Appendix A

System Impact Study

A division of
Imperial Irrigation District

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March 1, 2006

Dana Diller
High Energy Resource Services
6410 E. Everett Drive
Scottsdale, AZ 85254

VIA: Electronic Mail

Dear Ms. Diller,

Attached, please find "El Centro Unit #3-2 Repowering Project" System Impact Study dated February 14, 2006.

Three (3) hardcopies will be delivered to Generation Steam Plant by today's close of business day.

Should you have any questions or comments, please feel free to contact Jorge Barrientos, Superintendent, System Planning via telephone at (760) 482-3443 or e-mail at jlbarrientos@iid.com.

Sincerely,

David L. Barajas

David L. Barajas
General Superintendent,
System Planning and Engineering

Cc: J. C. Sandoval
H. Olstowlski
B. Aguilera
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J. Barrientos
M. Etherton
J. Montano

El Centro System Impact Study

Investigating the impact of
85MW re-powering of the El Centro #3
Plant in 2009

February 14, 2006
K.R. Saline & Associates, PLC

An Analysis for:
Imperial Irrigation District, "IID"

K. R. Saline & Associates, PLC

EXECUTIVE SUMMARY

The Imperial Irrigation District, "IID", in response to an OATT request (GI-2005-8), contracted with K.R. Saline & Associates, PLC to perform a System Impact Study, "SIS", to investigate the impact of an 85MW re-powering of El Centro Unit 3 by the summer of 2009. The study investigated the impact of the generation connected at the existing 92kV El Centro substation. Sensitivity cases were created to review the maximum existing and queue generation interconnected to the IID transmission system.

This SIS included power flow, stability, and short circuit impacts to both the IID and interconnected transmission systems. The El Centro facility is proposed to primarily meet the summer demand resource therefore the 2009 heavy summer scenario was reviewed for this analysis. The project has quick start capability and was reviewed for off peak power flow impact. The new resource was scheduled directly to IID as a network resource serving IID loads.

The interconnection of the proposed generating facility to the existing El Centro 92kV transmission system was found to have no significant impact on the IID system as shown by the lack of overload and voltage violations. The addition of the facility did not have significant impact on neighboring transmission systems as shown by the minimal change to IID's tie-lines.

The stability analysis concluded the addition of the facility had no significant impacts on the IID or neighboring transmission systems.

The short circuit analysis found that no facility interrupting capability rating violations would occur due to the increase in short circuit duties resulting from the generator addition. The incremental impact of the facility on short circuit levels at the interconnection busses was very minimal and no facility interrupting capability rating violations are anticipated on neighboring utility systems.

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INTRODUCTION

The Imperial Irrigation District, "IID", in response to an OATT request (GI-2005-8), contracted with K.R. Saline & Associates, PLC to perform a system impact study to investigate the impact of an 85MW re-powering of El Centro Unit 3 in 2009. The study investigated the impact of the generation connected at the existing 92kV El Centro substation. Sensitivity analysis was also performed to identify any impact to the system due to the addition of the project when all IID facilities were generating.

The 85MW El Centro facility was reviewed for power flow, stability and short circuit impacts pre and post contingency.

MODEL DETAILS

The study was conducted using General Electric's Positive Sequence Load Flow (PSLF) version 13.1 for both power flow and stability.

The base case for this study was developed from the 2008 WECC Heavy Summer Approved case with changes to the system to reflect IID's detailed system and anticipated changes in IID's load by 2009. Generation higher in IID's queue was included.

The IID detailed system was upgraded to include the following changes:

- Highline & Pruett 92kV upgrades
  - Highline-Drop 4 92kV line
  - Highline-Holtville 92kV line
  - Pruettap 92kV bus added to loop in the Pruett-El Centro 92kV line
  - SIGCtap-Pruettap 92kV jumper added
  - Pruettap-Highline 92kV line added (formerly the Highline-SIGCtap 92kV line)
- E-O 92kV line (El Centro-Imperial-Panno-Brawley) added
- Moved Jefferson 92kV load and bus to the Avenue 58-Avenue 48 92kV line
- Removed El Centro 230/161kV transformer, relocated at Bannister
- Coachella Valley 161/92kV transformer upgraded to 225MVA
- Added second Avenue 58 161/92kV 125MVA transformer
- Added 230/92kV 300MVA transformer at El Centro
- Capacitor Additions:
  - Avenue 58 92kV: 24.5MVAR
  - Avenue 42 92kV: 24.5MVAR
  - Coachella Switching Station 92kV : 9.6MVAR
  - El Centro Terminal 92kV: 24.5MVAR

The addition of the facility is intended to offset existing network resources, therefore the post project cases offset internal IID generation with the inclusion of the project.

GENERATION DISPATCH

The study reviewed the impact of the project under anticipated generation dispatch conditions and a maximum IID generation dispatch condition. Both post project cases reduced internal IID generation with higher heat rates.

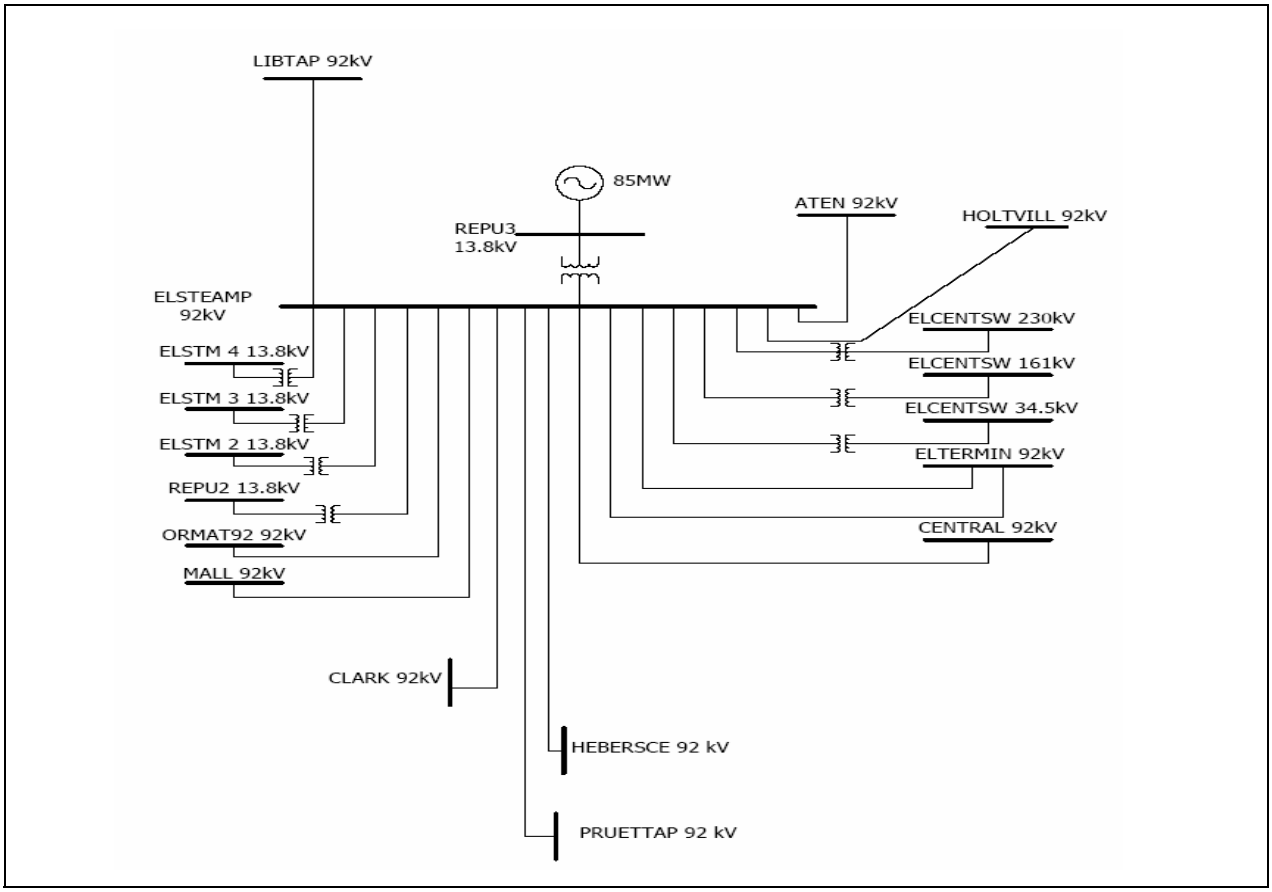
Generator	Base Cases		Sensitivity Cases	
	EC3 Pre	EC3 Pst	Max Pre	Max Pst
EC3 (Project)	Off	85 MW	Off	85 MW
Other El Centro Generation (w/o Project)	105MW	20MW	239 MW*	240 MW*
Peaking Gas Turbines	Off	Off	248 MW	163 MW

*slight difference due to rounding and the El Centro #4 as the IID swing machine

ONE-LINE DIAGRAM

The diagram below shows the configurations modeled for both power flow and stability analyses.

One line diagram of El Centro Re-Power #3



STUDY EVALUATION CRITERIA

POWER FLOW

The following load-flow related criteria were used:

- Pre-disturbance bus voltage must be between 0.95 per unit and 1.05 per unit. (IID requirement that is not included in the WECC criteria)
- Allowable voltage deviation of five (5) percent for N-1 Contingencies (deviation from pre-disturbance voltage).
- Allowable voltage deviation of ten (10) percent for N-2 contingencies (deviation from pre disturbance voltage).
- Post transient bus voltage must be at least 0.90 per unit (IID requirement that is not included in the WECC criteria)
- Pre and post disturbance loading to remain within the emergency ratings of all equipment and line conductors. The emergency ratings are determined by the owner/operator of each equipment item.

In clarification of the above list, all tables and results for loading criteria were based on the normal or continuous rating (Rating 1) as identified in the cases.

STABILITY

The following stability criteria, per NERC/WECC criteria were used to evaluate the impact of the project:

WECC DISTURBANCE-PERFORMANCE TABLE OF ALLOWABLE EFFECTS ON OTHER SYSTEMS

NERC and WECC Categories	Outage Frequency Associated with the Performance Category (outage/year)	Transient Voltage Dip Standard	Minimum Transient Frequency Standard	Post Transient Voltage Deviation Standard (See Note 2)
A	Not Applicable	Nothing in addition to NERC		
B	≥ 0.33	Not to exceed **25%** at load buses or **30%** at non-load buses. Not to exceed **20% for more than 20 cycles** at load buses.	Not below **59.6** Hz for 6 cycles or more at a load bus.	Not to exceed **5%** at any bus.
C	0.033 – 0.33	Not to exceed **30%** at any bus. Not to exceed **20% for more than 40 cycles** at load buses.	Not below **59.0** Hz for 6 cycles or more at a load bus.	Not to exceed **10%** at any bus.
D	< 0.033	Nothing in addition to NERC		

[1]

[1] (Reference: Western Electricity Coordinating Council NERC/WECC Planning Standards, Revised August 9, 2002, page 12-13)

POWER FLOW RESULTS

POST PROJECT PEAK ANALYSIS

The post-project analysis with the interconnection of the 85MW El Centro #3 Re-powering unit to the El Centro 92kV bus under peak conditions was found to not significantly impact the transmission system for the generation dispatch modeled. The incremental flow comparison tables on the following pages and the "difference" map in the appendix for the post-project case was found to have a consistent loading between the pre and post base cases, indicating no significant impact due to the addition of the project.

POST PROJECT OFF PEAK ANALYSIS

The facility was expected to operate during peak conditions however it was requested to review the impact of the facility under off peak conditions. Due to the light load (and generation) conditions and the number of lines emanating from the El Centro 92kV bus no loading issues were found pre or post contingency with the addition of the facility.

SENSTIVITY CASE (MAXIMUM GENERATION) ANALYSIS

The maximum generation sensitivity cases were developed to investigate the impact to the IID system under a condition where all IID generation, primarily at El Centro was operating and the project was interconnected at El Centro.

The sensitivity case found a minor impact to the IID transmission system near Dixieland with maximum El Centro area generation. An increase in loading of approximately 10% was found on the Dixieland-Dixieland Prison 54MVA 92kV line for the loss of the USNAF-El Centro terminal 92kV line. IID has plans to install facilities that would eliminate the impacts in this area by 2008.

This sensitivity also noted minor overloads under N-2 contingency conditions in the Coachella Valley region. An increase in loading of approximately 6% was found on the Coachella Valley 230/92kV transformers for loss of the Coachella Valley-Devers and Coachella Valley-Ramon 230kV lines. As the load continues to develop in the Coachella Valley area, IID also plans to reinforce the 230kV system to limit the exposure to higher loadings under this critical N-2 contingency.

POWER FLOW COMPARISON

The tables identify the element monitored, rating, and contingency causing the loading, and the percent loading. Highlighted cells indicate loading 110% or greater of the element's continuous rating, showing a violation in monitoring criteria (exceeding the emergency rating of the element).

The tables show that the addition of the project increased loading on lines as much as 10% in conjunction with outages, however the lines were overloaded (based on a continuous rating) prior to the addition of the project. The addition of the facility pushed a few elements into or beyond the assumed emergency rating (110% of continuous). Most IID elements have identical continuous and emergency ratings; the exact emergency rating of the overloaded elements should be identified prior to assigning the incremental impact to the project. IID's capital improvement projects may also eliminate these overloads.

N-1 Flow Comparison Table

Overloaded Element	Rated Mva	Pre	Post	Sensitivity Maxgen Pre	Sensitivity Maxgen Post	Outage description
DIXIELAN-DIXPRI2 92 ck 1 line	54	94%	94%	103%	113%	line USNAF to ELTERMIN 92 ck 1
MIDWAY 230/ 92 ck 1 tran	225	143%	143%	143%	143%	tran MIDWAY 230 to MIDWAY 92 ck 2

N-2 Flow Comparison Table

Overloaded Element	Rated Mva	Pre	Post	Sensitivity Maxgen Pre	Sensitivity Maxgen Post	Outage description
CVSUB 92/230 ck 1 tran	150	106%	105%	107%	113%	Coachella-Devers & Coachella-Ramon 230kV lines
CITAP1 -COACHELA 92 ck 1 line	152	97%	98%	121%	114%	Coachella-Devers & Coachella-Ramon 230kV lines
CITAP1 -VANBUREN 92 ck 1 line	152	97%	97%	121%	114%	Coachella-Devers & Coachella-Ramon 230kV lines
CMTAP2 -AVE42 92 ck 1 line	132	91%	91%	118%	110%	Coachella-Devers & Coachella-Ramon 230kV lines
CMTAP2 -VANBUREN 92 ck 1 line	132	91%	91%	118%	110%	Coachella-Devers & Coachella-Ramon 230kV lines
NILAND -BLYTHE 161 ck 1 line	165	114%	114%	97%	97%	Blythe-Knob and Blythesc-Eaglemtn 161kV lines
AV58TP1 -ESM161 161 ck 1 line	165	100%	100%	107%	115%	Coachella-Midway 230 kV ckts 1 &2 Coachella 230/92kV transformer 200MW of geothermal generation tripped

LOADS AND RESOURCES

The table below shows the loads, losses, generation, and area interchange for the cases studied.

Loads and Resources		Pre Project	Post Project	Sensitivity Max Gen – Pre	Sensitivity Max Gen – Post
Load (MW)	IID load	1134	1134	1134	1134
	IID losses	50	50	50	53
Generation (MW)	EC3	Off	85	Off	85
	IID GEN (Zone 30)	468	468	770	771
	IID IPP (Zone 45)	619	619	619	619
	Imperial Valley (Zone 227)	750	750	750	750
	Blythe	490	490	490	490
Area Interchange (MW)	IID	-96	-96	205	203
	AZ	6778	6778	6515	6515
	SDGE	-2411	-2411	-2450	-2447

TIE LINE FLOW

The table below shows the impact on neighboring utilities (Southern California Edison, "SCE", Arizona, San Diego, and Western). As the minimal changes in tie-line flow indicate, the impact on neighboring utilities was minimal with the addition of the project. The addition of the project had the tendency to reduce flow on neighboring lines, or caused an increase of less than 5MW.

In the sensitivity cases, the flow on the Imperial Valley-El Centro 230kV line reversed. The flow on the line in the sensitivity pre-project case was from Imperial Valley to El Centro (effectively an IID import) while the post project sensitivity case showed reverse flow (an export) of 10 MW from El Centro to the Imperial Valley substation.

Tie Line Flow(MW)	Neighboring Utility	Pre Project	Post Project	Sensitivity Max Gen – Pre	Sensitivity Max Gen – Post
Path 42	SCE	154	154	299	277
Coachella-Devers 230kV	SCE	82	82	141	134
Ramon- Mirage 230kV	SCE	72	72	157	142
Imperial Valley–El Centro 230kV	SDGE	86	86	5	-10
Blythe-Niland 161kV	Western	114	114	90	90
Pilot Knob-Knob	Western	80	80	46	42
Pilot Knob-Yucca 161kV	APS	37	37	32	33

STABILITY RESULTS

The stability analysis showed the proposed El Centro dynamics models (including generator, exciter, governor, and power system stabilizer) did not cause an unstable condition prior to, or during the ten seconds following a system fault and facility outage. The proposed model was stable for the outages tested and busses monitored.

The busses monitored:
El Centro 230kV, 161kV, 92kV
Coachella 230kV, 161kV, 92kV
Ramon 230kV
Imperial Valley 230kV
Avenue 58 161kV
Niland 161kV, 92kV
Mirage 92kV
Project bus (Repu 3) 13.8 kV

WECC/NERC Category B: Loss of a single Element
No outage
Niland-Blythe 161kV
Niland-El Centro 161kV
Niland-Coachella Valley 161kV
El Centro #3 Repower 92/13.8kV transformer
El Centro-Ave 58 161kV
Ramon 230/92kV transformer
Palo Verde-Devers 500kV
Imperial Valley – Miguel 500kV
Hassyampa – North Gila 500kV

WECC/NERC Category C: Loss of Two or more Elements
Path 42 with approximately 200MW of geothermal tripping

SHORT CIRCUIT RESULTS

The short circuit analysis found that no facility interrupting capability rating violations would occur due to the increase in short circuit duties resulting from the generator addition. The impact of the facility on short circuit levels at the interconnection busses was very minimal and no facility interrupting capability rating violations are anticipated on neighboring utility systems.

APPENDICES

Appendix A – Contingency List

Appendix B – Power Flow Results – Pre Project
Appendix C – Power Flow Results – Post Project
Appendix D – Power Flow Results – Sensitivity Cases
  Appendix D1 – Power Flow Results – Pre Project Max Gen
  Appendix D2 – Power Flow Results – Post Project Max Gen

Appendix E – Light Winter Analysis

Appendix F – Stability Switch Decks
Appendix G – Stability – Post Project

Appendix H – Short Circuit Analysis

EC3 System Impact Study

Appendix A
Contingency List

February 2006

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# contingency selection : from area 8 to 8; 90 kV to 999 kV
C_1             "C-AVE58-DESERTSHORES 92KV      "
   line "AVE58     92.00"  "RTP6OASS  92.00"  "1 "  1 0
   line "OASIS     92.00"  "RTP6OASS  92.00"  "1 "  1 0
   line "RTP5DSTS  92.00"  "RTP6OASS  92.00"  "1 "  1 0
0
C_2             "C-COACHELLA VALLEY-AVE58 92KV   "
   line "AVE58     92.00"  "RTAP8     92.00"  "1 "  1 0
   line "RTAP8     92.00"  "COACHELA  92.00"  "1 "  1 0
0
C_3             "C-COACHELLA VALLEY-AVE58 161KV "
   line "AV58     161.00"  "AV58TP2  161.00"  "1 "  1 0
   line "AV58TP2  161.00"  "CVSUB161 161.00"  "1 "  1 0
0
C_4pst          "C-ELCENTRO-AVE58  161KV       "
   line "AV58     161.00"  "AV58TP1  161.00"  "1 "  1 0
   line "AV58TP1  161.00"  "BANTP2   161.00"  "1 "  1 0
   line "BANISTER 161.00"  "BANTP2   161.00"  "1 "  1 0
   line "BANISTER 161.00"  "BANTP1   161.00"  "1 "  1 0
   line "BANTP1   161.00"  "ELCENTSW 161.00"  "1 "  1 0
0
C_4pre          "C-ELCENTRO-AVE58  161KV       "
   line "AV58     161.00"  "AV58TP1  161.00"  "1 "  1 0
   line "ELCENTSW 161.00"  "AV58TP1  161.00"  "1 "  1 0
0
C_5             "C-AVENUE 48-AVENUE 42  92KV   "
   line "AVE48     92.00"  "CWTAP2    92.00"  "1 "  1 0
   line "CWTAP2    92.00"  "SHIELDS   92.00"  "1 "  1 0
   line "AVE42     92.00"  "SHIELDS   92.00"  "1 "  1 0
0
C_6             "C-COACHELLA VALLEY-SKYVALLEY 92"
   line "SKY VLY   92.00"  "CMTAP1    92.00"  "1 "  1 0
   line "CMTAP1    92.00"  "COACHELA  92.00"  "1 "  1 0
0
C_7             "C-COACHELLA VALLEY-VANBUREN 92 "
   line "CITAP1    92.00"  "COACHELA  92.00"  "1 "  1 0
   line "CITAP1    92.00"  "VANBUREN  92.00"  "1 "  1 0
0
C_8             "C-VANBUREN-AVE 42 92KV         "
   line "CMTAP2    92.00"  "AVE42     92.00"  "1 "  1 0
   line "CMTAP2    92.00"  "VANBUREN  92.00"  "1 "  1 0
0
C_10            "C-DROP4 - ELSTEAM 92KV         "
   line "DROP4     92.00"  "ORMAT92   92.00"  "1 "  1 0
   line "ELSTEAMP  92.00"  "ORMAT92   92.00"  "1 "  1 0
0
C_11            "C-DIXILAN-CENTRAL  92KV                  "
   line "DIXIELAN  92.00"  "DIXPRI2   92.00"  "1 "  1 0
   line "DIXPRI    92.00"  "DIXPRI2   92.00"  "1 "  1 0
   line "DIXPRI1   92.00"  "DIXPRI    92.00"  "1 "  1 0
   line "RTAP1     92.00"  "DIXPRI1   92.00"  "1 "  1 0
   line "RTAP1     92.00"  "CENTRAL   92.00"  "1 "  1 0
0
C_12            "C-DIXILAN-RTPANZA 92KV         "
   line "DIXIELAN  92.00"  "RTP1      92.00"  "1 "  1 0
   line "RTAP2     92.00"  "RTP1      92.00"  "1 "  1 0
   line "RTAP2     92.00"  "RTP3ANZA  92.00"  "1 "  1 0
0
C_13            "C-ANZA-DESERT SHORES 92KV      "
   line "RTP3ANZA  92.00"  "RTP4SLTN  92.00"  "1 "  1 0
   line "RTP4SLTN  92.00"  "RTP5DSTS  92.00"  "1 "  1 0
0
C_14            "C-MECCA-NILAND 92KV            "
   line "MECCA     92.00"  "NORTHSHR  92.00"  "1 "  1 0
   line "BOMBAY    92.00"  "NILAND    92.00"  "1 "  1 0
   line "BOMBAY    92.00"  "NORTHSHR  92.00"  "1 "  1 0
0
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C_15            "C-MECCA-AVE52 92KV             "
   line "MECCA     92.00"  "KTP2      92.00"  "1 "  1 0
   line "THERMAL   92.00"  "KTP2      92.00"  "1 "  1 0
   line "AVE 52    92.00"  "THERMAL   92.00"  "1 "  1 0
0
line_1            "line YUCCA161 to PILOTKNB 161 ck 1"
 line "YUCCA161 161.00"  "PILOTKNB 161.00"  "1 "  1 0
0
line_2            "line CVSUB    to COACHELA  92 ck 1"
 line "CVSUB     92.00"  "COACHELA  92.00"  "1 "  1 0
0
line_3            "line CVSUB    to COACHELA  92 ck 2"
 line "CVSUB     92.00"  "COACHELA  92.00"  "2 "  1 0
0
line_4            "line CVSUB    to JACKSON   92 ck 1"
 line "CVSUB     92.00"  "JACKSON   92.00"  "1 "  1 0
0
line_5            "line CVSUB    to COLMAC    92 ck 1"
 line "CVSUB     92.00"  "COLMAC    92.00"  "1 "  1 0
0
line_6            "line AVE58    to JEFERSN   92 ck 1"
 line "AVE58     92.00"  "JEFERSN   92.00"  "1 "  1 0
0
line_8            "line AVE58    to MARSHALL  92 ck 1"
 line "AVE58     92.00"  "MARSHALL  92.00"  "1 "  1 0
0
line_10           "line USNAF    to DIXIELAN  92 ck 1"
 line "USNAF     92.00"  "DIXIELAN  92.00"  "1 "  1 0
0
line_11           "line USNAF    to ELTERMIN  92 ck 1"
 line "USNAF     92.00"  "ELTERMIN  92.00"  "1 "  1 0
0
line_12           "line JEFERSN  to MARSHALL  92 ck 1"
 line "JEFERSN   92.00"  "MARSHALL  92.00"  "1 "  1 0
0
line_13           "line LAQUINTA to N.LAQUIN  92 ck 1"
 line "LAQUINTA  92.00"  "N.LAQUIN  92.00"  "1 "  1 0
0
line_14           "line LAQUINTA to MARSHALL  92 ck 1"
 line "LAQUINTA  92.00"  "MARSHALL  92.00"  "1 "  1 0
0
line_16           "line RTAP8    to COACHELA  92 ck 2"
 line "RTAP8     92.00"  "COACHELA  92.00"  "2 "  1 0
0
line_17           "line N.VIEW   to AVE42     92 ck 1"
 line "N.VIEW    92.00"  "AVE42     92.00"  "1 "  1 0
0
line_18           "line N.VIEW   to MIRAGTIE  92 ck 1"
 line "N.VIEW    92.00"  "MIRAGTIE  92.00"  "1 "  1 0
0
line_20           "line N.LAQUIN to AVE42     92 ck 1"
 line "N.LAQUIN  92.00"  "AVE42     92.00"  "1 "  1 0
0
line_23           "line CITAP1   to CITP2     92 ck 1"
 line "CITAP1    92.00"  "CITP2     92.00"  "1 "  1 0
0
line_26           "line CARREON  to CITP4     92 ck 1"
 line "CARREON   92.00"  "CITP4     92.00"  "1 "  1 0
0
line_27           "line CARREON  to MONROE    92 ck 1"
 line "CARREON   92.00"  "MONROE    92.00"  "1 "  1 0
0
line_29           "line CITP2    to CITP4     92 ck 1"
 line "CITP2     92.00"  "CITP4     92.00"  "1 "  1 0
0
line_30           "line CITP2    to JACKSON   92 ck 1"
 line "CITP2     92.00"  "JACKSON   92.00"  "1 "  1 0
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0
line_31           "line CMTAP1   to CMTAP2    92 ck 1"
 line "CMTAP1    92.00"  "CMTAP2    92.00"  "1 "  1 0
0
line_36           "line AVE42    to EDOM      92 ck 1"
 line "AVE42     92.00"  "EDOM      92.00"  "1 "  1 0
0
line_37           "line AVE42    to FRANWAY   92 ck 1"
 line "AVE42     92.00"  "FRANWAY   92.00"  "1 "  1 0
0
line_38           "line FRANWAY  to EDOM      92 ck 1"
 line "FRANWAY   92.00"  "EDOM      92.00"  "1 "  1 0
0
line_39           "line AVE42    to MONROE    92 ck 1"
 line "AVE42     92.00"  "MONROE    92.00"  "1 "  1 0
0
line_40           "line COACHELA to RAMON    230 ck 1"
 line "COACHELA 230.00"  "RAMON    230.00"  "1 "  1 0
0
line_41           "line MECCA    to OASIS     92 ck 1"
 line "MECCA     92.00"  "OASIS     92.00"  "1 "  1 0
0
line_42           "line MECCA    to CVSUB     92 ck 1"
 line "MECCA     92.00"  "CVSUB     92.00"  "1 "  1 0
0
line_43           "line OASIS    to RTP6OASS  92 ck 2"
 line "OASIS     92.00"  "RTP6OASS  92.00"  "2 "  1 0
0
line_44           "line COACHELA to MIDWAY   230 ck 1"
 line   8311  8699  "1 "  1 0
0
line_45           "line COACHELA to MIDWAY   230 ck 2"
 line   8311  8699  "2 "  1 0
0
line_46           "line COACHELA to DEVERS   230 ck 1"
 line "COACHELA 230.00"  "DEVERS   230.00"  "1 "  1 0
0
line_47           "line COACHELA to JACKSON   92 ck 1"
 line "COACHELA  92.00"  "JACKSON   92.00"  "1 "  1 0
0
line_48           "line COACHELA to AVE 52    92 ck 1"
 line "COACHELA  92.00"  "AVE 52    92.00"  "1 "  1 0
0
line_51           "line DROP2    to DROP4     92 ck 1"
 line "DROP2     92.00"  "DROP4     92.00"  "1 "  1 0
0
line_52           "line DROP3    to DROP4     92 ck 1"
 line "DROP3     92.00"  "DROP4     92.00"  "1 "  1 0
0
line_53           "line DROP4    to BRAVO     92 ck 1"
 line "DROP4     92.00"  "BRAVO     92.00"  "1 "  1 0
0
line_54           "line DROP4    to PILOTKNB  92 ck 1"
 line "DROP4     92.00"  "PILOTKNB  92.00"  "1 "  1 0
0
line_56           "line DROP4    to HIGHLINE  92 ck 1"
 line "8326"  "8691"  "1 "  1 0
0
line_57           "line EDOM     to MIRAGTIE  92 ck 1"
 line "EDOM      92.00"  "MIRAGTIE  92.00"  "1 "  1 0
0
line_58           "line ELCENTSW to PILOTKNB 161 ck 1"
 line "ELCENTSW 161.00"  "PILOTKNB 161.00"  "1 "  1 0
0
line_62           "line ELSTEAMP to ELTERMIN  92 ck 1"
 line "ELSTEAMP  92.00"  "ELTERMIN  92.00"  "1 "  1 0
0
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line_63           "line ELSTEAMP to ELTERMIN  92 ck 2"
 line "ELSTEAMP  92.00"  "ELTERMIN  92.00"  "2 "  1 0
0
line_64           "line ELSTEAMP to HEBERSCE  92 ck 1"
 line "ELSTEAMP  92.00"  "HEBERSCE  92.00"  "1 "  1 0
0
line_65           "line ELSTEAMP to HOLTVILL  92 ck 1"
 line "ELSTEAMP  92.00"  "HOLTVILL  92.00"  "1 "  1 0
0
line_66           "line ELSTEAMP to CLARK     92 ck 1"
 line "ELSTEAMP  92.00"  "CLARK     92.00"  "1 "  1 0
0
line_68           "line ELSTEAMP to WSTBIOTP  92 ck 2"
 line "ELSTEAMP  92.00"  "WSTBIOTP  92.00"  "2 "  1 0
0
line_69           "line ELSTEAMP to ATEN      92 ck 1"
 line "ELSTEAMP  92.00"  "ATEN      92.00"  "1 "  1 0
0
line_70           "line ELSTEAMP to PRUETT    92 ck 1"
 line "ELSTEAMP  92.00"  "PRUETT    92.00"  "1 "  1 0
0
line_71           "line ELSTEAMP to IMPERIAL  92 ck 1"
 line "ELSTEAMP  92.00"  "IMPERIAL  92.00"  "1 "  1 0
0
line_72           "line ELSTEAMP to CENTRAL   92 ck 1"
 line "ELSTEAMP  92.00"  "CENTRAL   92.00"  "1 "  1 0
0
line_73           "line ELTERMIN to EUCLID    92 ck 1"
 line "ELTERMIN  92.00"  "EUCLID    92.00"  "1 "  1 0
0
line_74           "line EUCLID   to DAHLIA    92 ck 1"
 line "EUCLID    92.00"  "DAHLIA    92.00"  "1 "  1 0
0
line_75           "line HEBERSCE to PERRY     92 ck 1"
 line "HEBERSCE  92.00"  "PERRY     92.00"  "1 "  1 0
0
line_76           "line HOLTVILL to HIGHLINE  92 ck 1"
 line "8345"  "8691"  "2 "  1 0
0
line_77           "line HOLTVILL to ATEN      92 ck 1"
 line "HOLTVILL  92.00"  "ATEN      92.00"  "1 "  1 0
0
line_78           "line CLARK    to DAHLIA    92 ck 1"
 line "CLARK     92.00"  "DAHLIA    92.00"  "1 "  1 0
0
line_83           "line NILAND   to CVSUB161 161 ck 1"
 line "NILAND   161.00"  "CVSUB161 161.00"  "1 "  1 0
0
line_84           "line NILAND   to BLYTHE   161 ck 1"
 line "NILAND   161.00"  "BLYTHE   161.00"  "1 "  1 0
0
line_85           "line BRAVO    to PERRY     92 ck 1"
 line "BRAVO     92.00"  "PERRY     92.00"  "1 "  1 0
0
line_86           "line BRAVO    to CLX92     92 ck 1"
 line "BRAVO     92.00"  "CLX92     92.00"  "1 "  1 0
0
line_87           "line NILAND   to PRITP1    92 ck 1"
 line "NILAND    92.00"  "PRITP1    92.00"  "1 "  1 0
0
line_89           "line OASIS    to KTP2      92 ck 1"
 line "OASIS     92.00"  "KTP2      92.00"  "1 "  1 0
0
line_90           "line PERRY    to PRUETT    92 ck 1"
 line "PERRY     92.00"  "PRUETT    92.00"  "1 "  1 0
0
line_91           "line DESRTPWR to UNIT5     92 ck 1"
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 line "DESRTPWR  92.00"  "UNIT5     92.00"  "1 "  1 0
0
line 92           "line ROCKWOOD to WSTBIOTP  92 ck 2"
 line "ROCKWOOD  92.00"  "WSTBIOTP  92.00"  "2 "  1 0
0
line 93           "line ROCKWOOD to BRAW92    92 ck 1"
 line "ROCKWOOD  92.00"  "BRAW92    92.00"  "1 "  1 0
0
line 97           "line RTAP2    to SANFELIP  92 ck 1"
 line "RTAP2     92.00"  "SANFELIP  92.00"  "1 "  1 0
0
line 100          "line RTP3ANZA to WESTMORL  92 ck 1"
 line "RTP3ANZA  92.00"  "WESTMORL  92.00"  "1 "  1 0
0
line 104          "line CLX92    to MALL      92 ck 1"
 line "CLX92     92.00"  "MALL      92.00"  "1 "  1 0
0
line 105          "line ELSTEAMP to MALL      92 ck 1"
 line "ELSTEAMP  92.00"  "MALL      92.00"  "1 "  1 0
0
line 106          "line CALPTTAP to CALIPAT   92 ck 1"
 line "CALPTTAP  92.00"  "CALIPAT   92.00"  "1 "  1 0
0
line 107          "line CALPTTAP to PRITP2    92 ck 1"
 line "CALPTTAP  92.00"  "PRITP2    92.00"  "1 "  1 0
0
line 108          "line PRUETTAP to HIGHLINE  92 ck 1"
 line "8900"  "8691"  "1 "  1 0
0
line_109          "line SIGCTAP  to SIGC92    92 ck 1"
 line "SIGCTAP   92.00"  "SIGC92    92.00"  "1 "  1 0
0
line 110          "line JJELMORE to LEATHERS  92 ck 1"
 line "JJELMORE  92.00"  "LEATHERS  92.00"  "1 "  1 0
0
line_111          "line JJELMORE to DELRAN    92 ck 1"
 line "JJELMORE  92.00"  "DELRAN    92.00"  "1 "  1 0
0
line 112          "line LEATHERS to MIDWAY    92 ck 1"
 line "LEATHERS  92.00"  "MIDWAY    92.00"  "1 "  1 0
0
line_113          "line EARTHE2  to REG1EX    92 ck 1"
 line "EARTHE2   92.00"  "REG1EX    92.00"  "1 "  1 0
0
line 114          "line EARTHE2  to VULCAN    92 ck 1"
 line "EARTHE2   92.00"  "VULCAN    92.00"  "1 "  1 0
0
line_115          "line HIGHLINE to MIDWAY   230 ck 1"
 line   "8690"  "8699"  "1 "  1 0
0
line 116          "line HIGHLINE to MIDWAY   230 ck 2"
 line   "8690"  "8699"  "2 "  1 0
0
line_117          "line HIGHLINE to GEM23     92 ck 2"
 line "HIGHLINE  92.00"  "GEM23     92.00"  "2 "  1 0
0
line 118          "line RAMON    to MIRAGE   230 ck 1"
 line "RAMON    230.00"  "MIRAGE   230.00"  "1 "  1 0
0
line_119          "line MIRAGTIE to AVE42     92 ck 1"
 line "MIRAGTIE  92.00"  "AVE42     92.00"  "1 "  1 0
0
line 120          "line CALIPAT  to WESTMORL  92 ck 1"
 line "CALIPAT   92.00"  "WESTMORL  92.00"  "1 "  1 0
0
line_121          "line CALIPAT  to CALTP2    92 ck 1"
 line "CALIPAT   92.00"  "CALTP2    92.00"  "1 "  1 0
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0
line_122          "line MIDWAY   to MINPLNT   92 ck 1"
 line "MIDWAY    92.00"  "MINPLNT   92.00"  "1 "  1 0
0
line_123          "line MIDWAY   to VULCAN    92 ck 1"
 line "MIDWAY    92.00"  "VULCAN    92.00"  "1 "  1 0
0
line_124          "line MINPLNT  to UNIT5     92 ck 1"
 line "MINPLNT   92.00"  "UNIT5     92.00"  "1 "  1 0
0
line_125          "line WSTBIOTP to WESTBIO   92 ck 1"
 line "WSTBIOTP  92.00"  "WESTBIO   92.00"  "1 "  1 0
0
line_126          "line PARKVIEW to WESTMORL  92 ck 1"
 line "PARKVIEW  92.00"  "WESTMORL  92.00"  "1 "  1 0
0
line_127          "line PARKVIEW to CALIPAT   92 ck 1"
 line "PARKVIEW  92.00"  "CALIPAT   92.00"  "1 "  1 0
0
line_132          "line PRITP1   to PRISON    92 ck 1"
 line "PRITP1    92.00"  "PRISON    92.00"  "1 "  1 0
0
line_133          "line PRISON   to PRITP2    92 ck 1"
 line "PRISON    92.00"  "PRITP2    92.00"  "1 "  1 0
0
line_134          "line GEM92    to GEM23     92 ck 2"
 line "GEM92     92.00"  "GEM23     92.00"  "2 "  1 0
0
line_135          "line GEM23    to ORM2      92 ck 2"
 line "GEM23     92.00"  "ORM2      92.00"  "2 "  1 0
0
line_136          "line ORM2     to ORM1      92 ck 2"
 line "ORM2      92.00"  "ORM1      92.00"  "2 "  1 0
0
line_137          "line CALTP2   to BEEFPLNT  92 ck 1"
 line "CALTP2    92.00"  "BEEFPLNT  92.00"  "1 "  1 0
0
line_140          "line IMPERIAL to PANNO     92 ck 1"
 line "IMPERIAL  92.00"  "PANNO     92.00"  "1 "  1 0
0
line_141          "line IMPERIAL to BRAW92    92 ck 1"
 line "IMPERIAL  92.00"  "BRAW92    92.00"  "1 "  1 0
0
line_142          "line BRAW92   to PARKVIEW  92 ck 1"
 line "BRAW92    92.00"  "PARKVIEW  92.00"  "1 "  1 0
0
line_143          "line BRAW92   to PANNO     92 ck 1"
 line "BRAW92    92.00"  "PANNO     92.00"  "1 "  1 0
0
line_144          "line BRAW92   to BEEFPLNT  92 ck 1"
 line "BRAW92    92.00"  "BEEFPLNT  92.00"  "1 "  1 0
0
line_145          "line KNOB     to PILOTKNB 161 ck 1"
 line "KNOB     161.00"  "PILOTKNB 161.00"  "1 "  1 0
0
line_146          "line ELCENTSW to NILAND   161 ck 1"
 line "ELCENTSW 161.00"  "NILAND   161.00"  "1 "  1 0
0
line_148          "line BANISTER to BANTP2   161 ck 1"
 line "BANISTER 161.00"  "BANTP2   161.00"  "1 "  1 0
0
line 149          "line BANISTER to BANTP1   161 ck 1"
 line "BANISTER 161.00"  "BANTP1   161.00"  "1 "  1 0
0
line 150          "line AV58TP1  to BANTP2   161 ck 1"
 line "AV58TP1  161.00"  "BANTP2   161.00"  "1 "  1 0
0
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line_151          "line ELCENTSW to BANTP1   161 ck 1"
 line "ELCENTSW 161.00"  "BANTP1   161.00"  "1 "  1 0
0
line_154          "line AVE48    to AVE58     92 ck 1"
 line "AVE48     92.00"  "AVE58     92.00"  "1 "  1 0
0
line_155          "line AVE48    to JEFERSN   92 ck 1"
 line "AVE48     92.00"  "JEFERSN   92.00"  "1 "  1 0
0
line_157          "line ELSTEAMP to PRUETTAP  92 ck 1"
 line "ELSTEAMP  92.00"  "PRUETTAP  92.00"  "1 "  1 0
0
line_158          "line PRUETT   to PRUETTAP  92 ck 1"
 line "PRUETT    92.00"  "PRUETTAP  92.00"  "1 "  1 0
0
line_159          "line NILAND   to MW1TAP    92 ck 1"
 line "NILAND    92.00"  "MW1TAP    92.00"  "1 "  1 0
0
line_160          "line MW1TAP   to MIDWAY    92 ck 1"
 line "MW1TAP    92.00"  "MIDWAY    92.00"  "1 "  1 0
0
line_161          "line LEATHERS to MW1TAP    92 ck 1"
 line "LEATHERS  92.00"  "MW1TAP    92.00"  "1 "  1 0
0
line_162          "line SS6-230  to MIDWAY   230 ck 1"
 line   8600  8699  "1 "  1 0
0
line_163          "line SS6-230  to BANIS230 230 ck 1"
 line "SS6-230  230.00"  "BANIS230 230.00"  "1 "  1 0
0
tran_164          "tran CVSUB     92 to COACHELA  230 ck 1"
 tran "CVSUB     92.00"  "COACHELA 230.00"  "1 "  0
0
tran_165          "tran CVSUB     92 to COACHELA  230 ck 2"
 tran "CVSUB     92.00"  "COACHELA 230.00"  "2 "  0
0
tran_166          "tran CVSUB     92 to CVSUB161  161 ck 2"
 tran "CVSUB     92.00"  "CVSUB161 161.00"  "2 "  0
0
tran_167          "tran CVSUB     92 to CVSUB161  161 ck 1"
 tran "CVSUB     92.00"  "CVSUB161 161.00"  "1 "  0
0
tran_168          "tran AVE58     92 to AV58      161 ck 1"
 tran "AVE58     92.00"  "AV58     161.00"  "1 "  0
0
tran_169          "tran AVE58     92 to AV58      161 ck 2"
 tran "AVE58     92.00"  "AV58     161.00"  "2 "  0
0
tran_170          "tran BANISTER 161 to BANIS230  230 ck 1"
 tran "BANISTER 161.00"  "BANIS230 230.00"  "1 "  0
0
tran_171          "tran ELCENTSW 161 to ELCENTSW  230 ck 1"
 tran "ELCENTSW 161.00"  "ELCENTSW 230.00"  "1 "  0
0
tran_172          "tran ELCENTSW 161 to ELSTEAMP   92 ck 1"
 tran "ELCENTSW 161.00"  "ELSTEAMP  92.00"  "1 "  0
0
tran_173          "tran ELCENTSW 161 to ELSTEAMP   92 ck 2"
 tran "ELCENTSW 161.00"  "ELSTEAMP  92.00"  "2 "  0
0
tran_174          "tran NILAND   161 to NILAND     92 ck 2"
 tran "NILAND   161.00"  "NILAND    92.00"  "2 "  0
0
tran_175          "tran NILAND   161 to NILAND     92 ck 1"
 tran "NILAND   161.00"  "NILAND    92.00"  "1 "  0
0
tran_176          "tran PILOTKNB 161 to PILOTKNB   92 ck 1"
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 tran "PILOTKNB 161.00"  "PILOTKNB  92.00"  "1 "  0
0
tran_177          "tran MIRAGTIE  92 to RAMON     230 ck 1"
 tran "MIRAGTIE  92.00"  "RAMON    230.00"  "1 "  0
0
tran_178          "tran HIGHLINE 230 to HIGHLINE   92 ck 1"
 tran "HIGHLINE 230.00"  "HIGHLINE  92.00"  "1 "  0
0
tran_179          "tran ELCENTSW 230 to ELSTEAMP   92 ck 1"
 tran "ELCENTSW 230.00"  "ELSTEAMP  92.00"  "1 "  0
0
tran_180          "tran MIDWAY   230 to MIDWAY     92 ck 1"
 tran   8699  8700  "1 "  0
0
tran_181          "tran MIDWAY   230 to MIDWAY     92 ck 2"
 tran   8699  8700  "2 "  0
0
line_182        "line BANTP1 161 to ELCENTSW  161 ckt 1"
   line "BANTP1   161.00"  "ELCENTSW 161.00"  "1 "  1 0
0
line_183        "line BANTP1 161 to AV58TP1  161 ckt 1"
   line "BANTP2   161.00"  "AV58TP1 161.00"  "1 "  1 0
0
line_205        "line DEVERS   to VALLEYSC 500 ck 1"
 line    "DEVERS   500.00"  "VALLEYSC 500.00"   "1 "    1       0
0
line_206        "line HASSYAMP   to N.GILA 500 ck 1"
 line   "HASSYAMP   500.00"  "N.GILA 500.00"    "1 "    1       0
0
line_207        "line IMPRLVLY   to MIGUEL 500 ck 1"
 line   "IMPRLVLY   500.00"  "MIGUEL 500.00"    "1 "    1       0
0
line_208        "line MEAD   to MARKETPL 500 ck 1"
 line   "MEAD     500.00"  "MARKETPL 500.00"    "1 "    1       0
0
line_209        "line MEAD   to PERKINS 500 ck 1"
 line   "MEAD      500.00"  "PERKINS 500.00"    "1 "    1       0
0
line_210        "line N.GILA   to IMPRLVLY 500 ck 1"
 line   "N.GILA   500.00"  "IMPRLVLY 500.00"    "1 "    1       0
0
line_211        "line PALOVRDE   to DEVERS 500 ck 1"
 line   "PALOVRDE   500.00"  "DEVERS 500.00"    "1 "    1       0
0
tran_212        "tran DEVERS   to DEVERS 500/230 ck 1"
 tran   "DEVERS     500.00"  "DEVERS 230.00"    "1 "    1       0
0
tran_213        "tran MEAD   to MEAD N 500/230 ck 1"
 tran   "MEAD       500.00"  "MEAD N 230.00"    "1 "    1       0
0
tran_214        "tran N.GILA  to N.GILA 500/69 ck 1"
 tran   "N.GILA      500.00"  "N.GILA 69.00"    "1 "    1       0
0
line_215        "line BC TAP   to MEAD N 230 ck 1"
 line    "BC TAP   230.00"  "MEAD N   230.00"   "1 "    1       0
0
line_217        "line DAVIS   to MCCULLGH 230 ck 1"
 line    "DAVIS    230.00"  "MCCULLGH 230.00"   "1 "    1       0
0
line_218        "line DAVIS   to MEAD N 230 ck 1"
 line    "DAVIS      230.00"  "MEAD N 230.00"   "1 "    1       0
0
line_219        "line DAVIS   to TOPOCK 230 ck 1"
 line    "DAVIS      230.00"  "TOPOCK 230.00"   "1 "    1       0
0
line_220        "line DAVIS   to TOPOCK 230 ck 2"
 line    "DAVIS      230.00"  "TOPOCK 230.00"   "2 "    1       0
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0
line_221        "line DEVERS   to MIRAGE 230 ck 1"
 line    "DEVERS   230.00"  "MIRAGE 230.00"     "1 "    1       0
0
line_222        "line DEVERS   to SANBRDNO 230 ck 2"
 line    "DEVERS   230.00"  "SANBRDNO 230.00"   "2 "    1       0
0
line_223        "line DEVERS   to VSTA 230 ck 2"
 line    "DEVERS   230.00"  "VSTA 230.00"       "2 "    1       0
0
line_224        "line EAGLEMTN   to IRON MTN 230 ck 1"
 line    "EAGLEMTN 230.00"  "IRON MTN 230.00"   "1 "    1       0
0
line_226        "line ETIWANDA   to SANBRDNO 230 ck 1"
 line   "ETIWANDA 230.00"  "SANBRDNO 230.00"    "1 "    1       0
0
line_227        "line ETIWANDA   to VSTA 230 ck 1"
 line   "ETIWANDA     230.00"  "VSTA 230.00"    "1 "    1       0
0
line_228        "line GENE   to PARKER 230 ck 1"
 line   "GENE       230.00"  "PARKER 230.00"    "1 "    1       0
0
line_229        "line HILLTOP  to  MCCONICO     ck 1"
 line   "HILLTOP 230.00"  "MCCONICO 230.00"     "1 "    1       0
0
line_230        "line IRON MTN   to EAGLEMTN 230 ck 1"
 line   "IRON MTN 230.00"  "EAGLEMTN 230.00"    "1 "    1       0
0
line_231        "line J.HINDS   to EAGLEMTN 230 ck 1"
 line   "J.HINDS  230.00"  "EAGLEMTN 230.00"    "1 "    1       0
0
line_232        "line J.HINDS   to MIRAGE 230 ck 1"
 line   "J.HINDS    230.00"  "MIRAGE 230.00"    "1 "    1       0
0
line_233        "line LIBERTY  to  WESTWING ck 1"
 line   "LIBERTY 230.00"  "WESTWING 230.00"     "1 "    1       0
0
line_234        "line MCCONICO  to  DAVIS     ck 1"
 line   "MCCONICO 230.00"  "DAVIS   230.00"     "1 "    1       0
0
line_235        "line MCCONICO  to  GRIFFITH     ck 1"
 line   "MCCONICO 230.00" "GRIFFITH 230.00"     "1 "    1       0
0
line_236        "line MEAD   to IRON MTN ck 1"
 line   24019     25402 "1 "    1       0
 line   24019     19012 "E "    1       0
 line   24019     19012 "W "    1       0
 line   25405     24019 "1 "    1       0
0
line_237        "line MEAD S   to EQUEST 230 ck 1"
 line   "MEAD S     230.00"  "EQUEST 230.00"    "1 "    1       0
0
line_238        "line MEAD S   to MCCULLGH 230 ck 1"
 line   "MEAD S   230.00"  "MCCULLGH 230.00"    "1 "    1       0
0
line_239        "line MEAD S to GREENWAY ck 1"
 line   19012   18674   "1 "    1       0
0
line_240        "line MEAD S to PAHRUMP ck 1"
 line   "MEAD S   230.00"  "PAHRUMP 230.00"     "1 "    1       0
0
line_241        "line PARKER   to  BLK MESA ck 1"
 line   "PARKER  230.00"  "BLK MESA 230.00"     "1 "    1       0
0
line_242        "line PARKER   to  EAGLEYE  ck 1"
 line   "PARKER  230.00"  "EAGLEYE  230.00"     "1 "    1       0
0
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line_243        "line PARKER   to  HARCUVAR ck 1"
 line   "PARKER  230.00"  "HARCUVAR 230.00"     "1 "    1       0
0
line_244        "line PEACOCK   to   HILLTOP   ck 1"
 line   "PEACOCK 230.00"  "HILLTOP  230.00"     "1 "    1       0
0
line_246        "line SANBRDNO   to DEVERS 230 ck 1"
 line   "SANBRDNO   230.00"  "DEVERS 230.00"    "1 "    1       0
0
line_247        "line TOPOCK   to   BLK MESA ck 1"
 line   "TOPOCK  230.00"  "BLK MESA 230.00"     "1 "    1       0
0
line_248        "line TOPOCK   to   SOPOINT ck 1"
 line   "TOPOCK  230.00"  "SOPOINT  230.00"     "1 "    1       0
0
line_249        "line TOPOCK   to   SOPOINT ck 2"
 line   "TOPOCK  230.00"  "SOPOINT  230.00"     "2 "    1       0
0
line_250        "line VSTA   to DEVERS 230 ck 1"
 line   "VSTA     230.00"  "DEVERS 230.00"      "1 "    1       0
0
line_251        "line VSTA   to SANBRDNO 230 ck 2"
 line   "VSTA     230.00"  "SANBRDNO 230.00"    "2 "    1       0
0
tran_252        "tran MEAD   to MEAD N 345/230 ck 1"
 tran   "MEAD       345.00"  "MEAD N 230.00"    "1 "    1       0
0
tran_253        "tran MEAD S   to MEAD 230/287 ck 1"
 tran   "MEAD S       230.00"  "MEAD 287.00"    "1 "    1       0
0
tran_254        "tran MEAD S   to MEAD A 230/69 ck 1"
 tran   "MEAD S      230.00"  "MEAD A 69.00"    "1 "    1       0
0
tran_255        "tran MEAD S   to MEAD B 230/69 ck 1"
 tran   "MEAD S      230.00"  "MEAD B 69.00"    "1 "    1       0
0
tran_256        "tran PARKER   to PARKER 161/230 ck 1"
 tran   "PARKER     161.00"  "PARKER 230.00"    "1 "    1       0
0
tran_257        "tran PARKER   to PARKER 161/230 ck 2"
 tran   "PARKER     161.00"  "PARKER 230.00"    "2 "    1       0
0
line_259        "line LIBERTY   to PEACOCK 345 ck 1"
 line   "LIBERTY   345.00"  "PEACOCK 345.00"    "1 "    1       0
0
line_260        "line PEACOCK   to MEAD 345 ck 1"
 line   "PEACOCK      345.00"  "MEAD 345.00"    "1 "    1       0
0
line_261        "line ELCENT   to IVPS 230 ck 2"
 line   "8332"  "22357" "2 "    1       0
0
tran_262        "tran IVPS   to IMPERVLY PS ck 1"
 tran   "22356"  "22357"        1       0
0
line_263        "line GLT TAP   to BLYTHE   161 ck 1"
 line "19105"  "19020"  "1 "  1 0
 line "19105"  "19051"  "1 "  1 0
0
line_264        "line BUCKBLVD   to BLYTHE   161 ck 1"
 line "19101"  "19020"  "1 "  1 0
0
line_265        "line BLYTHESC   to BLYTHE   161 ck 1"
 line "24017"  "19020"  "1 "  1 0
0
line_266        "line HEADGATE   to BLYTHE   161 ck 1"
 line "19206"  "19020"  "1 "  1 0
0
```

