Xcel Energy℠

GENERATION INTERCONECTION

REQUEST # GI-2008-26

SYSTEM IMPACT STUDY REPORT

100 MW SOLAR THERMAL, ALAMOSA COUNTY, COLORADO

PERFORMED BY: TRANSERV INTERNATIONAL, INC.

PSCO TRANSMISSION ASSET MANAGEMENT

NOVEMBER 8, 2011

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Revision History

Version	Date	Description	Author
0.1	08/22/2011	Original Draft Report	TranServ
1.0	09/12/2011	Approved	TranServ
1.1	11/04/2011	Updated Version	TranServ
1.2	11/07/2011	Removed Appendix D and Minor Fixes	PSCo

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Executive Summary

PSCo received an interconnection request (GI-2008-26) for a 250 MW solar thermal generator interconnection to the PSCo system on the Poncha – San Luis Valley (SLV) 230 kV transmission line. Although the original GI-2008-26 requested maximum output level was 250 MW, the Customer has since notified PSCo of its desire to reduce the plant capacity to 100 MW. PSCo and Xcel Energy commissioned TranServ to perform an Interconnection System Impact Study (SIS) for a 100 MW solar thermal generator interconnection to the PSCo system on the Poncha – SLV 230 kV transmission line. The requested in-service date was June 15, 2010.

This is a joint SIS report by PSCo and TranServ. The stability analysis was performed by TranServ under PSCo direction. The steady-state and short circuit analyses are taken from the GI-2008-26 Feasibility Study Report dated April 01, 2010, performed by PSCo. The GI-2008-26 Feasibility Study Report can be found in on PSCo's oasis. The SIS study report was written by TranServ under PSCo direction. PSCo made the determination of injection constraints that are required to be mitigated by the interconnection Customer and developed the mitigation plan for interconnection. Planning level cost estimates were provided by PSCo.

This SIS evaluated the impact of the proposed solar thermal generator on the transmission system performance; including steady-state, stability, and short circuit analyses. The scope of the SIS is limited to identifying mitigation for injection constraints that likely would limit the ability of the generator to interconnect. In accordance with PSCo SIS practices, this study in conjunction with the feasibility study, only identified injection related steady-state impacts, stability impacts and short-circuits impacts that would be required to be mitigated in order for this generator to interconnect at the requested Point of Interconnection (POI).

The new 100 MW of steam-turbine generator will utilize the collected solar energy and pass it through a heat-exchanger to produce steam for the prime mover. The generator will be connected through a dedicated generator step-up transformer with the terminal voltage of 13.8 kV. The steam turbine is rated at 137 MVA with a capability of producing 39 MVARs and consuming 26 MVARs.

Since the Customer's generation facility is located adjacent to the transmission line, the POI will be a new three breaker ring-bus substation tapping the Poncha – SLV 230 kV line at approximately 10 miles north of the SLV substation per PSCo Large Generator Interconnection

Guidelines (LGIG), see Figure 1a. The Poncha – SLV 230 kV line is jointly owned by PSCo and Tri-State Generation and Transmission association (TSG&T) and operated by TSG&T. During the Facility study process, PSCo and TSG&T will discuss the ownership and operation breakdown of the new substation.

The subject interconnection request includes only a Network Resource Interconnection Service (NRIS) option. NRIS is an Interconnection Service that allows the Interconnection Customer to integrate their Large Generating Facility with the Transmission Provider's Transmission System in a manner comparable to that in which the Transmission Provider integrates its generating facilities to serve native load Customers. NRIS in and of itself does not convey transmission rights.

The request was studied as a Network Resource, stand-alone project only, with no evaluations made of other potential new generation requests that may exist in the Large Generator Interconnection Request (LGIR) queue, other than the generation projects that are already approved and planned to be in service by the summer of 2013. This stand-alone analysis consisted of a comparative study of the system behavior with the addition of the Customer's 100 MW project to the PSCo system compared with that associated with the existing PSCo system. The main purpose of this SIS was to evaluate the potential impact of GI-2008-26 on the PSCo transmission infrastructure as well as that of neighboring entities, when injecting a total of 100 MW of generation, and delivering that additional generation to native PSCo loads. The costs to interconnect the project with the transmission system at SLV Substation have been evaluated by PSCo Engineering. This study considered facilities that are part of the PSCo transmission system as well as monitoring other nearby entities' regional transmission systems.

Steady-State Analysis Results

As stated above, the steady-state analysis was taken from the GI-2008-26 Feasibility Study Report dated April 1, 2010, performed by PSCo. Upon completion of the Feasibility Study, PSCo determined that it is feasible to interconnect to the PSCo system by tapping the Poncha – SLV 230 kV line via a three breaker ring-bus substation. The results of this study indicate that 100 MW of the GI-2008-26 generation project delivered to PSCo native loads does not result in the overloading of facilities in the PSCo regional transmission system. However, the voltage levels at several buses violate criteria for certain single line contingencies with and without the project. TSG&T has an Under Voltage Load Shedding (UVLS) scheme established for the SLV region in case the voltages dip below 0.93 p.u. in order to avoid voltage collapse. In addition to

the UVLS, the region will need additional capacitor banks to maintain the voltage within criteria under N-1 contingencies. The additional capacitor banks will be installed at the Alamosa Terminal by 2013. Under these conditions, the 100 MW of Network Resource requested would not require any major Transmission Network Upgrades.

Stability Analysis Results

The power flow model used in the stability portion of this study is a 2013 Heavy Summer model with origins in a Western Electricity Coordinating Council (WECC) approved model. The stability analysis consisted of monitoring specific generator power output levels, line MW flows, bus voltages, bus frequencies and GI-2008-26 generation parameters during the first 30 seconds of the six tested disturbances. The stability analysis results indicate that with the proposed addition of the GI-2008-26 generation, the system is stable with satisfactory damping for all studied disturbances. Also the voltage and frequency responses of all monitored buses are within WECC criteria for all studied disturbances. No stability constraints were identified thus no transmission upgrades are required to mitigate for stability impacts.

Short Circuit Analysis Results

As stated above, the short circuit analysis was taken from the GI-2008-26 Feasibility Study Report dated April 01, 2010, performed by PSCo. The results of this study indicate that interconnection of 100 MW of GI-2008-26 generation does not result in increases in available fault current for any buses tested that are in excess of the interrupting current capabilities of the pertinent breakers.

Cost to Interconnect

The non-binding planning level cost estimates to interconnect the project with the transmission system at the SLV Substation have been evaluated by PSCo Engineering and are given in the feasibility study report as follows:

- As a network request, contingency analysis was performed to determine the upgrades that would be required to deliver the entire output of the GI-2008-26 solar thermal facility as provided at the POI to PSCo native loads. Under that condition, the total estimated cost of the recommended system upgrades to accommodate the project is approximately $5.665 million and includes:
    - $0.975 million for PSCo-Owned, Customer-Funded Interconnection Facilities.
    - $4.690 million for PSCo-Owned, PSCo-Funded Interconnection Facilities.

No additional costs were determined in the stability analysis. Thus the SIS identified cost required to interconnect the GI-2008-26 generation remains unchanged from the GI-2008-26 Feasibility Study Report dated April 01, 2010.

Figure 1 - Preliminary One-Line of the Proposed 100 MW Generating Facility

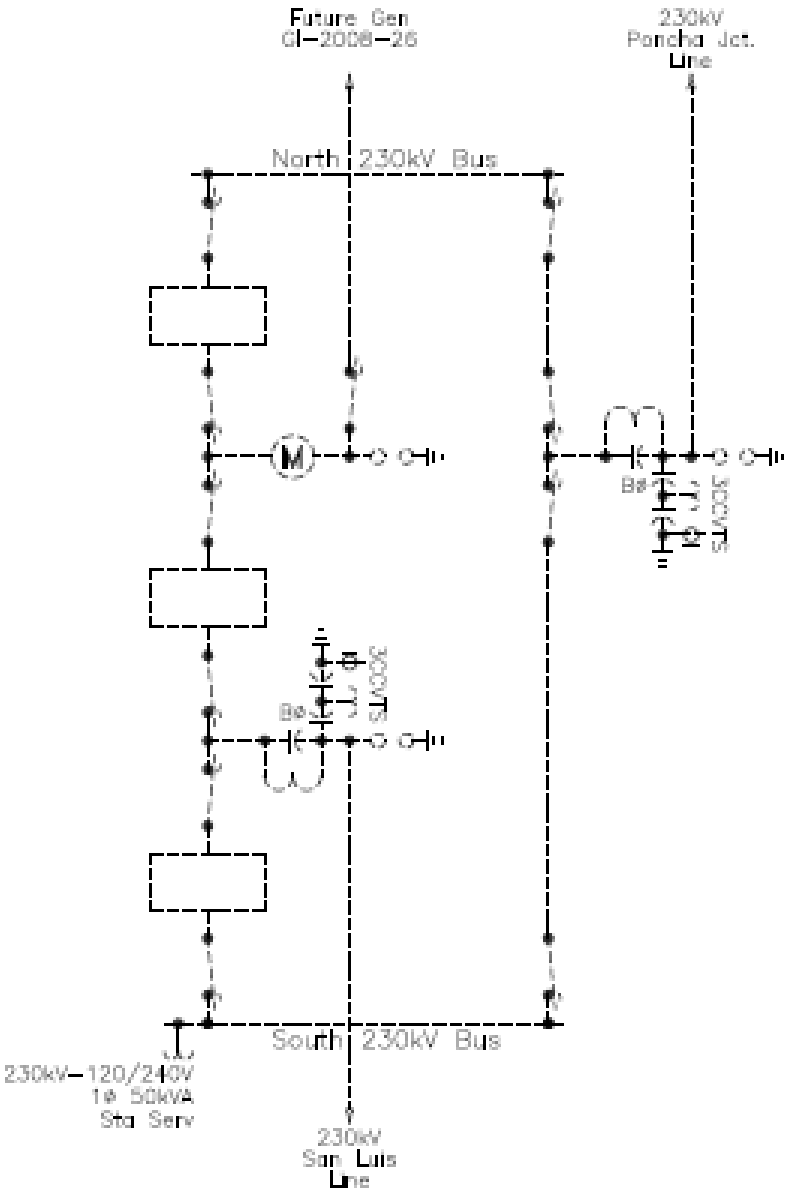


Figure 2 - Preliminary General Arrangement of the Proposed 100 MW Generating Facility

