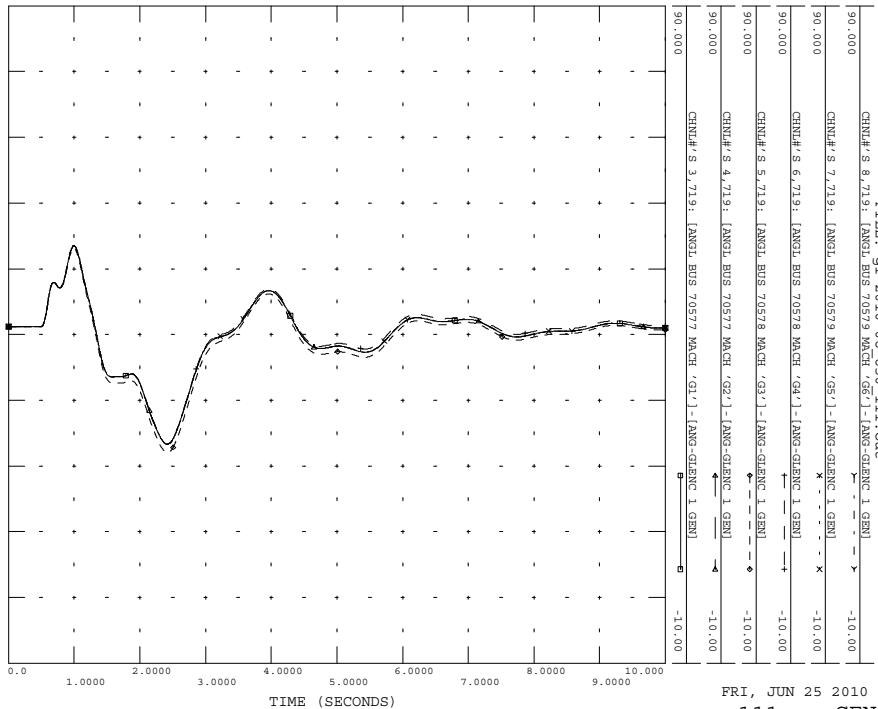
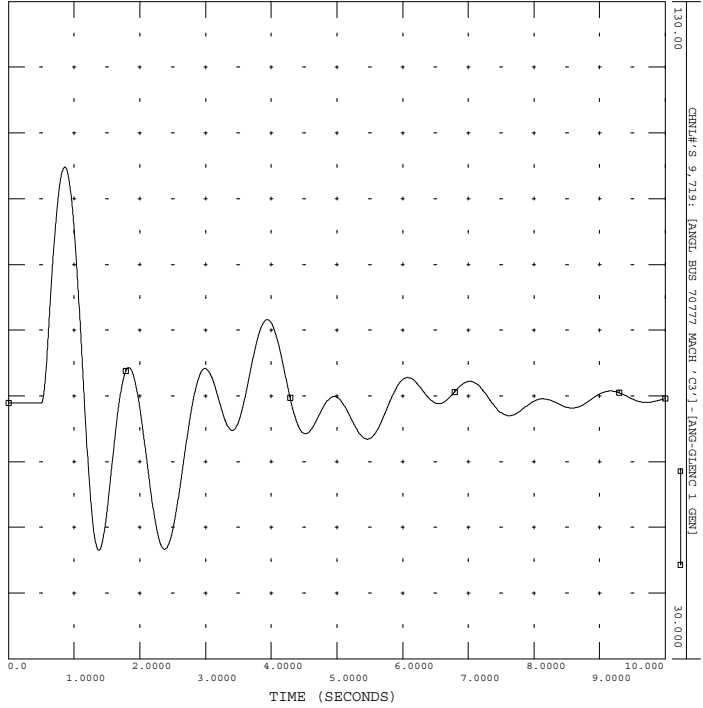
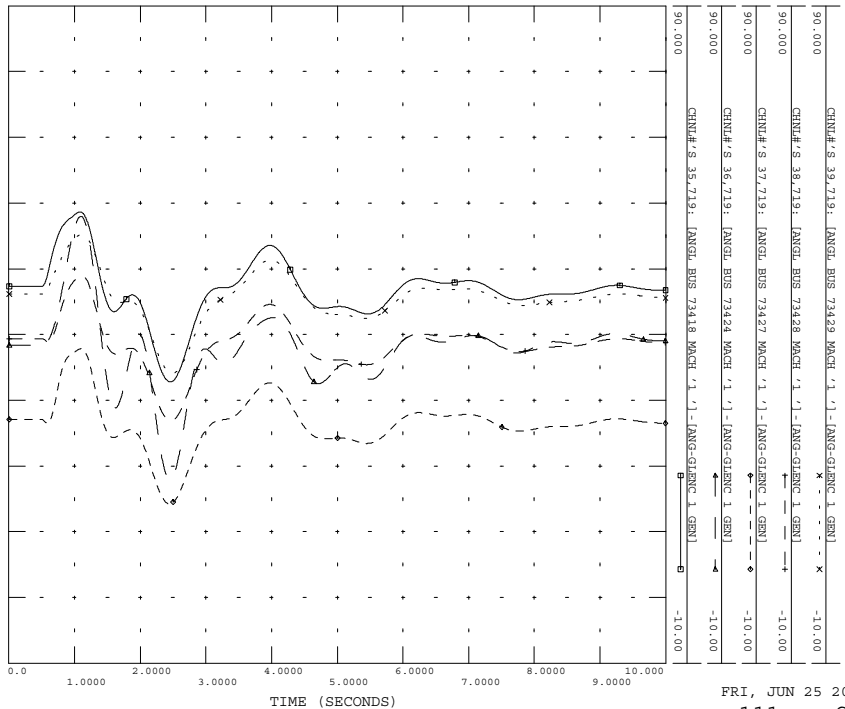
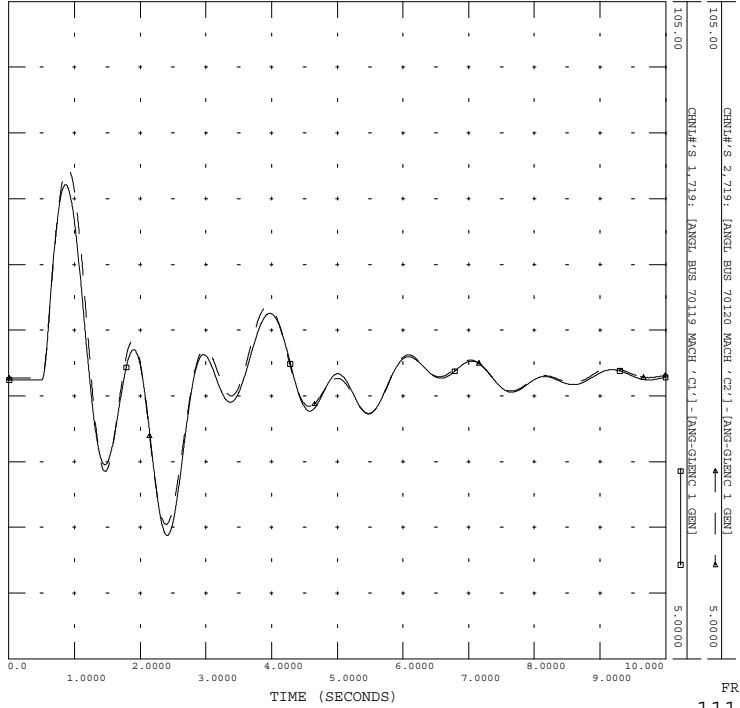


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3PH FLT COM 2/3 T3

FILE: gi-2010-08_850_110.out

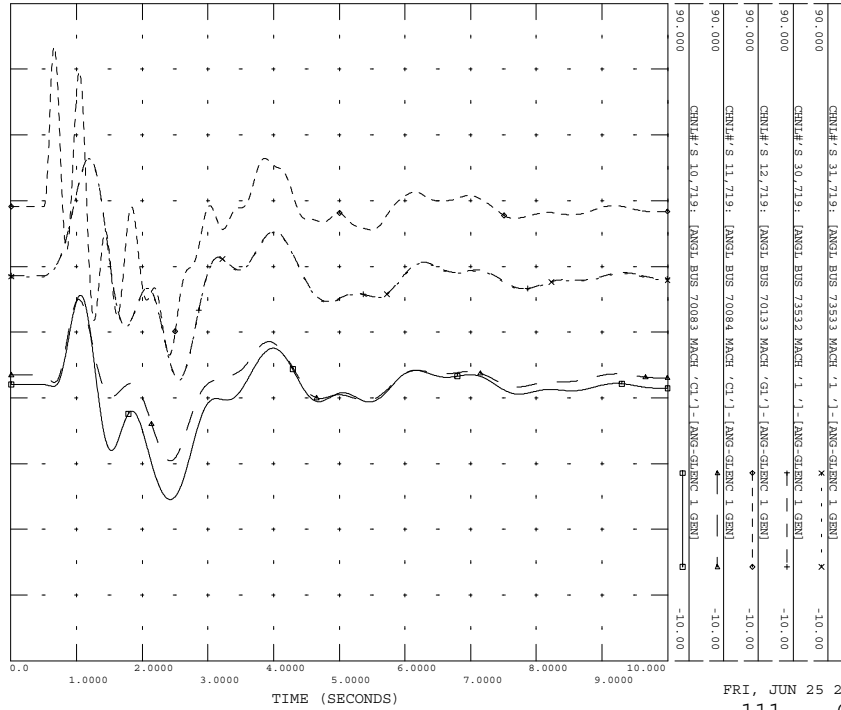


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110 - COM VLT



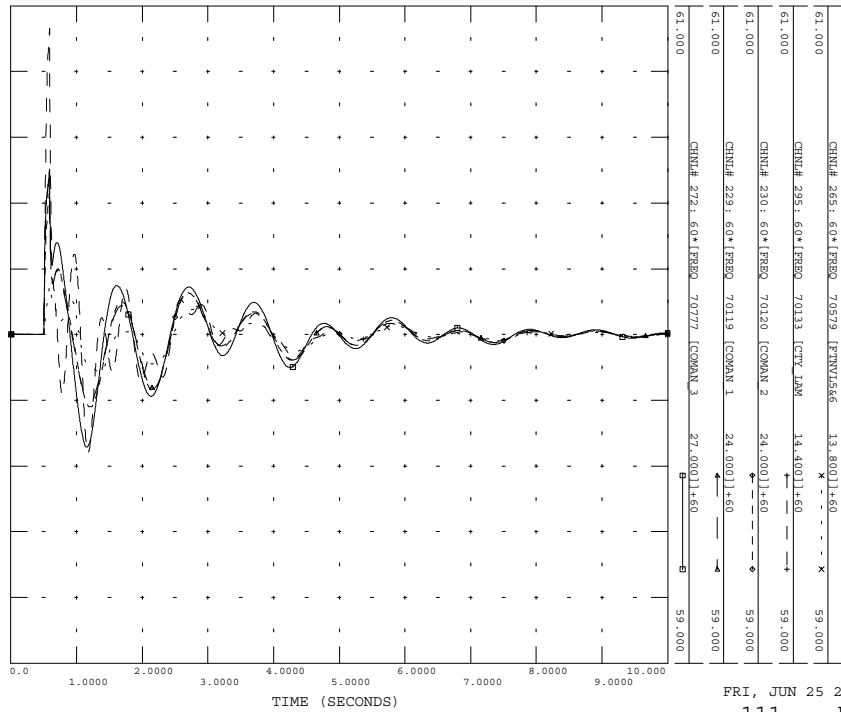
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FILE: gi-2010-08_850_111.out



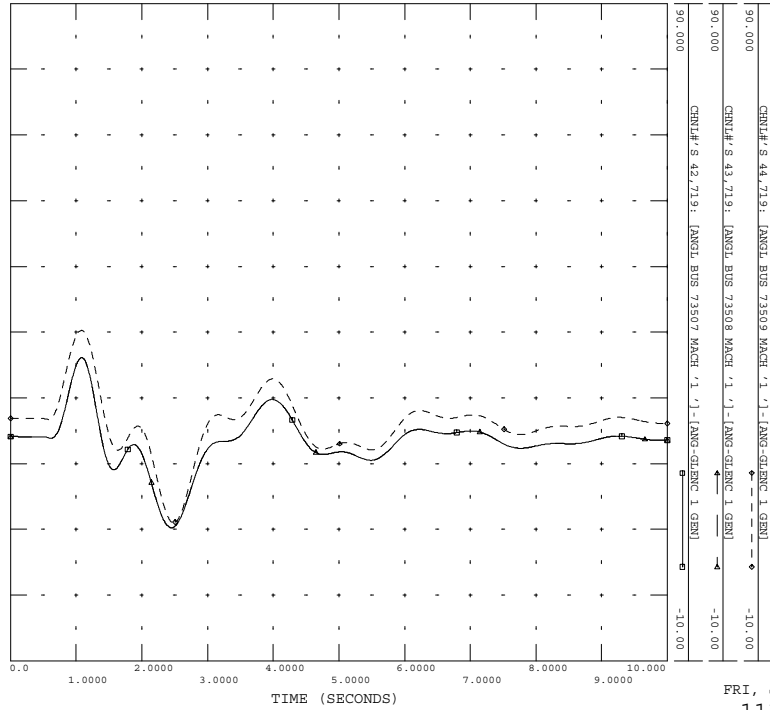
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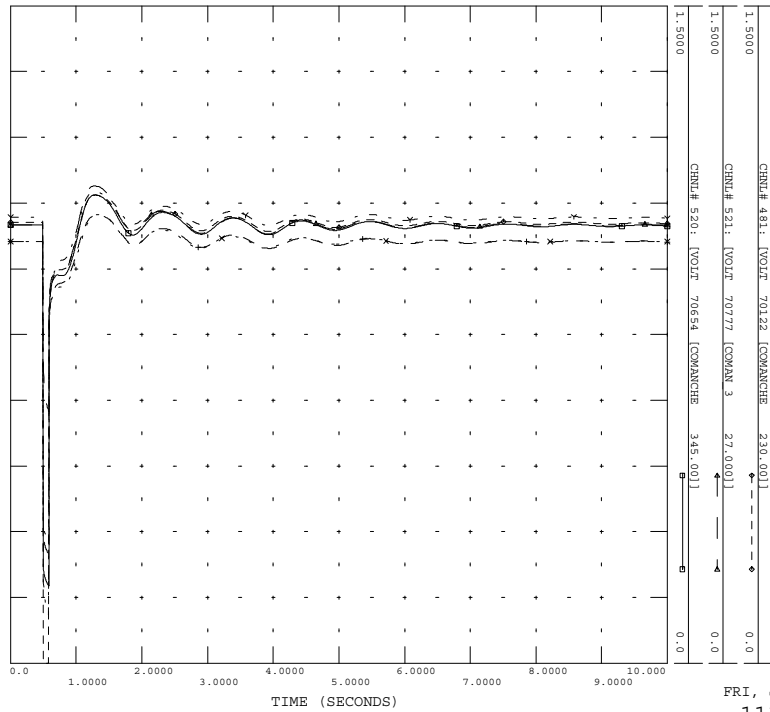
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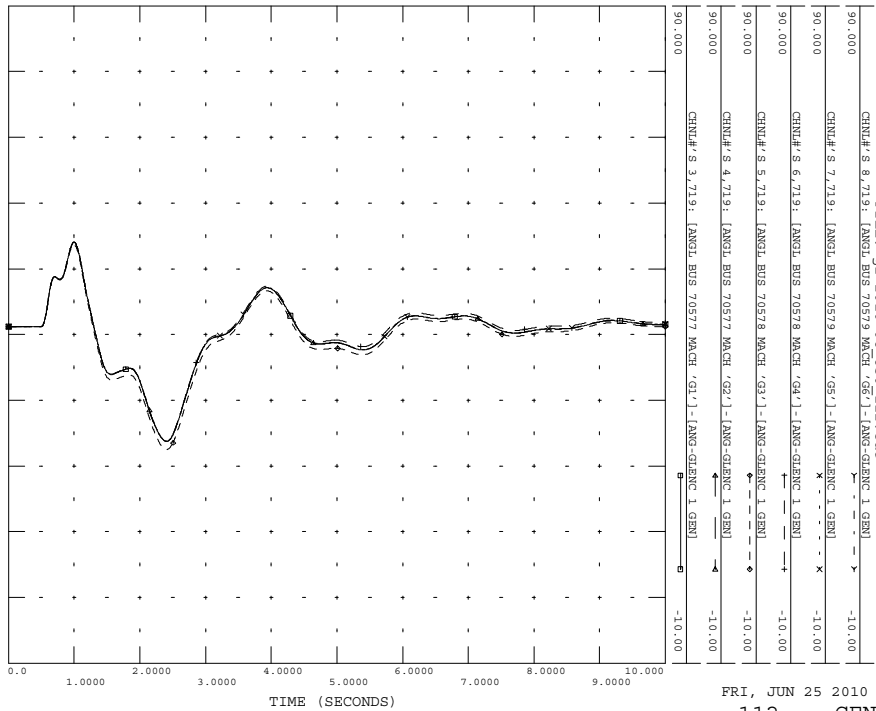
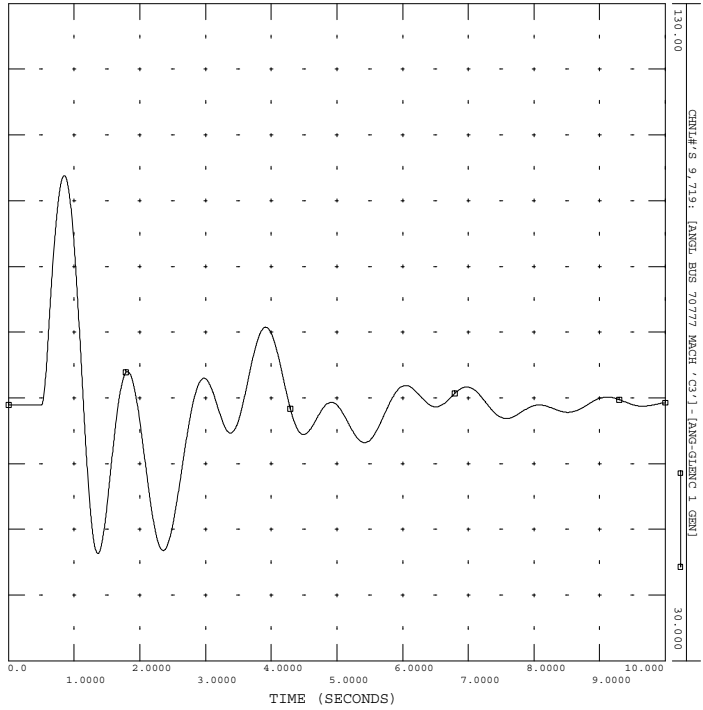
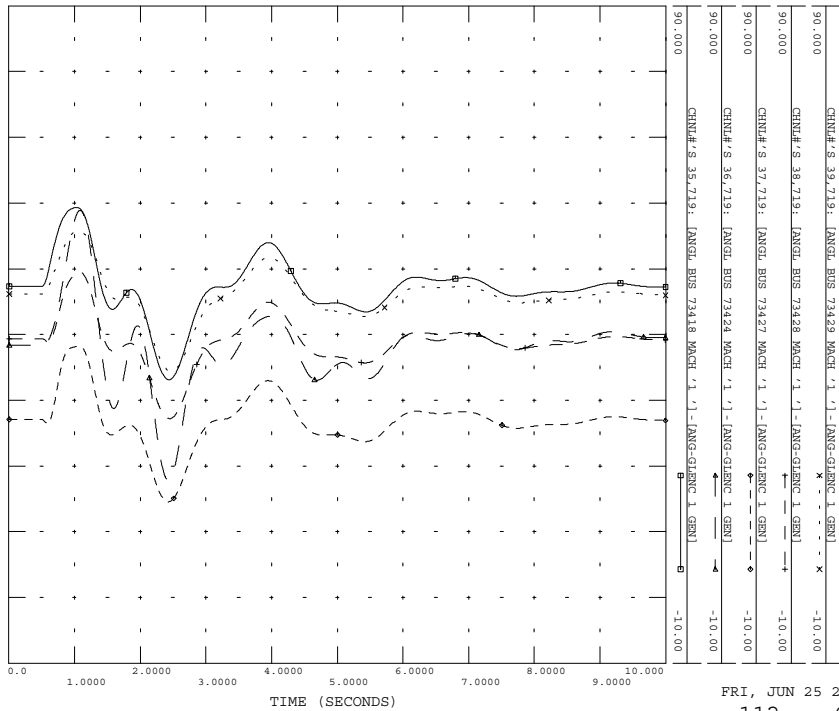
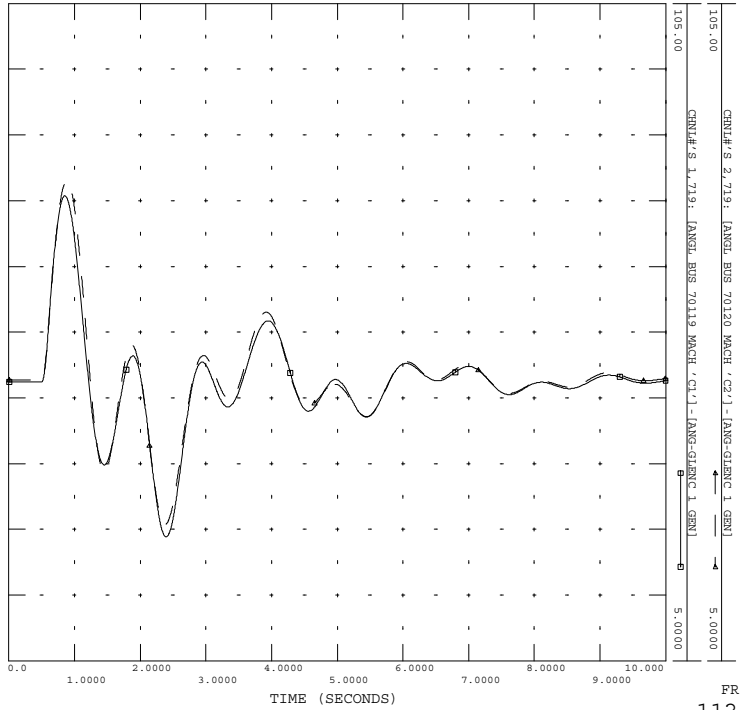
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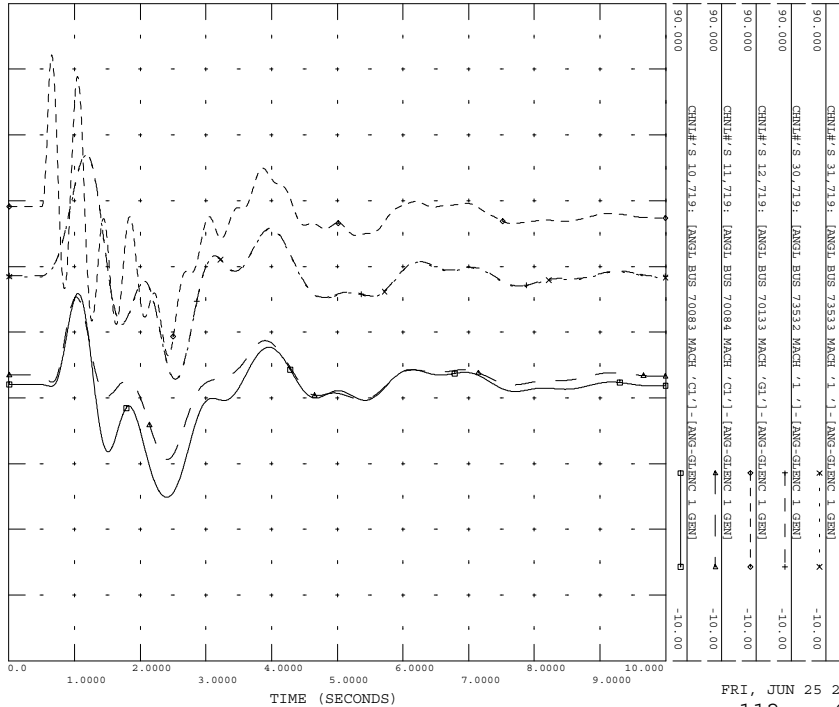






