APPENDIX N

Dorsey – Iron Range 500 kV Project

Preliminary Stability Analysis

Draft Report

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Executive Summary

A preliminary stability analyses was conducted for the proposed Dorsey – Iron Range 500 kV project and compared to results obtained for the proposed Dorsey – Bison 500 kV project. The study conclusions are:

1. The Dorsey – Iron Range 500 kV project provides a path for an incremental 1100 MW of MH-US transfers that is not impacted by North Dakota – Manitoba loop flow issues that create overloads of the Riel – Forbes 500 kV line (602 line). In the cases studied, MHEX transfers of 3290 MW simultaneous with NDEX transfers of 2217 MW were achievable without overloading the 602 line. Due to its negative impact on the loop flow issue, the Dorsey – Bison 500 kV project with 1100 MW MH-US transfers overloads 602 line by 106% at the same level of NDEX (2224 MW).
2. The power system dynamic performance and resulting transient voltage performance in response to the King – Eau Claire – Arpin with a King stuck breaker (PCS) disturbance is significantly better with the Dorsey – Iron Range 500 kV project. In the high transfer cases studied, the project demonstrates better Arrowhead, Stone Lake, and Minong transient voltage performance than in the base case at today's transfer levels. The Dorsey – Bison 500 kV project degrades these transient voltages compared to the base case performance.
3. 602 line tripping dynamic simulations demonstrate that the Dorsey – Iron Range 500 kV project, with an 1100 MW of incremental MH-US transfers, initiates a Manitoba Hydro DC reduction for the loss of 602 line that is 106 MW less than the reduction initiated in the base study case (today's system configuration). The 602 line trip DC reduction initiated for the Dorsey – Bison project found to be 1912 MW, which is 119 MW higher than the base case. An increase in DC reduction levels is unacceptable according to MISO's Special Protection System usage policy.

Background

Regional power system analysis has consistently shown that there is an existing North Dakota – Manitoba loop flow issue where higher levels of North Dakota export will flow into Manitoba on the Rugby – Glenboro (G82R) and Letellier - Drayton (L20D) 230 kV lines and cause overloads of the Riel – Forbes 500 kV line (602 line). This was recently documented in the Minnesota CapX study report, "Impact of CapX Facilities on North Dakota Export for the Year 2016", where it was found that even with the new Phase 1 CapX facilities, North Dakota export would be limited by overloads of the Roseau series capacitors on 602 line. Recent studies performed for a new Manitoba to U.S. 500 kV tie line have shown that a new 500 kV line between Dorsey and Bison will dramatically aggravate this problem by introducing a very low impedance path between North Dakota and Manitoba.

The flow limit on 602 line is based on the 2000 amp (1732 MW) rating of the Roseau series capacitors and line terminal equipment. Even if the rating of the Roseau series capacitors is increased through equipment upgrades, the flow limit on the line will need to remain at 1732 MW for several reasons.

1. When 602 line trips, the Manitoba Hydro (MH) DC reduction scheme will initiate a power order reduction on the MH HVDC lines connecting Winnipeg to hydroelectric generation in Northern

Manitoba equal to the amount of flow on the line. The loss of 602 line and associated DC runback is currently the largest single contingency in the MRO region and MISO footprint in terms of generation loss. Allowing 602 line flows to exceed today's 1732 MW limit would also increase the amount of DC reduction and the size of the largest contingency in the MISO footprint, which may not be acceptable.

2. MISO has a strict policy that prohibits the introduction of any new Special Protection Systems (SPS) that will reduce firm transfers in response to a single contingency, such as the loss of 602 line. Furthermore, they will not allow an increase in the amount of HVDC or generation runback on an existing SPS beyond its current maximum level. Allowing 602 line flows to exceed 1732 MW, thus increasing the amount of DC reduction, violates MISO's policy and would be deemed unacceptable.
3. Since large Manitoba Hydro DC power order reductions also result in overfrequency operation of Northern Manitoba hydro generation, Manitoba Hydro does not want to increase the maximum DC reduction beyond today's level.
4. Since 602 line was studied and designed to operate at a maximum level of 2000 amps, terminal equipment may not be able to operate at higher levels. For example, the transient recovery voltages seen by circuit breakers as they interrupt current may exceed their interrupting and voltage withstand capability.

Another finding from the CapX North Dakota Export (NDEX) study is that the simultaneous NDEX stability limit, with Manitoba export (MHEX) at 2175 MW and the Minnesota – Wisconsin export (MWEX) at 1665 MW is 2150 to 2200 MW based on transient under voltage at the Minong 161 kV bus as a result of the King – Eau Claire 345 kV fault with cross trip of the Eau Claire – Arpin 345 kV line and a stuck breaker at King (PCS disturbance). This limitation is also related to the North Dakota – Manitoba loop flow issue. Higher flows on 602 line create higher flows on the Arrowhead – Stone Lake 345 kV line which directly impact the Stone Lake 345/161 kV and nearby Minong 161 kV transient voltage performance. The trip of the King – Eau Claire – Arpin 345 kV line is currently the most limiting contingency, from both a voltage and transient stability perspective, on the MWEX interface.

Study Objectives

The purpose of this study was to conduct a preliminary power system stability assessment of both the MP Dorsey – Iron Range 500 kV and the proposed Dorsey – Bison 500 kV projects in order to:

1. Assess the impact of the proposed 500 kV lines on the North Dakota – Manitoba loop flow issue by determining NDEX restrictions due to 602 line loading limitations with 1100 MW of additional Manitoba to U.S. power transfer.
2. Assess the impact of the proposed 500 kV lines and 1100 MW of incremental Manitoba to U.S. transfers on the Minong 161 kV transient voltage performance for the King – Eau Claire – Arpin (PCS) disturbance.
3. Determine the amount of Manitoba Hydro DC reduction initiated for faults that result in the tripping of 602 line.

Model Development

CapX NDEX Study model

The power flow and stability models developed for the CapX NDEX study were used for this study. The complete modeling details can be found in the CapX study report, "Impact of CapX Facilities on North Dakota Export for the Year 2016".

In general, the CapX study stability model was developed from the December 03, 2010 NMORWG stability model and study package. Updates were made to include transmission facility additions with planned in-service dates between 2010 and 2016. Table XX in Appendix 1 summarizes the transmission facility additions.

The Phase 1 CapX facilities included in the model are:

- Bemidji-Grand Rapids 230 kV line.
- Twin Cities-Fargo 345 kV line.
- Twin Cities-Brookings 345 kV line.
- Twin Cities-La Crosse 345 kV line.

Manitoba – U.S. 1100 MW Facility Additions

For the Dorsey – Iron Range project the following facilities were added:

- New Blackberry 500/345 kV substation
- (2) Blackberry 500/345 kV transformers
- (1) Blackberry 500/230 kV transformer
- New 500 kV transmission line between Dorsey and Blackberry 500 kV substations
- 60% series compensation at the midpoint of the 500 kV line
- Double circuit Blackberry - Arrowhead 345 kV line

For the Dorsey – Fargo option the following facilities were added:

- New Bison 500/345 kV Substation
- (2) Bison 500/345 kV transformers
- New 500 kV transmission line between Dorsey and Bison 500 kV substations
- 60% series compensation at the midpoint of the 500 kV line
- A second Twin Cities – Fargo 345 kV line

For this preliminary stability analysis, the Manitoba Hydro facilities required to provide an 1100 MW incremental power transfer (Hydro generation additions and a 3rd HVDC Bipole) were not modeled in detail. A proxy representation consisting of an 1100 MW negative load, representing a 3rd bipole converter station, at the Riel 500 kV bus was used. For the purposes of this study, this representation was deemed adequate since the primary system impact under investigation was the 500 kV line tie sharing and post-project flow levels on the Riel – Forbes 500 kV line (602 line).

Study Cases

Two study cases were created from the CapX t1e-so16aa base case which had NDEX established at 2218 MW, MHEX at 2178 MW, and MWEX at 1660 MW. The CapX study found this point to be the simultaneous stability limit where the Minong 161 kV transient bus voltage was at its established minimum acceptable level of 0.82 p.u. for the PCS disturbance.

The y5k-so16aa case was created by adding the Dorsey – Iron Range project facilities and the additional 1100 MW of incremental MH-US transfer. The MWEX interface flow was re-established at approximately 1650 MW using the study package SETEXPORTS.IPL program.

The w3l-so16aa case was created by adding the Dorsey – Bison project facilities and the additional 1100 MW of incremental MH-US transfer. The MWEX interface flow was re-established at approximately 1650 MW using the study package SETEXPORTS.IPL program.

Table 1 below summarizes the major interface flows for each of the study cases in addition to the flows on 602 line and the new 500 kV line. Power flow summary reports generated by the PFINFO.IPL program are included in Appendix 2.

Case	Description	NDEX	MHEX	MWEX	New Line	602 Line	Arrowhead Stone Lake
t1e-so16aa	Base Case	2218	2178	1660	--	1793	726
y5k-so16aa	Dorsey – Iron Range	2217	3290	1657	1283	1687	972
w3l-so16aa	Dorsey - Bison	2224	3287	1639	1075	1912	733

Table 1: Interface flows for study power flow cases.

The following are notable observations for the study cases:

1. The flow sharing between 602 line and the new 500 kV line is better with the Dorsey – Iron Range project.
2. The flow on 602 line is much lower with the Dorsey – Iron Range project and is approximately 100 MW less than the base case (today's system).
3. The flow on 602 line observed with the Dorsey – Bison project is approximately 119 MW greater than in the base case which is loading the Roseau series capacitors to 2116 amps (106% of their 2000 amp rating).

Additional sensitivity analysis was performed on the study cases by varying both NDEX and MHEX to determine the various transfer levels where 602 line becomes limiting. Figure 1 graphically shows the impact of the 602 line loading limit on the simultaneous NDEX, MHEX export capability.

At a targeted design MHEX transfer level of 3285 MW, NDEX would be limited to 1733 MW with the Dorsey - Bison 500 kV line. In order to achieve the 2500 MW NDEX potential provided by the CapX Group 1 facilities, MHEX would be limited to 2862 MW, well below the capability of the MHEX interface.

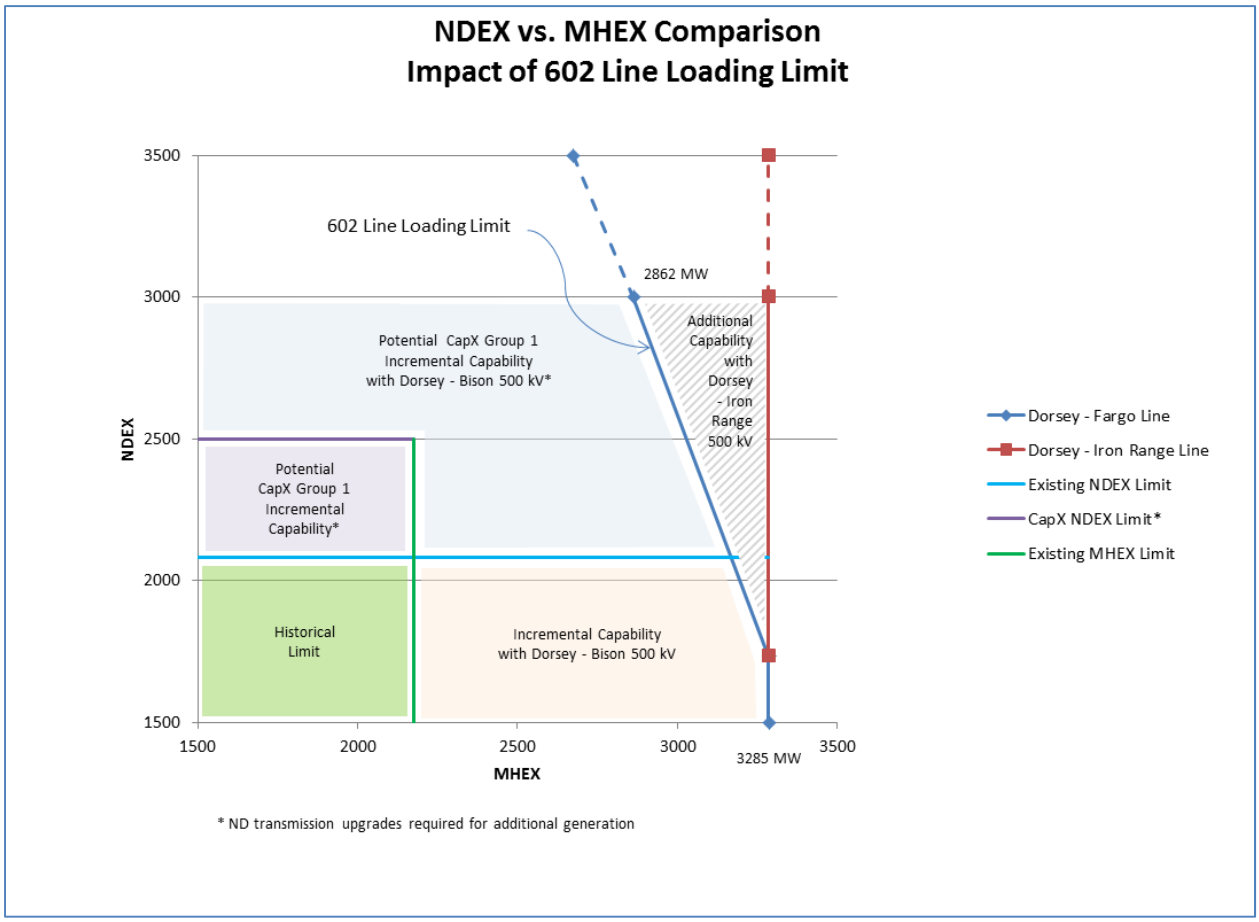


Figure 1 – Impact of 602 line loading on NDEX – MHEX capability

Study Procedure

A 5 second stability simulation was performed for each of the study cases and applying the following disturbances:

pcs	SLG fault on King - Eau Claire line with 8P6 breaker failure at King Trips King - Eau Claire - Arpin and King - Chisago 345 kV lines
nmz	4 CYCLE, THREE PHASE FAULT AT CHISAGO TRIP F601C, XTRIP D602F USE NEW 100% REDUCTION INIT FROM CHISAGO, LEAVE SVS ON MP SYS
nad	4 cycle 3 phase fault at forbes 500 kv post mmtu clear the forbes - dorsey 500 kv line

Table 2: Disturbance list

The stability simulation study package automatically creates a detailed report for each simulation describing the base case conditions, transient voltage violations, and Manitoba DC reduction events that occurred during the simulation. The reports for each simulation are included in Appendix 3.

Results

Transient performance for King – Eau Claire – Arpin with King 8P6 breaker failure (PCS)

All of the cases run demonstrated stable performance. In general, the most heavily impacted voltages for this disturbance are the Arrowhead 230, Arrowhead 345, Stone Lake 345, and Minong 161 kV. Of these buses, the Arrowhead 230 and Minong 161 kV have the most restrictive transient under voltage criterion of 0.82 (p.u.). These are standard MP criteria which have been established to optimize HVDC converter operation at Arrowhead and protect sensitive industrial loads such as the pipeline pumping customer at Minong. Table 3 below summarizes the minimum transient under voltages at Arrowhead and Minong for the study cases. These voltages are documented in the stability reports provided in Appendix 3.

Study Case	Case Name	Arrowhead 230 kV (p.u.)	Minong 161 kV (p.u.)
CapX NDEX Study Model - Benchmark	t1e-so16aa	0.83	0.79
Dorsey – Iron Range 500 kV	y5k-so16aa	0.92	0.85
Dorsey – Bison 500 kV	w3l-so16aa	0.80	0.77

Table 3: Transient voltage performance for stability analysis

From these results it can be seen that for the Dorsey – Bison project, there are voltage violations (V<0.82 p.u.) at both Arrowhead 230 and Minong 161 kV buses. The dynamic performance for the Dorsey – Iron Range project is considerably better with the transient under voltages well above criteria. Figures 2 and 3 present stability plots, that graphically compare the transient voltage responses and illustrate the improved performance observed with Dorsey – Iron Range project.

Figures 4 and 5 are comparison plots of Minong 161kV and Arrowhead 230 kV voltages for the base, Dorsey – Bison, and Dorsey – Iron Range cases. Here it can be seen that the Dorsey – Bison project with 1100 MW MH-US transfers actually degrades the transient voltage performance compared to the base case, while the Dorsey – Iron Range project with transfers significantly improves performance.

There are several reasons for the dynamic performance improvements provided by the Dorsey – Iron Range project.

1. The Blackberry (Iron Range) – Arrowhead 345 kV lines are tied directly to the Arrowhead 345 kV bus allowing flows on the Arrowhead – Stone Lake 345 kV line to bypass the Arrowhead 230/345 kV step-up and 230 kV phase shifting transformer (PST) which provides considerable voltage support at Arrowhead.
2. The Arrowhead 345 direct connection also eliminates the reactive power (I^2X) losses introduced by the transformers that negatively impact the Arrowhead, Stone Lake, and Minong transient voltages. In the base and Dorsey – Bison cases, the steady state and post-disturbance transient power flows on the Arrowhead – Stone Lake line flow through the transformers and degrade the voltage performance

Figure 2: Arrowhead 230 and Minong 161 kV voltage performance.

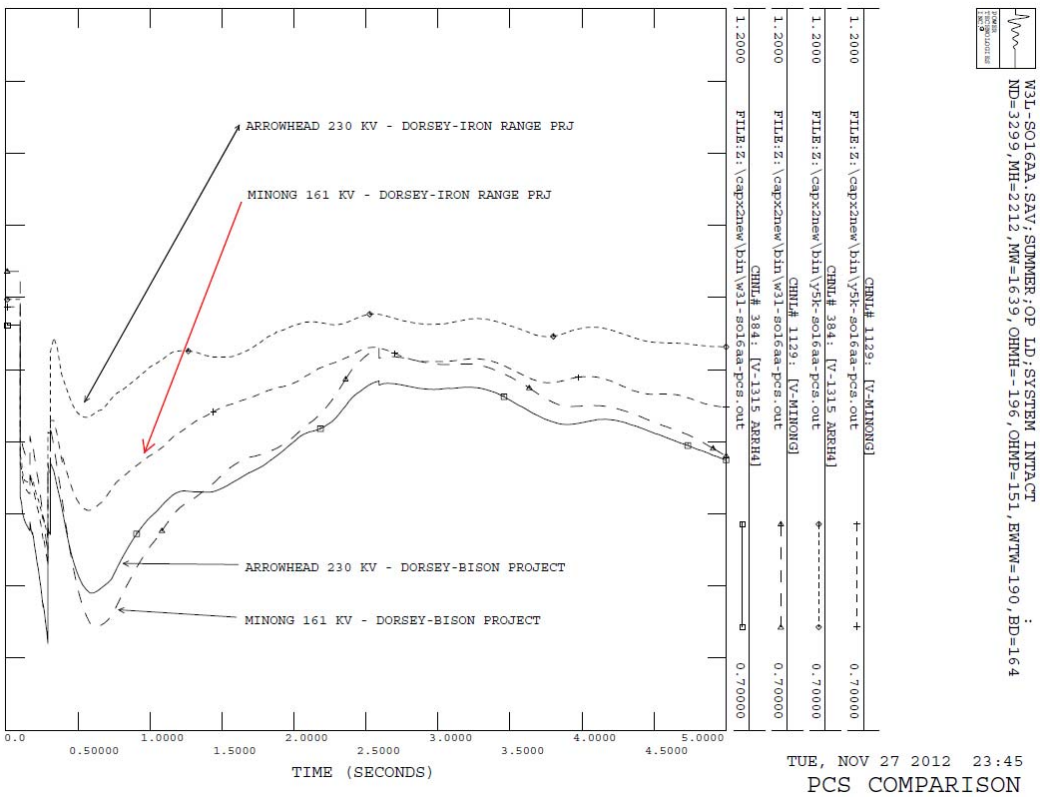


Figure 3: Arrowhead 345 and Stone Lake 345 kV voltage performance.

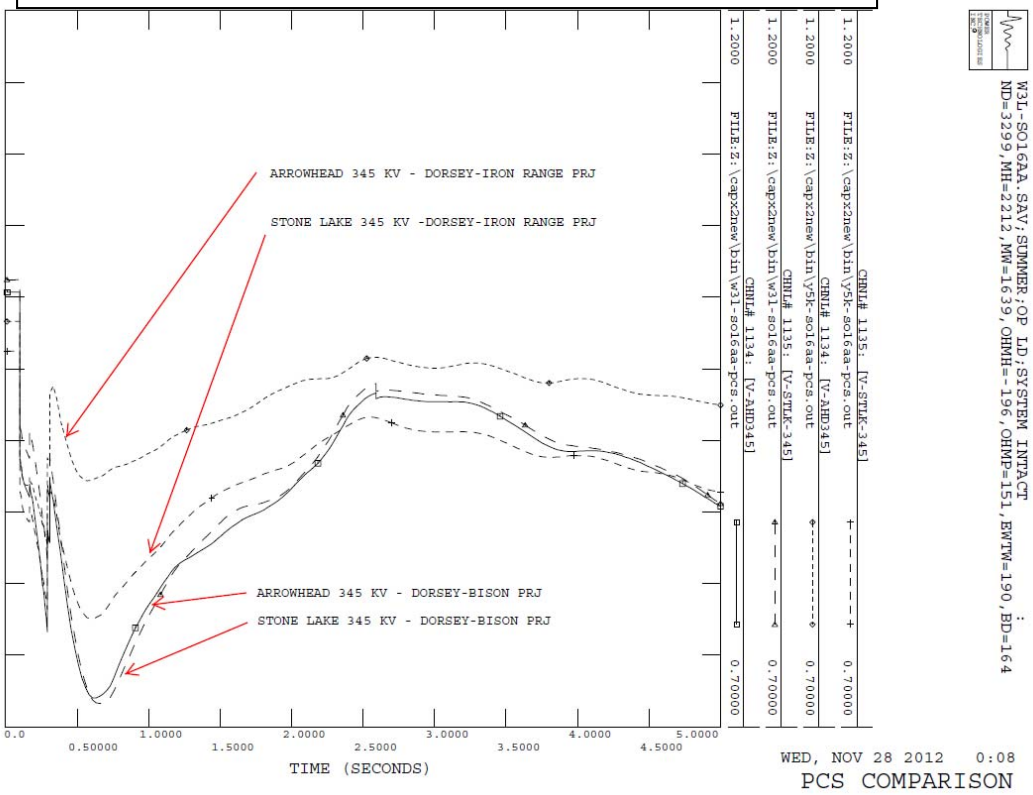


Figure 4: Arrowhead 230 voltage performance.

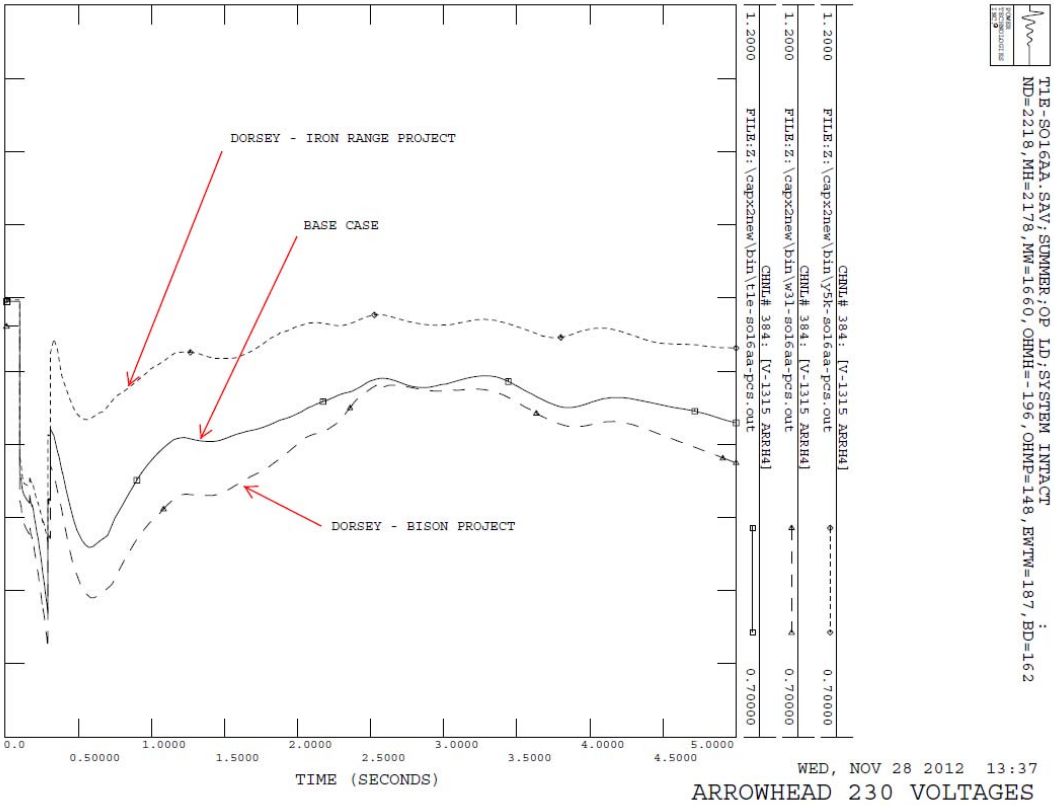
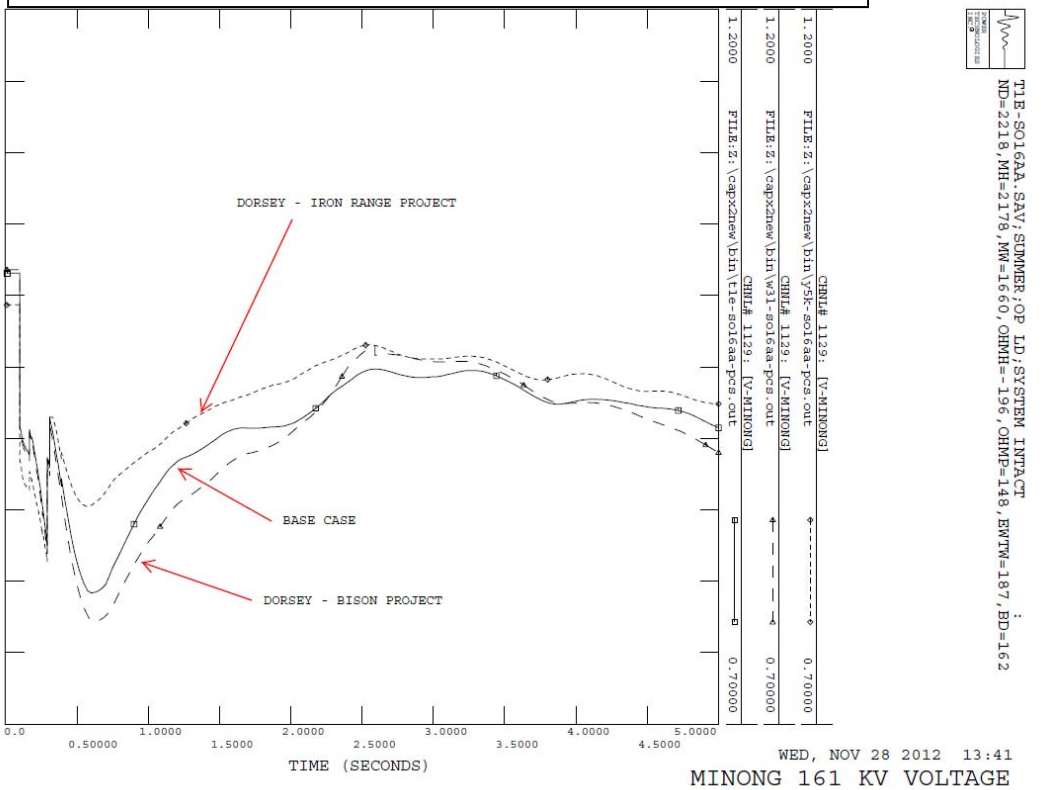


Figure 5: Minong 161 kV voltage performance.



Manitoba HVDC Reduction for Riel – Forbes 500 kV Tripping Events

Table 4 provides a summary of the 602 line trip initiated MH DC reductions initiated for each of the study cases. These reduction levels are documented in the stability reports provided in Appendix 3.

Study Case	Case Name	HVDC Reduction Amount
CapX NDEX Study Model – Base Case	t1e-so16aa	1793 MW
Dorsey – Iron Range 500 kV	y5k-so16aa	1687 MW
Dorsey – Bison 500 kV	w3l-so16aa	1912 MW

Table 4: MH DC Reduction amounts for 602 line tripping disturbances

Here it can be seen that the Dorsey – Bison project with 1100 MW MH-US transfers increases the amount of the MH DC reduction by 119 MW compared to the base case. According to MISO policy, this is an unacceptable outcome and firm MH-US transfers would not be approved at this level.

The Dorsey – Iron Range project actually reduces the amount of MH DC reduction by 106 MW compared to the base case which is in compliance with MISO's policy. This reduction in DC reduction levels can also be deemed to be a system reliability improvement over today's system. It also signifies that MH-US transfers beyond the 1100 MW level studied may be possible.

Conclusions

The primary findings of the preliminary stability analyses conducted during this study are:

1. The Dorsey – Iron Range 500 kV project provides a path for an incremental 1100 MW of MH-US transfers that is not impacted by North Dakota – Manitoba loop flow issues that cause 602 line flows to exceed its rating. In the cases studied, MHEX transfers of 3290 MW simultaneous with NDEX transfers of 2217 MW were achievable without overloading the Riel – Forbes 500 kV line (602 line). Due to its negative impact on the loop flow issue, the Dorsey – Bison 500 kV project with 1100 MW MH-US transfers overloads 602 line by 106% at the same level of NDEX (2224 MW).
2. The power system dynamic performance and resulting transient voltage performance in response to the King – Eau Claire – Arpin with a King stuck breaker (PCS) disturbance is significantly better with the Dorsey – Iron Range 500 kV project. In the high transfer cases studied, the project demonstrates better Arrowhead, Stone Lake, and Minong transient voltage performance than the base case at today's transfer levels. The Dorsey – Bison 500 kV project degrades these transient voltages compared to the base case performance.
3. 602 line tripping dynamic simulations demonstrate that the Dorsey – Iron Range 500 kV project with an 1100 MW of incremental MH-US transfers initiates a Manitoba Hydro DC reduction for the loss of 602 line that is 106 MW less than the reduction initiated in the base study case (today's system configuration). The 602 line trip DC reduction initiated for the Dorsey – Bison project found to be 1912 MW, which is 119 MW higher than the base case. An increase in DC reduction levels is unacceptable according to MISO's Special Protection System usage policy.

Appendix 1

Model Development

Pre-CapX 2010 Case Modifications to Create 2016 Study Base Case

Facilities	Idev Name	In Service Date (if Applicable)
Idev adds Buffalo -Casselton 115 kV line	OTP_AddBuff-CassLine.idv	
Correction to Bigstone station load	BSG_AQCS_Addition.idv	
Brookings-Hampton 345 kV	5BROOKINGS-HAMPTON_MASTER.idv	01/2015
Southdale-Scearcyville	5GRE-600-SCEARCYVILLE-SOUTHDALE115_[10-12-15_14_13].idv	06/2012
Cromwell -Savanna 115 kV line	5GRE-2634-CROMWELL-SAVANNA115.idv	12/2014
Wilton_Boswell-CassLk 230 kV	5OTP-279-CAPX-Wilton_Boswell-CassLk.idv	07/2012
Monticello-Bison 345 kV line	5XEL-286-MONTICELLO-BISON-345kV_REV3a.idv	05/2013
Hampton-Rochester-Lacrosse 345 kV	5XEL-PROJECT-1024-CAPX-HAMP_ROCH_LAX.idv	01/2015
Center-Grand Forks 345 kV transmission line	add-CGF-transmission-summer13-3Wto2W-5dig-rev29-2011-2-2.idv	09/2013
Updates impedance on Bemidji-Grand Rapids 230 kV line parameters	Update-BGR-Imp.idv	
Essar MN 230 kV substations and load detail	add-essar-mn-detail-r1.idv	
Add Bison units	bison_data.idv	
50 MW addition to Square Butte DC	sqb_550.idv	2013
Spirit Wood generation	5spiritwood.idv	06/2014
Byron-PL VLLY5 Impedance data changes	52012 - 3.1.12 - XEL-2178-RIGO.idv	03/2012

Facilities	Idev Name	In Service Date (if Applicable)
Minnesota Valley - Kerkhoven Tap	52014 - 6.1.14 - XEL-3312-MINN_VALLEY-KERKHOVEN_TAP.idv	06/2014
Lkmarion-Burnsville-115 kV	52015 - 12.31.15 - XEL-3121-LKMARION-BURNSVILLE-115kV-UPGRADE_R1.idv	
Adams Reactor	52012 - 6.1.12 - XEL-3474-ADAMS_2ND_REACTOR.idv	06/2012
Prairie 3 winding transformer impedance changes	52014 - 6.1.14 - XEL-3475-PRAIRIE_3RD_TR.idv	
Chisago-Apple River Phase 2 (Upgrade Scandia Tap to St. Croix Falls to 161 kV, add 161 kV line from St. Croix Falls to new DPC Poplar Lake substation and from Poplar Lake to Apple River.)	xel-2011-06-01_CHI-APP 2.idv	06/2011
Gravel Island Project Phase I Tap Wheaton - Hydro Lane 161 kV line with new Gravel Island substation. Add 161/69 kV transformers at Gravel Island. Reterminate 69 kV lines from Hydro Lane - Eau Claire to new Gravel Island substation. Upgrade Hallie substation to 161 kV and upgrade 69 kV double circuit lines out of Hallie to single circuit 161 kV.	xel-2010-11-01_Gravel Island 2.idv	
Gravel Island project Phase II (Addition of Hallie - Prescott Tap 161 kV line, Reconductor existing line from Eau Claire - Prescott Tap to 795 ACSS conductor.)	xel-2011-06-01_Gravel Island 2.idv	06/2011
WI part of Apple River-Chisago 161/69 project	52011 - 1.30.11 - DPC Portion - Chisago-Apple River.idv	01/2011
Eau Claire Area	52010 - 1.1.10-6.1.2011 - XEL-1549-EAUCLAIRE.idv	04/2011

Facilities	Idev Name	In Service Date (if Applicable)
Chisago-ST Croix -Falls Section of Chisago-Apple River Phase 1	52010 - 10.1.10 - XEL-56-CHISAGO-STCROIXFLS-R1-PHASE1	01/2010
Eau Claire 161 kV ASBUILT	52010 - 12.1.10 - XEL-1549-EAUCLAIRE 161 kV ASBUILT	12/2010
Chisago-ST Croix -Falls Section of Chisago-Apple River Phase 2	52011 - 1.30.11 - XEL-56-CHISAGO-STCROIXFLS-R2-PHASE2	01/2011
Eau Claire 69 kV ASBUILT	52011 - 4.2.11 - XEL-1549-EAUCLAIRE 69 kV ASBUILT.idv	04/2011
Chisago-ST Croix -Falls Section of Chisago-Apple River Phase 3	52011 - 5.1.11 - XEL-56-CHISAGO-STCROIXFLS-R2-PHASE3	01/2011
DPC-project-POPLK-XFMR	52013 - 5.1.13 - DPC Portion - Chisago-Apple River	05/2013
EAUCLAIRE PLAN - PHASE2	52014 - 6.1.14 - XEL-PROJECT-1957-EAUCLAIRE-P2.idv	06/2014
STCLOUD-LOOP	52015 - 6.2.15 - XEL-2307-STCLOUD-LOOP	06/2015
Byron-Rochester 161 kV	Byron-Rochester 161 Development.idv	
DPC-GNO-LACTAP	DPC-GNO-LACTAP.idv	06/2014
G359 POI4	TS_G359.idv	12/2012
Corrects the rating of the Heskett-Mandan 230 kV line (Only summer)	TS_MDU-MandanSub-Sum.idv	09/2011
Rebuild 115 kV line Charlie Creek -Williston; sub at Watford City	bepc-upgrade-chcrk-williston-07series.idv	Late 2011
Add in new combined cycle unit at White 115 kV in SD (unit may connect at 345 kV bus)	gi0704-deercreek-07series.idv	06/2012
Adds Bison transformer	bison_xfmr.idv	
Square Butte Wind level adjustment	sqbutte_wind_level.idv	

Facilities	Idev Name	In Service Date (if Applicable)
Coal Creek at top output including DC line (1128 MW)	GRE-2011-CUDC-1128.idv	2011-2012
Rating change for Center-CenterShunt	Center-CenterShunt_Rating.idv	
Purges the sq. butte-center 345/230 xmfr	MPC-remove-SqBtCntr-Xmfr.idv	N/A
Purges Langdon Wind model and replaces with a collector system rep	5MPC-LangdonWind-Correction29.idv	12/2007
Purges transmission to Pillsbury and lays Ashtabula I, II, and III	5MPC-replace-ashtabula-model29-consol.idv	12/2008
Creates Scribner bus and associated load	MPC_Scribner_SO16.idv	10/2010
Maximizes MPC01900 to 131.4 MW	5MPC_1200_1900_Full_v29.idv	06/2011
Fixes issues noticed with the CapX additions to the NDEX study	5OTP_Changes_CapX.idv	
Purges Lyon County-MN Valley 115 kV line as part of the Brookings Co - Hampton development	5purge LyonCo - MNValley 115.idv	
LaVerendrye - St Vital 230 kV line addition	lav-stvital-sum_v29.idv	
Letellier - St Vital 230 kV line addition	letellier-stvital-sum_v29.idv	
Modifes BA10 and TA11 line impedance	BA10_TA11.idv	
Reconfigure existing 110 kV lines VH2 and XS49, add St. Vital - Scotland 110 kV line using VH2 and 0.89 km of XS49, add Mohawk - Harrow 110 kV line using remaining 5.67 km of XS49	reconfig-xs49-vh2-s.idv	
Riel station and associated ac transmission, xfmr, Sectionalize D602F 500 kV line into Riel, Sectionalize R32V, and R33V 230 kV lines into Riel 500-230-46 kV 1200 MVA transformer, Move D602F 500 kV reactor to Riel end of new Riel - Roseau tie	riel-s-pc_r3.idv	
Sectionalize R49R into Riel	r49r-sect-s.idv	

Facilities	Idev Name	In Service Date (if Applicable)
Change Riel, Roseau Bus angles, add 73.4 MVAR caps to tertiary Riel bank	bus_ang_chng.idv	
Add 138 MW of wind at St Joseph	5StJoseph-wind-1-138s-at-30each-r2.idv	
St. Joseph tr	set stjoseph tr.idv	
Add Elm Creek generation	Elm Creek-2.idv	
Upgrades between Bemidji and Cass Lake required by the BGR project	Bemidji-Helga-Nary-CassLake_v29_summer.idv	
Fenton 69 kV addition	fenton69.idv	
G164 modification	G164-modified.idv	
MPC Capacitor data modification	MPC_Facility_Data_Change.idv	N/A
Disconnect Bison trs	remove-bisontrs.idv	
Changing the winding transformer data to 1.025	casslktap.idv	
Changing parameters for MPC wind units	mpcwind20.idv	N/A

Appendix 2

Powerflow Summaries

INITIATED AT LOAD FLOW ENTRY POINT ON TUE, NOV 27 2012 23:11

T1E-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2218,MH=2178,MW=1660,OHMH=-196,OHMP=148,EWTW=187,BD=162

P O W E R F L O W S U M M A R Y

NDEX:	2218 MW	ECL-ARP:	793 MW
MHEX:	2178 MW	PRI-NRC:	751 MW
MWEX:	1660 MW	AHD-SLK:	726 MW
KING-ECL:	934 MW	SLK-GPK:	562 MW
COOPER S:	1233 MW	WNE-WKS:	577 MW
FTCAL S:	657 MW	GGS:	1770 MW
GRIS-LNC:	781 MW	QC WEST:	-140 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2662.5 MW,	84.4%	OF	3156.0 MW
NSP	(AREA 600)	5412.5 MW,	45.5%	OF	11889.2 MW
MAN HYDRO	(AREA 667)	2248.2 MW,	73.1%	OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	2248/ 297	MH total gross	4914	ATC West Import	1716
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	597
NW	915/ 36	7 Sisters	170	ATC SE Import	-1197
Sask.	2150/ 82	OH total gross	21884	East Bias	225
MP	1840/ 222	northwest	717	SPC>WAPA (B10T)	162
NSP	5412/ 461	SPC total gross	2406	MH>SPC (3-230)	58
N. Dakota	2662/ 304	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3228	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	3058	OH>MP @Ft Fran	148
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	187
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	11630 MVARS	West gross	3010	F601C @Forbes	1319
NSP	1133 MVARS	net	2848	D602F @Dorsey	1794
N. Dakota	606 MVARS	Total net	4601	L20D @Letell	233
ATC	10046/ 346	WAPA SD Hydro	1497	R50M @Richer	141
ATC	3000 MVARS	Pleasant Valley	0	G82R @Glenboro	9
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	1038		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	369	ANTELOP-LELAND	119	CENTER-JAMESTN	503
STANTON- SQ BUT	-31	HETINGR-BISON	99	WILTON-CASS LK	32
CASS LK-BOSWELL	-25	BISON-ALEX SS3	326	ALEX SS-QUARRY	229
QUARRY-MNTCELO	86	BROOKNG-LYONCO	198	LYONCO-CEDARMT(T)	307
CEDARMT-HELENA(T)	257	LKMARN-HMPTCNR	8	HMPTCNR-NROC	533
NROC TR	175	NROC-NLAX	279	CNT-PRAIRIE 345	251
NROC-BYRON	815	LKFLDX-LAKEFLD3	28	AKPEXPORT	2755
ROSEAU CAP	1951 AMPS	PRI-NROC	7 ANG		
CENTER-JAMESTN	17 ANG	ECL-ARP	19 ANG		

Tfmrs	MVA/ Load	Ph Shifters	Deg/ MW	DC Lines	MW
Wshell #1 7-7	105/ 73%	Stinson	27/ 31	CU (1,2)	1128
Wshell #2 7-7	105/ 73%	Boundary Dam	0/ 163	SQ BU (3,4)	550
Drayton#1 4-7	49/ 35%	Whiteshell	109/ 200	MH Bipole 1	1514
Drayton#2 4-7	60/ 32%	Int Falls	129/ 148	MH Bipole 2	1715
Dorsey #1 2-4	621/ 51%	St. Lawrence	16/ 0	MH (BP1+BP2)	3230
Dorsey #2 2-4	719/ 59%	Arrowhead	0/ 726	Miles City E>W	-150
Forbes 2-4	183/ 27%			RCDC (15)	0

Stone Lk 3-5 146/ 43% Stegall (10) 0

Dorsey SC's		I/S	MVAR	Qmax/ Qmin
MIL 7-9G	17.0	2	393	600/ -330
SCE 1-3G	18.2	3	320	480/ -240
SCA 4-6G	18.2	3	320	480/ -240
Total			1034	1560/ -810
Margin			526	

SVC's	MVAR	Qmax/ Qmin
Forbes	500	39 400/ -450
Fargo	13.2	-26 20/ -135
Watertown	20.0	31 125/ -86

Series Caps	Num In Serv
Roseau 500	2 of 2
Chisago 500	1 of 1

Caps/Reactors		MVAR
Balta (FS)	230	0
Drayton	115	0
Drayton	13.8	-20
Eau Claire(FS)	161	267
Kohlman Lake	115	240
Parkers Lk(FS)	115	0
Prairie (FS)	115	0
Ramsey (FS)	230	0
Red Rock	115	160
Rugby	13.8	0
Split Rock(FS)	115	80
Sheyenne (FS)	115	40
Wilton/Bemidji	115	20
		0
		0
		0
		0

Caps/Reactors		MVAR
Arrowhead	230	160
Blackberry	230	47
Minntac	115	45
Riverton	230	47
Roseau Co.(FS)	230	0
Running (FS)	230	30
Running react	230	0
Shannon	230	72
		0
Glenboro	230	0
Laverendrye	110	98
Richer react	230	0
St Vital	110	98
		0
		0
		0
		0

Caps/Reactors		MVAR
Chisago T 9	34.5	60
Chisago T 10	34.5	60
Forbes	230	70
Forbes	500	600
		0
Fargo	115	54
Watertown	20	20
Watertown	230	0
		0
Arrowhead	345	150
Stone Lake	345	75
Stone Lk Reac	345	0
Stone Lake	161	20
Grdnr Pk Reac	345	0
Grdnr Pk Caps	115	0
Arpin Caps	138	52
Council Creek	138	16

Bus Voltages		V,pu
Adams	345	1.004
Alexandria	115	1.031
Audubon	115	1.043
Bemidji	115	1.033
Byron	345	1.010
Chisago Co.	345	1.021
Chisago Co.	500	1.019
Drayton	230	1.018
Eau Claire	345	0.967
WEST FARIBAULT	115	1.046
LaPorte	115	1.029
Maple River	230	1.035
Marshall Tap	115	1.052
Owatonna	161	1.011
Prairie	115	1.023
Prairie	230	1.032
Ramsey	230	1.017
Roseau County	230	1.016
Roseau County	500	1.060
Sheyenne	230	1.034
Thief R Falls	115	1.029
Tioga	230	1.027
Wahpeton	230	1.028
Winger	115	1.045
WILTON 4	230	1.033
MINONG 5	161	1.016
		0.000

Bus Voltages		V,pu
Arrowhead	230	0.998
Badoura	115	1.039
Blackberry	230	1.029
Boise Cascade	13.8	1.056
Boise Cascade	115	1.024
ETCO	115	1.007
Forbes	230	1.024
Forbes	500	1.021
Hubbard	115	0.000
Intl Falls	115	1.025
Minntac	115	1.015
Moranville	230	1.016
Riverton	230	1.034
Running	230	1.020
Shannon	230	1.027
Stinson MN	115	1.011
Jamestown	345	0.985
Groton	345	1.018
Watertown	230	1.030
Watertown	345	1.029
		0.000
Dorsey	230	1.045
Dorsey	500	1.045
ALEX SS3	34	1.008
BRKNGCO3	345	1.033
PRAIRIE3	345	1.010
		0.000

Bus Voltages		V,kV
Whiteshell	110	118.9
Kenora	220	246.1
Dryden	220	250.4
Fort Frances	220	243.0
Mackenzie	220	252.9
Lakehead	220	246.1
Marathon	220	252.8
Wawa	220	254.7
Mississagi	220	250.6
Fort Frances	118	119.6
Lakehead	118	122.8
Birch	118	120.2
Marathon	118	124.8
		0.000
Arrowhead	345	1.015
Stone Lake	345	1.014
Stone Lake	161	1.019
Gardner Park	345	1.030
Weston	115	1.035
Arpin	345	0.987
Eau Claire	161	1.019
Council Creek	161	0.967
Hydro Lane	161	1.001
Wien	115	1.032
NROC	345	1.009
LYON CO	345	1.037
CASS LK4	230	1.036

Steady State Relay Margins (measured from inner blinder)

	Relay Location	Manuf/Type	PSS Model	South	North	Em North
1)	B10T-Tioga (South)	GE OST	SLLP	340%	N/A	N/A
2)	-Tioga (North)	GE OST	SLLP	699%	N/A	N/A
3)	-Tioga (Em North)	GE OST	SLLP		N/A	N/A
4)	D602F-Dorsey	ATP ???	SLINOS	406%	N/A	N/A
5)	-Forbes (Normal)	ATP ???	SLINOS	242%	N/A	N/A
6)	-Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8)	F3M-Intl Falls	APT S-PRO	SLINOS	330%	N/A	N/A
9)	G82R-Rugby	APT	SLINOS	1125%	N/A	N/A
10)	L20D-Drayton (Normal)	APT, ASEA	SLINOS	876%	N/A	N/A
11)	-Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12)	R50M-Moranville (Norm)	APT, West	SLINOS	926%	N/A	N/A
13)	-Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

INITIATED AT LOAD FLOW ENTRY POINT ON TUE, NOV 27 2012 22:19

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164

P O W E R F L O W S U M M A R Y

NDEX:	2217 MW	ECL-ARP:	542 MW
MHEX:	2007 MW (3290)	PRI-NRC:	536 MW
MWEX:	773 MW (1657)	AHD-SLK:	88 MW (972)
KING-ECL:	685 MW	SLK-GPK:	654 MW
COOPER S:	1057 MW	WNE-WKS:	543 MW
FTCAL S:	528 MW	GGS:	1754 MW
GRIS-LNC:	757 MW	QC WEST:	22 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2662.5 MW,	84.4% OF	3156.0 MW
NSP	(AREA 600)	7500.4 MW,	63.1% OF	11889.2 MW
MAN HYDRO	(AREA 667)	1148.2 MW,	37.3% OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	1148/ 306	MH total gross	4914	ATC West Import	583
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	558
NW	915/ 36	7 Sisters	170	ATC SE Import	-1221
Sask.	2150/ 82	OH total gross	21884	East Bias	183
MP	1840/ 263	northwest	717	SPC>WAPA (B10T)	164
NSP	7500/ 437	SPC total gross	2406	MH>SPC (3-230)	60
N. Dakota	2662/ 310	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3228	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	3058	OH>MP @Ft Fran	152
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	191
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	12452 MVARS	West gross	3010	F601C @Forbes	1730
NSP	1554 MVARS	net	2848	D602F @Dorsey	1687
N. Dakota	606 MVARS	Total net	4601	L20D @Letell	212
ATC	9747/ 332	WAPA SD Hydro	1497	R50M @Richer	111
ATC	2911 MVARS	Pleasant Valley	0	G82R @Glenboro	-4
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	1235		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	366	ANTELOP-LELAND	122	CENTER-JAMESTN	513
STANTON- SQ BUT	-31	HETINGR-BISON	89	WILTON-CASS LK	-27
CASS LK-BOSWELL	-102	BISON-ALEX SS3	383	ALEX SS-QUARRY	310
QUARRY-MNTCELO	143	BROOKNG-LYONCO	287	LYONCO-CEDARMT(T)	396
CEDARMT-HELENA(T)	341	LKMARN-HMPTCNR	-36	HMPTCNR-NROC	345
NROC TR	136	NROC-NLAX	207	CNT-PRAIRIE 345	251
NROC-BYRON	530	LKFLDX-LAKEFLD3	-154	AKPEXPORT	1512
ROSEAU CAP	1841 AMPS	PRI-NROC	5 ANG		
CENTER-JAMESTN	17 ANG	ECL-ARP	12 ANG		

Tfmrs	MVA/ Load	Ph Shifters	Deg/ MW	DC Lines	MW
Wshell #1 7-7	103/ 71%	Stinson	27/ 29	CU (1,2)	1128
Wshell #2 7-7	103/ 71%	Boundary Dam	1/ 164	SQ BU (3,4)	550
Drayton#1 4-7	47/ 33%	Whiteshell	92/ 199	MH Bipole 1	1514
Drayton#2 4-7	57/ 31%	Int Falls	117/ 151	MH Bipole 2	1715
Dorsey #1 2-4	755/ 62%	St. Lawrence	16/ 0	MH (BP1+BP2)	3230
Dorsey #2 2-4	867/ 72%	Arrowhead	0/ 88	Miles City E>W	-150
Forbes 2-4	69/ 10%			RCDC (15)	0

Stone Lk 3-5 294/ 87% Stegall (10) 0

Dorsey SC's		I/S	MVAR	Qmax/ Qmin
MIL 7-9G	17.0	2	356	600/ -330
SCE 1-3G	18.2	3	290	480/ -240
SCA 4-6G	18.2	3	290	480/ -240
Total			938	1560/ -810
Margin			622	

SVC's	MVAR	Qmax/ Qmin
Forbes	500	54 400/ -450
Fargo	13.2	-10 20/ -135
Watertown	20.0	51 125/ -86

Series Caps		Num In Serv
Roseau	500	2 of 2
Chisago	500	1 of 1

Caps/Reactors		MVAR
Balta (FS)	230	0
Drayton	115	0
Drayton	13.8	-20
Eau Claire(FS)	161	178
Kohlman Lake	115	240
Parkers Lk(FS)	115	0
Prairie (FS)	115	0
Ramsey (FS)	230	0
Red Rock	115	240
Rugby	13.8	0
Split Rock(FS)	115	80
Sheyenne (FS)	115	40
Wilton/Bemidji	115	20
		0
		0
		0
		0

Caps/Reactors		MVAR
Arrowhead	230	160
Blackberry	230	47
Minntac	115	45
Riverton	230	47
Roseau Co.(FS)	230	0
Running (FS)	230	30
Running react	230	0
Shannon	230	72
		0
Glenboro	230	0
Laverendrye	110	98
Richer react	230	0
St Vital	110	98
		0
		0
		0
		0

Caps/Reactors		MVAR
Chisago T 9	34.5	60
Chisago T 10	34.5	60
Forbes	230	70
Forbes	500	600
		0
Fargo	115	54
Watertown	20	20
Watertown	230	0
		0
Arrowhead	345	150
Stone Lake	345	75
Stone Lk Reac	345	0
Stone Lake	161	40
Grdnr Pk Reac	345	0
Grdnr Pk Caps	115	0
Arpin Caps	138	52
Council Creek	138	16

Bus Voltages		V,pu
Adams	345	1.013
Alexandria	115	1.019
Audubon	115	1.036
Bemidji	115	1.029
Byron	345	1.022
Chisago Co.	345	1.013
Chisago Co.	500	1.009
Drayton	230	1.021
Eau Claire	345	0.999
WEST FARIBAULT	115	1.036
LaPorte	115	1.021
Maple River	230	1.029
Marshall Tap	115	1.050
Owatonna	161	1.005
Prairie	115	1.023
Prairie	230	1.032
Ramsey	230	1.018
Roseau County	230	1.042
Roseau County	500	1.053
Sheyenne	230	1.029
Thief R Falls	115	1.020
Tioga	230	1.027
Wahpeton	230	1.023
Winger	115	1.042
WILTON 4	230	1.028
MINONG 5	161	0.993
		0.000

Bus Voltages		V,pu
Arrowhead	230	0.999
Badoura	115	1.028
Blackberry	230	1.018
Boise Cascade	13.8	1.059
Boise Cascade	115	1.027
ETCO	115	1.002
Forbes	230	1.016
Forbes	500	1.015
Hubbard	115	0.000
Intl Falls	115	1.028
Minntac	115	1.009
Moranville	230	1.042
Riverton	230	1.020
Running	230	1.041
Shannon	230	1.024
Stinson MN	115	1.010
Jamestown	345	0.980
Groton	345	1.015
Watertown	230	1.030
Watertown	345	1.028
		0.000
Dorsey	230	1.045
Dorsey	500	1.036
ALEX SS3	34	0.997
BRKNGCO3	345	1.033
PRAIRIE3	345	1.011
		0.000

Bus Voltages		V,kV
Whiteshell	110	118.9
Kenora	220	248.2
Dryden	220	251.2
Fort Frances	220	244.6
Mackenzie	220	253.7
Lakehead	220	246.2
Marathon	220	252.8
Wawa	220	254.7
Mississagi	220	250.6
Fort Frances	118	120.5
Lakehead	118	122.8
Birch	118	120.2
Marathon	118	124.8
		0.000
Arrowhead	345	0.983
Stone Lake	345	0.962
Stone Lake	161	0.991
Gardner Park	345	1.031
Weston	115	1.035
Arpin	345	1.013
Eau Claire	161	1.033
Council Creek	161	0.981
Hydro Lane	161	1.016
Wien	115	1.031
NROC	345	1.020
LYON CO	345	1.034
CASS LK4	230	1.030

Steady State Relay Margins (measured from inner blinder)

	Relay Location	Manuf/Type	PSS Model	South	North	Em North
1)	B10T-Tioga (South)	GE OST	SLLP	335%	N/A	N/A
2)	-Tioga (North)	GE OST	SLLP	689%	N/A	N/A
3)	-Tioga (Em North)	GE OST	SLLP		N/A	N/A
4)	D602F-Dorsey	ATP ???	SLINOS	447%	N/A	N/A
5)	-Forbes (Normal)	ATP ???	SLINOS	266%	N/A	N/A
6)	-Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8)	F3M-Intl Falls	APT S-PRO	SLINOS	325%	N/A	N/A
9)	G82R-Rugby	APT	SLINOS	N/A	1096%	
10)	L20D-Drayton (Normal)	APT, ASEA	SLINOS	991%	N/A	N/A
11)	-Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12)	R50M-Moranville (Norm)	APT, West	SLINOS	1333%	N/A	N/A
13)	-Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

INITIATED AT LOAD FLOW ENTRY POINT ON TUE, NOV 20 2012 10:35

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164

P O W E R F L O W S U M M A R Y

NDEX:	3299 MW (2224)	ECL-ARP:	754 MW	Dorsey-Bison	1075
MHEX:	2212 MW (3287)	PRI-NRC:	718 MW		
MWEX:	1639 MW	AHD-SLK:	733 MW		
KING-ECL:	906 MW	SLK-GPK:	553 MW		
COOPER S:	1243 MW	WNE-WKS:	581 MW		
FTCAL S:	658 MW	GGS:	1781 MW		
GRIS-LNC:	800 MW	QC WEST:	-113 MW		

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2455.7 MW,	77.8%	OF 3156.0 MW
NSP	(AREA 600)	6500.6 MW,	54.7%	OF 11889.2 MW
MAN HYDRO	(AREA 667)	1148.2 MW,	37.3%	OF 3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	1148/ 285	MH total gross	4914	ATC West Import	1648
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	564
NW	915/ 37	7 Sisters	170	ATC SE Import	-1258
Sask.	2150/ 82	OH total gross	21884	East Bias	348
MP	1840/ 226	northwest	717	SPC>WAPA (B10T)	164
NSP	6500/ 548	SPC total gross	2406	MH>SPC (3-230)	60
N. Dakota	2455/ 347	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3081	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	2911	OH>MP @Ft Fran	151
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	190
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	11413 MVARS	West gross	3010	F601C @Forbes	1494
NSP	1353 MVARS	net	2848	D602F @Dorsey	1912
N. Dakota	562 MVARS	Total net	4601	L20D @Letell	173
ATC	9890/ 336	WAPA SD Hydro	1497	R50M @Richer	143
ATC	2953 MVARS	Pleasant Valley	0	G82R @Glenboro	-18
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	863		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	392	ANTELOP-LELAND	110	CENTER-JAMESTN	383
STANTON- SQ BUT	-79	HETINGR-BISON	119	WILTON-CASS LK	88
CASS LK-BOSWELL	38	BISON-ALEX SS3	436	ALEX SS-QUARRY	682
QUARRY-MNTCELO	458	BROOKNG-LYONCO	240	LYONCO-CEDARMT(T)	397
CEDARMT-HELENA(T)	352	LKMARN-HMPTCNR	20	HMPTCNR-NROC	512
NROC TR	170	NROC-NLAX	271	CNT-PRAIRIE 345	253
NROC-BYRON	775	LKFLDX-LAKEFLD3	-28	AKPEXPORT	2686
ROSEAU CAP	2116 AMPS	PRI-NROC	6 ANG		
CENTER-JAMESTN	12 ANG	ECL-ARP	18 ANG		

Tfmrs	MVA/ Load	Ph Shifters	Deg/ MW	DC Lines	MW
Wshell #1 7-7	104/ 72%	Stinson	29/ 29	CU (1,2)	1127
Wshell #2 7-7	104/ 72%	Boundary Dam	3/ 165	SQ BU (3,4)	550
Drayton#1 4-7	42/ 30%	Whiteshell	112/ 200	MH Bipole 1	1514
Drayton#2 4-7	51/ 27%	Int Falls	134/ 151	MH Bipole 2	1715
Dorsey #1 2-4	744/ 62%	St. Lawrence	16/ 0	MH (BP1+BP2)	3230
Dorsey #2 2-4	851/ 70%	Arrowhead	0/ 733	Miles City E>W	-150
Forbes 2-4	152/ 22%			RCDC (15)	0

Stone Lk 3-5 165/ 49% Stegall (10) 0

Dorsey SC's		I/S	MVAR	Qmax/ Qmin
MIL 7-9G	17.0	2	449	600/ -330
SCE 1-3G	18.2	3	366	480/ -240
SCA 4-6G	18.2	3	366	480/ -240
Total			1183	1560/ -810
Margin			377	

SVC's	MVAR	Qmax/ Qmin
Forbes	500	10 400/ -450
Fargo	13.2	2 20/ -135
Watertown	20.0	36 125/ -86

Series Caps		Num In Serv
Roseau	500	2 of 2
Chisago	500	1 of 1

Caps/Reactors		MVAR
Balta (FS)	230	0
Drayton	115	0
Drayton	13.8	-20
Eau Claire(FS)	161	356
Kohlman Lake	115	240
Parkers Lk(FS)	115	0
Prairie (FS)	115	0
Ramsey (FS)	230	0
Red Rock	115	240
Rugby	13.8	0
Split Rock(FS)	115	80
Sheyenne (FS)	115	40
Wilton/Bemidji	115	20
		0
		0
		0
		0

Caps/Reactors		MVAR
Arrowhead	230	160
Blackberry	230	47
Minntac	115	45
Riverton	230	47
Roseau Co.(FS)	230	0
Running (FS)	230	30
Running react	230	0
Shannon	230	72
		0
Glenboro	230	0
Laverendrye	110	98
Richer react	230	0
St Vital	110	98
		0
		0
		0
		0

Caps/Reactors		MVAR
Chisago T 9	34.5	60
Chisago T 10	34.5	60
Forbes	230	70
Forbes	500	600
		0
Fargo	115	27
Watertown	20	20
Watertown	230	76
		0
Arrowhead	345	150
Stone Lake	345	75
Stone Lk Reac	345	0
Stone Lake	161	40
Grdnr Pk Reac	345	0
Grdnr Pk Caps	115	0
Arpin Caps	138	52
Council Creek	138	16

Bus Voltages		V,pu
Adams	345	1.003
Alexandria	115	1.010
Audubon	115	1.034
Bemidji	115	1.026
Byron	345	1.012
Chisago Co.	345	1.005
Chisago Co.	500	1.000
Drayton	230	1.027
Eau Claire	345	0.982
WEST FARIBAULT	115	1.037
LaPorte	115	1.018
Maple River	230	1.037
Marshall Tap	115	1.046
Owatonna	161	1.006
Prairie	115	1.031
Prairie	230	1.040
Ramsey	230	1.025
Roseau County	230	1.009
Roseau County	500	1.063
Sheyenne	230	1.033
Thief R Falls	115	1.027
Tioga	230	1.029
Wahpeton	230	1.019
Winger	115	1.045
WILTON 4	230	1.026
MINONG 5	161	1.018
		0.000

Bus Voltages		V,pu
Arrowhead	230	0.981
Badoura	115	1.023
Blackberry	230	1.020
Boise Cascade	13.8	1.054
Boise Cascade	115	1.022
ETCO	115	0.992
Forbes	230	1.002
Forbes	500	0.994
Hubbard	115	0.000
Intl Falls	115	1.023
Minntac	115	1.001
Moranville	230	1.009
Riverton	230	1.020
Running	230	1.011
Shannon	230	1.016
Stinson MN	115	1.000
Jamestown	345	1.002
Groton	345	1.004
Watertown	230	1.030
Watertown	345	1.024
		0.000
Dorsey	230	1.045
Dorsey	500	1.033
ALEX SS3	34	0.981
BRKNGCO3	345	1.027
PRAIRIE3	345	1.018
		0.000

Bus Voltages		V,kV
Whiteshell	110	118.9
Kenora	220	245.2
Dryden	220	249.6
Fort Frances	220	240.6
Mackenzie	220	251.8
Lakehead	220	245.8
Marathon	220	252.6
Wawa	220	254.6
Mississagi	220	250.6
Fort Frances	118	119.9
Lakehead	118	122.8
Birch	118	120.2
Marathon	118	124.7
		0.000
Arrowhead	345	1.003
Stone Lake	345	1.012
Stone Lake	161	1.025
Gardner Park	345	1.033
Weston	115	1.035
Arpin	345	0.996
Eau Claire	161	1.044
Council Creek	161	0.977
Hydro Lane	161	1.022
Wien	115	1.026
NROC	345	1.011
LYON CO	345	1.029
CASS LK4	230	1.029