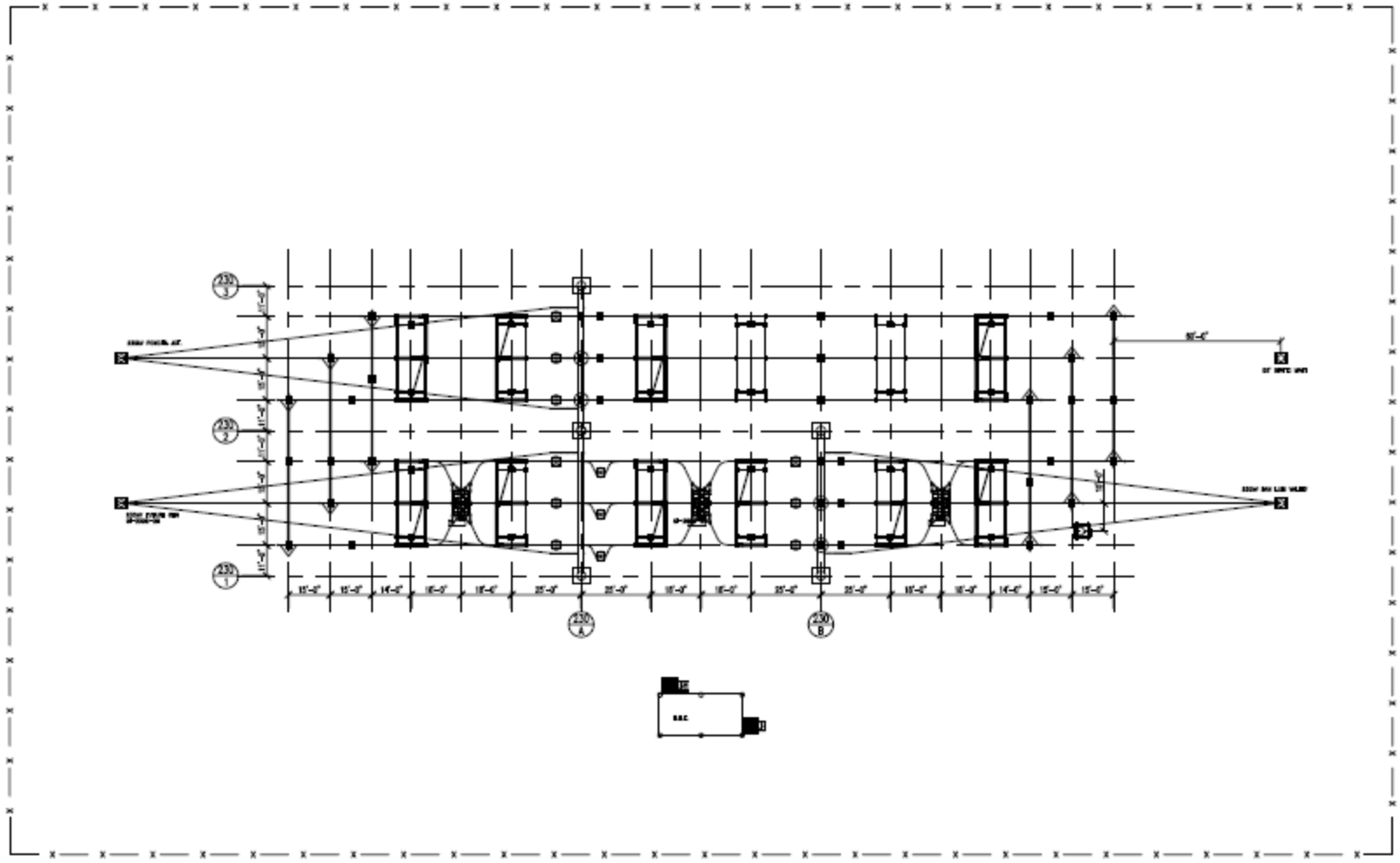
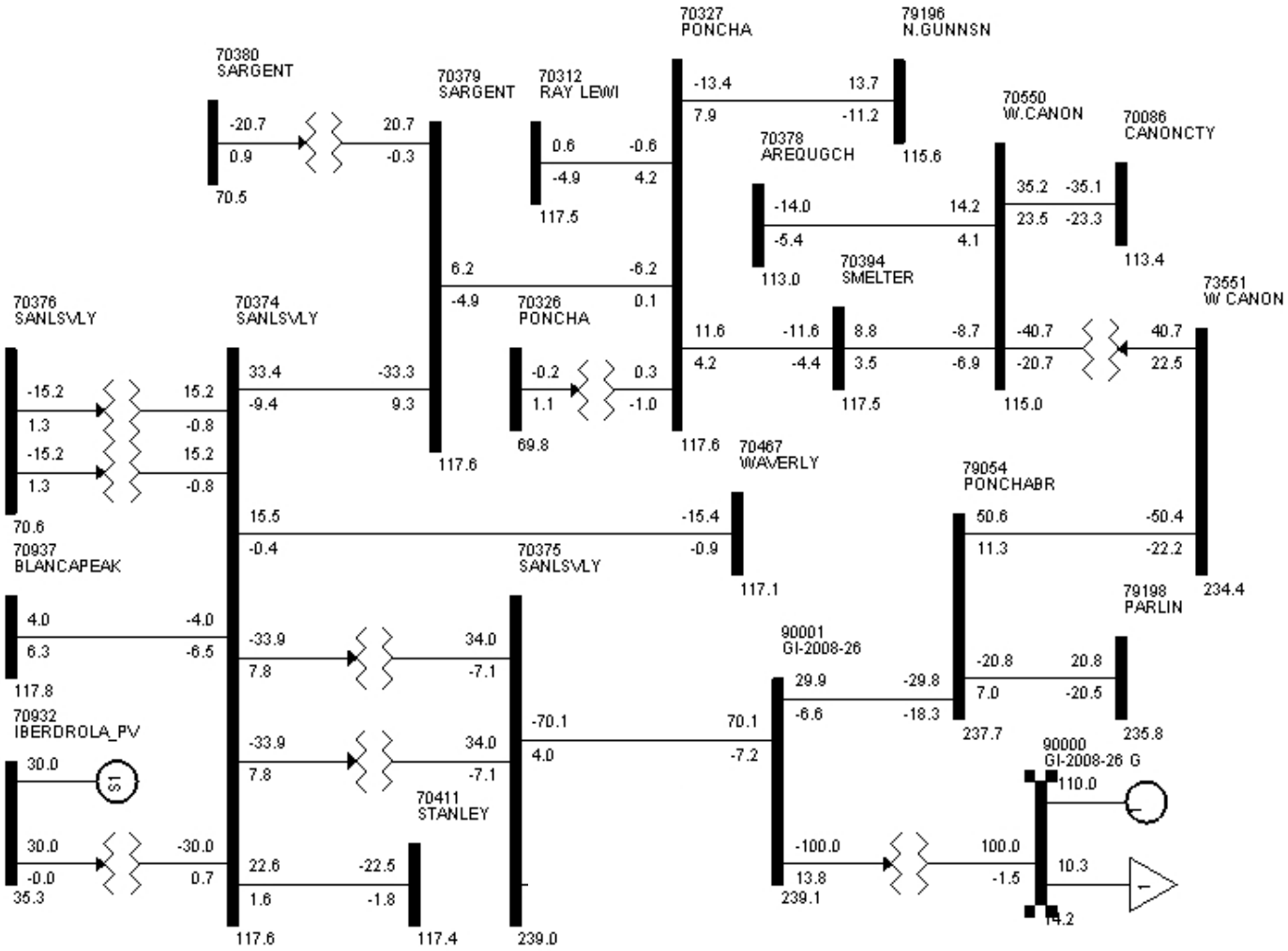


Figure 3 - Modeling of the Proposed 100 MW Generating Facility in the Stability Model



Introduction

PSCo received an interconnection request (GI-2008-26) for a 100 MW solar thermal generator interconnection to the PSCo system on the Poncha –SLV 230 kV transmission line. PSCo and Xcel Energy commissioned TranServ to perform an Interconnection SIS for this request. The original GI-2008-26 requested maximum output level was 250 MW, however the Customer has since notified PSCo of its desire to reduce the plant capacity to 100 MW. The details of the GI-2008-26 request are given below:

Queue Position	Queue Date	Location	Max Output (MW)	Point of Inter-connection	OASIS In Service Date	Inter-connection Service Type	Fuel Type
GI-2008-26	11-Feb-09	San Luis Valley, Colorado	100	Poncha – San Luis Valley 230 kV line	July 1, 2013	NR	Solar

Study Scope and Analysis

This is a joint SIS report by PSCo and TranServ. The SIS evaluated the transmission impacts associated with the proposed generation increase. It consisted of power flow, short circuit and dynamic analyses. The power flow analysis identified any thermal or voltage limit violations resulting from the generation addition and an identification of network upgrades required to deliver the proposed generation to PSCo loads. The short circuit analysis evaluated the impact on the transmission system of the increase in available fault current due to the generation addition. The steady-state and short circuit analyses are taken from the GI-2008-26 Feasibility Study Report dated April 01, 2010, performed by PSCo. The dynamic analysis was performed by TranServ under PSCo direction. The dynamic analysis identified any transient and oscillatory stability impacts due to the addition of the new generation. The study report was written by TranServ under PSCo direction. PSCo made the determination of injection constraints that are required to be mitigated by the interconnection Customer and developed the mitigation plan for interconnection. Planning level cost estimates were provided by PSCo.

This Generation Interconnection SIS analyzed the impact of this addition, located in South Central Colorado, in accordance with PSCo's study criteria. PSCo adheres to NERC & WECC Reliability Criteria, as well as internal Company criteria for planning studies. During system intact conditions, criteria are to maintain transmission system bus voltages between 0.95 and

1.05 per unit of nominal, and steady-state power flows below the thermal ratings of all facilities. Operationally, PSCo tries to maintain a transmission system voltage profile ranging from 1.02 per unit or higher at regulating (generation) buses to 1.0 per unit or higher at transmission load buses. Following a single contingency, transmission system steady state bus voltages must remain within 0.90 per unit to 1.05 per unit, and power flows within 100% of the facilities' continuous thermal ratings. Also, voltage deviations should not exceed 5%. Transient stability criteria require that all generating machines remain in synchronism and all power swings should be well damped. Also, transient voltage performance should meet the following criteria:

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

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

- Following fault clearing for Category B contingencies, frequency should not dip below 59.6 Hz for 6 cycles or more at a load bus.
- Following fault clearing for Category C contingencies, frequency should not dip below 59.0 Hz for 6 cycles or more at a load bus.

Note that load buses include generating unit auxiliary loads.

This project was studied as a Network Resource. NRIS shall mean an Interconnection Service that allows the Interconnection Customer to integrate its Large Generating Facility with the Transmission Provider's Transmission System in a manner comparable to that in which the Transmission Provider integrates its generating facilities to serve native load Customers. NRIS in and of itself does not convey transmission service.

For this project, TSG&T is an affected party.

Power Flow Study Models

WECC coordinates the preparation of regional power flow cases for transmission planning purposes. PSCo Transmission developed a base case with a 2013 summer peak load representation from WECC approved models for use in the steady state analyses. Further

steady-state model development details are given in the GI-2008-26 Feasibility Study Report dated April 01, 2010. The model used for the stability analysis was derived from a 2014 Heavy Summer model approved by WECC in March 2010. The WECC approved 2014 Heavy Summer model was modified by PSCo to obtain an updated 2013 representation. These modifications included topology and generation dispatch adjustments and the addition of the following generation:

- Iberdrola_PV (30 MW) at Bus 70932.
- Cogentrix_PV (30 MW) at Bus 70933.

This updated 2013 representation, 13hsp_r3C_pre.sav, was modified by adding the GI-2008-26 generation to obtain the post GI-2008-26 model, 13hsp_r3C_post.sav. The GI-2008-26 generation was modeled with MBase = 137 MVA, Pgen = 110 MW, Qmax = 39 MVAR, Qmin = -26 MVAR and the station load at 10 MW, see Figure 3. The GI-2008-26 generation was sunk to Bus 70106, Cherokee unit 4.

Power Flow Study Process and Results

The steady-state analysis is taken from the GI-2008-26 Feasibility Study Report dated April 01, 2010. Please see this report for a detailed explanation of the process used and the results found in the steady-state analysis.

Dynamic Stability Results

An analysis was performed to assess the transient stability system performance with the GI-2008-26 generation at 100 MW net. The examined disturbances are provided in Appendix A. The list of evaluated disturbances was limited to that necessary to adequately assess the transient stability performance of the system with the proposed addition as determined by PSCo. To perform the analyses, plots of generator power output, line MW flow, bus voltage, and bus frequency were produced for each disturbance. Minimum transient bus voltage dips and maximum transient frequency deviations, occurring after the fault was cleared, were also determined. The results can be found in Appendix B. Plots of generator power output, line MW flow, bus voltage, and bus frequency can be found in Appendix C. The results indicate that with the proposed addition of generation, the system is stable with satisfactory damping for all modeled disturbances. The PSCo determined monitored buses included in this study are listed in Table 1.

Table 1.
Buses Monitored for both Voltage and Frequency Response

Monitored Buses
San Luis Valley 230 kV
San Luis Valley 115 kV
GI-2008-26 230 kV
GI-2008-26 13.8 kV
Poncha 230 kV
Poncha 115 kV
Sargent 115 kV

The after fault clearing transient voltage dip results show that the system response is well within WECC transient voltage dip criteria. The after fault clearing lowest voltage dip among the disturbances was to 84% at the San Luis Valley 69 kV bus. In addition, the after fault clearing maximum transient frequency deviation was to 59.69 Hz at the GI-2008-26 Generation 13.8 kV bus. The after fault clearing transient frequency deviation results were within WECC criteria.

Network Resource (NR)

The results of the GI-2008-26 Feasibility Study Report dated April 01, 2010 indicate that the 100 MW of GI-2008-26 generation delivered to the San Luis Valley POI does not result in the overloading of facilities in the PSCo regional transmission system. The 100 MW of GI-2008-26 requested would not require any Transmission Network Upgrades. In addition, the stability analysis results given in this report do not indicate the need for further network upgrades.

Short Circuit Analysis

A short circuit study was conducted to determine the fault currents (three phase and single-line to ground) at the San Luis Valley substation. The approximate fault currents at San Luis Valley with the addition of the GI-2008-26 100 MW solar thermal facility are summarized in Table 2.

Table 2. Summary of fault results at San Luis Valley substation for 2013 ISD of GI-2008-26

San Luis Valley SS (kV)	Three Phase Fault (Amps)	Single-Line-Ground Fault (Amps)
230	5523	5761
115	7788	9033
69	7021	7900

Cost Estimates and Assumptions

Scoping level cost estimates for Interconnection Facilities and Network/Infrastructure Upgrades for Delivery (+/- 30% accuracy) were developed by PSCo Engineering. The cost estimates are in 2011 dollars with escalation and contingency applied (AFUDC is not included) and are based upon typical construction costs for previously performed similar construction. These estimated costs include all applicable labor and overheads associated with the siting support, engineering, design, and construction of these new PSCo facilities. This estimate does not include the cost for any other Customer owned equipment and associated design and engineering.

The estimated total cost for the required upgrades for is **$5,665,000.** Figure 1 represents a conceptual one-line of the proposed interconnection at the New PSCo 230 kV Transmission Substation sectionalizing the San Luis Valley-Poncha Jct. 230 kV OH Transmission Line. These estimates do not include costs for any other Customer owned equipment and associated design and engineering. The following tables list the improvements required to accommodate the interconnection and the delivery of the Project generation output. The cost responsibilities associated with these facilities shall be handled as per current FERC guidelines. System improvements are subject to change upon a more detailed and refined design.

Table 3. PSCo Owned; Customer Funded Transmission Provider Interconnection Facilities

Element	Description	Cost Est. (Millions)
PSCo's New 230kV Transmission Substation	Interconnect Customer to tap at PSCo's New 230 kV Substation (sectionalizing the SLV-Poncha Jct. 230kV OH Line). The new equipment includes: • One 230 kV gang switch • Three 230 kV combination CT/PT metering units • Three 230 kV lightning arresters • One relay panel • Associated bus, wiring and equipment • Associated foundations and structures • Associated transmission line communications, relaying and testing	**$0.340**
	Transmission line tap into substation. Structure, conductor, hardware and installation labor.	**$0.300**
Customer's 230kV Substation	Load Frequency/Automated Generation Control (LF/AGC) RTU and associated equipment.	**$0.185**
	Transmission line interconnection/tie (estimated at 2,000') between PSCo's New Sub and Customer's Solar Facility Sub	**$0.150**
	Total Cost Estimate for PSCo-Owned, Customer-Funded Interconnection Facilities	**$0.975**
Time Frame	**Design, procure and construct**	**18 Months**