```
line_267        "line PARKER   to BLYTHE   161 ck 1"
 line "19041"  "19020"  "1 "  1 0
0
tran 268          "tran SS6 16/230kV  ck 1"
 tran "8686"  "8600"  "1 "  0
0
line_269        "Line AVE58TP1 - ESM161 161kV"
 line "8806"  "8400"  "1 " 1 0
0
line 270        "Line BANTP2 - ESM161  161kV"
 line "8200"  "8400"  "1 " 1 0
0
tran_271        "tran ESM 161 - ESM13.8"
  tran "8400"  "8450"  "1 " 0
0
line 272       "Line ELSTEAMP - LIBTAP 92kV"
  line "8335"  "8725"  "2 " 1 0
0
line_273        "line LIBTAP-WSTBIOTP 92kV"
  line "8725"  "8720"  "2 " 1 0
0
line 274        "line LIBTAP-LIB92 92kV"
  line "8725"  "8726"  "2 " 1 0
0
tran_275        "tran LIBG1 - LIB92 13.8/92kV"
  tran "8727"  "8726"  "1 " 0
0
tran 276        "tran LIBG2 - LIB92 13.8/92kV"
  tran "8728"  "8726"  "1 " 0
0
tran_277        "tran LIBG3 - LIB92 13.8/92kV"
  tran "8728"  "8726"  "1 " 0
0
tran 278        "tran SIGC - ORCAL 13.8/92kV"
  tran "8960"  "8961" "1 " 0
0
tran_279A       "tran Niland 161/13.8kV"
  tran  "8359"  "8000"  "1 " 0
0
tran_279B       "tran Niland 161/13.8kV"
  tran  "8359"  "8050"  "1 " 0
0
tran_279C       "tran Niland 92/13.8kV"
  tran  "8361"  "8000"  "1 " 0
0
tran_279D       "tran Niland 92/13.8kV"
  tran  "8361"  "8050"  "1 " 0
0
line_283        "PRUETTAP - SIGCTAP"
  line  "8900"  "8652"  "1 " 1 0
0
line 284        "ELCENTSW - IVPS"
  line "8332"   "22357" "2 " 1 0
0
tran_285        "IVPS - IMPRLVLY"
  tran "22357"  "22356" "1 "  0
0
tran 286        "tran REPU3 - ELSTEAMP"
  tran "8100"   "8335" "2 "  0
end
# End of contingency list, 184 continegncies added to list
```

```
# N-2 contingency selection
n2otg_194    "N2-line DEVERS   to MIRAGE 230 ck 1"
 line "DEVERS 230.00"  "MIRAGE 230.00"  "1 "  1 0
 line "ETIWANDA    230.00"  "VSTA  230.00"  "1 "  1 0
0
n2otg_195    "N2-line VSTA   to DEVERS 230, 1 ck 1"
 line "VSTA     230.00"  "DEVERS 230.00"  "1 "  1 0
 line "VSTA    230.00"  "SANBRDNO  230.00"  "2 "  1 0
0
n2otg_196    "N2-line VSTA   to DEVERS 230, 2 ck 1"
 line "VSTA    230.00"  "DEVERS 230.00"  "1 "  1 0
 line "SANBRDNO 230.00"  "DEVERS 230.00"  "1 "  1 0
0
n2otg_197    "N2-line VSTA   to DEVERS 230, 3 ck 1"
 line "VSTA    230.00"  "DEVERS  230.00"  "1 "  1 0
 line "DEVERS 230.00" "SANBRDNO  230.00"  "1 "  1 0
0
n2otg_198    "N2-line VSTA   to DEVERS 230, 4 ck 1"
 line "VSTA     230.00" "DEVERS  230.00"  "1 "  1 0
 line "DEVERS  230.00"  "MIRAGE  230.00"  "1 "  1 0
0
n2otg_199    "N2-line VSTA   to DEVERS 230, 5 ck 1"
 line "VSTA    230.00"  "DEVERS  230.00"  "1 "  1 0
 line "ETIWANDA 230.00"  "SANBRDNO 230.00"  "1 "  1 0
0
n2otg_200    "N2-line COACHELA   to DEVERS 230, 1 ck 1"
 line "COACHELA 230.00"  "DEVERS 230.00"  "1 "  1 0
 line "J.HINDS    230.00"  "MIRAGE 230.00"  "1 "  1 0
0
n2otg_201    "N2-line COACHELA   to DEVERS 230, 2 ck 1"
 line "COACHELA 230.00"  "DEVERS  230.00"  "1 "  1 0
 line "DEVERS 230.00"  "MIRAGE  230.00"  "1 "  1 0
 line "8700"  "8703"  "1 "  1 0
 line "8700"  "8723"  "1 "  1 0
 line "8691"  "8912"  "2 "  1 0
0
n2otg_202    "N2-line COACHELA   to DEVERS 230, 3 ck 1"
 line "COACHELA 230.00"  "DEVERS 230.00"  "1 "  1 0
 line "RAMON      230.00"  "MIRAGE 230.00"  "1 "  1 0
0
n2otg_203    "N2-line COACHELA   to DEVERS 230, 4 ck 1"
 line "COACHELA 230.00"  "DEVERS 230.00"  "1 "  1 0
 line "COACHELA    230.00"  "RAMON 230.00"  "1 "  1 0
0
n2otg_205    "N2-line COACHELA   to RAMON 230 ck 1"
 line "COACHELA  230.00"  "RAMON   230.00"  "1 "  1 0
 line "RAMON    230.00"  "MIRAGE 230.00"  "1 "  1 0
0
n2otg_206    "N2-line COACHELA   to DEVERS 230, 6 ck 1"
 line "COACHELA 230.00"  "DEVERS 230.00"  "1 "  1 0
 line "COACHELA    230.00"  "RAMON 230.00"  "1 "  1 0
 tran "CVSUB     92.00"  "COACHELA 230.00"  "1 "  0
0
n2otg_207    "N2-line BLYTHESC to EAGLEMTN 161, 1 ck 1"
 line "BLYTHESC 161.00"  "EAGLEMTN 161.00"  "1 "  1 0
 line "EAGLEMTN 230.00"  "IRON MTN 230.00"  "1 "  1 0
0
n2otg_208    "N2-line BLYTHESC to EAGLEMTN 161, 2 ck 1"
 line "BLYTHESC 161.00"  "EAGLEMTN 161.00"  "1 "  1 0
 line "J.HINDS  230.00"  "EAGLEMTN 230.00"  "1 "  1 0
0
n2otg_209    "N2-line BLYTHE   to BLYTHESC 161, 1 ck 1"
 line "BLYTHE   161.00"  "BLYTHESC 161.00"  "1 "  1 0
 line "EAGLEMTN 230.00"  "IRON MTN 230.00"  "1 "  1 0
0
n2otg_210    "N2-line BLYTHE   to BLYTHESC 161, 2 ck 1"
 line "BLYTHE   161.00"  "BLYTHESC 161.00"  "1 "  1 0
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 line "J.HINDS  230.00"  "EAGLEMTN 230.00"  "1 "  1 0
0
n2otg_211    "N2-line BLYTHE   to BLYTHESC 161, 3 ck 1"
 line "BLYTHE   161.00"  "BLYTHESC 161.00"  "1 "  1 0
 line "BLYTHESC 161.00"  "EAGLEMTN 161.00"  "1 "  1 0
0
n2otg_212w    "N2-line BLYTHE   to KNOB 230, 1 ck 1"
 line "BLYTHE    161.00"  "GLT TAP 161.00"  "1 "  1 0
 line "GLT TAP   161.00"  "KNOB 161.00"     "1 "  1 0
 line "PARKER  161.00"  "BLYTHE    161.00"  "1 "  1 0
0
n2otg_213w    "N2-line BLYTHE   to KNOB 161, 2 ck 1"
 line "BLYTHE    161.00"  "GLT TAP 161.00"    "1 "  1 0
 line "GLT TAP   161.00"  "KNOB 161.00"       "1 "  1 0
 line "BLYTHE  161.00"    "HEADGATE  161.00"  "1 "  1 0
0
n2otg_214w    "N2-line BLYTHE   to KNOB 161, 3 ck 1"
 line "BLYTHE    161.00"  "GLT TAP 161.00"    "1 "  1 0
 line "GLT TAP   161.00"  "KNOB 161.00"       "1 "  1 0
 line "BLYTHE  161.00"  "NILAND    161.00"    "1 "  1 0
0
n2otg_215w    "N2-line BLYTHE   to KNOB 161, 4 ck 1"
 line "BLYTHE    161.00"  "GLT TAP 161.00"    "1 "  1 0
 line "GLT TAP   161.00"  "KNOB 161.00"       "1 "  1 0
 line "EAGLEMTN 161.00"  "BLYTHESC 161.00"  "1 "  1 0
0
n2otg_216    "N2-line BLYTHE   to PARKER 161, 1 ck 1"
 line "BLYTHE  161.00"  "PARKER    161.00"  "1 "  1 0
 line "BLYTHE   161.00"  "HEADGATE 161.00"  "1 "  1 0
0
n2otg_217    "N2-line BLYTHE   to PARKER 161, 2 ck 1"
 line "BLYTHE  161.00"  "PARKER    161.00"  "1 "  1 0
 line "BLYTHE   161.00"  "NILAND   161.00"  "1 "  1 0
0
n2otg_218    "N2-line BLYTHE   to PARKER 161, 3 ck 1"
 line "BLYTHE  161.00"  "PARKER    161.00"  "1 "  1 0
 line "EAGLEMTN 161.00"  "BLYTHESC 161.00"  "1 "  1 0
0
n2otg_219    "N2-line BLYTHE   to HEADGATE 161, 1 ck 1"
 line "BLYTHE  161.00"  "HEADGATE  161.00"  "1 "  1 0
 line "BLYTHE   161.00"  "NILAND   161.00"  "1 "  1 0
0
n2otg_220    "N2-line BLYTHE   to HEADGATE 161, 2 ck 1"
 line "BLYTHE  161.00"  "HEADGATE  161.00"  "1 "  1 0
 line "EAGLEMTN 161.00"  "BLYTHESC 161.00"  "1 "  1 0
0
n2otg_221    "N2-line BLYTHE   to NILAND 161 ck 1"
 line "BLYTHE  161.00"  "NILAND    161.00"  "1 "  1 0
 line "EAGLEMTN 161.00"  "BLYTHESC 161.00"  "1 "  1 0
0
n2otg_222    "N2-line PARKER   to BOUSE 161, 1 ck 1"
 line "PARKER   161.00"  "BOUSE    161.00"  "1 "  1 0
 line "PARKER 161.00"  "HEADGATE   161.00"  "1 "  1 0
0
n2otg_223    "N2-line PARKER   to BOUSE 161, 2 ck 1"
 line "PARKER   161.00"  "BOUSE    161.00"  "1 "  1 0
 line "BLYTHE   161.00"  "PARKER   161.00"  "1 "  1 0
0
n2otg_224    "N2-line PARKER   to HEADGATE 161 ck 1"
 line "PARKER   161.00"  "HEADGATE 161.00"  "1 "  1 0
 line "BLYTHE   161.00"  "PARKER   161.00"  "1 "  1 0
0
n2otg_225    "N2-line GENE   to PARKER 230, 1 ck 1"
 line "GENE       230.00"  "PARKER 230.00"  "1 "  1 0
 line "PARKER   230.00"  "EAGLEYE  230.00"  "1 "  1 0
0
n2otg_226    "N2-line GENE   to PARKER 230, 2 ck 1"
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 line "GENE       230.00"  "PARKER 230.00"  "1 "  1 0
 line "PARKER   230.00"  "HARCUVAR 230.00"  "1 "  1 0
0
n2otg_227    "N2-line GENE   to PARKER 230, 3 ck 1"
 line "GENE       230.00"  "PARKER 230.00"  "1 "  1 0
 line "PARKER   230.00"  "HAVASU   230.00"  "1 "  1 0
0
n2otg_228    "N2-line GENE   to PARKER 230, 4 ck 1"
 line "GENE       230.00"  "PARKER 230.00"  "1 "  1 0
 tran "PARKER   161.00"    "PARKER 230.00"  "1 "  0
0
n2otg_229    "N2-line GENE   to PARKER 230, 5 ck 1"
 line "GENE       230.00"  "PARKER 230.00"  "1 "  1 0
 tran "PARKER   161.00"    "PARKER 230.00"  "2 "  0
0
n2otg_230    "N2-line PARKER   to EAGLEYE 230, 1 ck 1"
 line "PARKER    230.00"  "EAGLEYE 230.00"  "1 "  1 0
 line "PARKER   230.00"  "HARCUVAR 230.00"  "1 "  1 0
0
n2otg_231    "N2-line PARKER   to EAGLEYE 230, 2 ck 1"
 line "PARKER    230.00"  "EAGLEYE 230.00"  "1 "  1 0
 line "PARKER   230.00"  "HAVASU   230.00"  "1 "  1 0
0
n2otg_232    "N2-line PARKER   to EAGLEYE 230, 3 ck 1"
 line "PARKER    230.00"  "EAGLEYE 230.00"  "1 "  1 0
 tran "PARKER   161.00"    "PARKER 230.00"  "1 "  0
0
n2otg_233    "N2-line PARKER   to EAGLEYE 230, 4 ck 1"
 line "PARKER    230.00"  "EAGLEYE 230.00"  "1 "  1 0
 tran "PARKER   161.00"    "PARKER 230.00"  "2 "  0
0
n2otg_234    "N2-line PARKER   to HARCUVAR 230, 1 ck 1"
 line "PARKER   230.00"  "HARCUVAR 230.00"  "1 "  1 0
 line "PARKER   230.00"  "HAVASU   230.00"  "1 "  1 0
0
n2otg_235    "N2-line PARKER   to HARCUVAR 230, 2 ck 1"
 line "PARKER   230.00"  "HARCUVAR 230.00"  "1 "  1 0
 tran "PARKER   161.00"    "PARKER 230.00"  "1 "  0
0
n2otg_236    "N2-line PARKER   to HARCUVAR 230, 3 ck 1"
 line "PARKER   230.00"  "HARCUVAR 230.00"  "1 "  1 0
 tran "PARKER   161.00"    "PARKER 230.00"  "2 "  0
0
n2otg_237    "N2-line PARKER   to HAVASU 230, 1 ck 1"
 line "PARKER   230.00"  "HAVASU   230.00"  "1 "  1 0
 tran "PARKER   161.00"    "PARKER 230.00"  "1 "  0
0
n2otg_238    "N2-line PARKER   to HAVASU 230, 2 ck 1"
 line "PARKER   230.00"  "HAVASU   230.00"  "1 "  1 0
 tran "PARKER   161.00"    "PARKER 230.00"  "2 "  0
0
n2otg_239    "N2-tran PARKER to PARKER 161/230 ck 1 & 2"
 tran "PARKER   161.00"    "PARKER 230.00"  "1 "  0
 tran "PARKER   161.00"    "PARKER 230.00"  "2 "  0
0
n2otg_261    "N2-line HIGHLINE   to MIDWAY  230 ck 1"
 line "8690"  "8699"  "1 "  1 0
 line "8690"  "8699"  "2 "  1 0
0
n2otg_262    "N2-line COACHELA to MIDWAY 230 ck 1"
 line "8311"  "8699"  "1 "  1 0
 line "8311"  "8699"  "2 "  1 0
 tran "8311"  "8279"  "1 "  0
 line "8700"  "8703"  "1 "  1 0
 line "8700"  "8723"  "1 "  1 0
0
n2otg_263    "N2-line AV58   to AV58TP2 161 ck 1"
```



```
 line "AV58    161.00"   "AV58TP2  161.00"  "1 "  1 0
 line "AV58    161.00"   "AV58TP1  161.00"  "1 "  1 0
0
n2otg_264    "N2-line BLYTHE   to BUCKBLVD 161 ck 1"
 line "BLYTHE 161.00"   "BUCKBLVD  161.00"  "1 "  1 0
 line "BLYTHE 161.00"   "HEADGATE  161.00"  "1 "  1 0
end

