

Engineering Connection Assessment

P2405 Sollair Solar Energy Project

Connection

General Land & Power Corp

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NOTE:

The conclusions and recommendations in this report are based on the results presented in *Attachment A: Engineering Connection Assessment: Study Results*, which was prepared by a third party consultant in accordance with the AESO Connection Process.

The AESO has reviewed the *Engineering Connection Assessment: Study Results*, and finds it acceptable for the purpose of assessing the potential impacts of the proposed connection on the performance of the Alberta interconnected electric system.

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Attachments

Attachment A: Engineering Connection Assessment Results

1 Introduction

This AESO Engineering Connection Assessment describes the engineering studies that were completed to assess the impact of the Project (as defined below) on the performance of the Alberta interconnected electric system (AIES). This report also provides the AESO's conclusions and recommendations based on the results of the engineering studies.

Attached to this Engineering Connection Assessment are the results of the engineering studies (see Attachment A) and the scope and methodology used to perform the studies (see Attachment A1 to Attachment A). These attachments provide details regarding the technical criteria, assumptions, and methods for performing these engineering studies, and the results of the engineering studies.

1.1 Project Overview

General Land & Power Corp. (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its proposed Sollair Solar Energy Project (Facility) to the AIES. The Facility includes a proposed collector substation, to be designated Sollair 1055S.

The Market Participant's request includes: a request for a new system access service in the area, with a Rate STS, *Supply Transmission Service*, contract capacity of 75 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 0.5 MW; and a request for transmission development (collectively, the Project).

The scheduled in-service date (ISD) for the Project is March 1, 2023.

2 Assessment Scope

2.1 Objectives

The objectives of the AESO Engineering Connection Assessment are as follows:

- Assess the impact of the Project on the performance of the AIES.
- Evaluate Project connection alternatives and identify the AESO's preferred alternative.
- Recommend mitigation measures, if required, to reliably connect the Project to the AIES.
- Identify Project dependencies, including any TFO projects or AESO plans to expand or enhance the transmission system that must be completed prior to connection.

2.2 Existing System

Geographically, the Project is located in the AESO planning area Airdrie (Area 57), which is part of the AESO Calgary planning region. Airdrie (Area 57) is surrounded by the planning areas of Calgary (Area 6), Seebe (Area 44), Hanna (Area 42), and Didsbury (Area 39).

From a transmission system perspective, Airdrie (Area 57) consists primarily of a 240 kV and 138 kV transmission system. Airdrie (Area 57) is connected to Calgary (Area 6) through a 138 kV and a 240 kV transmission lines and to Red Deer (Area 35) through a 240 kV transmission line.

Existing constraints in the Calgary planning region are managed in accordance with the procedures set out in Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management* (TCM Rule).

2.3 Study Area

The Study Area for the Project consists of the AESO Planning area of Airdrie (Area 57) and Calgary (Area 6), including the tie lines connecting this planning area to the rest of the AIES. All transmission facilities within the Study Area will be studied and monitored for violations of the Reliability Criteria (defined in Section 3.1 of Attachment A1).

3 Connection Alternatives

3.1 Overview

The AESO, in consultation with the TFO in the Study Area and the Market Participant, examined five transmission alternatives to meet the Market Participant's request for system access service, as detailed in Section 3.2.

3.2 Connection Alternatives Examined

Below is a description of the developments associated with the transmission alternatives that were examined for the Project.

Alternative 1 –T-tap connection to 138 kV transmission line 688L

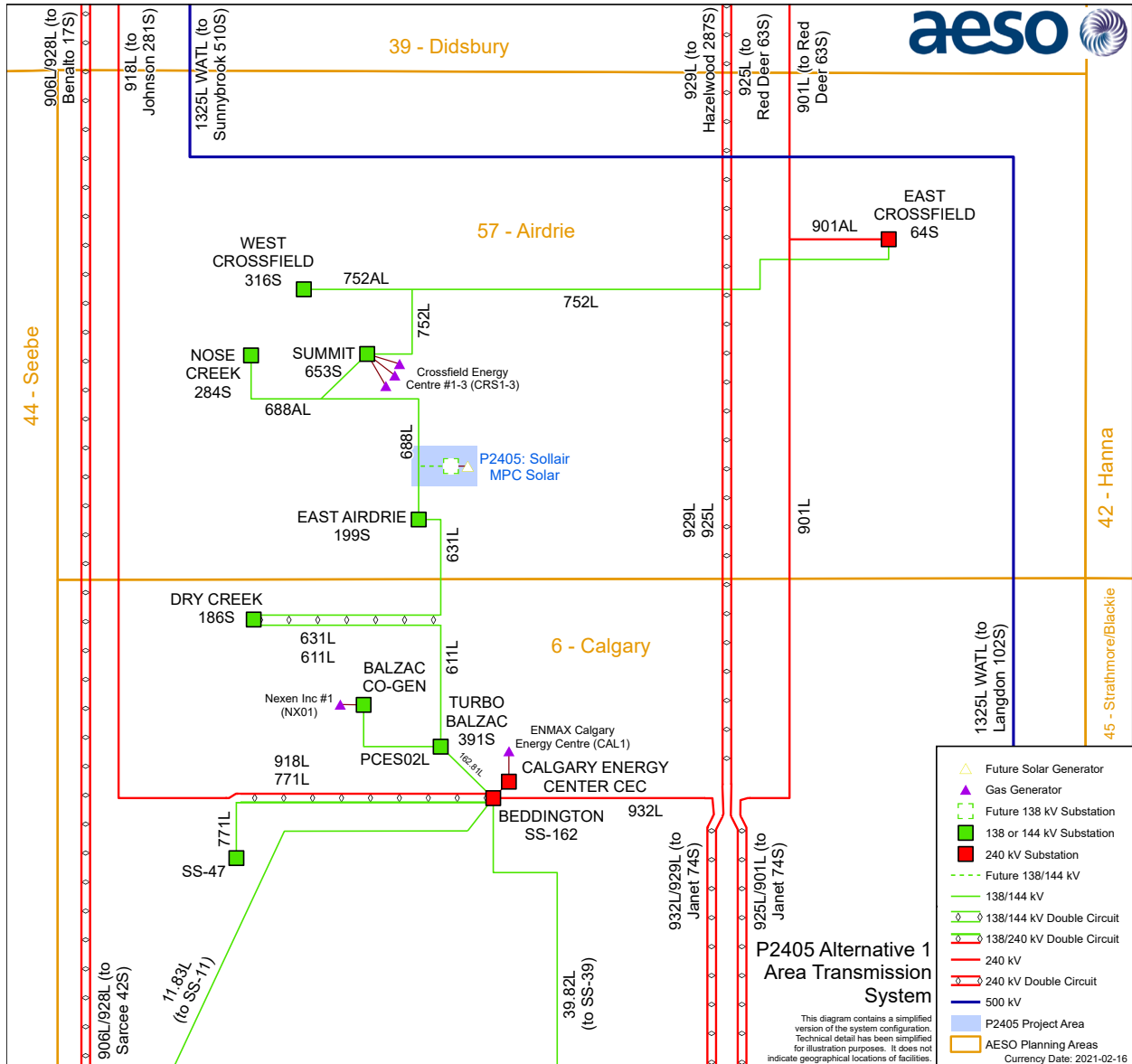
This alternative includes the following developments:

- Add one 138 kV circuit, approximately 200 m in length,¹ to connect the Facility to the existing 138 kV transmission line 688L (between East Airdrie 199S and Summit 653S tap) in a T-tap configuration; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-1.

¹ Exact line length to be determined by the Market Participant

Figure 3-1: Connection Alternative 1



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Alternative 2 – In-and-out connection to 138 kV transmission line 688L

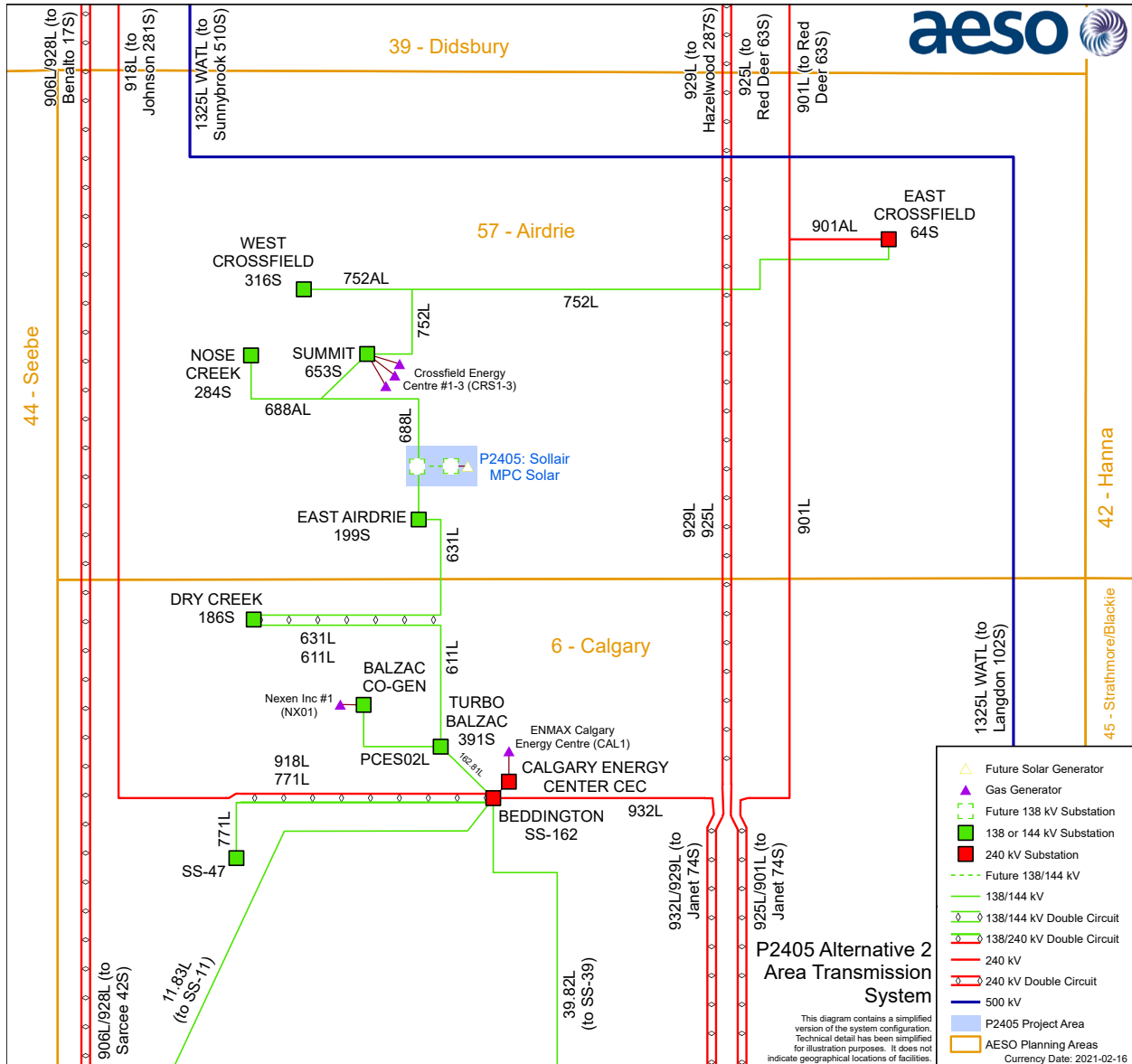
This alternative includes the following developments:

- Add a new 138 kV substation, including three 138 kV circuit breakers;
- Connect the 138 kV substation to the existing 138 kV transmission line 688L (between East Airdrie 199S and Summit 653S tap) using an in-and-out configuration;
- Add one 138 kV circuit, approximately 200 m in length,² to connect the Facility to the proposed 138 kV substation; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-2.

² Exact line length to be determined by the Market Participant

Figure 3-2: Connection Alternative 2



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Alternative 3 – Radial 138 KV connection to East Airdrie 199S substation

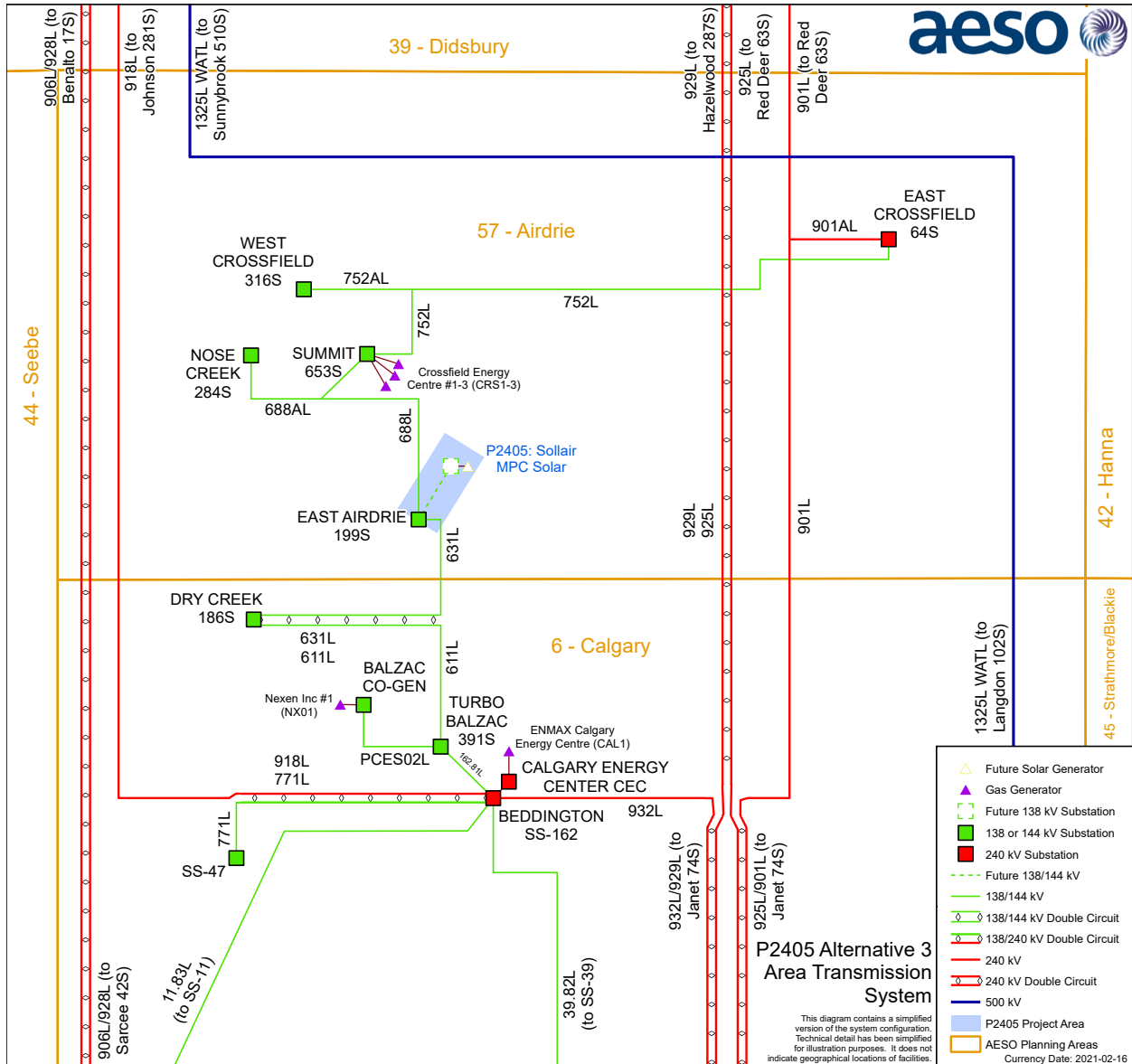
This alternative includes the following developments:

- Add one 138 kV circuit, approximately 4 km in length,³ to connect the Facility to the existing East Airdrie 199S substation in a radial configuration;
- Modify East Airdrie 199S, including adding one 138 kV circuit breaker; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-3.

³ Exact line length to be determined by the Market Participant

Figure 3-3: Connection Alternative 3



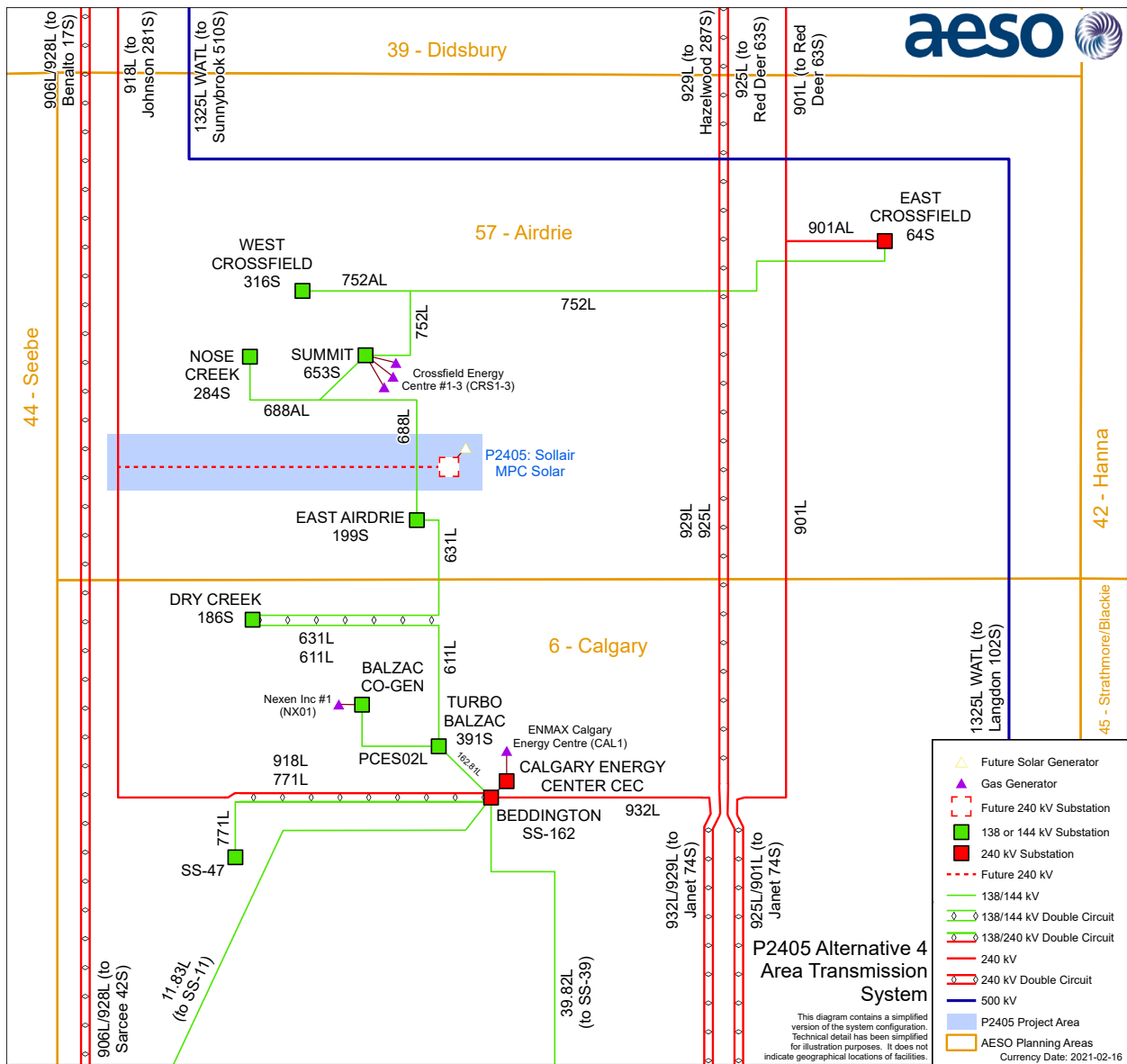
Alternative 4 – T-tap connection to 240 kV transmission line 918L

This alternative includes the following developments:

- Add one 240 kV circuit, approximately 20 km in length,⁴ to connect the Facility to the existing 240 kV transmission line 918L (between Johnson 281S and Beddington 162S substations) in a T-tap configuration (which involves crossing the existing 138 kV transmission line 688L); and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-4

Figure 3-4: Connection Alternative 4



⁴ Exact line length to be determined by the Market Participant

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Alternative 5 – T-Tap connection to 240 kV transmission Line 929L

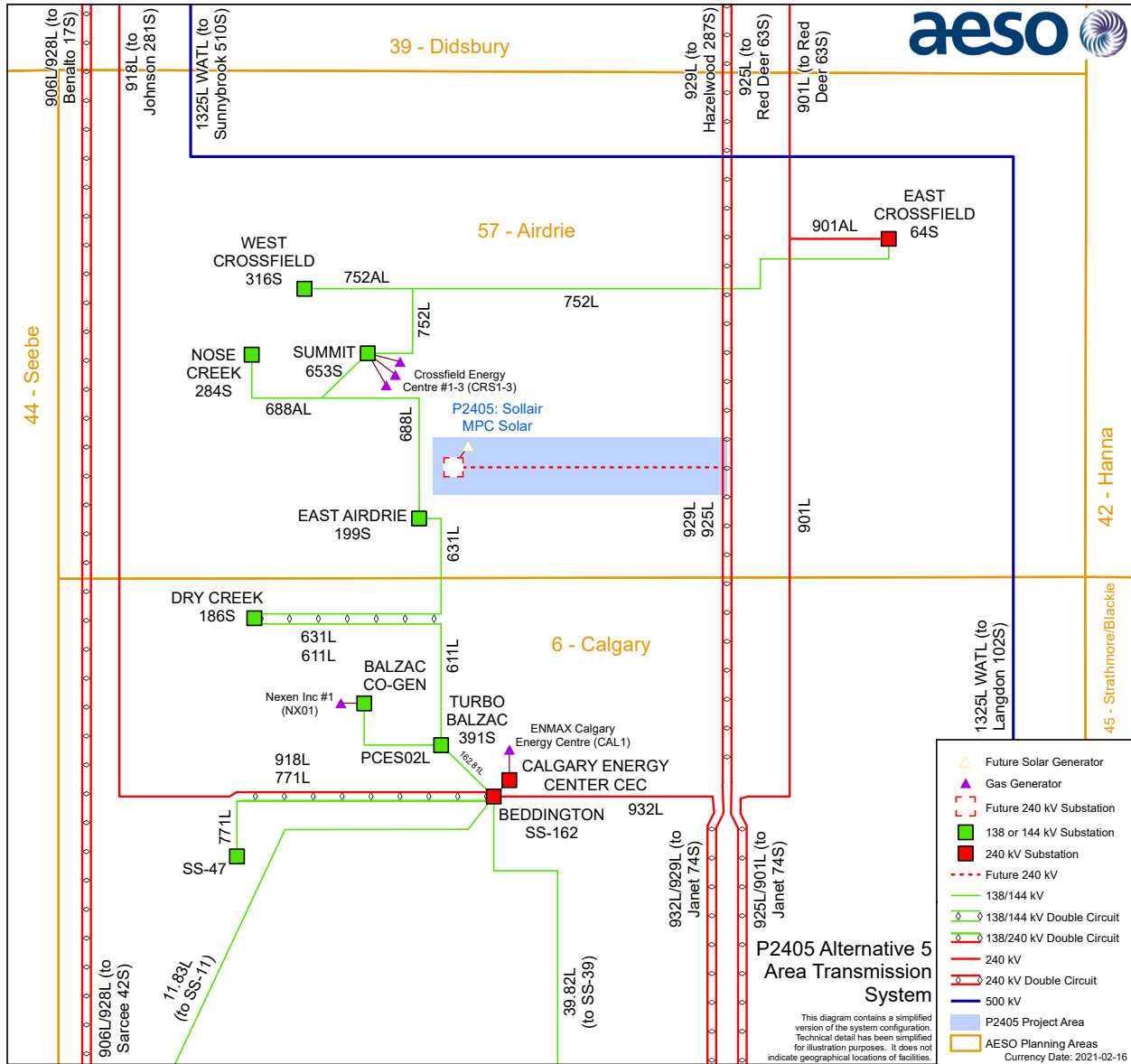
This alternative includes the following developments:

- Add one 240 kV circuit, approximately 10 km in length,⁵ to connect the Facility to the existing 240 kV transmission line 929L (between Janet 74S and Hazelwood 287S substations) in a T-tap configuration; and
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 3-5.

⁵ Exact line length to be determined by the Market Participant

Figure 3-5: Connection Alternative 5



3.3 Connection Alternatives Selected for Further Study

Alternative 1 is considered technically feasible and was selected for further study.

3.4 Connection Alternatives Not Selected for Further Study

Alternative 2 has similar system impacts and technical performance as Alternative 1, however Alternative 2 would involve increased transmission development and hence, increased cost compared to Alternative 1. Alternative 3 involves a longer transmission line as compared to Alternative 1. Alternatives 4 and 5 would involve a connection to a higher voltage level and a longer transmission line as compared to Alternative 1. Alternatives 3, 4 and 5 would involve increased transmission development and hence, increased cost, compared to Alternative 1. Therefore, Alternatives 2, 3, 4, and 5 were not selected for further study.

4 Assessment Approach

4.1 Standards, Criteria and Assumptions

A detailed description of the standards, criteria, and assumptions that were used for the connection assessment is provided in Attachment A (see Attachment A1).

4.2 Studies Performed

At the time of study, the scheduled ISD for the Project is March 1, 2023. Therefore, studies were performed using scenarios for 2023 Summer Peak (SP) and 2023 Summer light (SL).

Short-circuit studies were performed using the 2023 SP pre-Project scenario, 2023 SP and 2031 WP post-Project scenarios.

Table 4-1 lists the study scenarios. Post-Project scenarios reflect the final requested Rate STS contract capacity of 75 MW at the Sollair 1055S substation.

Table 4-1: Connection Study Scenarios

Scenario No.	Year/Season	System Generation Dispatch Conditions	Scenario Name	Project Load (MW)	Project Generation (MW)
Pre-Project					
1	2023 Summer Peak (SL)	High Renewable	2023 SL HR Pre-Project	0	0
2	2023 Summer Peak (SP)	High Renewable	2023 SP HR Pre-Project	0	0
Post-Project					
3	2023 SL	High Renewable	2023 SL HR Post Project	0.5	75
4	2023 SP	High Renewable	2023 SP HR Post Project	0.5	75
5	2031 Winter Peak (WP)	All Study Area Generation In Service	2031 WP Post-Project	0.5	75

The AESO Planning Region load forecasts used for the connection studies were based on the AESO's *2021 Long-term Outlook (2021 LTO)*.

4.2.1 Power Flow Studies

The purpose of the power flow studies is to identify and quantify any thermal and voltage criteria violations in the Study Area.

In addition, power flow studies are also used to identify POD low voltage bus voltage deviations beyond the limits listed in Table 3-1 of Attachment A1.⁶

Power flow studies were performed for 2023 Summer Light (SL) and 2023 Summer Peak (SP) pre-Project scenarios, and for 2023 SL and 2023 SP post-Project scenarios.

4.2.2 Transient Stability Studies

The purpose of the transient stability studies is to assess the post-Project stability of the transmission system after three-phase to ground faults are applied on select transmission lines in the Study Area.

Transient stability studies were performed for 2023 SL and 2023 SP post-Project scenarios.

4.2.3 Short-Circuit Current Level Studies

The purpose of short-circuit current level studies is to determine the expected system short-circuit current levels in the vicinity of the Project.

Short circuit studies were performed for the 2023 SP pre-Project scenario, 2023 SP and 2031 WP post-Project scenarios.

4.3 Mitigation Measure Development and Evaluation

As explained in Section 6 of Attachment A1, mitigation measures were developed to address system performance issues that were identified in the post-Project scenarios. Studies performed to assess the effectiveness of mitigation measures are briefly outlined below.

4.3.1 Post-Mitigation Studies

Power flow and transient stability studies were performed to assess the impact of the Project on the performance of the AIES following implementation of the AESO's proposed mitigation measures.

4.3.2 Constraint Effective Factor Studies

Constraint effective factor studies were used to determine the generator and load constraint effective factors and to identify the most effective generators or loads to manage thermal criteria violations that were observed under Category B conditions.

⁶ The AESO's desired post-contingency voltage deviations for low voltage busses represent guidelines rather than criteria. A POD bus voltage deviation that exceeds the desired limits shown in Table 3-1 of Attachment A1 does not represent a Reliability Criteria violation. Mitigation measures would not be developed to specifically address POD bus voltage deviations that exceed the desired values in Table 3-1 of Attachment A1.

5 Interpretation of Results

5.1 Results Overview

This section provides an assessment of the impact of the Project on the performance of the AIES. The Reliability Criteria violations observed during the connection assessment studies, and the proposed mitigation measures are summarized in Table 5-1.

- Section 5.2 includes an overview of the pre-Project studies results.
- Section 5.3 includes an overview of the post-Project studies results.
- Section 5.4 includes a description of the proposed mitigation measures to address observed Reliability Criteria violations.
- Section 5.5 includes an overview of the post-mitigation studies results.

Detailed study results are provided in Attachment A.

Table 5-1: Summary of Reliability Criteria Violations, Project Impact and Mitigation Measures



Scenario	Type of Reliability Criteria Violation		Contingency (System Element Lost)	Details of Violation	Project Impact	Pre-Project Mitigation Measures	Post-Project Mitigation Measures
	Pre-Project	Post-Project					
2023/SL	None	Thermal - above emergency rating	162.81L (Beddington to Balzac 391S)	East Crossfield 64S T2	New violation	None	Modify RAS 49 to include the project in the RAS logic
	Thermal - below emergency rating	Thermal - above emergency rating		752L (East Crossfield 64S to 752AL Tap)	Materially increased violation	Real-time operational practices	
	Thermal - below emergency rating	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	Materially increased violation	Real-time operational practices	
	None	Thermal - above emergency rating	64ST2 (East Crossfield 64S Transformer T2)	631L (Dry Creek 186S to East Airdrie 199S)	New violation	None	Modify RAS 50 to include the project in the RAS logic
	None	Thermal - above emergency rating		688L (East Airdrie 199S to P2405 Tap)	New violation	None	
	None	Thermal - above emergency rating		611L (Balzac 391S to Dry Creek 186S)	New violation	None	
	None	Thermal - above emergency rating	631L (East Airdrie 199S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	New violation	None	Modify RAS 49 to include the project in the RAS logic
	None	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	New violation	None	
	None	Thermal - above emergency rating	611L (Balzac 391S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	New violation	None	Modify RAS 49 to include the project in the RAS logic
	None	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	New violation	None	
	None	Thermal - above emergency rating	East Crossfield 64S Transformer T1	631L (Dry Creek 186S to East Airdrie 199S)	New violation	None	Modify RAS 50 to include the project in the RAS logic
	None	Thermal - above emergency rating		688L (East Airdrie 199S to P2405 Tap)	New violation	None	
	None	Thermal - above emergency rating		611L (Balzac 391S to Dry Creek 186S)	New violation	None	
	None	Thermal - above emergency rating	752L (East Crossfield 64S to Summit 653S)	631L (Dry Creek 186S to East Airdrie 199S)	New violation	None	Modify RAS 49 to include the project in the RAS logic
	None	Thermal - above emergency rating		688L (East Airdrie 199S to P2405 Tap)	New violation	None	
	None	Thermal - above emergency rating		611L (Balzac 391S to Dry Creek 186S)	New violation	None	
	None	Thermal - above emergency rating	199ST2 (East Airdrie 199S Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	New violation	None	Modify RAS 49 to include the project in the RAS logic
	None	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	New violation	None	
	None	Thermal - above emergency rating	901L (Janet 74S to Red Deer 63S)	631L (Dry Creek 186S to East Airdrie 199S)	New violation	None	Modify RAS 50 to include the project in the RAS logic
	None	Thermal - above emergency rating		688L (East Airdrie 199S to P2405 Tap)	New violation	None	
None	Thermal - above emergency rating	611L (Balzac 391S to Dry Creek 186S)		New violation	None		
None	Thermal - above emergency rating	186ST1 (Dry Creek 186S Transformer T1)	752L (East Crossfield 64S to 752AL Tap)	New violation	None	Modify RAS 49 to include the project in the RAS logic	
None	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	New violation	None		
None	Thermal - above emergency rating	186ST2 (Dry Creek 186S Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	New violation	None	Modify RAS 49 to include the project in the RAS logic	
None	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	New violation	None		
2023/SP	None	Thermal - below emergency rating	System Normal (N-0)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
	None	Thermal - below emergency rating	162ST1 (Enmax 162 Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
	None	Thermal - below emergency rating	162ST2 (Enmax 162 Transformer T2)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
	None	Thermal - above emergency rating	162.81L (Beddington to Balzac 391S)	East Crossfield 64S T2	New violation	None	Modify RAS 49 to include the project in the RAS logic
	Thermal - below emergency rating	Thermal - above emergency rating		752L (East Crossfield 64S to 752AL Tap)	Materially increased violation	Real-time operational practices	
	Thermal - below emergency rating	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	Materially increased violation	Real-time operational practices	
	None	Thermal - above emergency rating	64ST2 (East Crossfield 64S Transformer T2)	631L (Dry Creek 186S to East Airdrie 199S)	New violation	None	Modify RAS 50 to include the project in the RAS logic
	None	Thermal - above emergency rating		688L (East Airdrie 199S to P2405 Tap)	New violation	None	
	None	Thermal - below emergency rating		611L (Balzac 391S to Dry Creek 186S)	New violation	None	
	None	Thermal - below emergency rating	936L (Langdon 102S to East Calgary 5S)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
	None	Thermal - below emergency rating	937L (Langdon 102S to East Calgary 5S)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
	None	Thermal - below emergency rating	932L (Janet 74S to Enmax 162)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices



None	Thermal - below emergency rating	74ST1 (Janet 74S 240/138 kV Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	74ST2 (Janet 74S 240/138 kV Transformer T2)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - above emergency rating	631L (East Airdrie 199S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	New violation	None	Modify RAS 49 to include the project in the RAS logic
None	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	New violation	None	
None	Thermal - below emergency rating	PCES02L (Balzac 391S to PCES02S)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	611L (Balzac 391S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating		752L (Summit 653S to 752AL Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	37.82L (Janet 74S to Enmax 37)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	EnmaxT1 (Enmax 65 Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	EnmaxT2 (Enmax 65 Transformer T2)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	38.83L (Enmax 38S to Enmax 39S)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	37.81L (Enmax 37 Sub to Enmax 38 Sub)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	Beddington 162S Transformer T2	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	CECGT (CEC Generator GT)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	Balzac Power Station	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	316ST1 (West Crossfield 316S Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	Nose Creek 284S Transformer T1	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - above emergency rating	East Crossfield 64S Transformer T1	631L (Dry Creek 186S to East Airdrie 199S)	New violation	None	Modify RAS 50 to include the project in the RAS logic
None	Thermal - above emergency rating		688L (East Airdrie 199S to P2405 Tap)	New violation	None	
None	Thermal - below emergency rating		611L (Balzac 391S to Dry Creek 186S)	New violation	None	
Thermal - below emergency rating	Thermal - below emergency rating	688L (Summit 653S to East Airdrie 199S)	752L (Summit 653S to 752AL Tap)	No impact	Real-time operational practices	Real-time operational practices
None	Thermal - above emergency rating	752L (East Crossfield 64S to Summit 653S)	631L (Dry Creek 186S to East Airdrie 199S)	New violation	None	Modify RAS 50 to include the project in the RAS logic
None	Thermal - above emergency rating		688L (East Airdrie 199S to P2405 Tap)	New violation	None	
None	Thermal - above emergency rating		611L (Balzac 391S to Dry Creek 186S)	New violation	None	Real-time operational practices
Thermal - below emergency rating	Thermal - below emergency rating		688L (Summit 653S to 688AL Tap)	Marginally increased violation	Real-time operational practices	
None	Thermal - above emergency rating	199ST2 (East Airdrie 199S Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	New violation	None	Modify RAS 49 to include the project in the RAS logic
None	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	New violation	None	
None	Thermal - above emergency rating	901L (Janet 74S to Red Deer 63S)	631L (Dry Creek 186S to East Airdrie 199S)	New violation	None	Modify RAS 50 to include the project in the RAS logic
None	Thermal - above emergency rating		688L (East Airdrie 199S to P2405 Tap)	New violation	None	
None	Thermal - below emergency rating		611L (Balzac 391S to Dry Creek 186S)	New violation	None	
None	Thermal - above emergency rating	186ST1 (Dry Creek 186S Transformer T1)	752L (East Crossfield 64S to 752AL Tap)	New violation	None	Modify RAS 49 to include the project in the RAS logic
None	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	New violation	None	
None	Thermal - above emergency rating	186ST2 (Dry Creek 186S Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	New violation	None	Modify RAS 49 to include the project in the RAS logic
None	Thermal - above emergency rating		752L (Summit 653S to 752AL Tap)	New violation	None	
None	Thermal - below emergency rating	Enmax 38S Transformer T1 or T2 or T3	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices
None	Thermal - below emergency rating	Enmax37 Transformer T1 or T2	688L (East Airdrie 199S to P2405 Tap)	New violation	None	Real Time Operating Practices

Notes:

- Marginally increased (or marginally decreased) refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) between 0% and 3% (or -3%).
- Materially increased (or materially decreased) refers to a percent loading difference (post-Project percent loading minus pre-Project percent loading) above or equal to 3% (or below or equal to -3%).
- RAS No. 49 is an existing RAS (see Section 1.2.2 of Attachment A1).
- RAS No. 50 is an existing RAS (see Section 1.2.2 of Attachment A1).
- In this table, "Modify" refers to adding the Project to the logic of the respective RAS

5.2 Pre-Project Study Results

5.2.1 Category A Conditions

No Reliability Criteria violations were observed under the Category A conditions (i.e., all elements in service) for any of the pre-Project scenarios. The short-circuit fault levels were found to be within the typical capabilities of the nearby facilities.

5.2.2 Category B Conditions

The pre-Project power flow studies identified a number of thermal violations under Category B conditions (i.e., loss of a single system element).

5.3 Post-Project Study Results

5.3.1 Category A Conditions

The post-project power flow studies identified marginal thermal criteria violation under Category A conditions on the 138 kV transmission line 688L for the Summer peak post-Project scenario. Post-Project short-circuit fault levels were not significantly higher than pre-Project levels.

The long term short circuit levels were found to be within the designed capabilities of the nearby facilities.

5.3.2 Category B Conditions

Post-Project power flow studies identified a number of system performance issues under Category B conditions, namely: thermal criteria violations.

Results did not indicate any transient stability concerns, and the system showed acceptable dynamic response to all Category B conditions studied.

5.4 Mitigation Measures

This section discusses the AESO's proposed mitigation measures to address the system performance issues that were identified in the pre-Project and post-Project scenarios. As part of this Project, mitigation measures will not be specifically developed for the POD bus voltage deviations observed under certain Category B conditions during pre-Project and post-Project scenarios.

5.4.1 Pre-Project

Prior to connection of the Project, all of the observed thermal criteria violations can be managed by using real-time operational practices.

5.4.2 Post-Project

After connection of the Project, some of the thermal criteria violations observed can be mitigated by using real-time operational practices.

The Category A thermal criteria violation observed on the 138 kV transmission line 688L will be mitigated by applying the TCM Rule to dispatch down effective generation. The forecast study conditions represent

the credible worst case scenario, which assumes that the Facility is exporting its full STS to the system. The possibility of this scenario occurring is dependent on the generation profile of the Facility.

Should this Category A violation materialize, mitigations would be required to address the potential marginal thermal criteria violations under the Category A condition. The AESO would develop operational procedures or other mitigation measures, such as the following:

- Operational system reconfiguration
- Increasing the thermal rating of 138 kV transmission line 688L.

The remaining thermal criteria violations can be mitigated by modification of existing RAS 49 and existing RAS 50 by including the Project in the RAS logic.

5.4.3 Post-Project Mitigation Study Results

Most of the thermal criteria violations observed under Category B conditions can be alleviated by modifying the existing RAS 49 and RAS 50. After modified RAS 50 action, real-time operational procedures would be required to fully alleviate the thermal criteria violations observed on 138 kV transmission line 688L under certain Category B conditions.

6 Project Dependencies

The Project does not require the completion of any other AESO plans to expand or enhance the transmission system prior to connection.

7 Conclusions and Recommendations

Based on the study results, Alternative 1 is technically viable. The connection assessment identified a number of pre-Project and post-Project system performance issues.

The connection assessment uses credible worst-case conditions to assess the impact of the Facility connection on the Alberta interconnected electric system. Category A thermal criteria violations were observed under these credible worst-case load and generation forecast conditions. The probability of Category A thermal criteria violations materializing is highly dependent upon the production profile of the Facility and other generation facilities in the area. Closer to the ISD, if the AESO determines that congestion will arise under Category A conditions, the AESO will make an application to the AUC to obtain approval for an “exception” under Section 15(2) of the *Transmission Regulation*.

The identified system performance issues can be mitigated through the use of modified RAS 49, modified RAS 50, and real-time operational practices, alone or in combination, as appropriate. With implementation of these mitigation measures, connecting the project with the preferred alternative does not adversely affect the performance of the AIES.

The AESO recommends proceeding with the Project using Alternative 1 as the preferred alternative to respond to the Market Participant’s request for system access service. Real-time operational practices and the RAS mentioned above are recommended to mitigate the identified system performance issues.

Alternative 1 involves adding one 138 kV circuit to connect the Facility to the existing 138 kV transmission line 688L in a T-tap configuration. The conductor used for the 138 kV circuit should have a minimum capacity of 90 MVA to meet the Market Participant's requested STS contract capacity.

Attachment A: Engineering Connection Assessment Results

Engineering Connection Assessment: Study Results

P2405 Sollair Solar Energy Project Connection

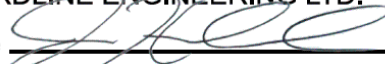
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Attachment A2 Pre-Project Power Flow Diagrams

Attachment A3 Post-Project Power Flow Diagrams

Attachment A4 Post-Project Transient Stability Diagrams

Attachment A5 Dynamic Data and Assumptions

Attachment A6 Post-Mitigation Power Flow Diagrams

Attachment A7 Constraint Effective Factors Table

1 Introduction

This report presents the results of the engineering studies that were completed by Hardline Engineering Ltd. (the Studies Consultant) to assess the impact of the Project (as defined in Attachment A1: AESO Engineering Connection Assessment Scope) on the performance of the Alberta interconnected electric system (AIES). The studies were performed in accordance with Attachment A1: AESO Engineering Connection Assessment: Study Scope, which was prepared by the AESO.

The power system network analysis tool that was used for the studies in this connection assessment was PSS/E version 34.

2 Pre-Project Study Results

This section describes the results of the pre-Project power flow studies.

2.1 Power Flow Studies

Power flow diagrams illustrating the pre-Project power flow studies results for Category A and Category B conditions are provided in Attachment A2.

2.1.1 Scenario 1: 2023 Summer Light High Renewables Pre-Project

Category A Conditions

No Reliability Criteria (as defined in Section 3.1 of Attachment A1) violations were observed under Category A conditions.

Category B Conditions

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category B conditions as shown in Table 2-1.

Table 2-1: Thermal Criteria Violations under Category B Conditions for Scenario 1

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings ^a (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Power Flow ^b (MVA)	% Loading ^c
162.81L (Beddington SS-162 to Balzac 391S)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	128.3	107.8
	752L (Summit 653S to 752AL Tap)	120.9	133.0	132.6	109.7

Notes:

^a The facility ratings shown in Attachment A1 have been adjusted from a 72/144 kV voltage base to a 69/138 kV voltage base, as is used by the power system network analysis tool.

^b Power flow (MVA) is current expressed as MVA (i.e., $S = \sqrt{3} \times V_{base} \times I_{actual}$)

^c Reported as a percentage of the power flow (in MVA, i.e., $S = \sqrt{3} \times V_{base} \times I_{actual}$) relative to the transmission line's Normal Rating (also in MVA), as shown in Attachment A1.

Voltage Criteria Violations

No voltage criteria violations were observed under Category B conditions.

POD Bus Voltage Deviations

No voltage deviations beyond the limits listed in Table 3-1 of Attachment A1 (hereafter referred to as point of delivery (POD) bus voltage deviations) were observed.

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2.1.2 Scenario 2: 2023 Summer Peak High Renewables Pre-Project

Category A Conditions

No Reliability Criteria (as defined in Section 3.1 of Attachment A1) violations were observed under Category A conditions.

Category B Conditions

Thermal Criteria Violations

Thermal criteria violations were observed under certain Category B conditions as shown in Table 2-2.

Table 2-2: Thermal Criteria Violations under Category B Conditions for Scenario 2

Contingency (System Element Lost)	Violation Location Details	Thermal Ratings ^a (MVA)		Pre-Project Results	
		Normal Rating	Emergency Rating	Power Flow ^b (MVA)	% Loading ^c
162.81L (Beddington SS-162 to Balzac 391S)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	123.5	103.8
	752L (Summit 653S to 752AL Tap)	120.9	133.0	129.5	107.1
688L (Summit 653S to East Airdrie199S)	752L (Summit 653S to 752AL Tap)	120.9	133.0	122.6	101.4
752L (East Crossfield 64S to Summit 653S)	688L (Summit 653S to 688AL Tap)	120.9	133.0	122.2	101.1

Notes:

^a The facility ratings shown in Attachment A1 have been adjusted from a [72/144] kV voltage base to a [69/138] kV voltage base, as is used by the power system network analysis tool.

^b Power flow (MVA) is current expressed as MVA (i.e., $S = \sqrt{3} \times V_{\text{base}} \times I_{\text{actual}}$)

^c Reported as a percentage of the power flow (in MVA, i.e., $S = \sqrt{3} \times V_{\text{base}} \times I_{\text{actual}}$) relative to the transmission line's Normal Rating (also in MVA), as shown in Attachment A1.

Voltage Criteria Violations

No voltage criteria violations were observed under Category B conditions.

POD Bus Voltage Deviations

No voltage deviations beyond the limits listed in Table 3-1 of Attachment A1 (hereafter referred to as point of delivery (POD) bus voltage deviations) were observed.

3 Post-Project Study Results

This section describes the results of the post-Project power flow studies and transient stability studies.

As described in Section 2 of Attachment A1, the post-Project studies were performed using Alternative 1.

3.1 Power Flow Studies

Power flow diagrams illustrating the post-Project power flow studies results for Category A and Category B conditions are included in Attachment A3.

3.1.1 Scenario 3: 2023 Summer Light High Renewables Post-Project

Category A Conditions

No Reliability Criteria violations were observed under Category A conditions.

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-1.

Table 3-1: Thermal Criteria Violations under Category B Conditions for Scenario 3

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
162.81L (Beddington SS-162 to Balzac 391S)	64ST2 (East Crossfield 64S 240/138kV Transformer T2)	191.2	191.2	126.1	66.0	198.5	103.8	37.8
	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	128.3	107.8	199.7	167.8	60.0
	752L (Summit 653S to 752AL Tap)	120.9	133.0	132.6	109.7	204.1	168.8	59.1
64ST2 (East Crossfield 64S 240/138kV Transformer T2)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	83.2	69.4	151.9	126.6	57.2
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	93.2	77.1	162.7	134.5	57.4
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	70.0	58.8	138.3	116.2	57.4
631L (East Airdrie 199S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	83.7	70.3	153.7	129.2	58.9
	752L (Summit 653S to 752AL Tap)	120.9	133.0	87.9	72.7	158.1	130.8	58.1
611L (Balzac 391S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	70.2	59.0	140.3	117.9	58.9
	752L (Summit 653S to 752AL Tap)	120.9	133.0	74.4	61.5	144.7	119.7	58.2

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Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
64ST1 (East Crossfield 64S 138/25kV Transformer T1)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	86.1	71.7	155.0	129.2	57.5
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.3	96.2	79.5	165.9	137.1	57.6
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	72.8	61.1	141.4	118.8	57.7
752L (East Crossfield 64S to Summit 653S)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	92.8	77.4	162.0	135.0	57.7
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.3	103.1	85.2	172.8	142.8	57.6
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	79.4	66.7	148.3	124.6	57.9
199ST2 (East Airdrie 199S 138/25kV Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	95.4	80.2	165.8	139.9	59.1
	752L (653S to 752AL Tap)	120.9	133.0	99.7	82.4	170.1	140.7	58.3
901L (Janet 74S to Red Deer 63S)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	83.1	69.3	151.8	126.5	57.3
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.3	93.1	77.0	162.6	134.4	57.4
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	69.8	58.7	138.2	116.1	57.4
186ST1 (Dry Creek 186S 138/25kV Transformer T1)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	93.7	70.3	153.7	129.2	58.9
	752L (Summit 653S to 752AL Tap)	120.9	133.0	57.9	72.7	158.1	130.8	58.2
186ST2 (Dry Creek 186S 138/25kV Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	76.9	64.6	147.1	123.6	59.0
	752L (Summit 653S to 752AL Tap)	120.9	133.0	81.1	67.0	151.4	125.2	58.2

Voltage Criteria Violations

No voltage criteria violations were observed under Category B conditions.

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

3.1.2 Scenario 4: 2023 Summer Peak High Renewables Post-Project

Category A Conditions

Thermal criteria violations were observed under certain Category A conditions as shown in Table 3-2. No other Reliability Criteria (as defined in Section 3.1 of Attachment A1) violations were observed under Category A conditions.

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Table 3-2: Thermal Criteria Violations under Category A Conditions for Scenario 4

Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
			Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	80.1	66.2	122.9	101.6	35.4

Category B Conditions

Thermal criteria violations were observed under certain Category B conditions as shown in Table 3-3.

Table 3-3: Thermal Criteria Violations under Category B Conditions for Scenario 4

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
162.81L (Beddington SS-162 to Balzac 391S)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	85.5	70.7	128.0	105.8	35.1
162.81L (Beddington SS-162 to Balzac 391S)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	85.4	70.6	127.9	105.7	35.1
162.81L (Beddington SS-162 to Balzac 391S)	64ST2 (East Crossfield 240/138kV Transformer T2)	191.2	191.2	122.6	64.1	194.5	101.7	37.6
	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	123.5	103.8	193.5	162.6	58.8
	752L (Summit 653S to 752AL Tap)	120.9	133.0	129.5	107.1	199.8	165.3	58.2
64ST2 (East Crossfield 64S 240/138kV Transformer T2)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	79.8	66.5	146.3	121.9	55.4
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	98.1	81.1	167.8	138.7	57.6
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	62.6	52.6	121.6	102.2	49.6
936L (Langdon 102S to East Calgary 5S)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	81.8	67.6	124.6	103.0	35.4
937L (Langdon 102S to East Calgary 5S)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	81.8	67.7	124.6	103.0	35.4

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Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
932L (Janet 74S to Enmax 162)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	83.3	68.8	125.7	103.9	35.1
74ST1 (Janet 74S 240/138kV Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	83.4	69.0	126.2	104.3	35.3
74ST2 (Janet 74S 249/138kV Transformer T2)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	83.4	69.0	126.2	104.3	35.3
631L (East Airdrie 199S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	83.3	70.0	150.6	126.3	56.3
	752L (Summit 653S to 752AL Tap)	120.9	133.0	88.6	73.3	156.3	129.3	56.0
PCES02L (Balzac 391S to PCES02S)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	85.7	70.9	128.7	106.4	35.5
611L (Balzac 391S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	57.7	48.5	120.4	101.2	52.7
	752L (Summit 653S to 752AL Tap)	120.9	133.0	61.8	51.1	126.3	104.5	53.4
37.82L (Janet 74S to Enmax 37)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	86.4	71.5	129.0	106.6	35.1
EnmaxT1 (Enmax 65 240/138kV Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	81.9	67.7	124.8	103.1	35.4
EnmaxT2 (Enmax 65 240/138kV Transformer T2)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	81.9	67.7	124.8	103.1	35.4
38.83L (Enmax 38S to Enmax 39S)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	83.0	68.6	125.5	103.7	35.1
37.81L (Enmax 37 37S to Enmax 38S)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	84.7	70.0	127.1	105.0	35.0
162ST2 (Beddington 162S 240/138kV Transformer T2)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	83.2	68.8	126.0	104.1	35.3
CECGT (CEC Generator GT)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	84.3	69.7	127.2	105.1	35.4
Balzac Power Station	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	85.7	70.9	128.7	106.4	35.5
316ST1 (West Crossfield 316S 138/25kV Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	83.1	68.7	126.0	104.1	35.4

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Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
284ST1 (Nose Creek 284S 138/4.16kV Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	86.0	71.1	129.0	106.6	35.5
64ST1 (East Crossfield 64S 138/25kV Transformer T1)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	83.4	69.5	150.4	125.3	55.8
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	102.2	84.5	172.1	142.2	57.7
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	65.1	54.7	125.4	105.4	50.7
688L (Summit 653S to East Airdrie 199S)	752L (Summit 653S to 752AL Tap)	120.9	133.0	122.6	101.4	122.6	101.4	0
752L (East Crossfield 64S to Summit 653S)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	92.4	77.0	160.1	133.4	56.4
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	111.9	92.5	181.9	150.3	57.8
	611L (Balzac 391S to Dry Creek186S)	119.0	131.0	72.4	60.8	134.8	113.3	52.5
	688L (Summit 653S to 688AL Tap)	120.9	133.0	122.2	101.1	124.3	102.8	1.7
199ST2 (East Airdrie 199S 138/25kV Transformer ST2)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	106.1	89.1	174.8	146.9	57.8
	752L (Summit 653S to 752AL Tap)	120.9	133.0	111.9	82.5	181.1	149.8	57.3
901L (Janet 74S to Red Deer 63S)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	79.7	66.4	146.2	121.8	55.4
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	98.0	81.0	167.7	138.6	57.6
	611L (Balzac 391S to Dry Creek186S)	119.0	131.0	62.5	52.5	121.4	102.0	49.5
186ST1 (Dry Creek 186S 138/25kV Transformer T1)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	83.3	70.0	150.3	126.3	56.3
	752L (Summit 653S to 752AL Tap)	120.9	133.0	88.7	73.3	156.3	129.3	56.0
186ST2 (Dry Creek 186S 138/25kV Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	69.9	58.7	135.3	113.7	55.0
	752L (Summit 653S to 752AL Tap)	120.9	133.0	74.7	61.8	141.3	116.9	55.1

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Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Normal Rating (MVA)	Emergency Rating (MVA)	Pre-Project Results		Post-Project Results		% Loading Difference (Post-Pre)
				Observed Power Flow (MVA)	% Loading	Observed Power Flow (MVA)	% Loading	
Enmax 38S T1 or T2 or T3 (138/13.8kV)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	82.9	68.5	125.4	103.6	35.1
Enmax 37S Transformer T1 or T2 (138/13.8kV)	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	84.4	69.8	126.8	104.8	35.0

Voltage Criteria Violations

No voltage criteria violations were observed under Category B conditions.

POD Bus Voltage Deviations

No POD bus voltage deviations were observed.

3.2 Transient Stability Studies

Transient stability studies were completed for Scenario 3 and 4.

The results did not indicate any transient stability concerns, and the system showed acceptable dynamic response to all Category B conditions studied, as shown in Table 3-3 and Table 3-4. The post-Project transient stability plots are provided in Attachment 4. The dynamic data and assumptions of all equipment proposed for the Facility are provided in Attachment 5.

Table 3-3: Transient Stability Study Results under Category B Conditions for Scenario 3

Studied Contingency	Fault Description and Location	Results
688L (Summit 653S – East Airdrie 199S)	3-phase fault Summit 653S	Stable
	3-phase fault at East Airdrie 199S	Stable
752L (East Crossfield 64S – Summit 653S)	3-phase fault at East Crossfield 64S	Stable
	3-phase fault at Summit 653S	Stable
631L (East Airdrie 199S – Dry Creek 186S)	3-phase fault at East Airdrie 199S	Stable
	3-phase fault at Dry Creek 186S	Stable
611L (Balzac 391S – Dry Creek 186S)	3-phase fault at Balzac 391S	Stable
	3-phase fault at Dry Creek 186S	Stable
162.81L (Balzac 391S – Beddington 162S)	3-phase fault at Balzac 391S	Stable
	3-phase fault at Beddington 162S	Stable
932L (Janet 74S – Beddington 162S)	3-phase fault at Janet 74S	Stable
	3-phase fault at Beddington 162S	Stable

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918L (Beddington 162S – Johnson 281S)	3-phase fault at Beddington 162S	Stable
	3-phase fault at Johnson 281S	Stable
929L (Janet 74S – Hazelwood 287S)	3-phase fault at Janet 74S	Stable
	3-phase fault at Hazelwood 287S	Stable
925L (Janet 74S – Red Deer 63S)	3-phase fault at Janet 74S	Stable
	3-phase fault at Red Deer 63S	Stable

Table 3-4: Transient Stability Study Results under Category B Conditions for Scenario 4

Studied Contingency	Fault Description and Location	Results
688L (Summit 653S – East Airdrie 199S)	3-phase fault Summit 653S	Stable
	3-phase fault at East Airdrie 199S	Stable
752L (East Crossfield 64S – Summit 653S)	3-phase fault at East Crossfield 64S	Stable
	3-phase fault at Summit 653S	Stable
631L (East Airdrie 199S – Dry Creek 186S)	3-phase fault at East Airdrie 199S	Stable
	3-phase fault at Dry Creek 186S	Stable
611L (Balzac 391S – Dry Creek 186S)	3-phase fault at Balzac 391S	Stable
	3-phase fault at Dry Creek 186S	Stable
162.81L (Balzac 391S – Beddington 162S)	3-phase fault at Balzac 391S	Stable
	3-phase fault at Beddington 162S	Stable
932L (Janet 74S – Beddington 162S)	3-phase fault at Janet 74S	Stable
	3-phase fault at Beddington 162S	Stable
918L (Beddington 162S – Johnson 281S)	3-phase fault at Beddington 162S	Stable
	3-phase fault at Johnson 281S	Stable
929L (Janet 74S – Hazelwood 287S)	3-phase fault at Janet 74S	Stable
	3-phase fault at Hazelwood 287S	Stable
925L (Janet 74S – Red Deer 63S)	3-phase fault at Janet 74S	Stable
	3-phase fault at Red Deer 63S	Stable

4 Short Circuit Studies

4.1 Pre-Project Results

4.1.1 Scenario 2: 2023 Summer Peak High Renewables Pre-Project

Pre-Project short-circuit current levels are provided in Table 4-1.

Table 4-1: Pre-Project Short-Circuit Current Levels for Scenario 2

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3- Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1- Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Summit 653S	138.0	141.7	9.15	0.011018+j0.046313	9.33	0.006192+j0.044676
Nose Creek 284S	138.0	141.6	8.21	0.013503+j0.051301	7.68	0.011553+j0.063286
East Airdrie 199S	138.0	141.2	8.86	0.015295+j0.046673	7.47	0.018875+j0.074423
Dry Creek 186S	138.0	141.8	11.38	0.012358+j0.036407	7.41	0.023719+j0.097714

4.2 Post-Project Results

4.2.1 Scenario 4: 2023 Summer Peak High Renewables Post-Project

Post-Project short-circuit current levels for Scenario 4 are provided in Table 4-2.

Table 4-2: Post-Project Short-Circuit Current Levels for Scenario 4

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3- Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1- Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Summit 653S	138.0	142.2	9.18	0.011021+j0.046329	9.66	0.005487+j0.040402
Nose Creek 284S	138.0	142.1	8.25	0.013506+j0.051318	7.92	0.010705+j0.058600
East Airdrie 199S	138.0	142.0	8.90	0.015301+j0.046695	8.24	0.013498+j0.059906
Dry Creek 186S	138.0	142.1	11.40	0.012359+j0.036415	7.60	0.022517+j0.093803
Sollair1	138.0	142.3	8.76	0.014668+j0.047830	8.71	0.008899+j0.050424

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4.2.2 Scenario 5: 2029 Summer Peak High Renewables Post-Project

Post-Project short-circuit current levels for Scenario 5 are provided in Table 4-3.

Table 4-3: Post-Project Short-Circuit Current Levels for Scenario 5

Substation Name and Number	Base Voltage (kV)	Pre-Fault Voltage (kV)	3-Φ Fault (kA)	Positive Sequence Thevenin Source Impedance (R1+jX1) (pu)	1-Φ Fault (kA)	Zero Sequence Thevenin Source Impedance (R0+jX0) (pu)
Summit 653S	138.0	140.1	9.13	0.010959+j0.045358	9.55	0.005491+j0.040329
Nose Creek 284S	138.0	140.1	8.17	0.013402+j0.050395	7.81	0.010711+j0.058522
East Airdrie 199S	138.0	140.7	8.96	0.015263+j0.045287	8.22	0.013544+j0.059184
Dry Creek 186S	138.0	141.1	11.78	0.012201+j0.034345	7.70	0.022385+j0.091834
Sollair1	138.0	140.8	8.78	0.014605+j0.046542	8.68	0.008934+j0.050034

5 Mitigation Measure Development and Evaluation

The Studies Consultant, in consultation with the AESO, developed mitigation measures to address the system performance issues that were identified in the post-Project scenarios. Existing remedial action schemes (RASs) are described in Section 1.2.2 of Attachment A1.

5.1 Pre-Project

Pre-Project mitigation measures are summarized in Table 5-1.

Table 5-1: Pre-Project Mitigation Measures

Mitigation Measure	Location of Observed Violation	Contingency
Real time operational practices	752L (East Crossfield 64S to 752AL Tap)	162.81L (Beddington 162S to Balzac 391S)
	752L (Summit 653S to 752AL Tap)	162.81L (Beddington 162S to Balzac 391S) 688L (Summit 653S to East Airdrie 199S)
	688L (Summit 653S to 688AL Tap)	752L (East Crossfield 64S to Summit 653S)

Notes:

^a RAS 49 is an existing RAS (see Section 1.2.2 of Attachment A1).

^b RAS 50 is an existing RAS (see Section 1.2.2 of Attachment A1).

5.2 Post-Project

Post-Project mitigation measures are summarized in Table 5-2.

Table 5-2: Post-Project Mitigation Measures

Mitigation Measure	Location of Observed Violation	Contingency
Modified RAS 49 ^a	64ST2 (East Crossfield 64S 240/138kV Transformer T2)	162.81L (Beddington 162S to Balzac 391S)
	752L (East Crossfield 64S to 752AL Tap)	162.81L (Beddington 162S to Balzac 391S) 631L (East Airdrie 199S to Dry Creek 186S) 611L (Balzac 391S to Dry Creek 186S) 199ST2 (East Airdrie 199S 138/25kV Transformer T2) 186ST1 (Dry Creek 186S 138/4.16kV Transformer T1) 186ST2 (Dry Creek 186S 138/4.16kV Transformer T2)
	752L (Summit 653S to 752AL Tap)	162.81L (Beddington 162S to Balzac 391S) 631L (East Airdrie 199S to Dry Creek 186S) 611L (Balzac 391S to Dry Creek 186S)

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		199ST2 (East Airdrie 199S 138/25kV Transformer T2) 186ST1 (Dry Creek 186S 138/4.16kV Transformer T1) 186ST2 (Dry Creek 186S 138/4.16kV Transformer T2)Transformer T2)
Modified RAS 50 ^b	631L (Dry Creek 186S to East Airdrie 199S)	64ST2 (East Crossfield 64S 240/138kV Transformer T2) 64ST1 (East Crossfield 64S 138/25kV Transformer T1) 752L (East Crossfield 64S to Summit 653S) 901L (Janet 74S to Red Deer 63S)
	688L (East Airdrie 199S to P2405 Tap)	64ST2 (East Crossfield 64S 240/138kV Transformer T2) 64ST1 (East Crossfield 64S 138/25kV Transformer T1) 752L (East Crossfield 64S to Summit 653S) 901L (Janet 74S to Red Deer 63S)
	611L (Balzac 391S to Dry Creek 186S)	64ST2 (East Crossfield 64S 240/138kV Transformer T2) 64ST1 (East Crossfield 64S 138/25kV Transformer T1) 752L (East Crossfield 64S to Summit 653S) 901L (Janet 74S to Red Deer 63S)
	688L (Summit 653S to 688AL Tap)	752L (East Crossfield 64S to Summit 653S)
Real time operational practices	752L (Summit 653S to 752AL Tap)	688L (Summit 653S to East Airdrie 199S) 611L (Balzac 391S to Dry Creek 186S)
	752L (East Crossfield 64S to 752AL Tap)	611L (Balzac 391S to Dry Creek 186S)
	688L (East Airdrie 199S to P2405 Tap)	Base Case 162ST1 (Beddington 162S 240/138kV Transformer T1) 162ST2 (Beddington 162S 240/138kV Transformer T2) PCES02L (Balzac 391S to PCES02S) 37.82L (Janet 74S to Enmax 37) EnmaxT1 (Enmax 65 240/138kV Transformer T1) EnmaxT2 (Enmax 65 240/138kV Transformer T2) 38.83L (Enmax 38S to Enmax 39S) 37.81L (Enmax 37S to Enmax 38S) 162ST2 (Beddington 162S 240/138kV Transformer T2) CEGT (CEC Generator GT) Balzac Power Station 316ST1 (West Crossfield 316S 138/25kV Transformer T1) 284ST1 (Nose Creek 284S 138/4.16kV Transformer T1)

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		Enmax 38ST1 or T2 or T3 (Enmax 38S 138/13.8kV Transformer T1, T2, T3) Enmax37ST1 or T2 (Enmax 37S 138/13.8kV Transformer T1, T2)
	688L (East Airdrie 199S to P2405 Tap)	936L (Langdon 102S to East Calgary 5S) 937L (Langdon 102S to East Calgary 5S) 932L (Janet 74S to Enmax 162) 74ST1 (Janet 74S 240/138 kV Transformer T1) 74ST2 (Janet 74S 240/138 kV Transformer T2)

Notes:

^a "Modify" refers to adding the Project to the logic of the existing RAS 49. Action 1: Trip P2405; Action 2: Trip one of the Crossfield generators.

^b "Modify" refers to adding the Project to the logic of the existing RAS 50.

5.3 Evaluation of Mitigation Measures

This section describes the results of the power flow studies that were performed to assess the impact of the Project on the performance of the AIES following the implementation of proposed mitigation measures.

The post-mitigation measures studies were performed under Category B conditions for Scenarios 3 and 4 using Alternative 1 and the RASs described in the previous section.

The post-mitigation power flow diagrams for selected Category B conditions are provided in Attachment 6. Post-mitigation power flow diagrams present only those post-Project contingencies that result in thermal criteria violations that require RAS mitigation. Post-Project contingencies that result in thermal criteria violations that can be mitigated by real-time operational practices or TFO capital maintenance projects were not studied.

5.3.1 Scenario 3: 2023 Summer Light High Renewables Post-Project

Category B Conditions

Thermal and voltage criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-3.

Table 5-3: Post-RAS Power Flow Study Results for Scenario 3

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Power Flow (MVA)	% Loading	Power Flow (MVA)	% Loading
162.81L (Beddington 162S to Balzac 391S)	64ST2 (East Crossfield 64S 240/138kV Transformer T2)	191.2	191.2	198.5	103.8	126.1	66.0
	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	199.7	167.8	93.3	78.4 ^a
	752L (Summit 653S to 752AL Tap)	120.9	133.0	204.1	168.8	97.7	80.8 ^a

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64ST2 (East Crossfield 64S 240/138kV Transformer T2)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	151.9	126.6	83.2	69.4
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	162.7	134.5	93.3	77.1
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	138.3	116.2	70.0	58.8
631L (East Airdrie 199S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	153.7	129.2	83.7	70.3
	752L (Summit 653S to 752AL Tap)	120.9	133.0	158.1	130.8	87.8	72.7
611L (Balzac 391S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	140.3	117.9	70.2	59.0
	752L (Summit 653S to 752AL Tap)	120.9	133.0	144.7	119.7	74.3	61.5
64ST1 (East Crossfield 64S 138/25kV Transformer T1)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	155.0	129.2	86.1	71.7
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.3	165.9	137.1	96.2	79.5
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	141.4	118.8	72.7	61.1
752L (East Crossfield 64S to Summit 653S)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	162.0	135.0	92.8	77.4
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.3	172.8	142.8	103.1	85.2
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	148.3	124.6	79.4	66.7
199ST2 (East Airdrie 199S 138/25kV Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	165.8	139.3	95.4	80.2
	752L (653S to 752AL Tap)	120.9	133.0	170.1	140.7	99.6	82.4
901L (Janet 74S to Red Deer 63S)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	151.8	126.5	83.1	69.3
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.3	162.6	134.4	93.1	77.0
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	138.2	116.1	69.8	58.7
186ST1 (Dry Creek 186S 138/25kV Transformer T1)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	153.7	129.2	83.7	70.3
	752L (Summit 653S to 752AL Tap)	120.9	133.0	158.1	130.8	87.8	72.7
186ST2 (Dry Creek 186S 138/25kV Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	147.1	123.6	76.9	64.6
	752L (Summit 653S to 752AL Tap)	120.9	133.0	151.4	125.2	81.0	67.0

Notes:

^a Violations remained following RAS 49 Action 1 (Trip P2405). Additional Action 2 (Trip one of Crossfield generators) required to mitigate violation.

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5.3.2 Scenario 4: 2023 Summer Peak High Renewables Post-Project

Category B Conditions

The thermal and voltage criteria violations observed under certain Category B conditions in the post-Project studies were mitigated by RASs as shown in Table 5-4.

After RAS actions were complete, real-time operational practices are required to fully alleviate certain thermal criteria violations observed on 138kV transmission lines 631L, 688L, and 611L.

Table 5-4: Post-RAS Power Flow Study Results for Scenario 4

Contingency (System Element Lost)	Details of Violation (Violation Observed On)	Seasonal Continuous Rating (MVA)	Short-term (Emergency) Rating (MVA)	Post-Project Results		Post-RAS Action Results	
				Power Flow (MVA)	% Loadin g	Powe r Flow (MVA)	% Loading
162.81L (Beddington SS-162 to Balzac 391S)	64ST2 (East Crossfield 240/138kV Transformer T2)	191.2	191.2	194.5	101.7	122.6	64.1
	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	193.5	162.6	84.1	70.7 ^a
	752L (Summit 653S to 752AL Tap)	120.9	133.0	199.8	165.3	90.1	74.5 ^a
64ST2 (East Crossfield 64S 240/138kV Transformer T2)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	146.3	121.9	79.8	66.5
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	167.8	138.7	98.1	81.1
	611L (Balzac 391S to Dry Creek186S)	119.0	131.0	121.6	102.2	62.6	52.6
631L (East Airdrie 199S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	150.3	126.3	83.3	70.0
	752L (Summit 653S to 752AL Tap)	120.9	133.0	156.3	129.3	88.6	73.3
64ST1 (East Crossfield 64S 138/25kV Transformer T1)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	150.4	125.3	83.4	69.5
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	172.1	142.2	102.2	84.5
	611L (Balzac 391S to Dry Creek 186S)	119.0	131.0	125.4	105.4	65.1	54.7
752L (East Crossfield 64S to Summit 653S)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	160.1	133.4	92.4	77.0
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	181.9	150.3	111.9	92.5
	611L (Balzac 391S to Dry Creek186S)	119.0	131.0	134.8	113.3	72.4	60.8
	688L (Summit 653S to 688AL Tap)	120.9	133.0	124.3	102.8	122.2	101.1 ^b
	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	174.8	146.9	106.1	89.1

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199ST2 (East Airdrie 199S 138/25kV Transformer ST2)	752L (Summit 653S to 752AL Tap)	120.9	133.0	181.1	149.8	111.9	92.5
901L (Janet 74S to Red Deer 63S)	631L (Dry Creek 186S to East Airdrie 199S)	120.0	132.0	146.2	121.8	79.7	66.4
	688L (East Airdrie 199S to P2405 Tap)	121.0	133.0	167.7	138.6	98.1	81.0
	611L (Balzac 391S to Dry Creek186S)	119.0	131.0	121.4	102.0	62.5	52.5
186ST1 (Dry Creek 186S 138/25kV Transformer T1)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	150.3	126.3	83.3	70.0
	752L (Summit 653S to 752AL Tap)	120.9	133.0	156.3	129.3	88.6	73.3
186ST2 (Dry Creek 186S 138/25kV Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	119.0	131.0	135.3	113.7	69.9	58.7
	752L (Summit 653S to 752AL Tap)	120.9	133.0	141.3	116.9	74.7	61.8

Notes:

^a Violations remained following RAS 49 Action 1 (Trip P2405). Additional Action 2 (Trip one of Crossfield generators) required to mitigate violation.

^b Violation remained following RAS 50 and real-time operational practices will be used to mitigate the overload.

5.4 Constraint Effective Factor Studies

Constraint effective factor studies were conducted for all post-Project scenarios. The constraint effective factors were calculated for all Category B conditions when the loadings of the monitored transmission elements in the Study Area exceeded 100% (i.e., for all of the contingencies that resulted in thermal criteria violations). The results of the constraint effective factor studies are provided in Attachment 7.

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Attachment A1

Engineering Connection Assessment: Study Scope



Engineering Connection Assessment: Study Scope





P2405 Sollair Solar Connection Project

1532094 Alberta Ltd.

Date: December 13, 2021

Version: V1

Classification: Public

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AESO	Fang Fang, P. Eng.	2021-12-14	
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Attachments

Attachment A: Transmission Planning Criteria – Basis and Assumptions

1 Introduction

This Study Scope provides an overview of the engineering studies to be completed by Hardline Engineering Ltd. (the Studies Consultant) to assess the impact of the Project (as defined in section 1.1) on the performance of the Alberta interconnected electric system (AIES). Technical criteria, assumptions and methods for performing these engineering studies are provided in this document.

1.1 Project Overview

1532094 Alberta Ltd. (Market Participant) has submitted a request for system access service to the Alberta Electric System Operator (AESO) to connect its proposed Sollair Solar (Facility) to the AIES.

The Facility includes a proposed collector substation, to be designated the Sollair 1055S.

The Market Participant's request includes: a request for a new system access service in the area, with a Rate STS, *Supply Transmission Service*, contract capacity of 75 MW and a Rate DTS, *Demand Transmission Service*, contract capacity of 0.5 MW; and a request for transmission development (collectively, the Project).

The Project in-service date (ISD) used for the purpose of the studies is December 1, 2022.

Load and generation components of the Project are listed in Table 1-1.

Table 1-1: Project Load and Generation Details

Project Component		Description
Load	Existing Rate DTS, <i>Demand Transmission Service</i> , contract capacity	No existing contract
	Requested Rate DTS	0.5 MW
	Type	station service
	Motors (number and size)	N/A
	Power factor	N/A
	Future load expansion plans	No;
Generation	Generation type	Solar
	Existing Rate STS, <i>Supply Transmission Service</i> , contract capacity	0 MW
	Requested Rate STS	75 MW
	Number and size of generating units	To be determined
	Maximum authorized real power (MARP)	75 MW
	Maximum capability (MC)	75 MW
	Reactive power capability	
		36.3 MVar (0.90 pf producing)

Project Component		Description
	Future generation expansion plans	No

Note:

MARP and MC are defined in the AESO's *Consolidated Authoritative Document Glossary*, which can be found on the AESO's website.

1.2 Existing System Overview

1.2.1 Study Area

Geographically, the Project is located in the AESO planning area of Airdrie (Area 57).

The Study Area consists of the AESO planning areas of Airdrie (Area 57) and Calgary (Area 6), including the tie lines connecting these planning areas to the rest of the AIES.

The existing transmission system in the Study Area is shown in Figure 1-1.

1.2.2 Existing Constraints

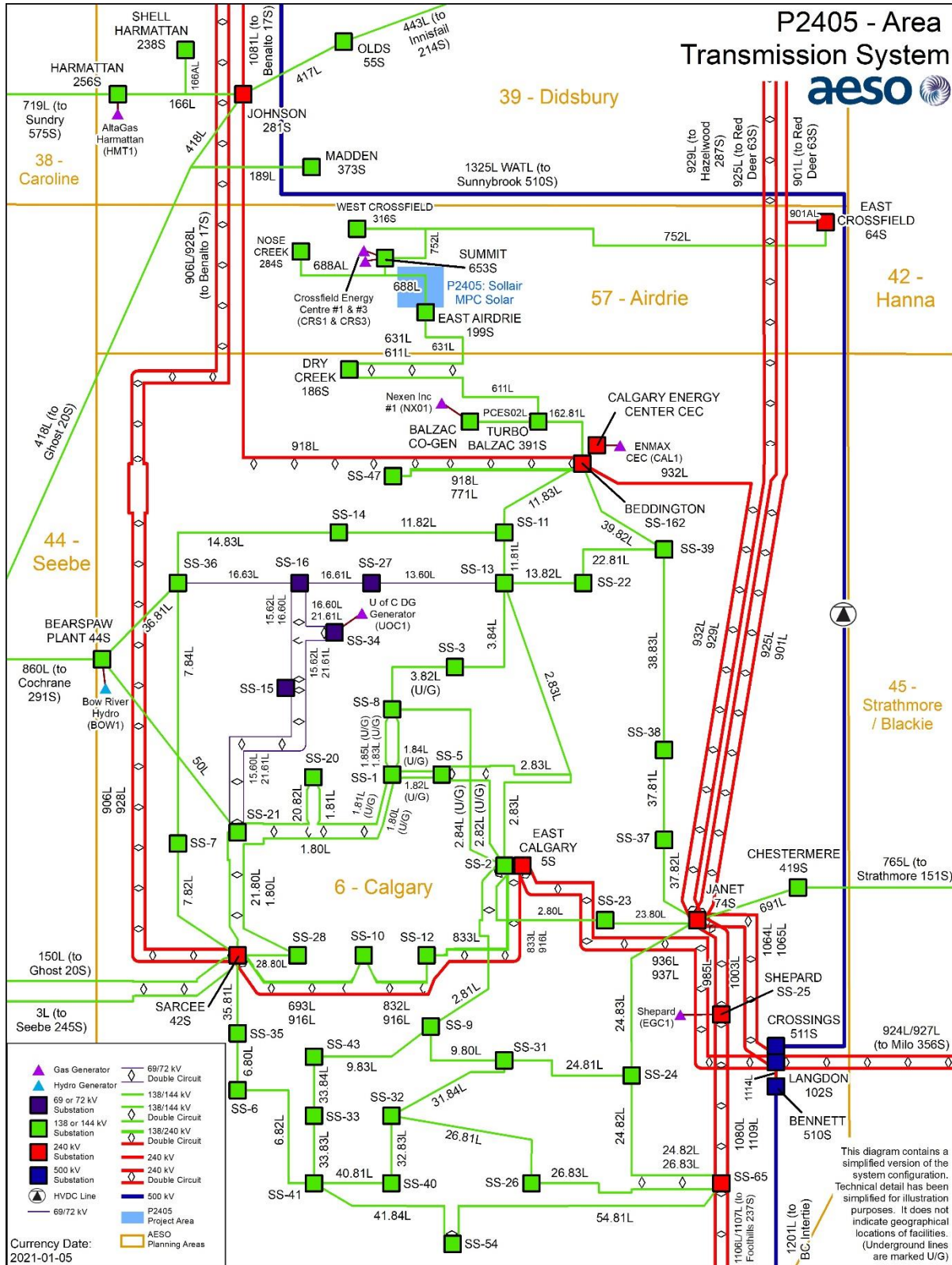
Existing constraints in the Study Area are managed in accordance with the procedures set out in Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management (TCM Rule)*.

There are a number of constraints in the Study Area that are mitigated by existing remedial action schemes (RASs) and/or other protection schemes.

The following existing RASs and/or other protection schemes are used to manage constraints in the area:

- RAS 11 Bennett 520S Underfrequency And Power Scheme
- RAS 12 Bennett 520S Undervoltage & Power Scheme
- RAS 49 Summit 653s (ENMAX Crossfield) 752L Overload Mitigation Scheme
- RAS 50 Summit 653s (ENMAX Crossfield) 688L Overload Mitigation Scheme
- RAS 133 Beddington 162s Overload Mitigation Scheme
- RAS 136 Direct Transfer Trip to MATL on Loss of 1201L
- RAS 145 Shepard RAS - Mitigation of 138 kV Thermal Constraints on ENMAX System
- RAS 153 Mitigation of 138 kV Thermal Constraints on ENMAX System at SS-65
- RAS 157 Chestermere 419S Overload and Voltage Stability Mitigation

Figure 1-1: Transmission System in the Study Area



2 Connection Alternative to be Studied

The following alternative will be studied:

2.1 Alternative 1 – T-tap connection to transmission line 688L

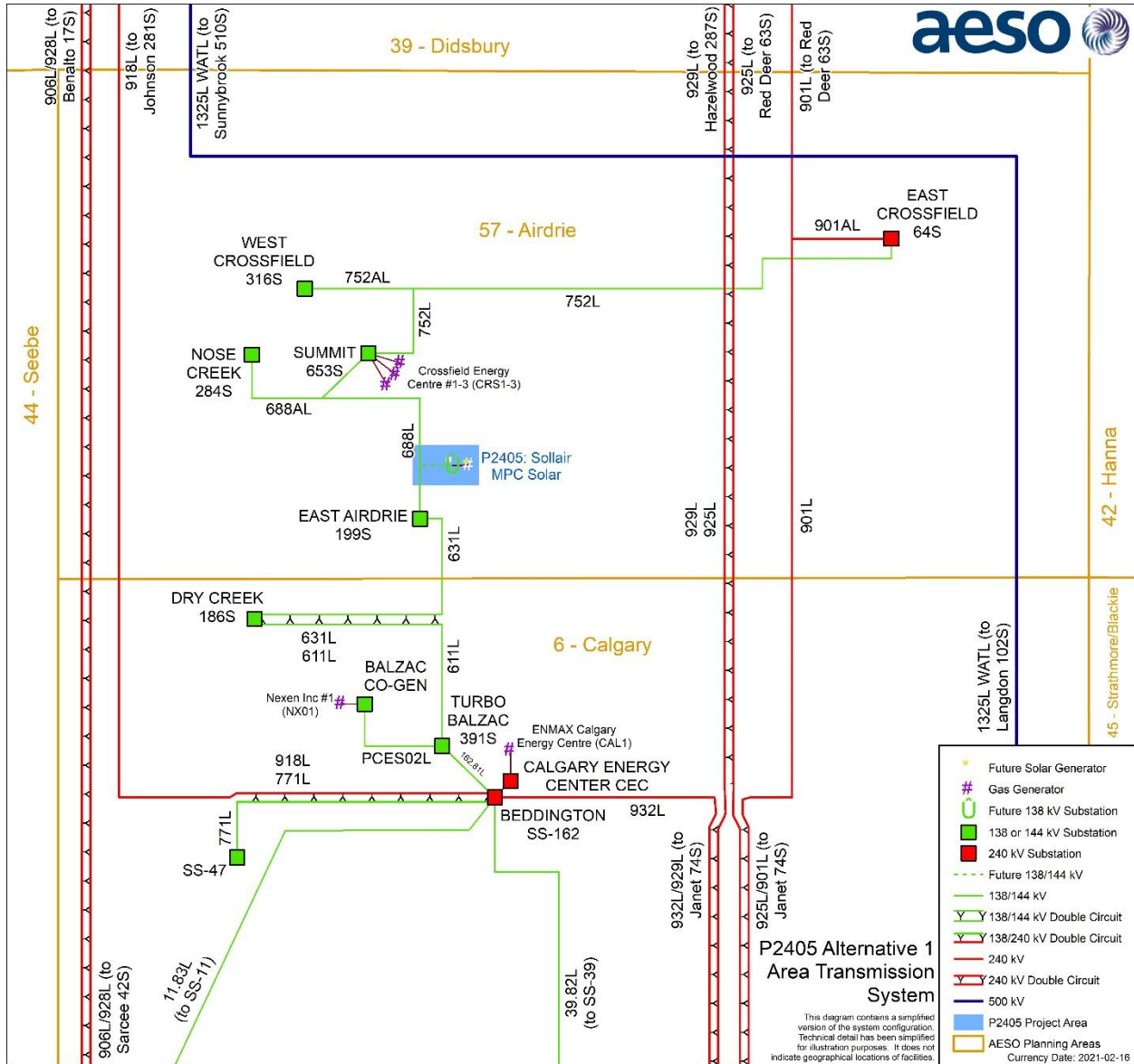
This alternative includes the following developments:

- Add a 138 kV circuit, approximately 0.2 km¹ in length, to connect facility to the existing 138 kV transmission line 688L (between East Airdrie 199S and Summit 653S tap) through a T-tap configuration;
- Add or modify associated equipment as required for the above transmission developments.

The proposed connection configuration is shown in Figure 2-1.

¹ Exact line length to be determined by the TFO.

Figure 2-1: Connection Alternative 1



3 Criteria, Standards and Requirements

3.1 AESO Reliability Criteria

The Transmission Planning (TPL) Standards, which are included in the Alberta Reliability Standards, and *Transmission Planning Criteria – Basis and Assumptions* (see Attachment A), (collectively, the Reliability Criteria) will be applied to evaluate system performance under Category A system conditions (i.e., all elements in-service) and following Category B contingencies (i.e., single element outage), prior to and following the studied alternatives. Below is a summary of Category A and Category B system conditions.

Category A, often referred to as the N-0 condition, represents a normal system with no contingencies and all facilities in service. Under this condition, the system must be able to supply all firm load 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, often referred to as an N-1 or N-G-1 with the most critical generator out of service, 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 transmission line. The acceptable impact on the system is the same as Category A. Planned or controlled interruptions of electric supply to radial customers or some local network customers, connected to or supplied by the faulted element or by the affected area, may occur in certain areas without impacting the overall reliability of the interconnected transmission systems. To prepare for the next contingency, system adjustments are permitted, including curtailments of contracted firm (non-recallable reserved) transmission service electric power transfers.

The TPL standards, TPL-001-AB-0 and TPL-002-AB1-0, have referenced Applicable Ratings when specifying the required system performance under Category A and Category B events. For the purpose of applying the TPL standards to the studies documented in this report, Applicable Ratings are defined as follows:

- Normal thermal rating of the line's loading limits for each season;
- The highest specified loading limits for transformers;
- For Category A conditions: Voltage range under normal operating condition per AESO Information Document #2010-007RS, *General Operating Practices – Voltage Control* (ID #2010-007RS). For the busses not listed in ID #2010-007RS, Table 2-1 in the *Transmission Planning Criteria – Basis and Assumptions* applies.
- For Category B conditions: The extreme voltage range values per Table 2-1 in the *Transmission Planning Criteria – Basis and Assumptions*; and
- Desired post-contingency voltage deviation limits for three defined post-event timeframes as provided in Table 3-1.

Table 3-1: Post-Contingency Voltage Deviation Guidelines for Low Voltage Busses

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 point of delivery (POD) low voltage bus.	±10%	±7%	±5%

3.2 ISO Rules and Information Documents

ID #2010-007RS will be used to establish system normal (i.e., pre-contingency) voltage profiles for the Study Area.

The TCM Rule will be followed to set up the study scenarios and assess the impact of the Project. In addition, due regard will be given to the following:

- The AESO’s *Connection Study Requirements*;
- Section 502.1 of the ISO rules, *Aggregated Generating Facilities Technical Requirements*;
- Section 502.16 of the ISO rules, *Aggregated Generating Facilities Operating Requirements*.

4 Scenarios and Assumptions

4.1 Scenarios

The following section describes the scenarios to be studied and the assumptions to be used in the studies. Connection scenarios must be studied as outlined in Table 4-1.

Table 4-1: Connection Study Scenarios

Scenario No.	Year/Season	System Generation Dispatch Conditions	Scenario Name	Project Load (MW)	Project Generation (MW)
Pre-Project					
1	2023 Summer Light (SL)	High Renewable	2023 SL HR Pre-Project	0	0
2	2023 Summer Peak (SP)	High Renewable	2023 SP HR Pre-Project	0	0
Post-Project					
3	2023 SL	High Renewable	2023 SL HR Post-Project	0.5	75
4	2023 SP	High Renewable	2023 SP HR Post-Project	0.5	75
5	2031 Winter Peak (WP)	All Study Area Generators In-Service	2031 WP Post-Project	0.5	75

4.2 Assumptions

4.2.1 System Project Assumptions

The pre-Project and post-Project connection assessment will not include any system transmission projects because there are no planned system transmission developments in the Study Area that are expected to be in service before the scheduled Project ISD.

4.2.2 Connection Project Assumptions

Table 4-2 summarizes the connection projects in the Study Area that should be included in the studies.

Table 4-2: Planned Connection Projects Included in the Studies

AESO Project No.	AESO Project Name	AESO Planning Area No.	Generation (MW)	Load (MW)	Scheduled ISD	AUC NID Decision No.
P2395	EPC Bonnybrook DER Cogen	06-Calgary	5	0	Nov 30, 2021	N/A

AESO Project No.	AESO Project Name	AESO Planning Area No.	Generation (MW)	Load (MW)	Scheduled ISD	AUC NID Decision No.
P2194	FortisAlberta East Crossfield 64S DER Solar	57-Airdrie	1	0	April 1, 2022	N/A

4.2.3 Load Assumptions

The load forecast to be used for the studies is shown in Table 4-3 and is a forecast for the AESO Calgary Planning Region peak based on the AESO's 2021 Long-term Outlook (2021 LTO)² with modifications to incorporate the latest forecast intelligence. For the post-Project studies, when the Study Area loads are modified to align with the regional load forecast, the active power to reactive power ratio in the base case scenarios shall be maintained.

Table 4-3: Forecast Load (at AESO Calgary Planning Region Peak)

AESO Planning Region Name	Forecast Peak Load by Year/Season (MW)	
	2023 SL	2023 SP
Calgary Planning Region ¹	753	1,589

Note:

¹ The Calgary Region comprises the following AESO planning areas: Calgary (Area 6) and Airdrie (Area 57).

IDEV files contain non-motor loads in zones 34, 36, and 351. These loads are not accounted for in the forecasted peak loads shown above and should not be considered when scaling load. The AESO engineer will provide guidance to load scaling procedures as required.

4.2.4 Generation Assumptions

The generation forecast to be used for the studies is based on the 2021 LTO with modifications to incorporate the latest forecast intelligence. The generation assumptions for the studies will assume high renewable generation. Additional studies may be required in the event of changes to the AESO's corporate forecast.

The existing generation (excluding wind and solar) dispatch conditions for the study scenarios are described in Table 4-4.

Table 4-4: Existing Generation (excluding Wind and Solar) Dispatch Conditions

Facility Name	Unit No.	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation ^a (MW) by Scenario	
					2023 SL	2023 SP
ENMAX Calgary Energy Centre (CAL1)	1	4187	188	6	164	159
	2	3187	132		118	116

² The 2021 LTO is available on the AESO website.

Facility Name	Unit No.	Bus No.	MC (MW)	AESO Planning Area No.	Unit Net Generation ^a (MW) by Scenario	
					2023 SL	2023 SP
Shepard (EGC1)	1	773,774,775	868	6	716	764
Nexen Inc #1 (NX01)	1	3290,4290	120	6	74	98
U of C Generator (UOC1)	1	2556	12	6	13	14
Crossfield Energy Centre #1 (CRS1)	1	4503	48	57	35	40
Crossfield Energy Centre #2 (CRS2)	2	3503	48	57	35	40
Crossfield Energy Centre #3 (CRS3)	3	2503	48	57	35	40

Notes:

^a "Unit Net Generation" refers to gross generating unit output (MW) less unit service load.

P2395 and P2194 will be dispatched at their maximum MW output in all the study scenarios.

4.2.5 Intertie Flow Assumptions

The intertie flow assumptions for the Alberta-British Columbia (AB-BC), Alberta-Saskatchewan (AB-SK), and Alberta-Montana (MATL) interties are shown in Table 4-5.

For the 2031 WP scenario, the intertie flow values should be set to the AESO planning base cases.

Table 4-5: Intertie Flows by Scenario

Scenario Number	Scenario Name	Import (-) / Export (+) (MW) by Intertie		
		AB-BC	AB-SK	MATL
1, 3	2023 SL HR Pre-Project, 2023 SL HR Post-Project	377	0	0
2, 4	2023 SP HR Pre-Project, 2023 SP HR Post-Project	338	0	0

4.2.6 HVDC Power Order Assumptions

The Western Alberta Transmission Line (WATL) and the Eastern Alberta Transmission Line (EATL) are high-voltage direct current (HVDC) transmission lines. The HVDC power order assumptions for the studies will be set to minimize losses for the pre-Project and post-Project study scenarios.

For the 2031 WP scenario, the HVDC power order should be as per the AESO base cases and will not be adjusted.

The reactive power limits of the MVar exchanges between the HVDC terminals (WATL and EATL) and the connected alternating current (AC) transmission systems are shown in Table 4-6. These limits must be maintained when performing the studies.

Table 4-6: HVDC to Adjacent AC System MVar Exchange Limits

HVDC Facility	North Terminal Reactive Power Limit (MVar)	South Terminal Reactive Power Limit (MVar)
EATL	-85 to 75	-35 to 35
WATL	-75 to 75	-35 to 35

4.2.7 Transmission Facility Ratings

The legal owner or legal owners of transmission facilities (TFO) provided the thermal ratings assumptions for the existing transmission lines in the Study Area. Table 4-7 shows the normal ratings and emergency ratings for the key transmission lines in the Study Area, which will be used to perform the engineering studies.

Table 4-7: Thermal Rating Assumptions for Key Transmission Lines in the Study Area

Line ID	From Substation	To Substation	Voltage Class (kV)	Summer Normal Rating (MVA)	Summer Emergency Rating (MVA)
611L	DRY CREEK	BALZAC	138	119	131
631L	EAST AIRDRIE	DRY CREEK	138	120	132
688L	SUMMIT	JCT. 688AL	138	121	133
688L	JCT. 688AL	EAST AIRDRIE	138	121	133
688AL	JCT. 688L	NOSE CREEK	138	120	132
752L	EAST CROSSFIELD	JCT. 752AL	138	119	131
752L	JCT. 752AL	SUMMIT	138	121	133
752AL	JCT. 752L	WEST CROSSFIELD	138	118	130
771L	BEDDINGTON (Enmax #162 sub)	(ENMAX #47 SUB)	138	328	361
901L	RED DEER	JCT. 901AL	240	408	490
901L	JCT. 901AL	JANET	240	337	404
901AL	JCT. 901L	EAST CROSSFIELD	240	481	577
918L	JOHNSON	BEDDINGTON - #162 sub	240	340 LTDL	408 LTDL
925L	RED DEER	JANET	240	476 TE	524 TE
929L	HAZELWOOD	JANET	240	441 LTDL	529 LTDL
932L	BEDDINGTON - #162 sub	JANET	240	481	577
1064L	LANGDON	JANET	240	974	1039 TE

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1065L	LANGDON	JANET	240	974	1169
1080L	(ENMAX #25 SUB)	(ENMAX #65 SUB)	240	487	584
1109L	(ENMAX #25 SUB)	(ENMAX #65 SUB)	240	487	584
1114L	LANGDON	BENNETT	240	1359 TE	1495 TE
1201L	BENNETT	BCH 5L94	500	1222	1589
162.81L	BALZAC	BEDDINGTON - #162 SUB	138	287	318 TE

Note:

"CT" indicates that the transmission line is limited by current transformer.

"LTDL" indicates that the transmission line rating is long-term derated from LiDAR surveys.

"TE" indicates that the transmission line rating is limited by other terminal equipment.

The TFO provided the details of the substation transformers in the Study Area. The key transformers in the Study Area are shown in Table 4-8.

Table 4-8: Summary of Key Transformer Ratings in the Study Area

Substation Name and Number	Transformer ID	Transformer Voltages (kV)	Summer Normal Transformer Rating (MVA)	Summer Emergency Transformer Rating (MVA)
Janet 74S	T1	240/138	341.8	376
Janet 74S	T2	240/138	341.8	376
East Calgary 5S	T1	240/138	400	400
East Calgary 5S	T2	240/138	400	400
Beddington SS-162	T1	240/138	400	400
Beddington SS-162	T2	240/138	400	400
Sarcee 42S	T1	240/138/13.8	341.8	374.7
Sarcee 42S	T2	240/138/13.8	341.8	374.7
ENMX65S4	T1	240/138	400	400
ENMX65S4	T2	240/138	400	400
East Crossfield	T2	240/138	191.2	191.2

The TFO provided the details of the shunt elements in the Study Area. The key shunt elements in the Study Area are shown in Table 4-9.

Table 4-9: Summary of Key Shunt Elements in the Study Area

Substation Name and Number	Voltage Class (kV)	Capacitors		Reactors	
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVA _r)	Number of Switched Shunt Blocks	Total at Nominal Voltage (MVA _r)
East Airdrie 199S	138	1	27.17		
Dry Creek 186S	138	1	27.17		

Substation Name and Number	Voltage Class (kV)	Capacitors		Reactors	
		Number of Switched Shunt Blocks	Total at Nominal Voltage (MVar)	Number of Switched Shunt Blocks	Total at Nominal Voltage (MVar)
Crossings 511S	240	5	676 (2x128+3x140)		
Crossings 511S	138	2	160		
Enmax #2 SUB	138	2	160		
Janet 74S	240	2	268.8		
Janet 74S	138	2	146.74		
SS-14	138	2	48.91		
SS-21	138	1	48.91		
Langdon 102S	240	SVC (Continuous)	2x(108.14 to - 148.1)		
Sarcee 42S	240	2	201.6		
Sarcee 42S	138	1	48.92		
SS-31	138	1	48.11		
SS-38	138	1	48.11		
SS-41	138	1	53.96		

4.2.8 Protection Fault Clearing Times

The transient stability studies will be performed using the actual fault clearing times for the selected contingencies, as provided by the TFOs and as shown in Table 4-10. Only those contingencies shown in Table 4-10 will be studied for transient stability studies. If the TFOs did not specify the fault clearing times (e.g. for new transmission lines) for a selected contingency, then the studies for that contingency will be performed using the standard fault clearing times that are specified in Table 2-3 of the AESO's *Transmission Planning Criteria – Basis and Assumptions*.

Table 4-10: Protection Fault Clearing Times

Contingency (System Element Lost)	Fault Location	Clearing Times (Cycles)	
		Near End	Far End
688L (Summit 653S – East Airdrie 199S)	Summit 653S	7	7
688L (Summit 653S – East Airdrie 199S)	East Airdrie 199S	7	7
752L (East Crossfield 64S – Summit 653S)	East Crossfield 64S	9	30
752L (East Crossfield 64S – Summit 653S)	Summit 653S	9	30
631L (East Airdrie 199S – Dry Creek 186S)	East Airdrie 199S	9	30
631L (East Airdrie 199S – Dry Creek 186S)	Dry creek 186S	9	30
611L (Balzac 391S – Dry creek 186S)	Balzac 391S	9	30
611L (Balzac 391S – Dry creek 186S)	Dry Creek 186S	9	30
162.81L (Balzac 391S – Beddington 162S)	Balzac 391S	9	30
162.81L (Balzac 391S – Beddington 162S)	Beddington 162S	9	30
932L (Janet 74S – Beddington 162S)	Janet 74S	5.5	6.5
932L (Janet 74S – Beddington 162S)	Beddington 162S	5.5	6.5
918L (Beddington 162S – Johnson 281S)	Beddington 162S	5.5	6.5
918L (Beddington 162S – Johnson 281S)	Johnson 281S	5.5	6.5
929L (Janet 74S – Hazelwood 287S)	Janet 74S	5.5	6.5
929L (Janet 74S – Hazelwood 287S)	Hazelwood 287S	5.5	6.5
925L (Janet 74S – Red Deer 63S)	Janet 74S	5.5	6.5
925L (Janet 74S – Red Deer 63S)	Red Deer 63S	5.5	6.5

4.2.9 Project Dynamic Data

Dynamic data for the Project can be found in Attachment A7.

4.2.10 Voltage Profile Assumption

ID #2010-007RS will be used to establish system normal (i.e., pre-contingency) voltage profiles for key area busses prior to commencing any studies. Table 2-1 of the *Transmission Planning Criteria – Basis and Assumptions* applies for the busses not included in ID #2010-007RS. These voltages will be used to set the voltage profile for the study base cases prior to the power flow studies.

5 Study Methodology

The studies to be performed for this connection assessment are identified in Table 5-1.

Table 5-1: Summary of the Studies to be Performed

Scenario No. and Name		Power Flow		Voltage Stability		Transient Stability		Motor Starting		Short Circuit
		Category		Category		Category		Category		Category A
		A	B	A	B	A	B	A	B	
Pre-Project										
1	2023 SL HR Pre-Project	x	x*							
2	2023 SP HR Pre-Project	x	x*							x*
Post-Project										
3	2023 SL HR Post-Project	x	x*			x*	x*			
4	2023 SP HR Post-Project	x	x*			x*	x*			x*
5	2029 WP Post-Project									x*

Notes:

“*” indicates that the AESO will decide if the studies are needed by performing with 2021LTO cases after reviewing the Category A results.

For the engineering studies, all transmission facilities 69 kV and above, within the Study Area and the transmission lines connecting these planning areas to neighbouring planning areas will be studied and monitored to assess the impact of the Project on the performance of the AIES, including any violations of the Reliability Criteria (as defined in Section 3.1).

5.1 Power Flow Studies

Power flow studies will be performed to identify thermal and voltage criteria violations as per the Reliability Criteria, and any deviations from the limits listed in Table 3-1.

For information purposes, the Studies Consultant must also provide, as a separate file, a list of any transmission elements where the thermal loading exceeds 95% of the element’s normal rating under Category A and Category B conditions.

For the Category B power flow studies, the transformer taps and switched shunt reactive compensating devices such as shunt capacitors and reactors will be locked and continuous shunt devices will be enabled.

Voltage deviations at point-of-delivery (POD) low voltage busses will also be assessed for both the pre-Project and post-Project networks by first locking all tap changers and area shunt reactive compensating devices to identify any post-transient voltage deviations above 10%. Second, tap changers will be allowed to move while shunt reactive compensating devices remained locked to determine if any voltage deviations above 7% would occur in the area. Third, all the taps and shunt reactive compensating devices will be allowed to adjust, and voltage deviations above 5% will be reported.

The scenarios to be studied are shown in Table 5-1.

5.1.1 Contingencies to be Studied

Power flow studies will be performed for the Category A and all Category B conditions in the Study Area.

5.2 Transient Stability Studies

The Genesee generating unit 3 in Wabamun (Area 40) will be used as the reference for the studies.

The report presenting the results of the transient stability studies must provide response plots for several variables, including rotor angle, and active and reactive power output for the study area generating units. The results report must also provide the 500 kV, 240 kV and 138 kV bus voltage levels for substations near the point of connection. Other busses will be monitored and will be reported as determined by the results. The results report must also provide the key branch active and reactive power flow surrounding the Facility.

Transient stability studies will be performed for the post-Project scenarios as shown in Table 5-1. If any transient stability issues are observed, transient stability analysis will be performed for the corresponding pre-Project scenarios.

5.2.1 Contingencies to be Studied

Transient stability studies will be performed for the contingencies shown in Table 4-10

5.3 Short-Circuit Current Level Studies

A maximum fault level must be provided for the substations in the vicinity of the Project assuming normal system operation with all transmission elements in service and generation dispatched. Three-phase faults and single line-to-ground faults will be simulated. Polar coordinates and per-unit values will be used for reporting the results.

Winter peak scenarios will be used for the short-circuit studies because winter peak scenarios generally produce higher short-circuit current levels than summer peak scenarios.

Estimated maximum three-phase faults and single line-to-ground short-circuit current levels will be reported for the following substations:

- Summit 653S
- Nose Creek 284S
- East Airdrie 199S
- Dry Creek 186S
- The proposed collector substation of the Facility (Sollair 1055S)

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Further sensitivity studies, in consultation with the TFO, may be required if the primary short-circuit analysis indicates a potential to exceed or approach the existing fault rating of the transmission facilities.

The scenarios to be studied are as shown in Table 5-1.

6 Mitigation Measures

6.1 Development

Mitigation measures may be required if the post-Project study results identify system performance issues. Mitigation measures for the Project may involve modifying or adding real-time operational practices and/or remedial action schemes (RASs).

The Studies Consultant must notify the AESO of any system performance issues in a timely manner, following which the AESO Studies Engineer may instruct the Studies Consultant as follows:

- Develop tables showing the constraint effective factors³ for generation or load based on thermal criteria violations that are observed.
- Collaborate with the AESO to propose changes, if any, to the connection alternatives that could remove the requirement for a RAS.
- Collaborate with the AESO to study modifications to existing and/or planned RASs, proposed by the AESO, to ensure the coordination of existing protection schemes with the addition of any proposed protection schemes.
- Collaborate with the AESO to identify and study new RASs, if any, that may be required to ensure system reliability is maintained after connecting the Project to the AES.

The AESO Studies Engineer will work closely with the Studies Consultant and guide the development and/or modifications of the proposed mitigation measures to ensure system reliability, security and compliance with AESO ID #2018-018T, *Provision of System Access Service and the Connection Process*.

6.2 Evaluation

6.2.1 Post-Mitigation Studies

Studies to evaluate the effectiveness of mitigation measures, if required, will be performed in accordance with the technical criteria, assumptions, and methods provided in this Study Scope and in accordance with further instructions from the AESO.

6.2.2 Constraint Effective Factor Studies

Constraint effective factor analysis are used to determine the generator- and load- constraint effective factors and to identify the most effective generators or loads to manage the thermal criteria violations, if any, that are observed under Category B conditions.

³ Constraint effective factor studies are performed to determine the generator- and load- constraint effective factors. Constraint effective factors are used to estimate the ability of generators and loads to manage transmission constraints. A generator's or load's constraint effective factor is defined as the change in power flow over a specific transmission line following a change in the generator's energy production or in the load's energy consumption. The greater the constraint effective factor, the more effective a generator or load can be in managing a thermal criteria violation on the specific transmission line.

7 Changes to Study Assumptions

This study will utilize the AESO's planning base cases, which are based on the AESO's current corporate forecast (2021 LTO) with modifications to incorporate the latest forecast intelligence. Sensitivity studies or restudy may be required in the event of revisions to the AESO's corporate forecast, forecast intelligence, or other study assumptions. Additional engineering studies may also be required to assess new connection alternatives, changes to project ISD, or delays in proposed system developments. Any additional or revised study requirements shall be captured in a signed Study Scope Amendment document.

Attachment A: Transmission Planning Criteria – Basis and Assumptions



Transmission Planning Criteria – Basis and Assumptions

Date: July 9, 2019

Version: V1.2

1. Introduction

This document presents the reliability standards, criteria, and assumptions to be used as the basis for planning the Alberta Transmission System. The criteria, standards and assumptions identified in this document supersede those previously established.

2. Transmission Reliability Standards and Criteria¹

The AESO applies the following Alberta Reliability Standards to ensure that the transmission system is planned to meet applicable performance requirements under a defined set of system conditions and contingencies. A brief description of each of these standards is given below:

1. TPL-001-AB-0: System Performance Under Normal Conditions

Category A represents a normal system condition with all elements in service (N-0). All equipment must be within its applicable rating, voltages must be within their applicable ratings and the system must be stable with no cascading outages. Under Category A, electric supply to load cannot be interrupted and generating units cannot be removed from service.

2. TPL-002-AB1-0: System Performance Following Loss of a Single BES Element

Category B events result in the loss of any single element (N-1) under specified fault conditions with normal clearing. The specified elements are a generating unit, a transmission circuit, a transformer or a single pole of a direct current transmission line. The acceptable impact on the system is the same as Category A with the exception that radial customers or some local network customers, including loads or generating units, are allowed to be disconnected from the system if they are connected through the faulted element. The loss of opportunity load or opportunity interchanges is allowed. No cascading can occur.

3. TPL-003-AB-0: System Performance Following Loss of Two or More BES Elements

Category C events result in the loss of two or more bulk electric system elements (sequential, N-1-1 or concurrent, N-2) under specified fault conditions and include both normal and delayed fault clearing. All of the system limits for Category A and B events apply with the exception that planned and controlled loss of firm load, firm transfers and/or generation is acceptable provided there is no cascading.

4. TPL-004-AB-0: System Performance Following Extreme BES Events

Category D represents a wide variety of extreme, rare and unpredictable events, which may result in the loss of load and generation in widespread areas. The system may not be able to reach a new stable steady state, which means a blackout is a possible outcome. The AESO needs to evaluate these events, at its discretion, for risks and consequences prior to creating mitigation plans.

5. FAC-014-AB1-2: Establishing and Communicating System Operating Limits

The AESO is required to establish system operating limits where a contingency is not mitigated through construction of transmission facilities

¹ A complete description of the *Alberta Reliability Standards* can be found on the AESO's website: <https://www.aeso.ca/rules-standards-and-tariff/alberta-reliability-standards/>

2.1 Thermal Loading Criteria

The AESO Thermal Loading Criteria require that the continuous thermal rating of any transmission element is not exceeded under normal and post-contingency operating conditions. Thermal limits are assumed to be 100% of the respective normal summer and winter ratings. Emergency limits are not considered in the planning evaluations.

2.2 Voltage Range and Voltage Stability Criteria

The normal minimum and maximum voltage limits as specified in the following table are used to identify Category A system voltage violations, while the extreme minimum and maximum limits are used to identify Category B and C system violations. Table 2-1 presents the acceptable steady state and contingency state voltage ranges for the AIES. Table 2-2 provides voltage stability criteria used to test the system performance.

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

Nominal Voltage	Extreme Minimum	Normal Minimum	Normal Maximum	Extreme Maximum
500	475	500	525	550
240	216	234	252	264
260 (Northeast & Northwest)*	234	247	266	275
144	130	137	151	155
138	124	135	145	152
72	65	68.5	75.5	79
69	62	65.5	72.5	76

Table 2-2: Voltage Stability Criteria

Performance Level	Disturbance (1)(2)(3)(4) Initiated by: Fault or No Fault DC Disturbance	MW Margin (P-V method) (5)(6)(7)	MVAr Margin (V-Q method) (6)(7)
A	Any element such as: One Generator One Circuit One Transformer One Reactive Power Source One DC Monopole	$\geq 5\%$	Worst Case Scenario(8)
B	Bus Section	$\geq 5\%$	50% of Margin Requirement in Level A
C	Any combination of two elements such as: A Line and a Generator A Line and a Reactive Power Source Two Generators Two Circuits Two Transformers Two Reactive Power Sources DC Bipole	$\geq 2.5\%$	50% of Margin Requirement in Level A
D	Any combination of three or more elements such as: Three or More Circuits on ROW Entire Substation Entire Plant Including Switchyard	> 0	> 0

2.3 Transient Stability Analysis Assumptions

Standard fault clearing times as shown in Table 2-3 are used for the new facilities or when the actual clearing times are not available for the existing facilities. Double line-to-ground faults are applied for the Category C5 events with normal clearing times. Single line-to-ground faults are applied for Category C6 to C9 events with delayed clearing times as depicted in Table 2-4 and Table 2-5.

Table 2-3: Fault Clearing Times

Nominal (kV)	Near End (Cycles)	Far End (Cycles)
500	4	5
240	5	6
144/138 with telecommunications	6	8
144/138 without telecommunications	6	30

Table 2-4: Stuck Breaker Clearing Times for Lines

Voltage (kV)	Fault Clearing Times (Cycles)		
	Near End	Far End	2 nd Ckt (C5 and C7 only)
138/144	15	24	24
240	12	6	14
500	9	5	11

Table 2-5: Stuck Breaker Clearing Times for Transformers

Voltage (kV)	Fault Location	Fault Clearing Times (Cycles)		
		High Side	Low Side	2 nd Ckt (breaker fail)
240/138	240 kV side	12	6	14
	138 kV side	5	15	24
500/240	500 kV side	9	5	11
	240 kV side	4	12	14

Engineering Connection Assessment: Study Results

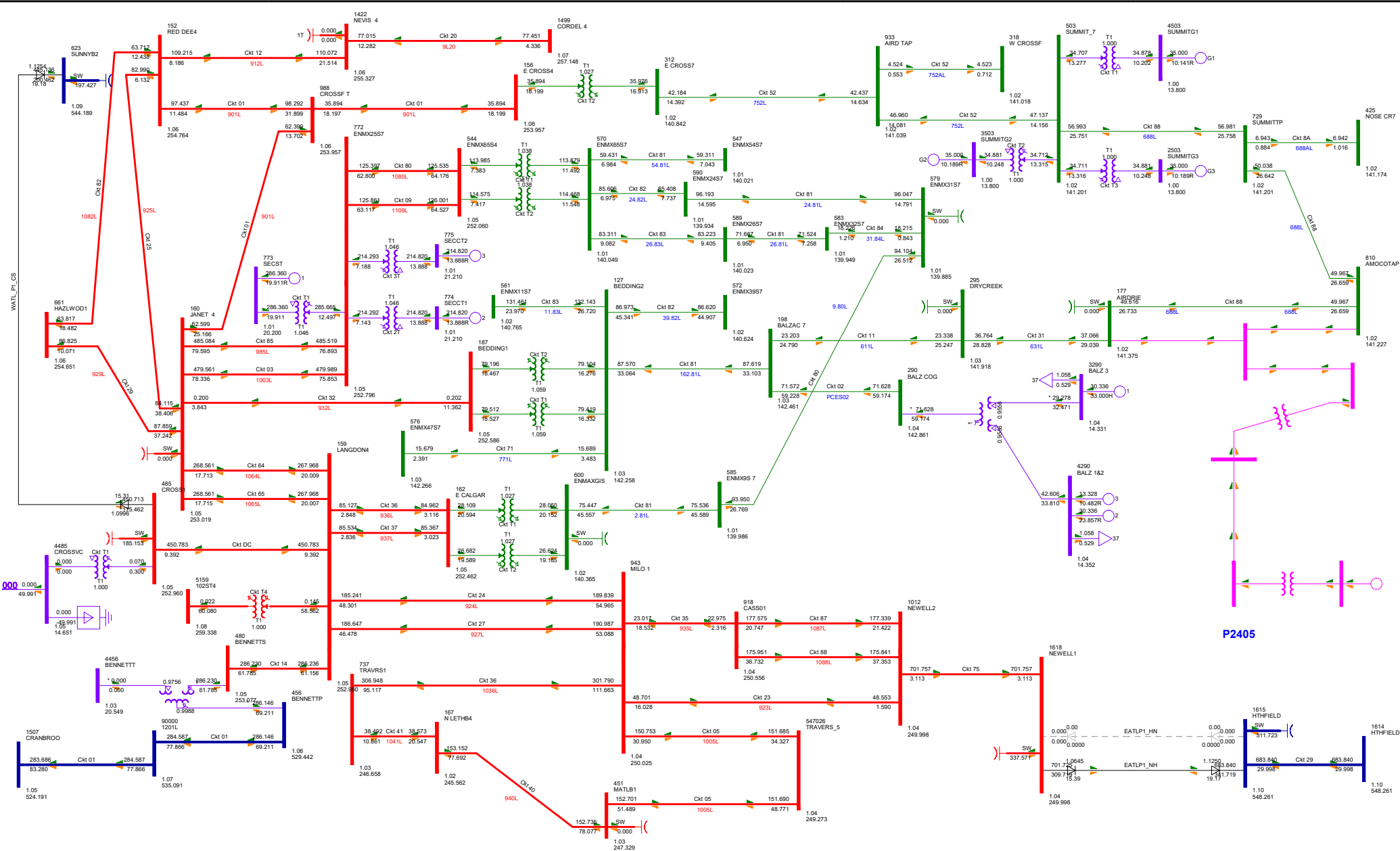
P2405 Sollair Solar Connection Project

V1D1

Attachment A2

Pre-Project Power Flow Diagrams



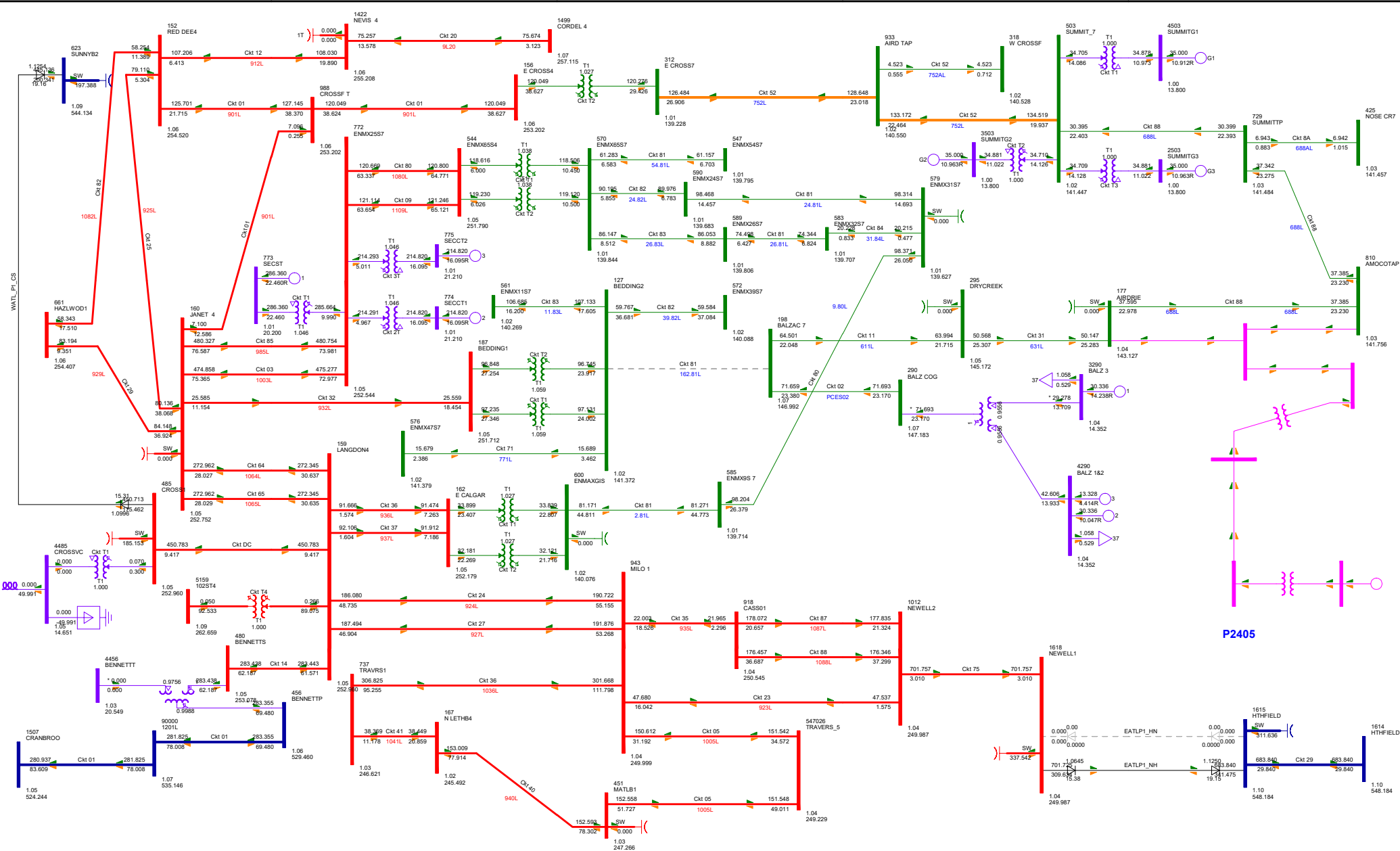


P2405 Sollair MPC Solar

BC Import:376.996 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export -13.589 MW

**FIGURE A2.1-1-N-0: NORMAL OPERATION
 2023 SUMMER LIGHT (PRE-CONNECTION)
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p)
 Branch - MW (MW) (p)
 Equipment - MW (MW) (p)
 1.000 (0.000000)
 1.000 (0.000000)
 MW = 10,000 = 100,000 = 1,000,000 = 10,000,000 = 100,000,000 = 1,000,000,000

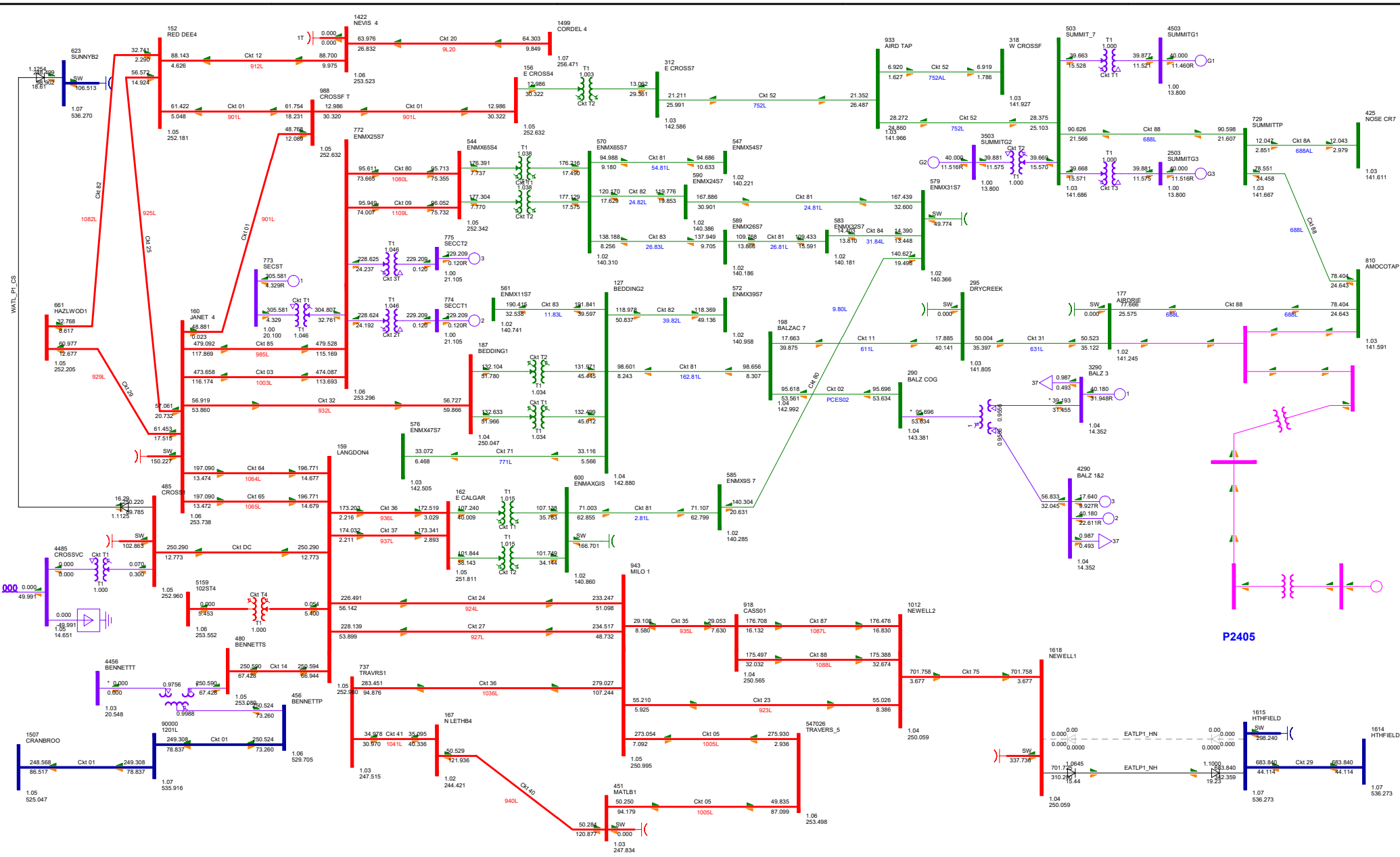


P2405 Sollair MPC Solar

BC Import:373.676 MW Sask Import:0.000 MW MATL Import:0.016 MW
 MH Export -13.589 MW

**FIGURE A2.1-2 N-1: 162.81L (BEDDINGTON TO BALZAC 391S)
 2023 SUMMER LIGHT (PRE-CONNECTION)
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (pu)
 Branch - MW (MW)
 Equipment - MW (MW)
 1.000 (1.000000)
 MW = 10,000 = 10,000 = 138,000 = 240,000 = 550,000 = 550,000



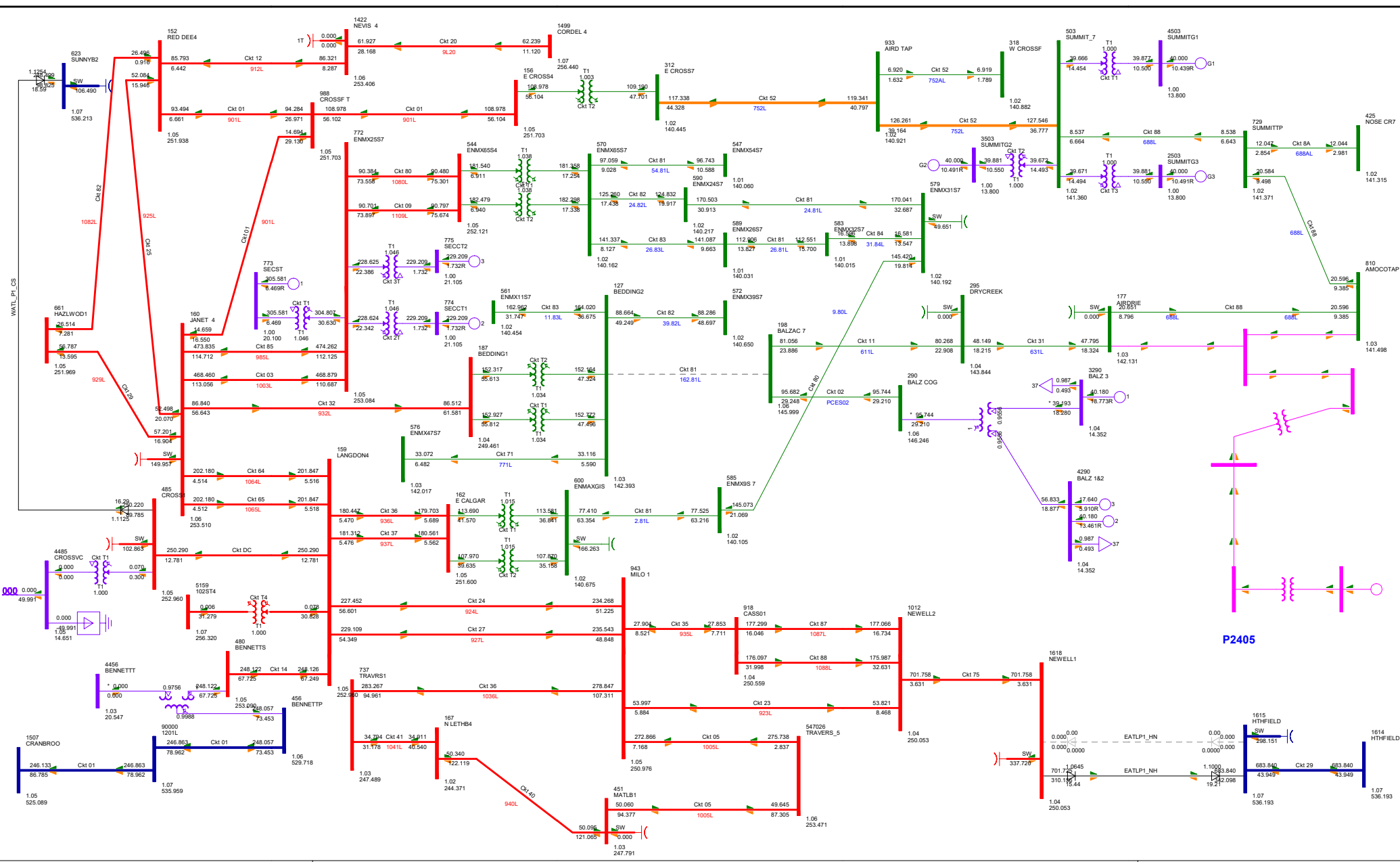
P2405

P2405 Sollair MPC Solar

BC Import:338.001 MW Sask Import:0.000 MW MATL Import:0.016 MW
 MH Export:27.199 MW

**FIGURE A2.2-1-N-0: NORMAL OPERATION
 2023 SUMMER PEAK (PRE-CONNECTION)
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV)
 Break - MW/MVA
 Equipment - MW/MVA
 Line - MW/MVA
 Loss - MW/MVA

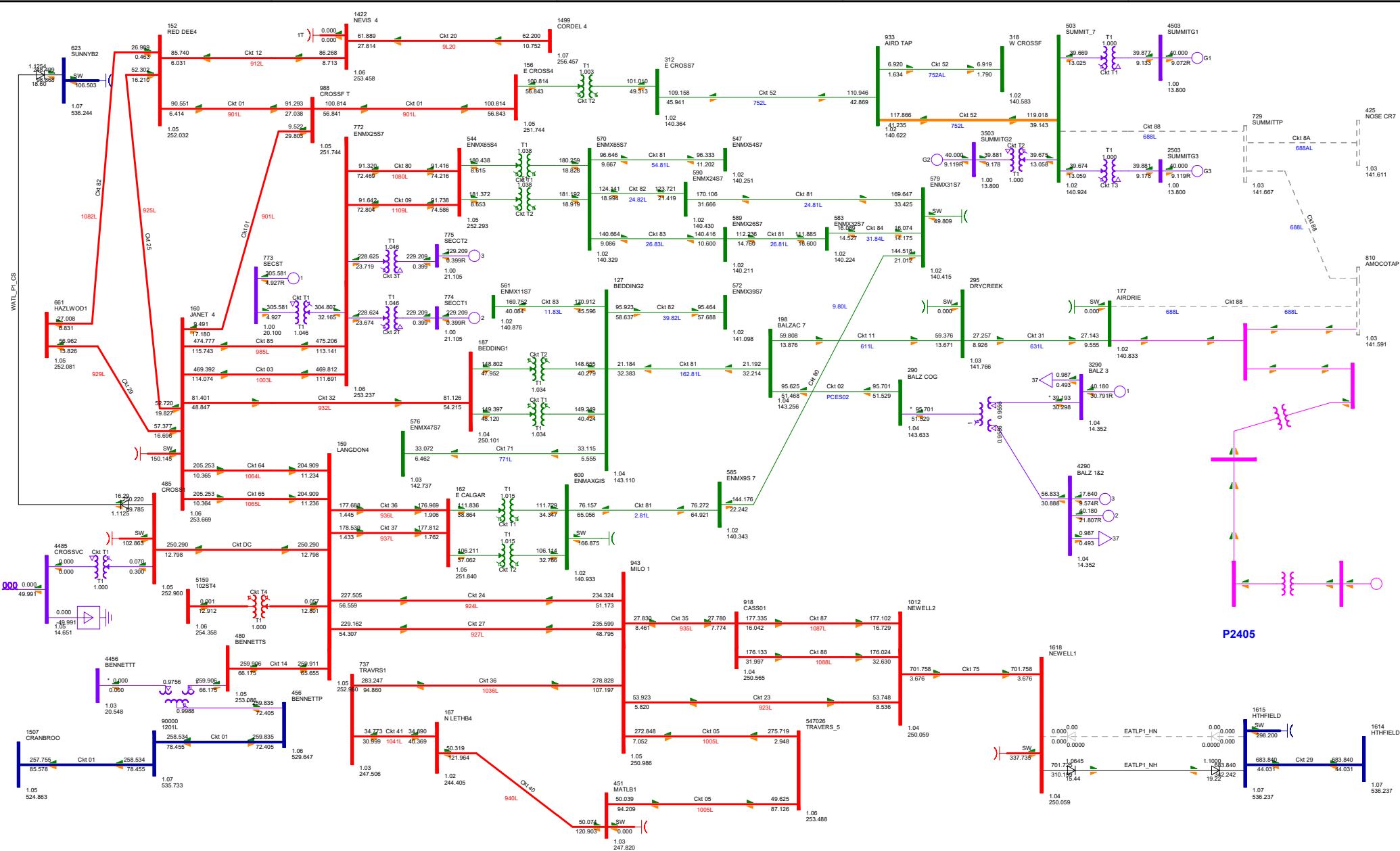


P2405 Sollair MPC Solar

**FIGURE A2.2-2 N-1: 162.81L (BEDDINGTON TO BALZAC 391S)
2023 SUMMER PEAK (PRE-CONNECTION)
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:335.036 MW Sask Import:0.000 MW MATL Import:0.016 MW
MH Export:27.199 MW

Bus - Voltage (kV) (pu)
Branch - MW (MW)
Equipment - MW (MW)
1.00 (1.000000)
MW = 10,000 = 100,000 = 1,000,000 = 10,000,000 = 100,000,000 = 1,000,000,000

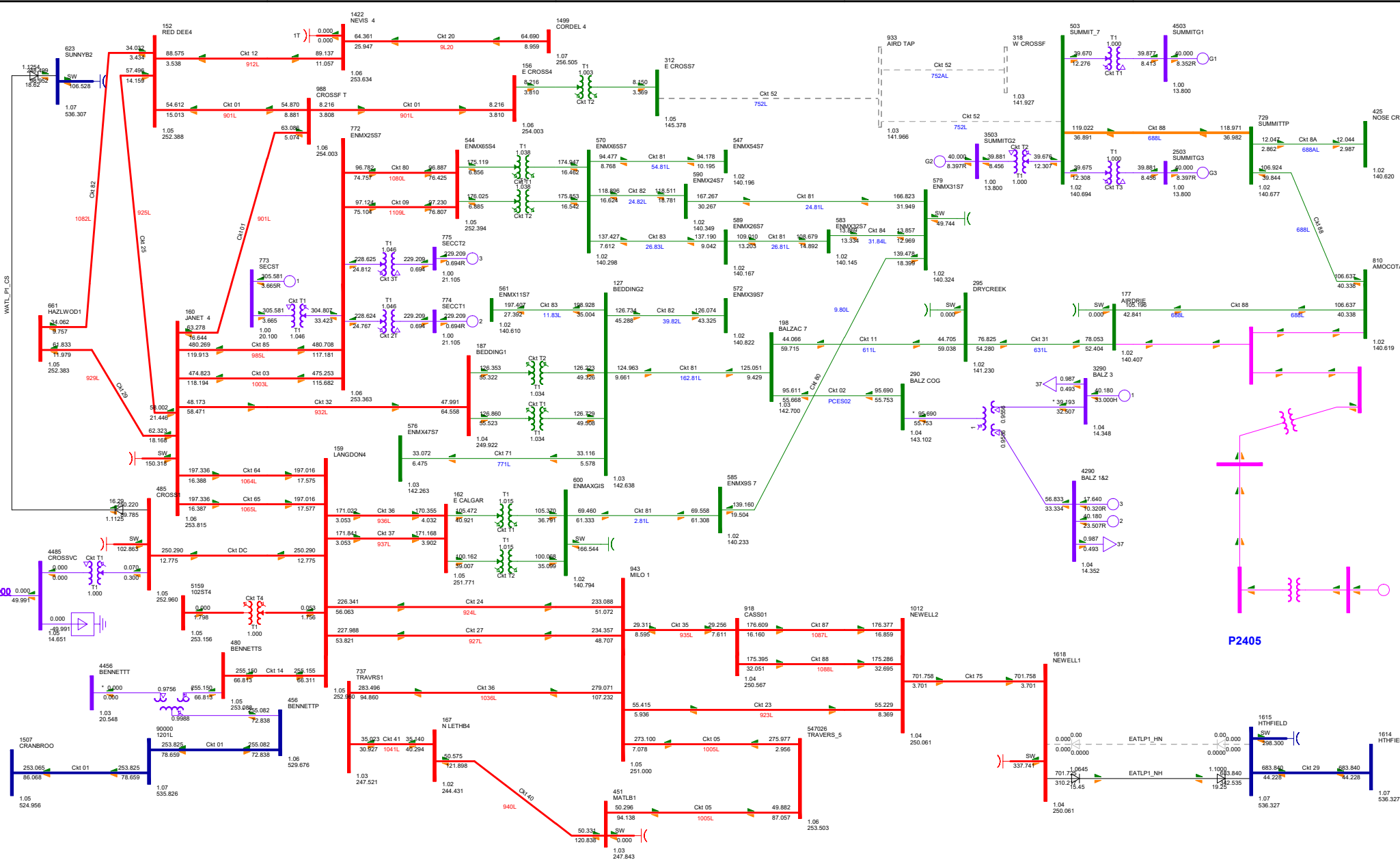


P2405 Sollair MPC Solar

**FIGURE A2.2-3 N-1:688L (SUMMIT 653S TO EAST AIRDRIE 199S)
2023 SUMMER PEAK (PRE-CONNECTION)
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:348.153 MW Sask Import:-0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV)pu
Branch - MW/Mvar
Equipment - MW/Mvar
1.000 (1.0000kV)
MW = 10.000 + 100.000 + 138.000 + 340.000 + 550.000 + 550.000



P2405 Sollair MPC Solar

BC Import:343.080 MW Sask Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

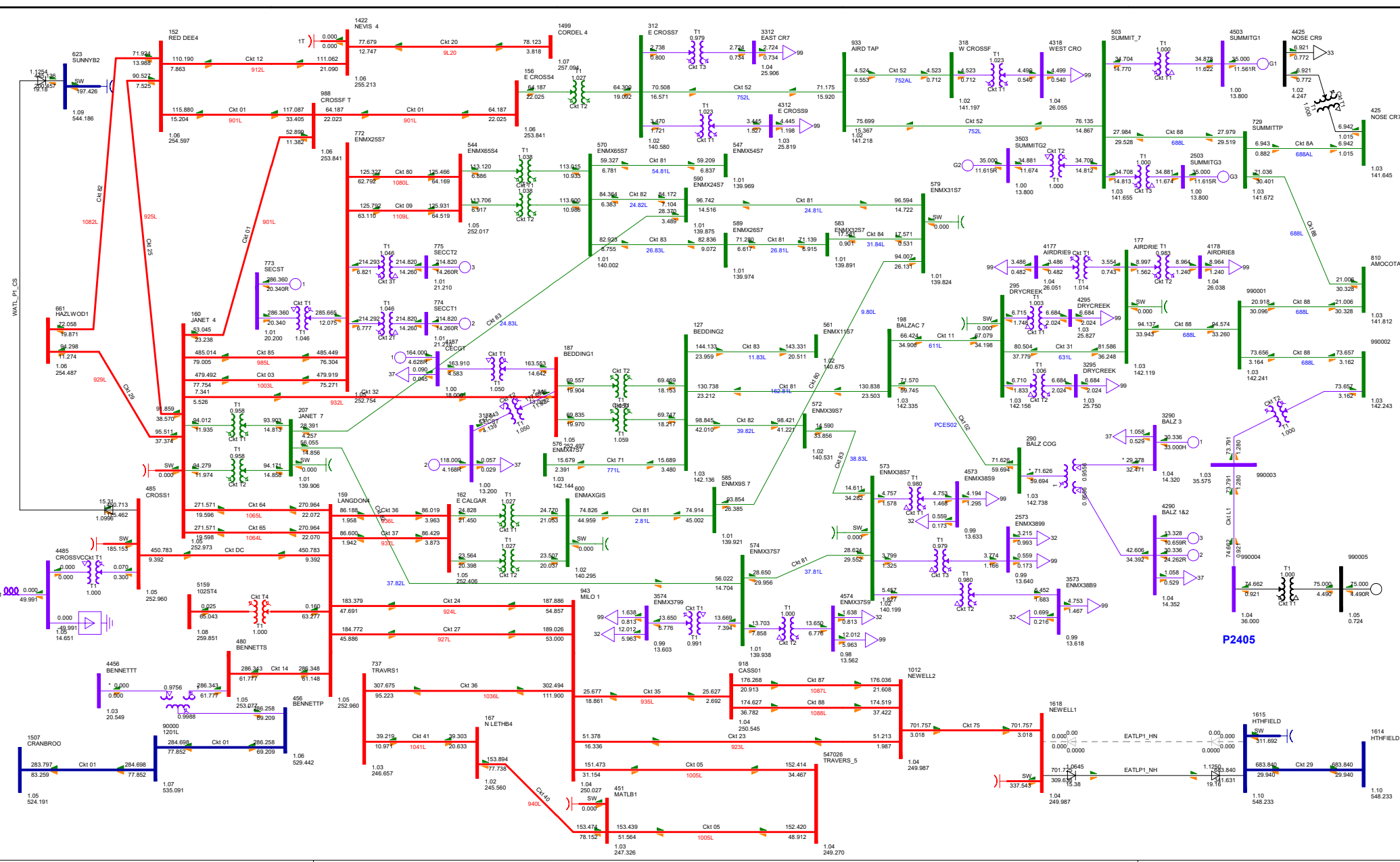
**FIGURE A2.2-4 N-1: 752L (EAST CROSSFIED 64S TO SUMMIT 65S3)
 2023 SUMMER PEAK (PRE-CONNECTION)
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV/pu)
 Breaker - MW/Mvar
 Equipment - MW/Mvar
 Transformer - MW/Mvar
 Line - MW/Mvar
 MW = 10,000 MW/Mvar = 138,000 + 340,000 + 500,000 + 500,000

