

March 8, 2013

Attention: Don Popowich
Director of Facilities
Alberta Utilities Commission
Fifth Avenue Place
4th Floor, 425 - 1 Street SW
Calgary, AB T2P 3L8

Dear Mr. Popowich:

Re: Application to the Alberta Utilities Commission (AUC) for approval of the BluEarth Hand Hills Wind Energy Connection Needs Identification Document

Please find enclosed the Alberta Electric System Operator (AESO) application for approval of the Needs Identification Document (NID) for the proposed BluEarth Hand Hills Wind Energy Connection pursuant to Section 34 of the *Electric Utilities Act*.

The AESO understands that ATCO Electric Ltd. will file the related facilities application shortly. The AESO requests that the Commission combine the NID and the facilities application and consider them together pursuant to Section 15.4 of the Hydro and Electric Energy Act.

Please do not hesitate to contact any of the individuals below if you have questions or concerns regarding the foregoing:

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Sincerely,



David Michaud
Manager, Regulatory Services



Alberta Utilities Commission

In the Matter of the Need for the BluEarth Hand Hills Wind Energy Connection

And in the matter of the *Electric Utilities Act*, S.A. 2003, c. E-5.1, the *Alberta Utilities Commission Act*, S.A. 2007, c. A-37.2, the *Hydro and Electric Energy Act*, R.S.A. 2000, c. H-16, the *Transmission Regulation*, AR 86/2007 and Alberta Utilities Commission Rule 007, all as amended

**Application of the Alberta Electric System Operator for
approval of the BluEarth Hand Hills Wind Energy Connection
Needs Identification Document**

PART A - APPLICATION

1 Introduction

1.1 Application – Pursuant to Section 34(1)(c) of the *Electric Utilities Act* (Act) and in accordance with the further legislative provisions set out in the recitals, the Alberta Electric System Operator (AESO) applies to the Alberta Utilities Commission (the “Commission”) for approval of the *BluEarth Hand Hills Wind Energy Connection Needs Identification Document* (Application).

1.2 Application Overview – This Application describes the need for transmission development arising from a request from 1712610 Alberta Ltd., a subsidiary of BluEarth Renewables Inc., (the “market participant”) for transmission system access service for its proposed 80 MW Hand Hills Wind Power wind aggregated generating facility, located in the Hanna area (Facility). Connection of the Facility to the transmission system will require modifying the previously approved Coyote Lake 963S substation¹ and a new 240 kV single-circuit transmission line between the market participant’s proposed Highland 572S collector substation and the Coyote Lake 963S substation (collectively, the Proposed Transmission Development, as further described in Paragraph 2.2). The expected in-service date for the new connection is Q3, 2014.

Having followed the AESO Connection Process,² the AESO has determined that the Proposed Transmission Development provides a reasonable opportunity for the market participant to exchange electricity and is consistent with the AESO’s long-term transmission forecasts and plans for the area. The AESO, in accordance with its

¹ The need for the Coyote Lake 963S substation was approved as part of the Hanna Region Transmission Development, *Decision 2010-592* and Approval No. U2010-435.

² The AESO Connection Process is also referenced in Part C, note iv.

BluEarth Hand Hills Wind Energy Connection Needs Identification Document

responsibility to plan the transmission system, submits this Application to the Commission for approval.^{3,4}

1.3 AESO Directions to the TFO – During the AESO Connection Process, the AESO issued various directions to ATCO Electric Ltd. (ATCO) as the legal owner of transmission facilities (TFO) in the area, including direction to assist the AESO in preparing its needs identification document.⁵

³ Some of the legislative provisions relating to the AESO's planning duties and duty to provide system access service are referenced in Part C, notes I and ii.

⁴ Application scope is further addressed in Part C, note v.

⁵ The directions are described in more detail in the following sections of this Application and in Part C, note vi.

2 Need Overview and Proposed Transmission Development

2.1 Duty to Provide Transmission System Access Service – The AESO, pursuant to its responsibilities under Section 29 of the Act, must provide system access service on the transmission system in a manner that gives all market participants a reasonable opportunity to exchange electric energy and ancillary services.

The market participant has requested connection of its Facility to the transmission system, thereby establishing the need for transmission development. Through the AESO Connection Process, the AESO, ATCO and the market participant have collaborated to determine the characteristics of the Proposed Transmission Development and the AESO has assessed the impacts of connecting the Facility to the transmission system and issued directions to ATCO to prepare a transmission facility proposal⁶ to meet the market participant's need.

2.2 Proposed Transmission Development – The Proposed Transmission Development is comprised of a new single-circuit 240 kV transmission line with a minimum 275 MVA capacity connecting the market participant's proposed Highland 572S substation to the Coyote Lake 963S substation; modifications to the Coyote Lake 963S substation including the addition of two 240 kV circuit breakers; and associated switching, connections, protections, controls and telecommunications.⁷

2.3 Proposed Transmission Development Cost – ATCO estimated the in-service cost of the Proposed Transmission Development to be in the order of \$24 million (+20%/-10%). In accordance with the ISO Tariff, the AESO has determined that there are no system related costs in respect of the Proposed Transmission Development.

⁶ Also referred to as facility application, or FA, under Commission Rule 007.

⁷ Details and configuration of equipment required for the Proposed Transmission Development, including substation single-line diagrams, are more specifically described in the AESO's Functional Specification included in ATCO's transmission facility proposal. Also, further details will be determined as detailed engineering progresses and the market participant's operating requirements are finalized. Routing and/or siting of transmission facilities do not form part of this Application and are addressed in ATCO's facility

2.4 Transmission Development Alternatives – No alternatives to the Proposed Transmission Development were identified by the AESO or ATCO.

2.5 Connection Assessment – Power flow, transient stability and short circuit analyses were conducted for Category A (all elements in service) and Category B (single element out of service) operating conditions to assess transmission system performance prior to, and following, connection of the proposed Facility. Transfer out analysis was also performed to determine the effectiveness of generators to relieve transmission constraints. The load and generation assumptions used in the analyses align with the AESO *2012 Long-term Outlook* (2012LTO) with a variance for forecast wind generation to capture uncertainties regarding the timing of future wind projects. The 2012LTO is used by the AESO to assess adequacy of the regional transmission system and to identify future transmission system expansion and enhancement plans.

Power flow analysis indicates that while connection of the Facility will not cause any overloads or voltage violations under Category A conditions, it will exacerbate existing or cause new overloads under the studied Category B contingencies for each of the 2014 and 2017 post-connection study years.

The analysis demonstrates that the identified 2014 overloads will be resolved by 2017 when the Central East Transmission Development (CETD)⁸ and the Eastern Alberta Transmission Line (EATL)⁹ are planned to be in-service. Until such time as the specified developments are in place, the AESO will analyze and implement or modify

proposal. Market participant facilities that may subsequently be connected to the Proposed Transmission Development are the responsibility of the market participant and are not included in the Application.

⁸ AESO, Central East Region Transmission System Development Needs Identification Document, Proceeding ID No. 645, *Decision 2011-048*.

⁹ ATCO Electric Ltd., Eastern Alberta Transmission Line Project, Proceeding ID No. 1069, *Decision 2012-303*.

operating procedures, including remedial action schemes, to relieve overloads as system conditions require.¹⁰

Power flow analysis for the 2017 study year shows new overloads on 7L129 transmission line that are not resolved by the CETD and EATL developments. The AESO is currently undertaking a comprehensive, long-term (2012-2032) review of the Central East Region which is expected to be completed by mid-2013. Early assessments indicate that additional system need identification documents or amendments to the approved CETD may be required in the area to address constraints; the AESO anticipates filing these need identification documents or amendments in the next 12-24 months. The AESO will develop operational measures, including remedial action schemes, to manage constraints in the area until adequate transmission is approved and constructed.

Based on the transient stability and short circuit analyses, connection of the Facility did not affect the response of the system under transient conditions and did not materially change the current fault levels in the system.

2.6 Participant Involvement Program – The AESO directed ATCO to assist the AESO in conducting a participant involvement program (PIP) in accordance with Commission Rule 007, NID13 and Appendix A. The AESO and ATCO utilized various methods to notify occupants, residents and landowners of the need for the Proposed Transmission Development in the area where transmission facilities could be installed to address the identified need. The AESO knows of no concerns related to the need for the Proposed Transmission Development.¹¹

2.7 Environmental and Socio-Economic Overview – As potential environmental effects are related to siting, routing, and on-going operations of the Proposed

¹⁰ The AESO develops appropriate ISO Rules (including remedial action schemes) and practices to address transmission constraints that may materialize from time to time. The creation and management of such ISO rules pertain to operational matters that are beyond the scope of this NID.

¹¹ Further information regarding the AESO's PIP for this Application is included as Appendix B.

Transmission Development, the AESO has not undertaken a separate environmental and socio-economic assessment of the sort contemplated in Commission Rule 007, section 6.1 – NID12. The AESO has been advised that ATCO's facility proposal will contain information in respect of Commission Rule 007, section 6.1 – NID12.¹²

2.8 Approval is in the Public Interest – Having regard to the following:

- the transmission planning duties of the AESO as described in Sections 29, 33 and 34 of the Act;
- the Connection Assessment;
- information obtained from the AESO PIP activities; and
- the AESO's long-term transmission system plans,

it is the conclusion of the AESO that the Proposed Transmission Development provides a reasonable opportunity for the market participant to exchange electricity. Further, the AESO confirms that the load and generation forecasts used in the AESO's Connection Assessment are consistent with the *AESO 2012 Long-term Outlook* used for transmission system planning and that connection to the transmission system as proposed is consistent with other system plans in the area. In consideration of these factors, the AESO submits that approval of the Application is in the public interest.

¹² As per Appendix D of this Application, the AESO has been advised that ATCO's facility proposal will contain information in respect of Commission Rule 007, Section 6.1 – NID12.

3 Request to Combine this Application with the Facility Proposal for Consideration in a Single Process

3.1 Pursuant to subsection 35(1) of the Act, the AESO has directed ATCO to prepare a transmission facility proposal to meet the need identified. The AESO understands that ATCO's facility proposal will be filed shortly.¹³ The AESO requests, and expects that ATCO will also request, that this Application be combined with the facility proposal for consideration by the Commission in a single process. Such a request is consistent with the principles contemplated by section 15.4 of the *Hydro and Electric Energy Act* and section 6 of Commission Rule 007. 3.2 While it is believed that this Application and the facility proposal will be materially consistent, the AESO respectfully requests that in its consideration of both, the Commission be mindful of the fact that the documents have been prepared separately and for different purposes. The purpose of this Application is to obtain approval for the identified transmission system need and provide a preliminary description of the manner proposed to meet that need. In contrast, the facility proposal will contain more detailed engineering and designs for the Proposed Transmission Development and seek approval for the construction and operation of specific facilities.

¹³ The AESO understands that ATCO intends to file a facility proposal relating to this Application to be titled *Hand Hills Transmission Project*.

4 Relief Requested

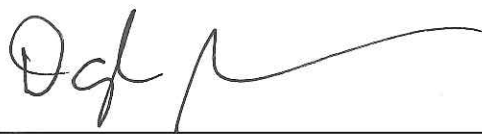
4.1 Having regard to the factors set out in section 38 of the *Transmission Regulation*, and in particular, subsections 38(d) and (e), the AESO submits that its assessment of the need to meet the market participant's request for transmission system access service is technically complete and that approval of the need for the Proposed Transmission Development is in the public interest.

4.2 For the reasons set out above, the AESO requests that the Commission approve this Application, and issue an approval indicating that the AESO has processed the requests for transmission system access according to the AESO Connection Process and determined that the Proposed Transmission Development, consisting of the following elements, is needed to address the market participant's request:

- A. Add a 240 kV single circuit transmission line to connect the proposed market participant's Highland 572S substation to the Coyote Lake 963S substation;
- B. Modify Coyote Lake 963S substation as required including the addition of two 240 kV circuit breakers; and
- C. Modify, alter, add or remove equipment and any operational, protections, control and telecommunication devices required at existing facilities in the area to undertake the work described above, and to ensure proper integration with the transmission system.

All of which is respectfully submitted this 8th day of March 2013.

Alberta Electric System Operator



Doyle Sullivan, P. Eng.
Director, Regulatory Services

Alberta Electric System Operator

PART B – APPLICATION APPENDICES

The following appended documents support the Application (Part A). They are provided for reference purposes only. The documents, and the work they represent, are not intended to be taken as the complete body of work conducted by the AESO, in the execution of its duties to plan the transmission system, or in the preparation of this application.

APPENDIX A **Connection Assessment** – Appendix A contains the *Engineering Study Report, Joss Wind Hand Hills: Aggregated Generation Facility Interconnection*, which contains an assessment of transmission system performance prior to and following the connection of the Proposed Transmission Development. Appendix A describes the study scope and methodology, assumptions, reliability criteria and detailed results. As part of the AESO Connection Process, a consultant was engaged to conduct the connection assessment (Study). The AESO defined the Study scope, and provided the system models and Study assumptions. The AESO also reviewed this report and its conclusions, and finds the Study acceptable for the purposes of assessing the impacts of the Proposed Transmission Development on the transmission system.

APPENDIX B **AESO PIP** – Appendix B contains a summary of the PIP activities conducted regarding the need for the Proposed Transmission Development. Copies of the relevant materials distributed during the PIP are attached for reference.

APPENDIX C **TFO Capital Cost Estimate** – Appendix C contains detailed cost estimates corresponding to the Proposed Transmission Development. These estimates have been prepared by ATCO at the direction of the AESO. The estimates are prepared to an approximate accuracy level of +20%/-10% which exceed the accuracy requirement of Commission Rule 007, NID10.

APPENDIX D **TFO confirmation that Commission Rule 007 NID 12 aspects are being addressed in Facility Proposal** – Appendix D contains a letter provided by

BluEarth Hand Hills Wind Energy Connection Needs Identification Document

ATCO confirming that the seven major aspects of Commission Rule 007, NID 12 are addressed throughout ATCO's facility proposal.

PART C – REFERENCES

- i. **AESO Planning Duties and Responsibilities** – Certain aspects of AESO duties and responsibilities with respect to planning the transmission system are described in the Act. For example, section 17, subsections (g), (h), (i), and (j), describe the general planning duties of the AESO.¹⁴ Section 33 of the Act states that the AESO “must forecast the needs of Alberta and develop plans for the transmission system to provide efficient, reliable, and non-discriminatory system access service and the timely implementation of required transmission system expansions and enhancements”. Where, as in this case, the market participant is requesting system access service, the AESO must prepare and submit for Commission approval, as per section 34(1)(c), a needs identification document that describes the need to respond to requests for system access service, including the assessments undertaken by the AESO regarding the manner proposed to address that need. Other aspects of the AESO’s transmission planning duties and responsibilities are set out in sections 8, 10, and 11, of the *Transmission Regulation*.
- ii. **Duty to Provide Transmission System Access** – Section 29 of the Act describes that the AESO “must provide system access service on the transmission system in a manner that gives all market participants wishing to exchange electric energy and ancillary services a reasonable opportunity to do so”.
- iii. **AESO Planning Criteria** – The AESO is required to plan a transmission system that satisfies applicable reliability standards. The AESO Planning Criteria is described at:
<http://www.aeso.ca/rulesprocedures/8677.html>.¹⁵
- iv. **AESO Connection Process** – For information, the AESO transmission system Connection Process, which changes from time to time, is generally described at:
<http://www.aeso.ca/8602.html>.¹⁶
- v. **Application for Approval of the Need for Expansion or Enhancement of the Capability of the Transmission System** – This Application is directed solely to the question of the need for expansion or enhancement of the capability of the transmission system. Any reference within the Application to existing market participants or other parties and/or the facilities they may own and

¹⁴ The legislation and regulations refer to the Independent System Operator or ISO. “AESO” and “Alberta Electric System Operator” are the registered trade names of the Independent System Operator.

¹⁵ This link is provided for ease of reference and does not form part of this Application.

¹⁶ This link is provided for ease of reference and does not form part of this Application.

BluEarth Hand Hills Wind Energy Connection Needs Identification Document

operate or may wish to, own and operate is not intended to constitute an application for approval of such facilities, and the responsibility for seeking such regulatory or other approval remains the responsibility of such market participant or other party.

- vi. **Directions to the TFO** – Pursuant to subsection 35(1) of the Act, the AESO has directed the TFO, in whose service territory the need is located, to prepare a facility proposal to meet the need identified. The facility proposal is also submitted to the Commission for approval. The TFO has also been directed by the AESO under section 39 of the Act to prepare a proposal to provide services to address the need for the Proposed Transmission Development. The AESO has also directed the TFO, pursuant to section 39 of the Act and section 14 of the *Transmission Regulation*, to assist in the preparation of the AESO's Application.
- vii. **Capital Cost Estimates** –The provision of capital costs estimates in the Application is for the purposes of relative comparison and context only. The AESO's responsibilities in respect of project cost reporting are described in the *Transmission Regulation*, including section 25, and AESO Rule 9.1.

APPENDIX A CONNECTION ASSESMENT

BluEarth Hand Hills Wind Project

RP-05-678

The attached engineering study report has been prepared by a third party as part of the AESOs connection process. The AESO has reviewed the report and the conclusions that it contains, and finds it acceptable for the purpose of assessing potential impacts of the proposed connection on the transmission system.

Information regarding the AESO's connection process can be found at:
<http://www.aeso.ca/8602.html>

Date: March 4, 2013

Function	Name	Company	Signature	Date
Engineer	Mahmoud (Maz) Mazadi P.Eng.	Alberta Electric System Operator	<i>Mazadi</i>	March 4 2013
Technical Resource Manager	Sami Abdulsalam P.Eng.	Alberta Electric System Operator	<i>S. Abdulsalam</i>	March 4th 2013

Public

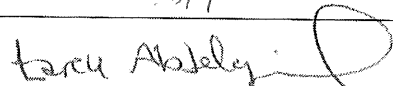
Engineering Study Report

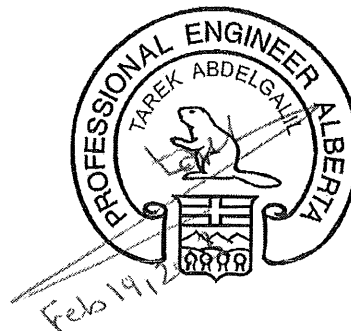
BluEarth Wind Hand Hills: Aggregated Generating Facilities Interconnection

File No. RP-05-678

Revision: 1

Jan 11, 2013

	Name	Date	Signature
Prepared by:	Jeffrey Jiang	Feb 19, 2013	
Reviewed by:	Frida Ceja-Gomez	Feb 19, 2013	
Approved by:	Tarek Abdelgalil	Feb 19, 2013	



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Executive Summary

1712610 Alberta Ltd. (BluEarth Renewables Inc.) submitted a Preliminary Assessment Application to the AESO for the connection of the proposed 78.2MW BluEarth Hand Hills Wind Aggregated Generation Facility (Project). The Project is located at LSD1 SEC18 TWP30 RGE16 M4M in the Hanna area. The proposed Project consists of 34 wind-turbine driven generators with a rating of 2.3MW each. The forecast In Service Date (ISD) for this Project is Q3, 2014.

The purpose of this study is to evaluate the proposed connection alternative(s) and identify any violation to the reliability criteria associated to the connection of the Project to the Alberta Interconnected Electrical System (AIES). Steady-state, short-circuit, and dynamic analyses are performed before and after the connection of the Project. The system performance is then evaluated and compared according to the relevant criteria, standards and requirements of the AESO.

The study covers the AESO planning areas Hanna (42), Sheerness (43), Battle River/Alliance (36), Wainwright (32), and Provost (37). The main interconnection points in the study area consist of the 240kV Anderson 801S and Cordel 755S substations, while the sub-transmission is carried at voltage levels of 138/144kV and 69/72kV. As part of the approved Hanna Region Transmission Development (HRTD), two new substations (Coyote Lake 963S and Oakland 946S) are planned to transfer the wind power from the Hand Hills area to the 240kV transmission system. It is assumed that both substations connecting to the new 240kV line 9L29 will be in service prior to the commissioning of the Project.

Two connection alternatives are considered for this Project:

- *Alternative 1: Direct connection to the 240kV Coyote Lake 963S substation.* This alternative is selected based on proximity to the Project and available power transfer capacity.
- *Alternative 2: Tapping of 72kV line 6L56.* After a preliminary evaluation, this alternative is discarded due to the limited thermal capacity of this line (6L56).

This report investigates and evaluates Alternative 1 only. Detailed technical analysis for Alternative 1 reveals the following:

- Following the Project connection, no thermal overloads or voltage violations are observed for the 2014 and 2017 study scenarios under normal (N-0) operating conditions.

In the 2014 cases, overloads on the 240/144kV Nevis Transformer and the 144kV line 7L50 (Jarrow Tap to Buffalo Creek) are observed for a number of (N-1) contingencies. Also, the outage of line 9L29 results in some overloads on some 144kV network elements (lines 7L159, 7L16, 7L85, and 7L128).

- In the 2017 cases, overloads on 144kV line 7L129 are observed for three difference contingencies (749L, 9L912 and 7L701). The AESO will address the demonstrated 2017SP overloads on 7L129 under N-1 contingencies prior to 2017. In addition to the remedial measure by HVDC dispatch described in section 6.5.2, the AESO is in the process of updating its regional plans, including that of the Central Region which will include a review of the approved Central East Transmission Development (CETD) and options to alleviate this constraint. The AESO will file the related needs identification

documents that may be necessary with the Alberta Utilities Commission once the Central Region plan has been completed.

- For 2014, the existing Halkirk RAS with some modifications proposed in this study will be employed to relieve (N-1) overloads.
- For 2014, development of a new RAS to run back the Project will be required to avoid the overloads observed on the 144kV transmission network elements west of Hanna following the loss of the 240kV line 9L29.
- For 2017, one option to reduce overload on 7L129 following the outage of 749L is to adjust HVDC dispatch level.
- Transient stability analysis with the connection of the Project is performed and the result shows that the system remains stable under all simulated contingencies.
- The connection of the project does not increase the short-circuit levels reported at Oakland 946S, Coyote Lake 963S, and Michichi Creek 802S. This is because the Project makes use of Type 4 wind turbines which effectively block any short-circuit current contribution to the system due to their configuration.

The study recommendations are as follows:

- Connect the Project to the new 240kV Coyote Lake 963S substation via a short single-circuit 240kV line.
- Modify the Halkirk RAS to enable the Project connection by 2014 as follows:
 - i. Run back or trip the Project for the overload observed on line 7L50.
 - ii. Run back or trip the Project for the overload observed on the 240/144kV Nevis transformer 766S 901T
- Develop a Remedial Action Scheme (RAS) to run back the Project following the loss of the 240kV line 9L29 (Oakland 946S to Coyote Lake 963S).

As load flow results indicated, the need for these RAS will be eliminated by 2017 when the CETD and ETAL project are in service.

1. Introduction

This Engineering Study Report presents the results of the study conducted to analyze the proposed connection of the 78.2MW BluEarth Hand Hills wind facility to the AIES.

1.1. The Project

1.1.1. The Project Overview

- Organization proposing the project: 1712610 Alberta Ltd. (BluEarth Renewables Inc.)
- Project content: 78.2MW Wind Aggregated Generation Facility and associated 240/34.5kV substation
- Project location: LSD1 SEC18 TWP30 RGE16 M4M
- Project purpose: Wind power generation
- In-Service date: Q3, 2014

1.1.2. Generation Component

- The proposed Project consists of 34 wind-turbine driven generators with a rating of 2.3MW each, with a total capacity of 78.2MW.
- Potential Supply Transmission Service (STS) after project connection: 78.2MW
- Possible Future Expansion: Customer advised that there is no plan for future expansion
- The generators are capable of producing 38 MVar when producing the maximum gross active power (78.2 MW).
- The estimated maximum and minimum continuous reactive power capability of the generators is 38 MVar and -38 MVar respectively.

1.2. Study Scope

1.2.1. Study Objectives

The objectives of this study are the following:

- Evaluate the proposed connection alternative(s) and identify the impact of this project on the system performance in terms of any reliability concern.

1.2.2. Study Area

1.2.2.1. Study Area Description

The project is located at approximately 4km southeast of the village of Delia in the Hanna Planning area (Area 42) in the Central Region. The study area includes the following Alberta Electric System Operator (AESO) planning areas: Hanna (42), Wainwright (32), Alliance/Battle

River (36), Provost (37), and Sheerness (43). Figure 1-1 presents a map of the planning areas in the vicinity of the Project.

The project area is primarily served by 138/144kV and 69/72kV transmission networks and two 240kV substations. Currently, there are three major 240kV interconnections from the Hanna region to the AIES bulk system. These three 240kV lines are 912L (Red Deer 63S - Nevis 766S), 9L933/933L (Anderson 801S - West Brooks 28S), and 931L (Ware Junction 132S - West Brooks 28S). The two major thermal power plants in the Hanna region are Sheerness and Battle River, which are connected by the 240kV line 9L59 (Anderson 801S - Cordel 755S).

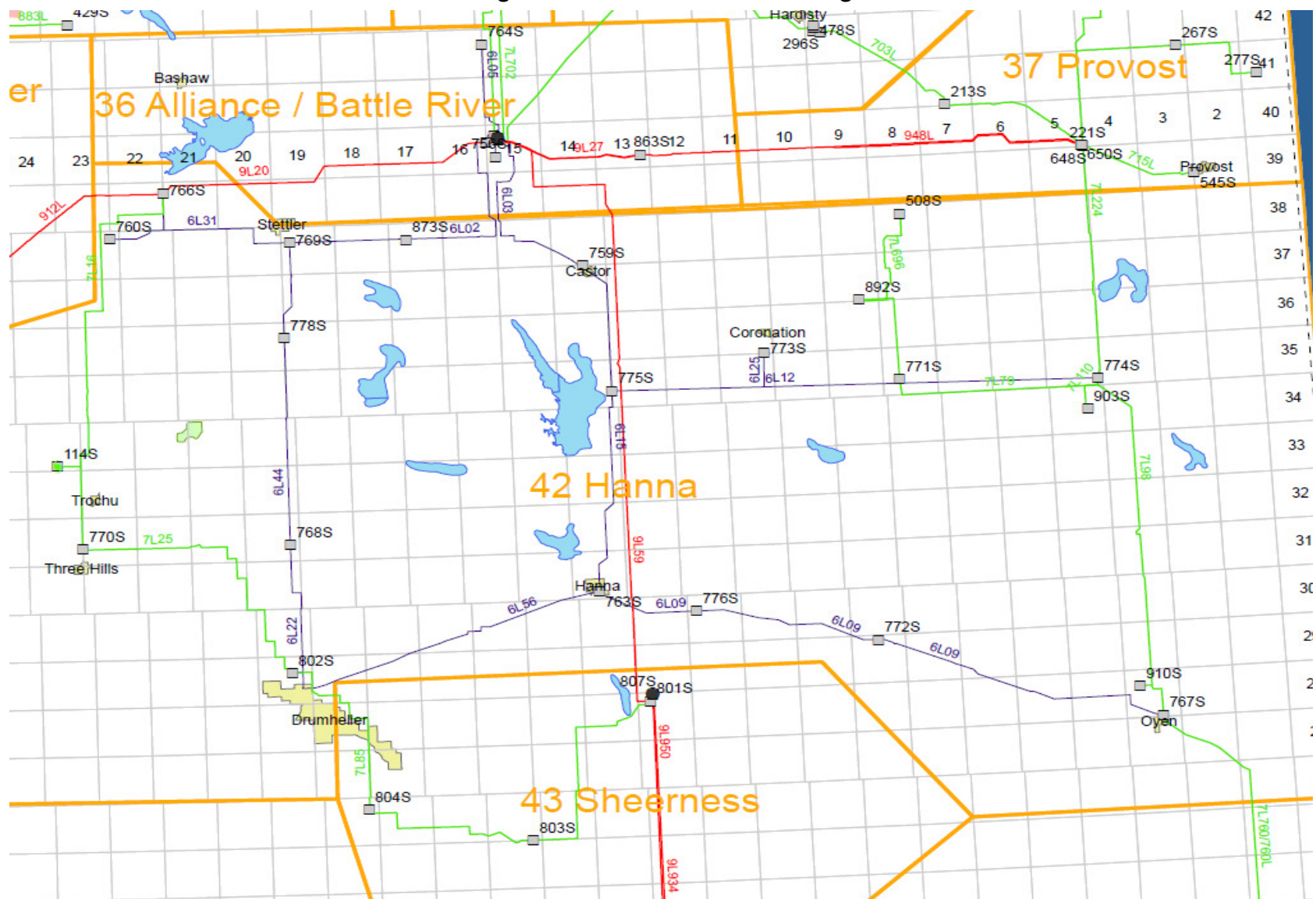
The generation is connected to load centers in the Wainwright and Provost Areas by the 240kV lines 9L953 (Cordel 755S - Hansman Lake 650S), 9L27 (Cordel 755S - Paint Earth 863S), and 9L948 (Paint Earth 863S - Hansman Lake 650S). The 240kV lines 951L and 944L/945L (Ware Junction 132S - Empress 163S) also connect the area generation to load centers in the Empress area.

The loads in the eastern part of the Hanna area are supplied by two 138/144kV sources, one from Hansman Lake 650S and one from Empress 163S. The western part of the Hanna area is supplied by two 144kV sources, one from Nevis 766S and one from Anderson 801S. Under the west part of the Hanna 144kV system, there is also a 72kV network that supplies remote loads. This 72kV system is also connected to Oyen 767S in the east and to Battle River in the northeast.

As part of the approved HRTD, two new substations (Coyote Lake 963S and Oakland 946S) and a new transmission Line 9L29 (Oakland 946S-Coyote Lake 963S) are planned to enable wind power transfer from the Hand Hills area via the 240kV transmission system.

The transmission system configuration in the study area for the proposed wind aggregated generation facilities (WAGF) projects is presented in Figure 1-2 and Figure 1-3.

Figure 1-1: AESO Central Planning Areas

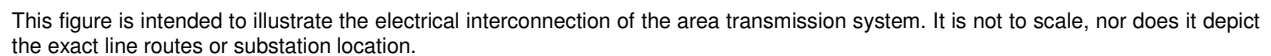


SNC Lavalin ATP



This figure is intended to illustrate the electrical interconnection of the area transmission system. It is not to scale, nor does it depict the exact line routes or substation location.

Central East Region Transmission Development (CETD)



1.2.2.2. Existing Constraints

The existing constraints in the study area are currently managed by the following RAS:

- 1- Sheerness and Battle River Thermal Protection Scheme (TPS) and RAS:
 - a. Battle River 7L50 and 7L701 TPS
- 2- Suncor Wintering Hills RAS
 - a. Suncor Wintering Hills runback to avoid Michichi Creek 701T and Nevis 701T thermal overloads
- 3- Capital Power Halkirk Project - Remedial Action Schemes associated with the connection of the Capital Power Halkirk Project¹

1.2.2.3. AESO Long-Term Plans

Stage 1 of the approved HRTD plan is assumed to be in service prior to the project connection. Any delay in the construction of the new substations (Coyote Lake 963S and Oakland 946S) or of the 240kV transmission line 9L29 (946S - 963S) will directly affect the ISD of this Project. Tables 1-1 and 1-2 provide a summary of the Hanna region and Central East region projects along with their planned ISDs.

For this study, all the transmission elements identified in these Tables are assumed to be in service as per their In-Service Date.

Table 1-1: Hanna Region Transmission Development Sub-Projects

Project	Sub project	Subproject Name	In-service Date
812	18	Energization 18 - Rowley 768S - Michichi-Three Hills 144kV DC Line 7L25 and salvage of 6L22 and 6L44	June 2012
812	21	Energization 21 - Hardisty Capacitor Bank (Formerly P1024,P1025)	June 2012
812	23	Energization 23 - New 240 kV line 966L from Pemukan 932S - Hansman Lake 650S	May 2013
812	8	Energization 8 - Oakland-Lanfine 240kV S/C Line 9L924	March 2013
812	6	Energization 6 - Relocate 7L98 Oyen 767S - Lanfine 959S	May 2013
812	7	Energization 7 - Oakland 946S 240kV S/S combined with Anderson-Oakland line	March 2013
812	5	Energization 5 - Lanfine-Oyen 144kV S/C Line 7L132	May 2013
812	17	Energization 17 - Heatburg 948S - Three Hills-Nevis 144kV D/C Line 7L16/7L159	May 2013
812	22	Energization 22 - Hansman Lake 650S SVC addition	October 2012

¹ This RAS has been finalized and implemented as of October 2012.

812	24	Energization 24 - New 240kV line 1060L from Ware Junction 132S-Cassils 324S	December 2012
812	19	Energization 19 - Stettler 769S - Nevis 768S 144kV S/C Line 7L143	May 2013
812	20	Energization 20 - Nilrem 574S combined with D/C 240kV 953L - 1047L and Tucuman 478S combined with D/C 138kV 679L-680L (Formerly P1024,P1025)	March 2013
812	12	Energization 12 - New Lanfine-Pemukan 240kV S/C Line 9L46	May 2013
812	16	Energization 16 - Relocate 7L79 line from Monitor 774S - Pemukan 932S	May 2013
812	15	Energization 15 - Pemukan 932S - Monitor 774S 144kV S/C Line 7L127	May 2013
812	13	Energization 13 - Three Hills 770S Capacitor Bank	December 2011
812	9	Energization 9 - Coyote Lake 963S 240kV S/S combined with Oakland-Coyote line	April 2013
812	10	Energization 10 - Coyote Lake 963S - Michichi Creek 802S 144kV SC Line 7L128	May 2013
812	14	Energization 14 - Hansman Lake - Pemukan 240kV S/C Line 9L966	May 2013
812	11	Energization 11 - Pemukan 932S 240 kV Substation	May 2013
812	1	Energization 1 - Youngstone 772S Capacitor bank addition	October 2011
812	3	Energization 3 - New Lanfine 240/144kV substation	March 2013
812	4	Energization 4 - Lanfine 959S 200MVar SVC	May 2013
812	2	Energization 2 - Battle River 757S Capacitor Bank addition	October 2011

Table 1.2: Central East Region Transmission Development

Project	Sub project	ATCO Service Area	In-Service Date
811	1	Cold Lake Area (Without Bonneyville or 7L/9L146) Reinforcements	August 2013
811	2	Cold Lake Area Reinforcements - Bonneyville Sub & 7L/9L146	August 2013
811	3	St. Paul Area Upgrades (Watt Lake 956S & 7LA92 ONLY)	December 2012
811	4	St. Paul Area Upgrades (St. Paul & Whitby Lake Subs & 7L139/7L70)	December 2013
811	5	Vermilion 710S Substation Upgrades	December 2012
811	6	Heisler 764S & 7LA701	December 2012
811	7	Kitscoty 705S & 7L14/7L130	July 2013
811	8	7L749 Replacement	Mid 2015
811	9	Double Circuit Line Clearance Mitigations 7L701	Complete
811	23	Double Circuit Line Clearance Mitigations 7L53/7L117	December 2012
811	22	Double Circuit Line Clearance Mitigations 7L14	December 2012

811	18	7L50 Buffalo Creek substation connection Stage 2 of Central East	May 2015
		ALTALINK Service Area	
811	13	138/69kV transformer addition at Wainwright 51S	Mid-2015
811	14	Build new 415L from Wainwright to Edgerton	July 2014
811	15	Rebuild 749L to service boundary	Mid 2016
811	16	Rebuild 749L/749AL	Mid 2016
811	17	Rebuild 704/704AL	October 2014

1.2.3. Studies Performed

The following studies are performed for the pre-connection and post-connection analyses considering Category A and B:

- Power flow analysis
- Transient stability analysis
- Short-Circuit fault studies
- Transfer-out analysis (effectiveness factors)

1.3. Report Overview

The Executive Summary provides a high-level summary of the report and its conclusions. Section 1 provides an Introduction. Section 2 describes the Criteria, System Data, and Study Assumptions. Section 3 presents the Study Methodology. Section 4 discusses the Pre-Connection System Assessment. Section 5 presents the Connection Alternatives. Section 6 provides a Technical Analysis of the Connection Alternatives. Section 7 provides the Short-Circuit Analysis. Section 8 discusses Project Interdependencies. Section 9 presents a Summary and Conclusion.

2. Criteria, System Data, and Study Assumptions

The system studies are conducted using PTI PSS/E version 32. The following subsections describe the criteria and assumptions used in these studies, and the methodology used in the analyses.

2.1. Criteria, Standards, and Requirements

2.1.1. AESO Transmission Reliability Criteria

The AESO Transmission Reliability Criteria³ is the basis for planning the AES. The transmission system will normally be designed to meet or exceed these criteria under credible worst-case loading and generation conditions. Therefore, the system performance must be evaluated under Category A (N-0) and Category B (N-1) operating conditions.

Category A represents a normal system with no contingencies and all facilities in service. Under these conditions, the system must be able to supply all firm load⁴ and firm transfers to other areas. All equipment must operate within its applicable rating, voltages must be within their applicable range, and the system must be stable with no cascading outages.

Category B events result in the loss of any single specified system element under specified fault conditions with normal clearing. These elements are a generator, a transmission circuit, a transformer, or a single pole of a DC line. The acceptable impact on the system is the same as for Category A.

The AESO Thermal Loading Criteria requires that the continuous thermal rating of any transmission element is not exceeded under normal operating conditions. In this study, thermal limits are assumed to be one hundred per cent of the normal summer and winter ratings. The normal minimum and maximum voltage limits specified by the AESO Transmission Reliability Criteria are used to identify Category A system voltage violations, while the extreme minimum and maximum limits are used to identify Category B system violations. Table 2-1 shows the acceptable steady state voltages for different transmission voltage classes.

Table 2-1: Acceptable Range of Steady State Voltage (kV)

Nominal	Extreme Minimum	Normal Minimum	Normal Maximum	Extreme Maximum
240	220	240	264	264
144	130	137	151	155
138	124	135	145	150
72	65	71	75	78
69	62	65	72	74

³ The AESO Transmission Reliability Criteria is available at:

<http://www.aeso.ca/rulesprocedures/8677.html>

⁴ "Firm load" refers to the load that the ISO and system members will use reasonable best efforts to supply without interruption.

The Voltage Deviation Criteria will be applied for Category B contingency analysis as shown in Table 2-2.

Table 2-2: Acceptable Post Contingency Voltages

Parameter and reference point	Time Period		
	Post Transient (up to 30 sec)	Post Auto Control (30 sec to 5 min)	Post Manual Control (Steady State)
Voltage deviation from steady state at POD low voltage bus.	±10%	±7%	±5%

Thermal limits will be monitored to record any violations based on 100% static seasonal thermal rating. All transmission elements must be operating within their ratings with no thermal overloads. Cascading outages or unplanned loss of load/generation following any simulated contingencies is not allowed. The Alberta system operating limits must be respected, including the minimum acceptable voltages. Any violation will be recorded in the engineering study report.

2.1.2. AESO Operating Policies and Procedures (OPPs) and Authoritative Documents (ADs)

The OPP 702 Voltage control is applied to power flow analysis to ensure a proper voltage profile for all the study base-cases.

2.1.3. Other Requirements

2.1.3.1. Remedial Action Scheme Requirements

RAS may be incorporated to satisfy the AESO Transmission Reliability Criteria performance requirements for contingencies in which the loss of any single transmission element causes overloads on the AIES transmission facilities. The governing ISO Rules and Regulations for the development of RAS are:

- ISO Rule 302.2 Connection RAS
- ISO Rule 9.4 Real Time Transmission Constraints Management
- TR Part 2 Transmission System Planning
- TR Part 3 Transmission System Criteria and Reliability Standards
- Alberta Reliability Standards TPL-001-AB, TPL-002-AB, and TPL-003-AB

2.1.3.2. Wind Aggregated Generation Facility (WAGF) Requirements

The connection of Project is required to meet the technical requirements of ISO Rules Section 502.1: Wind Aggregated Generation Facilities Technical requirements.

2.2. Load and Generation Assumptions

2.2.1. Load Assumptions

Table 2-3 presents the 2014-2017 AESO 2012 Long Term Outlook corporate forecast for the Central and South regions at Alberta Internal Load (AIL) peak. Guidance on the generation and load dispatch to use for this study was received from the AESO.

Table 2-3: Forecasted Area Load for Study Region (2012LTO)

Region Name and Season		Forecast Peak Load (MW)			
		2014	2015	2016	2017
Central	SP	1,570	1,573	1,607	1,630
	WP	1,734	1,756	1,785	1,823
	SL	1,166	1,164	1,198	1,223
South	SP	2,866	2,921	2,983	3,041
	WP	3,066	3,127	3,198	3,267
	SL	1,955	1,985	2,045	2,101
AIL	SP	10,671	11,042	11,457	11,923
	WP	11,764	12,130	12,581	13,005
	SL	7,831	8,128	8,526	8,864

*Note: The Central Region comprises the following AESO planning areas: 56,13,32,37,36,42,35,39,38,30,29 and 34

2.2.2. Generation Assumptions

The existing and proposed generators and their dispatch levels in the Study Region are listed in Table 2-4, Table 2-5 and Table 2-6. The wind dispatch level includes all existing and currently under construction wind generation facilities dispatched up to their contracted MC level. The remaining forecast wind growth is allocated to projects in the South/Central region as identified in Table 2-6 based on project information.

The forecast wind growths are based on the 2012 Long-term Outlook with a variance to capture an uncertainty around the timing of future wind projects

Table 2-4: Summary of Existing Non-Wind Generation in the Study Area

Generator	Bus	Pgen MW 2014SP	Pgen MW 2014SL	Pgen MW 2014WP	Pgen MW 2017SP	Pgen MW 2017SL	Pgen MW 2017WP
Battle River #3	1495	74.9	69.6	156.8	0	0	0
Battle River #4	1496	75.7	69.1	162.6	75.7	69.1	124.2
Battle River #5	1497	266.7	250.3	356.6	266.7	140	286.4
Sheerness #1	1482	220	202.5	259.8	211.3	202.5	259.8
Sheerness #29	1487	197	187.1	306	197	187.1	261.5

Table 2-5: Summary of Existing and Under Construction Wind Generation in Alberta

Plant Name	Planning Area	Bus Number in the Base cases	Net to Grid Output(MW) 2014	Net to Grid Output (MW) 2017
Existing Southern				
Castle River	53	2234, 3234	40	40
Cowley Ridge	53	255, 265, 4264	38	38
McBride Lake	53	2901, 3901, 4901	75	75
Summerview I	53	2338, 3338	69	69
Magrath	53	11002	30	30
Soderghen	53	12358, 13358	68	68
Chin Chute Wind	54	2389	30	30
Kettles Hill	53	2402, 3402	63	63
Taber Wind	52	15343, 16343	81	81
Blue Trail	53	66328, 67328	66	66
Summerview II	53	4339, 5337	66	66
Ardenville	53	4735, 4740	66	66
Castle Rock	53	67221	103	103
Suncor Wintering Hills	43	60789, 60791, 60793, 60846, 60848,, 60850	88	88
			883	883
Under construction				
Total			0	0
Subtotal South			883	883
Existing central				
Ghost Pine	42	2621-2625	82	82
Under construction				
Halkirk	42	66435, 67435	150	150
Total			150	150
Subtotal Central			232	232
Total Alberta			1115	1115

Table 2-6 shows the dispatch used for wind generation that has passed Gate 2 of the AESO connection process in the Central Region.

Table 2-6: Central Wind Projects (Passed Gate 2)

Project	Project number	ISD	Planning area	Buses	MC (MW)	Dispatch level to be used for the required studies (MW)	
						2014	2017
BluEarth Bull Creek Wind Project	789	December 2013	37-Provost	994	115	77	115
Wainwright Wind Project	937	May 2015	32-Wainwright	69016,69019	150	0	60
Suncor Hand Hills Wind Energy Project	635	December 2013	42-Hanna	60417,61417	80	80	80
BluEarth Wind Hand Hills Wind Project	678	October 2013	42-Hanna	1514,1516,1518,1521	80	80	80
Subtotal					425	237	335

2.2.3. Intertie Flow and HVDC Assumptions

The following intertie flows between Alberta and the WECC system are assumed.

Table 2-7: Alberta and WECC System Intertie Flow Assumptions

Scenario	Import (-) / Export (+) to BC	Import (-) / Export (+) to Saskatchewan	Import (-) / Export (+) to MATL
2014/2017WP	-780	-150	0
2014/2017SP	-780	-150	0
2014/2017SL	+800	+150	0

In the 2014 base cases, there is no HVDC in service. For the 2017 base cases, HVDC dispatch levels are assumed as shown in Table 2-8.

Table 2-8: HVDC Dispatch Levels in 2017 Base Cases

Scenario	EATL	WATL
2017WP	-350	0
2017SP	-260	0
2017SL	-350	0

*Negative means flow from south to north. Positive means flow from north to south

2.3. System Projects

System projects listed in Table 1-1 and Table 1-2 are all included in the study base-cases as per their respective ISD.

2.4. Customer Connection Projects

Table 2-9 presents a summary of customer connection projects that are expected to be in service prior to the connection of the Project.

Table 2-9: Summary of Customer Connection Assumptions

Project #	Project Description	ISD	Area
Customer Projects			
901	Imperial Oil Cold Lake Expansion Nabiye Plant	January 2013	28
1096	ATCO Electric Osum Taiga Central Process Facility	June 2013	28
734	FortisAlberta Wainwright 51S Transformer Addition	February 2012	32
858	FortisAlberta Tucuman Substation Upgrades	December 2011	32
937	Wainwright Wind Project (62MW)	December 2014	32
851	TransCanada Keystone KXL Pump station #2	November 2012	37
789	Windlab Bull Creek Wind Project	December 2013	37
1078	ATCO Electric Vegreville 709S Substation Upgrade	May 2012	56
723	Capital Power Halkirk Wind Project	October 2012	42
System Projects			
811	Central East Region Transmission Development	2012-2014	13,28,32,36,37,56
812	Hanna Region Transmission Development (Stage 1)	2012-2013	32,36,37,42,43

2.5. Facility Ratings and Shunt Elements

Key transmission line ratings, transformer ratings, and shunt elements parameters in the study region are presented in Table 2-10 to Table 2-12, respectively.

Table 2-10: Summary of the Existing Transmission Line Ratings

Base Voltage (kV)	Transmission Line	From Substation	To Substation	Summer Rate (MVA)	Winter Rate (MVA)
138	704L	Jarrow 252S	Wain TP	75	79
138	704L	Jarrow 252S	Jarrow Tap	85	90
138	7L129	Buffalo Creek 526S	Vermilion 710S	109.3	139.9
138	7L50	Buffalo Creek 526S	Jarrow Tap	109.3	139
138	7L701/701L	Strome 223S	Battle River 757S	139.9	149.0
138	7L702/702L	Sedgewick 137S	Battle River 757S	95.8	110.2
138	748L	Killarney Lake 267S	Hayter 277S	119	146
138	749L	Metiskow 648S	Killarney Tap	121	149
138	749L	Killarney Lake	Killarney Tap	121	148
138	749L	Edgerton 899S	Killarney Tap	88	96
138	749L	Edgerton 899S	PV TAP	88	96
138	749L	Lloydminster 716S	PV Tap	109.3	139
138	7L159	Ghost Pine 114S	Three Hills 770S	109.3	139
138	7L159	Ghost Pine 114S	Heatburg 948S	109.3	139
138	7L16	Nevis 766S	Heatburg 948S	109.3	139
138	7L85	Michichi Creek 802S	Wintering Hills 804S	109.3	109.3
138	7L25	Michichi Creek 802S	Cornish Lake 954S	109.3	139
138	7L128	Michichi Creek 802S	Coyote Lake 963S	157.2	201.3
138	7L85	Bullpound 803S	Anderson 801S	109.3	139
240	912L	Red Deer 63S	Nevis 766S	488	498
240	9L20	Nevis 766S	Cordell 755S	488	498
240	9L934/934L	Ware Junction 132S	Anderson 801S	519	663
240	9L950/950L	Ware Junction 132S	Anderson 801S	519	663
240	9L933/933L	West Brooks 28S	Anderson 801S	519	592
240	9L29	Oakland 946S	Coyote Lake 963S	874	1103
240	9L100	Anderson 801S	Sheerness 807S	498	498
240	9L70	Anderson 801S	Oakland 946S	874	1103

Table 2-11: Summary of Transformer Ratings

Substation Name and Number	Transformer ID	Transformer Voltages (kV)	MVA Rating
Nevis 766S	901T	240/138	100
Coyote Lake 963S	T1	240/138	300

Table 2-12: Summary of Shunt Elements in the Study Area

Substation Name and Number	Base Voltage (kV)	Capacitors			Reactors		
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVar)	Status in Study	Number of Switched Shunt Blocks	Total at Nominal Voltage (MVar)	Status in Study (on or off)
Buffalo Creek 526S	138	1x15	15	15	-	-	-
Battle River 757S	69	1x9.19	9.19	9.19	-	-	-
Three Hills 770S	138/25	1X17.38/1X4.95	22.33	4.95	-	-	-

2.6. Dynamic Data and Assumptions

The Project is represented by four equivalent wind generators. Each equivalent wind generator is modeled by a generic type 4 wind model comprising a generator/converter model WT4G1 and an electrical control module WT4E1 as per latest PDUP Stage 3. The parameters of these two models are given in Attachment A.

2.7. Protection Fault Clearing Times

The simulation uses the clearing times on various existing transmission lines provided by the AESO. For new transmission lines or those for which data is not available, the standard fault clearing times shown Table 2-13 are used.

Table 2-13: Summary of Protection Fault Clearing Times

Transmission Line	Fault Clearing Times (Cycles)		Assumed or Verified
	Near-End	Far-End	
500kV Lines	4	5 to 6	Assumed
240kV Lines	5	6 to 7	Assumed
144/138kV Lines	6	7 to 8	Assumed

2.8. Voltage Profile Assumptions

Table 2-14 shows the voltage at the key buses (nodes) in the study area in comparison with the nominal/minimum voltages given in AESO OPP-702 where applicable.

Table 2-14: Summary of Voltage at Key Nodes in the Study Region

Bus No. and Name	Nominal Voltage (kV)	Minimum Voltage (kV) - OPP-702	Voltage in the Study Case (kV)		
			2014WP	2014SP	2014SL
Cordel A755S	240	240	254	254	253
Battle River A757S	144	141	145	145	148
Nevis A766S	240	240	250	249	250
	144	137	144	147	148
Oyen A767S	144	137	150	148	142
Anderson A801S	240	255	257	257	256
	144	141	147	148	147
Oakland 946S	240	-	257	257	256
Coyote Lake 963S	240	-	254	254	253

3. Study Methodology

3.1. Study Objectives

The objective of this study is to evaluate the proposed connection alternative, to compare the system performance before and after Project connection, and to identify any reliability concerns associated with the connection of the Project to the AIES.

3.2. Study Scenarios

The study scenarios presented in Table 3-1 are considered when performing the studies identified in Sections 4 and 6. Generators in the study area are dispatched according to Table 2-4 and wind generation projects are dispatched as per Table 2-5 and Table 2-6.

Table 3-1: Study Scenarios

Scenario	Condition	Base Case	Import(-)/Export(+) to BC (MW)	Import(-)/Export(+) to Saskatchewan (MW)
1	Existing System	2014WP	-780	-150
2	Existing System	2014SL	+800	+150
3	Existing System	2014SP	-780	-150
4	With Project Connection	2014SL	+800	+150
5	With Project Connection	2014WP	-780	-150
6	With Project Connection	2014SP	-780	-150
7	With Project Connection	2017SL	+800	+150
8	With Project Connection	2017WP	-780	-150
9	With Project Connection	2017SP	-780	-150

3.3. Connection Studies Carried Out

The following connection studies are performed:

- Power flow (Category A and B)
- Transient stability analysis (Category B)
- Short-Circuit analysis

- Transfer out analysis to determine generation effectiveness factors

3.4. Power Flow Analysis

Power flow studies are performed for pre- and post-connection conditions for all loading scenarios presented in Section 3.2. The purpose of the power flow analysis is to quantify incremental thermal overloads and voltage violations following the project connection.

3.4.1. Contingencies Studied

Category A (normal system conditions), and Category B (single transmission element outage) in the vicinity of the project area are considered for analysis. The list of considered contingencies is presented in Tables 3-2 and 3-3 below.

Table 3-2: Contingency List – Transmission Lines

No #	Outage	From Substation	To Substation
Category B Contingency			
1	9L20	Nevis 766S	Cordel 755S
2	912L	Red Deer 63S	Nevis 766S
3	9L33	Ware Jct 132S	Anderson 801S
4	9L31	Ware Jct 132S	West Brooks 28S
5	947L	Hansman Lake 650S	Nilrem 574S
6	948L	Hansman Lake 650S	Paintearth 863S
7	951L	Ware Jct 132S	Jenner 275S
8	1002L	Jenner 275S	Amoco Empress 163S
9	1011L	Amoco Empress 163S	Cypress 562S
10	946L	Pemukan 932S	Lanfine 959S
11	9L966	Pemukan 932S	Hansman Lake 650S
12	9L59	Tinchebray 972S	Anderson 801S
13	9L16	Tinchebray 972S	Cordel 755S
14	9L24	Oakland 946S	Lanfine 959S
15	9L29	Oakland 946S	Coyote Lake 963S
16	9L70	Oakland 946S	ANDERSON 801S
17	7L50	Battle River 757S	Buffalo Creek 526S
18	702L	Battle River 757S	Hardisty 377S

No #	Outage	From Substation	To Substation
19	701L	Battle River 757S	IPPI Strome 223S
20	7L16	Nevis 766S	Three Hills 770S
21	7L25	Wintering Hills 804S	Michichi Creek 802S
22	7L85	Anderson 801S	Wintering Hills 804S
23	760L	Oyen 767S	Amoco Empress 163S
24	749L	Lloydminster 716S	Edgerton 889S
25	7L128	Coyote Lake 963S	Michichi Creek 802S
26	6L02	Stettler 769S	Battle River757S
27	6L03	Battle River757S	Sullivan Lake 775S
28	6L09	Oyen 767S	Hanna 763S
29	6L56	Michichi Creek 802S	Hanna 763S
30	9L27	Paintearth 863S	Cordel 755S
31	9L53	Nilrem 574S	CORDEL 755S

Table 3-3: Contingency List – Generator/Transformer/SVC

No.	Outage	Substation
1	240/138 kV 901T transformer (Bus 1422 to Bus 10422)	Nevis 766S
2	240/138 kV 901T transformer (Bus 1485 to Bus 10484)	Anderson 801S
3	240/138 kV 901T transformer (Bus 1422 to Bus 10422)	Anderson 801S
4	240/138 kV 901T transformer (Bus 10438 to Bus 19438)	Lanfine 959S
5	240/138 kV 901T transformer (Bus 11419 to Bus 19419)	Pemukan 932S
6	240/138 kV 901T transformer (Bus 11419 to Bus 19419)	Nilrem 574S
7	240/138 kV 901T transformer (Bus 11419 to Bus 19419)	Metiskow 648S
8	240/138 kV 901T transformer (Bus 11419 to Bus 19419)	Hansman Lake 650S
9	240/138 kV 901T transformer (Bus 11419 to Bus 19419)	Cypress 562S
10	240/138 kV 901T transformer (Bus 11419 to Bus 19419)	Amoco Empress 163S
11	240/138 kV 901T transformer (Bus 11419 to Bus 19419)	Coyote Lake 963S
12	144/72 kV 701T transformer (Bus 11419 to Bus 19419)	Stettler 769S
13	144/72 kV 701T transformer (Bus 1474 to Bus 10474)	Oyen 767S
14	144/72 kV 701T transformer (Bus 1449 to Bus 10448)	Michichi Creek 802S
15	144/72 kV 701T transformer (Bus 1449 to Bus 10448)	Battle River 757S

3.5. Short-Circuit Analysis

The short-circuit studies are performed for the following load conditions:

- 2014 Winter Peak for pre- and post- project connection conditions

- 2022 Winter Peak for post-connection condition

Maximum fault levels are provided for the proposed substation and neighbouring substations with the following assumption:

- Normal system operation with all transmission elements in service and generation dispatched.
- Three-phase faults and single line to ground fault are simulated.
- Polar coordinates and physical values are used for reporting the short-circuit currents.

The maximum fault levels at the following substations are provided: Coyote Lake 963S, Oakland 946S, Michichi Creek 802S, Rowley 768S, and the Project substation 572S.

3.6. Transient Stability Analysis

A total of thirteen category B disturbance conditions are simulated the 2014WP, 2014SP and 2014SL base cases. These disturbances cover all the major existing and planned 240kV transmission lines in Hanna and surrounding areas. The generating units, bus voltages, transmission line flows, motor loads, and bus frequencies in the Hanna area are monitored. The list of most relevant simulated disturbances is given in Table 3-4.

Table 3-4: Summary of Transient Stability

Contingency	Fault Description and Clearing Times
Category B Contingency	
3ph fault on Line 9L29 (Oakland 946S to Coyote Lake 963S)	3ph fault at Oakland 946S on 9L29 to Coyote Lake 963S 5 cycles: trip Oakland 946S CB on 9L29 to Coyote Lake 963S 6 cycles: trip Coyote Lake 963S CB on 9L29 to Oakland 946S
3ph fault on Line 9L29 (Oakland 946S to Coyote Lake 963S)	3ph fault at Coyote Lake 963S on 9L29 to Oakland 946S 5 cycles: trip Coyote Lake 963S CB on 9L29 to Oakland 946S 6 cycles: trip Oakland 946S CB on 9L29 to Coyote Lake 963S
3ph fault on Line 9L94 (Coyote Lake 963S to P635S)	3ph fault at Coyote Lake on 240 kV line to 5 cycles: trip Coyote Lake 963S CB on 240 kV line to P635 6 cycles: trip P635 CB on 240 kV line to Coyote Lake 963S Both P635 and P678 tripped entirely
3ph fault on Line 9L59 (Anderson 801S to Halkirk 615S)	3ph fault at Anderson 801S on 9L59 to Halkirk 615S 5.1 cycles: trip Anderson 801S CB on 9L59 to Halkirk 615S 6 cycles: trip Halkirk 615S CB on 9L59 to Anderson 801SS
3ph fault on Line 9L100 (Anderson 801S to Sheerness 807S)	3ph fault at Anderson 801S on 9L100 to Sheerness 801S 5.22 cycles: trip Anderson 801S CB on 9L100 to Sheerness 807S 5.82 cycles: trip Sheerness 807S CB on 9L100 to Anderson 801SS

Contingency	Fault Description and Clearing Times
3ph fault on Line 9L24 (Oakland 946S to Lanfine 959S)	3ph fault at Oakland 946S on 9L24 to Lanfine 959S 5 cycles: trip Oakland 946S CB on 9L24 to Lanfine 959S 6 cycles: trip Lanfine 959S CB on 9L24 to Oakland 946S
3ph fault on Line 9L24 (Oakland 946S to Lanfine 959S)	3ph fault at Lanfine 959S on 9L24 to Oakland 946S 5 cycles: trip Lanfine 959S CB on 9L24 to Oakland 946S 6 cycles: trip Oakland 946S CB on 9L24 to Lanfine 959S
3ph fault on Line 9L20 (Cordel 755S to Nevis 766S)	3ph fault at Cordel 755S on 9L20 to Nevis 766S 5.22 cycles: trip Cordel 755S CB on 9L20 to Nevis 766S 6.78 cycles: trip Nevis 766S CB on 9L20 to Cordel 755S
3ph fault on Line 9L20 (Cordel 755S to Nevis 766S)	3ph fault at Nevis 766S on 9L20 to Cordel 755S 5.22 cycles: trip Nevis 766S CB on 9L20 to Cordel 755S 6.78 cycles: trip Cordel 755S CB on 9L20 to Nevis 766S
3ph fault on Line 912L (Nevis 766S to Red Deer 63S)	3ph fault at Nevis 766S on 912L to Red Deer 63S 5.22 cycles: trip Nevis 766S CB on 912L to Red Deer 63S 6.78 cycles: trip Red Deer 63S CB on 9L20 to Nevis 766S
3ph fault on Line 912L (Nevis 766S to Red Deer 63S)	3ph fault at Red Deer 63S on 912L to Nevis 766S 5.22 cycles: trip Red Deer 63S CB on 912L to Nevis 766S 6.78 cycles: trip Nevis 766S CB on 9L20 to Red Deer 63S
3ph fault on Line 931L (Ware JKT 132S to West Brooks 28S)	3ph fault at Ware Junction 132S on 931L to West Brooks 28S 5.22 cycles: trip Ware JKT 132S CB on 931L to West Brooks 28S 6.78 cycles: trip West Brooks 28S CB on 951L to Ware JKT 132S
3ph fault on Line 931L (Ware JKT 132S to West Brooks 28S)	3ph fault at West Brooks 28S on 931L to Ware Junction 132S 5.22 cycles: trip West Brooks 28S CB on 931L to Ware JKT 132S 6.78 cycles: trip Ware JKT 132S CB on 951L to West Brooks 28S

3.7. Transfer Out Analysis Studies

Transfer out analysis studies are carried out to determine the Hanna region generator effectiveness factors and identify the most effective generator(s) to be curtailed in order to mitigate the overloads observed following several Category B contingencies in the study area.

4. Pre-Connection System Assessment

Load flow analysis includes Category A (N-0) and Category B (N-1) contingencies for the 2014 winter peak, 2014 summer peak and 2014 summer light base cases. Load flow plots for these studies are given in Attachment B.

4.1. 2014 Winter Peak

4.1.1. System Normal (N-0) Conditions

There are no resulting voltages or loading violations identified under these conditions. This is depicted on the slider entitled Fig 1: Pre-Project 2014 Winter Peak, All Elements in Service which is located in Attachment B.

4.1.2. Single Element Contingency (N-1) Conditions

Table 4-1 presents the results of Category B (N-1) contingency analysis. Overloads are observed on the following transmission elements: 749L (Edgerton 899S to Lloydminster 716S), 174L (North Holden 395S to Bardo 197S), 240/144kV Transformer at Nevis 776S, and 7L50 (Jarrow Tap to Buffalo Creek 526S).

The outage of the following transmission lines (sections) causes these overloads:

9L20 (Nevis 766S to Cordel 755S), 912L (Nevis 766S to Red Deer 63S), 749L (Edgerton 899S to Lloydminster 716S), and 7L50 (Battle River 757S to Buffalo Creek 526S)

Table 4-1: Summary of Overloads under N-1 Contingencies (2014WP, Pre-Project)

SLD REF.	Contingency Element	Overloaded Branch	Pre-Connection	
			Power Flow (MVA)	% MVA Loading
Fig. 2 Pre-Project 2014 Winter Peak	240kV 9L20, Nevis 766S to Cordel 755S	240/144kV Transformer at Nevis 766S	103.0	103.1
Fig. 3 Pre-Project 2014 Winter Peak	240kV 912L, Nevis 766S to Red Deer 63S	138kV 174L North Holden 395S to Bardo 197S	87	100.2
		144kV 7L50 Jarrow tap to Buffalo Creek 526S	139	100.0
Fig. 4 Pre-Project 2014 Winter Peak	144kV 749L, Edgerton 899S to Lloydminster 716S	144kV 7L50 Jarrow tap to Buffalo Creek 526S	144	101.9
Fig. 5 Pre-Project 2014 Winter Peak	144kV 7L50, Battle River 757S to Buffalo Creek 526S	138kV 749L Edgerton 899S to PV-Tap	101	104.1

4.2. 2014 Summer Peak

4.2.1. System Normal (N-0) Conditions

There are no resulting voltage or loading violations identified under these conditions. This is depicted on the slider entitled Fig 1: Pre-Project 2014 Summer Peak, All Elements in Service which is located in Attachment B.

4.2.2. Single Element Contingency (N-1) Conditions

Table 4-2 presents the results of Category B (N-1) contingency analysis. Only a minor overload is observed, which occurs following the outage of line 749L.

Table 4-2: List of Overloads under N-1 (2014SP, Pre-Project)

SLD REF.	Contingency Element	Overloaded Branch	Power Flow (MVA)	% MVA Loading
Fig. 2 Pre-Project 2014 Summer Peak	144kV 749L, Edgerton 899S to Lloydminster 716S	144kV 7L50 Jarrow Tap to Buffalo Creek 526S	115	102.2

4.3. 2014 Summer Light

4.3.1. System Normal (N-0) Conditions

There are no resulting voltages or loading violations identified under these conditions. This is depicted on slider entitled Fig.1: Pre-Project 2014 Summer Light, All Elements in Service located in Attachment B.

4.3.2. Single Element Contingency (N-1) Conditions

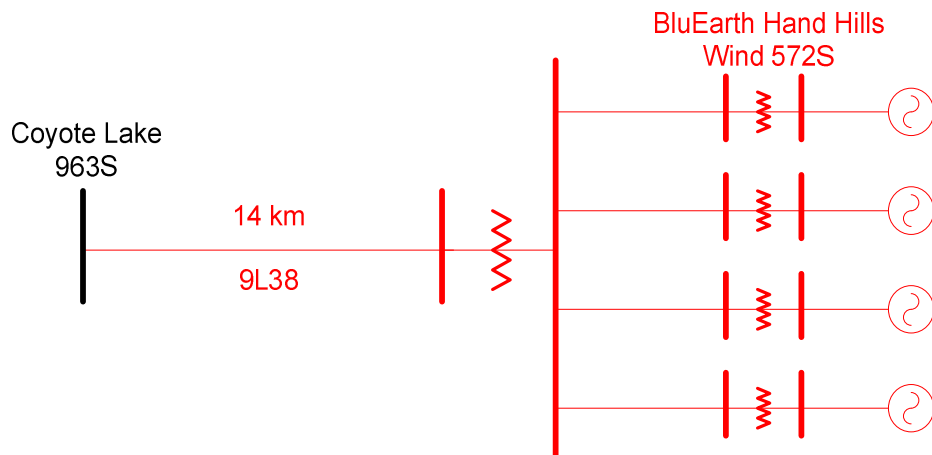
There is no overload or voltage violation observed under Category B conditions.

5. Alternatives

5.1. Overview

The Project will be connected to the AIES by the new single circuit 240kV transmission line 9L38, which will be 14 km-long and will go from the Project substation to the Coyote Lake 963S substation. A conceptual one-line diagram of the proposed connection is shown in Figure 5-1.

Figure 5-1: Single Line Diagram of Proposed Connection of BluEarth Hand Hills Wind Project



5.1.1. Connection Alternatives Selected for Further Studies

No further alternatives are selected for further study

6. Technical Analysis of the Connection Alternative

6.1. Post Connection Power Flow Analysis

This section summarizes the results of system performance under load flow analysis after the connection of the Project. The power flow plots are shown in attachment C (2014) and D (2017).

6.1.1. 2014 Winter Peak

6.1.1.1. System Normal (N-0) Conditions

There are no resulting voltages or loading violations identified under these conditions. This is depicted on slider entitled Fig 1: Post-Project 2014 Winter Peak, All Elements in Service located in Attachment C.

6.1.1.2. Single Element Contingency (N-1) Conditions

The comparison of system performance for the pre- and post-Project configurations is shown in Table 6-1. It is shown that:

- Connection of the Project increases the overload on the 240/144kV transformer at Nevis 766S by 8% under the loss of line 9L20 (766S-755S).
- All other overloads under different contingencies are minor.

Table 6-1: List of Overloads under N-1 (2014WP, Post-Project)

SLD REF.	Contingency Element	Overloaded Branch	Pre-Connection		Post-Connection		% Loading Difference
			Power Flow (MVA)	% MVA Loading	Power Flow (MVA)	% MVA Loading	
FIG 2: POST-PROJECT 2014 WINTER PEAK	240kV 9L20, Nevis 766S to Cordel 755S	240/144kV Transformer at Nevis 766S	103	103.1	111	111	+8
FIG 3: POST-PROJECT 2014 WINTER PEAK	240kV 912L, Nevis 766S to Red Deer 63S	144kV 7L50, Jarrow Tap Buffalo Creek 526S	139.0	100.0	143	103.9	+3.9
		144kV 7L701 Heisler 764S to Strome 223S	--	--	155	101.8	>+1.8
		138kV 174L North Holden 395S to Bardo 197S	87	100.2	93	107.4	+7.2

SLD REF.	Contingency Element	Overloaded Branch	Pre-Connection		Post-Connection		% Loading Difference
			Power Flow (MVA)	% MVA Loading	Power Flow (MVA)	% MVA Loading	
FIG 4: POST-PROJECT 2014 WINTER PEAK	144kV 749L, Edgerton 899S to Lloydminster 716S	144kV 7L50 Jarrow tap to Buffalo Creek 526S	144	101.9	148	105	3.1
FIG 5: POST-PROJECT 2014 WINTER PEAK	144kV 7L50 Battle River 757S to Buffalo Creek 526S	138kV 749L Edgerton 899S to PV- Tap	101	104.1	104	107.3	+3.2
FIG 6: POST-PROJECT 2014 WINTER PEAK	240kV 9L29, Coyote Lake 963S to Oakland 946S	240/144 kV Transformer, Nevis 766S	-	-	100	100.1	>+0.1
FIG 7: POST-PROJECT 2014 WINTER PEAK	144kV 7L129 Buffalo Creek 526S to Vermillion 710S	138kV 749L Edgerton 899S to PV- Tap	-	-	101	102.4	>+2.5

6.1.2. 2014 Summer Peak

6.1.2.1. System Normal (N-0) Conditions

There are no resulting voltages or loading violations identified under these conditions. This is depicted on slider entitled Fig 1: Post-Project 2014 Summer Peak, All Elements in Service located in Attachment C.

6.1.2.2. Single Element Contingency (N-1) Conditions

The comparison of system performance for pre- and post- Project configuration is shown in Table 6-2. It can be seen that the outage of line 9L29 from Oakland 946S to Coyote Lake 963S causes overloads on the 144kV transmission lines 7L159 (114S-948S), 7L16(948S-766S), 7L85(804S-803S), and 7L128(963S-802S).

Table 6-2: List of Overloads under N-1 (2014SP, Post-Project)

SLD REF.	Contingency Element	Overloaded Branch	Pre-Project		Post-Project		% Loading Difference
			Power Flow (MVA)	% MVA Loading	Power Flow (MVA)	% MVA Loading	
FIG 2: POST-PROJECT 2014 SUMMER PEAK	144kV 749L, Edgerton 899S to Lloydminster 716S	144kV 7L50 Jarrow Tap to Buffalo Creek	115	102.2	119	106.1	+3.9
FIG 3 POST-PROJECT 2014 SUMMER PEAK	240kV 912L, Nevis 766S to Red Deer 63S	144kV 7L50, Jarrow Tap to Buffalo Creek 526S	-	-	115	103.7	>+3.7
FIG 4: POST-PROJECT 2014 SUMMER PEAK	240kV 9L29, Coyote Lake 963S to Oakland 946S	144kV 7L159 Ghost Pine 114S to Heatburg 948S	-	-	124	106.9	>+6.9
		144kV 7L16 Heatburg 948S to Nevis 766S	-	-	119	103.8	>+3.8
		144kV 7L85, Wintering Hill 804S to Bullpond 803S	-	-	116	102.2	>+2.2
		144kV 7L128 Coyote Lake 963S to Michichi Creek 802S	-	-	160	100.6	>-.6

6.1.3. 2014 Summer Light

6.1.3.1. System Normal (N-0) Conditions

There are no resulting voltages or loading violations identified under these conditions. This is depicted on slider entitled Fig 1: Post-Project 2014 Summer Light, All Elements in Service located in Attachment C.

6.1.3.2. Single Element Contingency (N-1) Conditions

Compared to the Pre-Project conditions, only one contingency causes overloads in the west Hanna area. The overloaded elements are lines 7L128, 7L85 and the 240/144kV transformer at Nevis. Table 6-3 shows the details of the contingencies and overloaded elements.

Table 6-3: List of Overloads under N-1 (2014SL, Post-Project)

SLD REF.	Contingency Element	Overloaded Branch	Pre-Connection		Post-Connection		% Loading Difference
			Power Flow (MVA)	% MVA Loading	Power Flow (MVA)	% MVA Loading	
FIG 2: POST-PROJECT 2014 SUMMER LIGHT	240kV 9L29, Coyote Lake 963 to Oakland 946S	144kV 7L128 Coyote Lake 963S to Michichi Creek	-	-	160	100.5	>+0.5
		240/144kV transformer at Nevis 766S	-	-	105	105.5	>+5
		144kV 7L85, Wintering Hill 804S to Bullpond 803S	-	-	130	114.7	+14.7
		144kV 7L85 Bullpond 803S to Anderson 801S	-	-	122	108.6	>+8.6

6.2. Power Flow Analysis - 2017

Load flow analysis for the 2017 base cases is carried out to check the system performance with the connection of the Project. This section presents the results of this load flow analysis under normal and contingency operating conditions. Table 6-4 shows the selected performance parameters under normal operating conditions in the study area for the winter peak, summer peak and summer light base cases.

Table 6-4: Selected System Performance Parameters (2017)

Description	Amount		
	Winter Peak	Summer Peak	Summer Light
Load (MW)	577	522	386
Generation (MW)	1,586	1,403	1,253
SOA (MW)	509	479	604
Losses in Study Region	51	44	41
HVDC EATL (South to North)	355	566	356

Load flow plots of the power flow analysis are shown in attachment D.

6.2.1. 2017 Winter Peak

6.2.1.1. System Normal (N-0) Conditions

No overload or voltage violations are observed under normal operating conditions. This is depicted on slider entitled Fig 1: Post-Project 2017 Winter Peak, All Elements in Service located in Attachment D.

6.2.1.2. Single Element Contingency (N-1) Conditions

No overload or voltage violations are observed under these conditions.

6.2.2. 2017 Summer Peak

6.2.2.1. System Normal (N-0) Conditions

No overload and voltage violations are observed under these conditions. This is depicted on slider entitled Fig 1: Post-Project 2017 Summer Peak, All Elements in Service located in Attachment D.

6.2.2.2. Single Element Contingency (N-1) Conditions

Three contingencies cause overloads on 144kV line 7L129. Table 6-5 shows the details of the contingencies and overloaded elements.

Table 6-5: List of Overloads under N-1 (2017SP)

SLD REF.	Contingency Element	Overloaded Branch	Power Flow (MVA)	% MVA Loading
FIG 2: 2017 SUMMER PEAK	144kV 749L, Edgerton 899S to Lloydminster 716S	144kV 7L129 Buffalo Creek 526S to Bauer Tap	140	120.2
		144kV 7L129 Bauer Tap to Vermillion 710S	132	114.2
FIG 3: 2017 SUMMER PEAK	240kV 912L, Nevis 766S to Red Deer 63S	144kV 7L129 Buffalo Creek 526S to Bauer Tap	120	103.7
FIG 4: 2017 SUMMER PEAK	144kV 7L701 Heisler 764S to Strome 223S	144kV 7L129 Buffalo Creek 526S to Bauer Tap	118	101.6

6.2.3. 2017 Summer Light

6.2.3.1. System Normal (N-0) Conditions

No overload or voltage violation is observed under these conditions. This is depicted on slider entitled Fig 1: Post-Project 2017 Summer Light, All Elements in Service located in Attachment D.

6.2.3.2. Single Element Contingency (N-1) Conditions

No overload and voltage violation are observed under these conditions.

6.3. Transient Stability Analysis

A total of thirteen category B disturbance conditions are simulated for the 2014WP, 2014SP and 2014SL base cases. The complete set of plots is given in Attachment E.

The results of transient stability analysis are summarized below:

- The system remains stable under all the simulated contingencies
- Good voltage recovery is observed in all the cases
- The entire Project (P678) together with the Suncor Hand Hills Wind Project (P635) are tripped when line 9L94 (Coyote Lake 963S to the Mother Mountain 2055S) is out of service.
- Following the outage of line 9L100 (Anderson 801S- Sheerness 807S), one Sheerness generating unit becomes islanded and will be tripped by its own protection system. This is reflected in the relative rotor angle plot of the tripped unit. It is to be noted that the tripping of this Sheerness generating unit is due to its radial connection to the system and that the Project connection has no contribution to this tripping.

In conclusion, there is no sizable impact on the system transient stability by incorporating the Project.

6.4. Transfer Out Analysis

Transfer out analysis is carried out to determine the generator effectiveness factors which are used to estimate the ability of each generator to relieve transmission element constraints. A generator's effectiveness factor is defined as the change in power flow over a specific line following a change in the generator's output power. As such, the larger the generator effectiveness factor the more helpful it can be in alleviating an overload on the transmission line associated to it.

The results of the transfer out analysis are presented in detail in Attachment F. It was found that Battle River has the largest effectiveness factors for most lines. However, P518 proved to be the most effective generation to relieve overloads on the Nevis Transformer and P789 has the most impact in reducing overloads on line 704L.

6.5. Remedial Action Schemes (RAS)

6.5.1. 2014 Study Years

The steady-state analysis showed that the connection of the Project will not impact the system under normal operating conditions (N-0). However, several thermal overloads are observed after single element (N-1) contingency analysis in the 2014 scenarios. Some of these contingencies are worsened by the Project connection.

A modification to the existing Halkirk RAS will be required to run back or trip the Project under certain contingencies to alleviate these potential overloading conditions. In addition, one new RAS to run back or trip the Project following the outage of line 9L29 is needed to avoid the overloads caused by this contingency on the 144kV transmission elements west of Hanna.

6.5.2. 2017 Study Years

There are overloads observed on 144kV line 7L129 under three contingencies. Only one contingency (outage of 749L) leads to 120% of overload on 7L129. The overloads under other two contingencies are less than 5%.

The option of using HVDC dispatch to reduce the overload on 7L129 is simulated. It shows that when HVDC dispatch reaches 490MW, overload on 7L129 for the contingency of 749L can drop to less than 110%.

In addition to the HVDC dispatch, the AESO is in the process of updating its regional plans, including that of the Central Region which will include a review of the approved CETD and options to alleviate this constraint. The AESO will file the related needs identification documents that may be necessary with the Alberta Utilities Commission once the Central Region plan has been completed.

7. Short-Circuit Analysis

7.1. Pre-Connection

Pre-project short-circuit levels at substations near the project location for the 2014WP case are presented in Table 7-1.

Table 7-1: Fault current Levels: 2014 Winter Peak Base Case (Pre-Project)

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (p.u.)	3- Φ Fault (kA)	Positive Sequence Impedance ($R_1 + j X_1$) (p.u.)	1- Φ Fault (kA)	Zero Sequence Impedance ($R_0 + j X_0$) (p.u.)
Oakland 946S	240kV	1.0695	12.9	0.002777+j0.01982	11.5	0.00357+j0.02463
Coyote Lake 963S	240kV	1.0587	6.3	0.00527+j0.04021	4.4	0.01378+j0.08858
Michichi Creek 802S	138kV	1.073	4.0	0.03216+j0.10729	3.2	0.04216+j0.1969

7.2. Post-Connection

Post-connection short-circuit current levels for 2014WP and 2022WP are presented in Table 7-2 and 7-3, respectively. The connection of the project does not increase the short-circuit levels reported at Oakland 946S, Coyote Lake 963S, and Michichi Creek 802S. This is because the Project makes use of Type 4 wind turbines which effectively block any short-circuit current contribution to the system due to their configuration.

Table 7-2: Fault Current Levels: 2014 Winter Peak Base Case (Post-Project)

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (p.u.)	3- Φ Fault (kA)	Positive Sequence Impedance ($R_1 + j X_1$) (p.u.)	1- Φ Fault (kA)	Zero Sequence Impedance ($R_0 + j X_0$) (p.u.)
BluEarth Wind Hand Hills 572S	240kV	1.0748	4.9	0.00735+j0.05192	3.4	0.02301+j0.11551
Oakland 946S	240kV	1.0706	12.9	0.00278+j0.01986	11.5	0.00358+j0.02466
Coyote Lake 963S	240kV	1.0742	6.3	0.00531+j0.04036	4.4	0.014+j0.08928
Michichi Creek 802S	144kV	1.0806	4.0	0.0322+j0.10732	3.2	0.04218+j0.19698

Table 7-3: Fault Current Levels: 2022 Winter Peak Base Case (Post-Project)

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (p.u.)	3- Φ Fault (kA)	Positive Sequence Impedance ($R_1 + j X_1$) (p.u.)	1- Φ Fault (kA)	Zero Sequence Impedance ($R_0 + j X_0$) (p.u.)
BluEarth Wind Hand Hills 572S	240kV	1.0661	6.0	0.00684+j0.04229	4.4	0.0822+j0.08485
Oakland 946S	240kV	1.0731	13.0	0.00332+j0.01963	11.8	0.00346+j0.02393
Coyote Lake 963S	240kV	1.07	8.3	0.00474+j0.03048	6.3	0.00925+j0.0587
Michichi Creek 802S	144kV	1.078	4.0	0.03401+j0.10845	3.0	0.04801+j0.21595

8. Project Interdependencies

The Project will be connected to the proposed 240kV system via the new Coyote Lake 963S substation. It is assumed that this substation as well as Oakland 946S, line 9L29 (946S - 963S), the HRTD, and the CETD will be in service prior to the connection of the Project. Any delay in the construction of these transmission elements will directly affect the ISD of this Project

9. Summary and Conclusion

Technical analysis is performed for the 2014 and 2017 base cases under winter peak, summer peak and summer light load conditions. The system is analyzed under Category A (N-0) and Category B (N-1) contingencies. The major observations are outlined below:

- Under normal operating conditions (N-0), there are no overload or voltage violations for any of the 2014/2017 study scenarios.
- In the 2014 cases, overloads on the 240/144 Nevis Transformer and the 144kV 7L50 (Jarrow Tap to Buffalo Creek) are observed for a number of (N-1) contingencies. Also, the outage of line 9L29 will result in some overloads on some 144kV network elements (lines 7L159/7L16/7L85, and 7L128).
- In the 2017 cases, overloads on 144kV 7L129 are observed for three different contingencies (749L, 9L912 and 7L701). The AESO will address the demonstrated 2017SP overloads on 7L129 under N-1 contingencies prior to 2017. In addition to the HVDC dispatch described in section 6.5.2, the AESO is in the process of updating its

regional plans, including that of the Central Region which will include a review of the approved CETD and options to alleviate this constraint. The AESO will file the related needs identification documents that may be necessary with the Alberta Utilities Commission once the Central Region plan has been completed.

- For 2014, the existing Halkirk RAS with some modifications proposed in this study will be employed to relieve (N-1) overloads.
- For 2014, development of a new RAS to run back the Project will be required to avoid the overloads observed on the 144kV transmission network elements west of Hanna following the loss of the 240kV line 9L29.
- For 2017, one option to reduce overload on 7L129 following the outage of 749L is to adjust HVDC dispatch level.
- Transient stability analysis with the connection of the Project is performed and the result shows that the system remains stable under all simulated contingencies.
- The connection of the project does not increase the short-circuit levels reported at Oakland 946S, Coyote Lake 963S, and Michichi Creek 802S. This is because the Project makes use of Type 4 wind turbines which effectively block any short-circuit current contribution to the system due to their configuration.

The study recommendations are as follows:

- Connect the Project to the new 240kV Coyote Lake 963S substation via a short single-circuit 240kV line.
- Modify the Halkirk RAS to enable the Project connection by 2014 as follows:
 - i. Run back or trip the Project for the overload observed on line 7L50.
 - ii. Run back or trip the Project for the overload observed on the 240/144kV Nevis transformer 766S 901T
- Develop a Remedial Action Scheme (RAS) to run back the Project following the loss of the 240kV line 9L29 (Oakland 946S to Coyote Lake 963S).

As load flow results indicated, the need of these RAS will be eliminated by 2017 when the Central East transmission reinforcement and ETAL project are in service.

Attachment A

Dynamic Data of all Equipment Proposed for Connection

Table A-1: Generator/Converter Module W4G2U

WT4G1								
TlqCmd	TlpCmd	VLVPL1	VLVPL2	GLVPL	VHVRCR	CURHVRCR	Rlp_LVPL	T_LVPL
0.0200	0.0200	0.4000	0.900	1.1100	1.2000	2.0000	2.0000	0.0200

Table A-2: Electrical Control Module

WT4E1											
TFV	KPV	KIV	KPP	KIP	Kf	Tf	QMX	QMN	IPMAX	TRV	dPMX
0.15	18.00	5.000	0.050	0.100	0.0000	0.0800	0.47	-0.470	1.1000	0.0000	0.5000
dPMN	T_POWER	KQi	VMINCL	VMAXCL	Kvi	Tv	Tp	ImaxTD	lph1	lqh1	
-0.5000	0.0500	0.100	0.9	1.100	120.000	0.1500	0.0500	1.700	1.1100	1.11	

ICON(M+1) - PFAFLG = 0

ICON(M+2) - VARFLG = 1

ICON(M+3) - PQFLAG = 0

The over/under-voltage and frequency relays as shown in Table A-3 and A-4 are assumed in the modeling.

Table A-3: Over-/Under- Voltage Ride-Through Capability

Description	Terminal voltage	TP	TB
Lower Voltage Threshold	0.15 pu	0.85	0.05
Lower Voltage Threshold	0.40 pu	1.6	0.05
Lower Voltage Threshold	0.70 pu	2.6	0.05
Lower Voltage Threshold	0.85 pu	3.0	0.05
High Voltage Threshold	1.10 pu	1.0	0.05
High Voltage Threshold	1.20 pu	0.15	0.05

Note: TP – Relay Pickup time (Sec) TB – Breaker time (Sec)

Table A-4 Over-/Under- Frequency Characteristics of P678 BluEarth Hand Hills WTG

Description	Terminal Frequency	TP	TB
Lower Frequency Threshold	56.4 Hz	0.1	0.05
Lower Frequency Threshold	57 Hz	1.0	0.05
Over Frequency Threshold	62.4 Hz	0.1	0.05

Note: TP – Relay Pickup time (Sec) TB – Breaker time (Sec)

Attachment B

Pre-Connection Power Flow Plots

Pre-connection Plots

2014 Winter Peak

FIG 1: PRE-PROJECT 2014 WINTER PEAK
ALL ELEMENTS IN SERVICE
THU, NOV 22 2012 11:04

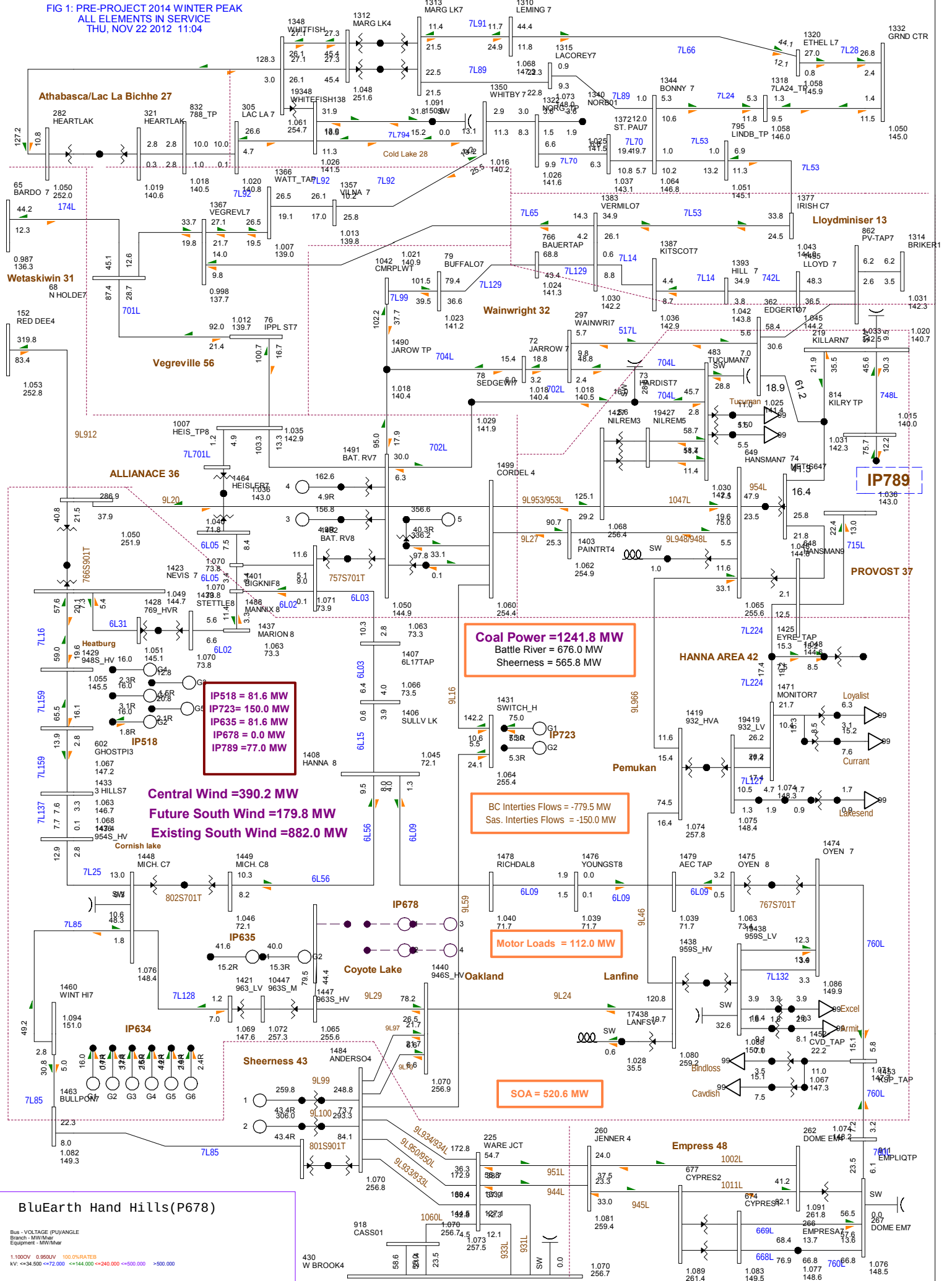
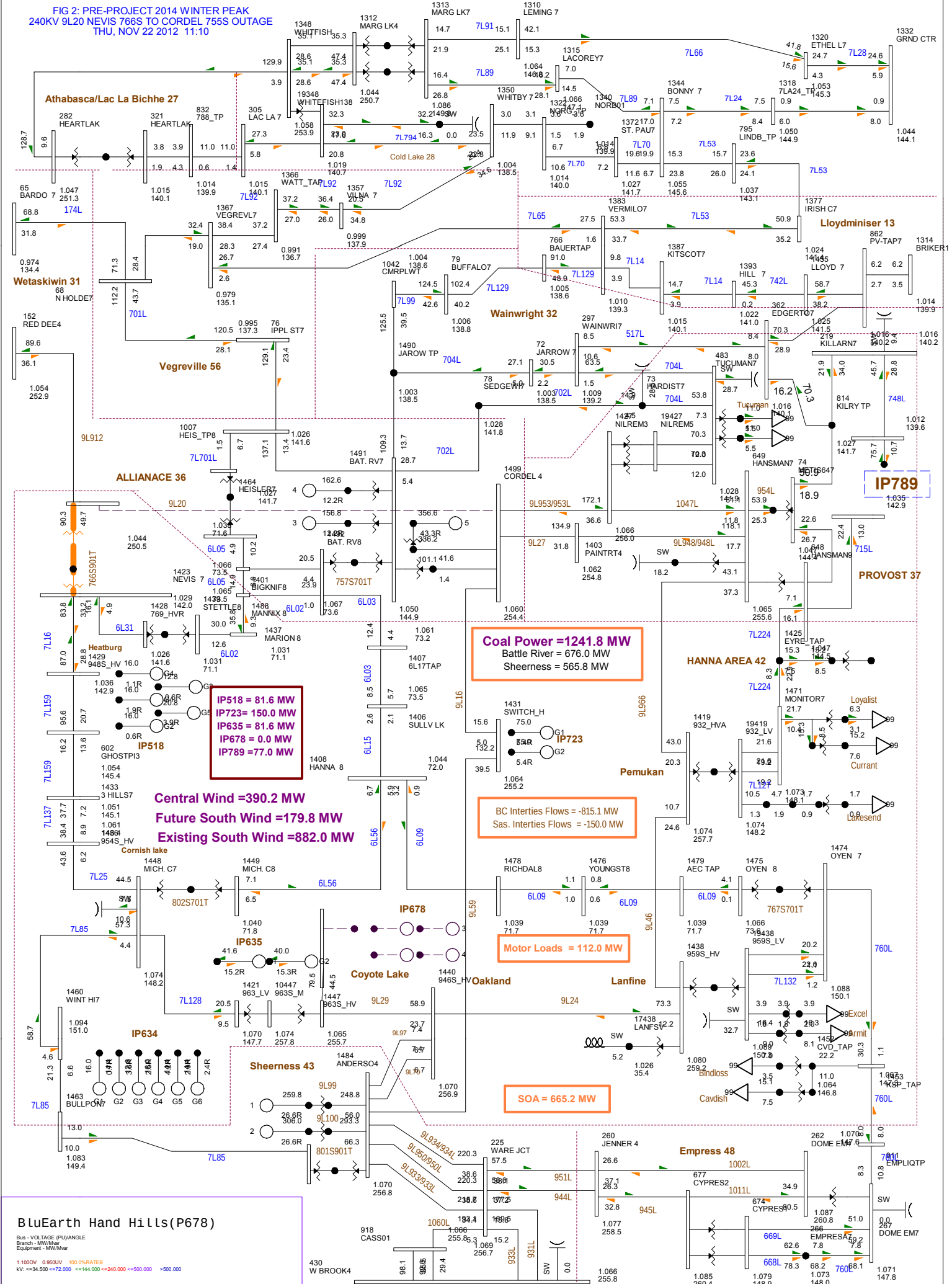


FIG 2: PRE-PROJECT 2014 WINTER PEAK
240KV 9L20 NEVIS 766S TO CORDEL 755S OUTAGE
THU, NOV 22 2012 11:10



BluEarth Hand Hills(P678)

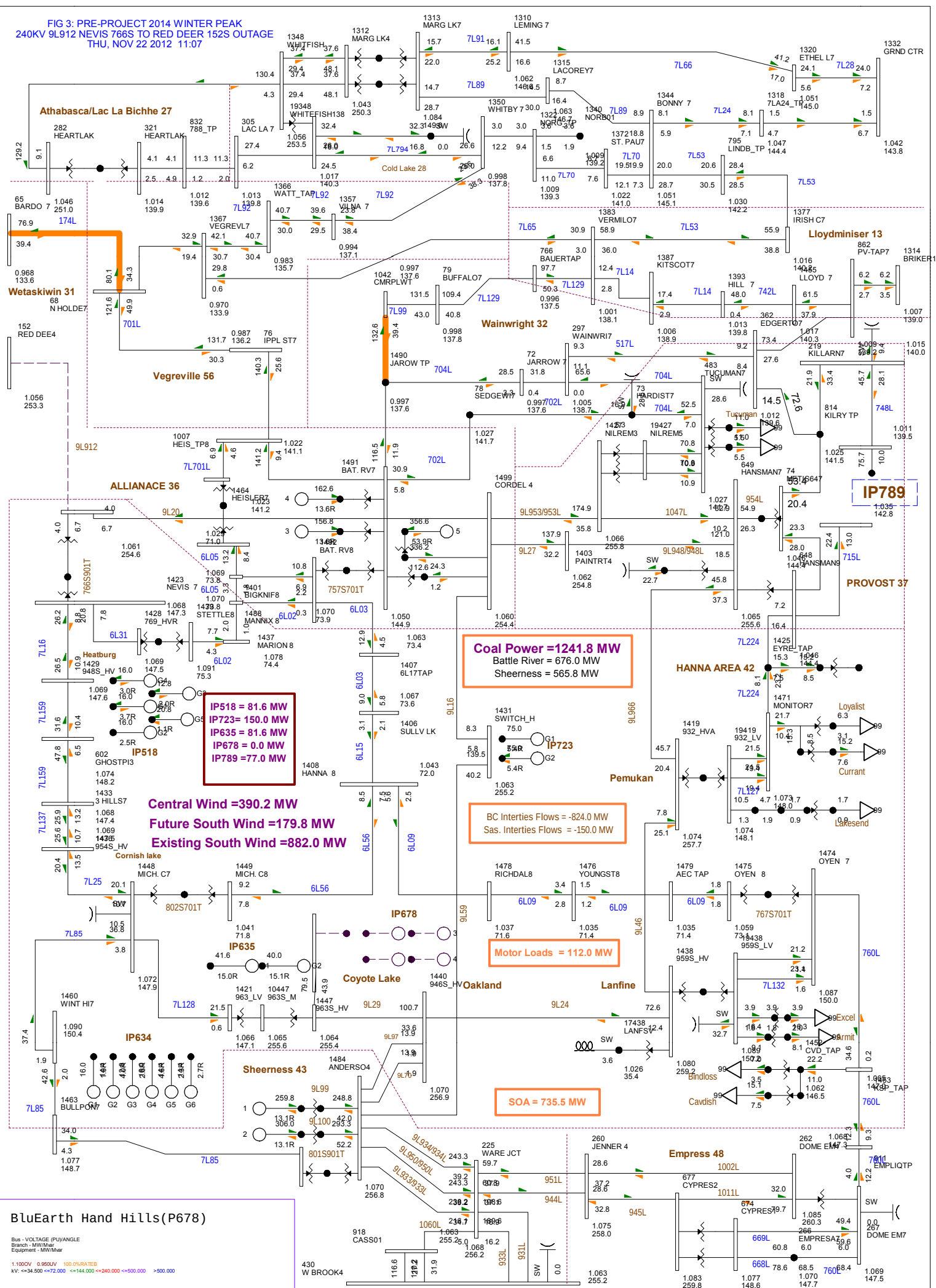


FIG 4: PRE-PROJECT 2014 WINTER PEAK
749L OUTAGE
THU, NOV 22 2012 11:11

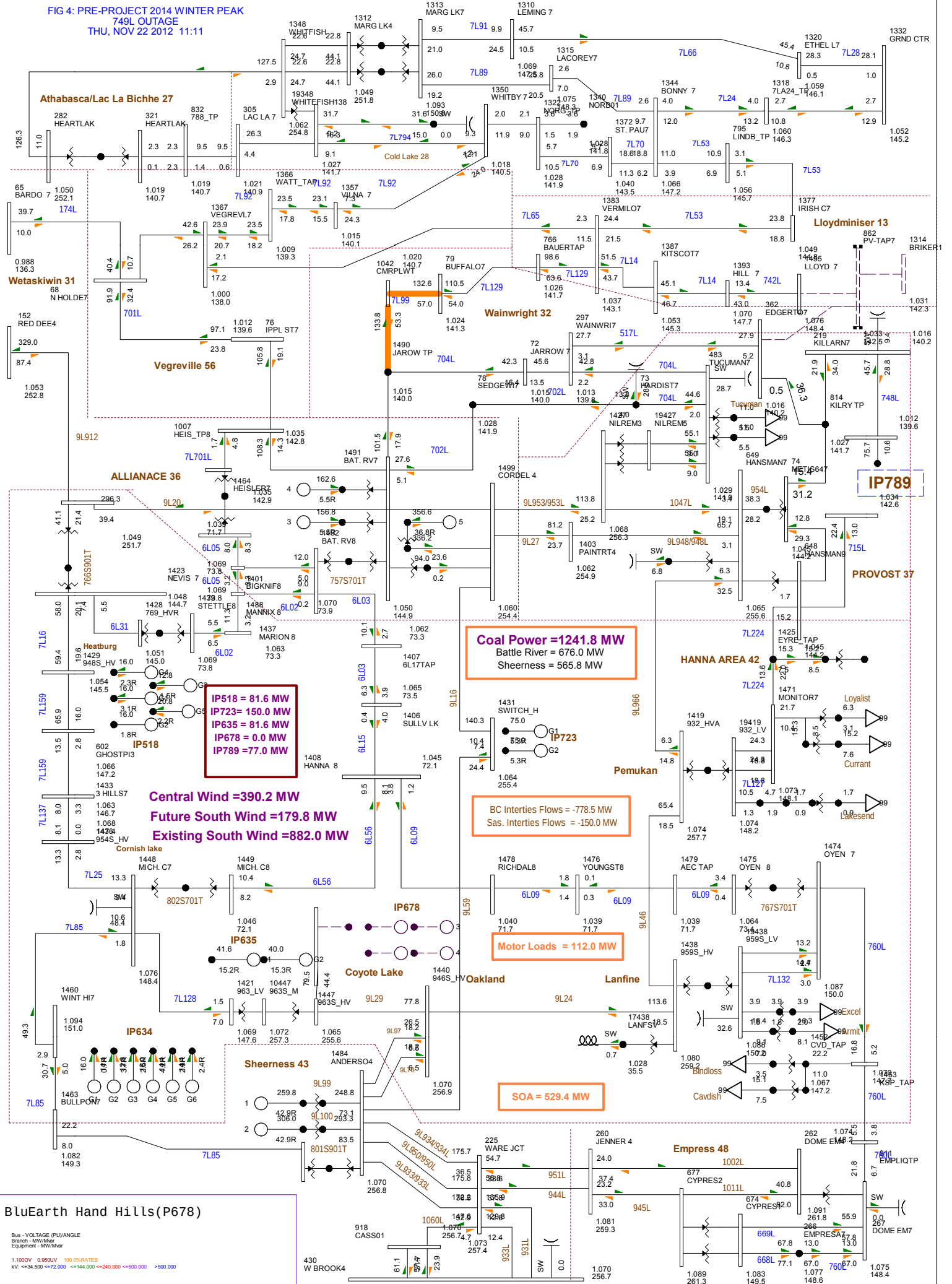
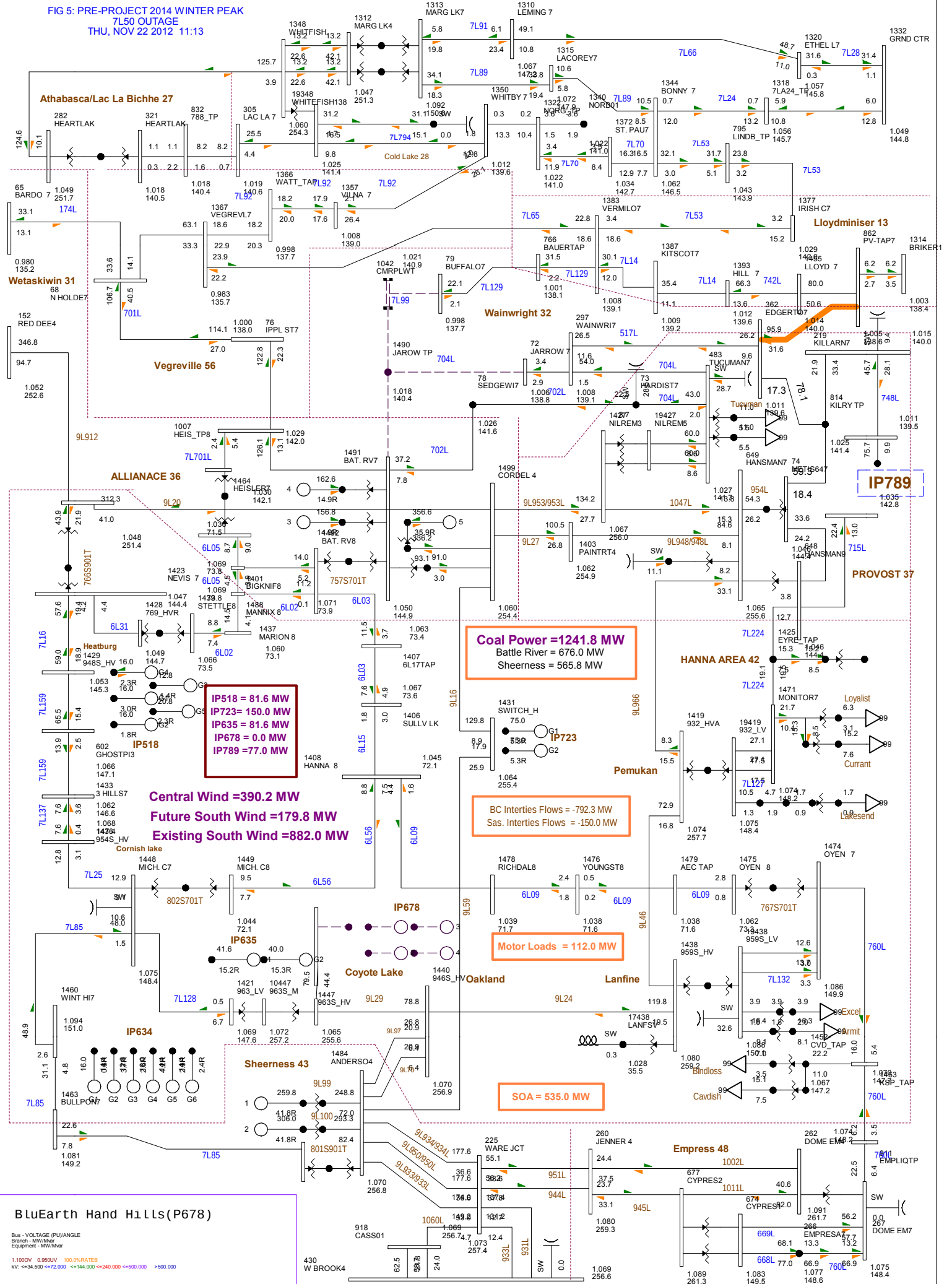


FIG 5: PRE-PROJECT 2014 WINTER PEAK
7L50 OUTAGE
THU, NOV 22 2012 11:13



Pre-connection Plots

2014 Summer Peak

FIG 1: PRE-PROJECT 2014 SUMMER PEAK
ALL ELEMENTS IN SERVICE
THU, NOV 22 2012 9:12

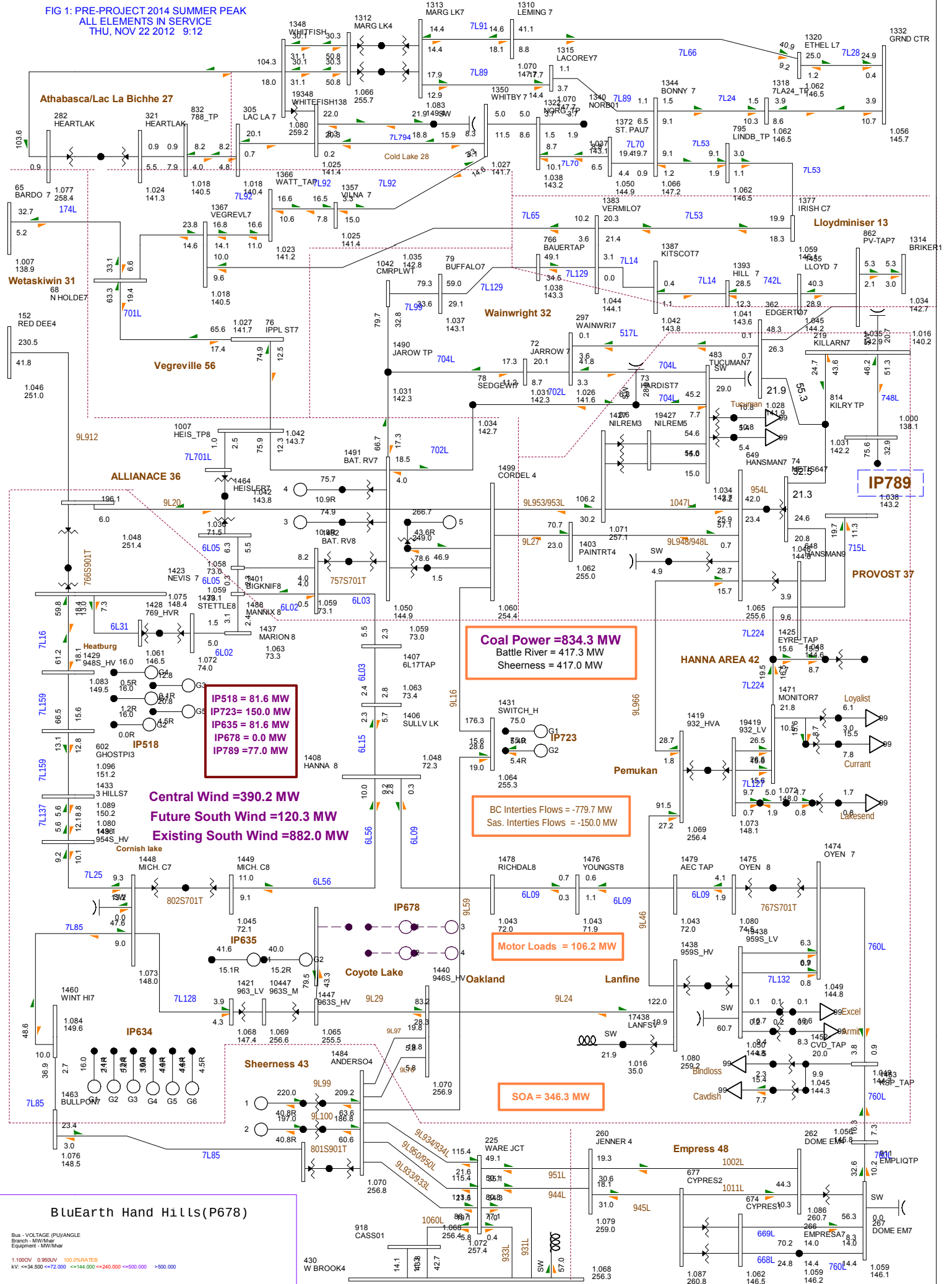


FIG 2: PRE-PROJECT 2014 SUMMER PEAK

138KV 749L EDGERTON 899S TO LLOYDMINSTER 716S OUTAGE

THU, NOV 22 2012 9:14

Athabasca/Lac La Biche 27

Wetaskiwin 31

Vegreville 56

Alliance 36

Central Wind = 390.2 MW

Future South Wind = 120.3 MW

Existing South Wind = 882.0 MW

Coal Power = 834.3 MW

Battle River = 417.3 MW

Sheerness = 417.0 MW

Hanna Area 42

IP518 = 81.6 MW

IP723 = 150.0 MW

IP635 = 81.6 MW

IP678 = 0.0 MW

IP789 = 77.0 MW

Motor Loads = 106.2 MW

SOA = 353.6 MW

Empress 48

BluEarth Hand Hills(P678)

Bus - VOLTAGE (PU)/ANGLE
Branch - MW/Mvar
Equipment - MW/Mvar

1.100V 0.950V 100.0% RATE
KV: <=34.500 <=72.000 <=144.000 <=240.000 <=500.000 >500.000

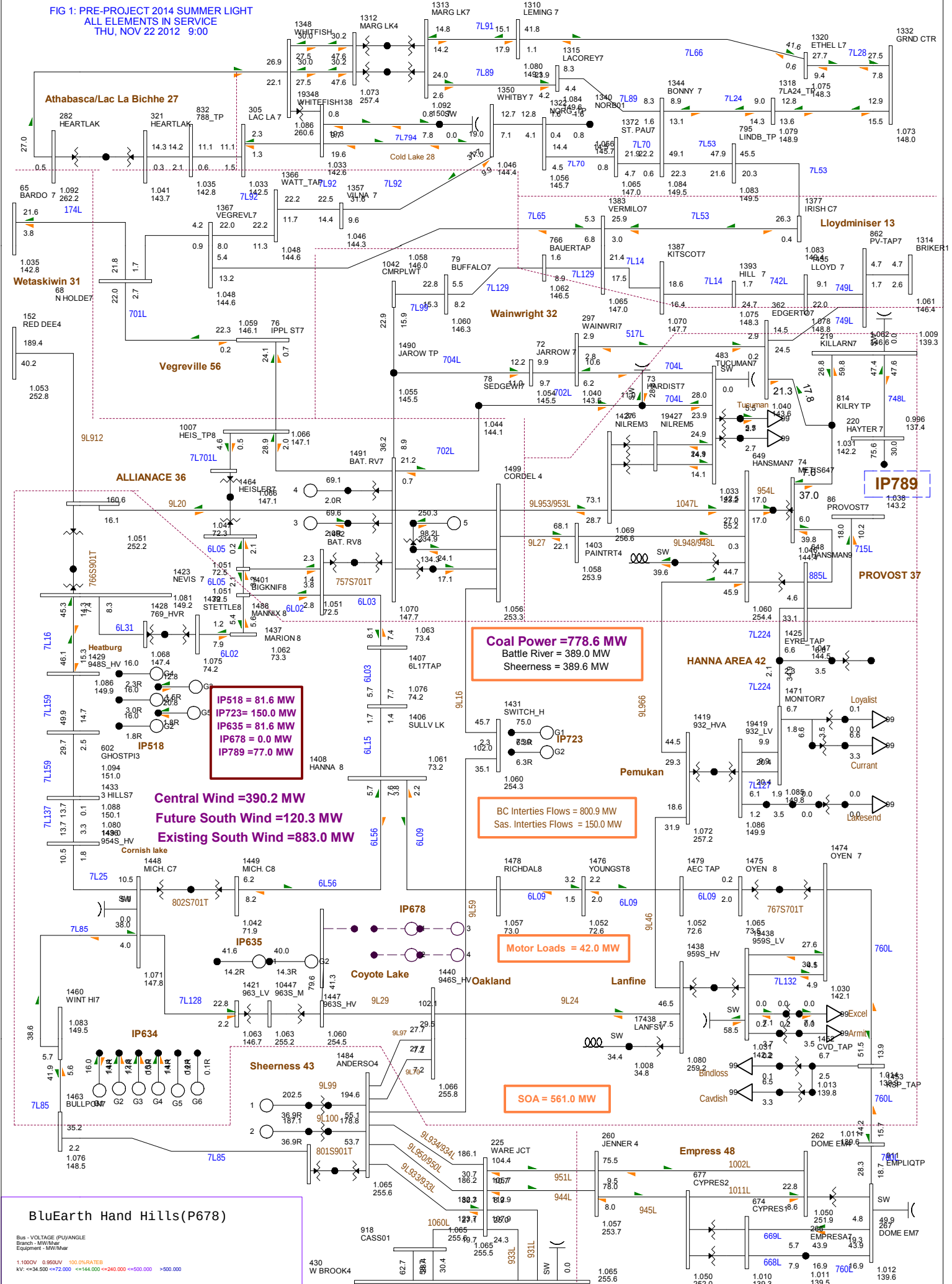
Bus - VOLTAGE (PU)/ANGLE
Branch - MW/Mvar
Equipment - MW/Mvar

1.1000V 0.9500V 100.0%RATEB
kV: <=34.500 <=72.000 <=144.000 <=240.000 <=500.000 >500.000

Pre-connection Plots

2014 Summer Light

FIG 1: PRE-PROJECT 2014 SUMMER LIGHT
ALL ELEMENTS IN SERVICE
THU, NOV 22 2012 9:00



BlueEarth Hand Hills(P678)

Bus - VOLTAGE (PU)/ANGLE
Branch - MW/Mvar
Equipment - MW/Mvar
1.1000V 0.9500V 100.0%RATE
KV: <=34.500 <=72.000 <=144.000 <=240.000 <=500.000 >500.000

ATTACHMENT C

Post-connection Power Flow Plots

2014 Winter Peak

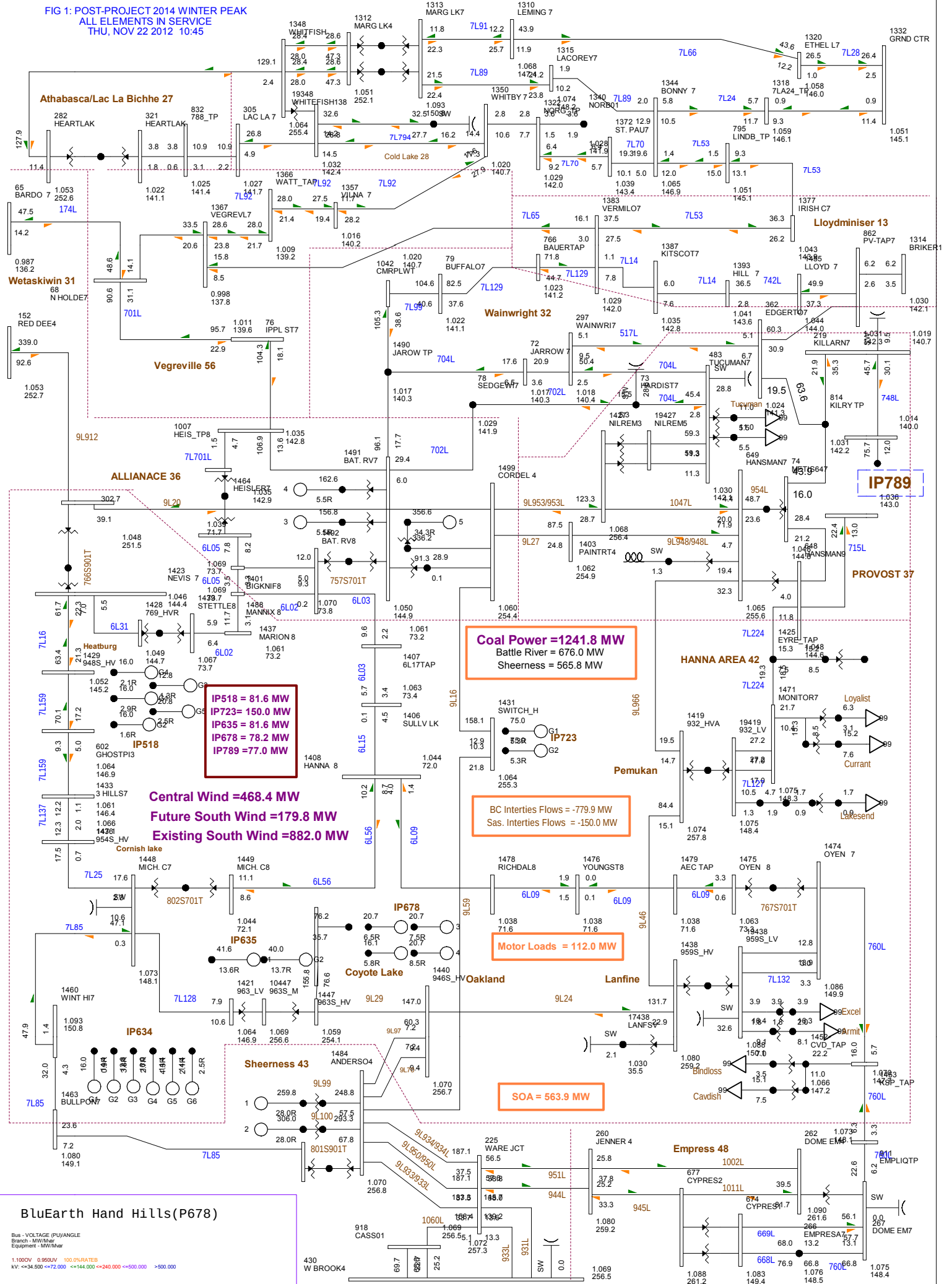
2014 Summer Peak

2014 Summer Light

Post-connection Plots

2014 Winter Peak

FIG 1: POST-PROJECT 2014 WINTER PEAK
ALL ELEMENTS IN SERVICE
THU, NOV 22 2012 10:45



[illegible]

1.1000V 0.950UV 100.0%RATEB
kV: <=34.500 <=72.000 <=144.000 <=240.000 <=500.000 >500.000

FIG 3: POST-PROJECT 2014 WINTER PEAK
240KV 9L912 NEVIS 766S TO RED DEER 152S OUTAGE
THU, NOV 22 2012 10:49

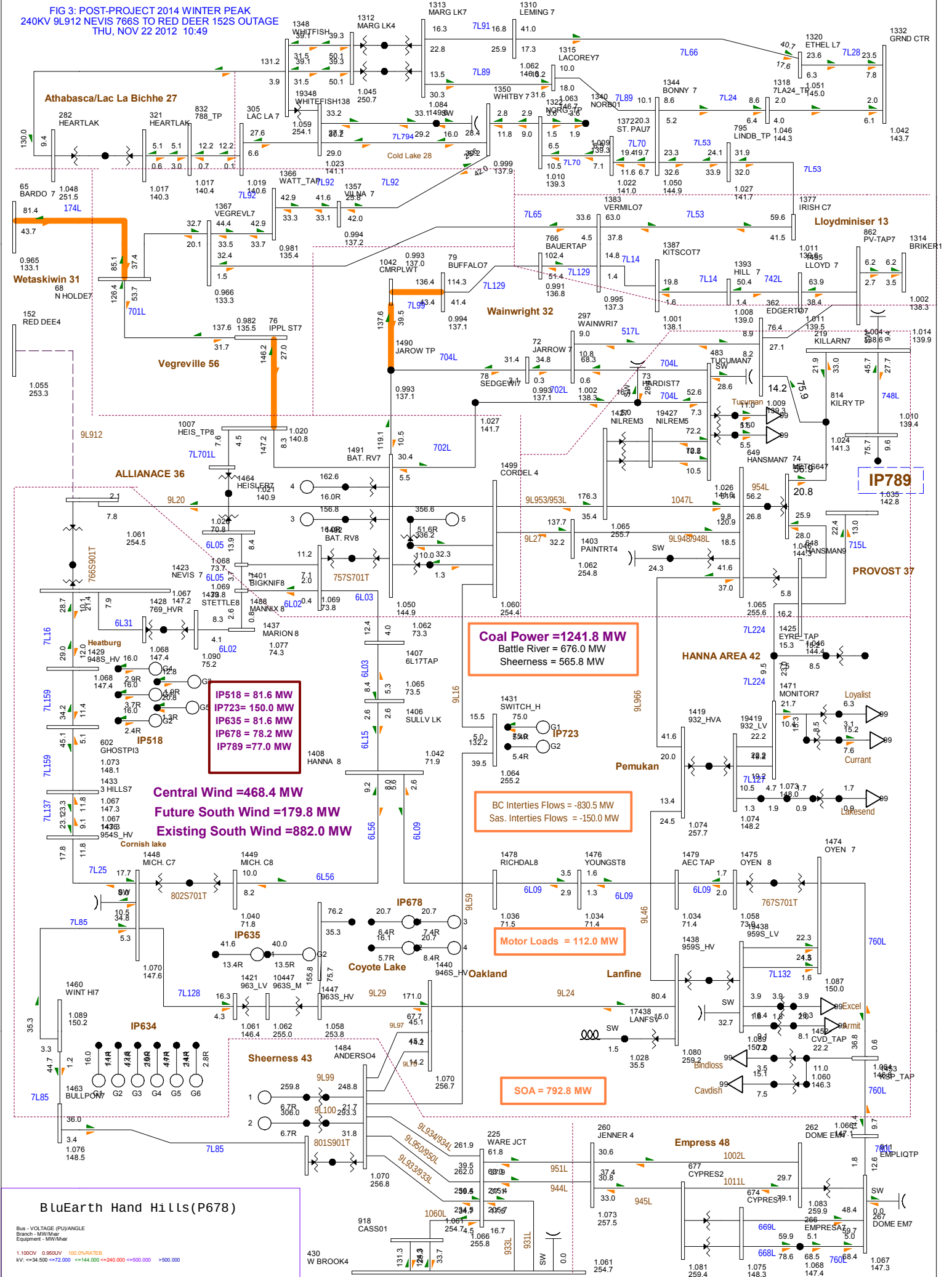


FIG 4: POST-PROJECT 2014 WINTER PEAK
749L OUTAGE
THU, NOV 22 2012 10:54

Athabasca/Lac La Biche 27

Wetaskiwin 31

Vegreville 56

ALLIANCE 36

Heatburg

IP518

Central Wind = 468.4 MW
Future South Wind = 179.8 MW
Existing South Wind = 882.0 MW

IP518 = 81.6 MW
IP723 = 150.0 MW
IP635 = 81.6 MW
IP678 = 78.2 MW
IP789 = 77.0 MW

Coal Power = 1241.8 MW
Battle River = 676.0 MW
Sheerness = 565.8 MW

BC Interties Flows = -779.0 MW
Sas. Interties Flows = -150.0 MW

Motor Loads = 112.0 MW

SOA = 573.0 MW

Sheerness 43

Empress 48

BluEarth Hand Hills(P678)

Bus - VOLTAGE (PU)/ANGLE
Branch - MW/MVar
Equipment - MW/MVar

1:1000V 0.950LV 100.0%RATED
kV: <=34.500 <=72.000 <=114.000 <=240.000 <=500.000 >500.000

1.1000V 0.950UV 100.0%RATEB
kV: <=34.500 <=72.000 <=144.000 <=240.000 <=500.000 >500.000

FIG 5: POST-PROJECT 2014 WINTER PEAK
7L50 OUTAGE
THU, NOV 22 2012 10:56

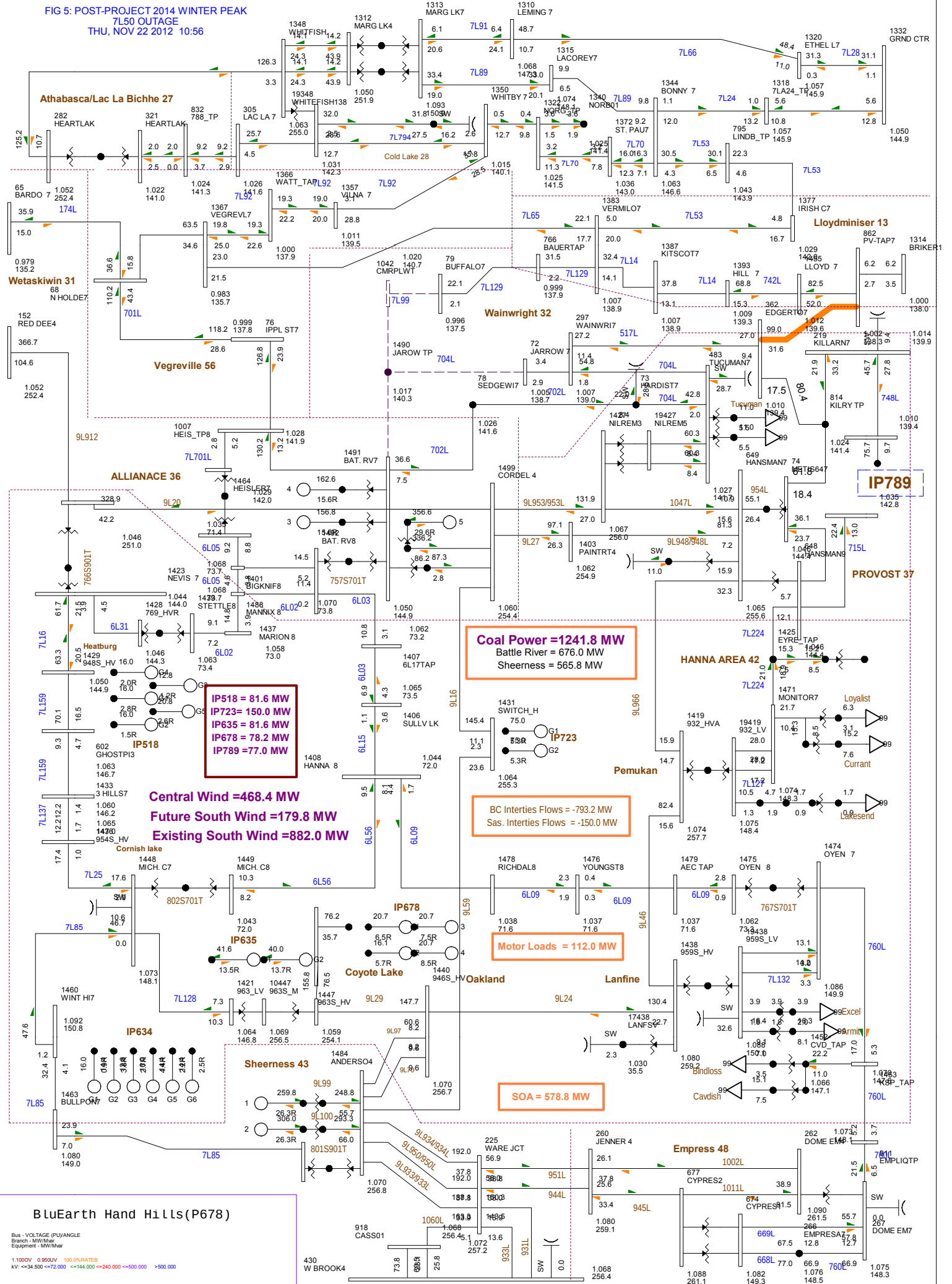
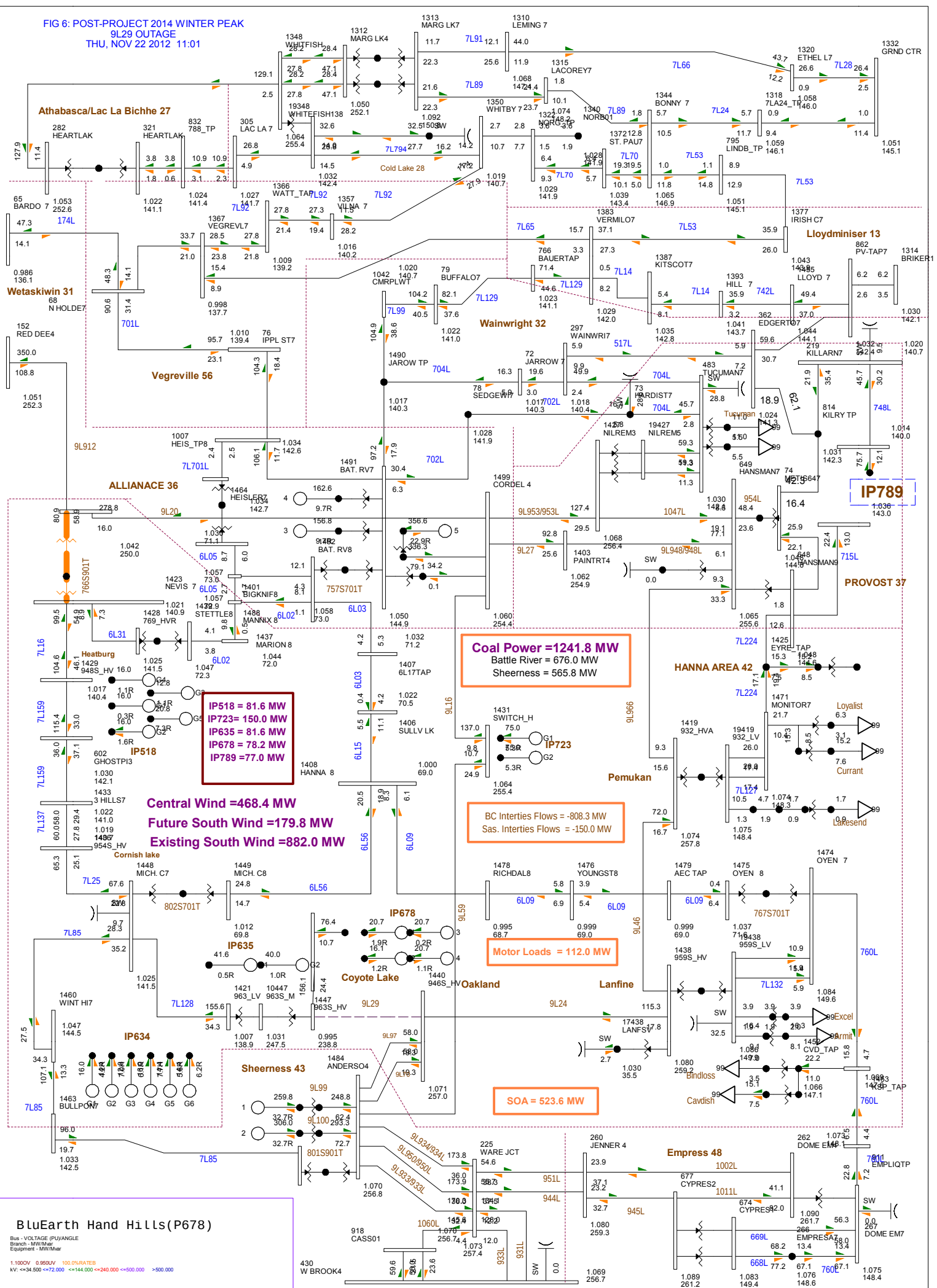


FIG 6: POST-PROJECT 2014 WINTER PEAK
9L29 OUTAGE
THU, NOV 22 2012 11:01



[illegible]

1.100OV 0.950UV 100.0%RATEB
kV: <=34.500 <=72.000 <=144.000 <=240.000 <=500.000 >500.000

Post-connection Plots

2014 Summer Peak

FIG 1: POST-PROJECT 2014 SUMMER PEAK
ALL ELEMENTS IN SERVICE
THU, NOV 22 2012 9:03

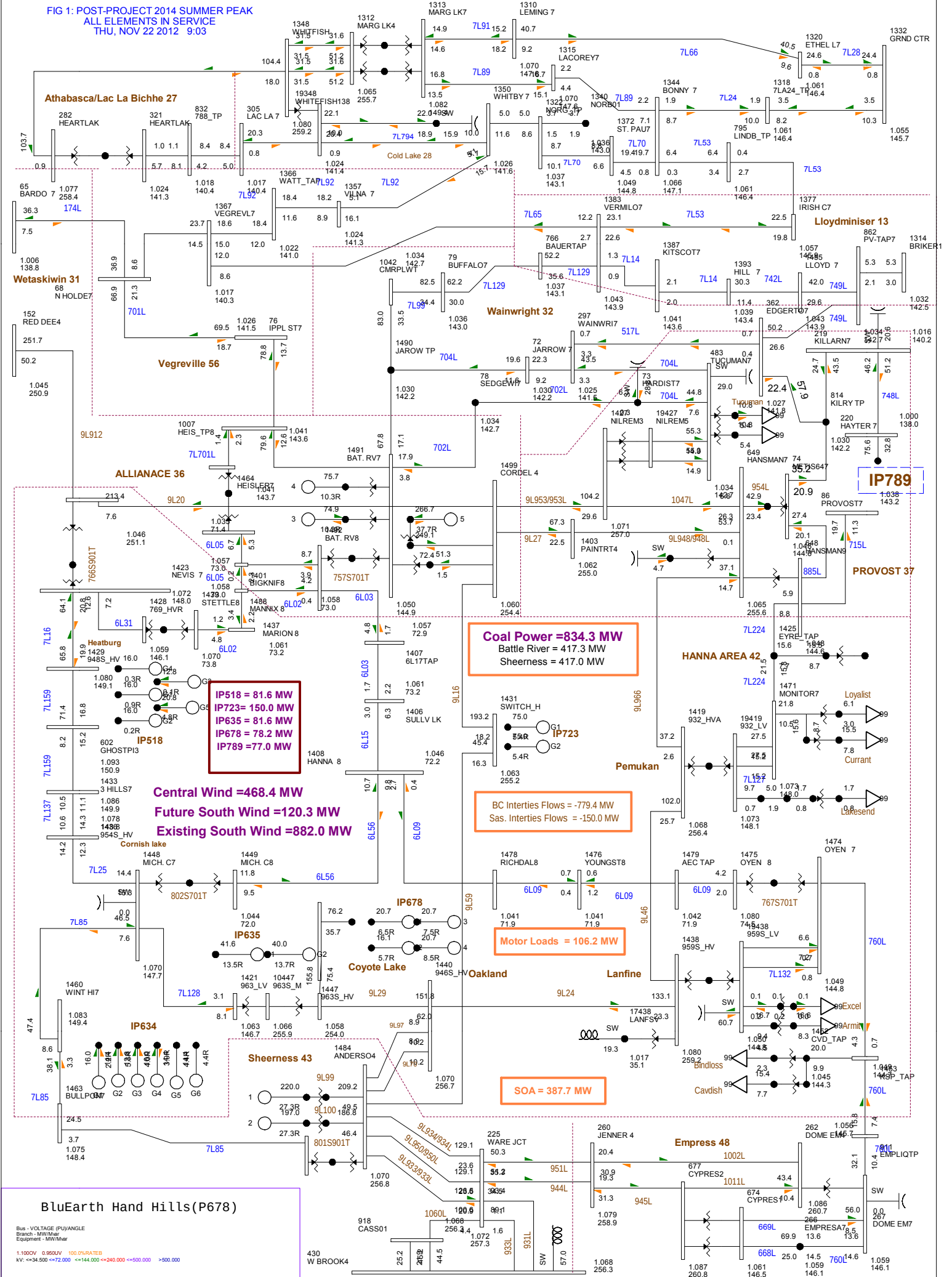


FIG 2: POST-PROJECT 2014 SUMMER PEAK
138KV 749L EDGERTON 899S TO LLOYDMINSTER 716S OUTAGE
THU, NOV 22 2012 9:08

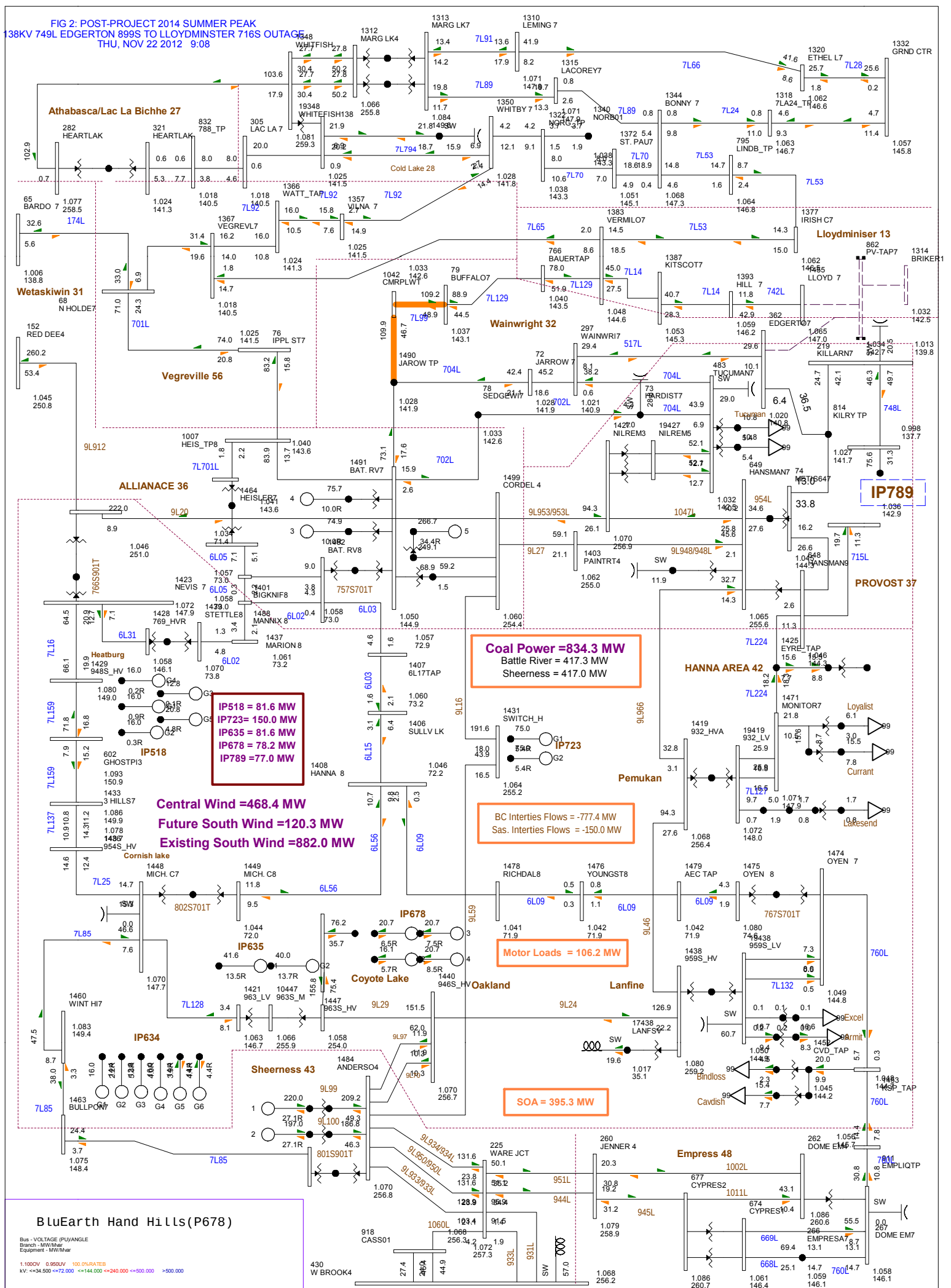


FIG 3: POST-PROJECT 2014 SUMMER PEAK
240KV 9L912 NEVIS 766S TO RED DEER 152S OUTAGE
THU, NOV 22 2012 9:06

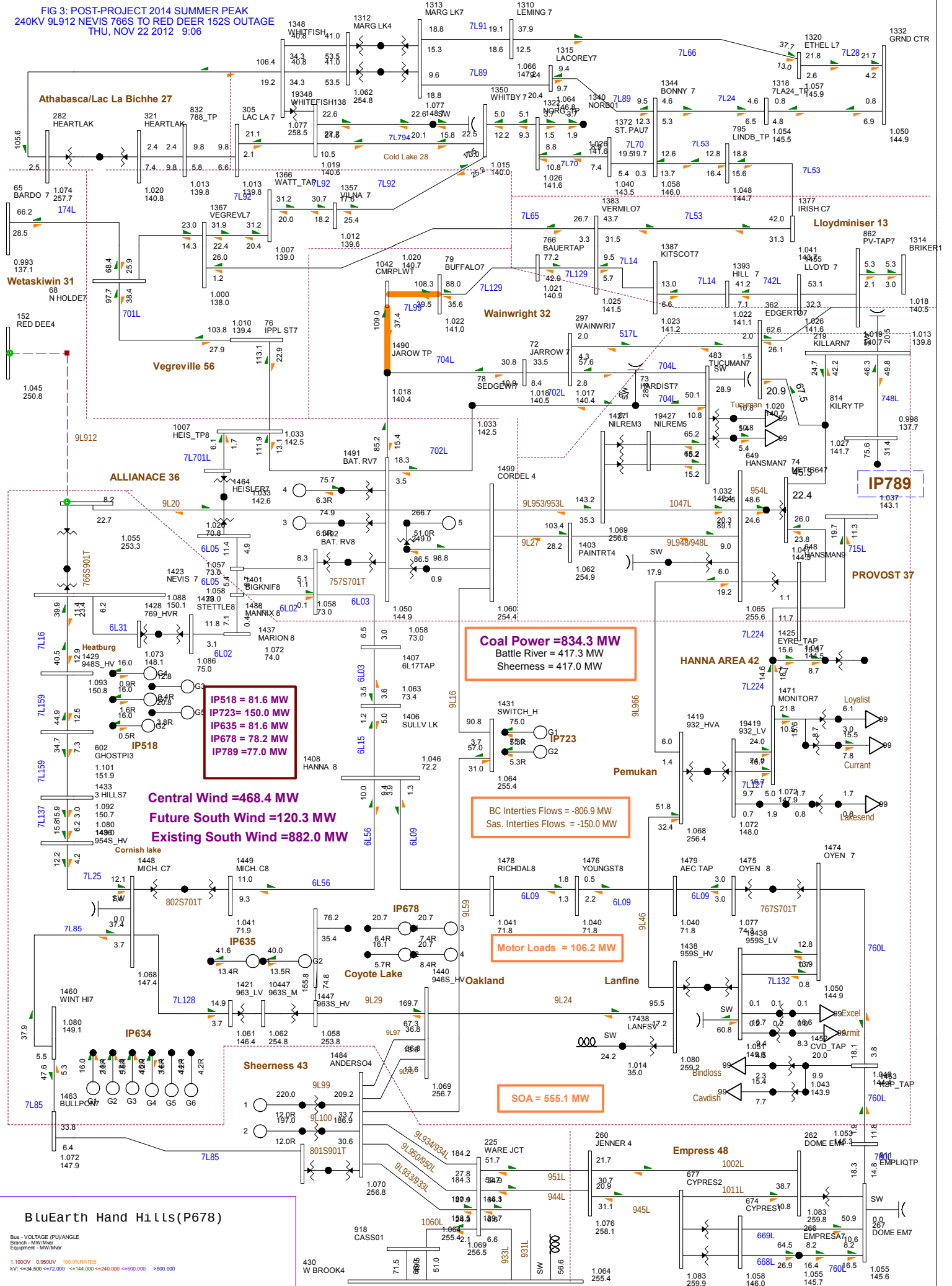
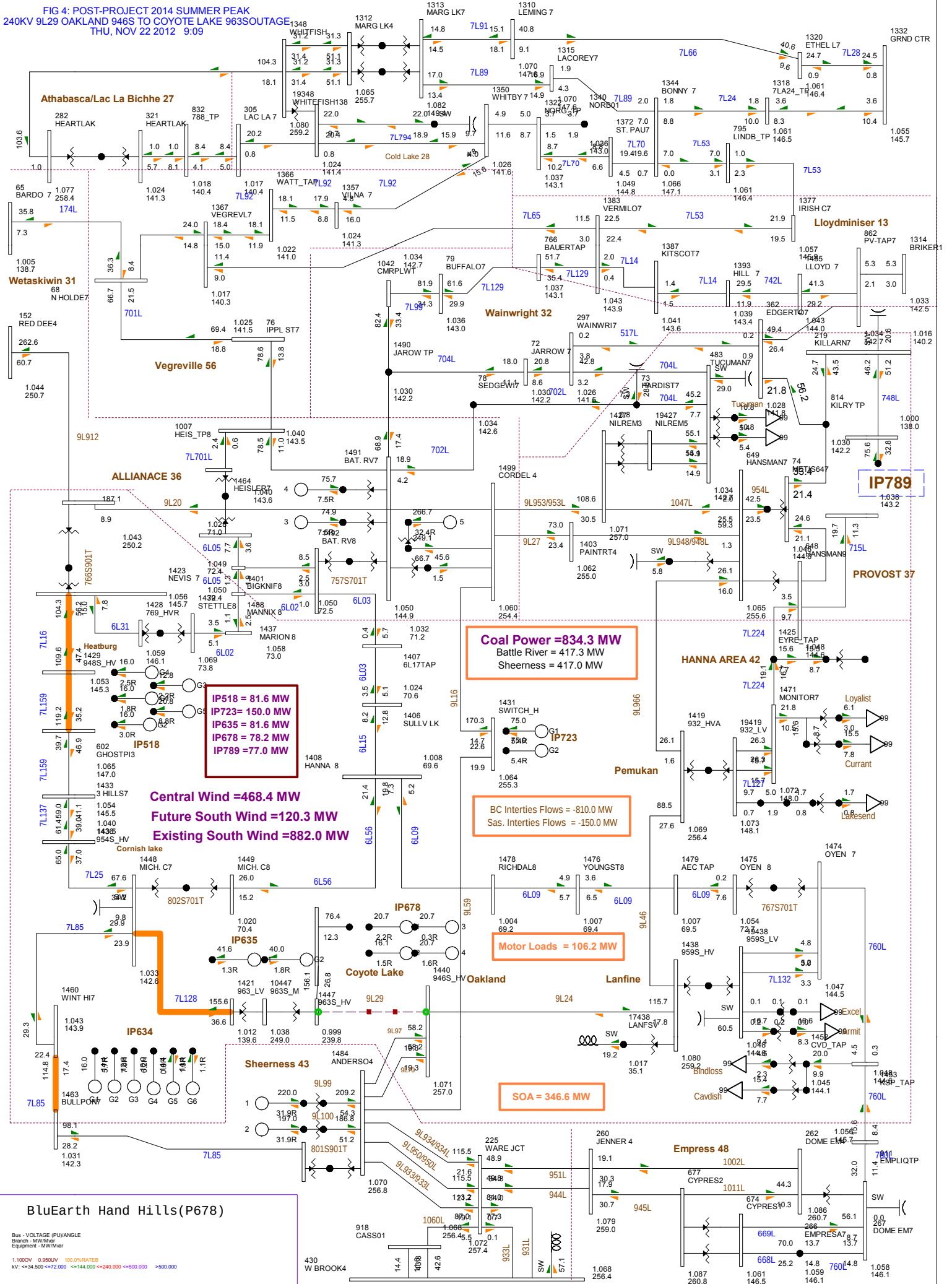