Steady State Relay Margins (measured from inner blinder)

Relay Location	Manuf/Type	PSS Model	South	North	Em North
1) B10T-Tioga (South)	GE OST	SLLP	336%	N/A	N/A
2) -Tioga (North)	GE OST	SLLP	691%	N/A	N/A
3) -Tioga (Em North)	GE OST	SLLP		N/A	N/A
4) D602F-Dorsey	ATP ???	SLINOS	334%	N/A	N/A
5) -Forbes (Normal)	ATP ???	SLINOS	198%	N/A	N/A
6) -Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8) F3M-Intl Falls	APT S-PRO	SLINOS	319%	N/A	N/A
9) G82R-Rugby	APT	SLINOS	N/A	1938%	
10) L20D-Drayton (Normal)	APT, ASEA	SLINOS	1274%	N/A	N/A
11) -Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12) R50M-Moranville (Norm)	APT, West	SLINOS	887%	N/A	N/A
13) -Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

Appendix 3

Stability Reports

THU, OCT 18 2012 9:37

INITIATED AT LOAD FLOW ENTRY POINT ON THU, OCT 18 2012 9:37

T1E-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2218,MH=2178,MW=1660,OHMH=-196,OHMP=148,EWTW=187,BD=162

SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

SPECIAL RESPONSE FILES AND COMMENTS

RESPONSE FILES

None

COMMENTS

None

P O W E R F L O W S U M M A R Y

NDEX:	2218 MW	ECL-ARP:	793 MW
MHEX:	2178 MW	PRI-NRC:	751 MW
MWEX:	1660 MW	AHD-SLK:	726 MW
KING-ECL:	934 MW	SLK-GPK:	562 MW
COOPER S:	1233 MW	WNE-WKS:	576 MW
FTCAL S:	657 MW	GGS:	1770 MW
GRIS-LNC:	780 MW	QC WEST:	-140 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2662.5 MW,	84.4% OF	3156.0 MW
NSP	(AREA 600)	5412.5 MW,	45.5% OF	11889.2 MW
MAN HYDRO	(AREA 667)	2248.2 MW,	73.1% OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	2248/ 297	MH total gross	4914	ATC West Import	1716
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	597
NW	915/ 36	7 Sisters	170	ATC SE Import	-1197
Sask.	2150/ 82	OH total gross	21884	East Bias	225
MP	1840/ 222	northwest	717	SPC>WAPA (B10T)	162
NSP	5412/ 461	SPC total gross	2406	MH>SPC (3-230)	58
N. Dakota	2662/ 304	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3228	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	3058	OH>MP @Ft Fran	148
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	187
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	11629 MVARS	West gross	3010	F601C @Forbes	1319
NSP	1133 MVARS	net	2848	D602F @Dorsey	1793
N. Dakota	606 MVARS	Total net	4601	L20D @Letell	233
ATC	10046/ 346	WAPA SD Hydro	1497	R50M @Richer	141
ATC	3000 MVARS	Pleasant Valley	0	G82R @Glenboro	9
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	1039		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	369	ANTELOP-LELAND	119	CENTER-JAMESTN	503
STANTON- SQ BUT	-31	HETINGR-BISON	99	WILTON-CASS LK	32

CASS LK-BOSWELL	-25		BISON-ALEX SS3	326		ALEX SS-QUARRY	229
QUARRY-MNTCELO	86		BROOKNG-LYONCO	198		LYONCO-CEDARMT(T)	307
CEDARMT-HELENA(T)	257		LKMARN-HMPTCNR	8		HMPTCNR-NROC	533
NROC TR	175		NROC-NLAX	279		CNT-PRAIRIE 345	251
NROC-BYRON	815		LKFLDX-LAKEFLD3	29		AKPEXPORT	2755
ROSEAU CAP	1951	AMPS	PRI-NROC	7	ANG		
CENTER-JAMESTN	17	ANG	ECL-ARP	19	ANG		

Tfmrs	MVA/	Load	Ph Shifters	Deg/	MW	DC Lines	MW
Wshell #1 7-7	105/	73%	Stinson	27/	31	CU (1,2)	1128
Wshell #2 7-7	105/	73%	Boundary Dam	0/	163	SQ BU (3,4)	550
Drayton#1 4-7	49/	35%	Whiteshell	109/	200	MH Bipole 1	1514
Drayton#2 4-7	60/	32%	Int Falls	129/	148	MH Bipole 2	1715
Dorsey #1 2-4	621/	51%	St. Lawrence	16/	0	MH (BP1+BP2)	3230
Dorsey #2 2-4	719/	59%	Arrowhead	0/	726	Miles City E>W	-150
Forbes 2-4	183/	27%				RCDC (15)	0
Stone Lk 3-5	146/	43%				Stegall (10)	0

Dorsey SC's		I/S	MVAR	Qmax/ Qmin
MIL 7-9G	17.0	2	393	600/ -330
SCE 1-3G	18.2	3	320	480/ -240
SCA 4-6G	18.2	3	320	480/ -240
Total			1034	1560/ -810
Margin			526	

SVC's	MVAR	Qmax/ Qmin
Forbes	500	39 400/ -450
Fargo	13.2	-26 20/ -135
Watertown	20.0	31 125/ -86

Series Caps		Num In Serv
Roseau	500	2 of 2
Chisago	500	1 of 1

Caps/Reactors		MVAR	Caps/Reactors		MVAR	Caps/Reactors		MVAR
Balta (FS)	230	0	Arrowhead	230	160	Chisago T 9	34.5	60
Drayton	115	0	Blackberry	230	47	Chisago T 10	34.5	60
Drayton	13.8	-20	Minntac	115	45	Forbes	230	70
Eau Claire(FS)	161	267	Riverton	230	47	Forbes	500	600
Kohlman Lake	115	240	Roseau Co.(FS)	230	0			0
Parkers Lk(FS)	115	0	Running (FS)	230	30	Fargo	115	54
Prairie (FS)	115	0	Running react	230	0	Watertown	20	20
Ramsey (FS)	230	0	Shannon	230	72	Watertown	230	0
Red Rock	115	160			0			0
Rugby	13.8	0	Glenboro	230	0	Arrowhead	345	150
Split Rock(FS)	115	80	Laverendrye	110	98	Stone Lake	345	75
Sheyenne (FS)	115	40	Richer react	230	0	Stone Lk Reac	345	0
Wilton/Bemidji	115	20	St Vital	110	98	Stone Lake	161	20
		0			0	Grdnr Pk Reac	345	0
		0			0	Grdnr Pk Caps	115	0
		0			0	Arpin Caps	138	52
		0			0	Council Creek	138	16

Bus Voltages		V,pu	Bus Voltages		V,pu	Bus Voltages		V,kV
Adams	345	1.004	Arrowhead	230	0.998	Whiteshell	110	118.9
Alexandria	115	1.031	Badoura	115	1.039	Kenora	220	246.1
Audubon	115	1.043	Blackberry	230	1.029	Dryden	220	250.4
Bemidji	115	1.033	Boise Cascade	13.8	1.056	Fort Frances	220	243.0
Byron	345	1.010	Boise Cascade	115	1.024	Mackenzie	220	252.9
Chisago Co.	345	1.021	ETCO	115	1.007	Lakehead	220	246.1
Chisago Co.	500	1.019	Forbes	230	1.024	Marathon	220	252.8
Drayton	230	1.018	Forbes	500	1.021	Wawa	220	254.7
Eau Claire	345	0.967	Hubbard	115	0.000	Mississagi	220	250.6
WEST FARIBAULT	115	1.046	Intl Falls	115	1.025	Fort Frances	118	119.6

LaPorte	115	1.029	Minntac	115	1.015	Lakehead	118	122.8
Maple River	230	1.035	Moranville	230	1.016	Birch	118	120.2
Marshall Tap	115	1.052	Riverton	230	1.034	Marathon	118	124.8
Owatonna	161	1.011	Running	230	1.020			0.000
Prairie	115	1.023	Shannon	230	1.027	Arrowhead	345	1.015
Prairie	230	1.032	Stinson MN	115	1.011	Stone Lake	345	1.014
Ramsey	230	1.017	Jamestown	345	0.985	Stone Lake	161	1.019
Roseau County	230	1.016	Groton	345	1.018	Gardner Park	345	1.030
Roseau County	500	1.060	Watertown	230	1.030	Weston	115	1.035
Sheyenne	230	1.034	Watertown	345	1.029	Arpin	345	0.987
Thief R Falls	115	1.029			0.000	Eau Claire	161	1.019
Tioga	230	1.027	Dorsey	230	1.045	Council Creek	161	0.967
Wahpeton	230	1.028	Dorsey	500	1.045	Hydro Lane	161	1.001
Winger	115	1.045	ALEX SS3	34	1.008	Wien	115	1.032
WILTON 4	230	1.033	BRKNGCO3	345	1.033	NROC	345	1.009
MINONG 5	161	1.016	PRAIRIE3	345	1.010	LYON CO	345	1.037
		0.000			0.000	CASS LK4	230	1.036

Steady State Relay Margins (measured from inner blinder)

Relay Location	Manuf/Type	PSS Model	South	North	Em North
1) B10T-Tioga (South)	GE OST	SLLP	340%	N/A	N/A
2) -Tioga (North)	GE OST	SLLP	699%	N/A	N/A
3) -Tioga (Em North)	GE OST	SLLP		N/A	N/A
4) D602F-Dorsey	ATP ???	SLINOS	406%	N/A	N/A
5) -Forbes (Normal)	ATP ???	SLINOS	242%	N/A	N/A
6) -Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8) F3M-Intl Falls	APT S-PRO	SLINOS	330%	N/A	N/A
9) G82R-Rugby	APT	SLINOS	1127%	N/A	N/A
10) L20D-Drayton (Normal)	APT, ASEA	SLINOS	876%	N/A	N/A
11) -Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12) R50M-Moranville (Norm)	APT, West	SLINOS	926%	N/A	N/A
13) -Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

SIMULATION CHECKS FOLLOW:
+ _____

ITER	DELTAV/TOL	X------ AT BUS ------X	REAL(DELTAV)	IMAG(DELTAV)
1	170.637	66539 [WATERSVC20.000]	-0.4651E-04	-0.1642E-03
2	85.218	66539 [WATERSVC20.000]	-0.2311E-04	-0.8202E-04
3	14.316	66584 [SIDNEYW4230.00]	-0.1008E-04	0.1017E-04
4	4.867	66584 [SIDNEYW4230.00]	0.3432E-05	-0.3451E-05
5	1.664	66584 [SIDNEYW4230.00]	-0.1177E-05	0.1177E-05
6	0.558	66584 [SIDNEYW4230.00]	0.3905E-06	-0.3990E-06

REACHED TOLERANCE IN 6 ITERATIONS

LARGEST MISMATCH: 0.00 MW 0.00 MVAR 0.00 MVA AT BUS 14276 [6BASIN 230.00]
SYSTEM TOTAL ABSOLUTE MISMATCH: 0.28 MVA

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IEESGO AT BUS 67345 MACHINE 2 INITIALIZED OUT OF LIMITS

****

INITIAL CONDITION LOAD FLOW USED 6 ITERATIONS

****

INITIAL CONDITIONS SUSPECT:
I DSTATE(I) STATE(I) MODEL STATE BUS X--- NAME ---X ID

```
     9   0.11739E-01  0.74730
    10   -12.543       396.96
 19874   0.19803E-04  0.19407E-02  CIMTR3   K+4   67816  STLEONWG0.6000   1
 32164  -0.83804E-02  0.66600      IEEET1   K+1   66748  CENTER2G20.000   2
 32278   0.64474E-02 -0.30190      SCRX     K     67683  KET1-12G13.800   1
 42495  -0.66387E-01  0.19916E-01  IEESGO   K+1   67345  HESKET2G13.800   2
 42496  -0.39832      0.92992      IEESGO   K+2   67345  HESKET2G13.800   2
 44902  -0.47544E-02 -0.89628E-01  CIMTR3   K+1   60136  MAPLE R7115.00   1
 44905   0.19486E-03  0.63435E-02  CIMTR3   K+4   60136  MAPLE R7115.00   1
 51181  -0.38147E-01   0.0000      ESAC8B   K+2   61776  BOSWE71G14.400   1
 51186  -0.38147E-01   0.0000      ESAC8B   K+2   61777  BOSWE72G14.400   2
 52722   0.10950E-03  0.16257E-02  CIMTR3   K+4   67473  MMU SW 7115.00   WN
 54092  -0.37560E-04  0.26212E-02  CIMTR3   K     39870  FWDEC G10.5750   W
 54892  -0.15094E-03  0.14050E-01  IEEET1   K+1   39386  OK C G6 18.000   L
 57166   0.31320E-04  0.10993E-02  CIMTR3   K+4   35026  G426/53834.500   1
 57220  -0.10431E-01   0.0000      ESAC8B   K+2   61775  BOSWE44G22.800   4
 58516   0.26946E-04  0.22246E-02  CIMTR3   K+4   67825  STJOS1 W0.6900   1

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     LINE SWITCHING EVENTS FOLLOW:
+    ____________________________

     MHEB DC REDUCTIONS FOLLOW:
+    __________________________
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     NETWORK NOT CONVERGED FOLLOW:
+    ____________________________

     RELOUV AND RELOUF SWITCHING EVENTS FOLLOW:
+    __________________________________________

     DC SWITCHING EVENTS FOLLOW:
+    ___________________________

 AT TIME = 0.1000 DC LINE  1 MANUALLY BLOCKED
 AT TIME = 0.1000 DC LINE  2 MANUALLY BLOCKED
 AT TIME = 0.1667 DC LINE  1 MANUALLY UNBLOCKED
 AT TIME = 0.1667 DC LINE  2 MANUALLY UNBLOCKED

     VSCAN EVENTS FOLLOW:
+    ____________________

 AT TIME =  0.500 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO

 AT TIME =  0.500 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO
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 AT TIME =  0.508 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO

 AT TIME =  0.517 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO

 AT TIME =  0.525 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.533 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.542 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.550 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.558 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.567 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.575 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.583 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.592 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO
1*** t1e-so16aa-pcs                                        Page   5

 AT TIME =  0.600 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.608 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.617 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.625 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.633 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO
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 AT TIME =  0.642 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.650 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.658 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.667 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.675 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.79   LO

 AT TIME =  0.683 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.692 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.700 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.708 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.717 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.725 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.733 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO

 AT TIME =  0.742 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO
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 AT TIME =  0.750 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO

 AT TIME =  0.758 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO

 AT TIME =  0.767 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO

 AT TIME =  0.775 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
```

```
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO


     PI 4 KV EVENTS FOLLOW:
+    ______________________

 ++++ PRICR:VOLTAGE AT BUS 60670[PI2 RCP94.00] DROPPED BELOW
      SETPOINT OF 0.7800 PU AT 0.2833 SEC
 ++++ PRICR:AT TIME = 0.3000 SEC, VOLTAGE AT BUS 60670[PI2 RCP9â•••] INCREASED
      ABOVE RESET VOLTAGE OF 0.8000. VOLTAGE WAS BELOW RESET VOLTAGE FOR
      0.0167


     RELAY SCAN EVENTS FOLLOW:
+    _________________________



     FARGO/WATERTOWN SVS EVENTS FOLLOW:
+    __________________________________

 AT TIME= 2.9916 CFGSVC: (1) 27.1 MVAR BSC(S) REMOVED AT BUS  66436 [FARGO  7]


     UDHOLD EVENTS FOLLOW:
+    _____________________



     DYNAMIC VOLTAGE CHECKS FOLLOW:
+    ______________________________

         FROM TIME      0.4000 TO TIME      5.0000

                          PU VOLT                                   VMAX
+                         _   ___
 CHAN                     MAX   MIN       MINIMUM        MAXIMUM     LESS
+                                         __________     __________
  NO.    DESCRIPTION      .LT.  .GT.     VOLT  TIME     VOLT  TIME    VMIN
+
 ----   -------------    ----------      ----  ----     ----  ----    ----
+<<<<   <<<<<<<<<<<<     <<<<<<<<<<      <<<<  <<<<     <<<<  <<<<    <<<<
  444   67503 DORSEY     1.25  0.70      1.03  0.85     1.07  0.42    0.04
  386   61624 FORBES     1.15  0.82      1.00  2.37     1.03  0.42    0.03
  384   61615 ARROWHD    1.15  0.82      0.83  0.57     0.95  3.29    0.12
  382   61612 RIVERTN    1.15  0.75      1.00  0.47     1.04  3.32    0.04
  362   66752 DRAYTON    1.20  0.80      1.00  1.60     1.03  3.37    0.03
  562   63229 WAHPETN    1.18  0.80      1.01  0.42     1.06  2.15    0.05
  ***   61631 MINONG5    1.20  0.82      0.79  0.60     0.95  2.60    0.16
  542   63369 JAMESTN    1.20  0.70      0.94  0.42     1.01  2.15    0.07
  390   63041 COAL CR    1.18  0.70      0.97  0.42     1.07  0.75    0.10
  334   66529 WATERTN    1.18  0.75      0.99  0.52     1.04  2.20    0.05
  360   67160 GROTON     1.15  0.70      0.96  0.52     1.03  2.20    0.07
  553   61754 BOISE      1.15  0.82      1.02  1.48     1.05  0.42    0.03
 ----   -------------    ----------      ----  ----     ----  ----    ----
+>>>>   >>>>>>>>>>>>>    >>>>>>>>>>      >>>>  >>>>     >>>>  >>>>    >>>>
  ***   61631 MINONG5    0.82  1.20      0.79  0.60


     POWERFLOW WARNINGS AT END OF SIMULATION FOLLOW:
+    _______________________________________________

BUSES WITH VOLTAGE GREATER THAN 1.1000:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
67554 SLAVEFL7 121 667 1.1001 133.11    67648 POINTD27 121 667 1.1036 133.54
67770 SK1 SUB7 110 667 1.1413 125.54    67771 STAR LK7 110 667 1.1397 125.37
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67772 BRERTON7 110 667 1.1411 125.52

BUSES WITH VOLTAGE LESS THAN 0.9500:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
60290 ST LAKE5 161 600 0.9022 145.25    60291 INOPUMP7 115 600 0.9315 107.12
1*** t1e-so16aa-pcs                                          Page   7

60292 IRONRIV7 115 600 0.9279 106.71    60293 FRMSINN5 161 600 0.9064 145.94
60294 GINGLES5 161 600 0.9327 150.16    60295 BAYFRNT7 115 600 0.9422 108.35
60350 GINGLES7 115 600 0.9411 108.23    60511 LAW CRK7 115 600 0.9497 109.21
60512 LAW CRK5 161 600 0.9426 151.76    61051 STCROIG7 161 600 0.9413 151.54
61554 AWHD1JCT 115 608 0.9297 106.92    61556 AWHD2JCT 115 608 0.9298 106.93
61570 STINSJCT 115 608 0.9279 106.70    61576 HILTPJCT 115 608 0.9279 106.70
61614 98L TAP4 230 608 0.9156 210.58    61615 ARROWHD4 230 608 0.9146 210.37
61616 HILLTOP4 230 608 0.9162 210.73    61630 STINSON5 161 608 0.9244 148.82
61631 MINONG 5 161 608 0.9074 146.09    61632 DAHLBRG7 115 608 0.9253 106.42
61672 HILLTOP7 115 608 0.9256 106.44    61673 ARROWHD7 115 608 0.9261 106.50
61674 HANESRD7 115 608 0.9262 106.52    61675 RIDGEVW7 115 608 0.9287 106.80
61676 HIBBARD7 115 608 0.9272 106.63    61678 NEMADJI7 115 608 0.9272 106.63
61679 GARY   7 115 608 0.9238 106.23    61680 WNTR ST7 115 608 0.9255 106.43
61681 LSPI   7 115 608 0.9269 106.60    61683 STIN-MN7 115 608 0.9274 106.65
   *** BUS UNDERVOLTAGE SEARCH TERMINATED AT 15 RECORDS ***

 BRANCH CURRENT LOADINGS ABOVE 100.0 % OF RATING SET A
+
X-------FROM BUS-------X  X--------TO BUS--------X       CURRENT(MVA)
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
61666  FONDULAC 115  608  61676* HIBBARD7 115  608  1     64.5    40.0   161.2
61721* ETCO   7 115  608  61722  FORBES 7 115  608  1     98.2    98.0   100.2
69507* SENECA 5 161  680  69508  GRANGRAE 161  680  1    214.8   201.0   106.9
69507* SENECA 5 161  680  69523  GENOA  5 161  680  1    367.8   302.0   121.8

 TRANSFORMER MVA LOADINGS ABOVE 100.0 % OF RATING SET A
+
```

WED, NOV 28 2012 0:00

INITIATED AT LOAD FLOW ENTRY POINT ON WED, NOV 28 2012 0:01

T1E-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2218,MH=2178,MW=1660,OHMH=-196,OHMP=148,EWTW=187,BD=162

4 CYCLE, THREE PHASE FAULT AT CHISAGO TRIP F601C, XTRIP D60
USE NEW 100% REDUCTION INIT FROM CHISAGO, LEAVE SVS ON MP S

SPECIAL RESPONSE FILES AND COMMENTS

RESPONSE FILES

None

COMMENTS

None

P O W E R F L O W S U M M A R Y

NDEX:	2218 MW	ECL-ARP:	793 MW
MHEX:	2178 MW	PRI-NRC:	751 MW
MWEX:	1660 MW	AHD-SLK:	726 MW
KING-ECL:	934 MW	SLK-GPK:	562 MW
COOPER S:	1233 MW	WNE-WKS:	576 MW
FTCAL S:	657 MW	GGS:	1770 MW
GRIS-LNC:	780 MW	QC WEST:	-140 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2662.5 MW,	84.4% OF	3156.0 MW
NSP	(AREA 600)	5412.5 MW,	45.5% OF	11889.2 MW
MAN HYDRO	(AREA 667)	2248.2 MW,	73.1% OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	2248/ 297	MH total gross	4914	ATC West Import	1716
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	597
NW	915/ 36	7 Sisters	170	ATC SE Import	-1197
Sask.	2150/ 82	OH total gross	21884	East Bias	225
MP	1840/ 222	northwest	717	SPC>WAPA (B10T)	162
NSP	5412/ 461	SPC total gross	2406	MH>SPC (3-230)	58
N. Dakota	2662/ 304	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3228	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	3058	OH>MP @Ft Fran	148
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	187
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	11629 MVARS	West gross	3010	F601C @Forbes	1319
NSP	1133 MVARS	net	2848	D602F @Dorsey	1793
N. Dakota	606 MVARS	Total net	4601	L20D @Letell	233
ATC	10046/ 346	WAPA SD Hydro	1497	R50M @Richer	141
ATC	3000 MVARS	Pleasant Valley	0	G82R @Glenboro	9
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	1039		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	369	ANTELOP-LELAND	119	CENTER-JAMESTN	503
STANTON- SQ BUT	-31	HETINGR-BISON	99	WILTON-CASS LK	32

CASS LK-BOSWELL	-25		BISON-ALEX SS3	326		ALEX SS-QUARRY	229
QUARRY-MNTCELO	86		BROOKNG-LYONCO	198		LYONCO-CEDARMT(T)	307
CEDARMT-HELENA(T)	257		LKMARN-HMPTCNR	8		HMPTCNR-NROC	533
NROC TR	175		NROC-NLAX	279		CNT-PRAIRIE 345	251
NROC-BYRON	815		LKFLDX-LAKEFLD3	29		AKPEXPORT	2755
ROSEAU CAP	1951	AMPS	PRI-NROC	7	ANG		
CENTER-JAMESTN	17	ANG	ECL-ARP	19	ANG		

Tfmrs	MVA/	Load	Ph Shifters	Deg/	MW	DC Lines	MW
Wshell #1 7-7	105/	73%	Stinson	27/	31	CU (1,2)	1128
Wshell #2 7-7	105/	73%	Boundary Dam	0/	163	SQ BU (3,4)	550
Drayton#1 4-7	49/	35%	Whiteshell	109/	200	MH Bipole 1	1514
Drayton#2 4-7	60/	32%	Int Falls	129/	148	MH Bipole 2	1715
Dorsey #1 2-4	621/	51%	St. Lawrence	16/	0	MH (BP1+BP2)	3230
Dorsey #2 2-4	719/	59%	Arrowhead	0/	726	Miles City E>W	-150
Forbes 2-4	183/	27%				RCDC (15)	0
Stone Lk 3-5	146/	43%				Stegall (10)	0

Dorsey SC's		I/S	MVAR	Qmax/	Qmin	SVC's	MVAR	Qmax/	Qmin
MIL 7-9G	17.0	2	393	600/	-330	Forbes	500	39	400/ -450
SCE 1-3G	18.2	3	320	480/	-240	Fargo	13.2	-26	20/ -135
SCA 4-6G	18.2	3	320	480/	-240	Watertown	20.0	31	125/ -86
Total			1034	1560/	-810	Series Caps		Num In Serv	
Margin			526			Roseau	500	2 of 2	
						Chisago	500	1 of 1	

Caps/Reactors		MVAR	Caps/Reactors		MVAR	Caps/Reactors		MVAR
Balta (FS)	230	0	Arrowhead	230	160	Chisago T 9	34.5	60
Drayton	115	0	Blackberry	230	47	Chisago T 10	34.5	60
Drayton	13.8	-20	Minntac	115	45	Forbes	230	70
Eau Claire(FS)	161	267	Riverton	230	47	Forbes	500	600
Kohlman Lake	115	240	Roseau Co.(FS)	230	0			0
Parkers Lk(FS)	115	0	Running (FS)	230	30	Fargo	115	54
Prairie (FS)	115	0	Running react	230	0	Watertown	20	20
Ramsey (FS)	230	0	Shannon	230	72	Watertown	230	0
Red Rock	115	160			0			0
Rugby	13.8	0	Glenboro	230	0	Arrowhead	345	150
Split Rock(FS)	115	80	Laverendrye	110	98	Stone Lake	345	75
Sheyenne (FS)	115	40	Richer react	230	0	Stone Lk Reac	345	0
Wilton/Bemidji	115	20	St Vital	110	98	Stone Lake	161	20
		0			0	Grdnr Pk Reac	345	0
		0			0	Grdnr Pk Caps	115	0
		0			0	Arpin Caps	138	52
		0			0	Council Creek	138	16

Bus Voltages		V,pu	Bus Voltages		V,pu	Bus Voltages		V,kV
Adams	345	1.004	Arrowhead	230	0.998	Whiteshell	110	118.9
Alexandria	115	1.031	Badoura	115	1.039	Kenora	220	246.1
Audubon	115	1.043	Blackberry	230	1.029	Dryden	220	250.4
Bemidji	115	1.033	Boise Cascade	13.8	1.056	Fort Frances	220	243.0
Byron	345	1.010	Boise Cascade	115	1.024	Mackenzie	220	252.9
Chisago Co.	345	1.021	ETCO	115	1.007	Lakehead	220	246.1
Chisago Co.	500	1.019	Forbes	230	1.024	Marathon	220	252.8
Drayton	230	1.018	Forbes	500	1.021	Wawa	220	254.7
Eau Claire	345	0.967	Hubbard	115	0.000	Mississagi	220	250.6
WEST FARIBAULT	115	1.046	Intl Falls	115	1.025	Fort Frances	118	119.6

LaPorte	115	1.029	Minntac	115	1.015	Lakehead	118	122.8
Maple River	230	1.035	Moranville	230	1.016	Birch	118	120.2
Marshall Tap	115	1.052	Riverton	230	1.034	Marathon	118	124.8
Owatonna	161	1.011	Running	230	1.020			0.000
Prairie	115	1.023	Shannon	230	1.027	Arrowhead	345	1.015
Prairie	230	1.032	Stinson MN	115	1.011	Stone Lake	345	1.014
Ramsey	230	1.017	Jamestown	345	0.985	Stone Lake	161	1.019
Roseau County	230	1.016	Groton	345	1.018	Gardner Park	345	1.030
Roseau County	500	1.060	Watertown	230	1.030	Weston	115	1.035
Sheyenne	230	1.034	Watertown	345	1.029	Arpin	345	0.987
Thief R Falls	115	1.029			0.000	Eau Claire	161	1.019
Tioga	230	1.027	Dorsey	230	1.045	Council Creek	161	0.967
Wahpeton	230	1.028	Dorsey	500	1.045	Hydro Lane	161	1.001
Winger	115	1.045	ALEX SS3	34	1.008	Wien	115	1.032
WILTON 4	230	1.033	BRKNGCO3	345	1.033	NROC	345	1.009
MINONG 5	161	1.016	PRAIRIE3	345	1.010	LYON CO	345	1.037
		0.000			0.000	CASS LK4	230	1.036

Steady State Relay Margins (measured from inner blinder)

Relay Location	Manuf/Type	PSS Model	South	North	Em North
1) B10T-Tioga (South)	GE OST	SLLP	340%	N/A	N/A
2) -Tioga (North)	GE OST	SLLP	699%	N/A	N/A
3) -Tioga (Em North)	GE OST	SLLP		N/A	N/A
4) D602F-Dorsey	ATP ???	SLINOS	406%	N/A	N/A
5) -Forbes (Normal)	ATP ???	SLINOS	242%	N/A	N/A
6) -Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8) F3M-Intl Falls	APT S-PRO	SLINOS	330%	N/A	N/A
9) G82R-Rugby	APT	SLINOS	1127%	N/A	N/A
10) L20D-Drayton (Normal)	APT, ASEA	SLINOS	876%	N/A	N/A
11) -Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12) R50M-Moranville (Norm)	APT, West	SLINOS	926%	N/A	N/A
13) -Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

SIMULATION CHECKS FOLLOW:
+ _____

ITER	DELTAV/TOL	X------ AT BUS ------X	REAL(DELTAV)	IMAG(DELTAV)
1	170.637	66539 [WATERSVC20.000]	-0.4651E-04	-0.1642E-03
2	85.218	66539 [WATERSVC20.000]	-0.2311E-04	-0.8202E-04
3	14.316	66584 [SIDNEYW4230.00]	-0.1008E-04	0.1017E-04
4	4.867	66584 [SIDNEYW4230.00]	0.3432E-05	-0.3451E-05
5	1.664	66584 [SIDNEYW4230.00]	-0.1177E-05	0.1177E-05
6	0.558	66584 [SIDNEYW4230.00]	0.3905E-06	-0.3990E-06

REACHED TOLERANCE IN 6 ITERATIONS

LARGEST MISMATCH: 0.00 MW 0.00 MVAR 0.00 MVA AT BUS 14276 [6BASIN 230.00]
SYSTEM TOTAL ABSOLUTE MISMATCH: 0.28 MVA

****

IEESGO AT BUS 67345 MACHINE 2 INITIALIZED OUT OF LIMITS

****

INITIAL CONDITION LOAD FLOW USED 6 ITERATIONS

****

INITIAL CONDITIONS SUSPECT:
I DSTATE(I) STATE(I) MODEL STATE BUS X--- NAME ---X ID

```
     9   0.11739E-01  0.74730
    10   -12.543       396.96
 19874   0.19803E-04  0.19407E-02  CIMTR3   K+4   67816  STLEONWG0.6000   1
 32164  -0.83804E-02  0.66600      IEEET1   K+1   66748  CENTER2G20.000   2
 32278   0.64474E-02 -0.30190      SCRX     K     67683  KET1-12G13.800   1
 42495  -0.66387E-01  0.19916E-01  IEESGO   K+1   67345  HESKET2G13.800   2
 42496  -0.39832      0.92992      IEESGO   K+2   67345  HESKET2G13.800   2
 44902  -0.47544E-02 -0.89628E-01  CIMTR3   K+1   60136  MAPLE R7115.00   1
 44905   0.19486E-03  0.63435E-02  CIMTR3   K+4   60136  MAPLE R7115.00   1
 51181  -0.38147E-01   0.0000      ESAC8B   K+2   61776  BOSWE71G14.400   1
 51186  -0.38147E-01   0.0000      ESAC8B   K+2   61777  BOSWE72G14.400   2
 52722   0.10950E-03  0.16257E-02  CIMTR3   K+4   67473  MMU SW 7115.00   WN
 54092  -0.37560E-04  0.26212E-02  CIMTR3   K     39870  FWDEC G10.5750   W
 54892  -0.15094E-03  0.14050E-01  IEEET1   K+1   39386  OK C G6 18.000   L
 57166   0.31320E-04  0.10993E-02  CIMTR3   K+4   35026  G426/53834.500   1
 57220  -0.10431E-01   0.0000      ESAC8B   K+2   61775  BOSWE44G22.800   4
 58516   0.26946E-04  0.22246E-02  CIMTR3   K+4   67825  STJOS1 W0.6900   1

 ****************************************************************************

 ****************************************************************************

     LINE SWITCHING EVENTS FOLLOW:
+    ____________________________


     MHEB DC REDUCTIONS FOLLOW:
+    _________________________
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```
 TIE LINE FROM 67503 TO 67700 CKT  2 TRIPPED AT  0.1500s *** INITIATING DC
 REDUCTION ***
 DC WILL BE REDUCED BY   1937.51 MW


     NETWORK NOT CONVERGED FOLLOW:
+    ____________________________


     RELOUV AND RELOUF SWITCHING EVENTS FOLLOW:
+    ___________________________________________

 *** SHUNT AT BUS67565 MODIFIED FROM    73.40 TO     0.00    BY RELOUV (OVER )
                 AT TIME =   0.3667 SECS.
 *** SHUNT AT BUS67503 MODIFIED FROM   755.60 TO   496.00    BY RELOUV (OVER )
                 AT TIME =   0.7750 SECS.


     DC SWITCHING EVENTS FOLLOW:
+    ___________________________

 AT TIME = 0.1000 DC LINE  1 MANUALLY BLOCKED
 AT TIME = 0.1000 DC LINE  2 MANUALLY BLOCKED
 AT TIME = 0.1583 DC LINE  1 MANUALLY UNBLOCKED
 AT TIME = 0.1583 DC LINE  2 MANUALLY UNBLOCKED


     VSCAN EVENTS FOLLOW:
+    ___________________
```

```
 AT TIME =  0.408 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67621 [RIEL   2 500] 1.21   HI

 AT TIME =  1.975 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI

 AT TIME =  1.983 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI

 AT TIME =  1.992 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI


     PI 4 KV EVENTS FOLLOW:
+    ______________________

 ++++ PRICR:VOLTAGE AT BUS 60670[PI2 RCP94.00] DROPPED BELOW
      SETPOINT OF 0.7800 PU AT 0.1167 SEC
 ++++ PRICR:VOLTAGE AT BUS 60667[PI1 RCP94.00] DROPPED BELOW
      SETPOINT OF 0.7800 PU AT 0.1250 SEC
 ++++ PRICR:AT TIME = 0.1667 SEC, VOLTAGE AT BUS 60667[PI1 RCP9â•••] INCREASED
      ABOVE RESET VOLTAGE OF 0.8000. VOLTAGE WAS BELOW RESET VOLTAGE FOR
      0.0417
 ++++ PRICR:AT TIME = 0.1667 SEC, VOLTAGE AT BUS 60670[PI2 RCP9â•••] INCREASED
      ABOVE RESET VOLTAGE OF 0.8000. VOLTAGE WAS BELOW RESET VOLTAGE FOR
      0.0500


     RELAY SCAN EVENTS FOLLOW:
+    _________________________



     FARGO/WATERTOWN SVS EVENTS FOLLOW:
+    __________________________________



     UDHOLD EVENTS FOLLOW:
+    _____________________

 UDHOLD FUNCTION AT BUS 3404 APPLIED AT TIME =  0.1333SEC
 UDHOLD FUNCTION AT BUS 3404 RESET AT TIME =  0.2500SEC


     DYNAMIC VOLTAGE CHECKS FOLLOW:
+    ______________________________
```

1*** t1e-so16aa-nmz Page 5

FROM TIME 0.4000 TO TIME 5.0000

CHAN NO.	DESCRIPTION	PU VOLT MAX .LT.	PU VOLT MIN .GT.	MINIMUM VOLT	MINIMUM TIME	MAXIMUM VOLT	MAXIMUM TIME	VMAX LESS VMIN
----	----------	----------		----	----	----	----	----
<<<<	<<<<<<<<<<<<	<<<<<<<<<<		<<<<	<<<<	<<<<	<<<<	<<<<
444	67503 DORSEY	1.25	0.70	1.04	0.80	1.18	0.42	0.14
386	61624 FORBES	1.15	0.82	1.00	0.53	1.04	2.95	0.04
384	61615 ARROWHD	1.15	0.82	0.96	0.42	1.05	0.93	0.09

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  382   61612 RIVERTN   1.15  0.75     0.96  0.46     1.08  1.27    0.12
  362   66752 DRAYTON   1.20  0.80     0.99  0.56     1.07  2.08    0.08
  562   63229 WAHPETN   1.18  0.80     0.94  0.51     1.10  1.27    0.16
  ***   61631 MINONG5   1.20  0.82     1.00  0.42     1.09  0.87    0.09
  542   63369 JAMESTN   1.20  0.70     0.85  0.51     1.04  1.27    0.19
  390   63041 COAL CR   1.18  0.70     0.96  0.42     1.09  1.18    0.13
  334   66529 WATERTN   1.18  0.75     0.95  0.51     1.07  1.22    0.12
  360   67160 GROTON    1.15  0.70     0.90  0.56     1.08  1.24    0.18
  553   61754 BOISE     1.15  0.82     0.95  0.76     1.05  1.87    0.10


     POWERFLOW WARNINGS AT END OF SIMULATION FOLLOW:
+    ______________________________________________

BUSES WITH VOLTAGE GREATER THAN 1.1000:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
67533 ST.JAME7 110 667 1.1071 121.78    67536 GREATFL7 110 667 1.1087 121.95
67537 MCARTHR7 110 667 1.1053 121.58    67538 7SISTER7 110 667 1.1131 122.44
67539 LACDUBN7 110 667 1.1092 122.01    67553 POINTDB7 121 667 1.1242 136.03
67554 SLAVEFL7 121 667 1.1257 136.21    67556 WHTSL1 4 220 667 1.1149 245.28
67580 SHERBK 7 110 667 1.1094 122.03    67589 WHTSL2 4 220 667 1.1149 245.27
67621 RIEL   2 500 667 1.1012 550.60    67648 POINTD27 121 667 1.1289 136.60
67705 WHSL2PH7 110 667 1.1226 123.49    67706 WHITESH7 110 667 1.1126 122.38
67734 SK1  TP7 110 667 1.1129 122.42    67751 WHSL1PH7 110 667 1.1226 123.49
67755 SHBK-PH7 110 667 1.1315 124.47    67769 SR3SW3T7 110 667 1.1130 122.43
67770 SK1 SUB7 110 667 1.1798 129.78    67771 STAR LK7 110 667 1.1783 129.61
67772 BRERTON7 110 667 1.1797 129.76    67774 SG12 TP7 110 667 1.1099 122.09
67775 BEAUSJ 7 110 667 1.1075 121.83

BUSES WITH VOLTAGE LESS THAN 0.9500:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)


 BRANCH CURRENT LOADINGS ABOVE 100.0 % OF RATING SET A
+
X-------FROM BUS-------X  X--------TO BUS--------X       CURRENT(MVA)
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT


 TRANSFORMER MVA LOADINGS ABOVE 100.0 % OF RATING SET A
+
X-------FROM BUS-------X  X--------TO BUS--------X       MVA      MVA
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
61752* I.FALLS7 118  608  61784  INTPHAS7 118  608  1    180.4   180.0   100.2
```

WED, NOV 28 2012 0:42

INITIATED AT LOAD FLOW ENTRY POINT ON WED, NOV 28 2012 0:43

T1E-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2218,MH=2178,MW=1660,OHMH=-196,OHMP=148,EWTW=187,BD=162

4 CYCLE 3 PHASE FAULT AT FORBES 500 KV POST MMTU
CLEAR THE FORBES - DORSEY 500 KV LINE

SPECIAL RESPONSE FILES AND COMMENTS
--- --- --- --- ---

RESPONSE FILES
--- ---
None

COMMENTS

None

P O W E R F L O W S U M M A R Y

NDEX:	2218 MW	ECL-ARP:	793 MW
MHEX:	2178 MW	PRI-NRC:	751 MW
MWEX:	1660 MW	AHD-SLK:	726 MW
KING-ECL:	934 MW	SLK-GPK:	562 MW
COOPER S:	1233 MW	WNE-WKS:	576 MW
FTCAL S:	657 MW	GGS:	1770 MW
GRIS-LNC:	780 MW	QC WEST:	-140 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2662.5 MW,	84.4% OF	3156.0 MW
NSP	(AREA 600)	5412.5 MW,	45.5% OF	11889.2 MW
MAN HYDRO	(AREA 667)	2248.2 MW,	73.1% OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	2248/ 297	MH total gross	4914	ATC West Import	1716
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	597
NW	915/ 36	7 Sisters	170	ATC SE Import	-1197
Sask.	2150/ 82	OH total gross	21884	East Bias	225
MP	1840/ 222	northwest	717	SPC>WAPA (B10T)	162
NSP	5412/ 461	SPC total gross	2406	MH>SPC (3-230)	58
N. Dakota	2662/ 304	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3228	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	3058	OH>MP @Ft Fran	148
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	187
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	11629 MVARS	West gross	3010	F601C @Forbes	1319
NSP	1133 MVARS	net	2848	D602F @Dorsey	1793
N. Dakota	606 MVARS	Total net	4601	L20D @Letell	233
ATC	10046/ 346	WAPA SD Hydro	1497	R50M @Richer	141
ATC	3000 MVARS	Pleasant Valley	0	G82R @Glenboro	9
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	1039		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	369	ANTELOP-LELAND	119	CENTER-JAMESTN	503
STANTON- SQ BUT	-31	HETINGR-BISON	99	WILTON-CASS LK	32

CASS LK-BOSWELL	-25		BISON-ALEX SS3	326		ALEX SS-QUARRY	229
QUARRY-MNTCELO	86		BROOKNG-LYONCO	198		LYONCO-CEDARMT(T)	307
CEDARMT-HELENA(T)	257		LKMARN-HMPTCNR	8		HMPTCNR-NROC	533
NROC TR	175		NROC-NLAX	279		CNT-PRAIRIE 345	251
NROC-BYRON	815		LKFLDX-LAKEFLD3	29		AKPEXPORT	2755
ROSEAU CAP	1951	AMPS	PRI-NROC	7	ANG		
CENTER-JAMESTN	17	ANG	ECL-ARP	19	ANG		

Tfmrs	MVA/	Load	Ph Shifters	Deg/	MW	DC Lines	MW
Wshell #1 7-7	105/	73%	Stinson	27/	31	CU (1,2)	1128
Wshell #2 7-7	105/	73%	Boundary Dam	0/	163	SQ BU (3,4)	550
Drayton#1 4-7	49/	35%	Whiteshell	109/	200	MH Bipole 1	1514
Drayton#2 4-7	60/	32%	Int Falls	129/	148	MH Bipole 2	1715
Dorsey #1 2-4	621/	51%	St. Lawrence	16/	0	MH (BP1+BP2)	3230
Dorsey #2 2-4	719/	59%	Arrowhead	0/	726	Miles City E>W	-150
Forbes 2-4	183/	27%				RCDC (15)	0
Stone Lk 3-5	146/	43%				Stegall (10)	0

Dorsey SC's		I/S	MVAR	Qmax/	Qmin	SVC's	MVAR	Qmax/	Qmin
MIL 7-9G	17.0	2	393	600/	-330	Forbes	500	39	400/ -450
SCE 1-3G	18.2	3	320	480/	-240	Fargo	13.2	-26	20/ -135
SCA 4-6G	18.2	3	320	480/	-240	Watertown	20.0	31	125/ -86
Total			1034	1560/	-810	Series Caps		Num In Serv	
Margin			526			Roseau	500	2 of 2	
						Chisago	500	1 of 1	

Caps/Reactors		MVAR	Caps/Reactors		MVAR	Caps/Reactors		MVAR
Balta (FS)	230	0	Arrowhead	230	160	Chisago T 9	34.5	60
Drayton	115	0	Blackberry	230	47	Chisago T 10	34.5	60
Drayton	13.8	-20	Minntac	115	45	Forbes	230	70
Eau Claire(FS)	161	267	Riverton	230	47	Forbes	500	600
Kohlman Lake	115	240	Roseau Co.(FS)	230	0			0
Parkers Lk(FS)	115	0	Running (FS)	230	30	Fargo	115	54
Prairie (FS)	115	0	Running react	230	0	Watertown	20	20
Ramsey (FS)	230	0	Shannon	230	72	Watertown	230	0
Red Rock	115	160			0			0
Rugby	13.8	0	Glenboro	230	0	Arrowhead	345	150
Split Rock(FS)	115	80	Laverendrye	110	98	Stone Lake	345	75
Sheyenne (FS)	115	40	Richer react	230	0	Stone Lk Reac	345	0
Wilton/Bemidji	115	20	St Vital	110	98	Stone Lake	161	20
		0			0	Grdnr Pk Reac	345	0
		0			0	Grdnr Pk Caps	115	0
		0			0	Arpin Caps	138	52
		0			0	Council Creek	138	16

Bus Voltages		V,pu	Bus Voltages		V,pu	Bus Voltages		V,kV
Adams	345	1.004	Arrowhead	230	0.998	Whiteshell	110	118.9
Alexandria	115	1.031	Badoura	115	1.039	Kenora	220	246.1
Audubon	115	1.043	Blackberry	230	1.029	Dryden	220	250.4
Bemidji	115	1.033	Boise Cascade	13.8	1.056	Fort Frances	220	243.0
Byron	345	1.010	Boise Cascade	115	1.024	Mackenzie	220	252.9
Chisago Co.	345	1.021	ETCO	115	1.007	Lakehead	220	246.1
Chisago Co.	500	1.019	Forbes	230	1.024	Marathon	220	252.8
Drayton	230	1.018	Forbes	500	1.021	Wawa	220	254.7
Eau Claire	345	0.967	Hubbard	115	0.000	Mississagi	220	250.6
WEST FARIBAULT	115	1.046	Intl Falls	115	1.025	Fort Frances	118	119.6

LaPorte	115	1.029	Minntac	115	1.015	Lakehead	118	122.8
Maple River	230	1.035	Moranville	230	1.016	Birch	118	120.2
Marshall Tap	115	1.052	Riverton	230	1.034	Marathon	118	124.8
Owatonna	161	1.011	Running	230	1.020			0.000
Prairie	115	1.023	Shannon	230	1.027	Arrowhead	345	1.015
Prairie	230	1.032	Stinson MN	115	1.011	Stone Lake	345	1.014
Ramsey	230	1.017	Jamestown	345	0.985	Stone Lake	161	1.019
Roseau County	230	1.016	Groton	345	1.018	Gardner Park	345	1.030
Roseau County	500	1.060	Watertown	230	1.030	Weston	115	1.035
Sheyenne	230	1.034	Watertown	345	1.029	Arpin	345	0.987
Thief R Falls	115	1.029			0.000	Eau Claire	161	1.019
Tioga	230	1.027	Dorsey	230	1.045	Council Creek	161	0.967
Wahpeton	230	1.028	Dorsey	500	1.045	Hydro Lane	161	1.001
Winger	115	1.045	ALEX SS3	34	1.008	Wien	115	1.032
WILTON 4	230	1.033	BRKNGCO3	345	1.033	NROC	345	1.009
MINONG 5	161	1.016	PRAIRIE3	345	1.010	LYON CO	345	1.037
		0.000			0.000	CASS LK4	230	1.036

Steady State Relay Margins (measured from inner blinder)

Relay Location	Manuf/Type	PSS Model	South	North	Em North
1) B10T-Tioga (South)	GE OST	SLLP	340%	N/A	N/A
2) -Tioga (North)	GE OST	SLLP	699%	N/A	N/A
3) -Tioga (Em North)	GE OST	SLLP		N/A	N/A
4) D602F-Dorsey	ATP ???	SLINOS	406%	N/A	N/A
5) -Forbes (Normal)	ATP ???	SLINOS	242%	N/A	N/A
6) -Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8) F3M-Intl Falls	APT S-PRO	SLINOS	330%	N/A	N/A
9) G82R-Rugby	APT	SLINOS	1127%	N/A	N/A
10) L20D-Drayton (Normal)	APT, ASEA	SLINOS	876%	N/A	N/A
11) -Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12) R50M-Moranville (Norm)	APT, West	SLINOS	926%	N/A	N/A
13) -Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

SIMULATION CHECKS FOLLOW:

+ _____

ITER	DELTAV/TOL	X------ AT BUS ------X	REAL(DELTAV)	IMAG(DELTAV)
1	170.637	66539 [WATERSVC20.000]	-0.4651E-04	-0.1642E-03
2	85.218	66539 [WATERSVC20.000]	-0.2311E-04	-0.8202E-04
3	14.316	66584 [SIDNEYW4230.00]	-0.1008E-04	0.1017E-04
4	4.867	66584 [SIDNEYW4230.00]	0.3432E-05	-0.3451E-05
5	1.664	66584 [SIDNEYW4230.00]	-0.1177E-05	0.1177E-05
6	0.558	66584 [SIDNEYW4230.00]	0.3905E-06	-0.3990E-06

REACHED TOLERANCE IN 6 ITERATIONS

LARGEST MISMATCH: 0.00 MW 0.00 MVAR 0.00 MVA AT BUS 14276 [6BASIN 230.00]
SYSTEM TOTAL ABSOLUTE MISMATCH: 0.28 MVA

****

IEESGO AT BUS 67345 MACHINE 2 INITIALIZED OUT OF LIMITS

****

INITIAL CONDITION LOAD FLOW USED 6 ITERATIONS

****

INITIAL CONDITIONS SUSPECT:

I	DSTATE(I)	STATE(I)	MODEL	STATE	BUS	X--- NAME ---X	ID

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     9   0.11739E-01  0.74730
    10   -12.543       396.96
 19874   0.19803E-04  0.19407E-02  CIMTR3   K+4   67816  STLEONWG0.6000   1
 32164  -0.83804E-02  0.66600      IEEET1   K+1   66748  CENTER2G20.000   2
 32278   0.64474E-02 -0.30190      SCRX     K     67683  KET1-12G13.800   1
 42495  -0.66387E-01  0.19916E-01  IEESGO   K+1   67345  HESKET2G13.800   2
 42496  -0.39832      0.92992      IEESGO   K+2   67345  HESKET2G13.800   2
 44902  -0.47544E-02 -0.89628E-01  CIMTR3   K+1   60136  MAPLE R7115.00   1
 44905   0.19486E-03  0.63435E-02  CIMTR3   K+4   60136  MAPLE R7115.00   1
 51181  -0.38147E-01   0.0000      ESAC8B   K+2   61776  BOSWE71G14.400   1
 51186  -0.38147E-01   0.0000      ESAC8B   K+2   61777  BOSWE72G14.400   2
 52722   0.10950E-03  0.16257E-02  CIMTR3   K+4   67473  MMU SW 7115.00   WN
 54092  -0.37560E-04  0.26212E-02  CIMTR3   K     39870  FWDEC G10.5750   W
 54892  -0.15094E-03  0.14050E-01  IEEET1   K+1   39386  OK C G6 18.000   L
 57166   0.31320E-04  0.10993E-02  CIMTR3   K+4   35026  G426/53834.500   1
 57220  -0.10431E-01   0.0000      ESAC8B   K+2   61775  BOSWE44G22.800   4
 58516   0.26946E-04  0.22246E-02  CIMTR3   K+4   67825  STJOS1 W0.6900   1

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     LINE SWITCHING EVENTS FOLLOW:
+    ____________________________

     MHEB DC REDUCTIONS FOLLOW:
+    __________________________
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 TIE LINE FROM 67621 TO 60173 CKT  1 TRIPPED AT  0.1667s *** INITIATING DC
 REDUCTION ***
 DC WILL BE REDUCED BY   1793.99 MW

     NETWORK NOT CONVERGED FOLLOW:
+    ____________________________

     RELOUV AND RELOUF SWITCHING EVENTS FOLLOW:
+    __________________________________________

 *** SHUNT AT BUS67565 MODIFIED FROM    73.40 TO     0.00    BY RELOUV (OVER )
                 AT TIME =   0.3833 SECS.
 *** SHUNT AT BUS67503 MODIFIED FROM   755.60 TO   496.00    BY RELOUV (OVER )
                 AT TIME =   0.7833 SECS.

     DC SWITCHING EVENTS FOLLOW:
+    ___________________________

     VSCAN EVENTS FOLLOW:
+    ____________________

     PI 4 KV EVENTS FOLLOW:
+    ______________________
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     RELAY SCAN EVENTS FOLLOW:
+    ________________________


     FARGO/WATERTOWN SVS EVENTS FOLLOW:
+    __________________________________

 AT TIME= 2.7583 CFGSVC: (1) 27.1 MVAR BSC(S) REMOVED AT BUS  66436 [FARGO  7]

     UDHOLD EVENTS FOLLOW:
+    _____________________

 UDHOLD FUNCTION AT BUS 3404 APPLIED AT TIME =  0.1333SEC
 UDHOLD FUNCTION AT BUS 3404 RESET AT TIME =  0.2500SEC

     DYNAMIC VOLTAGE CHECKS FOLLOW:
+    ______________________________

         FROM TIME      0.4000 TO TIME      5.0000

                          PU VOLT                                    VMAX
+                        _MAX___
 CHAN                    MAX   MIN       MINIMUM        MAXIMUM     LESS
+                                        __             __
  NO.    DESCRIPTION     .LT.  .GT.    VOLT  TIME     VOLT  TIME    VMIN
+
 ----   -------------   ----------     ----  ----     ----  ----    ----
+<<<<   <<<<<<<<<<<<<   <<<<<<<<<<     <<<<  <<<<     <<<<  <<<<    <<<<
  444   67503 DORSEY    1.25  0.70     1.04  0.80     1.15  0.42    0.11
  386   61624 FORBES    1.15  0.82     1.01  0.84     1.04  3.16    0.03
  384   61615 ARROWHD   1.15  0.82     1.00  0.42     1.05  0.77    0.05
  382   61612 RIVERTN   1.15  0.75     0.99  0.42     1.05  2.06    0.06
  362   66752 DRAYTON   1.20  0.80     0.99  0.80     1.06  1.98    0.07
  562   63229 WAHPETN   1.18  0.80     0.98  0.54     1.06  2.03    0.08
  ***   61631 MINONG5   1.20  0.82     1.03  2.78     1.09  0.77    0.06
  542   63369 JAMESTN   1.20  0.70     0.91  0.52     1.00  2.03    0.09
  390   63041 COAL CR   1.18  0.70     0.98  0.42     1.08  1.29    0.10
  334   66529 WATERTN   1.18  0.75     1.00  0.52     1.04  2.06    0.04
  360   67160 GROTON    1.15  0.70     0.96  0.55     1.05  2.08    0.09
  553   61754 BOISE     1.15  0.82     0.92  0.54     1.03  1.75    0.11

     POWERFLOW WARNINGS AT END OF SIMULATION FOLLOW:
+    _______________________________________________

BUSES WITH VOLTAGE GREATER THAN 1.1000:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
67533 ST.JAME7 110 667 1.1051 121.56    67536 GREATFL7 110 667 1.1074 121.82
67537 MCARTHR7 110 667 1.1030 121.33    67538 7SISTER7 110 667 1.1086 121.95
67539 LACDUBN7 110 667 1.1061 121.67    67553 POINTDB7 121 667 1.1228 135.86
67554 SLAVEFL7 121 667 1.1242 136.03    67556 WHTSL1 4 220 667 1.1098 244.16
67580 SHERBK 7 110 667 1.1074 121.81    67589 WHTSL2 4 220 667 1.1098 244.15
1*** t1e-so16aa-nad                                          Page   5

67648 POINTD27 121 667 1.1275 136.42    67705 WHSL2PH7 110 667 1.1173 122.90
67706 WHITESH7 110 667 1.1079 121.87    67734 SK1  TP7 110 667 1.1083 121.92
67751 WHSL1PH7 110 667 1.1173 122.91    67755 SHBK-PH7 110 667 1.1294 124.23
67769 SR3SW3T7 110 667 1.1085 121.93    67770 SK1 SUB7 110 667 1.1750 129.25
67771 STAR LK7 110 667 1.1735 129.08    67772 BRERTON7 110 667 1.1748 129.23
67774 SG12 TP7 110 667 1.1065 121.71    67775 BEAUSJ 7 110 667 1.1041 121.45

BUSES WITH VOLTAGE LESS THAN 0.9500:
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69515 HLSBORO5 161 680 0.9500 152.94
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
T1E-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT           :
ND=2218,MH=2178,MW=1660,OHMH=-196,OHMP=148,EWTW=187,BD=162

BRANCH LOADINGS ABOVE 100.0 % OF RATING SET A:

X-------FROM BUS-------X  X--------TO BUS--------X       CURRENT(MVA)
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
61752  I.FALLS7 118  608  61784* INTPHAS7 118  608  1    193.5   180.0   107.5
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TUE, NOV 20 2012 14:39

INITIATED AT LOAD FLOW ENTRY POINT ON TUE, NOV 20 2012 14:40

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164

SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

SPECIAL RESPONSE FILES AND COMMENTS

RESPONSE FILES

None

COMMENTS

None

P O W E R F L O W S U M M A R Y

NDEX:	2217 MW	ECL-ARP:	542 MW
MHEX:	2007 MW	PRI-NRC:	536 MW
MWEX:	773 MW	AHD-SLK:	88 MW
KING-ECL:	685 MW	SLK-GPK:	654 MW
COOPER S:	1057 MW	WNE-WKS:	543 MW
FTCAL S:	528 MW	GGS:	1753 MW
GRIS-LNC:	757 MW	QC WEST:	22 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2662.5 MW,	84.4% OF	3156.0 MW
NSP	(AREA 600)	7500.4 MW,	63.1% OF	11889.2 MW
MAN HYDRO	(AREA 667)	1148.2 MW,	37.3% OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	1148/ 306	MH total gross	4914	ATC West Import	583
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	558
NW	915/ 36	7 Sisters	170	ATC SE Import	-1221
Sask.	2150/ 82	OH total gross	21884	East Bias	183
MP	1840/ 263	northwest	717	SPC>WAPA (B10T)	164
NSP	7500/ 437	SPC total gross	2406	MH>SPC (3-230)	60
N. Dakota	2662/ 310	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3228	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	3058	OH>MP @Ft Fran	152
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	191
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	12452 MVARS	West gross	3010	F601C @Forbes	1730
NSP	1554 MVARS	net	2848	D602F @Dorsey	1687
N. Dakota	606 MVARS	Total net	4601	L20D @Letell	212
ATC	9747/ 332	WAPA SD Hydro	1497	R50M @Richer	111
ATC	2911 MVARS	Pleasant Valley	0	G82R @Glenboro	-4
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	1235		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	366	ANTELOP-LELAND	122	CENTER-JAMESTN	513
STANTON- SQ BUT	-31	HETINGR-BISON	89	WILTON-CASS LK	-27

CASS LK-BOSWELL	-102		BISON-ALEX SS3	383		ALEX SS-QUARRY	310
QUARRY-MNTCELO	143		BROOKNG-LYONCO	287		LYONCO-CEDARMT(T)	396
CEDARMT-HELENA(T)	341		LKMARN-HMPTCNR	-36		HMPTCNR-NROC	345
NROC TR	136		NROC-NLAX	207		CNT-PRAIRIE 345	251
NROC-BYRON	530		LKFLDX-LAKEFLD3	-154		AKPEXPORT	1512
ROSEAU CAP	1841	AMPS	PRI-NROC	5	ANG		
CENTER-JAMESTN	17	ANG	ECL-ARP	12	ANG		

Tfmrs	MVA/	Load	Ph Shifters	Deg/	MW	DC Lines	MW
Wshell #1 7-7	103/	71%	Stinson	27/	29	CU (1,2)	1128
Wshell #2 7-7	103/	71%	Boundary Dam	1/	164	SQ BU (3,4)	550
Drayton#1 4-7	47/	33%	Whiteshell	92/	199	MH Bipole 1	1514
Drayton#2 4-7	57/	31%	Int Falls	117/	151	MH Bipole 2	1715
Dorsey #1 2-4	754/	62%	St. Lawrence	16/	0	MH (BP1+BP2)	3230
Dorsey #2 2-4	867/	72%	Arrowhead	0/	88	Miles City E>W	-150
Forbes 2-4	69/	10%				RCDC (15)	0
Stone Lk 3-5	294/	87%				Stegall (10)	0

Dorsey SC's		I/S	MVAR	Qmax/	Qmin	SVC's	MVAR	Qmax/	Qmin
MIL 7-9G	17.0	2	356	600/	-330	Forbes	500	54	400/ -450
SCE 1-3G	18.2	3	290	480/	-240	Fargo	13.2	-10	20/ -135
SCA 4-6G	18.2	3	290	480/	-240	Watertown	20.0	51	125/ -86
Total			938	1560/	-810	Series Caps		Num In Serv	
Margin			622			Roseau	500	2 of 2	
						Chisago	500	1 of 1	

Caps/Reactors		MVAR	Caps/Reactors		MVAR	Caps/Reactors		MVAR
Balta (FS)	230	0	Arrowhead	230	160	Chisago T 9	34.5	60
Drayton	115	0	Blackberry	230	47	Chisago T 10	34.5	60
Drayton	13.8	-20	Minntac	115	45	Forbes	230	70
Eau Claire(FS)	161	178	Riverton	230	47	Forbes	500	600
Kohlman Lake	115	240	Roseau Co.(FS)	230	0			0
Parkers Lk(FS)	115	0	Running (FS)	230	30	Fargo	115	54
Prairie (FS)	115	0	Running react	230	0	Watertown	20	20
Ramsey (FS)	230	0	Shannon	230	72	Watertown	230	0
Red Rock	115	240			0			0
Rugby	13.8	0	Glenboro	230	0	Arrowhead	345	150
Split Rock(FS)	115	80	Laverendrye	110	98	Stone Lake	345	75
Sheyenne (FS)	115	40	Richer react	230	0	Stone Lk Reac	345	0
Wilton/Bemidji	115	20	St Vital	110	98	Stone Lake	161	40
		0			0	Grdnr Pk Reac	345	0
		0			0	Grdnr Pk Caps	115	0
		0			0	Arpin Caps	138	52
		0			0	Council Creek	138	16

Bus Voltages		V,pu	Bus Voltages		V,pu	Bus Voltages		V,kV
Adams	345	1.013	Arrowhead	230	0.999	Whiteshell	110	118.9
Alexandria	115	1.019	Badoura	115	1.028	Kenora	220	248.2
Audubon	115	1.036	Blackberry	230	1.018	Dryden	220	251.2
Bemidji	115	1.029	Boise Cascade	13.8	1.059	Fort Frances	220	244.6
Byron	345	1.022	Boise Cascade	115	1.027	Mackenzie	220	253.7
Chisago Co.	345	1.013	ETCO	115	1.002	Lakehead	220	246.2
Chisago Co.	500	1.009	Forbes	230	1.016	Marathon	220	252.8
Drayton	230	1.021	Forbes	500	1.015	Wawa	220	254.7
Eau Claire	345	0.999	Hubbard	115	0.000	Mississagi	220	250.6
WEST FARIBAULT	115	1.036	Intl Falls	115	1.028	Fort Frances	118	120.5

LaPorte	115	1.021	Minntac	115	1.009	Lakehead	118	122.8
Maple River	230	1.029	Moranville	230	1.042	Birch	118	120.2
Marshall Tap	115	1.050	Riverton	230	1.020	Marathon	118	124.8
Owatonna	161	1.005	Running	230	1.041			0.000
Prairie	115	1.023	Shannon	230	1.024	Arrowhead	345	0.983
Prairie	230	1.032	Stinson MN	115	1.010	Stone Lake	345	0.962
Ramsey	230	1.018	Jamestown	345	0.980	Stone Lake	161	0.991
Roseau County	230	1.042	Groton	345	1.015	Gardner Park	345	1.031
Roseau County	500	1.053	Watertown	230	1.030	Weston	115	1.035
Sheyenne	230	1.029	Watertown	345	1.028	Arpin	345	1.014
Thief R Falls	115	1.020			0.000	Eau Claire	161	1.033
Tioga	230	1.027	Dorsey	230	1.045	Council Creek	161	0.981
Wahpeton	230	1.023	Dorsey	500	1.036	Hydro Lane	161	1.016
Winger	115	1.042	ALEX SS3	34	0.997	Wien	115	1.031
WILTON 4	230	1.028	BRKNGCO3	345	1.033	NROC	345	1.020
MINONG 5	161	0.993	PRAIRIE3	345	1.011	LYON CO	345	1.034
		0.000			0.000	CASS LK4	230	1.030

Steady State Relay Margins (measured from inner blinder)

Relay Location	Manuf/Type	PSS Model	South	North	Em North
1) B10T-Tioga (South)	GE OST	SLLP	335%	N/A	N/A
2) -Tioga (North)	GE OST	SLLP	689%	N/A	N/A
3) -Tioga (Em North)	GE OST	SLLP		N/A	N/A
4) D602F-Dorsey	ATP ???	SLINOS	447%	N/A	N/A
5) -Forbes (Normal)	ATP ???	SLINOS	266%	N/A	N/A
6) -Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8) F3M-Intl Falls	APT S-PRO	SLINOS	325%	N/A	N/A
9) G82R-Rugby	APT	SLINOS	N/A	1095%	
10) L20D-Drayton (Normal)	APT, ASEA	SLINOS	991%	N/A	N/A
11) -Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12) R50M-Moranville (Norm)	APT, West	SLINOS	1333%	N/A	N/A
13) -Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

SIMULATION CHECKS FOLLOW:

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+    ________________________

 ITER DELTAV/TOL X------ AT BUS ------X  REAL(DELTAV)  IMAG(DELTAV)
    1   655.545  66539 [WATERSVC20.000]   -0.3434E-03   -0.5584E-03
    2   328.257  66539 [WATERSVC20.000]   -0.1717E-03   -0.2797E-03
    3     6.765  66584 [SIDNEYW4230.00]    0.4778E-05   -0.4789E-05
    4     2.266  66584 [SIDNEYW4230.00]   -0.1592E-05    0.1613E-05
    5     0.774  66584 [SIDNEYW4230.00]    0.5493E-06   -0.5449E-06

 REACHED TOLERANCE IN   5 ITERATIONS

 LARGEST MISMATCH:    0.00 MW   -0.02 MVAR     0.02 MVA AT BUS 62710
 [CHANDLR869.000]
 SYSTEM TOTAL ABSOLUTE MISMATCH:               0.30 MVA

 ***************************************************************************

 IEESGO AT BUS  67345 MACHINE 2  INITIALIZED OUT OF LIMITS

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 INITIAL CONDITION LOAD FLOW USED  6 ITERATIONS

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 INITIAL CONDITIONS SUSPECT:
     I   DSTATE(I)    STATE(I)     MODEL   STATE    BUS  X--- NAME ---X   ID
     9   0.82850E-02  0.80243
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    10   -9.1370       373.42
 19874   0.20416E-04  0.19309E-02  CIMTR3   K+4   67816  STLEONWG0.6000   1
 32164  -0.84549E-02  0.66600      IEEET1   K+1   66748  CENTER2G20.000   2
 32278   0.43527E-02 -0.30192      SCRX     K     67683  KET1-12G13.800   1
 42495  -0.66264E-01  0.19879E-01  IEESGO   K+1   67345  HESKET2G13.800   2
 42496  -0.39758      0.92988      IEESGO   K+2   67345  HESKET2G13.800   2
 44902  -0.46229E-02  0.24705      CIMTR3   K+1   60136  MAPLE R7115.00   1
 44905   0.19328E-03  0.64080E-02  CIMTR3   K+4   60136  MAPLE R7115.00   1
 51181  -0.76294E-01   0.0000      ESAC8B   K+2   61776  BOSWE71G14.400   1
 51186  -0.38147E-01   0.0000      ESAC8B   K+2   61777  BOSWE72G14.400   2
 52722   0.10450E-03  0.16301E-02  CIMTR3   K+4   67473  MMU SW 7115.00   WN
 57166   0.30520E-04  0.11005E-02  CIMTR3   K+4   35026  G426/53834.500   1
 57220  -0.20862E-01   0.0000      ESAC8B   K+2   61775  BOSWE44G22.800   4
 58513  -0.10215E-02 -0.69256E-01  CIMTR3   K+1   67825  STJOS1 W0.6900   1
 58516   0.27557E-04  0.22246E-02  CIMTR3   K+4   67825  STJOS1 W0.6900   1

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     LINE SWITCHING EVENTS FOLLOW:
+    ____________________________

     MHEB DC REDUCTIONS FOLLOW:
+    __________________________
```