Attachment A3

Post-Project Power Flow Diagrams



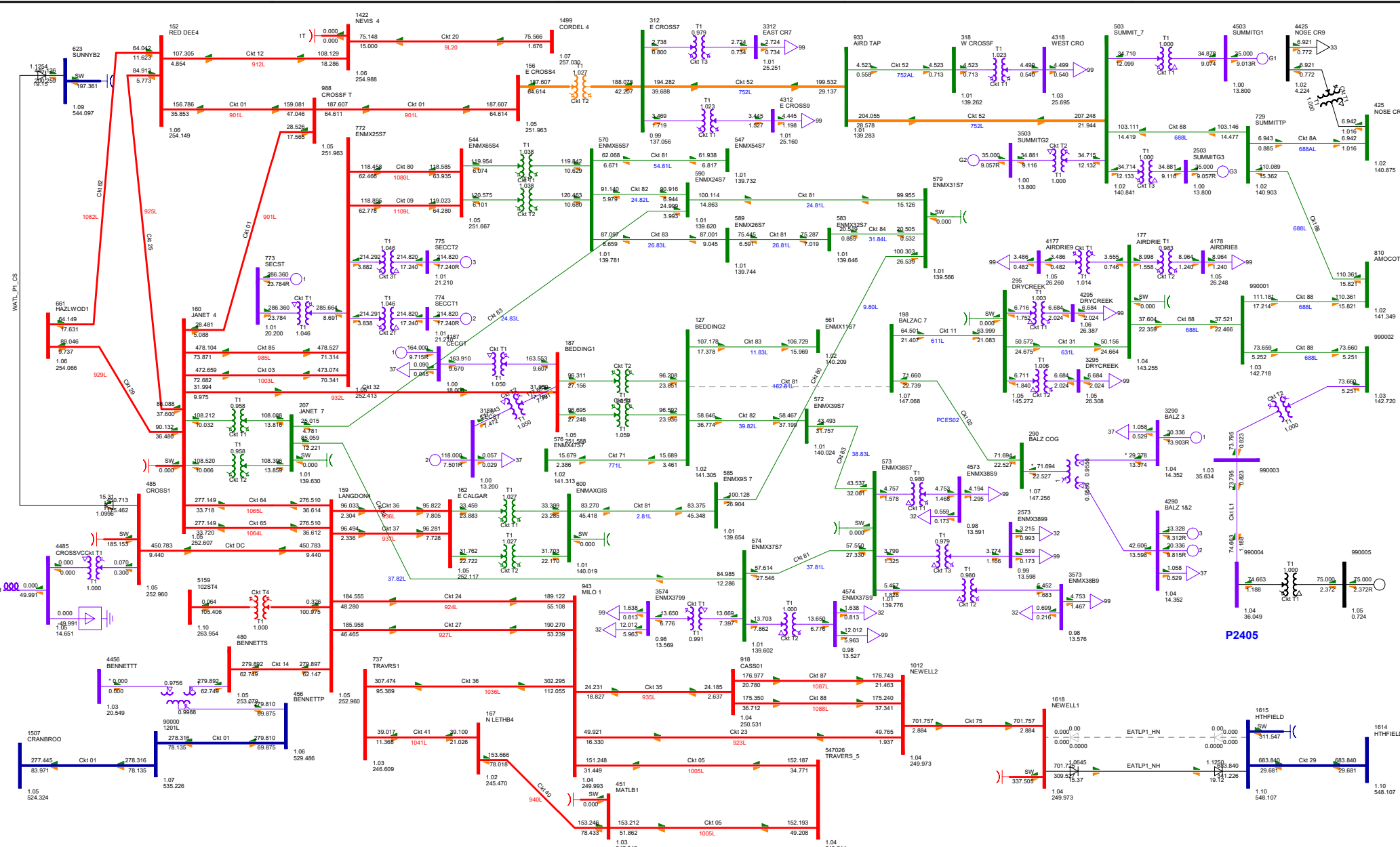


P2405 Sollair MPC Solar

BC Import:377.018 MW Ssk Import:-0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A3.1-1-N-0: NORMAL OPERATION
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p.u.)
 Branch - MW (MW)
 Equipment - MW (MW)
 Loss (MW)
 MW = 0.000+159.000+138.000+240.000+500.000+500.000

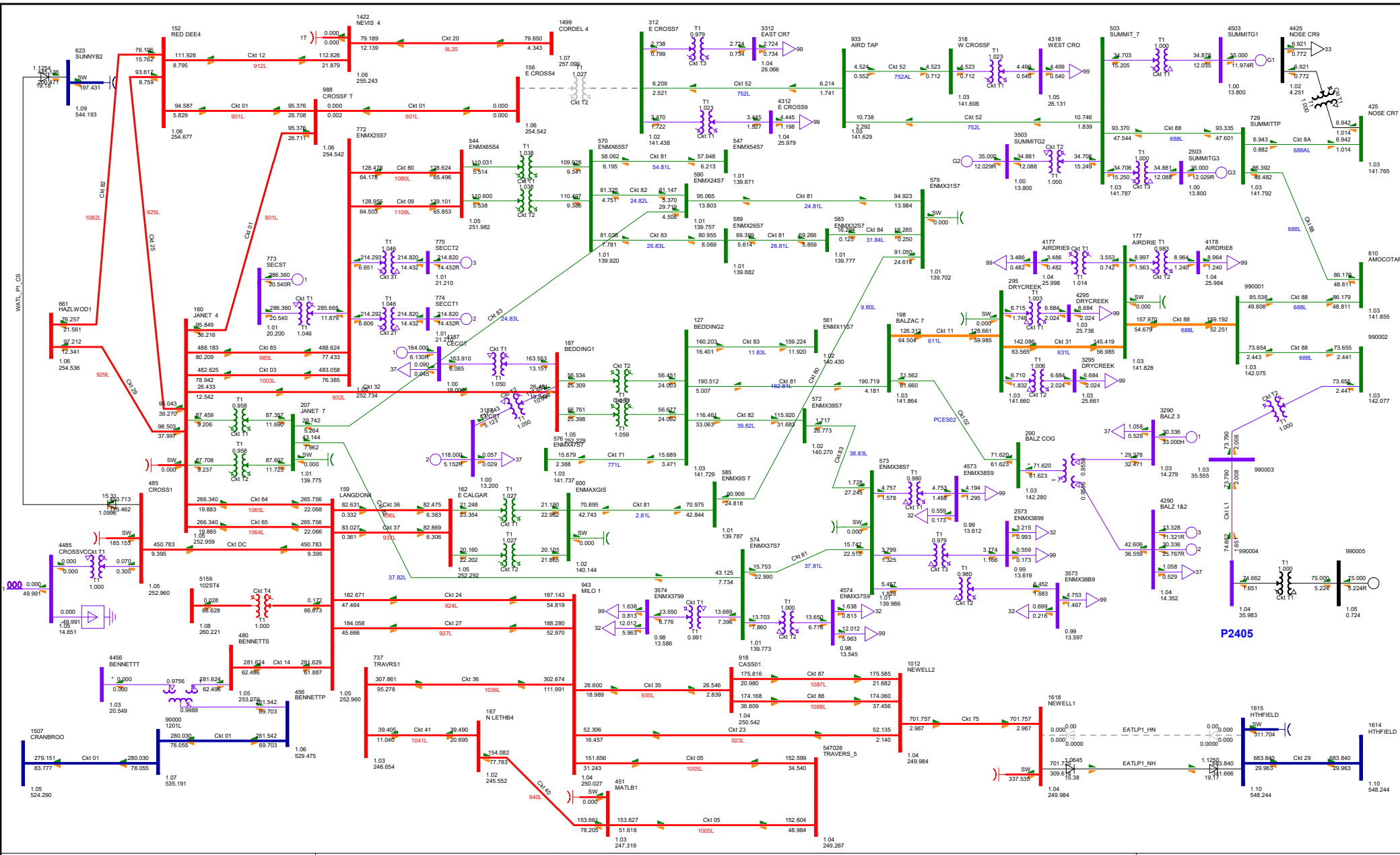


P2405 Sollair MPC Solar

BC Import:369.574 MW Sack Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

FIGURE A3.1-2 N-1: 162.81L (BEDDINGTON TO BALZAC 391S)
2023 SUMMER LIGHT (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022

Bus - Voltage (kV) (p.u.)
 Break - MW/MVA
 Equipment - MW/MVA
 1.000 (1.000000)
 MW =+3.000+169.000+138.000+240.000+500.000+500.000

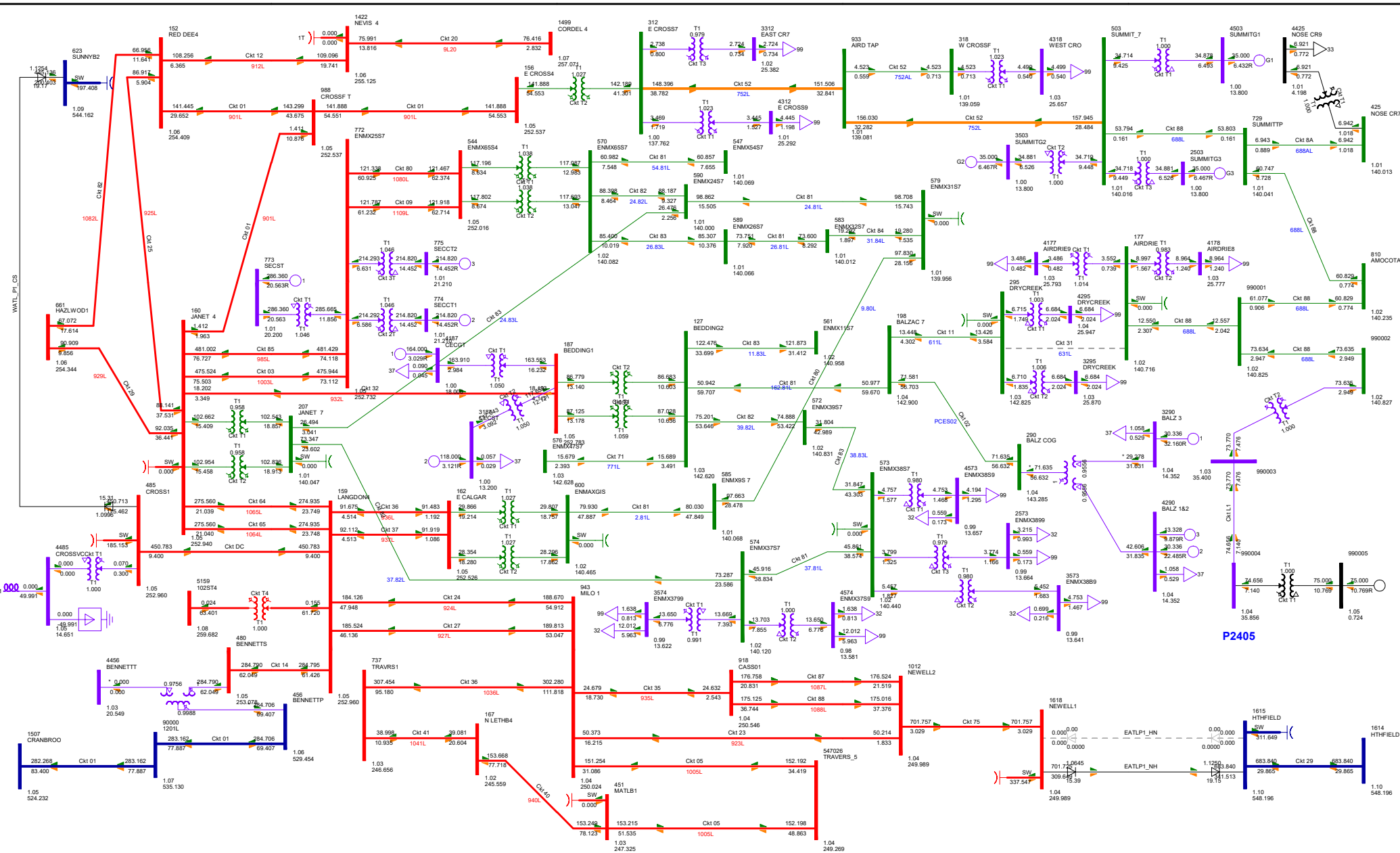


P2405 Sollair MPC Solar

FIGURE A3.1-3 N-1: 64S2 (EAST CROSSFIELD 64S TRANSFORMER T2) 2023 SUMMER LIGHT (POST-CONNECTION) - A1 PRINTED ON WEDNESDAY 30. MARCH 2022

BC Import:371.896 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

Bus - Voltage (kV/psi)
 Break - MW/MVA
 Equipment - MW/MVA
 1.000:0.00000
 MW = 0.000+169.000+138.000+240.000+500.000+500.000

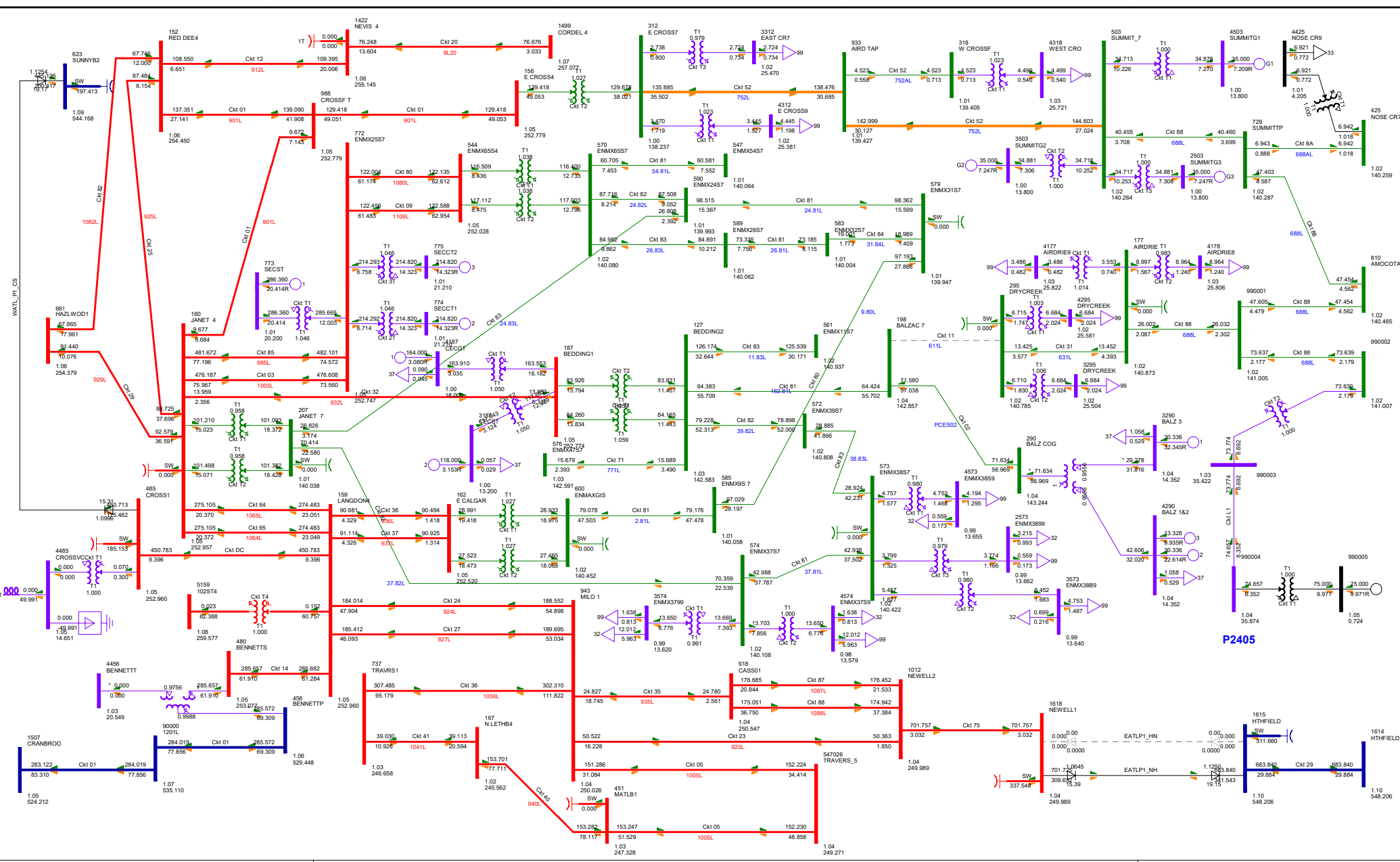


P2405 Sollair MPC Solar

BC Import:375.178 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A3.1-4 N-1: 631L (EAST AIRDRIE 199S TO DRY CREEK 186S)
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p.u.)
 Branch - MW (MW)
 Equipment - MW (MW)
 Loss - MW (MW)
 MW = 1000.000000
 MW = 1000.000000
 MW = 1000.000000
 MW = 1000.000000

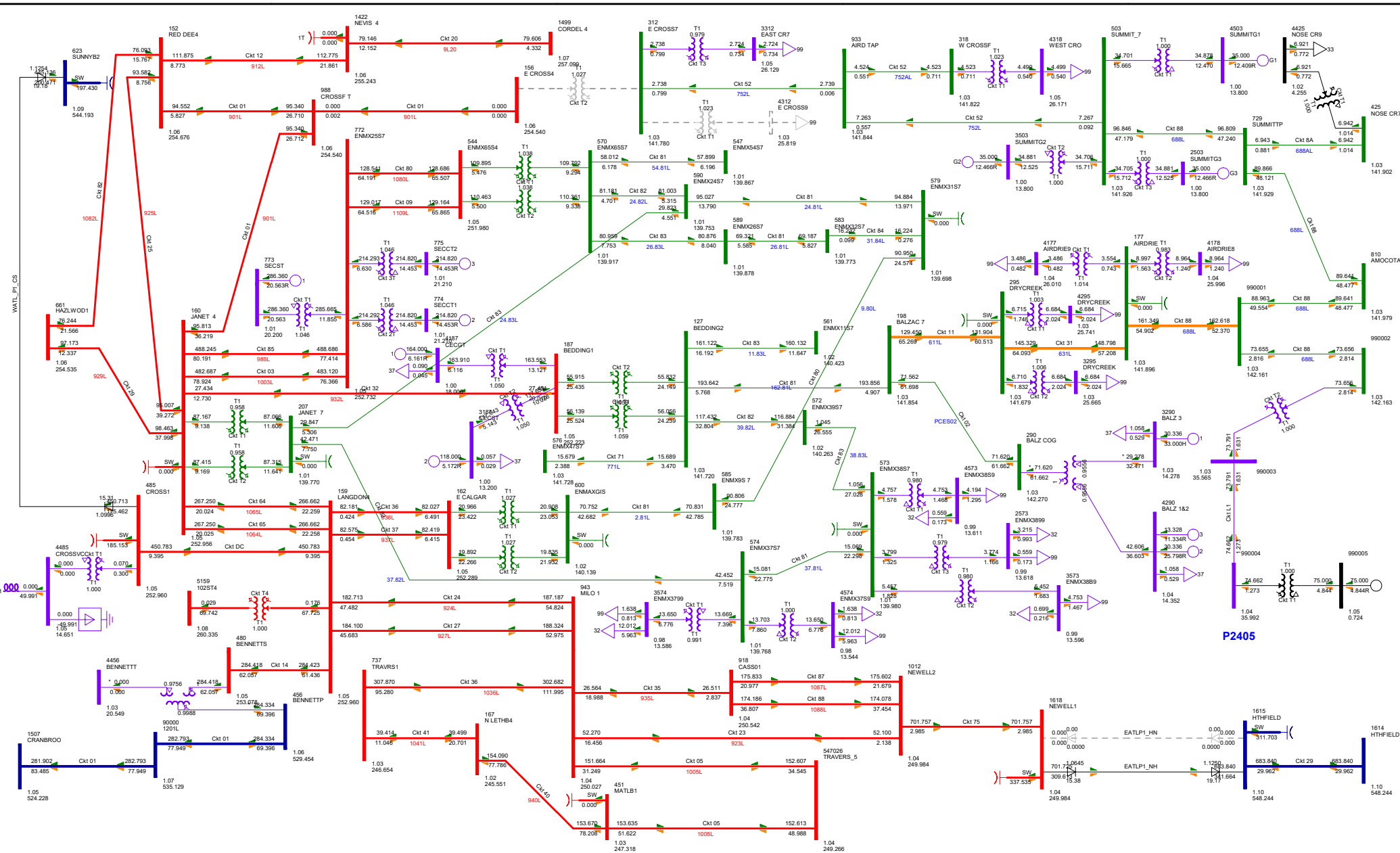


P2405 Sollair MPC Solar

BC Import:376.160 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A3.1-5 N-1:611L (BALZAC 391S TO DRY CREEK 186S)
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

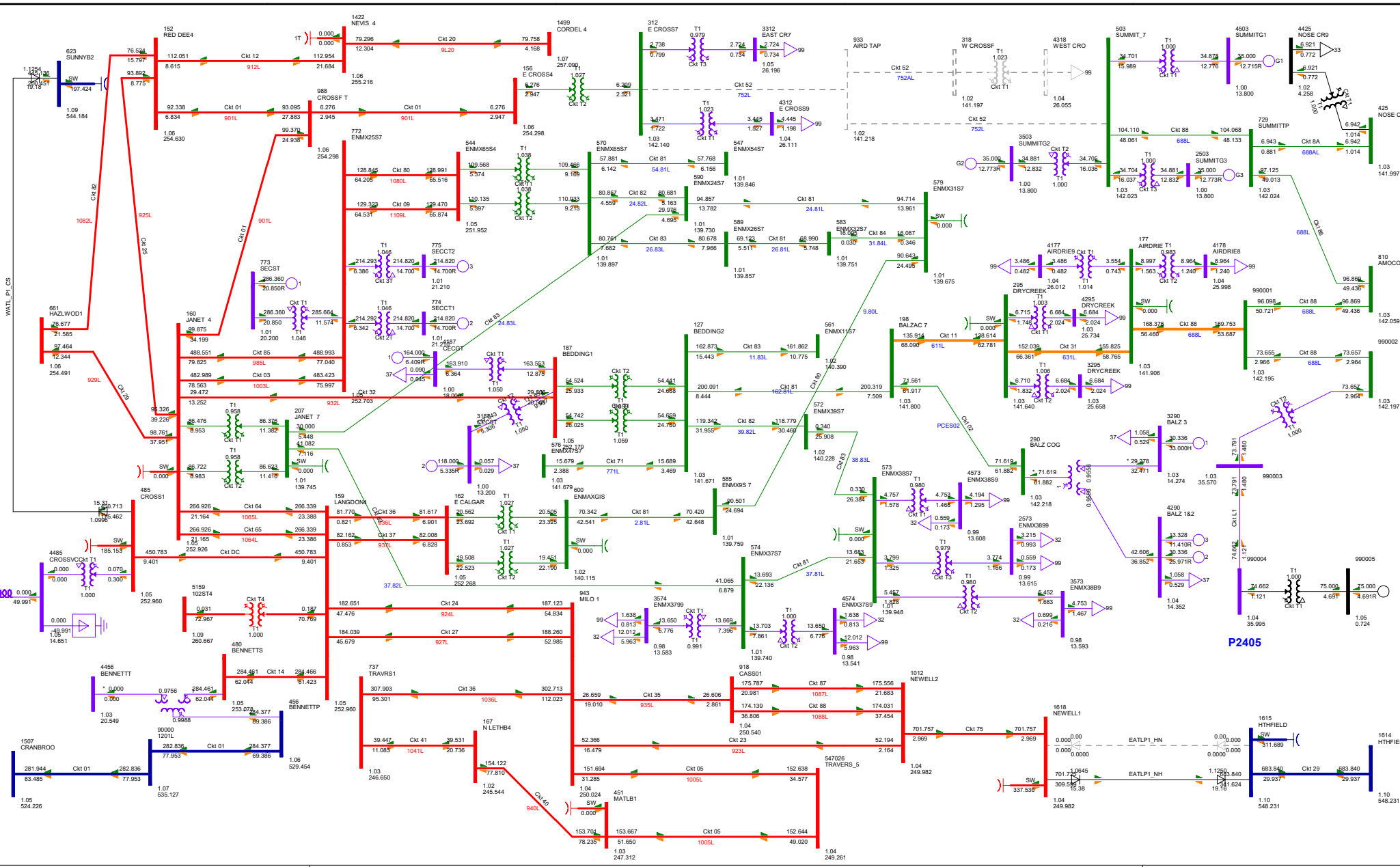
Bus - Voltage (KV) (p)
 Branch - MW (M)
 Equipment - MW (M)
 MW - MW (M)
 MW - MW (M)
 MW - MW (M)
 MW - MW (M)



P2405 Sollair MPC Solar
 BC Import:374.986 MW Ssk Import:-0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A3.1-6 N-1: EAST CROSSFIELD 64S TRANSFORMER T1
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

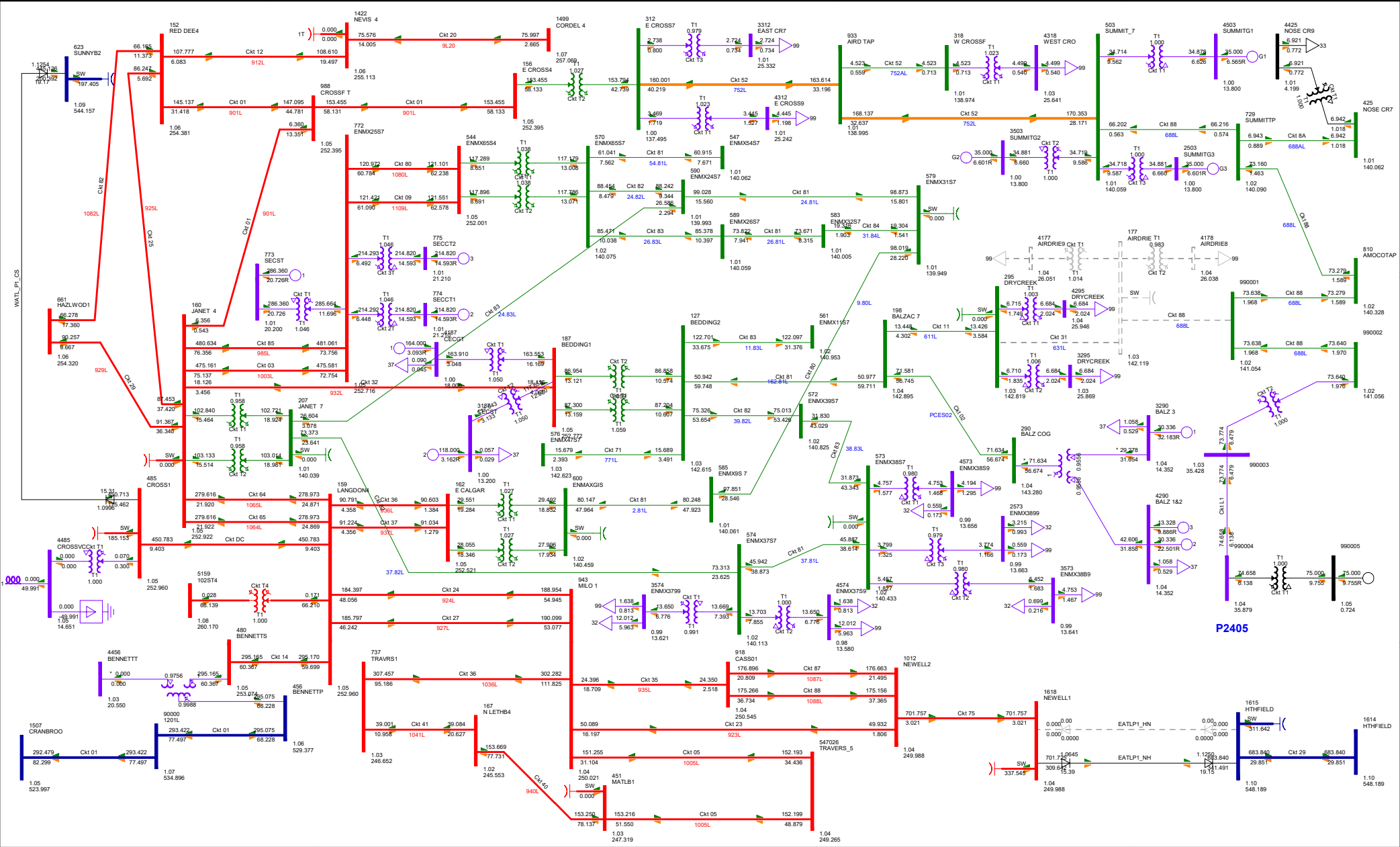
Bus - Voltage (kV) (p.u.)
 Branch - MW (MW)
 Equipment - MW (MW)
 Loss - MW (MW)
 MW = 0.000+169.000+138.000+240.000+500.000+500.000



P2405 Sollair MPC Solar
 BC Import:375.042 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

FIGURE A3.1-7 N-1: 752L (EAST CROSSFIED 64S TO SUMMIT 653S)
2023 SUMMER LIGHT (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022

Bus - Voltage (kV) (p) (n)
 Branch - MW (M) (W)
 Equipment - MW (M) (W)
 Loss (MW)
 Loss (%)
 Loss (MW) (M) (W)
 Loss (%) (M) (W)
 Loss (MW) (M) (W)
 Loss (%) (M) (W)
 Loss (MW) (M) (W)
 Loss (%) (M) (W)
 Loss (MW) (M) (W)
 Loss (%) (M) (W)

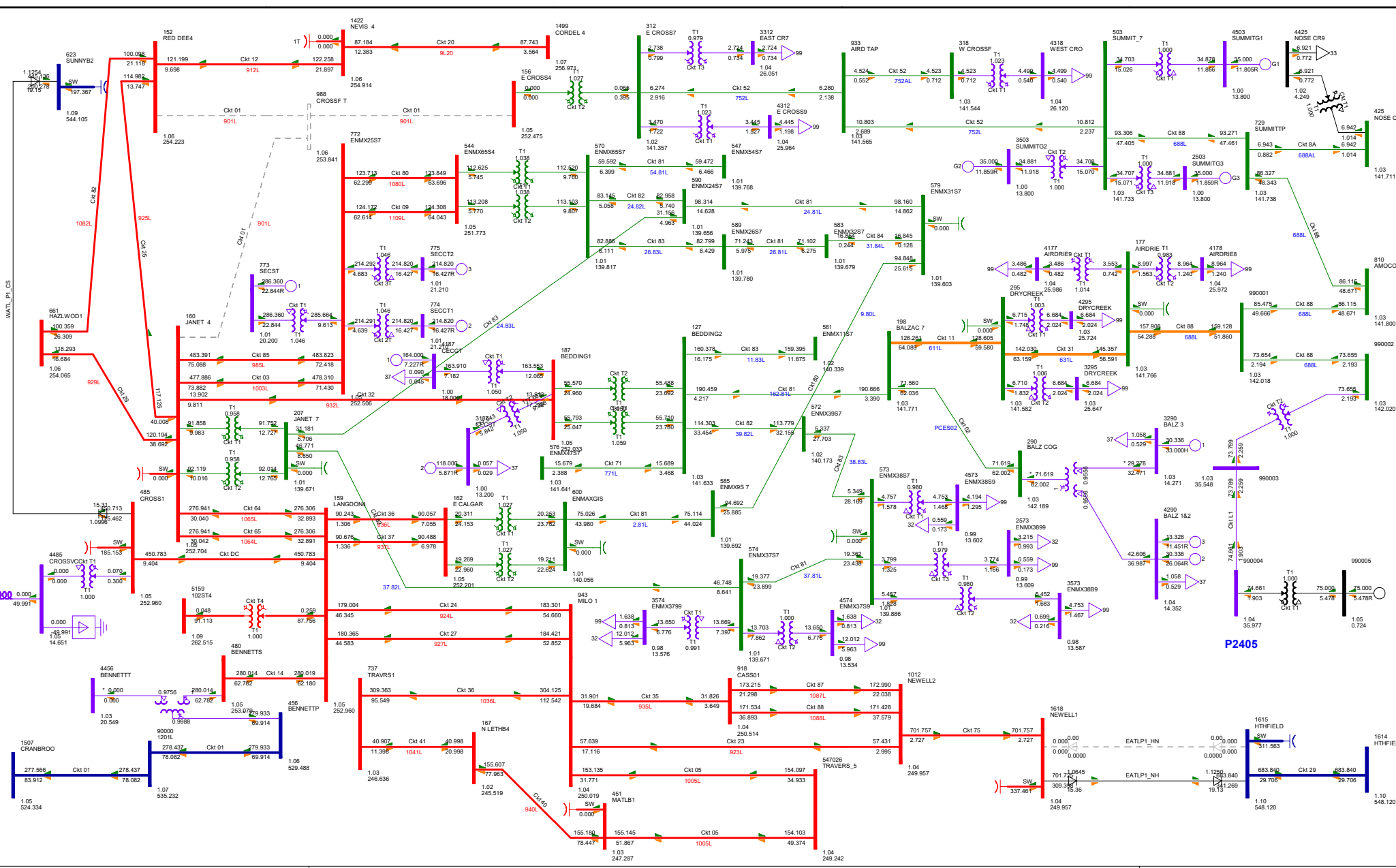


P2405 Sollair MPC Solar

**FIGURE A3.1-8 N-1: 199ST2 (EAST AIRDRIE 199S TRANSFORMER T2)
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:386.633 MW Sask Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

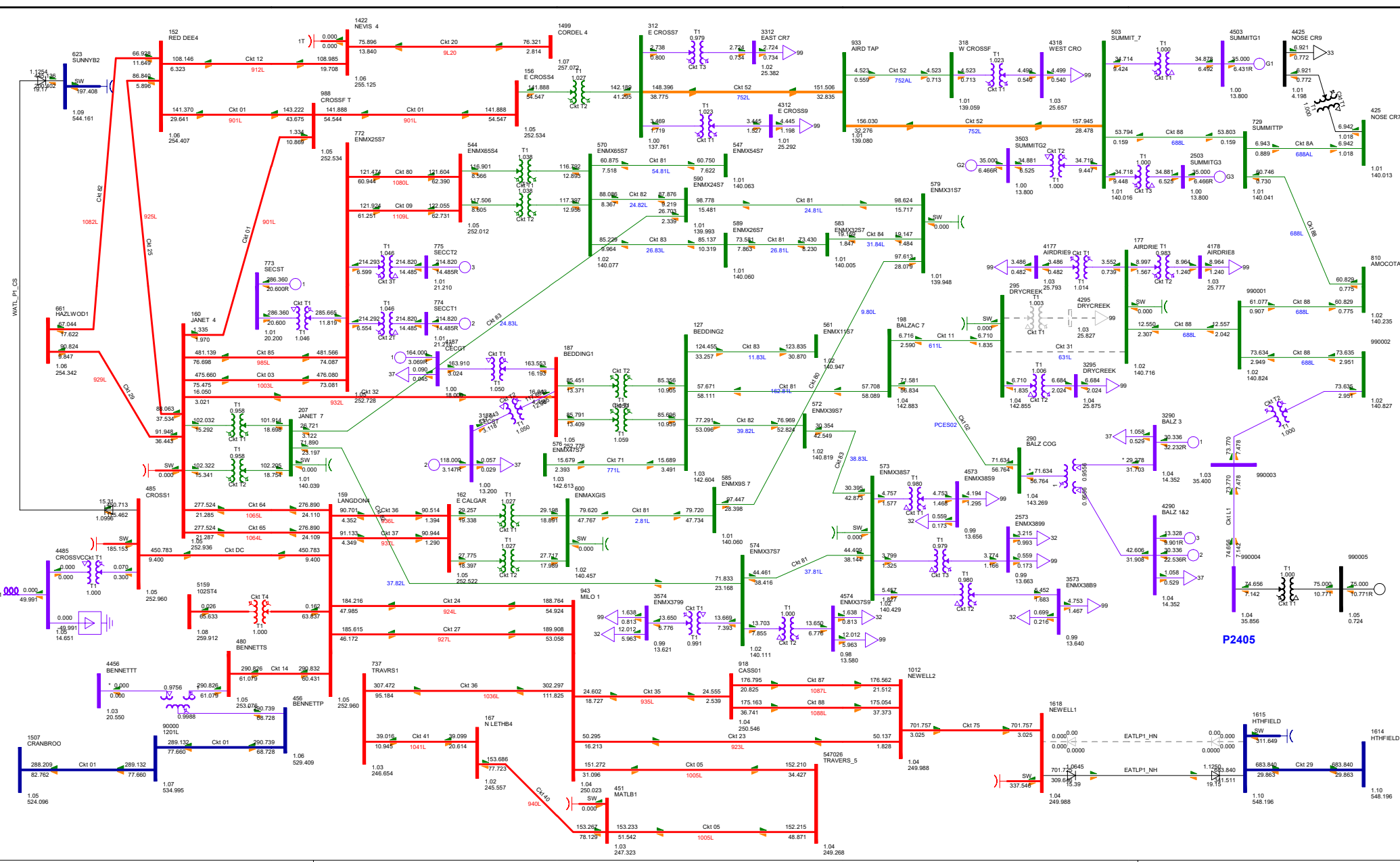
Bus - Voltage (kV)pu
 Branch - MW(MVA)
 Equipment - MW(MVA)
 100.00000000
 100.00000000
 MW = 0.0000000000 + 138.0000 + 340.0000 + 500.0000 + 500.0000



P2405 Sollair MPC Solar
 BC Import:369.711 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A3.1-9 N-1: 901L (JANET 74S TO RED DEER 63S)
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (KV/Ph)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 Loss (MW/Mvar)
 MW = 100.000000
 Mvar = 100.000000
 MW = 138.000 + 159.000 + 138.000 + 240.000 + 500.000 + 500.000

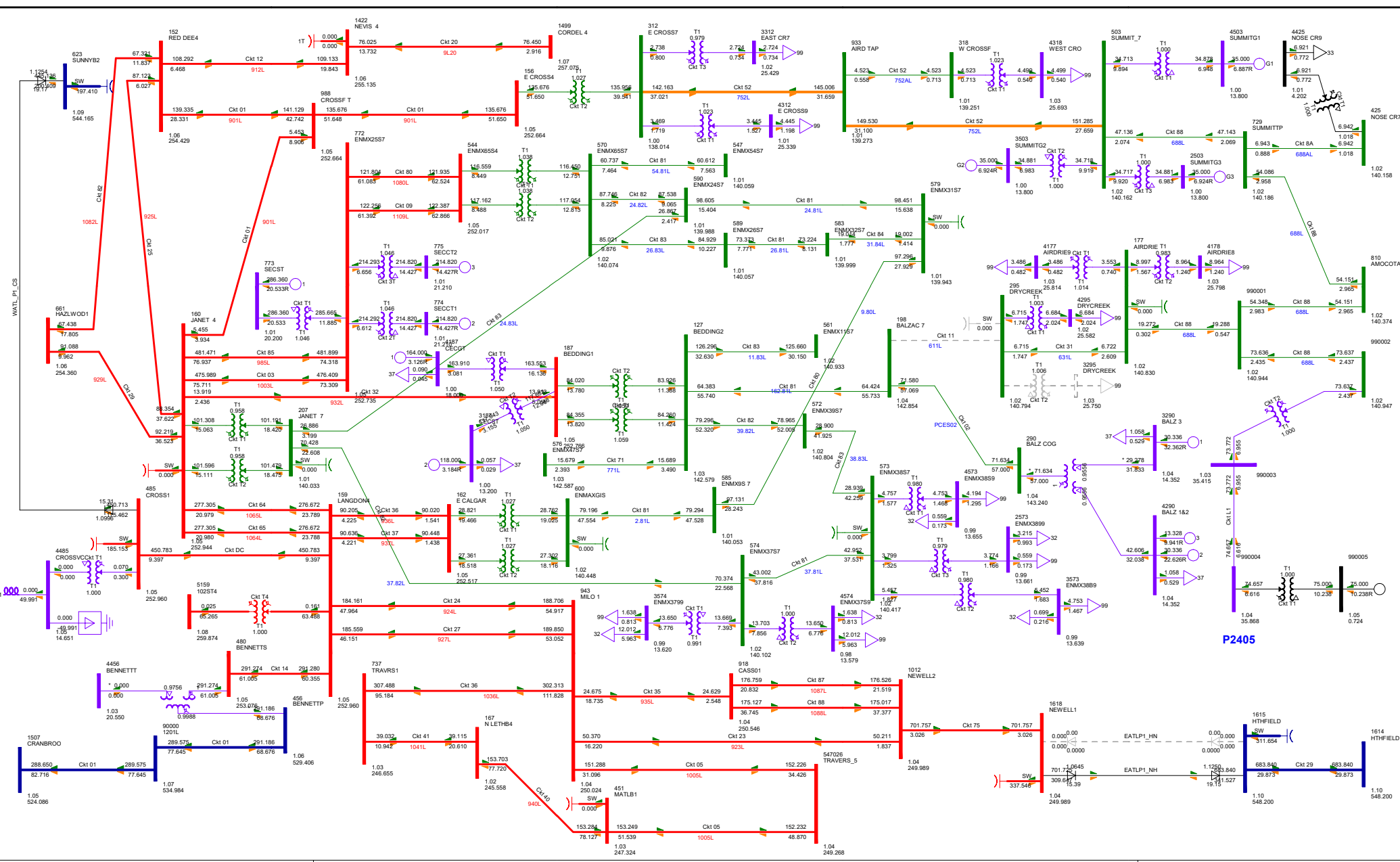


P2405 Sollair MPC Solar

BC Import:381.855 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A3.1-10 N-1: 186ST1 (DRY CREEK 186S TRANSFORMER T1)
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p) (n)
 Branch - MW (M) (p) (n)
 Equipment - MW (M) (p) (n)
 MW - MW (M) (p) (n)
 MW - MW (M) (p) (n)
 MW - MW (M) (p) (n)

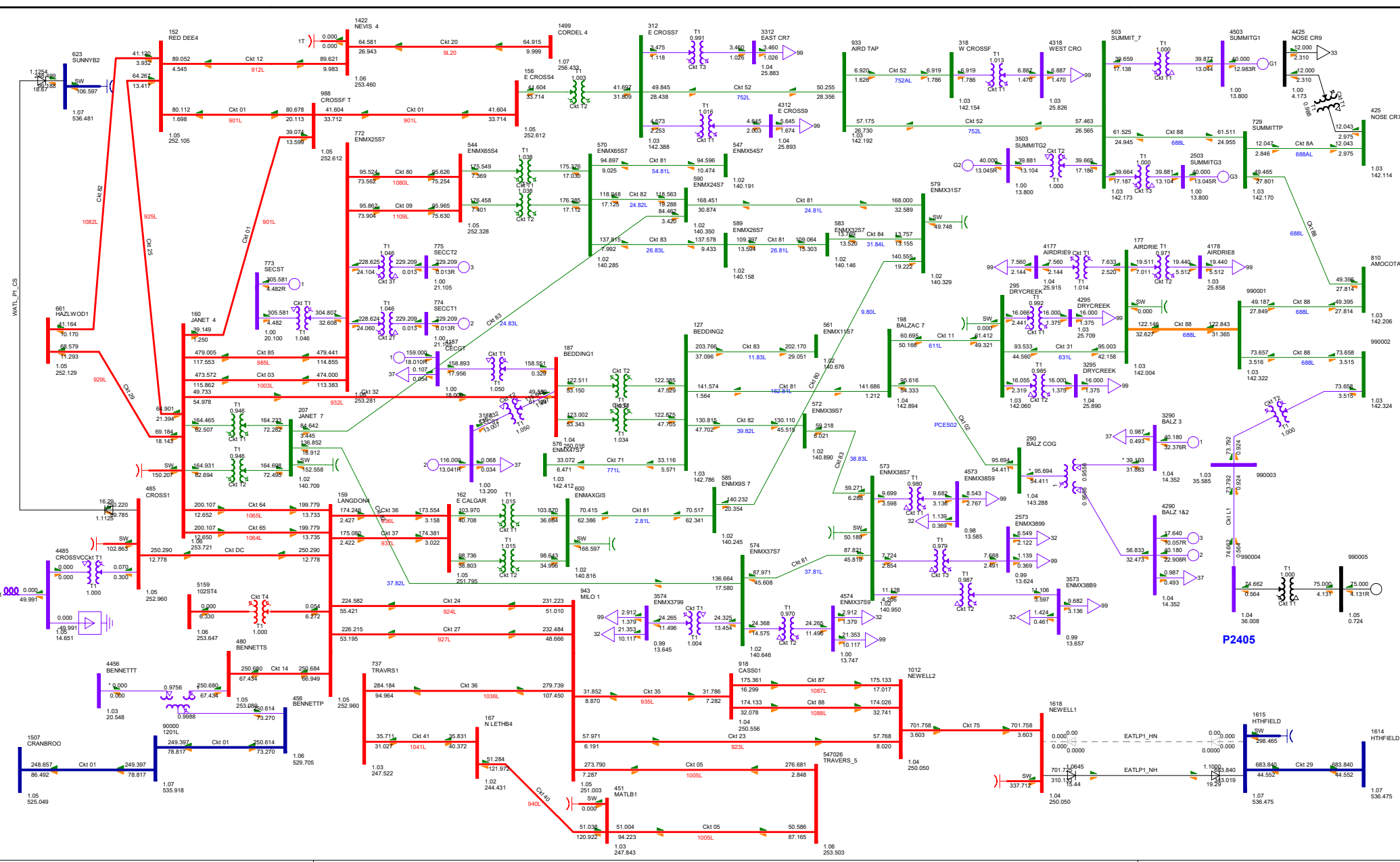


P2405 Sollair MPC Solar

BC Import:362.362 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A3.1-11 N-1: 186ST2 (DRY CREEK 186S TRANSFORMER T2)
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p.u.)
 Branch - MW (MW)
 Equipment - MW (MW)
 Loss - MW (MW)
 MW - MW (MW)
 MW - MW (MW)

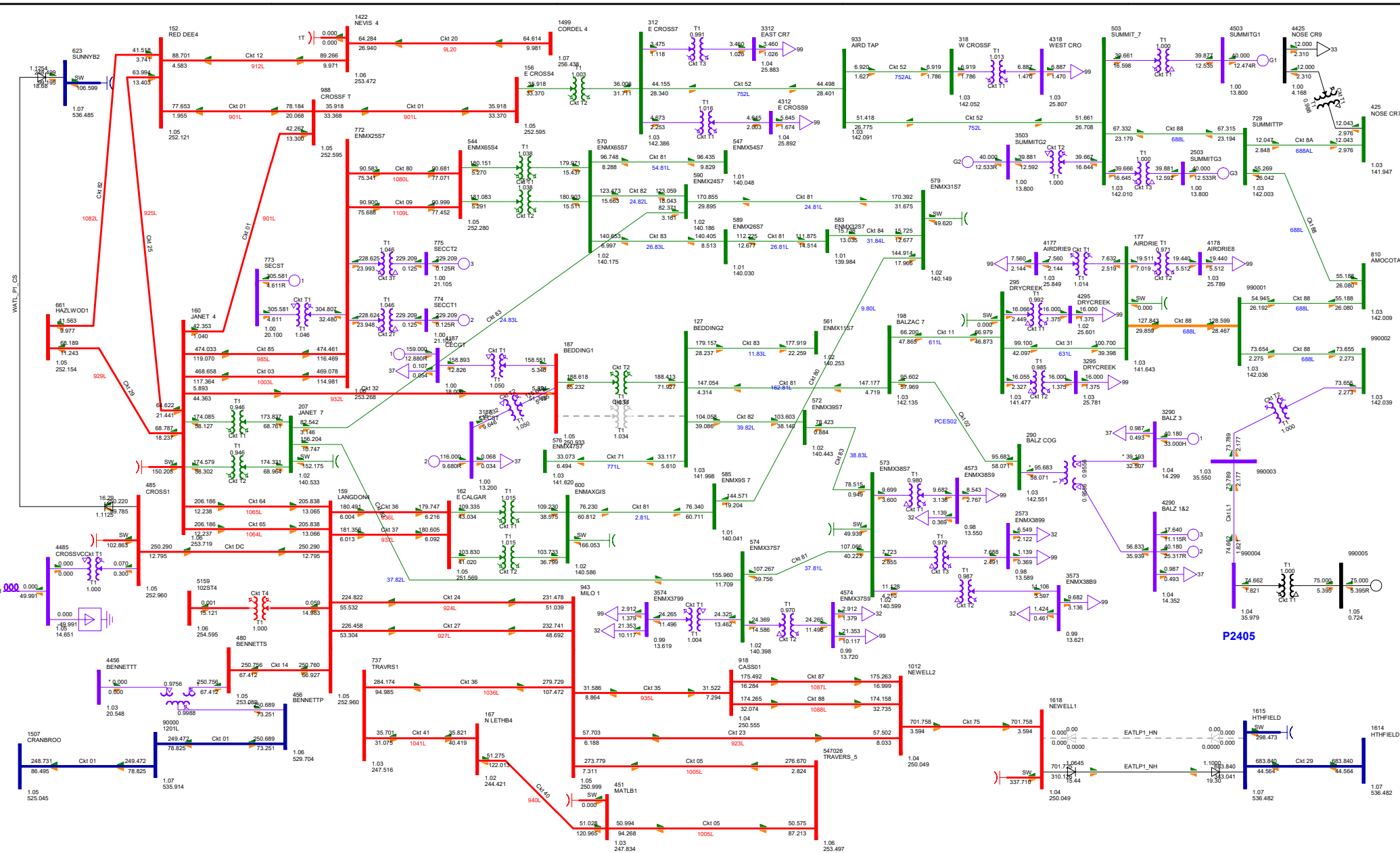


P2405 Sollair MPC Solar

BC Import:338.003 MW Ssk Import:-0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-1-N-0: NORMAL OPERATION
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p.u.)
 Branch - MW (MW)
 Equipment - MW (MW)
 Loss - MW (MW)
 MW = 0.000+159.000+138.000+240.000+500.000+500.000

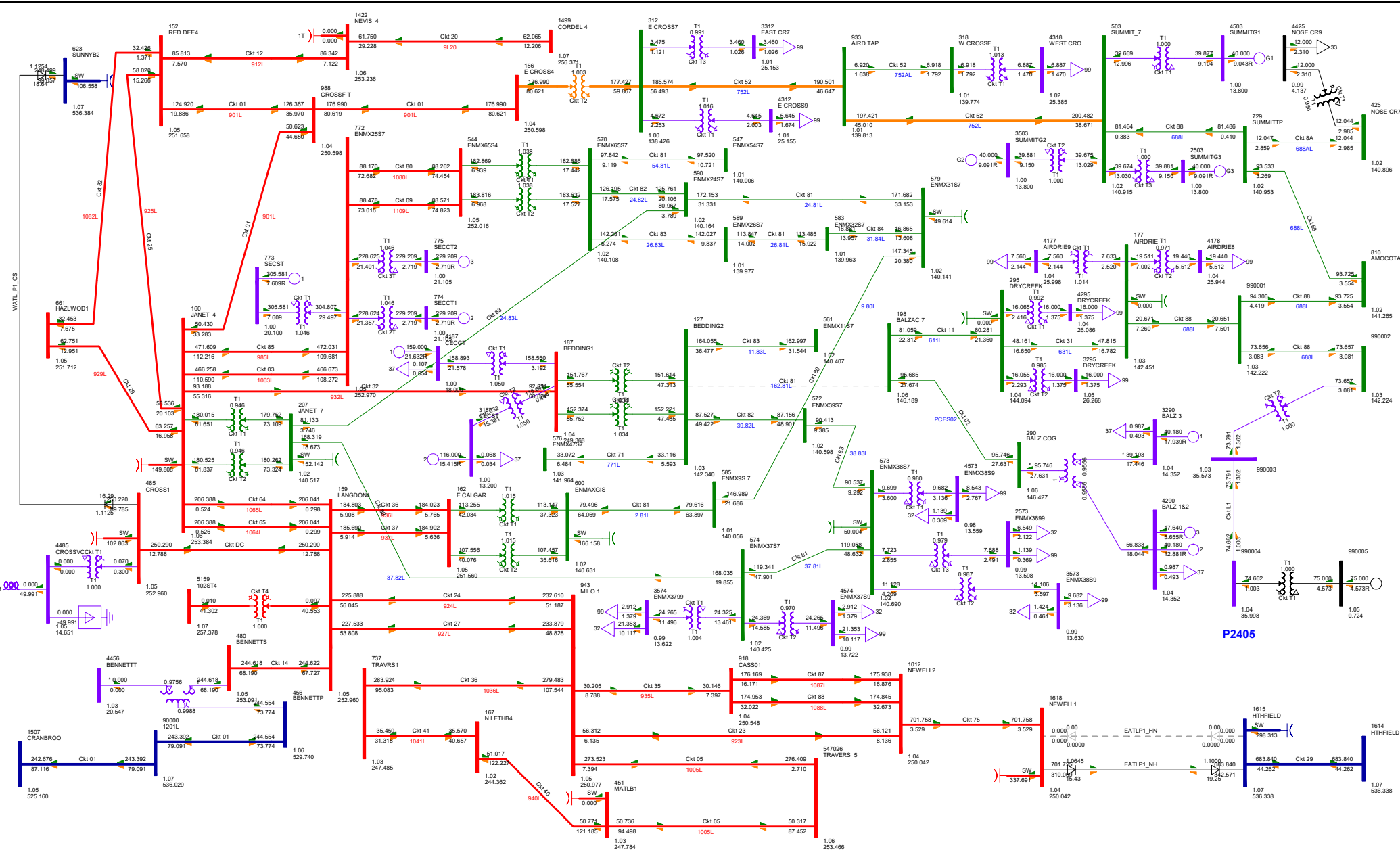


P2405 Sollair MPC Solar

**FIGURE A3.2-2 N-1:162ST1 (ENMAX 162 TRANSFORMER T1)
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:337.887 MW Ssk Import:0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p) (n)
Branch - MW (M) (W)
Equipment - MW (M) (W)
1.000 (0.000) (0.000)
MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000

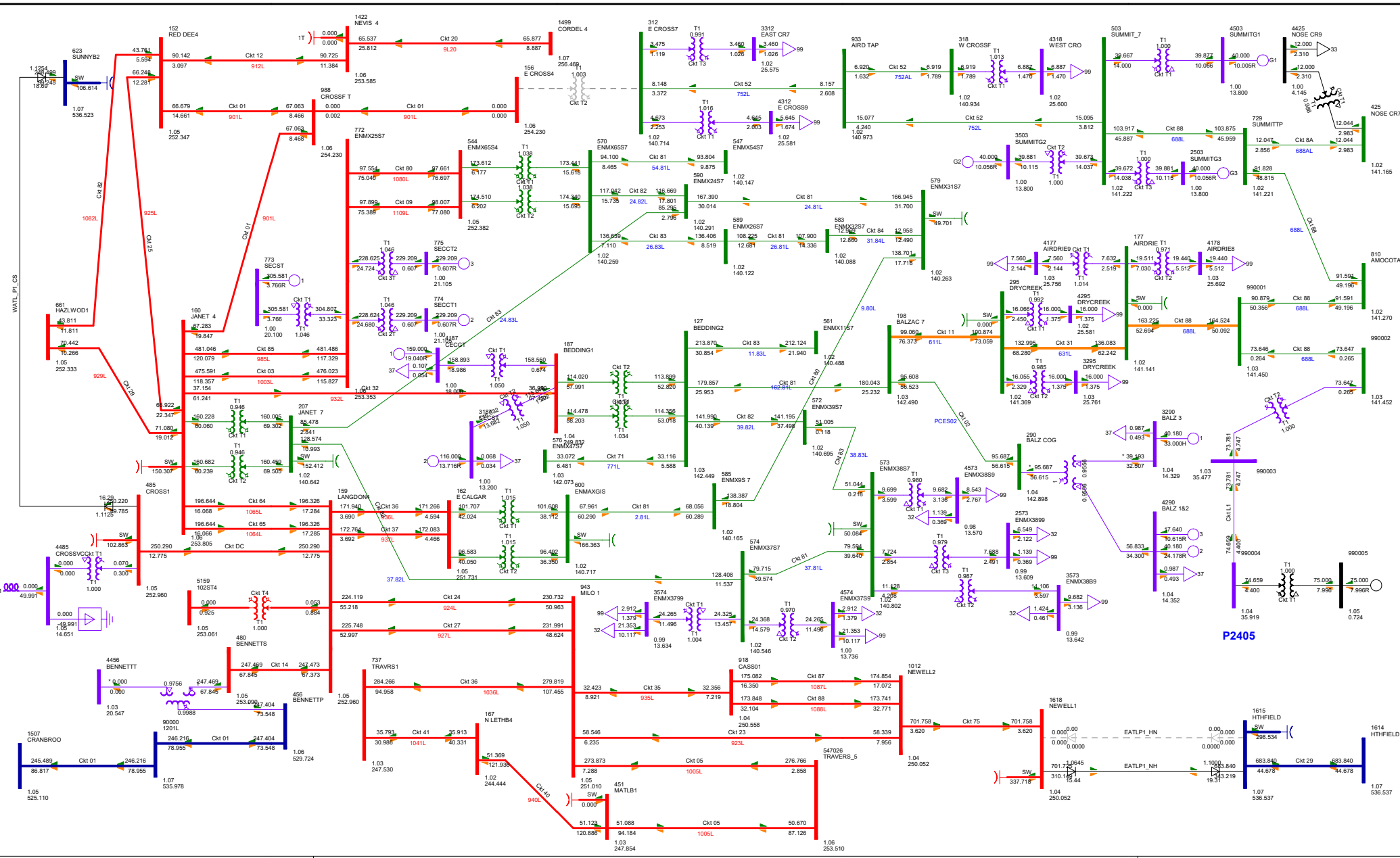


P2405 Sollair MPC Solar

**FIGURE A3.2-3 N-1: 162.81L (BEDDINGTON TO BALZAC 391S)
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:330.980 MW Sask Import:0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p.u.)
Branch - MW/Mvar
Equipment - MW/Mvar
1.000 = 0.000000
MW = 0.000000+0.000000+138.000+240.000+500.000+500.000

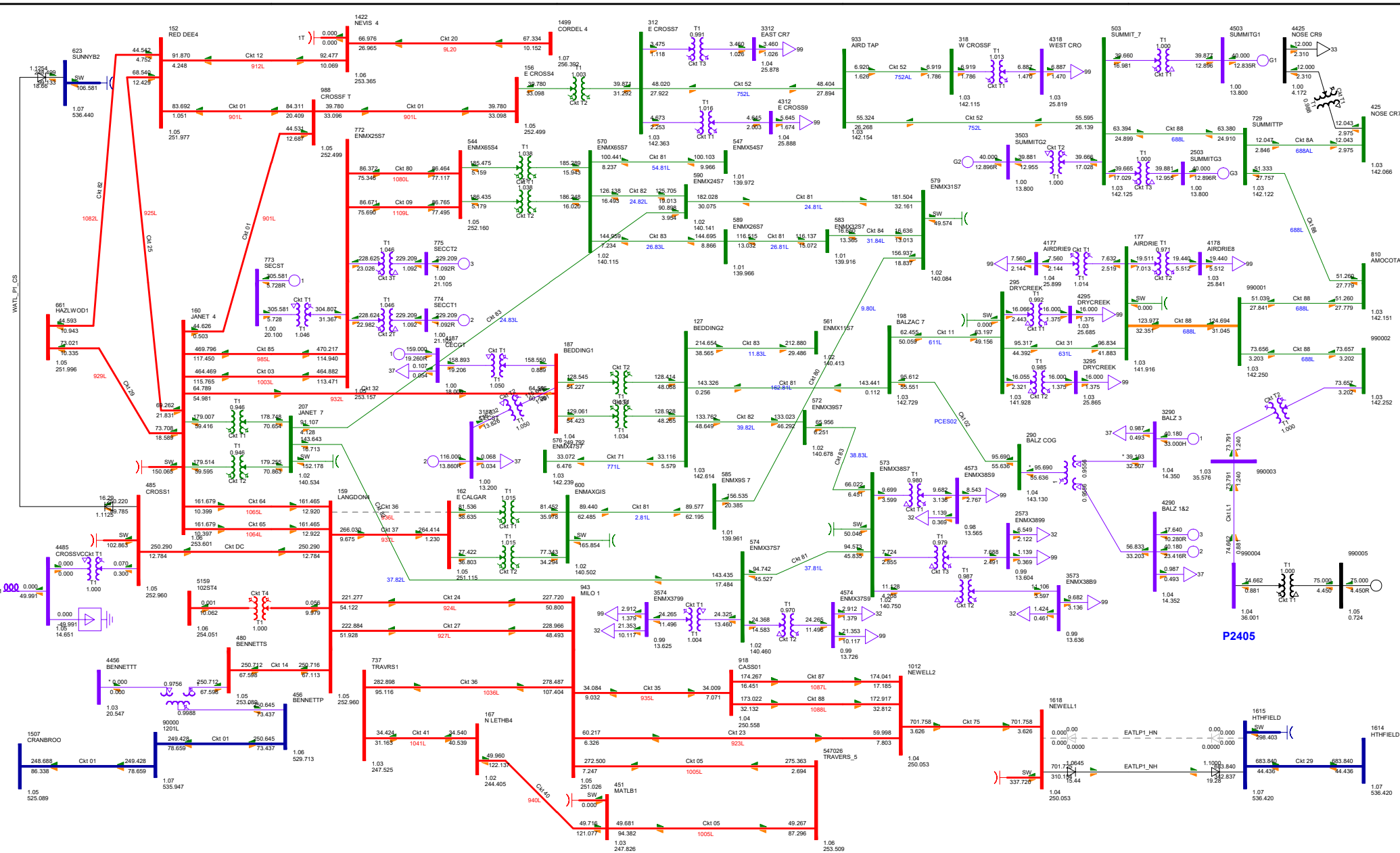


P2405 Sollair MPC Solar

BC Import:334.512 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-4 N-1: 64S2 (EAST CROSSFIELD 64S TRANSFORMER T2)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

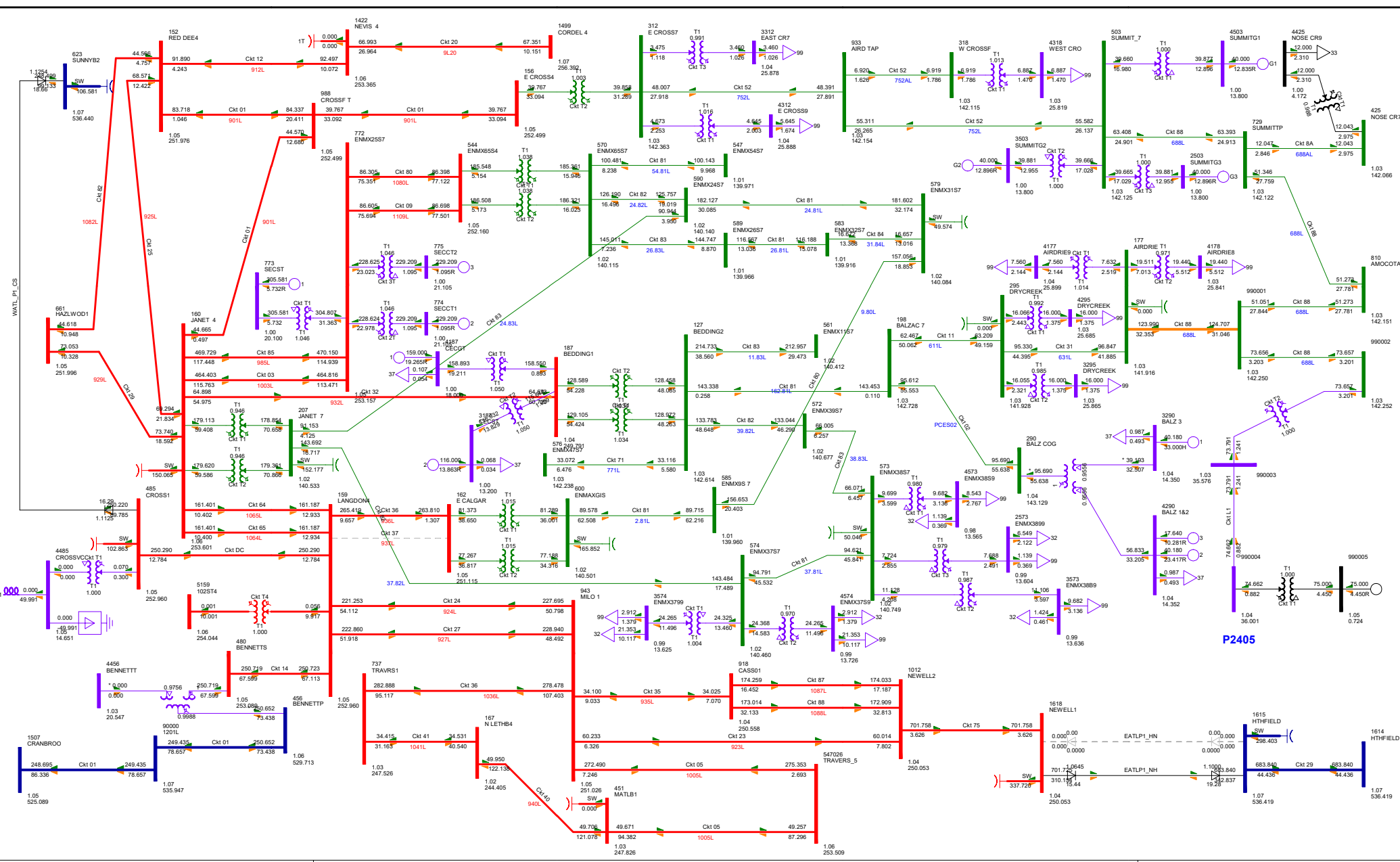
Bus - Voltage (kV) (p.u.)
 Branch - MW (MW)
 Equipment - MW (MW)
 Loss - MW (MW)
 MW = 1000.000000
 MW = 138.000 + 240.000 + 500.000 + 500.000



P2405 Sollair MPC Solar
 BC Import: 336.351 MW Ssk Import: -0.000 MW MATL Import: 0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-5 N-1:936L (LANGDON 102S TO EAST CALGARY 5S)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p.u.)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 1.000 (0.000000)
 MW = 0.000000+0.000000+138.000000+240.000000+500.000000+500.000000

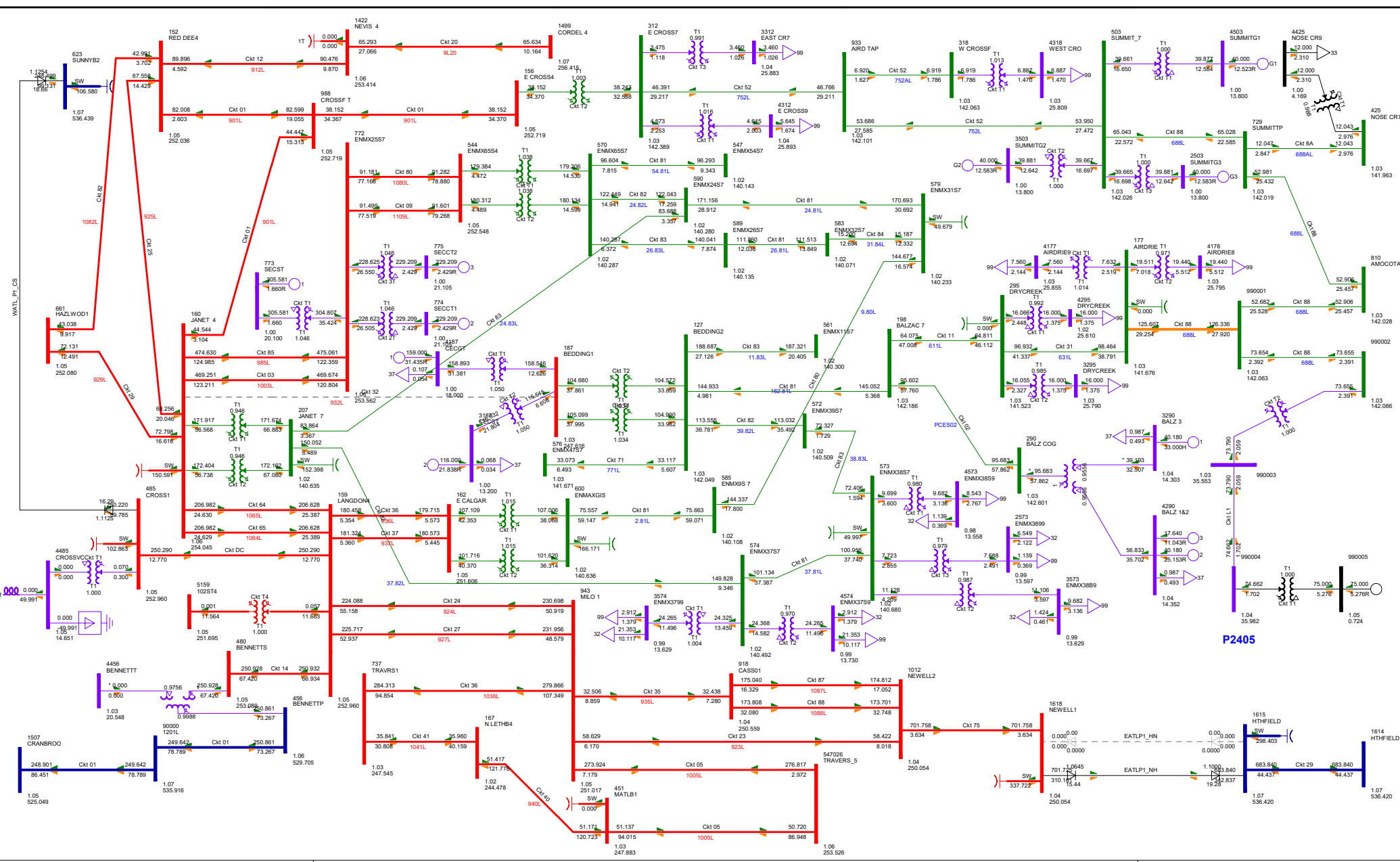


P2405 Sollair MPC Solar

BC Import:336.348 MW Sawk Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-6 N-1:937L (LANGDON 102S TO EAST CALGARY 5S)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

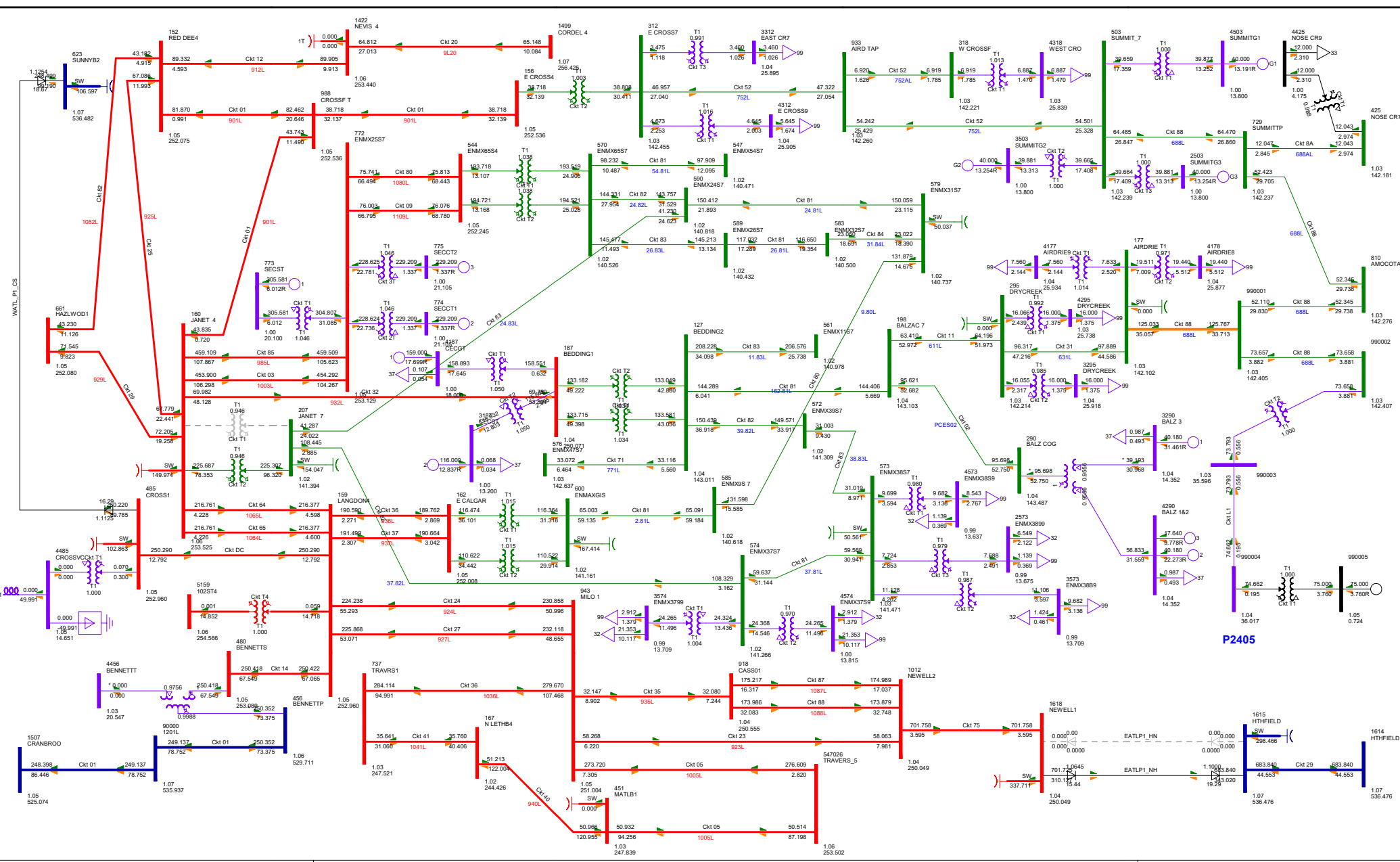
Bus - Voltage (kV) (p.u.)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 1.000 = 100.000%
 MW = 0.000+100.000+138.000+240.000+500.000+500.000



P2405 Sollair MPC Solar
 BC Import:337.960 MW Sack Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-7 N-1:932L (JANET 74S TO ENMAX 162)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

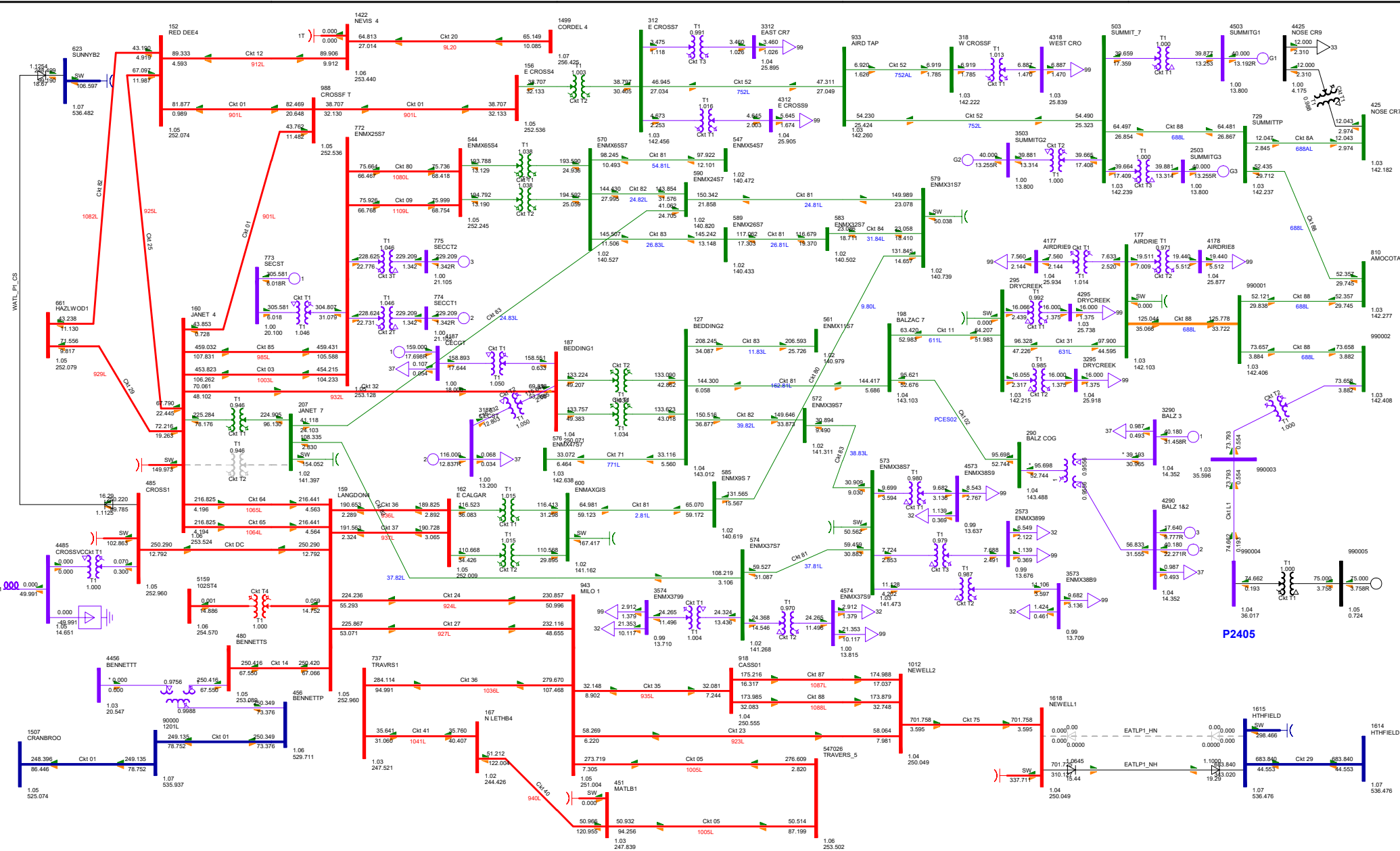
Bus - Voltage (kV) (p) (n)
 Branch - MW (M) (m)
 Equipment - MW (M) (m)
 Loss (MW) (M) (m)
 MW = 1000.000000
 MVA = 1000.000000
 MW = 138.000000 + 240.000000 + 500.000000 + 500.000000



P2405 Sollair MPC Solar
 BC Import:337.224 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-8 N-1:742T1 (JANET 745 240/138 KV TRANSFORMER T1)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

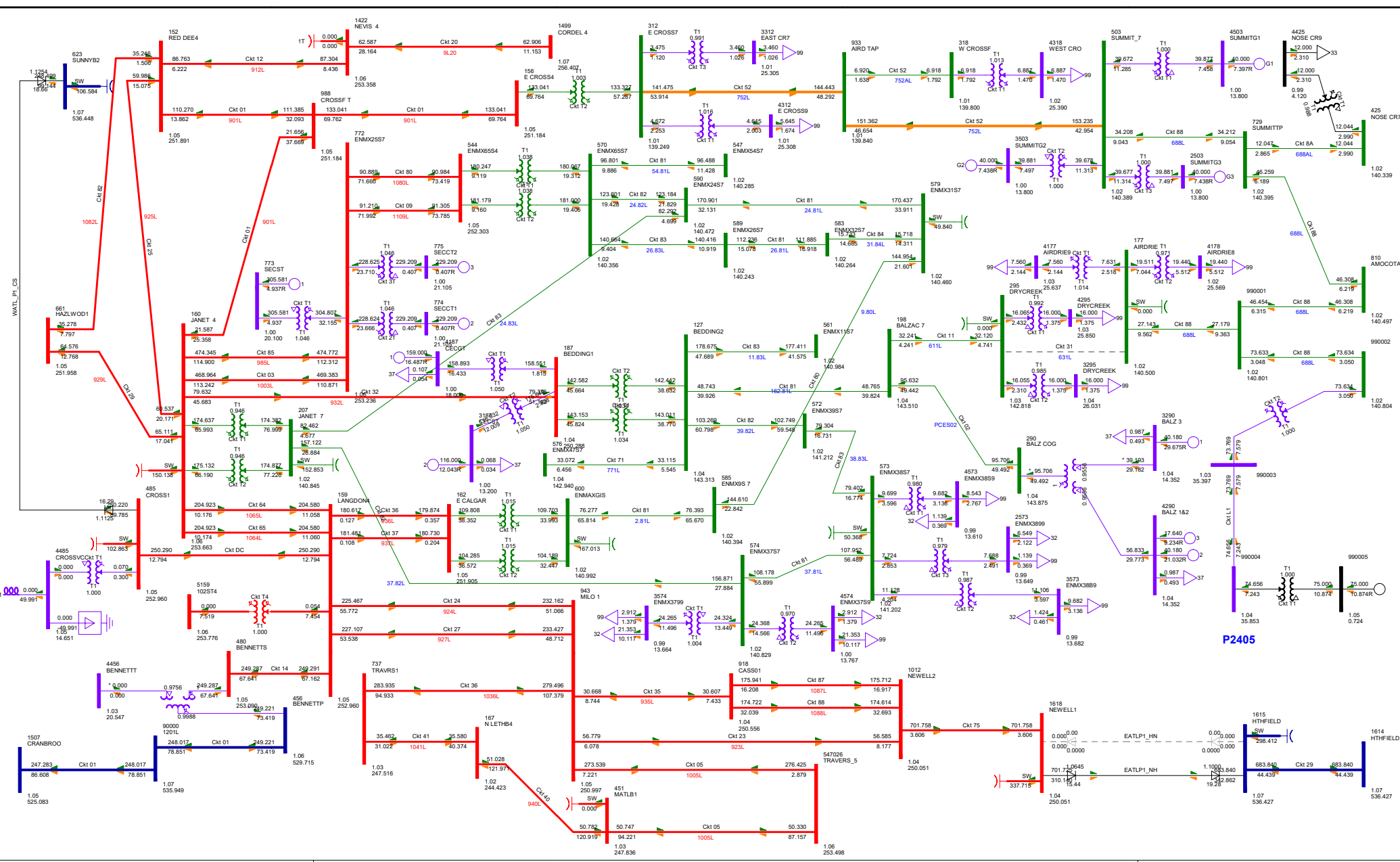
Bus - Voltage (KV) (p) (n)
 Break - Breaker
 Equipment - MVA/Mvar
 T - Transformer
 SW - Switch
 KV = 100.000000
 MW = 1000.000000
 MVA = 1000.000000
 MVAR = 1000.000000



P2405 Sollair MPC Solar
 BC Import:337.219 MW Ssk Import:-0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-9 N-1:742T2 (JANET 74S 240/138 KV TRANSFORMER T2)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (KV) (kV)
 Branch - MW/MVar
 Equipment - MW/MVar
 1000.00.0000
 1.000.0.00000
 kW = 0.000 + 139.000 + 138.000 + 240.000 + 500.000 + 500.000



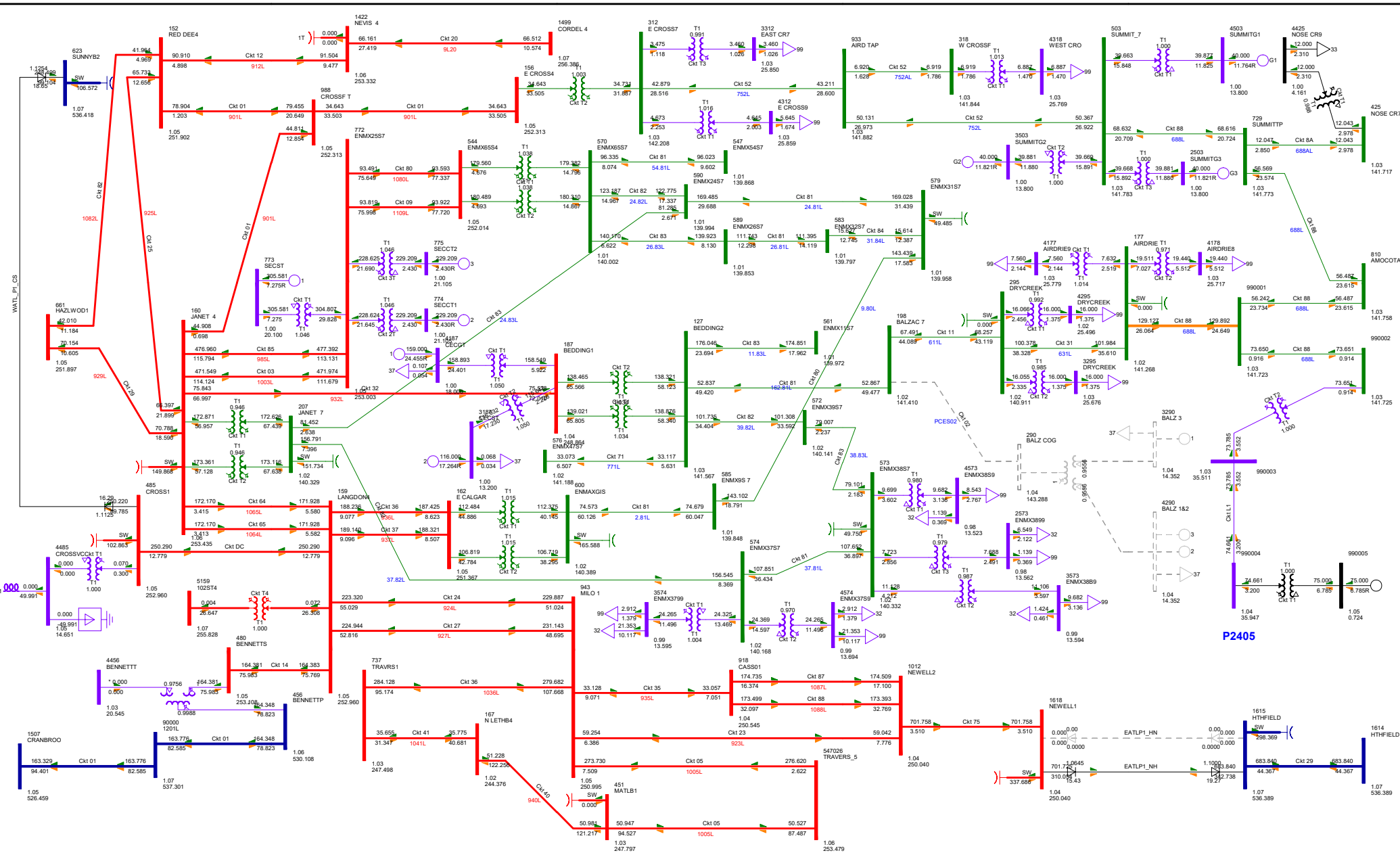
P2405 Sollair MPC Solar

BC Import:336.311 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-10 N-1: 631L (EAST AIRDRIE 199S TO DRY CREEK 186S)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (KV) [p]p
 Break - Breaker
 Equipment - MW/Mvar
 T - Transformer
 SW - Switch
 CKT - Circuit Breaker
 G1, G2, G3 - Generator

11500.000000
 11500.000000
 MW = 650000+660000+1380000+240000+5500000+550000

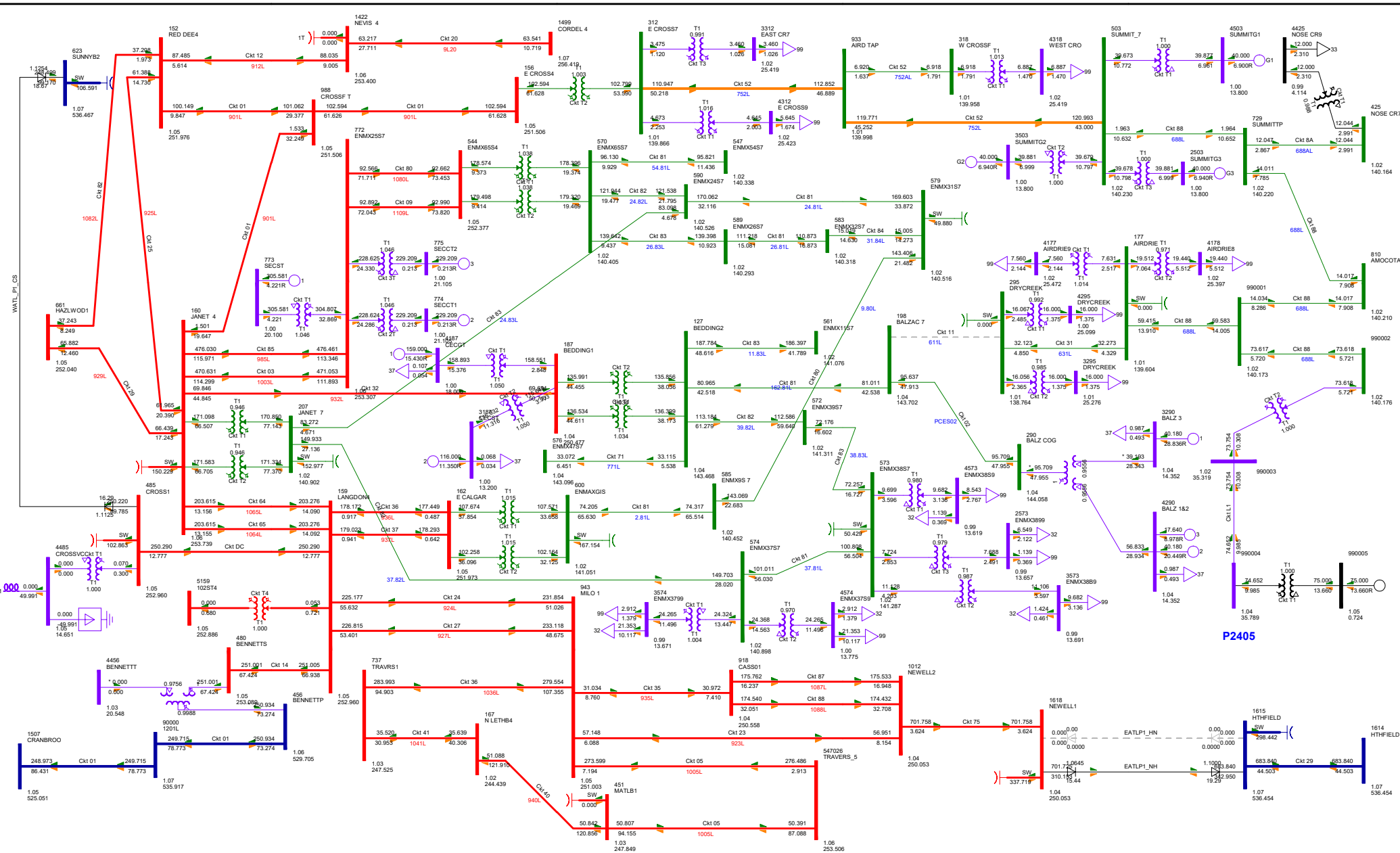


P2405 Sollair MPC Solar

**FIGURE A3.2-11 N-1:PCES02L (BALZAC 391S TO PCES02S)
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:242.361 MW Ssk Import:0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p) (n)
Branch - MW (M) (W)
Equipment - MW (M) (W)
1.000 (0.000) (0.000)
MW = 100,000 (100,000) + 138,000 + 240,000 + 500,000 (500,000)

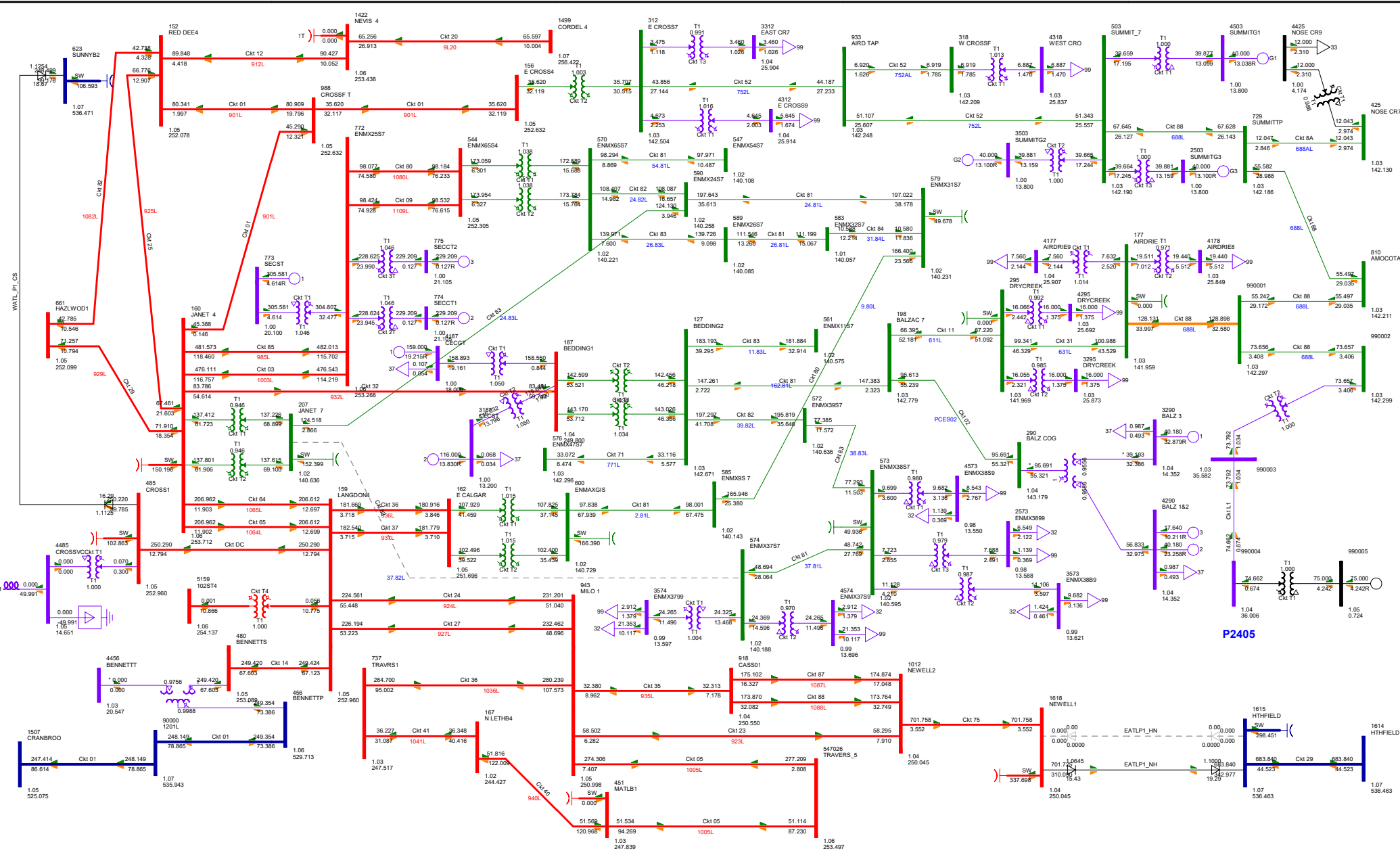


P2405 Sollair MPC Solar

**FIGURE A3.2-12 N-1:611L (BALZAC 391S TO DRY CREEK 186S)
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:338.283 MW Ssk Import:0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (KV) [p]p
Branch - MW/Mvar
Equipment - MW/Mvar
1000:10000:1
MW = 0.000+159.000+138.000+340.000+550.000+550.000

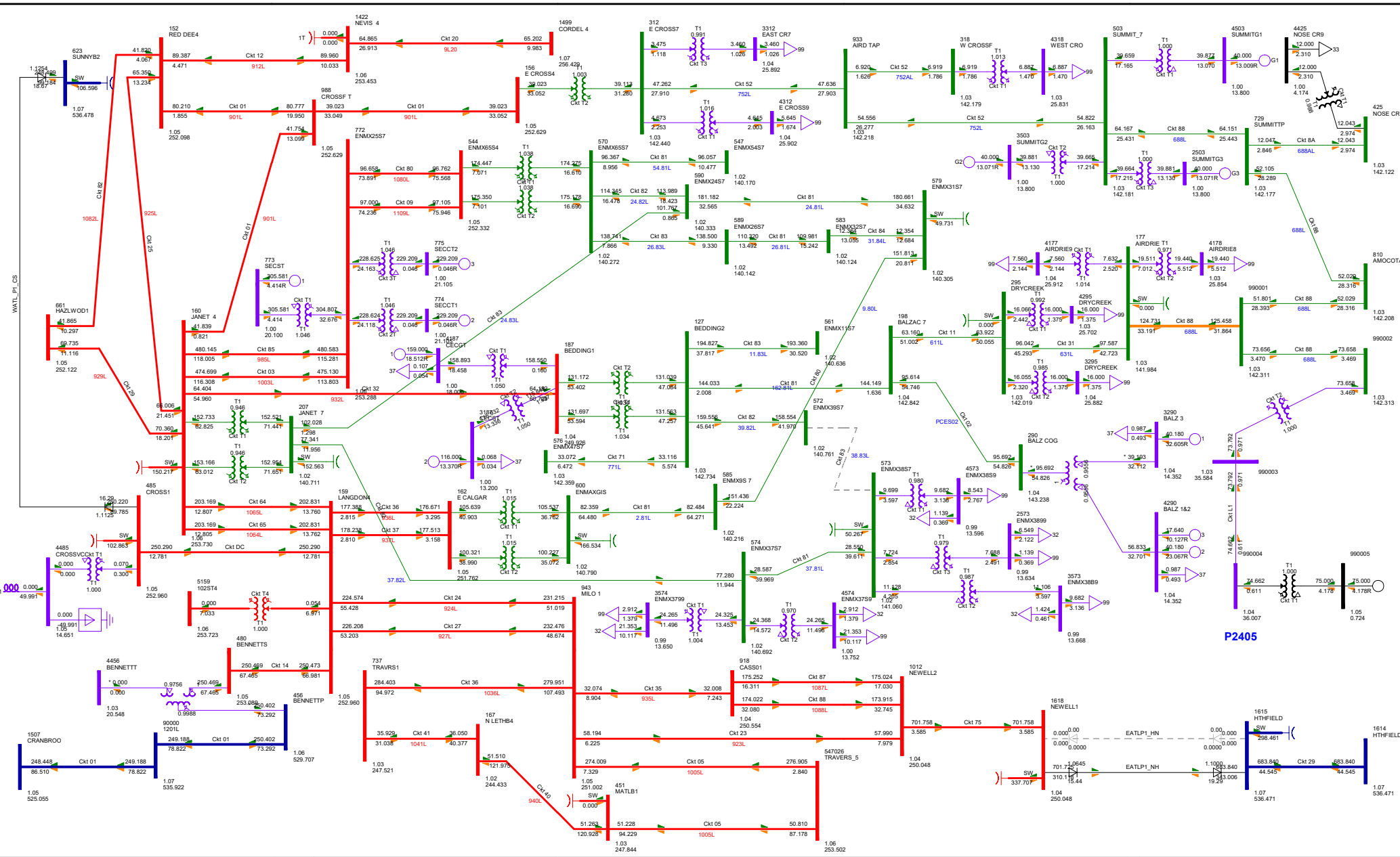


P2405 Sollair MPC Solar

**FIGURE A3.2-13 N-1:37.82L (JANET 74S TO ENMAX 37)
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:336.362 MW Ssk Import:0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p) (n)
Branch - MW (M) (m)
Equipment - MW (M) (m)
1.000 (0.000) (0.000)
MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000

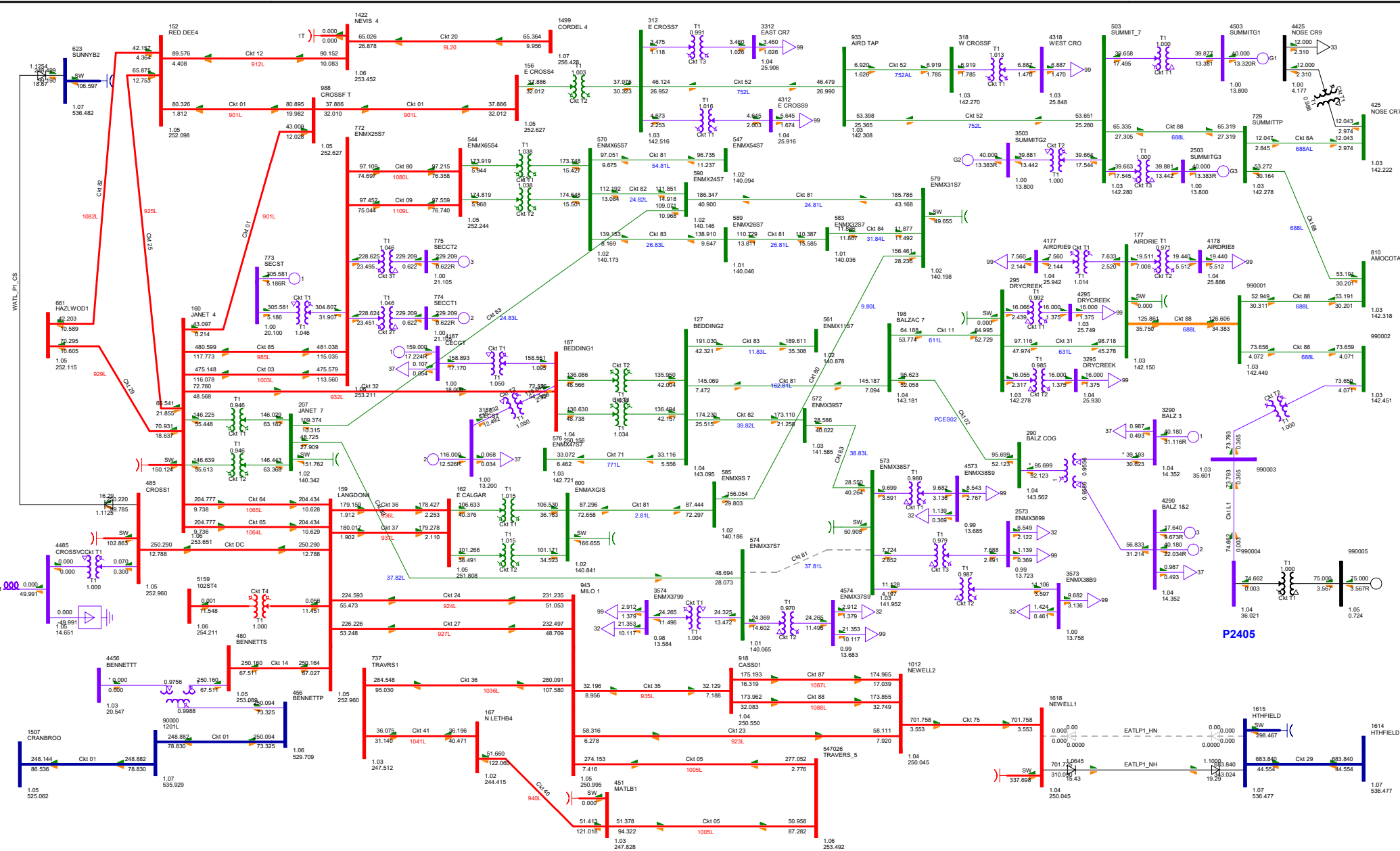


P2405 Sollair MPC Solar

BC Import:337.664 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-15 N-1:38.83L (ENMAX 38S TO ENMAX 39S)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (KV) (p) (n)
 Break - MVA (M) (p)
 Equipment - MVA (M) (p)
 1.000 (0.000) (p)
 MW = 6,500 + 650,000 + 138,000 + 240,000 + 550,000 + 500,000

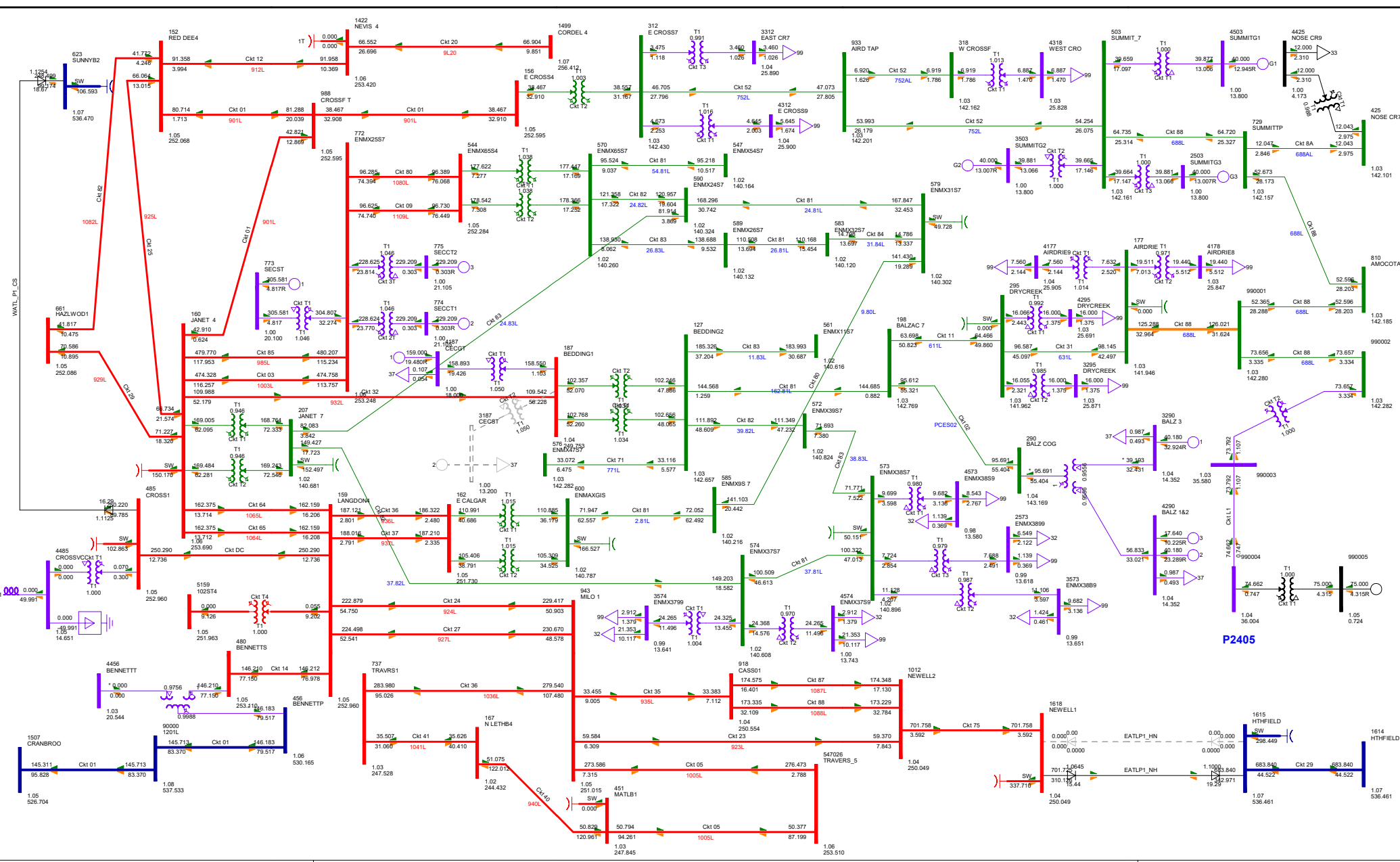


P2405 Sollair MPC Solar

BC Import:337.287 MW Sack Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-16 N-1:37.81L (ENMAX 37 SUB TO ENMAX 38 SUB)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p.u.)
 Branch - MW/MVar
 Equipment - MW/MVar
 (0.000/0.000)
 MW = 0.000+0.000+0.000+138.000+240.000+500.000+500.000

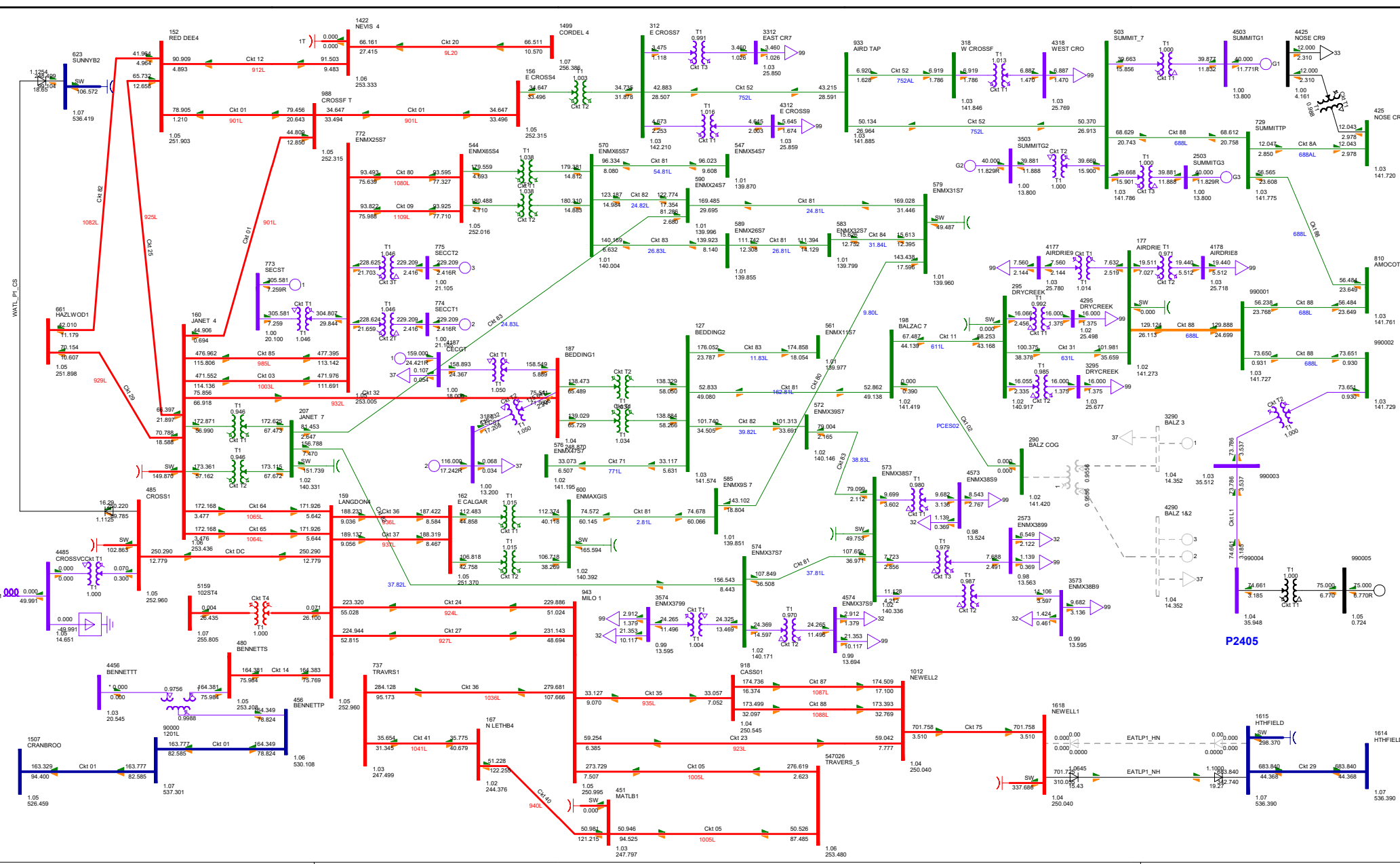


P2405 Sollair MPC Solar

BC Import:222.397 MW Sask Import:-0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-17 N-1:BEDDINGTON 162S TRANSFORMER T2
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

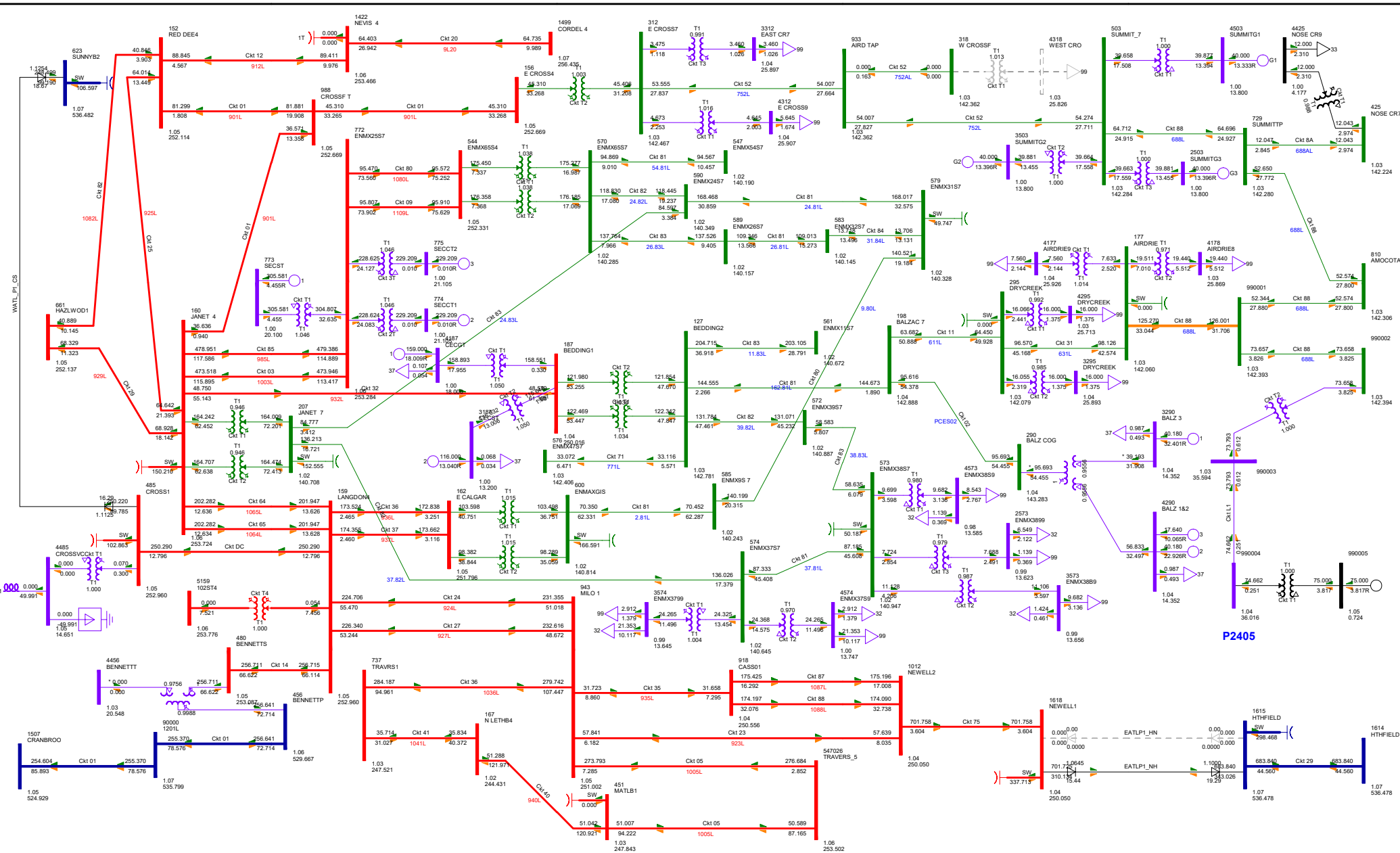
Bus - Voltage (kV) (p.u.)
 Branch - MW (MW)
 Equipment - MW (MW)
 MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000



P2405 Sollair MPC Solar
 BC Import:242.361 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-18 N-1: BALZAC POWER STATION
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p) (n)
 Break - MW/MW
 Equipment - MW/MW
 MW - MW/MW
 MW - MW/MW

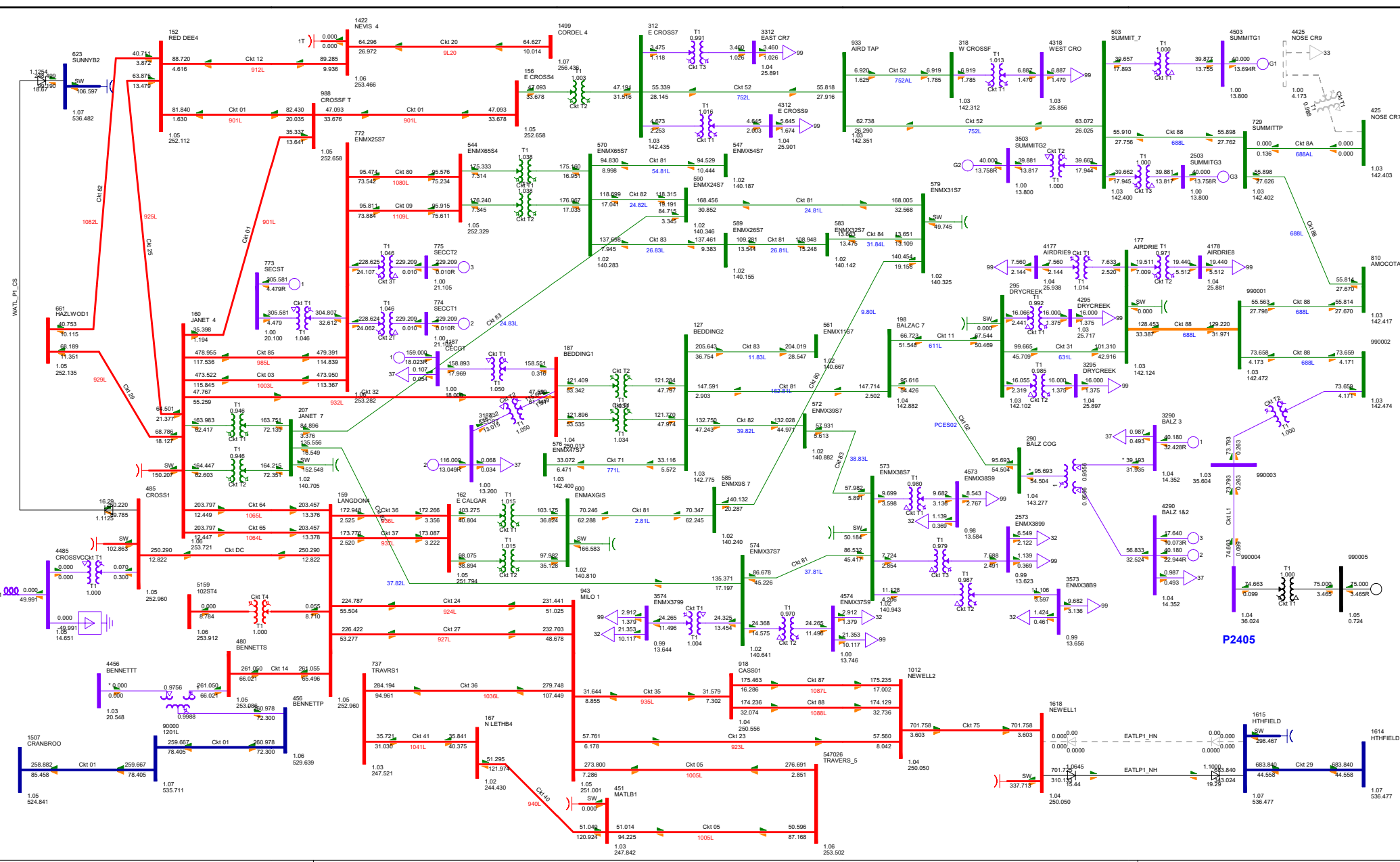


P2405 Sollair MPC Solar

**FIGURE A3.2-19 N-1:316S1 (WEST CROSSFIELD 316S TRANSFORMER T1)
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:344.673 MW Sask Import:0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p.u.)
Branch - MW/MVar
Equipment - MW/MVar
1.000 (0.000000)
MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000

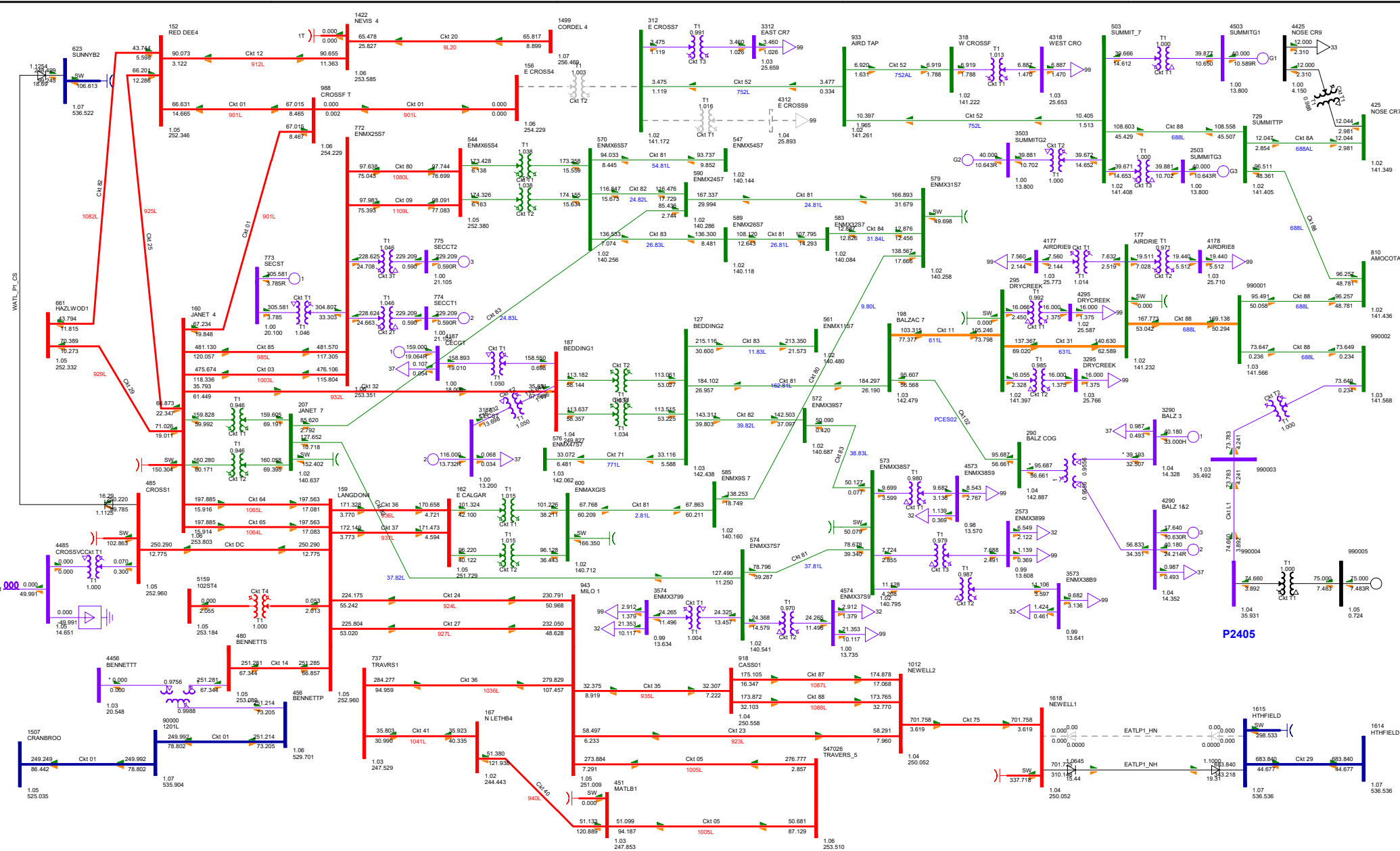


P2405 Sollair MPC Solar

BC Import:349.473 MW Sask Import:-0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-20 N-1:NOSE CREEK 284S TRANSFORMER T1
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p.u)
 Branch - MW (MW)
 Equipment - MW (MW)
 MW - MW (MW)
 MW - MW (MW)
 MW - MW (MW)
 MW - MW (MW)

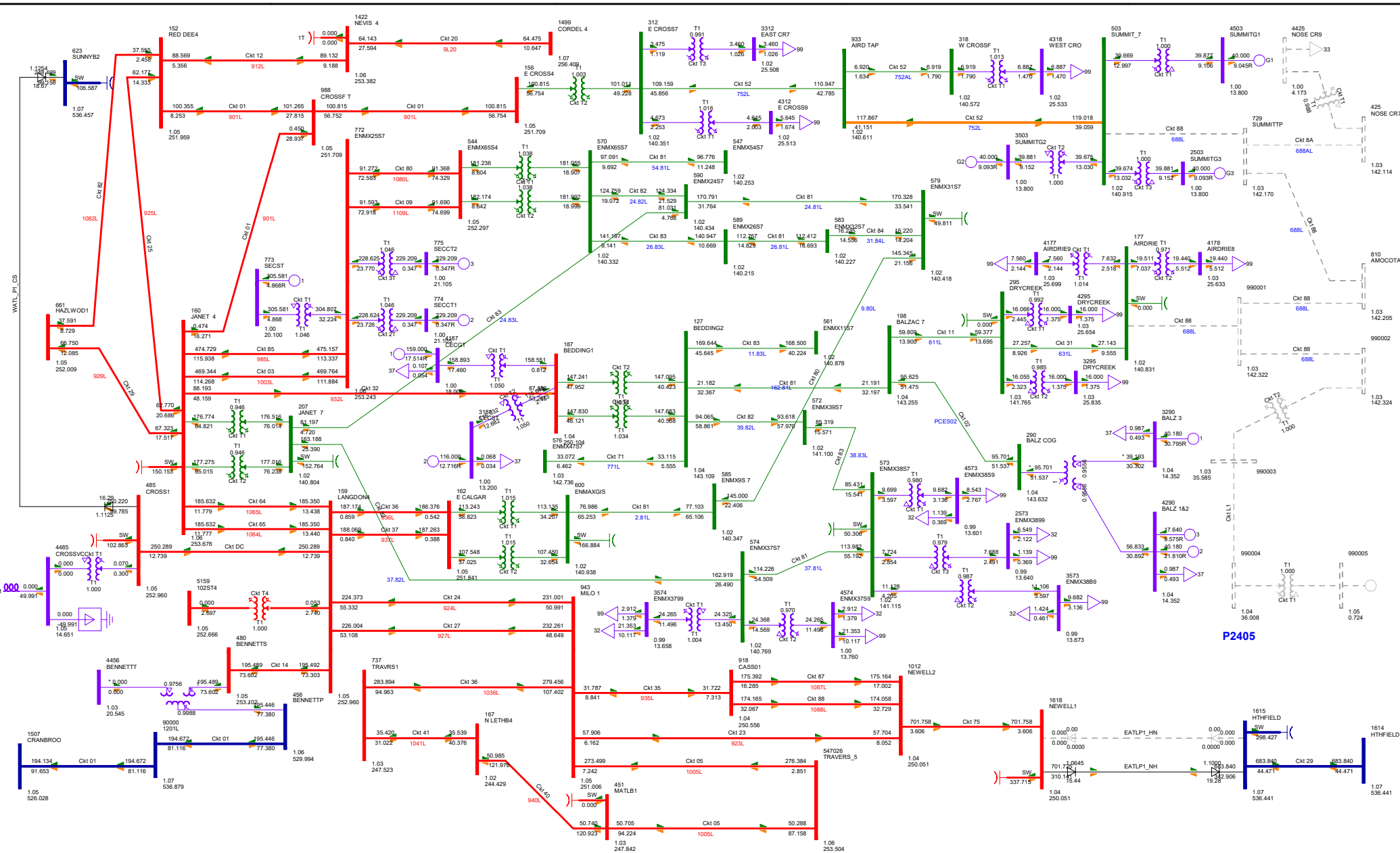


P2405 Sollair MPC Solar

BC Import:338.732 MW Sack Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-21 N-1: EAST CROSSFIELD 64S TRANSFORMER T1
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

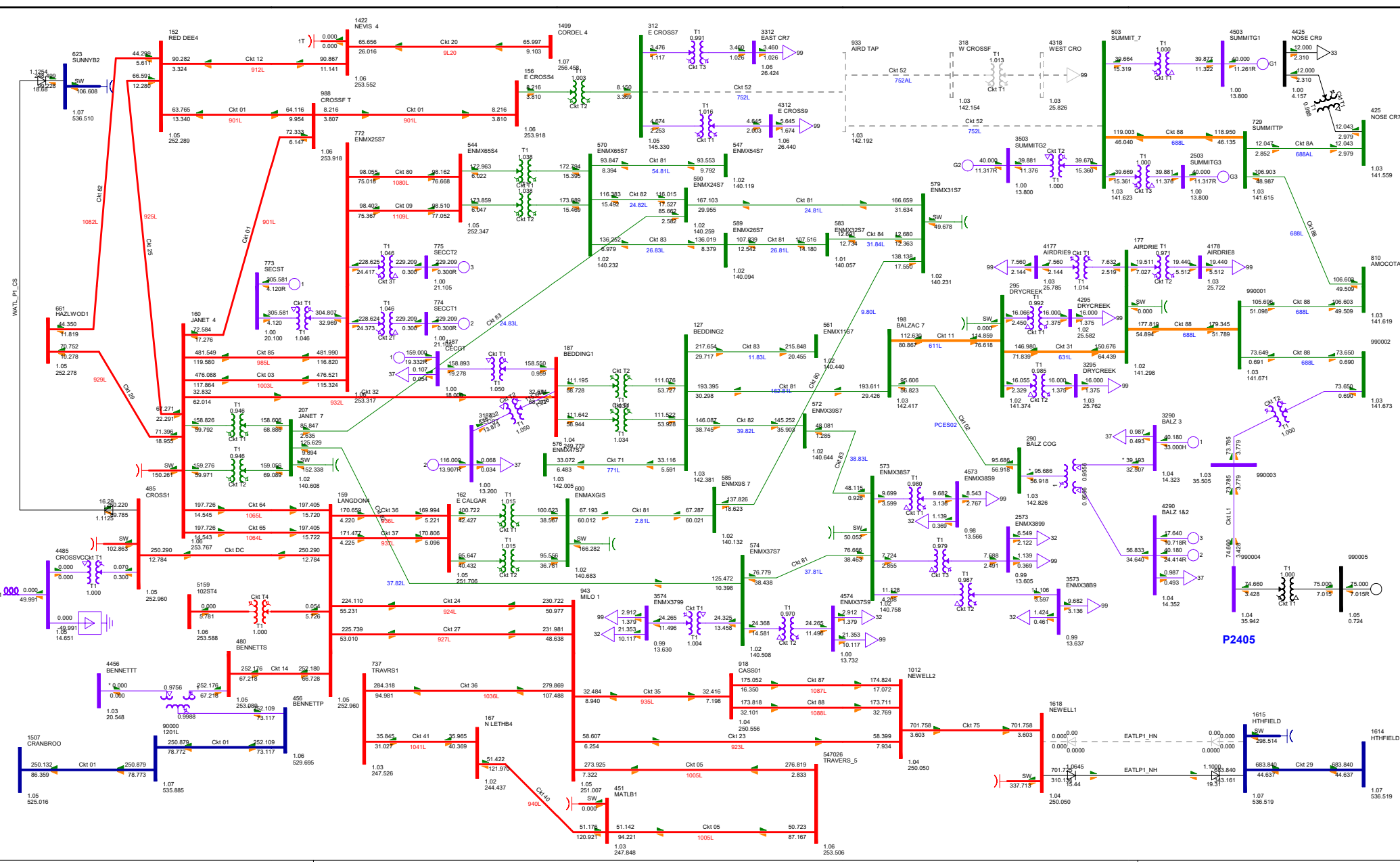
Bus - Voltage (KV) (p.u)
 Branch - MW (MW)
 Equipment - MW (MW)
 Loss - MW (MW)
 MW = 1000000000000
 KW = 1000000000000
 MV = 100000000000
 KV = 100000000000
 MW = 1000000000000
 KW = 1000000000000
 MV = 100000000000
 KV = 100000000000



P2405 Sollair MPC Solar
 BC Import: 276.787 MW Ssk Import: -0.000 MW MATL Import: 0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-22 N-1: 688L (SUMMIT 653S TO EAST AIRDRIE 199S)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p.u.)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 1.000 = 0.000000
 MW = 0.000 + j0.000 ← 138.000 + j240.000 ← 500.000 + j500.000

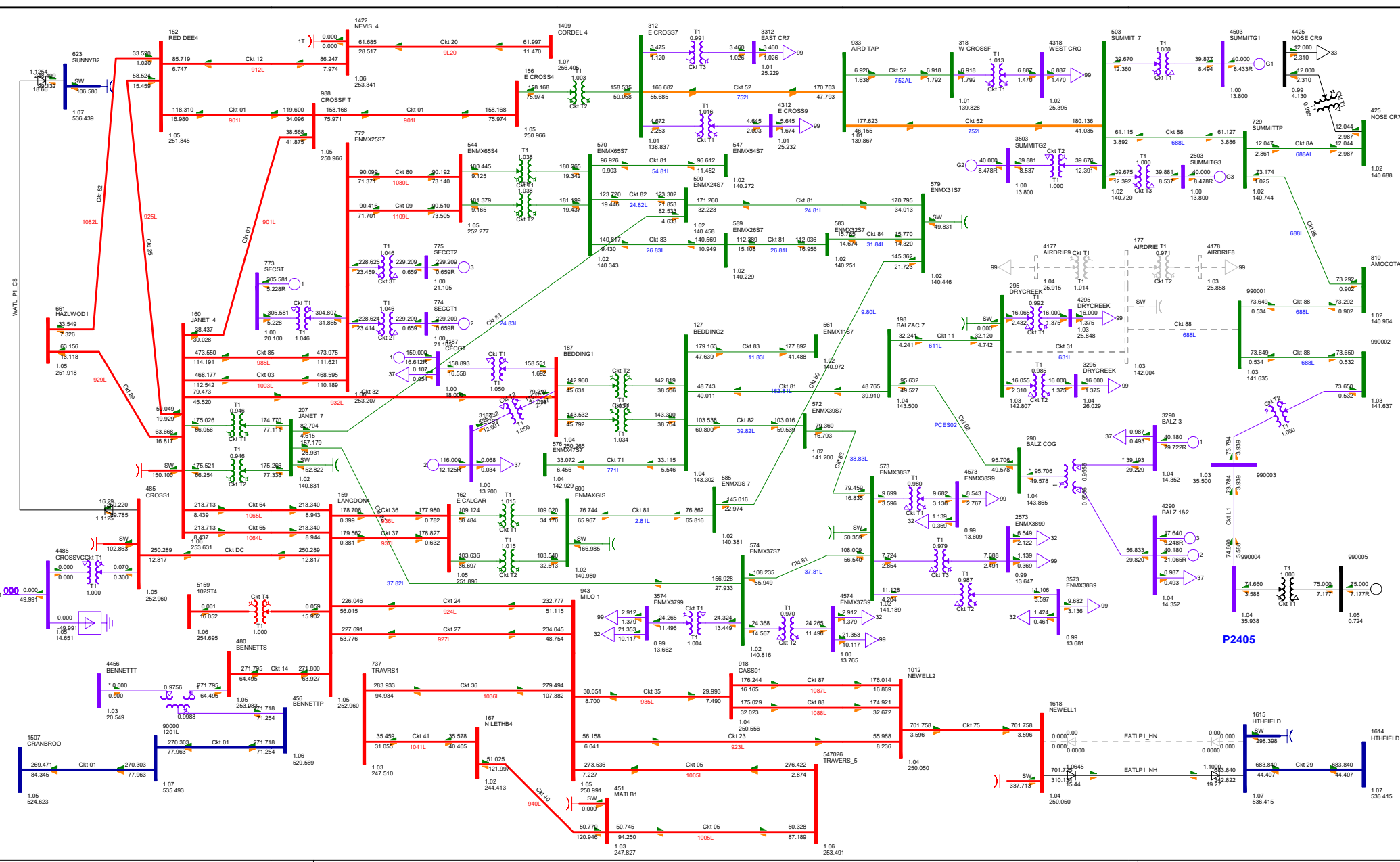


P2405 Sollair MPC Solar

BC Import:339.734 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-23 N-1: 752L (EAST CROSSFIED 64S TO SUMMIT 653S)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p) (n)
 Branch - MW (M) (m)
 Equipment - MW (M) (m)
 Loss (MW) (M) (m)
 MW = 1000, M = 1000, m = 1000
 MW = 1000, M = 1000, m = 1000

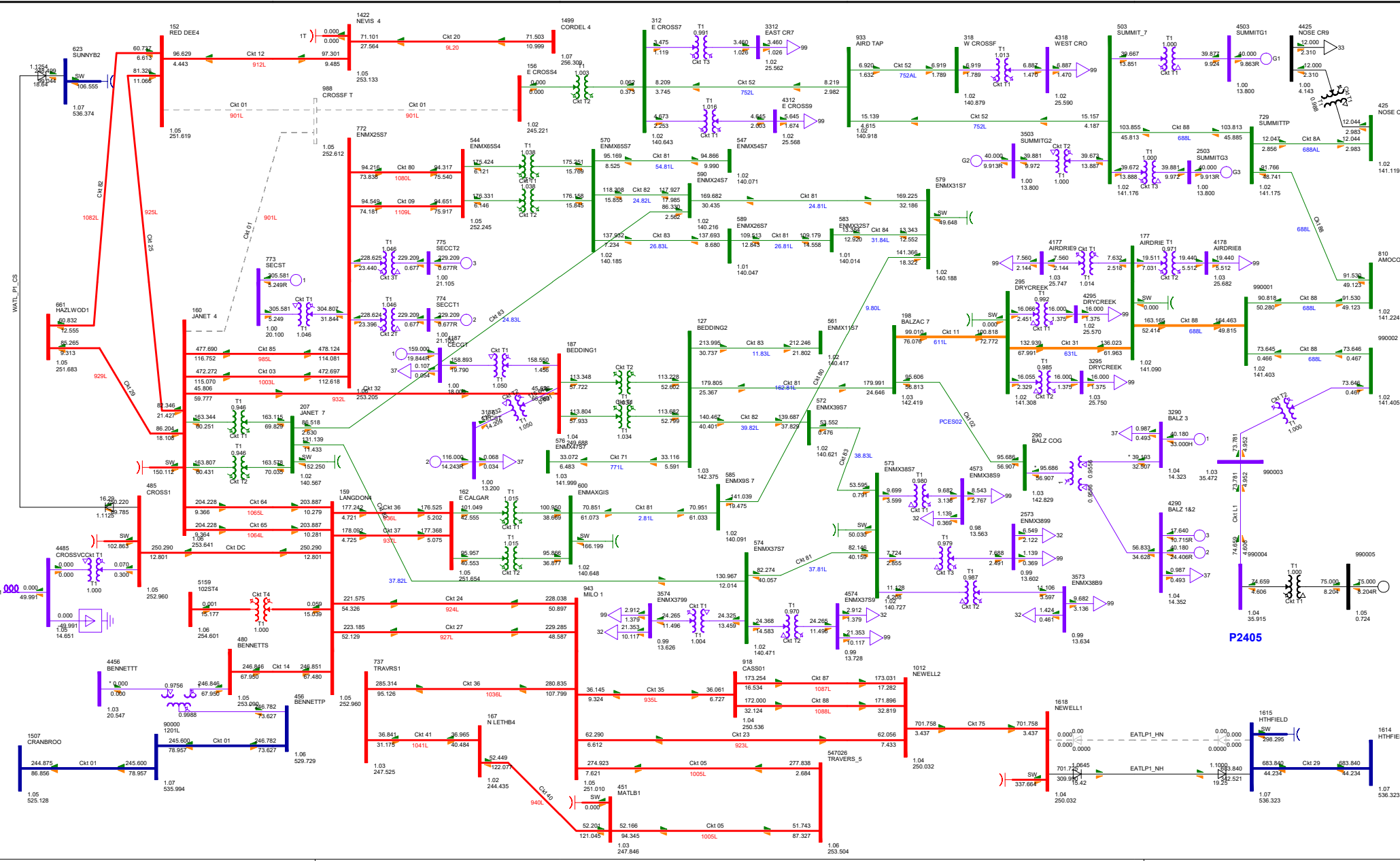


P2405 Sollair MPC Solar

BC Import:361.180 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-24 N-1: 199ST2 (EAST AIRDRIE 199S TRANSFORMER T2)
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