FIG 4: POST-PROJECT 2014 SUMMER PEAK
240KV 9L29 OAKLAND 946S TO COYOTE LAKE 963S OUTAGE
THU, NOV 22 2012 9:09



Post-connection Plots

2014 Summer Light

FIG 1: POST-PROJECT 2014 SUMMER LIGHT
ALL ELEMENTS IN SERVICE
THU, NOV 22 2012 8:55

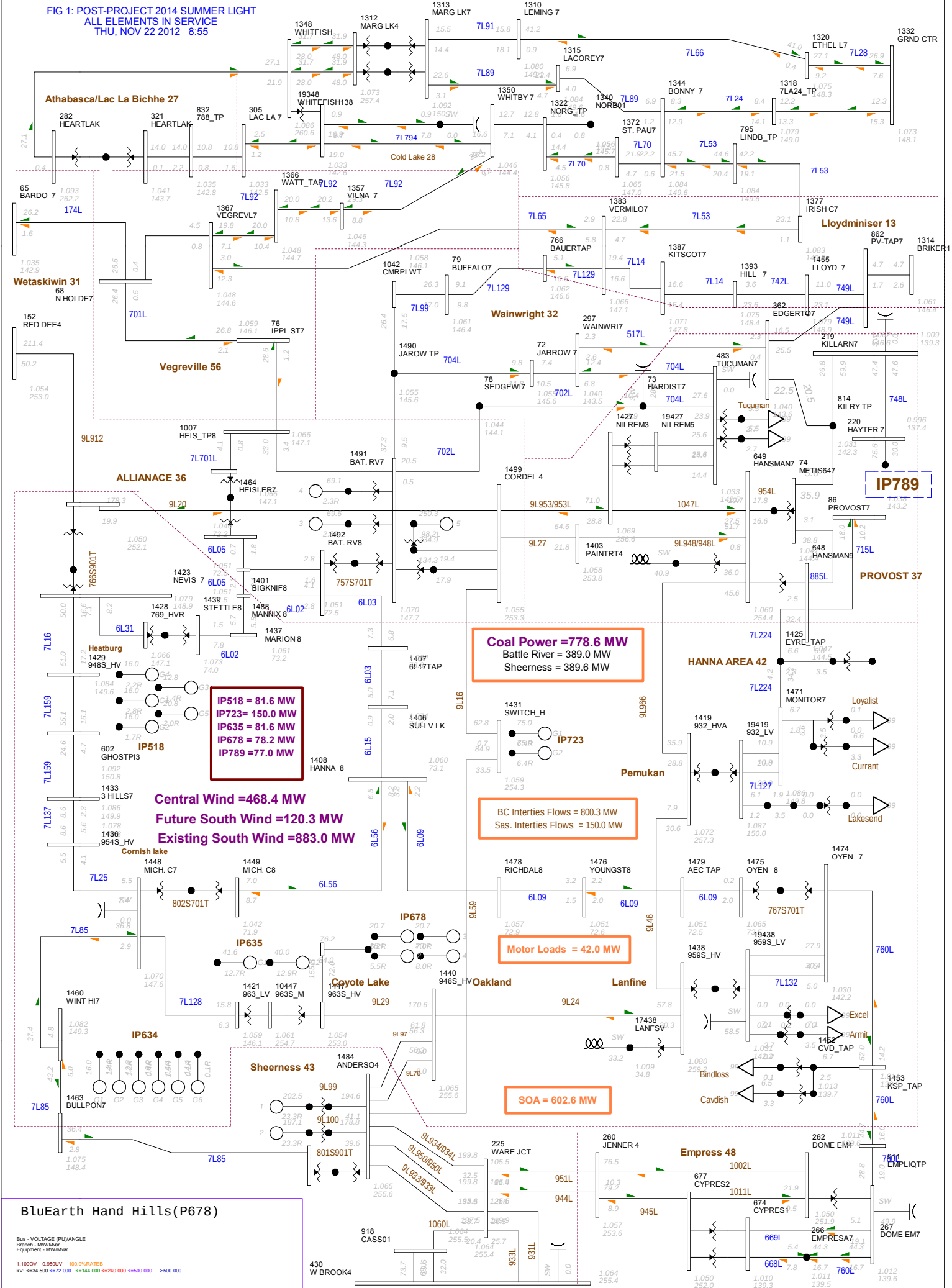
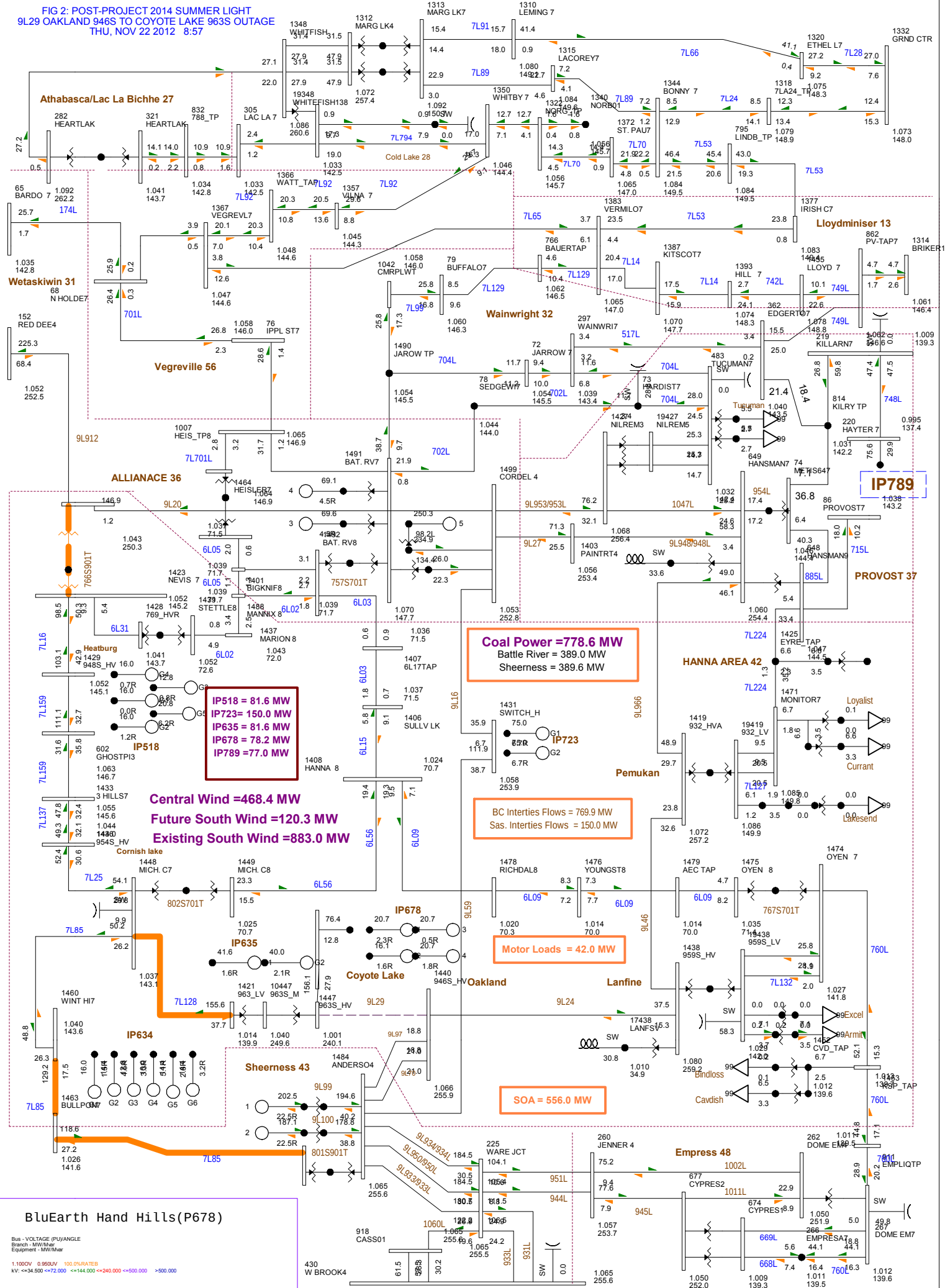


FIG 2: POST-PROJECT 2014 SUMMER LIGHT
9L29 OAKLAND 946S TO COYOTE LAKE 963S OUTAGE
THU, NOV 22 2012 8:57



ATTACHMENT D

Post-connection Power Flow Plots

2017 Winter Peak

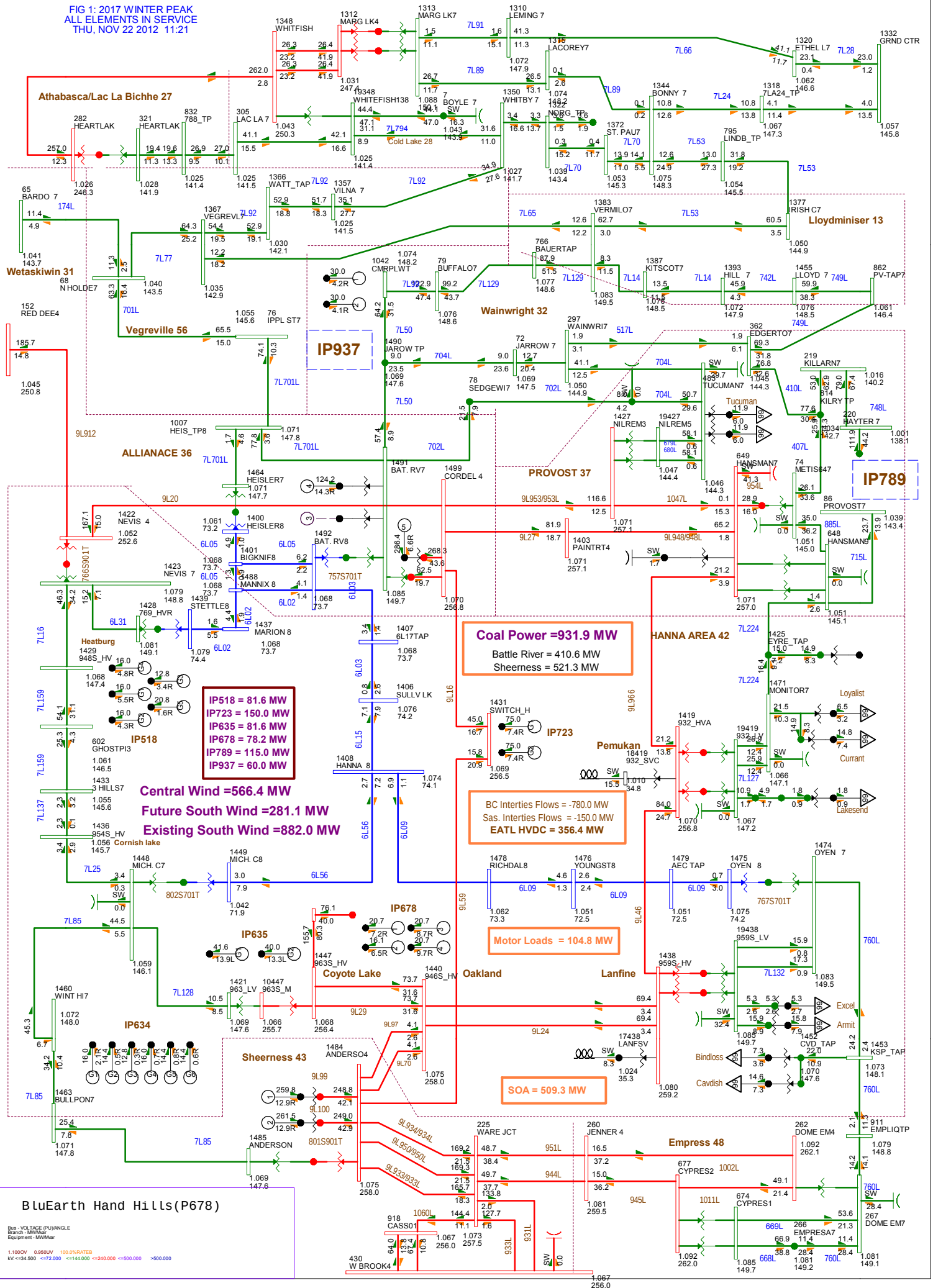
2017 Summer Peak

2017 Summer Light

Post-connection Plots

2017 Winter Peak

FIG 1: 2017 WINTER PEAK
ALL ELEMENTS IN SERVICE
THU, NOV 22 2012 11:21



Post-connection Plots

2017 Summer Peak

FIG 1: 2017 SUMMER PEAK
ALL ELEMENTS IN SERVICE
THU, NOV 22 2012 11:20

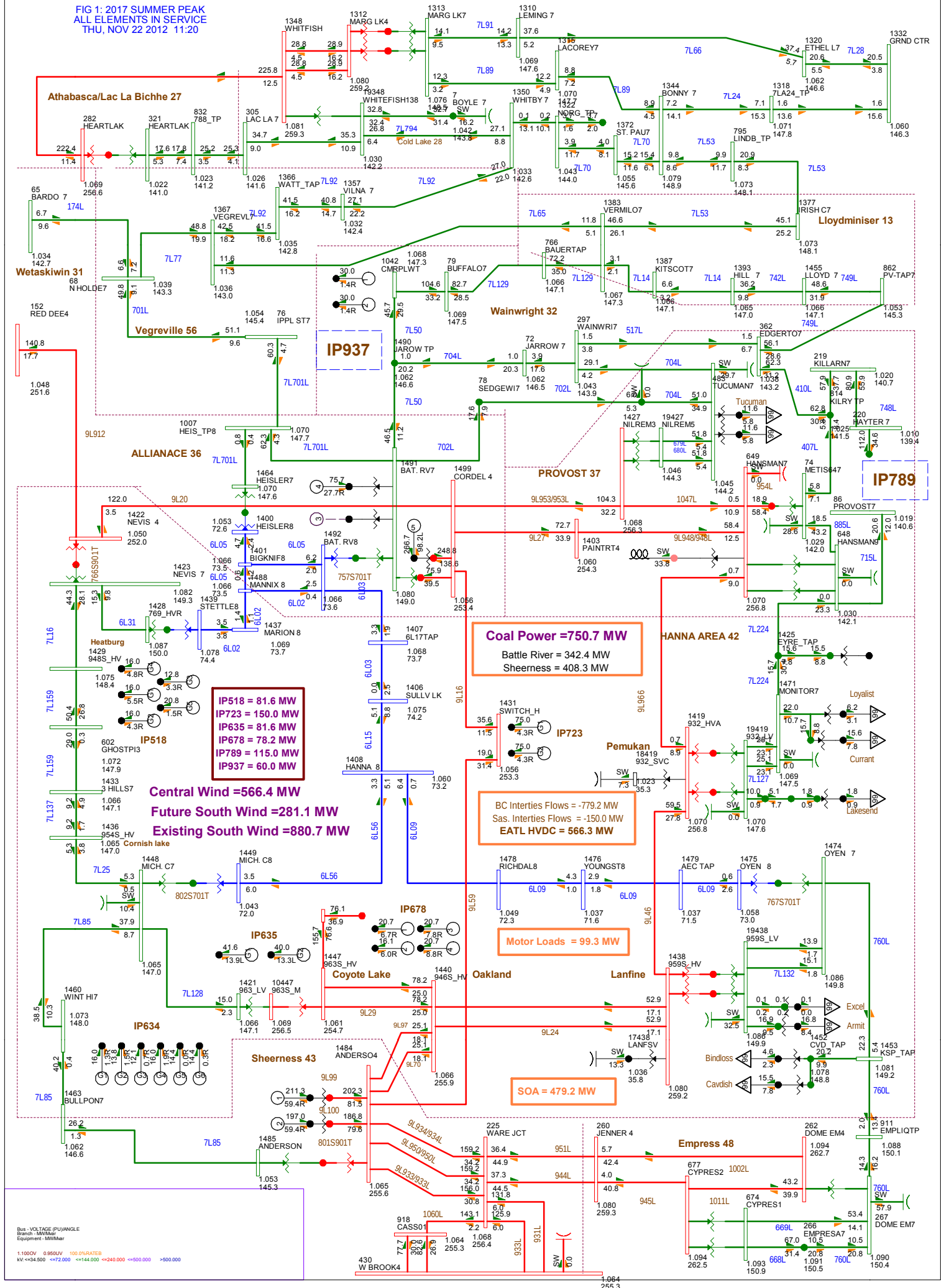


FIG 2: 2017 SUMMER PAEK
749L OUTAGE
WED, JAN 23 2013 14:01

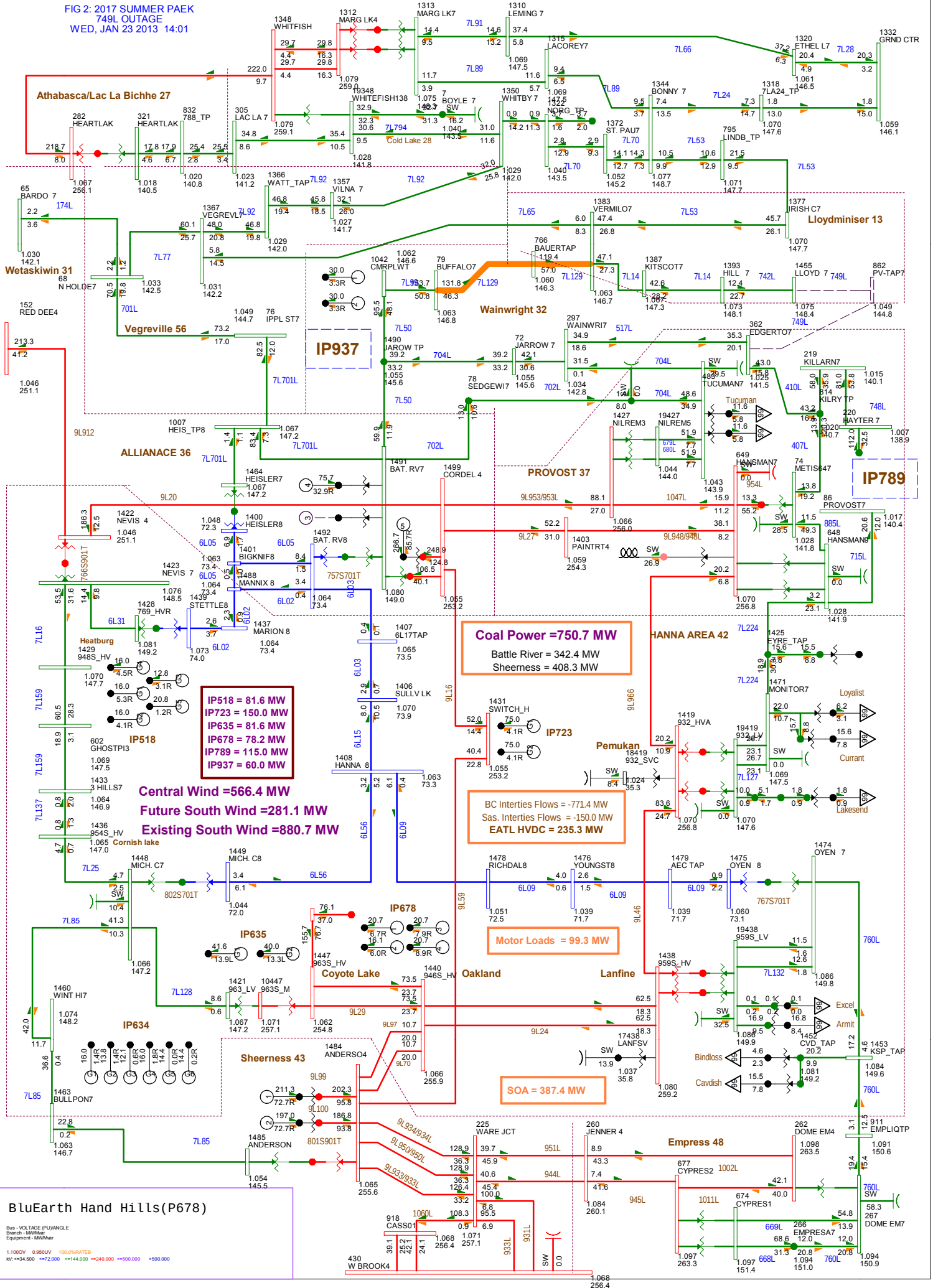


FIG 3: 2017 SUMMER PEAK
912L OUTAGE
WED, JAN 23 2013 14:05

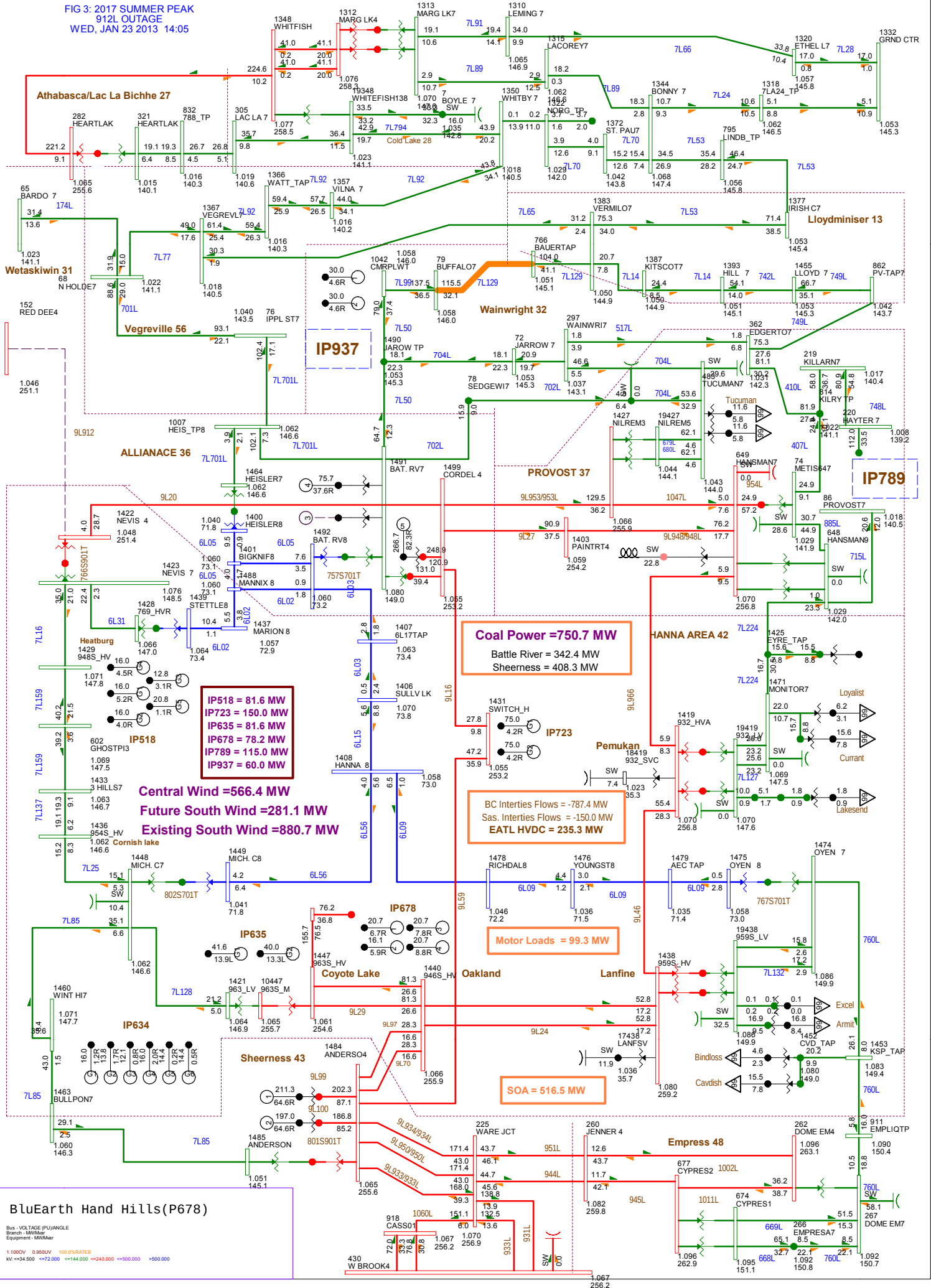
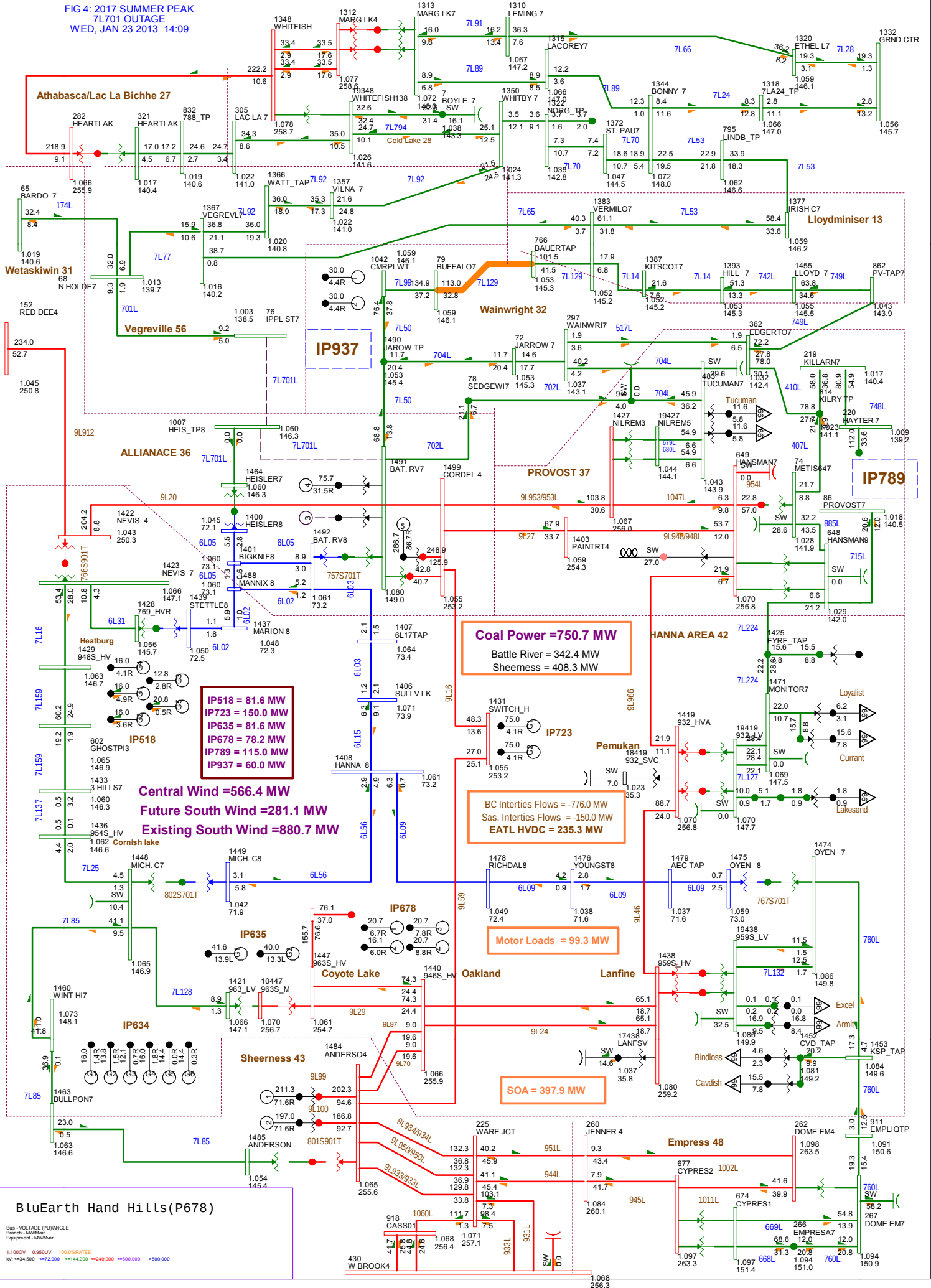


FIG 4: 2017 SUMMER PEAK
7L701 OUTAGE
WED, JAN 23 2013 14:09



Post-connection Plots

2017 Summer Light

Bus - VOLTAGE (PU) / ANGLE
Branch - MW / Mvar
Equipment - MW / Mvar

1.1000V 0.9500V 100.0% RATEB
kV: <=34.500 <=72.000 <=144.000 <=240.000 <=500.000 >500.000

Attachment E

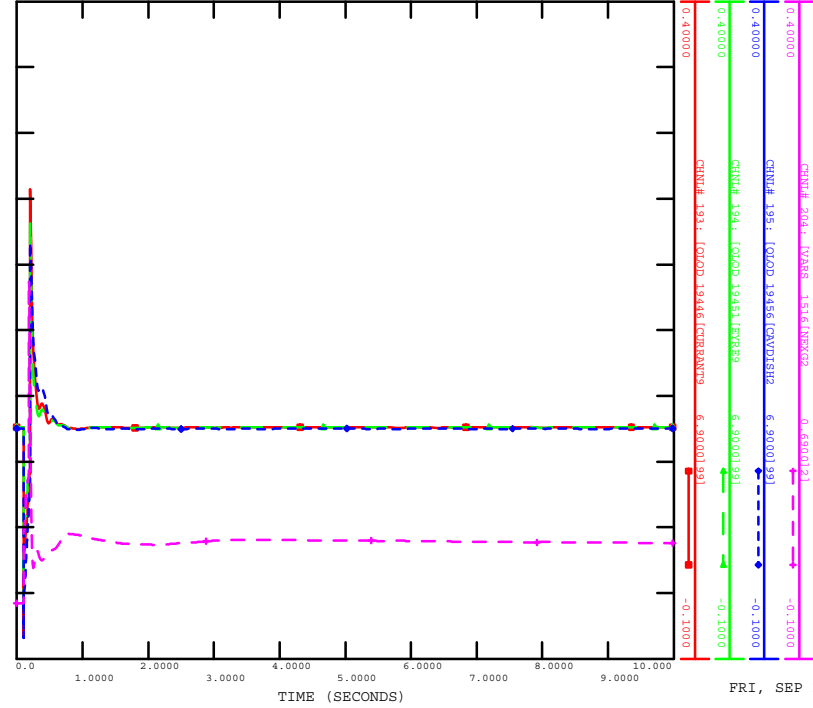
Transient Stability Plots (2014)

Engineering Study Report:**List of Contingencies**

Plot No.	Contingency	Fault Description and Clearing Times
	Category B Contingency	
B-01	3ph fault on Line 9L29 (Oakland 946S to Coyote Lake 963S)	3ph fault at Oakland 946S on 9L29 to Coyote Lake 963S 5 cycles: trip Oakland 946S CB on 9L29 to Coyote Lake 963S 6 cycles: trip Coyote Lake 963S CB on 9L29 to Oakland 946S
B-02	3ph fault on Line 9L29 (Oakland 946S to Coyote Lake 963S)	3ph fault at Coyote Lake 963S on 9L29 to Oakland 946S 5 cycles: trip Coyote Lake 963S CB on 9L29 to Oakland 946S 6 cycles: trip Oakland 946S CB on 9L29 to Coyote Lake 963S
B-04	3ph fault on Line 9L94 (Coyote Lake 963S to P635S)	3ph fault at Coyote Lake on 240 kV line to 5 cycles: trip Coyote Lake 963S CB on 240 kV line to P635 6 cycles: trip P635 CB on 240 kV line to Coyote Lake 963S Both P635 and P678 tripped entirely
B-05	3ph fault on Line 9L59 (Anderson 801S to Halkirk 615S)	3ph fault at Anderson 801S on 9L59 to Halkirk 615S 5.1 cycles: trip Anderson 801S CB on 9L59 to Halkirk 615S 6 cycles: trip Halkirk 615S CB on 9L59 to Anderson 801SS
B-07	3ph fault on Line 9L100 (Anderson 801S to Sheerness 807S)	3ph fault at Anderson 801S on 9L100 to Sheerness 801S 5.22 cycles: trip Anderson 801S CB on 9L100 to Sheerness 807S 5.82 cycles: trip Sheerness 807S CB on 9L100 to Anderson 801S
B-11	3ph fault on Line 9L24 (Oakland 946S to Lanfine 959S)	3ph fault at Oakland 946S on 9L24 to Lanfine 959S 5 cycles: trip Oakland 946S CB on 9L24 to Lanfine 959S 6 cycles: trip Lanfine 959S CB on 9L24 to Oakland 946S
B-12	3ph fault on Line 9L24 (Oakland 946S to Lanfine 959S)	3ph fault at Lanfine 959S on 9L24 to Oakland 946S 5 cycles: trip Lanfine 959S CB on 9L24 to Oakland 946S 6 cycles: trip Oakland 946S CB on 9L24 to Lanfine 959S
B-33	3ph fault on Line 9L20 (Cordel 755S to Nevis 766S)	3ph fault at Cordel 755S on 9L20 to Nevis 766S 5.22 cycles: trip Cordel 755S CB on 9L20 to Nevis 766S 6.78 cycles: trip Nevis 766S CB on 9L20 to Cordel 755S
B-34	3ph fault on Line 9L20 (Cordel 755S to Nevis 766S)	3ph fault at Nevis 766S on 9L20 to Cordel 755S 5.22 cycles: trip Nevis 766S CB on 9L20 to Cordel 755S 6.78 cycles: trip Cordel 755S CB on 9L20 to Nevis 766S
B-35	3ph fault on Line 912L (Nevis 766S to Red Deer 63S)	3ph fault at Nevis 766S on 912L to Red Deer 63S 5.22 cycles: trip Nevis 766S CB on 912L to Red Deer 63S 6.78 cycles: trip Red Deer 63S CB on 9L20 to Nevis 766S
B-36	3ph fault on Line 912L (Nevis 766S to Red Deer 63S)	3ph fault at Red Deer 63S on 912L to Nevis 766S 5.22 cycles: trip Red Deer 63S CB on 912L to Nevis 766S 6.78 cycles: trip Nevis 766S CB on 9L20 to Red Deer 63S
B-41	3ph fault on Line 931L (Ware JKT 132S to West Brooks 28S)	3ph fault at Ware Junction 132S on 931L to West Brooks 28S 5.22 cycles: trip Ware JKT 132S CB on 931L to West Brooks 28S 6.78 cycles: trip West Brooks 28S CB on 951L to Ware JKT 132S
B-42	3ph fault on Line 931L (Ware JKT 132S to West Brooks 28S)	3ph fault at West Brooks 28S on 931L to Ware Junction 132S 5.22 cycles: trip West Brooks 28S CB on 931L to Ware JKT 132S 6.78 cycles: trip Ware JKT 132S CB on 951L to West Brooks 28S

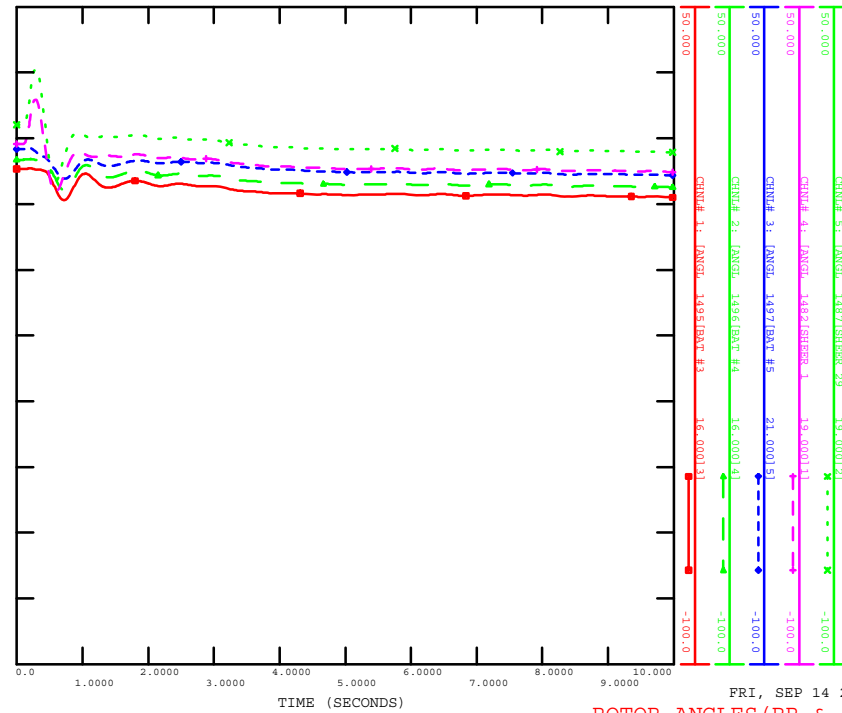
2014 Winter Peak

FILE: B-01.out



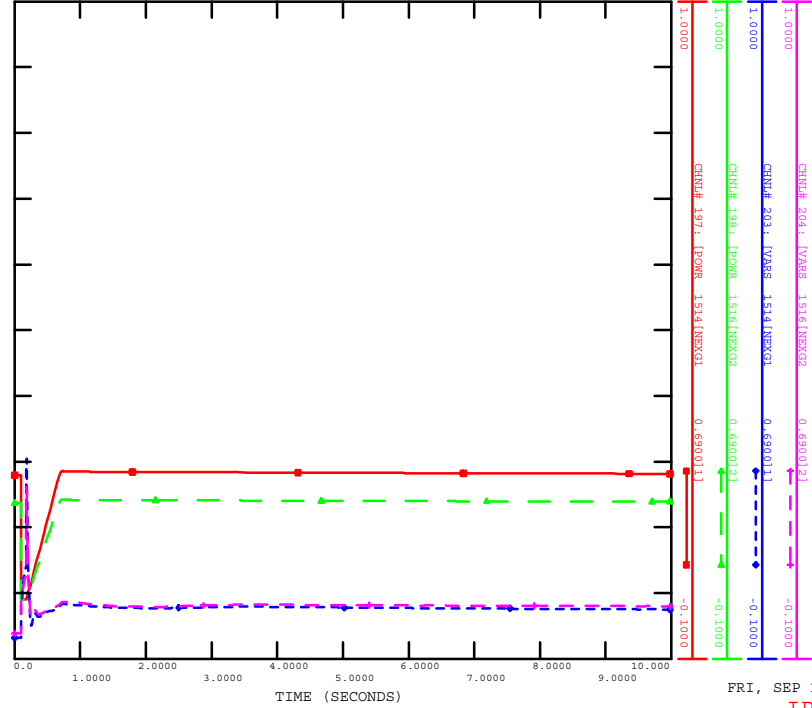
FRI, SEP 14 2012 11:14
IP678 (P)

FILE: B-01.out



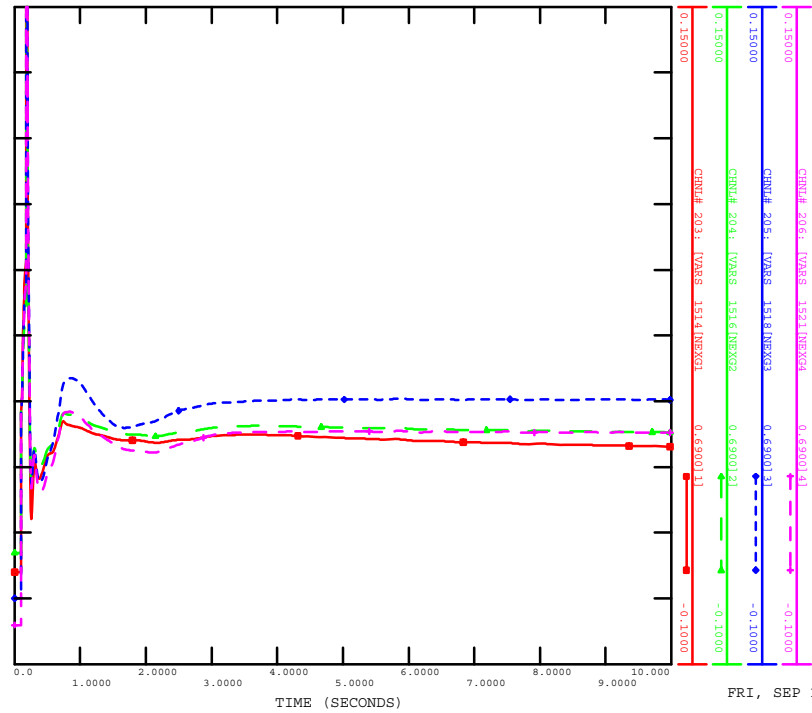
FRI, SEP 14 2012 11:14
ROTOR ANGLES (BR & SHEERNE)

FILE: B-01.out



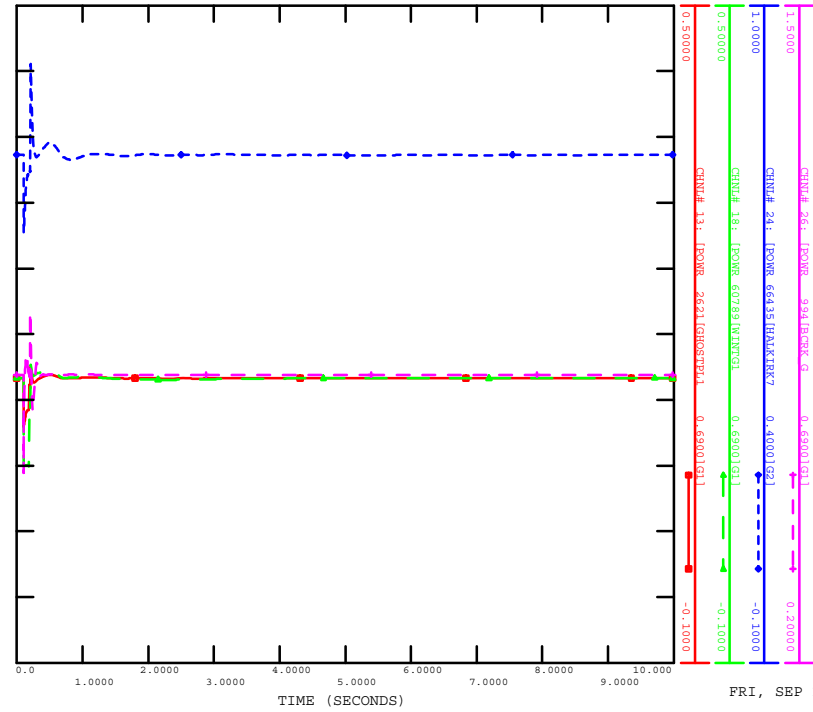
FRI, SEP 14 2012 11:14
IP635 (P&Q)

FILE: B-01.out

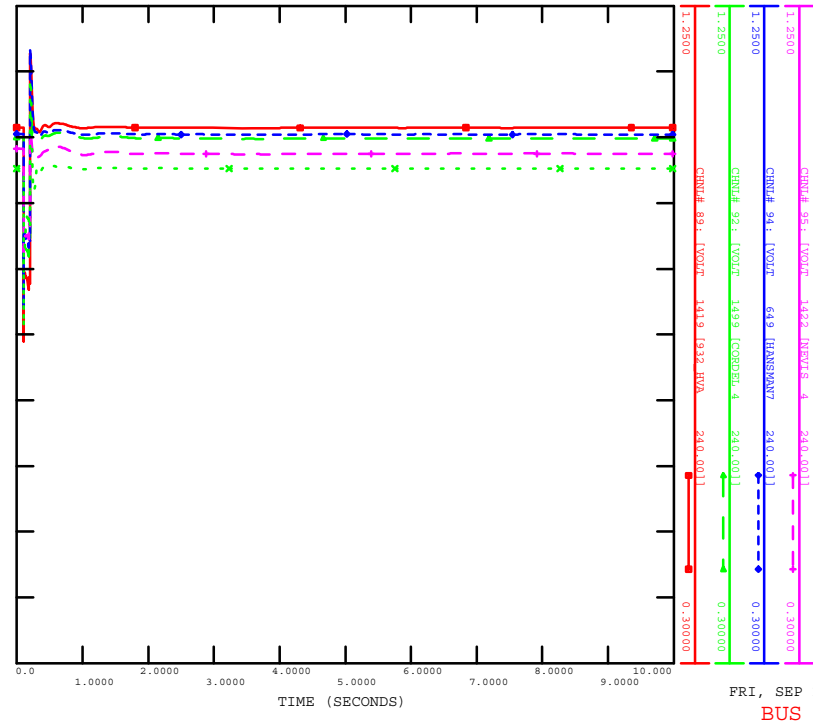


FRI, SEP 14 2012 11:14
IP678 (Q)

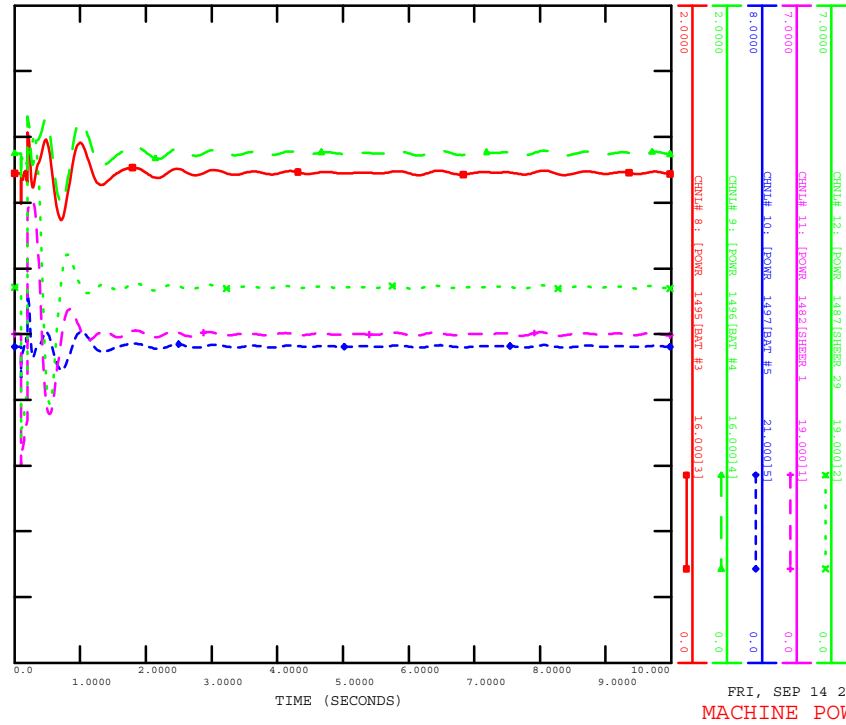
FILE: B-01.out



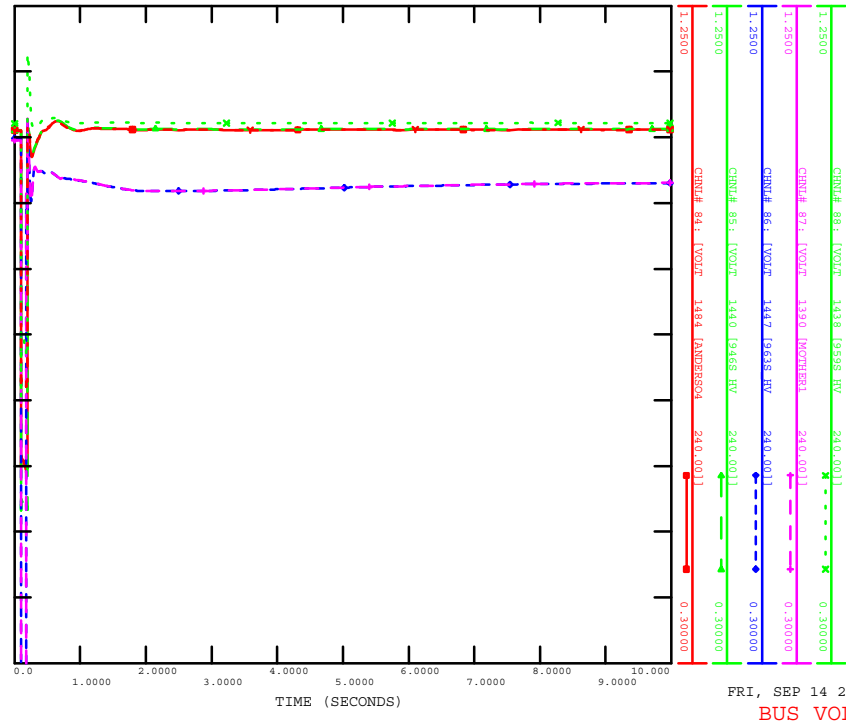
FILE: B-01.out



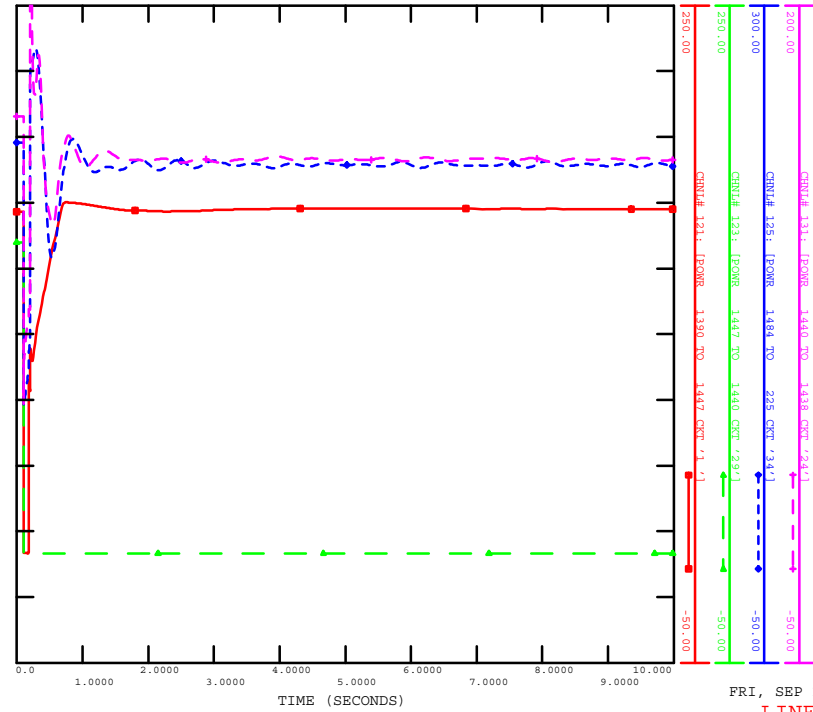
FILE: B-01.out



FILE: B-01.out

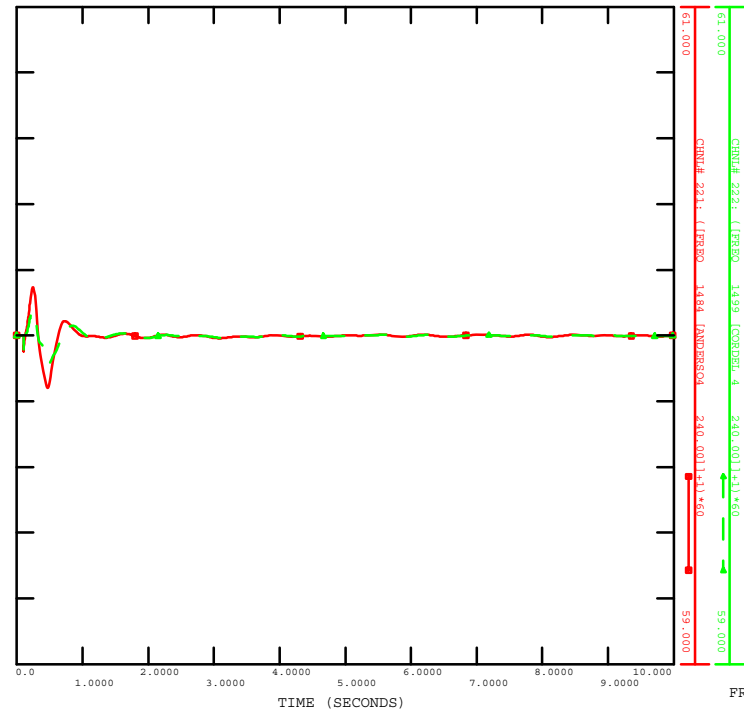


FILE: B-01.out



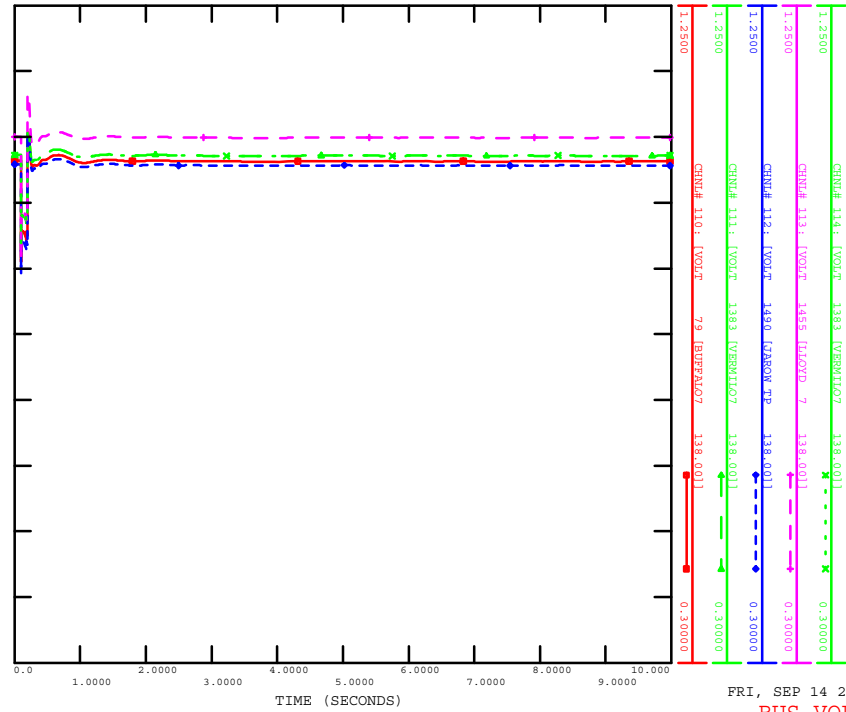
FRI, SEP 14 2012 11:14
LINE FLOW (P)

FILE: B-01.out



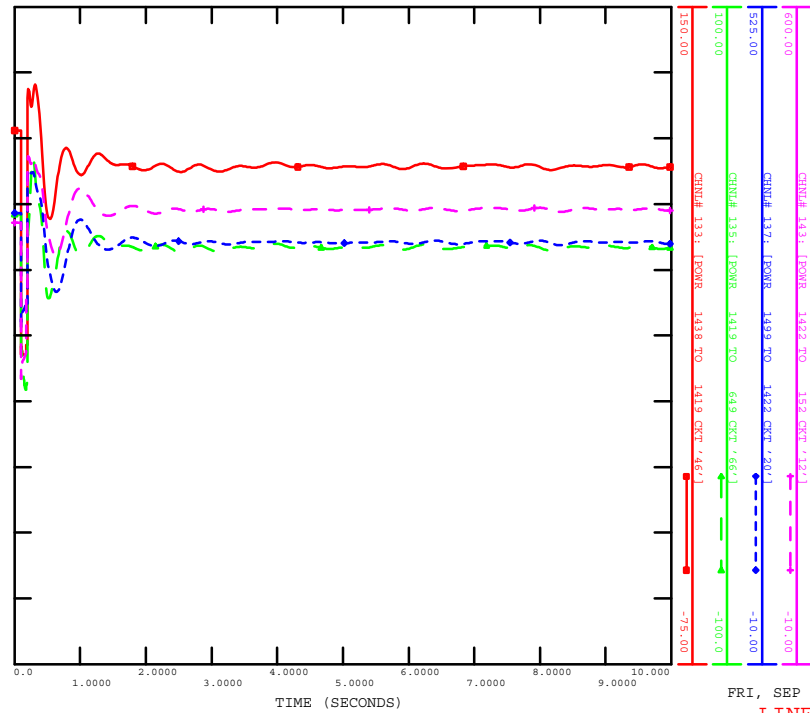
FRI, SEP 14 2012 11:14
BUS FREQUENCY

FILE: B-01.out



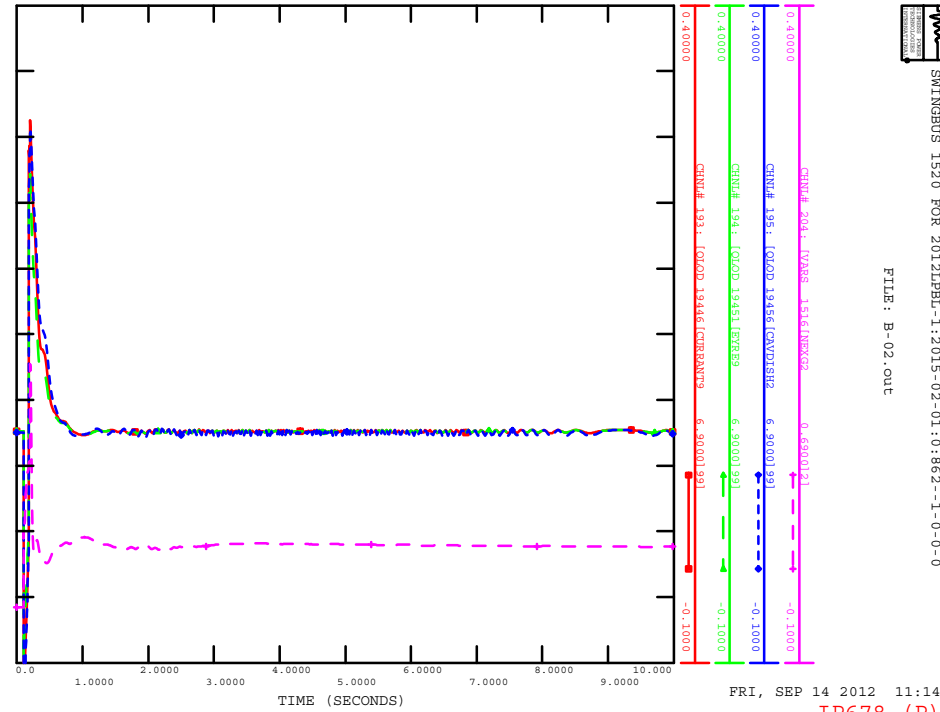
FRI, SEP 14 2012 11:14
BUS VOLT (PU)

FILE: B-01.out

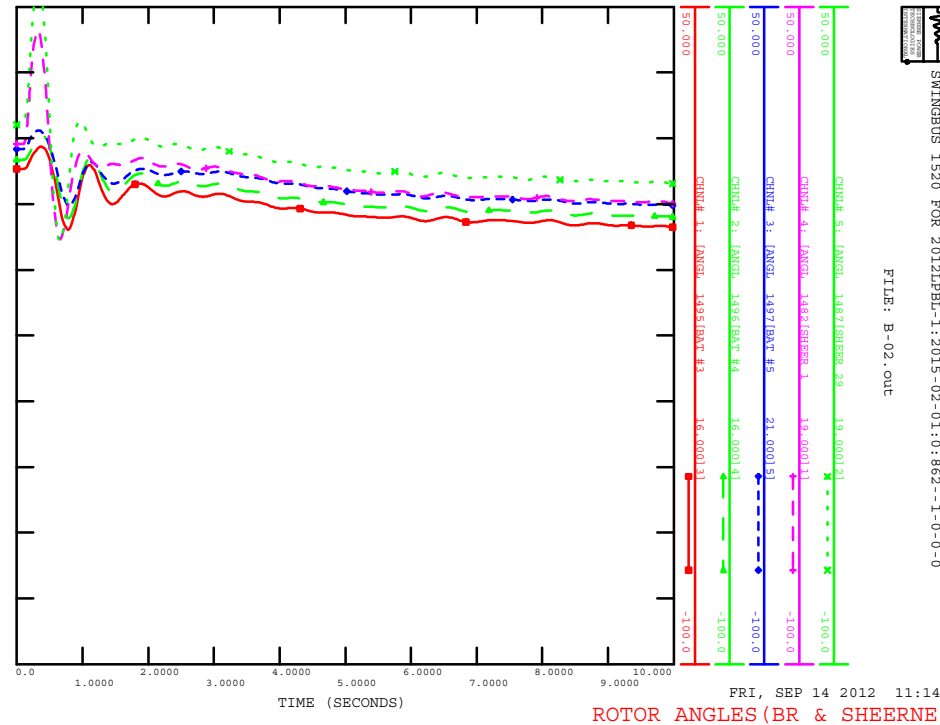


FRI, SEP 14 2012 11:14
LINE FLOW (P)

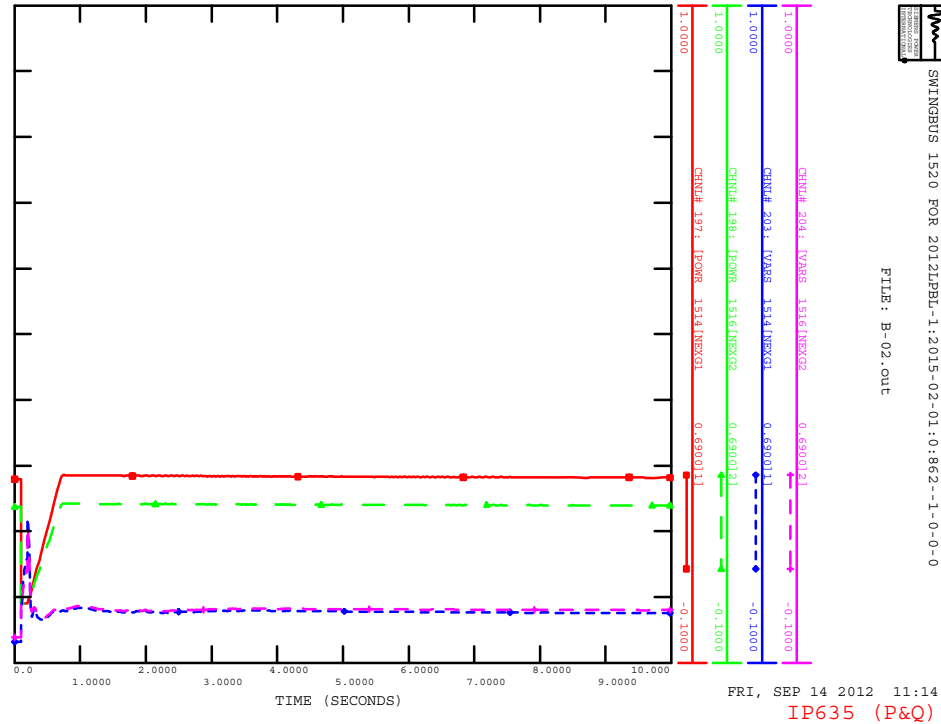
FILE: B-02.out



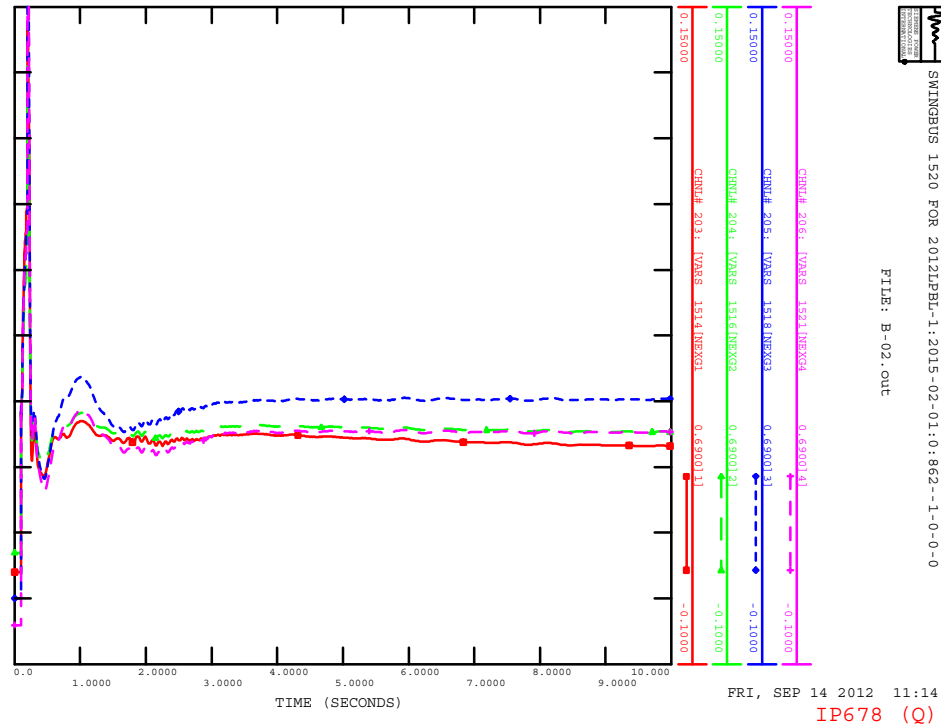
FILE: B-02.out



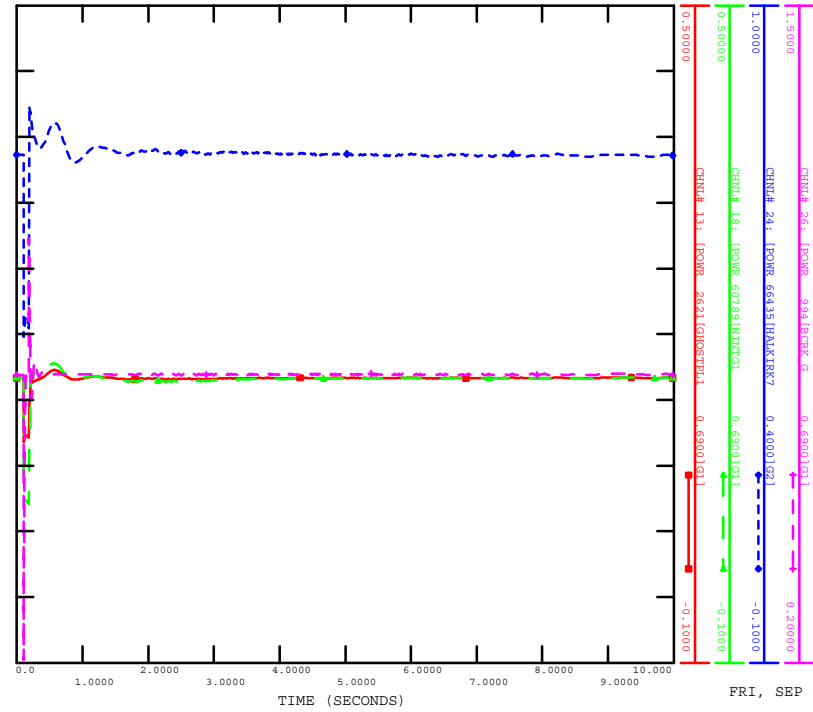
FILE: B-02.out



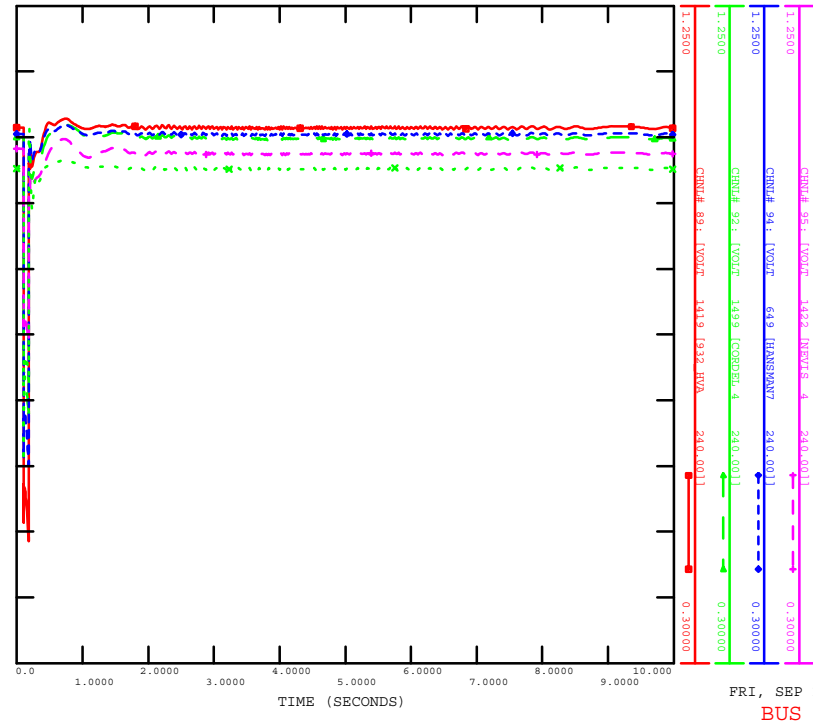
FILE: B-02.out



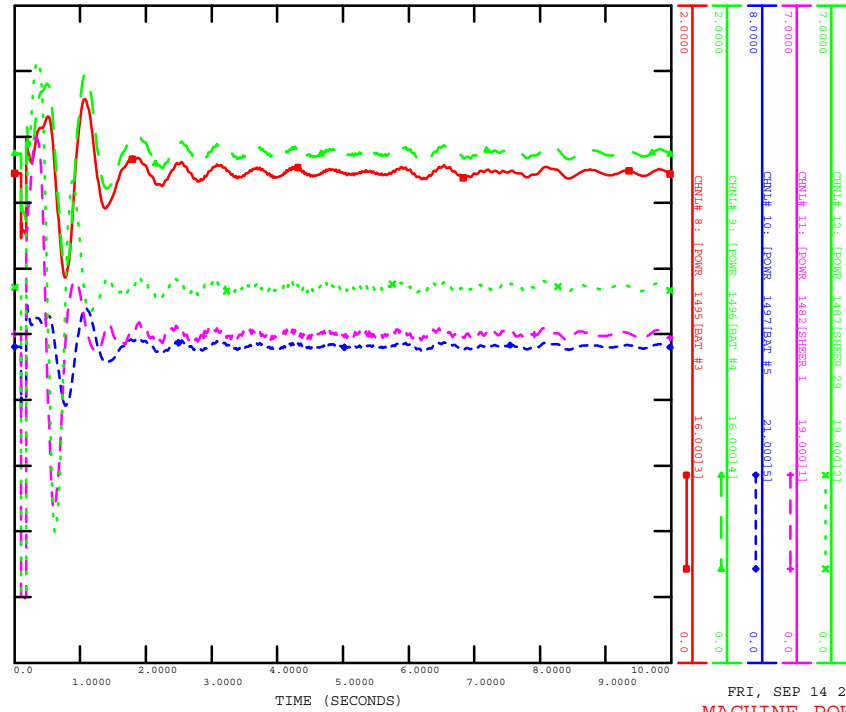
FILE: B-02.out



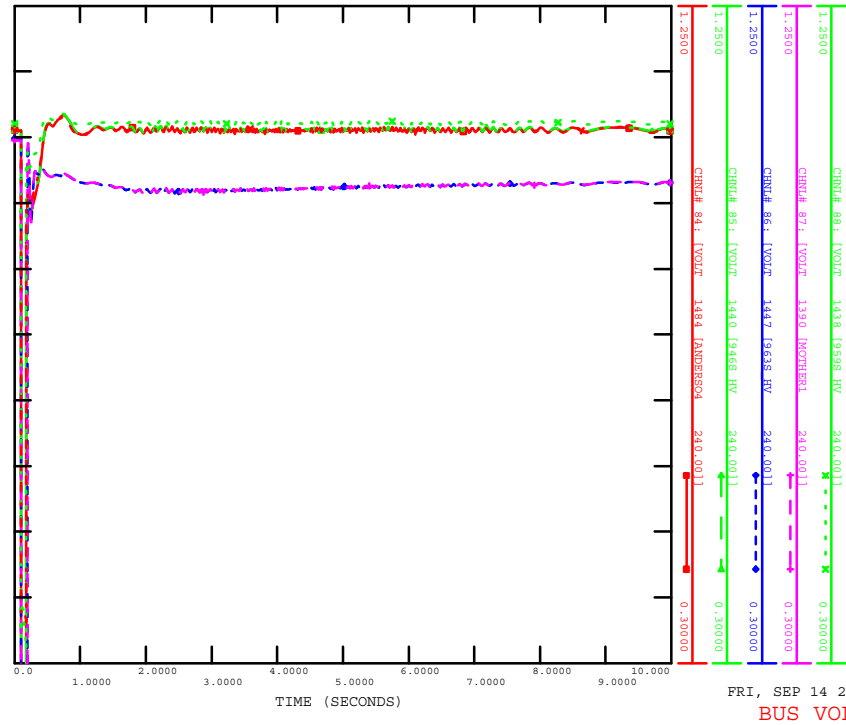
FILE: B-02.out



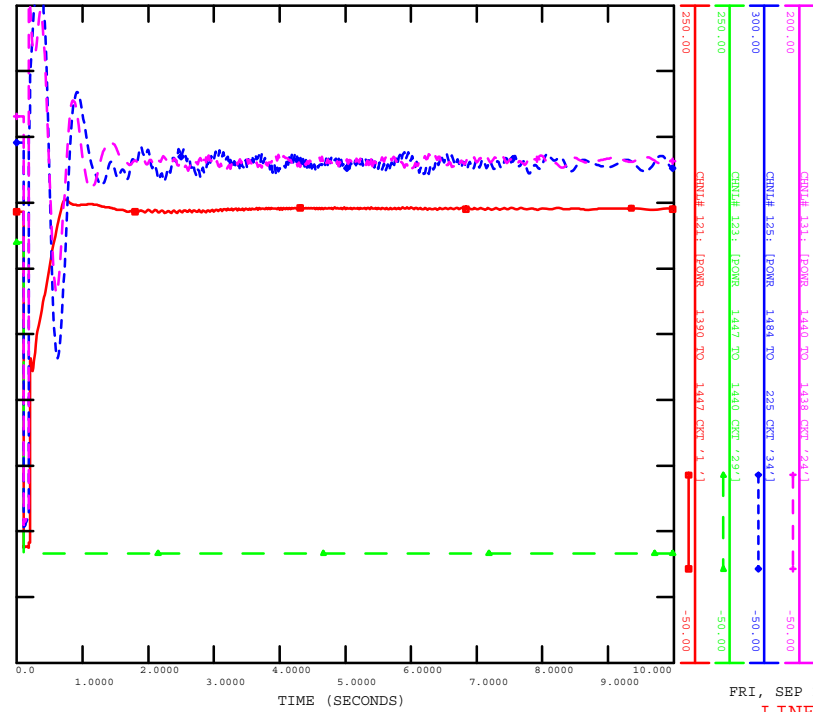
FILE: B-02.out



FILE: B-02.out

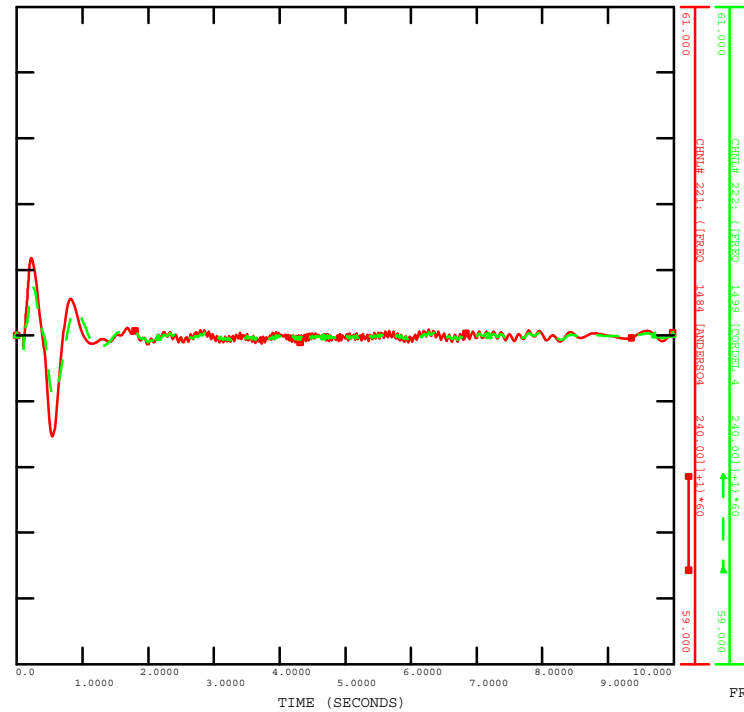


FILE: B-02.out



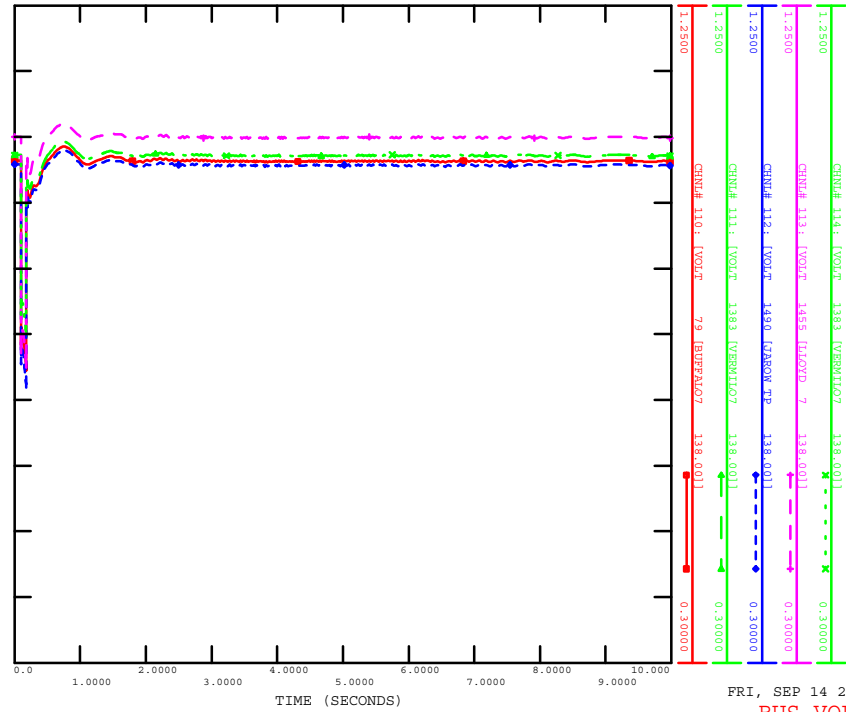
FRI, SEP 14 2012 11:14
LINE FLOW (P)

FILE: B-02.out



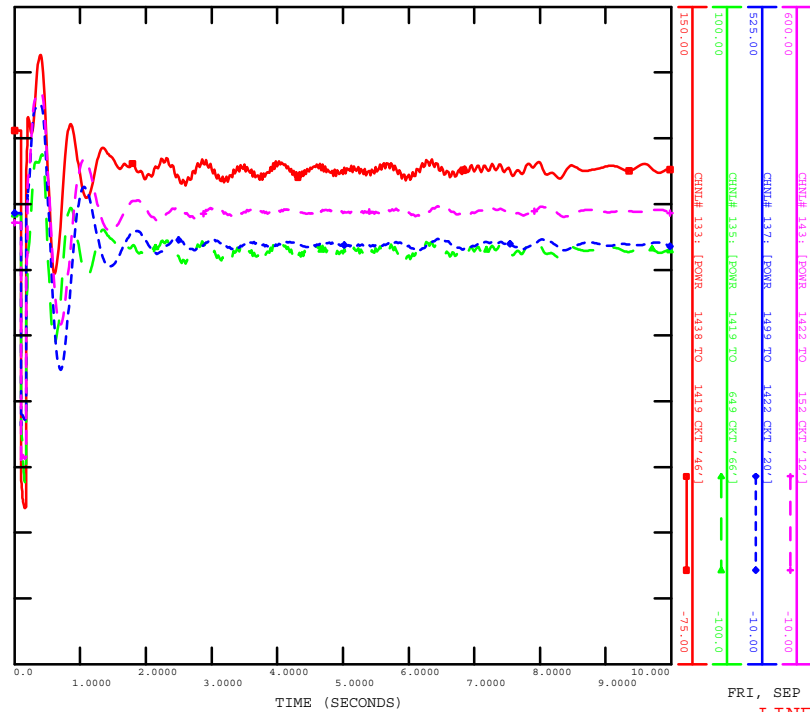
FRI, SEP 14 2012 11:14
BUS FREQUENCY

FILE: B-02.out



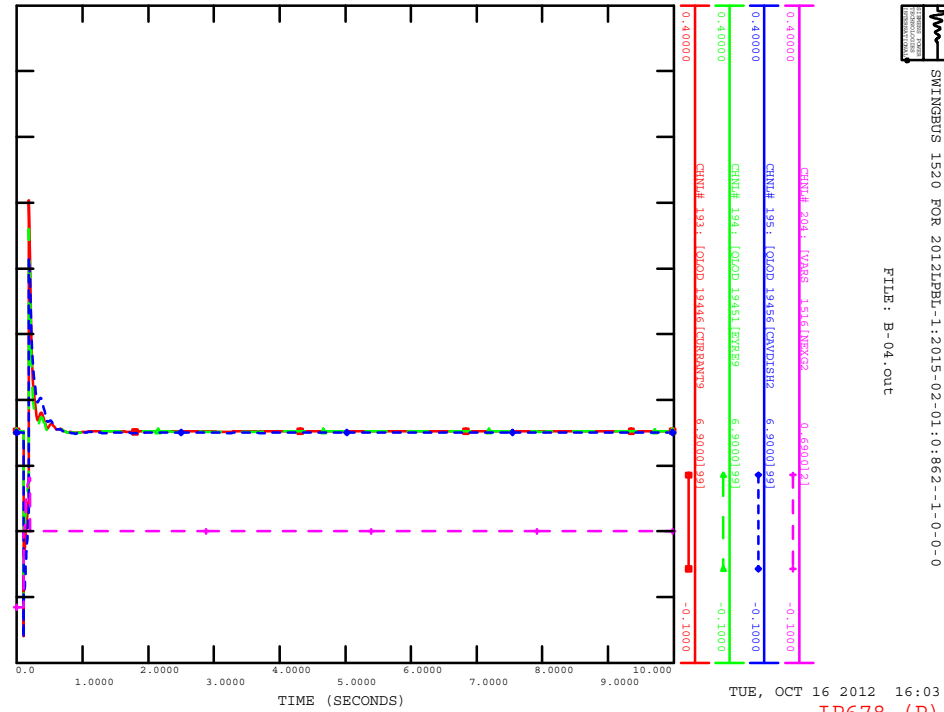
FRI, SEP 14 2012 11:14
BUS VOLT (PU)

FILE: B-02.out

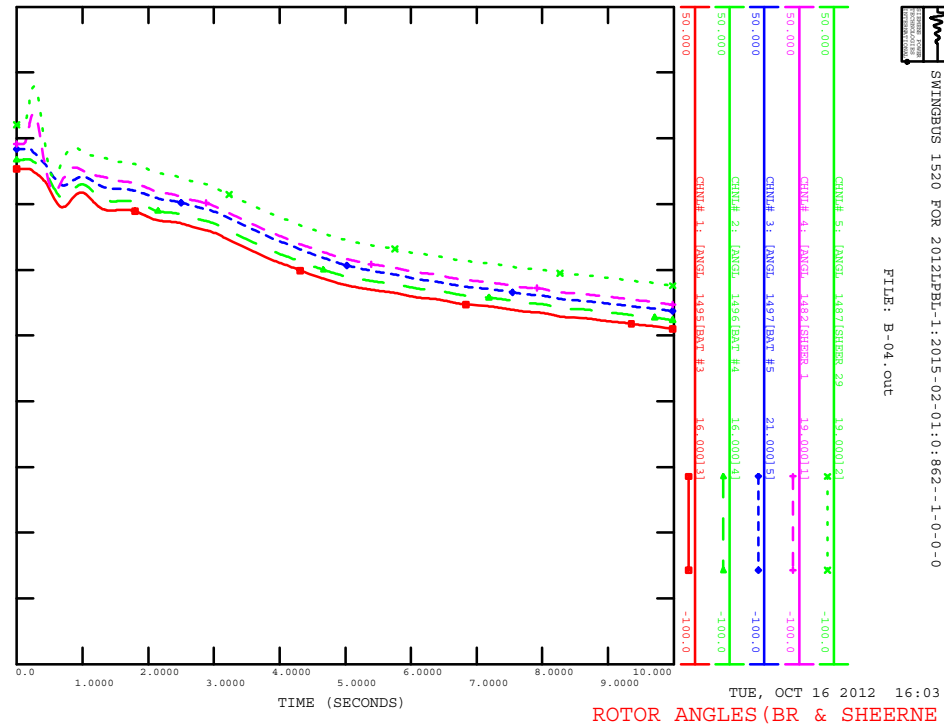


FRI, SEP 14 2012 11:14
LINE FLOW (P)

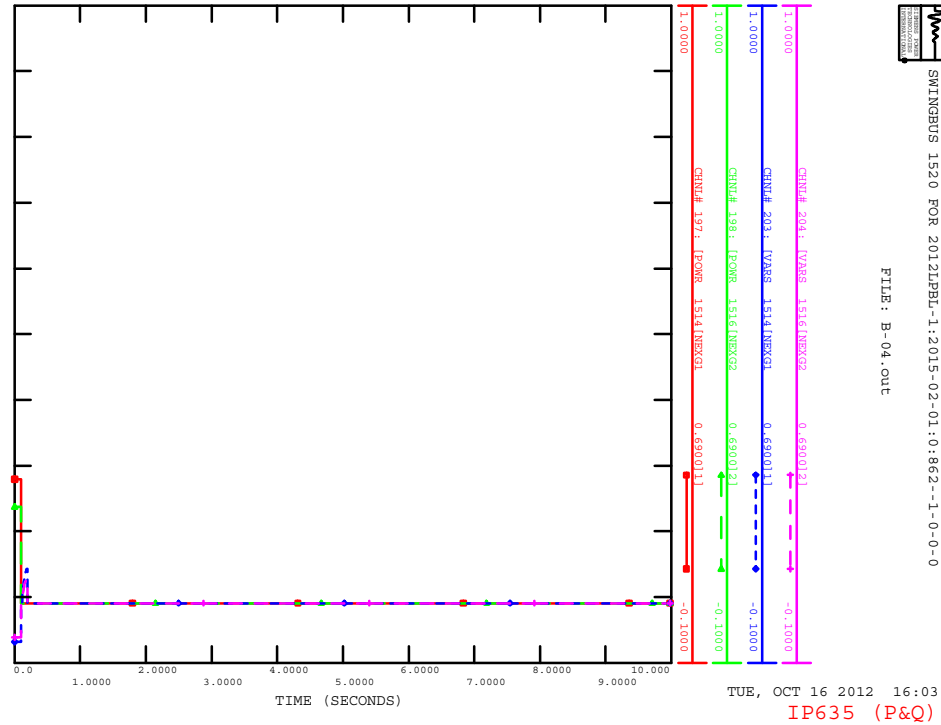
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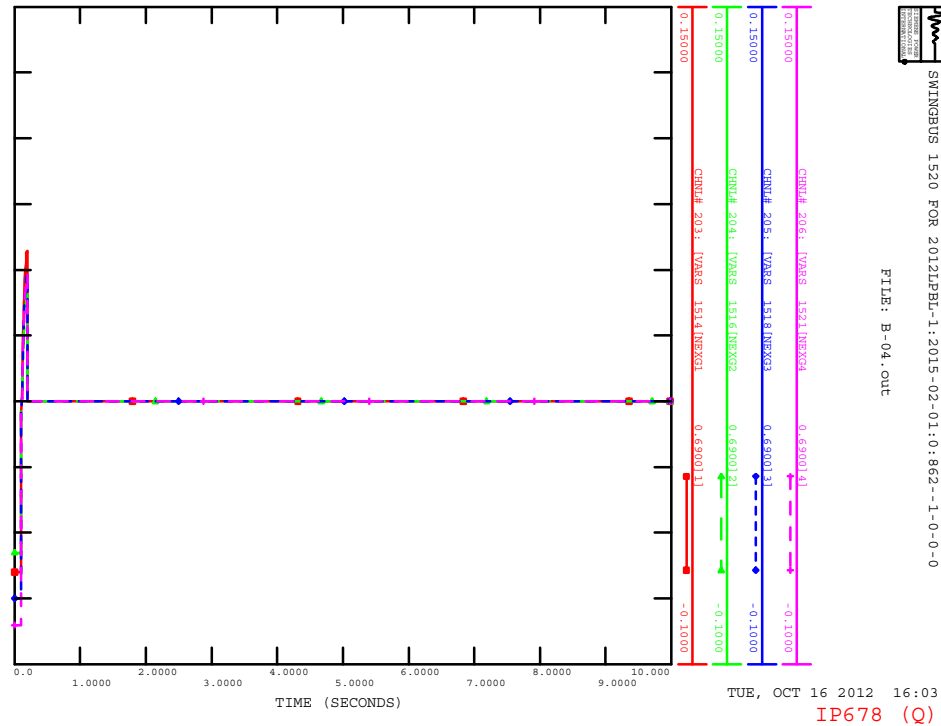
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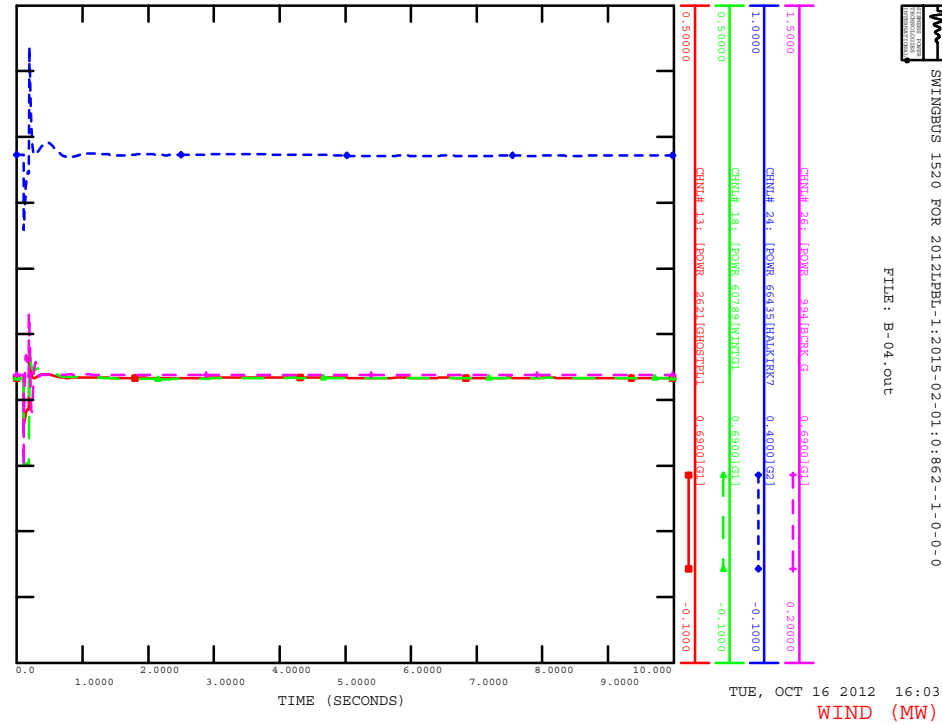
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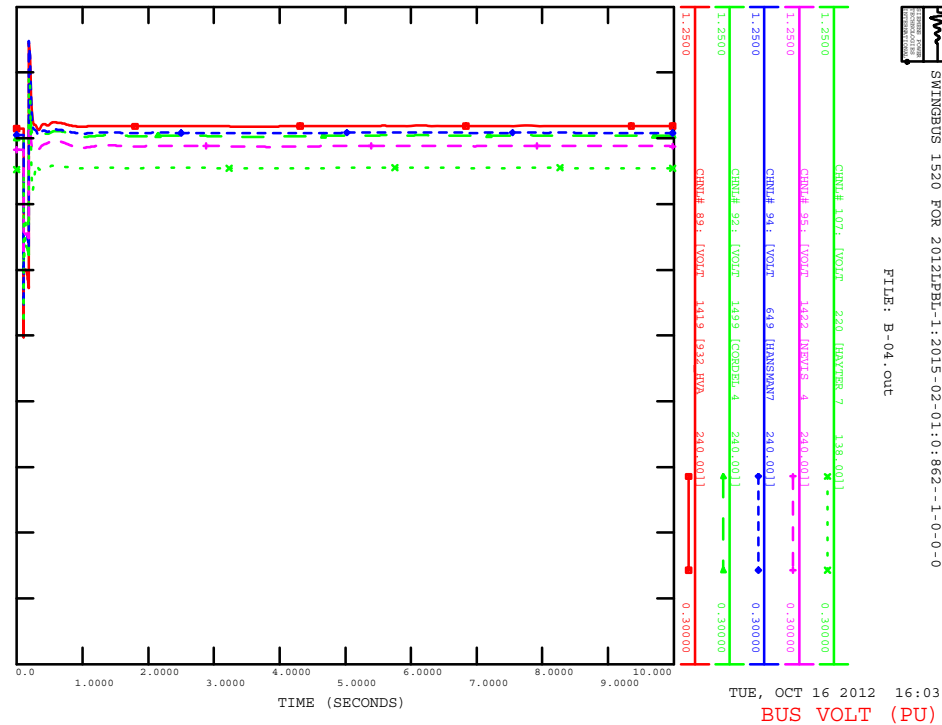
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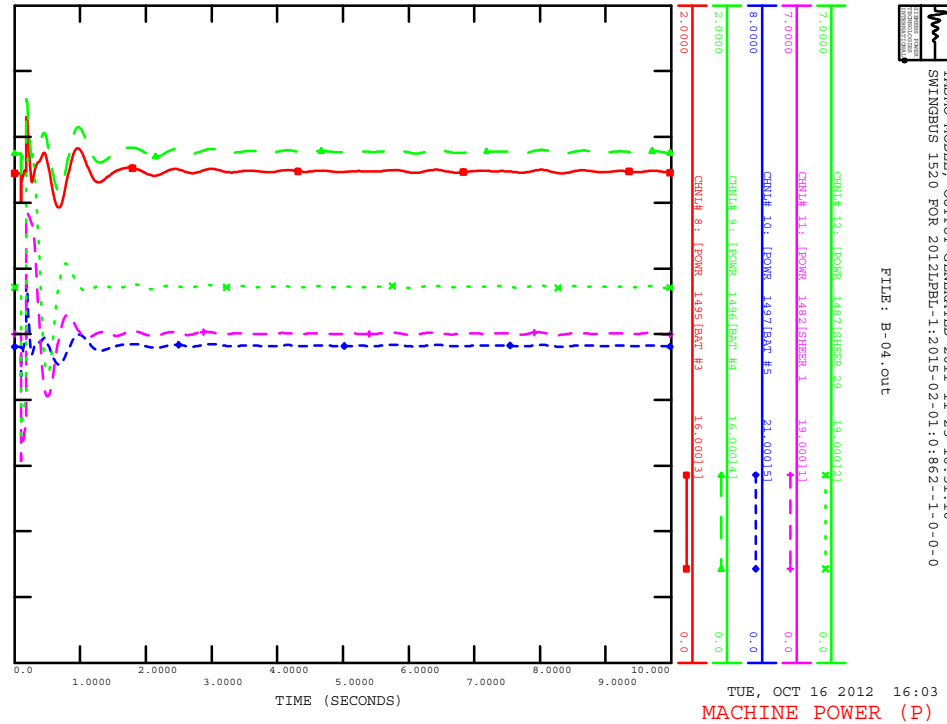
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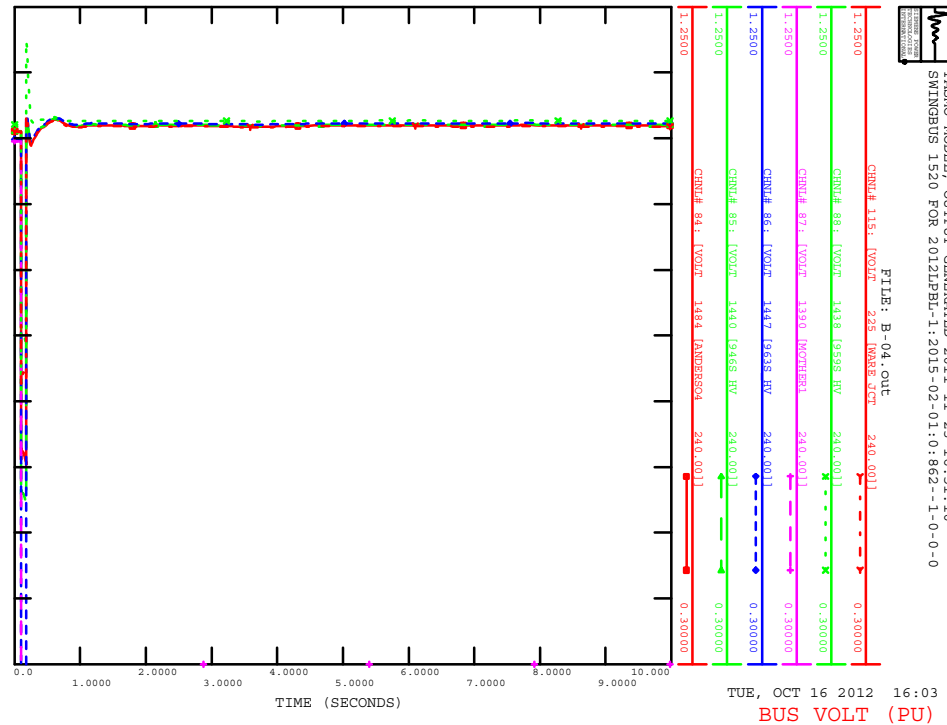
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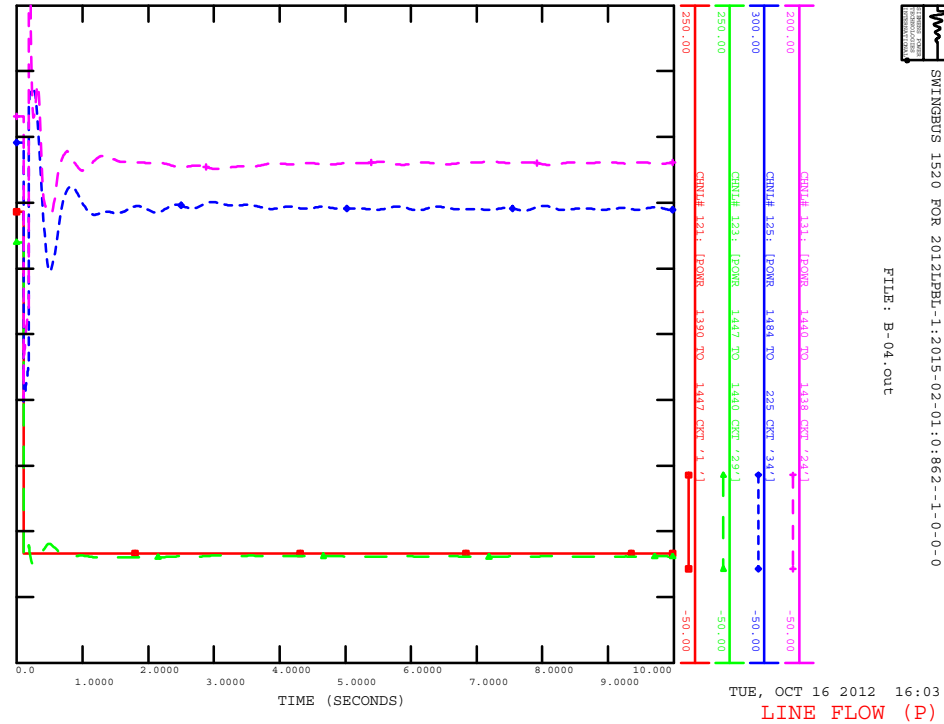
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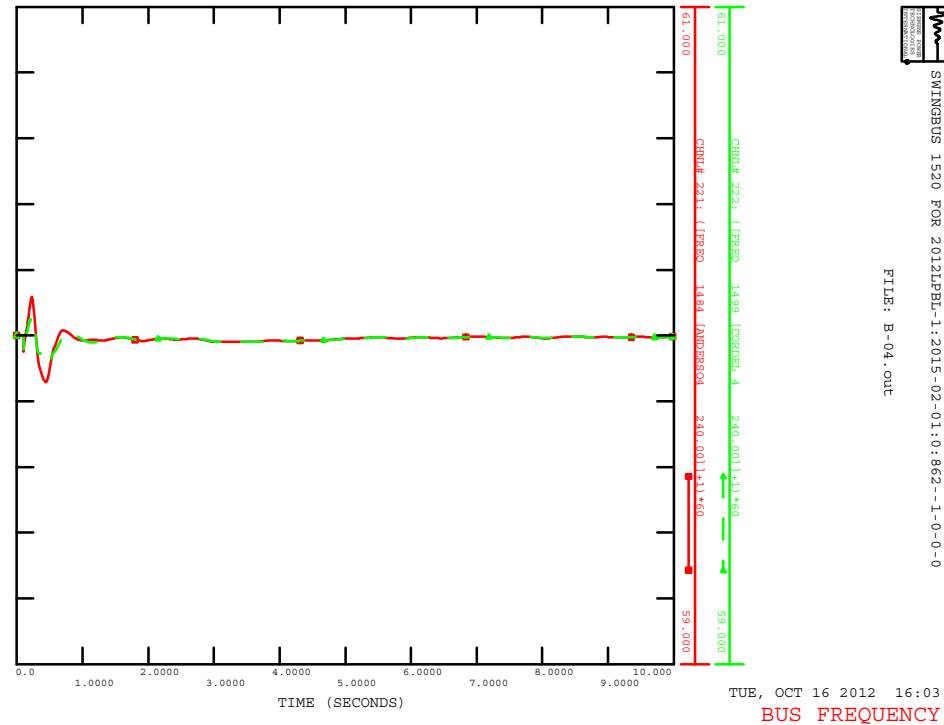
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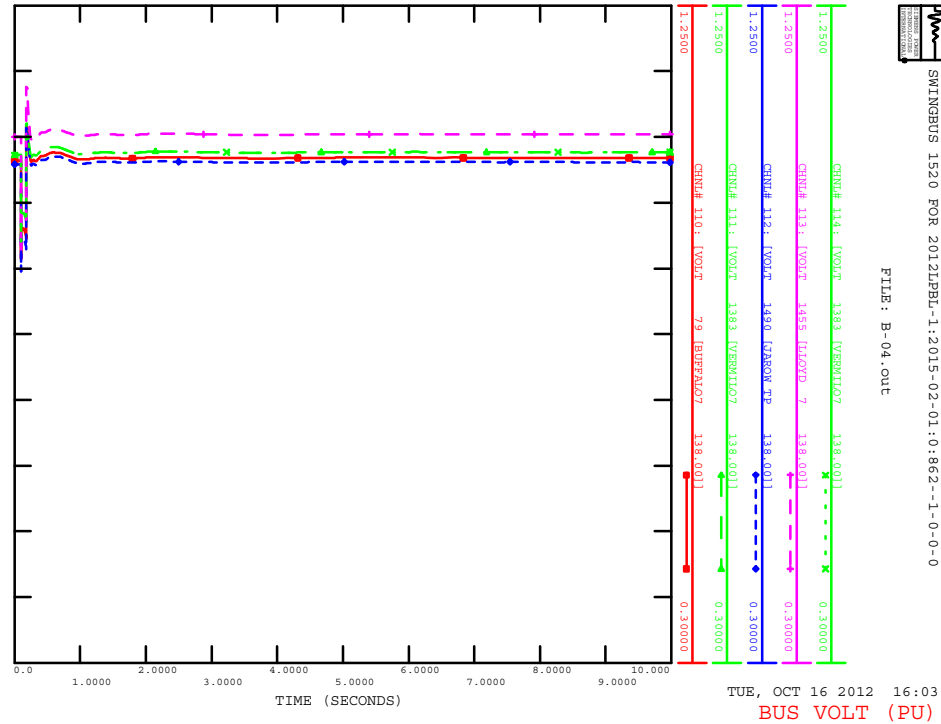
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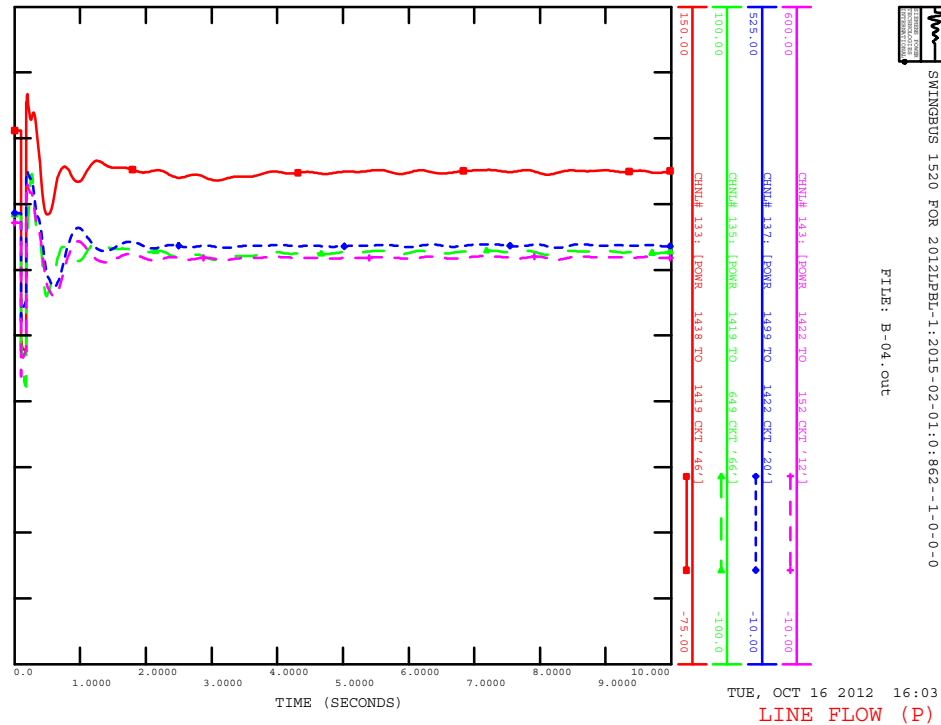
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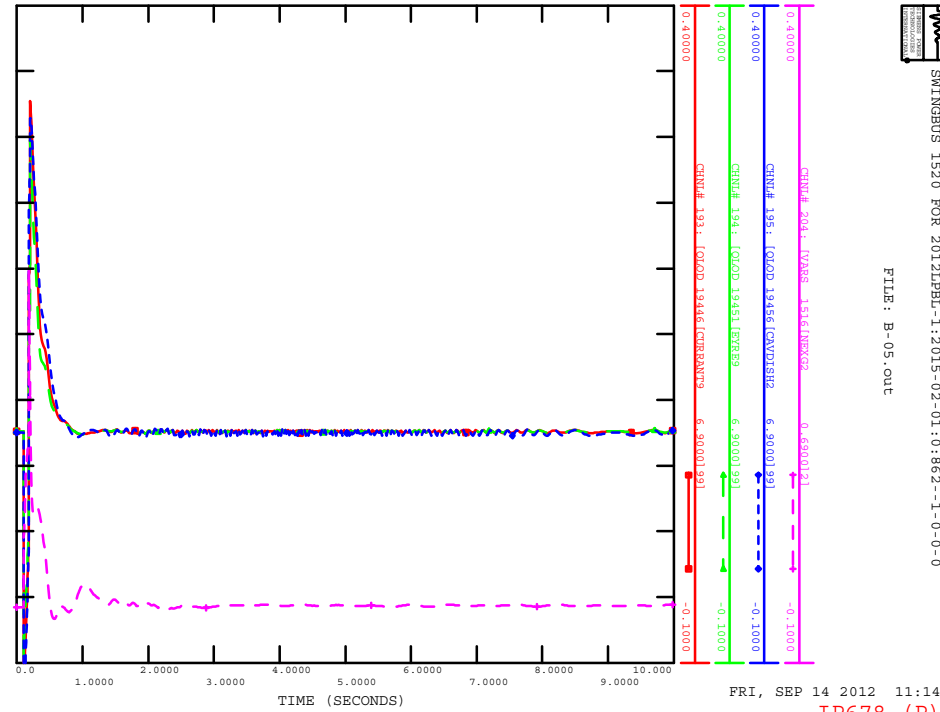
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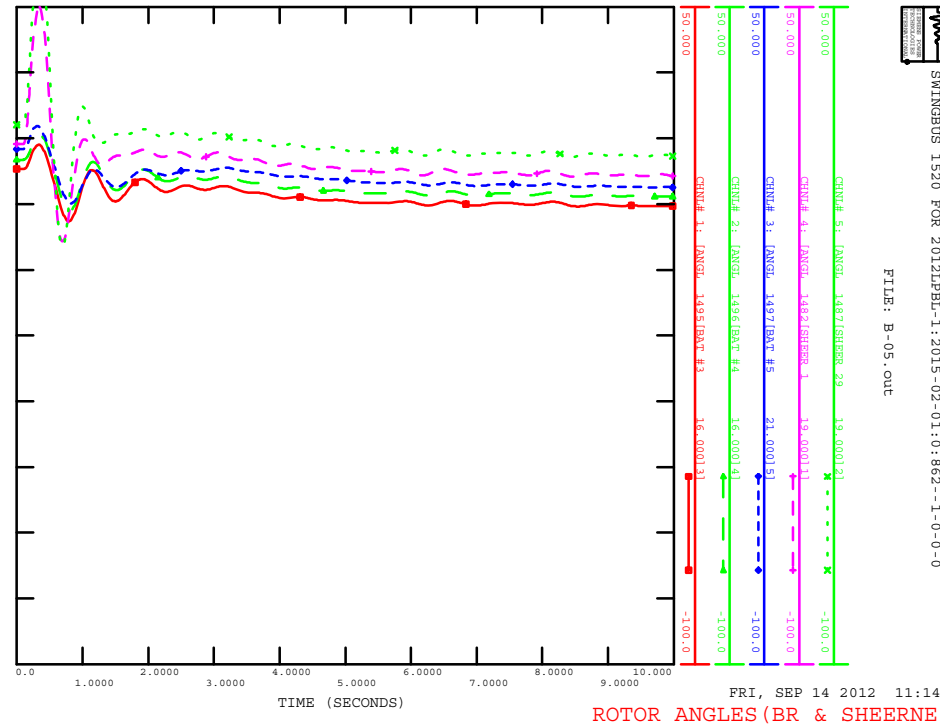
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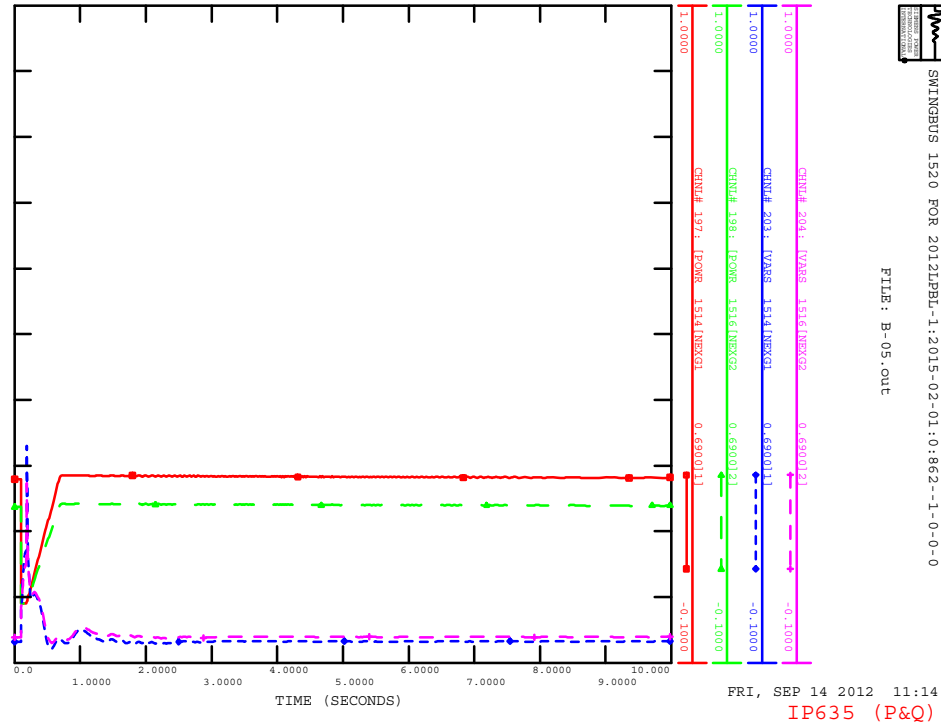
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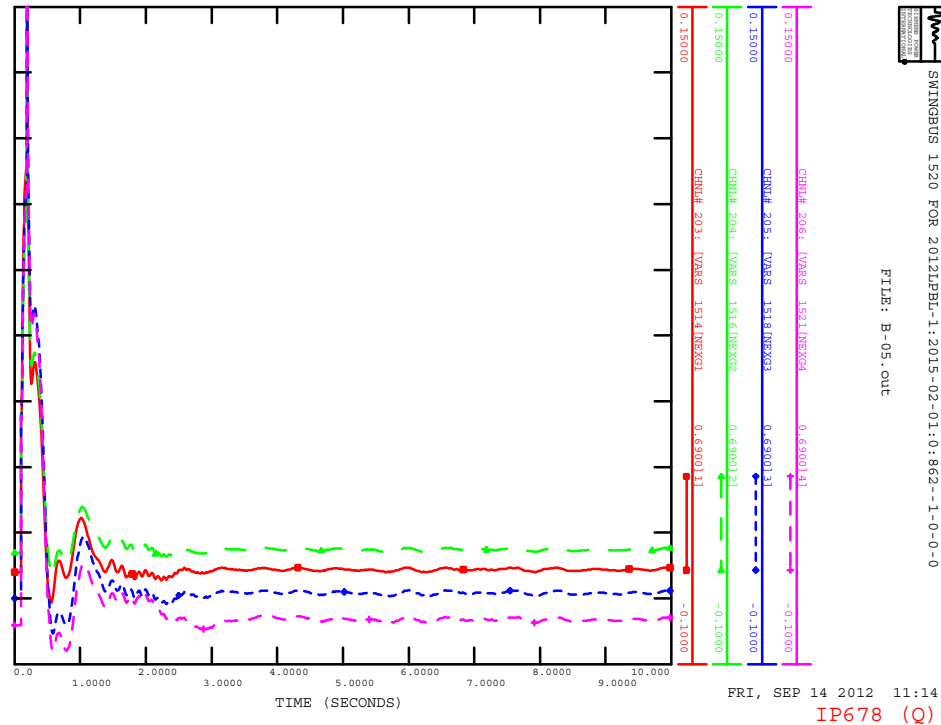
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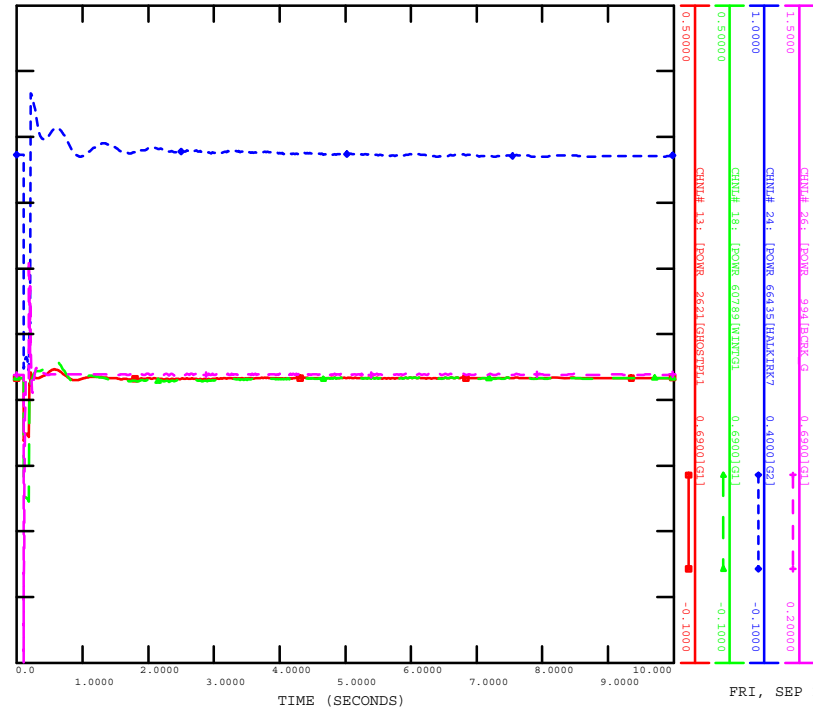
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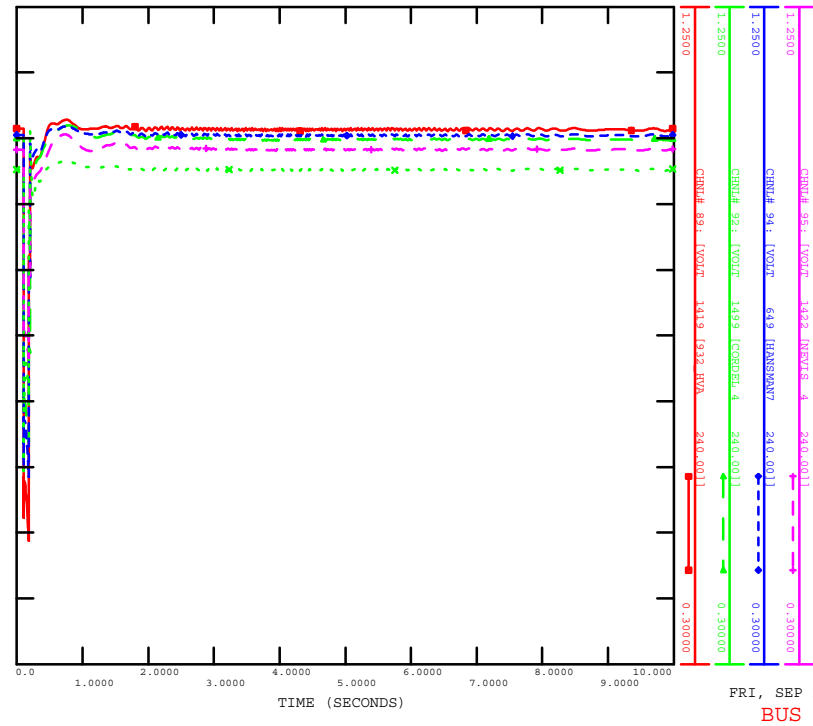
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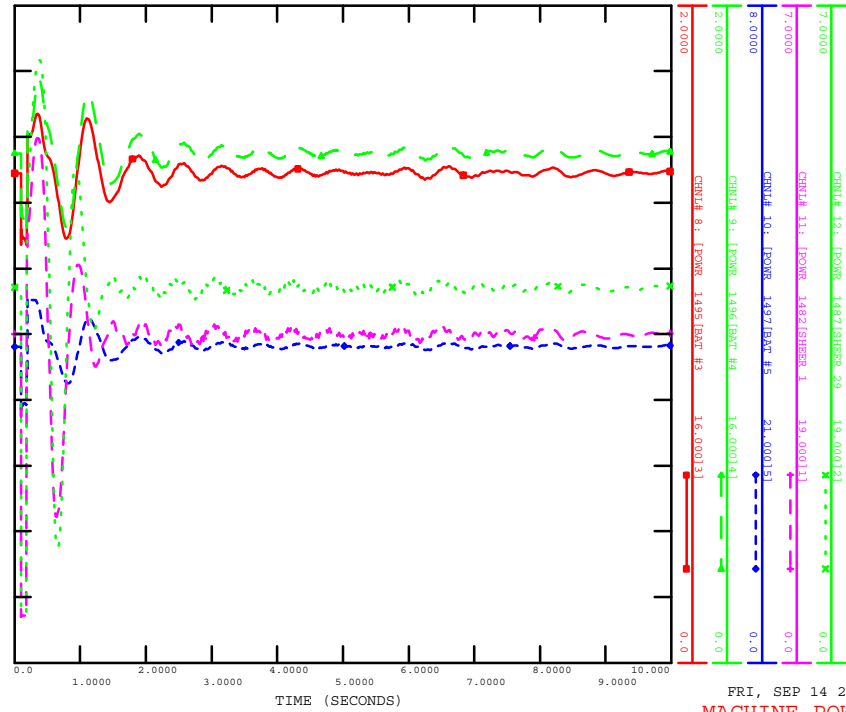
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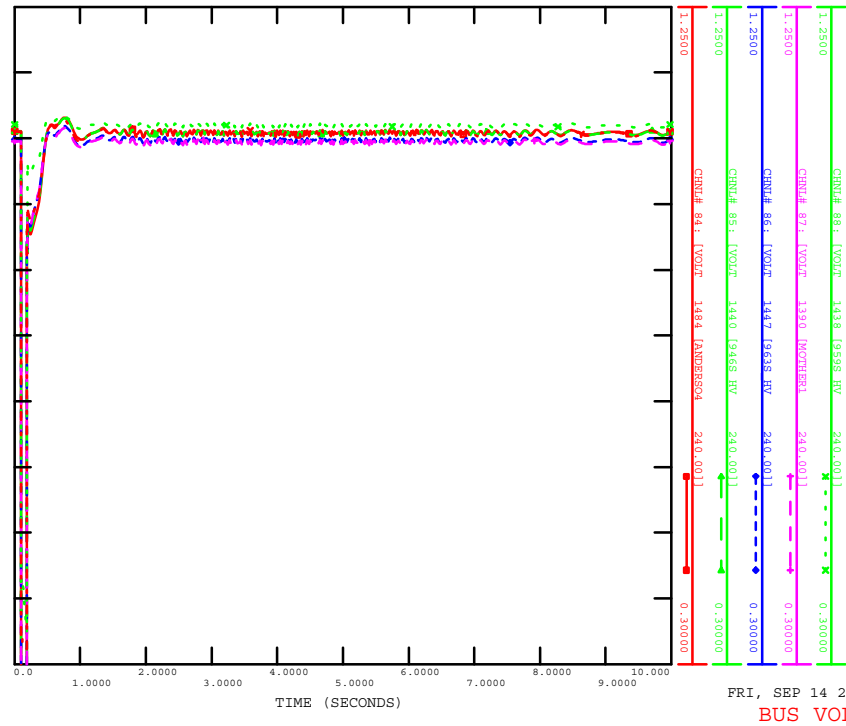
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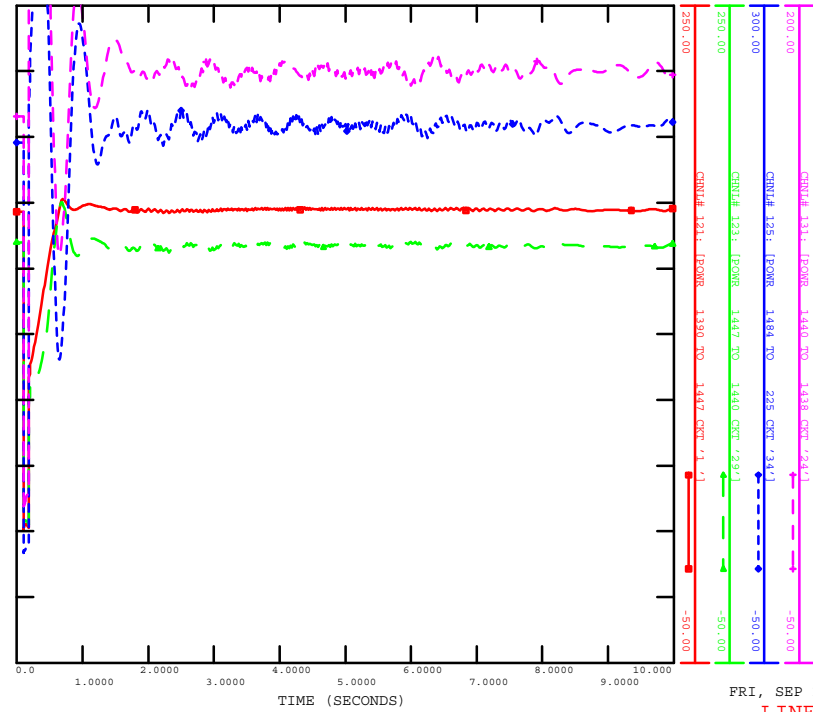
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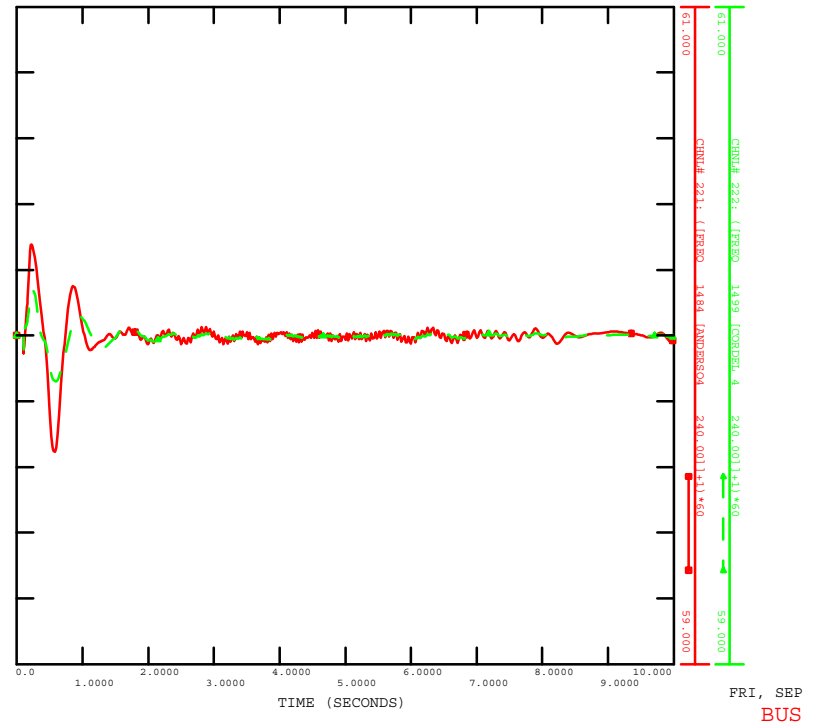
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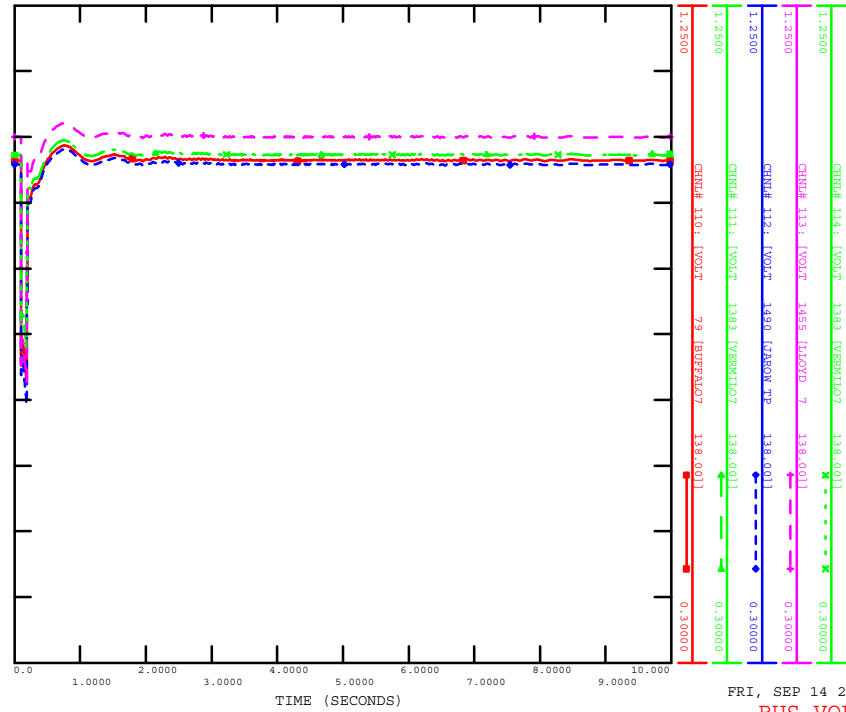
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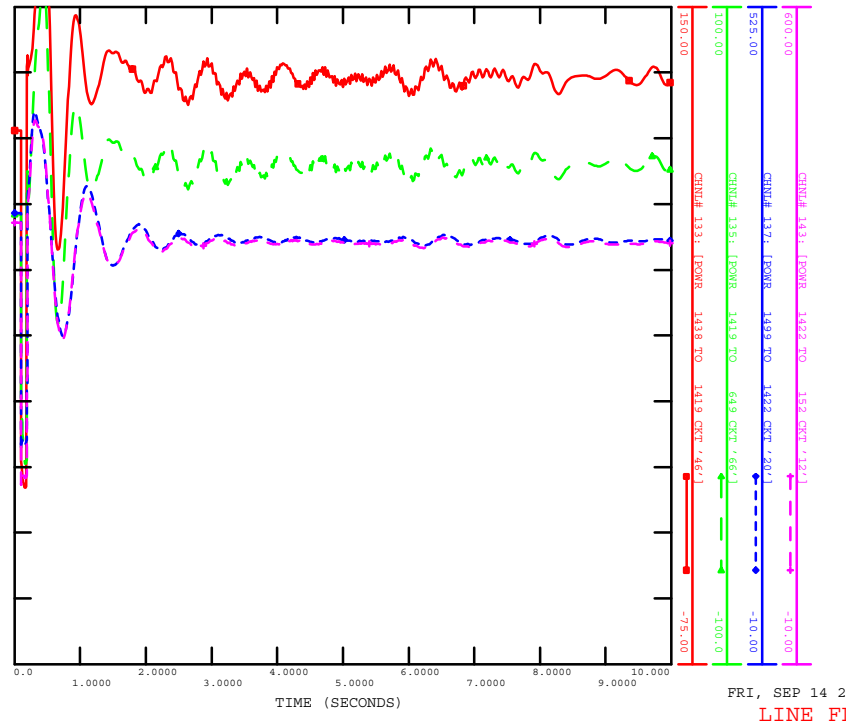
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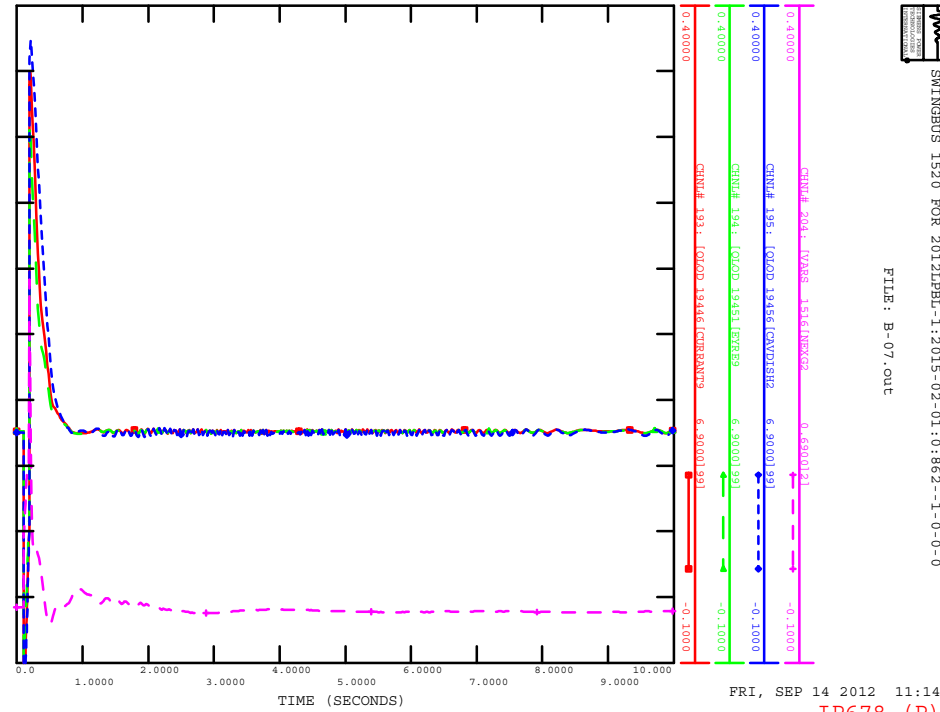
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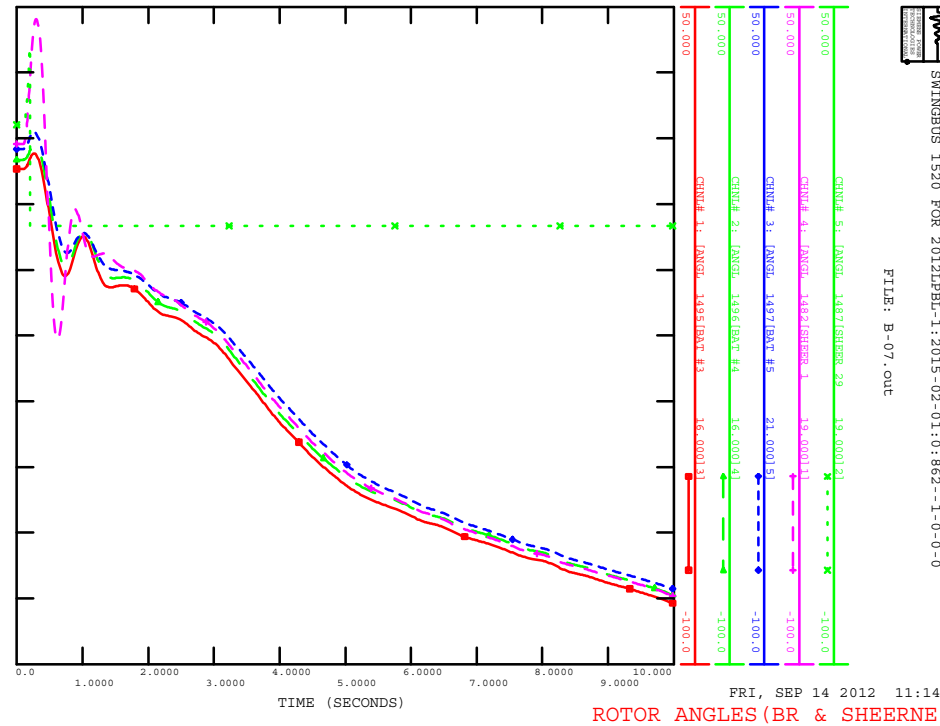
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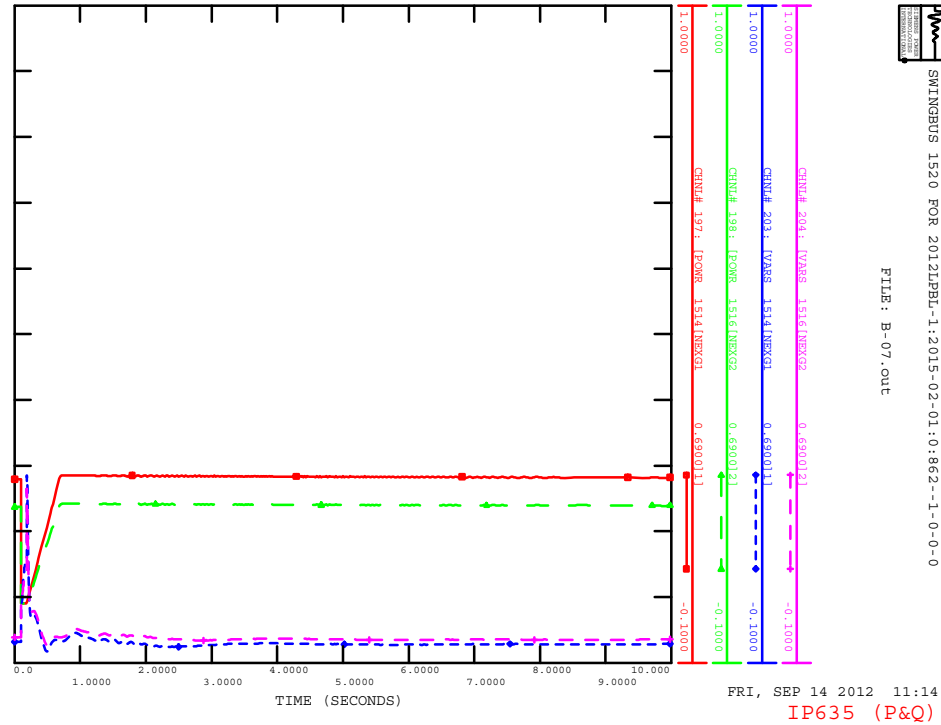
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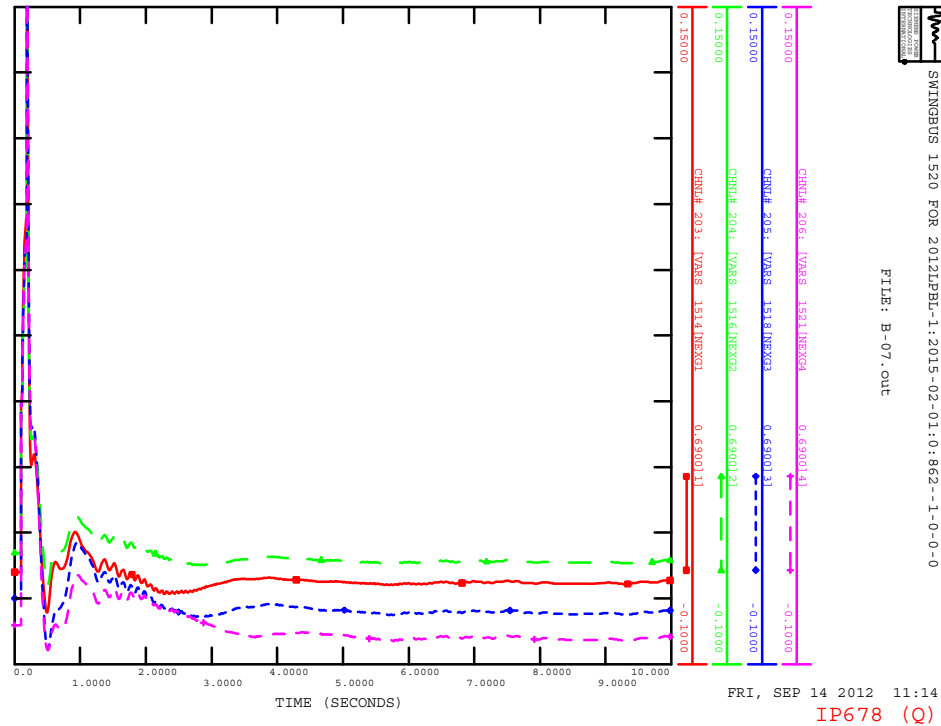
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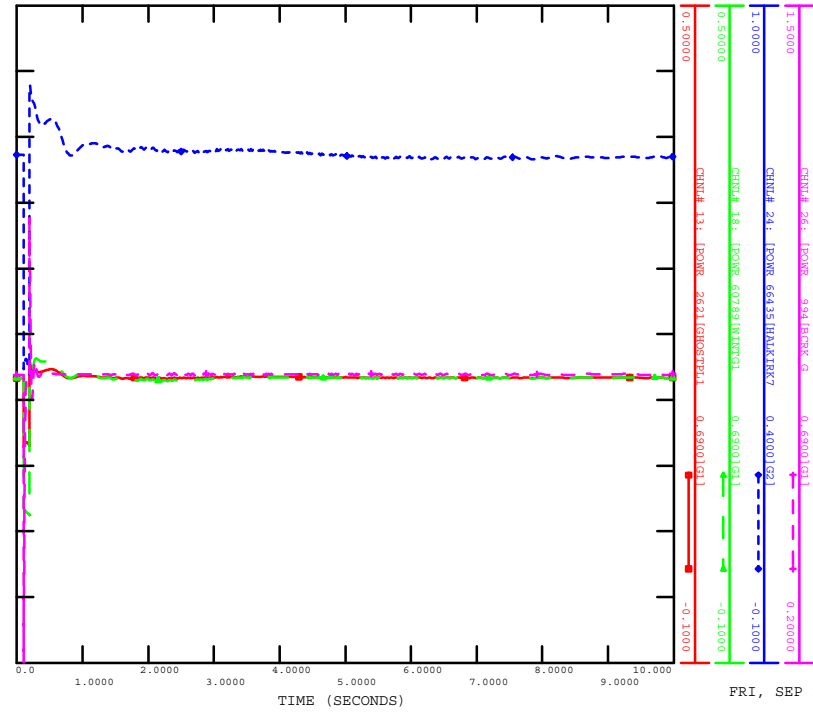
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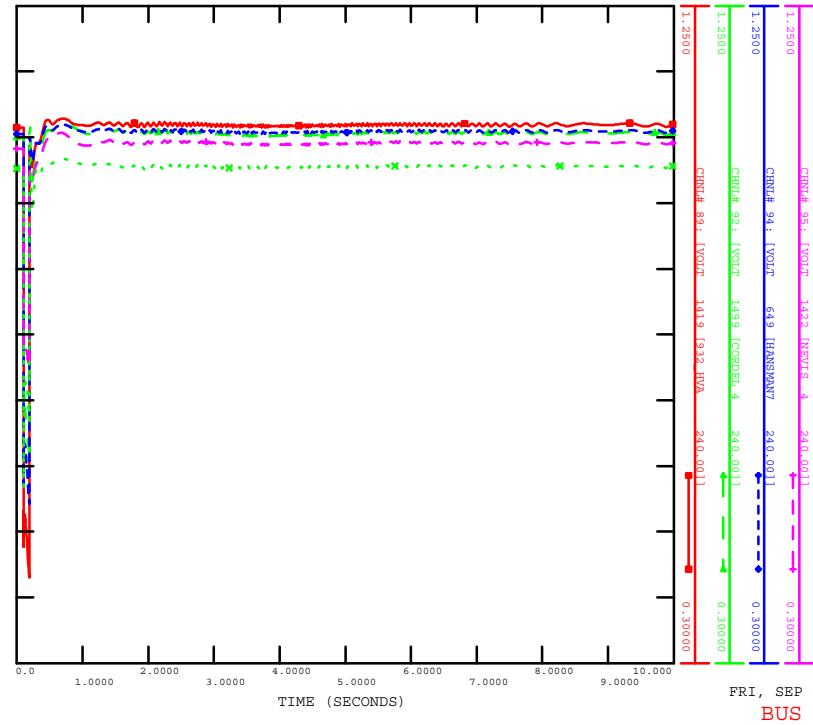
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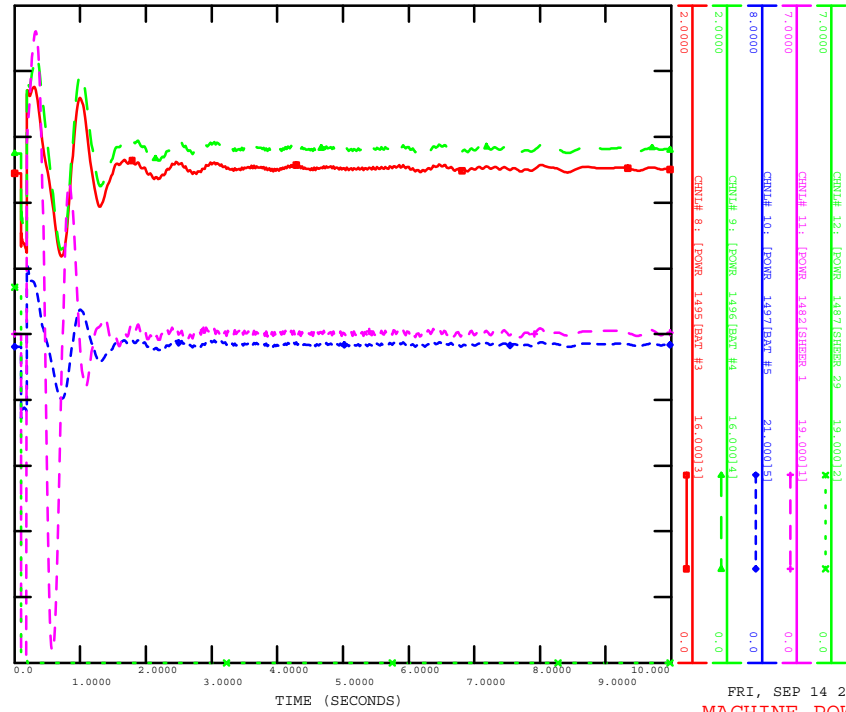
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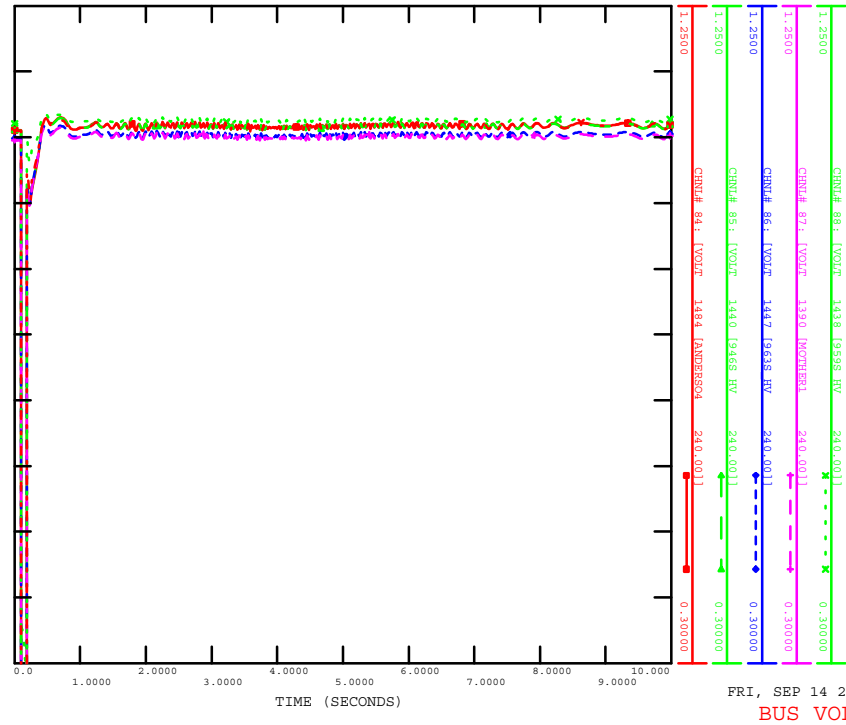
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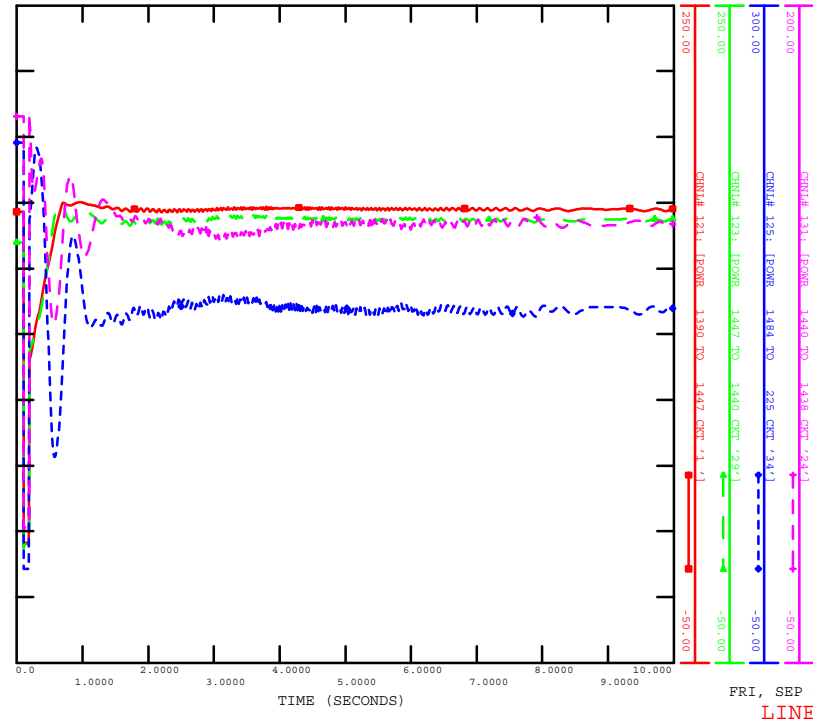
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FILE: B-07.out

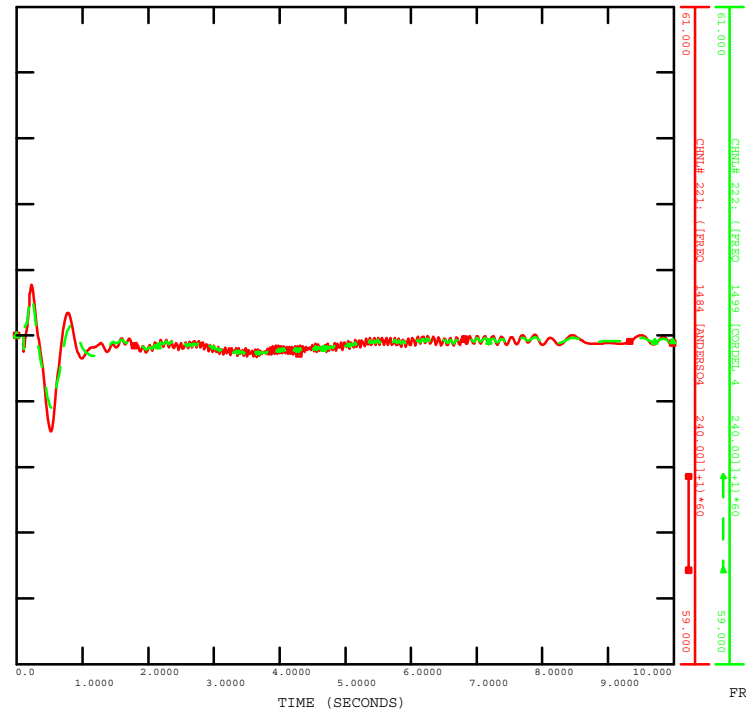


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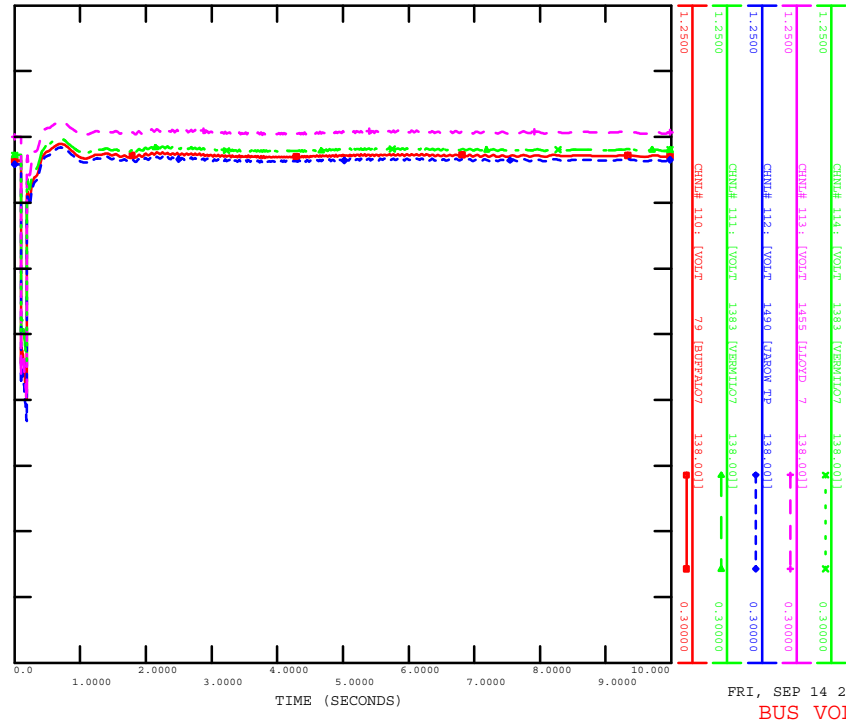
FRI, SEP 14 2012 11:14
LINE FLOW (P)

FILE: B-07.out



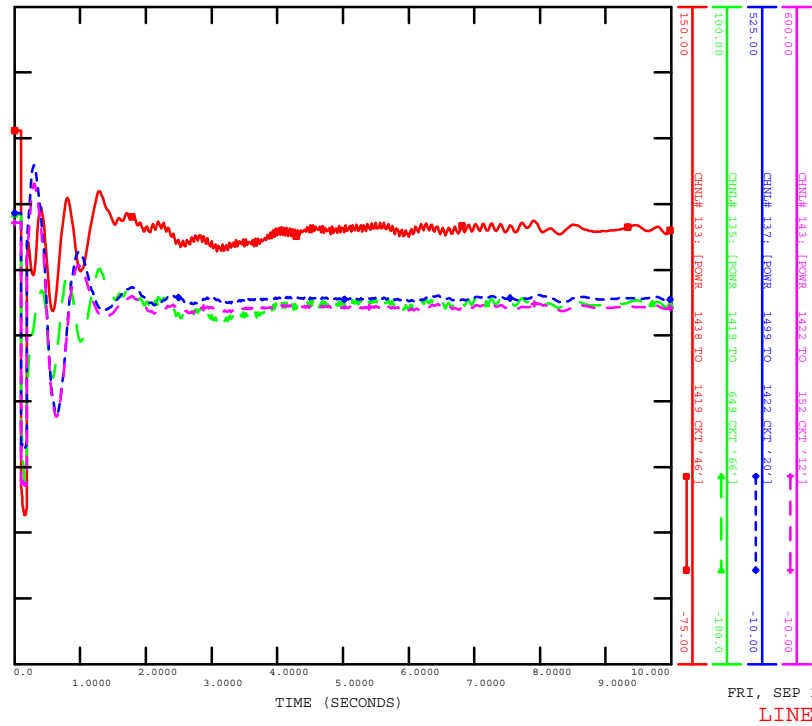
FRI, SEP 14 2012 11:14
BUS FREQUENCY

FILE: B-07.out



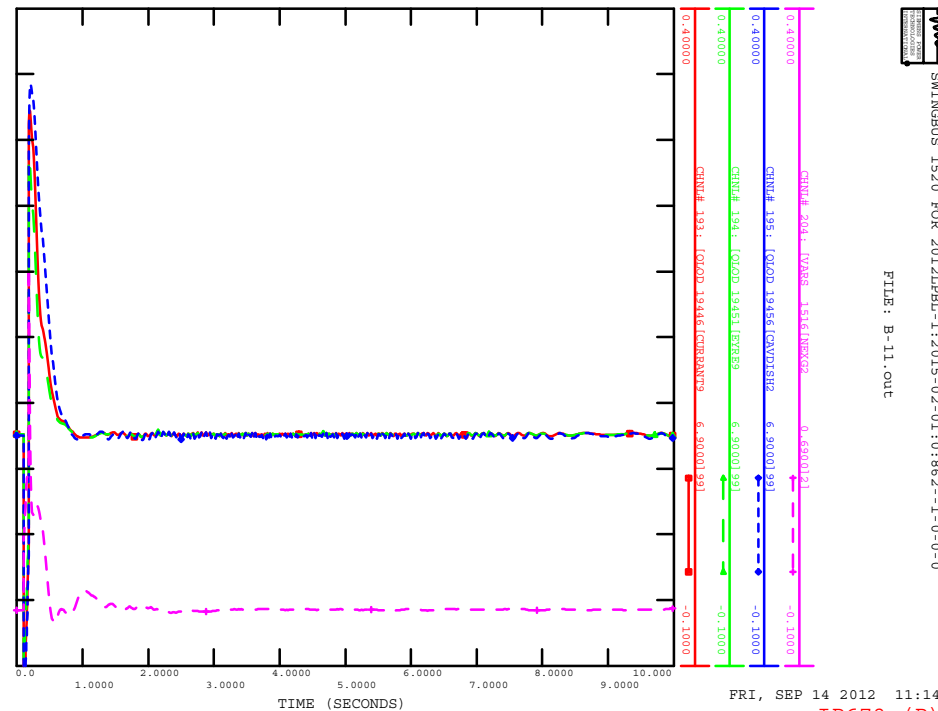
FRI, SEP 14 2012 11:14
BUS VOLT (PU)