GI-2010-08_850_112 --> JUN 10
3PH FLT COM-BOON

FILE: gi-2010-08_850_112.out

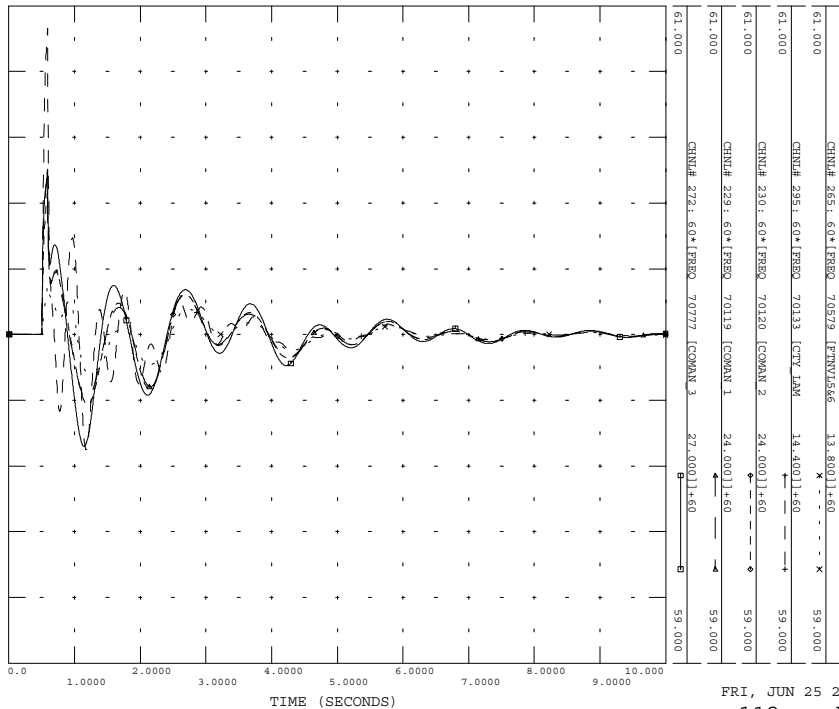


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112 - GEN ANG



GI-2010-08_850_112 --> JUN 10
3PH FLT COM-BOON

FILE: gi-2010-08_850_112.out

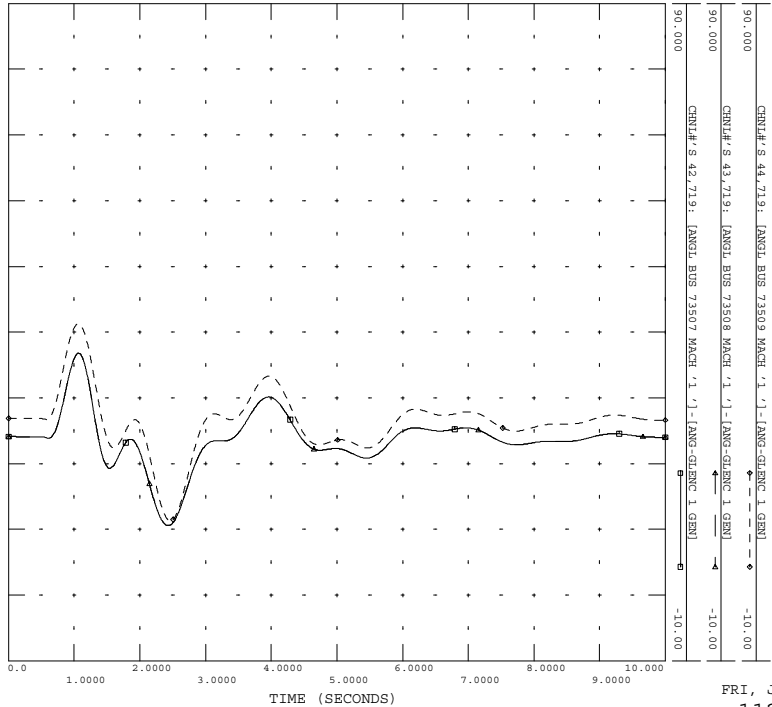


FRI, JUN 25 2010 16:14
112 - BUS FRQ



GI-2010-08_850_112 --> JUN 10
3PH FLT COM-BOON

FILE: gi-2010-08_850_112.out

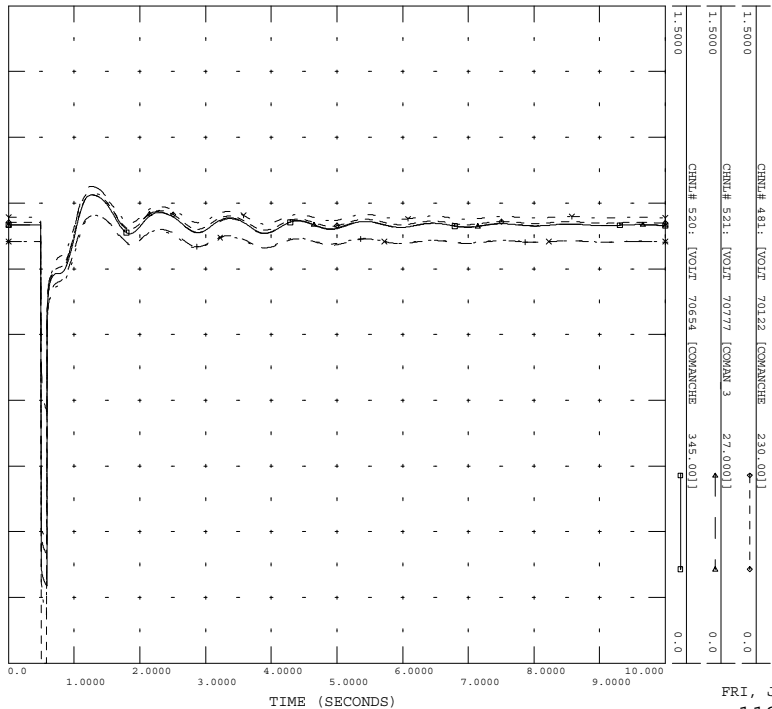


FRI, JUN 25 2010 16:14
112 - GEN ANG

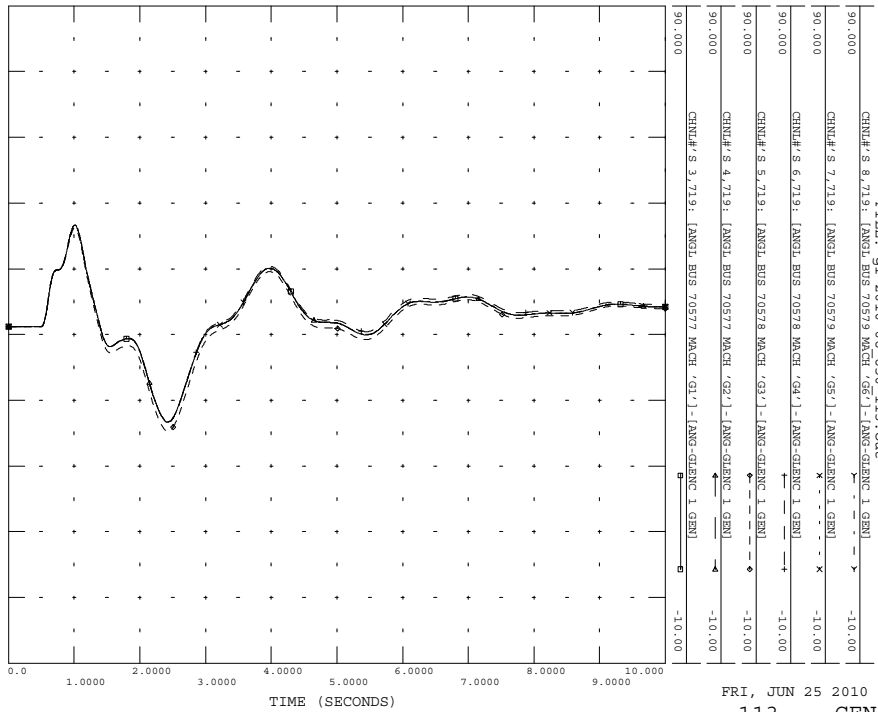
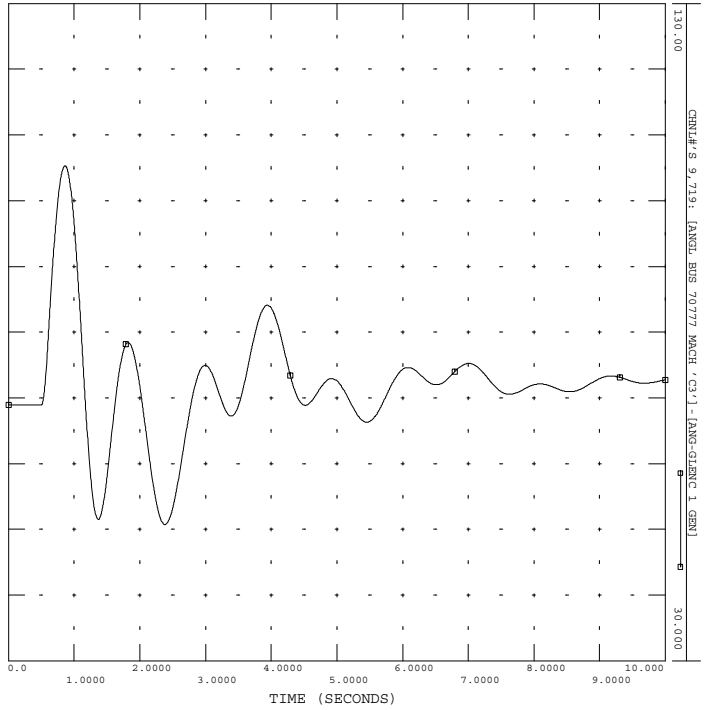
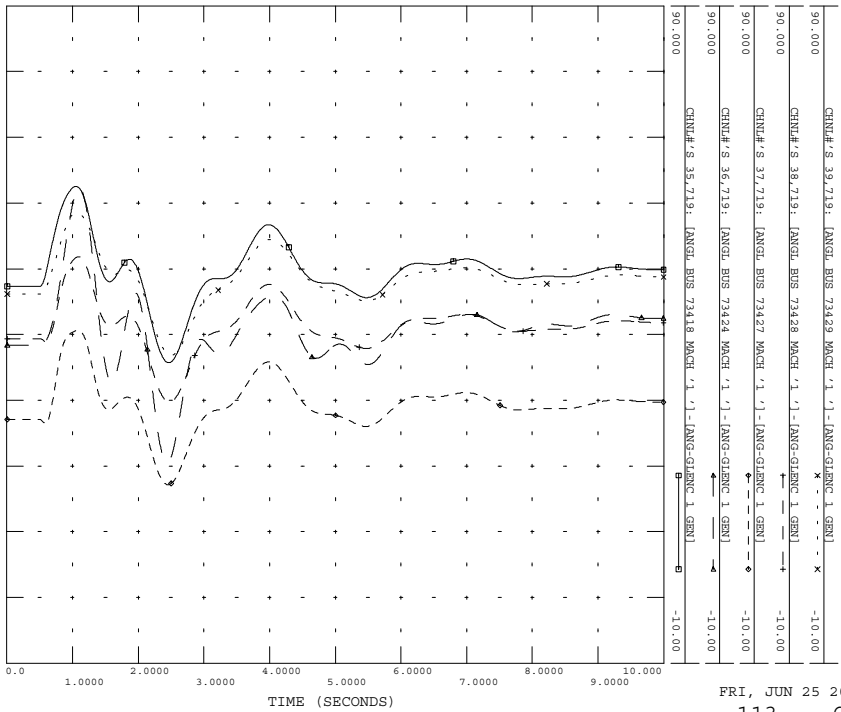
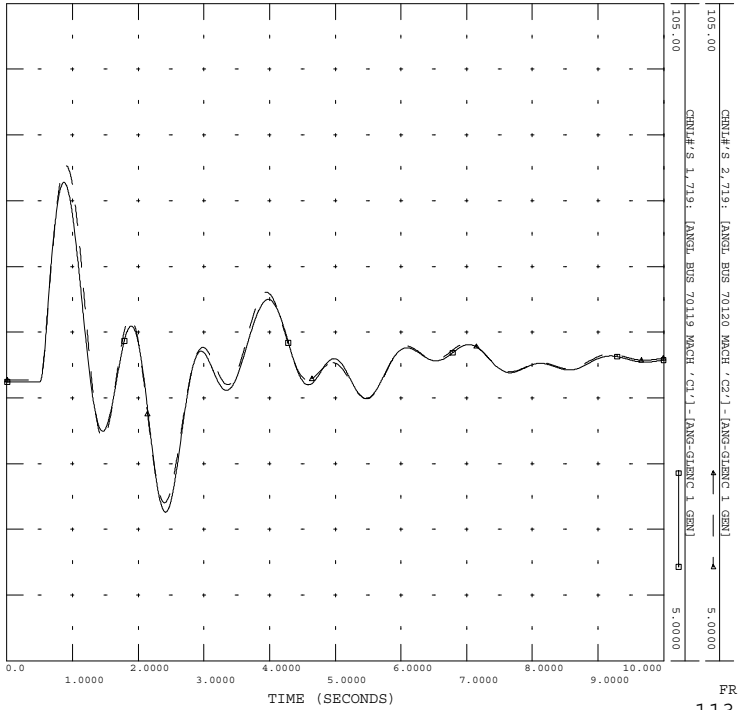


GI-2010-08_850_112 --> JUN 10
3PH FLT COM-BOON

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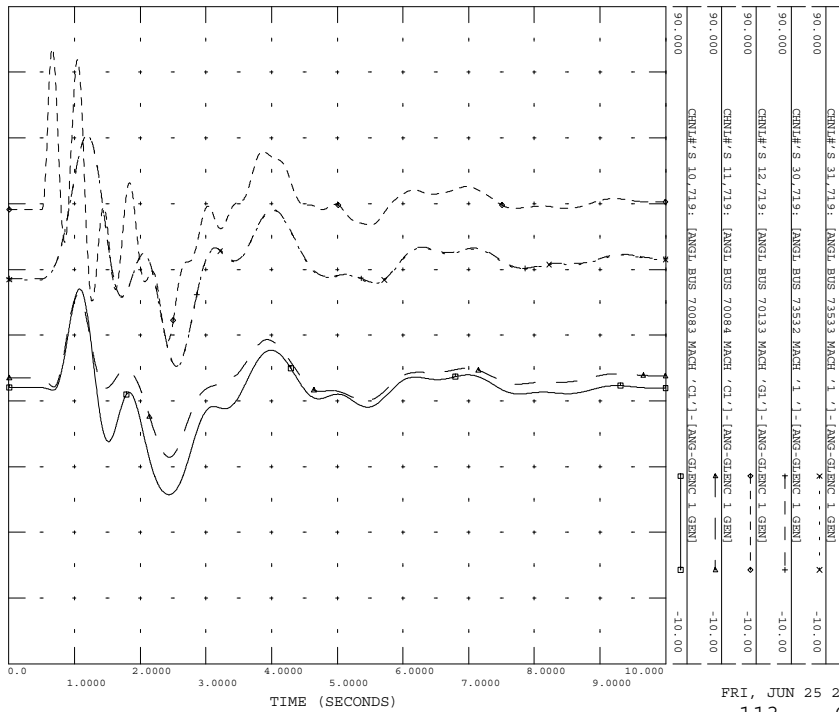
FRI, JUN 25 2010 16:14
112 - COM VLT





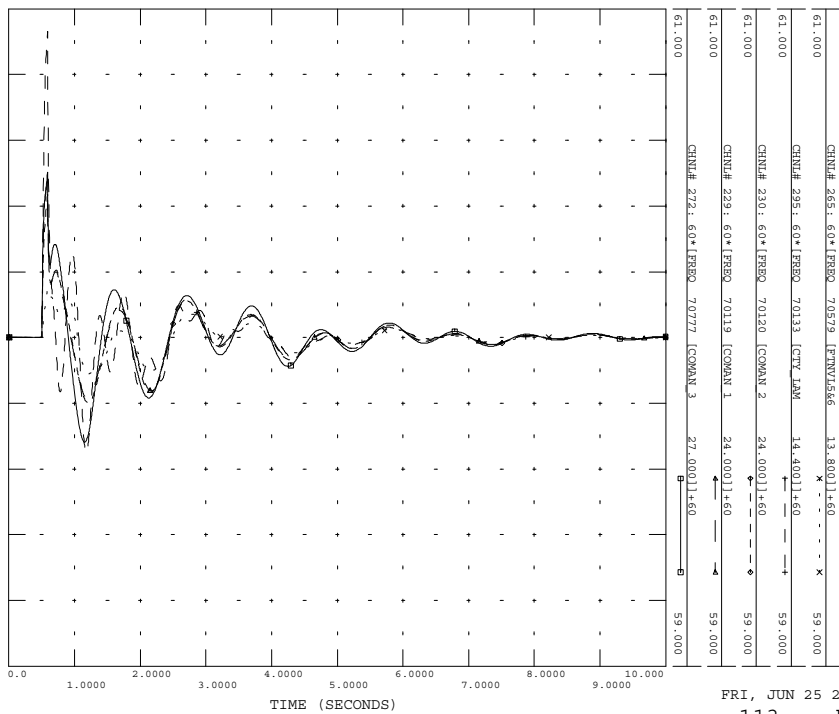
GI-2010-08_850_113 --> JUN 10
3PH FLT COM-WALS

FILE: gi-2010-08_850_113.out



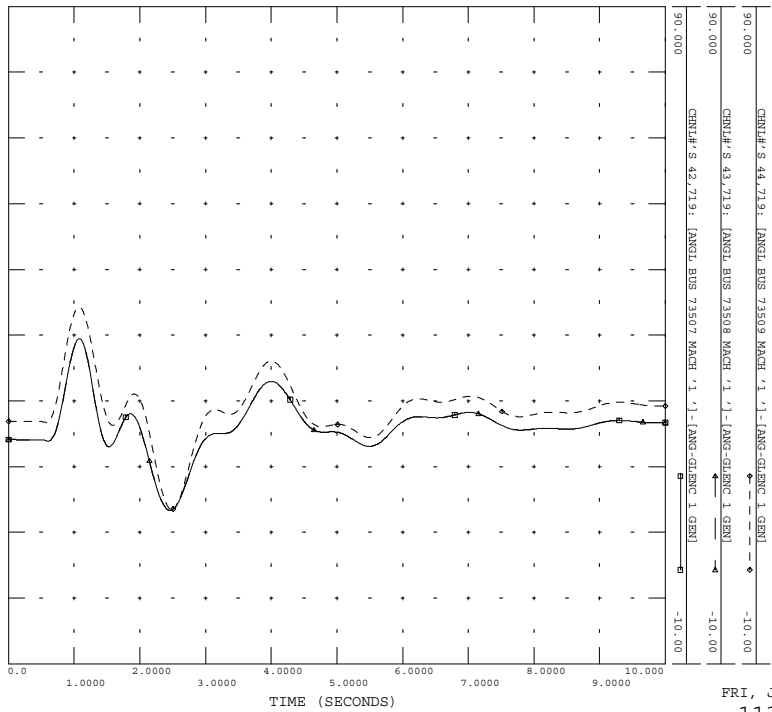
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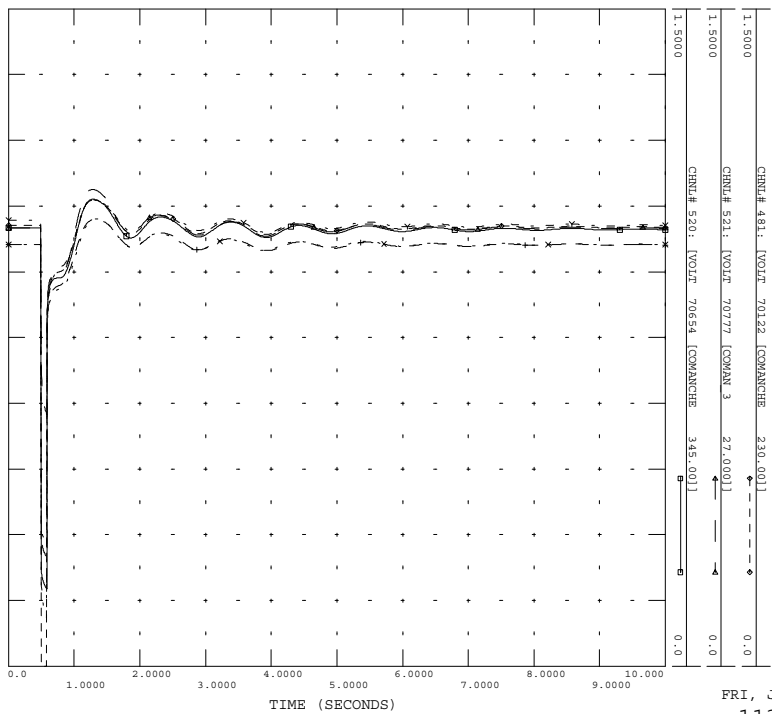
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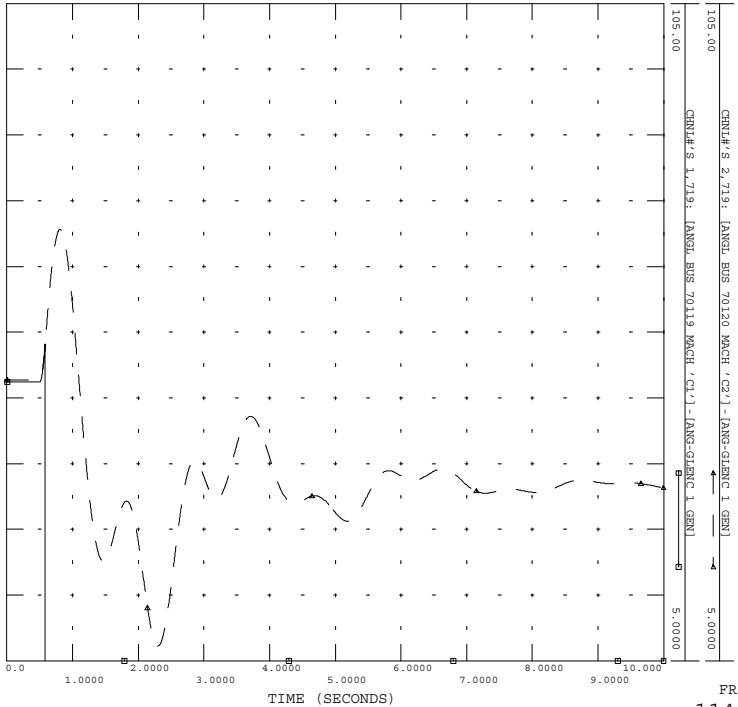
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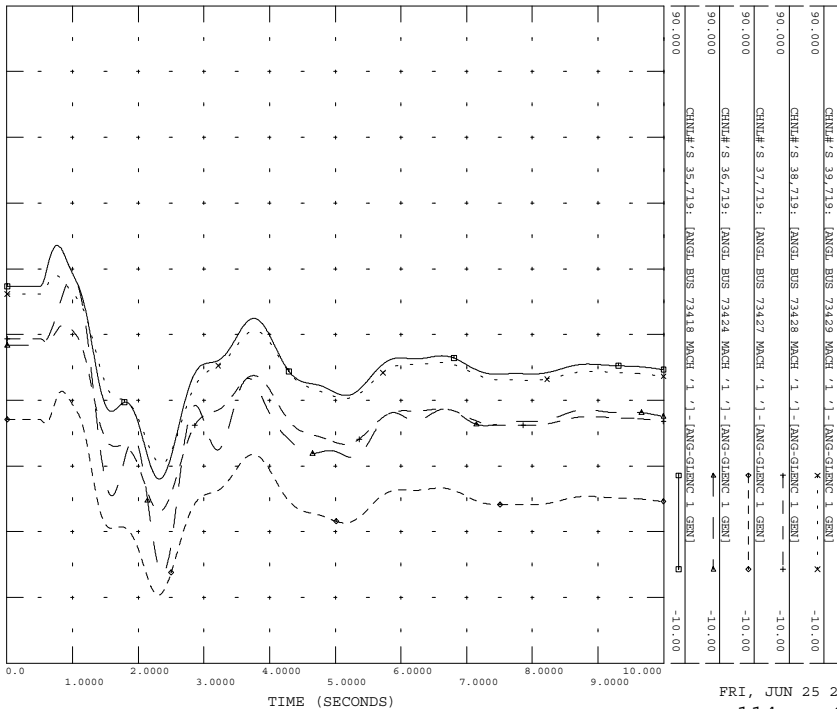
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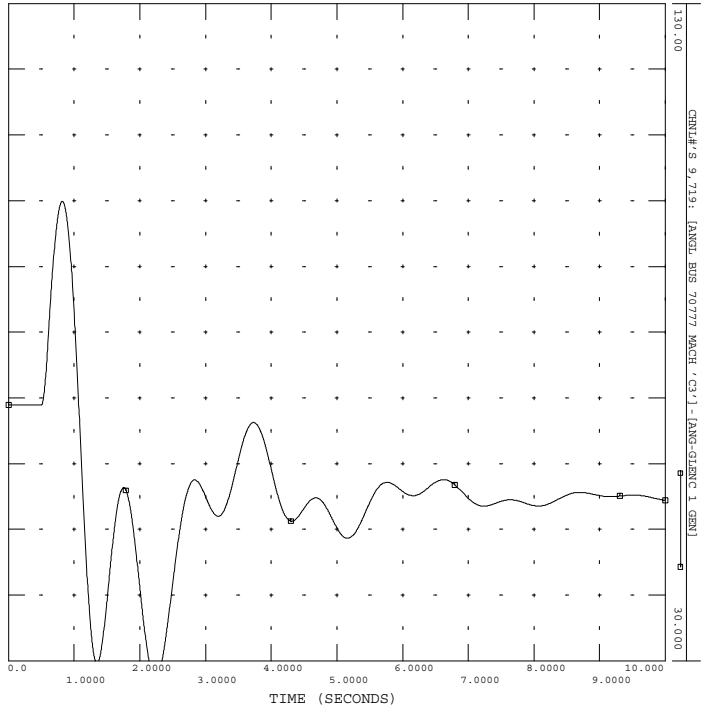




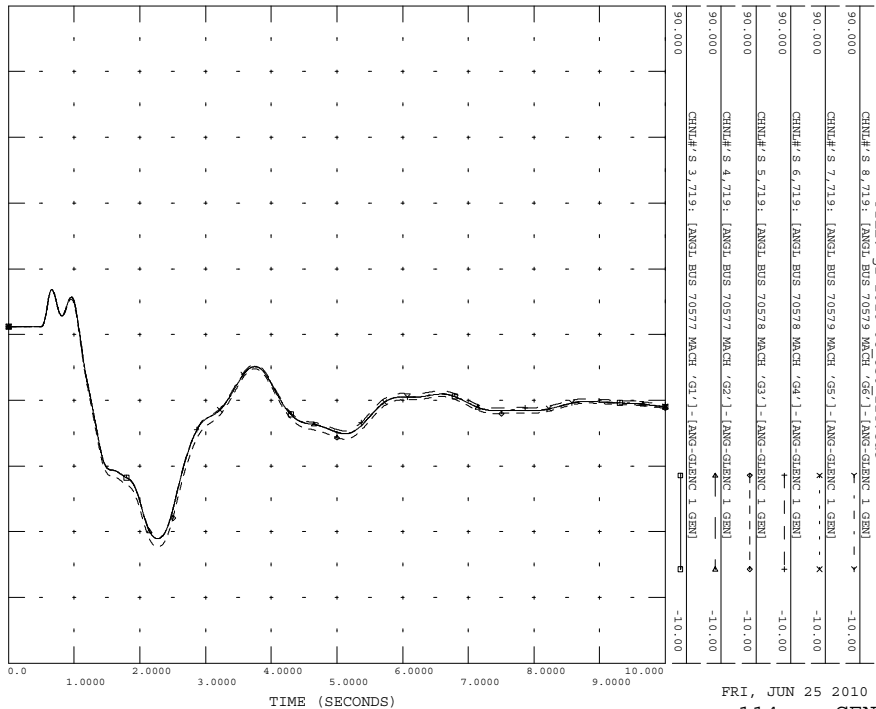
FRI, JUN 25 2010 16:14
114 - COM 12 ANG



FRI, JUN 25 2010 16:14
114 - GEN ANG



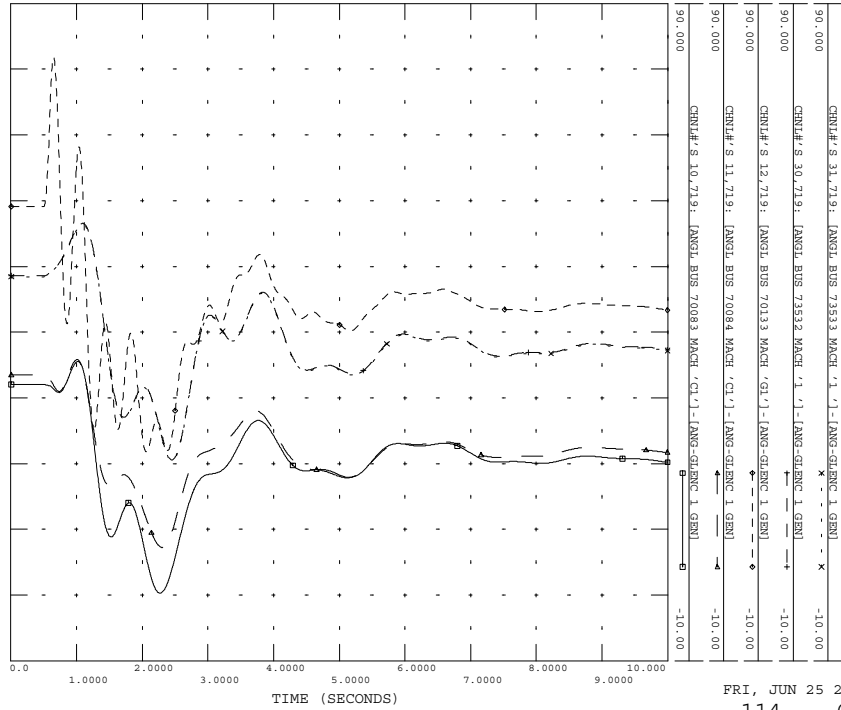
FRI, JUN 25 2010 16:14
114 - COM 3 ANG



FRI, JUN 25 2010 16:14
114 - GEN ANG

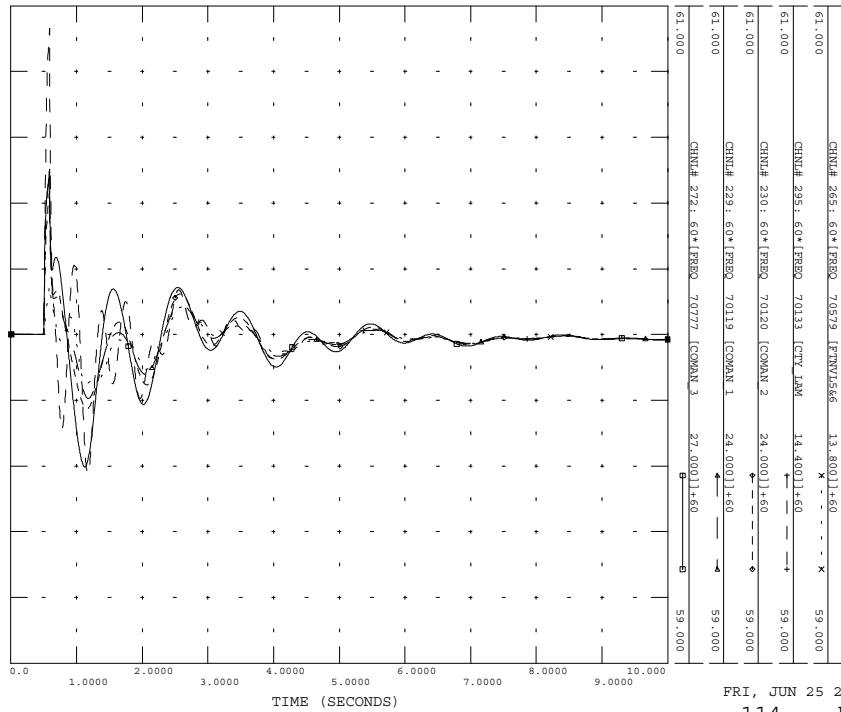
GI-2010-08_850_114 --> JUN 10
3PH FLT COM UI GSU

FILE: gi-2010-08_850_114.out



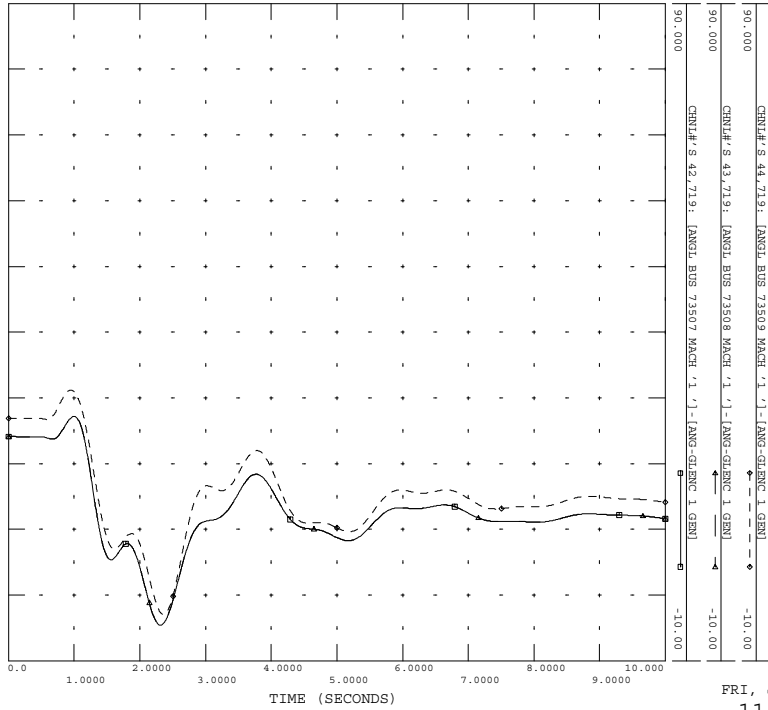
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3PH FLT COM UI GSU

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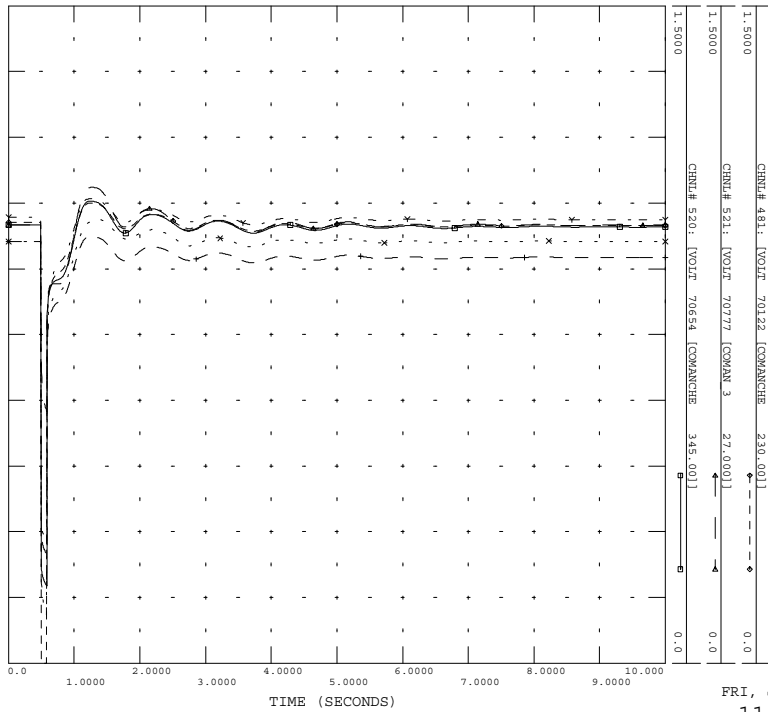
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3PH FLT COM UI GSU

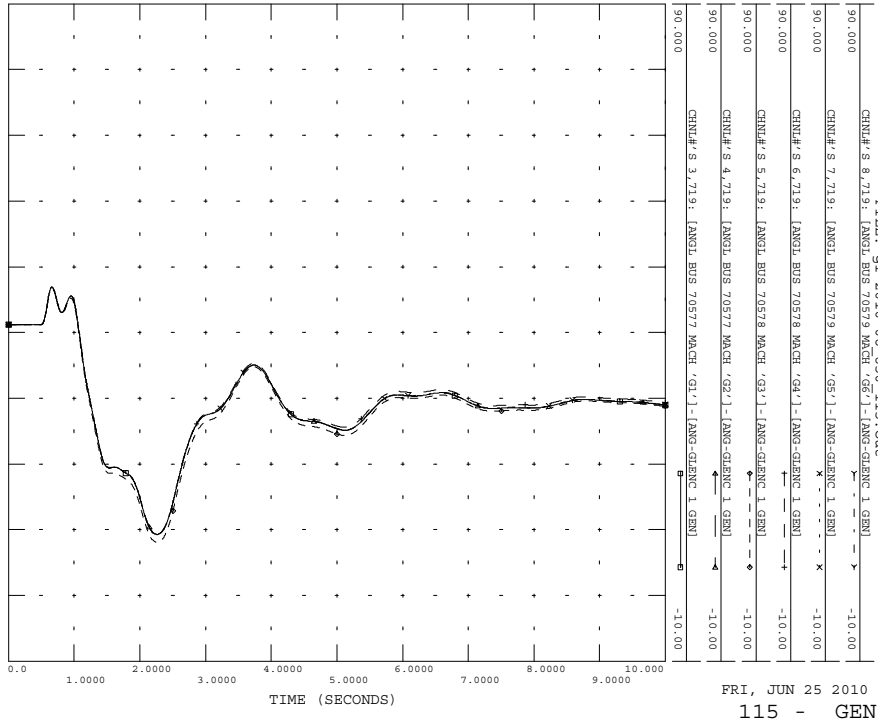
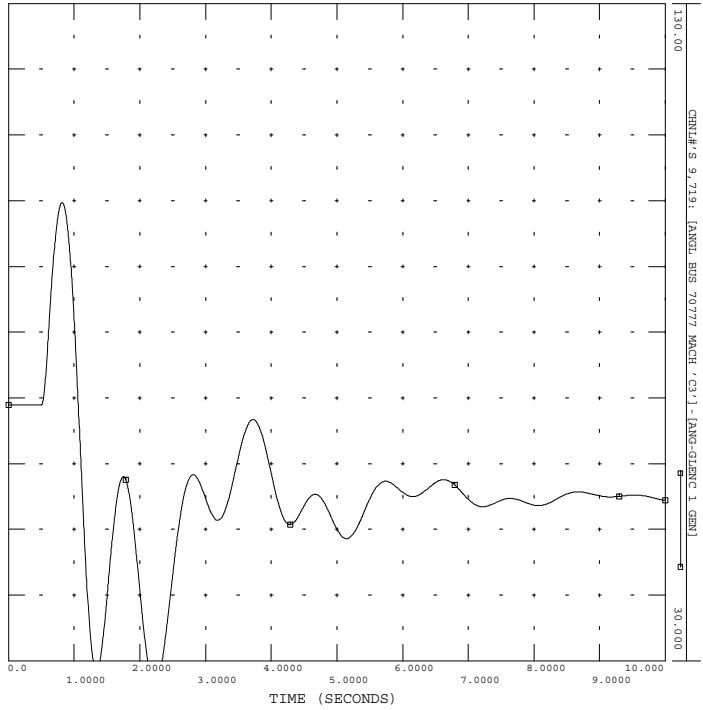
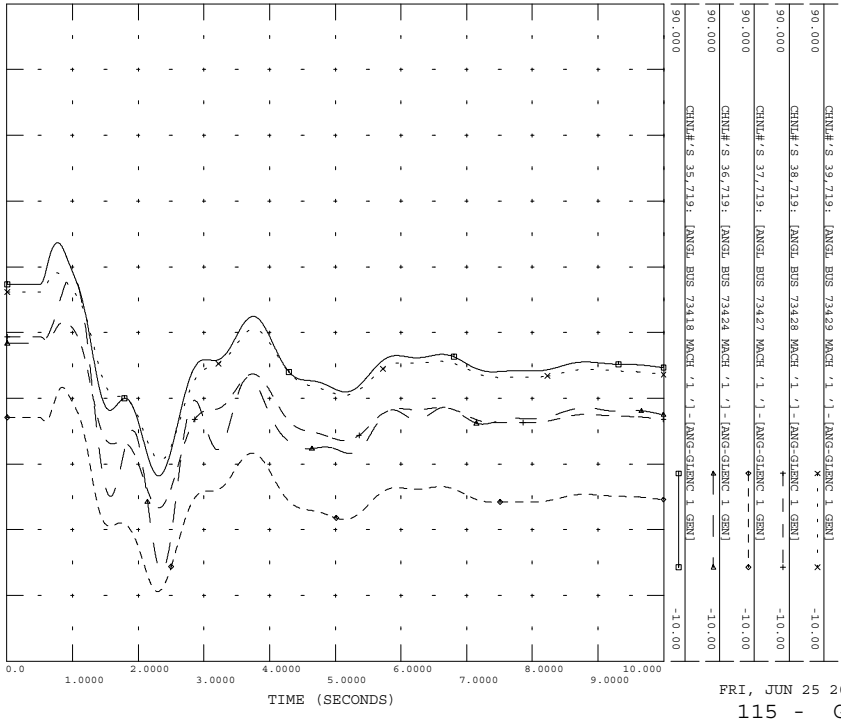
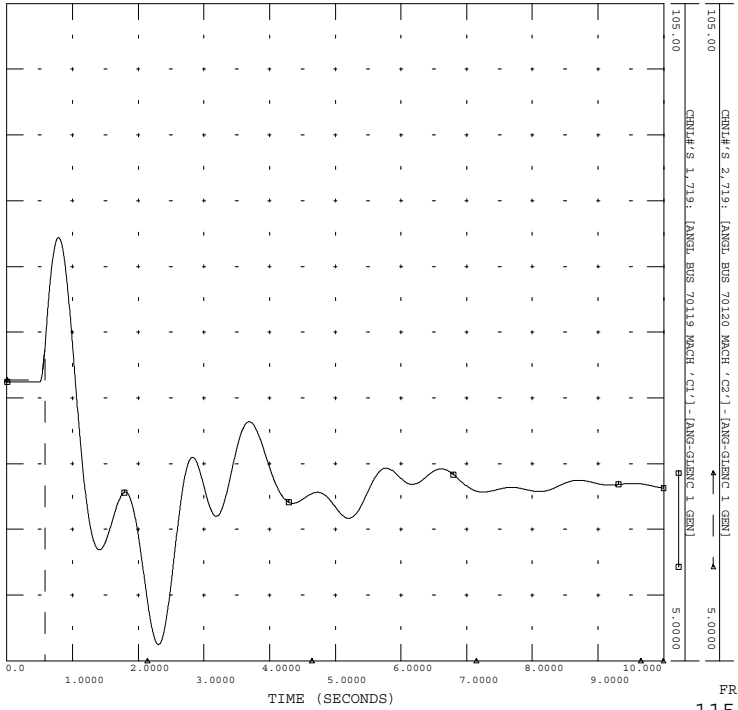
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GI-2010-08_850_114 --> JUN 10
3PH FLT COM UI GSU