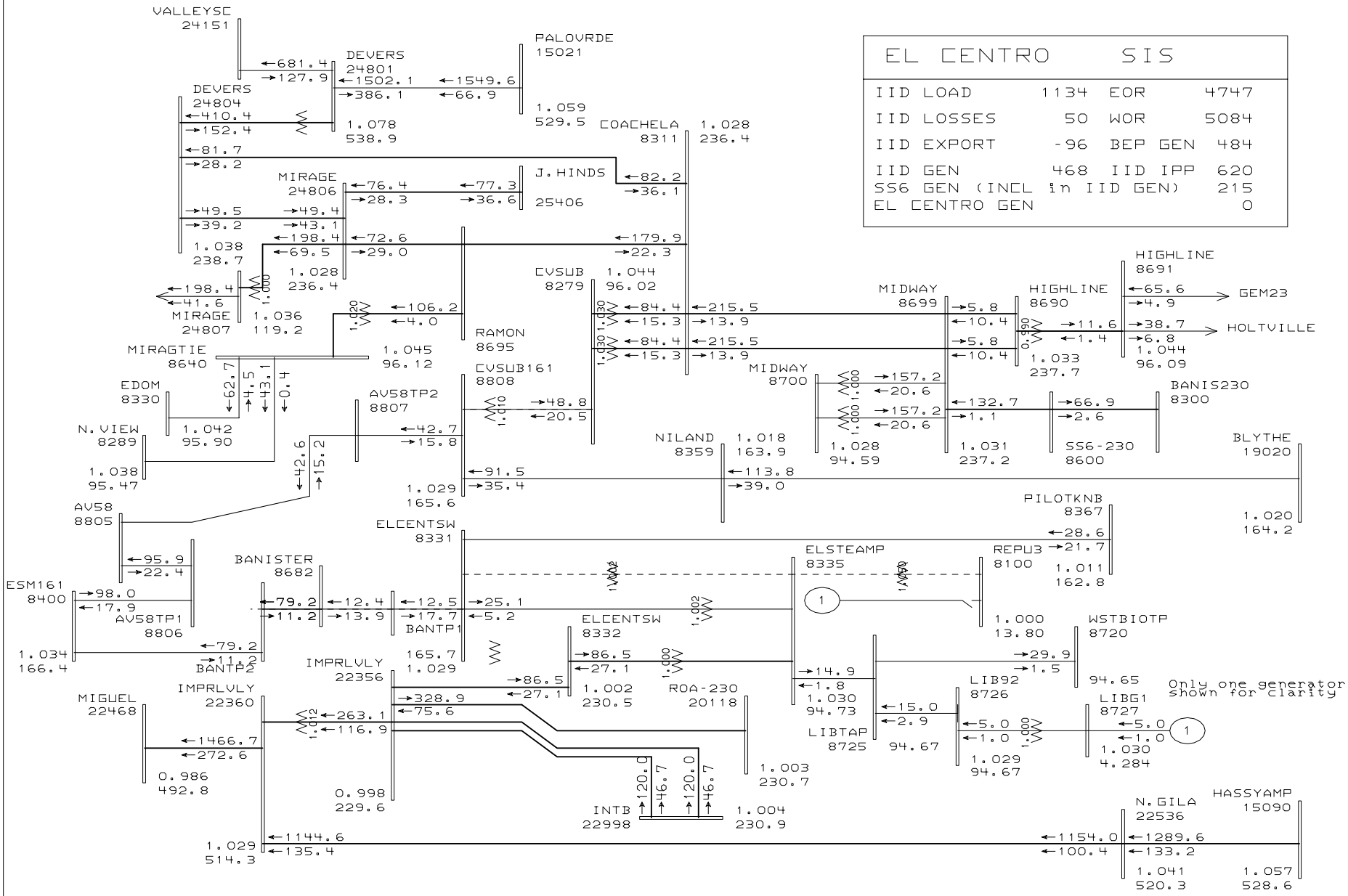
# End N-2 List

/*from ssg_n2_r2.otg, from original n-2 from BARTn-2.otg.  S
aved and re-named, corrected bus names, removed duplicate outages*/
```

EC3 System Impact Study

Appendix B
Power Flow Results
Pre-Project

February 2006



General Electric International, Inc. PSLF Program MW/MVAR Sun Nov 06 14:30:33 2005

r2_EC_PRE.sav FROM r1_ec_pre 11-03-05 KRSA
EL CENTRO System Impact Study
PRE - Project

draw\ec_pre.drw
cases\r2_ec_pre.sav
Rating = 1

r2_ec_pre.xls
Voltage Summary
N-0 Outages

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
none													

r2_ec_pre.xls
Flow Summary
N-0 Outages

LEGEND	% of RATING 1	
C_pu	100% - 110%	
C_pu	110% - 120%	P.U. of
C_pu	> 120%	Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8342	HEBERSCE	92	8	163	8666	HEBERSCE	13.8	8	163	1	tran	base	r2_ec_pre	50	-47	9.6	292.5	48	0.96	0.96	Base system (n-0)

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
none													

r2_ec_pre.xls
N1_flow

LEGEND	% of RATING 1
C_pu	100% - 110%
C_pu	110% - 120%
C_pu	> 120%

P.U. of Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8699	MIDWAY	230	8	164	8700	MIDWAY	92	8	164	2	tran	tran_180	r2_ec_pre	225	-312.1	80.9	793.7	322.4	1.43	0.7	tran MIDWAY 230 to MIDWAY 92 ck 1
8699	MIDWAY	230	8	164	8700	MIDWAY	92	8	164	1	tran	tran_181	r2_ec_pre	225	-312.1	80.9	793.7	322.4	1.43	0.7	tran MIDWAY 230 to MIDWAY 92 ck 2
8331	ELCENTSW	161	8	163	8335	ELSTEAMP	92	8	163	1	tran	line_210	r2_ec_pre	125	127.5	-20.8	461.2	129.2	1.05	0.21	line N.GILA to IMPRLVLY 500 ck 1
8279	CVSUB	92	8	162	8312	COACHELA	92	8	162	2	line	line_2	r2_ec_pre	132	142.6	0.8	858.3	142.6	1.036	0.613	line CVSUB to COACHELA 92 ck 1
8279	CVSUB	92	8	162	8312	COACHELA	92	8	162	1	line	line_3	r2_ec_pre	132	142.6	0.8	858.3	142.6	1.036	0.613	line CVSUB to COACHELA 92 ck 2
8672	LEATHERS	92	8	165	8051	LEATHERS	14.4	8	163	1	tran	line_160	r2_ec_pre	45	-40.7	-17.6	275	44.4	1.03	0.92	line MW1TAP to MIDWAY 92 ck 1
8672	LEATHERS	92	8	165	8051	LEATHERS	14.4	8	163	1	tran	line_161	r2_ec_pre	45	-40.7	-17.6	275	44.4	1.03	0.92	line LEATHERS to MW1TAP 92 ck 1
8671	JJELMORE	92	8	165	8054	JJELMORE	14.4	8	163	1	tran	line_110	r2_ec_pre	45	-40.4	-17.4	272.7	44	1.02	0.92	line JJELMORE to LEATHERS 92 ck 1
8671	JJELMORE	92	8	165	8054	JJELMORE	14.4	8	163	1	tran	line_160	r2_ec_pre	45	-40.4	-17.4	272.7	44	1.02	0.92	line MW1TAP to MIDWAY 92 ck 1
8671	JJELMORE	92	8	165	8054	JJELMORE	14.4	8	163	1	tran	line_161	r2_ec_pre	45	-40.4	-17.4	272.7	44	1.02	0.92	line LEATHERS to MW1TAP 92 ck 1
8335	ELSTEAMP	92	8	163	8337	ELTERMIN	92	8	163	2	line	line_62	r2_ec_pre	132	135.1	-9.2	825.1	135.4	0.996	0.527	line ELSTEAMP to ELTERMIN 92 ck 1
8335	ELSTEAMP	92	8	163	8337	ELTERMIN	92	8	163	1	line	line_63	r2_ec_pre	132	135.1	-9.2	825.1	135.4	0.996	0.527	line ELSTEAMP to ELTERMIN 92 ck 2
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	line_265	r2_ec_pre	165	-153.6	54.9	582.5	163.1	0.995	0.729	line BLYTHESC to BLYTHE 161 ck 1
8723	VULCAN	92	8	165	8055	VULCAN1	14.4	8	163	1	tran	line_123	r2_ec_pre	50	-44.7	-15.6	292	47.4	0.99	0.9	line MIDWAY to VULCAN 92 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	line_210	r2_ec_pre	165	-149.3	49	564.7	157.2	0.964	0.729	line N.GILA to IMPRLVLY 500 ck 1

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
8695	RAMON	230	8	162	n2otg_205	r2_ec_pre	1.028	0.973	-0.055	0.9	1.05	0.05	N2-line COACHELA to RAMON 230 ck 1
8330	EDOM	92	8	162	n2otg_205	r2_ec_pre	1.042	0.992	-0.051	0.9	1.05	0.05	N2-line COACHELA to RAMON 230 ck 1
8640	MIRAGTIE	92	8	162	n2otg_205	r2_ec_pre	1.045	0.992	-0.053	0.9	1.05	0.05	N2-line COACHELA to RAMON 230 ck 1

r2_ec_pre.xls
N2_flow

LEGEND	% of RATING 1
C_pu	100% - 110%
C_pu	110% - 120%
C_pu	> 120%

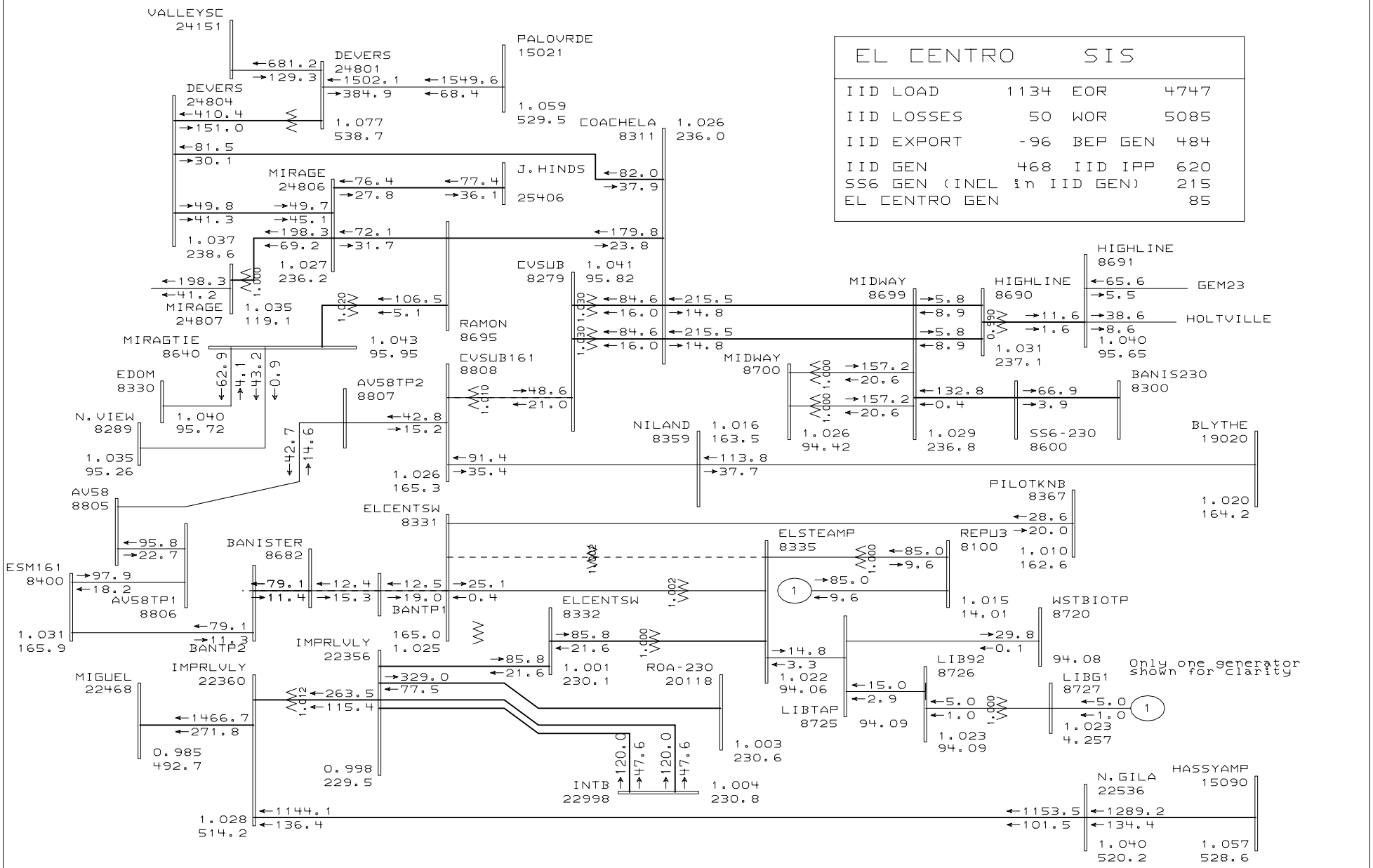
P.U. of Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_215w	r2_ec_pre	165	-174.6	68	671	187.4	1.144	0.729	N2-line BLYTHE to KNOB 161, 4 ck 1
8279	CVSUB	92	8	162	8311	COACHELA	230	8	164	1	tran	n2otg_203	r2_ec_pre	150	-156.6	8.5	968.2	156.9	1.06	0.57	N2-line COACHELA to DEVERS 230, 4 ck 1
8279	CVSUB	92	8	162	8311	COACHELA	230	8	164	2	tran	n2otg_203	r2_ec_pre	150	-156.6	8.5	968.2	156.9	1.06	0.57	N2-line COACHELA to DEVERS 230, 4 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_209	r2_ec_pre	165	-162.1	56.5	617.9	171.7	1.054	0.729	N2-line BLYTHE to BLYTHESC 161, 1 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_210	r2_ec_pre	165	-156	56.5	592.4	165.9	1.012	0.729	N2-line BLYTHE to BLYTHESC 161, 2 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_218	r2_ec_pre	165	-155.2	56.4	589.4	165.2	1.007	0.729	N2-line BLYTHE to PARKER 161, 3 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_220	r2_ec_pre	165	-154.4	56	586.2	164.3	1.001	0.729	N2-line BLYTHE to HEADGATE 161, 2 ck 1
8806	AV58TP1	161	8	162	8400	ESM161	161	8	163	1	line	n2otg_262	r2_ec_pre	165	-159	28.6	589.3	161.6	0.998	0.584	N2-line COACHELA to MIDWAY 230 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_212w	r2_ec_pre	165	-153.4	57.5	582.2	163.8	0.995	0.729	N2-line BLYTHE to KNOB 230, 1 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_211	r2_ec_pre	165	-153.1	55.3	580.7	162.8	0.992	0.729	N2-line BLYTHE to BLYTHESC 161, 3 ck 1
8723	VULCAN	92	8	165	8055	VULCAN1	14.4	8	163	1	tran	n2otg_201	r2_ec_pre	50	-44.7	-15.6	292	47.4	0.99	0.9	N2-line COACHELA to DEVERS 230, 2 ck 1
8723	VULCAN	92	8	165	8055	VULCAN1	14.4	8	163	1	tran	n2otg_262	r2_ec_pre	50	-44.7	-15.6	292	47.4	0.99	0.9	N2-line COACHELA to MIDWAY 230 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_213w	r2_ec_pre	165	-152.5	57.1	578.7	162.9	0.989	0.729	N2-line BLYTHE to KNOB 161, 2 ck 1
8301	CITAP1	92	8	162	8312	COACHELA	92	8	162	1	line	n2otg_203	r2_ec_pre	152	-147.5	23.6	925.9	149.4	0.971	0.661	N2-line COACHELA to DEVERS 230, 4 ck 1
8301	CITAP1	92	8	162	8389	VANBUREN	92	8	162	1	line	n2otg_203	r2_ec_pre	152	147.5	-23.6	925.9	149.4	0.971	0.661	N2-line COACHELA to DEVERS 230, 4 ck 1
8279	CVSUB	92	8	162	8349	JACKSON	92	8	162	1	line	n2otg_203	r2_ec_pre	132	128.8	-3.1	795	128.8	0.96	0.683	N2-line COACHELA to DEVERS 230, 4 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_207	r2_ec_pre	165	-147.1	51	555.8	155.7	0.95	0.729	N2-line BLYTHESC to EAGLEMTN 161, 1 ck 1

EC3 System Impact Study

Appendix C
Power Flow Results
Post Project

February 2006



General Electric International, Inc. PSLF Program MW/MVAR Sun Nov 06 14:22:00 2005

r2_EC_PST.sav FROM r1_EC_Pst 11-03-05 KRSA
EL CENTRO System Impact Study
POST - Project

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cases\r2_ec_pst.sav
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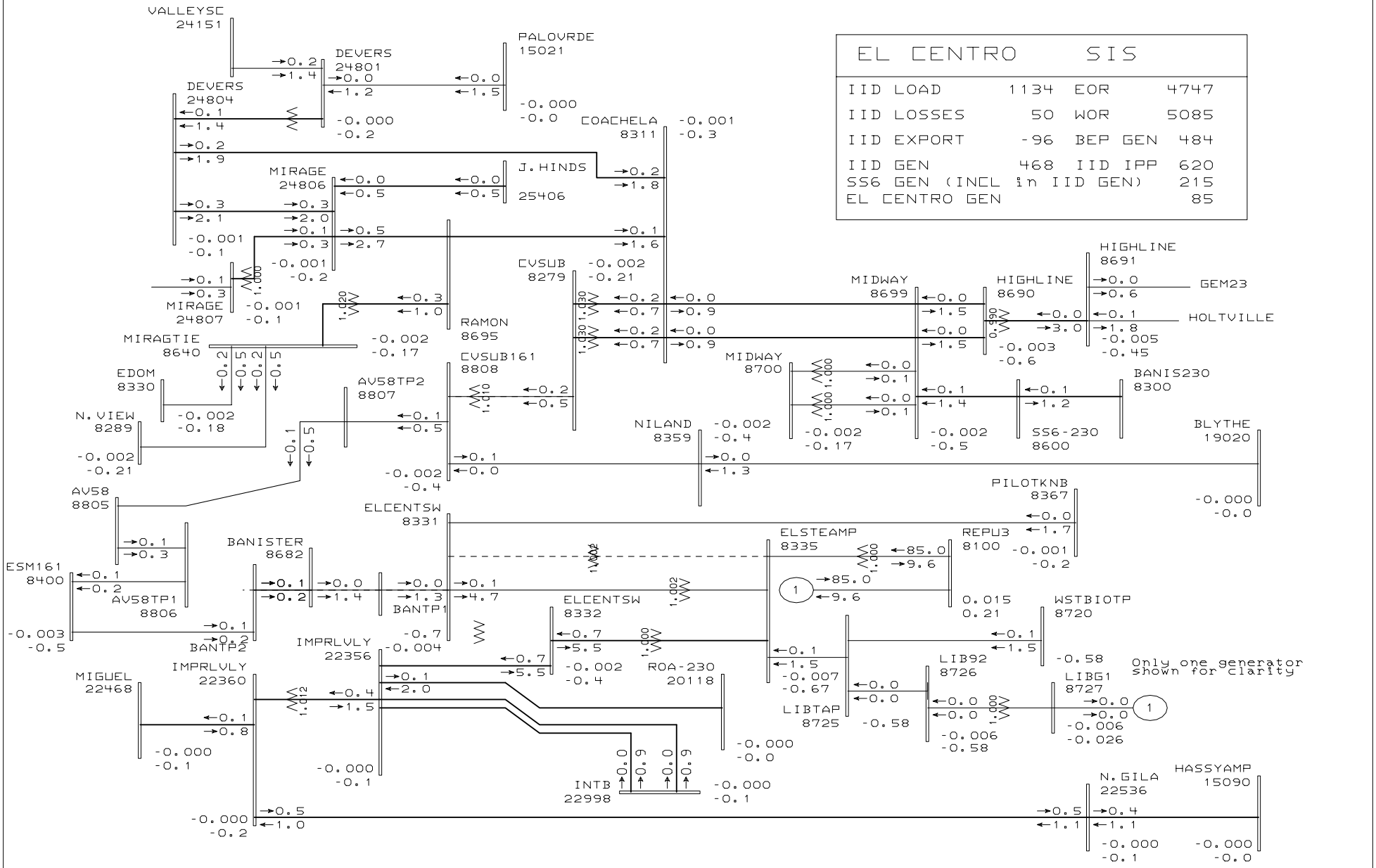


General Electric International, Inc. PSLF Program MW/MVAR Sun Nov 06 14:24:18 2005

Differences between base case cases\r2_ec_pre.sav
and delta case cases\r2_ec_pst.sav

draw\ec_pst.drw

r2_ec_pst.xls
Voltage Summary
N-0 Outages

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
none													

r2_ec_pst.xls
Flow Summary
N-0 Outages

LEGEND	% of RATING 1	
C_pu	100% - 110%	
C_pu	110% - 120%	P.U. of
C_pu	> 120%	Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8342	HEBERSCE	92	8	163	8666	HEBERSCE	13.8	8	163	1	tran	base	r2_ec_pst	50	-47	6.1	290.5	47.4	0.95	0.95	Base system (n-0)

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
	NONE												

r2_ec_pst.xls
N1_flow

LEGEND	% of RATING 1
C_pu	100% - 110%
C_pu	110% - 120%
C_pu	> 120%

P.U. of Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8699	MIDWAY	230	8	164	8700	MIDWAY	92	8	164	2	tran	tran_180	r2_ec_pst	225	-312.1	81	795.3	322.4	1.43	0.7	tran MIDWAY 230 to MIDWAY 92 ck 1
8699	MIDWAY	230	8	164	8700	MIDWAY	92	8	164	1	tran	tran_181	r2_ec_pst	225	-312.1	81	795.3	322.4	1.43	0.7	tran MIDWAY 230 to MIDWAY 92 ck 2
8279	CVSUB	92	8	162	8312	COACHELA	92	8	162	2	line	line_2	r2_ec_pst	132	142.7	1.3	861	142.7	1.039	0.615	line CVSUB to COACHELA 92 ck 1
8279	CVSUB	92	8	162	8312	COACHELA	92	8	162	1	line	line_3	r2_ec_pst	132	142.7	1.3	861	142.7	1.039	0.615	line CVSUB to COACHELA 92 ck 2
8672	LEATHERS	92	8	165	8051	LEATHERS	14.4	8	163	1	tran	line_160	r2_ec_pst	45	-40.8	-17.6	275.6	44.5	1.03	0.92	line MW1TAP to MIDWAY 92 ck 1
8672	LEATHERS	92	8	165	8051	LEATHERS	14.4	8	163	1	tran	line_161	r2_ec_pst	45	-40.8	-17.6	275.6	44.5	1.03	0.92	line LEATHERS to MW1TAP 92 ck 1
8331	ELCENTSW	161	8	163	8335	ELSTEAMP	92	8	163	1	tran	line_210	r2_ec_pst	125	127.1	-16.8	459	128.2	1.03	0.2	line N.GILA to IMPRLVLY 500 ck 1
8671	JJELMORE	92	8	165	8054	JJELMORE	14.4	8	163	1	tran	line_110	r2_ec_pst	45	-40.5	-17.4	273.2	44.1	1.02	0.92	line JJELMORE to LEATHERS 92 ck 1
8671	JJELMORE	92	8	165	8054	JJELMORE	14.4	8	163	1	tran	line_160	r2_ec_pst	45	-40.5	-17.4	273.2	44.1	1.02	0.92	line MW1TAP to MIDWAY 92 ck 1
8671	JJELMORE	92	8	165	8054	JJELMORE	14.4	8	163	1	tran	line_161	r2_ec_pst	45	-40.5	-17.4	273.2	44.1	1.02	0.92	line LEATHERS to MW1TAP 92 ck 1
8704	UNIT5	92	8	164	8706	UNIT5L	13.8	8	164	1	tran	line_122	r2_ec_pst	54	-48.9	-16.3	320.4	51.5	1.01	0.94	line MIDWAY to MINPLNT 92 ck 1
8704	UNIT5	92	8	164	8706	UNIT5L	13.8	8	164	1	tran	line_124	r2_ec_pst	54	-48.9	-16.3	320.4	51.5	1.01	0.94	line MINPLNT to UNIT5 92 ck 1
8335	ELSTEAMP	92	8	163	8337	ELTERMIN	92	8	163	2	line	line_62	r2_ec_pst	132	134.9	-8.7	829.7	135.2	1.002	0.53	line ELSTEAMP to ELTERMIN 92 ck 1
8335	ELSTEAMP	92	8	163	8337	ELTERMIN	92	8	163	1	line	line_63	r2_ec_pst	132	134.9	-8.7	829.7	135.2	1.002	0.53	line ELSTEAMP to ELTERMIN 92 ck 2
8723	VULCAN	92	8	165	8055	VULCAN1	14.4	8	163	1	tran	line_123	r2_ec_pst	50	-44.9	-15.6	292.9	47.5	1	0.9	line MIDWAY to VULCAN 92 ck 1

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
8695	RAMON	230	8	162	n2otg_205	r2_ec_pst	1.027	0.968	-0.058	0.9	1.05	0.05	N2-line COACHELA to RAMON 230 ck 1
8330	EDOM	92	8	162	n2otg_205	r2_ec_pst	1.04	0.987	-0.053	0.9	1.05	0.05	N2-line COACHELA to RAMON 230 ck 1
8640	MIRAGTIE	92	8	162	n2otg_205	r2_ec_pst	1.043	0.988	-0.055	0.9	1.05	0.05	N2-line COACHELA to RAMON 230 ck 1
8906	ORM11	13.8	8	164	n2otg_201	r2_ec_pst	1.017	1.071	0.054	0.9	1.05	0.05	N2-line COACHELA to DEVERS 230, 2 ck 1

r2_ec_pst.xls
N2_flow

LEGEND	% of RATING 1
C_pu	100% - 110%
C_pu	110% - 120%
C_pu	> 120%

P.U. of Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_215w	r2_ec_pst	165	-174.5	66.6	670.5	186.8	1.143	0.728	N2-line BLYTHE to KNOB 161, 4 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_209	r2_ec_pst	165	-162	55.3	617.6	171.2	1.053	0.728	N2-line BLYTHE to BLYTHESC 161, 1 ck 1
8279	CVSUB	92	8	162	8311	COACHELA	230	8	164	1	tran	n2otg_203	r2_ec_pst	150	-156.4	9.3	972.7	156.7	1.05	0.57	N2-line COACHELA to DEVERS 230, 4 ck 1
8279	CVSUB	92	8	162	8311	COACHELA	230	8	164	2	tran	n2otg_203	r2_ec_pst	150	-156.4	9.3	972.7	156.7	1.05	0.57	N2-line COACHELA to DEVERS 230, 4 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_210	r2_ec_pst	165	-155.9	55.2	592	165.4	1.011	0.728	N2-line BLYTHE to BLYTHESC 161, 2 ck 1
8704	UNIT5	92	8	164	8706	UNIT5L	13.8	8	164	1	tran	n2otg_201	r2_ec_pst	54	-48.9	-16.3	320.4	51.5	1.01	0.94	N2-line COACHELA to DEVERS 230, 2 ck 1
8704	UNIT5	92	8	164	8706	UNIT5L	13.8	8	164	1	tran	n2otg_262	r2_ec_pst	54	-48.9	-16.3	320.4	51.5	1.01	0.94	N2-line COACHELA to MIDWAY 230 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_218	r2_ec_pst	165	-155.2	55.1	589	164.7	1.006	0.728	N2-line BLYTHE to PARKER 161, 3 ck 1
8806	AV58TP1	161	8	162	8400	ESM161	161	8	163	1	line	n2otg_262	r2_ec_pst	165	-158.9	28.7	590.6	161.5	1.001	0.585	N2-line COACHELA to MIDWAY 230 ck 1
8723	VULCAN	92	8	165	8055	VULCAN1	14.4	8	163	1	tran	n2otg_201	r2_ec_pst	50	-44.9	-15.6	292.9	47.5	1	0.9	N2-line COACHELA to DEVERS 230, 2 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_220	r2_ec_pst	165	-154.4	54.8	585.8	163.8	1	0.728	N2-line BLYTHE to HEADGATE 161, 2 ck 1
8723	VULCAN	92	8	165	8055	VULCAN1	14.4	8	163	1	tran	n2otg_262	r2_ec_pst	50	-44.9	-15.6	292.9	47.5	1	0.9	N2-line COACHELA to MIDWAY 230 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_212w	r2_ec_pst	165	-153.3	56.2	581.7	163.3	0.994	0.728	N2-line BLYTHE to KNOB 230, 1 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_211	r2_ec_pst	165	-153.1	54	580.3	162.3	0.991	0.728	N2-line BLYTHE to BLYTHESC 161, 3 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_213w	r2_ec_pst	165	-152.5	55.8	578.2	162.4	0.988	0.728	N2-line BLYTHE to KNOB 161, 2 ck 1
8301	CITAP1	92	8	162	8312	COACHELA	92	8	162	1	line	n2otg_203	r2_ec_pst	152	-147.2	23.9	929.5	149.1	0.975	0.663	N2-line COACHELA to DEVERS 230, 4 ck 1
8301	CITAP1	92	8	162	8389	VANBUREN	92	8	162	1	line	n2otg_203	r2_ec_pst	152	147.2	-23.9	929.5	149.1	0.974	0.662	N2-line COACHELA to DEVERS 230, 4 ck 1
8279	CVSUB	92	8	162	8349	JACKSON	92	8	162	1	line	n2otg_203	r2_ec_pst	132	128.6	-3.3	798.3	128.6	0.964	0.684	N2-line COACHELA to DEVERS 230, 4 ck 1
8301	CITAP1	92	8	162	8312	COACHELA	92	8	162	1	line	n2otg_205	r2_ec_pst	152	-144.4	10.1	908.6	144.7	0.953	0.663	N2-line COACHELA to RAMON 230 ck 1
8301	CITAP1	92	8	162	8389	VANBUREN	92	8	162	1	line	n2otg_205	r2_ec_pst	152	144.4	-10.1	908.6	144.7	0.952	0.662	N2-line COACHELA to RAMON 230 ck 1

EC3 System Impact Study

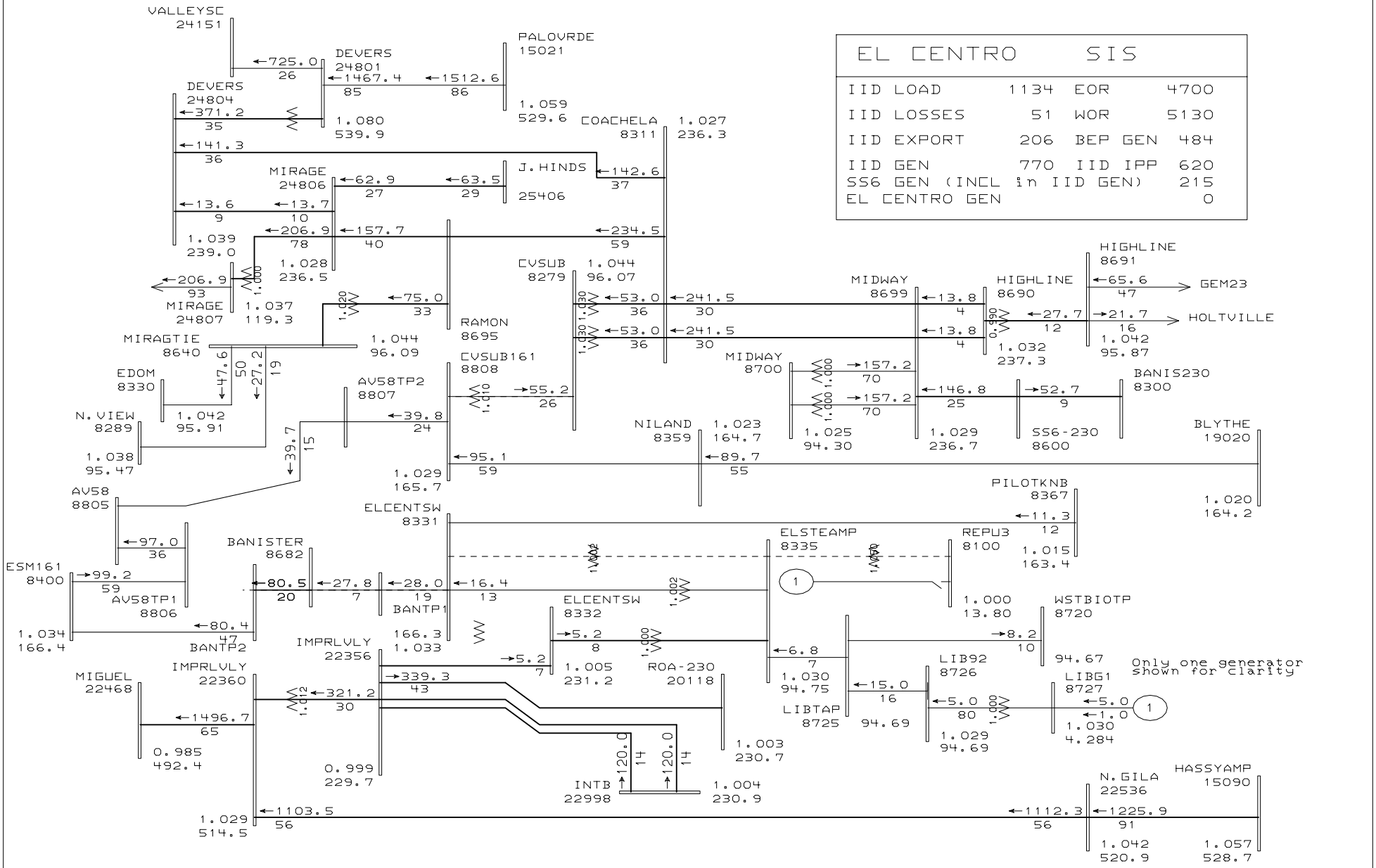
Appendix D
Power Flow Results
Sensitivity Cases

February 2006

EC3 System Impact Study

Appendix D1
Power Flow Results
Pre Project Max Gen

February 2006



General Electric International, Inc. PSLF Program MW/Pct Mon Feb 13 15:56:16 2006

r3_EC_PRE_maxgen.sav from r2_EC_Pre_maxgen.sav 02-13-06 KRSA
EL CENTRO System Impact Study
PRE - Project Senstivity with IID at max gen

ec_pre.drw
cases\r3_ec_pre_maxgen.sav
Rating = 1

r3_ec_pre_maxgen.xls
Voltage Summary
N-0 Outages

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
8320	DROP1	34.5	8	163	base	r3_ec_pre_maxgen	1.051	1.051	0	0.95	1.05	0.05	Base system (n-0)
8973	A3B4	34.5	8	163	base	r3_ec_pre_maxgen	1.051	1.051	0	0.95	1.05	0.05	Base system (n-0)

r3_ec_pre_maxgen.xls
Flow Summary
N-0 Outages

LEGEND	% of RATING 1	
C_pu	100% - 110%	
C_pu	110% - 120%	P.U. of
C_pu	> 120%	Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8342	HEBERSCE	92	8	163	8666	HEBERSCE	13.8	8	163	1	tran	base	r3_ec_pre_maxgen	50	-47	9.6	292.4	48	0.96	0.96	Base system (n-0)

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
None													

r3_ec_pre_maxgen.xls
N1_flow

LEGEND	% of RATING 1
C_pu	100% - 110%
C_pu	110% - 120%
C_pu	> 120%

P.U. of Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8699	MIDWAY	230	8	164	8700	MIDWAY	92	8	164	2	tran	tran_180	r3_ec_pre_maxgen	225	-312.1	80.9	794.6	322.4	1.43	0.71	tran MIDWAY 230 to MIDWAY 92 ck 1
8699	MIDWAY	230	8	164	8700	MIDWAY	92	8	164	1	tran	tran_181	r3_ec_pre_maxgen	225	-312.1	80.9	794.6	322.4	1.43	0.71	tran MIDWAY 230 to MIDWAY 92 ck 2
8301	CITAP1	92	8	162	8312	COACHELA	92	8	162	1	line	line_4	r3_ec_pre_maxgen	152	-163.5	19.2	1000.7	164.6	1.049	0.773	line CVSUB to JACKSON 92 ck 1
8301	CITAP1	92	8	162	8389	VANBUREN	92	8	162	1	line	line_4	r3_ec_pre_maxgen	152	163.5	-19.2	1000.7	164.6	1.049	0.773	line CVSUB to JACKSON 92 ck 1
8732	COLMAC	92	8	164	8714	COLMAC	13.8	8	164	1	tran	line_5	r3_ec_pre_maxgen	75	-45.8	-59.3	470.6	75	1.04	0.61	line CVSUB to COLMAC 92 ck 1
8319	DIXIELAN	92	8	163	8946	DIXPRI2	92	8	163	1	line	line_11	r3_ec_pre_maxgen	54	-55.3	12.1	349.5	56.6	1.032	0.321	line USNAF to ELTERMIN 92 ck 1
8335	ELSTEAMP	92	8	163	8337	ELTERMIN	92	8	163	2	line	line_62	r3_ec_pre_maxgen	132	138.3	-9.2	844.8	138.6	1.02	0.54	line ELSTEAMP to ELTERMIN 92 ck 1
8335	ELSTEAMP	92	8	163	8337	ELTERMIN	92	8	163	1	line	line_63	r3_ec_pre_maxgen	132	138.3	-9.2	844.8	138.6	1.02	0.54	line ELSTEAMP to ELTERMIN 92 ck 2
8307	CMTAP2	92	8	162	8309	AVE42	92	8	162	1	line	line_4	r3_ec_pre_maxgen	132	134.1	-21.1	827.4	135.8	0.999	0.683	line CVSUB to JACKSON 92 ck 1
8307	CMTAP2	92	8	162	8389	VANBUREN	92	8	162	1	line	line_4	r3_ec_pre_maxgen	132	-134.1	21.1	827.4	135.8	0.999	0.683	line CVSUB to JACKSON 92 ck 1
8279	CVSUB	92	8	162	8349	JACKSON	92	8	162	1	line	C_7	r3_ec_pre_maxgen	132	136.1	-1.7	822.5	136.1	0.993	0.699	C-COACHELLA VALLEY-VANBUREN 92
8301	CITAP1	92	8	162	8312	COACHELA	92	8	162	1	line	tran_177	r3_ec_pre_maxgen	152	-149.7	12.9	920.4	150.3	0.965	0.773	tran MIRAGTIE 92 to RAMON 230 ck 1
8301	CITAP1	92	8	162	8389	VANBUREN	92	8	162	1	line	tran_177	r3_ec_pre_maxgen	152	149.7	-12.9	920.4	150.3	0.965	0.773	tran MIRAGTIE 92 to RAMON 230 ck 1

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
None													

r3_ec_pre_maxgen.xls
N2_flow

LEGEND	% of RATING 1
C_pu	100% - 110%
C_pu	110% - 120%
C_pu	> 120%

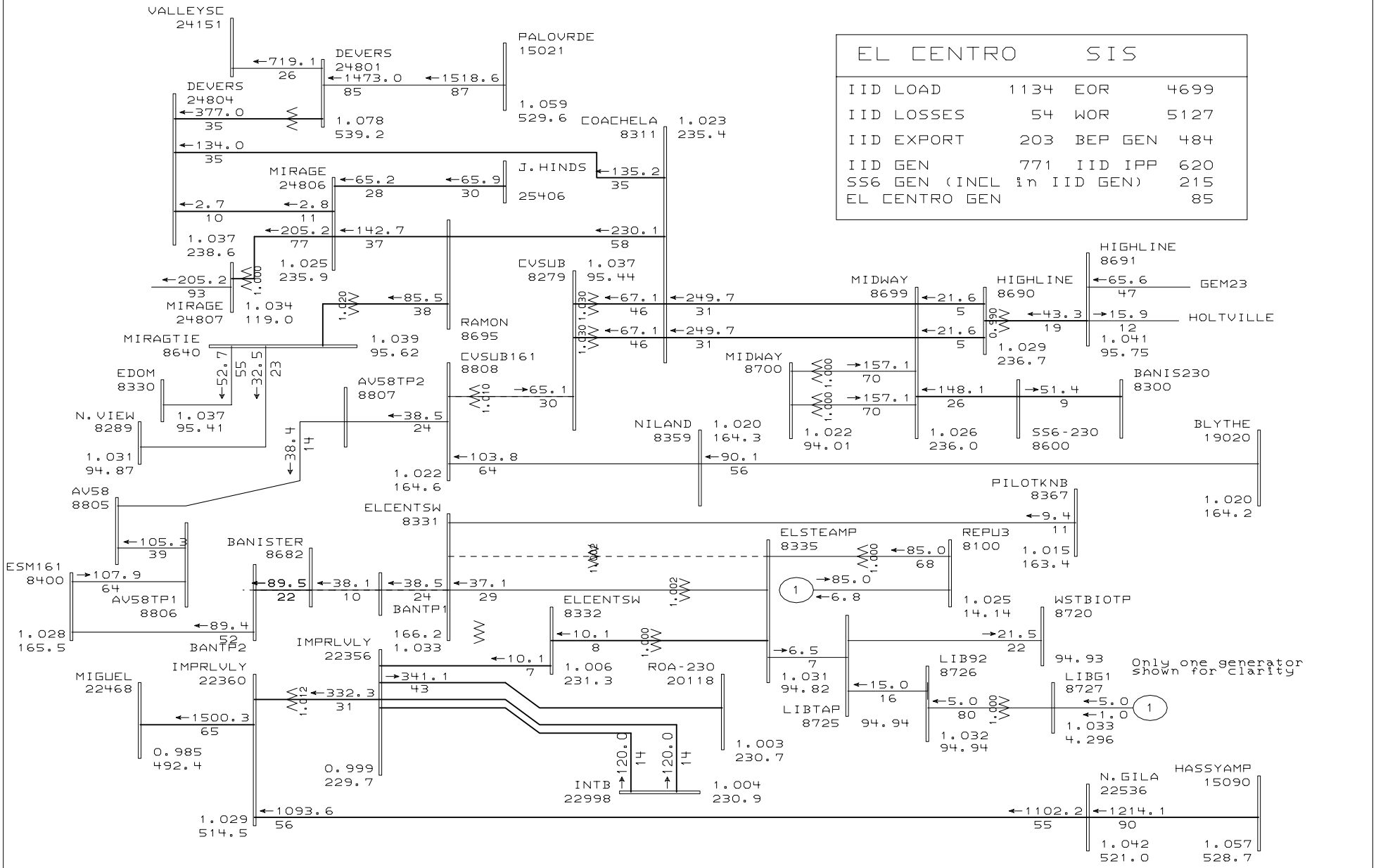
P.U. of Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8904	GEM92	92	8	164	8912	GEM23	92	8	164	2	line	n2otg_201	r3_ec_pre_maxgen	132	-13.4	-213.1	1303.4	213.5	1.573	0.207	N2-line COACHELA to DEVERS 230, 2 ck 1
8673	EARTHE2	92	8	165	8702	REG1EX	92	8	165	1	line	n2otg_201	r3_ec_pre_maxgen	132	3.6	216.3	1299	216.3	1.569	0.287	N2-line COACHELA to DEVERS 230, 2 ck 1
8673	EARTHE2	92	8	165	8702	REG1EX	92	8	165	1	line	n2otg_262	r3_ec_pre_maxgen	132	3.6	216.3	1299	216.3	1.569	0.287	N2-line COACHELA to MIDWAY 230 ck 1
8301	CITAP1	92	8	162	8312	COACHELA	92	8	162	1	line	n2otg_203	r3_ec_pre_maxgen	152	-184.9	19.6	1151.7	185.9	1.207	0.773	N2-line COACHELA to DEVERS 230, 4 ck 1
8301	CITAP1	92	8	162	8389	VANBUREN	92	8	162	1	line	n2otg_203	r3_ec_pre_maxgen	152	184.9	-19.6	1151.7	185.9	1.207	0.773	N2-line COACHELA to DEVERS 230, 4 ck 1
8307	CMTAP2	92	8	162	8309	AVE42	92	8	162	1	line	n2otg_203	r3_ec_pre_maxgen	132	155.3	-23.2	975.3	157	1.177	0.683	N2-line COACHELA to DEVERS 230, 4 ck 1
8307	CMTAP2	92	8	162	8389	VANBUREN	92	8	162	1	line	n2otg_203	r3_ec_pre_maxgen	132	-155.3	23.2	975.3	157	1.177	0.683	N2-line COACHELA to DEVERS 230, 4 ck 1
8279	CVSUB	92	8	162	8349	JACKSON	92	8	162	1	line	n2otg_203	r3_ec_pre_maxgen	132	146.3	1.6	901	146.3	1.088	0.699	N2-line COACHELA to DEVERS 230, 4 ck 1
8279	CVSUB	92	8	162	8311	COACHELA	230	8	164	1	tran	n2otg_203	r3_ec_pre_maxgen	150	-158.4	9.7	977.3	158.7	1.07	0.36	N2-line COACHELA to DEVERS 230, 4 ck 1
8279	CVSUB	92	8	162	8311	COACHELA	230	8	164	2	tran	n2otg_203	r3_ec_pre_maxgen	150	-158.4	9.7	977.3	158.7	1.07	0.36	N2-line COACHELA to DEVERS 230, 4 ck 1
8806	AV58TP1	161	8	162	8400	ESM161	161	8	163	1	line	n2otg_262	r3_ec_pre_maxgen	165	-169.6	35.4	630.1	173.3	1.068	0.591	N2-line COACHELA to MIDWAY 230 ck 1
8376	RTAP2	92	8	163	8974	RTP1	92	8	163	1	line	n2otg_262	r3_ec_pre_maxgen	57	-52.1	14.6	347	54.1	0.974	0.675	N2-line COACHELA to MIDWAY 230 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_215w	r3_ec_pre_maxgen	165	-150.2	55.5	569.2	160.2	0.973	0.574	N2-line BLYTHE to KNOB 161, 4 ck 1
8301	CITAP1	92	8	162	8312	COACHELA	92	8	162	1	line	n2otg_205	r3_ec_pre_maxgen	152	-150.4	13.1	926	151	0.971	0.773	N2-line COACHELA to RAMON 230 ck 1
8301	CITAP1	92	8	162	8389	VANBUREN	92	8	162	1	line	n2otg_205	r3_ec_pre_maxgen	152	150.4	-13.1	926	151	0.971	0.773	N2-line COACHELA to RAMON 230 ck 1

EC3 System Impact Study

Appendix D2
Power Flow Results
Post Project Max Gen

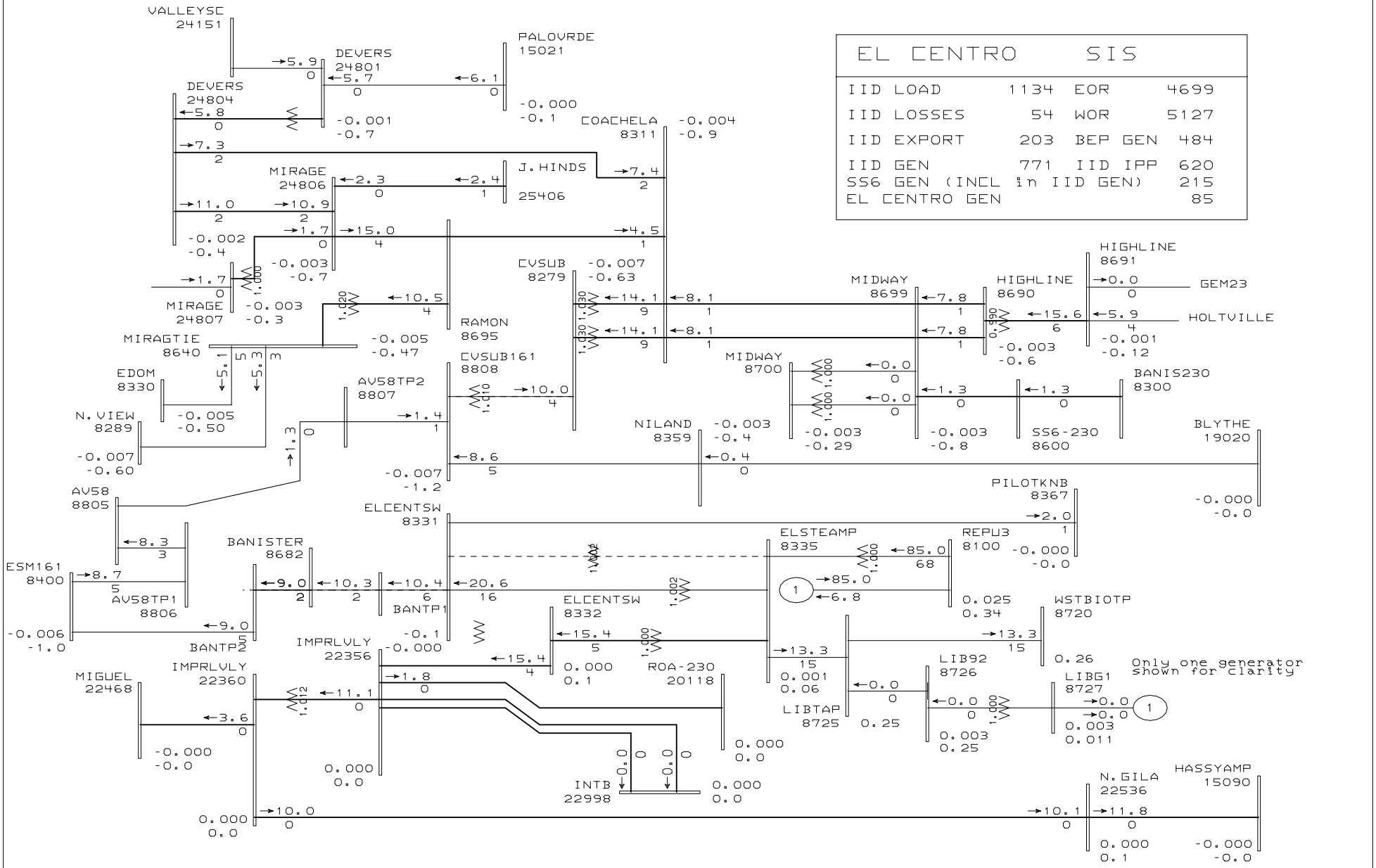
February 2006



General Electric International, Inc. PSLF Program MW/Pct Mon Feb 13 15:56:47 2006

r3_EC_pst_maxgen.sav from r2_s_EC_Pst_maxgen.sav 02-13-06 KRSA
EL CENTRO System Impact Study
Post - Project Senstivity with IID at max gen

ec_pst.drw
cases\r3_ec_pst_maxgen.sav
Rating = 1



General Electric International, Inc. PSLF Program MW/Pct Mon Feb 13 15:57:54 2006

Differences between base case cases\r3_ec_pre_maxgen.sav
and delta case cases\r3_ec_pst_maxgen.sav

ec_pst.drw

r3_ec_pst_maxgen.xls
Voltage Summary
N-0 Outages

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
8320	DROP1	34.5	8	163	base	r3_ec_pst_maxgen	1.051	1.051	0	0.95	1.05	0.05	Base system (n-0)
8973	A3B4	34.5	8	163	base	r3_ec_pst_maxgen	1.051	1.051	0	0.95	1.05	0.05	Base system (n-0)

r3_ec_pst_maxgen.xls
Flow Summary
N-0 Outages

LEGEND	% of RATING 1	
C_pu	100% - 110%	
C_pu	110% - 120%	P.U. of
C_pu	> 120%	Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8342	HEBERSCE	92	8	163	8666	HEBERSCE	13.8	8	163	1	tran	base	r3_ec_pst_maxgen	50	-47	9.9	292.7	48	0.96	0.96	Base system (n-0)

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
None													

r3_ec_pst_maxgen.xls
N1_flow

LEGEND	% of RATING 1
C_pu	100% - 110%
C_pu	110% - 120%
C_pu	> 120%

P.U. of Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8699	MIDWAY	230	8	164	8700	MIDWAY	92	8	164	2	tran	tran_180	r3_ec_pst_maxgen	225	-312	81.2	797.1	322.4	1.43	0.71	tran MIDWAY 230 to MIDWAY 92 ck 1
8699	MIDWAY	230	8	164	8700	MIDWAY	92	8	164	1	tran	tran_181	r3_ec_pst_maxgen	225	-312	81.2	797.1	322.4	1.43	0.71	tran MIDWAY 230 to MIDWAY 92 ck 2
8319	DIXIELAN	92	8	163	8946	DIXPRI2	92	8	163	1	line	line_11	r3_ec_pst_maxgen	54	-60.4	11.9	381.5	61.6	1.126	0.361	line USNAF to ELTERMIN 92 ck 1
8335	ELSTEAMP	92	8	163	8337	ELTERMIN	92	8	163	2	line	line_62	r3_ec_pst_maxgen	132	141.7	-8.4	864.5	142	1.044	0.553	line ELSTEAMP to ELTERMIN 92 ck 1
8335	ELSTEAMP	92	8	163	8337	ELTERMIN	92	8	163	1	line	line_63	r3_ec_pst_maxgen	132	141.7	-8.4	864.5	142	1.044	0.553	line ELSTEAMP to ELTERMIN 92 ck 2
8301	CITAP1	92	8	162	8312	COACHELA	92	8	162	1	line	line_4	r3_ec_pst_maxgen	152	-152.6	17.9	940.5	153.6	0.986	0.71	line CVSUB to JACKSON 92 ck 1
8301	CITAP1	92	8	162	8389	VANBUREN	92	8	162	1	line	line_4	r3_ec_pst_maxgen	152	152.6	-17.9	940.5	153.6	0.986	0.71	line CVSUB to JACKSON 92 ck 1
8806	AV58TP1	161	8	162	8400	ESM161	161	8	163	1	line	line_162	r3_ec_pst_maxgen	165	-156.7	38.8	578.1	161.4	0.981	0.645	line SS6-230 to MIDWAY 230 ck 1
8281	AVE58	92	8	162	8805	AV58	161	8	162	2	tran	tran_168	r3_ec_pst_maxgen	125	-117.2	33.6	740.4	121.9	0.98	0.6	tran AVE58 92 to AV58 161 ck 1
8281	AVE58	92	8	162	8805	AV58	161	8	162	1	tran	tran_169	r3_ec_pst_maxgen	125	-117.2	33.6	740.4	121.9	0.98	0.6	tran AVE58 92 to AV58 161 ck 2
8319	DIXIELAN	92	8	163	8946	DIXPRI2	92	8	163	1	line	line_10	r3_ec_pst_maxgen	54	-52	12	328.5	53.3	0.97	0.361	line USNAF to DIXIELAN 92 ck 1
8279	CVSUB	92	8	162	8349	JACKSON	92	8	162	1	line	C_7	r3_ec_pst_maxgen	132	131.9	-1.5	801.2	131.9	0.967	0.697	C-COACHELLA VALLEY-VANBUREN 92

Bus	Name	kV	Area	Zone	Outage	Case	Vbase	Vcont	DeltaV	Vmin	Vmax	Max-dv	Contingency Description
None													

r3_ec_pst_maxgen.xls
N2_flow

LEGEND	% of RATING 1
C_pu	100% - 110%
C_pu	110% - 120%
C_pu	> 120%

P.U. of Rate 1

FROM	FR	BKV	frar	frzo	TO	TO	BKV	toar	tozo	CK	TYPE	Outage_Name	Case	Rate-Mva	Pflow	Qflow	Amps	MVA	C_pu	B_pu	Contingency_Description
8904	GEM92	92	8	164	8912	GEM23	92	8	164	2	line	n2otg_201	r3_ec_pst_maxgen	132	-13.3	-213.1	1303.4	213.5	1.573	0.207	N2-line COACHELA to DEVERS 230, 2 ck 1
8673	EARTHE2	92	8	165	8702	REG1EX	92	8	165	1	line	n2otg_201	r3_ec_pst_maxgen	132	3.4	216.3	1299.2	216.3	1.569	0.288	N2-line COACHELA to DEVERS 230, 2 ck 1
8673	EARTHE2	92	8	165	8702	REG1EX	92	8	165	1	line	n2otg_262	r3_ec_pst_maxgen	132	3.4	216.3	1299.2	216.3	1.569	0.288	N2-line COACHELA to MIDWAY 230 ck 1
8806	AV58TP1	161	8	162	8400	ESM161	161	8	163	1	line	n2otg_262	r3_ec_pst_maxgen	165	-180.3	32.3	681.8	183.2	1.154	0.645	N2-line COACHELA to MIDWAY 230 ck 1
8301	CITAP1	92	8	162	8312	COACHELA	92	8	162	1	line	n2otg_203	r3_ec_pst_maxgen	152	-170.5	22.8	1091.4	172	1.144	0.71	N2-line COACHELA to DEVERS 230, 4 ck 1
8301	CITAP1	92	8	162	8389	VANBUREN	92	8	162	1	line	n2otg_203	r3_ec_pst_maxgen	152	170.5	-22.8	1091.4	172	1.144	0.71	N2-line COACHELA to DEVERS 230, 4 ck 1
8279	CVSUB	92	8	162	8311	COACHELA	230	8	164	1	tran	n2otg_203	r3_ec_pst_maxgen	150	-166.8	10.1	1053.7	167.1	1.13	0.46	N2-line COACHELA to DEVERS 230, 4 ck 1
8279	CVSUB	92	8	162	8311	COACHELA	230	8	164	2	tran	n2otg_203	r3_ec_pst_maxgen	150	-166.8	10.1	1053.7	167.1	1.13	0.46	N2-line COACHELA to DEVERS 230, 4 ck 1
8307	CMTAP2	92	8	162	8309	AVE42	92	8	162	1	line	n2otg_203	r3_ec_pst_maxgen	132	141	-26.3	911.8	143.4	1.101	0.61	N2-line COACHELA to DEVERS 230, 4 ck 1
8307	CMTAP2	92	8	162	8389	VANBUREN	92	8	162	1	line	n2otg_203	r3_ec_pst_maxgen	132	-141	26.3	911.8	143.4	1.101	0.61	N2-line COACHELA to DEVERS 230, 4 ck 1
8376	RTAP2	92	8	163	8974	RTP1	92	8	163	1	line	n2otg_262	r3_ec_pst_maxgen	57	-58.6	12.8	391.7	59.9	1.098	0.772	N2-line COACHELA to MIDWAY 230 ck 1
8279	CVSUB	92	8	162	8349	JACKSON	92	8	162	1	line	n2otg_203	r3_ec_pst_maxgen	132	142.7	-0.1	900.2	142.7	1.087	0.697	N2-line COACHELA to DEVERS 230, 4 ck 1
8200	BANTP2	161	8	163	8400	ESM161	161	8	163	1	line	n2otg_262	r3_ec_pst_maxgen	165	172.5	7.4	610.7	172.7	1.032	0.526	N2-line COACHELA to MIDWAY 230 ck 1
8376	RTAP2	92	8	163	8974	RTP1	92	8	163	1	line	n2otg_263	r3_ec_pst_maxgen	57	-54.3	17.7	361.7	57.2	1.016	0.772	N2-line AV58 to AV58TP2 161 ck 1
8359	NILAND	161	8	163	19020	BLYTHE	161	14	191	1	line	n2otg_215w	r3_ec_pst_maxgen	165	-150.2	54.1	568.9	159.7	0.972	0.574	N2-line BLYTHE to KNOB 161, 4 ck 1

EC3 System Impact Study

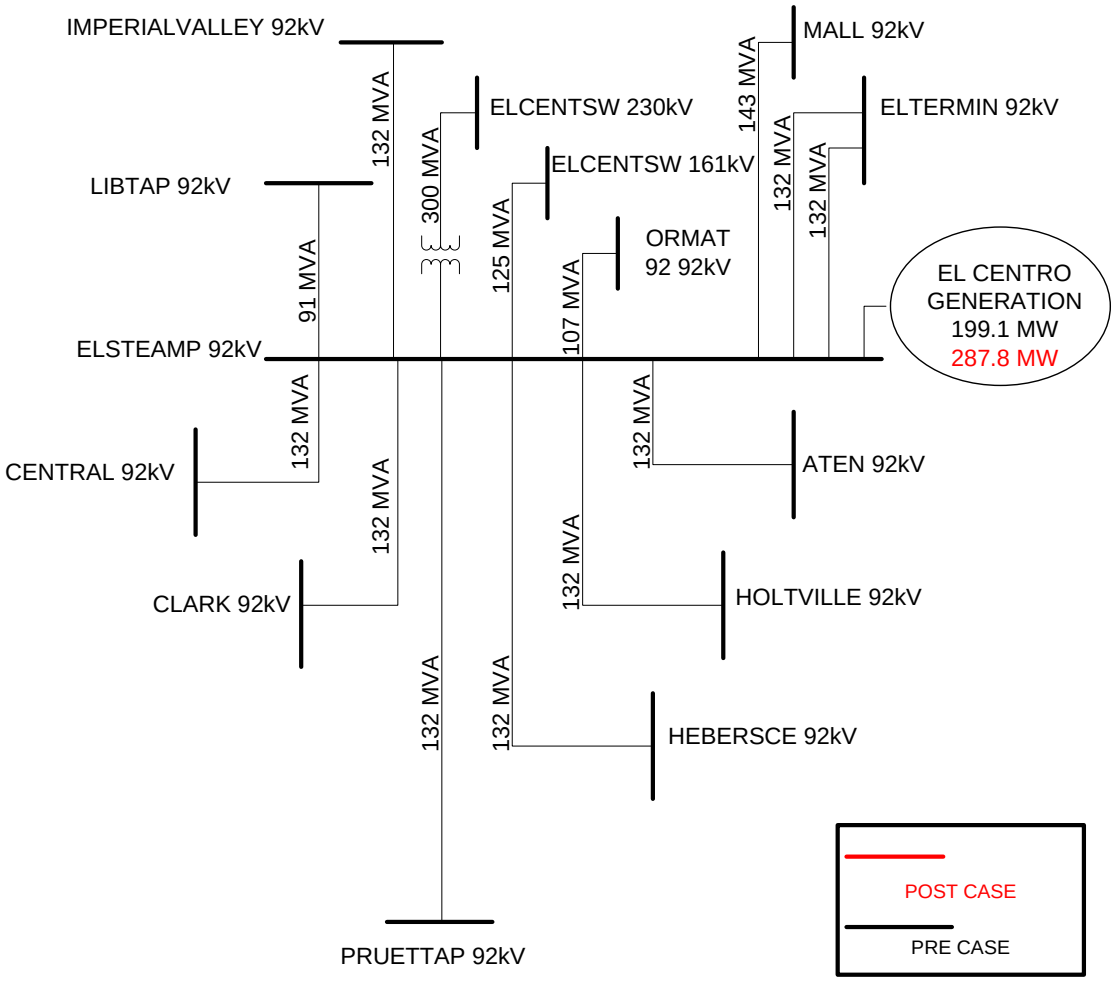
Appendix E
Light Winter Analysis

February 2006

Task:
Determine if there would be any system impact for operating the re-powered El Centro Unit #3 under off-peak conditions, should a system event call for the need of their quick-start generating capacity.

El Centro
The El Centro 85MW facility is connected to the El Centro 92kV bus via a 13.8/92kV transformer. At the El Centro there are numerous 92kV lines connecting El Centro to various 92kV and a transformer connecting the 92kV El Centro to the 161kV El Centro substation.

EL CENTRO SIS



As the one line diagram shows, due to the number of lines and MVA rating of the lines, there is no anticipated transmission elements overloading due to the start-up of the facility for some system event that would require the start up of the Re-power of El Centro Unit 3.

The analysis was tested only for a light winter 2007 condition. The data below details the MW flow on each line, due to an outage of another line out of the bus. The X represents the line taken as an outage.

(8335) EL CENTRO 92kV LINES -LW PRE CASE

OUTAGE	MVA	MONITORED FLOW	EL CENTRO92kV - LIBTAP 92kV	EL CENTRO92kV - IMPERIAL VALLEY 92kV	ELCENTRO92kV - ELCENTSW 230kV	EL CENTRO 92kV - ELCENTSW 161kV	EL CENTRO 92kV - ORMAT92 92kV	EL CENTRO 92kV - MALL 92kV	EL CENTRO 92kV - ELTERMIN 92kV	EL CENTRO 92kV - ELTERMIN 92kV	EL CENTRO 92kV - ATEN 92kV	EL CENTRO 92kV - HOLTVILLE 92kV	EL CENTRO 92kV - HERBERSCE 92kV	EL CENTRO 92kV - PRUETT 92kV	EL CENTRO 92kV - CENTRAL 92kV	EL CENTRO 92kV - CLARK 92kV	EL CENTRO 92kV - ELCENTSW 35kV
		MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
EL CENTRO 92kV - LIBTAP 92kV	91	X	17.4	-0.8	6.1	6.6	6.9	6.9	6.7	6.9	6.9	6.7	6.8	7.2	6.8	7.7
EL CENTRO 92kV - IMPERIAL VALLEY 92k	132	19	X	9.9	14.3	14.7	14.9	14.9	14.9	14.9	14.9	14.8	14.9	15.1	14.9	15.3
EL CENTRO 92kV - ELCENTSW 230kV	300	-65.6	-65.2	X	-67.9	-66.9	-66.1	-66.1	-66.1	-66.2	-66.2	-66.6	-66.2	-65.2	-66.2	-66.1
EL CENTRO 92kV - ELCENTSW 161kV	125	-3.5	-2.7	-41.5	X	-5.8	-4.5	-4.5	-4.5	-4.6	-4.6	-5.2	-4.6	-3.2	-4.6	-4.4
EL CENTRO 92kV - ORMAT92 92kV	107	-9.3	-9.3	-12.7	-9.7	X	-9	-9.4	-9.4	-9.4	-9.4	-11.2	-9.4	-9.3	-9.4	-9.3
EL CENTRO 92kV - MALL 92kV	143	3.3	3.3	0.9	3.1	0.8	X	3.2	3.2	3.3	3.3	-3.5	3.2	3.3	3.2	3.7
EL CENTRO 92kV - ELTERMIN 92kV	132	29.5	29.6	27.6	29.3	29.4	29.5	X	55.7	29.5	29.5	29.5	29.5	39.2	37.4	29.5
EL CENTRO 92kV - ELTERMIN 92kV	132	29.5	29.6	27.6	29.3	29.4	29.5	55.7	X	29.5	29.5	29.5	29.5	39.2	37.4	29.5
EL CENTRO 92kV - ATEN 92kV	132	5.9	6	5.6	5.8	5.7	5.9	5.8	5.8	X	9.5	5.6	5.8	5.8	5.8	5.9
EL CENTRO 92kV - HOLTVILLE 92kV	132	4	4.1	3.7	3.9	3.8	4	3.9	3.9	9.4	X	3.7	3.9	3.9	3.9	4.4
EL CENTRO 92kV - HERBERSCE 92kV	132	-24.8	-24.7	-26.8	-25	-27	23.6	24.9	-24.9	-24.8	-24.8	X	-24.8	-24.8	-24.8	-23.8
EL CENTRO 92kV - PRUETT 92kV	132	3.6	-3.5	-5.5	-3.8	-5.7	-2.5	-3.6	-3.6	-3.6	-3.6	-16.9	X	-3.6	-3.6	-2.7
EL CENTRO 92kV - CENTRAL 92kV	132	23.5	23.6	20.9	23.2	23.4	23.5	24	18.6	23.5	23.5	23.4	23.5	X	23.6	23.5
EL CENTRO 92kV - CLARK 92kV	132	16	16	15.8	16	16	16	18.6	18.6	16	16	16	16	17	X	16
EL CENTRO 92kV - ELCENTSW 35kV	83	4.7	4.9	3.9	4.3	4.2	4.5	4.4	4.4	4.4	4.4	3.4	4.4	4.4	4.4	X

(8335) EL CENTRO 92kV LINES - LW PST CASE

OUTAGE	MVA	MONITORED FLOW MW	EL CENTRO92kV - LIBTAP 92kV MW	EL CENTRO92kV - IMPERIAL VALLEY 92kV MW	ELCENTRO92kV - ELCENTSW 230kV MW	EL CENTRO 92kV - ELCENTSW 161kV MW	EL CENTRO 92kV - ORMAT92 92kV MW	EL CENTRO 92kV - MALL 92kV MW	EL CENTRO 92kV - ELTERMIN 92kV MW	EL CENTRO 92kV - ELTERMIN 92kV MW	EL CENTRO 92kV - ATEN 92kV MW	EL CENTRO 92kV - HOLTVILLE 92kV MW	EL CENTRO 92kV - HERBERSCE 92kV MW	EL CENTRO 92kV - PRUETT 92kV MW	EL CENTRO 92kV - CENTRAL 92kV MW	EL CENTRO 92kV - CLARK 92kV MW	EL CENTRO 92kV - ELCENTSW 35kV MW
EL CENTRO 92kV - LIBTAP 92kV	91	X	26.1	9.3	16.8	6.6	12.8	12.8	12.8	12.8	12.8	12.6	6.8	13.1	12.8	13.7
EL CENTRO 92kV - IMPERIAL VALLEY 92k	132	26.6	X	16.5	21.4	14.7	18.8	18.8	18.8	18.8	18.8	18.7	14.9	19	18.8	19.3
EL CENTRO 92kV - ELCENTSW 230kV	300	-29.1	-29	X	-19.1	-66.9	-30.1	-30.1	-30.1	-30.2	-30.2	-30.6	-66.2	-29.1	-30.2	-30.1
EL CENTRO 92kV - ELCENTSW 161kV	125	25.5	25.8	6.6	X	-5.8	23.7	23.5	23.5	23.5	23.5	22.9	14.9	24.9	23.5	23.6
EL CENTRO 92kV - ORMAT92 92kV	107	-6.8	-6.8	-8.5	-5.6	X	-6.4	-6.9	-6.9	-6.9	-6.9	-8.7	-9.7	-6.9	-7	-6.8
EL CENTRO 92kV - MALL 92kV	143	4.9	4.9	3.7	5.7	0.8	X	4.8	4.8	4.9	4.8	-1.6	2.3	4.9	4.8	5.3
EL CENTRO 92kV - ELTERMIN 92kV	132	31.1	31.1	30.2	31.7	29.4	31	X	58.6	31	31	31	29.5	41.5	39	31
EL CENTRO 92kV - ELTERMIN 92kV	132	31.1	31.1	30.2	31.7	29.4	31	58.6	X	31	31	31	29.5	41.5	39	31
EL CENTRO 92kV - ATEN 92kV	132	6.2	6.2	5.9	6.1	5.7	6	6	6	X	9.8	5.7	5.8	6	6	6.1
EL CENTRO 92kV - HOLTVILLE 92kV	132	4.3	4.3	4	4.1	3.8	4.1	4.1	4.1	9.6	X	3.8	3.9	4.1	4.1	4.2
EL CENTRO 92kV - HERBERSCE 92kV	132	-23.3	-23.3	-24.3	-22.6	-27	-21.5	-23.4	-23.4	-23.3	-23.3	X	-26.8	-23.3	-23.4	-22.3
EL CENTRO 92kV - PRUETT 92kV	132	-2.2	-2.2	-3.2	-1.5	-5.7	-0.6	-2.3	-2.3	-2.2	-2.2	-14.8	X	-2.2	-2.3	-1.3
EL CENTRO 92kV - CENTRAL 92kV	132	25.6	25.7	24.4	26.4	23.4	25.5	26.1	26.1	25.5	25.5	25.5	23.4	X	25.7	25.5
EL CENTRO 92kV - CLARK 92kV	132	16.5	16.2	16.1	16.2	16	16.2	18.9	18.9	16.2	16.2	16.1	16	17.2	X	16.2
EL CENTRO 92kV - ELCENTSW 35kV	83	5.4	5.4	4.5	5	4.2	4.9	4.8	4.8	4.8	4.8	3.8	4.2	4.8	4.8	X

EC3 System Impact Study

Appendix F
Stability Switch Decks

February 2006