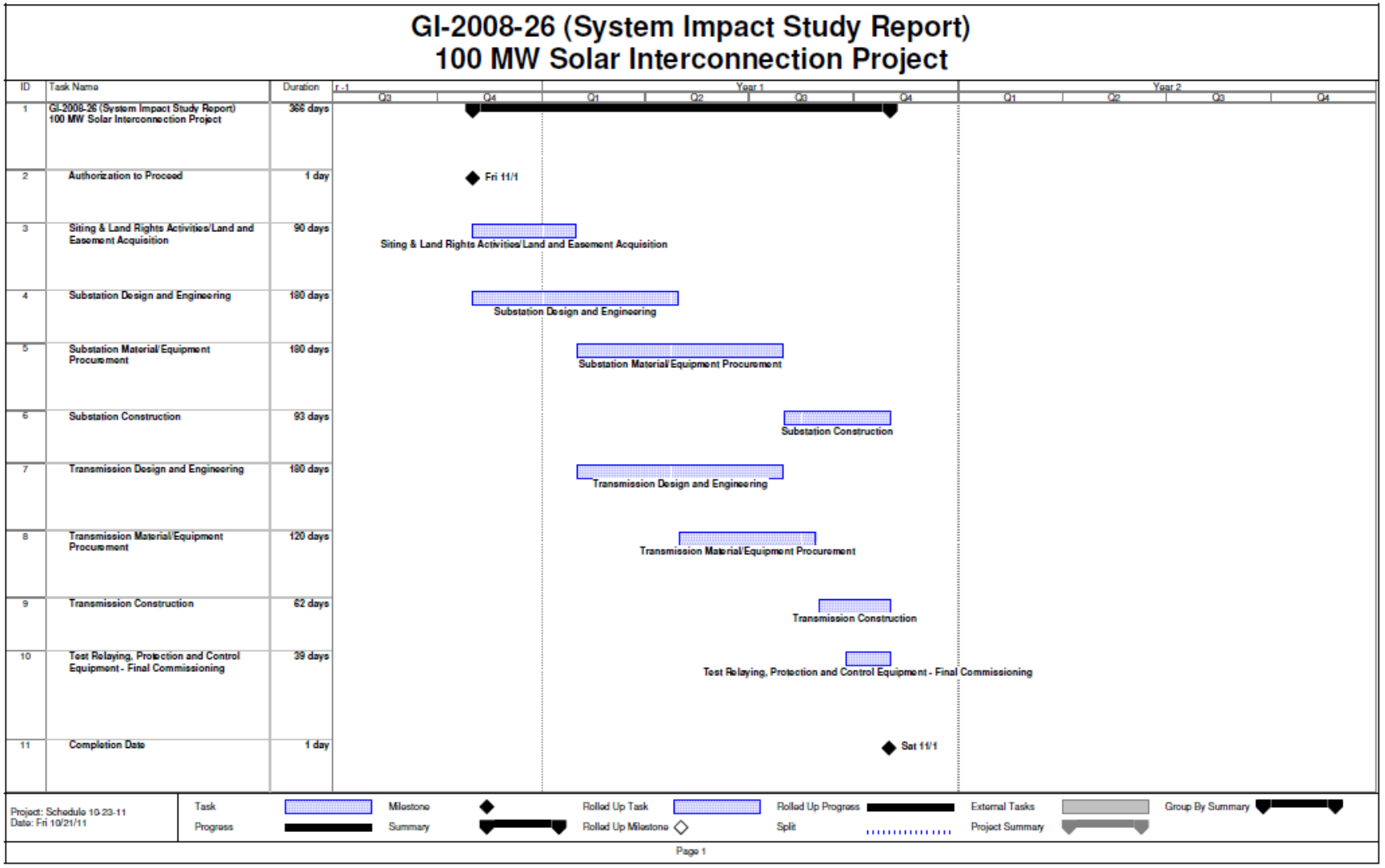
Table 4. PSCo Owned; PSCo Funded Interconnection Network Facilities

Element	Description	Cost Est. (Millions)
PSCo's New 230kV Transmission Substation	Interconnect Customer to tap at PSCo's New 230 kV Transmission Substation (sectionalizing the SLV-Poncha Jct. 230 kV OH Line). The new equipment includes: • Three 230 kV circuit breakers • Ten 230 kV gang switches • Six 230 kV CCVT's • One 230 kV SSVT (station service) • One Electric Equipment Enclosure (control bldg.) • Associated communications, supervisory and SCADA equipment • Associated line relaying and testing • Associated bus, miscellaneous electrical equipment, cabling and wiring • Associated foundations and structures • Associated road and site development, fencing and grounding	**$4.510**
	Siting and Land Rights support for substation land acquisition and construction.	**$0.180**
	Total Cost Estimate for PSCo-Owned, PSCo-Funded Interconnection Facilities	**$4.690**
Time Frame	**Site, design, procure and construct**	**18 Months**

Cost Estimate Assumptions

- Scoping level cost estimates for Interconnection Facilities and Network/Infrastructure Upgrades for Delivery (+/- 30% accuracy) were developed by PSCo Engineering.
- Estimates are based on 2011 dollars (appropriate contingency and escalation applied).
- AFUDC has been excluded.
- Labor is estimated for straight time only – no overtime included.
- Lead times for materials were considered for the schedule.
- The Solar Generation Facility is not in PSCo's retail service territory. Therefore, no costs for retail load metering are included in these estimates.
- PSCo (or it's Contractor) crews will perform all construction, wiring, testing and commissioning for PSCo owned and maintained facilities.
- The estimated time to design, procure and construct the interconnection facilities is approximately 18 months after authorization to proceed has been obtained.
- A CPCN will not be required for the interconnection facilities construction.
- Customer will string OPGW fiber into substation as part of the transmission line construction scope.
- All land will be acquired and required permitting completed by the Customer. PSCo will require a 10-acre substation yard. A subdivision process will be required to acquire PSCo's substation land.
- Breaker duty study determined that no breaker replacements are needed in neighboring substations.
- Station service provided primarily from a station service VT and secondly by the local utility provider.

GI-2008-26 (System Impact Study Report)
100 MW Solar Interconnection Project



Appendix A

Listing of Disturbances Tested

Disturbance Scenario #	Fault Type	Clearing Time	Faulted Bus	Disturbance Description
01s	Three Phase	4 Cycles	San Luis Valley 230 kV	Fault on the San Luis Valley - GI-2008-26 230 kV line: clear the fault by tripping the San Luis Valley - GI-2008-26 230 kV line.
02s	Three Phase	4 Cycles	GI-2008-26 230 kV	Fault on the San Luis Valley - GI-2008-26 230 kV line: clear the fault by tripping the San Luis Valley - GI-2008-26 230 kV line.
03s	Three Phase	4 Cycles	GI-2008-26 230 kV	Fault on the Poncha - GI-2008-26 230 kV line: clear the fault by tripping the Poncha - GI-2008-26 230 kV line.
04s	Three Phase	4 Cycles	Poncha 230 kV	Fault on the Poncha - GI-2008-26 230 kV line: clear the fault by tripping the Poncha - GI-2008-26 230 kV line.
05s	Three Phase	4 Cycles	Poncha 115 kV	Fault on the Poncha - Sargent 115 kV line: clear the fault by tripping the Poncha - Sargent 115 kV line.
06s	Three Phase	4 Cycles	Sargent 115 kV	Fault on the Poncha - Sargent 115 kV line: clear the fault by tripping the Poncha - Sargent 115 kV line.

Appendix B

Transient Stability Study Results

Minimum Voltage and Frequency Found for each Studied Disturbance

Disturbance Scenario #	Transient Voltage Dip		Minimum Transient Frequency		
	Bus	Minimum Voltage Dip (pu)	Bus	Minimum Frequency (Hz)	Time at or Below WECC Limit (seconds)
01s	SANLSVLY 69 kV	0.84	GI-2008-26 GEN 13.8 kV	59.76	0
02s	SANLSVLY 69 kV	0.85	GI-2008-26 GEN 13.8 kV	59.73	0
03s	SANLSVLY 69 kV	0.84	GI-2008-26 GEN 13.8 kV	59.69	0
04s	SANLSVLY 69 kV	0.90	GI-2008-26 GEN 13.8 kV	59.84	0
05s	PONCHA 69 kV	0.98	GI-2008-26 GEN 13.8 kV	59.97	0
06s	SANLSVLY 69 kV	0.89	GI-2008-26 GEN 13.8 kV	59.85	0

Transient Stability Study Results

Complete Minimum Voltage and Frequency Results for All Monitored Elements

Transient Voltage Dip		Minimum Transient Frequency		
Bus	Minimum Voltage Dip (pu)	Bus	Minimum Frequency (Hz)	Time at or Below WECC Limit (seconds)
Disturbance 01s – Three phase fault at San Luis Valley on the San Luis Valley - GI-2008-26 230 kV line				
San Luis Valley 230 kV	0.89	San Luis Valley 230 kV	59.88	0
San Luis Valley 115 kV	0.85	San Luis Valley 115 kV	59.86	0
GI-2008-26 230 kV	0.95	GI-2008-26 230 kV	59.87	0
GI-2008-26 13.8 kV	0.89	GI-2008-26 13.8 kV	59.76	0
Poncha 230 kV	0.97	Poncha 230 kV	59.93	0
Poncha 115 kV	0.95	Poncha 115 kV	59.96	0

Transient Voltage Dip		Minimum Transient Frequency		
Bus	Minimum Voltage Dip (pu)	Bus	Minimum Frequency (Hz)	Time at or Below WECC Limit (seconds)
Sargent 115 kV	0.85	Sargent 115 kV	59.87	0
SANLSVLY 69 kV	0.84	SANLSVLY 69 kV	59.86	0
Disturbance 02s – Three phase fault at GI-2008-26 on the San Luis Valley - GI-2008-26 230 kV line				
San Luis Valley 230 kV	0.89	San Luis Valley 230 kV	59.89	0
San Luis Valley 115 kV	0.86	San Luis Valley 115 kV	59.88	0
GI-2008-26 230 kV	0.94	GI-2008-26 230 kV	59.86	0
GI-2008-26 13.8 kV	0.88	GI-2008-26 13.8 kV	59.73	0
Poncha 230 kV	0.96	Poncha 230 kV	59.92	0
Poncha 115 kV	0.95	Poncha 115 kV	59.96	0
Sargent 115 kV	0.86	Sargent 115 kV	59.88	0
SANLSVLY 69 kV	0.85	SANLSVLY 69 kV	59.88	0
Disturbance 03s – Three phase fault at GI-2008-26 on the Poncha - GI-2008-26 230 kV line				
San Luis Valley 230 kV	0.88	San Luis Valley 230 kV	59.85	0
San Luis Valley 115 kV	0.85	San Luis Valley 115 kV	59.85	0
GI-2008-26 230 kV	0.87	GI-2008-26 230 kV	59.84	0
GI-2008-26 13.8 kV	0.84	GI-2008-26 13.8 kV	59.69	0
Poncha 230 kV	0.98	Poncha 230 kV	59.98	0
Poncha 115 kV	0.95	Poncha 115 kV	59.96	0
Sargent 115 kV	0.85	Sargent 115 kV	59.86	0
SANLSVLY 69 kV	0.84	SANLSVLY 69 kV	59.85	0
Disturbance 04s – Three phase fault at Poncha on the Poncha - GI-2008-26 230 kV line				
San Luis Valley 230 kV	0.93	San Luis Valley 230 kV	59.91	0
San Luis Valley 115 kV	0.91	San Luis Valley 115 kV	59.91	0
GI-2008-26 230 kV	0.93	GI-2008-26 230 kV	59.91	0

Transient Voltage Dip		Minimum Transient Frequency		
Bus	**Minimum Voltage Dip (pu)**	**Bus**	**Minimum Frequency (Hz)**	**Time at or Below WECC Limit (seconds)**
GI-2008-26 13.8 kV	0.91	GI-2008-26 13.8 kV	59.84	0
Poncha 230 kV	0.98	Poncha 230 kV	59.97	0
Poncha 115 kV	0.96	Poncha 115 kV	59.96	0
Sargent 115 kV	0.91	Sargent 115 kV	59.91	0
SANLSVLY 69 kV	0.90	SANLSVLY 69 kV	59.91	0
Disturbance 05s – Three phase fault at Poncha on the Poncha - Sargent 115 kV line				
San Luis Valley 230 kV	1.00	San Luis Valley 230 kV	59.98	0
San Luis Valley 115 kV	0.98	San Luis Valley 115 kV	59.98	0
GI-2008-26 230 kV	1.01	GI-2008-26 230 kV	59.98	0
GI-2008-26 13.8 kV	1.00	GI-2008-26 13.8 kV	59.97	0
Poncha 230 kV	1.01	Poncha 230 kV	59.98	0
Poncha 115 kV	0.98	Poncha 115 kV	59.98	0
Sargent 115 kV	0.98	Sargent 115 kV	59.98	0
SANLSVLY 69 kV	0.98	SANLSVLY 69 kV	59.98	0
Disturbance 06s – Three phase fault at Sargent on the Poncha - Sargent 115 kV line				
San Luis Valley 230 kV	0.94	San Luis Valley 230 kV	59.92	0
San Luis Valley 115 kV	0.90	San Luis Valley 115 kV	59.91	0
GI-2008-26 230 kV	0.94	GI-2008-26 230 kV	59.92	0
GI-2008-26 13.8 kV	0.93	GI-2008-26 13.8 kV	59.85	0
Poncha 230 kV	0.97	Poncha 230 kV	59.95	0
Poncha 115 kV	0.99	Poncha 115 kV	59.98	0
Sargent 115 kV	0.90	Sargent 115 kV	59.91	0
SANLSVLY 69 kV	0.89	SANLSVLY 69 kV	59.91	0