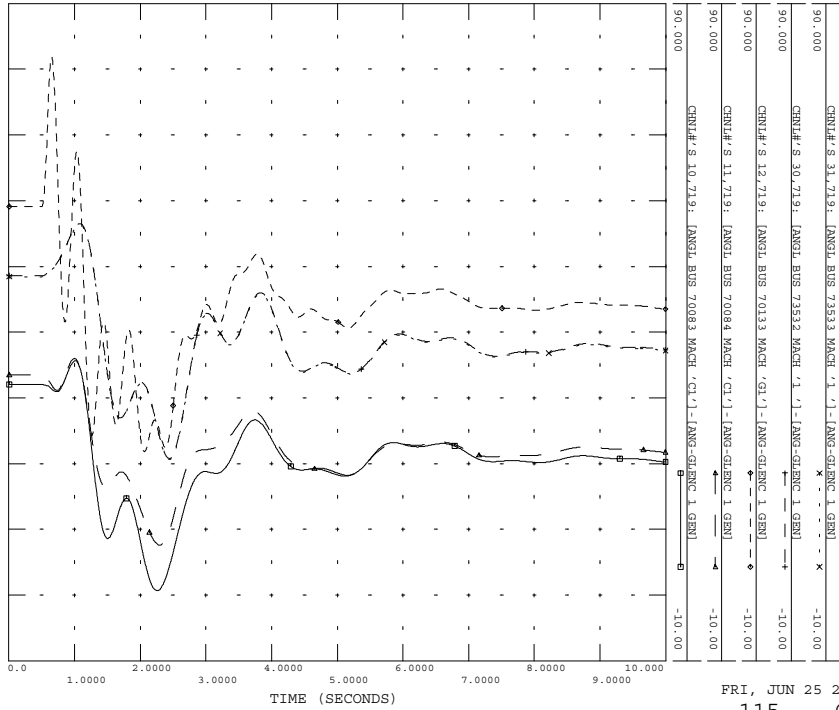
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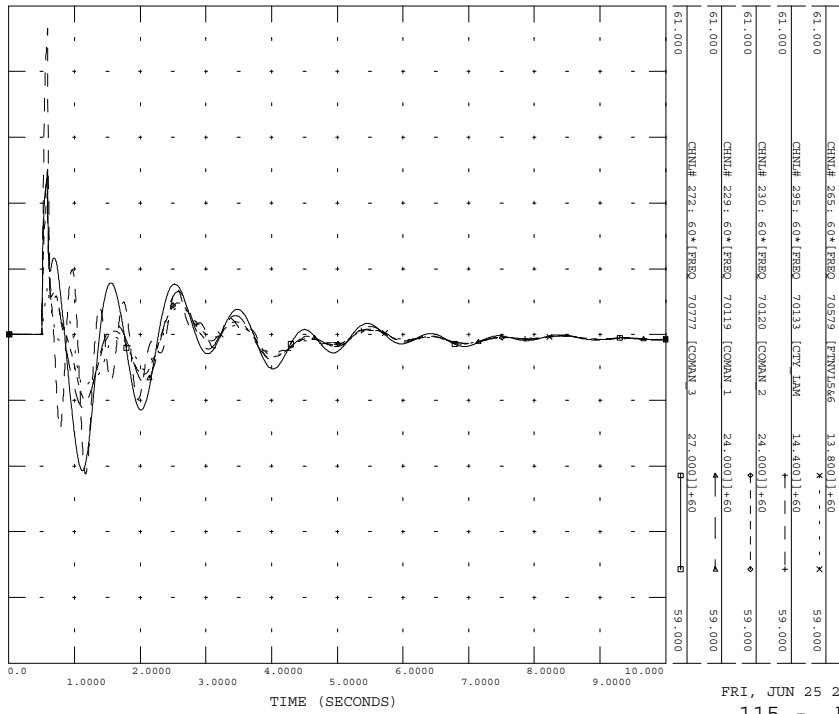
GI-2010-08_850_115 --> JUN 10
3PH FLT COM U2 G5U

FILE: gi-2010-08_850_115.out



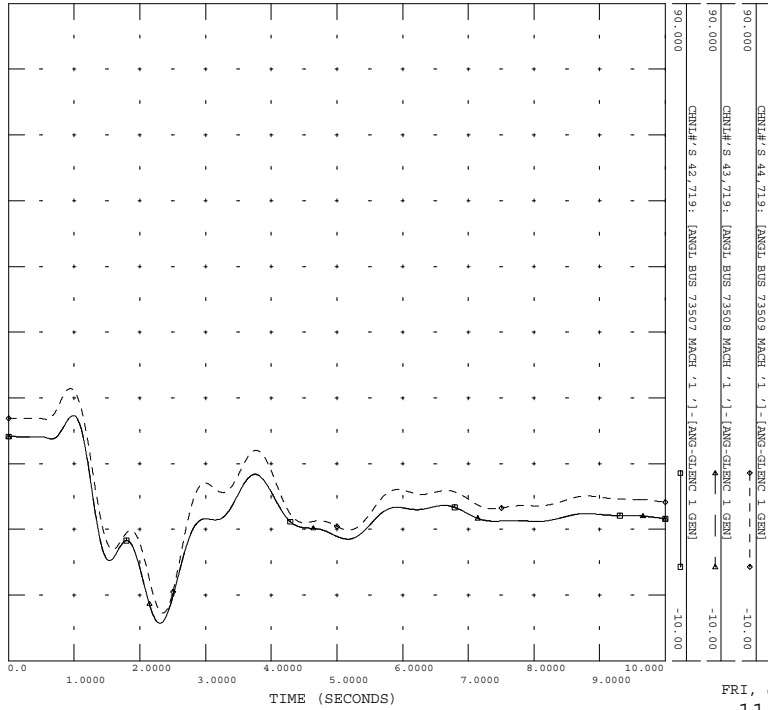
GI-2010-08_850_115 --> JUN 10
3PH FLT COM U2 G5U

FILE: gi-2010-08_850_115.out



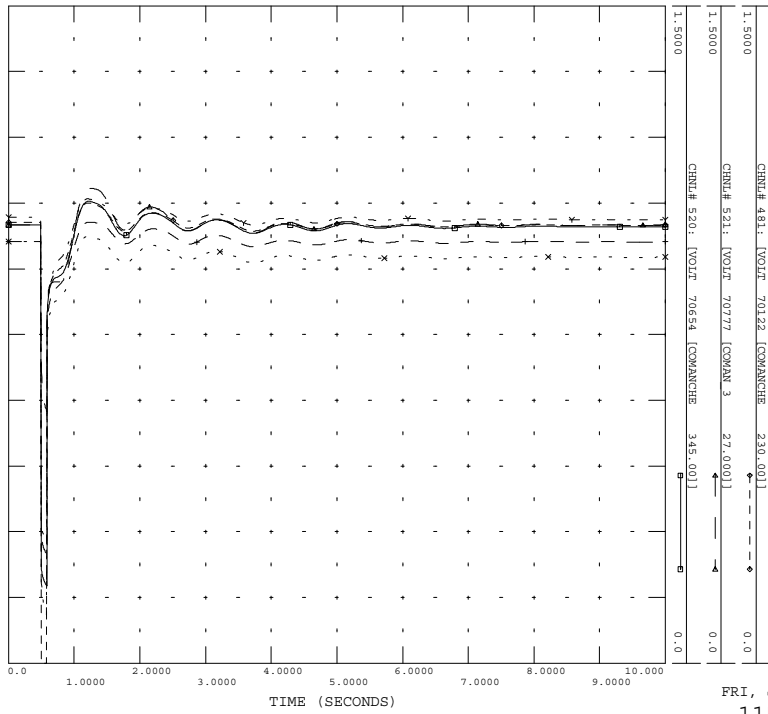
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3PH FLT COM U2 G5U

FILE: gi-2010-08_850_115.out



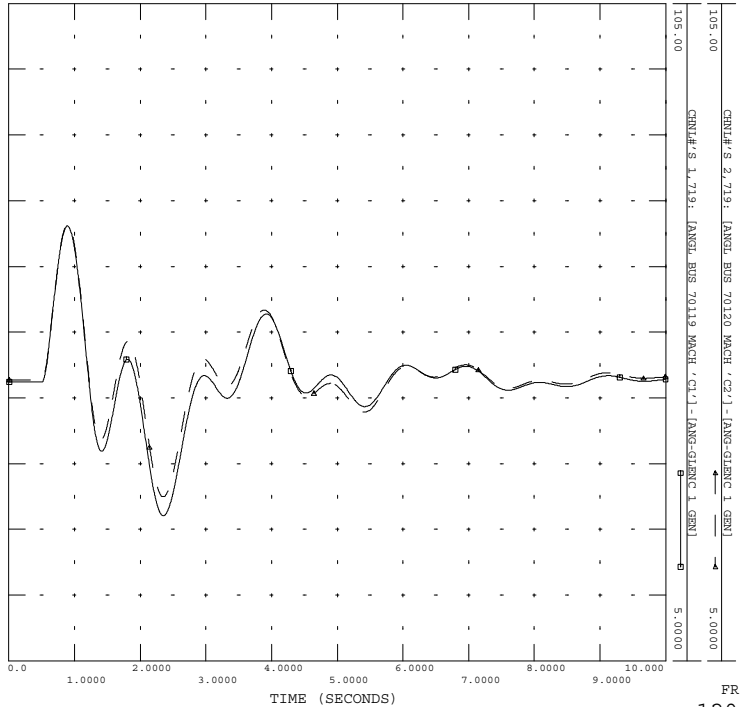
GI-2010-08_850_115 --> JUN 10
3PH FLT COM U2 G5U

FILE: gi-2010-08_850_115.out



GI-2010-08_850_120 --> JUN 10
3PH FLT MID-JF

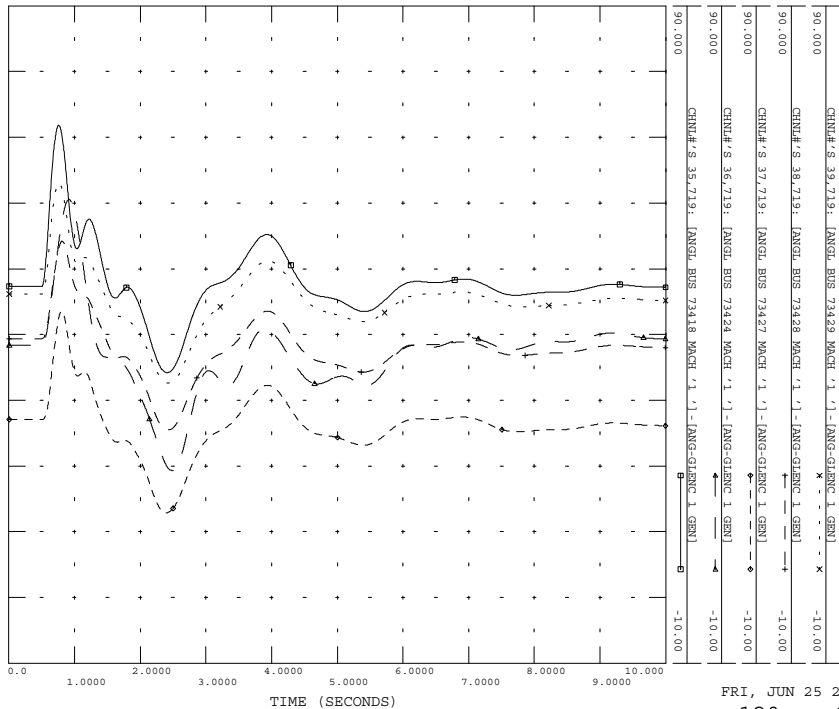
FILE: gi-2010-08_850_120.out



FRI, JUN 25 2010 16:14
120 - COM 12 ANG

GI-2010-08_850_120 --> JUN 10
3PH FLT MID-JF

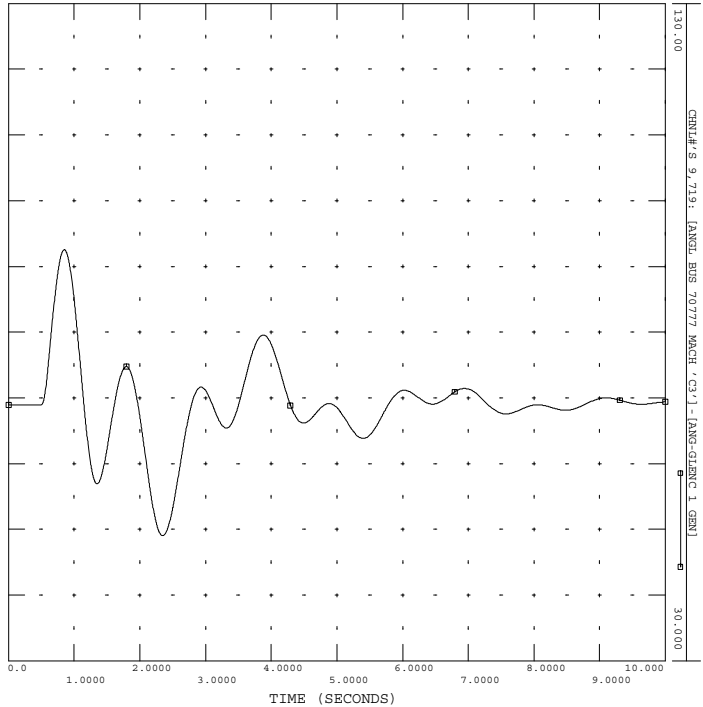
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FRI, JUN 25 2010 16:14
120 - GEN ANG

GI-2010-08_850_120 --> JUN 10
3PH FLT MID-JF

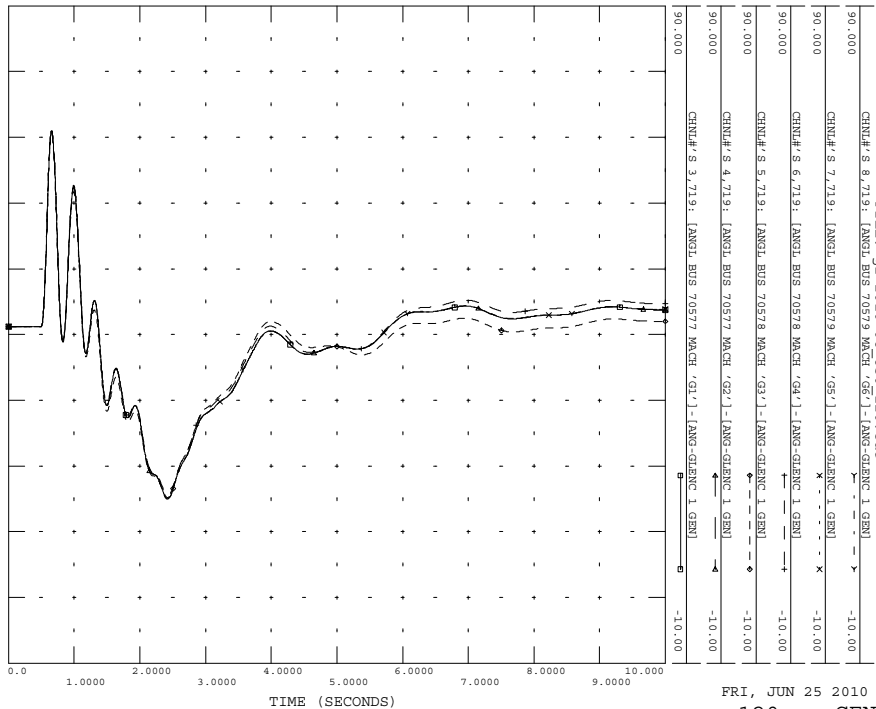
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FRI, JUN 25 2010 16:14
120 - COM 3 ANG

GI-2010-08_850_120 --> JUN 10
3PH FLT MID-JF

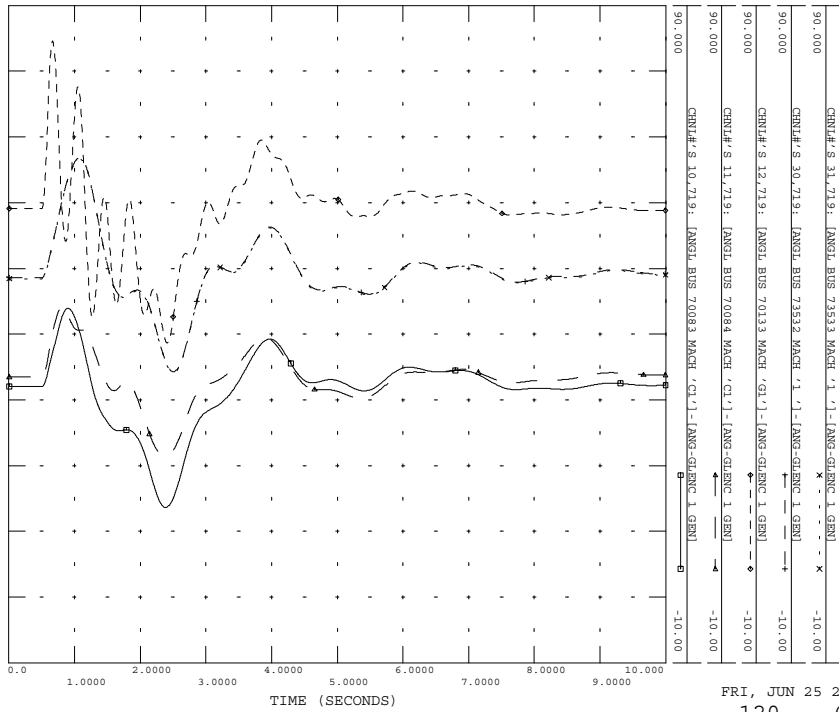
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FRI, JUN 25 2010 16:14
120 - GEN ANG

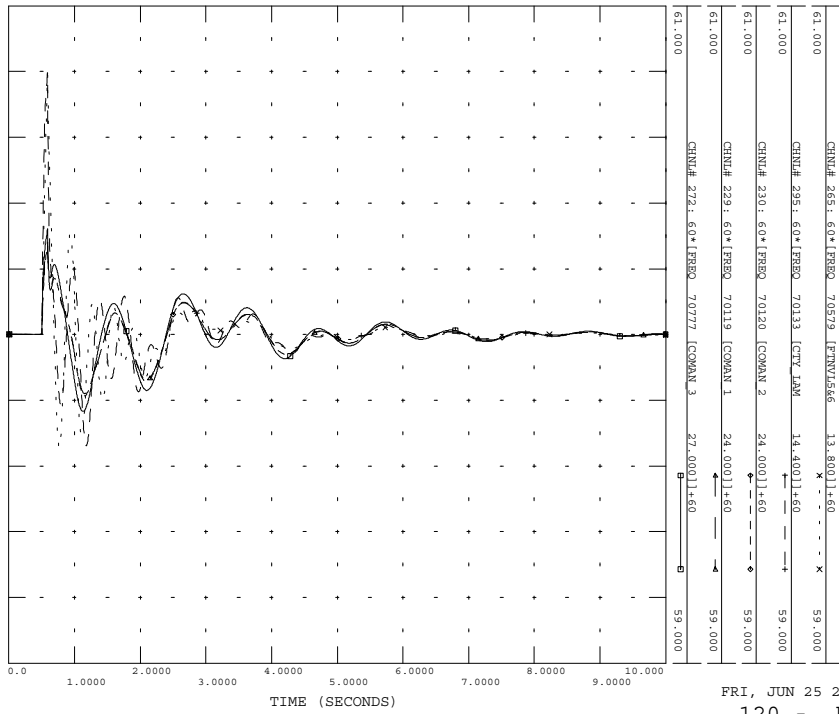
GI-2010-08_850_120 --> JUN 10
3PH FLT MID-JF

FILE: gi-2010-08_850_120.out



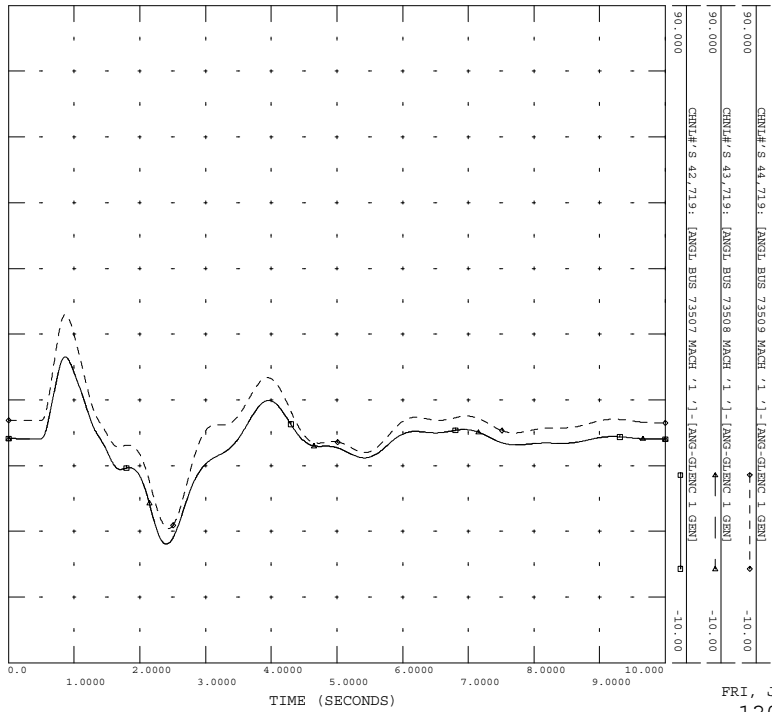
GI-2010-08_850_120 --> JUN 10
3PH FLT MID-JF

FILE: gi-2010-08_850_120.out



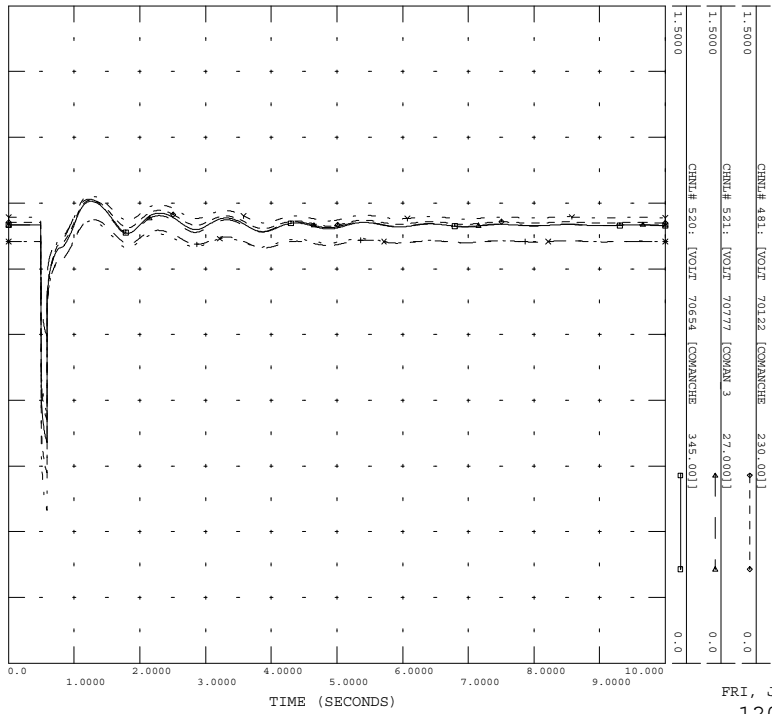
GI-2010-08_850_120 --> JUN 10
3PH FLT MID-JF

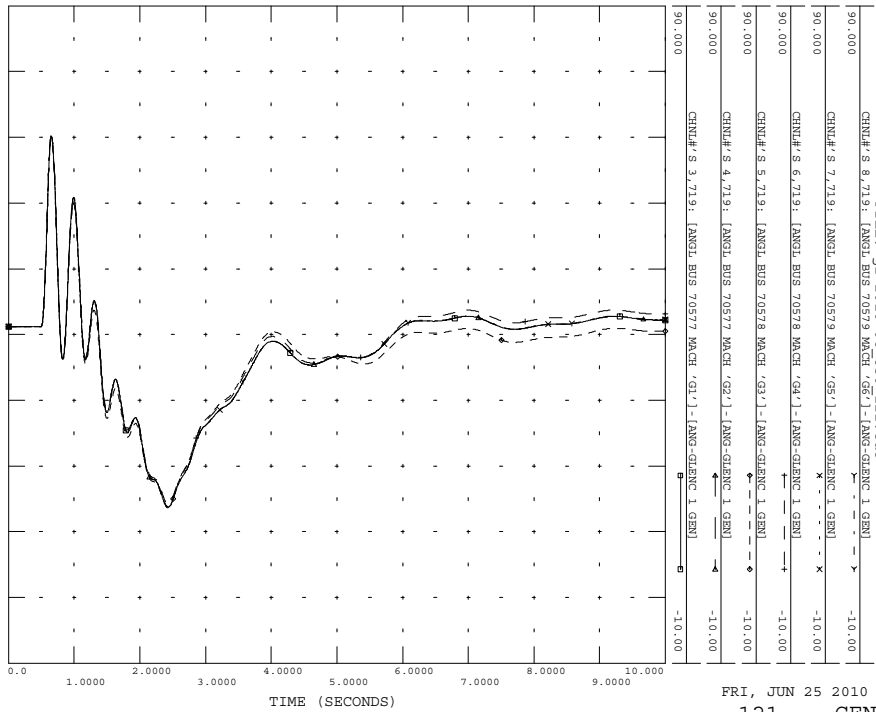
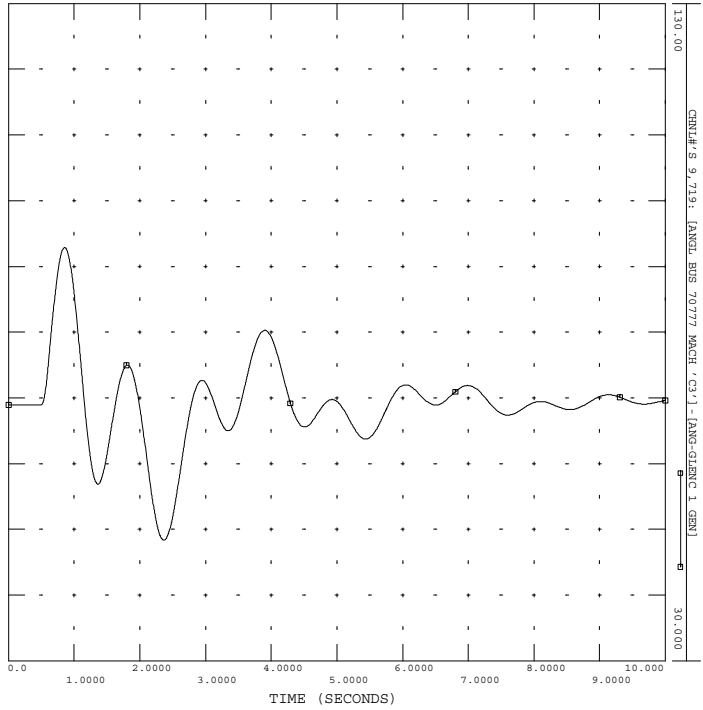
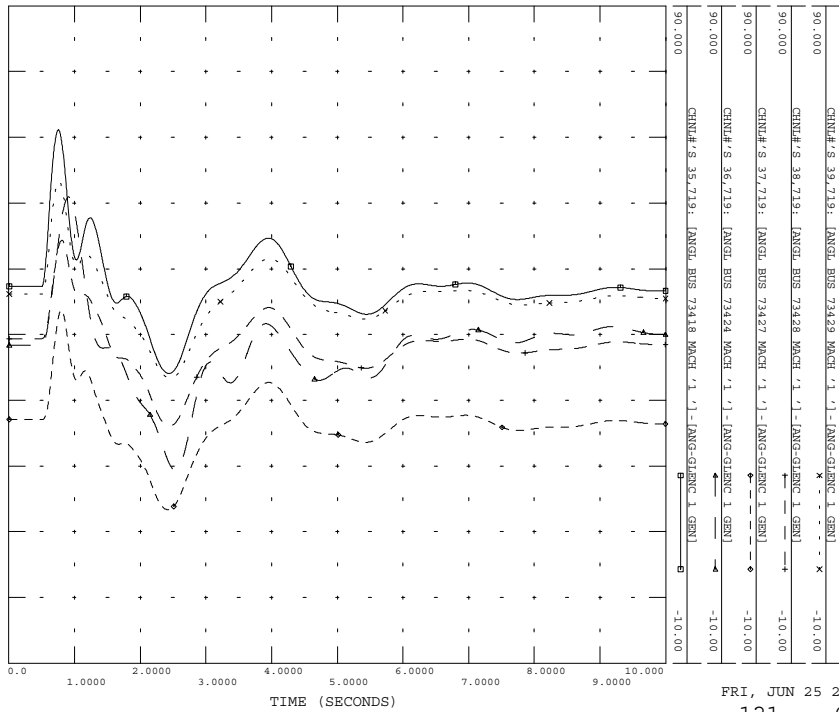
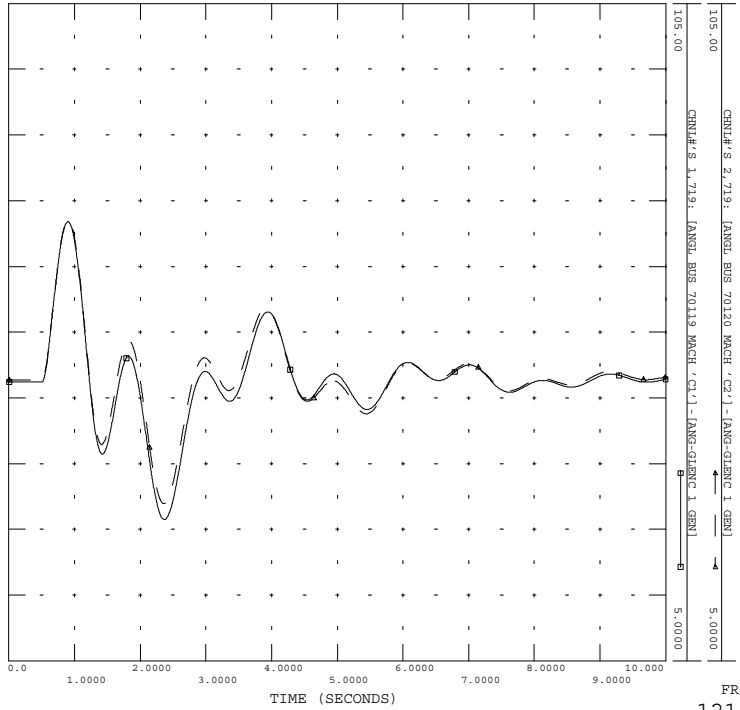
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GI-2010-08_850_120 --> JUN 10
3PH FLT MID-JF