```
*   ================================================================
*   No Outage
*   ================================================================


*   ================================================================
*   EC-AVE58 161kV line outage
*   ==========================================================================
*   Fault Bus at EC 161kV bus
FB  0.0  "8331"   161.
*   Clear fault from EC 161kV bus
CFB 5.0  "8331"   161.
*   Switch out EC-AVE58 161kV line
DL  5.0  "8331"   161.   "8806"   161.  "1 "


*   ================================================================
*   El Centro Generator step up transformer outage
*   ==========================================================================
*   Fault bus at EL Centro 92kV
*
FB   0.0 "ELSTEAMP  " 92.
*
*   Clear fault at El Centro 92kV
*
CFB  4.0 "ELSTEAMP   " 92.
*
*   Trip El Centro Repower #3 GEN STEP-UP XFMR
*
DL   4.0 "8335 " 92. "REPU3  " 13.8. "2 "
*

*   ================================================================
*   Loss of NILAND-ELCENTRO 161 kV Line
*   ==========================================================================
*   Fault bus at NILAND
FB   0.0 "NILAND  " 161.
*   Clear fault at NILAND
CFB  4.0 "NILAND   " 161.
*   Trip NILAND-ELCENTSW 161 kV Line
DL   4.0 "NILAND  " 161. "ELCENTSW " 161. "1 "
```

```
*   ================================================================
*   Hassyampa - North Gila 500kV line outage
*   including Generator fault damping at three PV units
*   ==========================================================================
*   Fault Bus at Palo Verde
FB  0.0  "HASSYAMP"   500.

*   Generator Fault Damping at Palo Verde
GFD 0.0  "PALOVRD1"  24.0   "1 "   0.072
GFD 0.0  "PALOVRD2"  24.0   "1 "   0.072
GFD 0.0  "PALOVRD3"  24.0   "1 "   0.072
*
*   Flash Series Capacitors
FC  0.0  "PALOVRDE"   500.   "DEVERS"   500.  "1 "   2
FC  0.0  "PALOVRDE"   500.   "DEVERS"   500.  "1 "   4
FC  0.0  "HASSYAMP"   500.   "N.GILA"   500.  "1 "   2
FC  0.0  "N.GILA"    500.   "IMPRLVLY" 500.  "1 "   2
FC  0.0  "IMPRLVLY"   500.   "MIGUEL"   500.  "1 "   1
FC  0.0  "MEAD"      500.   "PERKINS" 500.  "1 "   1
FC  0.0  "MEAD"      500.   "PERKINS" 500.  "1 "   3
FC  0.0  "MOENKOPI"   500.   "YAVAPAI"  500.  "1 "   1
FC  0.0  "YAVAPAI"    500.   "WESTWING" 500.  "1 "   2
FC  0.0  "NAVAJO"    500.   "WESTWING" 500.  "1 "   1
FC  0.0  "NAVAJO"    500.   "WESTWING" 500.  "1 "   3
*
*   Clear fault from Palo Verde 500kV buss
CFB 4.0  "HASSYAMP"   500.
*
*   Switch out Hassy-NGILA 500kV line
DL  4.0  "HASSYAMP"   500.   "N.GILA"   500.  "1 "
*
*   Reinsert Series Capacitors
RC  4.0  "HASSYAMP"   500.   "N.GILA"   500.  "1 "   2
RC  4.0  "N.GILA"    500.   "IMPRLVLY" 500.  "1 "   2
RC  4.0  "IMPRLVLY"   500.   "MIGUEL"   500.  "1 "   1
RC  4.0  "MEAD"      500.   "PERKINS" 500.  "1 "   1
RC  4.0  "MEAD"      500.   "PERKINS" 500.  "1 "   3
*
*   Remove Generator Fault Damping at Palo Verde
GFD 4.0  "PALOVRD1"  24.0   "1 "   0.0
GFD 4.0  "PALOVRD2"  24.0   "1 "   0.0
GFD 4.0  "PALOVRD3"  24.0   "1 "   0.0
*
*   Reinsert Series Capacitors
RC  8.0   "MOENKOPI"   500.   "YAVAPAI"  500.  "1 "   1
RC  8.0   "YAVAPAI"    500.   "WESTWING" 500.  "1 "   2
RC  8.0   "NAVAJO"    500.   "WESTWING" 500.  "1 "   1
RC  8.0   "NAVAJO"    500.   "WESTWING" 500.  "1 "   3
```

```
*   ==================================================================
*   IV - MIGUEL 500kV line outage
*   ==================================================================
FB  0.0  "IMPRLVLY"   500.
*   Flash Series Capacitors
FC  0.0  "HASSYAMP"   500.   "N.GILA"   500.  "1 "   2
FC  0.0  "N.GILA"     500.   "IMPRLVLY" 500.  "1 "   2
FC  0.0  "IMPRLVLY"   500.   "MIGUEL"   500.  "1 "   1
*
*   Clear fault from IV 500kV buss
CFB 4.0  "IMPRLVLY"   500.
*
*   Switch out IV - MIGUEL 500kV line
DL  4.0  "IMPRLVLY"   500.   "MIGUEL"   500.  "1 "
*
*   Reinsert Series Capacitors
RC  4.0  "HASSYAMP"   500.   "N.GILA"   500.  "1 "   2
RC  4.0  "IMPRLVLY"   500.   "N.GILA"   500.  "1 "   2
*

*   ==================================================================
*    Trip Ramon-Mirage 230/92kV xfmr
*   ==================================================================
*   Bus fault at Ramon (MIRAGE) 92kV
FB   0.0 "MIRAGTIE"  92.
*   Clear bus fault at Ramon (MIRAGE) 92kV #8640
CFB  4.0 "MIRAGTIE"  92.
*   Trip Ramon-Mirage 230/92kV xfmr
*
DL   5.0 "8640"  92.  "8695"  230.  "1 "


*   ==================================================================
*   Path 42 Line trip with RAS
*   ==================================================================
*   Fault Bus - Mirage 230kV
FB  0.0 "MIRAGE" 230.
*
*   Clear Fault
CFB 5 "MIRAGE" 230.
*
*   Trip Path 42 Elements
DL  5  "COACHELA " 230.  "DEVERS " 230.  "1 "
DL  5  "RAMON "    230.  "MIRAGE " 230.  "1 "
*
*   Trip 92kV ties and Generation as part of RAS (approx 200MW)
DL  8  "MIDWAY "   92.   "VULCAN "  92.  "1 "
DL  8  "MIDWAY "   92.   "LEATHERS "  92.  "1 "
TG  8  "VULCAN1 "  14.4 "1 "
TG  8  "VULCAN1 "  14.4 "2 "
TG  8  "EARTHE2 "  92 "1 "
TG  8  "LEATHERS "  14.4 "1 "
TG  8  "JJELMORE "  14.4 "1 "
TG  8  "DELRANCH "  14.4 "1 "
```

```
*   ==================================================================
*   Palo Verde - Devers 500kV line outage
*   including Generator fault damping at three PV units
*   ==========================================================================
*   Fault Bus at Palo Verde
FB  0.0  "PALOVRDE"   500.
*   Generator Fault Damping at Palo Verde
GFD 0.0  "PALOVRD1"  24.0   "1 "   0.072
GFD 0.0  "PALOVRD2"  24.0   "1 "   0.072
GFD 0.0  "PALOVRD3"  24.0   "1 "   0.072
*   Flash Series Capacitors
FC  0.0  "PALOVRDE"   500.   "DEVERS"   500.  "1 "   2
FC  0.0  "PALOVRDE"   500.   "DEVERS"   500.  "1 "   4
FC  0.0  "HASSYAMP"   500.   "N.GILA"   500.  "1 "   2
FC  0.0  "N.GILA"     500.   "IMPRLVLY" 500.  "1 "   2
FC  0.0  "IMPRLVLY"   500.   "MIGUEL"   500.  "1 "   1
FC  0.0  "MEAD"       500.   "PERKINS" 500.  "1 "   1
FC  0.0  "MEAD"       500.   "PERKINS" 500.  "1 "   3
FC  0.0  "MOENKOPI"   500.   "YAVAPAI"  500.  "1 "   1
FC  0.0  "YAVAPAI"    500.   "WESTWING" 500.  "1 "   2
FC  0.0  "NAVAJO"     500.   "WESTWING" 500.  "1 "   1
FC  0.0  "NAVAJO"     500.   "WESTWING" 500.  "1 "   3
*
*   Clear fault from Palo Verde 500kV buss
CFB 4.0  "PALOVRDE"   500.
*
*   Switch out Hassy-NGILA 500kV line
DL  4.0  "PALOVRDE"   500.   "DEVERS"   500.  "1 "
*
*   Reinsert Series Capacitors
RC  4.0  "HASSYAMP"   500.   "N.GILA"   500.  "1 "   2
RC  4.0  "N.GILA"     500.   "IMPRLVLY" 500.  "1 "   2
RC  4.0  "IMPRLVLY"   500.   "MIGUEL"   500.  "1 "   1
RC  4.0  "MEAD"       500.   "PERKINS" 500.  "1 "   1
RC  4.0  "MEAD"       500.   "PERKINS" 500.  "1 "   3
*
*   Remove Generator Fault Damping at Palo Verde
GFD 4.0  "PALOVRD1"  24.0   "1 "   0.0
GFD 4.0  "PALOVRD2"  24.0   "1 "   0.0
GFD 4.0  "PALOVRD3"  24.0   "1 "   0.0
*
*   Reinsert Series Capacitors
RC  8.0   "MOENKOPI"   500.   "YAVAPAI"  500.  "1 "   1
RC  8.0   "YAVAPAI"    500.   "WESTWING" 500.  "1 "   2
RC  8.0   "NAVAJO"     500.   "WESTWING" 500.  "1 "   1
RC  8.0   "NAVAJO"     500.   "WESTWING" 500.  "1 "   3
```