Appendix C

Transient Stability Study Plots

13hsp_r3C_post_01s.pdf

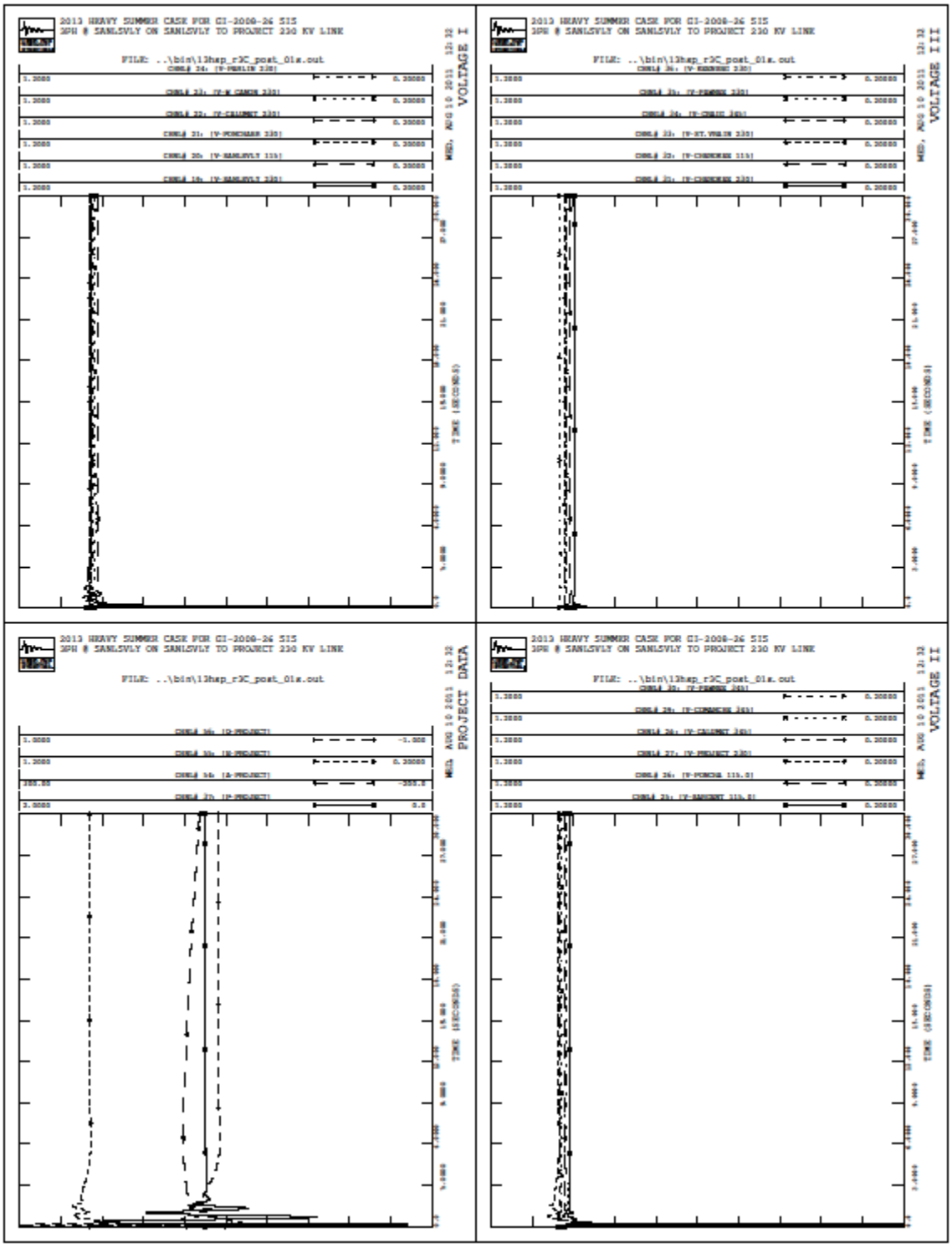
13hsp_r3C_post_02s.pdf

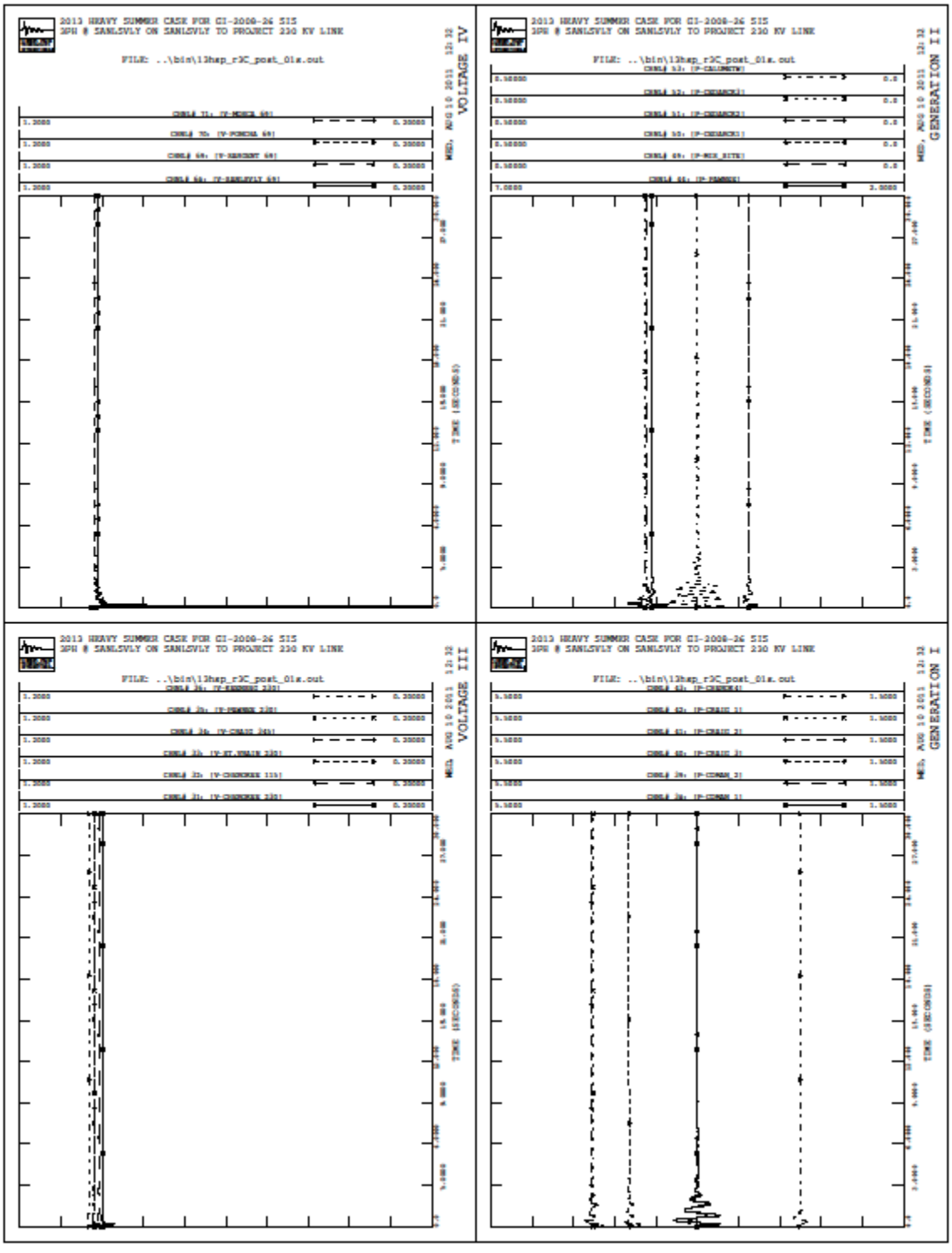
13hsp_r3C_post_03s.pdf

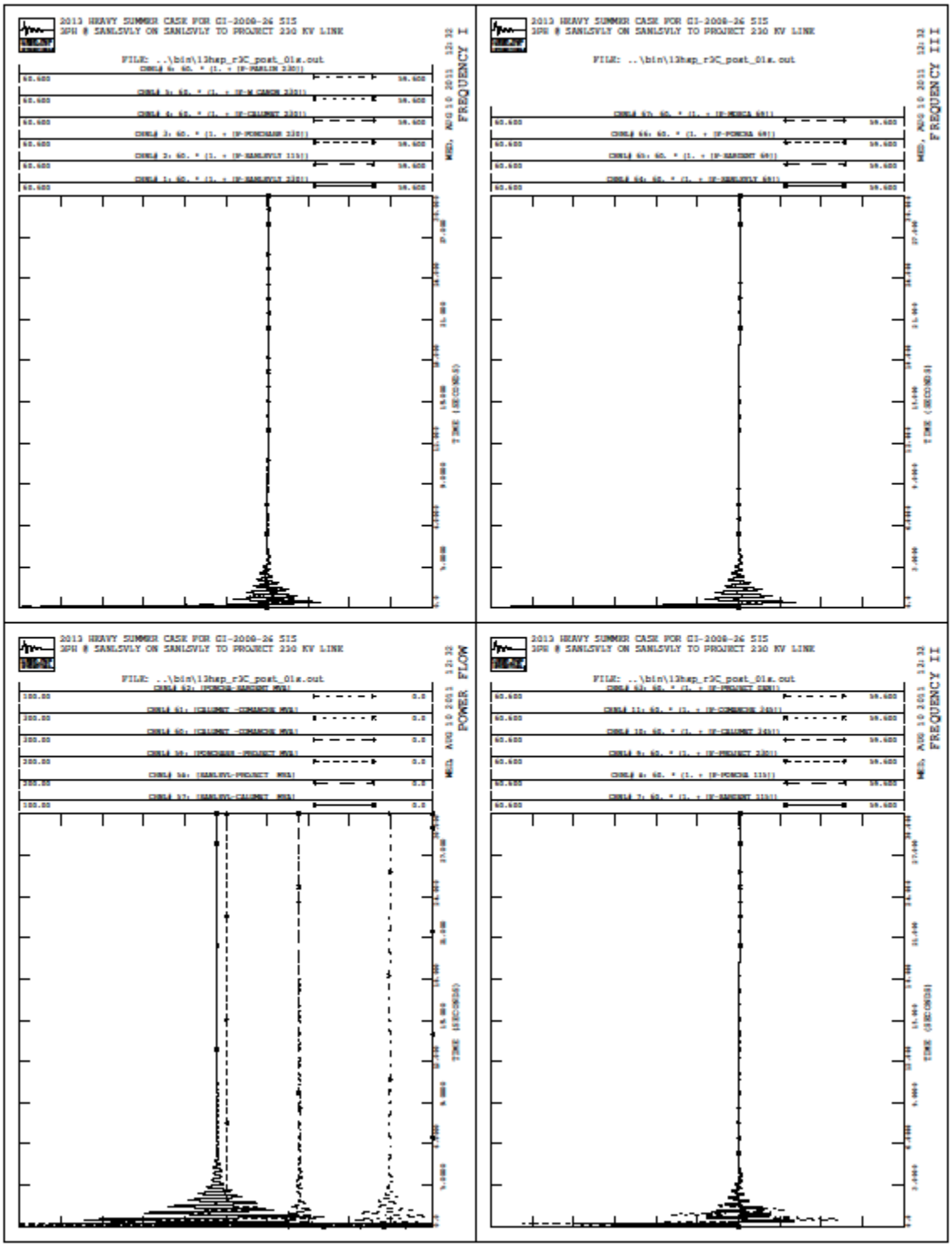
13hsp_r3C_post_04s.pdf

13hsp_r3C_post_05s.pdf

13hsp_r3C_post_06s.pdf


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ SANLSVLY ON SANLSVLY TO PROJECT 230 KV LINE
FILE: ..\bin\13hsp_r3C_post_01s.out
VOLTAGE I
VOLTAGE III
PROJECT DATA
VOLTAGE II
WED, AUG 10 2011 12:32
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ SANLSVLY ON SANLSVLY TO PROJECT 230 KV LINE
FILE: ..\bin\13hsp_r3C_post_01s.out
VOLTAGE IV
GENERATION II
VOLTAGE III
GENERATION I