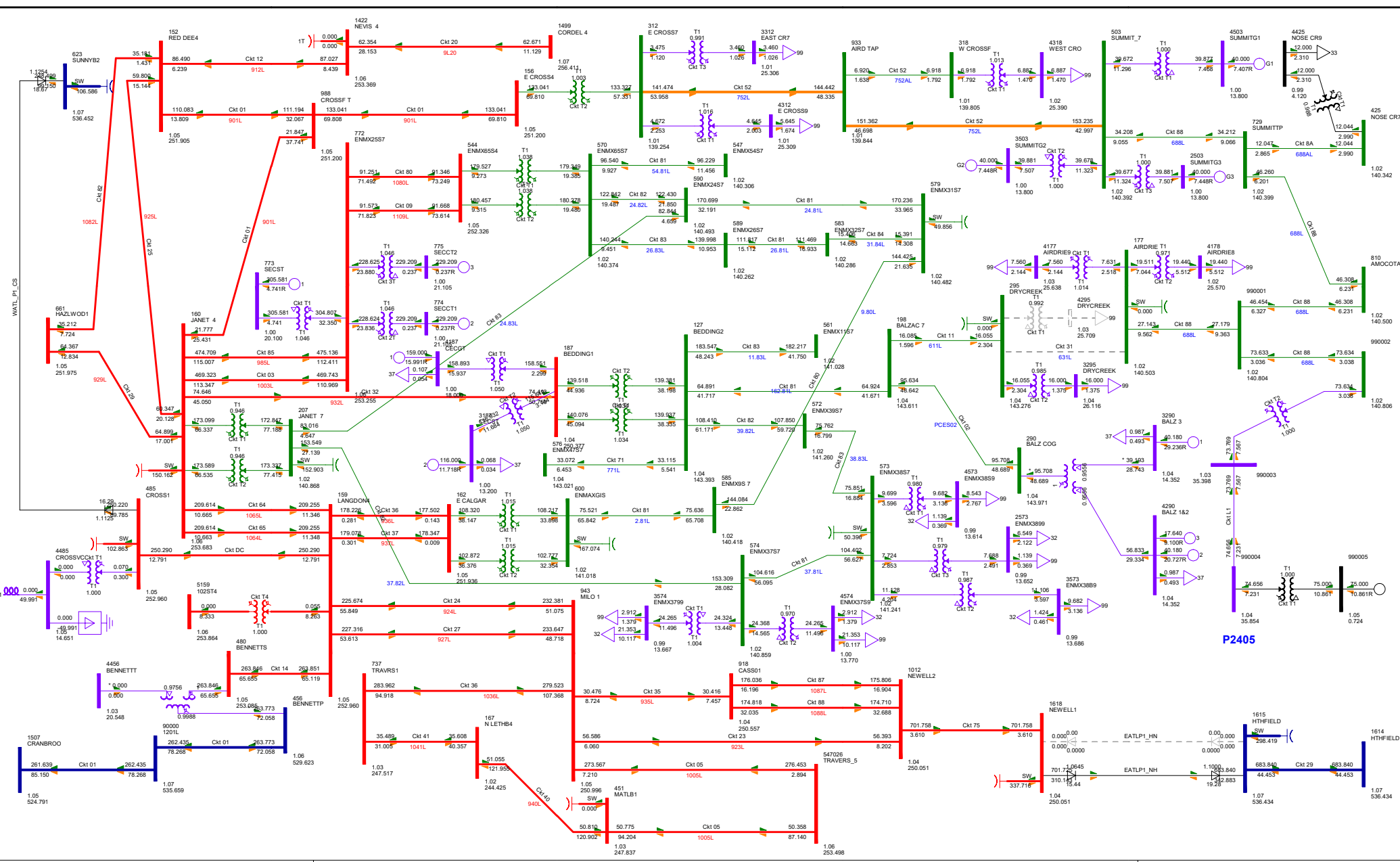
Bus - Voltage (kV) (p) (n)
 Branch - MW (p) (n)
 Equipment - MW (p) (n)
 MW - MW (p) (n)
 MW - MW (p) (n)
 MW - MW (p) (n)



P2405 Sollair MPC Solar
 BC Import:333.534 MW Sack Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

FIGURE A3.2-25 N-1: 901L (JANET 74S TO RED DEER 63S)
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022

Bus - Voltage (kV)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 Losses - MW/Mvar
 MW = 0.000+0.000+0.000+0.000+0.000+0.000+0.000+0.000+0.000+0.000
 Mvar = 0.000+0.000+0.000+0.000+0.000+0.000+0.000+0.000+0.000+0.000

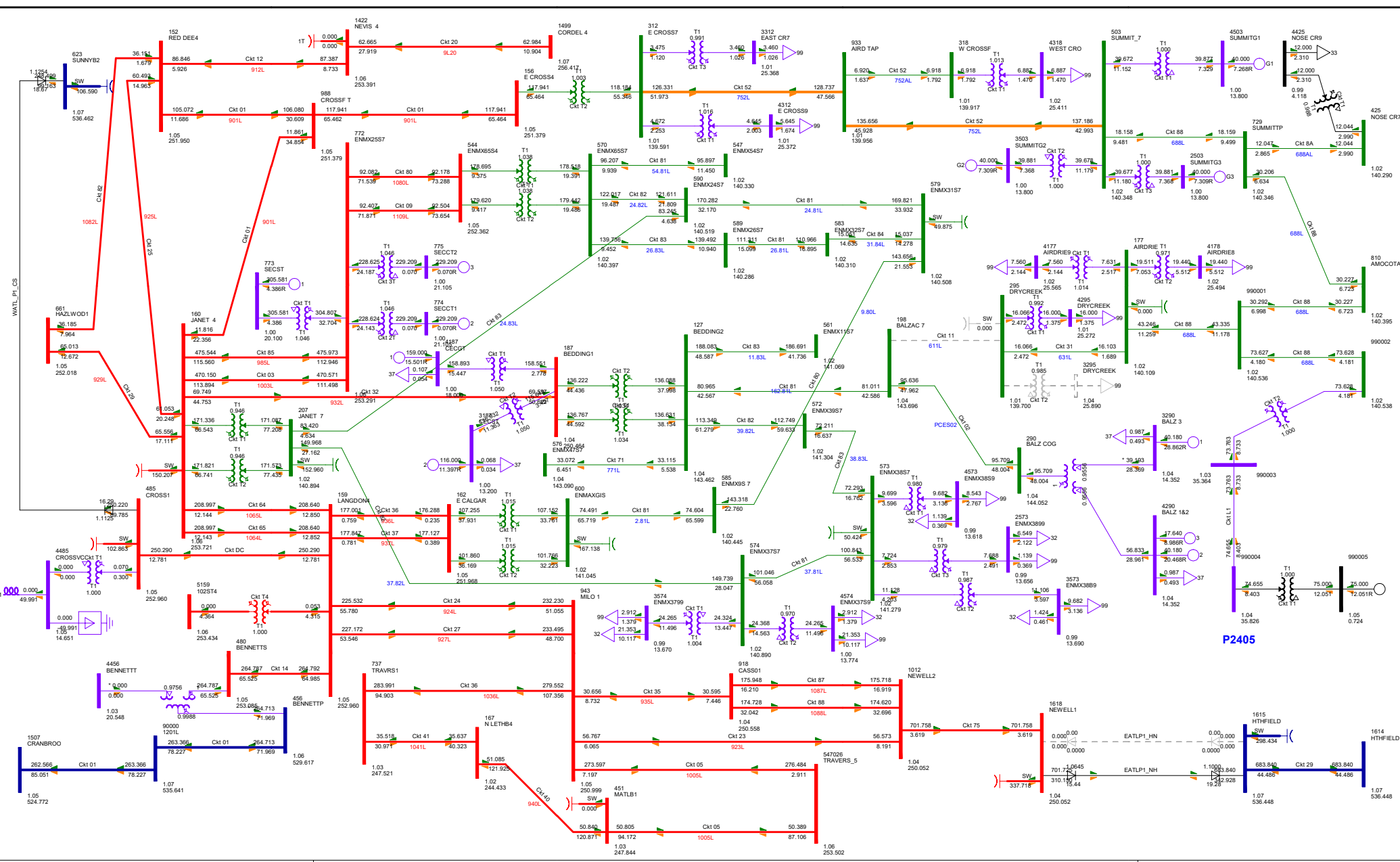


P2405 Sollair MPC Solar

**FIGURE A3.2-26 N-1: 186ST1 (DRY CREEK 186S TRANSFORMER T1)
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:352.438 MW Ssk Import:0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p) (n)
Branch - MW (p) (n)
Equipment - MW (p) (n)
MW - MW (p) (n)
MW - MW (p) (n)
MW - MW (p) (n)
MW - MW (p) (n)

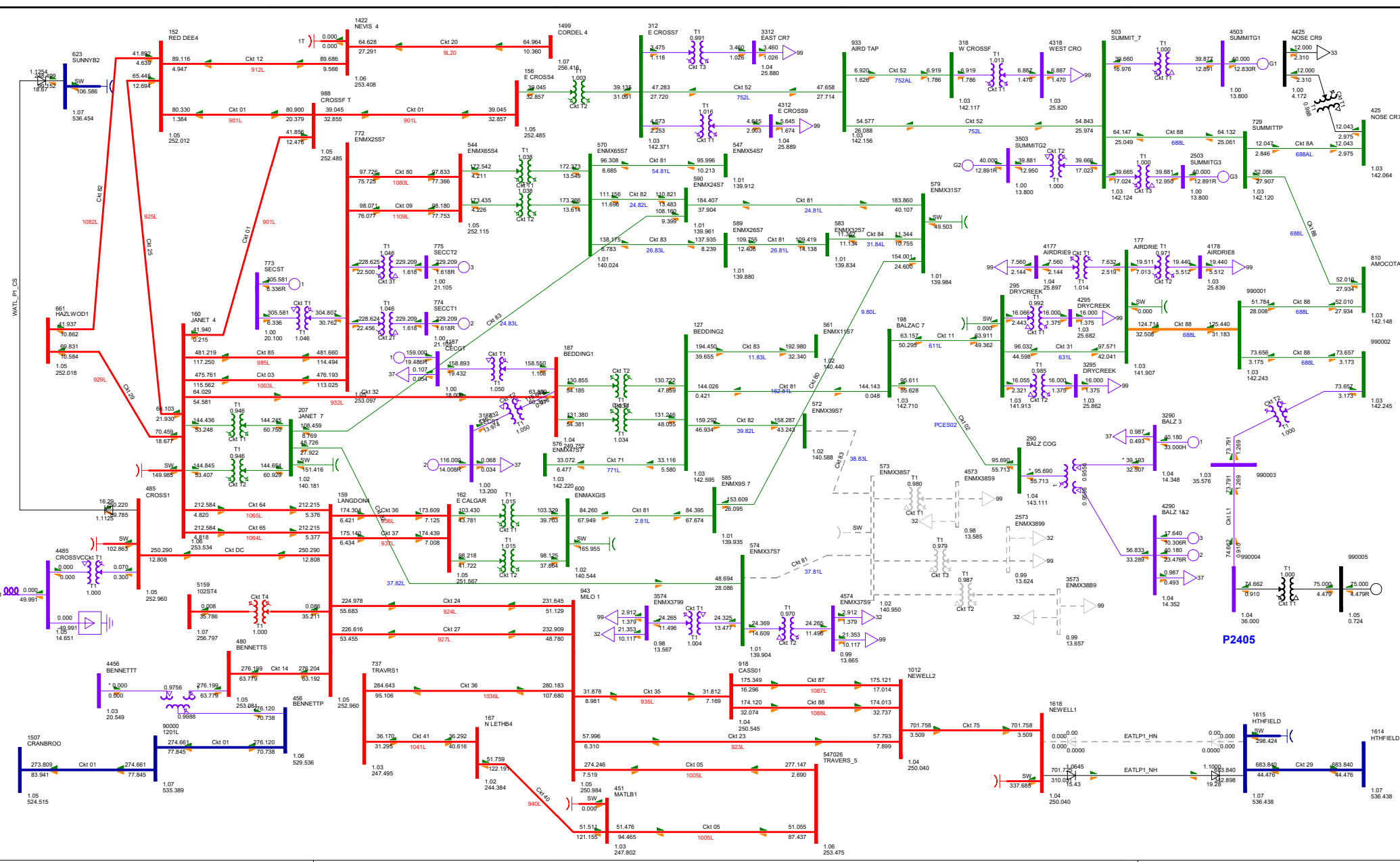


P2405 Sollair MPC Solar

**FIGURE A3.2-27 N-1: 186S2 (DRY CREEK 186S TRANSFORMER T2)
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import: 353.515 MW Ssk Import: 0.000 MW MATL Import: 0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (kV)
Branch - MW (MW)
Equipment - MW (MW)
Loss - MW (MW)
MW = 1000.000000
kV = 1000.000000



P2405 Sollair MPC Solar

BC Import:366.078 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

**FIGURE A3.2-28 N-1:ENMAX 38S TRANSFORMER T1 OR T2 OR T3
 2023 SUMMER PEAK (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p) (n)
 Branch - MW (M) (W)
 Equipment - MW (M) (W)
 1000.000000
 MW = 0.000000+0.000000+138.000000+240.000000+500.000000-500.000000

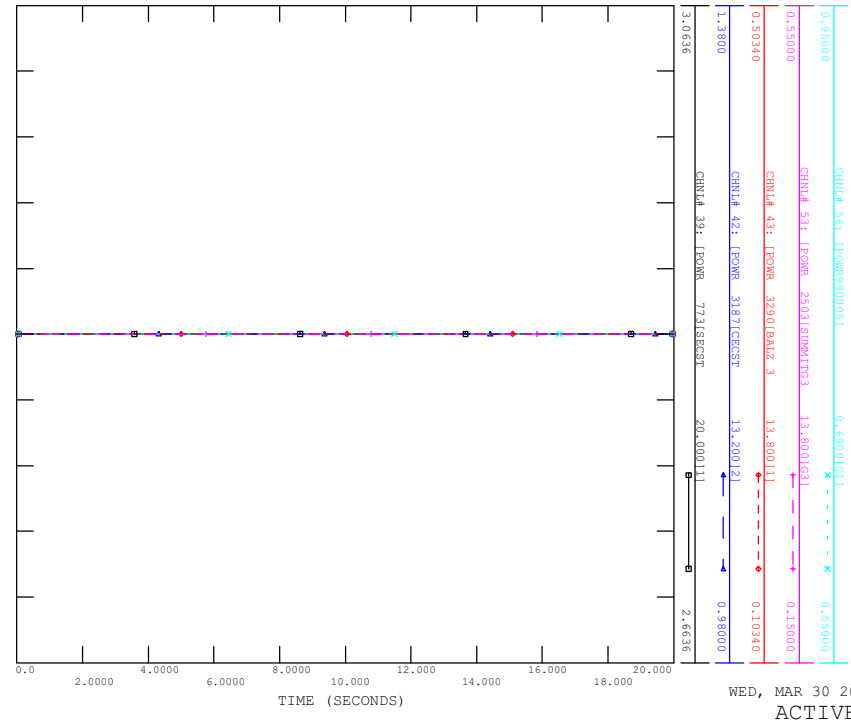
Attachment A4

Post-Project Transient Stability Diagrams



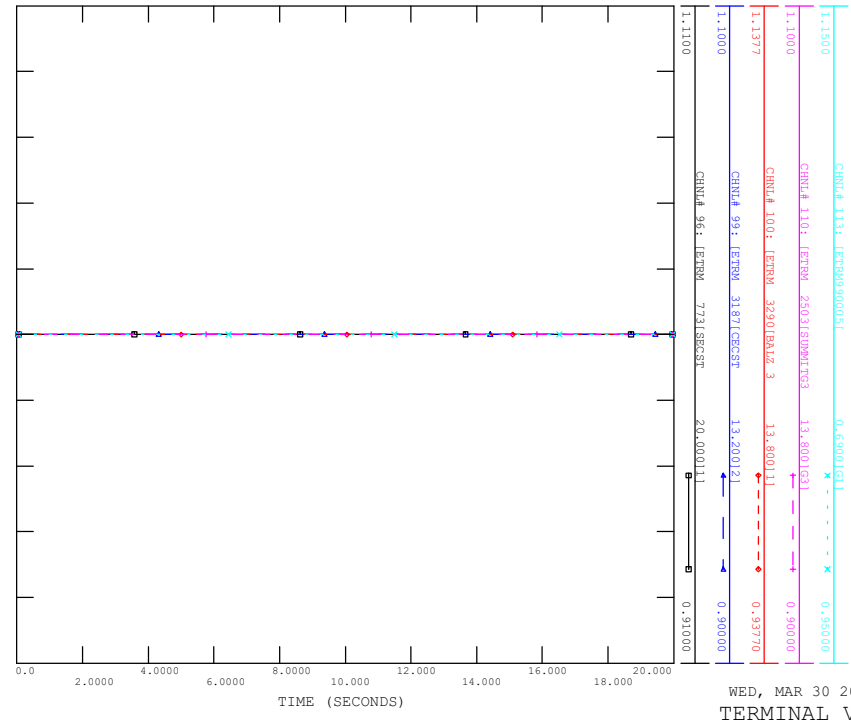
Channel#	Variable	Description	Unit
1	[ANGL 773[SECST 20.000]1]	Shepard ST Rotor Angle	DEG
4	[ANGL 3187[CECST 13.200]2]	Calgary Energy Centre Rotor Angle	DEG
5	[ANGL 3290[BALZ 3 13.800]1]	Nexen Inc #1 Rotor Angle	DEG
15	[ANGL 2503[SUMMITG3 13.800]G3]	Crossfield Energy Centre#3 Rotor Angle	DEG
18	[ANGL990005[0.6900]G1]	P2405 Generator Rotor Angle	DEG
39	[POWR 773[SECST 20.000]1]	Shepard ST Active Power	PU
42	[POWR 3187[CECST 13.200]2]	Calgary Energy Centre Active Power	PU
43	[POWR 3290[BALZ 3 13.800]1]	Nexen Inc #1 Active Power	PU
53	[POWR 2503[SUMMITG3 13.800]G3]	Crossfield Energy Centre#3 Active Power	PU
56	[POWR990005[0.6900]G1]	P2405 Generator Active Power	PU
96	[ETRM 773[SECST 20.000]1]	Shepard ST Terminal Voltage	PU
99	[ETRM 3187[CECST 13.200]2]	Calgary Energy Centre Terminal Voltage	PU
100	[ETRM 3290[BALZ 3 13.800]1]	Nexen Inc #1 Terminal Voltage	PU
110	[ETRM 2503[SUMMITG3 13.800]G3]	Crossfield Energy Centre#3 Terminal Voltage	PU
113	[ETRM990005[0.6900]G1]	P2405 Generator Terminal Voltage	PU
58	[VARS 773[SECST 20.000]1]	Shepard ST Reactive Power	PU
61	[VARS 3187[CECST 13.200]2]	Calgary Energy Centre Reactive Power	PU
62	[VARS 3290[BALZ 3 13.800]1]	Nexen Inc #1 Reactive Power	PU
72	[VARS 2503[SUMMITG3 13.800]G3]	Crossfield Energy Centre#3 Reactive Power	PU
75	[VARS990005[0.6900]G1]	P2405 Generator Reactive Power	PU
125	[VOLT 127 [BEDDING2 138.00]]	Beddington 138kV Bus Voltage	PU
126	[VOLT 156 [E CROSS4 240.00]]	East Crossfiled 240kV Bus Voltage	PU
127	[VOLT 159 [LANGDON4 240.00]]	Langdon 240kV Bus Voltage	PU
128	[VOLT 160 [JANET 4 240.00]]	Janet 240kV Bus Voltage	PU
129	[VOLT 177 [AIRDRIE 138.00]]	East Airdrie 138kV Bus Voltage	PU
145	[688L_P]	688L Active Power	MW
147	[162.81_P]	162.81L Active Power	MW
149	[918L_P]	918L Active Power	MW
151	[752L_P]	752L Active Power	MW
135	[611L_P]	611L Active Power	MW
137	[925L_P]	925L Active Power	MW
139	[631L_P]	631L Active Power	MW
141	[932L_P]	932L Active Power	MW
143	[929L_P]	929L Active Power	MW
146	[688L_Q]	688L Reactive Power	MVAR
148	[162.81_Q]	162.81L Reactive Power	MVAR
150	[918L_Q]	918L Reactive Power	MVAR
152	[752L_Q]	752L Reactive Power	MVAR
136	[611L_Q]	611L Reactive Power	MVAR
138	[925L_Q]	925L Reactive Power	MVAR
140	[631L_Q]	631L Reactive Power	MVAR
142	[932L_Q]	932L Reactive Power	MVAR
144	[929L_Q]	929L Reactive Power	MVAR

FILE: scn3_sl_nofault.out



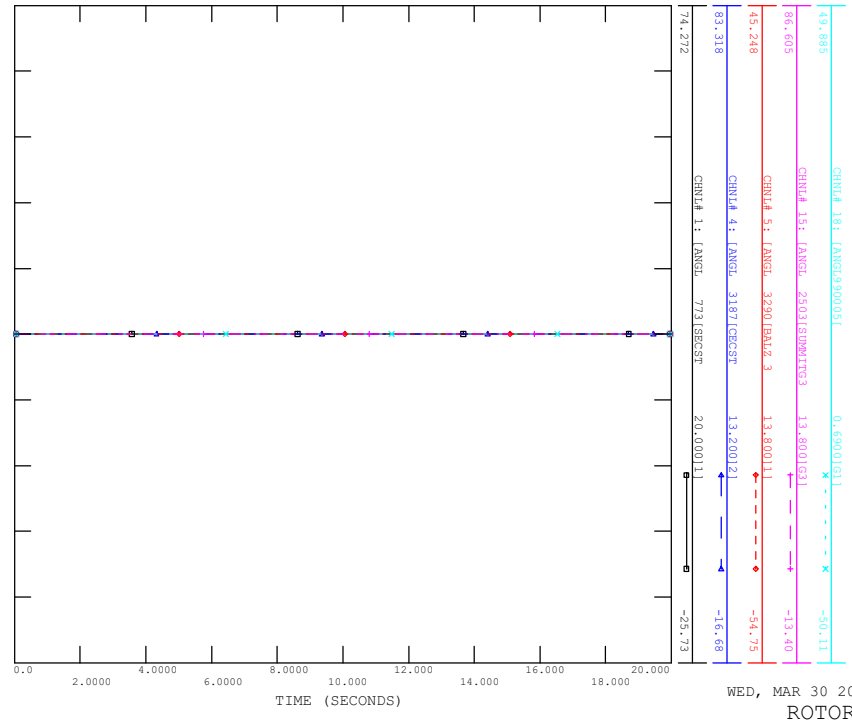
WED, MAR 30 2022 0:34
ACTIVE POWER

FILE: scn3_sl_nofault.out



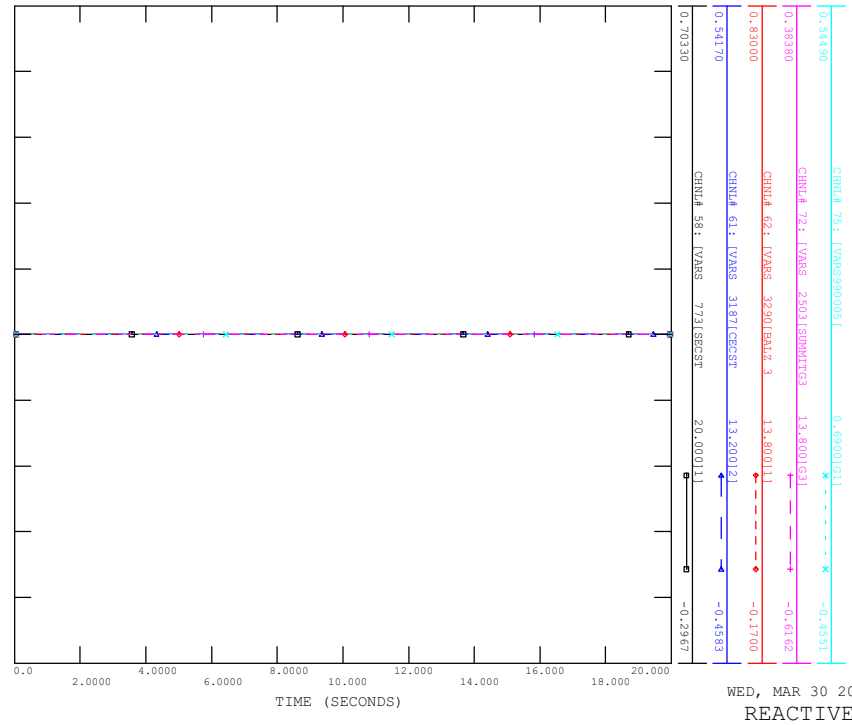
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

FILE: scn3_sl_nofault.out



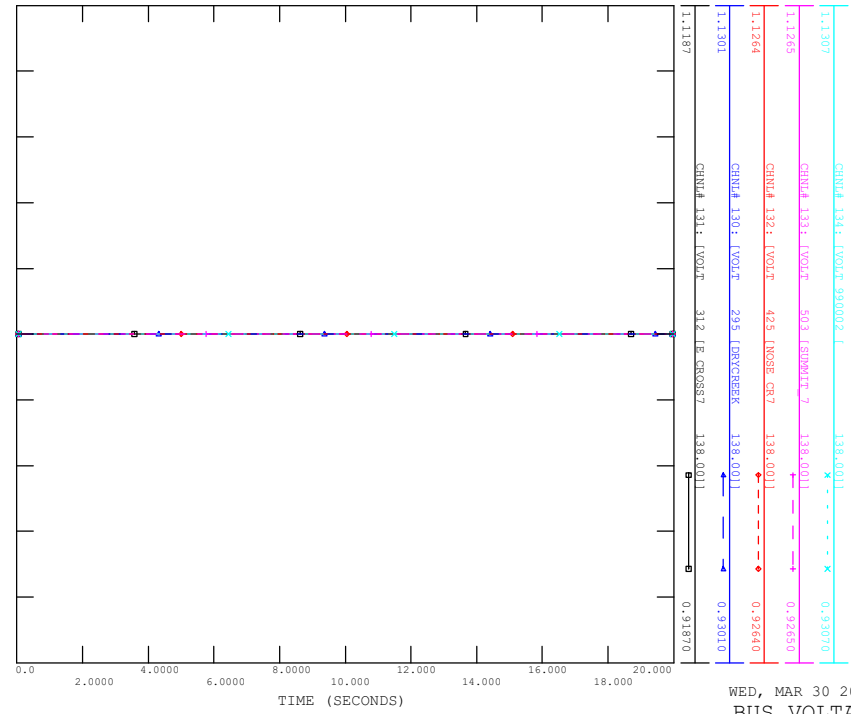
WED, MAR 30 2022 0:34
ROTOR ANGLE

FILE: scn3_sl_nofault.out

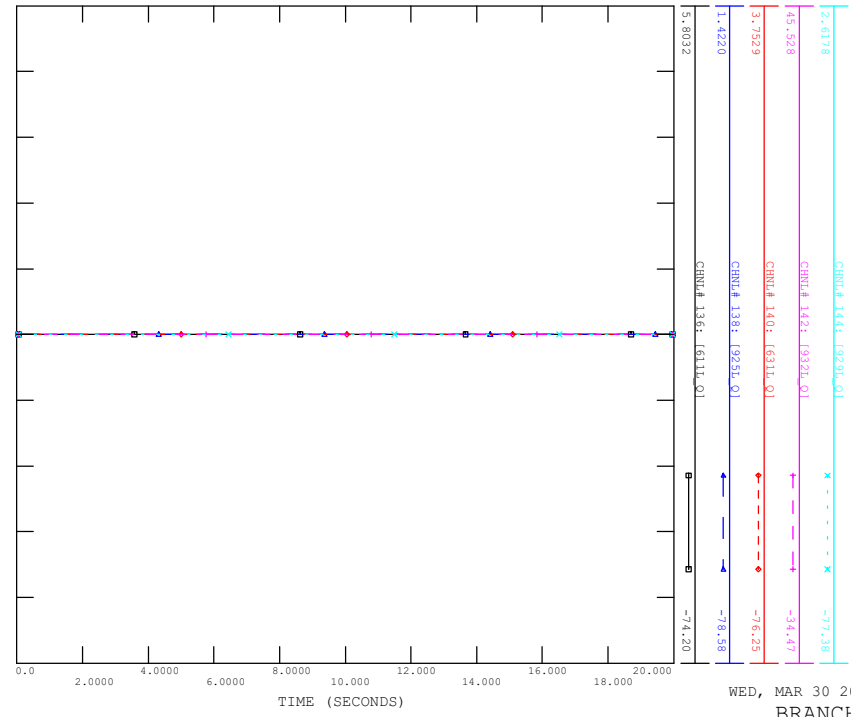


WED, MAR 30 2022 0:34
REACTIVE POWER

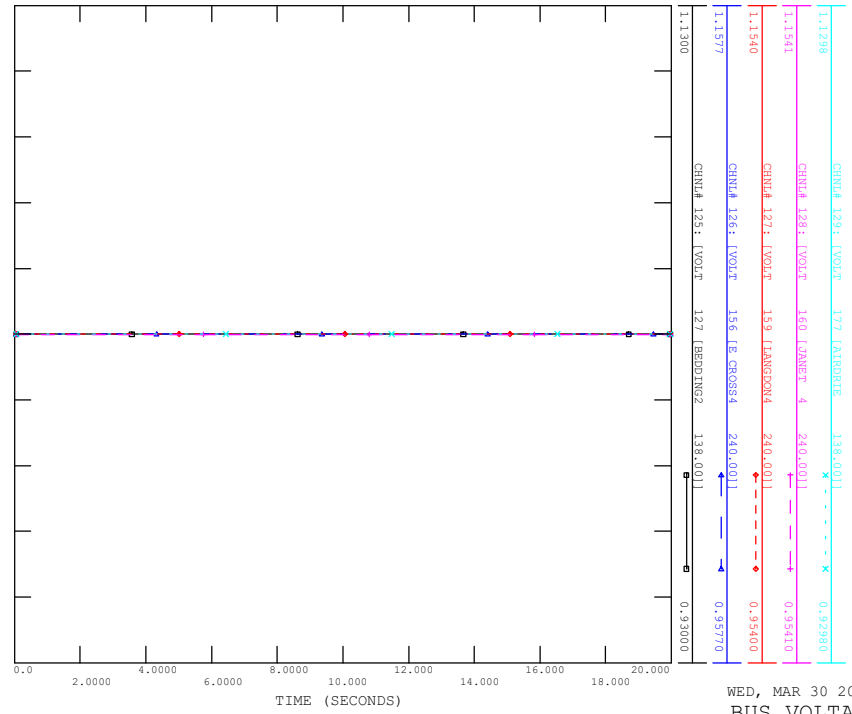
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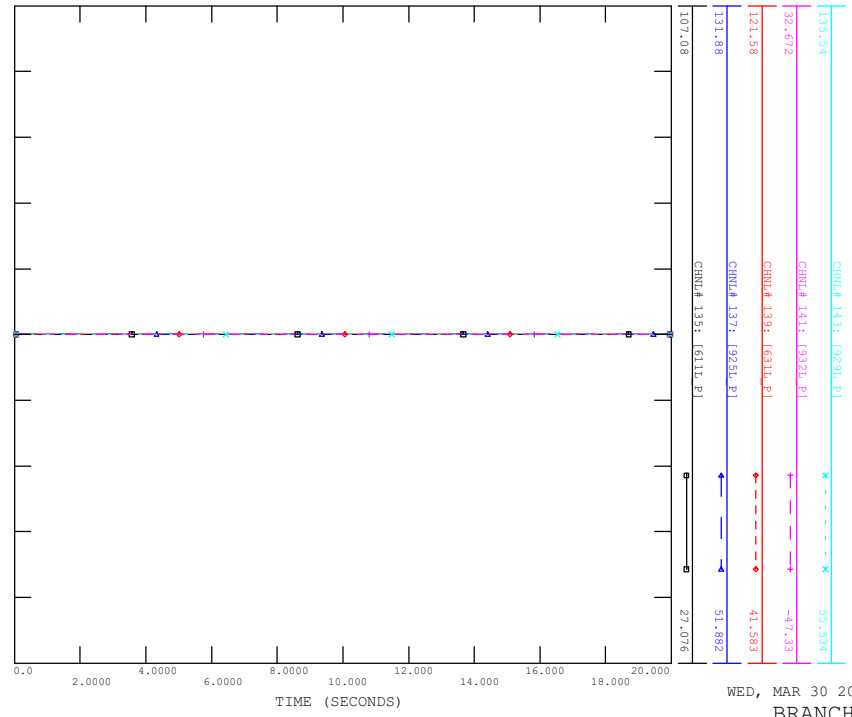
FILE: scen3_sl_nofault.out



FILE: scen3_sl_nofault.out



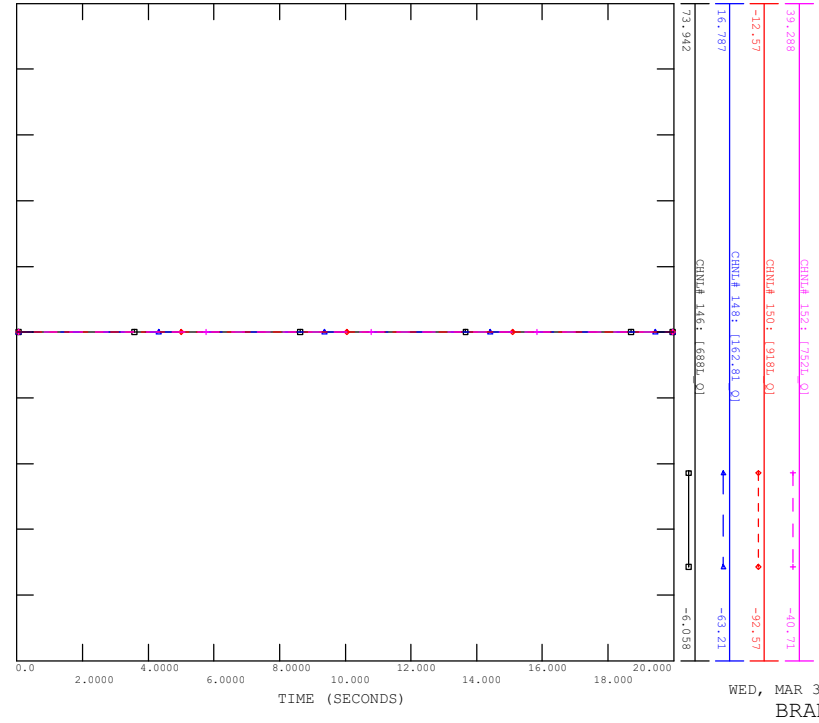
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SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_NOFAULT

FILE: scn3_sl_nofault.out

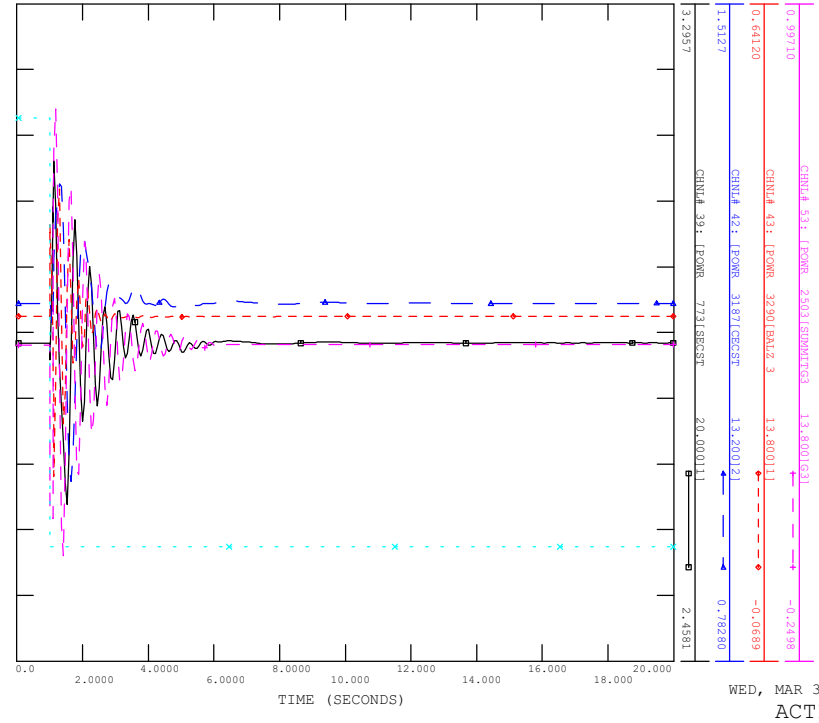


WED, MAR 30 2022 0:34
BRANCH Q (2)



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_01_6881_SUMMIT

FILE: scn3_sl_01_6881_Summit.out

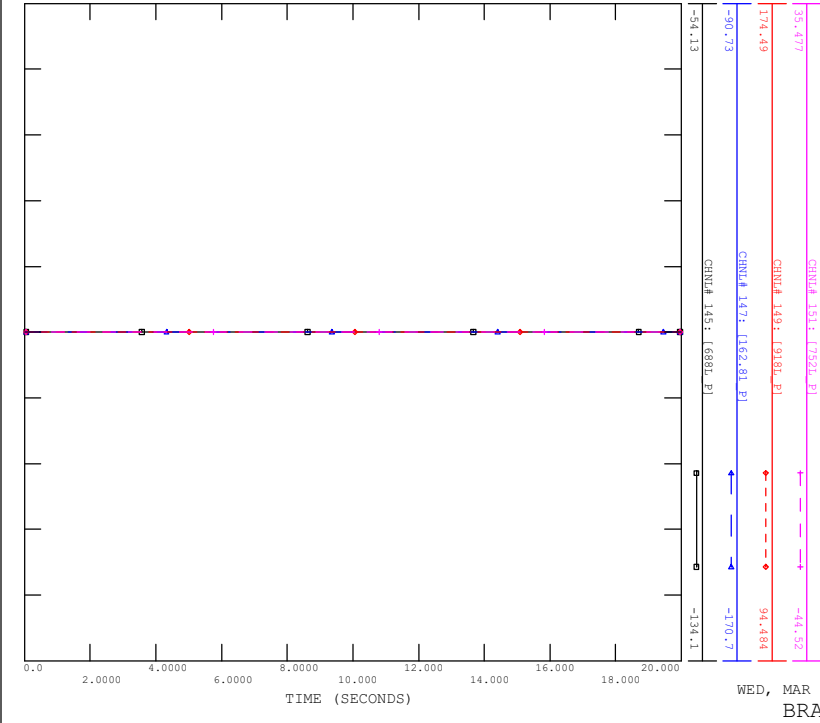


WED, MAR 30 2022 0:34
ACTIVE POWER



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_NOFAULT

FILE: scn3_sl_nofault.out

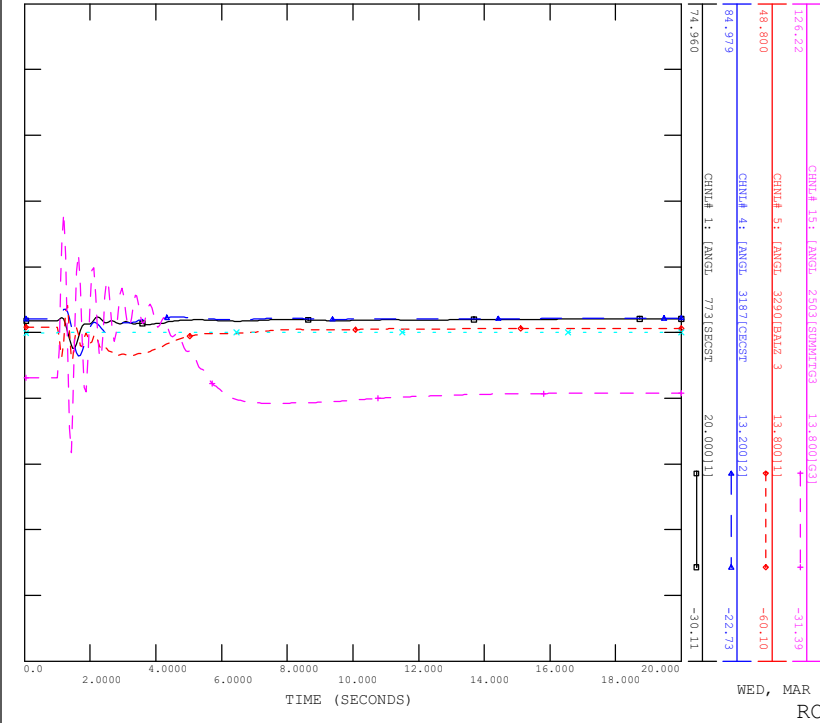


WED, MAR 30 2022 0:34
BRANCH P (2)

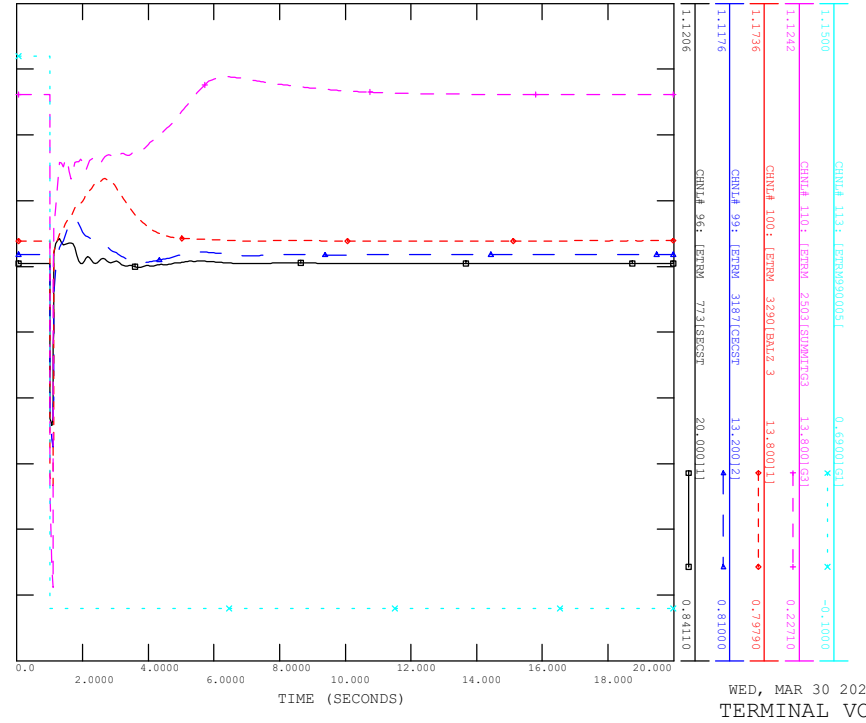


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_01_6881_SUMMIT

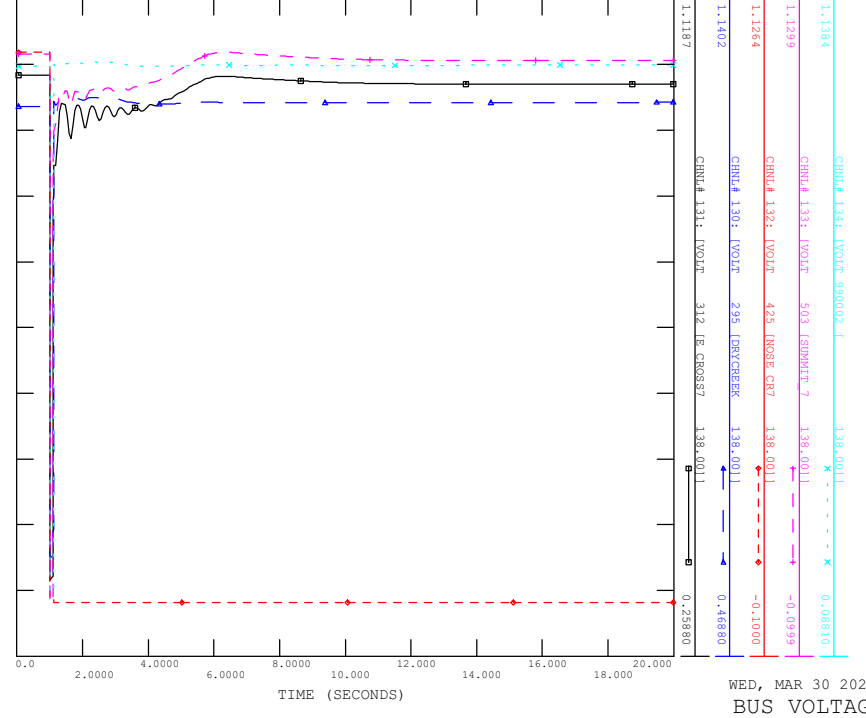
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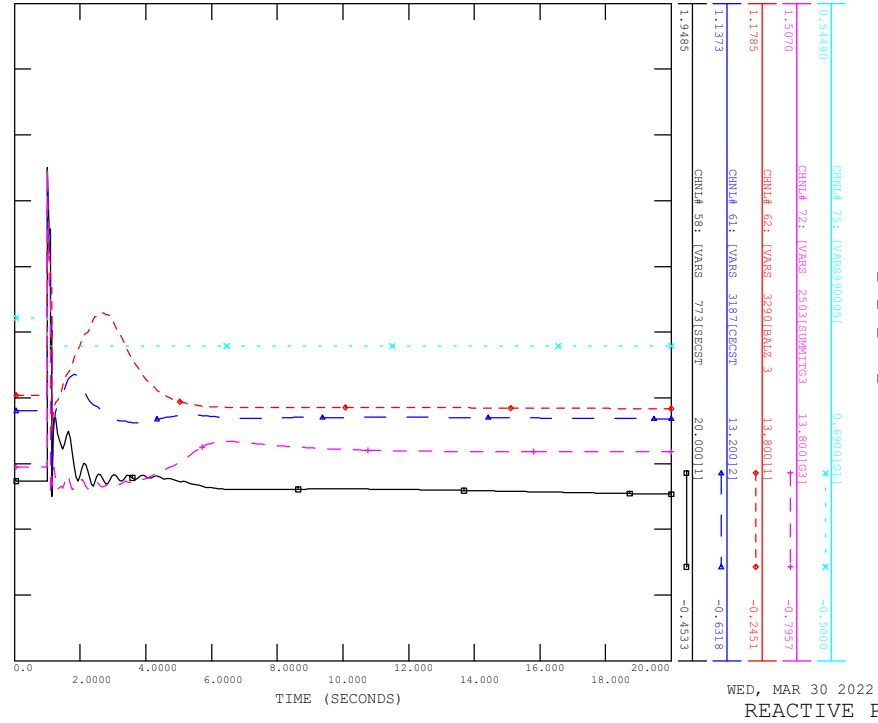
WED, MAR 30 2022 0:34
ROTOR ANGLE



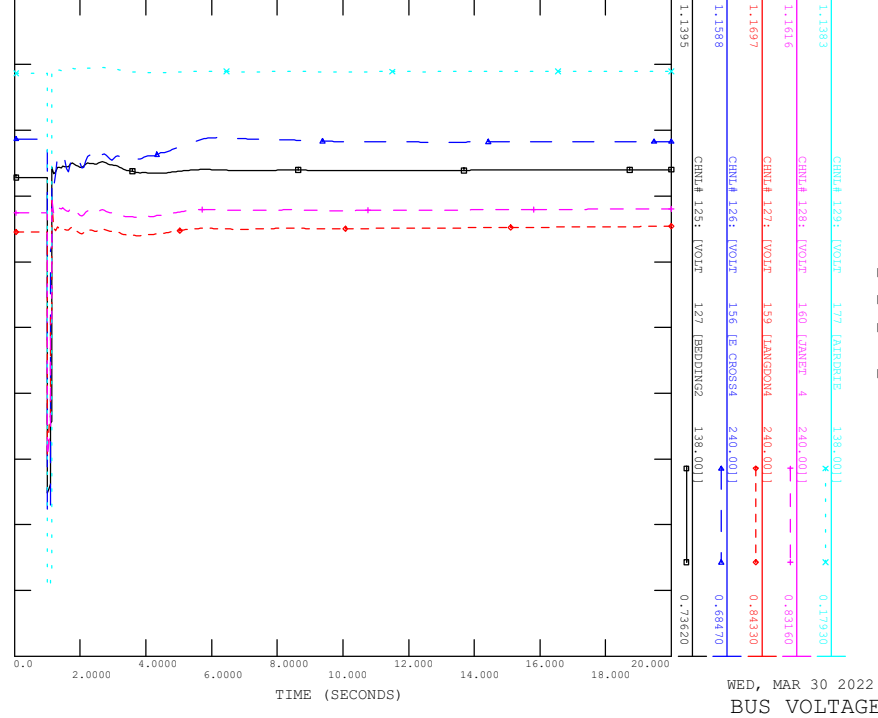
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE



WED, MAR 30 2022 0:34
BUS VOLTAGE (2)



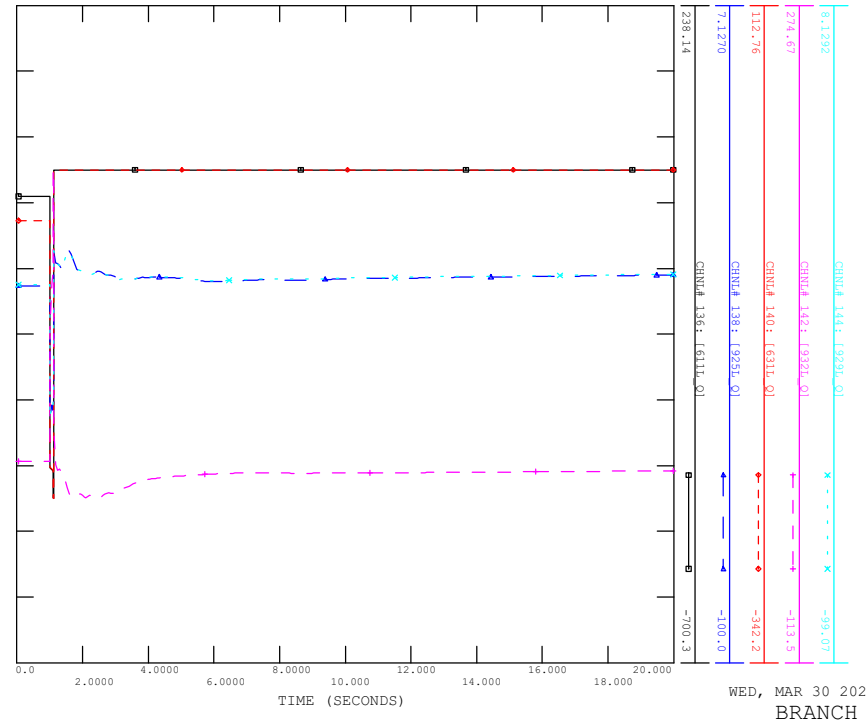
WED, MAR 30 2022 0:34
REACTIVE POWER



WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

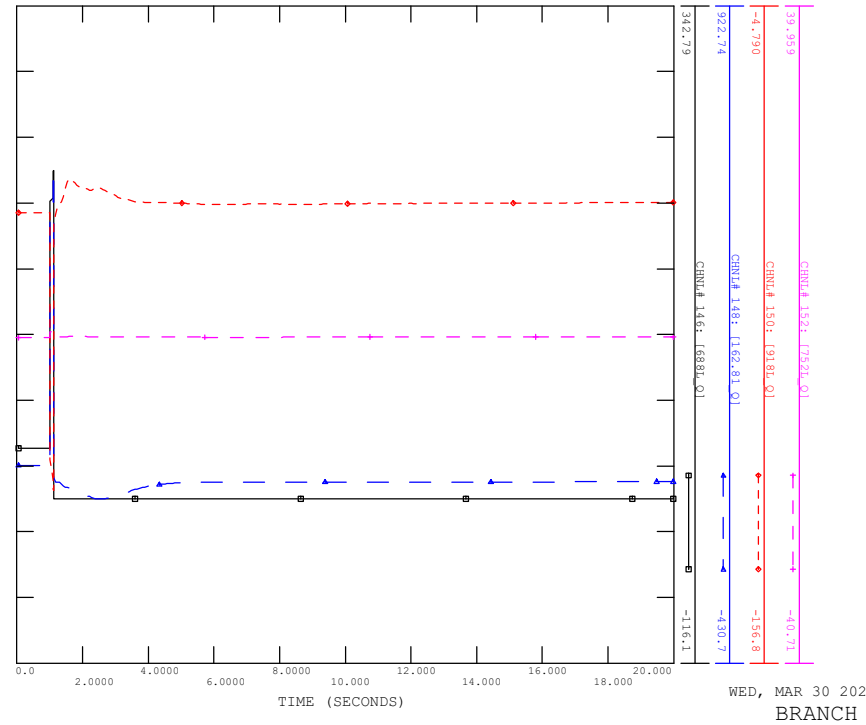
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_01_6881L_SUMMITT

FILE: scen3_sl_01_6881L_Summit.t.out



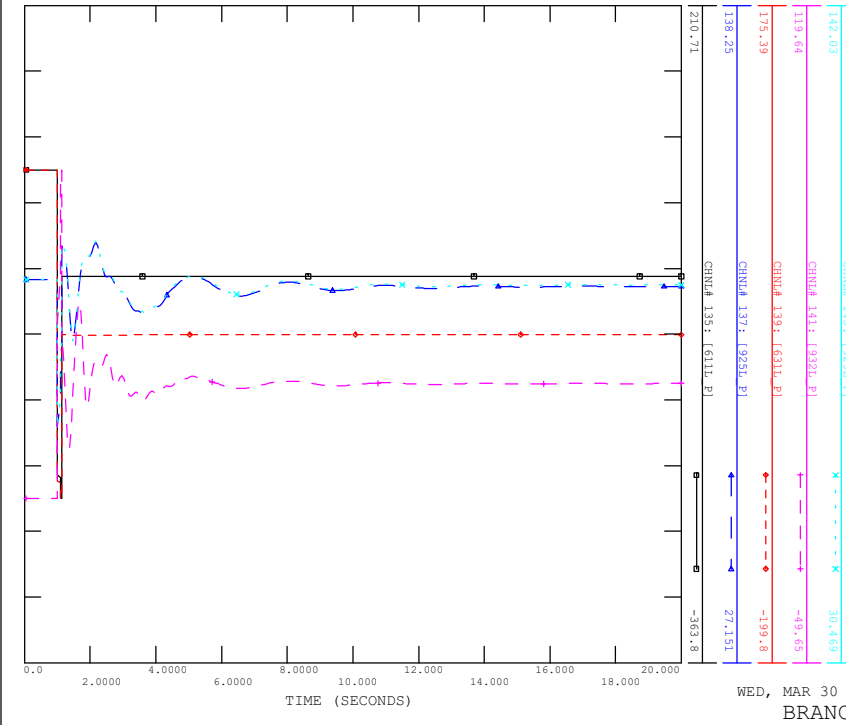
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_01_6881L_SUMMITT

FILE: scen3_sl_01_6881L_Summit.t.out



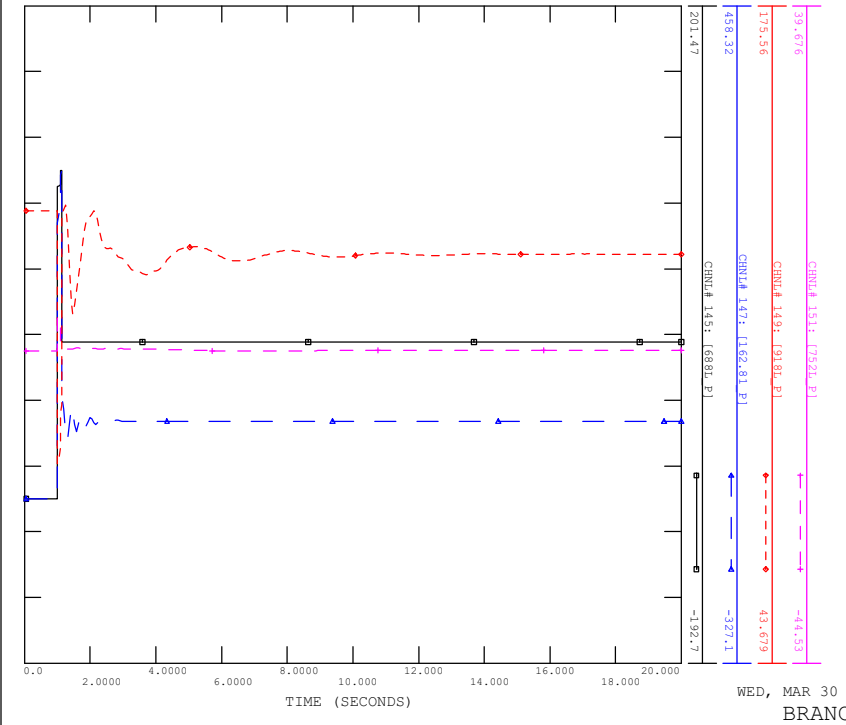
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_01_6881L_SUMMITT

FILE: scen3_sl_01_6881L_Summit.t.out

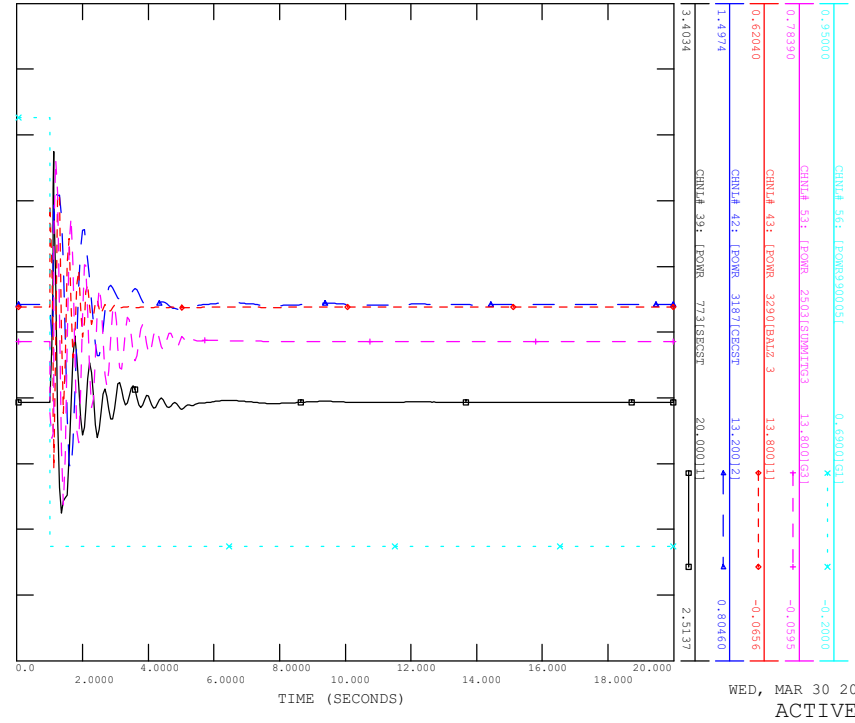


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_01_6881L_SUMMITT

FILE: scen3_sl_01_6881L_Summit.t.out

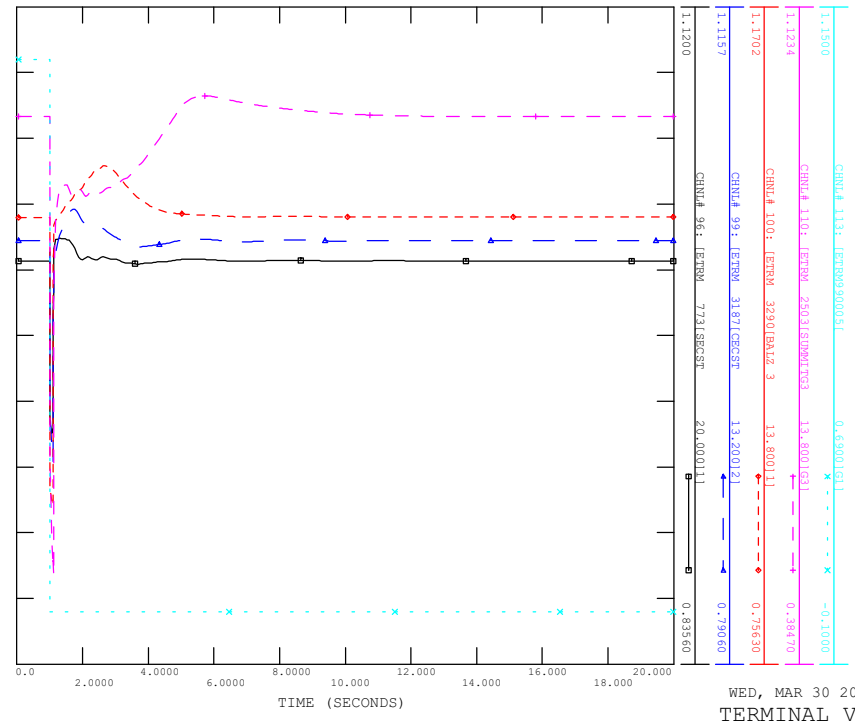


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_02_688L_EAST_AIRDIE
FILE: scn3_sl_02_688L_East_Airdie.out



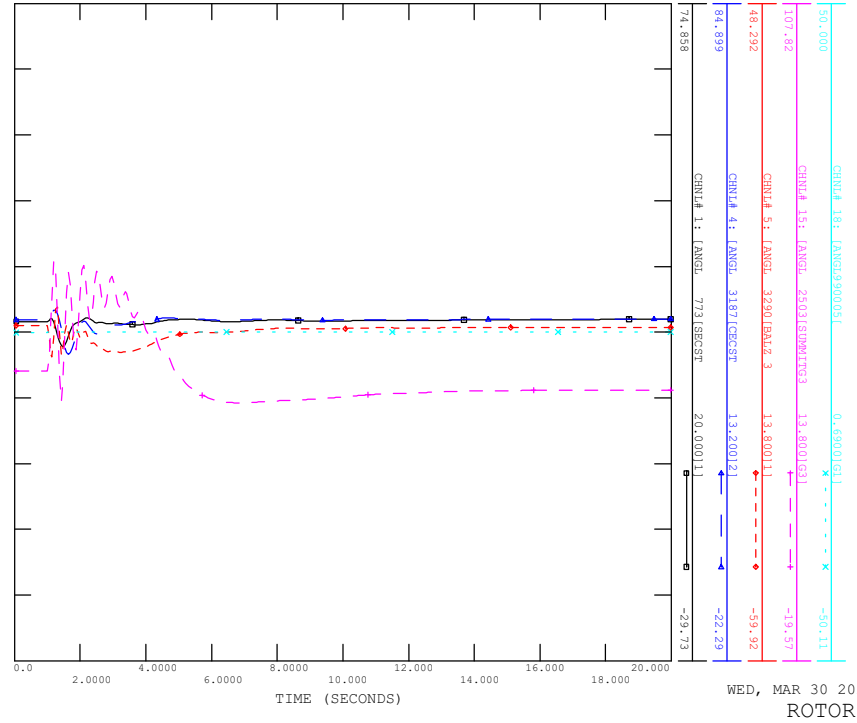
WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_02_688L_EAST_AIRDIE
FILE: scn3_sl_02_688L_East_Airdie.out



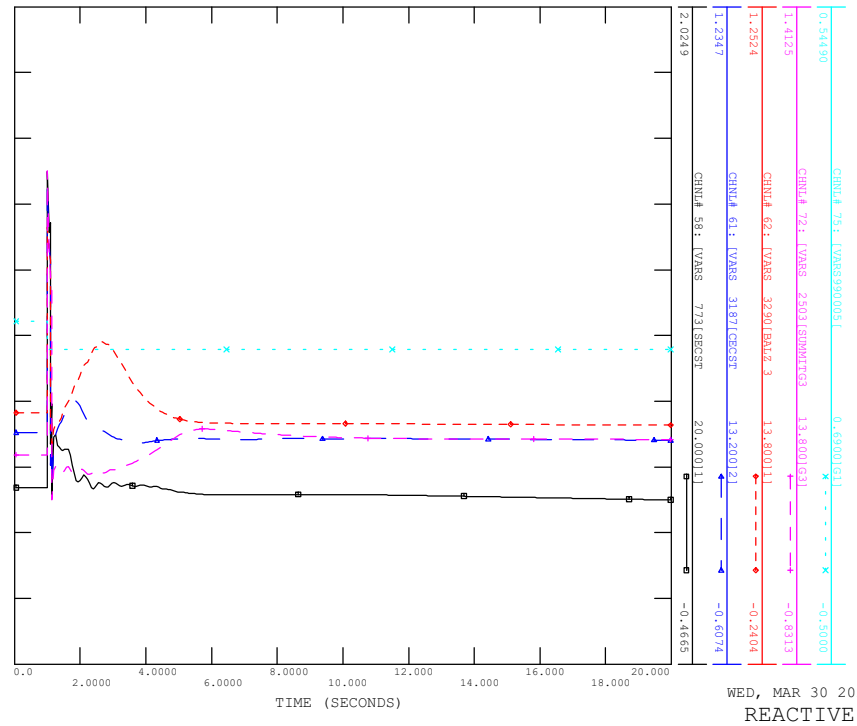
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_02_688L_EAST_AIRDIE
FILE: scn3_sl_02_688L_East_Airdie.out



WED, MAR 30 2022 0:34
ROTOR ANGLE

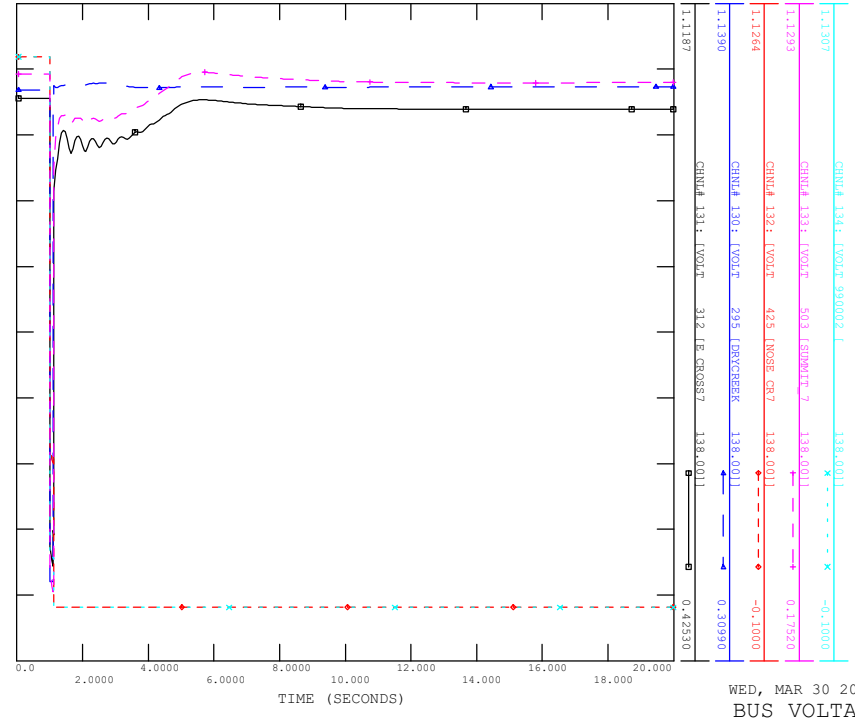
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_02_688L_EAST_AIRDIE
FILE: scn3_sl_02_688L_East_Airdie.out



WED, MAR 30 2022 0:34
REACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_02_688L_EAST_AIRDIE

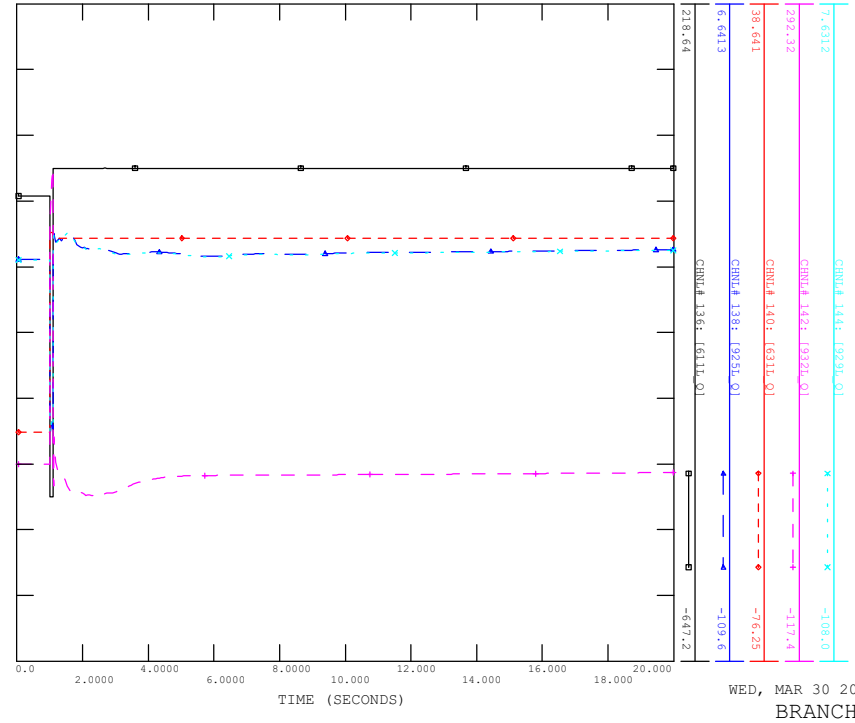
FILE: scn3_sl_02_688L_East_Airdie.out



WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_02_688L_EAST_AIRDIE

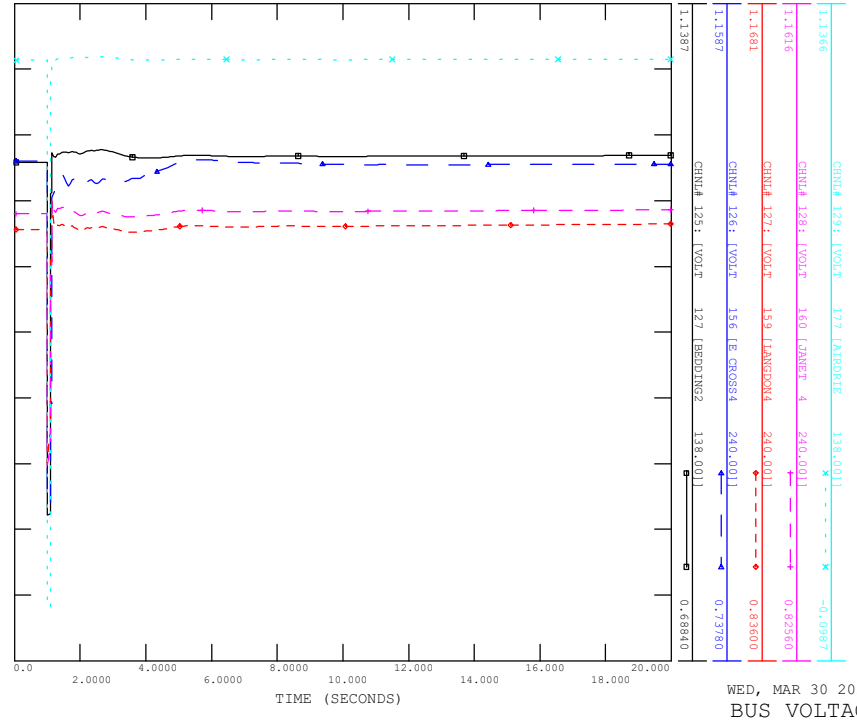
FILE: scn3_sl_02_688L_East_Airdie.out



WED, MAR 30 2022 0:34
BRANCH Q (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_02_688L_EAST_AIRDIE

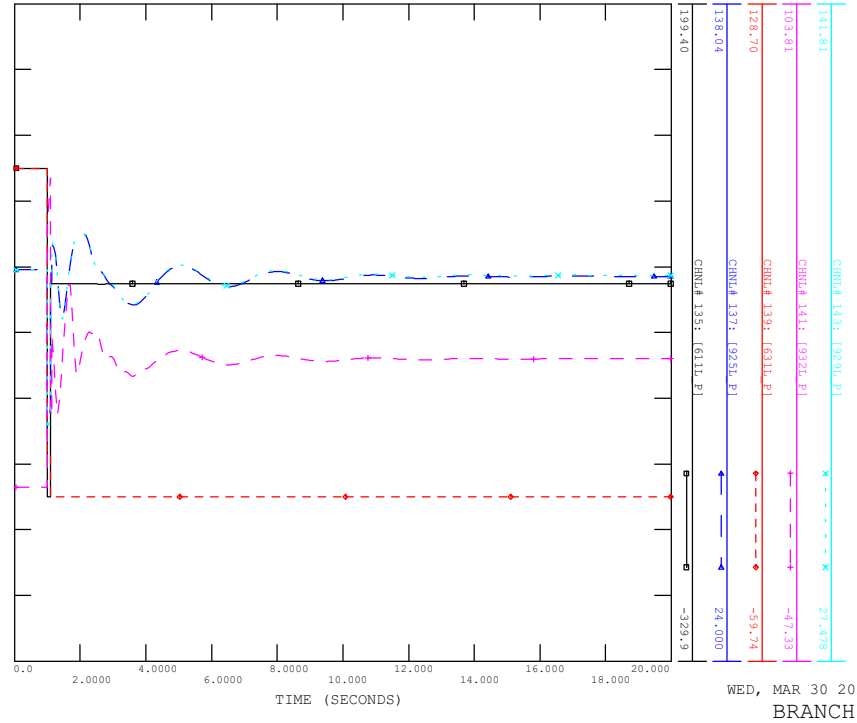
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WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

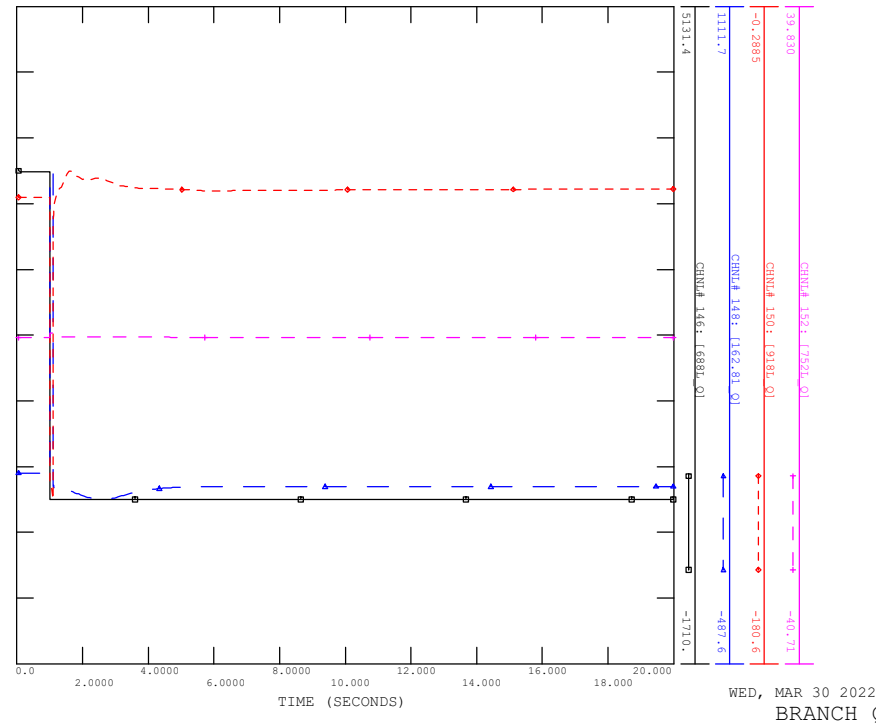
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_02_688L_EAST_AIRDIE

FILE: scn3_sl_02_688L_East_Airdie.out

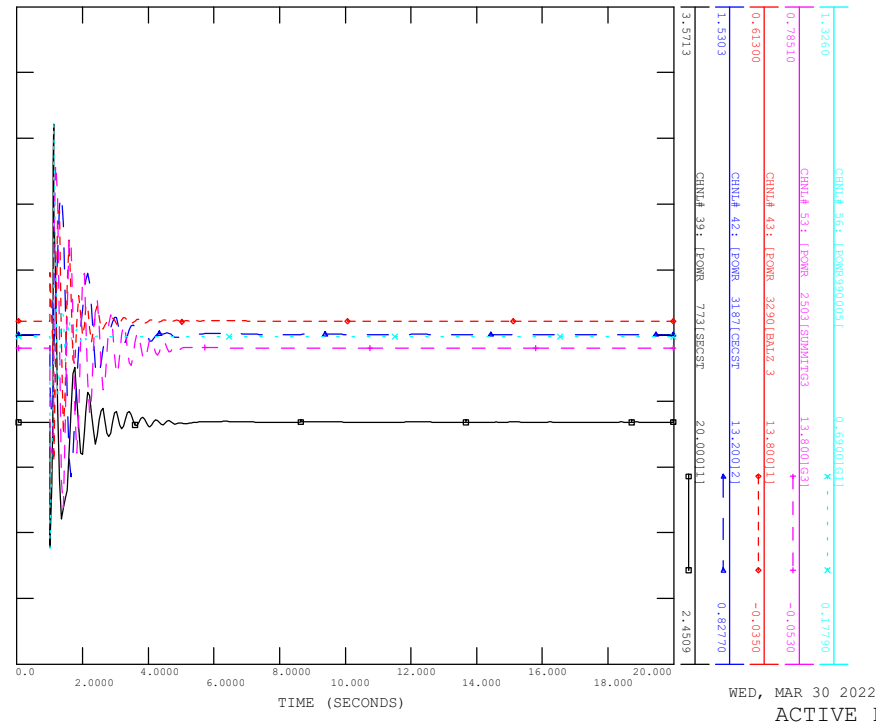


WED, MAR 30 2022 0:34
BRANCH P (1)

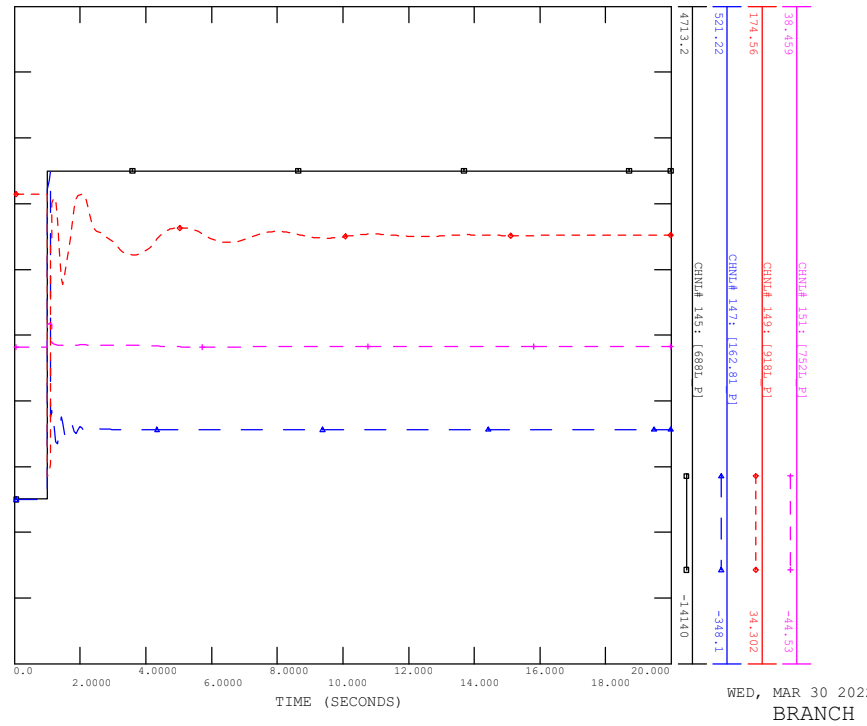
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_02_688L_East_AIRDRIE
FILE: scn3_sl_02_688L_East_Airdrie.out



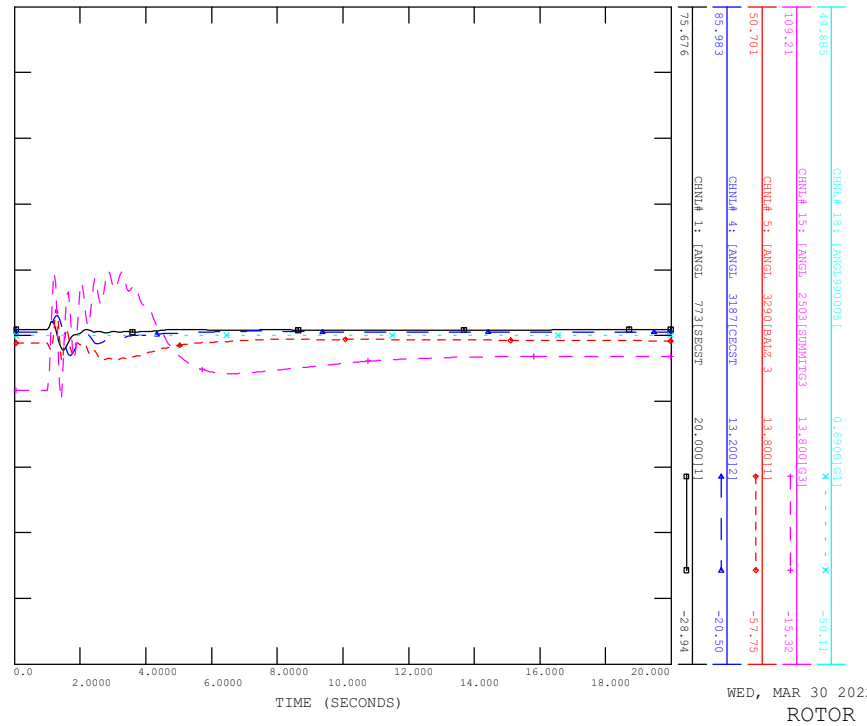
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_03_752L_East_CROSSFIELD
FILE: scn3_sl_03_752L_East_Crossfield.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_02_688L_East_AIRDRIE
FILE: scn3_sl_02_688L_East_Airdrie.out

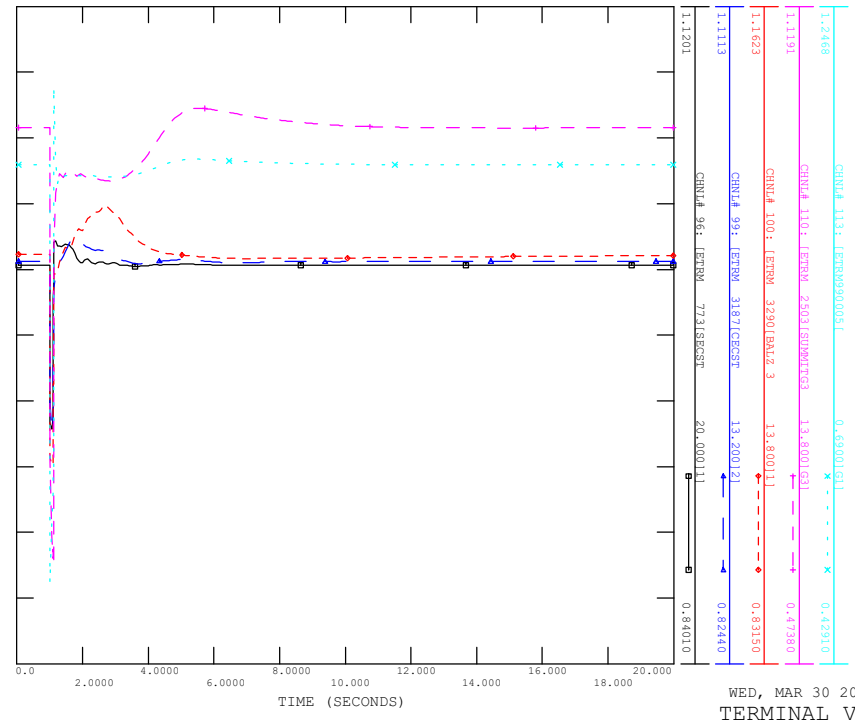


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_03_752L_East_CROSSFIELD
FILE: scn3_sl_03_752L_East_Crossfield.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_03_752L_EAST_CROSSFIELD

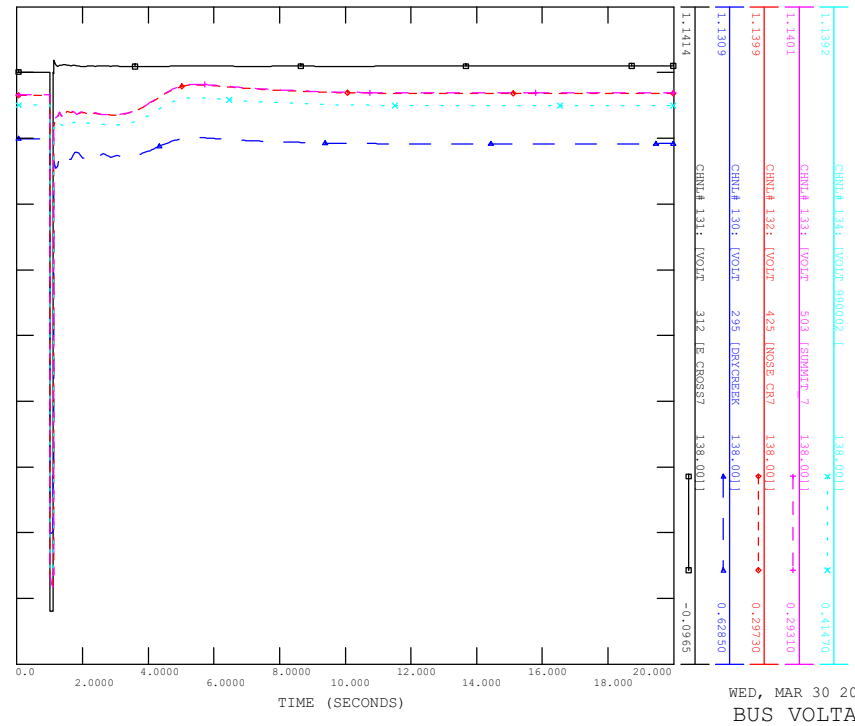
FILE: scn3_sl_03_752L_East_Crossfield.out



WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_03_752L_EAST_CROSSFIELD

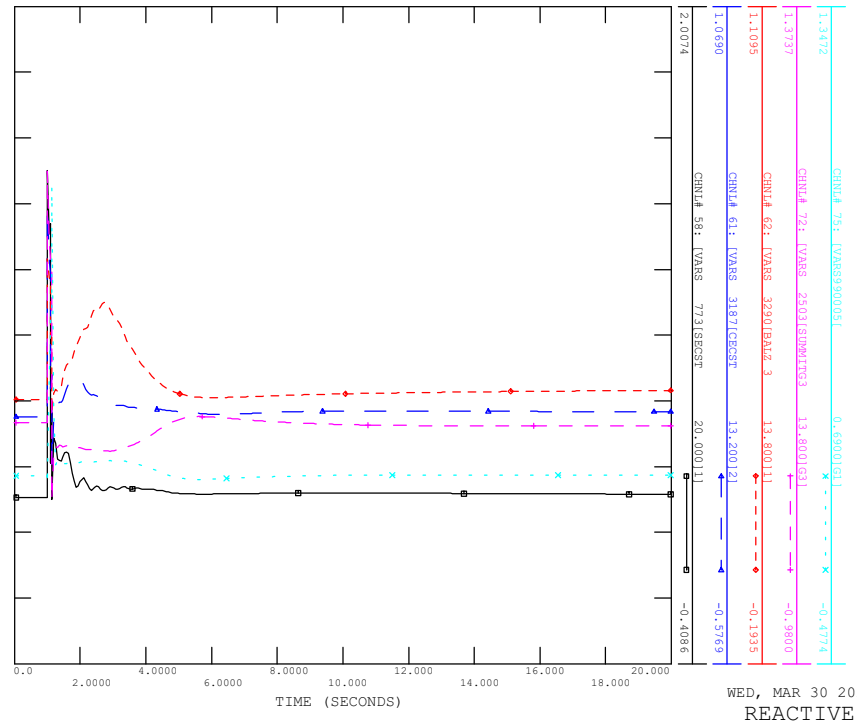
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WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_03_752L_EAST_CROSSFIELD

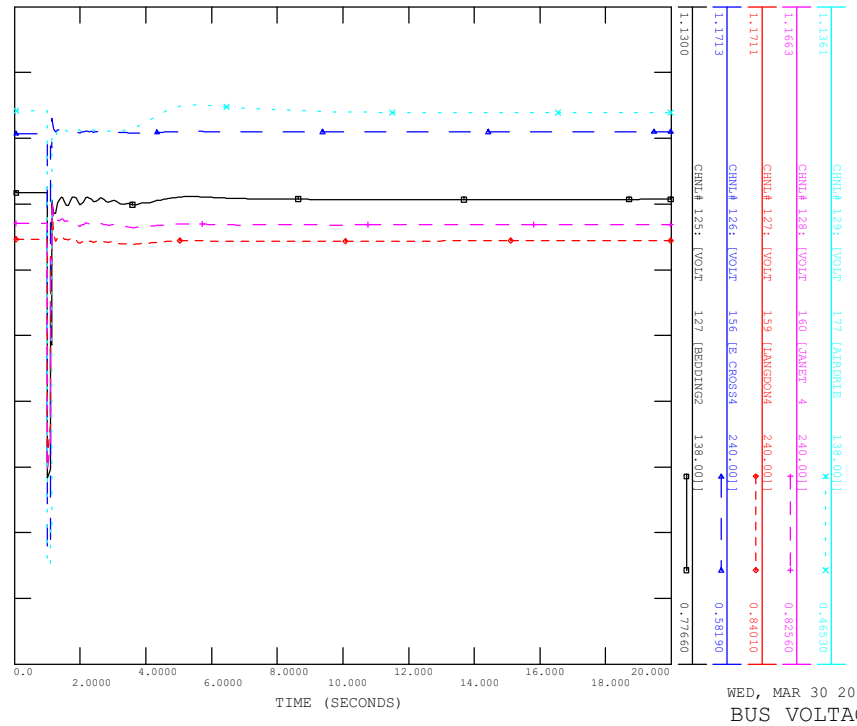
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WED, MAR 30 2022 0:34
REACTIVE POWER

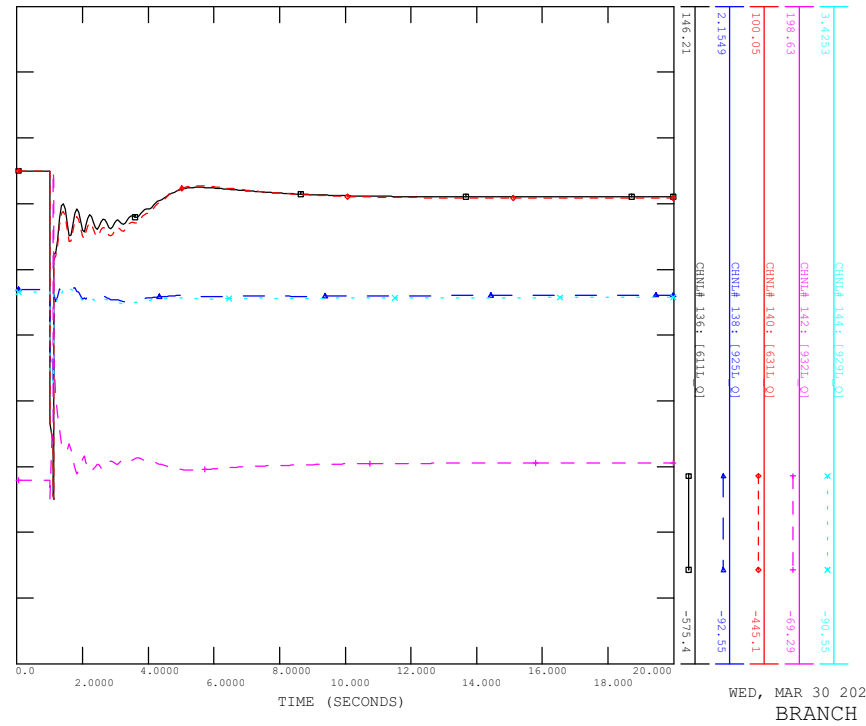
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_03_752L_EAST_CROSSFIELD

FILE: scn3_sl_03_752L_East_Crossfield.out

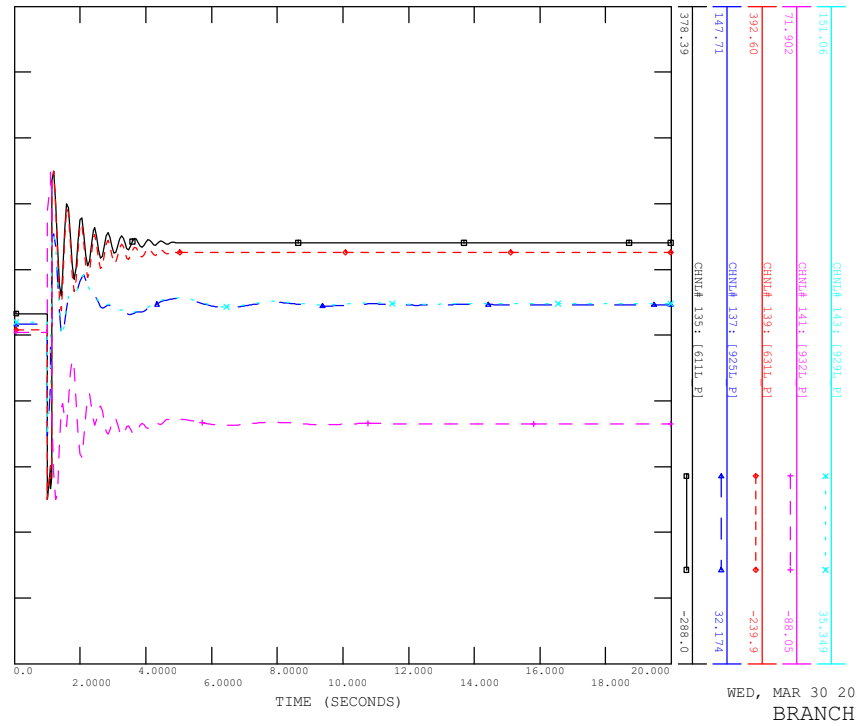


WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

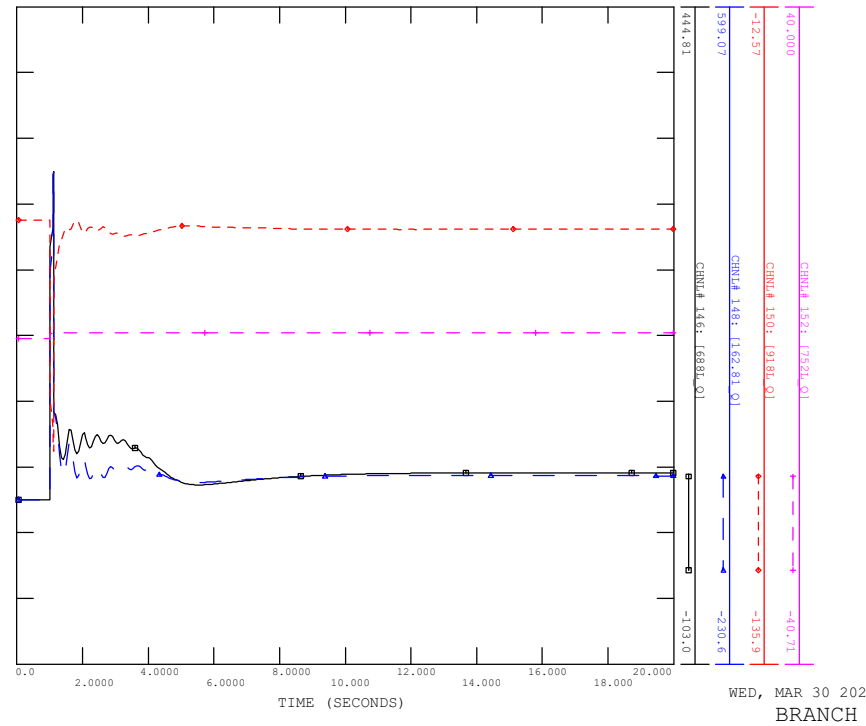
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_03_752L_EAST_CROSSFIELD
FILE: scn3_sl_03_752L_East_Crossfield.out
WED, MAR 30 2022 0:34
BRANCH Q (1)



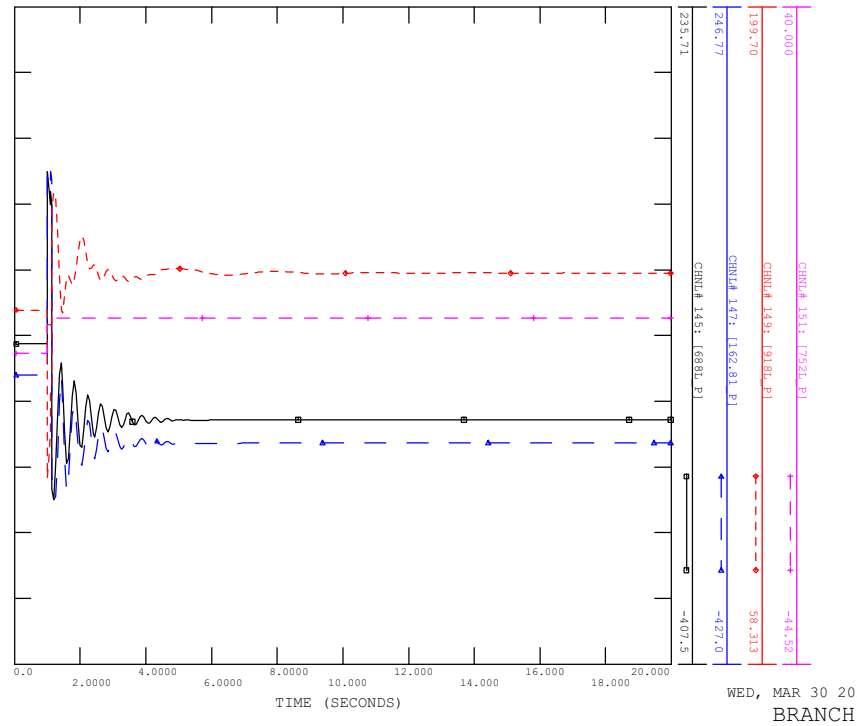
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_03_752L_EAST_CROSSFIELD
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WED, MAR 30 2022 0:34
BRANCH P (1)



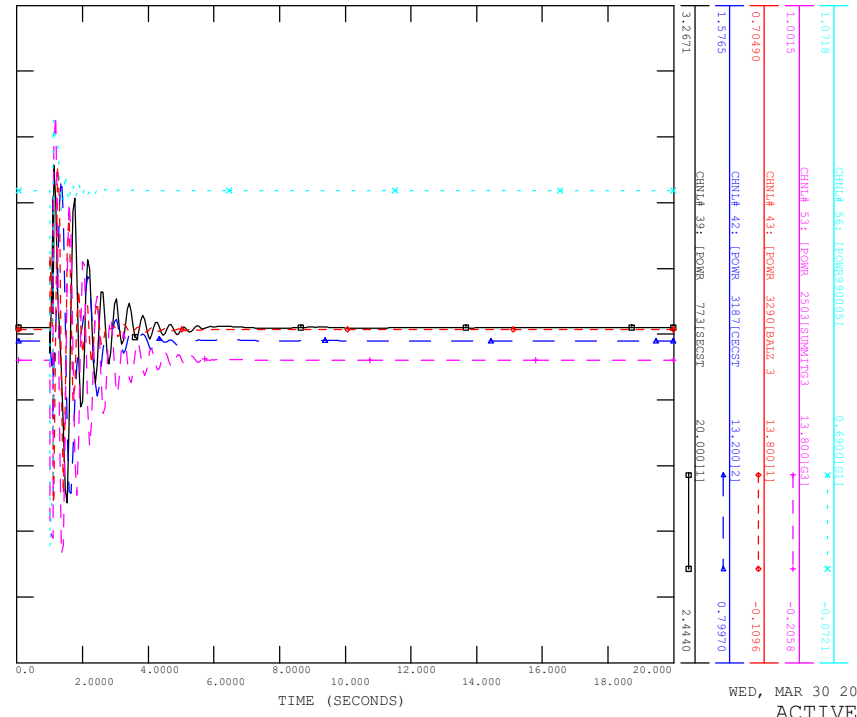
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_03_752L_EAST_CROSSFIELD
FILE: scn3_sl_03_752L_East_Crossfield.out
WED, MAR 30 2022 0:34
BRANCH Q (2)



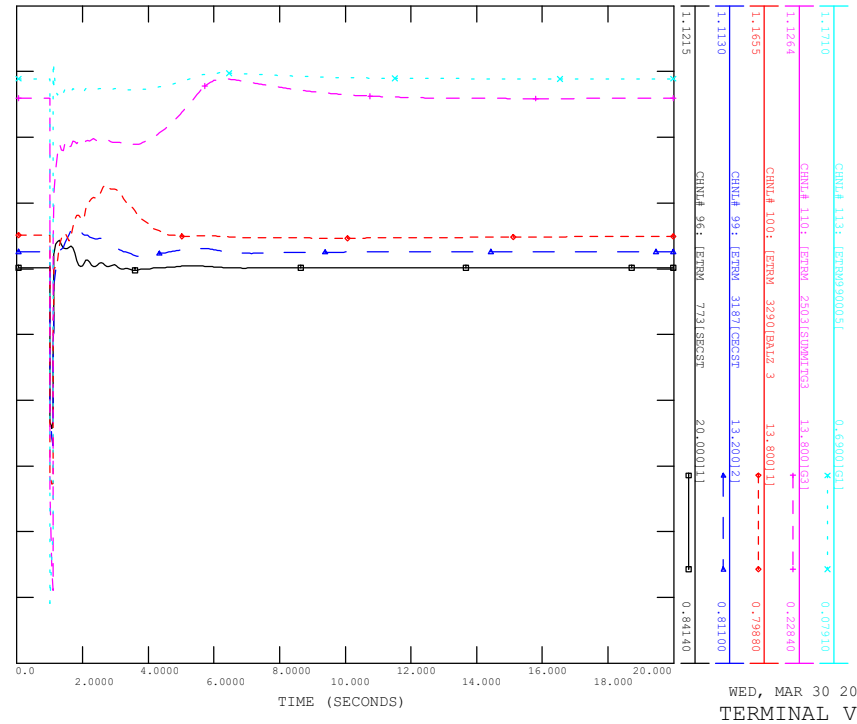
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_03_752L_EAST_CROSSFIELD
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WED, MAR 30 2022 0:34
BRANCH P (2)



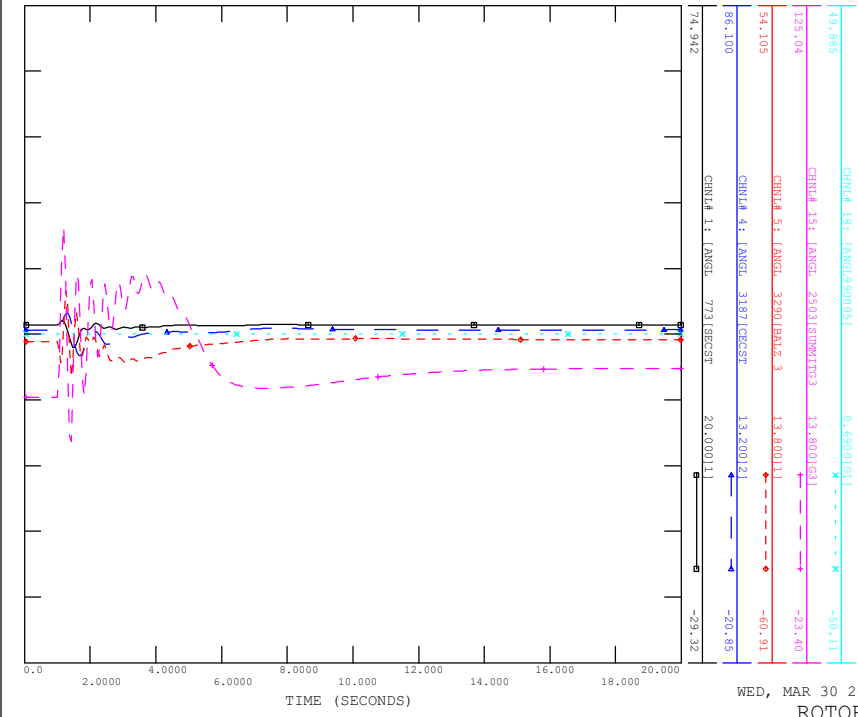
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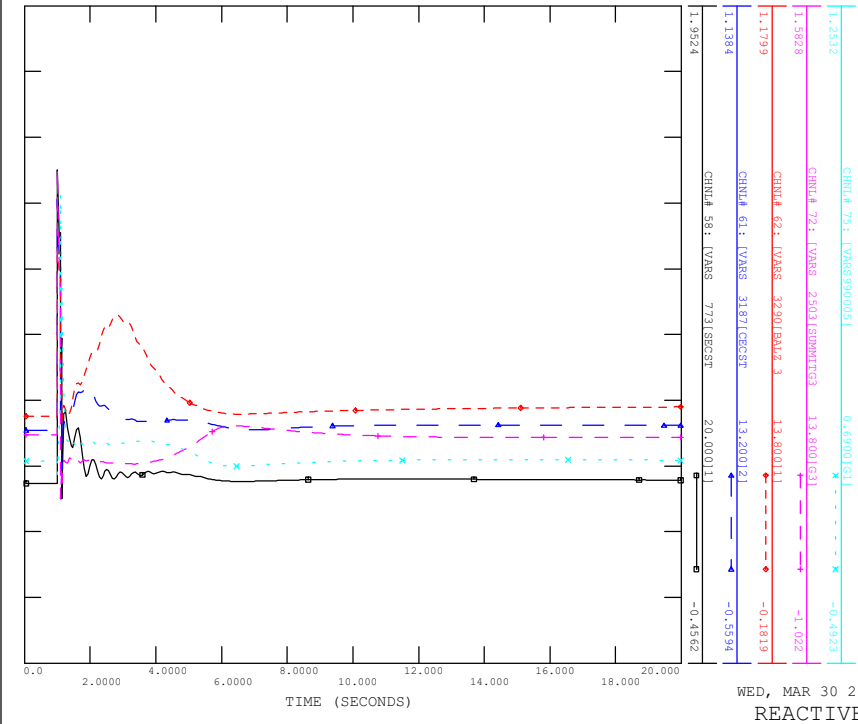
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FILE: scn3_sl_04_752L_Summit.out

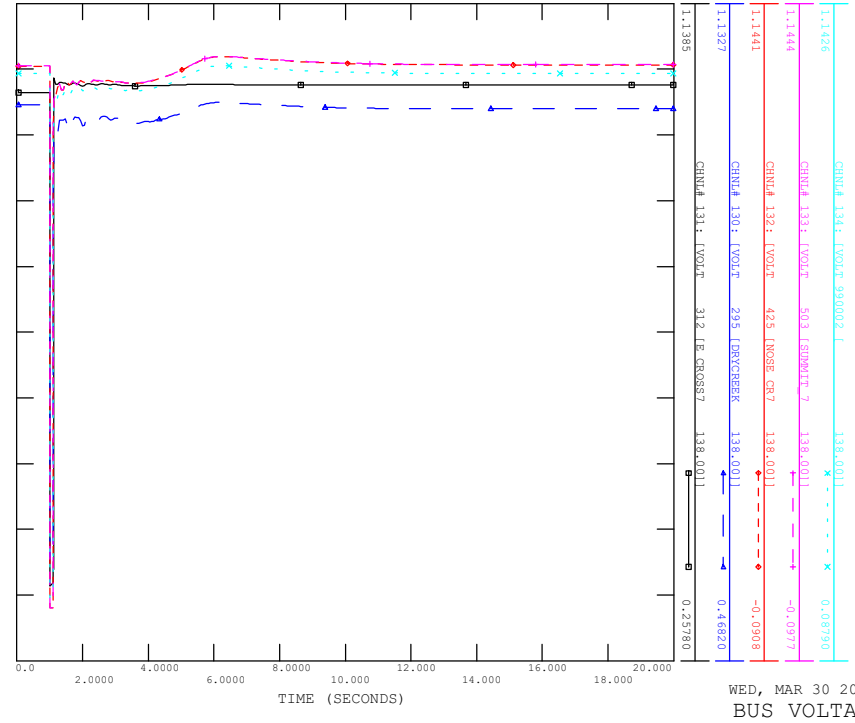


FILE: scn3_sl_04_752L_Summit.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_04_752L_SUMMIT

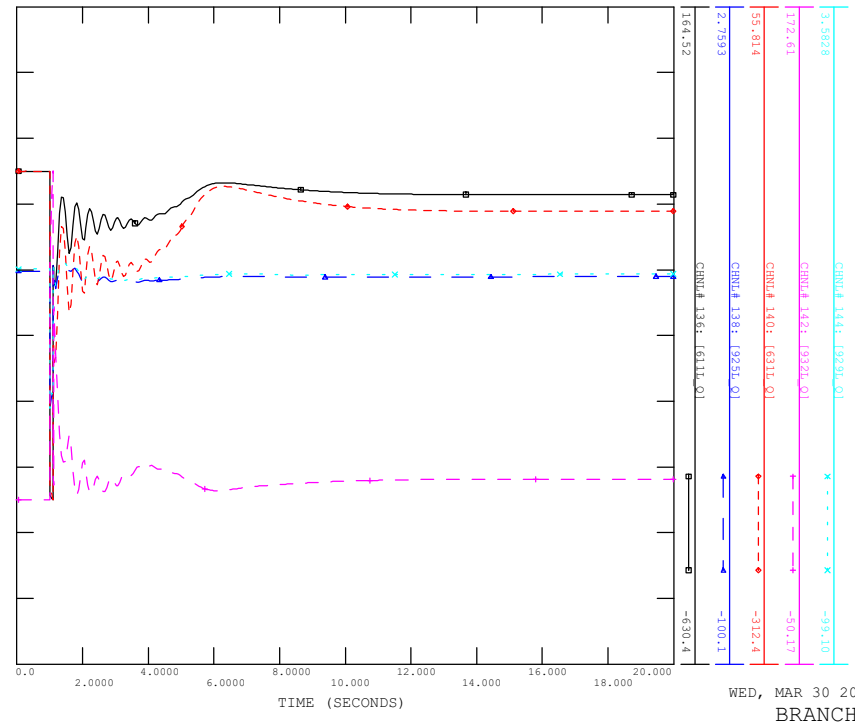
FILE: scn3_sl_04_752L_Summit.out



WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_04_752L_SUMMIT

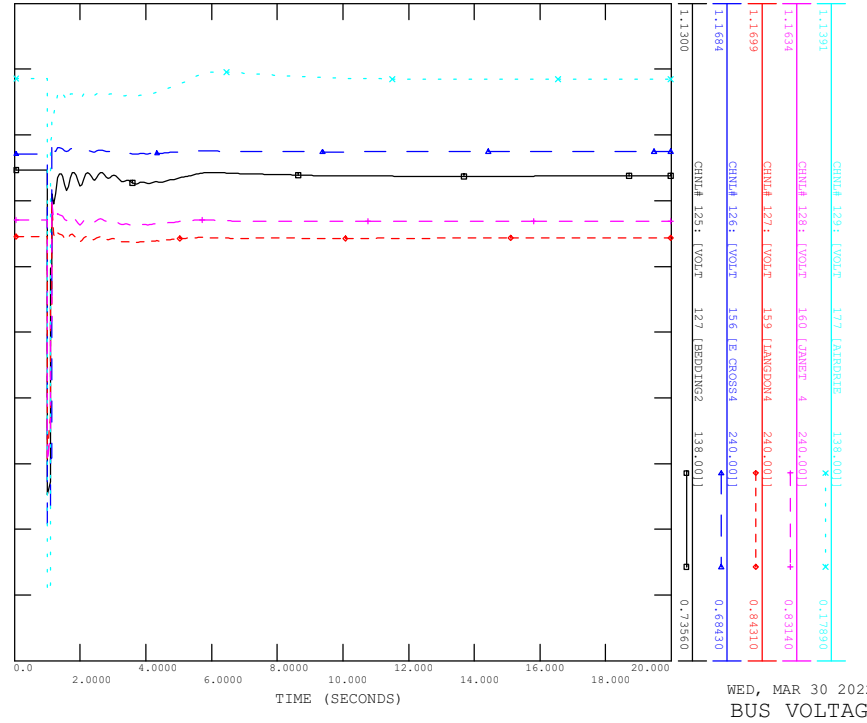
FILE: scn3_sl_04_752L_Summit.out



WED, MAR 30 2022 0:34
BRANCH Q (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_04_752L_SUMMIT

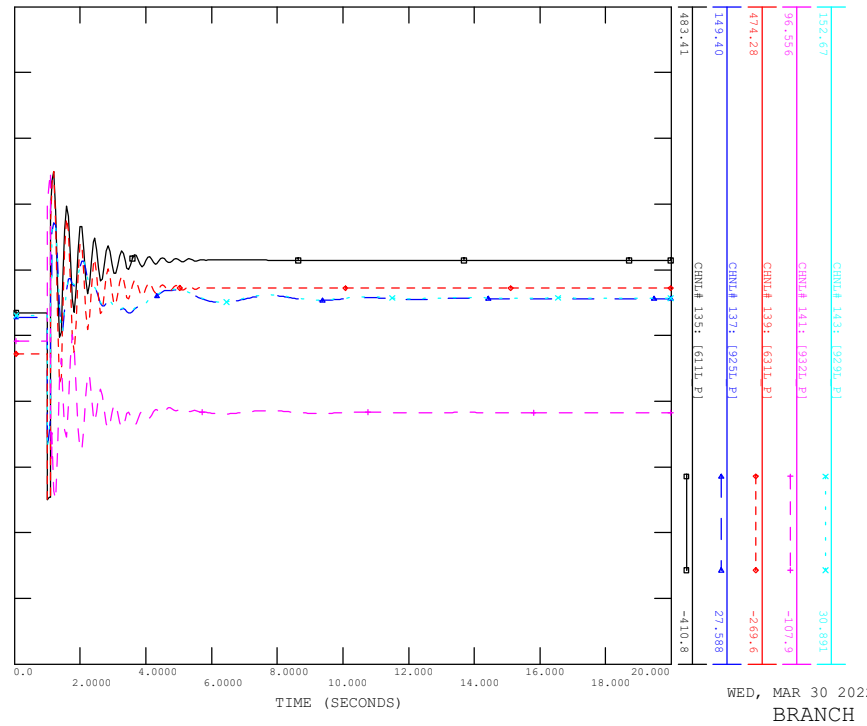
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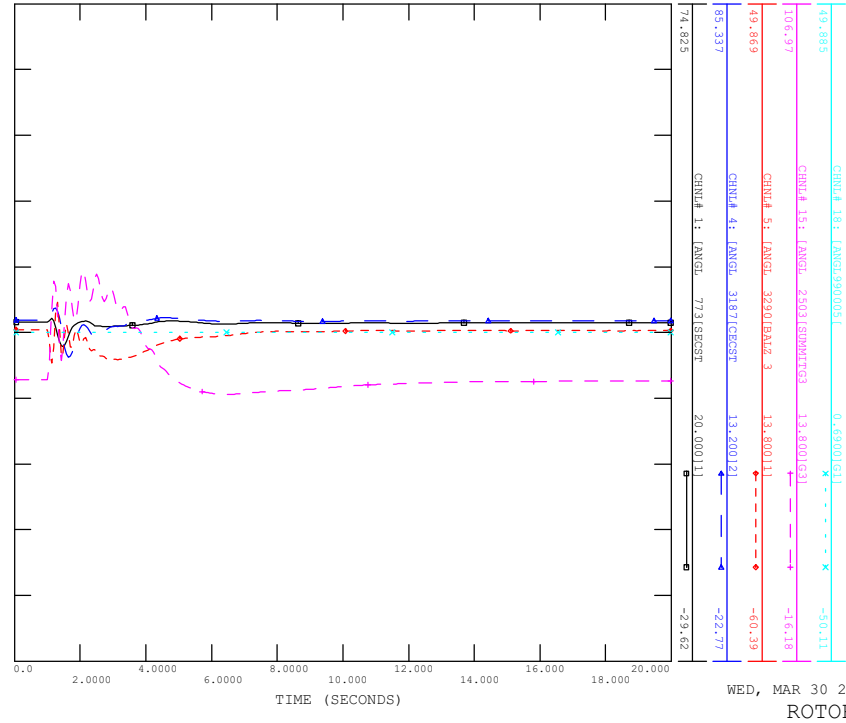
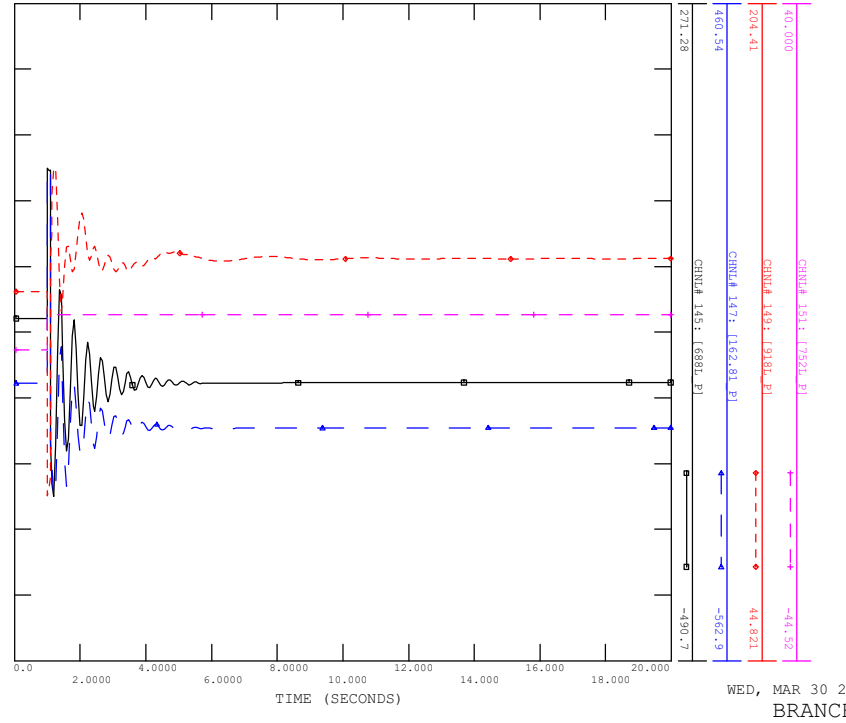
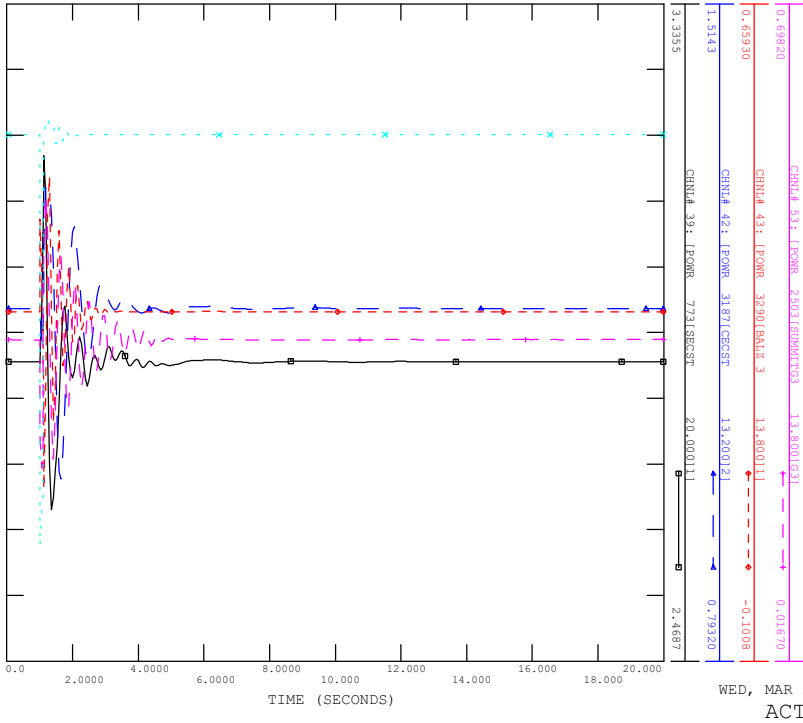
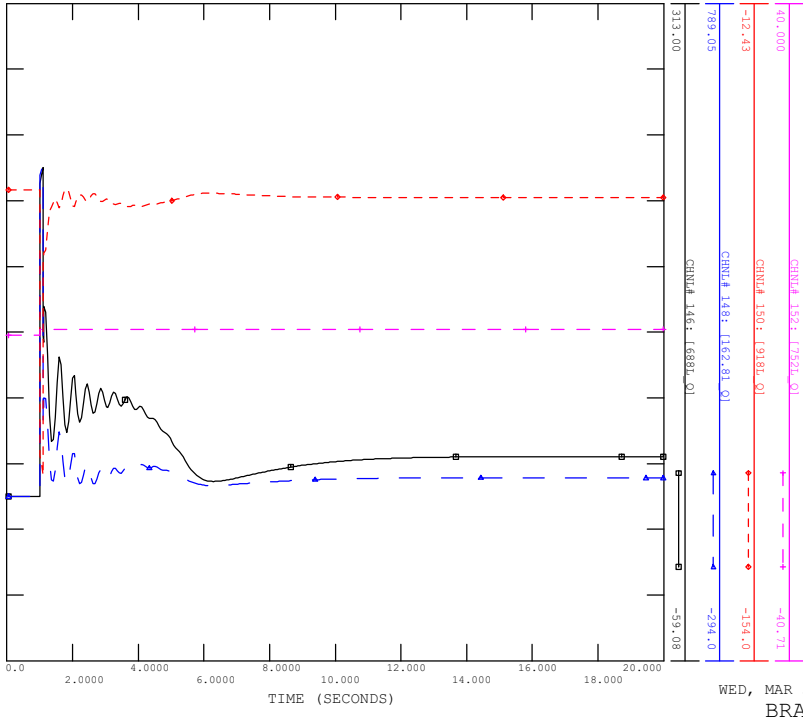
WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_04_752L_SUMMIT

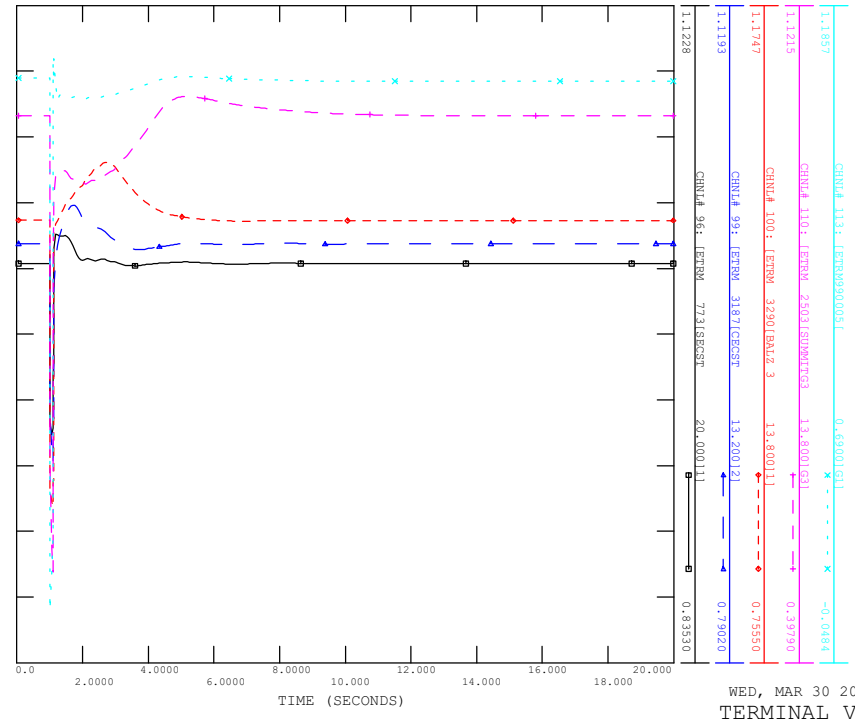
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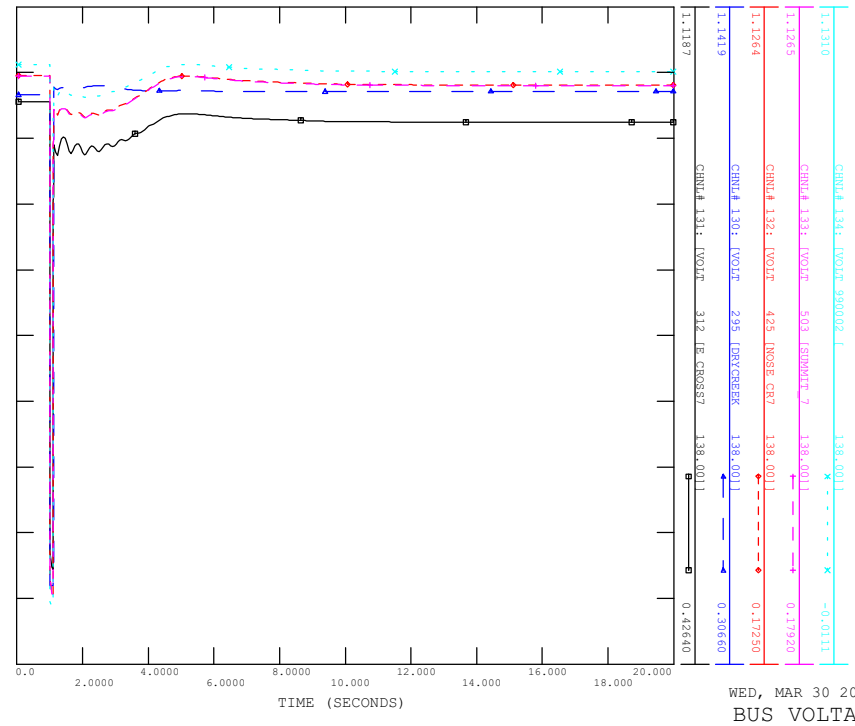
WED, MAR 30 2022 0:34
BRANCH P (1)



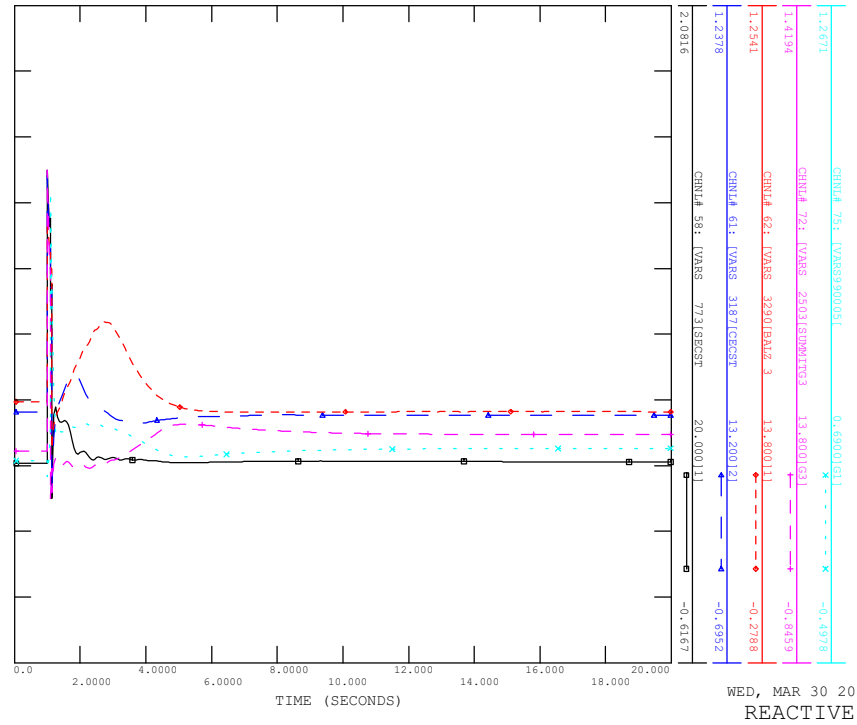
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_05_631L_EAST_AIRDIE



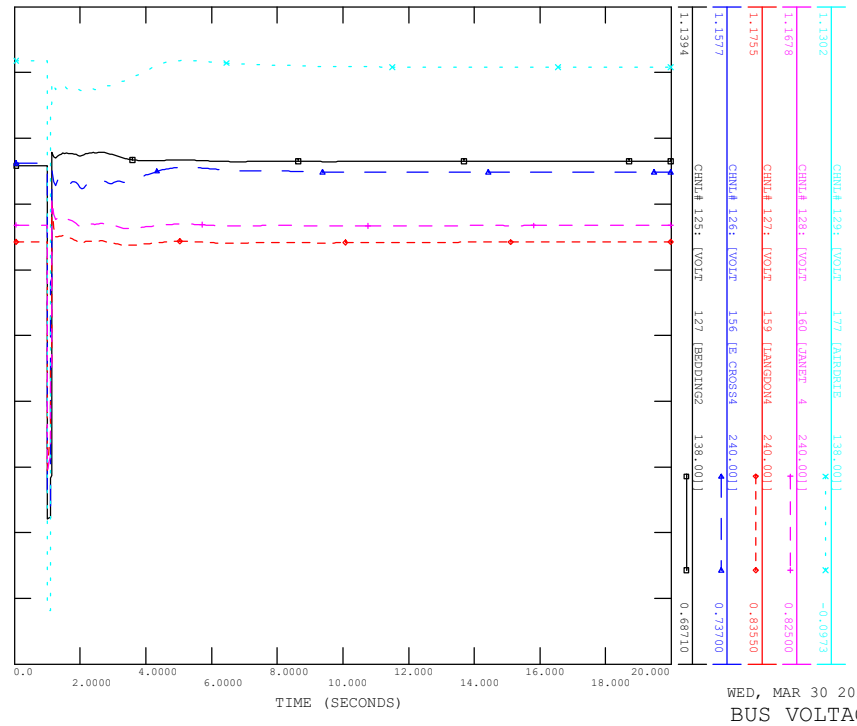
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_05_631L_EAST_AIRDIE



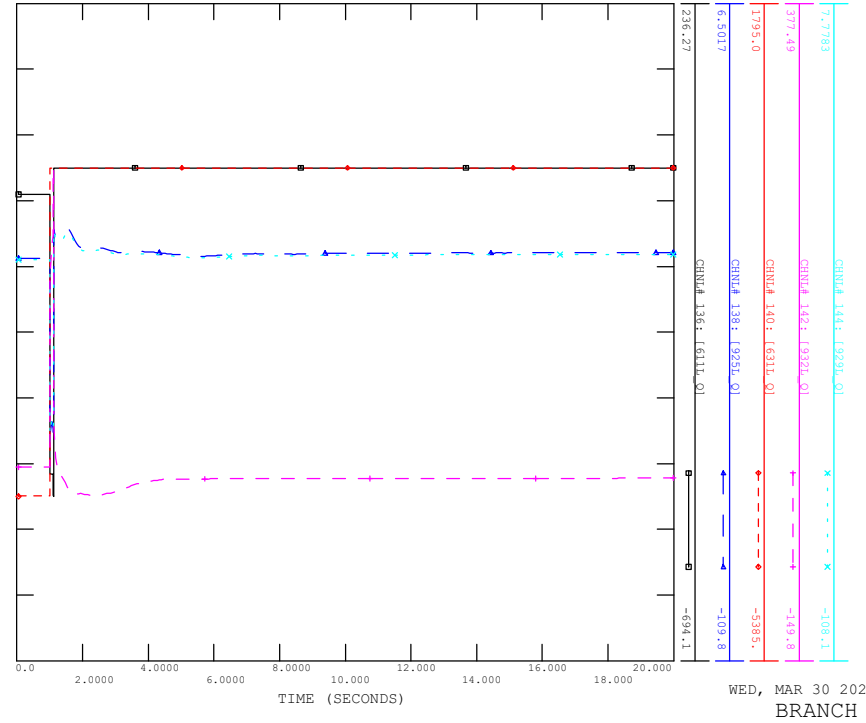
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CONTINGENCY -SCN3_SL_05_631L_EAST_AIRDIE



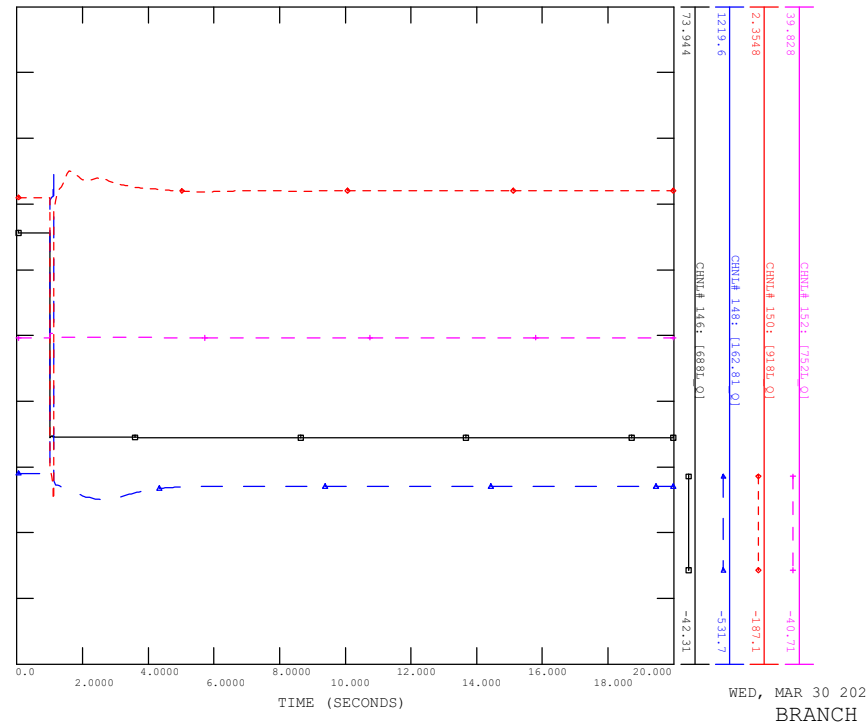
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CONTINGENCY -SCN3_SL_05_631L_EAST_AIRDIE



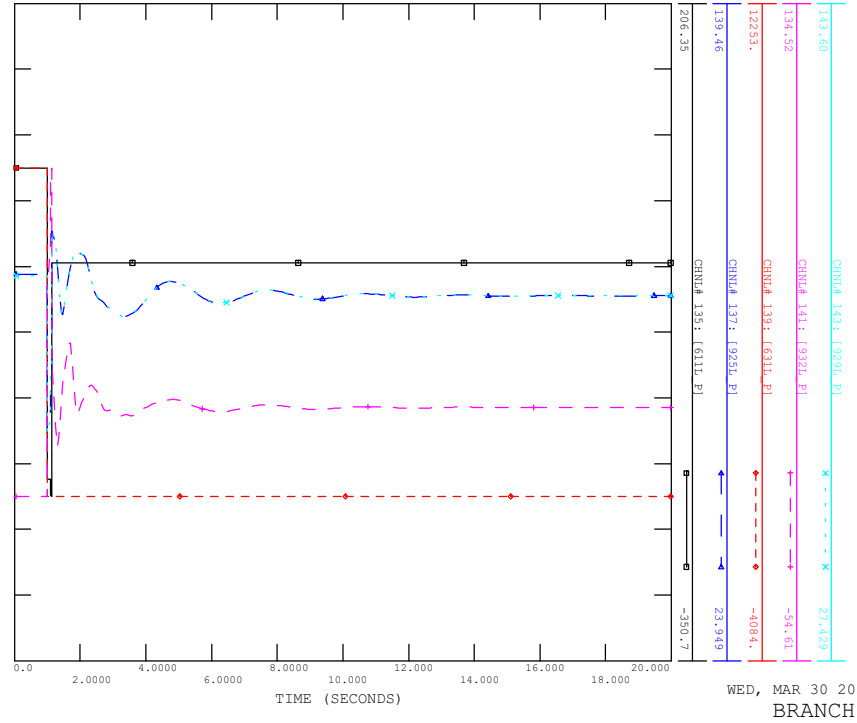
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_05_631L_EAST_AIRDIE



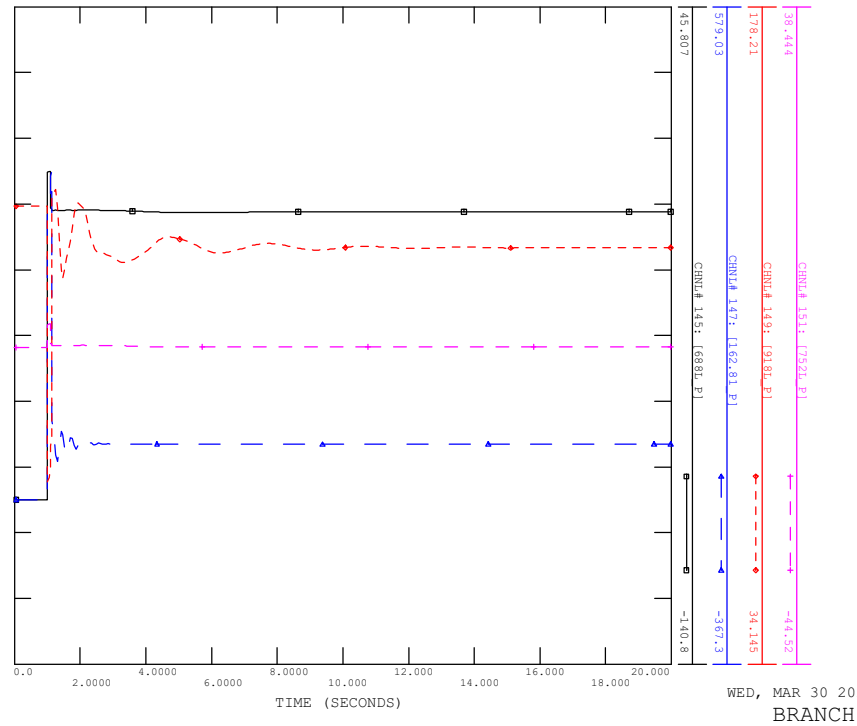
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CONTINGENCY -SCN3_SL_05_631L_EAST_AIRDIE



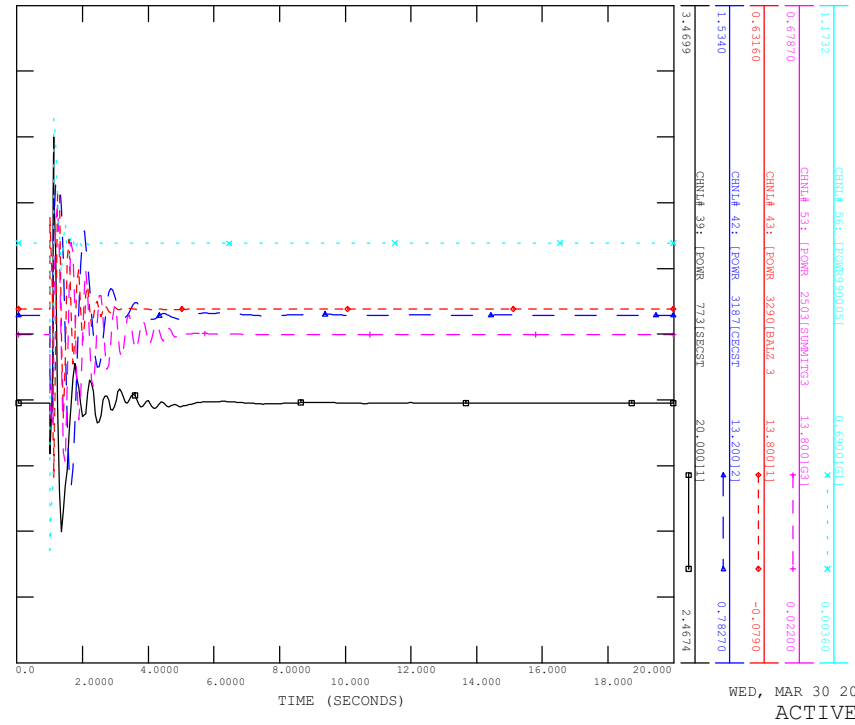
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_05_631L_EAST_AIRDIE



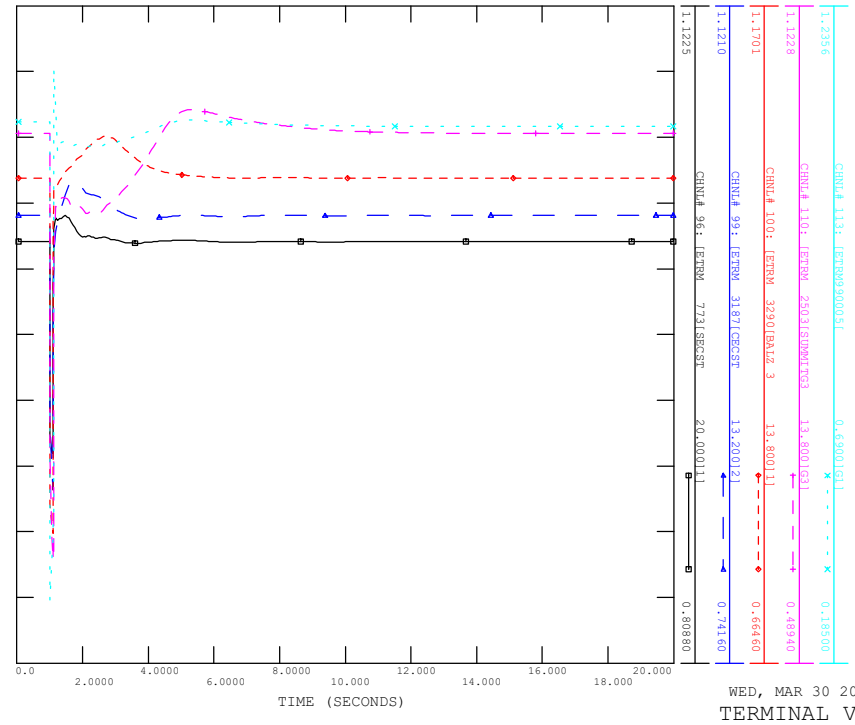
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_05_631L_EAST_AIRDIE