```
*   ====================================================================
*   Loss of NILAND-CVSUB161 161 kV Line
*   ====================================================================
*   Fault bus at NILAND
*
FB   0.0 "NILAND  " 161.
*
*   Clear fault at NILAND
*
CFB  4.0 "NILAND   " 161.
*
*   Trip NILAND-CVSUB161 161 kV Line
*
DL   4.0 "NILAND  " 161. "CVSUB161" 161. "1 "
```

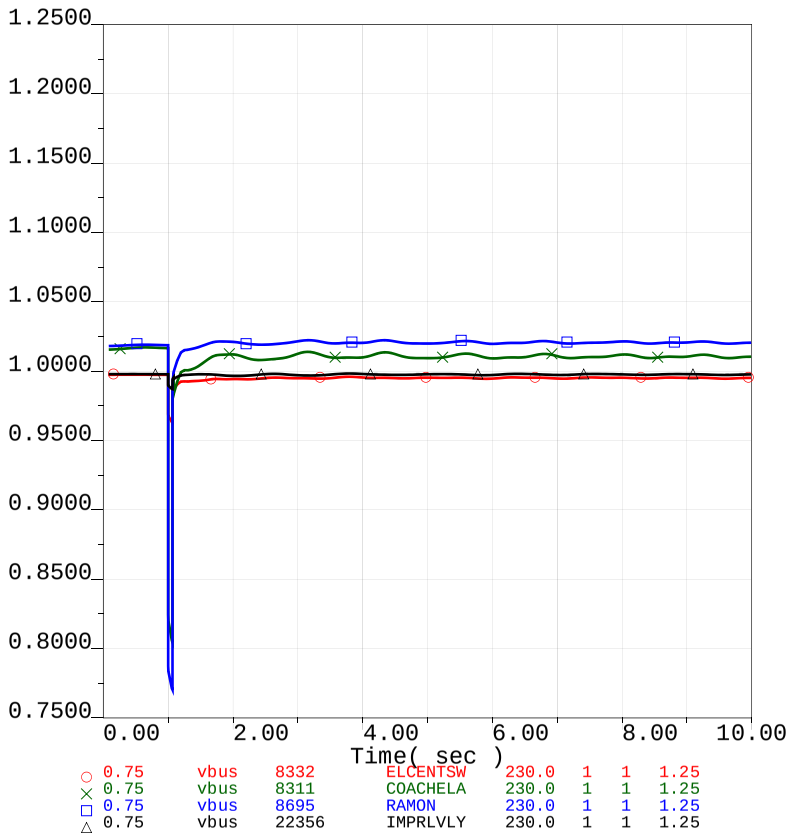
```
*   ====================================================================
*   Loss of NILAND-BLYTHE 161 kV Line
*   ====================================================================
*
*   Fault bus at NILAND
*
FB   0.0 "NILAND  " 161.
*
*   Clear fault at NILAND
*
CFB  4.0 "NILAND   " 161.
*
*   Trip NILAND-BLYTHE 161 kV Line
*
DL   4.0 "NILAND  " 161. "BLYTHE  " 161. "1 "
*
```

EC3 System Impact Study

Appendix G
Stability
Post Project

February 2006

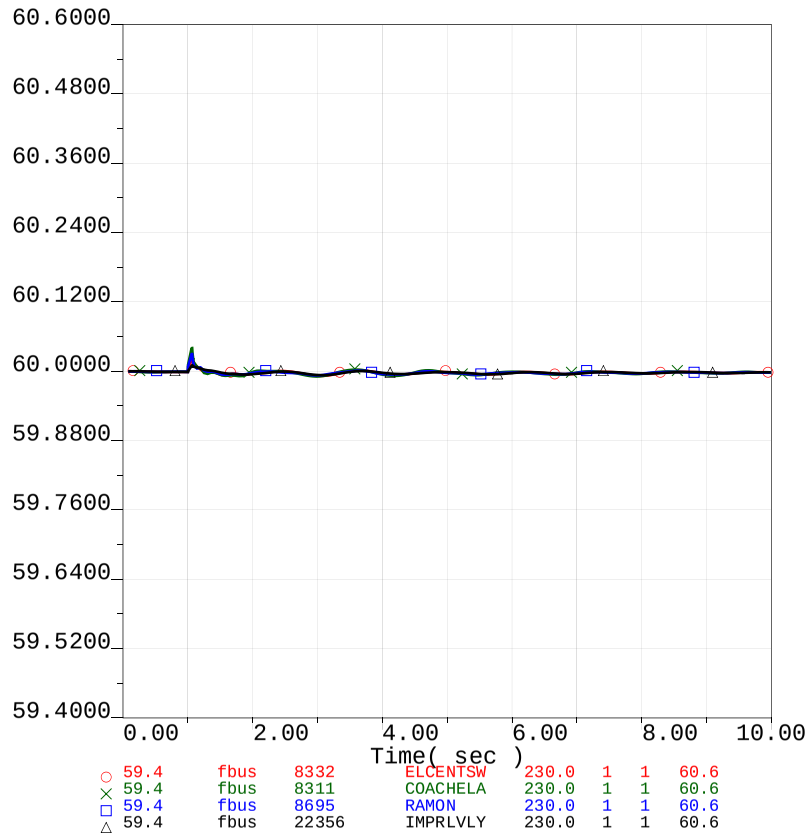
IID 230kV Voltage plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Ramon-Mirage 230/92kV xfmr
Case EC3_PST.SAV

pst_rmnmir | Fri Oct 28 12:55:51 2005

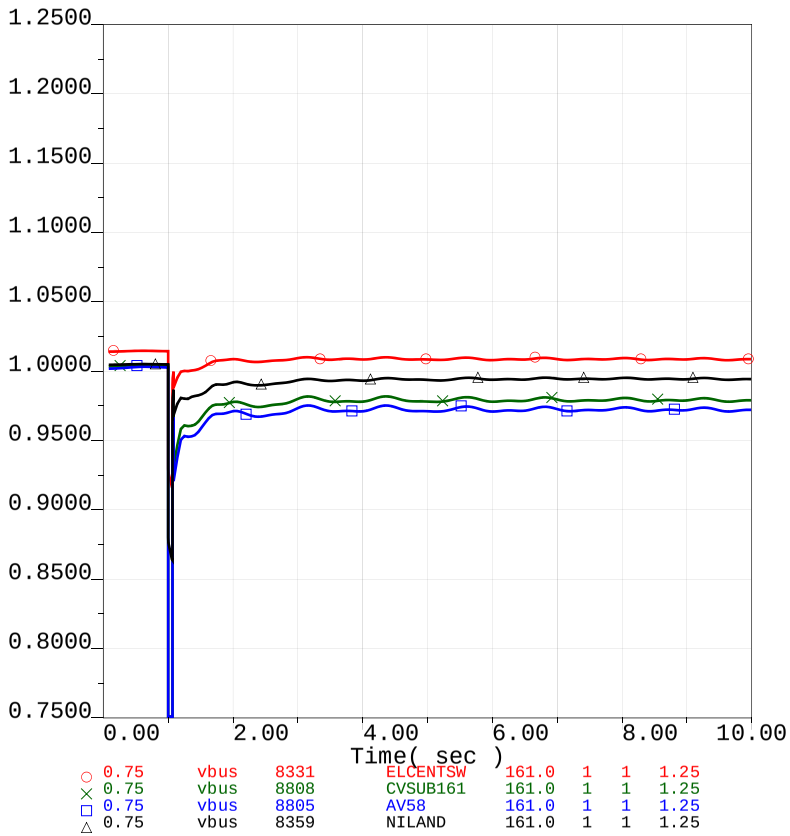
IID 230kV Frequency plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Ramon-Mirage 230/92kV xfmr
Case EC3_PST.SAV

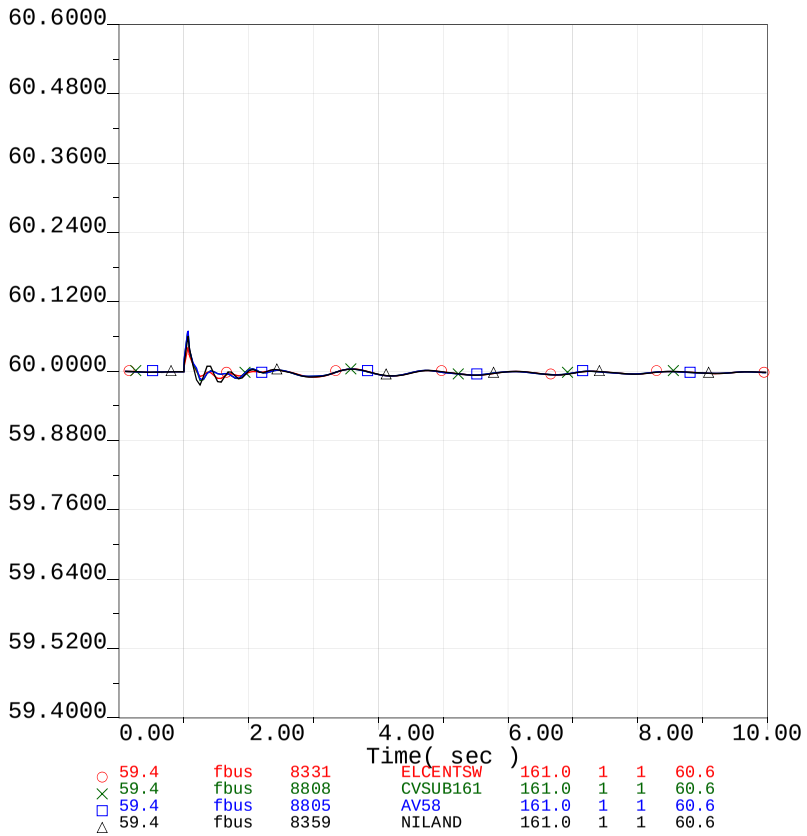
pst_rmnmir | Fri Oct 28 12:55:52 2005

IID 161kV Voltage plots EC, CV, AV58, NIL



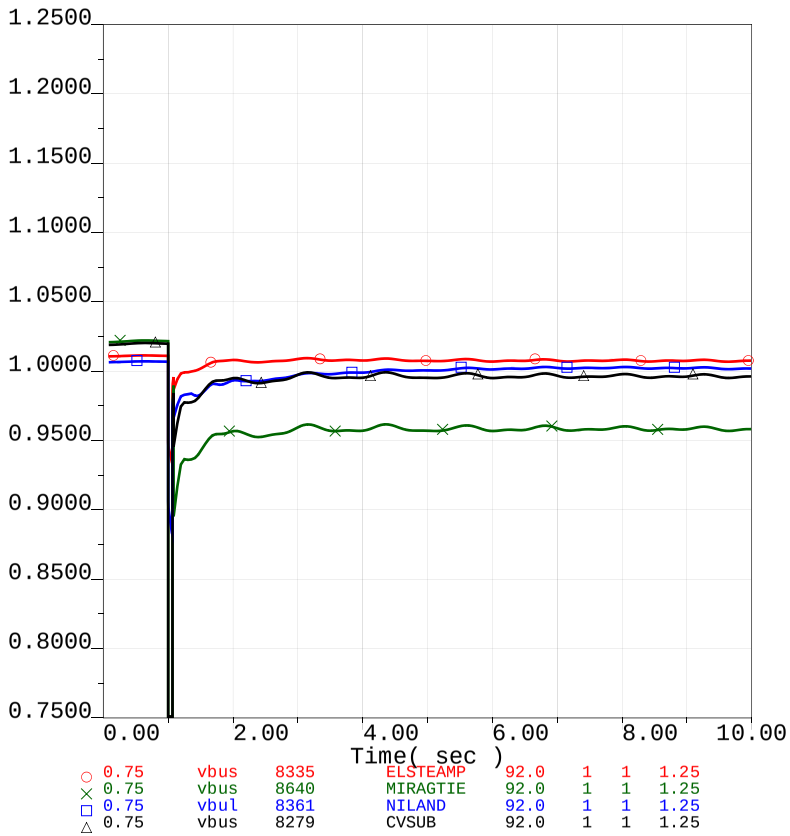
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Ramon-Mirage 230/92kV xfmr
Case EC3_PST.SAV

IID 161kV Frequncy plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Ramon-Mirage 230/92kV xfmr
Case EC3_PST.SAV

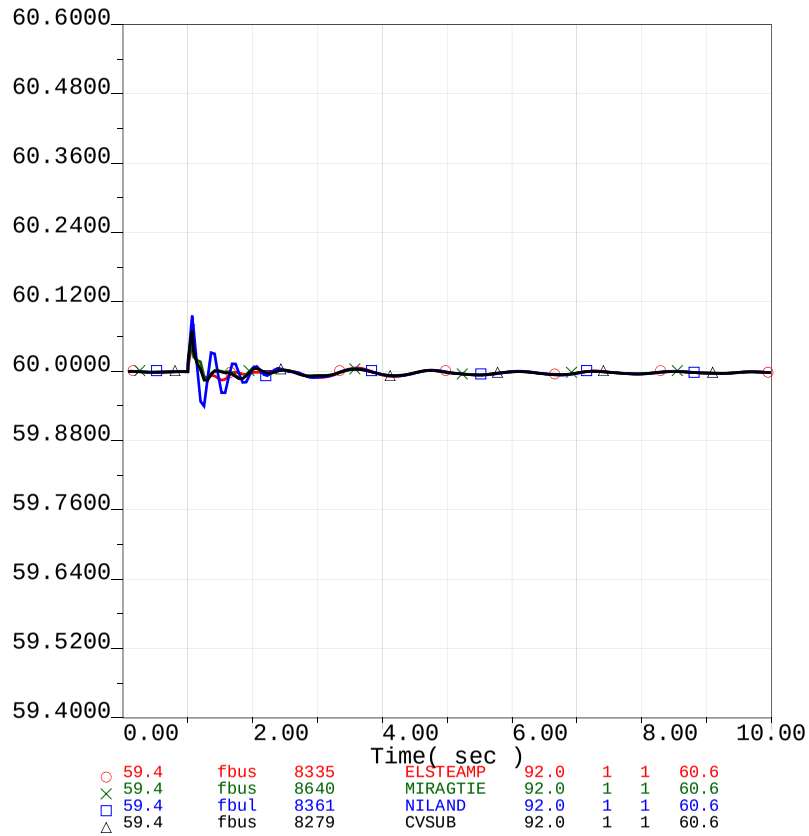
IID 92kV Voltage plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Ramon-Mirage 230/92kV xfmr
Case EC3_PST.SAV

pst_rmnmir | Fri Oct 28 12:55:54 2005

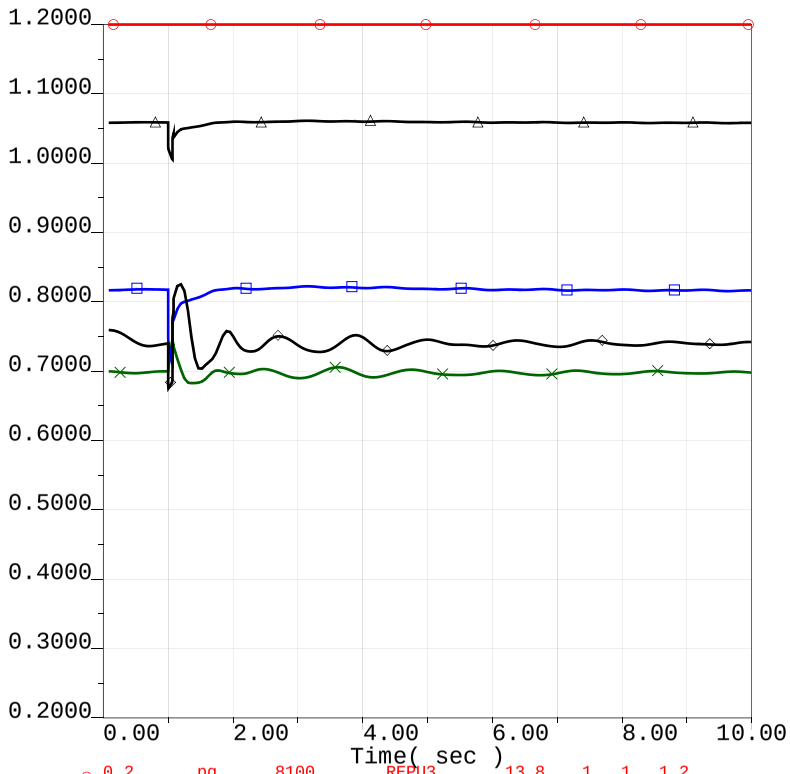
IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Ramon-Mirage 230/92kV xfmr
Case EC3_PST.SAV

pst_rmnmir | Fri Oct 28 12:55:55 2005

El Centro Generator Bus 8100



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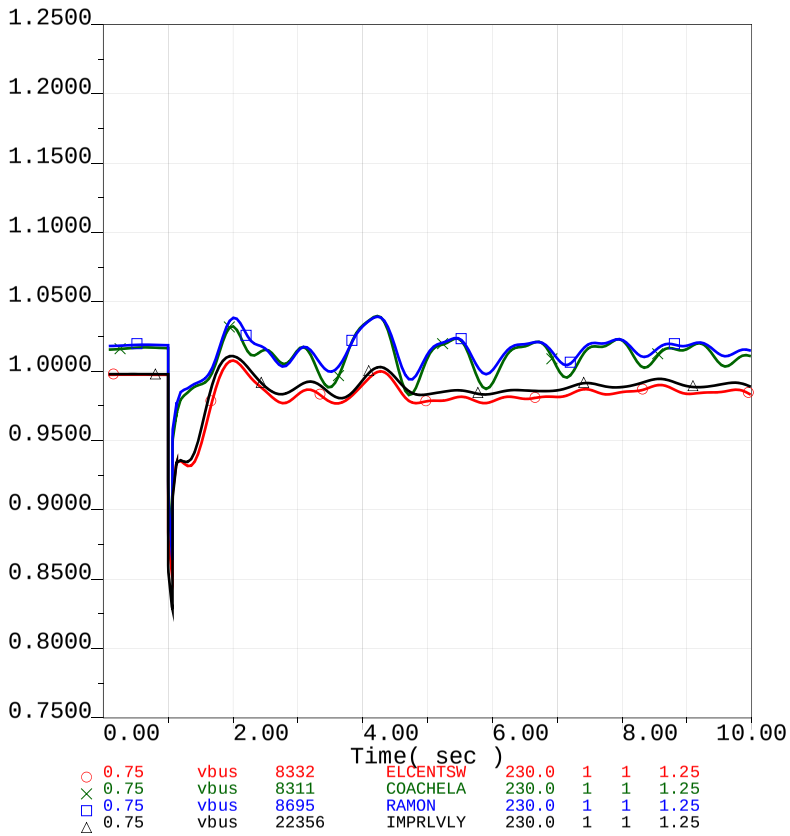
△	0.2	vt	8100	REPU3	13.8	4	1	1.2
◇	0.2	it	8100	REPU3	13.8	4	1	1.2

SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Ramon-Mirage 230/92kV xfmr
Case EC3_PST.SAV

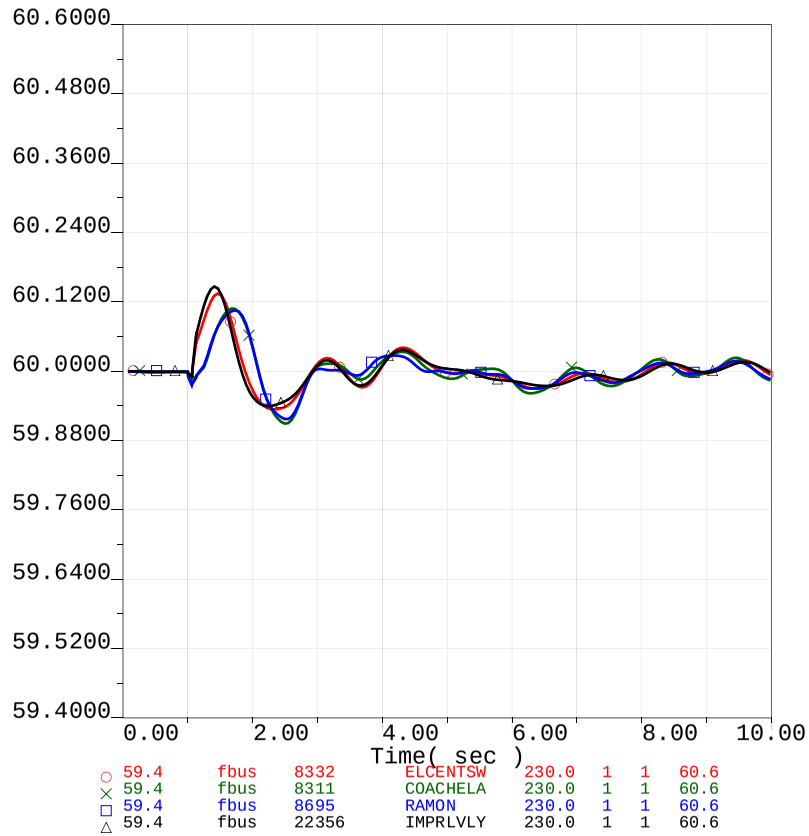
IID 230kV Voltage plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip PV-Devers 500kV line
Case EC3_PST.SAV

pst_pvdev2 | Fri Oct 28 12:53:22 2005

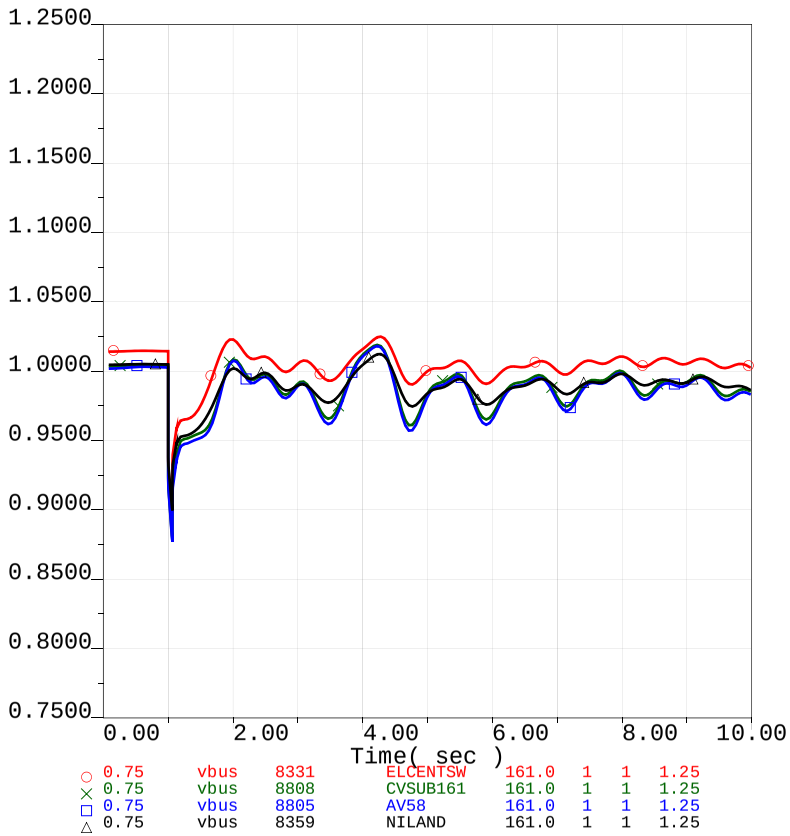
IID 230kV Frequency plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip PV-Devers 500kV line
Case EC3_PST.SAV

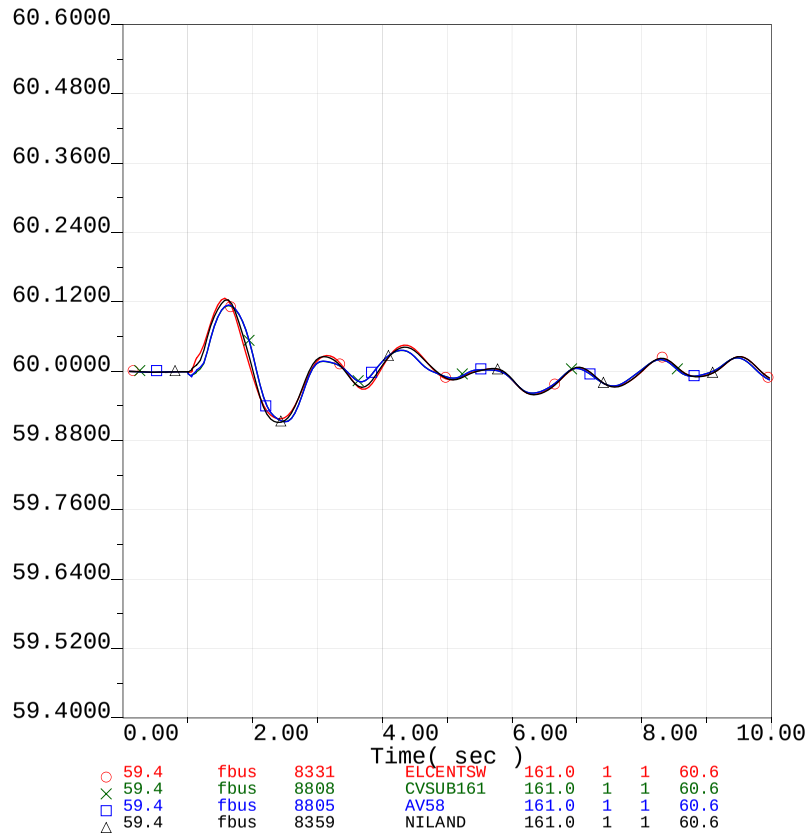
pst_pvdev2 | Fri Oct 28 12:53:23 2005

IID 161kV Voltage plots EC, CV, AV58, NIL



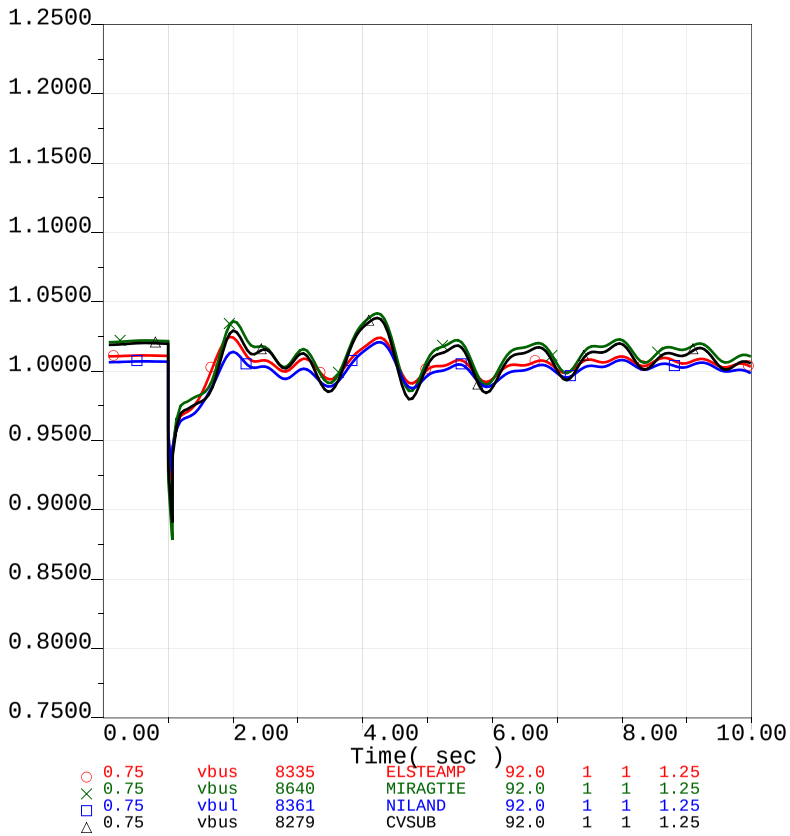
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip PV-Devers 500kV line
Case EC3_PST.SAV

IID 161kV Frequncy plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip PV-Devers 500kV line
Case EC3_PST.SAV

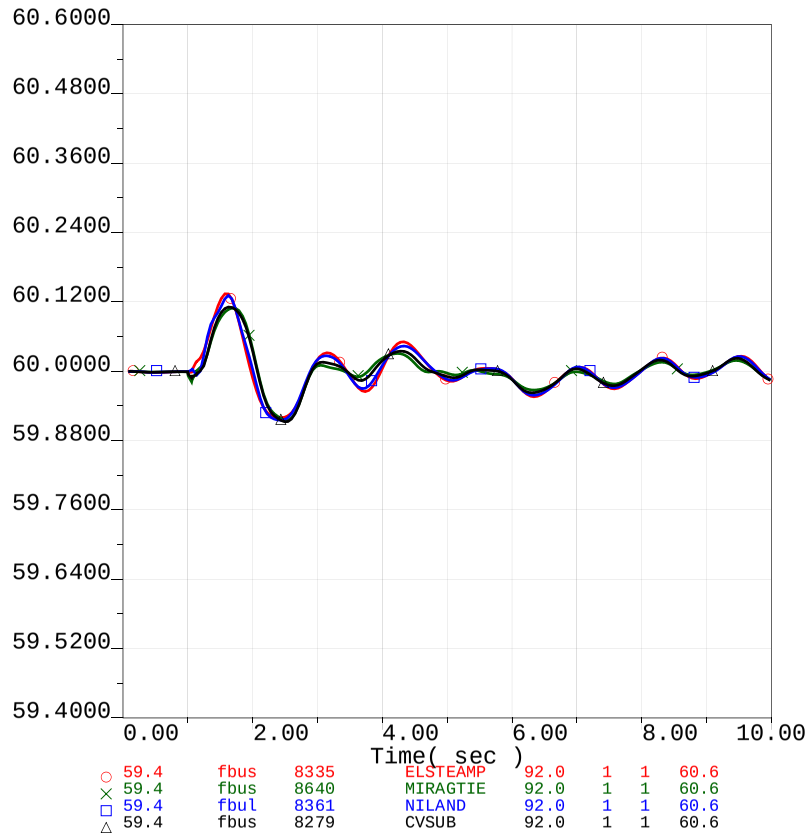
IID 92kV Voltage plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip PV-Devers 500kV line
Case EC3_PST.SAV

pst_pvdev2 | Fri Oct 28 12:53:25 2005

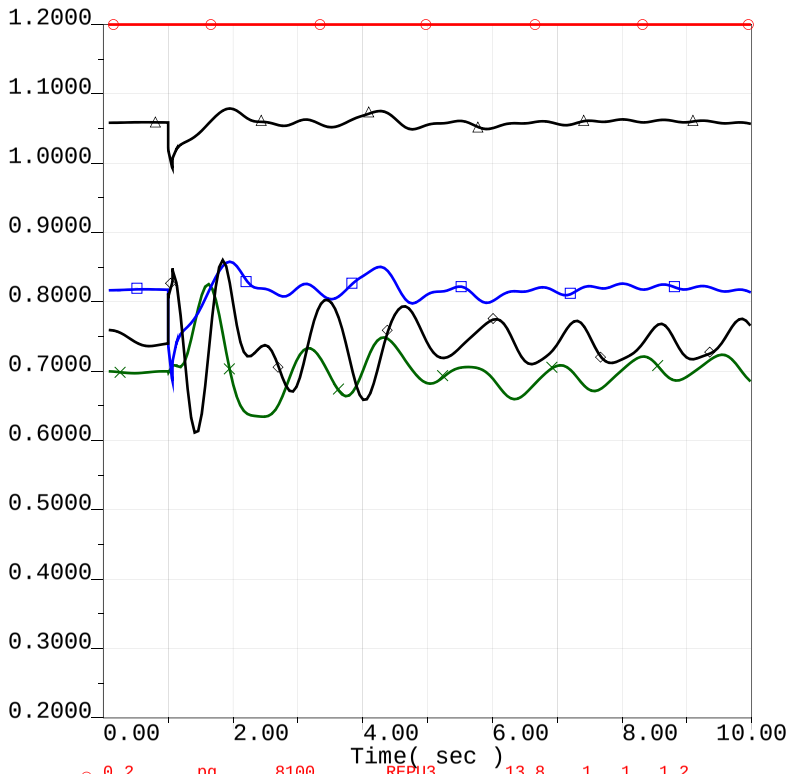
IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip PV-Devers 500kV line
Case EC3_PST.SAV

pst_pvdev2 | Fri Oct 28 12:53:26 2005

El Centro Generator Bus 8100



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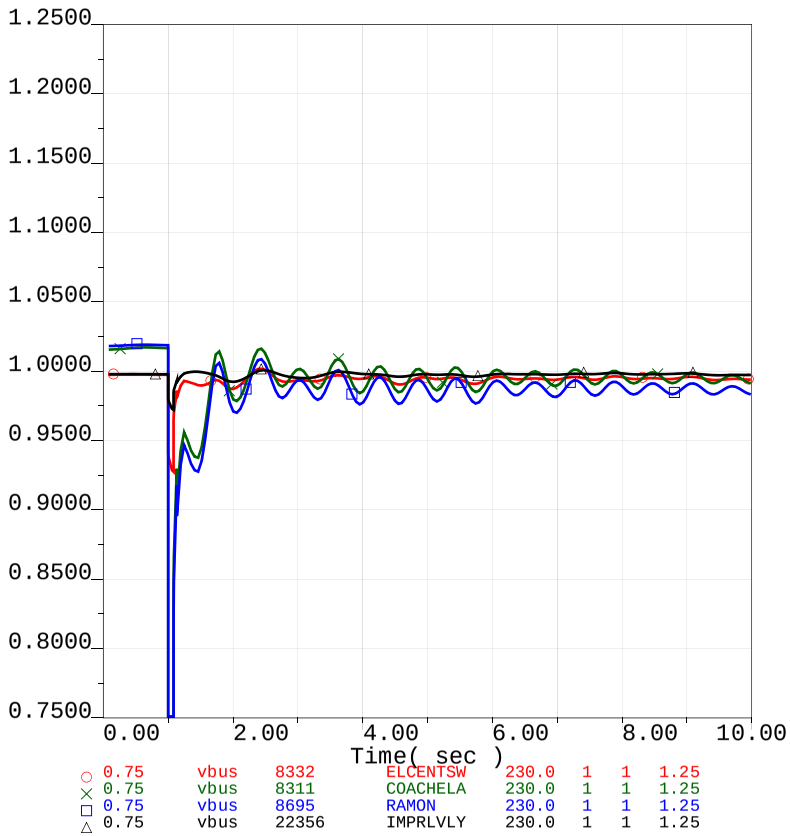
□	0.75	vbug	8100	REPU3	13.8	1	1	1.25
△	0.2	vt	8100	REPU3	13.8	4	1	1.2
◇	0.2	it	8100	REPU3	13.8	4	1	1.2

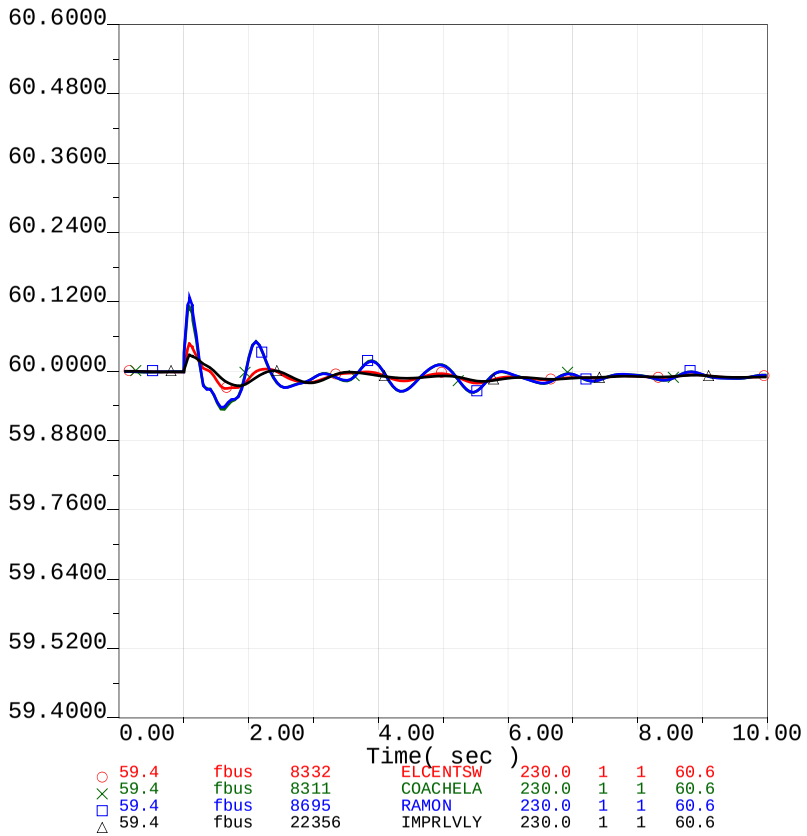
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip PV-Devers 500kV line
Case EC3_PST.SAV

IID 230kV Voltage plots EC, CV, RMN, IV



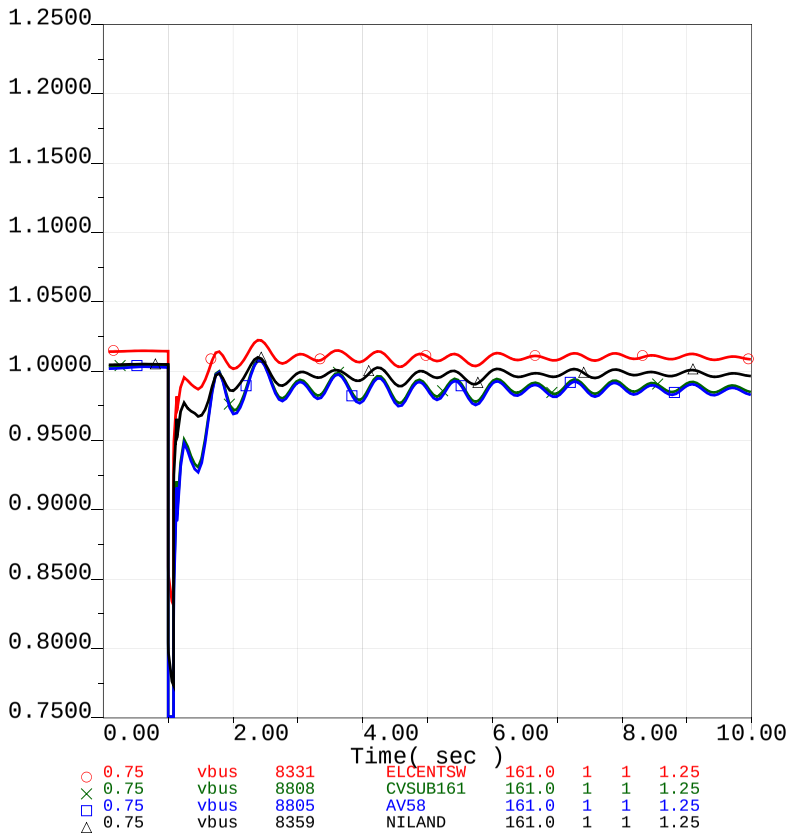
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Path 42 with IID RAS SCHEME
Case EC3_PST.SAV

IID 230kV Frequency plots EC, CV, RMN, IV



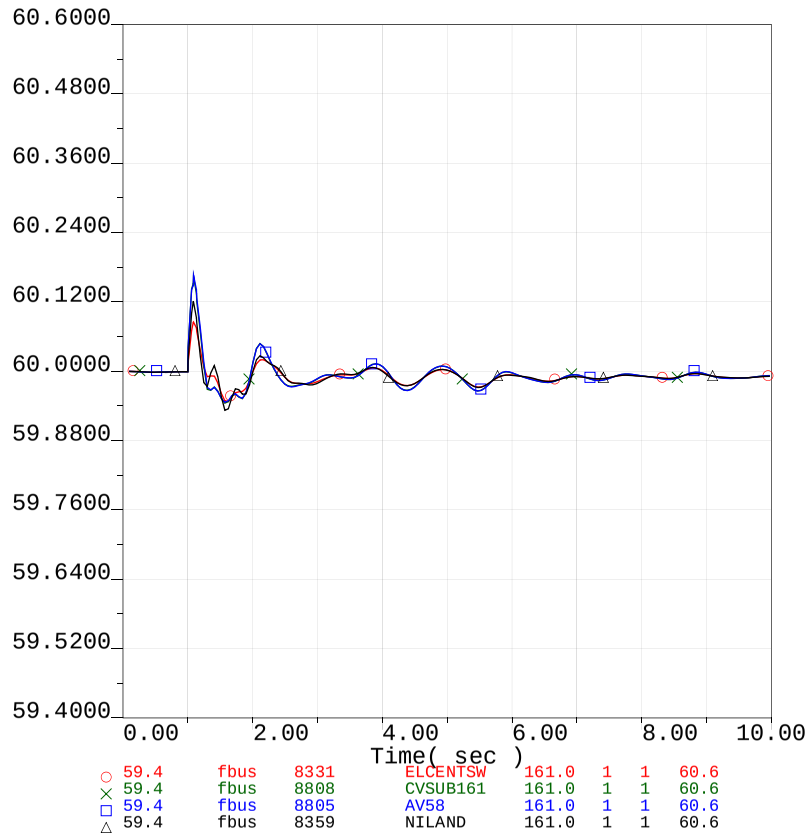
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Path 42 with IID RAS SCHEME
Case EC3_PST.SAV

IID 161kV Voltage plots EC, CV, AV58, NIL



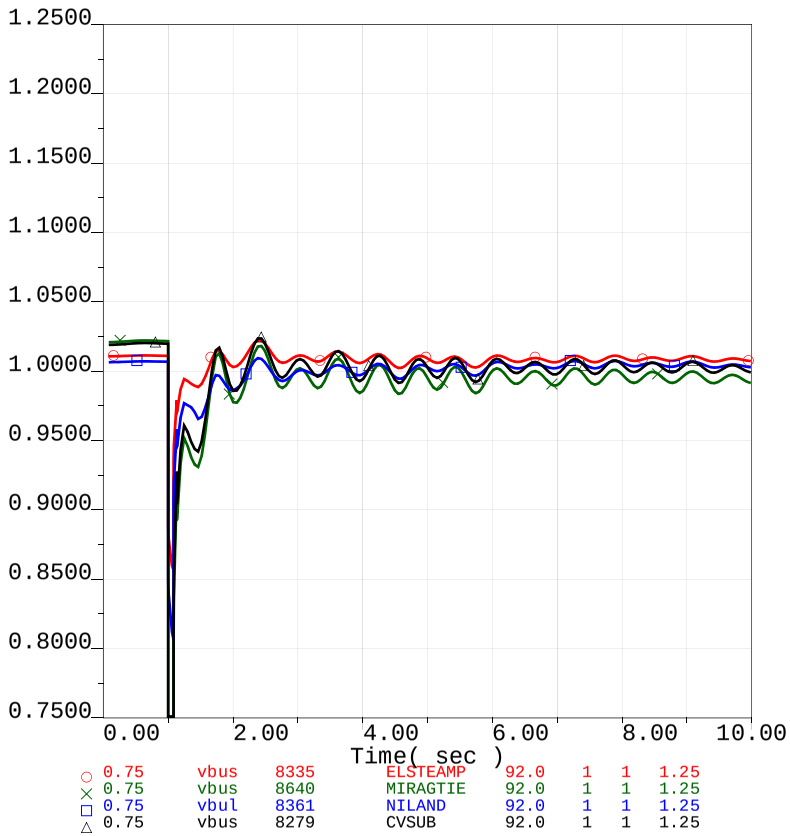
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Path 42 with IID RAS SCHEME
Case EC3_PST.SAV

IID 161kV Frequncy plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Path 42 with IID RAS SCHEME
Case EC3_PST.SAV

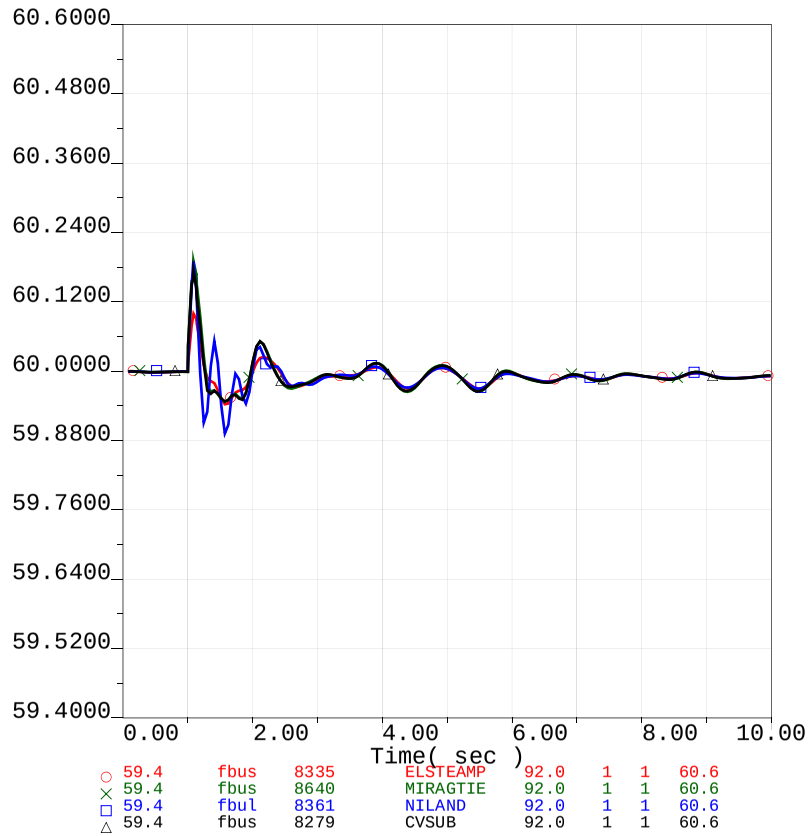
IID 92kV Voltage plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Path 42 with IID RAS SCHEME
Case EC3_PST.SAV

pst_p42_ras | Fri Oct 28 12:50:02 2005

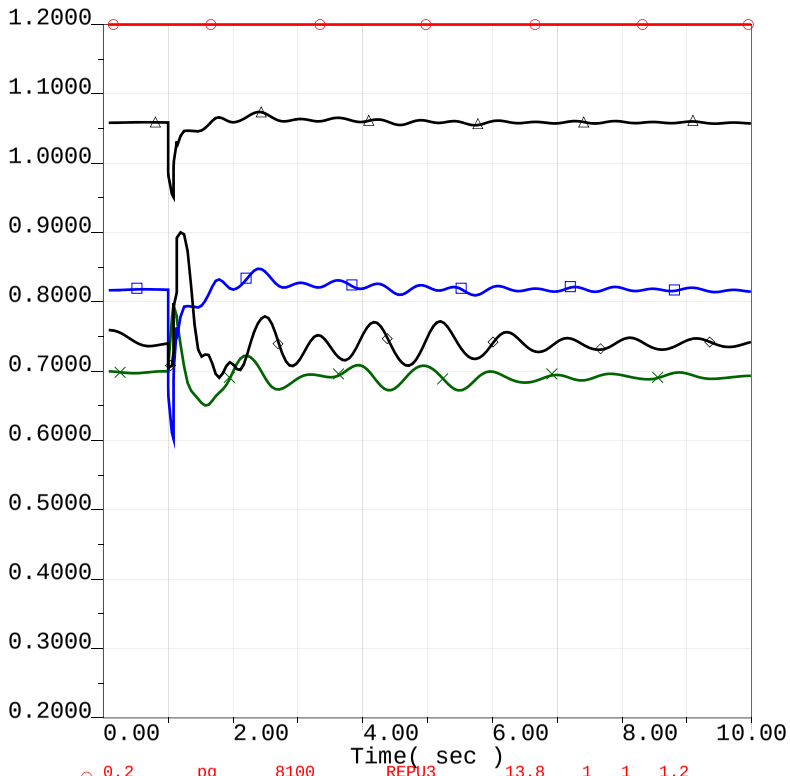
IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Path 42 with IID RAS SCHEME
Case EC3_PST.SAV

pst_p42_ras | Fri Oct 28 12:50:03 2005

El Centro Generator Bus 8100



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× 59.4	fbug	8100	REPU3	13.8	1	1	60.6
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△ 0.2	vt	8100	REPU3	13.8	4	1	1.2
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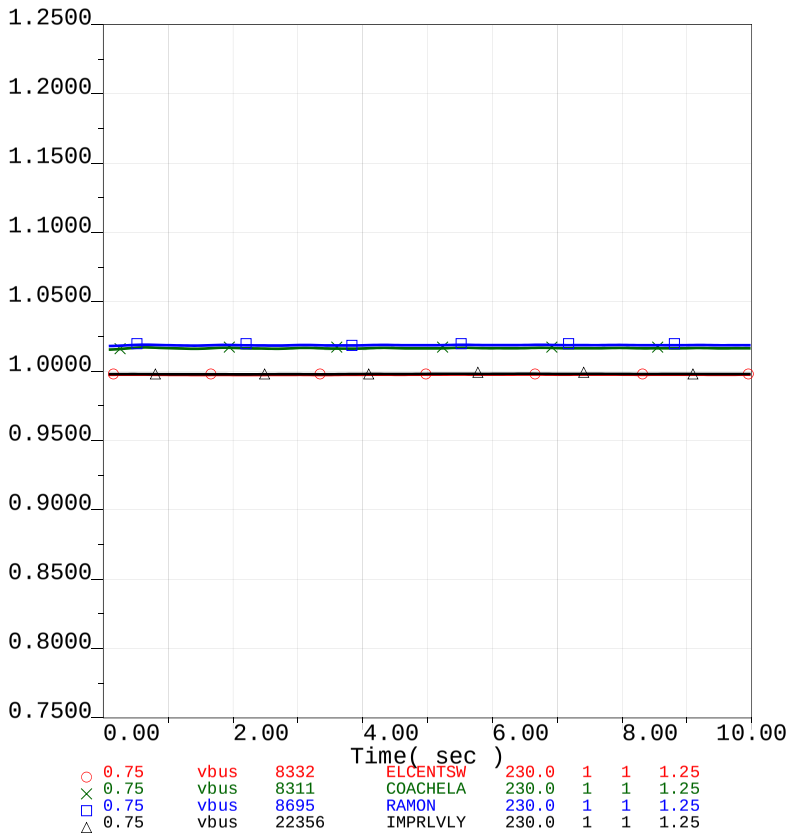
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Path 42 with IID RAS SCHEME
Case EC3_PST.SAV

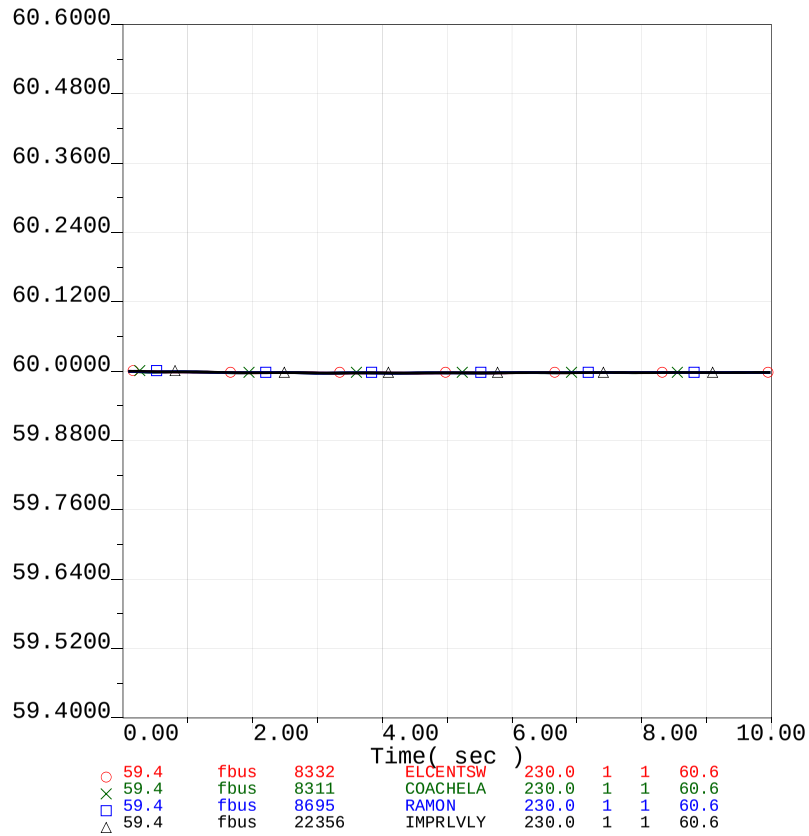
IID 230kV Voltage plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip No Outage
Case EC_PST.SAV

pst_no_otg | Fri Oct 28 12:52:15 2005

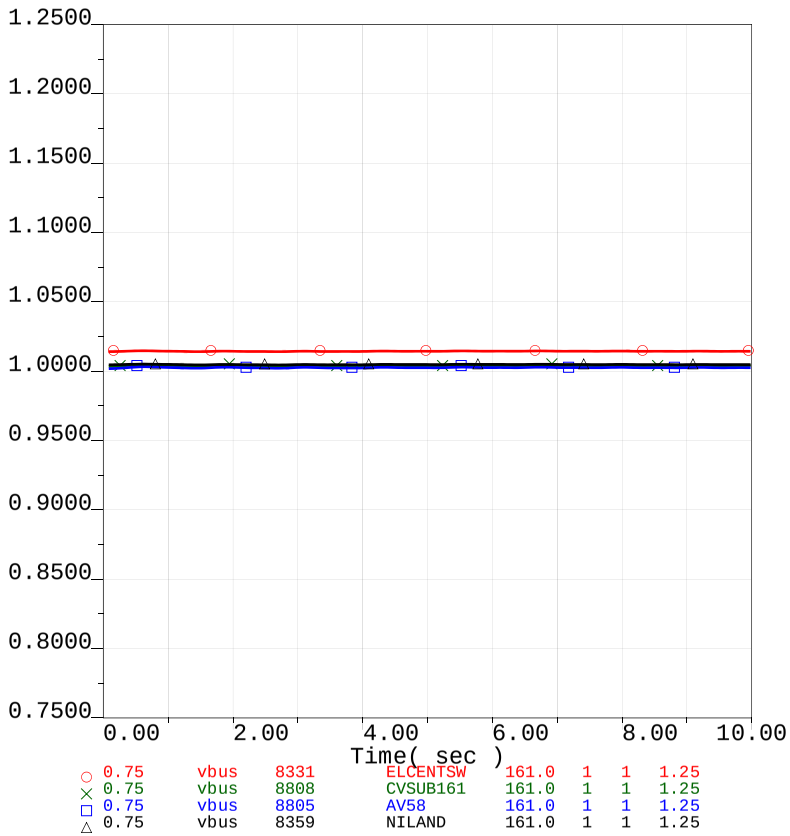
IID 230kV Frequency plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip No Outage
Case EC_PST.SAV

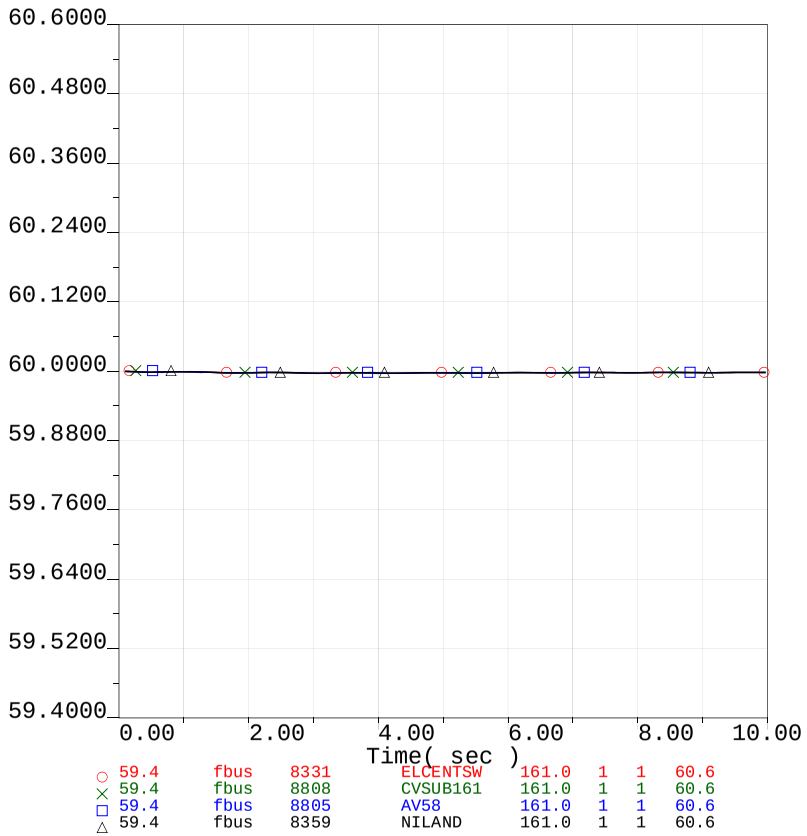
pst_no_otg | Fri Oct 28 12:52:16 2005

IID 161kV Voltage plots EC, CV, AV58, NIL



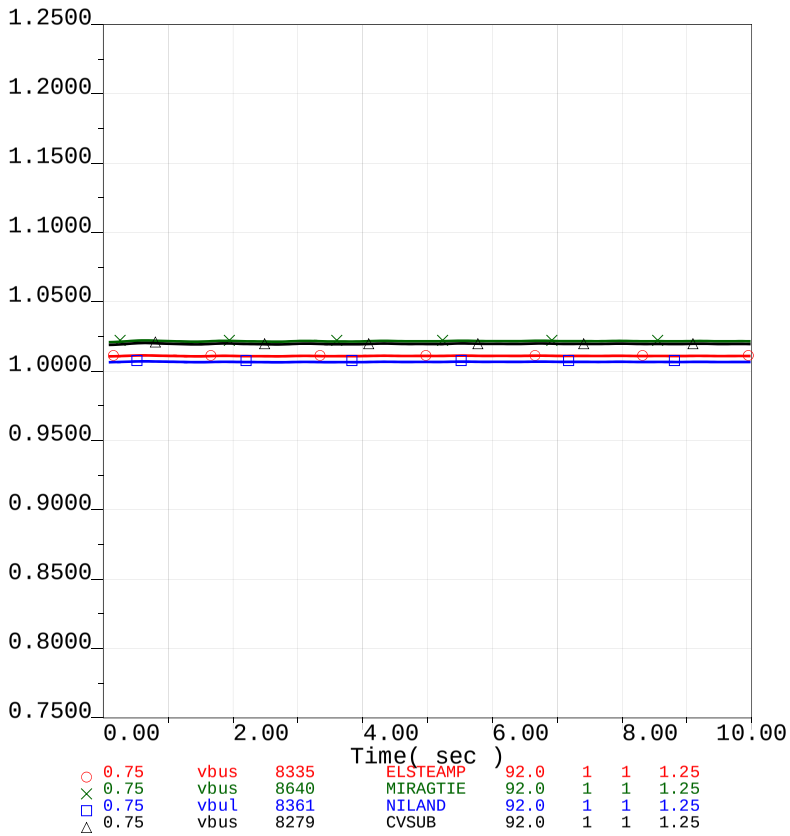
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip No Outage
Case EC_PST.SAV

IID 161kV Frequncy plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip No Outage
Case EC_PST.SAV

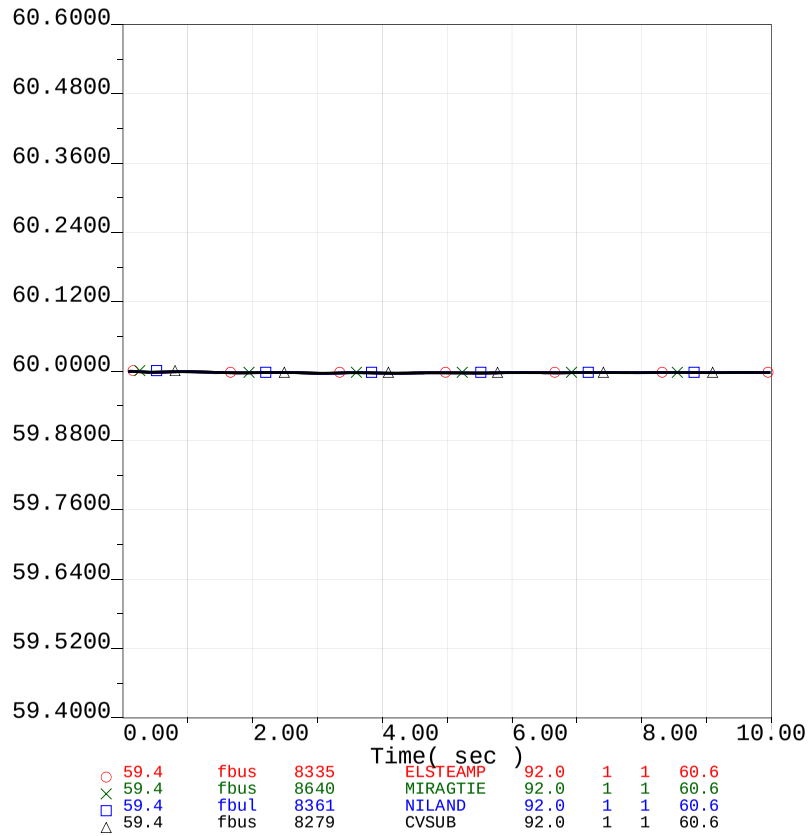
IID 92kV Voltage plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip No Outage
Case EC_PST.SAV

pst_no_otg | Fri Oct 28 12:52:18 2005

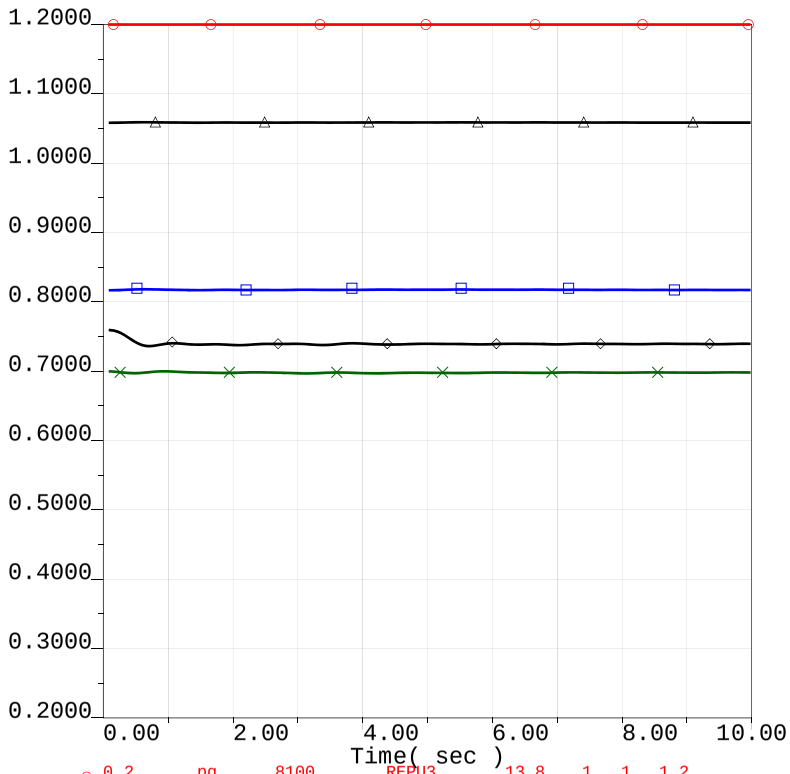
IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip No Outage
Case EC_PST.SAV

pst_no_otg | Fri Oct 28 12:52:19 2005

El Centro Generator Bus 8100



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× 59.4	fbug	8100	REPU3	13.8	1	1	60.6
□ 0.75	vbug	8100	REPU3	13.8	1	1	1.25
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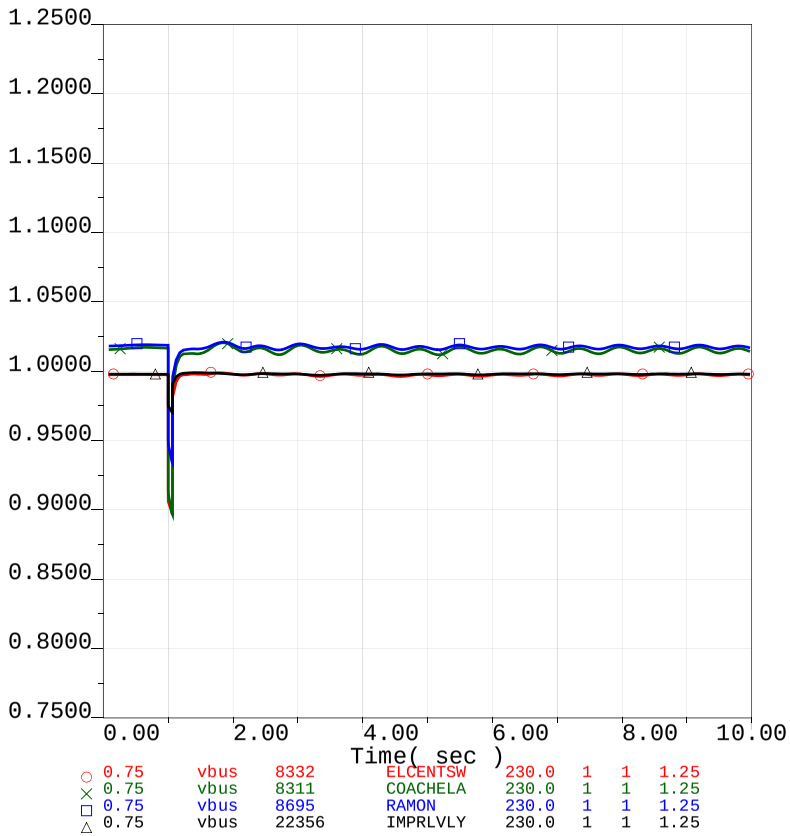
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip No Outage
Case EC_PST.SAV

pst_no_otg

Fri Oct 28 12:52:20 2005

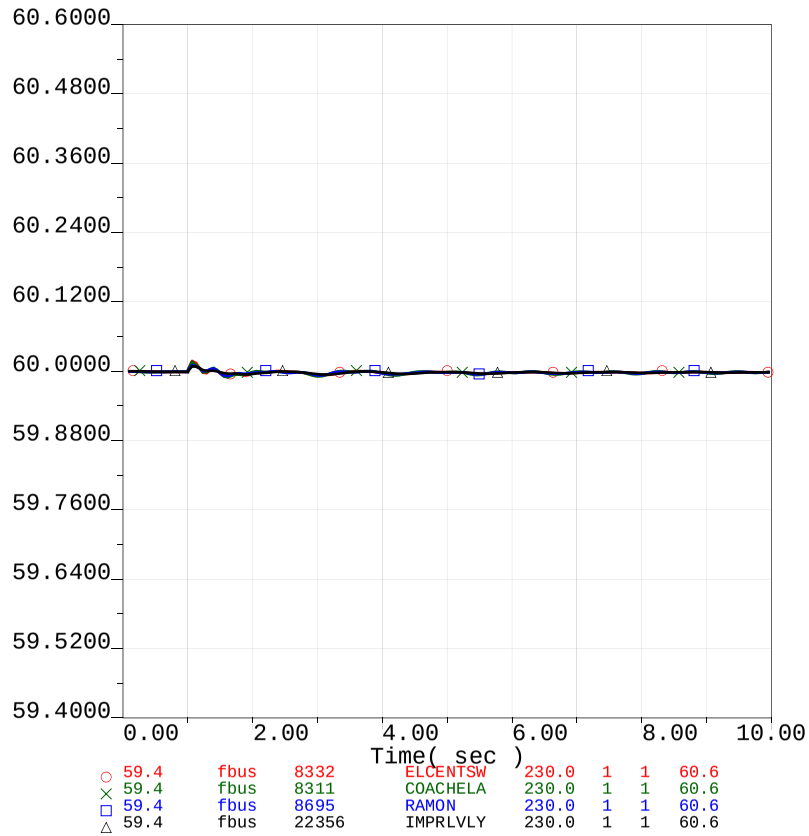
IID 230kV Voltage plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-CVSUB161 161kV
Case EC3_PST.SAV

pst_nil-cv_n1 | Fri Oct 28 12:48:26 2005

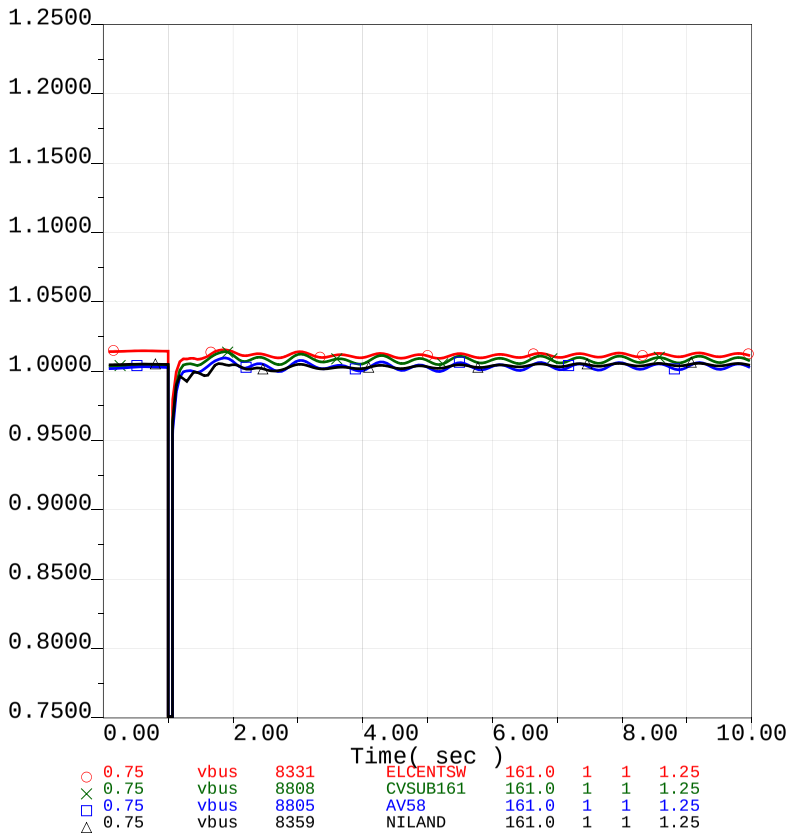
IID 230kV Frequency plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-CVSUB161 161kV
Case EC3_PST.SAV

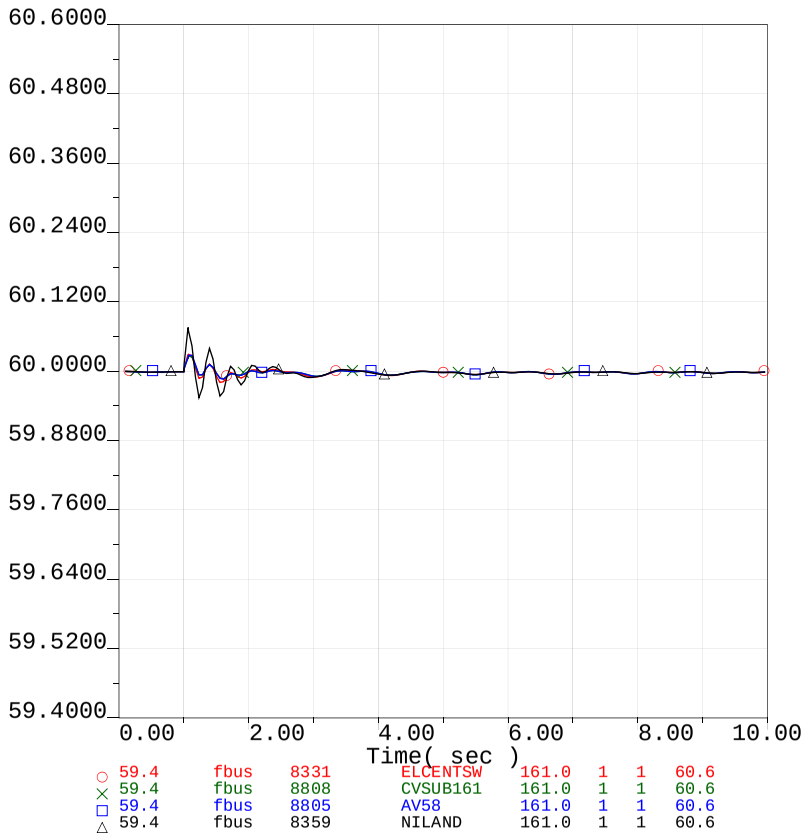
pst_nil-cv_n1 | Fri Oct 28 12:48:27 2005

IID 161kV Voltage plots EC, CV, AV58, NIL