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ SANLUVLY ON SANLUVLY TO PROJECT 230 KV LINE
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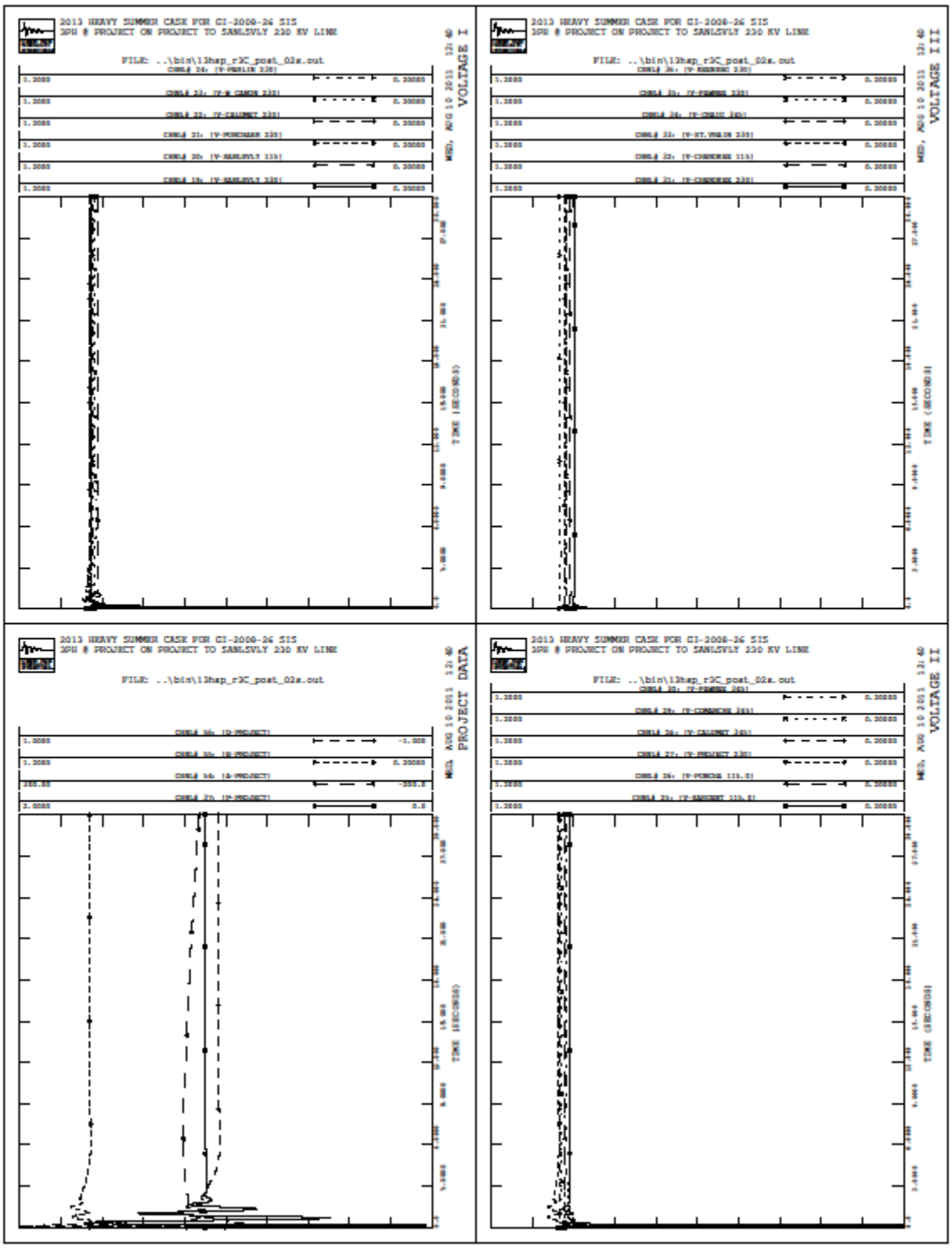
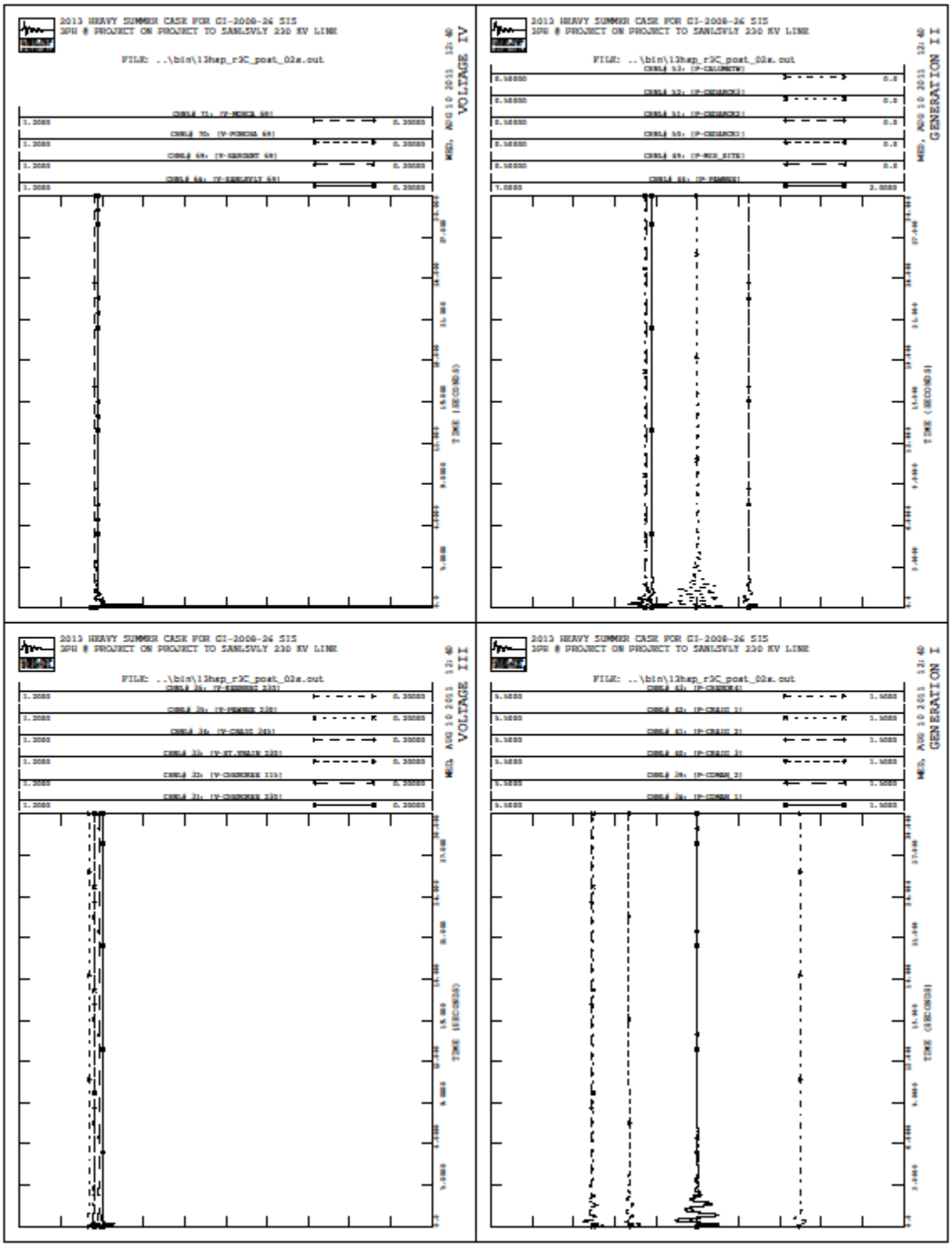
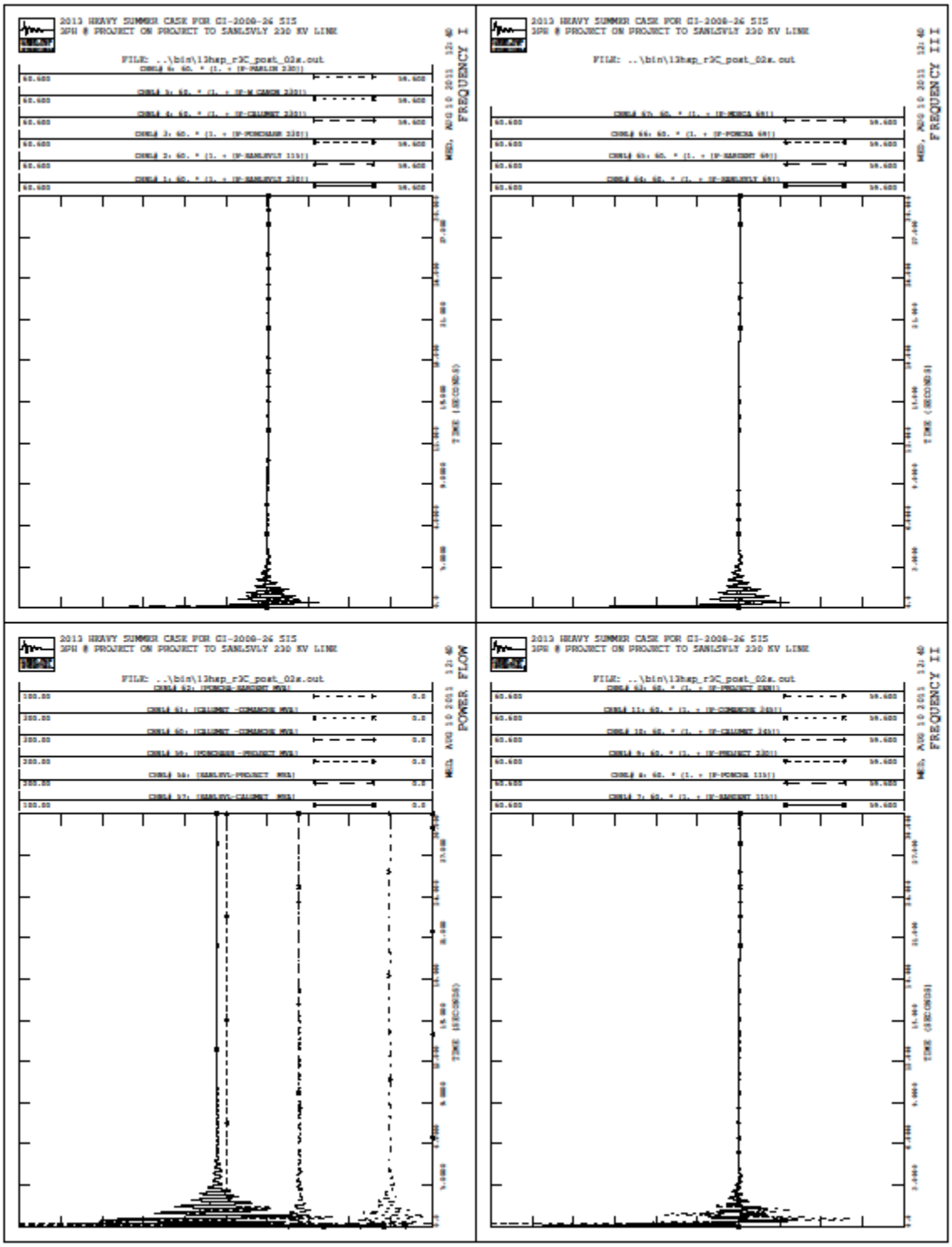
FREQUENCY I
FREQUENCY II
FREQUENCY III
POWER FLOW
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ PROJECT ON PROJECT TO SANLSVLY 230 KV LINE
FILE: ..\bin\13hsp_r3C_post_02s.out
VOLTAGE I
VOLTAGE II
VOLTAGE III
PROJECT DATA


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ PROJECT ON PROJECT TO SANLSVLY 230 KV LINE
FILE: ..\bin\13hsp_r3C_post_02s.out
VOLTAGE IV
GENERATION II
VOLTAGE III
GENERATION I
TIME (SECONDS)
WED, AUG 10 2011 12:40