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     NETWORK NOT CONVERGED FOLLOW:
+    ____________________________

     RELOUV AND RELOUF SWITCHING EVENTS FOLLOW:
+    __________________________________________

     DC SWITCHING EVENTS FOLLOW:
+    ___________________________

 AT TIME = 0.1000 DC LINE  1 MANUALLY BLOCKED
 AT TIME = 0.1000 DC LINE  2 MANUALLY BLOCKED
 AT TIME = 0.1667 DC LINE  1 MANUALLY UNBLOCKED
 AT TIME = 0.1667 DC LINE  2 MANUALLY UNBLOCKED

     VSCAN EVENTS FOLLOW:
+    ____________________

     PI 4 KV EVENTS FOLLOW:
+    ______________________

 ++++ PRICR:VOLTAGE AT BUS 60670[PI2 RCP94.00] DROPPED BELOW
      SETPOINT OF 0.7800 PU AT 0.2417 SEC
 ++++ PRICR:VOLTAGE AT BUS 60667[PI1 RCP94.00] DROPPED BELOW
      SETPOINT OF 0.7800 PU AT 0.2500 SEC
 ++++ PRICR:AT TIME = 0.3000 SEC, VOLTAGE AT BUS 60667[PI1 RCP9â•••] INCREASED
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      ABOVE RESET VOLTAGE OF 0.8000. VOLTAGE WAS BELOW RESET VOLTAGE FOR
      0.0500
 ++++ PRICR:AT TIME = 0.3000 SEC, VOLTAGE AT BUS 60670[PI2 RCP9â•••] INCREASED
      ABOVE RESET VOLTAGE OF 0.8000. VOLTAGE WAS BELOW RESET VOLTAGE FOR
      0.0583


     RELAY SCAN EVENTS FOLLOW:
+    ________________________



     FARGO/WATERTOWN SVS EVENTS FOLLOW:
+    __________________________________



     UDHOLD EVENTS FOLLOW:
+    _____________________

 UDHOLD FUNCTION AT BUS 3404 APPLIED AT TIME =  0.1583SEC
 UDHOLD FUNCTION AT BUS 3404 RESET AT TIME =  0.2500SEC


     DYNAMIC VOLTAGE CHECKS FOLLOW:
+    ______________________________

         FROM TIME      0.4000 TO TIME      5.0000
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CHAN NO.	DESCRIPTION	PU VOLT MAX .LT.	PU VOLT MIN .GT.	MINIMUM VOLT	MINIMUM TIME	MAXIMUM VOLT	MAXIMUM TIME	VMAX LESS VMIN
444	67503 DORSEY	1.25	0.70	1.03	0.87	1.07	0.42	0.04
386	61624 FORBES	1.15	0.82	1.00	1.57	1.02	0.42	0.02
384	61615 ARROWHD	1.15	0.82	0.92	0.57	0.99	2.55	0.07
382	61612 RIVERTN	1.15	0.75	0.98	0.47	1.03	2.10	0.05
362	66752 DRAYTON	1.20	0.80	1.00	0.89	1.03	2.08	0.03
562	63229 WAHPETN	1.18	0.80	1.00	0.44	1.06	2.12	0.06
***	61631 MINONG5	1.20	0.82	0.85	0.57	0.97	2.55	0.12
542	63369 JAMESTN	1.20	0.70	0.93	0.44	1.00	2.10	0.07
390	63041 COAL CR	1.18	0.70	0.98	0.42	1.07	2.12	0.09
334	66529 WATERTN	1.18	0.75	0.99	0.52	1.04	1.87	0.05
360	67160 GROTON	1.15	0.70	0.96	0.52	1.03	2.15	0.07
553	61754 BOISE	1.15	0.82	1.02	0.97	1.04	0.42	0.02

```
     POWERFLOW WARNINGS AT END OF SIMULATION FOLLOW:
+    ___________________________________________________

BUSES WITH VOLTAGE GREATER THAN 1.1000:
1*** y5k-so16aa-pcs                                          Page   5

X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
61586 MIDCOMPS 500 608 1.1010 550.52    67556 WHTSL1 4 220 667 1.1040 242.88
67589 WHTSL2 4 220 667 1.1040 242.87    67648 POINTD27 121 667 1.1013 133.25
67770 SK1 SUB7 110 667 1.1392 125.31    67771 STAR LK7 110 667 1.1376 125.14
67772 BRERTON7 110 667 1.1390 125.29

BUSES WITH VOLTAGE LESS THAN 0.9500:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
60290 ST LAKE5 161 600 0.9115 146.76    60293 FRMSINN5 161 600 0.9160 147.48
60294 GINGLES5 161 600 0.9456 152.25    61631 MINONG 5 161 608 0.9240 148.77
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63055 BEARCK 4 230 618 0.9494 218.37    69515 HLSBORO5 161 680 0.9310 149.89
69561 WASHCO 5 161 680 0.9348 150.50

 BRANCH CURRENT LOADINGS ABOVE 100.0 % OF RATING SET A
+
60288  IRONWD_7 115  600  60289* HURLEY 7 115  600  1     66.1    61.0   108.3
X-------FROM BUS-------X  X--------TO BUS--------X       CURRENT(MVA)
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT           :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164

TRANSFORMER LOADINGS ABOVE 100.0 % OF RATING SET A:

X-------FROM BUS-------X  X--------TO BUS--------X       MVA      MVA
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
```

TUE, NOV 20 2012 14:47

INITIATED AT LOAD FLOW ENTRY POINT ON TUE, NOV 20 2012 14:47

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164

4 CYCLE, THREE PHASE FAULT AT CHISAGO TRIP F601C, XTRIP D60
USE NEW 100% REDUCTION INIT FROM CHISAGO, LEAVE SVS ON MP S

SPECIAL RESPONSE FILES AND COMMENTS

RESPONSE FILES

None

COMMENTS

None

P O W E R F L O W S U M M A R Y

NDEX:	2217 MW	ECL-ARP:	542 MW
MHEX:	2007 MW	PRI-NRC:	536 MW
MWEX:	773 MW	AHD-SLK:	88 MW
KING-ECL:	685 MW	SLK-GPK:	654 MW
COOPER S:	1057 MW	WNE-WKS:	543 MW
FTCAL S:	528 MW	GGS:	1753 MW
GRIS-LNC:	757 MW	QC WEST:	22 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2662.5 MW,	84.4% OF	3156.0 MW
NSP	(AREA 600)	7500.4 MW,	63.1% OF	11889.2 MW
MAN HYDRO	(AREA 667)	1148.2 MW,	37.3% OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	1148/ 306	MH total gross	4914	ATC West Import	583
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	558
NW	915/ 36	7 Sisters	170	ATC SE Import	-1221
Sask.	2150/ 82	OH total gross	21884	East Bias	183
MP	1840/ 263	northwest	717	SPC>WAPA (B10T)	164
NSP	7500/ 437	SPC total gross	2406	MH>SPC (3-230)	60
N. Dakota	2662/ 310	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3228	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	3058	OH>MP @Ft Fran	152
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	191
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	12452 MVARS	West gross	3010	F601C @Forbes	1730
NSP	1554 MVARS	net	2848	D602F @Dorsey	1687
N. Dakota	606 MVARS	Total net	4601	L20D @Letell	212
ATC	9747/ 332	WAPA SD Hydro	1497	R50M @Richer	111
ATC	2911 MVARS	Pleasant Valley	0	G82R @Glenboro	-4
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	1235		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	366	ANTELOP-LELAND	122	CENTER-JAMESTN	513
STANTON- SQ BUT	-31	HETINGR-BISON	89	WILTON-CASS LK	-27

CASS LK-BOSWELL	-102		BISON-ALEX SS3	383		ALEX SS-QUARRY	310
QUARRY-MNTCELO	143		BROOKNG-LYONCO	287		LYONCO-CEDARMT(T)	396
CEDARMT-HELENA(T)	341		LKMARN-HMPTCNR	-36		HMPTCNR-NROC	345
NROC TR	136		NROC-NLAX	207		CNT-PRAIRIE 345	251
NROC-BYRON	530		LKFLDX-LAKEFLD3	-154		AKPEXPORT	1512
ROSEAU CAP	1841	AMPS	PRI-NROC	5	ANG		
CENTER-JAMESTN	17	ANG	ECL-ARP	12	ANG		

1*** y5k-so16aa-nmz Page 2

Tfmrs	MVA/	Load	Ph Shifters	Deg/	MW	DC Lines	MW
Wshell #1 7-7	103/	71%	Stinson	27/	29	CU (1,2)	1128
Wshell #2 7-7	103/	71%	Boundary Dam	1/	164	SQ BU (3,4)	550
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Drayton	13.8	-20	Minntac	115	45	Forbes	230	70
Eau Claire(FS)	161	178	Riverton	230	47	Forbes	500	600
Kohlman Lake	115	240	Roseau Co.(FS)	230	0			0
Parkers Lk(FS)	115	0	Running (FS)	230	30	Fargo	115	54
Prairie (FS)	115	0	Running react	230	0	Watertown	20	20
Ramsey (FS)	230	0	Shannon	230	72	Watertown	230	0
Red Rock	115	240			0			0
Rugby	13.8	0	Glenboro	230	0	Arrowhead	345	150
Split Rock(FS)	115	80	Laverendrye	110	98	Stone Lake	345	75
Sheyenne (FS)	115	40	Richer react	230	0	Stone Lk Reac	345	0
Wilton/Bemidji	115	20	St Vital	110	98	Stone Lake	161	40
		0			0	Grdnr Pk Reac	345	0
		0			0	Grdnr Pk Caps	115	0
		0			0	Arpin Caps	138	52
		0			0	Council Creek	138	16

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MINONG 5	161	0.993	PRAIRIE3	345	1.011	LYON CO	345	1.034
		0.000			0.000	CASS LK4	230	1.030

Steady State Relay Margins (measured from inner blinder)

Relay Location	Manuf/Type	PSS Model	South	North	Em North
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2) -Tioga (North)	GE OST	SLLP	689%	N/A	N/A
3) -Tioga (Em North)	GE OST	SLLP		N/A	N/A
4) D602F-Dorsey	ATP ???	SLINOS	447%	N/A	N/A
5) -Forbes (Normal)	ATP ???	SLINOS	266%	N/A	N/A
6) -Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8) F3M-Intl Falls	APT S-PRO	SLINOS	325%	N/A	N/A
9) G82R-Rugby	APT	SLINOS	N/A	1095%	
10) L20D-Drayton (Normal)	APT, ASEA	SLINOS	991%	N/A	N/A
11) -Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12) R50M-Moranville (Norm)	APT, West	SLINOS	1333%	N/A	N/A
13) -Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

SIMULATION CHECKS FOLLOW:
+ _____

ITER	DELTAV/TOL	X------ AT BUS ------X	REAL(DELTAV)	IMAG(DELTAV)
1	655.545	66539 [WATERSVC20.000]	-0.3434E-03	-0.5584E-03
2	328.257	66539 [WATERSVC20.000]	-0.1717E-03	-0.2797E-03
3	6.765	66584 [SIDNEYW4230.00]	0.4778E-05	-0.4789E-05
4	2.266	66584 [SIDNEYW4230.00]	-0.1592E-05	0.1613E-05
5	0.774	66584 [SIDNEYW4230.00]	0.5493E-06	-0.5449E-06

REACHED TOLERANCE IN 5 ITERATIONS

LARGEST MISMATCH: 0.00 MW -0.02 MVAR 0.02 MVA AT BUS 62710
[CHANDLR869.000]
SYSTEM TOTAL ABSOLUTE MISMATCH: 0.30 MVA

****

IEESGO AT BUS 67345 MACHINE 2 INITIALIZED OUT OF LIMITS

****

INITIAL CONDITION LOAD FLOW USED 6 ITERATIONS

****

INITIAL CONDITIONS SUSPECT:

I	DSTATE(I)	STATE(I)	MODEL	STATE	BUS	X--- NAME ---X	ID
9	0.82850E-02	0.80243					

```
    10   -9.1370       373.42
 19874   0.20416E-04  0.19309E-02  CIMTR3   K+4   67816  STLEONWG0.6000   1
 32164  -0.84549E-02  0.66600      IEEET1   K+1   66748  CENTER2G20.000   2
 32278   0.43527E-02 -0.30192      SCRX     K     67683  KET1-12G13.800   1
 42495  -0.66264E-01  0.19879E-01  IEESGO   K+1   67345  HESKET2G13.800   2
 42496  -0.39758      0.92988      IEESGO   K+2   67345  HESKET2G13.800   2
 44902  -0.46229E-02  0.24705      CIMTR3   K+1   60136  MAPLE R7115.00   1
 44905   0.19328E-03  0.64080E-02  CIMTR3   K+4   60136  MAPLE R7115.00   1
 51181  -0.76294E-01   0.0000      ESAC8B   K+2   61776  BOSWE71G14.400   1
 51186  -0.38147E-01   0.0000      ESAC8B   K+2   61777  BOSWE72G14.400   2
 52722   0.10450E-03  0.16301E-02  CIMTR3   K+4   67473  MMU SW 7115.00   WN
 57166   0.30520E-04  0.11005E-02  CIMTR3   K+4   35026  G426/53834.500   1
 57220  -0.20862E-01   0.0000      ESAC8B   K+2   61775  BOSWE44G22.800   4
 58513  -0.10215E-02 -0.69256E-01  CIMTR3   K+1   67825  STJOS1 W0.6900   1
 58516   0.27557E-04  0.22246E-02  CIMTR3   K+4   67825  STJOS1 W0.6900   1


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     LINE SWITCHING EVENTS FOLLOW:
+    ____________________________


     MHEB DC REDUCTIONS FOLLOW:
+    __________________________

 TIE LINE FROM 67503 TO 67700 CKT  2 TRIPPED AT  0.1500s *** INITIATING DC
 REDUCTION ***
 DC WILL BE REDUCED BY   1822.49 MW
1*** y5k-so16aa-nmz                                        Page   4


     NETWORK NOT CONVERGED FOLLOW:
+    ____________________________


     RELOUV AND RELOUF SWITCHING EVENTS FOLLOW:
+    __________________________________________

 *** SHUNT AT BUS67565 MODIFIED FROM    73.40 TO     0.00    BY RELOUV (OVER )
                 AT TIME =   0.3667 SECS.


     DC SWITCHING EVENTS FOLLOW:
+    ___________________________

 AT TIME = 0.1000 DC LINE  1 MANUALLY BLOCKED
 AT TIME = 0.1000 DC LINE  2 MANUALLY BLOCKED
 AT TIME = 0.1583 DC LINE  1 MANUALLY UNBLOCKED
 AT TIME = 0.1583 DC LINE  2 MANUALLY UNBLOCKED


     VSCAN EVENTS FOLLOW:
+    ____________________


 AT TIME =  2.042 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI
```

```
 AT TIME =  2.050 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI

 AT TIME =  2.058 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI

 AT TIME =  2.067 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI


     PI 4 KV EVENTS FOLLOW:
+    ______________________

 ++++ PRICR:VOLTAGE AT BUS 60667[PI1 RCP94.00] DROPPED BELOW
      SETPOINT OF 0.7800 PU AT 0.1083 SEC
 ++++ PRICR:VOLTAGE AT BUS 60670[PI2 RCP94.00] DROPPED BELOW
      SETPOINT OF 0.7800 PU AT 0.1083 SEC
 ++++ PRICR:AT TIME = 0.1667 SEC, VOLTAGE AT BUS 60667[PI1 RCP9â•••] INCREASED
      ABOVE RESET VOLTAGE OF 0.8000. VOLTAGE WAS BELOW RESET VOLTAGE FOR
      0.0583
 ++++ PRICR:AT TIME = 0.1667 SEC, VOLTAGE AT BUS 60670[PI2 RCP9â•••] INCREASED
      ABOVE RESET VOLTAGE OF 0.8000. VOLTAGE WAS BELOW RESET VOLTAGE FOR
      0.0583


     RELAY SCAN EVENTS FOLLOW:
+    _________________________



     FARGO/WATERTOWN SVS EVENTS FOLLOW:
+    __________________________________

 AT TIME= 2.0000 CFGSVC: (1) 27.1 MVAR BSC(S) REMOVED AT BUS  66436 [FARGO  7]


     UDHOLD EVENTS FOLLOW:
+    _____________________

 UDHOLD FUNCTION AT BUS 3404 APPLIED AT TIME =  0.1333SEC
 UDHOLD FUNCTION AT BUS 3404 RESET AT TIME =  0.2500SEC


     DYNAMIC VOLTAGE CHECKS FOLLOW:
+    ______________________________
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1*** y5k-so16aa-nmz Page 5

FROM TIME 0.4000 TO TIME 5.0000

CHAN NO.	DESCRIPTION	PU VOLT MAX .LT.	PU VOLT MIN .GT.	MINIMUM VOLT	MINIMUM TIME	MAXIMUM VOLT	MAXIMUM TIME	VMAX LESS VMIN
444	67503 DORSEY	1.25	0.70	1.07	0.59	1.10	2.08	0.03
386	61624 FORBES	1.15	0.82	0.99	0.58	1.04	3.42	0.05
384	61615 ARROWHD	1.15	0.82	0.90	0.44	1.04	2.15	0.14
382	61612 RIVERTN	1.15	0.75	0.89	0.51	1.05	2.15	0.16
362	66752 DRAYTON	1.20	0.80	0.97	0.51	1.07	2.15	0.10
562	63229 WAHPETN	1.18	0.80	0.90	0.51	1.08	1.31	0.18

```
  ***   61631 MINONG5   1.20  0.82     0.88  0.44     1.06  2.15    0.18
  542   63369 JAMESTN   1.20  0.70     0.83  0.52     1.02  2.15    0.19
  390   63041 COAL CR   1.18  0.70     0.93  0.52     1.08  1.02    0.15
  334   66529 WATERTN   1.18  0.75     0.92  0.52     1.05  2.15    0.13
  360   67160 GROTON    1.15  0.70     0.86  0.58     1.06  2.17    0.20
  553   61754 BOISE     1.15  0.82     1.01  1.48     1.04  3.05    0.03


     POWERFLOW WARNINGS AT END OF SIMULATION FOLLOW:
+    ______________________________________________

BUSES WITH VOLTAGE GREATER THAN 1.1000:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
61586 MIDCOMPS 500 608 1.1486 574.28    67533 ST.JAME7 110 667 1.1076 121.84
67536 GREATFL7 110 667 1.1097 122.07    67537 MCARTHR7 110 667 1.1063 121.69
67538 7SISTER7 110 667 1.1143 122.57    67539 LACDUBN7 110 667 1.1103 122.14
67553 POINTDB7 121 667 1.1233 135.92    67554 SLAVEFL7 121 667 1.1247 136.09
67556 WHTSL1 4 220 667 1.1360 249.91    67580 SHERBK 7 110 667 1.1099 122.09
67589 WHTSL2 4 220 667 1.1359 249.91    67591 MIDCOMPN 500 667 1.1233 561.63
67648 POINTD27 121 667 1.1279 136.47    67705 WHSL2PH7 110 667 1.1214 123.36
67706 WHITESH7 110 667 1.1135 122.49    67725 INKSTER7 110 667 1.1004 121.04
67734 SK1  TP7 110 667 1.1140 122.54    67751 WHSL1PH7 110 667 1.1214 123.36
67755 SHBK-PH7 110 667 1.1321 124.53    67769 SR3SW3T7 110 667 1.1141 122.56
67770 SK1 SUB7 110 667 1.1810 129.91    67771 STAR LK7 110 667 1.1795 129.74
67772 BRERTON7 110 667 1.1808 129.89    67774 SG12 TP7 110 667 1.1111 122.22
67775 BEAUSJ 7 110 667 1.1087 121.96

BUSES WITH VOLTAGE LESS THAN 0.9500:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)


 BRANCH CURRENT LOADINGS ABOVE 100.0 % OF RATING SET A
+
X-------FROM BUS-------X  X--------TO BUS--------X       CURRENT(MVA)
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
60288  IRONWD 7 115  600  60289* HURLEY 7 115  600  1     62.3    61.0   102.1
61653  RIVERTN7 115  626  62448* HILLCTY7 115  608  1     53.6    53.0   101.1
61740* GR RPDS7 115  608  62448  HILLCTY7 115  608  1     55.5    53.0   104.8

 TRANSFORMER MVA LOADINGS ABOVE 100.0 % OF RATING SET A
+            ___
```

TUE, NOV 20 2012 14:55

INITIATED AT LOAD FLOW ENTRY POINT ON TUE, NOV 20 2012 14:56

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164

4 CYCLE 3 PHASE FAULT AT FORBES 500 KV POST MMTU
CLEAR THE FORBES - DORSEY 500 KV LINE

SPECIAL RESPONSE FILES AND COMMENTS
--- --- --- --- ---

RESPONSE FILES
--- ---
None

COMMENTS

None

P O W E R F L O W S U M M A R Y

NDEX:	2217 MW	ECL-ARP:	542 MW
MHEX:	2007 MW	PRI-NRC:	536 MW
MWEX:	773 MW	AHD-SLK:	88 MW
KING-ECL:	685 MW	SLK-GPK:	654 MW
COOPER S:	1057 MW	WNE-WKS:	543 MW
FTCAL S:	528 MW	GGS:	1753 MW
GRIS-LNC:	757 MW	QC WEST:	22 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2662.5 MW,	84.4%	OF	3156.0 MW
NSP	(AREA 600)	7500.4 MW,	63.1%	OF	11889.2 MW
MAN HYDRO	(AREA 667)	1148.2 MW,	37.3%	OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	1148/ 306	MH total gross	4914	ATC West Import	583
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	558
NW	915/ 36	7 Sisters	170	ATC SE Import	-1221
Sask.	2150/ 82	OH total gross	21884	East Bias	183
MP	1840/ 263	northwest	717	SPC>WAPA (B10T)	164
NSP	7500/ 437	SPC total gross	2406	MH>SPC (3-230)	60
N. Dakota	2662/ 310	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3228	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	3058	OH>MP @Ft Fran	152
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	191
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	12452 MVARS	West gross	3010	F601C @Forbes	1730
NSP	1554 MVARS	net	2848	D602F @Dorsey	1687
N. Dakota	606 MVARS	Total net	4601	L20D @Letell	212
ATC	9747/ 332	WAPA SD Hydro	1497	R50M @Richer	111
ATC	2911 MVARS	Pleasant Valley	0	G82R @Glenboro	-4
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	1235		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	366	ANTELOP-LELAND	122	CENTER-JAMESTN	513
STANTON- SQ BUT	-31	HETINGR-BISON	89	WILTON-CASS LK	-27

CASS LK-BOSWELL	-102		BISON-ALEX SS3	383		ALEX SS-QUARRY	310
QUARRY-MNTCELO	143		BROOKNG-LYONCO	287		LYONCO-CEDARMT(T)	396
CEDARMT-HELENA(T)	341		LKMARN-HMPTCNR	-36		HMPTCNR-NROC	345
NROC TR	136		NROC-NLAX	207		CNT-PRAIRIE 345	251
NROC-BYRON	530		LKFLDX-LAKEFLD3	-154		AKPEXPORT	1512
ROSEAU CAP	1841	AMPS	PRI-NROC	5	ANG		
CENTER-JAMESTN	17	ANG	ECL-ARP	12	ANG		

1*** y5k-so16aa-nad Page 2

Tfmrs	MVA/	Load	Ph Shifters	Deg/	MW	DC Lines	MW
Wshell #1 7-7	103/	71%	Stinson	27/	29	CU (1,2)	1128
Wshell #2 7-7	103/	71%	Boundary Dam	1/	164	SQ BU (3,4)	550
Drayton#1 4-7	47/	33%	Whiteshell	92/	199	MH Bipole 1	1514
Drayton#2 4-7	57/	31%	Int Falls	117/	151	MH Bipole 2	1715
Dorsey #1 2-4	754/	62%	St. Lawrence	16/	0	MH (BP1+BP2)	3230
Dorsey #2 2-4	867/	72%	Arrowhead	0/	88	Miles City E>W	-150
Forbes 2-4	69/	10%				RCDC (15)	0
Stone Lk 3-5	294/	87%				Stegall (10)	0

Dorsey SC's		I/S	MVAR	Qmax/ Qmin	SVC's	MVAR	Qmax/ Qmin
MIL 7-9G	17.0	2	356	600/ -330	Forbes	500	54 400/ -450
SCE 1-3G	18.2	3	290	480/ -240	Fargo	13.2	-10 20/ -135
SCA 4-6G	18.2	3	290	480/ -240	Watertown	20.0	51 125/ -86
Total			938	1560/ -810	Series Caps		Num In Serv
Margin			622		Roseau	500	2 of 2
					Chisago	500	1 of 1

Caps/Reactors		MVAR	Caps/Reactors		MVAR	Caps/Reactors		MVAR
Balta (FS)	230	0	Arrowhead	230	160	Chisago T 9	34.5	60
Drayton	115	0	Blackberry	230	47	Chisago T 10	34.5	60
Drayton	13.8	-20	Minntac	115	45	Forbes	230	70
Eau Claire(FS)	161	178	Riverton	230	47	Forbes	500	600
Kohlman Lake	115	240	Roseau Co.(FS)	230	0			0
Parkers Lk(FS)	115	0	Running (FS)	230	30	Fargo	115	54
Prairie (FS)	115	0	Running react	230	0	Watertown	20	20
Ramsey (FS)	230	0	Shannon	230	72	Watertown	230	0
Red Rock	115	240			0			0
Rugby	13.8	0	Glenboro	230	0	Arrowhead	345	150
Split Rock(FS)	115	80	Laverendrye	110	98	Stone Lake	345	75
Sheyenne (FS)	115	40	Richer react	230	0	Stone Lk Reac	345	0
Wilton/Bemidji	115	20	St Vital	110	98	Stone Lake	161	40
		0			0	Grdnr Pk Reac	345	0
		0			0	Grdnr Pk Caps	115	0
		0			0	Arpin Caps	138	52
		0			0	Council Creek	138	16

Bus Voltages		V,pu	Bus Voltages		V,pu	Bus Voltages		V,kV
Adams	345	1.013	Arrowhead	230	0.999	Whiteshell	110	118.9
Alexandria	115	1.019	Badoura	115	1.028	Kenora	220	248.2
Audubon	115	1.036	Blackberry	230	1.018	Dryden	220	251.2
Bemidji	115	1.029	Boise Cascade	13.8	1.059	Fort Frances	220	244.6
Byron	345	1.022	Boise Cascade	115	1.027	Mackenzie	220	253.7
Chisago Co.	345	1.013	ETCO	115	1.002	Lakehead	220	246.2
Chisago Co.	500	1.009	Forbes	230	1.016	Marathon	220	252.8
Drayton	230	1.021	Forbes	500	1.015	Wawa	220	254.7
Eau Claire	345	0.999	Hubbard	115	0.000	Mississagi	220	250.6
WEST FARIBAULT	115	1.036	Intl Falls	115	1.028	Fort Frances	118	120.5

LaPorte	115	1.021	Minntac	115	1.009	Lakehead	118	122.8
Maple River	230	1.029	Moranville	230	1.042	Birch	118	120.2
Marshall Tap	115	1.050	Riverton	230	1.020	Marathon	118	124.8
Owatonna	161	1.005	Running	230	1.041			0.000
Prairie	115	1.023	Shannon	230	1.024	Arrowhead	345	0.983
Prairie	230	1.032	Stinson MN	115	1.010	Stone Lake	345	0.962
Ramsey	230	1.018	Jamestown	345	0.980	Stone Lake	161	0.991
Roseau County	230	1.042	Groton	345	1.015	Gardner Park	345	1.031
Roseau County	500	1.053	Watertown	230	1.030	Weston	115	1.035
Sheyenne	230	1.029	Watertown	345	1.028	Arpin	345	1.014
Thief R Falls	115	1.020			0.000	Eau Claire	161	1.033
Tioga	230	1.027	Dorsey	230	1.045	Council Creek	161	0.981
Wahpeton	230	1.023	Dorsey	500	1.036	Hydro Lane	161	1.016
Winger	115	1.042	ALEX SS3	34	0.997	Wien	115	1.031
WILTON 4	230	1.028	BRKNGCO3	345	1.033	NROC	345	1.020
MINONG 5	161	0.993	PRAIRIE3	345	1.011	LYON CO	345	1.034
		0.000			0.000	CASS LK4	230	1.030

Steady State Relay Margins (measured from inner blinder)

Relay Location	Manuf/Type	PSS Model	South	North	Em North
1) B10T-Tioga (South)	GE OST	SLLP	335%	N/A	N/A
2) -Tioga (North)	GE OST	SLLP	689%	N/A	N/A
3) -Tioga (Em North)	GE OST	SLLP		N/A	N/A
4) D602F-Dorsey	ATP ???	SLINOS	447%	N/A	N/A
5) -Forbes (Normal)	ATP ???	SLINOS	266%	N/A	N/A
6) -Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8) F3M-Intl Falls	APT S-PRO	SLINOS	325%	N/A	N/A
9) G82R-Rugby	APT	SLINOS	N/A	1095%	
10) L20D-Drayton (Normal)	APT, ASEA	SLINOS	991%	N/A	N/A
11) -Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12) R50M-Moranville (Norm)	APT, West	SLINOS	1333%	N/A	N/A
13) -Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

SIMULATION CHECKS FOLLOW:

+ _____

ITER	DELTAV/TOL	X------ AT BUS ------X	REAL(DELTAV)	IMAG(DELTAV)
1	655.545	66539 [WATERSVC20.000]	-0.3434E-03	-0.5584E-03
2	328.257	66539 [WATERSVC20.000]	-0.1717E-03	-0.2797E-03
3	6.765	66584 [SIDNEYW4230.00]	0.4778E-05	-0.4789E-05
4	2.266	66584 [SIDNEYW4230.00]	-0.1592E-05	0.1613E-05
5	0.774	66584 [SIDNEYW4230.00]	0.5493E-06	-0.5449E-06

REACHED TOLERANCE IN 5 ITERATIONS

LARGEST MISMATCH: 0.00 MW -0.02 MVAR 0.02 MVA AT BUS 62710
[CHANDLR869.000]
SYSTEM TOTAL ABSOLUTE MISMATCH: 0.30 MVA

****

IEESGO AT BUS 67345 MACHINE 2 INITIALIZED OUT OF LIMITS

****

INITIAL CONDITION LOAD FLOW USED 6 ITERATIONS

****

INITIAL CONDITIONS SUSPECT:

I	DSTATE(I)	STATE(I)	MODEL	STATE	BUS	X--- NAME ---X	ID
9	0.82850E-02	0.80243					

```
    10   -9.1370       373.42
 19874   0.20416E-04  0.19309E-02  CIMTR3   K+4   67816  STLEONWG0.6000   1
 32164  -0.84549E-02  0.66600      IEEET1   K+1   66748  CENTER2G20.000   2
 32278   0.43527E-02 -0.30192      SCRX     K     67683  KET1-12G13.800   1
 42495  -0.66264E-01  0.19879E-01  IEESGO   K+1   67345  HESKET2G13.800   2
 42496  -0.39758      0.92988      IEESGO   K+2   67345  HESKET2G13.800   2
 44902  -0.46229E-02  0.24705      CIMTR3   K+1   60136  MAPLE R7115.00   1
 44905   0.19328E-03  0.64080E-02  CIMTR3   K+4   60136  MAPLE R7115.00   1
 51181  -0.76294E-01   0.0000      ESAC8B   K+2   61776  BOSWE71G14.400   1
 51186  -0.38147E-01   0.0000      ESAC8B   K+2   61777  BOSWE72G14.400   2
 52722   0.10450E-03  0.16301E-02  CIMTR3   K+4   67473  MMU SW 7115.00   WN
 57166   0.30520E-04  0.11005E-02  CIMTR3   K+4   35026  G426/53834.500   1
 57220  -0.20862E-01   0.0000      ESAC8B   K+2   61775  BOSWE44G22.800   4
 58513  -0.10215E-02 -0.69256E-01  CIMTR3   K+1   67825  STJOS1 W0.6900   1
 58516   0.27557E-04  0.22246E-02  CIMTR3   K+4   67825  STJOS1 W0.6900   1

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     LINE SWITCHING EVENTS FOLLOW:
+    ____________________________


     MHEB DC REDUCTIONS FOLLOW:
+    __________________________

 TIE LINE FROM 67621 TO 60173 CKT  1 TRIPPED AT  0.1667s *** INITIATING DC
 REDUCTION ***
 DC WILL BE REDUCED BY   1687.49 MW
1*** y5k-so16aa-nad                                        Page   4


     NETWORK NOT CONVERGED FOLLOW:
+    ____________________________


     RELOUV AND RELOUF SWITCHING EVENTS FOLLOW:
+    __________________________________________


     DC SWITCHING EVENTS FOLLOW:
+    ___________________________


     VSCAN EVENTS FOLLOW:
+    ____________________


     PI 4 KV EVENTS FOLLOW:
+    ______________________


     RELAY SCAN EVENTS FOLLOW:
+    _________________________
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FARGO/WATERTOWN SVS EVENTS FOLLOW:

AT TIME= 2.0667 CFGSVC: (1) 27.1 MVAR BSC(S) REMOVED AT BUS 66436 [FARGO 7]

UDHOLD EVENTS FOLLOW:

UDHOLD FUNCTION AT BUS 3404 APPLIED AT TIME = 0.1333SEC
UDHOLD FUNCTION AT BUS 3404 RESET AT TIME = 0.2667SEC

DYNAMIC VOLTAGE CHECKS FOLLOW:

FROM TIME 0.4000 TO TIME 5.0000

CHAN NO.	DESCRIPTION	PU VOLT MAX .LT.	PU VOLT MIN .GT.	MINIMUM VOLT	MINIMUM TIME	MAXIMUM VOLT	MAXIMUM TIME	VMAX LESS VMIN
444	67503 DORSEY	1.25	0.70	1.07	0.50	1.09	1.83	0.02
386	61624 FORBES	1.15	0.82	0.99	0.42	1.03	3.22	0.04
384	61615 ARROWHD	1.15	0.82	0.95	0.42	1.04	1.98	0.09
382	61612 RIVERTN	1.15	0.75	0.97	0.42	1.05	2.01	0.08
362	66752 DRAYTON	1.20	0.80	1.01	0.43	1.07	1.98	0.06
562	63229 WAHPETN	1.18	0.80	0.98	0.42	1.06	2.03	0.08
***	61631 MINONG5	1.20	0.82	0.96	0.42	1.06	2.01	0.10
542	63369 JAMESTN	1.20	0.70	0.91	0.42	1.01	2.03	0.10
390	63041 COAL CR	1.18	0.70	0.98	0.43	1.07	1.18	0.09
334	66529 WATERTN	1.18	0.75	0.99	0.43	1.04	2.03	0.05
360	67160 GROTON	1.15	0.70	0.96	0.43	1.05	2.06	0.09
553	61754 BOISE	1.15	0.82	0.98	0.47	1.03	2.59	0.05

POWERFLOW WARNINGS AT END OF SIMULATION FOLLOW:

BUSES WITH VOLTAGE GREATER THAN 1.1000:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)
61586 MIDCOMPS	500 608	1.1447	572.34	67533 ST.JAME7	110 667	1.1065	121.72
67536 GREATFL7	110 667	1.1085	121.93	67537 MCARTHR7	110 667	1.1049	121.54
67538 7SISTER7	110 667	1.1117	122.29	67539 LACDUBN7	110 667	1.1083	121.92
67553 POINTDB7	121 667	1.1224	135.80	67554 SLAVEFL7	121 667	1.1237	135.97
67556 WHTSL1 4	220 667	1.1320	249.03	67580 SHERBK 7	110 667	1.1088	121.97
67589 WHTSL2 4	220 667	1.1319	249.03	67591 MIDCOMPN	500 667	1.1292	564.58
67648 POINTD27	121 667	1.1270	136.36	67705 WHSL2PH7	110 667	1.1183	123.01
67706 WHITESH7	110 667	1.1109	122.20	67734 SK1 TP7	110 667	1.1114	122.25
67751 WHSL1PH7	110 667	1.1183	123.01	67755 SHBK-PH7	110 667	1.1309	124.40
67769 SR3SW3T7	110 667	1.1116	122.27	67770 SK1 SUB7	110 667	1.1783	129.61
67771 STAR LK7	110 667	1.1767	129.44	67772 BRERTON7	110 667	1.1781	129.59

1*** y5k-so16aa-nad Page 5

67774 SG12 TP7	110 667	1.1089	121.98	67775 BEAUSJ 7	110 667	1.1066	121.72

BUSES WITH VOLTAGE LESS THAN 0.9500:

X------ BUS -----X	AREA	V(PU)	V(KV)	X------ BUS -----X	AREA	V(PU)	V(KV)

BRANCH CURRENT LOADINGS ABOVE 100.0 % OF RATING SET A

```
X-------FROM BUS-------X  X--------TO BUS--------X       CURRENT(MVA)
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
61624  FORBES 4 230  608  61625* BLCKBRY4 230  608  1    388.7   370.0   105.1
61752  I.FALLS7 118  608  61784* INTPHAS7 118  608  1    186.1   180.0   103.4

 TRANSFORMER MVA LOADINGS ABOVE 100.0 % OF RATING SET A
+
X-------FROM BUS-------X  X--------TO BUS--------X       MVA      MVA
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
61752* I.FALLS7 118  608  61784  INTPHAS7 118  608  1    190.0   180.0   105.6
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TUE, NOV 20 2012 10:36

INITIATED AT LOAD FLOW ENTRY POINT ON TUE, NOV 20 2012 10:37

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164

SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

SPECIAL RESPONSE FILES AND COMMENTS

RESPONSE FILES

None

COMMENTS

None

P O W E R F L O W S U M M A R Y

NDEX:	3299 MW	ECL-ARP:	754 MW
MHEX:	2212 MW	PRI-NRC:	718 MW
MWEX:	1639 MW	AHD-SLK:	733 MW
KING-ECL:	906 MW	SLK-GPK:	553 MW
COOPER S:	1243 MW	WNE-WKS:	581 MW
FTCAL S:	658 MW	GGS:	1780 MW
GRIS-LNC:	799 MW	QC WEST:	-113 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2455.7 MW,	77.8% OF	3156.0 MW
NSP	(AREA 600)	6500.6 MW,	54.7% OF	11889.2 MW
MAN HYDRO	(AREA 667)	1148.2 MW,	37.3% OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	1148/ 285	MH total gross	4914	ATC West Import	1648
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	564
NW	915/ 37	7 Sisters	170	ATC SE Import	-1258
Sask.	2150/ 82	OH total gross	21884	East Bias	348
MP	1840/ 226	northwest	717	SPC>WAPA (B10T)	164
NSP	6500/ 548	SPC total gross	2406	MH>SPC (3-230)	60
N. Dakota	2455/ 347	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3081	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	2911	OH>MP @Ft Fran	151
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	190
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	11413 MVARS	West gross	3010	F601C @Forbes	1494
NSP	1353 MVARS	net	2848	D602F @Dorsey	1912
N. Dakota	562 MVARS	Total net	4601	L20D @Letell	173
ATC	9890/ 336	WAPA SD Hydro	1497	R50M @Richer	143
ATC	2953 MVARS	Pleasant Valley	0	G82R @Glenboro	-18
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	863		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	392	ANTELOP-LELAND	110	CENTER-JAMESTN	383
STANTON- SQ BUT	-79	HETINGR-BISON	119	WILTON-CASS LK	88

CASS LK-BOSWELL	38		BISON-ALEX SS3	436		ALEX SS-QUARRY	682
QUARRY-MNTCELO	458		BROOKNG-LYONCO	240		LYONCO-CEDARMT(T)	396
CEDARMT-HELENA(T)	352		LKMARN-HMPTCNR	20		HMPTCNR-NROC	512
NROC TR	170		NROC-NLAX	271		CNT-PRAIRIE 345	253
NROC-BYRON	775		LKFLDX-LAKEFLD3	-28		AKPEXPORT	2686
ROSEAU CAP	2116	AMPS	PRI-NROC	6	ANG		
CENTER-JAMESTN	12	ANG	ECL-ARP	18	ANG		

Tfmrs	MVA/	Load	Ph Shifters	Deg/	MW	DC Lines	MW
Wshell #1 7-7	104/	72%	Stinson	29/	29	CU (1,2)	1127
Wshell #2 7-7	104/	72%	Boundary Dam	3/	165	SQ BU (3,4)	550
Drayton#1 4-7	42/	30%	Whiteshell	112/	200	MH Bipole 1	1514
Drayton#2 4-7	51/	27%	Int Falls	134/	151	MH Bipole 2	1715
Dorsey #1 2-4	744/	62%	St. Lawrence	16/	0	MH (BP1+BP2)	3230
Dorsey #2 2-4	851/	70%	Arrowhead	0/	733	Miles City E>W	-150
Forbes 2-4	152/	22%				RCDC (15)	0
Stone Lk 3-5	165/	49%				Stegall (10)	0

Dorsey SC's		I/S	MVAR	Qmax/ Qmin	SVC's	MVAR	Qmax/ Qmin
MIL 7-9G	17.0	2	449	600/ -330	Forbes	500	10 400/ -450
SCE 1-3G	18.2	3	366	480/ -240	Fargo	13.2	2 20/ -135
SCA 4-6G	18.2	3	366	480/ -240	Watertown	20.0	36 125/ -86
Total			1183	1560/ -810	Series Caps		Num In Serv
Margin			377		Roseau	500	2 of 2
					Chisago	500	1 of 1

Caps/Reactors		MVAR	Caps/Reactors		MVAR	Caps/Reactors		MVAR
Balta (FS)	230	0	Arrowhead	230	160	Chisago T 9	34.5	60
Drayton	115	0	Blackberry	230	47	Chisago T 10	34.5	60
Drayton	13.8	-20	Minntac	115	45	Forbes	230	70
Eau Claire(FS)	161	356	Riverton	230	47	Forbes	500	600
Kohlman Lake	115	240	Roseau Co.(FS)	230	0			0
Parkers Lk(FS)	115	0	Running (FS)	230	30	Fargo	115	27
Prairie (FS)	115	0	Running react	230	0	Watertown	20	20
Ramsey (FS)	230	0	Shannon	230	72	Watertown	230	76
Red Rock	115	240			0			0
Rugby	13.8	0	Glenboro	230	0	Arrowhead	345	150
Split Rock(FS)	115	80	Laverendrye	110	98	Stone Lake	345	75
Sheyenne (FS)	115	40	Richer react	230	0	Stone Lk Reac	345	0
Wilton/Bemidji	115	20	St Vital	110	98	Stone Lake	161	40
		0			0	Grdnr Pk Reac	345	0
		0			0	Grdnr Pk Caps	115	0
		0			0	Arpin Caps	138	52
		0			0	Council Creek	138	16

Bus Voltages		V,pu	Bus Voltages		V,pu	Bus Voltages		V,kV
Adams	345	1.003	Arrowhead	230	0.981	Whiteshell	110	118.9
Alexandria	115	1.010	Badoura	115	1.023	Kenora	220	245.2
Audubon	115	1.034	Blackberry	230	1.020	Dryden	220	249.6
Bemidji	115	1.026	Boise Cascade	13.8	1.054	Fort Frances	220	240.6
Byron	345	1.012	Boise Cascade	115	1.022	Mackenzie	220	251.8
Chisago Co.	345	1.005	ETCO	115	0.992	Lakehead	220	245.8
Chisago Co.	500	1.000	Forbes	230	1.002	Marathon	220	252.6
Drayton	230	1.027	Forbes	500	0.994	Wawa	220	254.6
Eau Claire	345	0.983	Hubbard	115	0.000	Mississagi	220	250.6
WEST FARIBAULT	115	1.037	Intl Falls	115	1.023	Fort Frances	118	119.9

LaPorte	115	1.018	Minntac	115	1.001	Lakehead	118	122.8
Maple River	230	1.037	Moranville	230	1.009	Birch	118	120.2
Marshall Tap	115	1.046	Riverton	230	1.020	Marathon	118	124.7
Owatonna	161	1.006	Running	230	1.011			0.000
Prairie	115	1.031	Shannon	230	1.016	Arrowhead	345	1.003
Prairie	230	1.040	Stinson MN	115	1.000	Stone Lake	345	1.012
Ramsey	230	1.025	Jamestown	345	1.002	Stone Lake	161	1.025
Roseau County	230	1.009	Groton	345	1.004	Gardner Park	345	1.033
Roseau County	500	1.063	Watertown	230	1.030	Weston	115	1.035
Sheyenne	230	1.033	Watertown	345	1.024	Arpin	345	0.996
Thief R Falls	115	1.027			0.000	Eau Claire	161	1.044
Tioga	230	1.029	Dorsey	230	1.045	Council Creek	161	0.977
Wahpeton	230	1.019	Dorsey	500	1.033	Hydro Lane	161	1.022
Winger	115	1.045	ALEX SS3	34	0.981	Wien	115	1.026
WILTON 4	230	1.026	BRKNGCO3	345	1.027	NROC	345	1.011
MINONG 5	161	1.018	PRAIRIE3	345	1.018	LYON CO	345	1.029
		0.000			0.000	CASS LK4	230	1.029

Steady State Relay Margins (measured from inner blinder)

Relay Location	Manuf/Type	PSS Model	South	North	Em North
1) B10T-Tioga (South)	GE OST	SLLP	336%	N/A	N/A
2) -Tioga (North)	GE OST	SLLP	691%	N/A	N/A
3) -Tioga (Em North)	GE OST	SLLP		N/A	N/A
4) D602F-Dorsey	ATP ???	SLINOS	334%	N/A	N/A
5) -Forbes (Normal)	ATP ???	SLINOS	198%	N/A	N/A
6) -Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8) F3M-Intl Falls	APT S-PRO	SLINOS	319%	N/A	N/A
9) G82R-Rugby	APT	SLINOS	N/A	1938%	
10) L20D-Drayton (Normal)	APT, ASEA	SLINOS	1274%	N/A	N/A
11) -Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12) R50M-Moranville (Norm)	APT, West	SLINOS	887%	N/A	N/A
13) -Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

SIMULATION CHECKS FOLLOW:

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+    _________________________

 ITER DELTAV/TOL X------ AT BUS ------X  REAL(DELTAV)  IMAG(DELTAV)
    1   109.438  66584 [SIDNEYW4230.00]   -0.1019E-03    0.4003E-04
    2    38.523  66584 [SIDNEYW4230.00]   -0.3784E-04    0.7207E-05
    3    12.084  66584 [SIDNEYW4230.00]    0.8660E-05   -0.8428E-05
    4     4.151  66584 [SIDNEYW4230.00]   -0.2964E-05    0.2906E-05
    5     1.423  66584 [SIDNEYW4230.00]    0.1016E-05   -0.9973E-06
    6     0.471  66584 [SIDNEYW4230.00]   -0.3293E-06    0.3364E-06

 REACHED TOLERANCE IN   6 ITERATIONS

 LARGEST MISMATCH:    0.02 MW    0.03 MVAR     0.04 MVA AT BUS 62710
 [CHANDLR869.000]
 SYSTEM TOTAL ABSOLUTE MISMATCH:               0.32 MVA

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 INITIAL CONDITION LOAD FLOW USED  6 ITERATIONS

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 INITIAL CONDITIONS SUSPECT:
     I   DSTATE(I)    STATE(I)     MODEL   STATE    BUS  X--- NAME ---X   ID
     9   0.13863E-01  0.75671
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    10   -14.699       392.78
 19874   0.24588E-04  0.19286E-02  CIMTR3   K+4   67816  STLEONWG0.6000   1
 32164  -0.83655E-02  0.66600      IEEET1   K+1   66748  CENTER2G20.000   2
 32278   0.83031E-02 -0.30191      SCRX     K     67683  KET1-12G13.800   1
 32586   0.18599E-03 -0.59674E-02  IEEET1   K+1   72371  BP #4 GN22.000   1
 44905   0.14308E-03  0.64182E-02  CIMTR3   K+4   60136  MAPLE R7115.00   1
 51181  -0.38147E-01   0.0000      ESAC8B   K+2   61776  BOSWE71G14.400   1
 51186  -0.38147E-01   0.0000      ESAC8B   K+2   61777  BOSWE72G14.400   2
 52722   0.10617E-03  0.16393E-02  CIMTR3   K+4   67473  MMU SW 7115.00   WN
 54892   0.40178E-04  0.37108E-02  IEEET1   K+1   39386  OK C G6 18.000   L
 57166   0.29495E-04  0.10986E-02  CIMTR3   K+4   35026  G426/53834.500   1
 57220  -0.20862E-01   0.0000      ESAC8B   K+2   61775  BOSWE44G22.800   4
 58516   0.31630E-04  0.22246E-02  CIMTR3   K+4   67825  STJOS1 W0.6900   1

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     LINE SWITCHING EVENTS FOLLOW:
+    ____________________________

     MHEB DC REDUCTIONS FOLLOW:
+    __________________________

     NETWORK NOT CONVERGED FOLLOW:
+    ____________________________
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     RELOUV AND RELOUF SWITCHING EVENTS FOLLOW:
+    __________________________________________

     DC SWITCHING EVENTS FOLLOW:
+    ___________________________

 AT TIME = 0.1000 DC LINE  1 MANUALLY BLOCKED
 AT TIME = 0.1000 DC LINE  2 MANUALLY BLOCKED
 AT TIME = 0.1667 DC LINE  1 MANUALLY UNBLOCKED
 AT TIME = 0.1667 DC LINE  2 MANUALLY UNBLOCKED

     VSCAN EVENTS FOLLOW:
+    ____________________

 AT TIME =  0.467 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO

 AT TIME =  0.475 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61631 [MINONG 5 161] 0.81   LO

 AT TIME =  0.483 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61614 [98L TAP4 230] 0.81   LO    61615 [ARROWHD4 230] 0.81   LO
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 61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.492 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61614 [98L TAP4 230] 0.81   LO    61615 [ARROWHD4 230] 0.81   LO
 61616 [HILLTOP4 230] 0.81   LO    61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.500 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61614 [98L TAP4 230] 0.81   LO    61615 [ARROWHD4 230] 0.81   LO
 61616 [HILLTOP4 230] 0.81   LO    61631 [MINONG 5 161] 0.80   LO

 AT TIME =  0.508 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61614 [98L TAP4 230] 0.81   LO    61615 [ARROWHD4 230] 0.81   LO
 61616 [HILLTOP4 230] 0.81   LO    61630 [STINSON5 161] 0.81   LO
 61631 [MINONG 5 161] 0.79   LO    61632 [DAHLBRG7 115] 0.81   LO

 AT TIME =  0.517 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61614 [98L TAP4 230] 0.81   LO    61615 [ARROWHD4 230] 0.80   LO
 61616 [HILLTOP4 230] 0.81   LO    61630 [STINSON5 161] 0.81   LO
 61631 [MINONG 5 161] 0.79   LO    61632 [DAHLBRG7 115] 0.81   LO

 AT TIME =  0.525 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61570 [STINSJCT 115] 0.81   LO    61614 [98L TAP4 230] 0.80   LO
 61615 [ARROWHD4 230] 0.80   LO    61616 [HILLTOP4 230] 0.81   LO
 61630 [STINSON5 161] 0.81   LO    61631 [MINONG 5 161] 0.79   LO
 61632 [DAHLBRG7 115] 0.81   LO    61678 [NEMADJI7 115] 0.81   LO
 61679 [GARY   7 115] 0.81   LO    61683 [STIN-MN7 115] 0.81   LO
 61684 [STIN-WI7 115] 0.81   LO

 AT TIME =  0.533 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61570 [STINSJCT 115] 0.81   LO    61614 [98L TAP4 230] 0.80   LO
 61615 [ARROWHD4 230] 0.80   LO    61616 [HILLTOP4 230] 0.80   LO
 61630 [STINSON5 161] 0.81   LO    61631 [MINONG 5 161] 0.79   LO
 61632 [DAHLBRG7 115] 0.81   LO    61678 [NEMADJI7 115] 0.81   LO
 61679 [GARY   7 115] 0.81   LO    61680 [WNTR ST7 115] 0.81   LO
 61683 [STIN-MN7 115] 0.81   LO    61684 [STIN-WI7 115] 0.81   LO
 61686 [15TH AV7 115] 0.81   LO
1*** w3l-so16aa-pcs                                        Page   5

 AT TIME =  0.542 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61570 [STINSJCT 115] 0.81   LO    61614 [98L TAP4 230] 0.80   LO
 61615 [ARROWHD4 230] 0.80   LO    61616 [HILLTOP4 230] 0.80   LO
 61630 [STINSON5 161] 0.81   LO    61631 [MINONG 5 161] 0.78   LO
 61632 [DAHLBRG7 115] 0.81   LO    61678 [NEMADJI7 115] 0.81   LO
 61679 [GARY   7 115] 0.81   LO    61680 [WNTR ST7 115] 0.81   LO
 61683 [STIN-MN7 115] 0.81   LO    61684 [STIN-WI7 115] 0.81   LO
 61686 [15TH AV7 115] 0.81   LO

 AT TIME =  0.550 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61570 [STINSJCT 115] 0.81   LO    61614 [98L TAP4 230] 0.80   LO
 61615 [ARROWHD4 230] 0.80   LO    61616 [HILLTOP4 230] 0.80   LO
 61630 [STINSON5 161] 0.80   LO    61631 [MINONG 5 161] 0.78   LO
 61632 [DAHLBRG7 115] 0.80   LO    61672 [HILLTOP7 115] 0.81   LO
 61678 [NEMADJI7 115] 0.81   LO    61679 [GARY   7 115] 0.81   LO
 61680 [WNTR ST7 115] 0.81   LO    61683 [STIN-MN7 115] 0.81   LO
 61684 [STIN-WI7 115] 0.81   LO    61686 [15TH AV7 115] 0.81   LO

 AT TIME =  0.558 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
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 61570 [STINSJCT 115] 0.81   LO    61614 [98L TAP4 230] 0.80   LO
 61615 [ARROWHD4 230] 0.80   LO    61616 [HILLTOP4 230] 0.80   LO
 61630 [STINSON5 161] 0.80   LO    61631 [MINONG 5 161] 0.78   LO
 61632 [DAHLBRG7 115] 0.80   LO    61672 [HILLTOP7 115] 0.81   LO
 61678 [NEMADJI7 115] 0.81   LO    61679 [GARY   7 115] 0.81   LO
 61680 [WNTR ST7 115] 0.81   LO    61683 [STIN-MN7 115] 0.81   LO
 61684 [STIN-WI7 115] 0.81   LO    61686 [15TH AV7 115] 0.81   LO

 AT TIME =  0.567 VOLTAGES OUTSIDE OF BAND 0.82000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 61570 [STINSJCT 115] 0.81   LO    61614 [98L TAP4 230] 0.80   LO
 61615 [ARROWHD4 230] 0.80   LO    61616 [HILLTOP4 230] 0.80   LO
 61630 [STINSON5 161] 0.80   LO    61631 [MINONG 5 161] 0.78   LO
 61632 [DAHLBRG7 115] 0.80   LO    61672 [HILLTOP7 115] 0.81   LO
 61676 [HIBBARD7 115] 0.81   LO    61678 [NEMADJI7 115] 0.81   LO
 61679 [GARY   7 115] 0.81   LO    61680 [WNTR ST7 115] 0.81   LO
 61681 [LSPI   7 115] 0.81   LO
   *** VSCAN SEARCH TERMINATED AT 60 RECORDS ***


     PI 4 KV EVENTS FOLLOW:
+    ______________________



     RELAY SCAN EVENTS FOLLOW:
+    _________________________



     FARGO/WATERTOWN SVS EVENTS FOLLOW:
+    __________________________________

 AT TIME= 1.2083 CFGSVC: (1) 27.1 MVAR BSC(S) ADDED AT BUS  66436 [FARGO  7]
 AT TIME= 3.0833 CFGSVC: (1) 27.1 MVAR BSC(S) REMOVED AT BUS  66436 [FARGO  7]


     UDHOLD EVENTS FOLLOW:
+    ______________________



     DYNAMIC VOLTAGE CHECKS FOLLOW:
+    ______________________________
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FROM TIME 0.4000 TO TIME 5.0000

CHAN NO.	DESCRIPTION	PU VOLT MAX .LT.	PU VOLT MIN .GT.	MINIMUM VOLT	MINIMUM TIME	MAXIMUM VOLT	MAXIMUM TIME	VMAX LESS VMIN
444	67503 DORSEY	1.25	0.70	1.03	1.31	1.07	0.41	0.04
386	61624 FORBES	1.15	0.82	0.98	1.61	1.00	4.13	0.02
384	61615 ARROWHD	1.15	0.82	0.80	0.61	0.94	2.59	0.14
382	61612 RIVERTN	1.15	0.75	0.98	0.48	1.03	3.36	0.05
362	66752 DRAYTON	1.20	0.80	1.01	1.63	1.04	3.36	0.03
562	63229 WAHPETN	1.18	0.80	1.00	0.46	1.05	3.36	0.05
***	61631 MINONG5	1.20	0.82	0.77	0.63	0.96	2.59	0.19
542	63369 JAMESTN	1.20	0.70	0.97	0.46	1.02	3.36	0.05
390	63041 COAL CR	1.18	0.70	0.97	0.41	1.06	0.71	0.09
334	66529 WATERTN	1.18	0.75	0.98	0.53	1.03	3.31	0.05

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  360   67160 GROTON    1.15  0.70     0.94  0.53     1.02  3.31    0.08
  553   61754 BOISE     1.15  0.82     1.02  1.58     1.05  0.41    0.03
 ----   -------------   ----------     ----  ----     ----  ----    ----
+>>>>   >>>>>>>>>>>>>   >>>>>>>>>>     >>>>  >>>>     >>>>  >>>>    >>>>
  384   61615 ARROWHD   0.82  1.15     0.80  0.61
  ***   61631 MINONG5   0.82  1.20     0.77  0.63


     POWERFLOW WARNINGS AT END OF SIMULATION FOLLOW:
+    ______________________________________________

BUSES WITH VOLTAGE GREATER THAN 1.1000:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
67648 POINTD27 121 667 1.1032 133.48    67770 SK1 SUB7 110 667 1.1399 125.39
67771 STAR LK7 110 667 1.1383 125.21    67772 BRERTON7 110 667 1.1397 125.37

BUSES WITH VOLTAGE LESS THAN 0.9500:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
60288 IRONWD 7 115 600 0.9466 108.86    60289 HURLEY 7 115 600 0.9465 108.84
60290 ST LAKE5 161 600 0.8867 142.76    60291 INOPUMP7 115 600 0.9120 104.88
60292 IRONRIV7 115 600 0.9073 104.34    60293 FRMSINN5 161 600 0.8911 143.46
60294 GINGLES5 161 600 0.9160 147.47    60295 BAYFRNT7 115 600 0.9252 106.39
60312 PINE LK5 161 600 0.9481 152.65    60314 PINELKT5 161 600 0.9489 152.77
60315 T-CRNRS7 115 600 0.9424 108.38    60340 PHILIPS7 115 600 0.9479 109.01
60350 GINGLES7 115 600 0.9241 106.27    60361 ROCKCR 4 230 600 0.9430 216.89
60511 LAW CRK7 115 600 0.9348 107.50    60512 LAW CRK5 161 600 0.9268 149.21
61051 STCROIG7 161 600 0.9252 148.95    61554 AWHD1JCT 115 608 0.9056 104.15
61556 AWHD2JCT 115 608 0.9057 104.16    61570 STINSJCT 115 608 0.9050 104.08
61576 HILTPJCT 115 608 0.9038 103.94    61614 98L TAP4 230 608 0.8885 204.35
61615 ARROWHD4 230 608 0.8874 204.11    61616 HILLTOP4 230 608 0.8895 204.59
61630 STINSON5 161 608 0.9037 145.49    61631 MINONG 5 161 608 0.8901 143.30
61632 DAHLBRG7 115 608 0.9035 103.90    61666 FONDULAC 115 608 0.9469 108.90
61667 POTLTCH7 115 608 0.9424 108.38    61668 CLOQUET7 115 608 0.9377 107.83
   *** BUS UNDERVOLTAGE SEARCH TERMINATED AT 15 RECORDS ***

 BRANCH CURRENT LOADINGS ABOVE 100.0 % OF RATING SET A
+
X-------FROM BUS-------X  X--------TO BUS--------X       CURRENT(MVA)
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
61666  FONDULAC 115  608  61676* HIBBARD7 115  608  1     70.8    40.0   177.0
69507* SENECA 5 161  680  69508  GRANGRAE 161  680  1    211.3   201.0   105.1
69507* SENECA 5 161  680  69523  GENOA  5 161  680  1    360.9   302.0   119.5

 TRANSFORMER MVA LOADINGS ABOVE 100.0 % OF RATING SET A
+            ___
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TUE, NOV 20 2012 10:43

INITIATED AT LOAD FLOW ENTRY POINT ON TUE, NOV 20 2012 10:43

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164

4 CYCLE, THREE PHASE FAULT AT CHISAGO TRIP F601C, XTRIP D60
USE NEW 100% REDUCTION INIT FROM CHISAGO, LEAVE SVS ON MP S

SPECIAL RESPONSE FILES AND COMMENTS

RESPONSE FILES

None

COMMENTS

None

P O W E R F L O W S U M M A R Y

NDEX:	3299 MW	ECL-ARP:	754 MW
MHEX:	2212 MW	PRI-NRC:	718 MW
MWEX:	1639 MW	AHD-SLK:	733 MW
KING-ECL:	906 MW	SLK-GPK:	553 MW
COOPER S:	1243 MW	WNE-WKS:	581 MW
FTCAL S:	658 MW	GGS:	1780 MW
GRIS-LNC:	799 MW	QC WEST:	-113 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2455.7 MW,	77.8% OF	3156.0 MW
NSP	(AREA 600)	6500.6 MW,	54.7% OF	11889.2 MW
MAN HYDRO	(AREA 667)	1148.2 MW,	37.3% OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	1148/ 285	MH total gross	4914	ATC West Import	1648
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	564
NW	915/ 37	7 Sisters	170	ATC SE Import	-1258
Sask.	2150/ 82	OH total gross	21884	East Bias	348
MP	1840/ 226	northwest	717	SPC>WAPA (B10T)	164
NSP	6500/ 548	SPC total gross	2406	MH>SPC (3-230)	60
N. Dakota	2455/ 347	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3081	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	2911	OH>MP @Ft Fran	151
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	190
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	11413 MVARS	West gross	3010	F601C @Forbes	1494
NSP	1353 MVARS	net	2848	D602F @Dorsey	1912
N. Dakota	562 MVARS	Total net	4601	L20D @Letell	173
ATC	9890/ 336	WAPA SD Hydro	1497	R50M @Richer	143
ATC	2953 MVARS	Pleasant Valley	0	G82R @Glenboro	-18
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	863		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	392	ANTELOP-LELAND	110	CENTER-JAMESTN	383
STANTON- SQ BUT	-79	HETINGR-BISON	119	WILTON-CASS LK	88

CASS LK-BOSWELL	38		BISON-ALEX SS3	436		ALEX SS-QUARRY	682
QUARRY-MNTCELO	458		BROOKNG-LYONCO	240		LYONCO-CEDARMT(T)	396
CEDARMT-HELENA(T)	352		LKMARN-HMPTCNR	20		HMPTCNR-NROC	512
NROC TR	170		NROC-NLAX	271		CNT-PRAIRIE 345	253
NROC-BYRON	775		LKFLDX-LAKEFLD3	-28		AKPEXPORT	2686
ROSEAU CAP	2116	AMPS	PRI-NROC	6	ANG		
CENTER-JAMESTN	12	ANG	ECL-ARP	18	ANG		

Tfmrs	MVA/	Load	Ph Shifters	Deg/	MW	DC Lines	MW
Wshell #1 7-7	104/	72%	Stinson	29/	29	CU (1,2)	1127
Wshell #2 7-7	104/	72%	Boundary Dam	3/	165	SQ BU (3,4)	550
Drayton#1 4-7	42/	30%	Whiteshell	112/	200	MH Bipole 1	1514
Drayton#2 4-7	51/	27%	Int Falls	134/	151	MH Bipole 2	1715
Dorsey #1 2-4	744/	62%	St. Lawrence	16/	0	MH (BP1+BP2)	3230
Dorsey #2 2-4	851/	70%	Arrowhead	0/	733	Miles City E>W	-150
Forbes 2-4	152/	22%				RCDC (15)	0
Stone Lk 3-5	165/	49%				Stegall (10)	0

Dorsey SC's		I/S	MVAR	Qmax/ Qmin	SVC's	MVAR	Qmax/ Qmin
MIL 7-9G	17.0	2	449	600/ -330	Forbes	500	10 400/ -450
SCE 1-3G	18.2	3	366	480/ -240	Fargo	13.2	2 20/ -135
SCA 4-6G	18.2	3	366	480/ -240	Watertown	20.0	36 125/ -86
Total			1183	1560/ -810	Series Caps		Num In Serv
Margin			377		Roseau	500	2 of 2
					Chisago	500	1 of 1

Caps/Reactors		MVAR	Caps/Reactors		MVAR	Caps/Reactors		MVAR
Balta (FS)	230	0	Arrowhead	230	160	Chisago T 9	34.5	60
Drayton	115	0	Blackberry	230	47	Chisago T 10	34.5	60
Drayton	13.8	-20	Minntac	115	45	Forbes	230	70
Eau Claire(FS)	161	356	Riverton	230	47	Forbes	500	600
Kohlman Lake	115	240	Roseau Co.(FS)	230	0			0
Parkers Lk(FS)	115	0	Running (FS)	230	30	Fargo	115	27
Prairie (FS)	115	0	Running react	230	0	Watertown	20	20
Ramsey (FS)	230	0	Shannon	230	72	Watertown	230	76
Red Rock	115	240			0			0
Rugby	13.8	0	Glenboro	230	0	Arrowhead	345	150
Split Rock(FS)	115	80	Laverendrye	110	98	Stone Lake	345	75
Sheyenne (FS)	115	40	Richer react	230	0	Stone Lk Reac	345	0
Wilton/Bemidji	115	20	St Vital	110	98	Stone Lake	161	40
		0			0	Grdnr Pk Reac	345	0
		0			0	Grdnr Pk Caps	115	0
		0			0	Arpin Caps	138	52
		0			0	Council Creek	138	16

Bus Voltages		V,pu	Bus Voltages		V,pu	Bus Voltages		V,kV
Adams	345	1.003	Arrowhead	230	0.981	Whiteshell	110	118.9
Alexandria	115	1.010	Badoura	115	1.023	Kenora	220	245.2
Audubon	115	1.034	Blackberry	230	1.020	Dryden	220	249.6
Bemidji	115	1.026	Boise Cascade	13.8	1.054	Fort Frances	220	240.6
Byron	345	1.012	Boise Cascade	115	1.022	Mackenzie	220	251.8
Chisago Co.	345	1.005	ETCO	115	0.992	Lakehead	220	245.8
Chisago Co.	500	1.000	Forbes	230	1.002	Marathon	220	252.6
Drayton	230	1.027	Forbes	500	0.994	Wawa	220	254.6
Eau Claire	345	0.983	Hubbard	115	0.000	Mississagi	220	250.6
WEST FARIBAULT	115	1.037	Intl Falls	115	1.023	Fort Frances	118	119.9

LaPorte	115	1.018	Minntac	115	1.001	Lakehead	118	122.8
Maple River	230	1.037	Moranville	230	1.009	Birch	118	120.2
Marshall Tap	115	1.046	Riverton	230	1.020	Marathon	118	124.7
Owatonna	161	1.006	Running	230	1.011			0.000
Prairie	115	1.031	Shannon	230	1.016	Arrowhead	345	1.003
Prairie	230	1.040	Stinson MN	115	1.000	Stone Lake	345	1.012
Ramsey	230	1.025	Jamestown	345	1.002	Stone Lake	161	1.025
Roseau County	230	1.009	Groton	345	1.004	Gardner Park	345	1.033
Roseau County	500	1.063	Watertown	230	1.030	Weston	115	1.035
Sheyenne	230	1.033	Watertown	345	1.024	Arpin	345	0.996
Thief R Falls	115	1.027			0.000	Eau Claire	161	1.044
Tioga	230	1.029	Dorsey	230	1.045	Council Creek	161	0.977
Wahpeton	230	1.019	Dorsey	500	1.033	Hydro Lane	161	1.022
Winger	115	1.045	ALEX SS3	34	0.981	Wien	115	1.026
WILTON 4	230	1.026	BRKNGCO3	345	1.027	NROC	345	1.011
MINONG 5	161	1.018	PRAIRIE3	345	1.018	LYON CO	345	1.029
		0.000			0.000	CASS LK4	230	1.029

Steady State Relay Margins (measured from inner blinder)

Relay Location	Manuf/Type	PSS Model	South	North	Em North
1) B10T-Tioga (South)	GE OST	SLLP	336%	N/A	N/A
2) -Tioga (North)	GE OST	SLLP	691%	N/A	N/A
3) -Tioga (Em North)	GE OST	SLLP		N/A	N/A
4) D602F-Dorsey	ATP ???	SLINOS	334%	N/A	N/A
5) -Forbes (Normal)	ATP ???	SLINOS	198%	N/A	N/A
6) -Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8) F3M-Intl Falls	APT S-PRO	SLINOS	319%	N/A	N/A
9) G82R-Rugby	APT	SLINOS	N/A	1938%	
10) L20D-Drayton (Normal)	APT, ASEA	SLINOS	1274%	N/A	N/A
11) -Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12) R50M-Moranville (Norm)	APT, West	SLINOS	887%	N/A	N/A
13) -Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

SIMULATION CHECKS FOLLOW:

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+    _________________________

 ITER DELTAV/TOL X------ AT BUS ------X  REAL(DELTAV)  IMAG(DELTAV)
    1   109.438  66584 [SIDNEYW4230.00]   -0.1019E-03    0.4003E-04
    2    38.523  66584 [SIDNEYW4230.00]   -0.3784E-04    0.7207E-05
    3    12.084  66584 [SIDNEYW4230.00]    0.8660E-05   -0.8428E-05
    4     4.151  66584 [SIDNEYW4230.00]   -0.2964E-05    0.2906E-05
    5     1.423  66584 [SIDNEYW4230.00]    0.1016E-05   -0.9973E-06
    6     0.471  66584 [SIDNEYW4230.00]   -0.3293E-06    0.3364E-06

 REACHED TOLERANCE IN   6 ITERATIONS

 LARGEST MISMATCH:    0.02 MW    0.03 MVAR     0.04 MVA AT BUS 62710
 [CHANDLR869.000]
 SYSTEM TOTAL ABSOLUTE MISMATCH:               0.32 MVA

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 INITIAL CONDITION LOAD FLOW USED  6 ITERATIONS

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 INITIAL CONDITIONS SUSPECT:
     I   DSTATE(I)    STATE(I)     MODEL   STATE    BUS  X--- NAME ---X   ID
     9   0.13863E-01  0.75671
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    10   -14.699       392.78
 19874   0.24588E-04  0.19286E-02  CIMTR3   K+4   67816  STLEONWG0.6000   1
 32164  -0.83655E-02  0.66600      IEEET1   K+1   66748  CENTER2G20.000   2
 32278   0.83031E-02 -0.30191      SCRX     K     67683  KET1-12G13.800   1
 32586   0.18599E-03 -0.59674E-02  IEEET1   K+1   72371  BP #4 GN22.000   1
 44905   0.14308E-03  0.64182E-02  CIMTR3   K+4   60136  MAPLE R7115.00   1
 51181  -0.38147E-01   0.0000      ESAC8B   K+2   61776  BOSWE71G14.400   1
 51186  -0.38147E-01   0.0000      ESAC8B   K+2   61777  BOSWE72G14.400   2
 52722   0.10617E-03  0.16393E-02  CIMTR3   K+4   67473  MMU SW 7115.00   WN
 54892   0.40178E-04  0.37108E-02  IEEET1   K+1   39386  OK C G6 18.000   L
 57166   0.29495E-04  0.10986E-02  CIMTR3   K+4   35026  G426/53834.500   1
 57220  -0.20862E-01   0.0000      ESAC8B   K+2   61775  BOSWE44G22.800   4
 58516   0.31630E-04  0.22246E-02  CIMTR3   K+4   67825  STJOS1 W0.6900   1

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     LINE SWITCHING EVENTS FOLLOW:
+    ____________________________

     MHEB DC REDUCTIONS FOLLOW:
+    __________________________

 TIE LINE FROM 67503 TO 67700 CKT  2 TRIPPED AT  0.1500s *** INITIATING DC
 REDUCTION ***
 DC WILL BE REDUCED BY   2065.91 MW
1*** w3l-so16aa-nmz                                        Page   4

     NETWORK NOT CONVERGED FOLLOW:
+    ____________________________

     RELOUV AND RELOUF SWITCHING EVENTS FOLLOW:
+    __________________________________________

 *** SHUNT AT BUS67565 MODIFIED FROM    73.40 TO     0.00    BY RELOUV (OVER )
                 AT TIME =   0.4000 SECS.
 *** SHUNT AT BUS67503 MODIFIED FROM   755.60 TO   496.00    BY RELOUV (OVER )
                 AT TIME =   0.7750 SECS.

     DC SWITCHING EVENTS FOLLOW:
+    ___________________________

 AT TIME = 0.1000 DC LINE  1 MANUALLY BLOCKED
 AT TIME = 0.1000 DC LINE  2 MANUALLY BLOCKED
 AT TIME = 0.1583 DC LINE  1 MANUALLY UNBLOCKED
 AT TIME = 0.1583 DC LINE  2 MANUALLY UNBLOCKED

     VSCAN EVENTS FOLLOW:
+    ____________________

 AT TIME =  1.917 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI
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 AT TIME =  1.925 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI

 AT TIME =  1.933 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI

 AT TIME =  1.942 VOLTAGES OUTSIDE OF BAND 0.70000 TO 1.20000:
 X------ BUS -------X VOLTAGE      X------ BUS -------X VOLTAGE
 67508 [PONTON 4 230] 1.21   HI


     PI 4 KV EVENTS FOLLOW:
+    ______________________

 ++++ PRICR:VOLTAGE AT BUS 60670[PI2 RCP94.00] DROPPED BELOW
      SETPOINT OF 0.7800 PU AT 0.1250 SEC
 ++++ PRICR:VOLTAGE AT BUS 60667[PI1 RCP94.00] DROPPED BELOW
      SETPOINT OF 0.7800 PU AT 0.1333 SEC
 ++++ PRICR:AT TIME = 0.1667 SEC, VOLTAGE AT BUS 60667[PI1 RCP9â•••] INCREASED
      ABOVE RESET VOLTAGE OF 0.8000. VOLTAGE WAS BELOW RESET VOLTAGE FOR
      0.0333
 ++++ PRICR:AT TIME = 0.1667 SEC, VOLTAGE AT BUS 60670[PI2 RCP9â•••] INCREASED
      ABOVE RESET VOLTAGE OF 0.8000. VOLTAGE WAS BELOW RESET VOLTAGE FOR
      0.0417


     RELAY SCAN EVENTS FOLLOW:
+    _________________________



     FARGO/WATERTOWN SVS EVENTS FOLLOW:
+    __________________________________

 AT TIME= 2.0417 CFGSVC: (1) 27.1 MVAR BSC(S) REMOVED AT BUS  66436 [FARGO  7]
 AT TIME= 3.7166 CFGSVC: (1) 27.1 MVAR BSC(S) ADDED AT BUS  66436 [FARGO  7]


     UDHOLD EVENTS FOLLOW:
+    _____________________

 UDHOLD FUNCTION AT BUS 3404 APPLIED AT TIME =  0.1333SEC
 UDHOLD FUNCTION AT BUS 3404 RESET AT TIME =  0.2500SEC


     DYNAMIC VOLTAGE CHECKS FOLLOW:
+    ______________________________
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1*** w3l-so16aa-nmz Page 5

FROM TIME 0.4000 TO TIME 5.0000

CHAN NO.	DESCRIPTION	PU VOLT MAX .LT.	PU VOLT MIN .GT.	MINIMUM VOLT	MINIMUM TIME	MAXIMUM VOLT	MAXIMUM TIME	VMAX LESS VMIN
444	67503 DORSEY	1.25	0.70	1.05	0.80	1.09	0.43	0.04
386	61624 FORBES	1.15	0.82	0.98	0.55	1.02	3.40	0.04
384	61615 ARROWHD	1.15	0.82	0.93	0.43	1.05	1.40	0.12
382	61612 RIVERTN	1.15	0.75	0.93	0.50	1.06	2.03	0.13
362	66752 DRAYTON	1.20	0.80	0.98	0.55	1.08	2.03	0.10

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  562   63229 WAHPETN   1.18  0.80     0.93  0.55     1.09  2.03    0.16
  ***   61631 MINONG5   1.20  0.82     0.99  0.43     1.09  1.40    0.10
  542   63369 JAMESTN   1.20  0.70     0.90  0.52     1.05  2.03    0.15
  390   63041 COAL CR   1.18  0.70     0.95  0.45     1.08  1.21    0.13
  334   66529 WATERTN   1.18  0.75     0.93  0.52     1.06  1.26    0.13
  360   67160 GROTON    1.15  0.70     0.86  0.55     1.07  2.14    0.21
  553   61754 BOISE     1.15  0.82     0.95  0.70     1.04  2.00    0.09


     POWERFLOW WARNINGS AT END OF SIMULATION FOLLOW:
+    ___________________________________________

BUSES WITH VOLTAGE GREATER THAN 1.1000:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
67533 ST.JAME7 110 667 1.1057 121.62    67536 GREATFL7 110 667 1.1092 122.01
67537 MCARTHR7 110 667 1.1061 121.68    67538 7SISTER7 110 667 1.1143 122.58
67539 LACDUBN7 110 667 1.1101 122.11    67553 POINTDB7 121 667 1.1236 135.95
67554 SLAVEFL7 121 667 1.1251 136.13    67556 WHTSL1 4 220 667 1.1134 244.96
67580 SHERBK 7 110 667 1.1080 121.88    67589 WHTSL2 4 220 667 1.1134 244.95
67648 POINTD27 121 667 1.1283 136.52    67705 WHSL2PH7 110 667 1.1230 123.53
67706 WHITESH7 110 667 1.1137 122.51    67734 SK1  TP7 110 667 1.1141 122.55
67751 WHSL1PH7 110 667 1.1230 123.53    67755 SHBK-PH7 110 667 1.1301 124.31
67769 SR3SW3T7 110 667 1.1142 122.56    67770 SK1 SUB7 110 667 1.1811 129.92
67771 STAR LK7 110 667 1.1796 129.75    67772 BRERTON7 110 667 1.1810 129.91
67774 SG12 TP7 110 667 1.1109 122.20    67775 BEAUSJ 7 110 667 1.1086 121.94
91062 DBCOMPS  500 620 1.1073 553.66

BUSES WITH VOLTAGE LESS THAN 0.9500:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)


 BRANCH CURRENT LOADINGS ABOVE 100.0 % OF RATING SET A
+
X-------FROM BUS-------X  X--------TO BUS--------X       CURRENT(MVA)
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
61666  FONDULAC 115  608  61676* HIBBARD7 115  608  1     40.6    40.0   101.5
61752  I.FALLS7 118  608  61784* INTPHAS7 118  608  1    184.9   180.0   102.7

 TRANSFORMER MVA LOADINGS ABOVE 100.0 % OF RATING SET A
+
X-------FROM BUS-------X  X--------TO BUS--------X       MVA      MVA
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
61752* I.FALLS7 118  608  61784  INTPHAS7 118  608  1    187.4   180.0   104.1
```