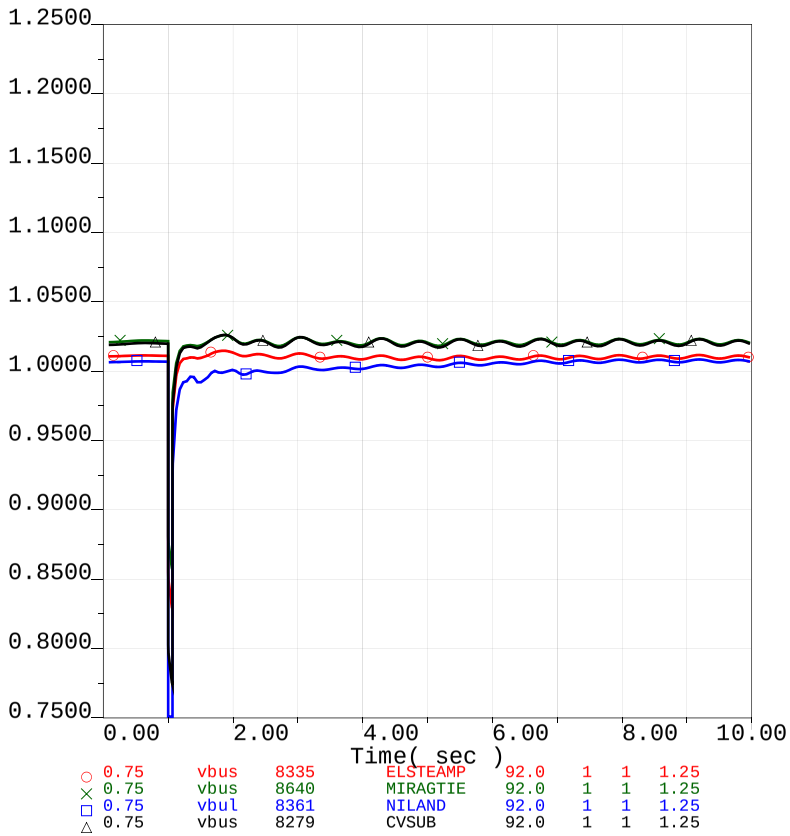
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-CVSUB161 161kV
Case EC3_PST.SAV

IID 161kV Frequncy plots EC, CV, AV58, NIL



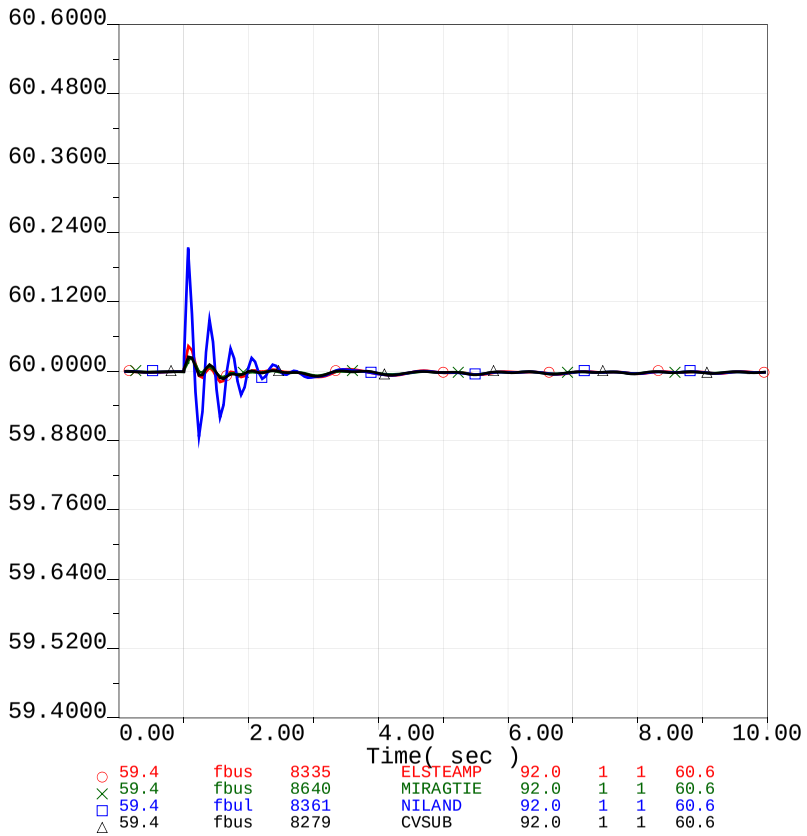
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-CVSUB161 161kV
Case EC3_PST.SAV

IID 92kV Voltage plots EC, MIR, NIL, CV



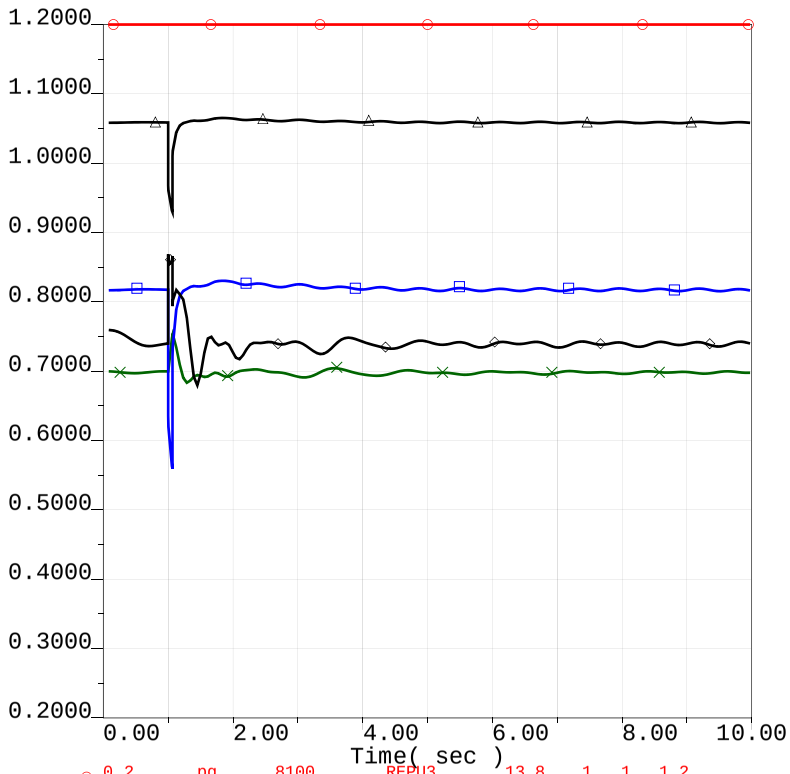
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-CVSUB161 161kV
Case EC3_PST.SAV

IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-CVSUB161 161kV
Case EC3_PST.SAV

El Centro Generator Bus 8100



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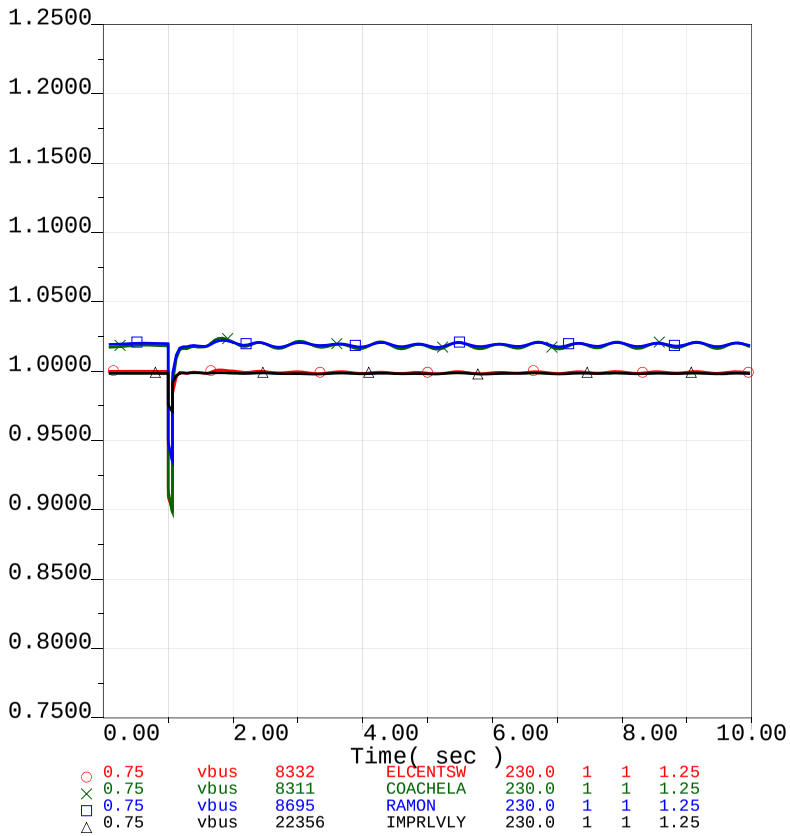
◇	0.2	it	8100	REPU3	13.8	4	1	1.2

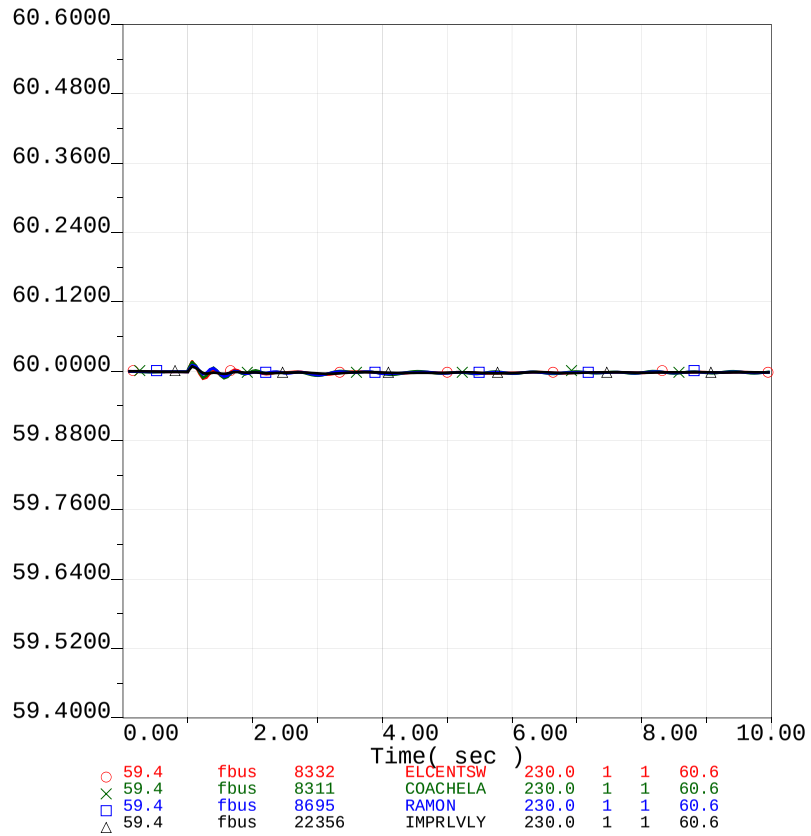
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-CVSUB161 161kV
Case EC3_PST.SAV

IID 230kV Voltage plots EC, CV, RMN, IV



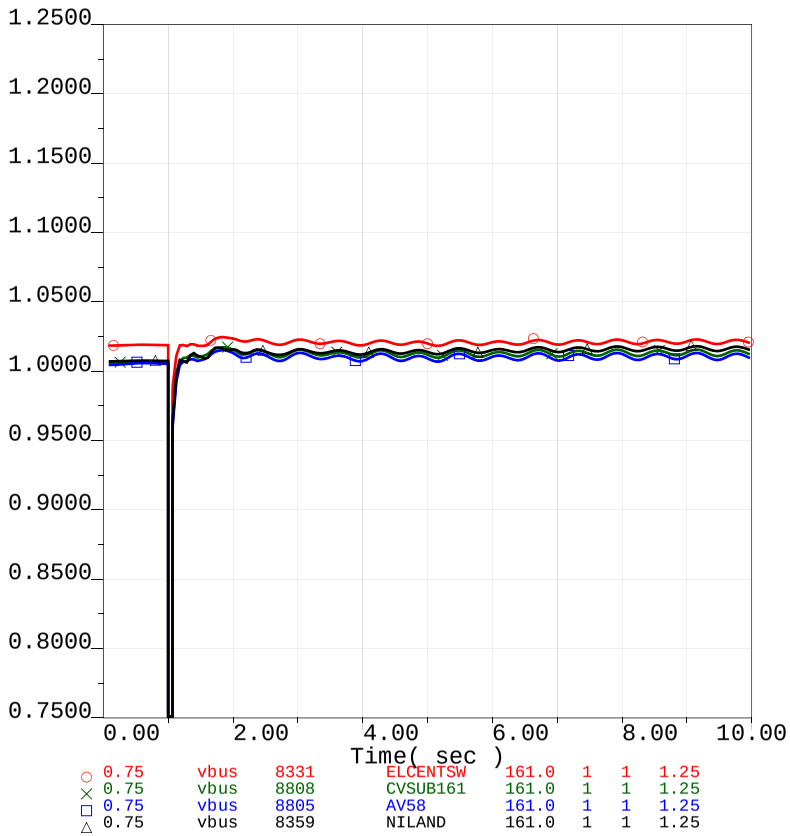
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-BLYTHE 161kV
Case EC3_PRE.SAV

IID 230kV Frequency plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-BLYTHE 161kV
Case EC3_PRE.SAV

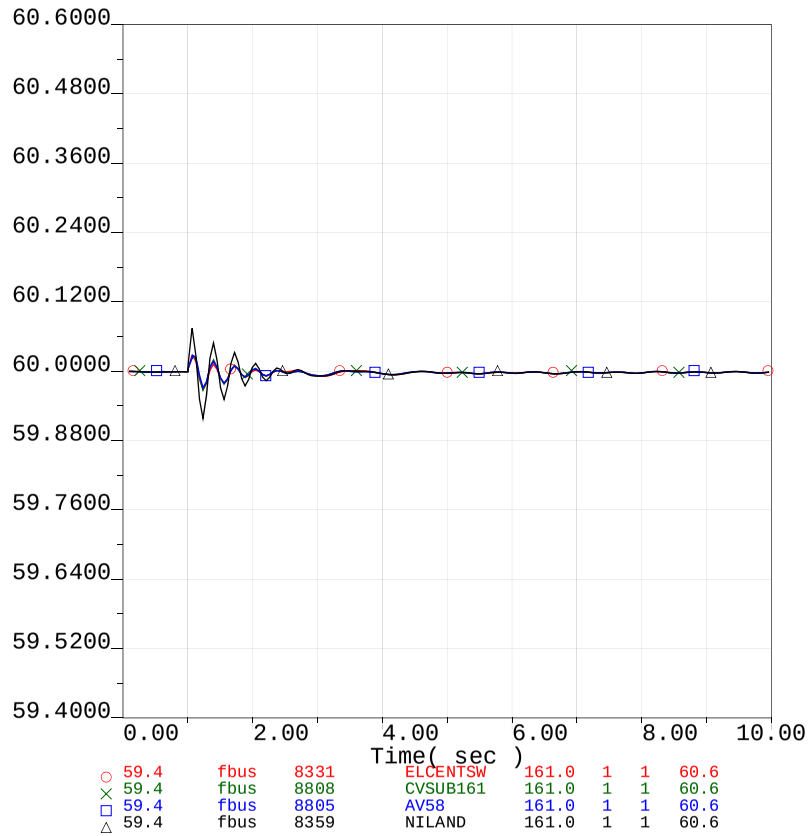
IID 161kV Voltage plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-BLYTHE 161kV
Case EC3_PRE.SAV

pst_nil-bly_n1 | Fri Oct 28 12:47:08 2005

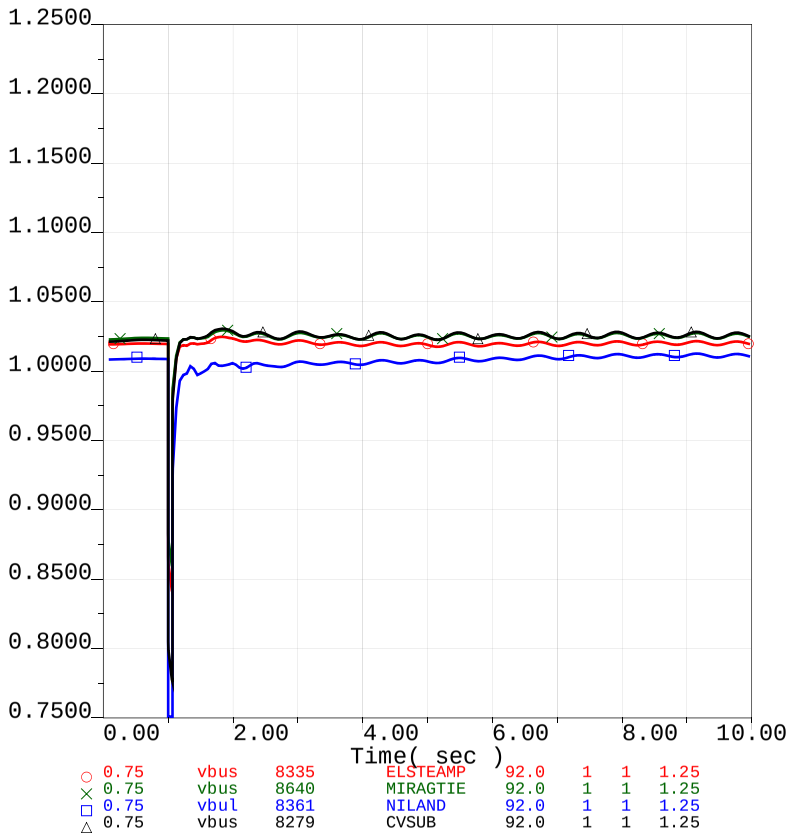
IID 161kV Frequncy plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-BLYTHE 161kV
Case EC3_PRE.SAV

pst_nil-bly_n1 | Fri Oct 28 12:47:09 2005

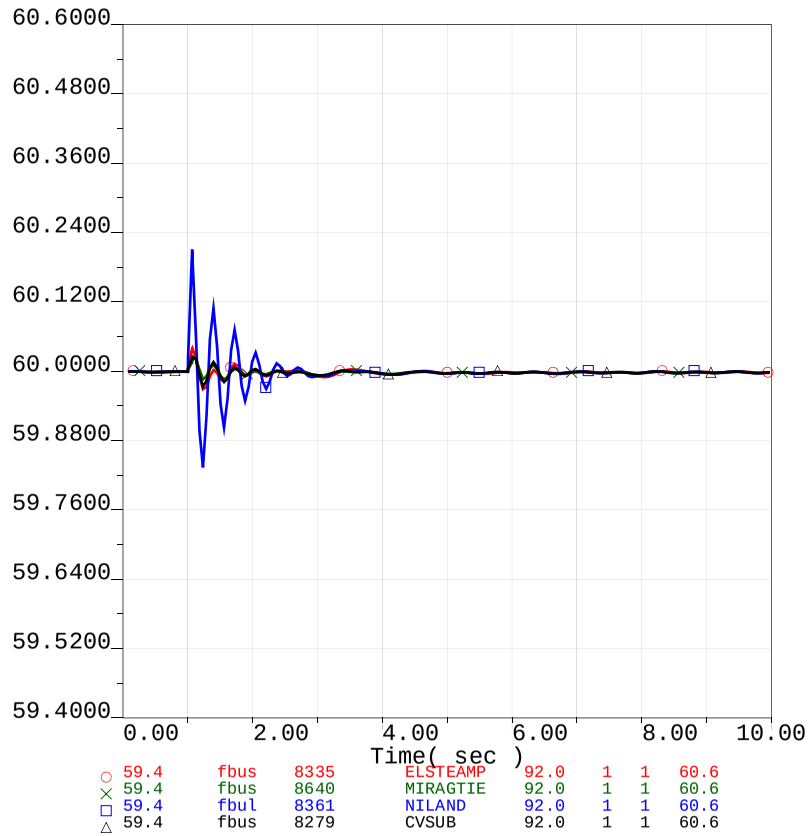
IID 92kV Voltage plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-BLYTHE 161kV
Case EC3_PRE.SAV

pst_nil-bly_n1 | Fri Oct 28 12:47:09 2005

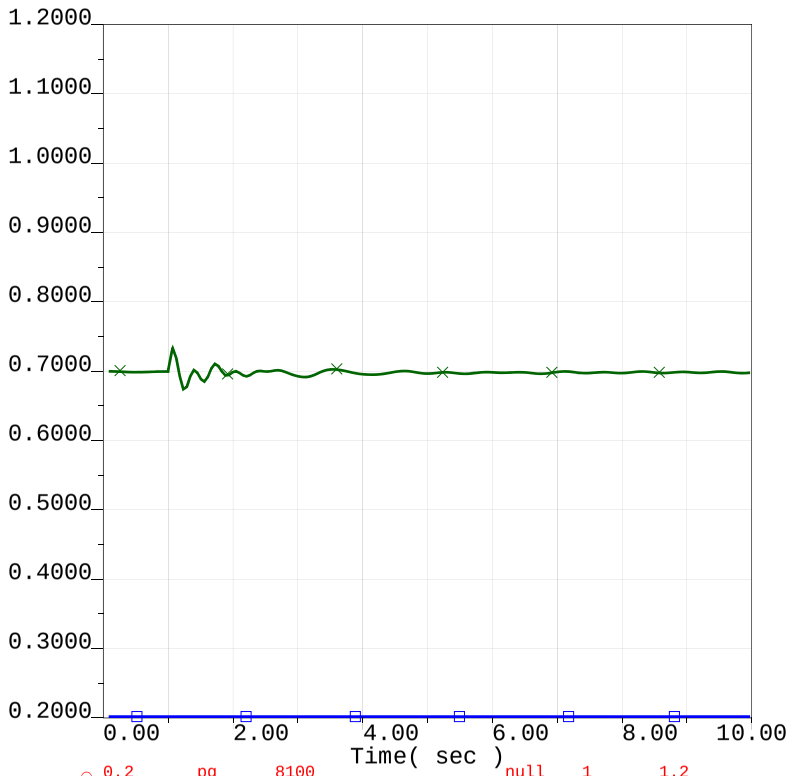
IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-BLYTHE 161kV
Case EC3_PRE.SAV

pst_nil-bly_n1 | Fri Oct 28 12:47:10 2005

El Centro Generator Bus 8100



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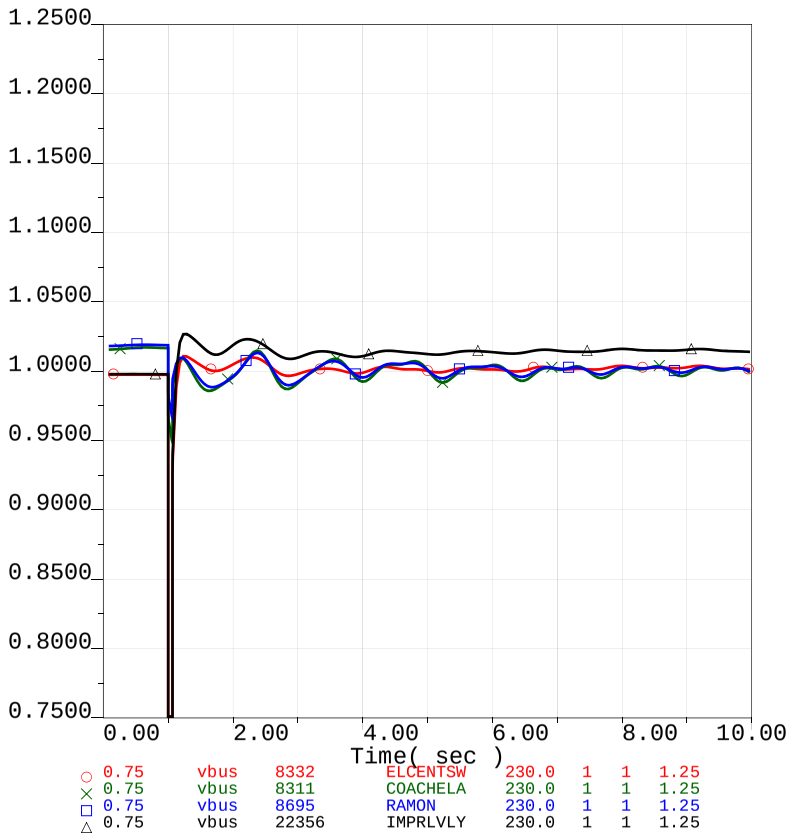
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-BLYTHE 161kV
Case EC3_PRE.SAV

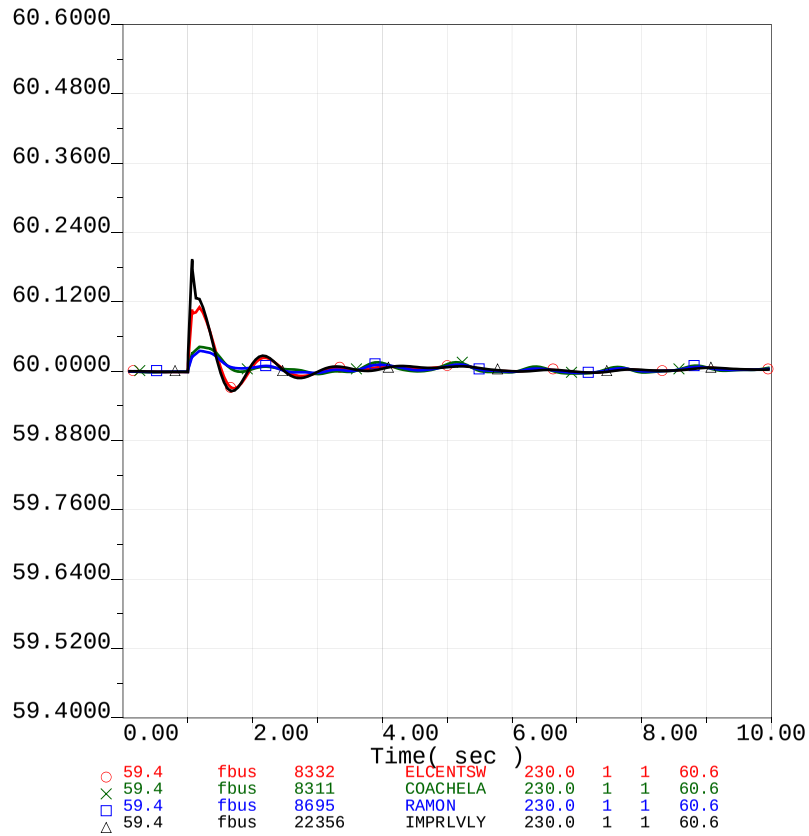
IID 230kV Voltage plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip IV-MIGUEL 500kV line
Case EC3_pst.SAV

pst_iv_miguel | Fri Oct 28 12:44:33 2005

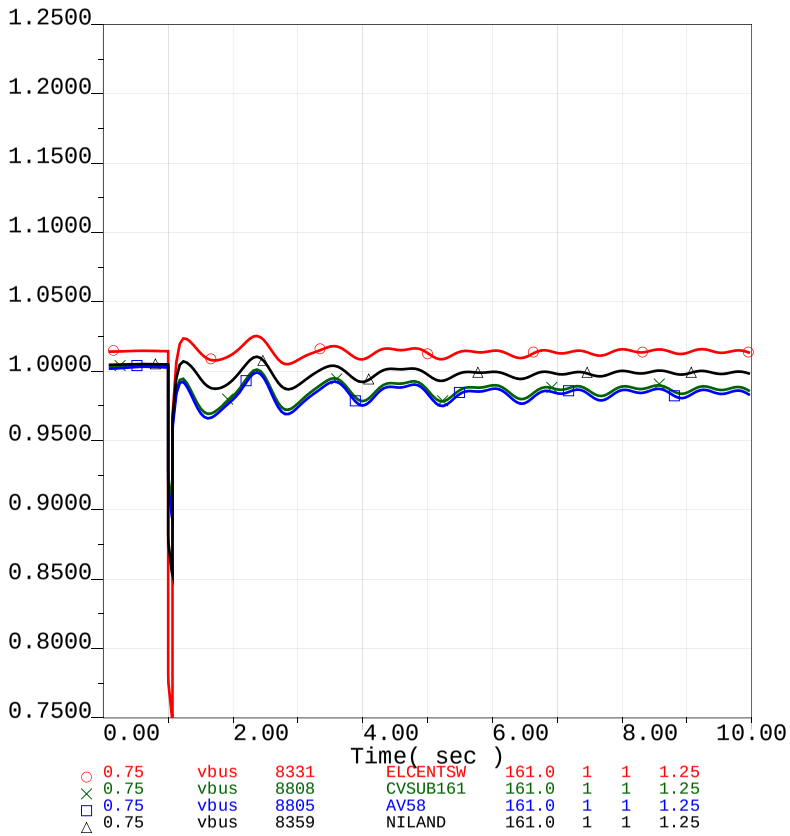
IID 230kV Frequency plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip IV-MIGUEL 500kV line
Case EC3_pst.SAV

pst_iv_miguel | Fri Oct 28 12:44:33 2005

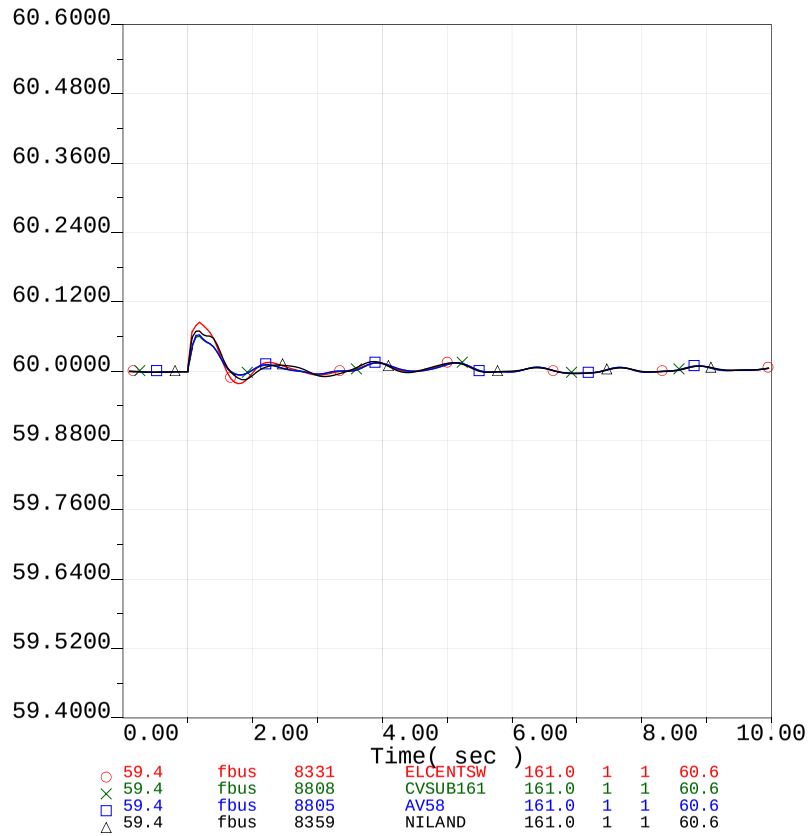
IID 161kV Voltage plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip IV-MIGUEL 500kV line
Case EC3_pst.SAV

pst_iv_miguel | Fri Oct 28 12:44:34 2005

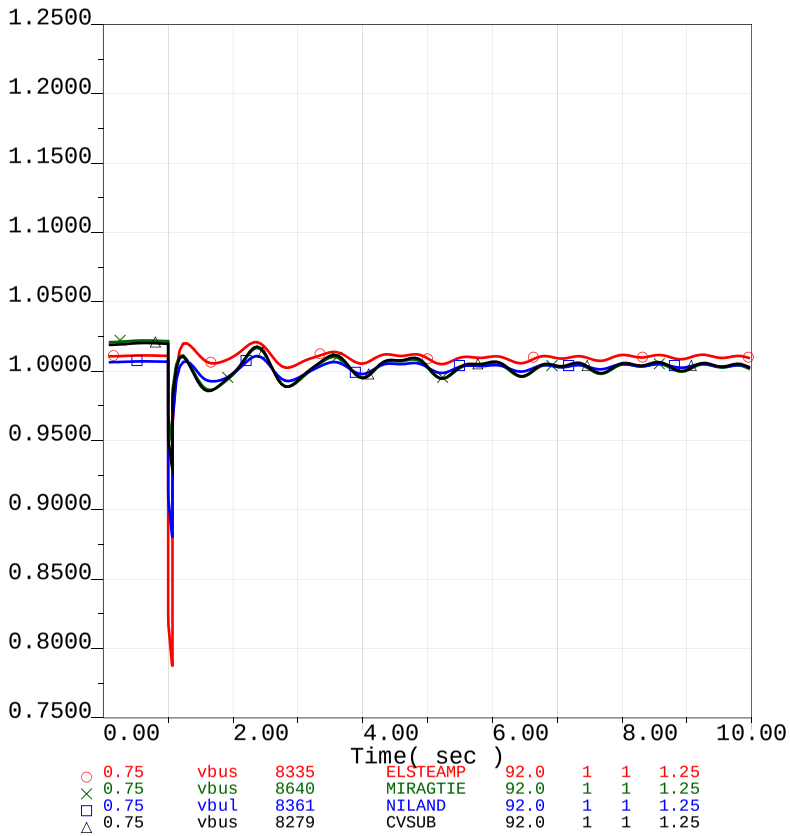
IID 161kV Frequncy plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip IV-MIGUEL 500kV line
Case EC3_pst.SAV

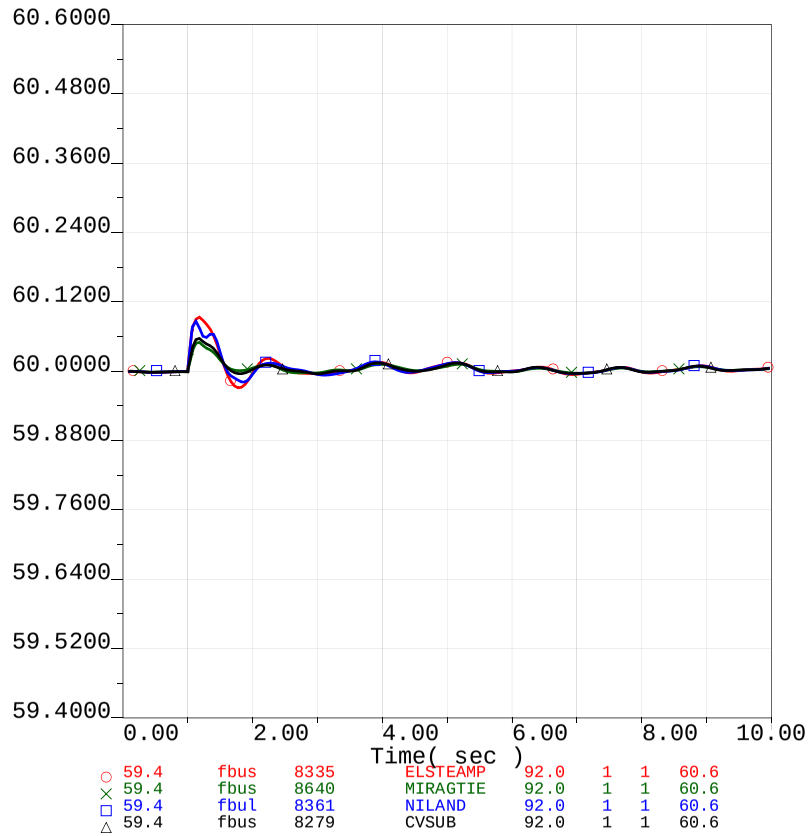
pst_iv_miguel | Fri Oct 28 12:44:35 2005

IID 92kV Voltage plots EC, MIR, NIL, CV



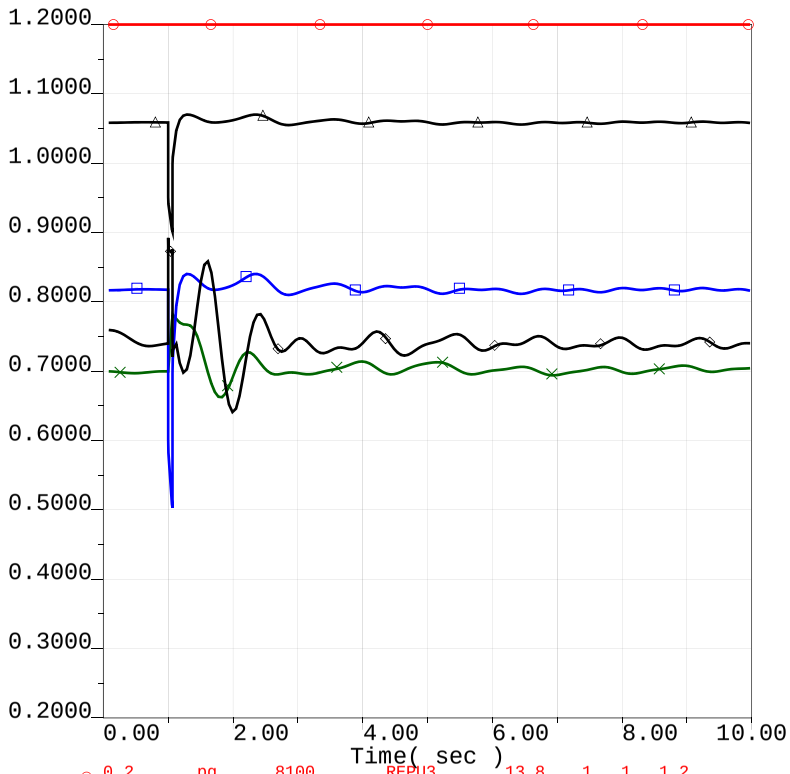
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip IV-MIGUEL 500kV line
Case EC3_pst.SAV

IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip IV-MIGUEL 500kV line
Case EC3_pst.SAV

El Centro Generator Bus 8100



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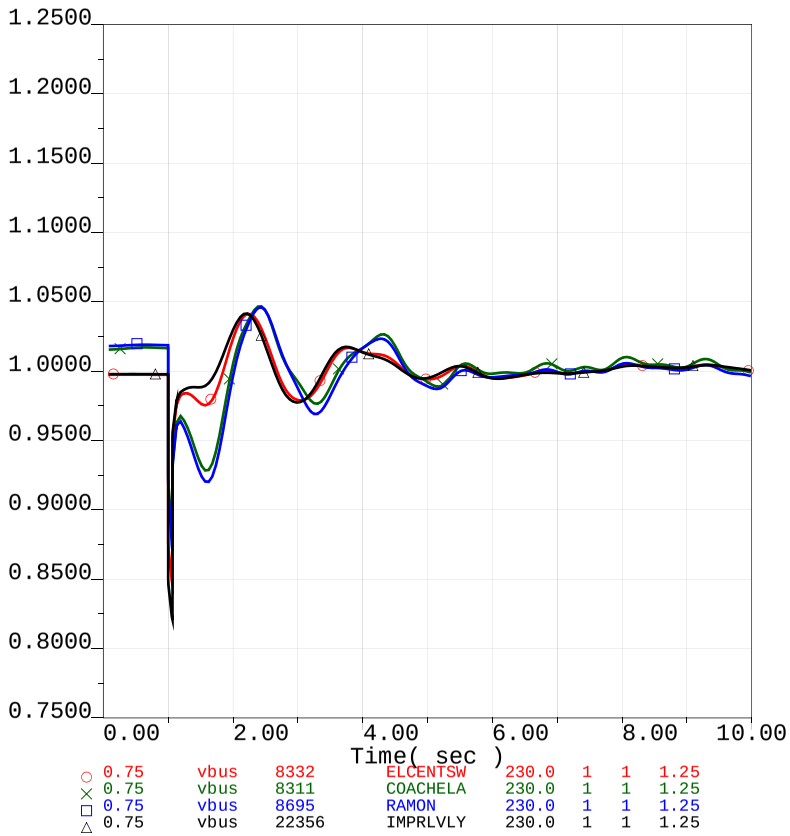
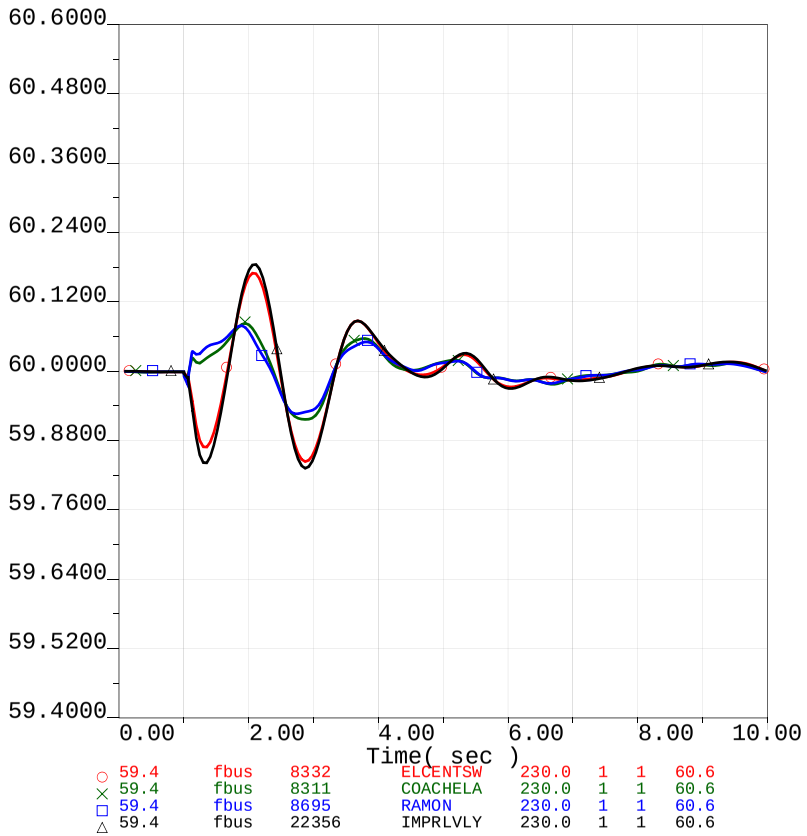
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip IV-MIGUEL 500kV line
Case EC3_pst.SAV

IID 230kV Voltage plots EC, CV, RMN, IV



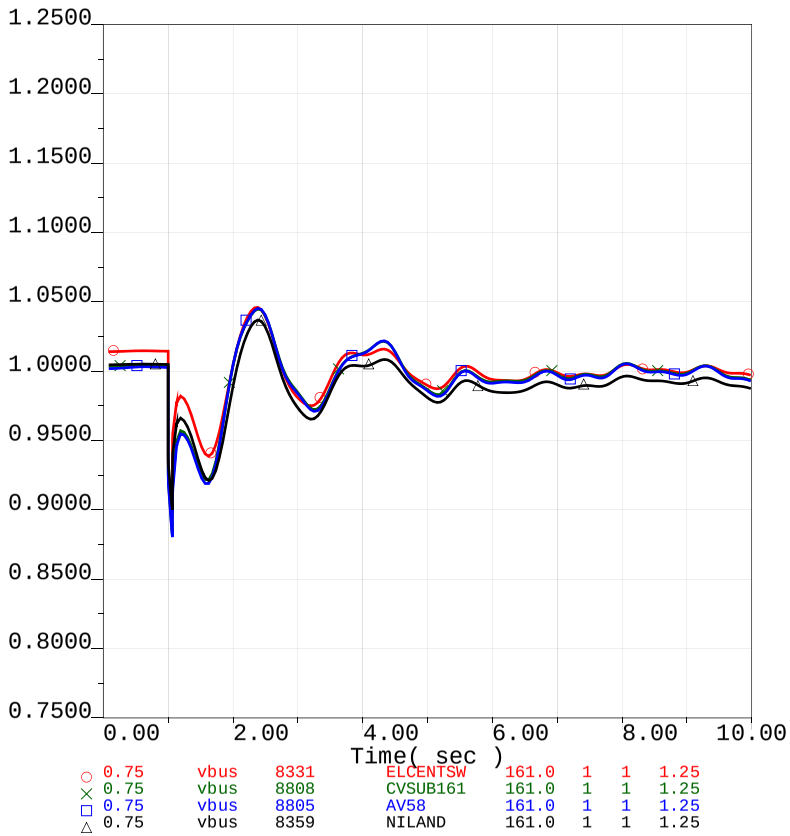
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Hassyampa-North Gila 500kV line
Case EC3_pst.SAV

IID 230kV Frequency plots EC, CV, RMN, IV



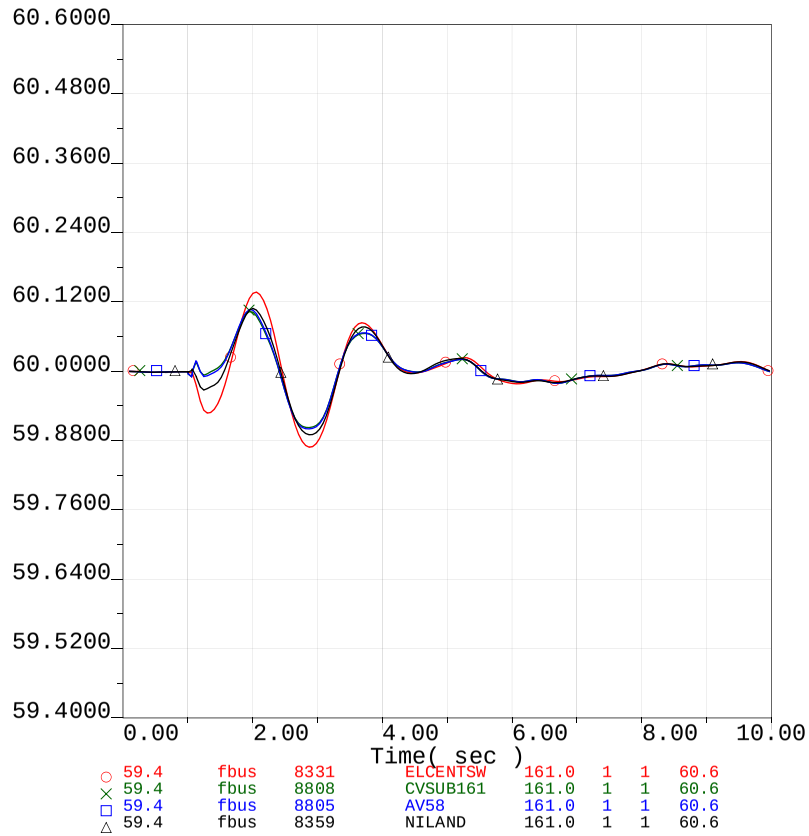
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Hassyampa-North Gila 500kV line
Case EC3_pst.SAV

IID 161kV Voltage plots EC, CV, AV58, NIL



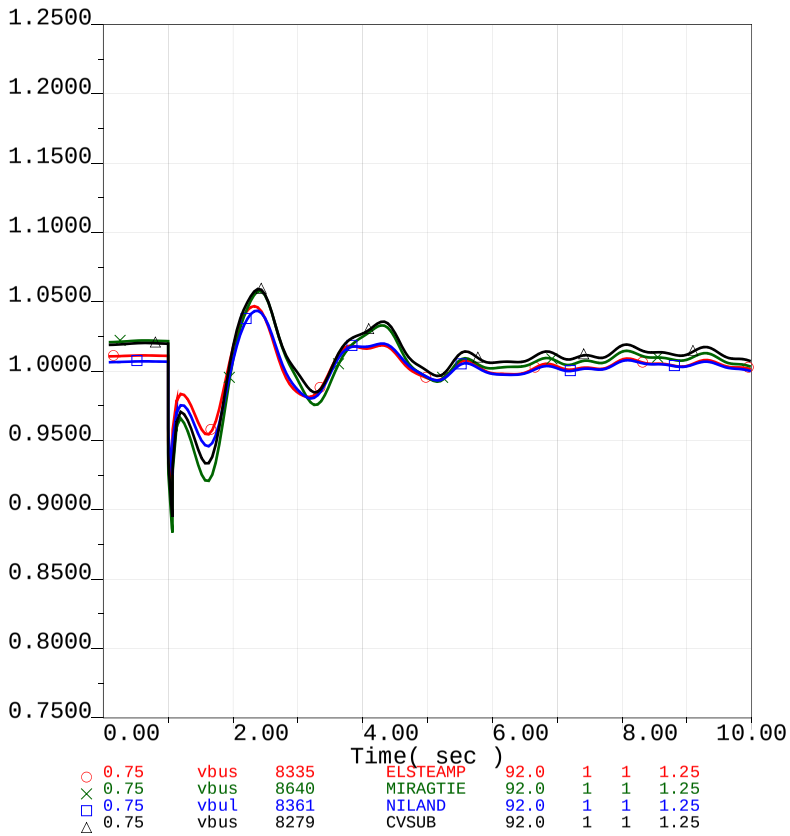
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Hassyampa-North Gila 500kV line
Case EC3_pst.SAV

IID 161kV Frequncy plots EC, CV, AV58, NIL



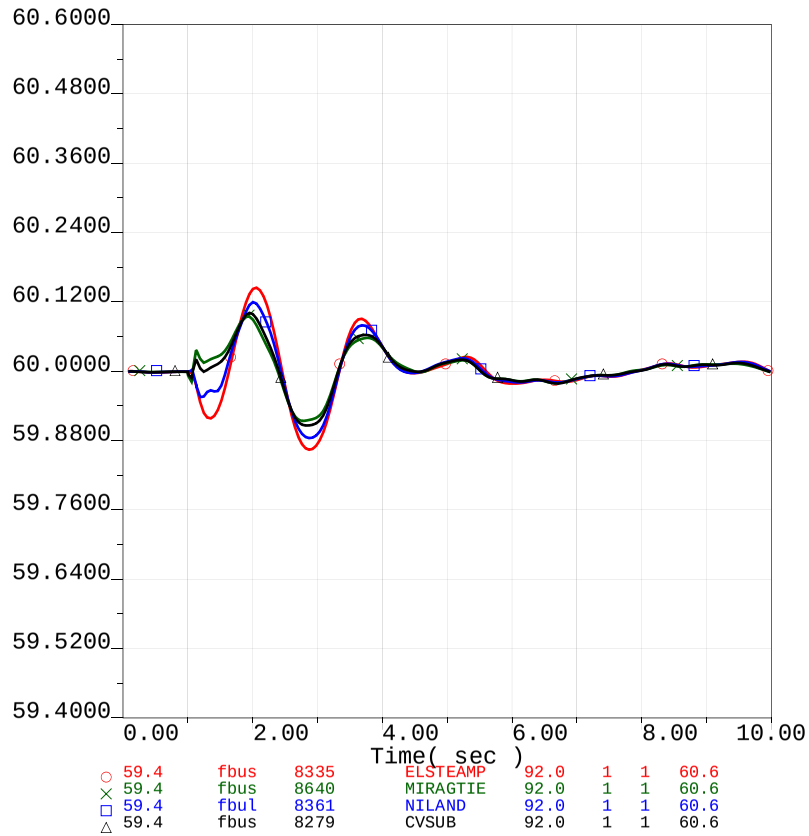
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Hassyampa-North Gila 500kV line
Case EC3_pst.SAV

IID 92kV Voltage plots EC, MIR, NIL, CV



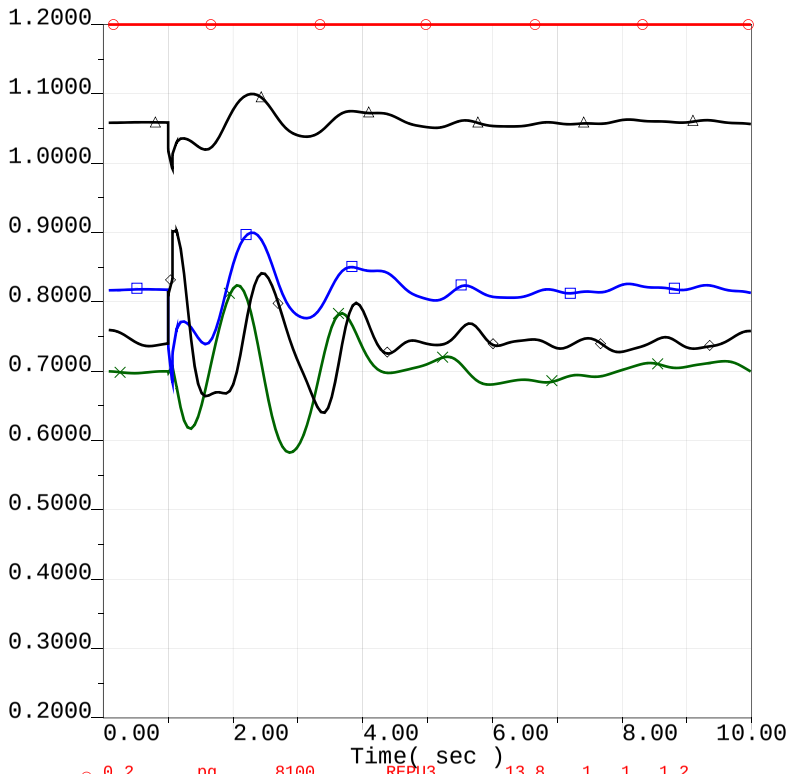
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Hassyampa-North Gila 500kV line
Case EC3_pst.SAV

IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Hassyampa-North Gila 500kV line
Case EC3_pst.SAV

El Centro Generator Bus 8100



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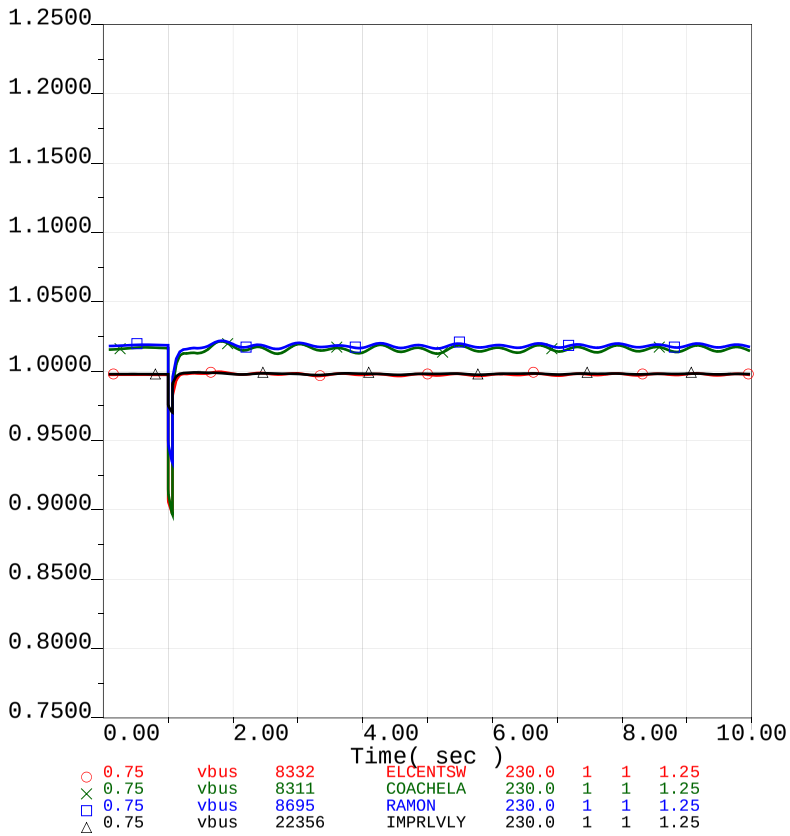
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip Hassyampa-North Gila 500kV line
Case EC3_pst.SAV

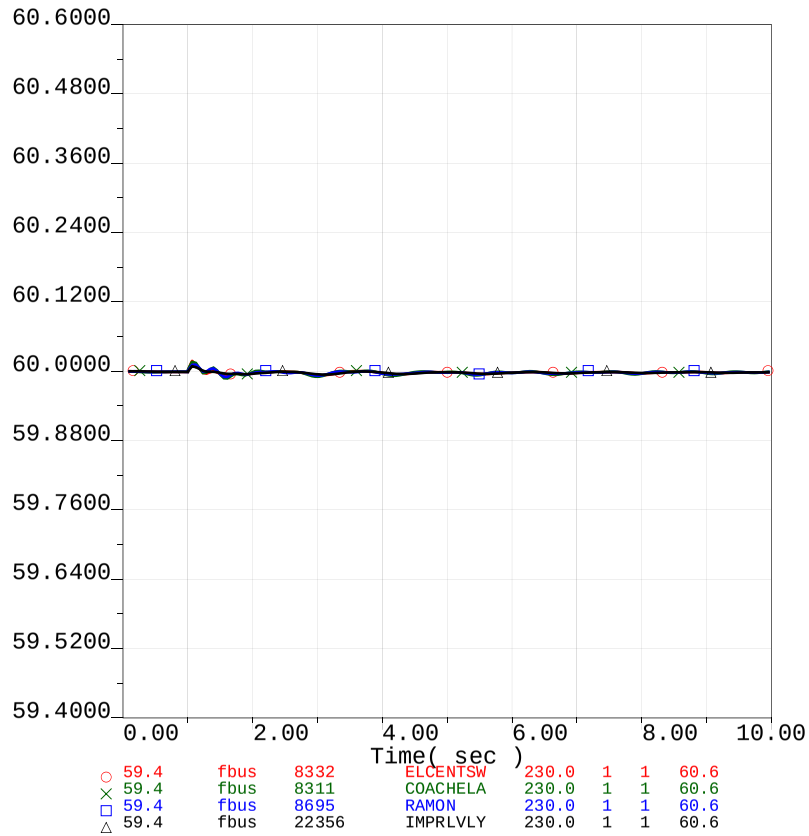
IID 230kV Voltage plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-ELCENTSW 161kV
Case EC3_pst.SAV

pst_ec-nil_n1 | Fri Oct 28 12:37:30 2005

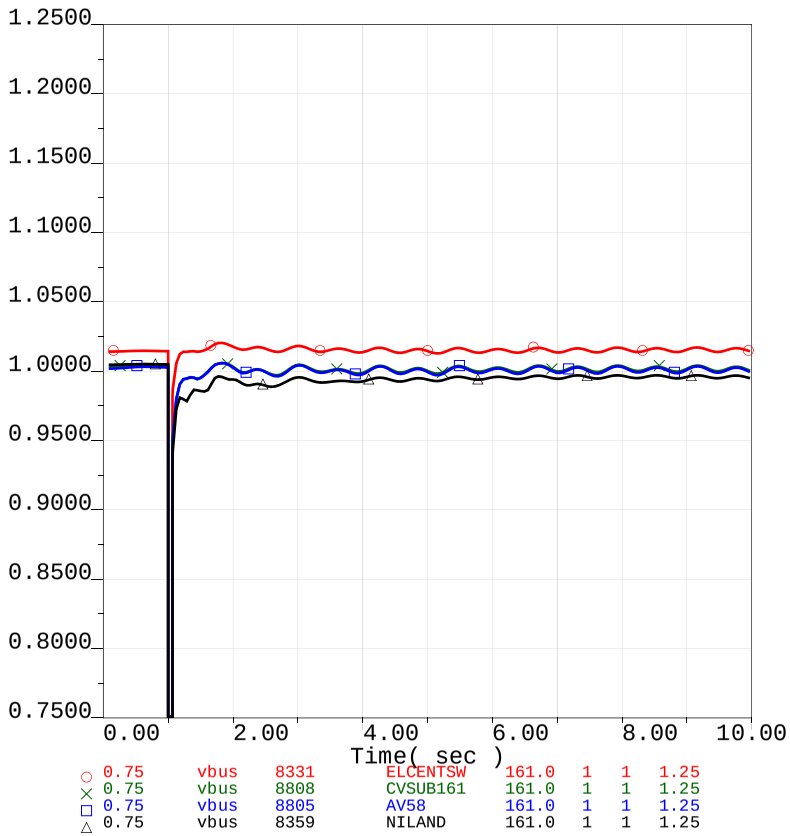
IID 230kV Frequency plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-ELCENTSW 161kV
Case EC3_pst.SAV

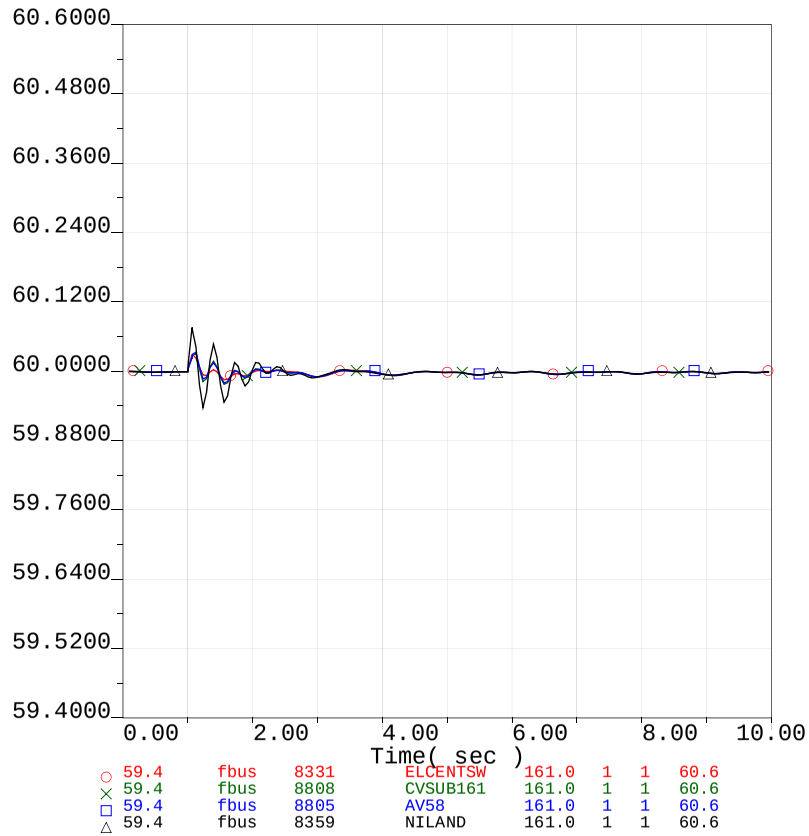
pst_ec-nil_n1 | Fri Oct 28 12:37:31 2005

IID 161kV Voltage plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-ELCENTSW 161kV
Case EC3_pst.SAV

IID 161kV Frequncy plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
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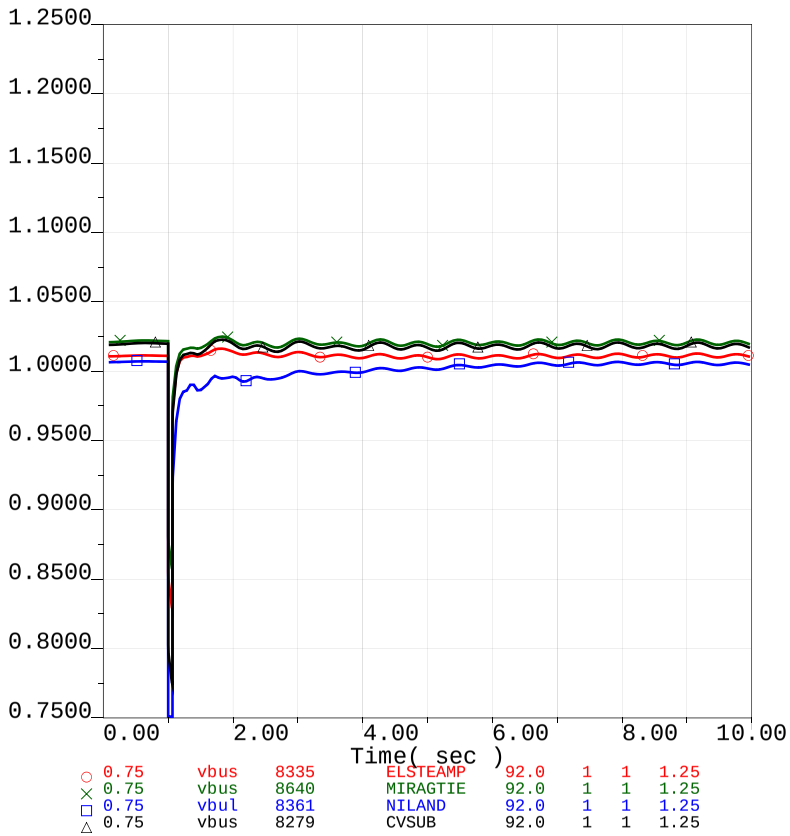
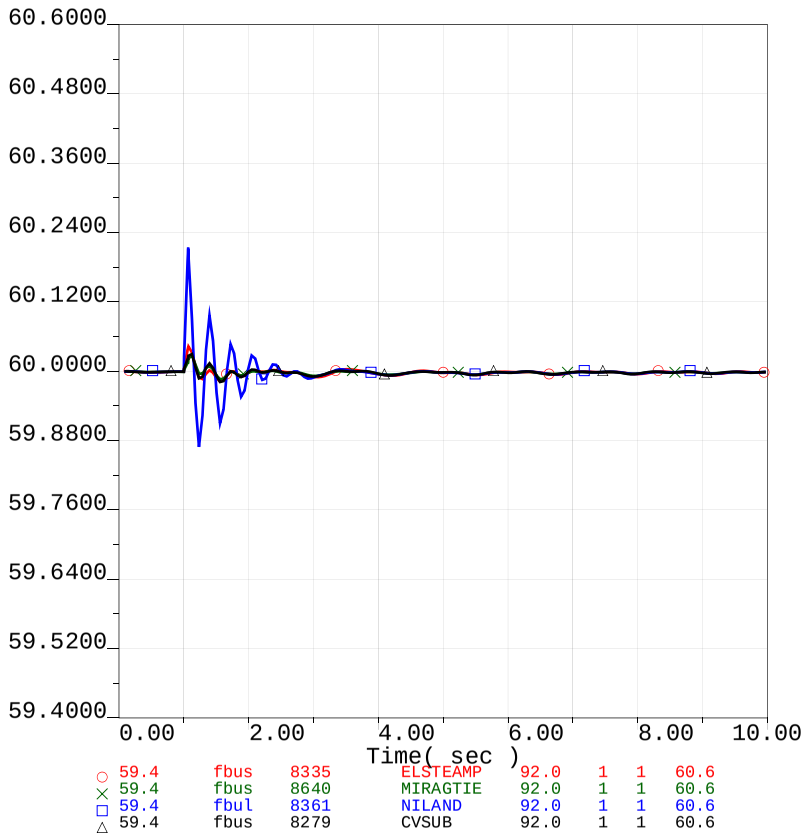
Case EC3_pst.SAV

IID 92kV Voltage plots EC, MIR, NIL, CV



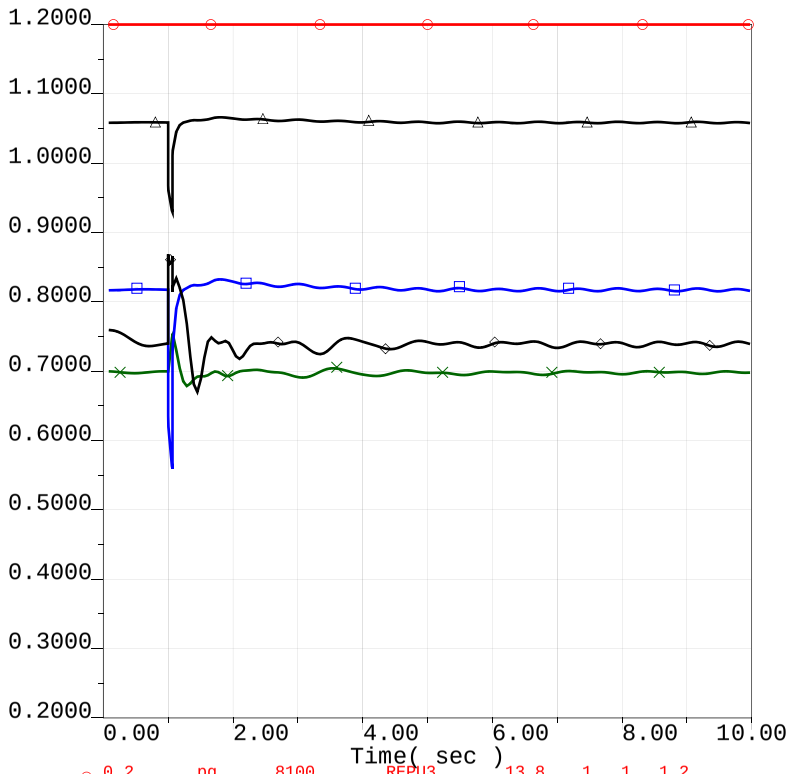
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-ELCENTSW 161kV
Case EC3_pst.SAV

IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-ELCENTSW 161kV
Case EC3_pst.SAV

El Centro Generator Bus 8100



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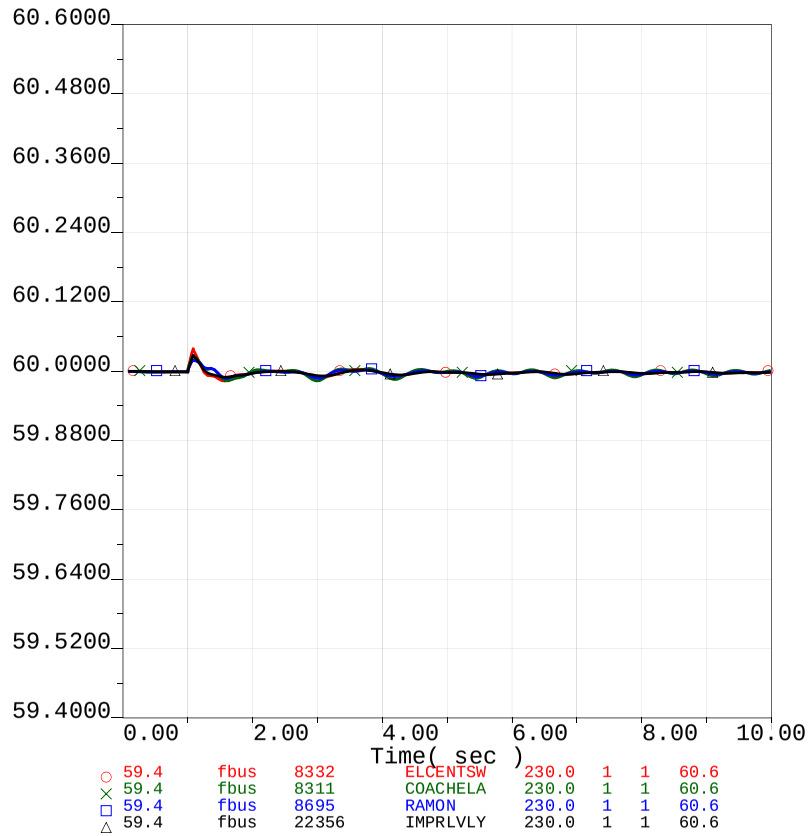
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip NILAND-ELCENTSW 161kV
Case EC3_pst.SAV

IID 230kV Voltage plots EC, CV, RMN, IV

SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip EC-AVE58 161kV
Case EC3_PST.SAV

pst_ec_ave58 | Fri Oct 28 12:32:11 2005

IID 230kV Frequency plots EC, CV, RMN, IV



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Trip EC-AVE58 161kV
Case EC3_PST.SAV

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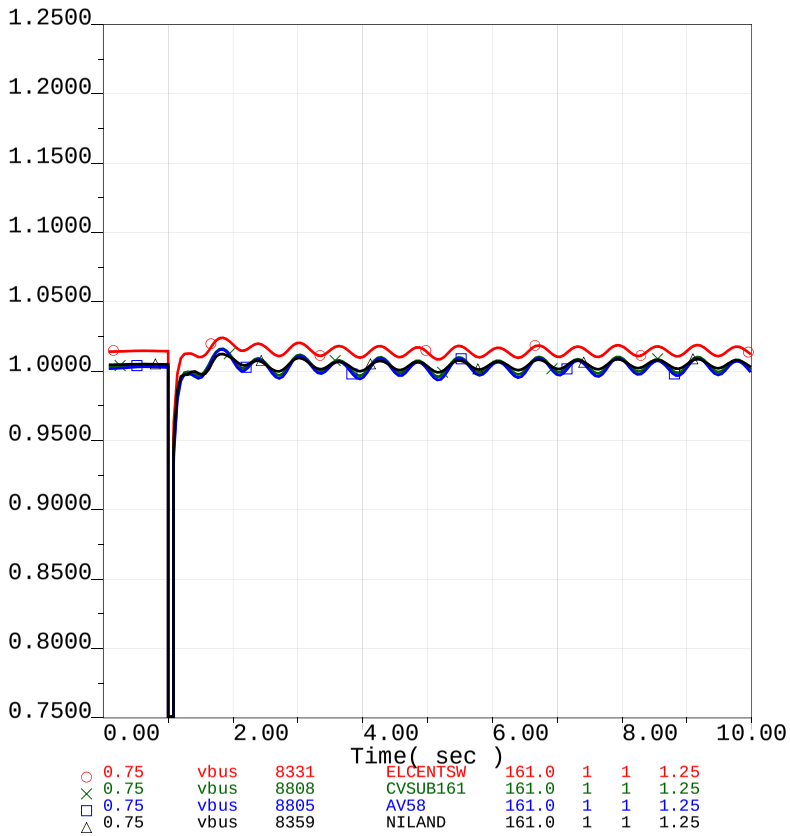
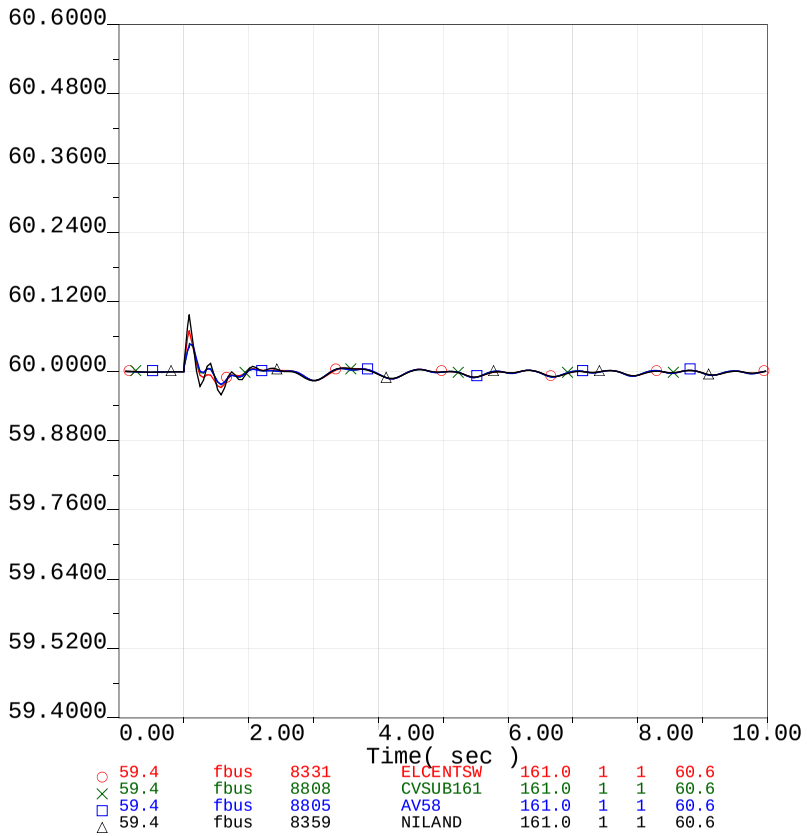
IID 161kV Voltage plots EC, CV, AV58, NIL



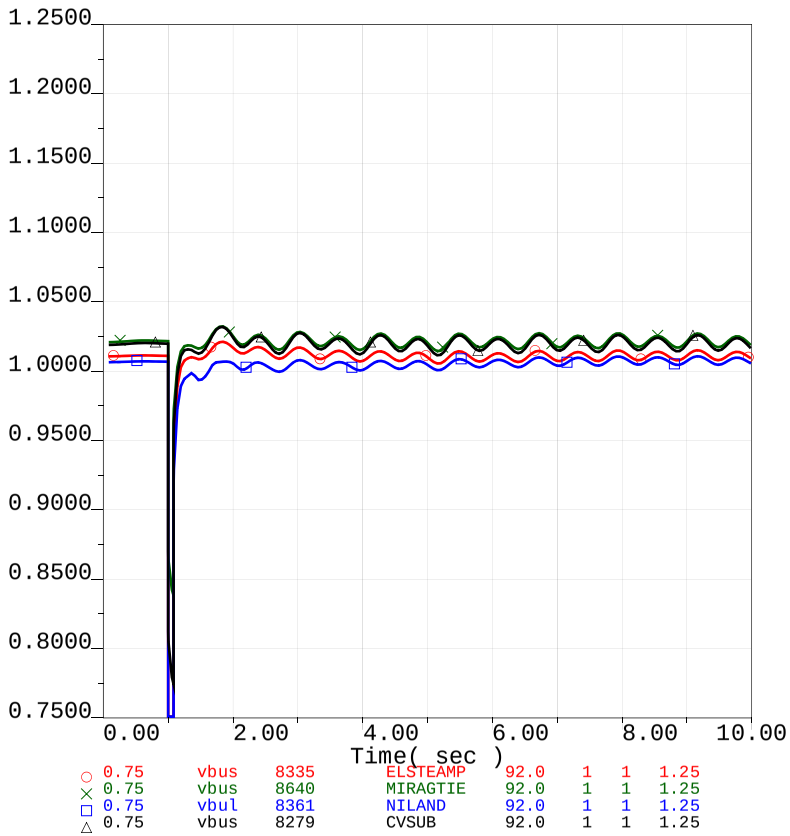
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip EC-AVE58 161kV
Case EC3_PST.SAV

IID 161kV Frequncy plots EC, CV, AV58, NIL



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip EC-AVE58 161kV
Case EC3_PST.SAV

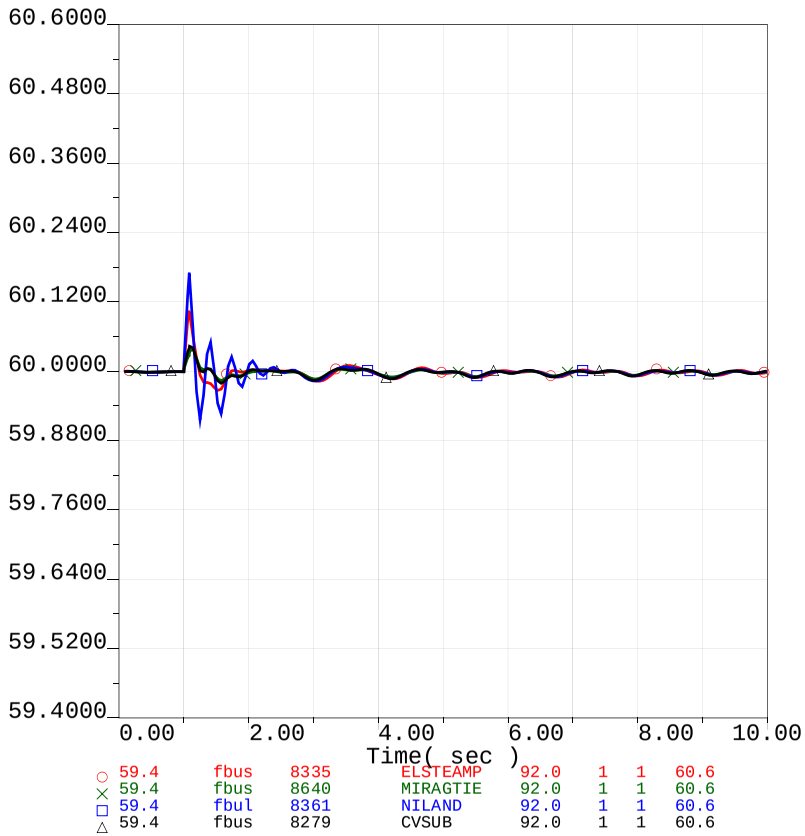
IID 92kV Voltage plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip EC-AVE58 161kV
Case EC3_PST.SAV

pst_ec_ave58 | Fri Oct 28 12:32:14 2005

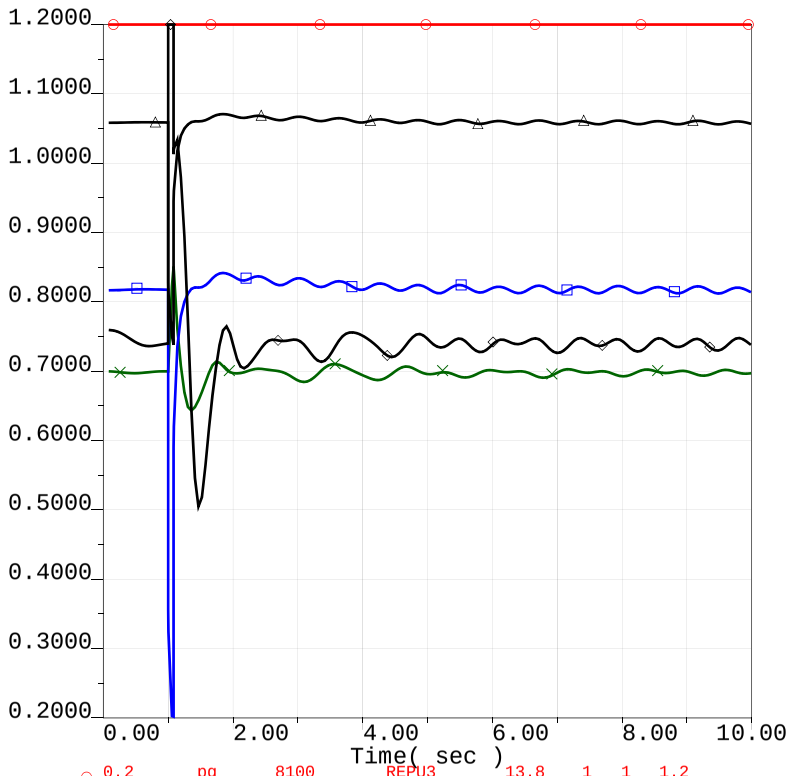
IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip EC-AVE58 161kV
Case EC3_PST.SAV

pst_ec_ave58 | Fri Oct 28 12:32:15 2005

El Centro Generator Bus 8100