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
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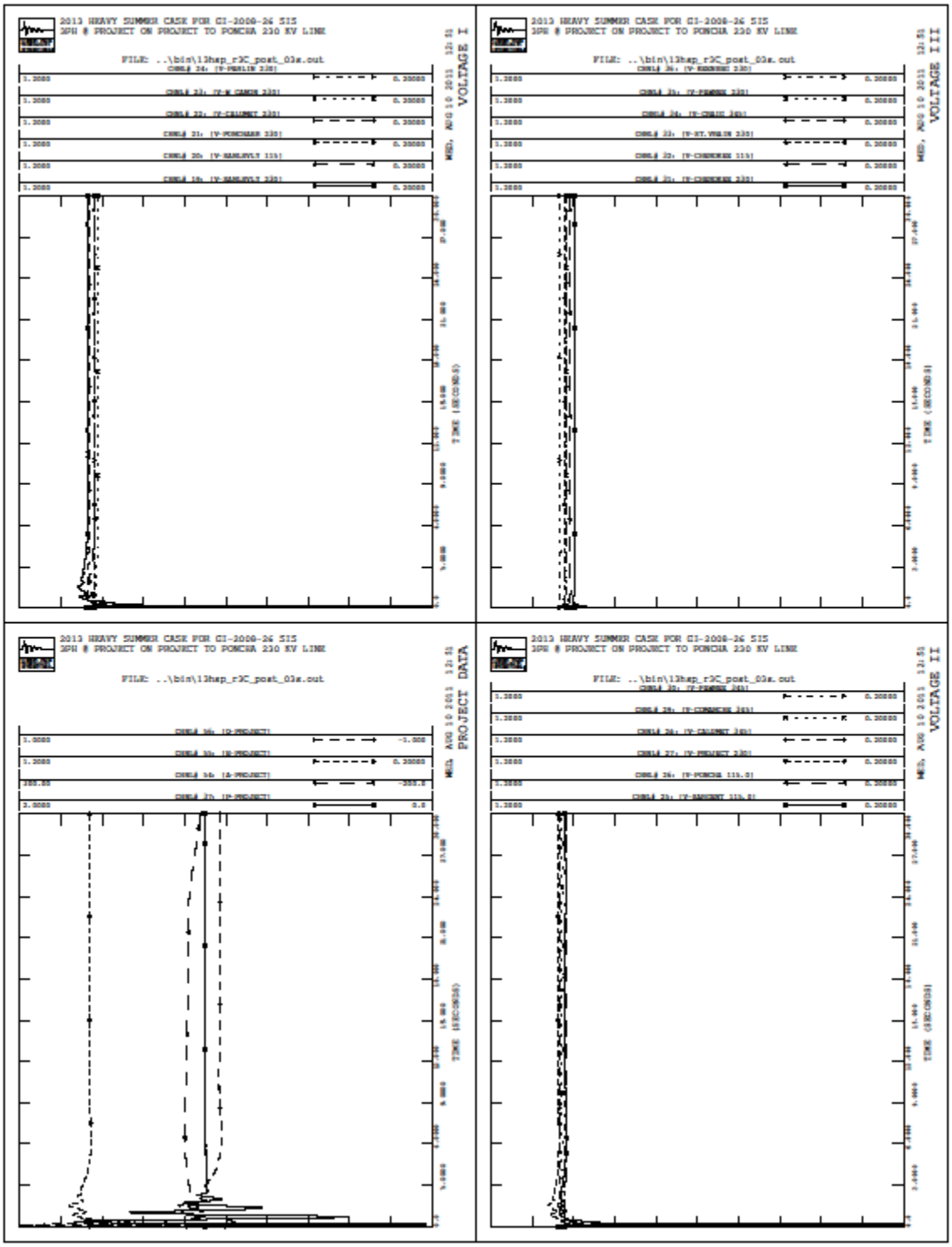
FREQUENCY I
FREQUENCY II
FREQUENCY III
POWER FLOW
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
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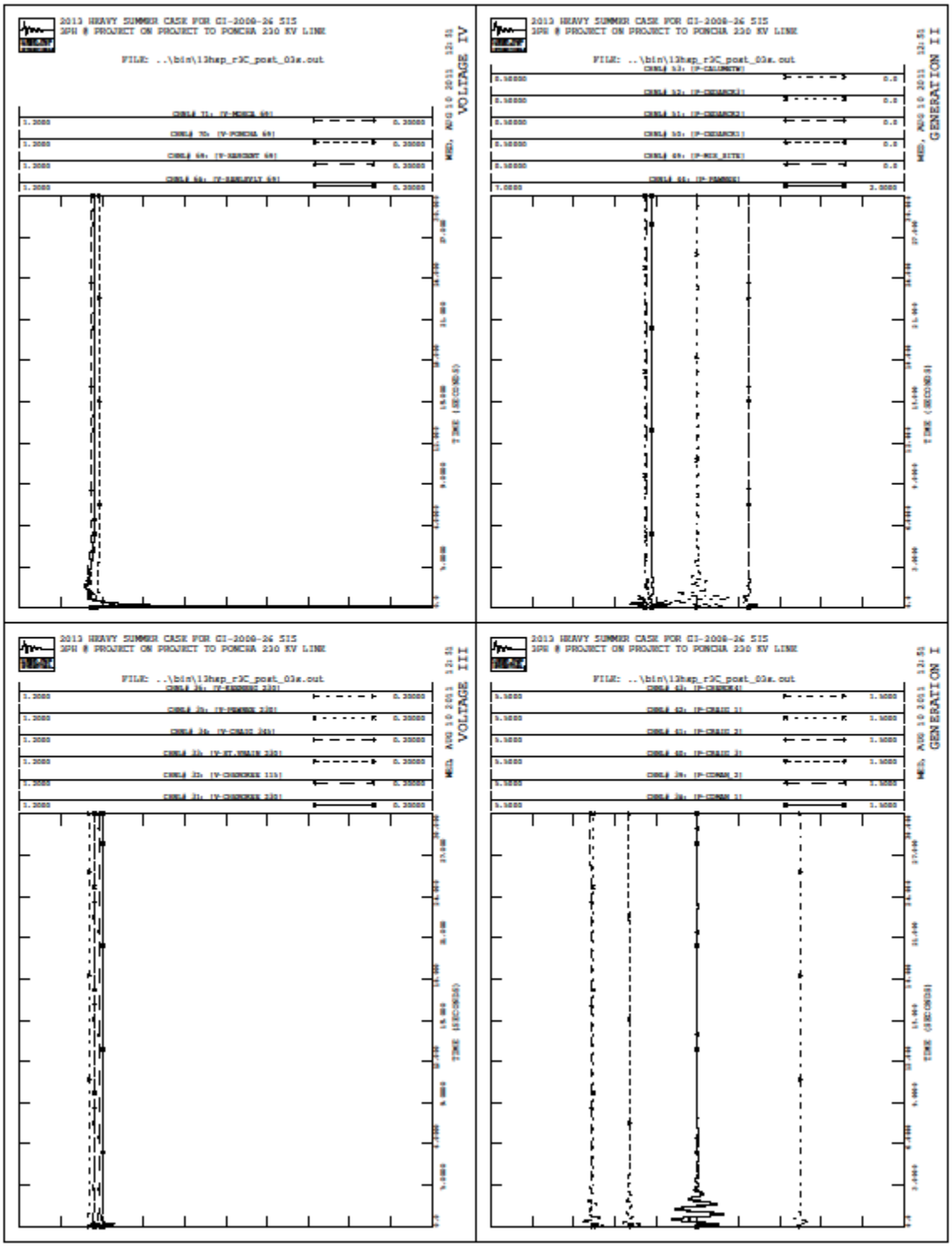
FILE: ..\bin\13hsp_r3C_post_03s.out
VOLTAGE I
VOLTAGE II
VOLTAGE III
PROJECT DATA
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
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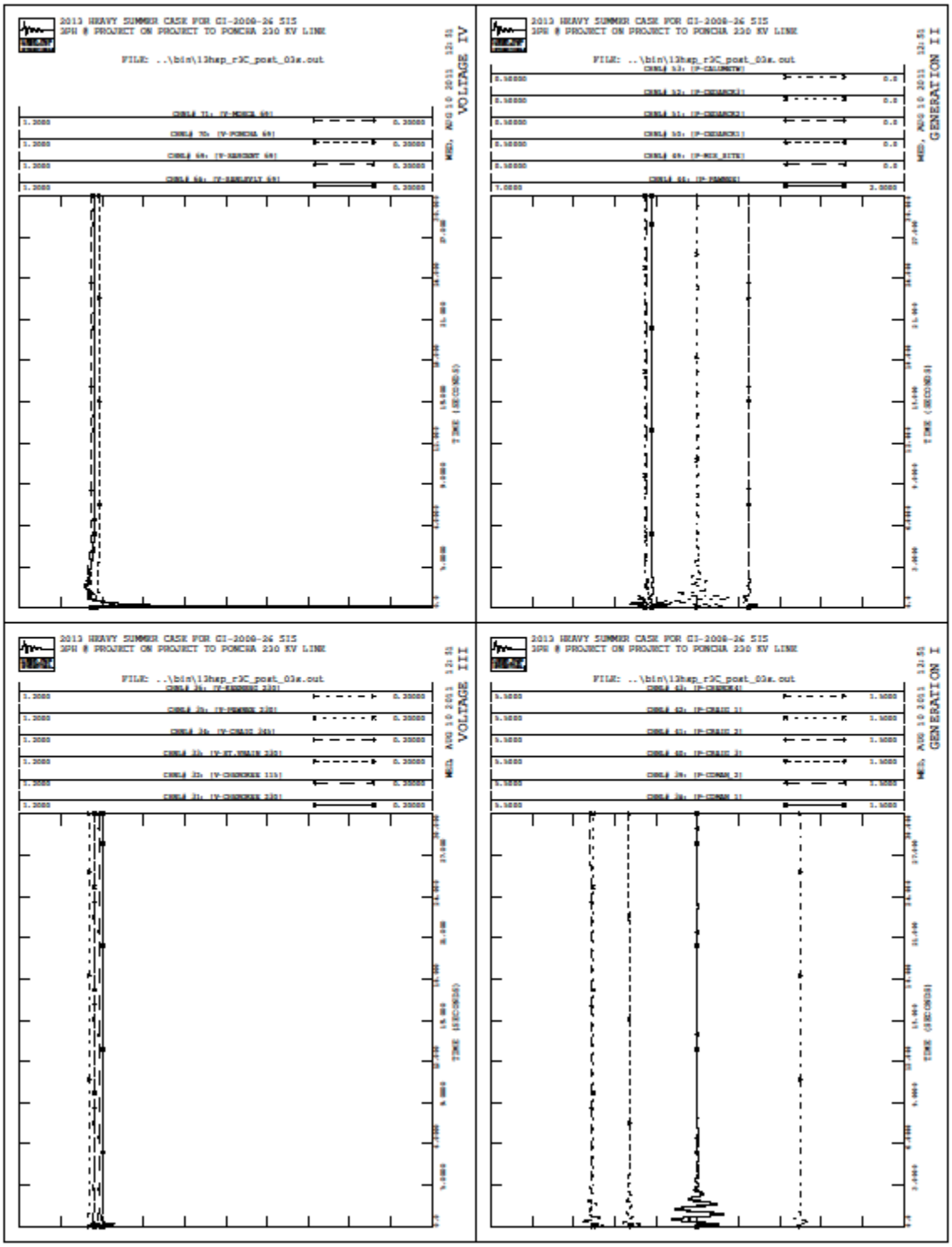
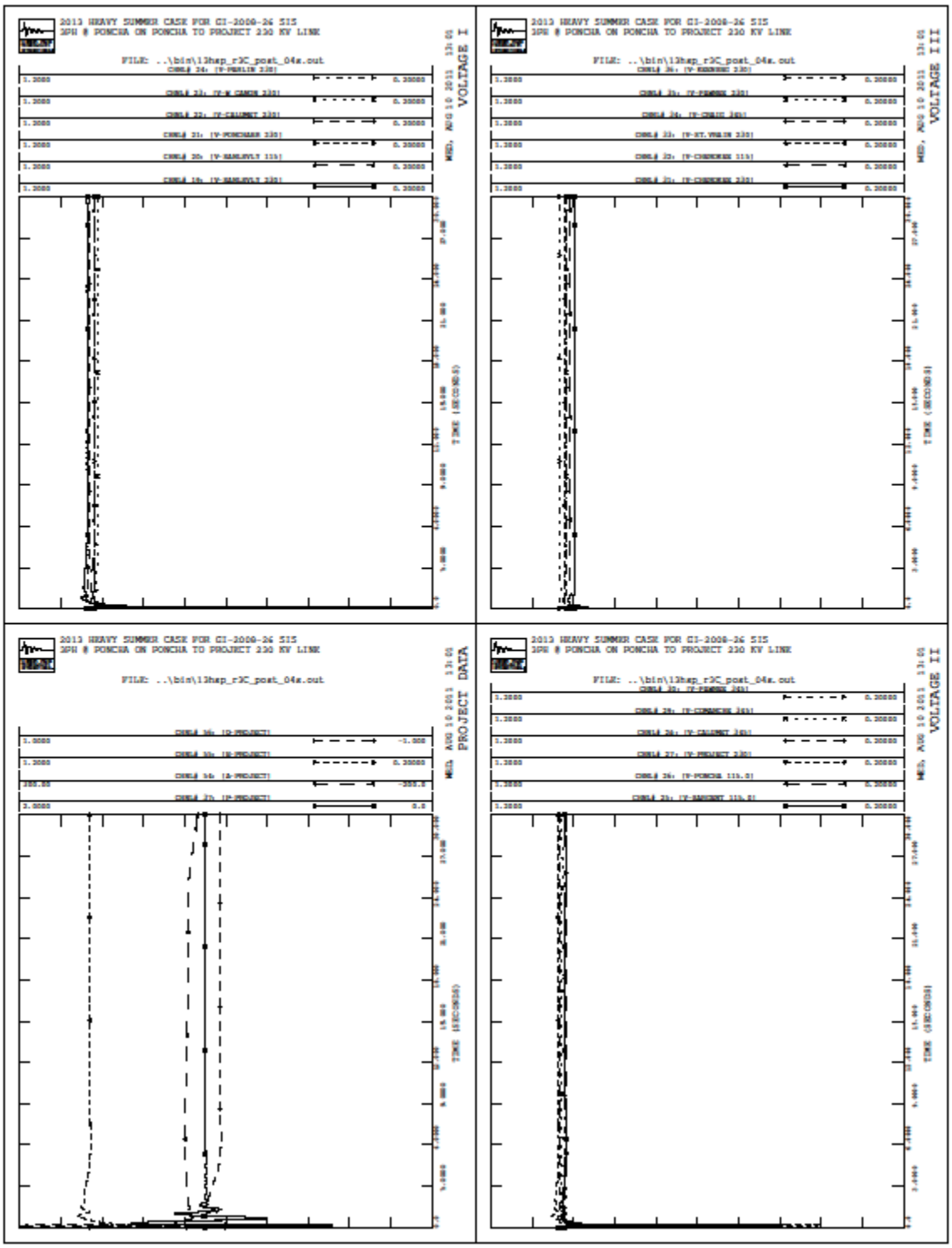