TUE, NOV 20 2012 10:40

INITIATED AT LOAD FLOW ENTRY POINT ON TUE, NOV 20 2012 10:40

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164

4 CYCLE 3 PHASE FAULT AT FORBES 500 KV POST MMTU
CLEAR THE FORBES - DORSEY 500 KV LINE

SPECIAL RESPONSE FILES AND COMMENTS
--- --- --- --- ---

RESPONSE FILES
--- ---
None

COMMENTS

None

P O W E R F L O W S U M M A R Y

NDEX:	3299 MW	ECL-ARP:	754 MW
MHEX:	2212 MW	PRI-NRC:	718 MW
MWEX:	1639 MW	AHD-SLK:	733 MW
KING-ECL:	906 MW	SLK-GPK:	553 MW
COOPER S:	1243 MW	WNE-WKS:	581 MW
FTCAL S:	658 MW	GGS:	1780 MW
GRIS-LNC:	799 MW	QC WEST:	-113 MW

LOAD LEVELS AS PERCENT OF 2016 SUMMER PEAK:

NORTH DAKOTA	(ZONE 90,990)	2455.7 MW,	77.8% OF	3156.0 MW
NSP	(AREA 600)	6500.6 MW,	54.7% OF	11889.2 MW
MAN HYDRO	(AREA 667)	1148.2 MW,	37.3% OF	3076.0 MW

Load/Losses	MW / MW	Generation	MW	Export	MW
Manitoba	1148/ 285	MH total gross	4914	ATC West Import	1648
Ont. total	22150/ 478	Wpg River	568	ATC SW Import	564
NW	915/ 37	7 Sisters	170	ATC SE Import	-1258
Sask.	2150/ 82	OH total gross	21884	East Bias	348
MP	1840/ 226	northwest	717	SPC>WAPA (B10T)	164
NSP	6500/ 548	SPC total gross	2406	MH>SPC (3-230)	60
N. Dakota	2455/ 347	MP total gross	2760	MH>SPC (FALLS)	0
Manitoba	457 MVARS	ND Cfd AC gross	3081	OH>MH @Kenora	-196
Ont. total	13082 MVARS	net	2911	OH>MP @Ft Fran	151
NW	489 MVARS	NSP East gross	1100	OH E>W @Wawa	190
Sask.	502 MVARS	net	1017	OH>East USA	0
MP	11413 MVARS	West gross	3010	F601C @Forbes	1494
NSP	1353 MVARS	net	2848	D602F @Dorsey	1912
N. Dakota	562 MVARS	Total net	4601	L20D @Letell	173
ATC	9890/ 336	WAPA SD Hydro	1497	R50M @Richer	143
ATC	2953 MVARS	Pleasant Valley	0	G82R @Glenboro	-18
		LGS/Trimont	39		
		SW MN Wind	336		
		N DAK WIND	533		
		Swing Bus	863		
		SWMN LakeF Wind	468		

ANTELOP-BROADLD	392	ANTELOP-LELAND	110	CENTER-JAMESTN	383
STANTON- SQ BUT	-79	HETINGR-BISON	119	WILTON-CASS LK	88

CASS LK-BOSWELL	38		BISON-ALEX SS3	436		ALEX SS-QUARRY	682
QUARRY-MNTCELO	458		BROOKNG-LYONCO	240		LYONCO-CEDARMT(T)	396
CEDARMT-HELENA(T)	352		LKMARN-HMPTCNR	20		HMPTCNR-NROC	512
NROC TR	170		NROC-NLAX	271		CNT-PRAIRIE 345	253
NROC-BYRON	775		LKFLDX-LAKEFLD3	-28		AKPEXPORT	2686
ROSEAU CAP	2116	AMPS	PRI-NROC	6	ANG		
CENTER-JAMESTN	12	ANG	ECL-ARP	18	ANG		

Tfmrs	MVA/	Load	Ph Shifters	Deg/	MW	DC Lines	MW
Wshell #1 7-7	104/	72%	Stinson	29/	29	CU (1,2)	1127
Wshell #2 7-7	104/	72%	Boundary Dam	3/	165	SQ BU (3,4)	550
Drayton#1 4-7	42/	30%	Whiteshell	112/	200	MH Bipole 1	1514
Drayton#2 4-7	51/	27%	Int Falls	134/	151	MH Bipole 2	1715
Dorsey #1 2-4	744/	62%	St. Lawrence	16/	0	MH (BP1+BP2)	3230
Dorsey #2 2-4	851/	70%	Arrowhead	0/	733	Miles City E>W	-150
Forbes 2-4	152/	22%				RCDC (15)	0
Stone Lk 3-5	165/	49%				Stegall (10)	0

Dorsey SC's		I/S	MVAR	Qmax/ Qmin	SVC's	MVAR	Qmax/ Qmin
MIL 7-9G	17.0	2	449	600/ -330	Forbes	500	10 400/ -450
SCE 1-3G	18.2	3	366	480/ -240	Fargo	13.2	2 20/ -135
SCA 4-6G	18.2	3	366	480/ -240	Watertown	20.0	36 125/ -86
Total			1183	1560/ -810	Series Caps		Num In Serv
Margin			377		Roseau	500	2 of 2
					Chisago	500	1 of 1

Caps/Reactors		MVAR	Caps/Reactors		MVAR	Caps/Reactors		MVAR
Balta (FS)	230	0	Arrowhead	230	160	Chisago T 9	34.5	60
Drayton	115	0	Blackberry	230	47	Chisago T 10	34.5	60
Drayton	13.8	-20	Minntac	115	45	Forbes	230	70
Eau Claire(FS)	161	356	Riverton	230	47	Forbes	500	600
Kohlman Lake	115	240	Roseau Co.(FS)	230	0			0
Parkers Lk(FS)	115	0	Running (FS)	230	30	Fargo	115	27
Prairie (FS)	115	0	Running react	230	0	Watertown	20	20
Ramsey (FS)	230	0	Shannon	230	72	Watertown	230	76
Red Rock	115	240			0			0
Rugby	13.8	0	Glenboro	230	0	Arrowhead	345	150
Split Rock(FS)	115	80	Laverendrye	110	98	Stone Lake	345	75
Sheyenne (FS)	115	40	Richer react	230	0	Stone Lk Reac	345	0
Wilton/Bemidji	115	20	St Vital	110	98	Stone Lake	161	40
		0			0	Grdnr Pk Reac	345	0
		0			0	Grdnr Pk Caps	115	0
		0			0	Arpin Caps	138	52
		0			0	Council Creek	138	16

Bus Voltages		V,pu	Bus Voltages		V,pu	Bus Voltages		V,kV
Adams	345	1.003	Arrowhead	230	0.981	Whiteshell	110	118.9
Alexandria	115	1.010	Badoura	115	1.023	Kenora	220	245.2
Audubon	115	1.034	Blackberry	230	1.020	Dryden	220	249.6
Bemidji	115	1.026	Boise Cascade	13.8	1.054	Fort Frances	220	240.6
Byron	345	1.012	Boise Cascade	115	1.022	Mackenzie	220	251.8
Chisago Co.	345	1.005	ETCO	115	0.992	Lakehead	220	245.8
Chisago Co.	500	1.000	Forbes	230	1.002	Marathon	220	252.6
Drayton	230	1.027	Forbes	500	0.994	Wawa	220	254.6
Eau Claire	345	0.983	Hubbard	115	0.000	Mississagi	220	250.6
WEST FARIBAULT	115	1.037	Intl Falls	115	1.023	Fort Frances	118	119.9

LaPorte	115	1.018	Minntac	115	1.001	Lakehead	118	122.8
Maple River	230	1.037	Moranville	230	1.009	Birch	118	120.2
Marshall Tap	115	1.046	Riverton	230	1.020	Marathon	118	124.7
Owatonna	161	1.006	Running	230	1.011			0.000
Prairie	115	1.031	Shannon	230	1.016	Arrowhead	345	1.003
Prairie	230	1.040	Stinson MN	115	1.000	Stone Lake	345	1.012
Ramsey	230	1.025	Jamestown	345	1.002	Stone Lake	161	1.025
Roseau County	230	1.009	Groton	345	1.004	Gardner Park	345	1.033
Roseau County	500	1.063	Watertown	230	1.030	Weston	115	1.035
Sheyenne	230	1.033	Watertown	345	1.024	Arpin	345	0.996
Thief R Falls	115	1.027			0.000	Eau Claire	161	1.044
Tioga	230	1.029	Dorsey	230	1.045	Council Creek	161	0.977
Wahpeton	230	1.019	Dorsey	500	1.033	Hydro Lane	161	1.022
Winger	115	1.045	ALEX SS3	34	0.981	Wien	115	1.026
WILTON 4	230	1.026	BRKNGCO3	345	1.027	NROC	345	1.011
MINONG 5	161	1.018	PRAIRIE3	345	1.018	LYON CO	345	1.029
		0.000			0.000	CASS LK4	230	1.029

Steady State Relay Margins (measured from inner blinder)

Relay Location	Manuf/Type	PSS Model	South	North	Em North
1) B10T-Tioga (South)	GE OST	SLLP	336%	N/A	N/A
2) -Tioga (North)	GE OST	SLLP	691%	N/A	N/A
3) -Tioga (Em North)	GE OST	SLLP		N/A	N/A
4) D602F-Dorsey	ATP ???	SLINOS	334%	N/A	N/A
5) -Forbes (Normal)	ATP ???	SLINOS	198%	N/A	N/A
6) -Forbes (Em Nrth)	APT S-PRO	SLINOS		N/A	N/A
8) F3M-Intl Falls	APT S-PRO	SLINOS	319%	N/A	N/A
9) G82R-Rugby	APT	SLINOS	N/A	1938%	
10) L20D-Drayton (Normal)	APT, ASEA	SLINOS	1274%	N/A	N/A
11) -Drayton (Em Nrth)	ASEA RXZF2	SLINOS		N/A	N/A
12) R50M-Moranville (Norm)	APT, West	SLINOS	887%	N/A	N/A
13) -Moranville (Em N)	ASEA RXZF2	SLINOS		N/A	N/A

SIMULATION CHECKS FOLLOW:

+ _____

ITER	DELTAV/TOL	X------ AT BUS ------X	REAL(DELTAV)	IMAG(DELTAV)
1	109.438	66584 [SIDNEYW4230.00]	-0.1019E-03	0.4003E-04
2	38.523	66584 [SIDNEYW4230.00]	-0.3784E-04	0.7207E-05
3	12.084	66584 [SIDNEYW4230.00]	0.8660E-05	-0.8428E-05
4	4.151	66584 [SIDNEYW4230.00]	-0.2964E-05	0.2906E-05
5	1.423	66584 [SIDNEYW4230.00]	0.1016E-05	-0.9973E-06
6	0.471	66584 [SIDNEYW4230.00]	-0.3293E-06	0.3364E-06

REACHED TOLERANCE IN 6 ITERATIONS

LARGEST MISMATCH: 0.02 MW 0.03 MVAR 0.04 MVA AT BUS 62710
[CHANDLR869.000]
SYSTEM TOTAL ABSOLUTE MISMATCH: 0.32 MVA

****

****

INITIAL CONDITION LOAD FLOW USED 6 ITERATIONS

****

INITIAL CONDITIONS SUSPECT:

I	DSTATE(I)	STATE(I)	MODEL	STATE	BUS	X--- NAME ---X	ID
9	0.13863E-01	0.75671					

```
    10   -14.699       392.78
 19874   0.24588E-04  0.19286E-02  CIMTR3   K+4   67816  STLEONWG0.6000   1
 32164  -0.83655E-02  0.66600      IEEET1   K+1   66748  CENTER2G20.000   2
 32278   0.83031E-02 -0.30191      SCRX     K     67683  KET1-12G13.800   1
 32586   0.18599E-03 -0.59674E-02  IEEET1   K+1   72371  BP #4 GN22.000   1
 44905   0.14308E-03  0.64182E-02  CIMTR3   K+4   60136  MAPLE R7115.00   1
 51181  -0.38147E-01   0.0000      ESAC8B   K+2   61776  BOSWE71G14.400   1
 51186  -0.38147E-01   0.0000      ESAC8B   K+2   61777  BOSWE72G14.400   2
 52722   0.10617E-03  0.16393E-02  CIMTR3   K+4   67473  MMU SW 7115.00   WN
 54892   0.40178E-04  0.37108E-02  IEEET1   K+1   39386  OK C G6 18.000   L
 57166   0.29495E-04  0.10986E-02  CIMTR3   K+4   35026  G426/53834.500   1
 57220  -0.20862E-01   0.0000      ESAC8B   K+2   61775  BOSWE44G22.800   4
 58516   0.31630E-04  0.22246E-02  CIMTR3   K+4   67825  STJOS1 W0.6900   1

 ****************************************************************************

 ****************************************************************************

     LINE SWITCHING EVENTS FOLLOW:
+    ____________________________


     MHEB DC REDUCTIONS FOLLOW:
+    __________________________

 TIE LINE FROM 67621 TO 60173 CKT  1 TRIPPED AT  0.1667s *** INITIATING DC
 REDUCTION ***
 DC WILL BE REDUCED BY   1912.88 MW
1*** w3l-so16aa-nad                                          Page   4


     NETWORK NOT CONVERGED FOLLOW:
+    ____________________________


     RELOUV AND RELOUF SWITCHING EVENTS FOLLOW:
+    ___________________________________________

 *** SHUNT AT BUS67503 MODIFIED FROM   755.60 TO   496.00    BY RELOUV (OVER )
                 AT TIME =   0.8083 SECS.

     DC SWITCHING EVENTS FOLLOW:
+    ___________________________


     VSCAN EVENTS FOLLOW:
+    ____________________


     PI 4 KV EVENTS FOLLOW:
+    ______________________


     RELAY SCAN EVENTS FOLLOW:
+    _________________________
```

FARGO/WATERTOWN SVS EVENTS FOLLOW:

```
 AT TIME= 0.2667 CFGSVC: (2) 27.1 MVAR BSC(S) ADDED AT BUS  66436 [FARGO  7]
 AT TIME= 1.0750 CFGSVC: (1) 27.1 MVAR BSC(S) REMOVED AT BUS  66436 [FARGO  7]
 AT TIME= 1.2750 CFGSVC: (1) 27.1 MVAR BSC(S) REMOVED AT BUS  66436 [FARGO  7]
 AT TIME= 1.4750 CFGSVC: (1) 27.1 MVAR BSC(S) REMOVED AT BUS  66436 [FARGO  7]
```

UDHOLD EVENTS FOLLOW:

```
 UDHOLD FUNCTION AT BUS 3404 APPLIED AT TIME =  0.1333SEC
 UDHOLD FUNCTION AT BUS 3404 RESET AT TIME =  0.2500SEC
```

DYNAMIC VOLTAGE CHECKS FOLLOW:

FROM TIME 0.4000 TO TIME 5.0000

CHAN NO.	DESCRIPTION	PU VOLT MAX .LT.	PU VOLT MIN .GT.	MINIMUM VOLT	MINIMUM TIME	MAXIMUM VOLT	MAXIMUM TIME	VMAX LESS VMIN
444	67503 DORSEY	1.25	0.70	1.05	0.83	1.10	0.42	0.05
386	61624 FORBES	1.15	0.82	0.99	0.87	1.02	3.21	0.03
384	61615 ARROWHD	1.15	0.82	0.98	0.42	1.05	1.28	0.07
382	61612 RIVERTN	1.15	0.75	0.95	0.42	1.05	2.01	0.10
362	66752 DRAYTON	1.20	0.80	1.00	0.52	1.07	1.27	0.07
562	63229 WAHPETN	1.18	0.80	0.96	0.52	1.07	2.01	0.11
***	61631 MINONG5	1.20	0.82	1.03	2.76	1.09	0.86	0.06
542	63369 JAMESTN	1.20	0.70	0.94	0.49	1.04	2.03	0.10
390	63041 COAL CR	1.18	0.70	0.96	0.44	1.08	1.27	0.12
334	66529 WATERTN	1.18	0.75	0.97	0.49	1.05	2.03	0.08
360	67160 GROTON	1.15	0.70	0.92	0.52	1.05	2.06	0.13
553	61754 BOISE	1.15	0.82	0.93	0.54	1.03	2.66	0.10

POWERFLOW WARNINGS AT END OF SIMULATION FOLLOW:

```
BUSES WITH VOLTAGE GREATER THAN 1.1000:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
67533 ST.JAME7 110 667 1.1055 121.60    67536 GREATFL7 110 667 1.1083 121.91
67537 MCARTHR7 110 667 1.1046 121.51    67538 7SISTER7 110 667 1.1110 122.21
67539 LACDUBN7 110 667 1.1078 121.86    67553 POINTDB7 121 667 1.1232 135.90
67554 SLAVEFL7 121 667 1.1246 136.08    67556 WHTSL1 4 220 667 1.1094 244.07
67580 SHERBK 7 110 667 1.1078 121.85    67589 WHTSL2 4 220 667 1.1094 244.07
67648 POINTD27 121 667 1.1278 136.47    67705 WHSL2PH7 110 667 1.1189 123.08
1*** w3l-so16aa-nad                                          Page   5

67706 WHITESH7 110 667 1.1102 122.12    67734 SK1  TP7 110 667 1.1107 122.18
67751 WHSL1PH7 110 667 1.1189 123.08    67755 SHBK-PH7 110 667 1.1298 124.28
67769 SR3SW3T7 110 667 1.1109 122.20    67770 SK1 SUB7 110 667 1.1775 129.53
67771 STAR LK7 110 667 1.1760 129.36    67772 BRERTON7 110 667 1.1773 129.51
67774 SG12 TP7 110 667 1.1083 121.92    67775 BEAUSJ 7 110 667 1.1060 121.66
91062 DBCOMPS  500 620 1.1059 552.94

BUSES WITH VOLTAGE LESS THAN 0.9500:
X------ BUS -----X AREA V(PU)  V(KV)    X------ BUS -----X AREA V(PU)  V(KV)
```

```
 BRANCH CURRENT LOADINGS ABOVE 100.0 % OF RATING SET A
+
X-------FROM BUS-------X  X--------TO BUS--------X       CURRENT(MVA)
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
60133  SHEYNNE4 230  626  63336* AUDUBON4 230  626  1    271.2   254.0   106.8
61666  FONDULAC 115  608  61676* HIBBARD7 115  608  1     42.7    40.0   106.7
61752  I.FALLS7 118  608  61784* INTPHAS7 118  608  1    200.7   180.0   111.5

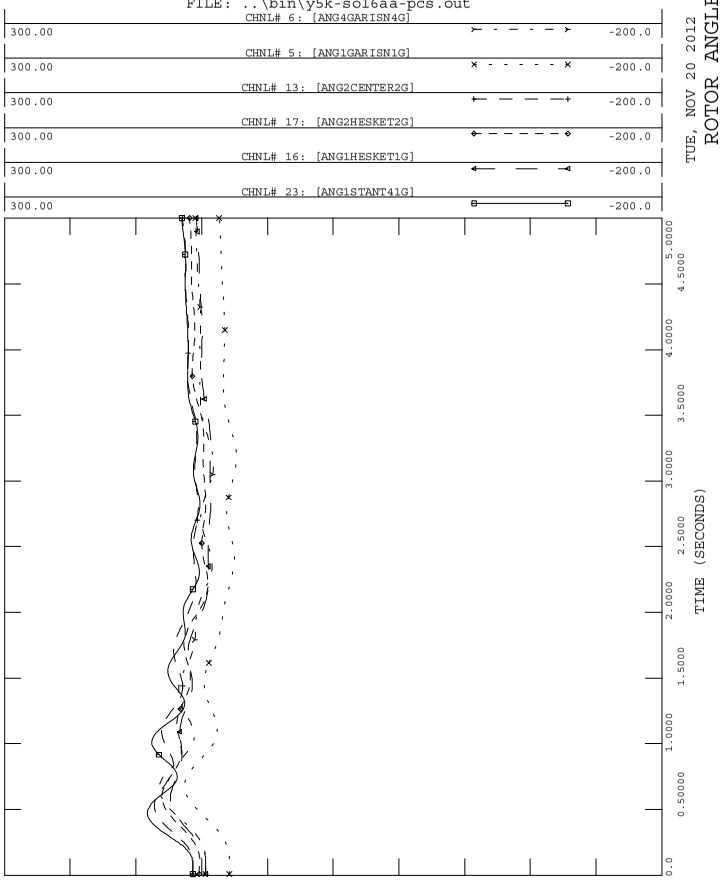
 TRANSFORMER MVA LOADINGS ABOVE 100.0 % OF RATING SET A
+
X-------FROM BUS-------X  X--------TO BUS--------X       MVA      MVA
  BUS    NAME  BSKV AREA    BUS    NAME  BSKV AREA CKT LOADING  RATING PERCENT
61752* I.FALLS7 118  608  61784  INTPHAS7 118  608  1    204.3   180.0   113.5
```

Appendix 4

Stability Plots

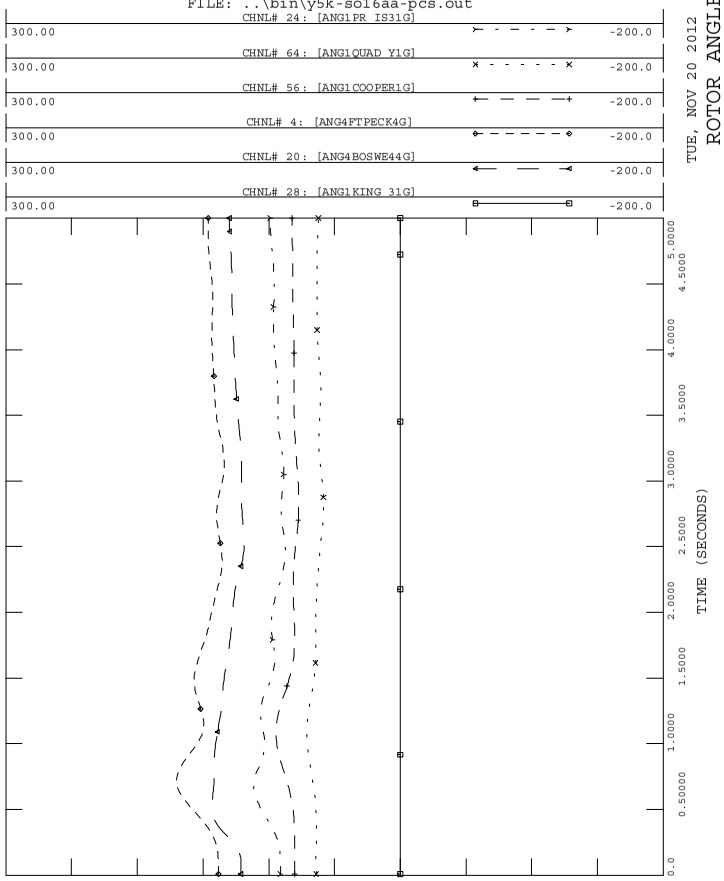
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:46
ROTOR ANGLES 2



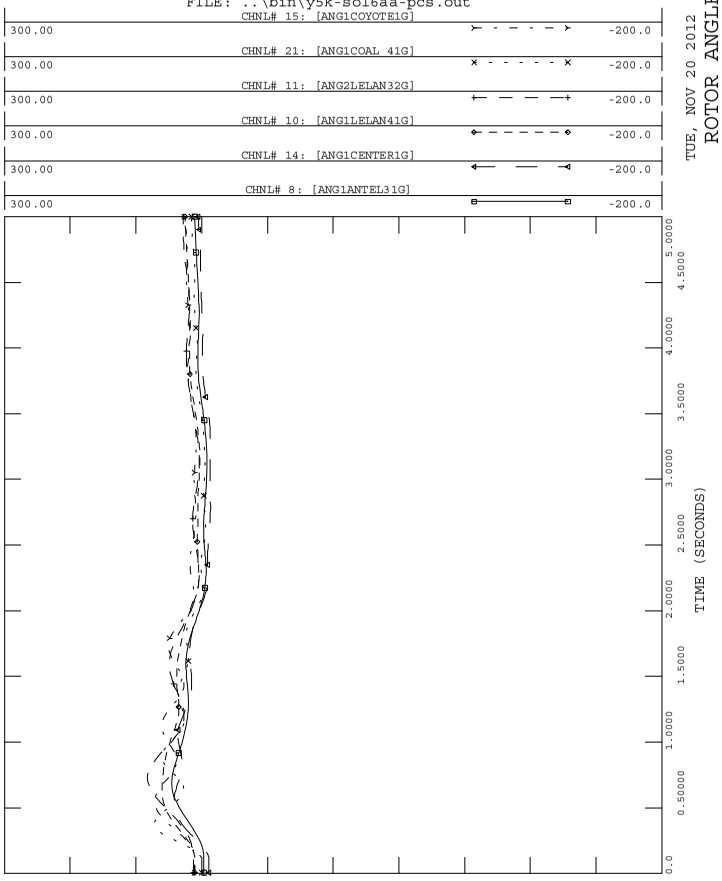
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:46
ROTOR ANGLES 4



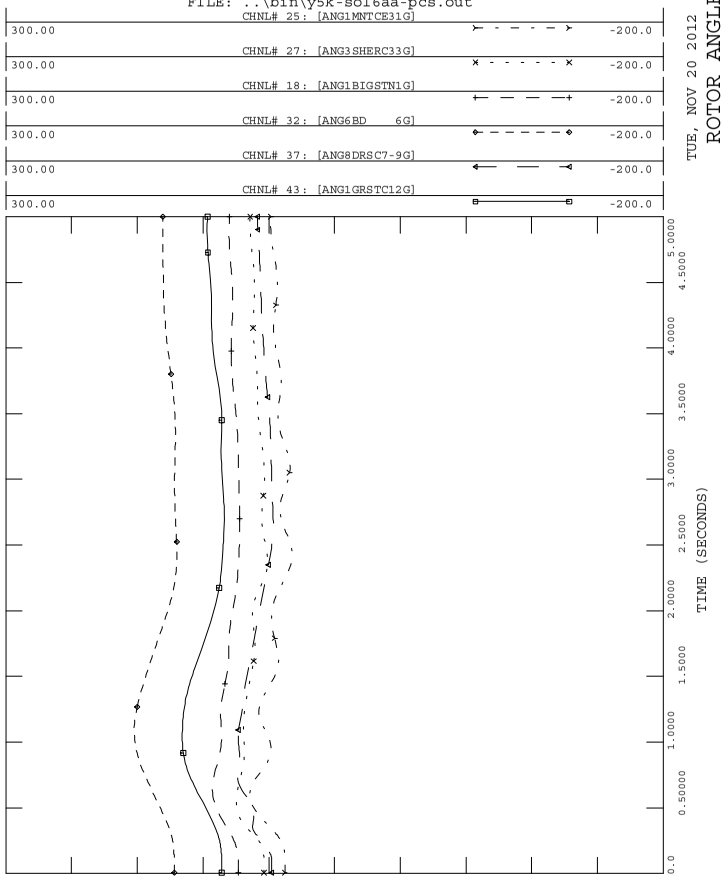
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:46
ROTOR ANGLES 1



Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:46
ROTOR ANGLES 3



Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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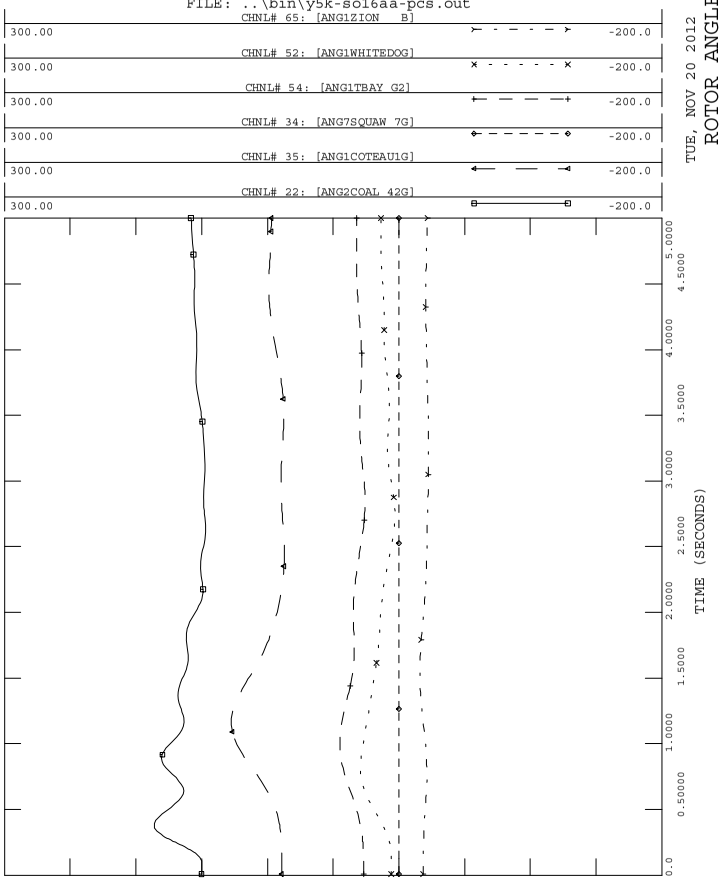

TUE, NOV 20 2012 14:47
ROTOR ANGLES 6

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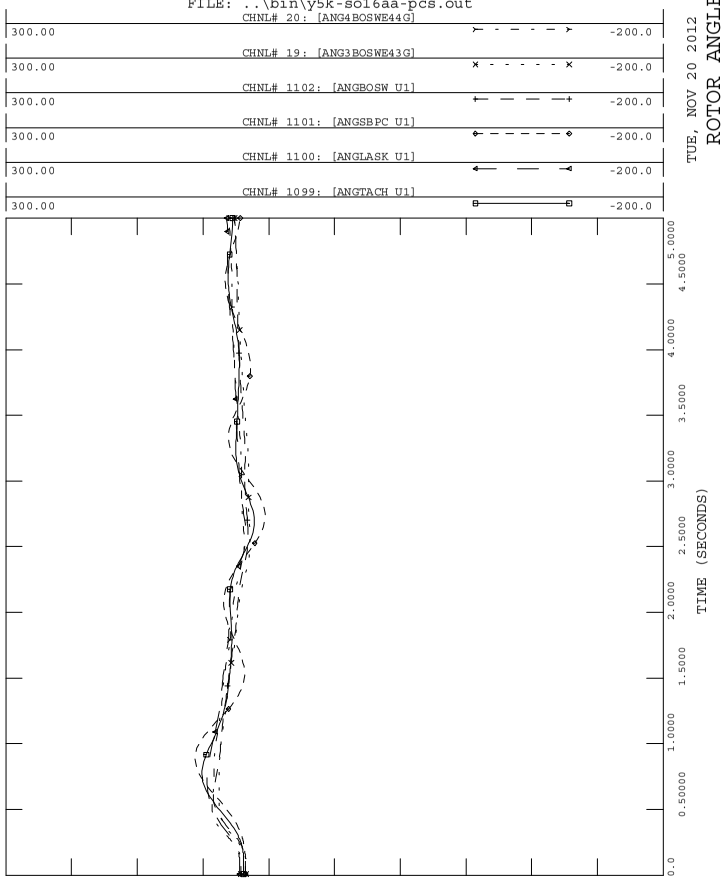

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ROTOR ANGLES 8

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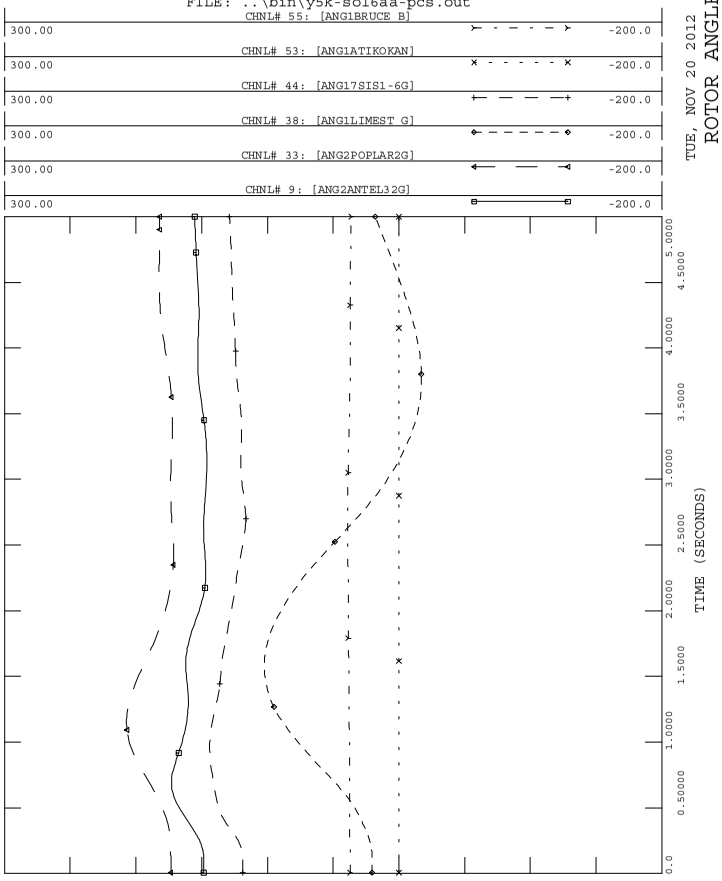

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ROTOR ANGLES 5

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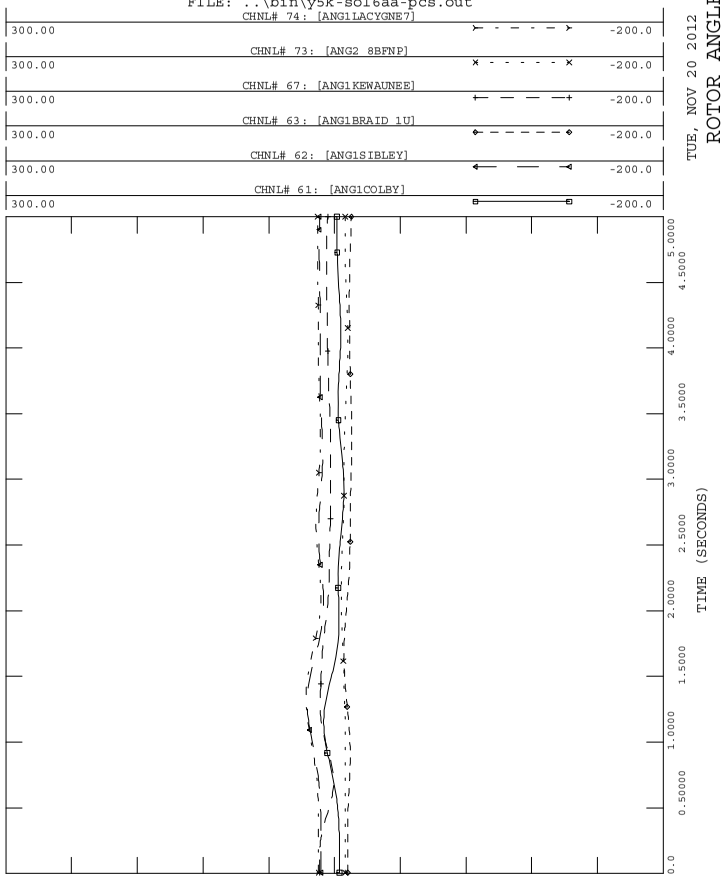

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ROTOR ANGLES 7

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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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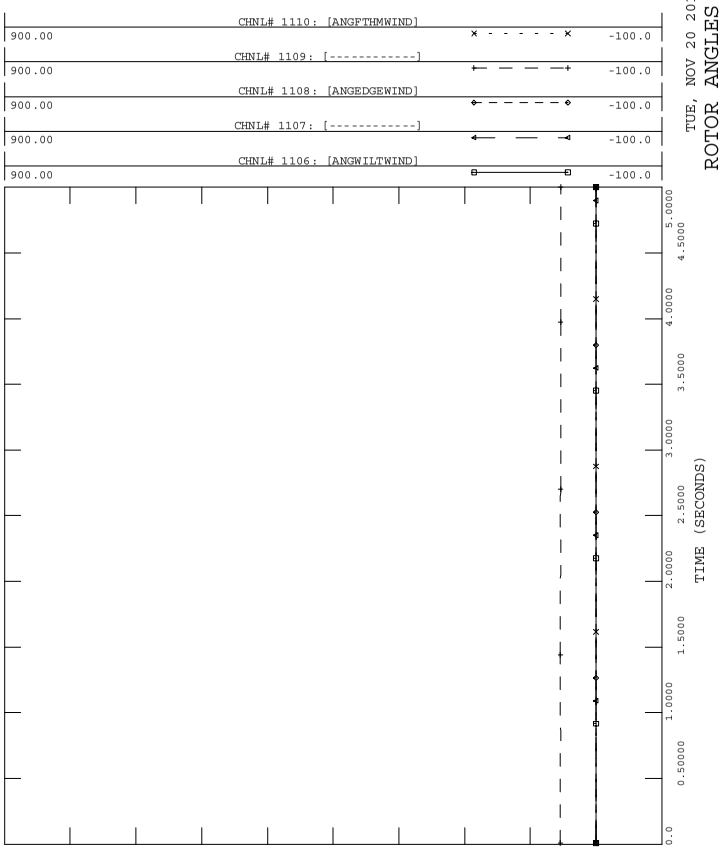
TUE, NOV 20 2012 14:47

ROTOR ANGLES WIND2



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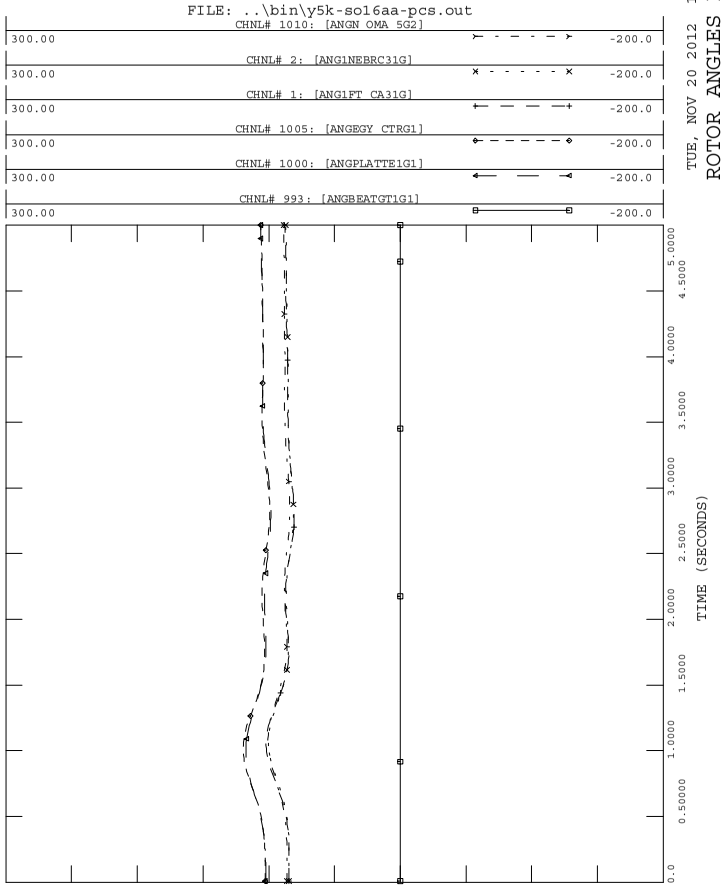
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:47

ROTOR ANGLES NB2



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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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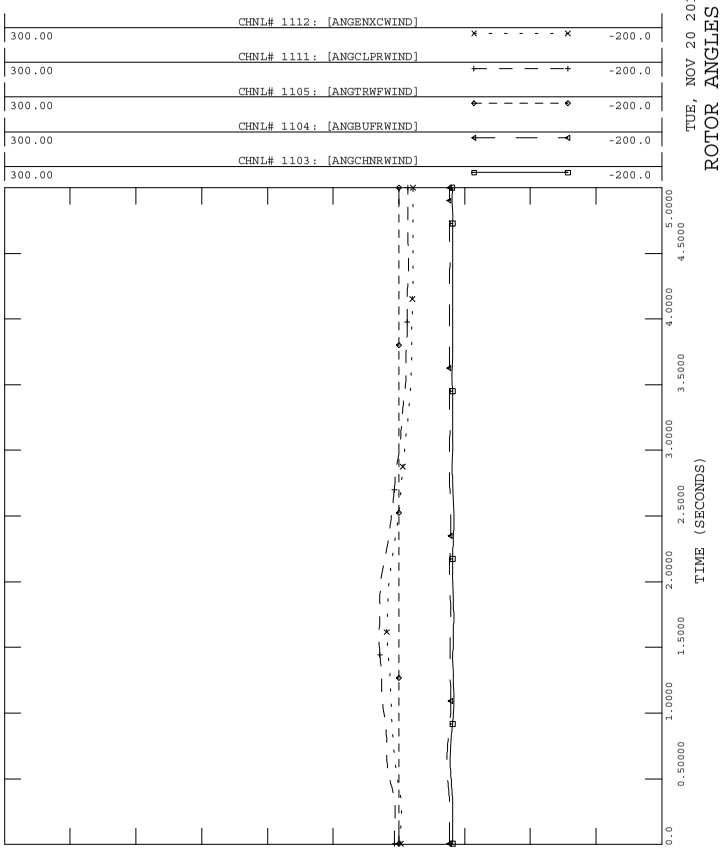
TUE, NOV 20 2012 14:47

ROTOR ANGLES WIND1



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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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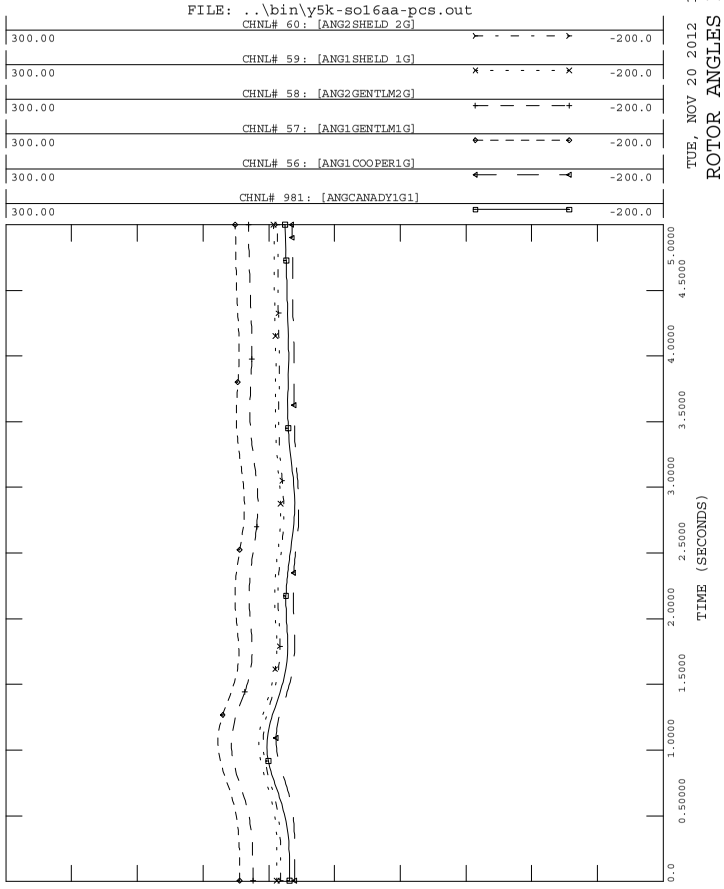
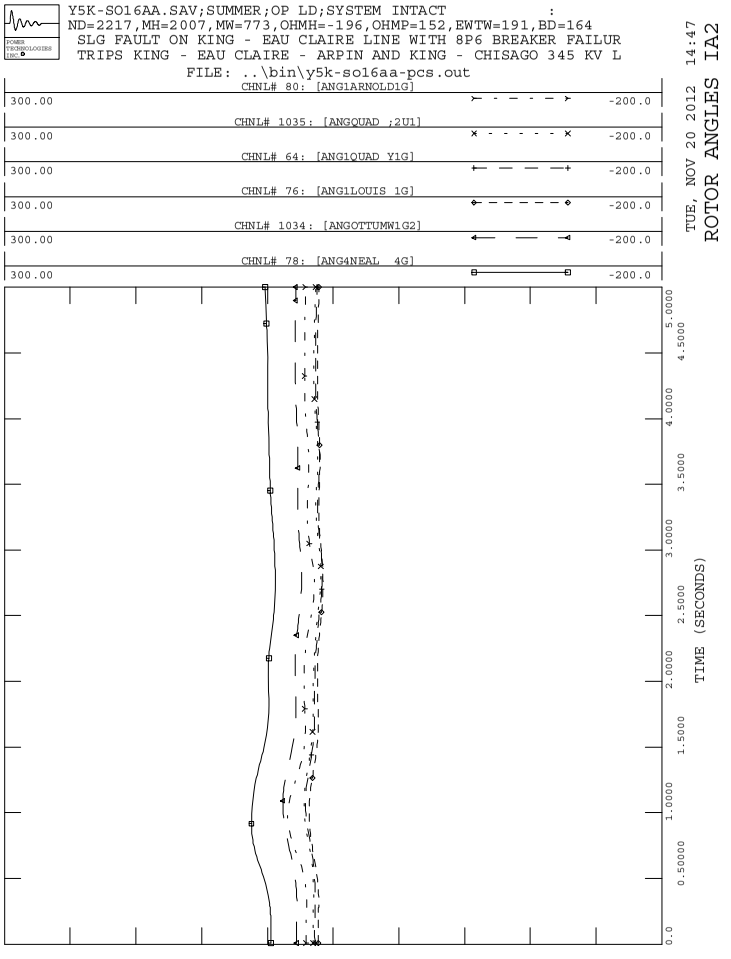
TUE, NOV 20 2012 14:47