FILE: B-07.out

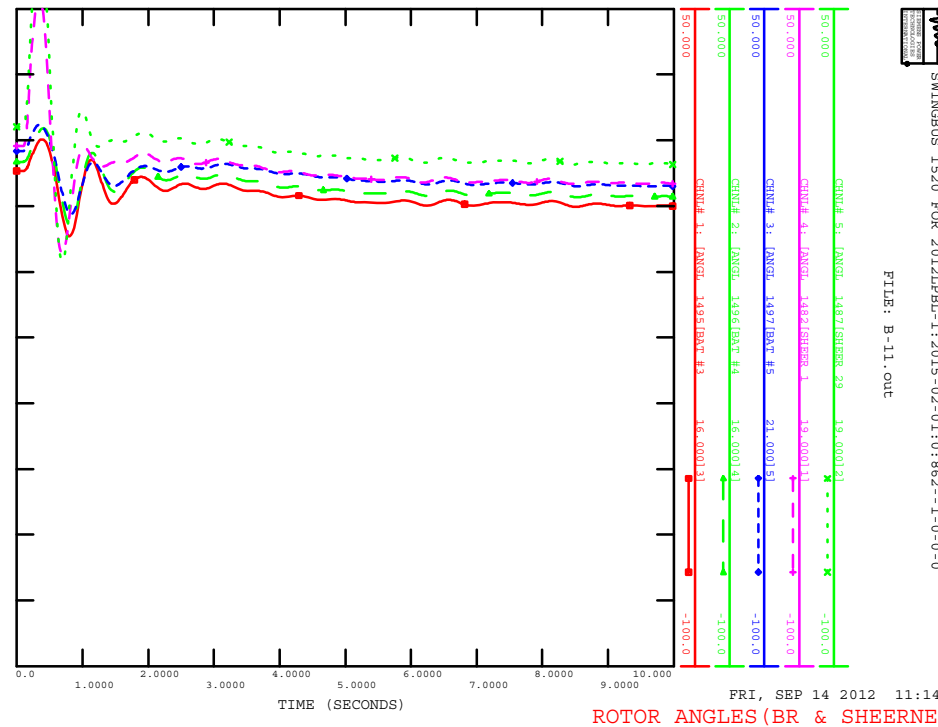


FRI, SEP 14 2012 11:14
LINE FLOW (P)

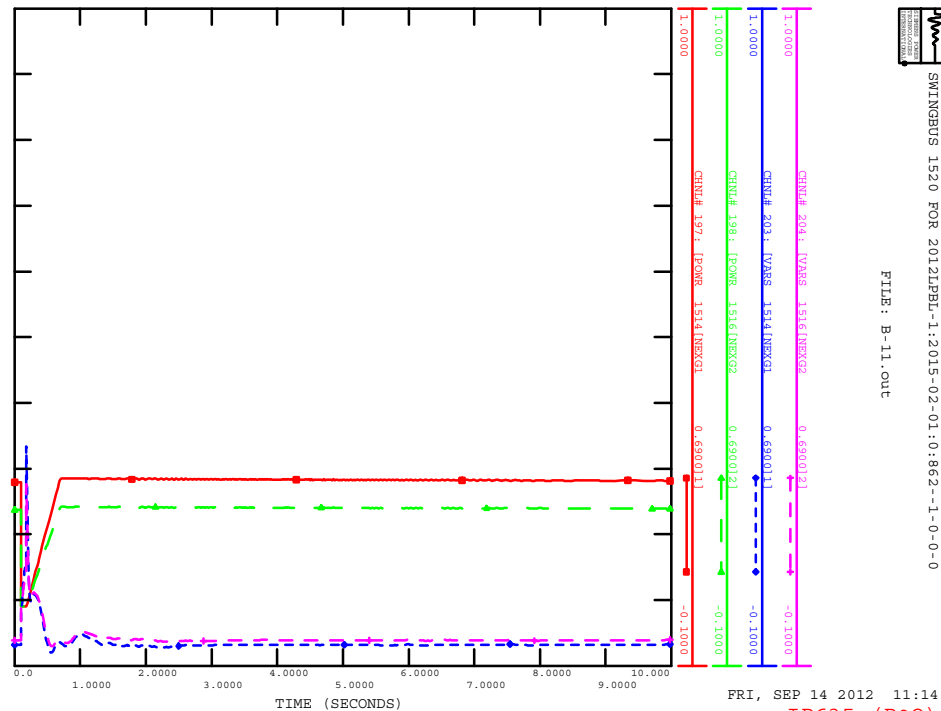
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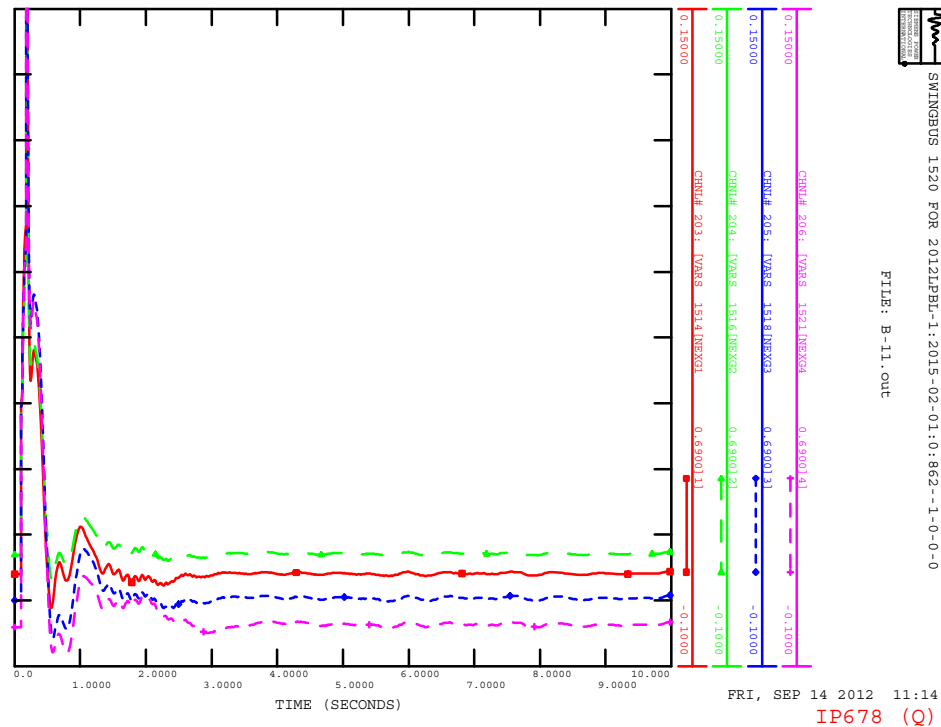
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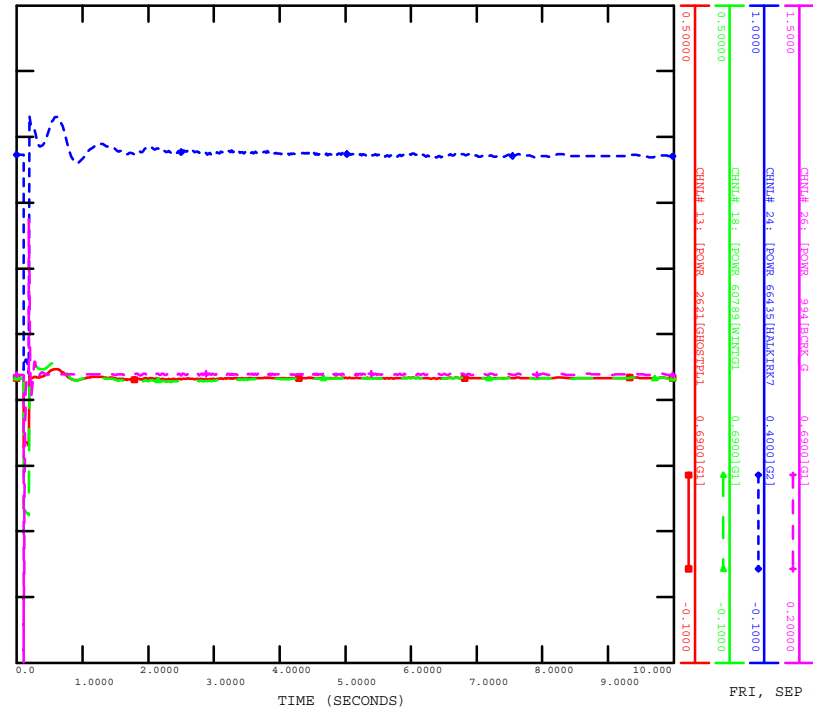
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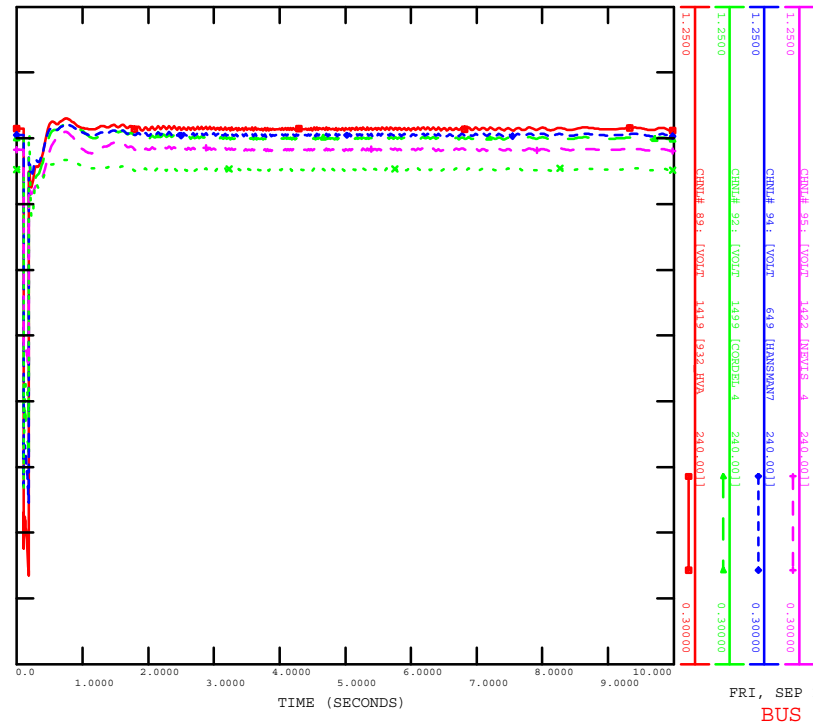
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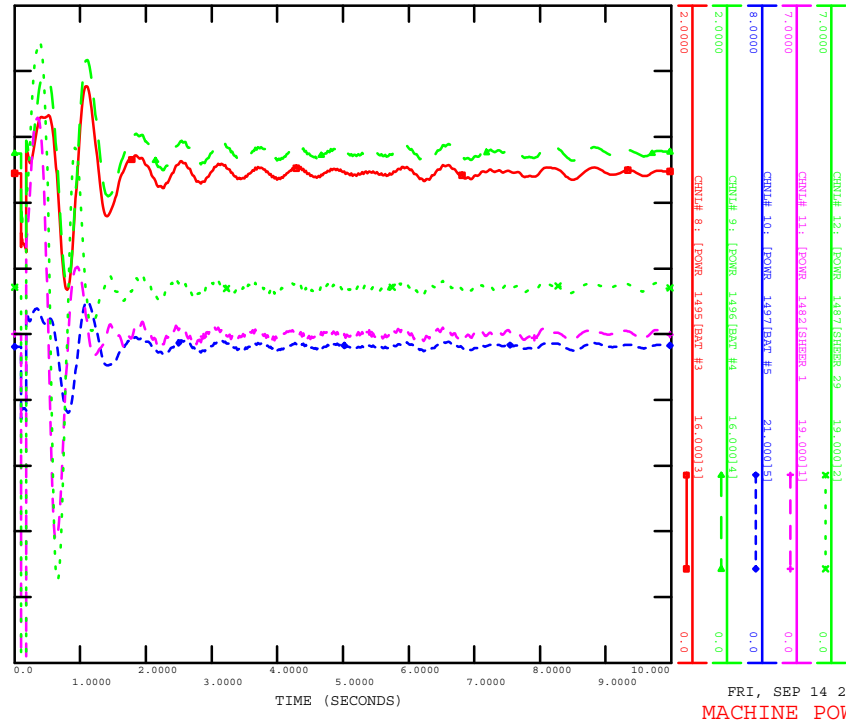
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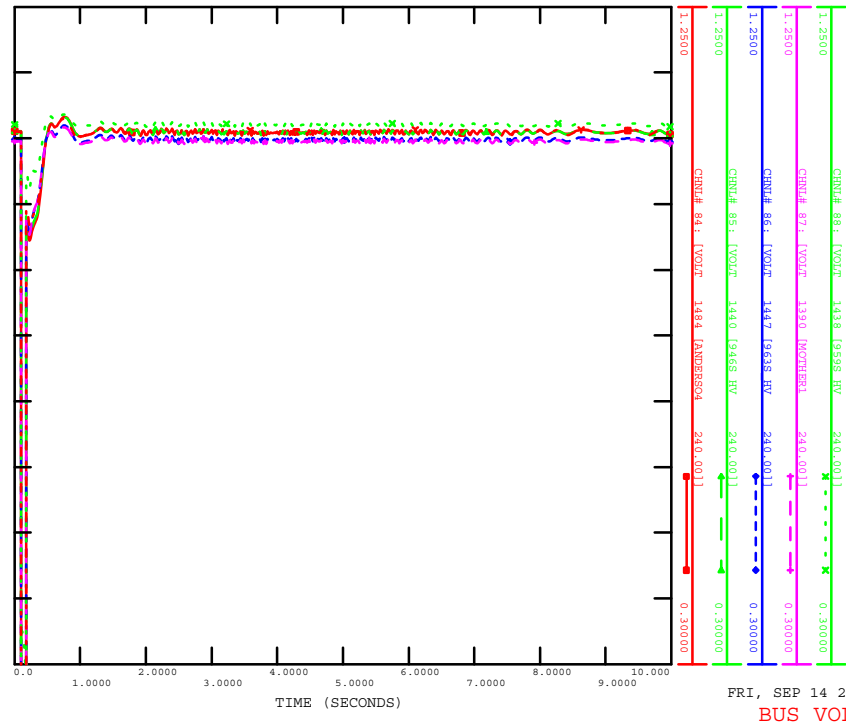
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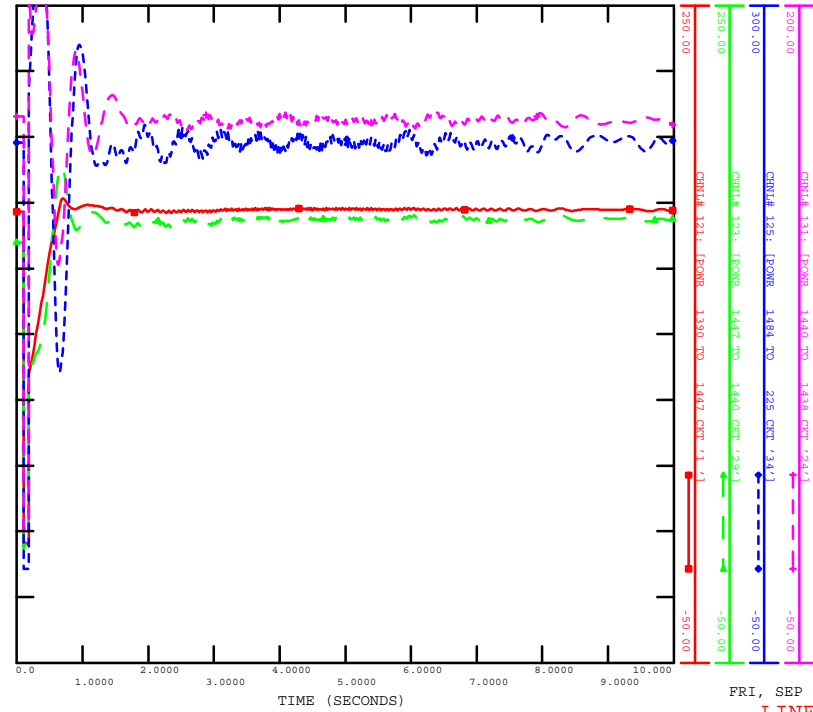
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FILE: B-11.out

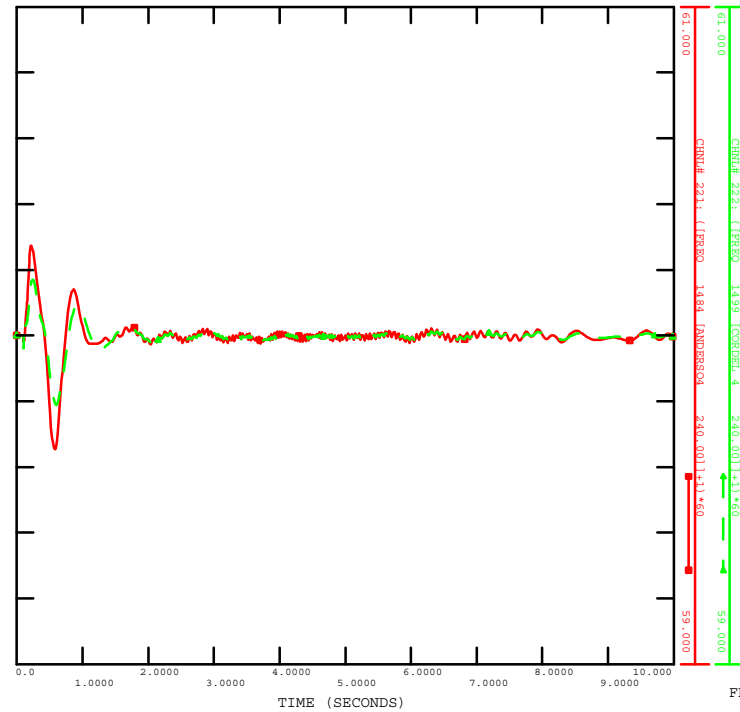


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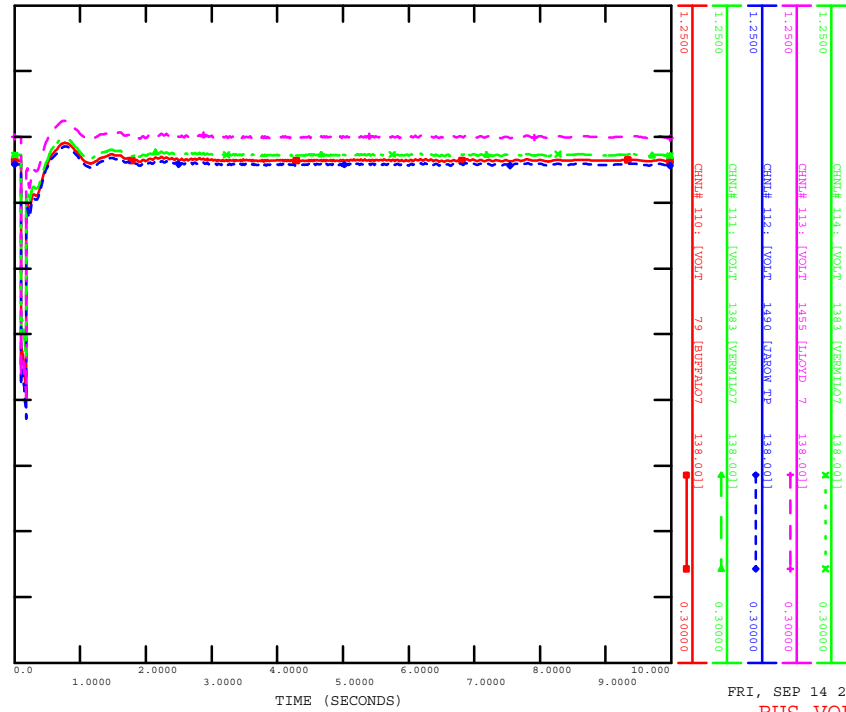
FRI, SEP 14 2012 11:14
LINE FLOW (P)

FILE: B-11.out



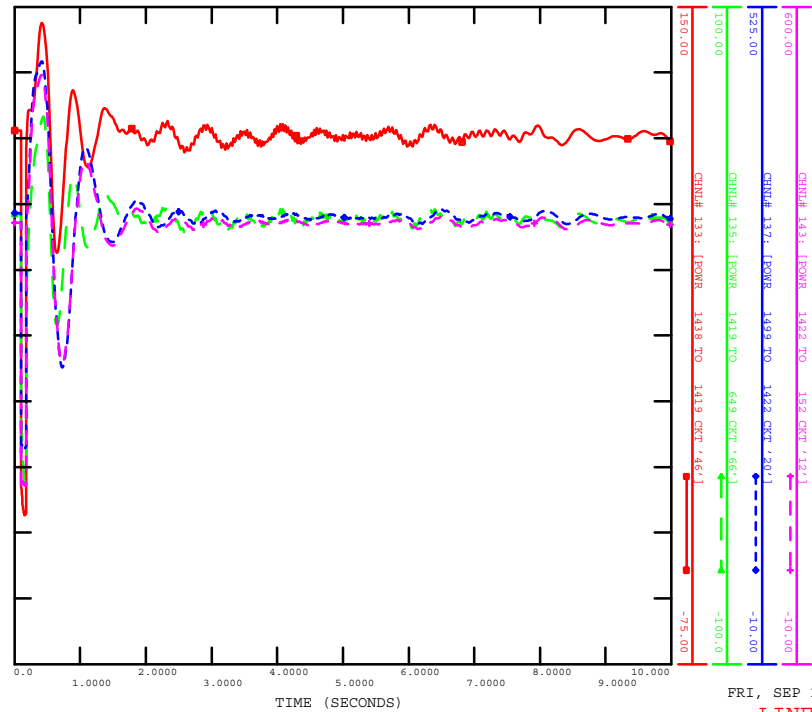
FRI, SEP 14 2012 11:14
BUS FREQUENCY

FILE: B-11.out



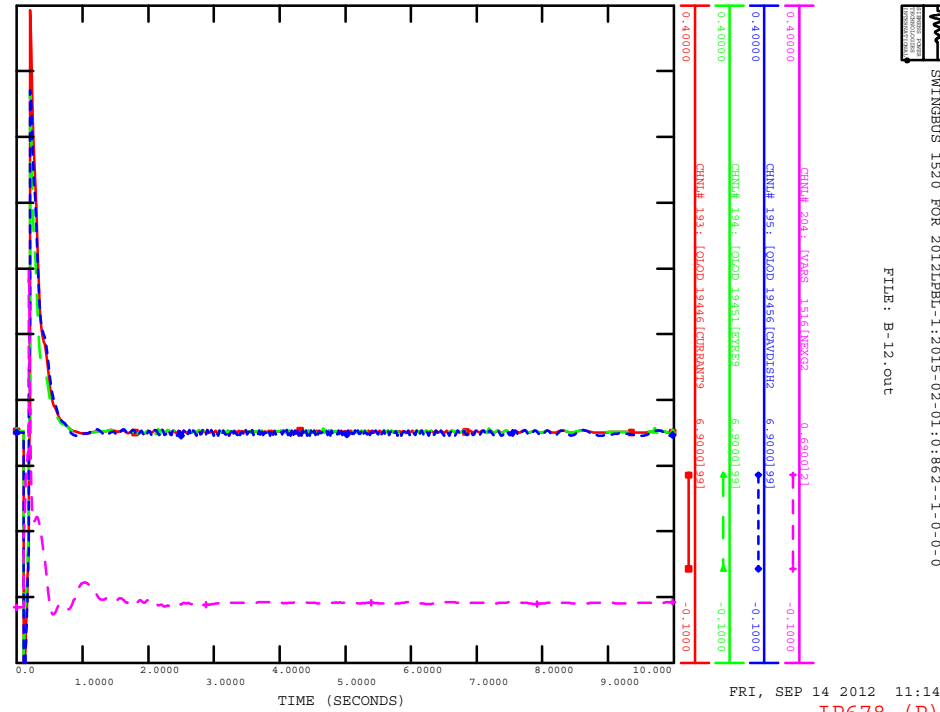
FRI, SEP 14 2012 11:14
BUS VOLT (PU)

FILE: B-11.out

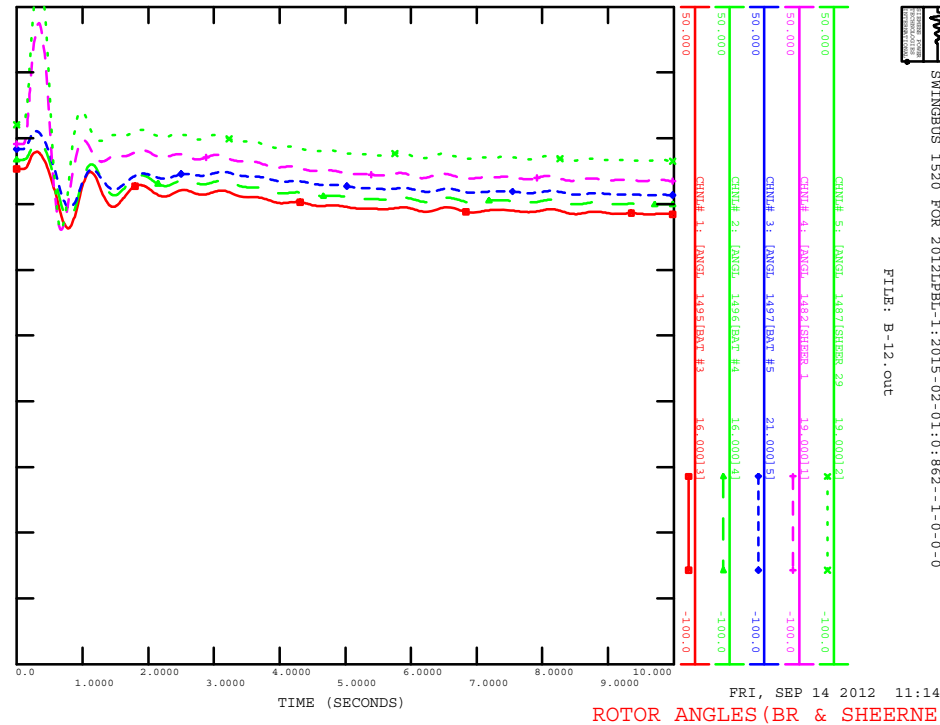


FRI, SEP 14 2012 11:14
LINE FLOW (P)

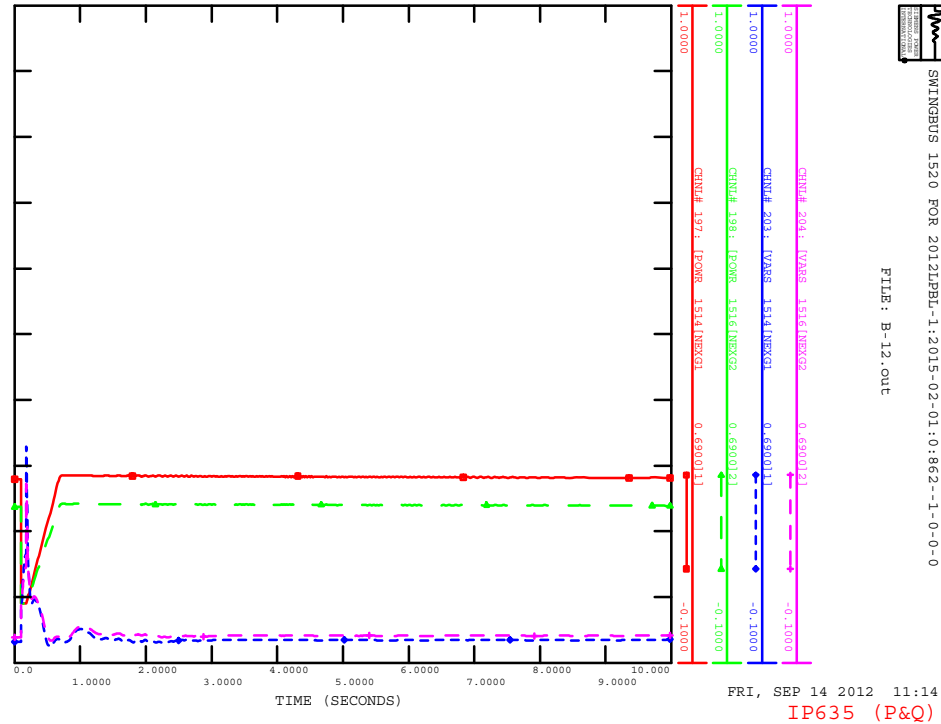
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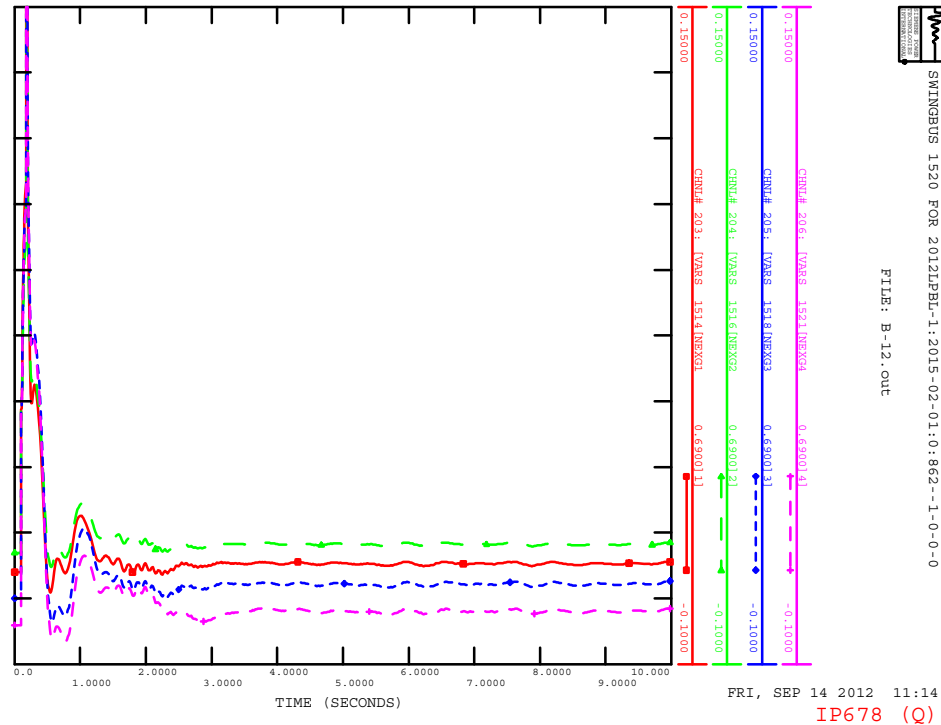
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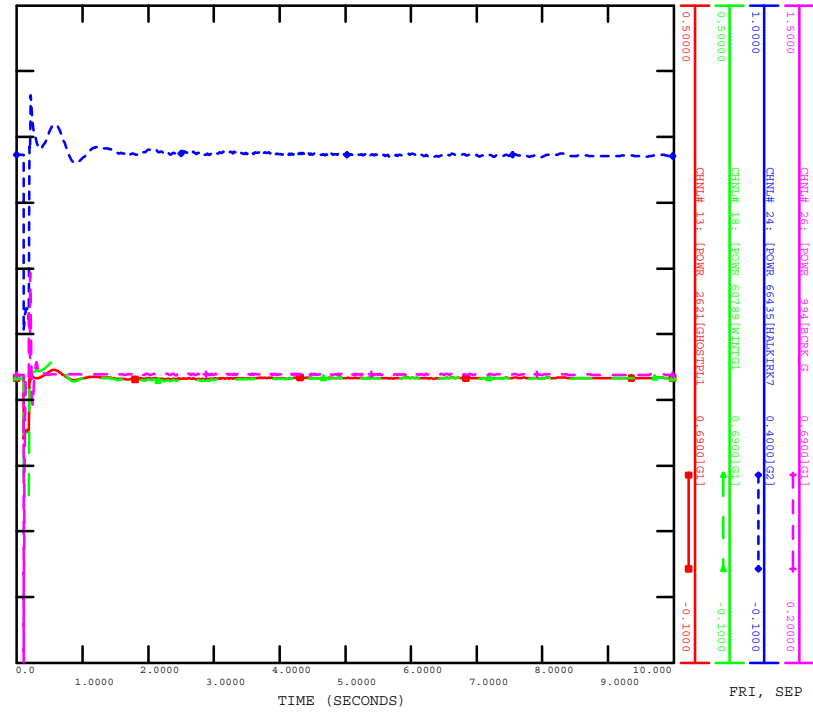
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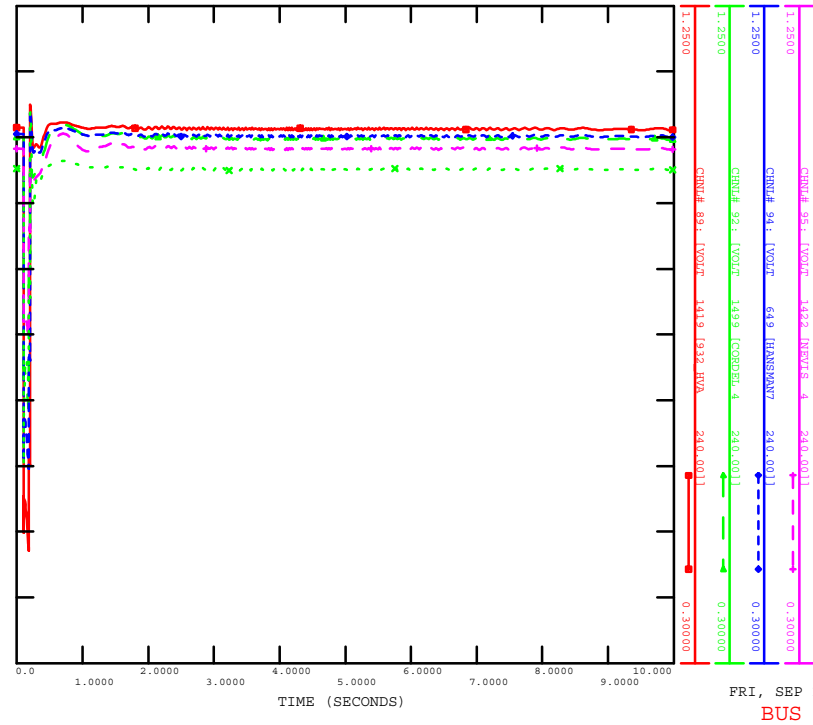
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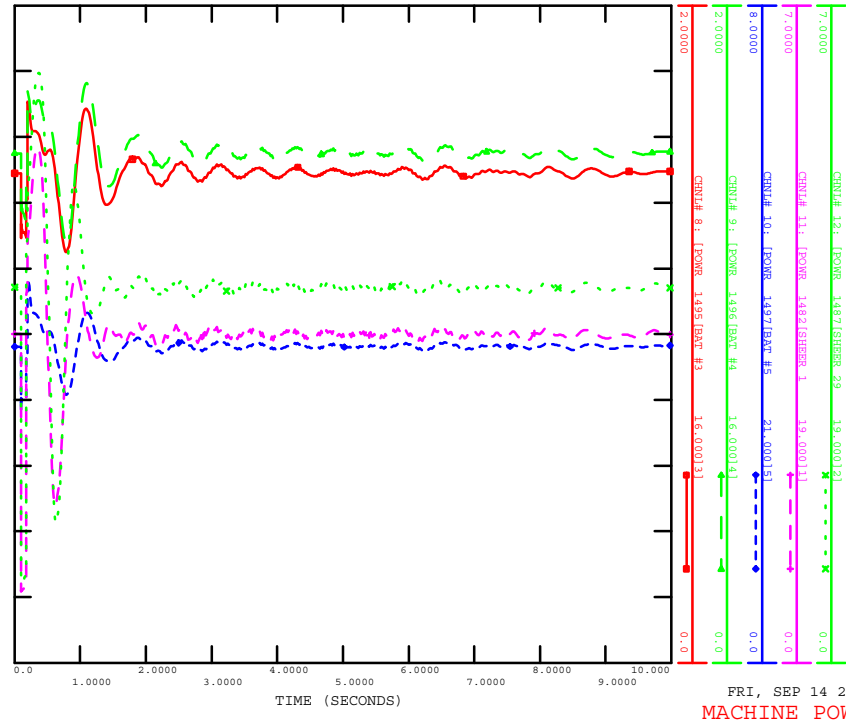
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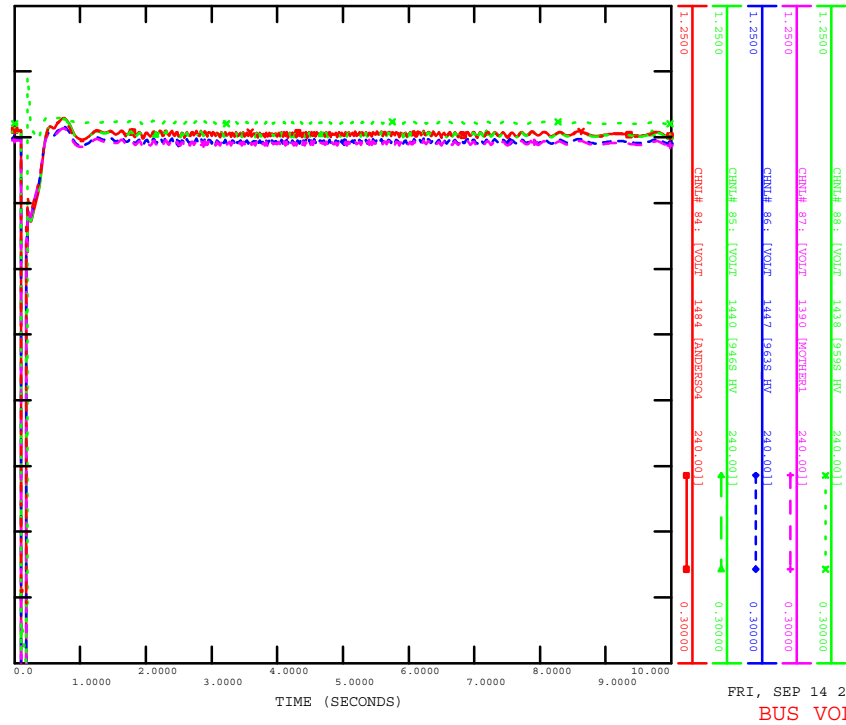
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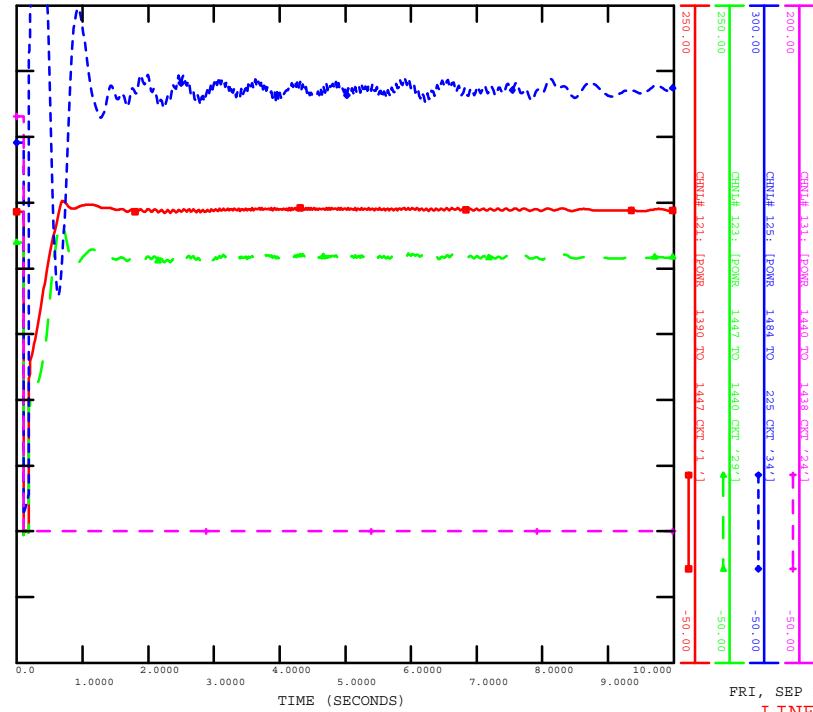
FILE: B-12.out



FILE: B-12.out

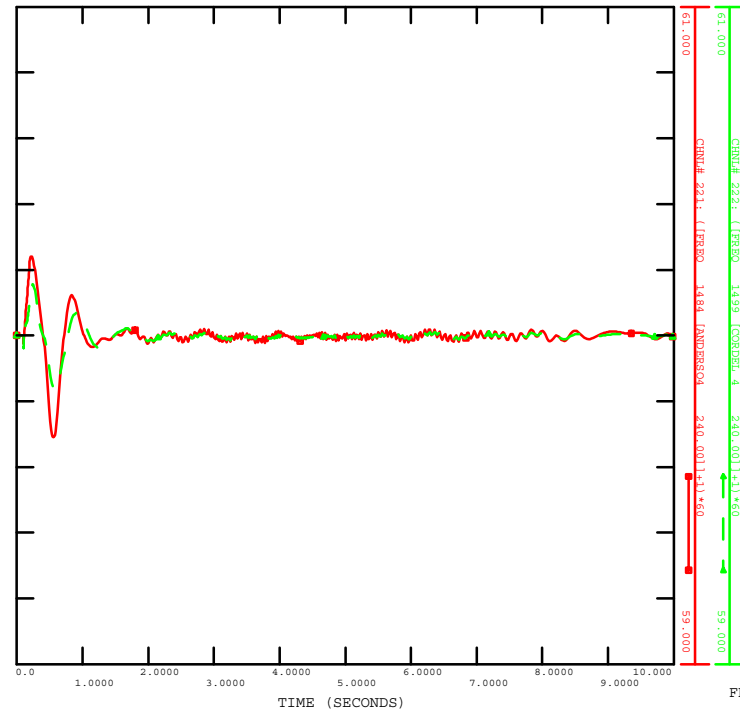


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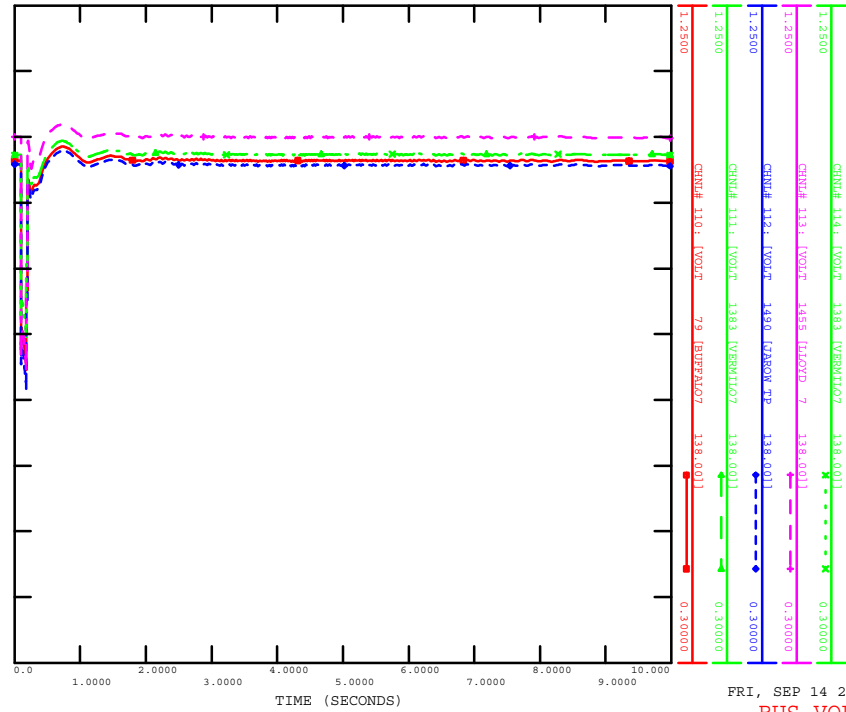
FRI, SEP 14 2012 11:14
LINE FLOW (P)

FILE: B-12.out



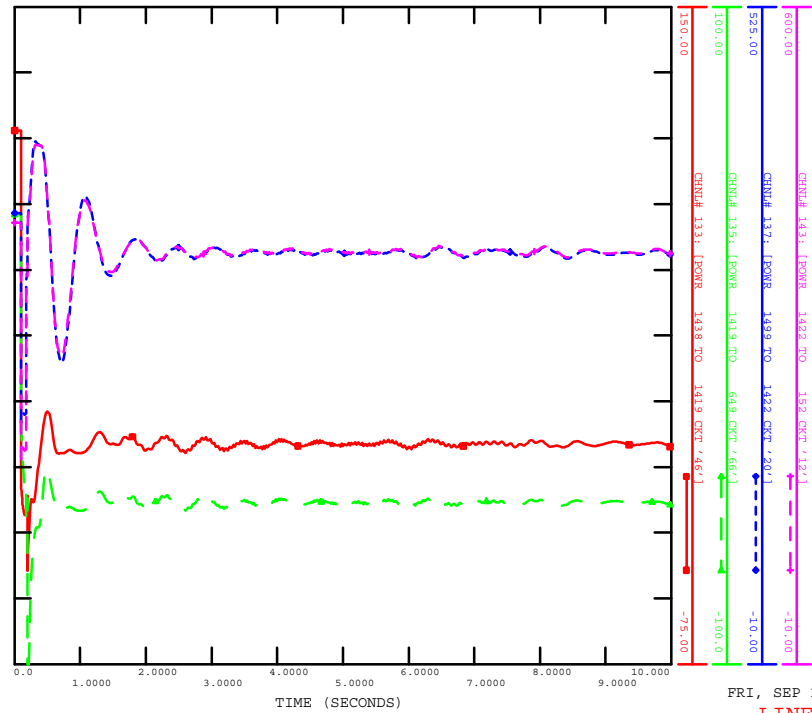
FRI, SEP 14 2012 11:14
BUS FREQUENCY

FILE: B-12.out



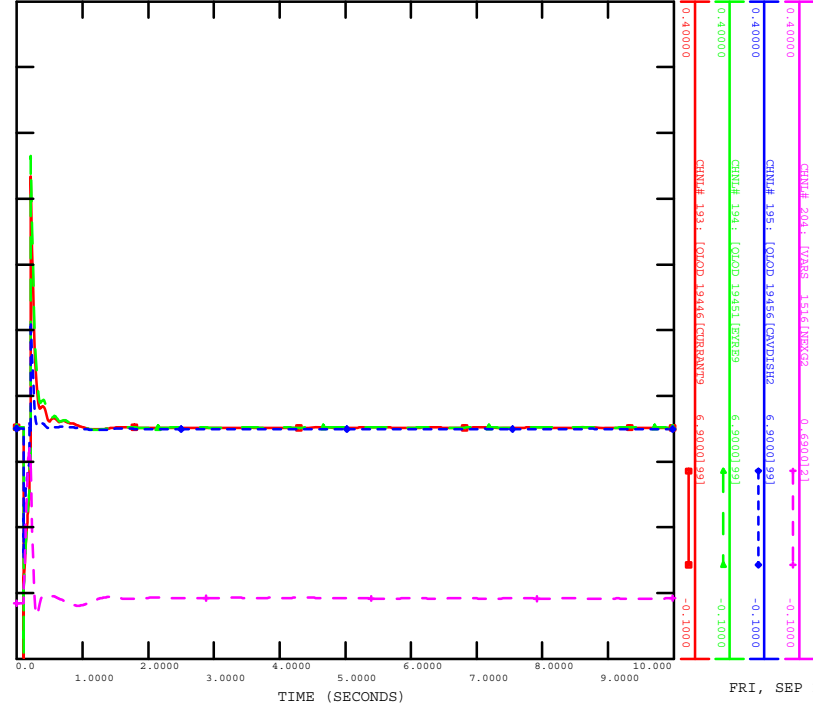
FRI, SEP 14 2012 11:14
BUS VOLT (PU)

FILE: B-12.out

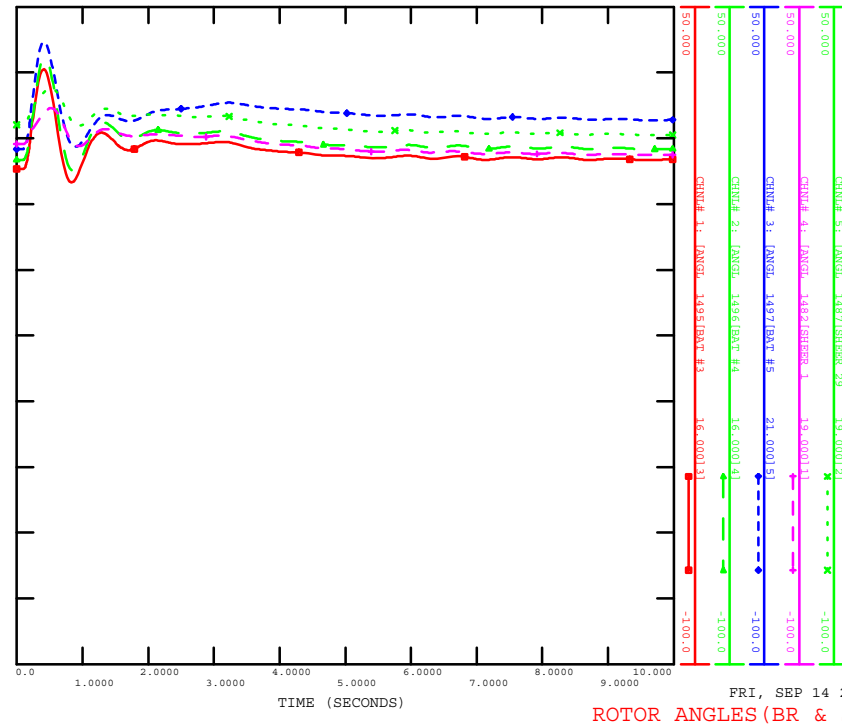


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LINE FLOW (P)

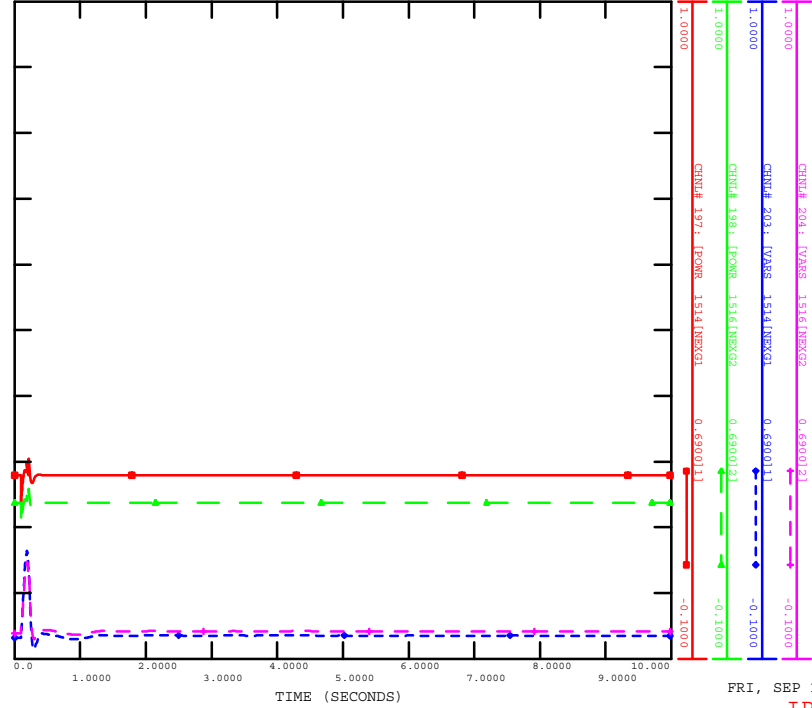
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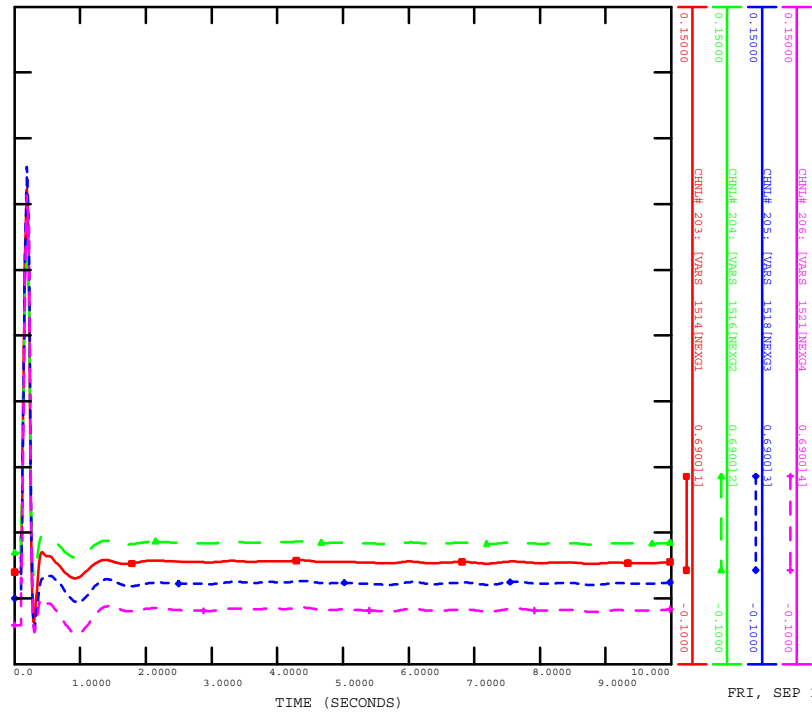
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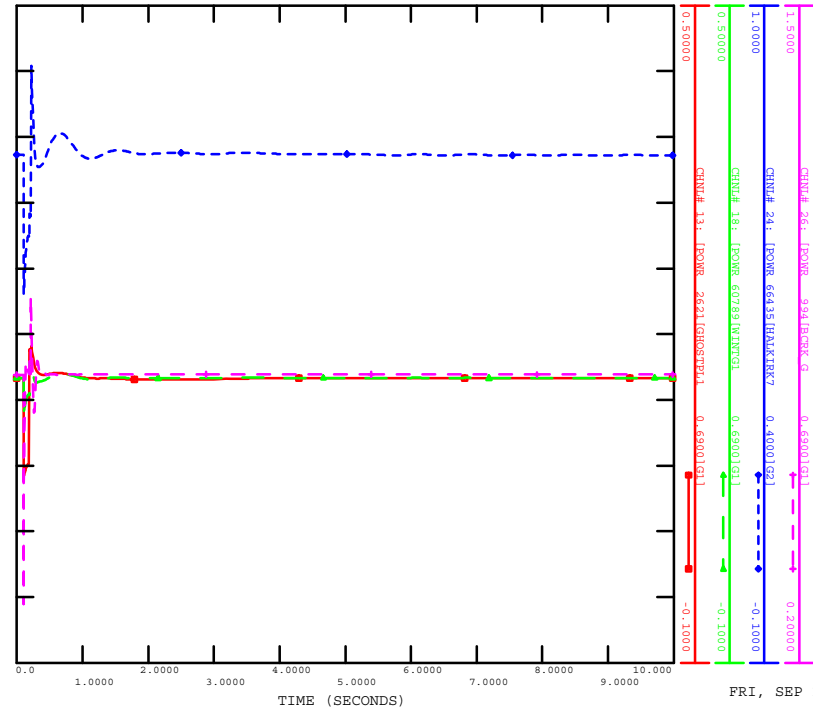
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FILE: B-33.out

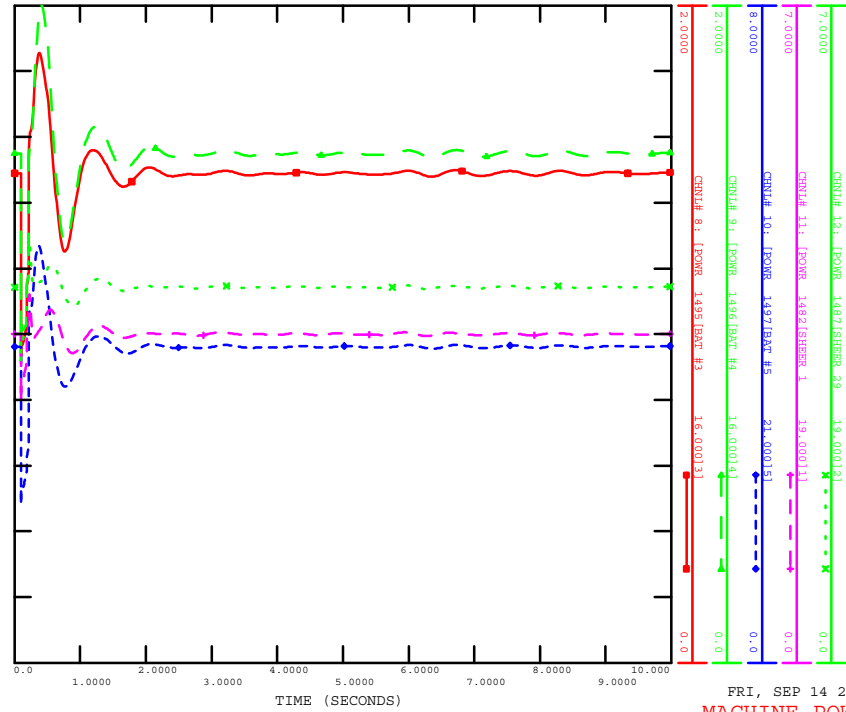


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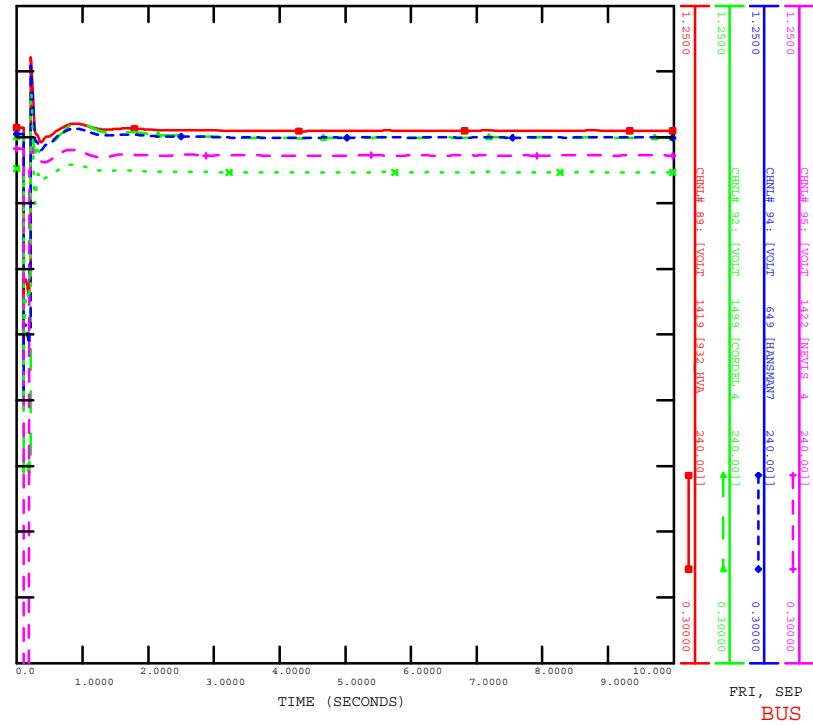
FRI, SEP 14 2012 11:15

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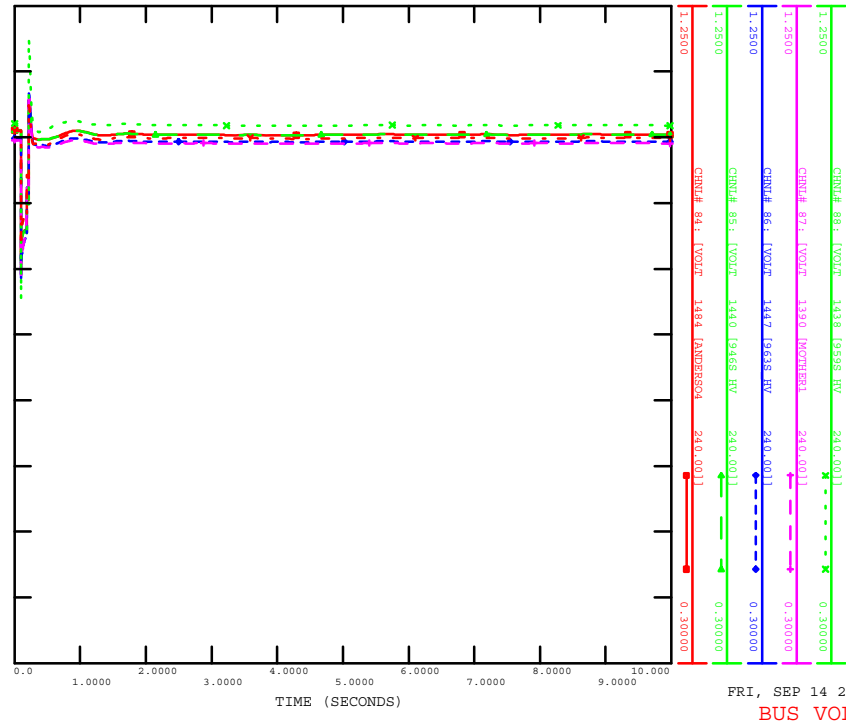
FRI, SEP 14 2012 11:15

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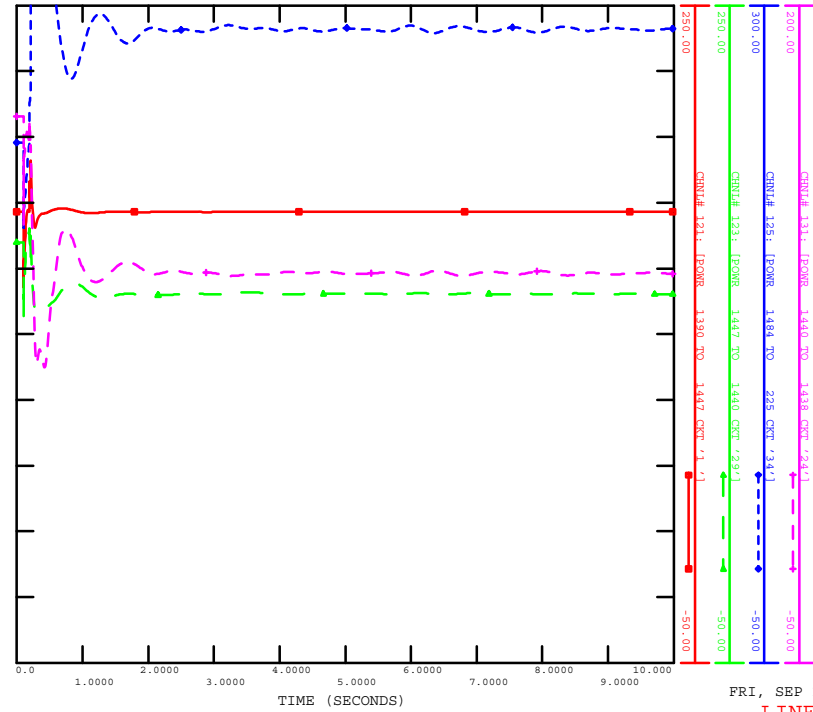
FRI, SEP 14 2012 11:15

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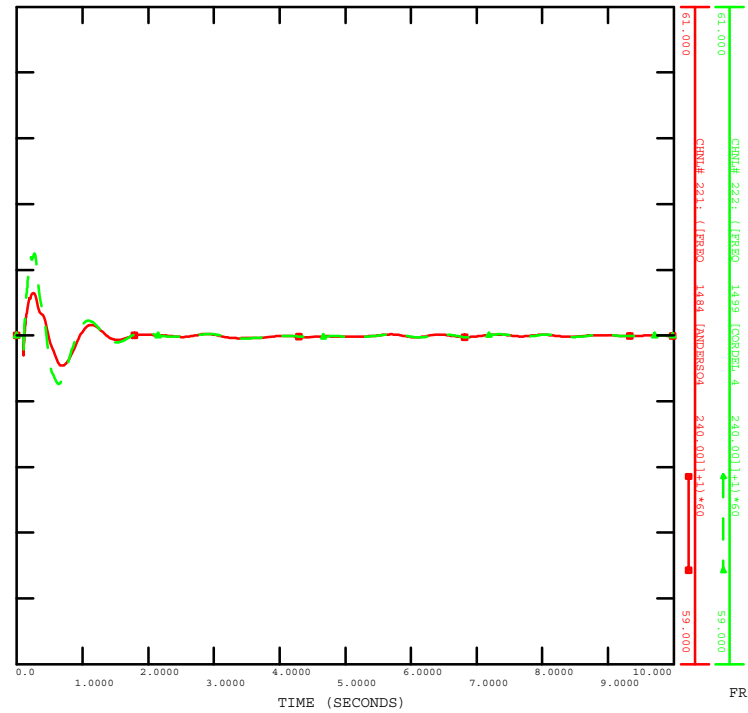
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FILE: B-33.out



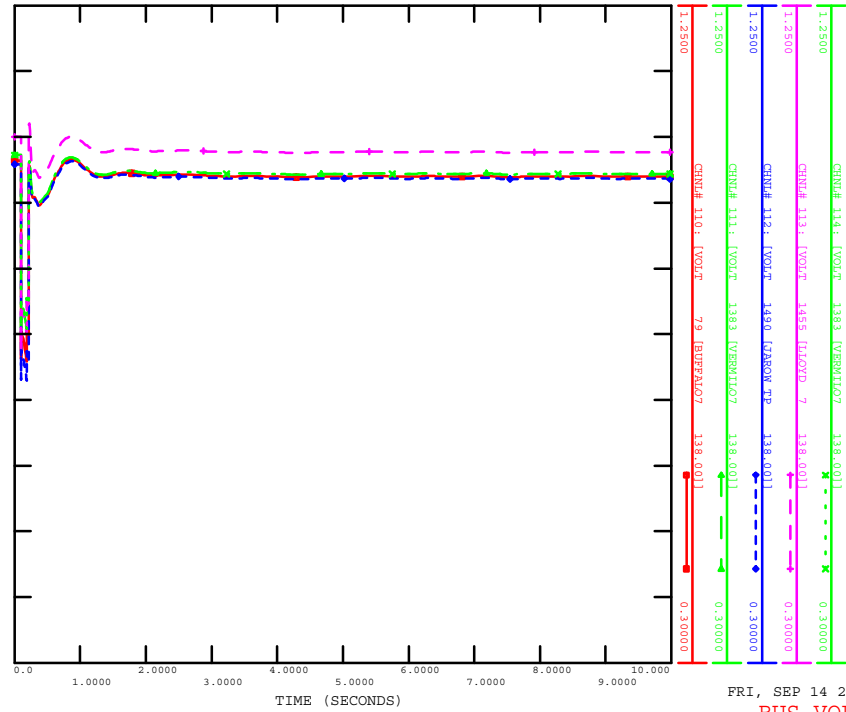
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LINE FLOW (P)

FILE: B-33.out



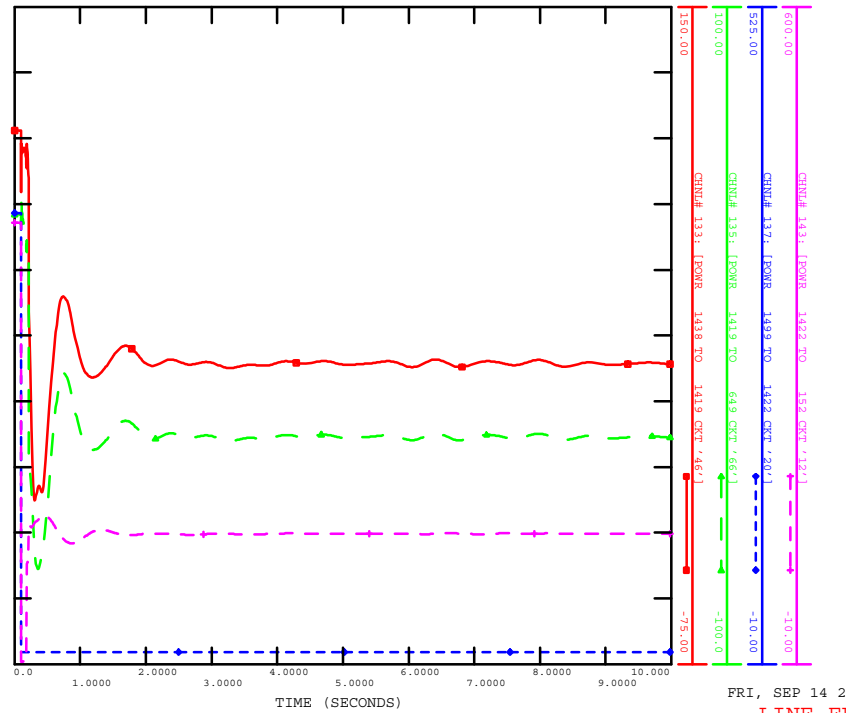
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BUS FREQUENCY

FILE: B-33.out



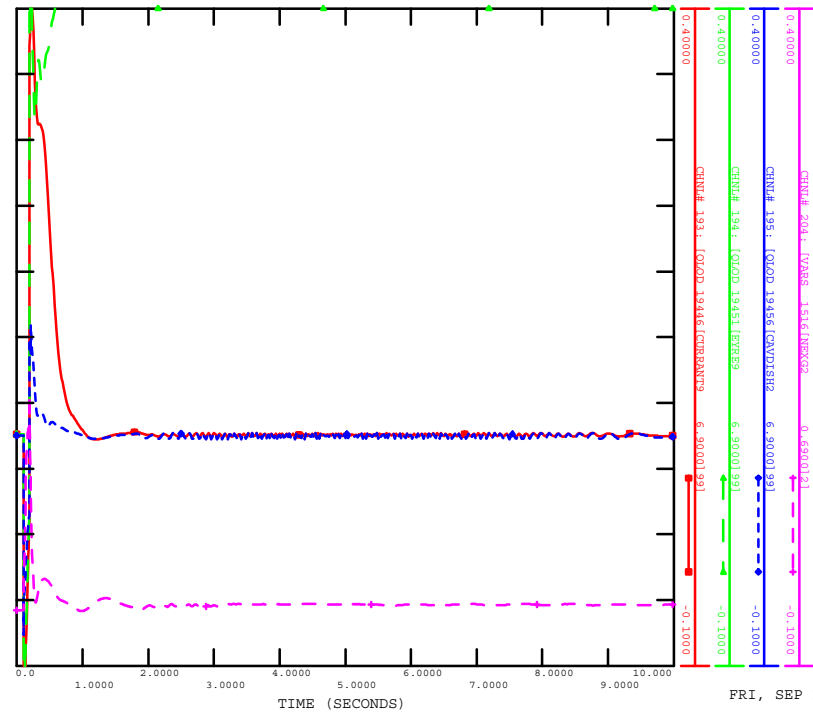
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BUS VOLT (PU)

FILE: B-33.out

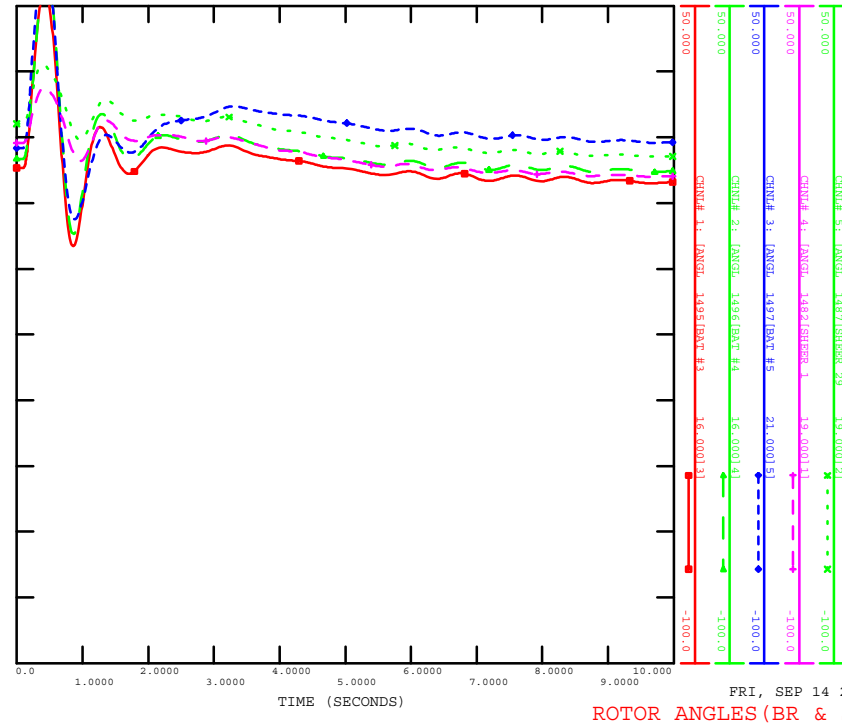


FRI, SEP 14 2012 11:15
LINE FLOW (P)

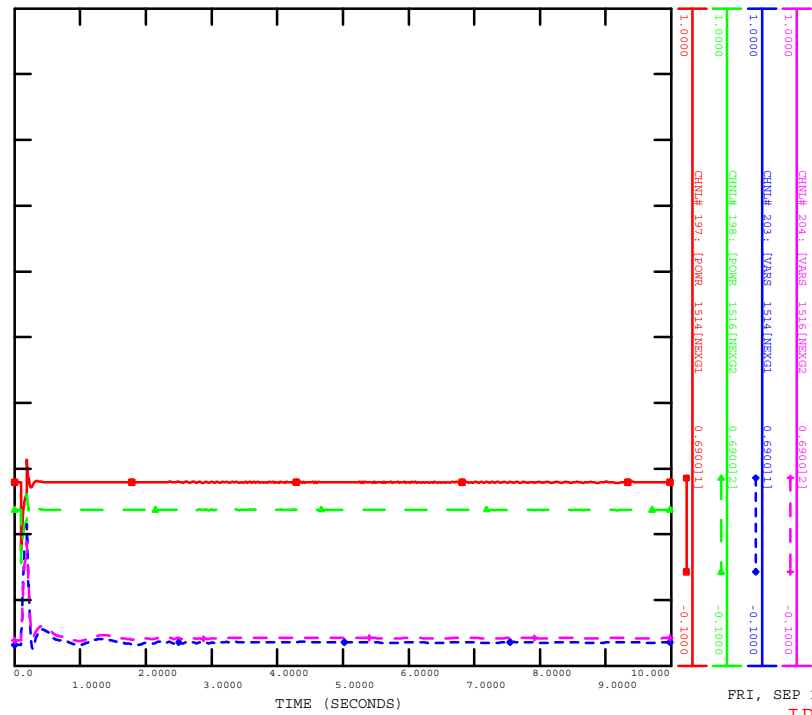
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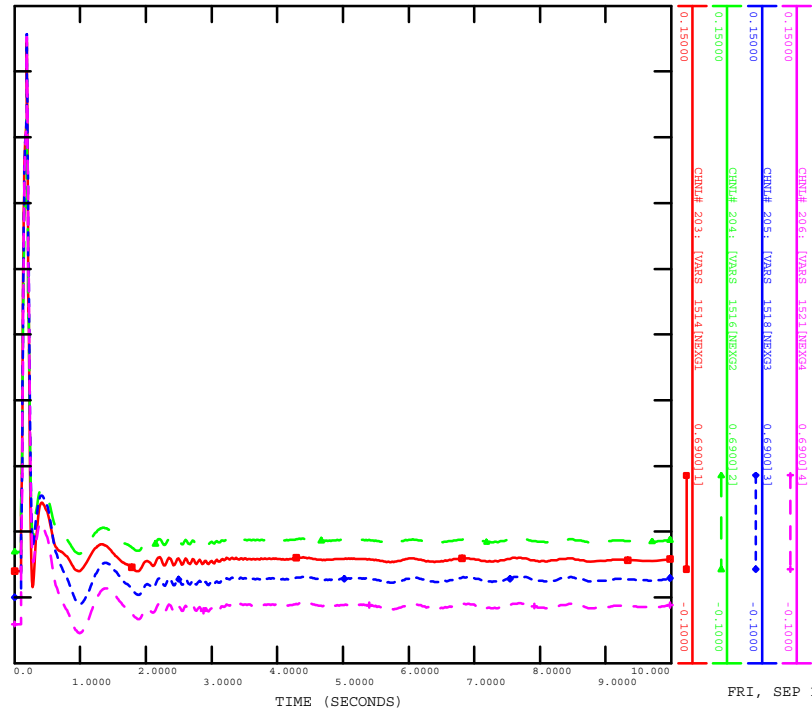
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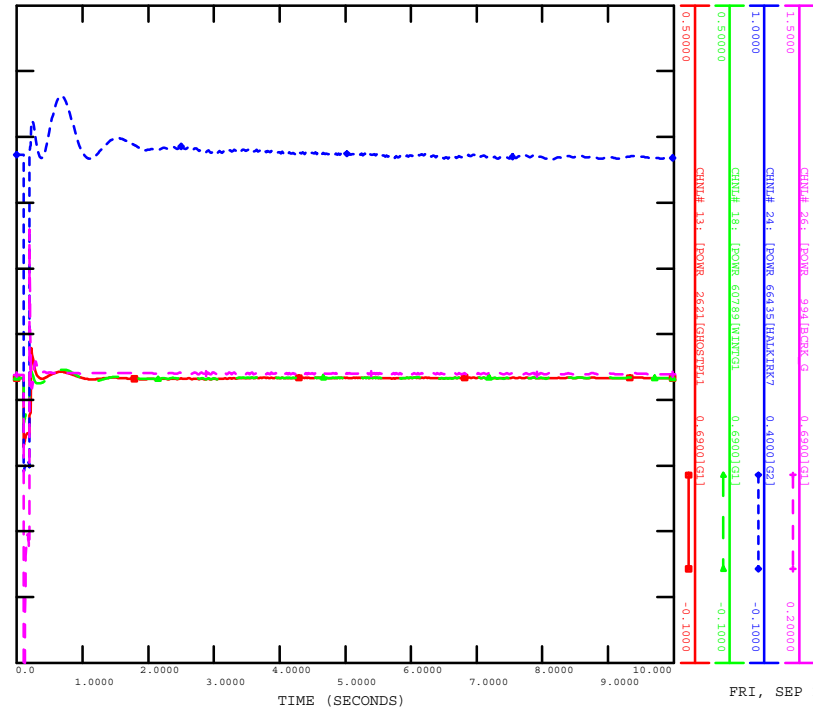
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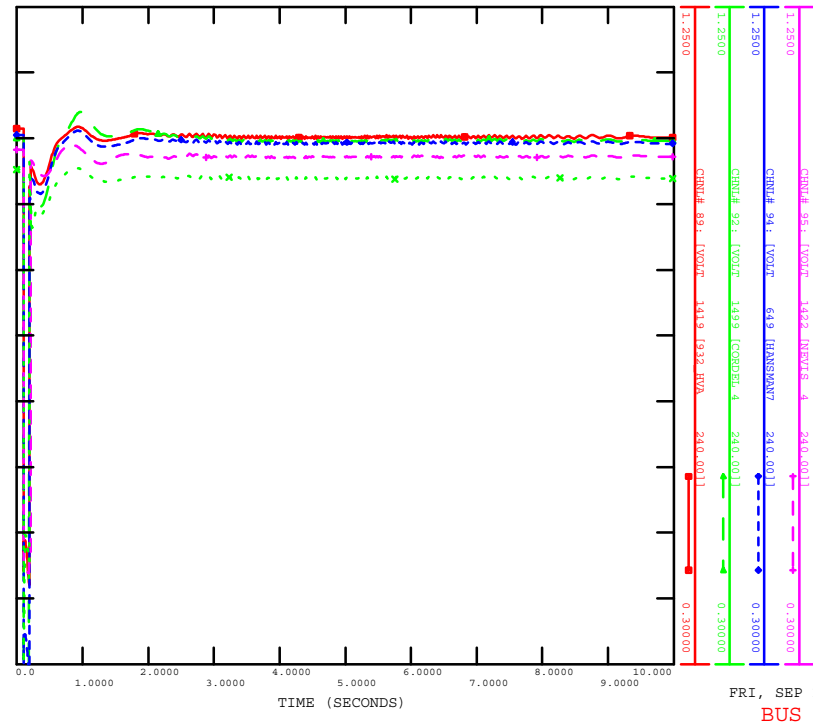
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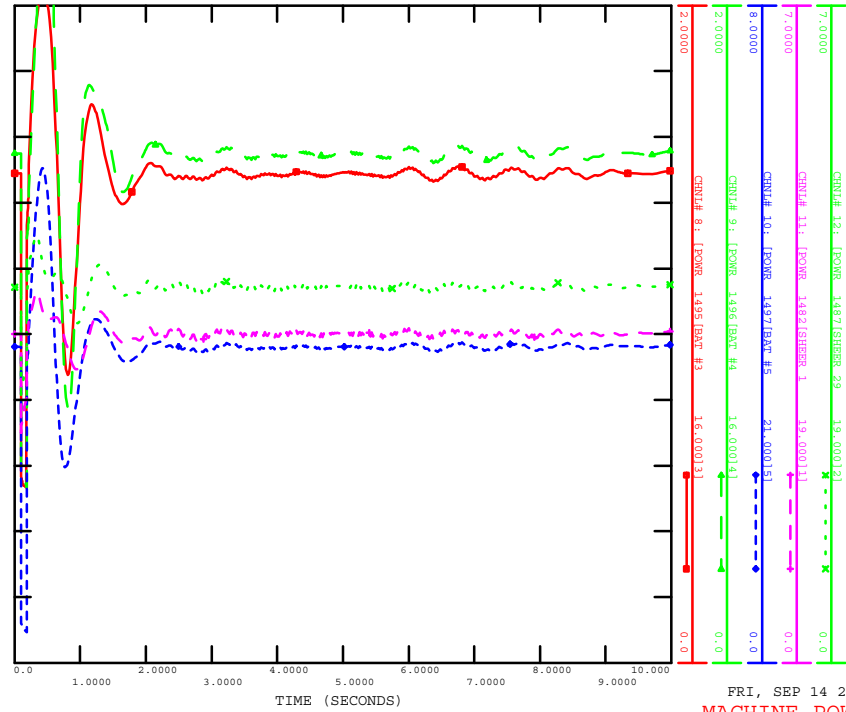
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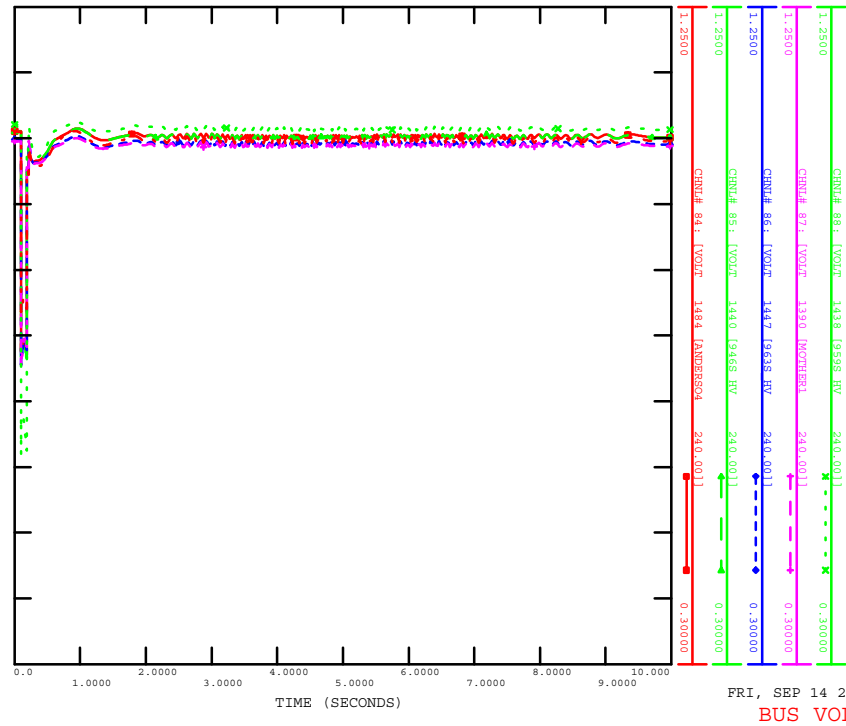
FILE: B-34.out



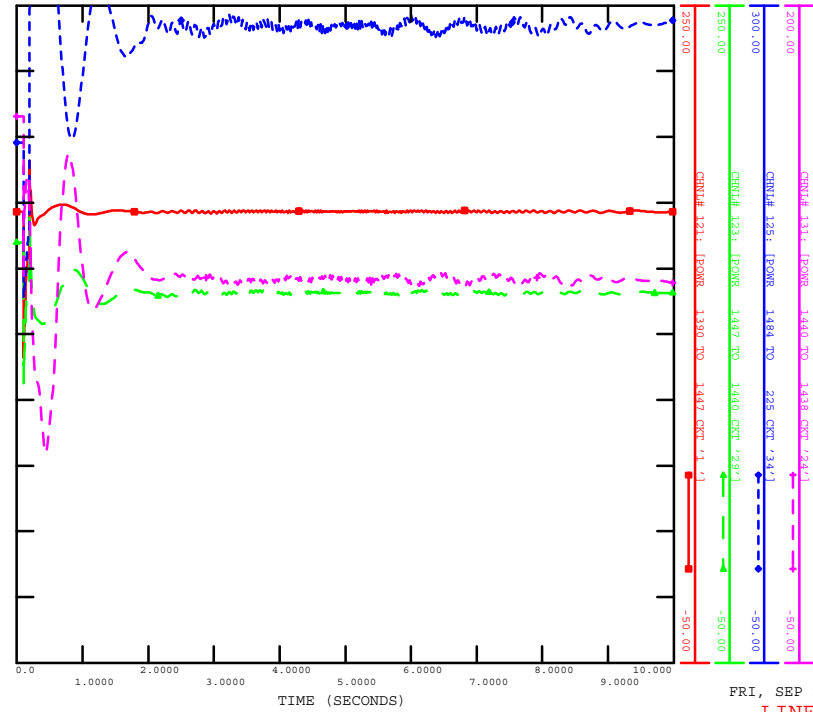
FILE: B-34.out



FILE: B-34.out

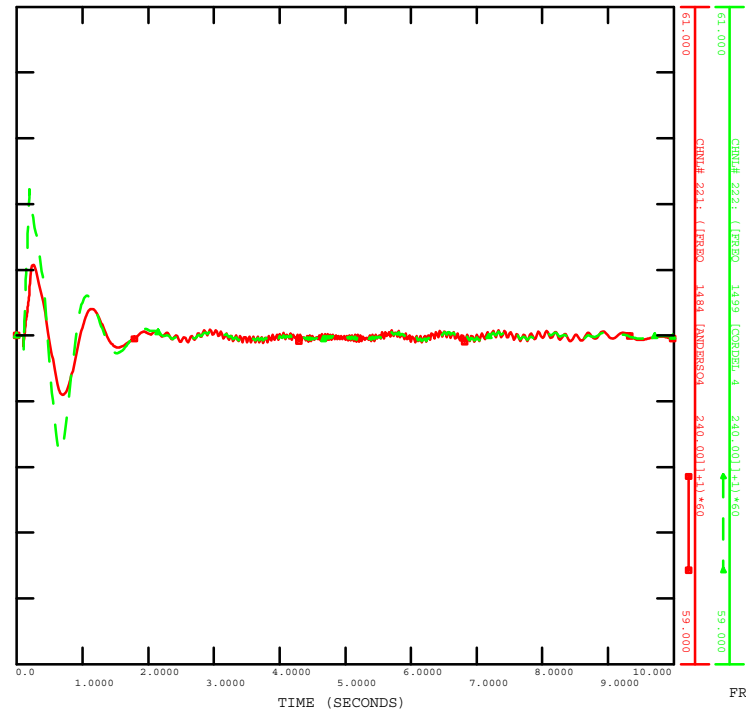


FILE: B-34.out



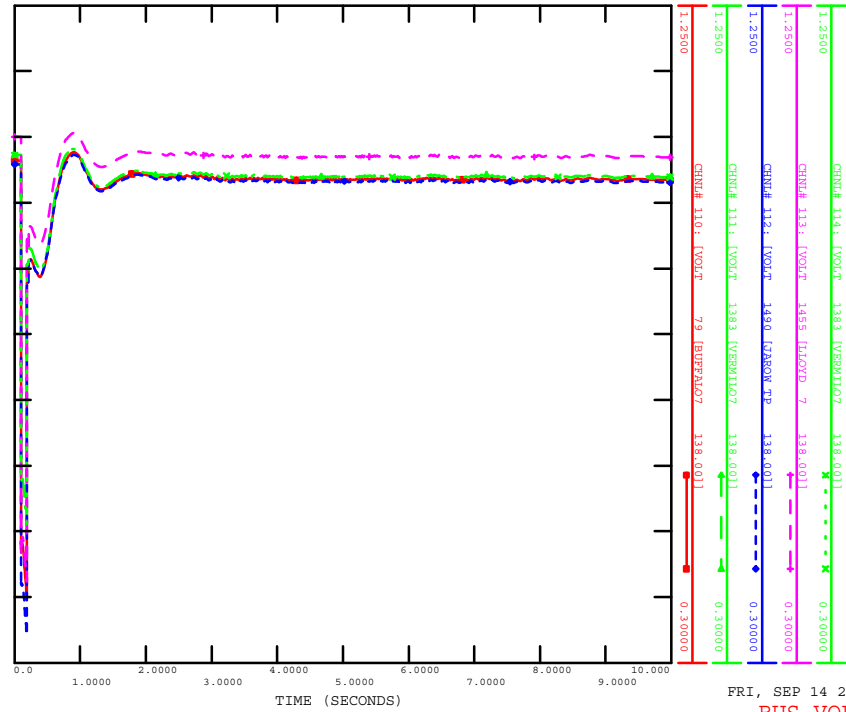
FRI, SEP 14 2012 11:15
LINE FLOW (P)

FILE: B-34.out



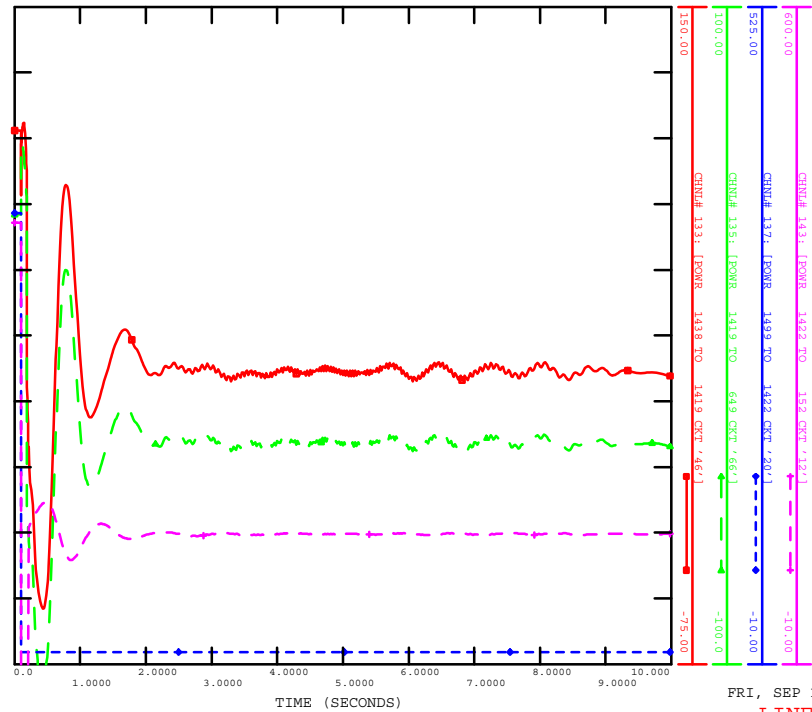
FRI, SEP 14 2012 11:15
BUS FREQUENCY

FILE: B-34.out



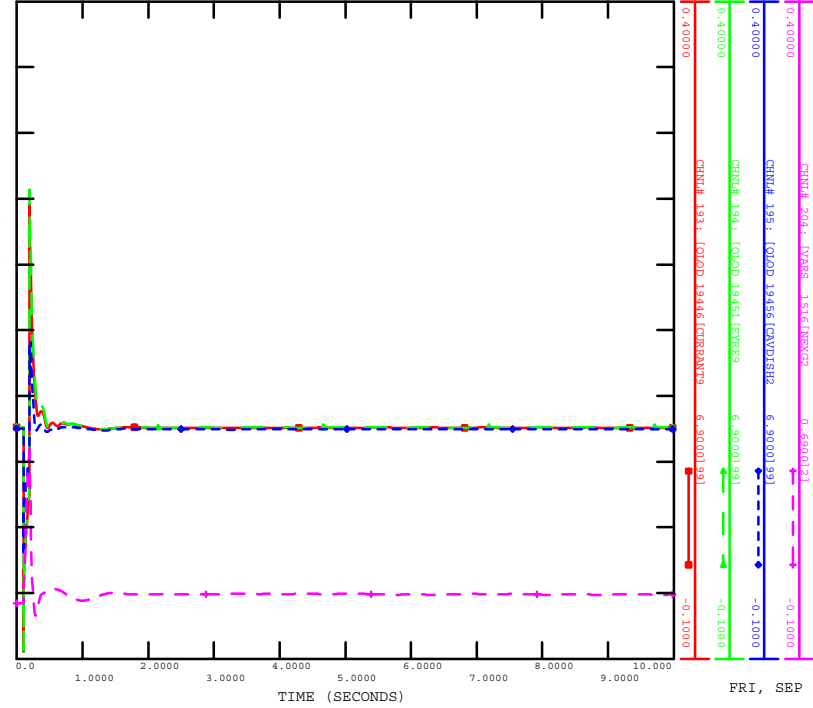
FRI, SEP 14 2012 11:15
BUS VOLT (PU)

FILE: B-34.out



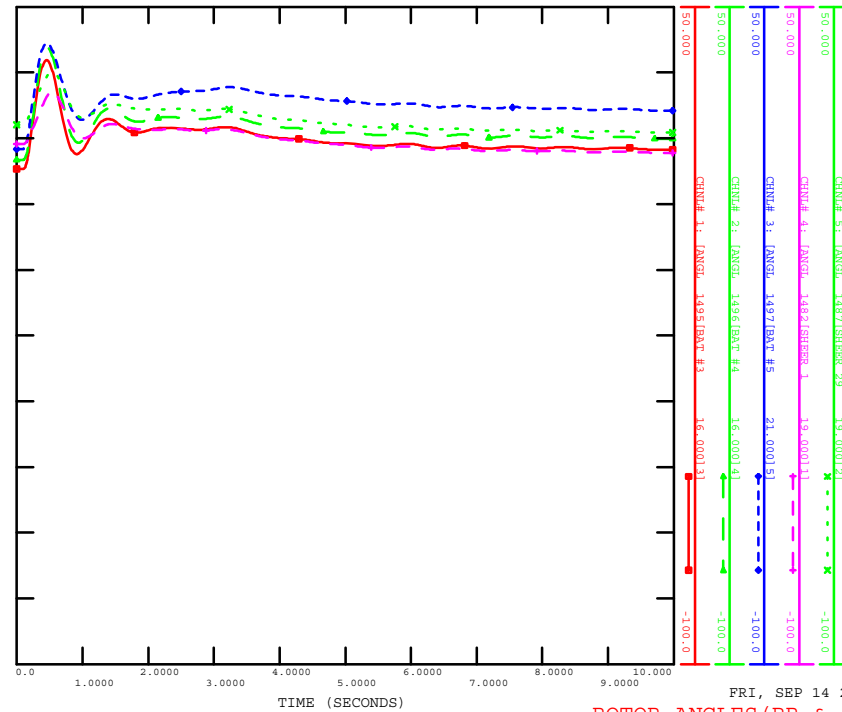
FRI, SEP 14 2012 11:15
LINE FLOW (P)

FILE: B-35.out



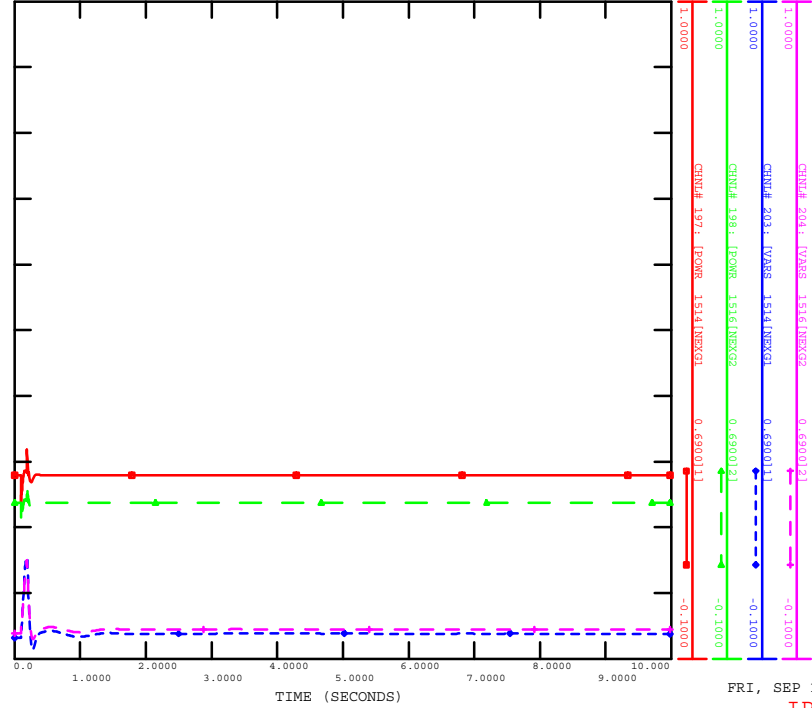
FRI, SEP 14 2012 11:15
IP678 (P)

FILE: B-35.out



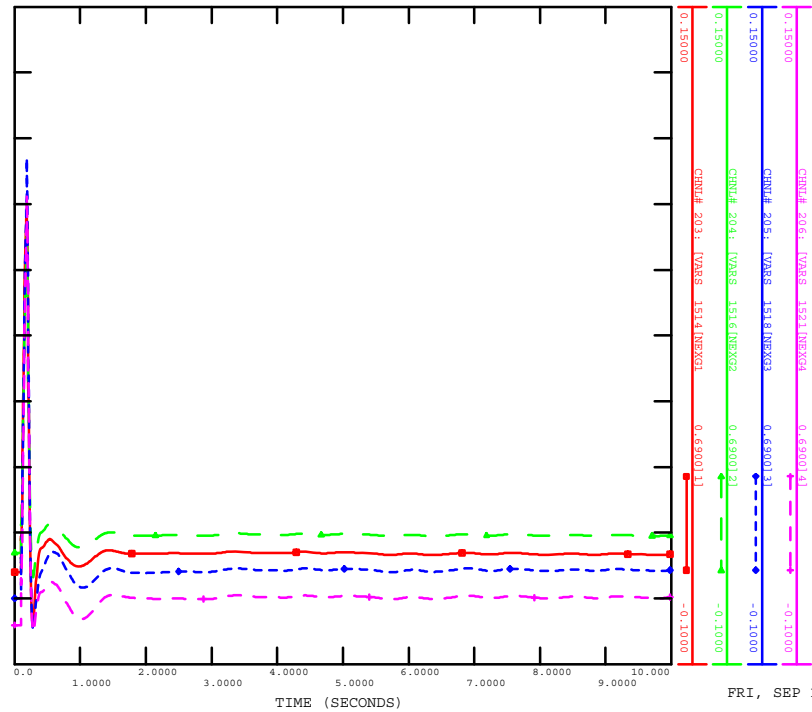
FRI, SEP 14 2012 11:15
ROTOR ANGLES (BR & SHEERNE)

FILE: B-35.out



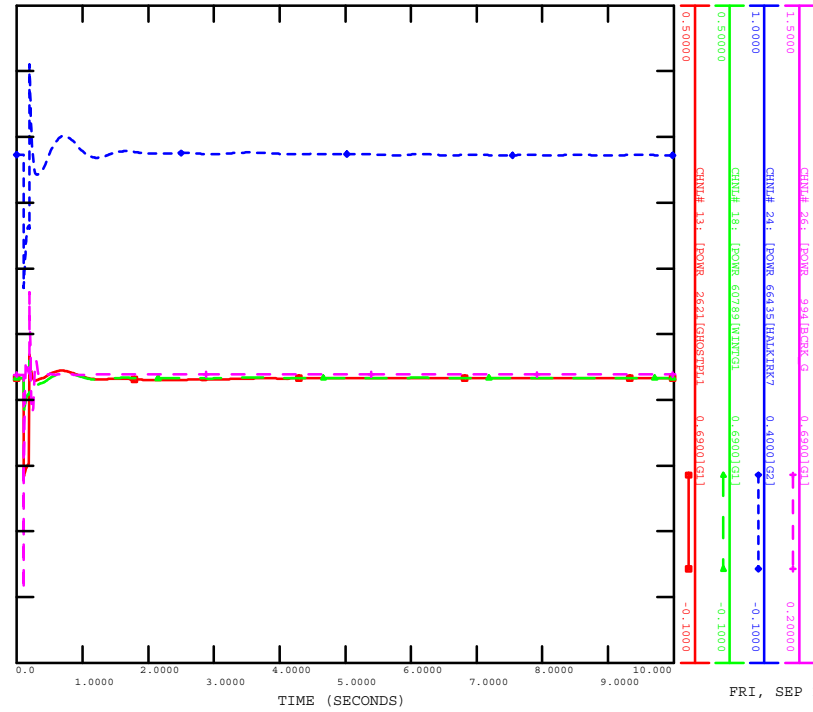
FRI, SEP 14 2012 11:15
IP635 (P&Q)

FILE: B-35.out



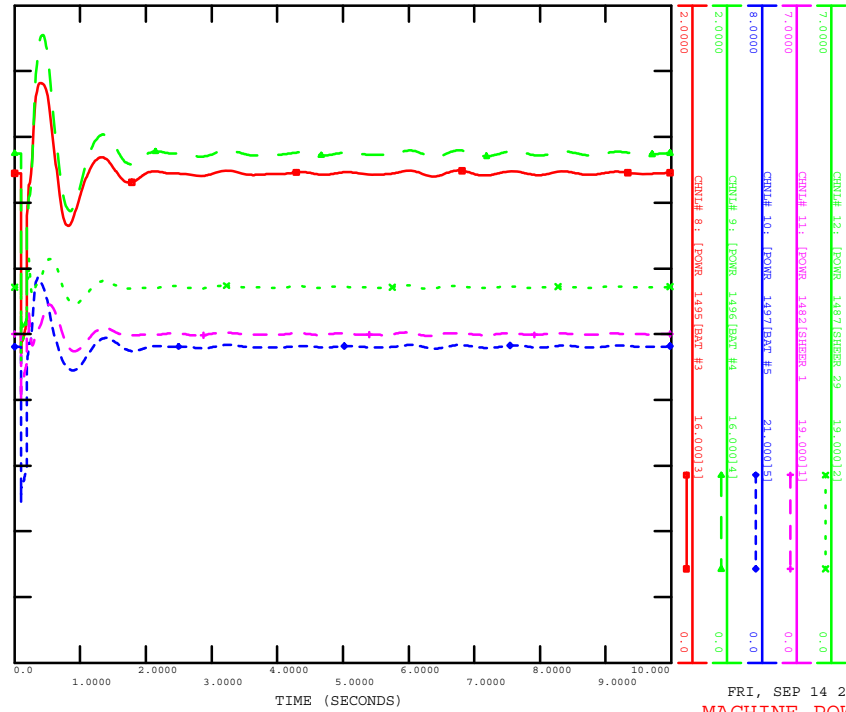
FRI, SEP 14 2012 11:15
IP678 (Q)

FILE: B-35.out



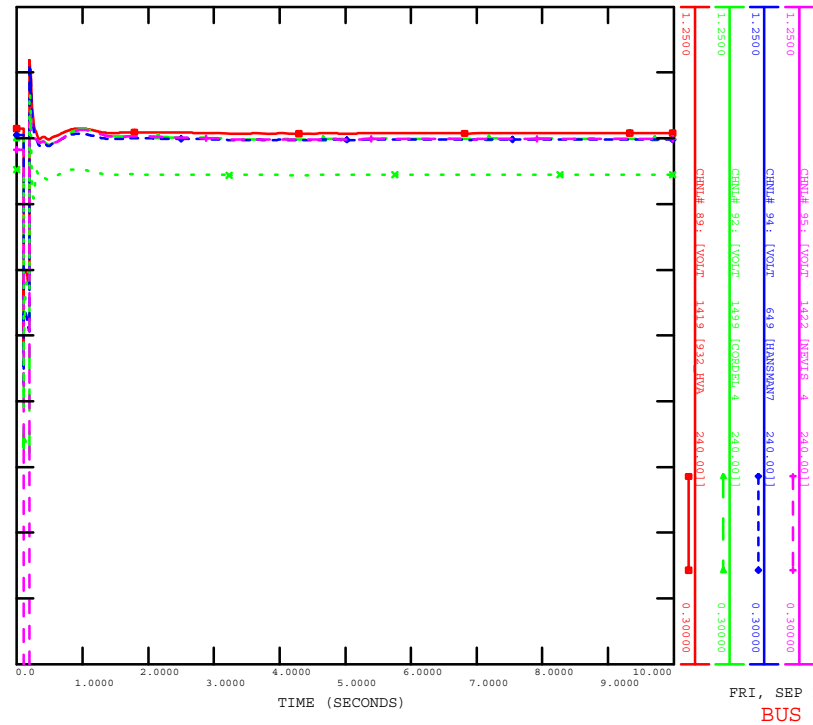
FRI, SEP 14 2012 11:15

FILE: B-35.out



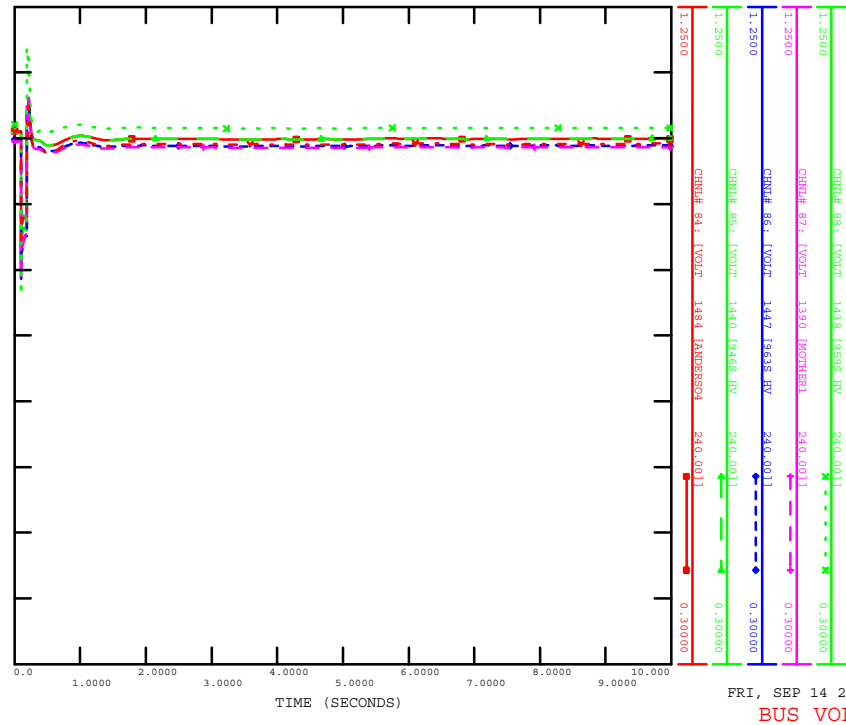
FRI, SEP 14 2012 11:15

FILE: B-35.out



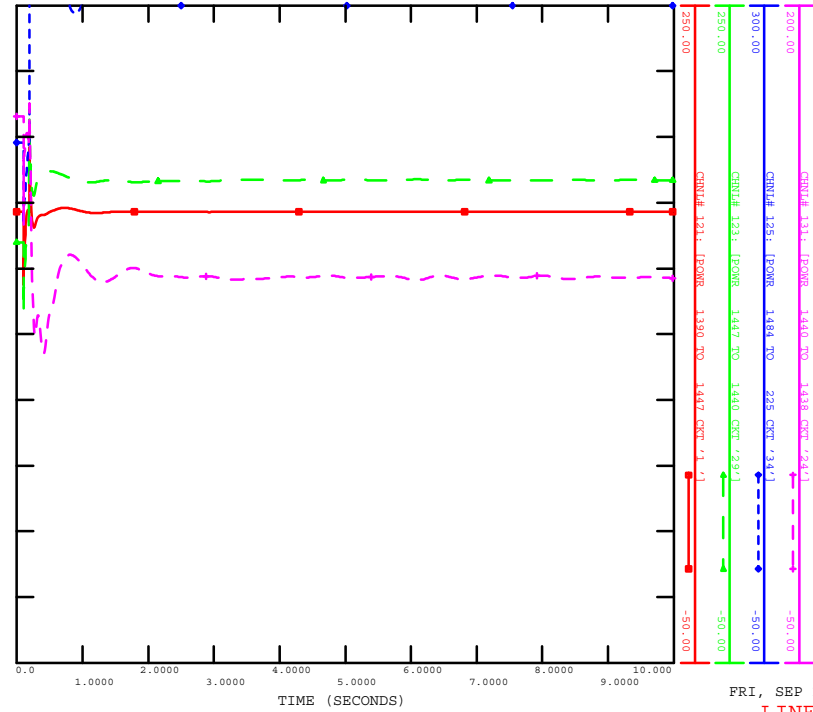
FRI, SEP 14 2012 11:15

FILE: B-35.out



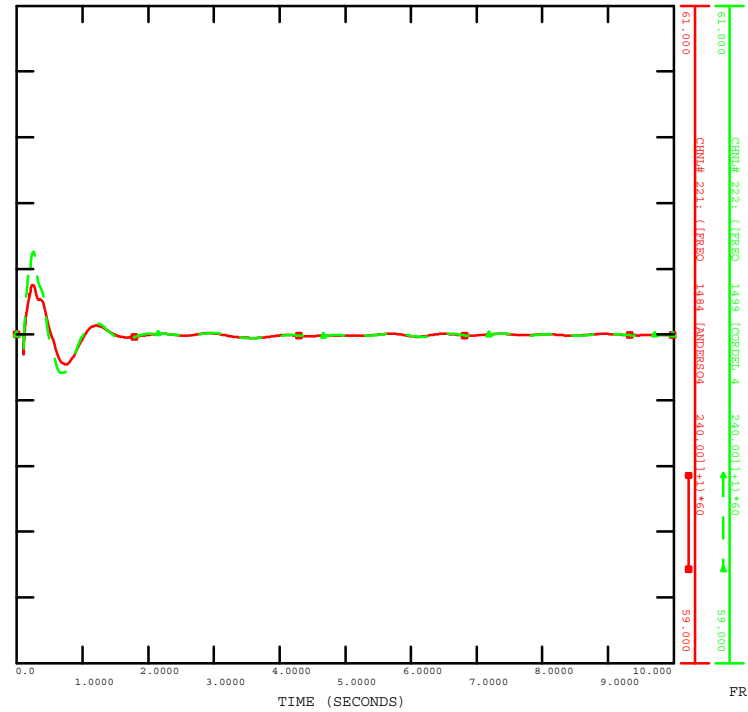
FRI, SEP 14 2012 11:15

FILE: B-35.out



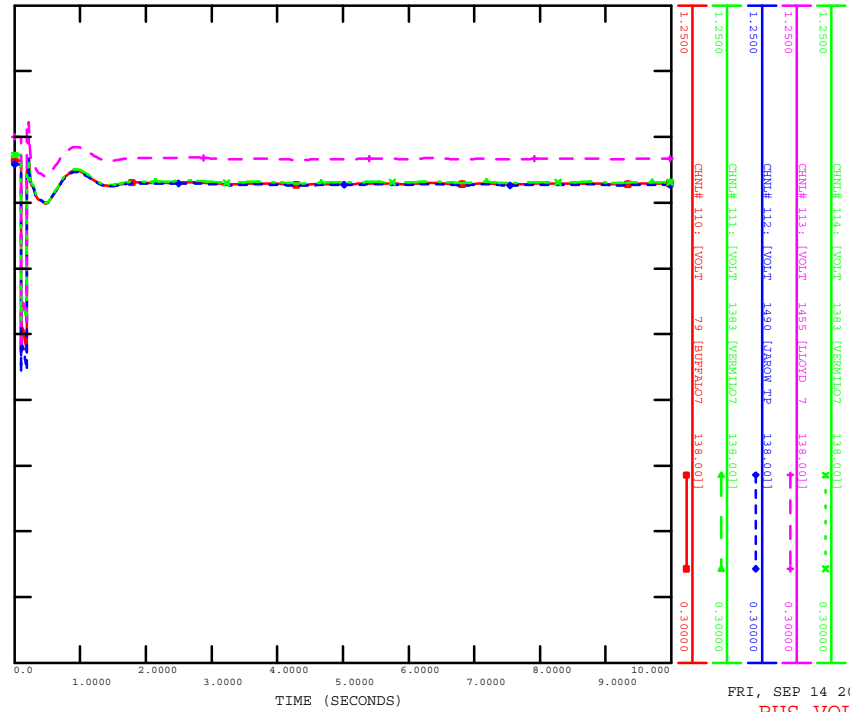
FRI, SEP 14 2012 11:15
LINE FLOW (P)

FILE: B-35.out



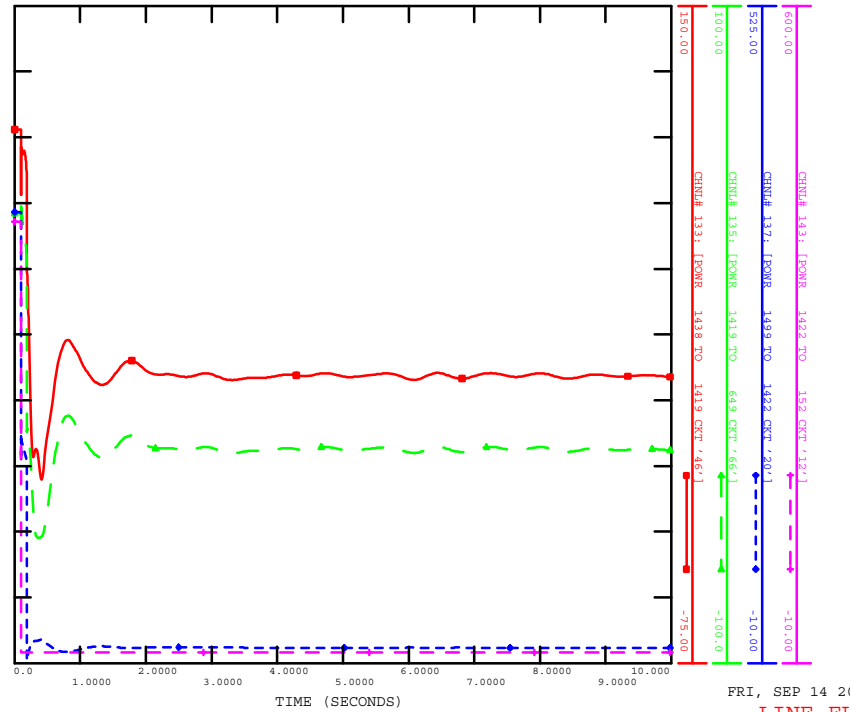
FRI, SEP 14 2012 11:15
BUS FREQUENCY

FILE: B-35.out



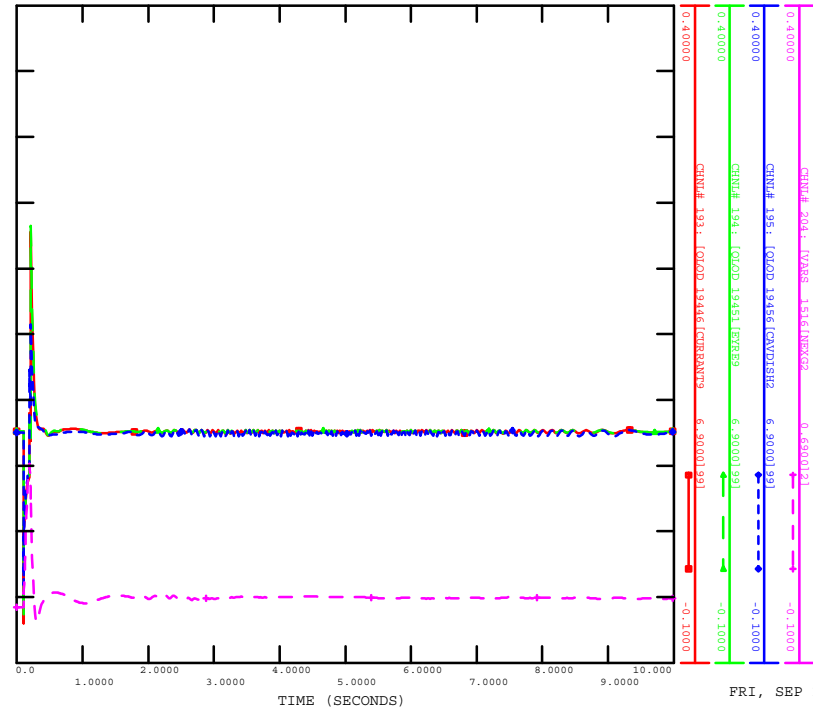
FRI, SEP 14 2012 11:15
BUS VOLT (PU)

FILE: B-35.out

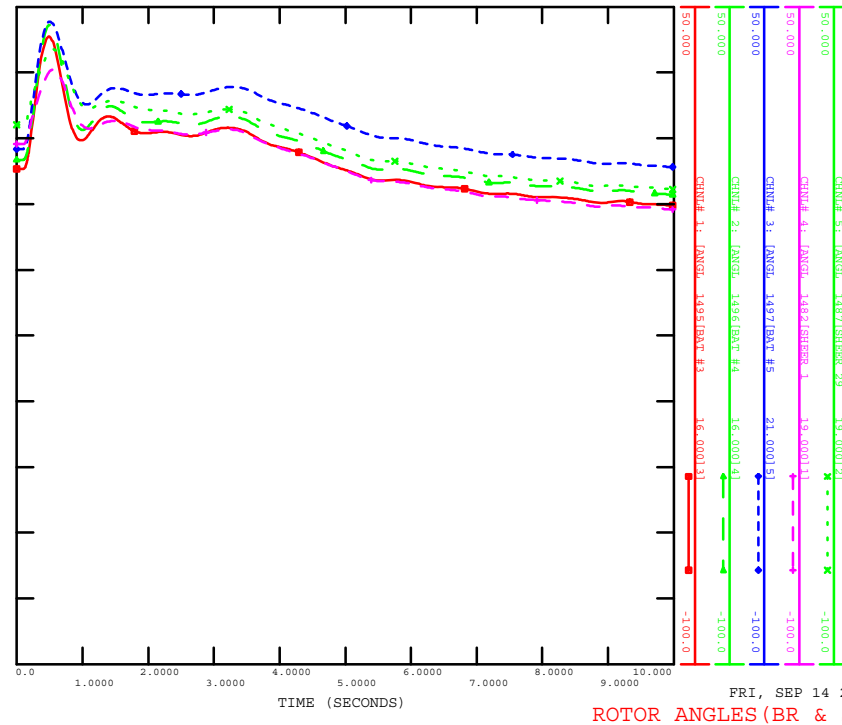


FRI, SEP 14 2012 11:15
LINE FLOW (P)

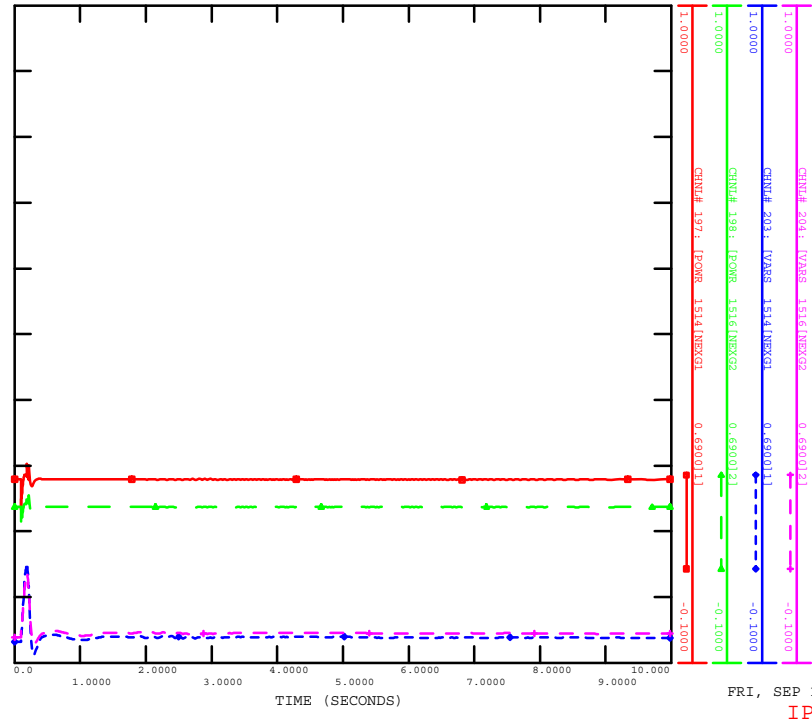
FILE: B-36.out



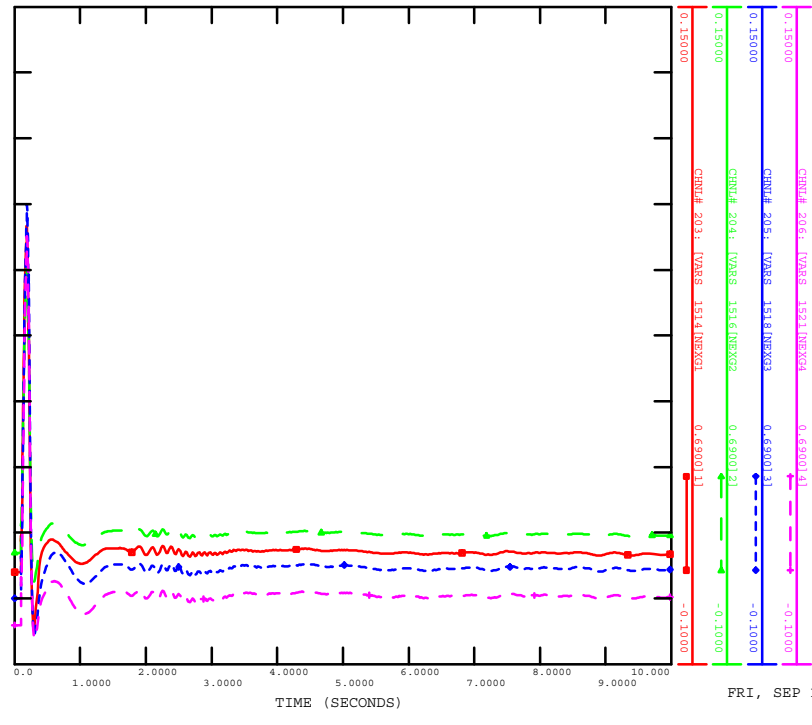
FILE: B-36.out



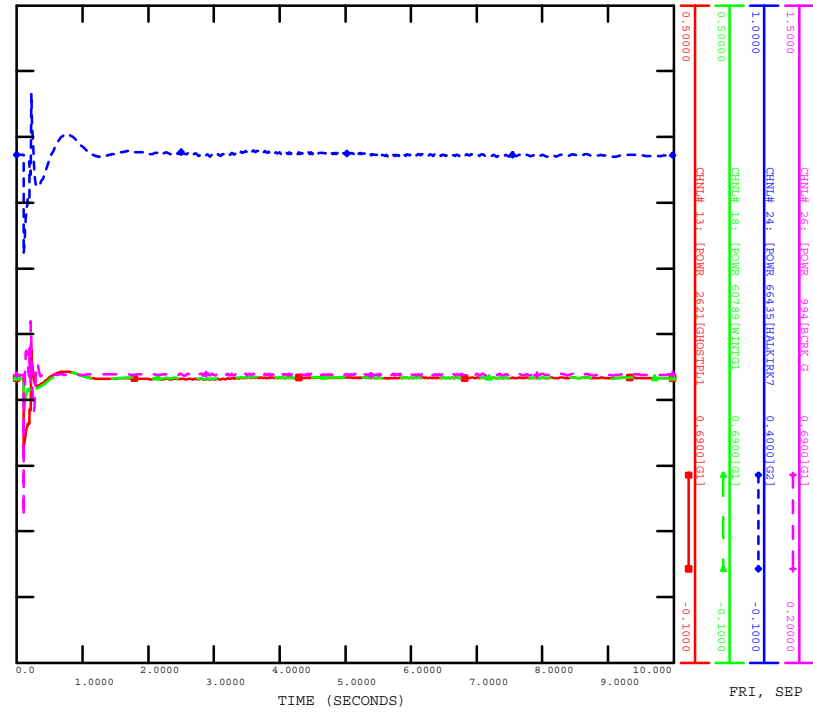
FILE: B-36.out



FILE: B-36.out

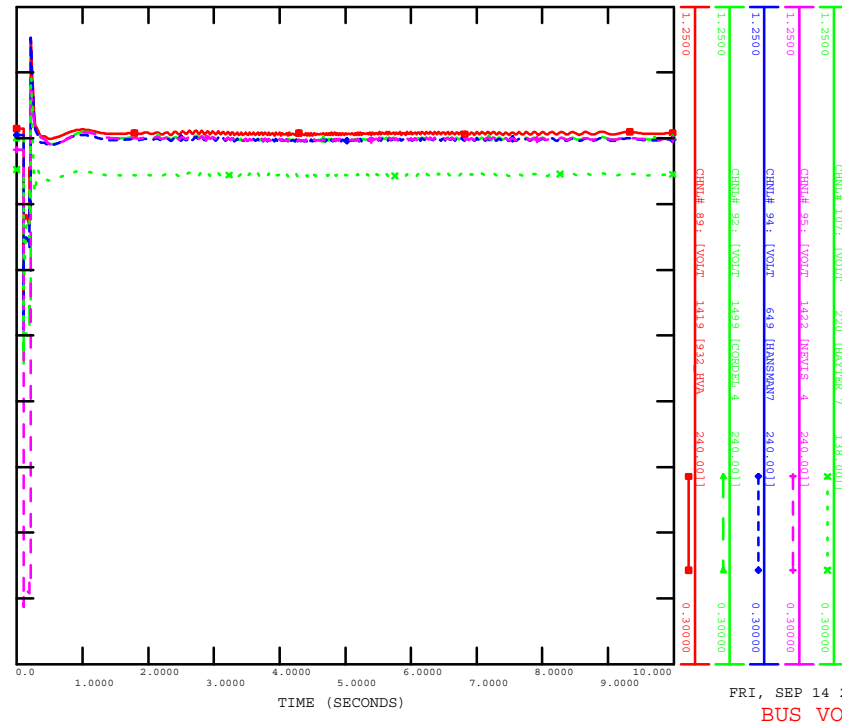


FILE: B-36.out



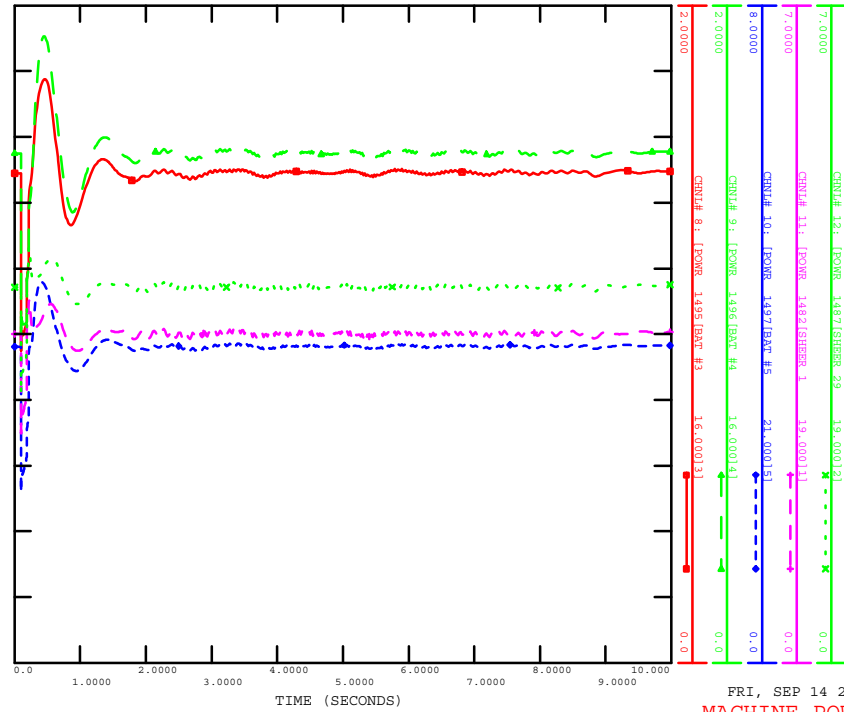
FRI, SEP 14 2012 11:15
WIND (MW)

FILE: B-36.out



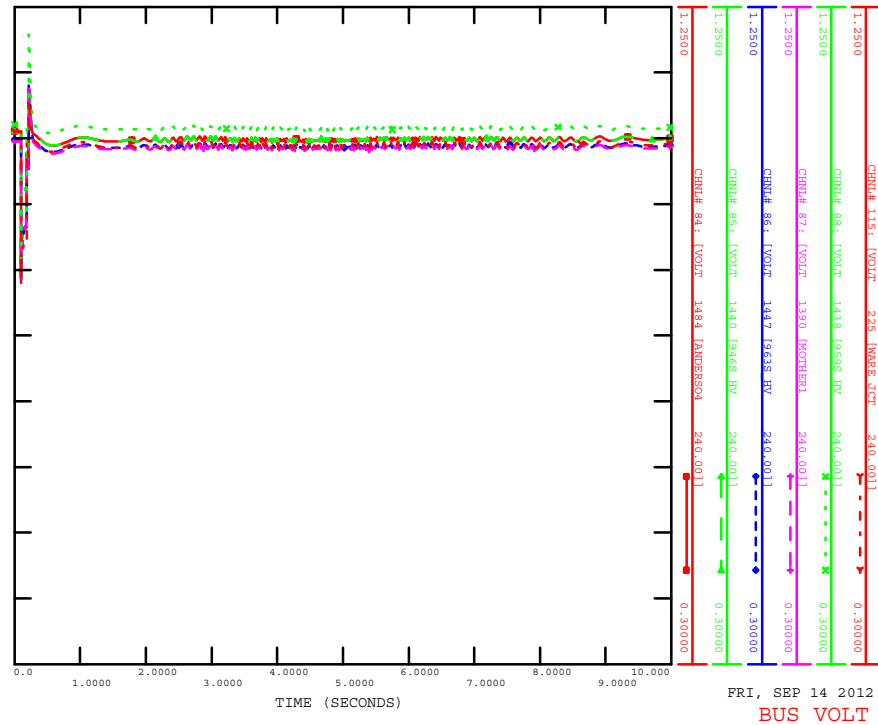
FRI, SEP 14 2012 11:15
BUS VOLT (PU)

FILE: B-36.out



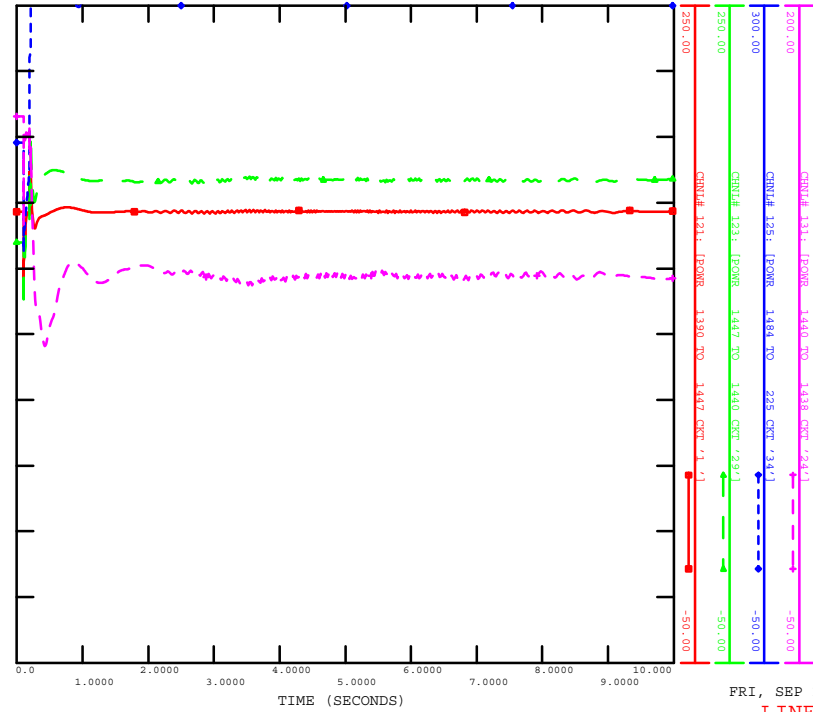
FRI, SEP 14 2012 11:15
MACHINE POWER (P)

FILE: B-36.out

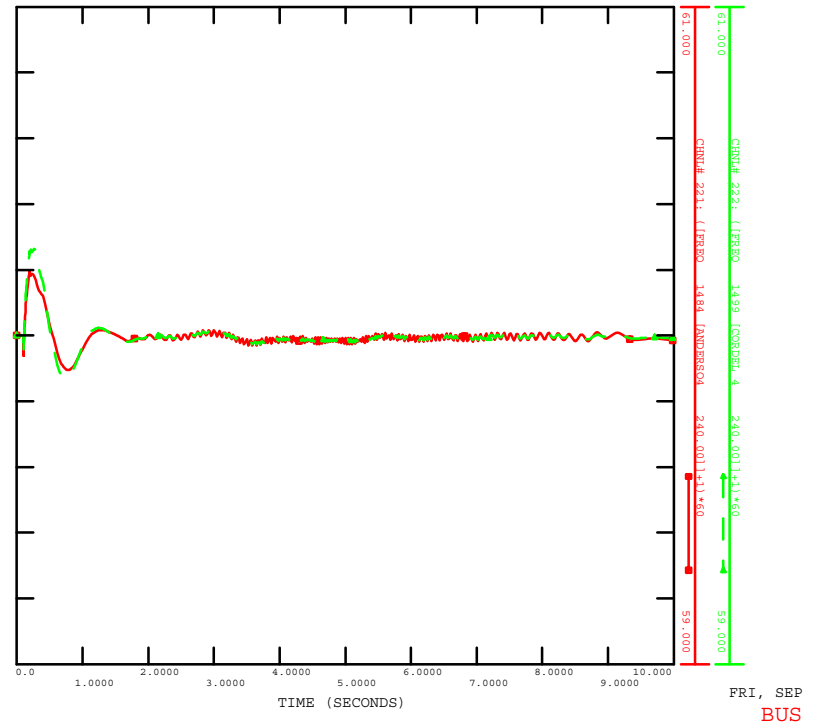


FRI, SEP 14 2012 11:15
BUS VOLT (PU)

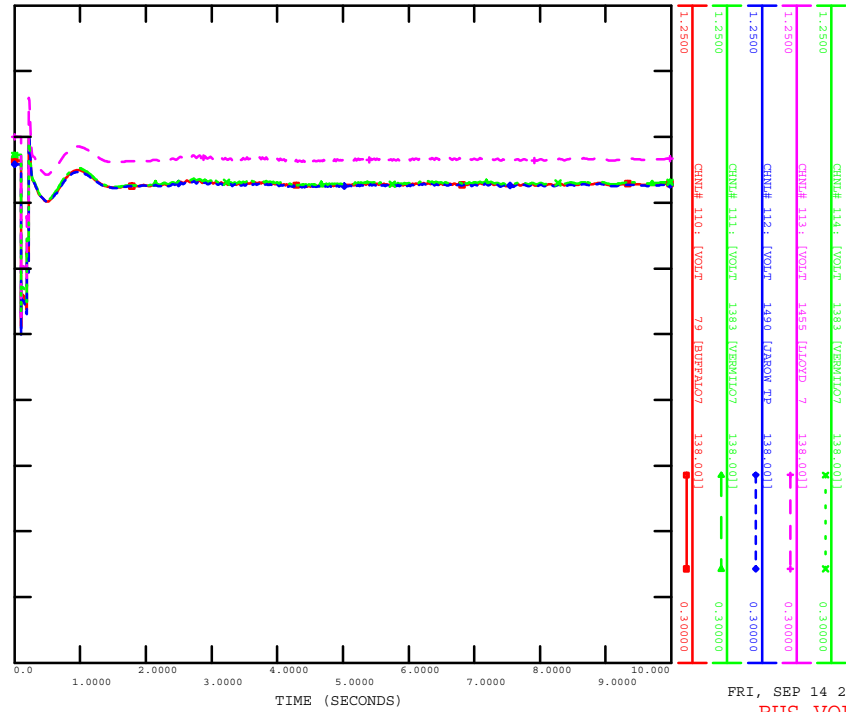
FILE: B-36.out



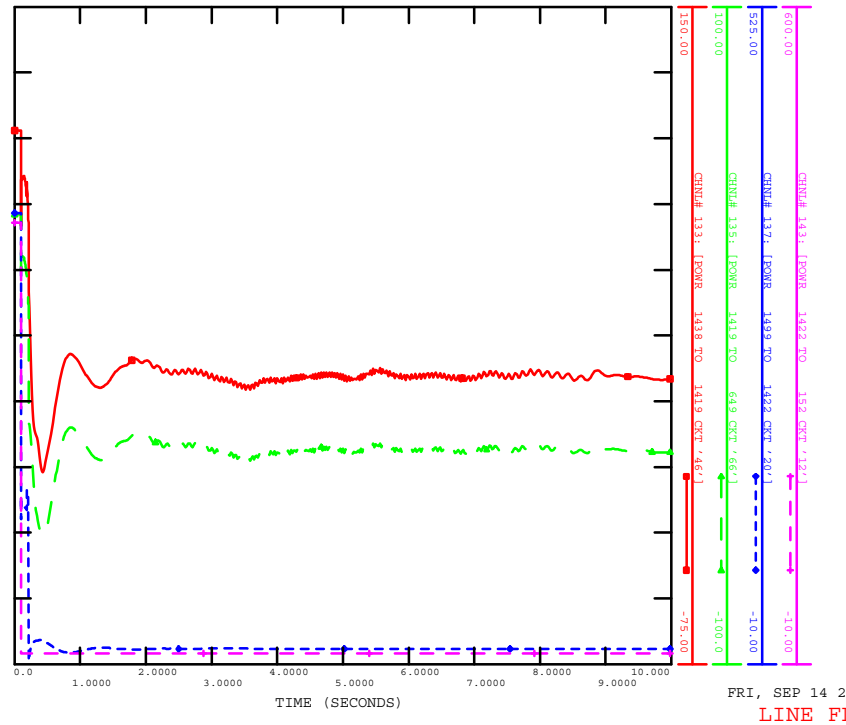
FILE: B-36.out



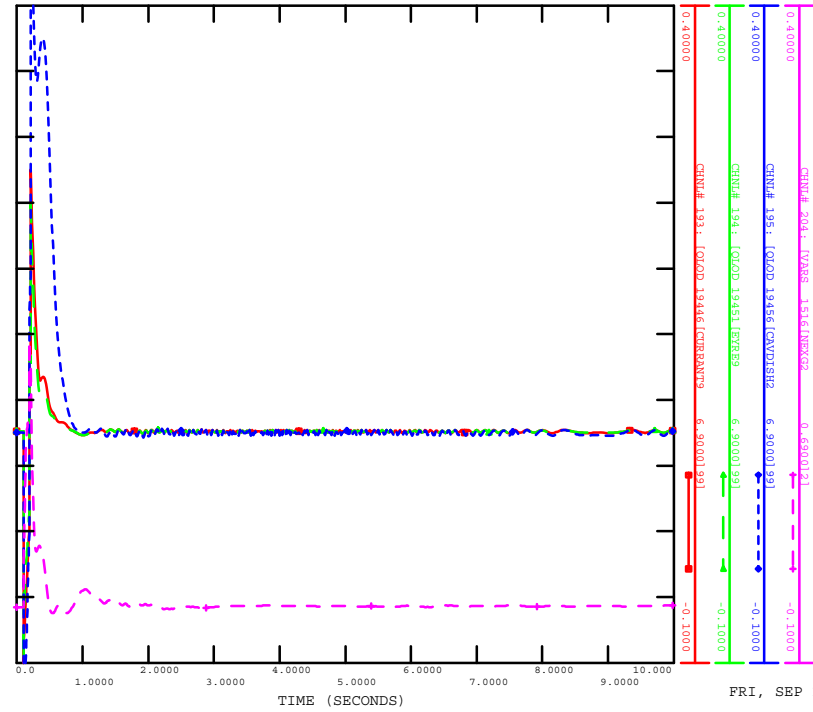
FILE: B-36.out



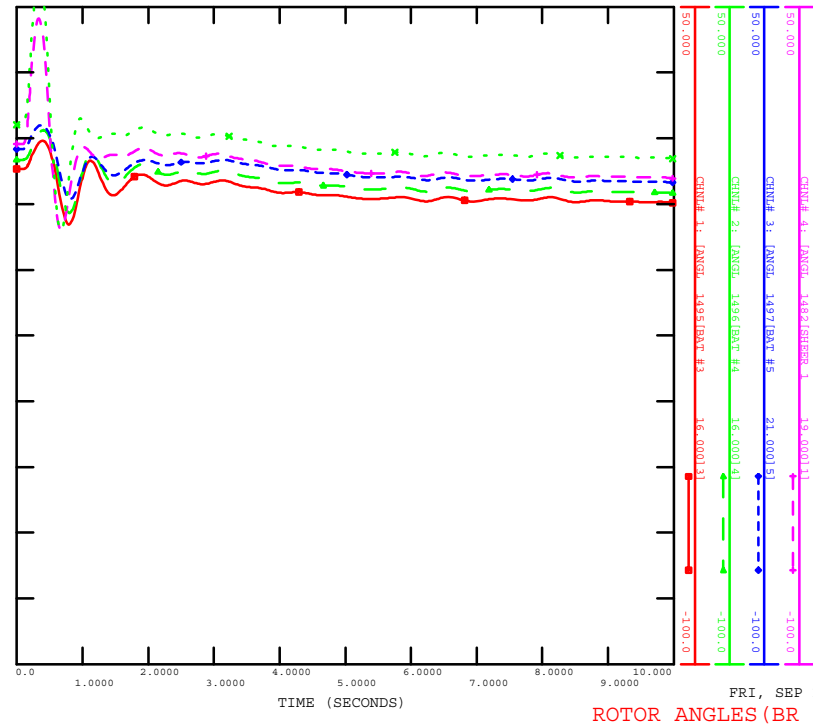
FILE: B-36.out



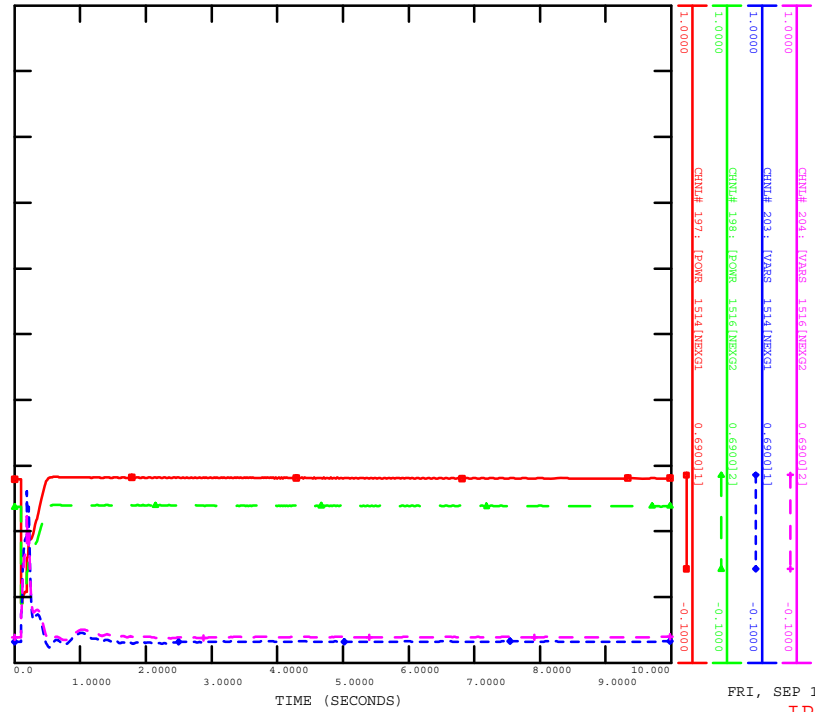
FILE: B-41.out



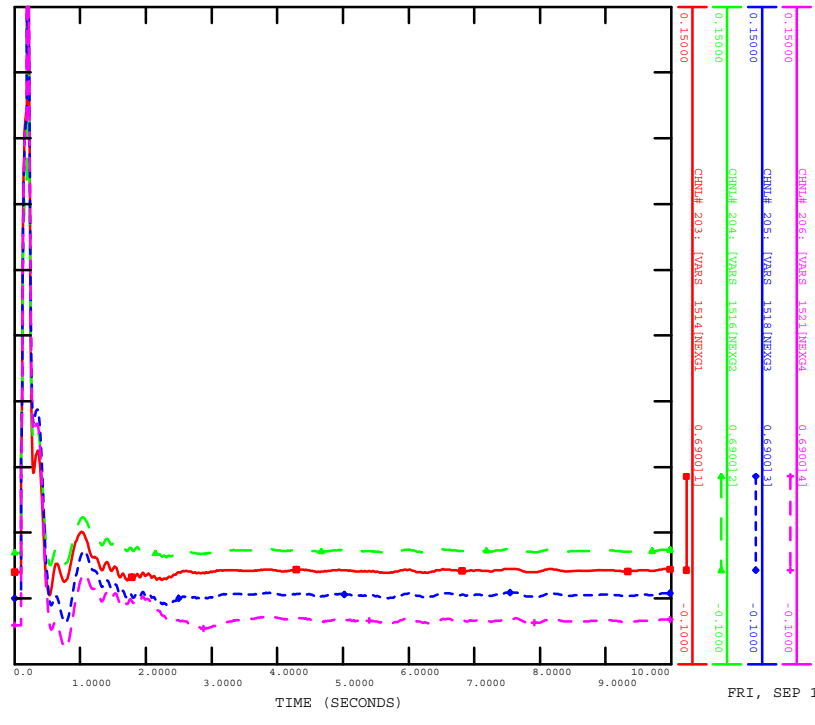
FILE: B-41.out



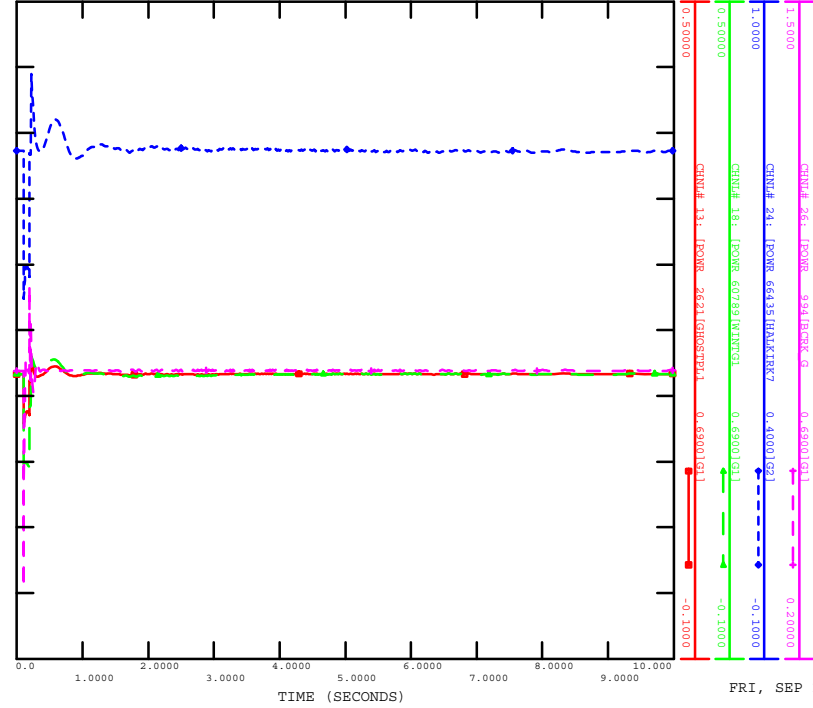
FILE: B-41.out



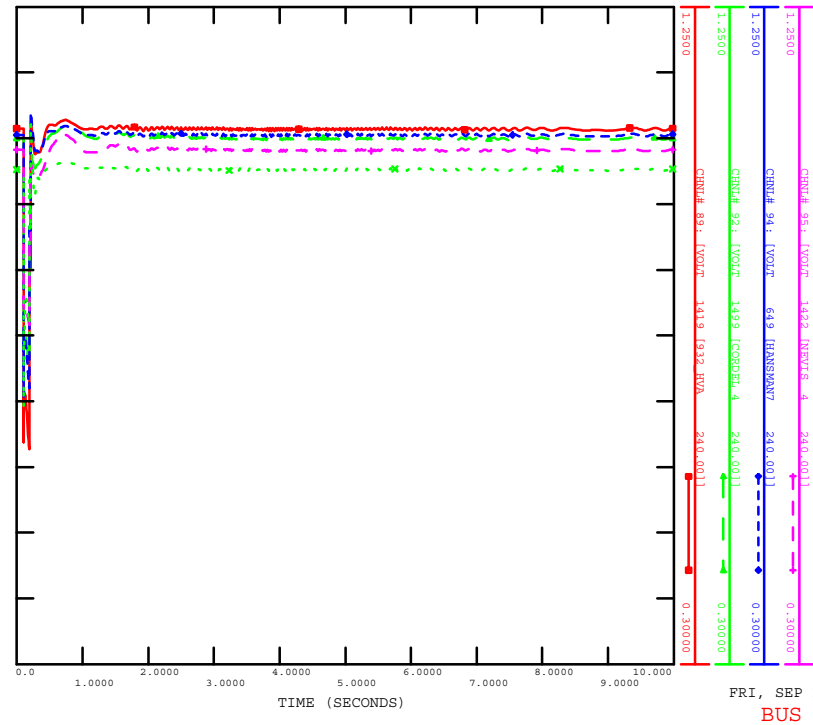
FILE: B-41.out



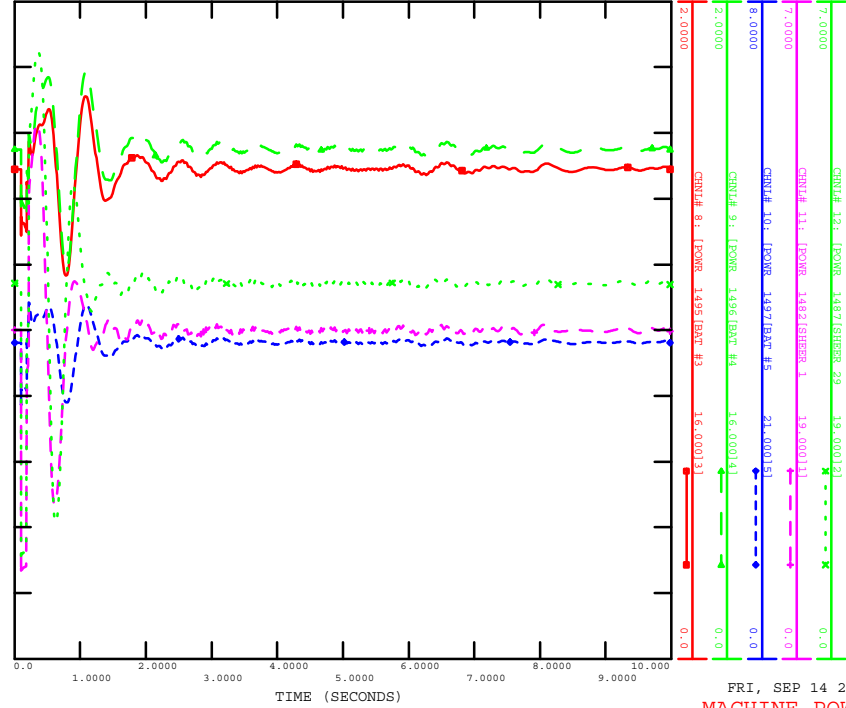
FILE: B-41.out



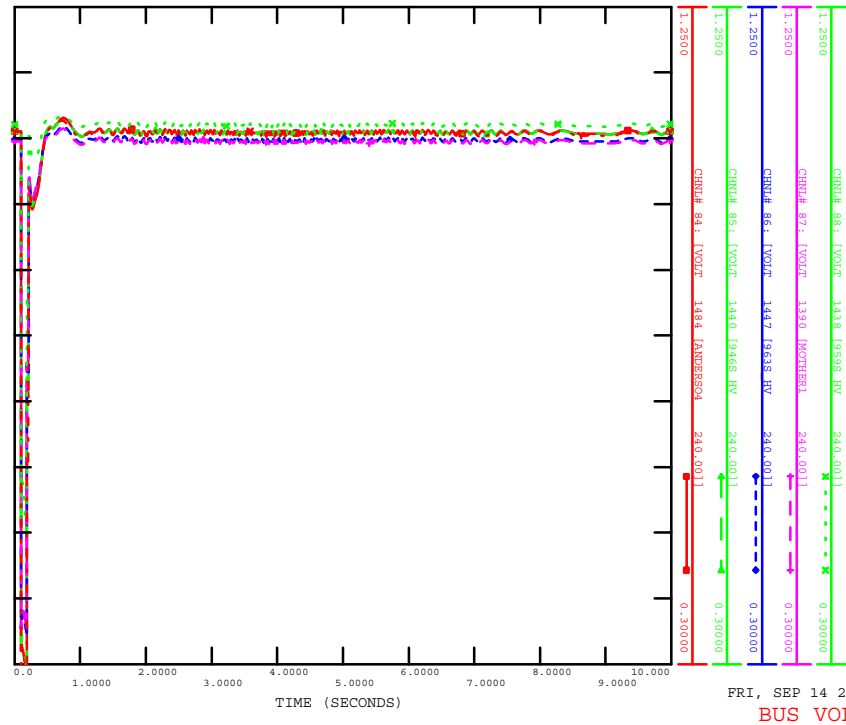
FILE: B-41.out



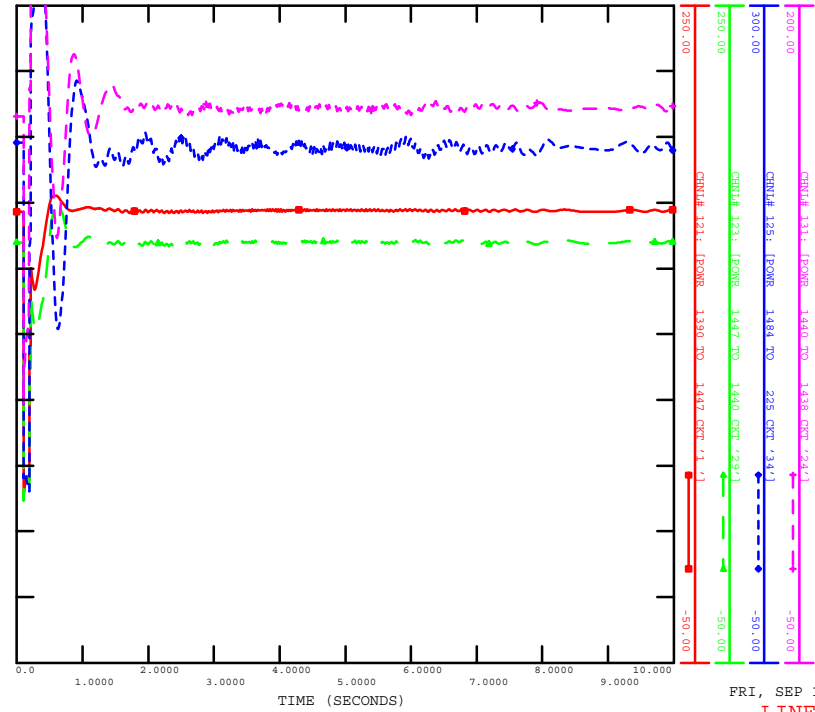
FILE: B-41.out



FILE: B-41.out

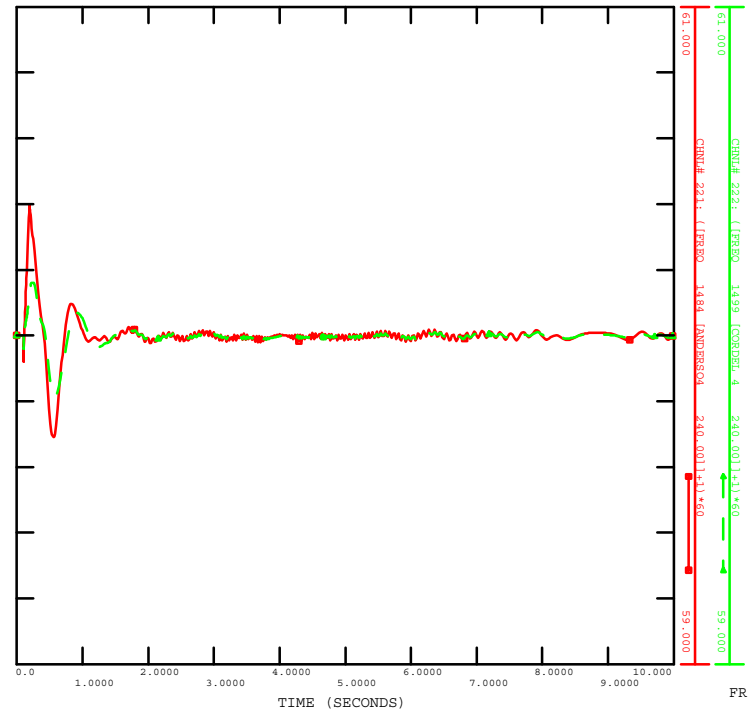


FILE: B-41.out



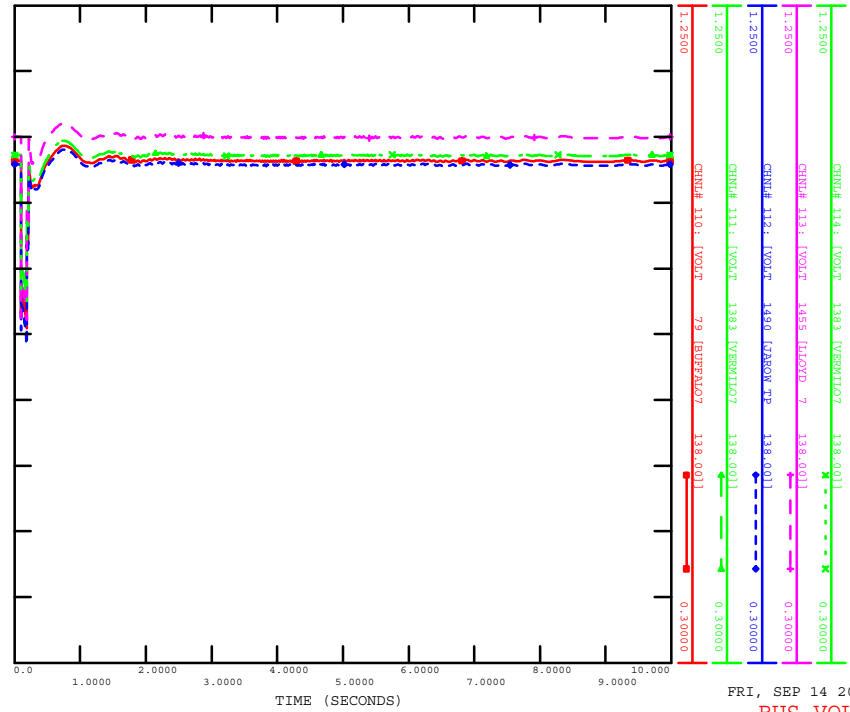
FRI, SEP 14 2012 11:15
LINE FLOW (P)