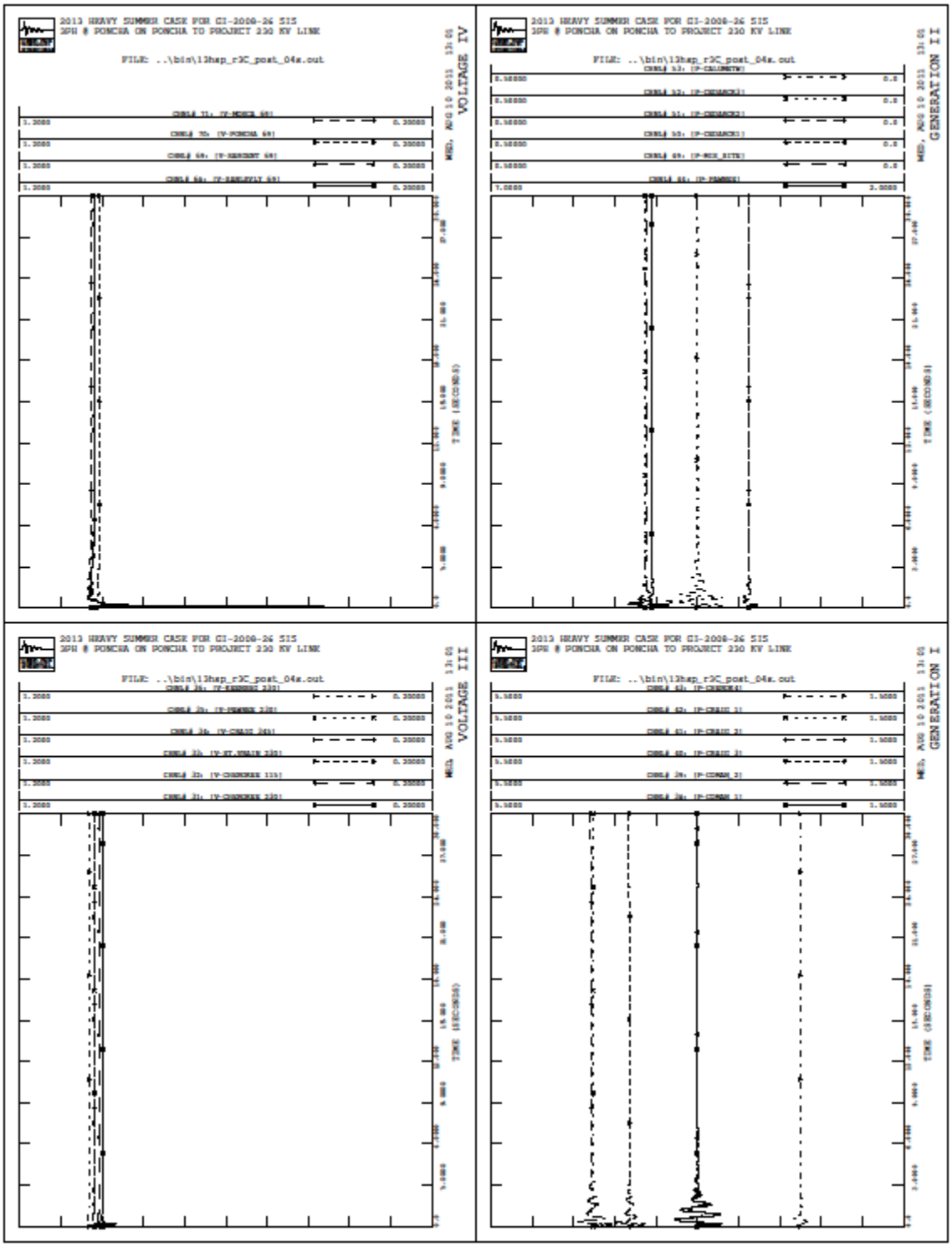
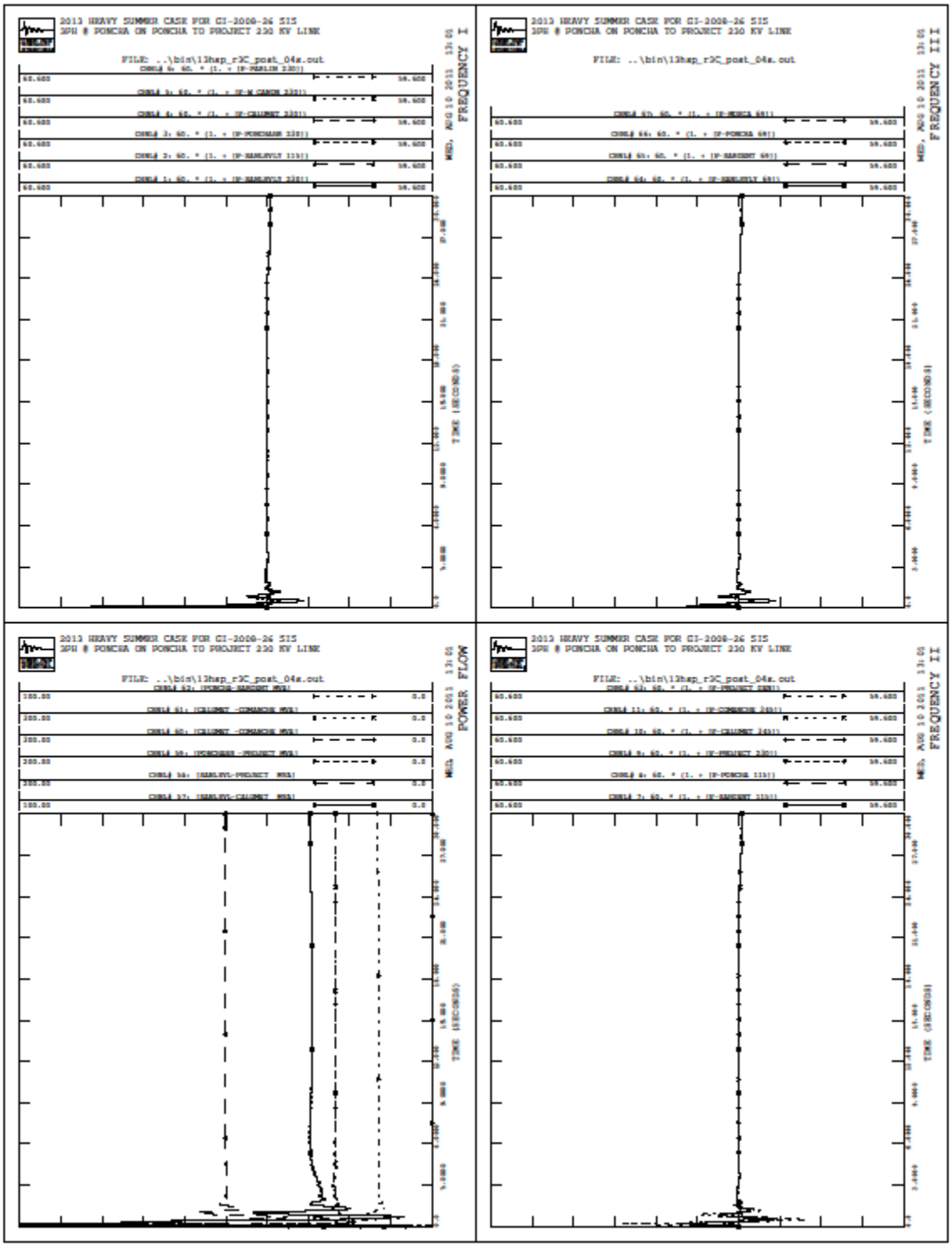
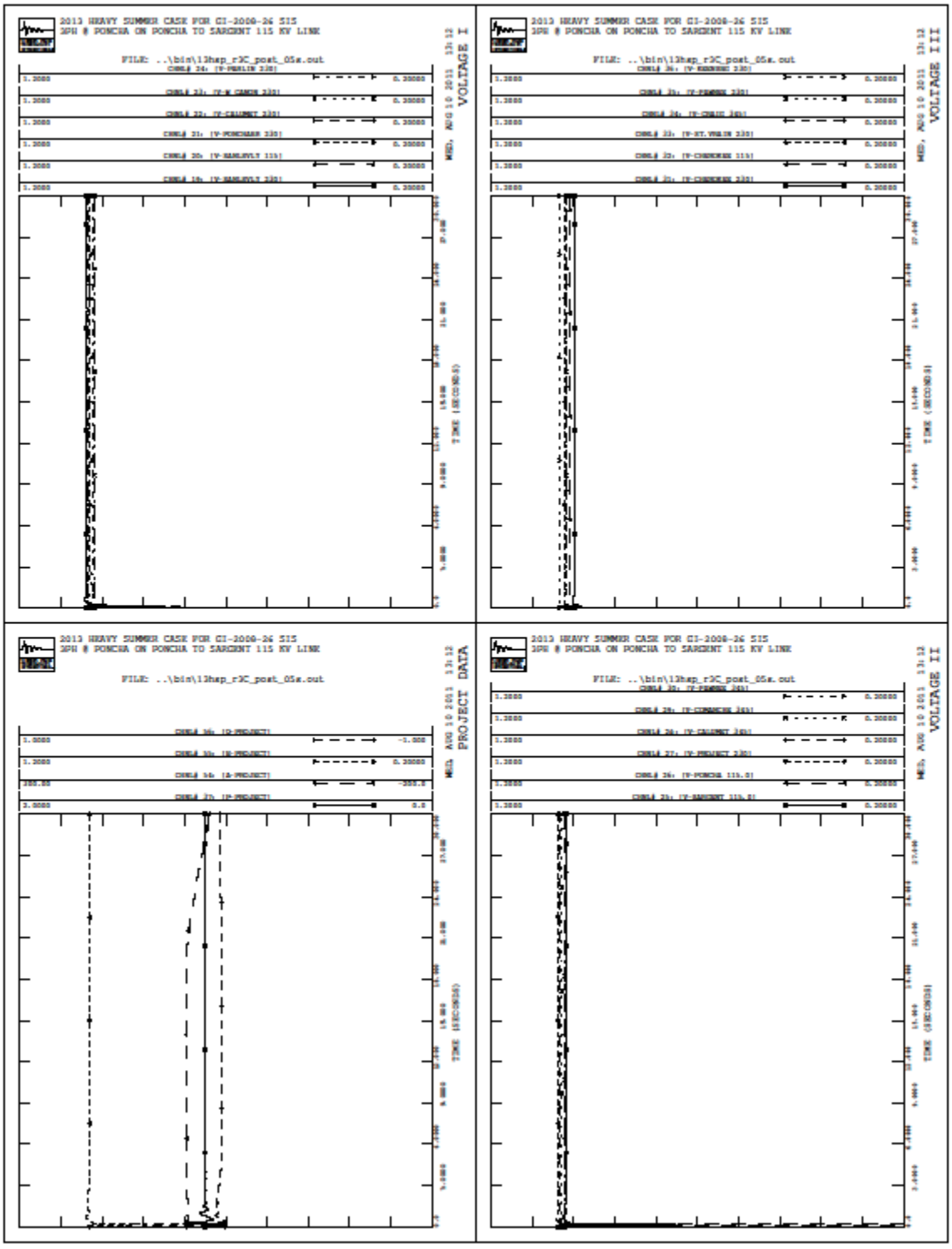
FILE: ..\bin\13hsp_r3C_post_03s.out
VOLTAGE IV
2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ PROJECT ON PROJECT TO PONCHA 230 KV LINE
FILE: ..\bin\13hsp_r3C_post_03s.out
GENERATION II
2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ PROJECT ON PROJECT TO PONCHA 230 KV LINE
FILE: ..\bin\13hsp_r3C_post_03s.out
VOLTAGE III
2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ PROJECT ON PROJECT TO PONCHA 230 KV LINE
FILE: ..\bin\13hsp_r3C_post_03s.out
GENERATION I