ROTOR ANGLES NB1

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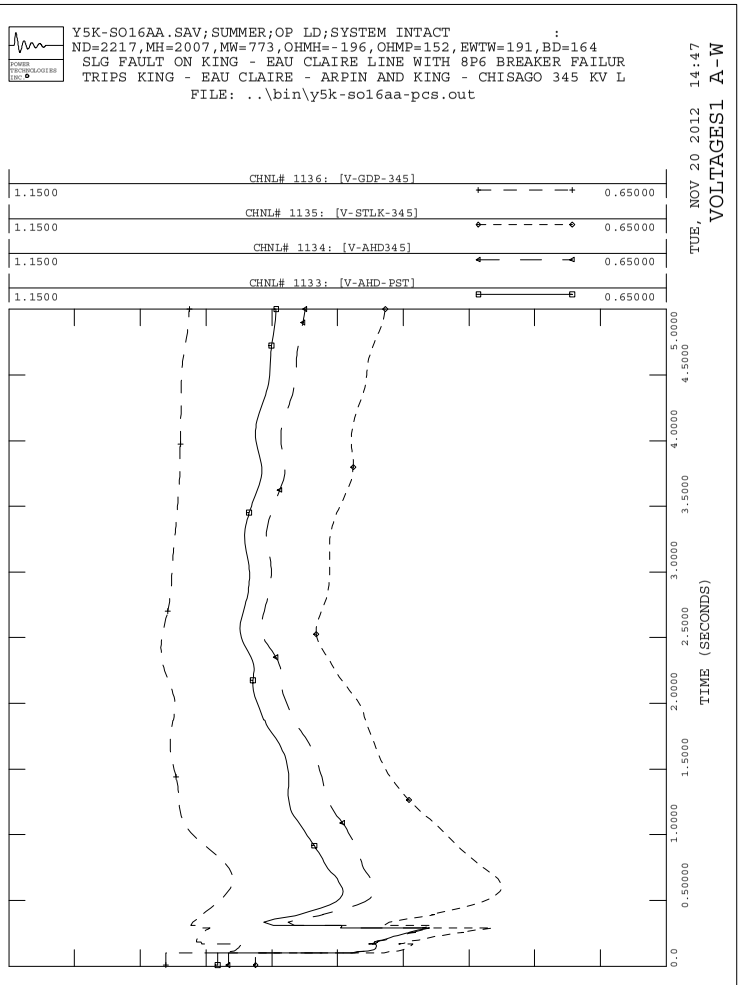
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 80: [ANG1ARNOLD1G]
CHNL# 1035: [ANGQUAD ;2U1]
CHNL# 64: [ANG1QUAD Y1G]
CHNL# 76: [ANG1LOUIS 1G]
CHNL# 1034: [ANGOTTUMW1G2]
CHNL# 78: [ANG4NEAL 4G]
300.00
-200.0
TUE, NOV 20 2012 14:47
ROTOR ANGLES IA2
TIME (SECONDS)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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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CHNL# 1136: [V-GDP-345]
CHNL# 1135: [V-STLK-345]
CHNL# 1134: [V-AHD345]
CHNL# 1133: [V-AHD-PST]
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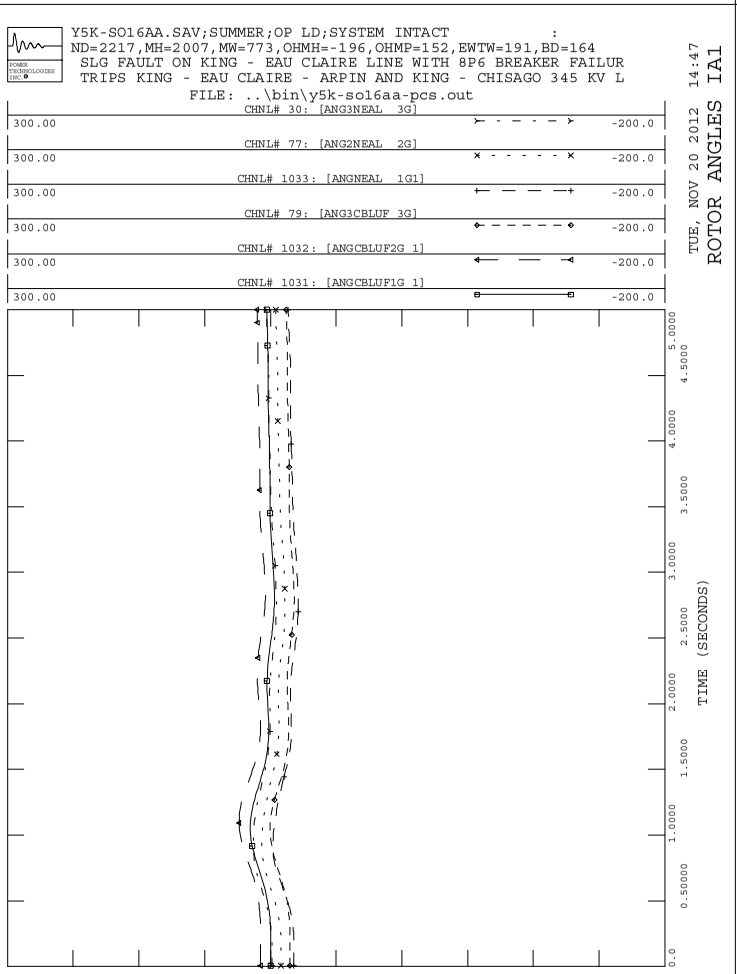
TUE, NOV 20 2012 14:47
VOLTAGES1 A-W
TIME (SECONDS)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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 30: [ANG3NEAL 3G]
CHNL# 77: [ANG2NEAL 2G]
CHNL# 1033: [ANGNEAL 1G1]
CHNL# 79: [ANG3CBLUF 3G]
CHNL# 1032: [ANGCBLUF2G 1]
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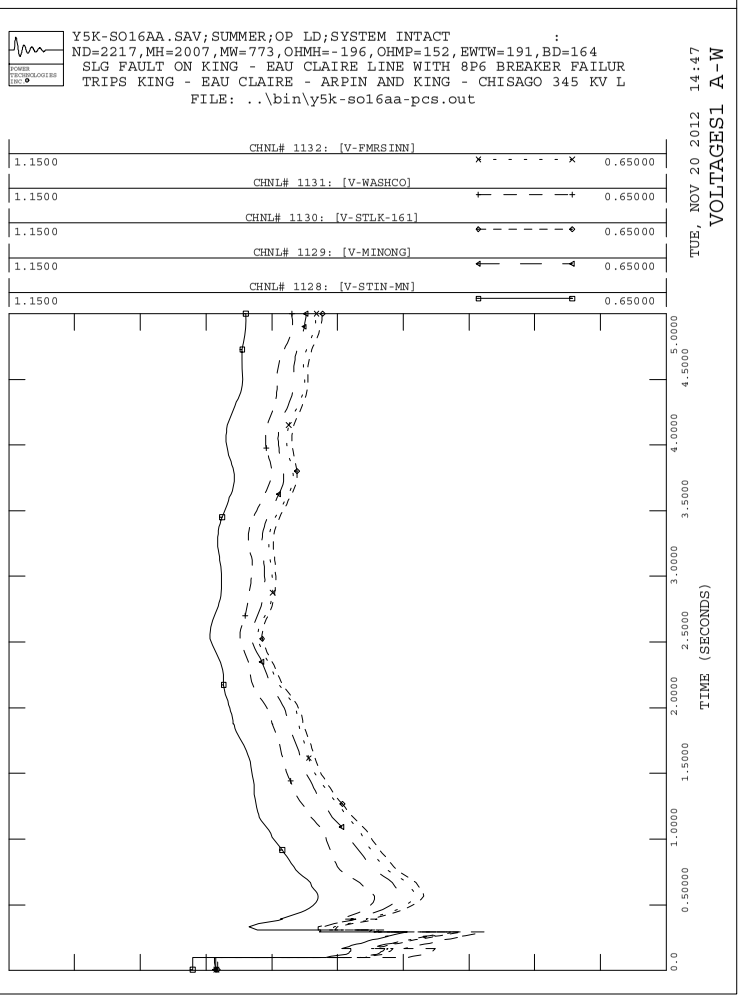
TUE, NOV 20 2012 14:47
ROTOR ANGLES IA1
TIME (SECONDS)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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 1132: [V-FMRSINN]
CHNL# 1131: [V-WASHCO]
CHNL# 1130: [V-STLK-161]
CHNL# 1129: [V-MINONG]
CHNL# 1128: [V-STIN-MN]
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TUE, NOV 20 2012 14:47
VOLTAGES1 A-W
TIME (SECONDS)

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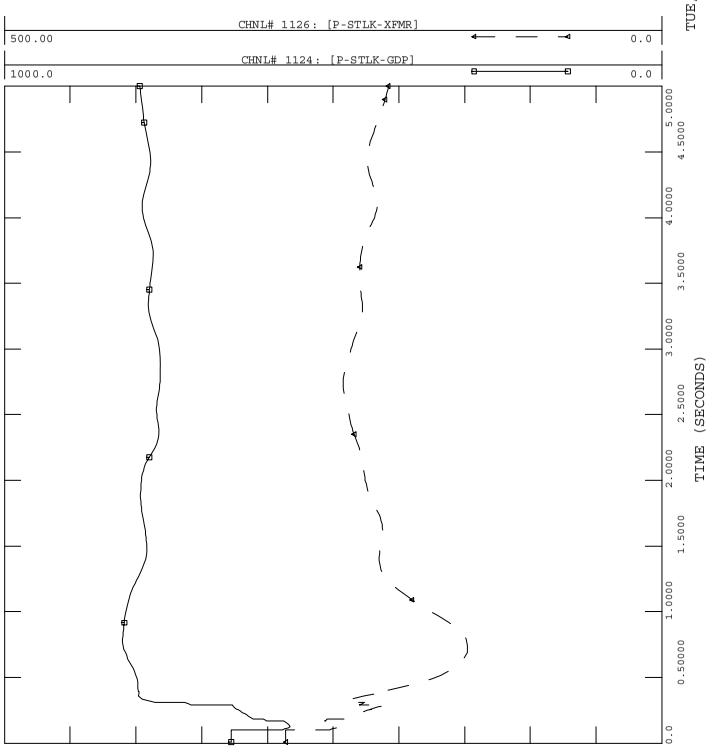
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:47
A-W FLOWS 2



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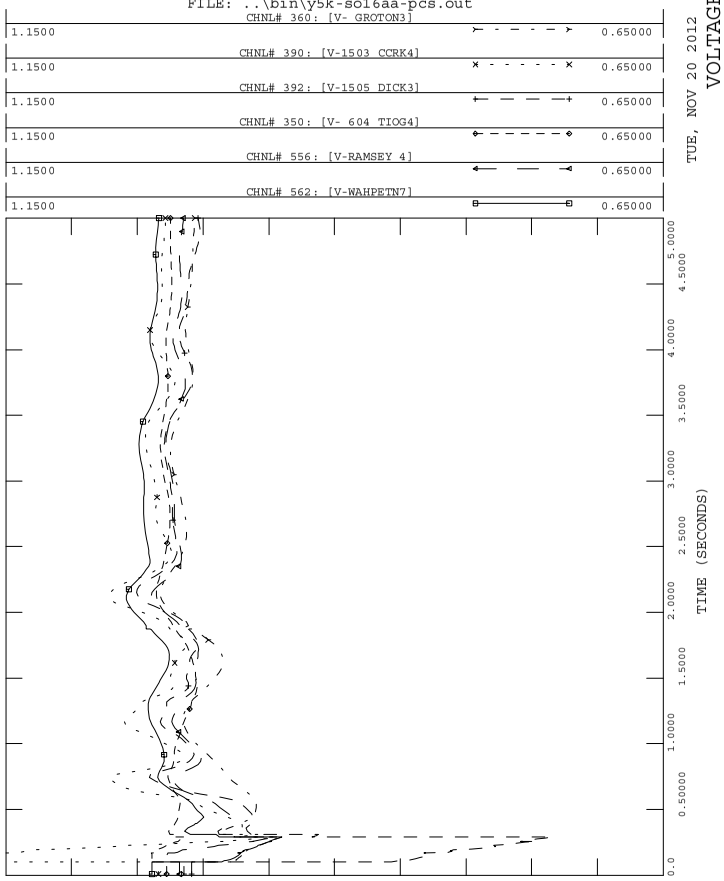
TUE, NOV 20 2012 14:47
VOLTAGES 2



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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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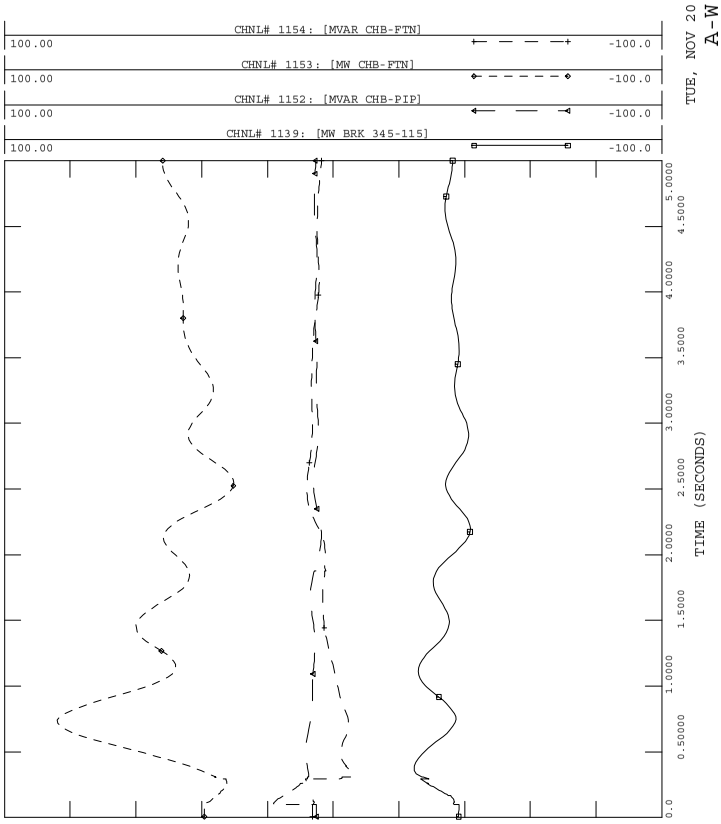
TUE, NOV 20 2012 14:47
A-W FLOWS 1



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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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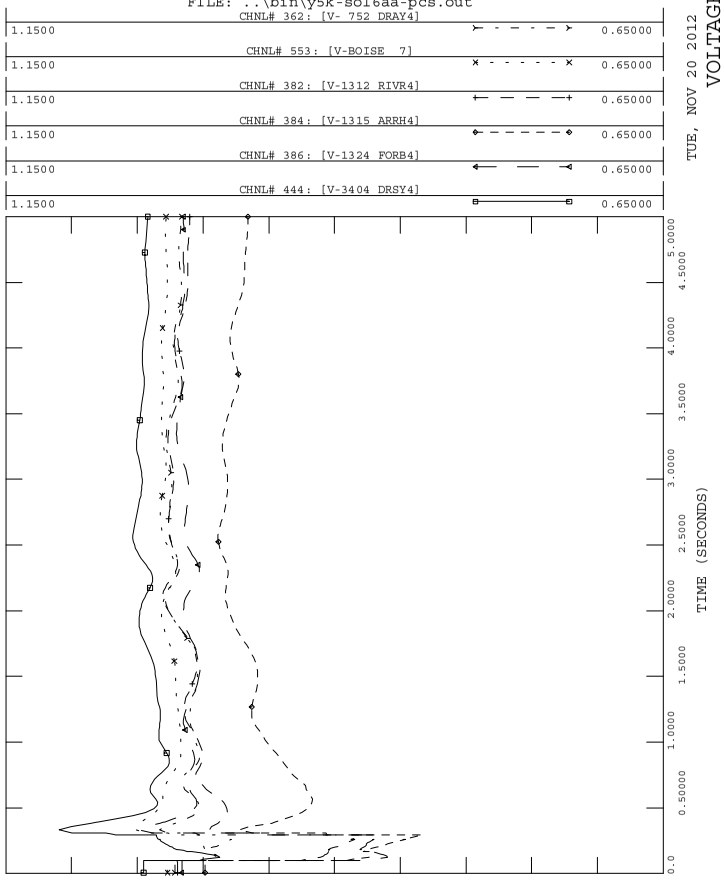
TUE, NOV 20 2012 14:47
VOLTAGES 1



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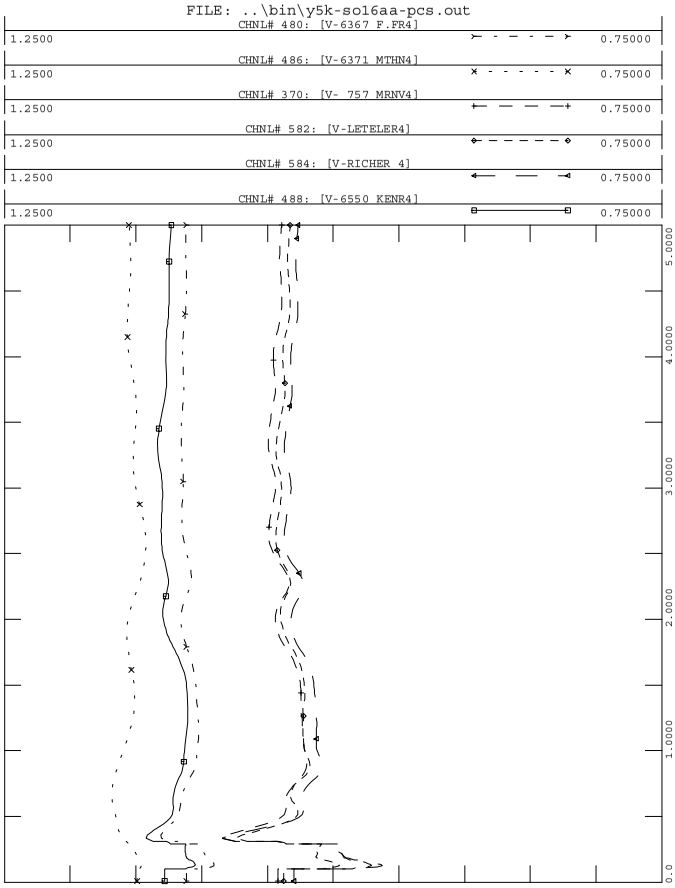
TUE, NOV 20 2012 14:47
VOLTAGES 4



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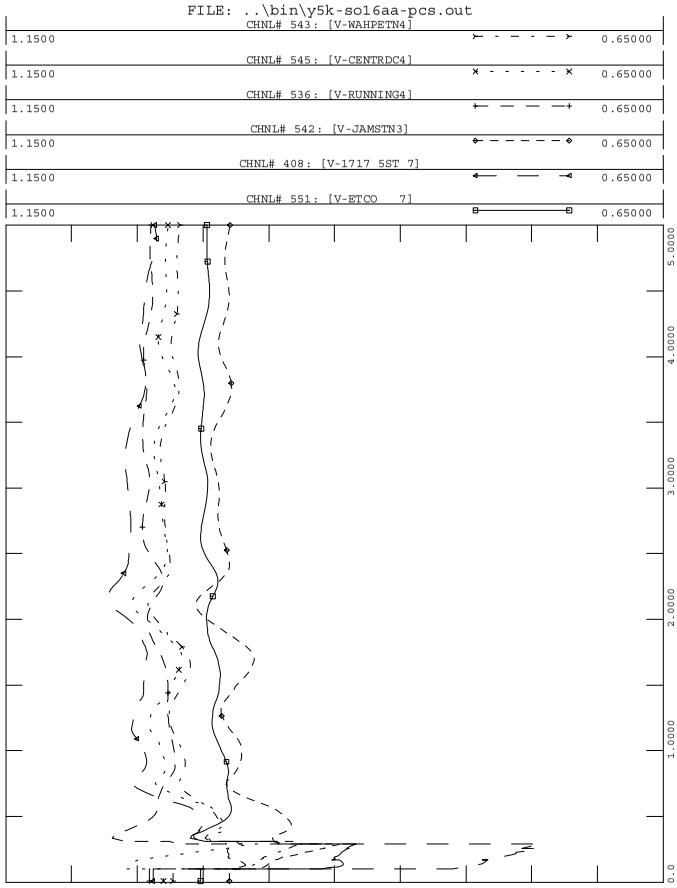
TUE, NOV 20 2012 14:47
VOLTAGES 6



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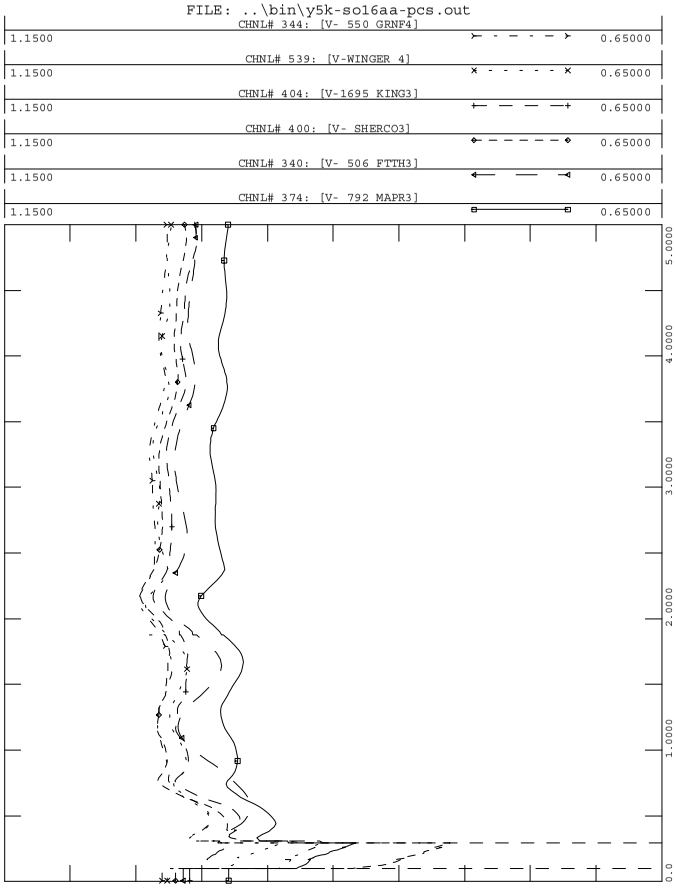
VOLTAGES 3



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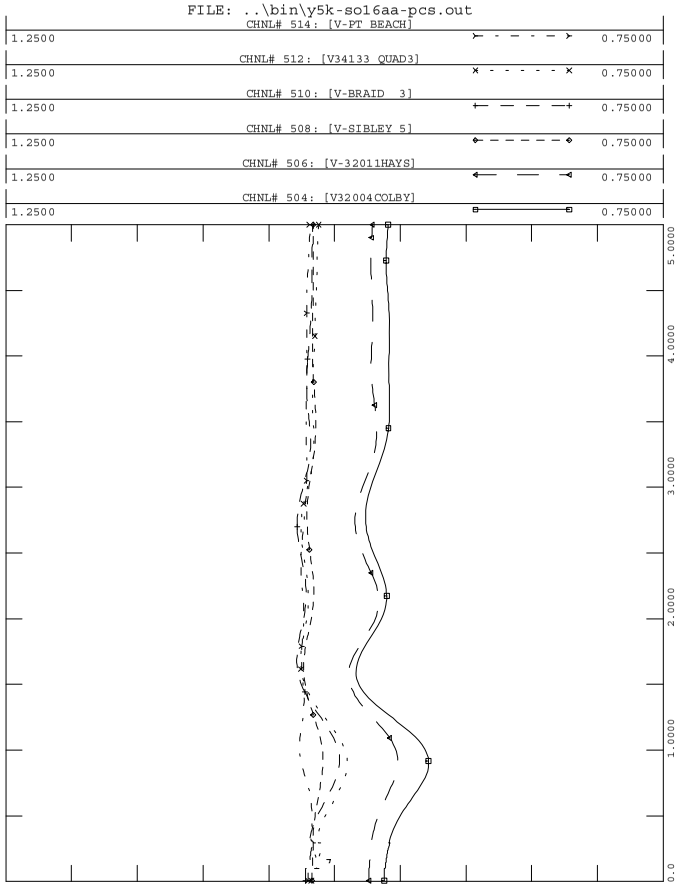
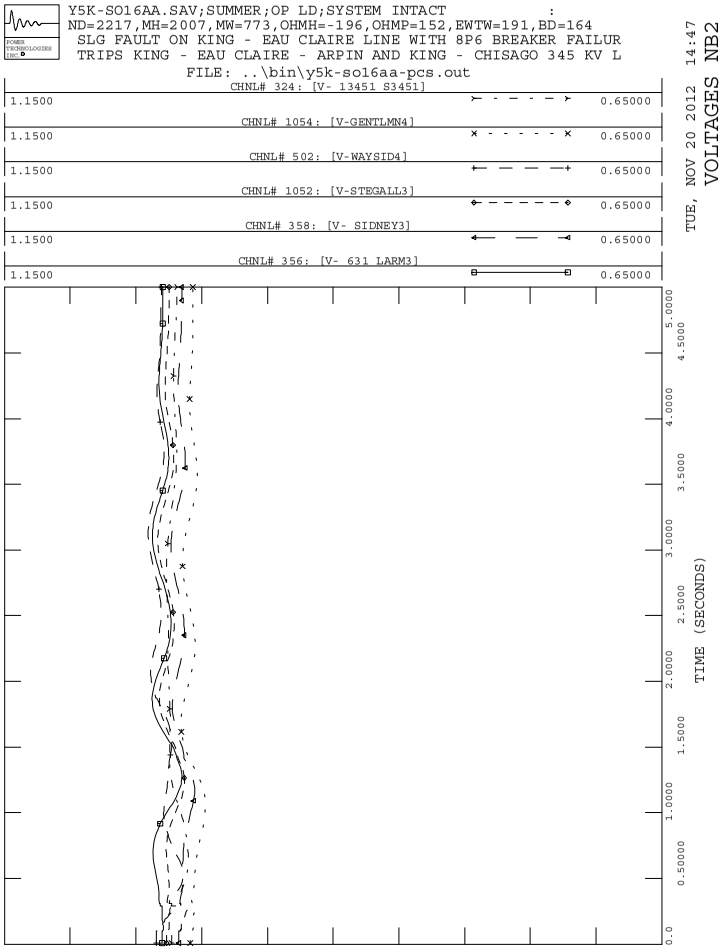
VOLTAGES 5

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CHNL# 1054: [V-GENTLMN4]
CHNL# 502: [V-WAYSID4]
CHNL# 1052: [V-STEGALL3]
CHNL# 358: [V- SIDNEY3]
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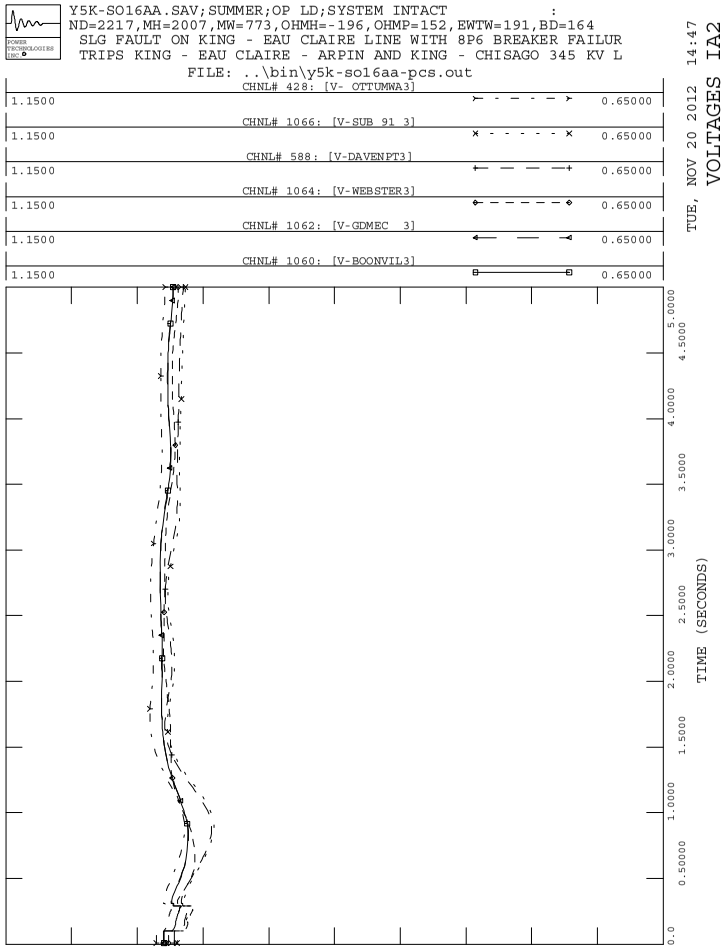
TIME (SECONDS)
TUE, NOV 20 2012 14:47
VOLTAGES NB2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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 428: [V- OTTUMWA3]
CHNL# 1066: [V-SUB 91 3]
CHNL# 588: [V-DAVENPT3]
CHNL# 1064: [V-WEBSTER3]
CHNL# 1062: [V-GDMEC 3]
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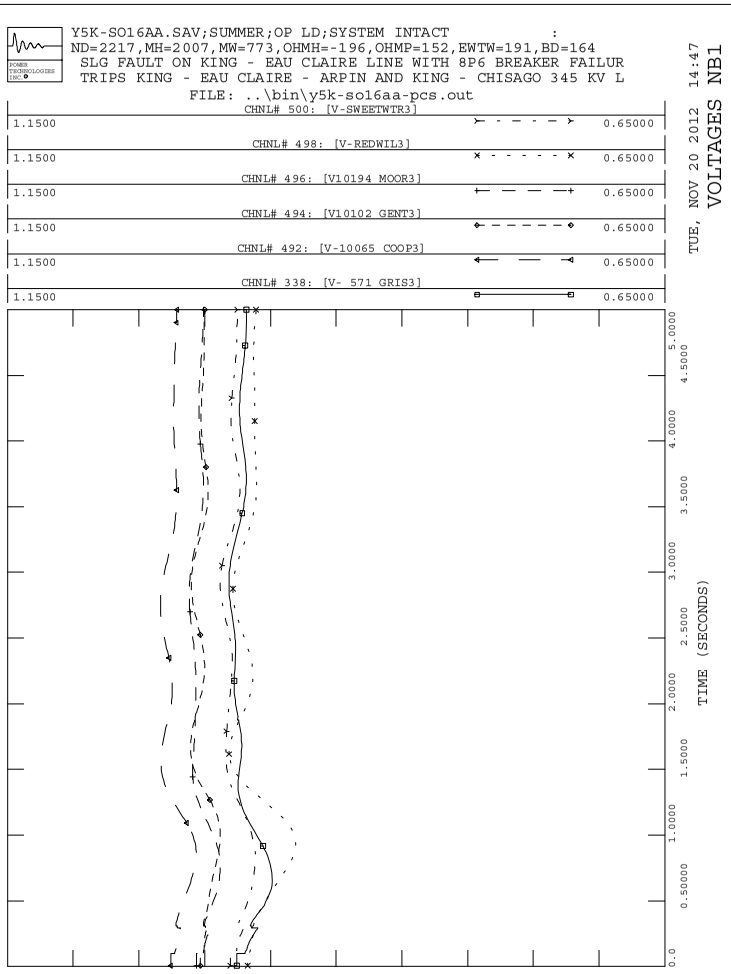
TUE, NOV 20 2012 14:47
VOLTAGES IA2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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
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CHNL# 498: [V-REDWIL3]
CHNL# 496: [V10194 MOOR3]
CHNL# 494: [V10102 GENT3]
CHNL# 492: [V-10065 COOP3]
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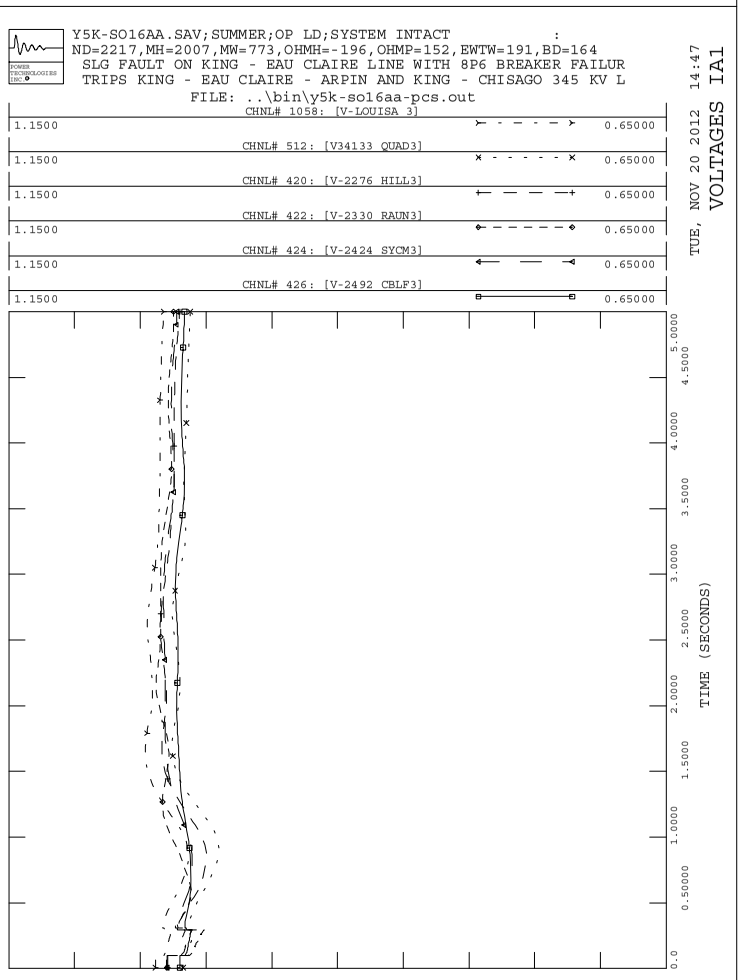
TUE, NOV 20 2012 14:47
VOLTAGES NB1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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 1058: [V-LOUISA 3]
CHNL# 512: [V34133 QUAD3]
CHNL# 420: [V-2276 HILL3]
CHNL# 422: [V-2330 RAUN3]
CHNL# 424: [V-2424 SYCM3]
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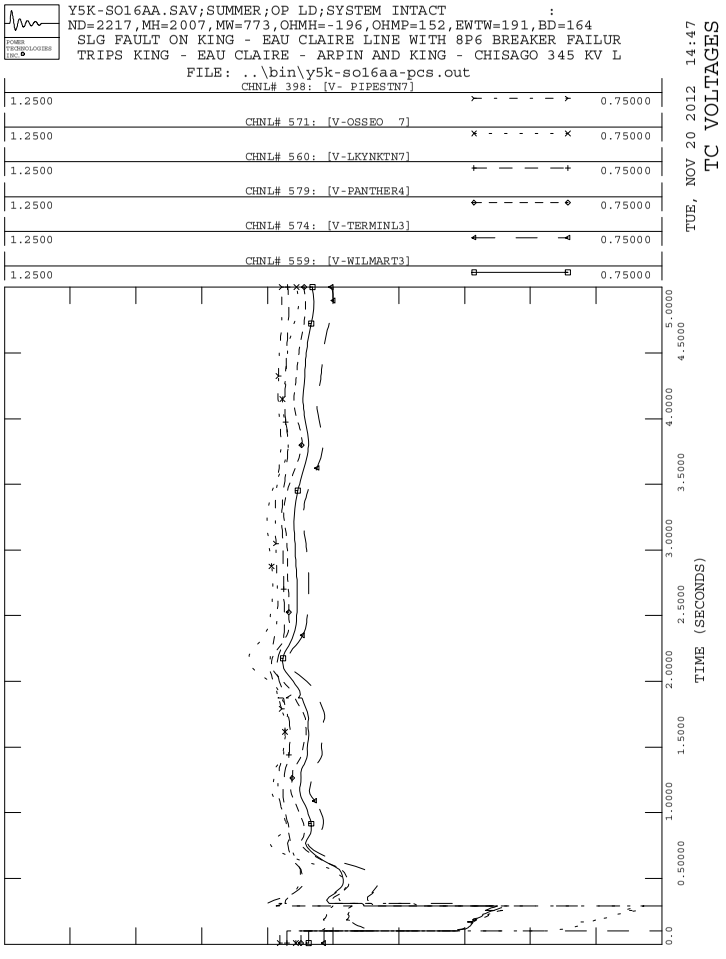
VOLTAGES IA1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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 398: [V- PIPESTN7]
CHNL# 571: [V-OSSEO 7]
CHNL# 560: [V-LKYNKTN7]
CHNL# 579: [V-PANTHER4]
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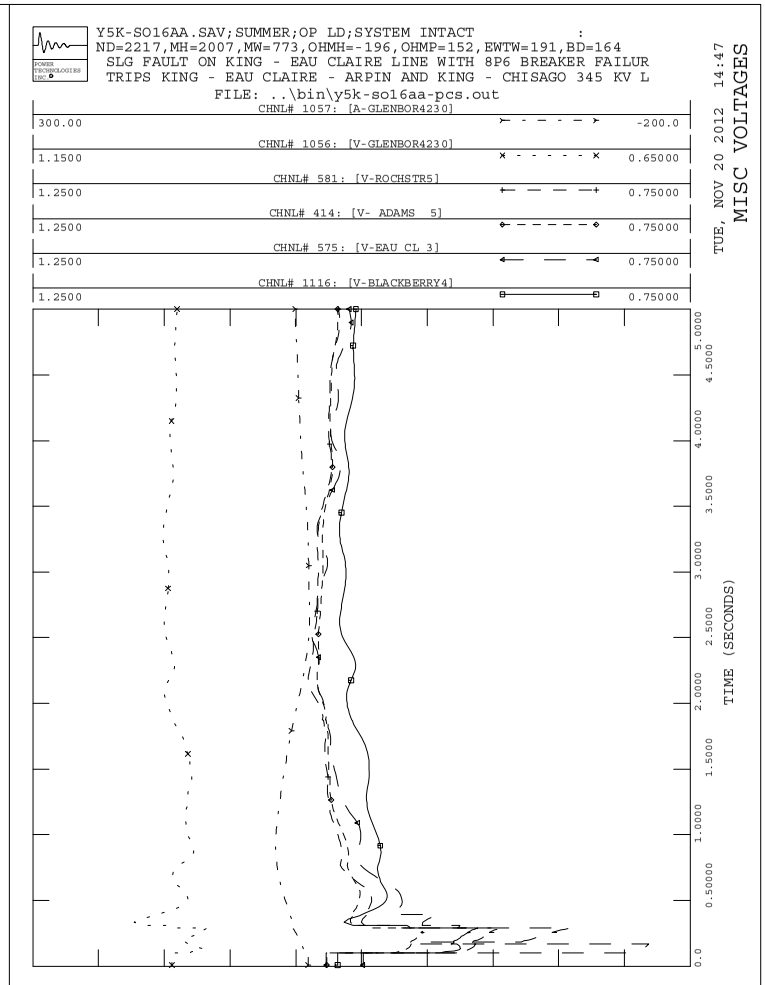
TIME (SECONDS)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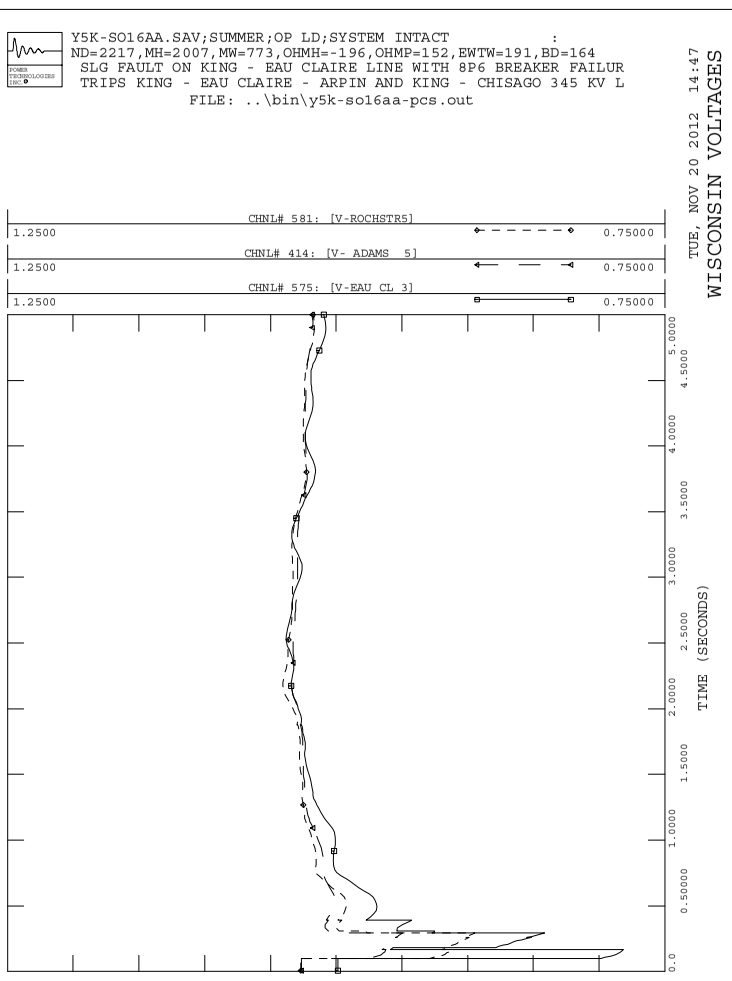
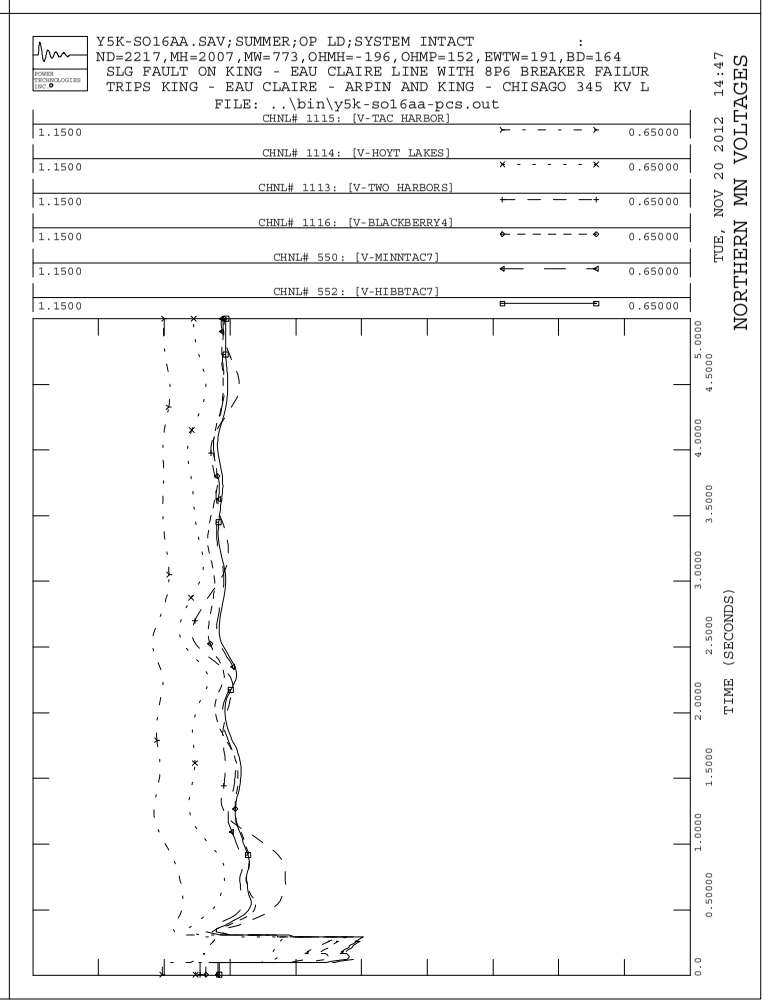
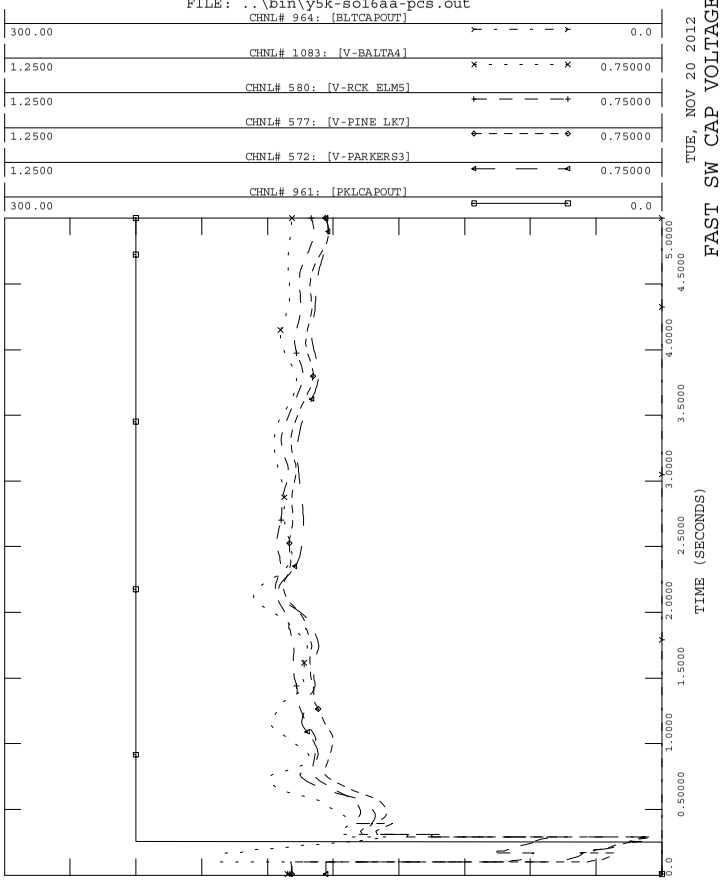
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 1057: [A-GLENBOR4230]
CHNL# 1056: [V-GLENBOR4230]
CHNL# 581: [V-ROCHSTR5]
CHNL# 414: [V- ADAMS 5]
CHNL# 575: [V-EAU CL 3]
CHNL# 1116: [V-BLACKBERRY4]
TUE, NOV 20 2012 14:47
MISC VOLTAGES
TIME (SECONDS)


Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 581: [V-ROCHSTR5]
CHNL# 414: [V- ADAMS 5]
CHNL# 575: [V-EAU CL 3]
TUE, NOV 20 2012 14:47
WISCONSIN VOLTAGES
TIME (SECONDS)

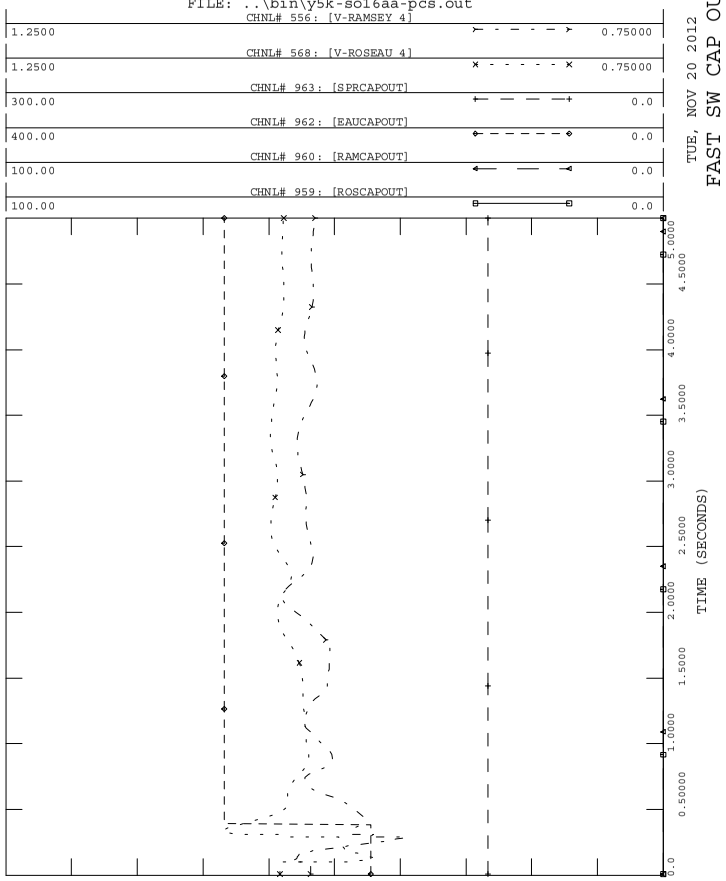

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 1115: [V-TAC HARBOR]
CHNL# 1114: [V-HOYT LAKES]
CHNL# 1113: [V-TWO HARBORS]
CHNL# 1116: [V-BLACKBERRY4]
CHNL# 550: [V-MINNTAC7]
CHNL# 552: [V-HIBBTAC7]
TUE, NOV 20 2012 14:47
NORTHERN MN VOLTAGES
TIME (SECONDS)

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out



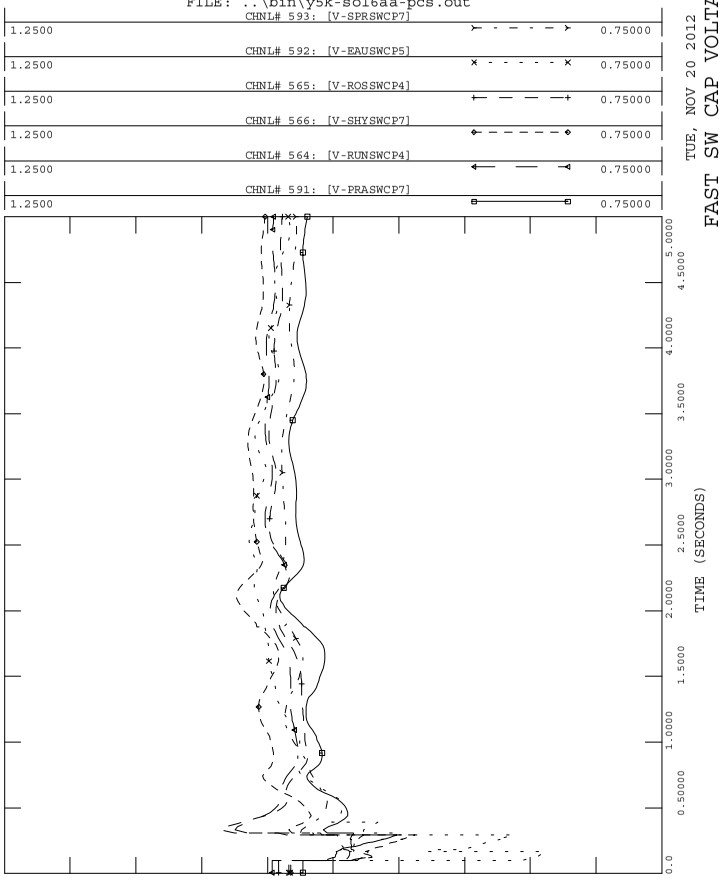
TUE, NOV 20 2012 14:47
FAST SW CAP VOLTAGES 2

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out



TUE, NOV 20 2012 14:47
FAST SW CAP OUT 2

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out



TUE, NOV 20 2012 14:47
FAST SW CAP VOLTAGES

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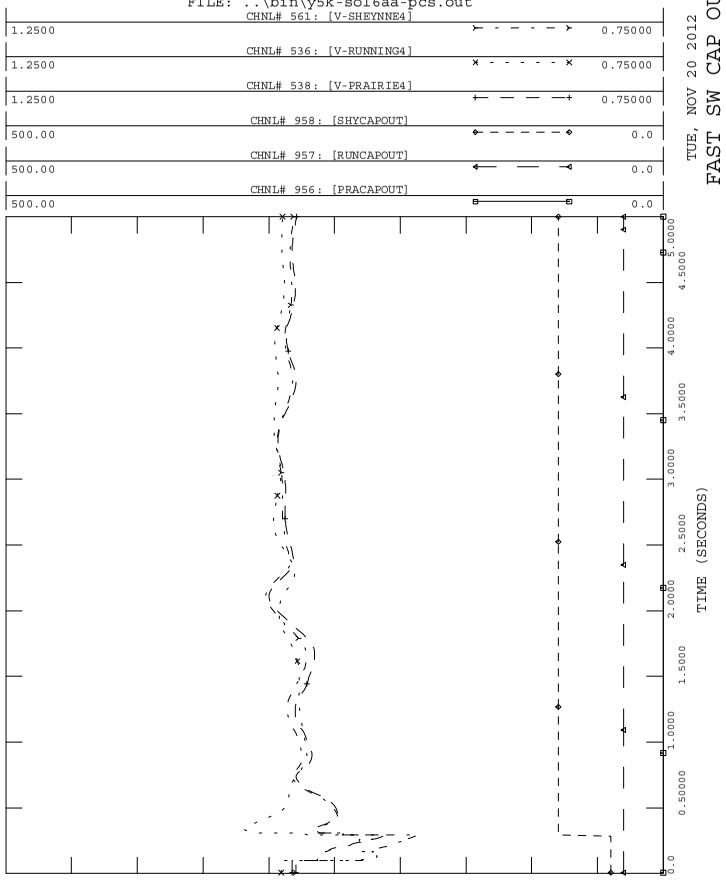
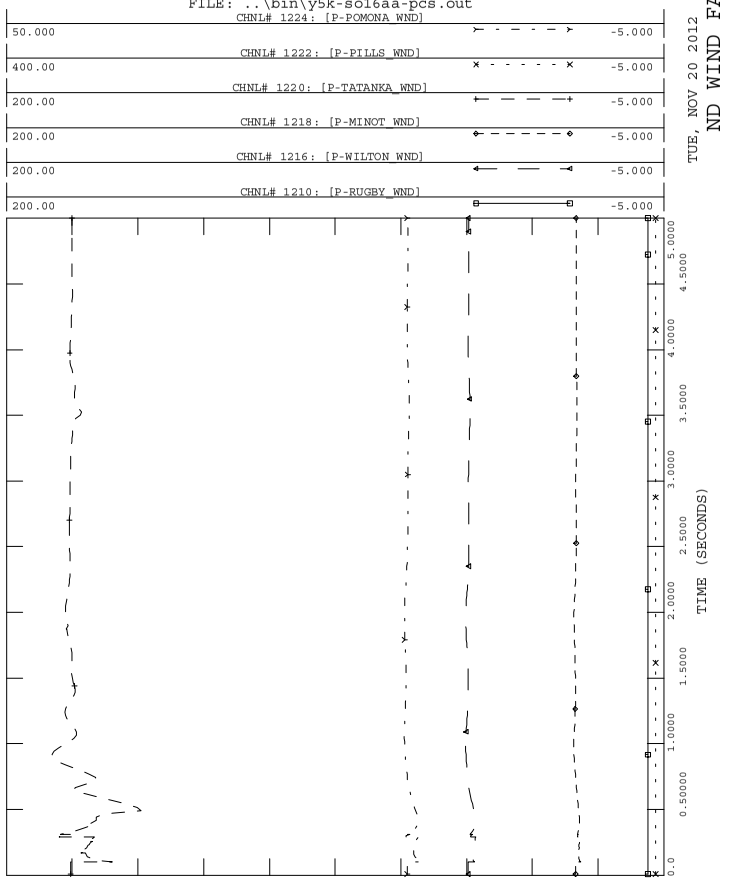
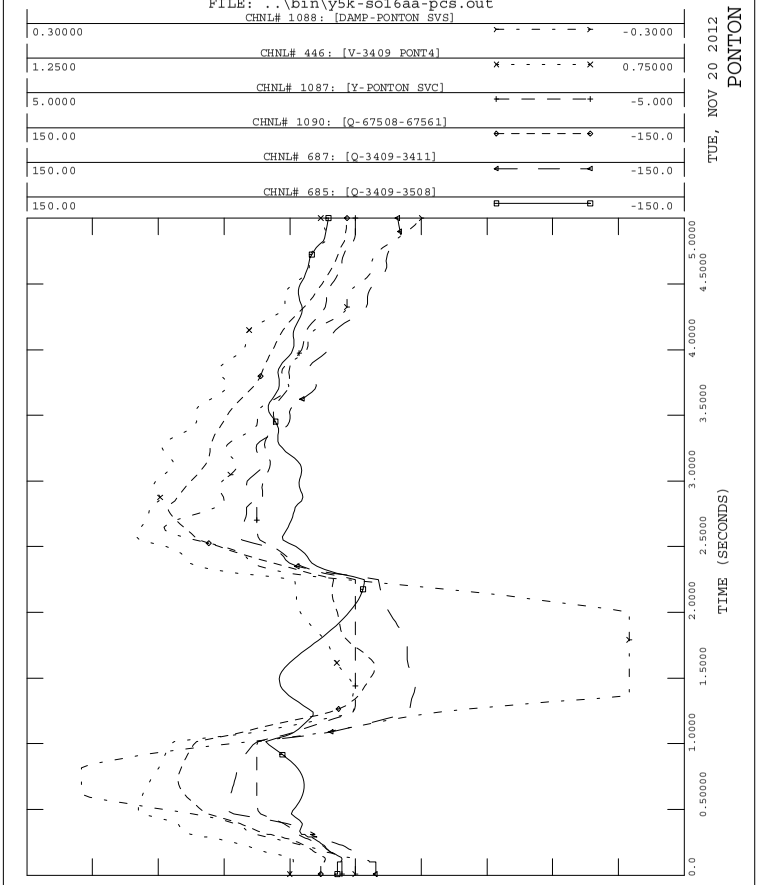
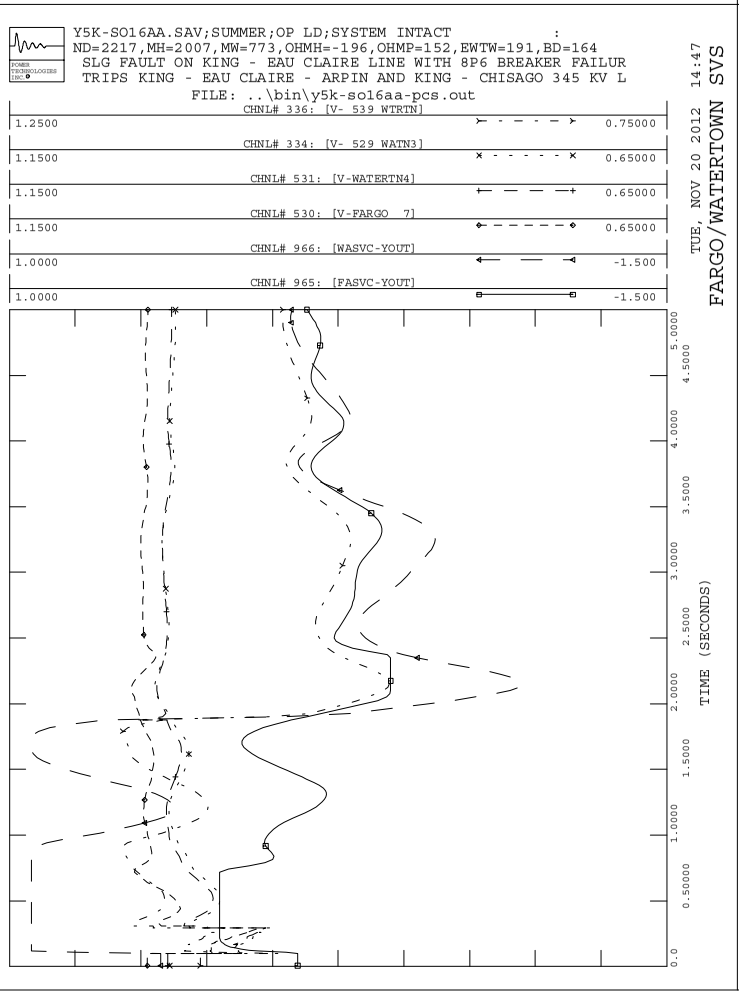
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

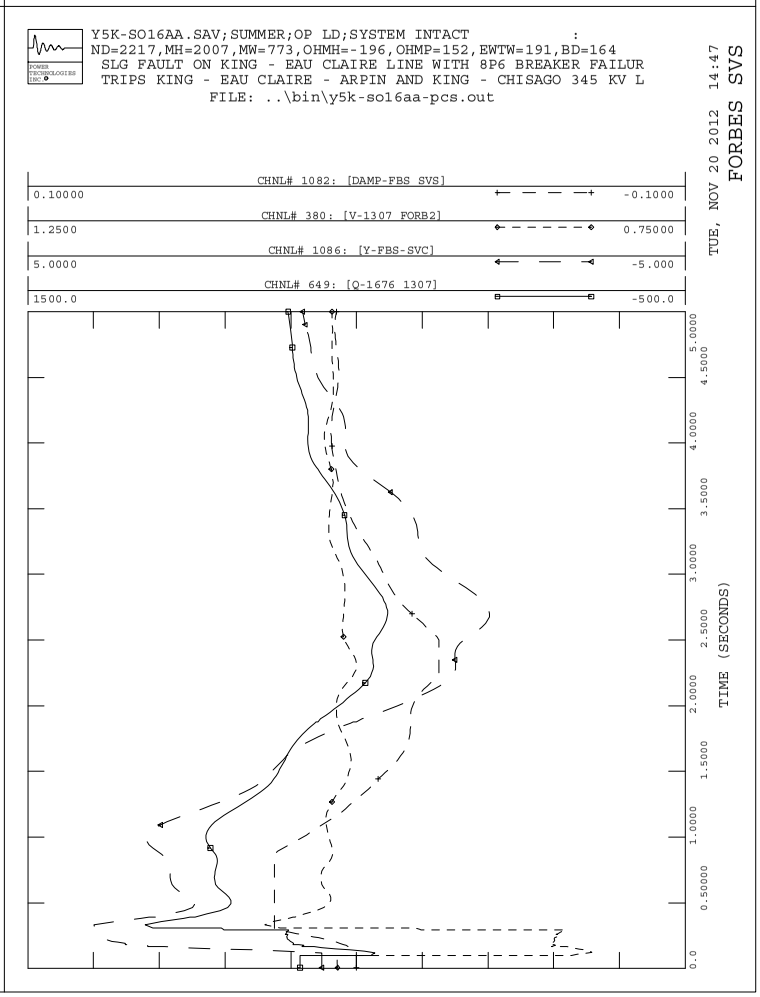


TUE, NOV 20 2012 14:47
FAST SW CAP OUT 1


Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 1224: [P-POMONA WND]
50.000
-5.000
CHNL# 1222: [P-PILLS_WND]
400.00
-5.000
CHNL# 1220: [P-TATANKA_WND]
200.00
-5.000
CHNL# 1218: [P-MINOT_WND]
200.00
-5.000
CHNL# 1216: [P-WILTON WND]
200.00
-5.000
CHNL# 1210: [P-RUGBY_WND]
200.00
-5.000
TUE, NOV 20 2012 14:47
ND WIND FARMS
TIME (SECONDS)