FILE: B-41.out



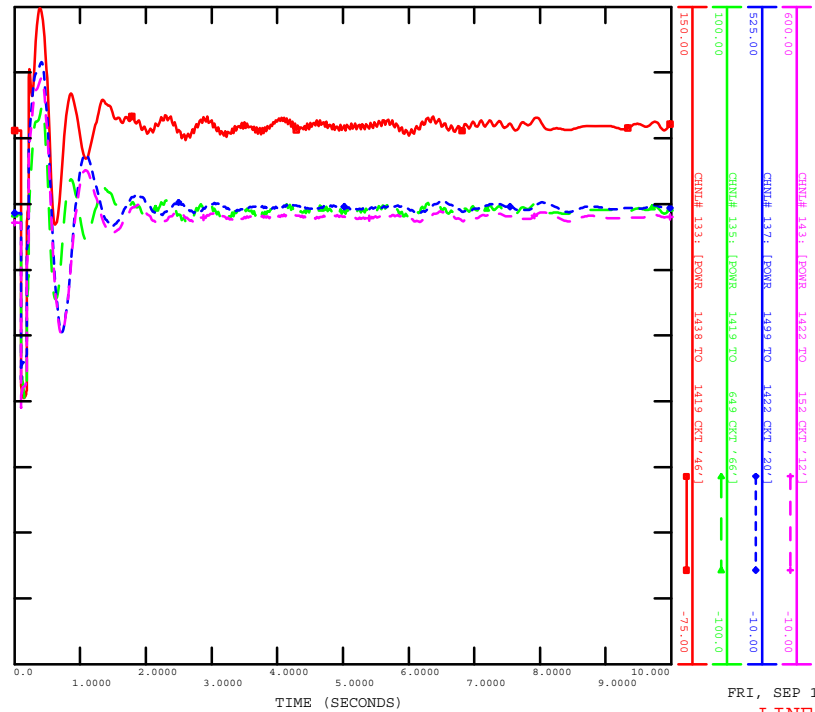
FRI, SEP 14 2012 11:15
BUS FREQUENCY

FILE: B-41.out



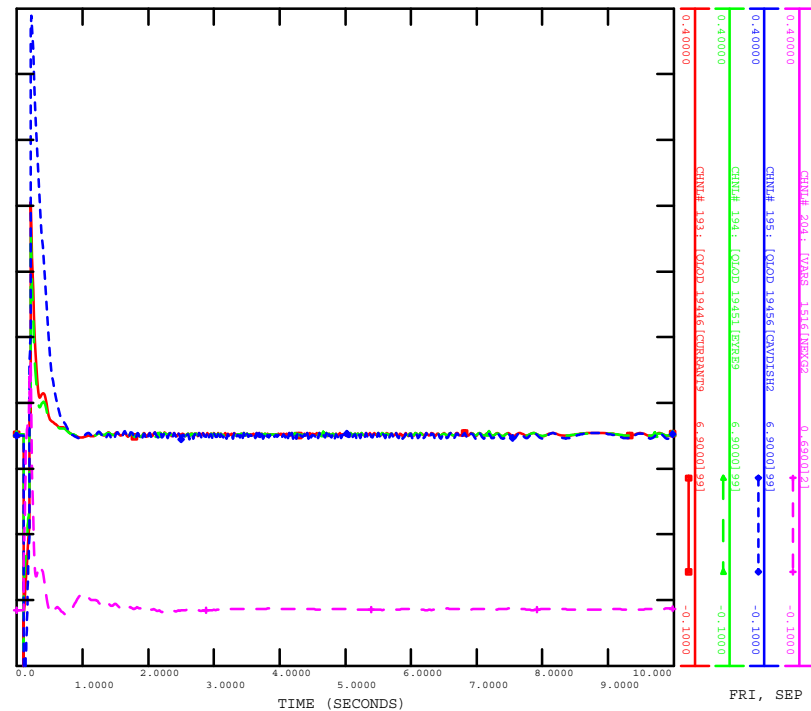
FRI, SEP 14 2012 11:15
BUS VOLT (PU)

FILE: B-41.out



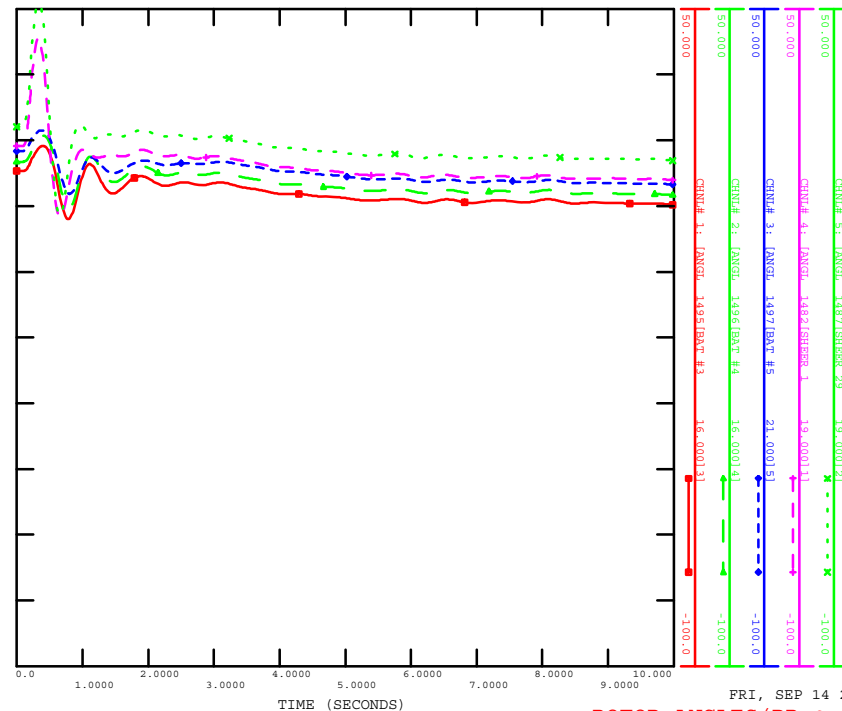
FRI, SEP 14 2012 11:15
LINE FLOW (P)

FILE: B-42.out



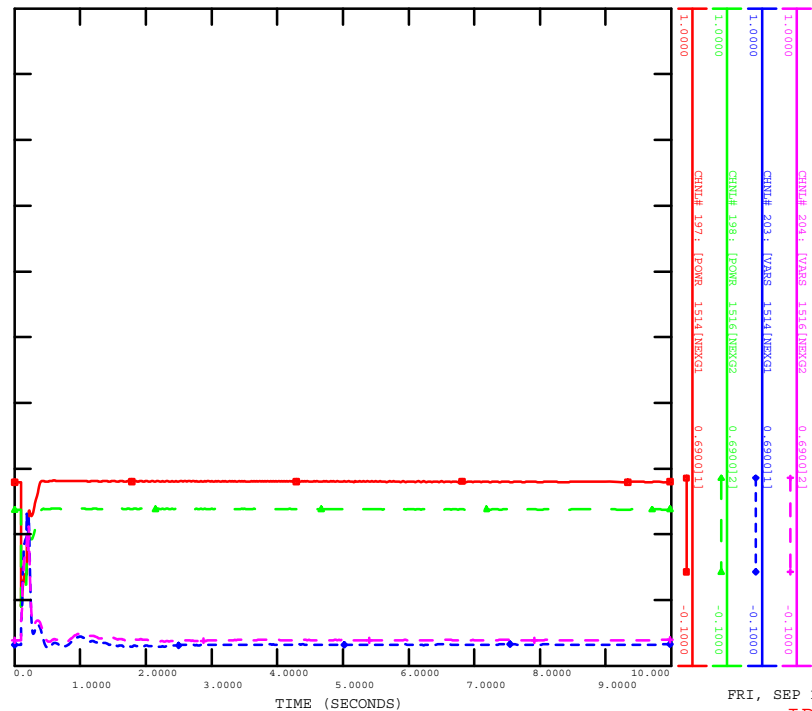
FRI, SEP 14 2012 11:15
IP678 (P)

FILE: B-42.out



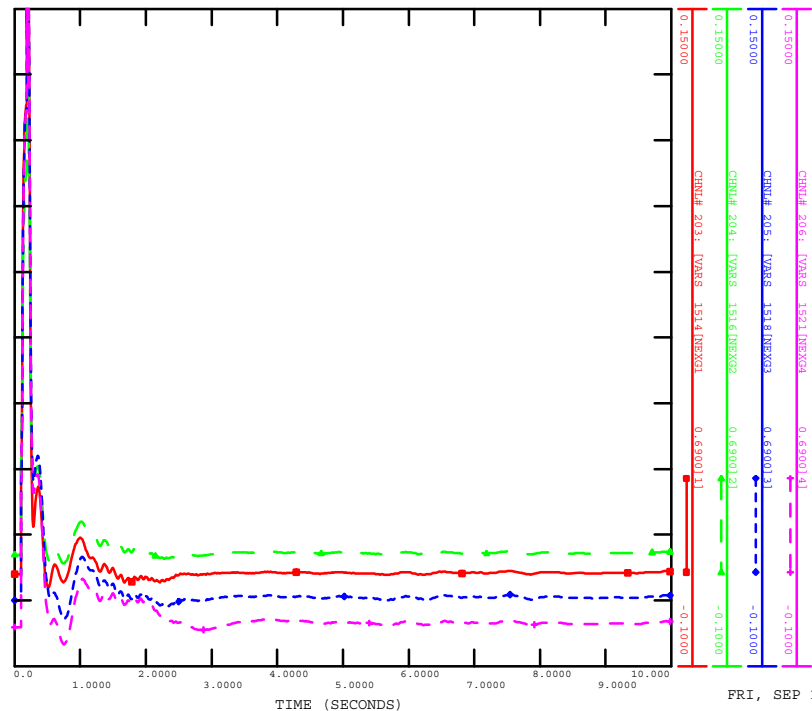
FRI, SEP 14 2012 11:15
ROTOR ANGLES (BR & SHEERNE)

FILE: B-42.out



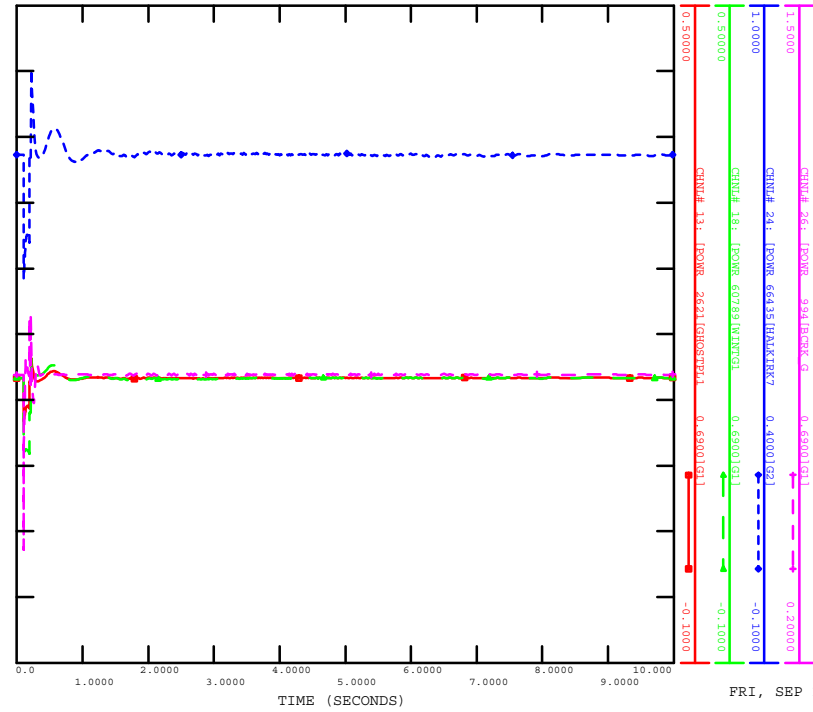
FRI, SEP 14 2012 11:15
IP635 (P&Q)

FILE: B-42.out



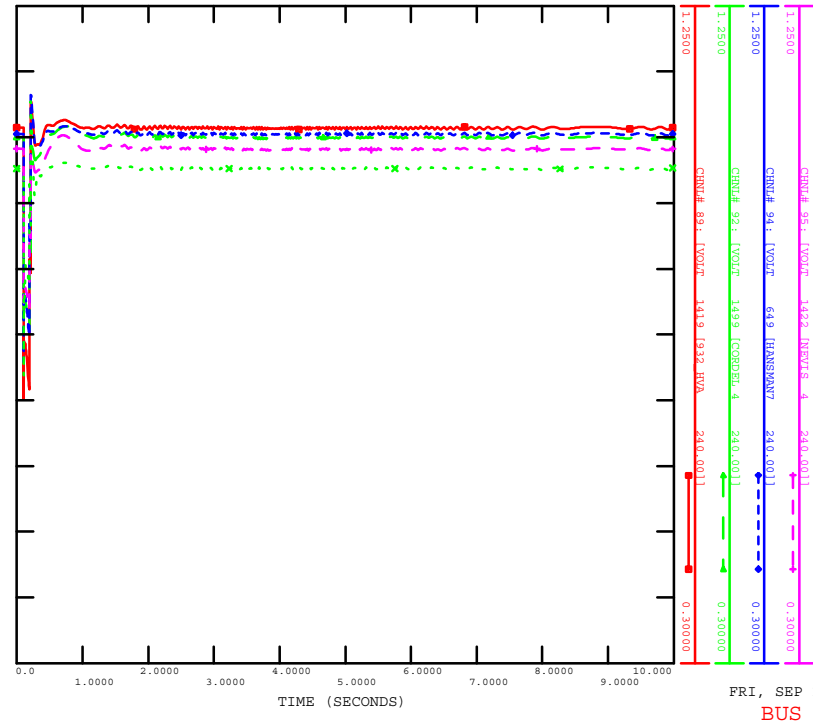
FRI, SEP 14 2012 11:15
IP678 (Q)

FILE: B-42.out



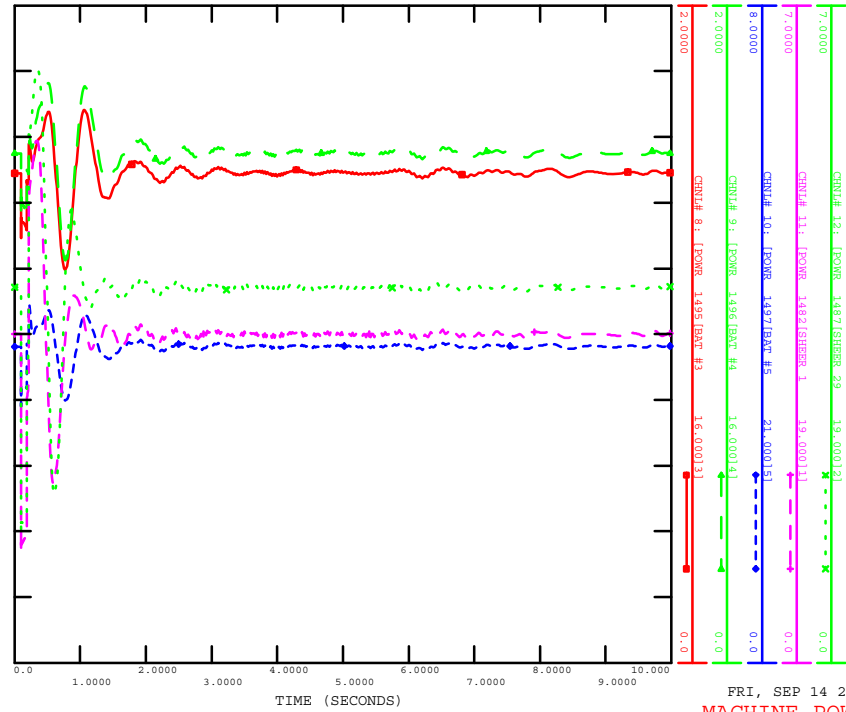
FRI, SEP 14 2012 11:15
WIND (MW)

FILE: B-42.out



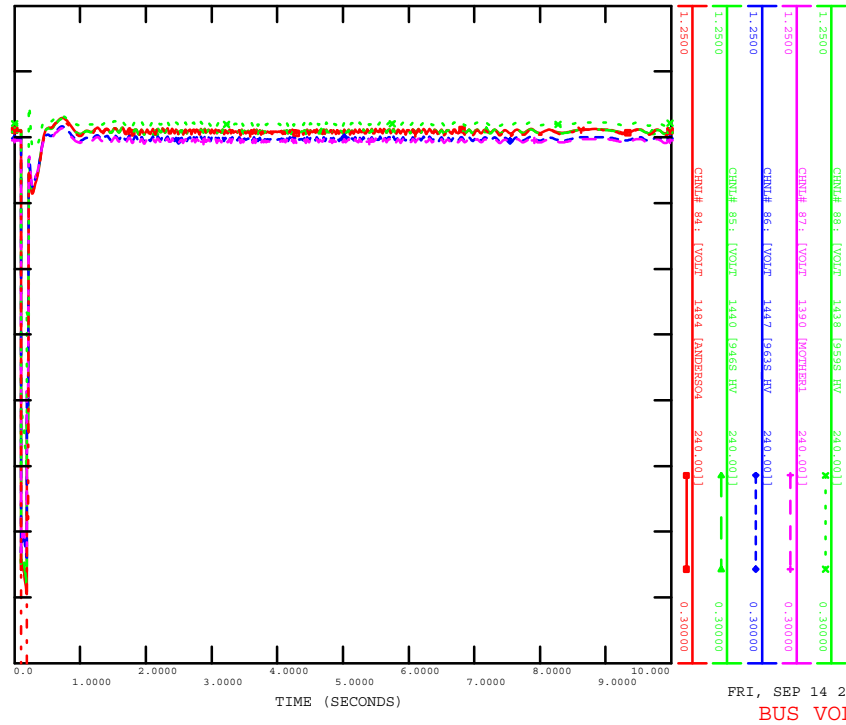
FRI, SEP 14 2012 11:15
BUS VOLT (PU)

FILE: B-42.out



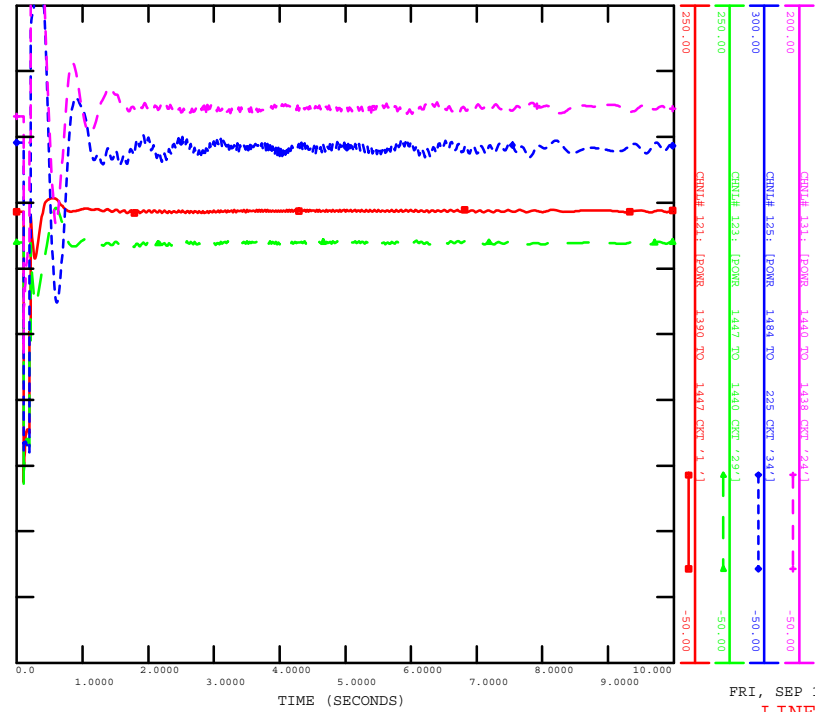
FRI, SEP 14 2012 11:15
MACHINE POWER (P)

FILE: B-42.out



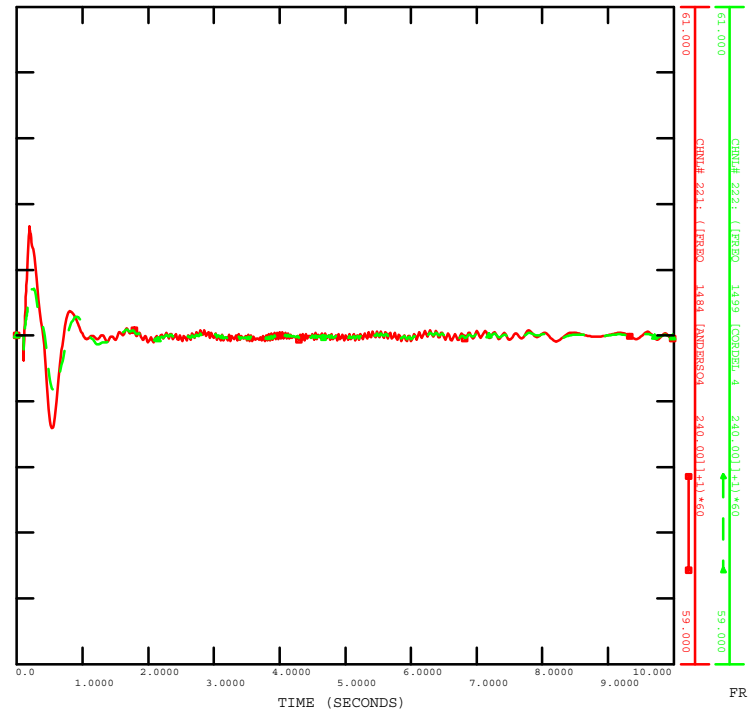
FRI, SEP 14 2012 11:15
BUS VOLT (PU)

FILE: B-42.out



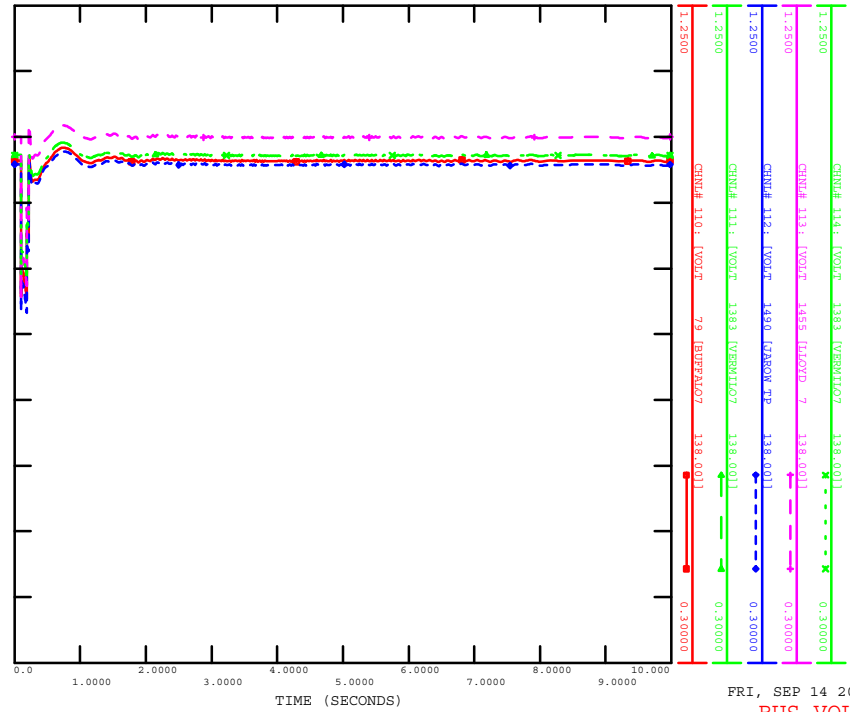
FRI, SEP 14 2012 11:15
LINE FLOW (P)

FILE: B-42.out



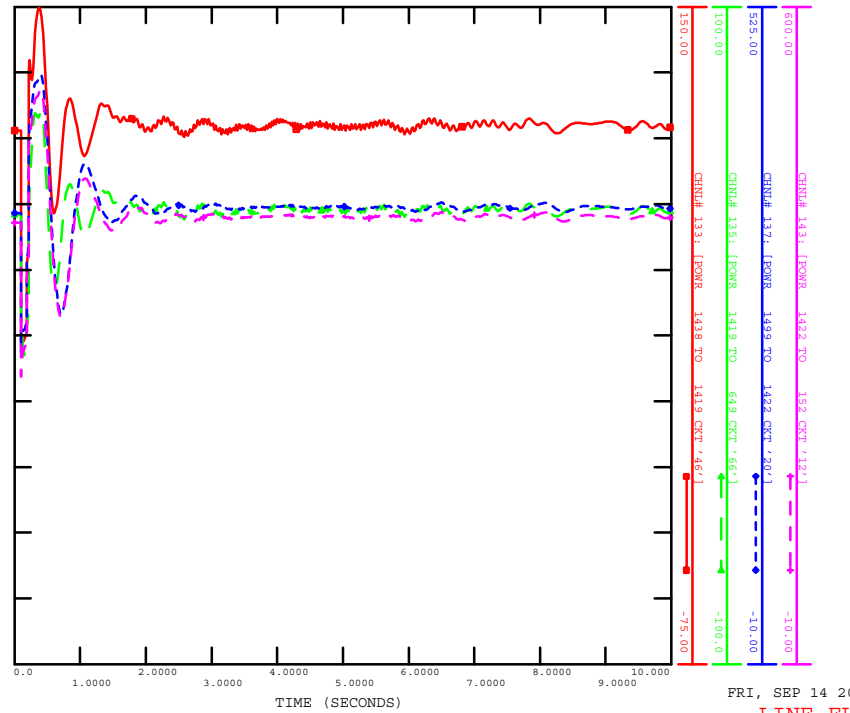
FRI, SEP 14 2012 11:15
BUS FREQUENCY

FILE: B-42.out



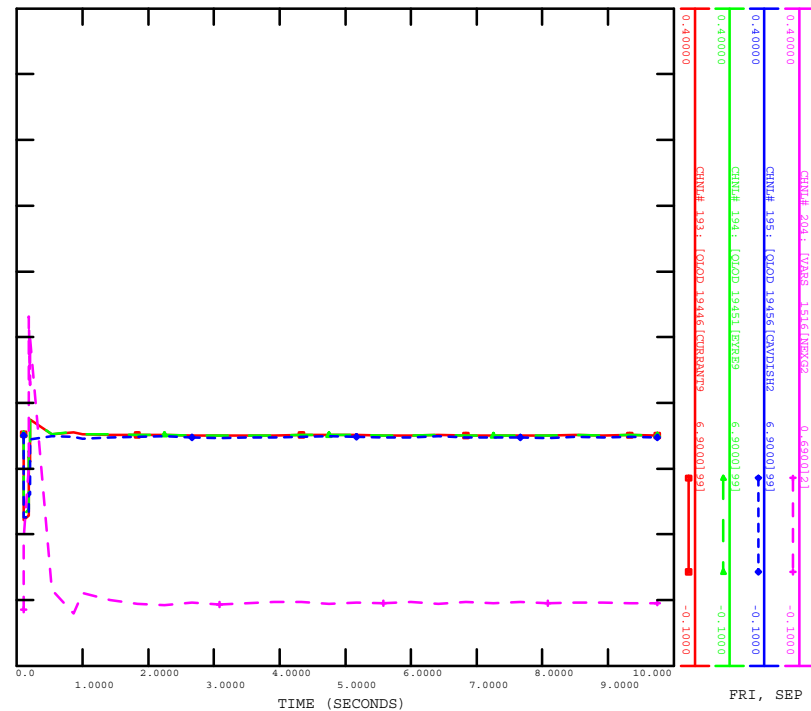
FRI, SEP 14 2012 11:15
BUS VOLT (PU)

FILE: B-42.out



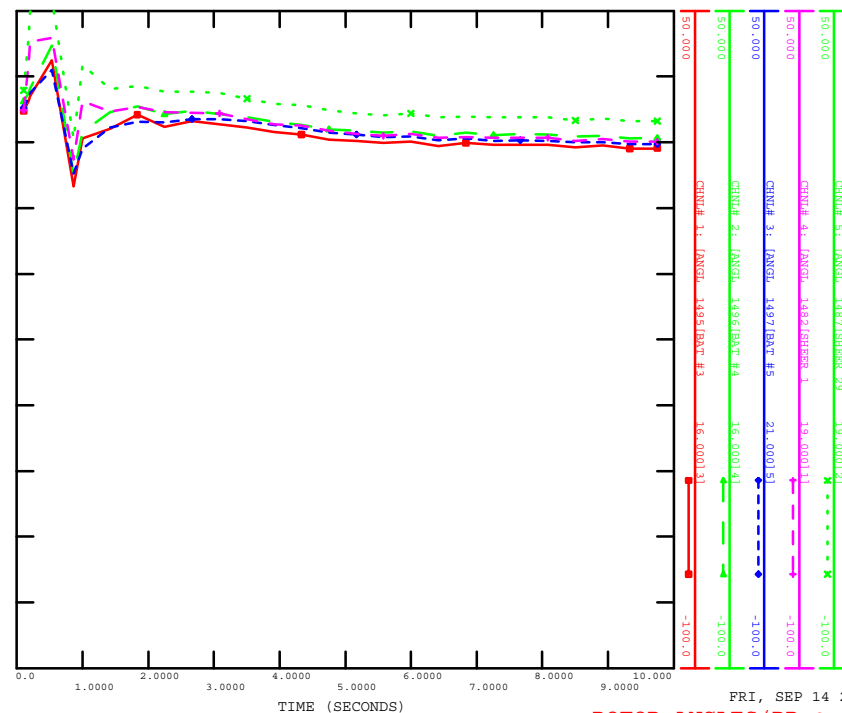
FRI, SEP 14 2012 11:15
LINE FLOW (P)

FILE: CS-01.out



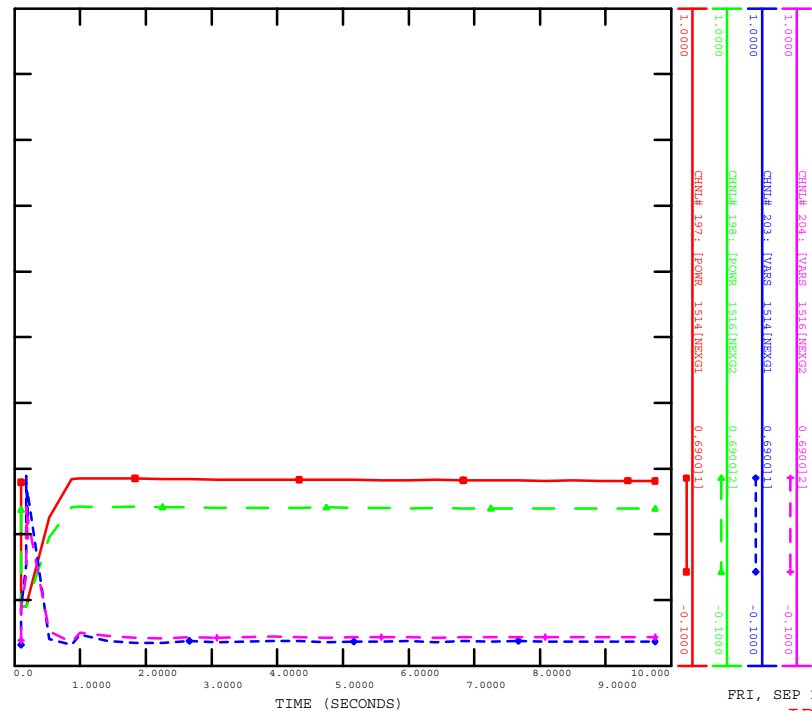
FRI, SEP 14 2012 11:15
IP678 (P)

FILE: CS-01.out



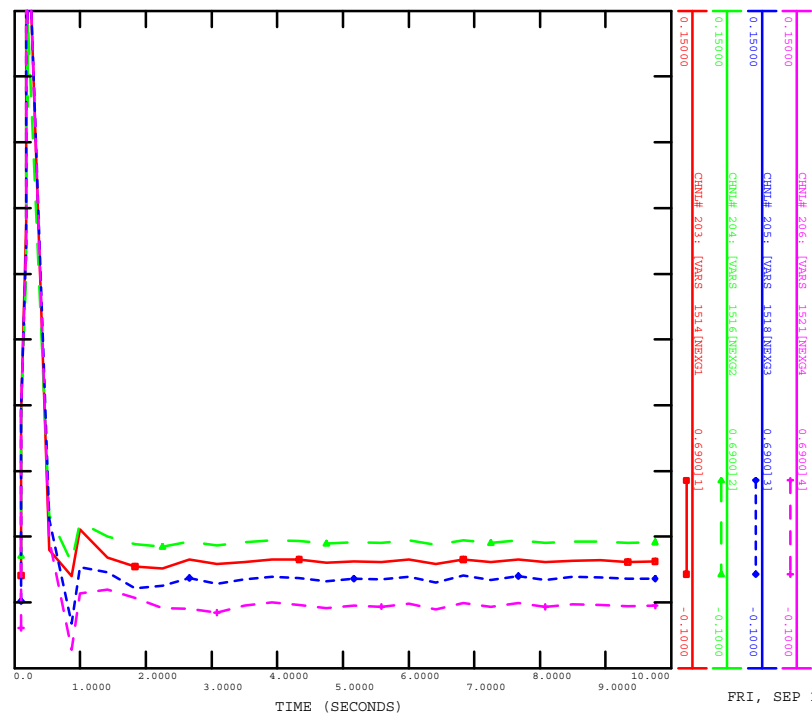
ROTOR ANGLES (BR & SHEERNE)

FILE: CS-01.out



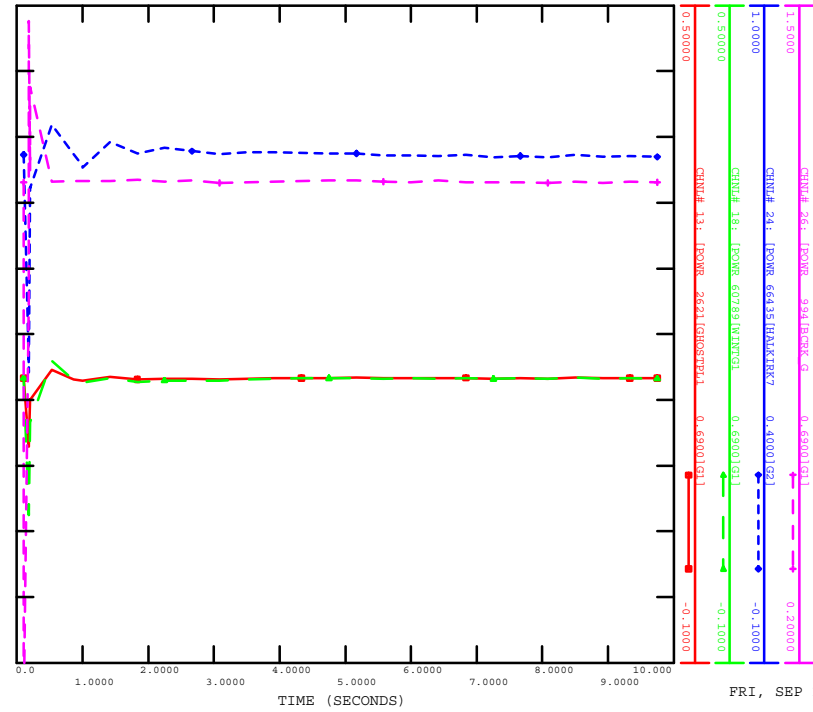
FRI, SEP 14 2012 11:15
IP635 (P&Q)

FILE: CS-01.out



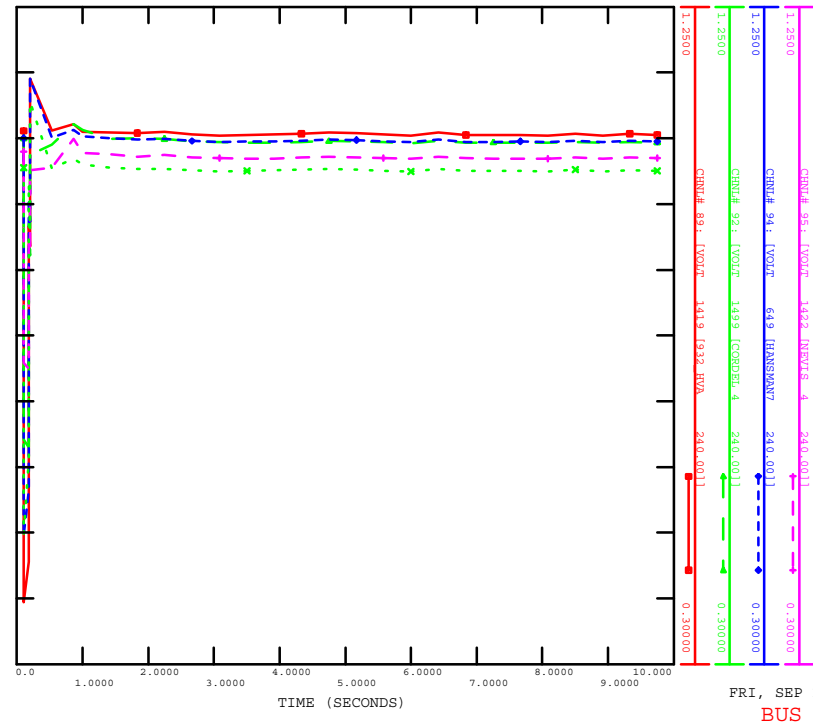
FRI, SEP 14 2012 11:15
IP678 (Q)

FILE: C5-01.out



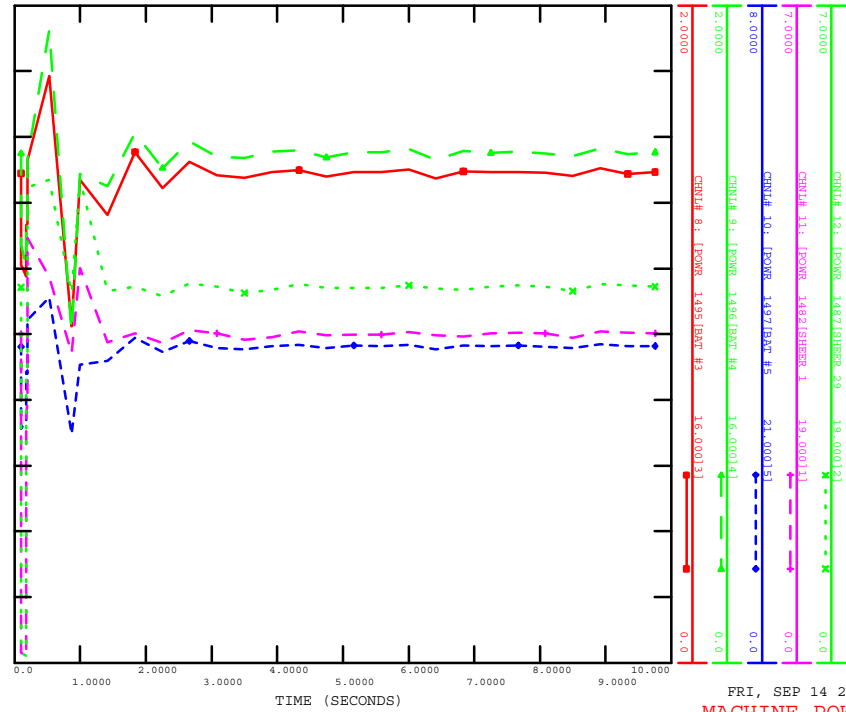
FRI, SEP 14 2012 11:15
WIND (MW)

FILE: C5-01.out



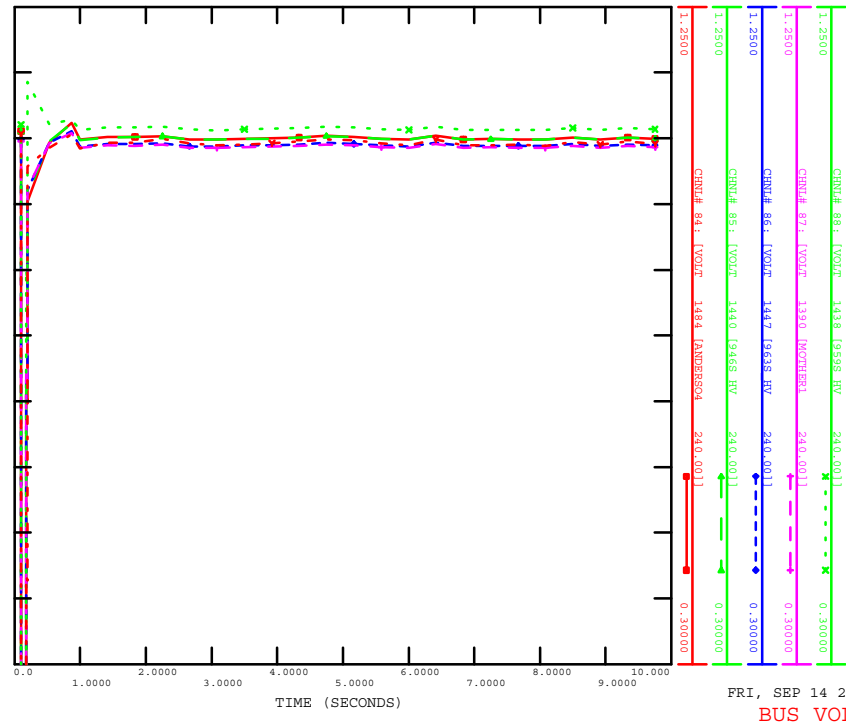
FRI, SEP 14 2012 11:15
BUS VOLT (PU)

FILE: C5-01.out



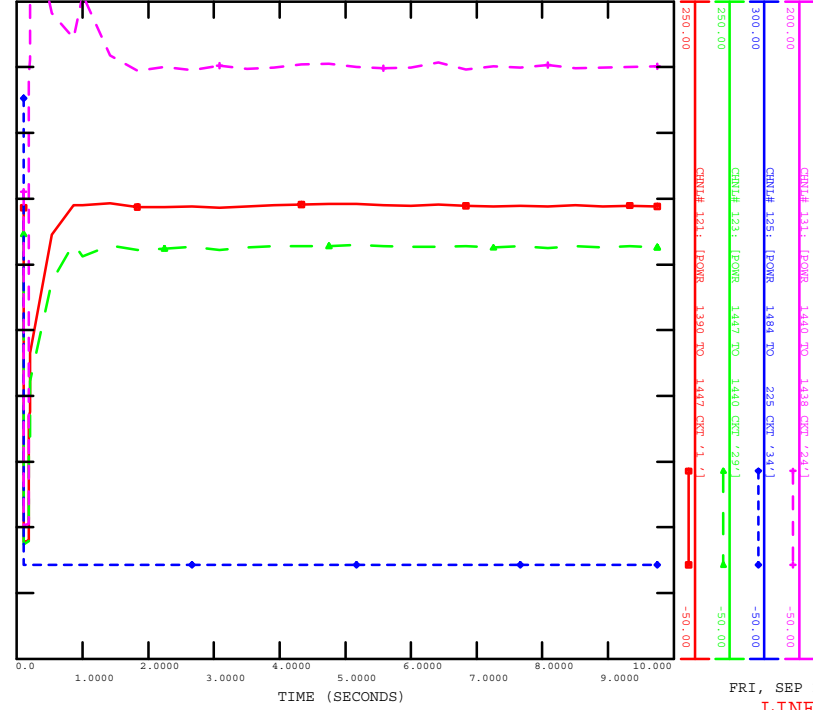
FRI, SEP 14 2012 11:15
MACHINE POWER (P)

FILE: C5-01.out



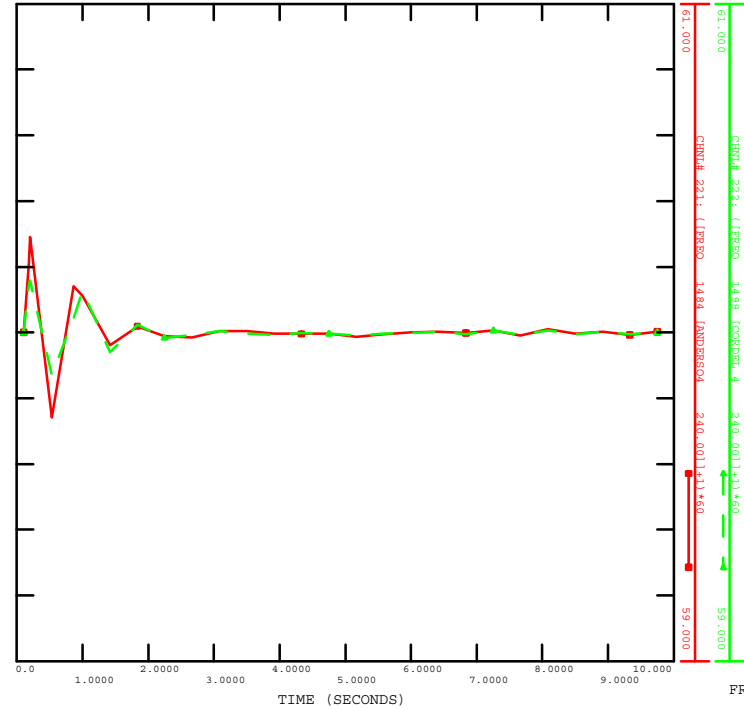
FRI, SEP 14 2012 11:15
BUS VOLT (PU)

FILE: C5-01.out



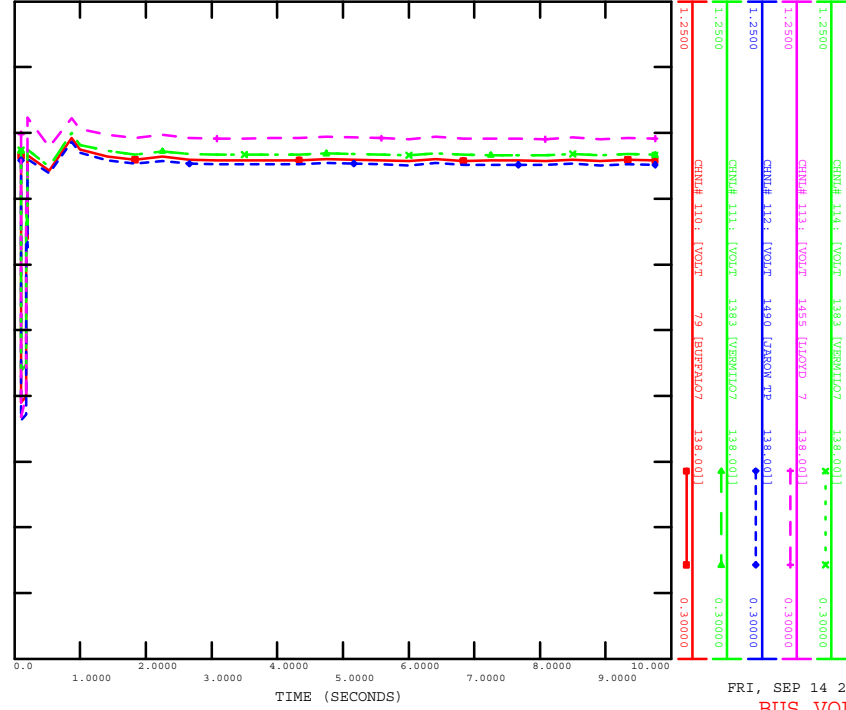
FRI, SEP 14 2012 11:15
LINE FLOW (P)

FILE: C5-01.out



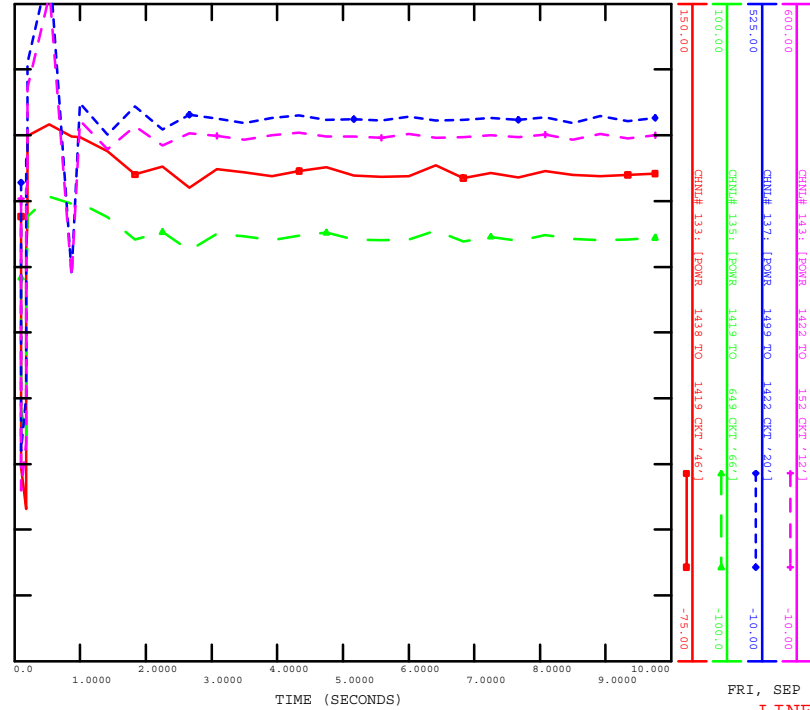
FRI, SEP 14 2012 11:15
BUS FREQUENCY

FILE: C5-01.out



FRI, SEP 14 2012 11:15
BUS VOLT (PU)

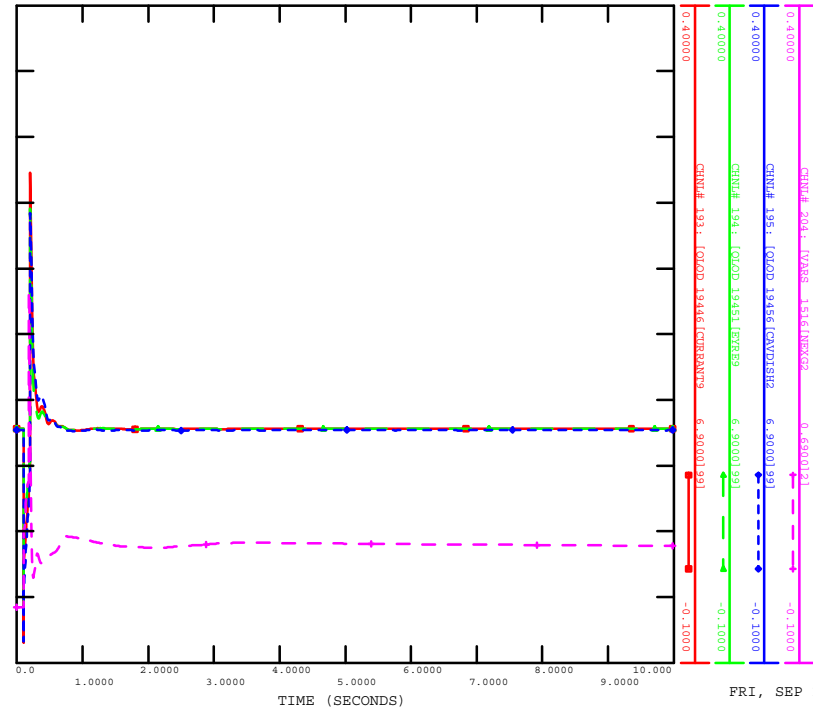
FILE: C5-01.out



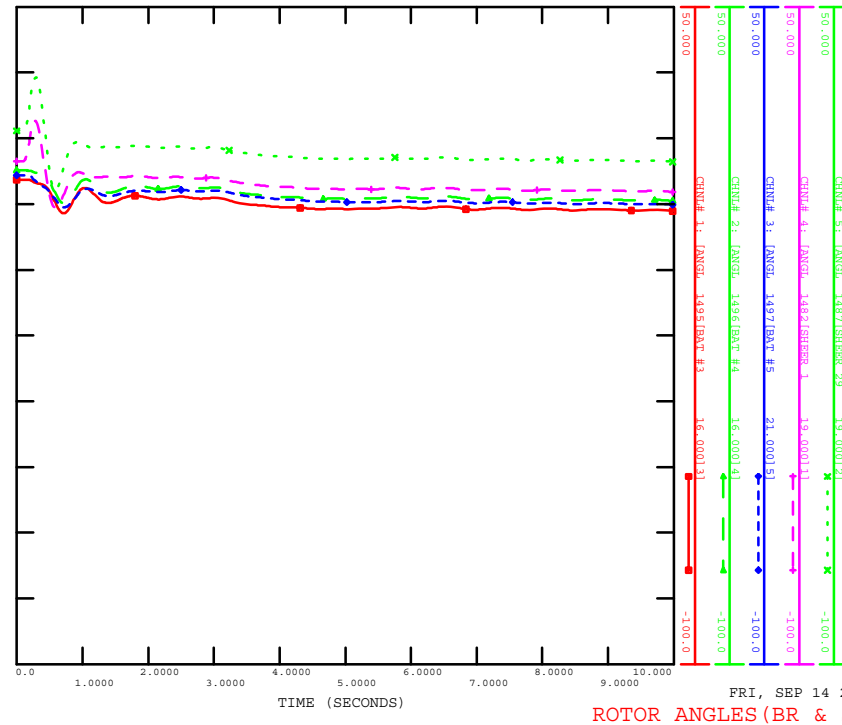
FRI, SEP 14 2012 11:15
LINE FLOW (P)

2014 Summer Peak

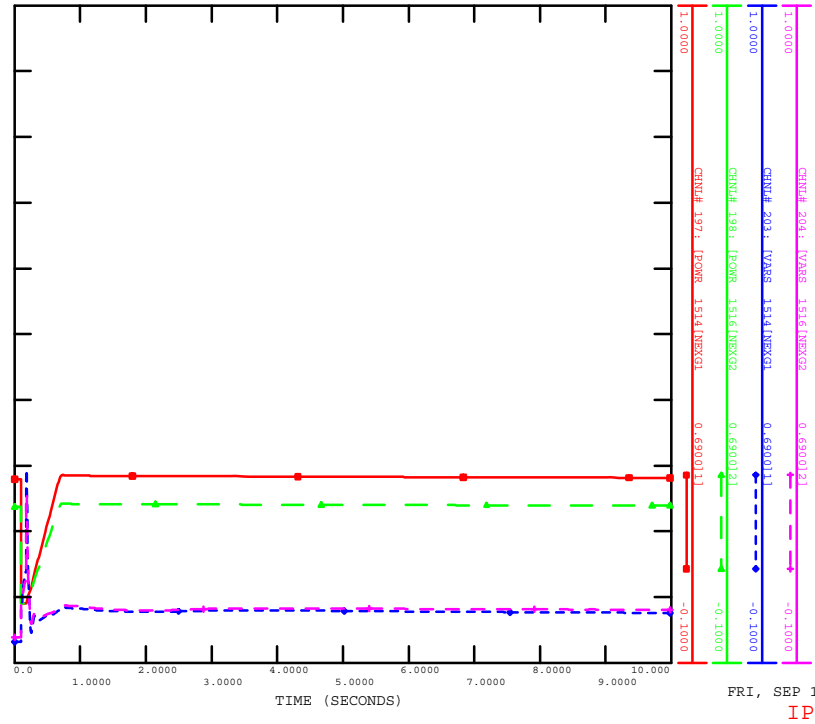
FILE: B-01.out



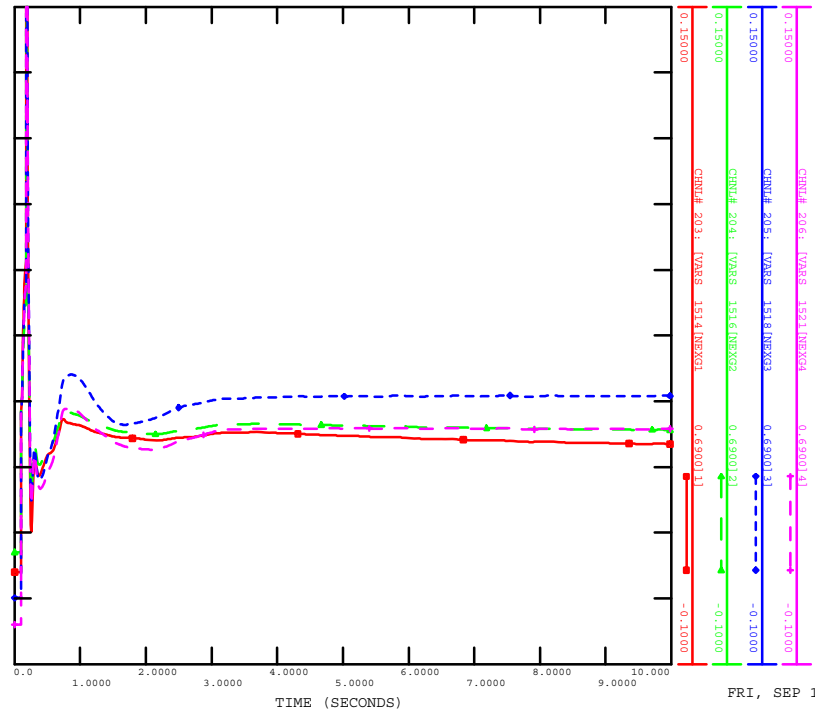
FILE: B-01.out



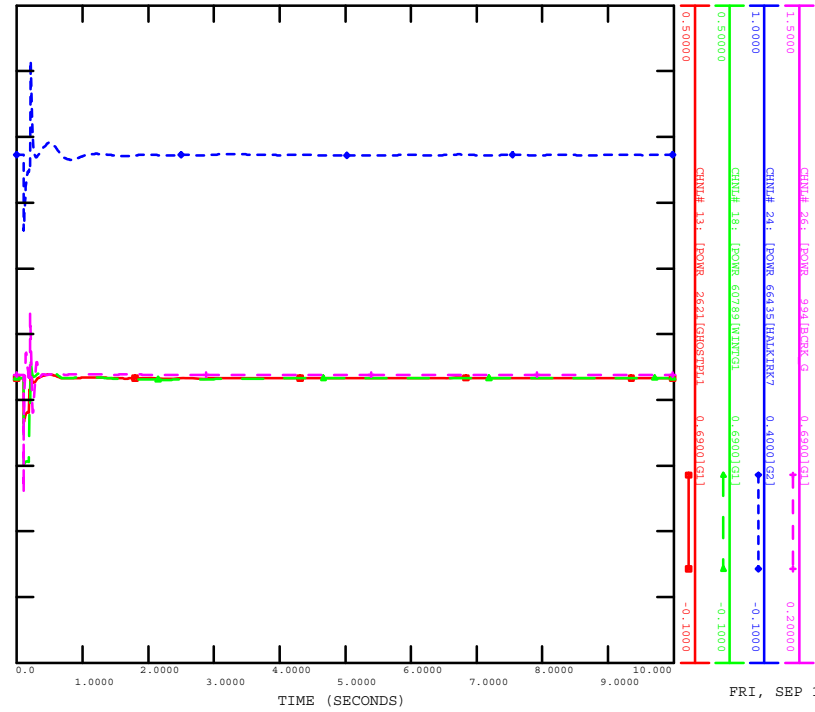
FILE: B-01.out



FILE: B-01.out

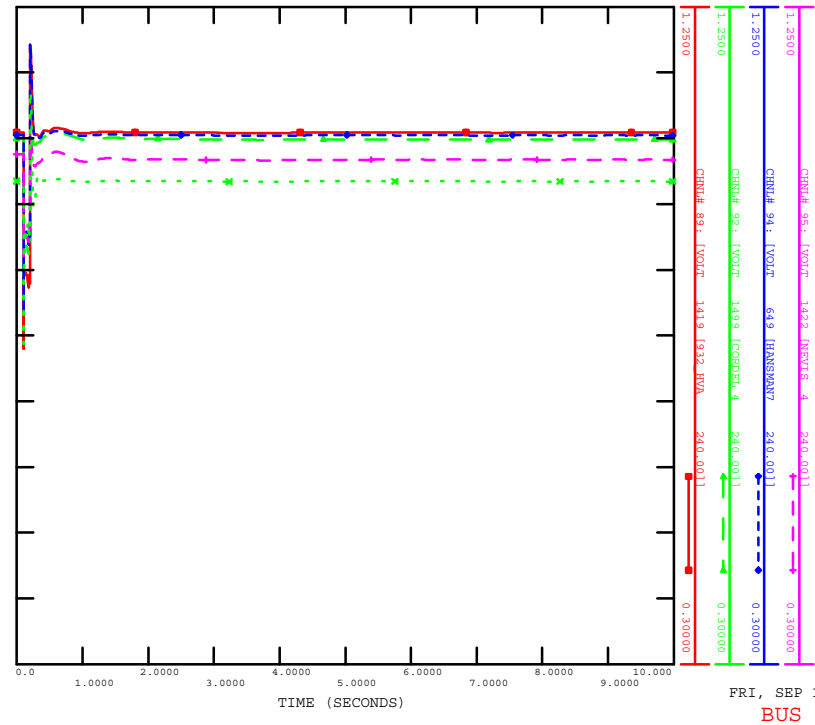


FILE: B-01.out



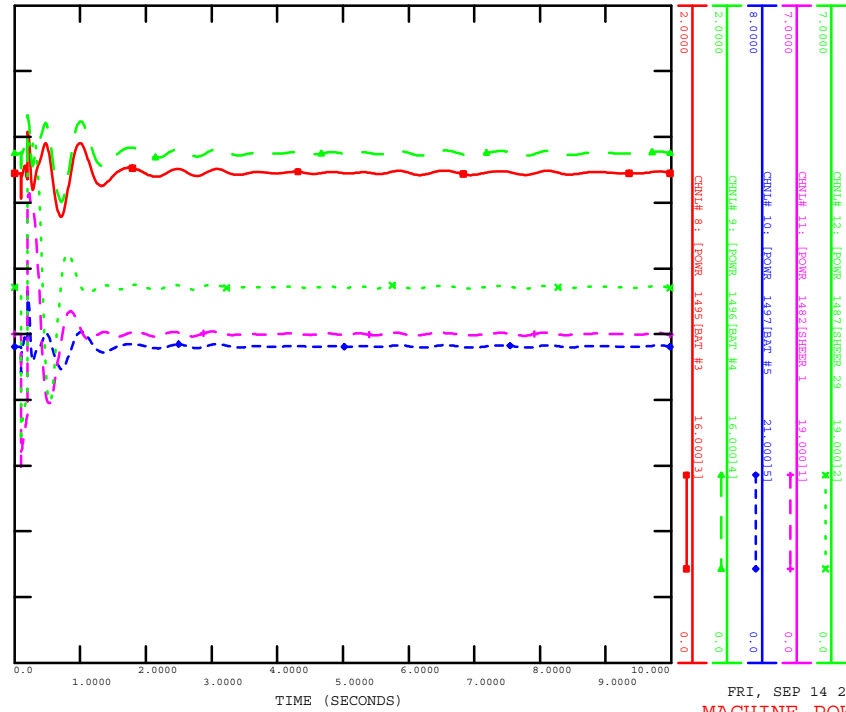
FRI, SEP 14 2012 11:12
WIND (MW)

FILE: B-01.out



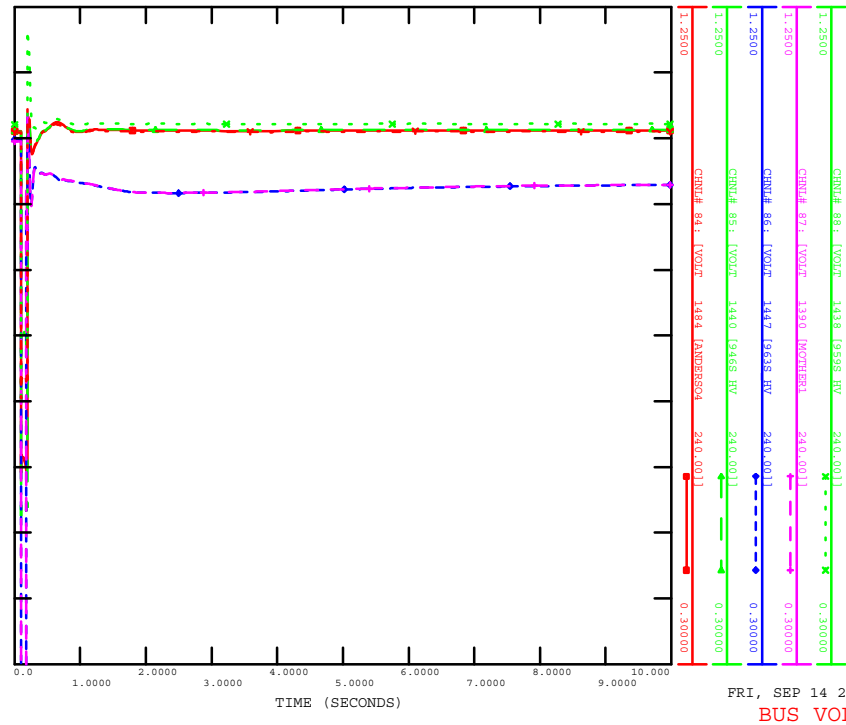
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-01.out



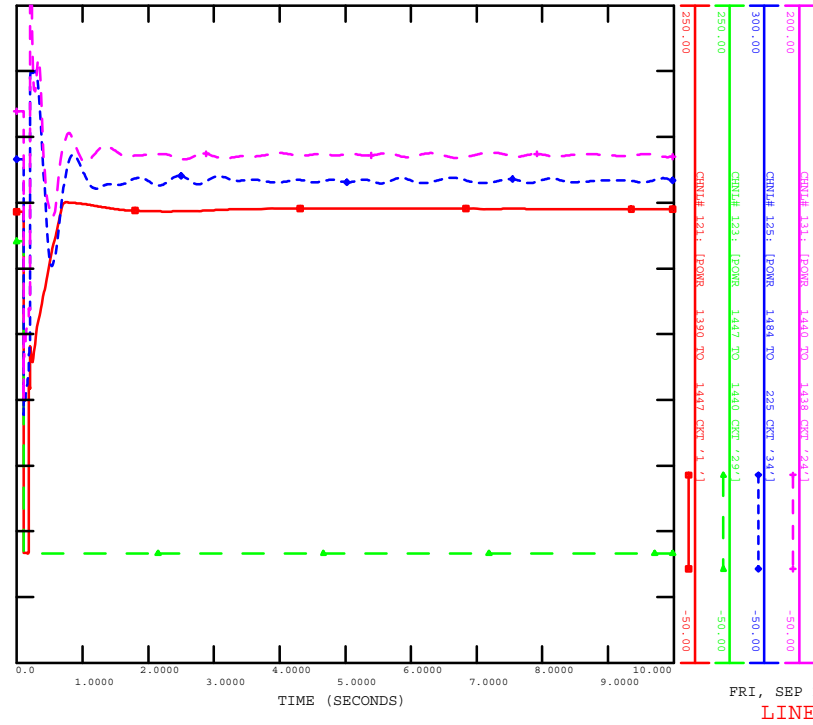
FRI, SEP 14 2012 11:12
MACHINE POWER (P)

FILE: B-01.out

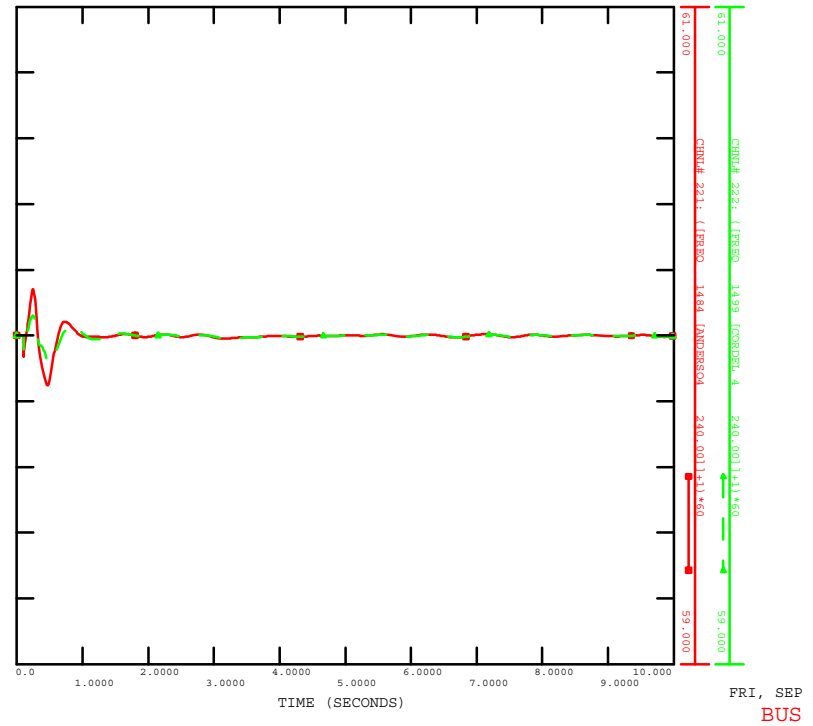


FRI, SEP 14 2012 11:12
BUS VOLT (PU)

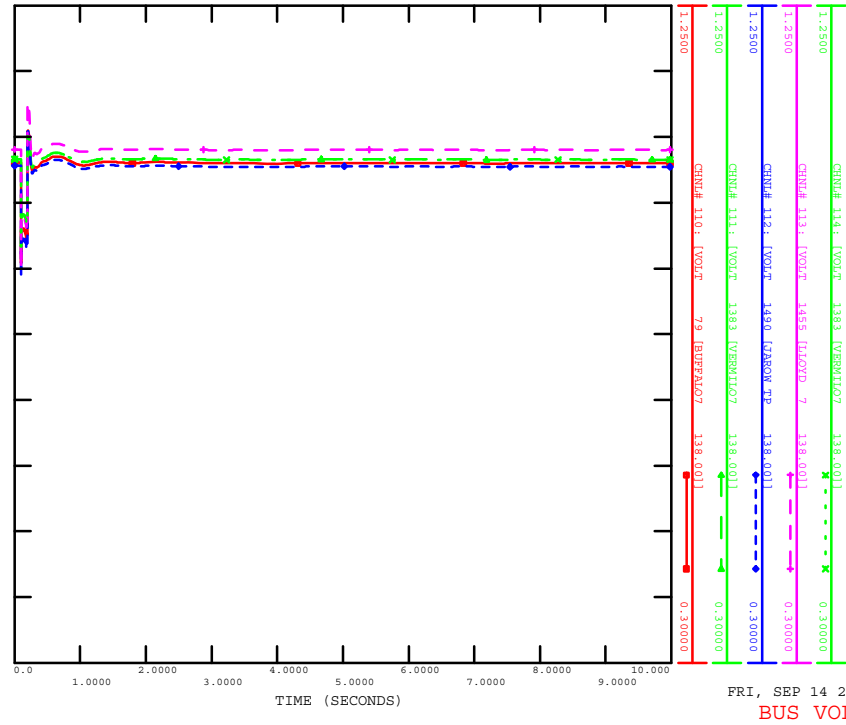
FILE: B-01.out



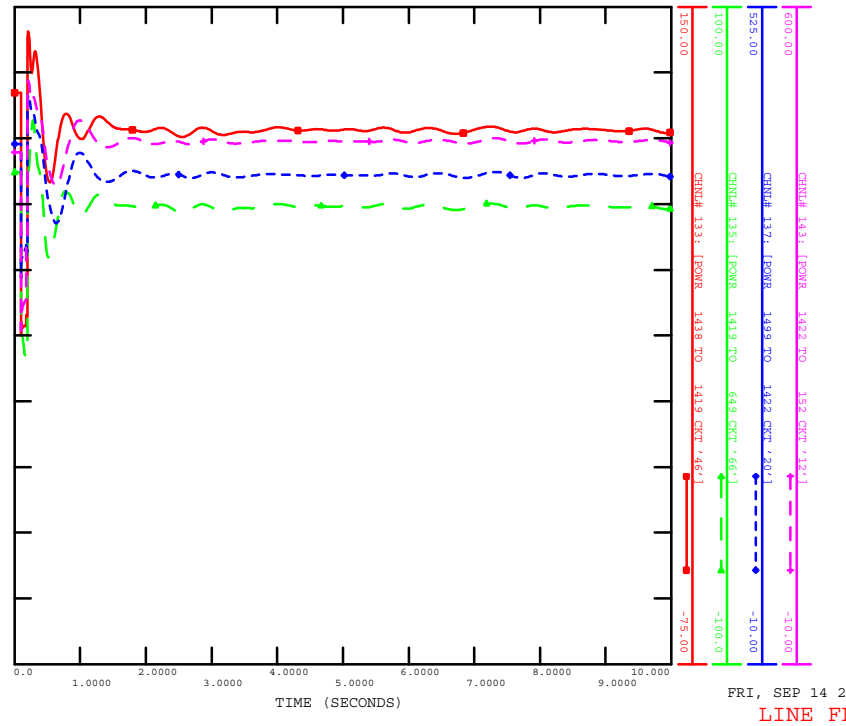
FILE: B-01.out



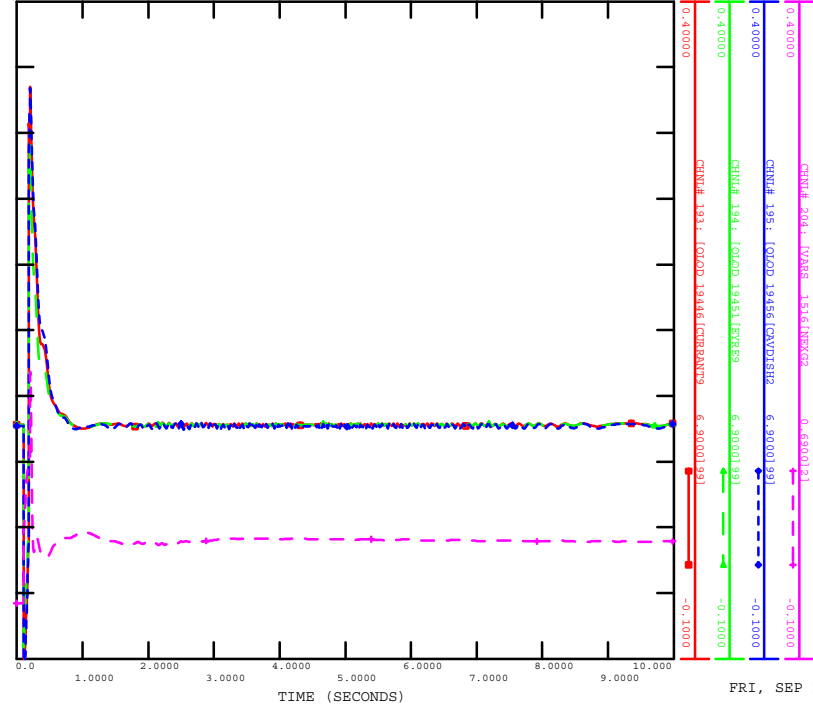
FILE: B-01.out



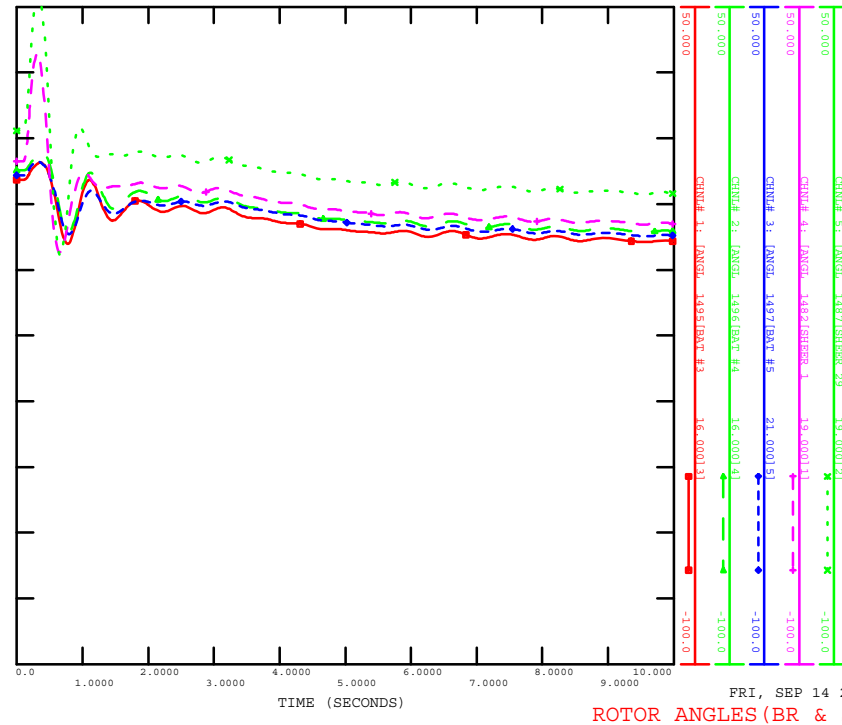
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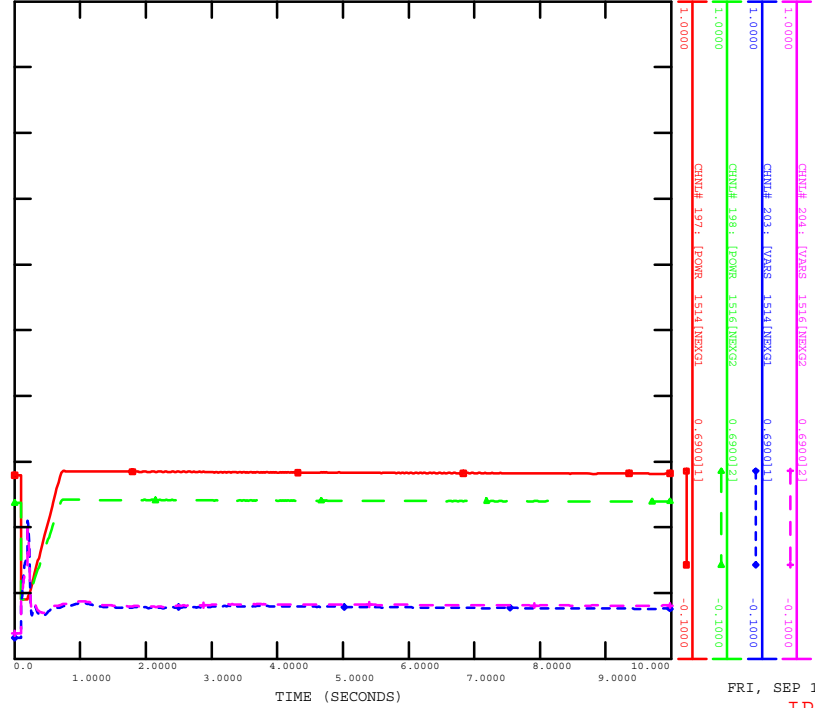
FILE: B-02.out



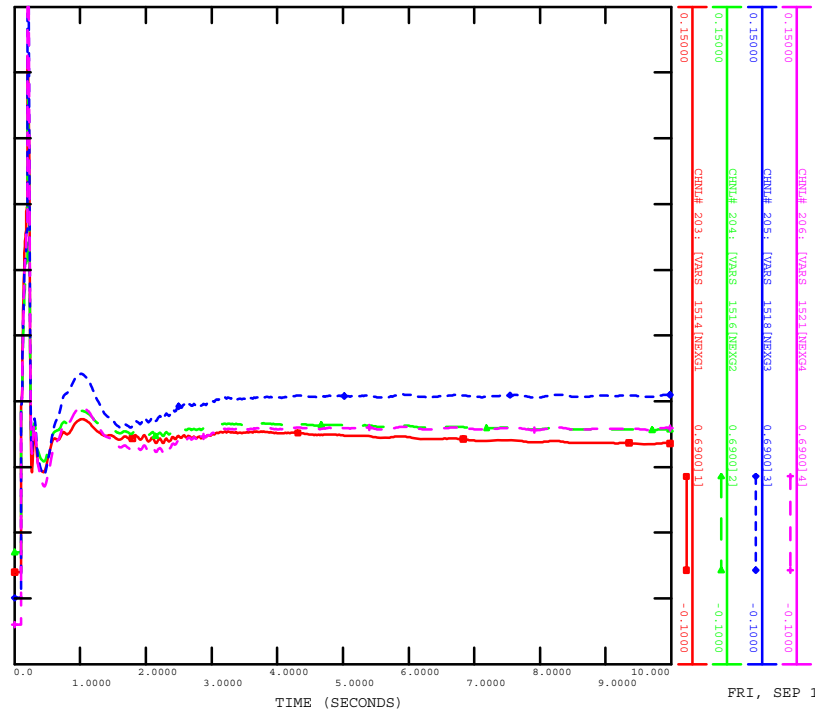
FILE: B-02.out



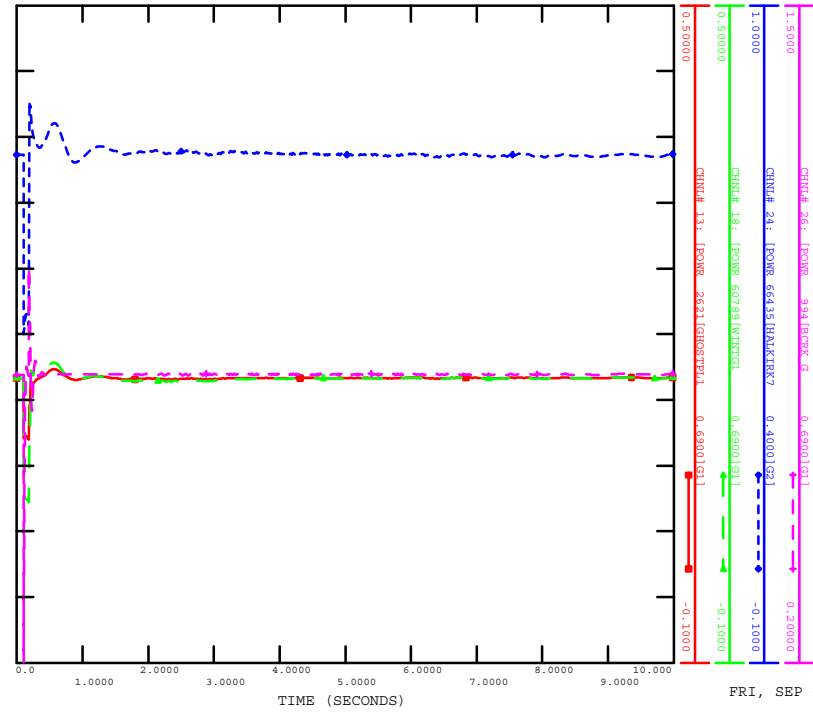
FILE: B-02.out



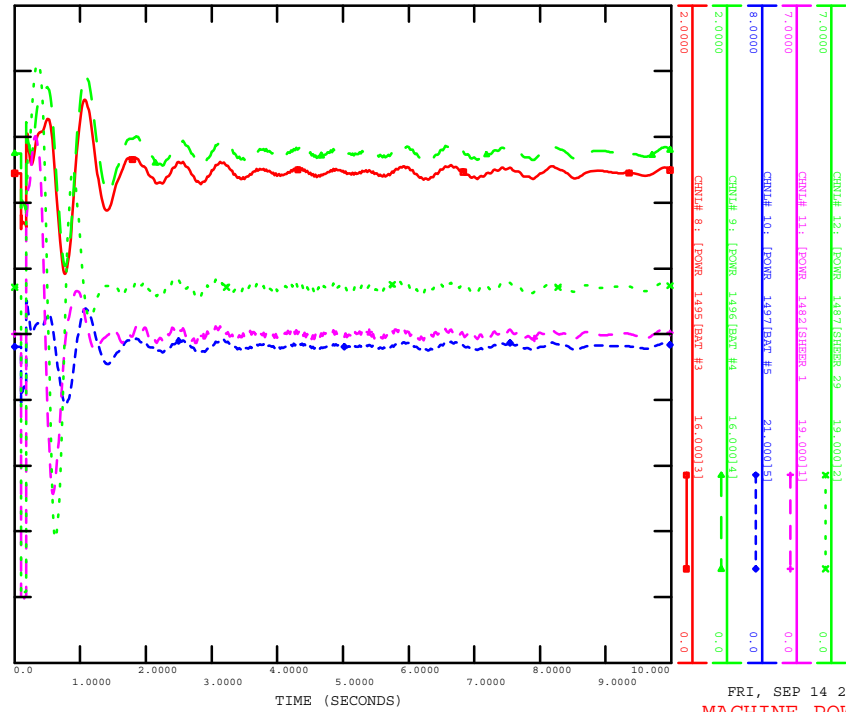
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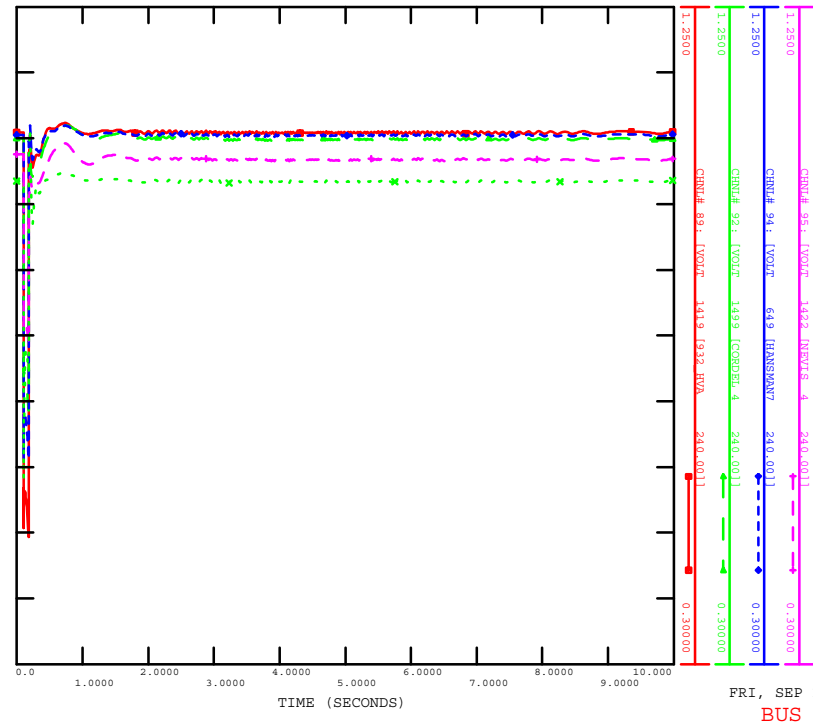
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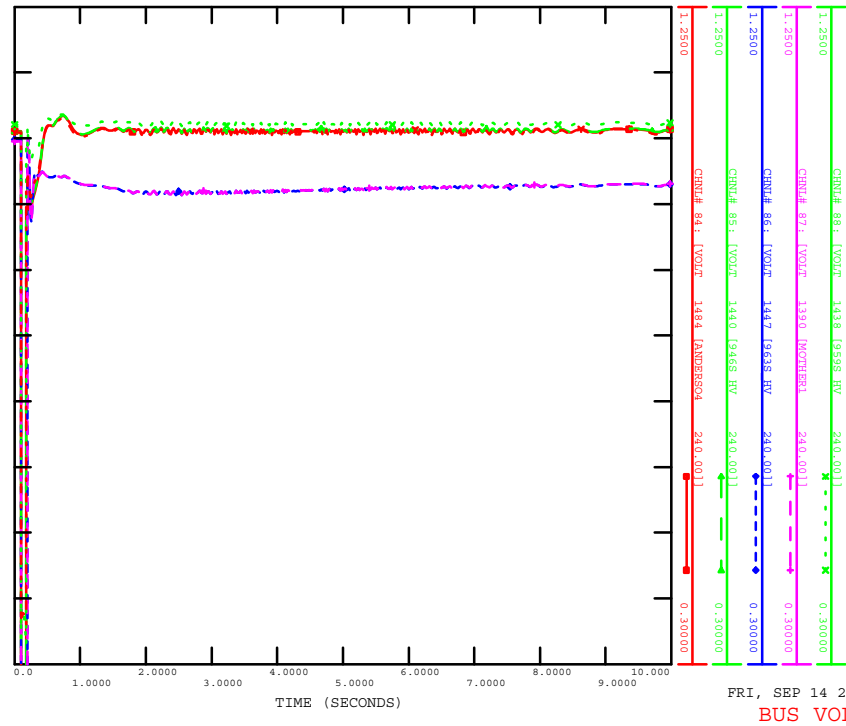
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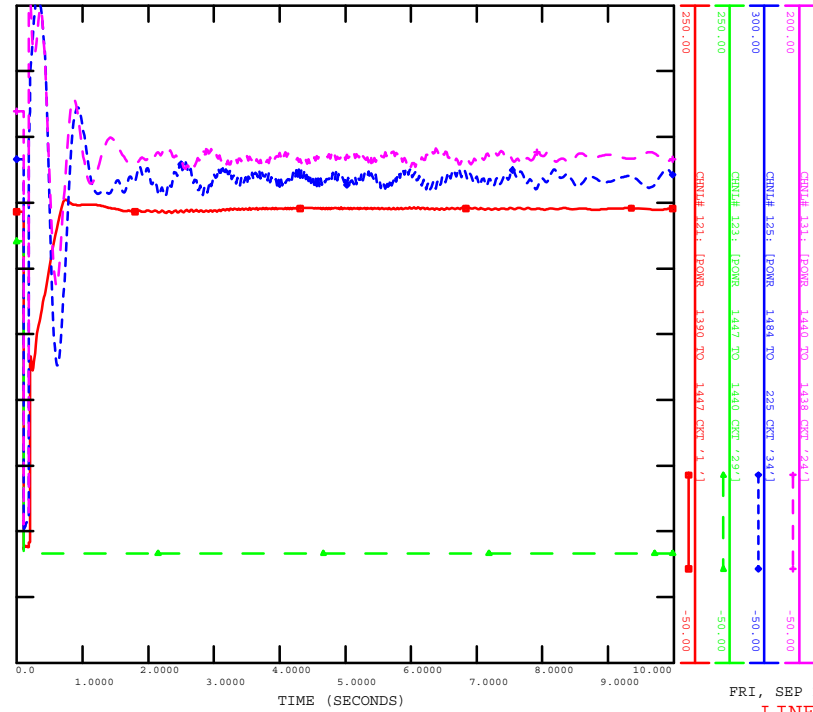
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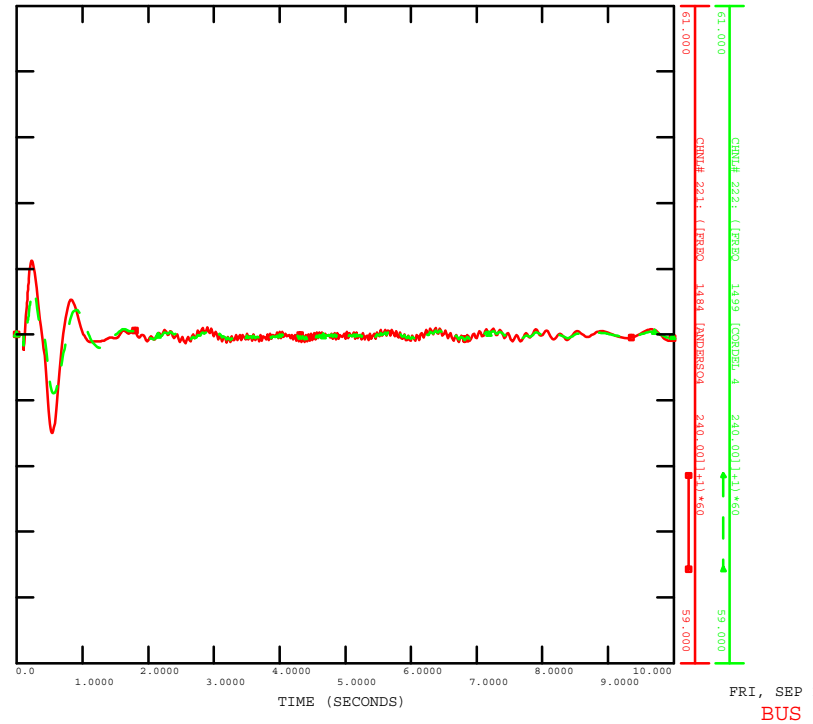
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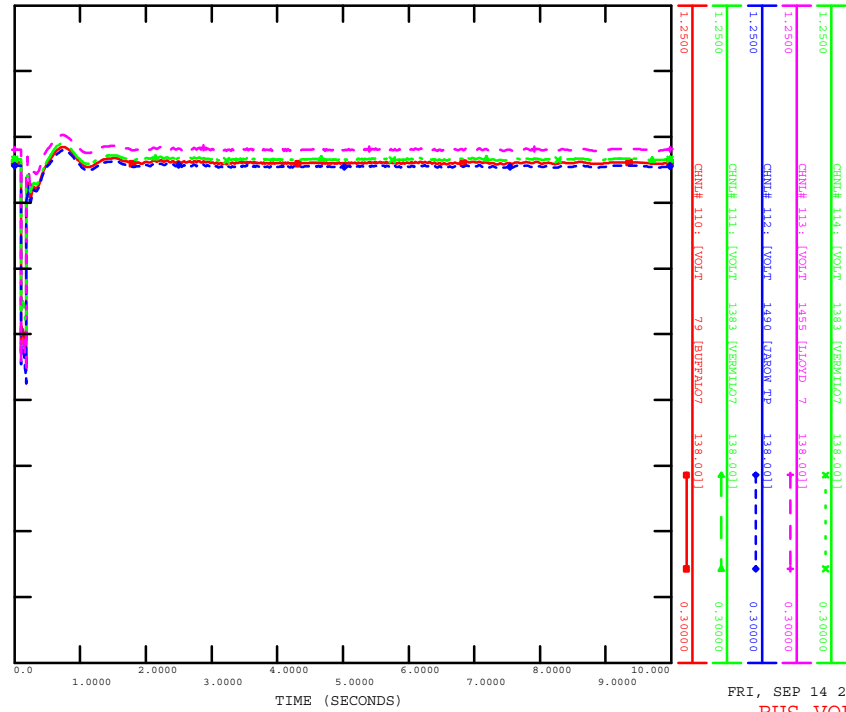
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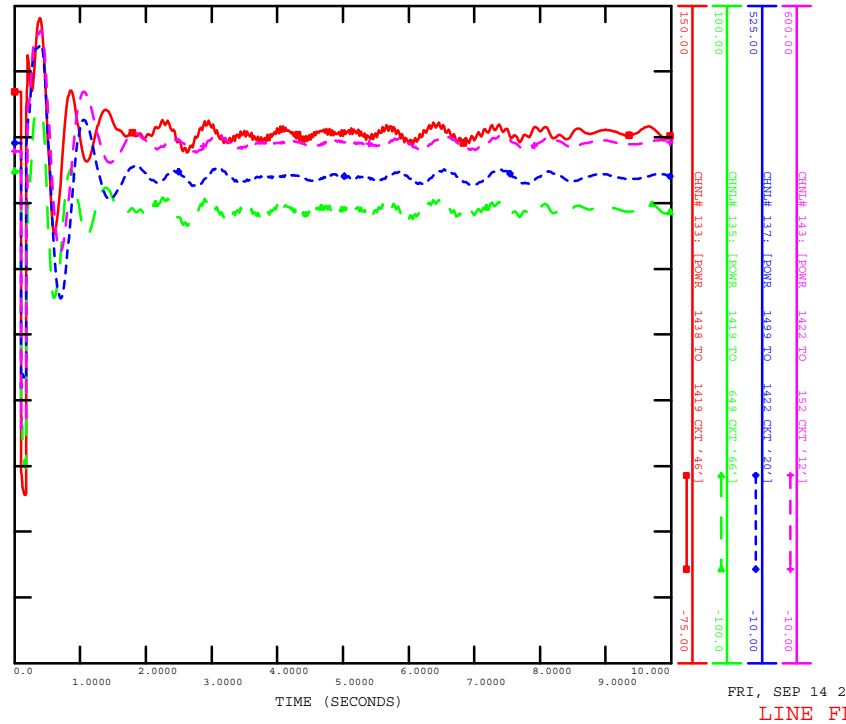
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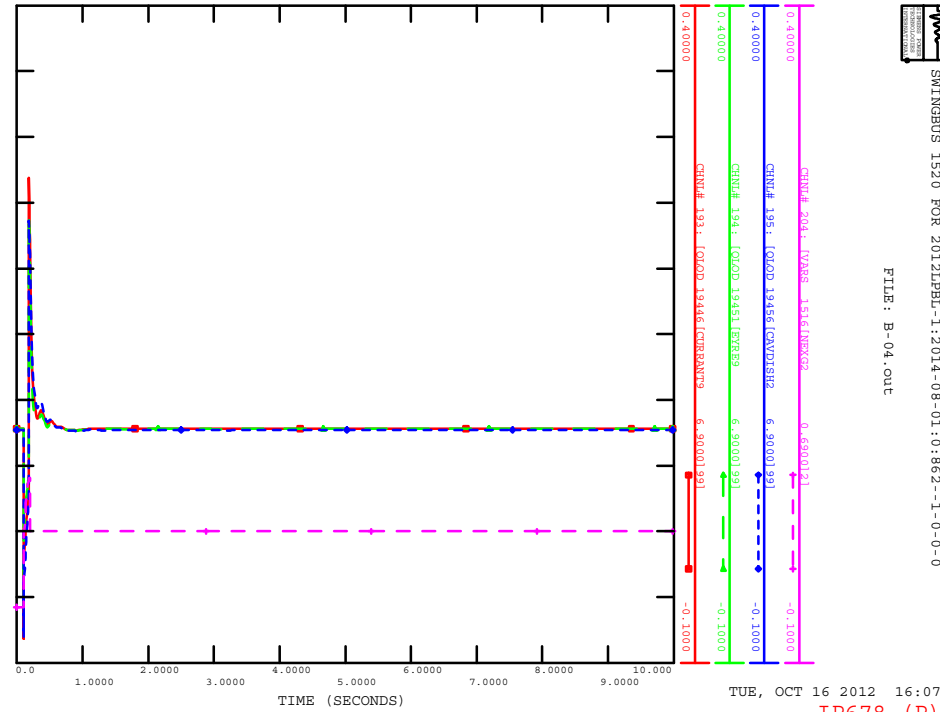
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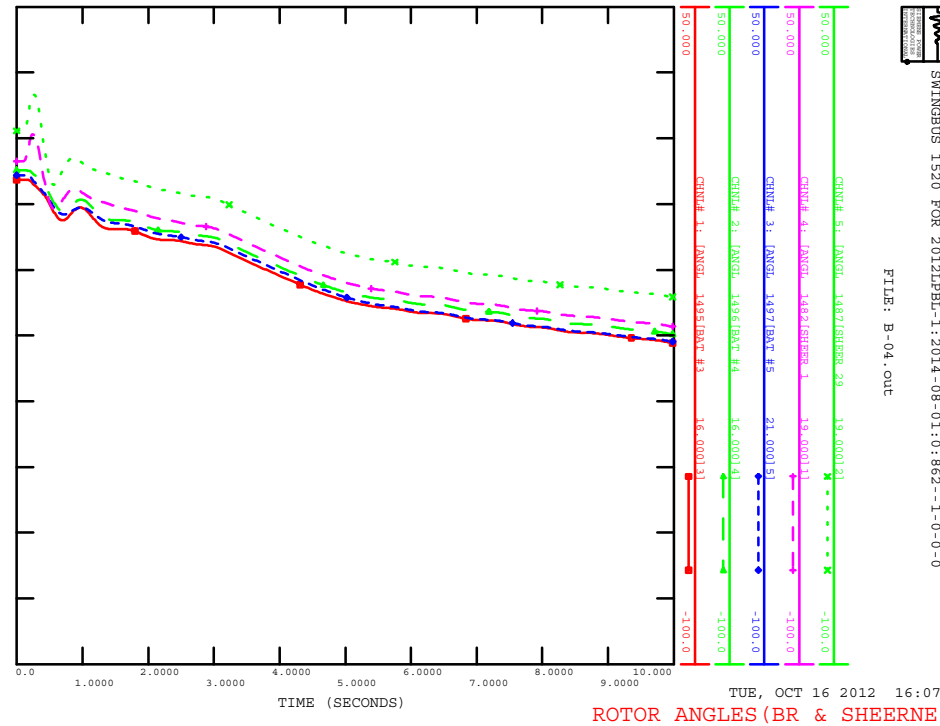
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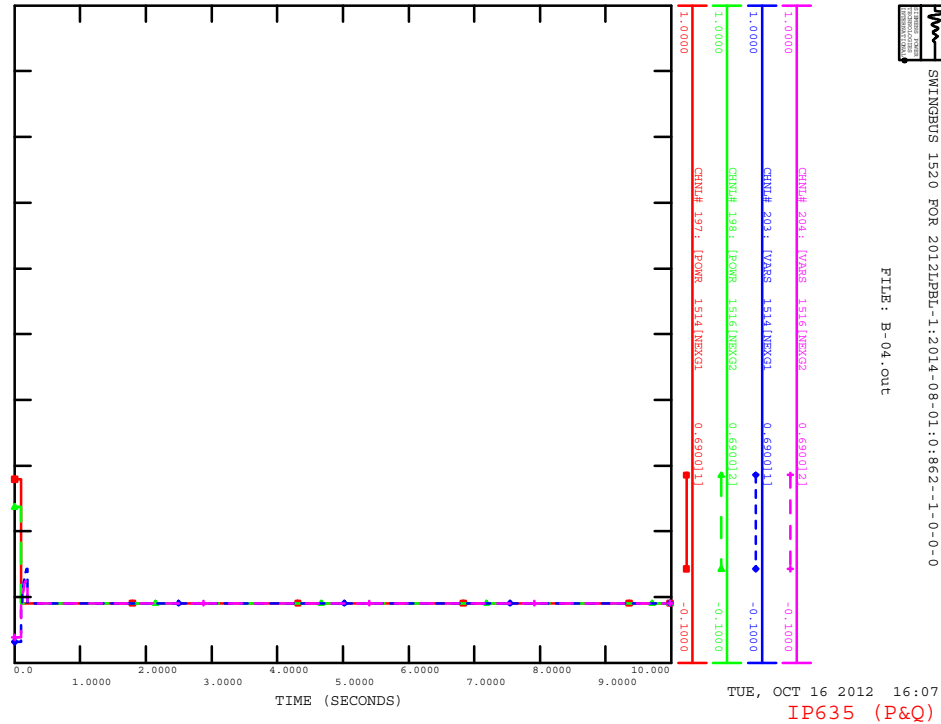
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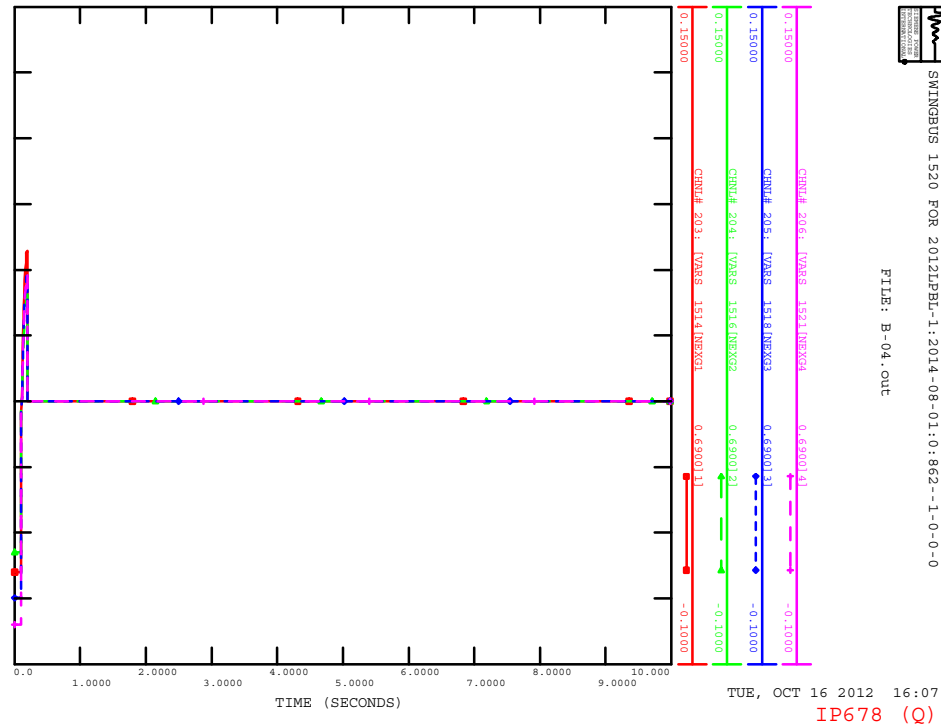
FILE: B-04.out



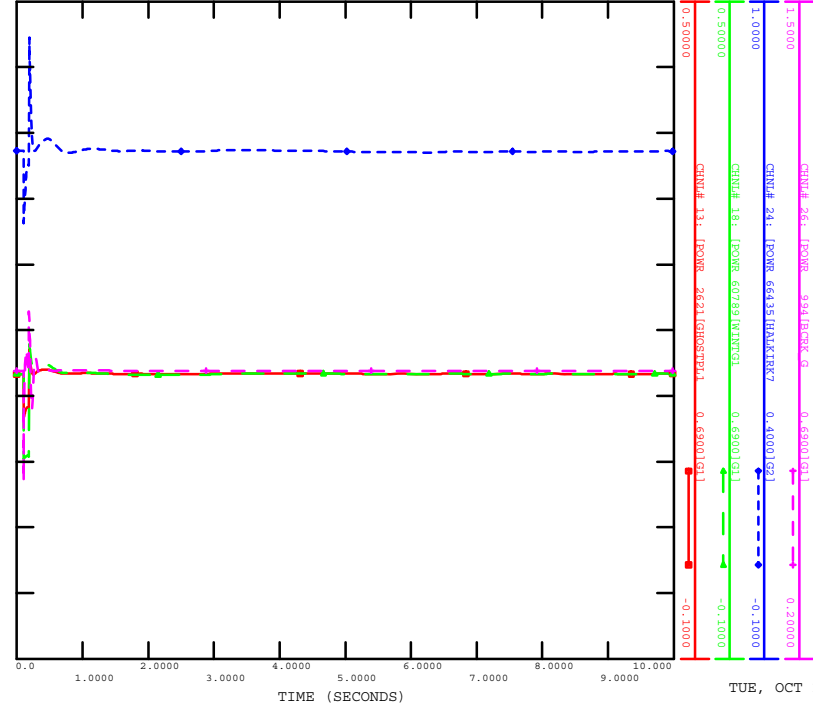
FILE: B-04.out



FILE: B-04.out

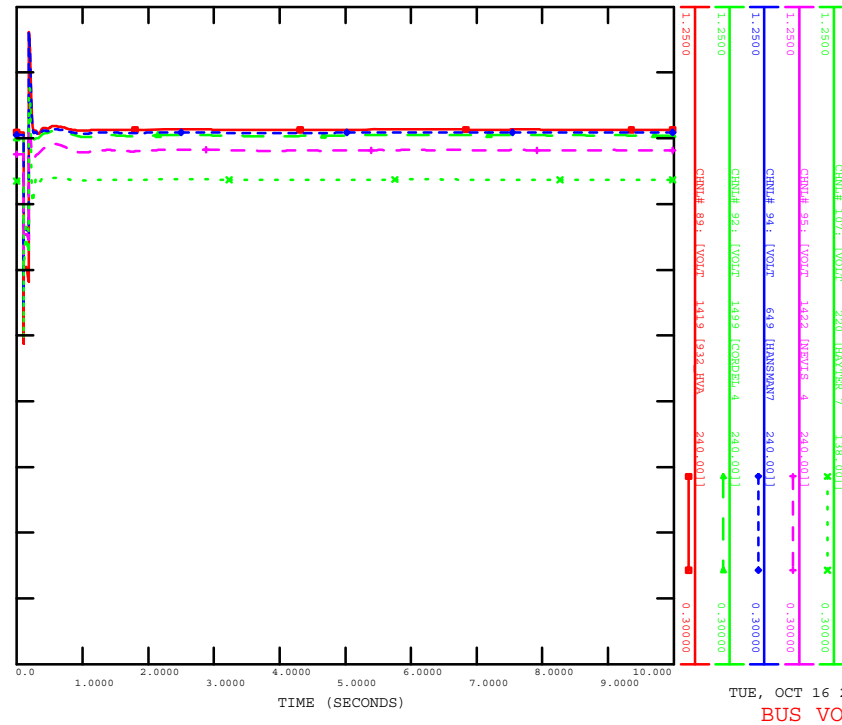


FILE: B-04.out



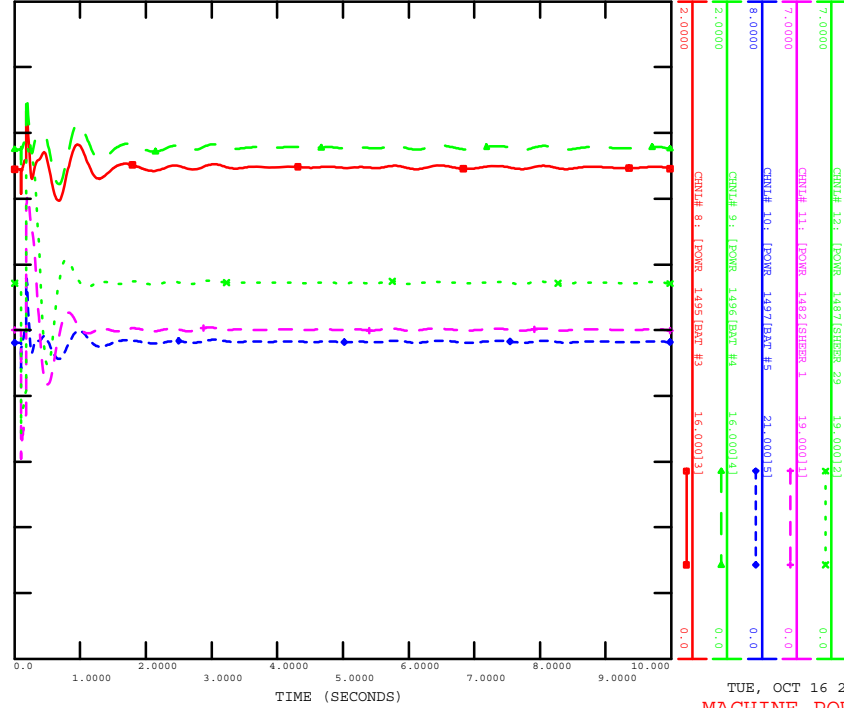
TUE, OCT 16 2012 16:07
WIND (MW)

FILE: B-04.out



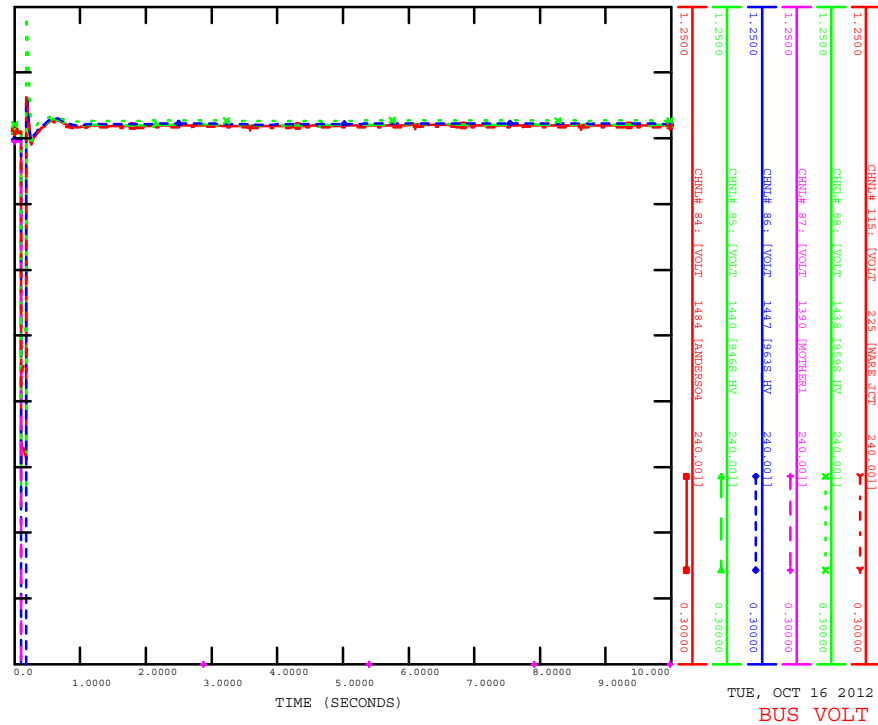
TUE, OCT 16 2012 16:07
BUS VOLT (PU)

FILE: B-04.out



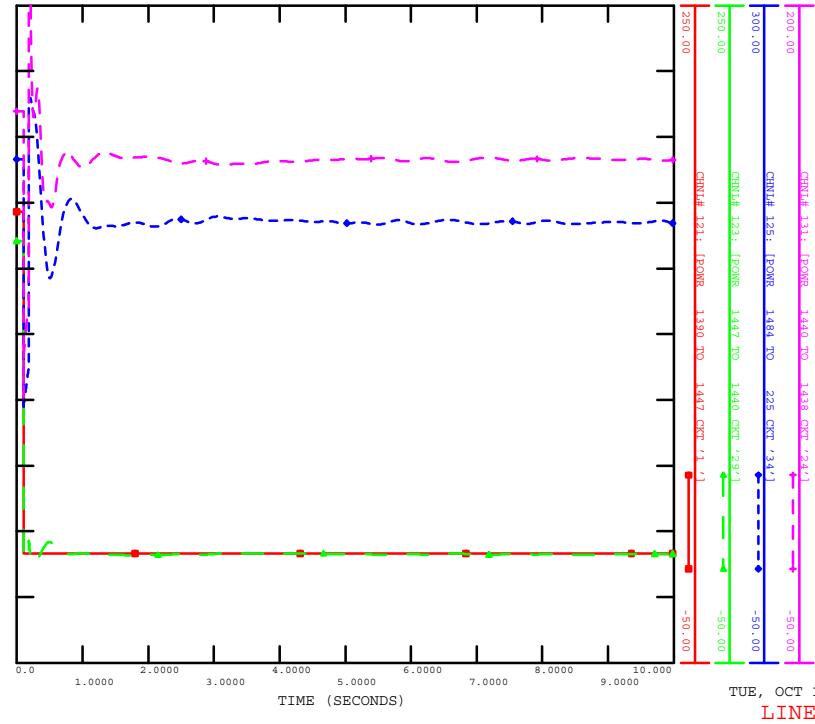
TUE, OCT 16 2012 16:07
MACHINE POWER (P)

FILE: B-04.out

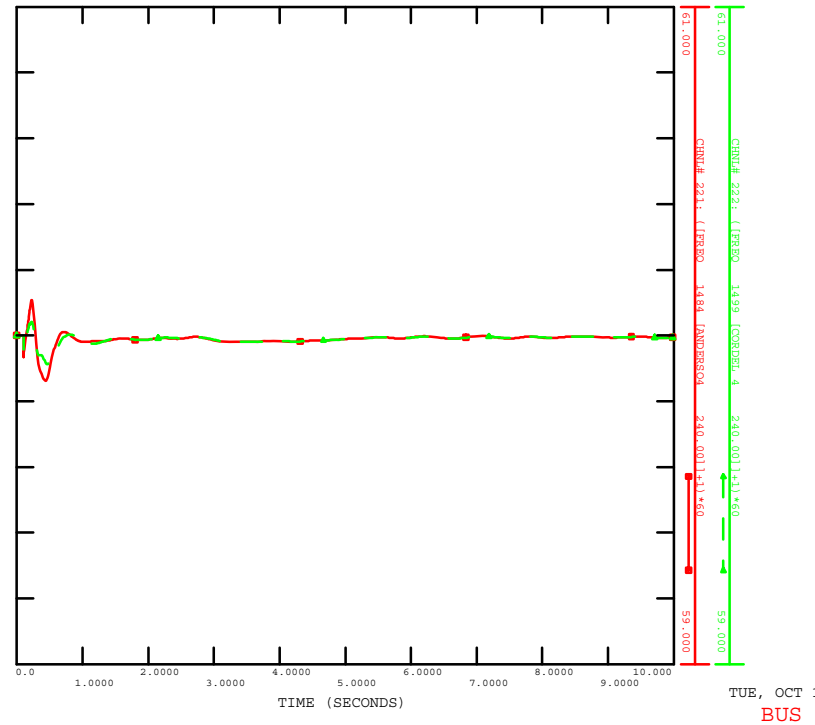


TUE, OCT 16 2012 16:07
BUS VOLT (PU)

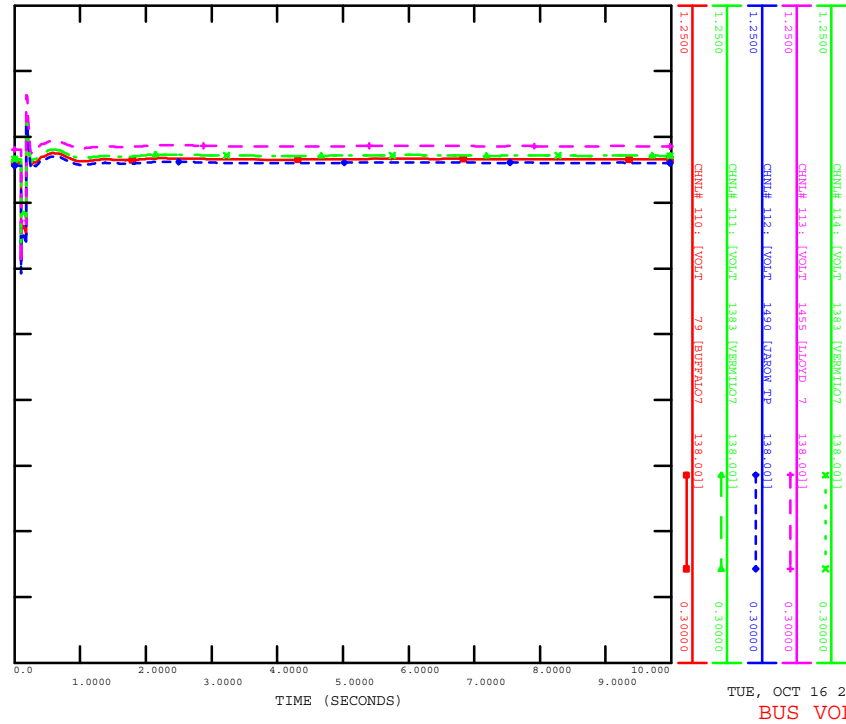
FILE: B-04.out



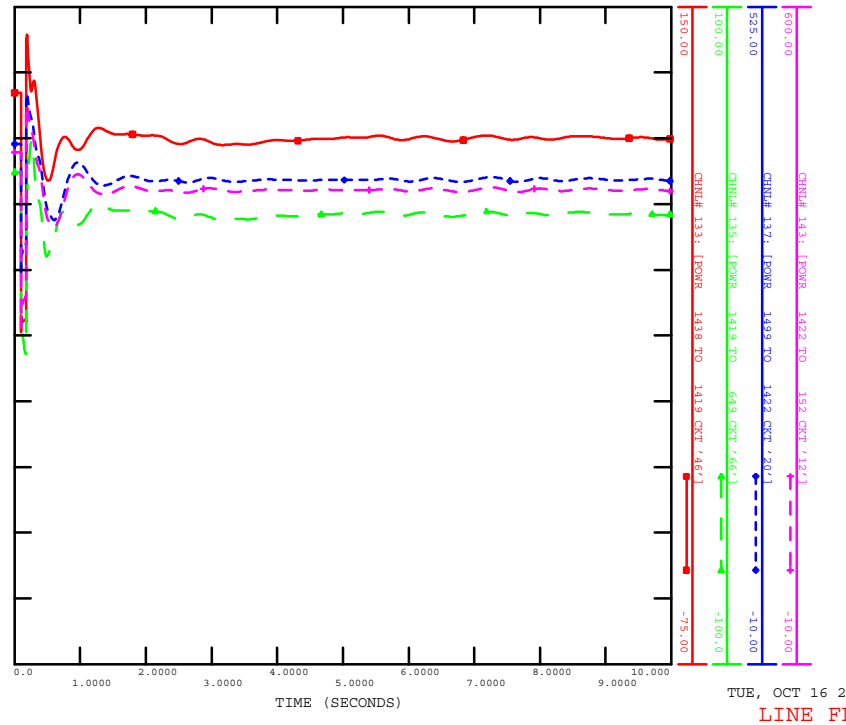
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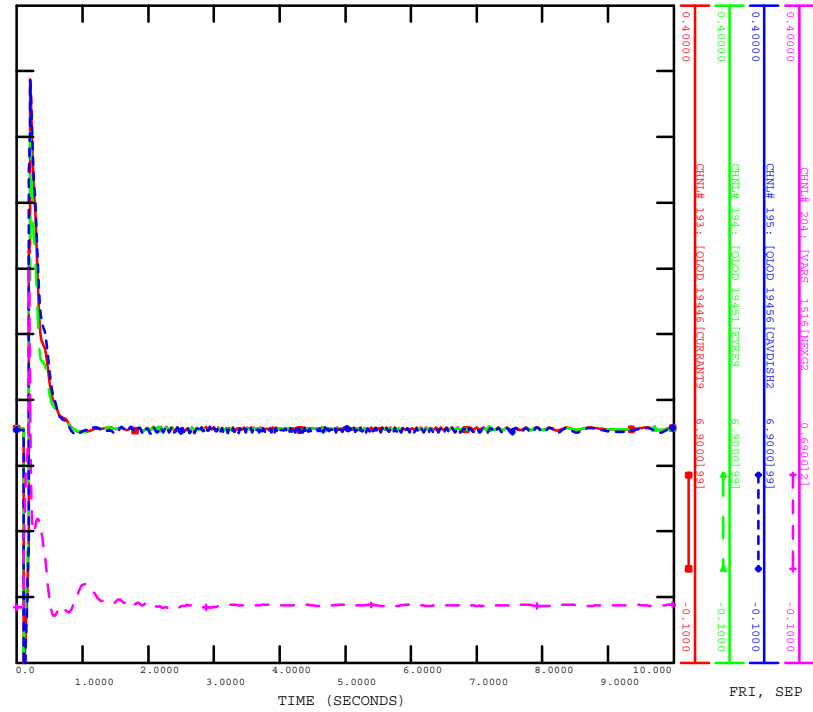
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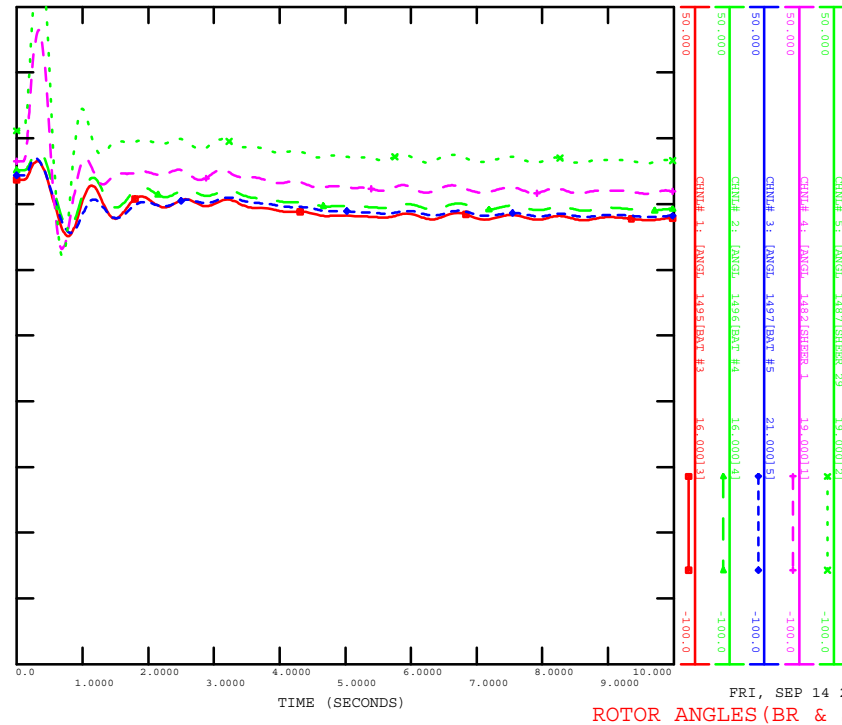
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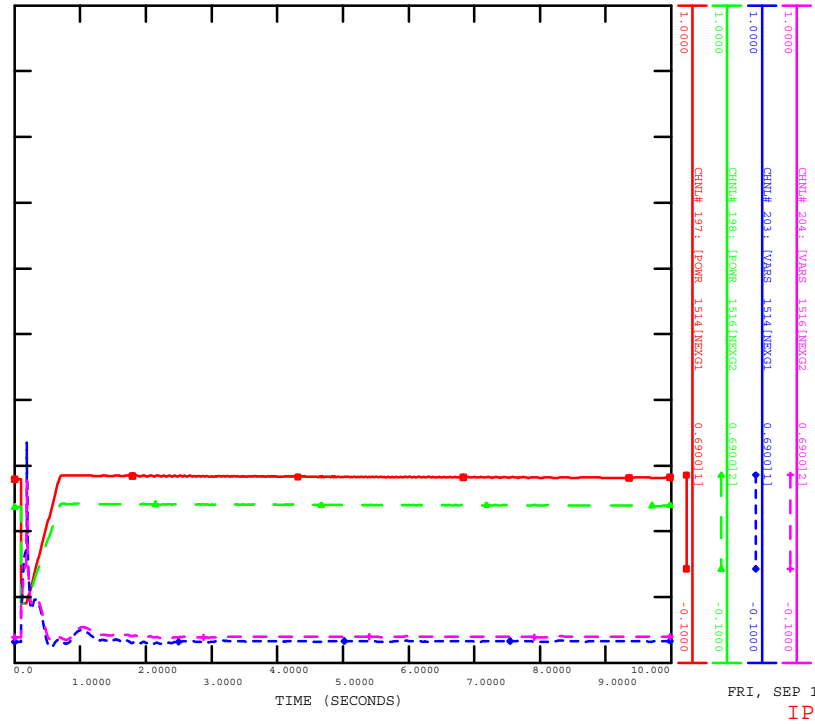
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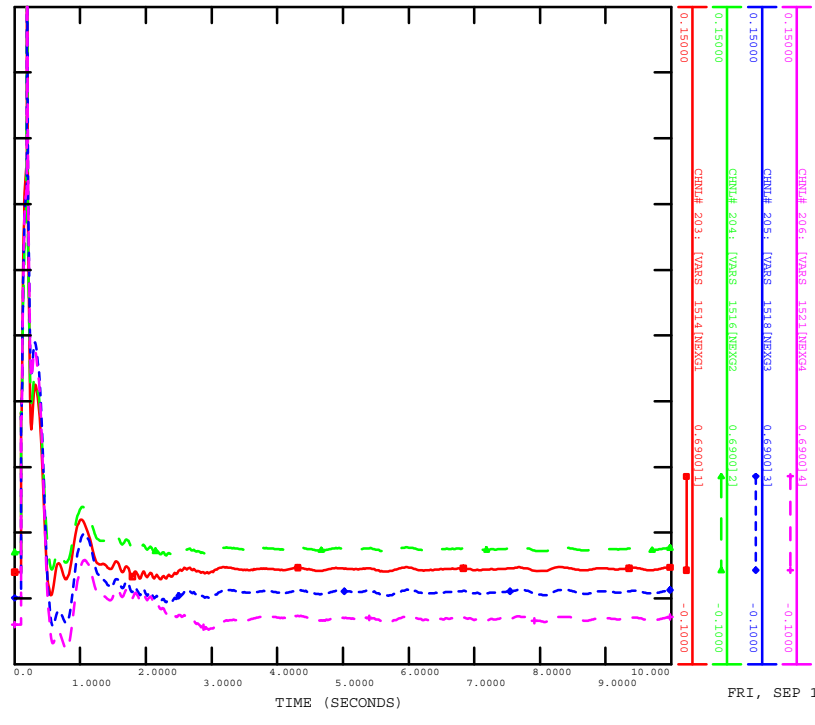
FILE: B-05.out



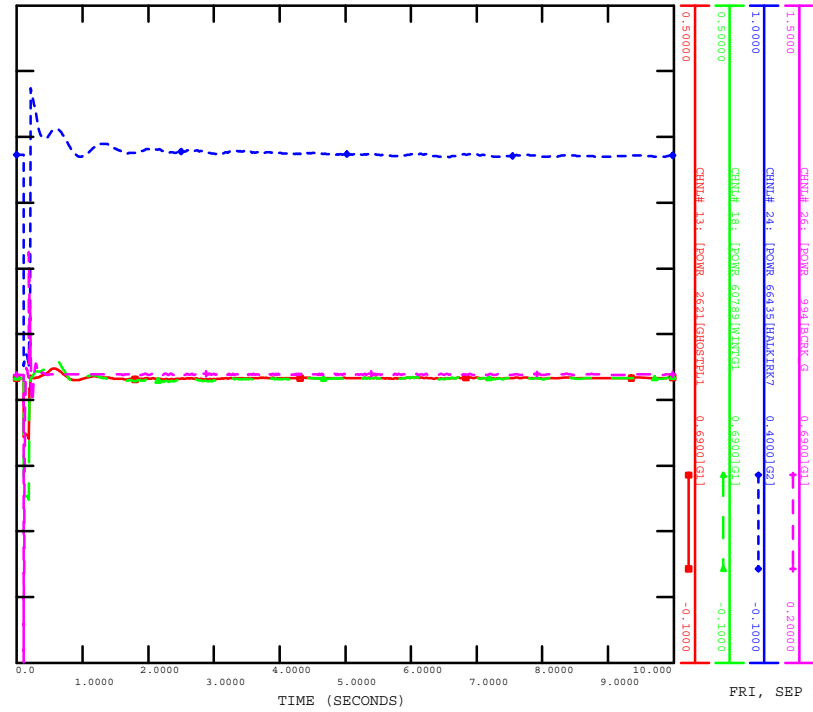
FILE: B-05.out



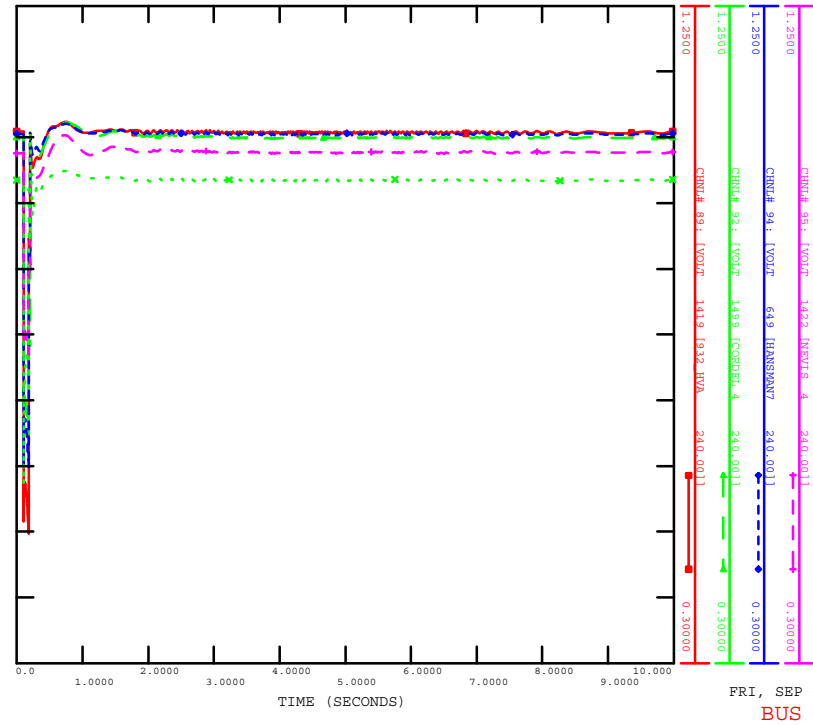
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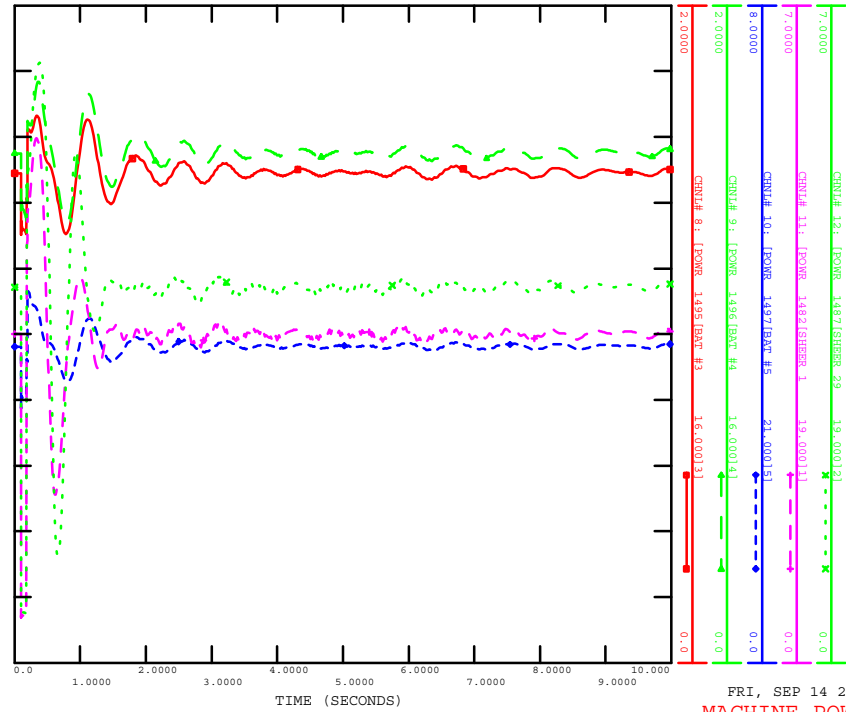
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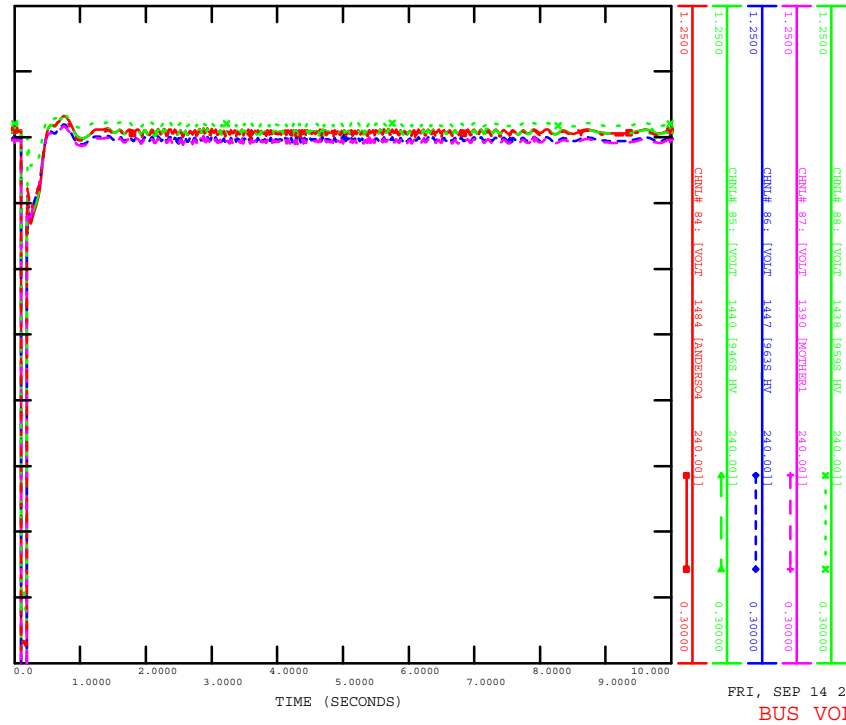
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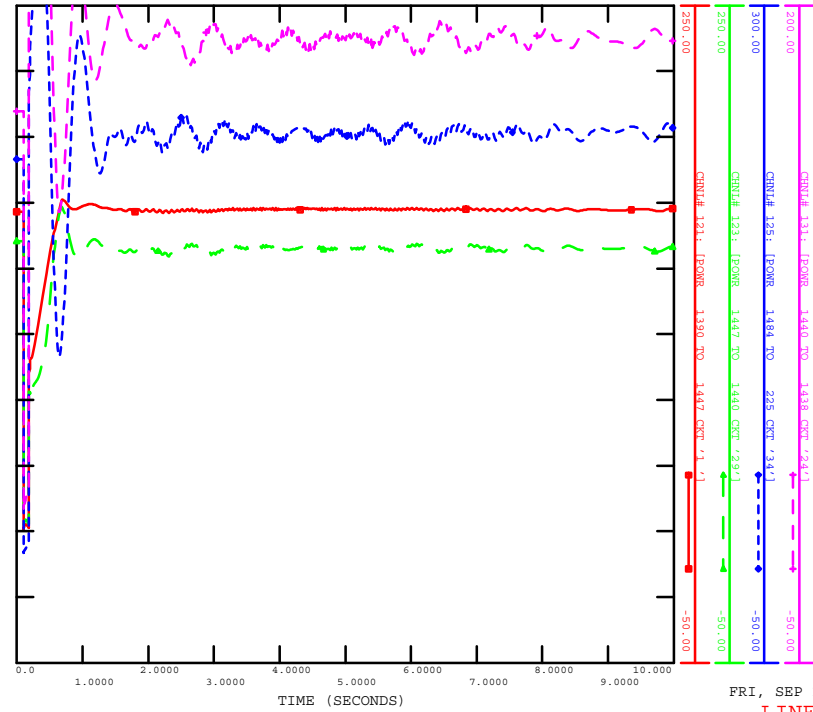
FILE: B-05.out



FILE: B-05.out

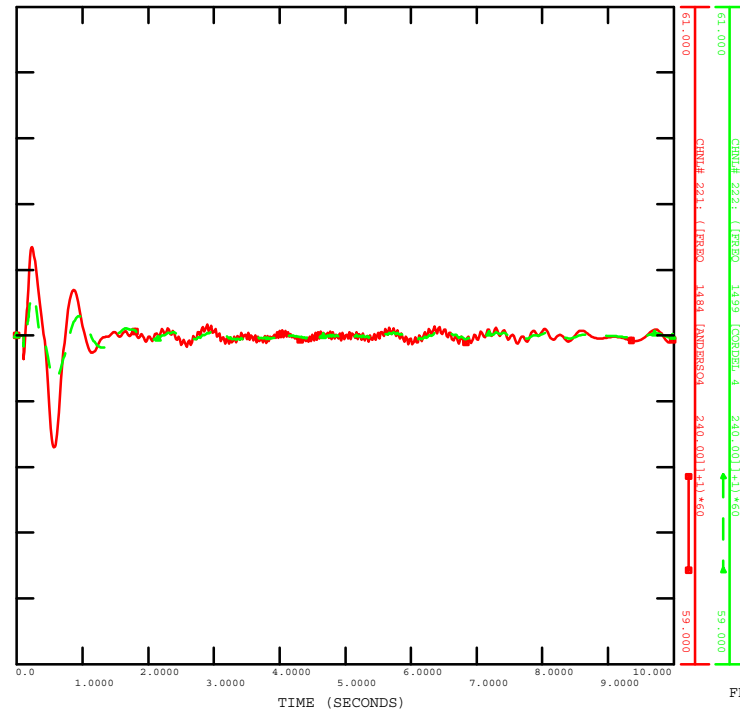


FILE: B-05.out



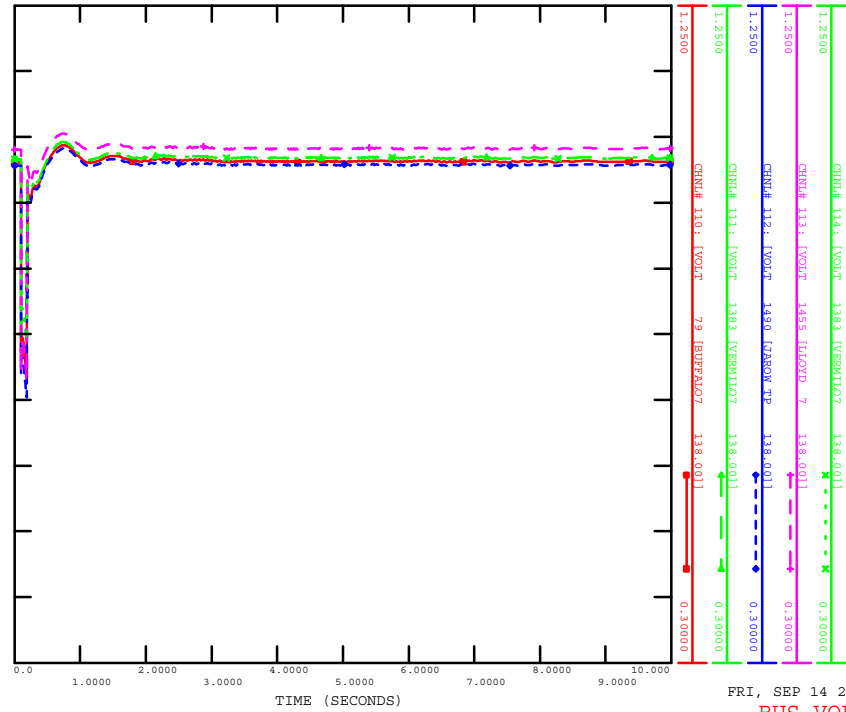
FRI, SEP 14 2012 11:12
LINE FLOW (P)