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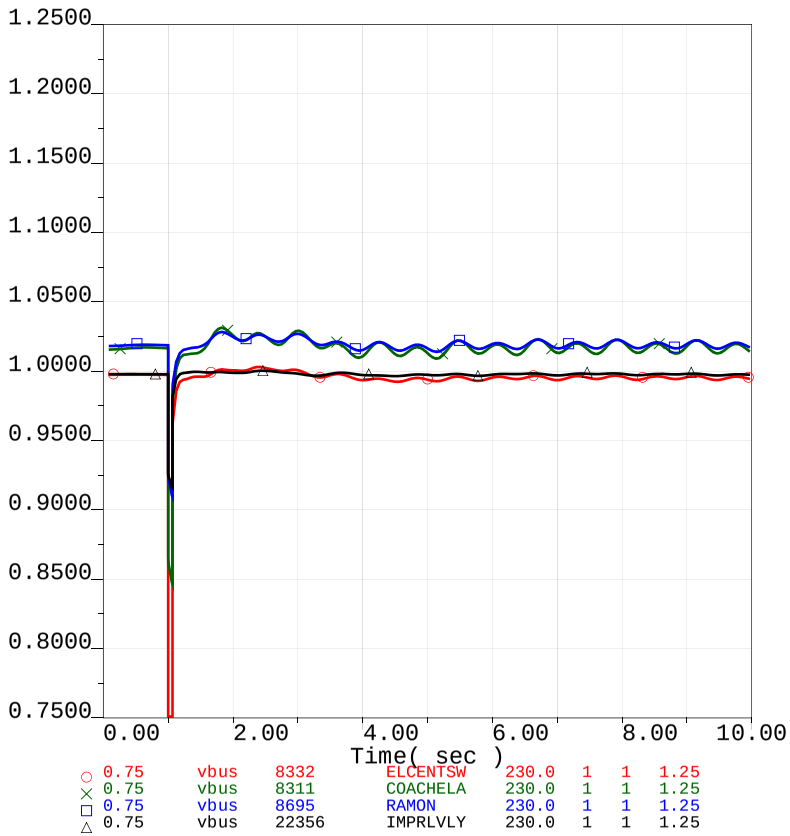
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip EC-AVE58 161kV
Case EC3_PST.SAV

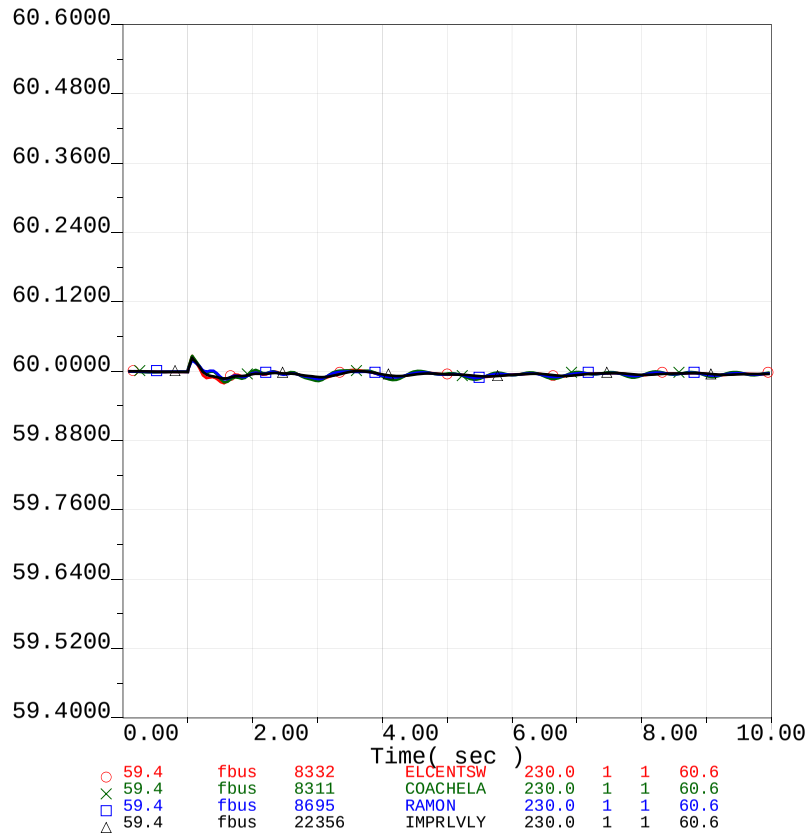
IID 230kV Voltage plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip El Centro Repower #3 step-up transformer
Case EC3_PST.SAV

pst_ec3genxfmr | Fri Oct 28 12:36:10 2005

IID 230kV Frequency plots EC, CV, RMN, IV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip El Centro Repower #3 step-up transformer
Case EC3_PST.SAV

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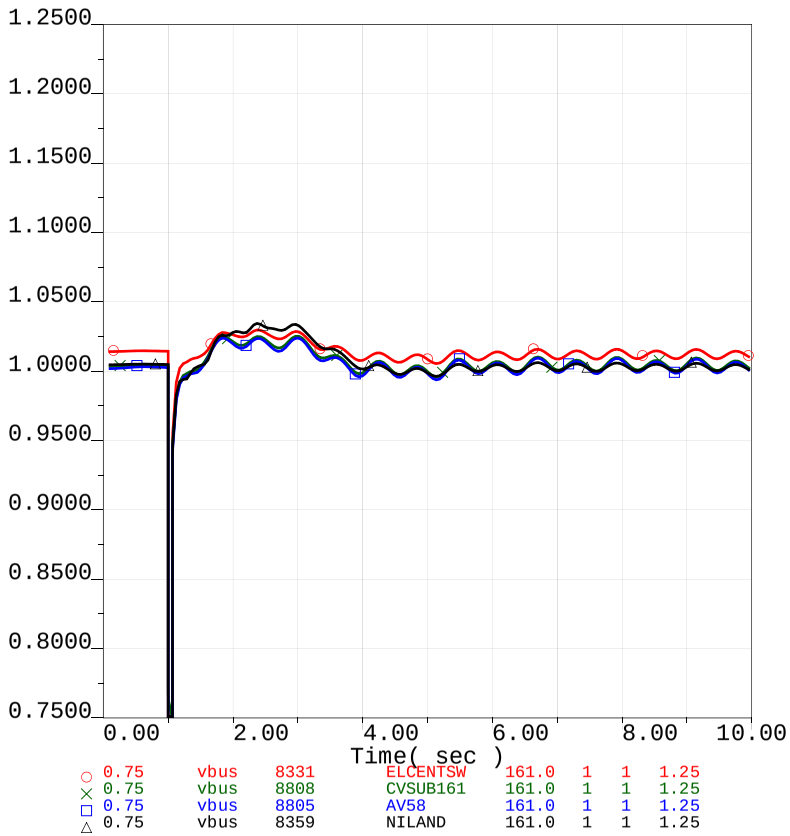
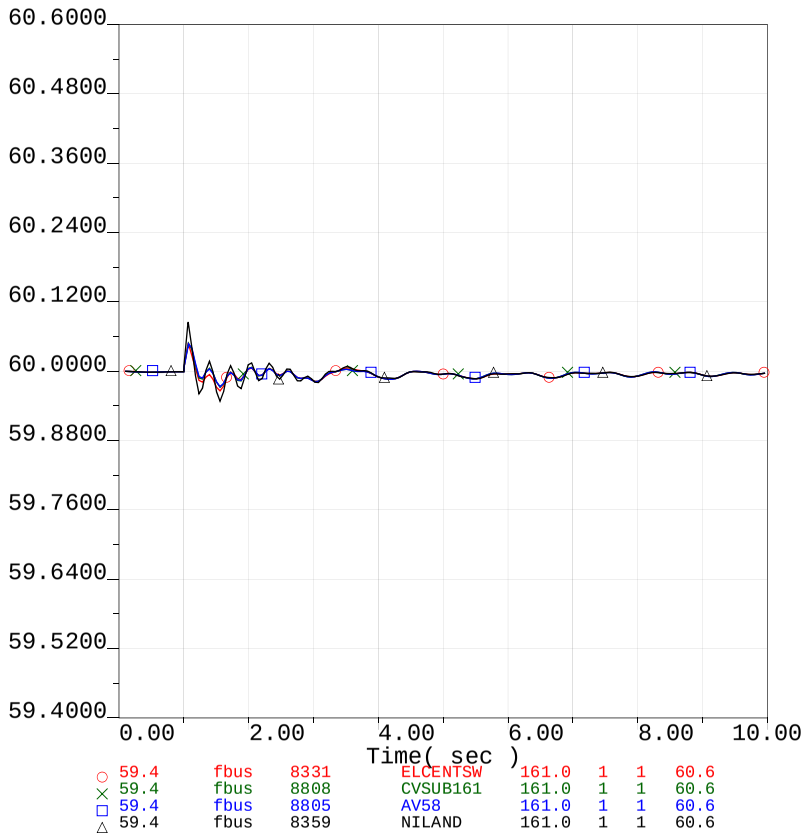
IID 161kV Voltage plots EC, CV, AV58, NIL



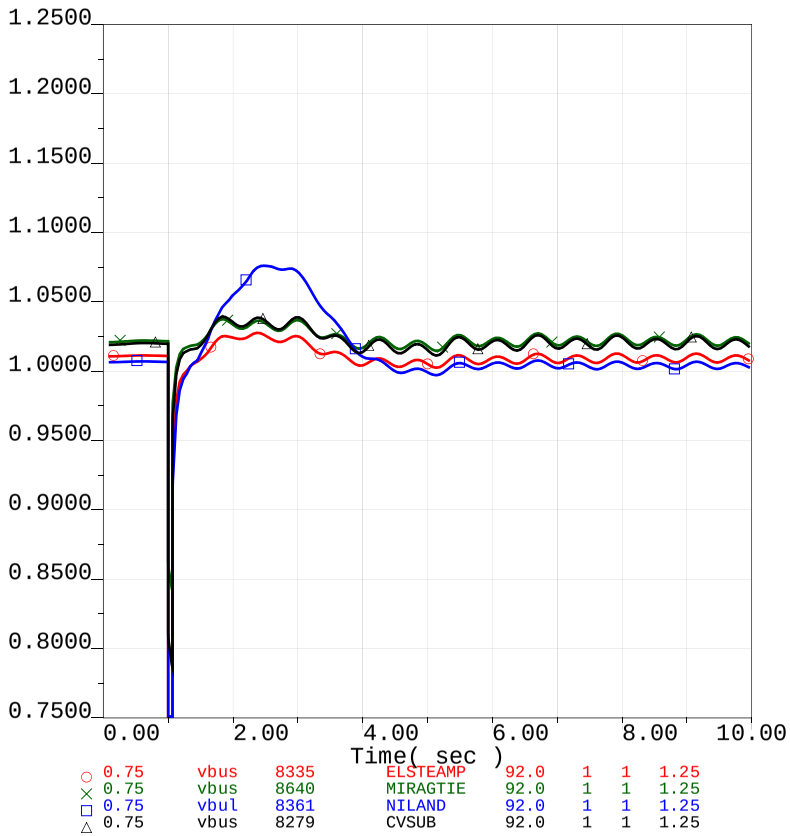
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip El Centro Repower #3 step-up transformer
Case EC3_PST.SAV

IID 161kV Frequncy plots EC, CV, AV58, NIL



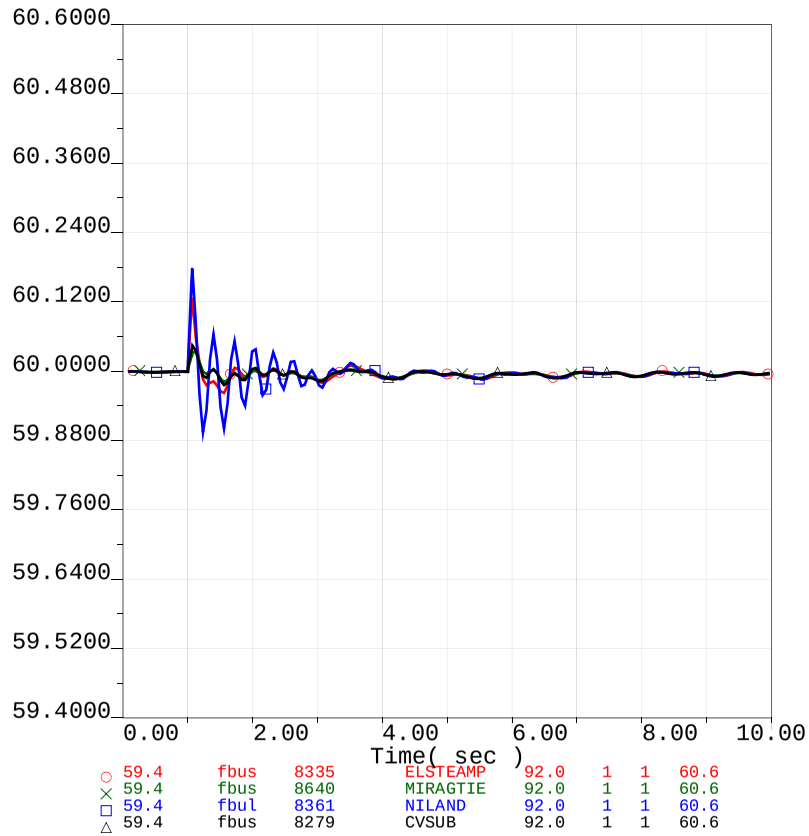
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip El Centro Repower #3 step-up transformer
Case EC3_PST.SAV

IID 92kV Voltage plots EC, MIR, NIL, CV



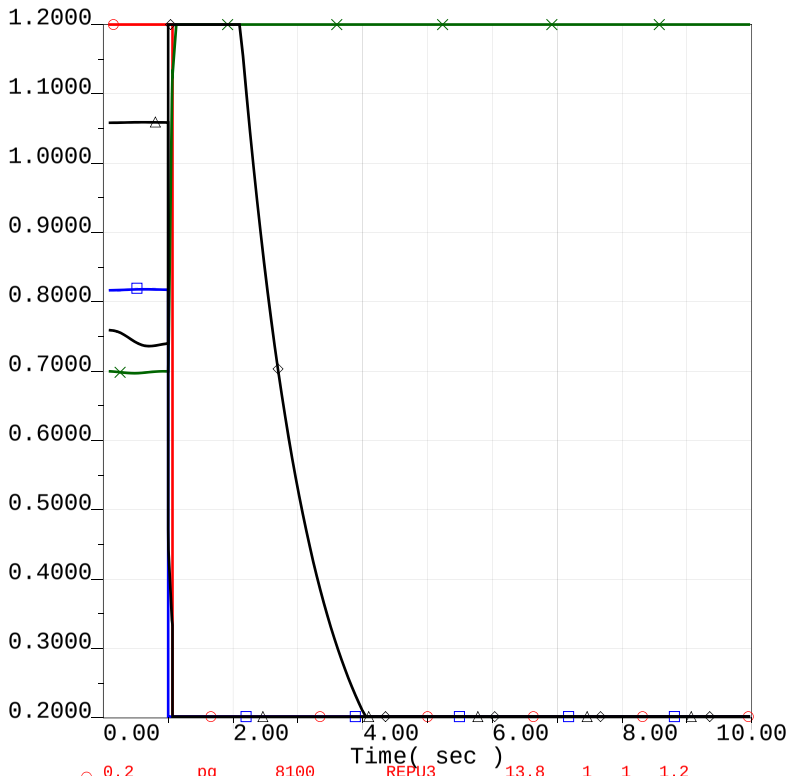
SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip El Centro Repower #3 step-up transformer
Case EC3_PST.SAV

IID 92kV Frequncy plots EC, MIR, NIL, CV



SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip El Centro Repower #3 step-up transformer
Case EC3_PST.SAV

El Centro Generator Bus 8100



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SIS EL CENTRO #3 REPOWER STUDY
2009 Heavy Summer Case
Trip El Centro Repower #3 step-up transformer
Case EC3_PST.SAV

EC3 System Impact Study

Appendix H
Short Circuit Analysis

February 2006

Executive Summary

This report outlines the results of a short circuit study and breaker capability analysis that was performed to evaluate the impact of the addition of an 85 MW generator to the 92 kV El Centro Switching Station. The results of the study indicate that with the GSU impedance modeled at 12.18% on 100 MVA base, no interrupting violations were found in going from pre-project to post-project conditions. Also, no impacts on neighboring utility systems are anticipated due to the minimal impact on the short circuit levels at the interconnection busses.

1.0 Introduction

This report outlines the results of a short circuit study and breaker capability analysis that was performed to evaluate the impact of the addition of a 85 MW generator to the existing 92 kV El Centro Switching Station bus in 2009. The generation will be interconnected to the IID Energy electrical grid via a 100 MVA generator step-up transformer (GSU).

The specific focus of this study is to evaluate the impact of the generator addition on system short circuit levels and to determine if the increase in short circuit levels, related to the generation addition, exceeds the interrupting rating of any short circuit interrupting devices (i.e. Circuit breakers, circuit switchers, etc.).

In addition to examining the impact of the addition of the generation on the IID Energy electrical grid, a study was also performed to determine the impact on the short circuit current levels at the interconnection points with the electrical grids of neighboring utilities.

2.0 Study Description

The study was conducted by modeling the addition of the generation at El Centro Switching Station to the IID Energy 2009 Base Case Short Circuit Models. All short circuit analysis was performed using ASPEN, Inc. OneLiner short circuit analysis software. To conduct the study, the following assumptions were used.

- To compare the interrupting ratings of the short circuit interrupting devices to the short circuit levels, symmetrical current values were used from the short circuit case for X/R ratios below seventeen (17).
- The “All-in” bus fault duties were utilized for the initial evaluation of short circuit levels vs. interrupting ratings. In the event that interrupting rating violations were found, individual breaker contributions were evaluated to determine if actual interrupting rating violations were present.

3.0 Study Results

The tabular results of the study have been provided in two attachments at the end of this report for the cases modeled. In reviewing the tabular results it should be noted that short circuit levels above 90% of the interrupting ratings are marked in yellow. Levels above 100% of rating are marked in red. The results of the study are the following:

- The net change in short circuit levels on the 92 kV ECSS bus is approximately 8.5%. The short circuit duty contribution from the proposed Unit #3 is 2,334 A for three phase faults and 3,692 A for phase to ground faults.
- With the Unit #3 GSU impedance modeled at 0.1218 pu on a 100 MVA base, no interrupting rating violations were found for IID Energy equipment in going from pre-project to post-project conditions. The short circuit current exposure of the 92 kV circuit switchers (H40 & H50) installed at Euclid Substation was found to go from 92% to 97% in going from pre-project to post-project conditions. However, IID Energy is not requiring the replacement of these circuit switchers at this time.
- 92 kV circuit breakers with a 63 kA interrupting rating should be used for the ECGS Unit #3 interconnection. The maximum breaker exposure for the 92 kV Unit #3 GSU circuit breakers will be 34.1 kA in the 2009 case. Future system expansion plans will result in a further increase of the short circuit duty, likely taking these circuit breakers over a 40 kA interrupting rating. To avoid the need for future replacement of these circuit breakers, an interrupting rating of 63 kA should be selected.

- The impact on the short circuit levels at interconnection busses was found to be minimal as documented in the table below:

	2009 Base		2009 with ECSG #3 Generation			
Bus	**3 Phase (A)**	**L-G (A)**	**3 Phase (A)**	**L-G (A)**	**3 Phase Change (%)**	**L-G Change (%)**
Imperial Valley 230 kV	35,007	33,493	35,027	33,508	0.06%	0.04%
Devers 230 kV	49,065	47,441	49,094	47,460	0.06%	0.04%
Mirage 230 kV	27,795	19,666	27,824	19,676	0.10%	0.05%
Knob 161 kV	10,281	9,217	10,293	9,224	0.12%	0.08%
Blythe 161 kV	29,518	28,701	29,520	28,702	0%	0%
Yucca 69 kV	22,683	24,918	22,687	24,921	0.02%	0.01%

Note: ECSG #3 GSU Impedance Modeled at 12.18% pu on 100 MVA base

As can be seen in the table above, the impact of the addition of the generation at El Centro Switching Station on the short circuit levels at the interconnection busses is very minimal and no criteria violations are anticipated on neighboring utility systems.

4.0 Conclusion

This study has examined the impact of the addition of an 85 MW generator to the 92 kV bus at El Centro Switching Station on short circuit levels and circuit breaker and circuit switcher interrupting ratings. Modeling the #3 GSU impedance to match the existing Unit #2-2 GSU (12.18% on 100 MVA) resulted short circuit levels below 95% of the circuit breaker ratings. Therefore, to avoid the need for circuit breaker replacement, it is recommended that the #3 GSU impedance be specified to be 12.18% on 100 MVA. With the GSU impedance modeled at this value, no interrupting violations were found in going from pre-project to post-project conditions. No impacts on neighboring utility systems are anticipated due to the minimal impact on the short circuit levels at the interconnection busses.