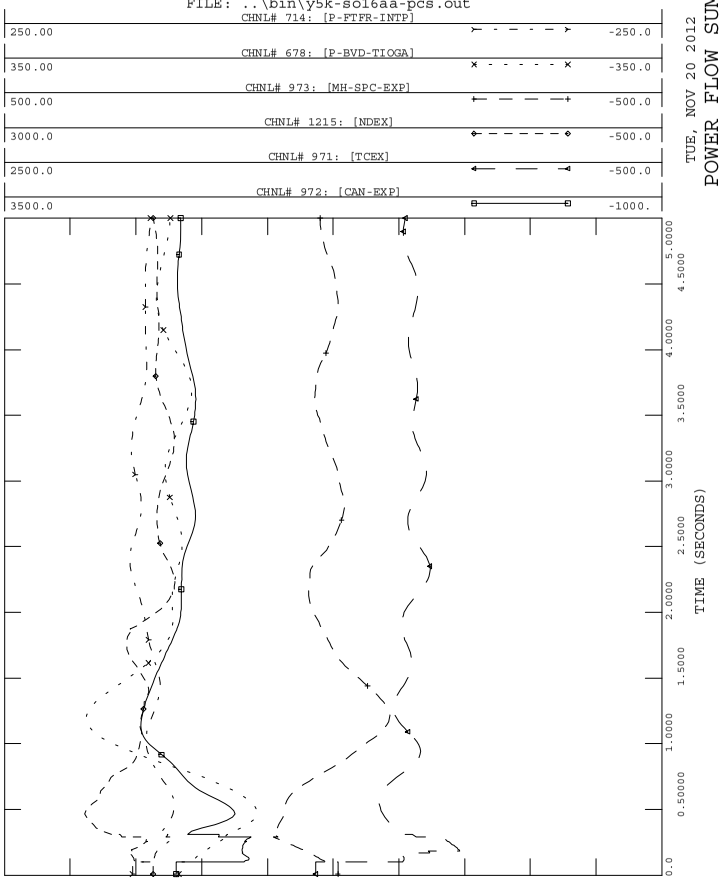

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 1088: [DAMP-PONTON SVS]
0.30000
-0.3000
CHNL# 446: [V-3409 PONT4]
1.2500
0.75000
CHNL# 1087: [Y-PONTON SVC]
5.0000
-5.000
CHNL# 1090: [Q-67508-67561]
150.00
-150.0
CHNL# 687: [Q-3409-3411]
150.00
-150.0
CHNL# 685: [Q-3409-3508]
150.00
-150.0
TUE, NOV 20 2012 14:47
PONTON SVS
TIME (SECONDS)


Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 336: [V- 539 WTRTN]
1.2500
0.75000
CHNL# 334: [V- 529 WATN3]
1.1500
0.65000
CHNL# 531: [V-WATERTN4]
1.1500
0.65000
CHNL# 530: [V-FARGO 7]
1.1500
0.65000
CHNL# 966: [WASVC-YOUT]
1.0000
-1.500
CHNL# 965: [FASVC-YOUT]
1.0000
-1.500
TUE, NOV 20 2012 14:47
FARGO/WATERTOWN SVS
TIME (SECONDS)


Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 1082: [DAMP-FBS SVS]
0.10000
-0.1000
CHNL# 380: [V-1307 FORB2]
1.2500
0.75000
CHNL# 1086: [Y-FBS-SVC]
5.0000
-5.000
CHNL# 649: [Q-1676 1307]
1500.0
-500.0
TUE, NOV 20 2012 14:47
FORBES SVS
TIME (SECONDS)

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:47
POWER FLOW SUMS 1



Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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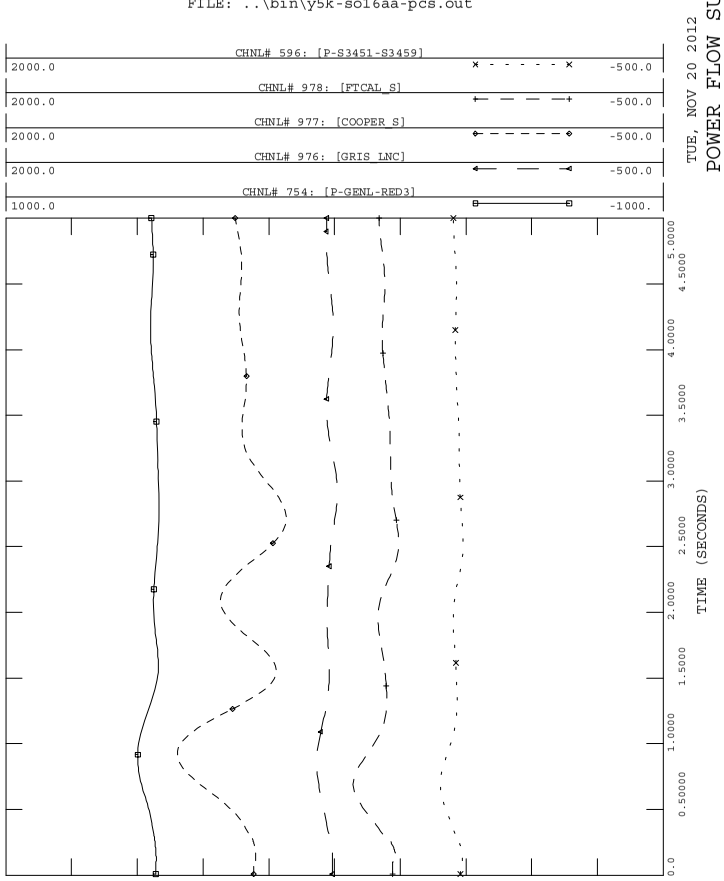
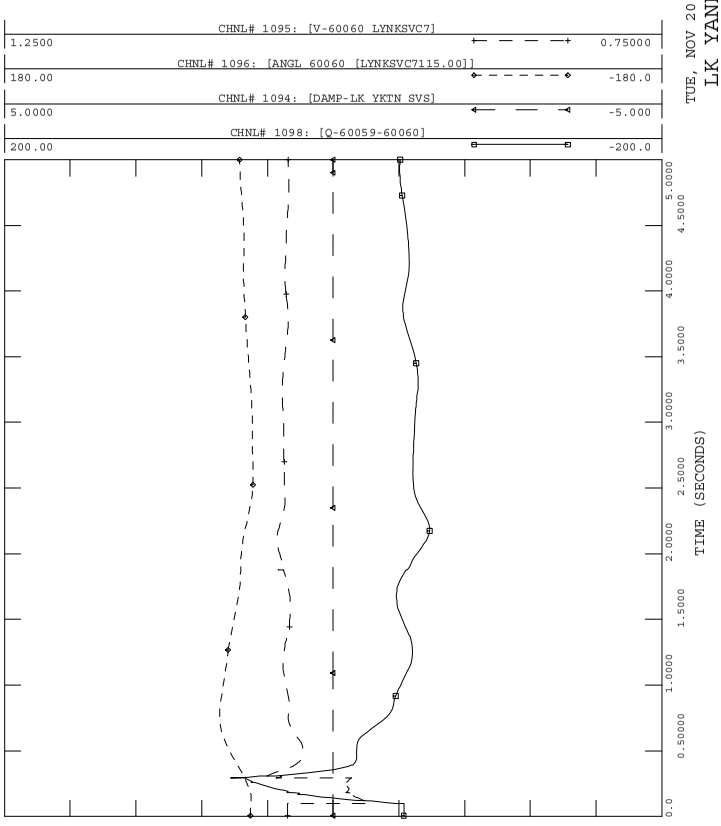
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:47
POWER FLOW SUM 3



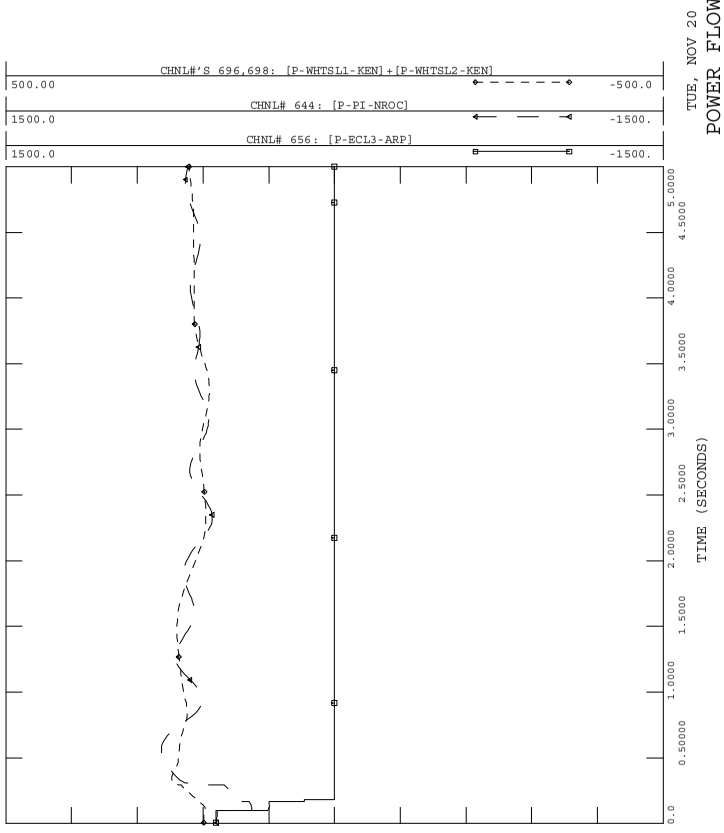
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

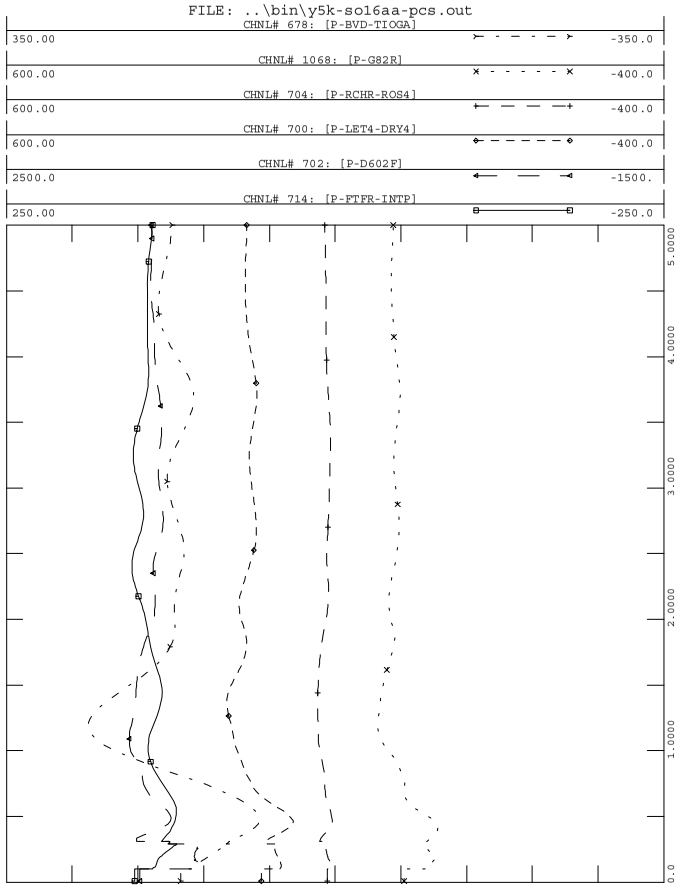
TUE, NOV 20 2012 14:47
LK YANKTON SVS



Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:47
POWER FLOW SUMS 2

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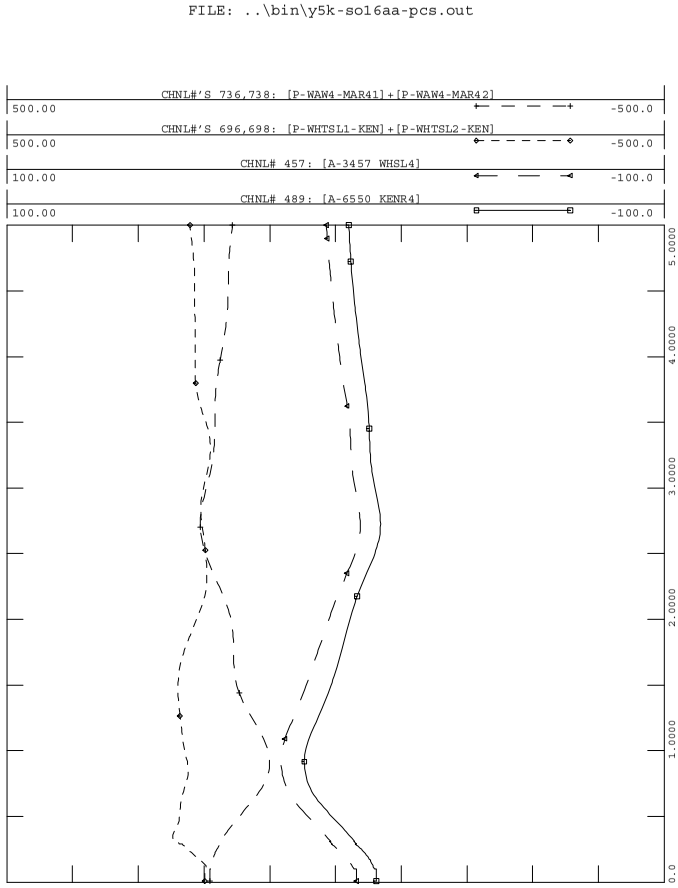
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL# 678: [P-BVD-TIOGA]
350.00
-350.0
CHNL# 1068: [P-G82R]
600.00
-400.0
CHNL# 704: [P-RCHR-ROS4]
600.00
-400.0
CHNL# 700: [P-LET4-DRY4]
600.00
-400.0
CHNL# 702: [P-D602F]
2500.0
-1500.
CHNL# 714: [P-FTFR-INTP]
250.00
-250.0
TIME (SECONDS)
TUE, NOV 20 2012 14:47
CAN. TIE FLOWS


Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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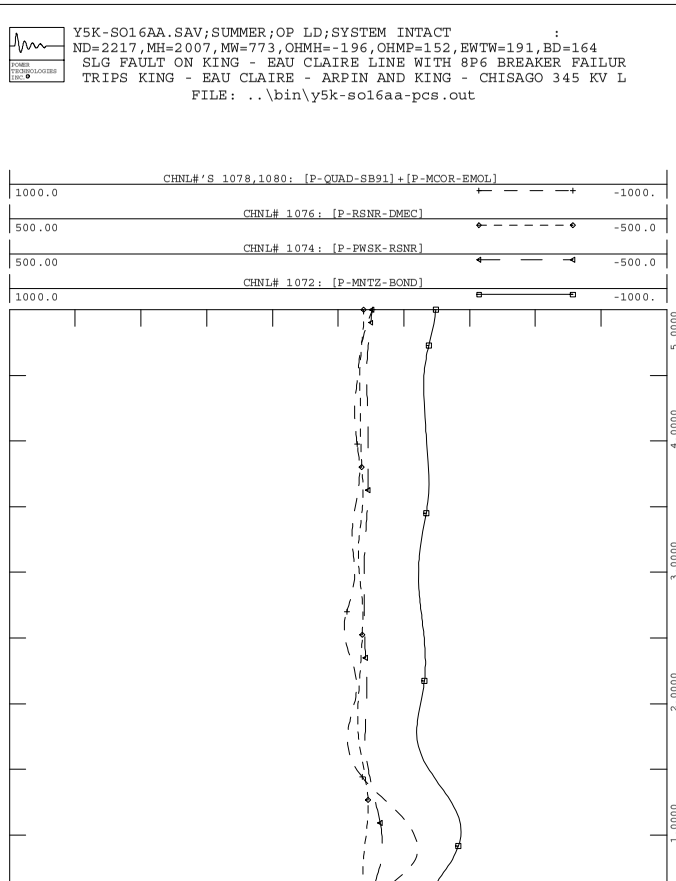
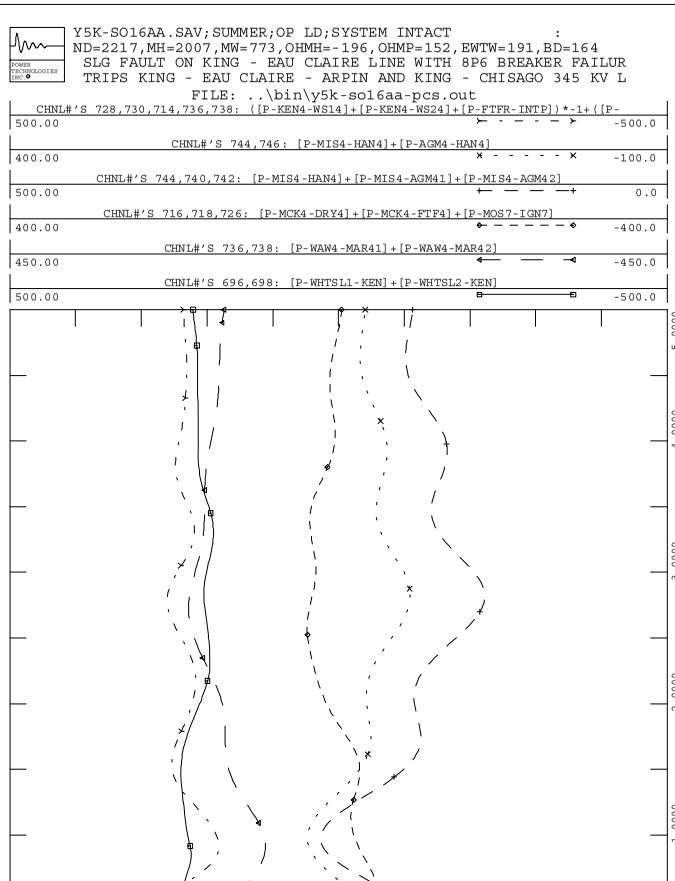
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL#'S 736,738: [P-WAW4-MAR41]+[P-WAW4-MAR42]
500.00
-500.0
CHNL#'S 696,698: [P-WHTSL1-KEN]+[P-WHTSL2-KEN]
500.00
-500.0
CHNL# 457: [A-3457 WHSL4]
100.00
-100.0
CHNL# 489: [A-6550 KENR4]
100.00
-100.0
TIME (SECONDS)
TUE, NOV 20 2012 14:47
NW ONTARIO TIES

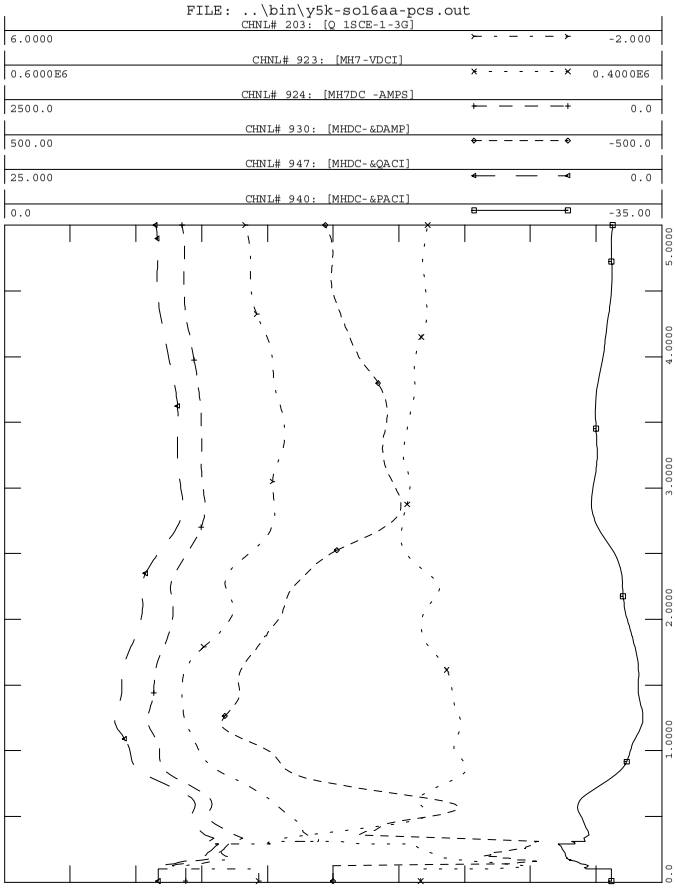

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL#'S 1078,1080: [P-QUAD-SB91]+[P-MCOR-EMOL]
1000.0
-1000.
CHNL# 1076: [P-RSNR-DMEC]
500.00
-500.0
CHNL# 1074: [P-PWSK-RSNR]
500.00
-500.0
CHNL# 1072: [P-MNTZ-BOND]
1000.0
-1000.
TIME (SECONDS)
TUE, NOV 20 2012 14:47
POWER FLOW SUM 4


Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out
CHNL#'S 728,730,714,736,738: ([P-KEN4-WS14]+[P-KEN4-WS24]+[P-FTFR-INTP])*-1+([P-
500.00
-500.0
CHNL#'S 744,746: [P-MIS4-HAN4]+[P-AGM4-HAN4]
400.00
-100.0
CHNL#'S 744,740,742: [P-MIS4-HAN4]+[P-MIS4-AGM41]+[P-MIS4-AGM42]
500.00
0.0
CHNL#'S 716,718,726: [P-MCK4-DRY4]+[P-MCK4-FTF4]+[P-MOS7-IGN7]
400.00
-400.0
CHNL#'S 736,738: [P-WAW4-MAR41]+[P-WAW4-MAR42]
450.00
-450.0
CHNL#'S 696,698: [P-WHTSL1-KEN]+[P-WHTSL2-KEN]
500.00
-500.0
TIME (SECONDS)
TUE, NOV 20 2012 14:47
OH TIE FLOWS

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:47

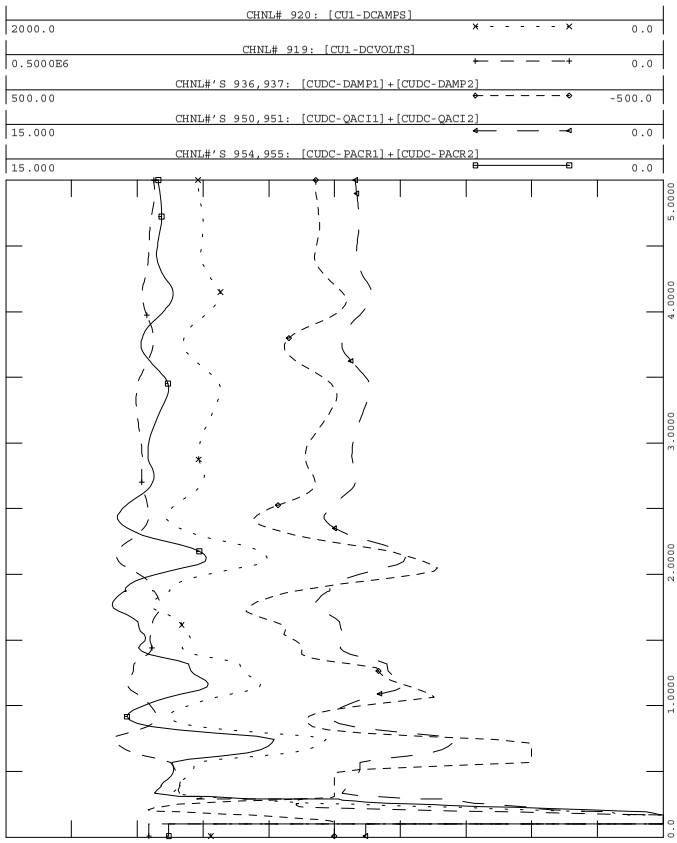
MH DC PARAMETERS



Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:47

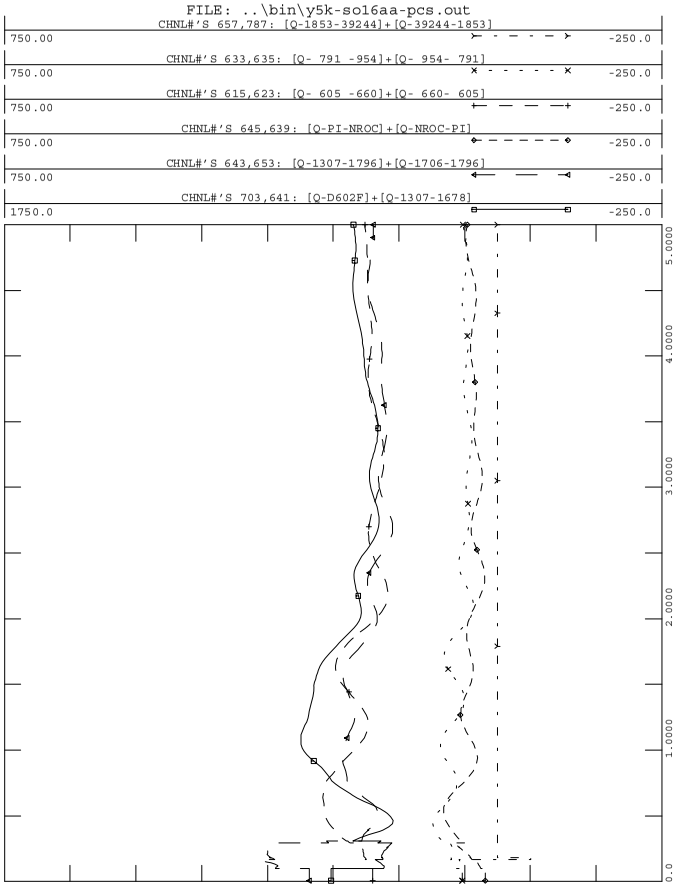
CU DC #1



Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:47

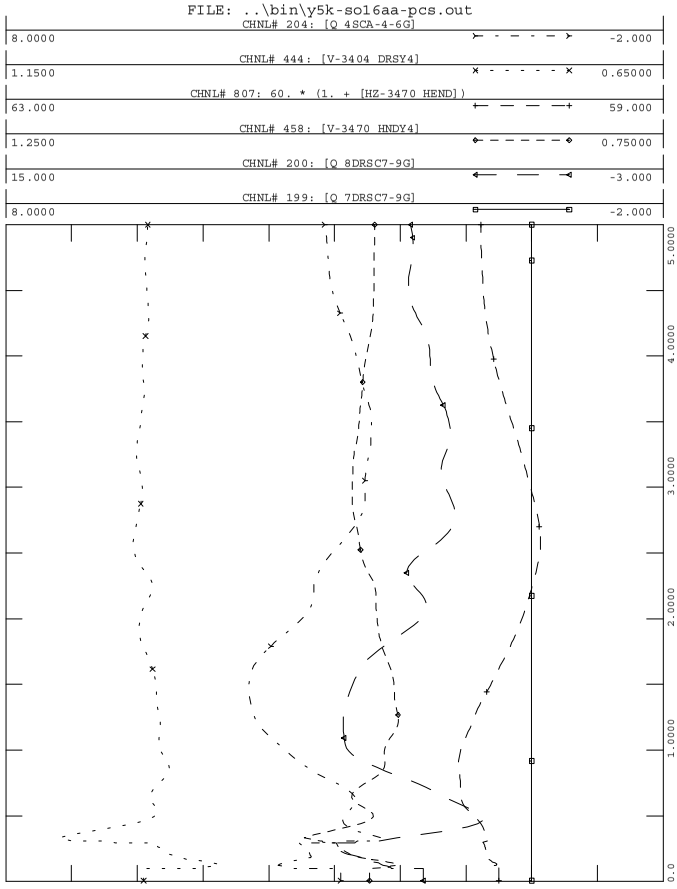
VAR LOSSES



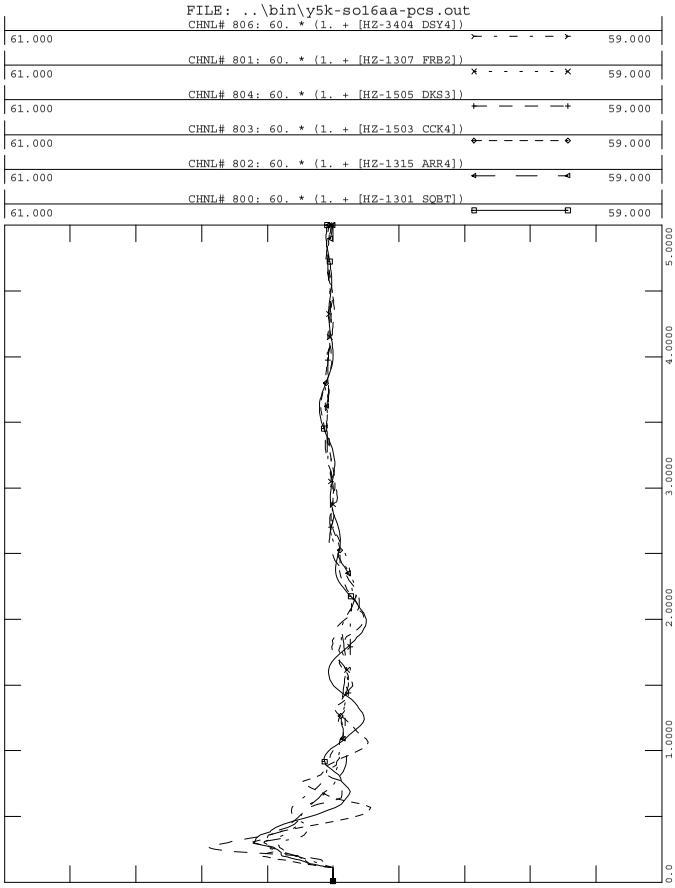
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out

TUE, NOV 20 2012 14:47

MH DC PARAMETERS



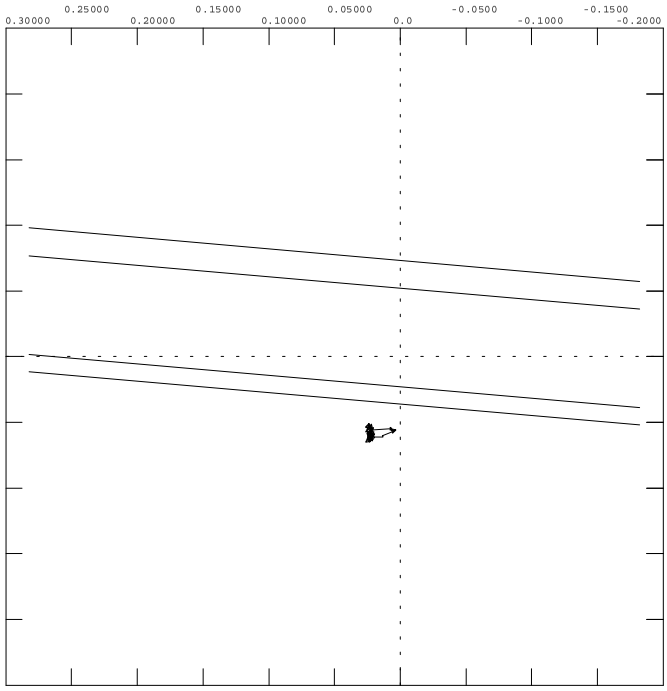
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out



TUE, NOV 20 2012 14:47
FREQ AT DC TERMINALS

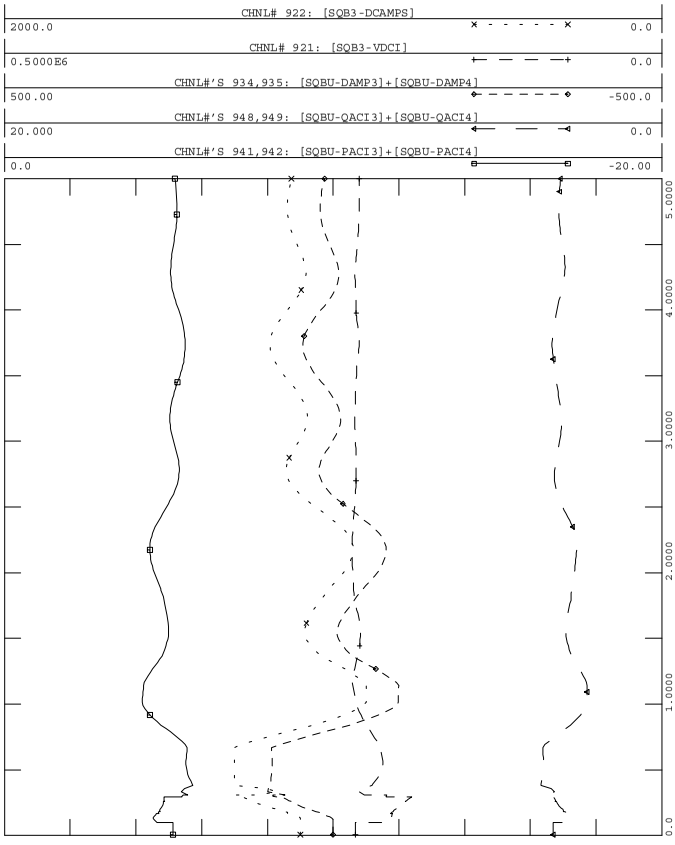
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\y5k-so16aa-pcs.out
RELAY: SLNOS1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 824: [X-FRB2-ROS2]



TUE, NOV 20 2012 14:47
D602F-FORBES-EMRG (778)

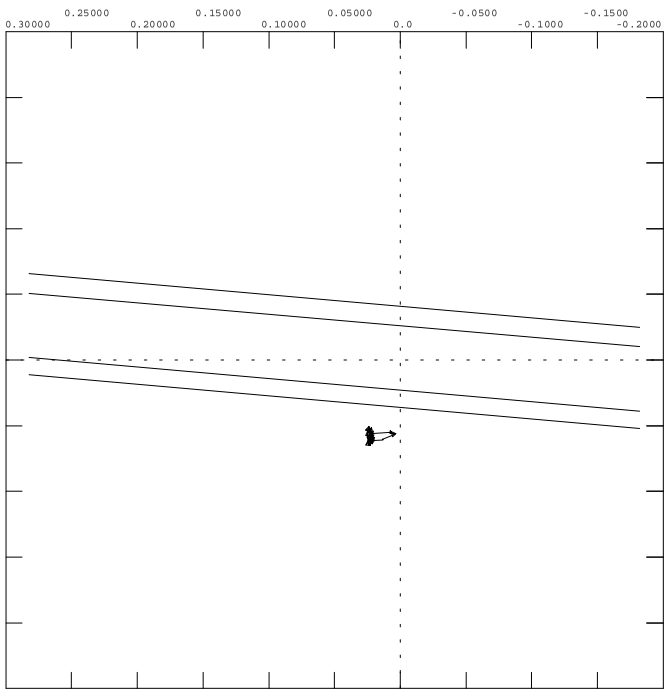
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\y5k-so16aa-pcs.out



TUE, NOV 20 2012 14:47
SQB DC #3

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\y5k-so16aa-pcs.out
RELAY: SLNOS1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 824: [X-FRB2-ROS2]



TUE, NOV 20 2012 14:47
D602F-FORBES (612)

Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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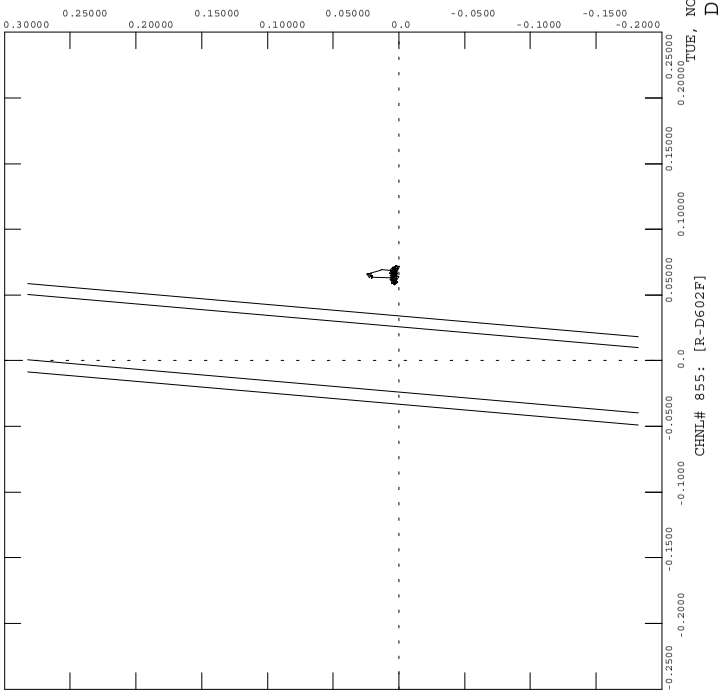
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\y5k-so16aa-pcs.out

RELAY: SLNOS1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 856: [X-D602F]



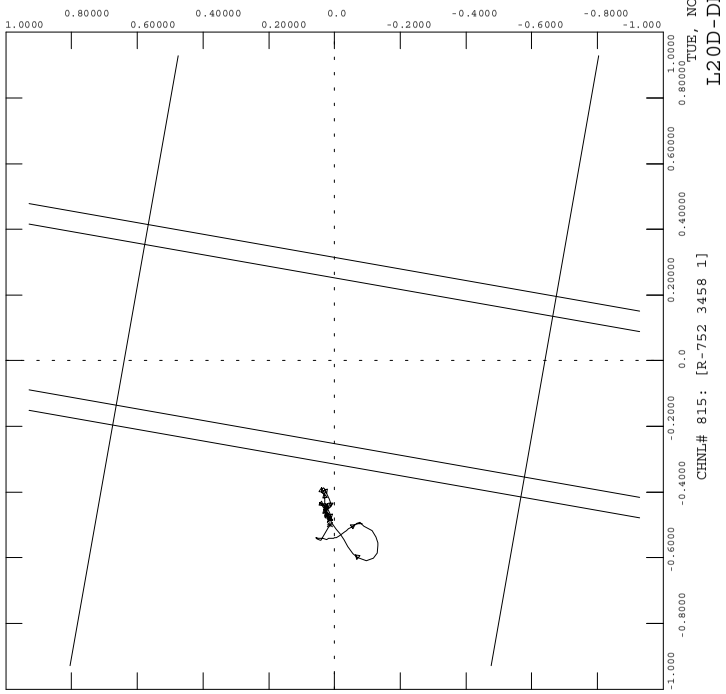
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\y5k-so16aa-pcs.out

RELAY: SLNOS1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 816: [X-DRY4-LET4]



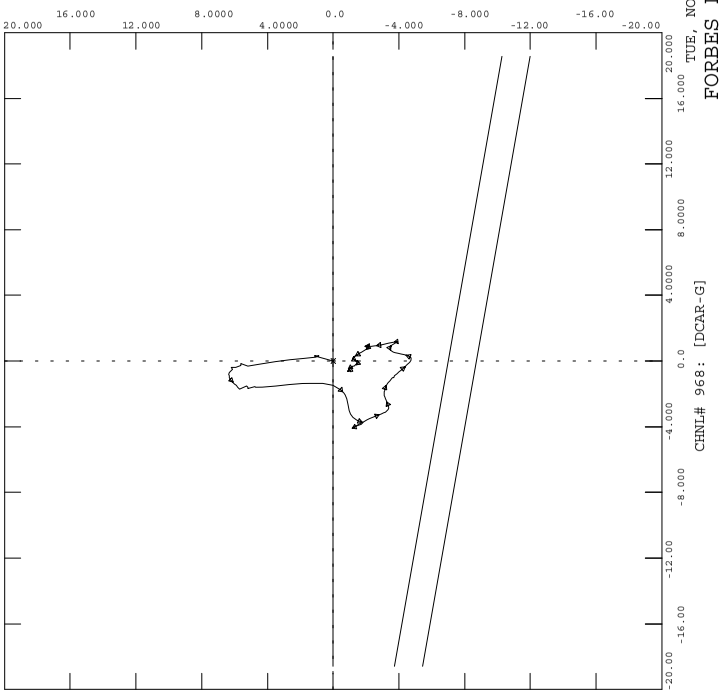
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\y5k-so16aa-pcs.out

RELAY: SLNOS1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 969: [DCAR-B]



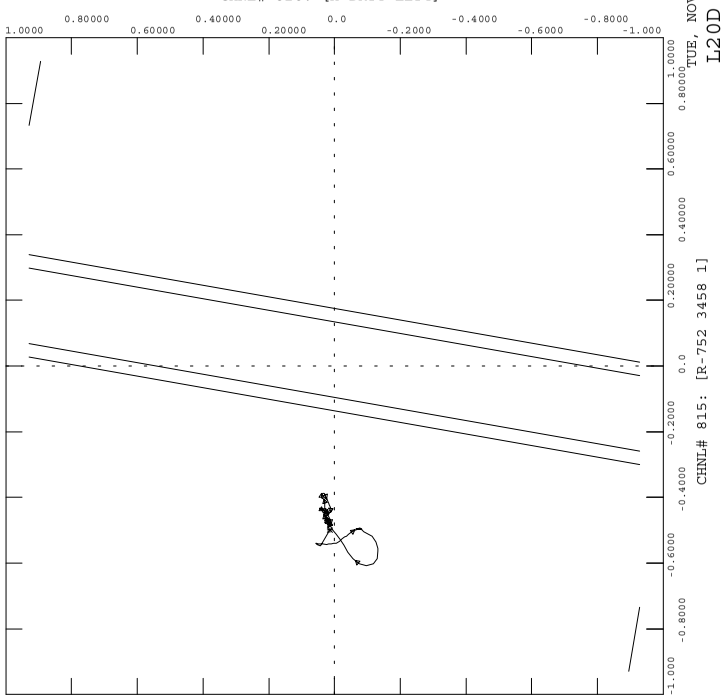
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\y5k-so16aa-pcs.out

RELAY: SLNOS1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 816: [X-DRY4-LET4]



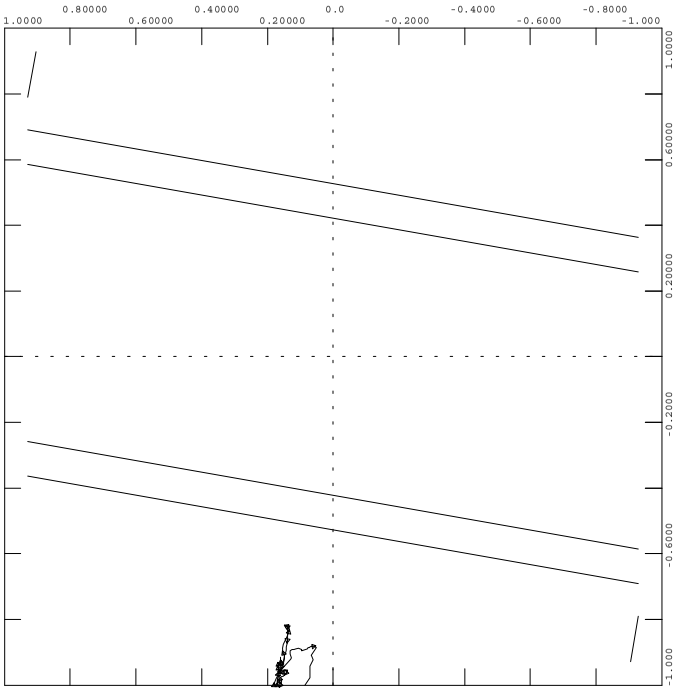
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\y5k-so16aa-pcs.out

RELAY: SLNOS1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 822: [X-MRV4-RCH4]



TUE, NOV 20 2012 14:47

R50M-MORANVILLE-EMRG (777

CHNL# 821: [R-757 1679 1]

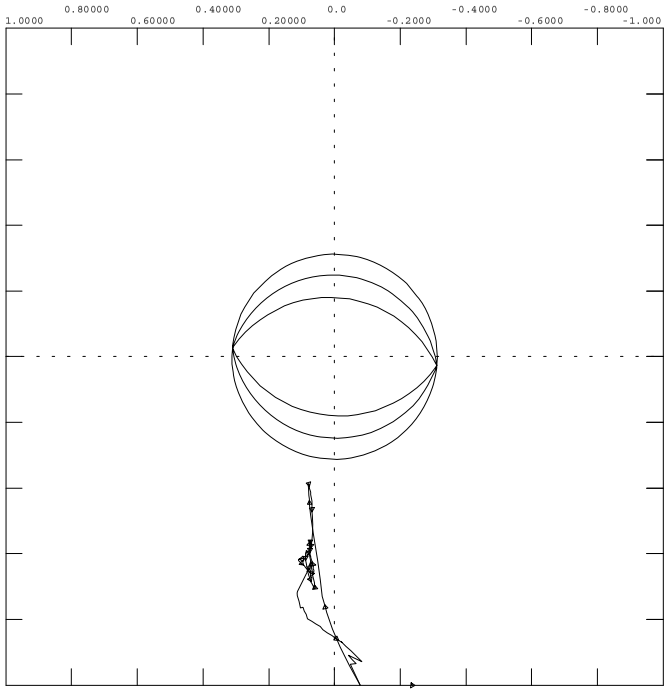
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\y5k-so16aa-pcs.out

RELAY: SLLP1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 814: [X-TGA4-BD 4]



TUE, NOV 20 2012 14:47

TIOGA-B.DAM-NORTH (268)

CHNL# 813: [R-604 3203 1]

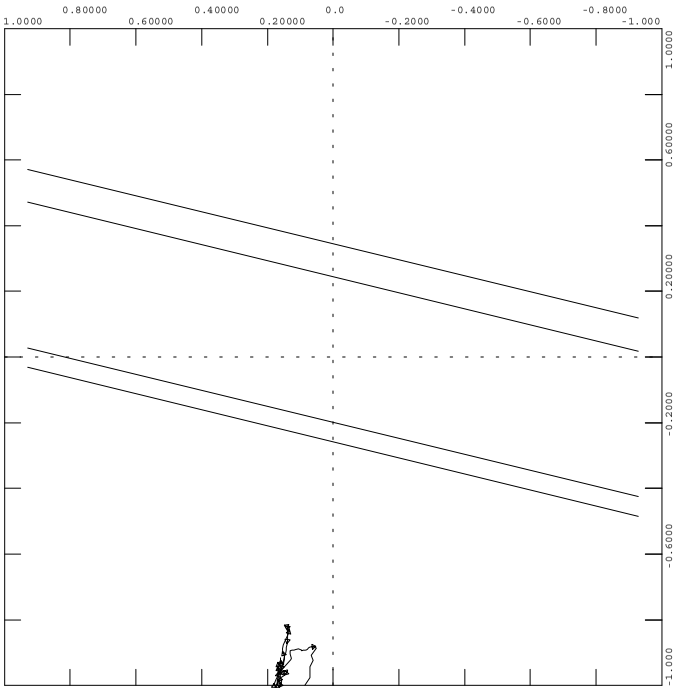
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\y5k-so16aa-pcs.out

RELAY: SLNOS1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 822: [X-MRV4-RCH4]



TUE, NOV 20 2012 14:47

R50M AT MORANVILLE (520

CHNL# 821: [R-757 1679 1]

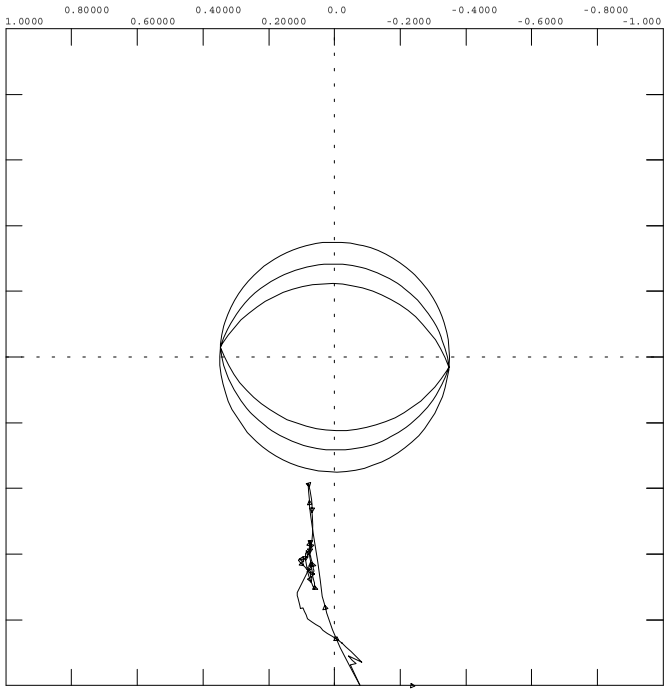
Y5K-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=2217,MH=2007,MW=773,OHMH=-196,OHMP=152,EWTW=191,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\y5k-so16aa-pcs.out

RELAY: SLLP1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 814: [X-TGA4-BD 4]



TUE, NOV 20 2012 14:47

TIOGA-B.DAM-SOUTH (266)

CHNL# 813: [R-604 3203 1]

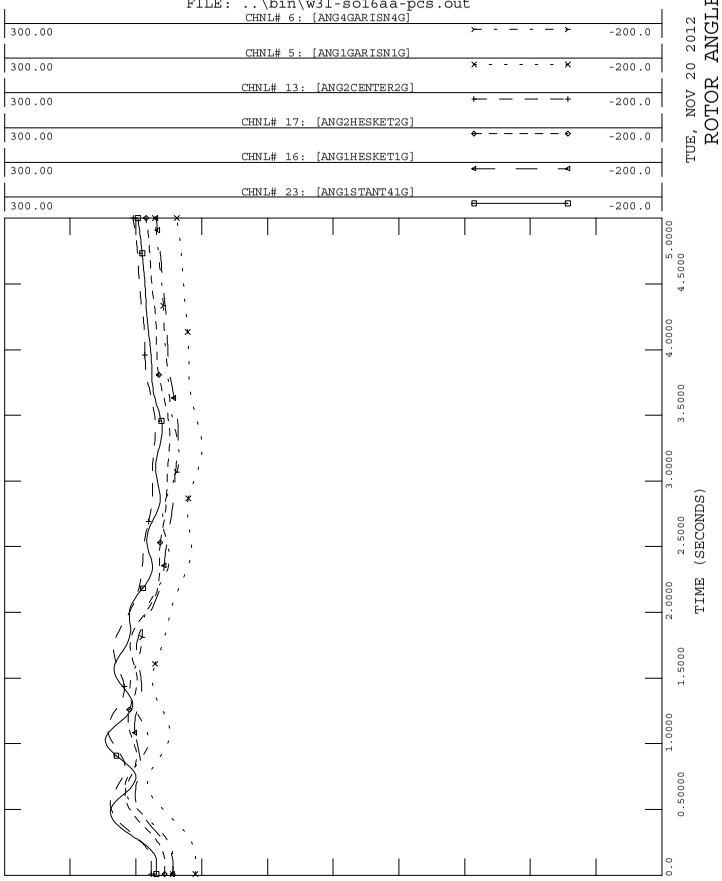
MP-OH I.FALLS (779)

TIOGA-B.DAM-EMRG (267)

G82R (780)

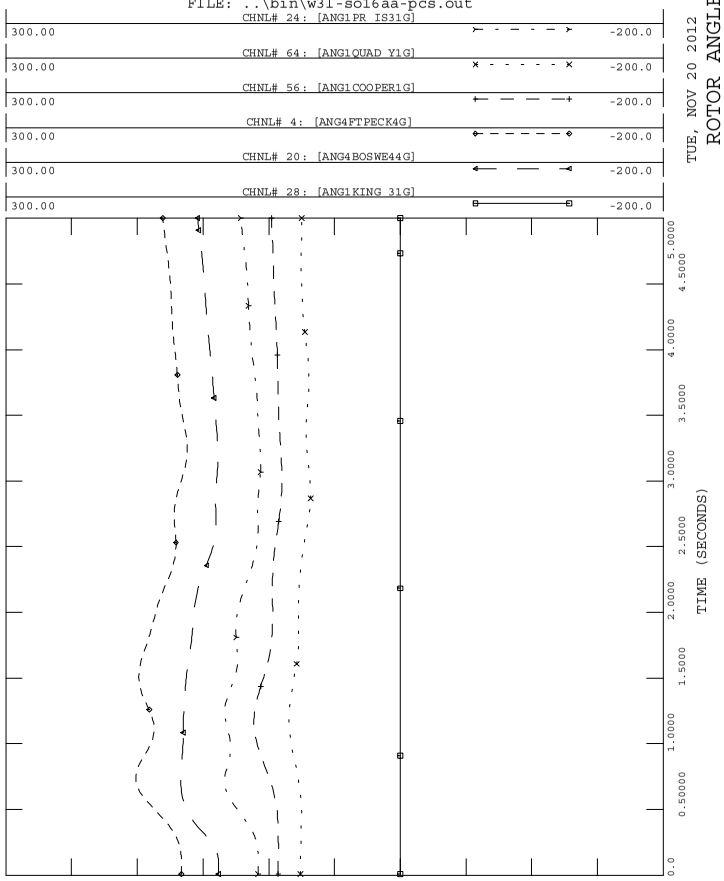
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
ROTOR ANGLES 2



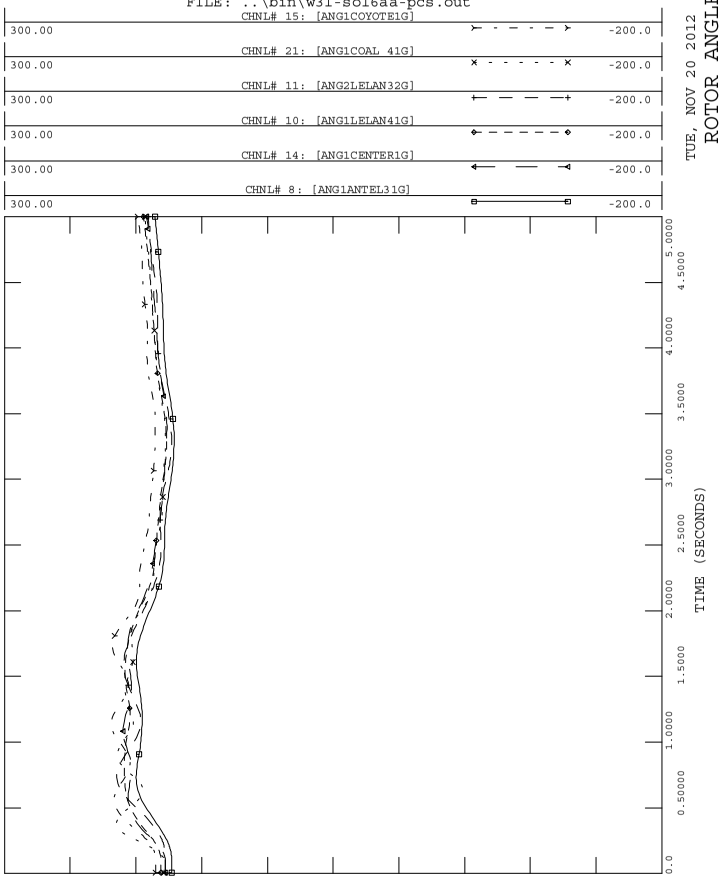
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
ROTOR ANGLES 4



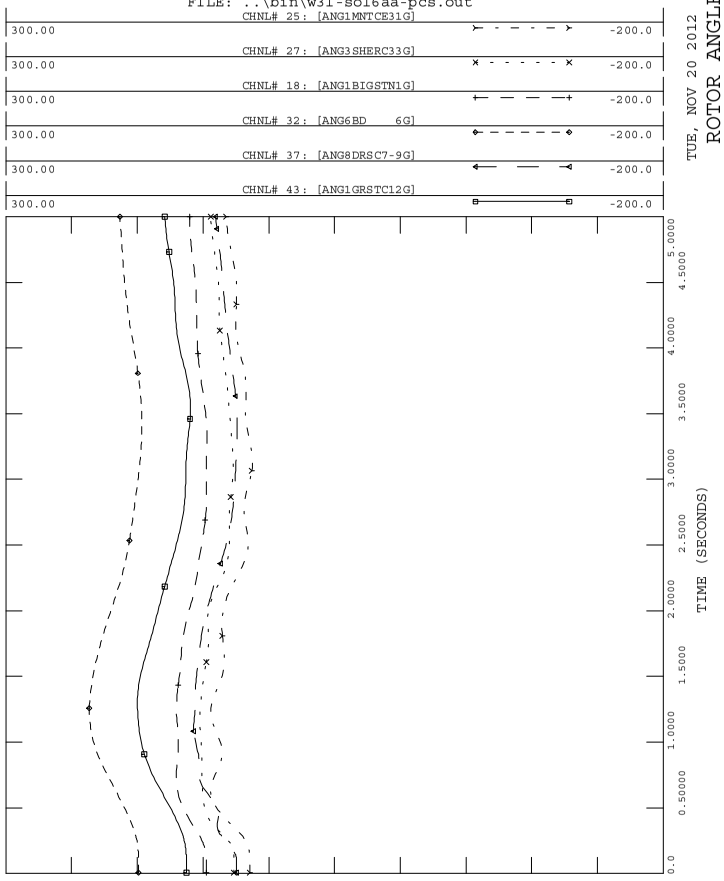
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
ROTOR ANGLES 1



W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
ROTOR ANGLES 3



W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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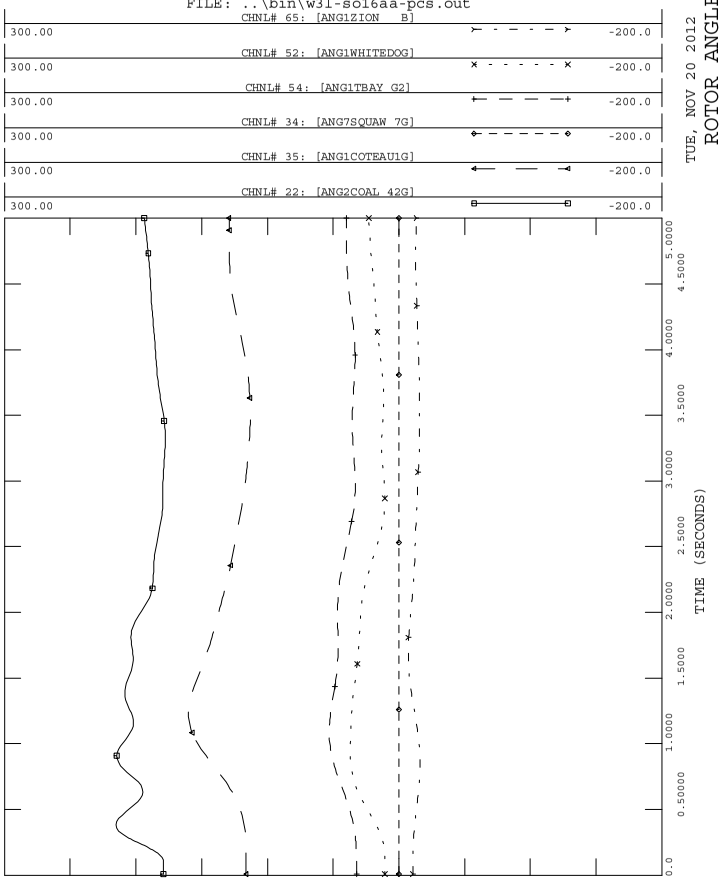
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out



TUE, NOV 20 2012 10:39
ROTOR ANGLES 6

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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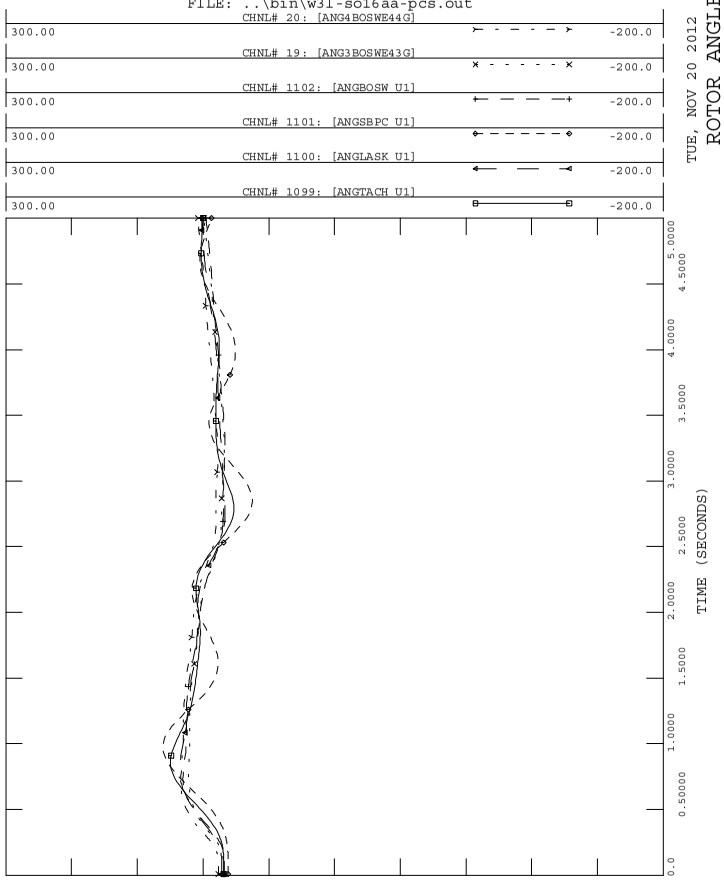
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out



TUE, NOV 20 2012 10:39
ROTOR ANGLES 8

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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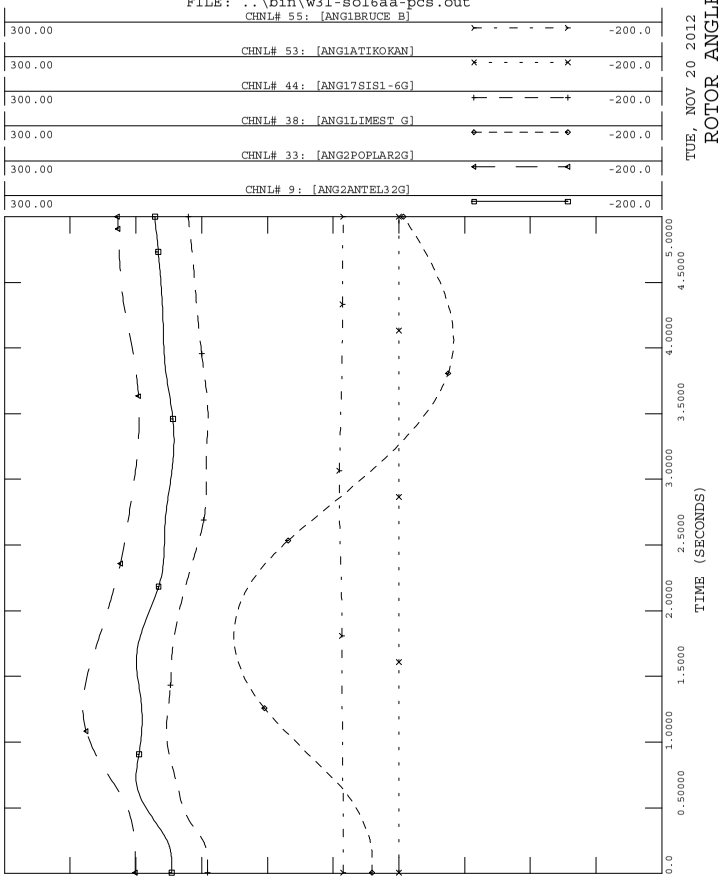
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out