FILE: B-05.out



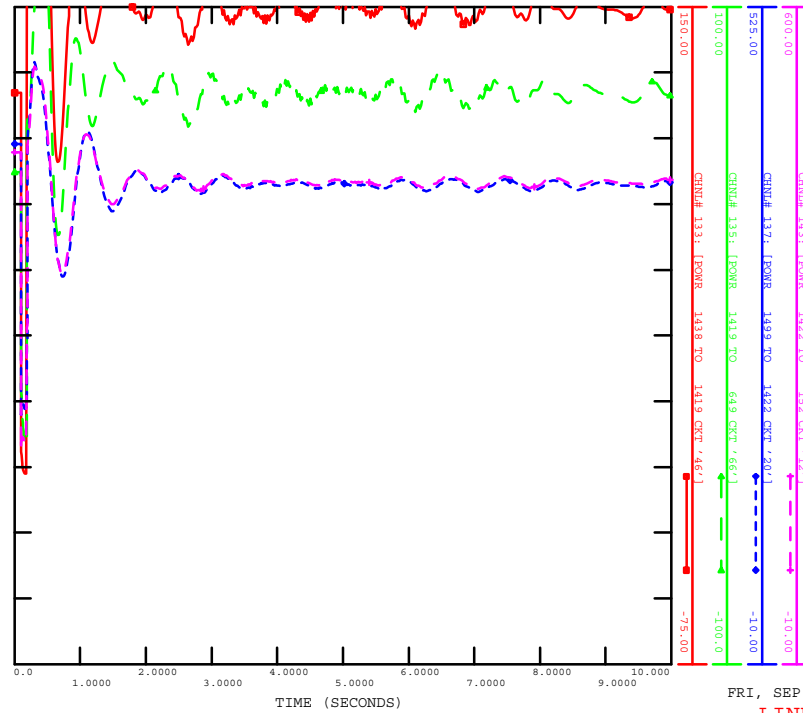
FRI, SEP 14 2012 11:12
BUS FREQUENCY

FILE: B-05.out



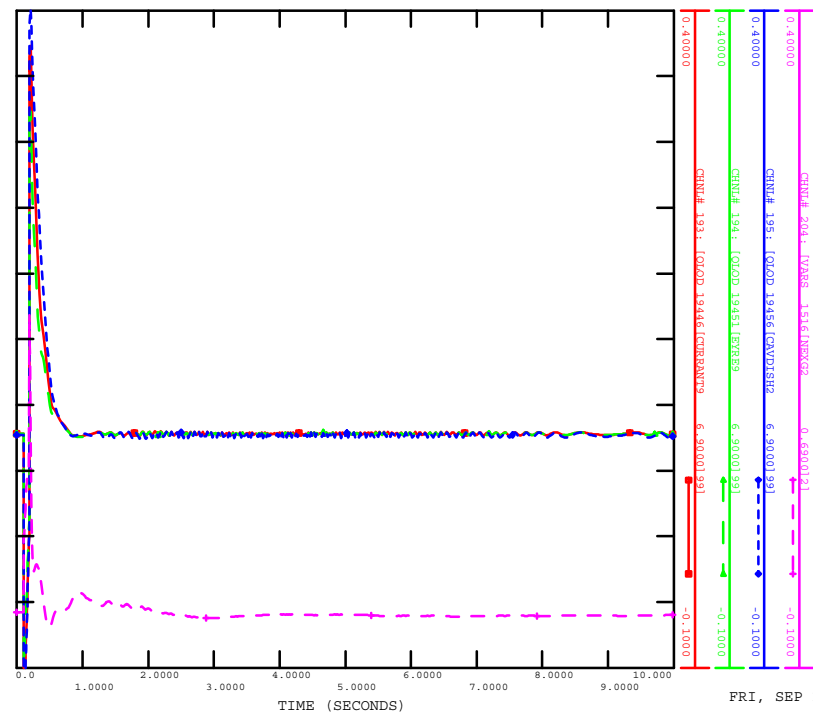
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-05.out

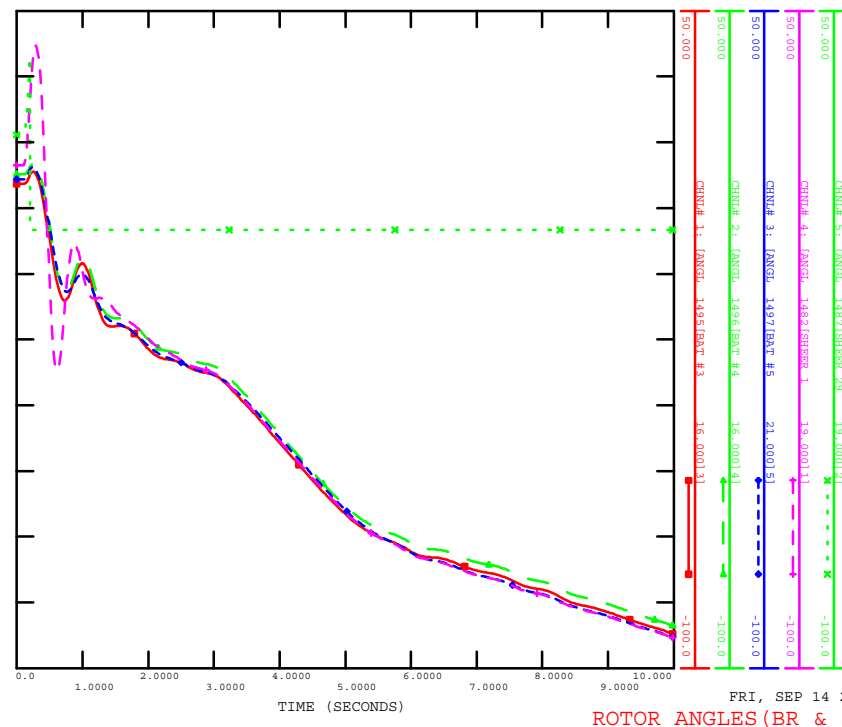


FRI, SEP 14 2012 11:12
LINE FLOW (P)

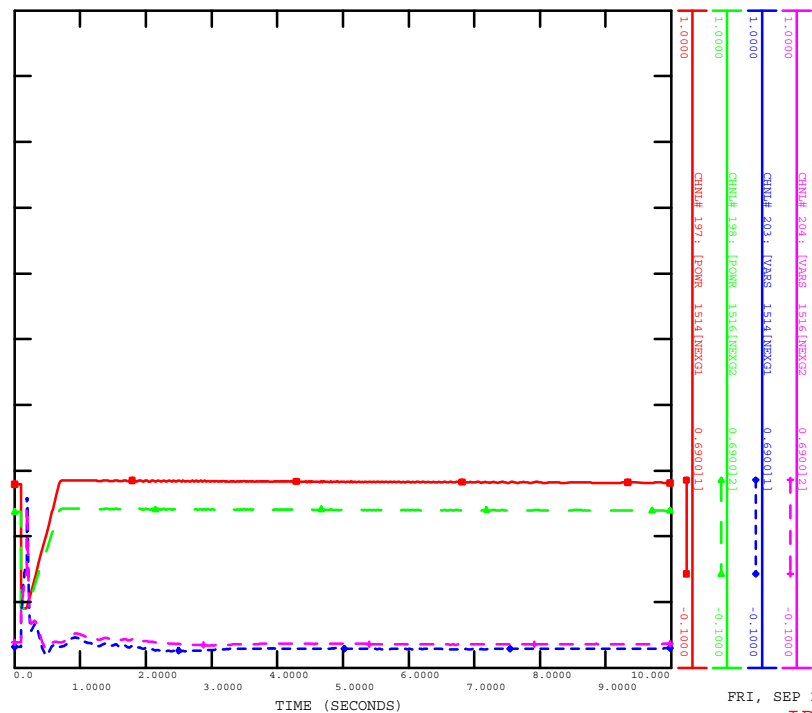
FILE: B-07.out



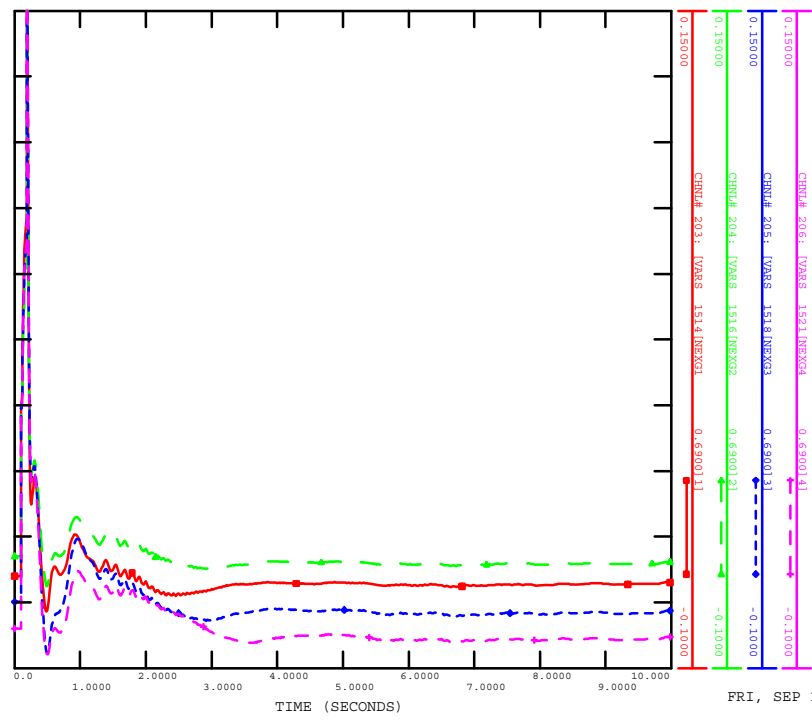
FILE: B-07.out



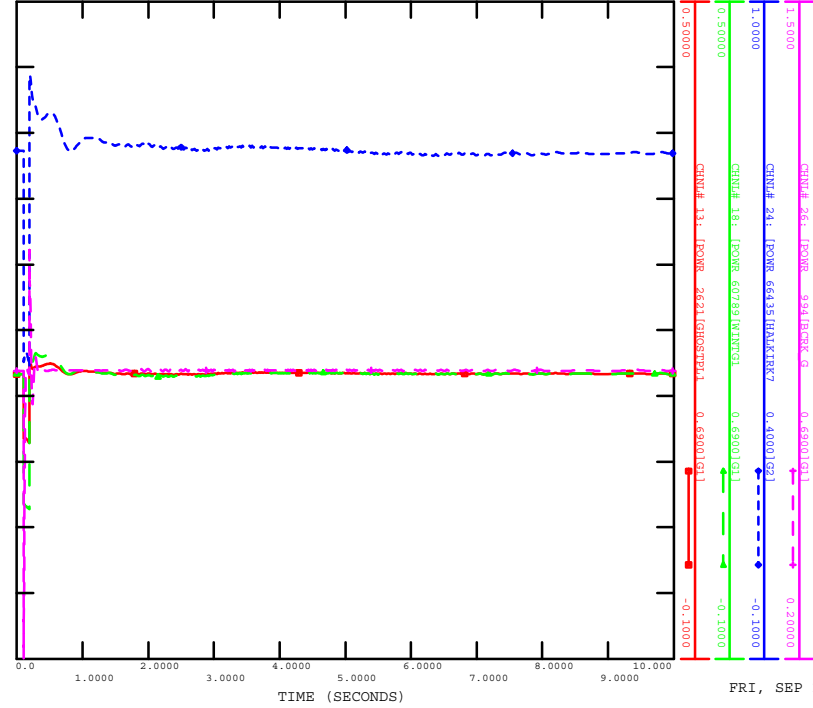
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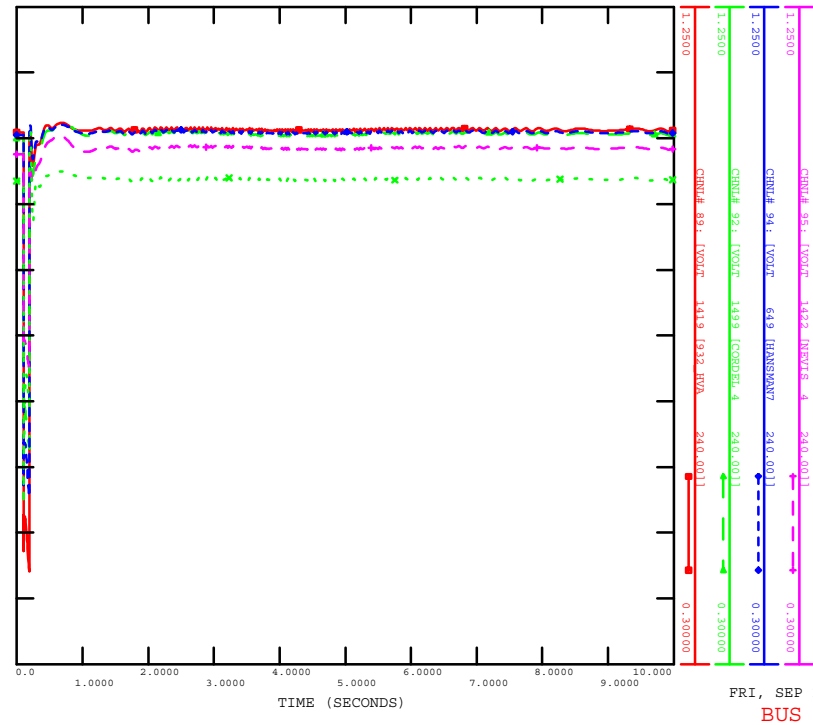
FILE: B-07.out



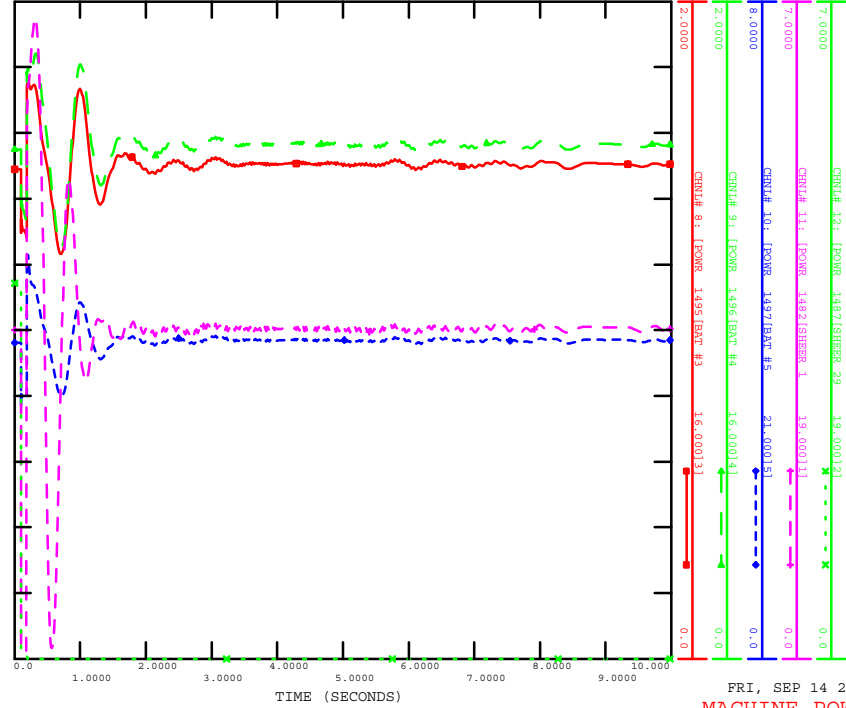
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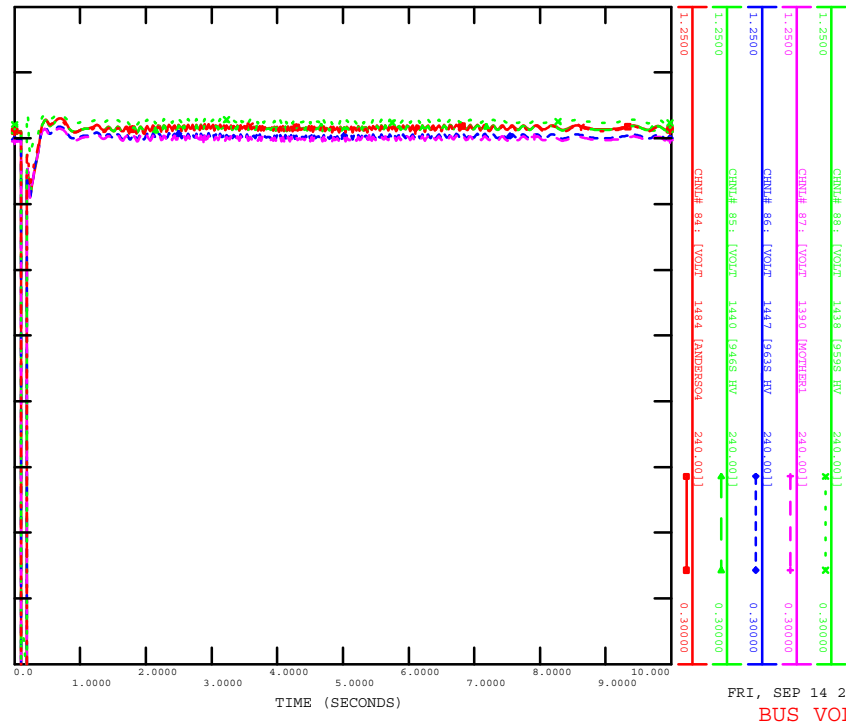
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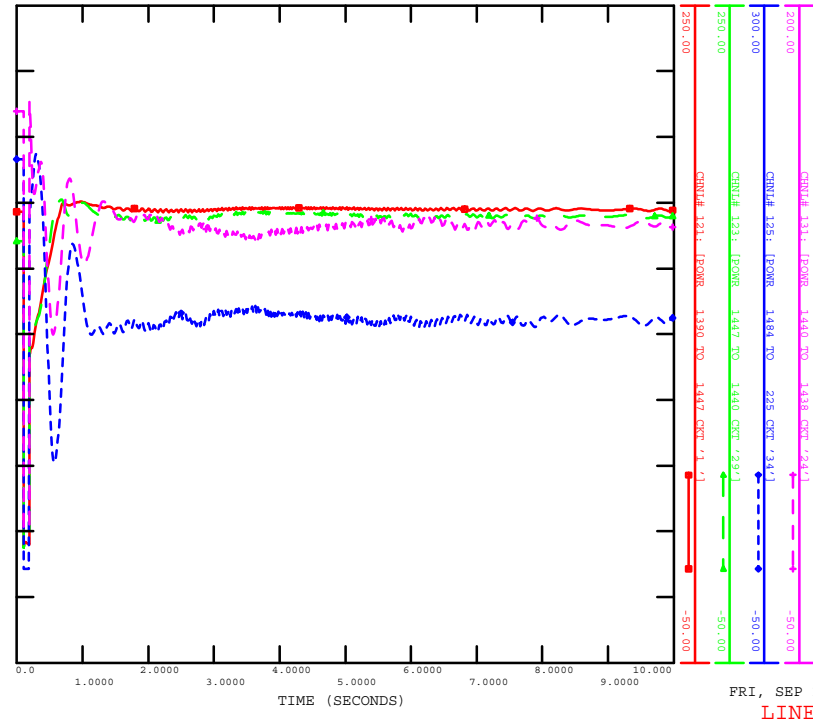
FILE: B-07.out



FILE: B-07.out

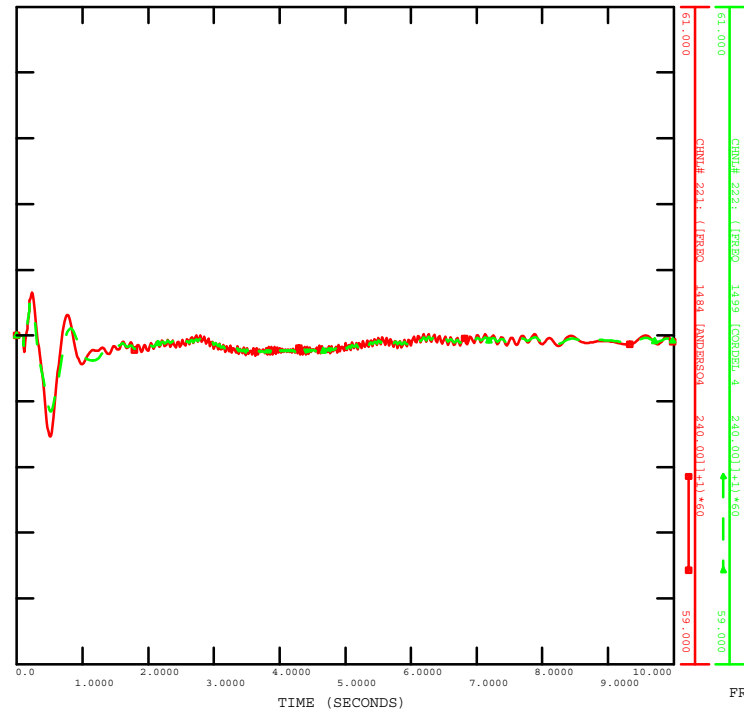


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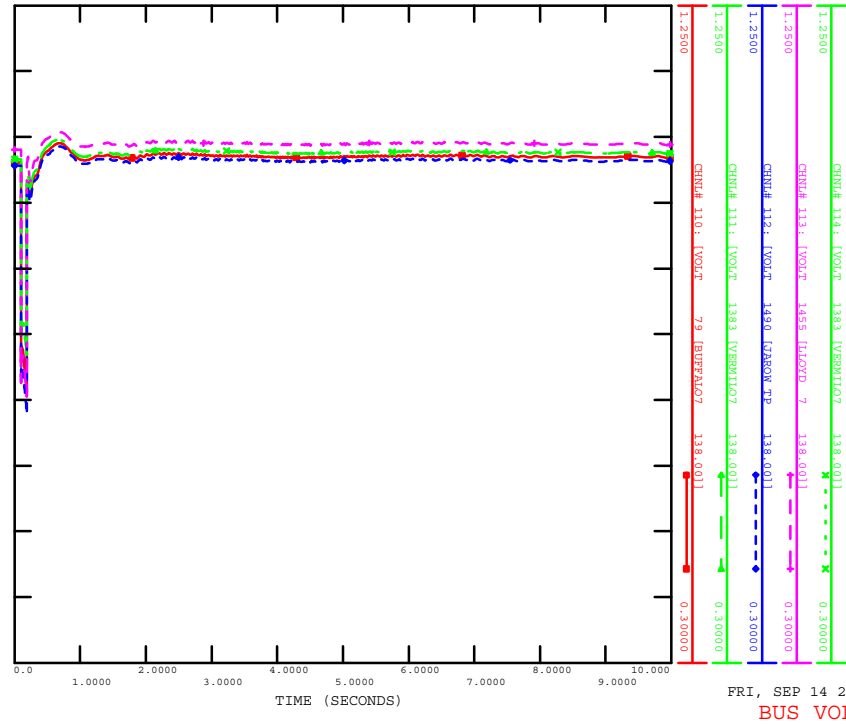
FRI, SEP 14 2012 11:12
LINE FLOW (P)

FILE: B-07.out



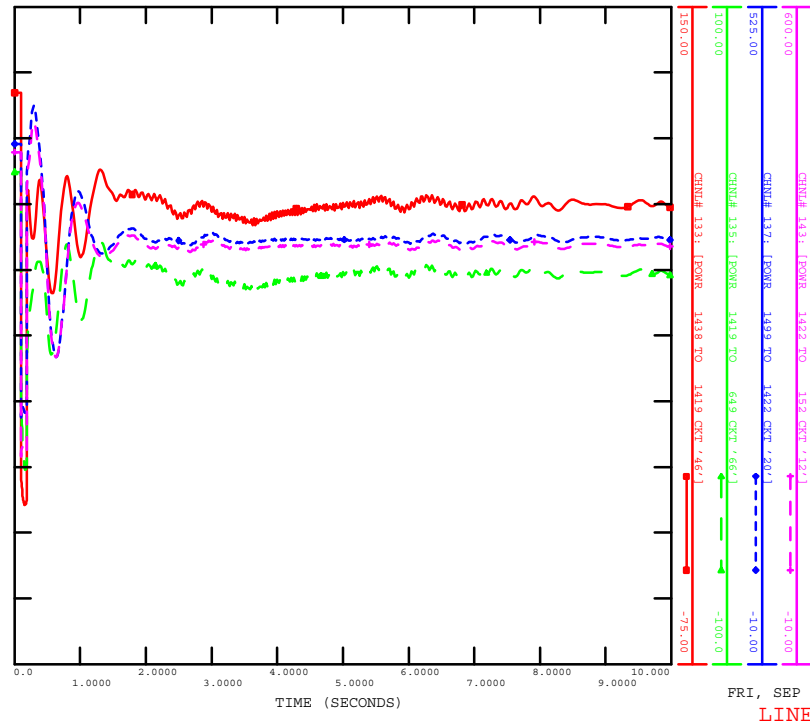
FRI, SEP 14 2012 11:12
BUS FREQUENCY

FILE: B-07.out



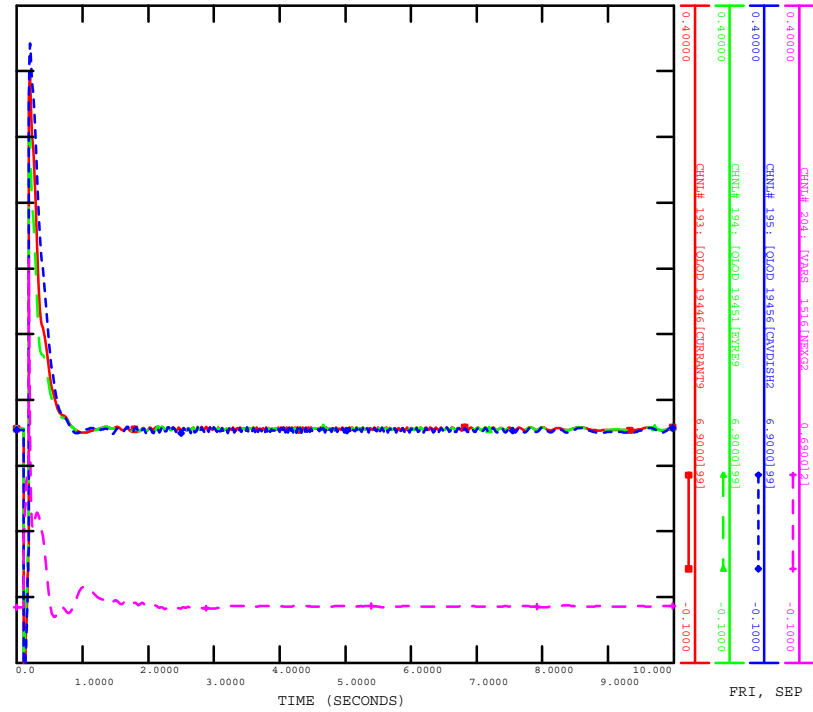
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-07.out

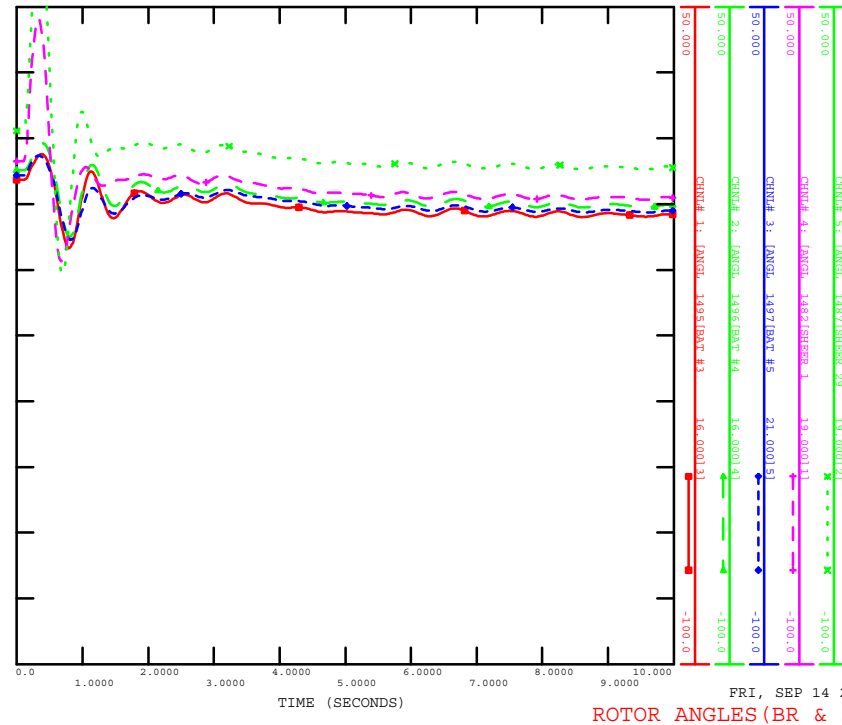


FRI, SEP 14 2012 11:12
LINE FLOW (P)

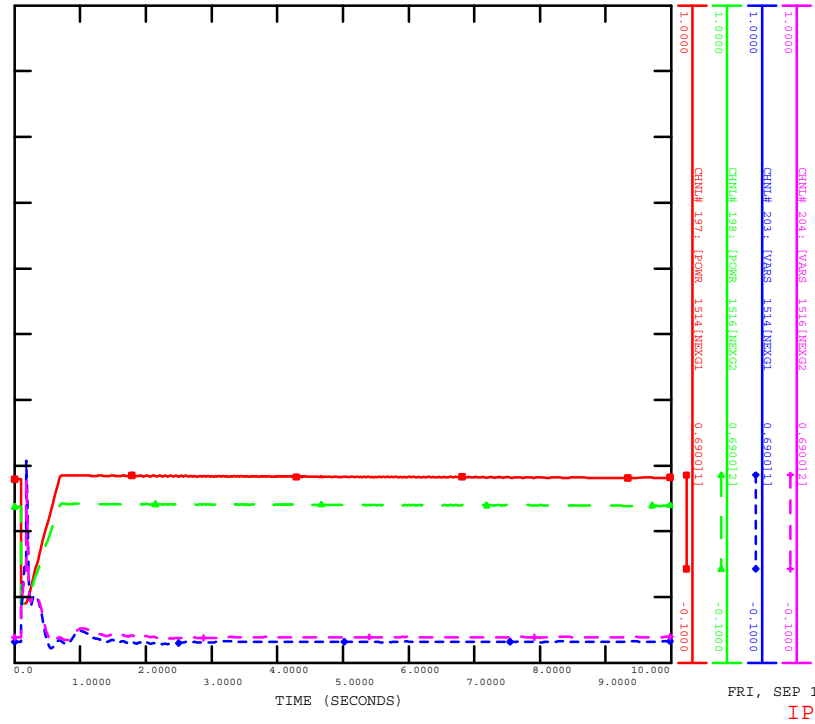
FILE: B-11.out



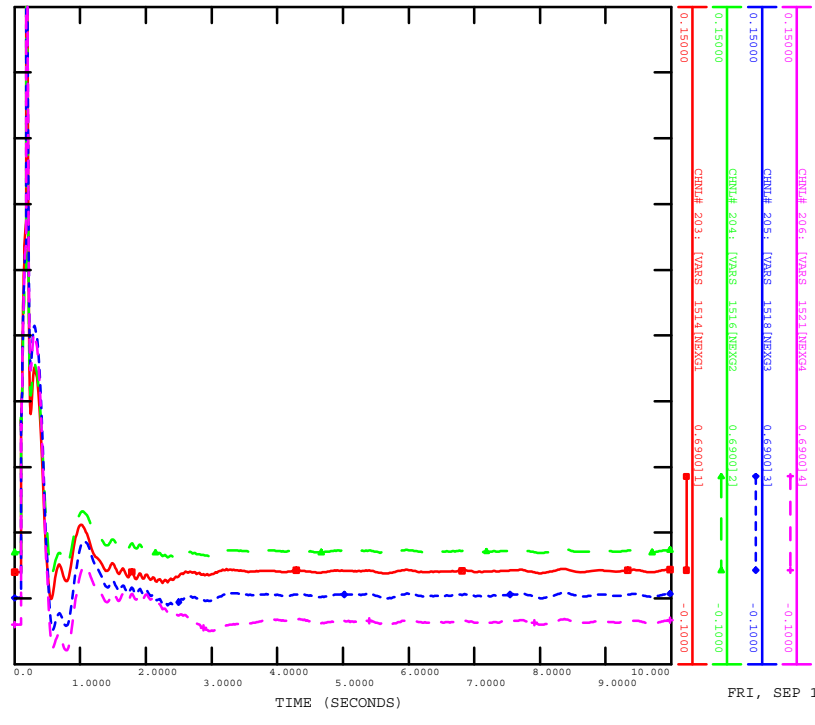
FILE: B-11.out



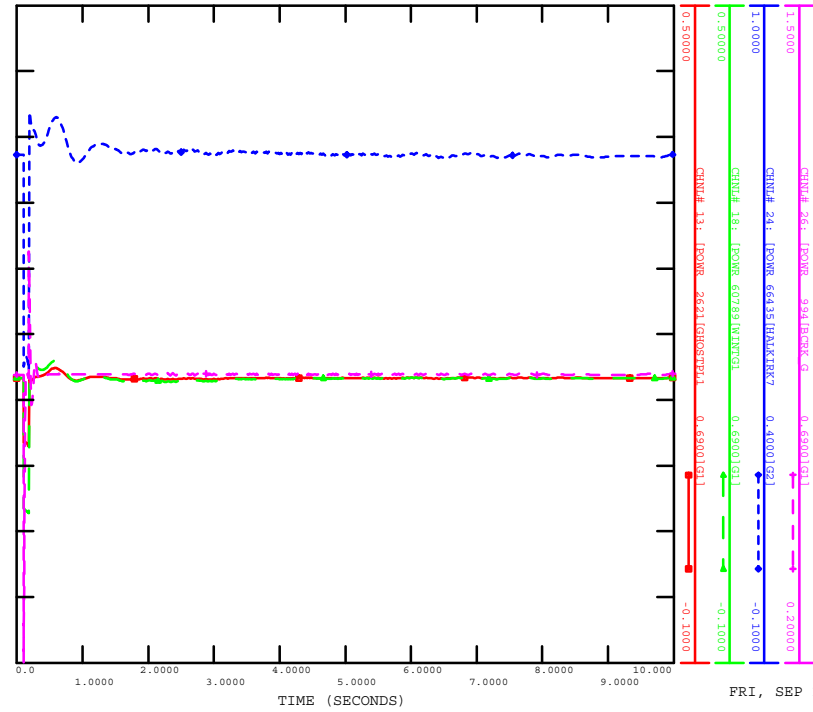
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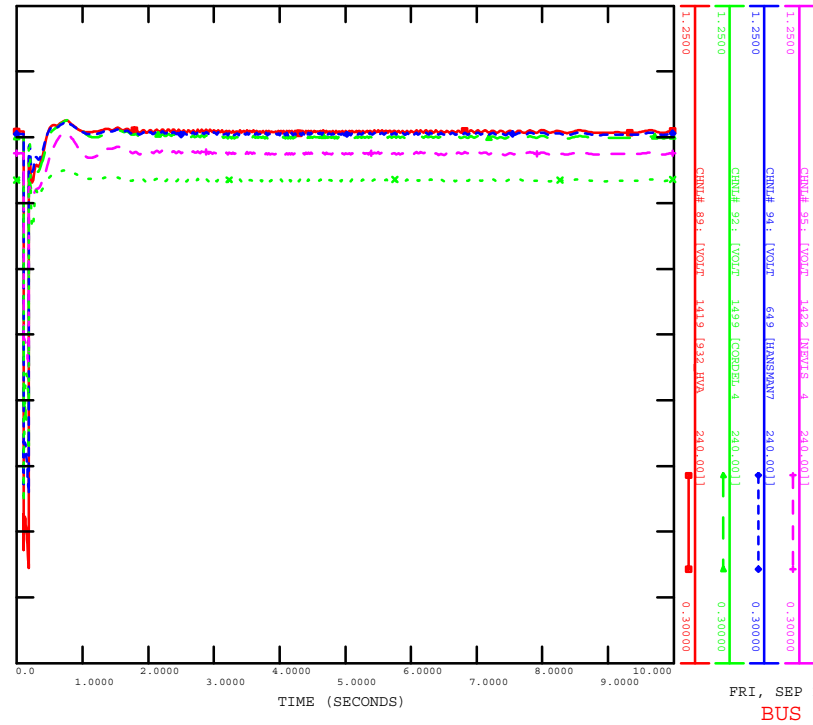
FILE: B-11.out



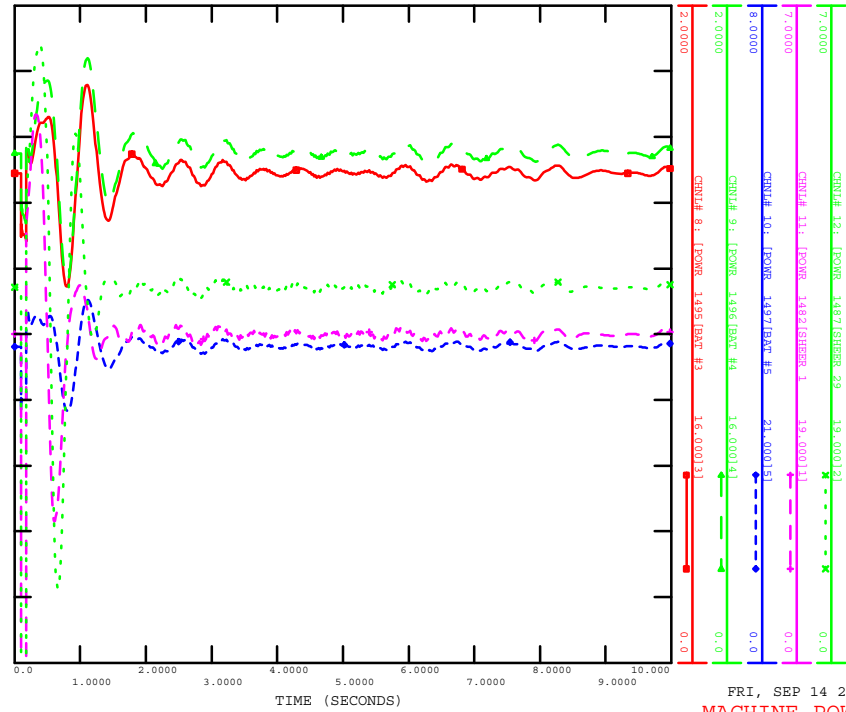
FILE: B-11.out



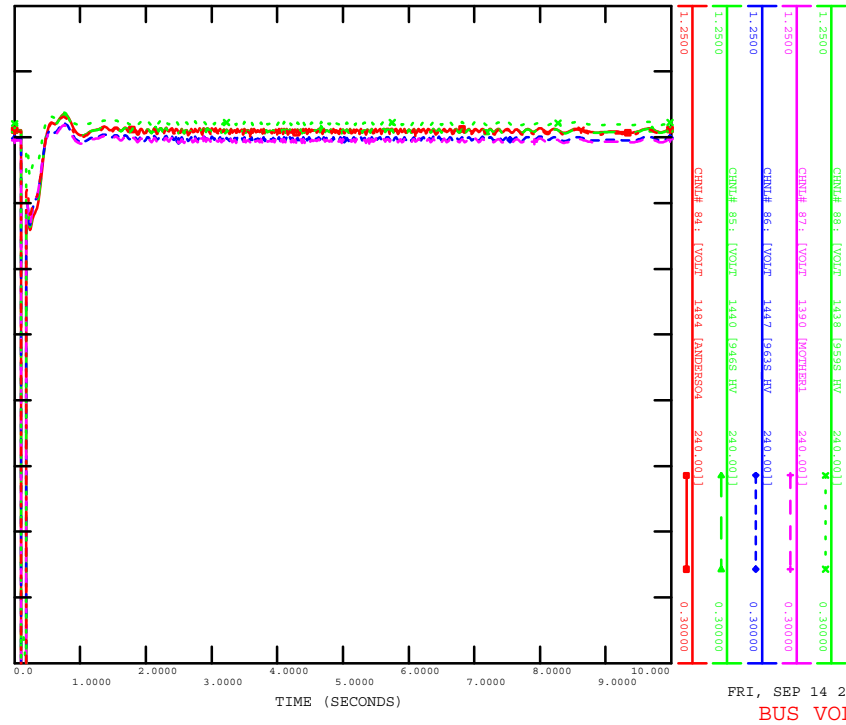
FILE: B-11.out



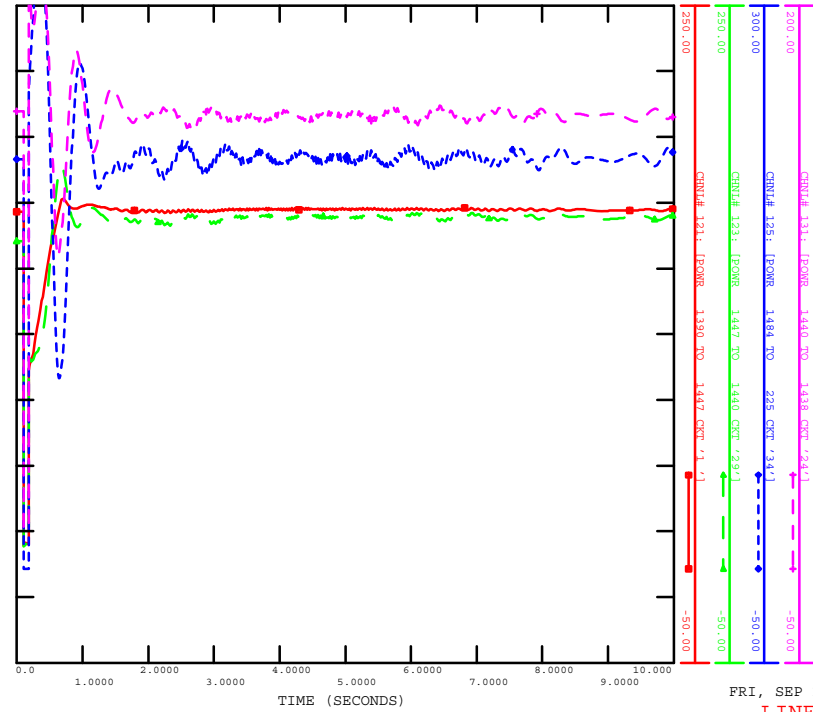
FILE: B-11.out



FILE: B-11.out

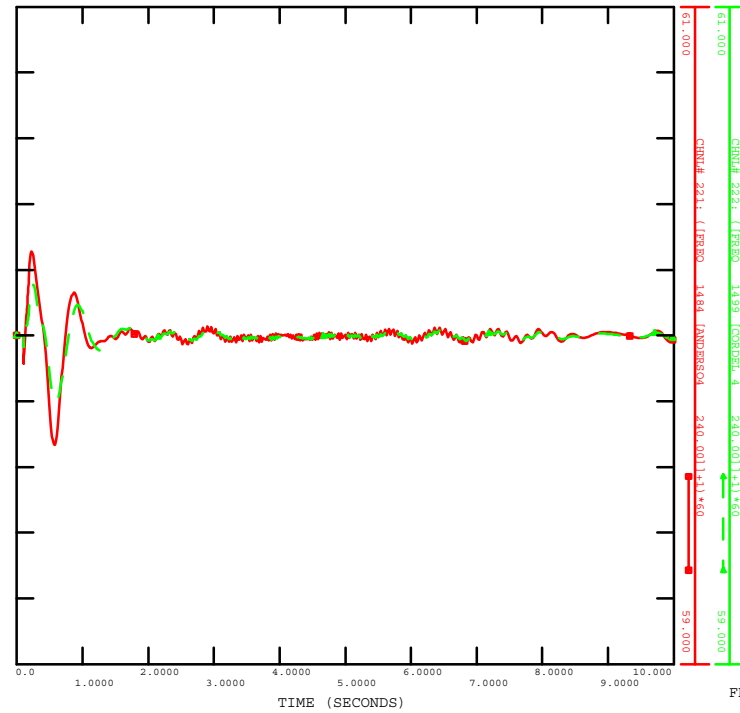


FILE: B-11.out



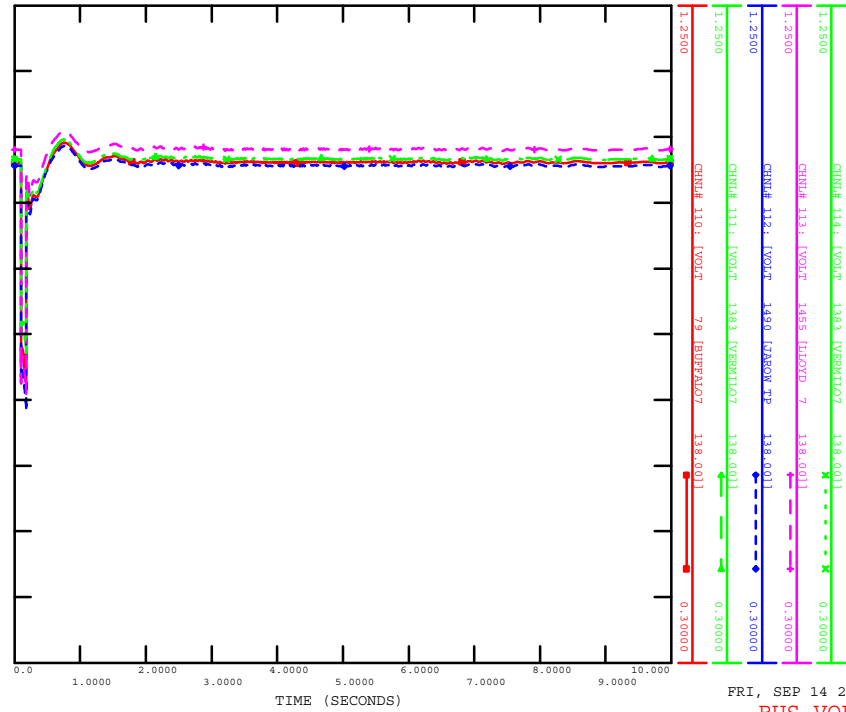
FRI, SEP 14 2012 11:12
LINE FLOW (P)

FILE: B-11.out



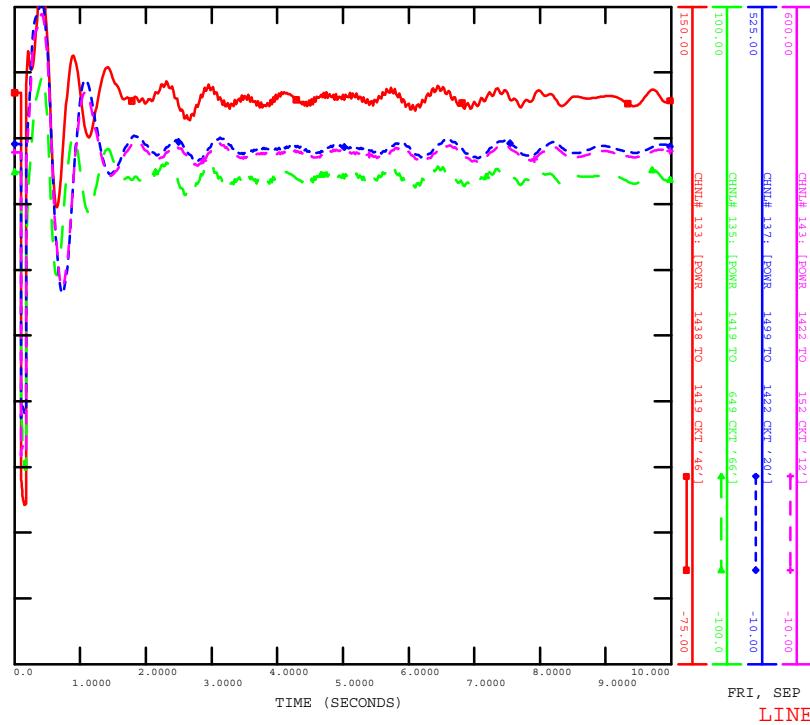
FRI, SEP 14 2012 11:12
BUS FREQUENCY

FILE: B-11.out



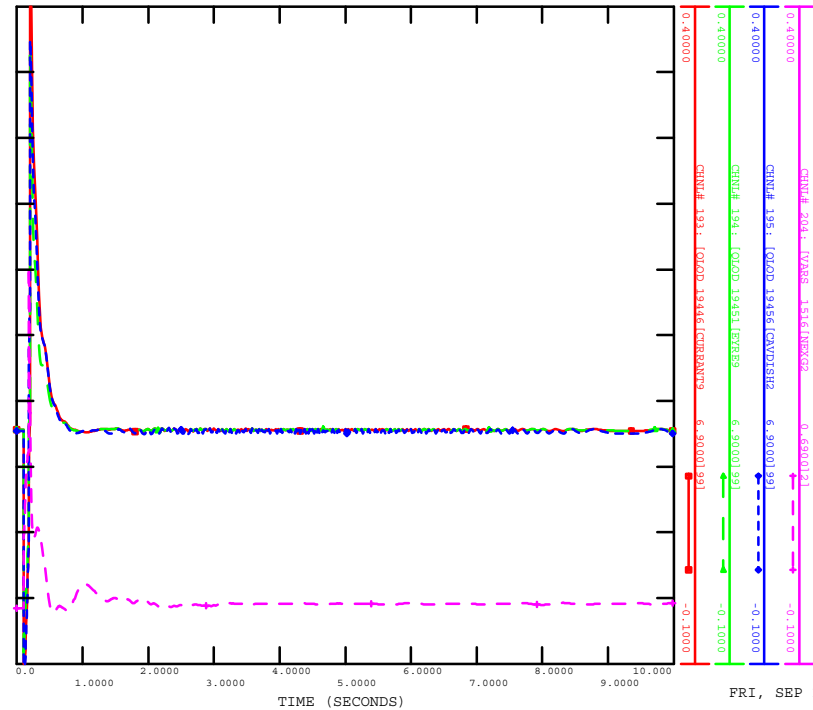
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-11.out

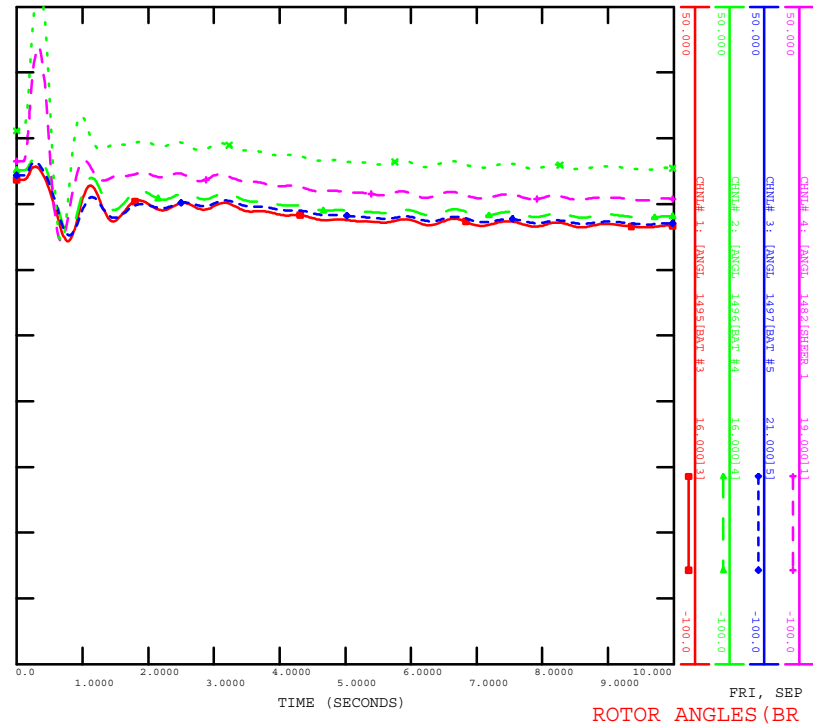


FRI, SEP 14 2012 11:12
LINE FLOW (P)

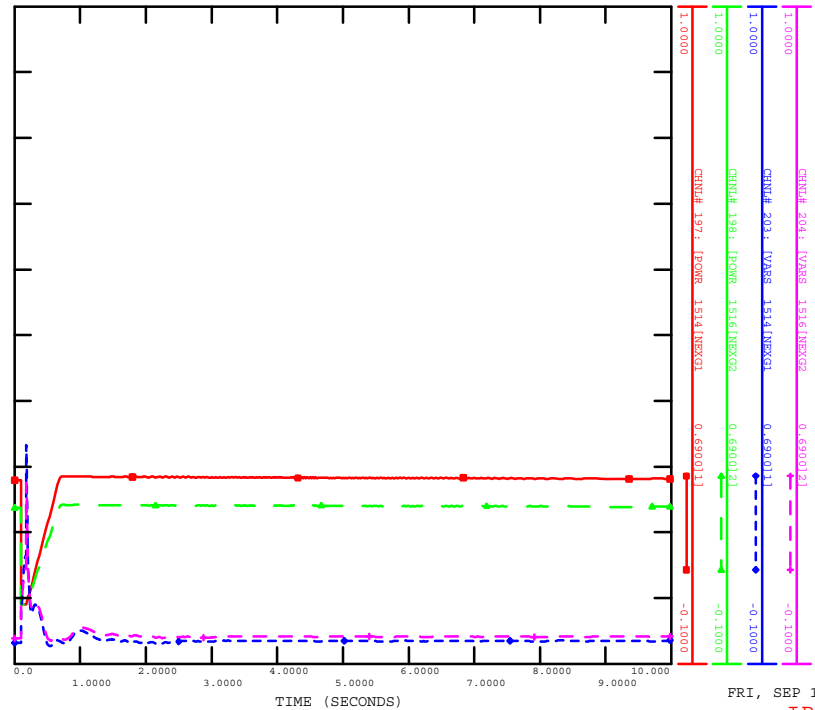
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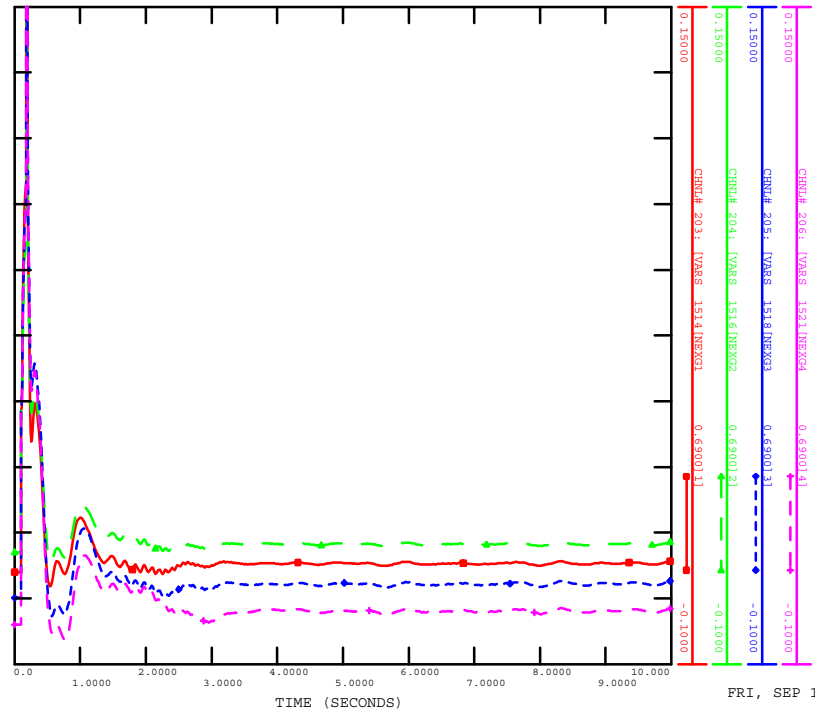
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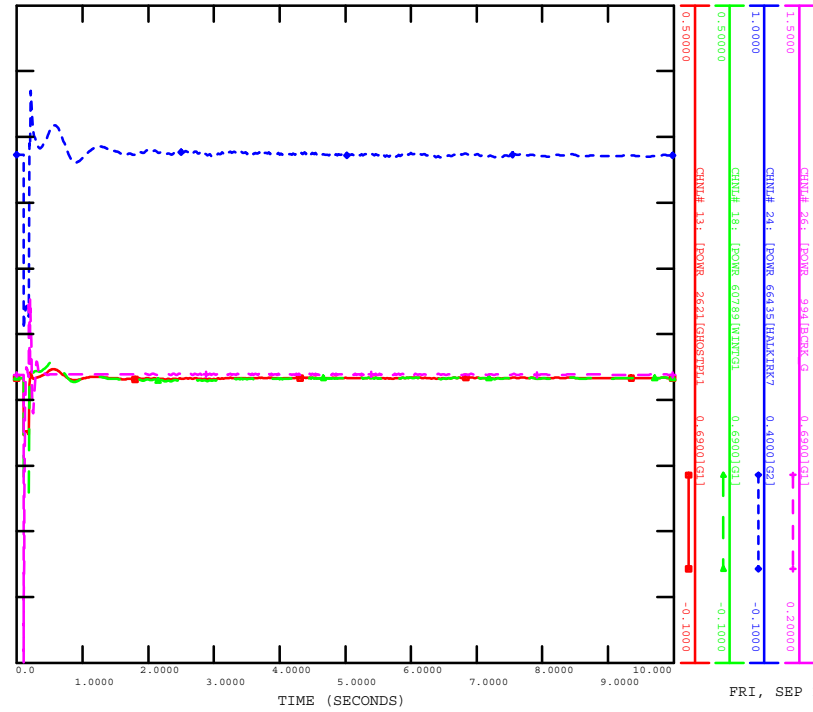
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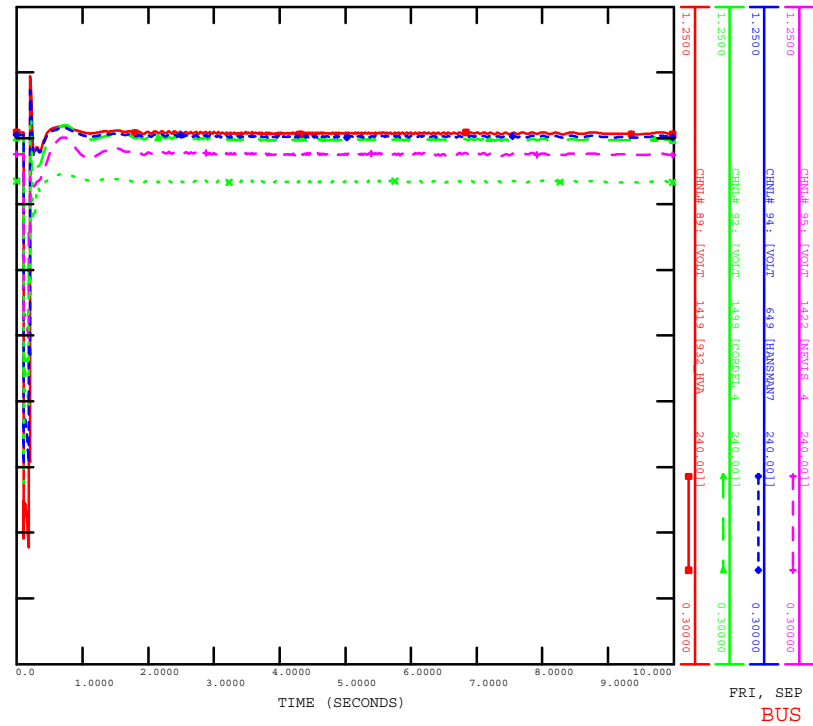
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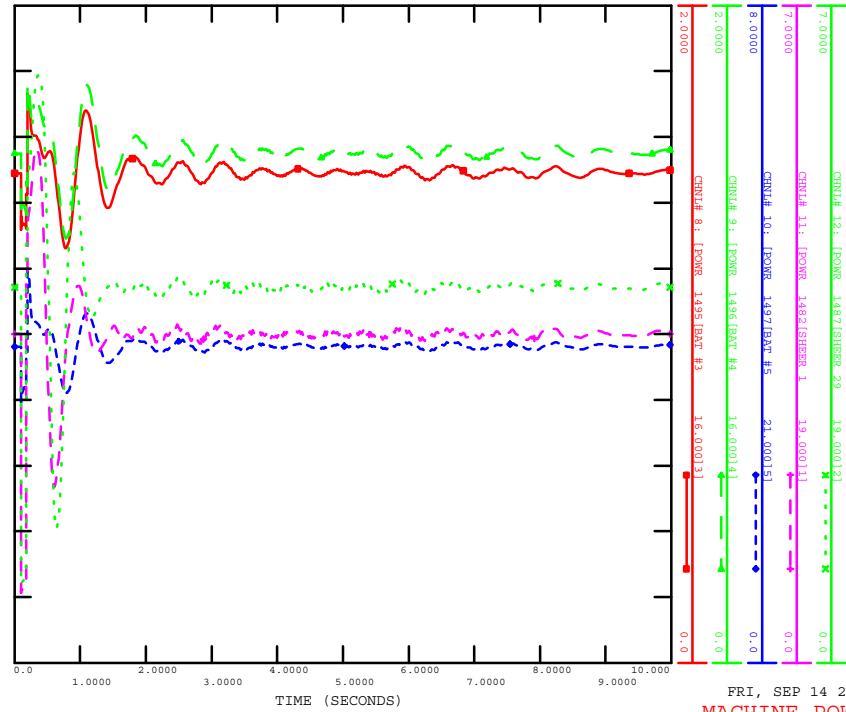
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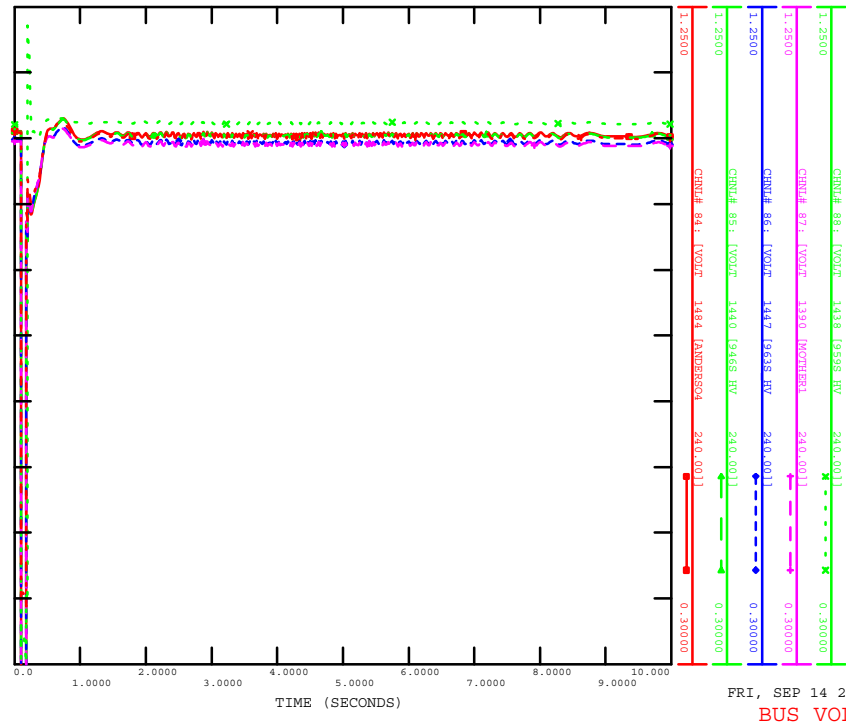
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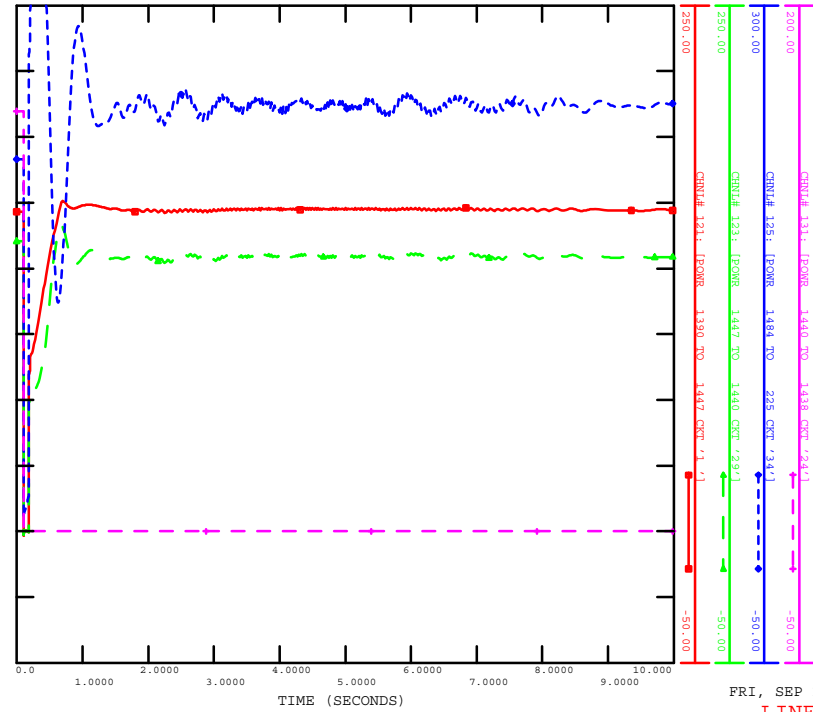
FILE: B-12.out



FILE: B-12.out

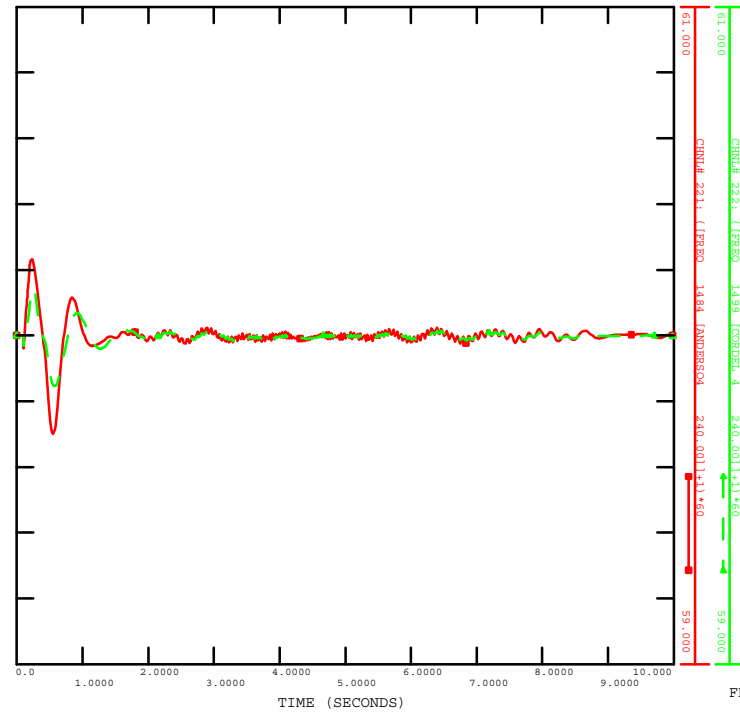


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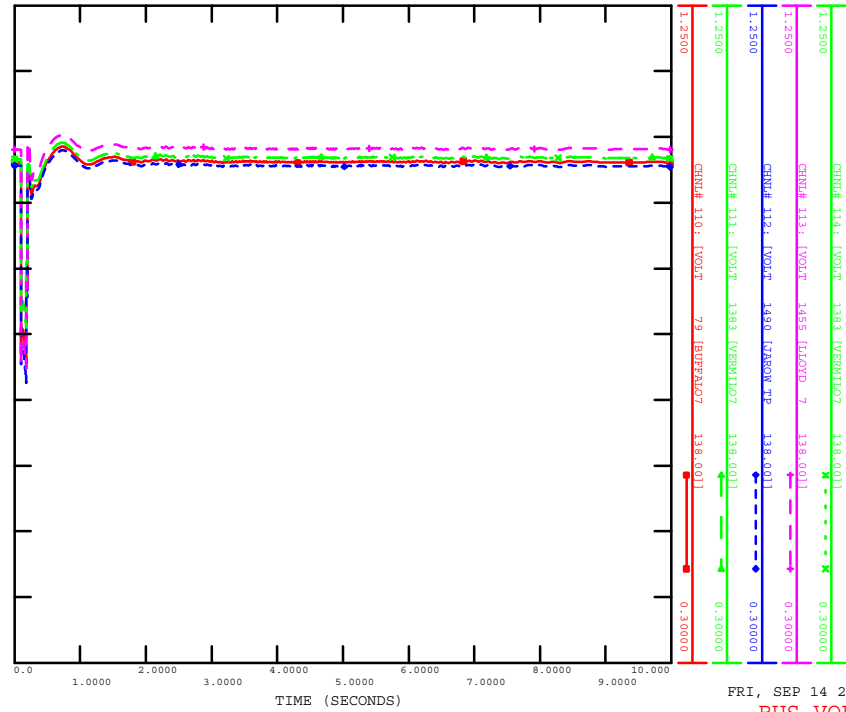
FRI, SEP 14 2012 11:12
LINE FLOW (P)

FILE: B-12.out



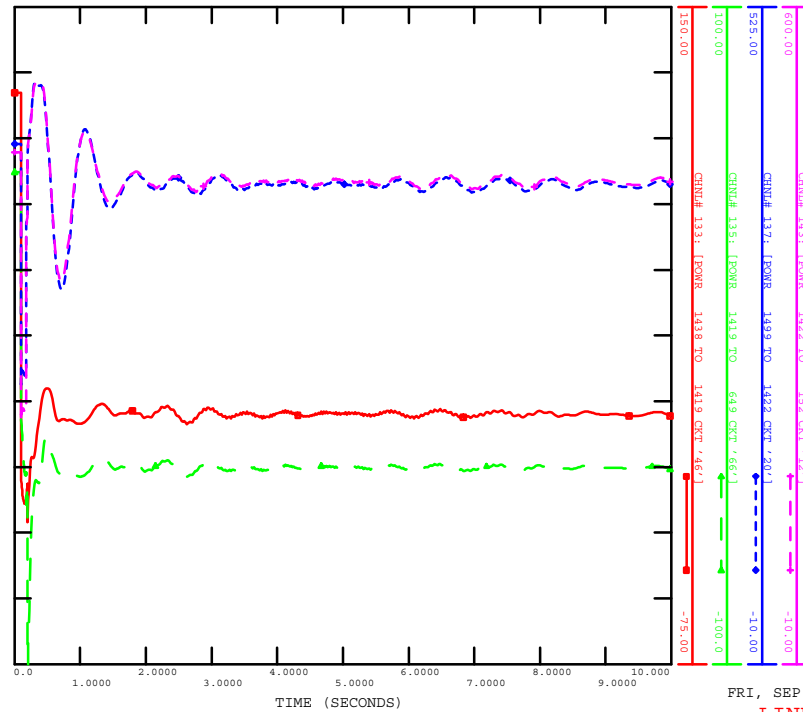
FRI, SEP 14 2012 11:12
BUS FREQUENCY

FILE: B-12.out



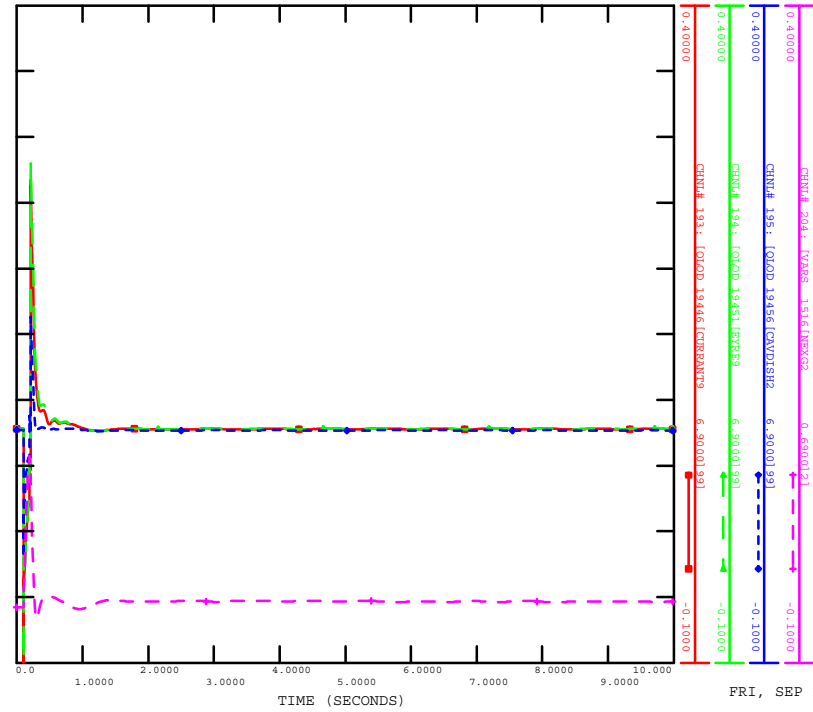
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-12.out

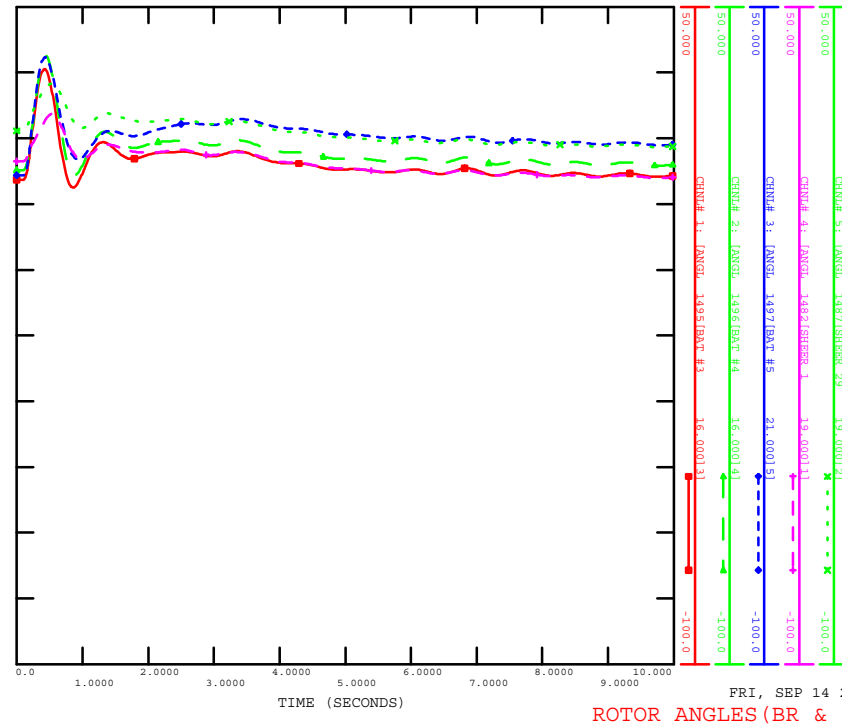


FRI, SEP 14 2012 11:12
LINE FLOW (P)

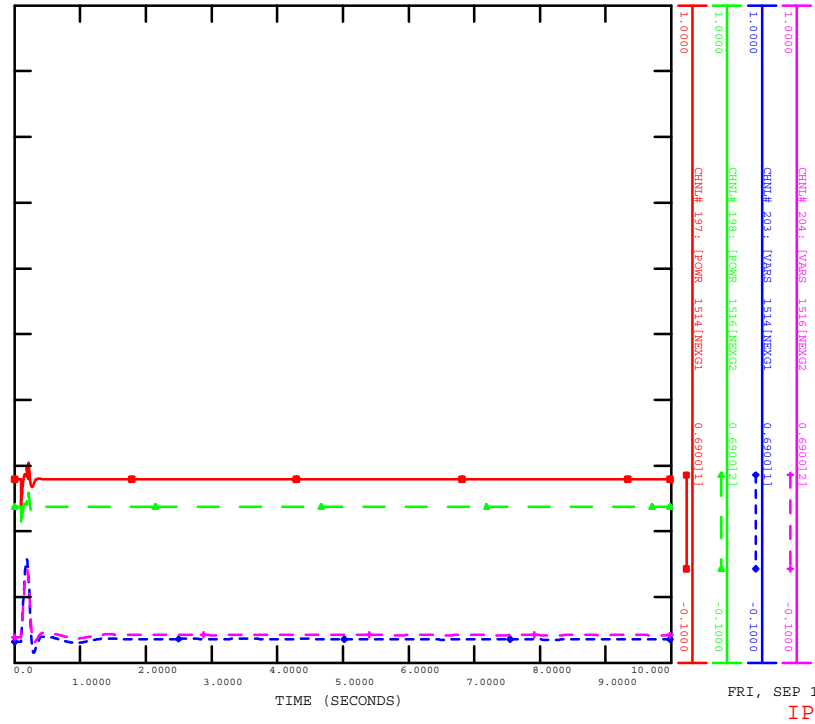
FILE: B-33.out



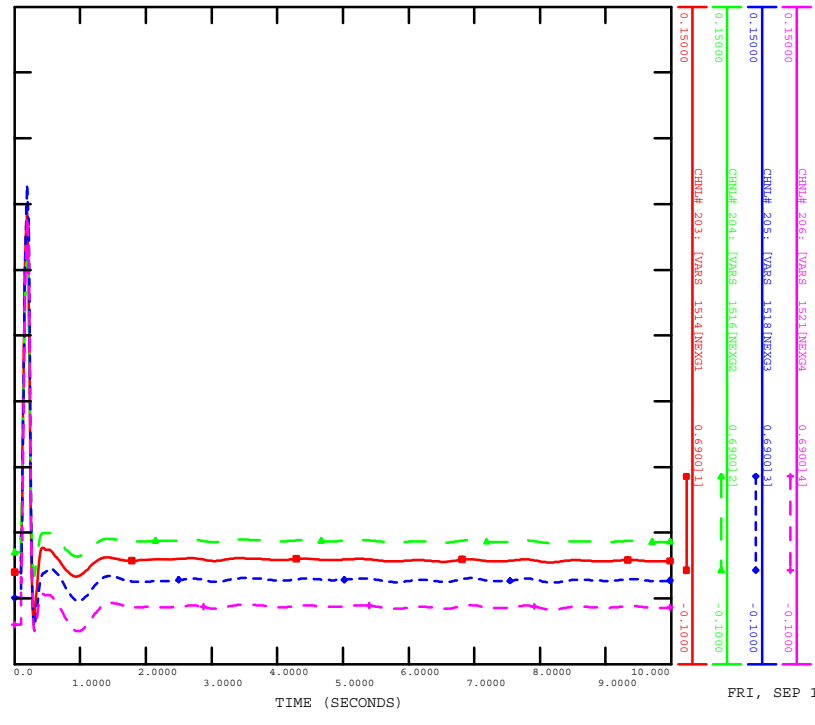
FILE: B-33.out



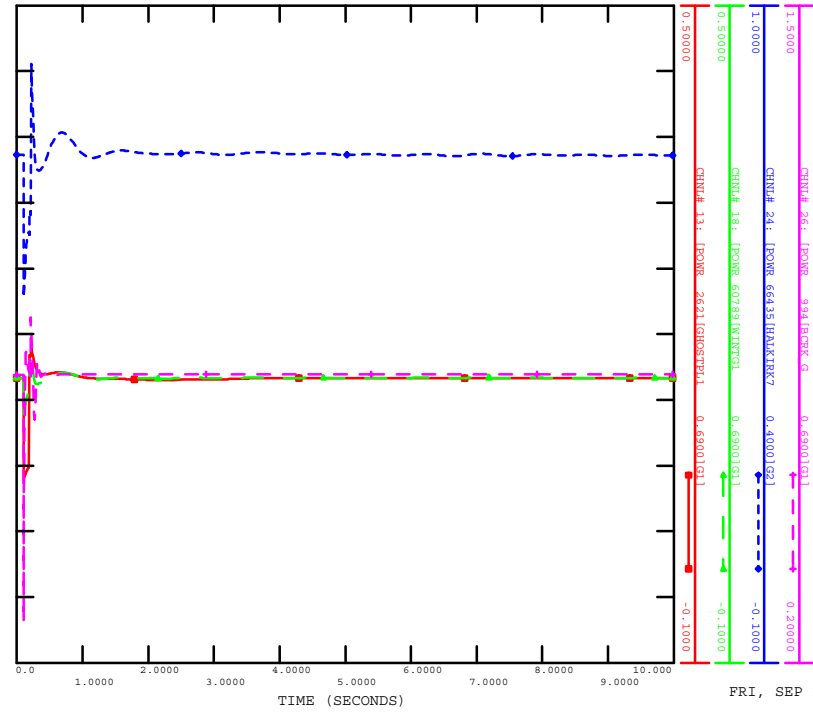
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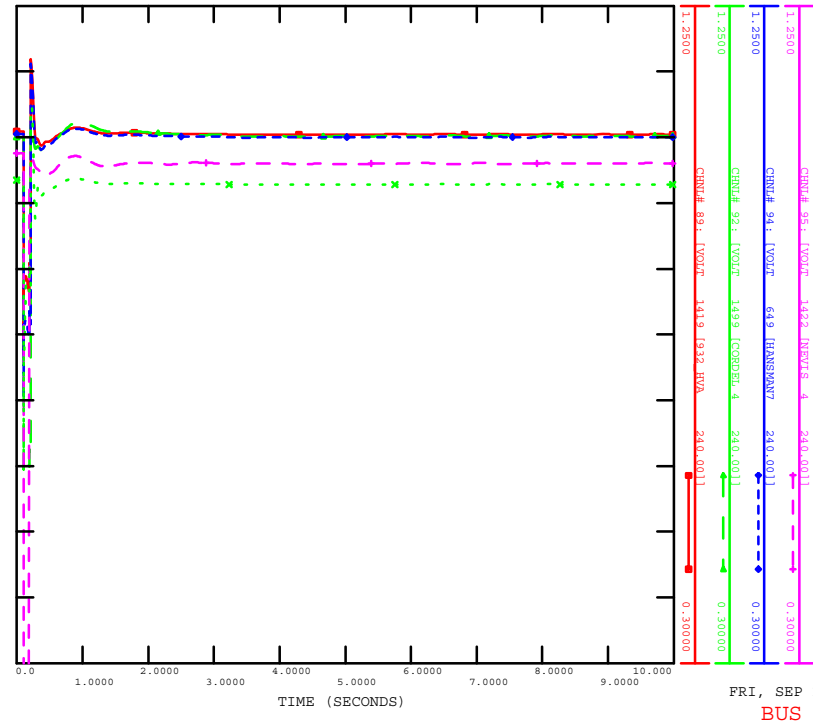
FILE: B-33.out



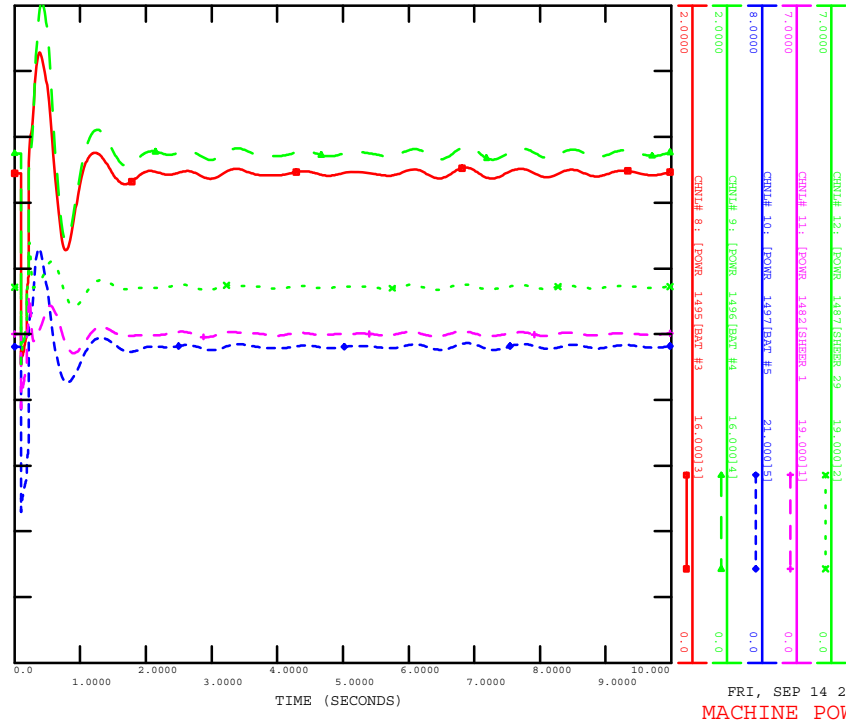
FILE: B-33.out



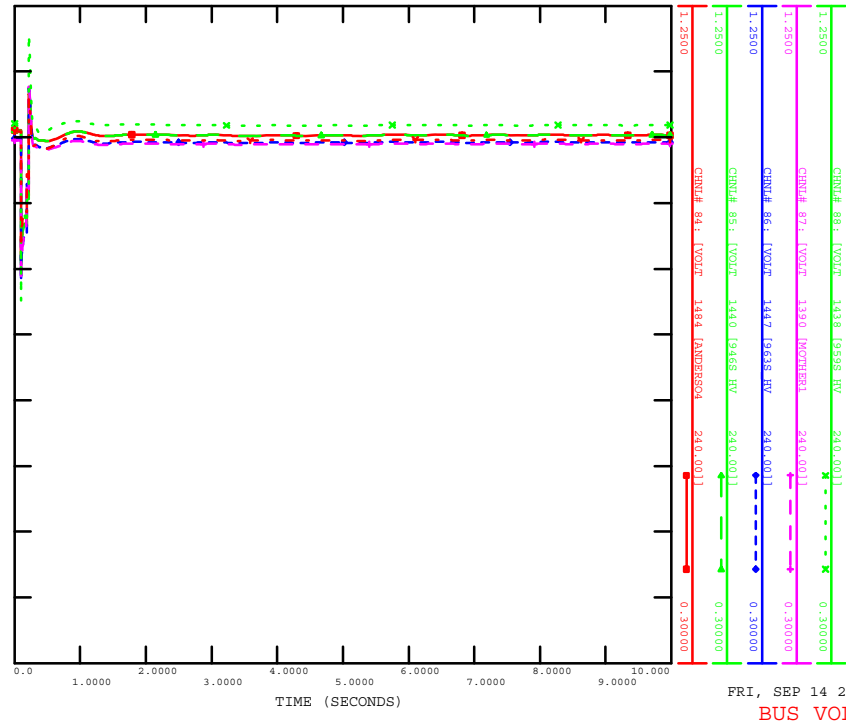
FILE: B-33.out



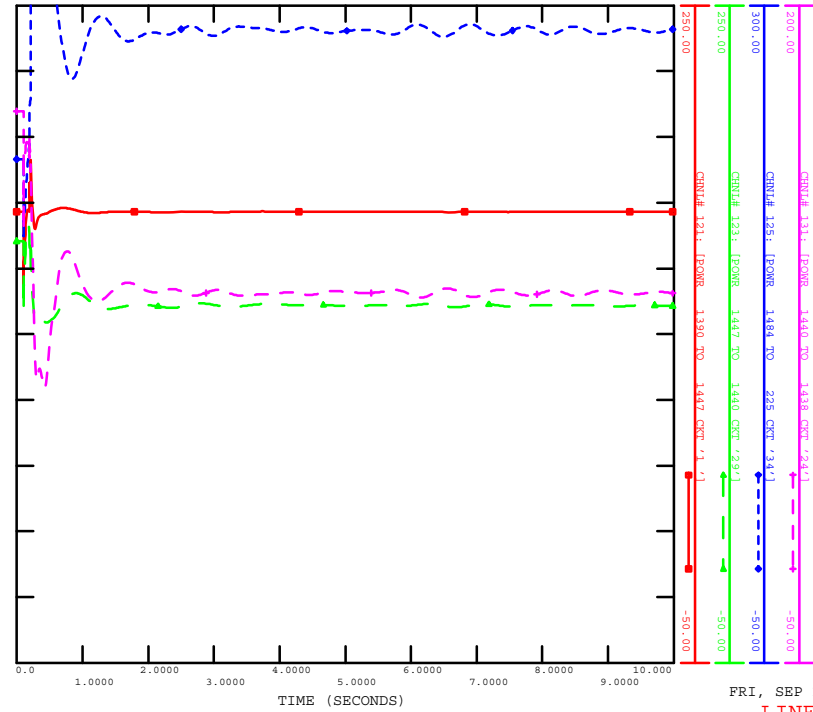
FILE: B-33.out



FILE: B-33.out

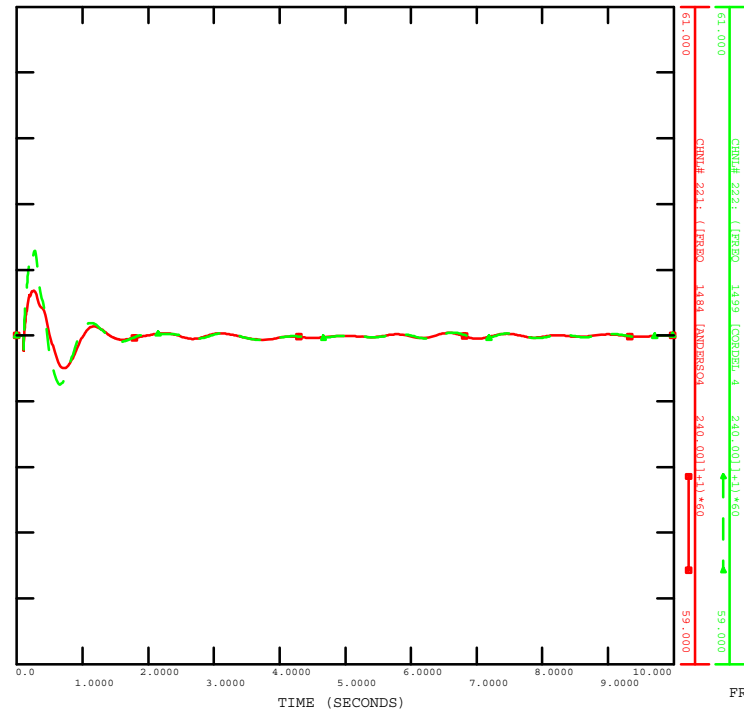


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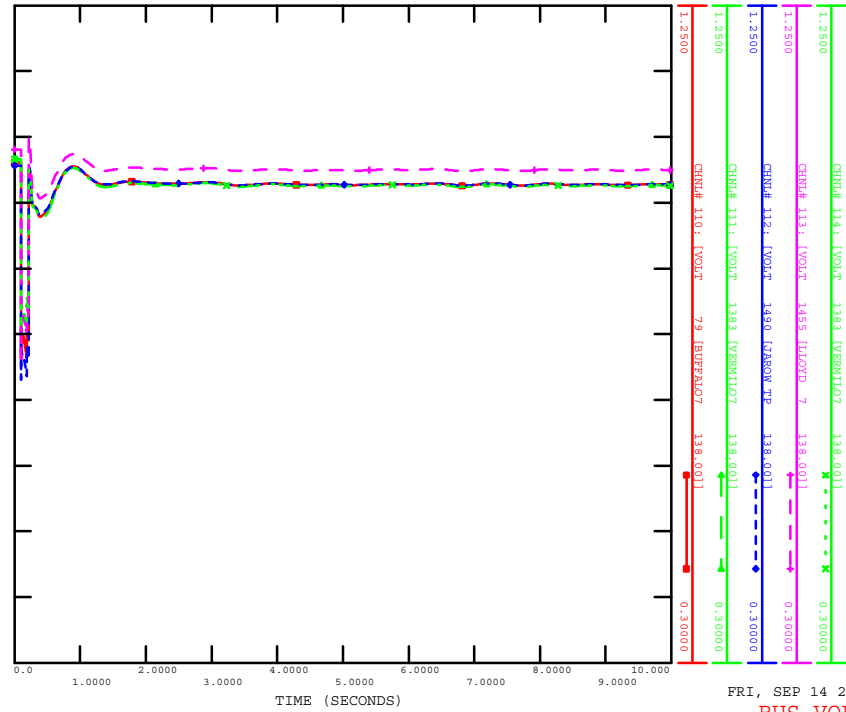
FRI, SEP 14 2012 11:13
LINE FLOW (P)

FILE: B-33.out



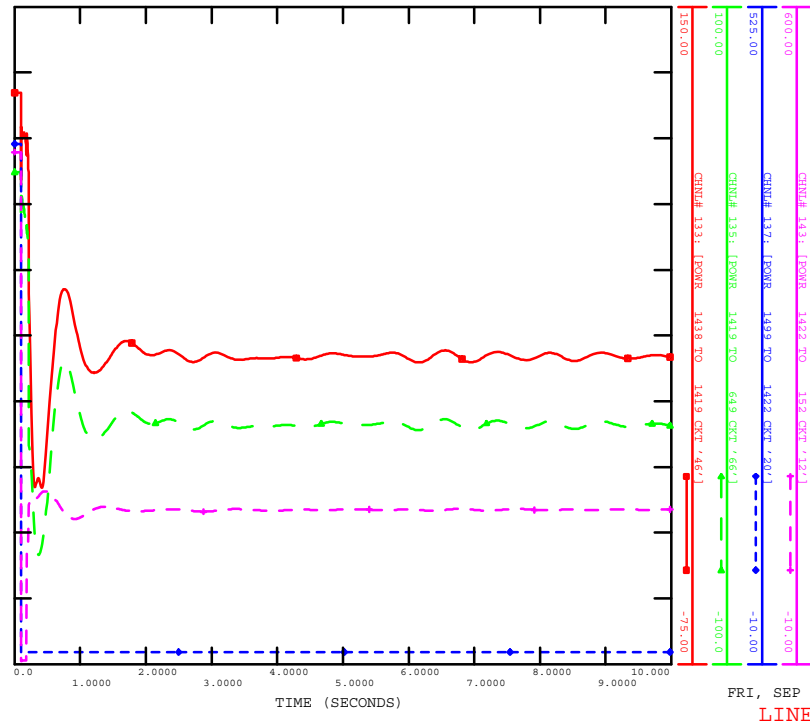
FRI, SEP 14 2012 11:13
BUS FREQUENCY

FILE: B-33.out



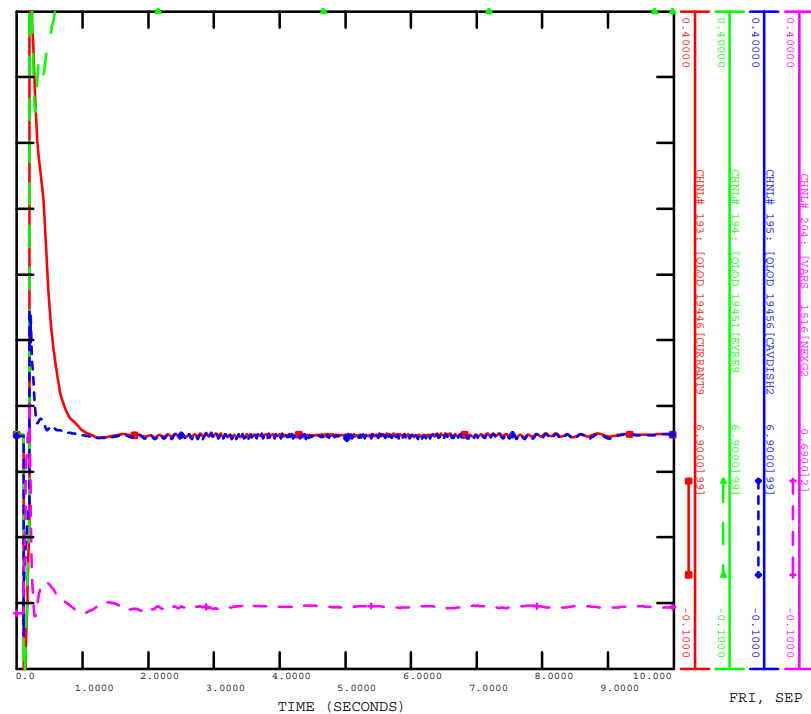
FRI, SEP 14 2012 11:13
BUS VOLT (PU)

FILE: B-33.out

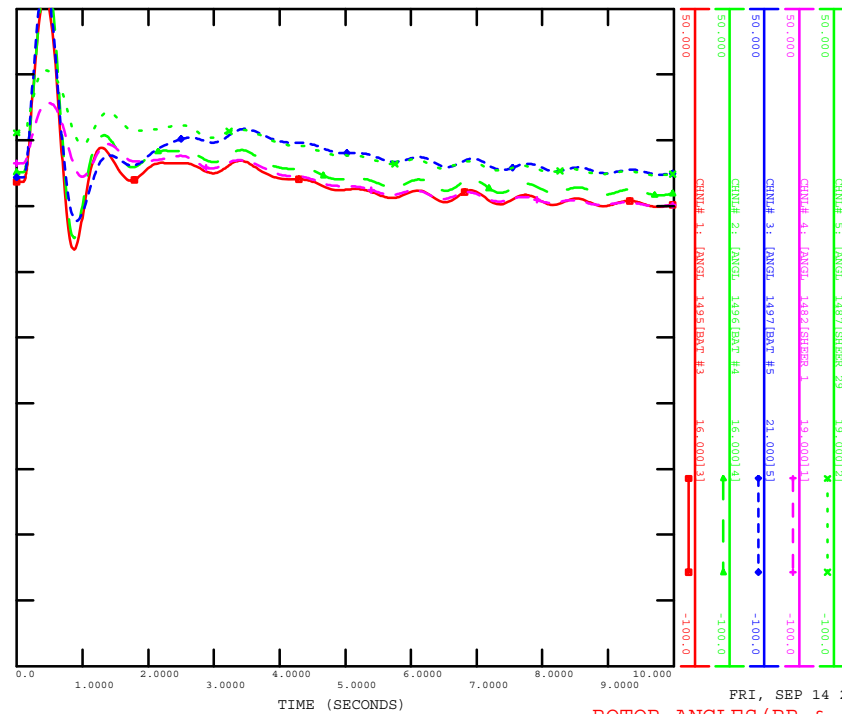


FRI, SEP 14 2012 11:13
LINE FLOW (P)

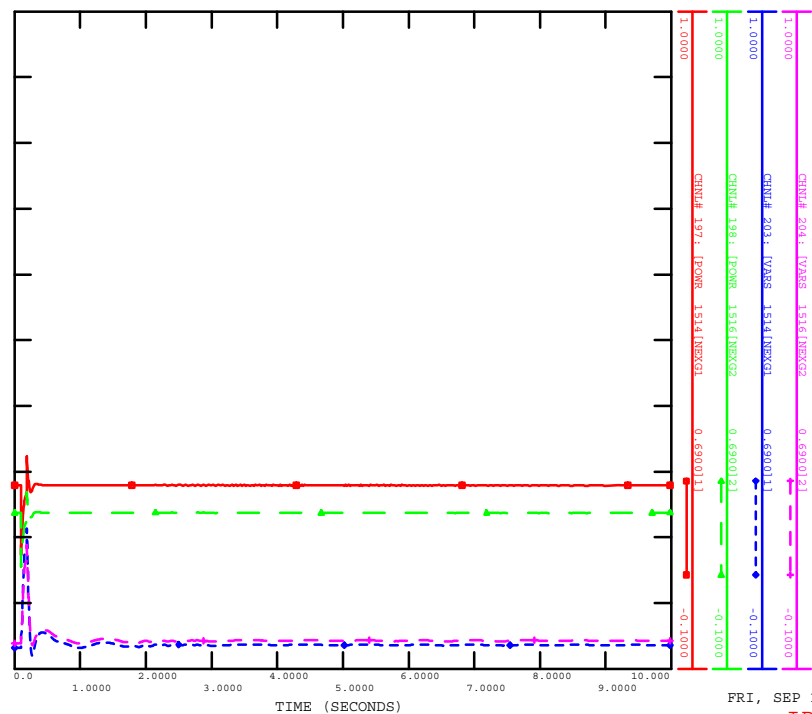
FILE: B-34.out



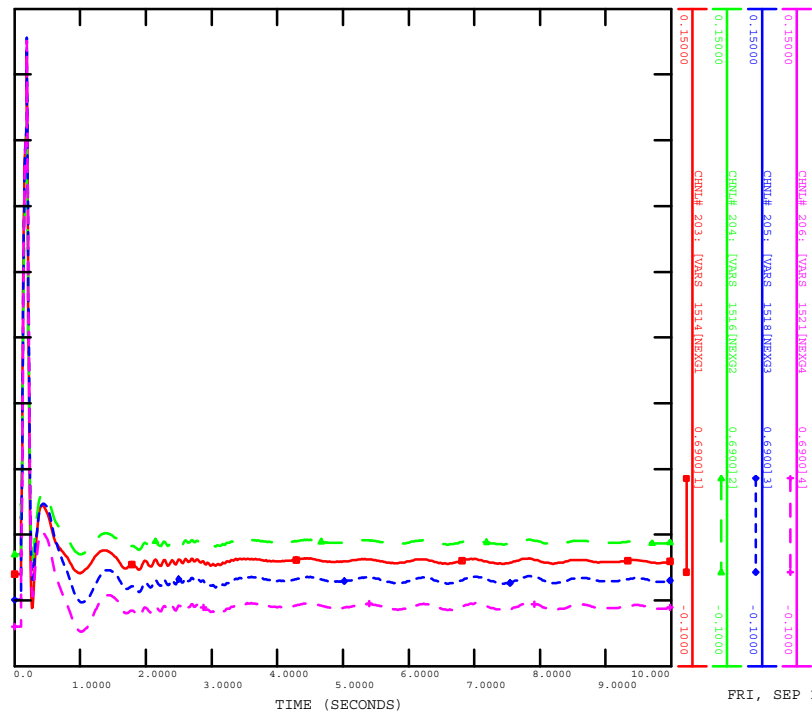
FILE: B-34.out



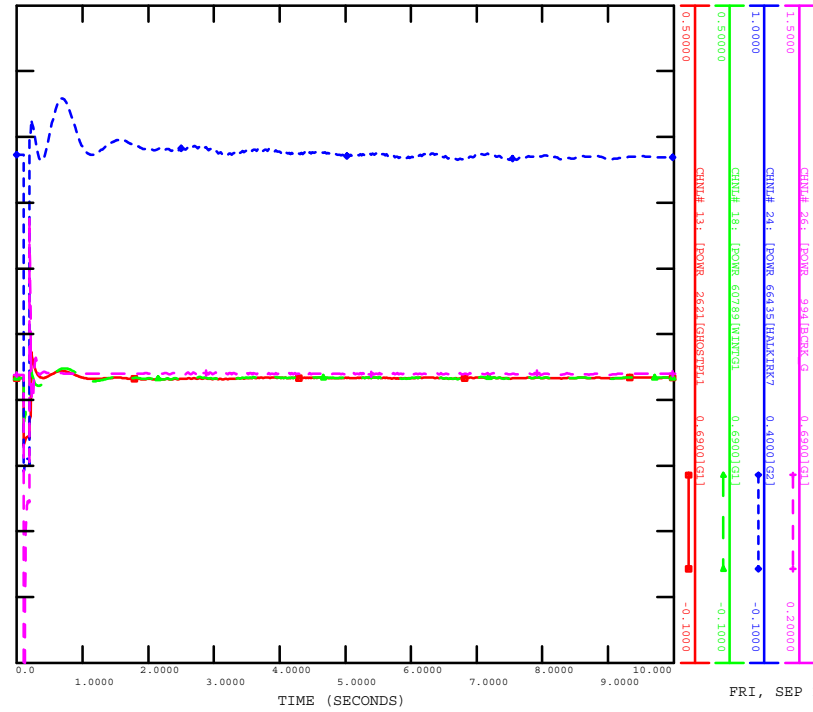
FILE: B-34.out



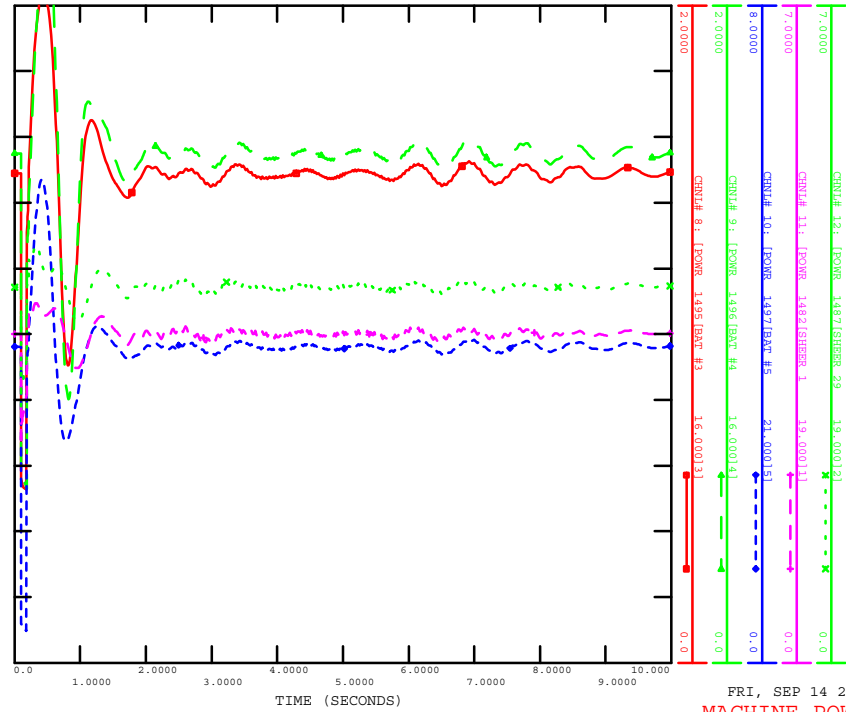
FILE: B-34.out



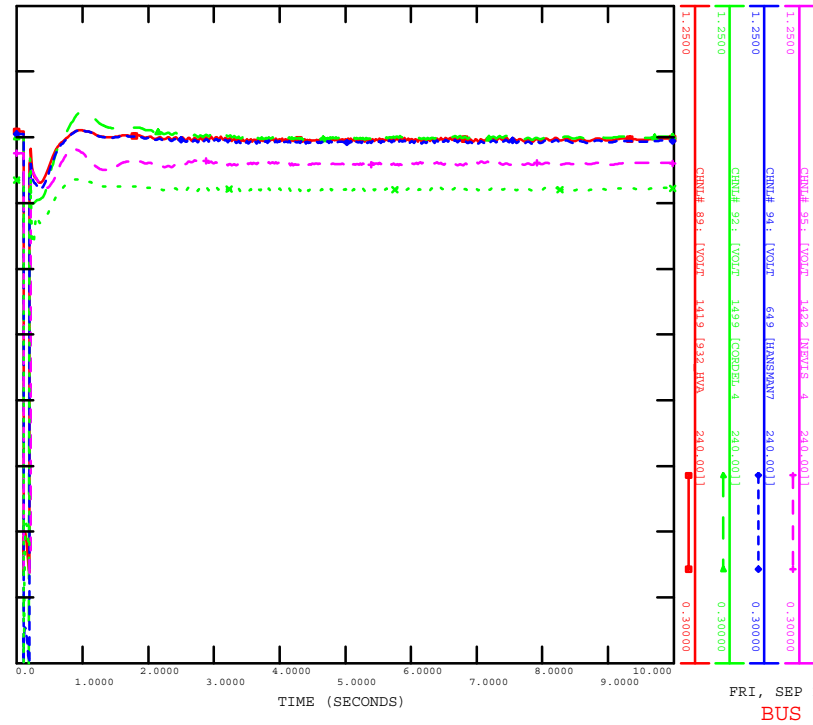
FILE: B-34.out



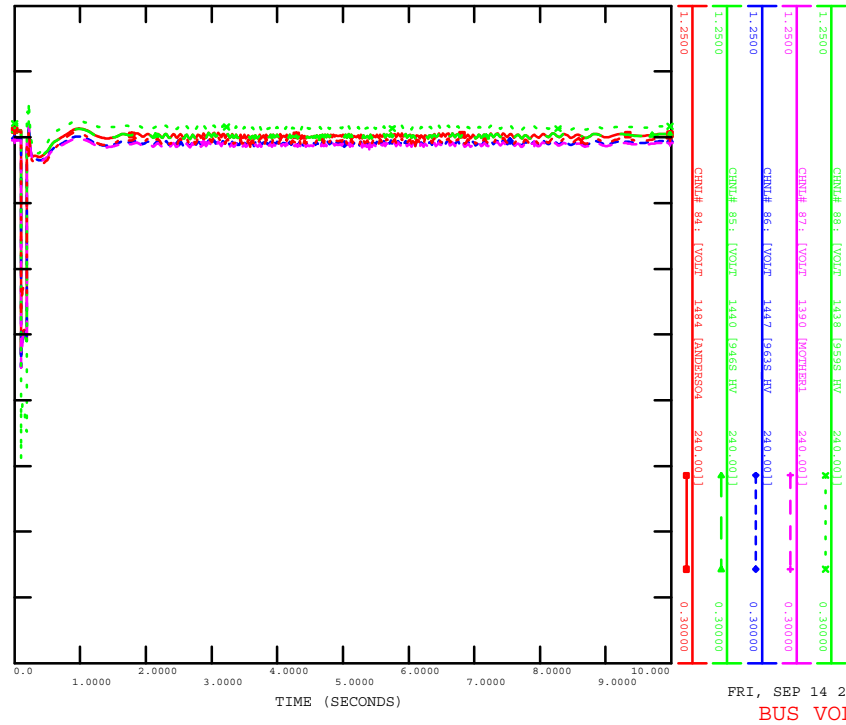
FILE: B-34.out



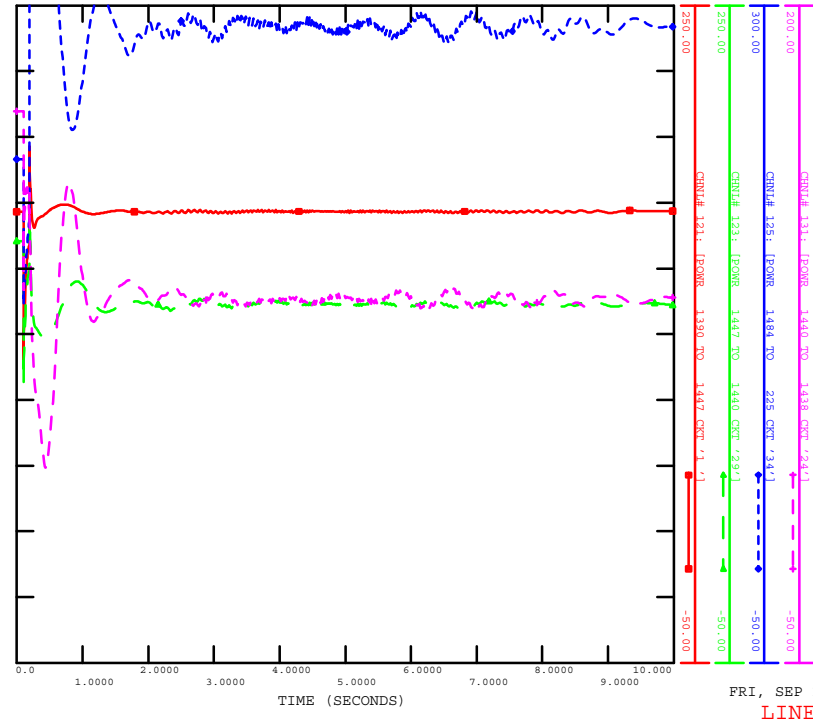
FILE: B-34.out



FILE: B-34.out

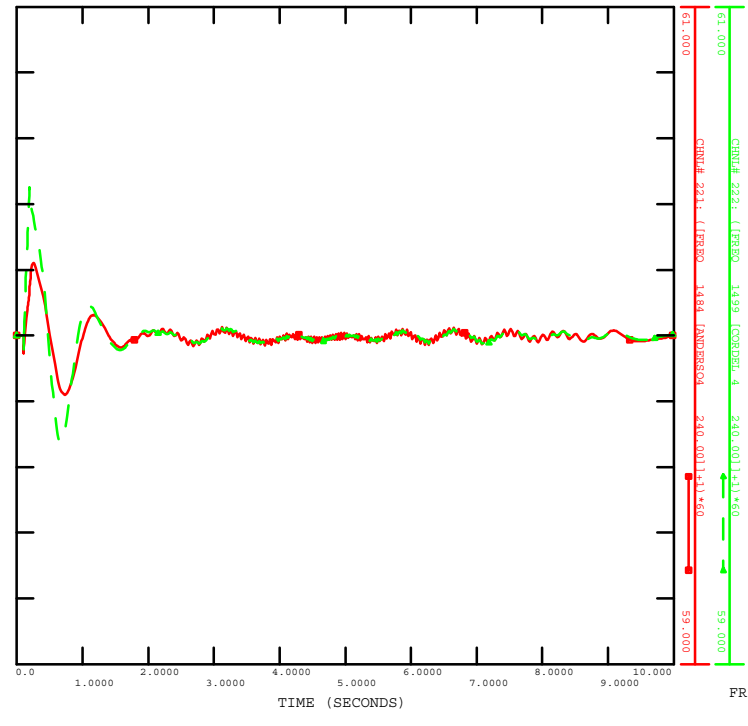


FILE: B-34.out



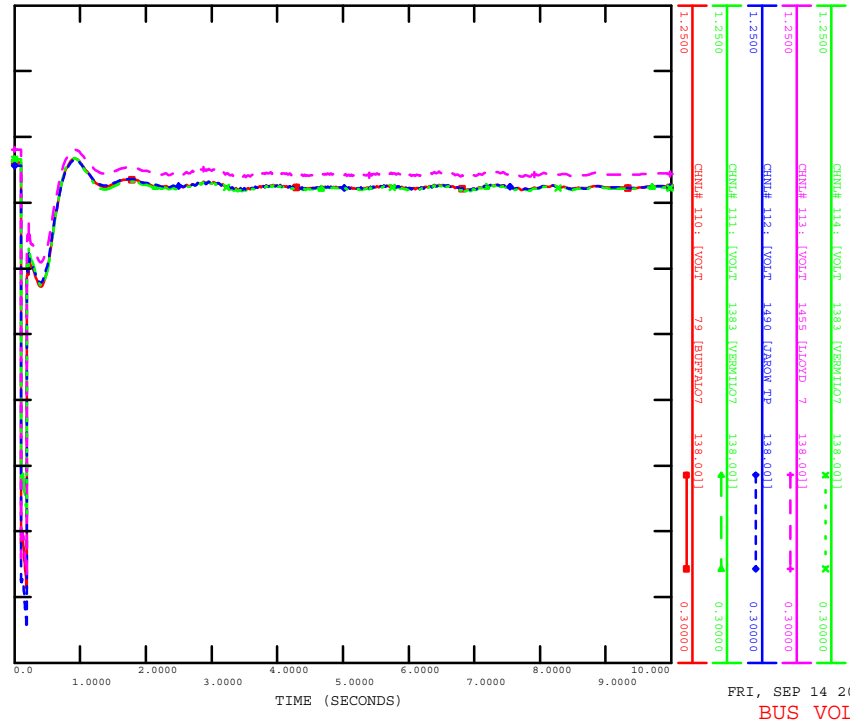
FRI, SEP 14 2012 11:13
LINE FLOW (P)

FILE: B-34.out



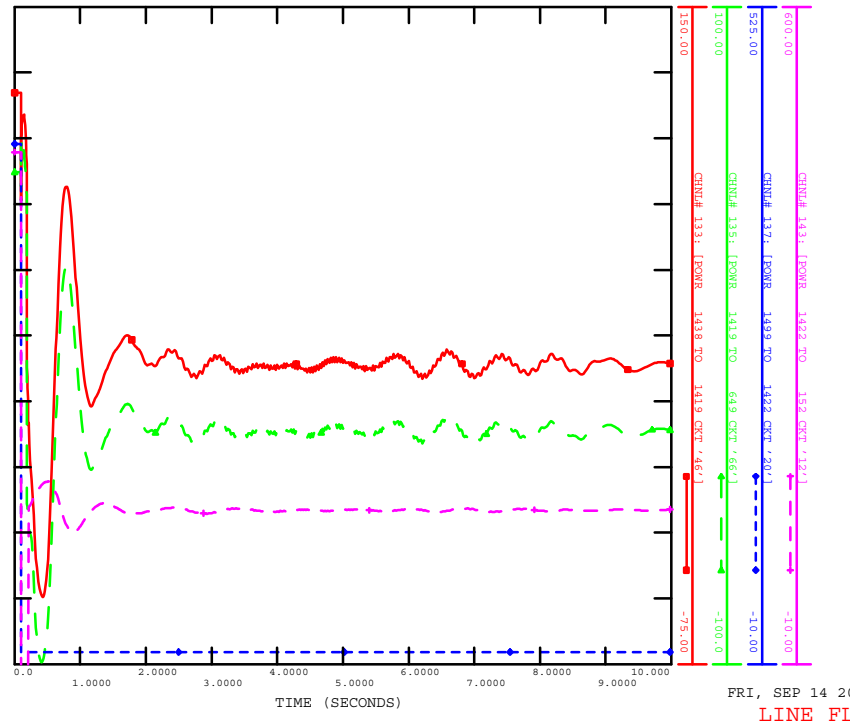
FRI, SEP 14 2012 11:13
BUS FREQUENCY

FILE: B-34.out



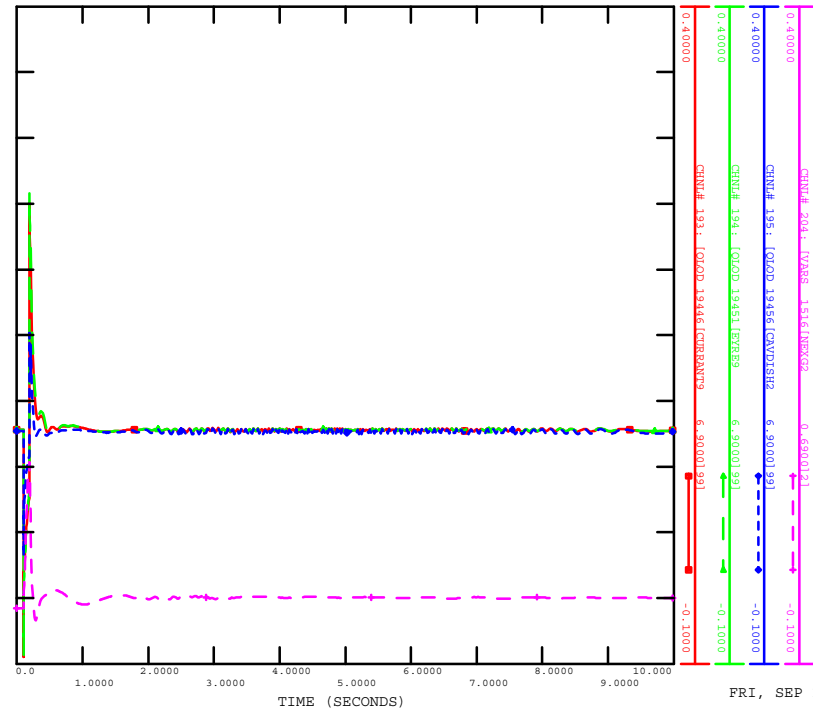
FRI, SEP 14 2012 11:13
BUS VOLT (PU)

FILE: B-34.out



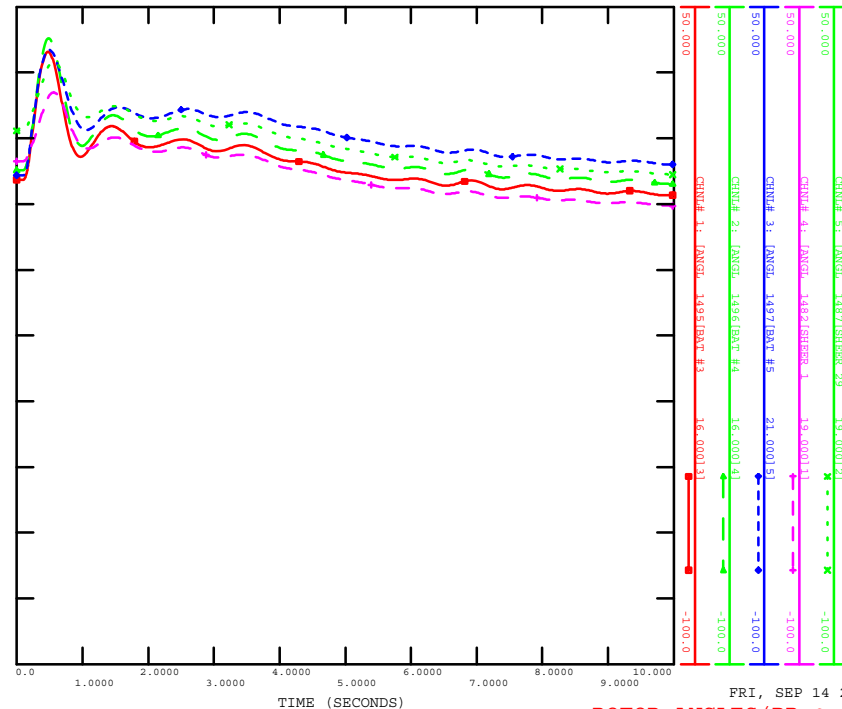
FRI, SEP 14 2012 11:13
LINE FLOW (P)

FILE: B-35.out



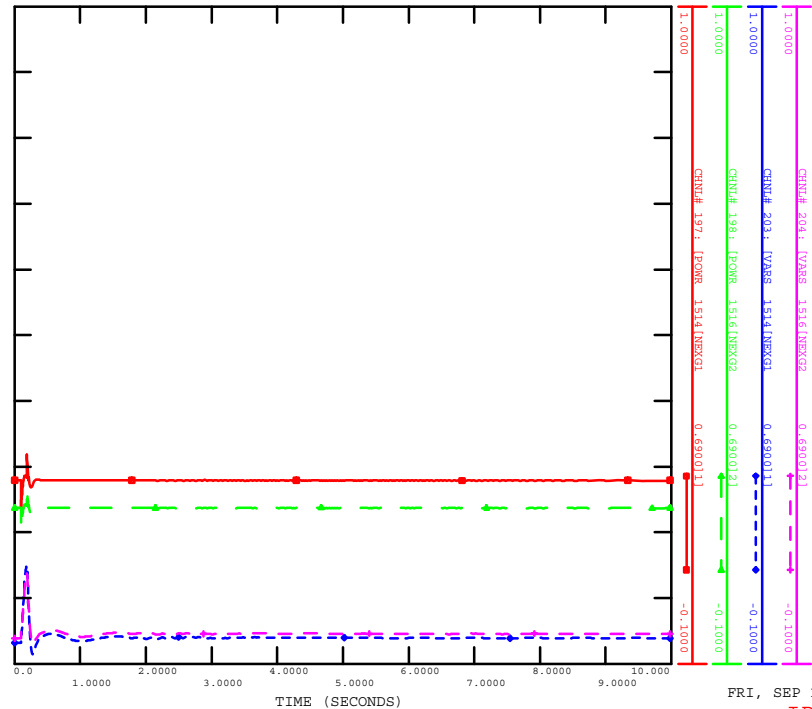
FRI, SEP 14 2012 11:13
IP678 (P)

FILE: B-35.out



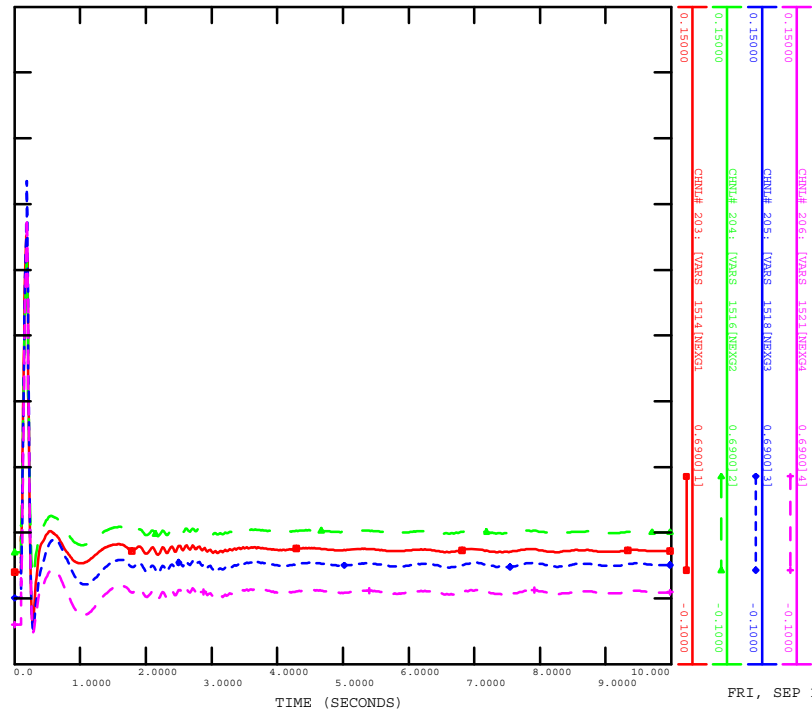
FRI, SEP 14 2012 11:13
ROTOR ANGLES (BR & SHEERNE)

FILE: B-35.out



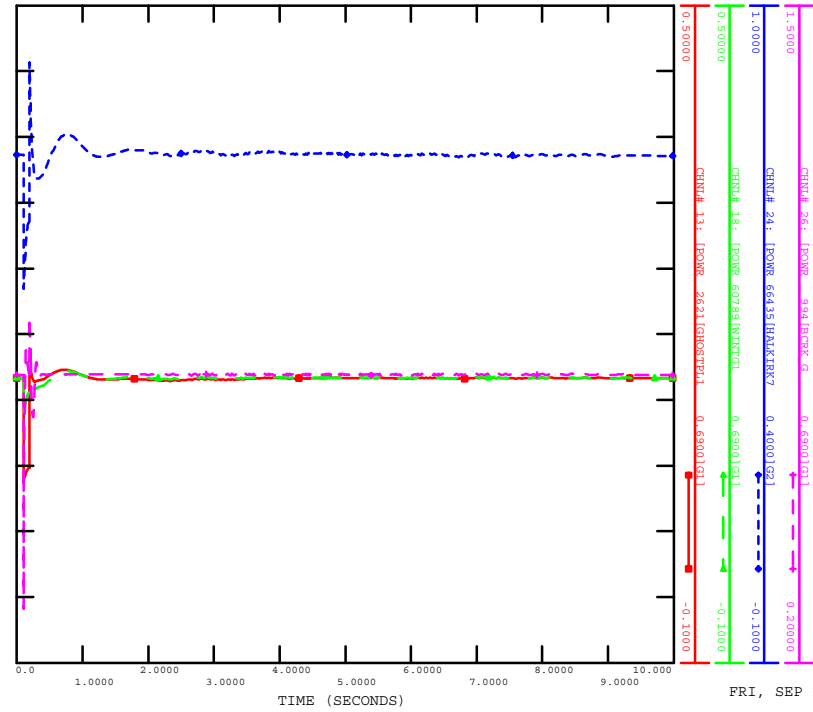
FRI, SEP 14 2012 11:13
IP635 (P&Q)

FILE: B-35.out

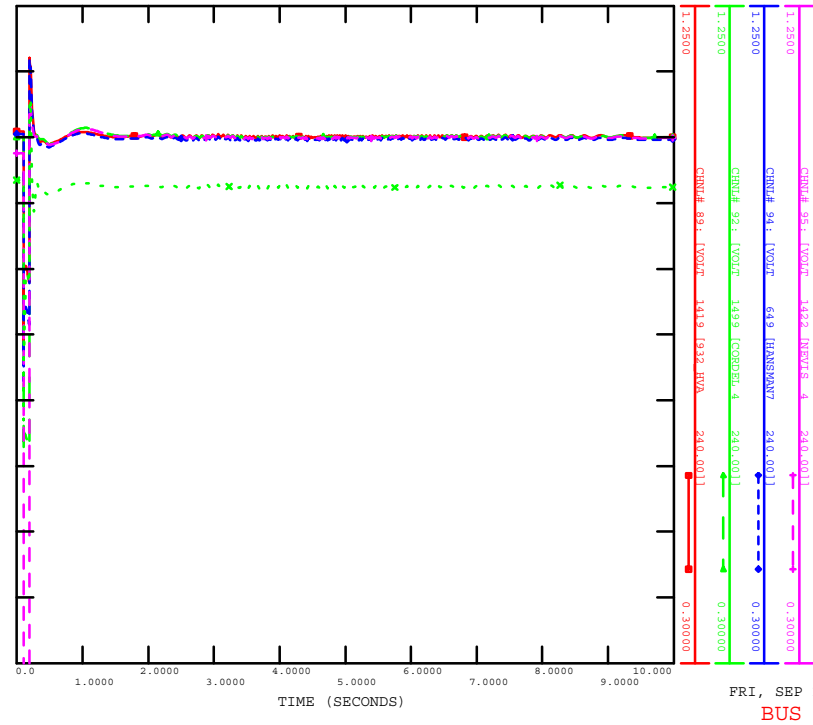


FRI, SEP 14 2012 11:13
IP678 (Q)

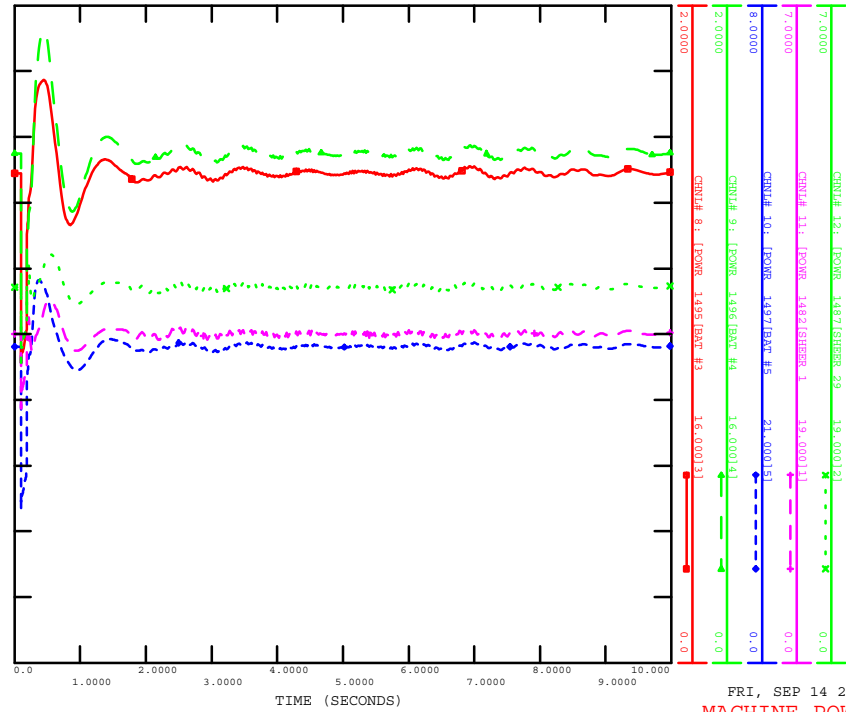
FILE: B-35.out



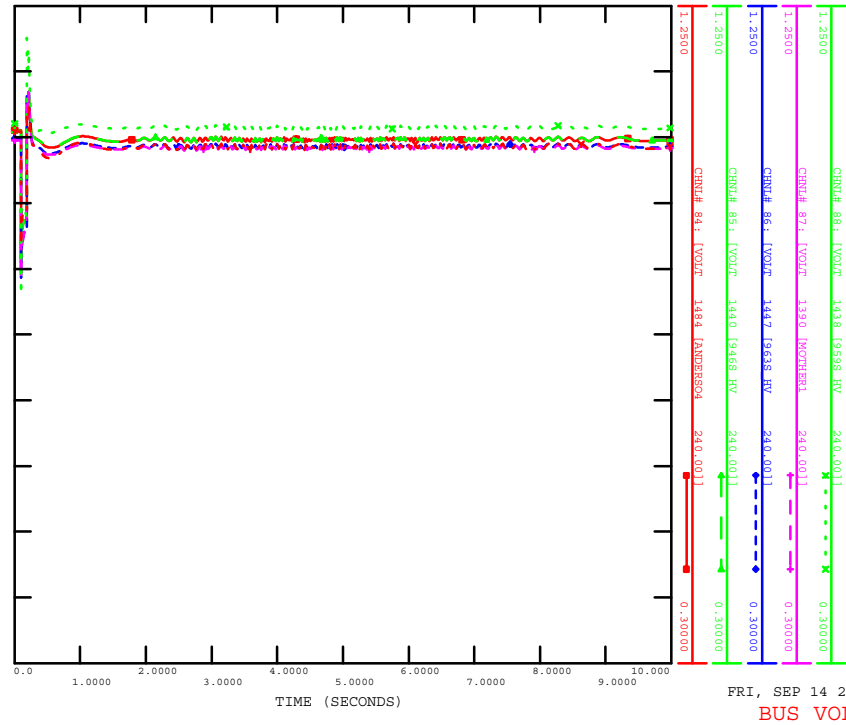
FILE: B-35.out



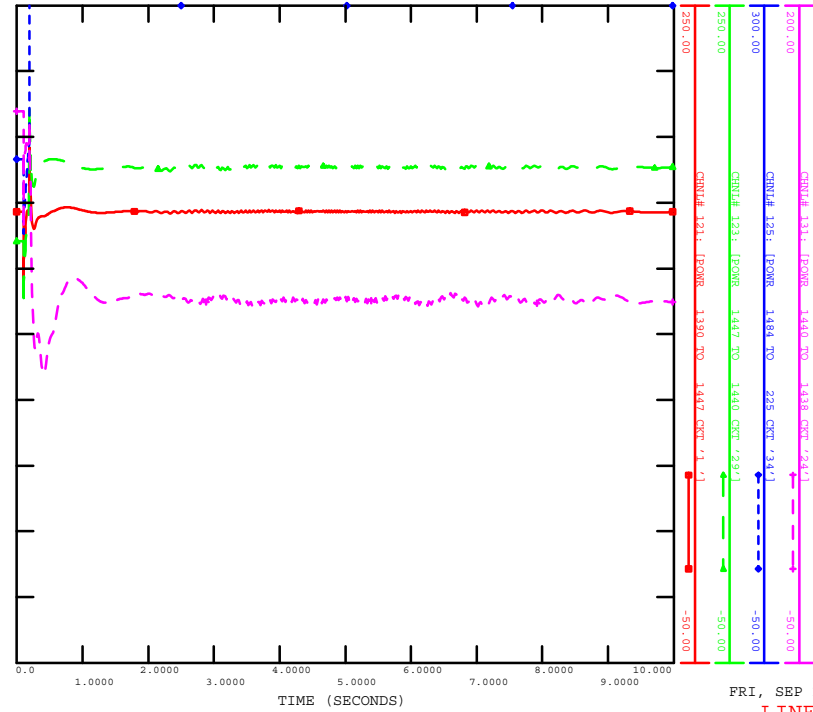
FILE: B-35.out



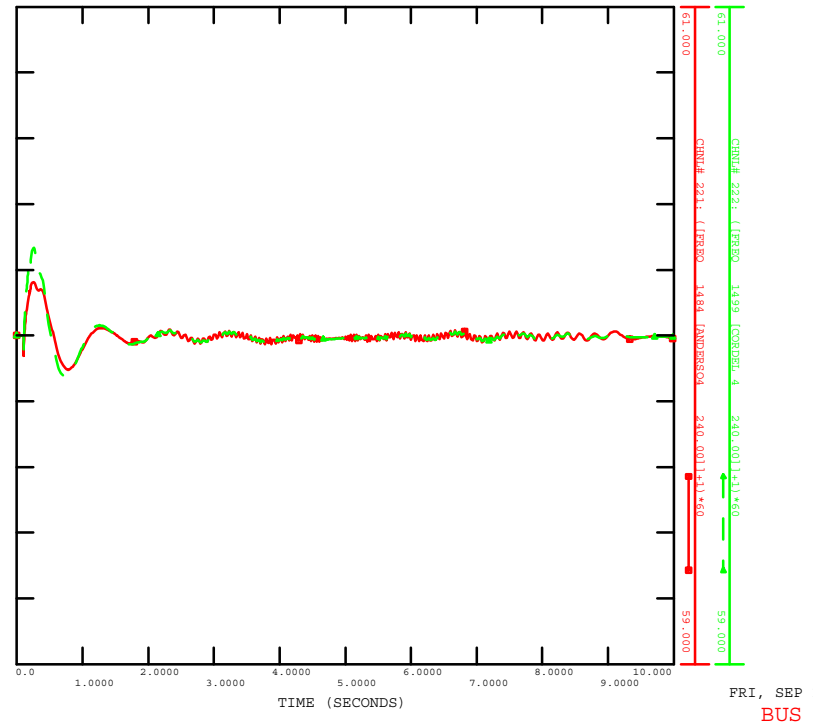
FILE: B-35.out



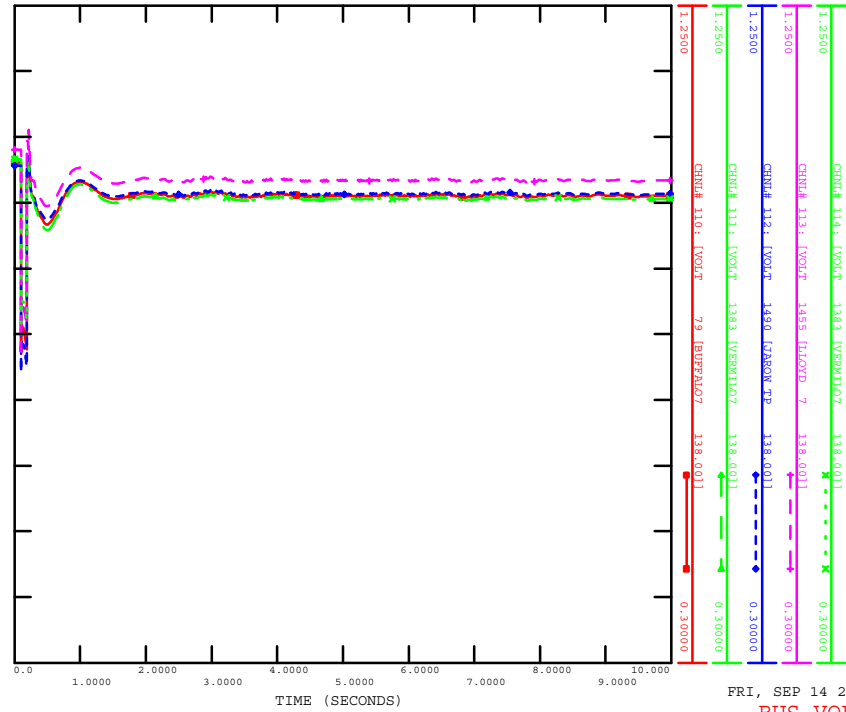
FILE: B-35.out



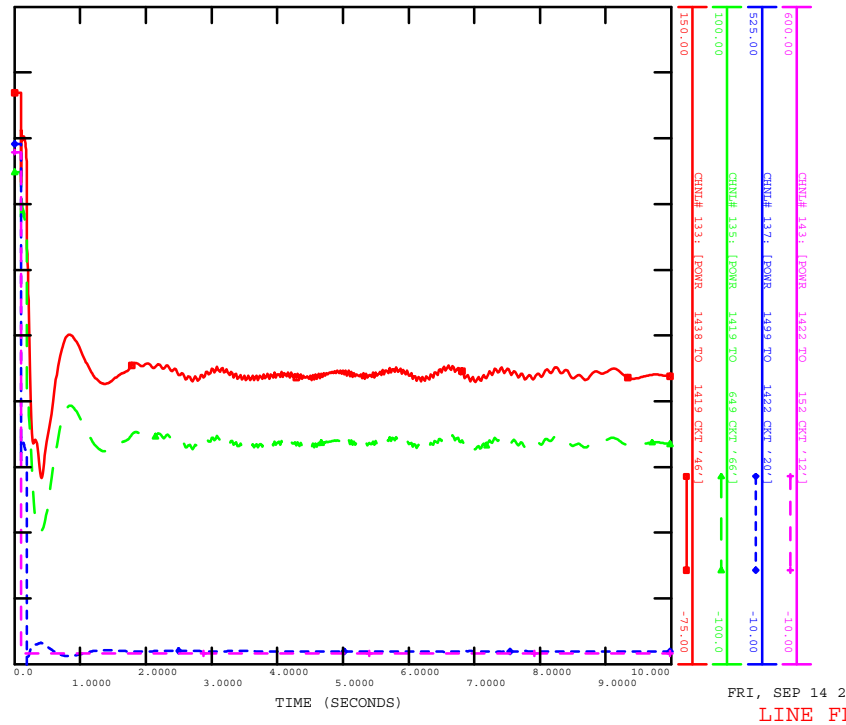
FILE: B-35.out



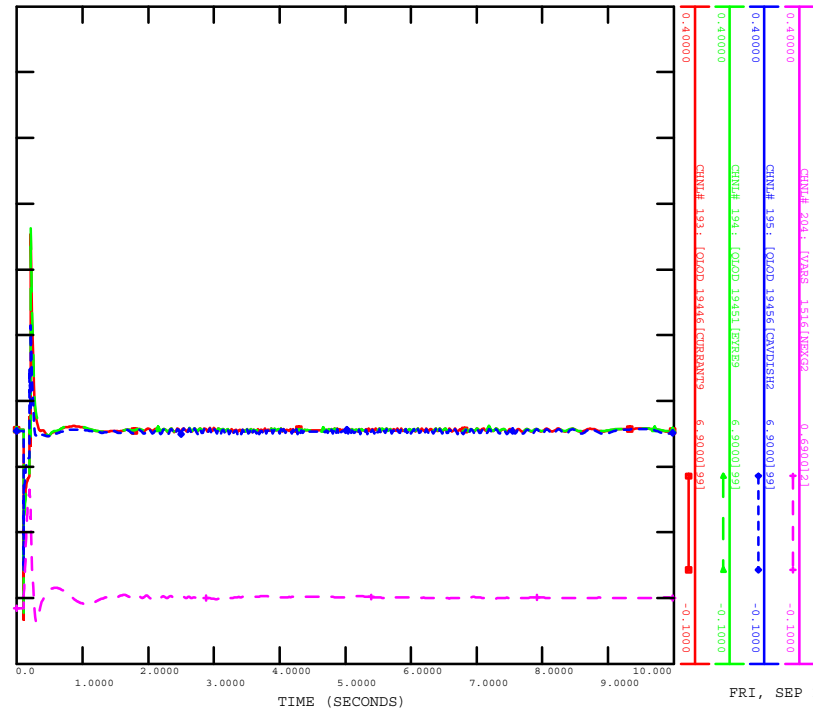
FILE: B-35.out



FILE: B-35.out

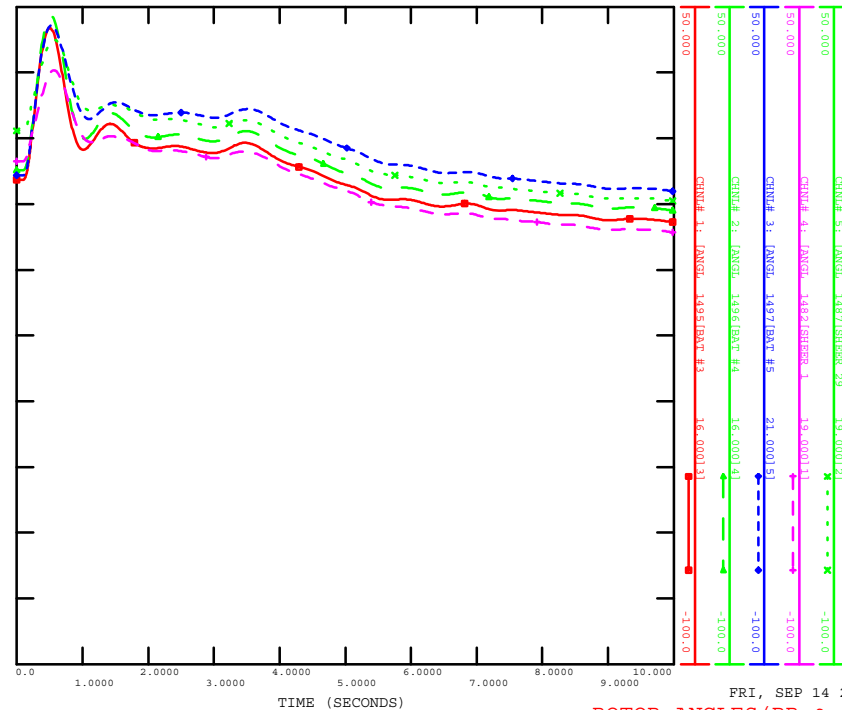


FILE: B-36.out



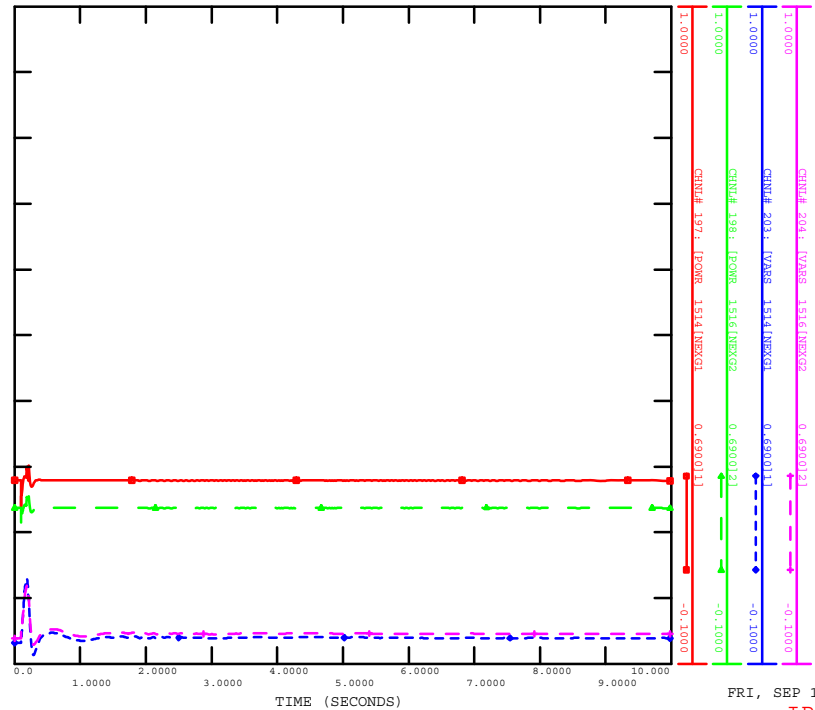
FRI, SEP 14 2012 11:13
IP678 (P)

FILE: B-36.out



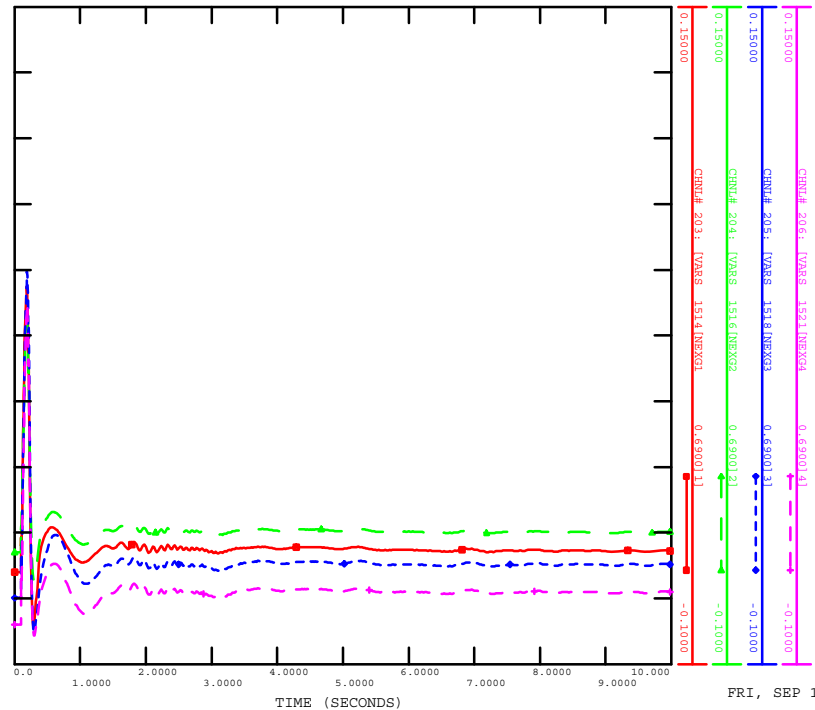
FRI, SEP 14 2012 11:13
ROTOR ANGLES (BR & SHEERNE)

FILE: B-36.out



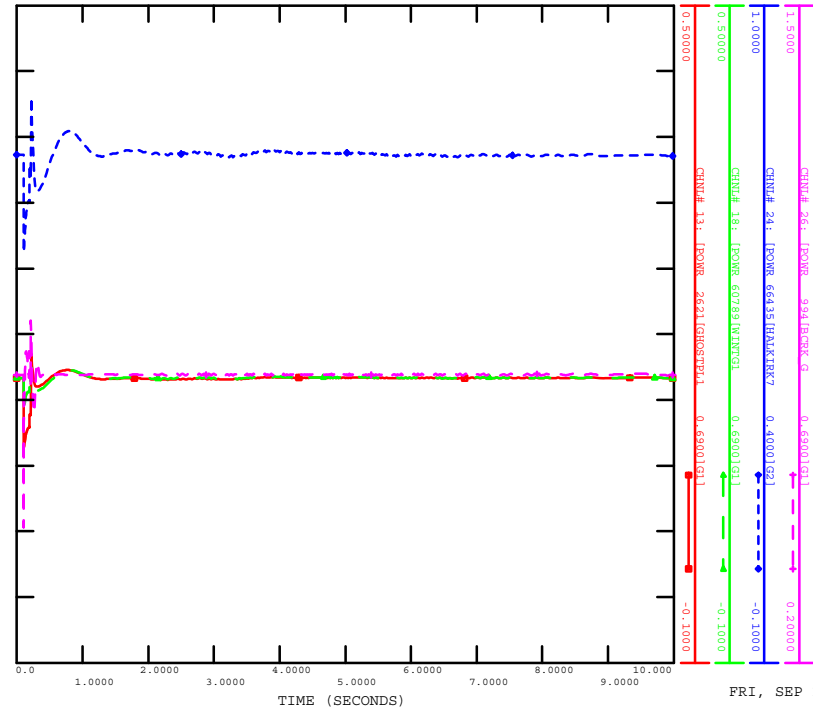
FRI, SEP 14 2012 11:13
IP635 (P&Q)