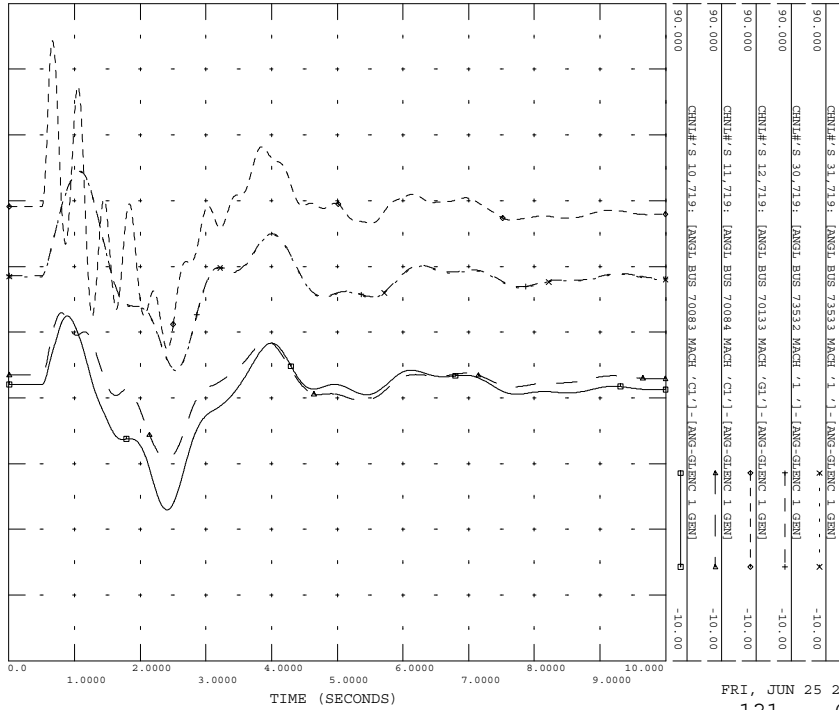
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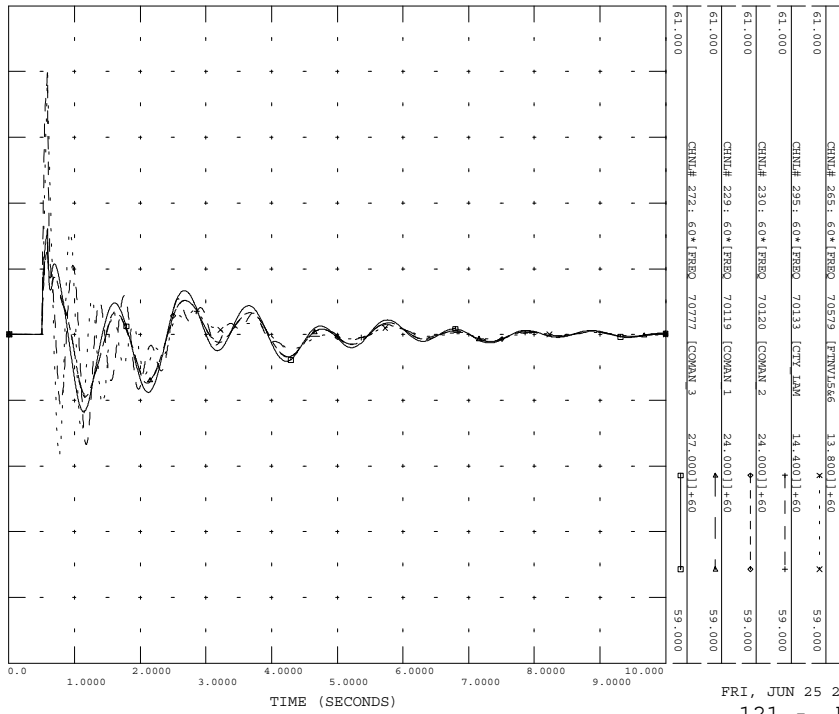
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3PH FLT MID-COM 1

FILE: gi-2010-08_850_121.out



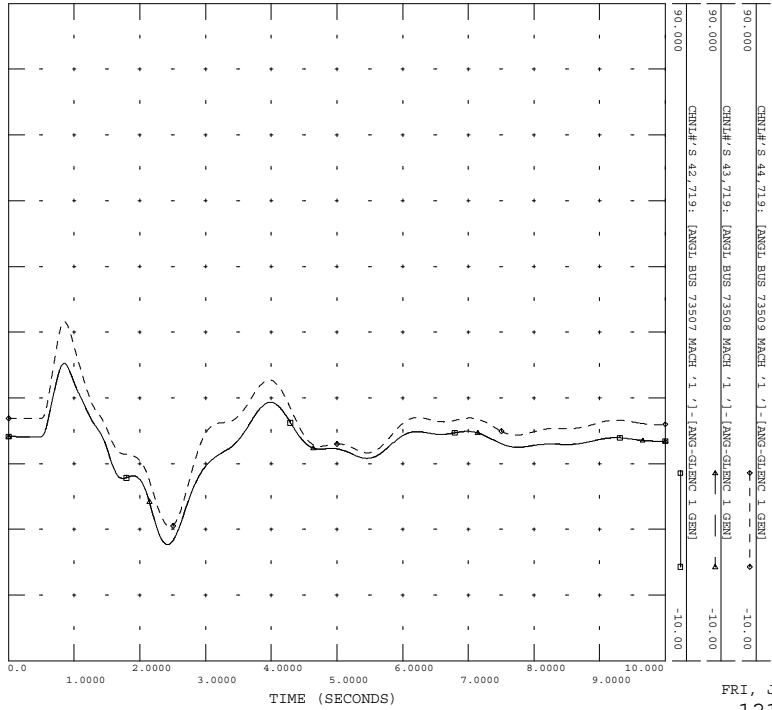
GI-2010-08_850_121 --> JUN 10
3PH FLT MID-COM 1

FILE: gi-2010-08_850_121.out



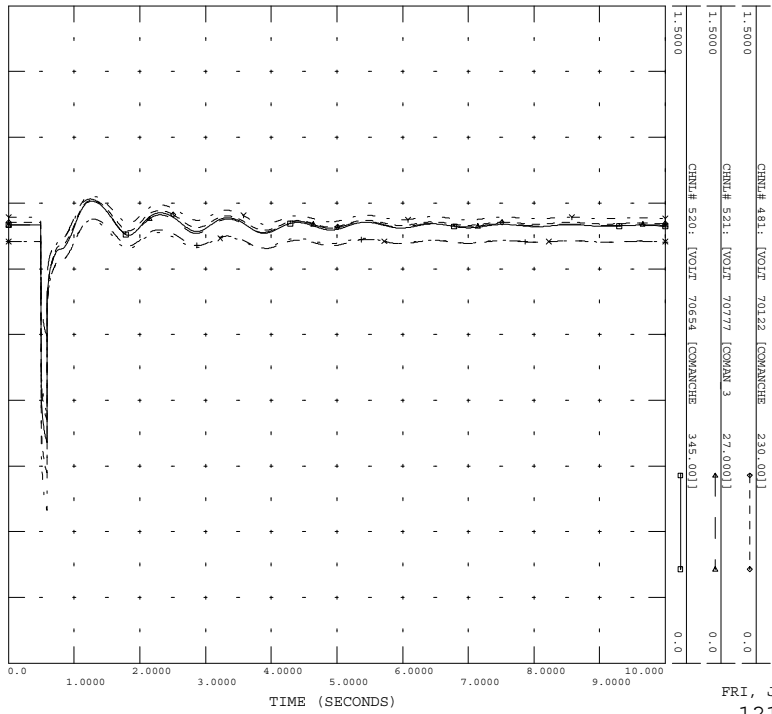
GI-2010-08_850_121 --> JUN 10
3PH FLT MID-COM 1

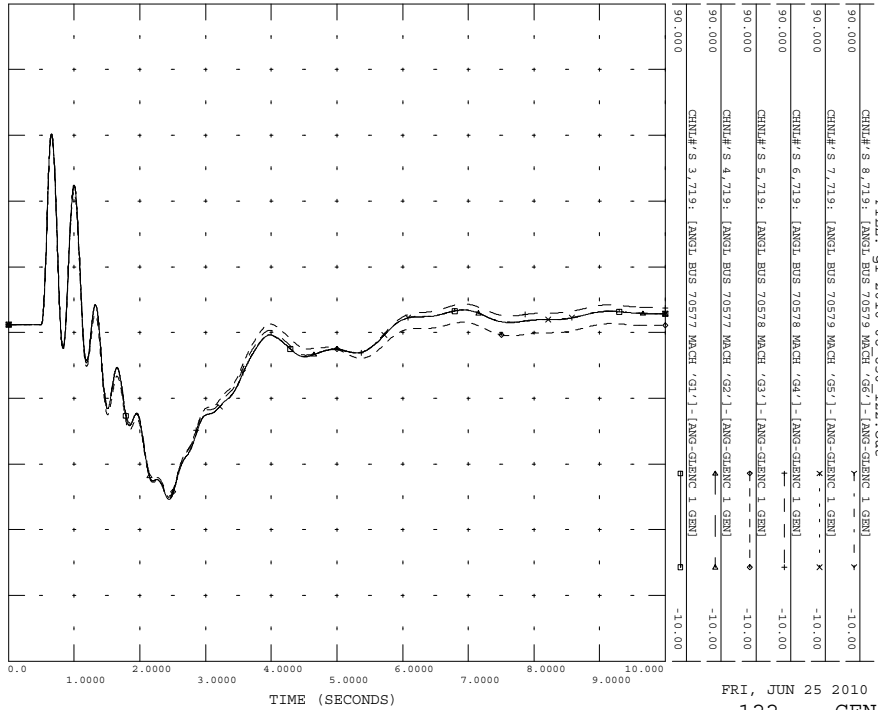
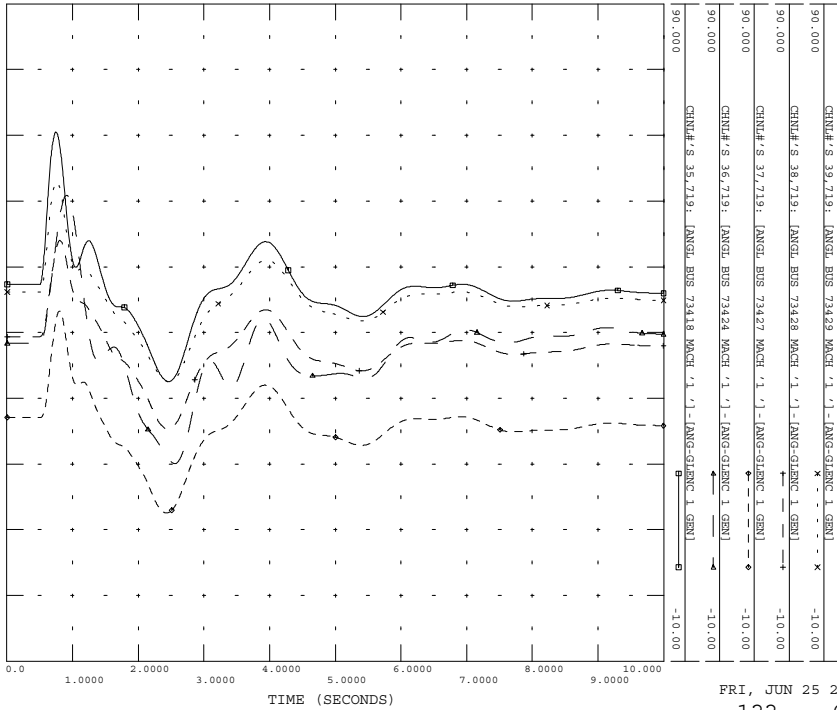
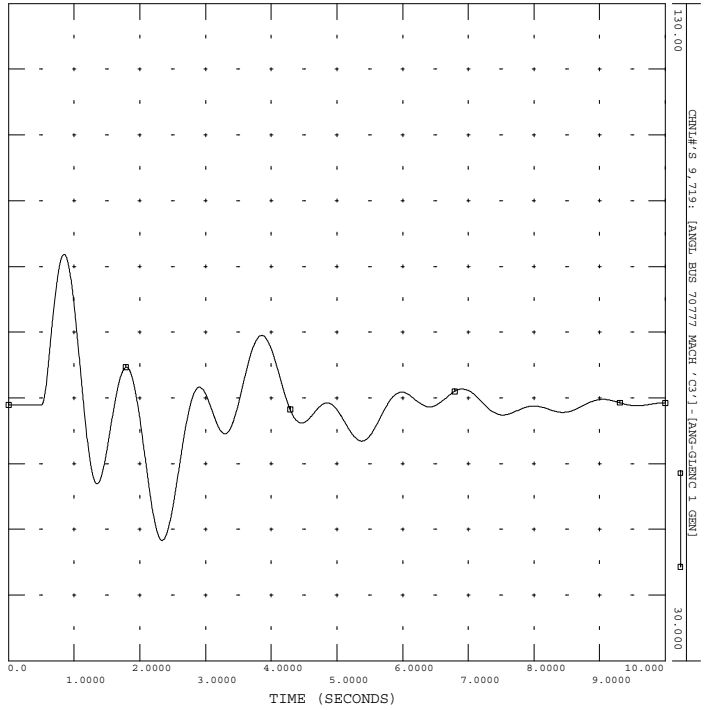
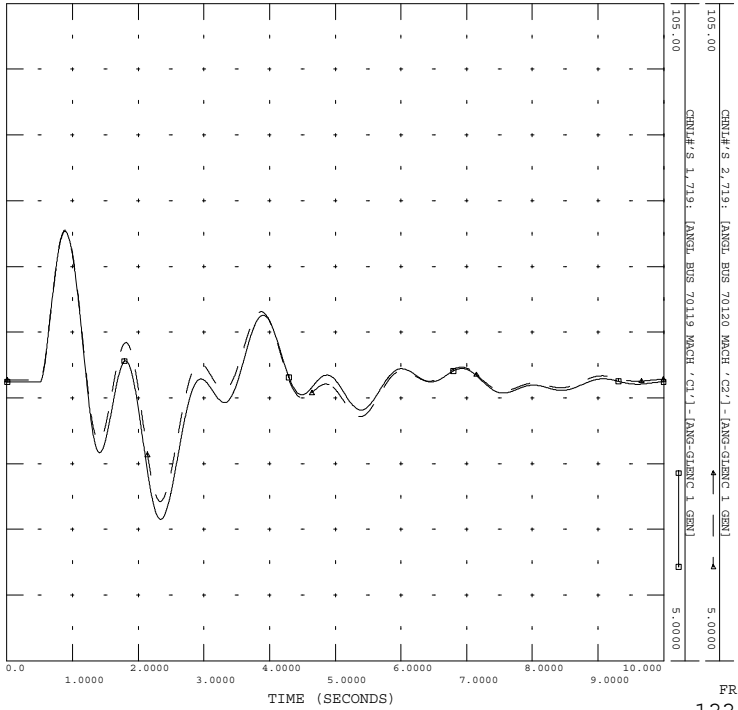
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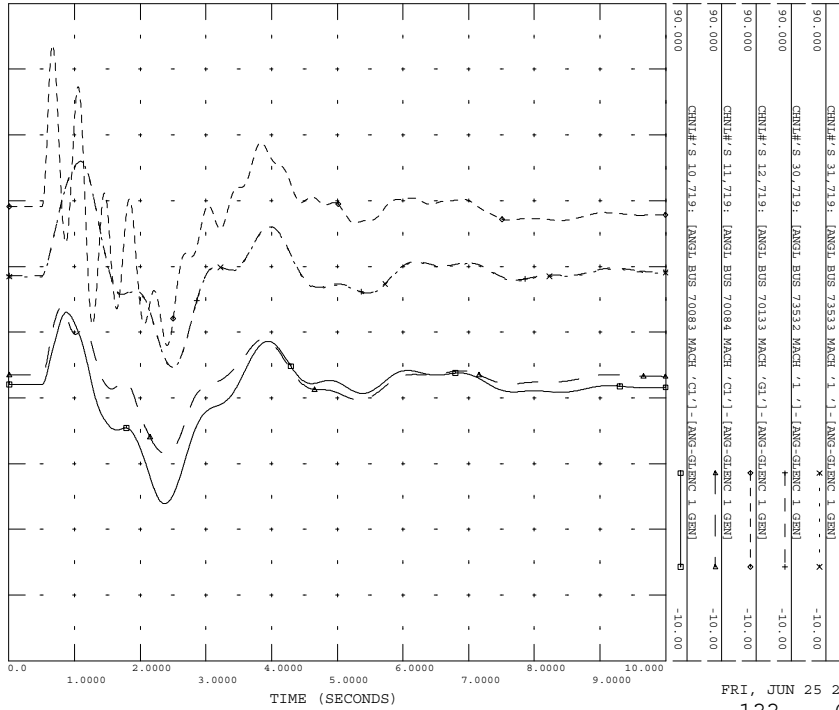
GI-2010-08_850_121 --> JUN 10
3PH FLT MID-COM 1

FILE: gi-2010-08_850_121.out



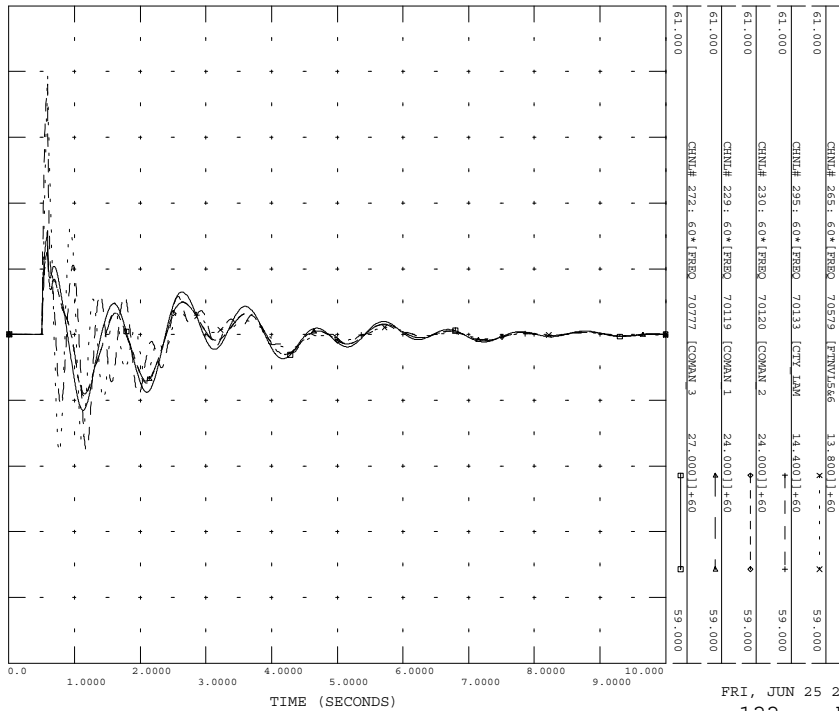


FILE: gi-2010-08_850_122.out



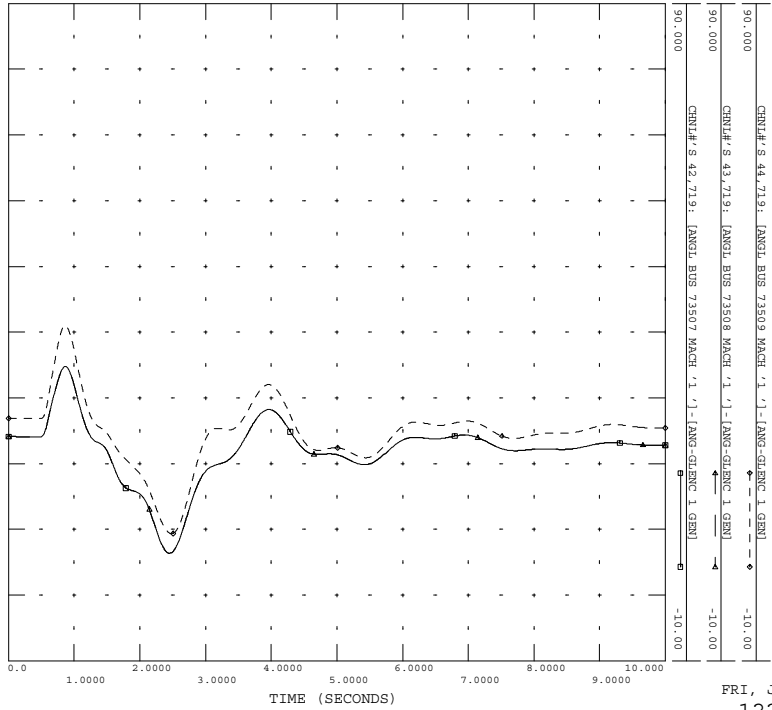
FRI, JUN 25 2010 16:14
122 - GEN ANG

FILE: gi-2010-08_850_122.out



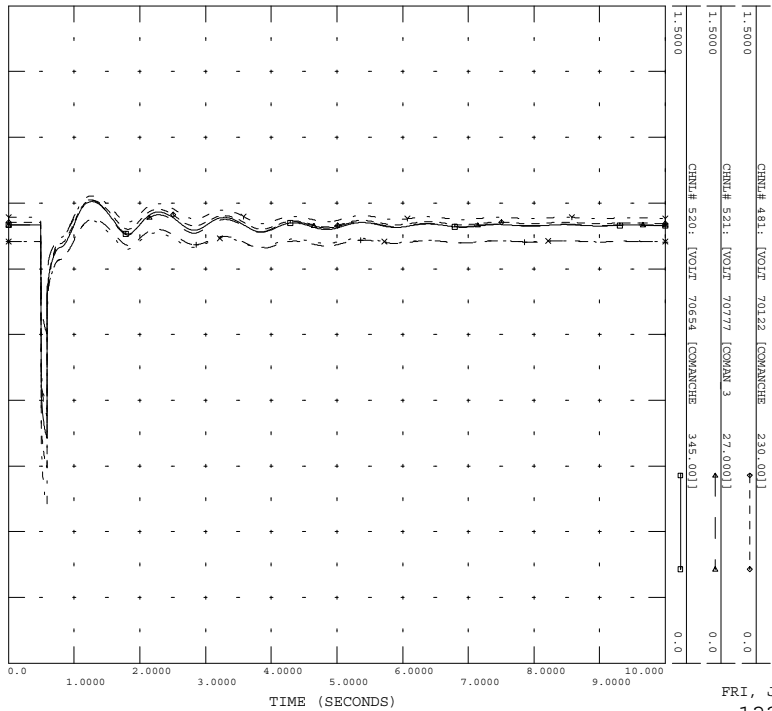
FRI, JUN 25 2010 16:14
122 - BUS FRQ

FILE: gi-2010-08_850_122.out

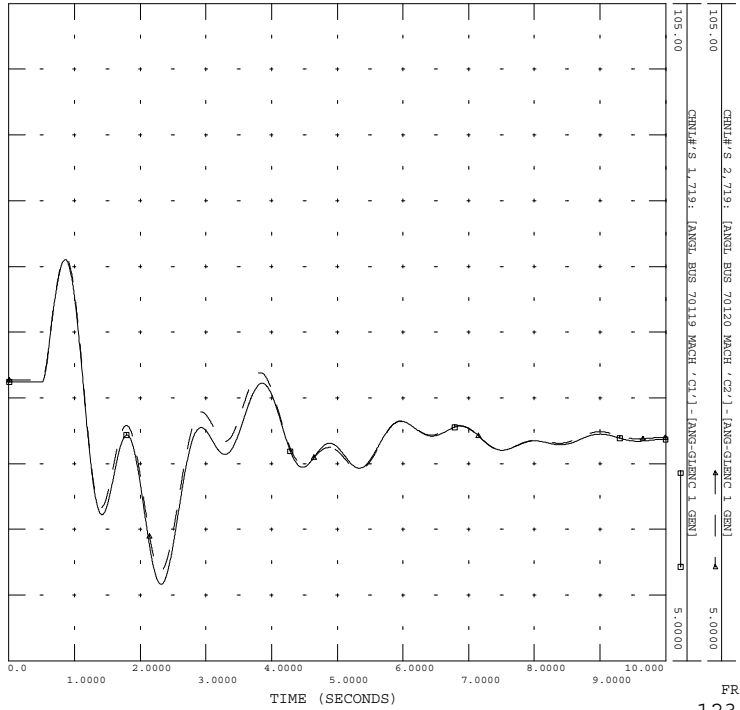


FRI, JUN 25 2010 16:14
122 - GEN ANG

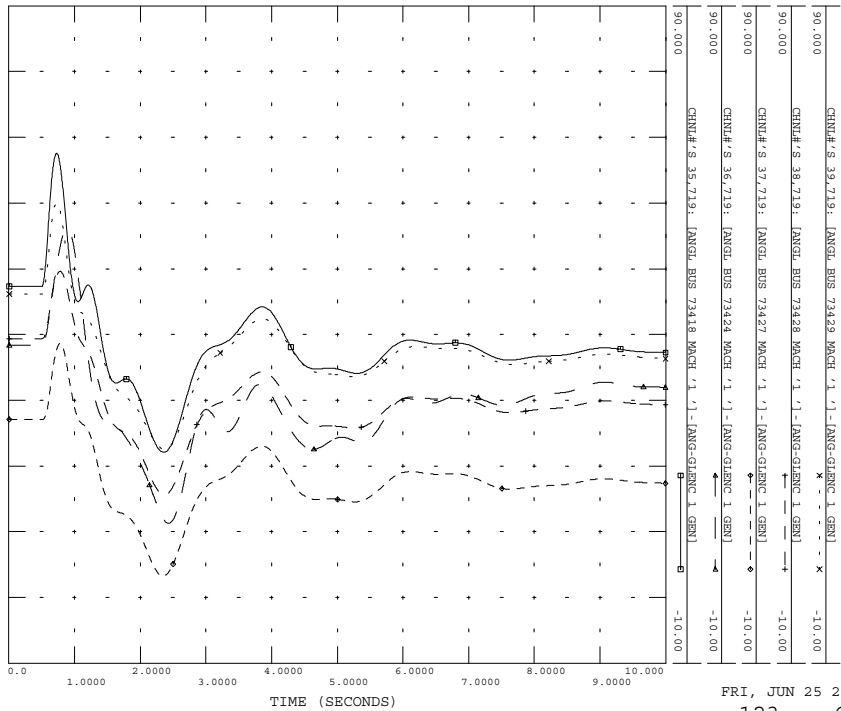
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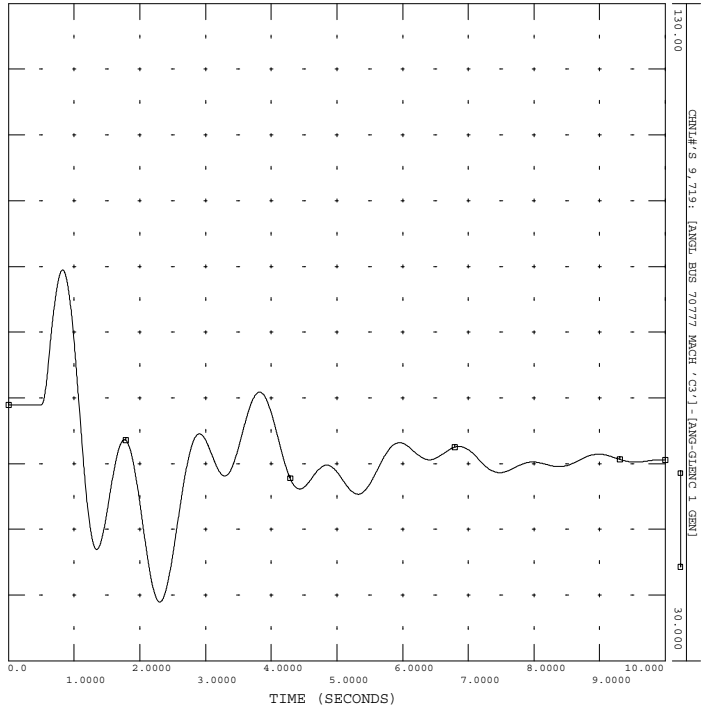
FRI, JUN 25 2010 16:14
122 - COM VLT