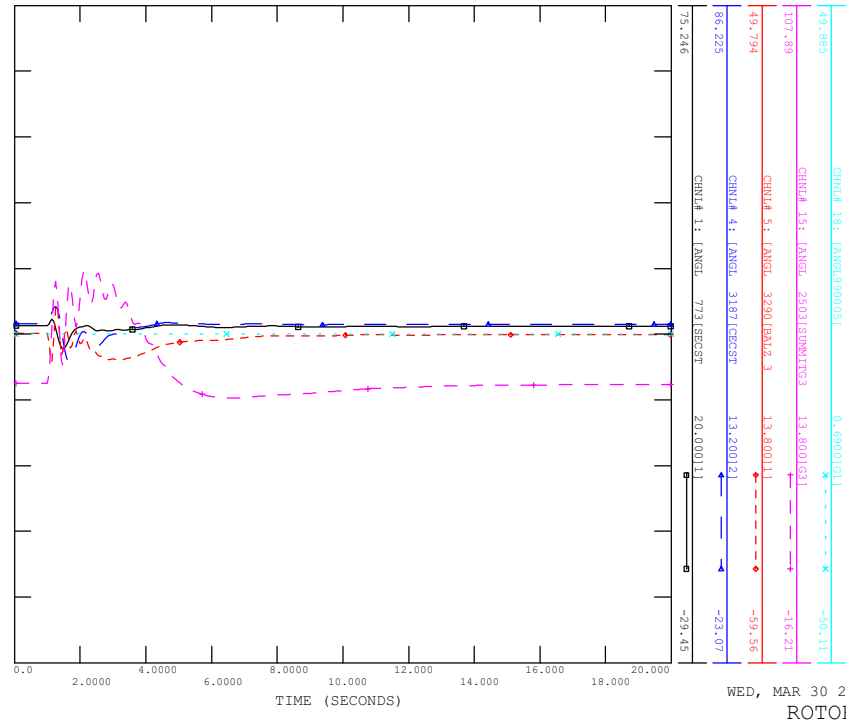
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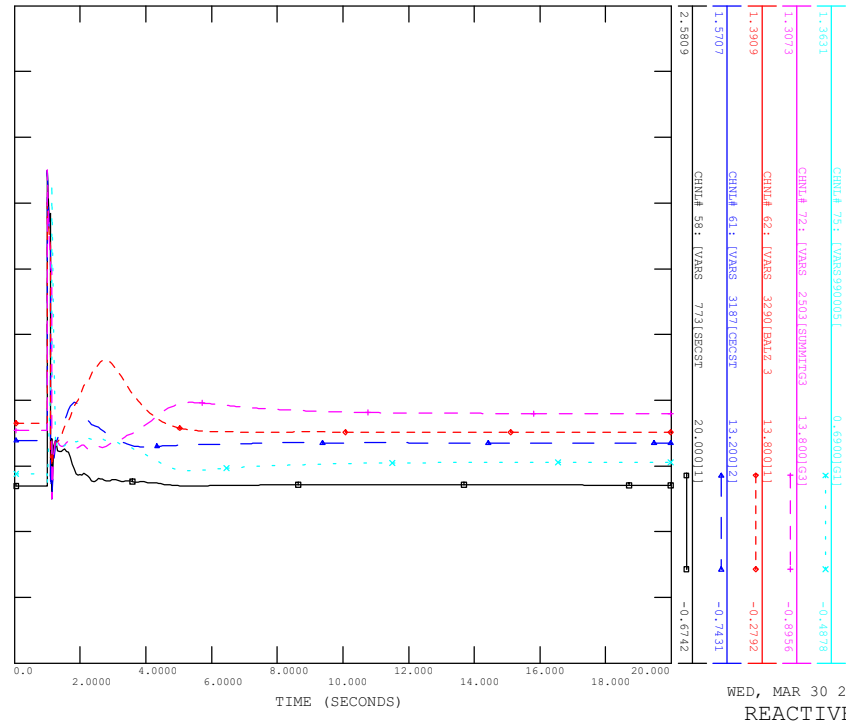
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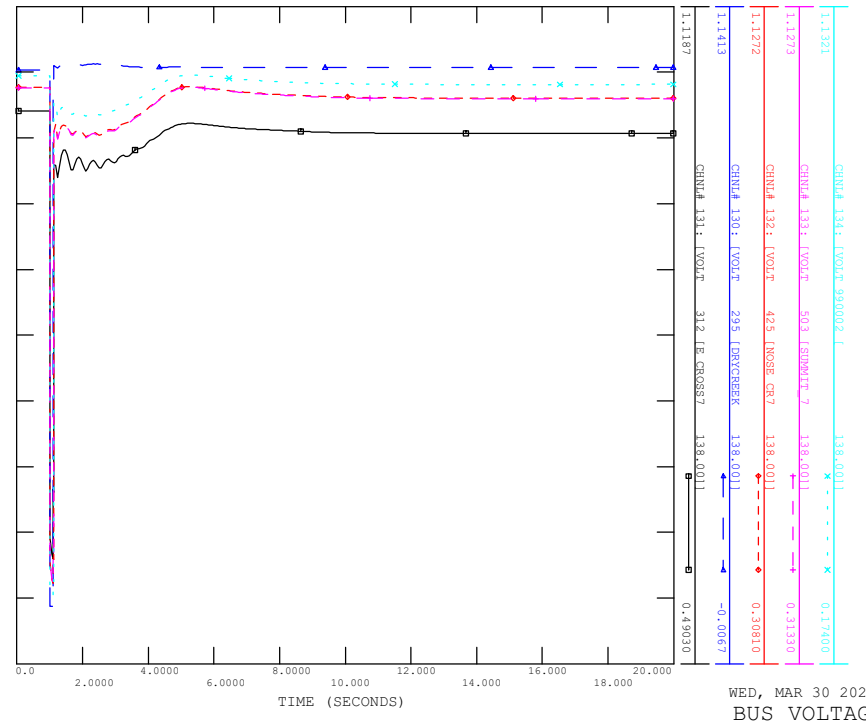
FILE: scn3_sl_06_631L_Dry_Creek.out



FILE: scn3_sl_06_631L_Dry_Creek.out

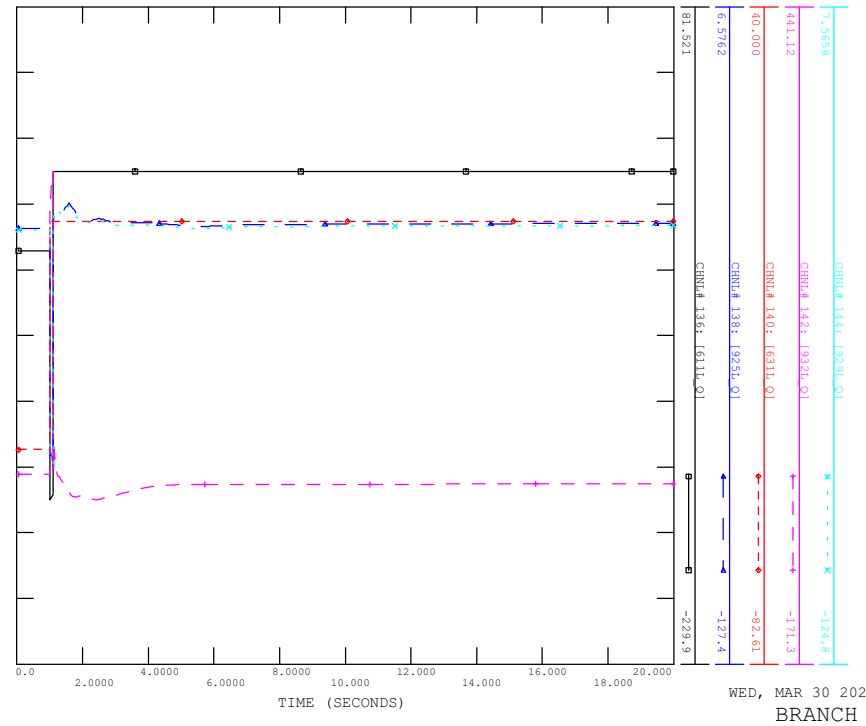


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_06_631L_DRY_CREEK
FILE: scn3_sl_06_631L_Dry_Creek.out



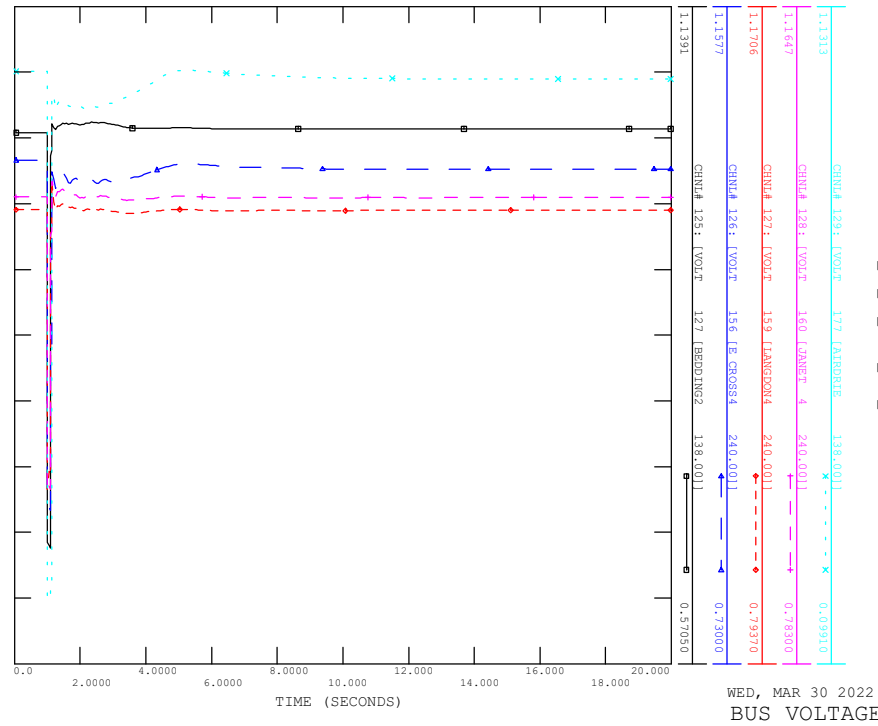
WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_06_631L_DRY_CREEK
FILE: scn3_sl_06_631L_Dry_Creek.out



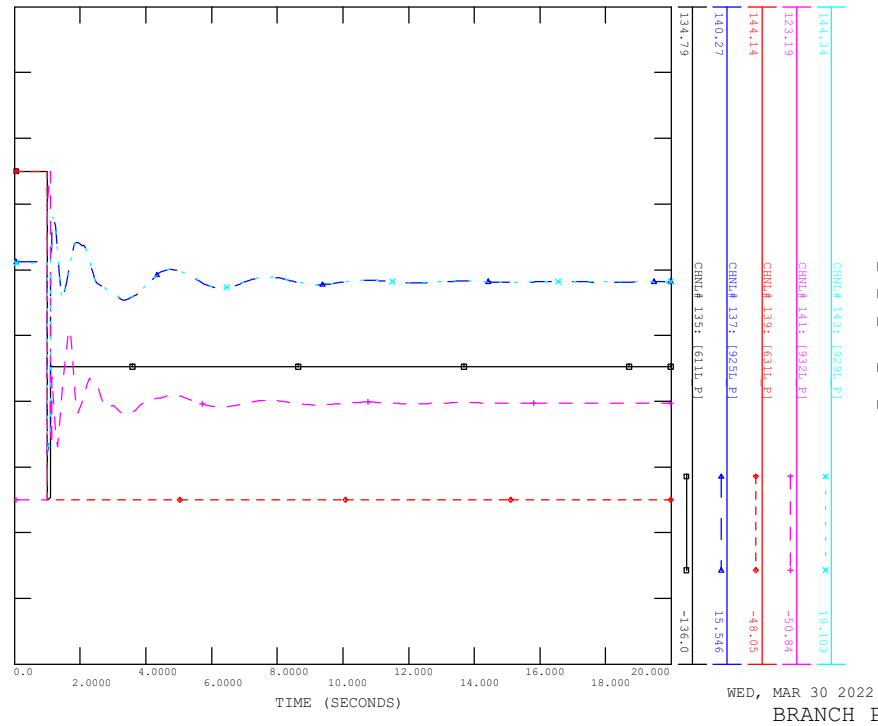
WED, MAR 30 2022 0:34
BRANCH Q (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_06_631L_DRY_CREEK
FILE: scn3_sl_06_631L_Dry_Creek.out



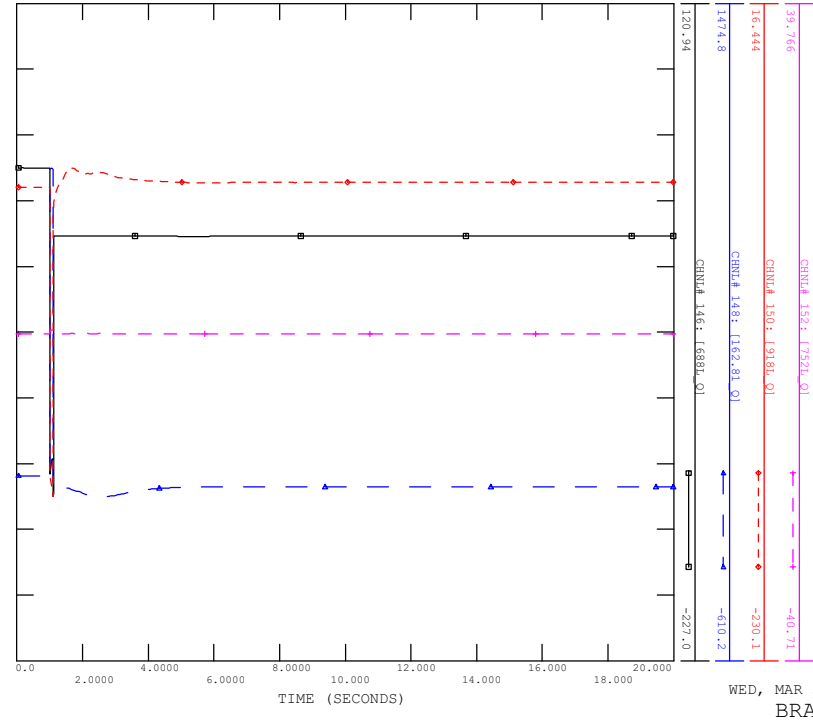
WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_06_631L_DRY_CREEK
FILE: scn3_sl_06_631L_Dry_Creek.out

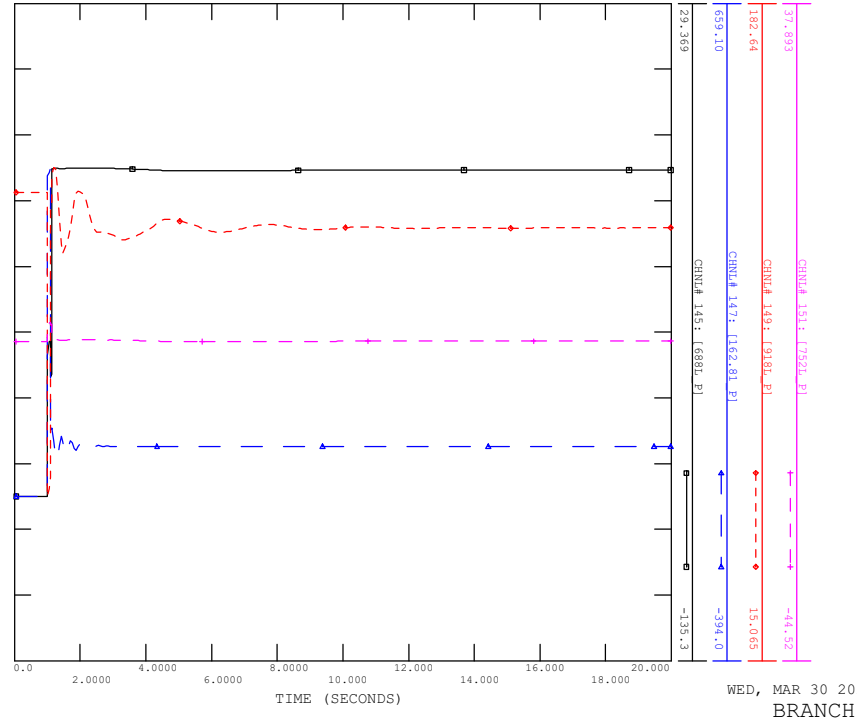


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BRANCH P (1)

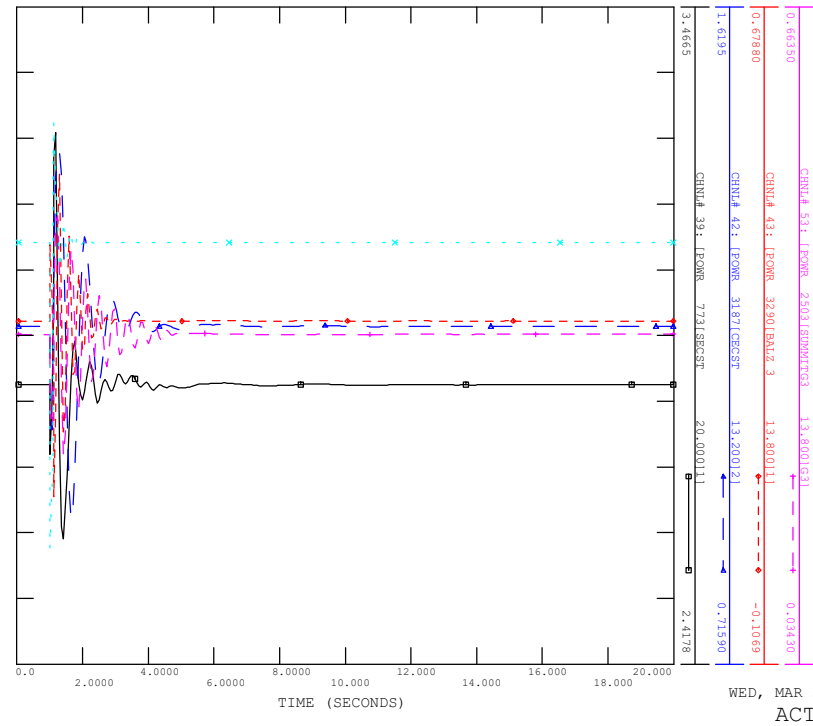
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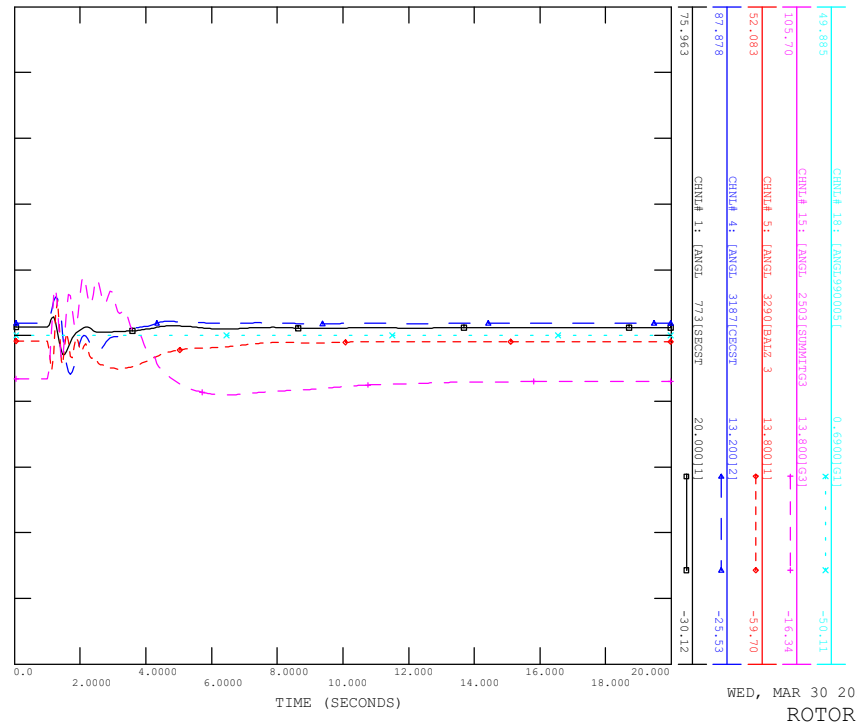
FILE: scn3_sl_06_631L_Dry_Creek.out



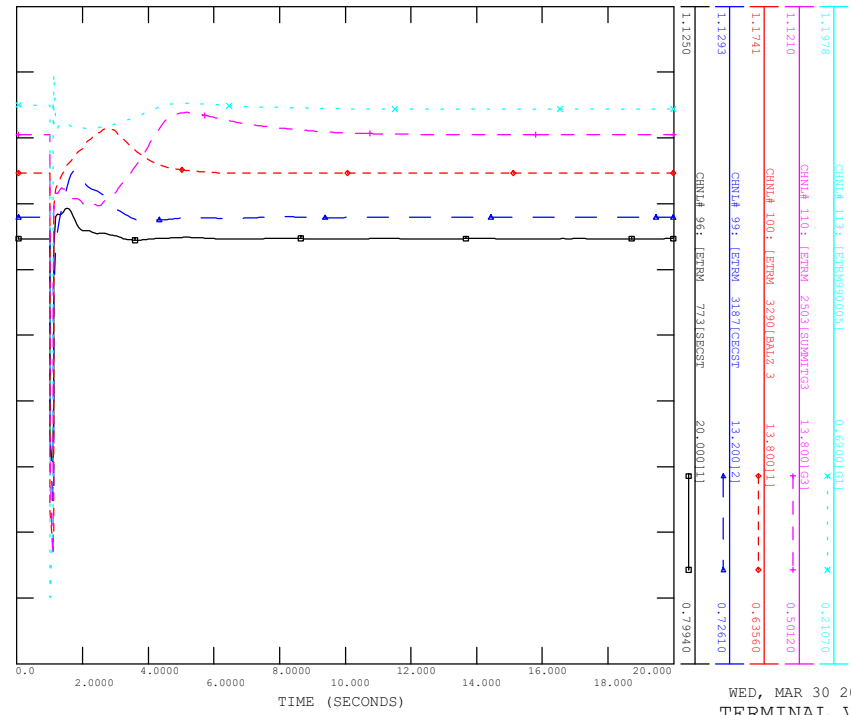
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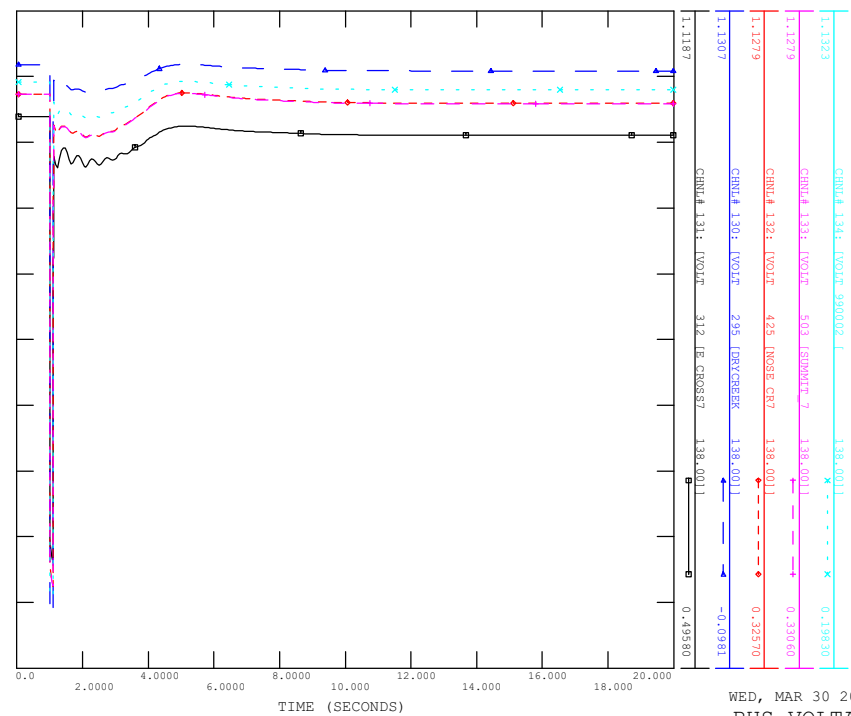
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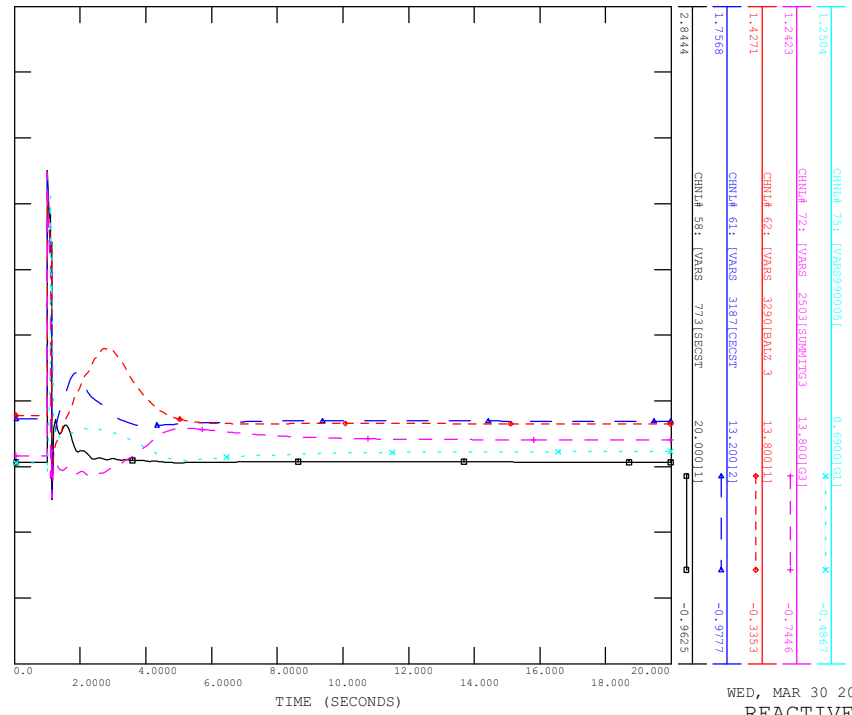
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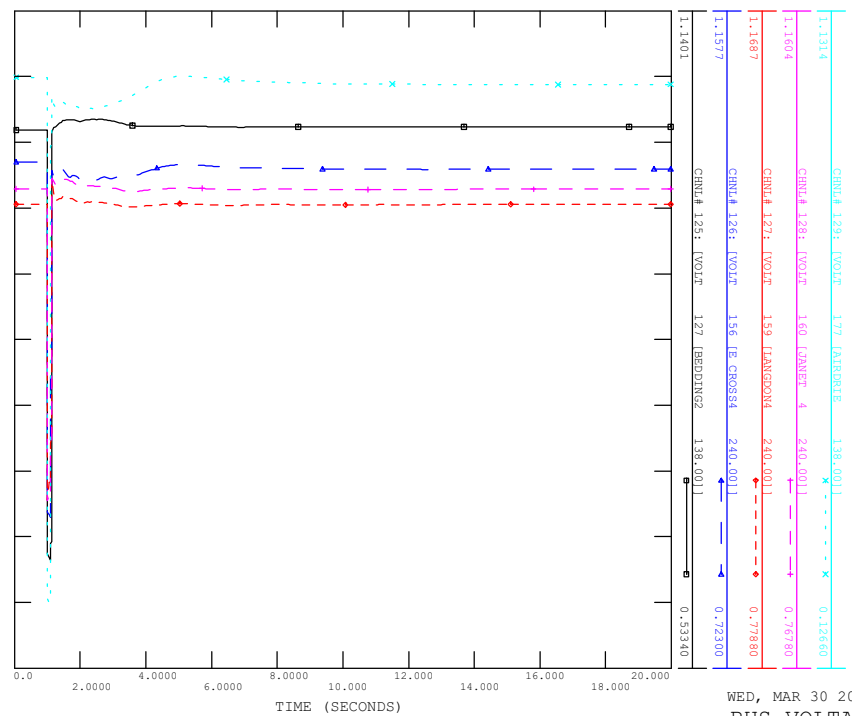
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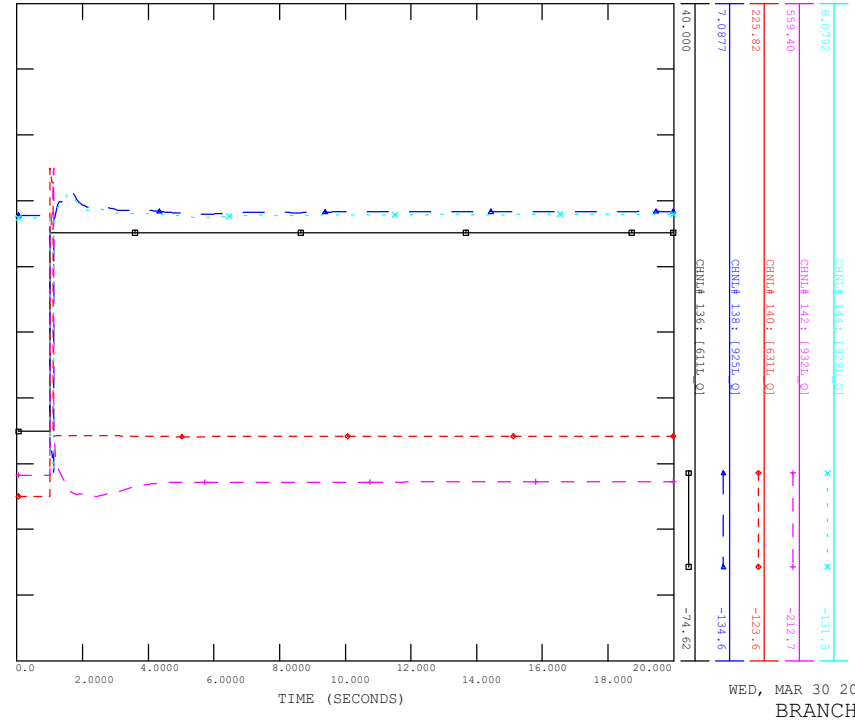
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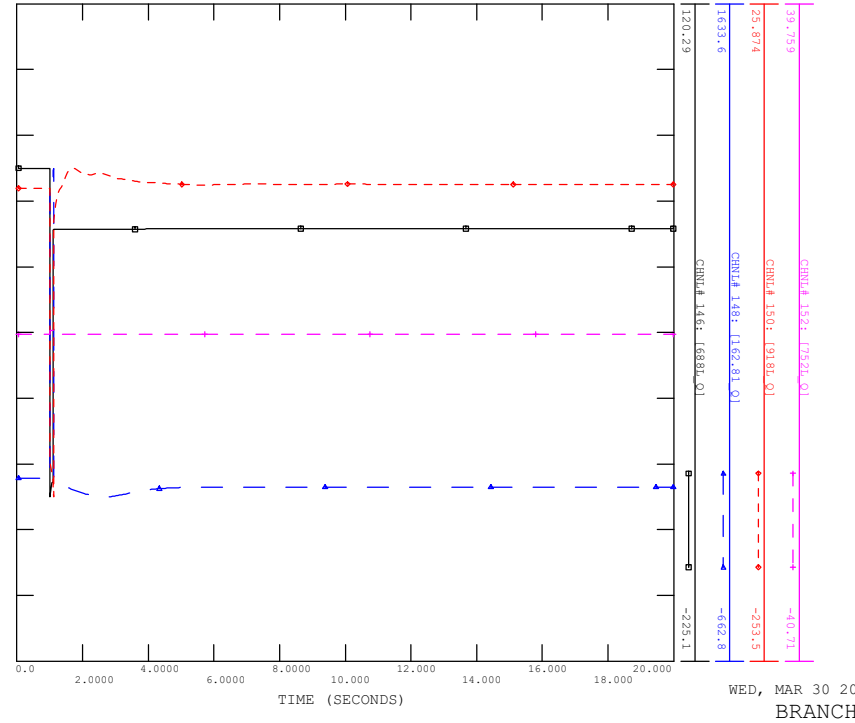
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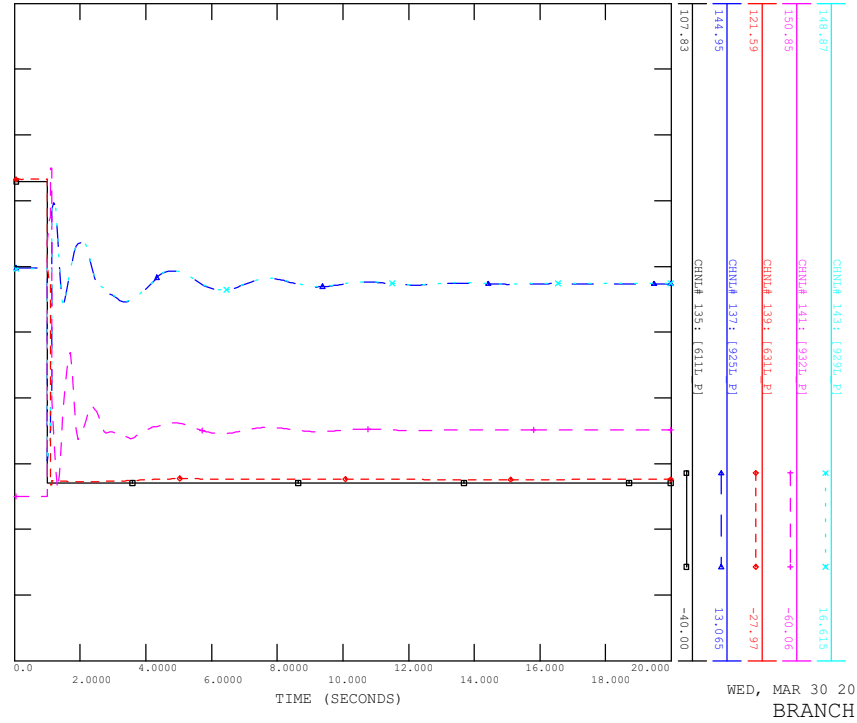
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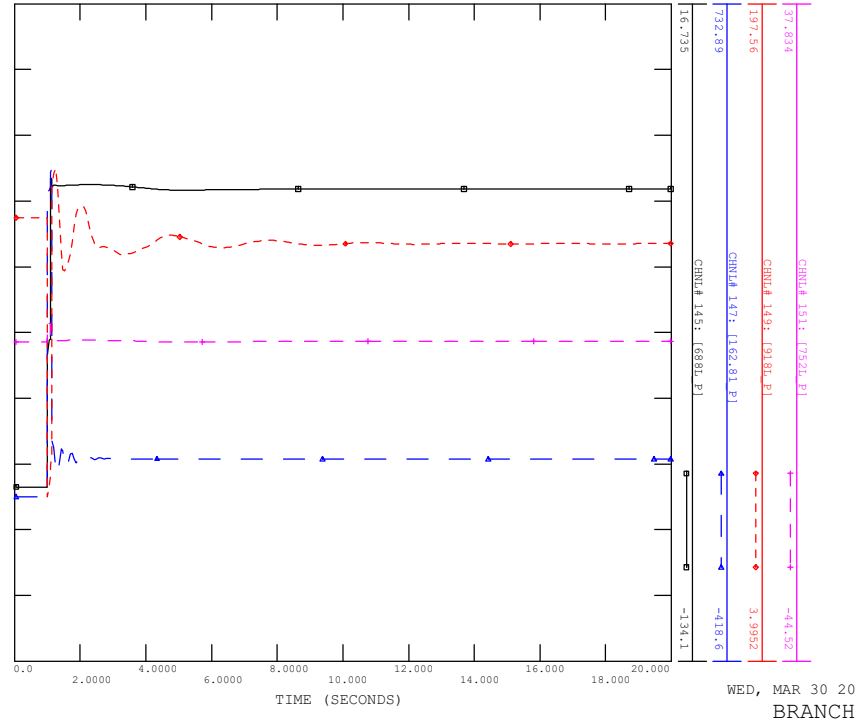
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FILE: scn3_sl_07_611L_Balzac.out

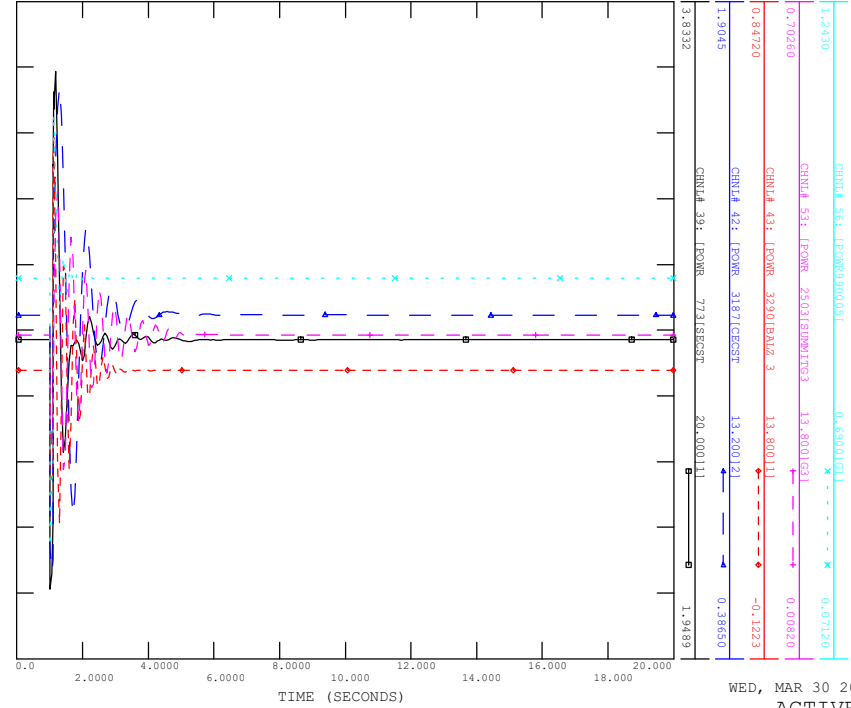


FILE: scn3_sl_07_611L_Balzac.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_08_611L_DRY_CREEK

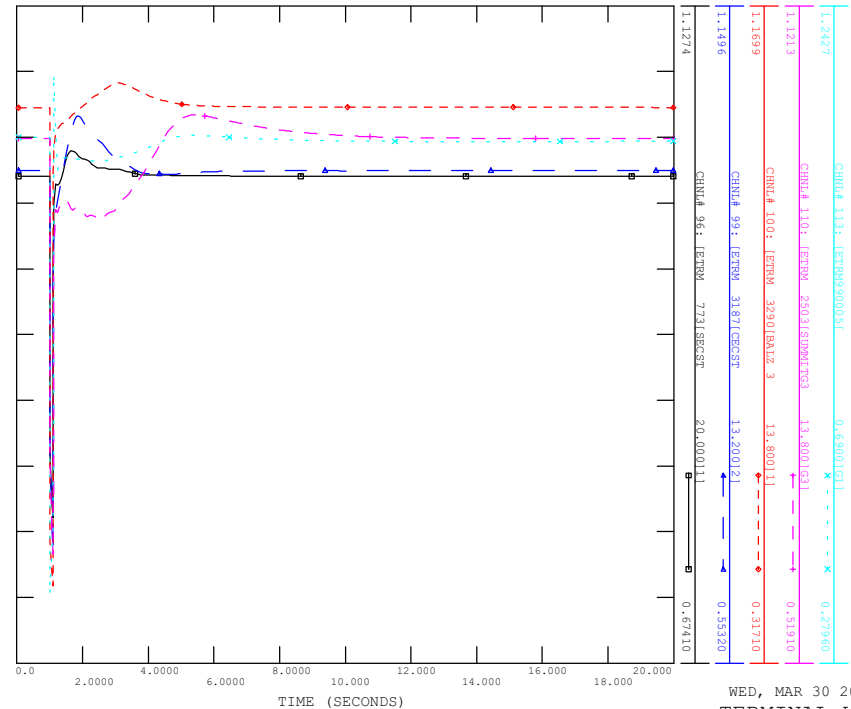
FILE: scn3_sl_08_611L_Dry_Creek.out



WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_08_611L_DRY_CREEK

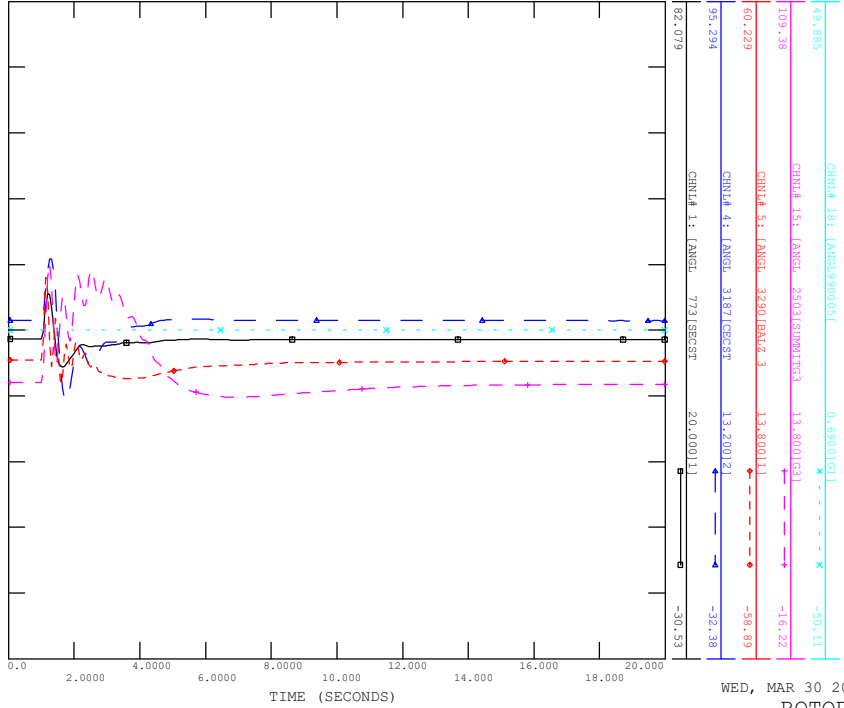
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WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_08_611L_DRY_CREEK

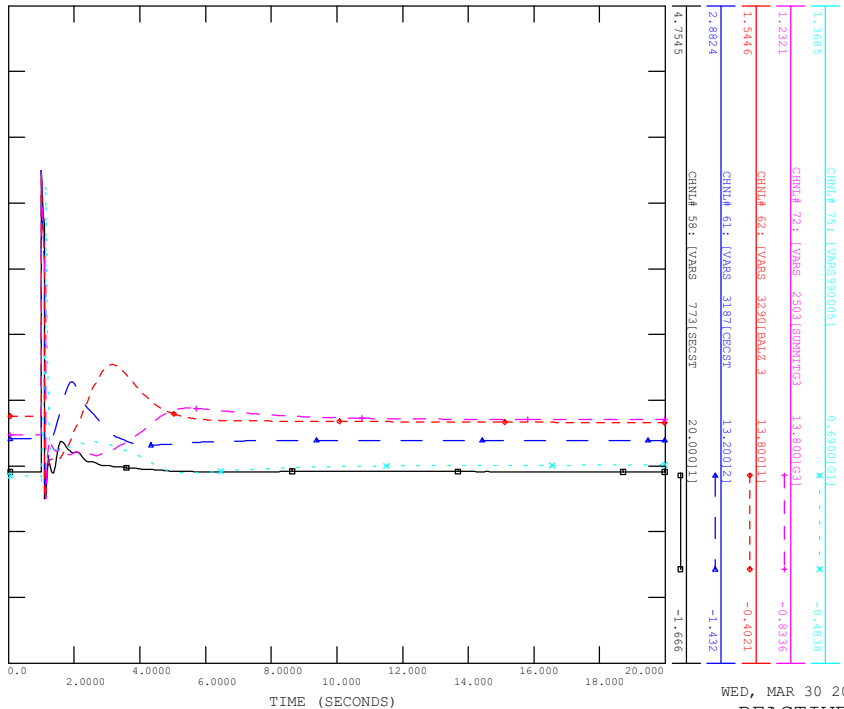
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WED, MAR 30 2022 0:34
ROTOR ANGLE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_08_611L_DRY_CREEK

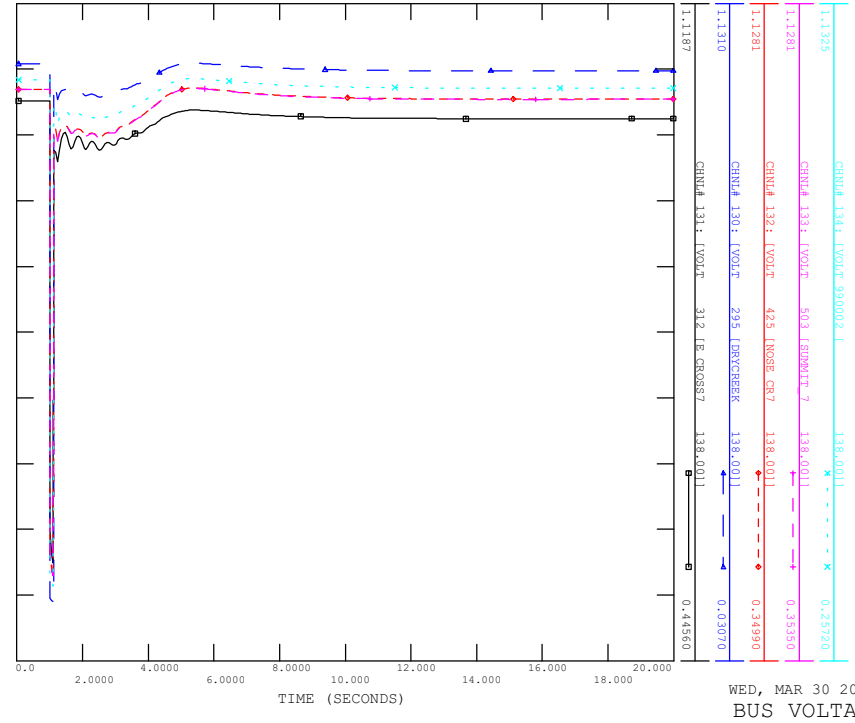
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WED, MAR 30 2022 0:34
REACTIVE POWER

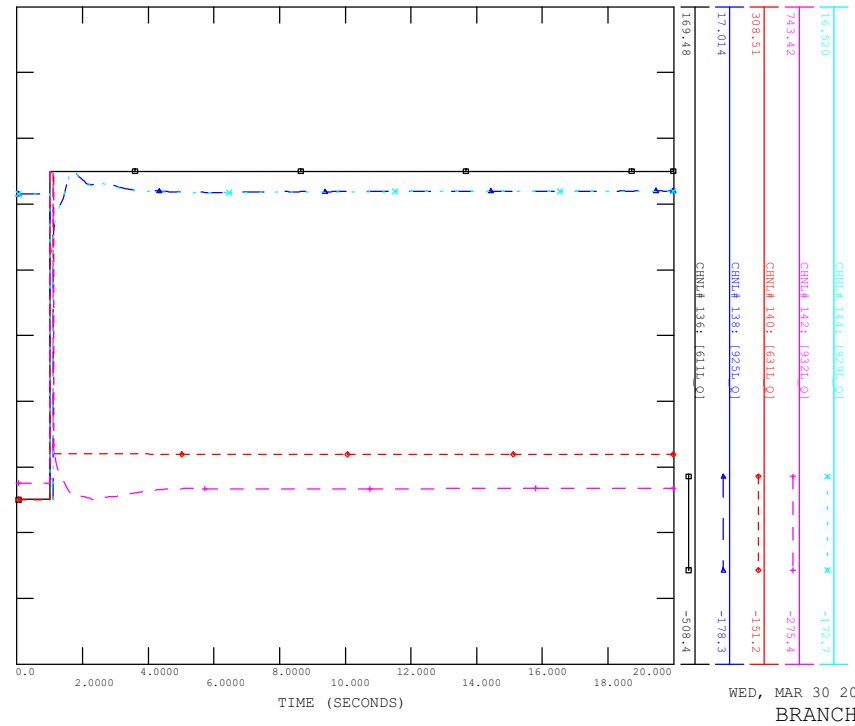
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CONTINGENCY -SCN3_SL_08_611L_DRY_CREEK

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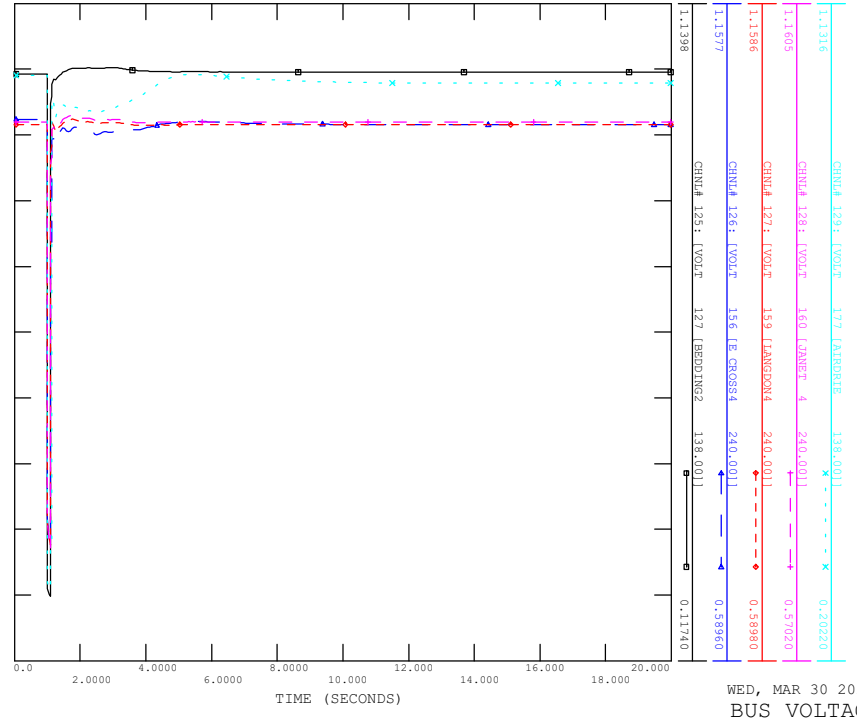
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_08_611L_DRY_CREEK

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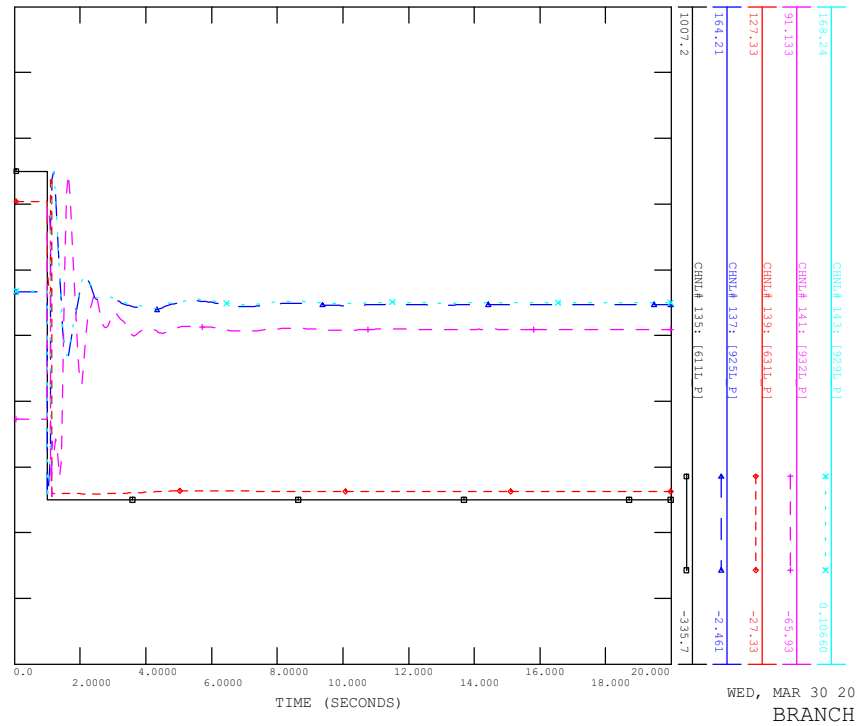
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_08_611L_DRY_CREEK

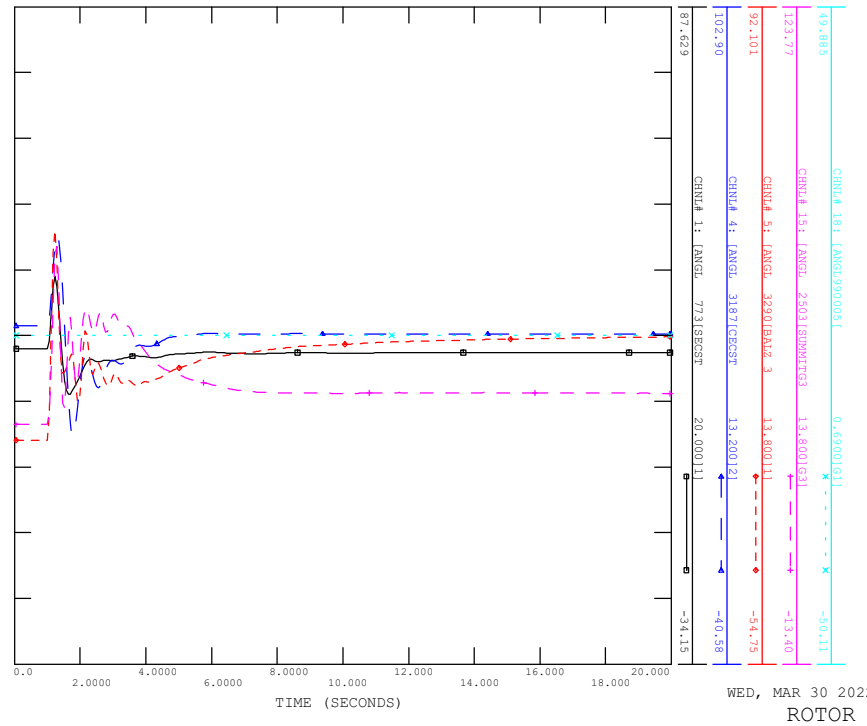
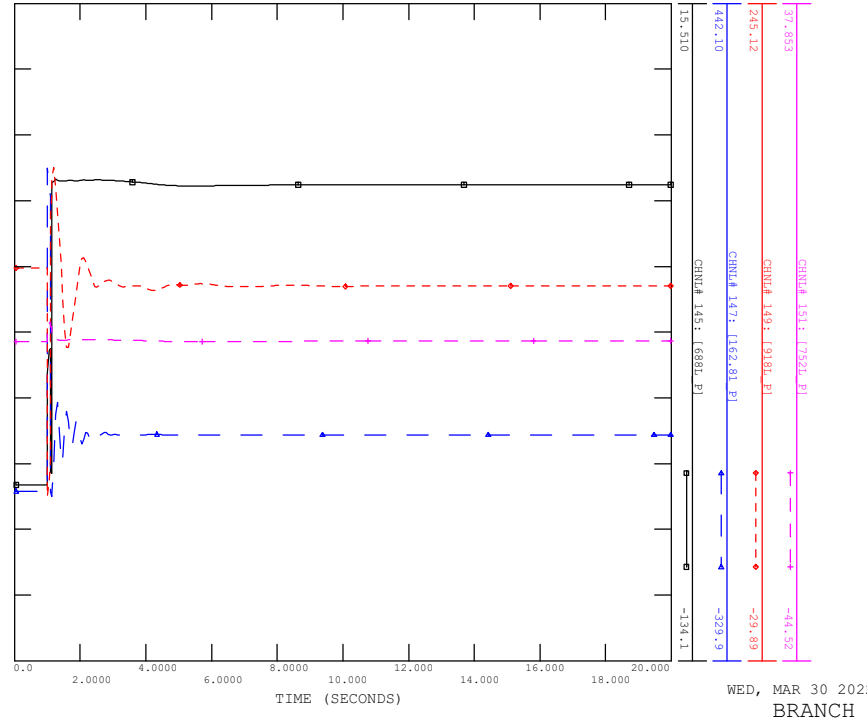
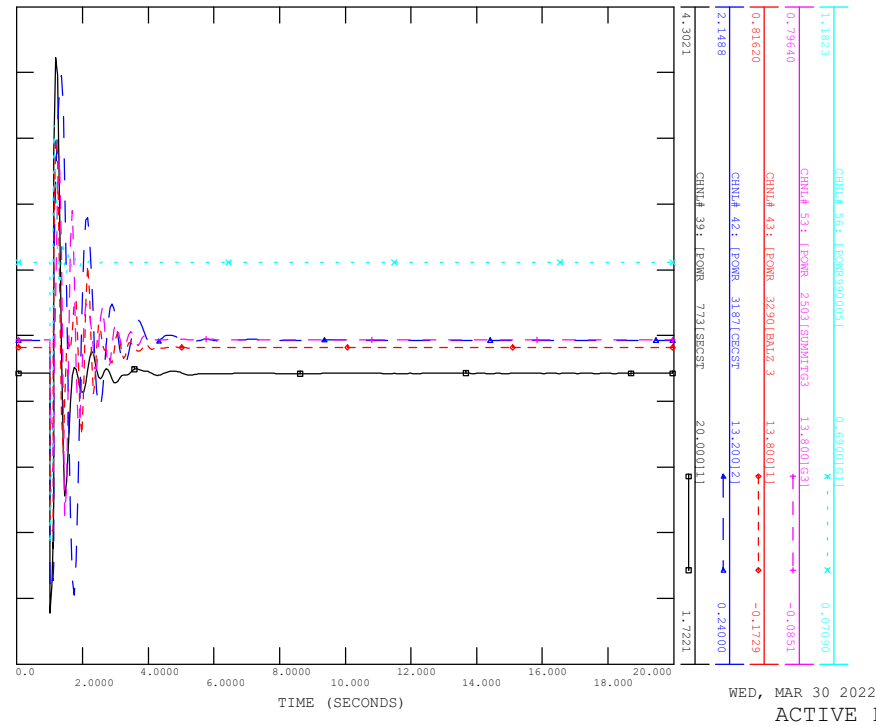
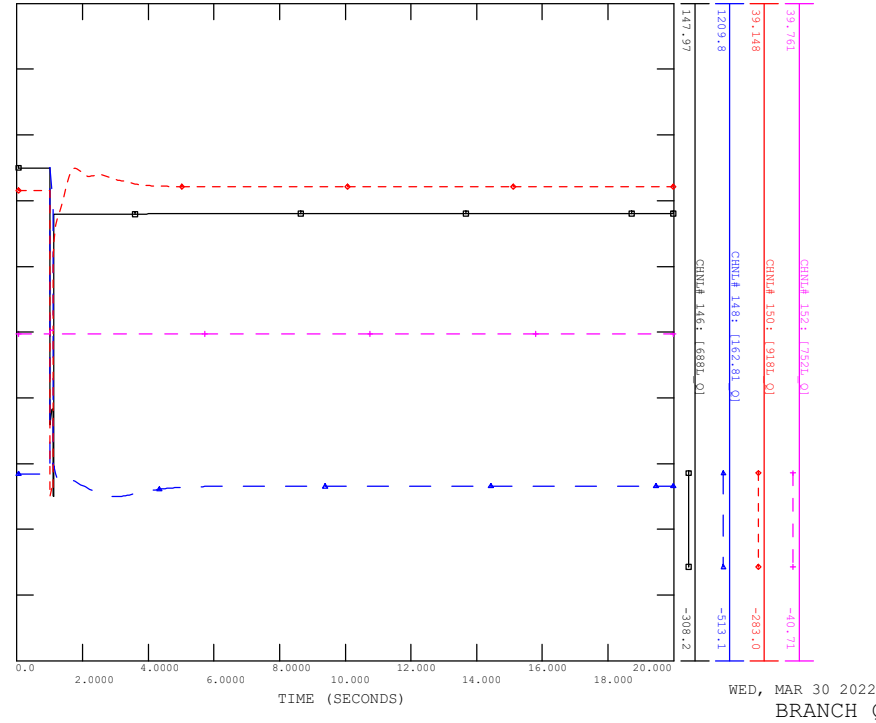
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SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_08_611L_DRY_CREEK

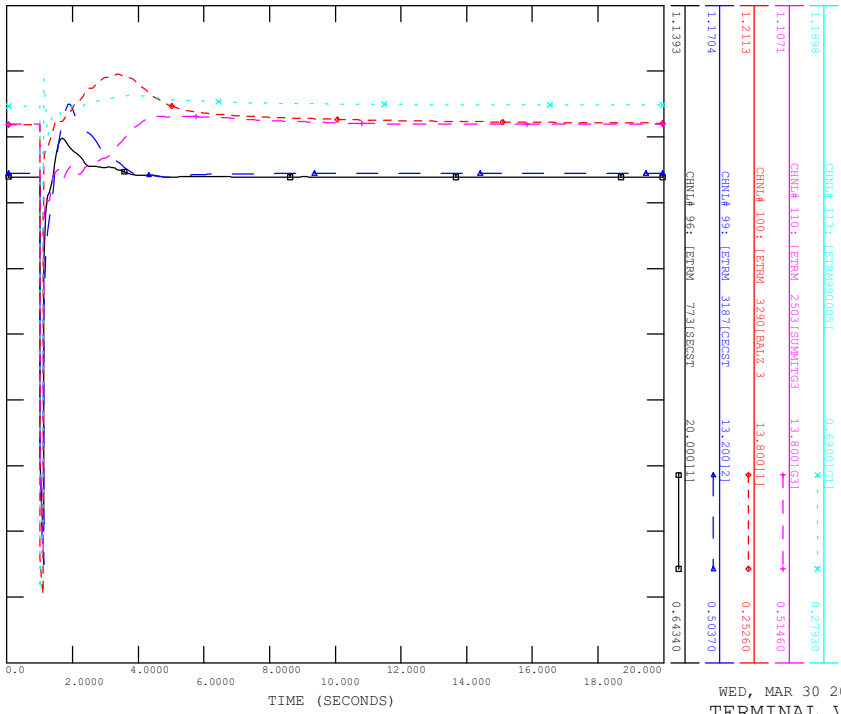
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SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_09_16281L_BALZAC

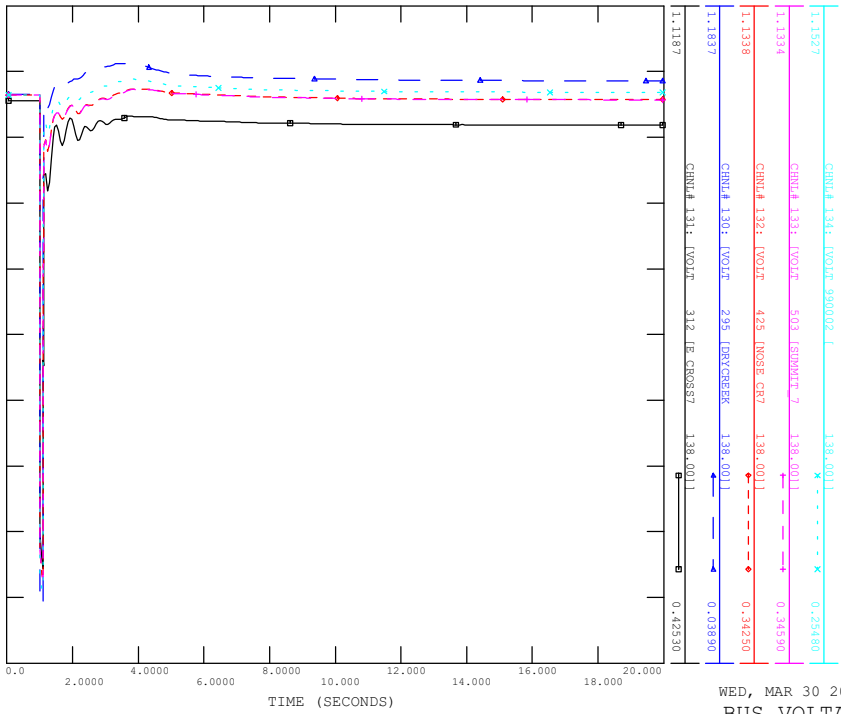
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WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_09_16281L_BALZAC

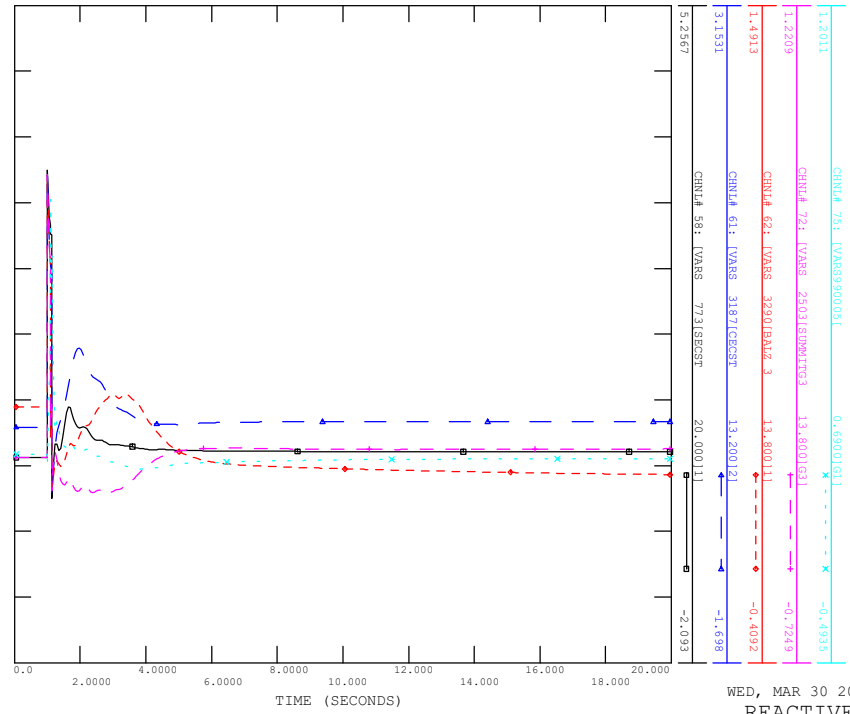
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WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_09_16281L_BALZAC

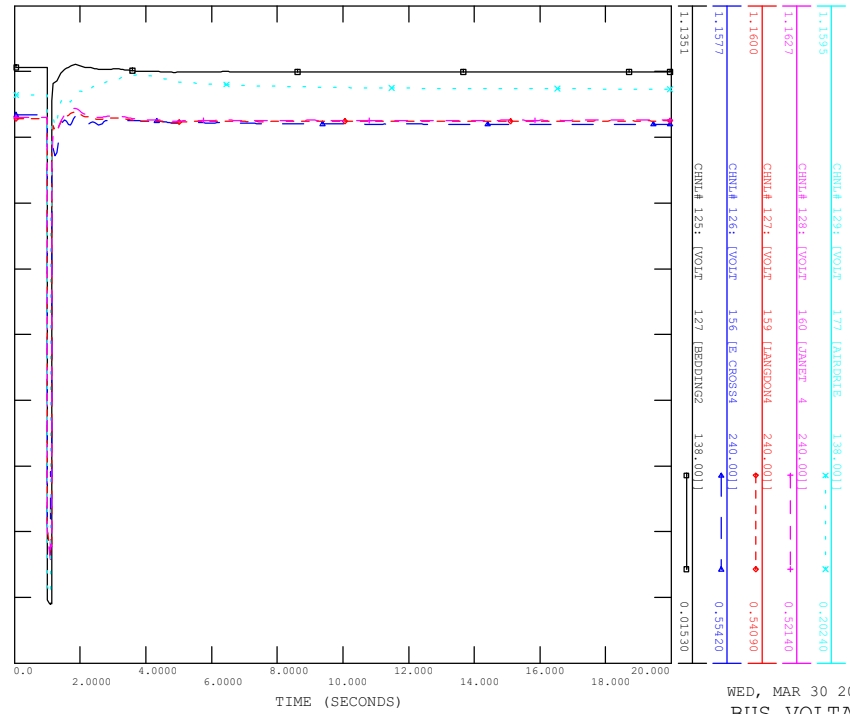
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WED, MAR 30 2022 0:34
REACTIVE POWER

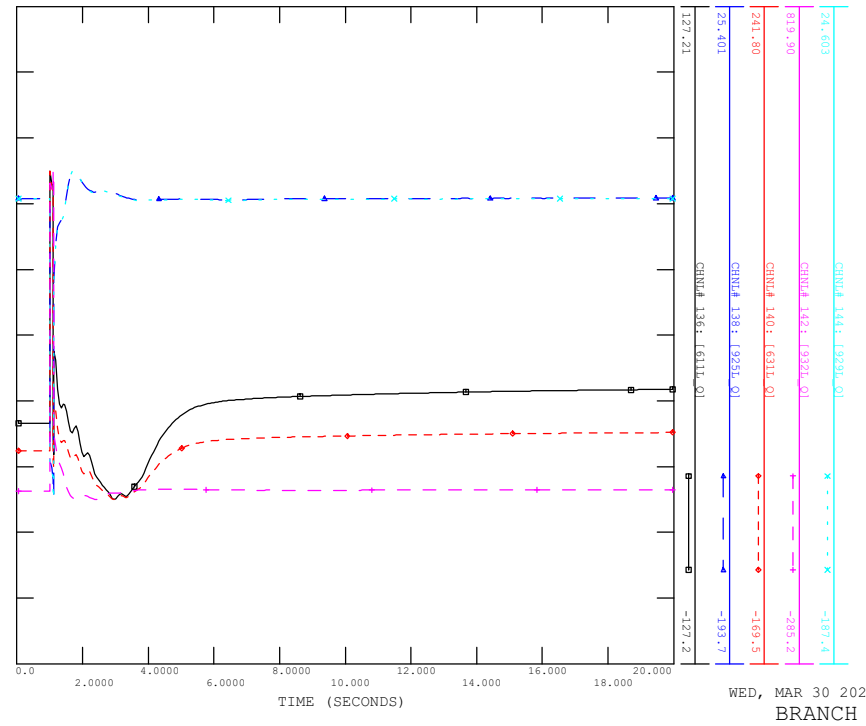
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_09_16281L_BALZAC

FILE: scn3_sl_09_16281L_Balzac.out



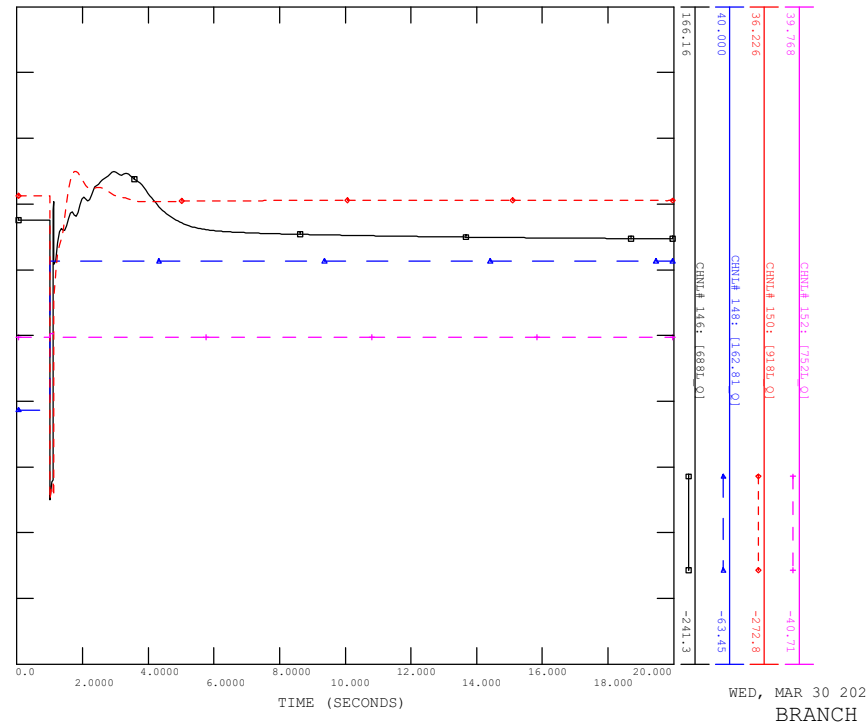
WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_09_16281L_BALZAC
FILE: scn3_sl_09_16281L_Balzac.out



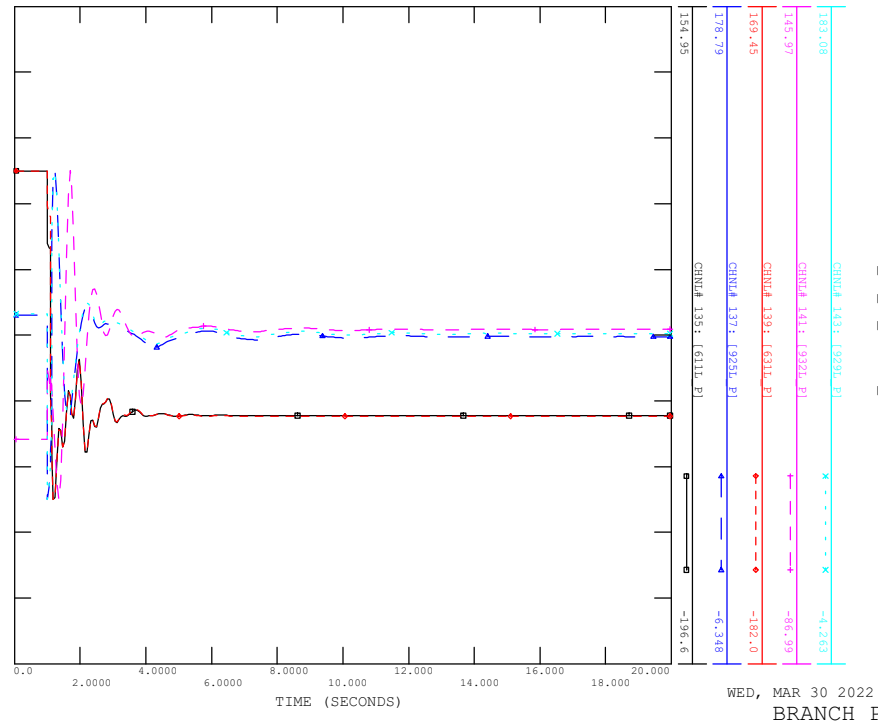
WED, MAR 30 2022 0:34
BRANCH Q (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_09_16281L_BALZAC
FILE: scn3_sl_09_16281L_Balzac.out



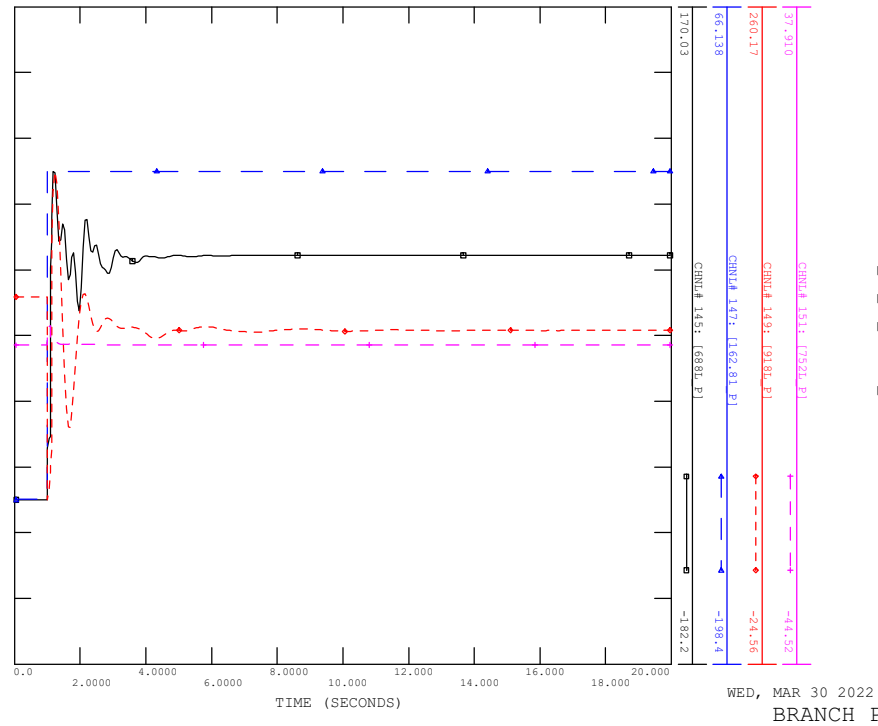
WED, MAR 30 2022 0:34
BRANCH Q (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_09_16281L_BALZAC
FILE: scn3_sl_09_16281L_Balzac.out



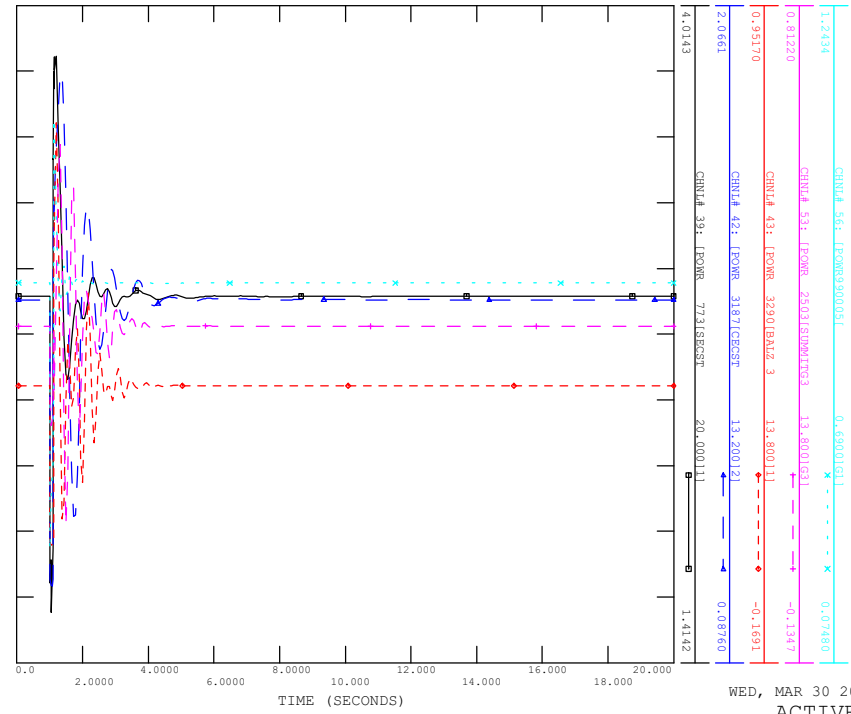
WED, MAR 30 2022 0:34
BRANCH P (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_09_16281L_BALZAC
FILE: scn3_sl_09_16281L_Balzac.out



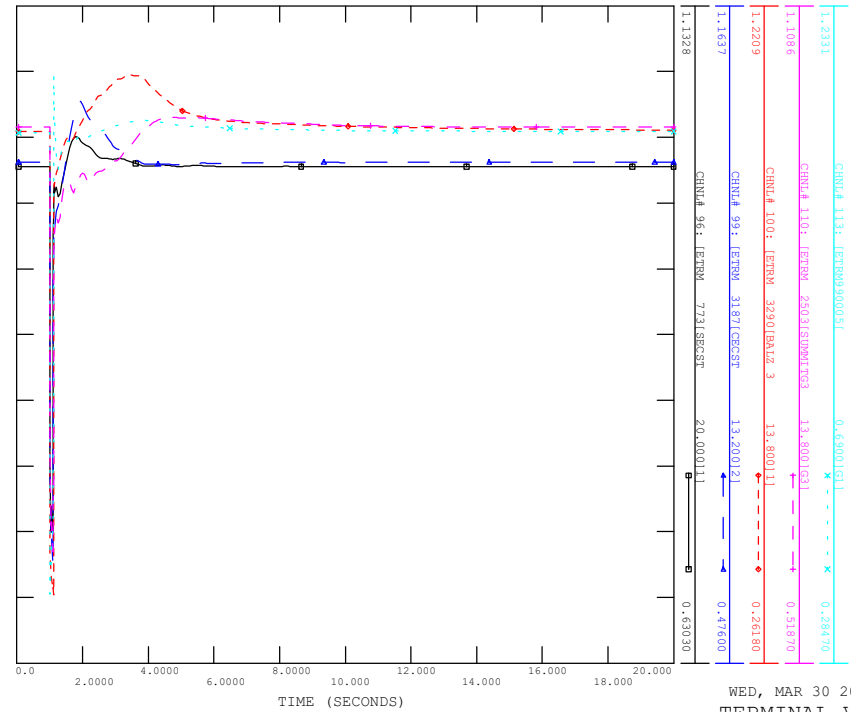
WED, MAR 30 2022 0:34
BRANCH P (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_10_16281L_BEDDINGTON
FILE: scn3_stl_10_16281L_Beddington.out



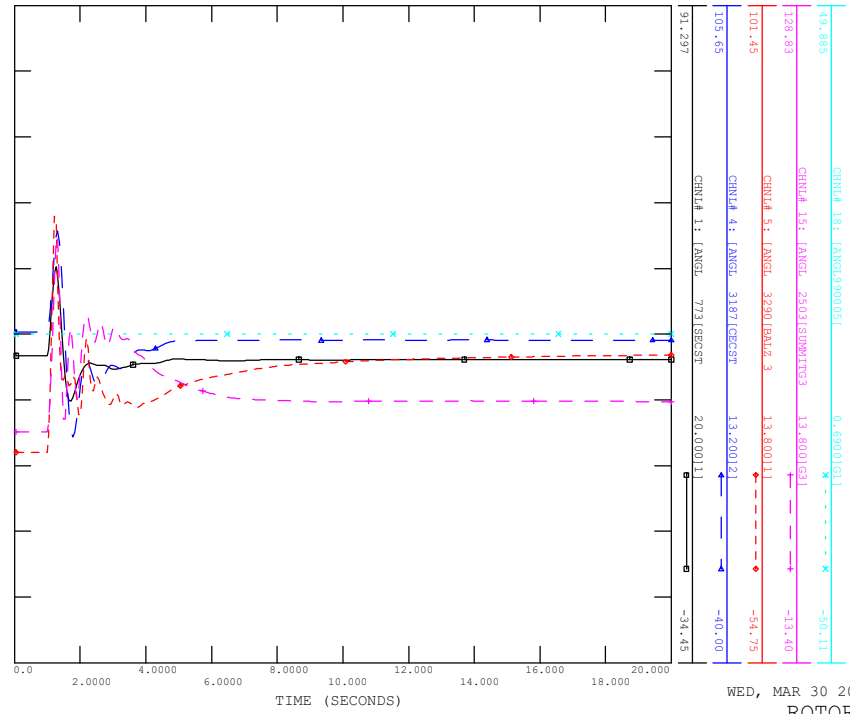
WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_10_16281L_BEDDINGTON
FILE: scn3_stl_10_16281L_Beddington.out



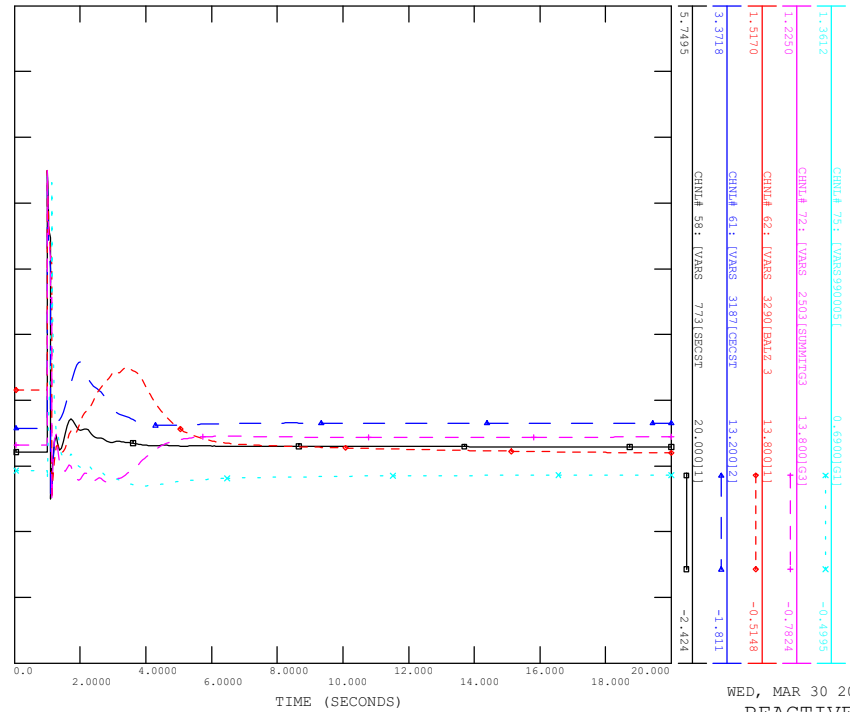
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_10_16281L_BEDDINGTON
FILE: scn3_stl_10_16281L_Beddington.out



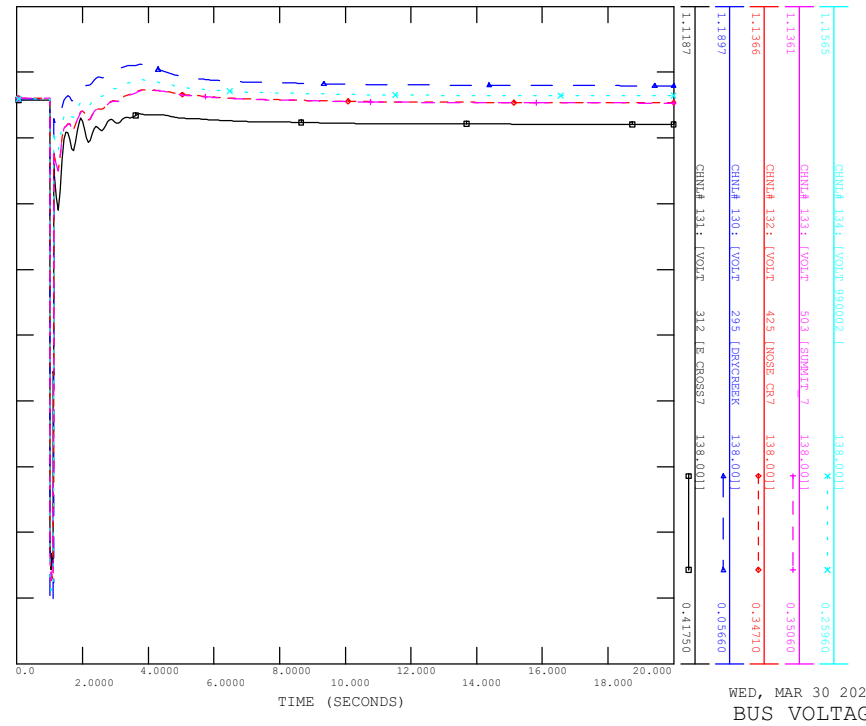
WED, MAR 30 2022 0:34
ROTOR ANGLE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_10_16281L_BEDDINGTON
FILE: scn3_stl_10_16281L_Beddington.out

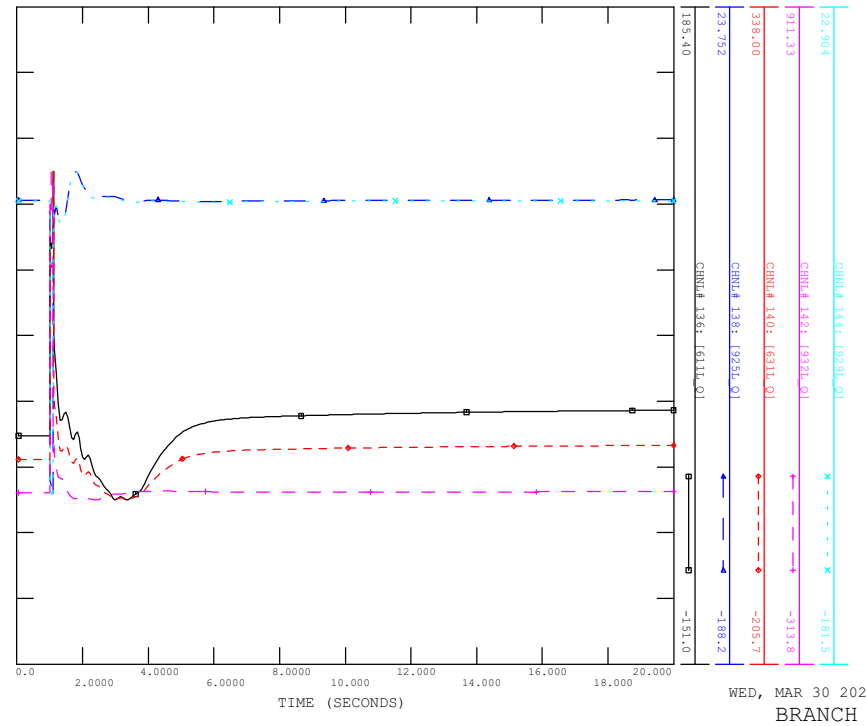


WED, MAR 30 2022 0:34
REACTIVE POWER

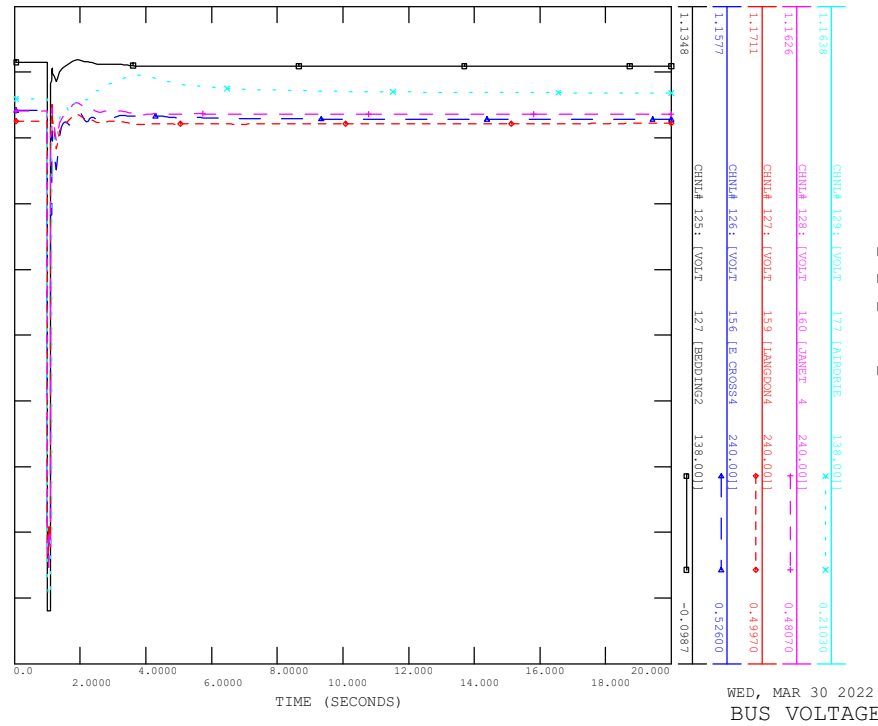
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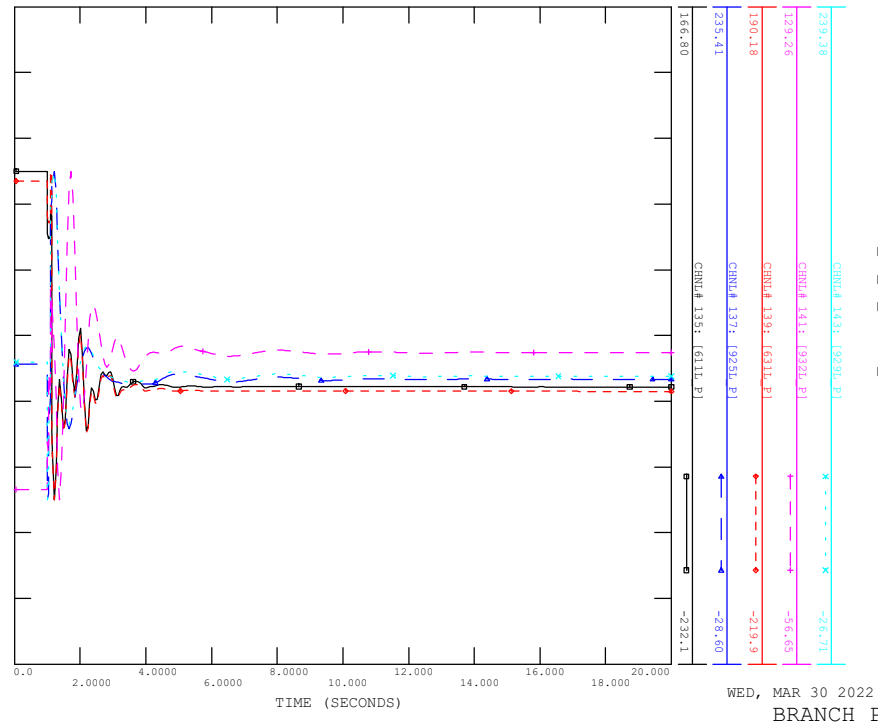
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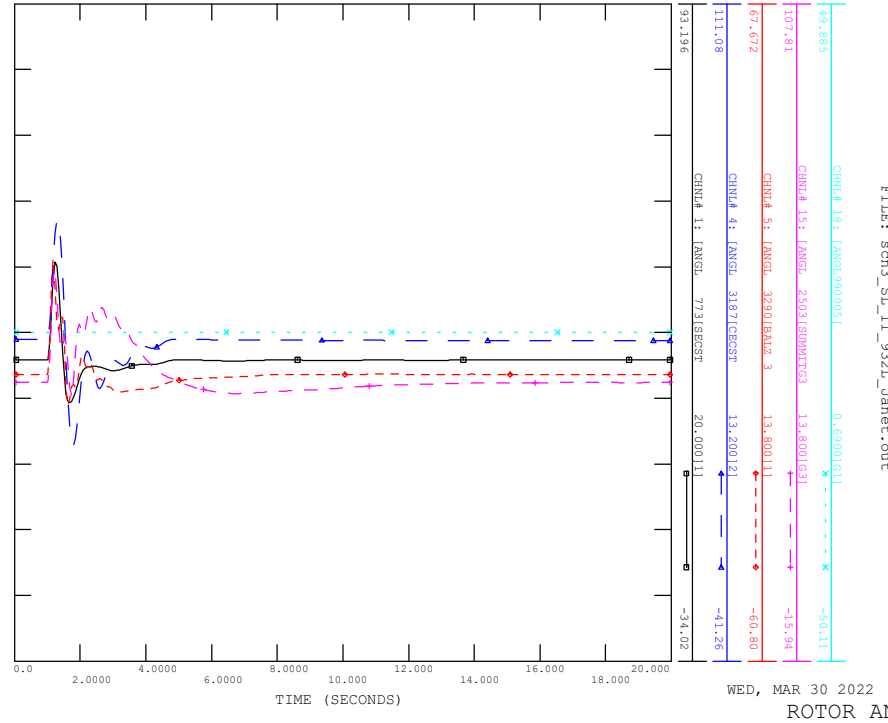
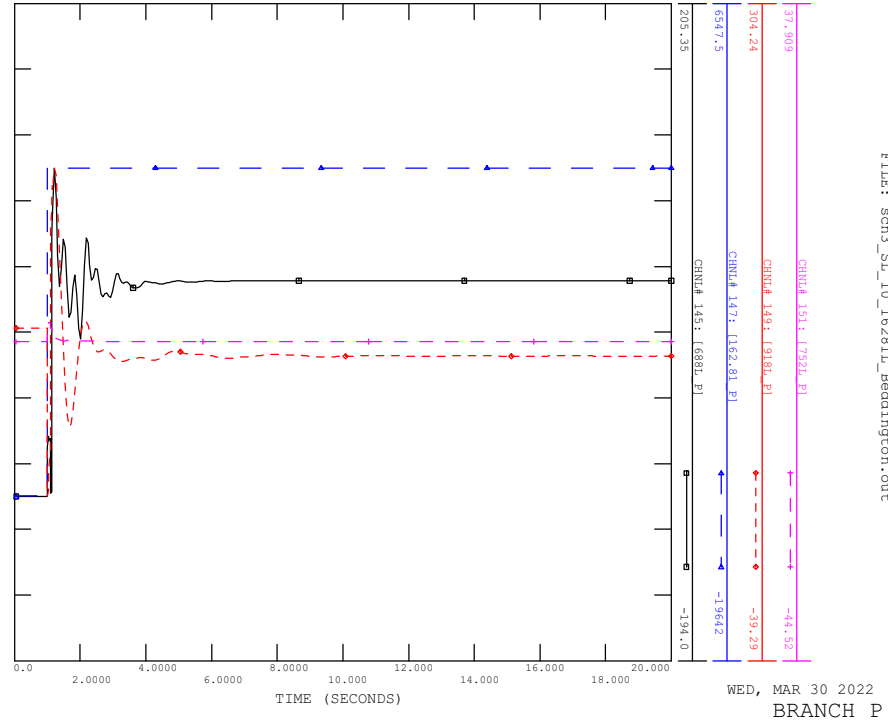
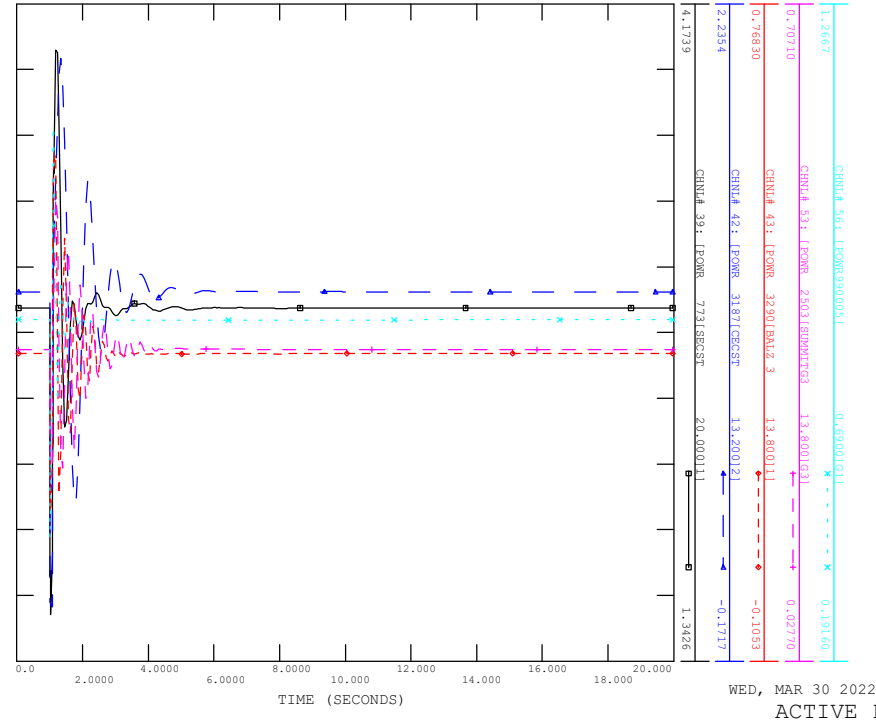
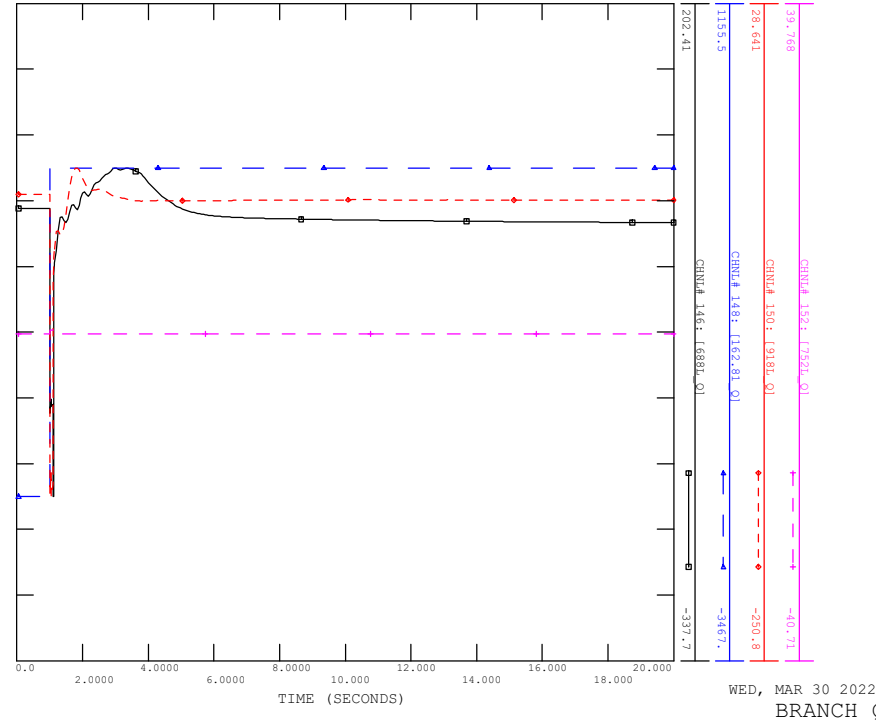


SCENARIO: P2405 SYSTEM IMPACT STUDY
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FILE: scn3_sl_10_16281L_Beddington.out



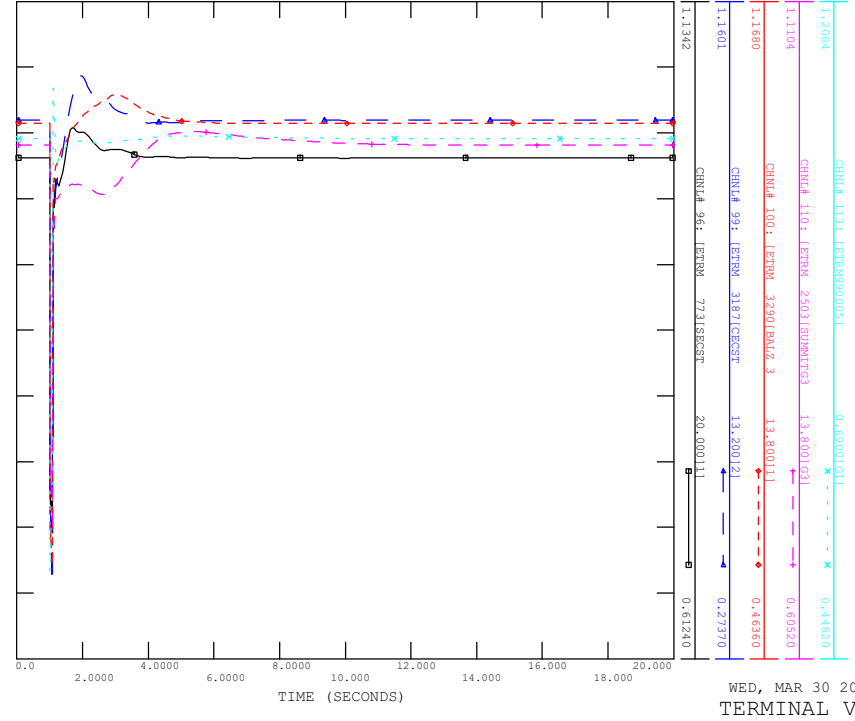
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_10_16281L_BEDDINGTON
FILE: scn3_sl_10_16281L_Beddington.out





SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_11_932L_JANET

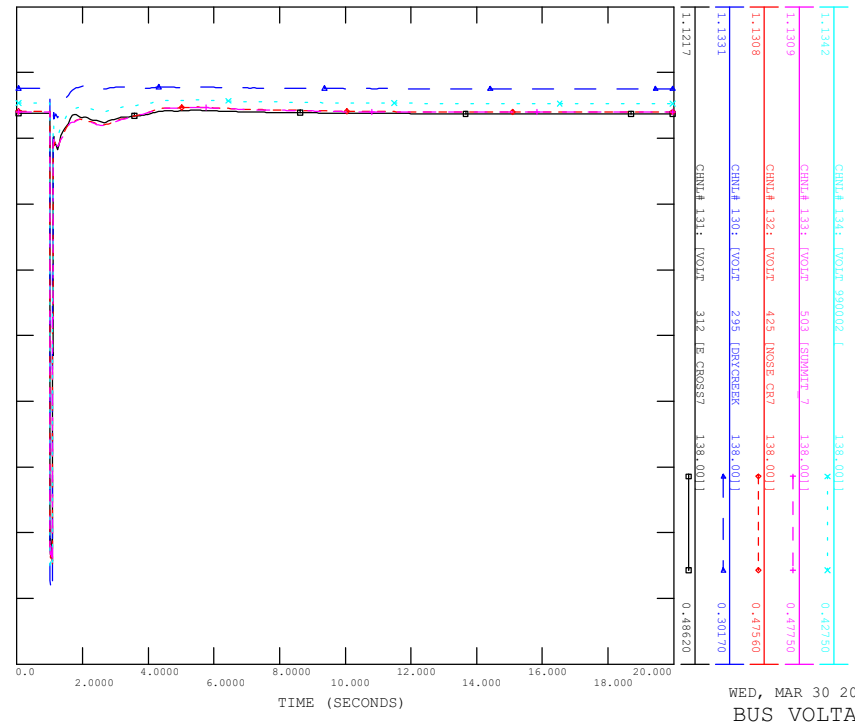
FILE: scn3_SL_11_932L_Janet.out



0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_11_932L_JANET

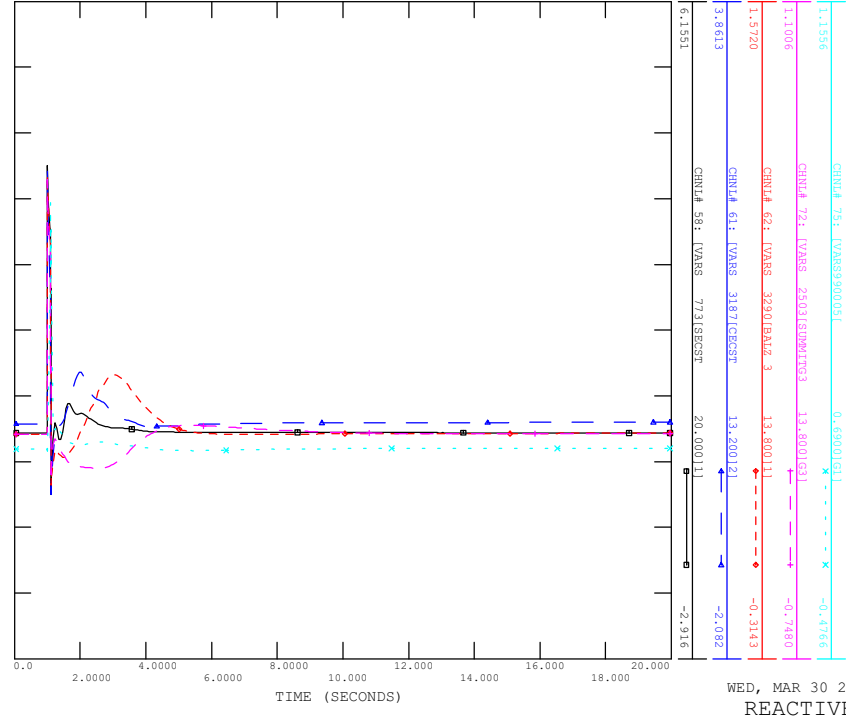
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0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_11_932L_JANET

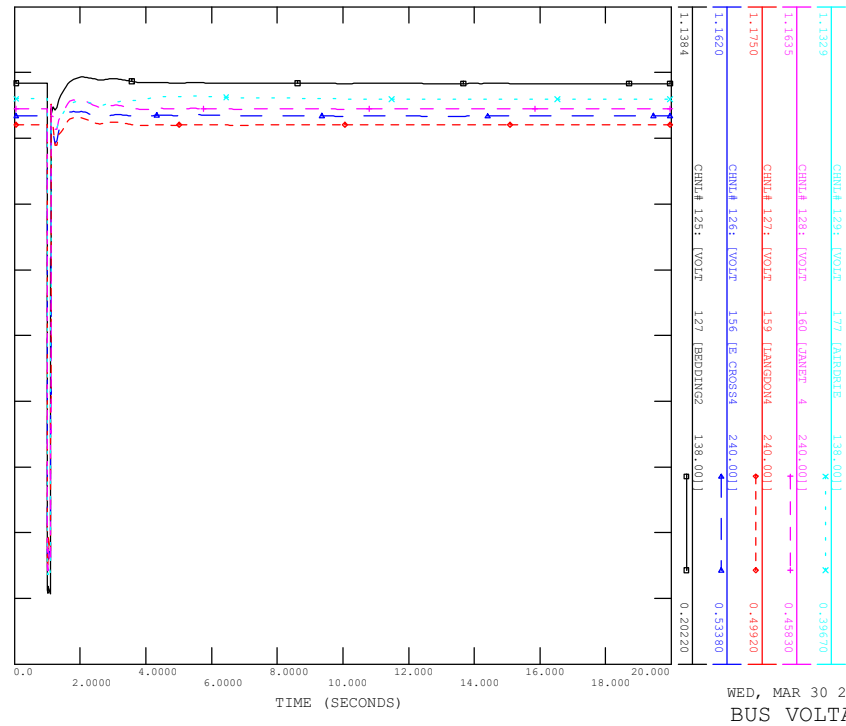
FILE: scn3_SL_11_932L_Janet.out



0:34
REACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_11_932L_JANET

FILE: scn3_SL_11_932L_Janet.out

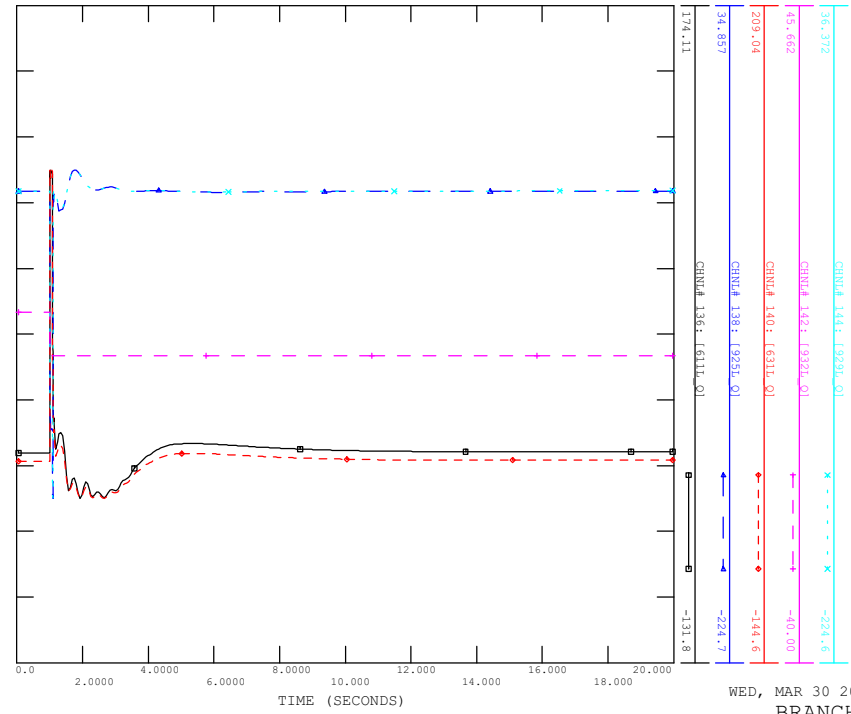


0:34
BUS VOLTAGE (1)



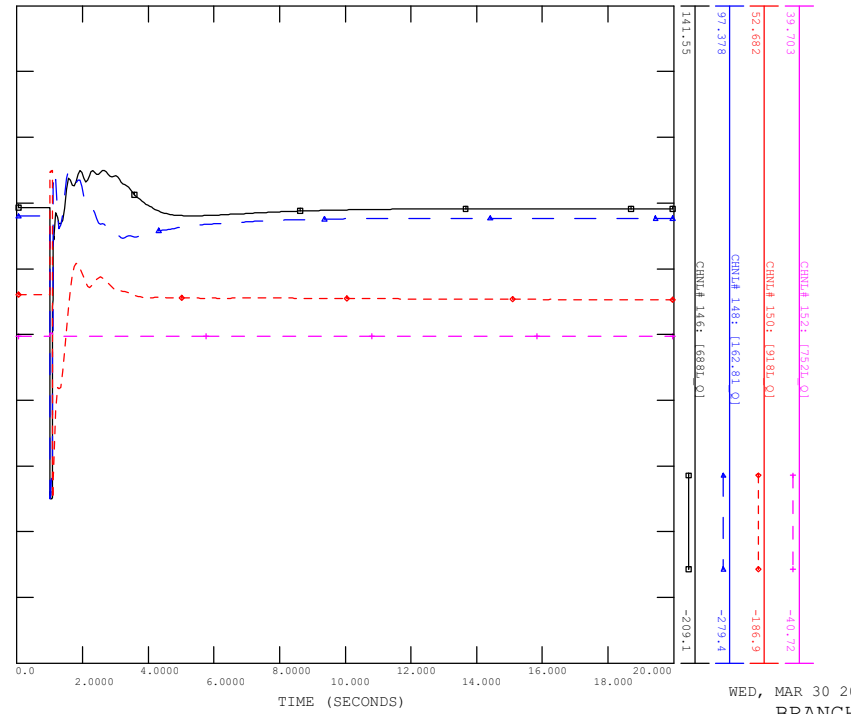
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_11_932L_JANET

FILE: scn3_sl_11_932L_Janet.out



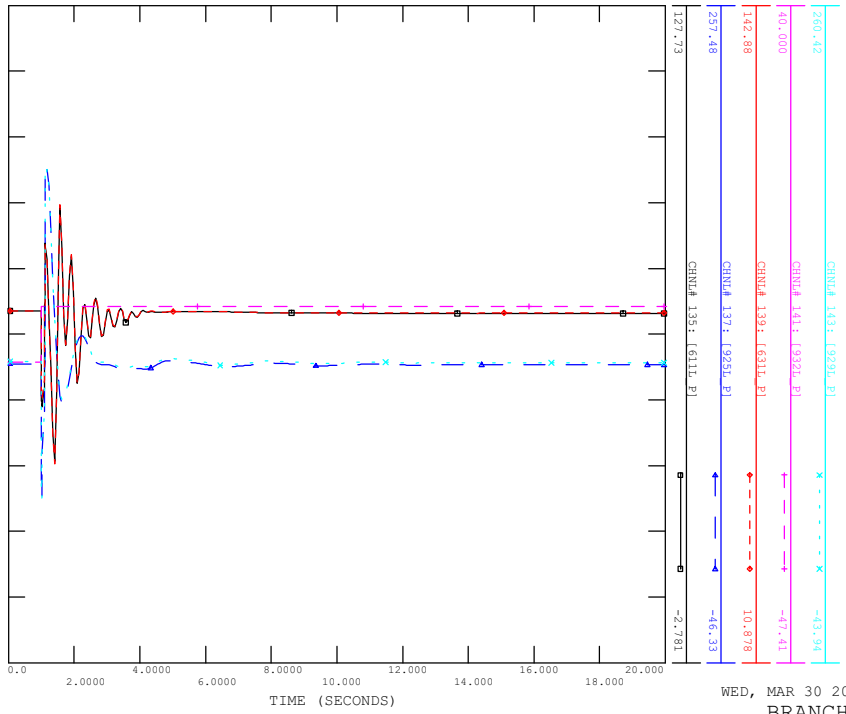
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FILE: scn3_sl_11_932L_Janet.out



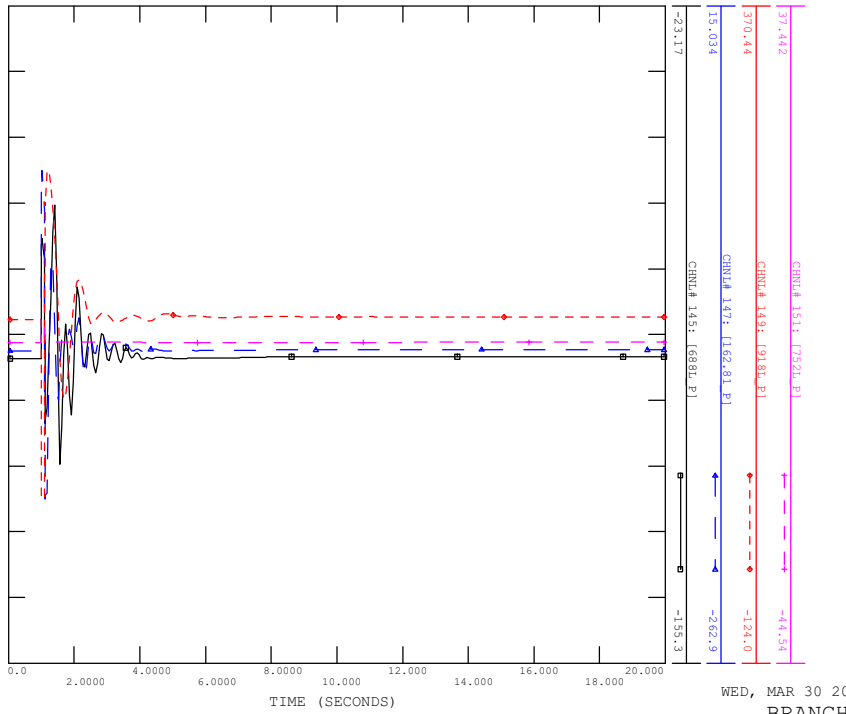
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CONTINGENCY -SCN3_SL_11_932L_JANET

FILE: scn3_sl_11_932L_Janet.out



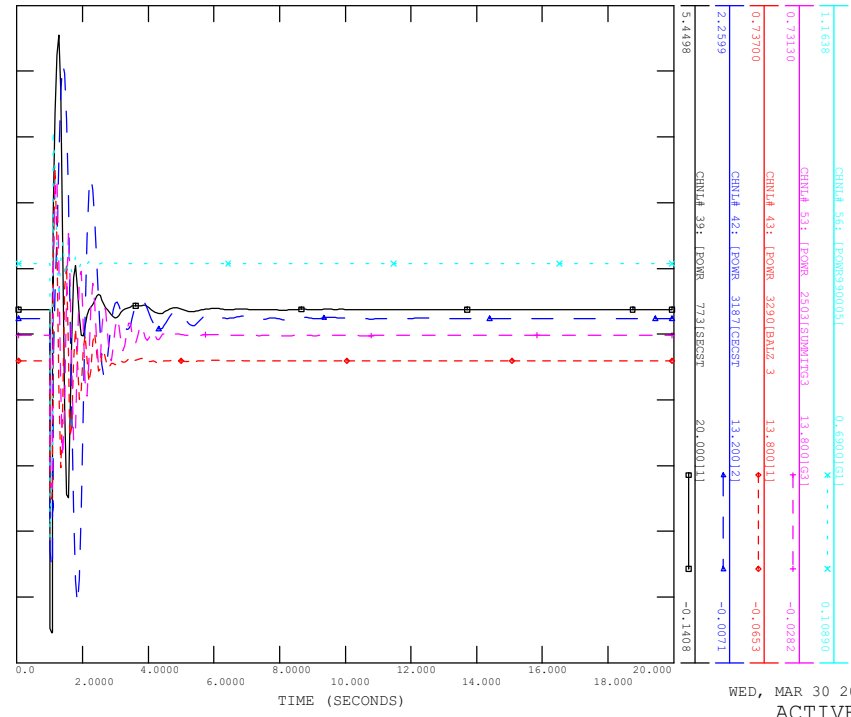
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CONTINGENCY -SCN3_SL_11_932L_JANET

FILE: scn3_sl_11_932L_Janet.out



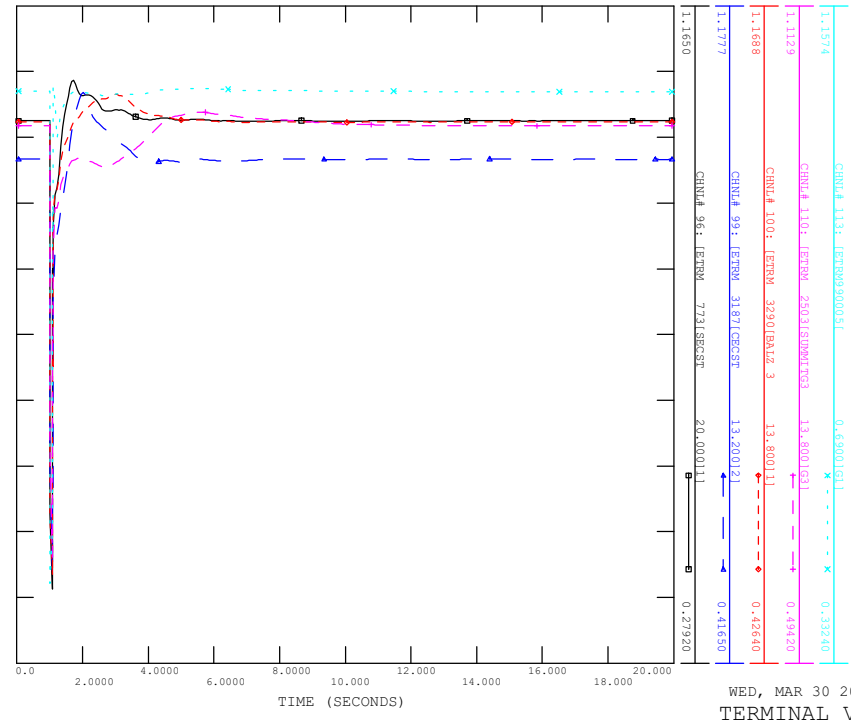
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_12_932L_BEDDINGTON

FILE: scn3_sl_12_932L_Beddington.out



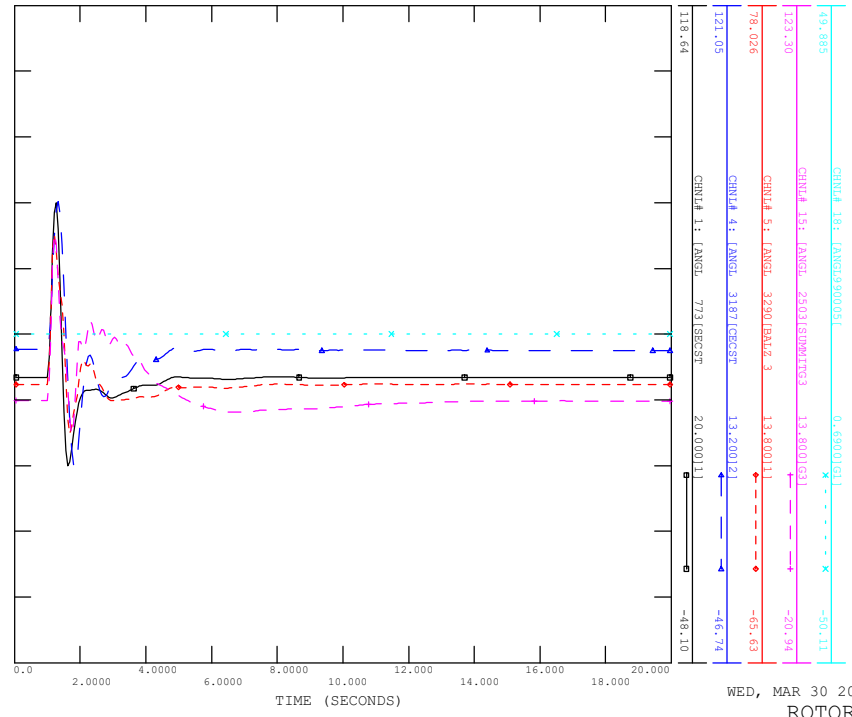
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_12_932L_BEDDINGTON

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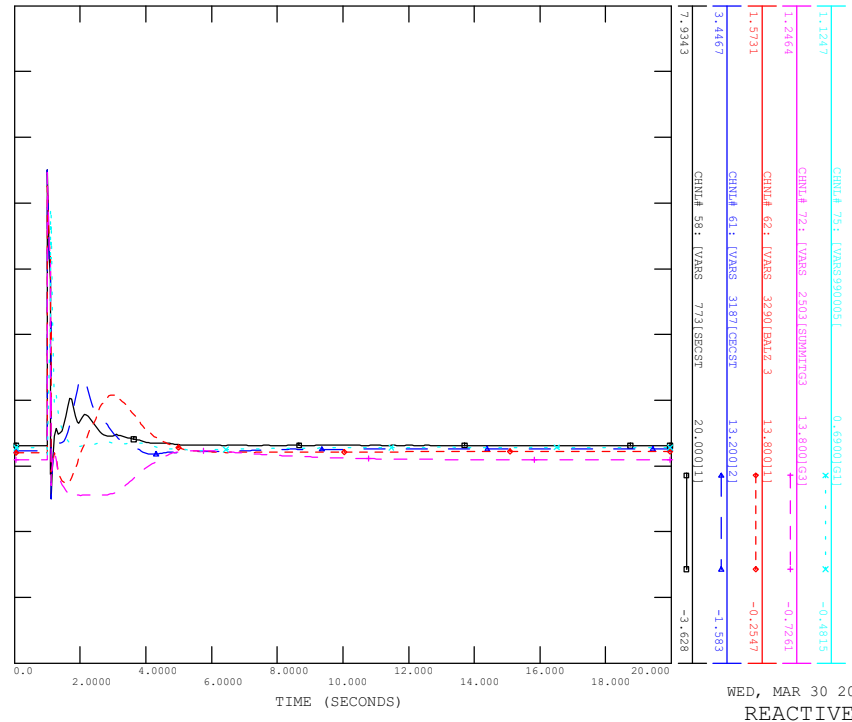
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CONTINGENCY -SCN3_SL_12_932L_BEDDINGTON

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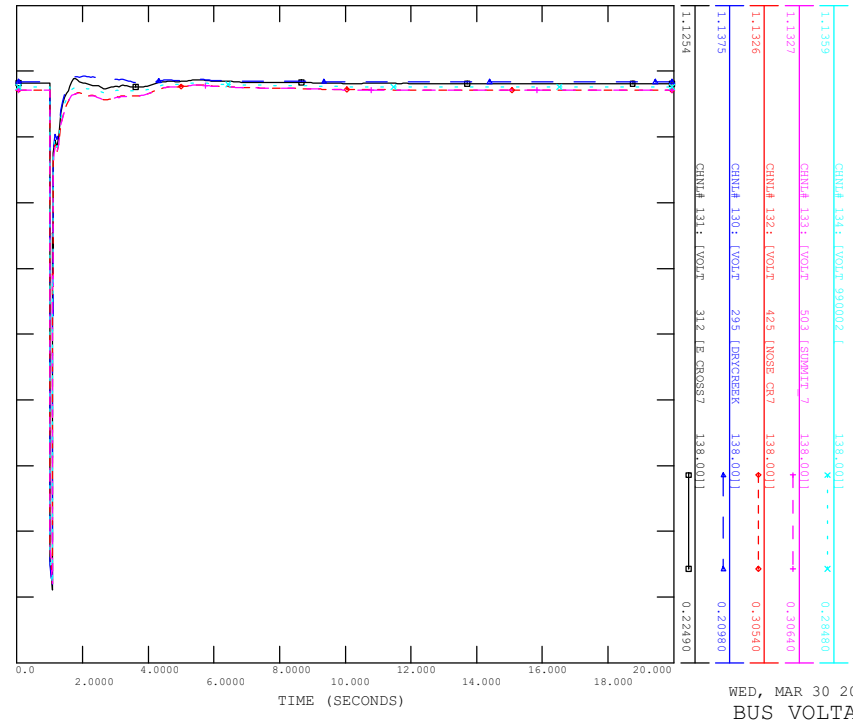
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CONTINGENCY -SCN3_SL_12_932L_BEDDINGTON

FILE: scn3_sl_12_932L_Beddington.out



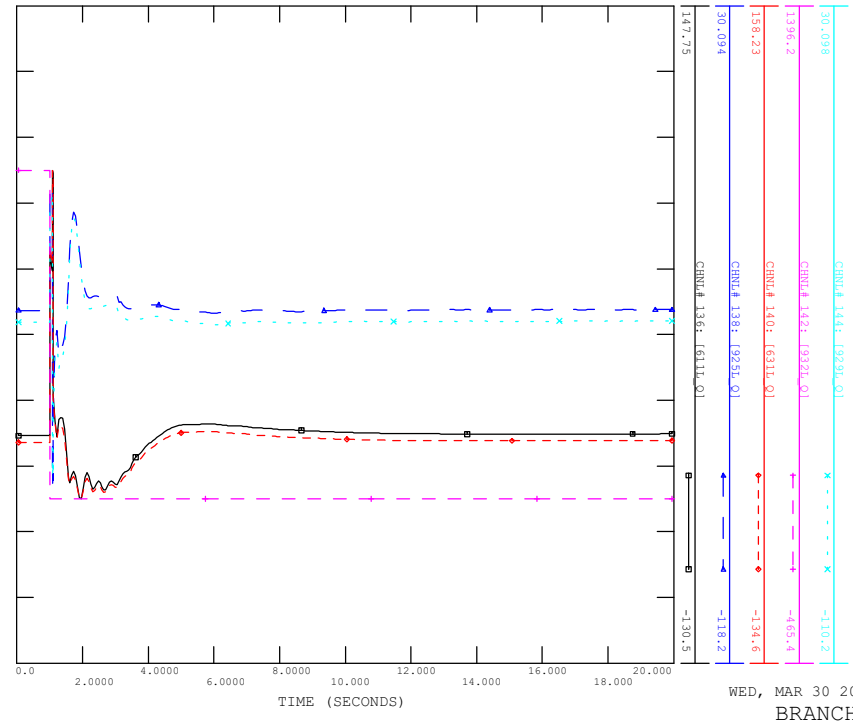
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CONTINGENCY -SCN3_SL_12_932L_BEDDINGTON

FILE: scn3_sl_12_932L_Beddington.out



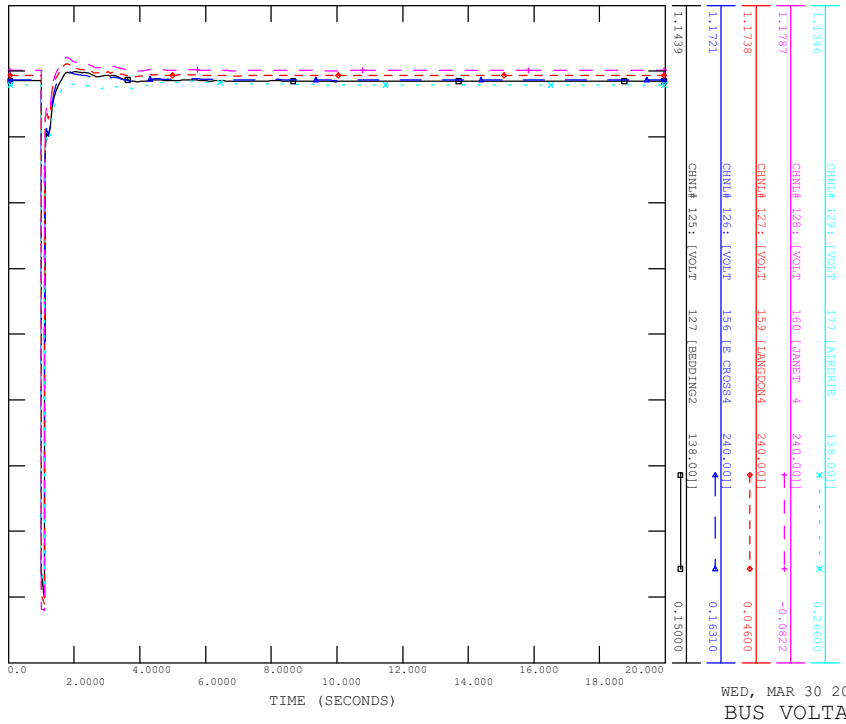
SCENARIO: P2405 SYSTEM IMPACT STUDY
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FILE: scn3_sl_12_932L_Beddington.out



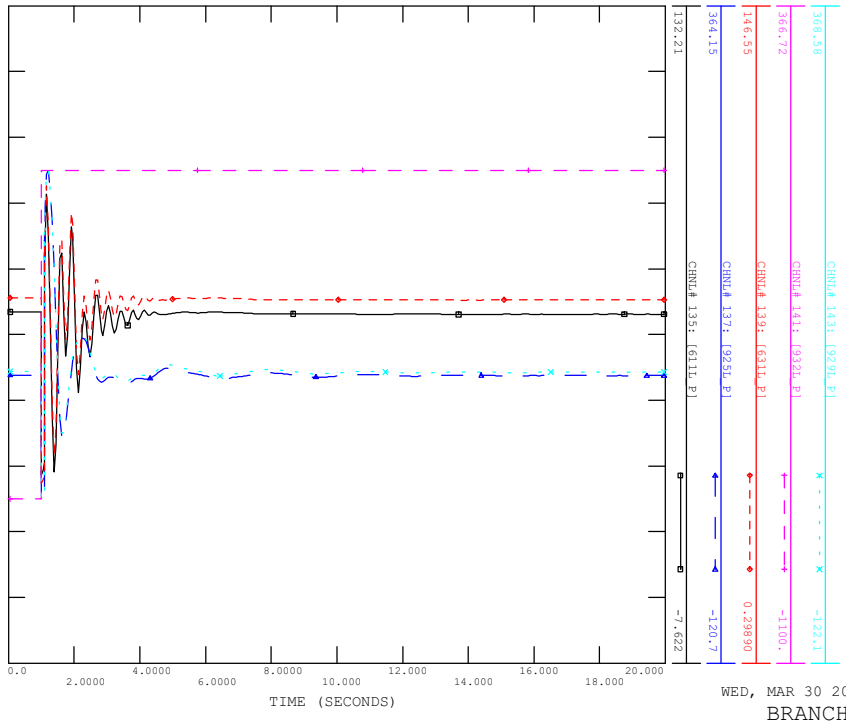
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CONTINGENCY -SCN3_SL_12_932L_BEDDINGTON

FILE: scn3_sl_12_932L_Beddington.out



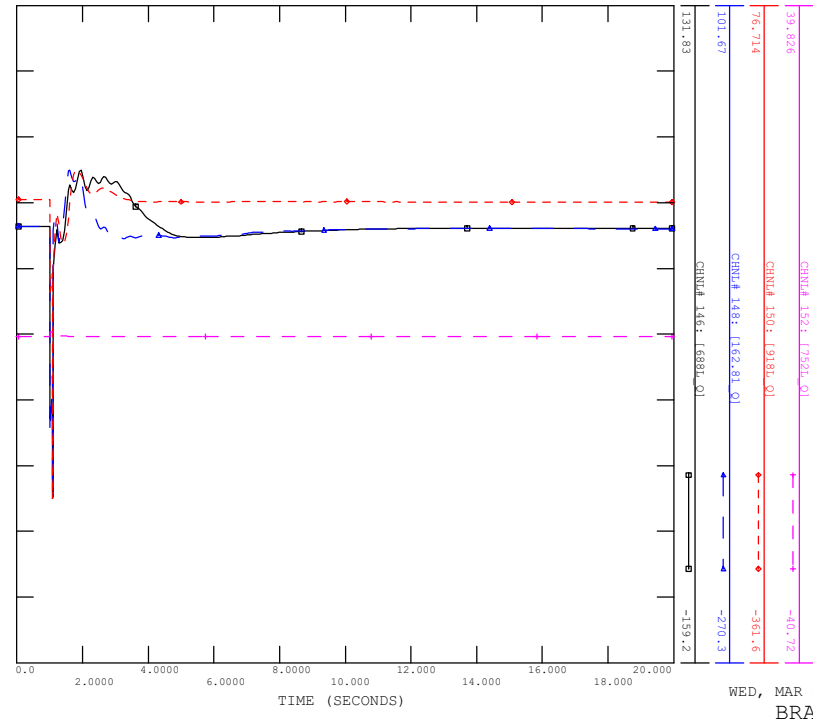
SCENARIO: P2405 SYSTEM IMPACT STUDY
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FILE: scn3_sl_12_932L_Beddington.out



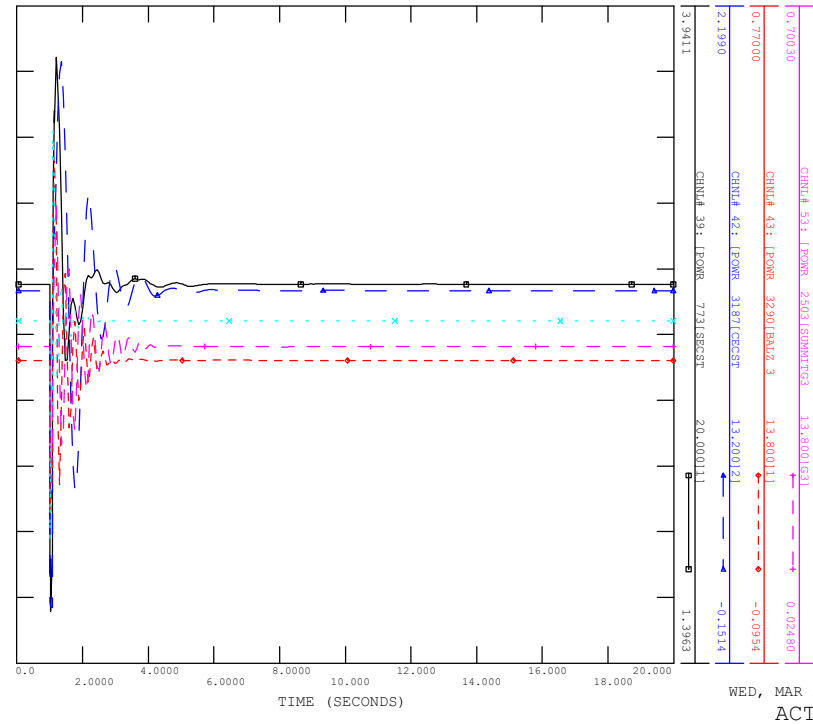
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CONTINGENCY -SCN3_SL_12_932L_BEDDINGTON

FILE: scn3_sl_12_932L_Beddington.out



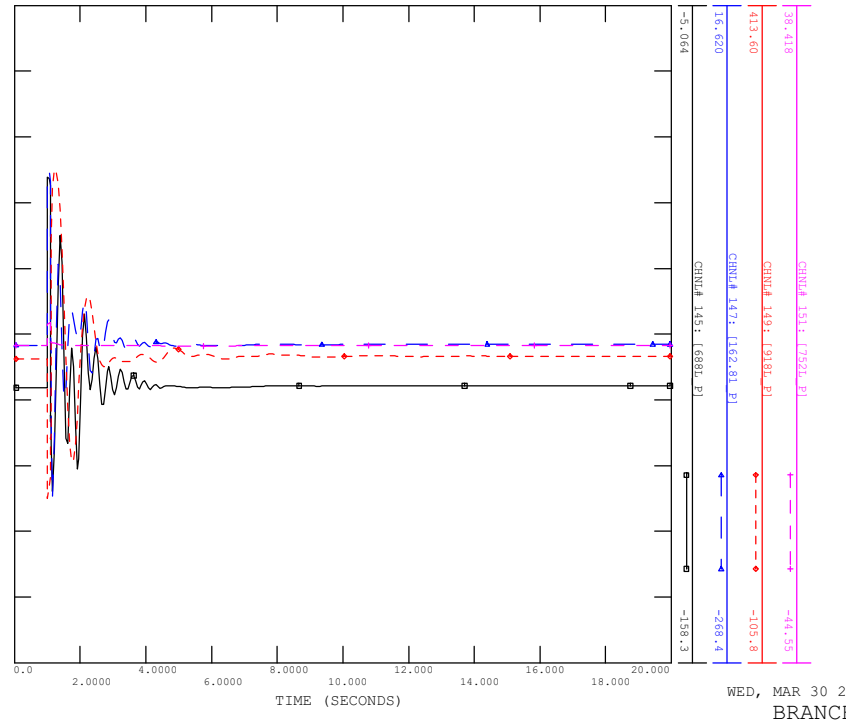
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_13_918L_BEDDINGTON