FILE: B-36.out



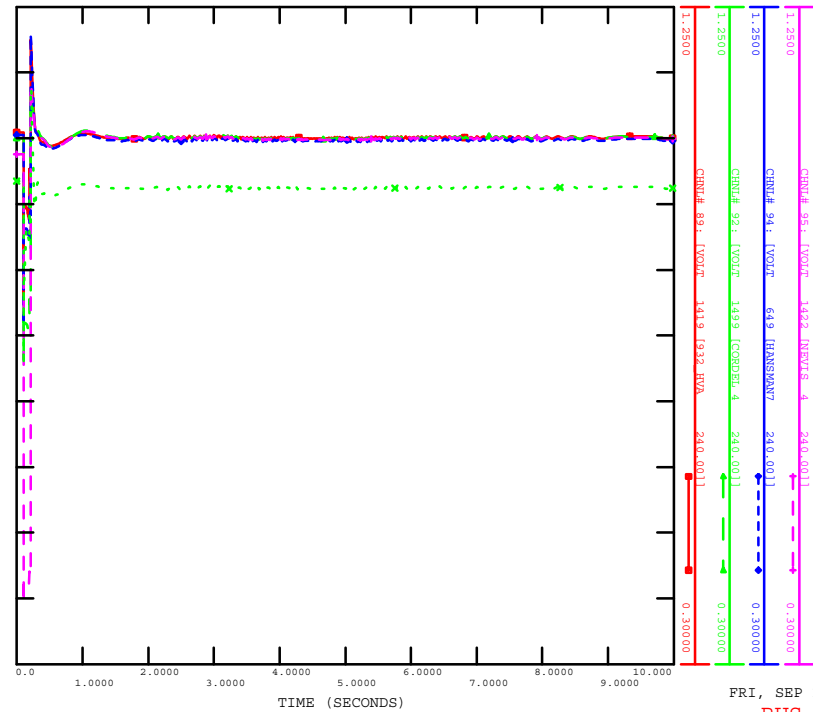
FRI, SEP 14 2012 11:13
IP678 (Q)

FILE: B-36.out



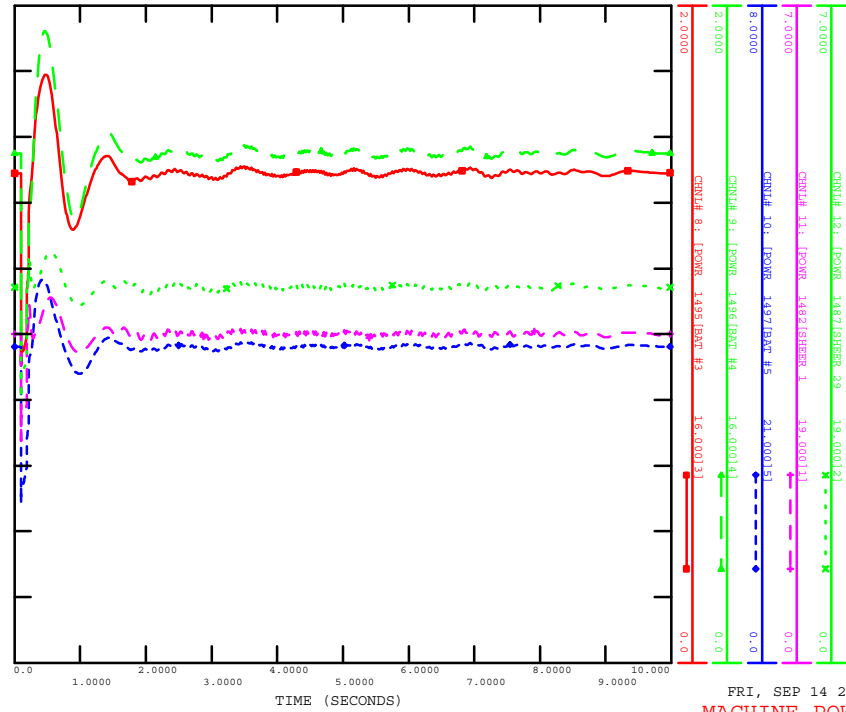
FRI, SEP 14 2012 11:14
WIND (MW)

FILE: B-36.out



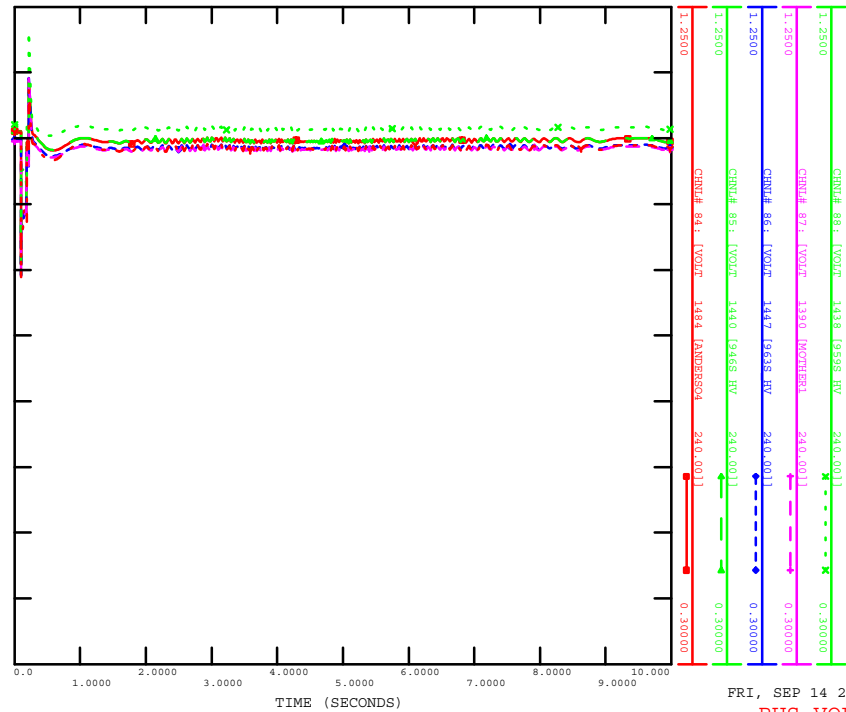
FRI, SEP 14 2012 11:14
BUS VOLT (PU)

FILE: B-36.out



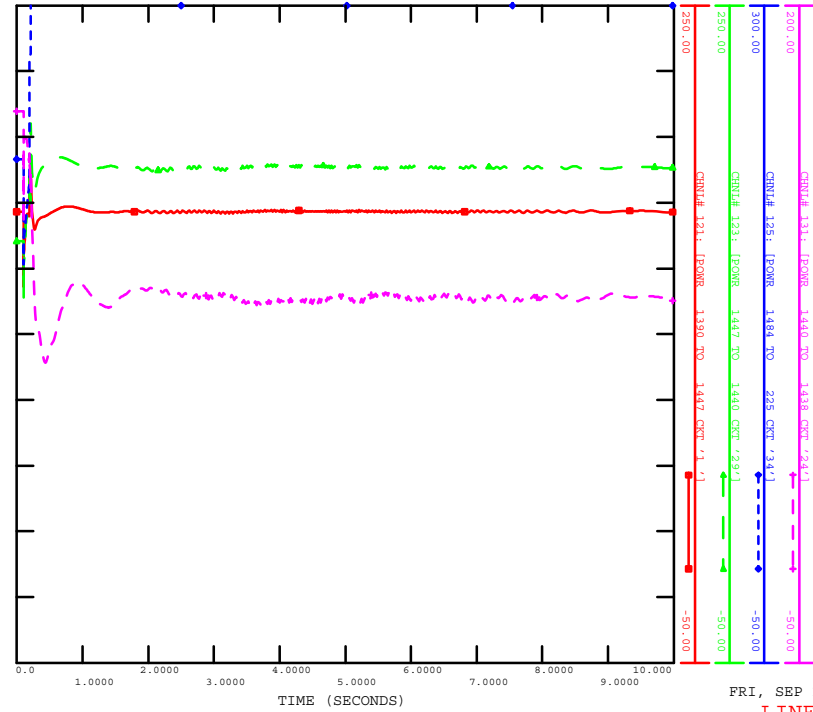
FRI, SEP 14 2012 11:14
MACHINE POWER (P)

FILE: B-36.out

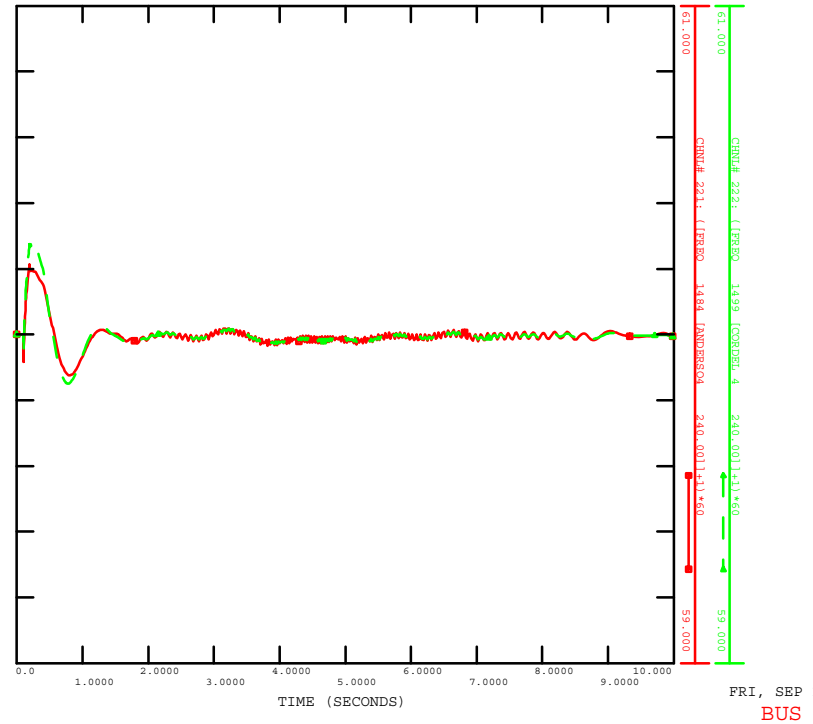


FRI, SEP 14 2012 11:14
BUS VOLT (PU)

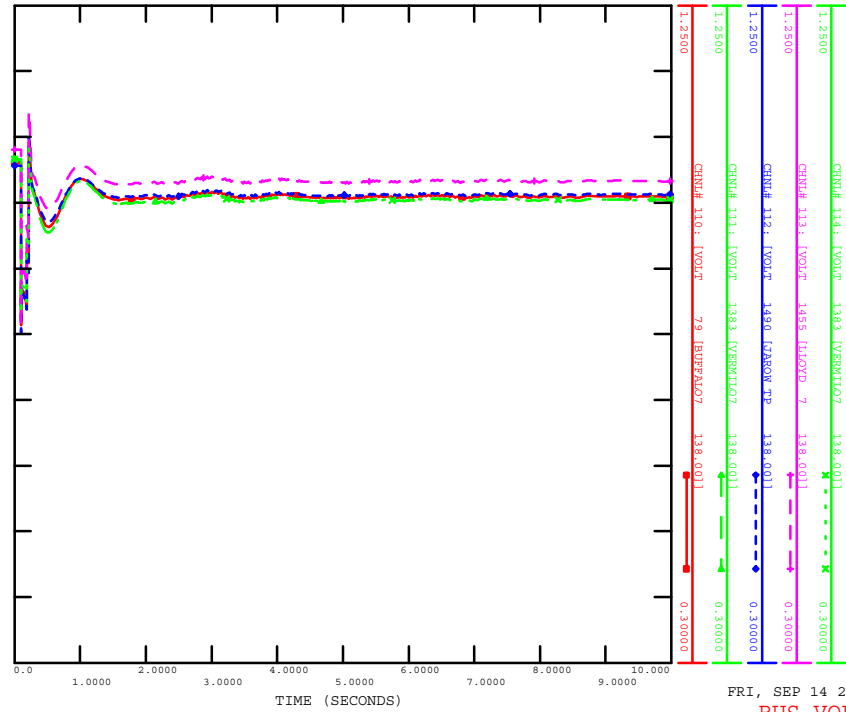
FILE: B-36.out



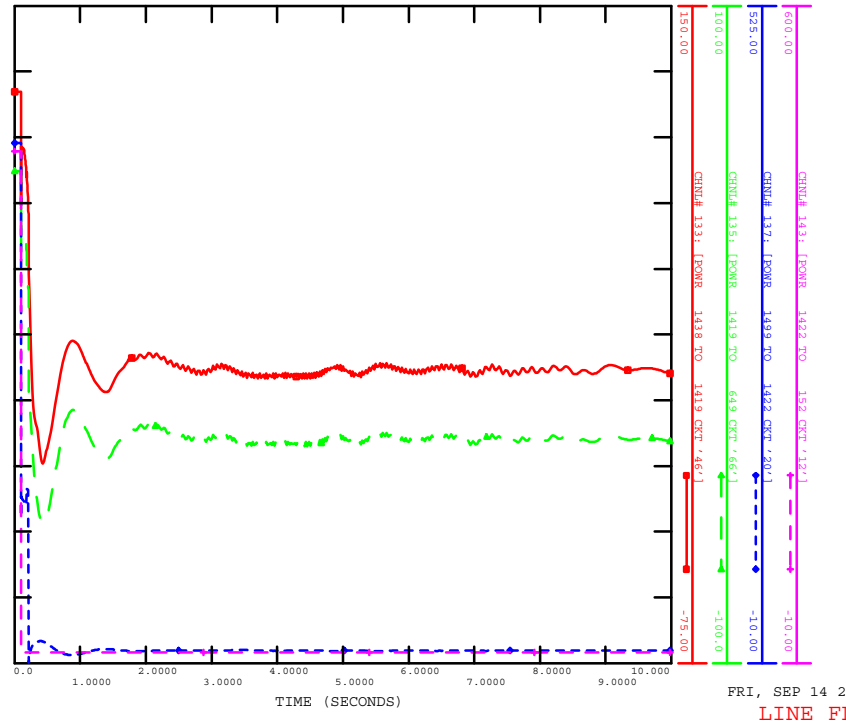
FILE: B-36.out



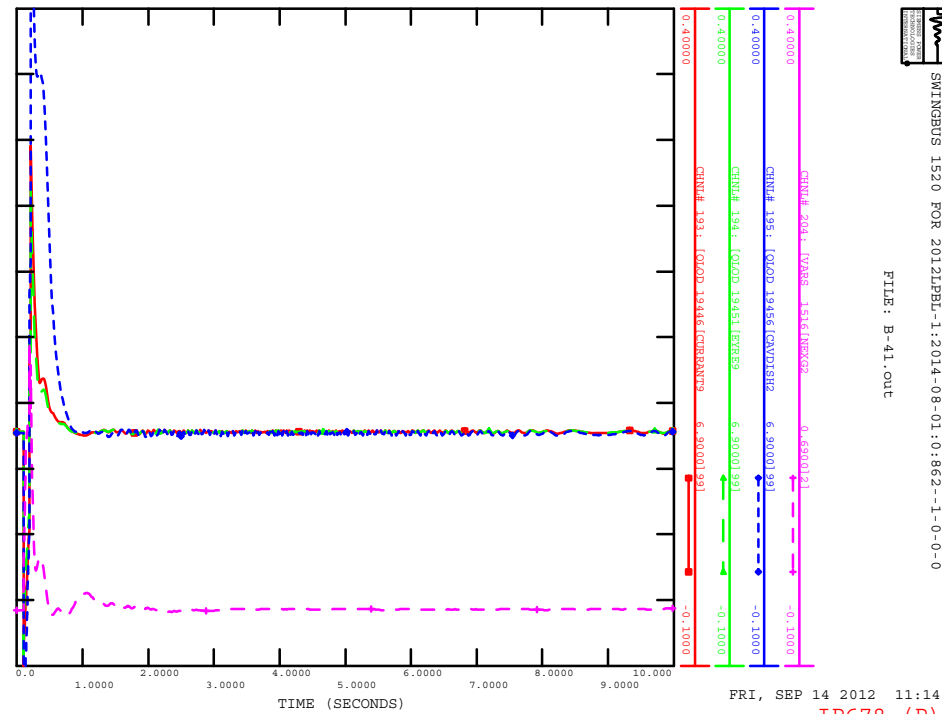
FILE: B-36.out



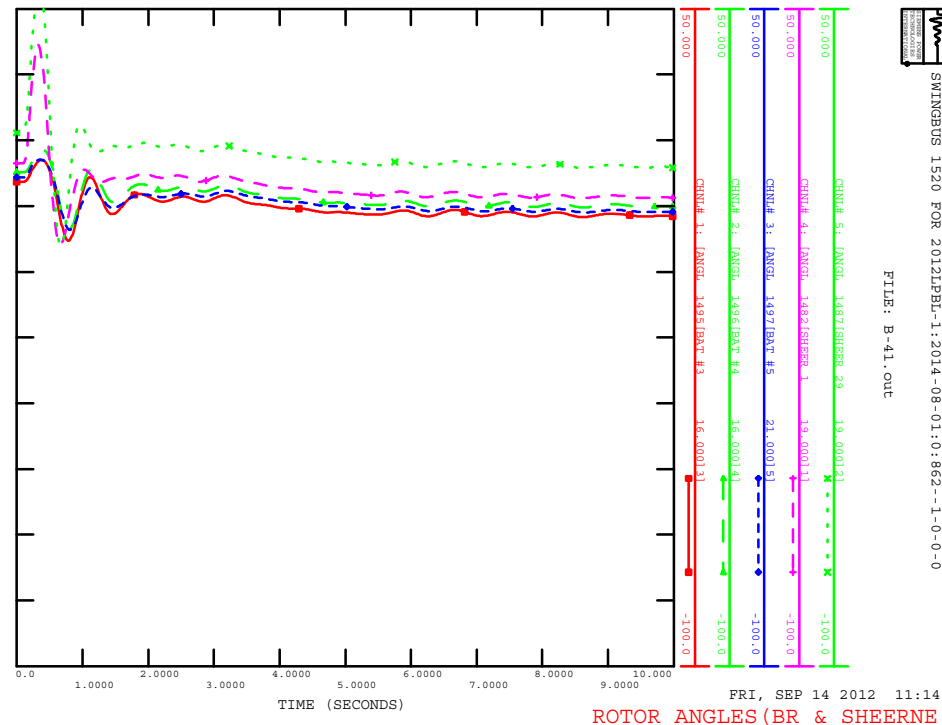
FILE: B-36.out



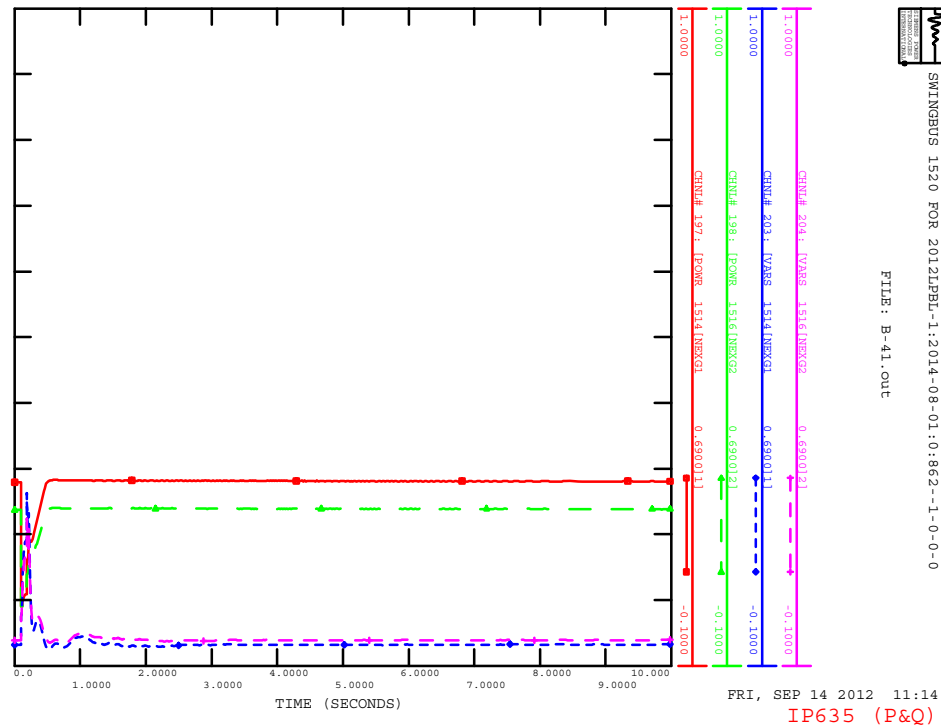
FILE: B-41.out



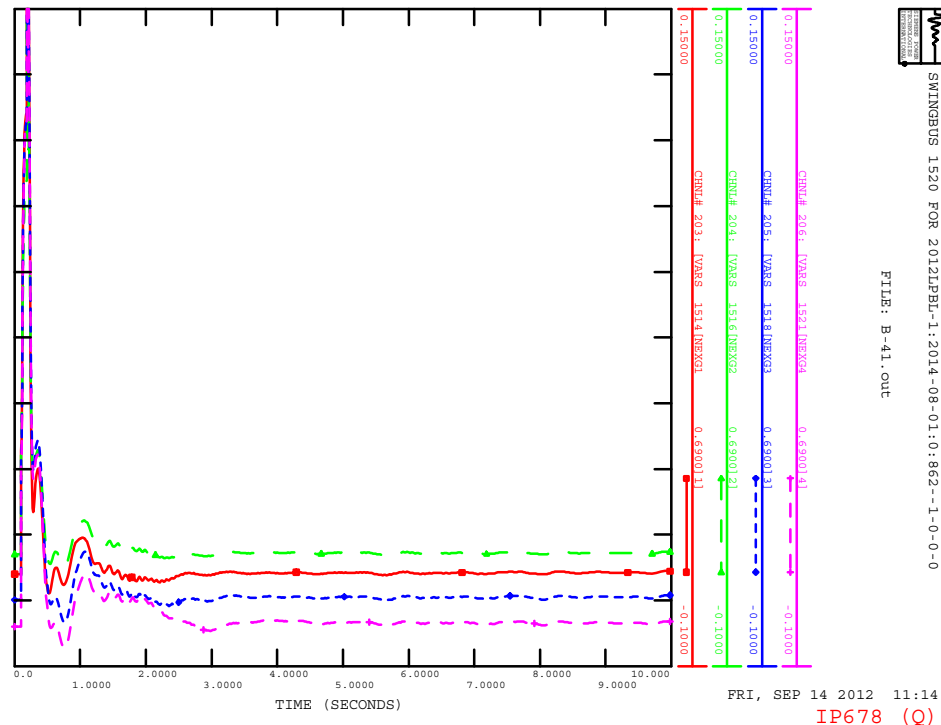
FILE: B-41.out



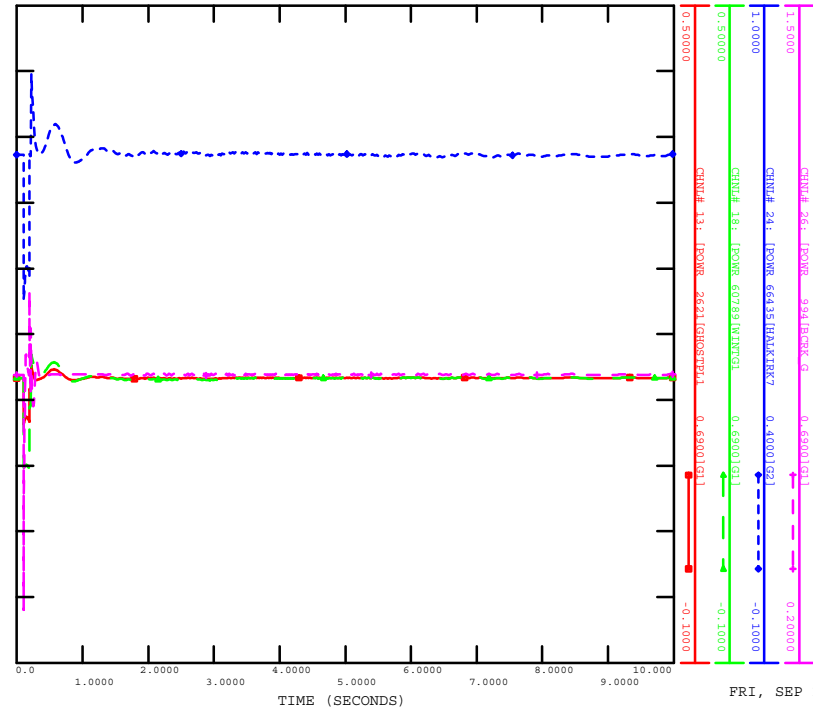
FILE: B-41.out



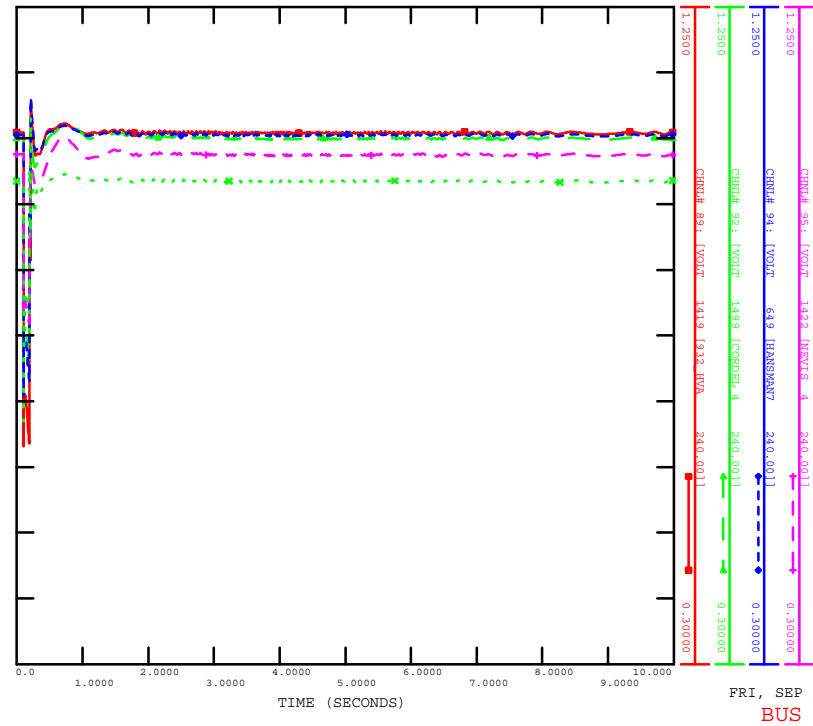
FILE: B-41.out



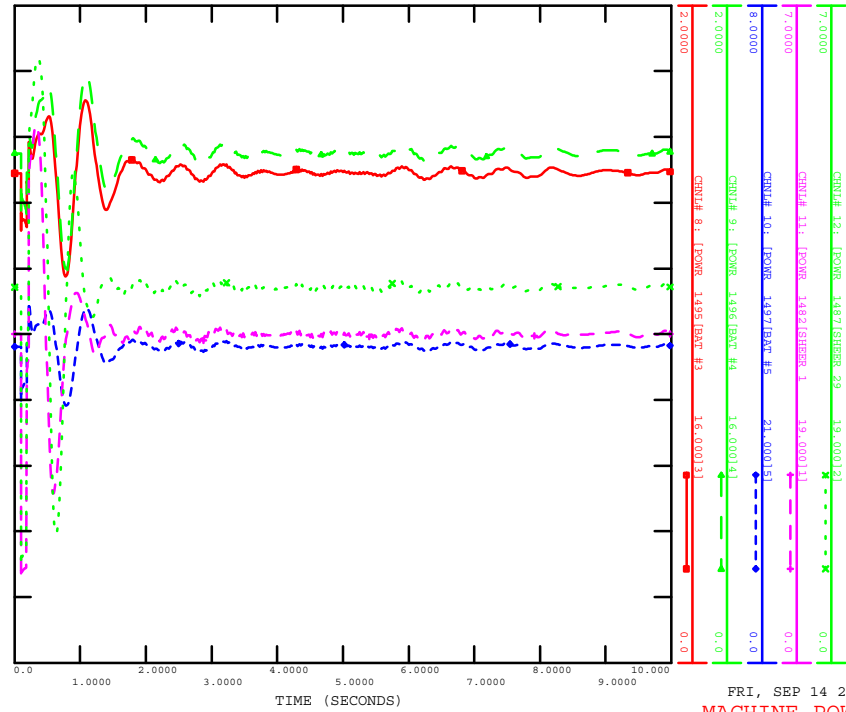
FILE: B-41.out



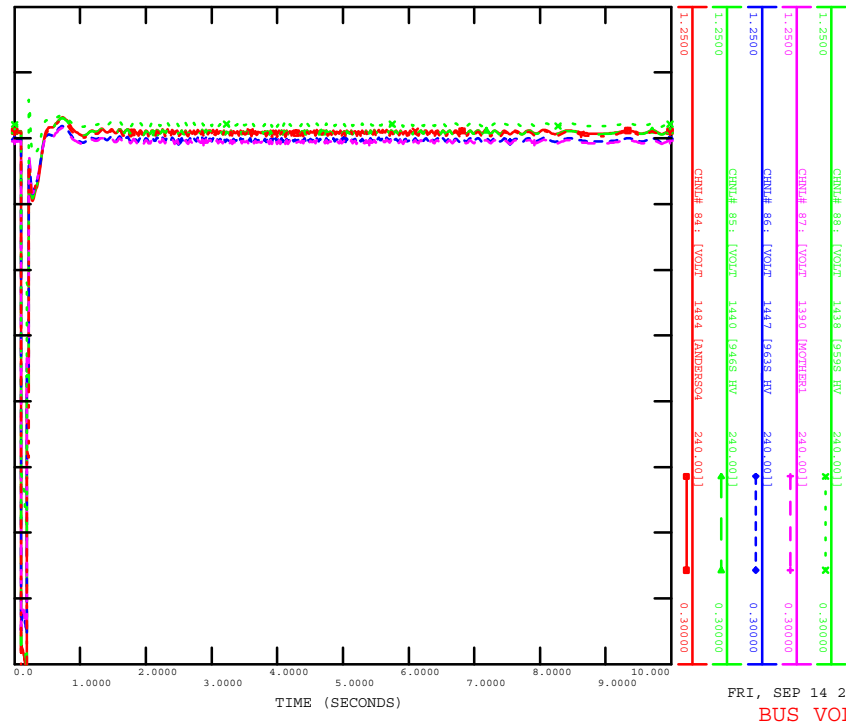
FILE: B-41.out



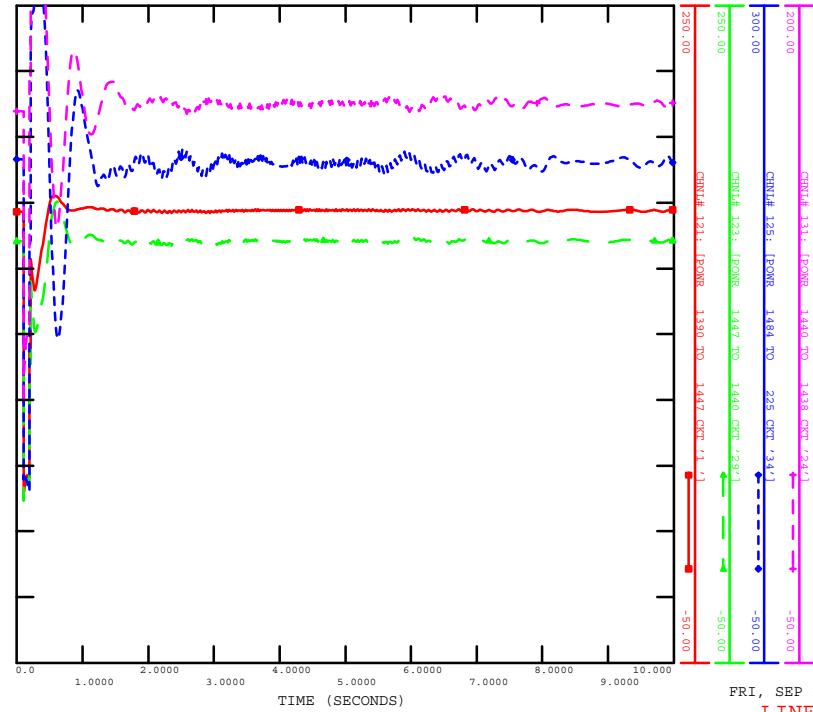
FILE: B-41.out



FILE: B-41.out

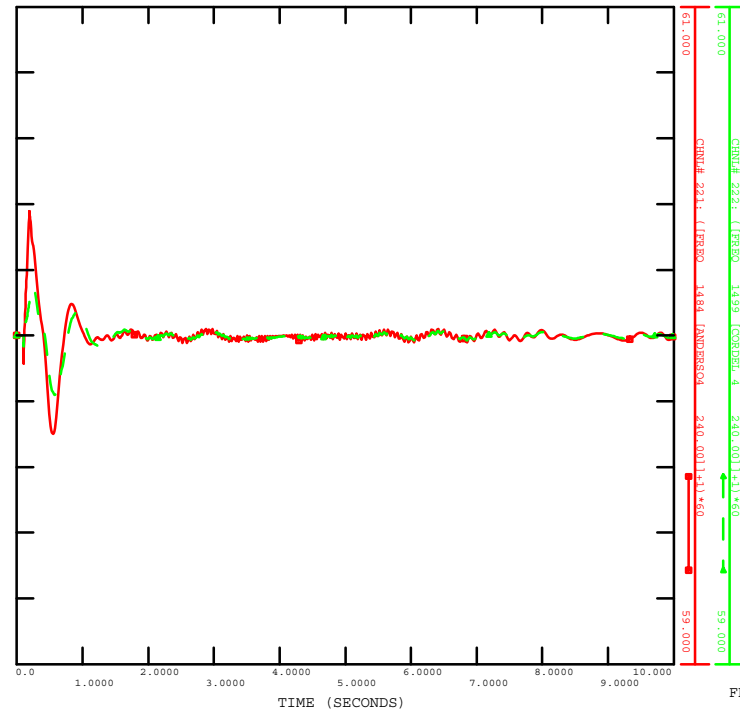


FILE: B-41.out



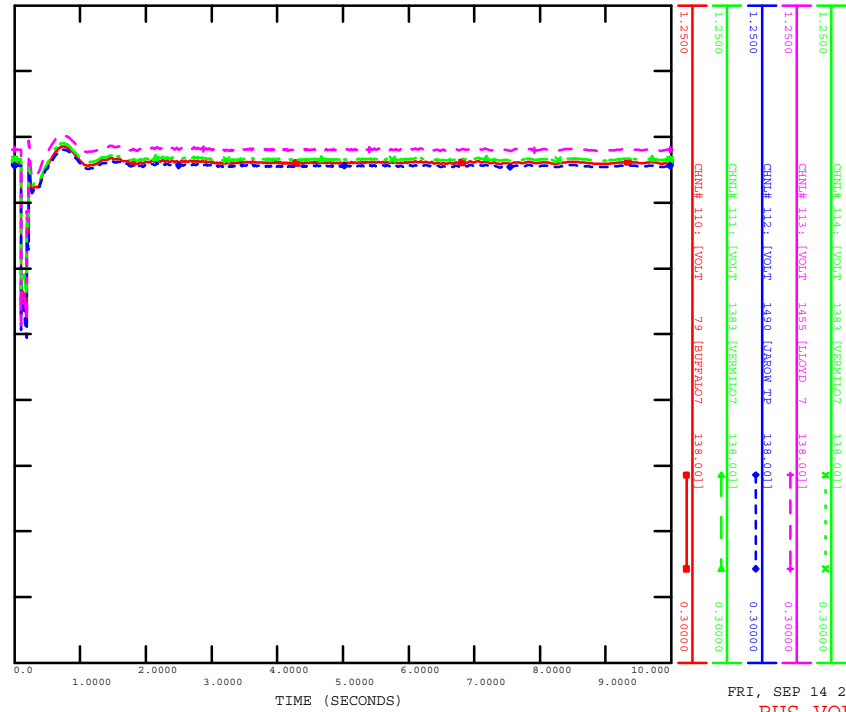
FRI, SEP 14 2012 11:14
LINE FLOW (P)

FILE: B-41.out



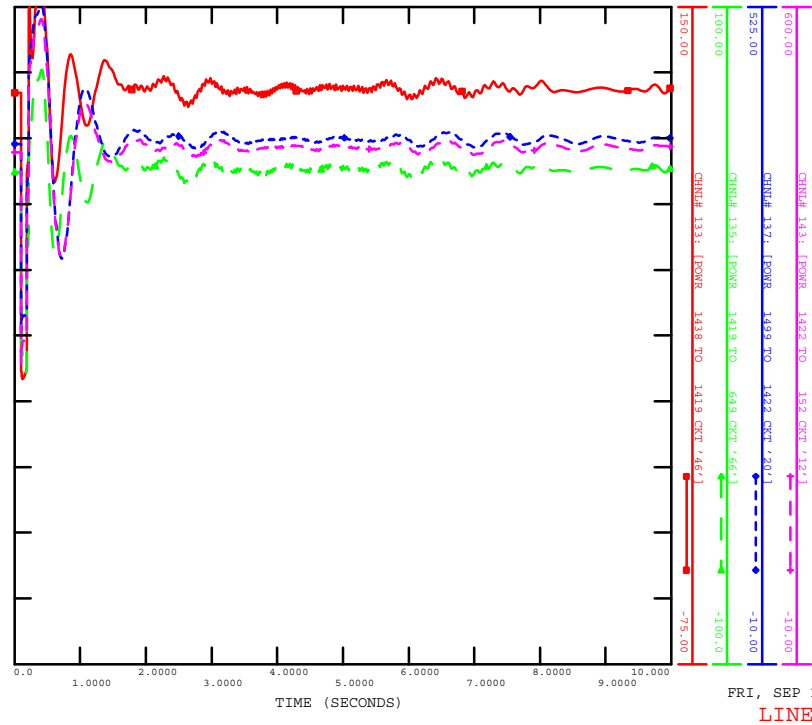
FRI, SEP 14 2012 11:14
BUS FREQUENCY

FILE: B-41.out



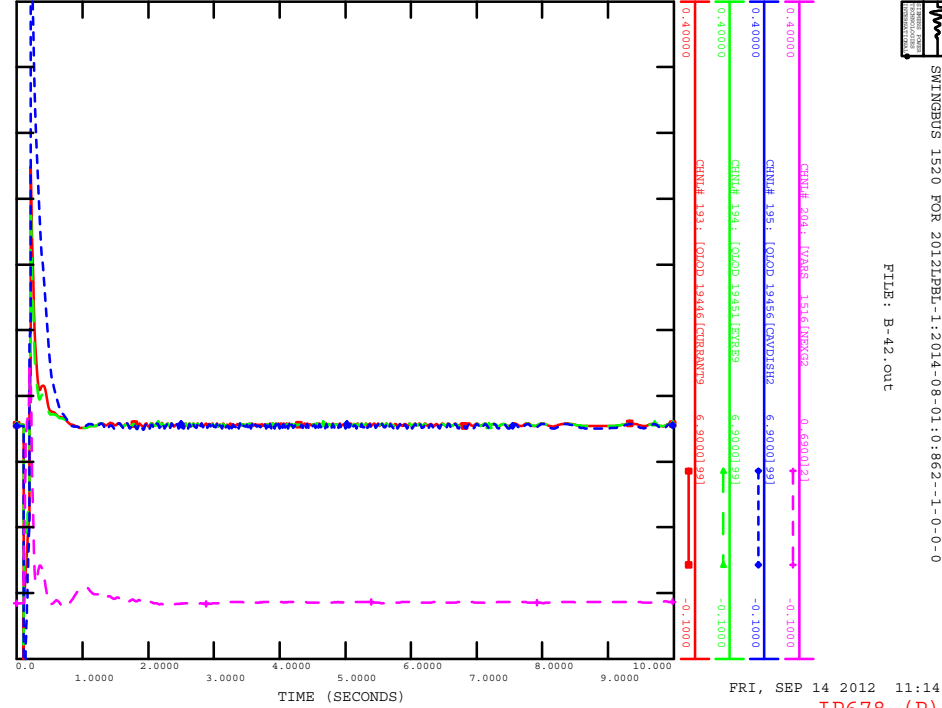
FRI, SEP 14 2012 11:14
BUS VOLT (PU)

FILE: B-41.out

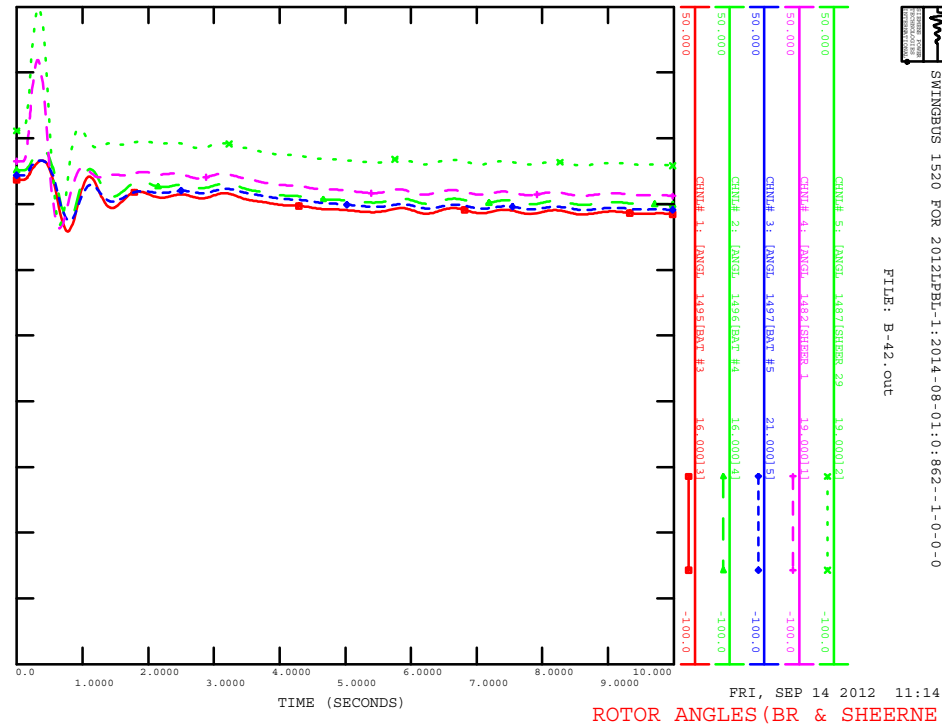


FRI, SEP 14 2012 11:14
LINE FLOW (P)

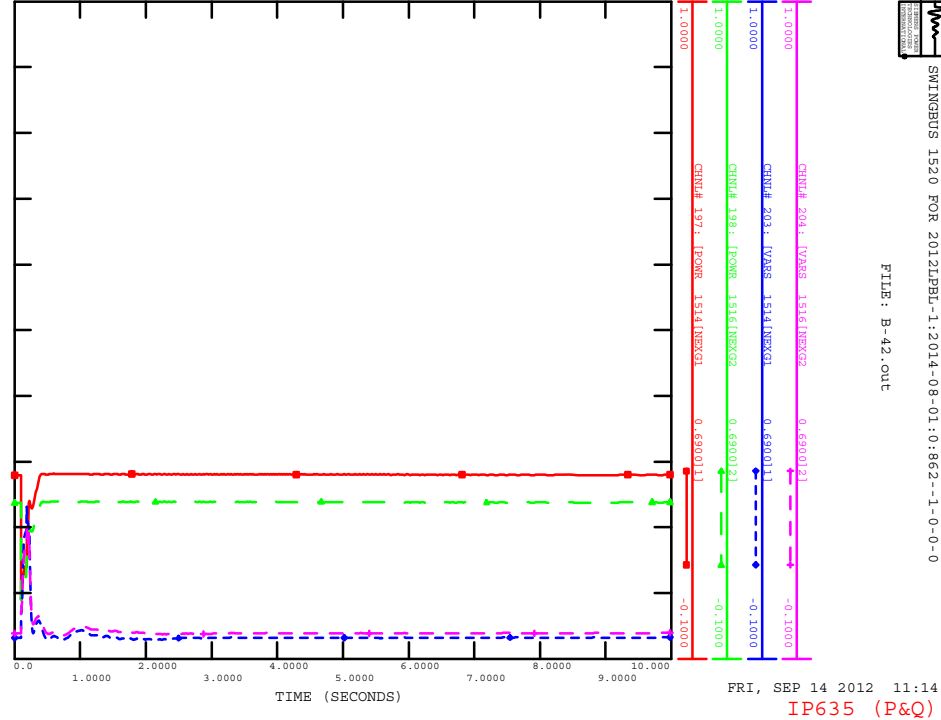
FILE: B-42.out



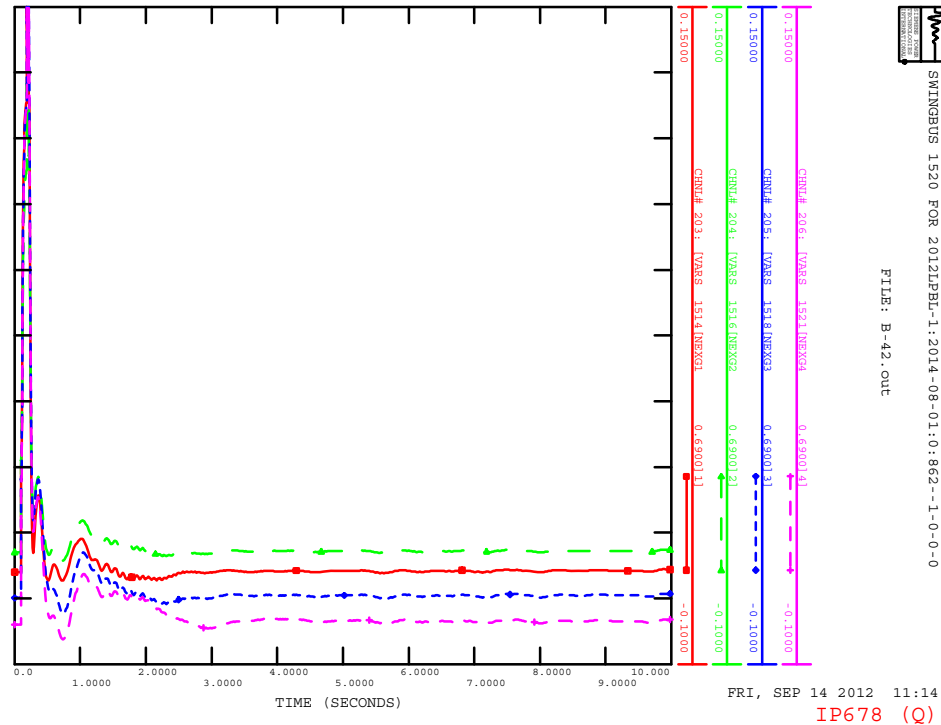
FILE: B-42.out



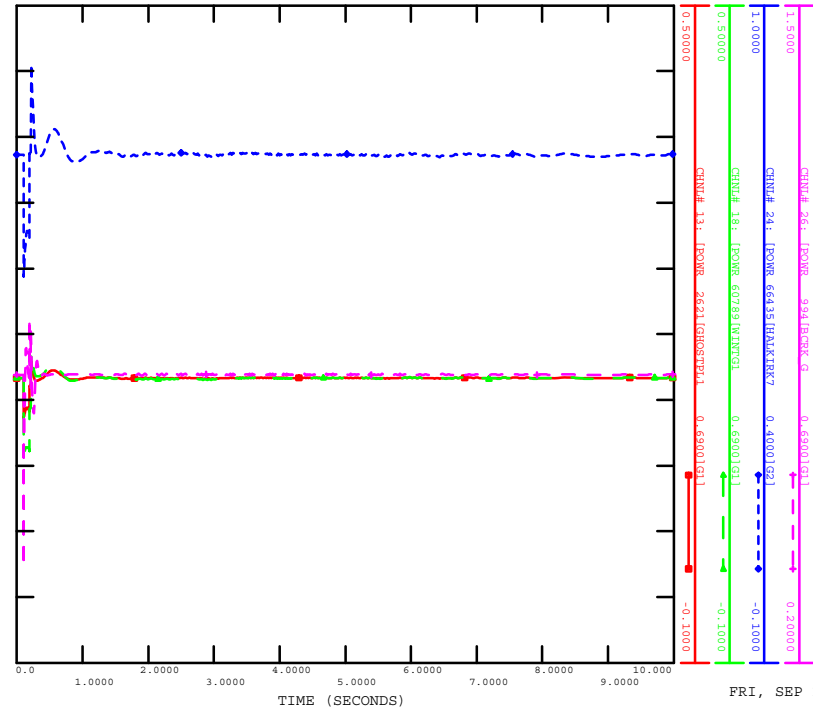
FILE: B-42.out



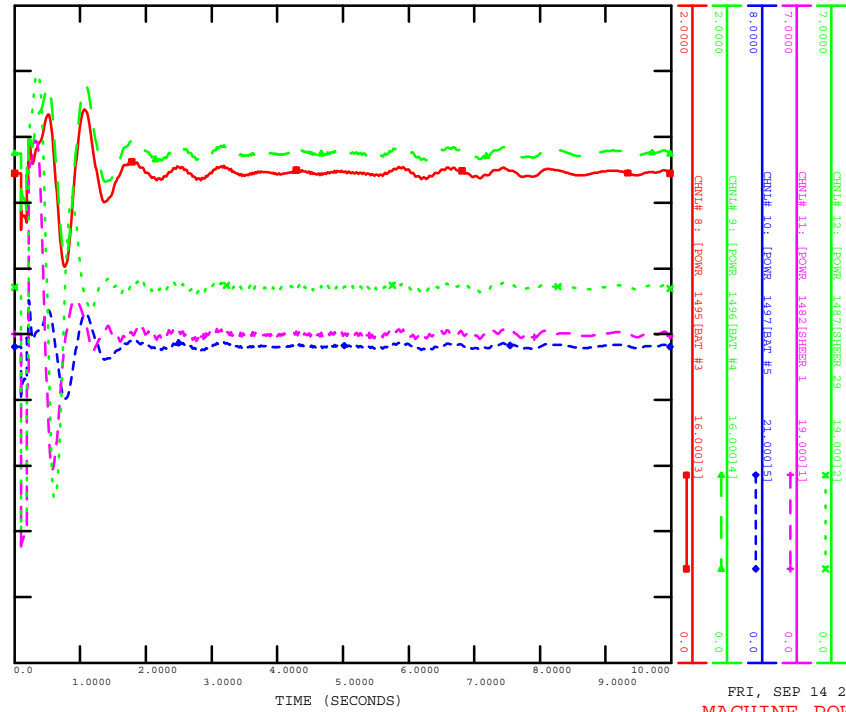
FILE: B-42.out



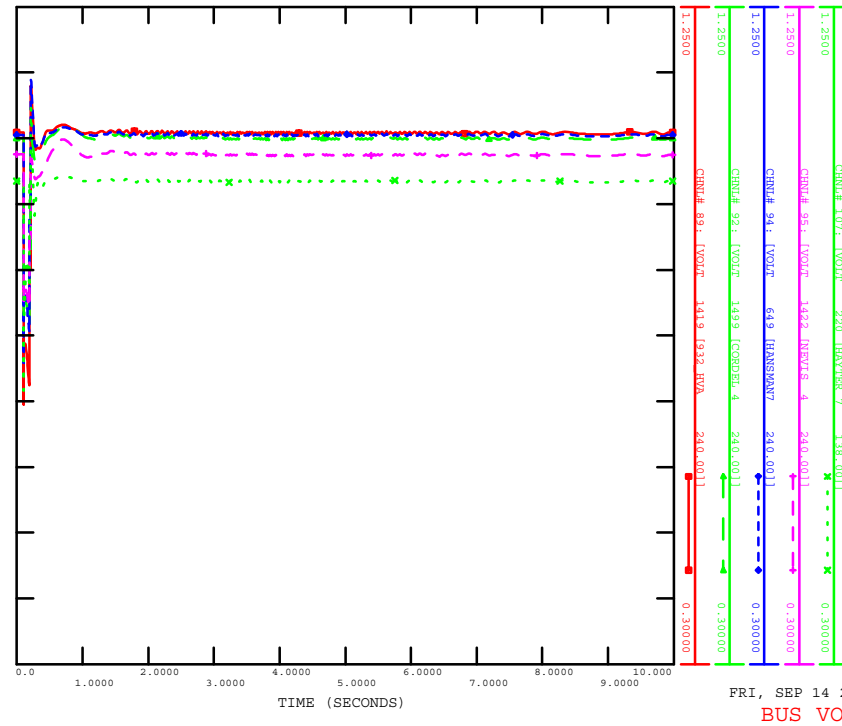
FILE: B-42.out



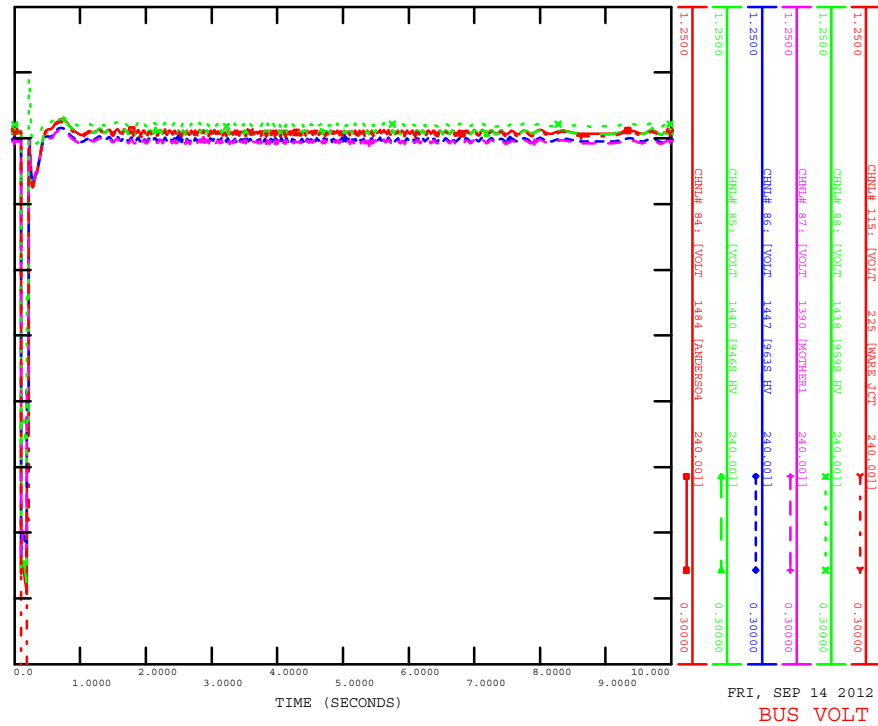
FILE: B-42.out



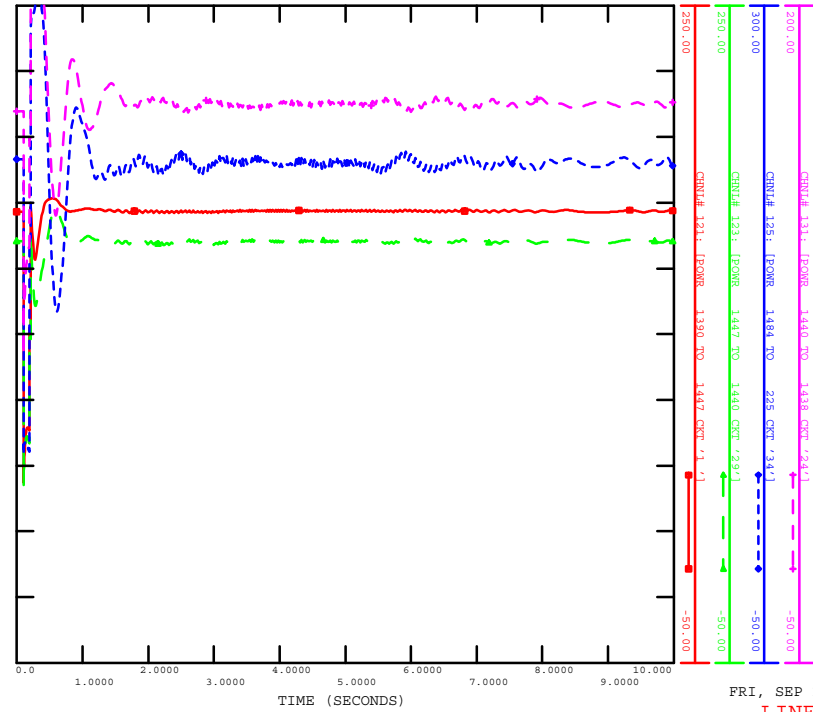
FILE: B-42.out



FILE: B-42.out

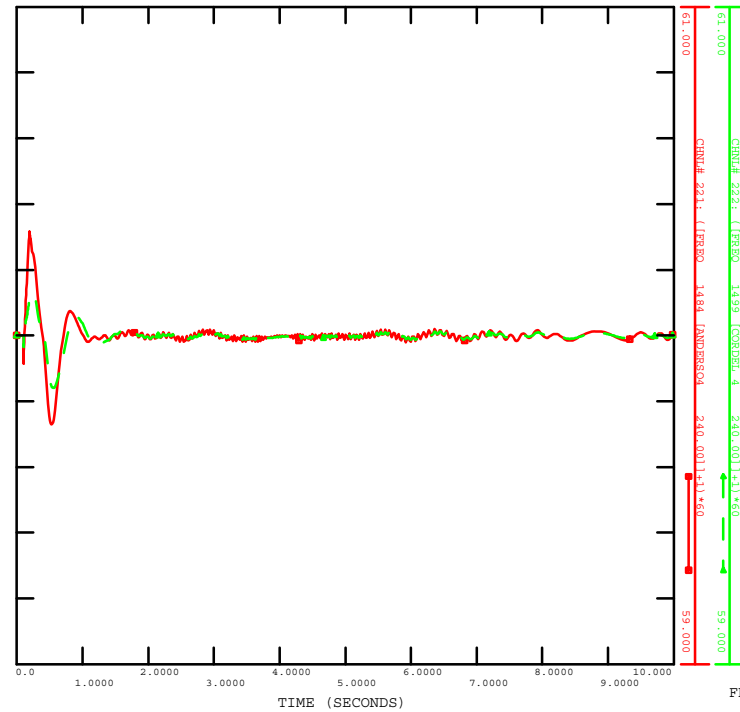


FILE: B-42.out



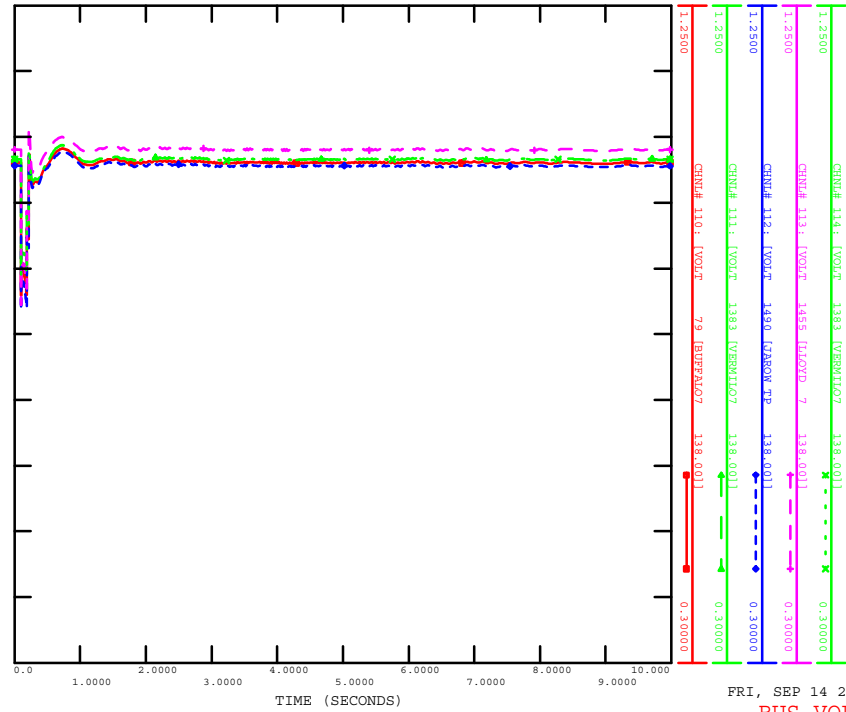
FRI, SEP 14 2012 11:14
LINE FLOW (P)

FILE: B-42.out



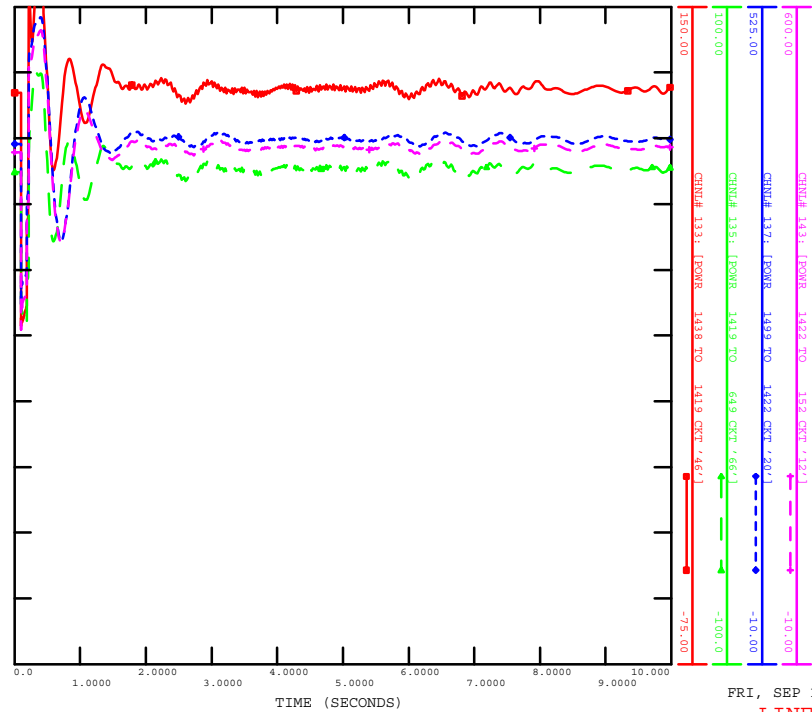
FRI, SEP 14 2012 11:14
BUS FREQUENCY

FILE: B-42.out



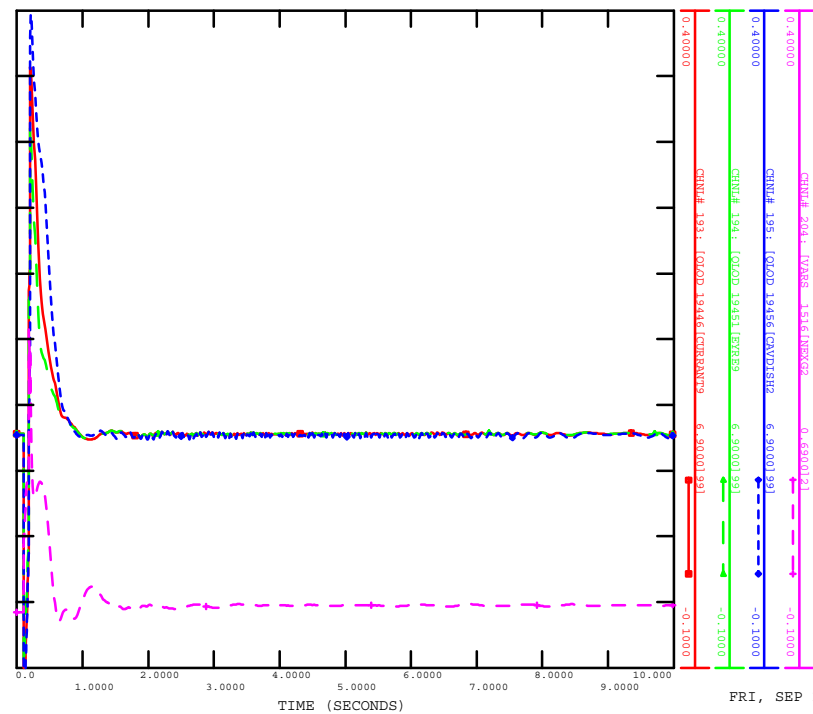
FRI, SEP 14 2012 11:14
BUS VOLT (PU)

FILE: B-42.out

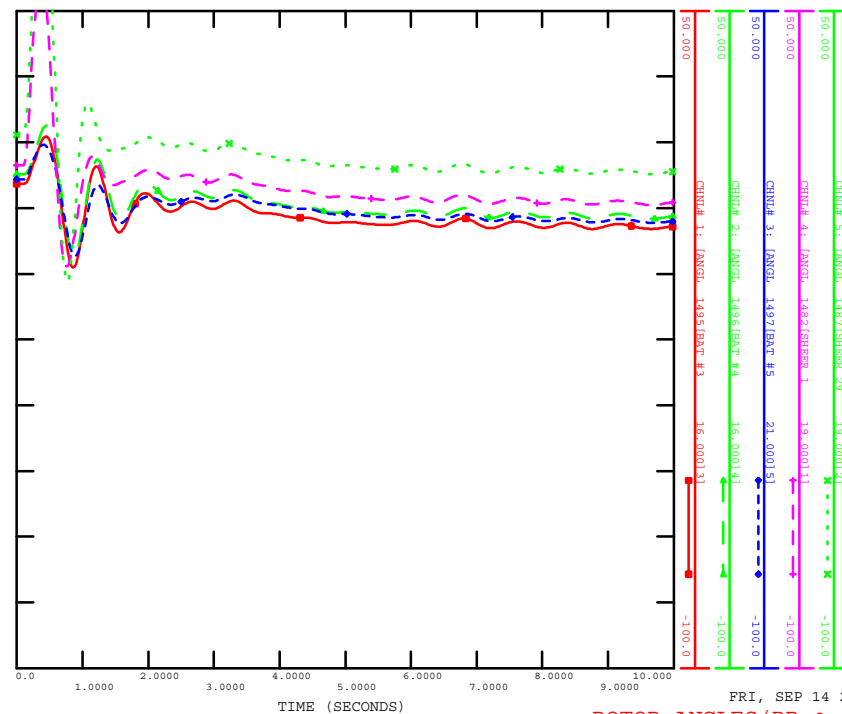


FRI, SEP 14 2012 11:14
LINE FLOW (P)

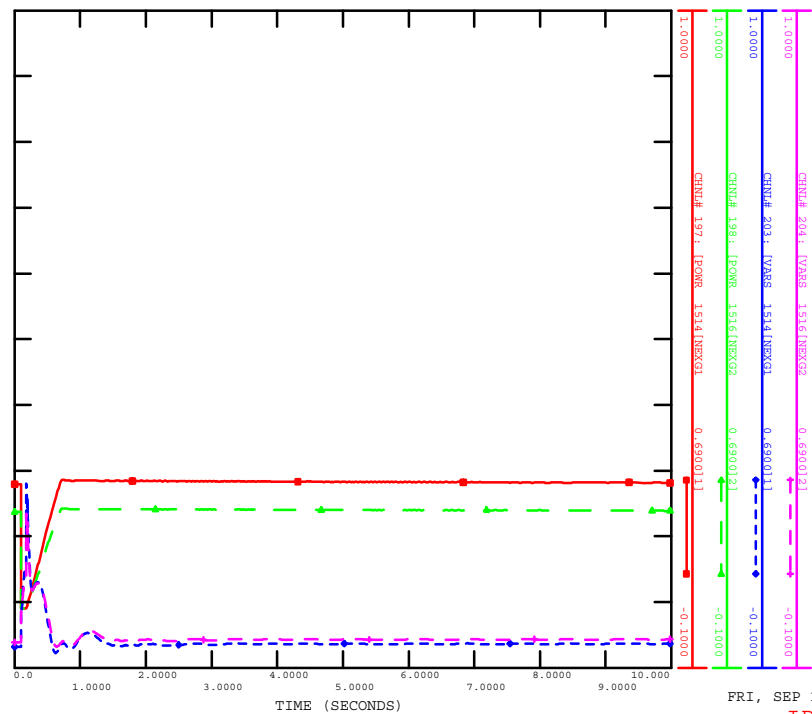
FILE: C5-01.out



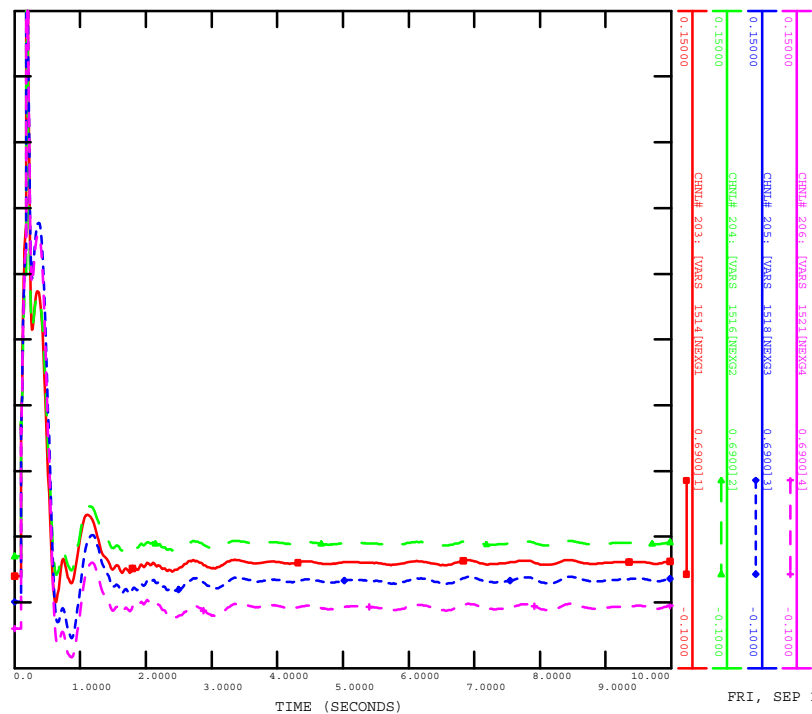
FILE: C5-01.out



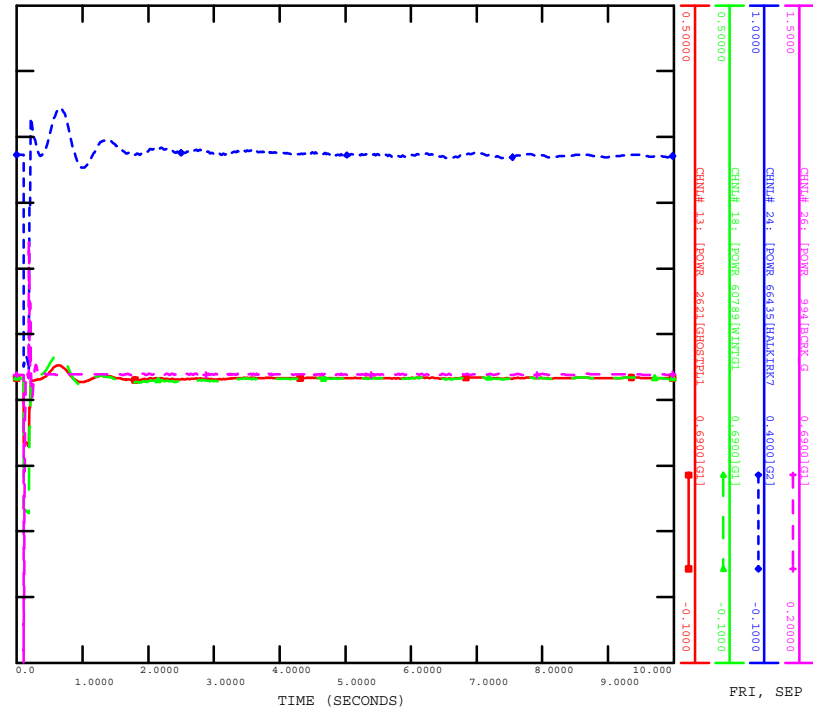
FILE: C5-01.out



FILE: C5-01.out

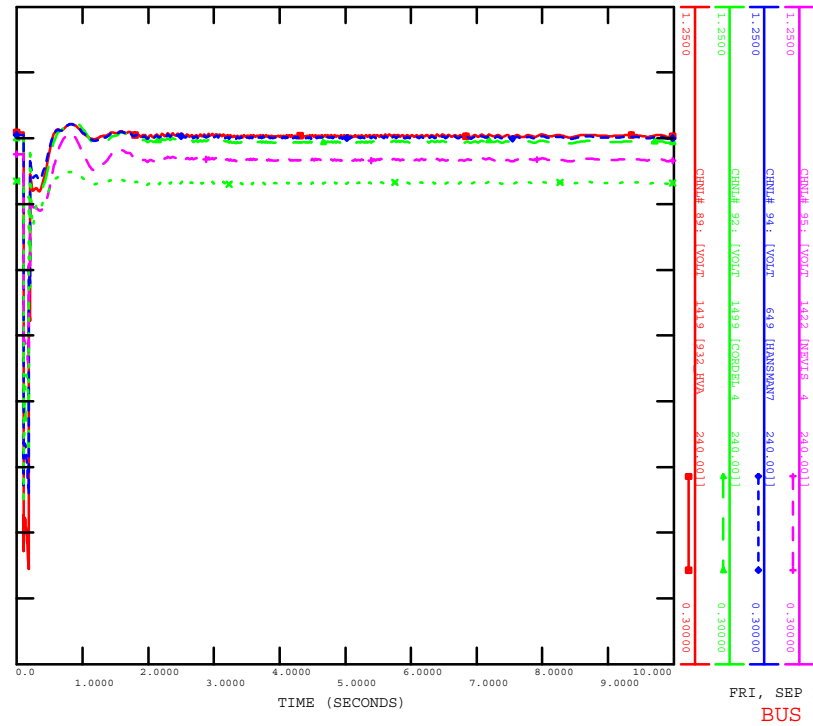


FILE: C5-01.out



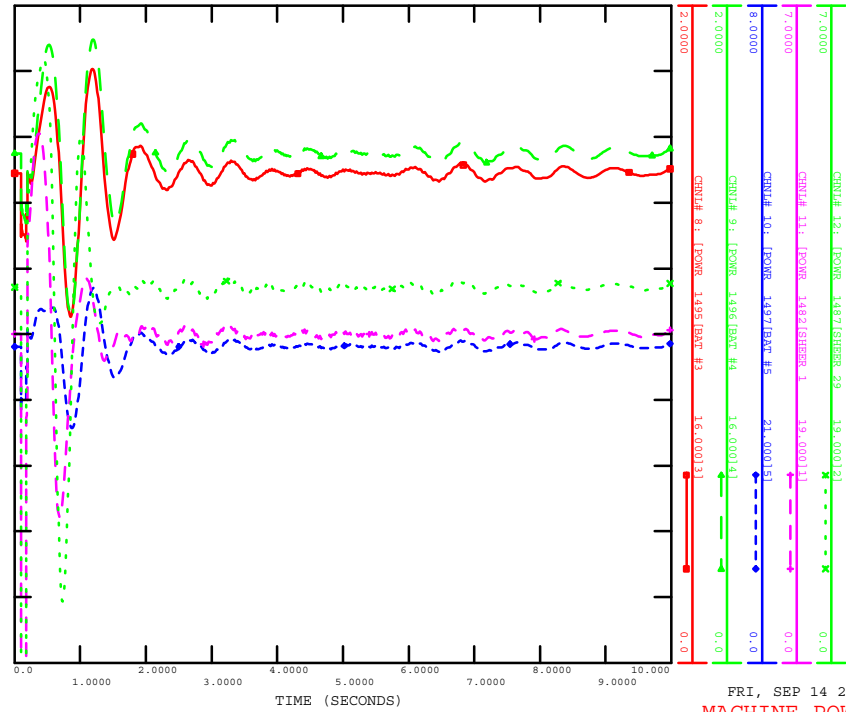
FRI, SEP 14 2012 11:14
WIND (MW)

FILE: C5-01.out



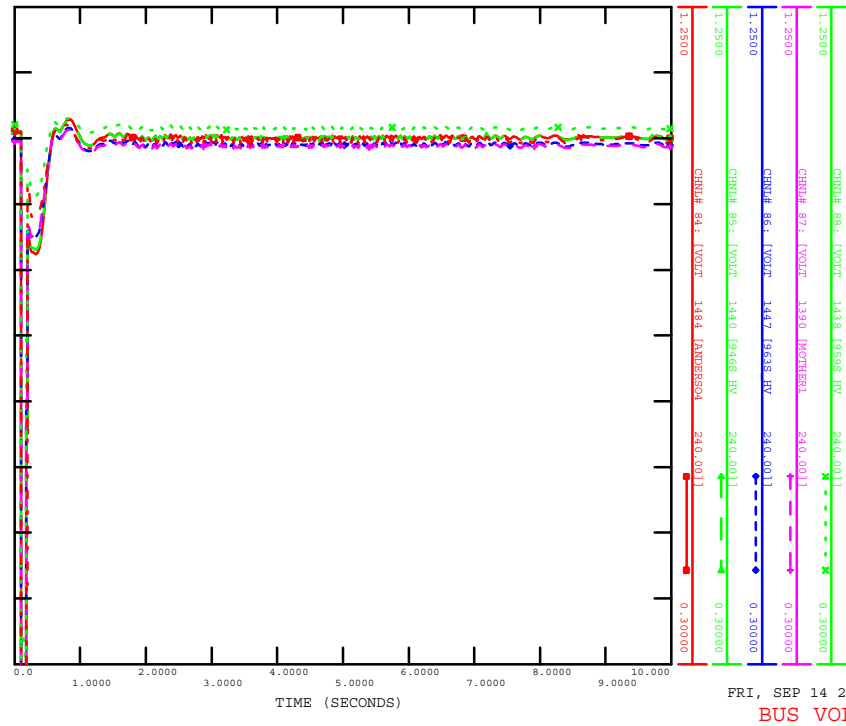
FRI, SEP 14 2012 11:14
BUS VOLT (PU)

FILE: C5-01.out



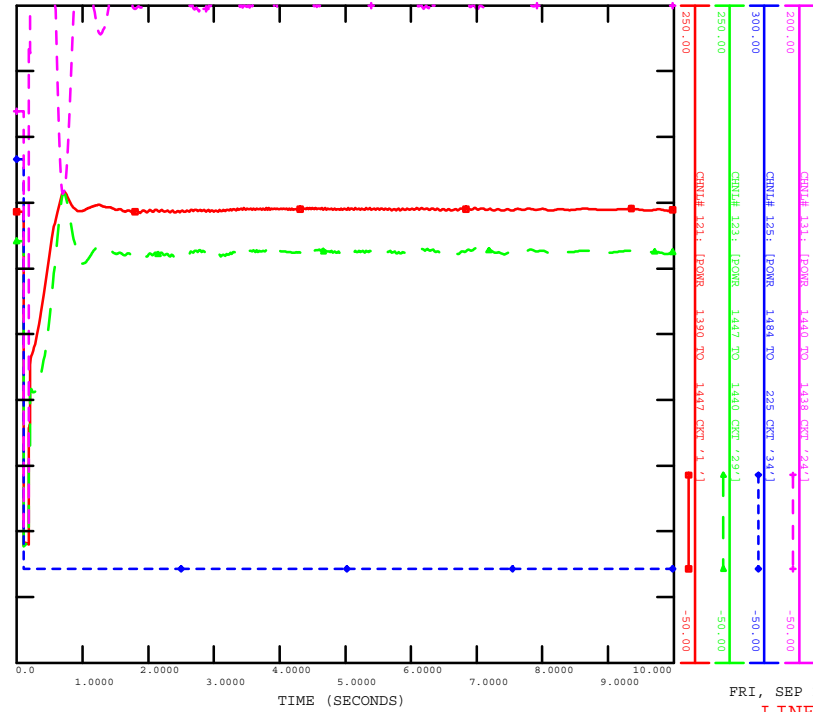
FRI, SEP 14 2012 11:14
MACHINE POWER (P)

FILE: C5-01.out

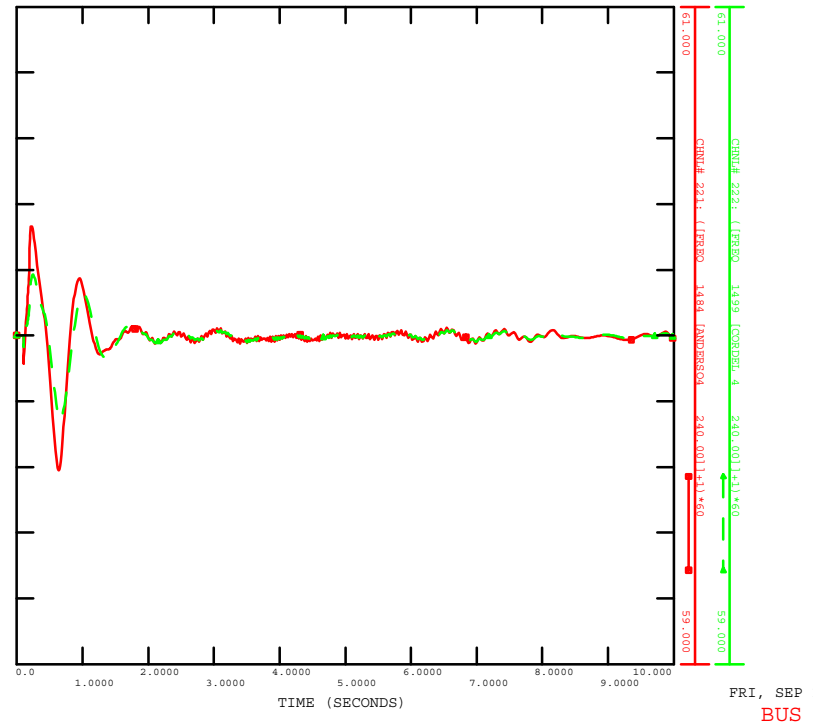


FRI, SEP 14 2012 11:14
BUS VOLT (PU)

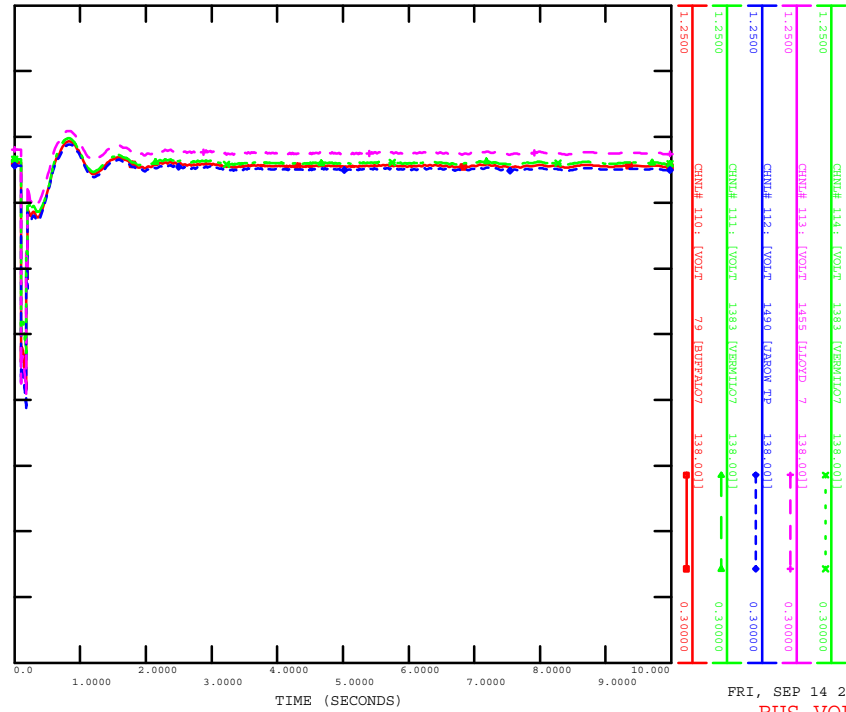
FILE: C5-01.out



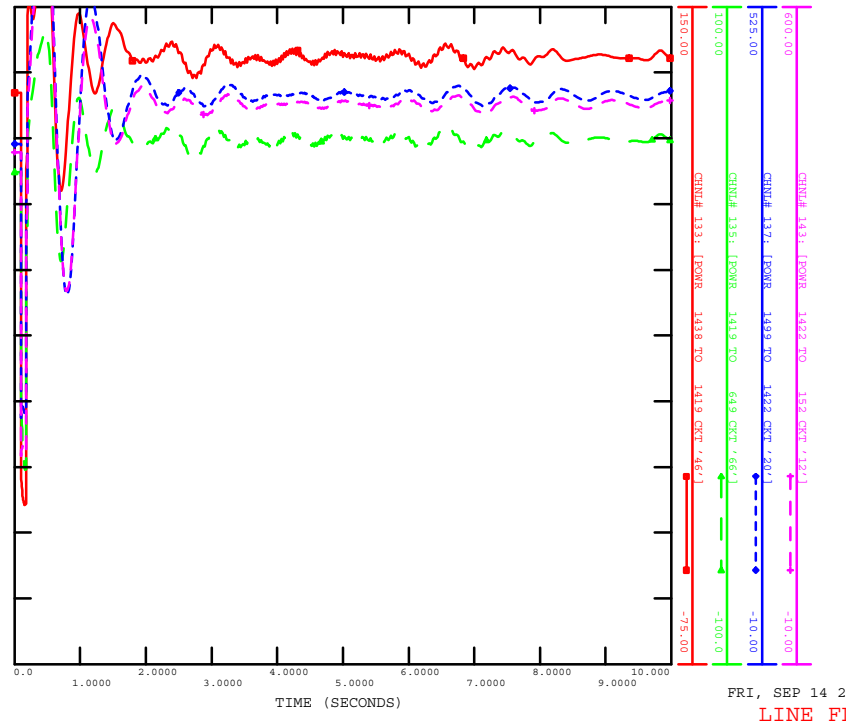
FILE: C5-01.out



FILE: C5-01.out

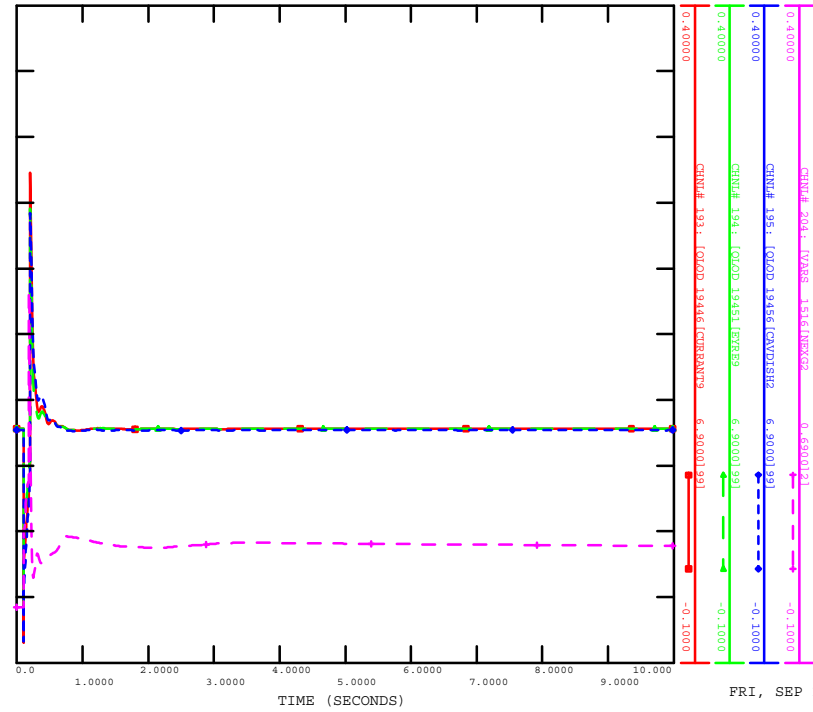


FILE: C5-01.out

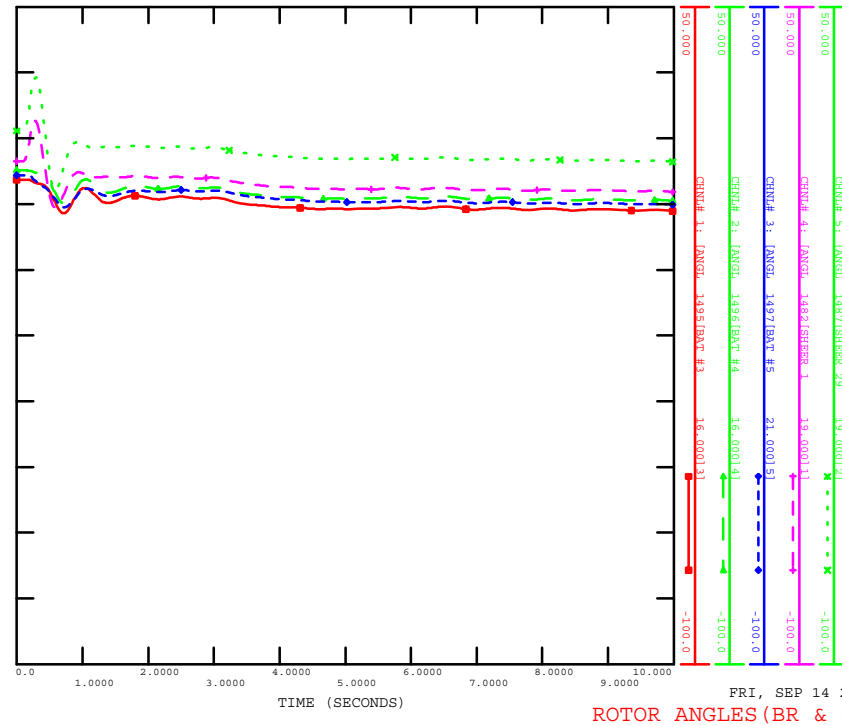


2014 Summer Light

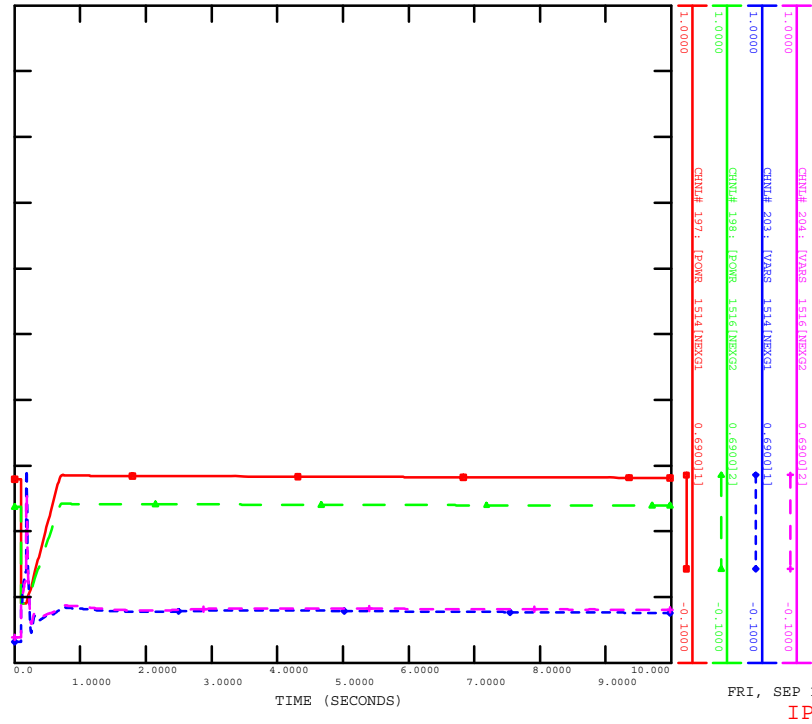
FILE: B-01.out



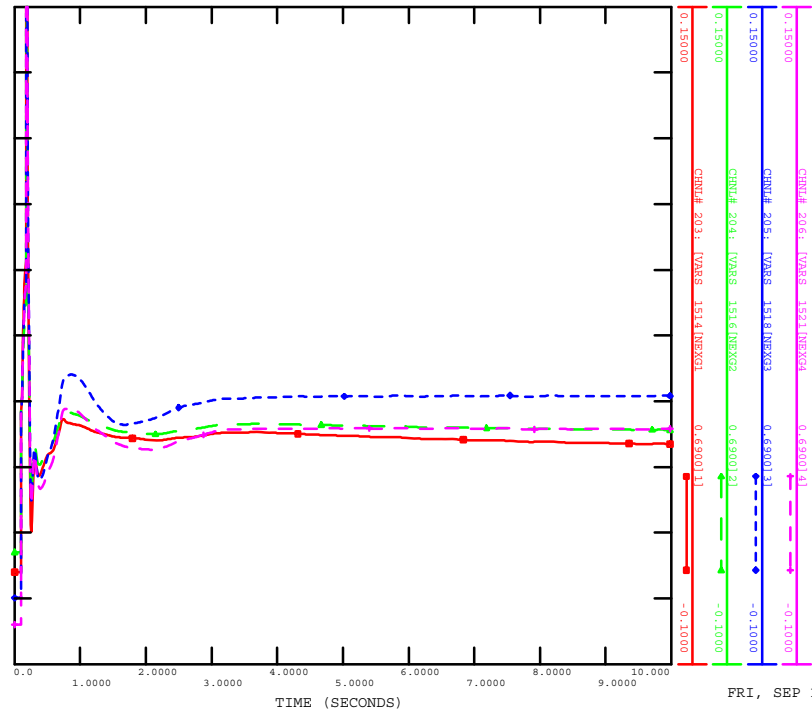
FILE: B-01.out



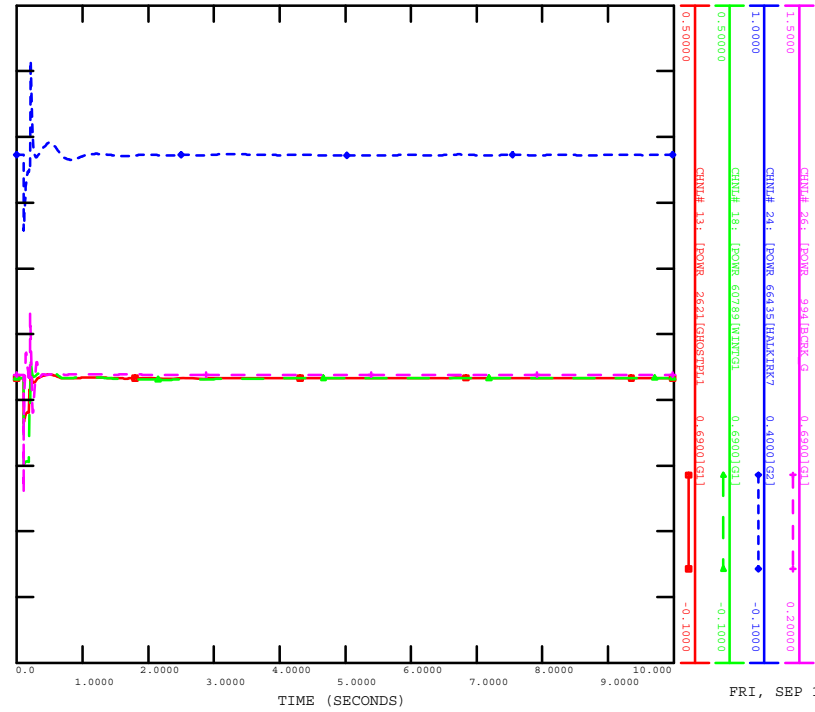
FILE: B-01.out



FILE: B-01.out

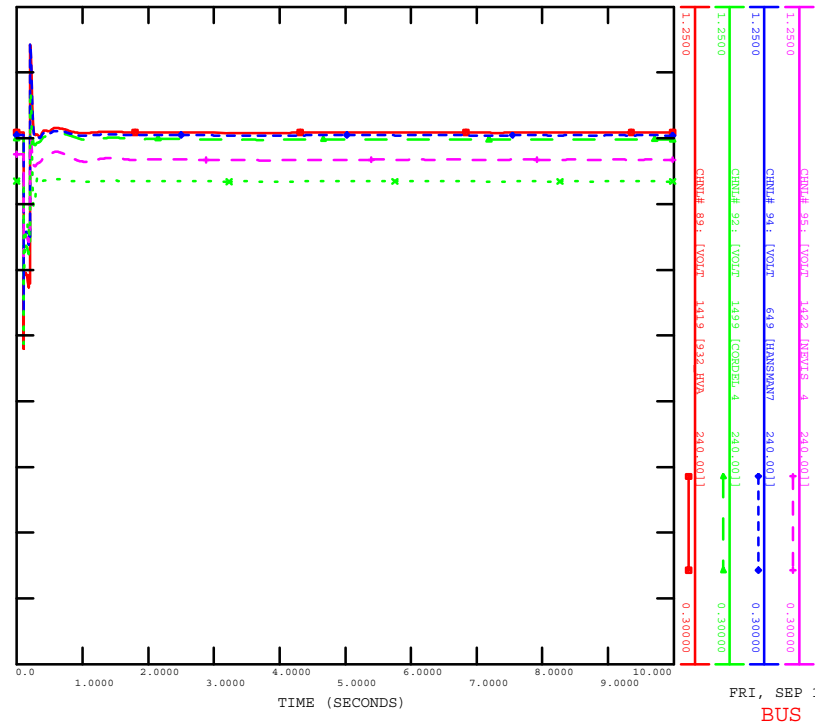


FILE: B-01.out



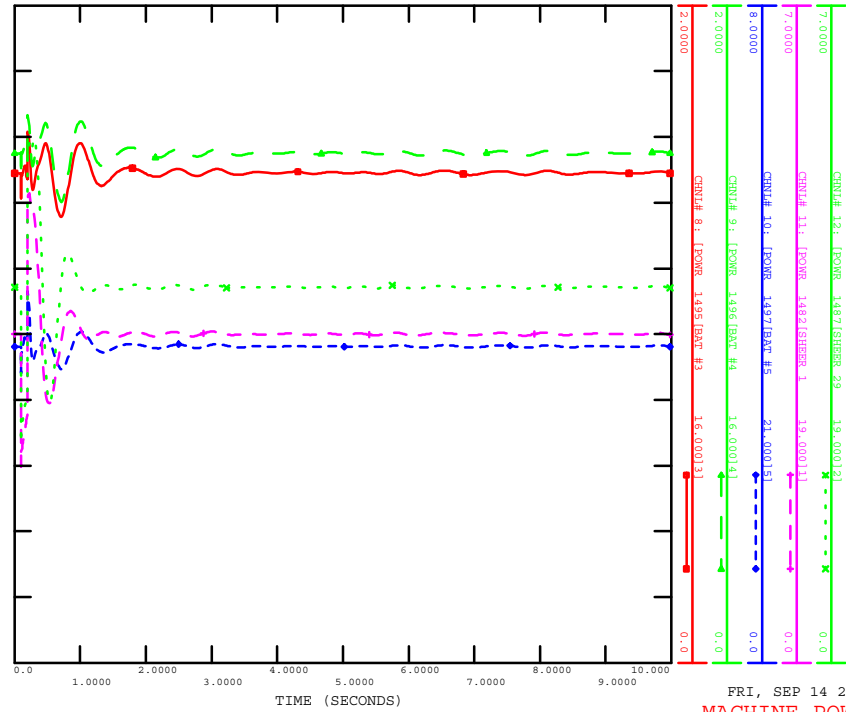
FRI, SEP 14 2012 11:12
WIND (MW)

FILE: B-01.out



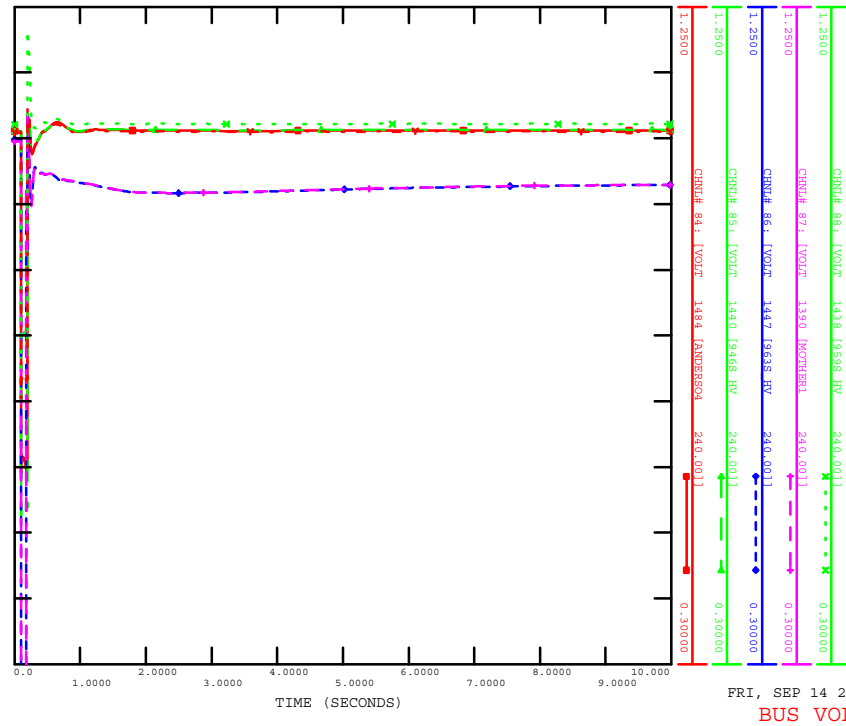
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-01.out



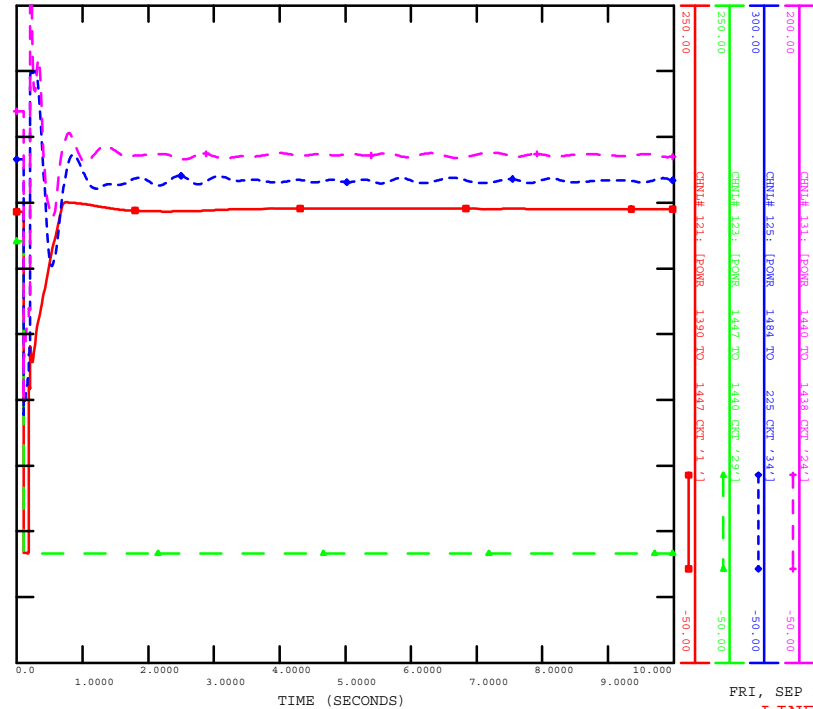
FRI, SEP 14 2012 11:12
MACHINE POWER (P)

FILE: B-01.out



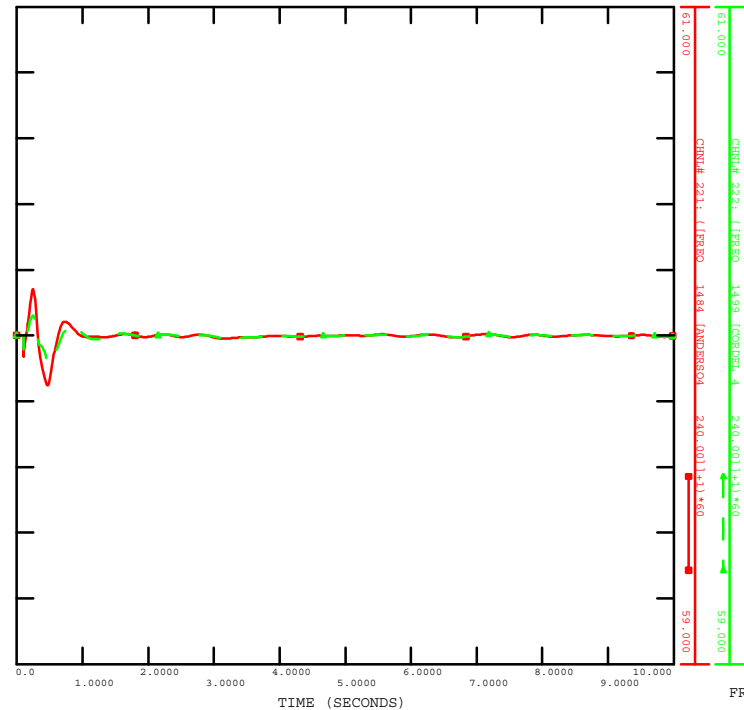
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-01.out



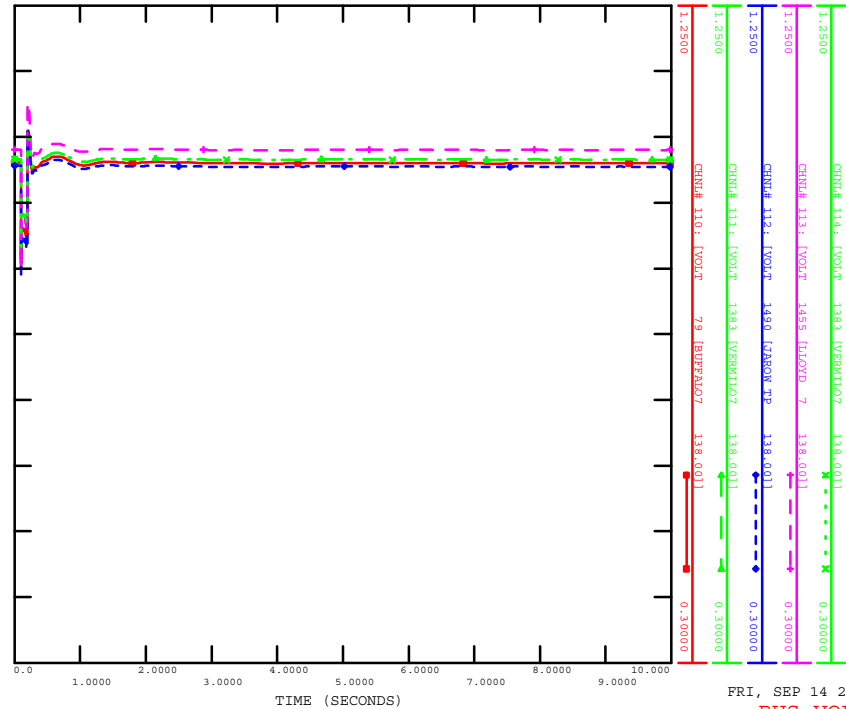
FRI, SEP 14 2012 11:12
LINE FLOW (P)

FILE: B-01.out



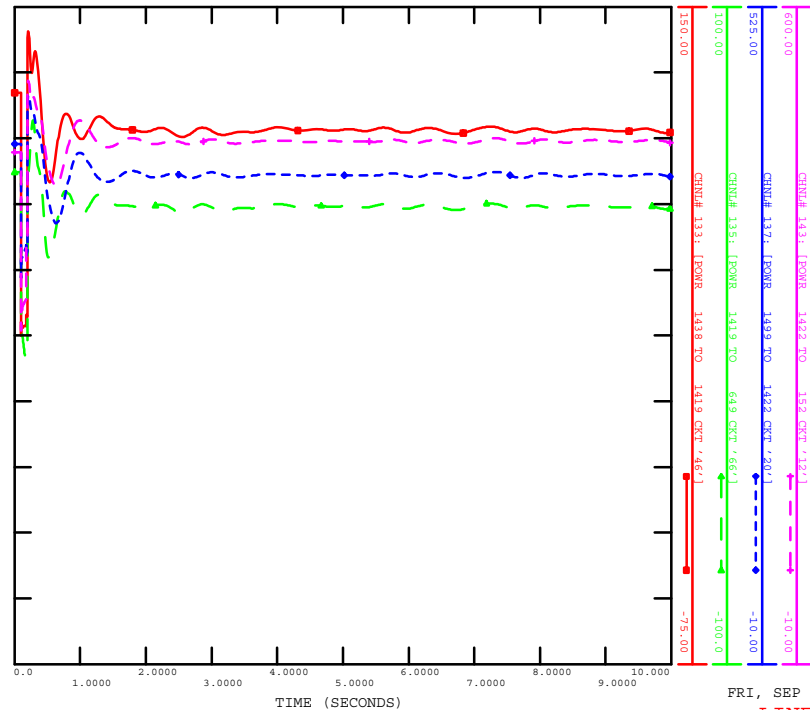
FRI, SEP 14 2012 11:12
BUS FREQUENCY

FILE: B-01.out



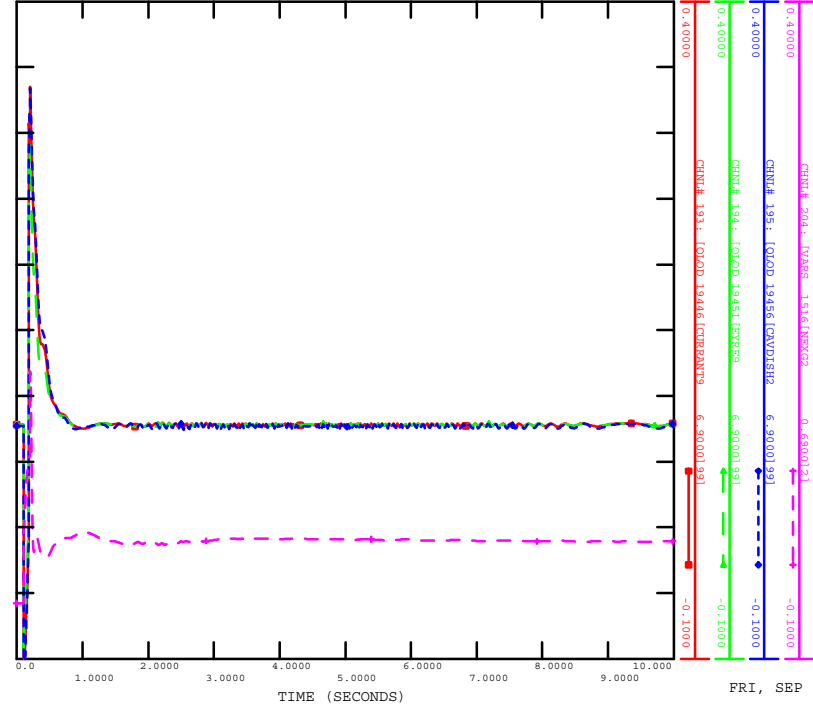
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-01.out



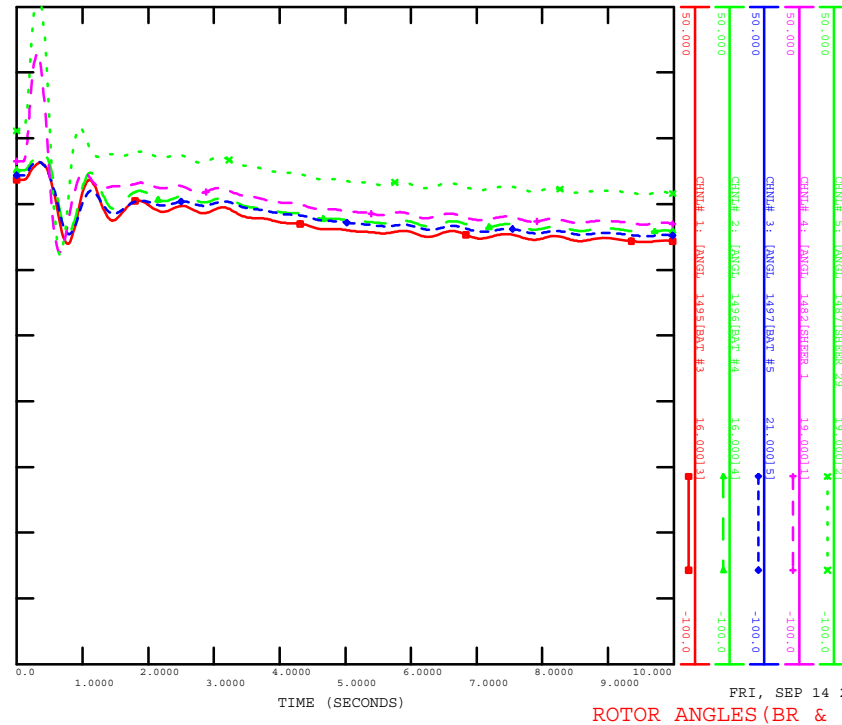
FRI, SEP 14 2012 11:12
LINE FLOW (P)

FILE: B-02.out



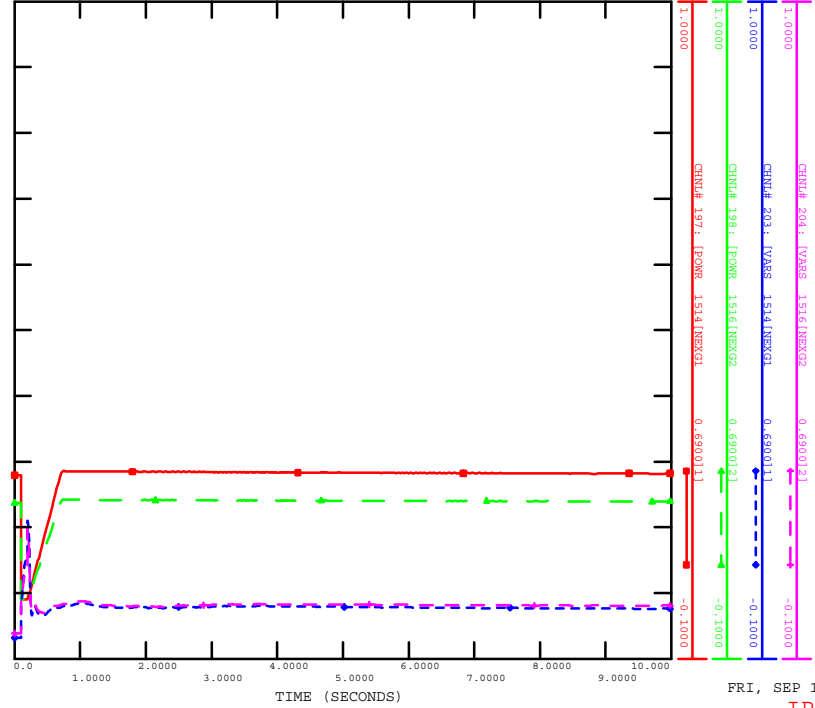
FRI, SEP 14 2012 11:12
IP678 (P)

FILE: B-02.out



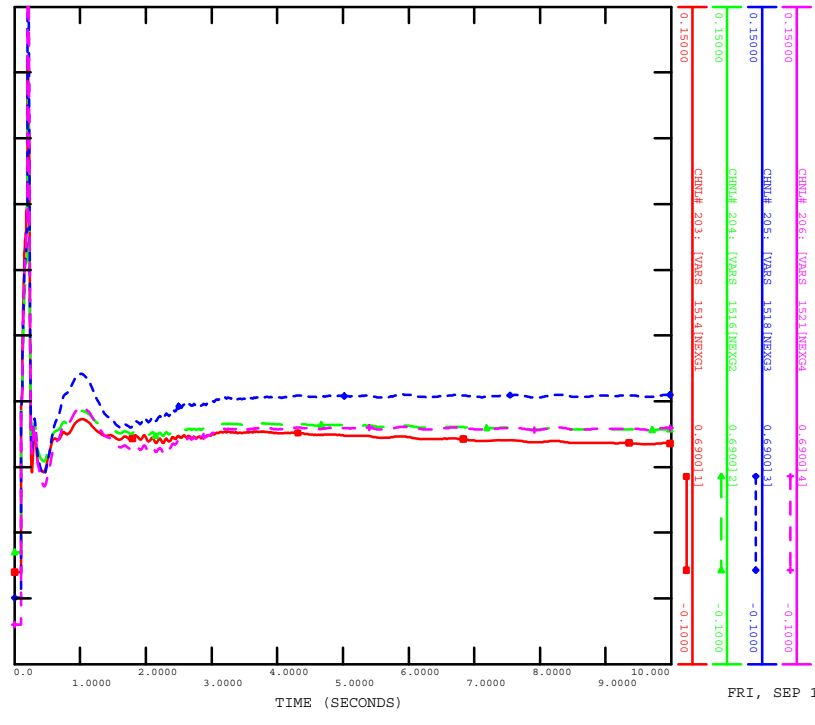
FRI, SEP 14 2012 11:12
ROTOR ANGLES (BR & SHEERNE)

FILE: B-02.out



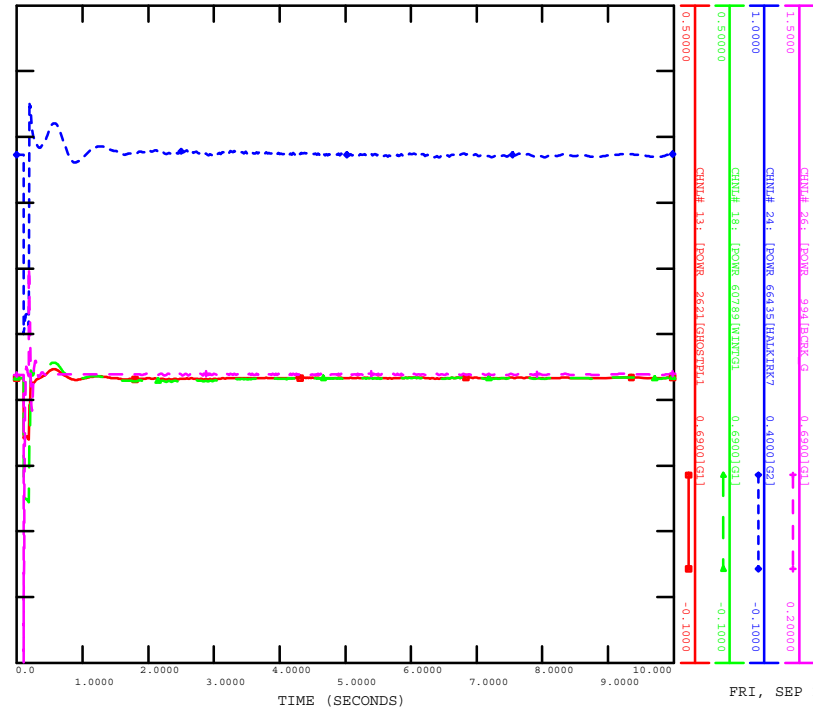
FRI, SEP 14 2012 11:12
IP635 (P&Q)

FILE: B-02.out

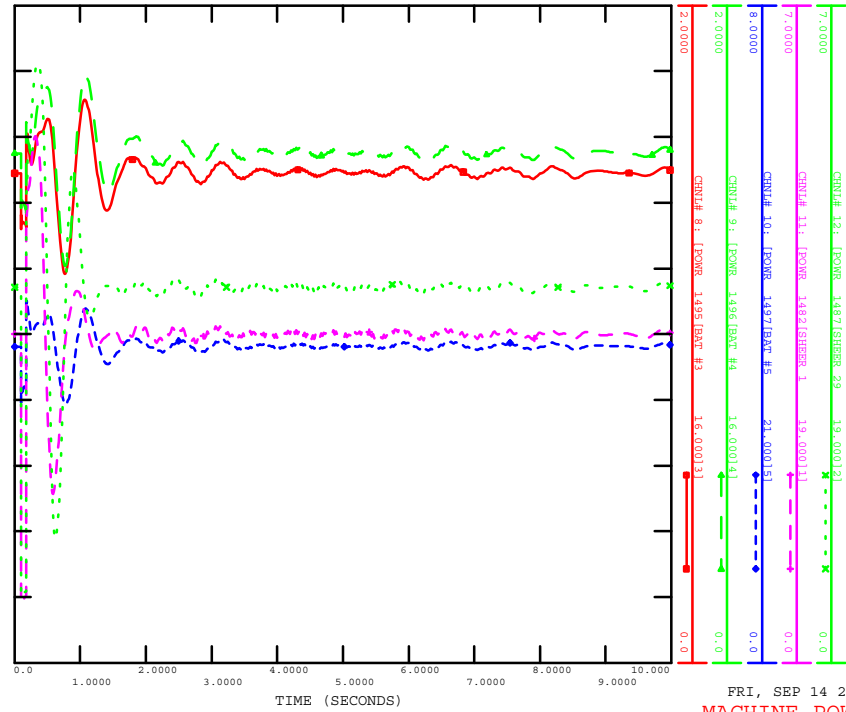


FRI, SEP 14 2012 11:12
IP678 (Q)

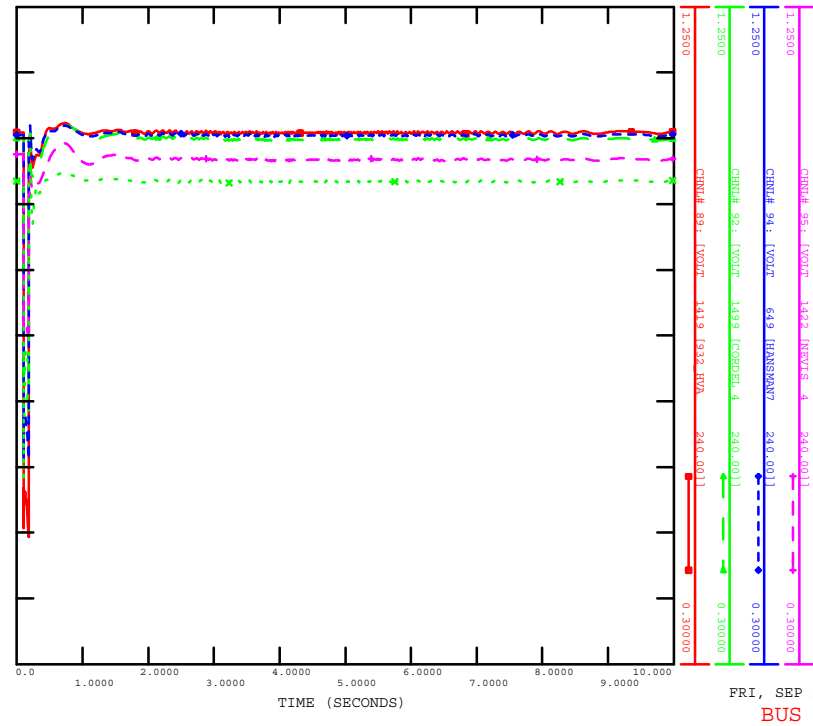
FILE: B-02.out



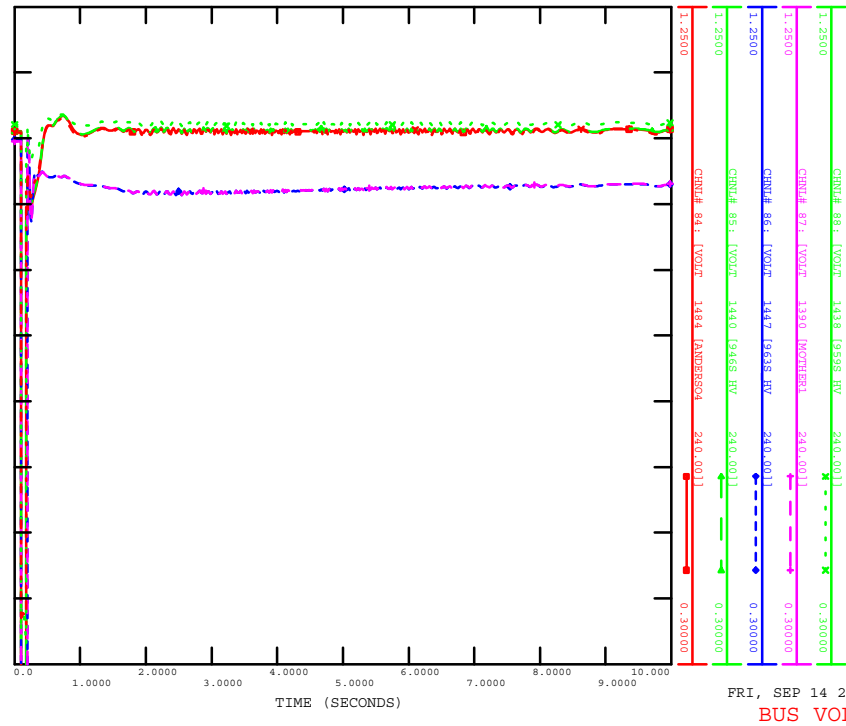
FILE: B-02.out



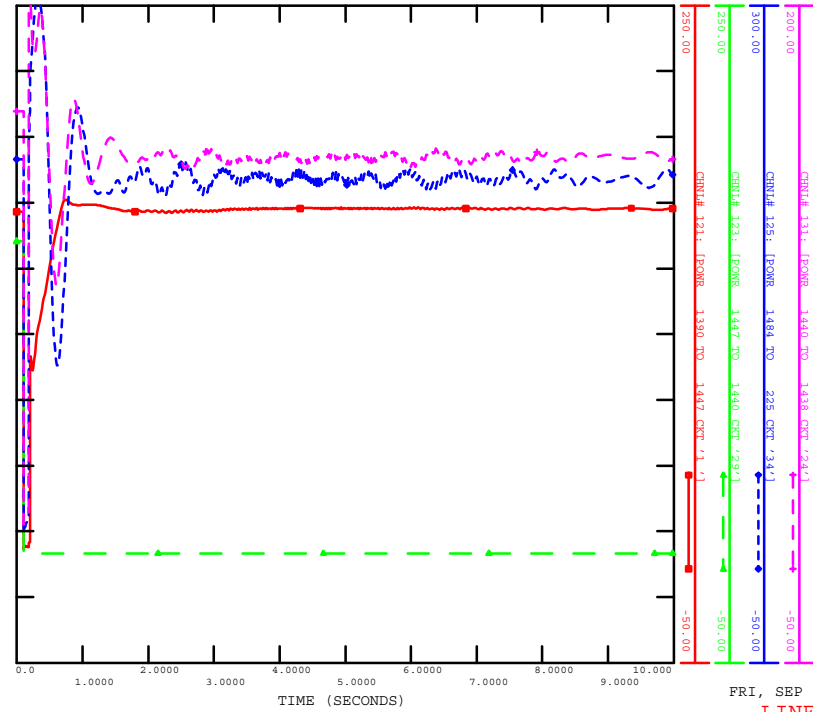
FILE: B-02.out



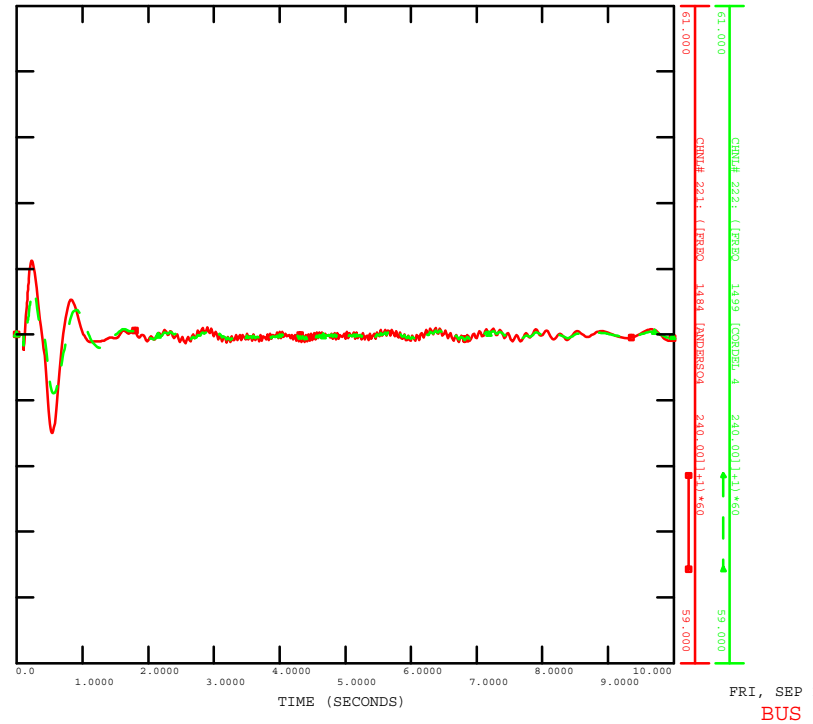
FILE: B-02.out



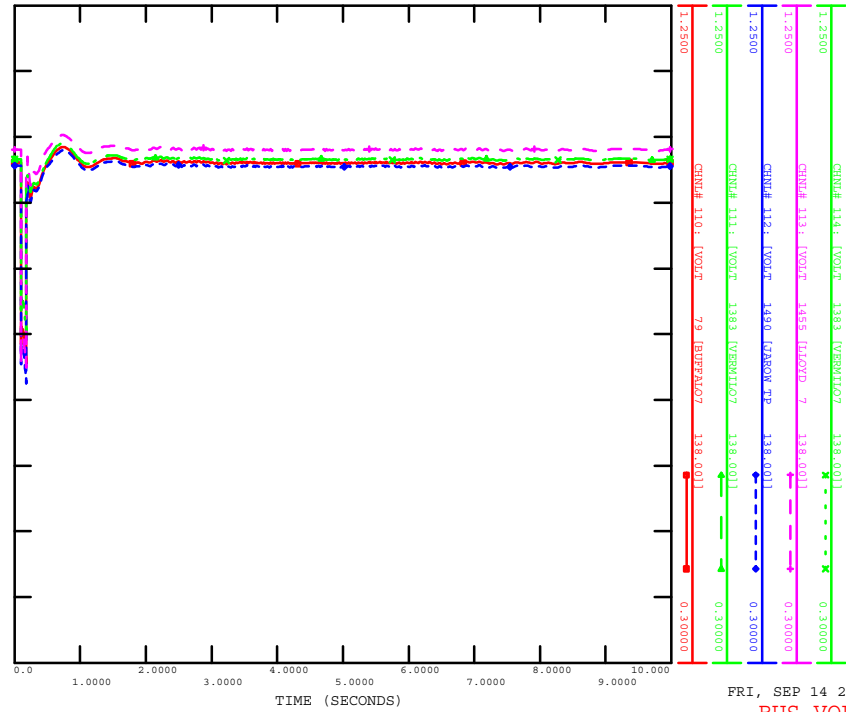
FILE: B-02.out



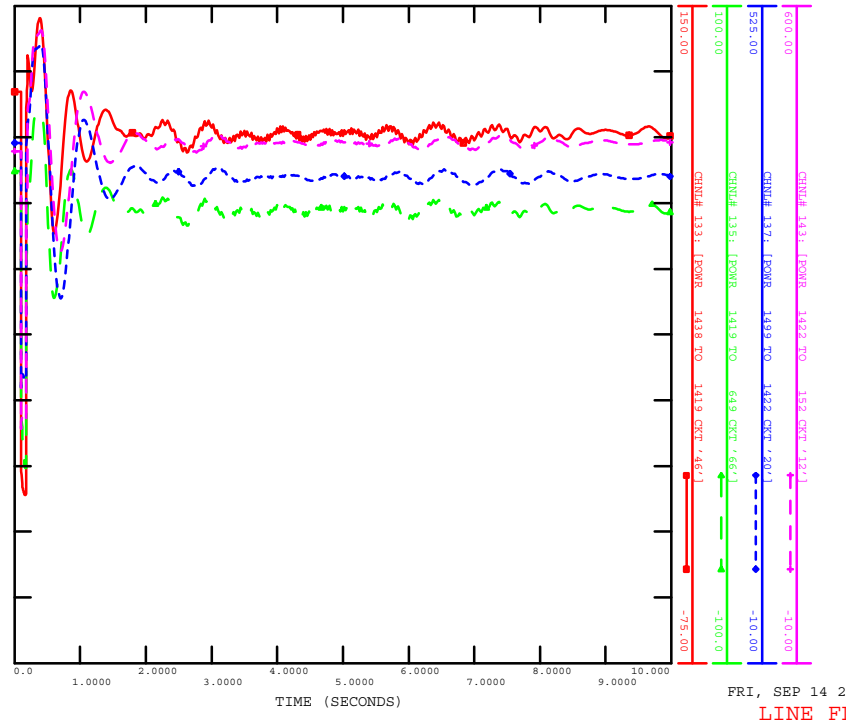
FILE: B-02.out



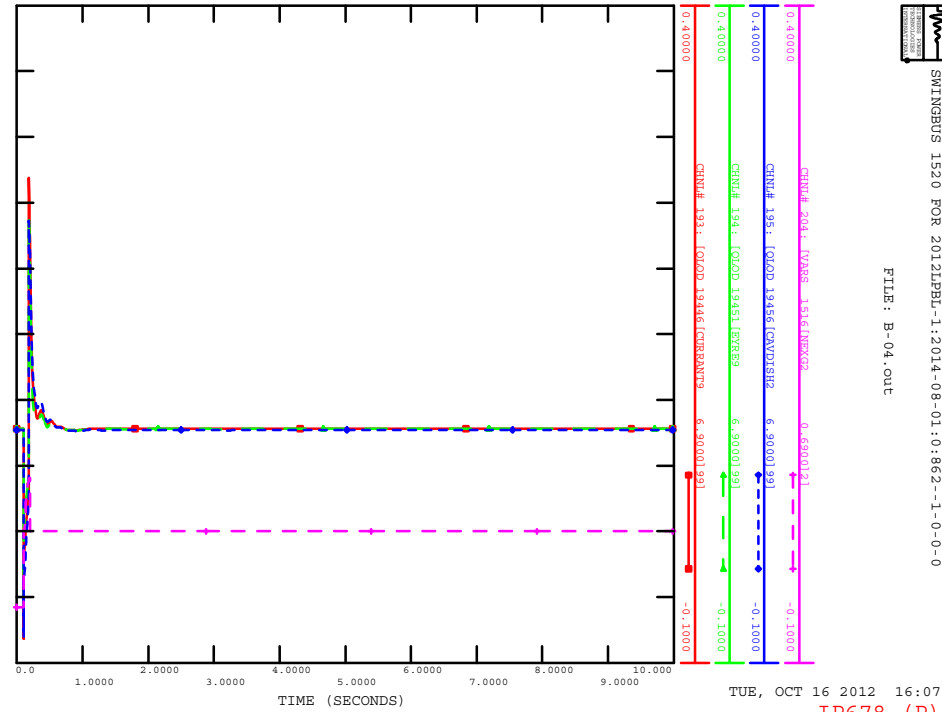
FILE: B-02.out



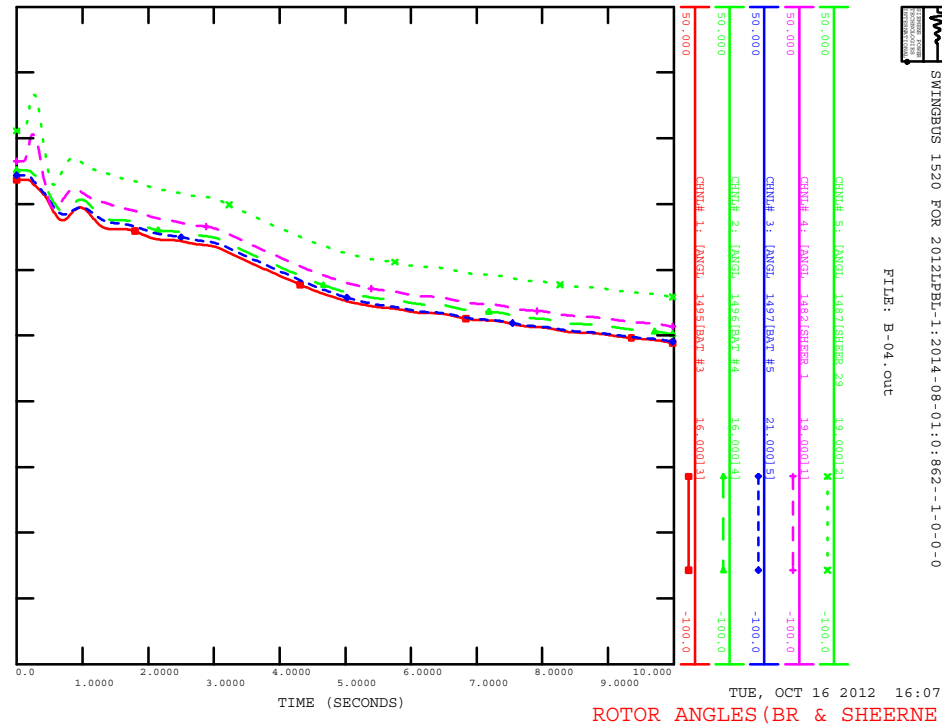
FILE: B-02.out



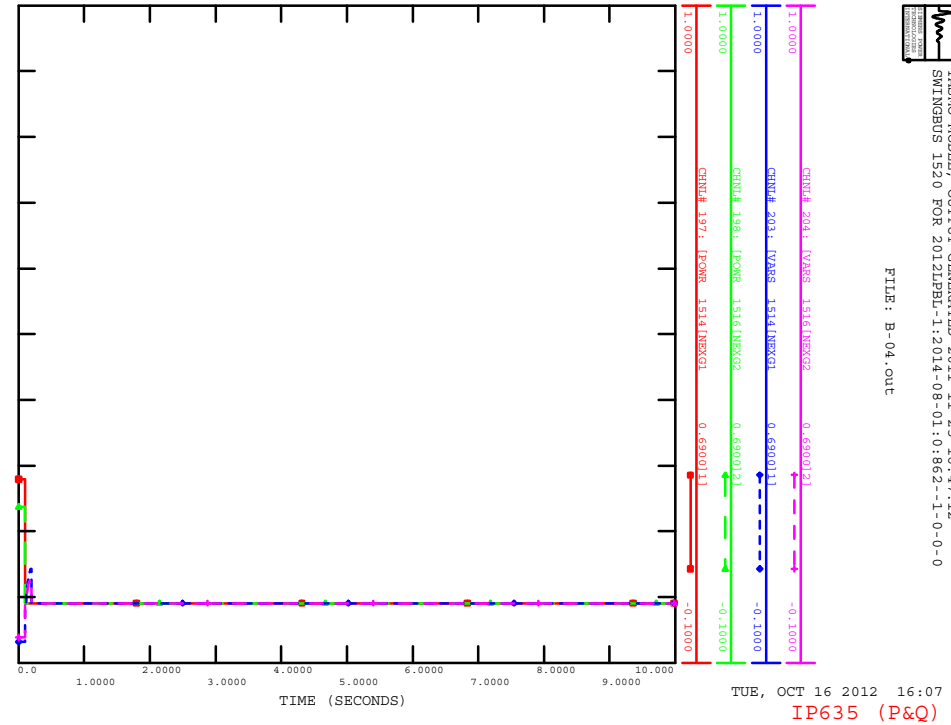
FILE: B-04.out



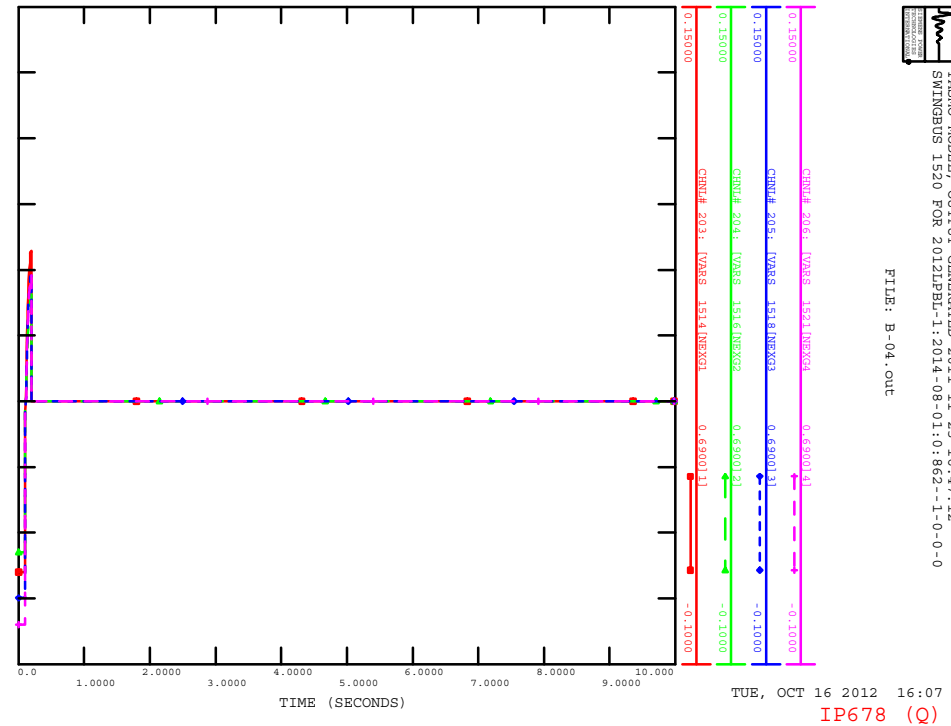
FILE: B-04.out



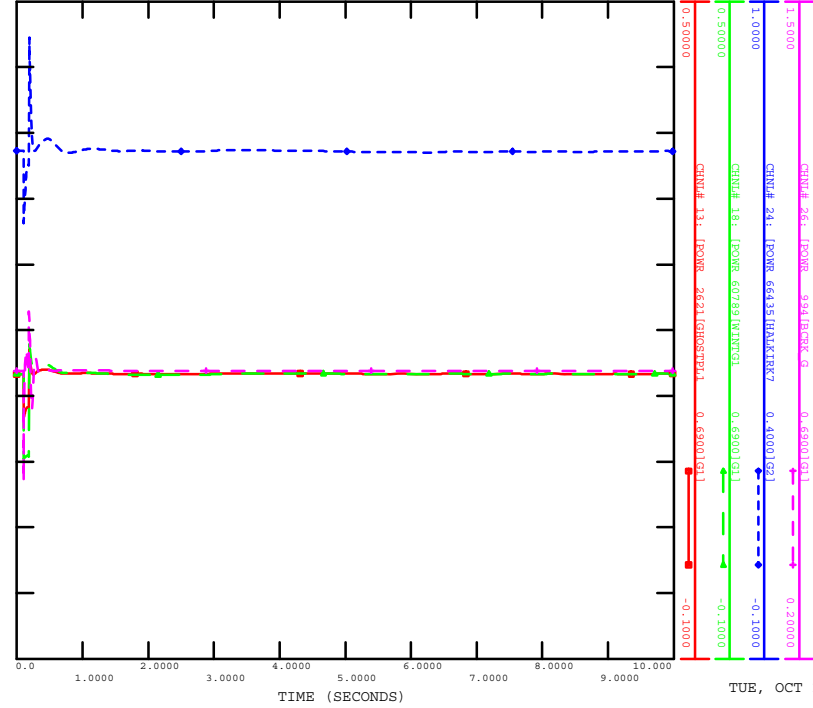
FILE: B-04.out



FILE: B-04.out

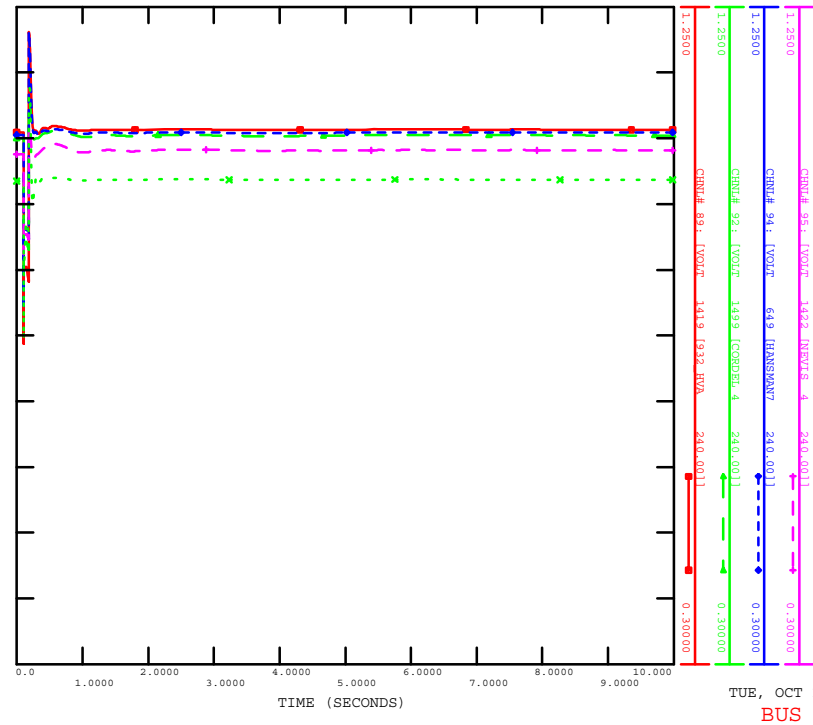


FILE: B-04.out



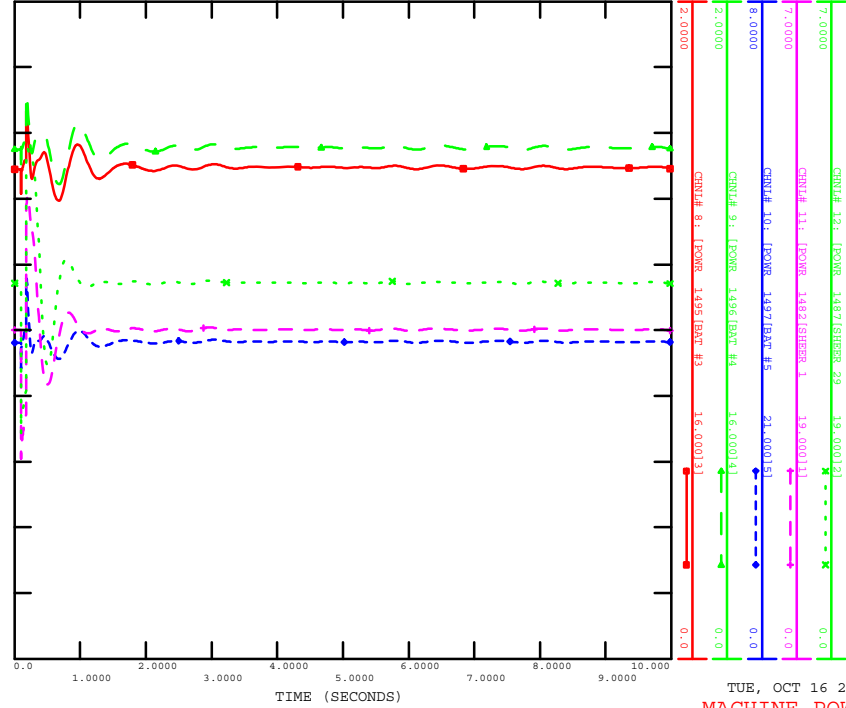
TUE, OCT 16 2012 16:07
WIND (MW)

FILE: B-04.out



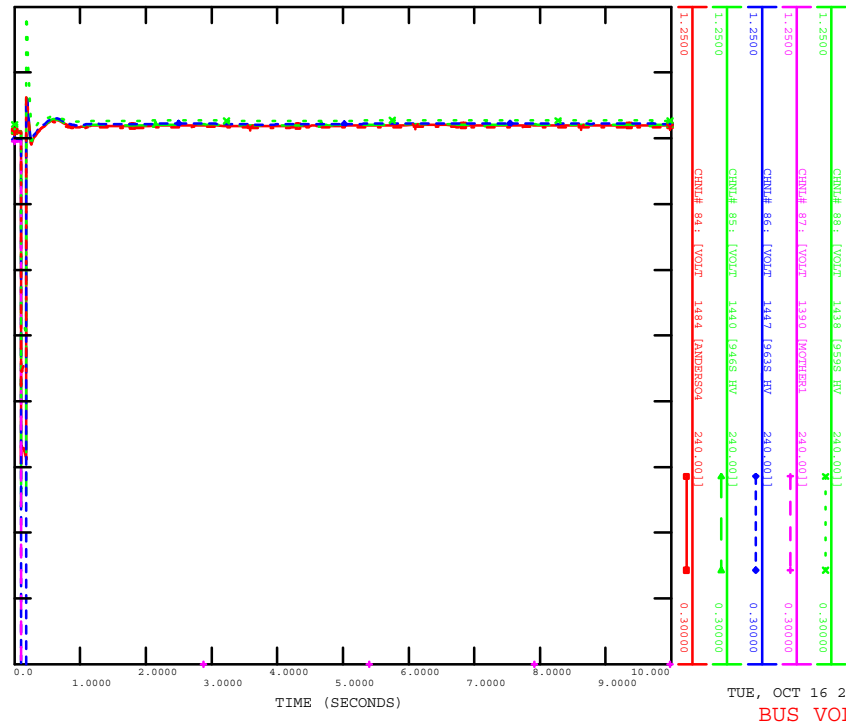
TUE, OCT 16 2012 16:07
BUS VOLT (PU)

FILE: B-04.out



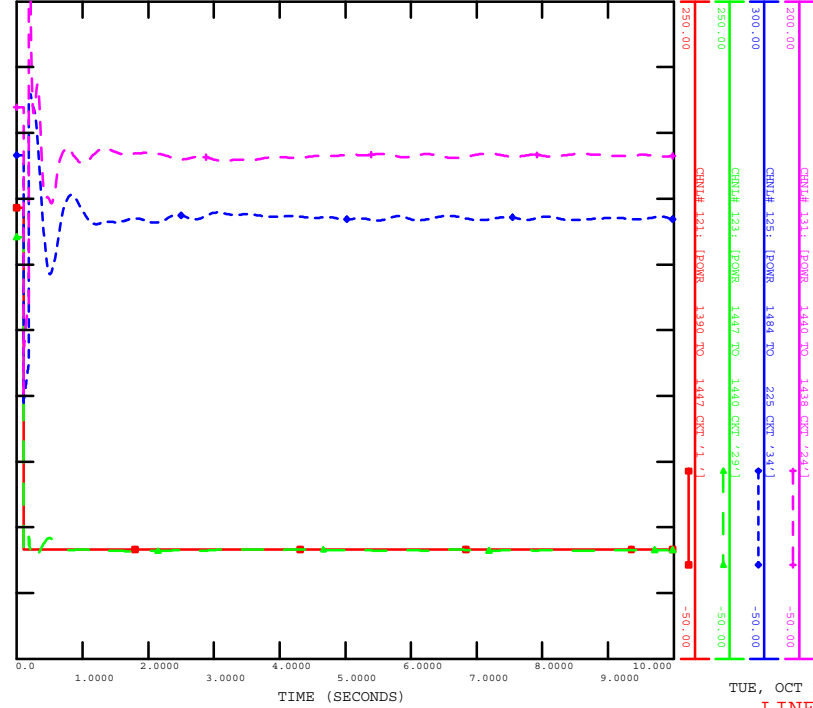
TUE, OCT 16 2012 16:07
MACHINE POWER (P)

FILE: B-04.out



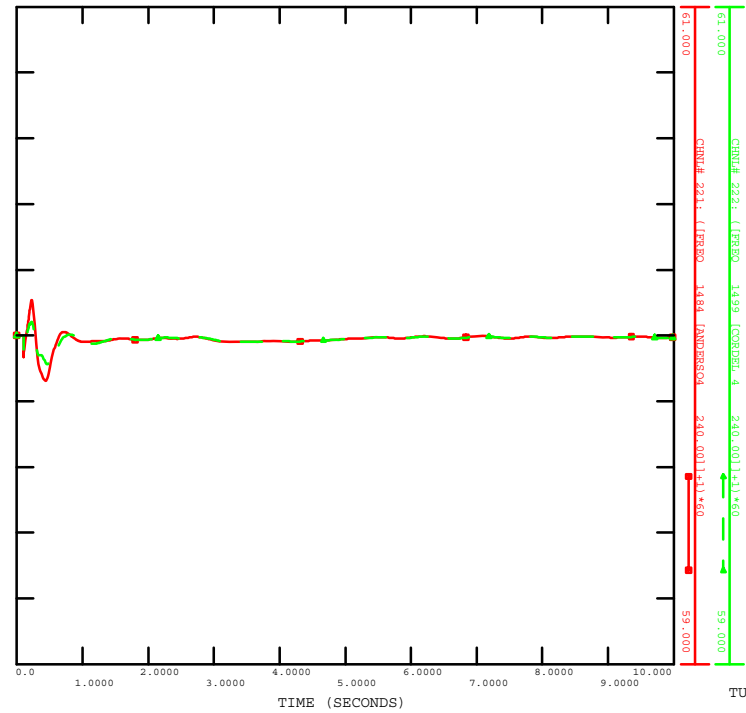
TUE, OCT 16 2012 16:07
BUS VOLT (PU)