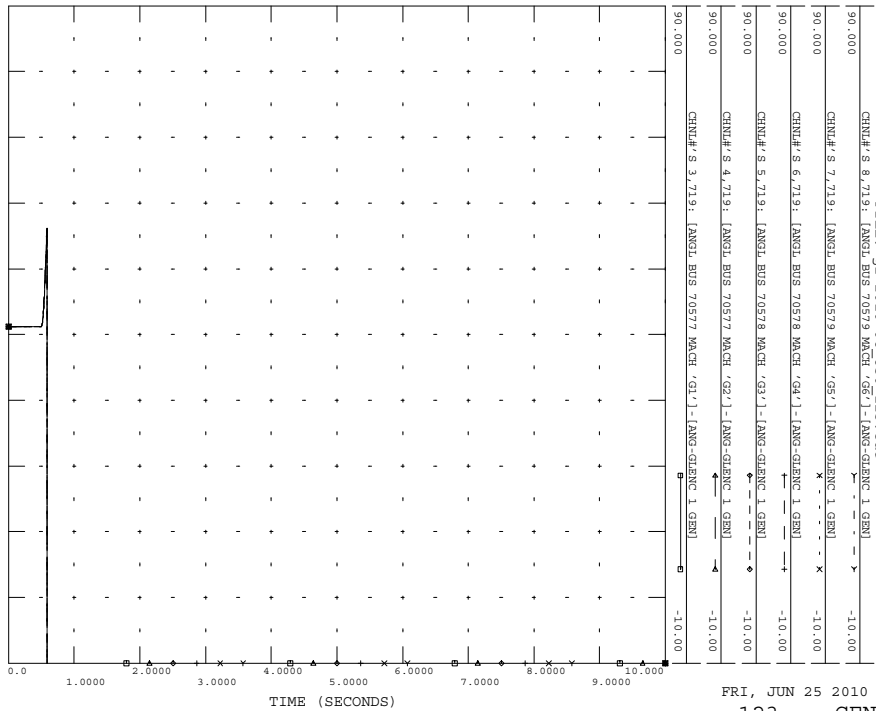
FRI, JUN 25 2010 16:14
123 - COM 12 ANG



FRI, JUN 25 2010 16:15
123 - GEN ANG

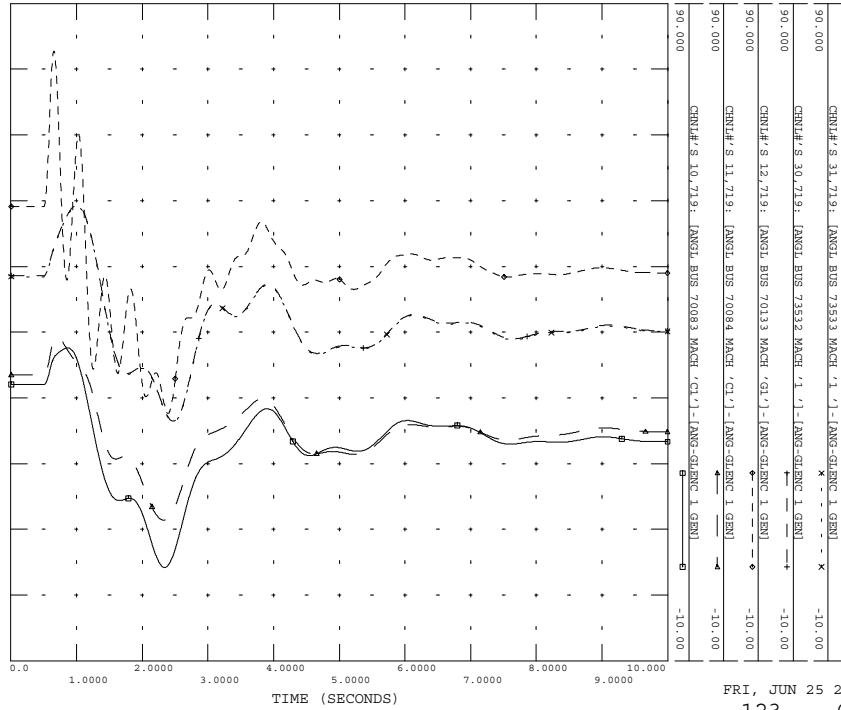


FRI, JUN 25 2010 16:14
123 - COM 3 ANG

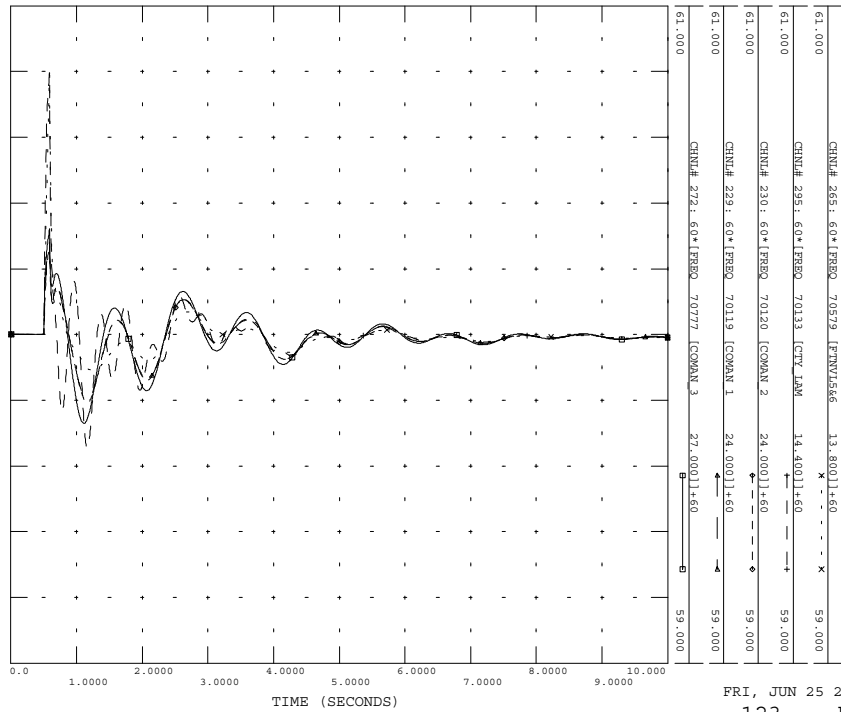


FRI, JUN 25 2010 16:15
123 - GEN ANG

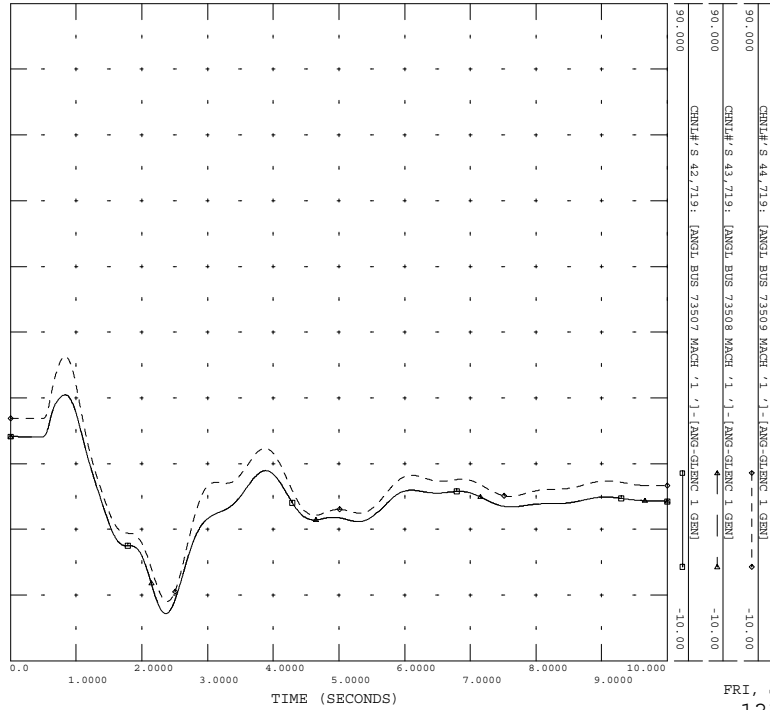
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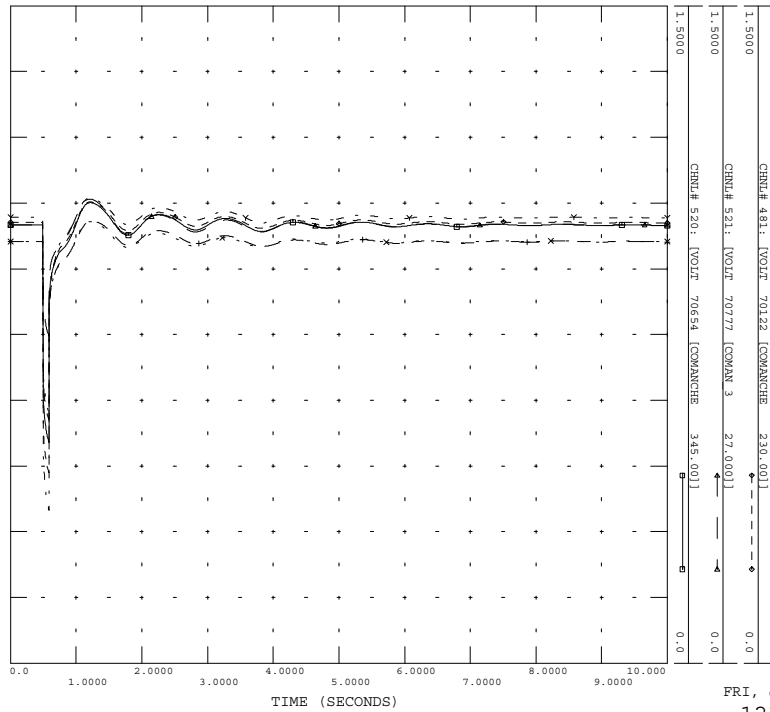
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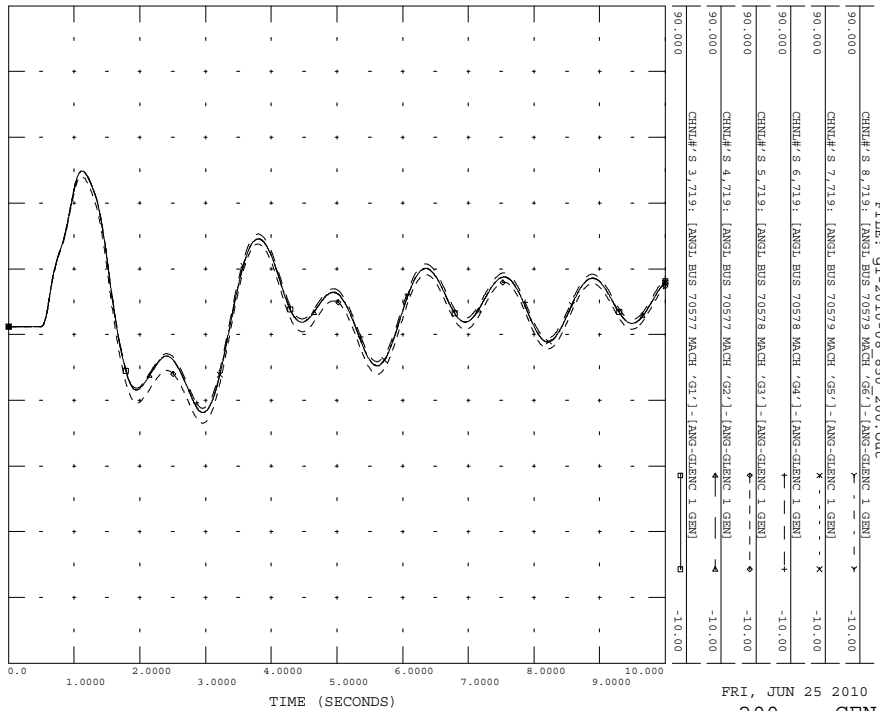
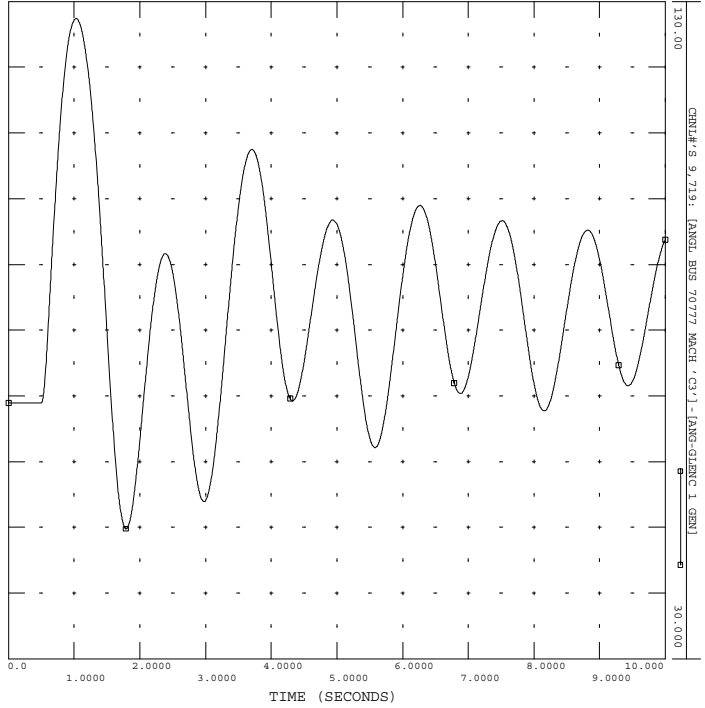
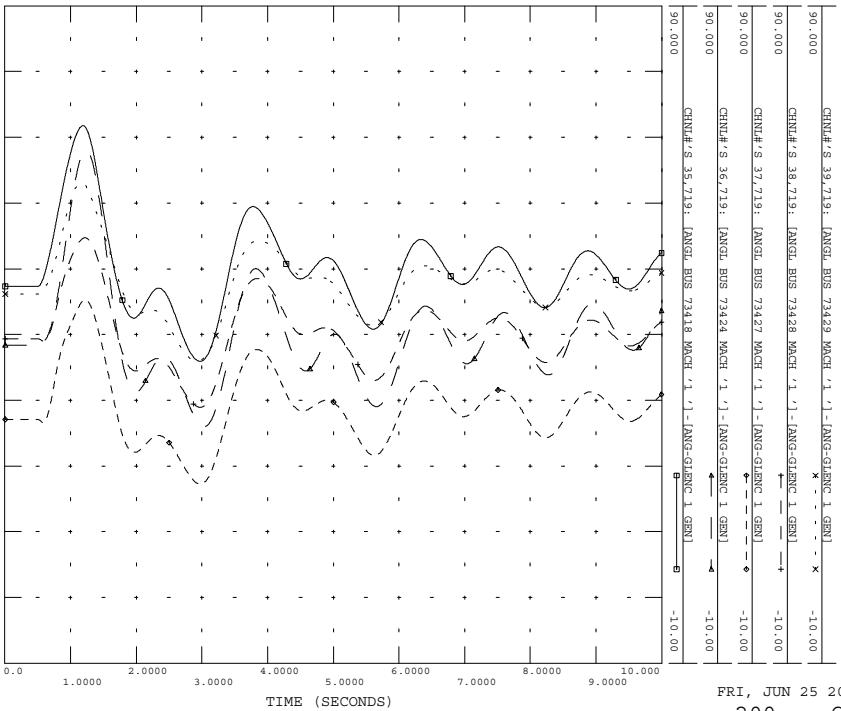
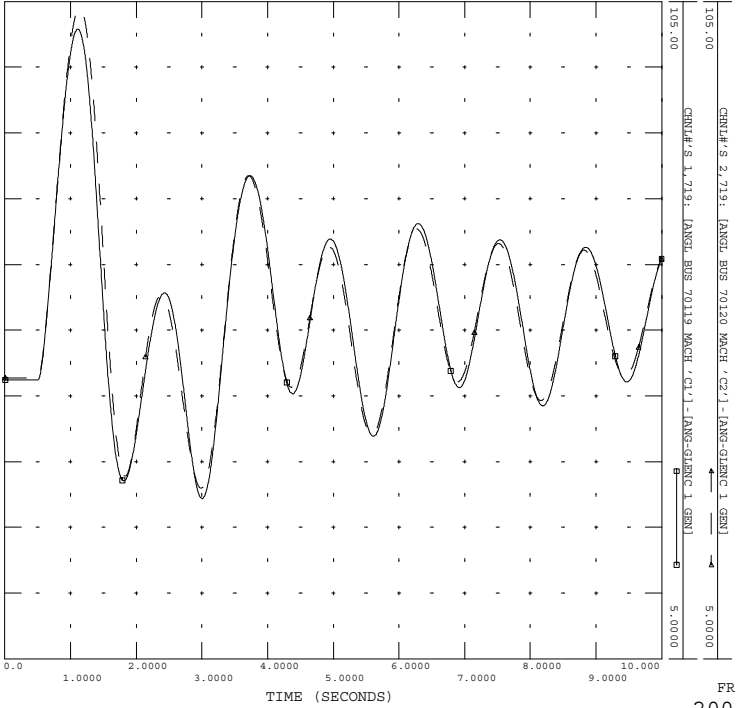


FILE: gi-2010-08_850_123.out



FILE: gi-2010-08_850_123.out

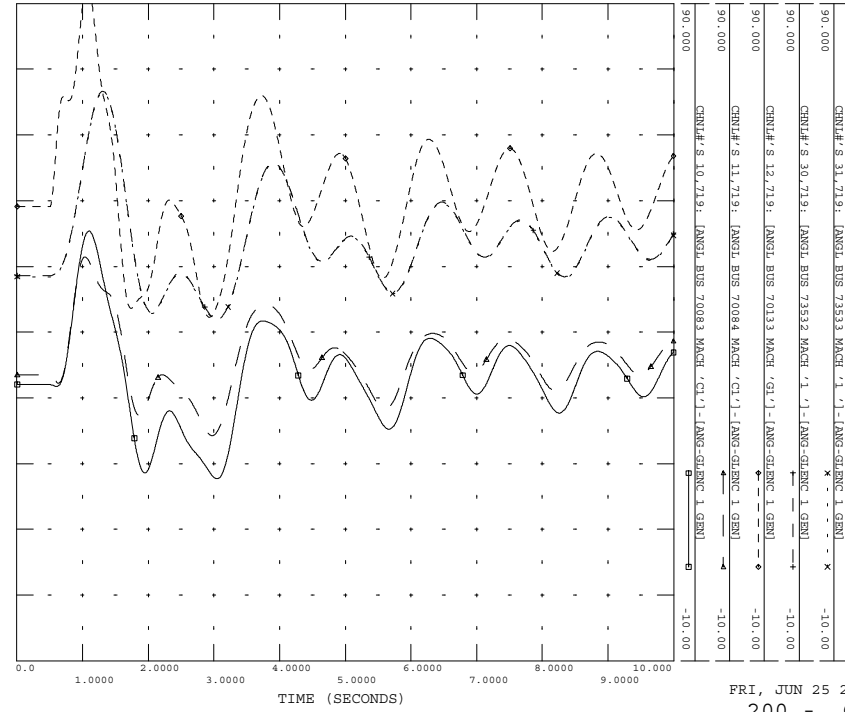






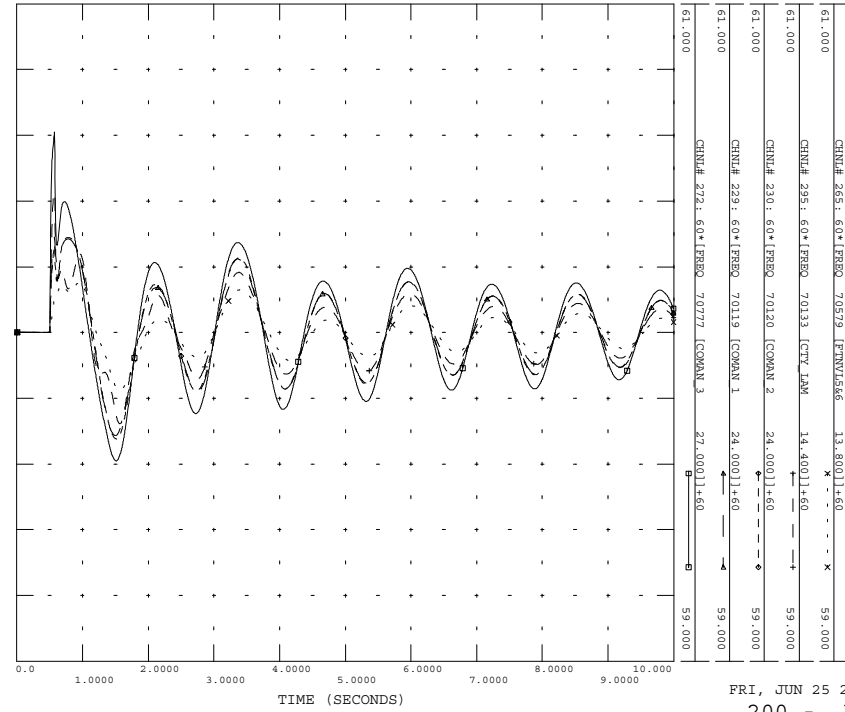
GI-2010-08_850_200 --> JUN 10
3PH FLT COM-DP 1&2

FILE: gi-2010-08_850_200.out



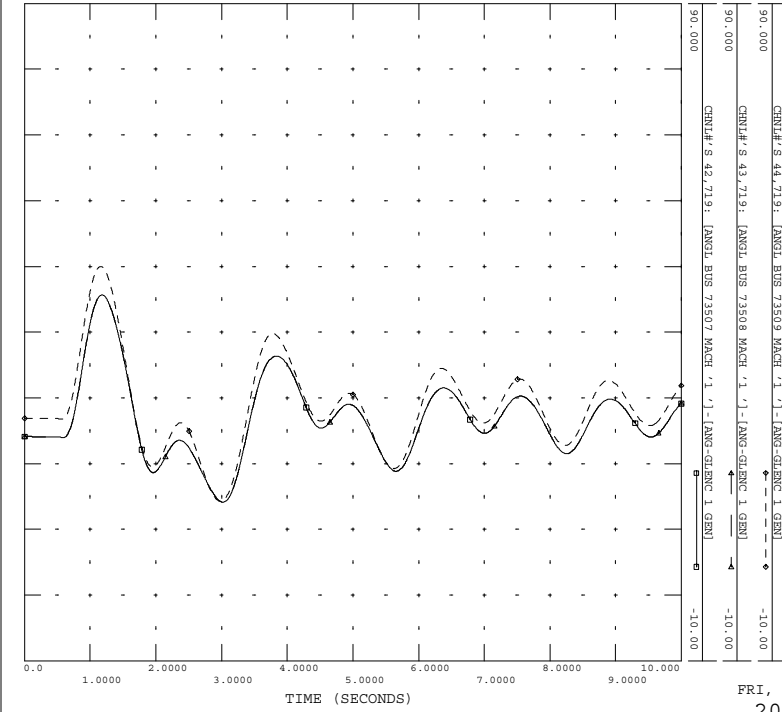
GI-2010-08_850_200 --> JUN 10
3PH FLT COM-DP 1&2

FILE: gi-2010-08_850_200.out



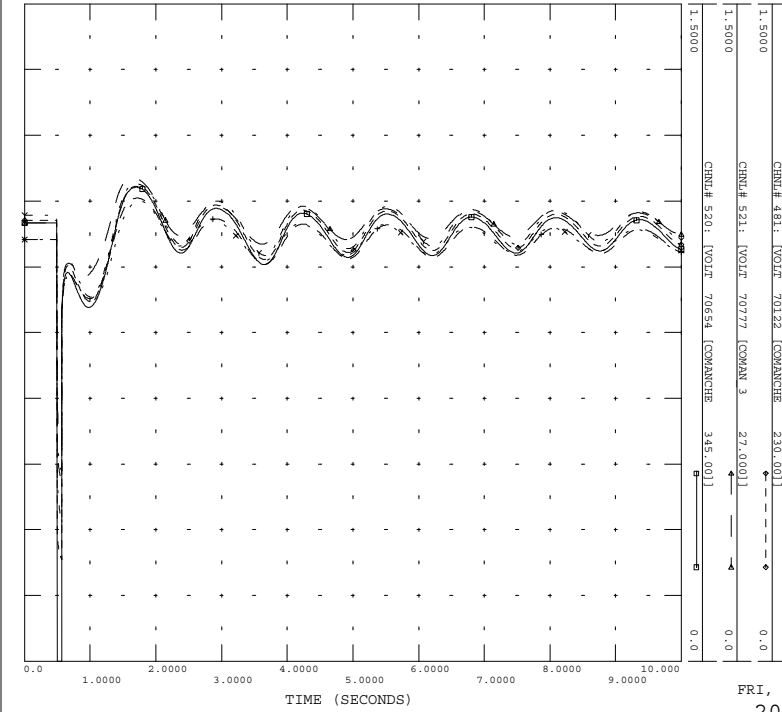
GI-2010-08_850_200 --> JUN 10
3PH FLT COM-DP 1&2

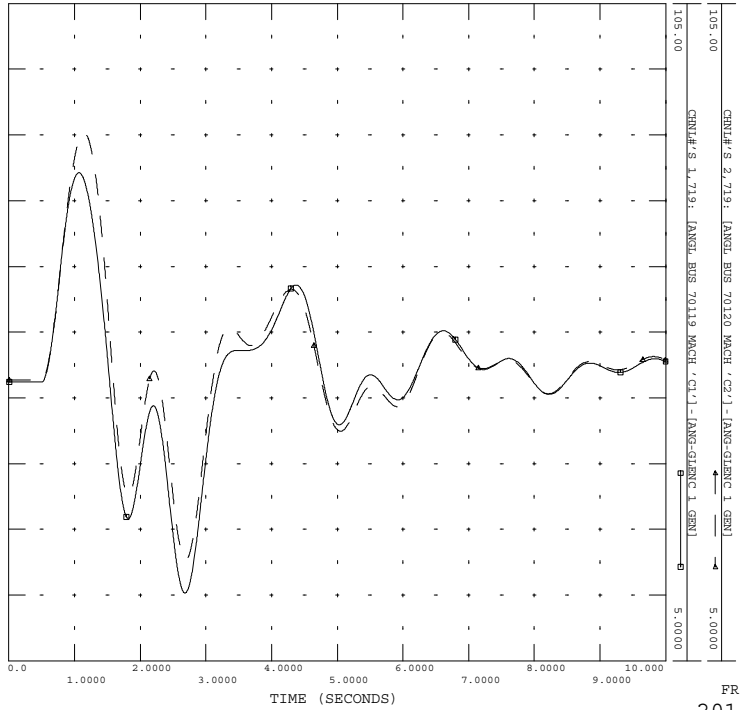
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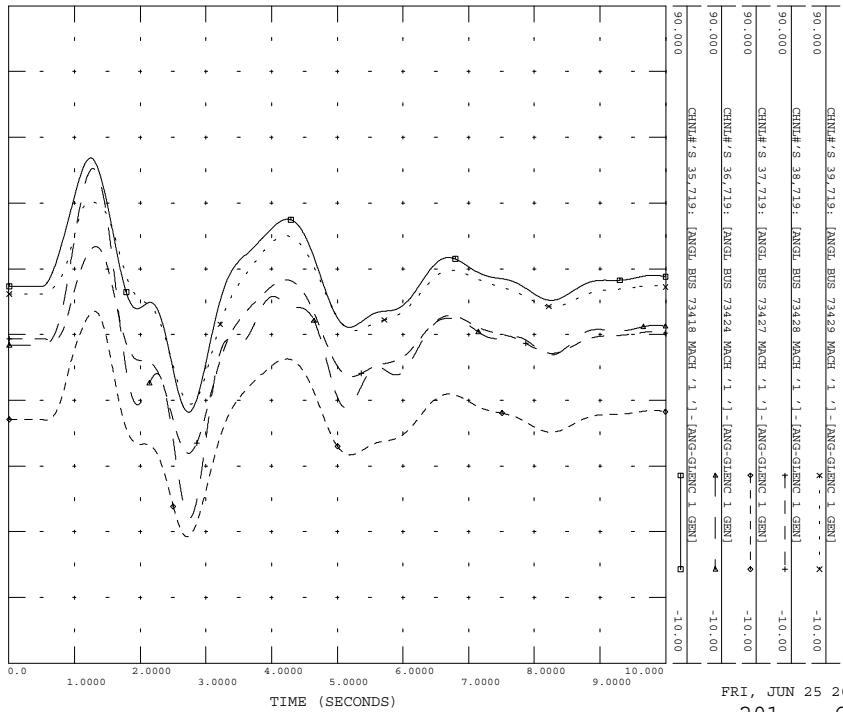
GI-2010-08_850_200 --> JUN 10
3PH FLT COM-DP 1&2