FILE: scn3_sl_13_918L_Beddington.out



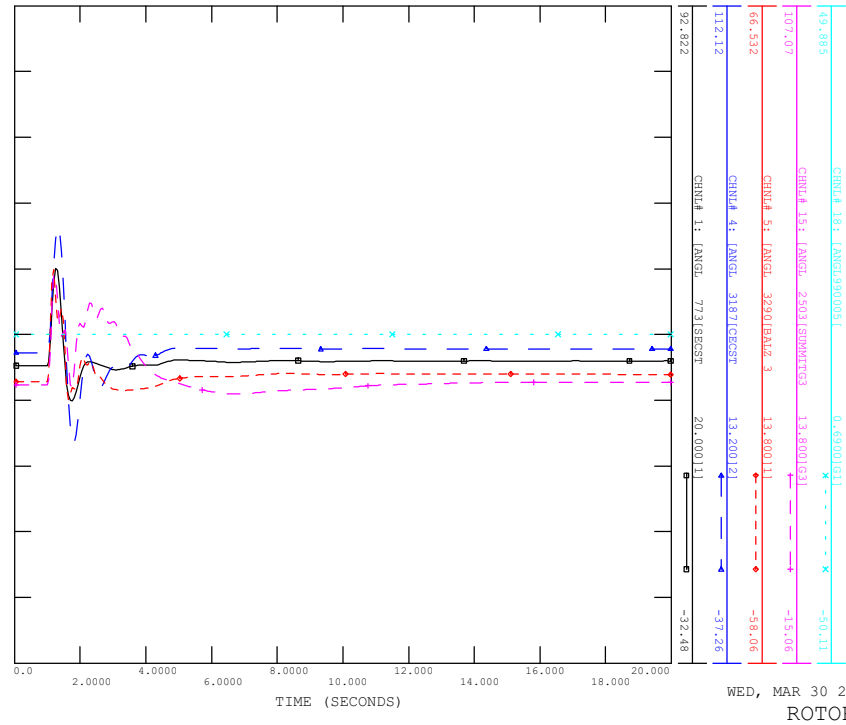
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_12_932L_BEDDINGTON

FILE: scn3_sl_12_932L_Beddington.out

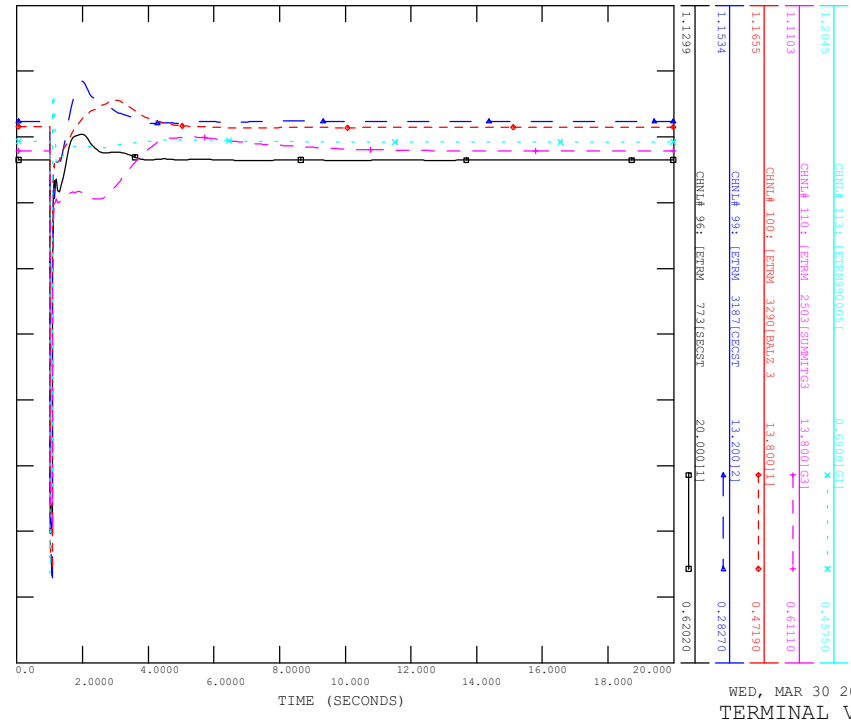


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_13_918L_BEDDINGTON

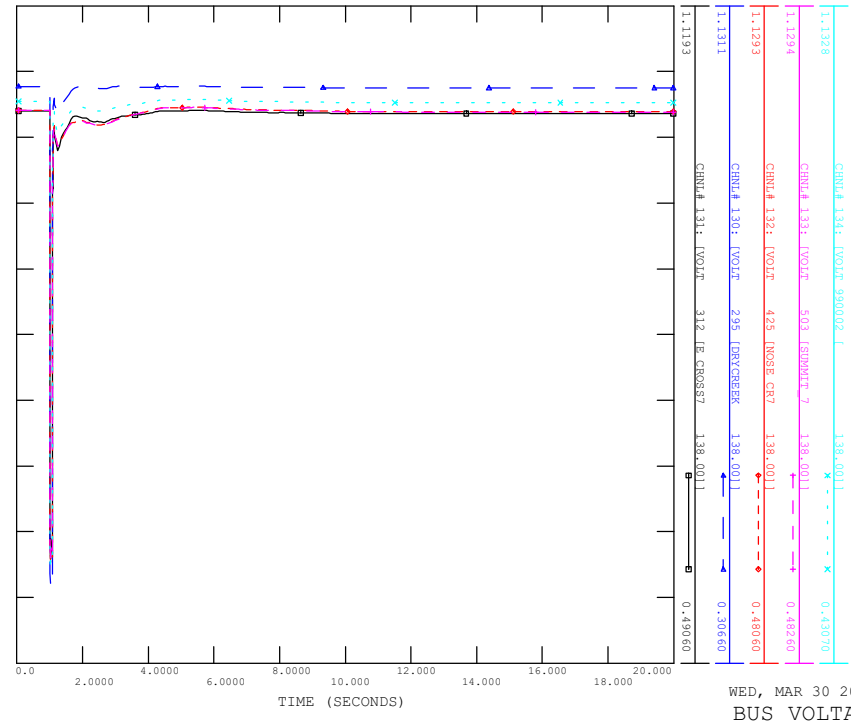
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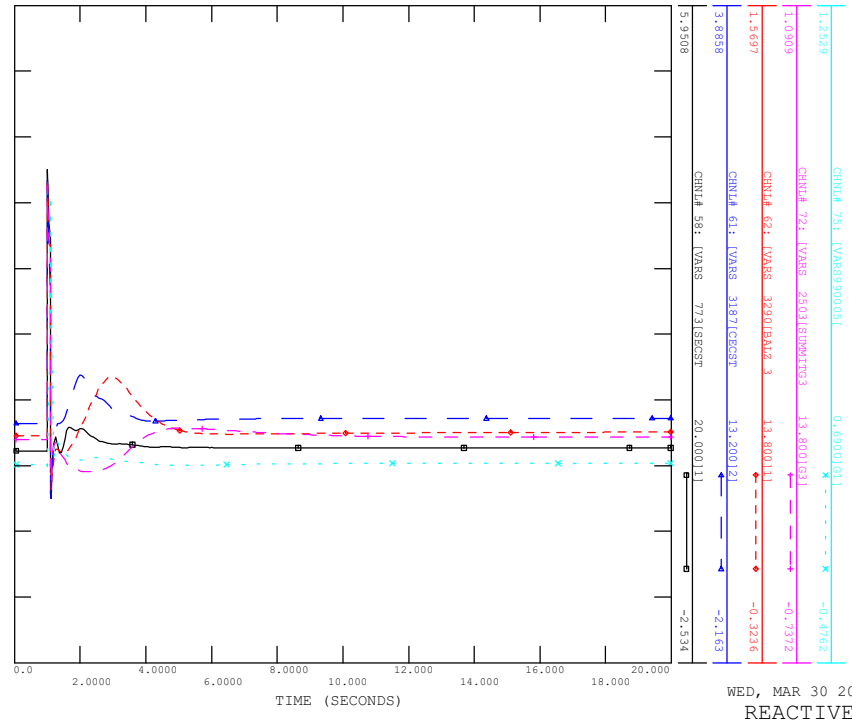
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_13_918L_BEDDINGTON
FILE: scn3_sl_13_918L_Beddington.out



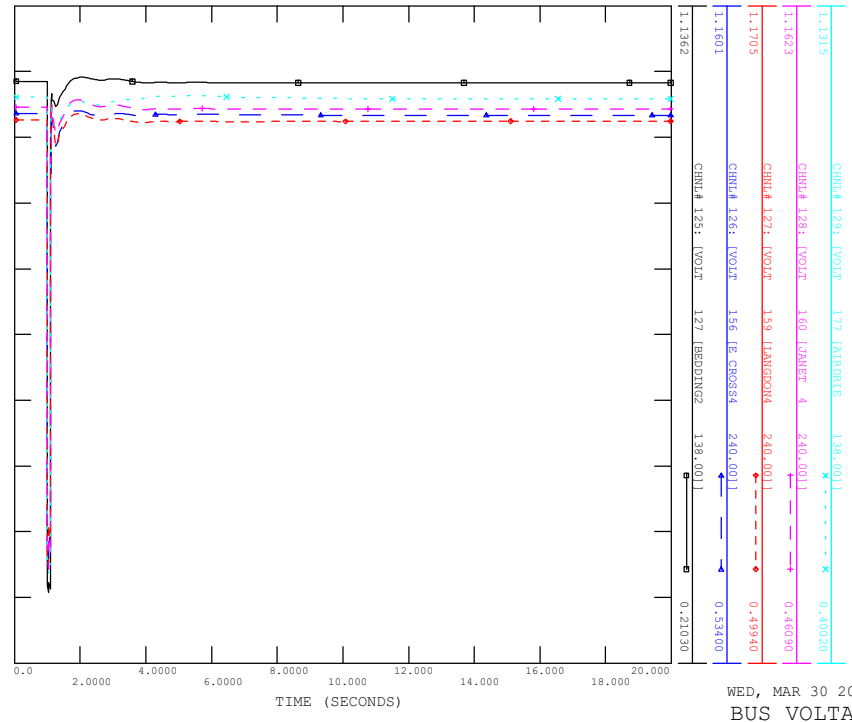
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CONTINGENCY -SCN3_SL_13_918L_BEDDINGTON
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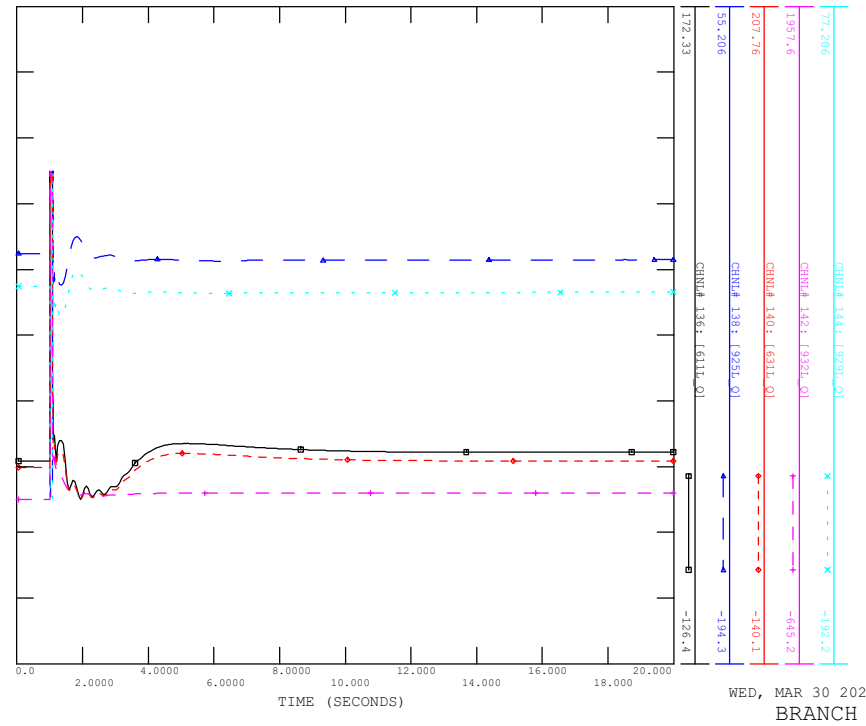
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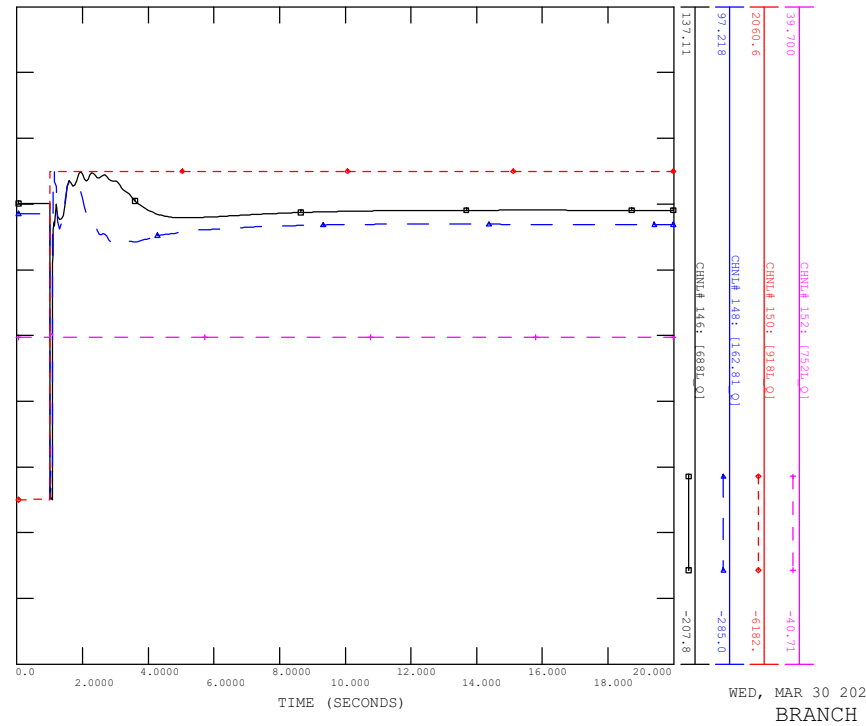
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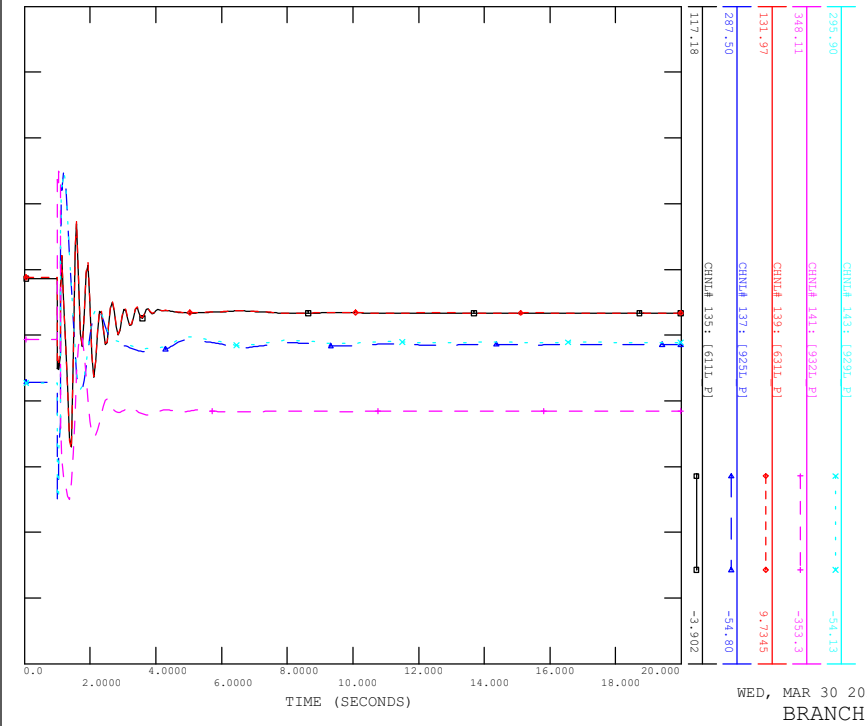
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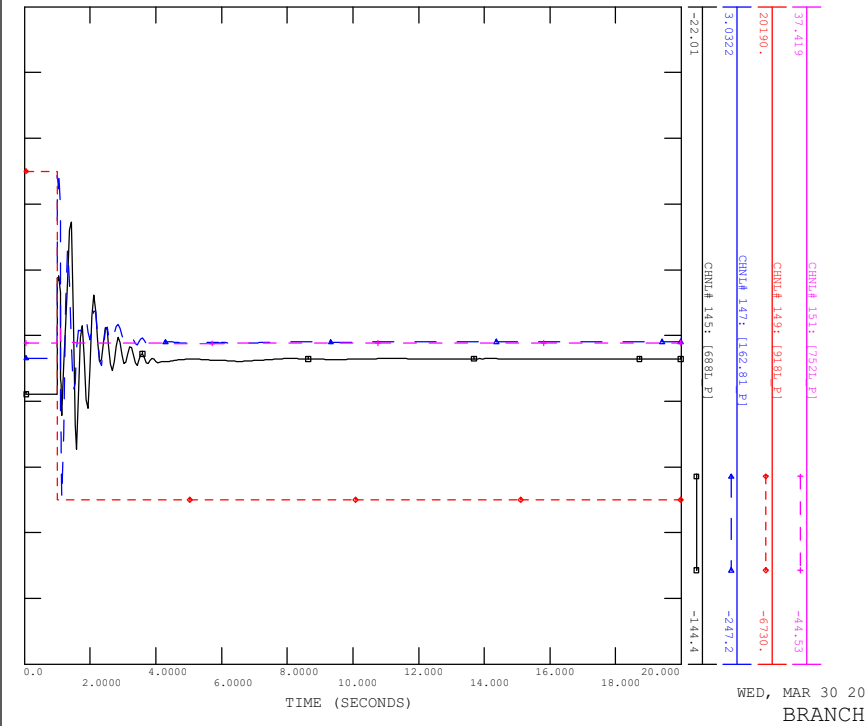
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CONTINGENCY -SCN3_SL_13_918L_BEDDINGTON
FILE: scn3_sl_13_918L_Beddington.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_13_918L_BEDDINGTON
FILE: scn3_sl_13_918L_Beddington.out

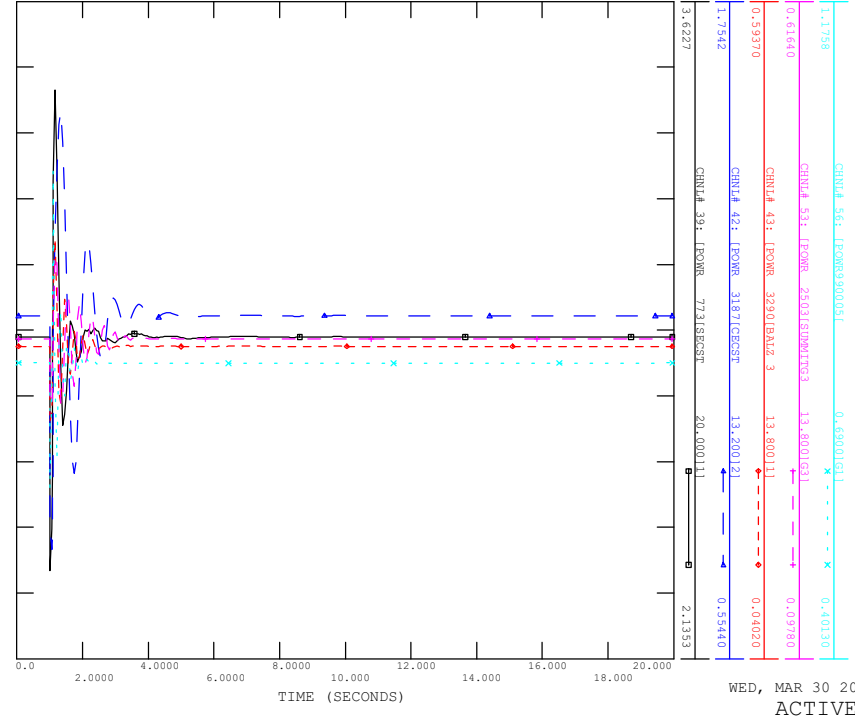


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_13_918L_BEDDINGTON
FILE: scn3_sl_13_918L_Beddington.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_14_918L_JOHNSON

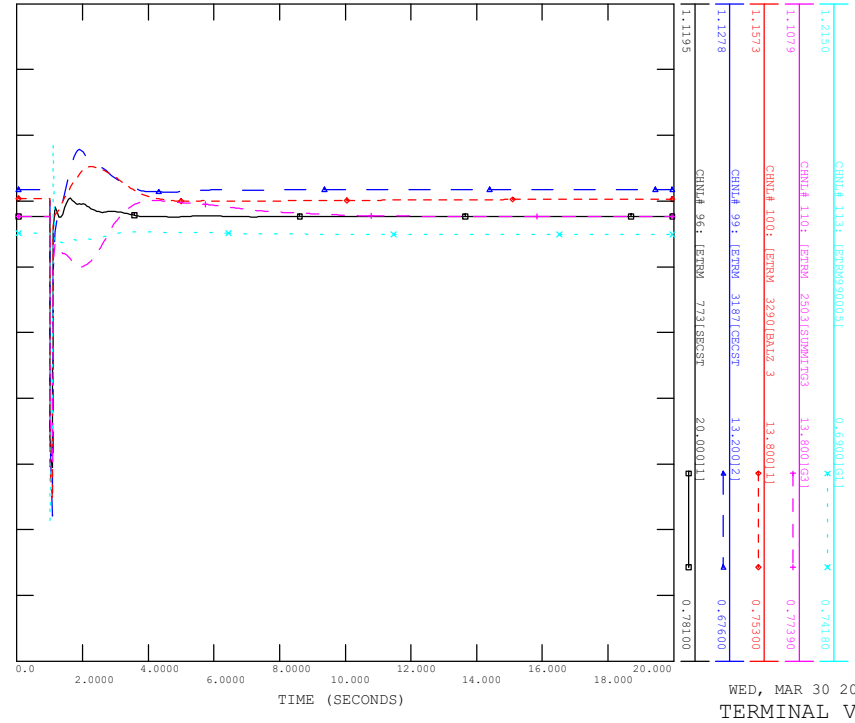
FILE: scn3_sl_14_918L_johnson.out



WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_14_918L_JOHNSON

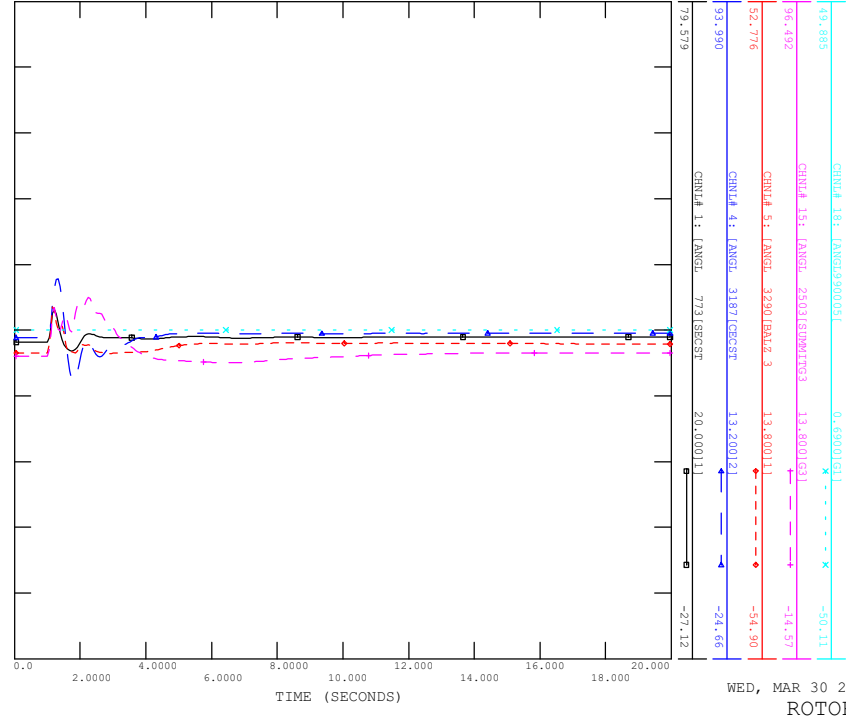
FILE: scn3_sl_14_918L_johnson.out



WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_14_918L_JOHNSON

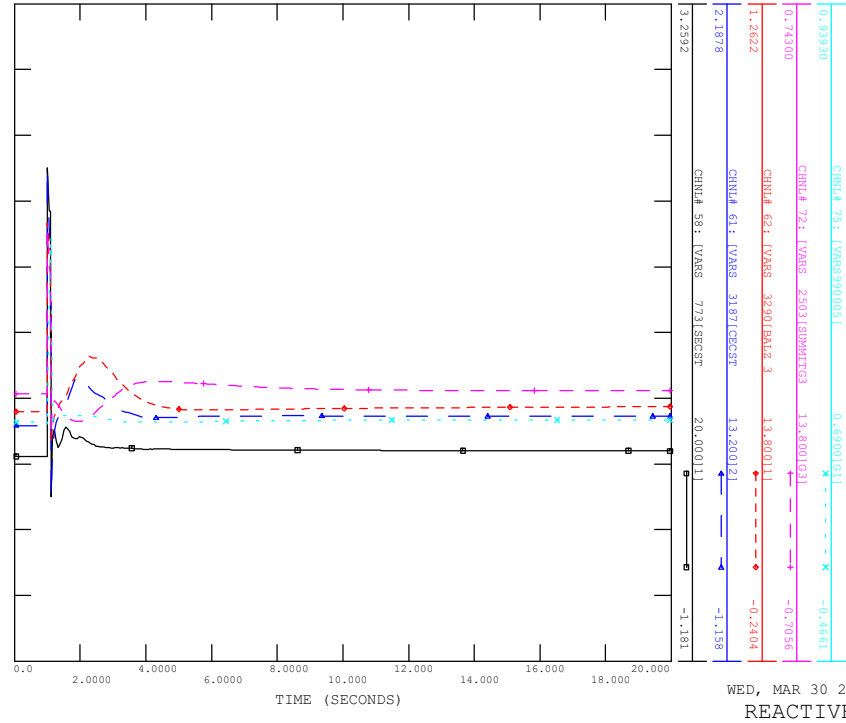
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WED, MAR 30 2022 0:34
ROTOR ANGLE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_14_918L_JOHNSON

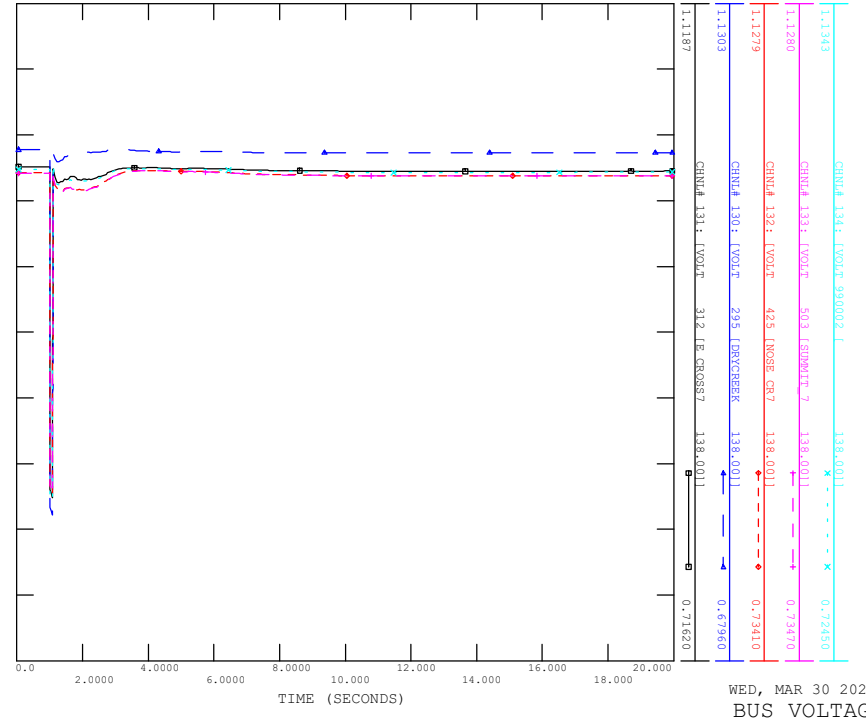
FILE: scn3_sl_14_918L_johnson.out



WED, MAR 30 2022 0:34
REACTIVE POWER

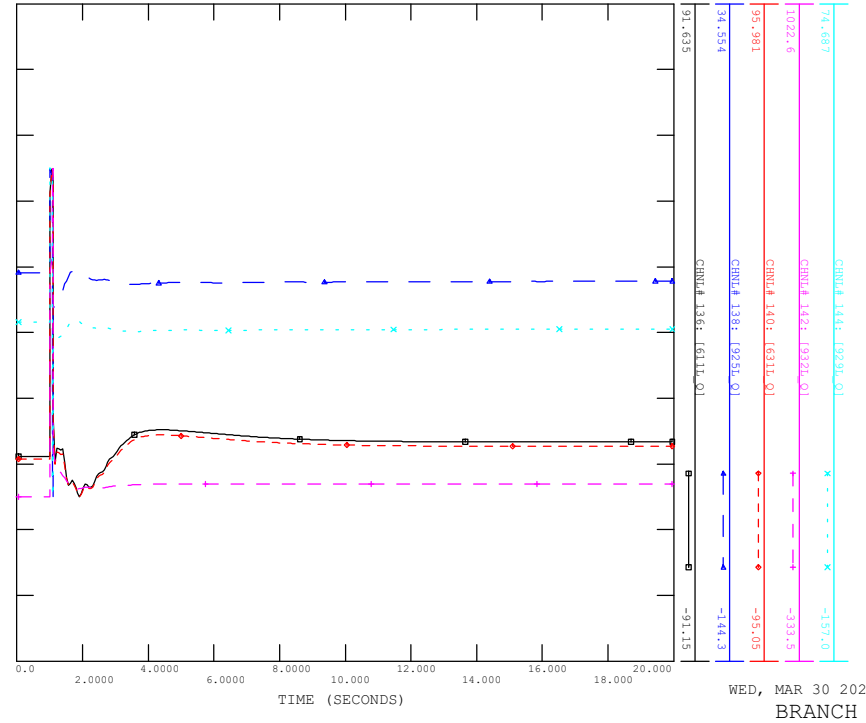
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CONTINGENCY -SCN3_SL_14_918L_JOHNSON

FILE: scn3_sl_14_918L_johnson.out



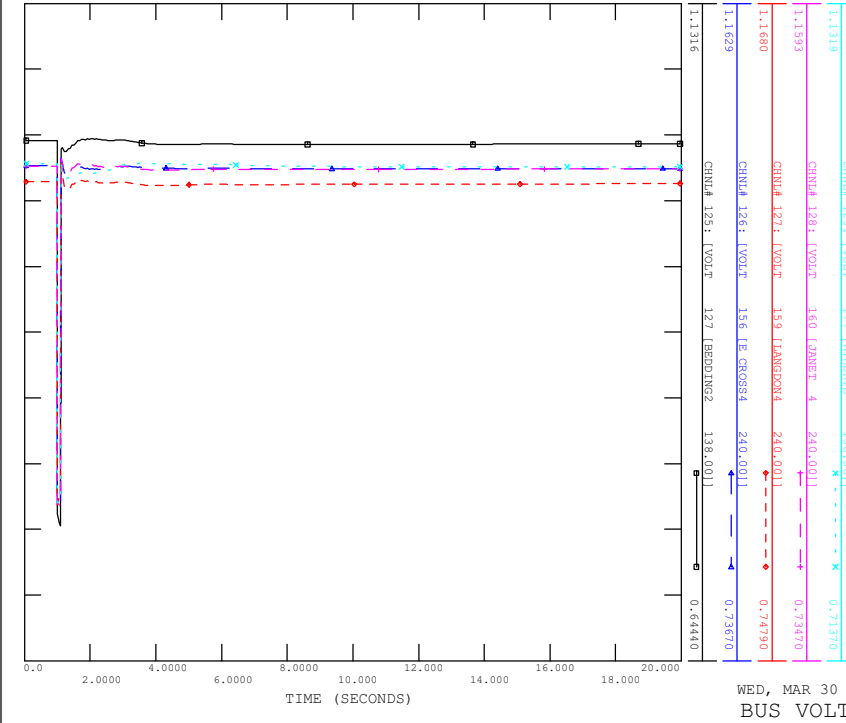
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_14_918L_JOHNSON

FILE: scn3_sl_14_918L_johnson.out



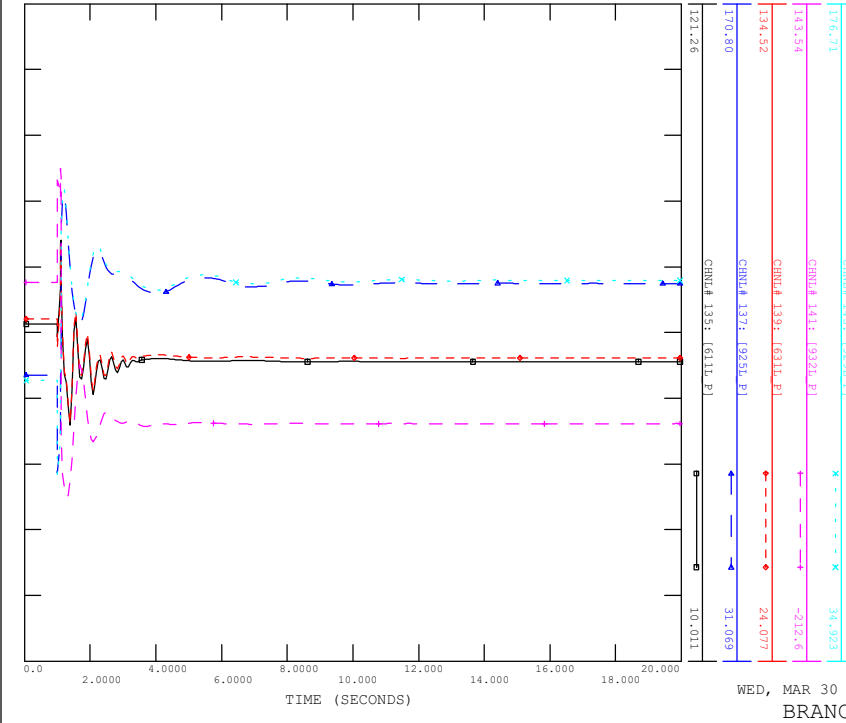
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_14_918L_JOHNSON

FILE: scn3_sl_14_918L_johnson.out



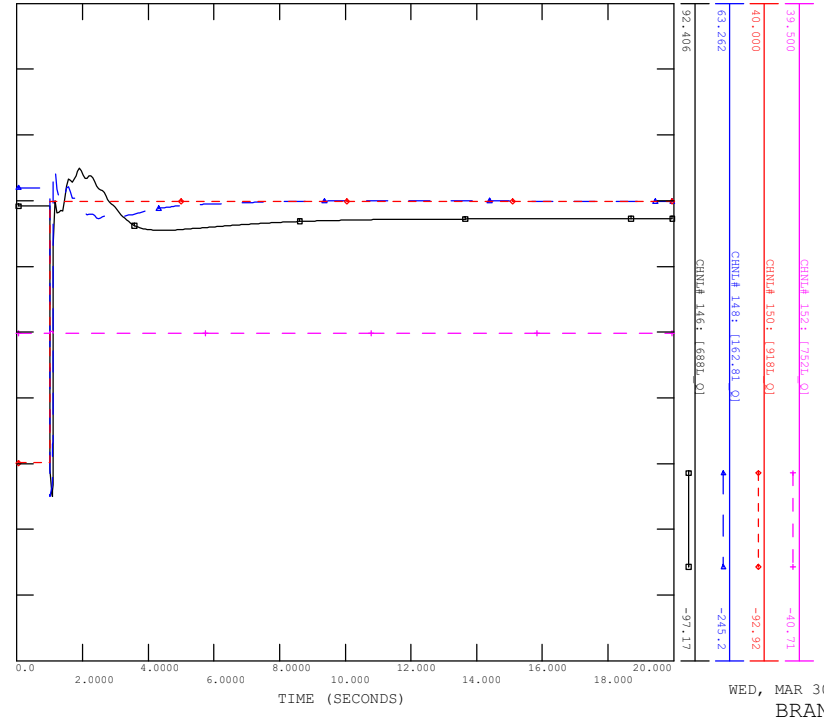
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_14_918L_JOHNSON

FILE: scn3_sl_14_918L_johnson.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_14_9181_JOHNSON

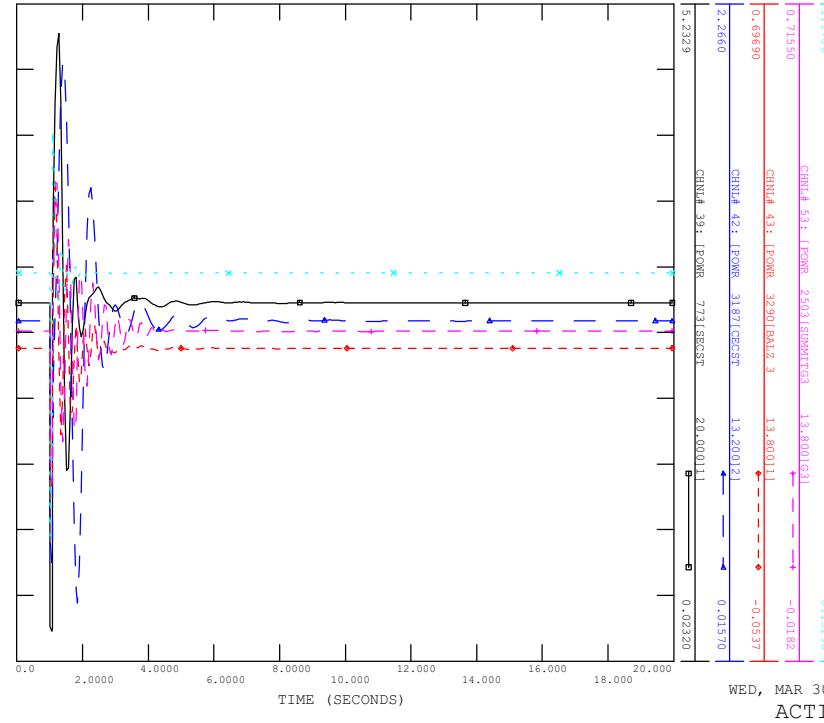
FILE: scn3_sl_14_9181_Johnson.out



WED, MAR 30 2022 0:34
BRANCH Q (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_15_9291_JANET

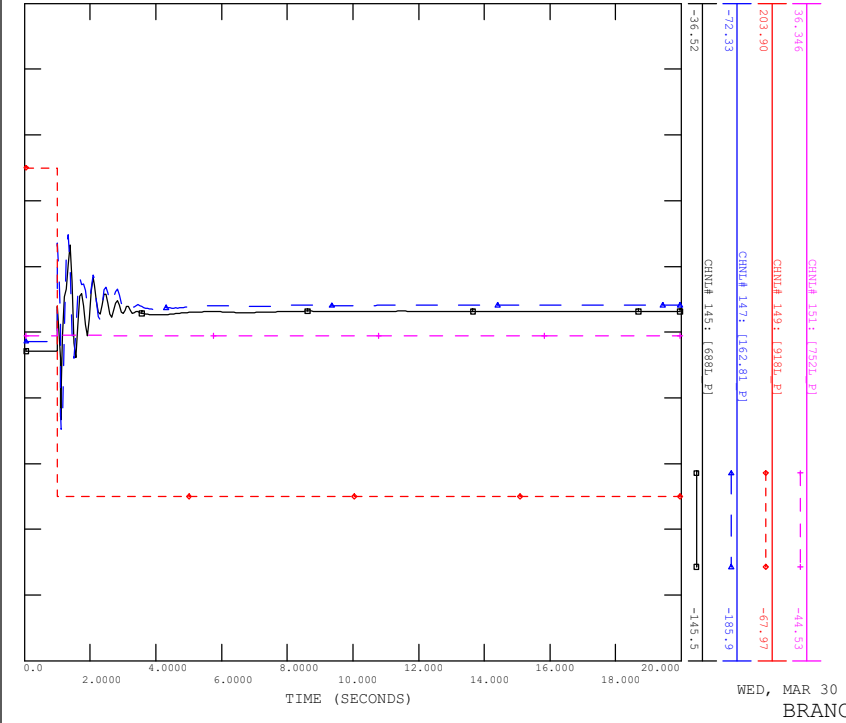
FILE: scn3_sl_15_9291_Janet.out



WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_14_9181_JOHNSON

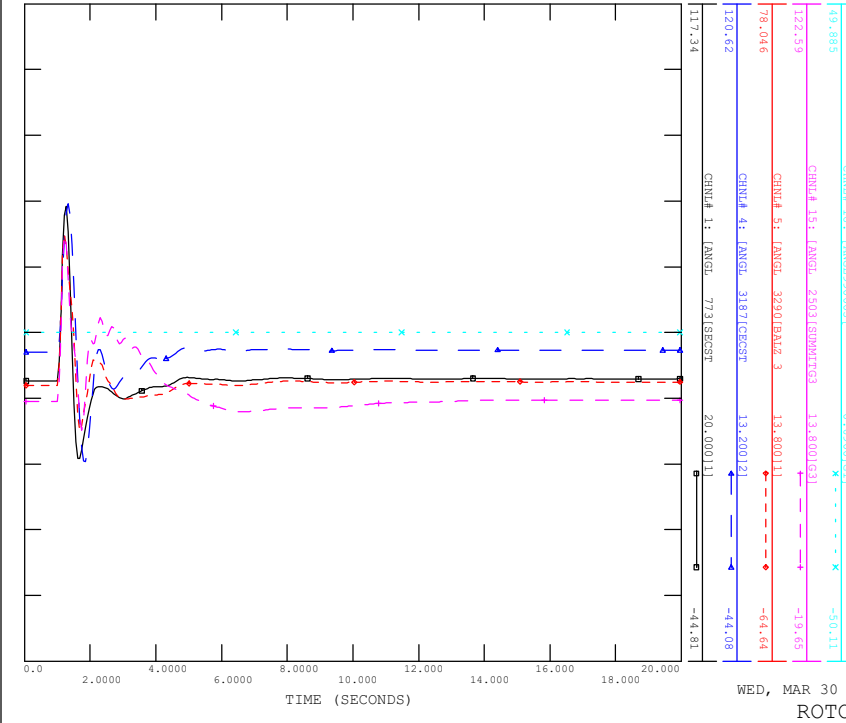
FILE: scn3_sl_14_9181_Johnson.out



WED, MAR 30 2022 0:34
BRANCH P (2)

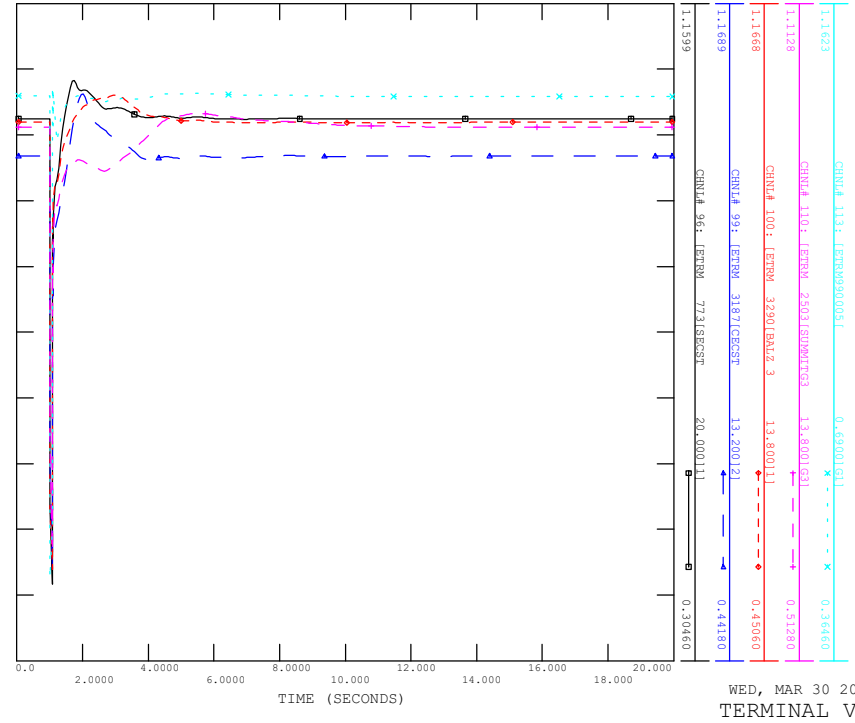
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_15_9291_JANET

FILE: scn3_sl_15_9291_Janet.out



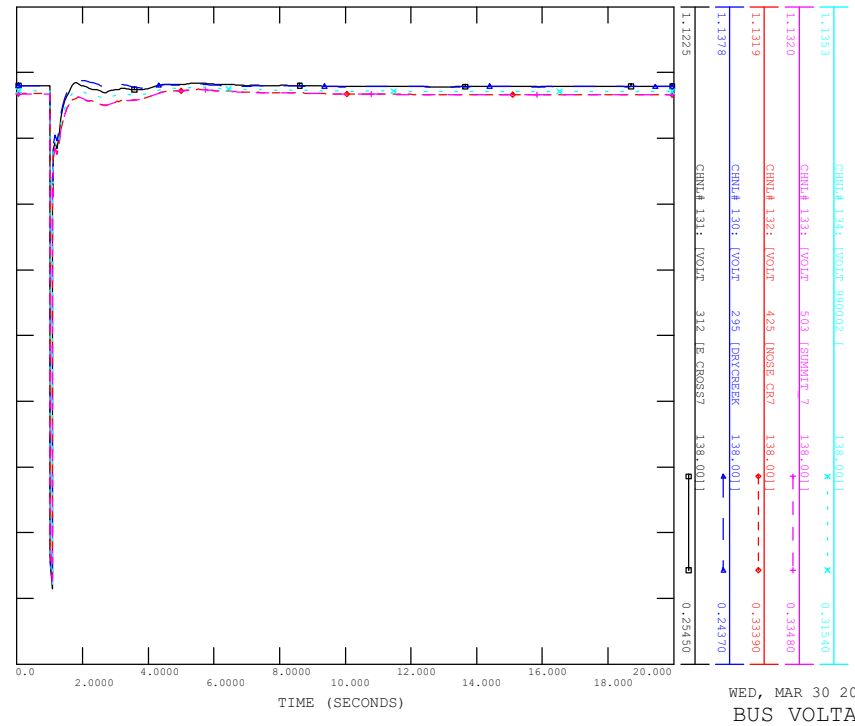
WED, MAR 30 2022 0:34
ROTOR ANGLE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_15_929L_JANET
FILE: scn3_sl_15_929L_Janet.out



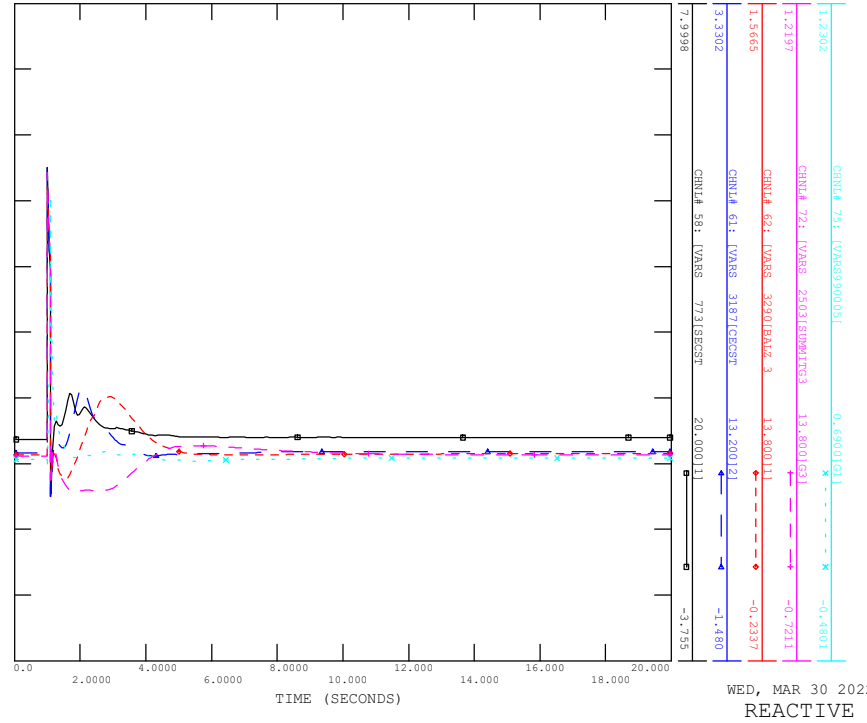
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_15_929L_JANET
FILE: scn3_sl_15_929L_Janet.out



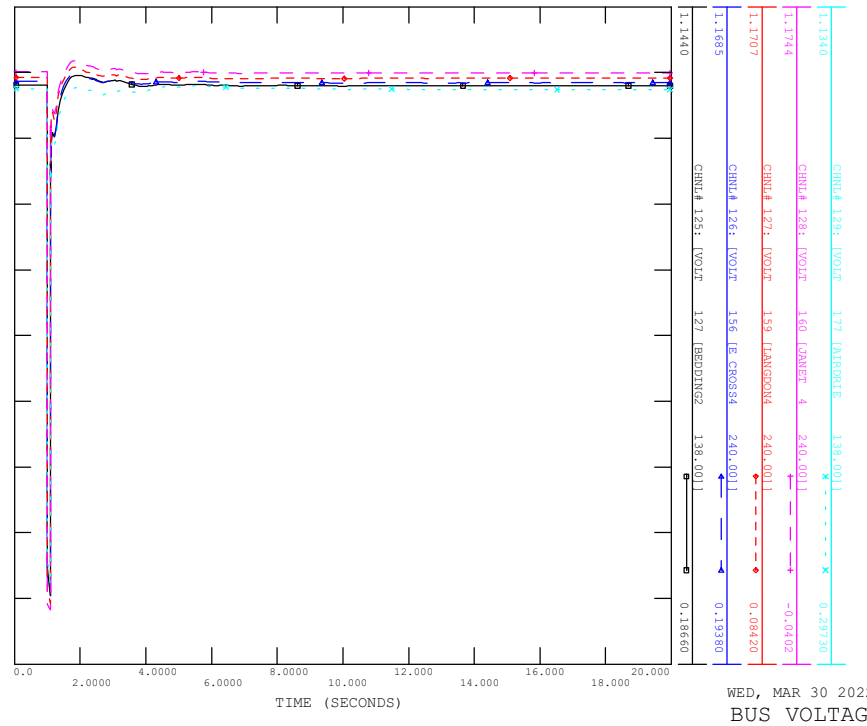
WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_15_929L_JANET
FILE: scn3_sl_15_929L_Janet.out



WED, MAR 30 2022 0:34
REACTIVE POWER

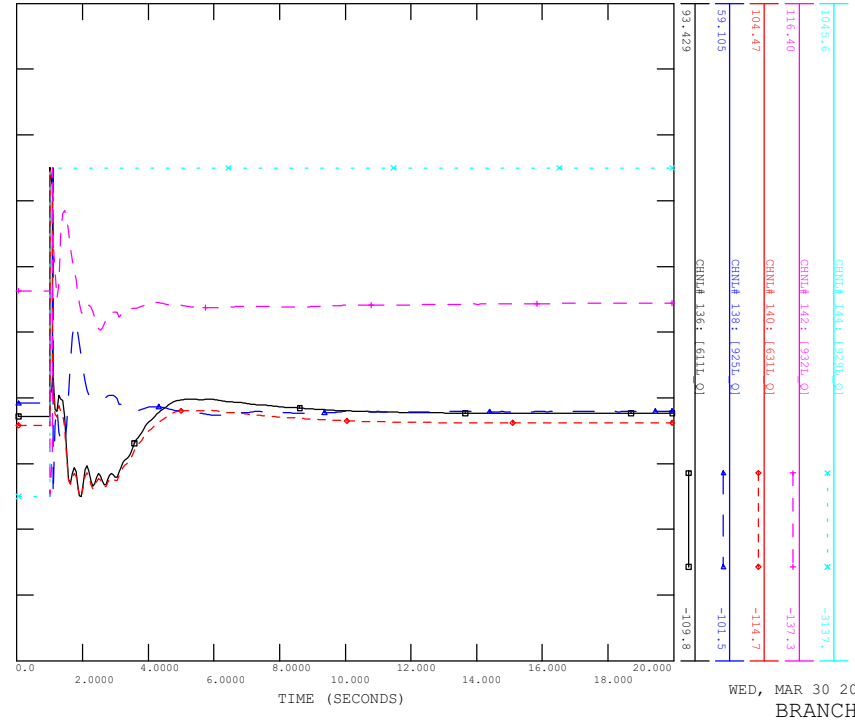
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_15_929L_JANET
FILE: scn3_sl_15_929L_Janet.out



WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

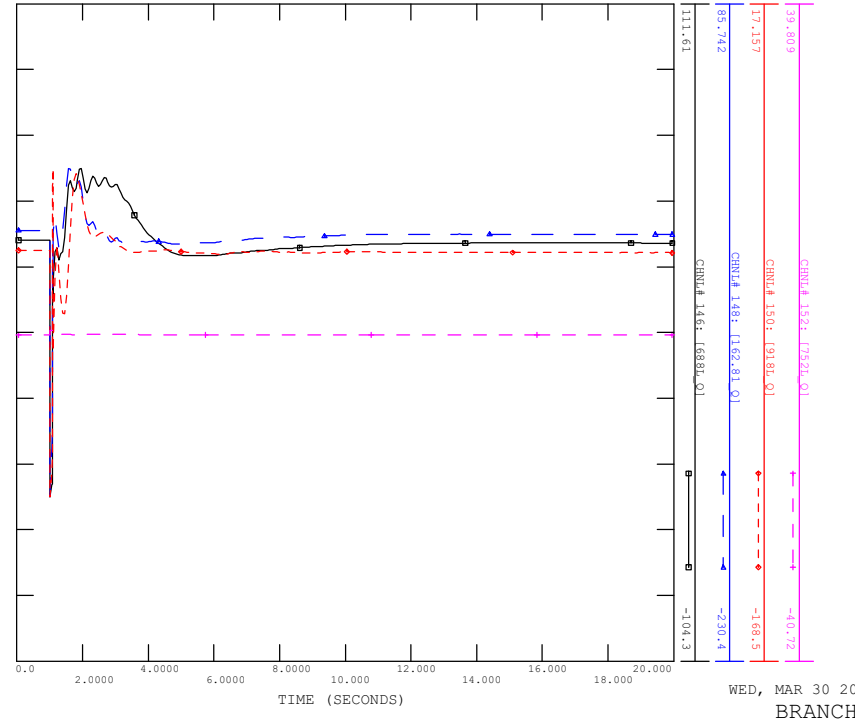
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_15_9291_JANET

FILE: scn3_sl_15_9291_Janet.out



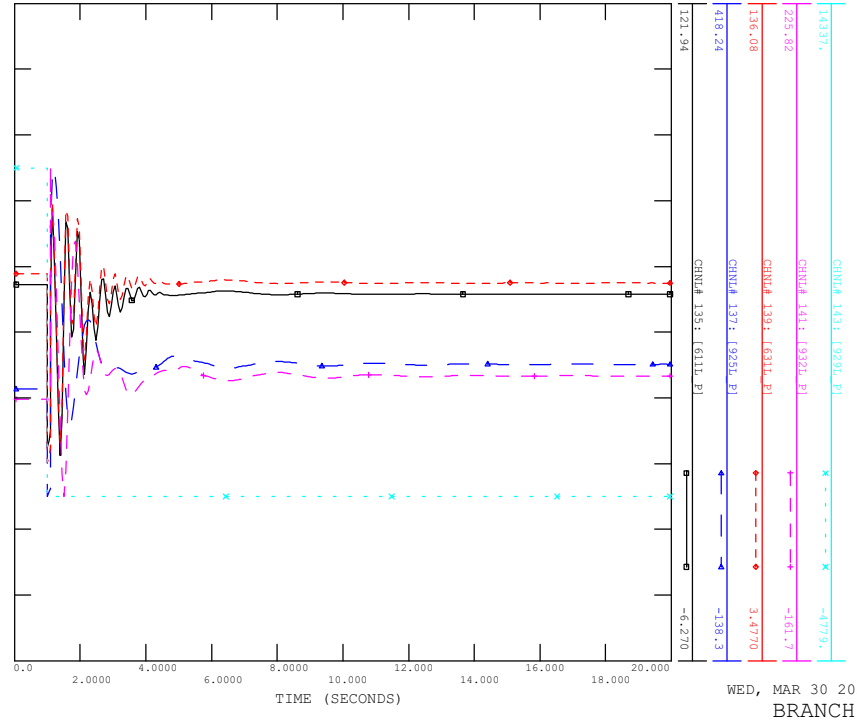
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CONTINGENCY -SCN3_SL_15_9291_JANET

FILE: scn3_sl_15_9291_Janet.out



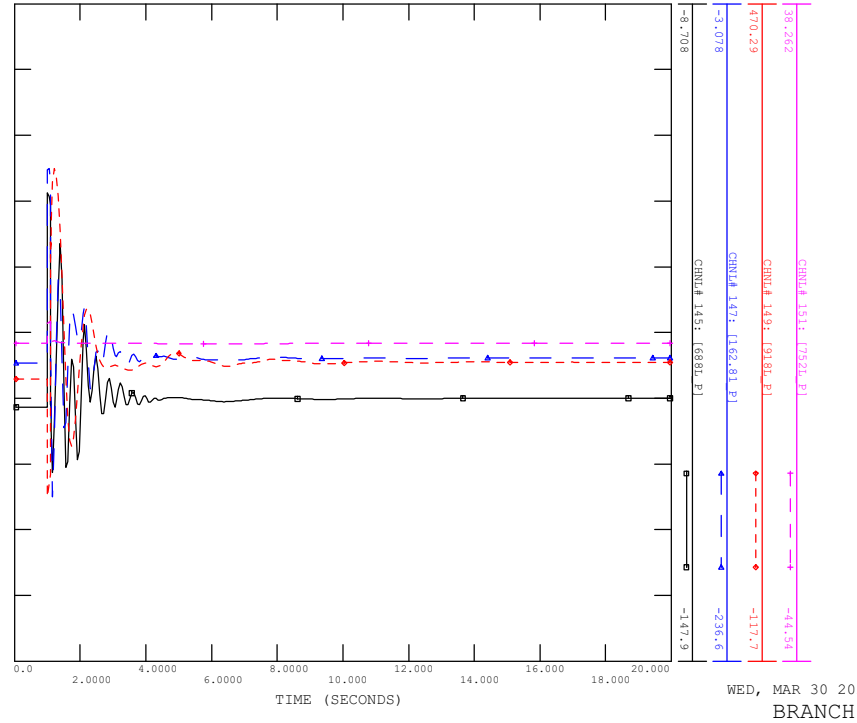
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CONTINGENCY -SCN3_SL_15_9291_JANET

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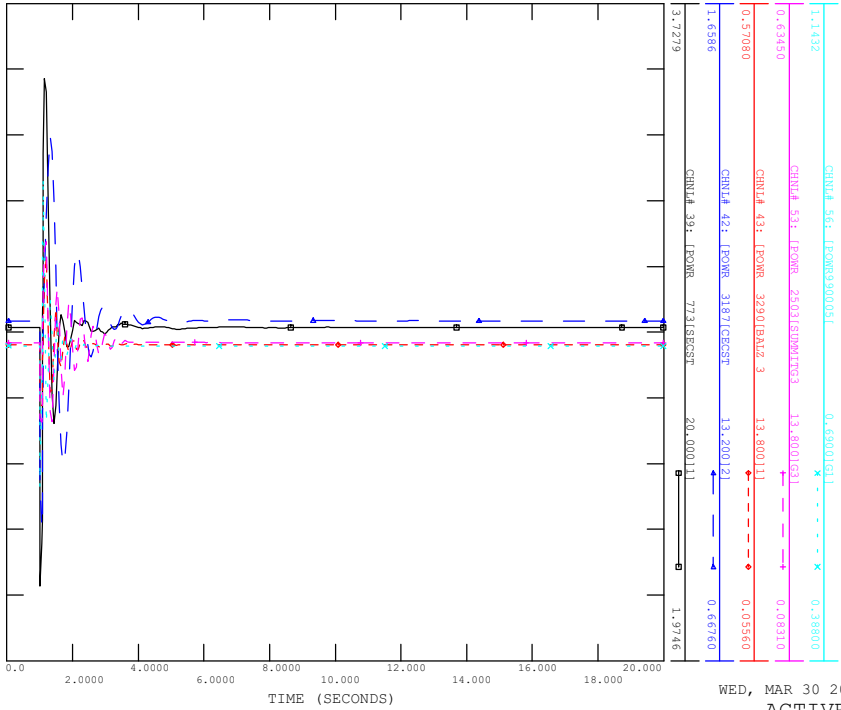
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_15_9291_JANET

FILE: scn3_sl_15_9291_Janet.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_16_9291_HAZELWOOD

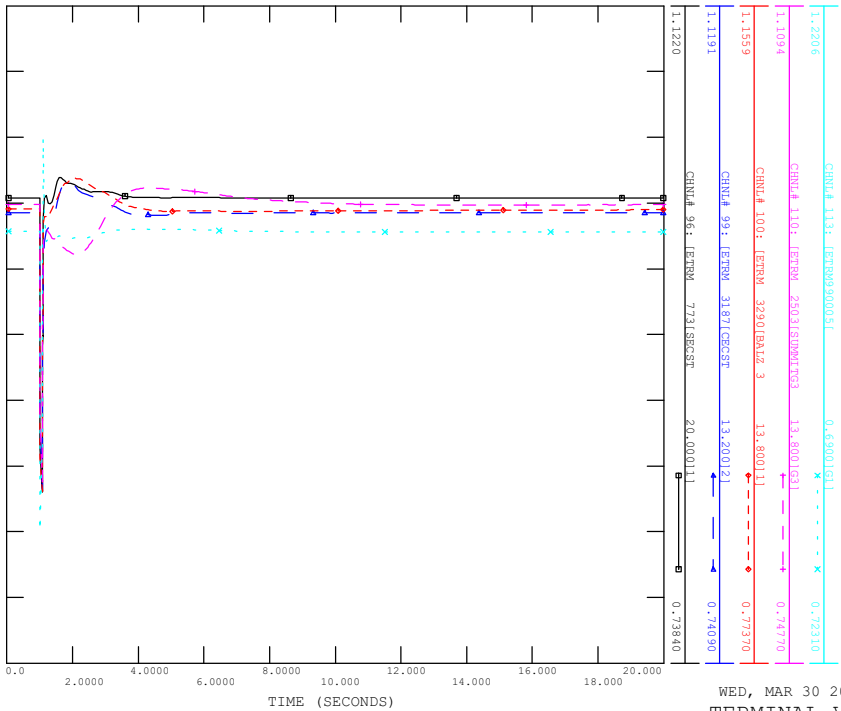
FILE: scn3_sl_16_9291_Hazelwood.out



WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_16_9291_HAZELWOOD

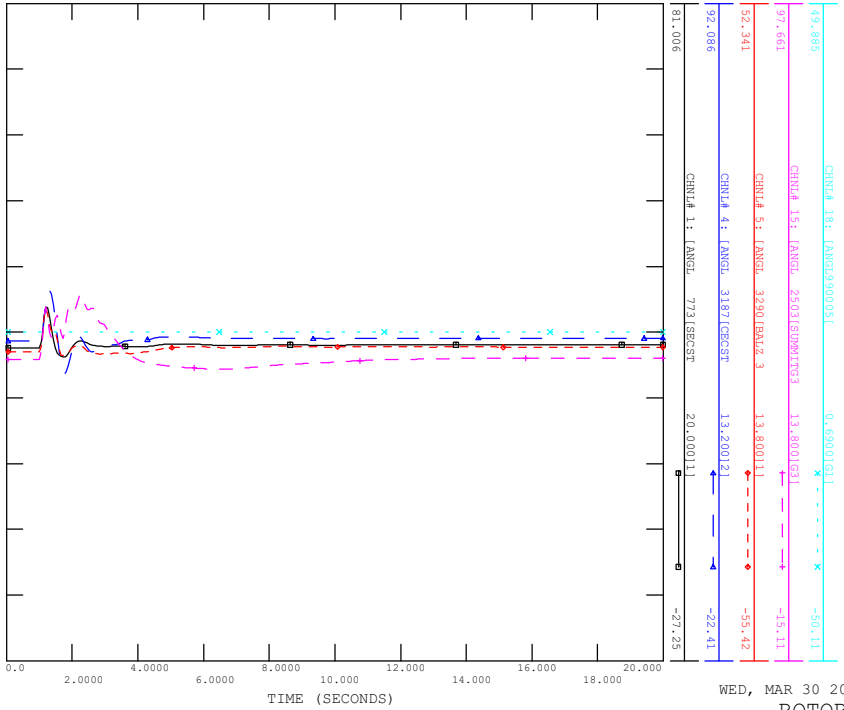
FILE: scn3_sl_16_9291_Hazelwood.out



WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_16_9291_HAZELWOOD

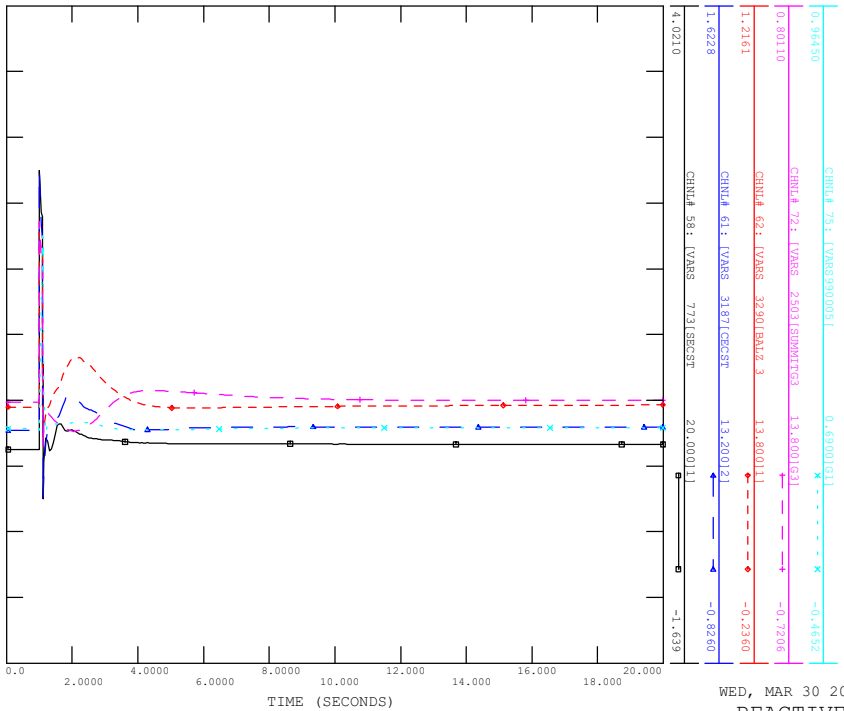
FILE: scn3_sl_16_9291_Hazelwood.out



WED, MAR 30 2022 0:34
ROTOR ANGLE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_16_9291_HAZELWOOD

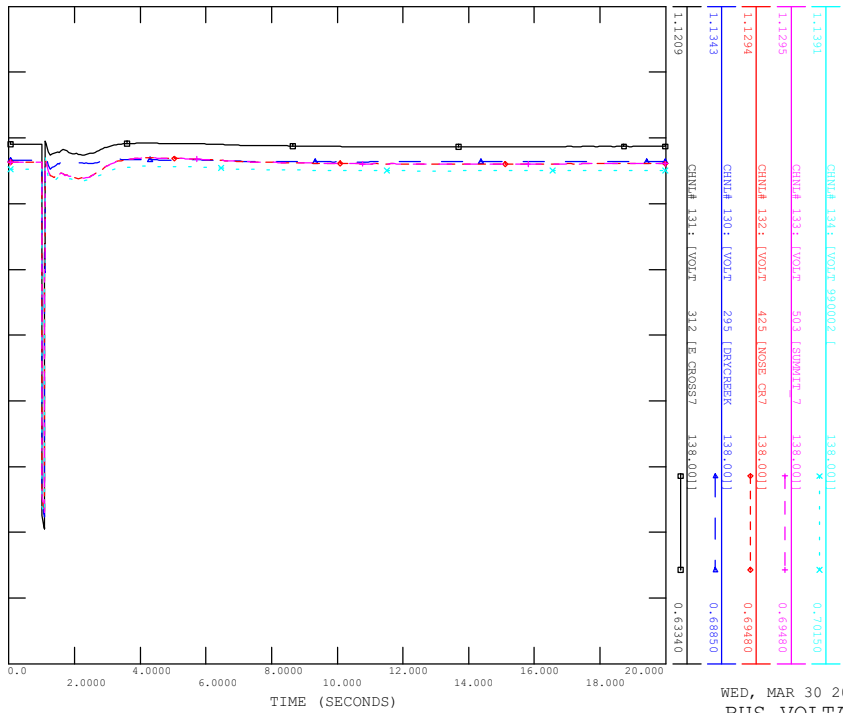
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WED, MAR 30 2022 0:34
REACTIVE POWER

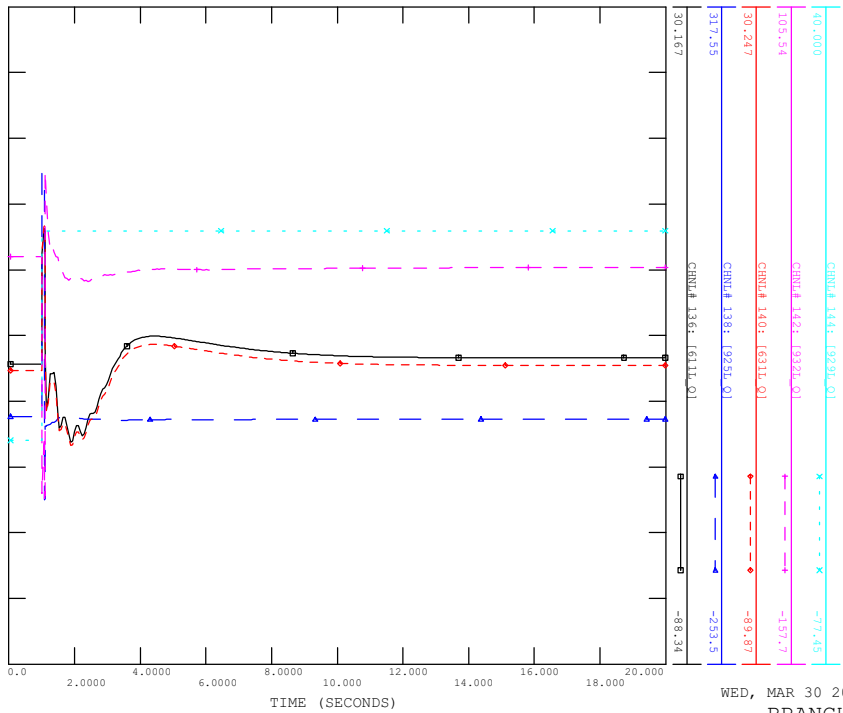
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_16_929L_HAZELWOOD

FILE: scn3_sl_16_929L_Hazelwood.out



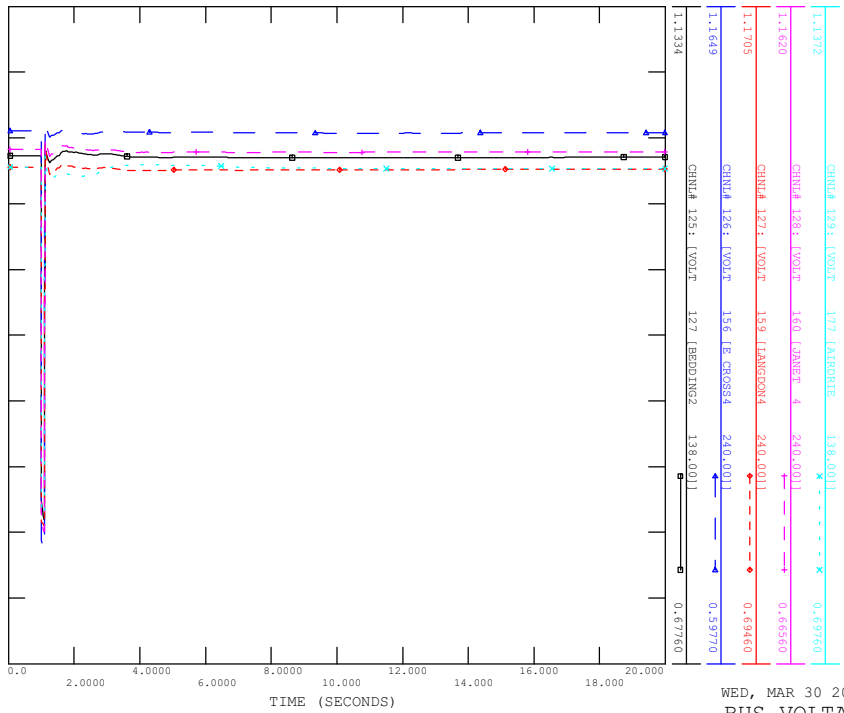
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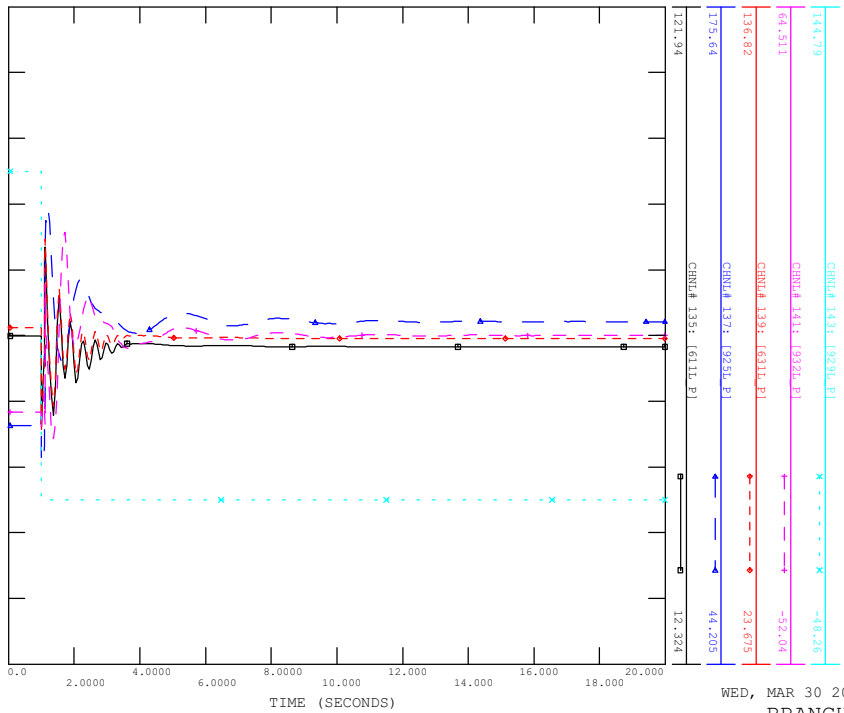
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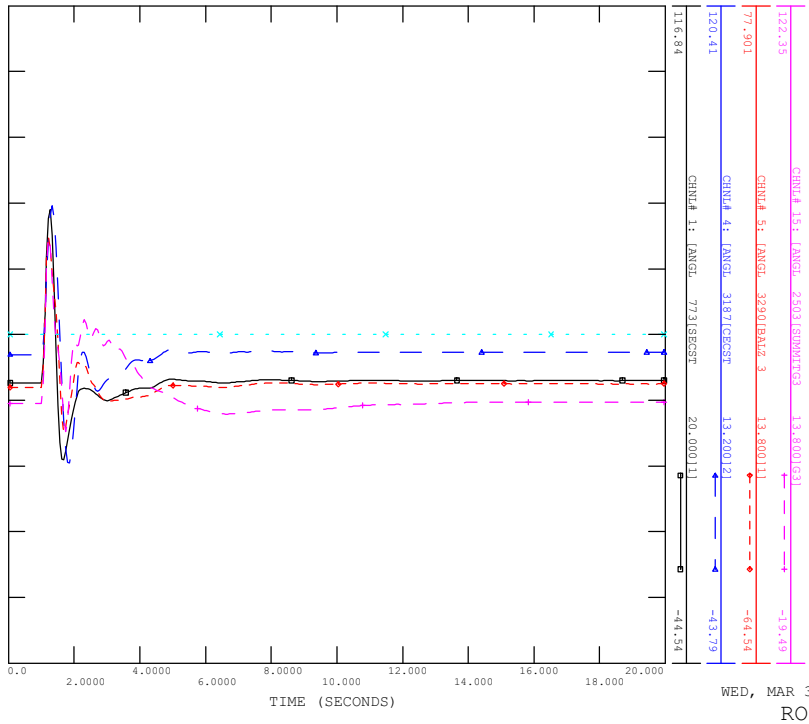
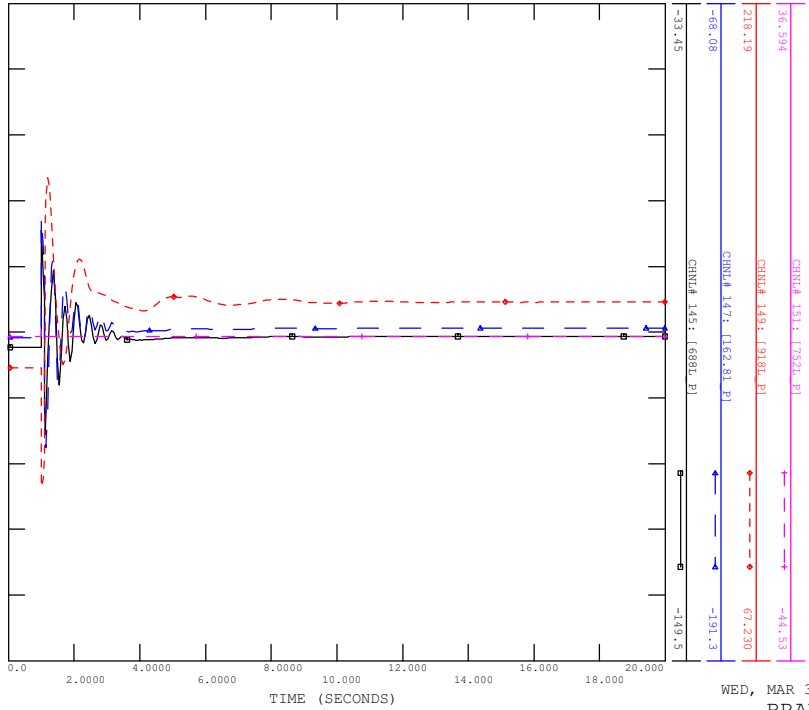
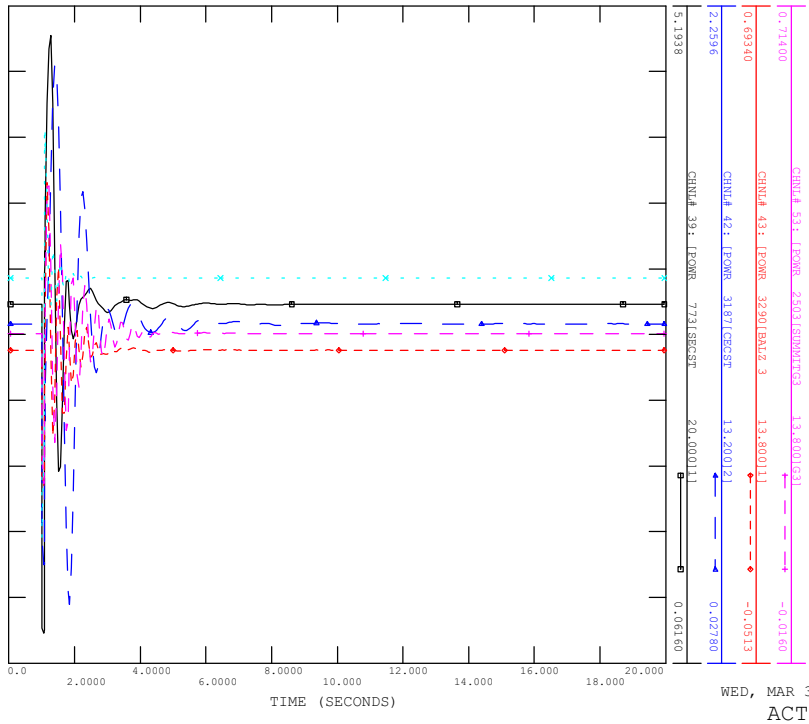
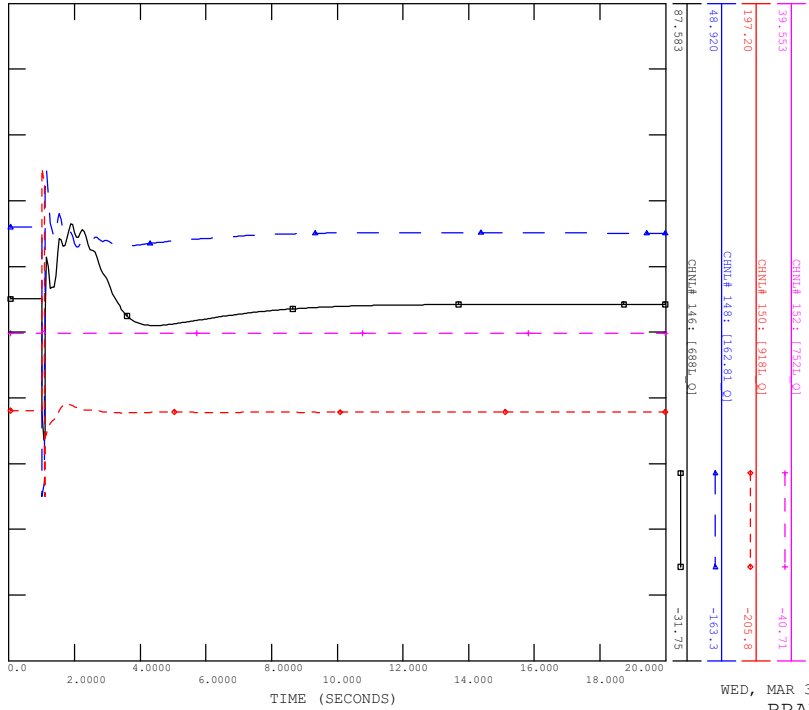
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SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_16_929L_HAZELWOOD

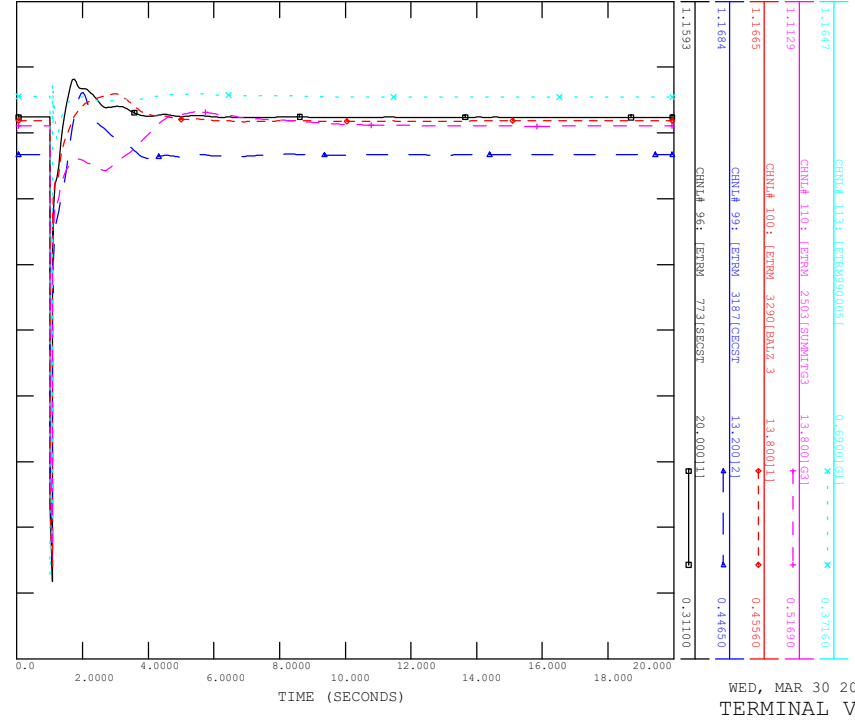
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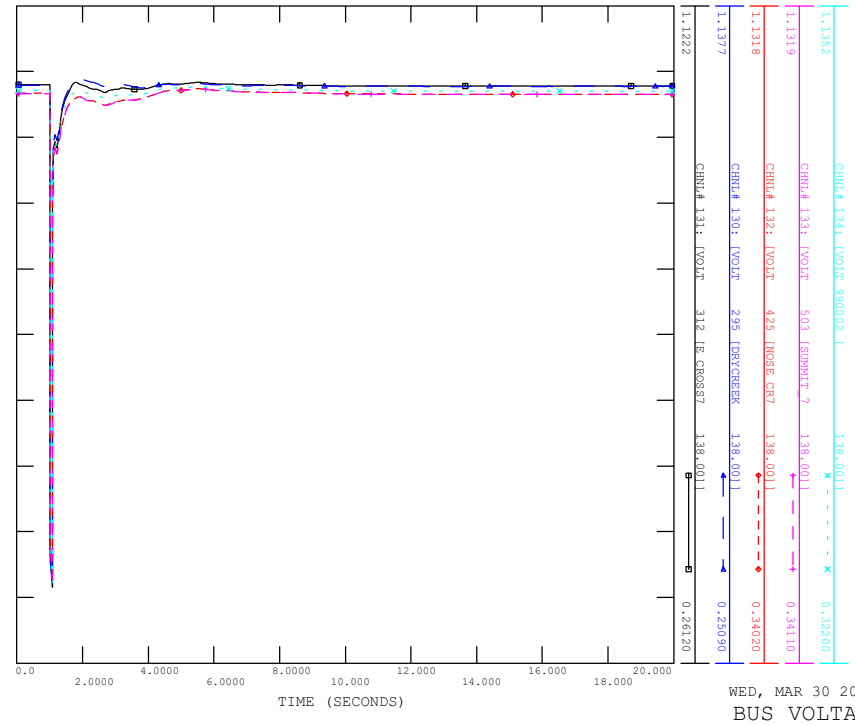
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CONTINGENCY -SCN3_SL_17_925L_JANBT

FILE: scn3_sl_17_925L_Janet.out



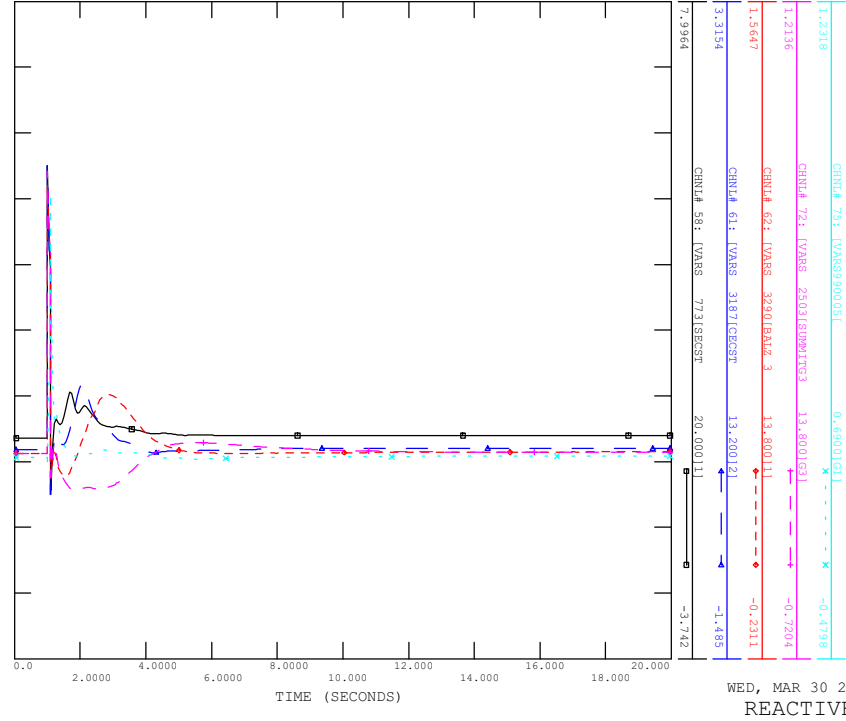
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_17_925L_JANBT

FILE: scn3_sl_17_925L_Janet.out



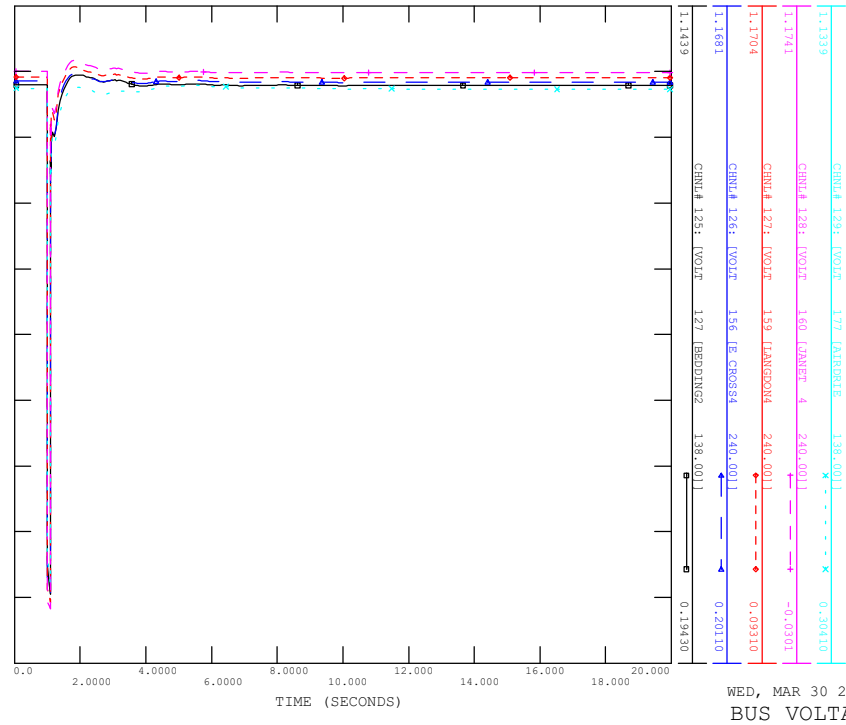
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CONTINGENCY -SCN3_SL_17_925L_JANBT

FILE: scn3_sl_17_925L_Janet.out



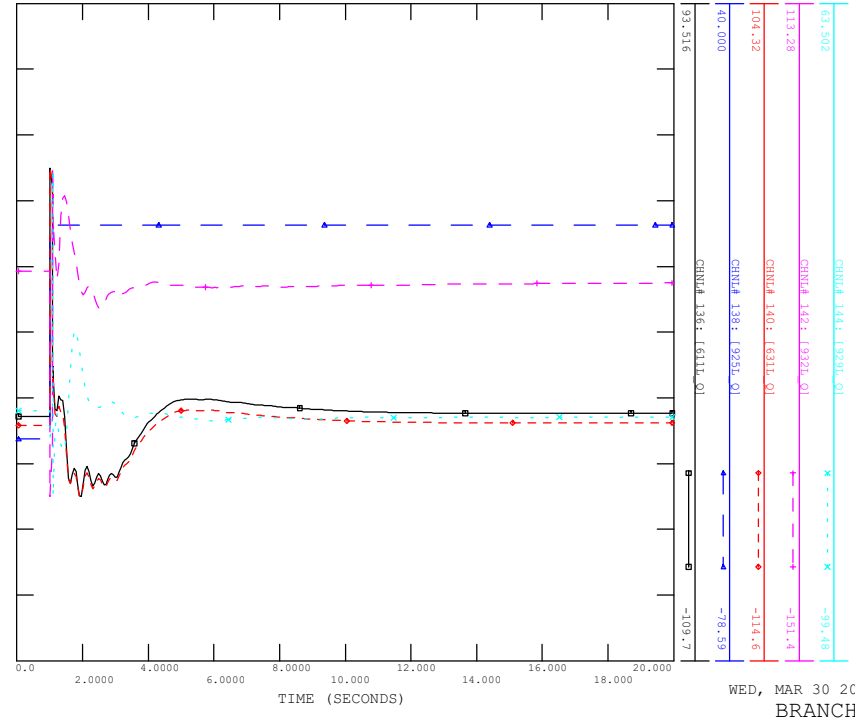
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_17_925L_JANBT

FILE: scn3_sl_17_925L_Janet.out



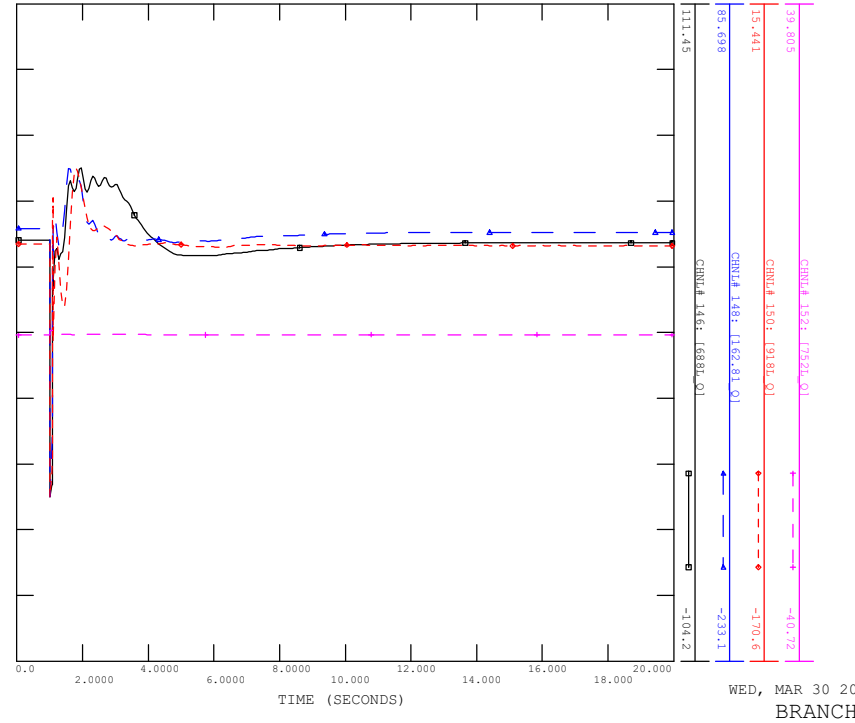
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CONTINGENCY -SCN3_SL_17_925L_JANET

FILE: scn3_sl_17_925L_Janet.out



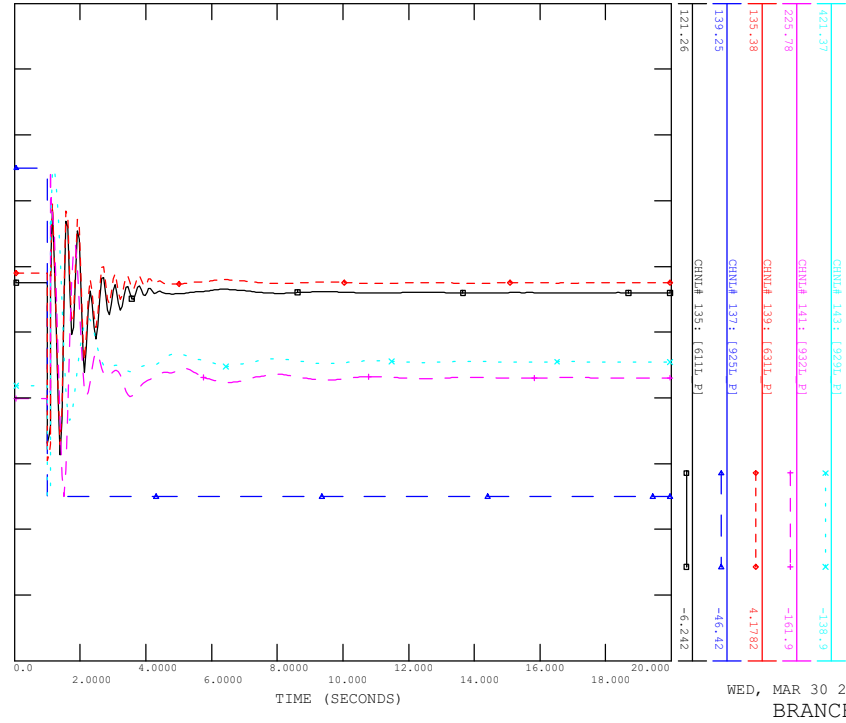
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_17_925L_JANET

FILE: scn3_sl_17_925L_Janet.out



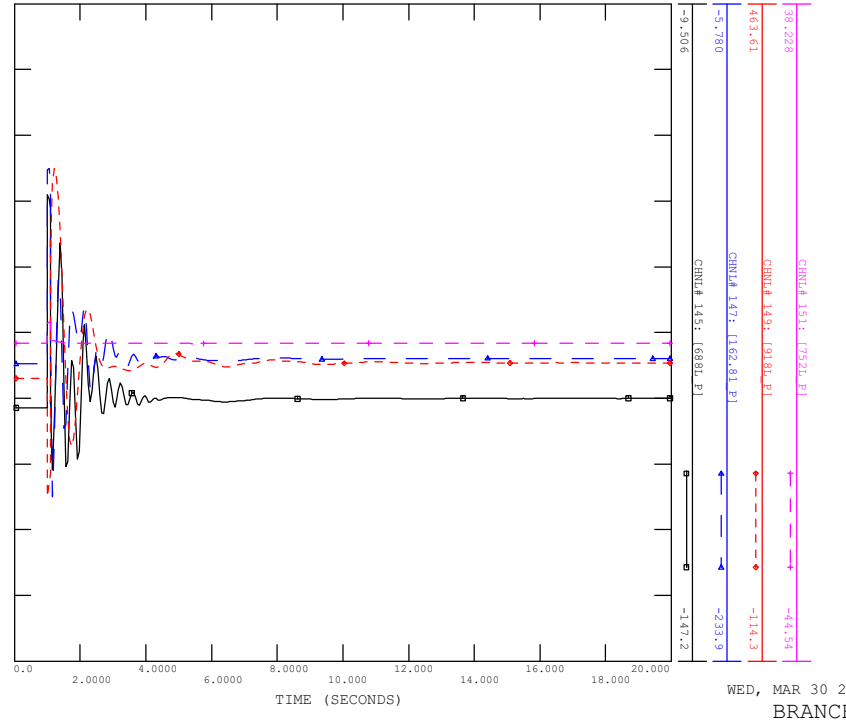
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_17_925L_JANET

FILE: scn3_sl_17_925L_Janet.out



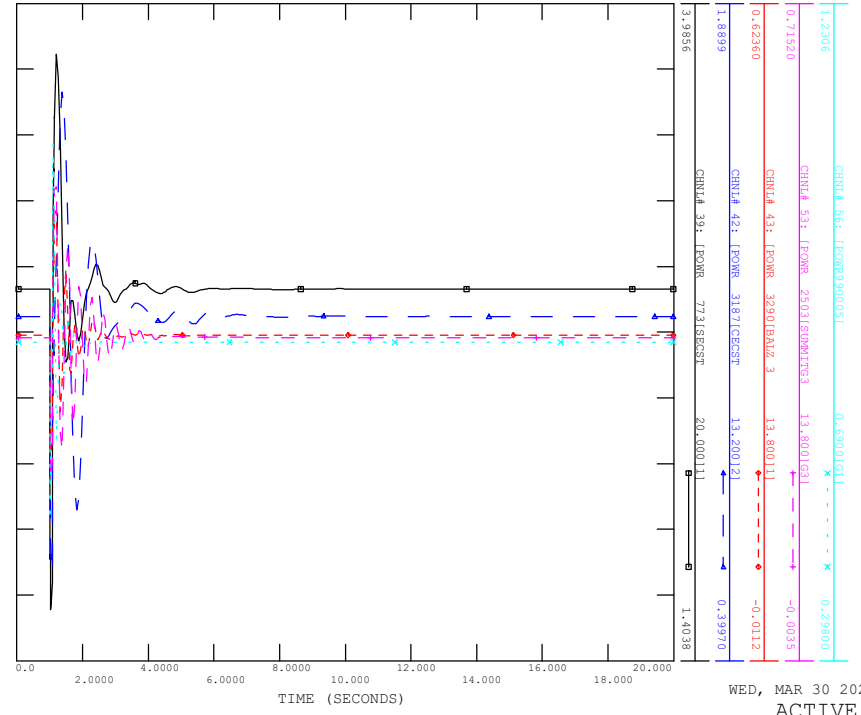
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_SL_17_925L_JANET

FILE: scn3_sl_17_925L_Janet.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_18_925L_RED_DEER

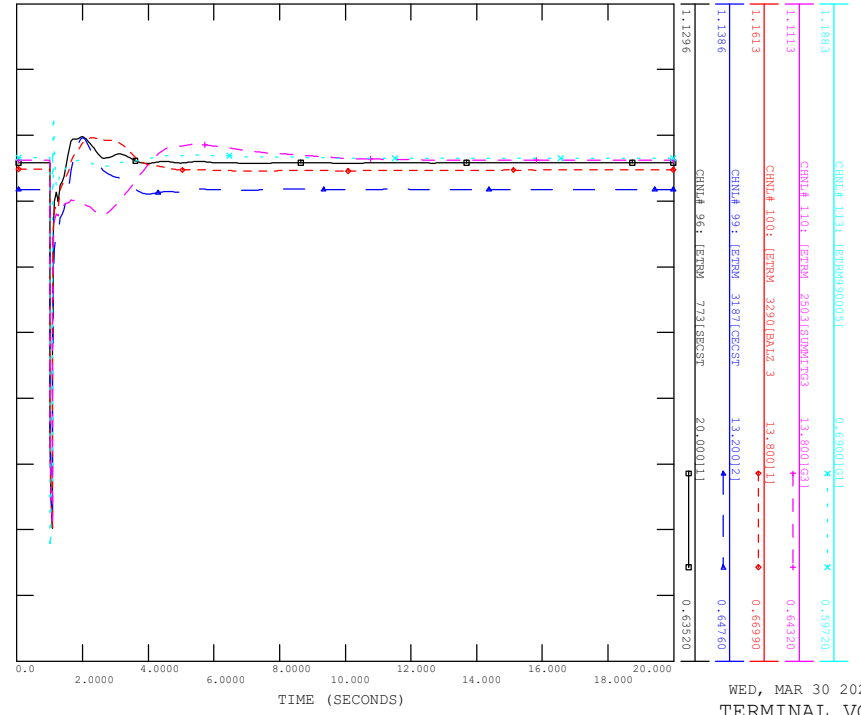
FILE: scn3_stl_18_925L_Red_Deer.out



WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_18_925L_RED_DEER

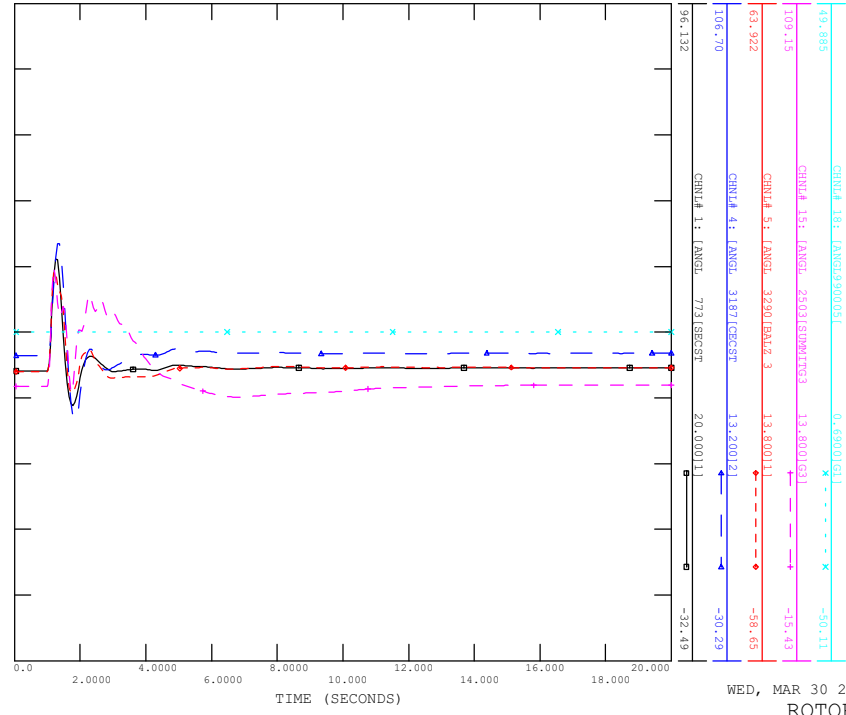
FILE: scn3_stl_18_925L_Red_Deer.out



WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_18_925L_RED_DEER

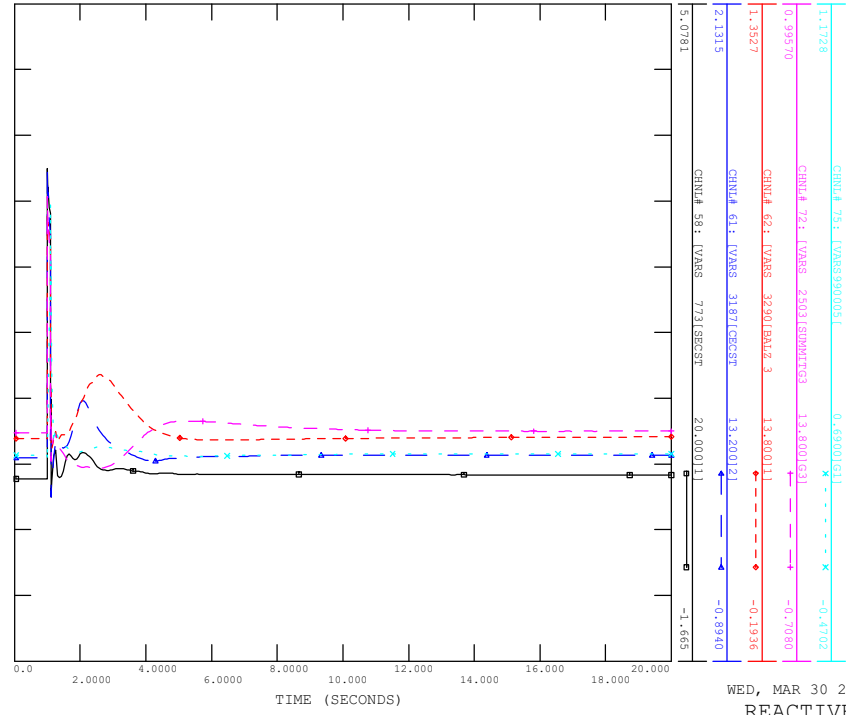
FILE: scn3_stl_18_925L_Red_Deer.out



WED, MAR 30 2022 0:34
ROTOR ANGLE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_18_925L_RED_DEER

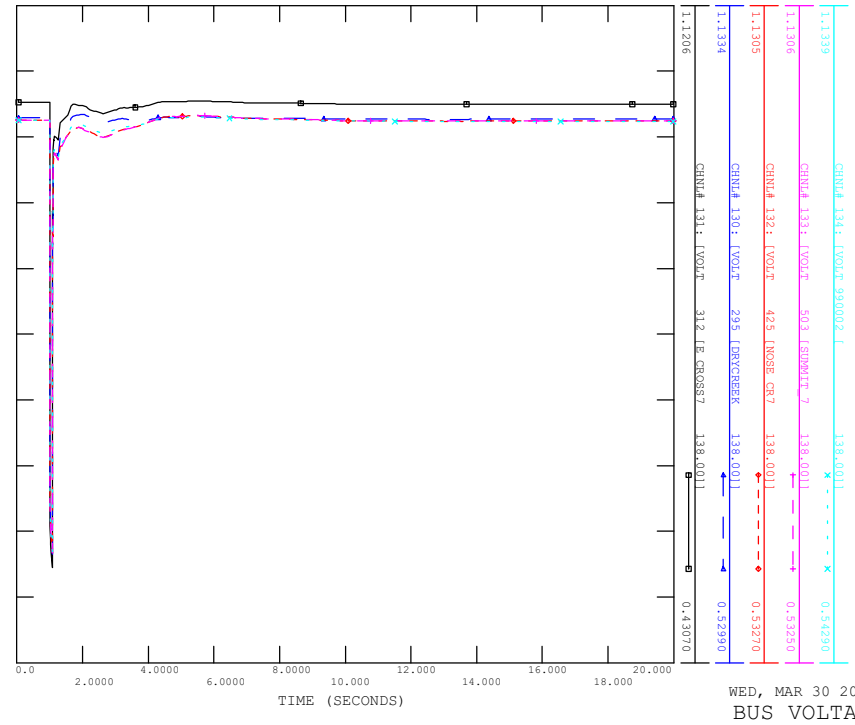
FILE: scn3_stl_18_925L_Red_Deer.out



WED, MAR 30 2022 0:34
REACTIVE POWER

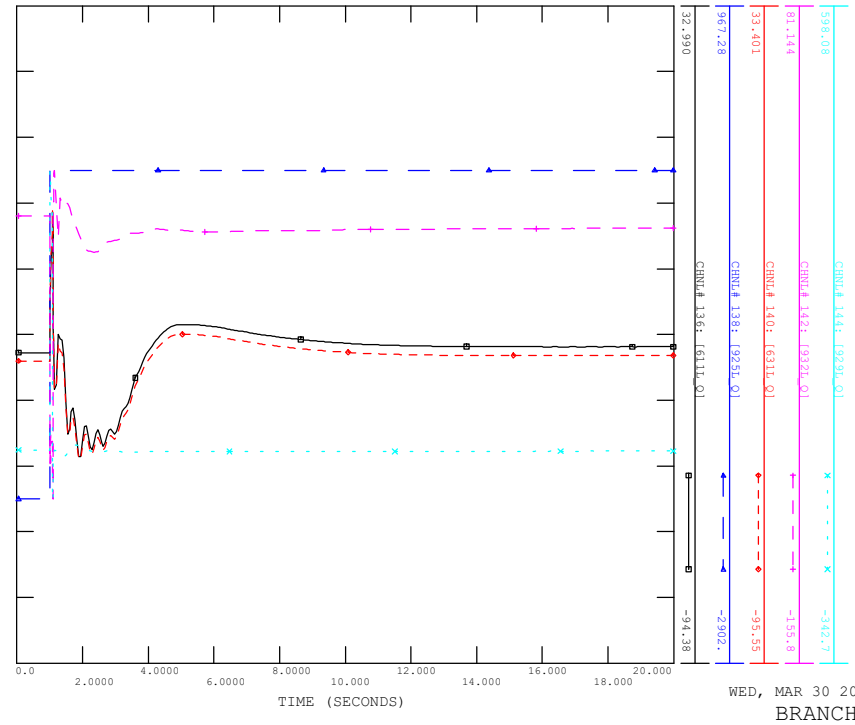
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_18_925L_RED_DEER

FILE: scn3_stl_18_925L_Red_Deer.out



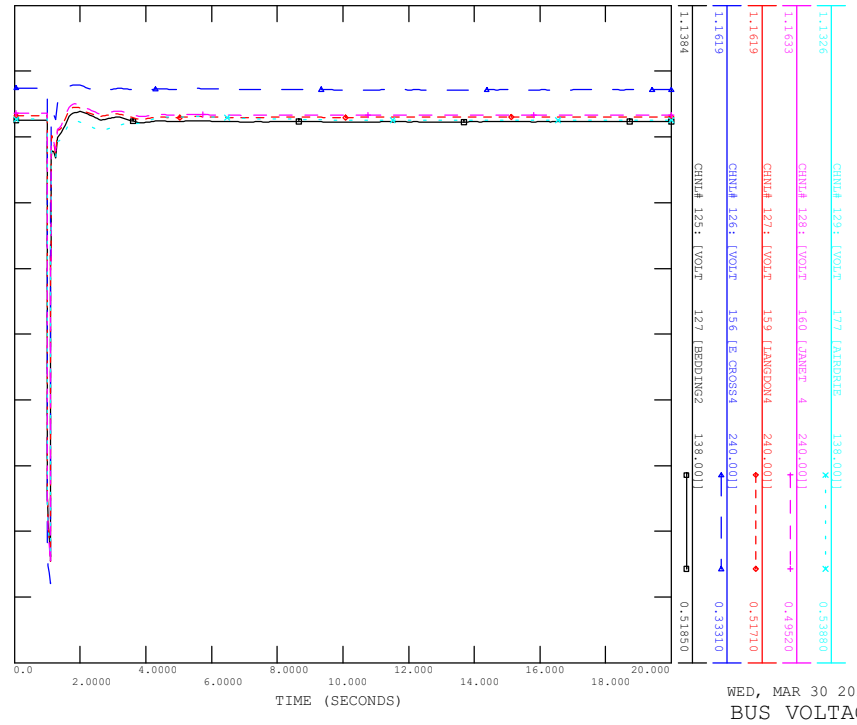
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_18_925L_RED_DEER

FILE: scn3_stl_18_925L_Red_Deer.out



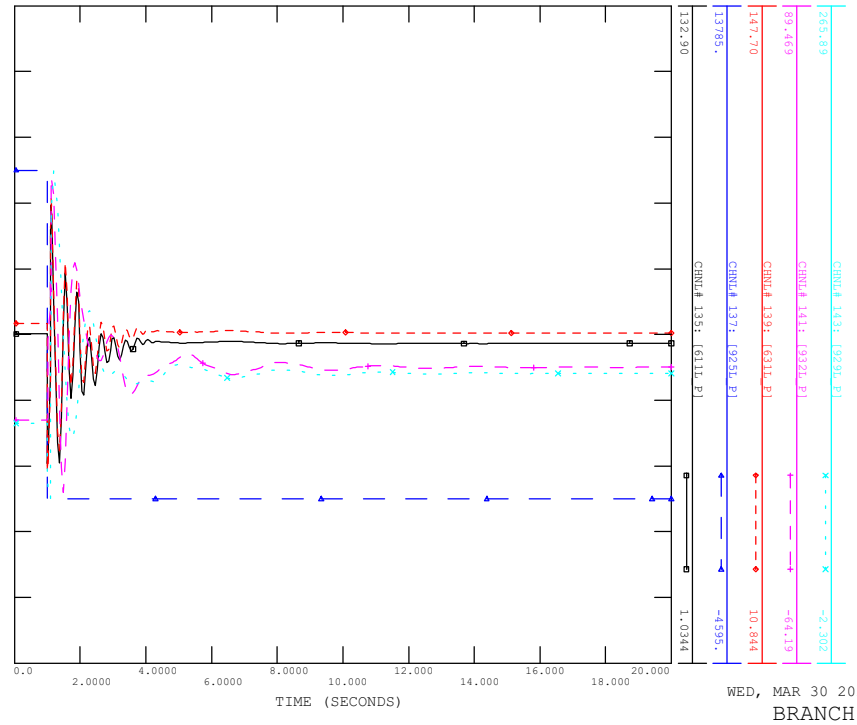
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_18_925L_RED_DEER

FILE: scn3_stl_18_925L_Red_Deer.out



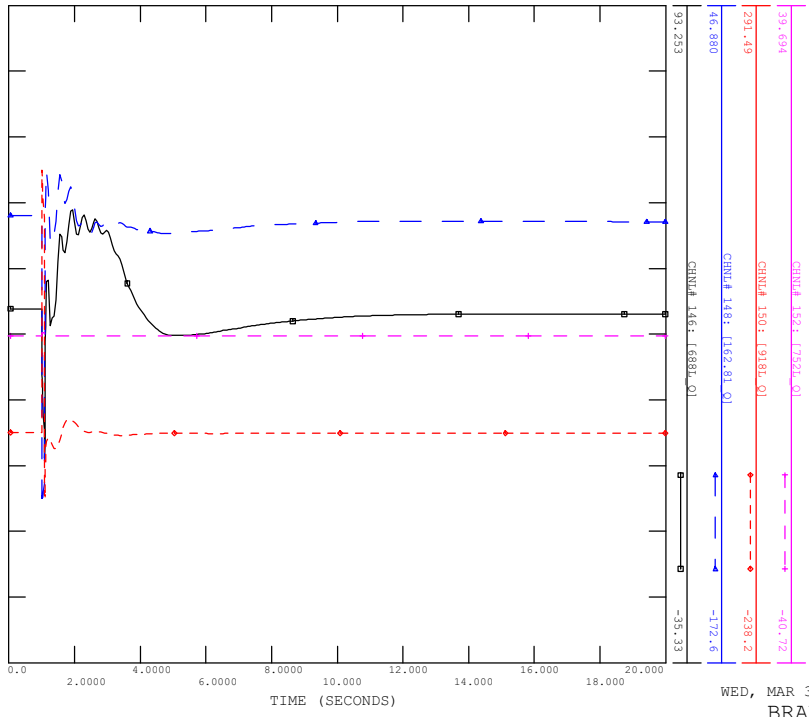
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_18_925L_RED_DEER

FILE: scn3_stl_18_925L_Red_Deer.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_18_925L_RED_DEER

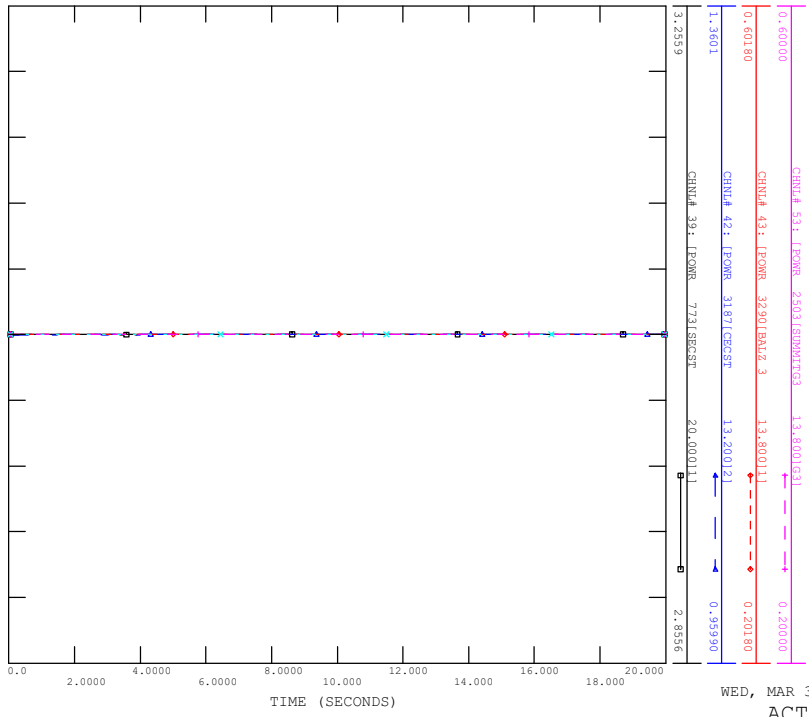
FILE: scn3_stl_18_925L_Red_Deer.out



WED, MAR 30 2022 0:34
BRANCH Q (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_NOFAULT

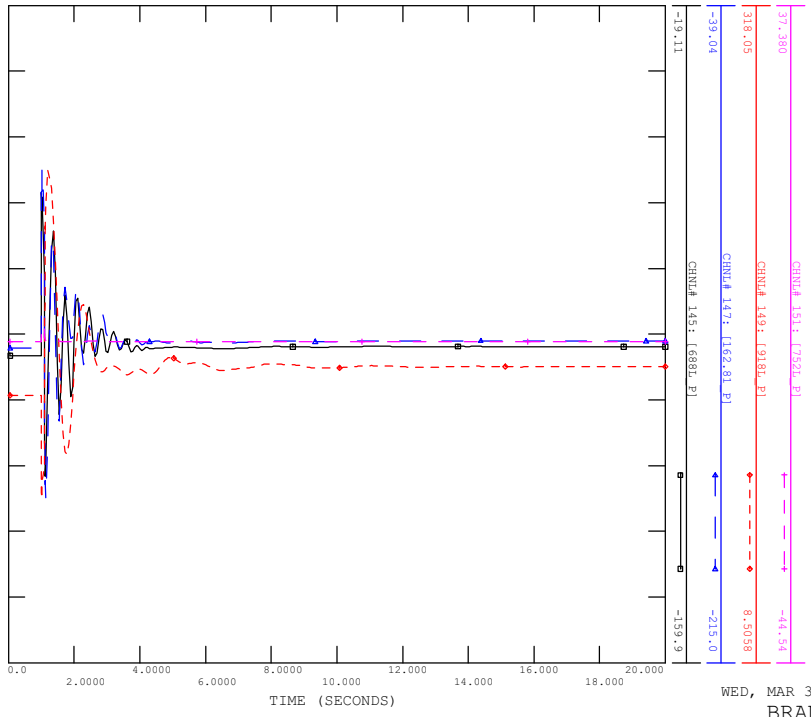
FILE: Scn4_sp_nofault.out



WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN3_STL_18_925L_RED_DEER

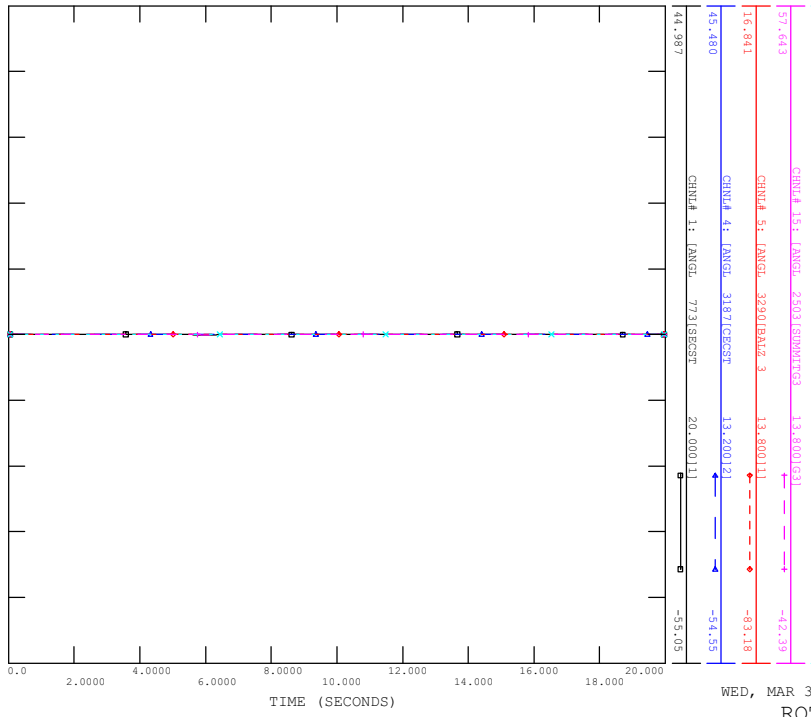
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WED, MAR 30 2022 0:34
BRANCH P (2)

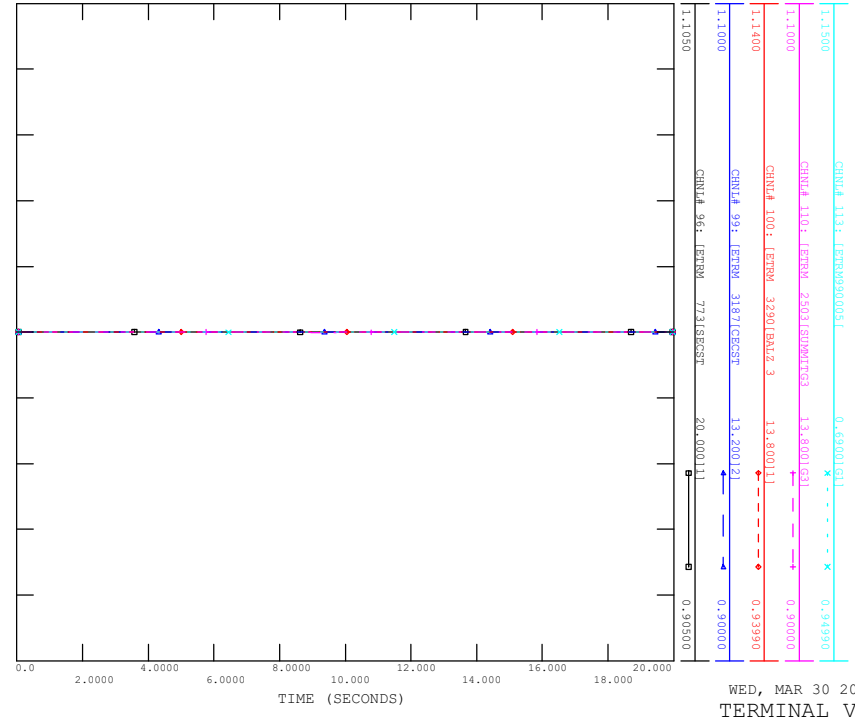
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_NOFAULT

FILE: Scn4_sp_nofault.out



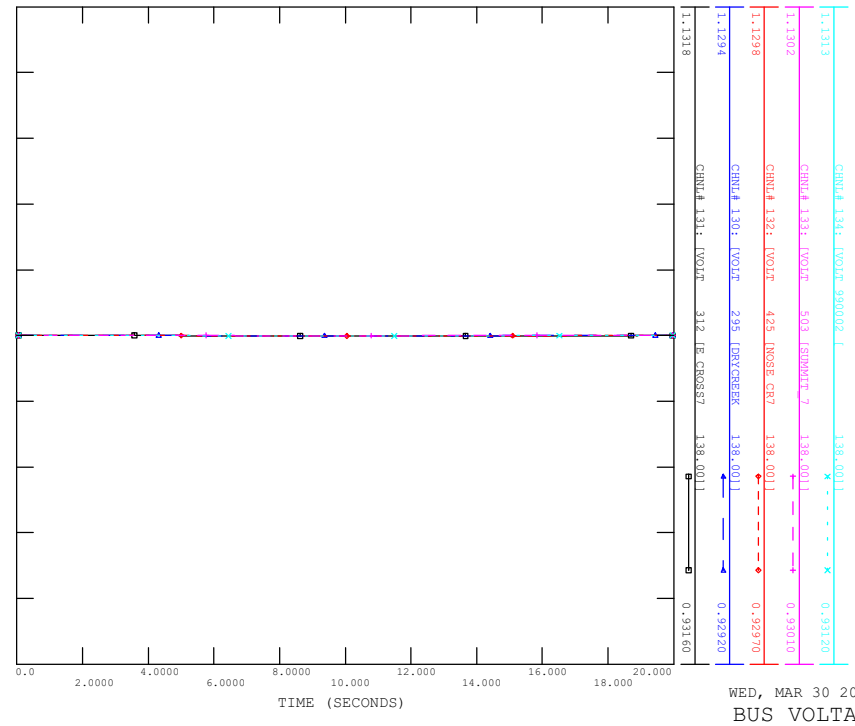
WED, MAR 30 2022 0:34
ROTOR ANGLE

FILE: Scn4_sp_nofault.out



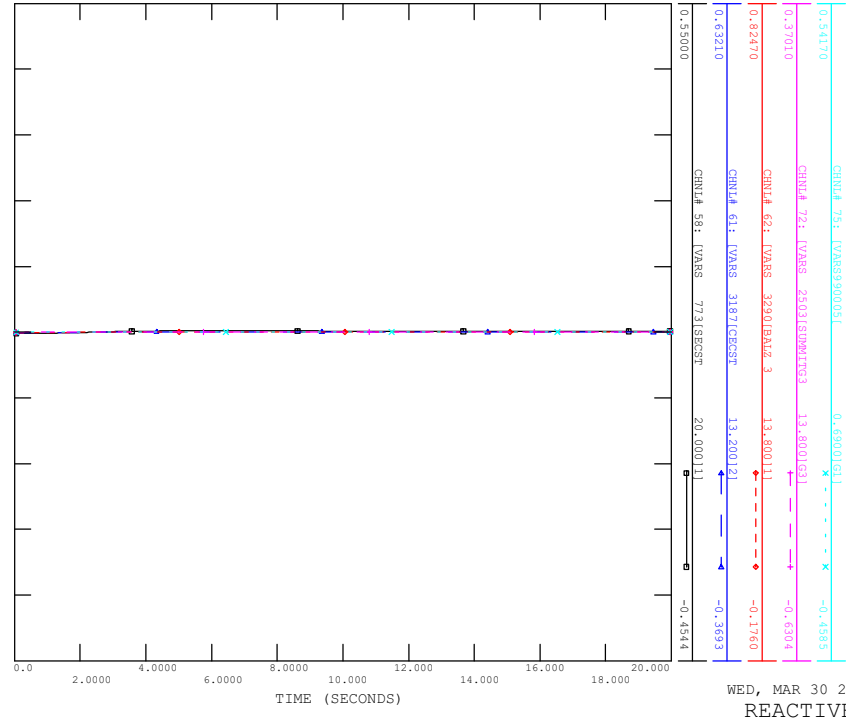
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

FILE: Scn4_sp_nofault.out



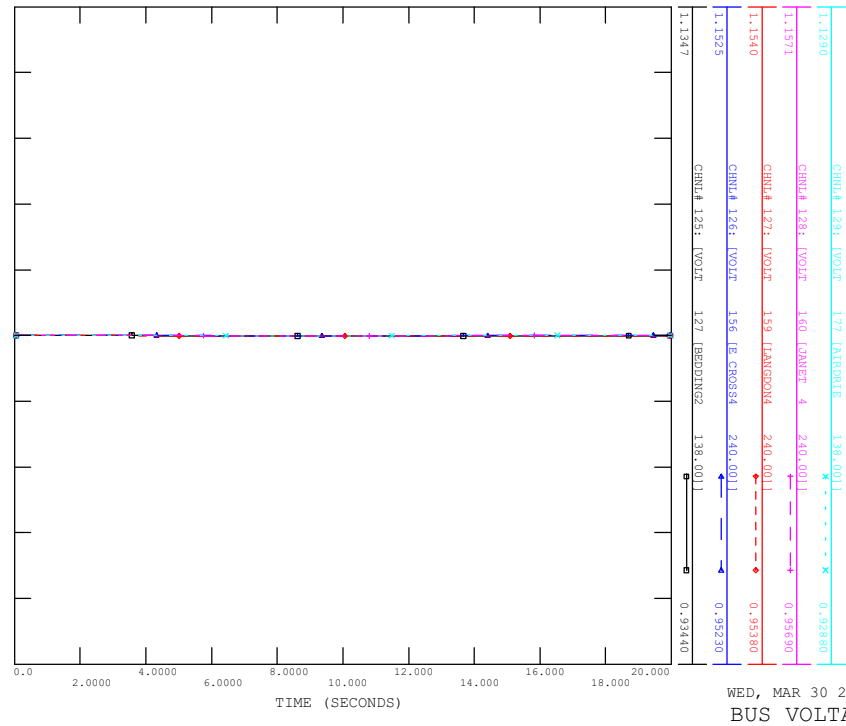
WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

FILE: Scn4_sp_nofault.out



WED, MAR 30 2022 0:34
REACTIVE POWER

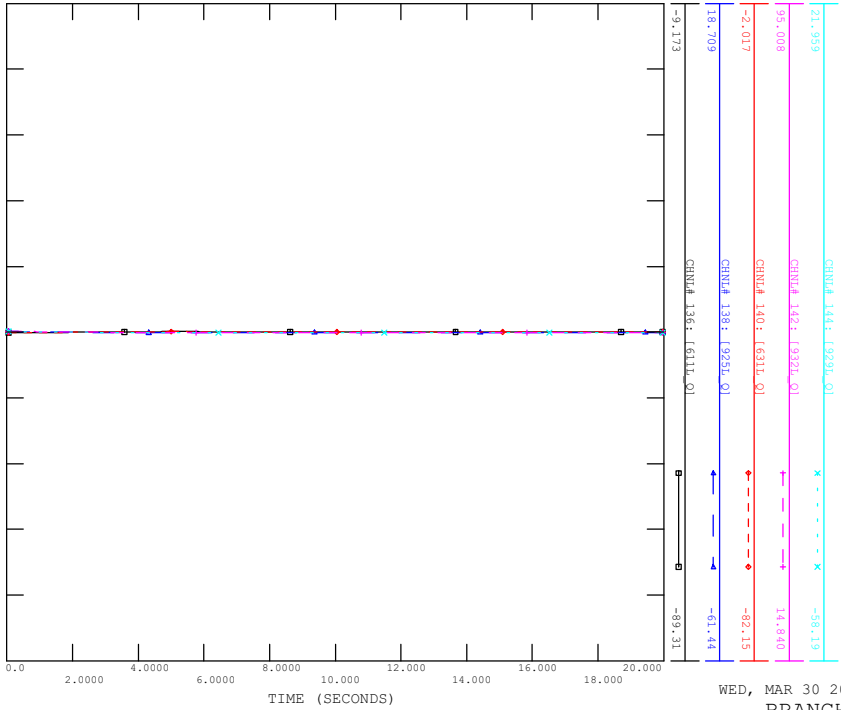
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WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_NOFAULT

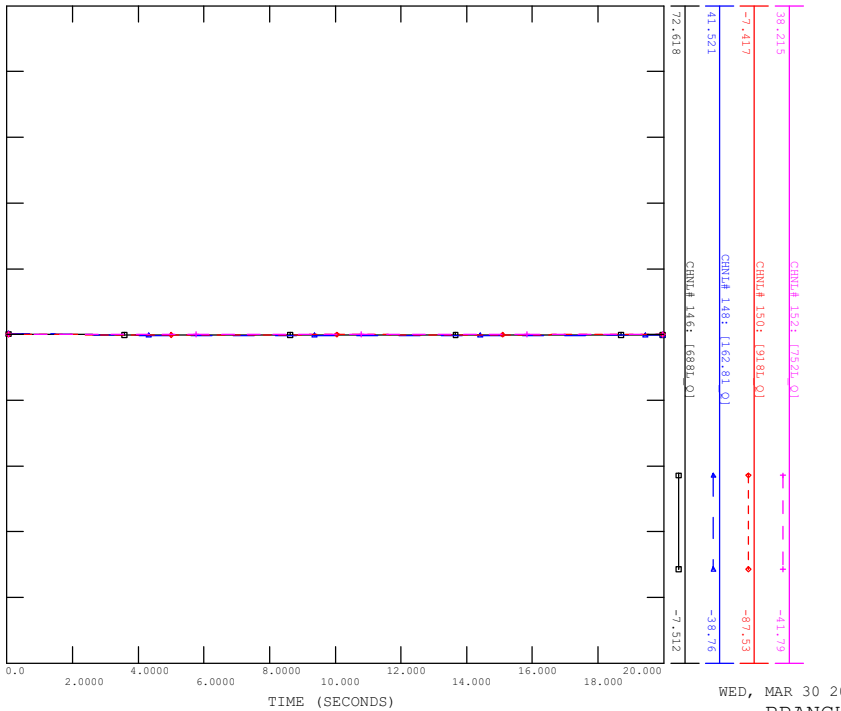
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WED, MAR 30 2022 0:34
BRANCH Q (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_NOFAULT

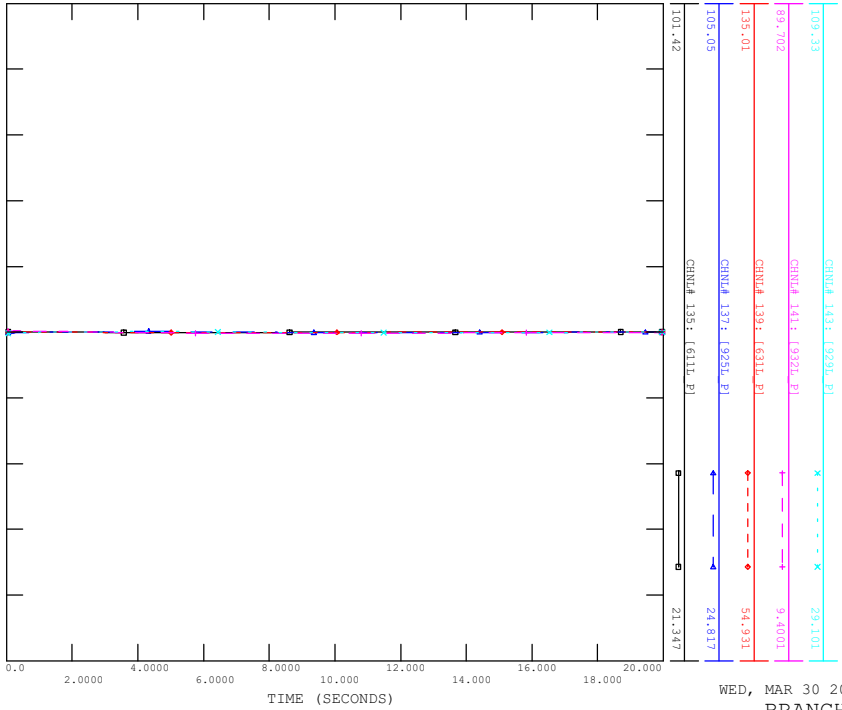
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WED, MAR 30 2022 0:34
BRANCH Q (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_NOFAULT

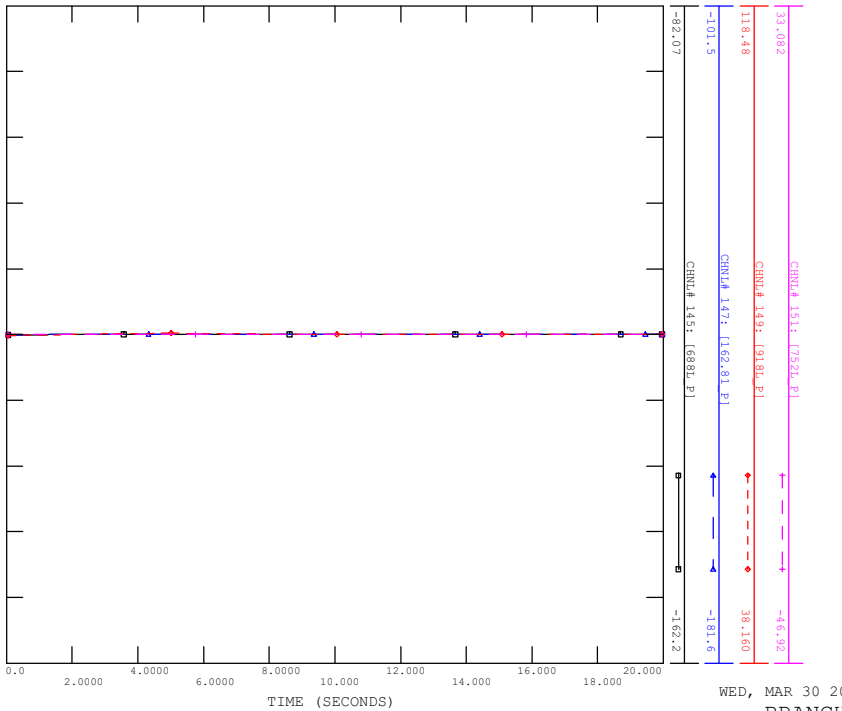
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WED, MAR 30 2022 0:34
BRANCH P (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_NOFAULT

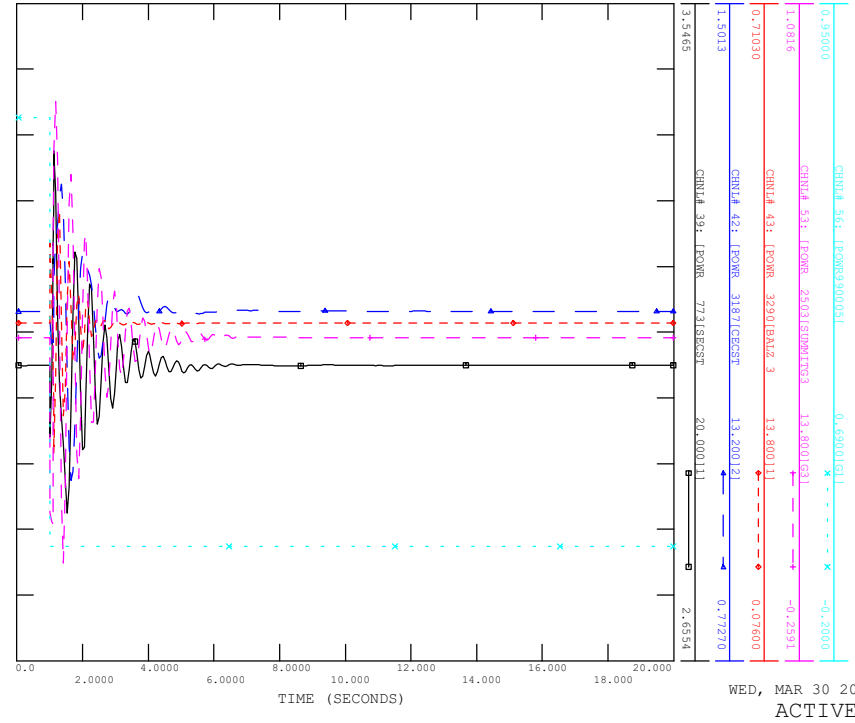
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WED, MAR 30 2022 0:34
BRANCH P (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_01_6881L_SUMMIT