TUE, NOV 20 2012 10:39
ROTOR ANGLES 5

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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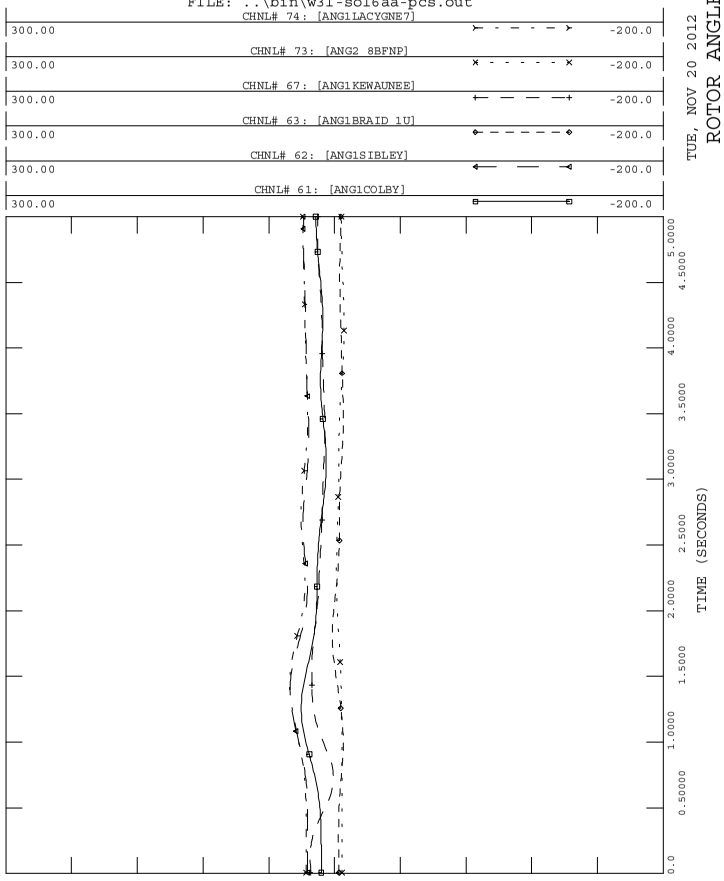
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out



TUE, NOV 20 2012 10:39
ROTOR ANGLES 7

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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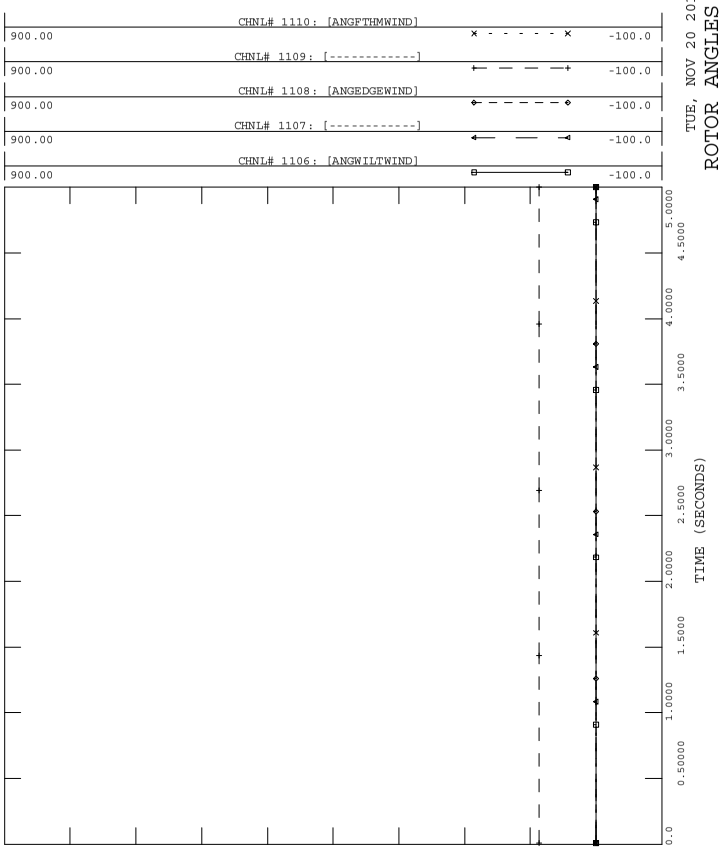
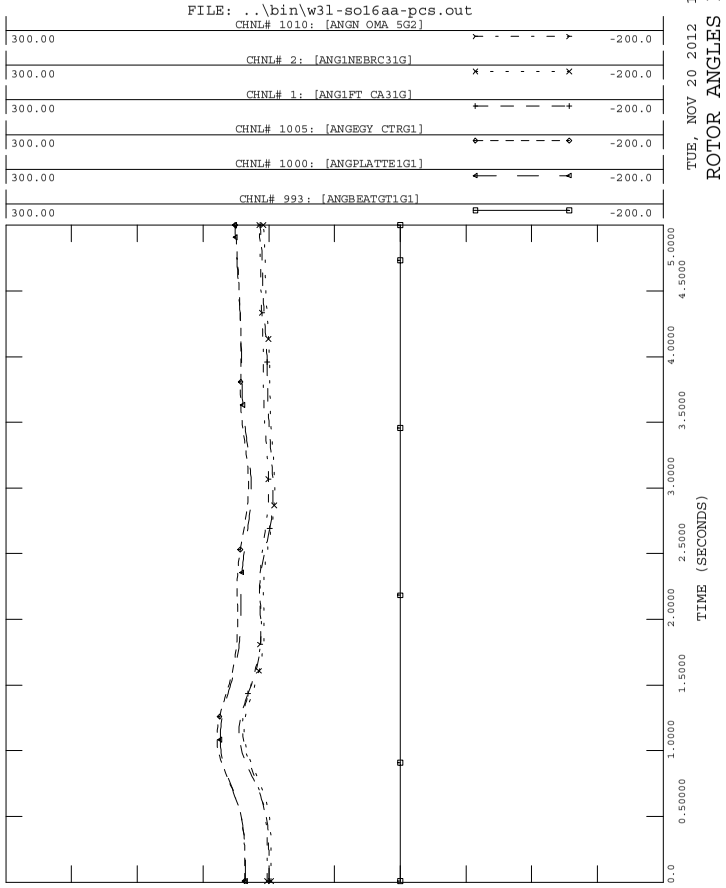
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out



TUE, NOV 20 2012 10:39
ROTOR ANGLES WIND2

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out



TUE, NOV 20 2012 10:39
ROTOR ANGLES NB2

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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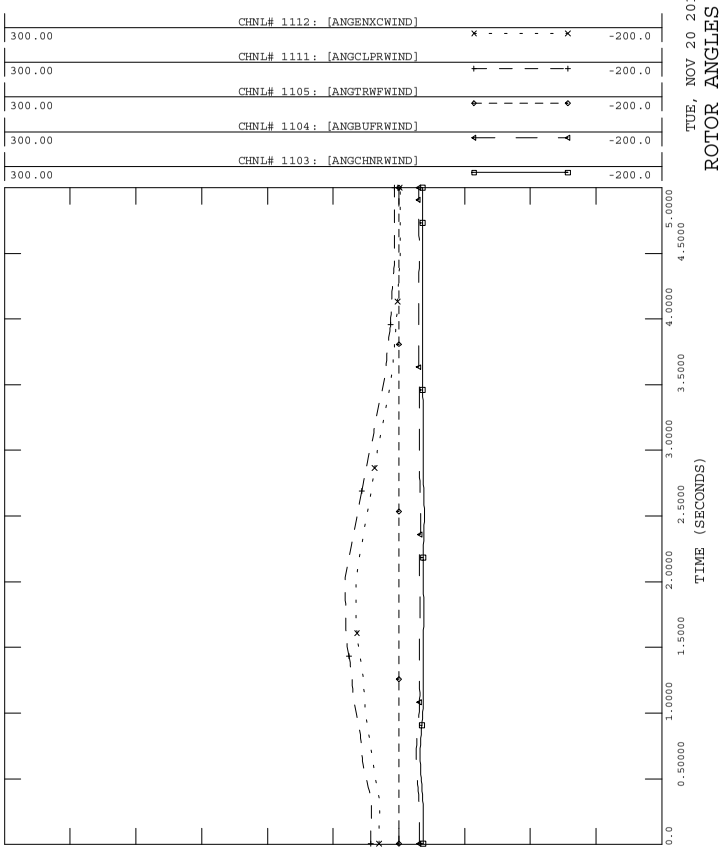
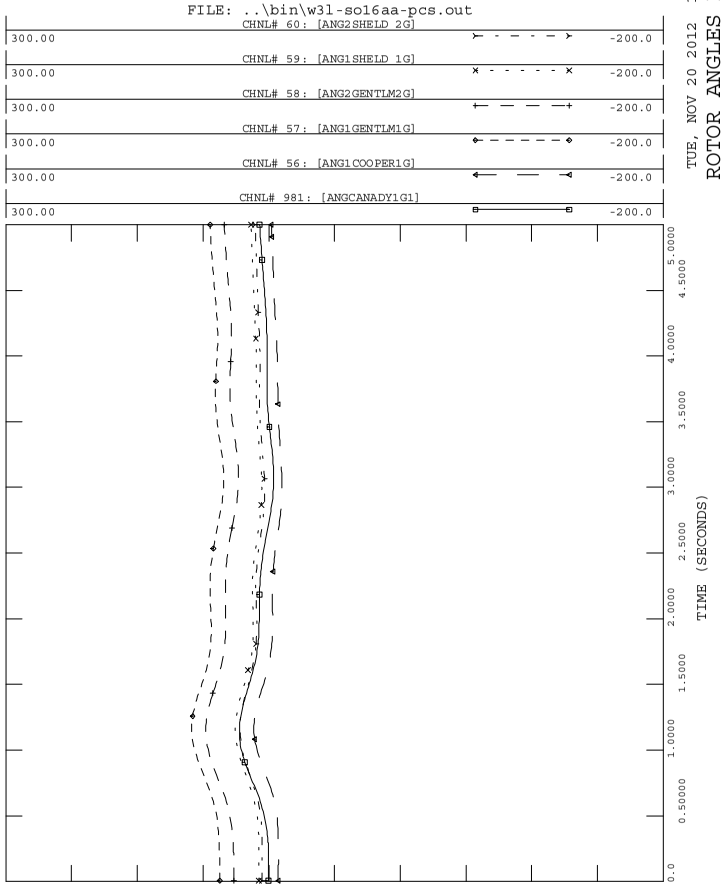
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out



TUE, NOV 20 2012 10:39
ROTOR ANGLES WIND1

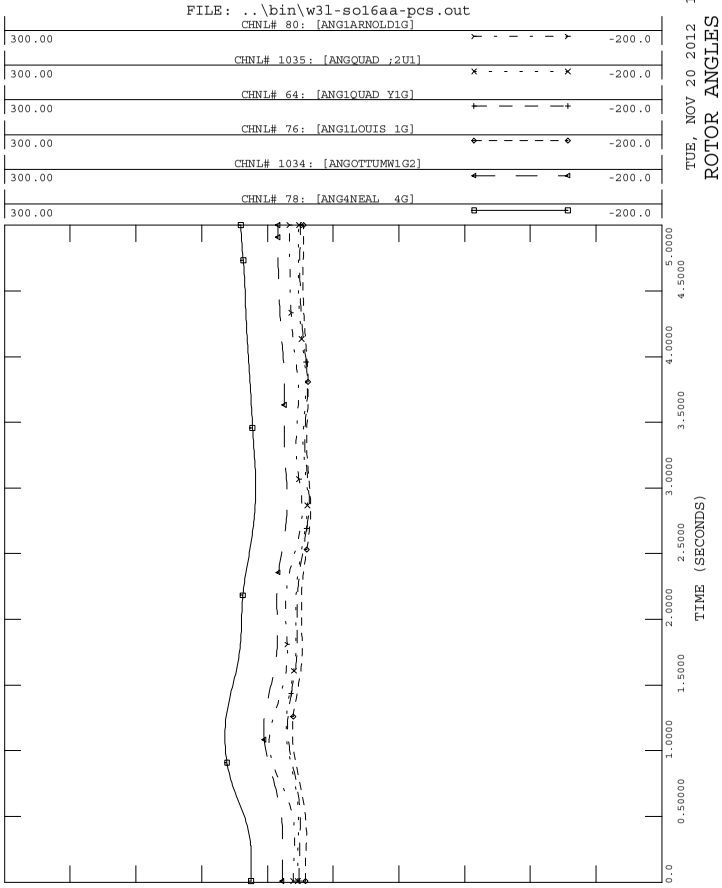
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out



TUE, NOV 20 2012 10:39
ROTOR ANGLES NB1

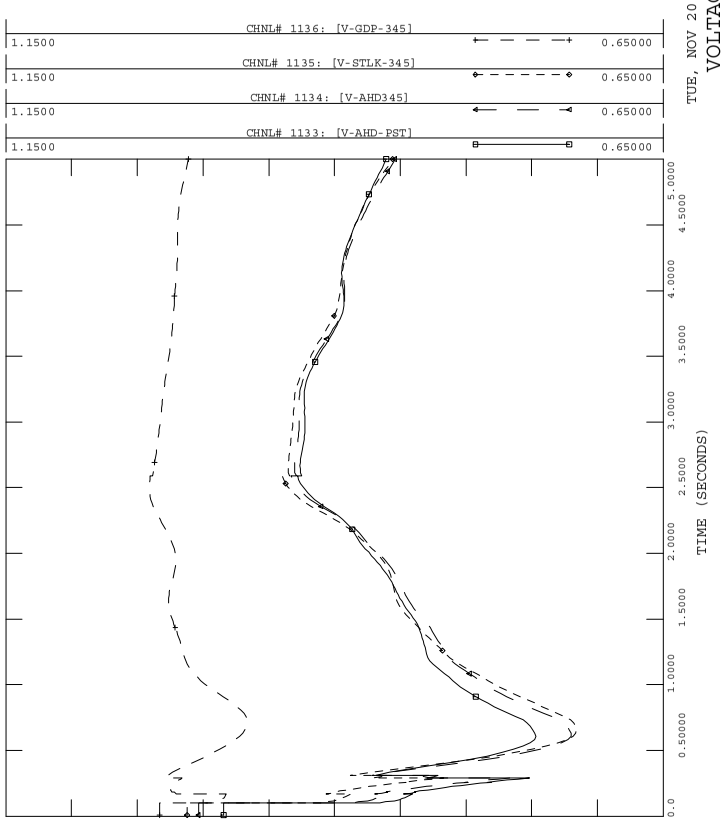
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
ROTOR ANGLES IA2



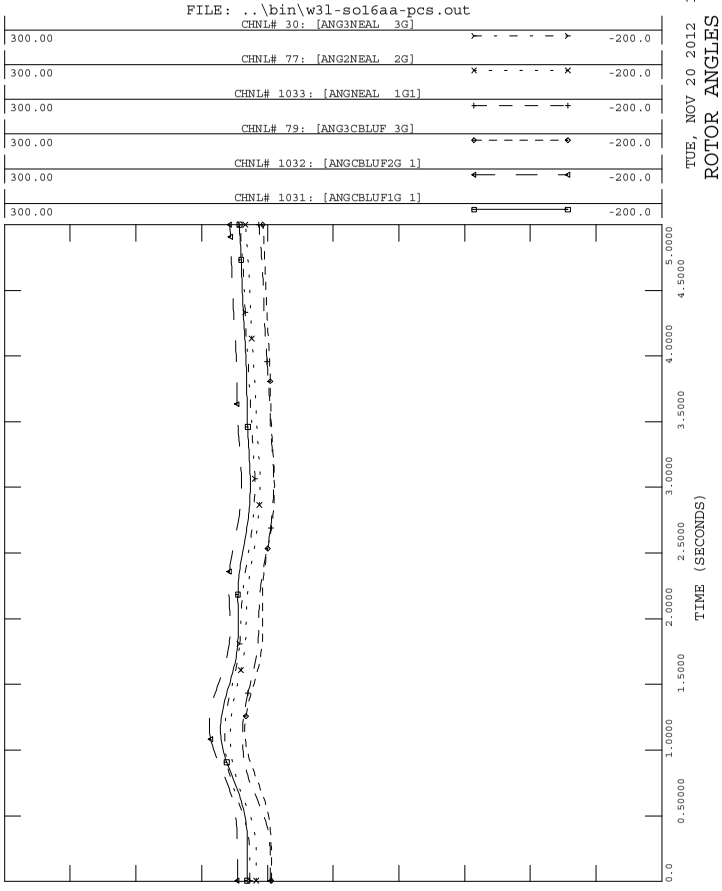
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
VOLTAGES1 A-W



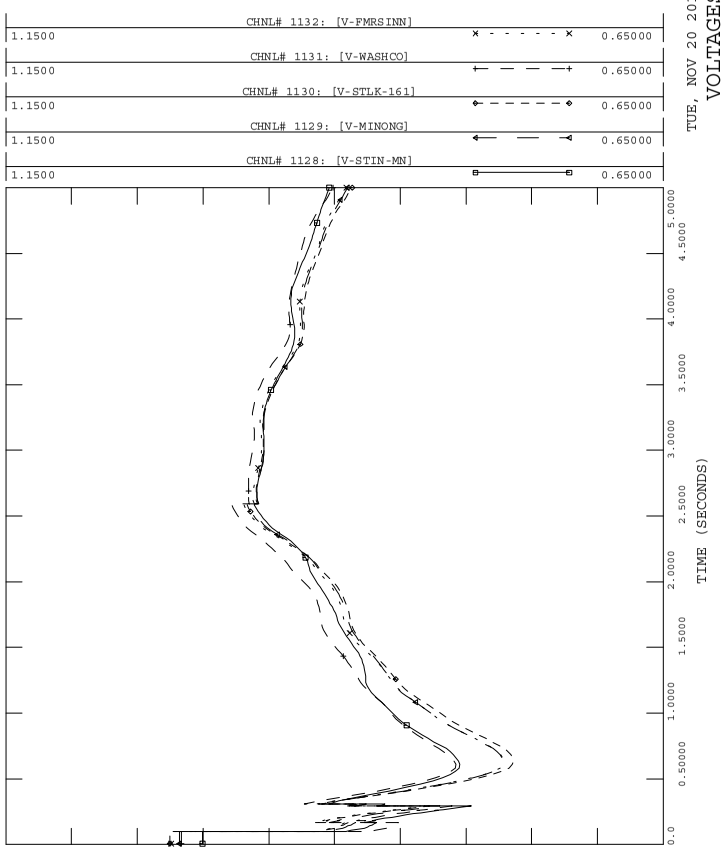
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
ROTOR ANGLES IA1



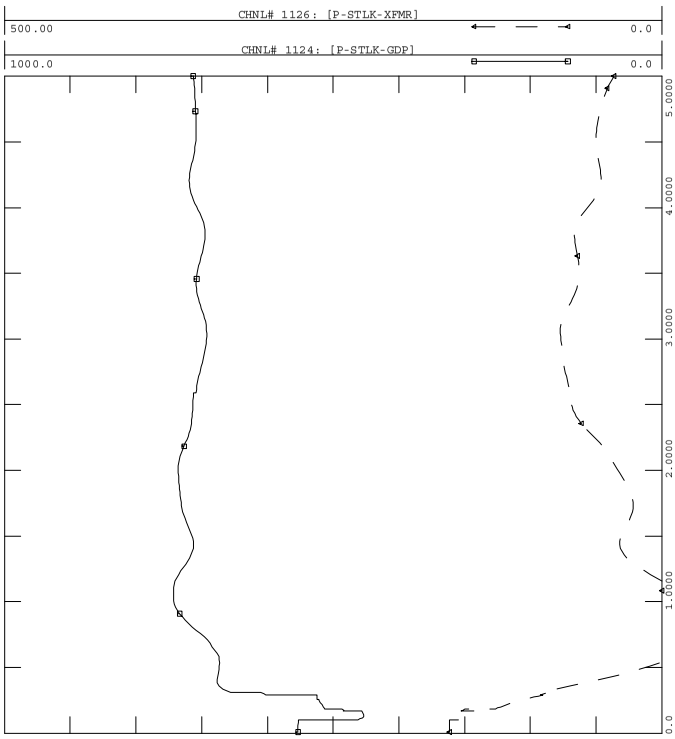
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
VOLTAGES1 A-W



W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
A-W FLOWS 2



W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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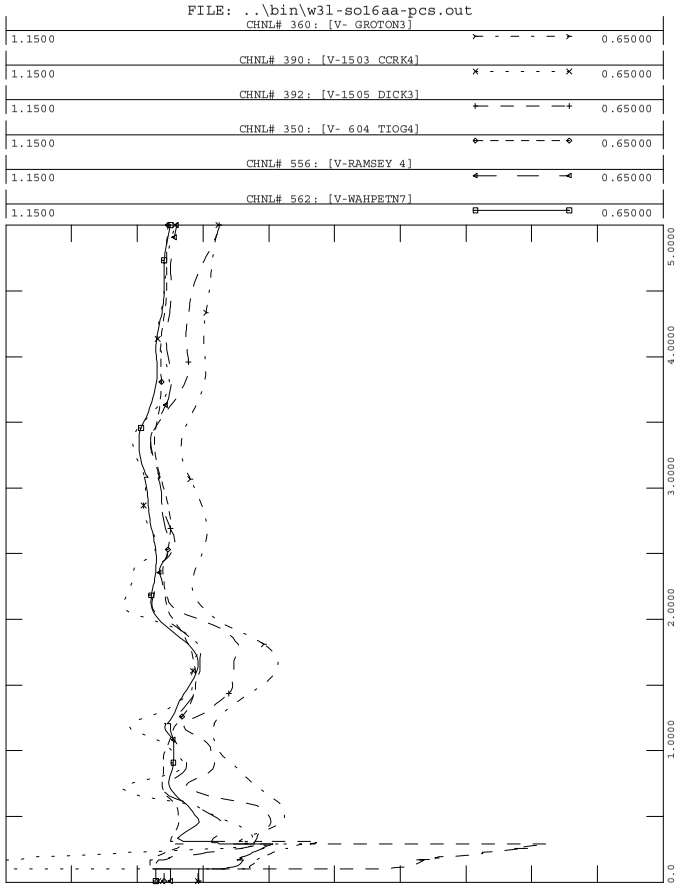
TUE, NOV 20 2012 10:39
VOLTAGES 2



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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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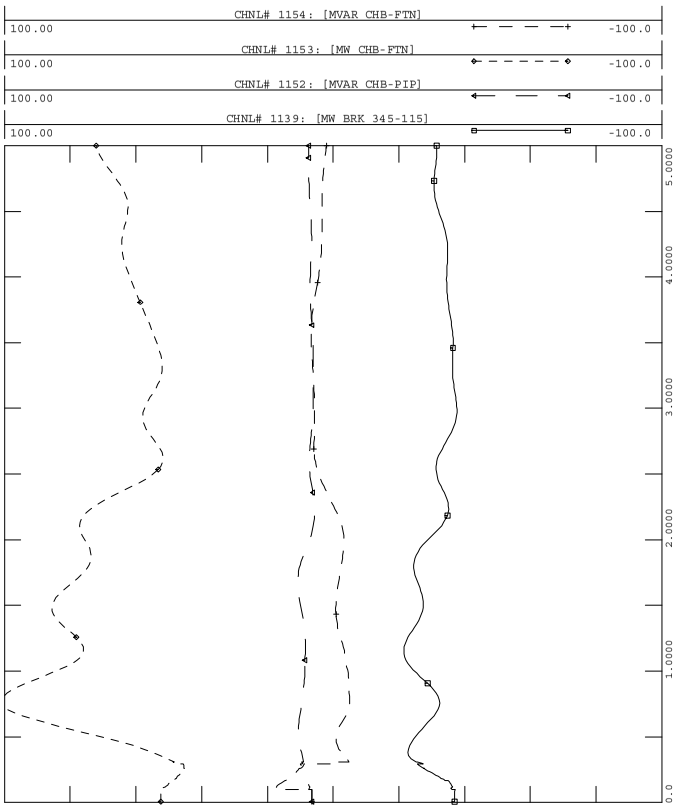
TUE, NOV 20 2012 10:39
A-W FLOWS 1



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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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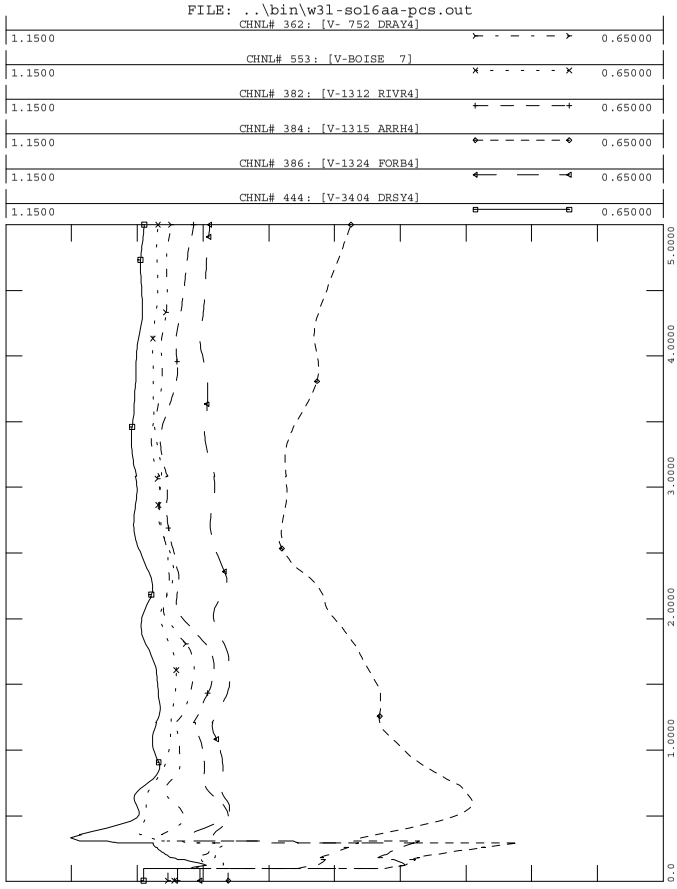
TUE, NOV 20 2012 10:39
VOLTAGES 1



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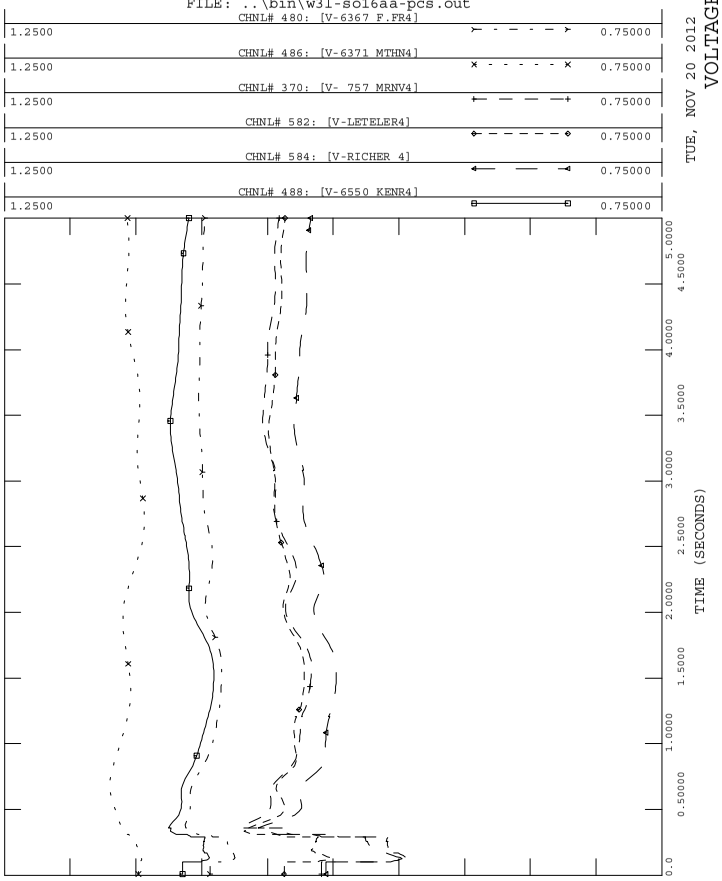
TUE, NOV 20 2012 10:39
VOLTAGES 4



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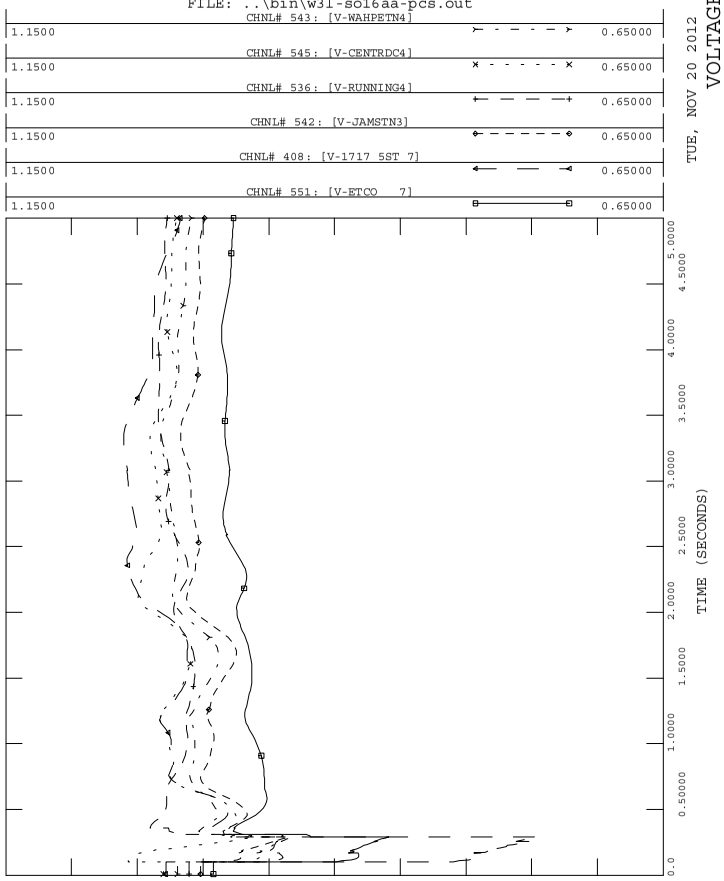
TUE, NOV 20 2012 10:39
VOLTAGES 6



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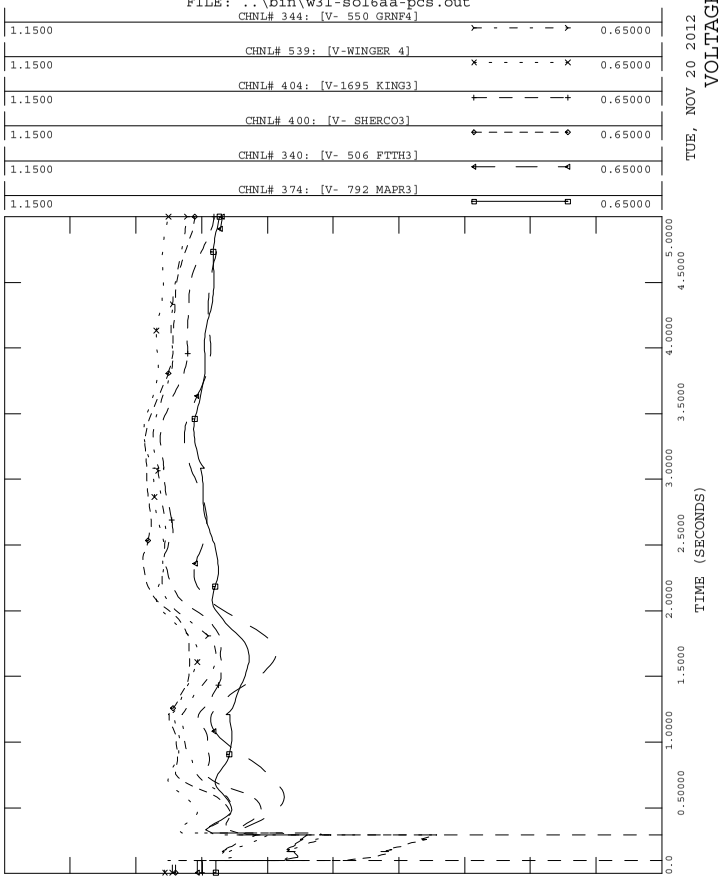
TUE, NOV 20 2012 10:39
VOLTAGES 3



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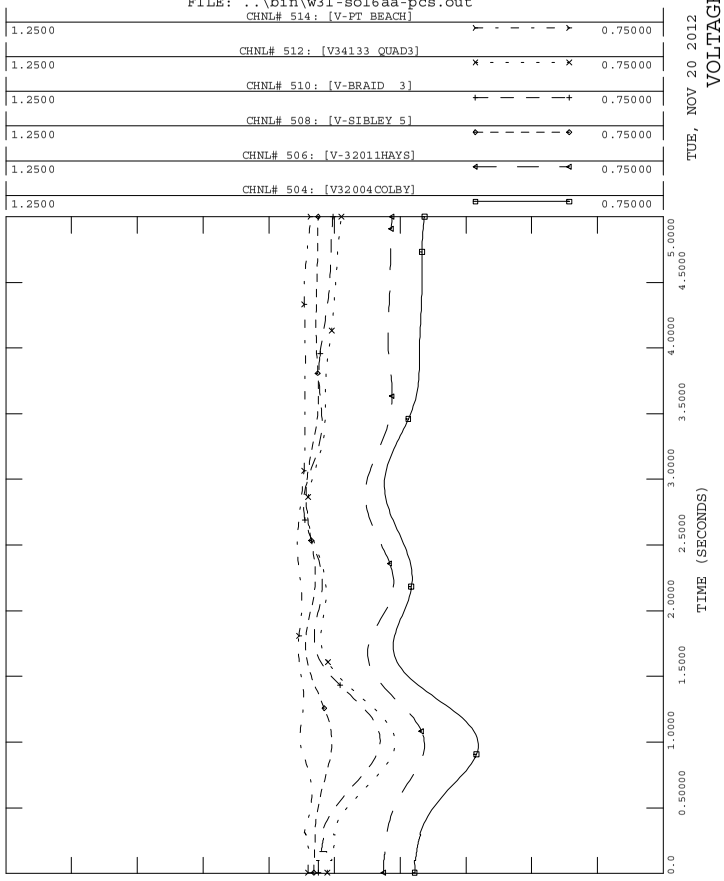
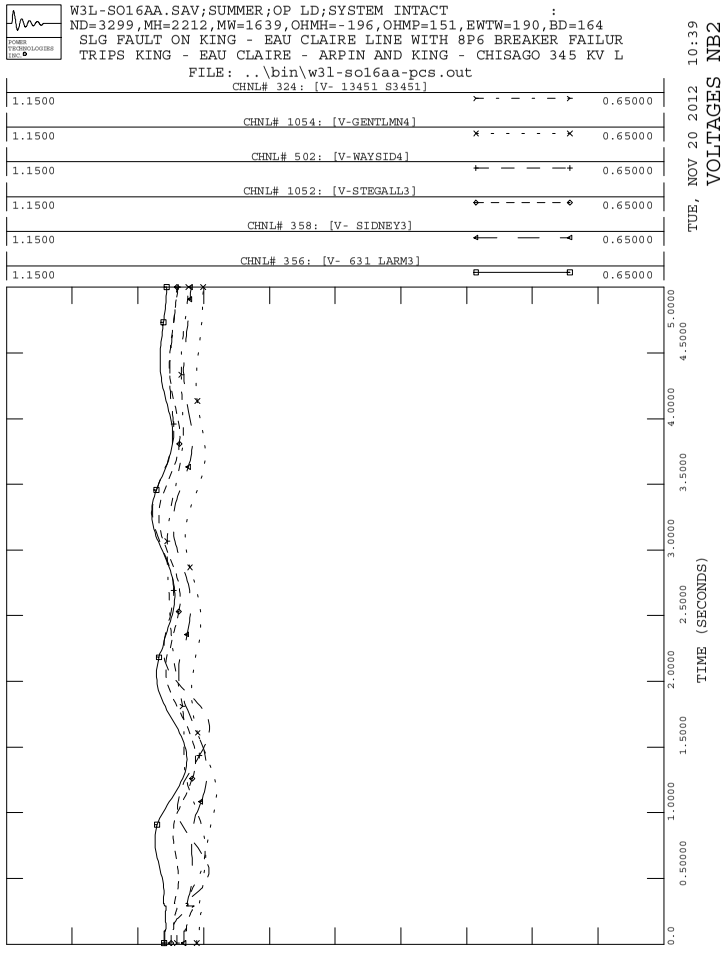
TUE, NOV 20 2012 10:39
VOLTAGES 5

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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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CHNL# 324: [V- 13451 S3451]
CHNL# 1054: [V-GENTLMN4]
CHNL# 502: [V-WAYSID4]
CHNL# 1052: [V-STEGALL3]
CHNL# 358: [V- SIDNEY3]
CHNL# 356: [V- 631 LARM3]
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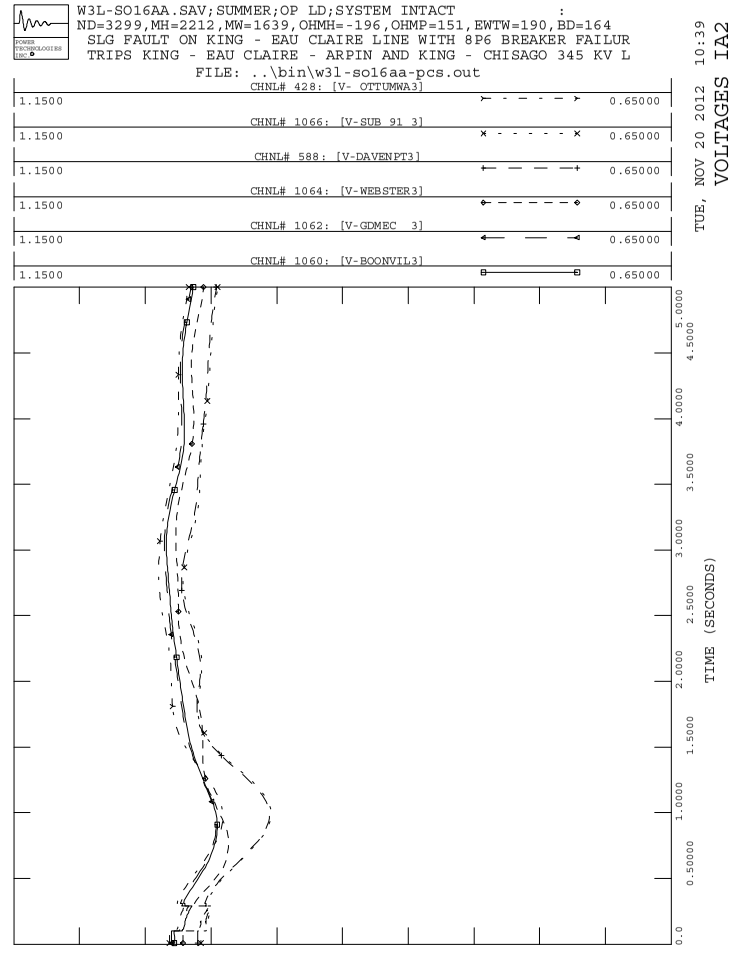
TIME (SECONDS)
TUE, NOV 20 2012 10:39
VOLTAGES NB2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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 428: [V- OTTUMWA3]
CHNL# 1066: [V-SUB 91 3]
CHNL# 588: [V-DAVENPT3]
CHNL# 1064: [V-WEBSTER3]
CHNL# 1062: [V-GDMEC 3]
CHNL# 1060: [V-BOONVIL3]
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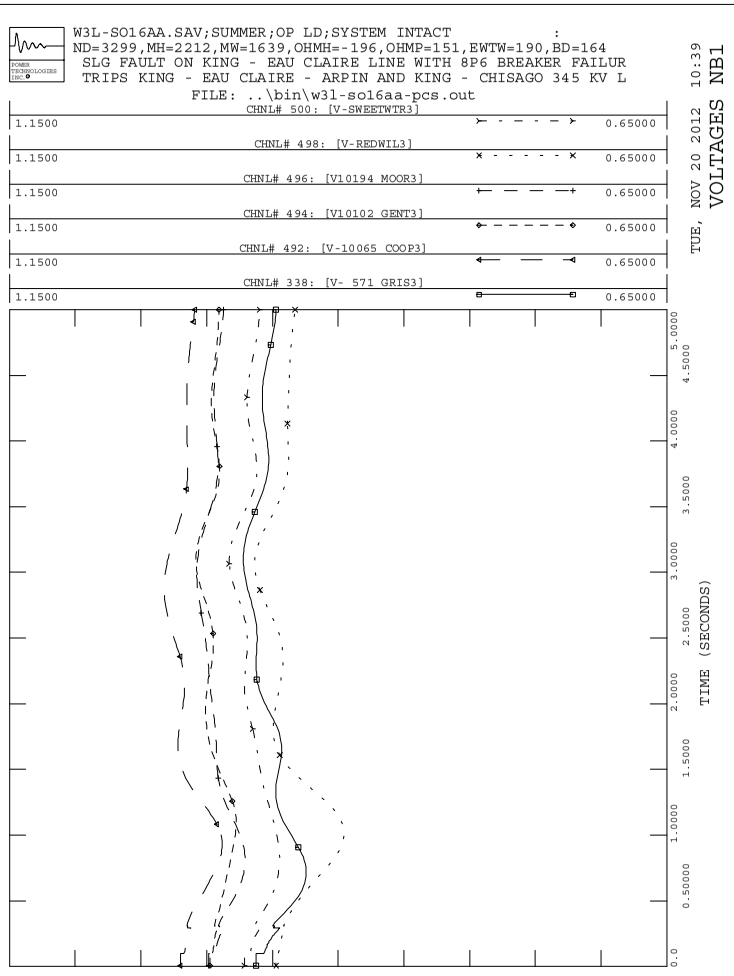
TIME (SECONDS)
TUE, NOV 20 2012 10:39
VOLTAGES IA2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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 500: [V-SWEETWTR3]
CHNL# 498: [V-REDWIL3]
CHNL# 496: [V10194 MOOR3]
CHNL# 494: [V10102 GENT3]
CHNL# 492: [V-10065 COOP3]
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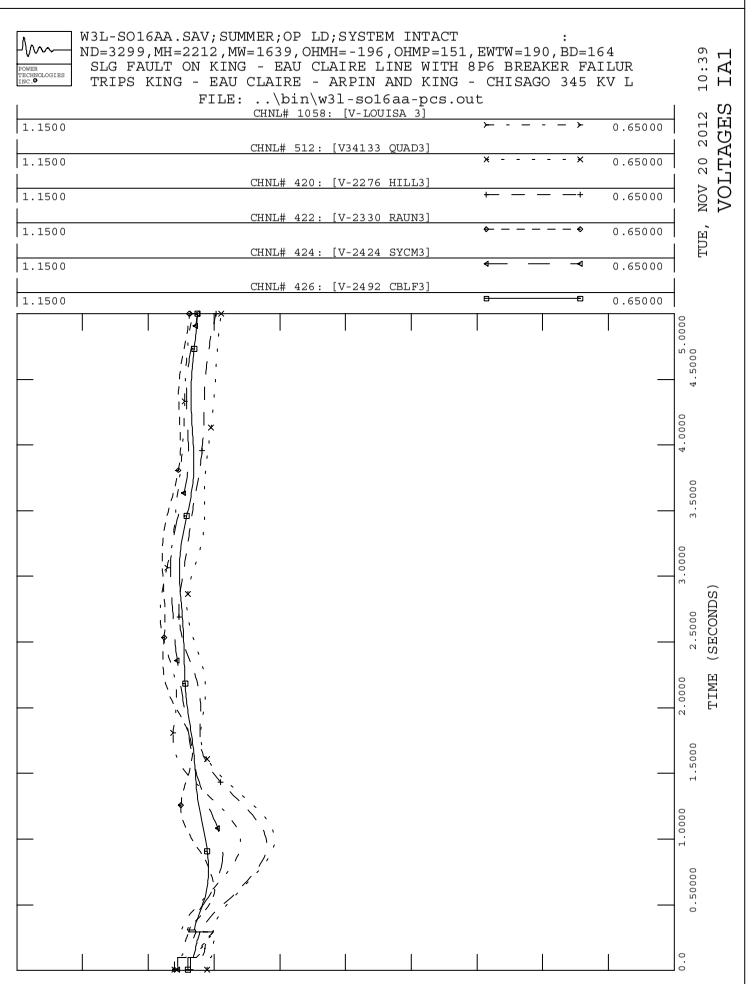
TIME (SECONDS)
TUE, NOV 20 2012 10:39
VOLTAGES NB1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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 1058: [V-LOUISA 3]
CHNL# 512: [V34133 QUAD3]
CHNL# 420: [V-2276 HILL3]
CHNL# 422: [V-2330 RAUN3]
CHNL# 424: [V-2424 SYCM3]
CHNL# 426: [V-2492 CBLF3]
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TIME (SECONDS)
TUE, NOV 20 2012 10:39
VOLTAGES IA1

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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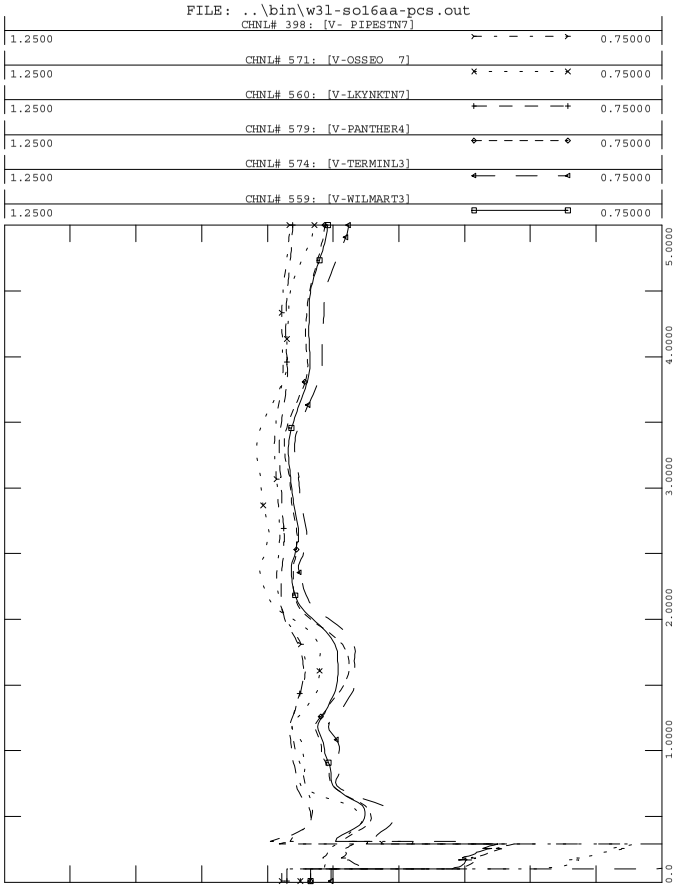
TUE, NOV 20 2012 10:39

TC VOLTAGES



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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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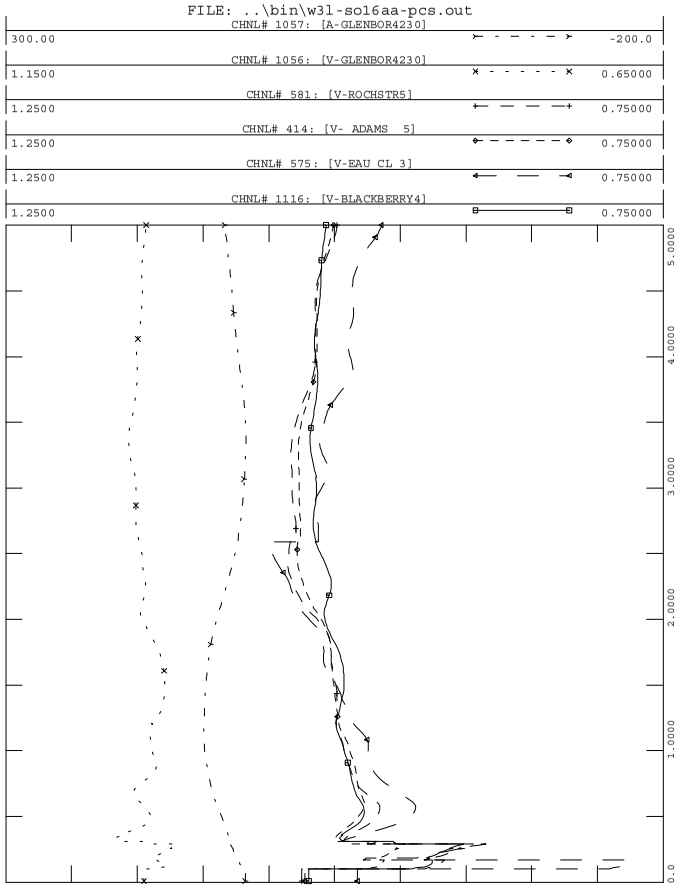
TUE, NOV 20 2012 10:39

MISC VOLTAGES



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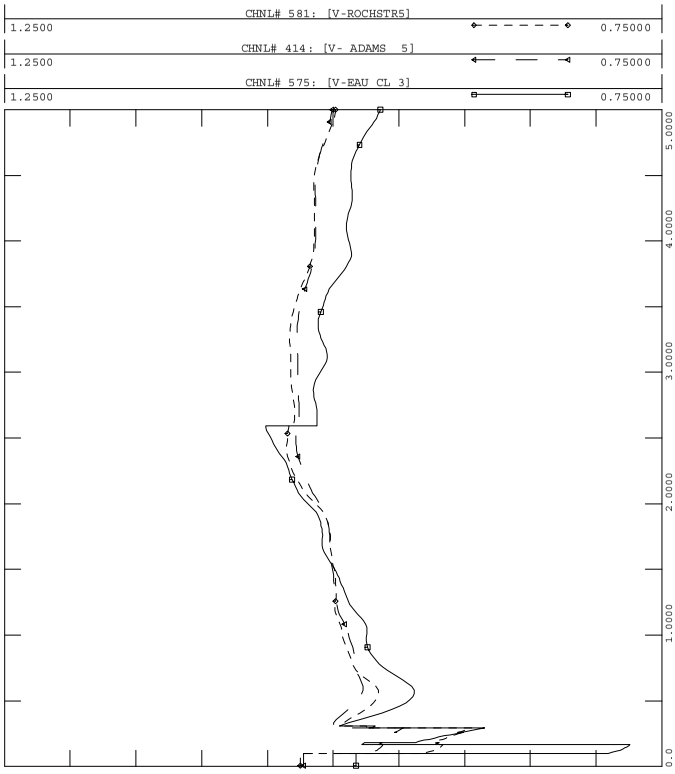
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39

WISCONSIN VOLTAGES



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SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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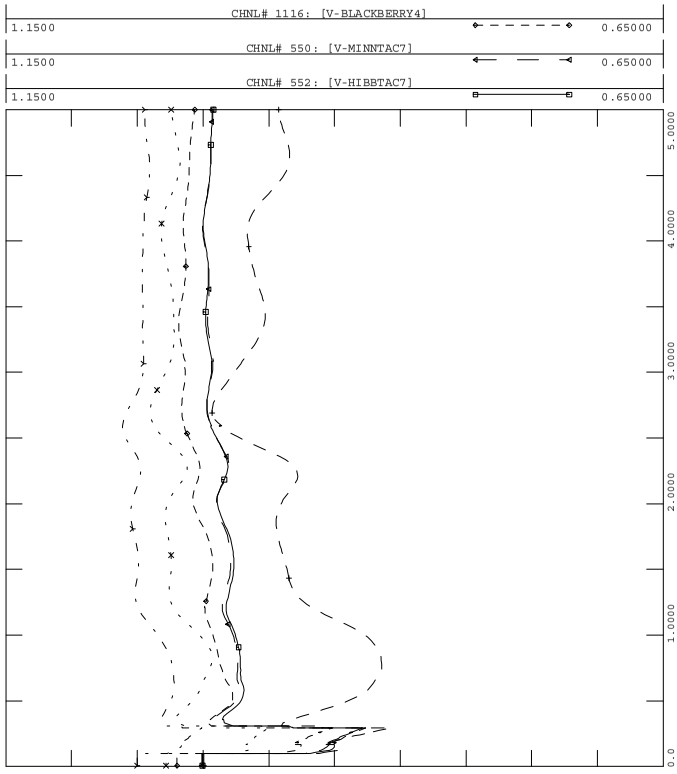
TUE, NOV 20 2012 10:39

NORTHERN MN VOLTAGES



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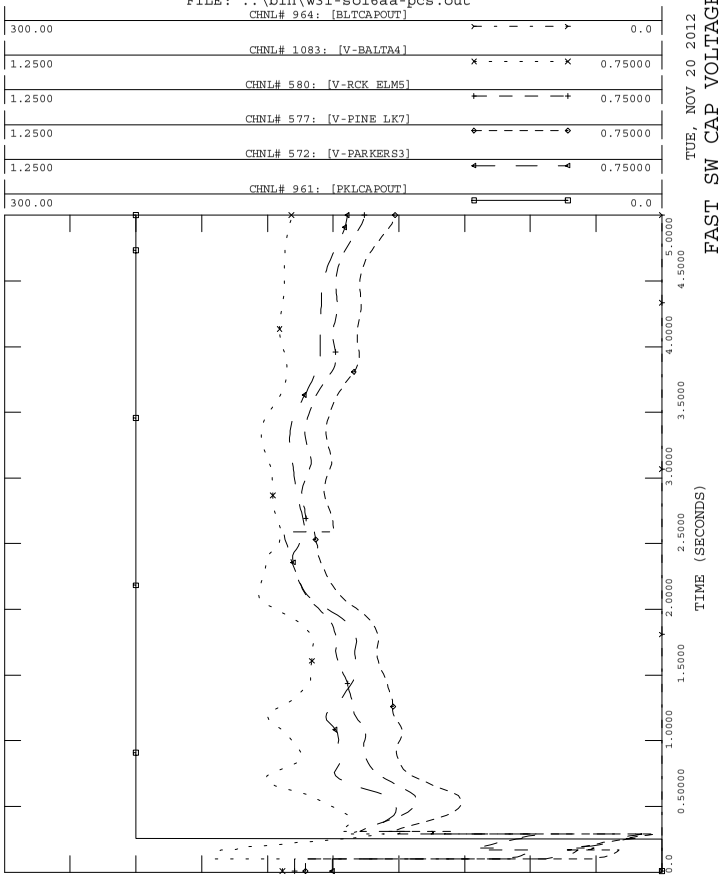

TUE, NOV 20 2012 10:39
FAST SW CAP VOLTAGES 2

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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
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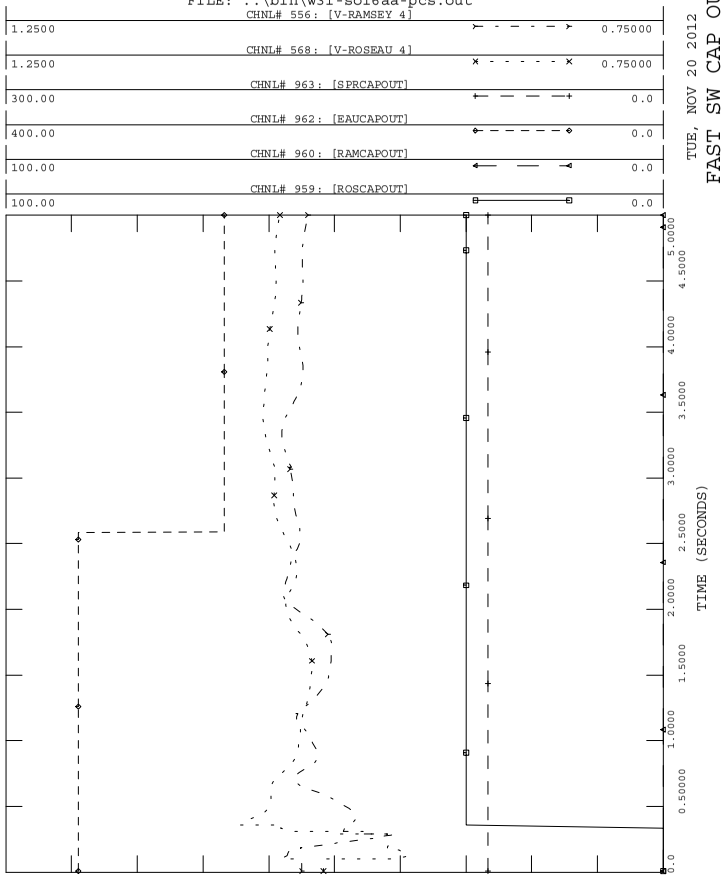

TUE, NOV 20 2012 10:39
FAST SW CAP OUT 2

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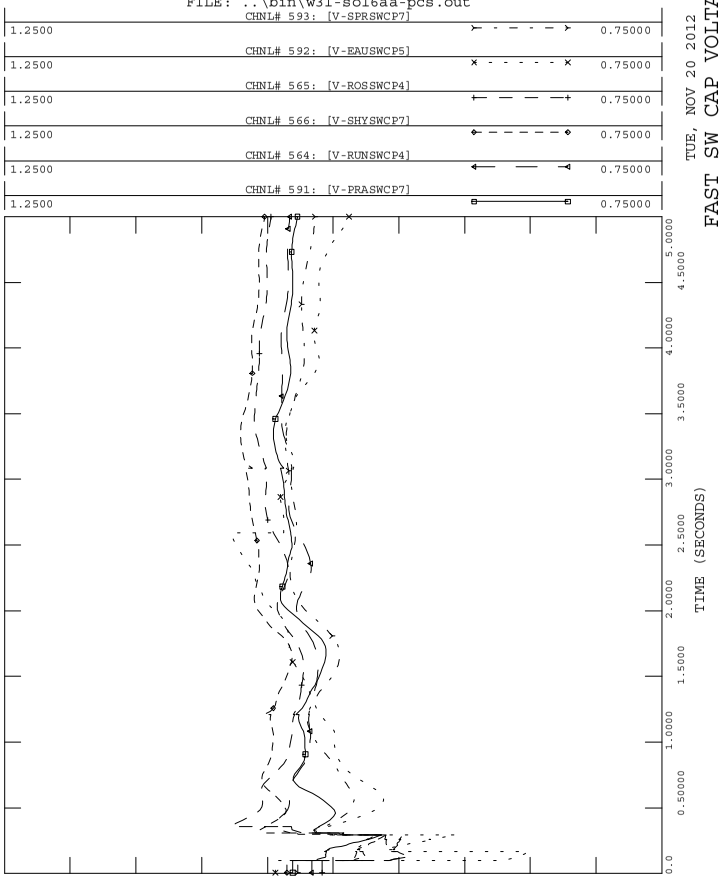

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FAST SW CAP VOLTAGES

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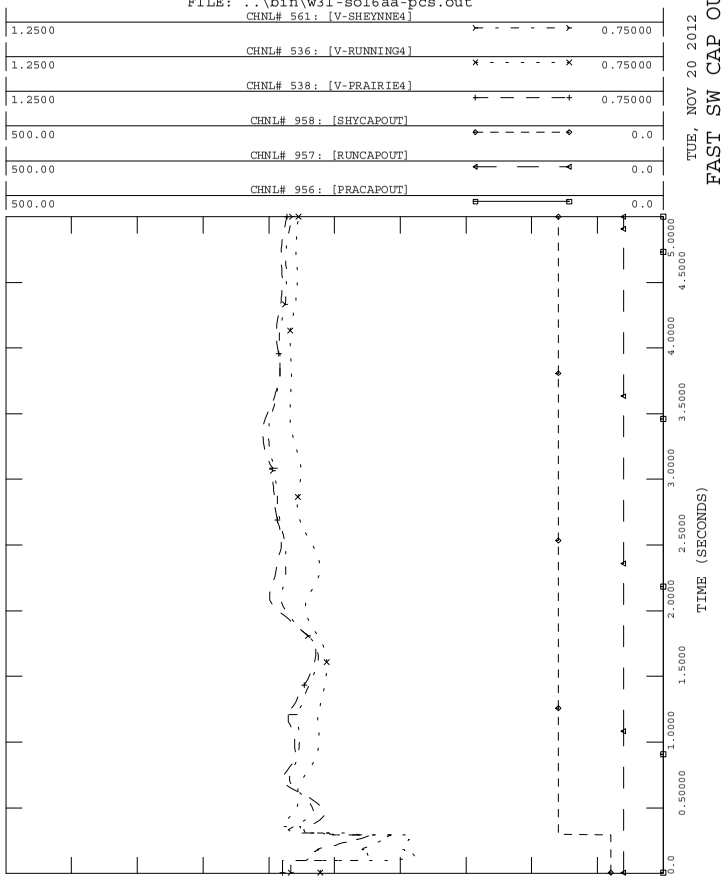
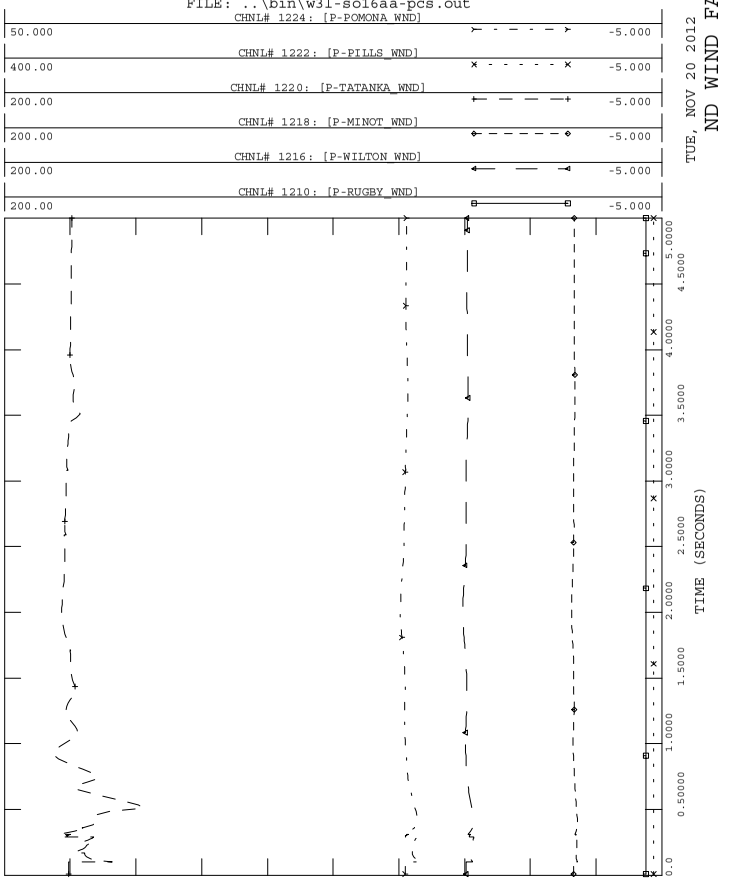