FILE: gi-2010-08_850_200.out

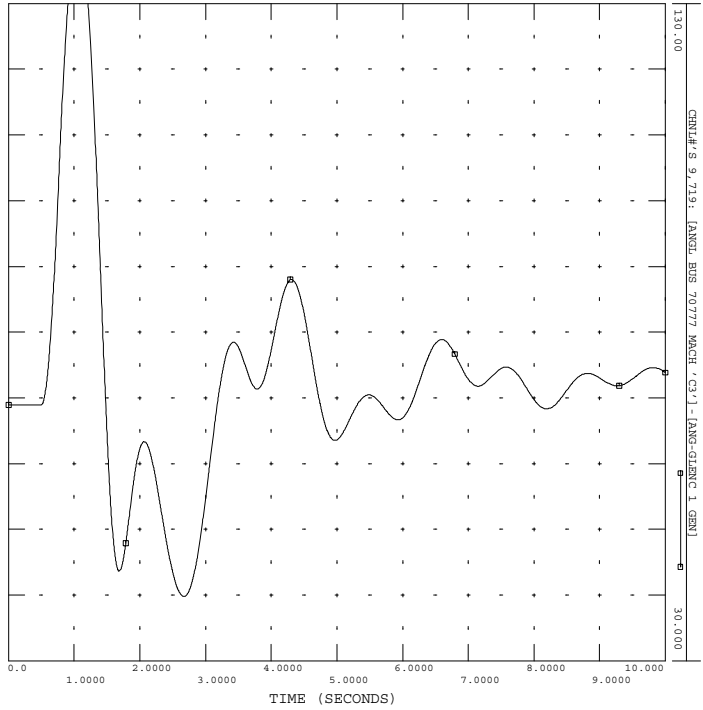




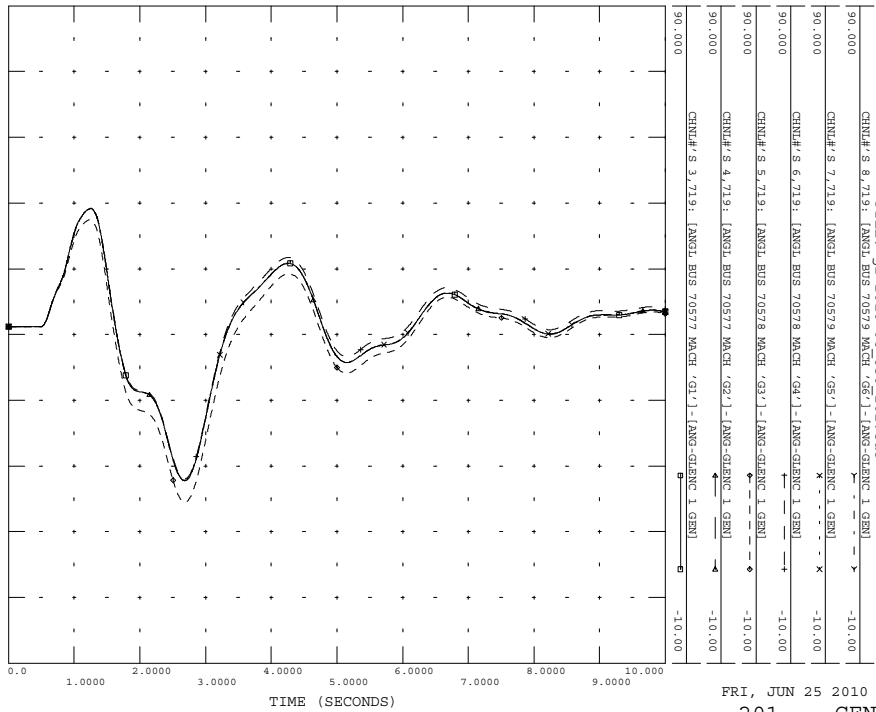
FRI, JUN 25 2010 16:15
201 - COM 12 ANG



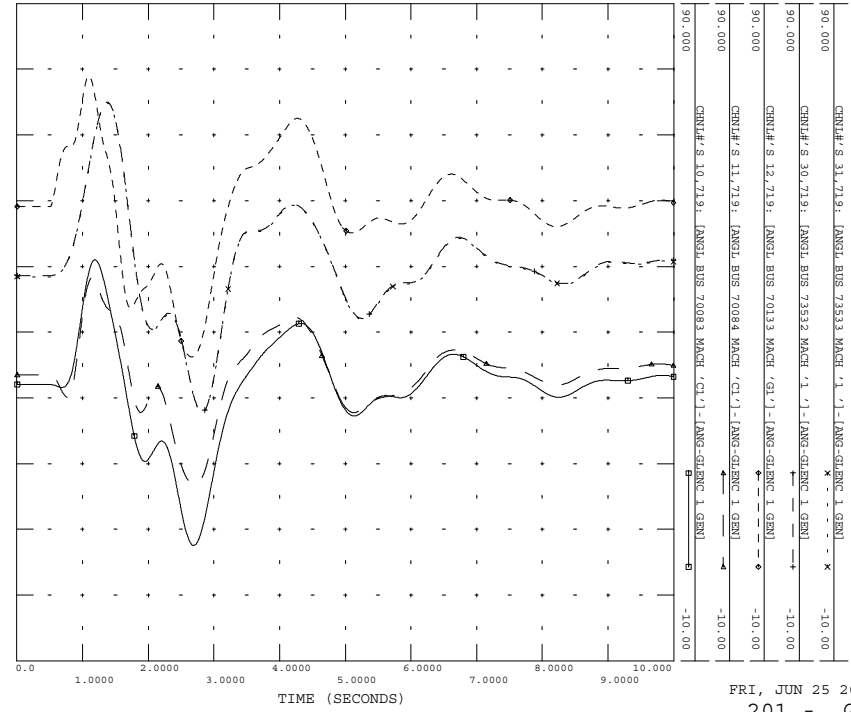
FRI, JUN 25 2010 16:15
201 - GEN ANG



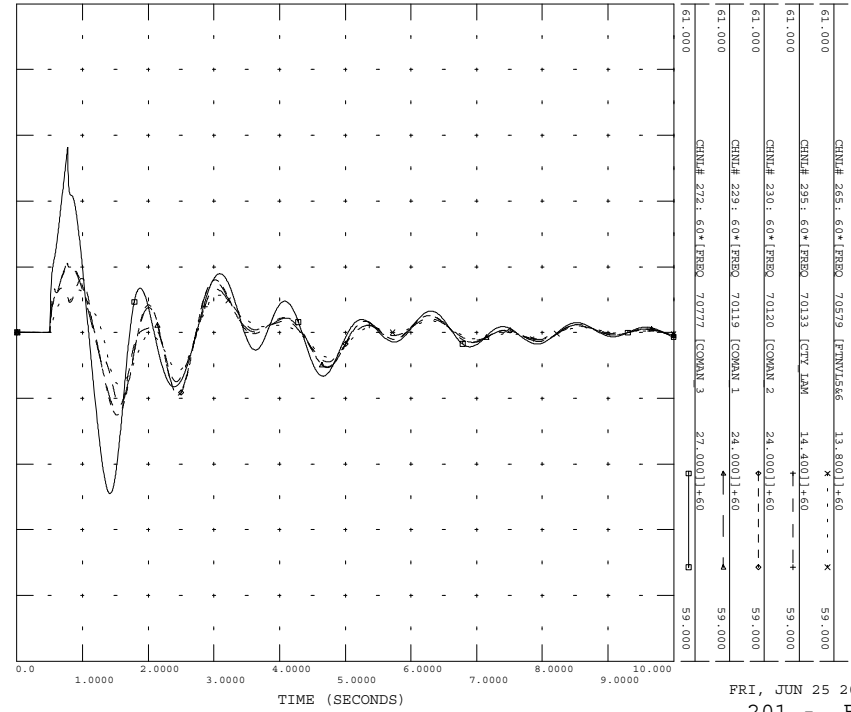
FRI, JUN 25 2010 16:15
201 - COM 3 ANG



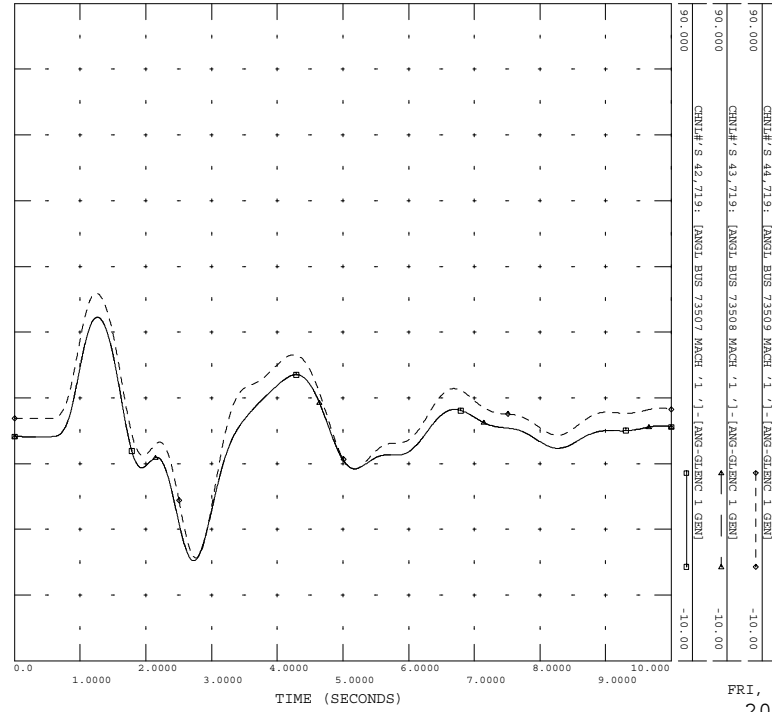
FRI, JUN 25 2010 16:15
201 - GEN ANG



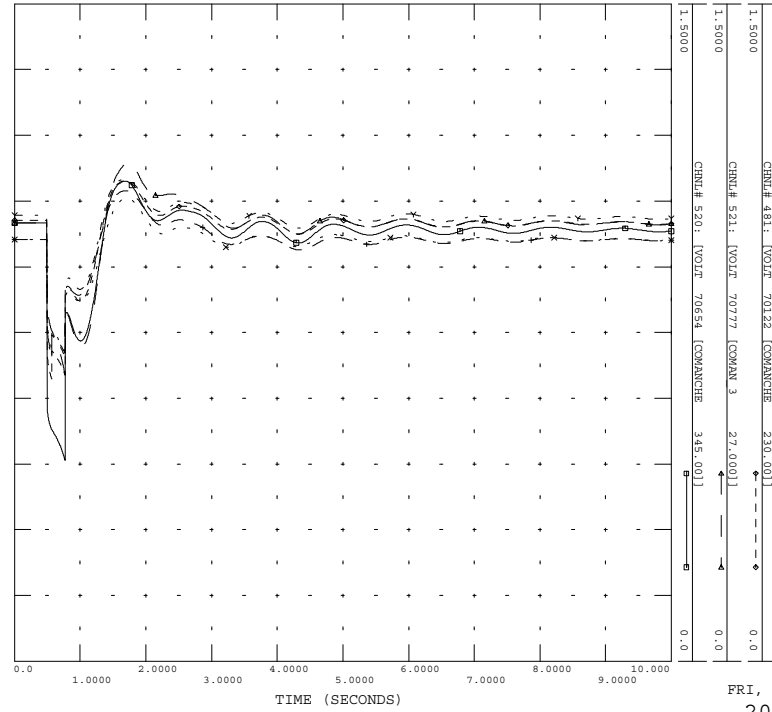
FRI, JUN 25 2010 16:15
201 - GEN ANG



FRI, JUN 25 2010 16:15
201 - BUS FRQ

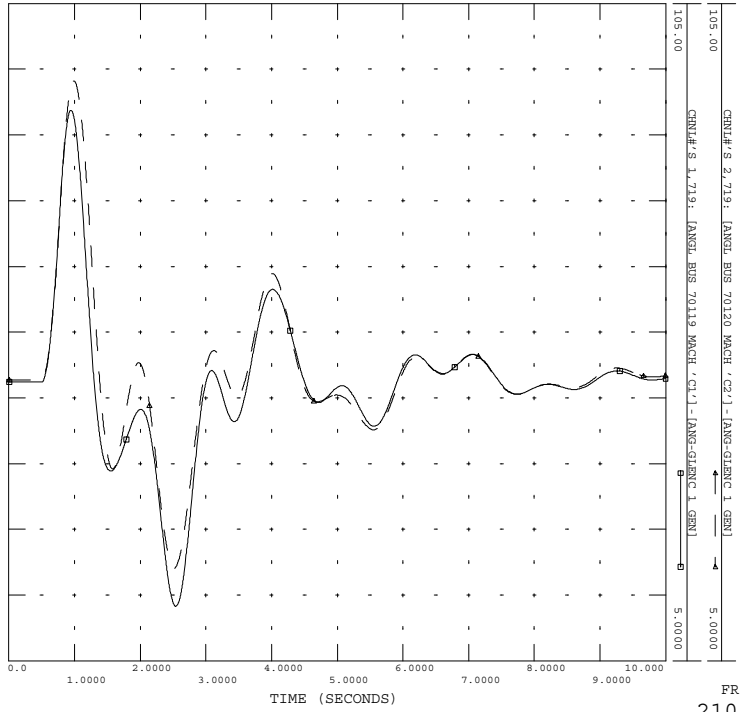


FRI, JUN 25 2010 16:15
201 - GEN ANG

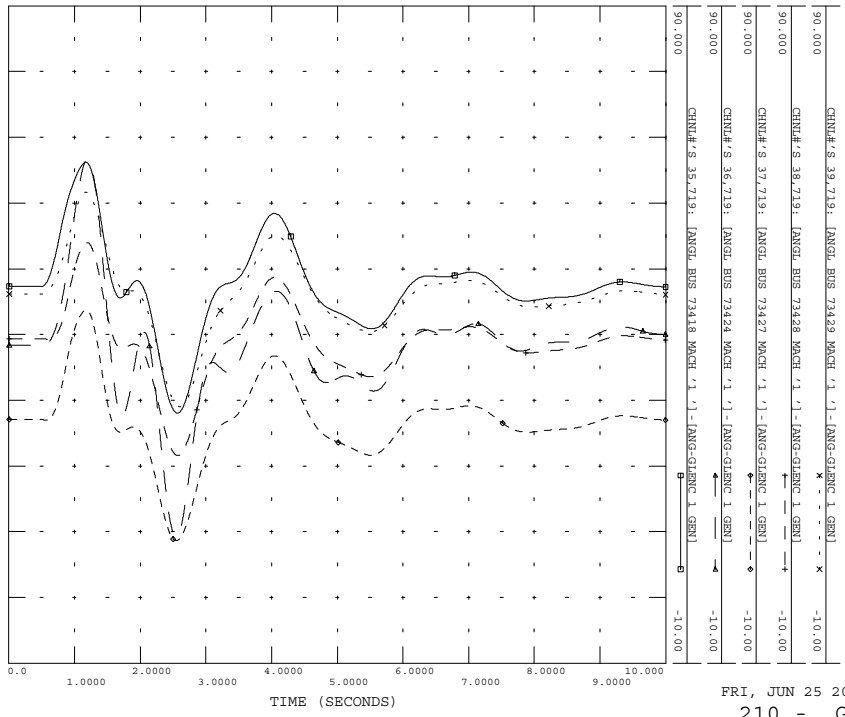


FRI, JUN 25 2010 16:15
201 - COM VLT

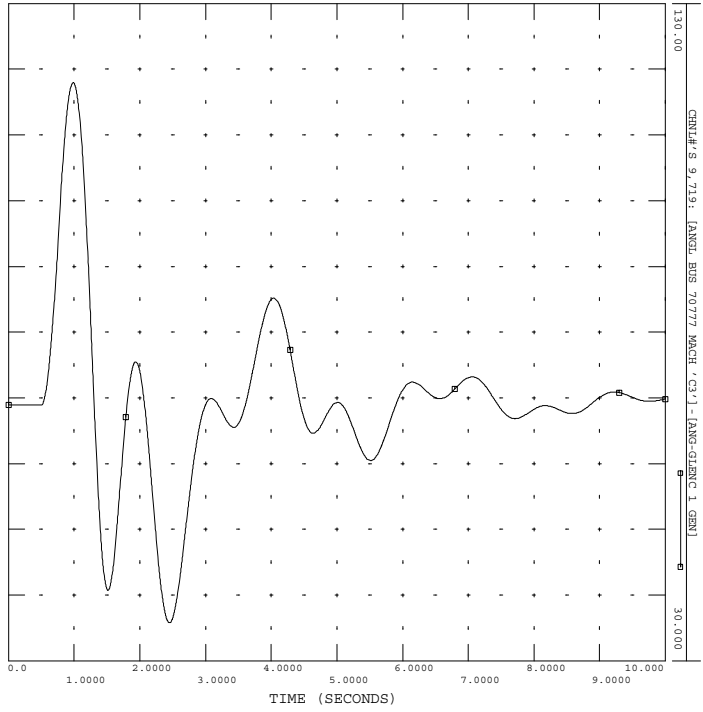
FILE: gi-2010-08_850_210.out



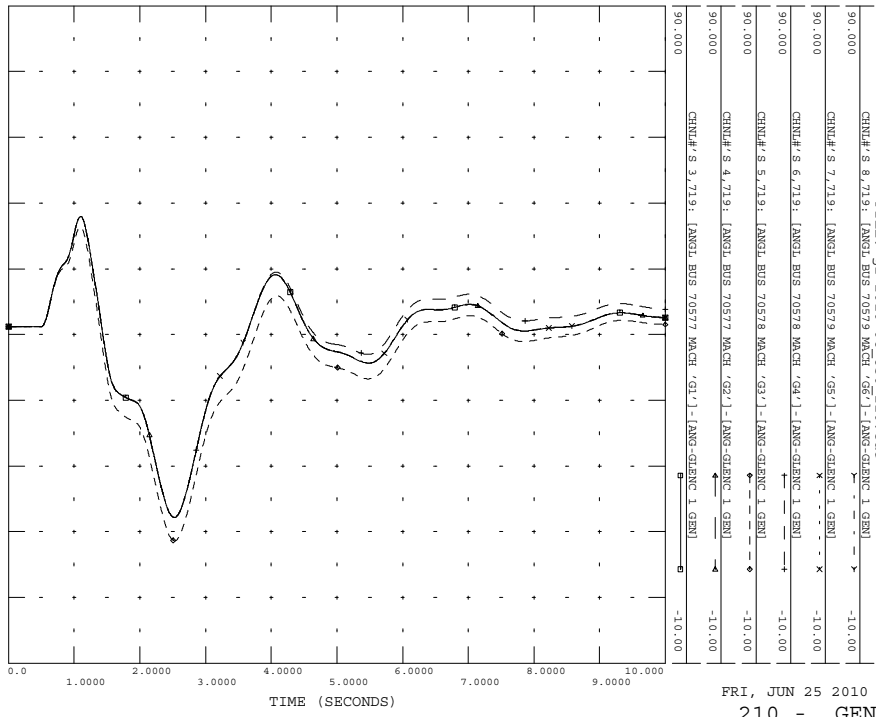
FILE: gi-2010-08_850_210.out

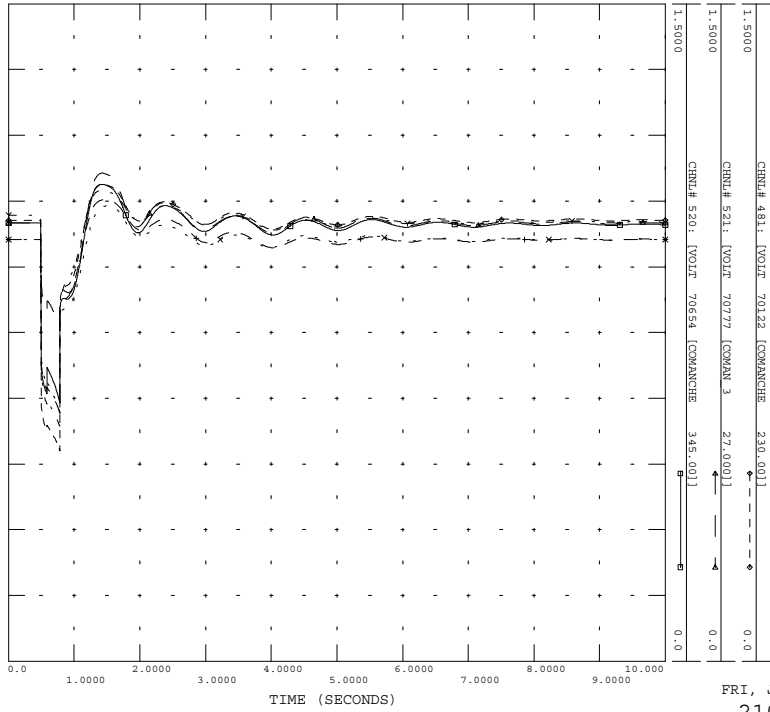
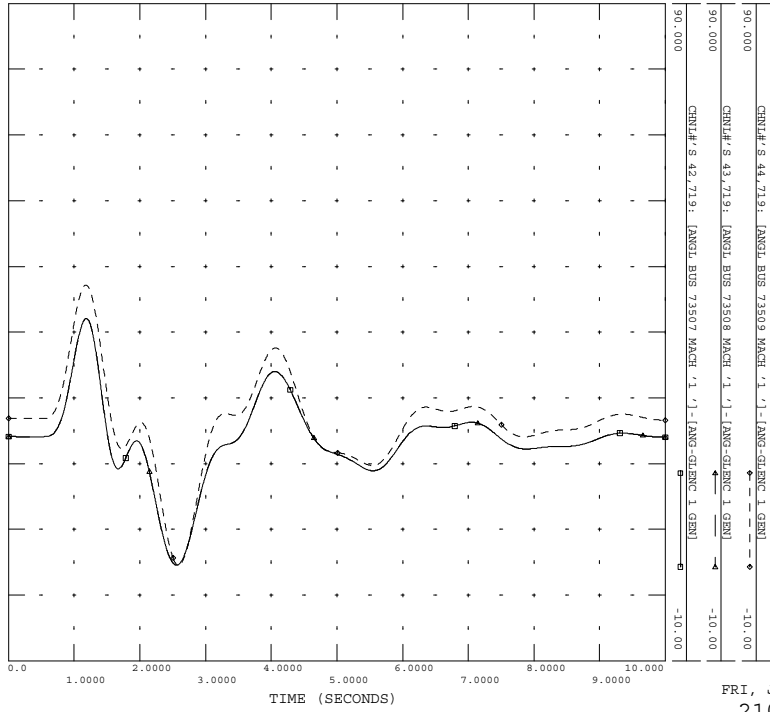
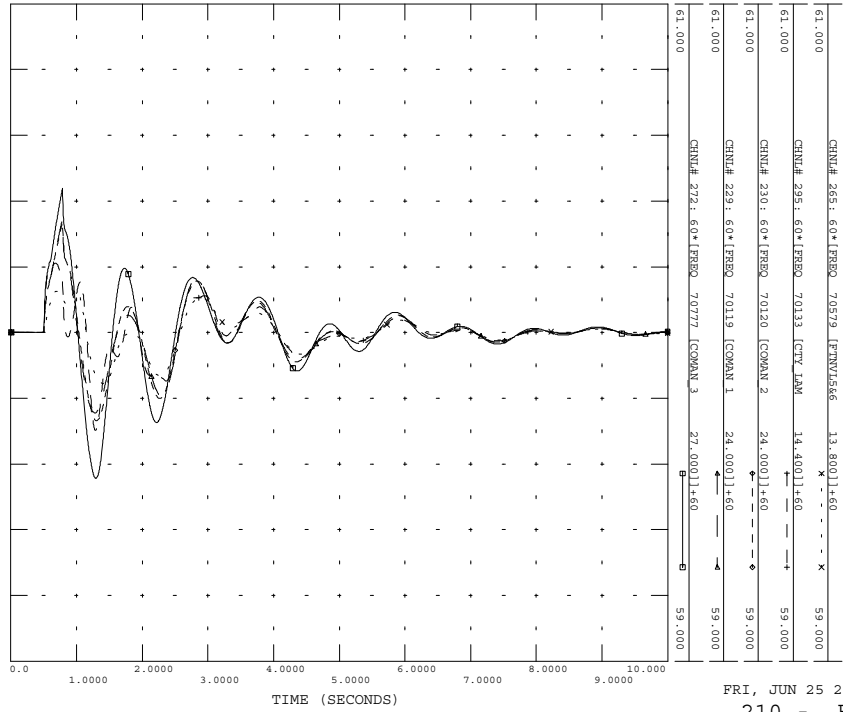
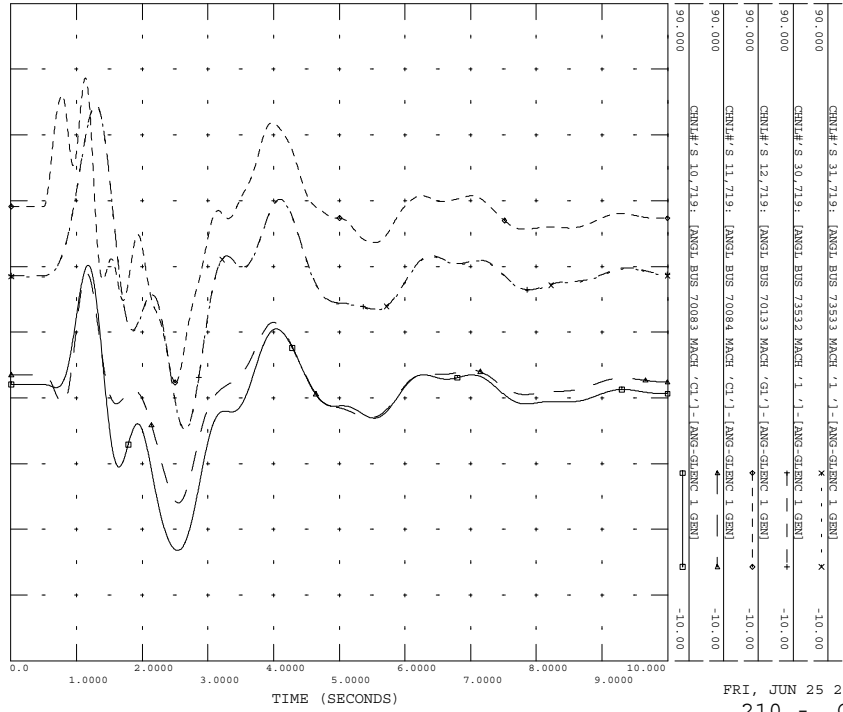


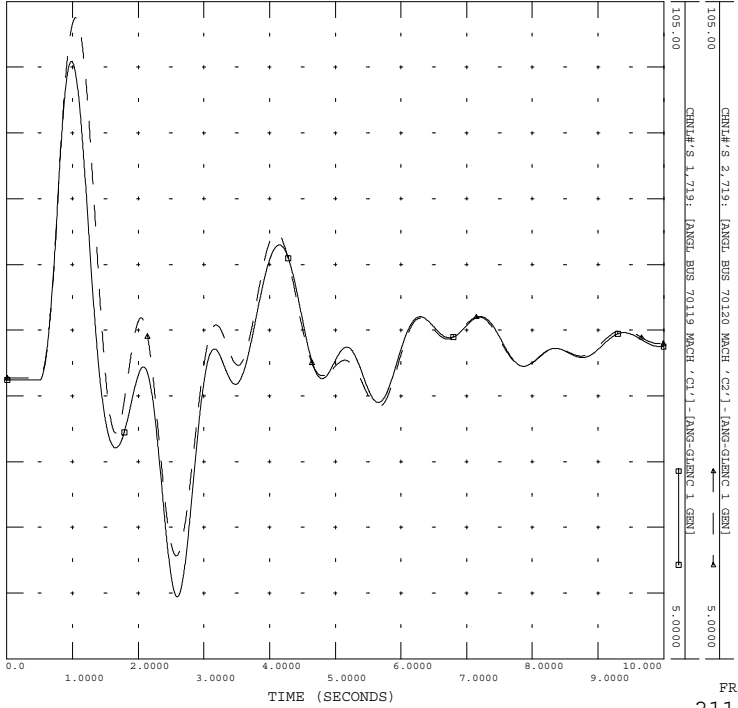
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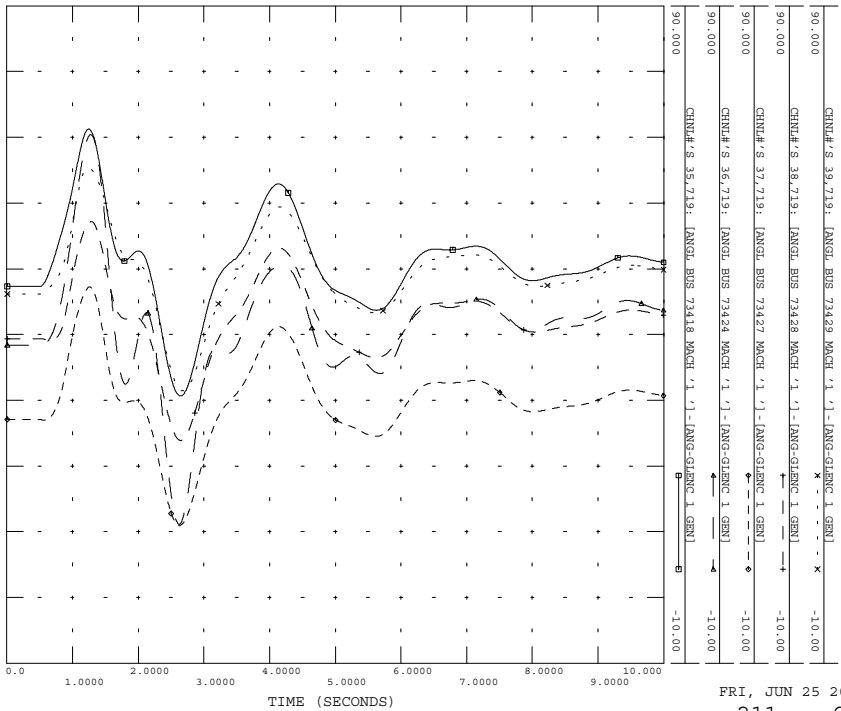
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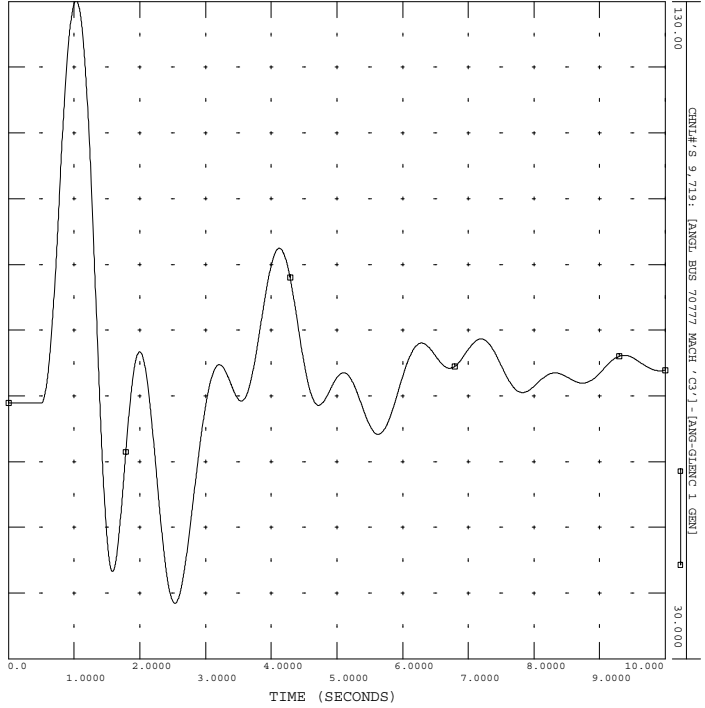




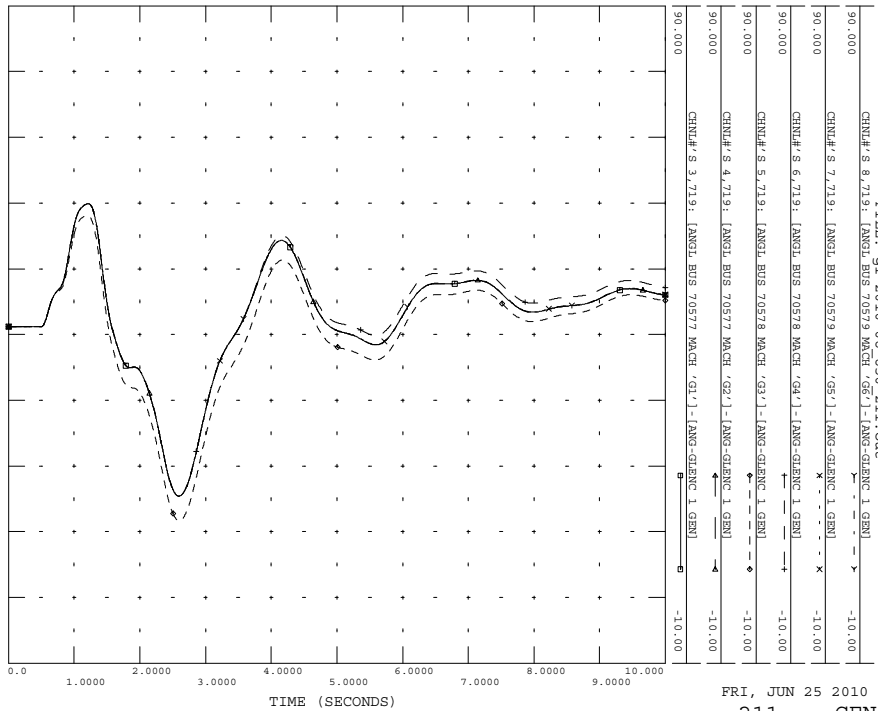
FRI, JUN 25 2010 16:15
 211 - COM 12 ANG



FRI, JUN 25 2010 16:15
 211 - GEN ANG

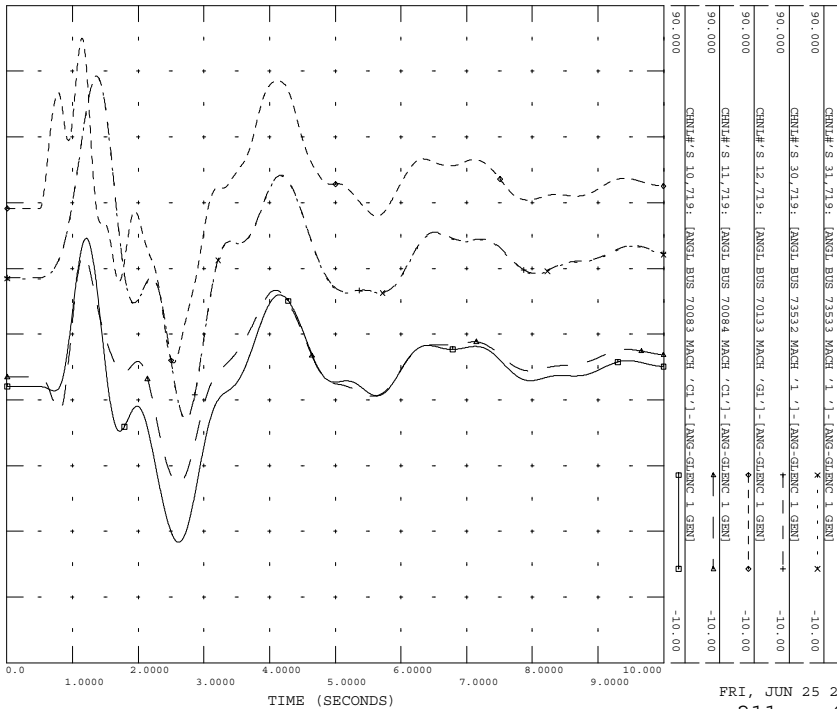


FRI, JUN 25 2010 16:15
 211 - COM 3 ANG

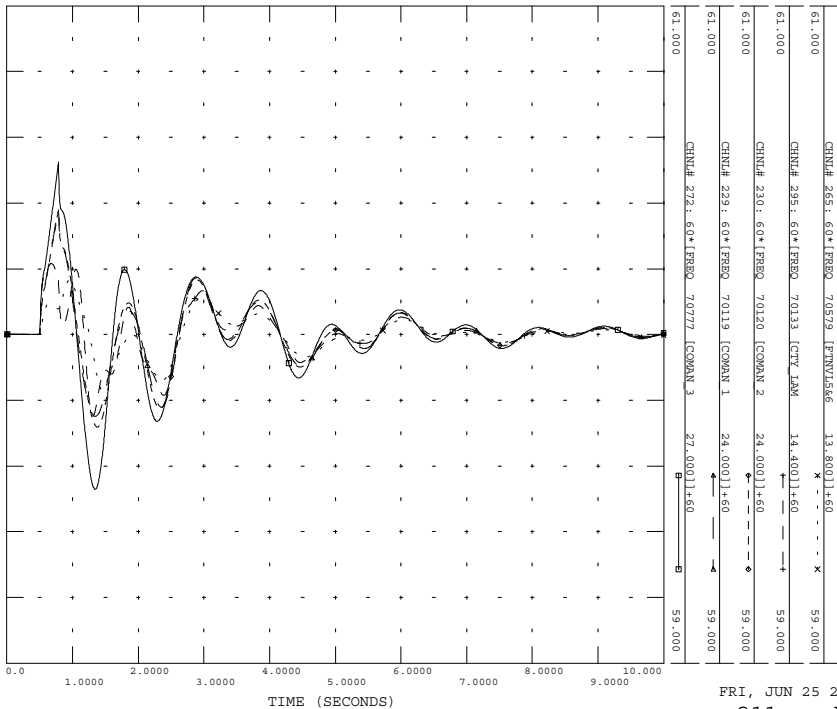


FRI, JUN 25 2010 16:15
 211 - GEN ANG

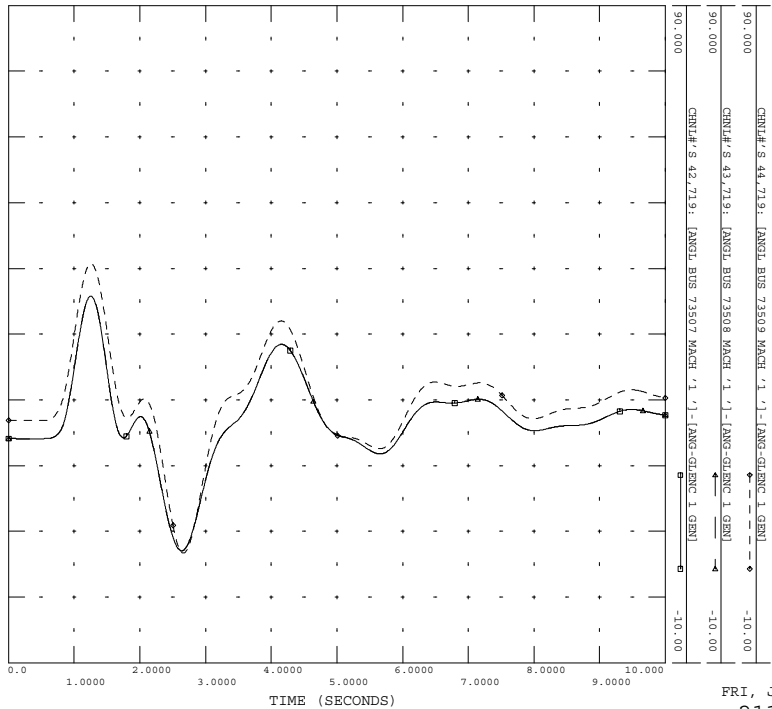
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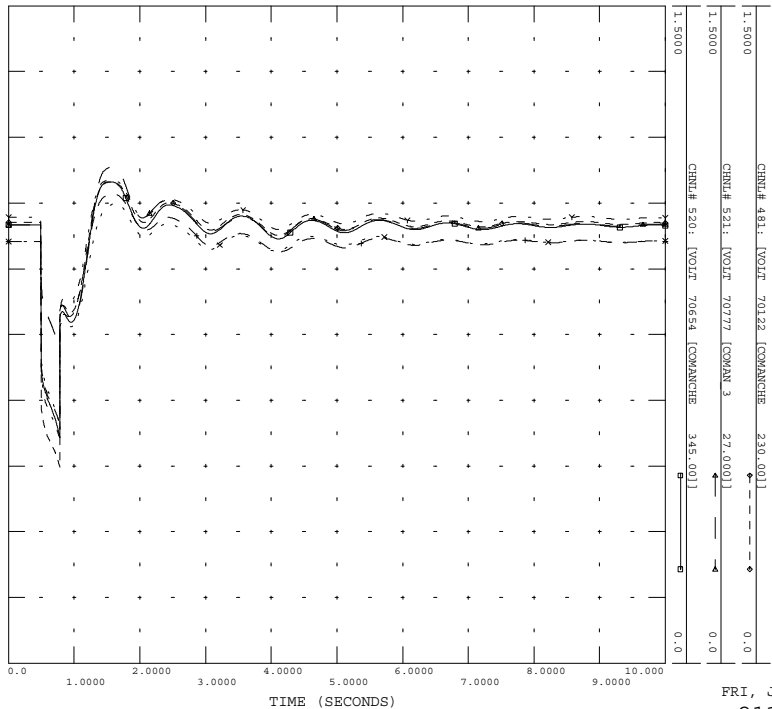
FILE: gi-2010-08_850_211.out