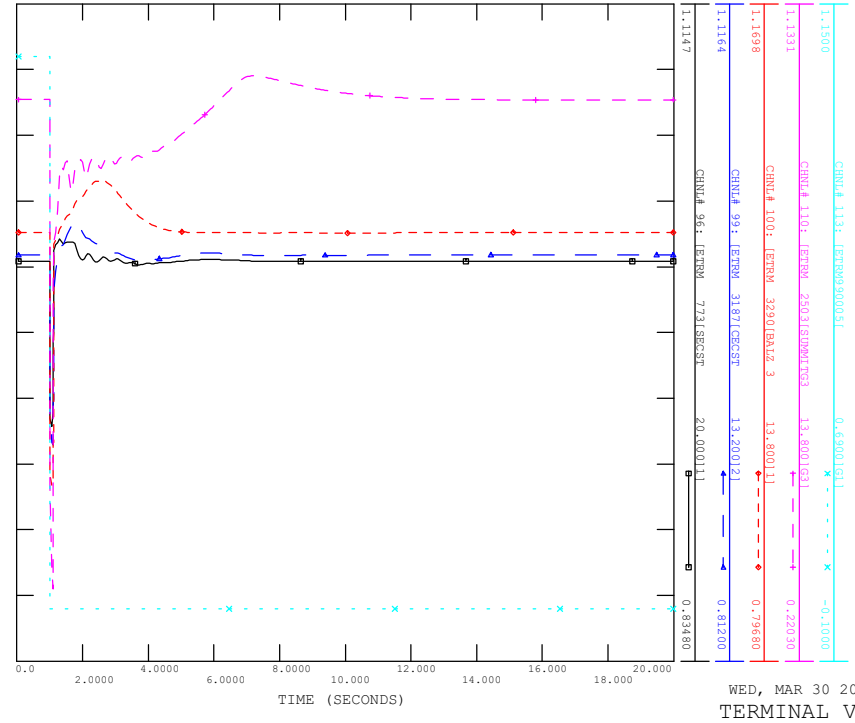
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WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_01_6881L_SUMMIT

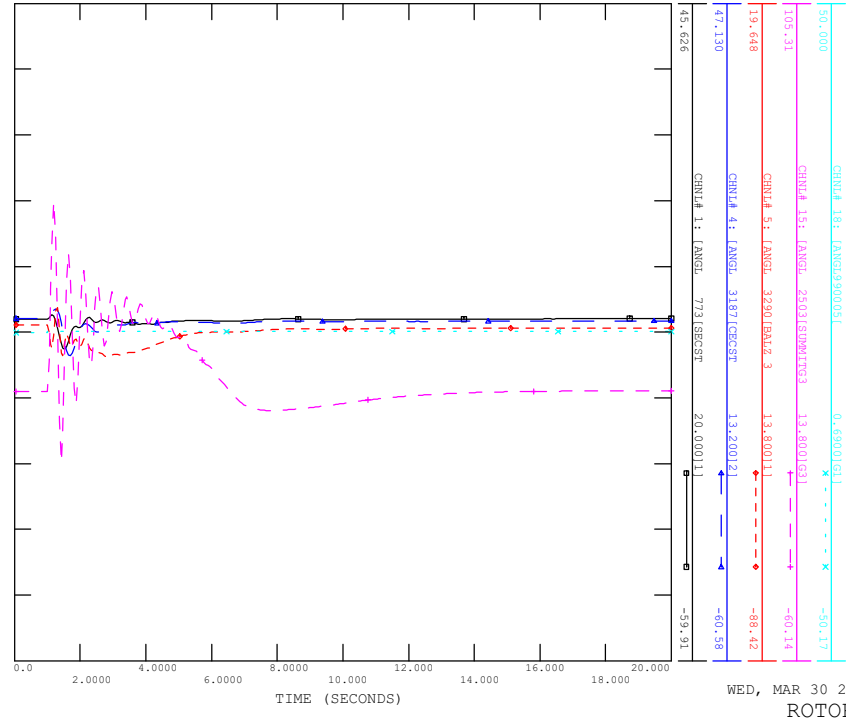
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WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_01_6881L_SUMMIT

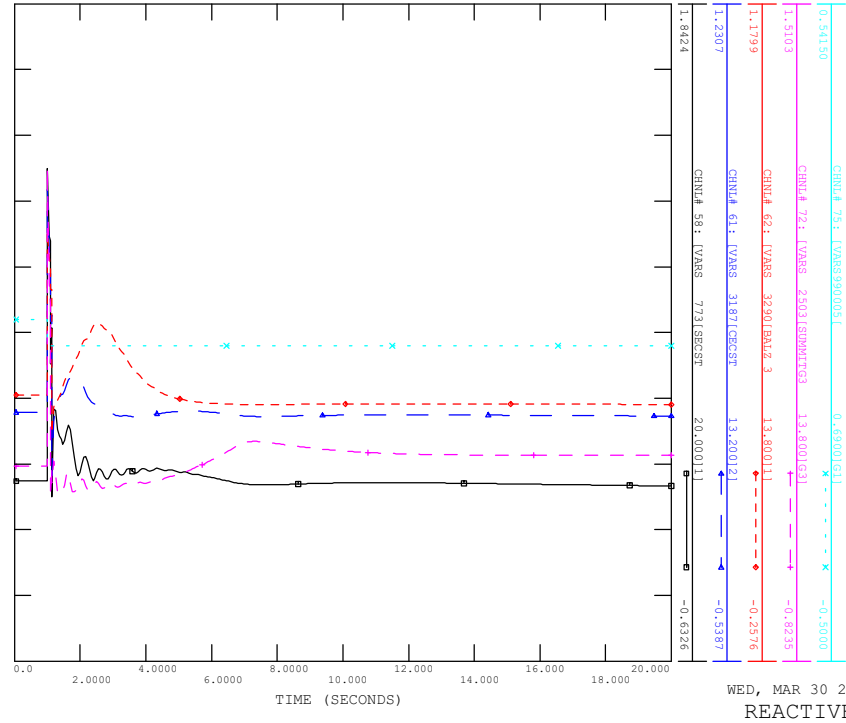
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WED, MAR 30 2022 0:34
ROTOR ANGLE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_01_6881L_SUMMIT

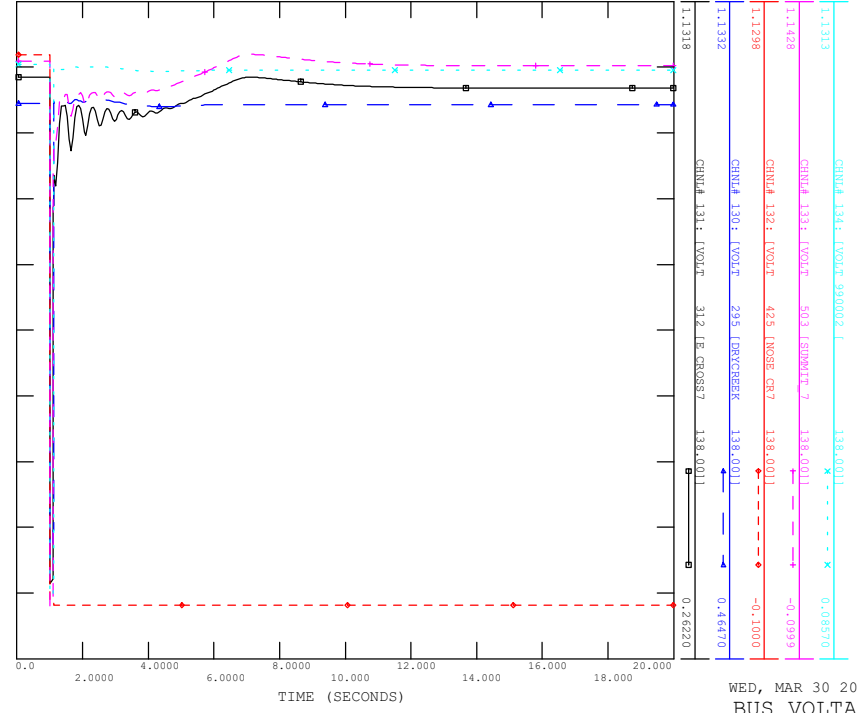
FILE: scn4_sp_01_6881L_Summit.out



WED, MAR 30 2022 0:34
REACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_01_688L_SUMMIT

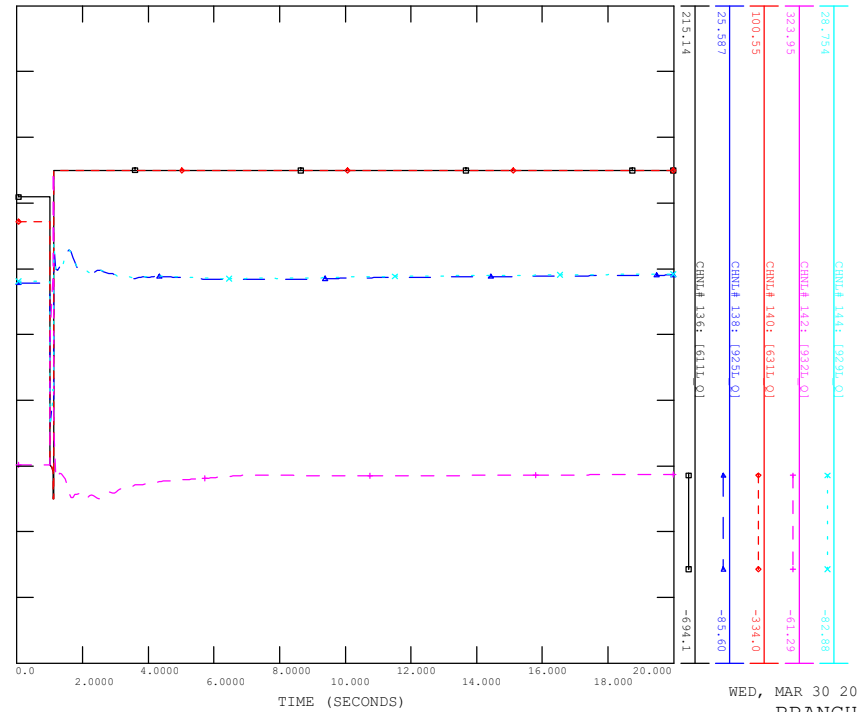
FILE: scn4_sp_01_688L_Summit.out



WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_01_688L_SUMMIT

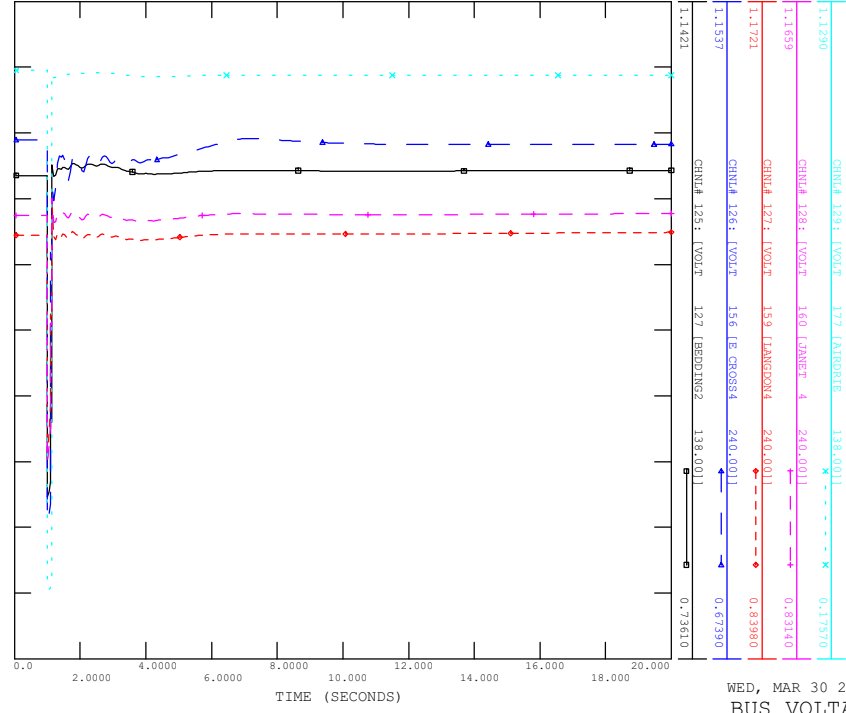
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WED, MAR 30 2022 0:34
BRANCH Q (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_01_688L_SUMMIT

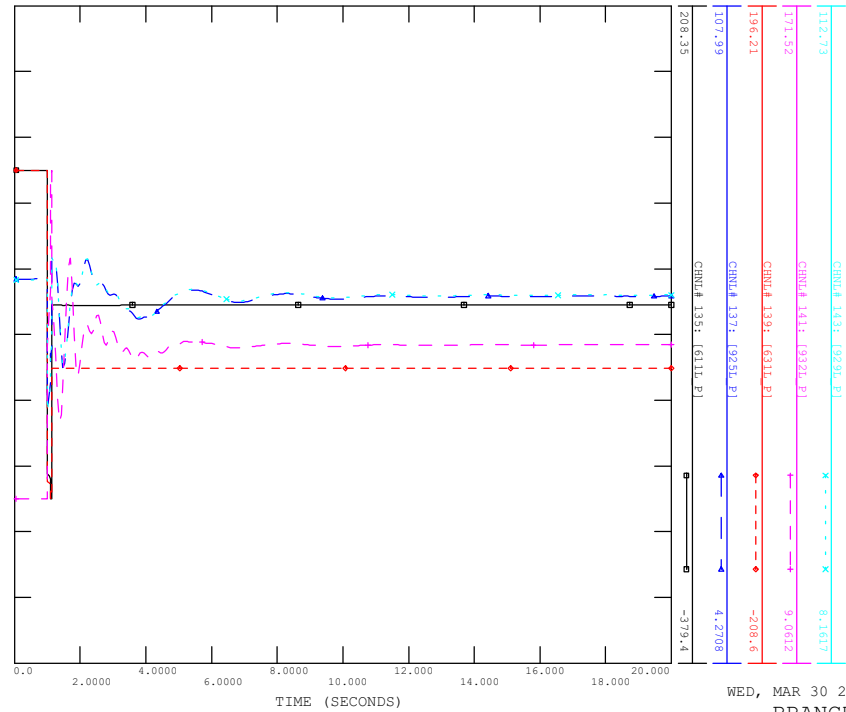
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WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

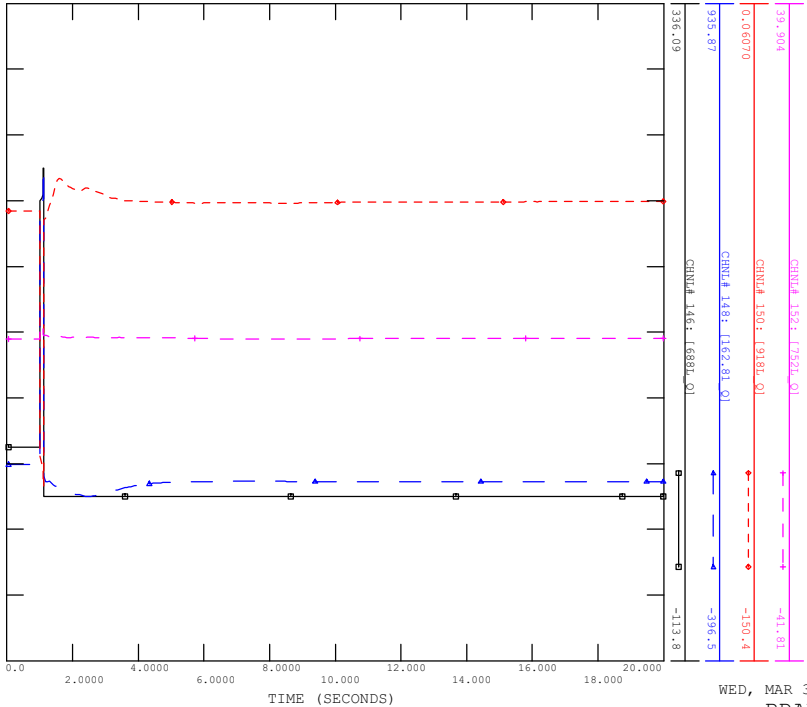
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_01_688L_SUMMIT

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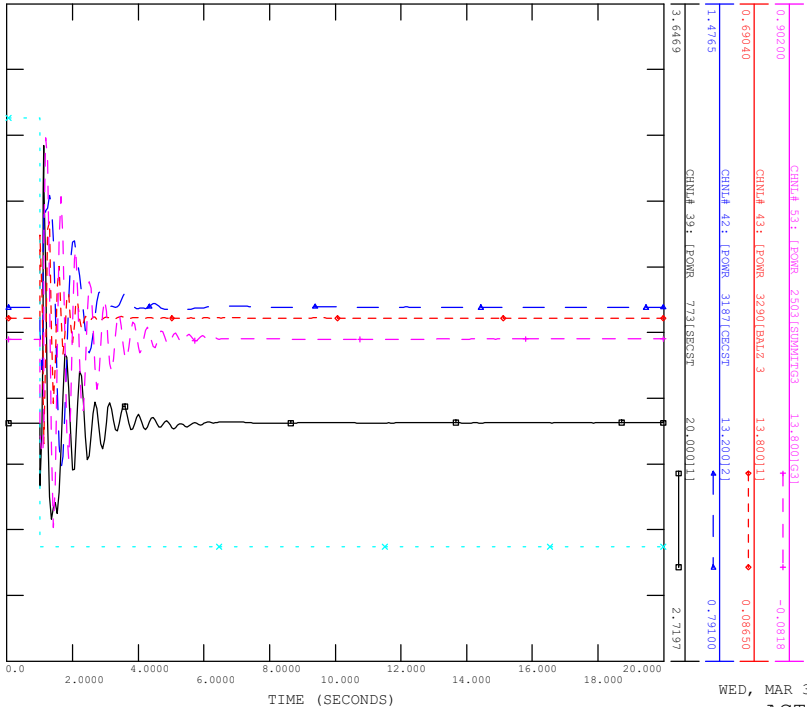


WED, MAR 30 2022 0:34
BRANCH P (1)

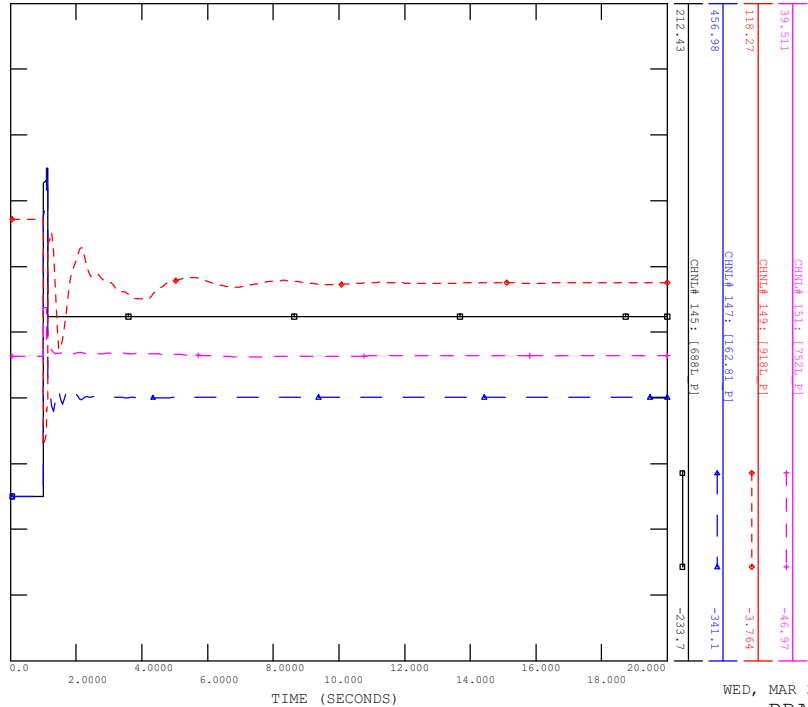
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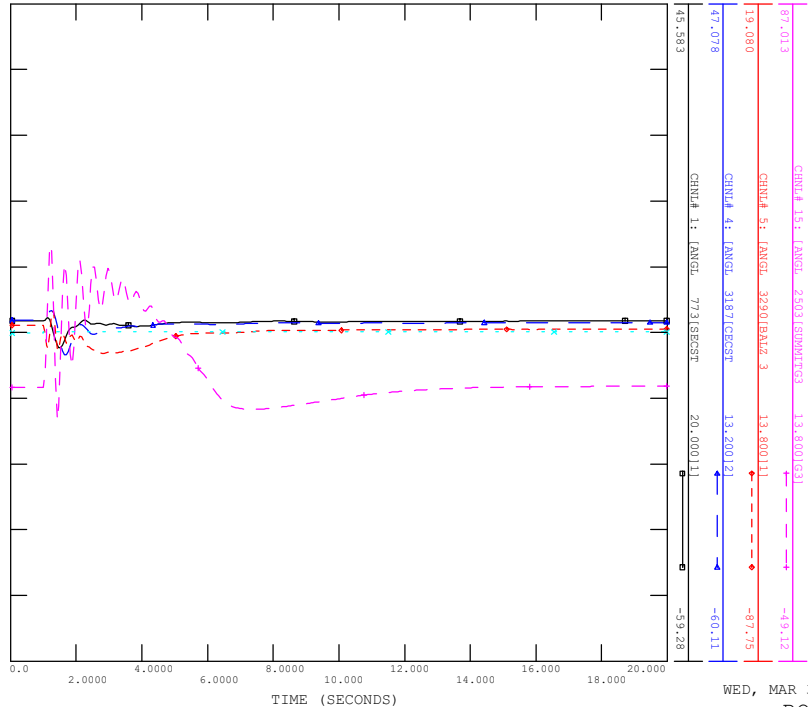
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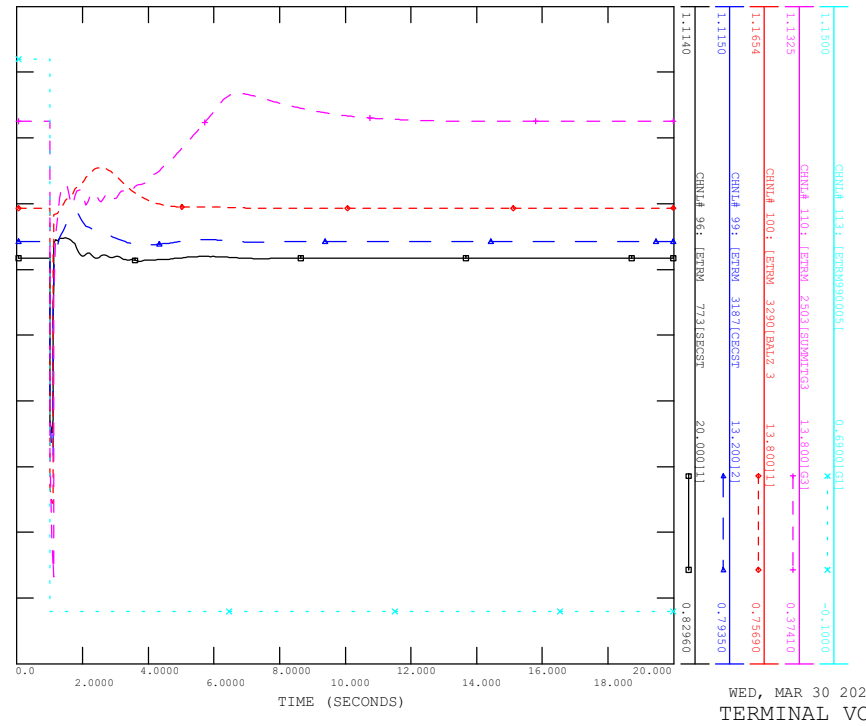
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FILE: scn4_sp_02_688L_East_Airdrie.out

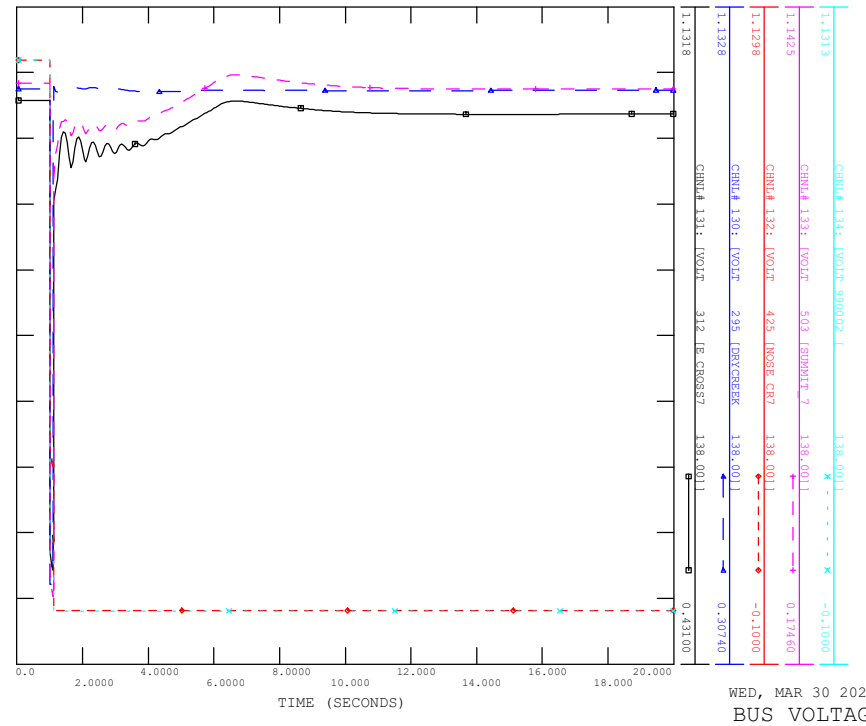


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_02_6881L_EAST_AIRDRIE
FILE: scn4_sp_02_6881L_East_Airdrie.out



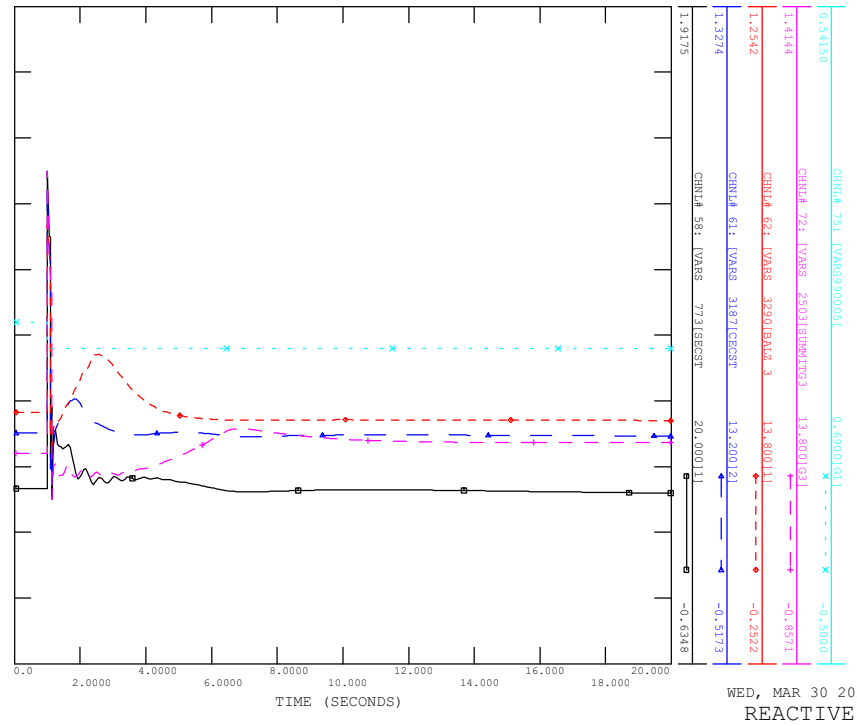
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_02_6881L_EAST_AIRDRIE
FILE: scn4_sp_02_6881L_East_Airdrie.out



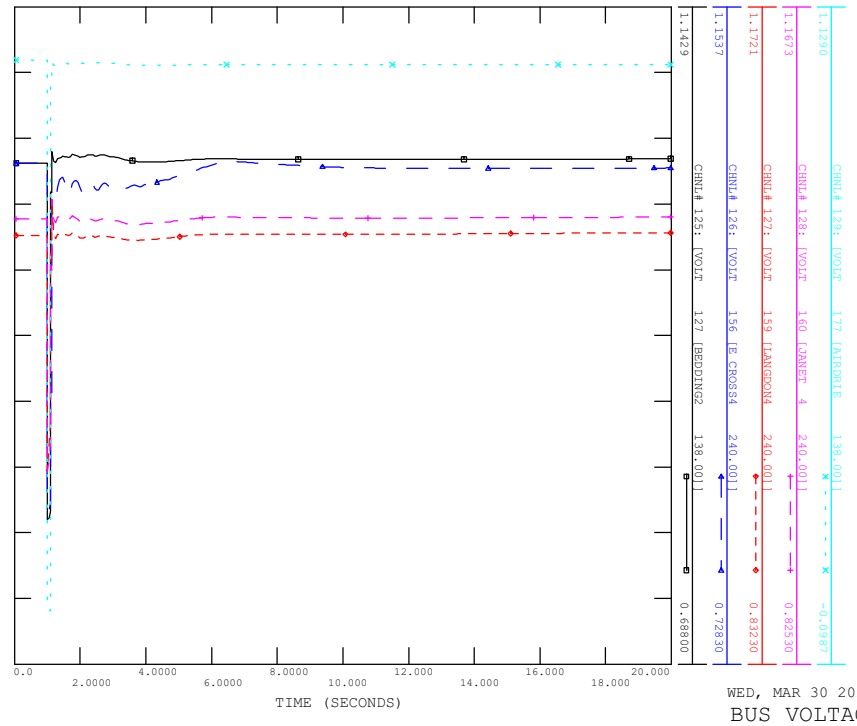
WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_02_6881L_EAST_AIRDRIE
FILE: scn4_sp_02_6881L_East_Airdrie.out



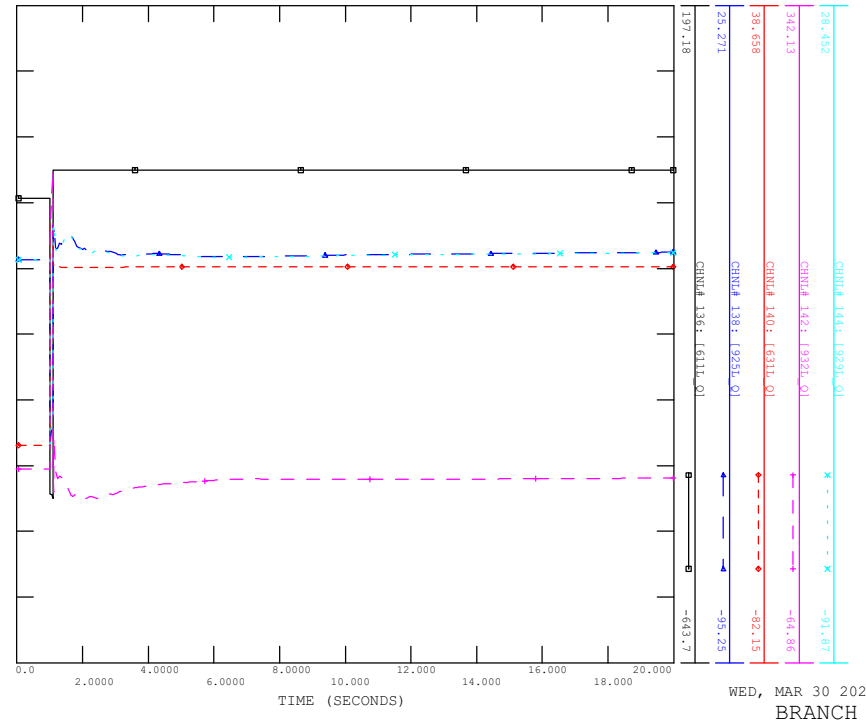
WED, MAR 30 2022 0:34
REACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_02_6881L_EAST_AIRDRIE
FILE: scn4_sp_02_6881L_East_Airdrie.out

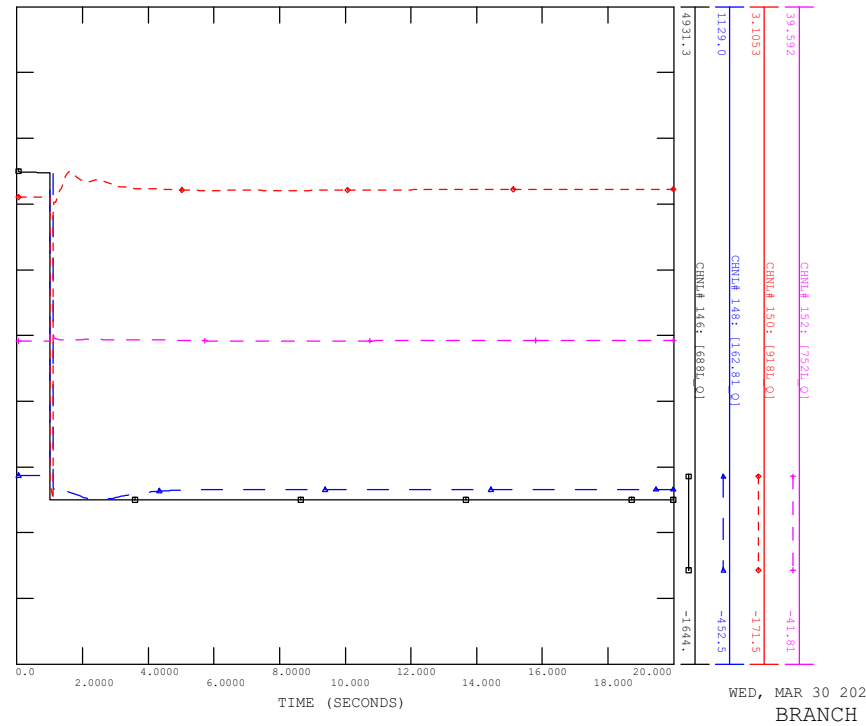


WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

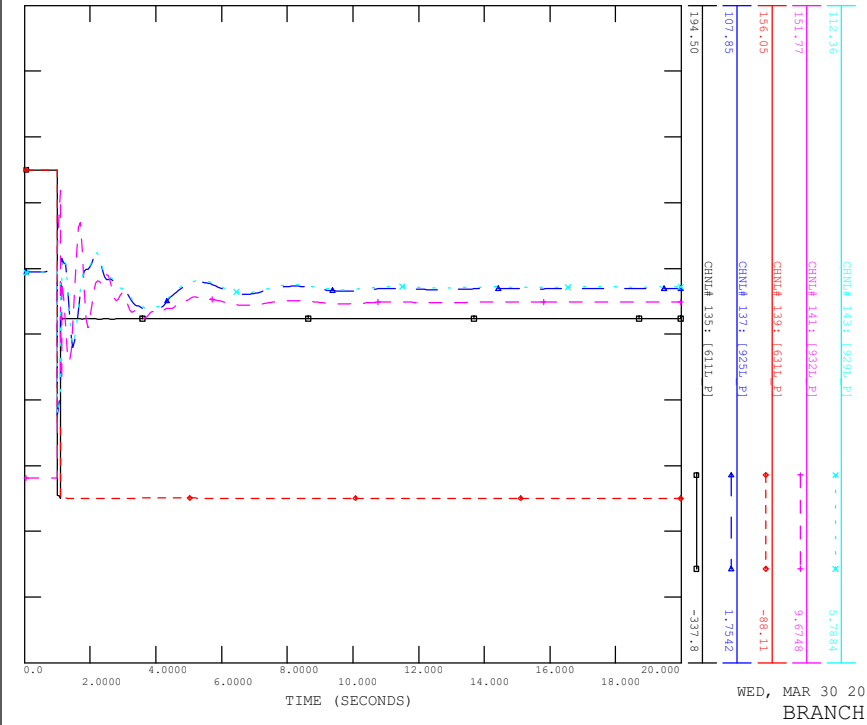
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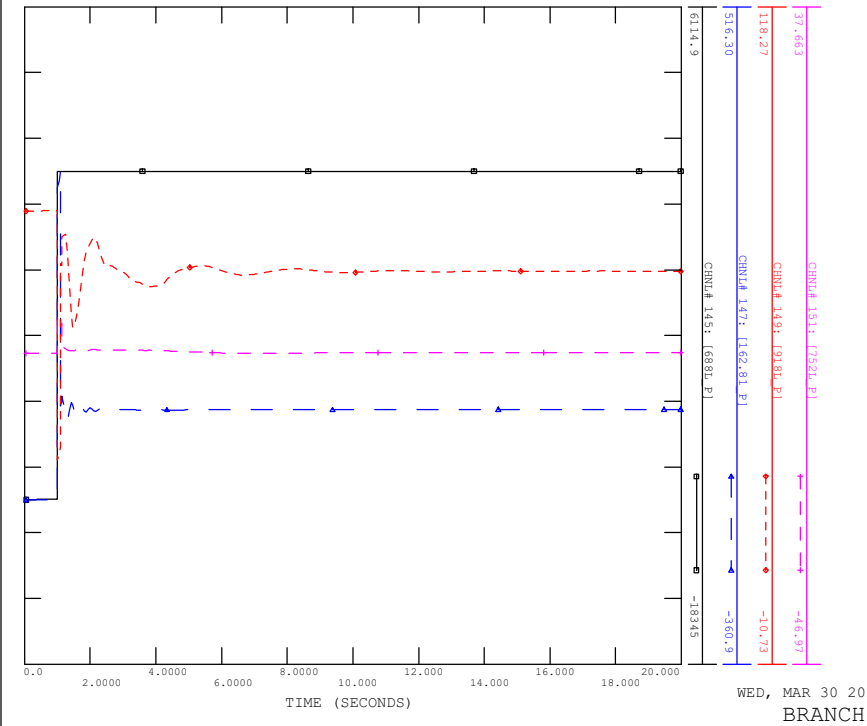
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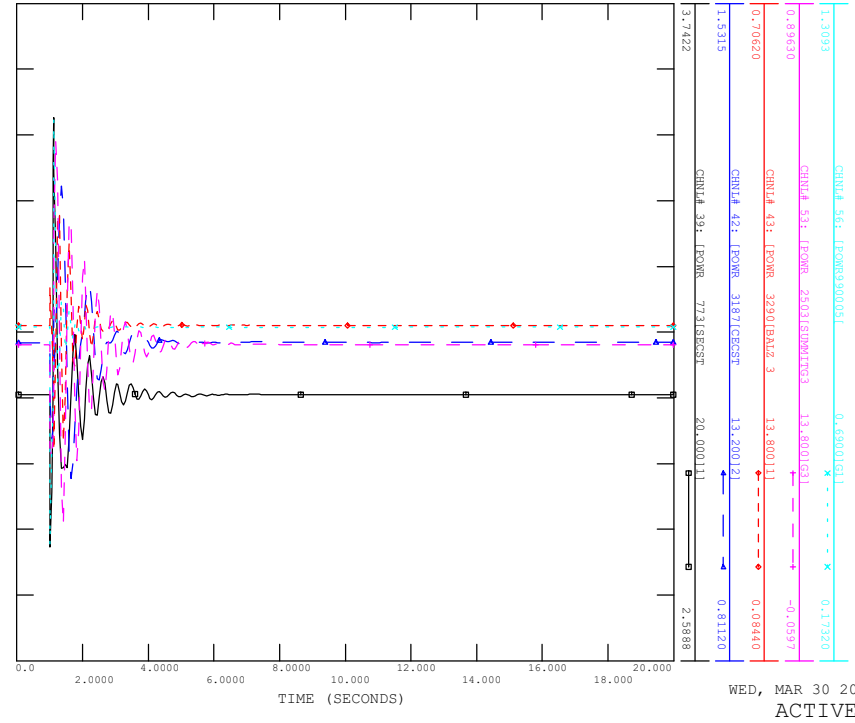
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_02_688L_EAST_AIRDRIE
FILE: scn4_sp_02_688L_East_Airdrie.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_02_688L_EAST_AIRDRIE
FILE: scn4_sp_02_688L_East_Airdrie.out

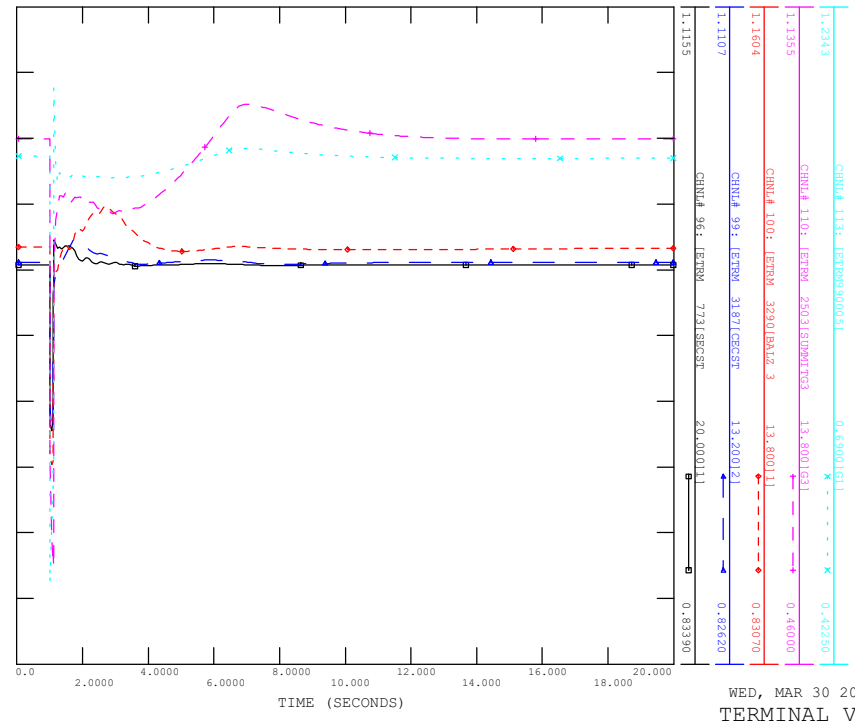


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_03_752L_EAST_CROSSFIELD
FILE: scn4_sp_03_752L_East_Crossfield.out



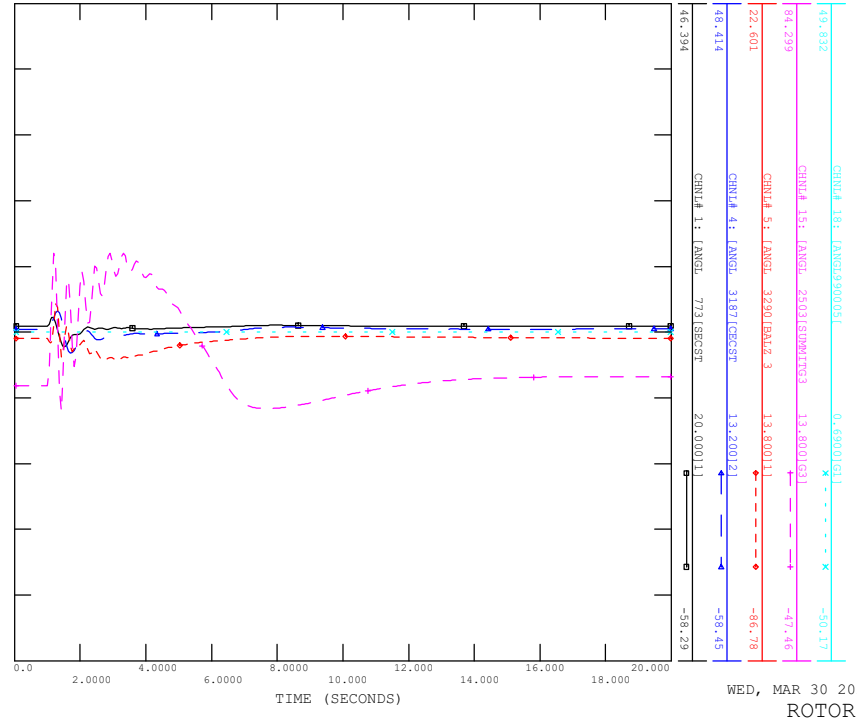
WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_03_752L_EAST_CROSSFIELD
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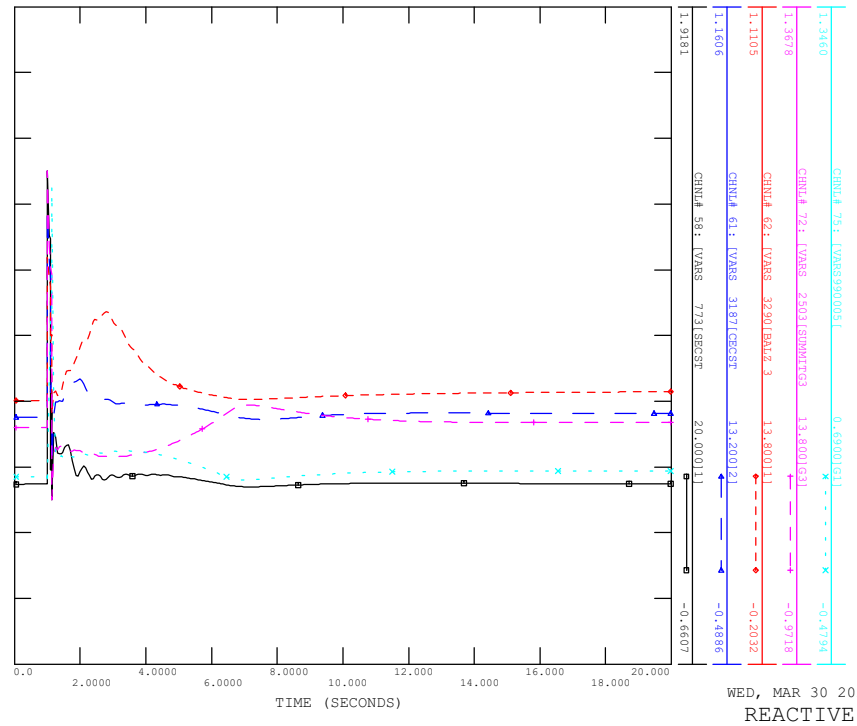
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_03_752L_EAST_CROSSFIELD
FILE: scn4_sp_03_752L_East_Crossfield.out



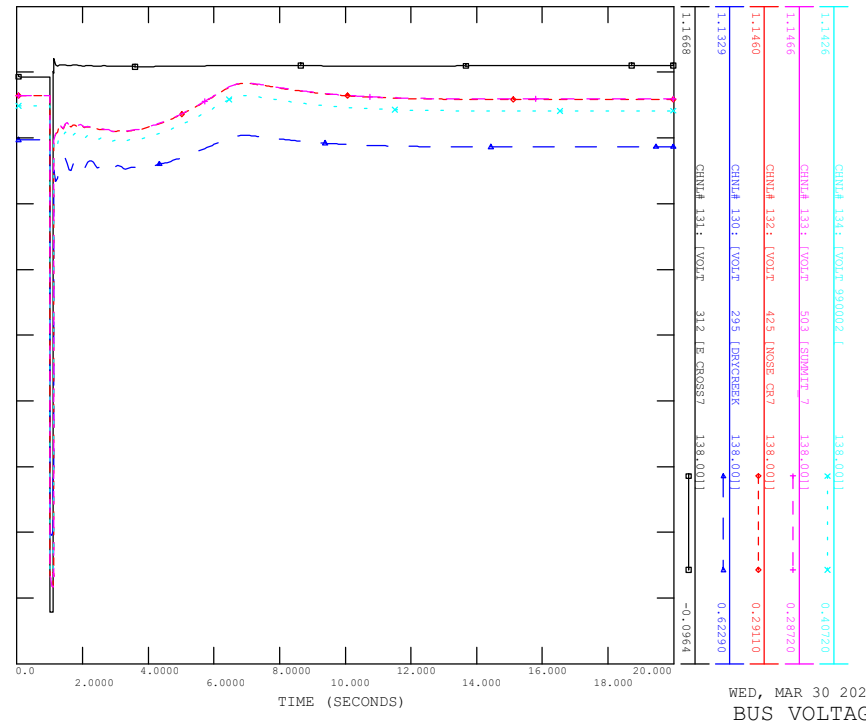
WED, MAR 30 2022 0:34
ROTOR ANGLE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_03_752L_EAST_CROSSFIELD
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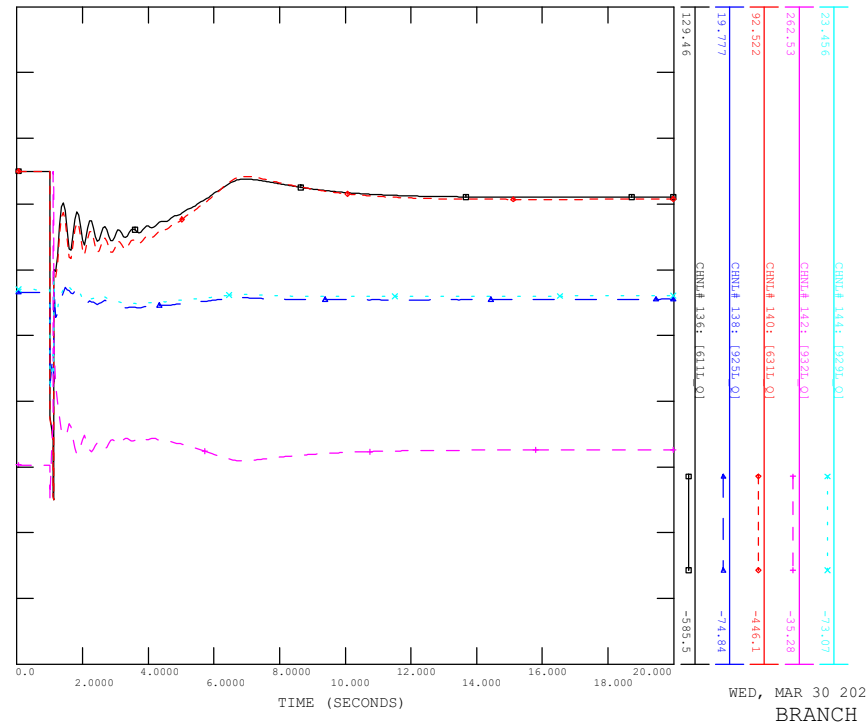


WED, MAR 30 2022 0:34
REACTIVE POWER

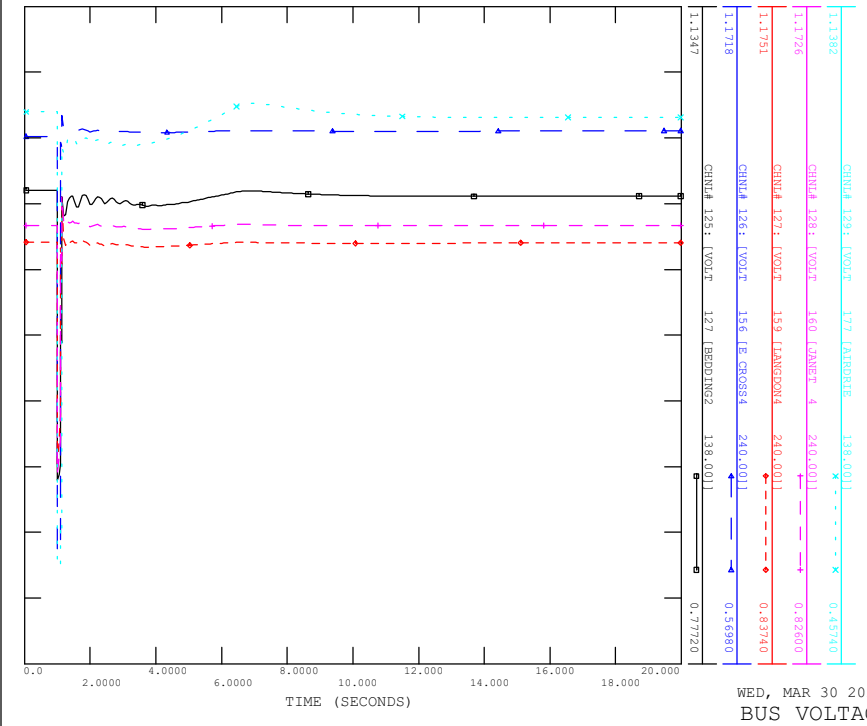
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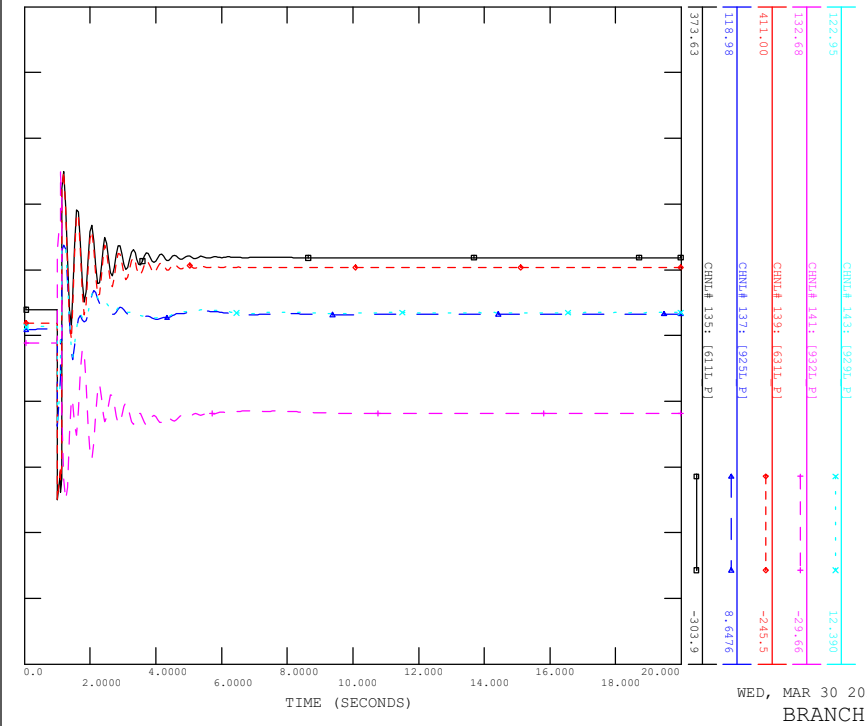
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FILE: scn4_sp_03_752L_East_Crossfield.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_03_752L_EAST_CROSSFIELD
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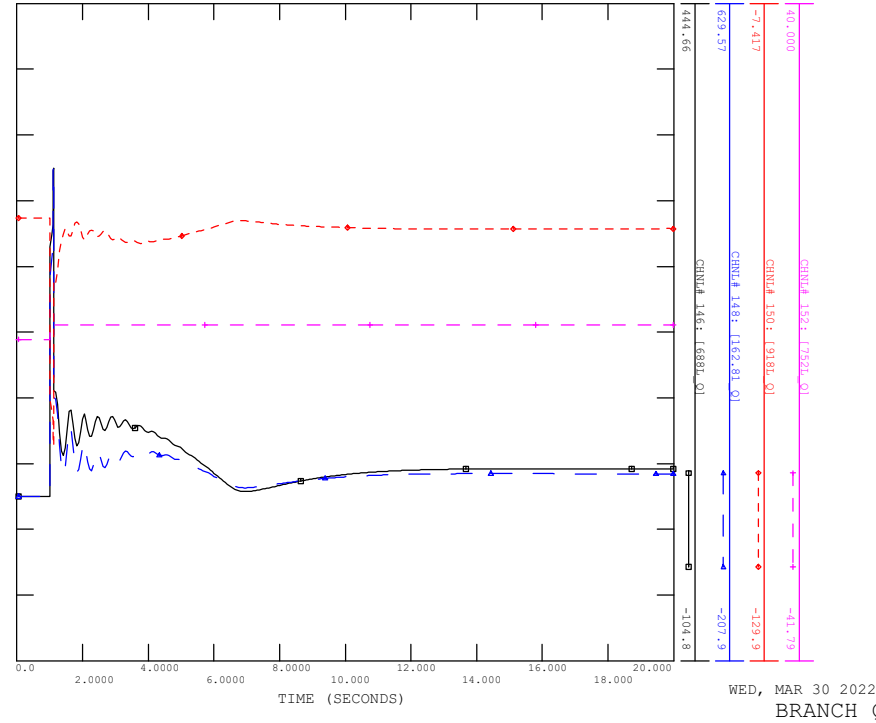


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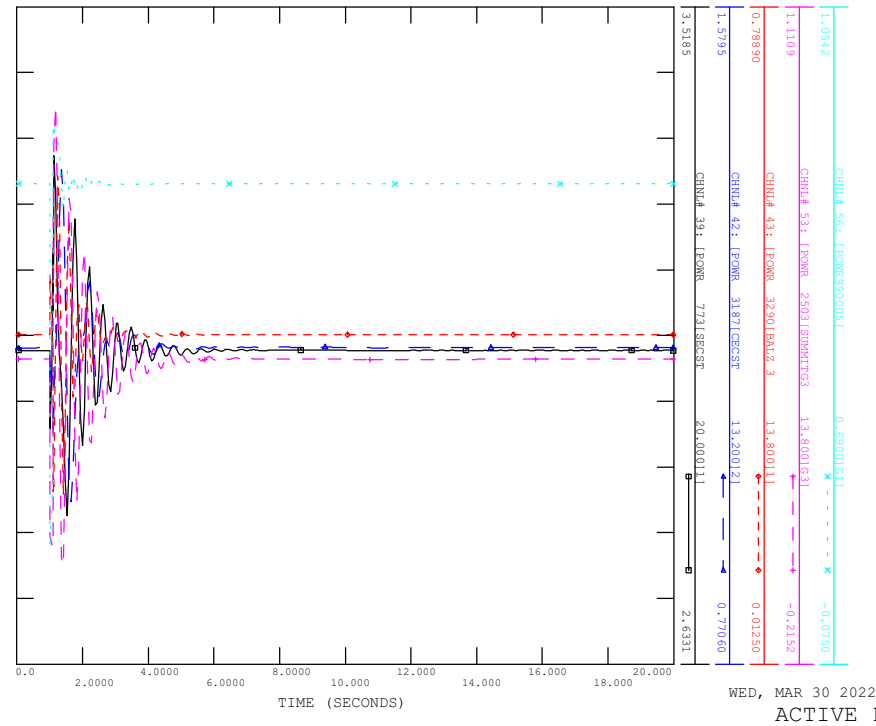
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FILE: scn4_sp_03_752L_East_Crossfield.out



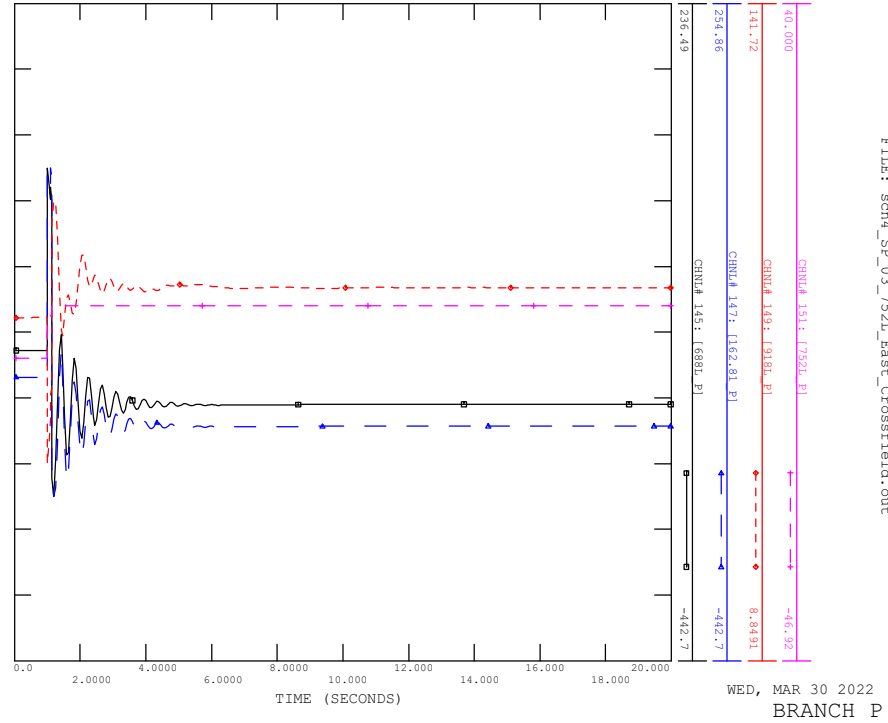
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CONTINGENCY -SCN4_SP_04_752L_SUMMIT

FILE: scn4_sp_04_752L_Summit.out



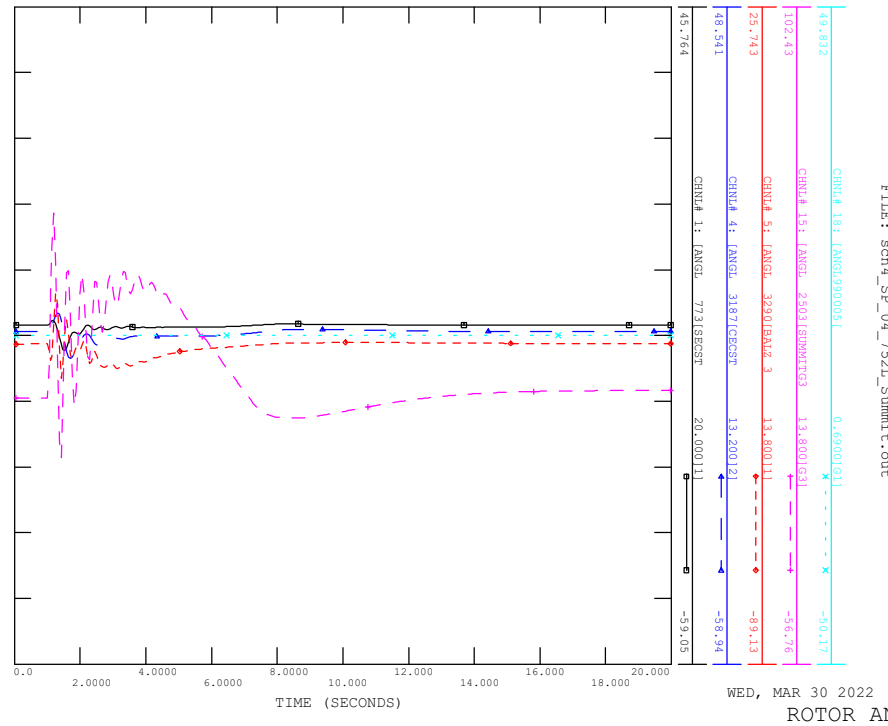
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CONTINGENCY -SCN4_SP_03_752L_EAST_CROSSFIELD

FILE: scn4_sp_03_752L_East_Crossfield.out

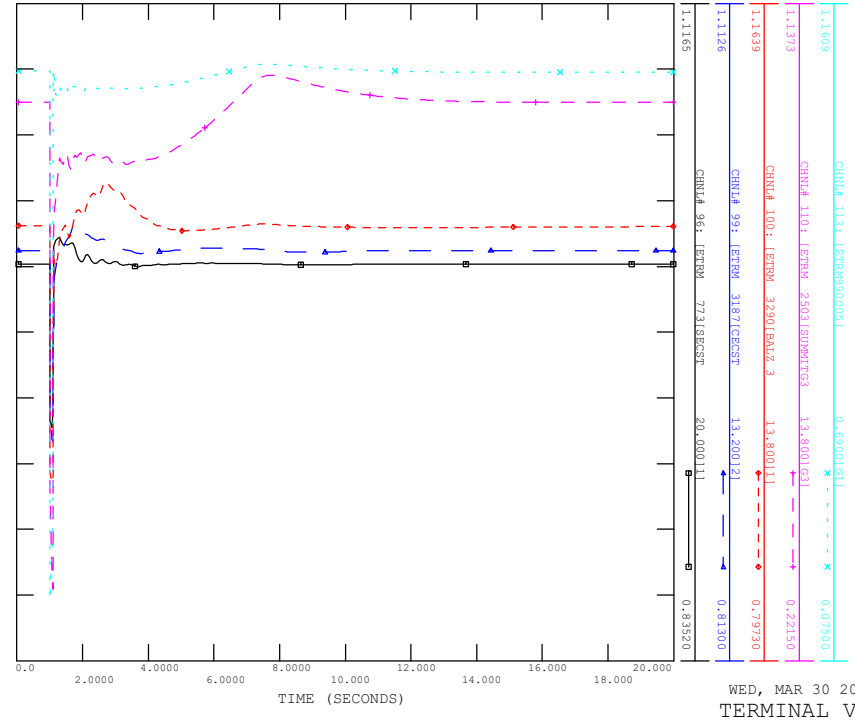


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_04_752L_SUMMIT

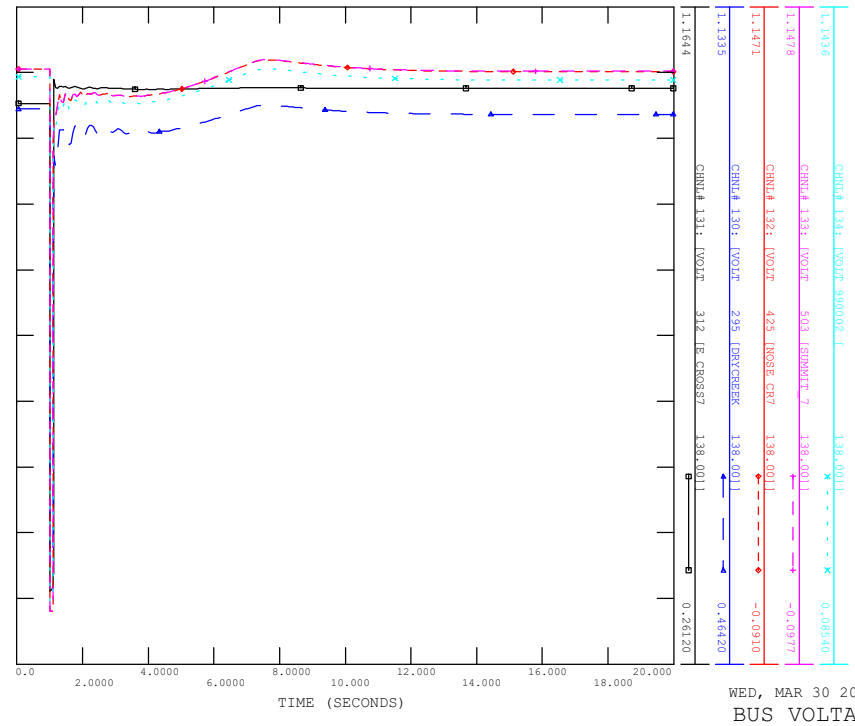
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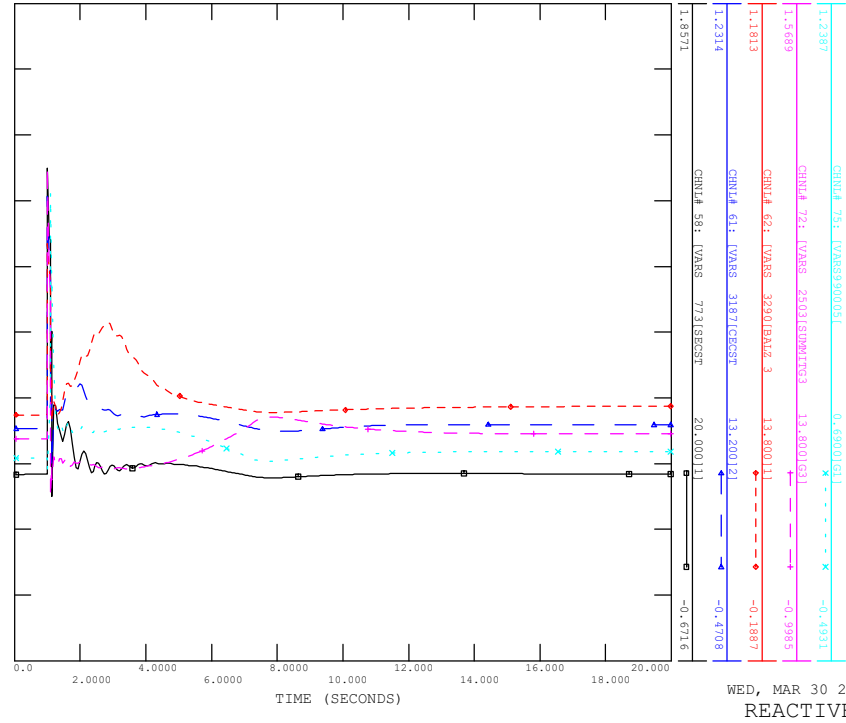
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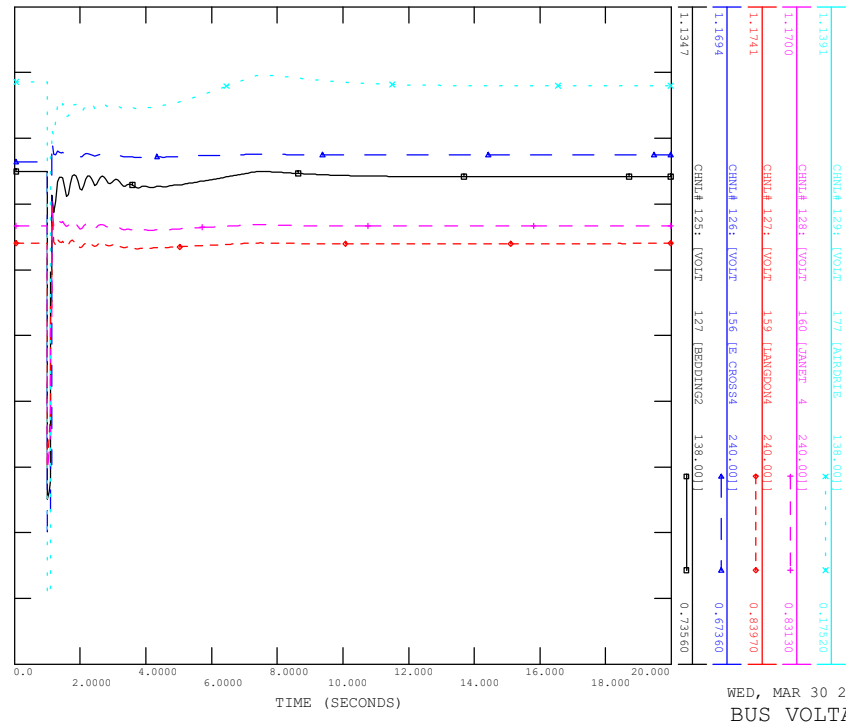
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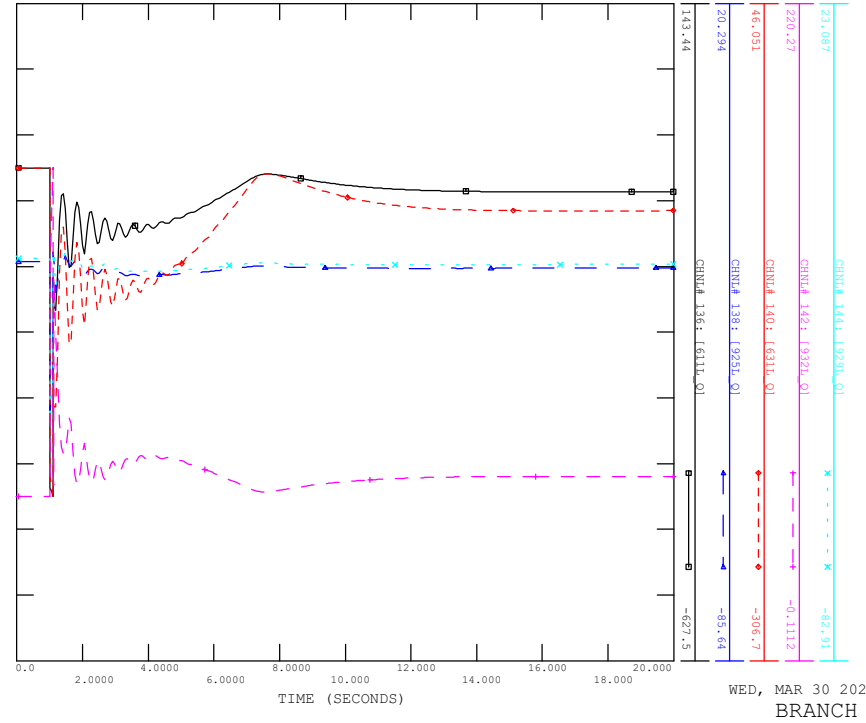
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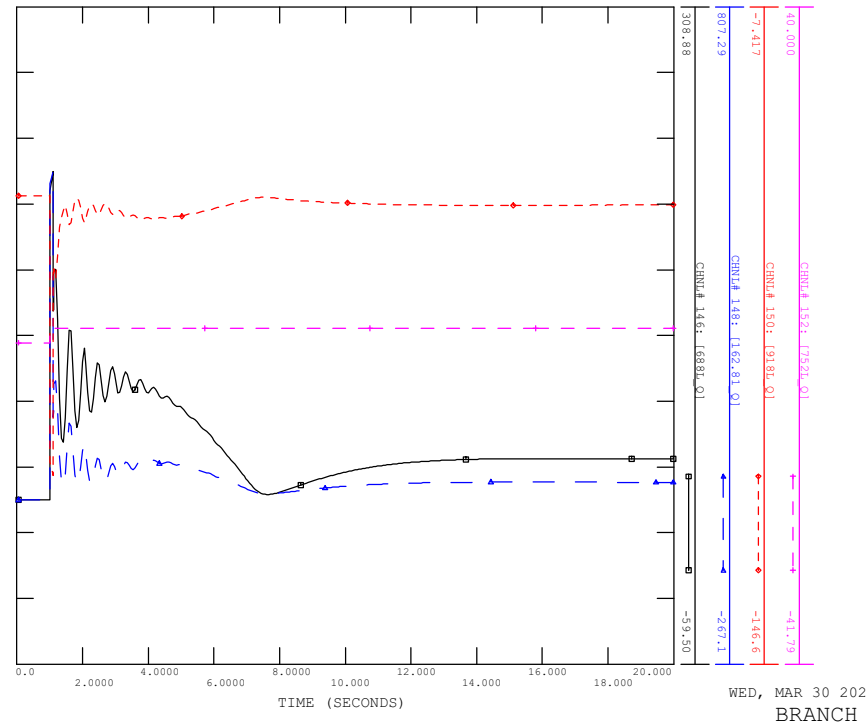
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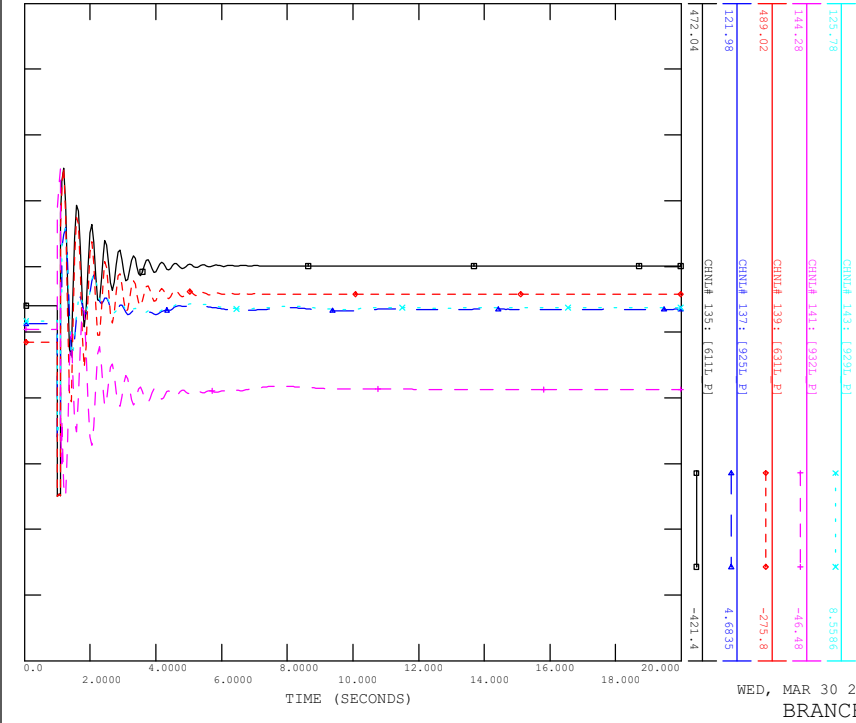
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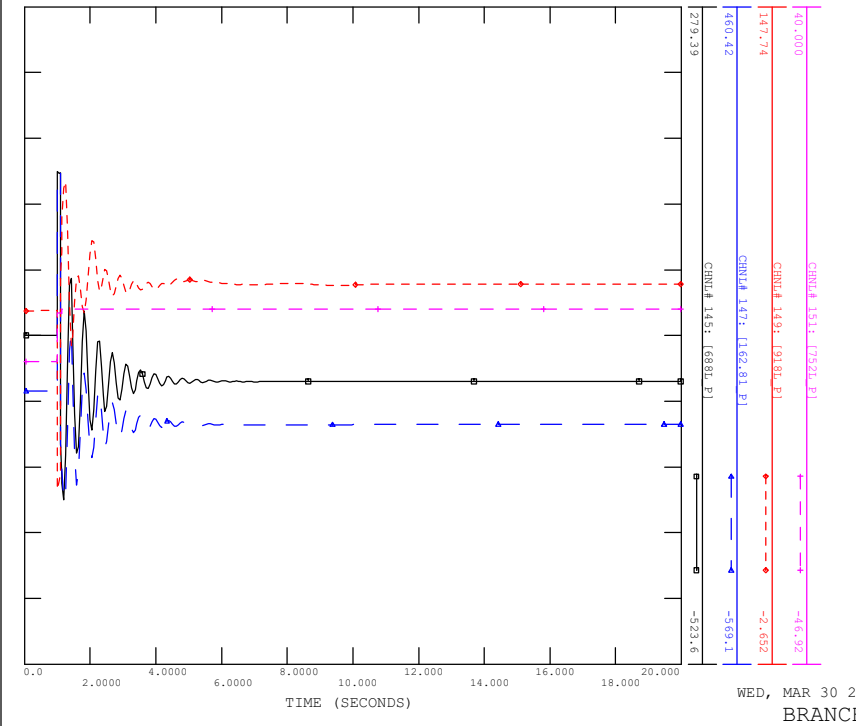
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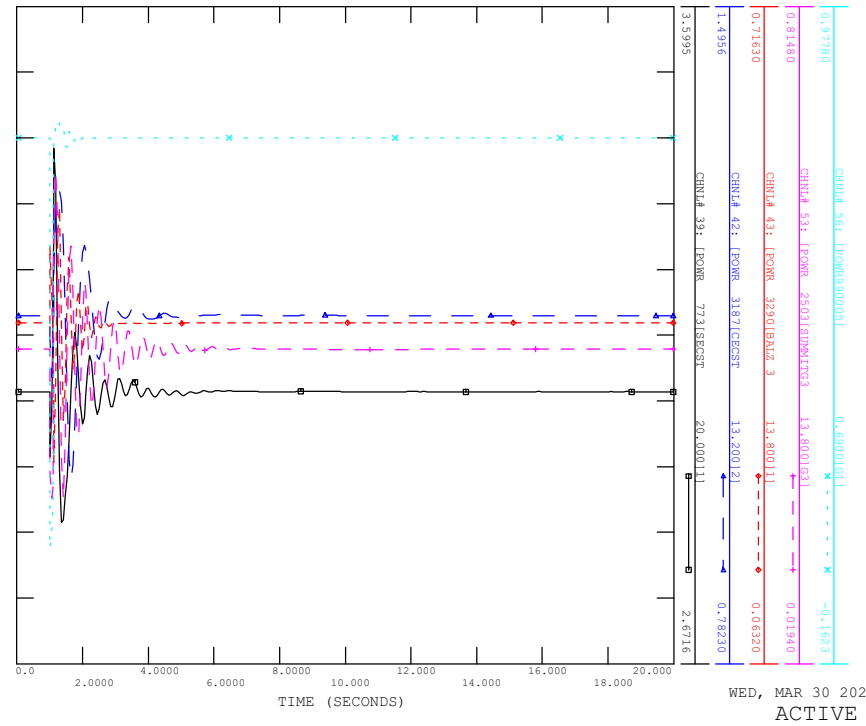
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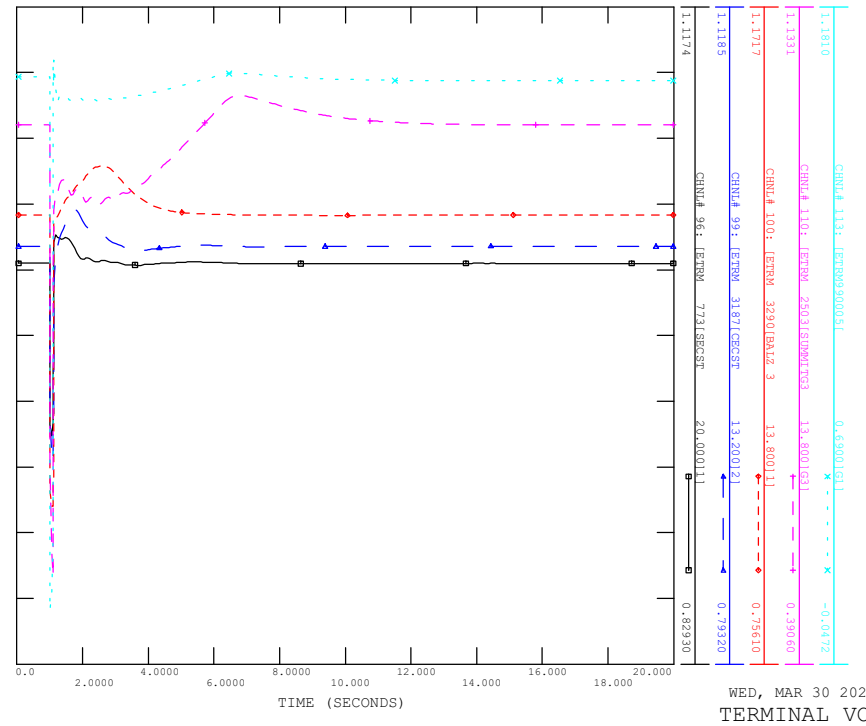
FILE: scn4_sp_04_752L_Summit.out



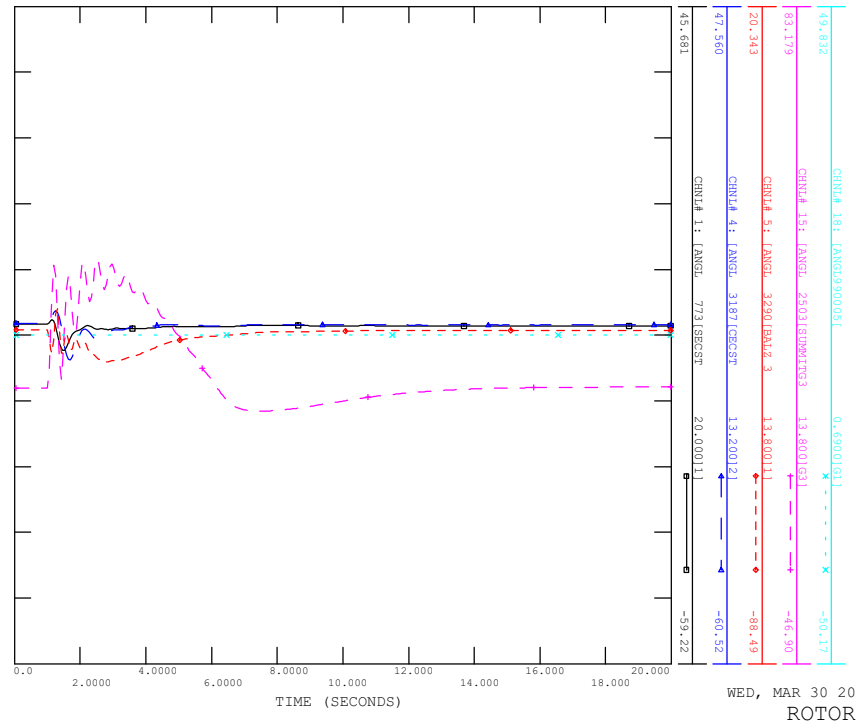
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CONTINGENCY -SCN4_SP_05_631L_EAST_AIRDIE



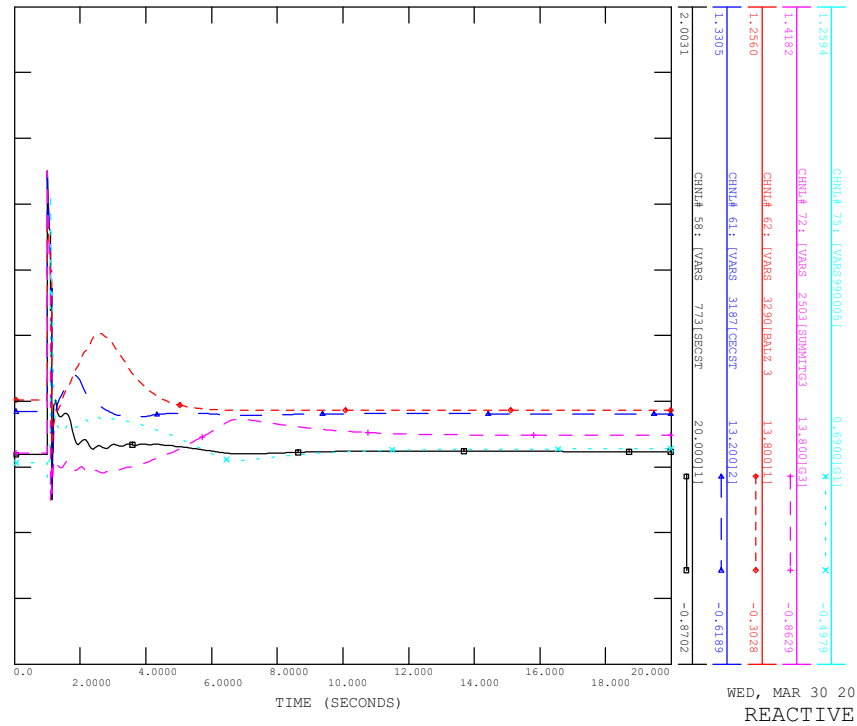
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_05_631L_EAST_AIRDIE



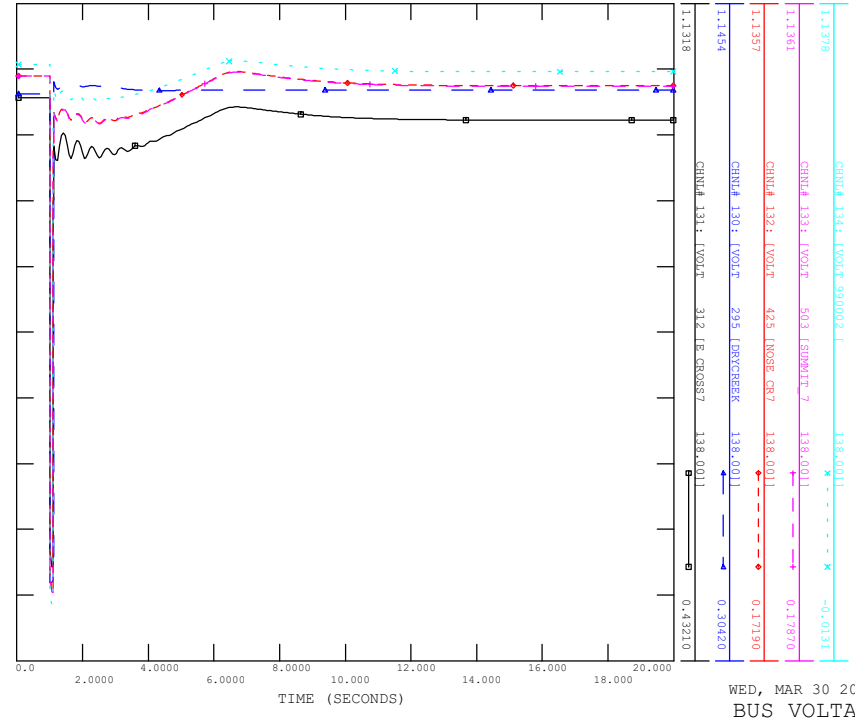
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_05_631L_EAST_AIRDIE



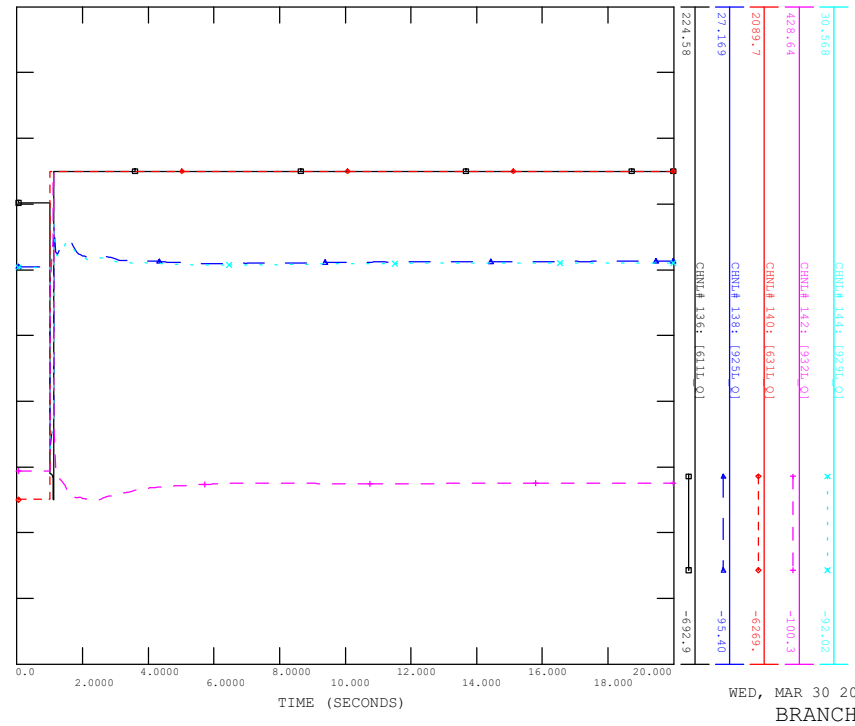
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_05_631L_EAST_AIRDIE



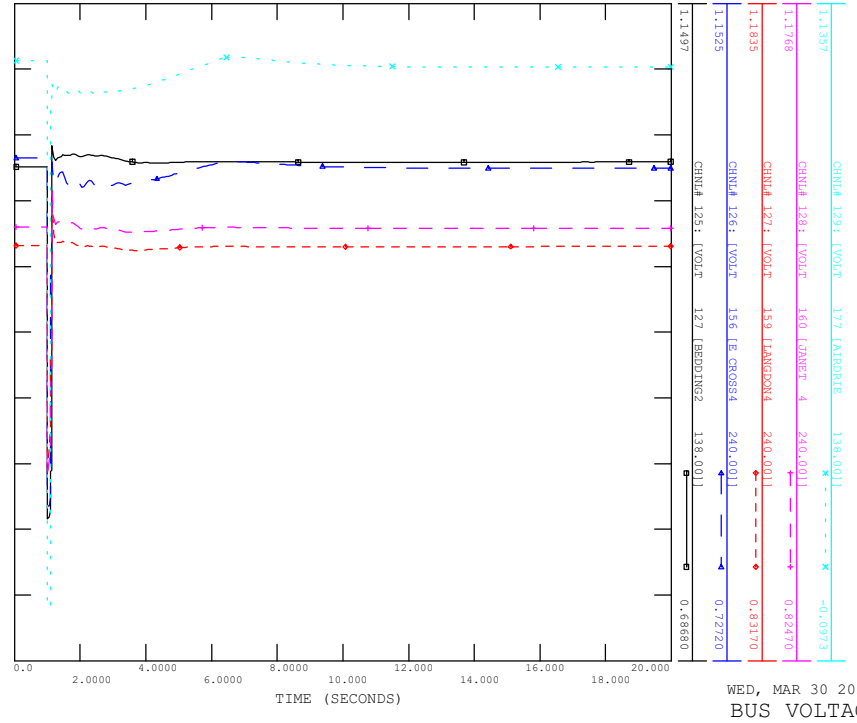
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_05_631L_EAST_AIRDRIE
FILE: scn4_sp_05_631L_East_Airdrie.out



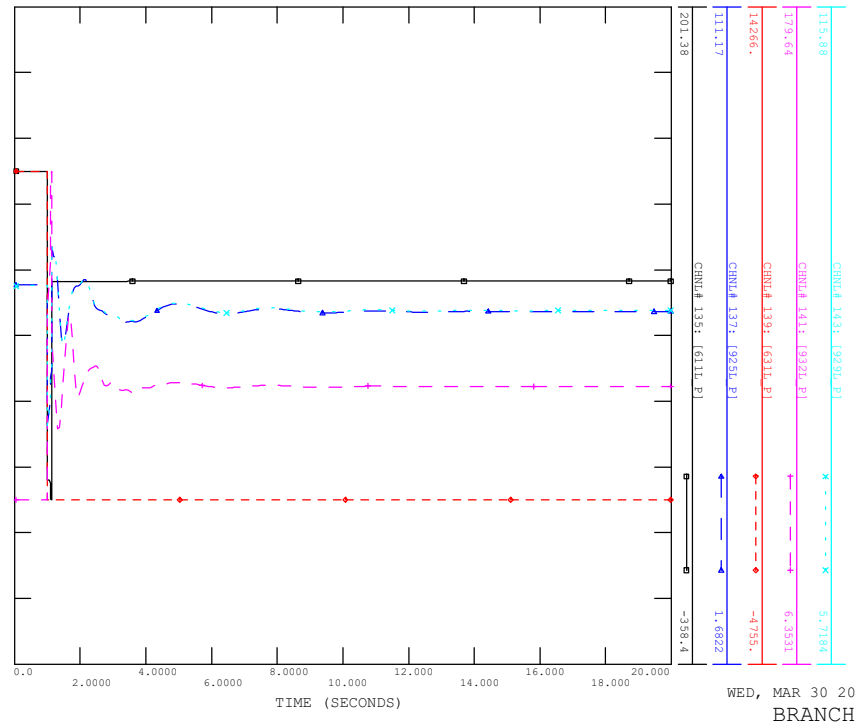
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_05_631L_EAST_AIRDRIE
FILE: scn4_sp_05_631L_East_Airdrie.out

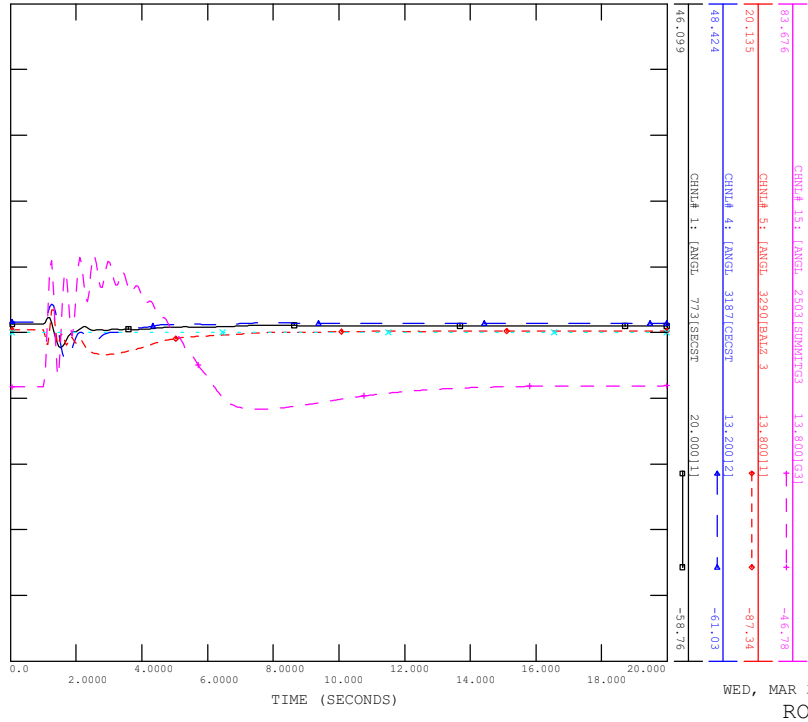
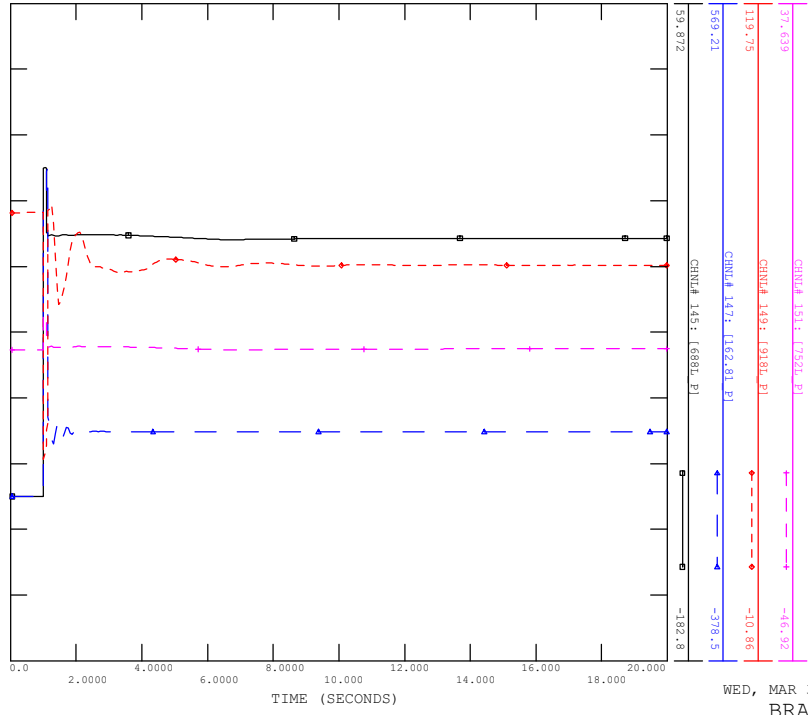
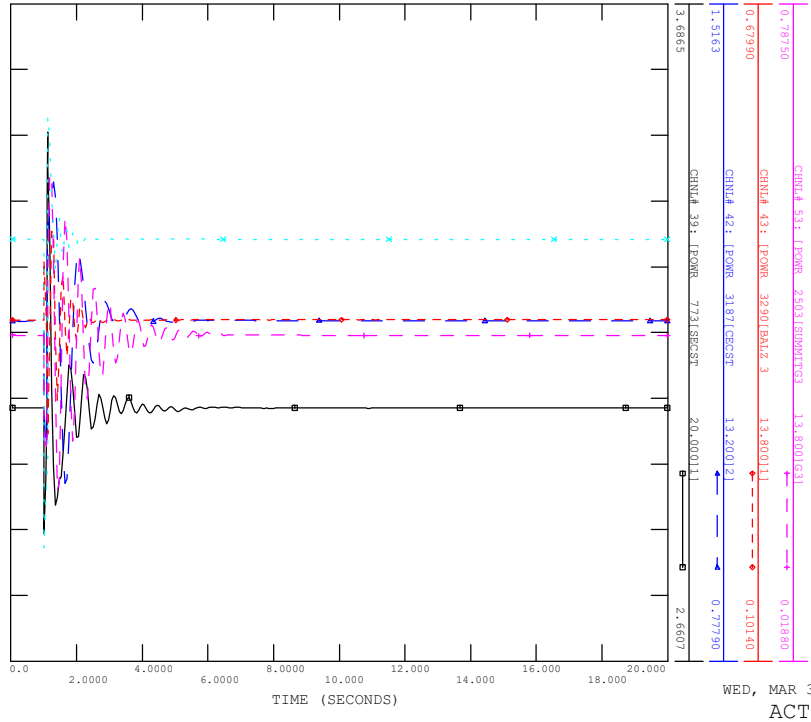
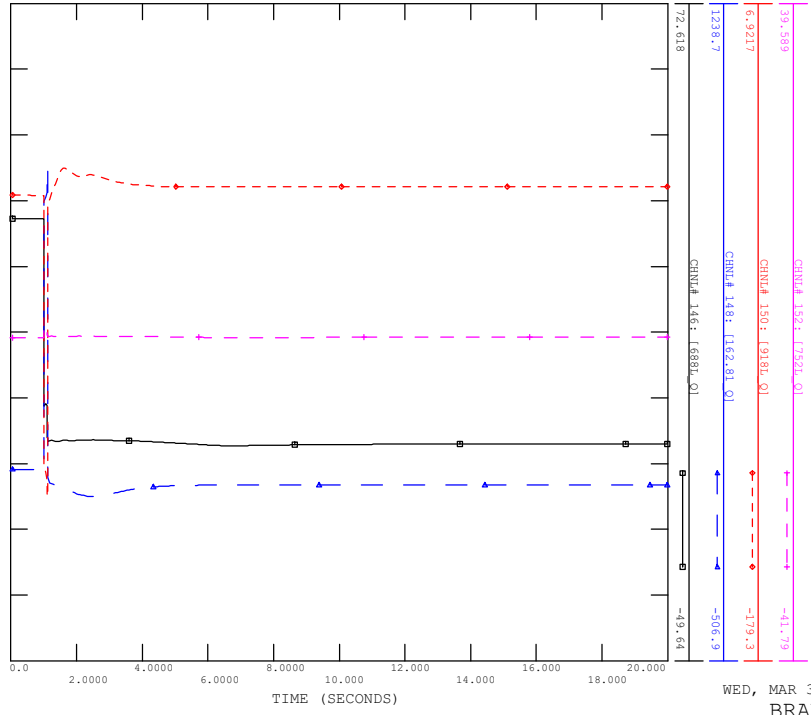


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_05_631L_EAST_AIRDRIE
FILE: scn4_sp_05_631L_East_Airdrie.out

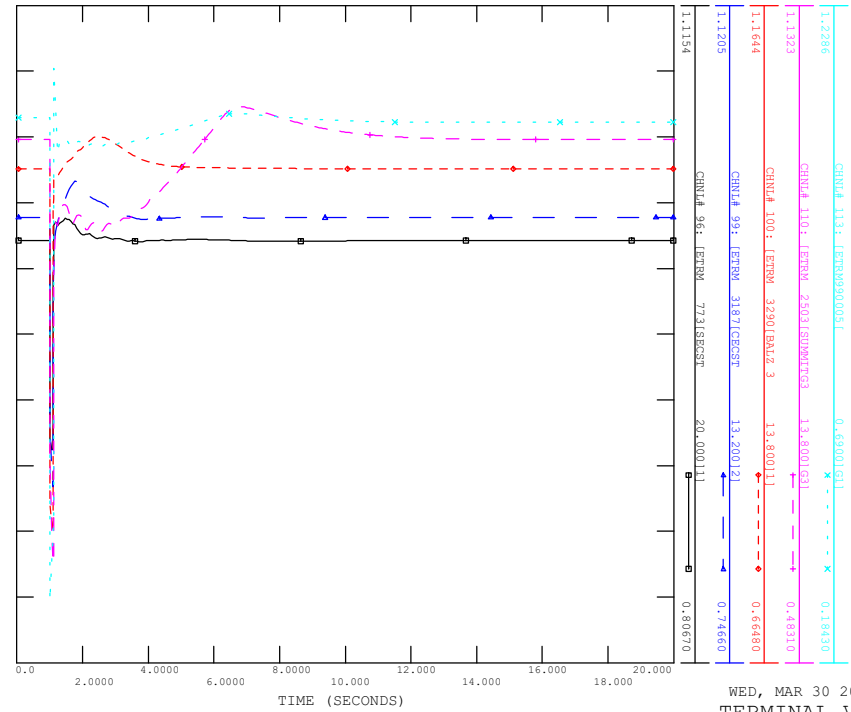


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_05_631L_EAST_AIRDRIE
FILE: scn4_sp_05_631L_East_Airdrie.out



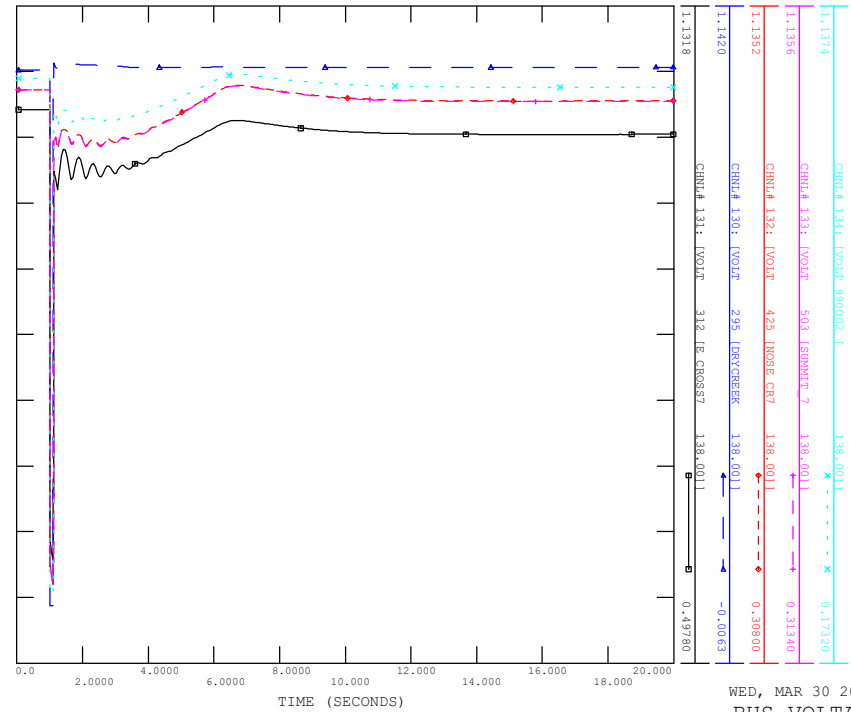


FILE: scn4_sp_06_631L_Dry_Creek.out



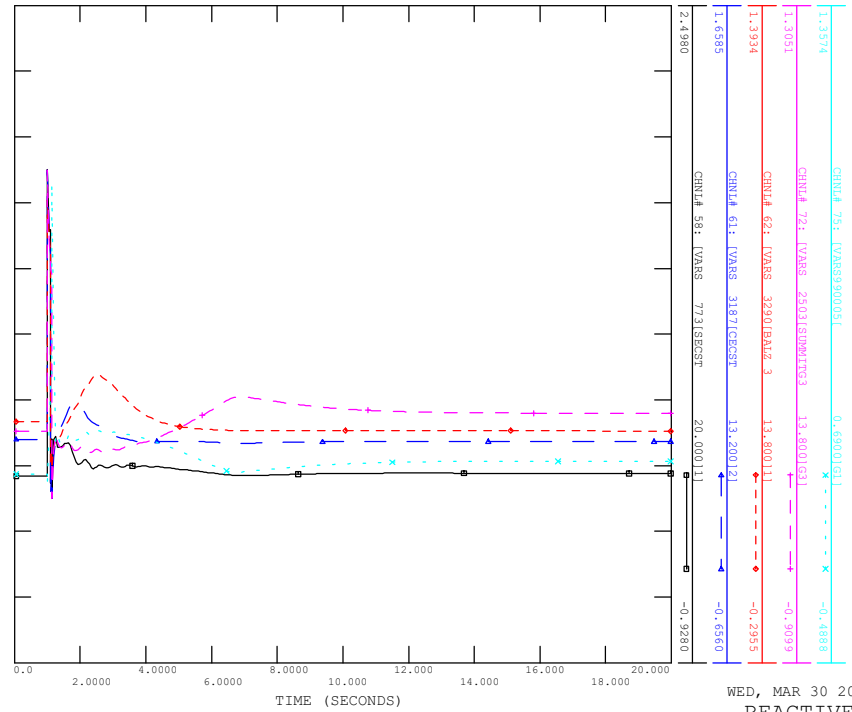
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

FILE: scn4_sp_06_631L_Dry_Creek.out



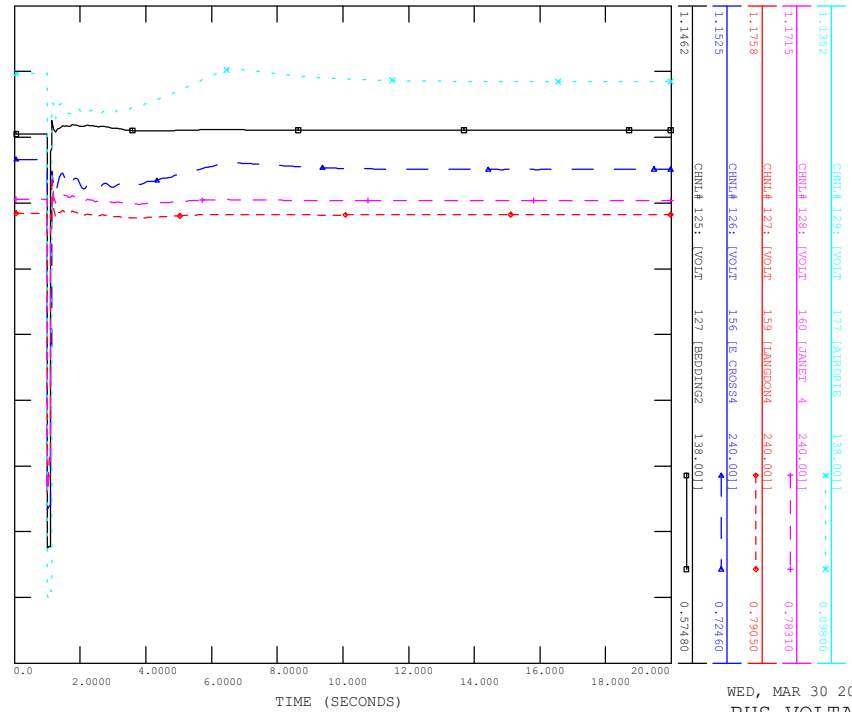
WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

FILE: scn4_sp_06_631L_Dry_Creek.out



WED, MAR 30 2022 0:34
REACTIVE POWER

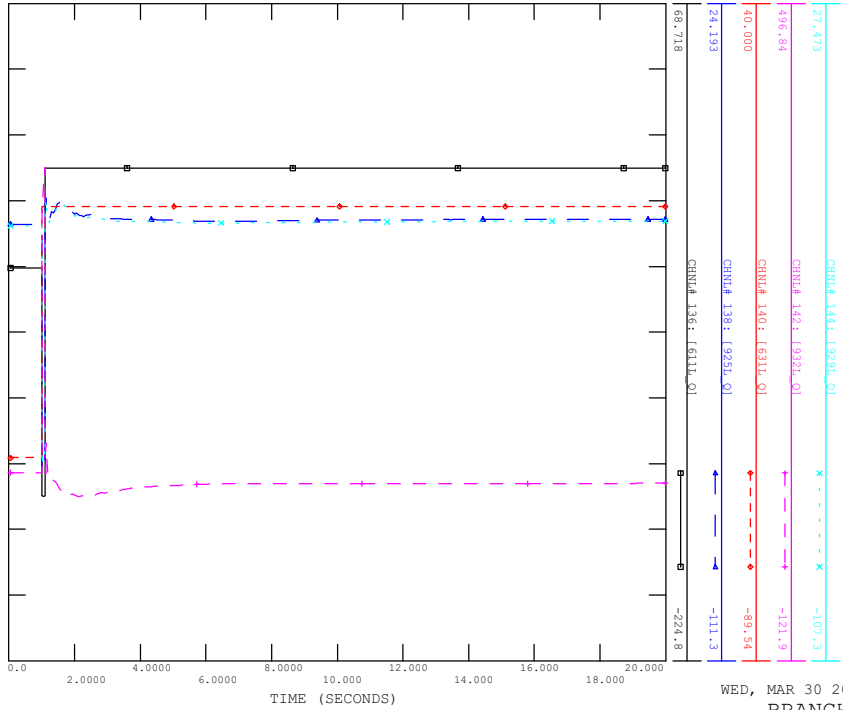
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WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

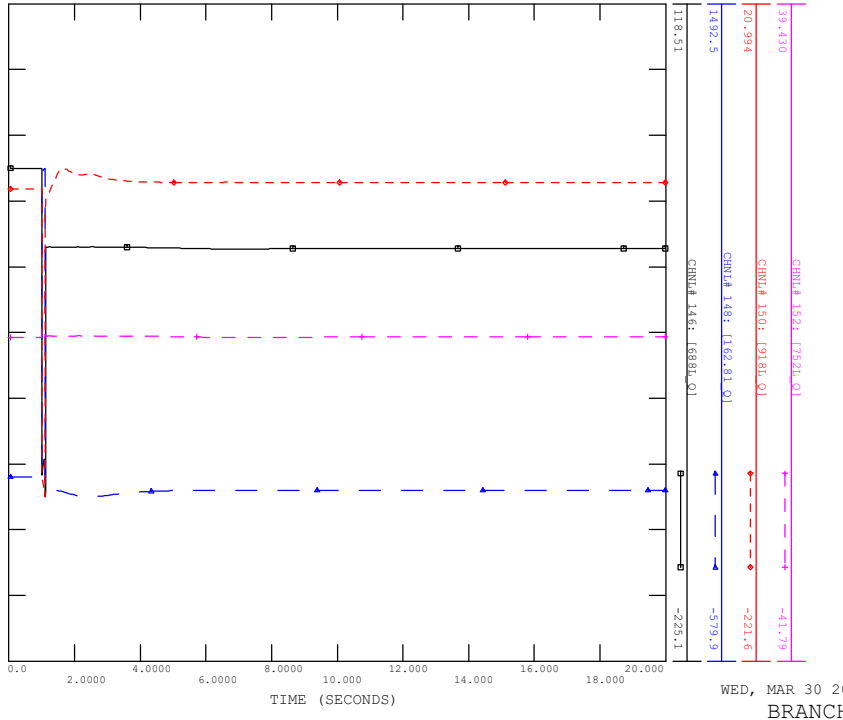
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_06_631L_DRY_CREEK

FILE: scn4_sp_06_631L_Dry_Creek.out



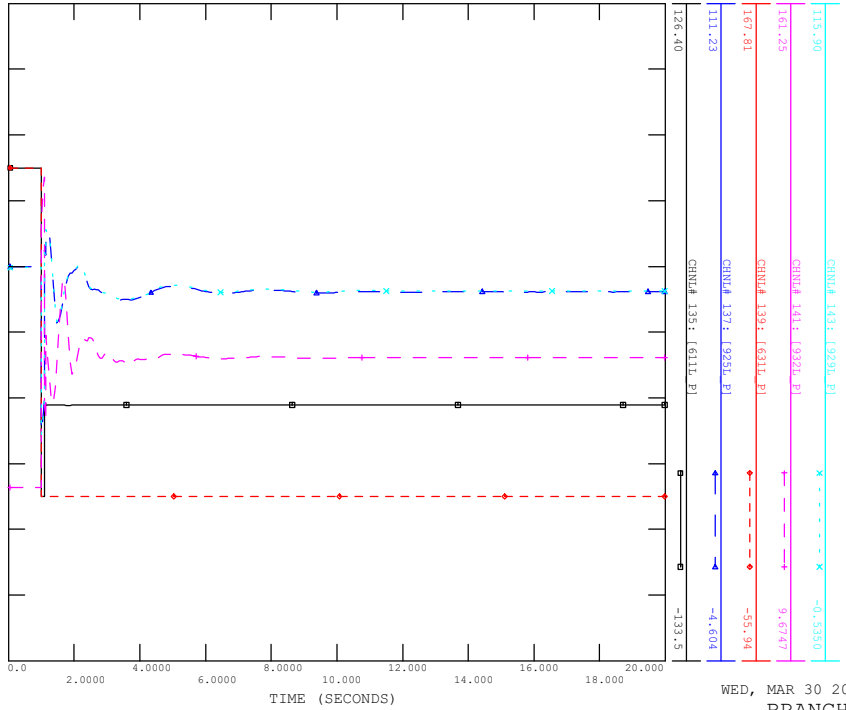
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_06_631L_DRY_CREEK

FILE: scn4_sp_06_631L_Dry_Creek.out



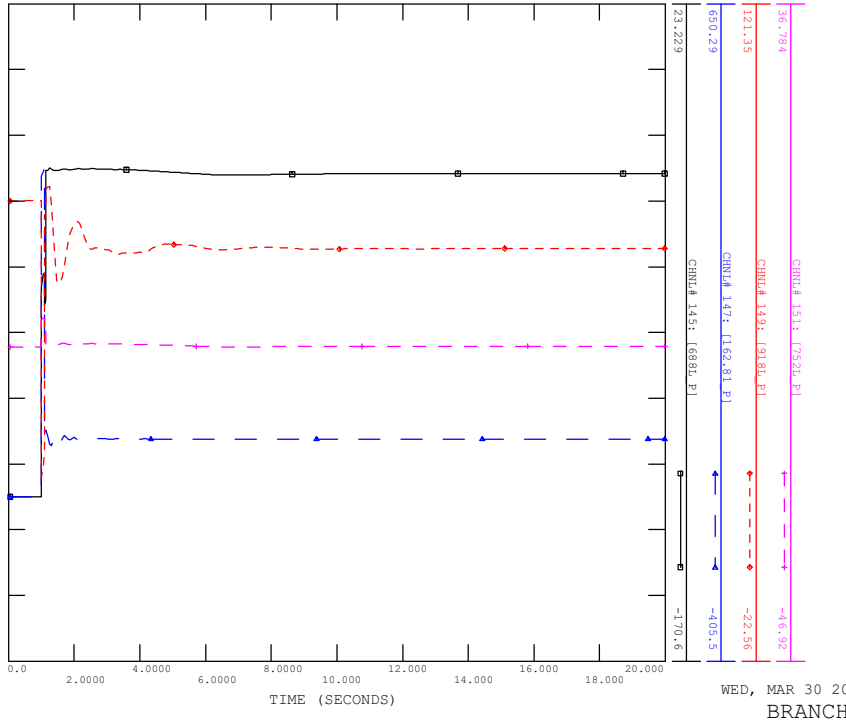
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CONTINGENCY -SCN4_SP_06_631L_DRY_CREEK

FILE: scn4_sp_06_631L_Dry_Creek.out



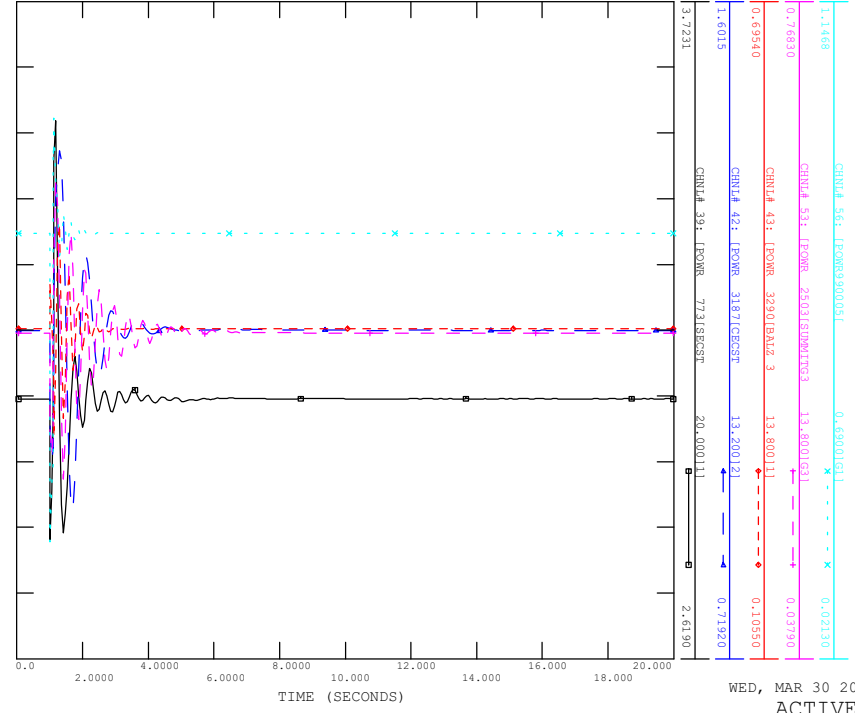
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_06_631L_DRY_CREEK

FILE: scn4_sp_06_631L_Dry_Creek.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_07_611L_BALZAC

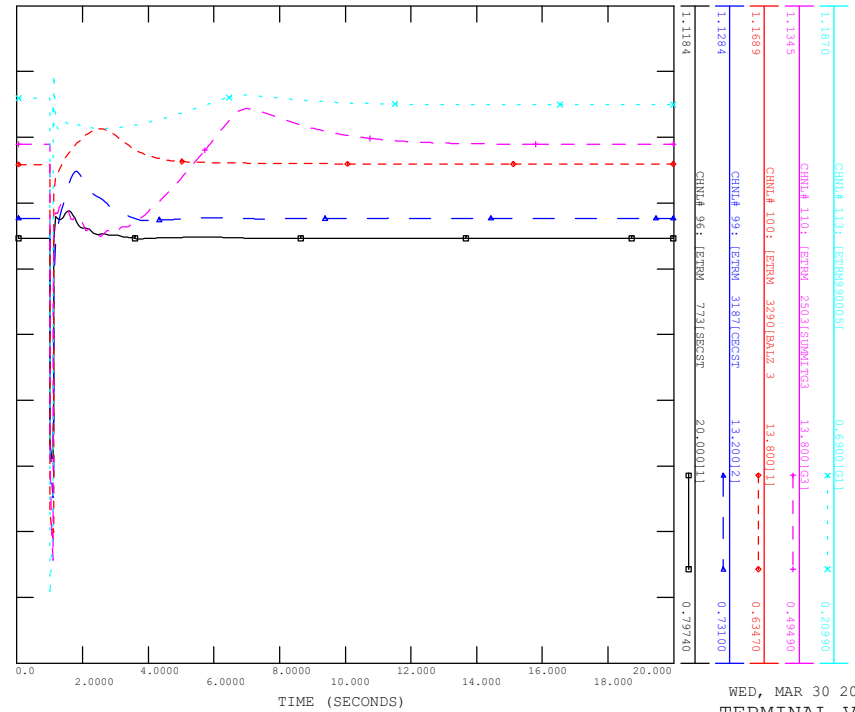
FILE: scn4_sp_07_611L_Balzac.out



WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_07_611L_BALZAC

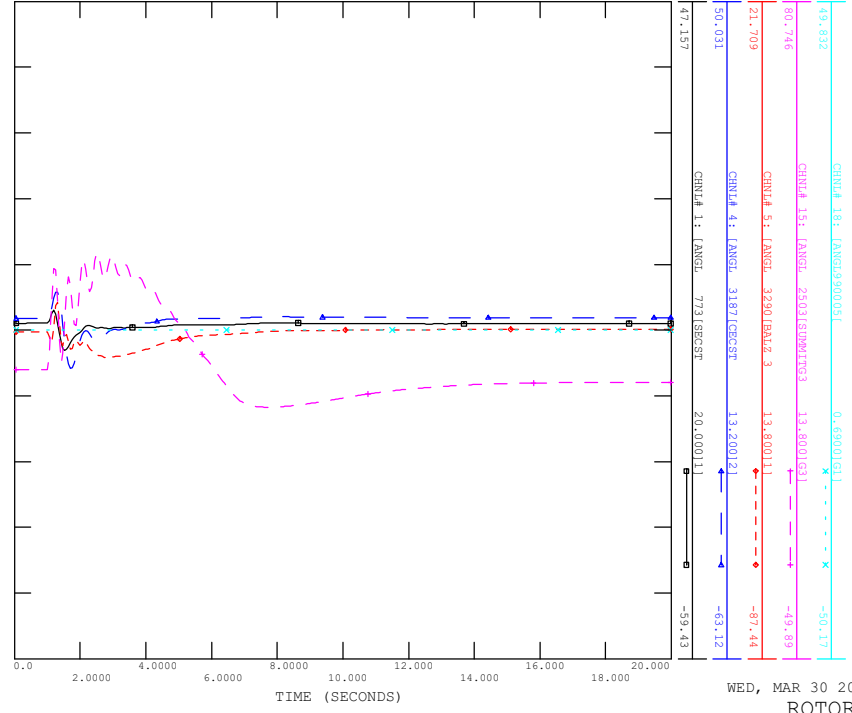
FILE: scn4_sp_07_611L_Balzac.out



WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_07_611L_BALZAC

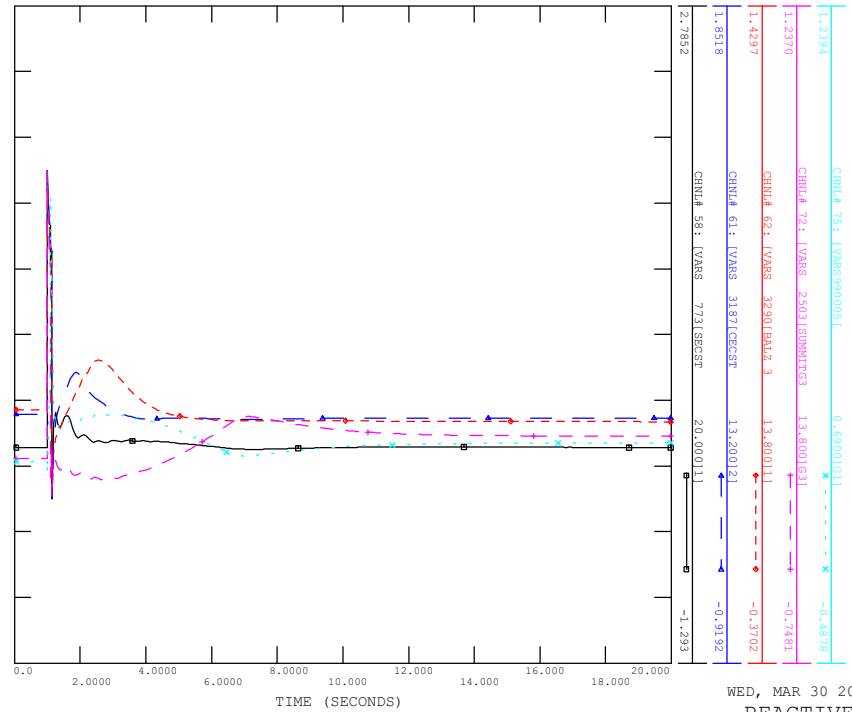
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WED, MAR 30 2022 0:34
ROTOR ANGLE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_07_611L_BALZAC

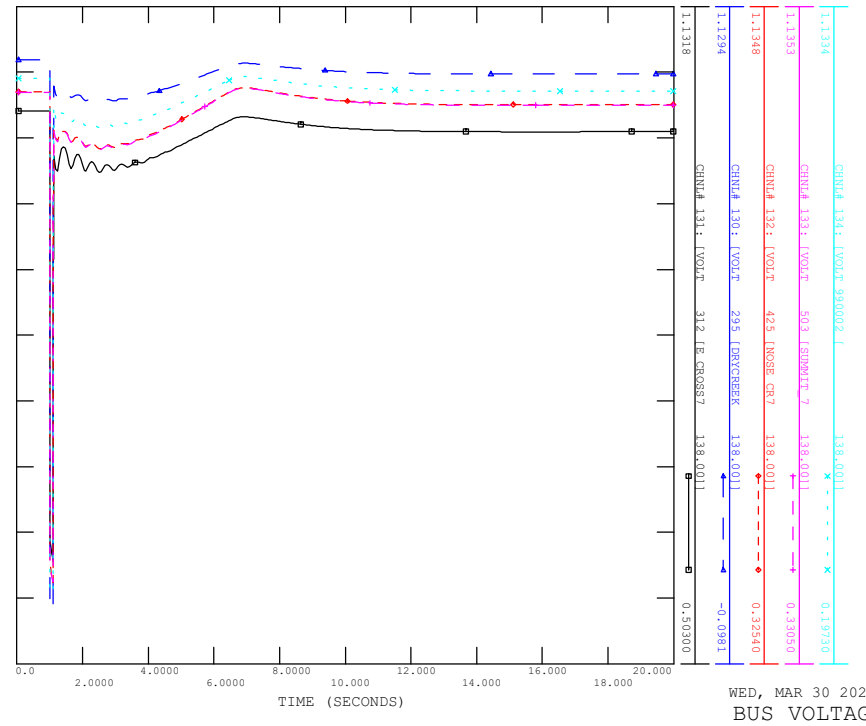
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WED, MAR 30 2022 0:34
REACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_07_611L_BALZAC

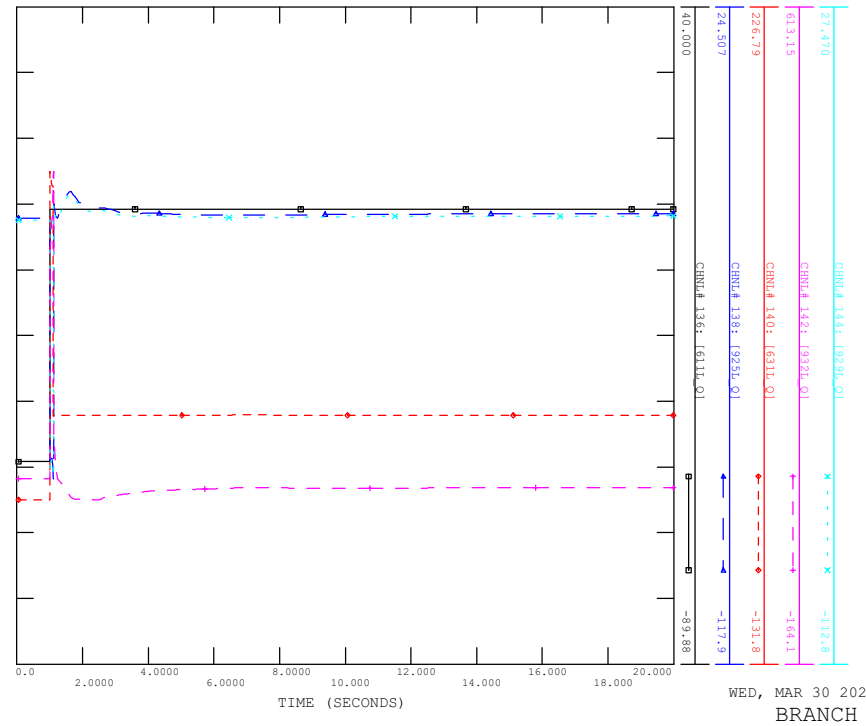
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WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_07_611L_BALZAC

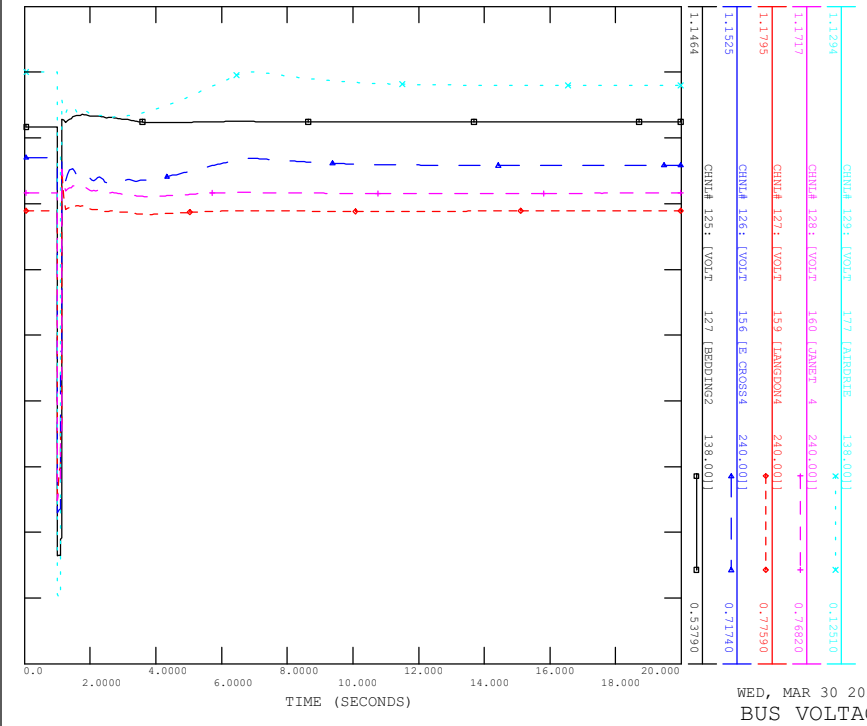
FILE: scn4_sp_07_611L_Balzac.out



WED, MAR 30 2022 0:34
BRANCH Q (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_07_611L_BALZAC

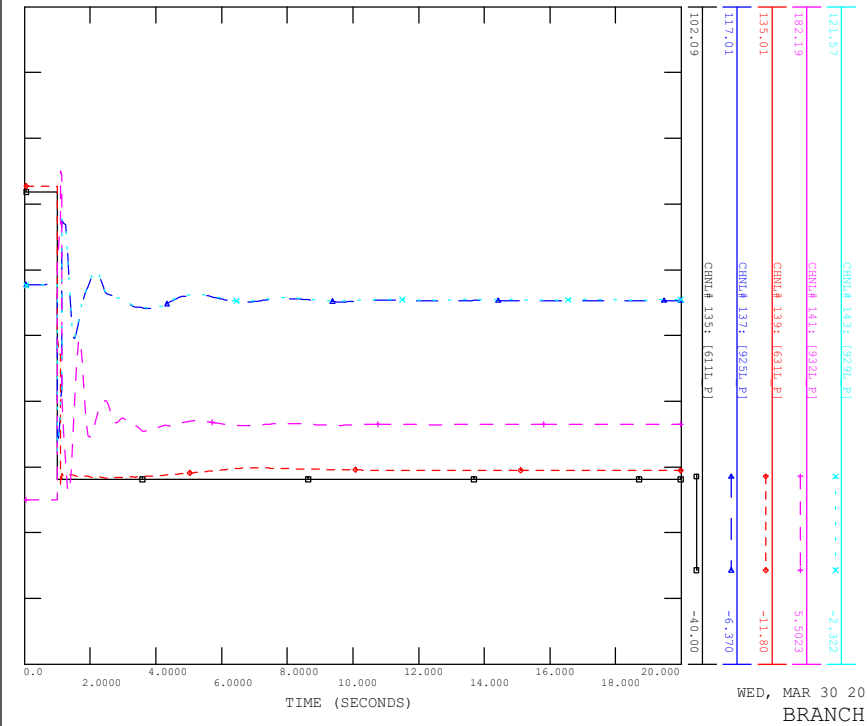
FILE: scn4_sp_07_611L_Balzac.out



WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_07_611L_BALZAC

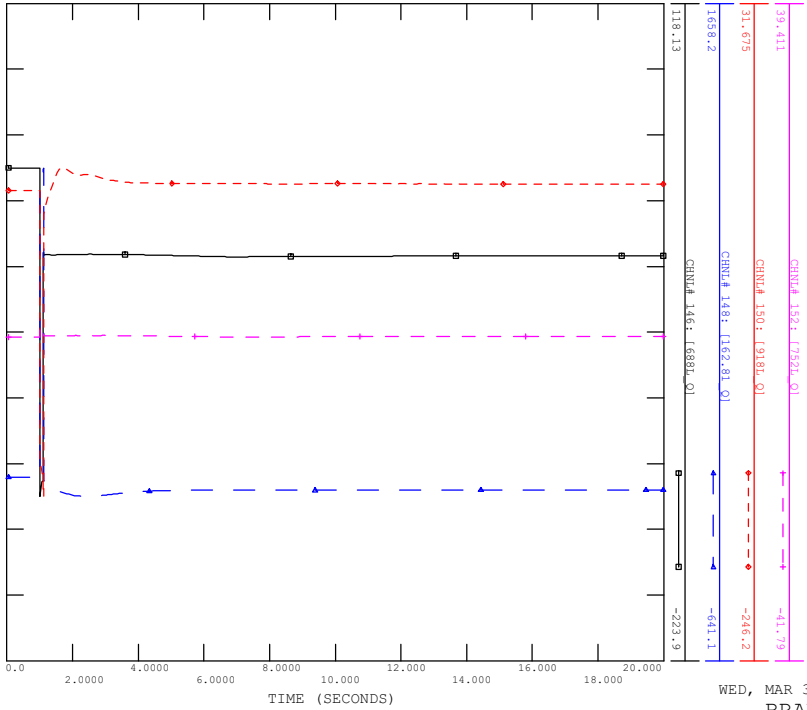
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WED, MAR 30 2022 0:34
BRANCH P (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_07_611L_BALZAC

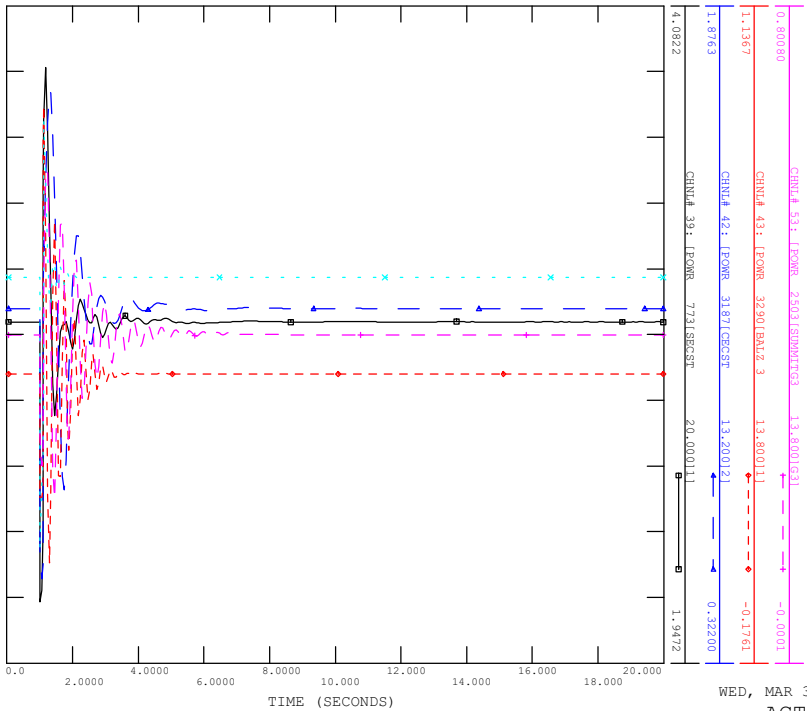
FILE: scn4_sp_07_611L_Balzac.out



WED, MAR 30 2022 0:34
BRANCH Q (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_08_611L_DRY_CREEK

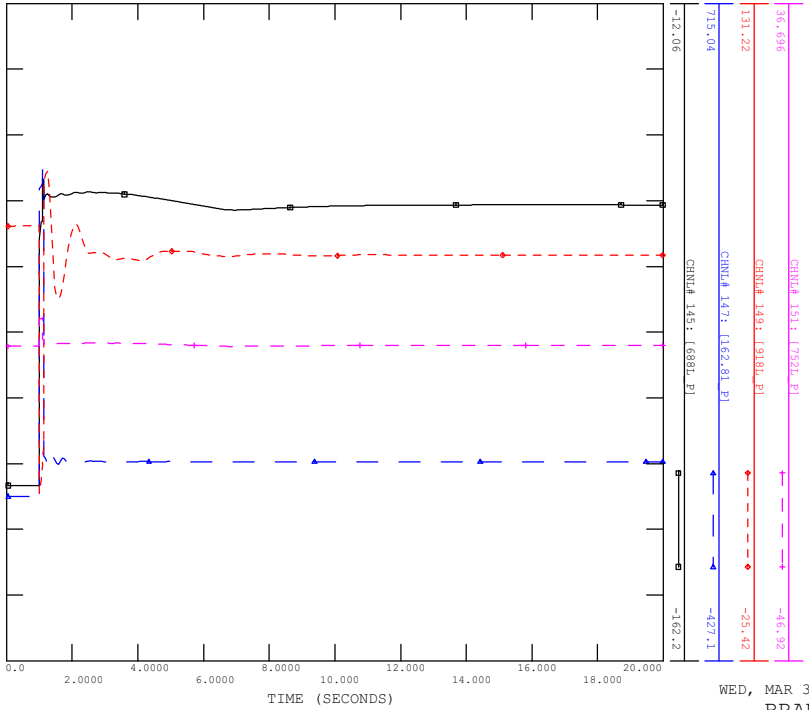
FILE: scn4_sp_08_611L_Dry_Creek.out



WED, MAR 30 2022 0:34
ACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_07_611L_BALZAC