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ PROJECT ON PROJECT TO PONCHA 230 KV LINE
FILE: ..\bin\13hsp_r3C_post_03s.out
VOLTAGE IV
GENERATION II
VOLTAGE III
GENERATION I
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
2PH @ PONCHA ON PONCHA TO PROJECT 230 KV LINE
FILE: ..\bin\13hsp_r3C_post_04s.out
VOLTAGE I
VOLTAGE II
VOLTAGE III
PROJECT DATA
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ PONCHA ON PONCHA TO PROJECT 230 KV LINK
FILE: ..\bin\13hsp_r3C_post_04s.out
VOLTAGE IV
GENERATION II
VOLTAGE III
GENERATION I
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
2PH @ PONCHA ON PONCHA TO PROJECT 230 KV LINE
FILE: ..\bin\13hsp_r3C_post_04s.out
FREQUENCY I
FREQUENCY III
POWER FLOW
FREQUENCY II


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ PONCHA ON PONCHA TO SARGENT 115 KV LINK
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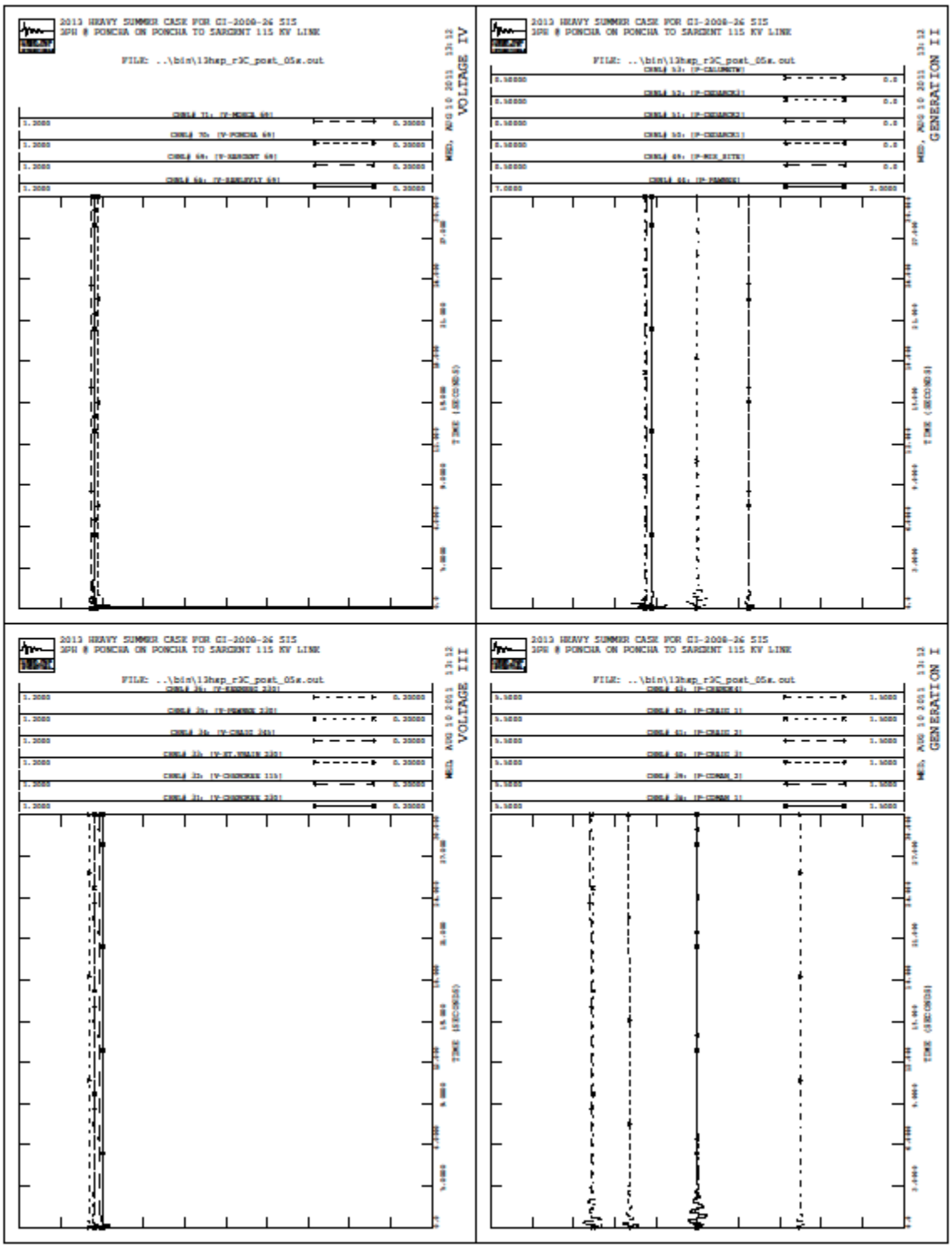
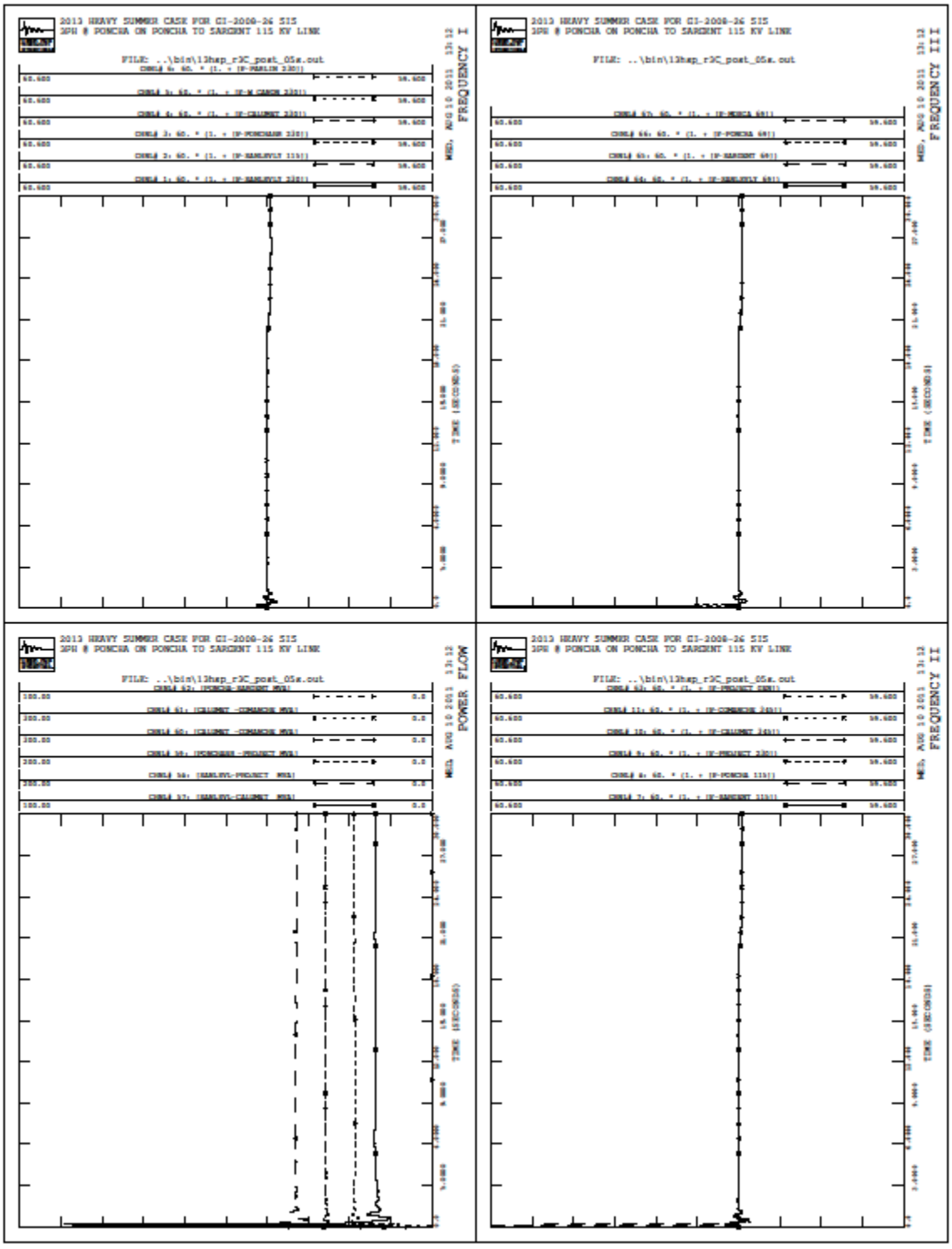
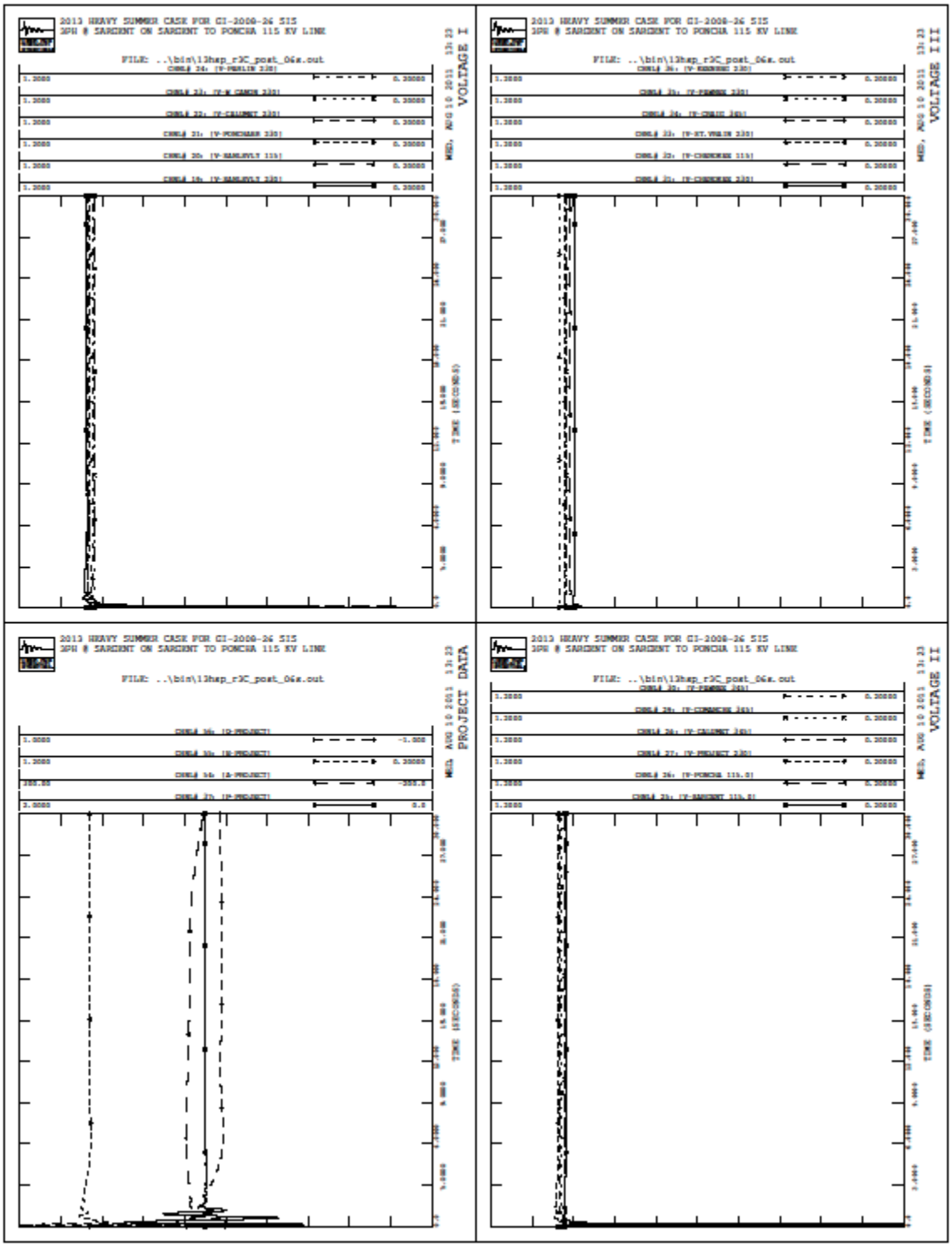
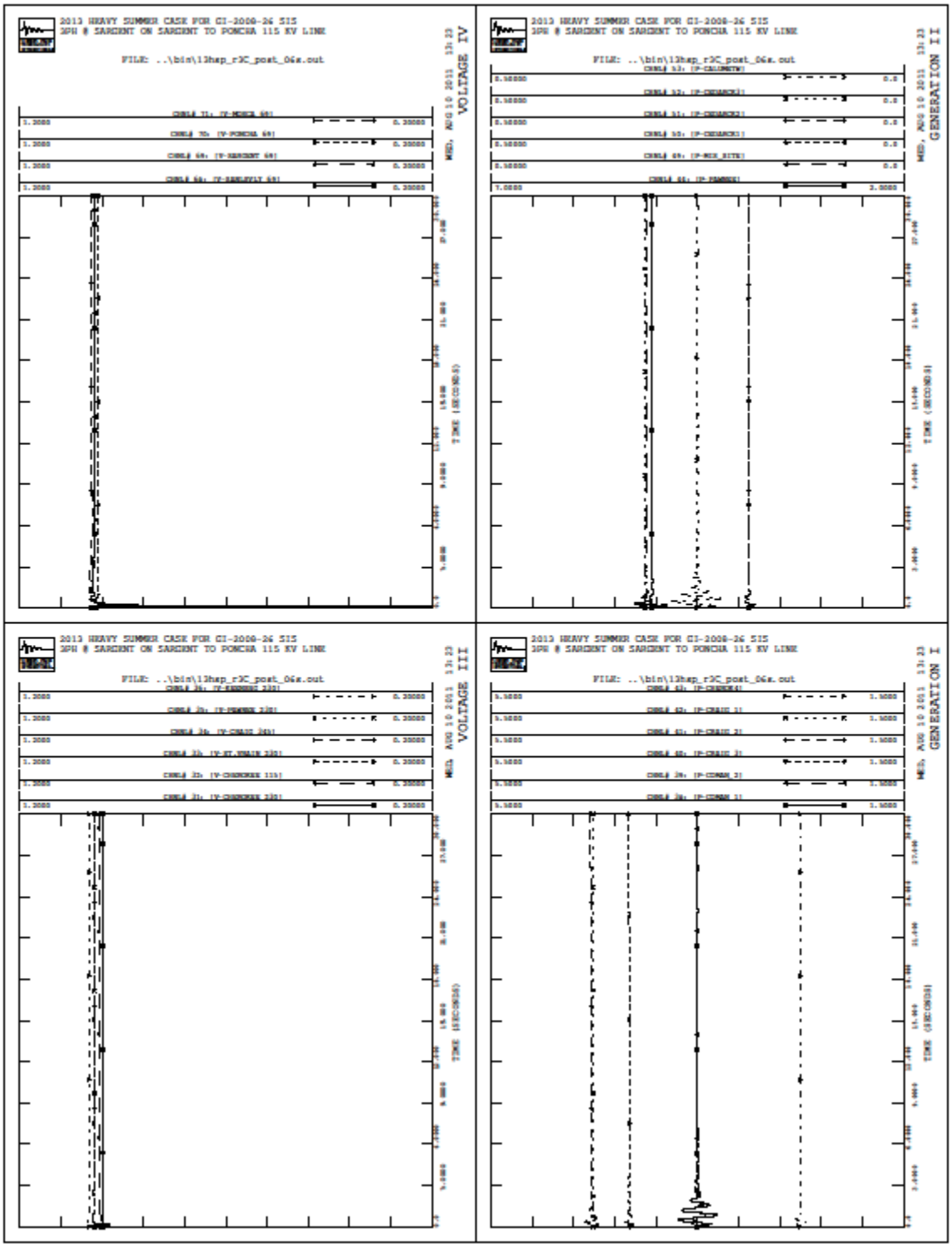
VOLTAGE I
VOLTAGE II
VOLTAGE III
PROJECT DATA
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
2PH @ PONCHA ON PONCHA TO SARGENT 115 KV LINE
FILE: ..\bin\13hsp_r3C_post_05s.out
VOLTAGE IV
GENERATION II
VOLTAGE III
GENERATION I


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ PONCHA ON PONCHA TO SARGENT 115 KV LINE
FILE: ..\bin\13hsp_r3C_post_05s.out
FREQUENCY I
FREQUENCY II
FREQUENCY III
POWER FLOW
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ SARGENT ON SARGENT TO PONCHA 115 KV LINE
FILE: ..\bin\13hap_r3C_post_06s.out
VOLTAGE I
VOLTAGE II
PROJECT DATA


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ SARGENT ON SARGENT TO PONCHA 115 KV LINE
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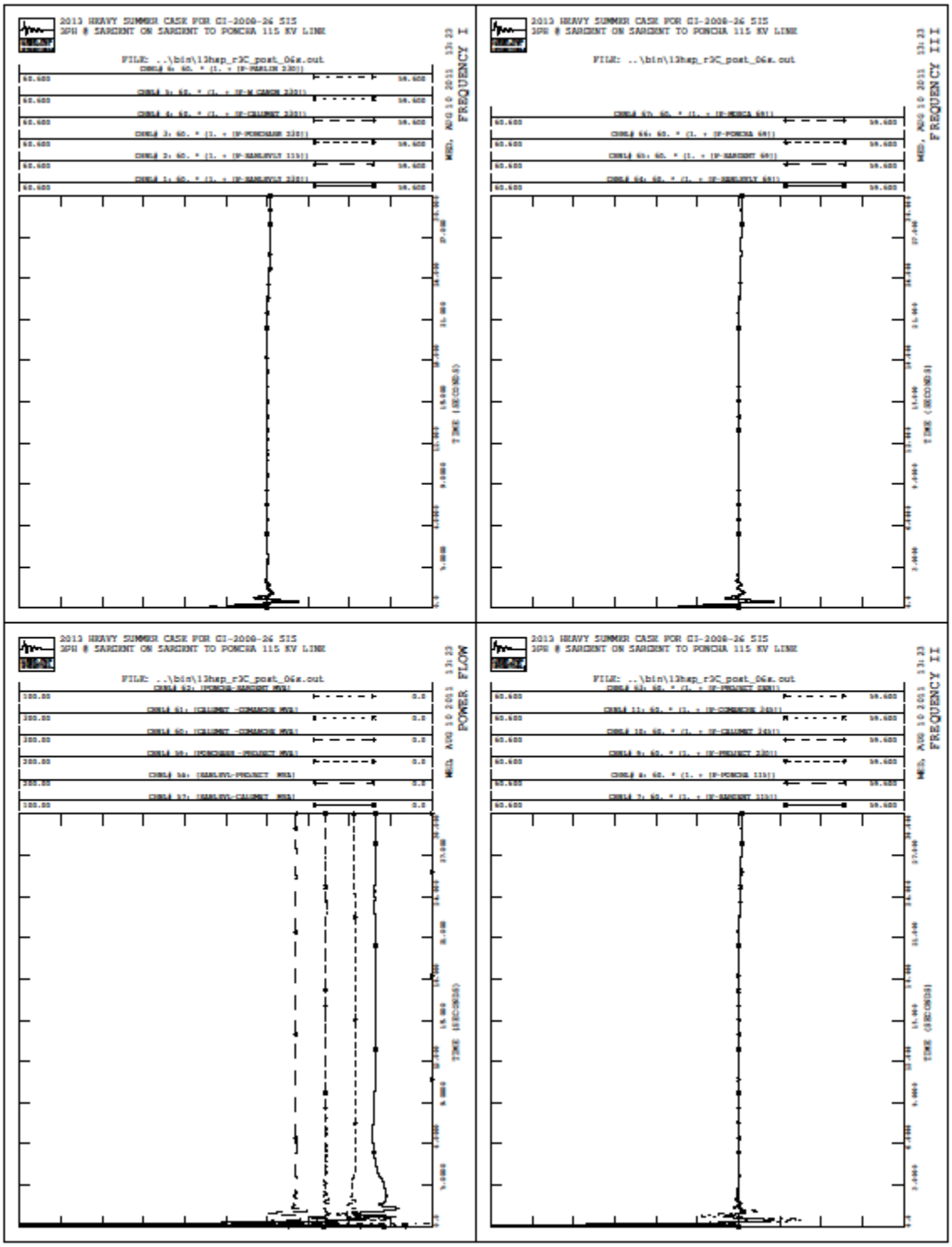
VOLTAGE IV
GENERATION II
VOLTAGE III
GENERATION I
TIME (SECONDS)


2013 HEAVY SUMMER CASE FOR GI-2008-26 SIS
3PH @ SARGENT ON SARGENT TO PONCHA 115 KV LINE
FILE: ..\bin\13hsp_r3C_post_06s.out
FREQUENCY
POWER FLOW
FREQUENCY