FILE: B-04.out



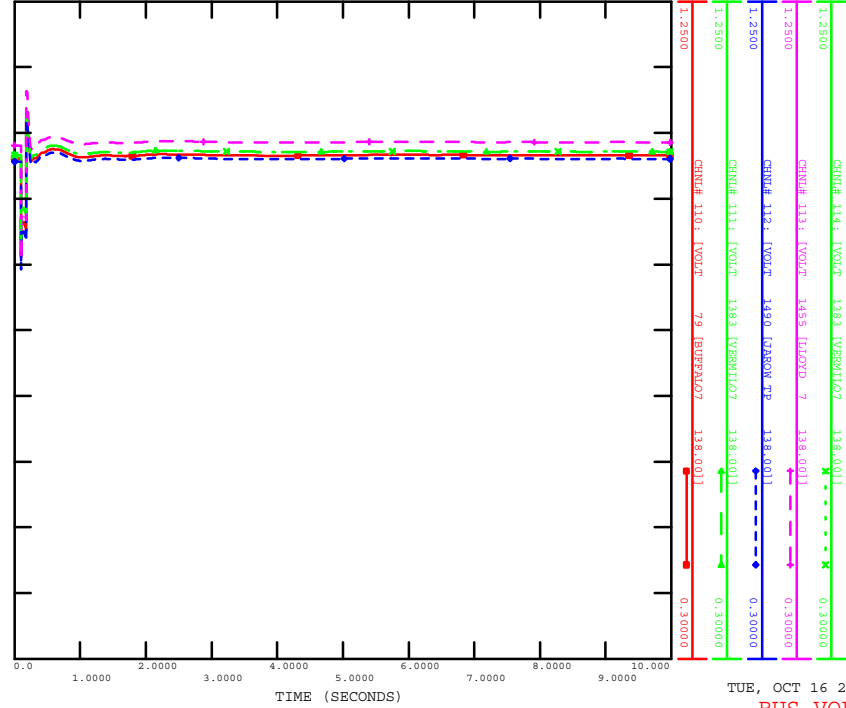
TUE, OCT 16 2012 16:07
LINE FLOW (P)

FILE: B-04.out



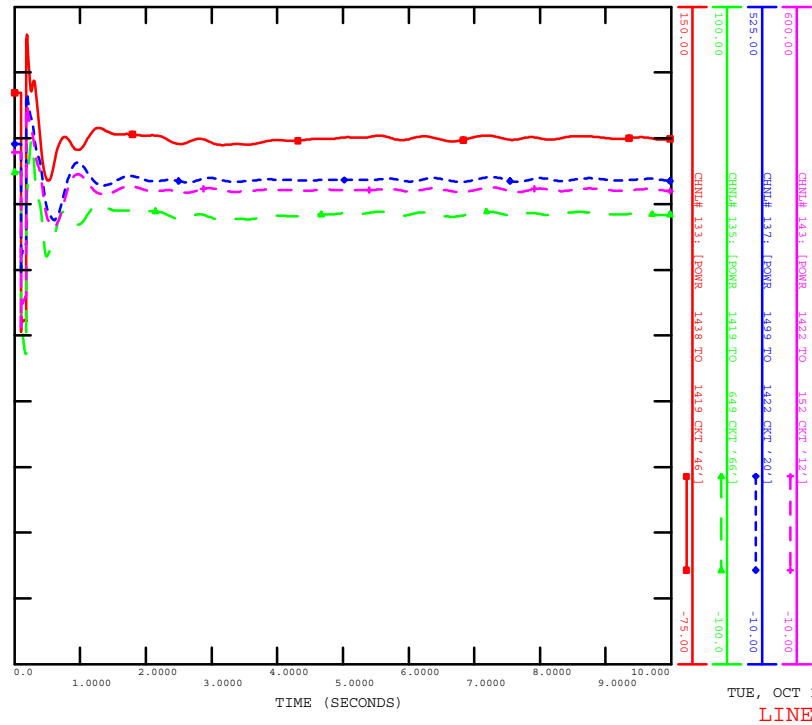
TUE, OCT 16 2012 16:07
BUS FREQUENCY

FILE: B-04.out



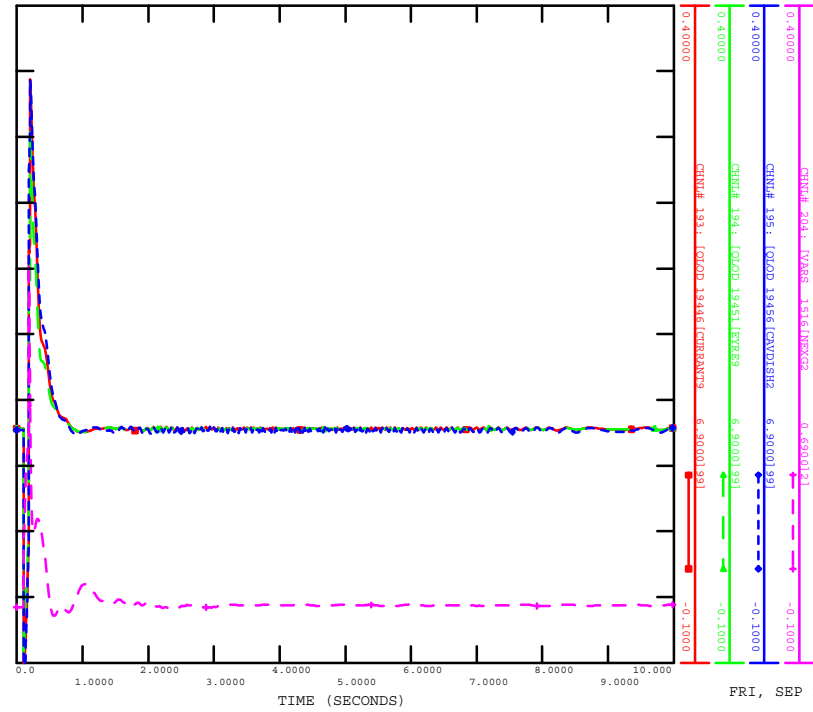
TUE, OCT 16 2012 16:07
BUS VOLT (PU)

FILE: B-04.out

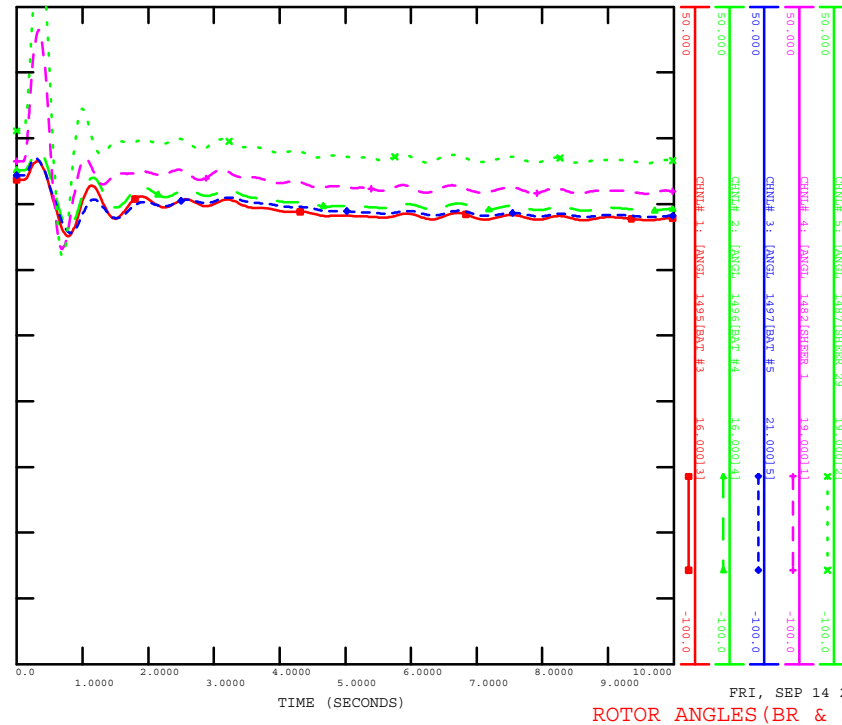


TUE, OCT 16 2012 16:07
LINE FLOW (P)

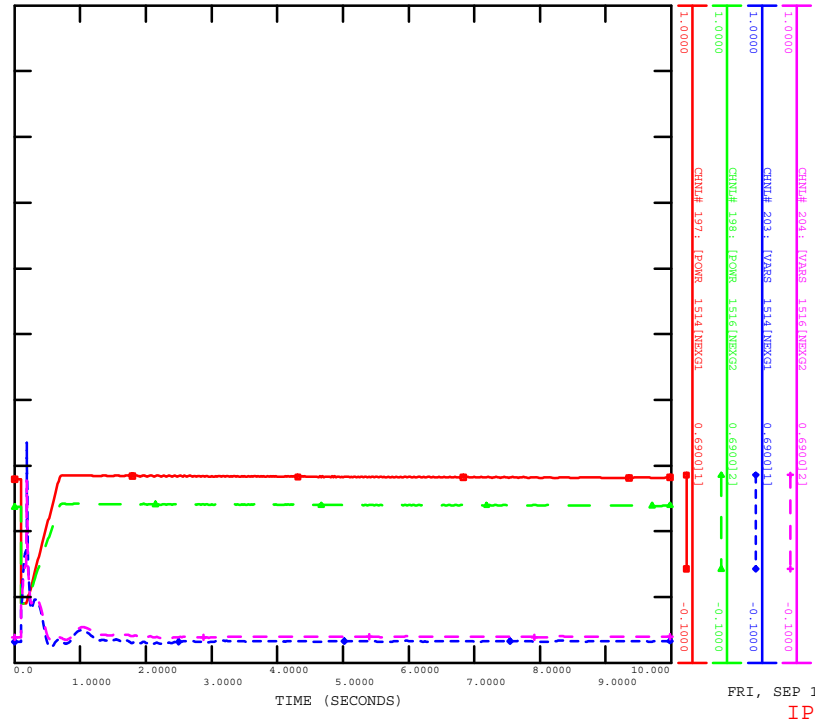
FILE: B-05.out



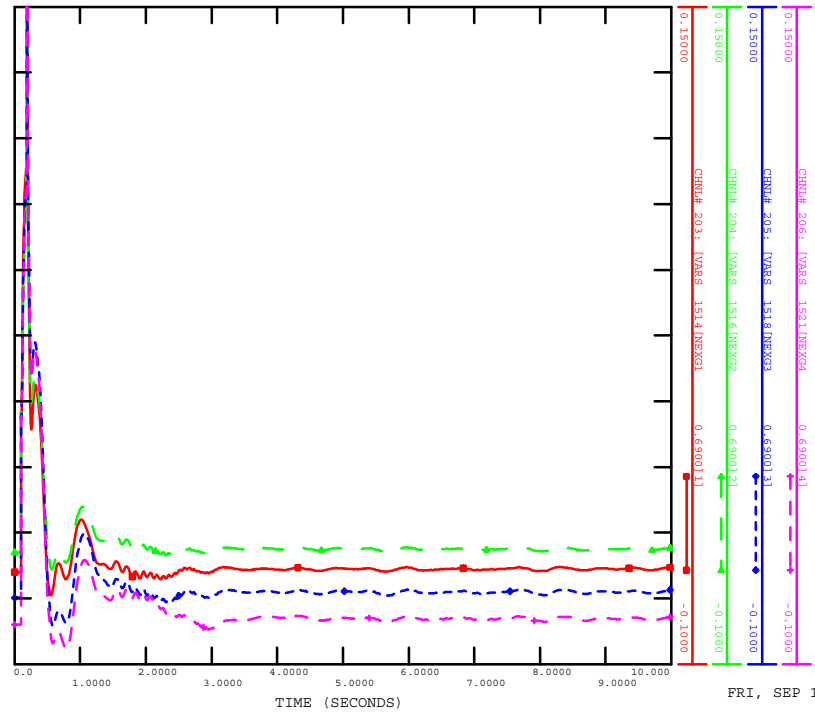
FILE: B-05.out



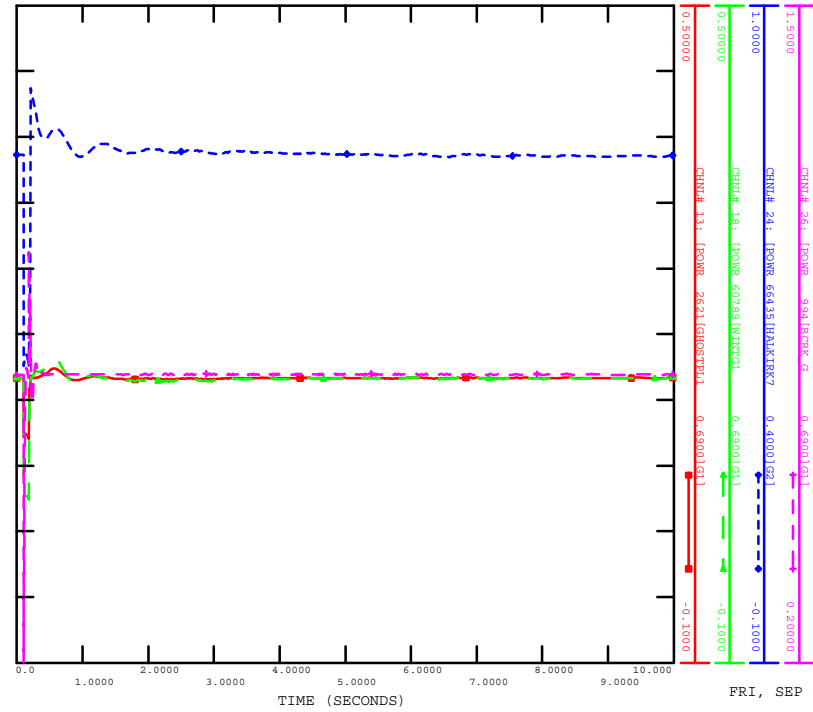
FILE: B-05.out



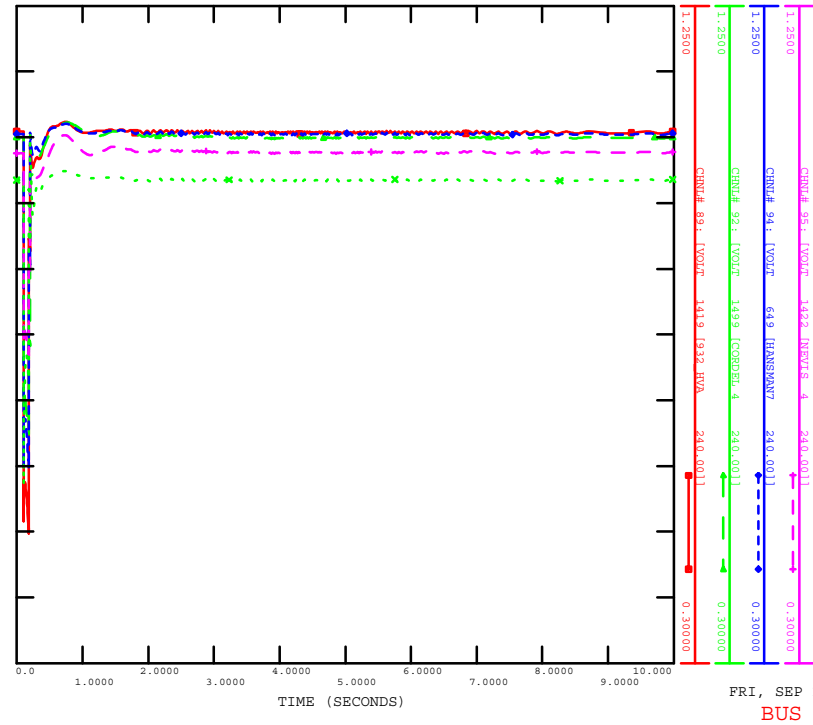
FILE: B-05.out



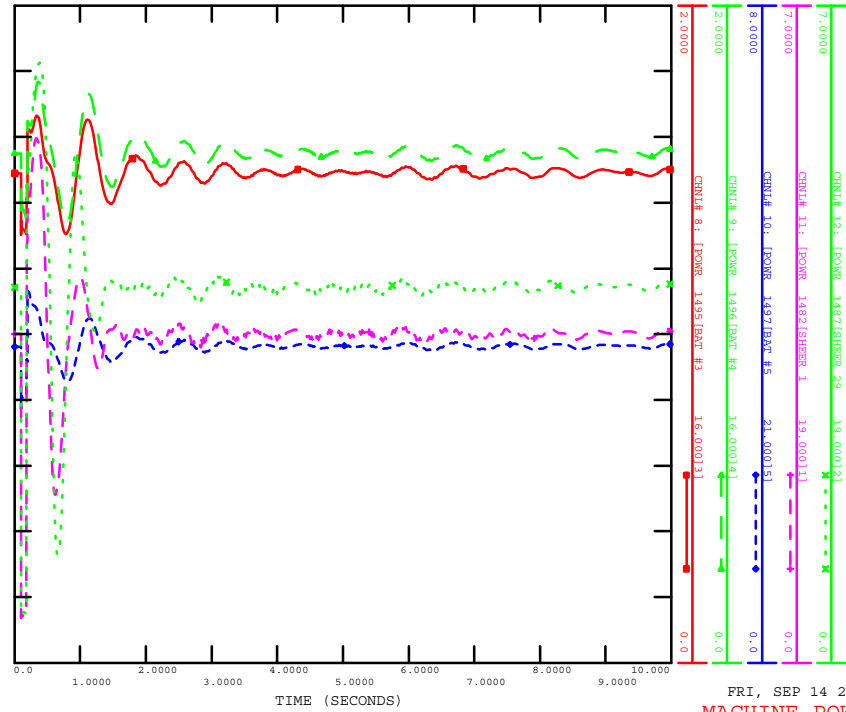
FILE: B-05.out



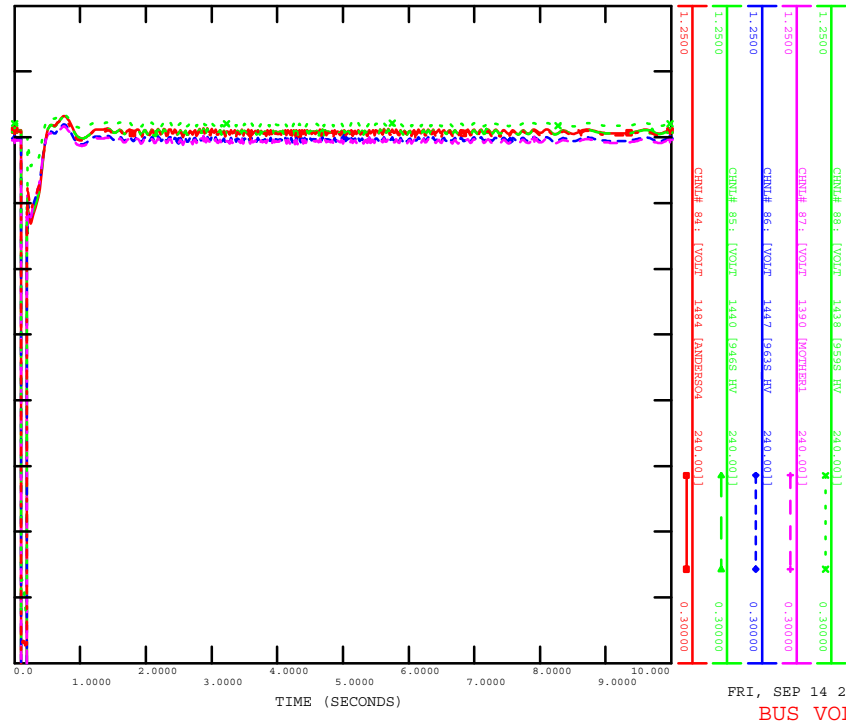
FILE: B-05.out



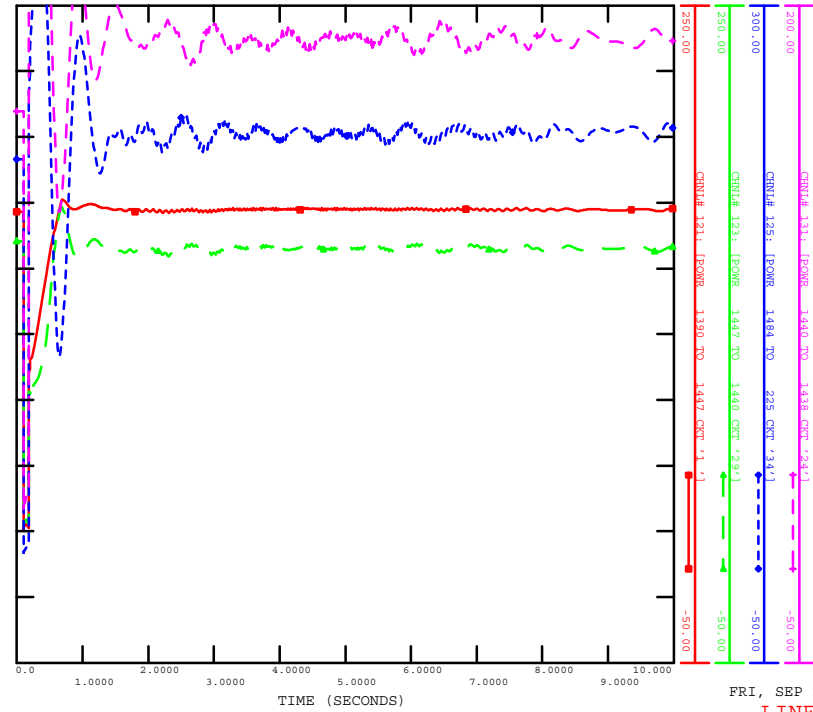
FILE: B-05.out



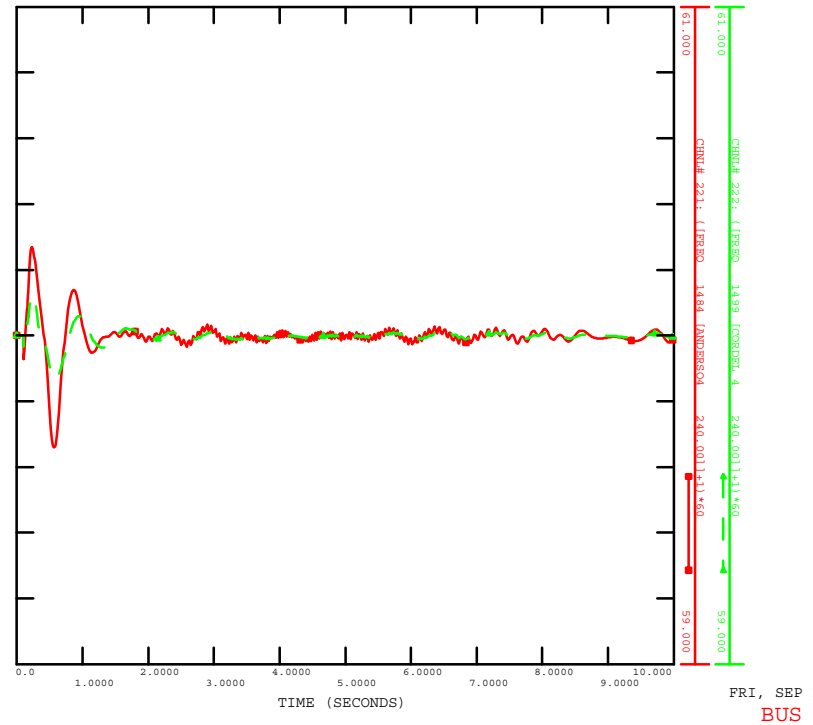
FILE: B-05.out



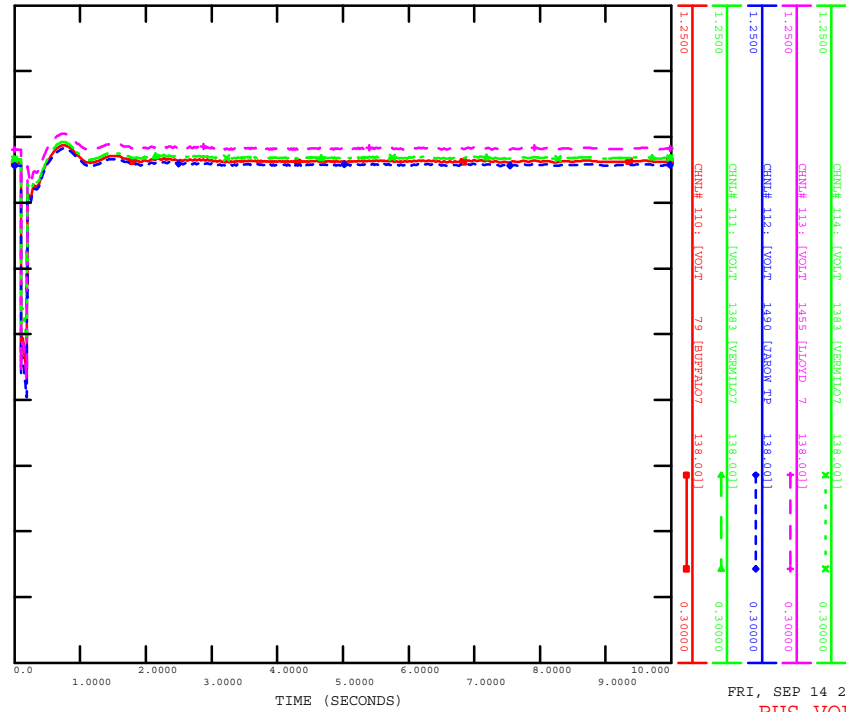
FILE: B-05.out



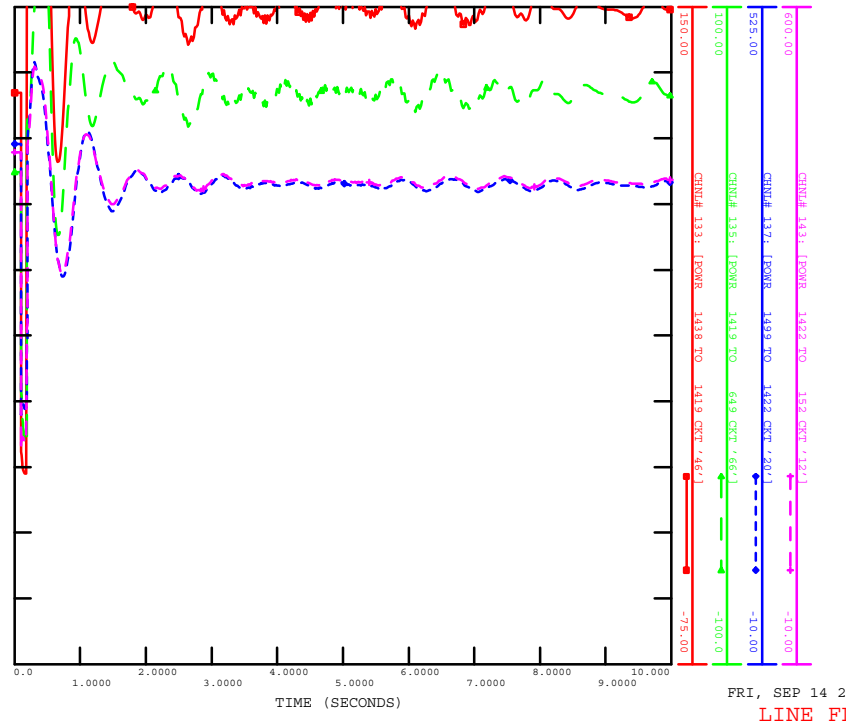
FILE: B-05.out



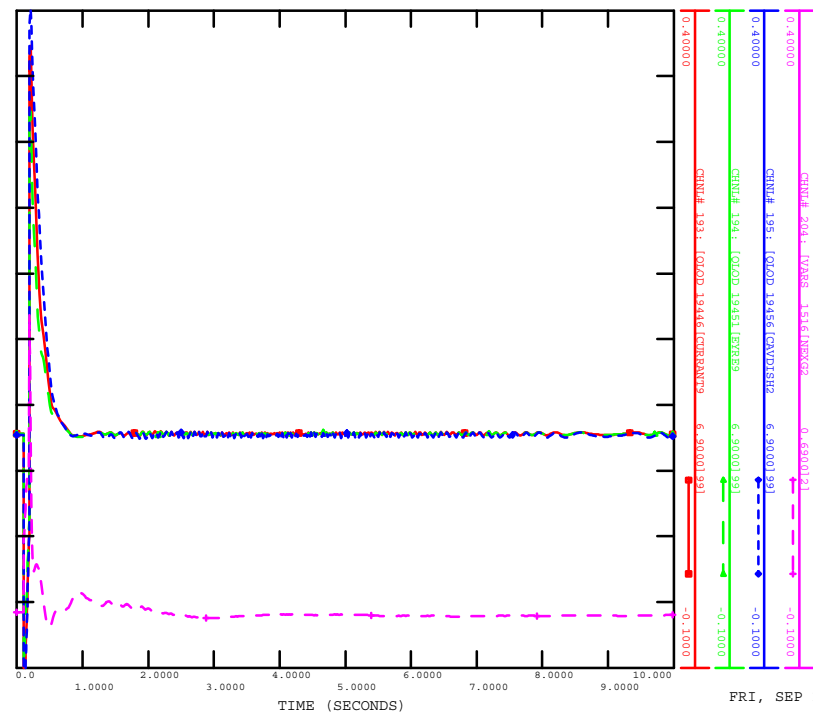
FILE: B-05.out



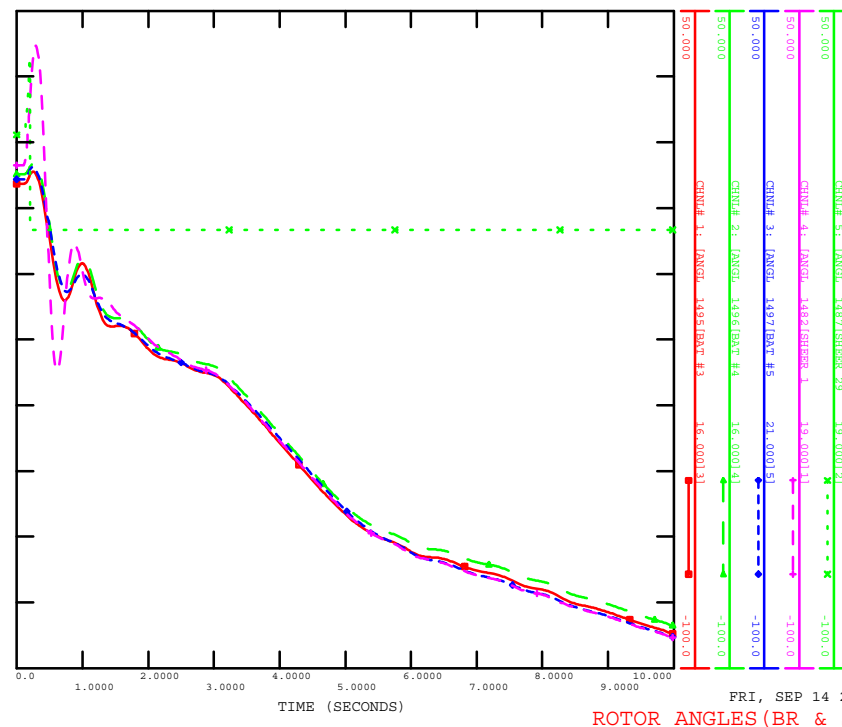
FILE: B-05.out



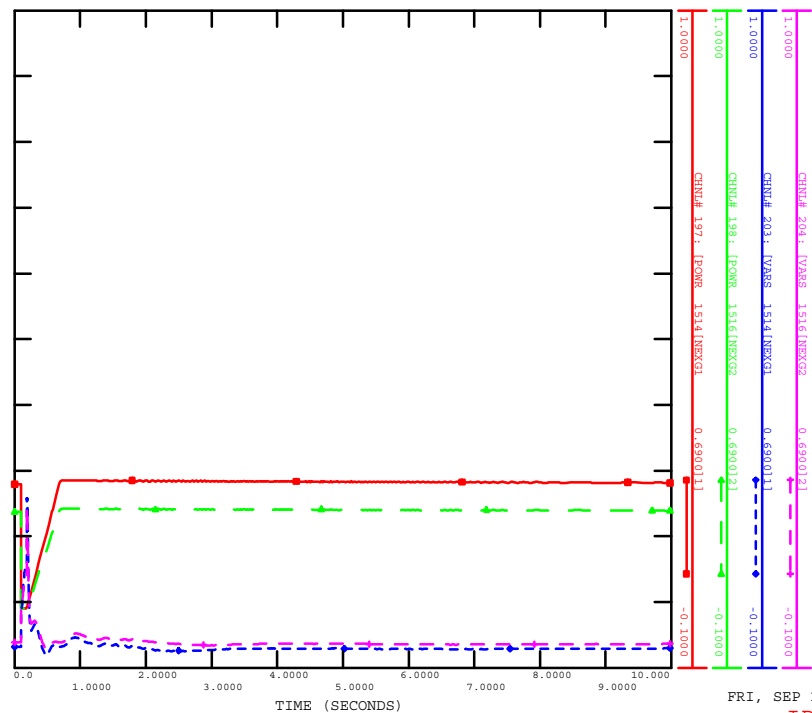
FILE: B-07.out



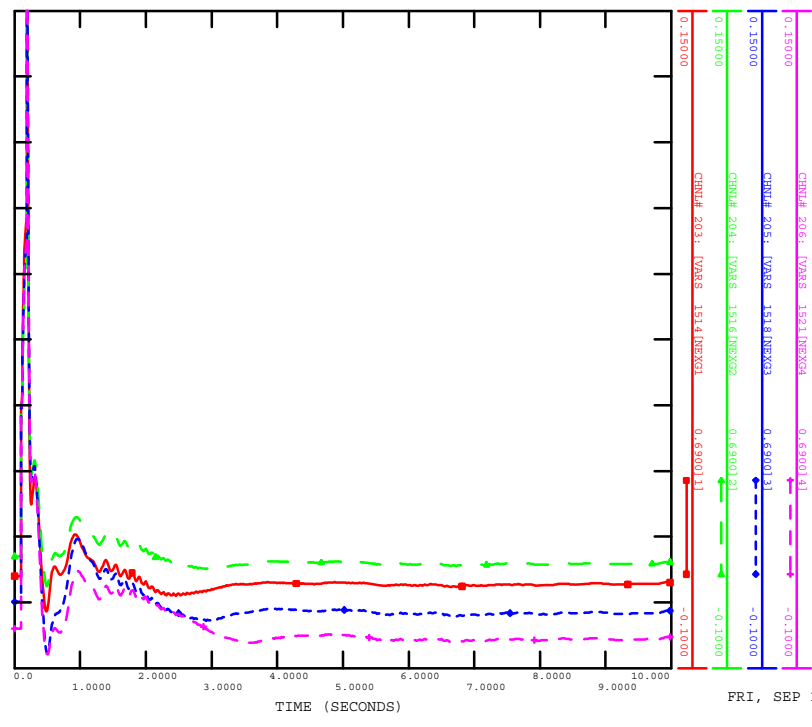
FILE: B-07.out



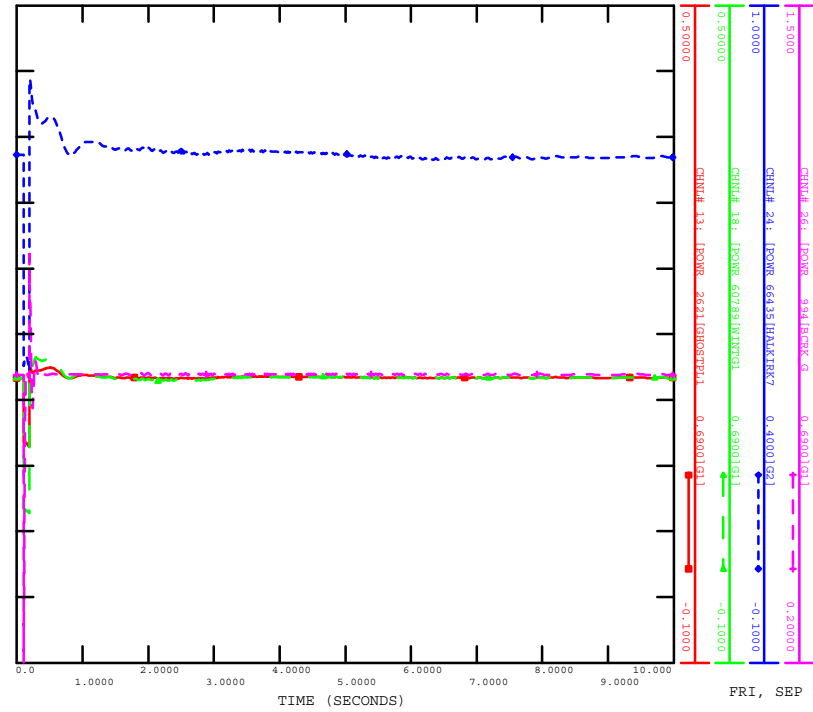
FILE: B-07.out



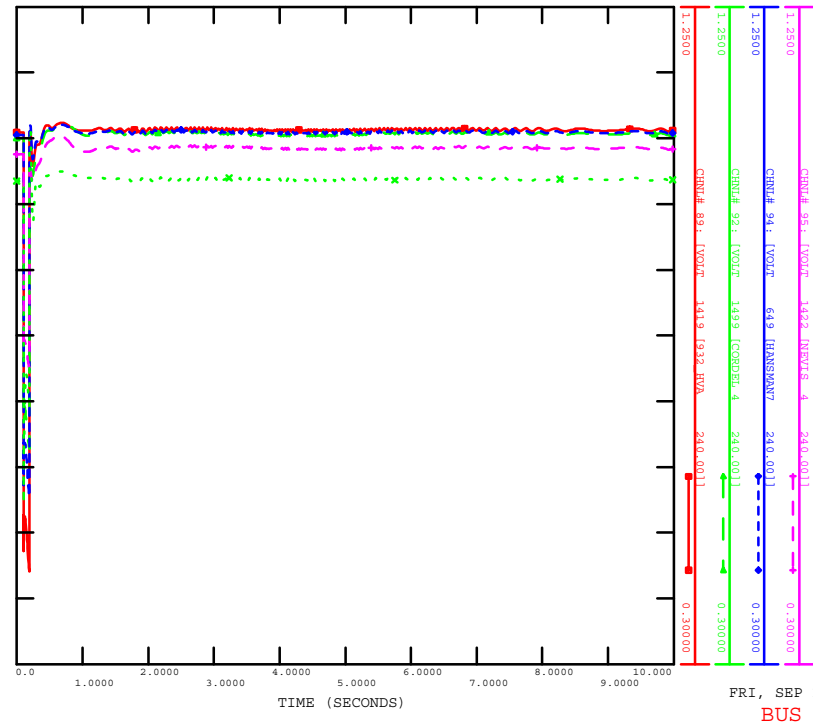
FILE: B-07.out



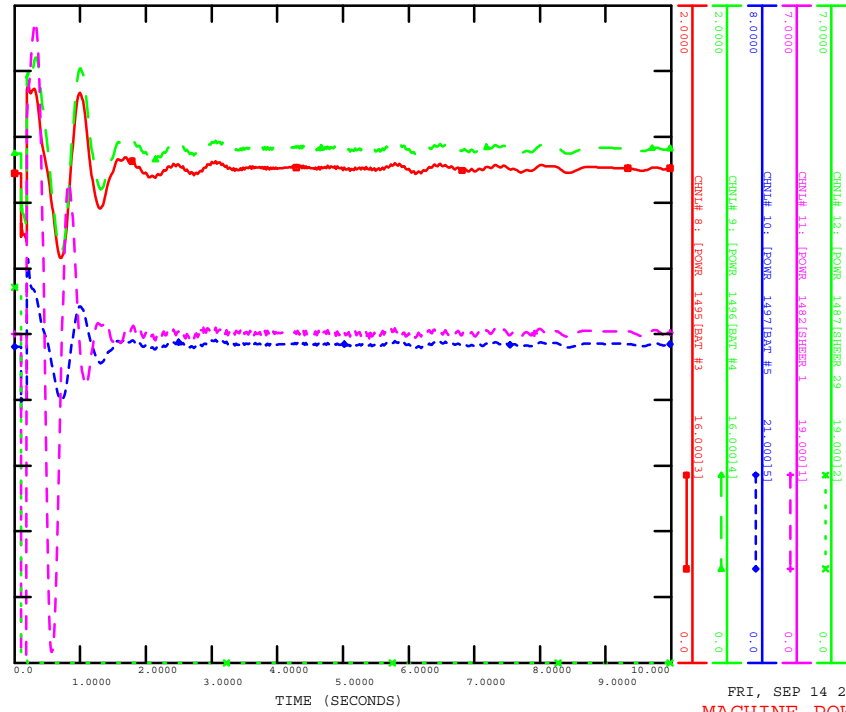
FILE: B-07.out



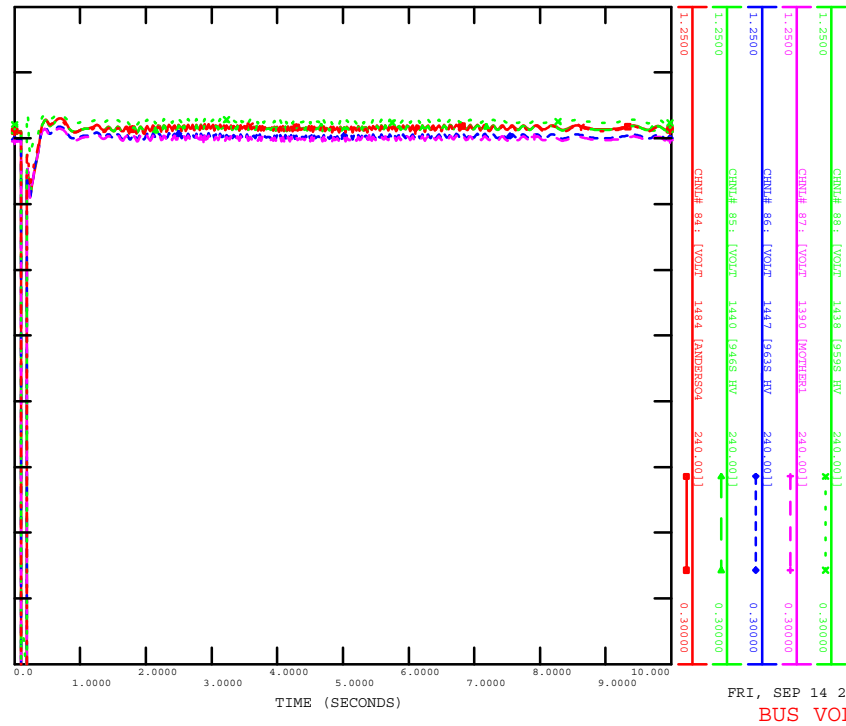
FILE: B-07.out



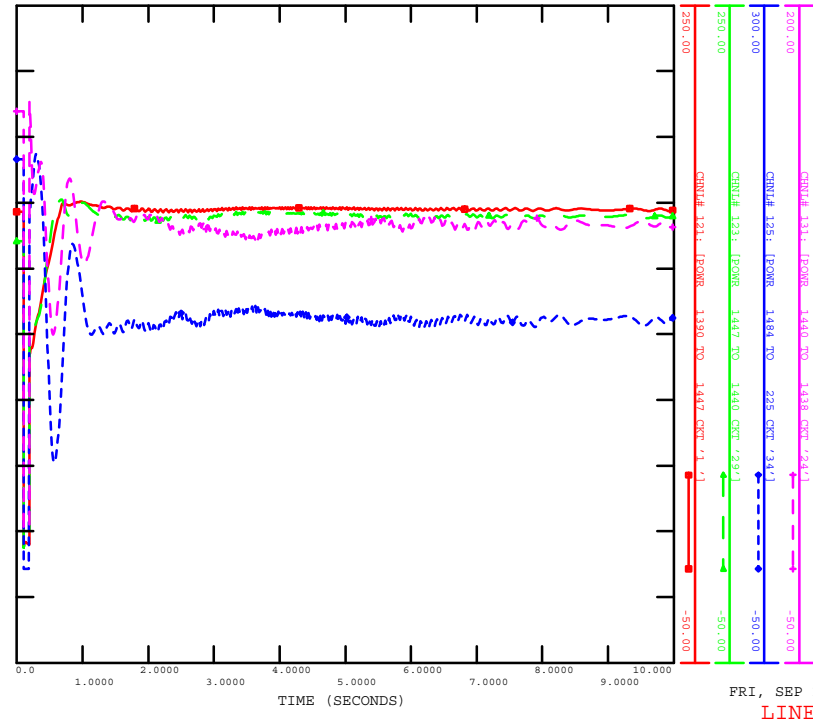
FILE: B-07.out



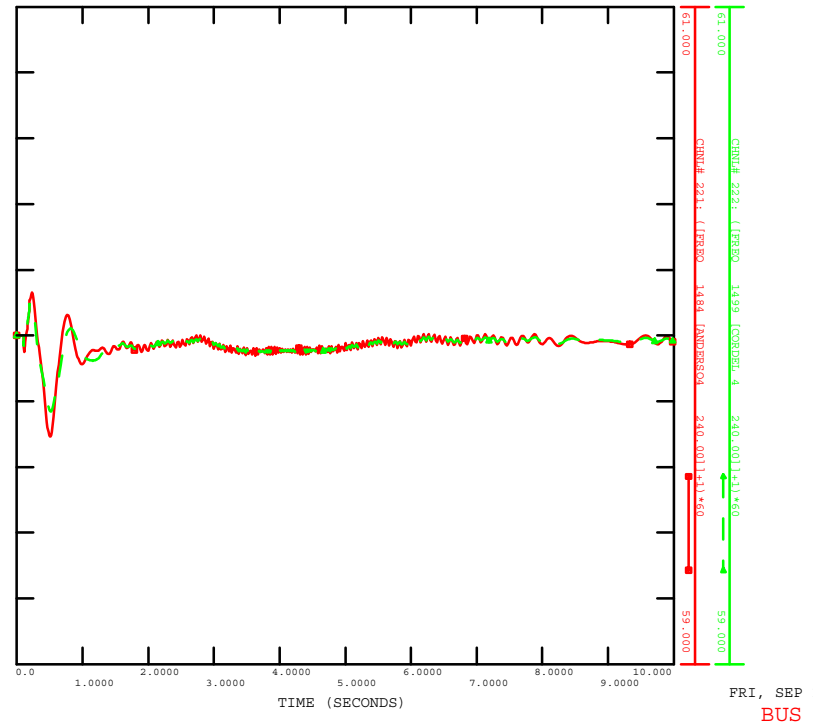
FILE: B-07.out



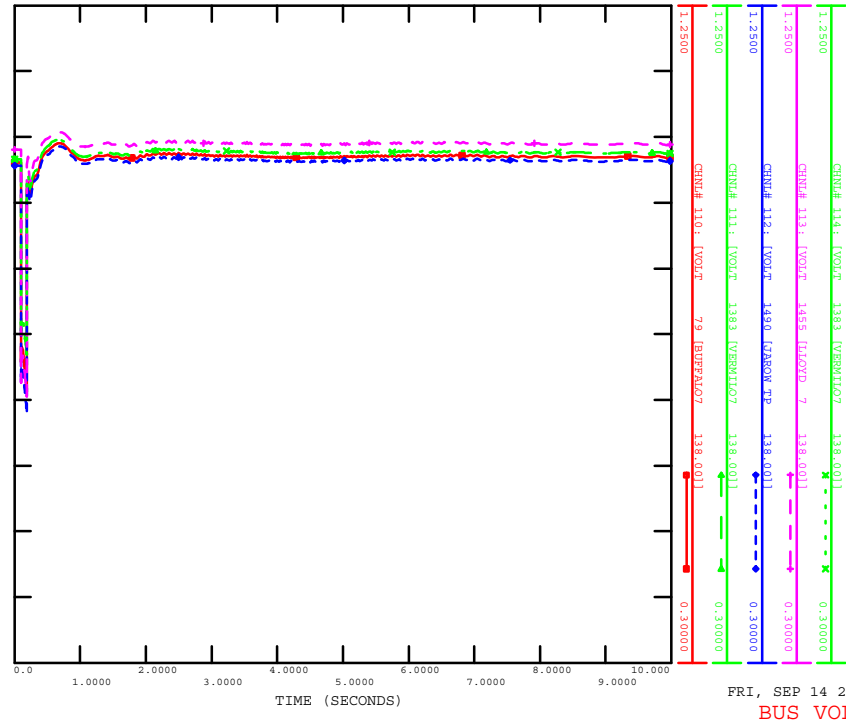
FILE: B-07.out



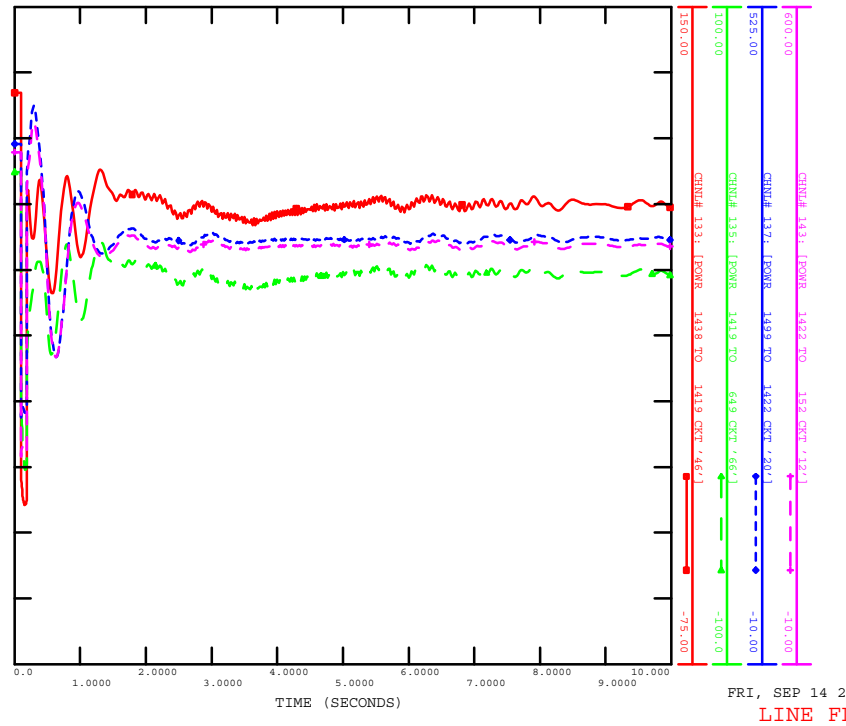
FILE: B-07.out



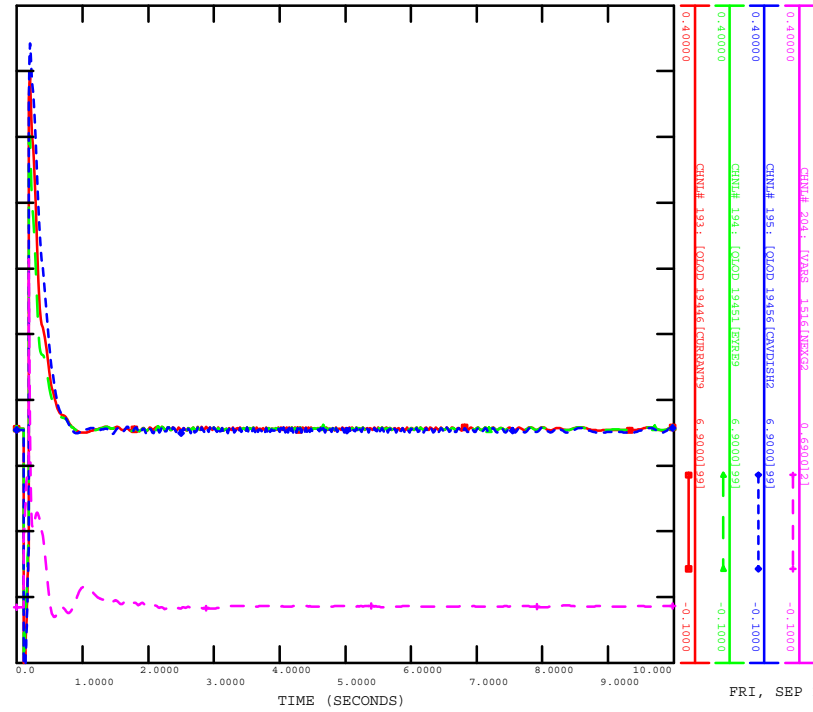
FILE: B-07.out



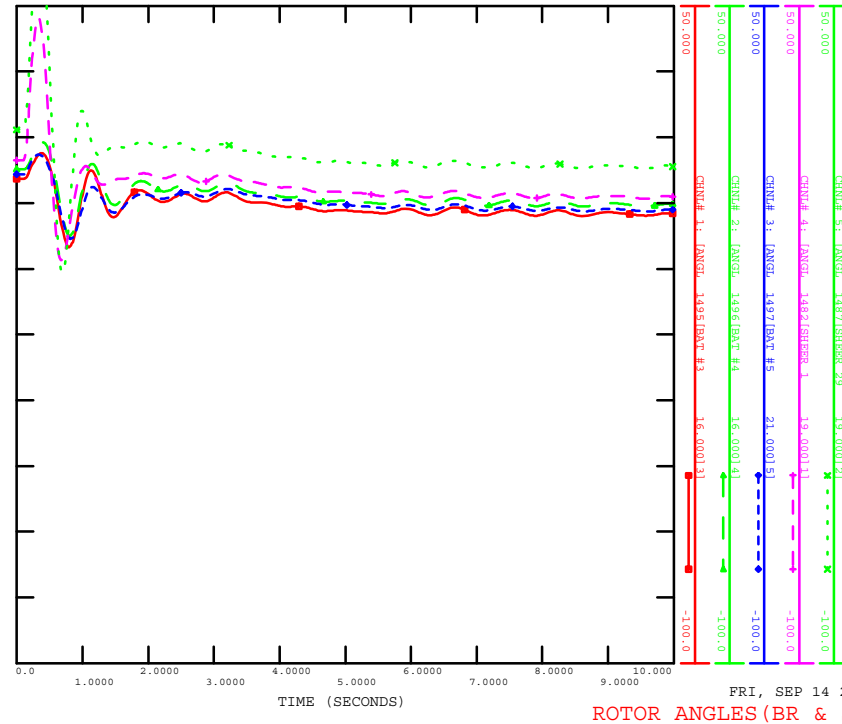
FILE: B-07.out



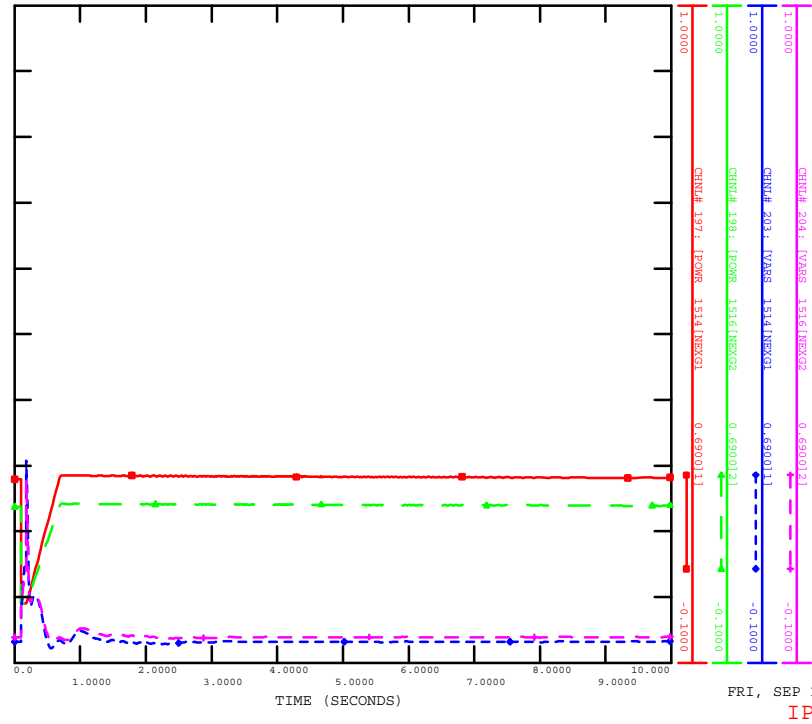
FILE: B-11.out



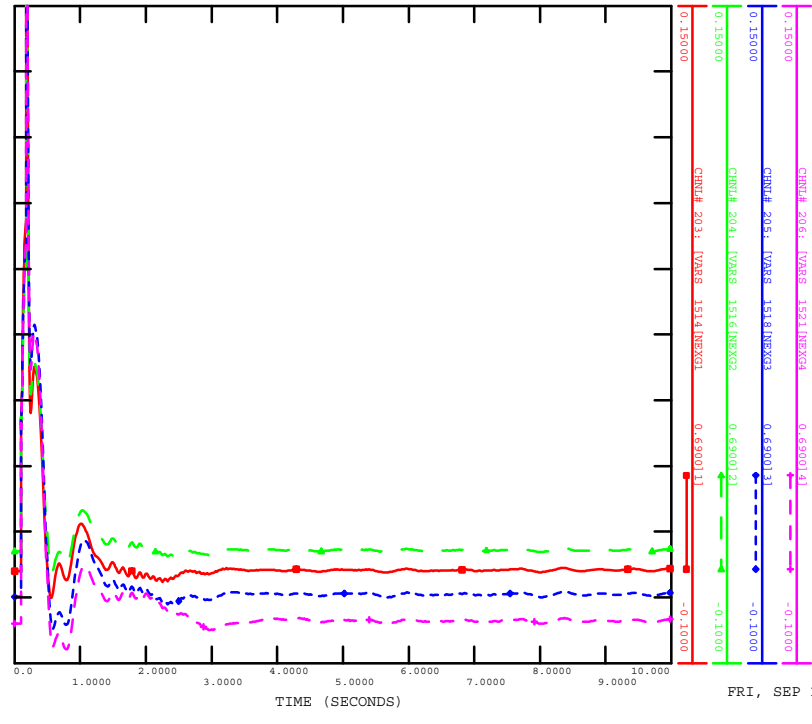
FILE: B-11.out



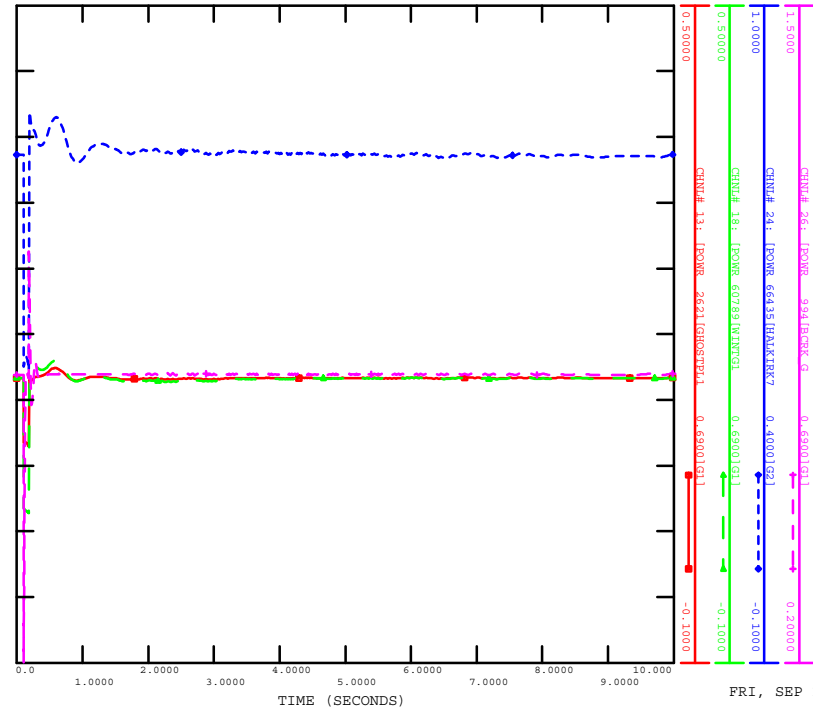
FILE: B-11.out



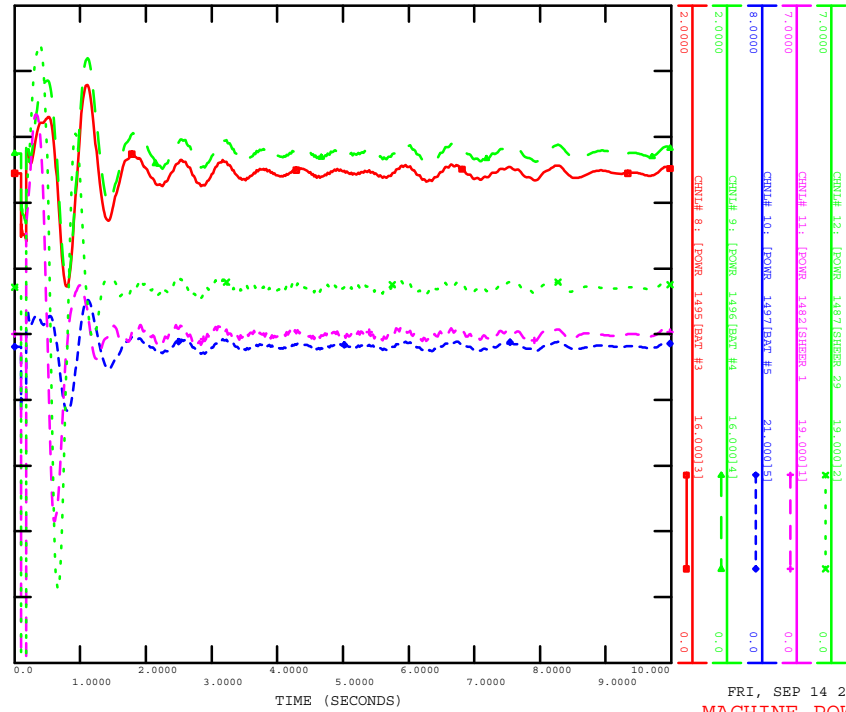
FILE: B-11.out



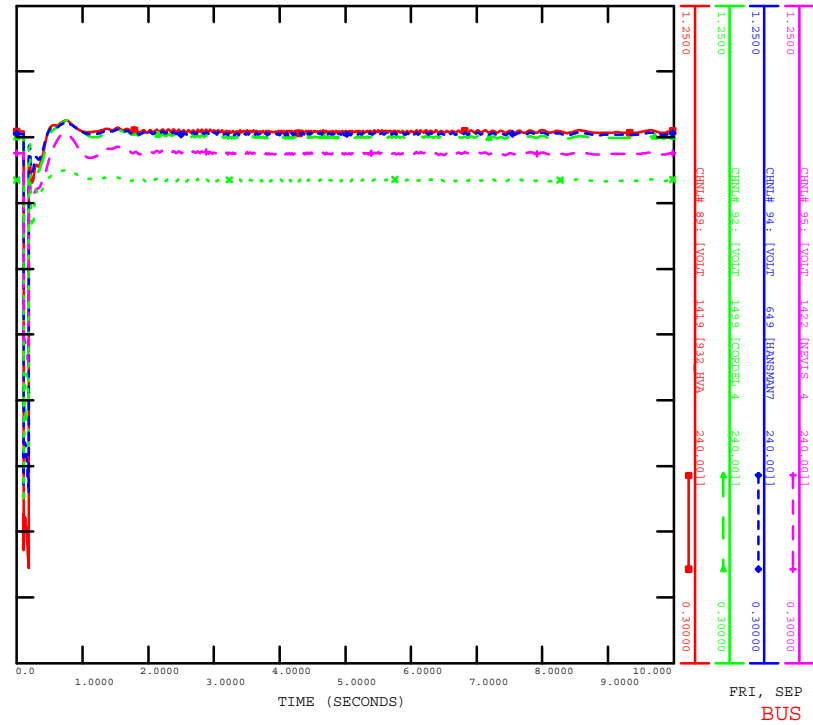
FILE: B-11.out



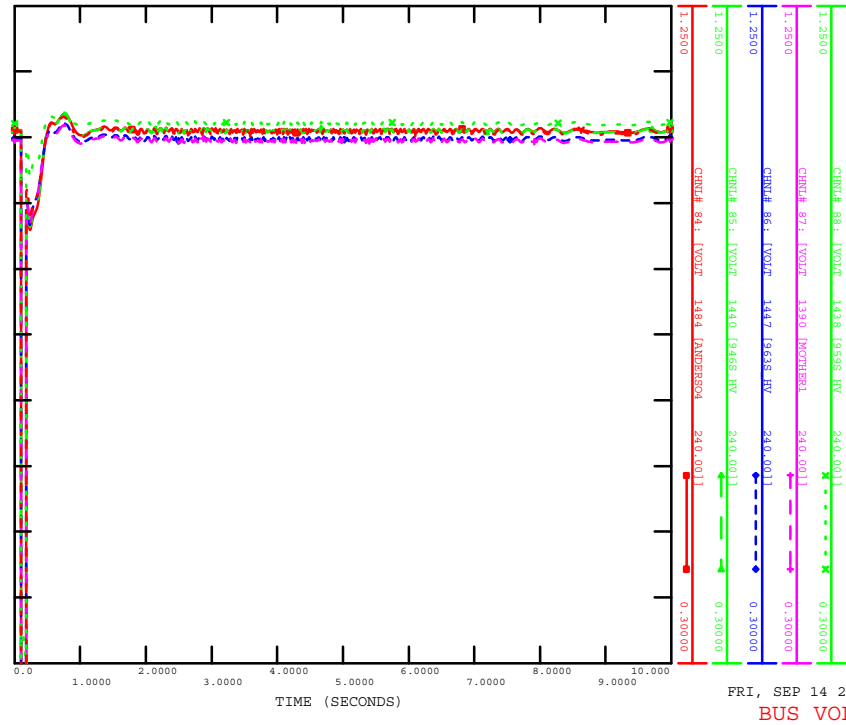
FILE: B-11.out



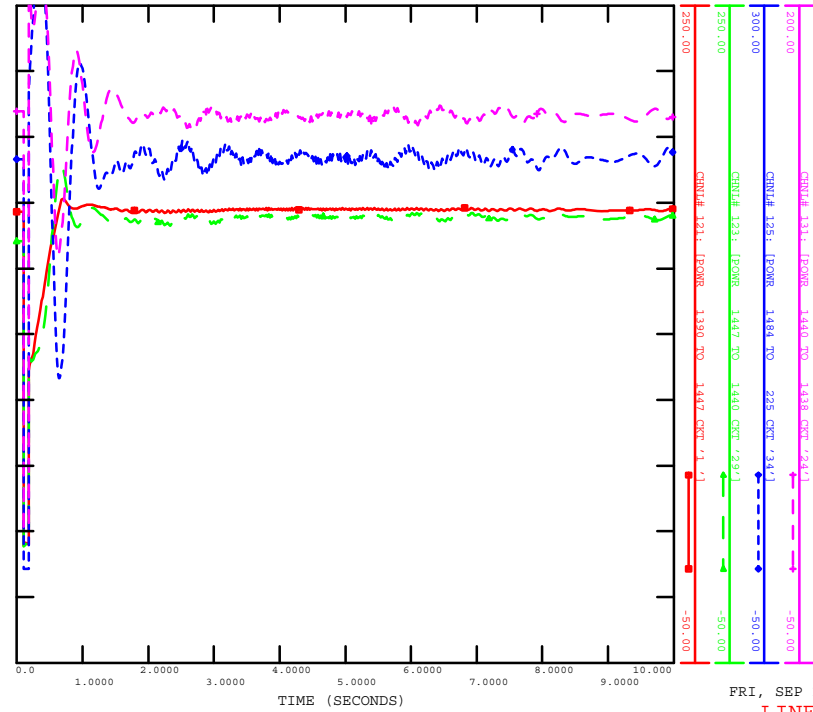
FILE: B-11.out



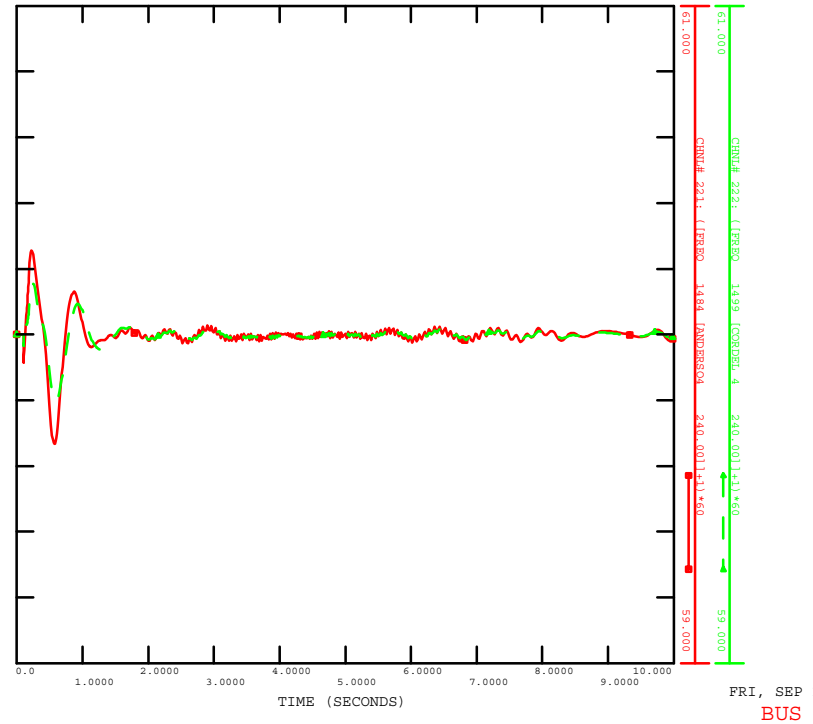
FILE: B-11.out



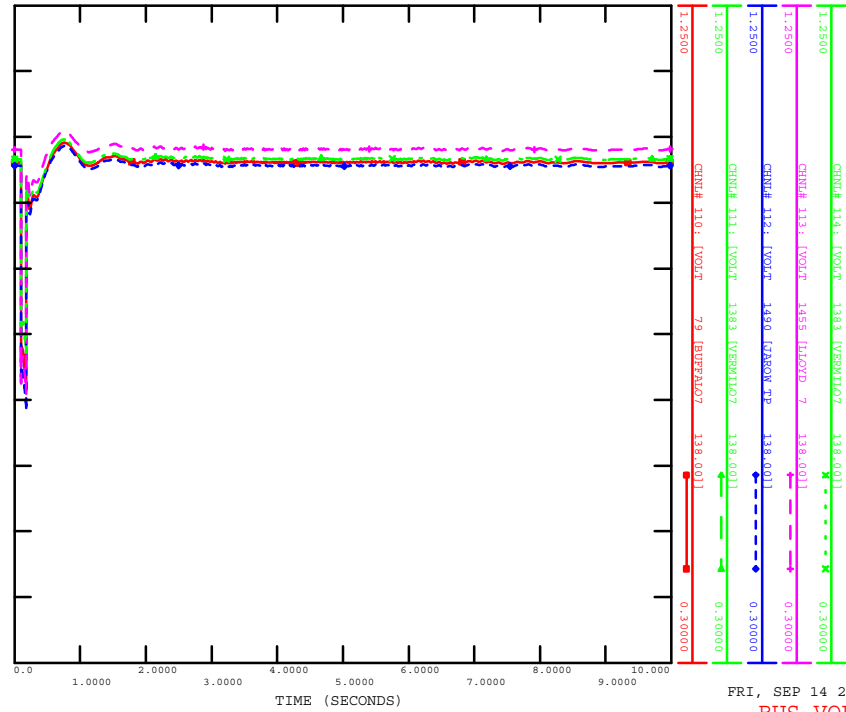
FILE: B-11.out



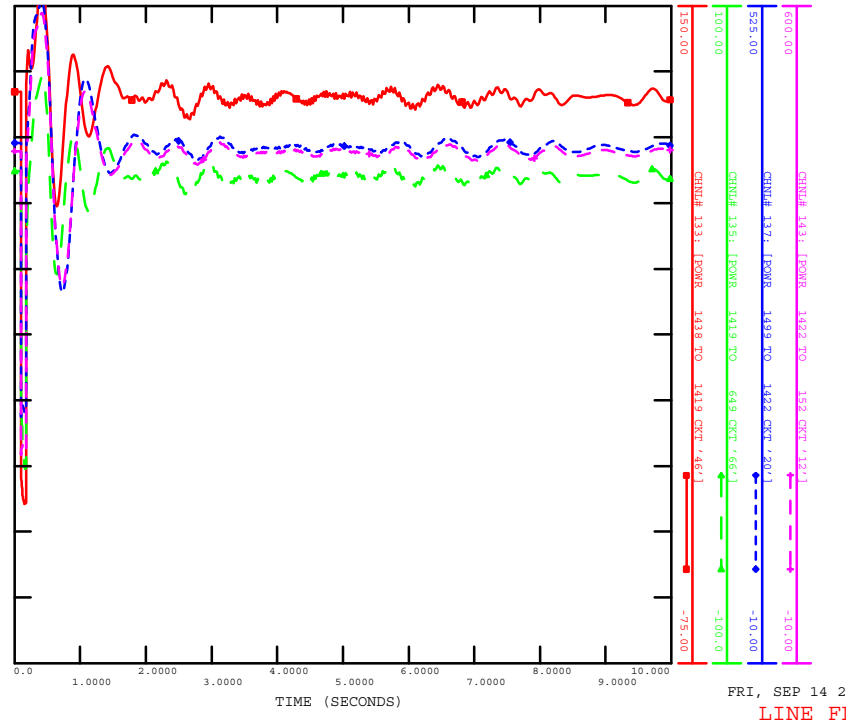
FILE: B-11.out



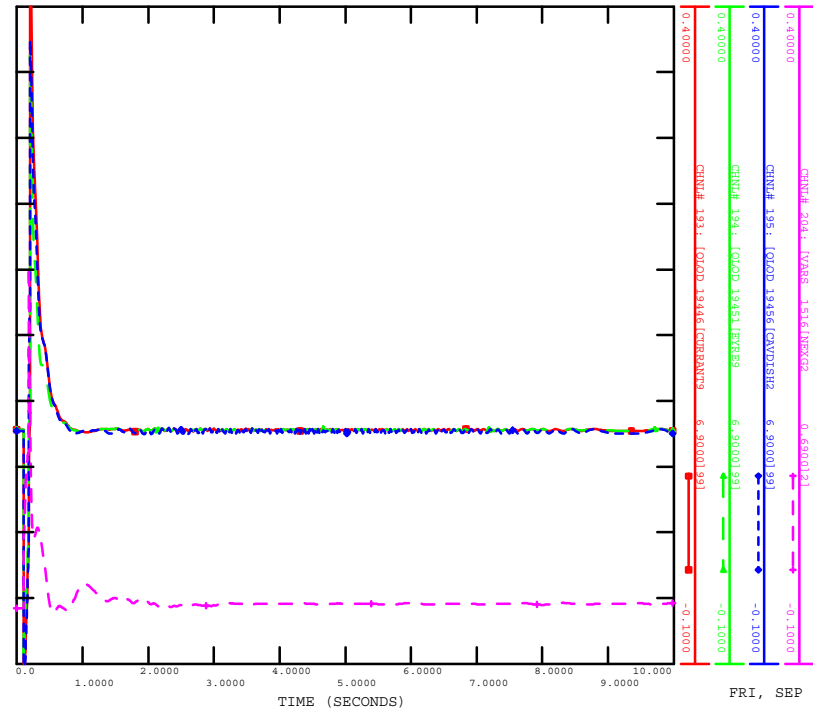
FILE: B-11.out



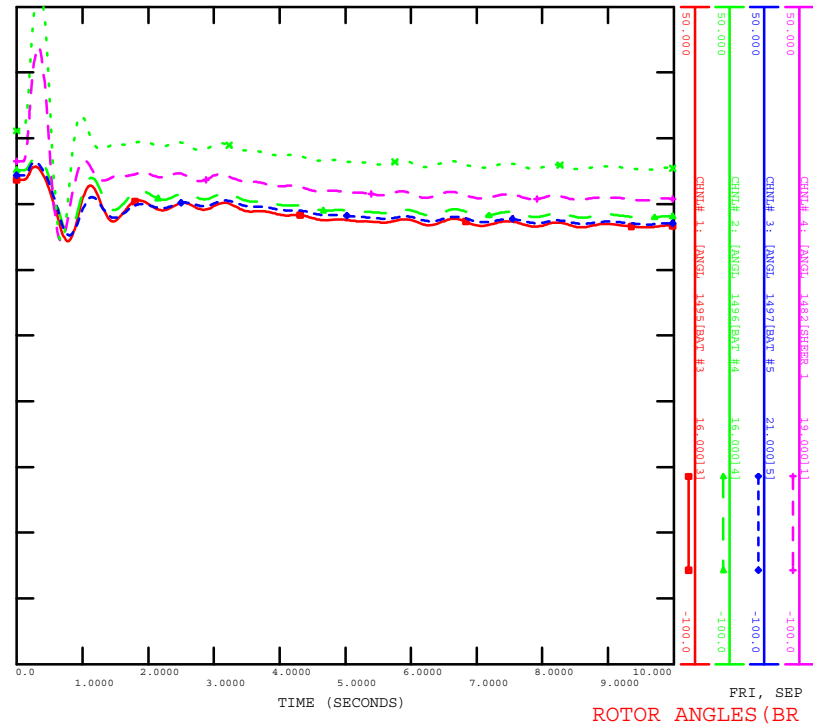
FILE: B-11.out



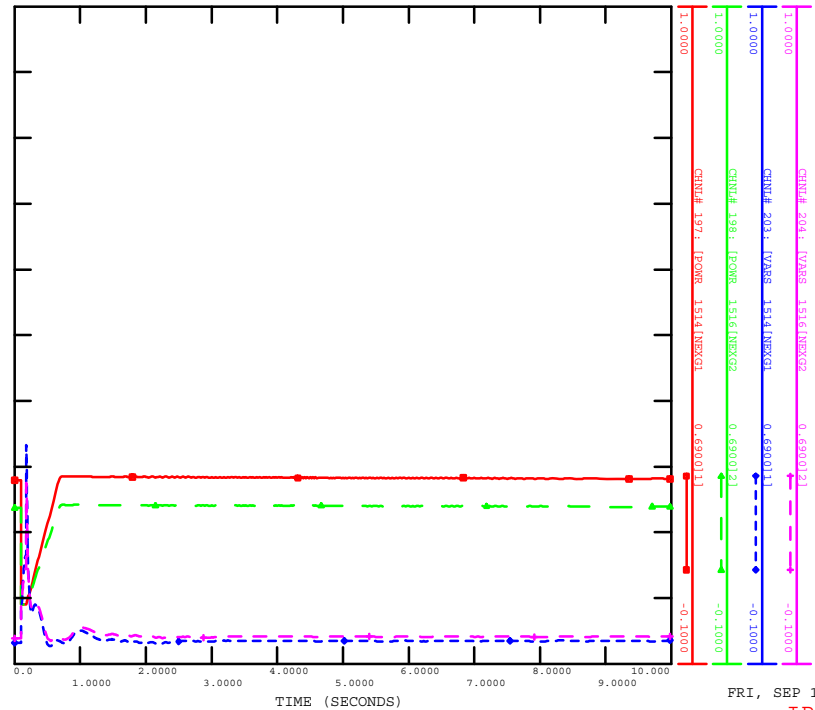
FILE: B-12.out



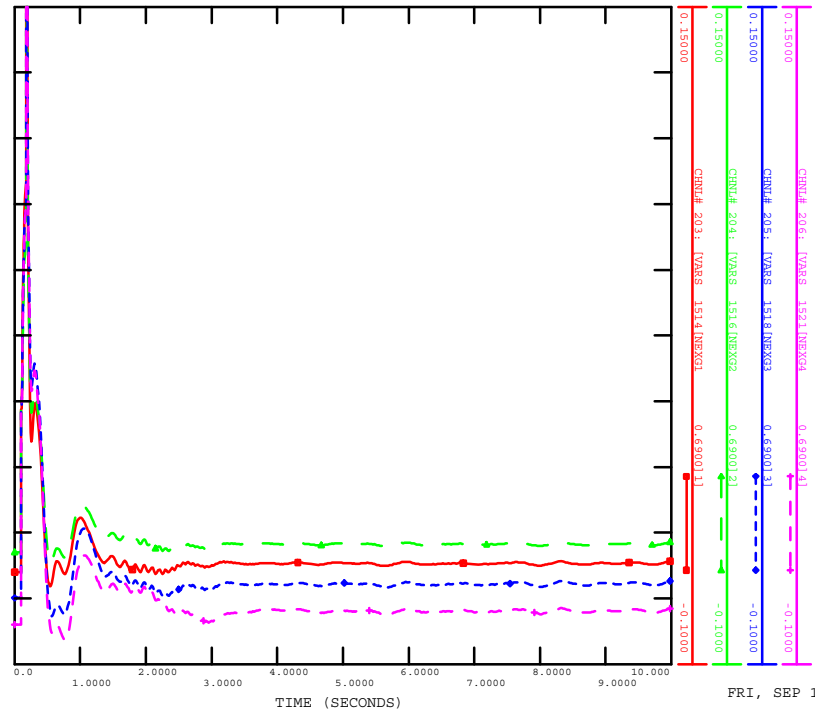
FILE: B-12.out



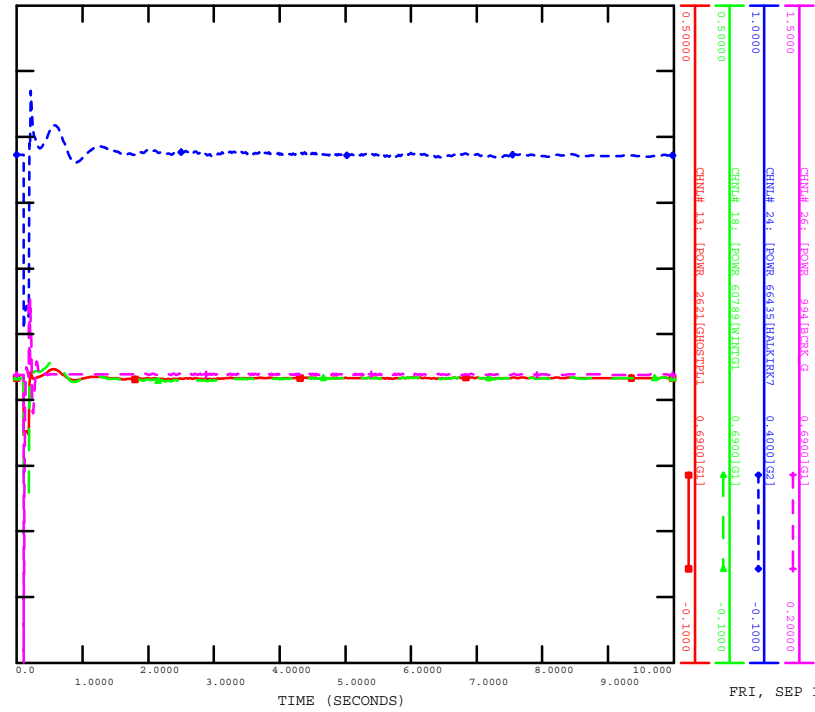
FILE: B-12.out



FILE: B-12.out

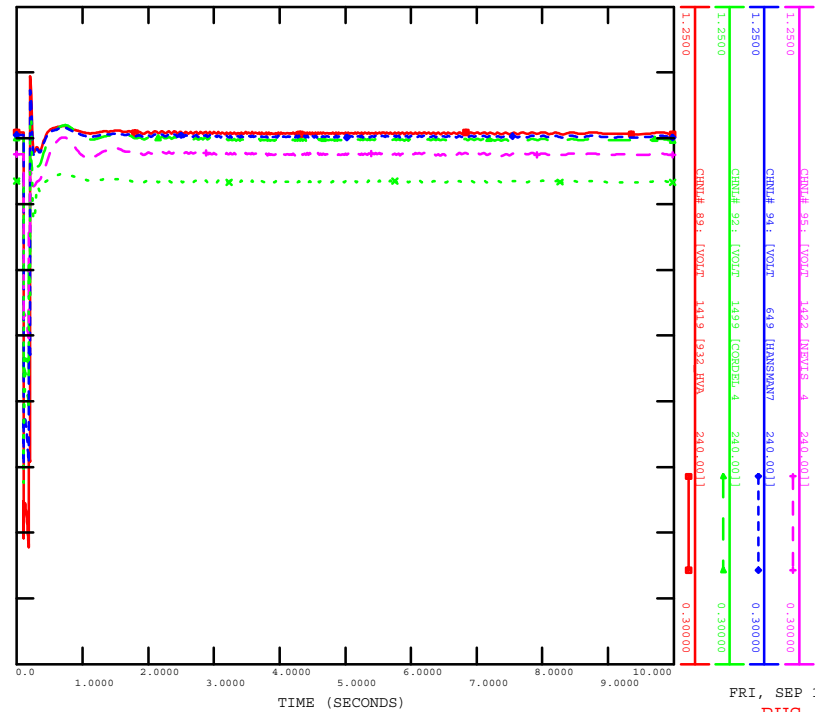


FILE: B-12.out



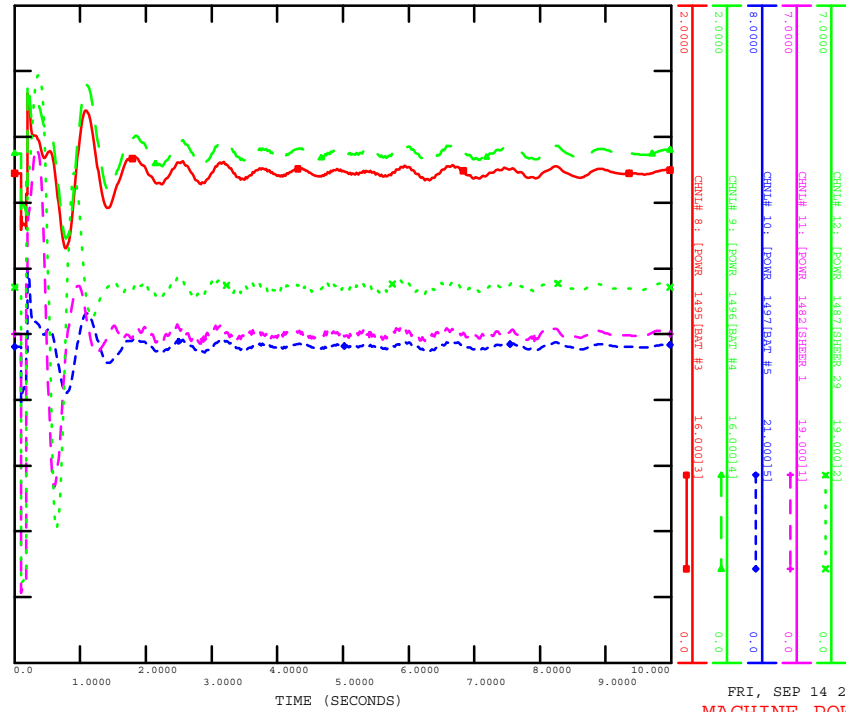
FRI, SEP 14 2012 11:12
WIND (MW)

FILE: B-12.out



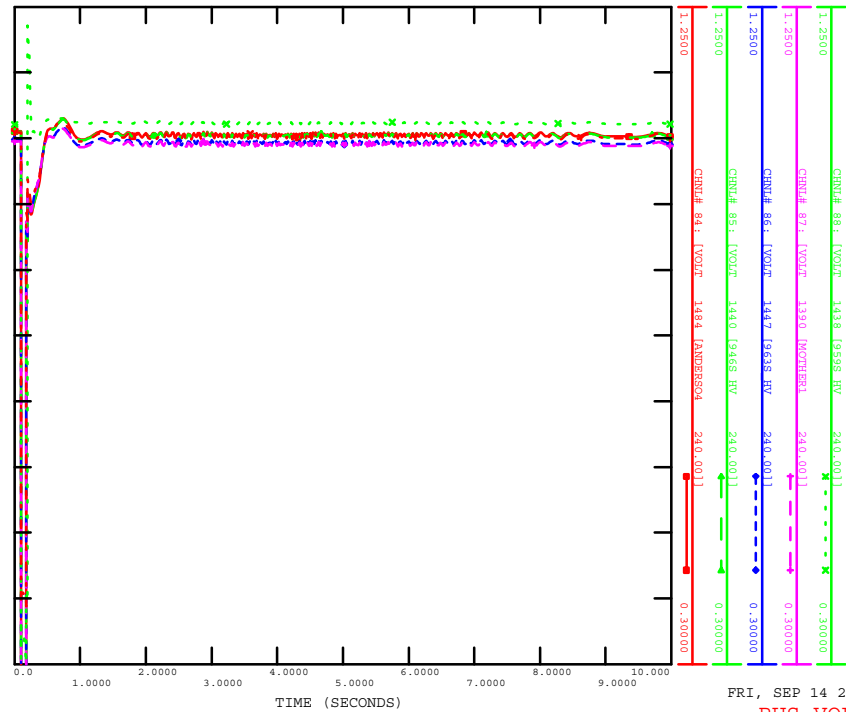
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-12.out



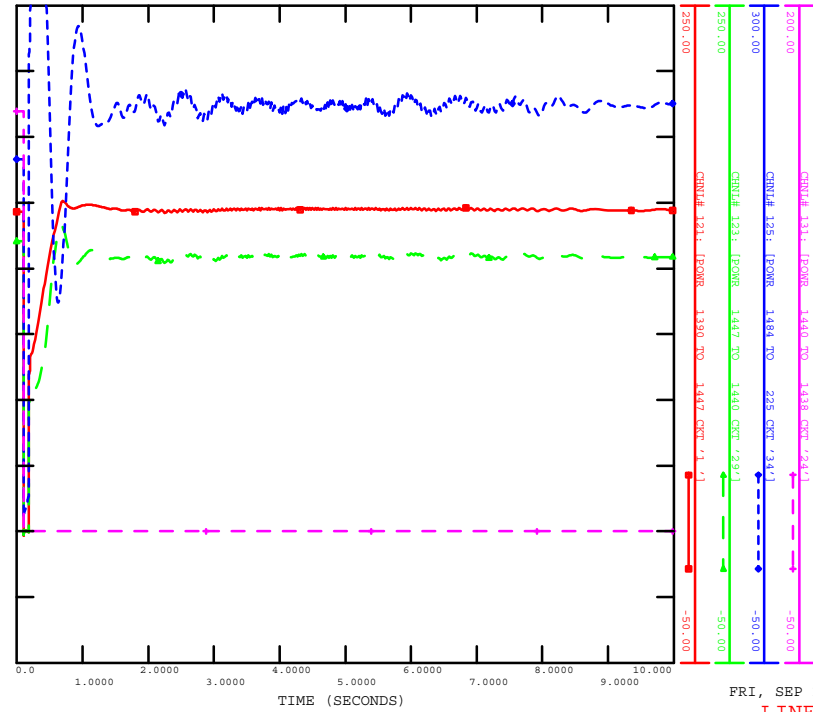
FRI, SEP 14 2012 11:12
MACHINE POWER (P)

FILE: B-12.out



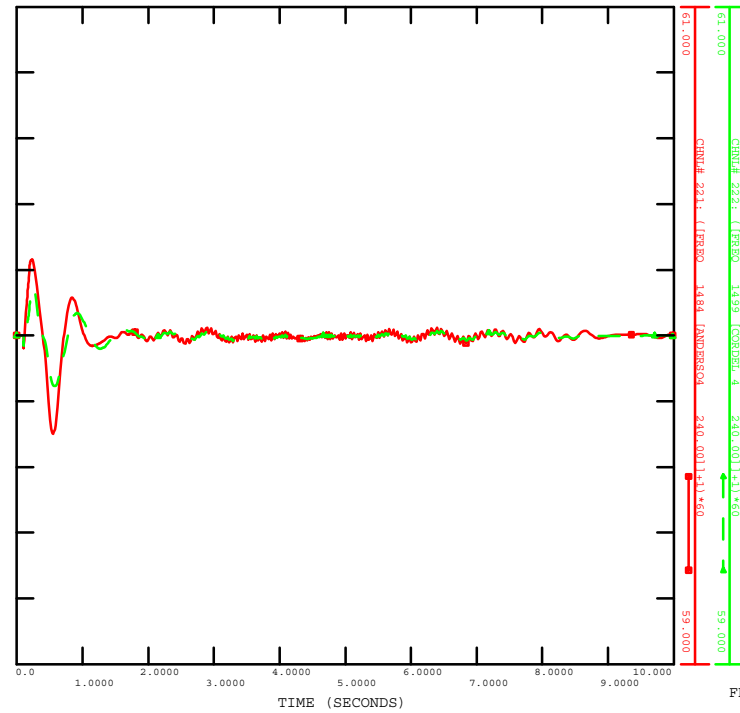
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-12.out



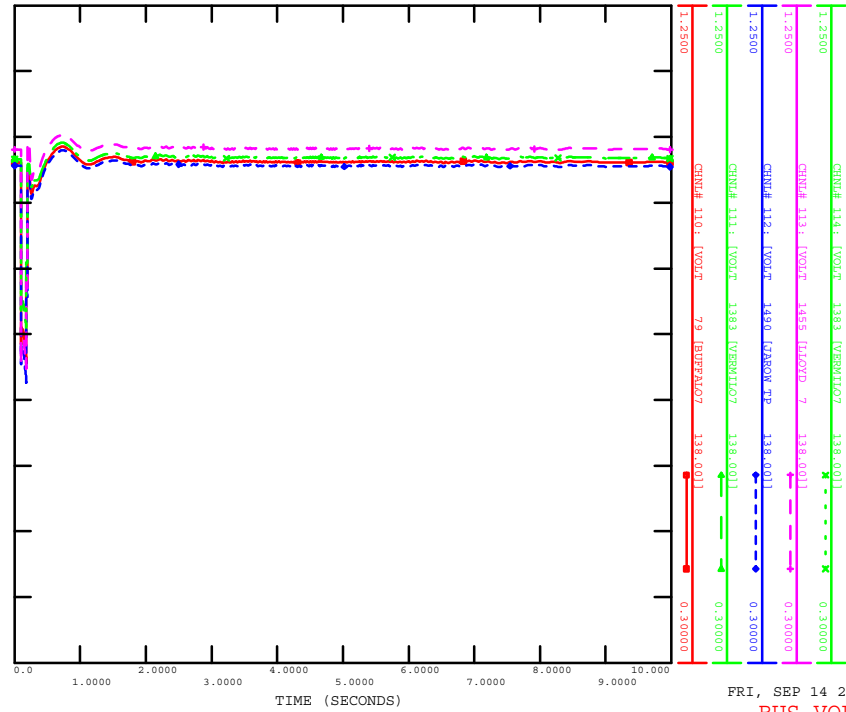
FRI, SEP 14 2012 11:12
LINE FLOW (P)

FILE: B-12.out



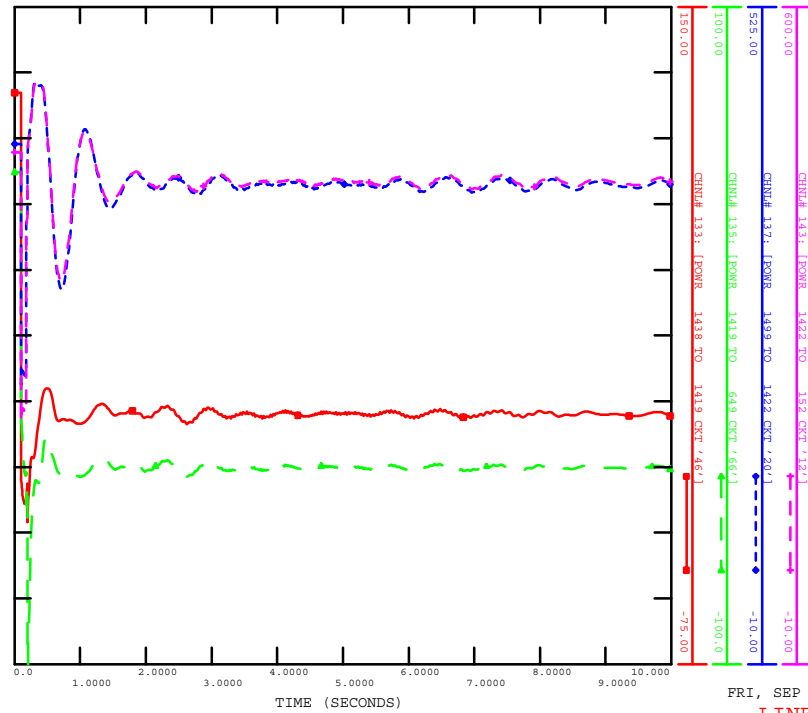
FRI, SEP 14 2012 11:12
BUS FREQUENCY

FILE: B-12.out



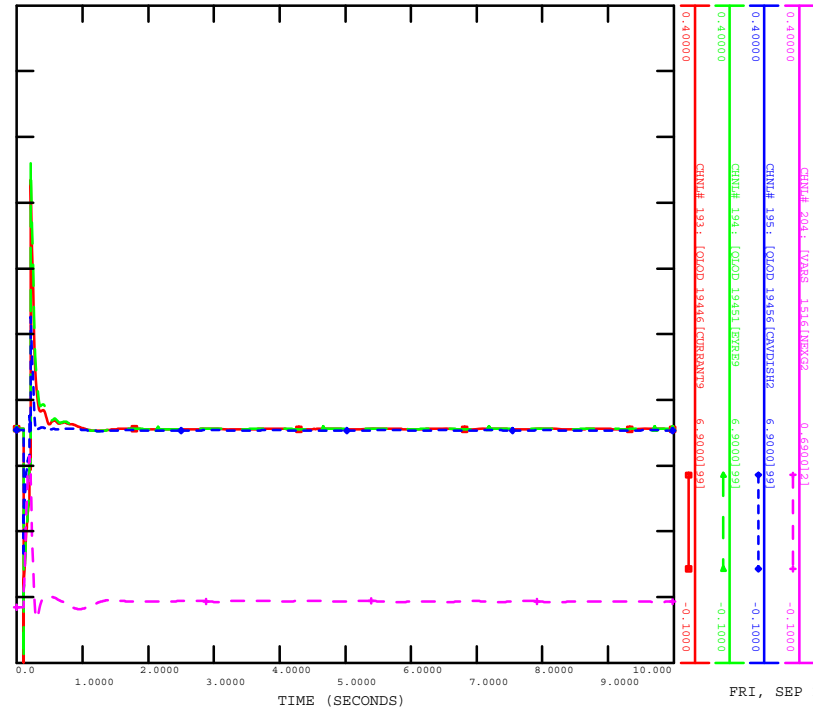
FRI, SEP 14 2012 11:12
BUS VOLT (PU)

FILE: B-12.out

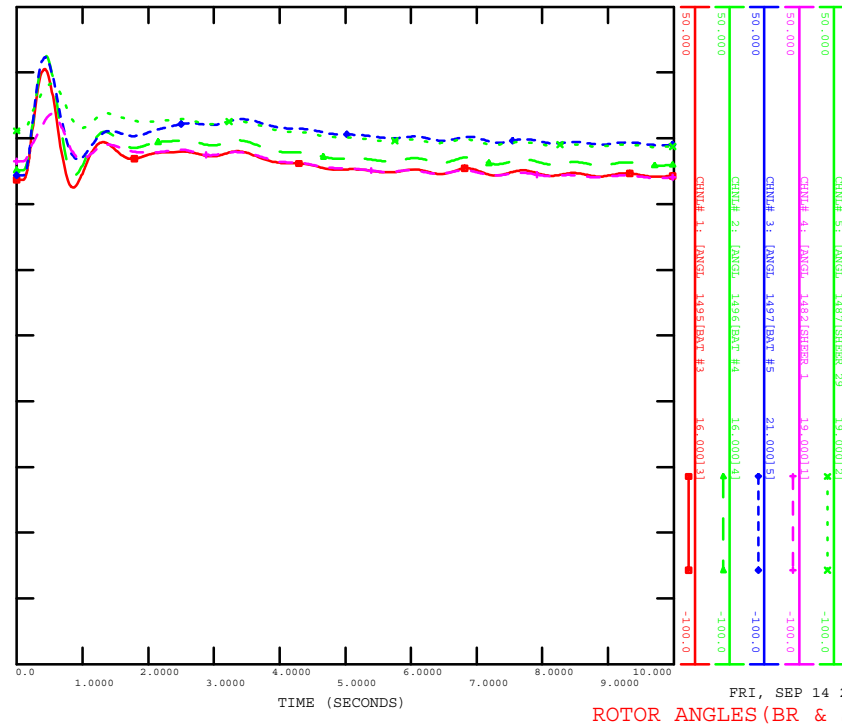


FRI, SEP 14 2012 11:12
LINE FLOW (P)

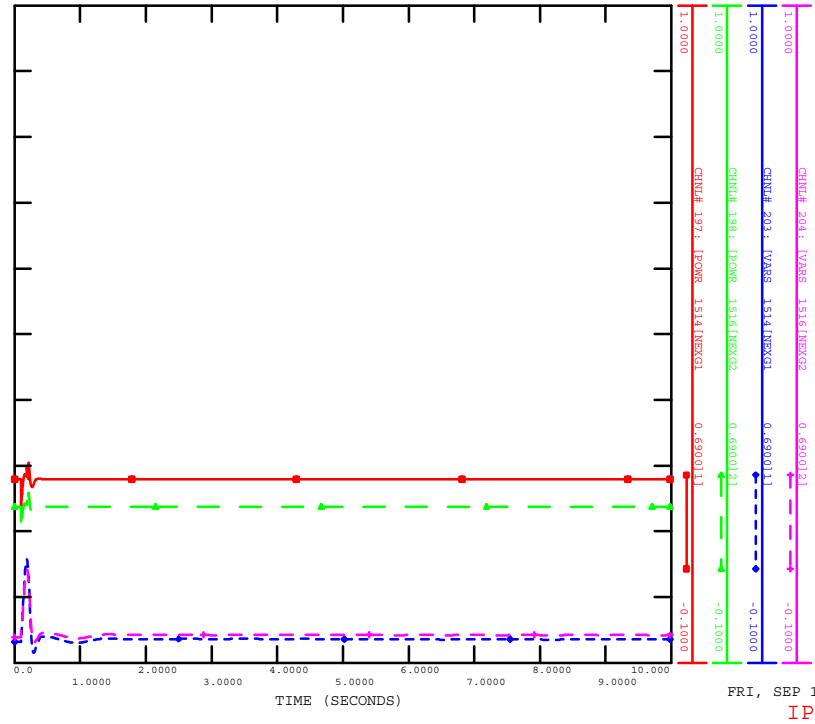
FILE: B-33.out



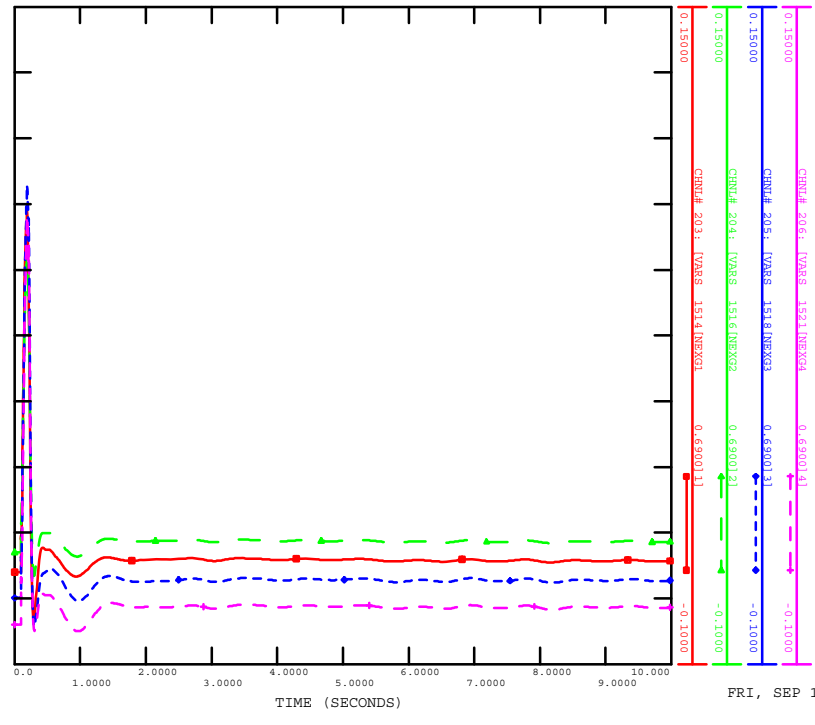
FILE: B-33.out



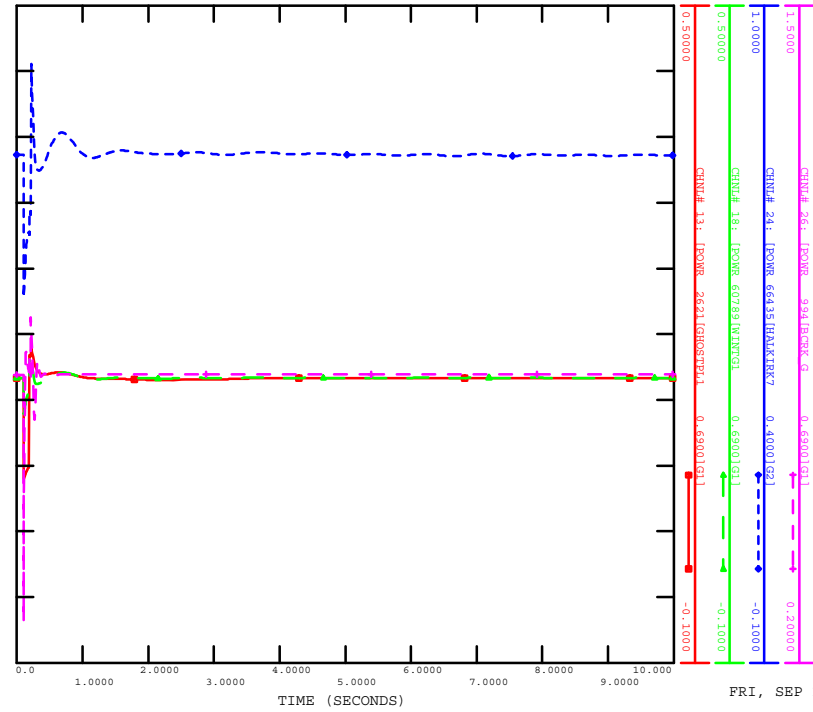
FILE: B-33.out



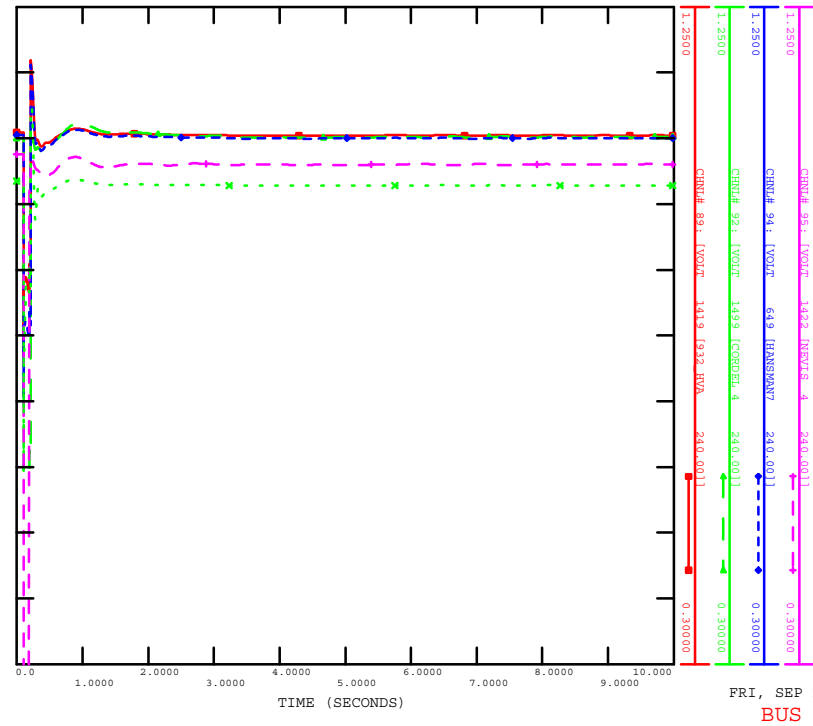
FILE: B-33.out



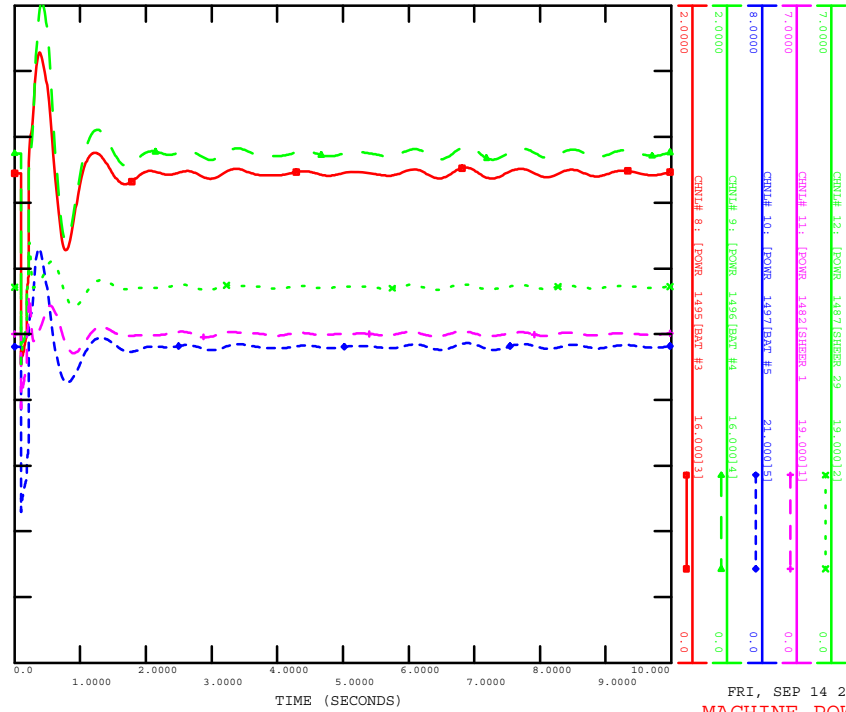
FILE: B-33.out



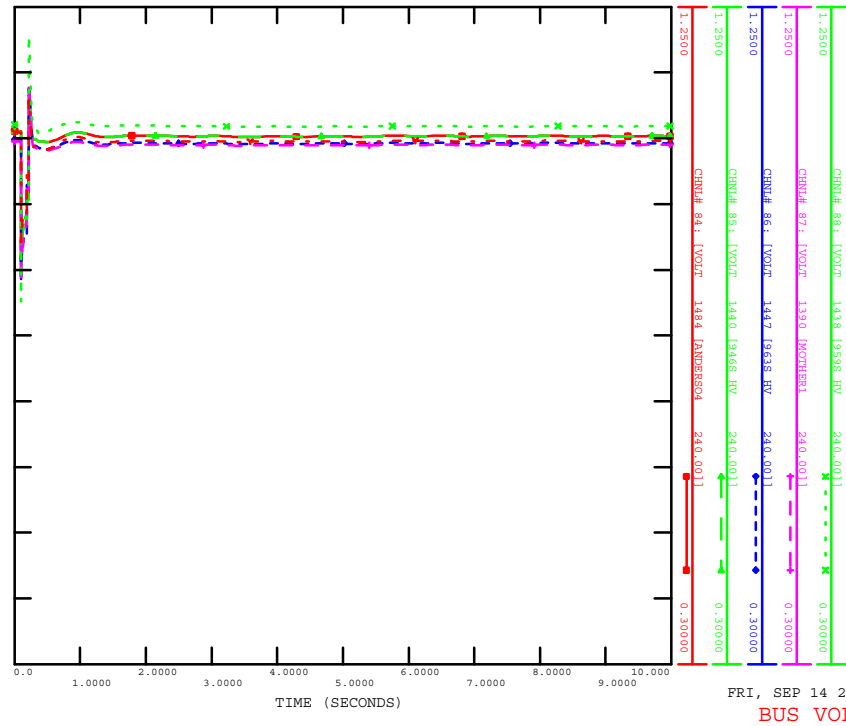
FILE: B-33.out



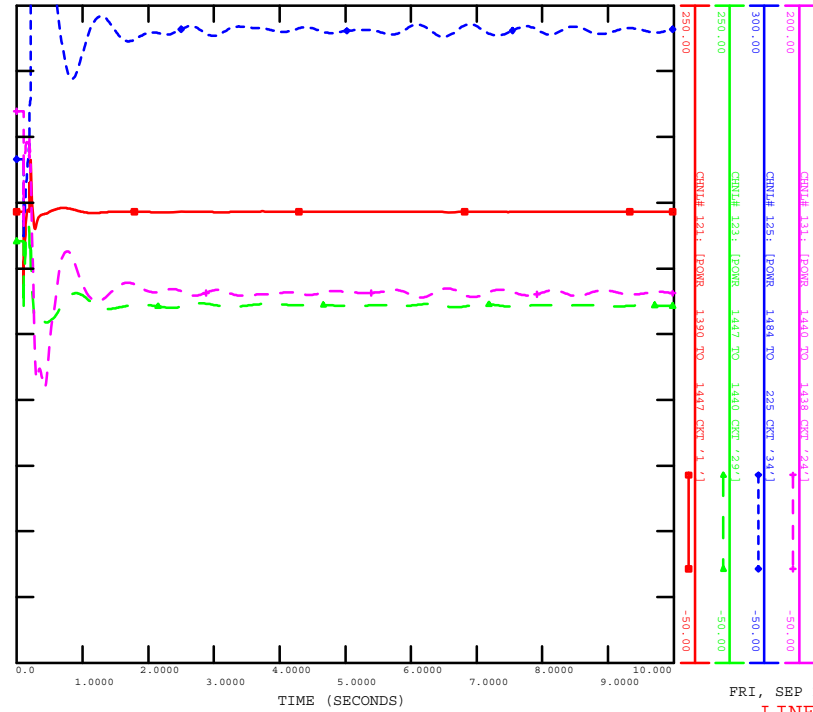
FILE: B-33.out



FILE: B-33.out

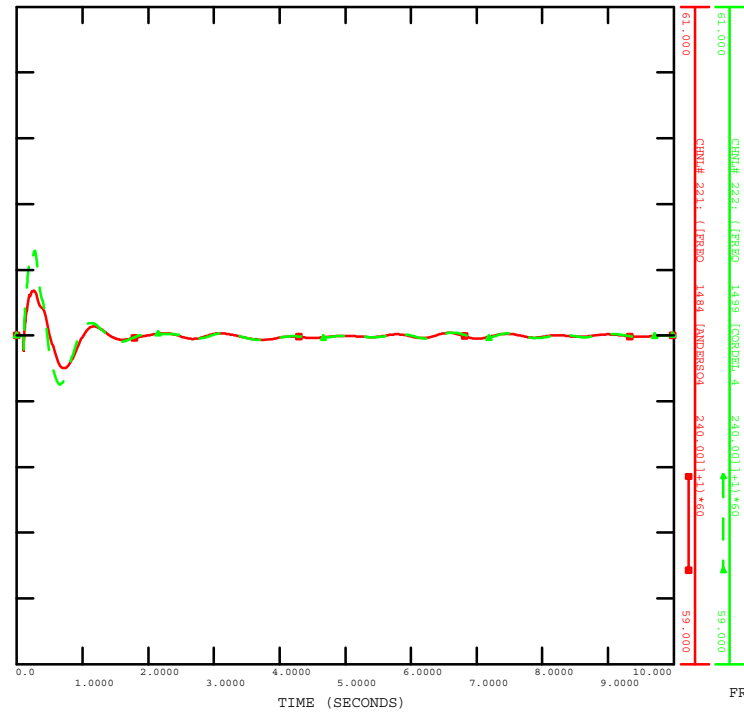


FILE: B-33.out



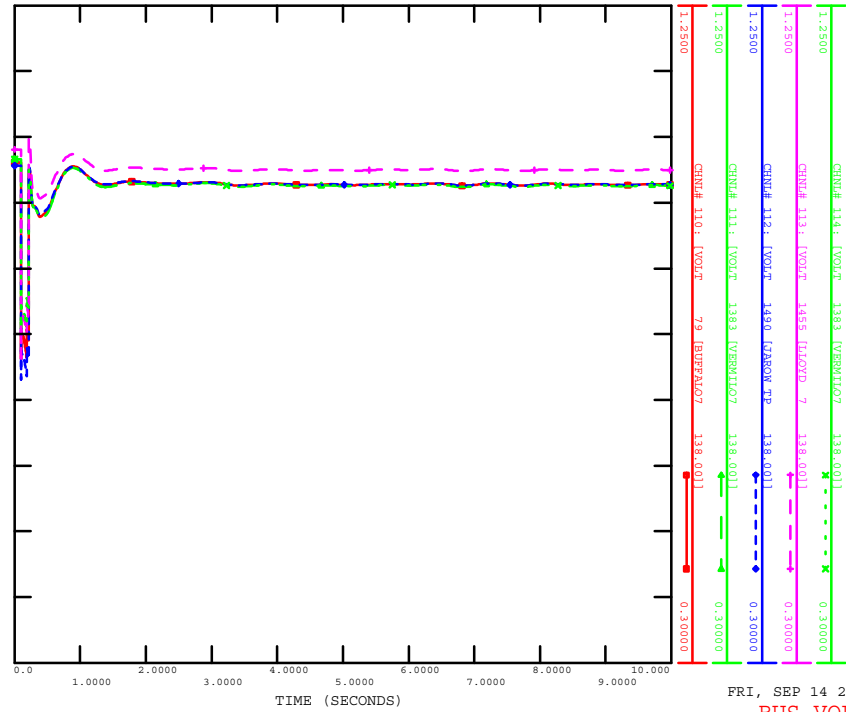
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LINE FLOW (P)

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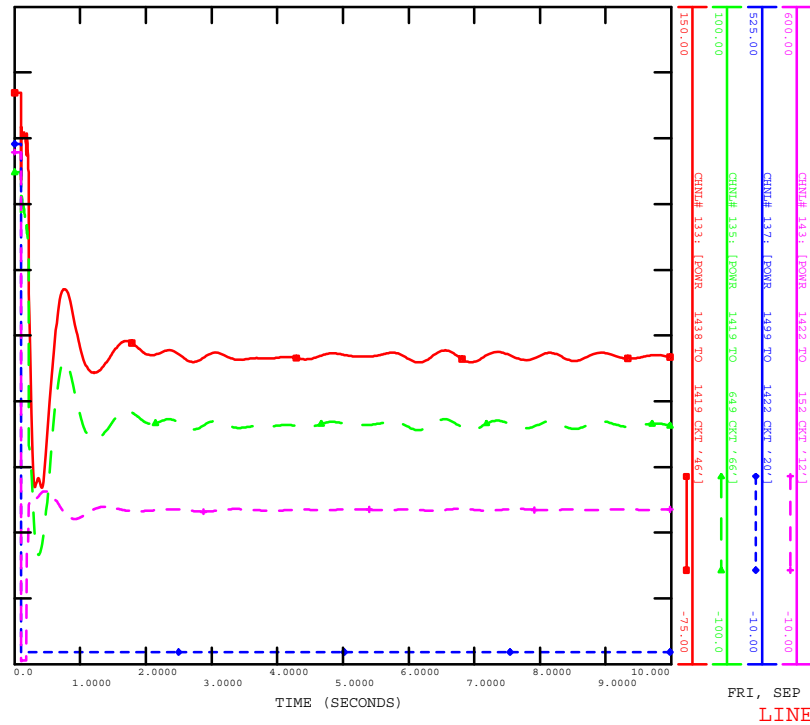
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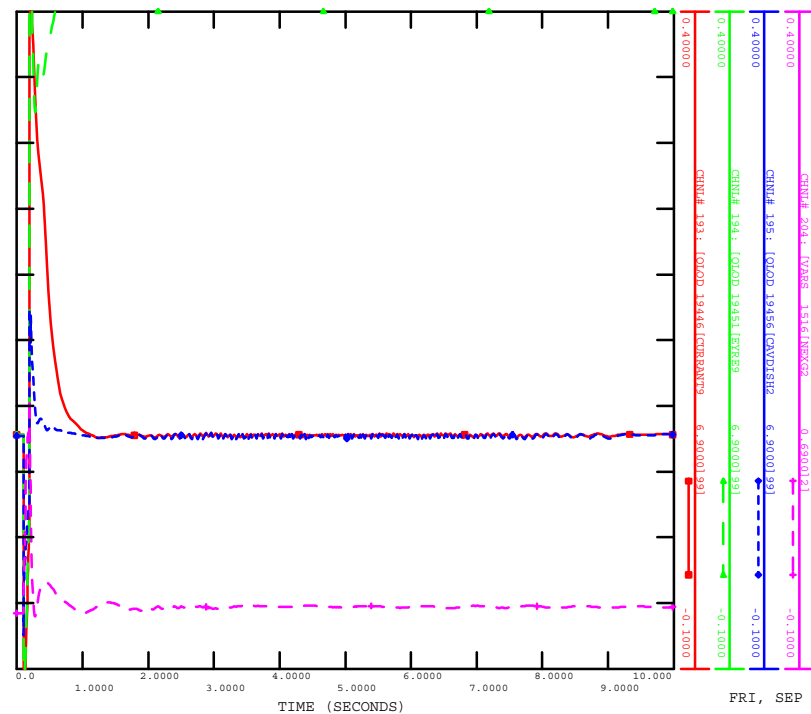
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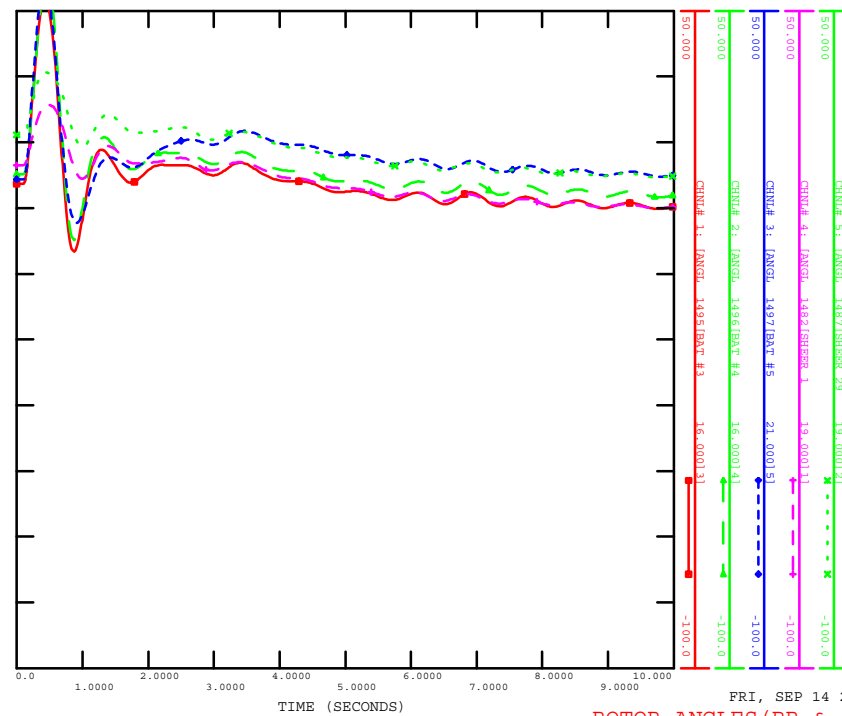


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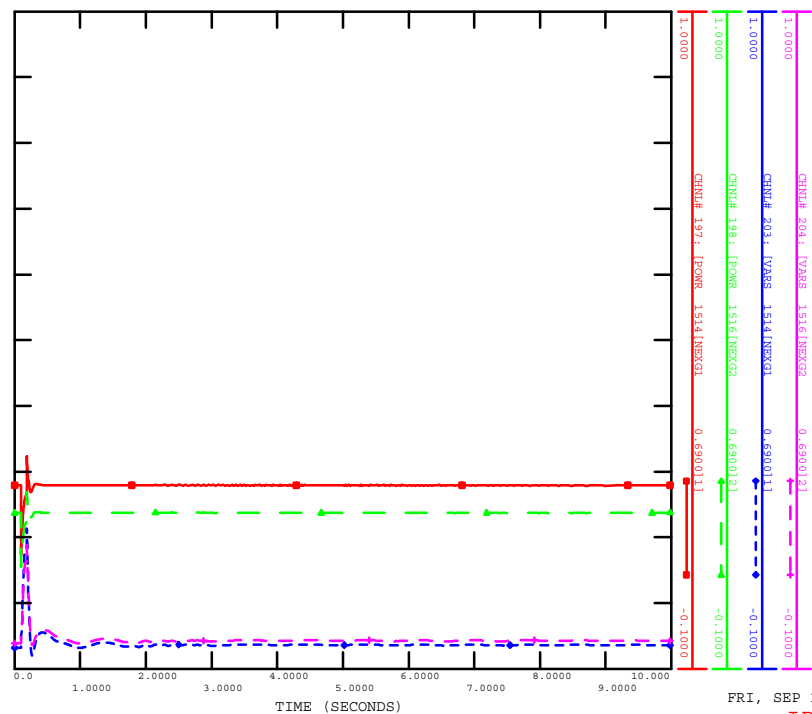
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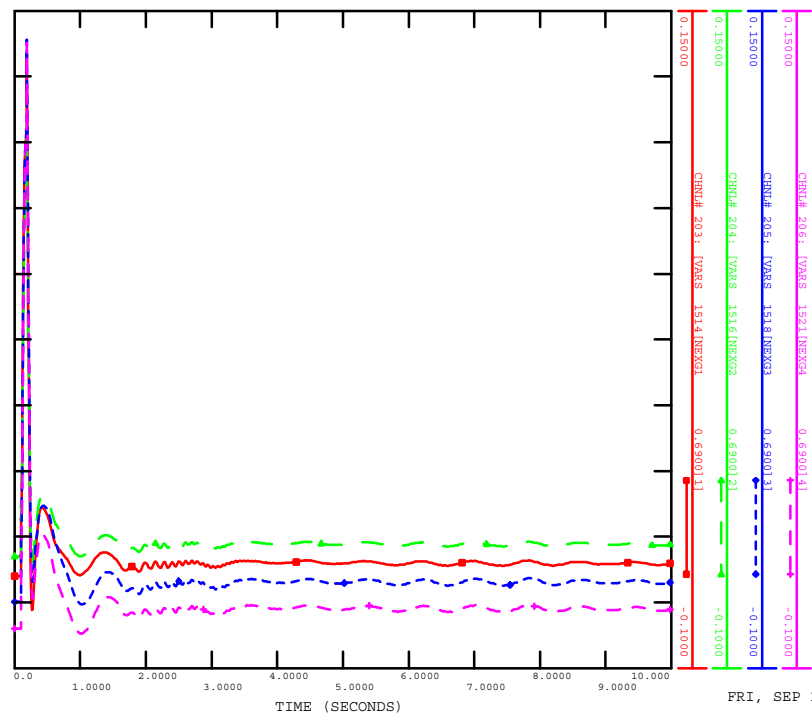
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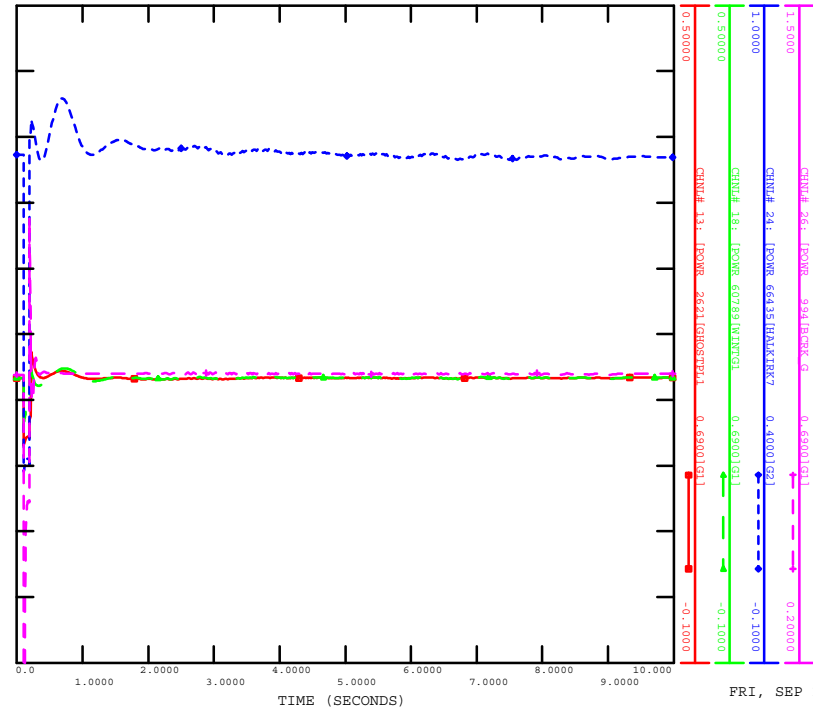
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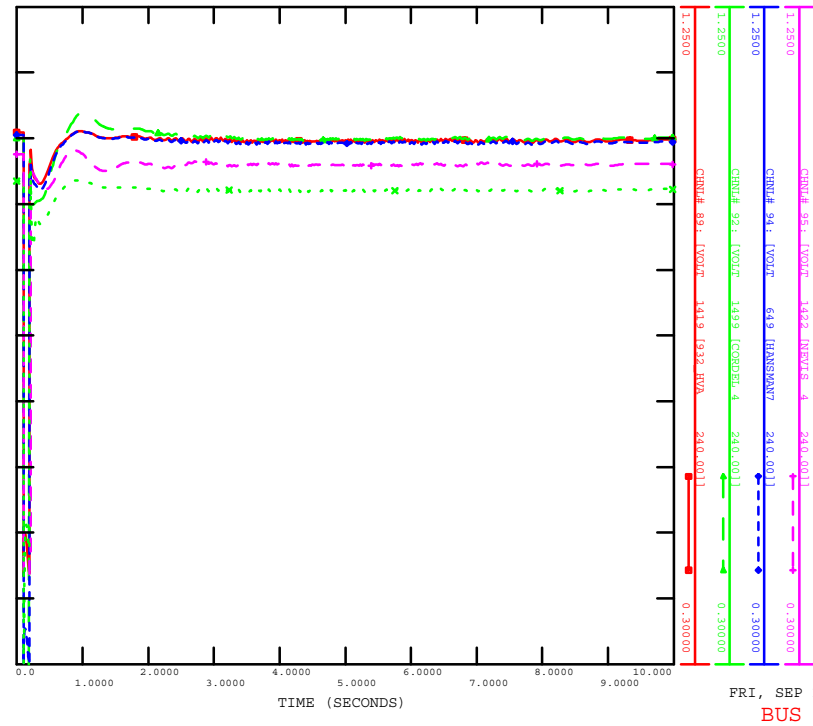
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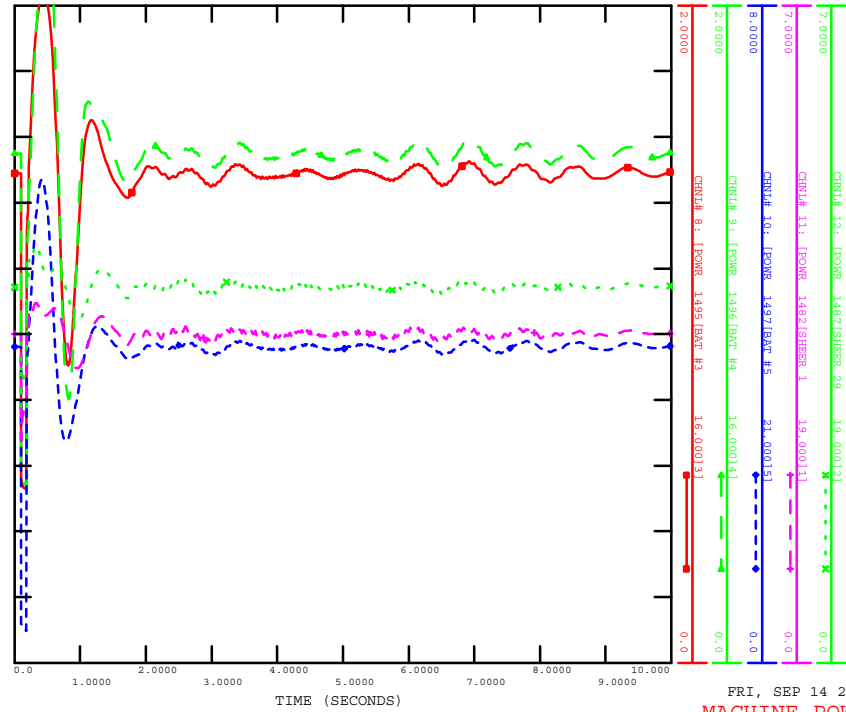
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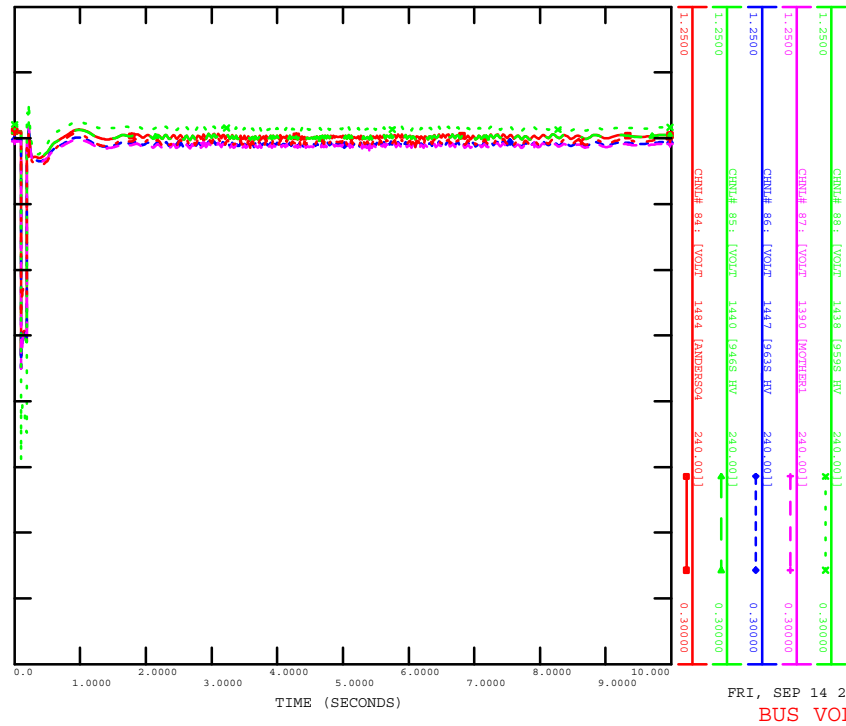
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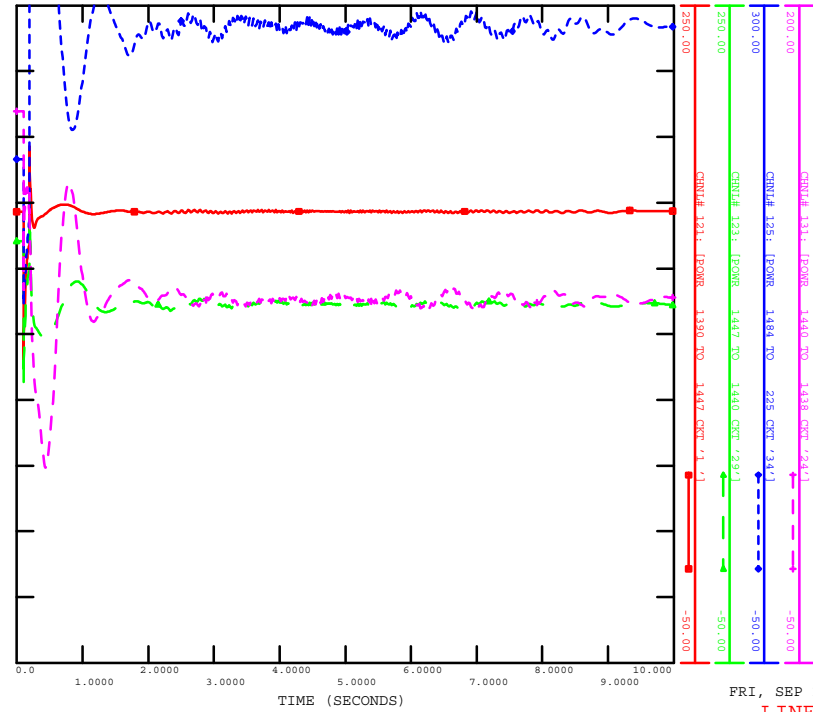
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FILE: B-34.out

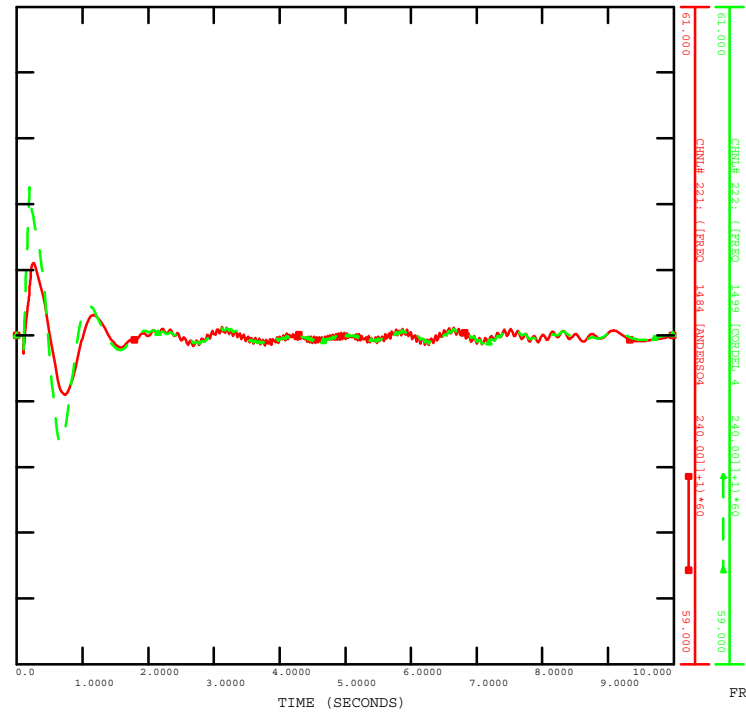


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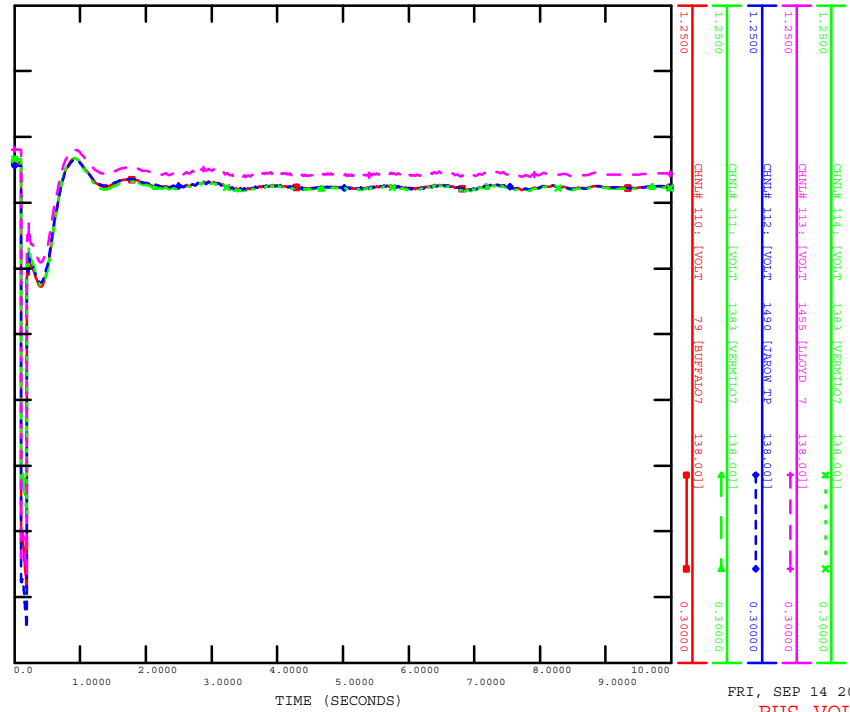
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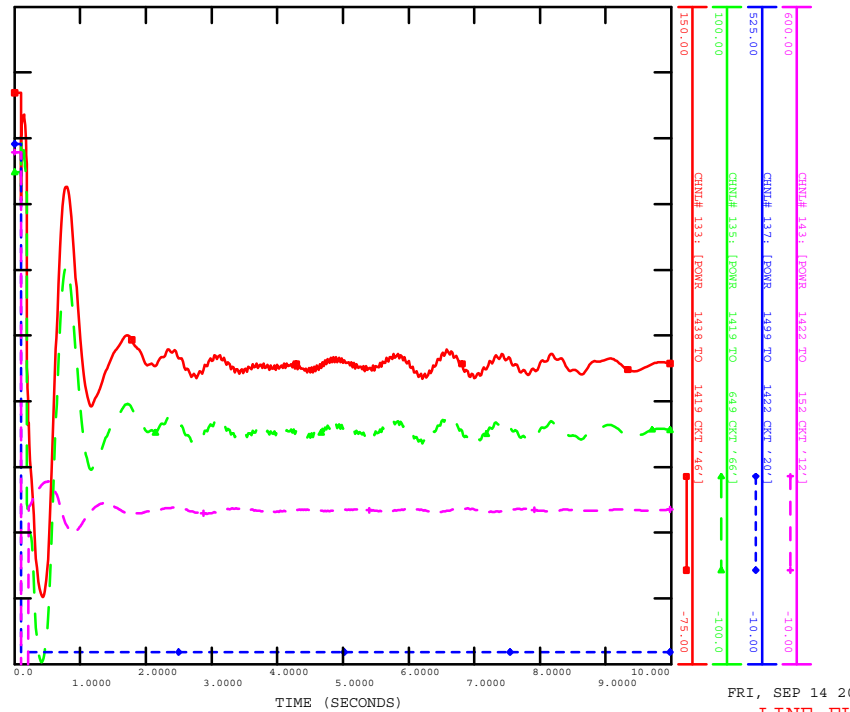
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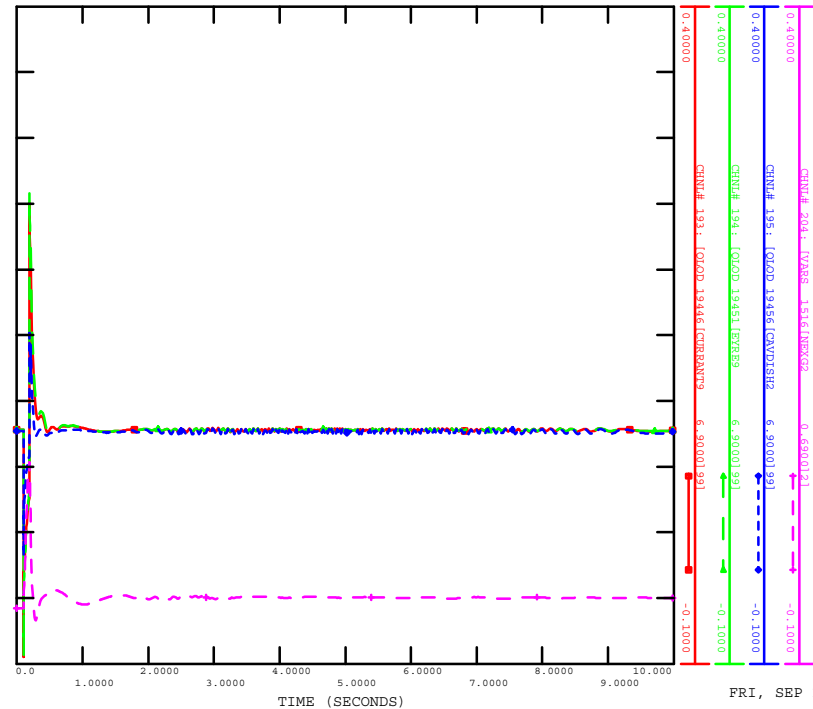
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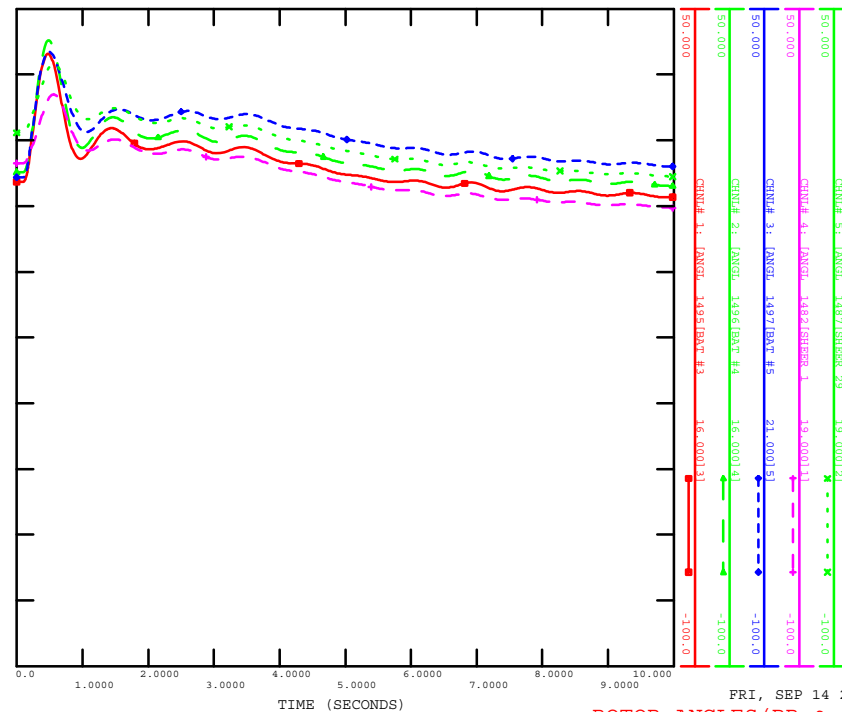
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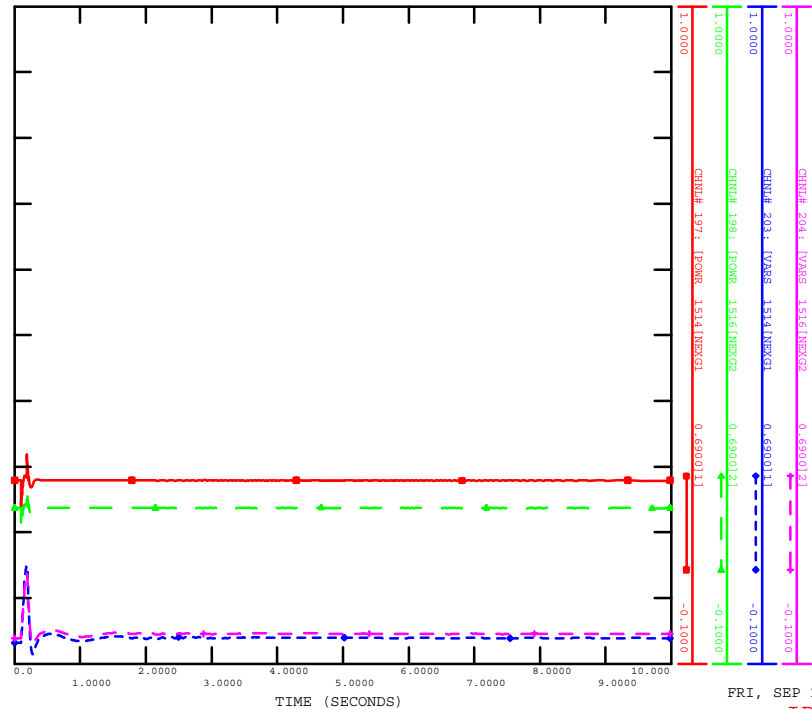
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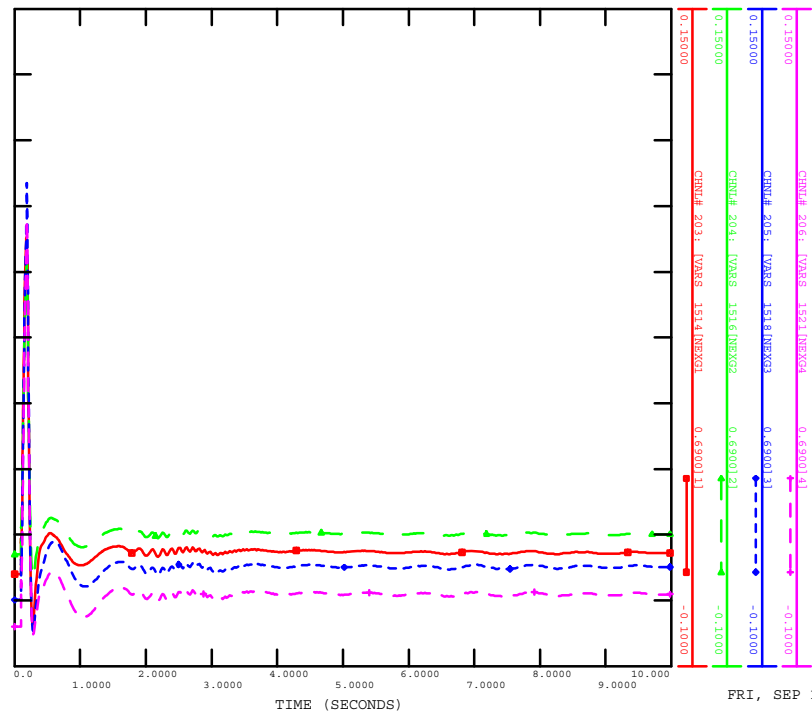
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ROTOR ANGLES (BR & SHEERNE)