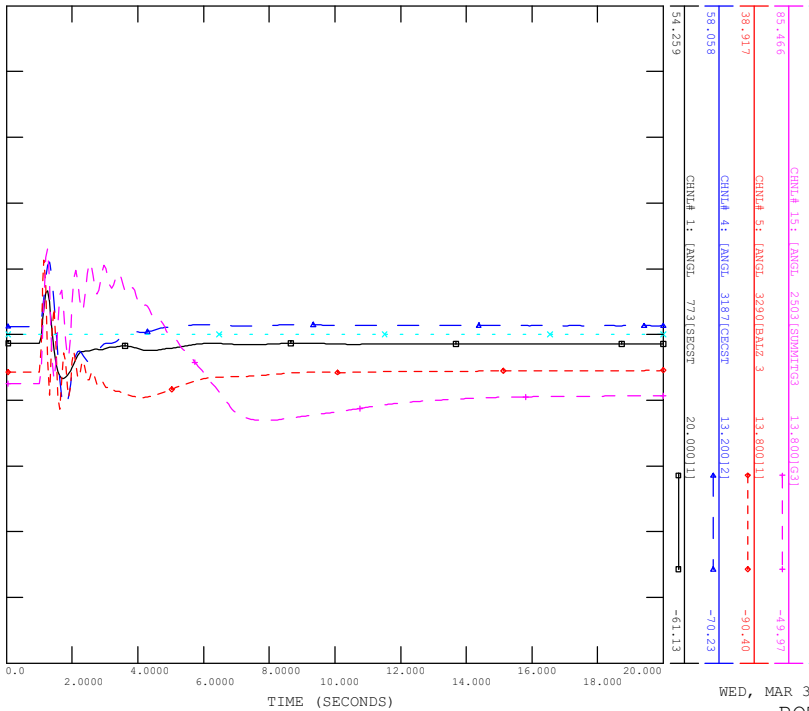
FILE: scn4_sp_07_611L_Balzac.out



WED, MAR 30 2022 0:34
BRANCH P (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_08_611L_DRY_CREEK

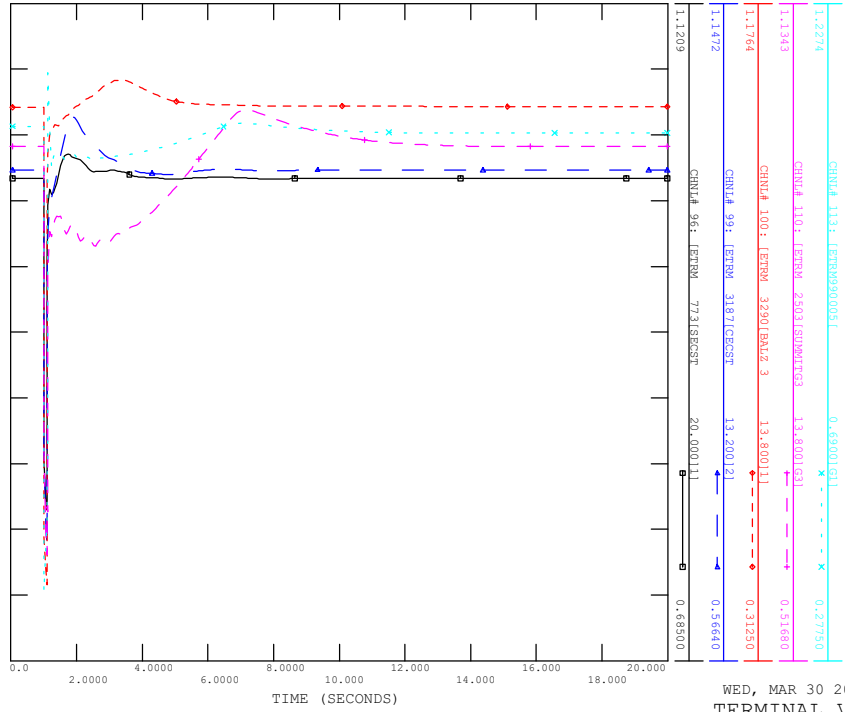
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WED, MAR 30 2022 0:34
ROTOR ANGLE

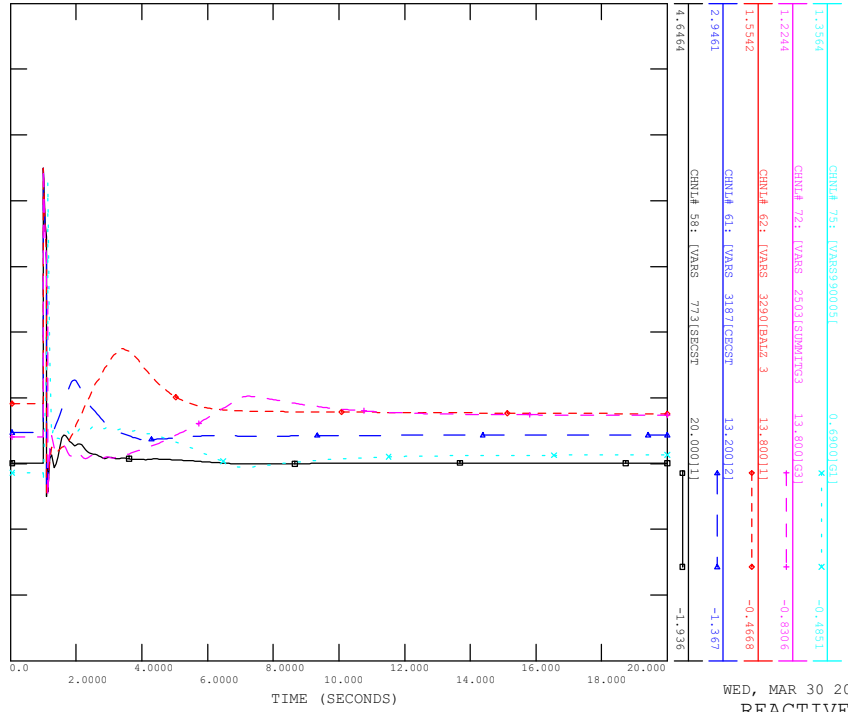
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_08_611L_DRY_CREEK

FILE: scn4_sp_08_611L_Dry_Creek.out



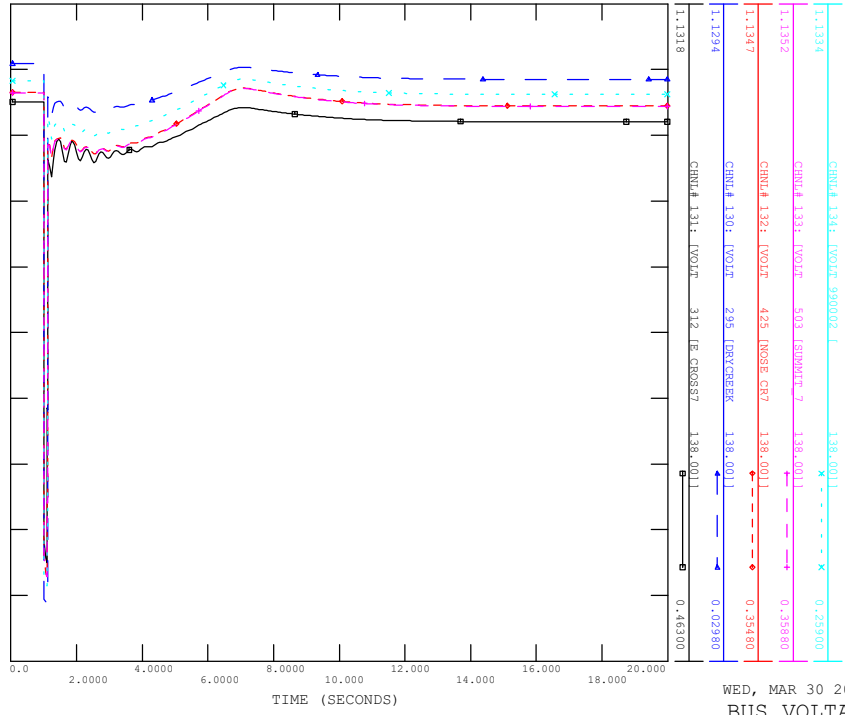
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CONTINGENCY -SCN4_SP_08_611L_DRY_CREEK

FILE: scn4_sp_08_611L_Dry_Creek.out



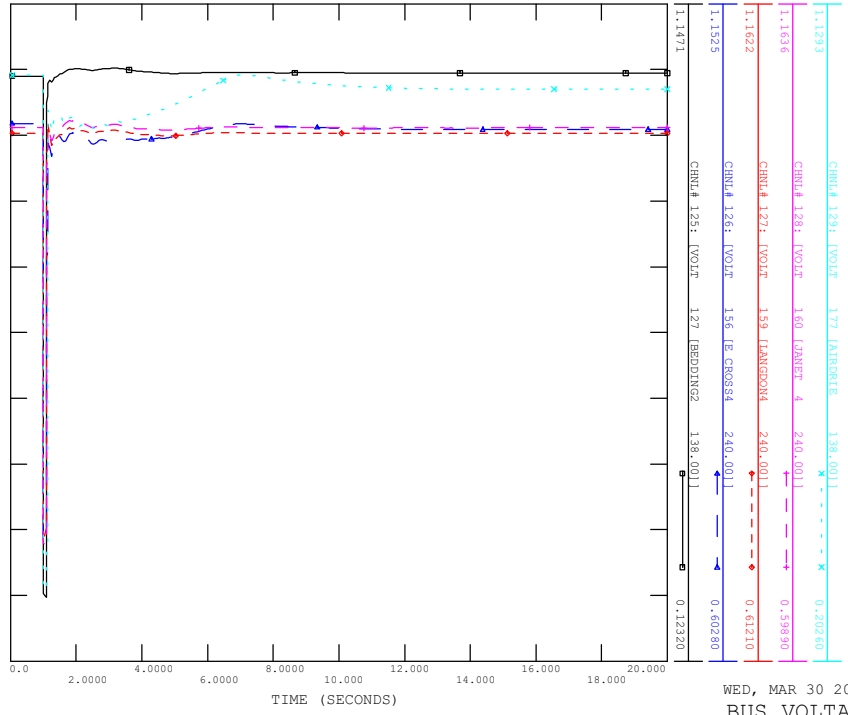
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_08_611L_DRY_CREEK

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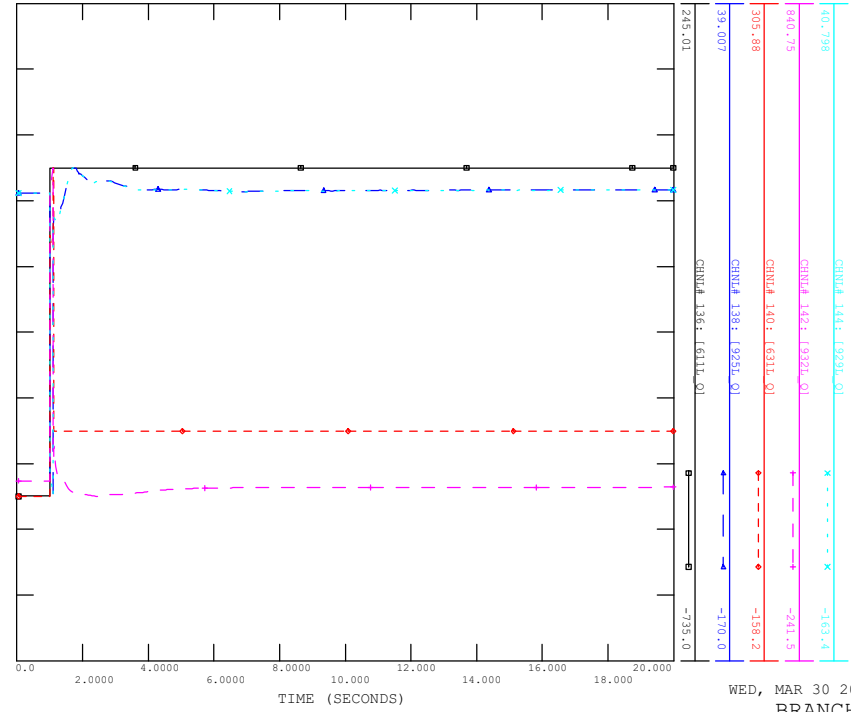
SCENARIO: P2405 SYSTEM IMPACT STUDY
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FILE: scn4_sp_08_611L_Dry_Creek.out



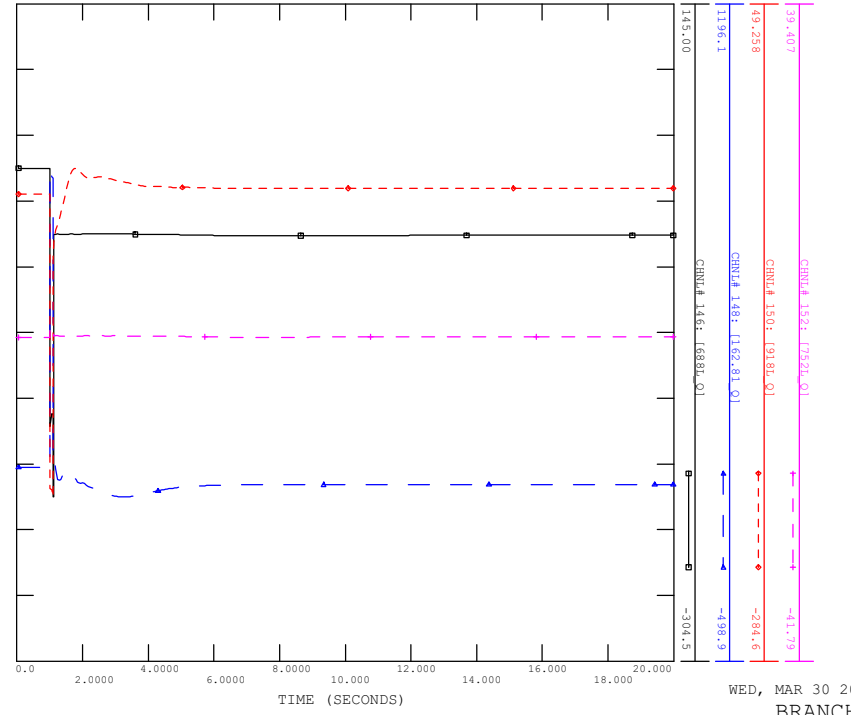
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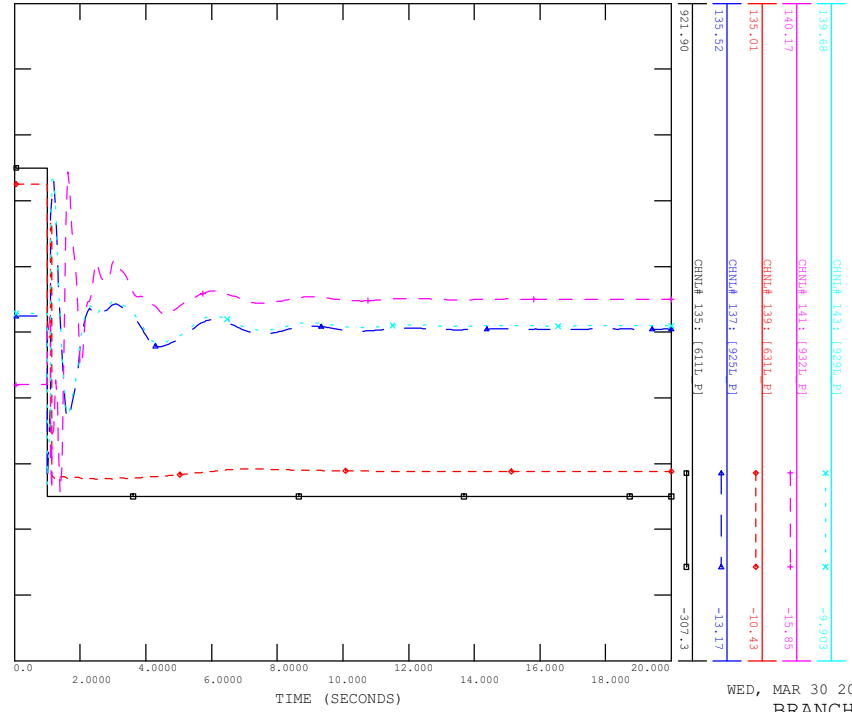
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CONTINGENCY -SCN4_SP_08_611L_DRY_CREEK

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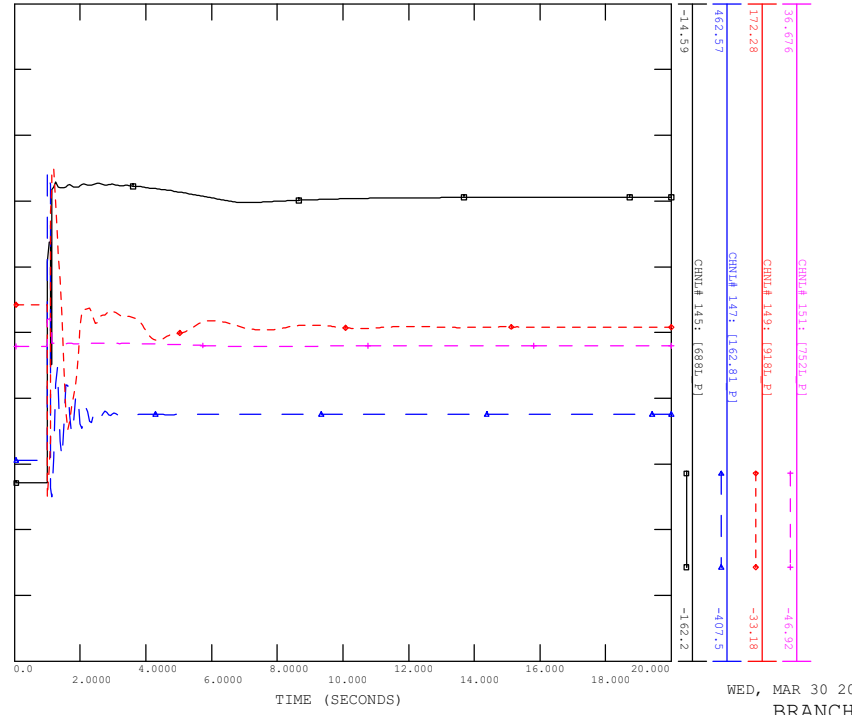
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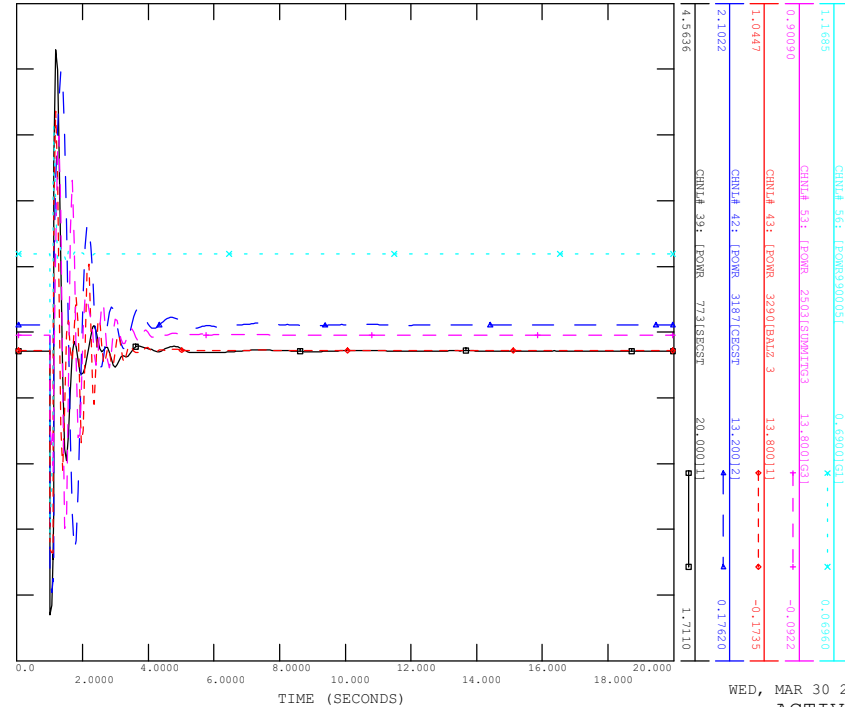


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_08_611L_DRY_CREEK

FILE: scn4_sp_08_611L_Dry_Creek.out

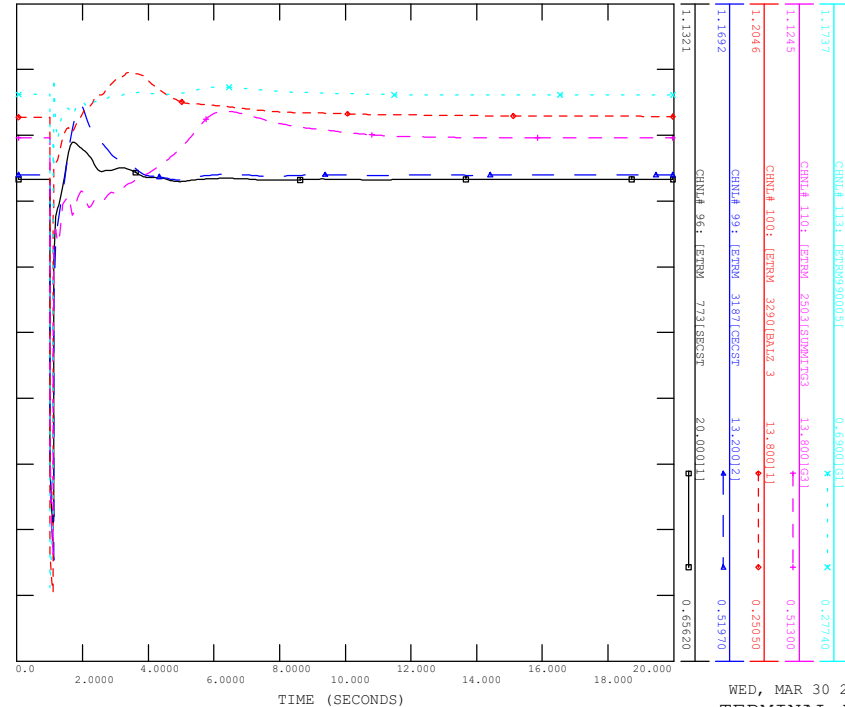


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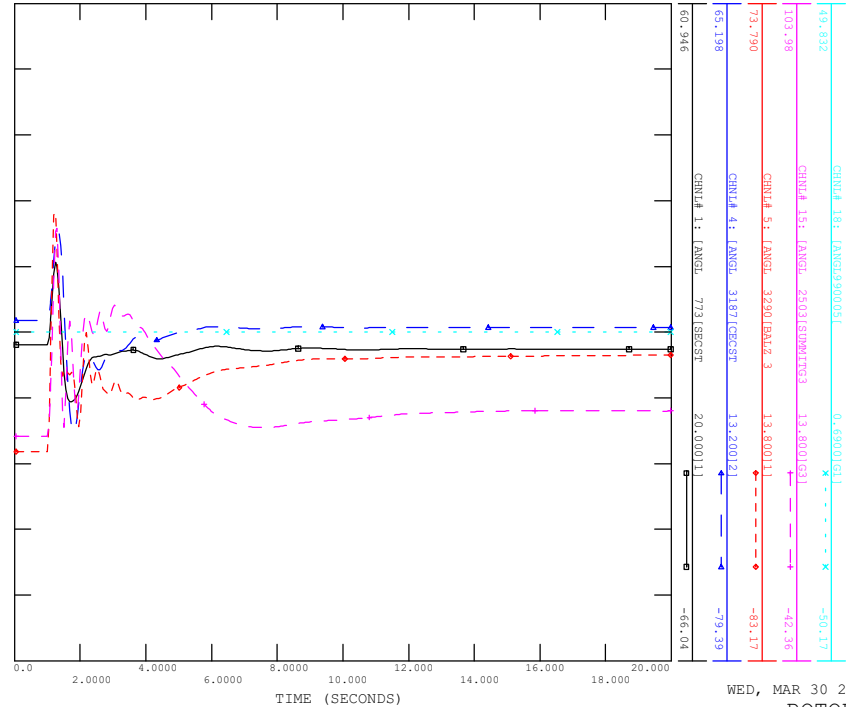
WED, MAR 30 2022 0:34
ACTIVE POWER

FILE: scn4_sp_09_16281L_Balzac.out



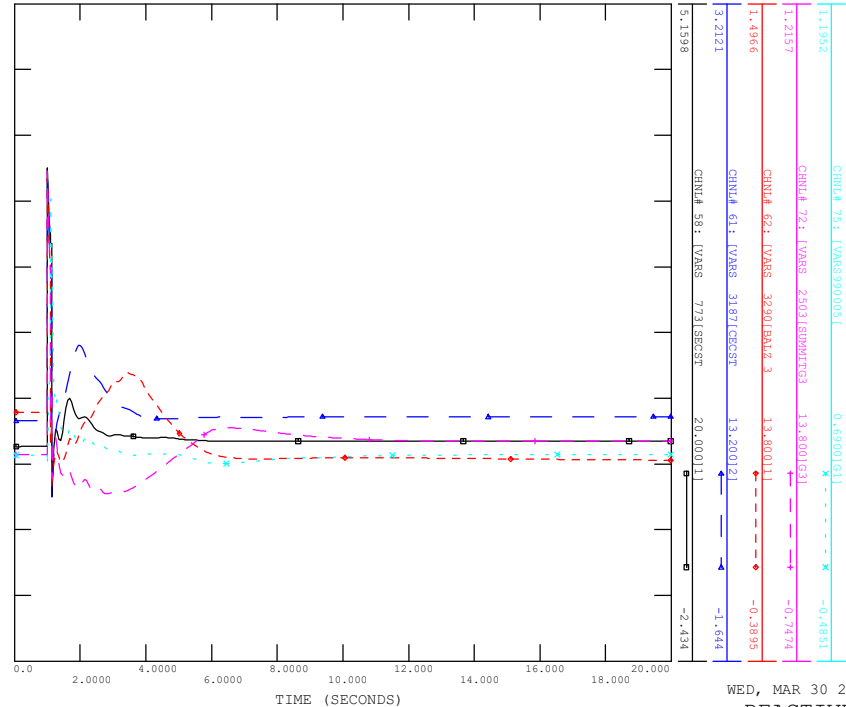
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

FILE: scn4_sp_09_16281L_Balzac.out



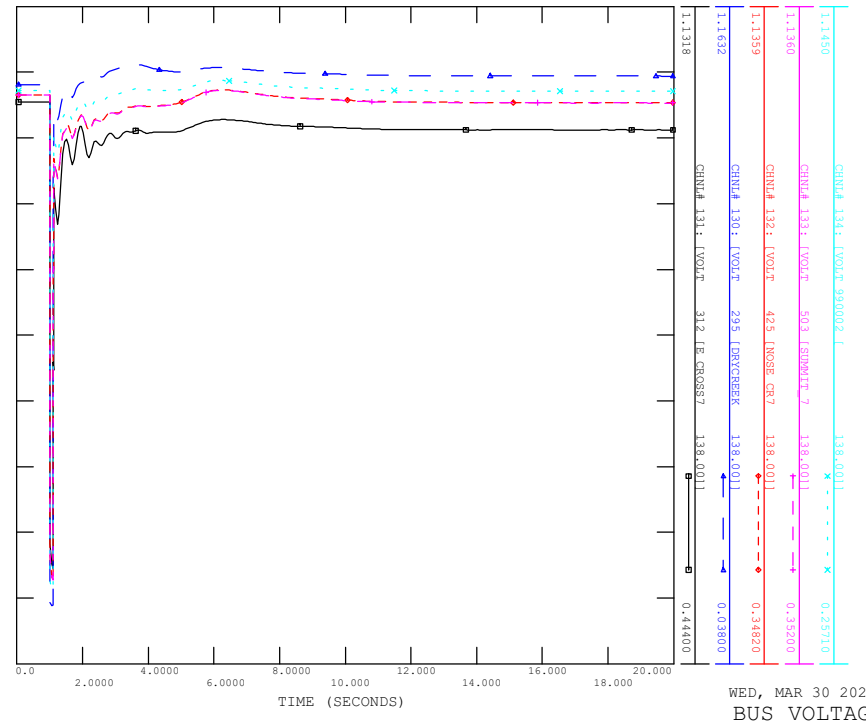
WED, MAR 30 2022 0:34
ROTOR ANGLE

FILE: scn4_sp_09_16281L_Balzac.out

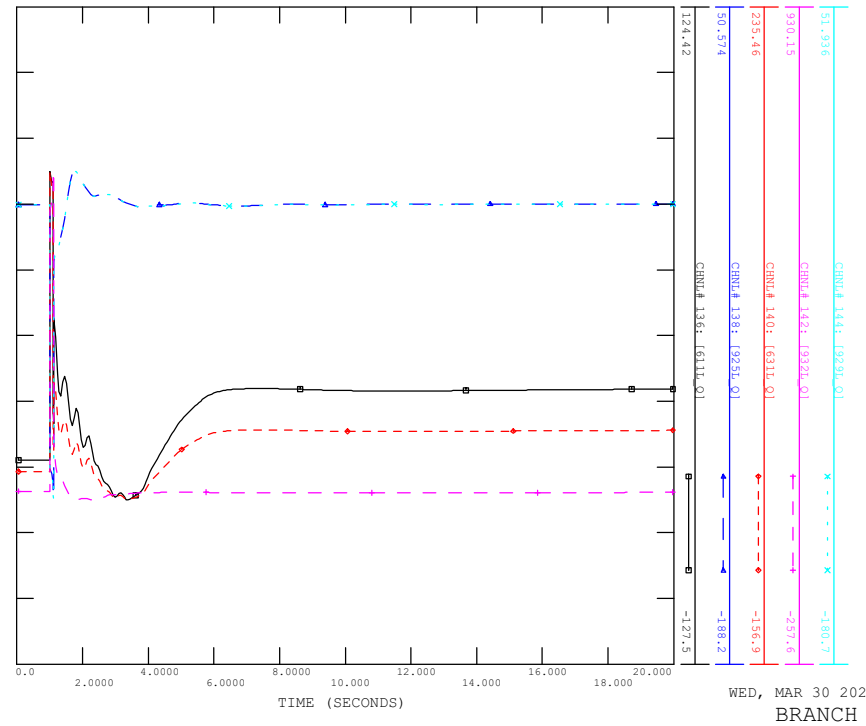


WED, MAR 30 2022 0:34
REACTIVE POWER

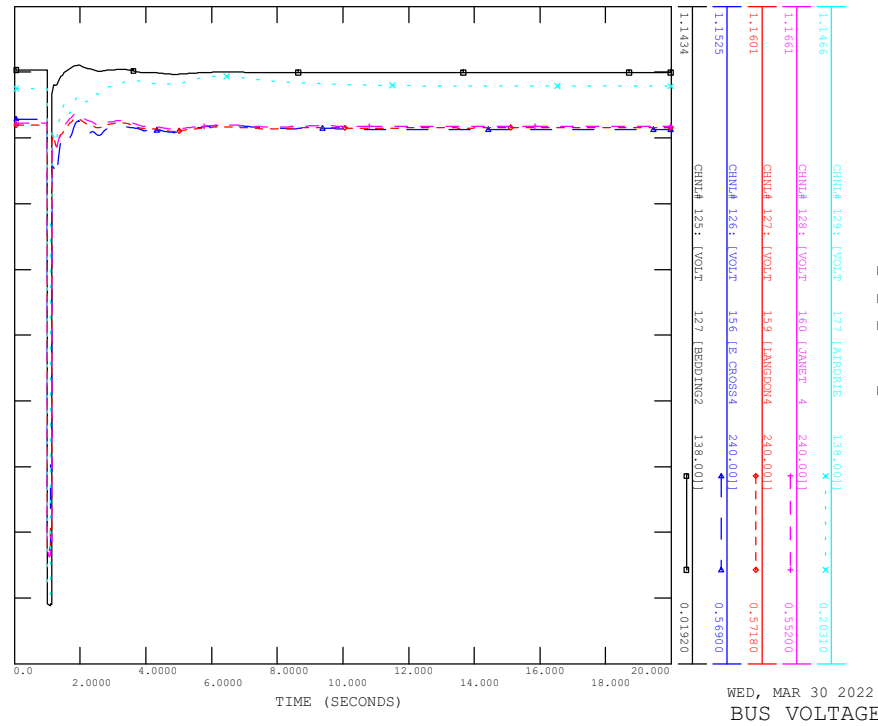
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CONTINGENCY -SCN4_SP_09_16281L_BALZAC
FILE: scn4_sp_09_16281L_Balzac.out



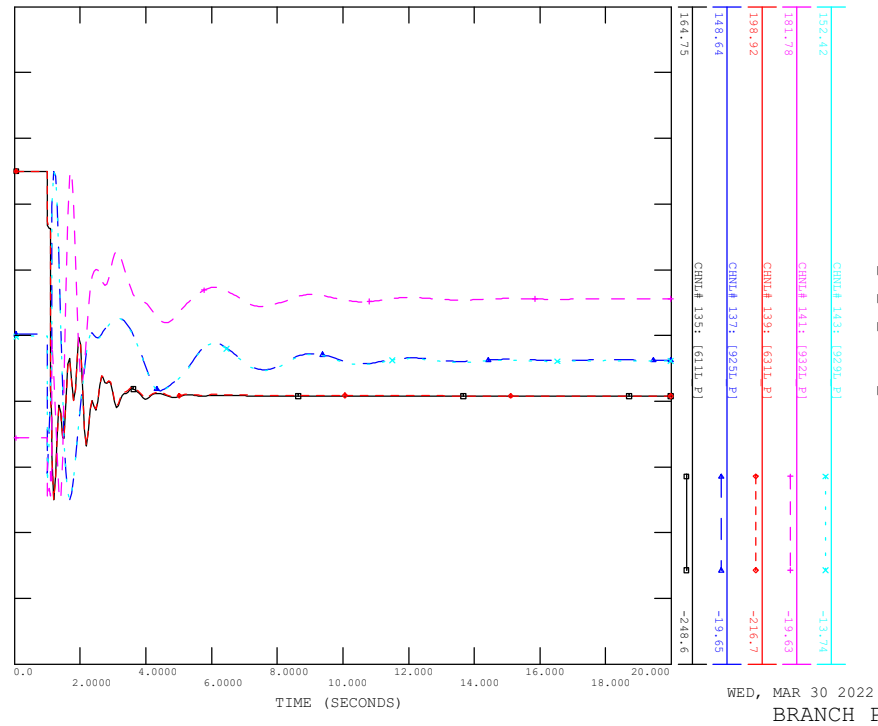
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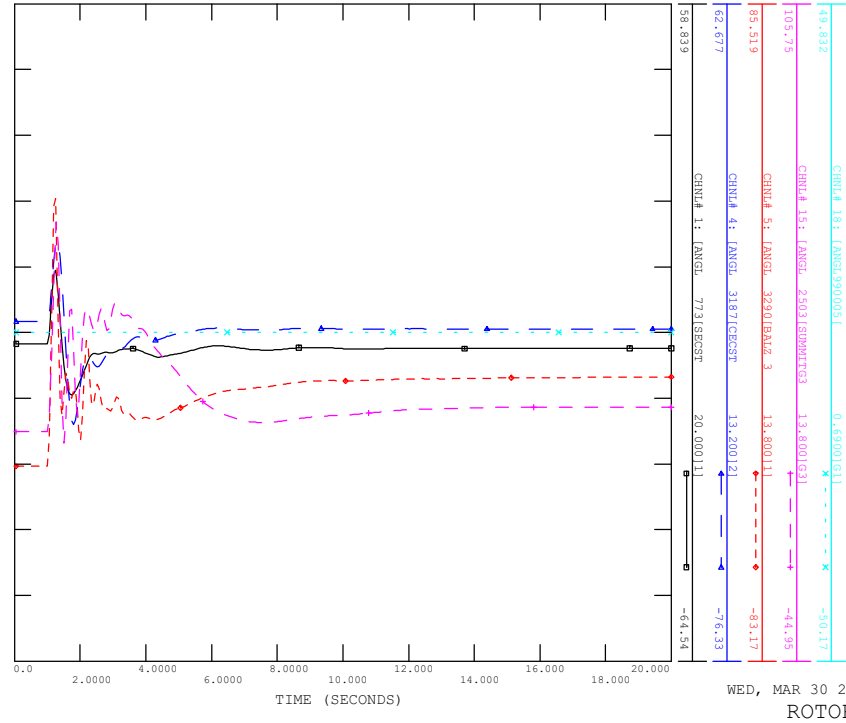
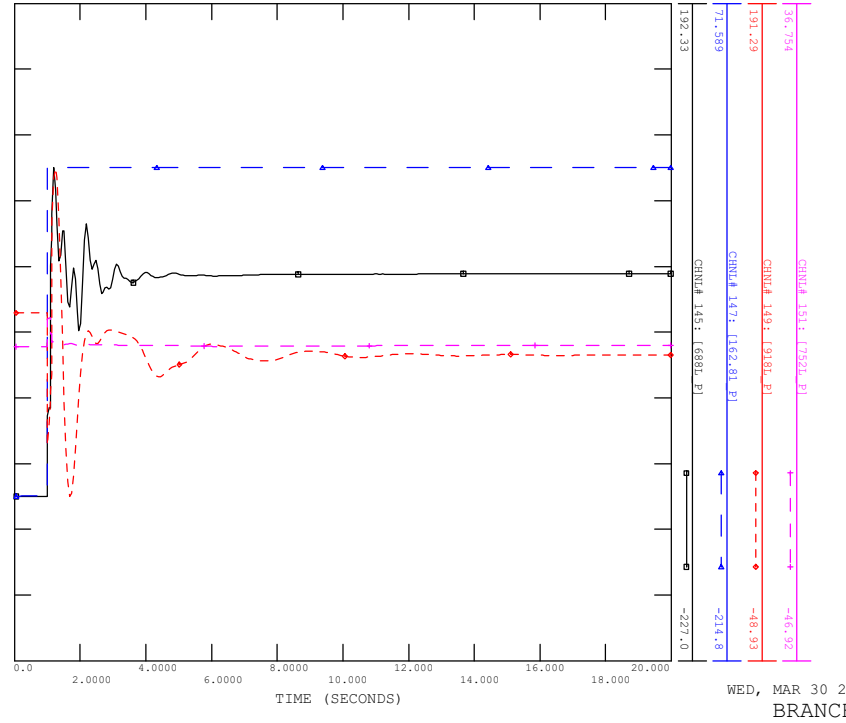
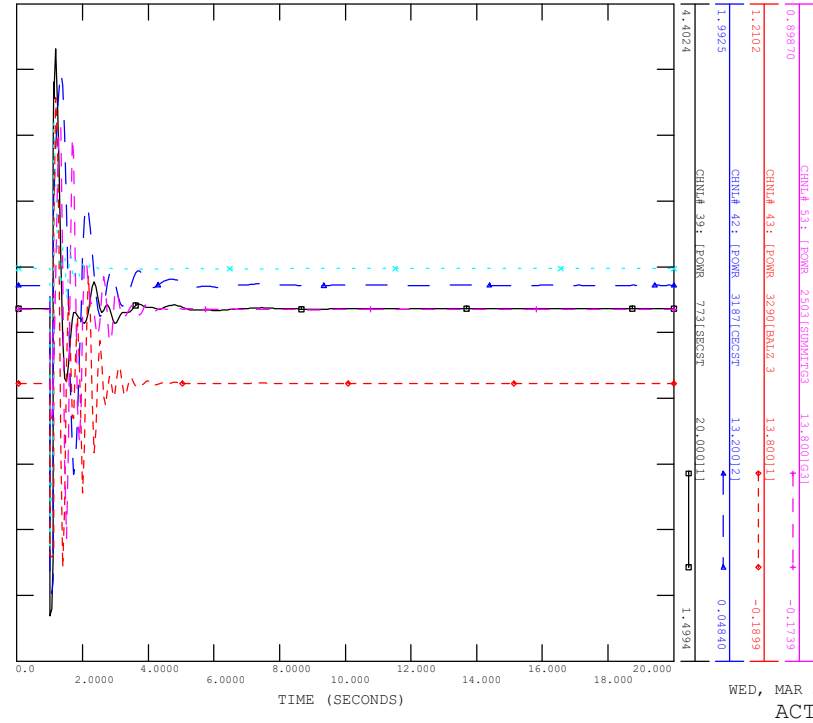
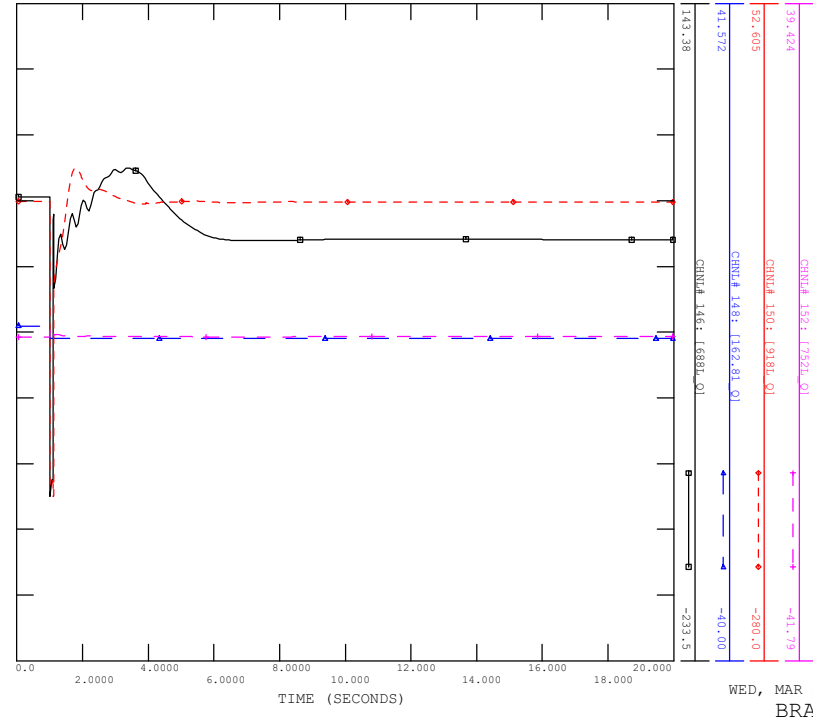


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_09_16281L_BALZAC
FILE: scn4_sp_09_16281L_Balzac.out

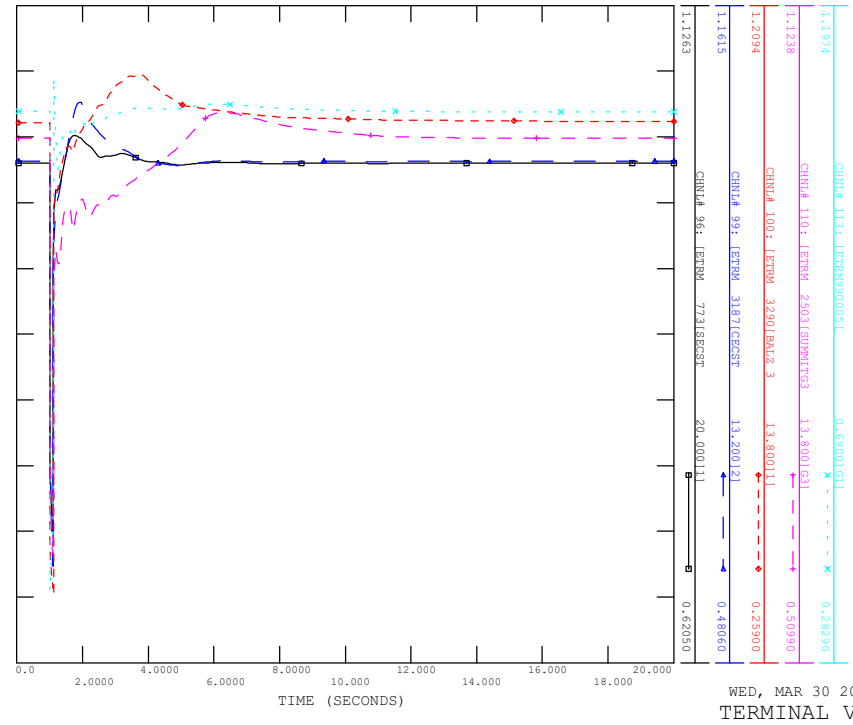


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_09_16281L_BALZAC
FILE: scn4_sp_09_16281L_Balzac.out



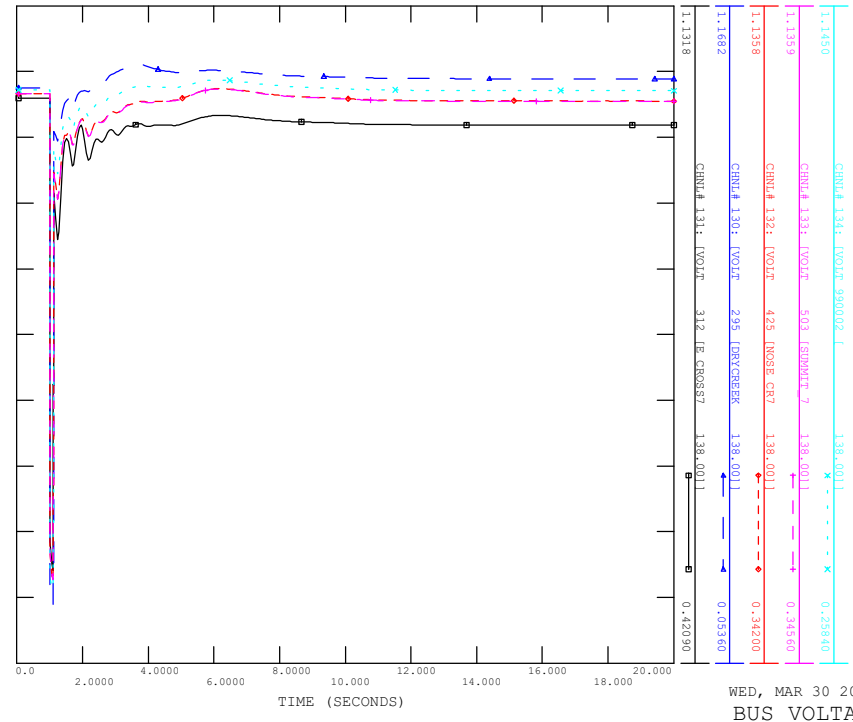


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_10_16281L_BEDDINGTON
FILE: scn4_sp_10_16281L_Beddington.out



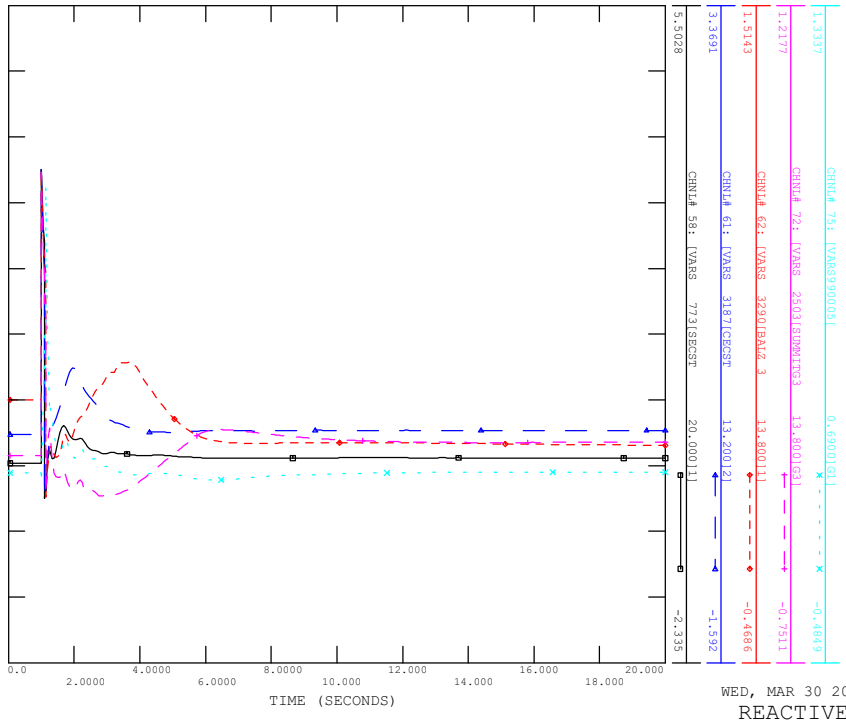
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_10_16281L_BEDDINGTON
FILE: scn4_sp_10_16281L_Beddington.out



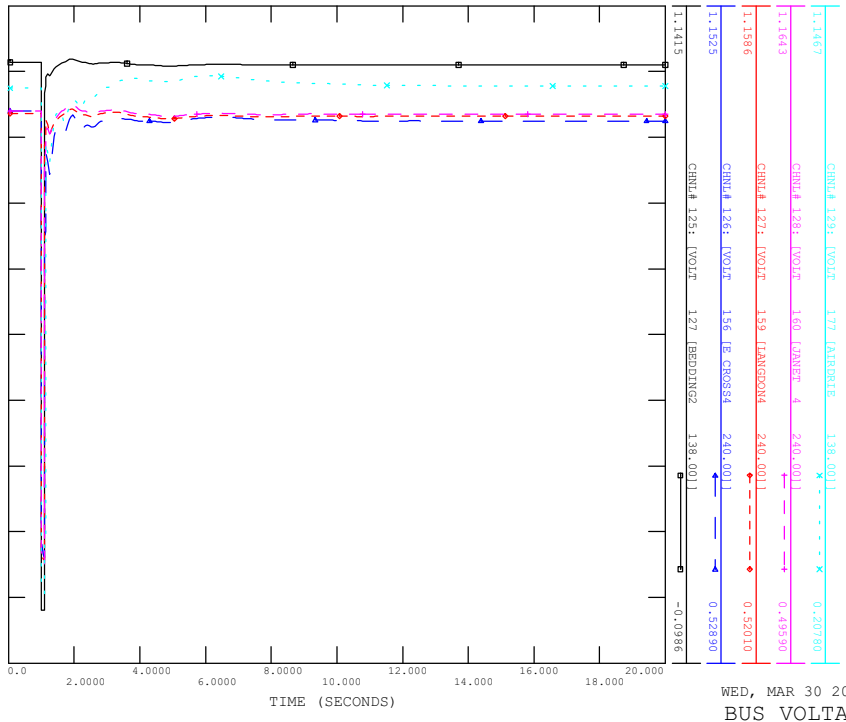
WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_10_16281L_BEDDINGTON
FILE: scn4_sp_10_16281L_Beddington.out



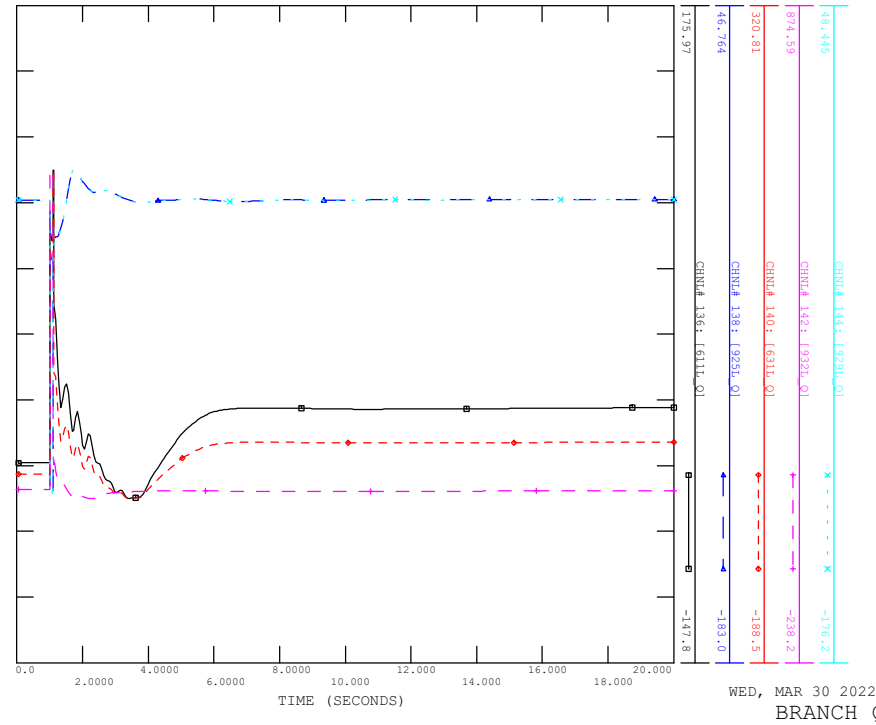
WED, MAR 30 2022 0:34
REACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_10_16281L_BEDDINGTON
FILE: scn4_sp_10_16281L_Beddington.out

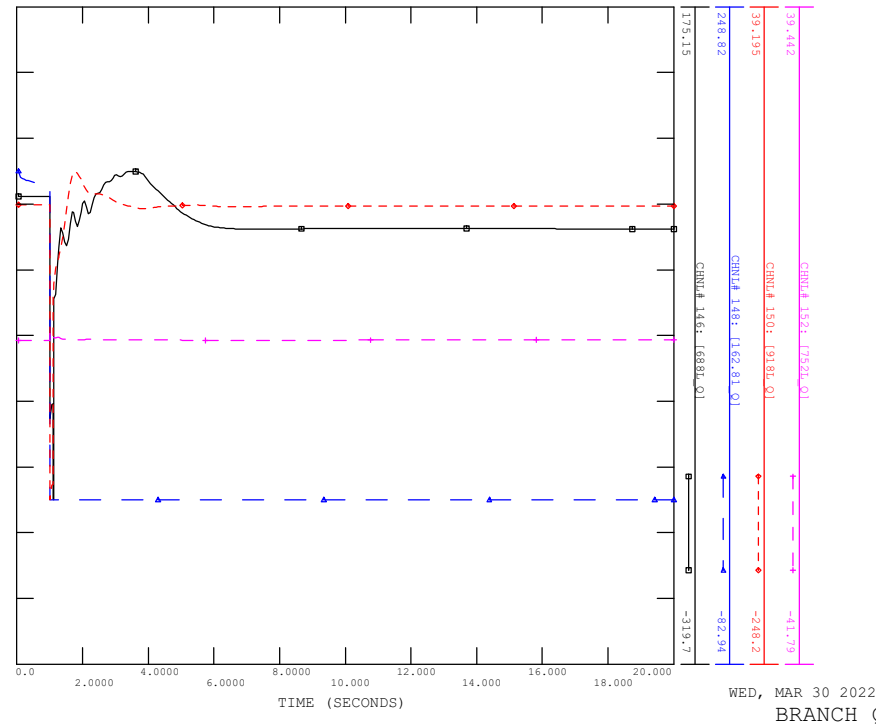


WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

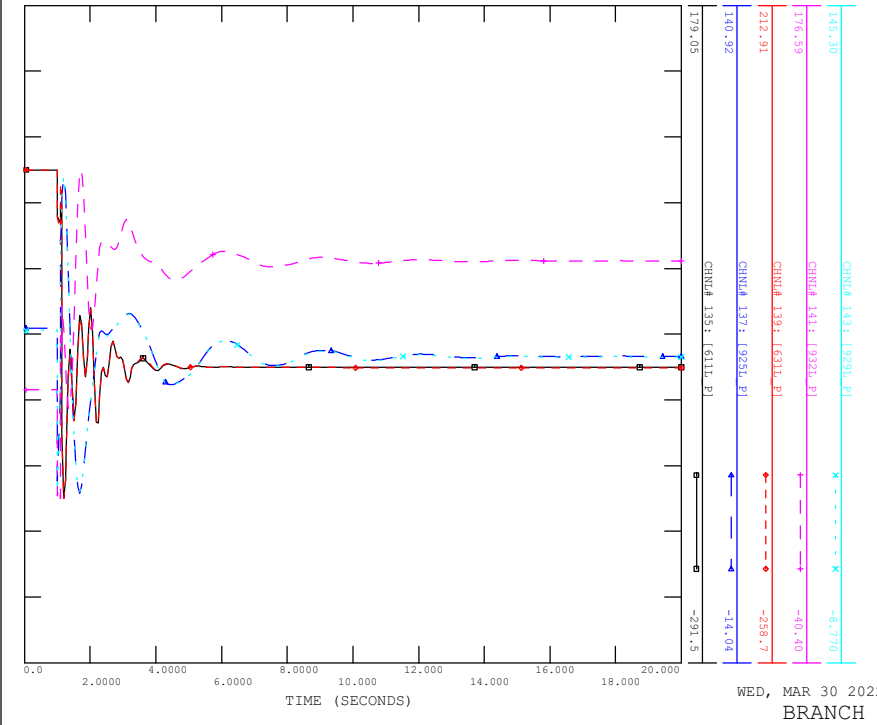
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_10_16281L_BEDDINGTON
FILE: scn4_sp_10_16281L_Beddington.out



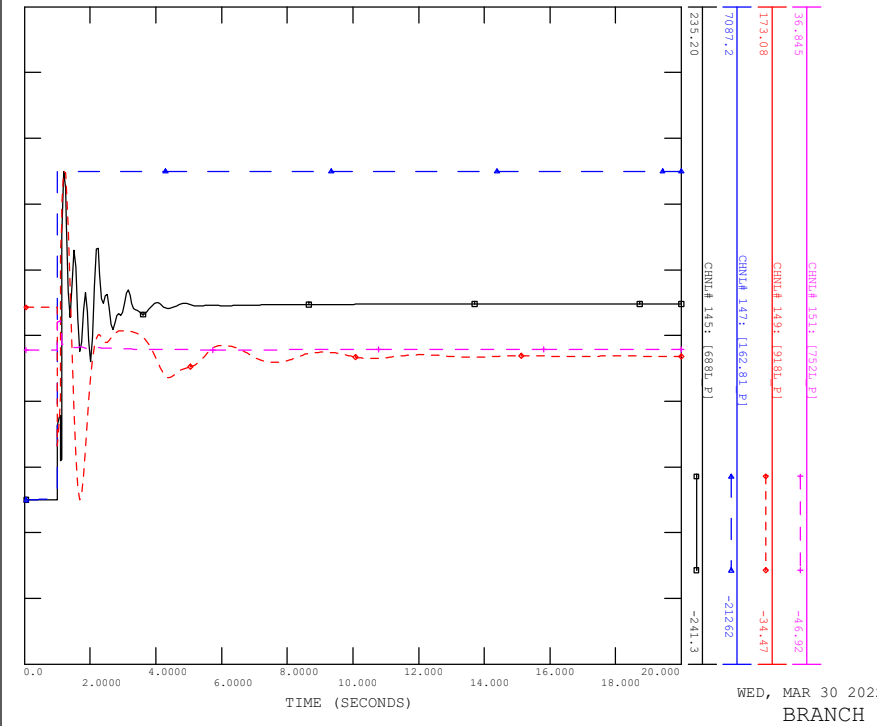
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_10_16281L_BEDDINGTON
FILE: scn4_sp_10_16281L_Beddington.out



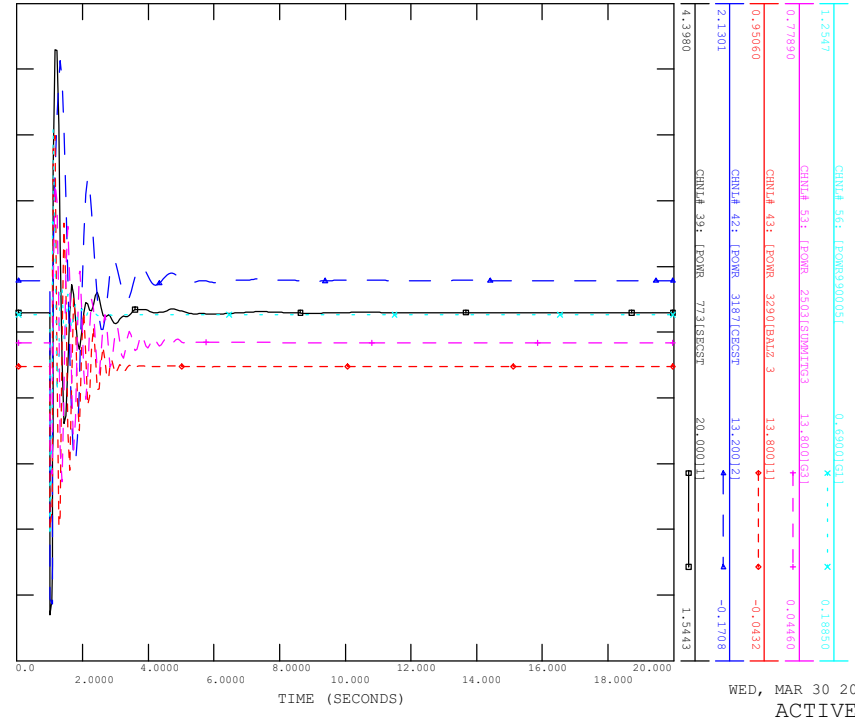
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_10_16281L_BEDDINGTON
FILE: scn4_sp_10_16281L_Beddington.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_10_16281L_BEDDINGTON
FILE: scn4_sp_10_16281L_Beddington.out

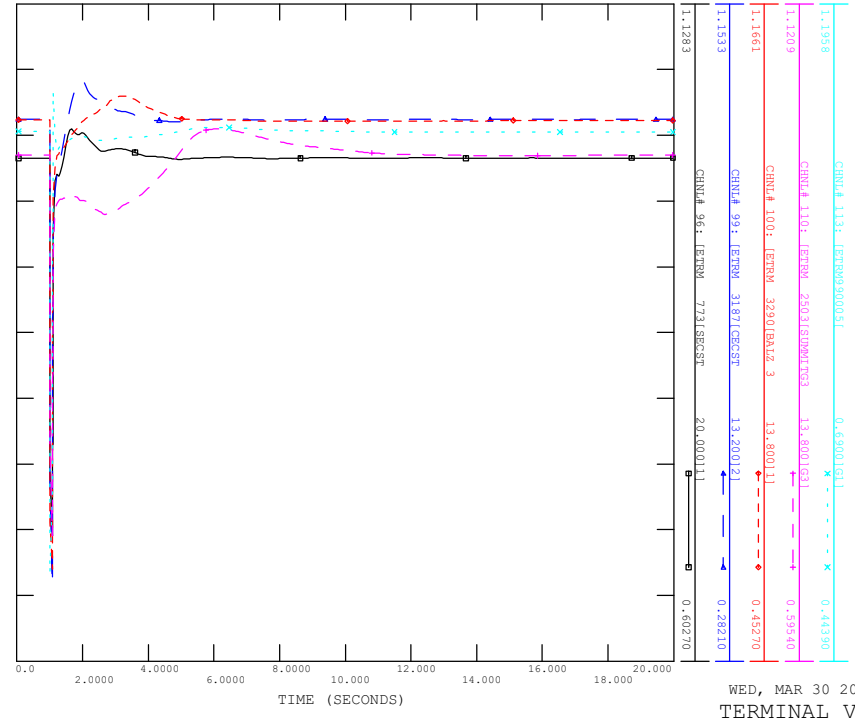


FILE: scn4_sp_11_932L_Janet.out



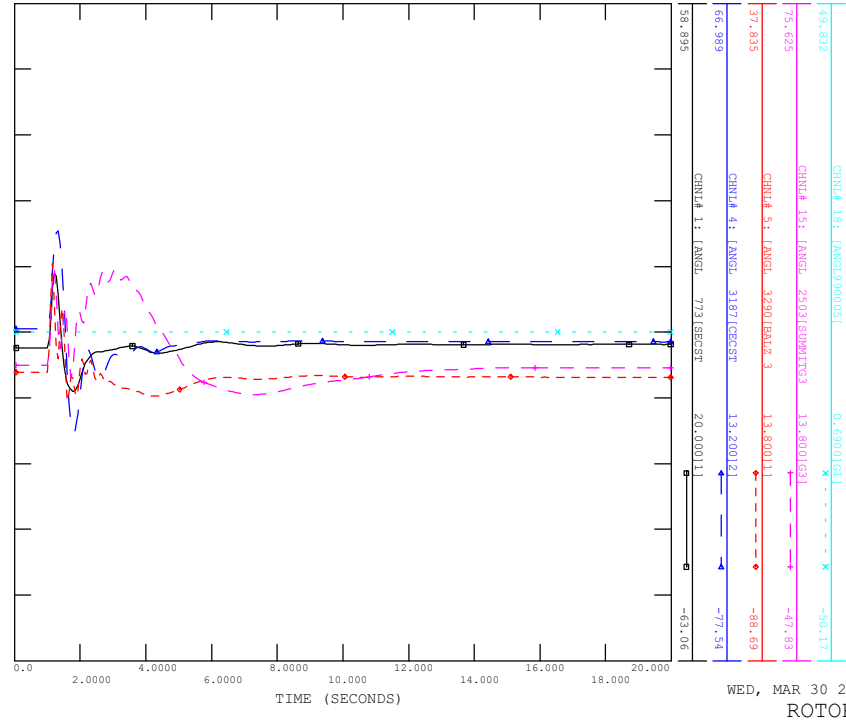
WED, MAR 30 2022 0:34
ACTIVE POWER

FILE: scn4_sp_11_932L_Janet.out



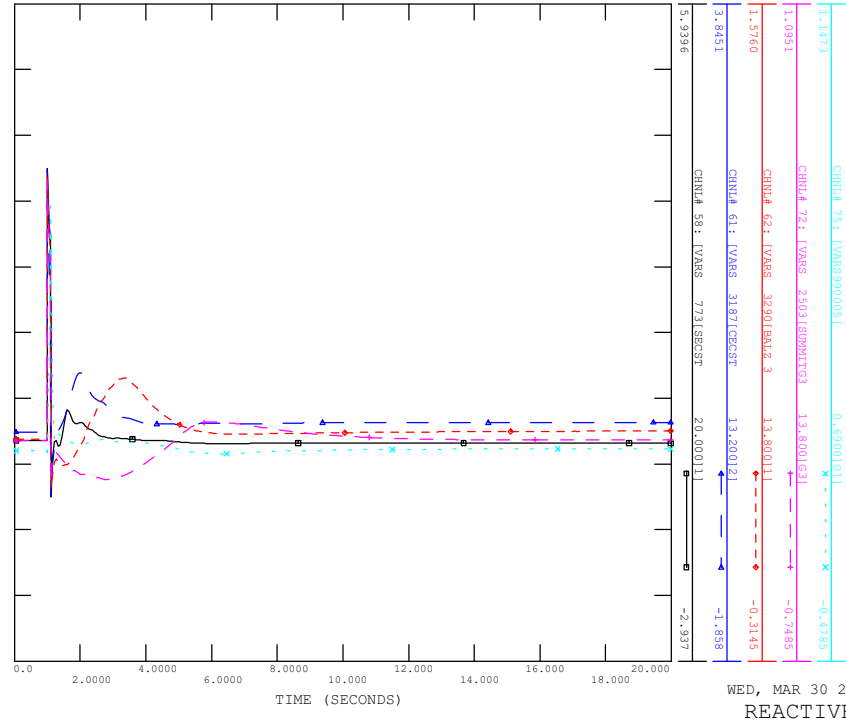
WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

FILE: scn4_sp_11_932L_Janet.out



WED, MAR 30 2022 0:34
ROTOR ANGLE

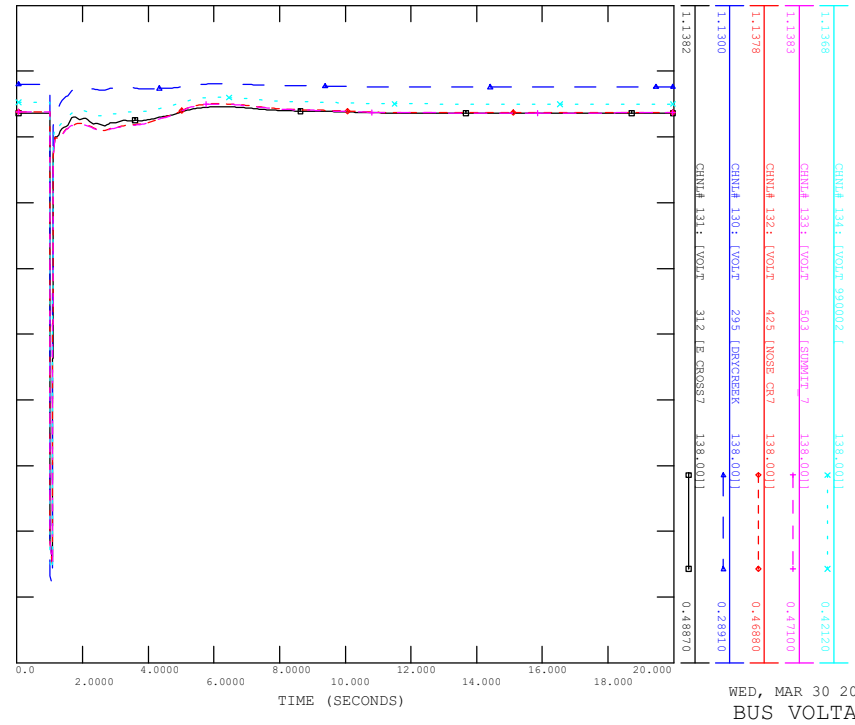
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WED, MAR 30 2022 0:34
REACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_11_932L_JANBT

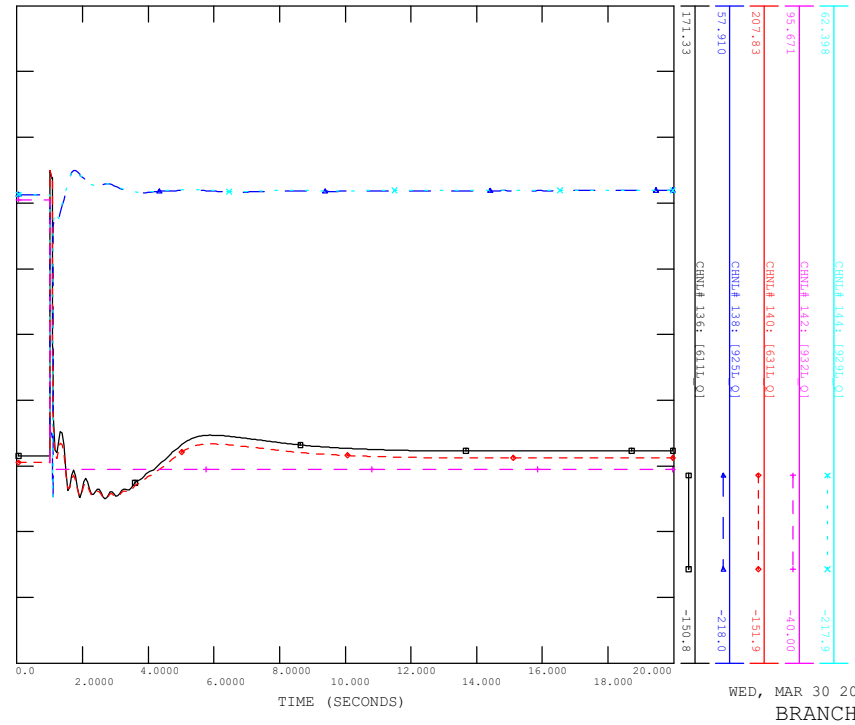
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WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_11_932L_JANBT

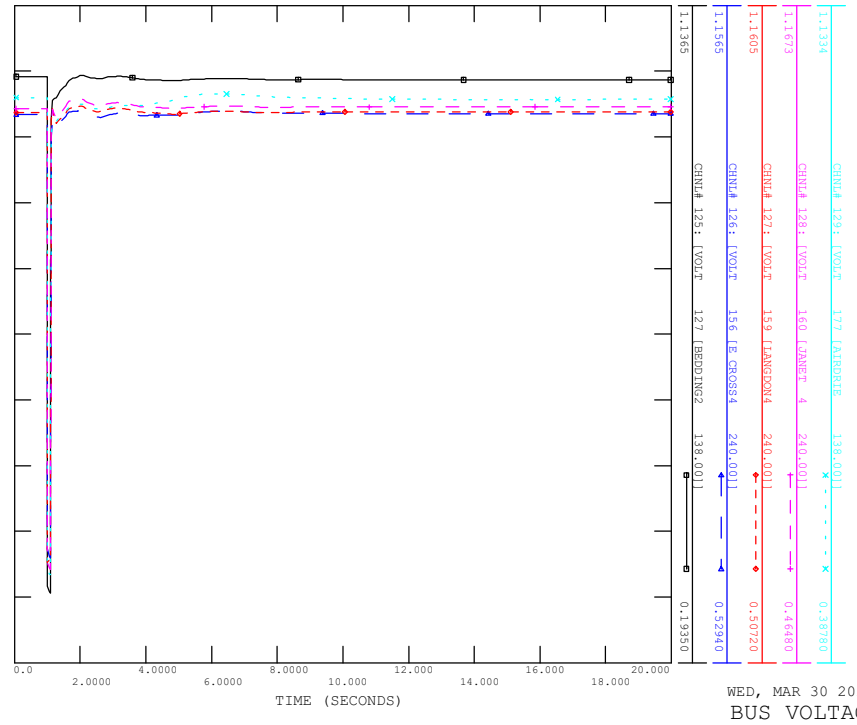
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WED, MAR 30 2022 0:34
BRANCH Q (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_11_932L_JANBT

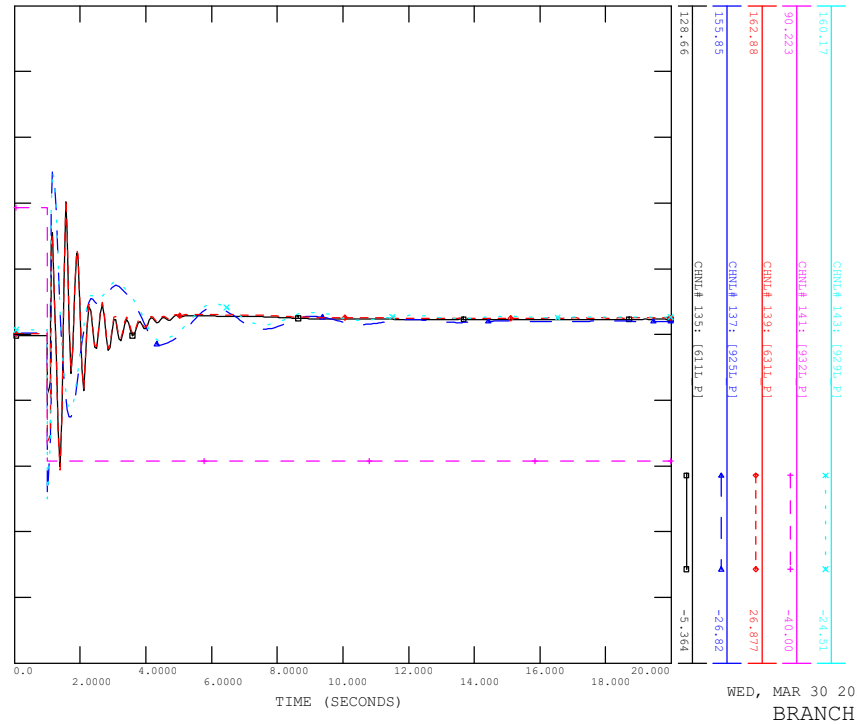
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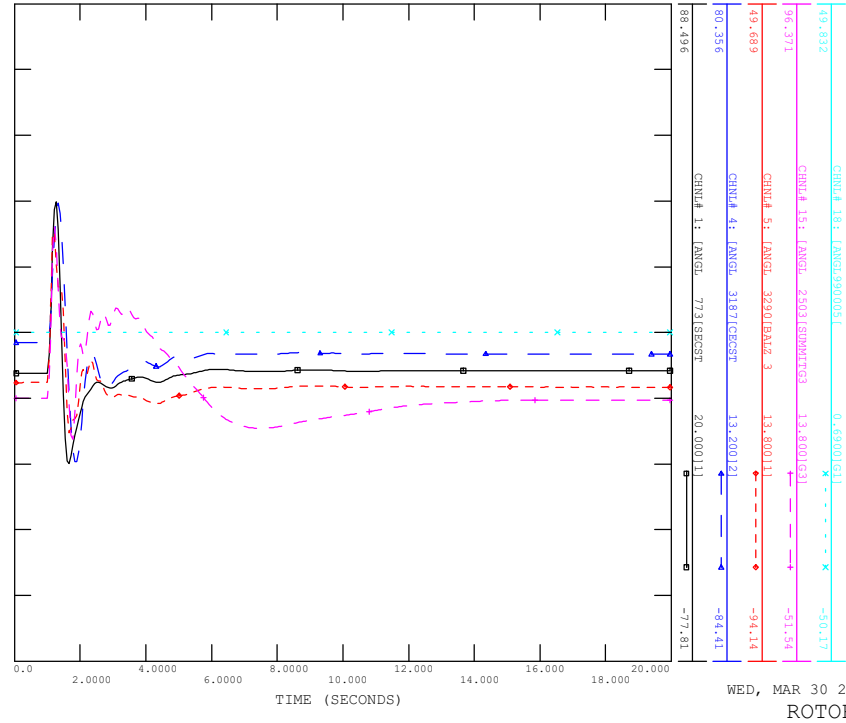
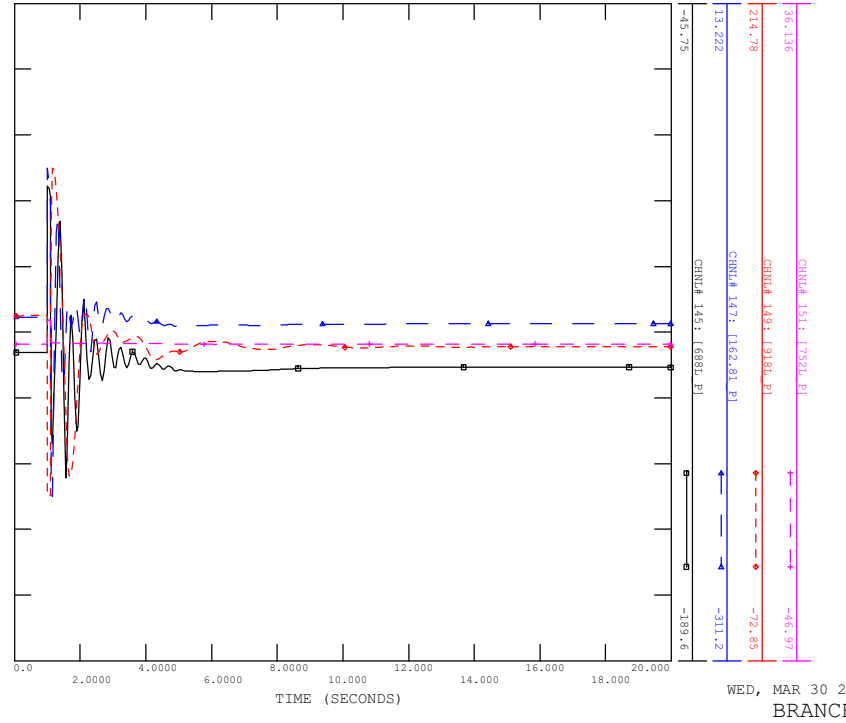
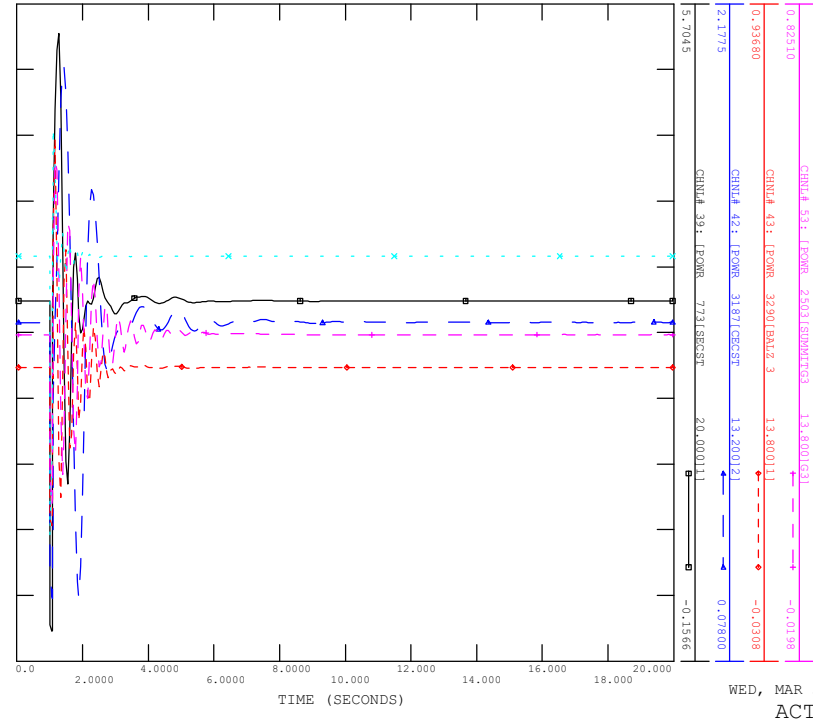
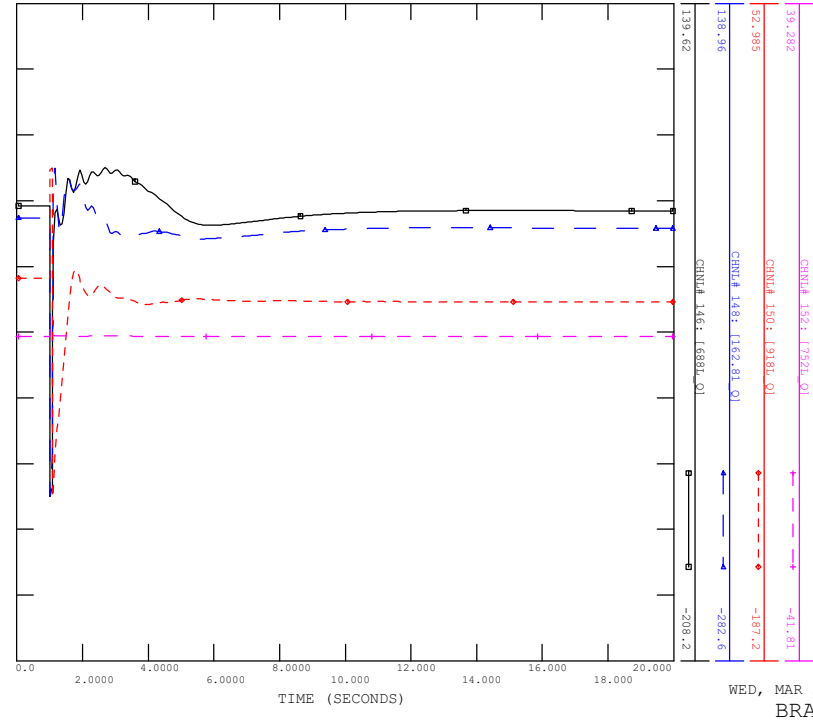
WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_11_932L_JANBT

FILE: scn4_sp_11_932L_Janet.out

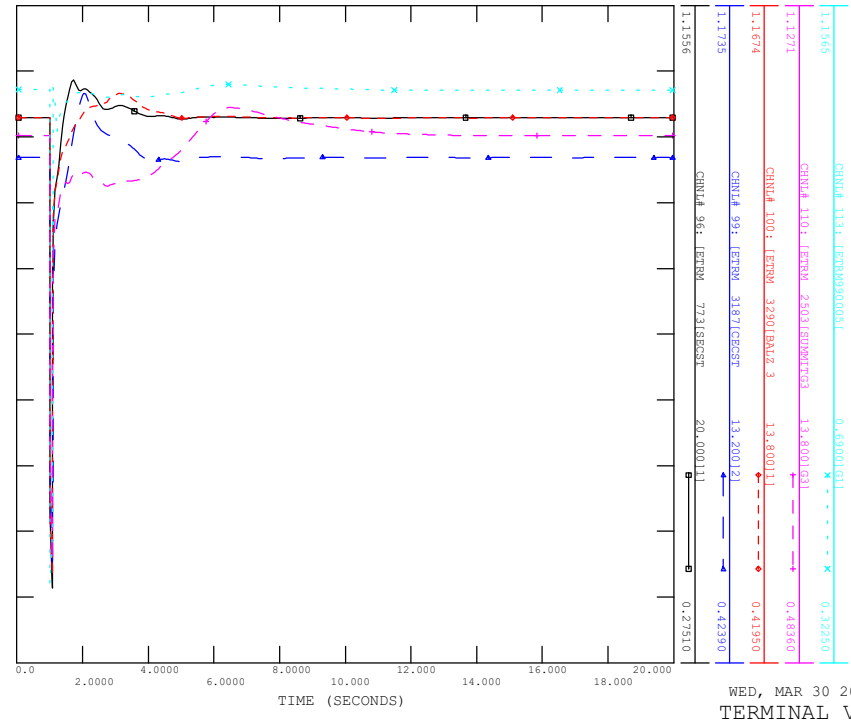


WED, MAR 30 2022 0:34
BRANCH P (1)



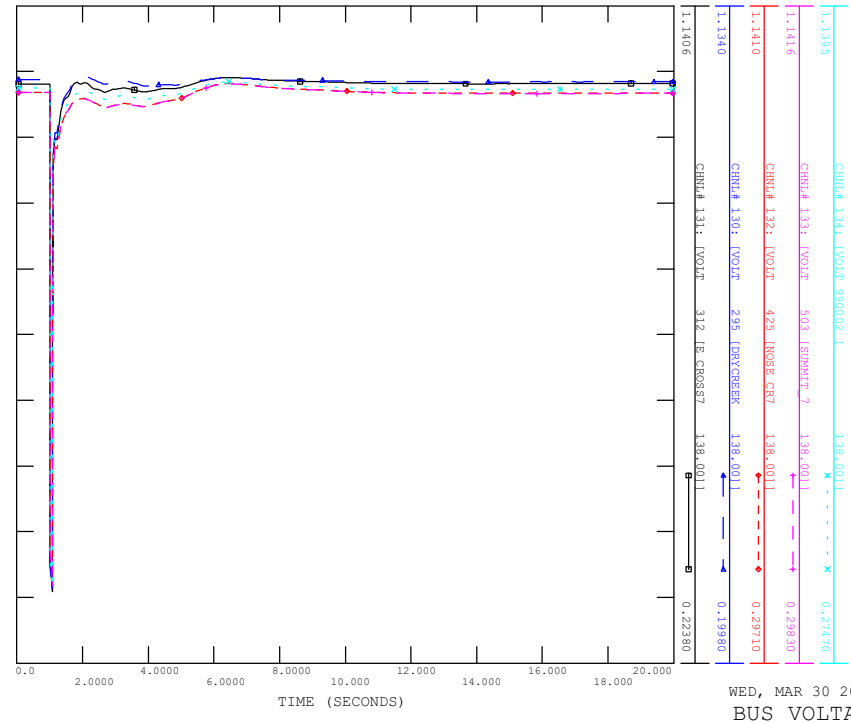
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_12_932L_BEDDINGTON

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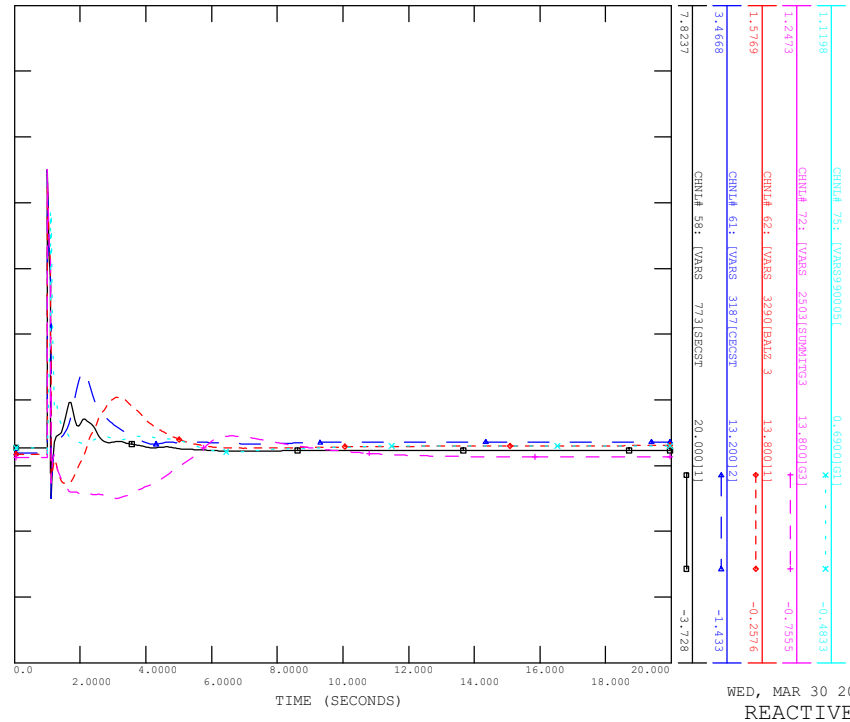
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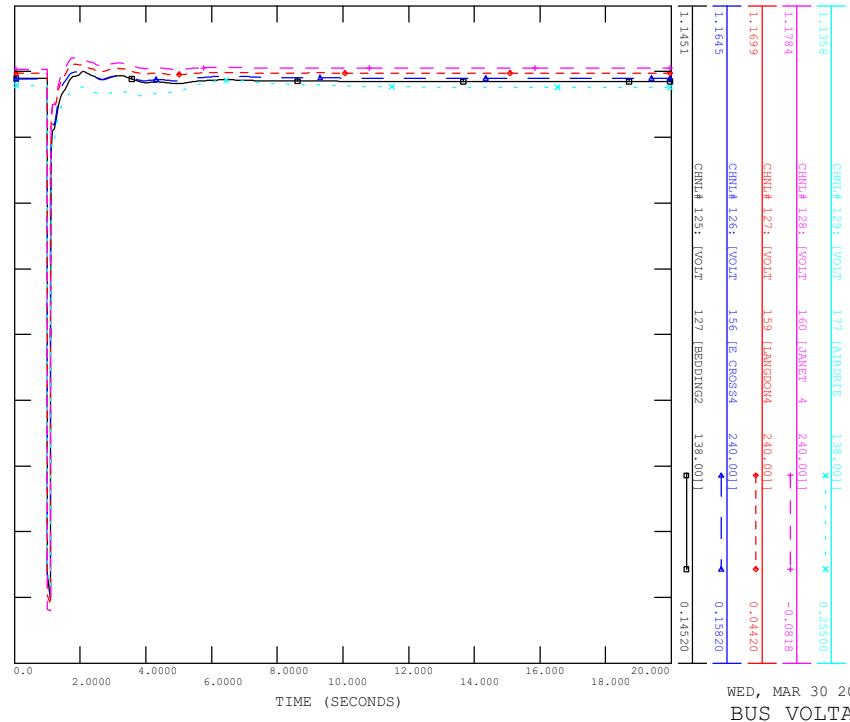
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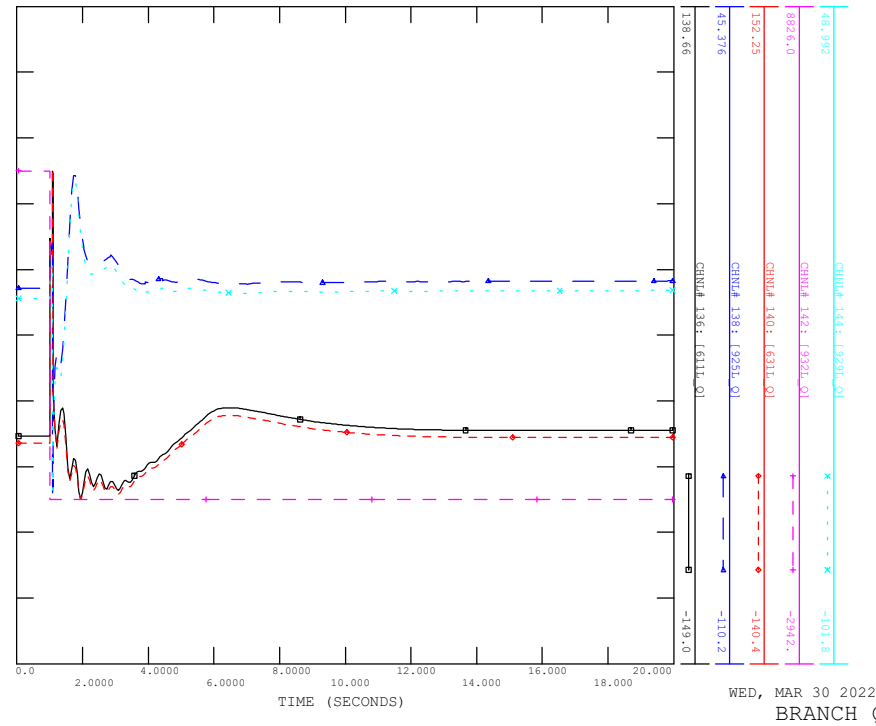


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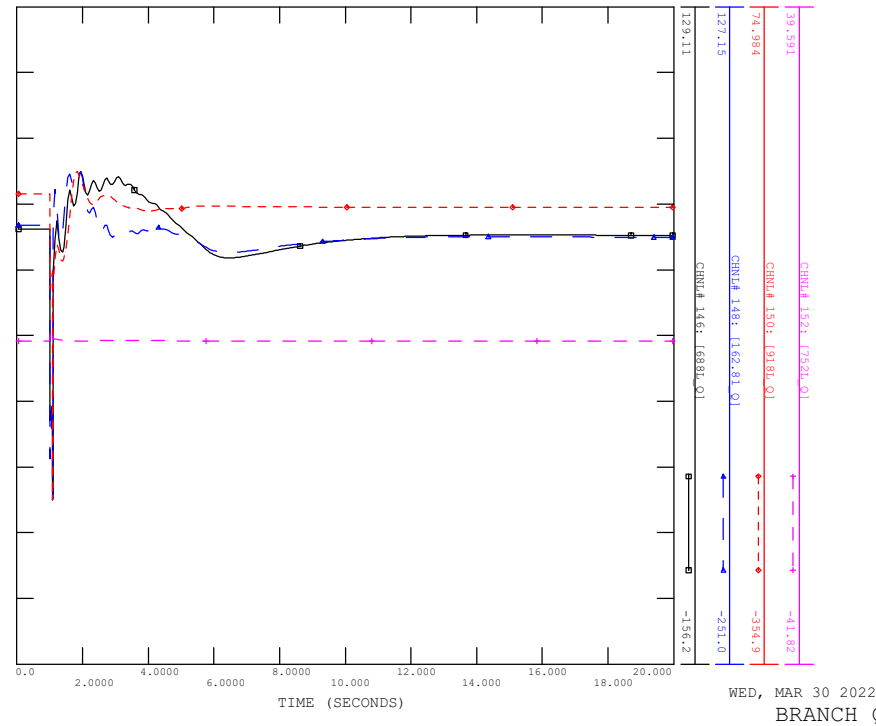


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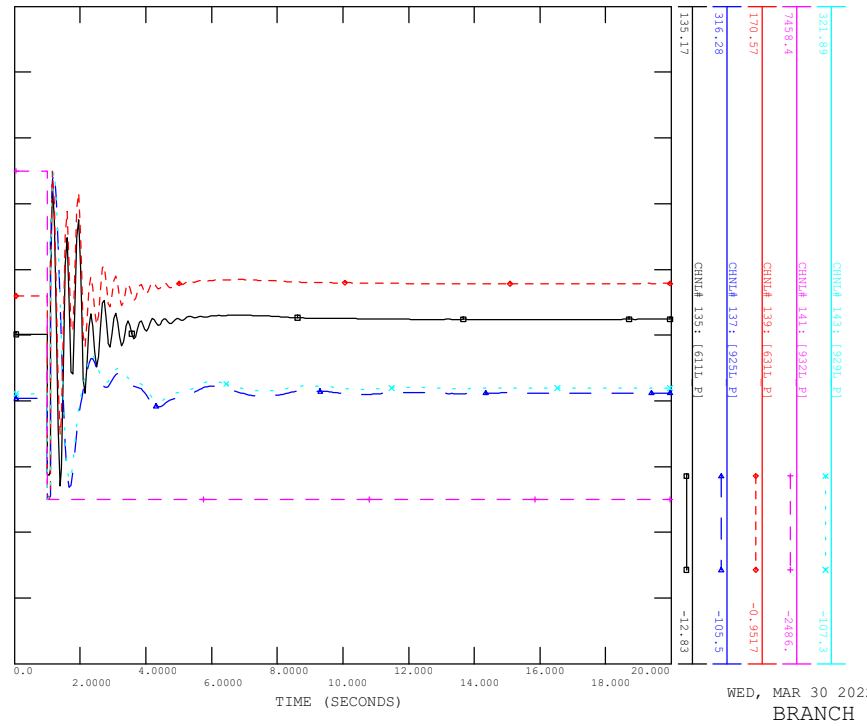
WED, MAR 30 2022 0:34
BRANCH Q (1)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_12_932L_BEDDINGTON
FILE: scn4_sp_12_932L_Beddington.out



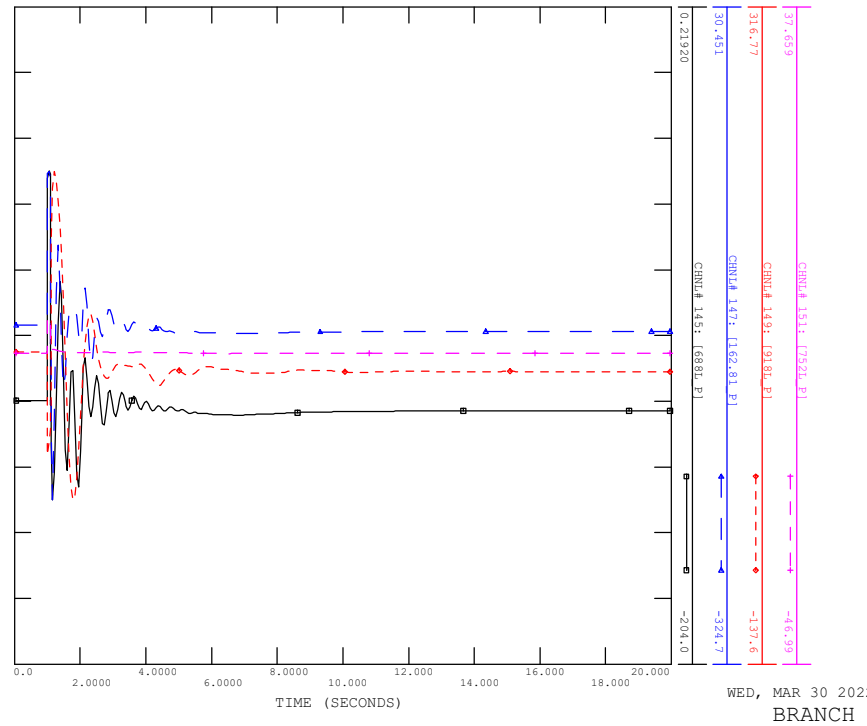
WED, MAR 30 2022 0:34
BRANCH Q (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_12_932L_BEDDINGTON
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WED, MAR 30 2022 0:34
BRANCH P (1)

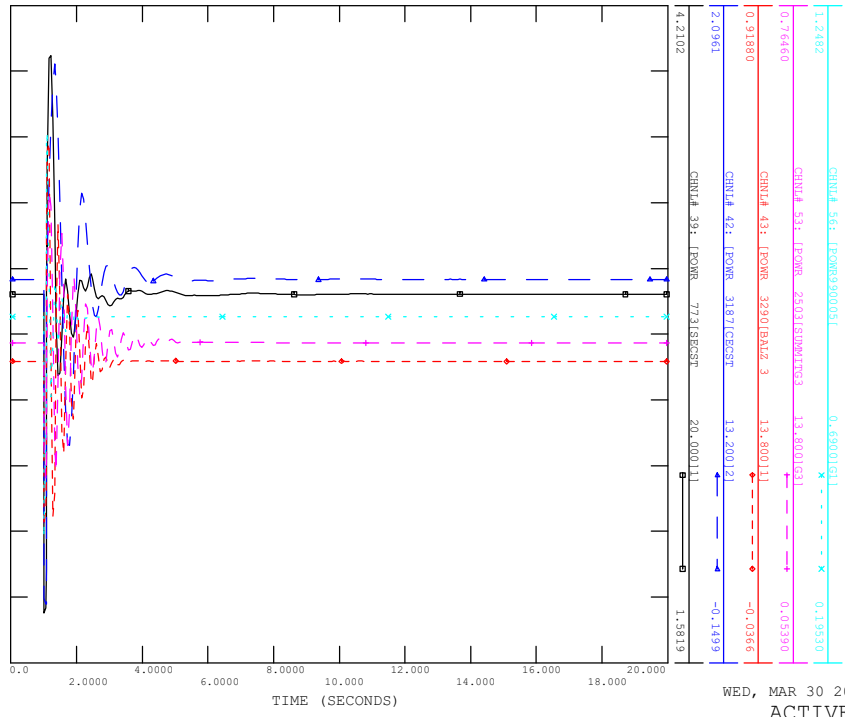
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WED, MAR 30 2022 0:34
BRANCH P (2)

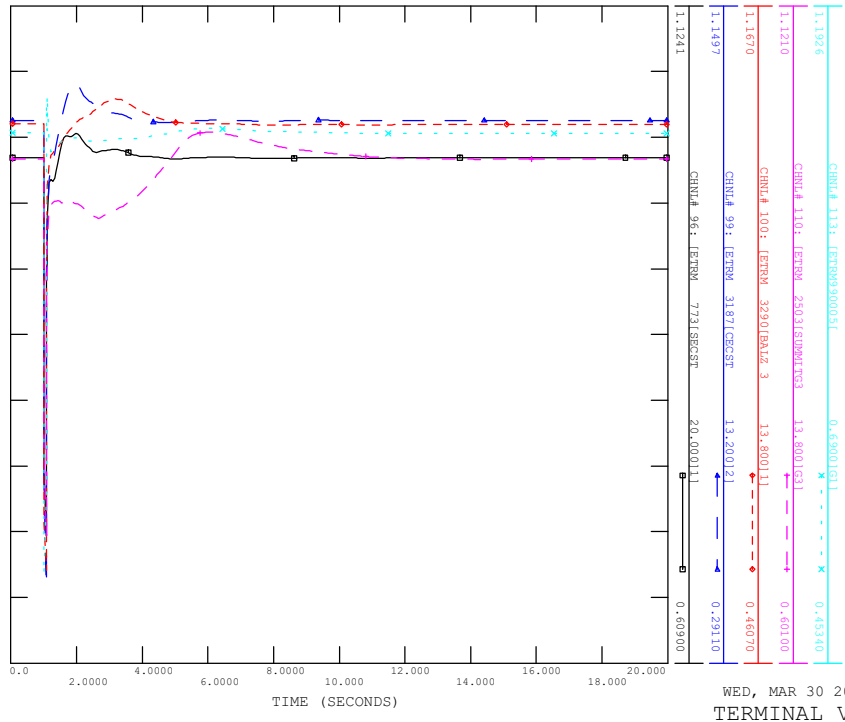
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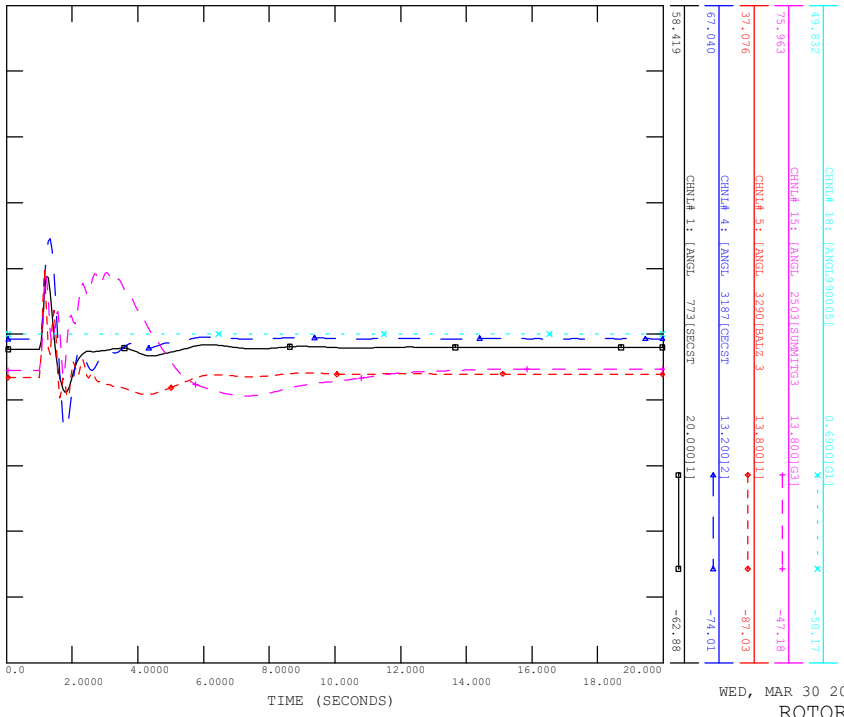
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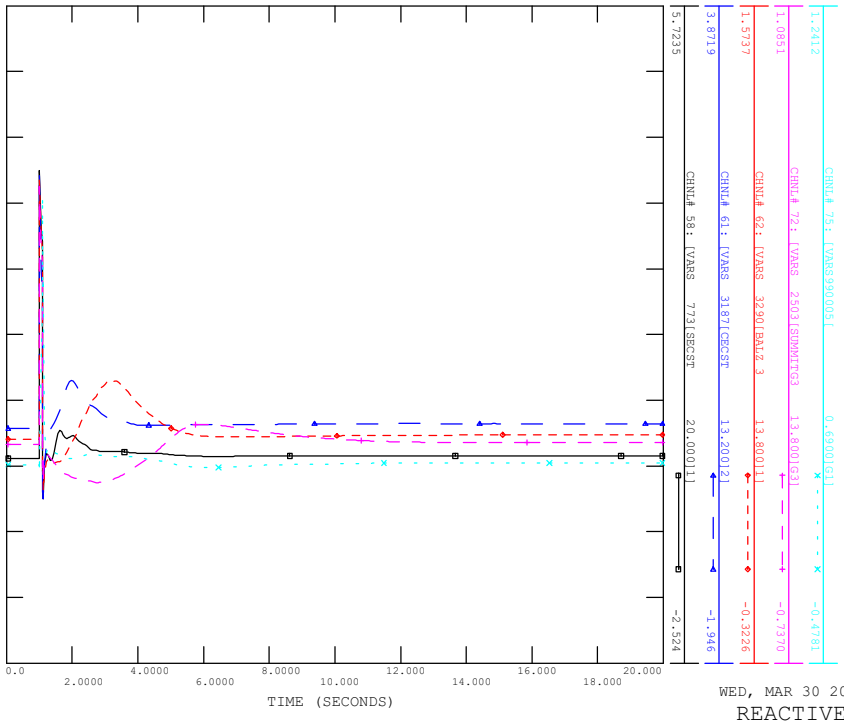
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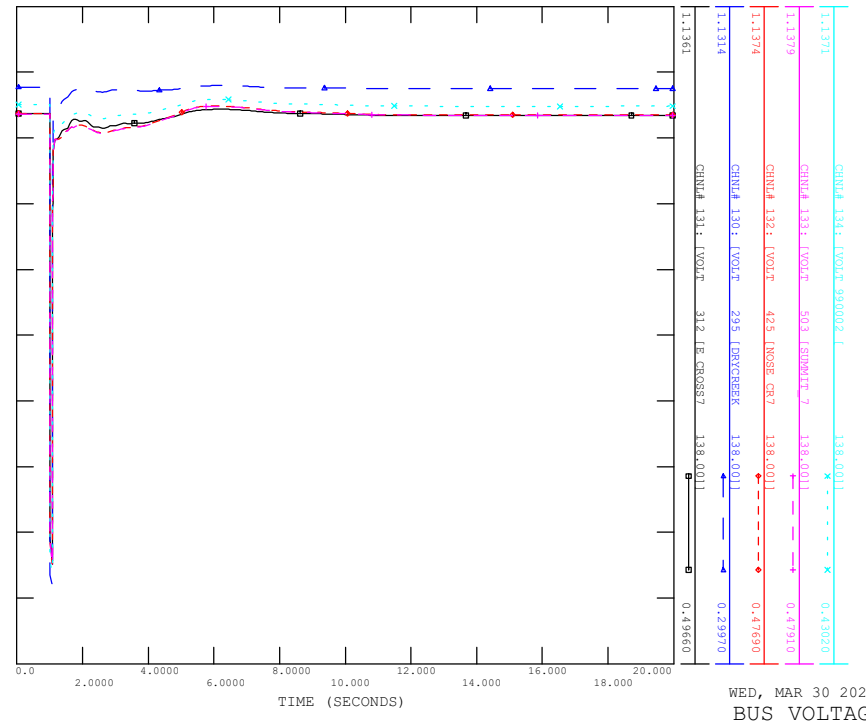


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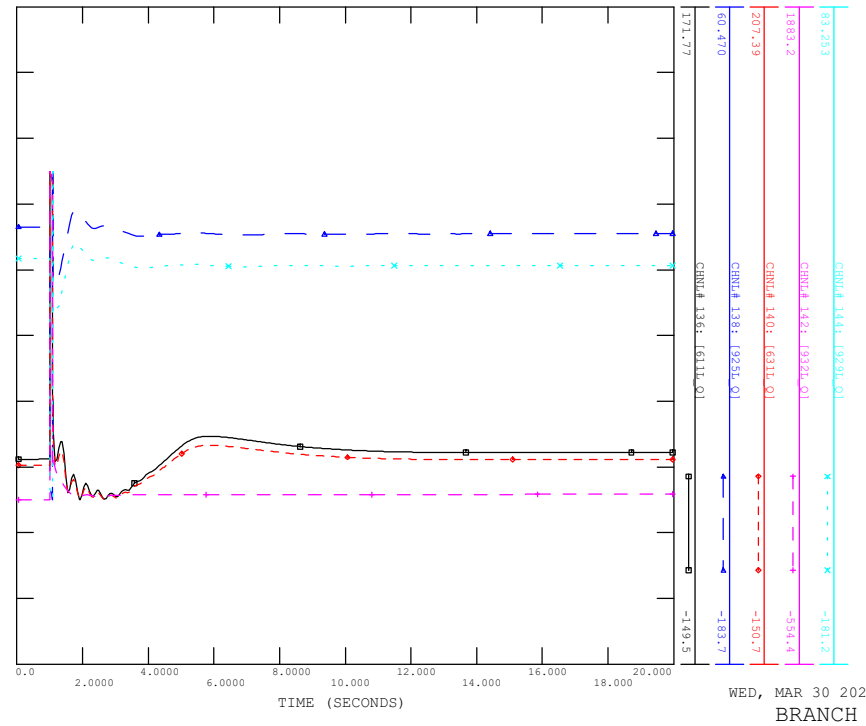
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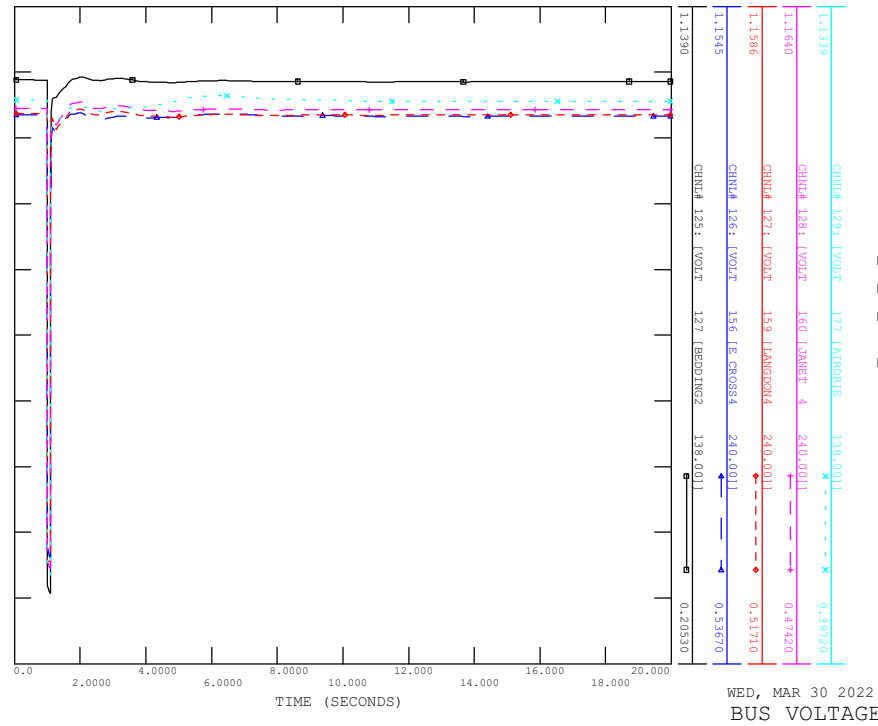
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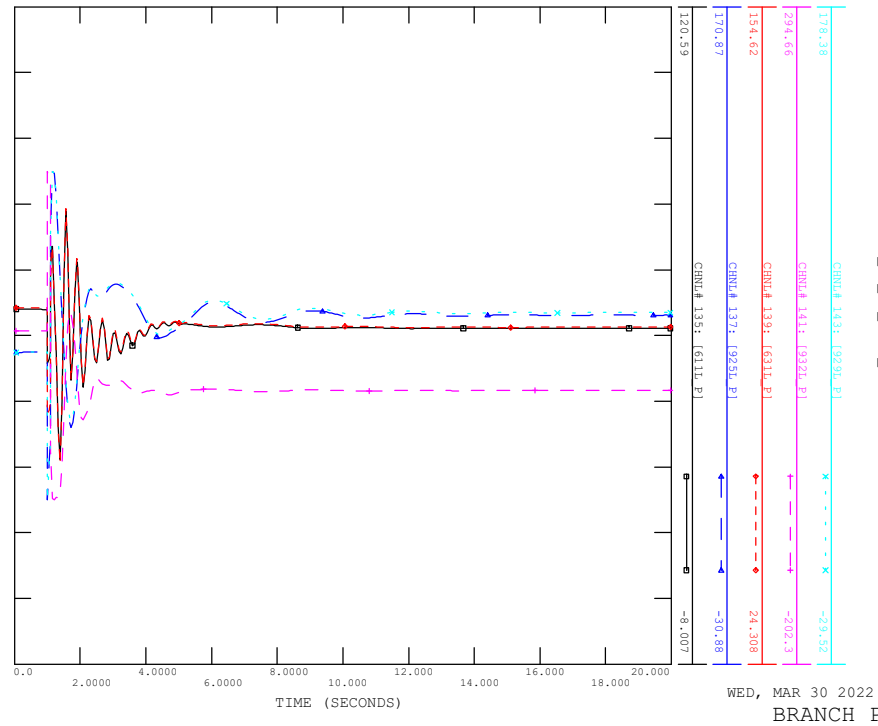
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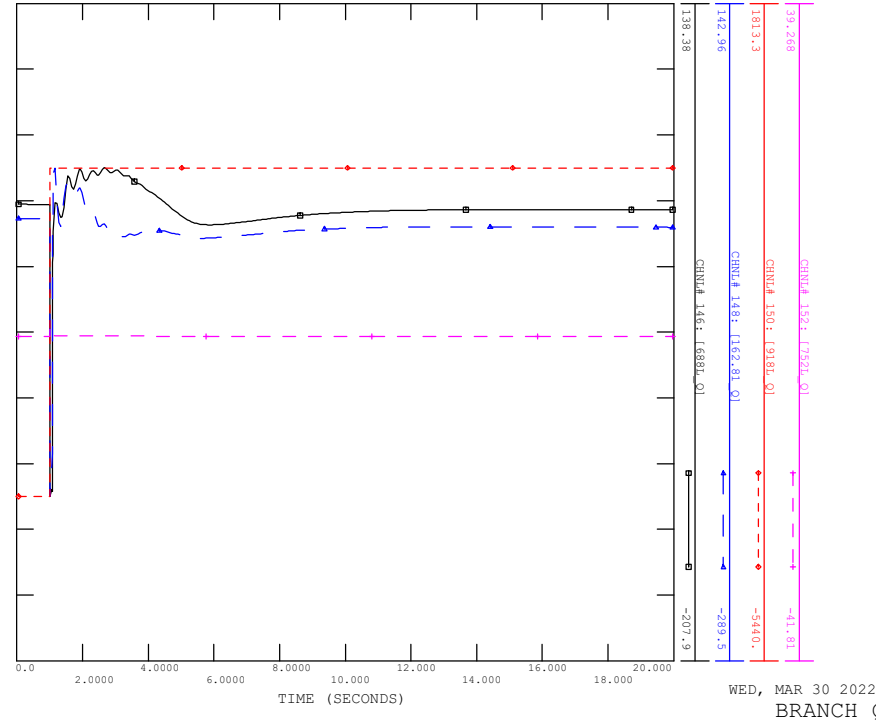
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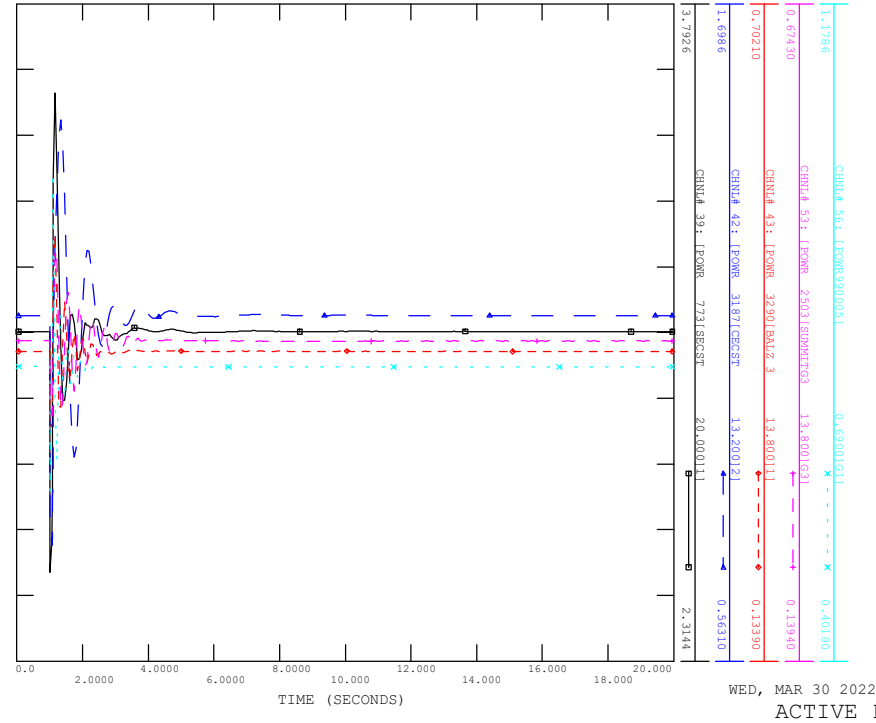
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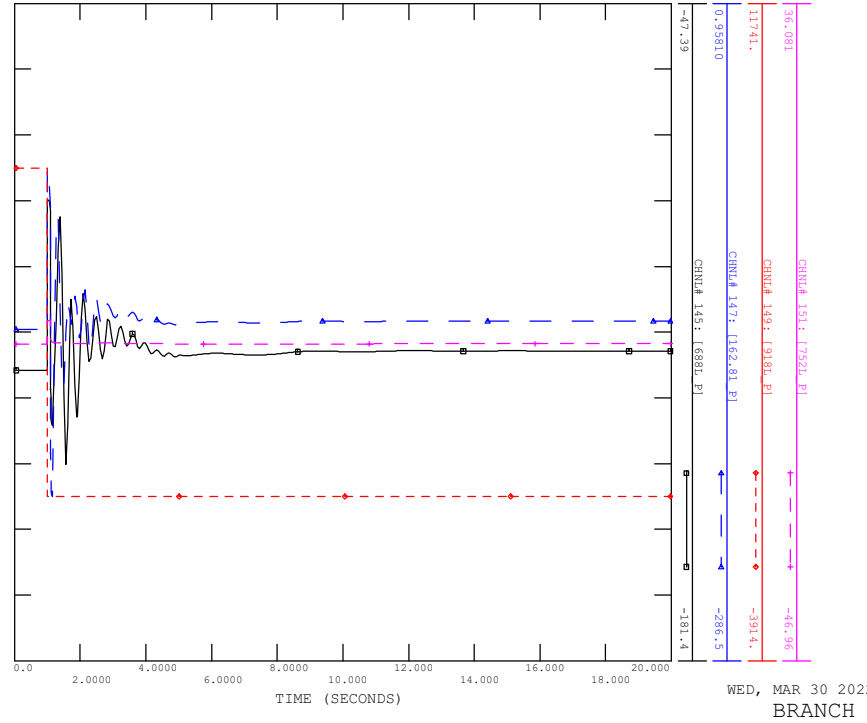
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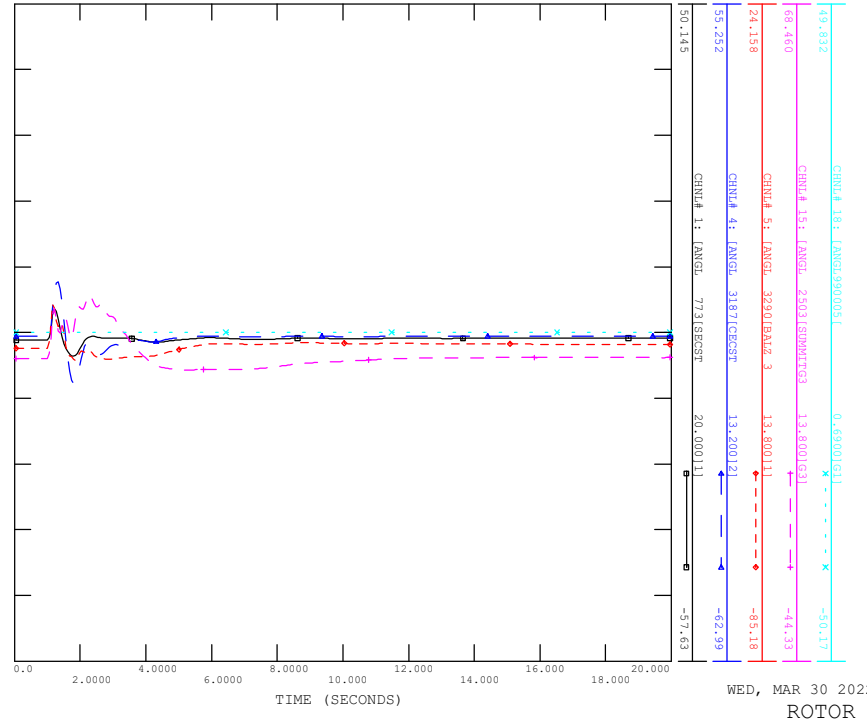
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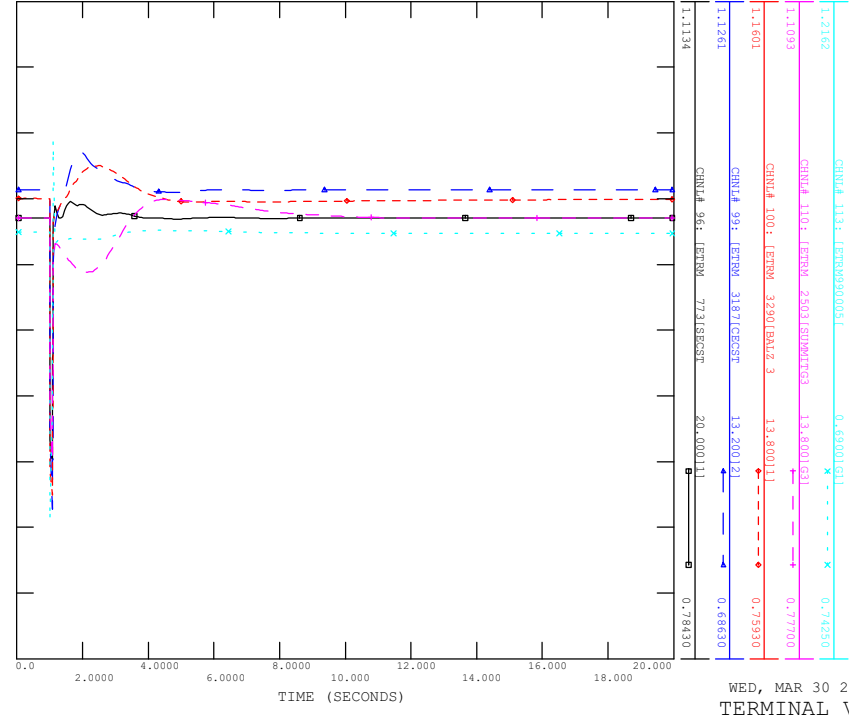
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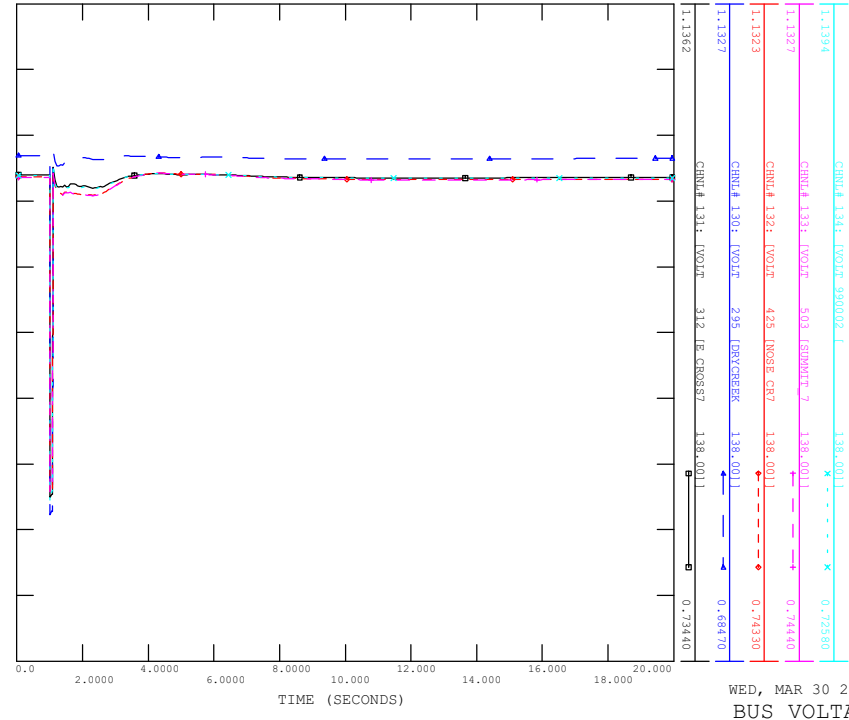
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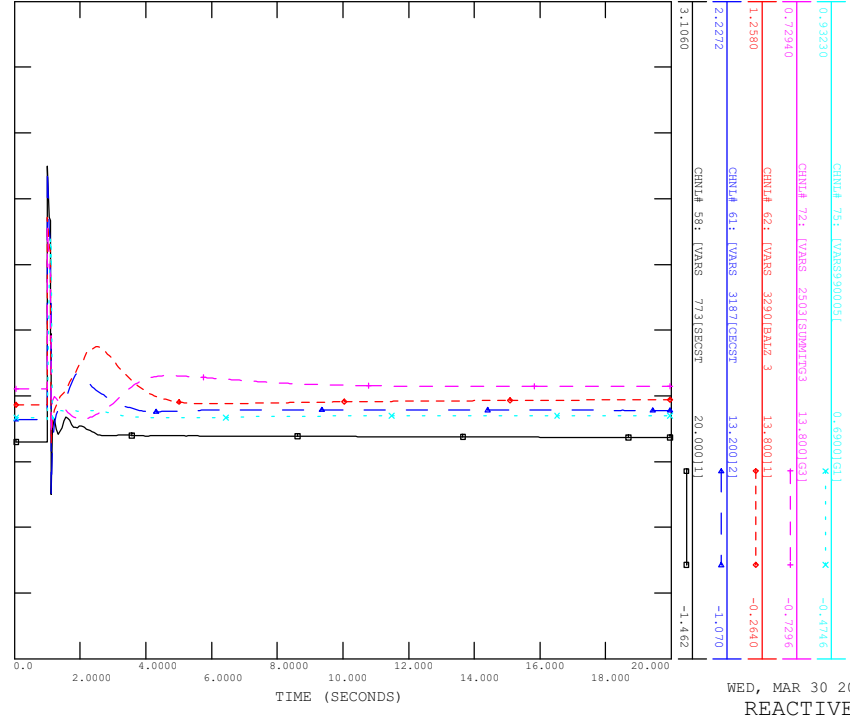
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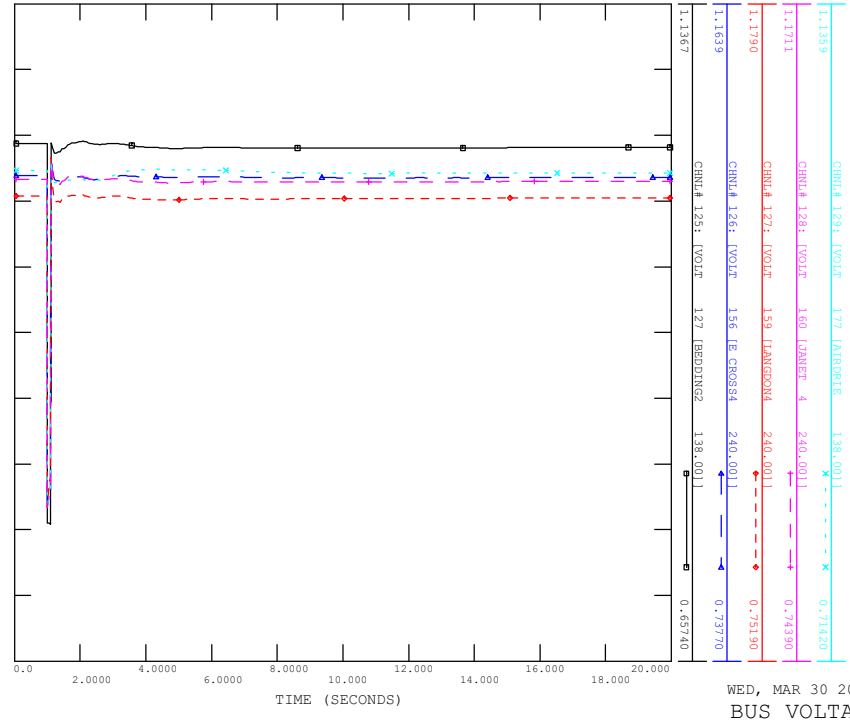
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FILE: scn4_sp_14_918L_johnson.out



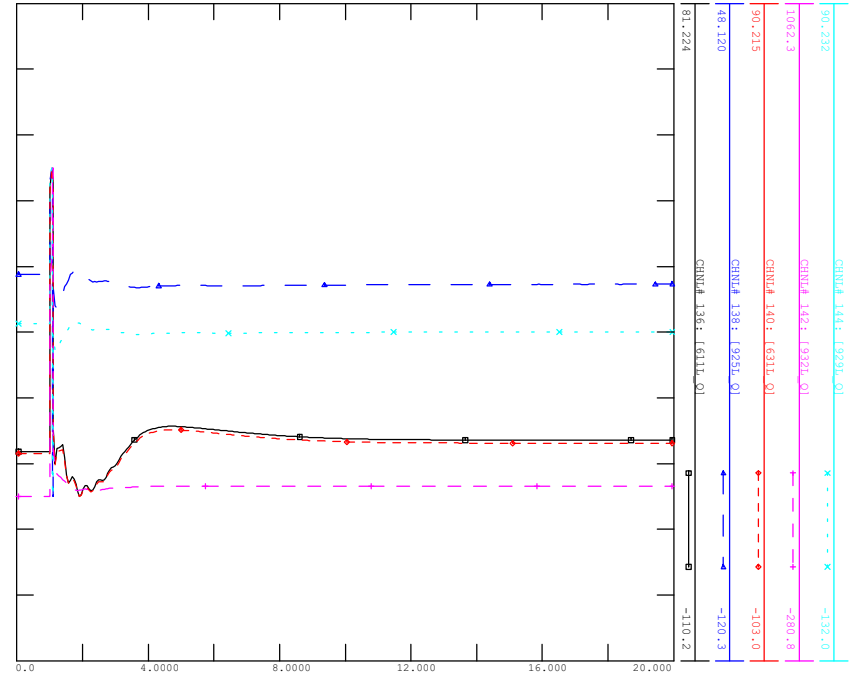
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SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_14_918L_JOHNSON

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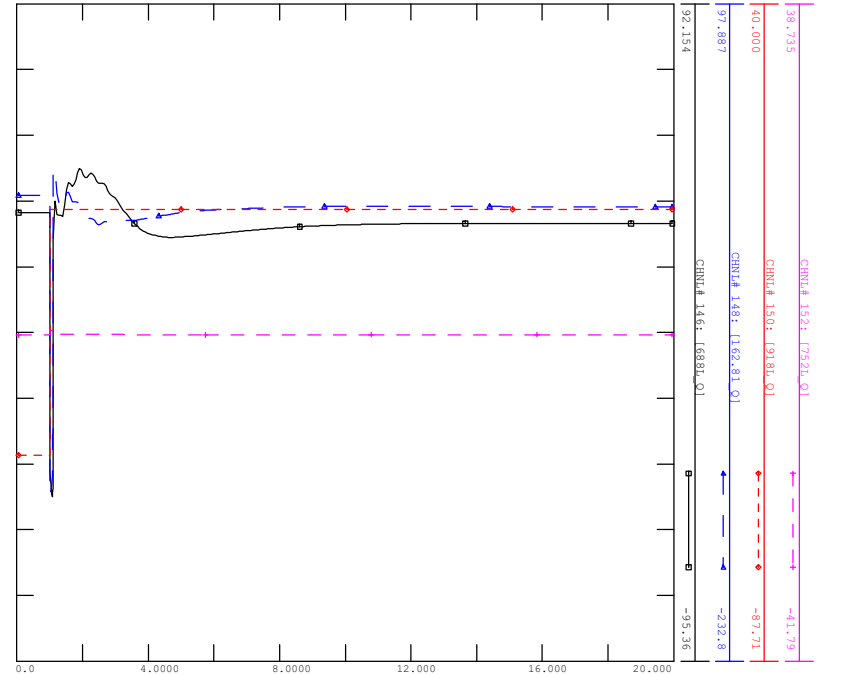


WED, MAR 30 2022 0:34
BRANCH Q (1)



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_14_918L_JOHNSON

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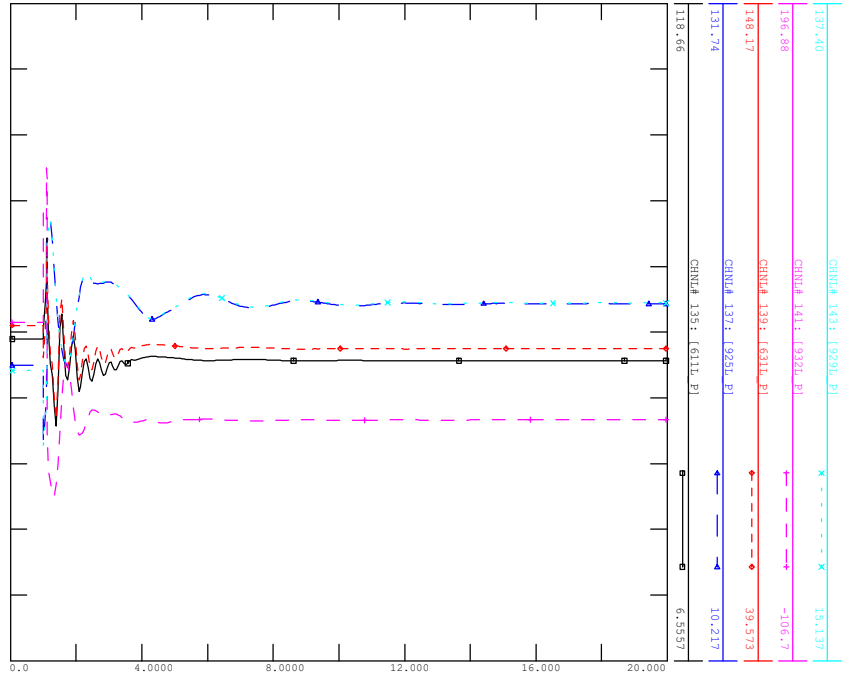


WED, MAR 30 2022 0:34
BRANCH Q (2)



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_14_918L_JOHNSON

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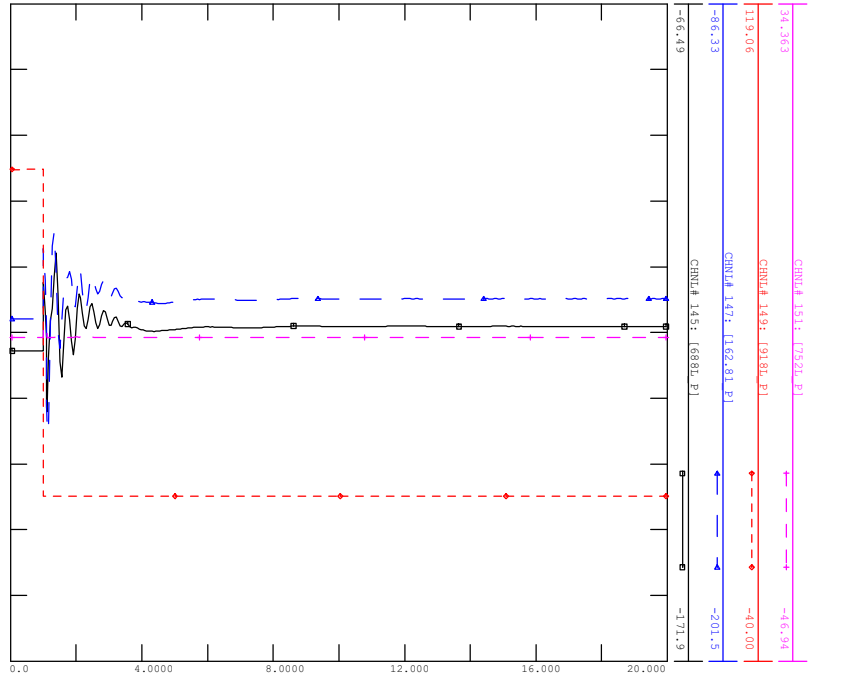


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BRANCH P (1)



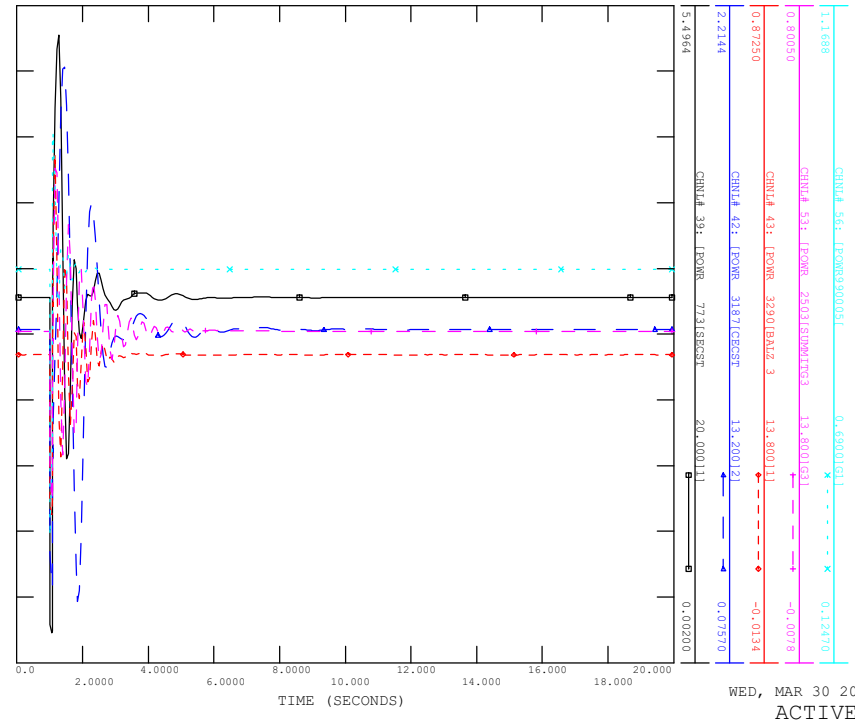
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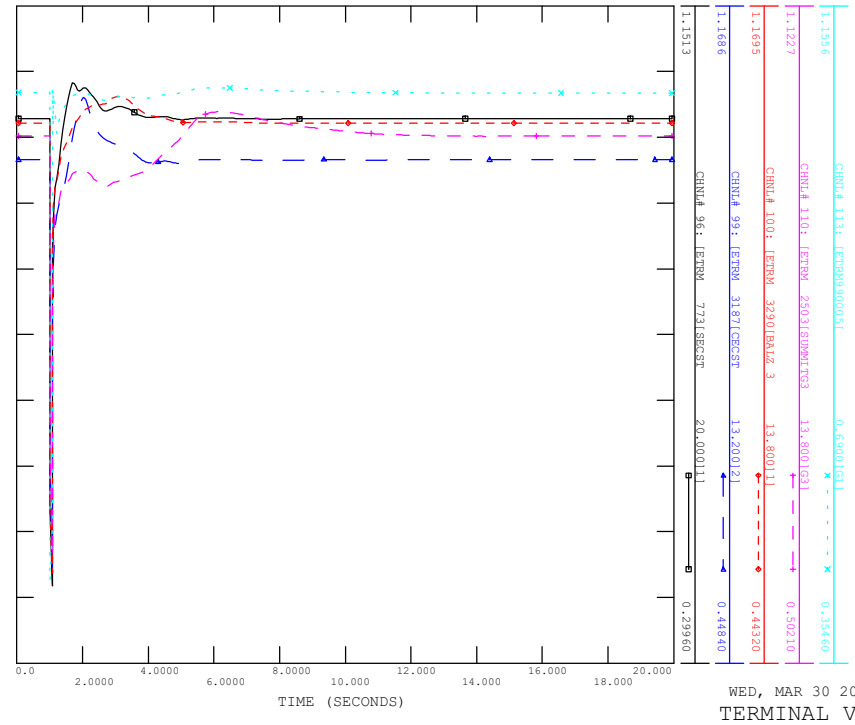