TUE, NOV 20 2012 10:39
FAST SW CAP OUT 1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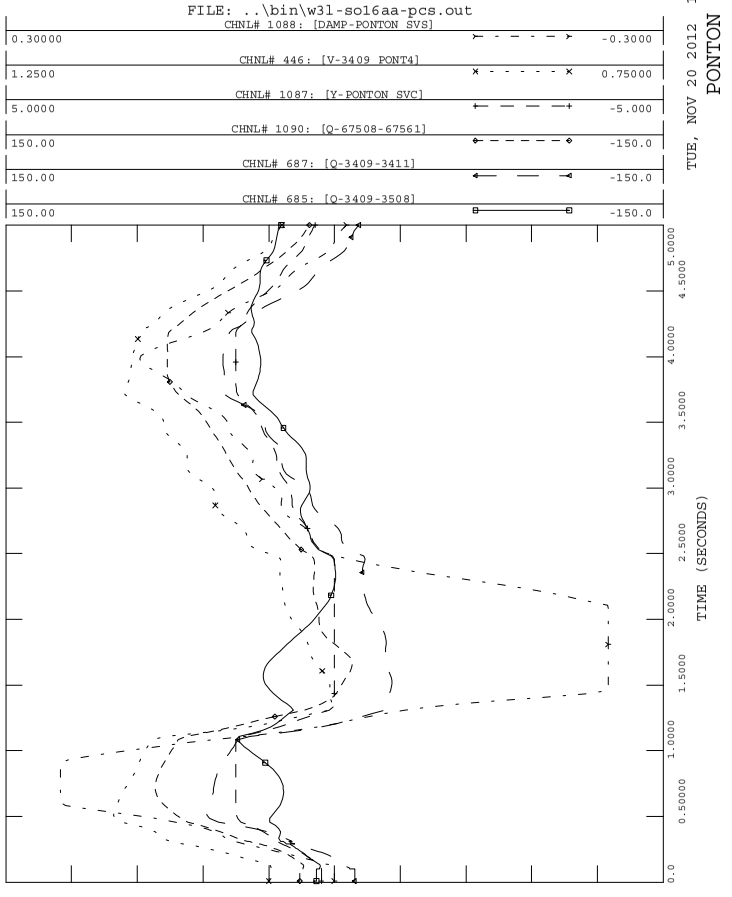
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 1224: [P-POMONA WND]
CHNL# 1222: [P-PILLS_WND]
CHNL# 1220: [P-TATANKA_WND]
CHNL# 1218: [P-MINOT_WND]
CHNL# 1216: [P-WILTON WND]
CHNL# 1210: [P-RUGBY_WND]
TUE, NOV 20 2012 10:39
ND WIND FARMS
TIME (SECONDS)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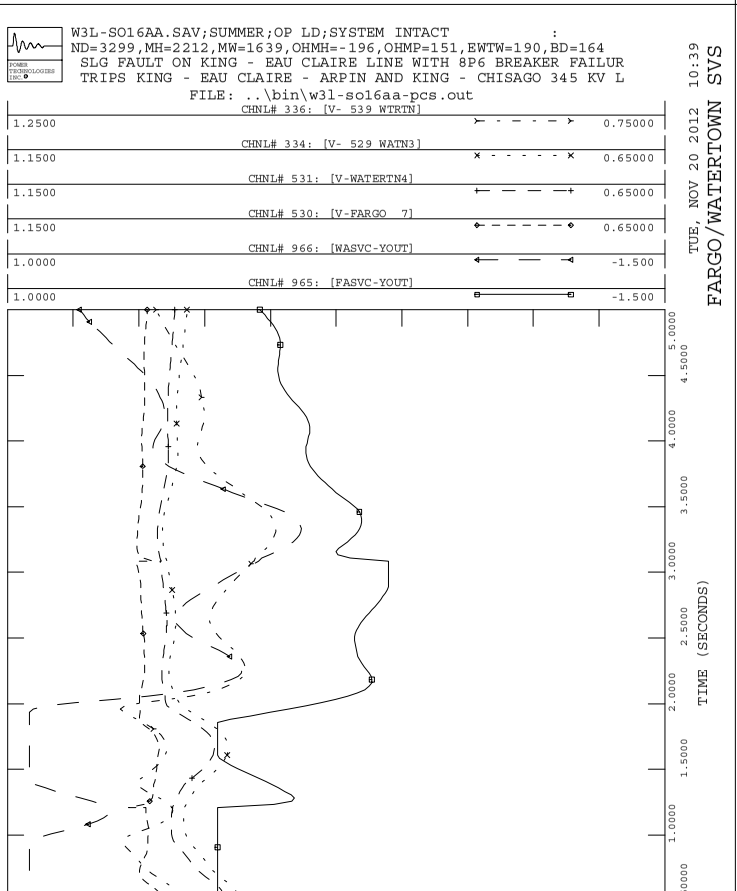
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 1088: [DAMP-PONTON SVS]
CHNL# 446: [V-3409 PONT4]
CHNL# 1087: [Y-PONTON SVC]
CHNL# 1090: [Q-67508-67561]
CHNL# 687: [Q-3409-3411]
CHNL# 685: [Q-3409-3508]
TUE, NOV 20 2012 10:39
PONTON SVS
TIME (SECONDS)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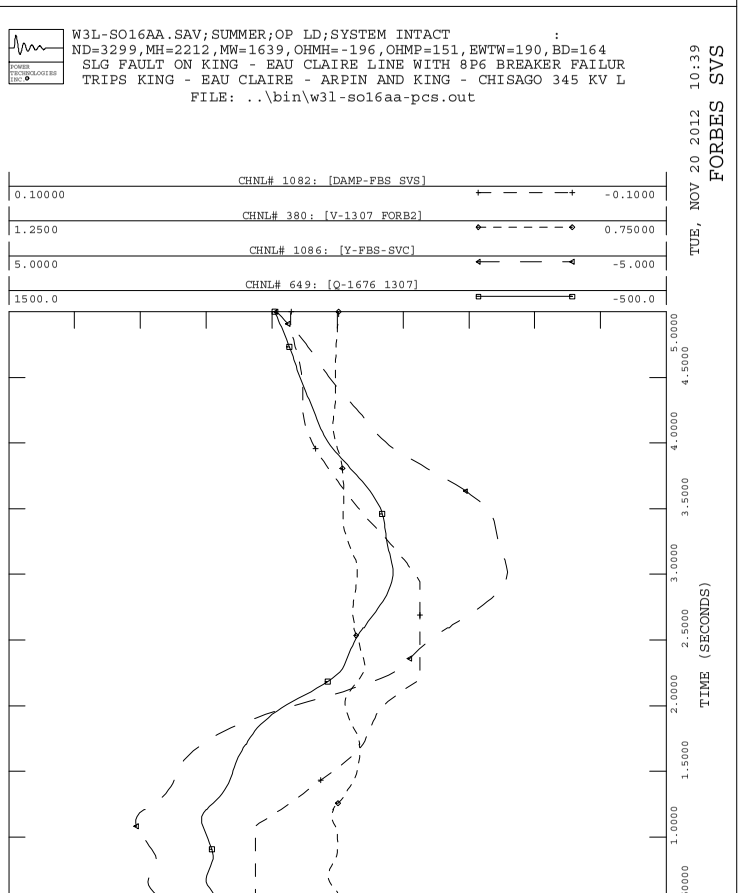
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 336: [V- 539 WTRTN]
CHNL# 334: [V- 529 WATN3]
CHNL# 531: [V-WATERTN4]
CHNL# 530: [V-FARGO 7]
CHNL# 966: [WASVC-YOUT]
CHNL# 965: [FASVC-YOUT]
TUE, NOV 20 2012 10:39
FARGO/WATERTOWN SVS
TIME (SECONDS)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TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 1082: [DAMP-FBS SVS]
CHNL# 380: [V-1307 FORB2]
CHNL# 1086: [Y-FBS-SVC]
CHNL# 649: [Q-1676 1307]
TUE, NOV 20 2012 10:39
FORBES SVS
TIME (SECONDS)

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
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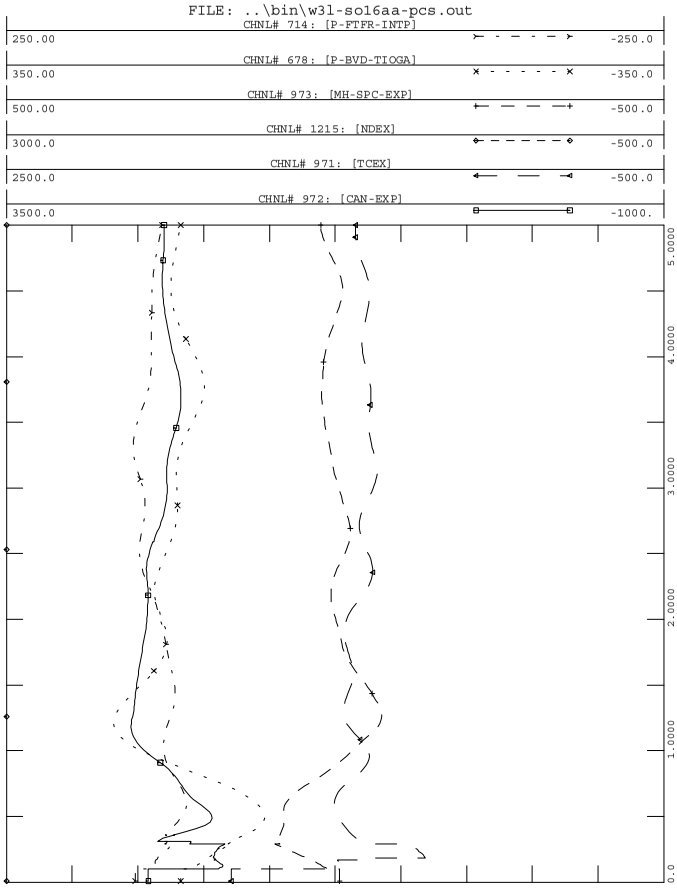
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
POWER FLOW SUMS 1



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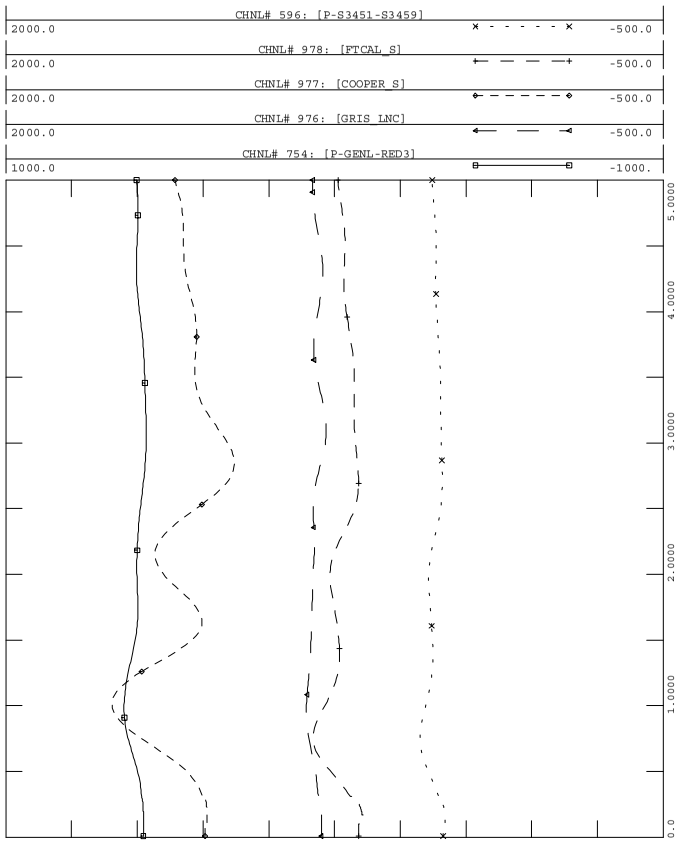
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

TUE, NOV 20 2012 10:39
POWER FLOW SUM 3



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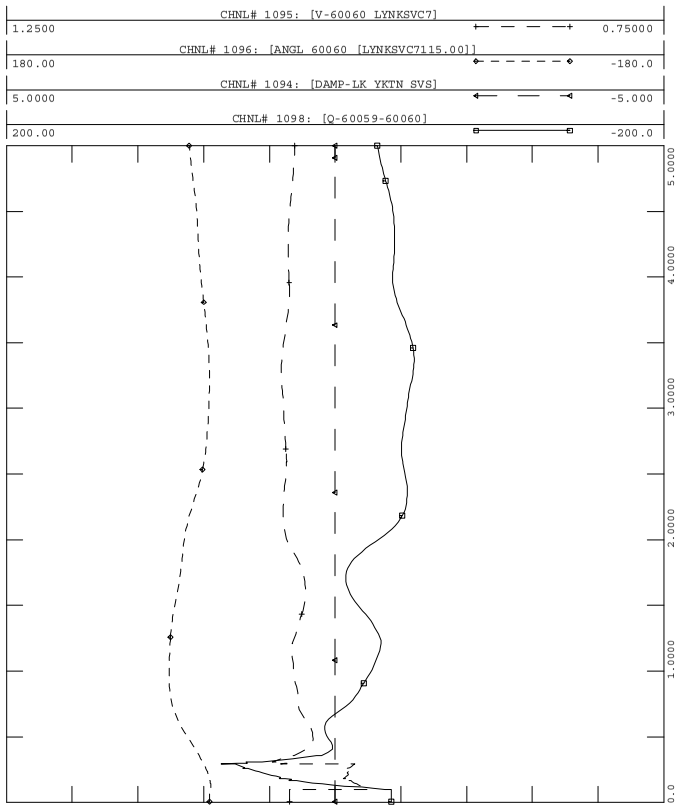
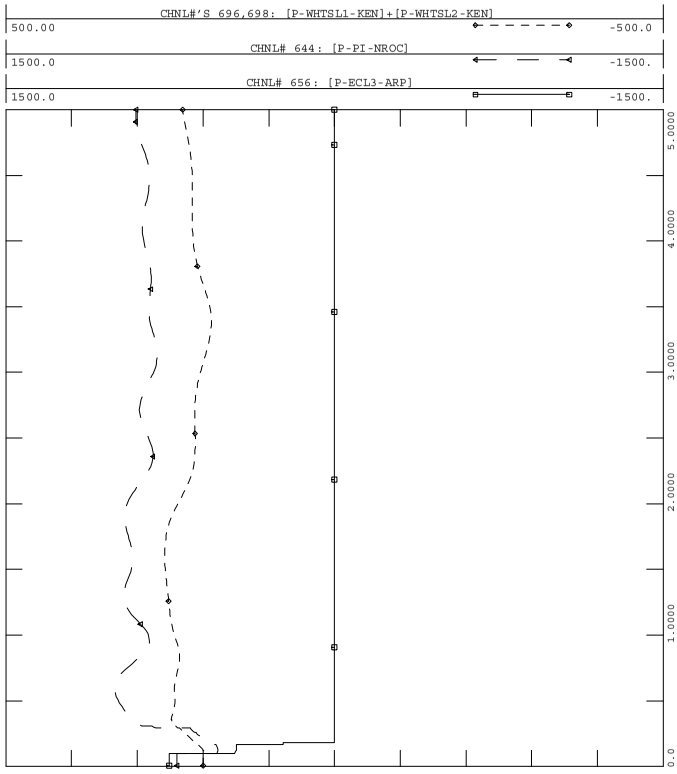
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

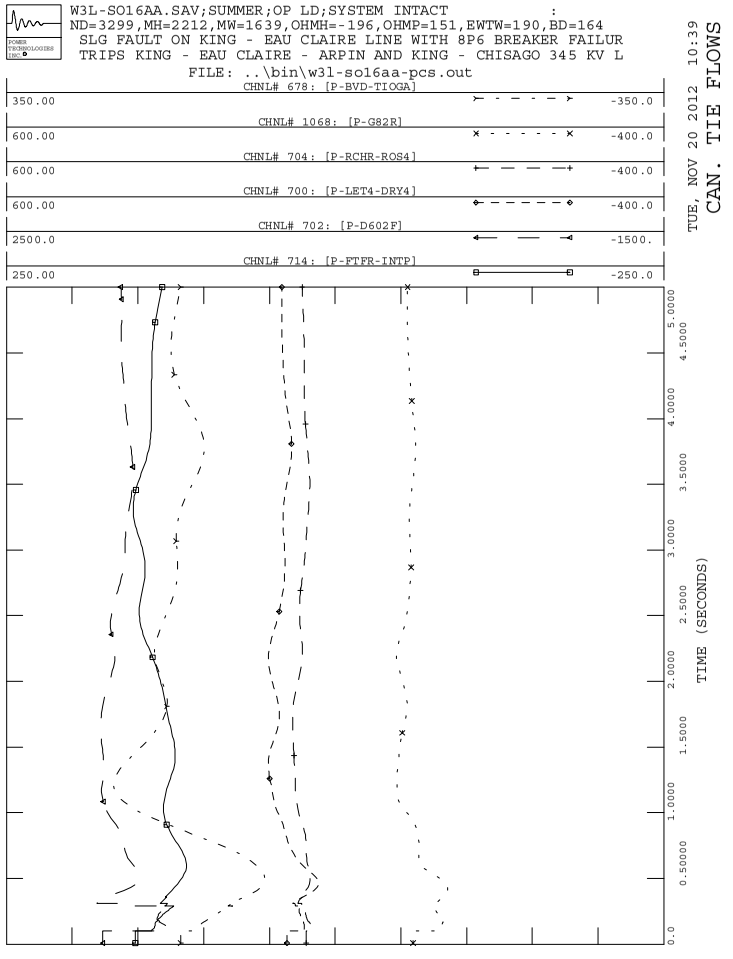
TUE, NOV 20 2012 10:39
LK YANKTON SVS

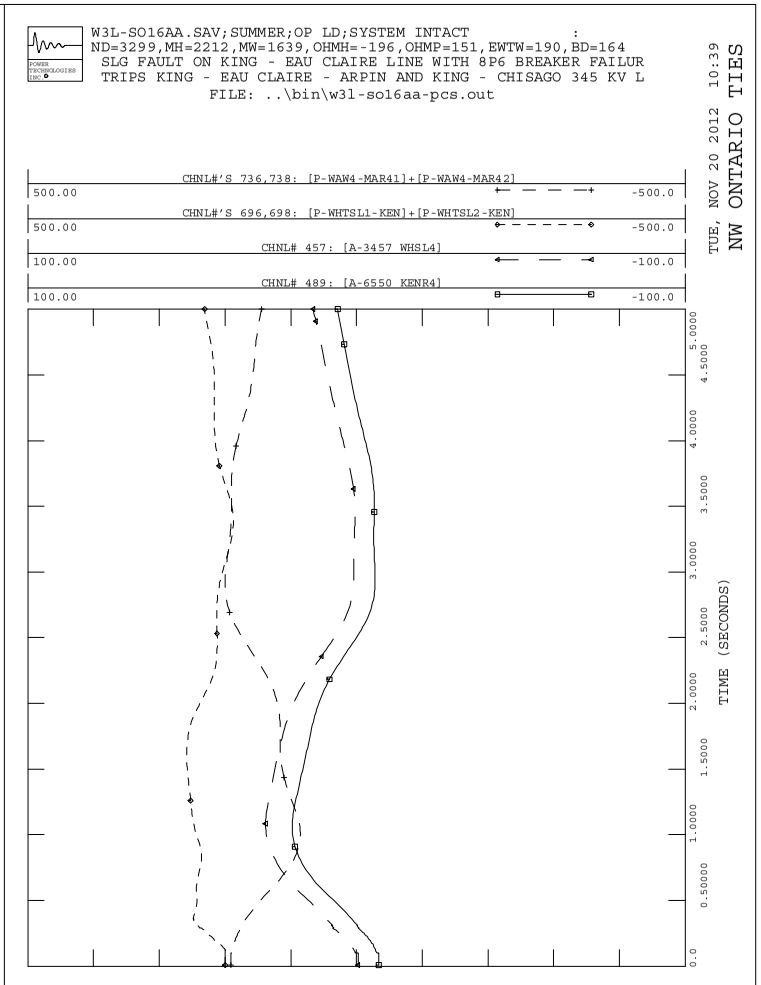


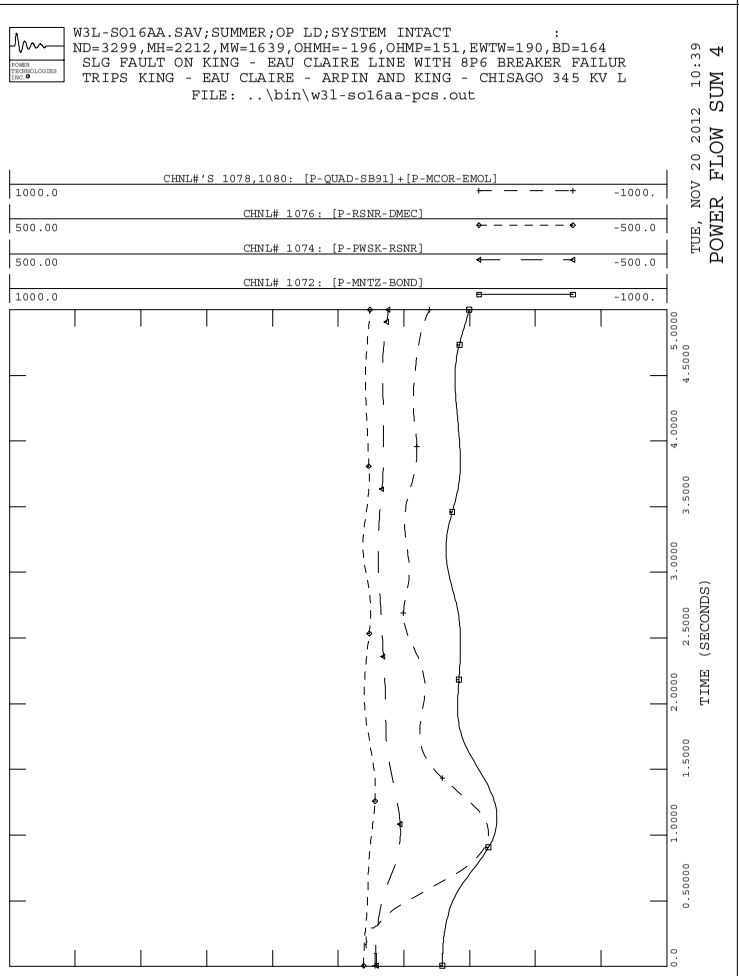
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out

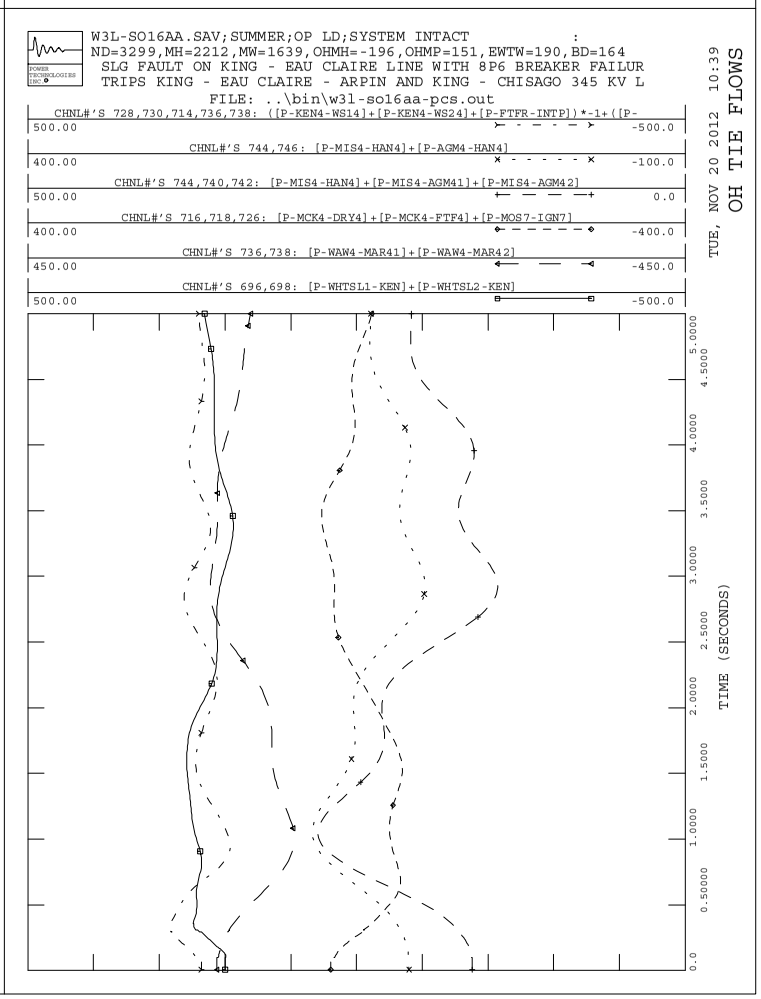
TUE, NOV 20 2012 10:39
POWER FLOW SUMS 2

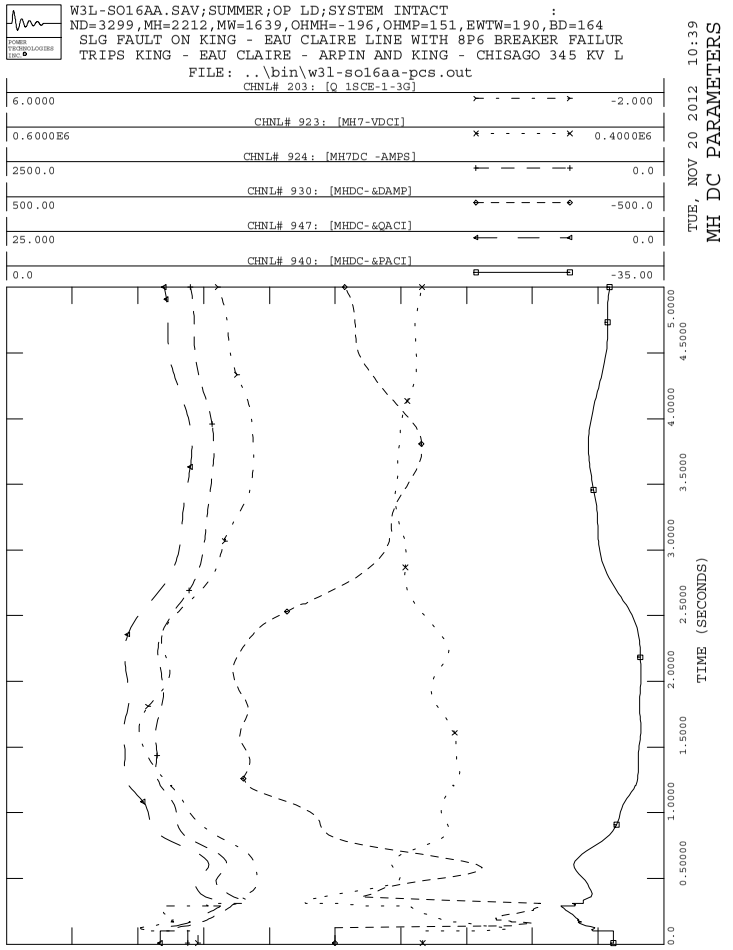


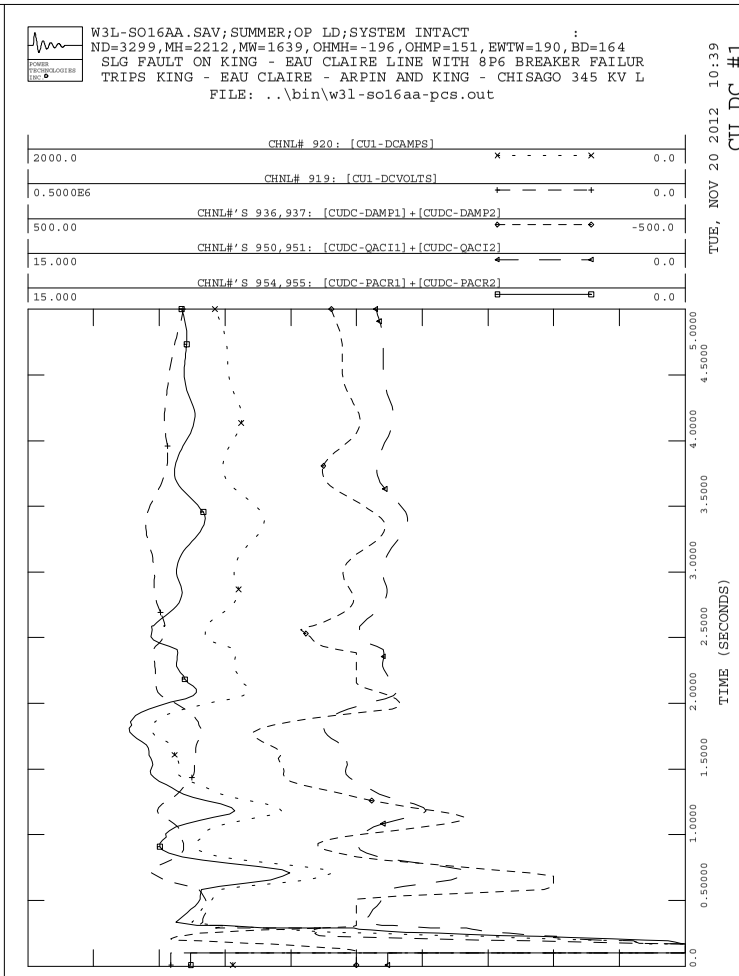

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 678: [P-BVD-TIOGA]
350.00
-350.0
CHNL# 1068: [P-G82R]
600.00
-400.0
CHNL# 704: [P-RCHR-ROS4]
600.00
-400.0
CHNL# 700: [P-LET4-DRY4]
600.00
-400.0
CHNL# 702: [P-D602F]
2500.0
-1500.
CHNL# 714: [P-FTFR-INTP]
250.00
-250.0
TIME (SECONDS)
TUE, NOV 20 2012 10:39
CAN. TIE FLOWS

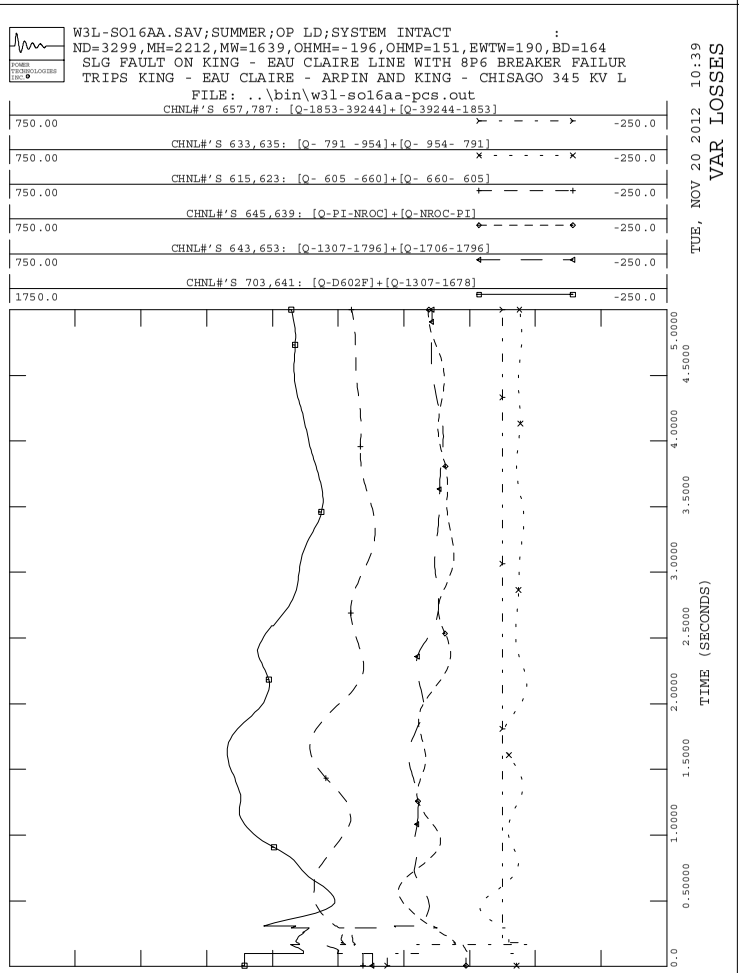

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL#'S 736,738: [P-WAW4-MAR41]+[P-WAW4-MAR42]
500.00
-500.0
CHNL#'S 696,698: [P-WHTSL1-KEN]+[P-WHTSL2-KEN]
500.00
-500.0
CHNL# 457: [A-3457 WHSL4]
100.00
-100.0
CHNL# 489: [A-6550 KENR4]
100.00
-100.0
TIME (SECONDS)
TUE, NOV 20 2012 10:39
NW ONTARIO TIES

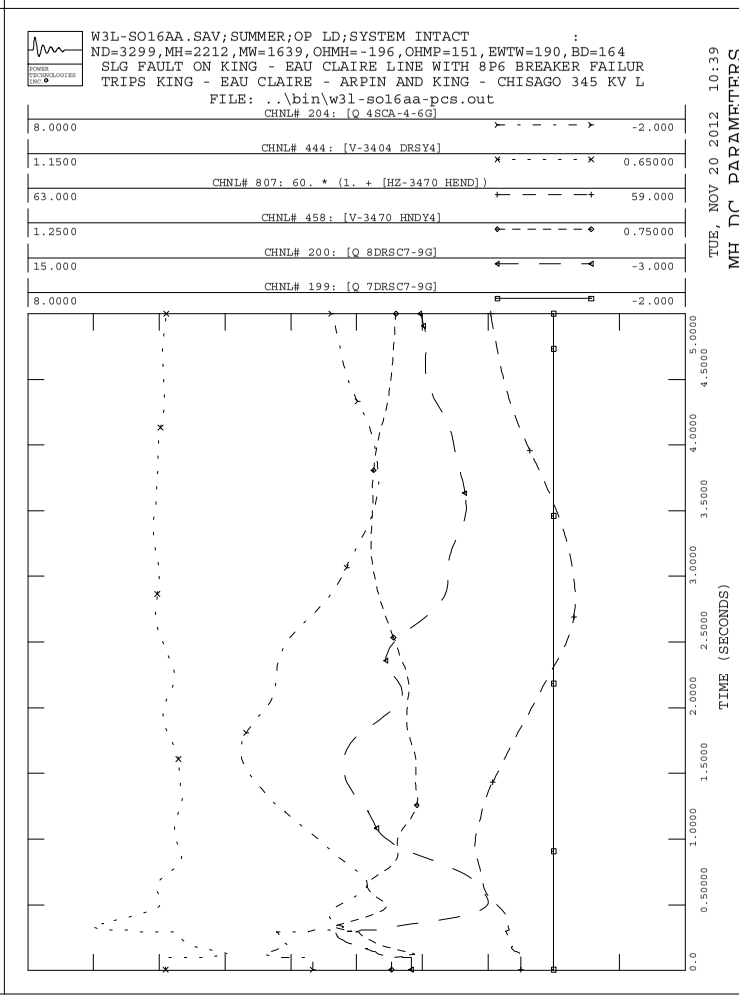

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL#'S 1078,1080: [P-QUAD-SB91]+[P-MCOR-EMOL]
1000.0
-1000.
CHNL# 1076: [P-RSNR-DMEC]
500.00
-500.0
CHNL# 1074: [P-PWSK-RSNR]
500.00
-500.0
CHNL# 1072: [P-MNTZ-BOND]
1000.0
-1000.
TIME (SECONDS)
TUE, NOV 20 2012 10:39
POWER FLOW SUM 4


W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL#'S 728,730,714,736,738: ([P-KEN4-WS14]+[P-KEN4-WS24]+[P-FTFR-INTP])*-1+([P-
500.00
-500.0
CHNL#'S 744,746: [P-MIS4-HAN4]+[P-AGM4-HAN4]
400.00
-100.0
CHNL#'S 744,740,742: [P-MIS4-HAN4]+[P-MIS4-AGM41]+[P-MIS4-AGM42]
500.00
0.0
CHNL#'S 716,718,726: [P-MCK4-DRY4]+[P-MCK4-FTF4]+[P-MOS7-IGN7]
400.00
-400.0
CHNL#'S 736,738: [P-WAW4-MAR41]+[P-WAW4-MAR42]
450.00
-450.0
CHNL#'S 696,698: [P-WHTSL1-KEN]+[P-WHTSL2-KEN]
500.00
-500.0
TIME (SECONDS)
TUE, NOV 20 2012 10:39
OH TIE FLOWS

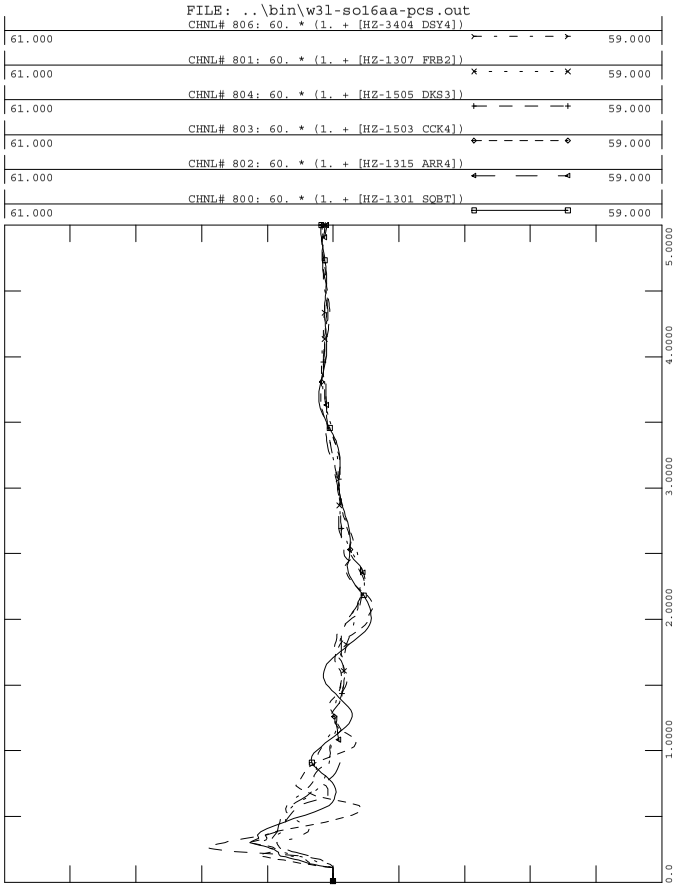

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 203: [Q 1SCE-1-3G]
6.0000
-2.000
CHNL# 923: [MH7-VDCI]
0.6000E6
0.4000E6
CHNL# 924: [MH7DC -AMPS]
2500.0
0.0
CHNL# 930: [MHDC-&DAMP]
500.00
-500.0
CHNL# 947: [MHDC-&QACI]
25.000
0.0
CHNL# 940: [MHDC-&PACI]
0.0
-35.00
TUE, NOV 20 2012 10:39
MH DC PARAMETERS
TIME (SECONDS)


W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 920: [CU1-DCAMPS]
2000.0
0.0
CHNL# 919: [CU1-DCVOLTS]
0.5000E6
0.0
CHNL#'S 936,937: [CUDC-DAMP1]+[CUDC-DAMP2]
500.00
-500.0
CHNL#'S 950,951: [CUDC-QACI1]+[CUDC-QACI2]
15.000
0.0
CHNL#'S 954,955: [CUDC-PACR1]+[CUDC-PACR2]
15.000
0.0
TUE, NOV 20 2012 10:39
CU DC #1
TIME (SECONDS)


W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL#'S 657,787: [Q-1853-39244]+[Q-39244-1853]
750.00
-250.0
CHNL#'S 633,635: [Q- 791 -954]+[Q- 954- 791]
750.00
-250.0
CHNL#'S 615,623: [Q- 605 -660]+[Q- 660- 605]
750.00
-250.0
CHNL#'S 645,639: [Q-PI-NROC]+[Q-NROC-PI]
750.00
-250.0
CHNL#'S 643,653: [Q-1307-1796]+[Q-1706-1796]
750.00
-250.0
CHNL#'S 703,641: [Q-D602F]+[Q-1307-1678]
1750.0
-250.0
TUE, NOV 20 2012 10:39
VAR LOSSES
TIME (SECONDS)


W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out
CHNL# 204: [Q 4SCA-4-6G]
8.0000
-2.000
CHNL# 444: [V-3404 DRSY4]
1.1500
0.65000
CHNL# 807: 60. * (1. + [HZ-3470 HEND])
63.000
59.000
CHNL# 458: [V-3470 HNDY4]
1.2500
0.75000
CHNL# 200: [Q 8DRSC7-9G]
15.000
-3.000
CHNL# 199: [Q 7DRSC7-9G]
8.0000
-2.000
TUE, NOV 20 2012 10:39
MH DC PARAMETERS
TIME (SECONDS)

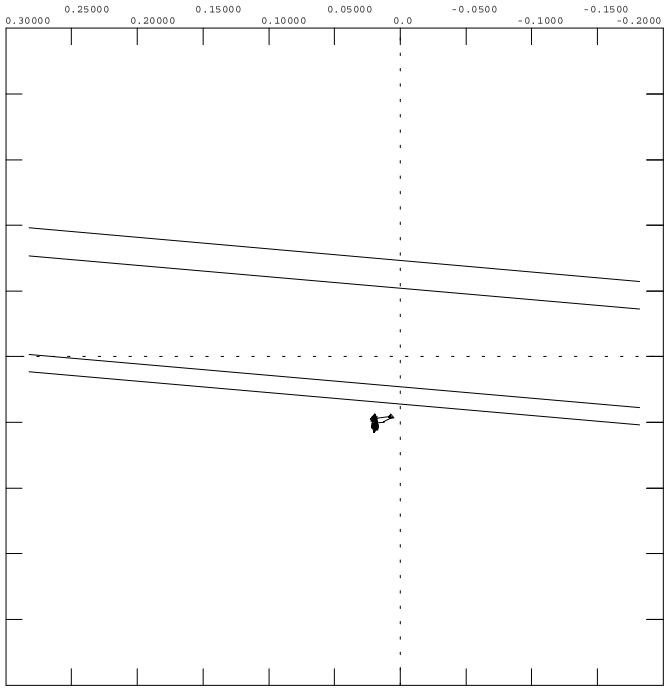
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out



TUE, NOV 20 2012 10:39
FREQ AT DC TERMINALS

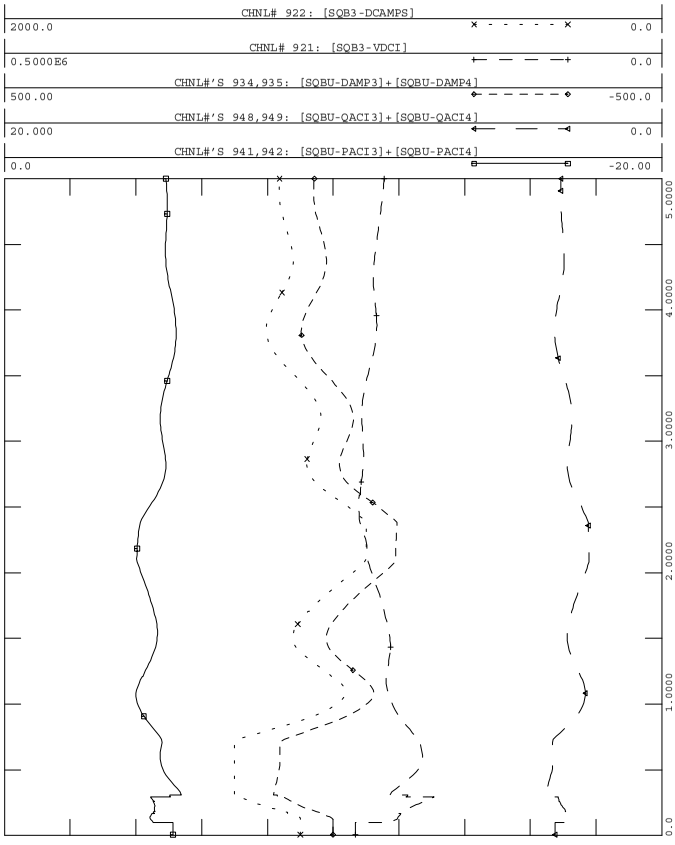
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out
RELAY: SLNOS1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 824: [X-FRB2-ROS2]



TUE, NOV 20 2012 10:39
D602F-FORBES-EMRG (778)

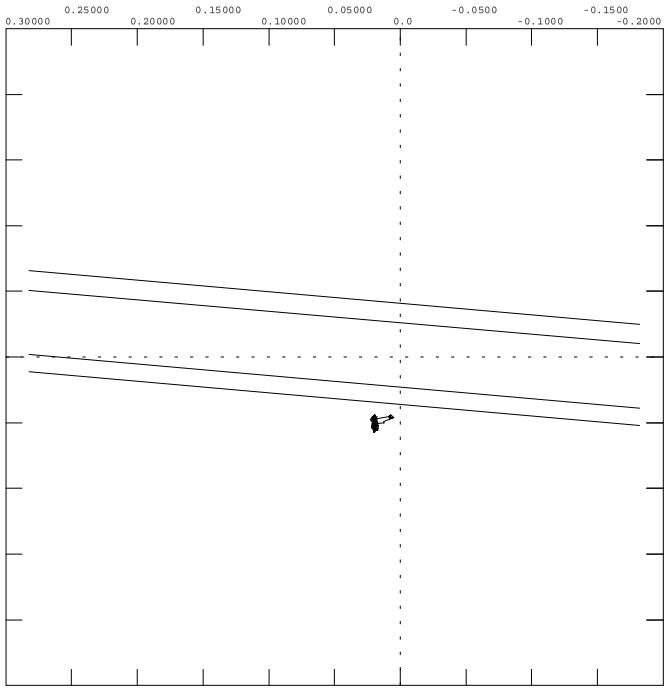
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L
FILE: ..\bin\w3l-so16aa-pcs.out



TUE, NOV 20 2012 10:39
SQB DC #3

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out
RELAY: SLNOS1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 824: [X-FRB2-ROS2]



TUE, NOV 20 2012 10:39
D602F-FORBES (612)

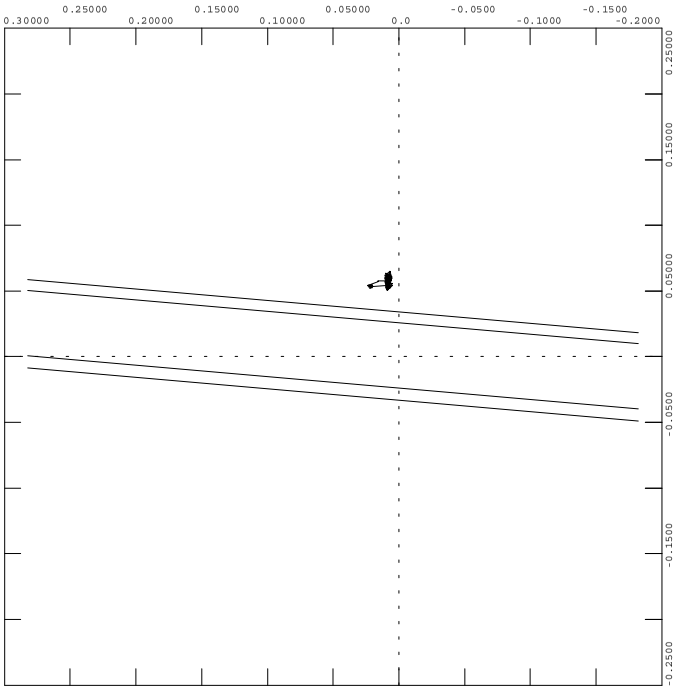
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLNOS1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 856: [X-D602F]



TUE, NOV 20 2012 10:39
D602F-DORSEY (606)

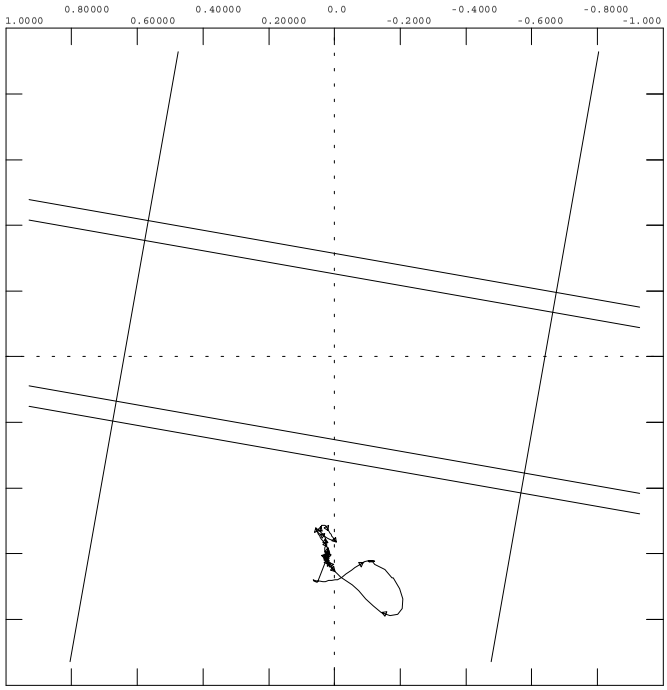
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLNOS1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 816: [X-DRY4-LET4]



TUE, NOV 20 2012 10:39
L20D-DRAYTON-EMRG (776)

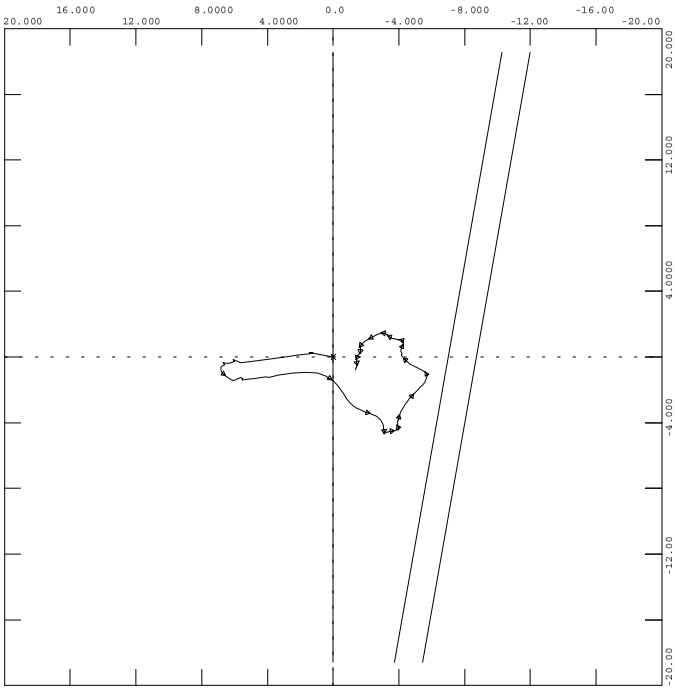
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLNOS1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 969: [DCAR-B]



TUE, NOV 20 2012 10:39
FORBES DC RED DCAR (679)

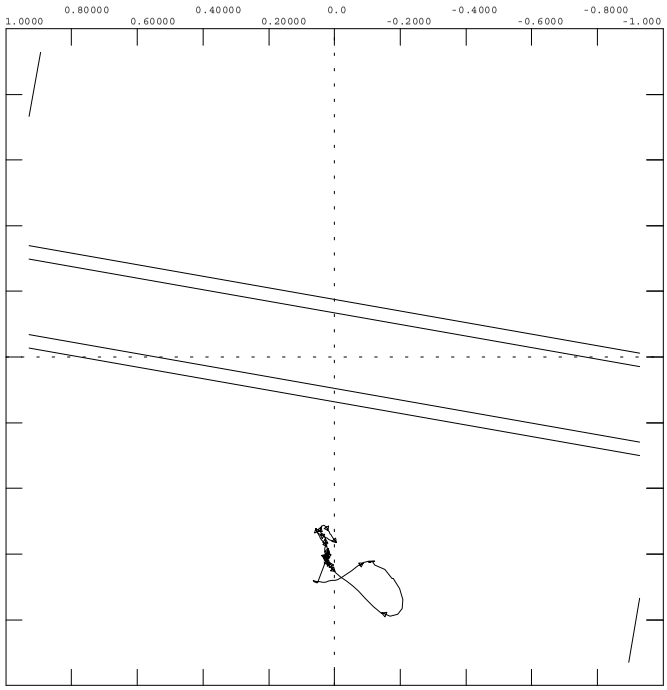
W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLNOS1

TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25

CHNL# 816: [X-DRY4-LET4]

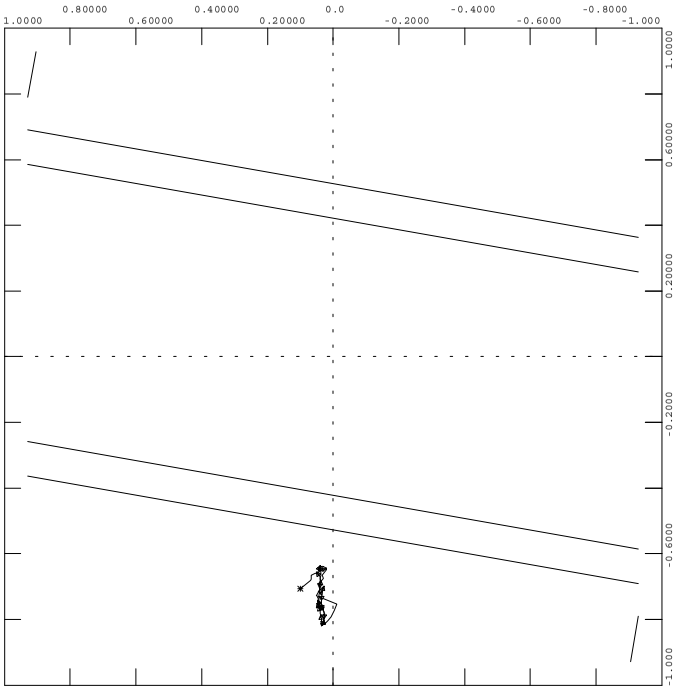


TUE, NOV 20 2012 10:39
L20D AT DRAYTON (506)

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLNOS1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 822: [X-MRV4-RCH4]

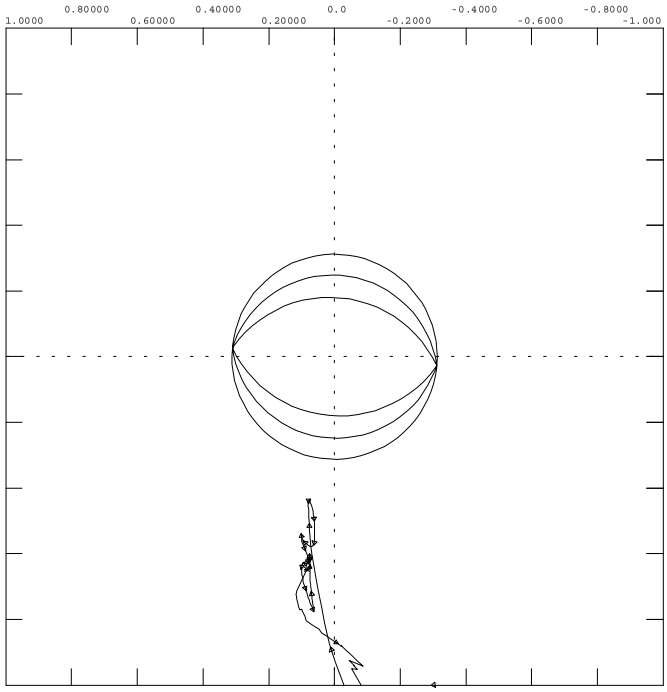


TUE, NOV 20 2012 10:39
R50M-MORANVILLE-EMRG (777)

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLLP1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 814: [X-TGA4-BD 4]

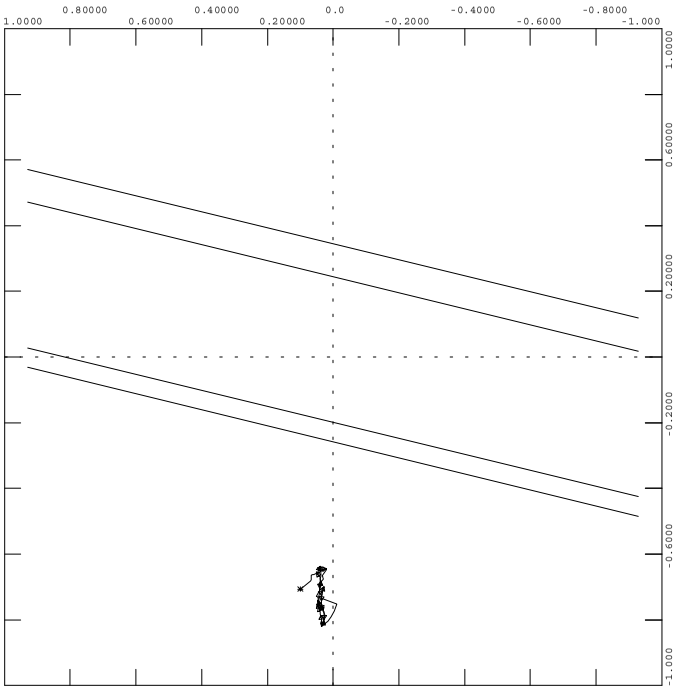


TUE, NOV 20 2012 10:39
TIOGA-B.DAM-NORTH (268)

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLNOS1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 822: [X-MRV4-RCH4]

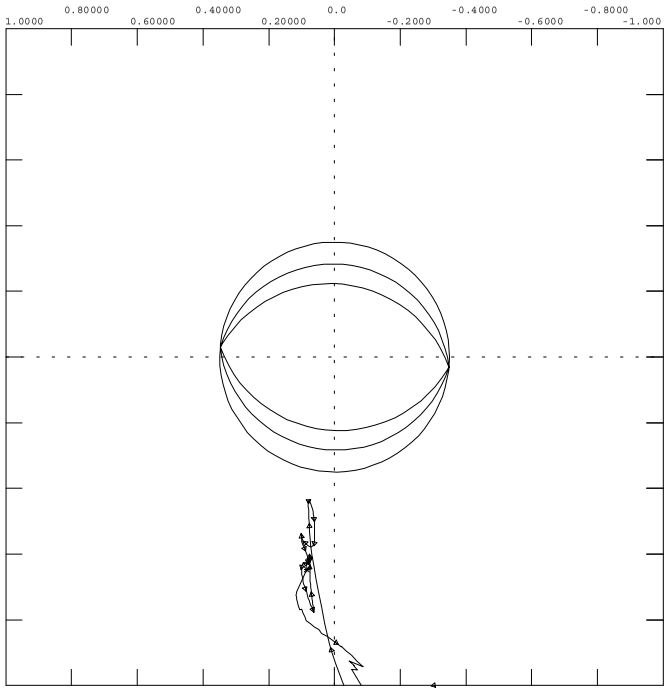


TUE, NOV 20 2012 10:39
R50M AT MORANVILLE (520)

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLLP1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 814: [X-TGA4-BD 4]

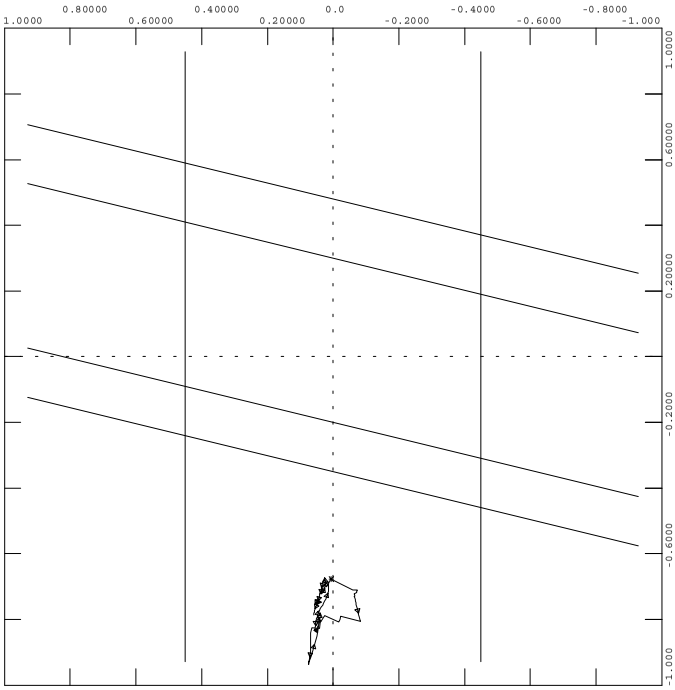


TUE, NOV 20 2012 10:39
TIOGA-B.DAM-SOUTH (266)

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLNOS1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 848: [X-INT.F-FTF]

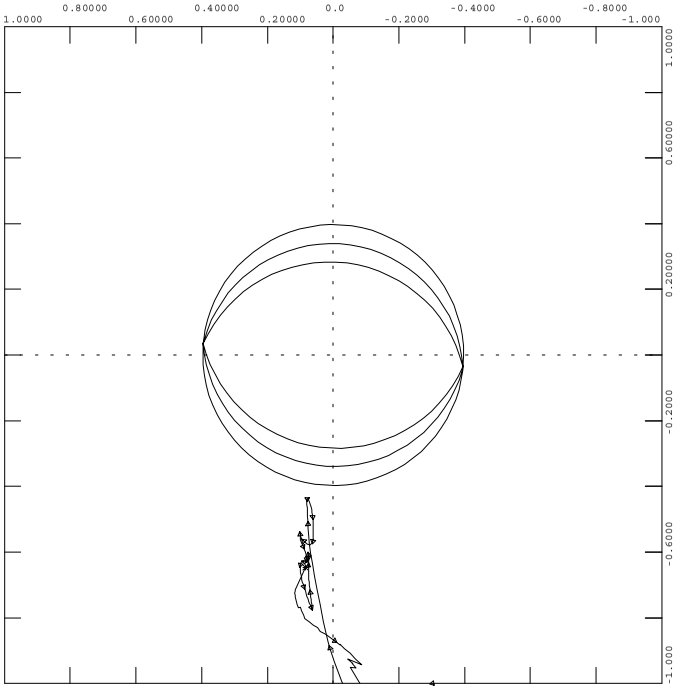


CHNL# 847: [R-1484 6011]
TUE, NOV 20 2012 10:39
MP-OH I.FALLS (779)

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLLP1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 814: [X-TGA4-BD 4]

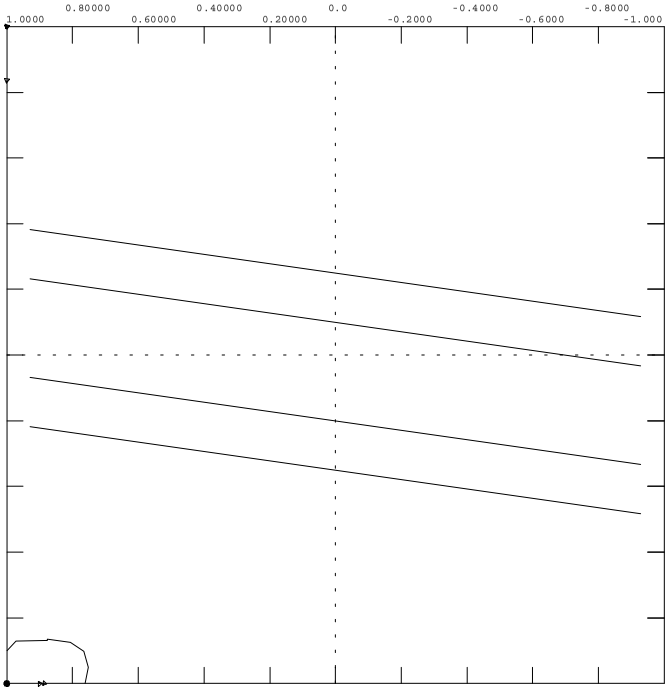


CHNL# 813: [R-604 3203 1]
TUE, NOV 20 2012 10:39
TIOGA-B.DAM-EMRG (267)

W3L-SO16AA.SAV;SUMMER;OP LD;SYSTEM INTACT :
ND=3299,MH=2212,MW=1639,OHMH=-196,OHMP=151,EWTW=190,BD=164
SLG FAULT ON KING - EAU CLAIRE LINE WITH 8P6 BREAKER FAILUR
TRIPS KING - EAU CLAIRE - ARPIN AND KING - CHISAGO 345 KV L

FILE: ..\bin\w3l-so16aa-pcs.out

RELAY: SLNOS1
TSTART: 0.0 TSTOP: 5.0 TIC INCREMENT: 0.25
CHNL# 1071: [X-G82R]



CHNL# 1070: [R-G82R]
TUE, NOV 20 2012 10:39
G82R (780)