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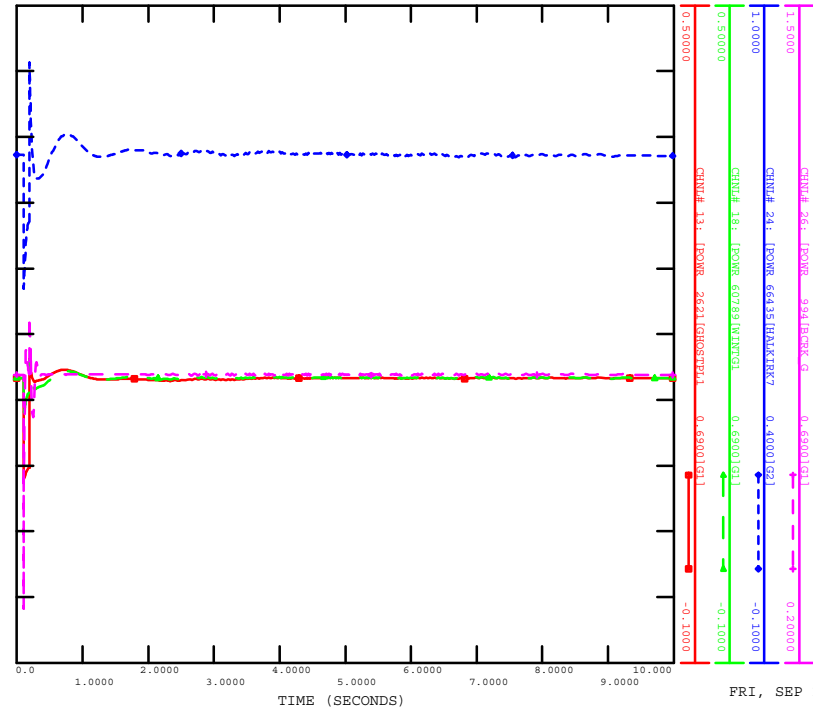
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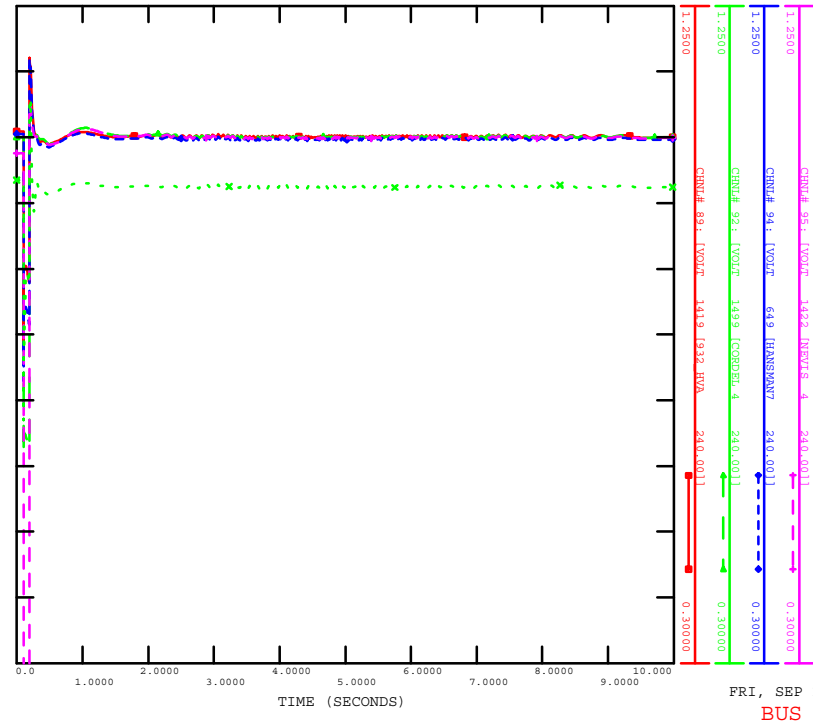


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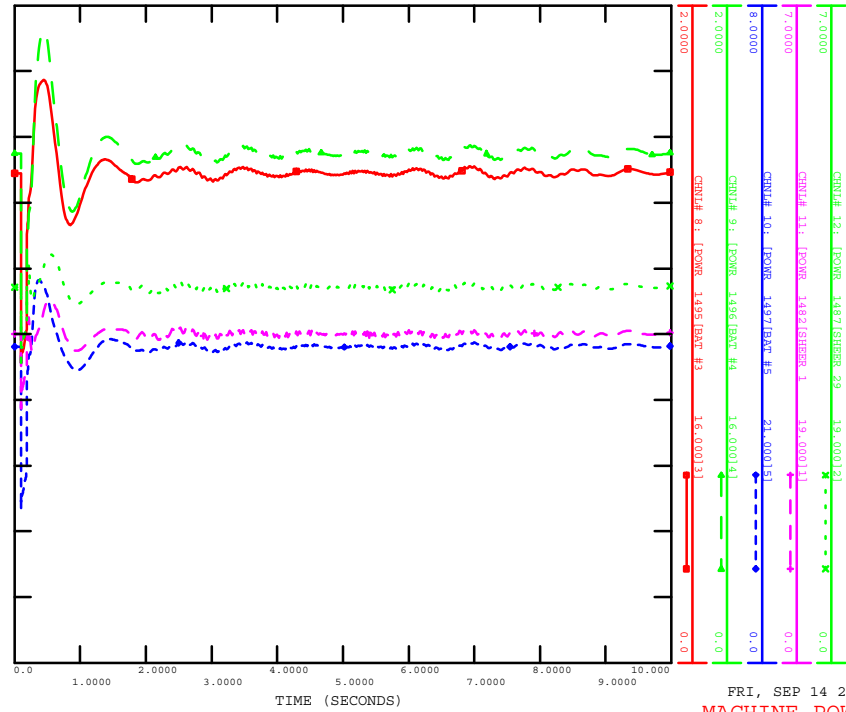
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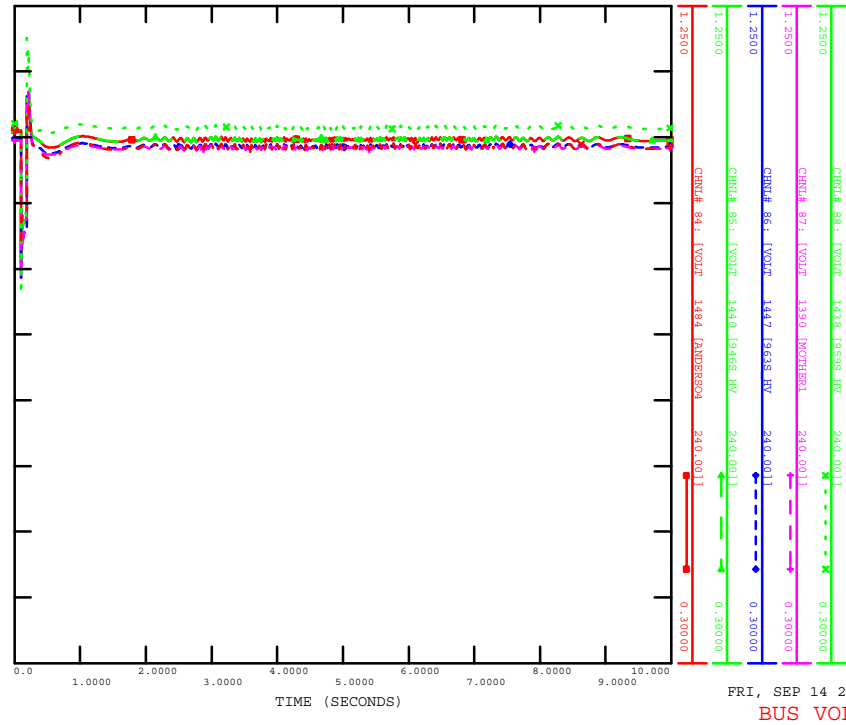
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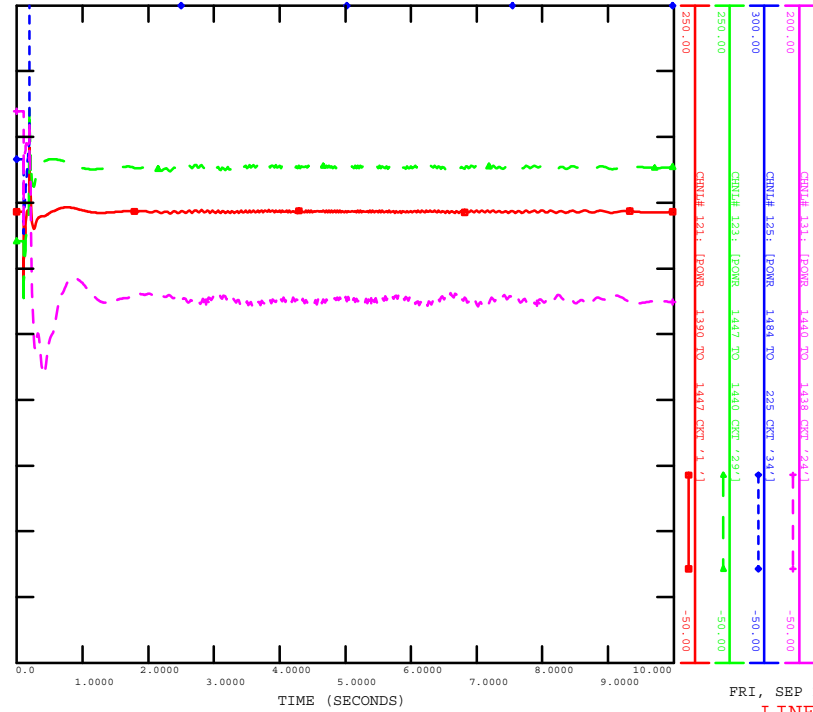
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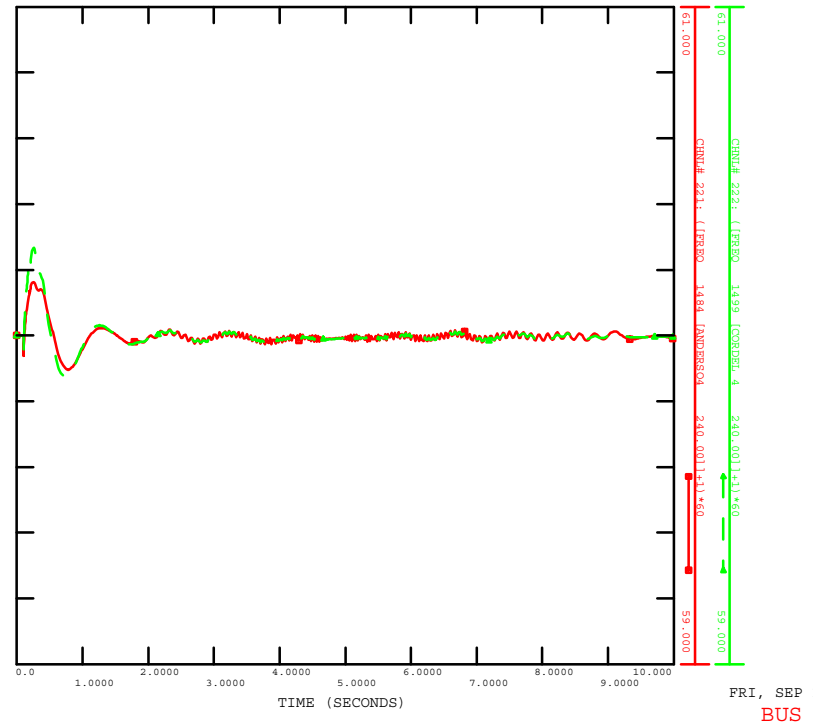
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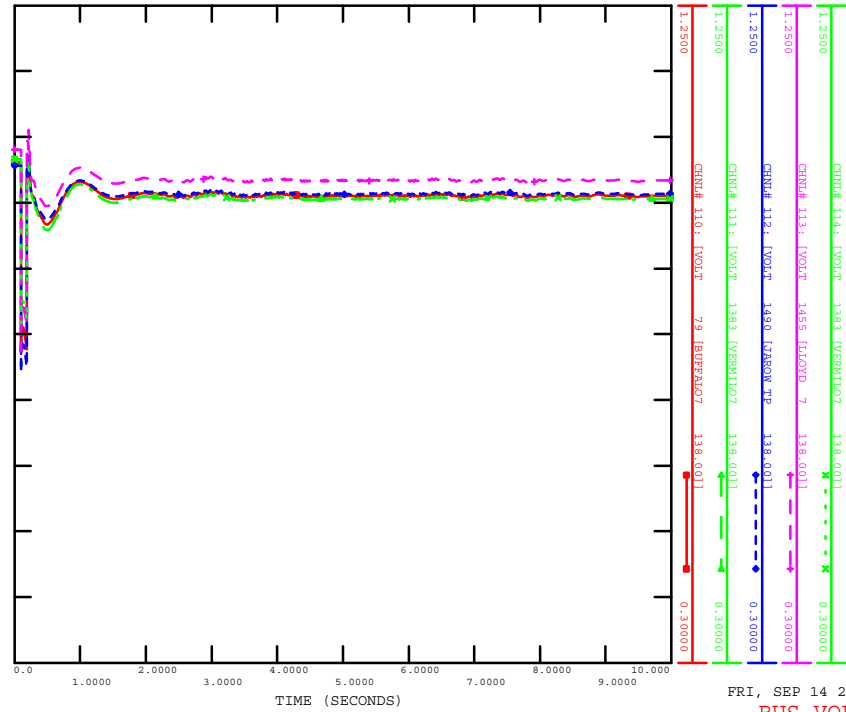
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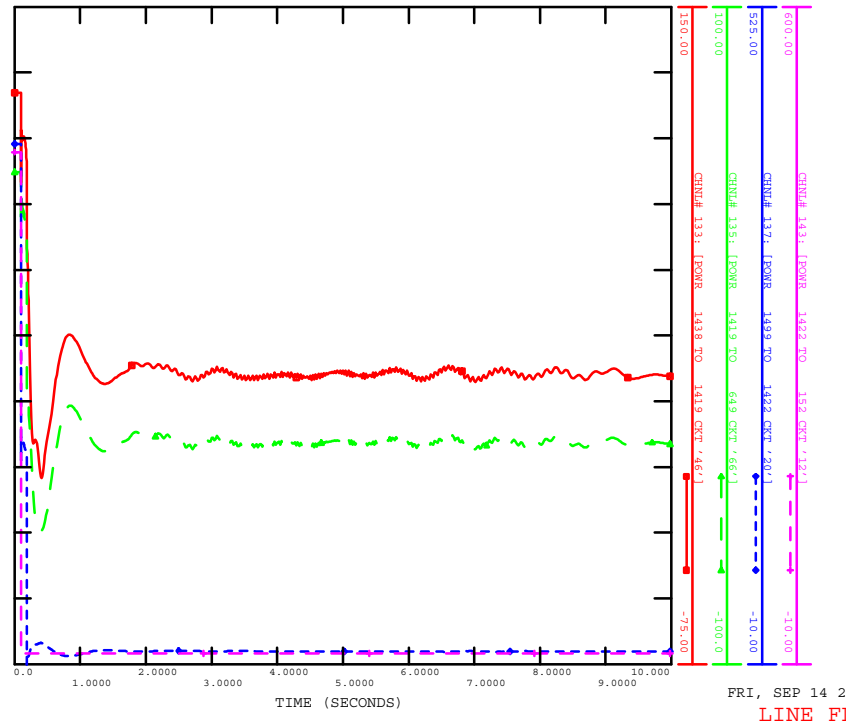
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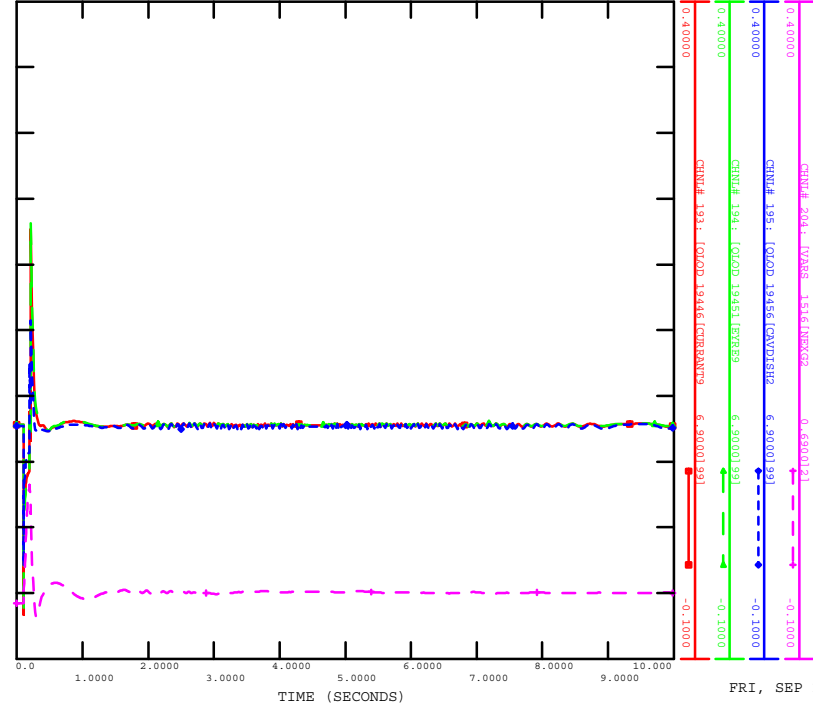
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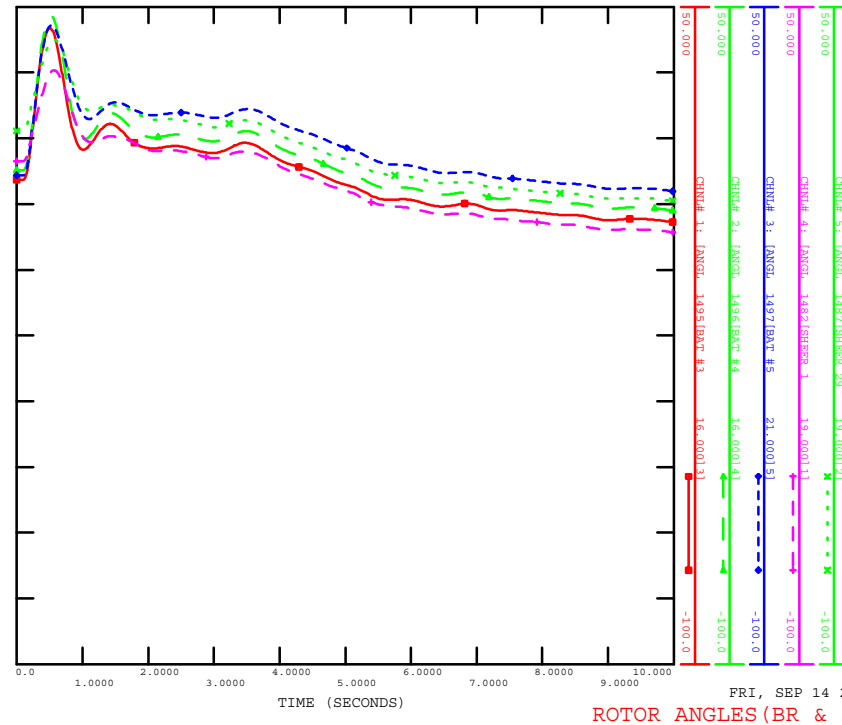
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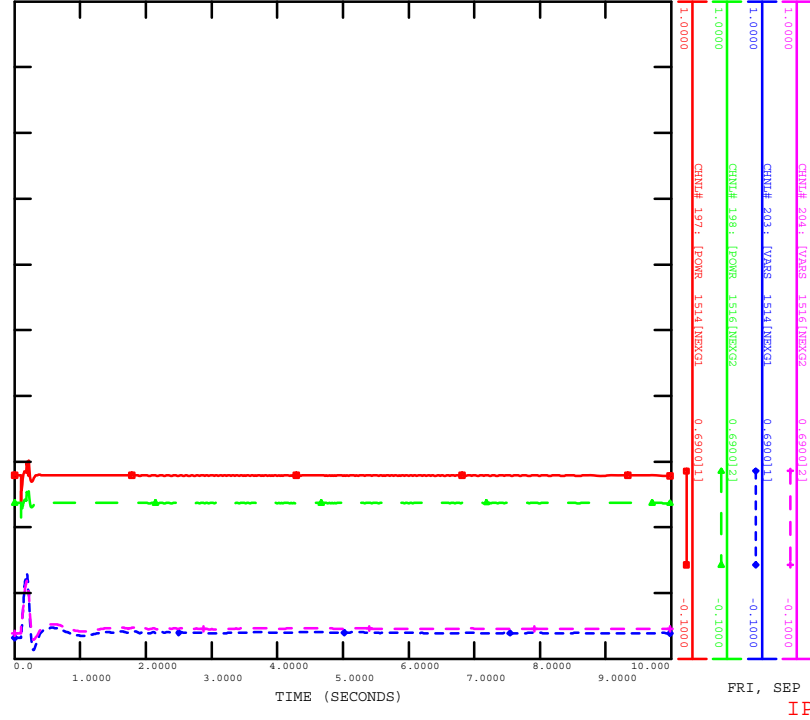
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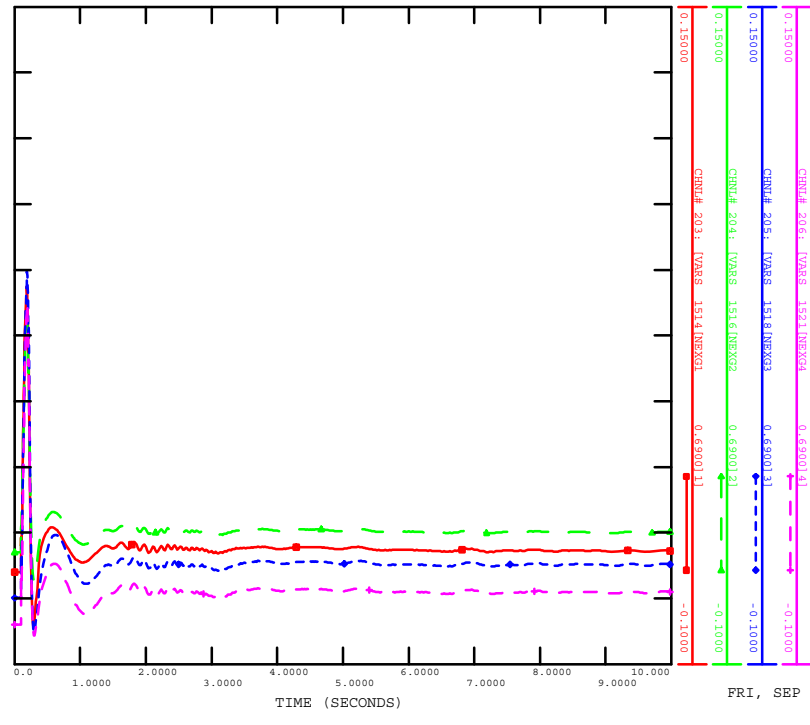
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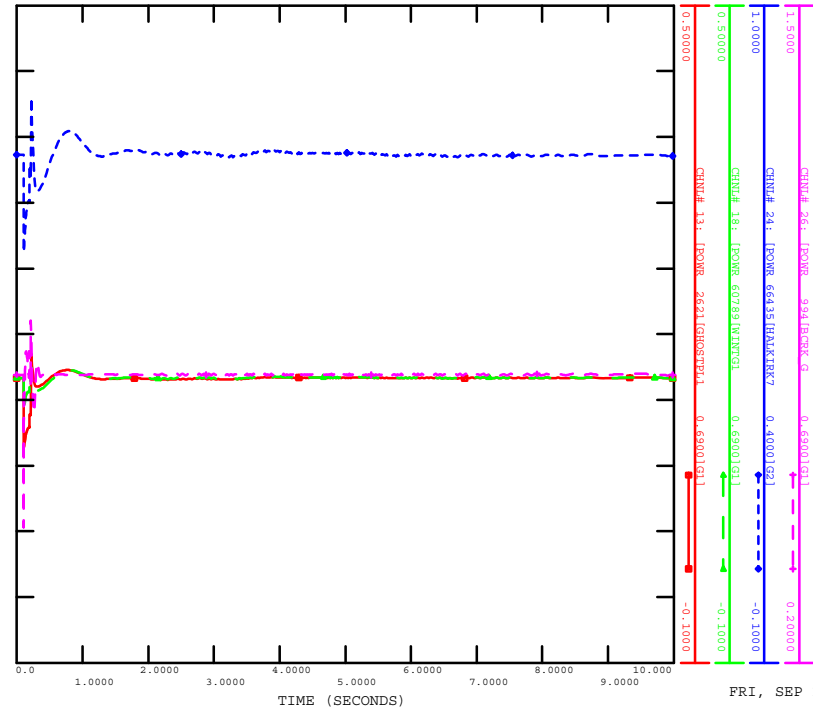
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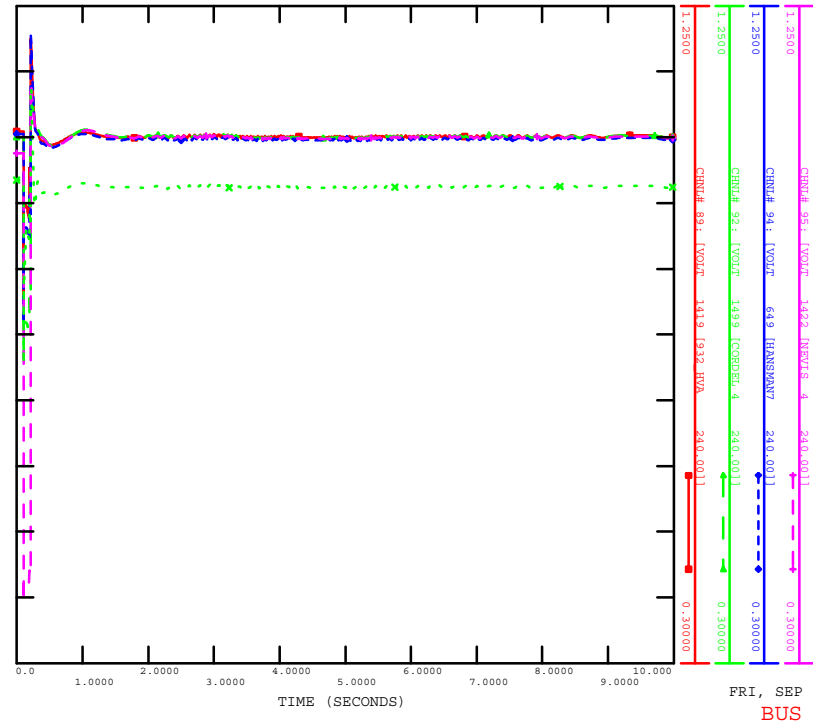
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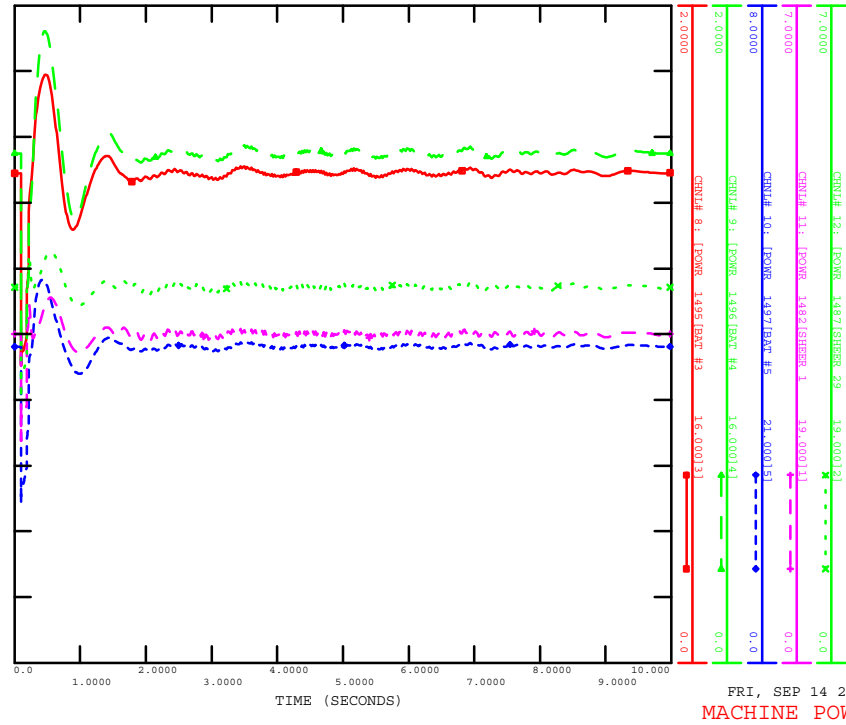
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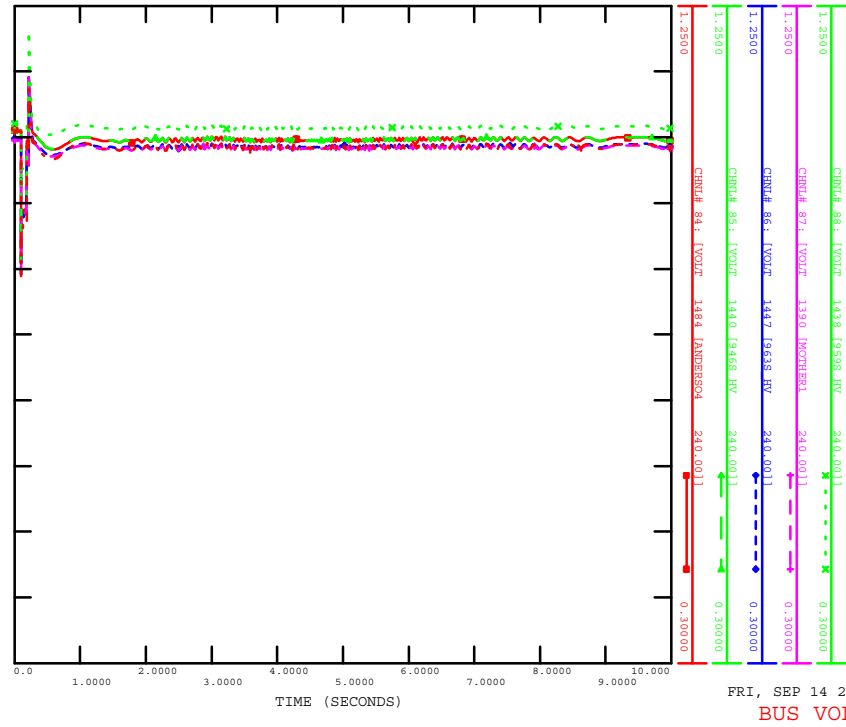
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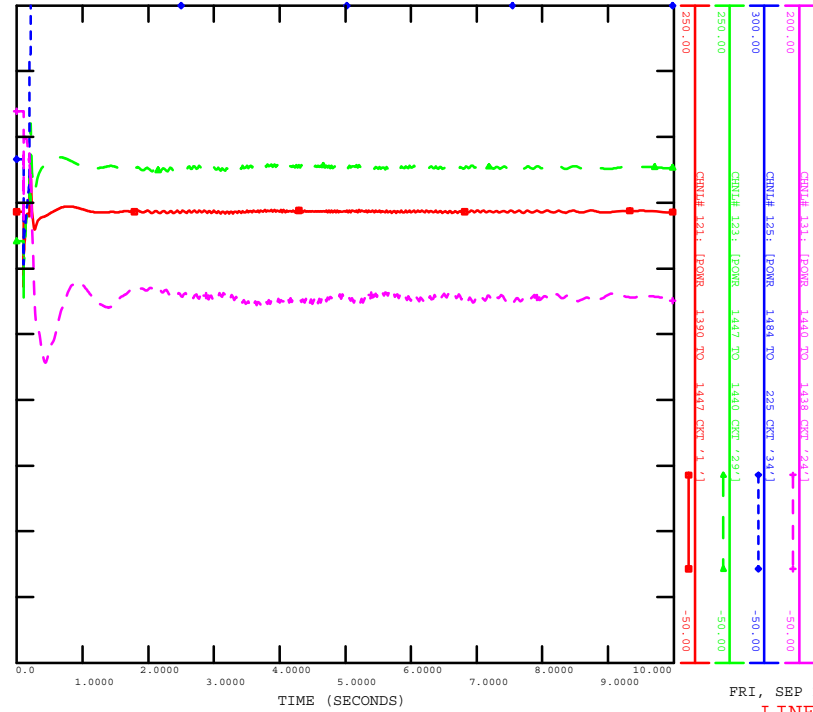
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FILE: B-36.out

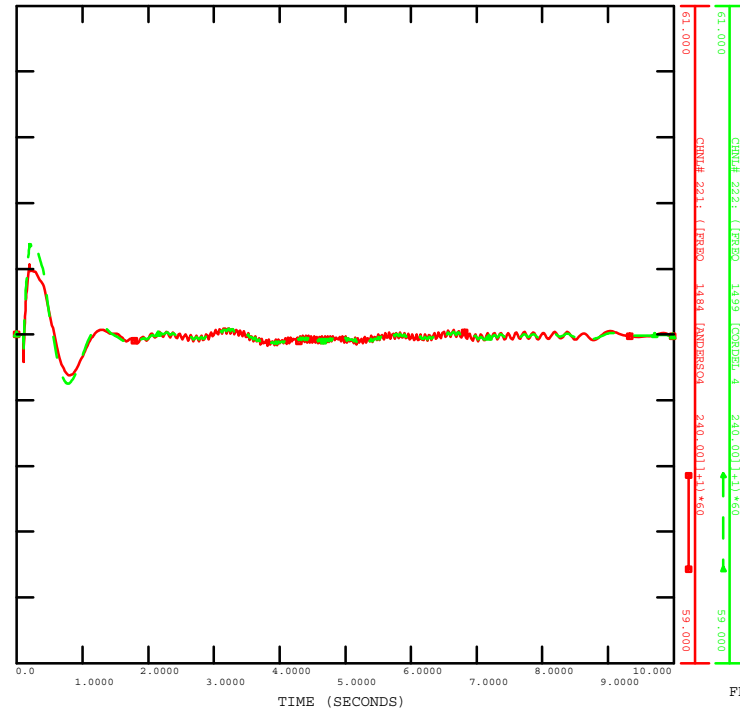


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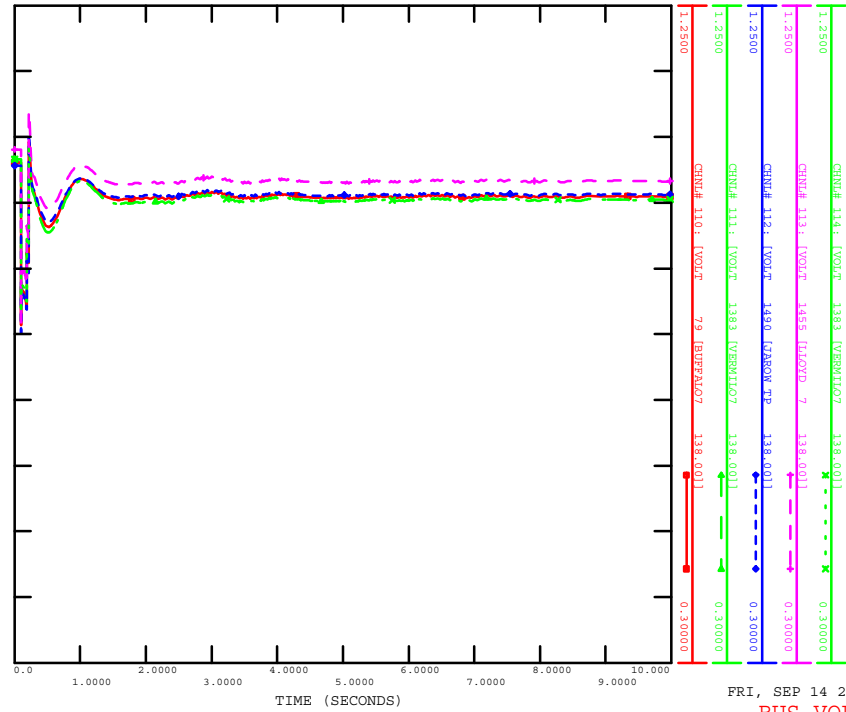
FRI, SEP 14 2012 11:14
LINE FLOW (P)

FILE: B-36.out



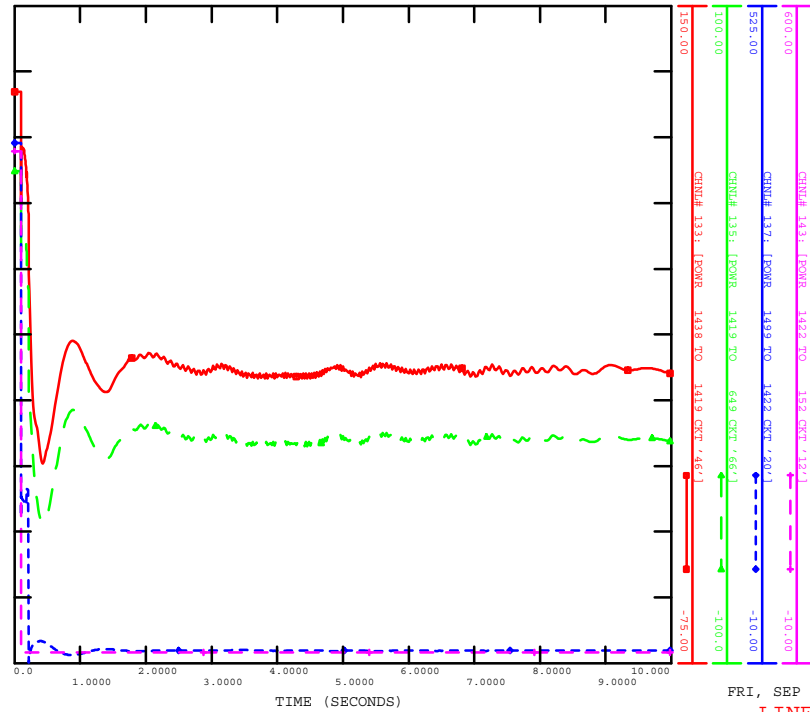
FRI, SEP 14 2012 11:14
BUS FREQUENCY

FILE: B-36.out



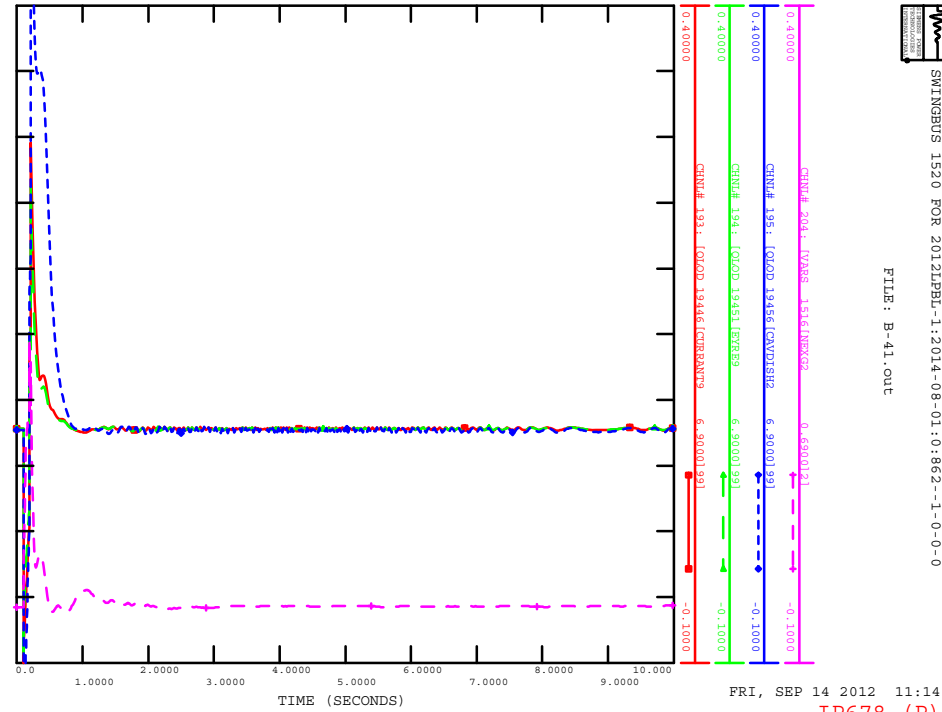
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BUS VOLT (PU)

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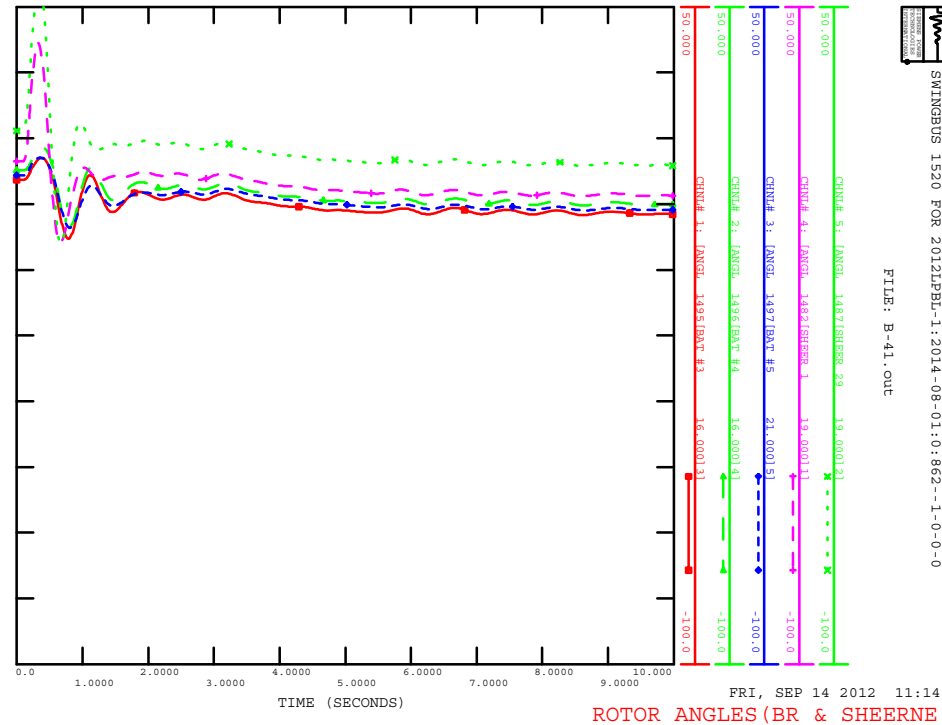


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LINE FLOW (P)

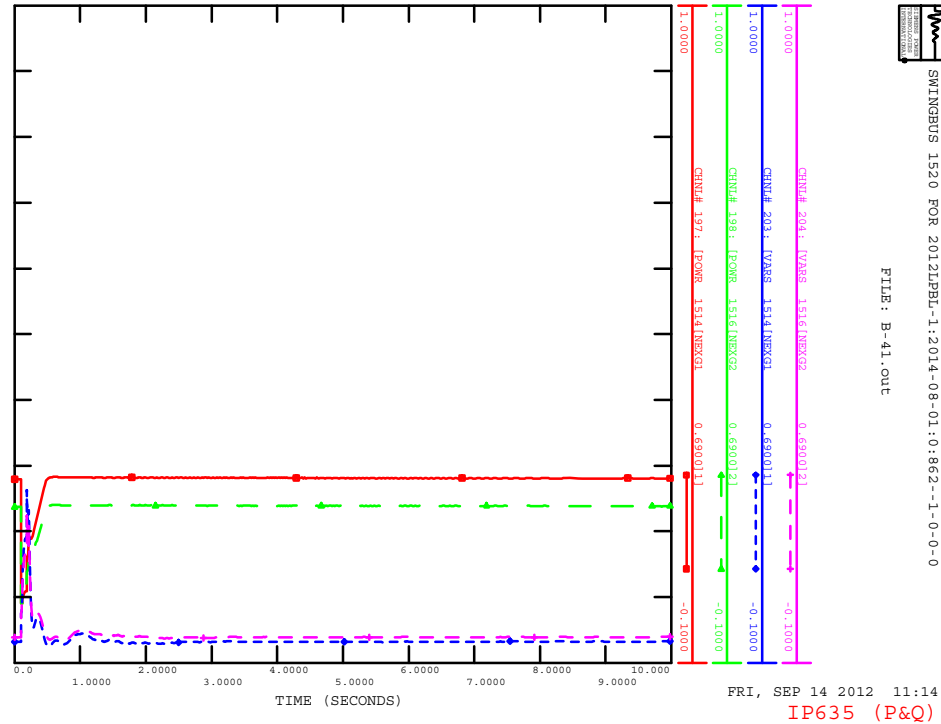
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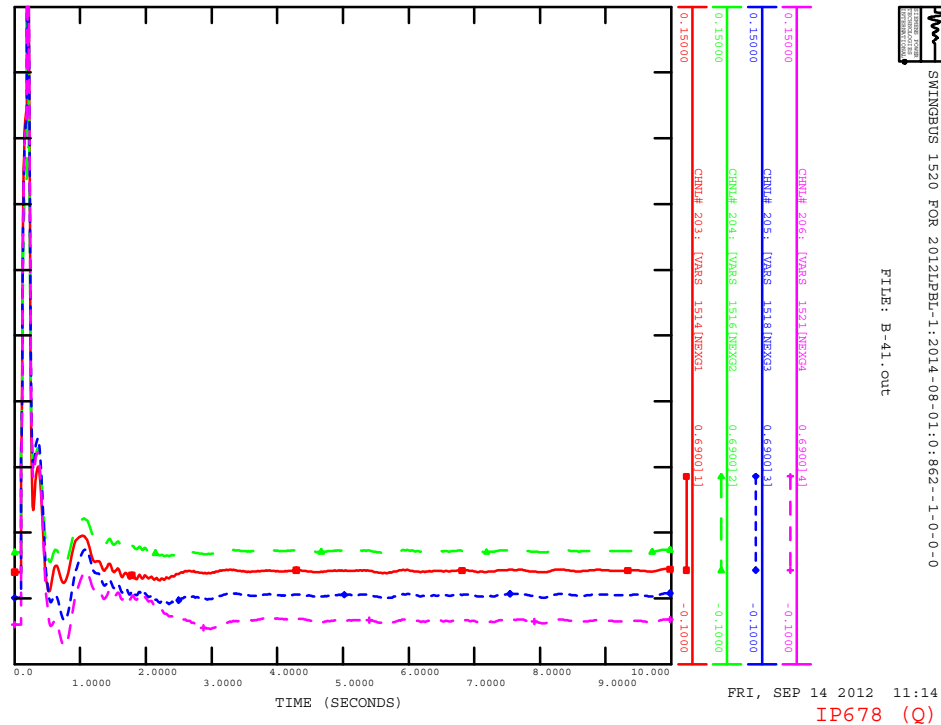
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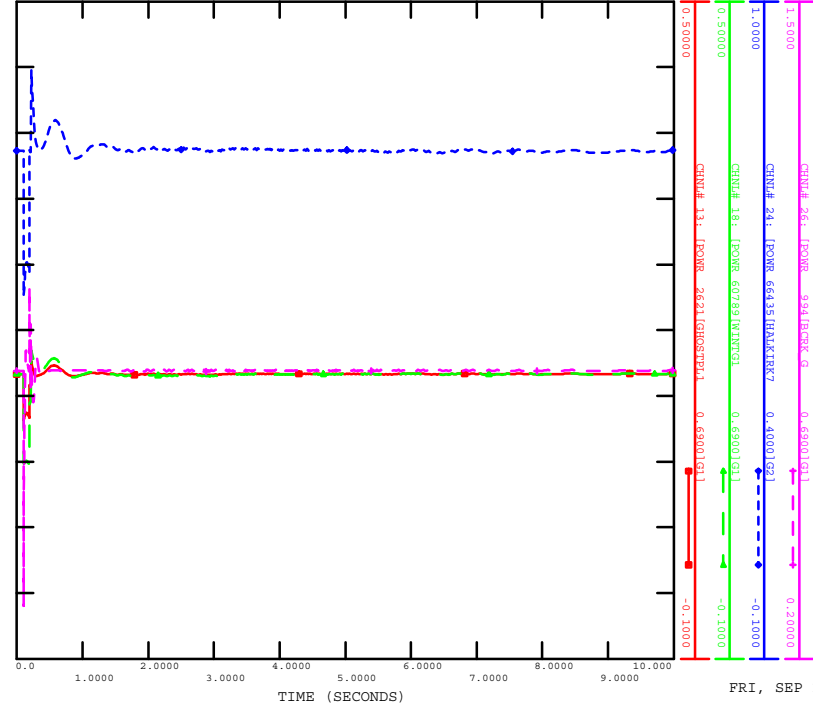
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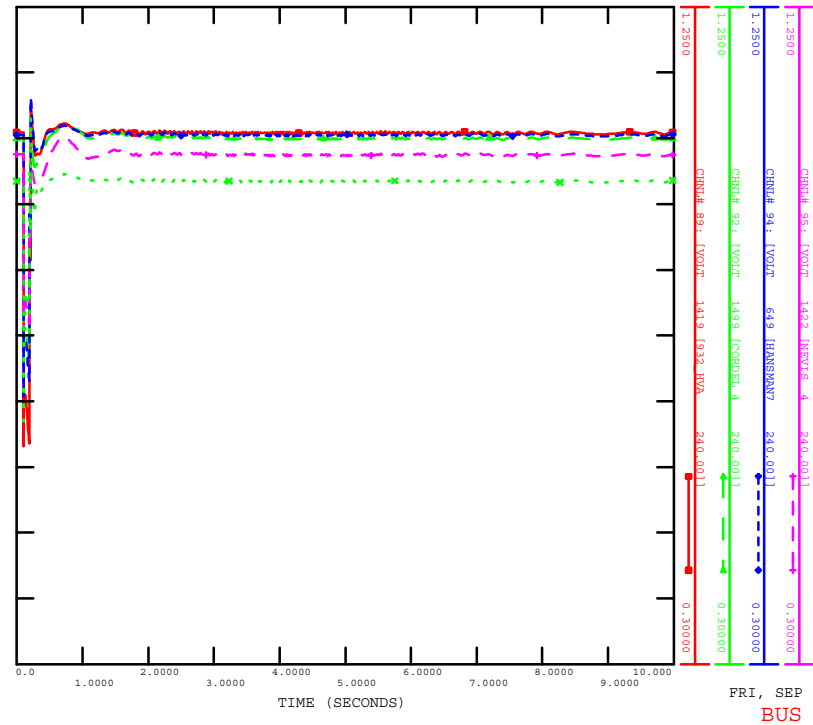
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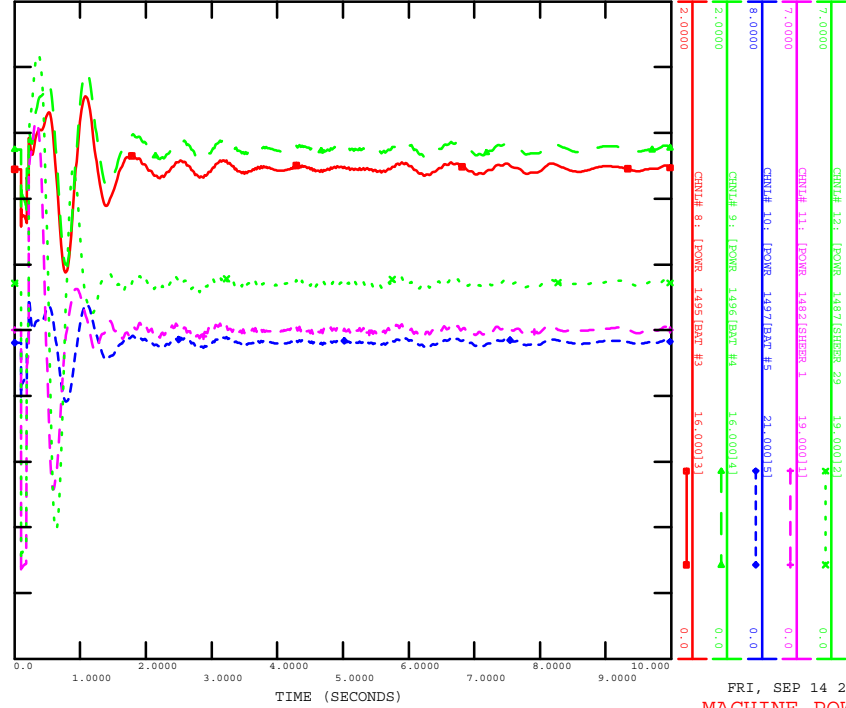
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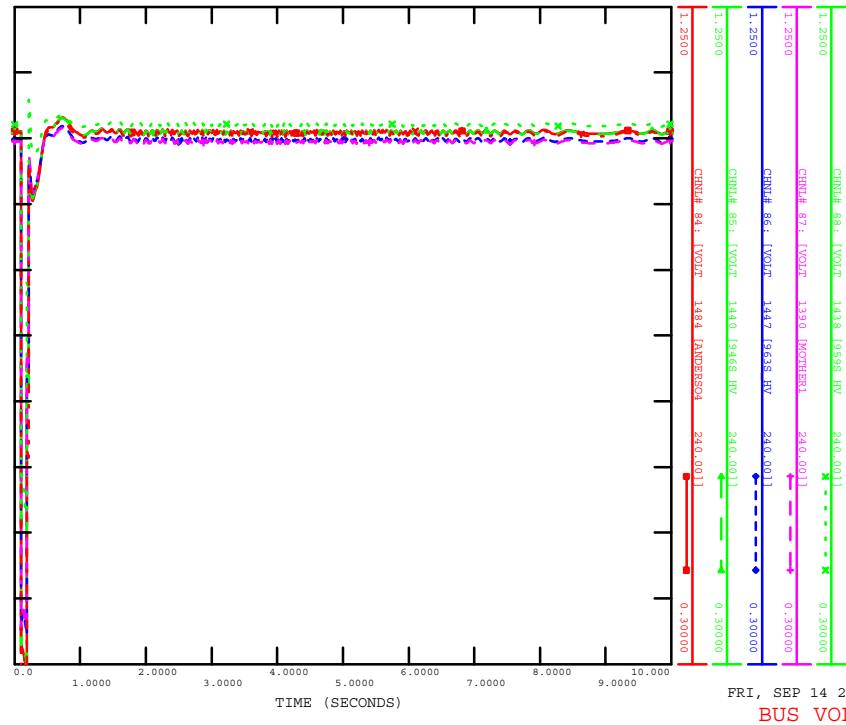
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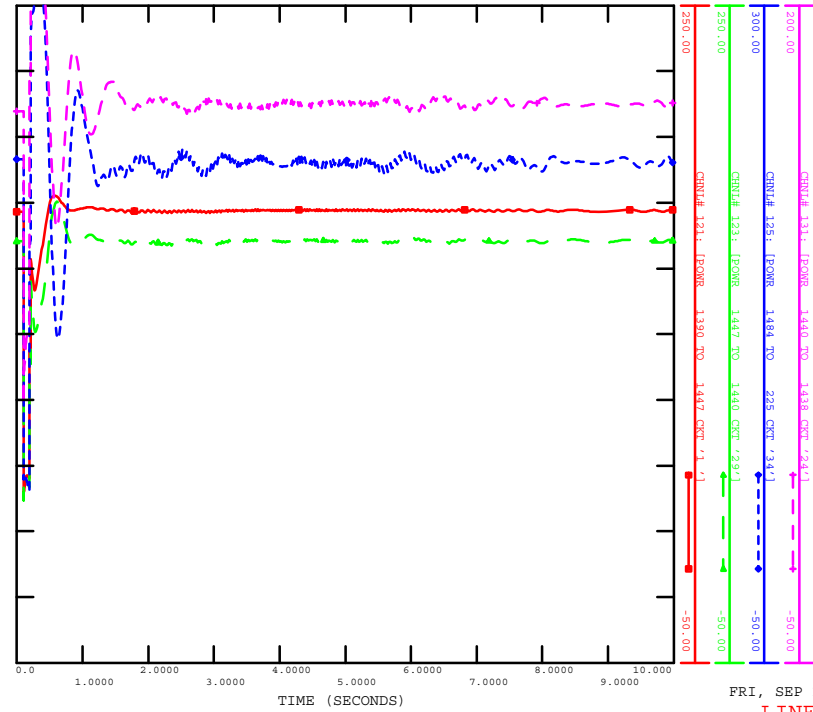
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FILE: B-41.out

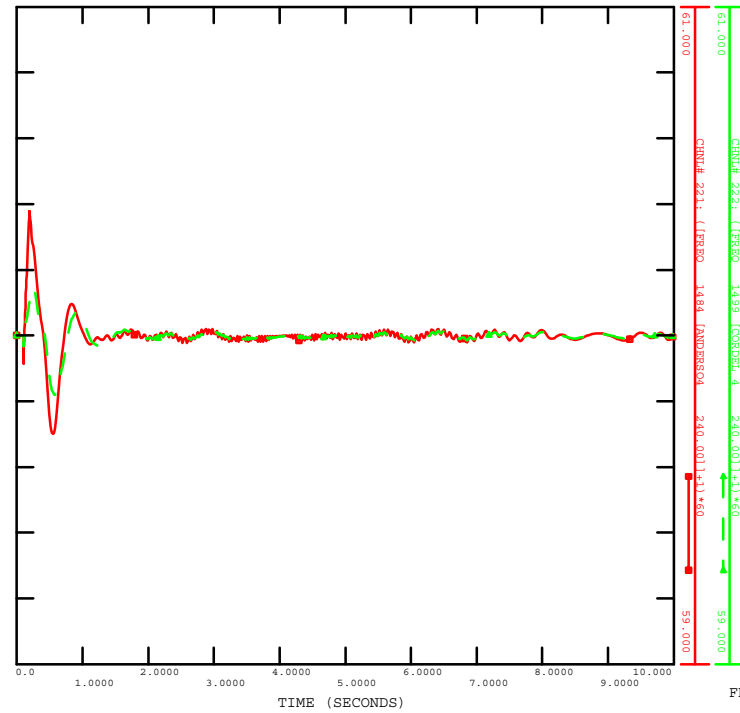


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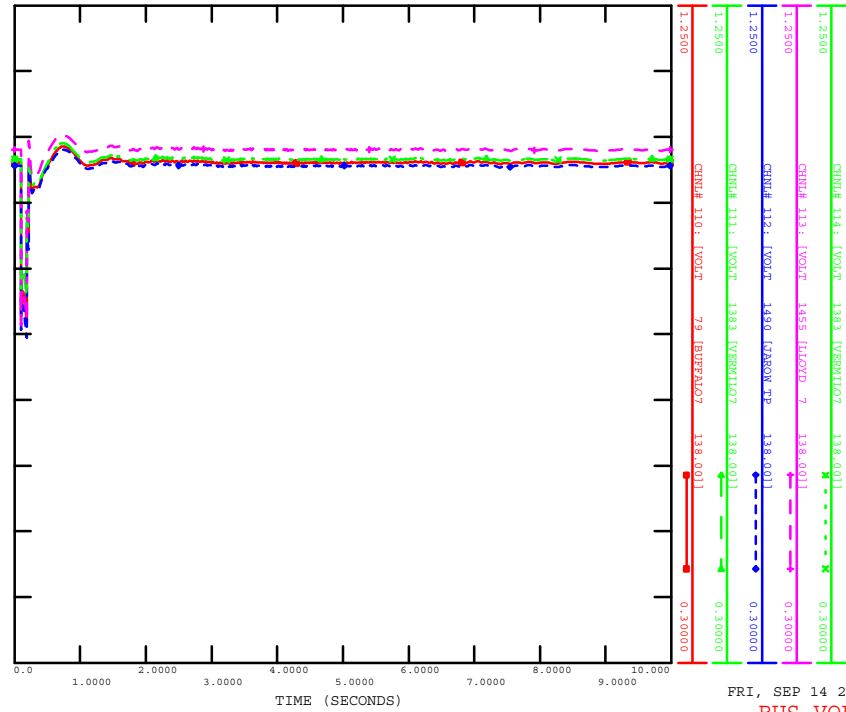
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LINE FLOW (P)

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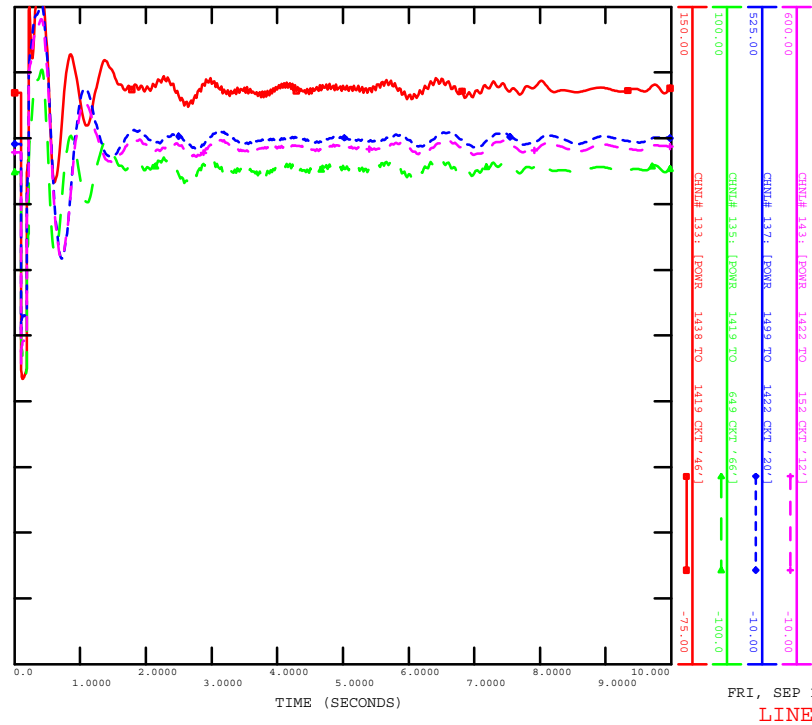
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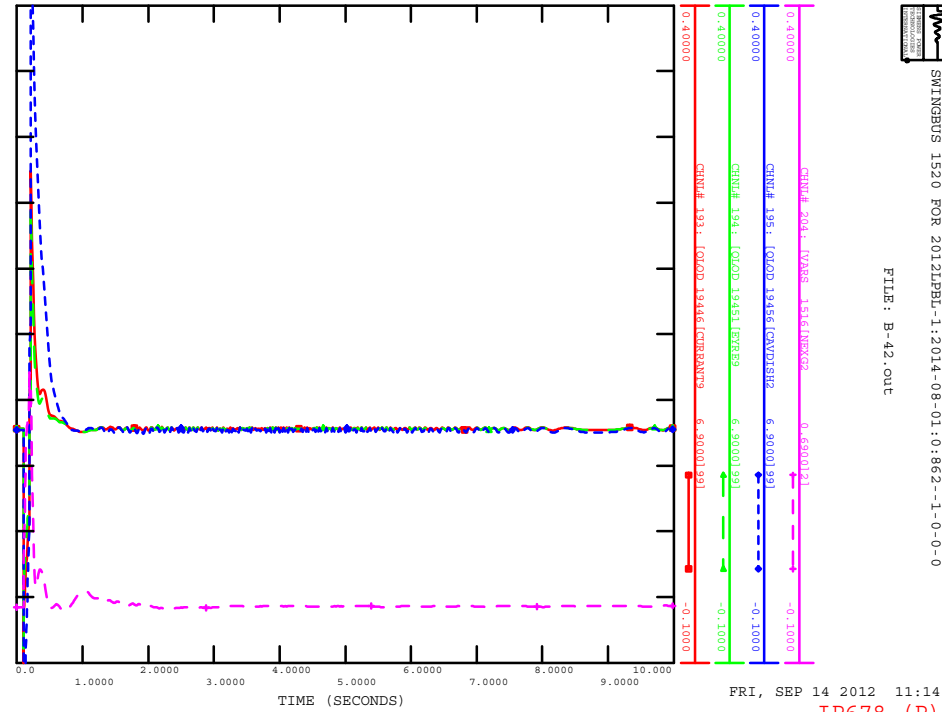
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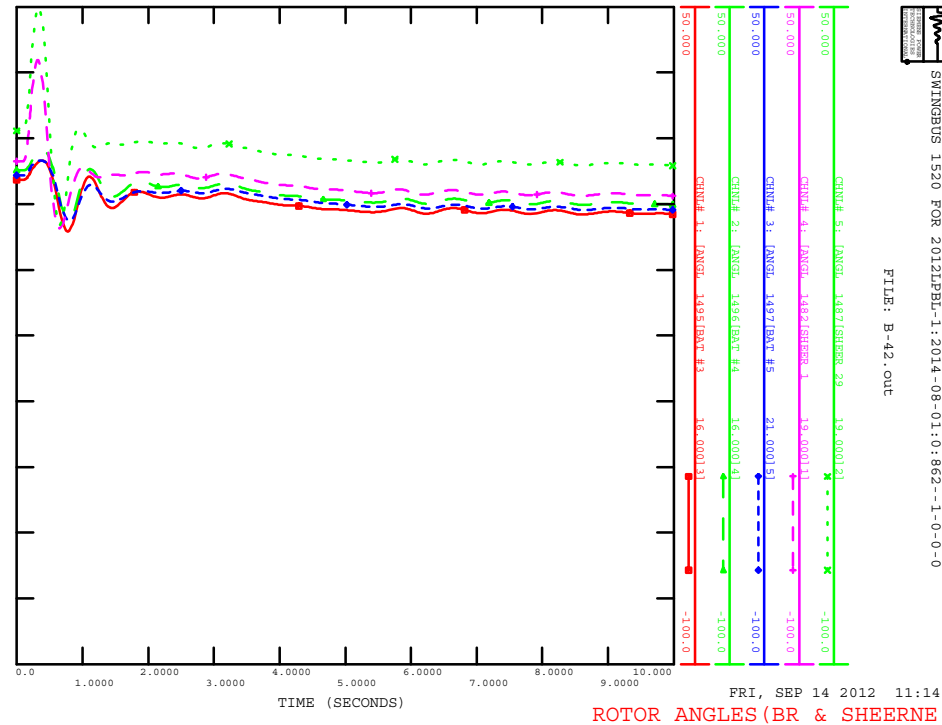


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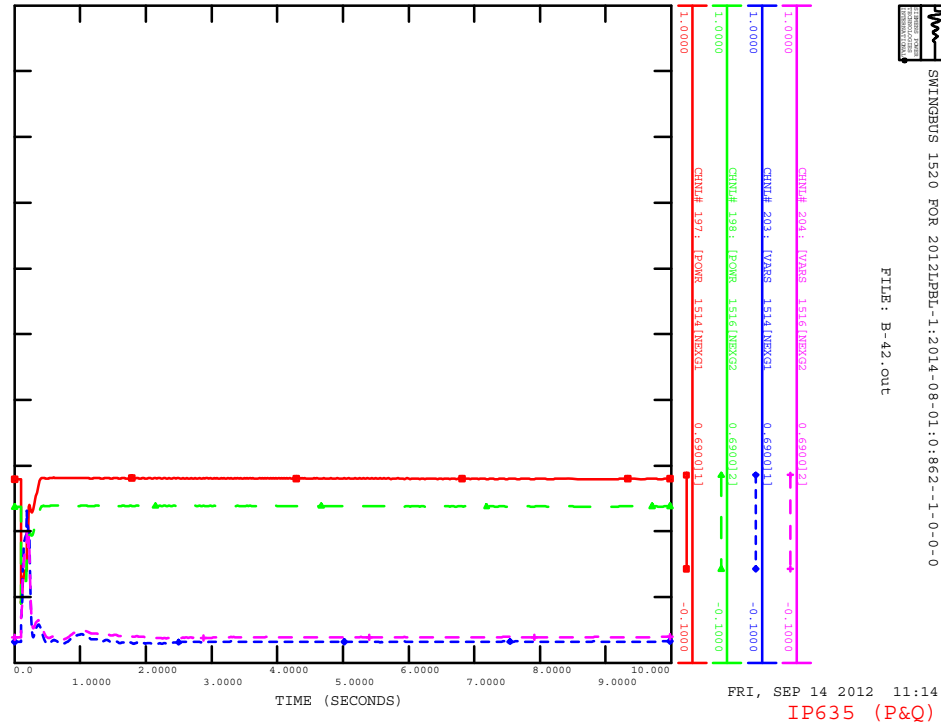
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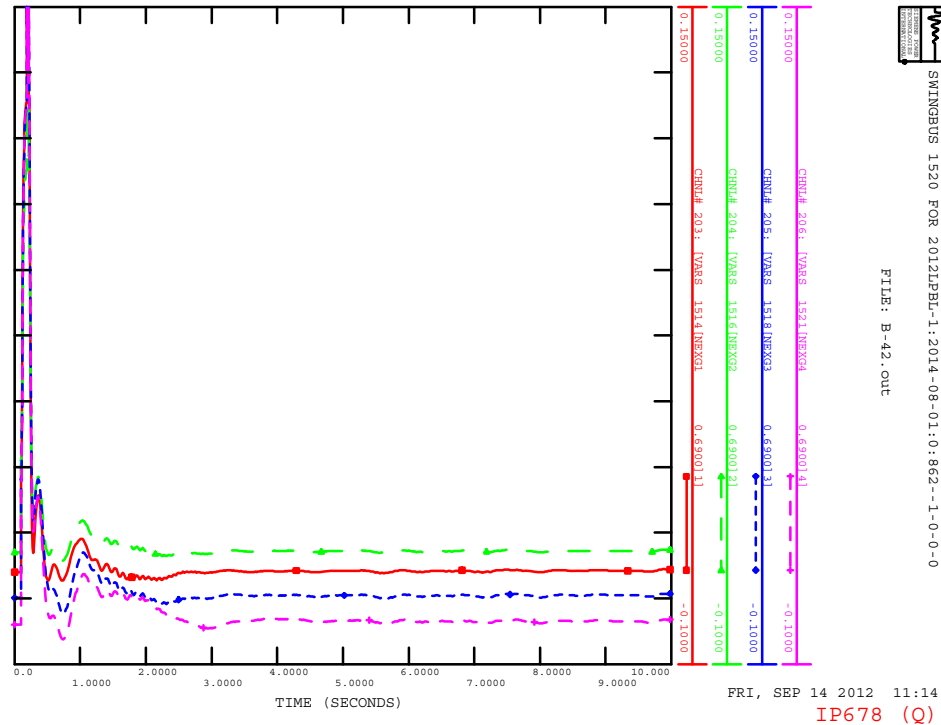
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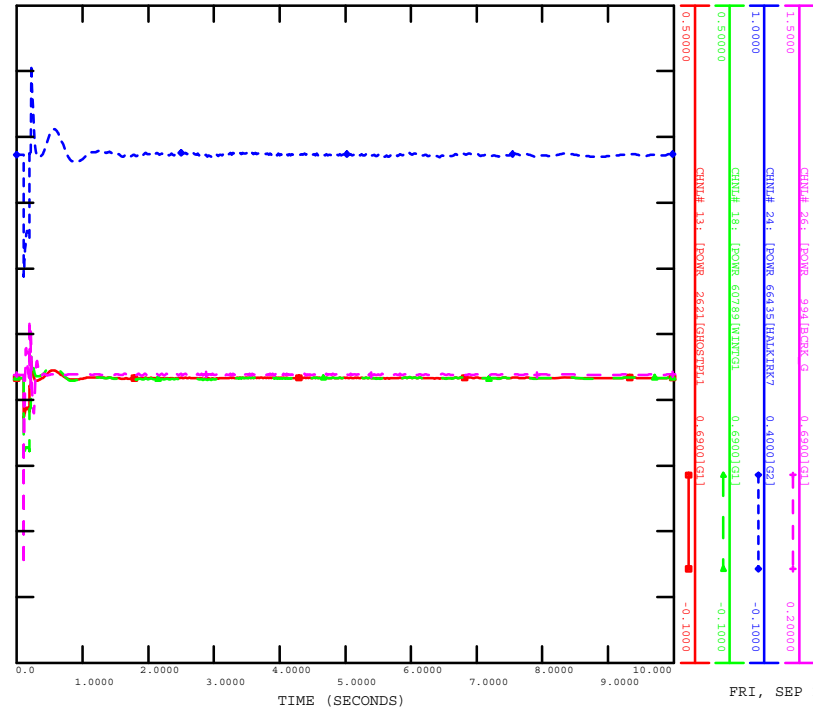
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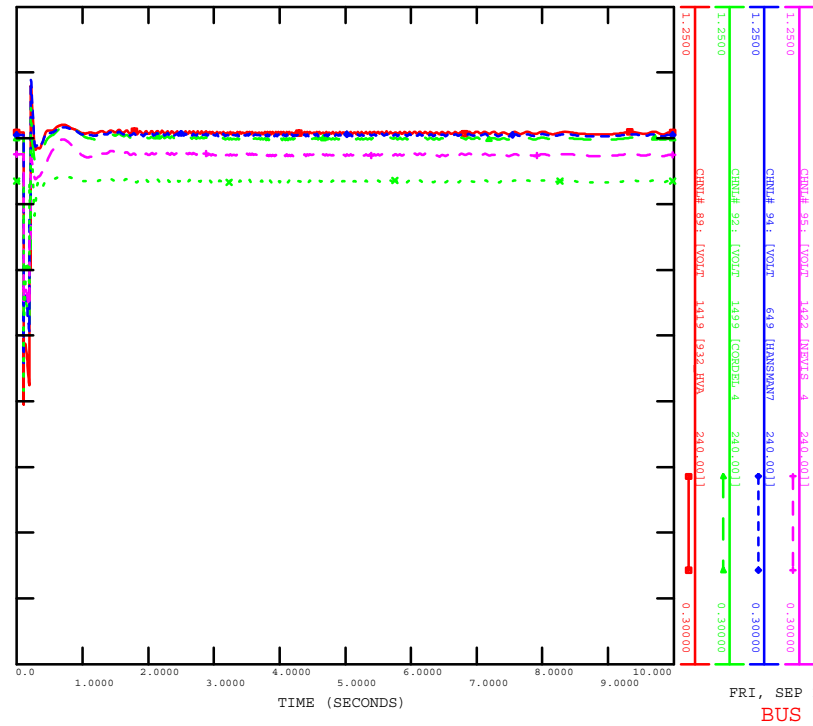
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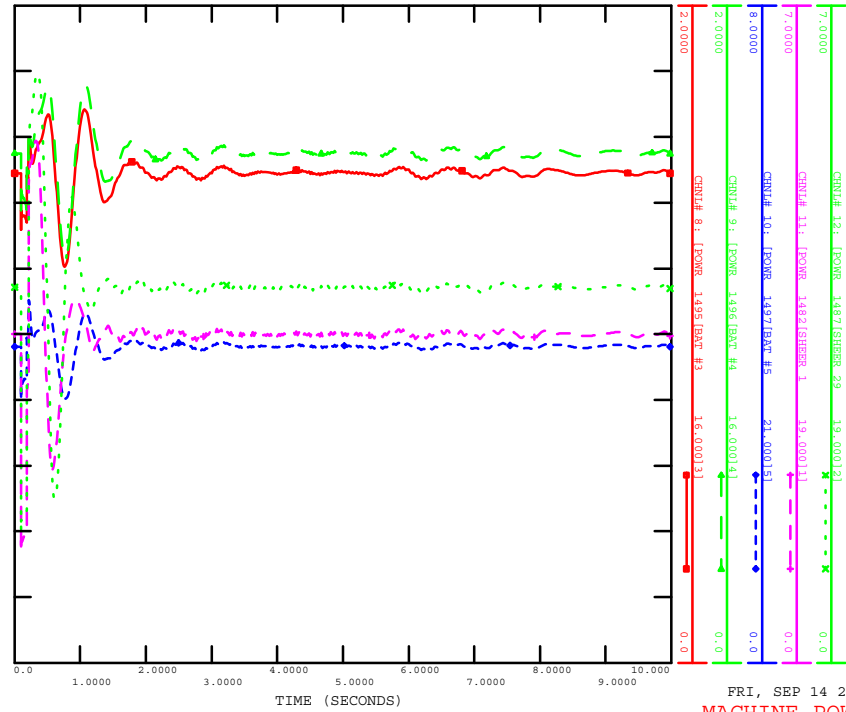
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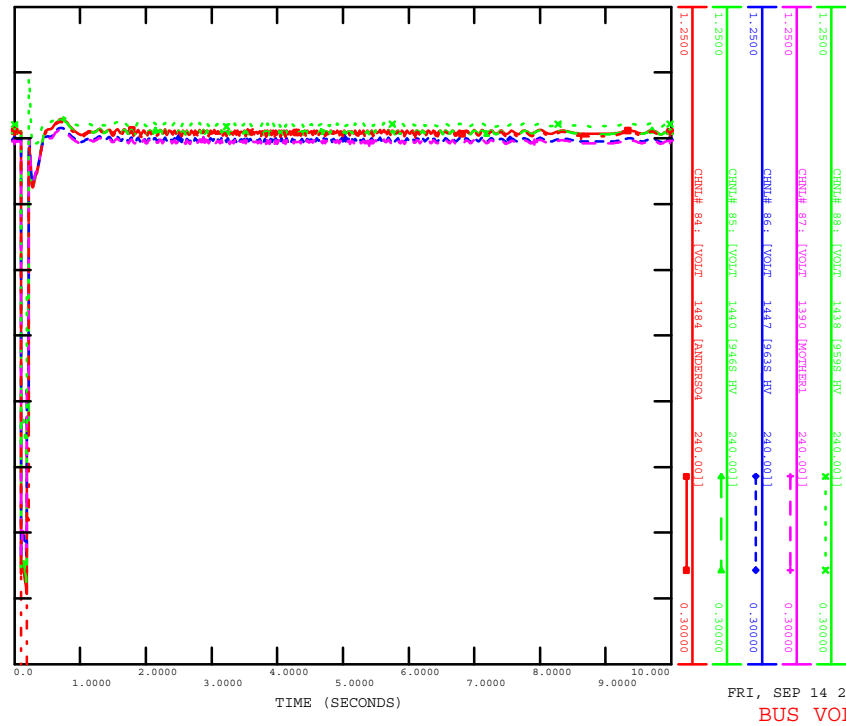
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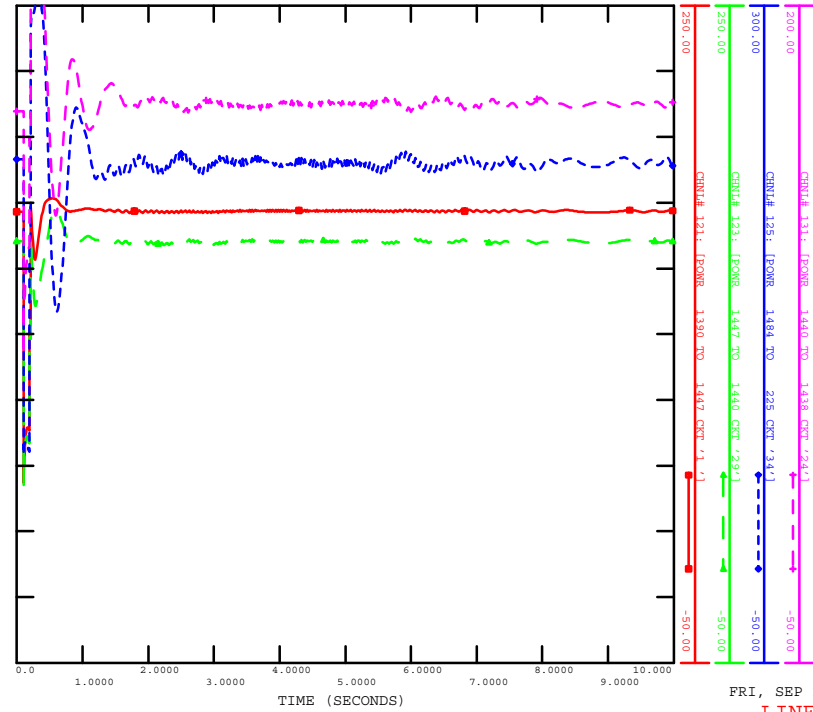
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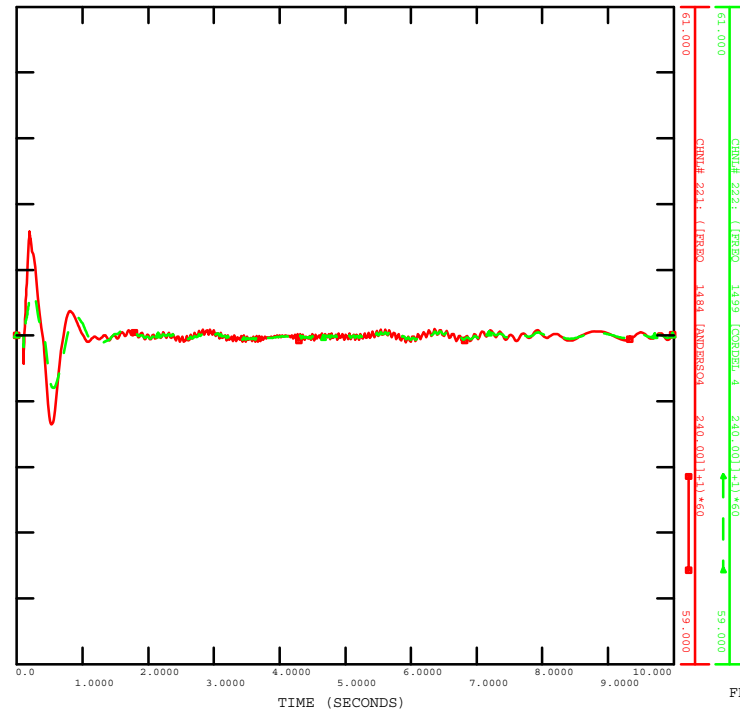


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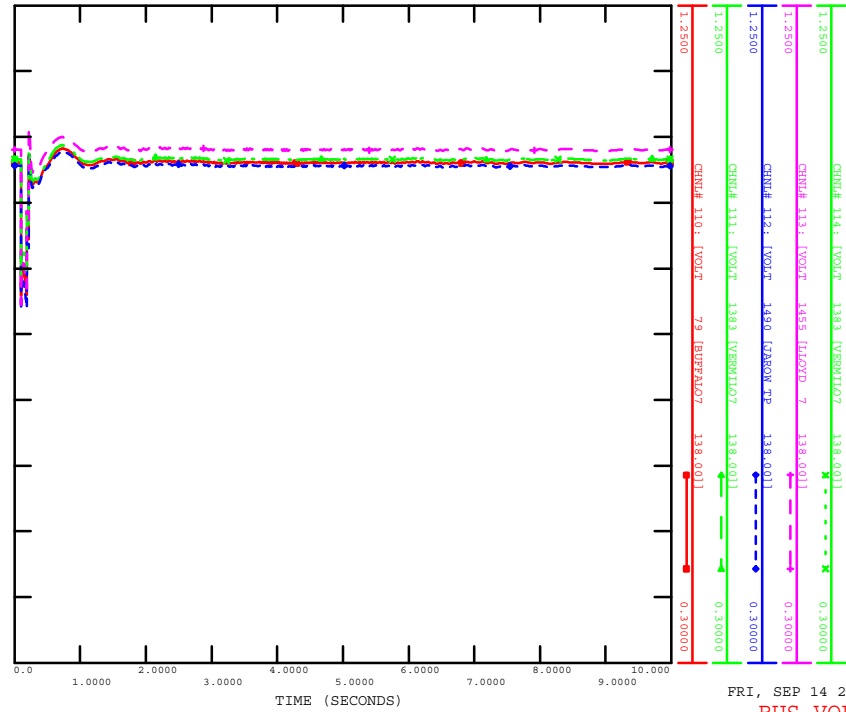
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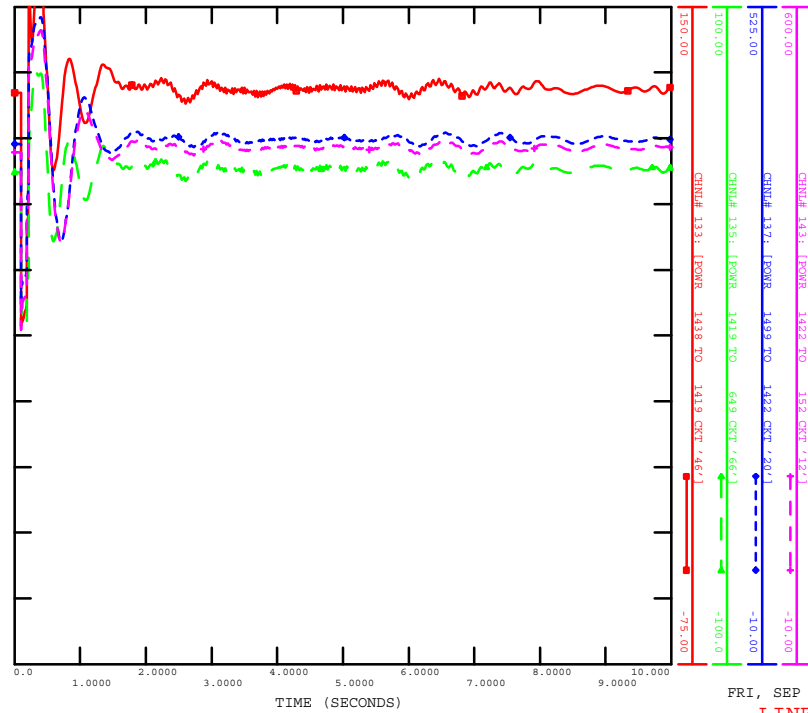
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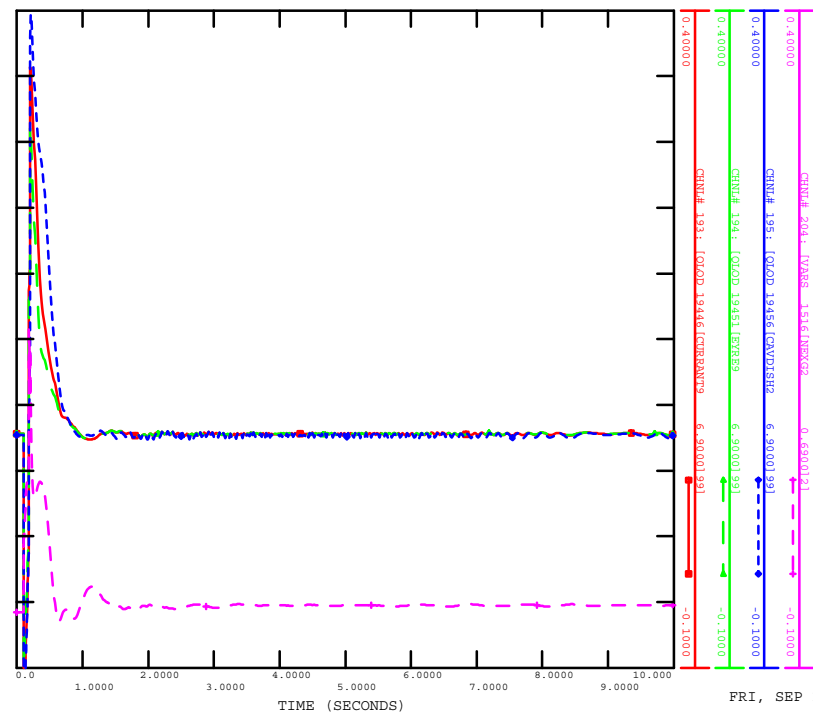
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BUS VOLT (PU)

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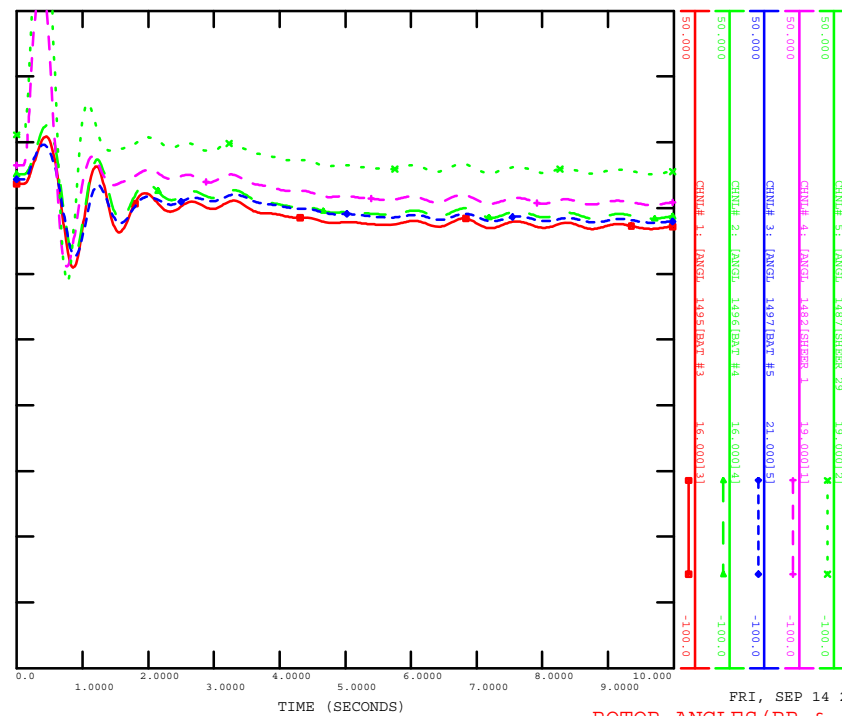


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LINE FLOW (P)

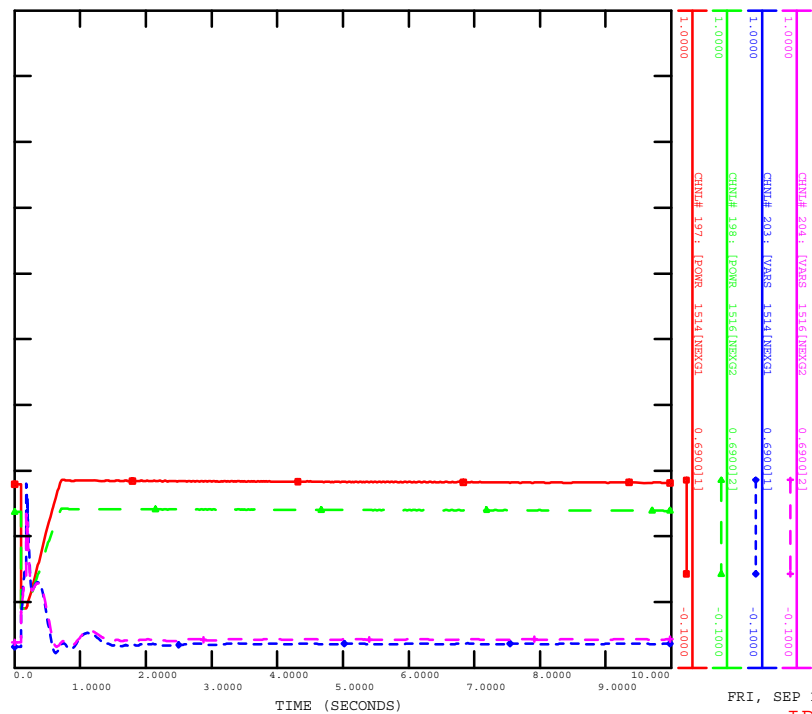
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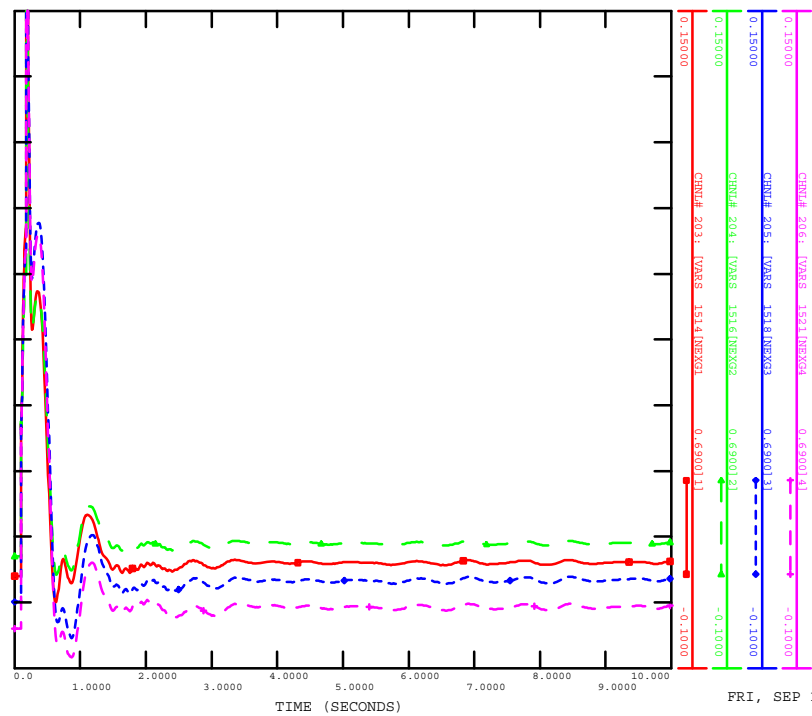
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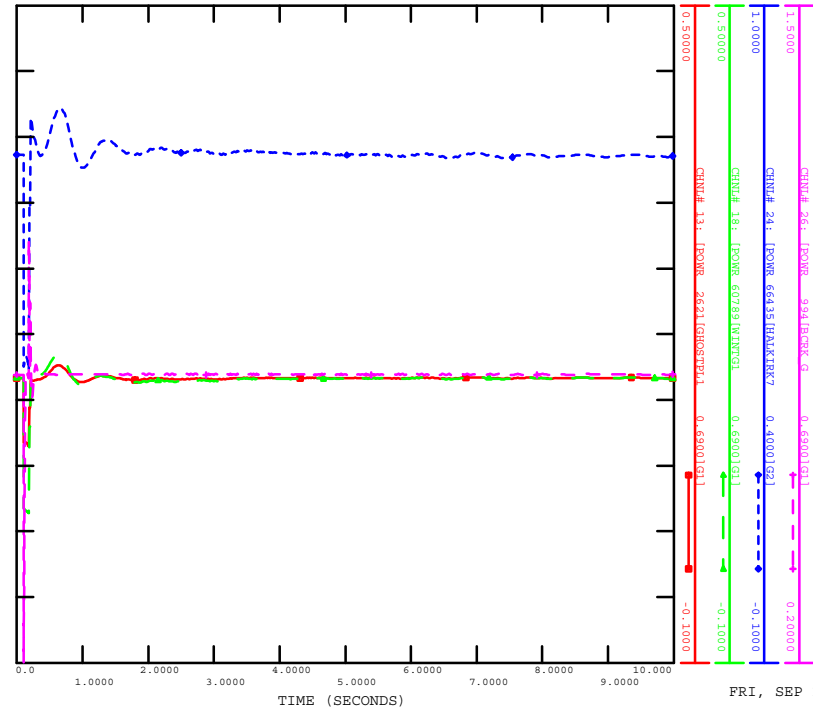
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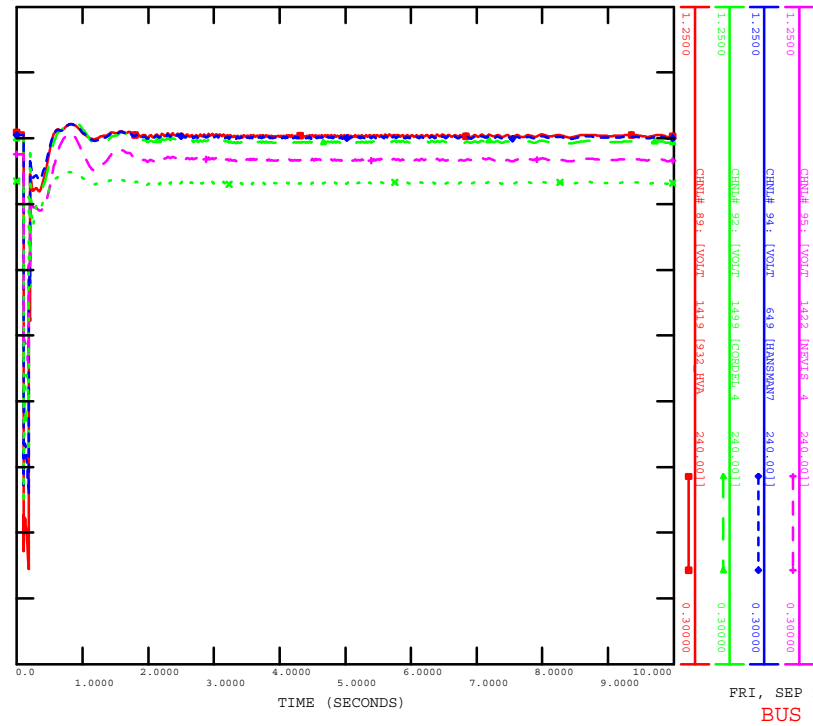
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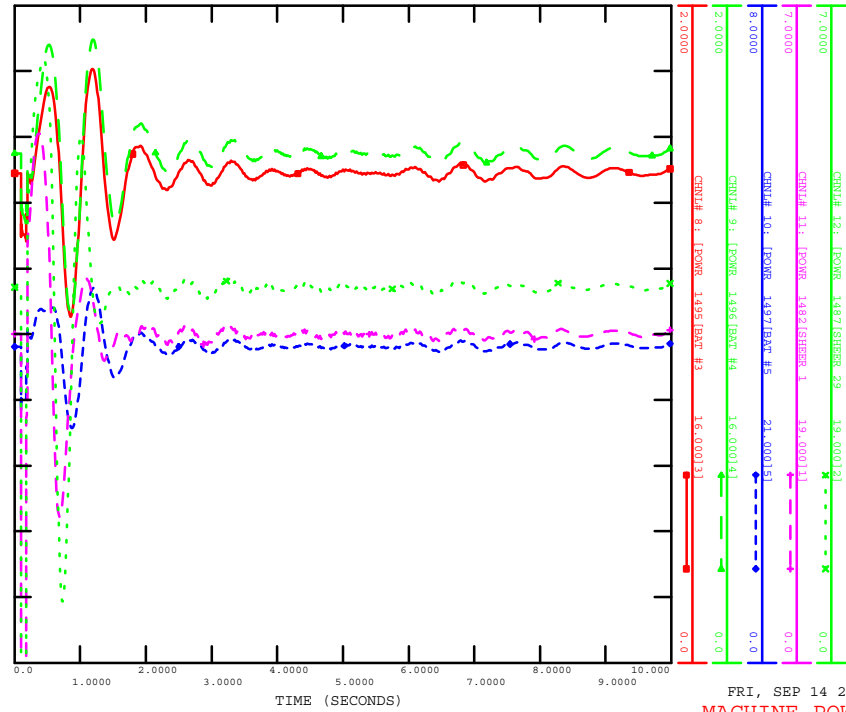
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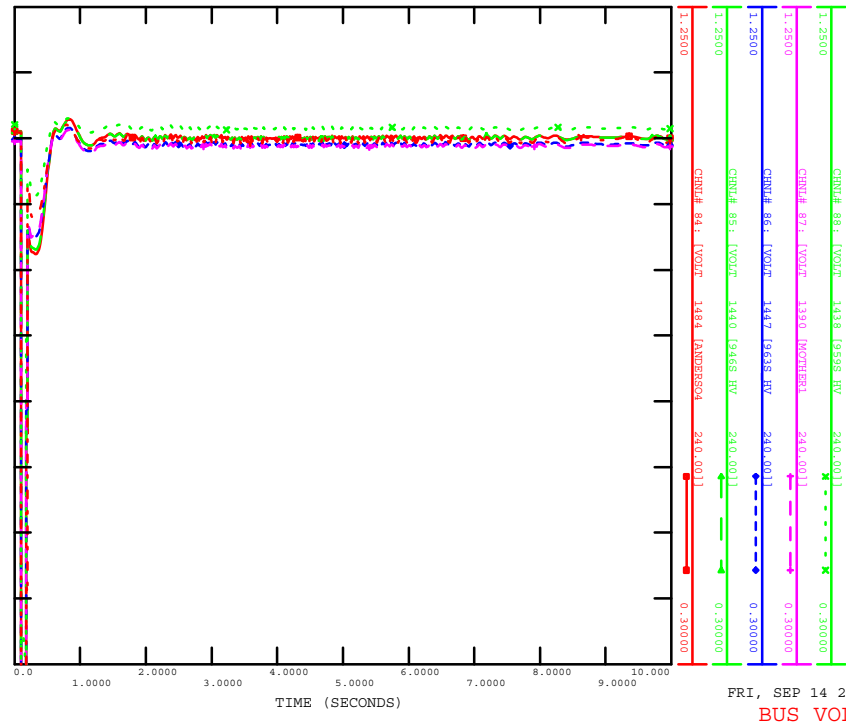
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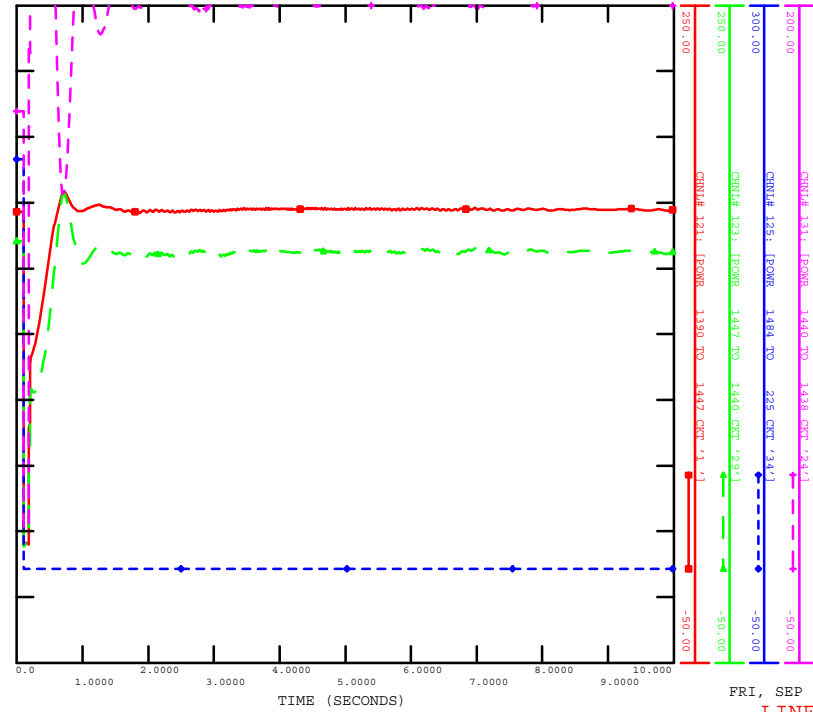
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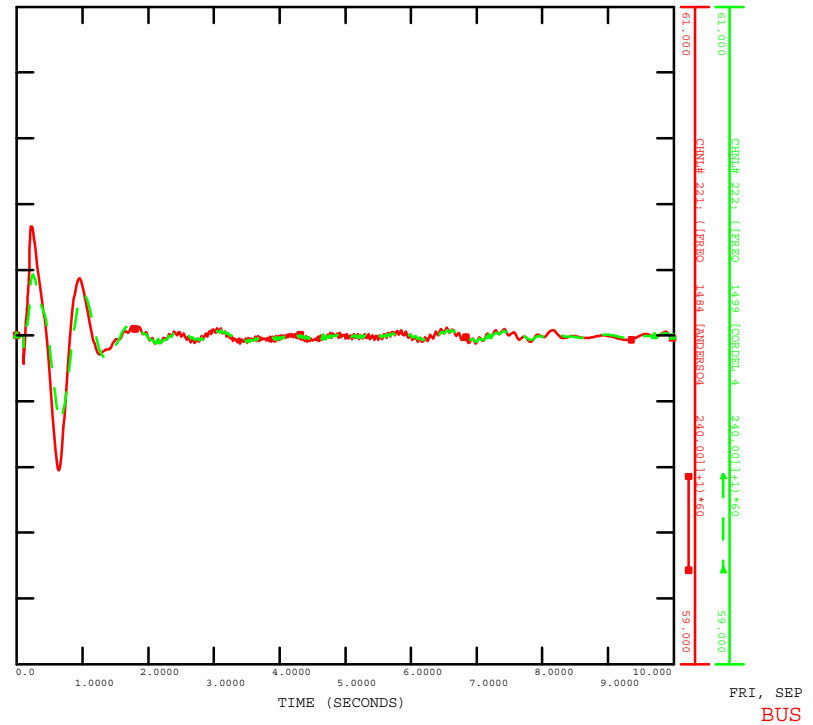
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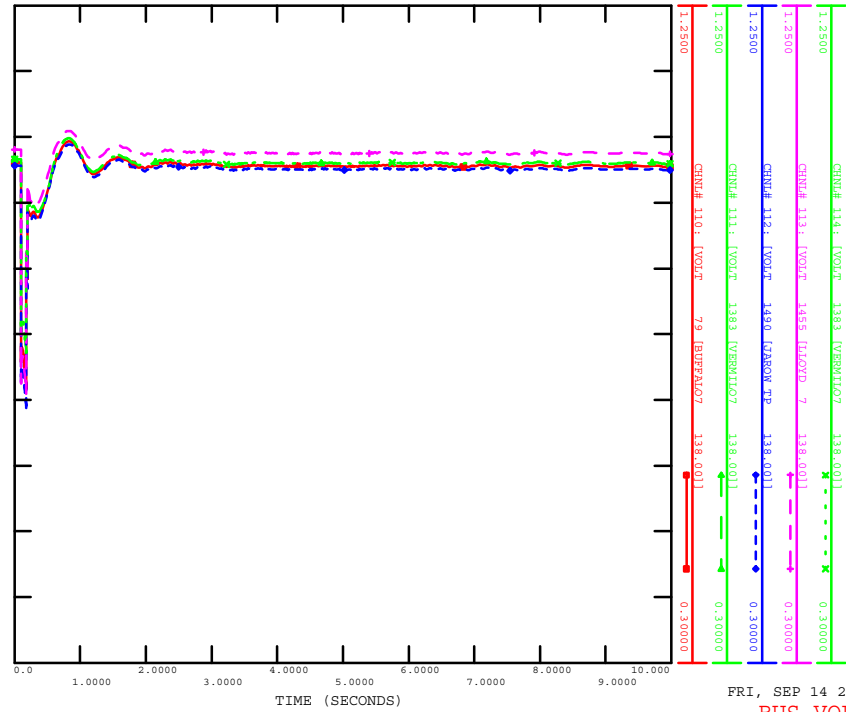
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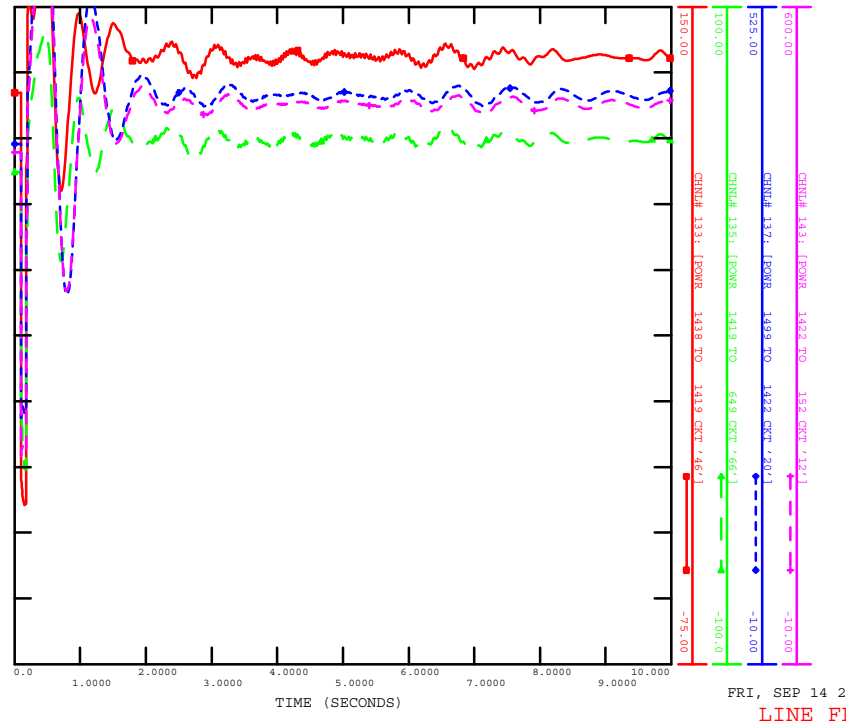
FILE: C5-01.out



FILE: C5-01.out



FILE: C5-01.out



Attachment F

Transfer Out Analysis and Calculation of Effectiveness Generation Factors

Transfer out analysis is carried out to determine the generator effectiveness factors which are used to estimate the ability of each generator to relieve transmission element constraints. A generator's effectiveness factor is defined as the change in power flow over a specific line following a change in the generator's output power. As such, the larger the generator effectiveness factor the more helpful it can be in alleviating an overload on the transmission line associated to it.

Table F-1 provides the Hanna region effectiveness factors for constraint transmission elements under steady state (N-0) conditions. In developing these effectiveness factors, it is assumed that any specific generation output increase in Hanna region will be accompanied by an equivalent reduction in either Area 40, 28, or 25 and BC generation so that the tie flow with BC is maintained following the generation shift except the case that BC is the opposing system. (Note that a shaded cell shows the Largest Effectiveness Factor for generations in the Hanna Region.)

Table F-1: Effectiveness Factors for the Area Generation under N-0 Condition

Opposing system : Area 40								
Line/Generator	BR	SH	P518	P634	P723	P678	P635	P789
912L	0.469	0.289	0.539	0.355	0.433	0.303	0.303	0.407
920L	0.441	0.238	0.039	0.174	0.409	0.229	0.229	0.381
Nevis TX	0.027	0.052	0.578	0.182	0.025	0.074	0.074	0.026
7L701(BR-H)	0.126	0.060	0.054	0.057	0.082	0.060	0.060	0.076
7L701(H-St)	0.129	0.067	0.072	0.071	0.088	0.068	0.068	0.079
701L(St-N.H)	0.129	0.067	0.072	0.071	0.088	0.068	0.068	0.079
7L50	0.084	0.017	0.027	0.021	0.032	0.017	0.017	0.059
7L99	0.085	0.051	0.051	0.052	0.065	0.052	0.052	0.067
7L129	0.085	0.051	0.051	0.052	0.065	0.052	0.052	0.067
174L	0.123	0.071	0.072	0.073	0.091	0.072	0.072	0.117
704L	0.001	0.034	0.024	0.031	0.033	0.034	0.034	0.126
Opposing system : BC								
Line/Generator	BR	SH	P518	P634	P723	P678	P635	P789
912L	0.414	0.235	0.484	0.301	0.379	0.249	0.249	0.352
920L	0.399	0.195	0.082	0.131	0.366	0.186	0.186	0.338
Nevis TX	0.016	0.040	0.566	0.170	0.013	0.062	0.062	0.014
7L701(BR-H)	0.094	0.028	0.022	0.025	0.050	0.028	0.028	0.001
7L701(H-St)	0.093	0.031	0.035	0.035	0.052	0.032	0.032	0.043
701L(St-N.H)	0.093	0.031	0.035	0.035	0.052	0.032	0.032	0.043
7L50	0.073	0.006	0.016	0.010	0.021	0.006	0.006	0.070
7L99	0.057	0.023	0.023	0.024	0.037	0.024	0.024	0.039
7L129	0.057	0.023	0.023	0.024	0.037	0.024	0.024	0.039
174L	0.087	0.035	0.036	0.037	0.055	0.036	0.036	0.081
704L	0.015	0.017	0.007	0.014	0.016	0.018	0.018	0.109
Opposing system : Area 25								
Line/Generator	BR	SH	P518	P634	P723	P678	P635	P789
912L	0.439	0.259	0.509	0.325	0.404	0.273	0.273	0.377
920L	0.414	0.210	0.066	0.146	0.381	0.202	0.202	0.354
Nevis TX	0.025	0.049	0.575	0.179	0.022	0.071	0.071	0.023

7L701(BR-H)	0.134	0.069	0.063	0.066	0.091	0.068	0.068	0.084
7L701(H-St)	0.139	0.077	0.081	0.081	0.098	0.078	0.078	0.089
701L(St-N.H)	0.139	0.077	0.081	0.081	0.098	0.078	0.078	0.089
7L50	0.098	0.031	0.041	0.035	0.046	0.031	0.031	0.045
7L99	0.111	0.077	0.076	0.078	0.091	0.077	0.077	0.092
7L129	0.111	0.077	0.076	0.078	0.091	0.077	0.077	0.092
174L	0.085	0.033	0.034	0.036	0.053	0.034	0.034	0.079
704L	0.013	0.046	0.036	0.043	0.045	0.046	0.046	0.137
Opposing system : Area 28								
Line/Generator	BR	SH	P518	P634	P723	P678	P635	P789
912L	0.382	0.203	0.452	0.269	0.347	0.216	0.216	0.320
920L	0.362	0.158	0.119	0.094	0.329	0.149	0.149	0.301
Nevis TX	0.020	0.045	0.571	0.175	0.018	0.067	0.067	0.018
7L701(BR-H)	0.141	0.075	0.069	0.072	0.097	0.075	0.075	0.090
7L701(H-St)	0.147	0.085	0.090	0.089	0.106	0.086	0.086	0.097
701L(St-N.H)	0.147	0.085	0.090	0.089	0.106	0.086	0.086	0.097
7L50	0.130	0.064	0.074	0.068	0.078	0.064	0.064	0.012
7L99	0.169	0.135	0.135	0.136	0.149	0.135	0.135	0.151
7L129	0.169	0.135	0.135	0.136	0.149	0.135	0.135	0.151
174L	0.036	0.016	0.015	0.013	0.004	0.015	0.015	0.030
704L	0.039	0.071	0.061	0.068	0.070	0.072	0.072	0.163

Note: P 518: Ghost Pine WAGF, P 634: Wintering Hills WAGF, P 723: Halkirk WAGF, P 678: BluEarth Hand Hills WAGF, P 635: Suncor Hand Hills WAGF, and P 789: Windlab Bull Creek WAGF.

Tables F-2 to F-7 provide the effectiveness factors for the study area generators, assumed opposing system as Area 40, under the outage of 912L, 9L20, 9L29, 7L50, 701L and 749L respectively.

Table F-2: Effectiveness Factors for the Area Generation following 9L20 Outage

Line/Generator	BR	SH	P518	P634	P723	P678	P635	P789
912L	0.118	0.101	0.570	0.218	0.109	0.121	0.121	0.104
Nevis TX	0.118	0.101	0.570	0.218	0.109	0.121	0.121	0.104
7L701(BR-H)	0.185	0.092	0.049	0.080	0.137	0.091	0.091	0.127
7L701(H-St)	0.183	0.096	0.067	0.092	0.138	0.096	0.096	0.126
701L(St-N.H)	0.183	0.096	0.067	0.092	0.138	0.096	0.096	0.126
7L50	0.105	0.028	0.025	0.030	0.052	0.028	0.028	0.040
7L99	0.125	0.073	0.047	0.068	0.102	0.073	0.073	0.102
7L129	0.125	0.073	0.047	0.068	0.102	0.073	0.073	0.102
174L	0.182	0.103	0.066	0.096	0.145	0.102	0.102	0.168
704L	0.021	0.044	0.022	0.038	0.051	0.044	0.044	0.142

Table F-3: Effectiveness Factors for the Area Generation following 912L Outage

Line/Generator	BR	SH	P518	P634	P723	P678	P635	P789
920L	0.041	0.010	0.499	0.130	0.038	0.030	0.030	0.034
Nevis TX	0.041	0.010	0.499	0.130	0.038	0.030	0.030	0.034
7L701(BR-H)	0.188	0.099	0.126	0.105	0.140	0.100	0.100	0.130
7L701(H-St)	0.200	0.111	0.154	0.125	0.154	0.114	0.114	0.141
701L(St-N.H)	0.200	0.111	0.154	0.125	0.154	0.114	0.114	0.141
7L50	0.114	0.035	0.061	0.044	0.060	0.037	0.037	0.033
7L99	0.135	0.082	0.108	0.090	0.111	0.084	0.084	0.110
7L129	0.135	0.082	0.108	0.090	0.111	0.084	0.084	0.110
174L	0.198	0.117	0.158	0.130	0.160	0.120	0.120	0.182
704L	0.021	0.046	0.047	0.046	0.052	0.047	0.047	0.143

Table F-4: Effectiveness Factors for the Area Generation following 9L29 Outage

Line/Generator	BR	SH	P518	P634	P723	P678	P635	P789
912L	0.469	0.283	0.578	0.413	0.432	0.457	0.457	0.406
920L	0.441	0.244	0.080	0.114	0.411	0.070	0.070	0.382
Nevis TX	0.029	0.039	0.659	0.300	0.021	0.386	0.386	0.024
7L701(BR-H)	0.126	0.060	0.052	0.054	0.082	0.052	0.052	0.076
7L701(H-St)	0.129	0.067	0.074	0.074	0.088	0.076	0.076	0.079
701L(St-N.H)	0.129	0.067	0.074	0.074	0.088	0.076	0.076	0.079
7L50	0.084	0.017	0.030	0.026	0.032	0.029	0.029	0.059
7L99	0.085	0.051	0.051	0.053	0.065	0.053	0.053	0.067
7L129	0.085	0.051	0.051	0.053	0.065	0.053	0.053	0.067
174L	0.123	0.071	0.073	0.075	0.091	0.076	0.076	0.117
704L	0.001	0.035	0.021	0.027	0.033	0.025	0.025	0.126

Table F-5: Effectiveness Factors for the Area Generation following 7L50 Outage

Line/Generator	BR	SH	P518	P634	P723	P678	P635	P789
912L	0.491	0.301	0.551	0.368	0.449	0.315	0.315	0.419
920L	0.461	0.249	0.028	0.185	0.423	0.241	0.241	0.394
Nevis TX	0.030	0.053	0.579	0.183	0.026	0.075	0.075	0.025
7L701(BR-H)	0.146	0.069	0.064	0.066	0.094	0.068	0.068	0.078
7L701(H-St)	0.150	0.076	0.082	0.080	0.100	0.077	0.077	0.082
701L(St-N.H)	0.150	0.076	0.082	0.080	0.100	0.077	0.077	0.082
174L	0.116	0.066	0.067	0.068	0.085	0.067	0.067	0.108

Table F-6: Effectiveness Factors for the Area Generation following 701L Outage

Line/Generator	BR	SH	P518	P634	P723	P678	P635	P789
912L	0.523	0.318	0.569	0.386	0.471	0.332	0.332	0.440
920L	0.490	0.262	0.014	0.199	0.442	0.254	0.254	0.411
Nevis TX	0.033	0.056	0.583	0.187	0.029	0.078	0.078	0.029
7L50	0.112	0.031	0.042	0.036	0.051	0.032	0.032	0.041

7L99	0.115	0.067	0.067	0.068	0.085	0.067	0.067	0.085
7L129	0.115	0.067	0.067	0.068	0.085	0.067	0.067	0.085
174L	0.053	0.035	0.033	0.035	0.043	0.035	0.035	0.074
704L	0.003	0.035	0.025	0.032	0.034	0.035	0.035	0.127

Table F-7: Effectiveness Factors for the Area Generation following 749L Outage

Line/Generator	BR	SH	P518	P634	P723	P678	P635	P789
912L	0.474	0.295	0.543	0.361	0.440	0.309	0.309	0.427
920L	0.446	0.243	0.034	0.179	0.415	0.235	0.235	0.401
Nevis TX	0.028	0.052	0.578	0.182	0.025	0.074	0.074	0.026
7L701(BR-H)	0.129	0.063	0.057	0.060	0.085	0.063	0.063	0.087
7L701(H-St)	0.132	0.070	0.074	0.074	0.091	0.071	0.071	0.091
701L(St-N.H)	0.132	0.070	0.074	0.074	0.091	0.071	0.071	0.091
7L50	0.087	0.021	0.030	0.025	0.036	0.021	0.021	0.045
7L99	0.103	0.071	0.067	0.071	0.086	0.072	0.072	0.137
7L129	0.103	0.071	0.067	0.071	0.086	0.072	0.072	0.137
174L	0.120	0.068	0.069	0.070	0.087	0.069	0.069	0.106
704L	0.016	0.050	0.037	0.046	0.050	0.050	0.050	0.182

APPENDIX B PARTICIPANT INVOLVEMENT PROGRAM (PIP)

BluEarth Hand Hills Wind Energy Connection Needs Identification Document

1.0 Participant Involvement Program (PIP)

From December 2011 to February 2013, the AESO conducted a Participant Involvement Program (PIP) to assist in preparing its *BluEarth Hand Hills Wind Energy Connection Needs Identification Document* (NID). The AESO directed transmission facility owner (TFO) ATCO Electric Ltd. (ATCO) to assist the AESO in providing notification in accordance with NID 13 and Appendix A of Alberta Utilities Commission Rule 007.

The AESO's PIP was designed to notify and provide information to all occupants, residents and landowners within 800 metres of the proposed development, as well as to other interested parties, including the following First Nations, government agencies and other organizations.

Government agencies and other organizations notified:

- Alberta Culture Alberta Environment and Sustainable Resource Development
- Alberta Transportation
- County of Paintearth
- NAV Canada
- Special Areas Board
- Starland County
- TELUS Communications Inc.
- Transport Canada
- Village of Delia

First Nations notified:

- Blood Tribe
- Ermineskin Tribe
- Louis Bull Tribe
- Montana First Nation
- Piikani Nation
- Samson Cree Nation
- Siksika Nation
- Stoney Nakoda Nation (includes Bearspaw First Nation, Chiniki First Nation, Wesley First Nation)

- Tsuu T'ina Nation
- Saddle Lake Cree Nation
- Métis Nation of Alberta including Region 3
- Treaty 7 Management Corporation

1.1 Description of Participant Involvement Program

The AESO used a variety of methods to notify stakeholders on the need for the BluEarth Hand Hills Wind Energy Connection. The AESO developed a one-page need overview document and a subsequent updated need overview document that described the need for the proposed transmission development. The updated AESO need overview also provided stakeholders with information on the proposed date of the AESO's NID application to the Alberta Utilities Commission and the change of market participant from Nexen Inc. to Joss Wind Power Inc. Copies of these documents were posted to the AESO website at <http://www.aeso.ca/transmission/27117.html> on January 9, 2012 and October 17, 2012 respectively. A copy of the updated need overview is included in Attachment 1.

The need overview was also included with ATCO's Project-Specific Information Package mailed on December 16, 2011 to occupants, residents and landowners within 800 meters of the proposed transmission development as well as to the First Nations, government agencies and other organizations noted above. The updated need overview was mailed to the above stakeholders on October 2, 2012. Attachment 2 includes a copy of ATCO's brochure.

Most recently, the AESO advertised its intention to file the BluEarth Hand Hills Wind Energy Connection NID in the Drumheller Inside newspaper on February 8, 2013 and in the Drumheller Mail and Hanna Herald newspapers on February 13, 2013. The notice made reference to the previous name of "Joss Hand Hills Wind Power Facility". A copy of the final proof has been included in Attachment 3.

As directed by the AESO, ATCO was prepared to direct any inquiries or concerns about the need to the AESO. ATCO has indicated that stakeholders have not identified any concerns with the need for the proposed transmission development.

To ensure that stakeholders have the opportunity to provide feedback, the AESO also provides stakeholders with a dedicated, toll-free telephone line (1-888-866-2959) and a dedicated email address (stakeholder.relations@aeso.ca). AESO contact information, along with the AESO's mailing address (2500, 330 5th Ave, SW, Calgary) and website address (www.aeso.ca), and a privacy statement that describes how the AESO honours Alberta's Personal Information Protection Act, were included on all AESO communications related to this application.

1.2 Issues and Concerns Raised

The AESO has received no indication of concern from any party about the need for the proposed transmission development.

1.3 List of Attachments

- Attachment 1 – AESO Need Overview
- Attachment 2 –ATCO Mail out - *“ATCO Project Information – Hand Hills Transmission Project”* (December 16, 2011)
- Attachment 3– Notification of Filing Advertisement – Final Proof

Attachment 1 – AESO Need Overview Newsletter

Need for the Joss Hand Hills Wind Energy Connection in the Hanna Area

Transmission Development Information for Stakeholders

Update

In December 2011, stakeholders were sent an information package from ATCO Electric Ltd. containing a one-page AESO document describing the need for the Nexen Hand Hills Wind Energy Connection. The purpose of this letter is to update stakeholders on the proposed date of the AESO's application to the Alberta Utilities Commission and also the change of market participant from Nexen Inc. to Joss Wind Power Inc.

Why is this transmission development needed?

Joss Wind Power Inc. (Joss) has requested transmission system access for its proposed Joss Hand Hills Wind Power Facility (Facility) southeast of the Village of Delia in the Hanna area. Joss's request can be addressed by constructing a new 240kV single circuit transmission line to connect the Facility to the proposed Coyote Lake 963S substation.

The Alberta Electric System Operator (AESO) is processing Joss's request, including providing information to landowners, occupants, residents and agencies in the Hanna area that may be near the proposed transmission development. The AESO intends to apply to the Alberta Utilities Commission (AUC) for approval of this need in Fall/Winter 2012. The AESO's needs identification document (NID) application will be available at www.aeso.ca/transmission/8969.html at the time of its application to the AUC.

Who is the AESO?

Alberta's transmission system, sometimes referred to as the Alberta Interconnected Electric System (AIES), is planned and operated by the AESO. The transmission system comprises the high-voltage lines, towers and equipment (generally 69kV and above) that transmit electricity from generators to lower voltage systems that distribute electricity to cities, towns, rural areas and large industrial customers.

The AESO's role is to maintain safe, reliable and economic operation of the AIES. The AESO's planning responsibility includes determining the need for transmission system development and the manner in which that need is met. The AESO is also mandated to facilitate the interconnection of qualified market participants to the AIES. The AESO is regulated by the AUC and must apply to the AUC for approval of its NID.

How is ATCO involved?

ATCO Electric Ltd. (ATCO) is the transmission facilities owner (TFO) in the Hanna area. While the AESO is responsible for identifying that transmission system development is needed, ATCO is responsible for detailed siting and routing, constructing, operating and maintaining the associated transmission facilities. The AESO has directed ATCO to provide information to stakeholders on this need and to file a facility

proposal application with the AUC which will include a detailed description and location of the proposed transmission development.

Further Information

The AESO appreciates your views on the need for transmission system development and your comments are encouraged. If you have any questions or suggestions regarding the need for the proposed transmission connection or the AESO's application regarding this need, please contact:

Marina Lakhani
AESO Stakeholder Relations 1-888-866-2959
stakeholder.relations@aeso.ca
2500, 330 – 5th Avenue SW Calgary, Alberta T2P 0L4

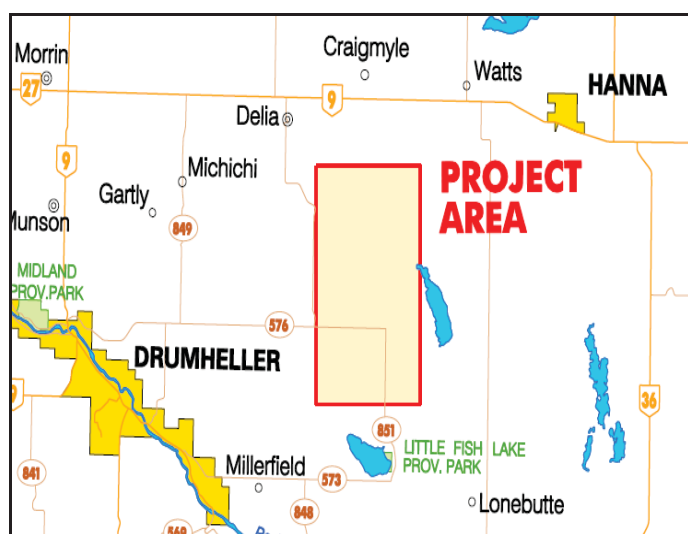
The AESO is committed to protecting your personal privacy in accordance with Alberta's Personal Information Protection Act. Any personal information collected by the AESO with regard to this project may be used to provide you with further information about the project, may be disclosed to the Alberta Utilities Commission (and as a result, may become public), and may also be disclosed to ATCO as the legal owner of transmission facilities in your area. If you have any questions about how the AESO will use and disclose your personal information, please contact us at 1-888-866-2959 or at stakeholder.relations@aeso.ca

Attachment 2 – TFO Mail out – “*ATCO Project Information – Hand Hills Transmission Project*” (December 16, 2012)



December 2011

Hand Hills Transmission Project



Project Overview

The **Hand Hills Transmission Project** is needed to connect the proposed Coyote Lake substation to the Highland substation, proposed by Nexen Inc. If approved, this project will involve constructing a transmission line that is approximately 14 kilometers (km) long in the Hand Hills area of Alberta.

Why are you receiving this project information package?

New transmission facilities are needed in the Hanna area of southeastern Alberta. ATCO Electric has direction from the Alberta Electric System Operator (AESO) to assess site and route options for these upgrades.

We have prepared this summary for landowners, occupants, agencies and interested parties located near the proposed power transmission facilities.

This package will provide you with important project information and will outline our continuing public consultation process. We invite any comments, questions or concerns that you may have. Please refer to page six for our contact information and details.

Included in This Package:

- Project Information brochure
- Reply form and envelope
- Open House invitation
- Alberta Electric System Operator document: Need Overview
- ATCO Electric Information Sheets
- Alberta Utilities Commission brochure *Public Involvement in Needs or Facilities Applications*
- Maps and drawings of the proposed facilities



Project Need and Details

The Alberta Electrical System Operator (AESO) is an independent, not-for-profit organization responsible for the safe, reliable and economic planning and operation of the provincial transmission grid. The AESO has determined that new transmission facilities are required to connect the proposed Nexen Hand Hills Wind Power Facility to the Alberta Electrical System. For more information about why this project is needed, please refer to the AESO's *Need Overview* included with this package, or visit www.aeso.ca.

If you have any questions or concerns about the need for this project you may contact the AESO directly or you can make your concerns known to an ATCO Electric representative who will communicate them to the AESO on your behalf.

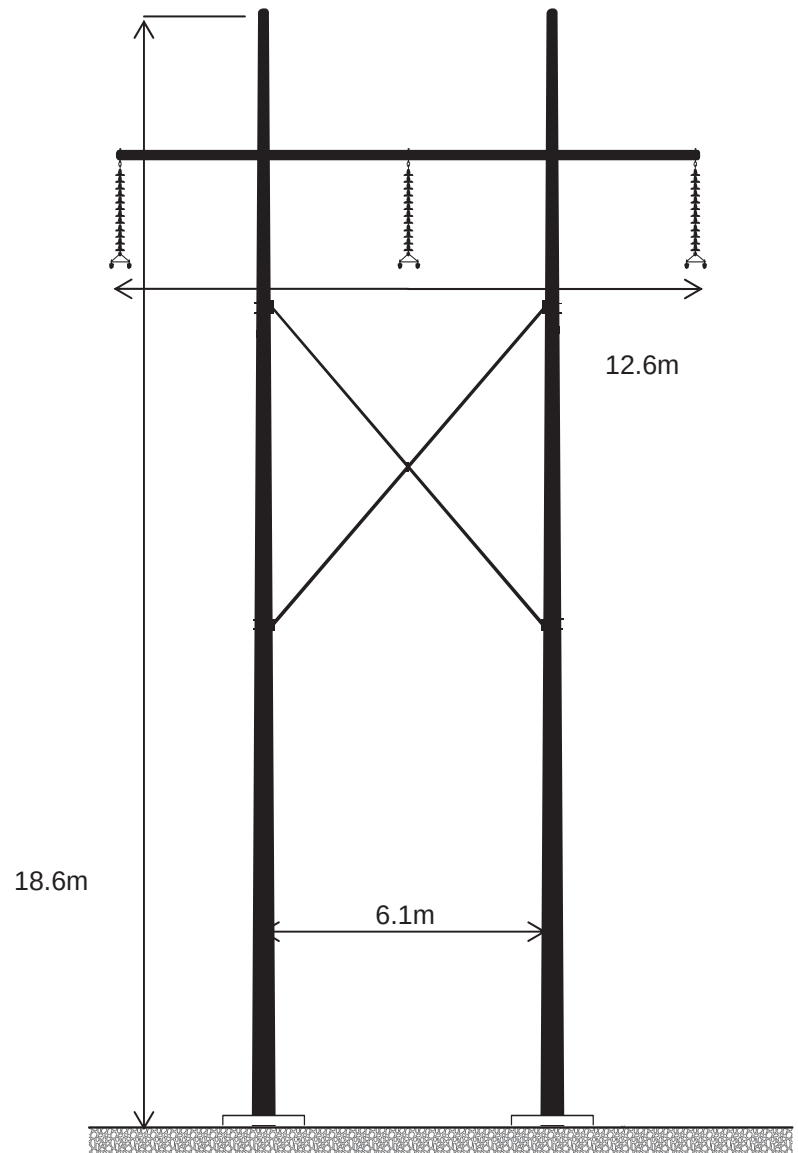
240 Kilovolt (kV) Transmission line 9L94

If approved, the connection between the proposed Highland substation and the proposed Coyote Lake substation will be a 240 kilovolt (kV) transmission line called 9L94. Several options for this transmission line are illustrated on the map enclosed.

This line will consist of three conductor wires and two overhead shield wires strung on an "H-frame" structure. The typical "H-frame" structure will be approximately 18.6 metres (m) tall. The base of the structure will be about 6.1 m wide. The typical distance between structures will range from 170 to 220m.

Non-typical structures with wider bases, more poles and/or guy wires and anchors will be required where the line ends or bends, at corners and to go over and around obstacles. In all cases, minimum ground clearance will meet or exceed the requirements of provincial safety regulations.

Typical Single-Circuit 240 kV
"H-Frame" Structure





Typical Right-of-Way

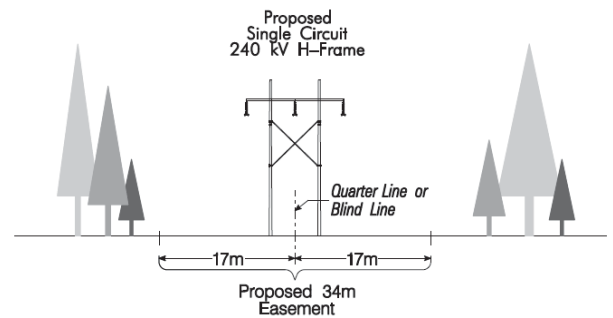
Transmission lines are located in a corridor that has been cleared of brush and other obstacles. This is called a 'right-of-way.'

The right-of-way must have a minimum width to ensure safety and to allow for construction and ongoing access for maintenance purposes.

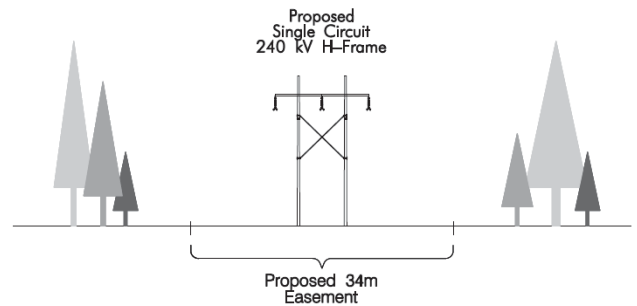
The width of the right-of-way, and the position of transmission structures within it, depends on the type of structure that is used.

Typical rights-of-way associated with this project are shown on the right and below. Details may change as the project develops and designs are finalized

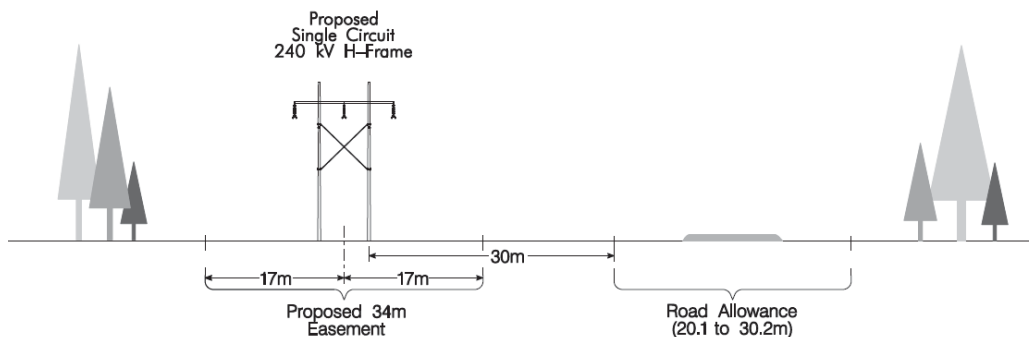
Typical Right-of-Way Along Blind Lines & Quarter Lines



Typical Right-of-Way Cross – Country Alignment



Typical Right-of-Way Along Road Allowance



* Additional Vegetation clearing may be required outside the proposed easement.



Coyote Lake Substation

If approved, the proposed transmission line will connect to the previously proposed new Coyote Lake substation. ATCO Electric applied to the Alberta Utilities Commission for approval to build the Coyote Lake substation as a part of the Hanna Region Transmission Development.

If the Coyote Lake substation is approved, it will be located about 30 km east of the Town of Drumheller. This location is illustrated on the attached map. In order for transmission line 9L94 to connect to this substation, two 240 kV circuit breakers and related support equipment and structures will need to be installed there. These will be located within the previously proposed fenced substation area.

Highland Substation

The proposed transmission line will connect to the proposed Highland substation. The substation has been proposed to the Alberta Utilities Commission (AUC) by Nexen Inc., and the AUC is currently reviewing the Nexen Hand Hills Wind Power Facilities Application. If the application is approved, then the Highland substation will be built by Nexen Inc. in a location about 17 kilometers (km) southwest of Delia. This location is illustrated on the attached map.



Typical substation in Alberta



Route and Site Selection

In an effort to collect landowner input early in the planning process, ATCO Electric distributed a Land Feature Survey to landowners in the project area in June 2011. This input was combined with information from other sources to identify preliminary route options for the Hand Hills transmission project

Preliminary options are shown on the enclosed map. We have selected route options that:

- Avoid homes and minimize impacts on residences.
- Follow existing disturbances and property boundaries wherever possible to provide access and to avoid impacts to agriculture.
- Minimize impacts on built-up areas, highways, agricultural, oil and gas operations and communication facilities.
- Minimize impacts to environmentally sensitive areas such as watercourses, wet or steep areas, wildlife habitat, recreational use and other sensitive areas such as designated historical sites.
- Minimize impacts to additional, important land features that were identified by landowners in the study area.

Other options for transmission line routes may be considered if identified during our consultation process.

The preferred transmission line route will be selected after we have considered all landholder, agency and industry comments and concerns.

Facilities Application Process

Once the preferred transmission line routes and the switching substation site have been identified, ATCO Electric will submit a Facilities Application to the Alberta Utilities Commission (AUC) to obtain approval for the construction and operation of the proposed transmission facilities.

For more information about how you can participate in the process, please refer to the enclosed AUC brochure entitled *Public Involvement in Needs or Facilities Applications*.



Did you contribute to our Land Feature Survey?

If so, thank you for your input!

Proposed Timeline*

December 2011 – February 2012

Consultation with landowners and agencies

February 2012 – April 2012

Selection of preferred site and route options and submission of the Facilities Application to the Alberta Utilities Commission (AUC)

December 2012

If approval is granted by the AUC, construction will commence

May 2013

Facilities completed and operating

**Timing may be adjusted to reflect final plans.*

Contact Us

Your comments and concerns are important to us. Please contact us toll free: **1-855-420-5775** or direct:

Kristen House, Project Planner
Hand Hills Transmission Project

ATCO Electric
10035-105 Street
Edmonton, AB T5J 2V6

Phone: 780-733-2690

Fax: 780-420-5030

Email: consultation@atcoelectric.com

Website: www.atcoelectric.com

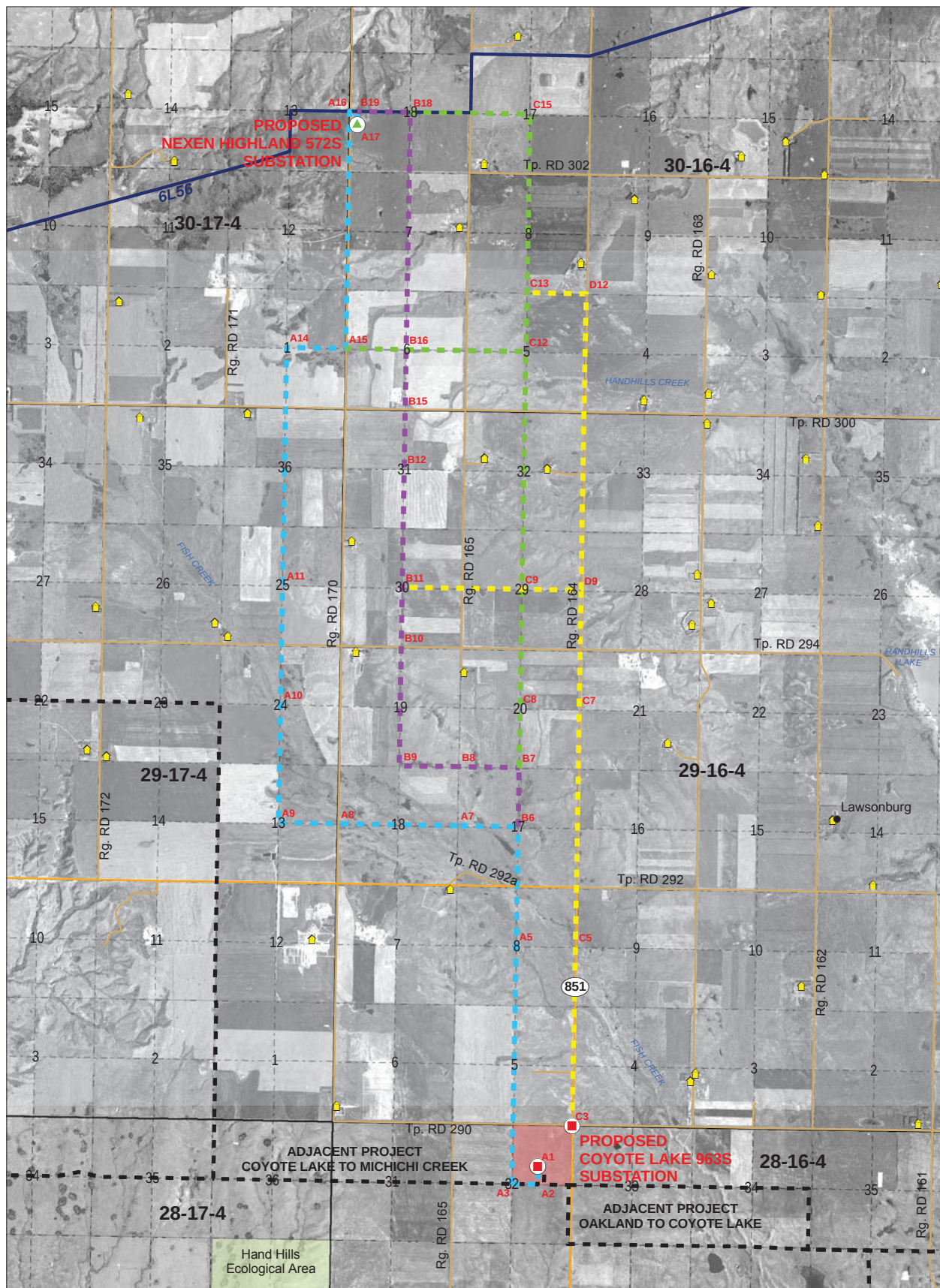
ATCO Electric

Albertans count on us for the safe, reliable and cost-effective delivery of electricity to their homes, farms and businesses. We have delivered electricity to Albertans for more than 80 years. Headquartered in Edmonton, ATCO Electric has 38 service offices serving nearly two-thirds of the province in northern and east-central Alberta.

We help keep the lights on across the province by building, operating and maintaining more than 71,000 kilometers of transmission and distribution power lines. We also operate an additional 12,000 kilometers of distribution power lines on behalf of Rural Electrification Associations.

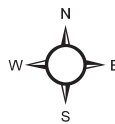
We are committed to responsible development and environmental practices. We conduct an open and transparent consultation process, carefully considering the impacts to landowners, communities and the environment.





LEGEND

- Preliminary Route Start Point(s)
- Preliminary Route End Point(s)
- Preliminary 240 kV Transmission Line Route Option A
- Preliminary 240 kV Transmission Line Route Option B
- Preliminary 240 kV Transmission Line Route Option C
- Preliminary 240 kV Transmission Line Route Option D
- Preliminary Transmission Line Route Option for Adjacent Projects
- Reference Point
- Residence
- Existing 72 kV Transmission Line
- Primary Highway / Secondary Highway
- Local Road



NOTES:
 - Only facilities in the vicinity of the route options are shown.
 - Several route options are shown, but only one route/line will be built.

ATCO Electric

Hand Hills
Transmission Project
Preliminary Route Mosaic

1:50,000 RS-9L94-P01

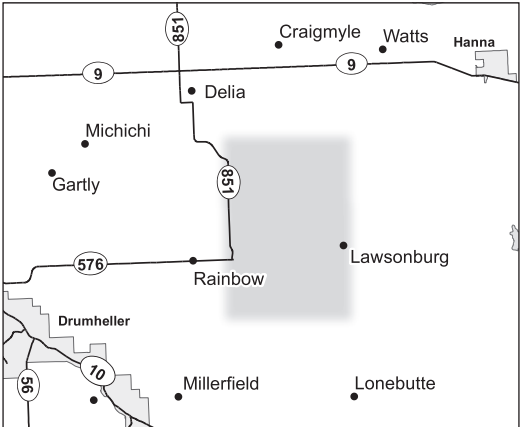
Cartography by Golder Associates Approved by Kristen House November 2011

Attachment 3 – Notification of Filing Advertisement – Final Proof

Notification of AESO Regulatory Filing Addressing the Need for the BluEarth Hand Hills Wind Energy Connection in the Hanna Area

The Alberta Electric System Operator (AESO) advises you of its intention to file a Needs Identification Document (NID) for the connection of the BluEarth Hand Hills Wind Power Facility (Facility) (formerly the Joss Hand Hills Wind Power Facility) with the Alberta Utilities Commission (AUC) on or after February 27, 2013.

1712610 Alberta Ltd., a subsidiary of BluEarth Renewables Inc., (BluEarth) has requested transmission system access for its proposed BluEarth Hand Hills Wind Power Facility (Facility) southeast of the Village of Delia in the Hanna area. BluEarth's request requires transmission system development which is proposed to include a new 240kV single circuit transmission line to connect the Facility to the previously approved Coyote Lake 963S substation.



The shaded area on the map indicates the approximate area where the transmission connection is needed. In a separate application called a Facility Application, ATCO Electric Ltd. (ATCO), the transmission facilities owner (TFO) in the Hanna area, will describe the specific routes and sites they propose to implement the proposed transmission connection and request AUC approval to construct and operate the specific transmission facilities. The specific siting and transmission line routes applied for by ATCO may extend beyond the area shown.

The AESO and ATCO presented this need to stakeholders, including residents, occupants and landowners, from December 2011 to February 2013. The AESO has considered feedback gathered from stakeholders, and technical and cost considerations, and will apply to the AUC for approval of the need for this transmission development. Once filed, the NID will be posted on the AESO website at <http://www.aeso.ca/transmission/27117.html>

Please visit our website, www.aeso.ca for more information, or contact the AESO at 1-888-866-2959 or stakeholder.relations@aeso.ca



 Integrated Marketing Communications	
Artist:	2N
Docket:	103238
Date:	Jan 28, 2013
Size:	6.1"
Proof:	4
1 of 3	
Publications(s):	DrumMail

APPENDIX C TFO CAPITAL COST ESTIMATE

Proposal to Provide Services (PPS) - Estimate Summary

Project: Joss Wind Hand Hills
TFO: ATCO Electric
Prepared by: Owen Ehgoetz / Arif Kurji
Date: 14-Nov-12
Accuracy: +20 / -10%

	System Portion	Customer Portion	TOTAL
Transmission Line Costs			
Material	\$ -	\$ 3,979,695	\$ 3,979,695
Labour	\$ -	\$ 5,635,343	\$ 5,635,343
Total-Transmission line	\$ -	\$ 9,615,037	\$ 9,615,037
Substation Facilities Cost			
Material	\$ -	\$ 1,161,562	\$ 1,161,562
Labour	\$ -	\$ 2,043,881	\$ 2,043,881
Total-Substations	\$ -	\$ 3,205,443	\$ 3,205,443
Telecommunications Cost			
Material	\$ -	\$ 49,877	\$ 49,877
Labour	\$ -	\$ 115,625	\$ 115,625
Total-Telecommunication	\$ -	\$ 165,502	\$ 165,502
Owner Costs			
Proposal to Provide Service	\$ -	\$ 258,000	\$ 258,000
Facility Applications	\$ -	\$ 521,864	\$ 521,864
Land Rights - Easements	\$ -	\$ 345,620	\$ 345,620
Land - Damage Claims	\$ -	\$ -	\$ -
Land - Acquisitions	\$ -	\$ 262,770	\$ 262,770
Owners Costs	\$ -	\$ 1,388,254	\$ 1,388,254
Distributed Costs			
Procurement	\$ -	\$ 100,000	\$ 100,000
Project Management	\$ -	\$ 306,400	\$ 306,400
Construction Management	\$ -	\$ 1,066,725	\$ 1,066,725
Contingency	\$ -	\$ 2,383,892	\$ 2,383,892
Distributed Costs	\$ -	\$ 3,857,017	\$ 3,857,017
Total Owners and Dist. Costs	\$ -	\$ 5,245,270	\$ 5,245,270
Total Direct Costs	\$ -	\$ 18,231,253	\$ 18,231,253
Salvage - Transmission Line Labour	\$ -	\$ -	\$ -
Salvage - Substation Labour	\$ -	\$ -	\$ -
Land Remediation and Reclamation	\$ -	\$ -	\$ -
Salvage Costs	\$ -	\$ -	\$ -
Other Costs			
Inflation	\$ -	\$ 3,162,423	\$ 3,162,423
E&S	\$ -	\$ 1,897,603	\$ 1,897,603
AFUDC	\$ -	\$ -	\$ -
Total Indirect Costs	\$ -	\$ 5,060,026	\$ 5,060,026
TOTAL PROJECT COSTS	\$ -	\$ 23,291,278	\$ 23,291,279

Assumptions and Risks

Based on an ISD of July 31, 2014

Pricing based on 2012 dollars

Inflation rate = 14.8% for 2013 and 20.8% for 2014

E&S rate = 9% for 2013 and 2014

Substation costs allocated 50% system, 50% customer per direction from AESO

Land costs allocated 100% customer because 100% of costs relate to the transmission line

Owner costs (excluding land) and Distributed costs allocated approximately 12% system, 88% customer per system vs. customer allocation of facility costs (\$1,603/(\$9,615+\$3,205+\$165))

**APPENDIX D TFO CONFIRMATION THAT COMMISSION RULE 007
NID 12 ASPECTS ARE BEING ADDRESSED IN
FACILITY PROPOSAL**



October 17, 2012

Sonja Tessari
Alberta Electric System Operator
2500, 330 – 5th Avenue SW
Calgary, Alberta T2P 0L4

Dear Ms. Tessari;

**RE: Confirmation of AUC Rule 007 NID 12 Content in Facility Application
Hand Hills Transmission Project
AESO Project File No.: 678**

The seven major aspects of AUC Rule 007, NID 12 are addressed throughout ATCO Electric's Facilities Application where applicable. Each major aspect is specifically addressed in the sections of the Facilities Application outlined below:

1. Agricultural Impact
2. Residential Impact
3. Environmental Impact
4. Cost
5. Electrical Considerations
6. Visual Impact
7. Special Constraints

Sincerely,
ATCO Electric Ltd.

A handwritten signature in blue ink, appearing to read "Laura Caden", with a long, sweeping horizontal line extending to the right.

Laura Caden
Environmental/ Right-of-Way Planner
Tel: 780-733-2828
Email: Laura.Caden@atcoelectric.com