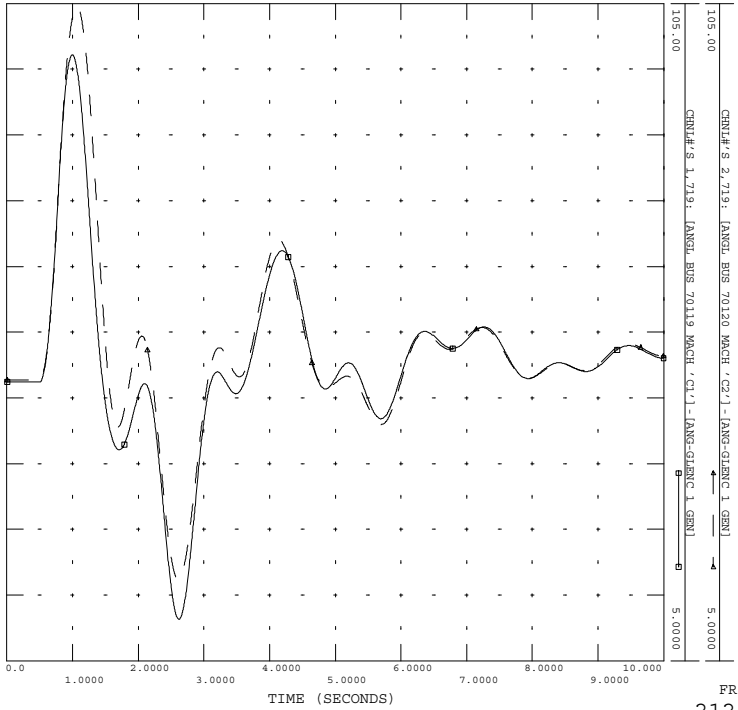
FILE: gi-2010-08_850_211.out



FILE: gi-2010-08_850_211.out

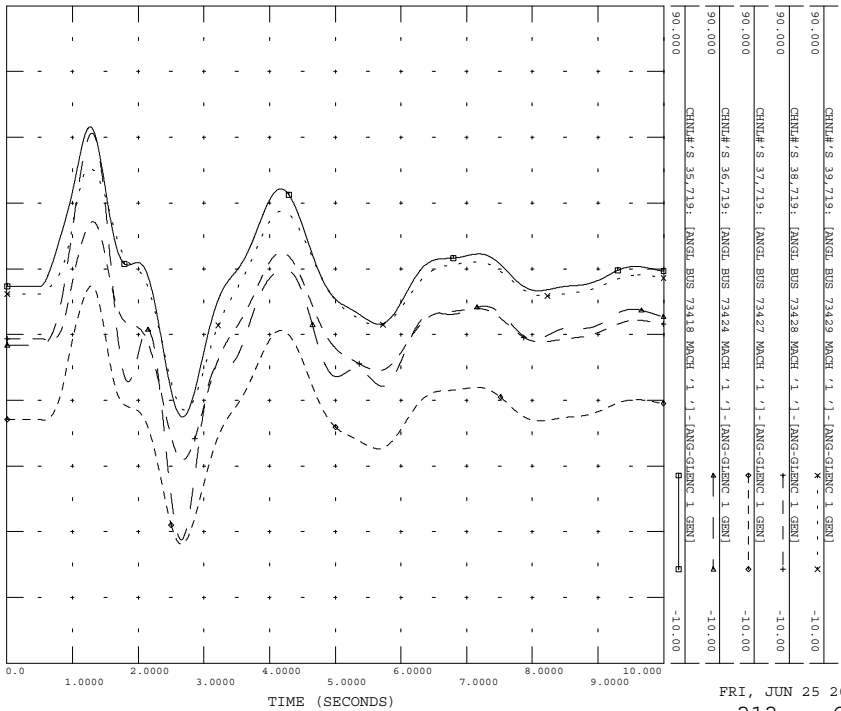


FILE: gi-2010-08_850_212.out



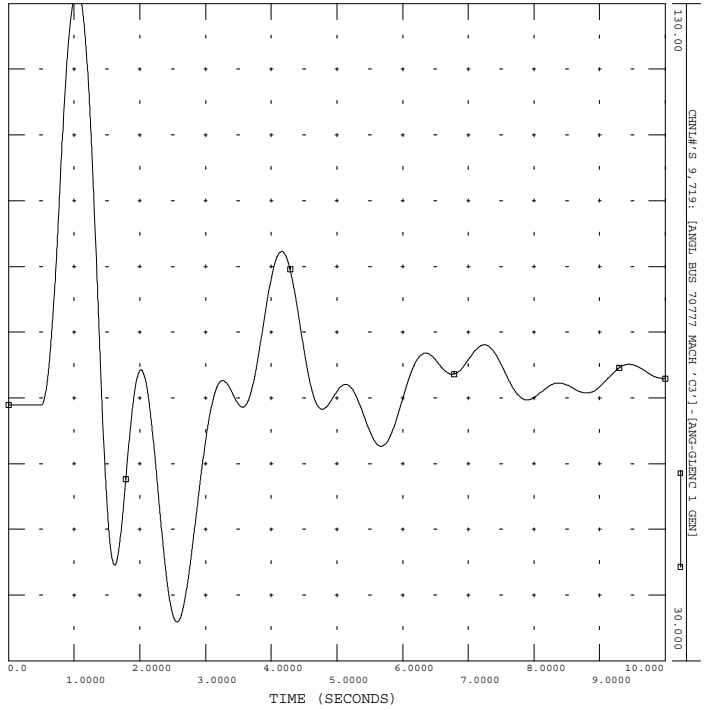
FRI, JUN 25 2010 16:15
212 - COM 12 ANG

FILE: gi-2010-08_850_212.out



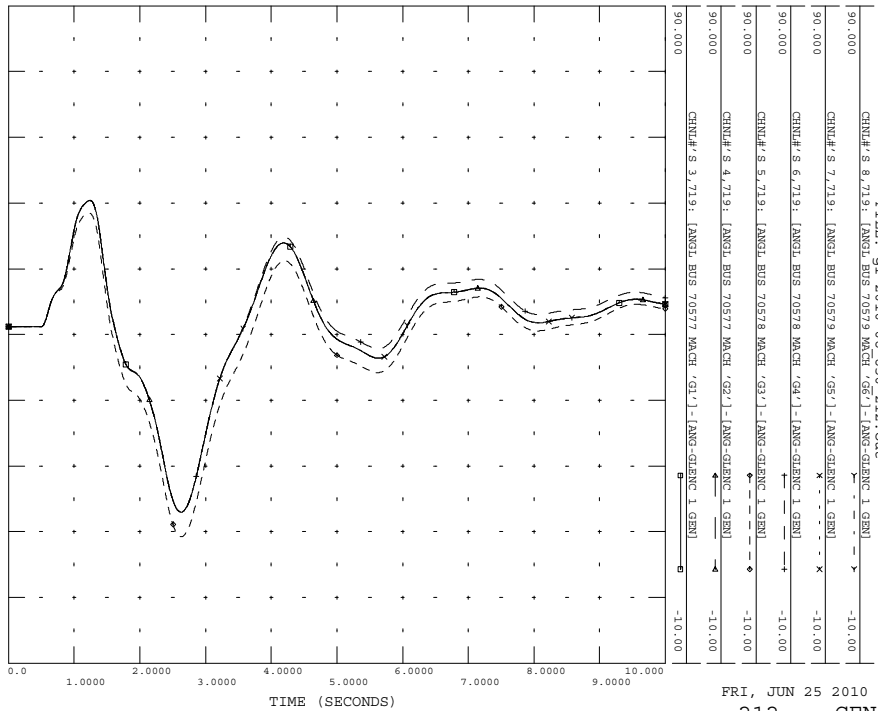
FRI, JUN 25 2010 16:15
212 - GEN ANG

FILE: gi-2010-08_850_212.out



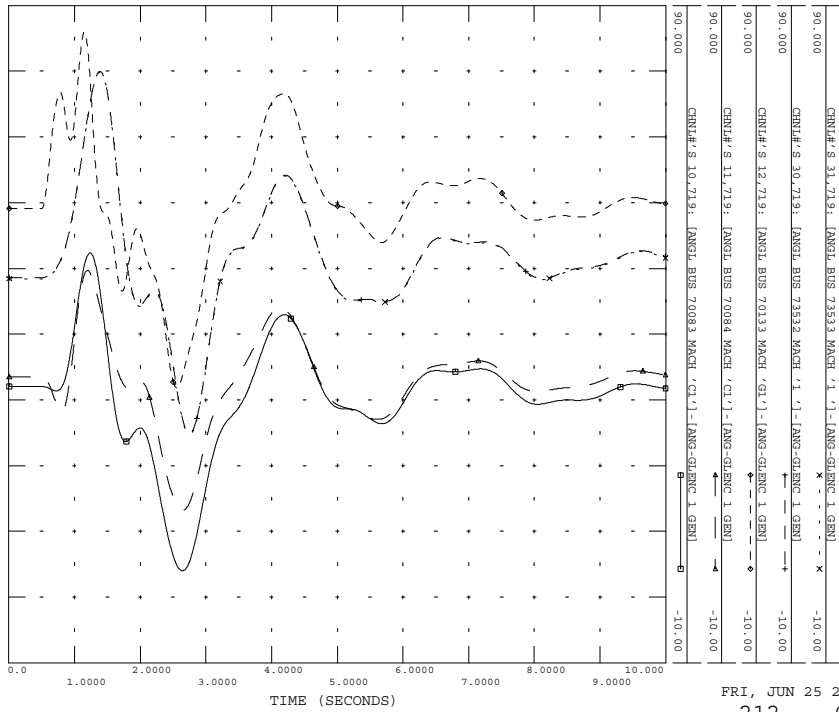
FRI, JUN 25 2010 16:15
212 - COM 3 ANG

FILE: gi-2010-08_850_212.out



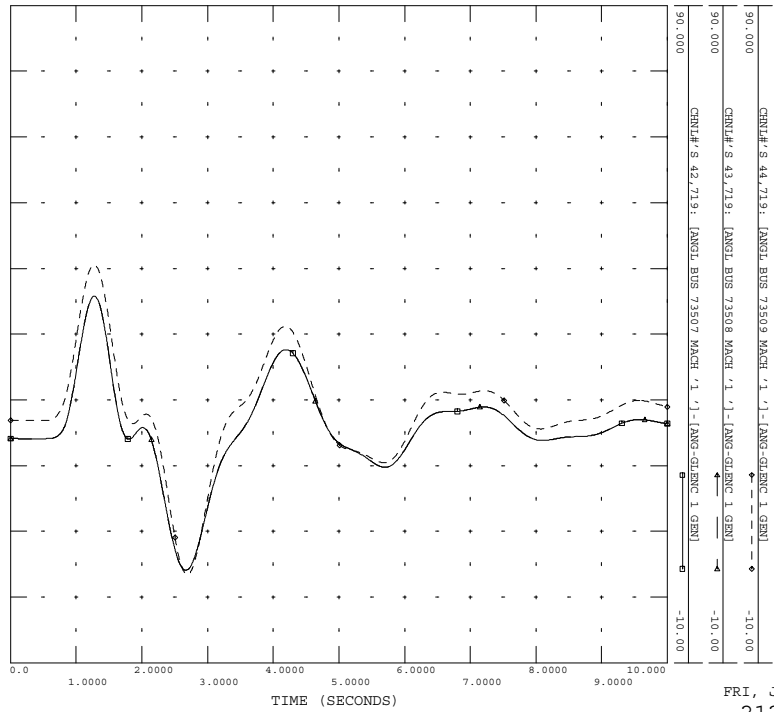
FRI, JUN 25 2010 16:15
212 - GEN ANG

FILE: gi-2010-08_850_212.out



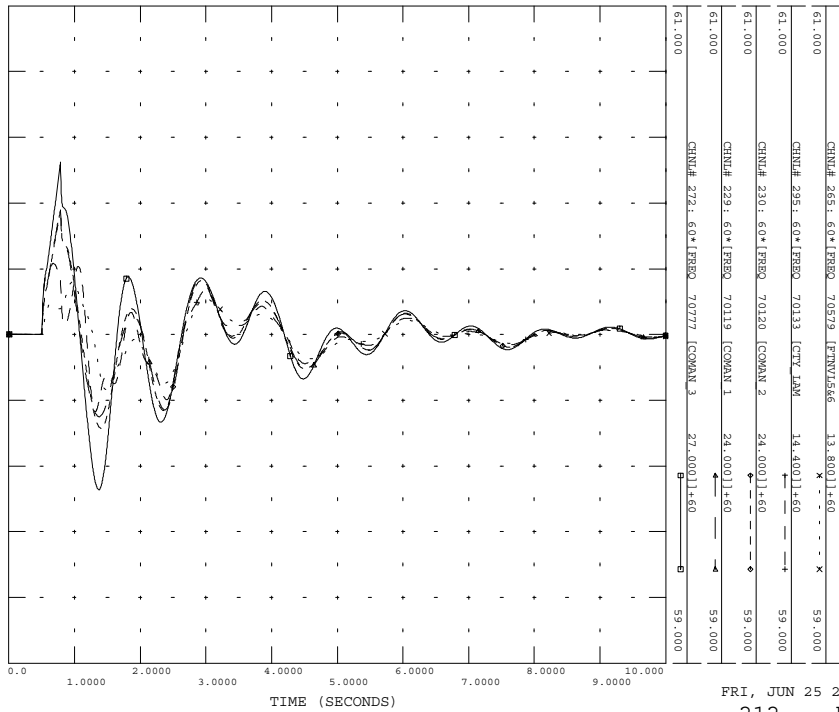
FRI, JUN 25 2010 16:15
212 - GEN ANG

FILE: gi-2010-08_850_212.out



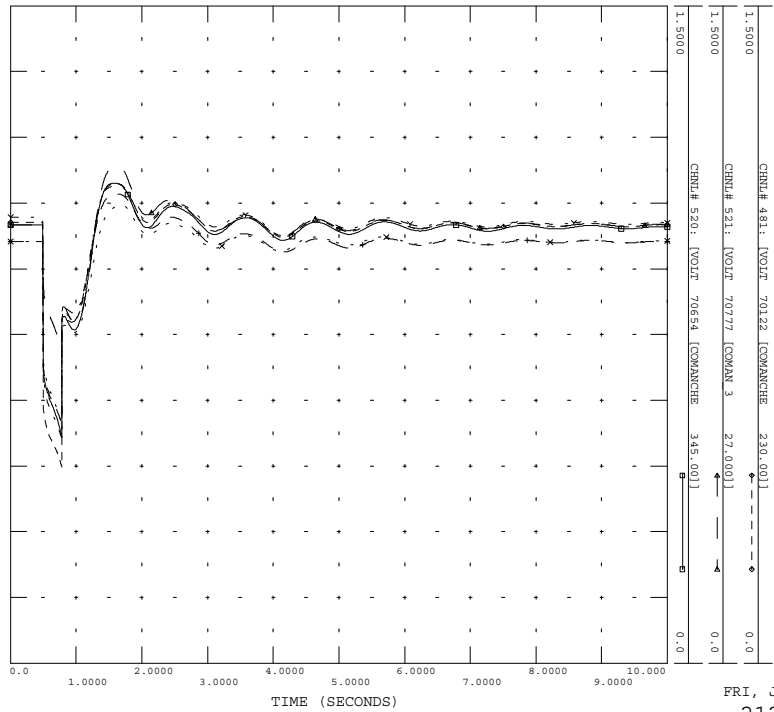
FRI, JUN 25 2010 16:15
212 - GEN ANG

FILE: gi-2010-08_850_212.out

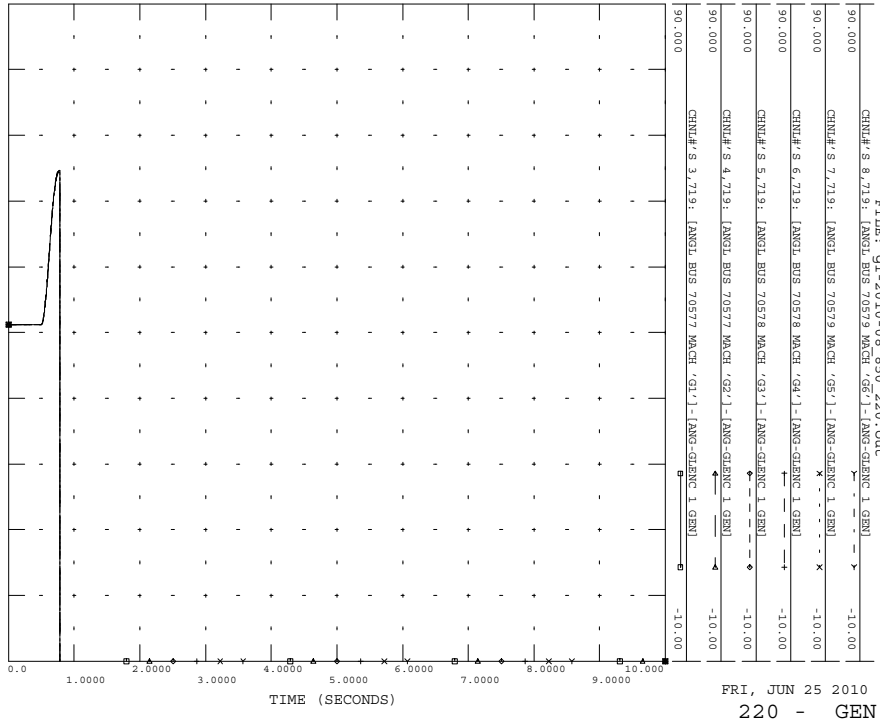
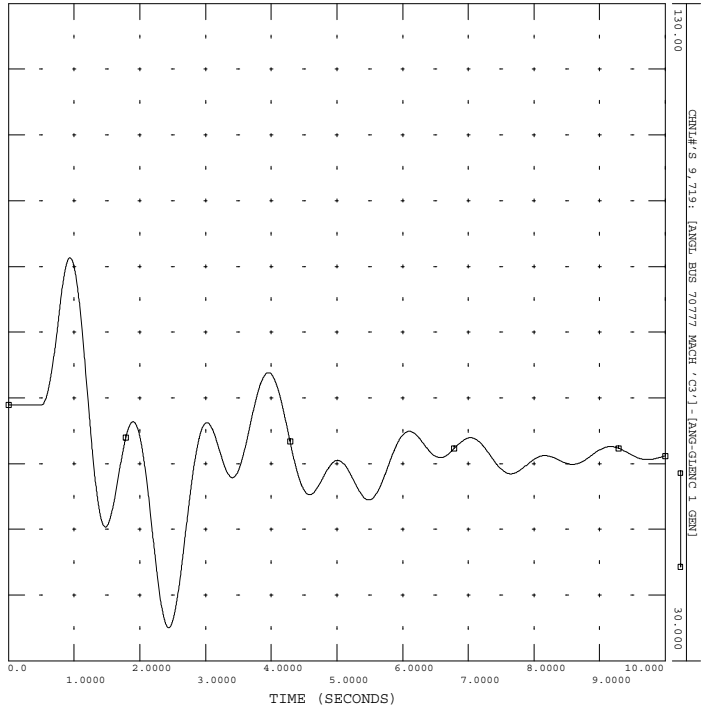
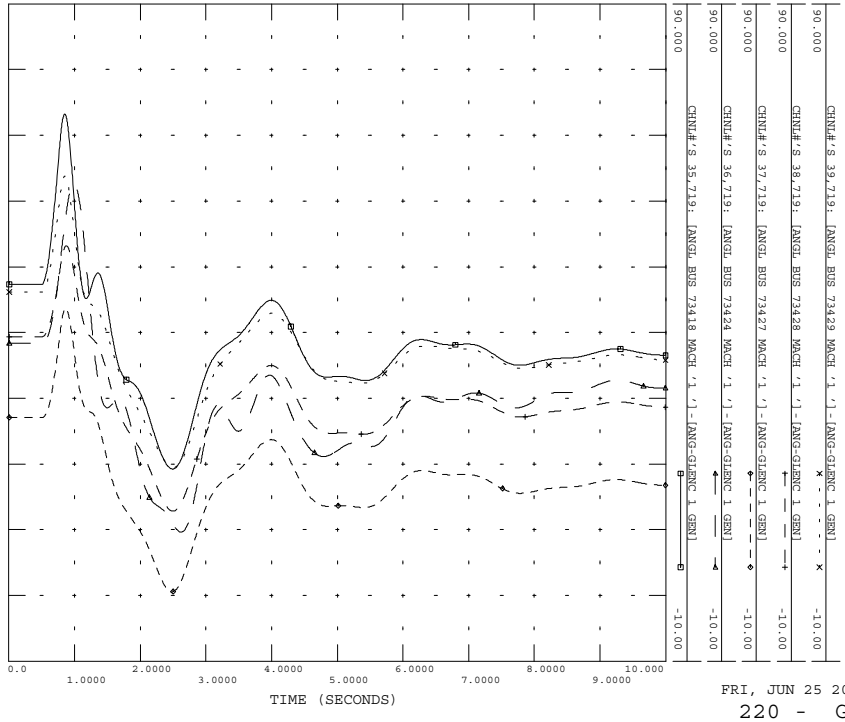
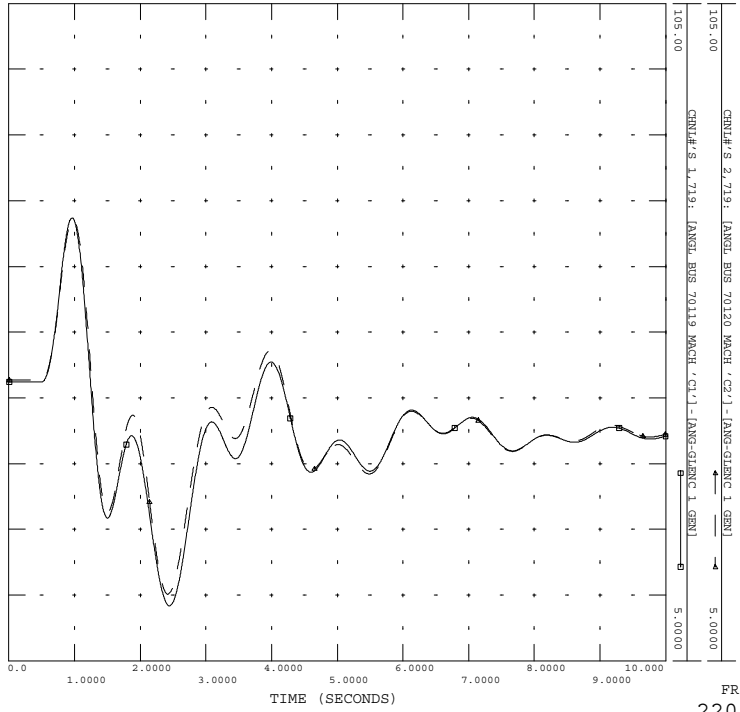


FRI, JUN 25 2010 16:15
212 - BUS FRQ

FILE: gi-2010-08_850_212.out

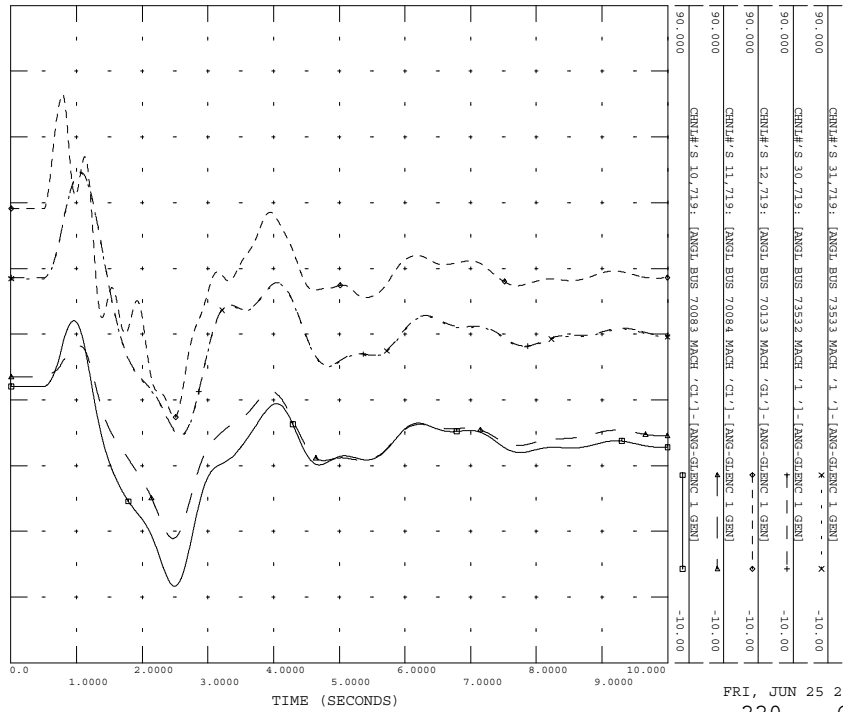


FRI, JUN 25 2010 16:15
212 - COM VLT



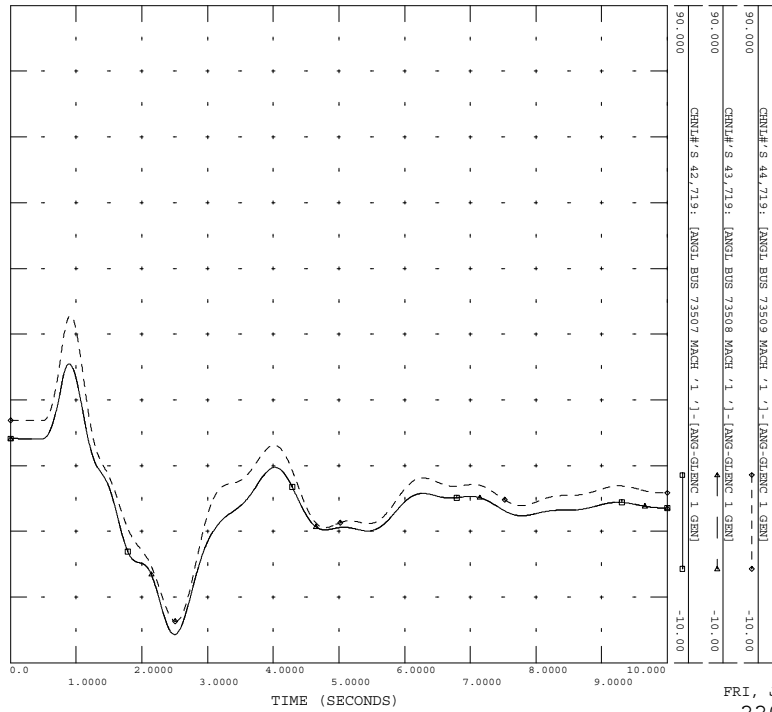
GI-2010-08_850_220 --> JUN 10
1PH FLT MID-COM 2, BF MID-FMT VAL

FILE: gi-2010-08_850_220.out



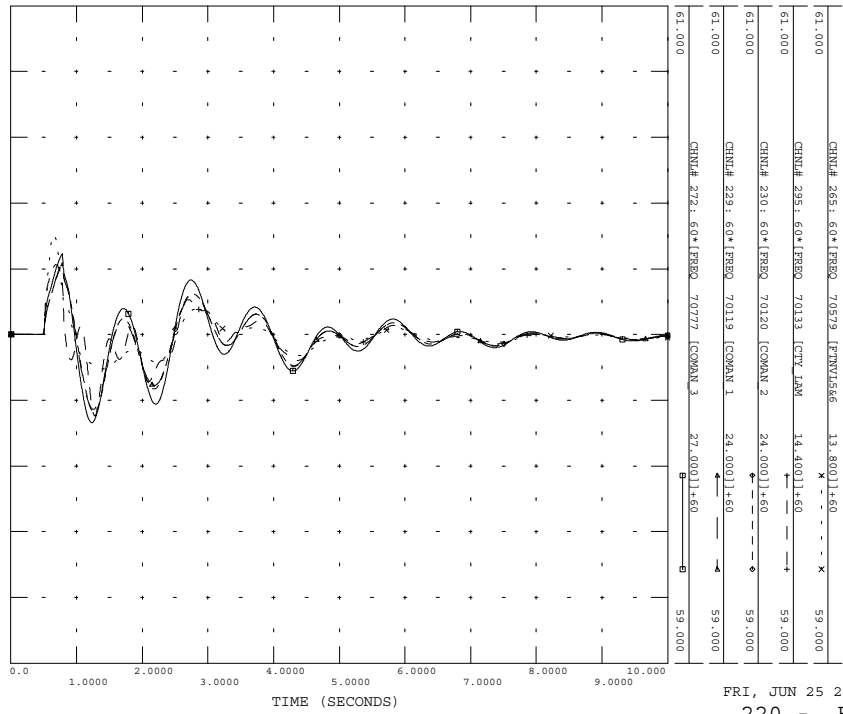
GI-2010-08_850_220 --> JUN 10
1PH FLT MID-COM 2, BF MID-FMT VAL