Attachment I

ECSS Unit #3 Generation Project - System Impact Study
Circuit Breaker Capability Study Summary
ECGS #3 GSU Impedance = 12.18% on 100 MVA

					2009 Case without ECSS Unit #3 Gen (Pre-Project)		2009 Case with ECSS Unit #3 Gen (Post Project)	
Bus Name	**IID Substation Name**	**kV**	**Breaker Rating (kA)**	**Note**	**Maximum Fault Symmetrical (A)**	**% of Interrupting Rating**	**Maximum Fault Symmetrical (A)**	**% of Interrupting Rating**
ANZA	ANZA	92	N/A		2,988	N/A	2,995	N/A
ATEN	ATEN	92	40,000		16,322	41%	16,942	42%
AVE-52	AVE. 52	92	N/A		14,770	N/A	14,799	N/A
AVE.42 N.BUS	AVE. 42	92	40,000		13,881	35%	13,907	35%
AVE48	AVE. 48	92	40,000		11,559	29%	11,579	29%
AVE58-161KV	AVE. 58	161	40,000		6,212	16%	6,243	16%
AVE58-92	AVE. 58	92	40,000		14,171	35%	14,201	36%
BEEF PLANT	BEEF PLANT	92	40,000		7,817	20%	7,876	20%
BRAVO 92 KV.	BRAVO	92	40,000		14,012	35%	14,320	36%
BRAWLEY	BRAWLEY	92	40,000		12,263	31%	12,443	31%
CALEXICO	CALEXICO	92	40,000		11,786	29%	12,029	30%
CALIPAT92	CALIPATRIA	92	40,000		9,543	24%	9,603	24%
CARREON	CARREON	92	40,000		10,899	27%	10,914	27%
CENTRAL	CENTRAL	92	40,000		12,523	31%	12,901	32%
CLARK	CLARK	92	40,000		15,832	40%	16,457	41%
CLPT-PRISON	CALIPATRIA PRISON	92	40,000		10,185	25%	10,235	26%
			40,000			45%		45%
COACHELA	COACHELLA SW STA	92	22,000	GTO CB	18,079	82%	18,108	82%
COLMAC92	COLMAC	92	40,000		8,889	22%	8,896	22%
CV-161	COACHELLA VALLEY	161	40,000		7,197	18%	7,214	18%
CV-230	COACHELLA VALLEY	230	40,000		16,578	41%	16,667	42%
CV-92	COACHELLA VALLEY	92	40,000		21,866	55%	21,907	55%
DAHLIA	DAHLIA	92	40,000		16,382	41%	17,050	43%
DESERT SHORE	DESERT SHORES	92	40,000		4,027	10%	4,034	10%
DIXIE-PRISON	DIXIELAND PRISON	92	40,000		7,212	18%	7,323	18%
DIXIELAND	DIXIELAND	92	40,000		7,630	19%	7,752	19%
DROP4	DROP 4	92	40,000		13,108	33%	13,274	33%
E.MESA	EAST MESA	92	40,000		8,196	20%	8,281	21%
EARTH-PLANT	(CALENERGY) SALTON SEA 2 - EARTH PLANT	92	20,000		6,154	31%	6,161	31%
EDOM	EDOM	92	40,000		9,835	25%	9,842	25%
ELCENTSW	EL CENTRO SW STA	92	40,000		34,121	85%	37,028	93%
ELCENTSW	EL CENTRO SW STA	161	40,000		9,058	23%	9,240	23%
ELCENTSW	EL CENTRO SW STA	230	40,000		9,923	25%	9,956	25%
ELMORE-92 k	(CALENERGY) ELMORE	92	31,500		7,551	24%	7,562	24%
			40,000			46%		48%
EUCLID	EUCLID	92	20,000	H40 & H50	18,461	92%	19,314	97%
FRANCES WAY-	FRANCES WAY	92	40,000		9,020	23%	9,028	23%
GEM 2 &3	GEM 2 & GEM 3	92	N/A		14,954	N/A	15,125	N/A
E. MESA 3	EAST MESA #3	92	40,000		16,660	42%	16,877	42%
HEBER IMP.	HEBER IMPERIAL	92	40,000		16,752	42%	17,187	43%
HEBERSCE	HGC PLANT (HEBER SCE)	92	N/A		14,821	N/A	15,218	N/A
HIGHLINE230	HIGHLINE	230	40,000		6,891	17%	6,974	17%
HIGHLINE92	HIGHLINE	92	40,000		19,645	49%	19,866	50%
HOCH	(CALENERGY) HOCH PLANT DEL RANCH	92	31,500		6,267	20%	6,274	20%
			40,000			34%		34%
HOLTVILLE	HOLTVILLE	92	16,000	H10	13,463	84%	13,792	86%
JACKSON	JACKSON	92	40,000		9,795	24%	9,808	25%
JEFFERSON92	JEFFERSON	92	40,000		8,992	22%	9,007	23%
LAQUINTA92	LA QUINTA	92	40,000		8,966	22%	8,979	22%
LEATHE-PLANT	(CALENERGY) LEATHERS PLANT	92	31,500		7,911	25%	7,924	25%

MALL	MALL	92	40,000		14,087	35%	14,522	36%
MARSHALL	MARSHALL	92	40,000		8,661	22%	8,670	22%
MIDWAY230	MIDWAY	230	40,000		10,590	26%	10,824	27%
MIDWAY92	MIDWAY	92	40,000		16,798	42%	16,923	42%
MONROE	MONROE	92	40,000		12,158	30%	12,178	30%
N. LA QUINTA	NORTH LA QUINTA	92	40,000		9,757	24%	9,771	24%
NAVY BASE	NAVY BASE	92	40,000		9,609	24%	9,819	25%
NEW BOMBAY		92	7,500		5,546	74%	5,553	74%
NEW IMPERIAL	NEW IMPERIAL	92	40,000		12,671	32%	13,002	33%
NEW MECCA	NEW MECCA	92	40,000		6,100	15%	6,106	15%
NILAND	NILAND	92	40,000		15,188	38%	15,236	38%
			40,000			24%		24%
			16,000	FOB		60%		60%
NILAND	NILAND	161	31,000	H10 & NOB	9,532	31%	9,569	31%
NORTHVIEW	NORTH VIEW	92	40,000		10,320	26%	10,331	26%
ORMESA1-92 1	ORMESA #1	92	N/A		9,419	N/A	9,469	N/A
ORMESA2-92	ORMESA #2	92	N/A		11,817	N/A	11,908	N/A
PANNO	PANNO	92	40,000		10,363	26%	10,512	26%
			40,000			22%		22%
PARKVIEW	PARKVIEW	92	20,000	H10 & H20	8,889	44%	8,970	45%
			40,000			41%		42%
PERRY	PERRY	92	26,000	PWO & PNO	16,459	63%	16,896	65%
PILOTKNOB	PILOT KNOB	92	40,000		6,713	17%	6,718	17%
			40,000			26%		26%
PILOTKNOB	PILOT KNOB	161	16,000	AXO	10,281	64%	10,293	64%
PLASTER-CITY	PLASTER CITY	92	64,000		5,488	9%	5,551	9%
PRUETT	PRUETT	92	40,000		16,155	40%	16,570	41%
RAMON	RAMON	92	40,000		13,510	34%	13,518	34%
RAMON	RAMON	230	40,000		27,244	68%	27,273	68%
ROCKWOOD	ROCKWOOD	92	20,000		12,324	62%	12,509	63%
SANFELIP	SAN FELIPE	92	N/A		2,272	N/A	2,280	N/A
SHADOW HILLS	SHADOW HILLS	92	40,000		11,887	30%	11,906	30%
SKYVALLEY	SKY VALLEY	92	7,500		1,856	25%	1,856	25%
SSIP230	SSIP	230	40,000		7,657	19%	8,006	20%
TERMINAL 92	TERMINAL	92	40,000		25,659	64%	27,333	68%
TRX WESTBIO	WESTERN 1	92	N/A		10,330	N/A	10,478	N/A
TRX-WESTBIO	WESTERN 2	92	N/A		10,311	N/A	10,458	N/A
UNIT NO.4	(CALENERGY) SALTON SEA 4 - UNIT 4	92	40,000		6,297	16%	6,305	16%
			31,500	UNIT 3		18%		18%
UNIT NO.5	(CALENERGY) SALTON SEA - UNITS 3 & 5	92	40,000	UNIT 5	5,687	14%	5,693	14%
VANBUREN	VAN BUREN	92	40,000		12,265	31%	12,285	31%
VULCAN 1	(CALENERGY) VULCAN 1	92	40,000		7,217	18%	7,228	18%

El Centro Switching Station Breaker Duty Analysis **Attachment I**

Case: 2009 with Niland and ECSS Unit #3 (GSU Impedance = 12.18% on 100 MVA

				Breaker Short Circuit Current Exposure					
				All-In		Line Out			
Circuit	**Remote Terminal**	**Circuit Breakers**	**Qty**	**3 Phase**	**L-G**	**3 Phase**	**L-G**	**CB Rating**	**% of Rating**
Bank 2 (161-92)	N/A	X2NO, X2SO	2	28,131	32,415	28,656	32,798	40,000	82.0%
Bank 1 (230-92)	N/A	N/A							
R Line	Central	RNO, RSO	2	32,139	36,590	32,373	36,866	40,000	92.2%
PW Line	Pruett Tap	PWNO, PWSO	2	30,291	34,927	31,674	36,096	40,000	90.2%
LU Line	Clark	LUNO, LUSO	2	32,382	36,828	32,403	36,983	40,000	92.46%
ED Line	Mall	EDNO, EDSO	2	31,270	35,801	32,082	36,522	40,000	91.3%
TE Line	Terminal	TENO, TESO	2	32,210	36,474	32,401	36,981	40,000	92.5%
TW Line	Terminal	TWNO, TWSO	2	32,210	36,474	32,401	36,981	40,000	92.5%
B Line	Drop 4 (E. Mesa)	BNO, BSO	2	31,377	36,084	31,936	36,521	40,000	91.3%
LH Line	Aten	LHNO, LHSO	2	31,447	36,095	32,198	36,748	40,000	91.9%
J Line	Rockwood (Westbio Tap)	JNO, JSO	2	30,271	35,106	31,303	35,844	40,000	89.6%
Bank 3 (92-34.5)	N/A	H3NO, H3SO	2	31,350	36,205	31,649	36,371	40,000	90.9%
E Line	Holtville	ENO, ESO	2	31,208	35,863	32,112	36,640	40,000	91.6%
P Line	HGC/Perry (HeberSCE)	PNO, PSO	2	30,504	35,164	31,763	36,218	40,000	90.5%
EO Line	New Imperial/Brawley	EONO, EOSO	2	31,030	35,662	31,826	36,293	40,000	90.7%
G1-1	N/A	U1-1NO, U1-1SO	2						
G2-1	N/A	U2-1NO, U2-1SO	2	31,331	35,703	31,333	35,734	40,000	89.3%
G2-2	N/A	U2-2NO, U2-2SO	2	30,072	34,024	30,077	34,122	40,000	85.3%
G3-1	N/A	U3-NO, U3-SO	2	30,977	35,227	30,980	35,279	40,000	88.2%
G4-1	N/A	U4-1NO, U4-1SO	2	29,642	33,689	29,649	33,749	40,000	84.4%
			38						