FILE: gi-2010-08_850_220.out



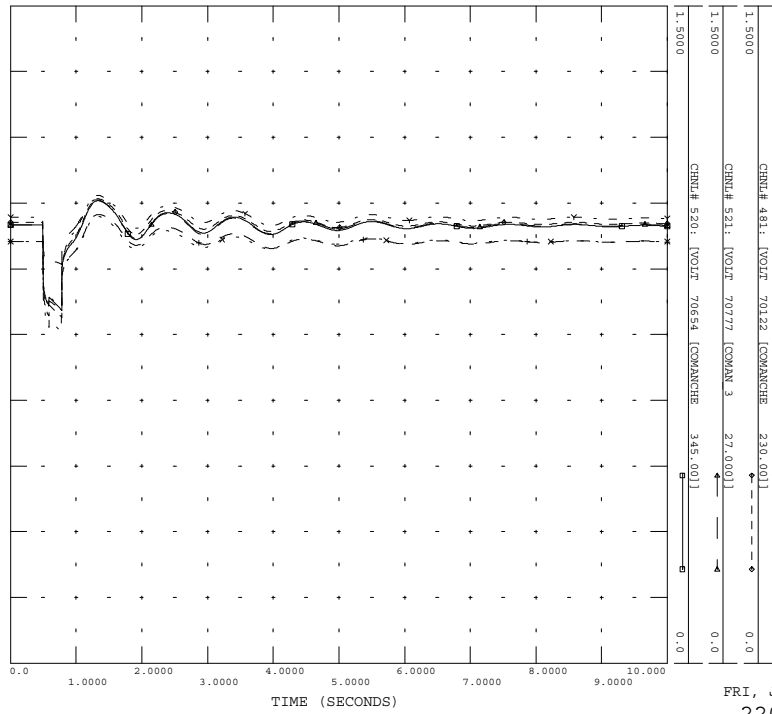
GI-2010-08_850_220 --> JUN 10
1PH FLT MID-COM 2, BF MID-FMT VAL

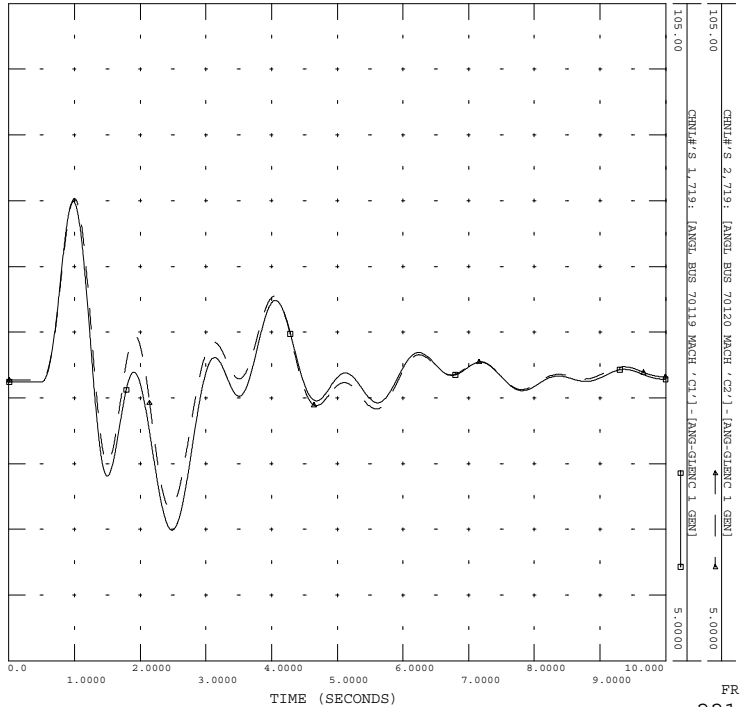
FILE: gi-2010-08_850_220.out



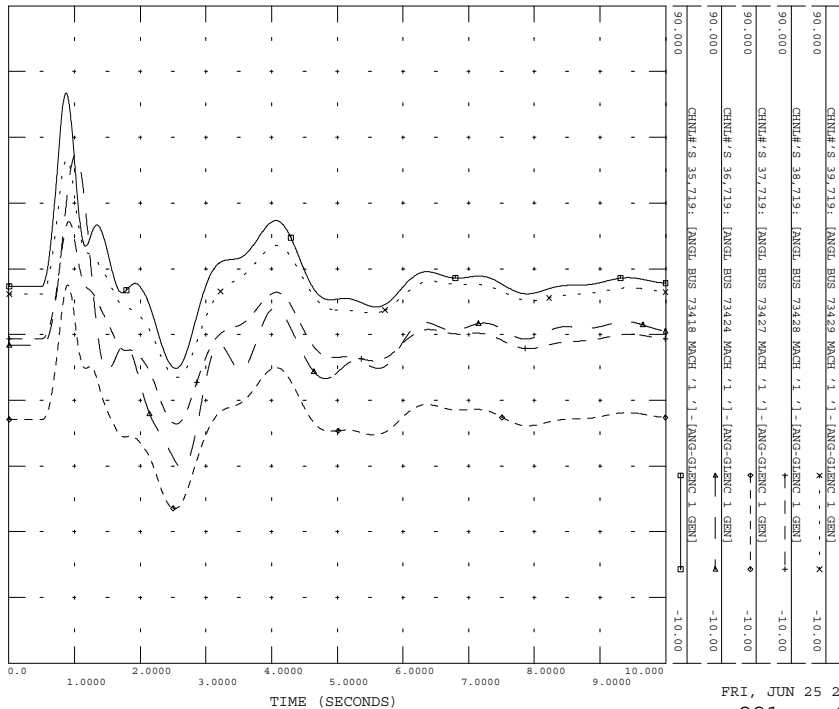
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1PH FLT MID-COM 2, BF MID-FMT VAL

FILE: gi-2010-08_850_220.out

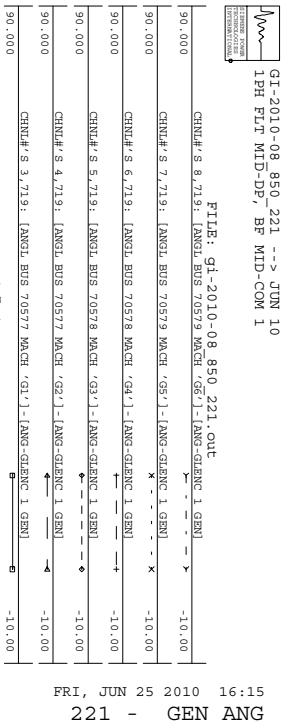




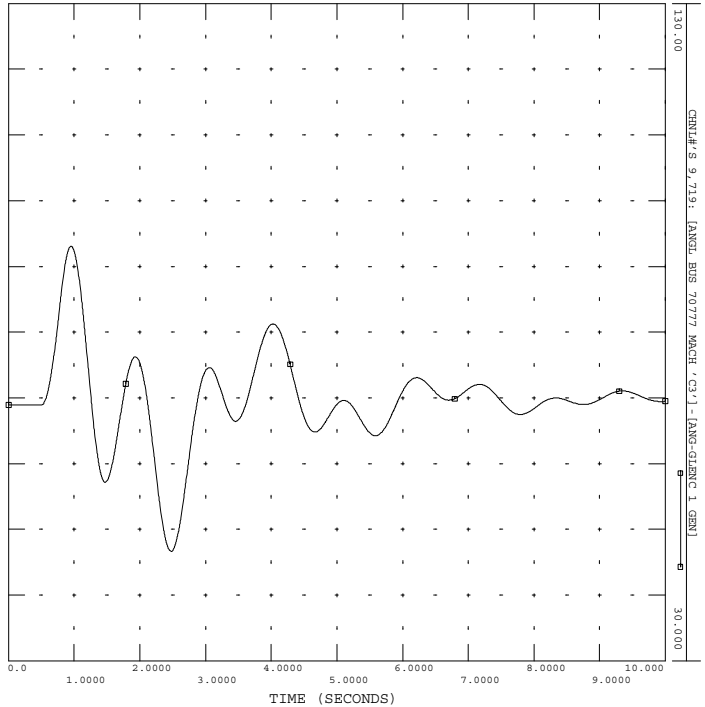
FRI, JUN 25 2010 16:15
221 - COM 12 ANG



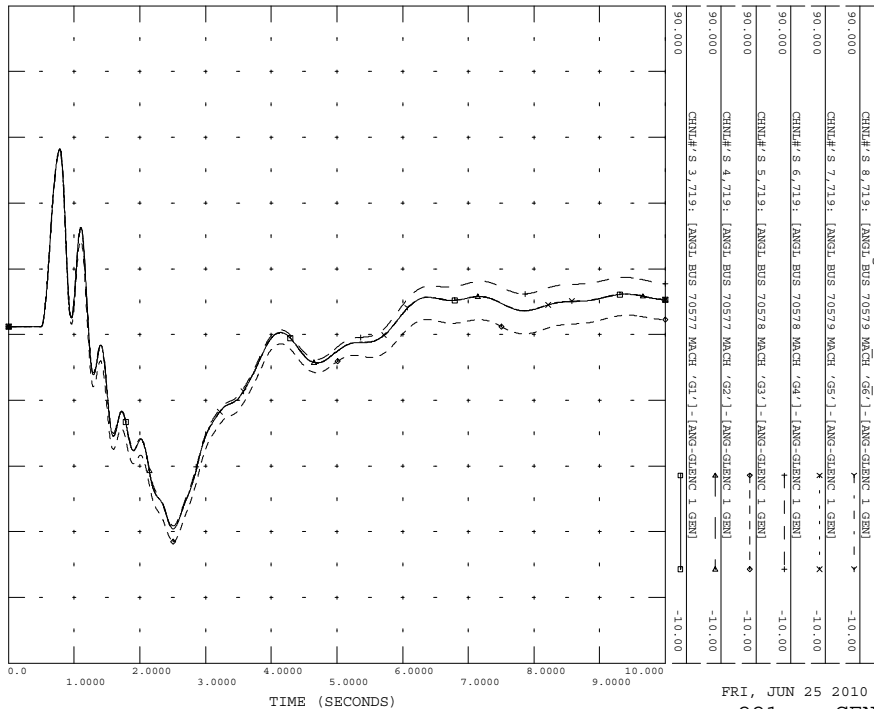
FRI, JUN 25 2010 16:15
221 - COM 3 ANG



FRI, JUN 25 2010 16:15
221 - GEN ANG



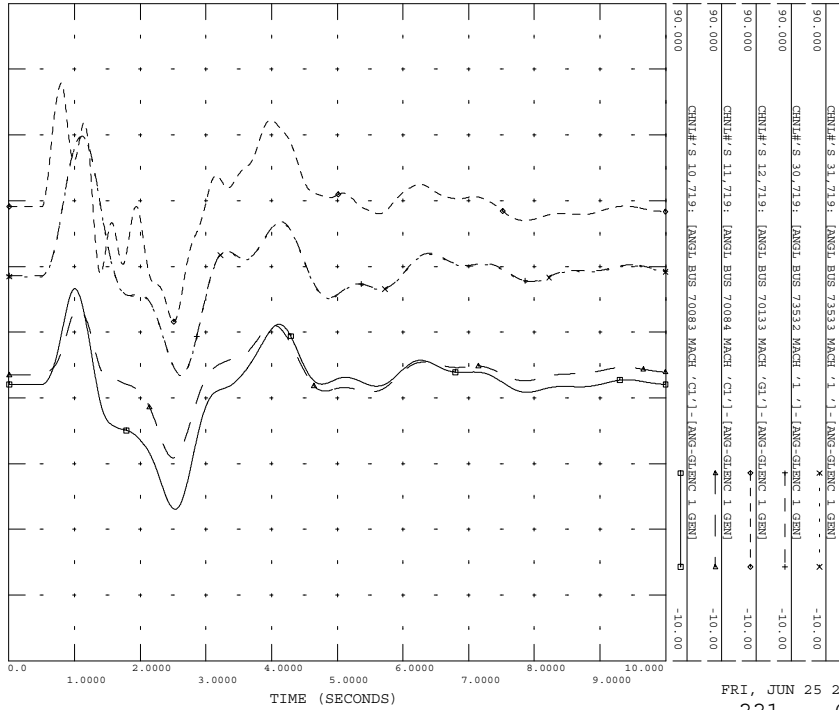
FRI, JUN 25 2010 16:15
221 - COM 3 ANG



FRI, JUN 25 2010 16:15
221 - GEN ANG

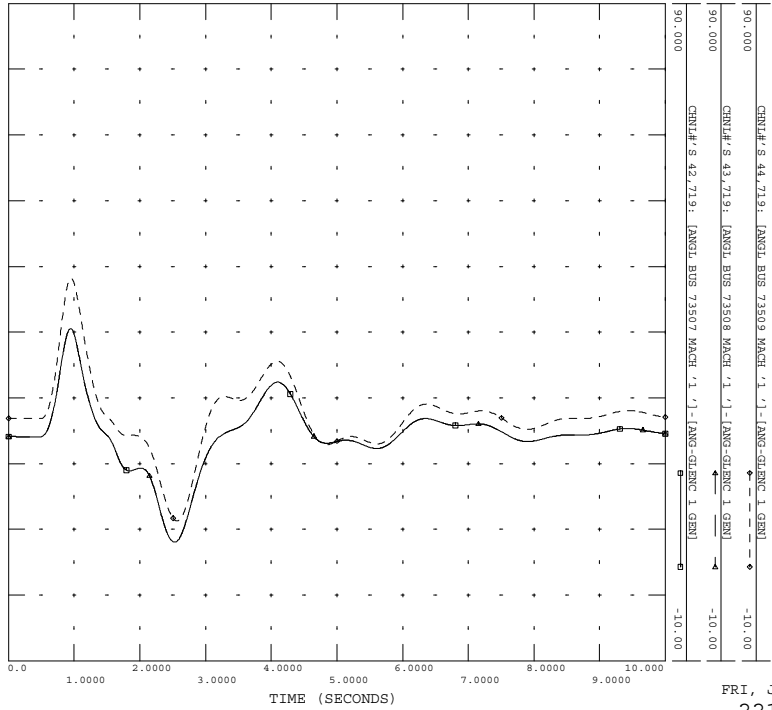
GI-2010-08_850_221 --> JUN 10
1PH FLT MID-DP, BF MID-COM 1

FILE: gi-2010-08_850_221.out



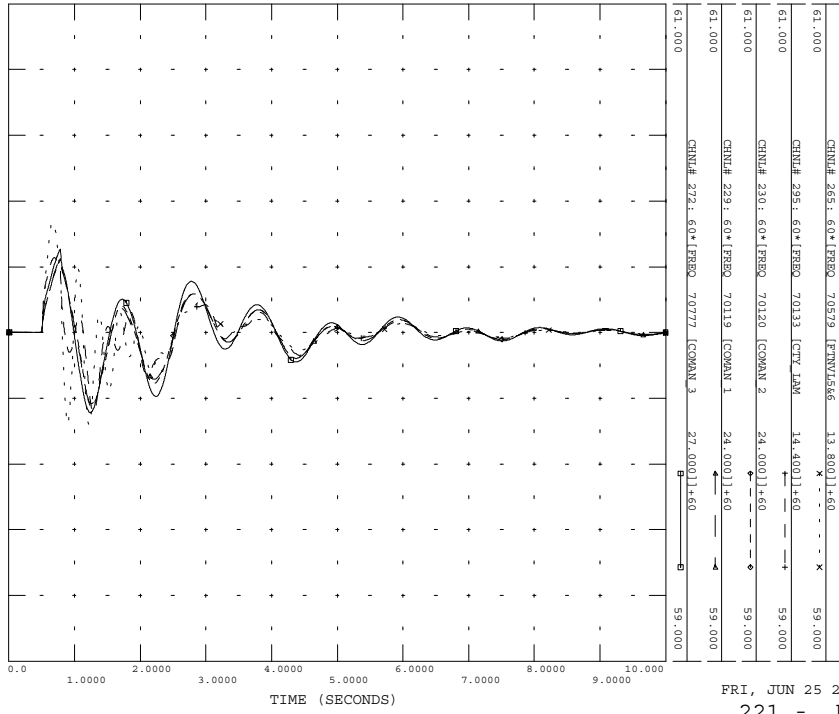
GI-2010-08_850_221 --> JUN 10
1PH FLT MID-DP, BF MID-COM 1

FILE: gi-2010-08_850_221.out



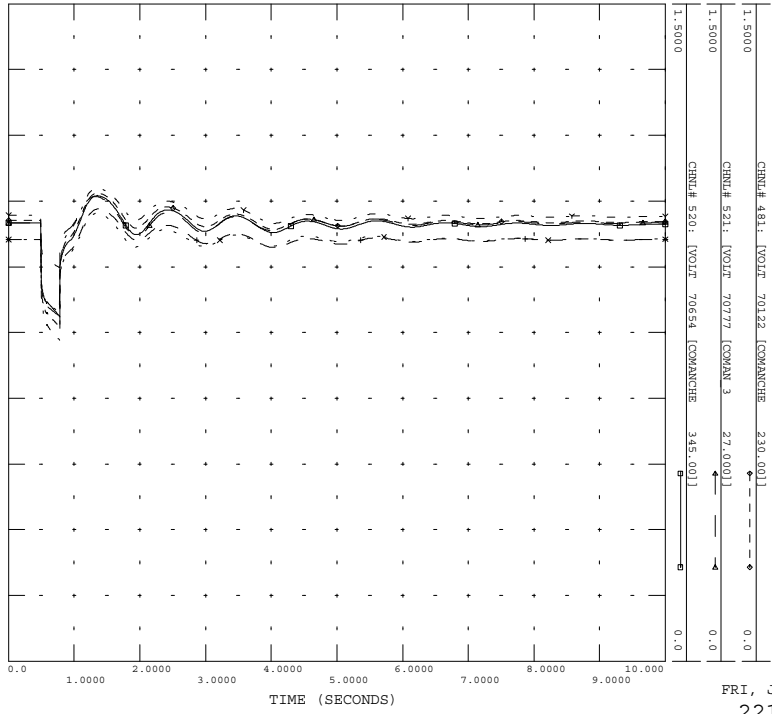
GI-2010-08_850_221 --> JUN 10
1PH FLT MID-DP, BF MID-COM 1

FILE: gi-2010-08_850_221.out

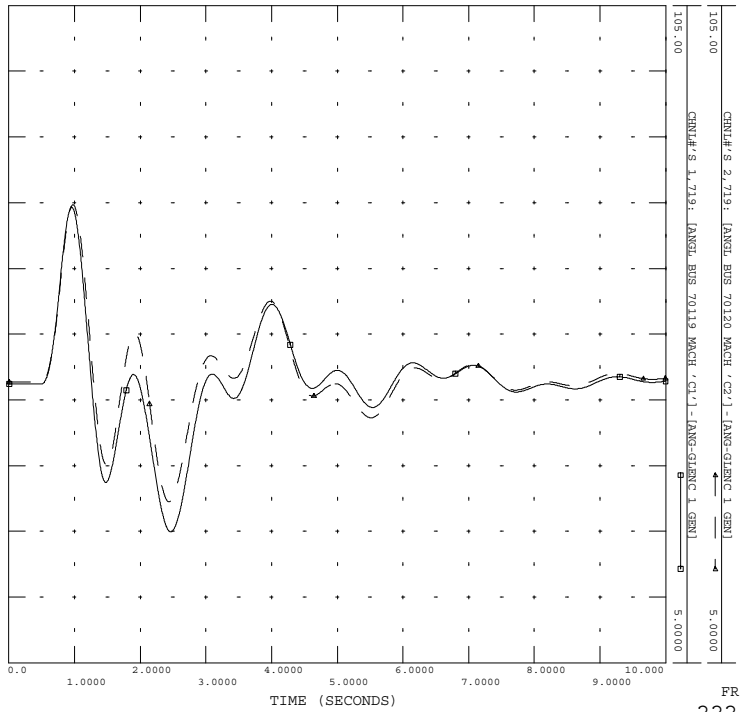


GI-2010-08_850_221 --> JUN 10
1PH FLT MID-DP, BF MID-COM 1

FILE: gi-2010-08_850_221.out

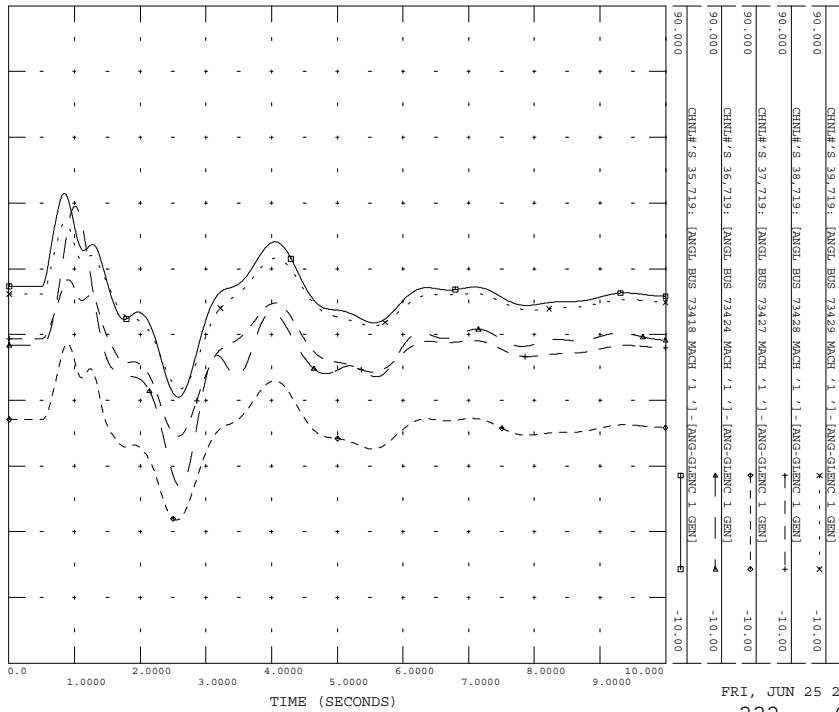


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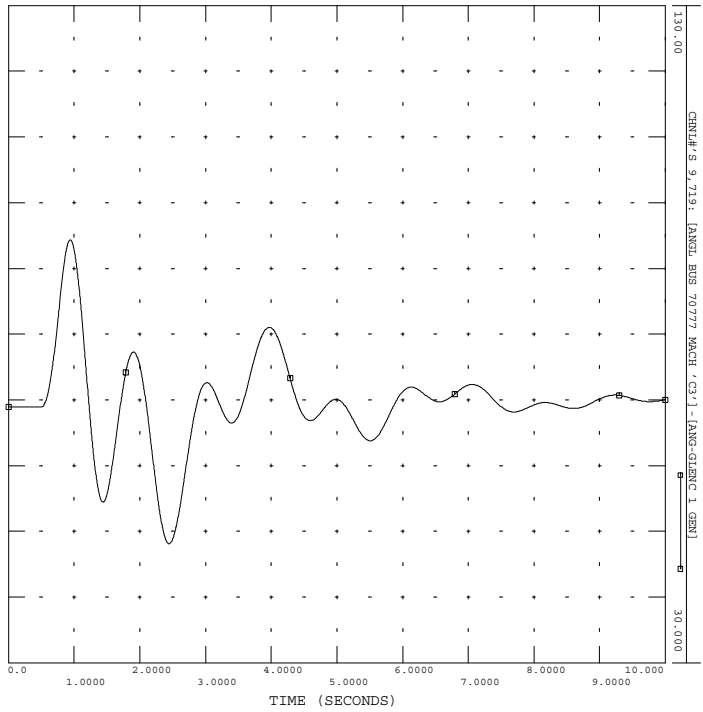
FRI, JUN 25 2010 16:15
222 - COM 12 ANG

FILE: gi-2010-08_850_222.out



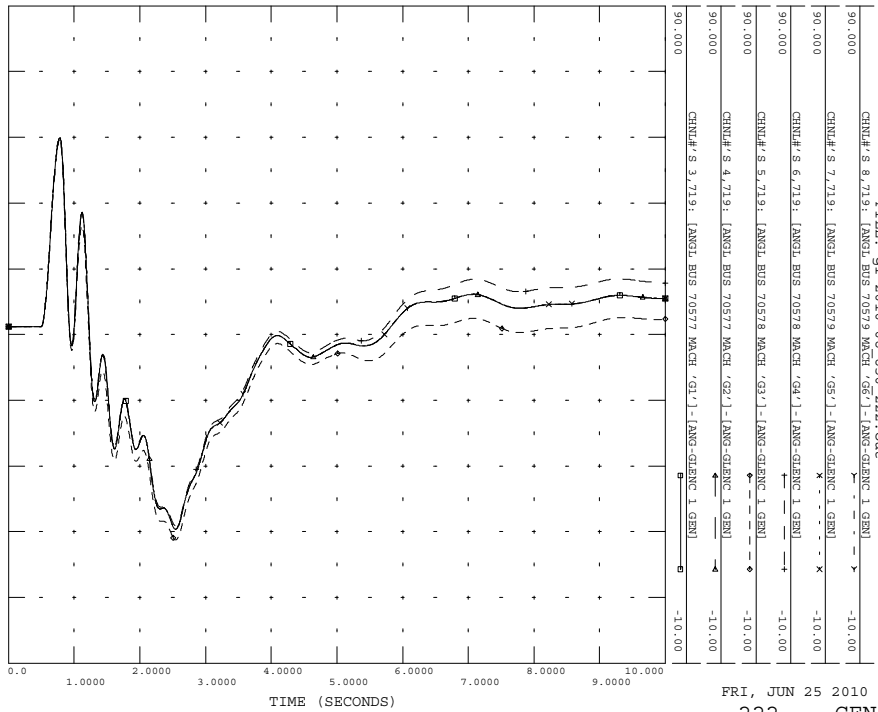
FRI, JUN 25 2010 16:15
222 - GEN ANG

FILE: gi-2010-08_850_222.out



FRI, JUN 25 2010 16:15
222 - COM 3 ANG

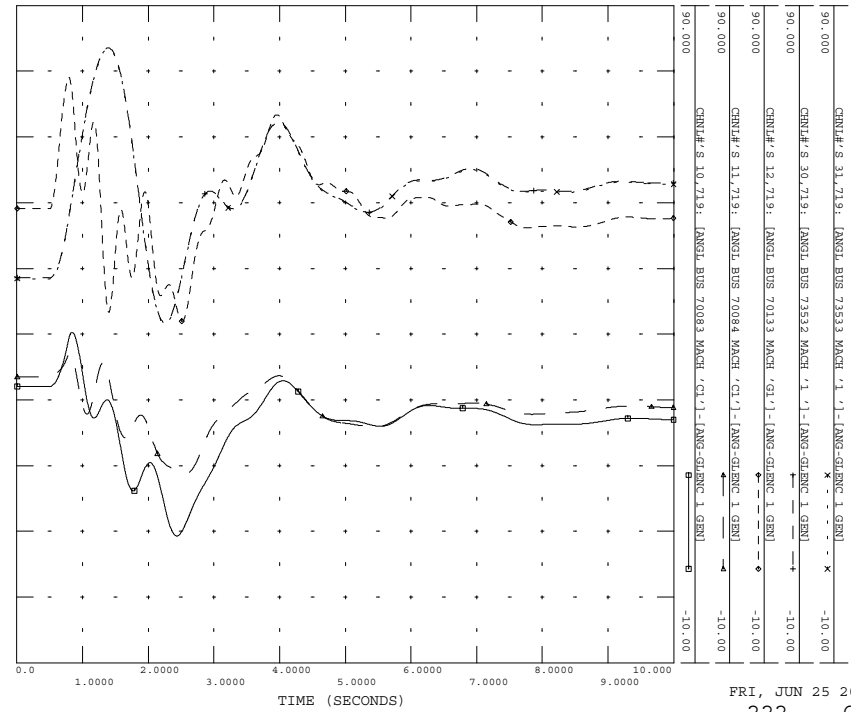
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FRI, JUN 25 2010 16:15
222 - GEN ANG

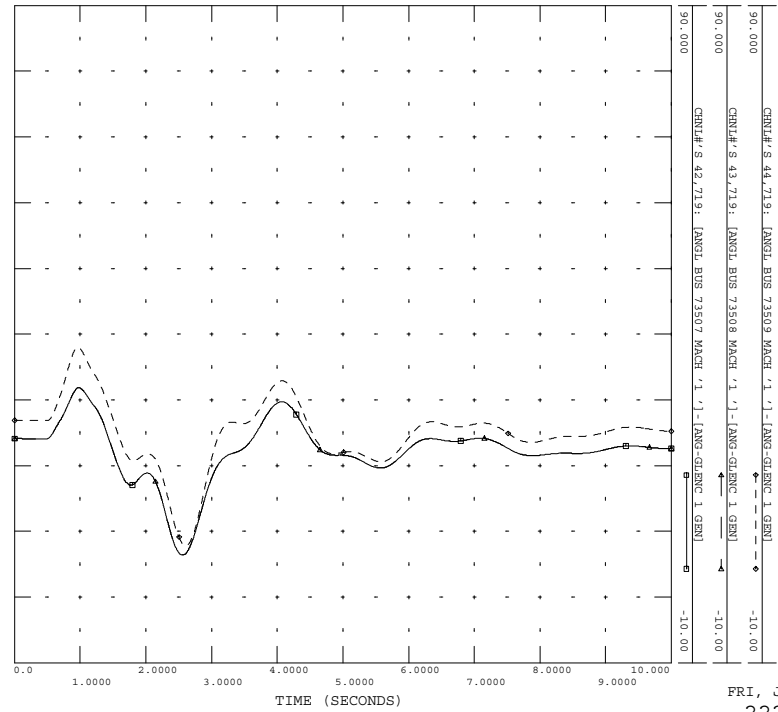
GI-2010-08_850_222 --> JUN 10
1PH FLT MID-NIX, BF MID-WAPA+

FILE: gi-2010-08_850_222.out



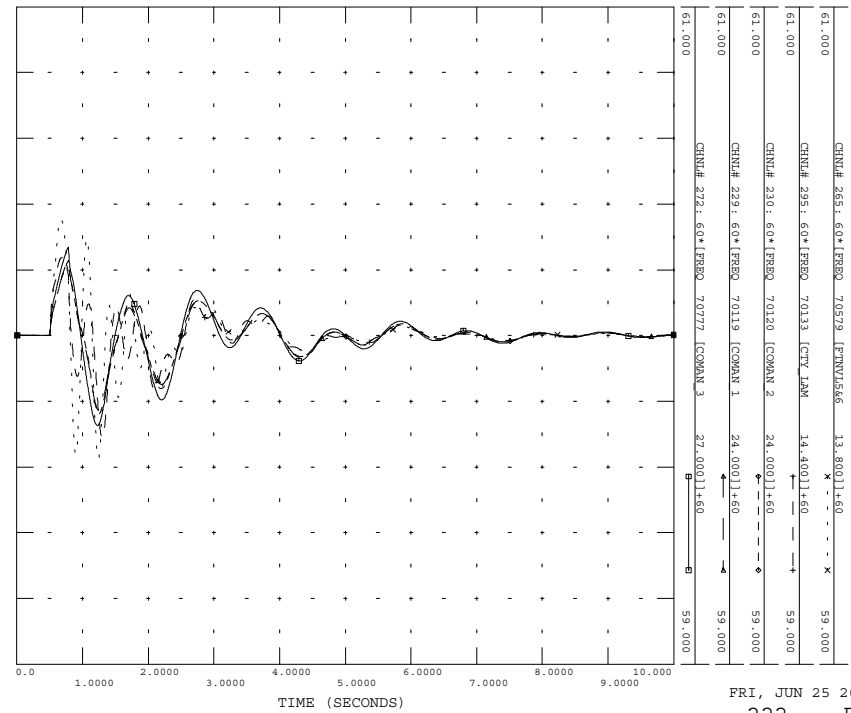
GI-2010-08_850_222 --> JUN 10
1PH FLT MID-NIX, BF MID-WAPA+

FILE: gi-2010-08_850_222.out



GI-2010-08_850_222 --> JUN 10
1PH FLT MID-NIX, BF MID-WAPA+

FILE: gi-2010-08_850_222.out



GI-2010-08_850_222 --> JUN 10
1PH FLT MID-NIX, BF MID-WAPA+

FILE: gi-2010-08_850_222.out