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BRANCH P (2)

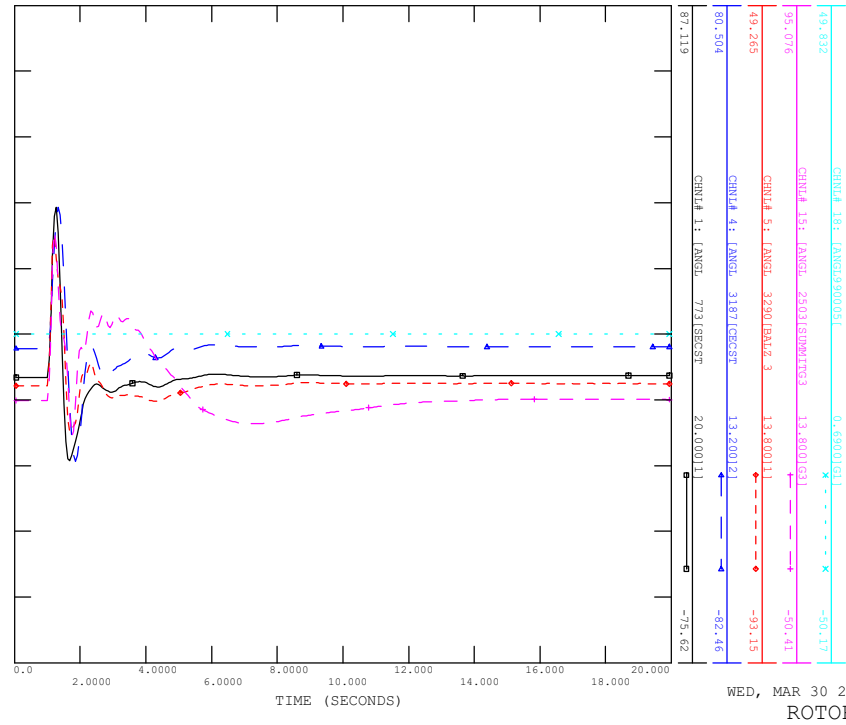
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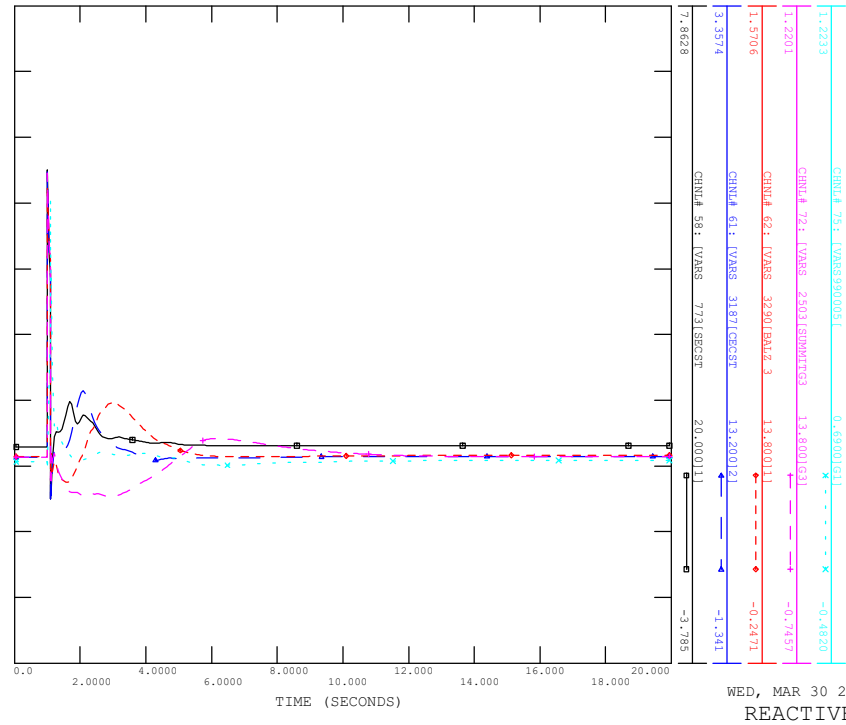
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FILE: scn4_sp_15_9291_Janet.out

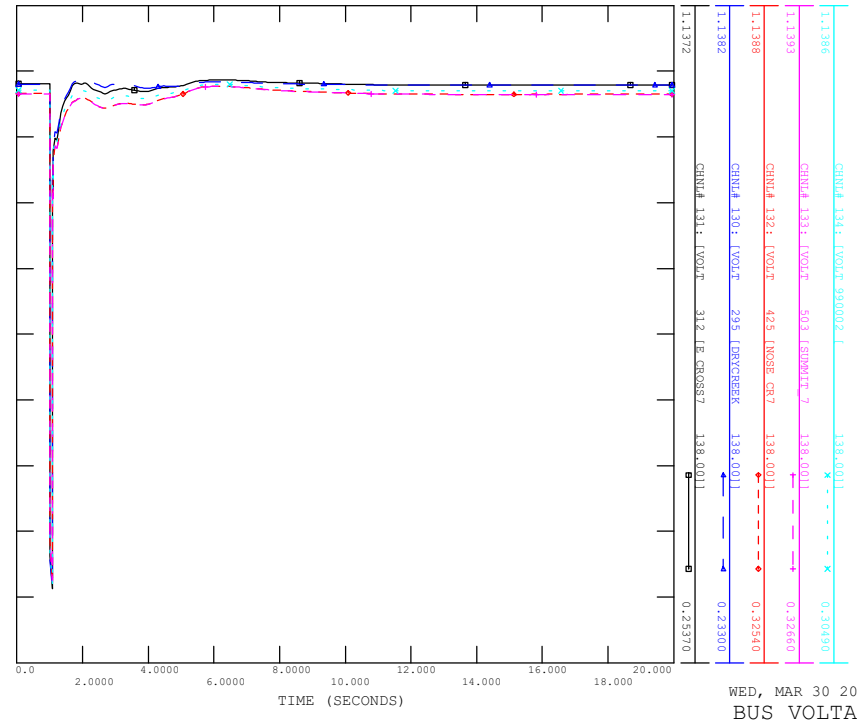


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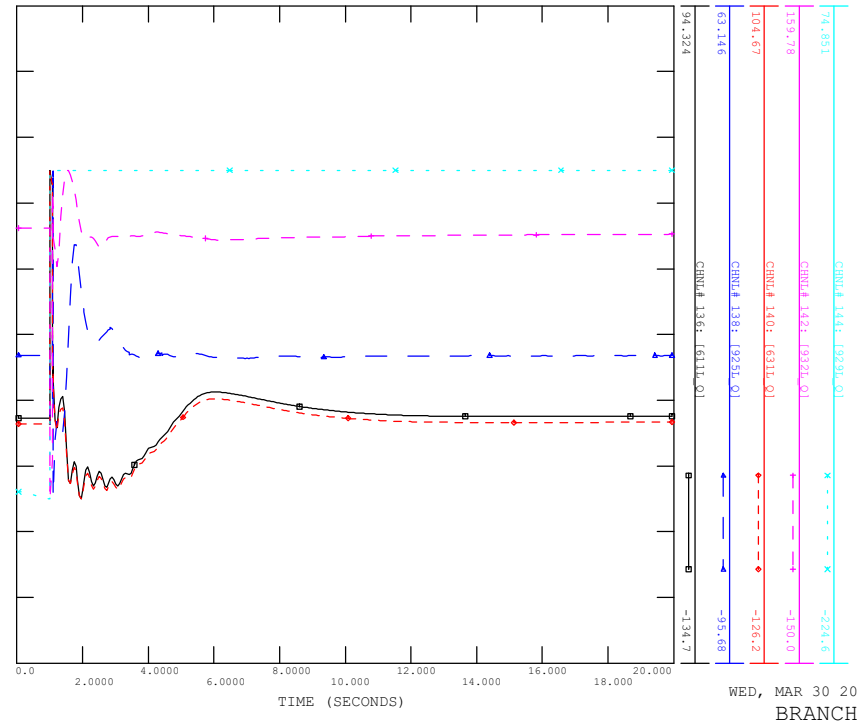
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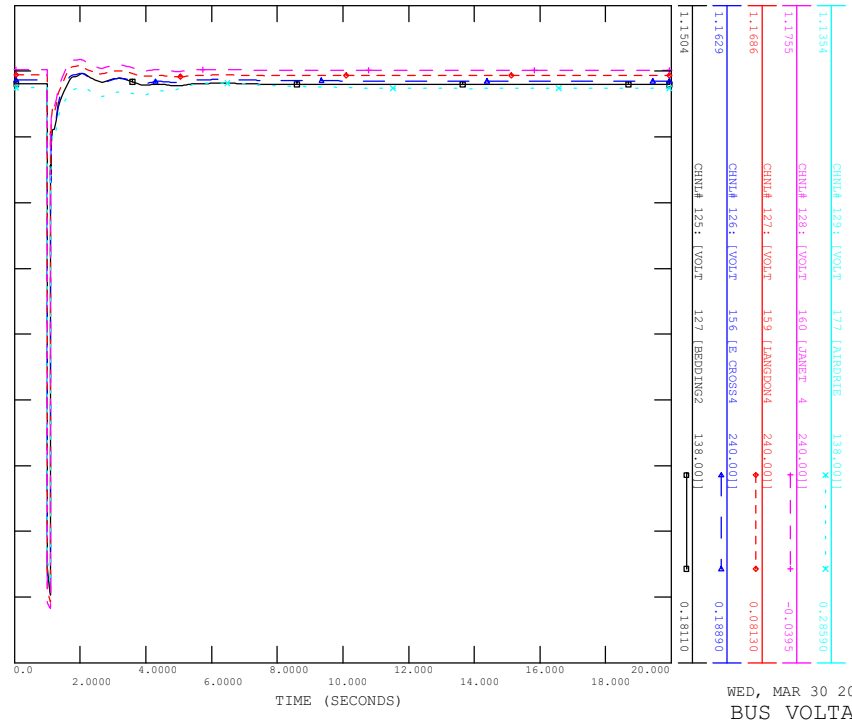
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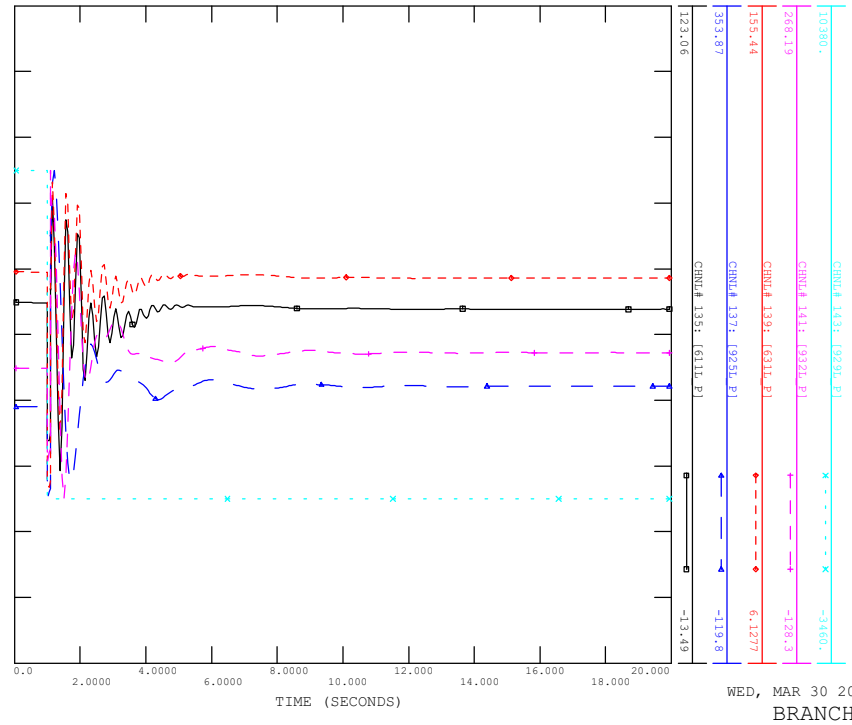
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CONTINGENCY -SCN4_SP_15_929L_JANET

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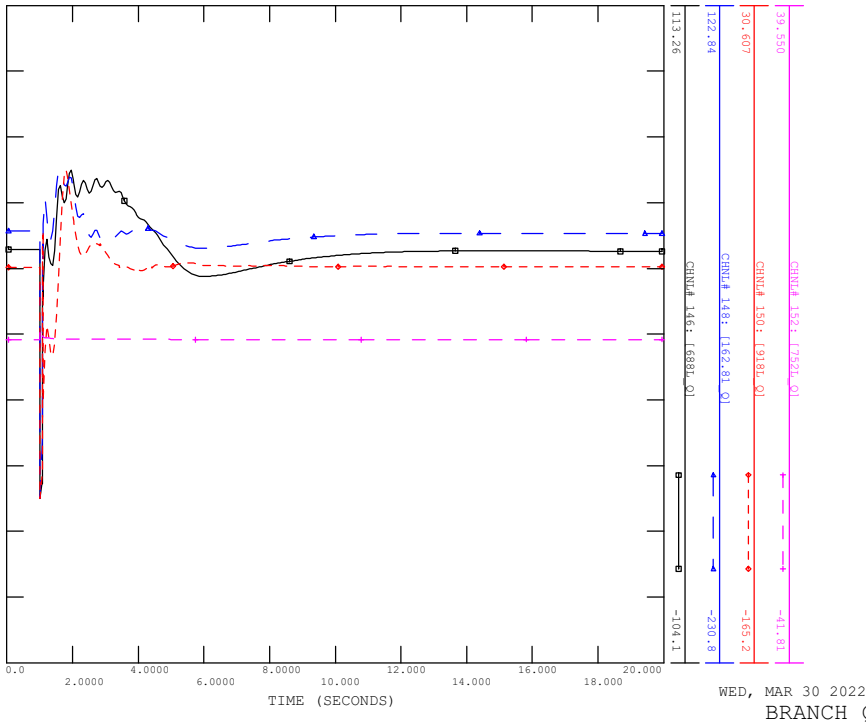


SCENARIO: P2405 SYSTEM IMPACT STUDY
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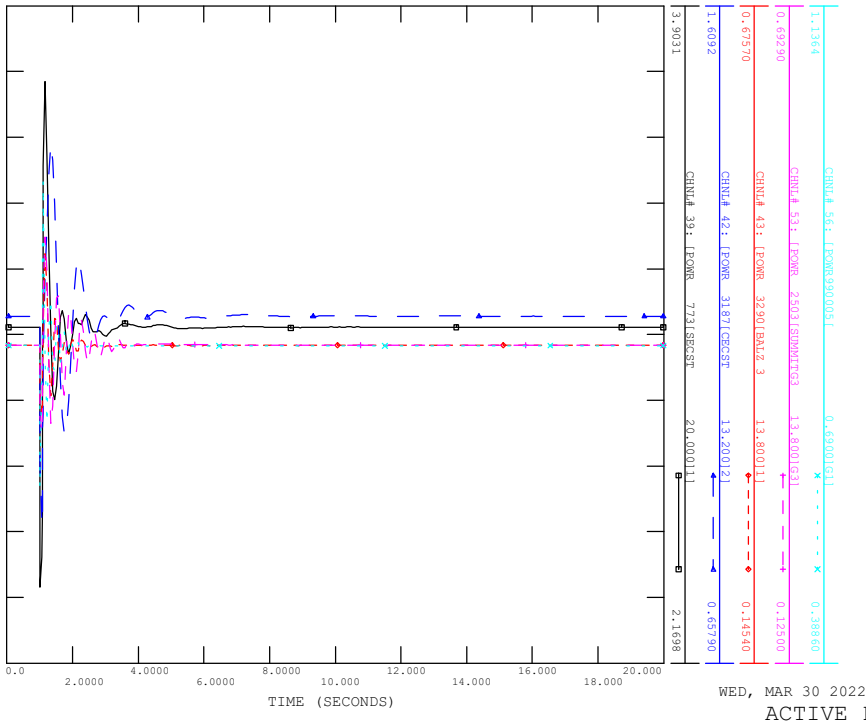
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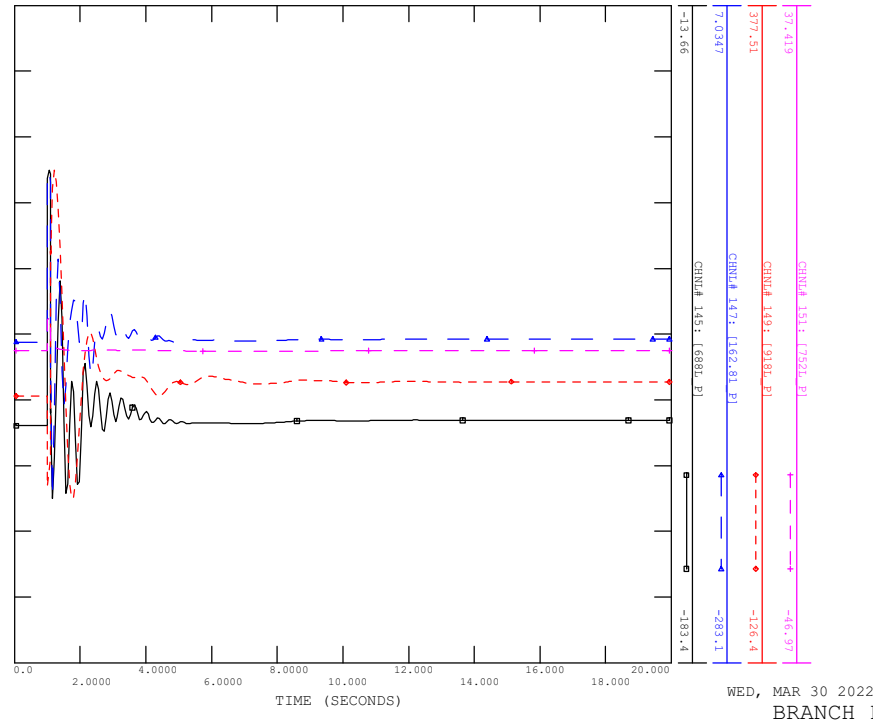
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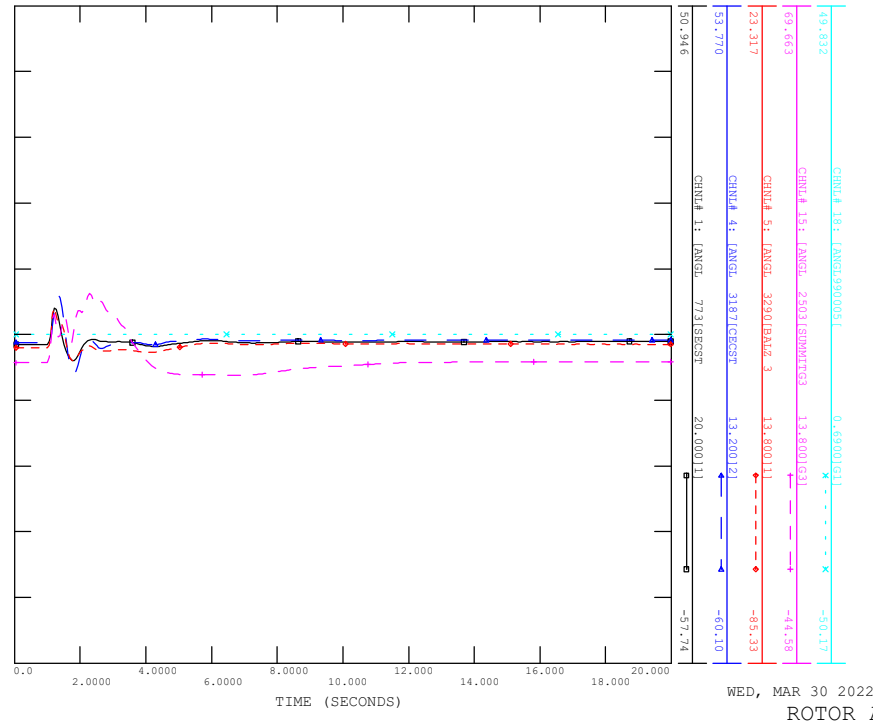
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FILE: scn4_sp_15_9291_Janet.out

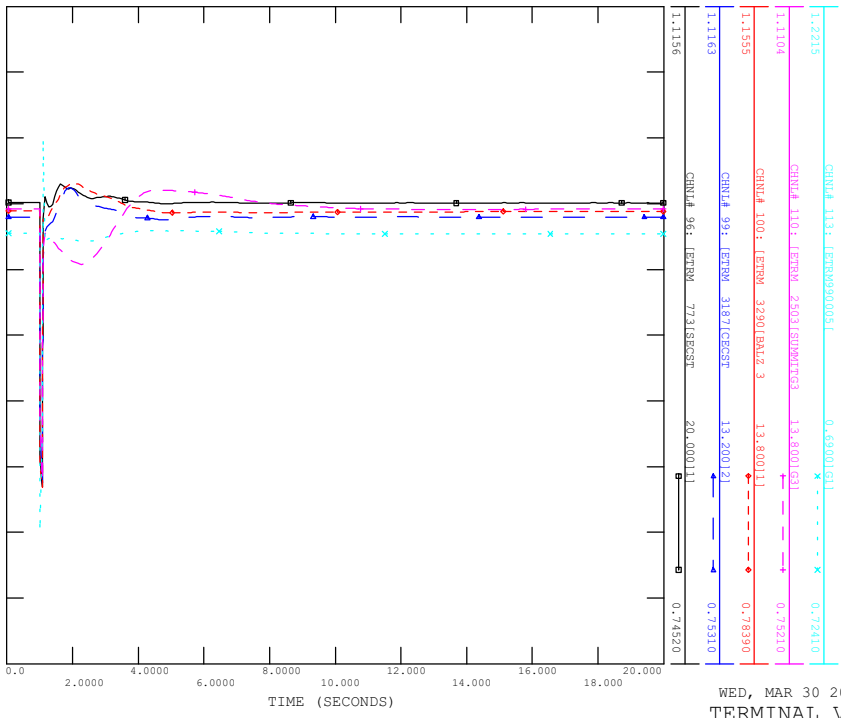


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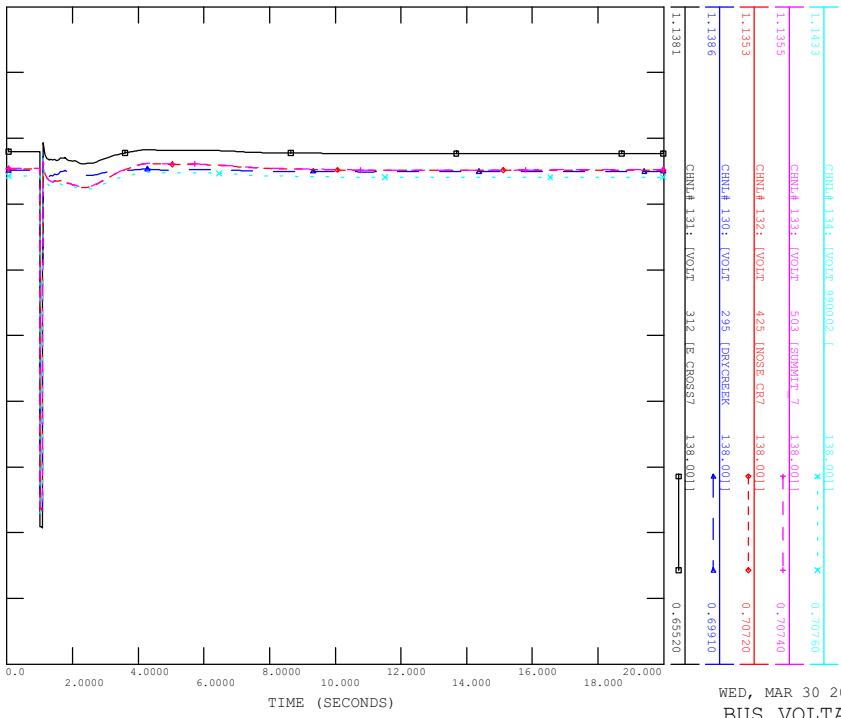
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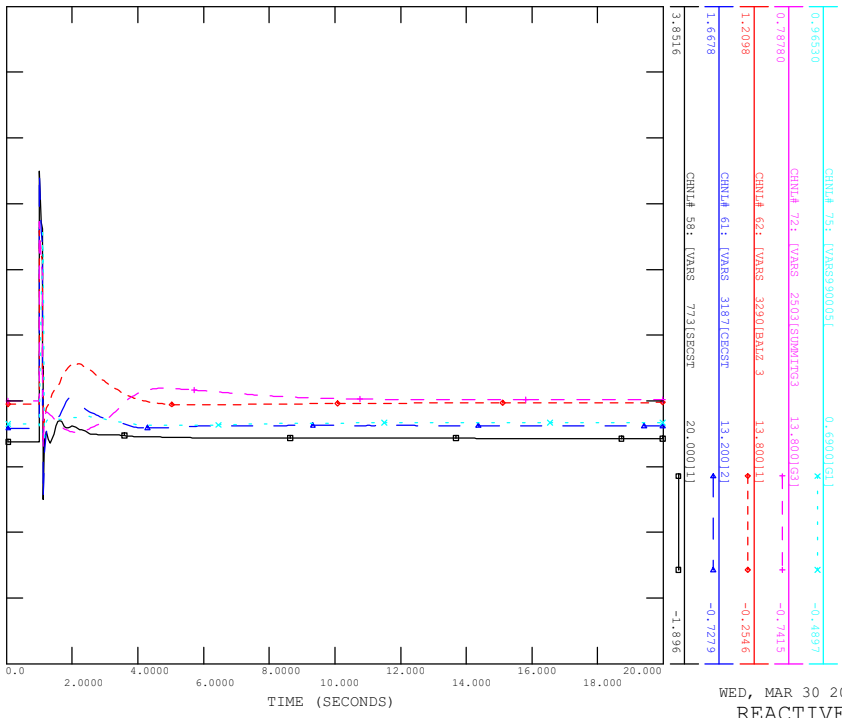
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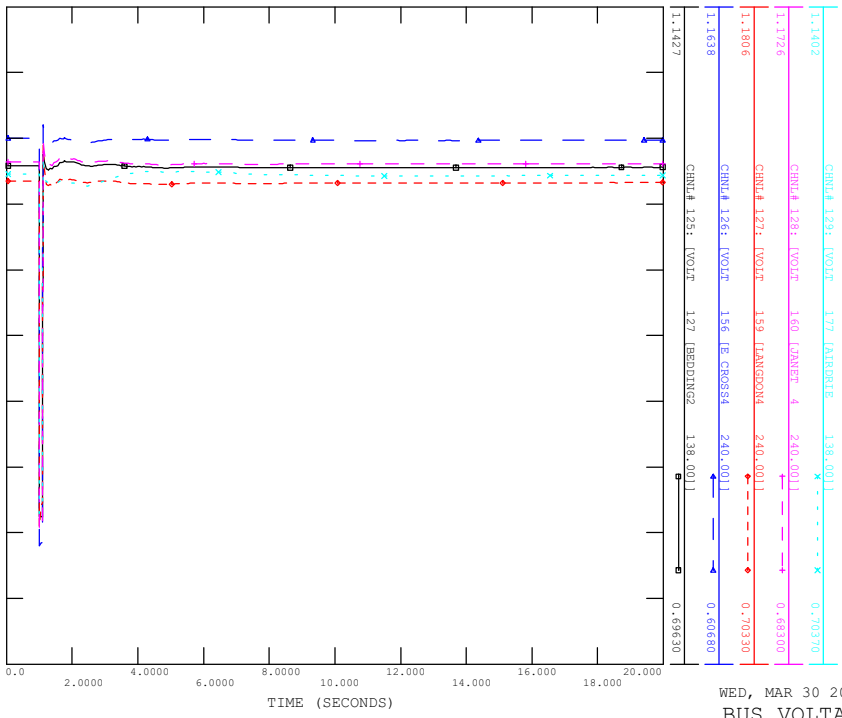
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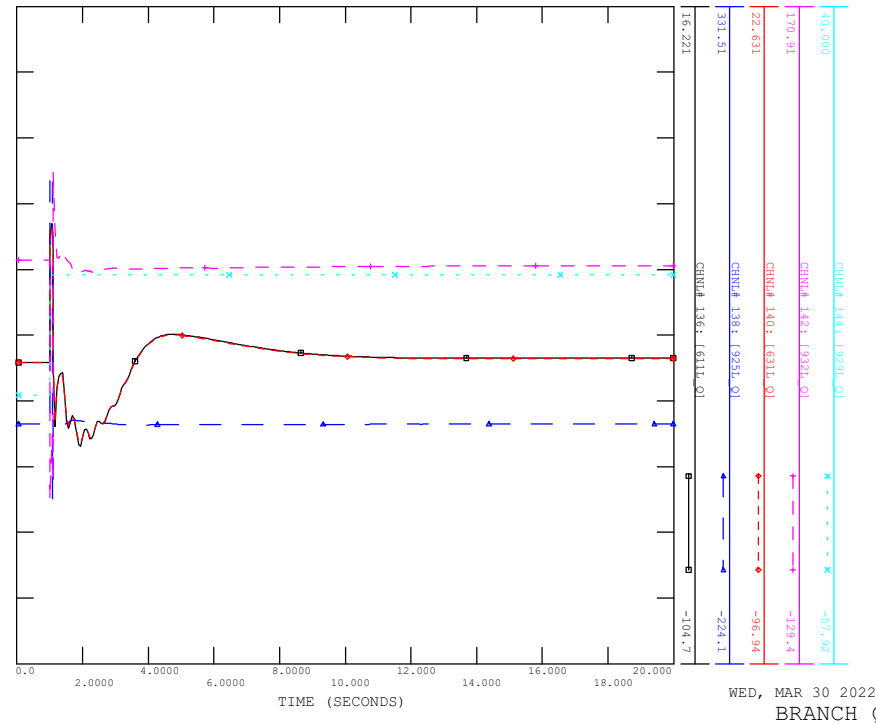


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_16_929L_HAZELWOOD

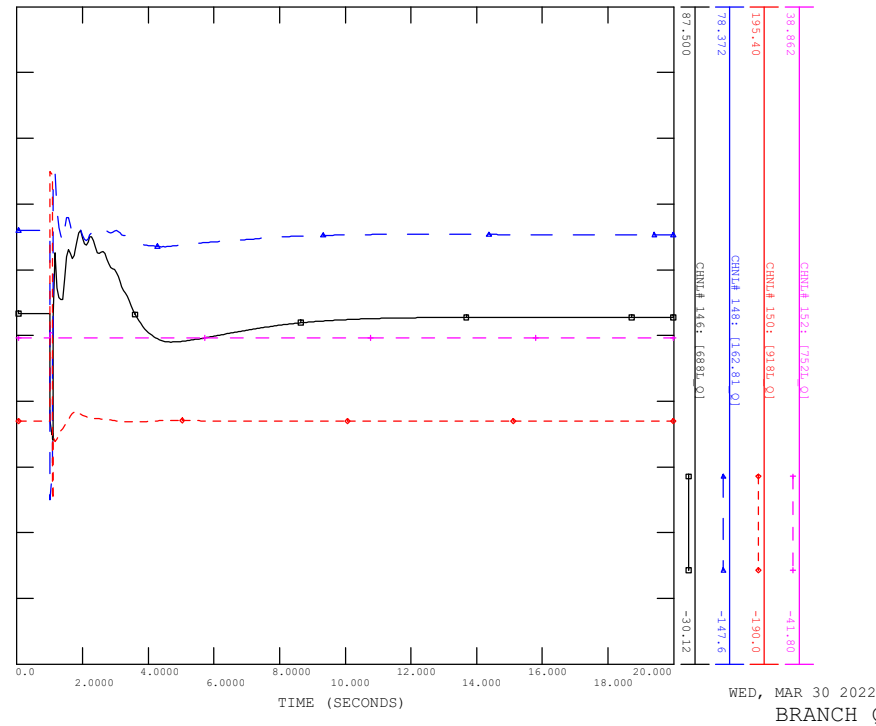
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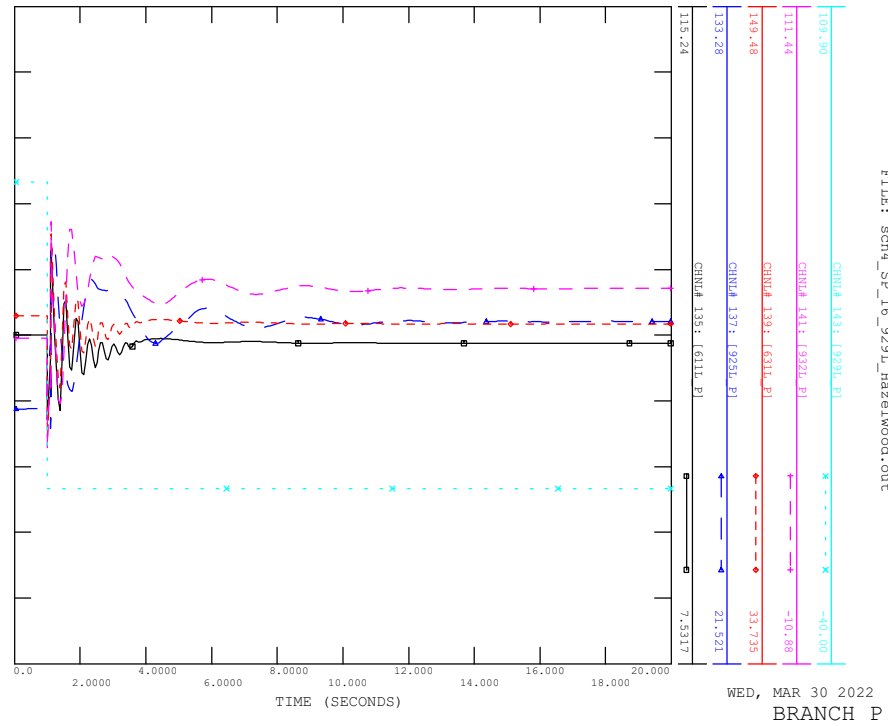
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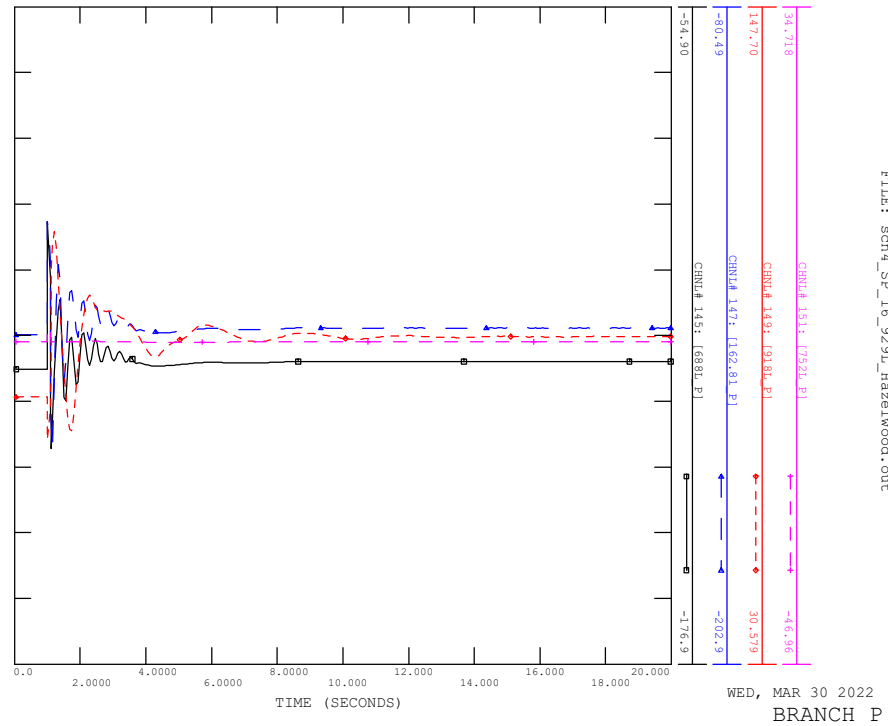
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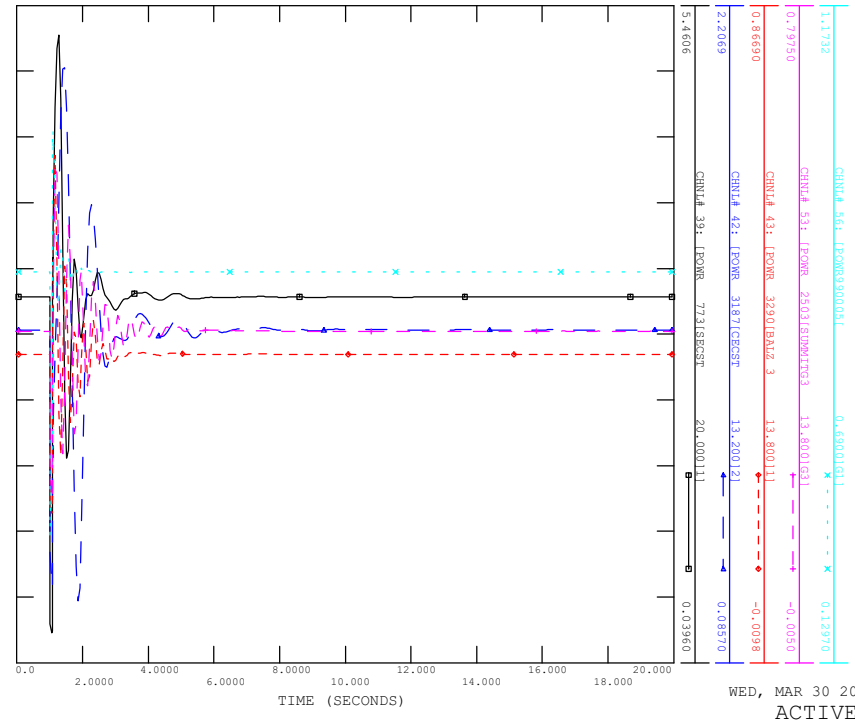
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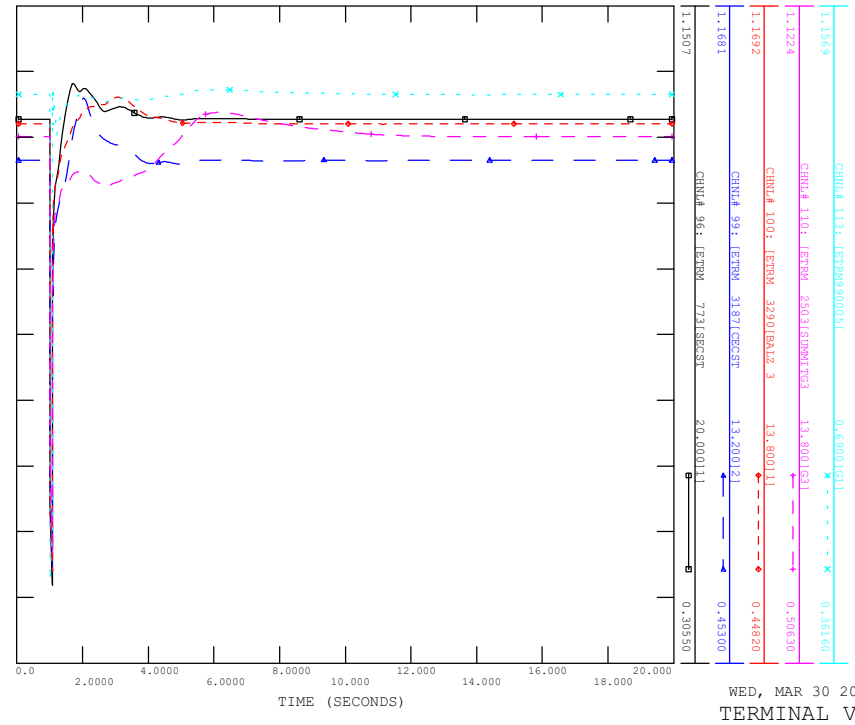
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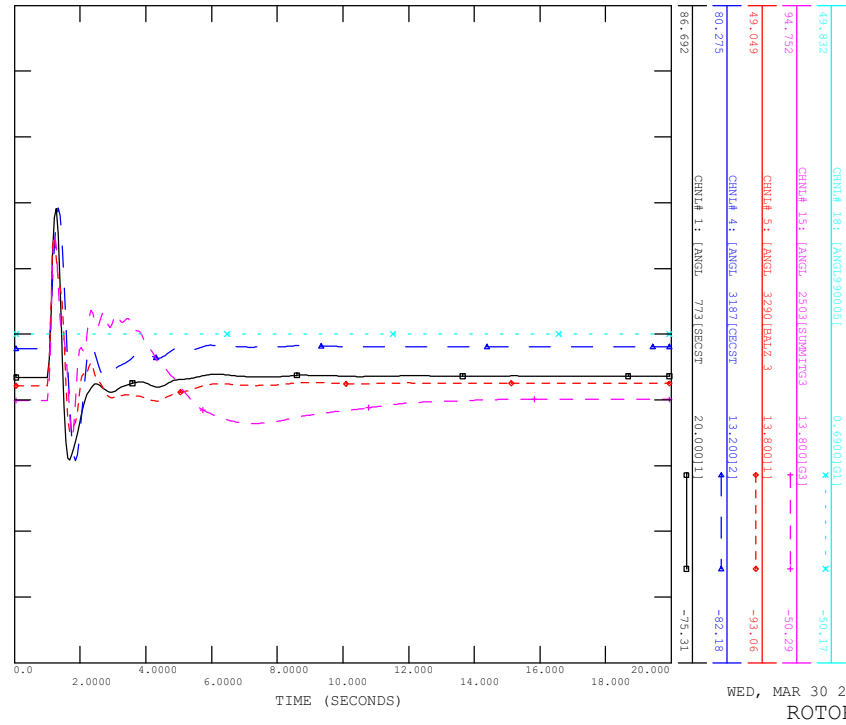
FILE: scn4_sp_17_925L_Janet.out



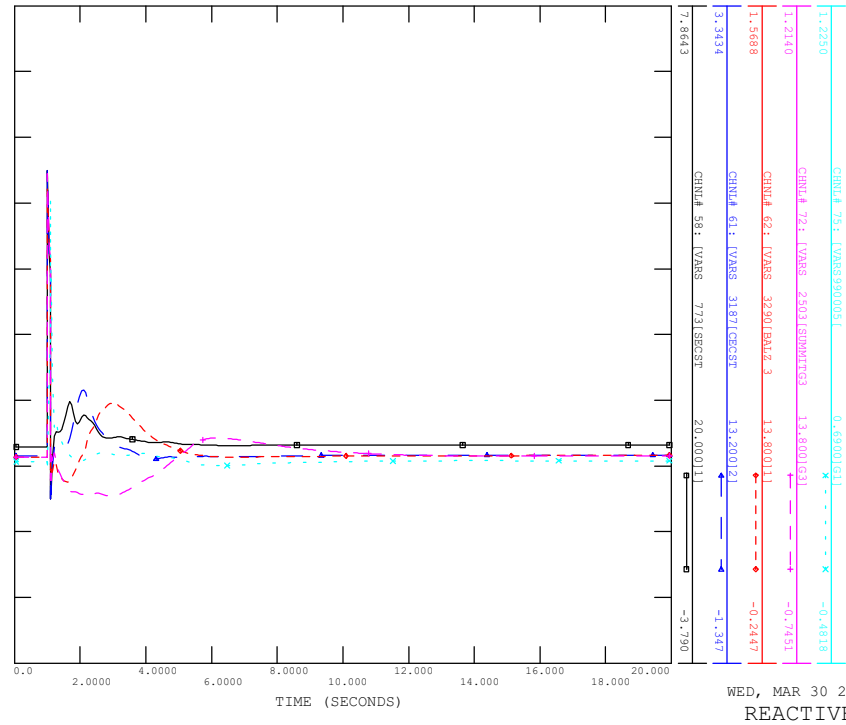
FILE: scn4_sp_17_925L_Janet.out



FILE: scn4_sp_17_925L_Janet.out



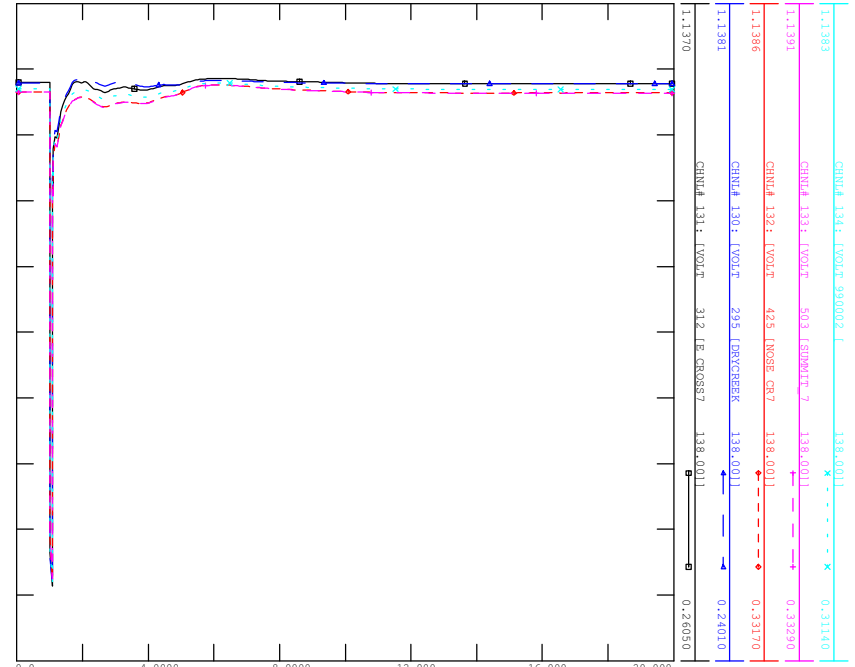
FILE: scn4_sp_17_925L_Janet.out





SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_17_925L_JANBT

FILE: scn4_sp_17_925L_Janet.out

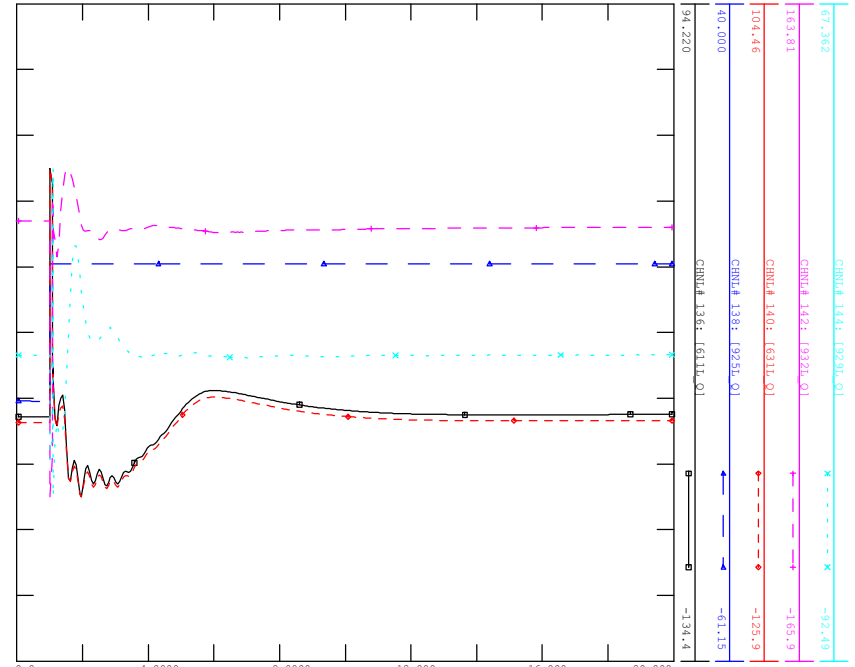


WED, MAR 30 2022 0:34
BUS VOLTAGE (2)



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_17_925L_JANBT

FILE: scn4_sp_17_925L_Janet.out

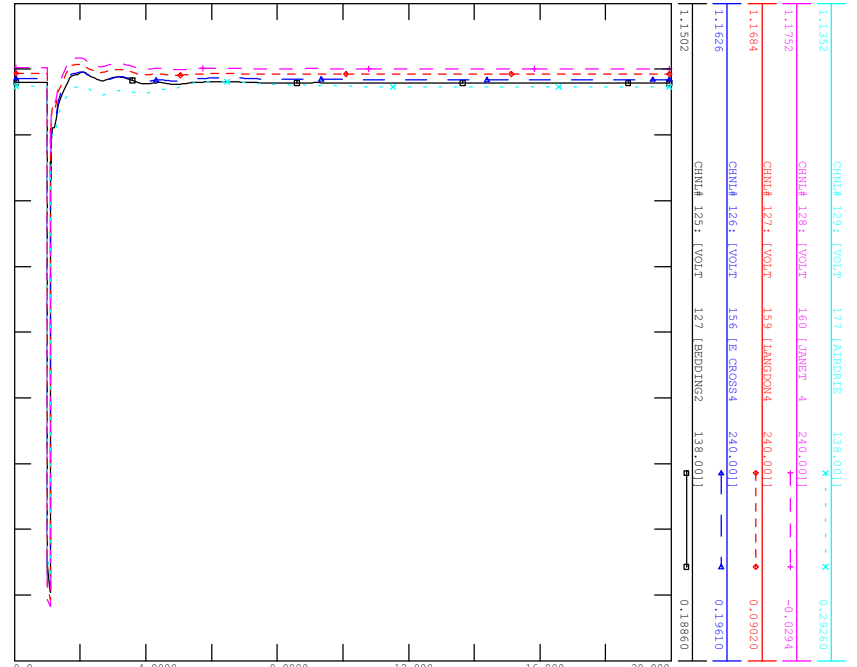


WED, MAR 30 2022 0:34
BRANCH P (1)



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_17_925L_JANBT

FILE: scn4_sp_17_925L_Janet.out

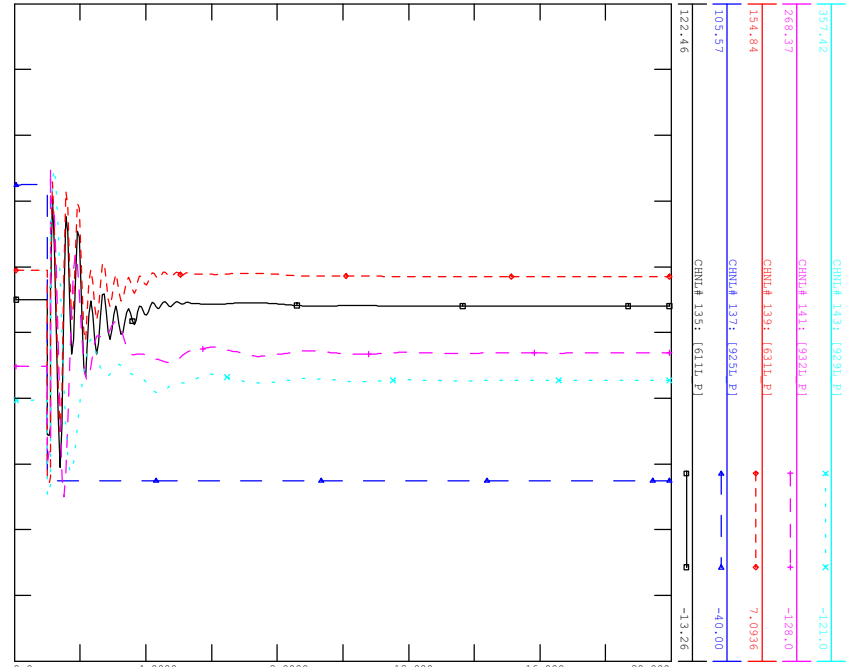


WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

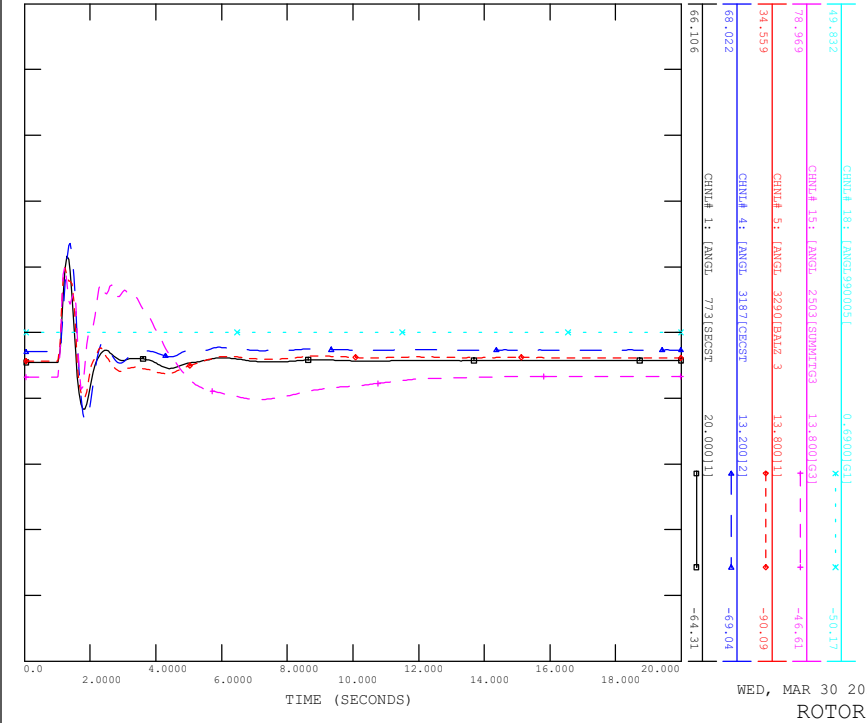
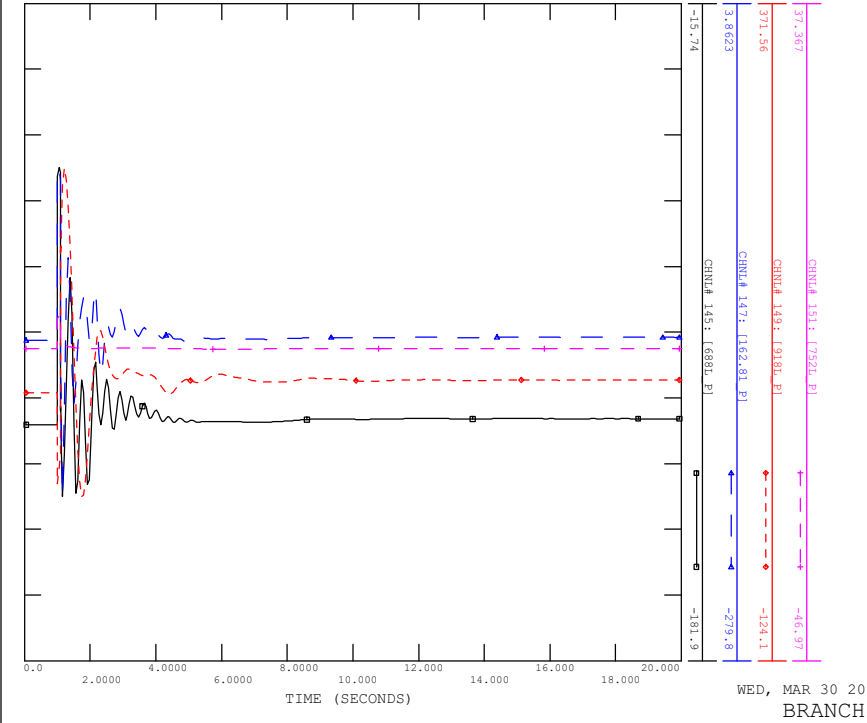
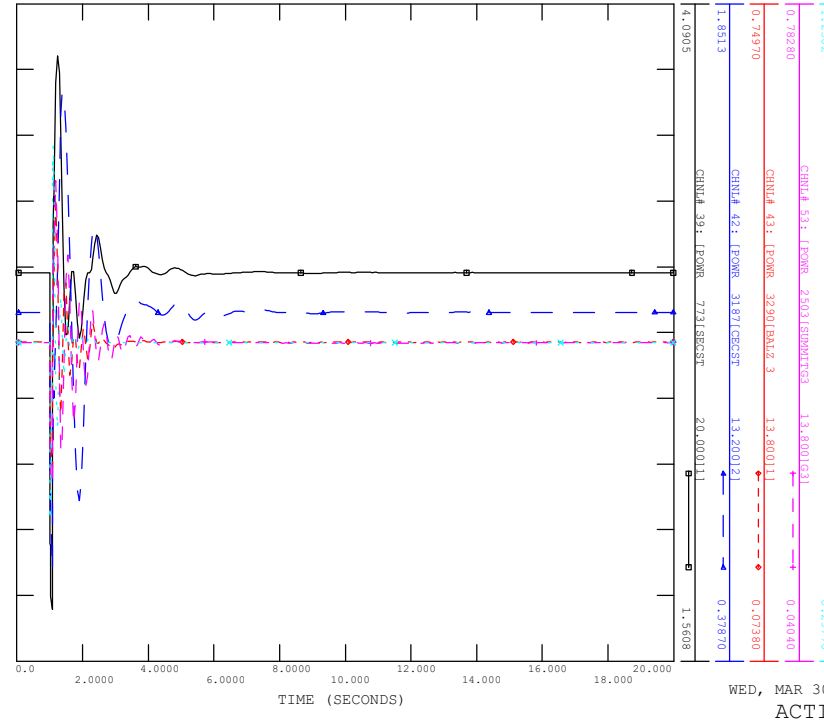
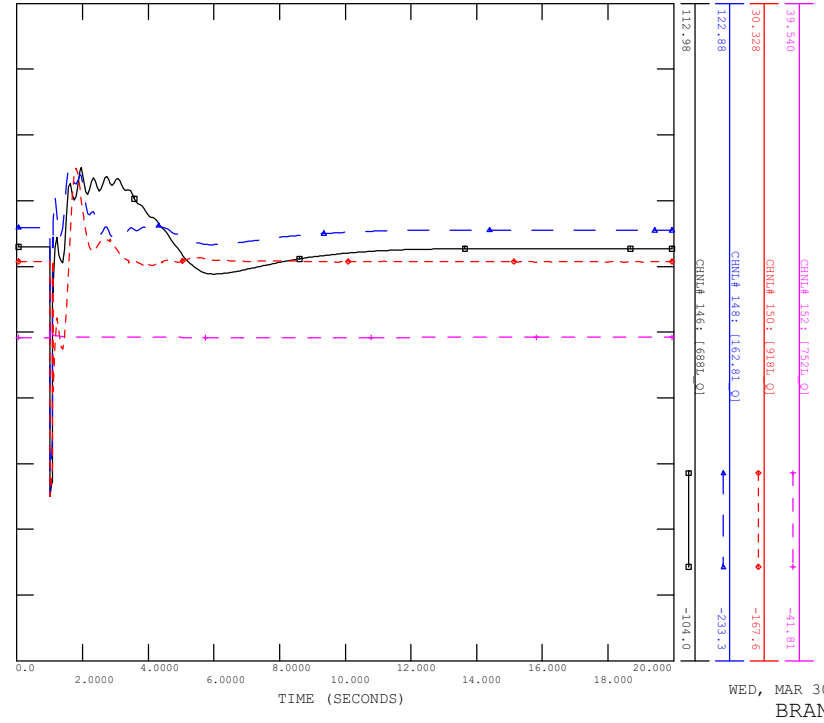


SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_17_925L_JANBT

FILE: scn4_sp_17_925L_Janet.out

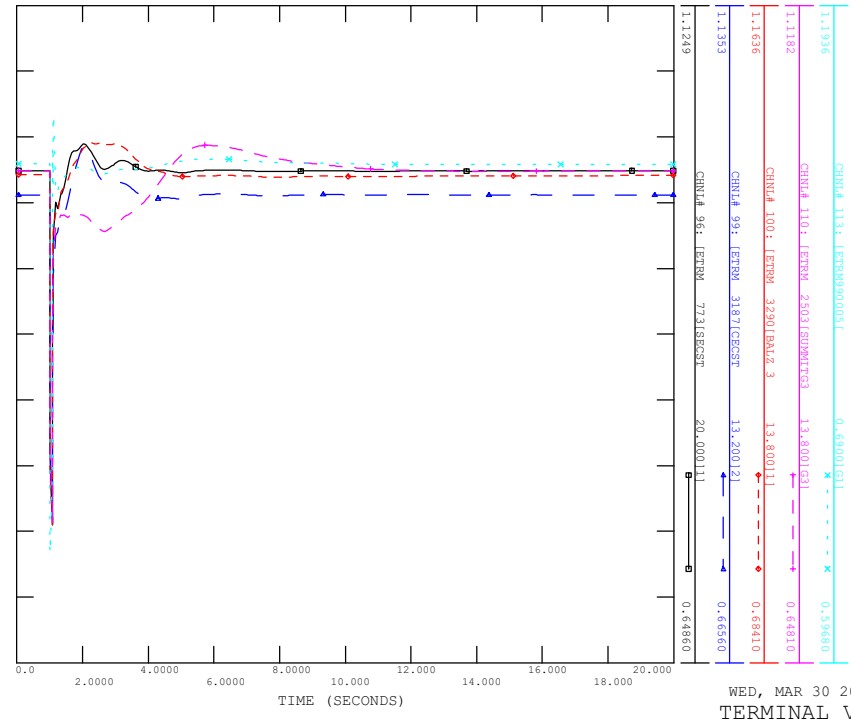


WED, MAR 30 2022 0:34
BRANCH Q (1)



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_18_925L_RED_DEER

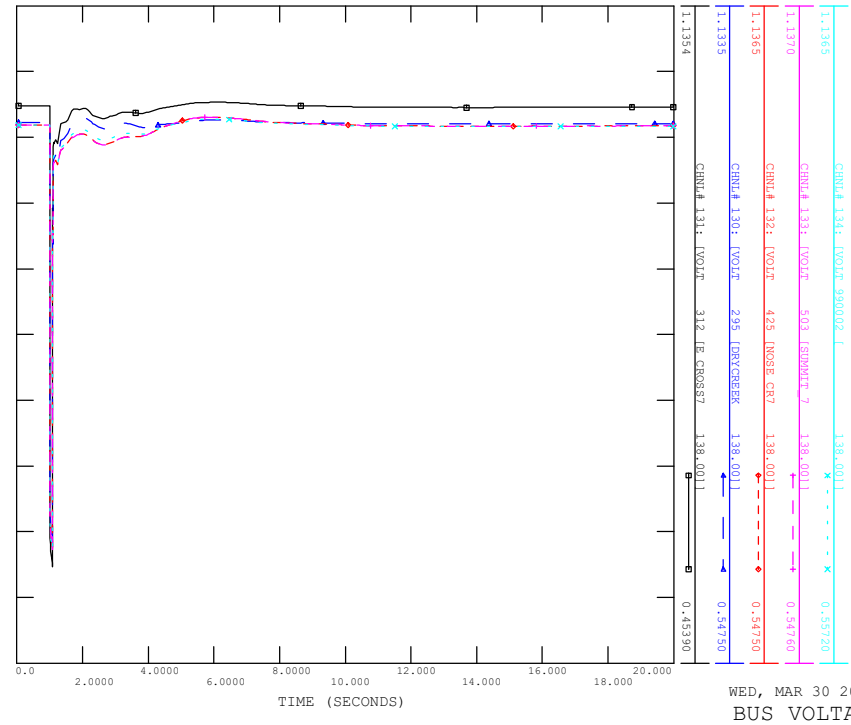
FILE: scn4_sp_18_925L_Red_Deer.out



WED, MAR 30 2022 0:34
TERMINAL VOLTAGE

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_18_925L_RED_DEER

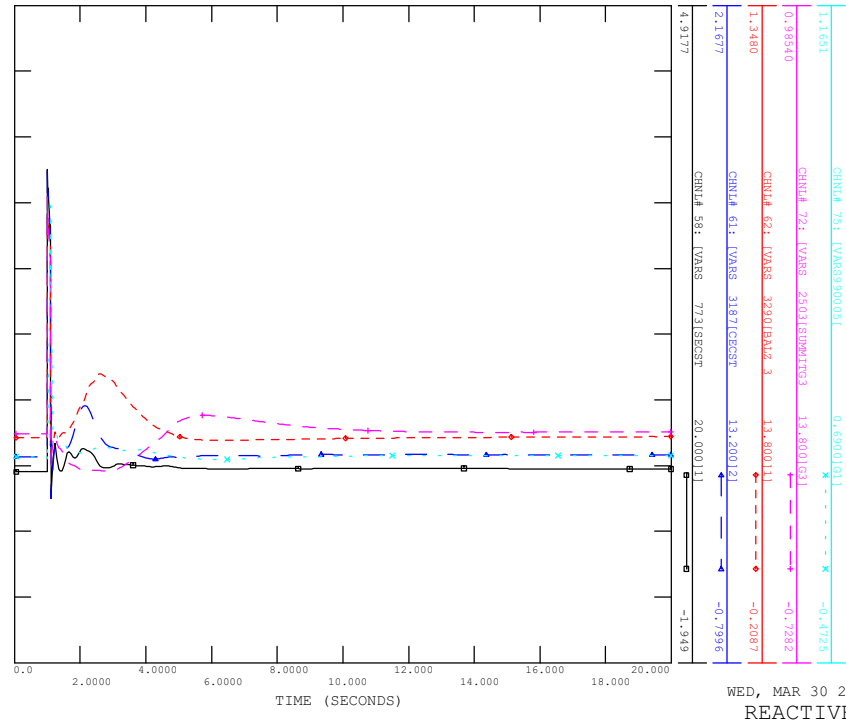
FILE: scn4_sp_18_925L_Red_Deer.out



WED, MAR 30 2022 0:34
BUS VOLTAGE (2)

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_18_925L_RED_DEER

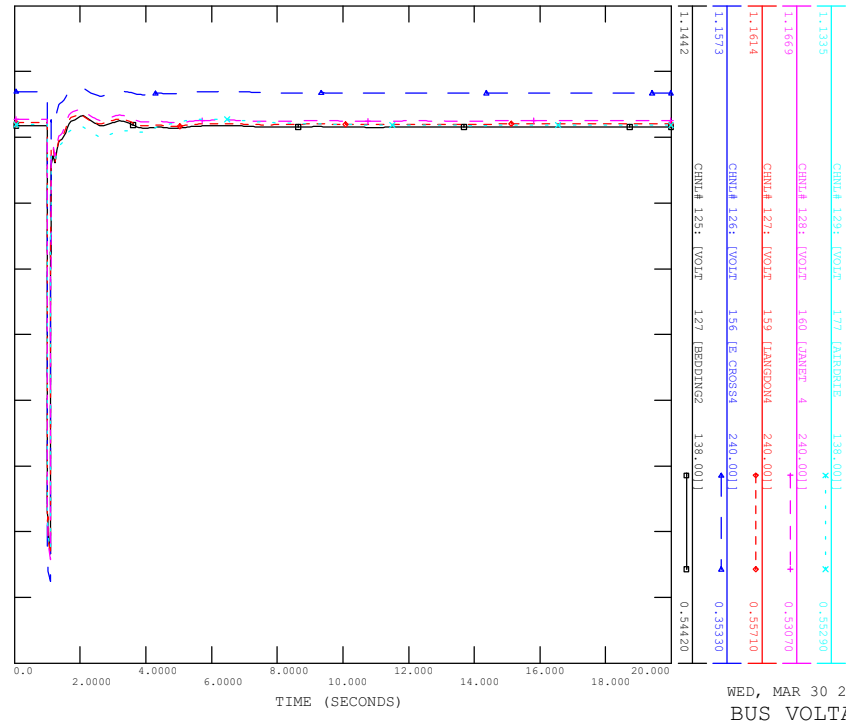
FILE: scn4_sp_18_925L_Red_Deer.out



WED, MAR 30 2022 0:34
REACTIVE POWER

SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_18_925L_RED_DEER

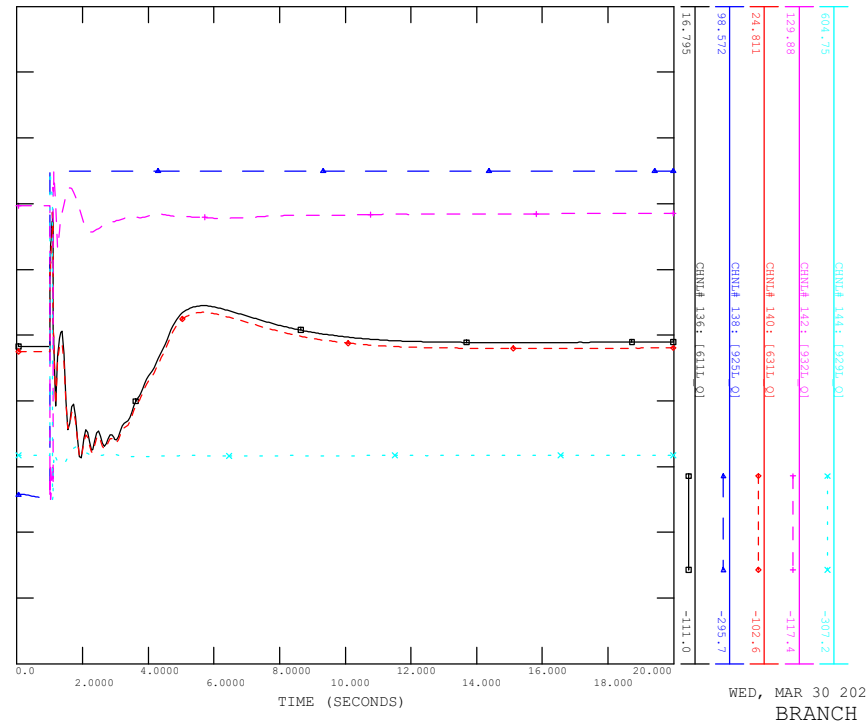
FILE: scn4_sp_18_925L_Red_Deer.out



WED, MAR 30 2022 0:34
BUS VOLTAGE (1)

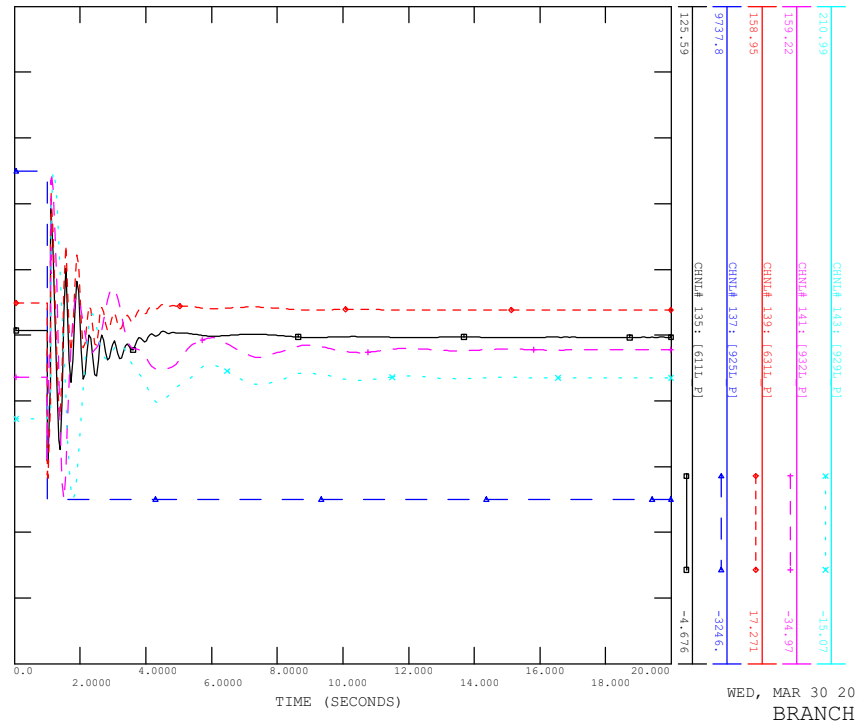
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_18_925L_RED_DEER

FILE: scn4_sp_18_925L_Red_Deer.out



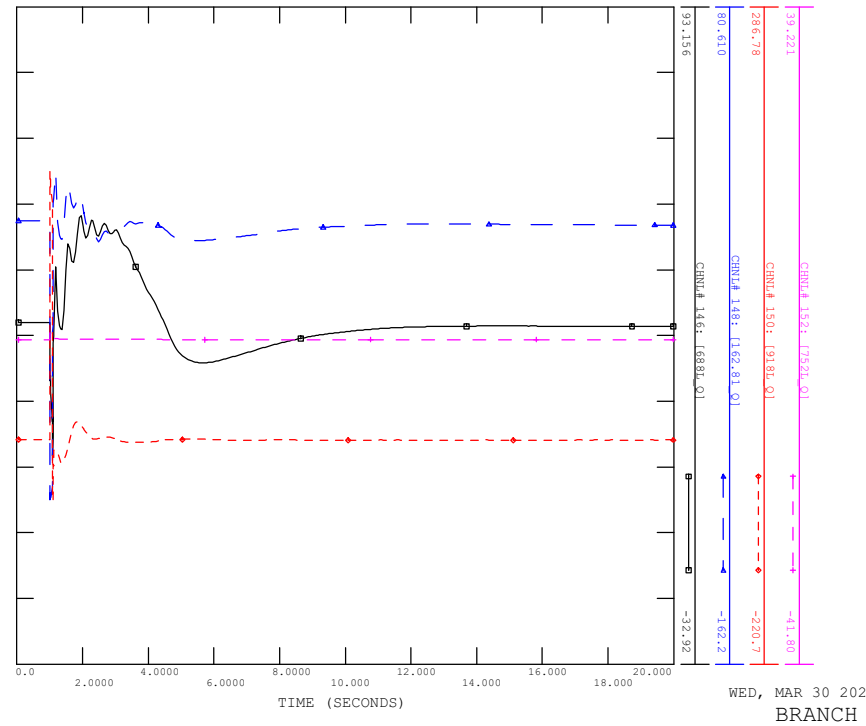
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_18_925L_RED_DEER

FILE: scn4_sp_18_925L_Red_Deer.out



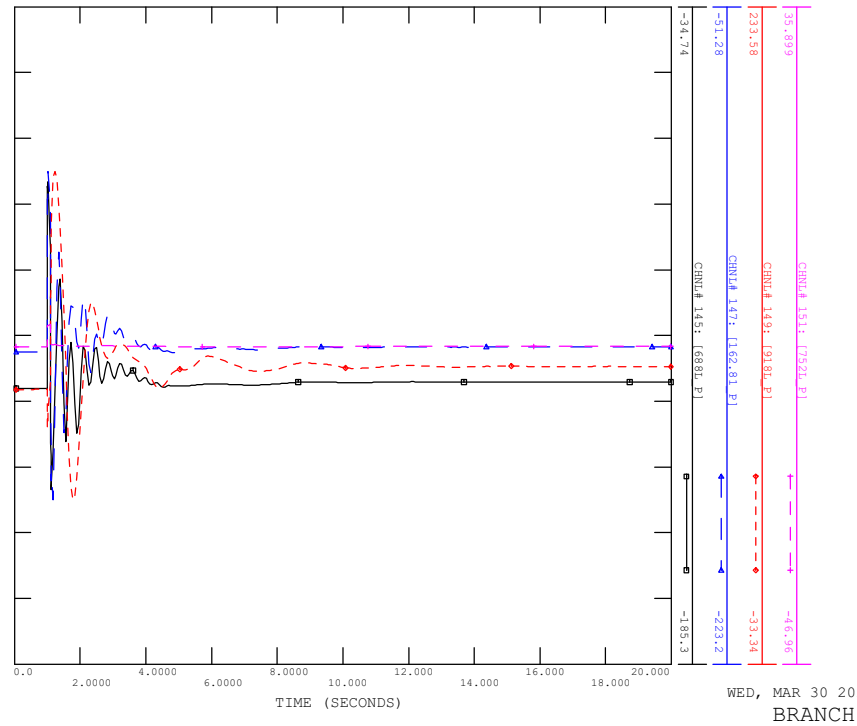
SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_18_925L_RED_DEER

FILE: scn4_sp_18_925L_Red_Deer.out



SCENARIO: P2405 SYSTEM IMPACT STUDY
CONTINGENCY -SCN4_SP_18_925L_RED_DEER

FILE: scn4_sp_18_925L_Red_Deer.out



Attachment A5

Dynamic Data and Assumptions



/ ***** P2405: 75 MW solar generation
569071 'USRMDL' G1 'REGCAU1' 101 1 1 14 3 4
0
0.02 10.0 0.9 0.5 1.1 1.1 0.90 0.00 -1.0 0.01 0 99 -99 1/

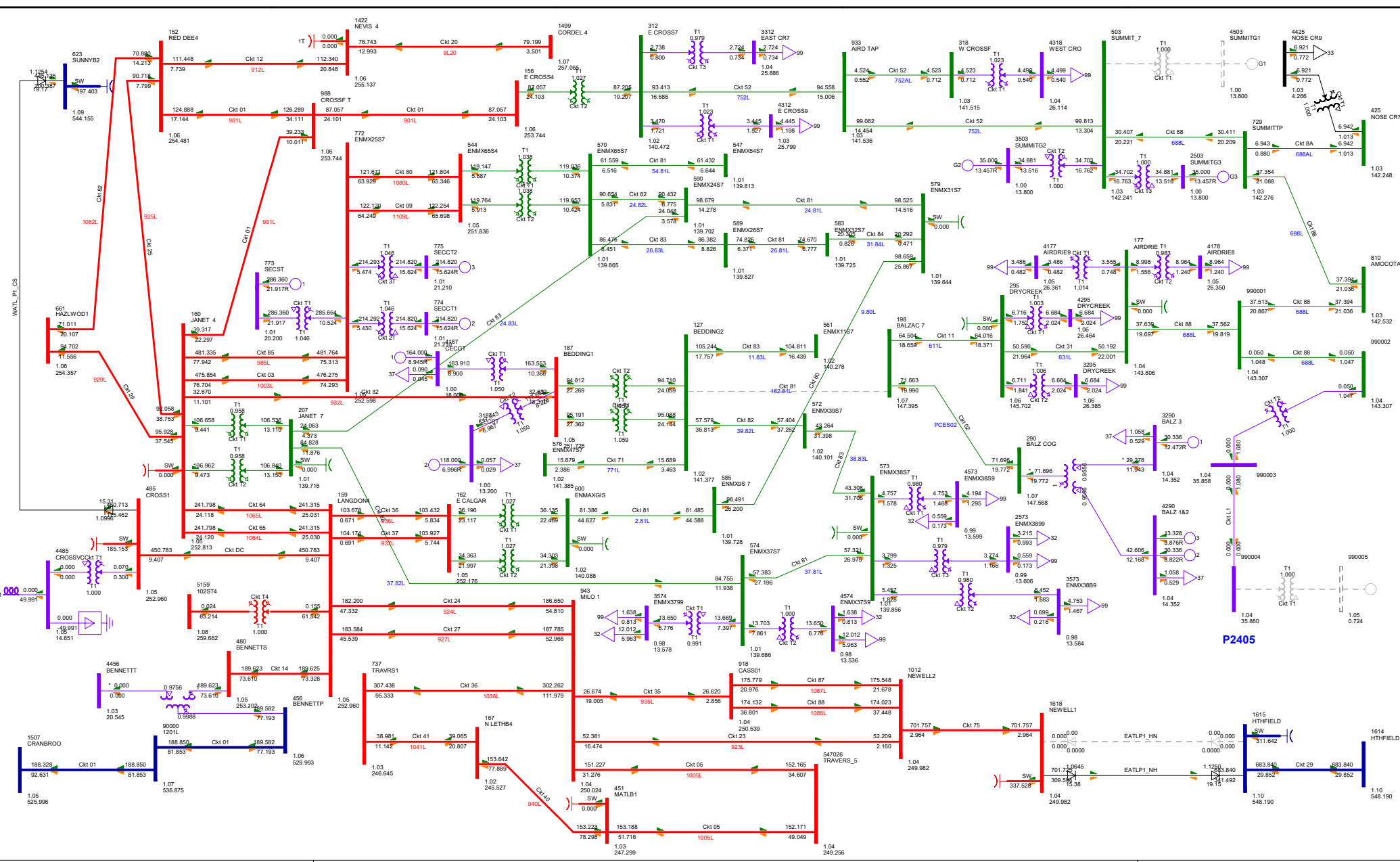
569071 'USRMDL' G1 'REECAU1' 102 0 6 45 6 9
0 0 1 0 0 0
0.90 1.1 0.01 -0.10 0.10 1 1.0 -1.0 1.00 0 0 0
0.01 0.60 -0.60 1.10 0.9 0.3 5.0 0.5 0.0 0
0.01 99 -99 1 0 1.0 0.01
0.00 0.01 0.49 0.01 0.5 1 1.2 1
0.00 0.01 0.49 0.01 0.5 1 1.2 1/

569071 'USRMDL' G1 'REPCAUI' 107 0 7 27 7 9
894 894 872 '80' 1 1 1
0.05 0.5 3 0 0.05 0.9 0 0 0 0.05 -0.05 0 0 0.6 -0.6
0.5 0.25 0.25 -0.0006 0.0006 999 -999 1 0 0.5 20 20/

Attachment A6

Post-Mitigation Power Flow Diagrams



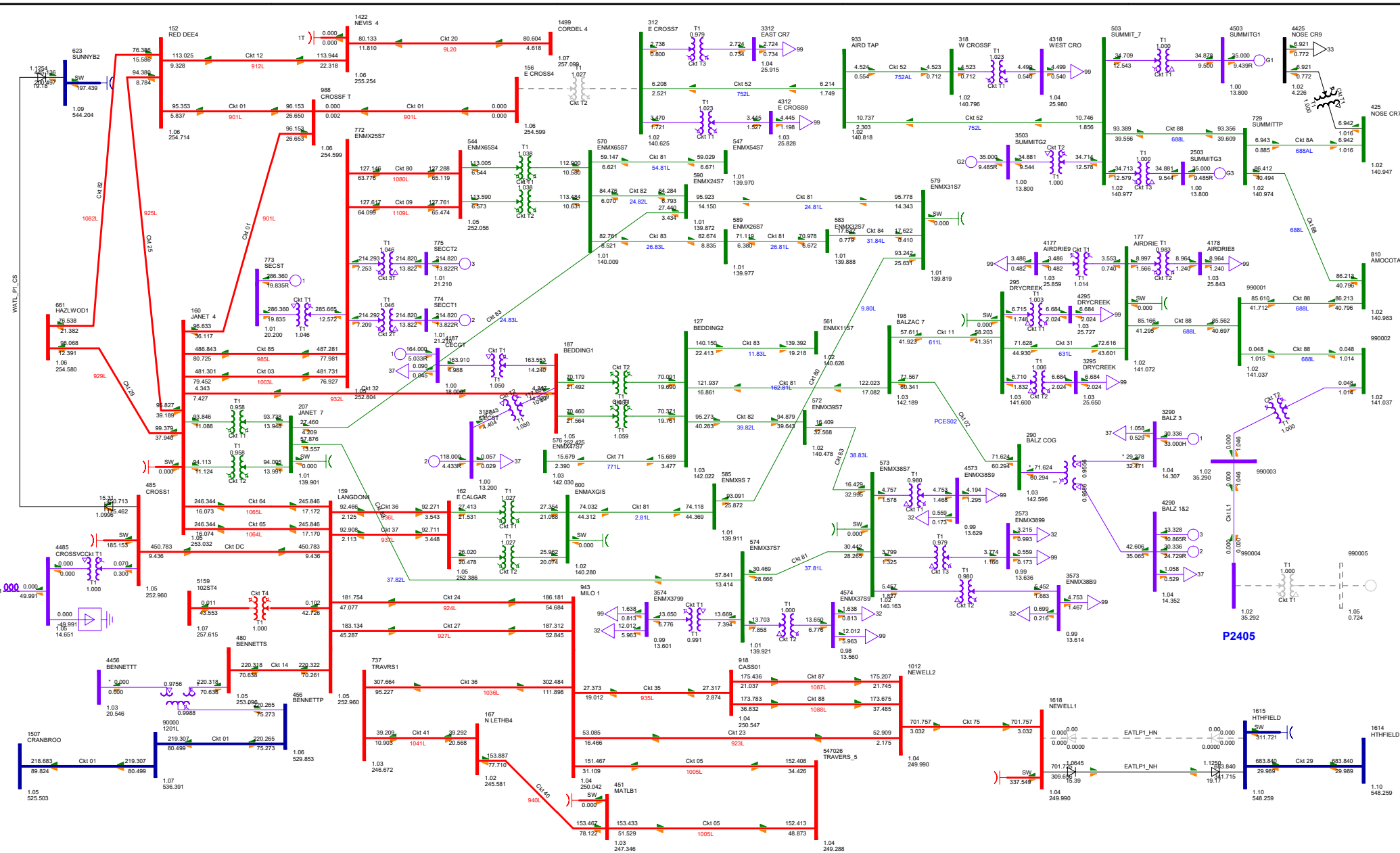


P2405 Sollair MPC Solar

**FIGURE A6.1-1 N-1: 162.81L (BEDDINGTON TO BALZAC 391S) WITH RAS
2023 SUMMER LIGHT (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:269.888 MW Sack Import:0.000 MW MATL Import:0.016 MW
MH Export: -13.589 MW

Bus - Voltage (kV) (p.u.)
Branch - MW (MW)
Equipment - MW (MW)
1.000 (1.000000)
MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000

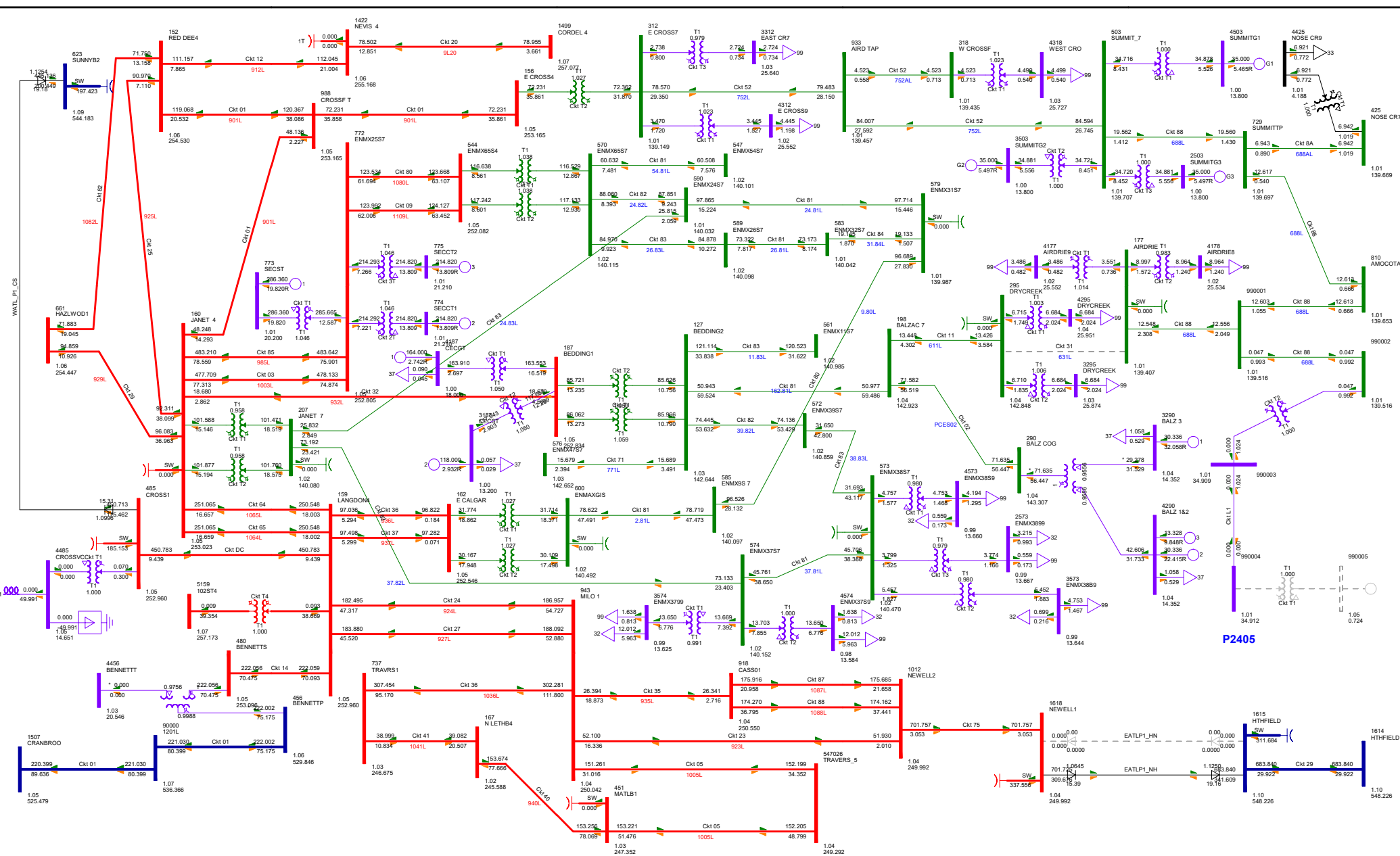


P2405 Sollair MPC Solar

BC Import:304.077 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A6.1-2 N-1: 64S2 (EAST CROSSFIELD 64S TRANSFORMER T2) WITH RAS
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p.u.)
 Branch - MW (MW)
 Equipment - MW (MW)
 Loss (MW)
 MW = 0.000 + 159.000 + 138.000 + 240.000 + 500.000 + 500.000

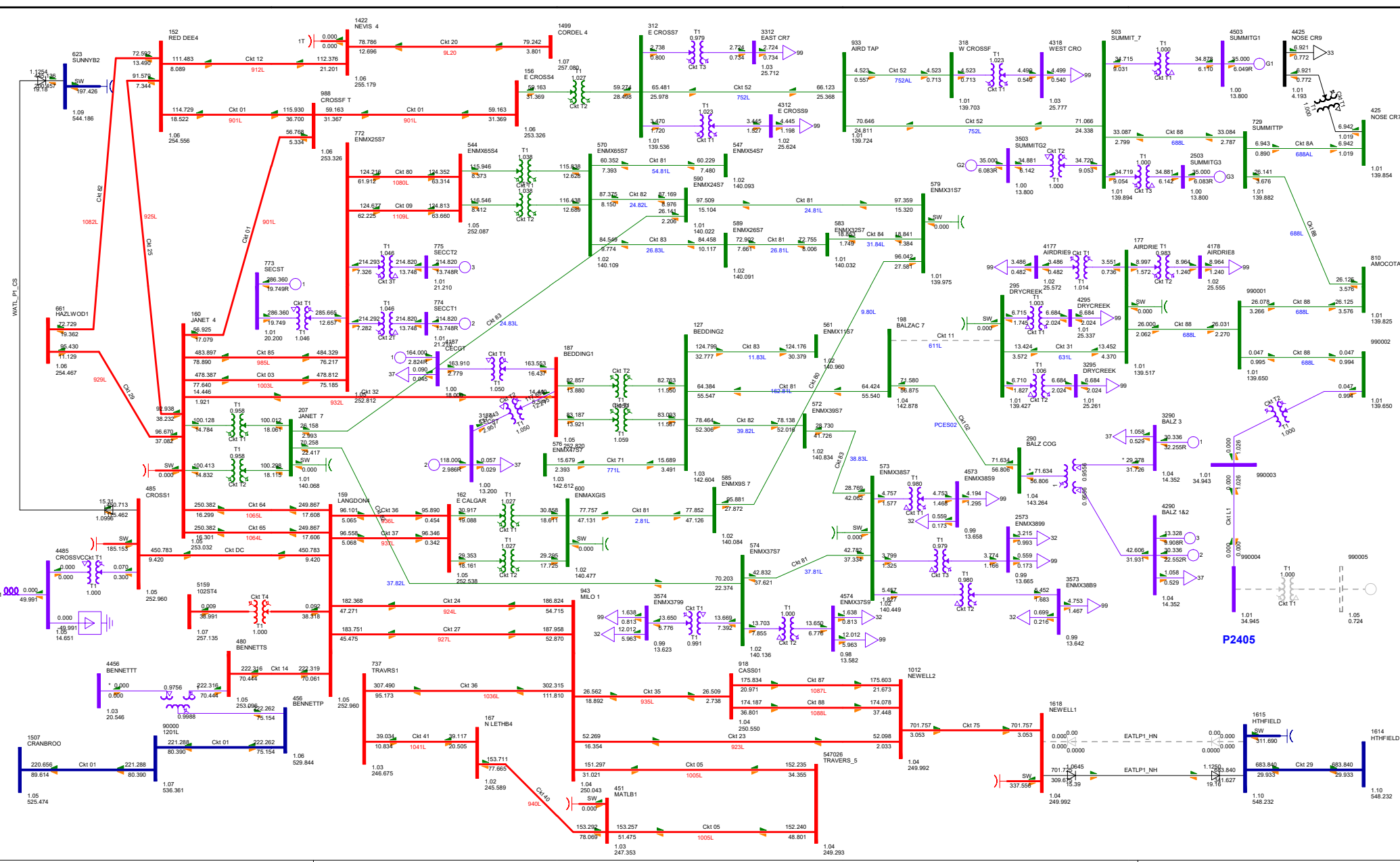


P2405 Sollair MPC Solar

**FIGURE A6.1-3 N-1: 631L (EAST AIRDRIE 199S TO DRY CREEK 186S) WITH RAS
2023 SUMMER LIGHT (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:305.896 MW Ssk Import:0.000 MW MATL Import:0.016 MW
MH Export: -13.589 MW

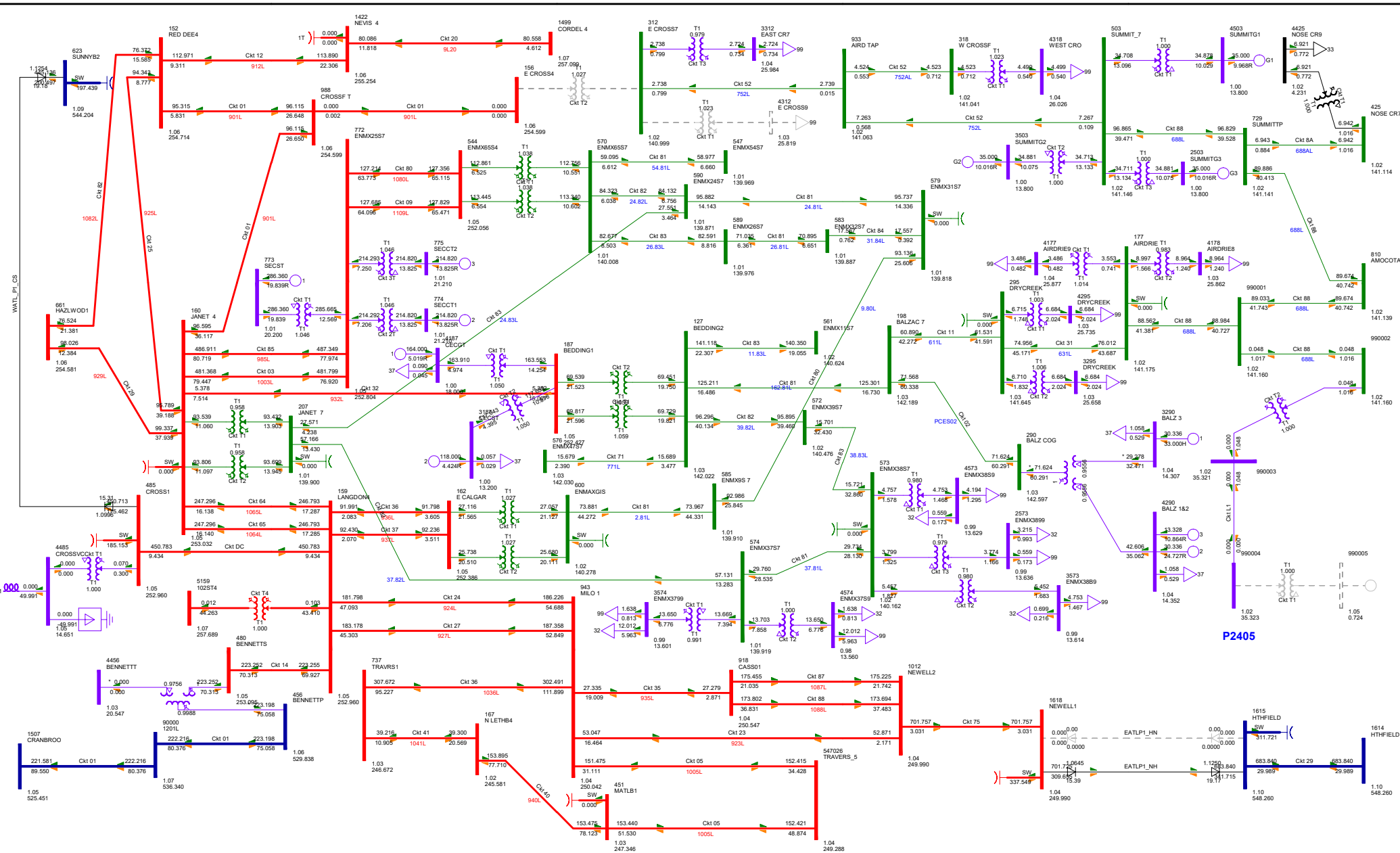
Bus - Voltage (kV) (p) (u)
Branch - MW/Mvar
Equipment - MW/Mvar
10000.000000
1.0000000000
MW = 0.000+0.000+0.000+0.000+0.000+0.000+0.000+0.000+0.000



P2405 Sollair MPC Solar
 BC Import:306.207 MW Sack Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

FIGURE A6.1-4 N-1:611L (BALZAC 391S TO DRY CREEK 186S) WITH RAS
2023 SUMMER LIGHT (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022

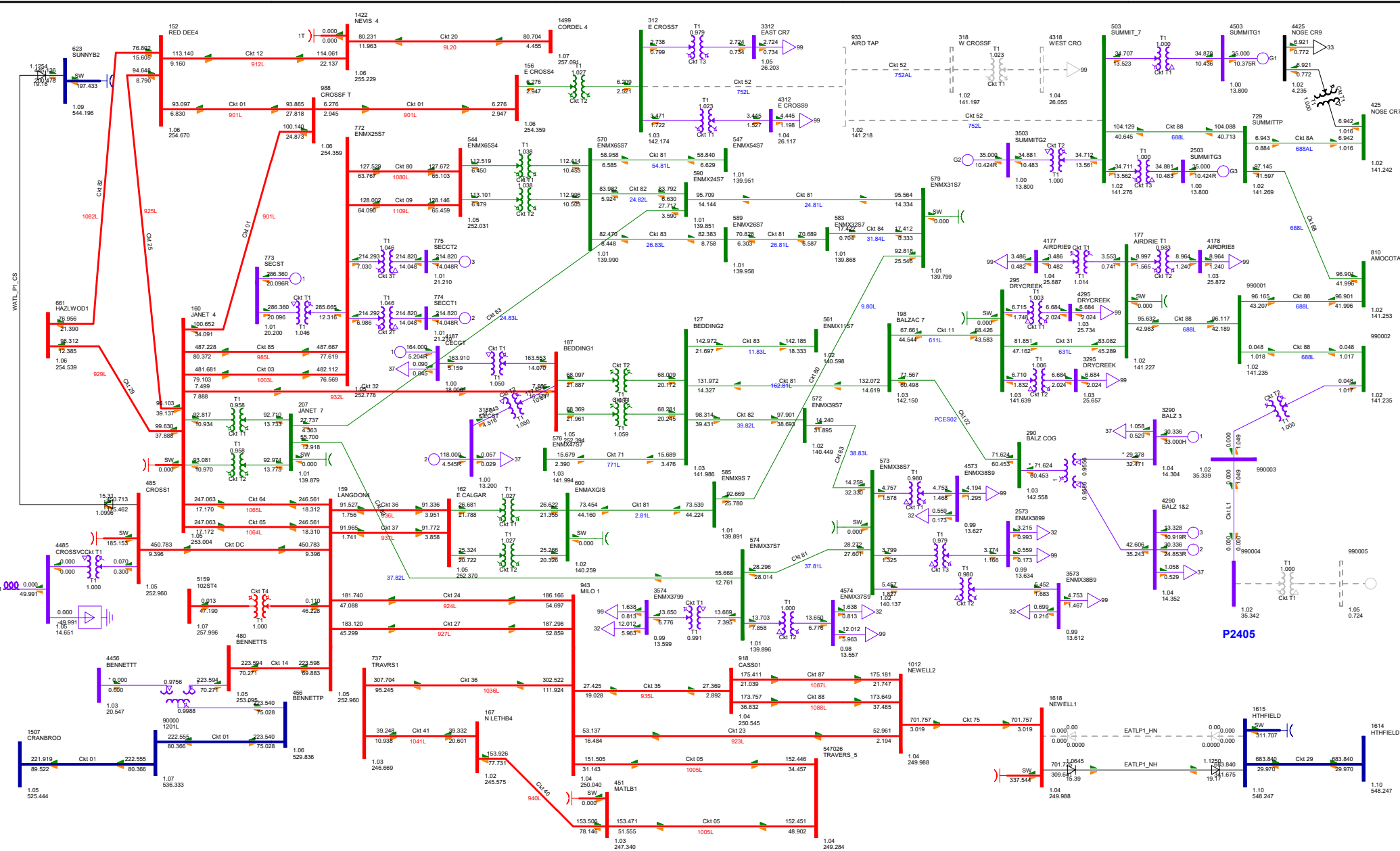
Bus - Voltage (kV) (p.u.)
 Branch - MW (MW)
 Equipment - MVA (MVA)
 1.000 (1.00000)
 MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000



P2405 Sollair MPC Solar
 BC Import:307.323 MW Sack Import:-0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A6.1-5 N-1:EAST CROSSFIELD 64S TRANSFORMER T1 WITH RAS
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (KV) or MW
 Break - Breaker
 Equipment - MW/Mvar
 100.000000
 1.0000000000
 MW = 0.000000+138.000000+500.000000+500.000000

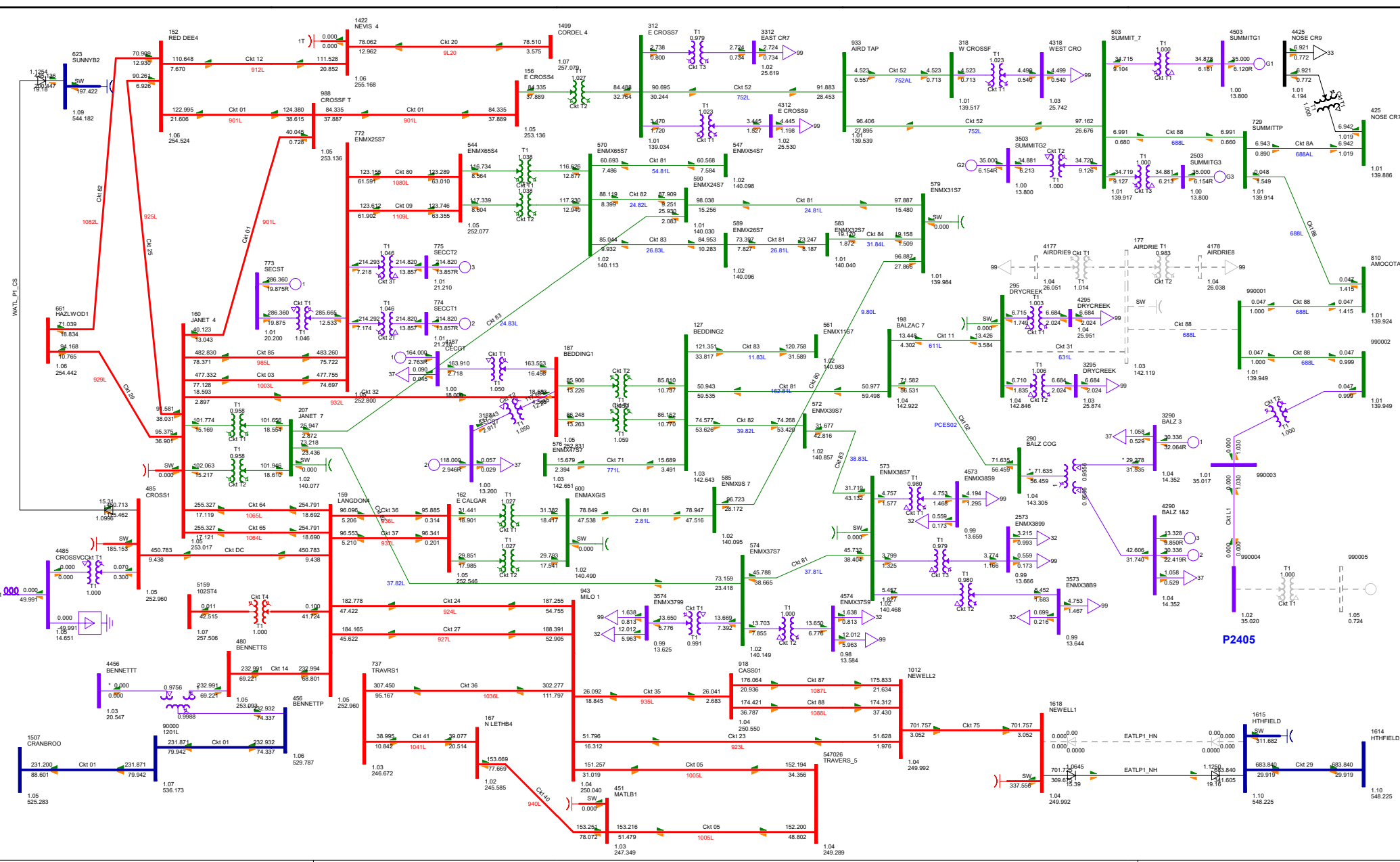


P2405 Sollair MPC Solar

BC Import:307.711 MW Sawk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A6.1-6 N-1: 752L (EAST CROSSFIED 64S TO SUMMIT 653S) WITH RAS
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON FRIDAY 15. APRIL 2022**

Bus - Voltage (kV) (p.u.)
 Branch - MW (MW)
 Equipment - MW (MW)
 1.000 (1.000000)
 MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000

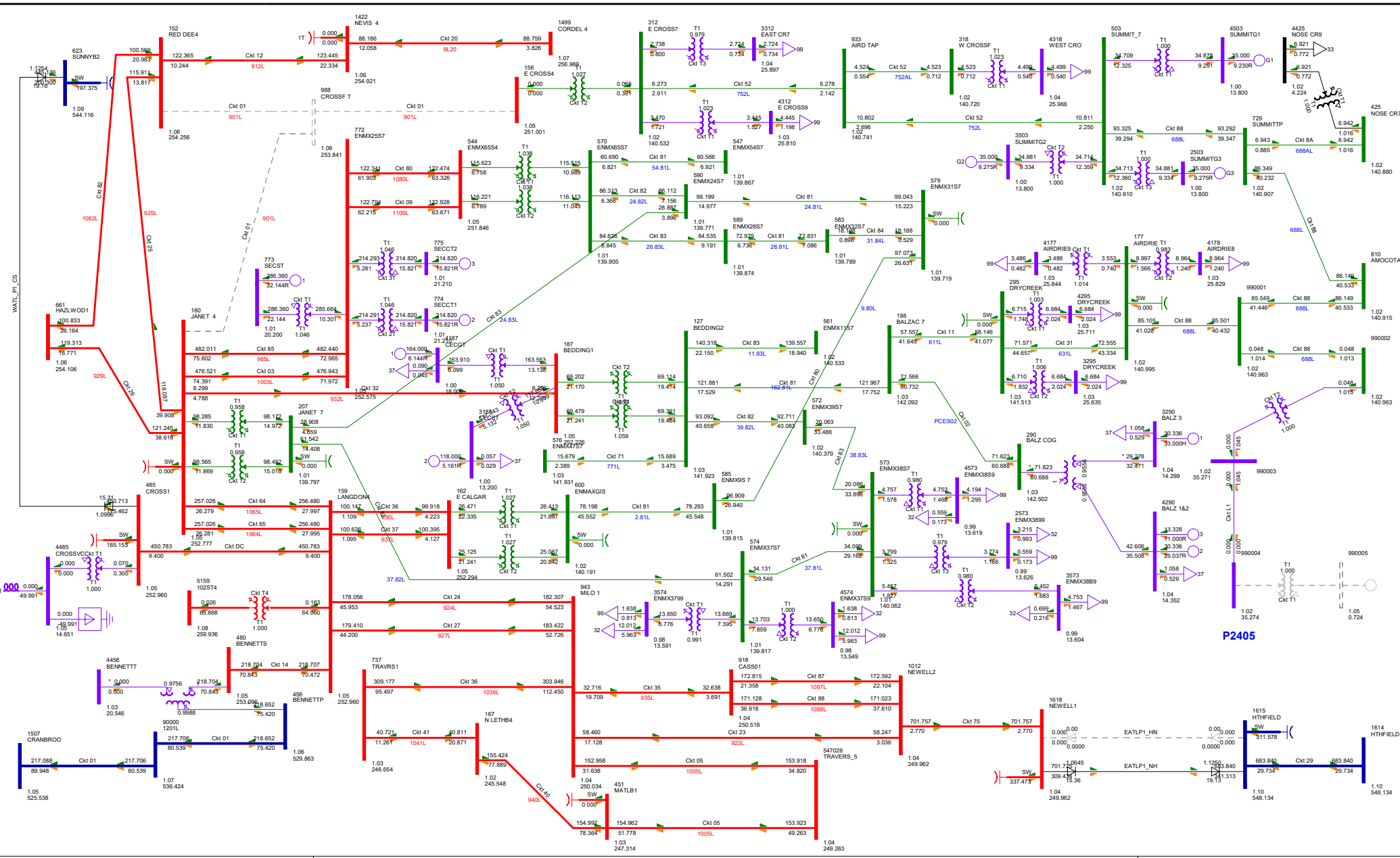


P2405 Sollair MPC Solar

BC Import:317.915 MW Sawk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A6.1-7 N-1: 199ST2 (EAST AIRDRIE 199S TRANSFORMER T2) WITH RAS
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p) (n)
 Branch - MW (M) (W)
 Equipment - MW (M) (W)
 1.000 (0.000000)
 MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000

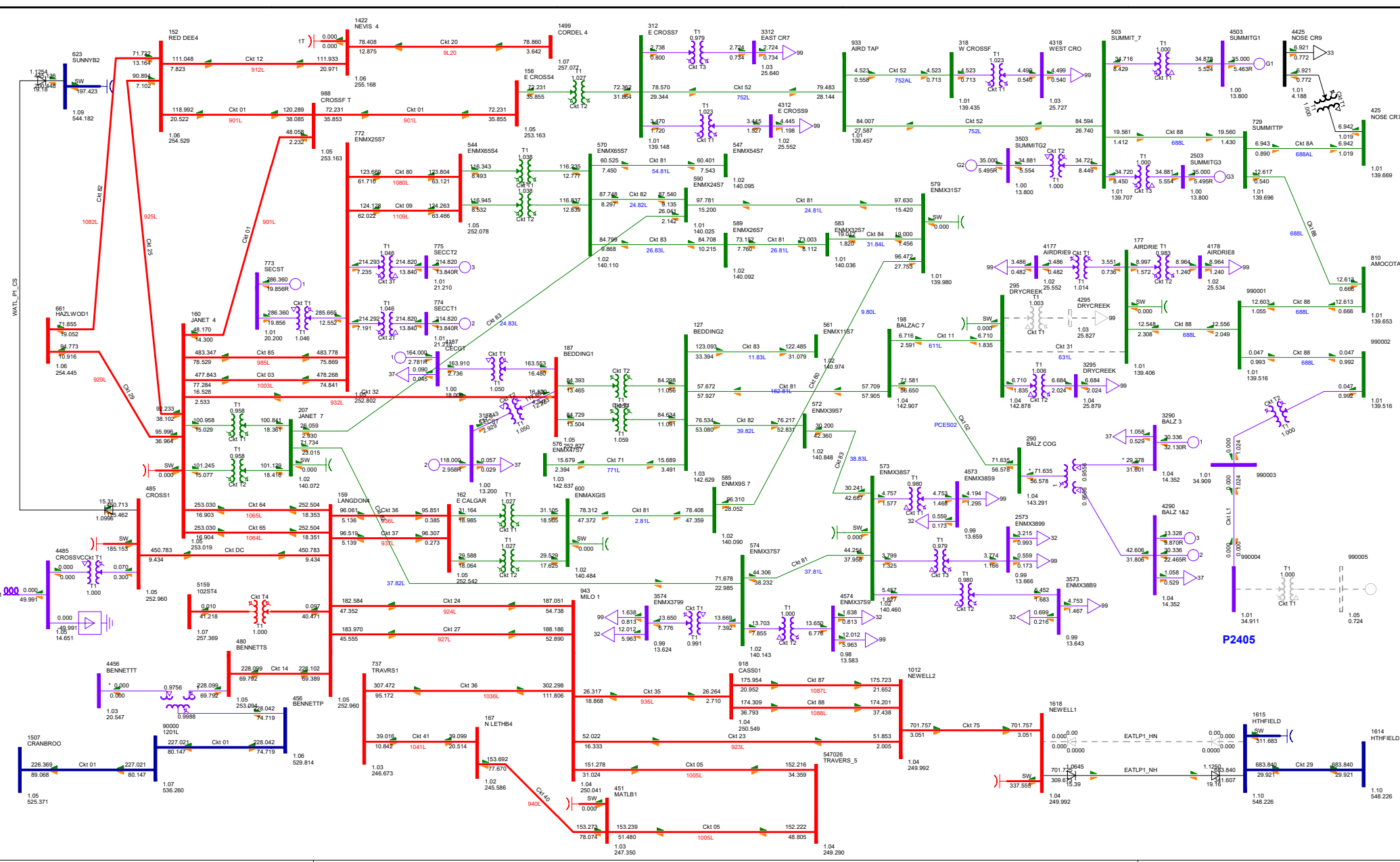


P2405 Sollair MPC Solar

**FIGURE A6.1-8 N-1: 901L (JANET 74S TO RED DEER 63S) WITH RAS
2023 SUMMER LIGHT (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:301.883 MW Ssk Import:-0.000 MW MATL Import:0.016 MW
MH Export: -13.589 MW

Bus - Voltage (kV) (p.u.)
Branch - MW (MW)
Equipment - MW (MW)
Loss (MW)
MW = 0.000 + 330.000 + 138.000 + 240.000 + 500.000 + 600.000

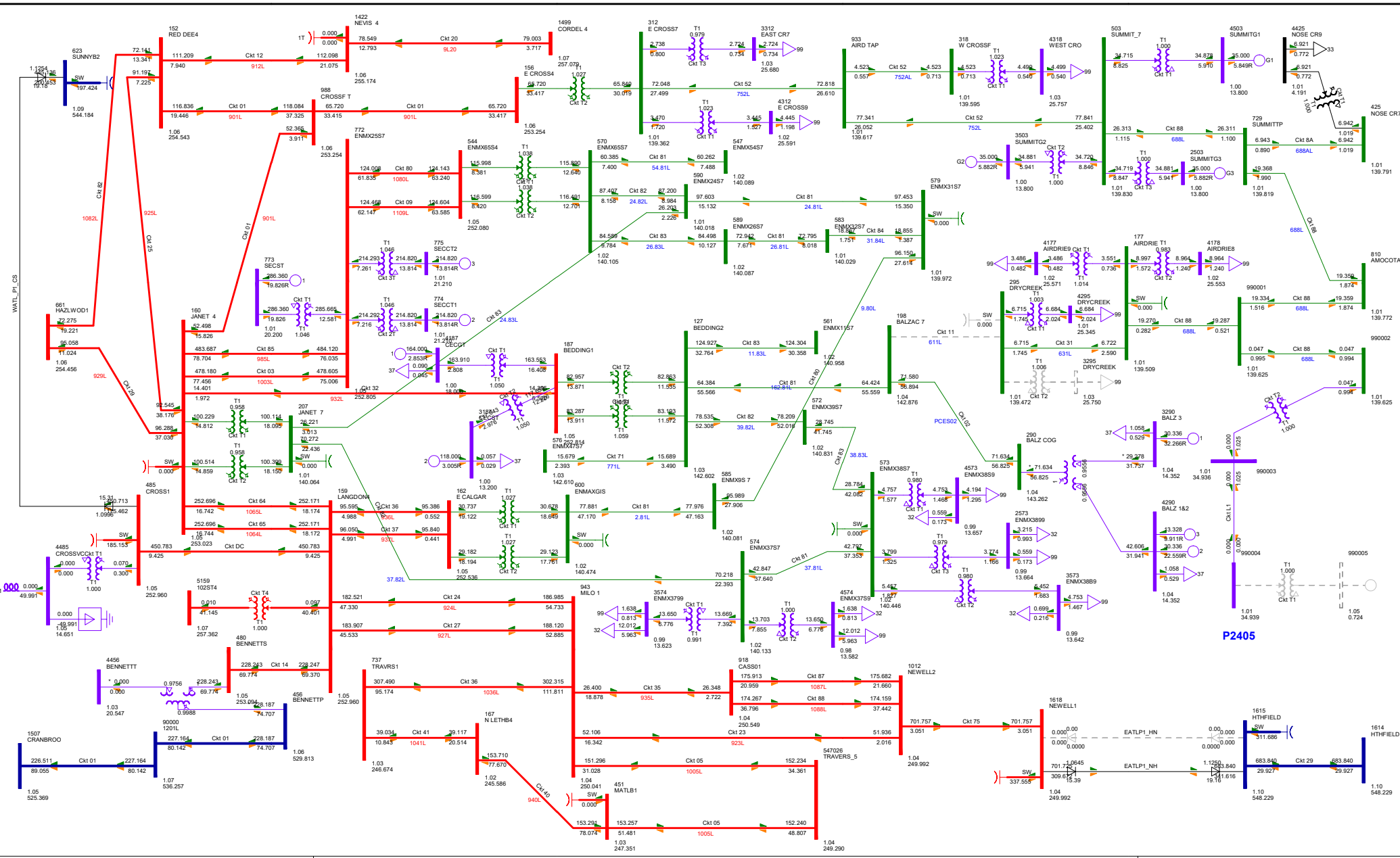


P2405 Sollair MPC Solar

BC Import:312.583 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A6.1-9 N-1: 186ST1 (DRY CREEK 186S TRANSFORMER T1) WITH RAS
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

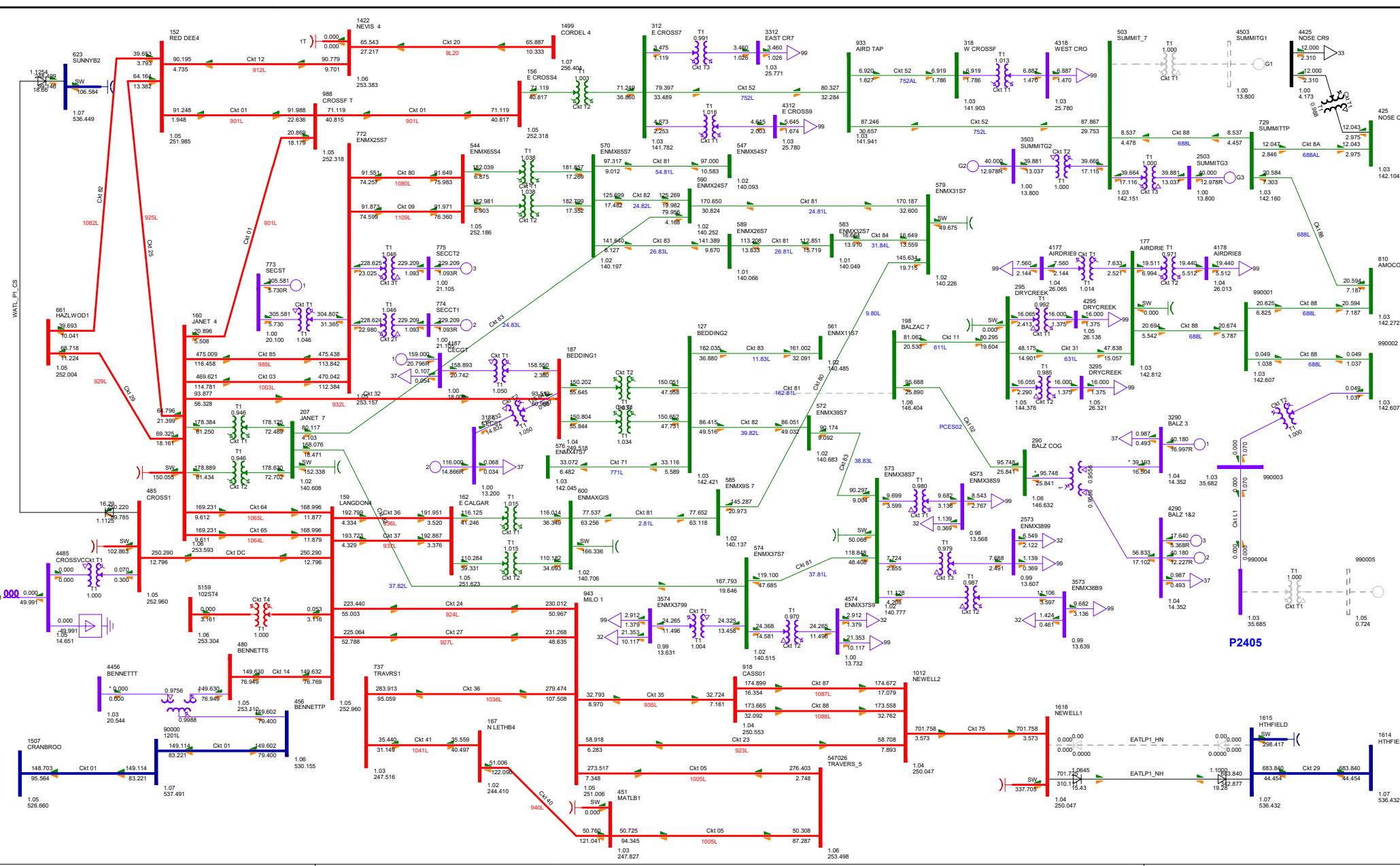
Bus - Voltage (KV) (p.u.)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 1.000 = 100.000%
 MW = 0.000+166.000+138.000+240.000+500.000+500.000



P2405 Sollair MPC Solar
 BC Import:312.754 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: -13.589 MW

**FIGURE A6.1-10 N-1: 186ST2 (DRY CREEK 186S TRANSFORMER T2) WITH RAS
 2023 SUMMER LIGHT (POST-CONNECTION) - A1
 PRINTED ON WEDNESDAY 30. MARCH 2022**

Bus - Voltage (kV) (p.u.)
 Branch - MW/Mvar
 Equipment - MW/Mvar
 (0.000/0.000)
 MW = 0.000+0.000+0.000+138.000+240.000+500.000+500.000

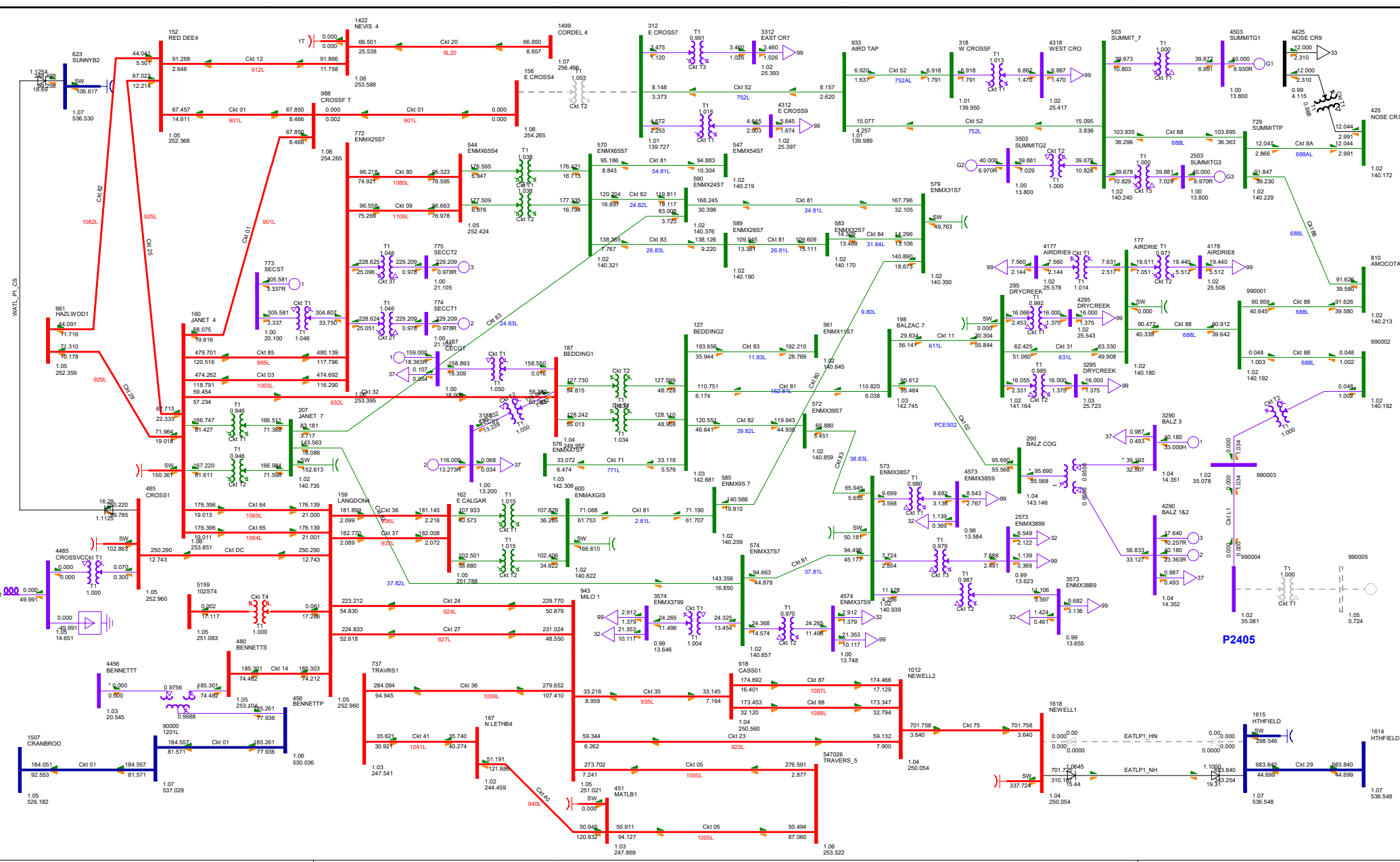


P2405 Sollair MPC Solar

BC Import: 226.007 MW Sack Import: -0.000 MW MATL Import: 0.016 MW
MH Export: 27.199 MW

FIGURE A6.2-1 N-1: 162.81L (BEDDINGTON TO BALZAC 391S) WITH RAS
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022

Bus - Voltage (kV) (p.u.)
Branch - MW (MW)
Equipment - MW (MW)
Loss - MW (MW)
MW - MW (MW)

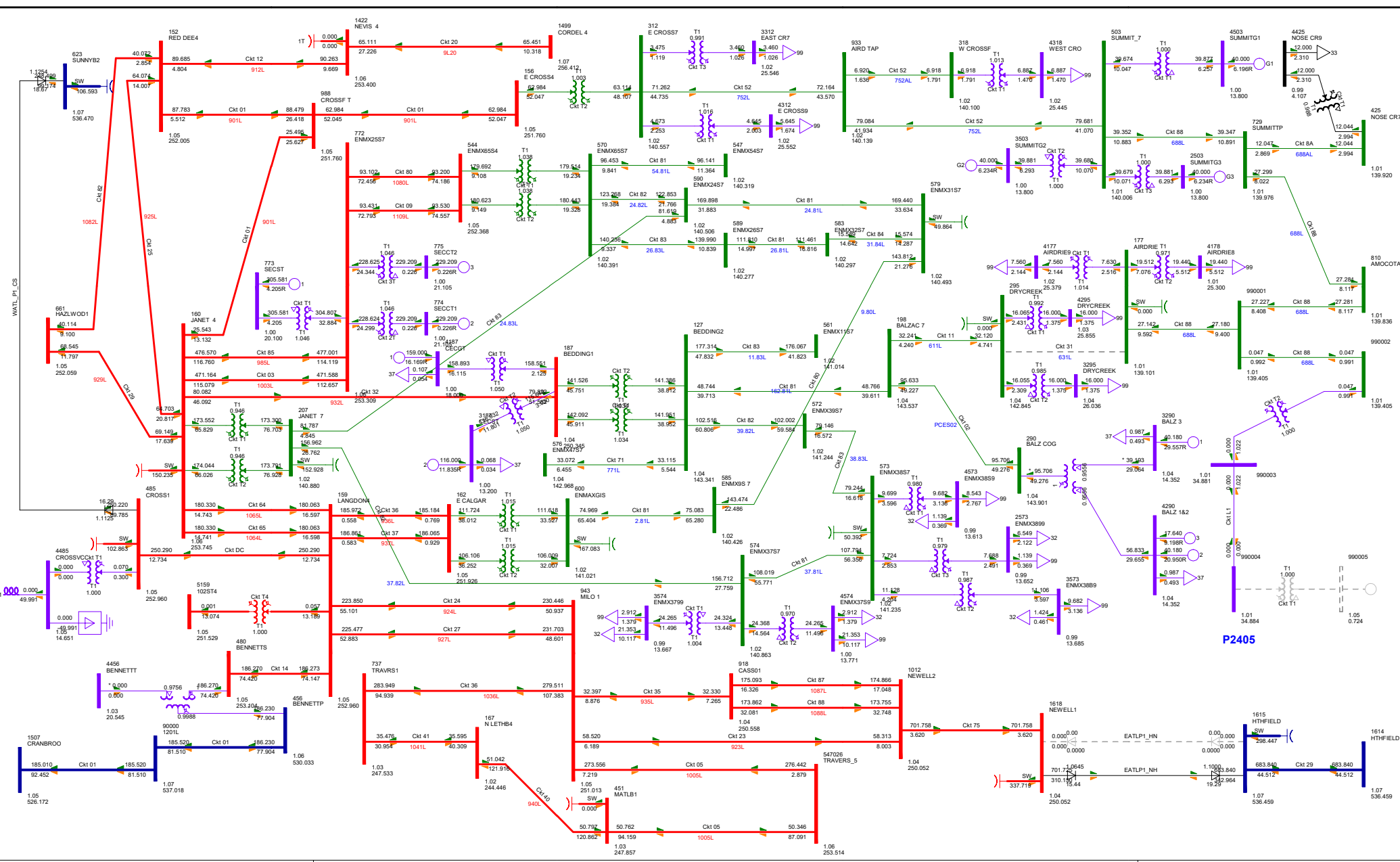


P2405 Sollair MPC Solar

**FIGURE A6.2-2 N-1: 64ST2 (EAST CROSSFIELD 64S TRANSFORMER T2) WITH RAS
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:265.682 MW Sask Import:-0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p) (n)
Branch - MW (M) (W)
Equipment - MW (M) (W)
1.000 (0.000) (0.000)
MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000

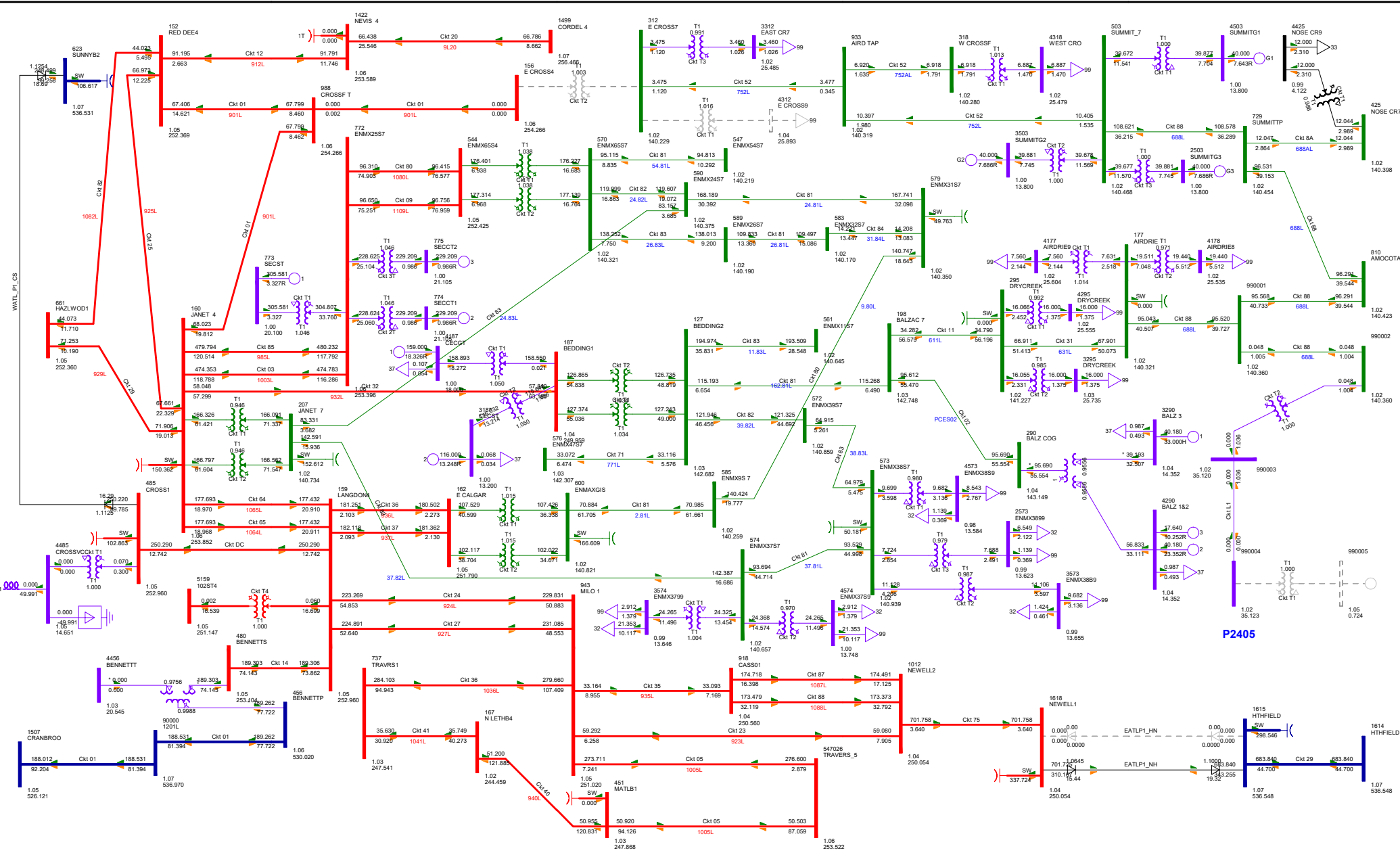


P2405 Sollair MPC Solar

**FIGURE A6.2-3 N-1: 631L (EAST AIRDRIE 199S TO DRY CREEK 186S) WITH RAS
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:266.688 MW Sask Import:0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p) (n)
Branch - MW (M) (W)
Equipment - MW (M) (W)
1.000 (0.000) (0.000)
MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000

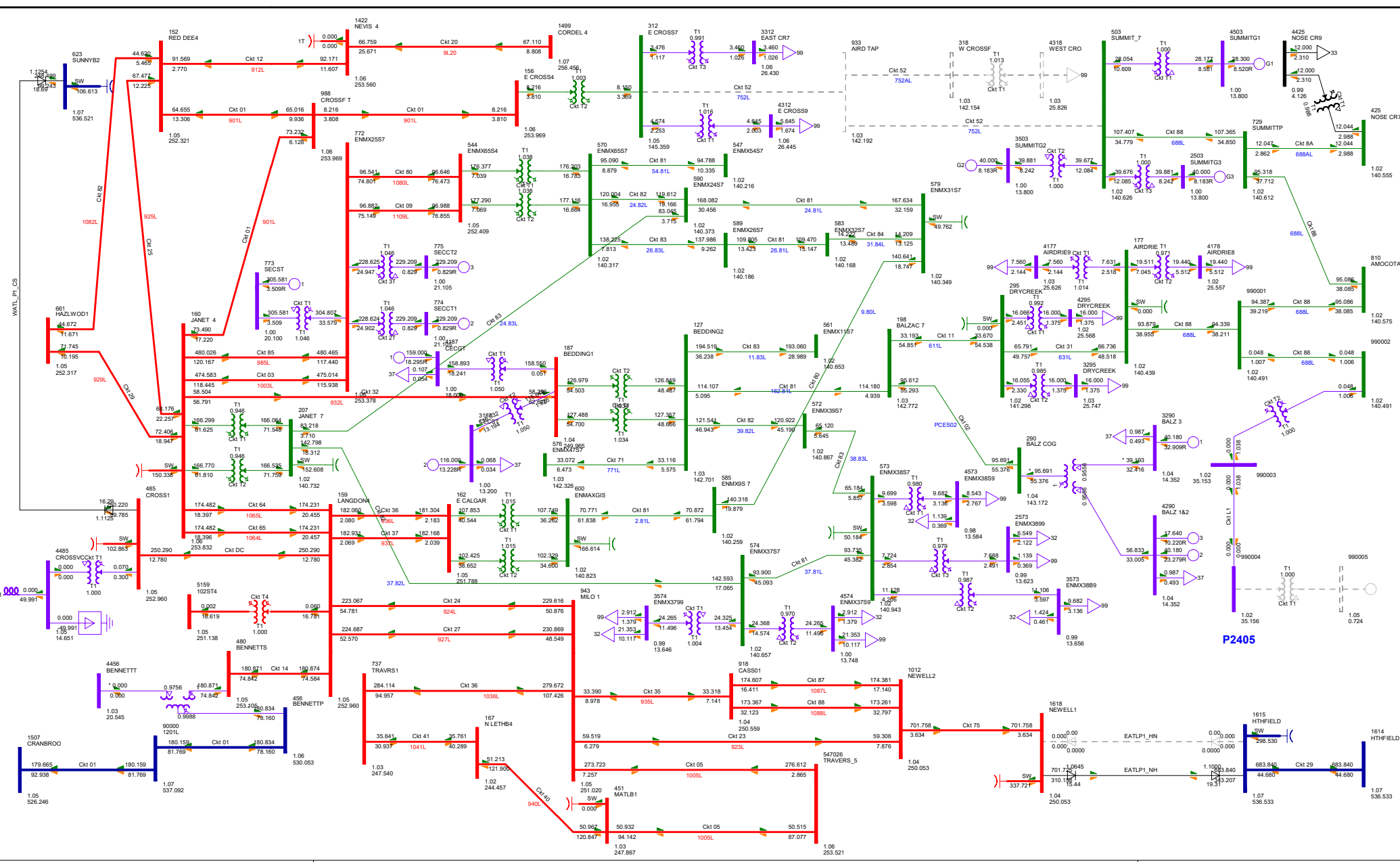


P2405 Sollair MPC Solar

**FIGURE A6.2-4 N-1: EAST CROSSFIELD 64S TRANSFORMER T1 WITH RAS
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import: 270.116 MW Ssk Import: 0.000 MW MATL Import: 0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV)
Branch - MW/MVA
Equipment - MW/MVA
Loss - MW/MVA
MW = 1000.000000
MVA = 1000.000000
MW = 138.000 + 240.000 + 500.000 + 500.000

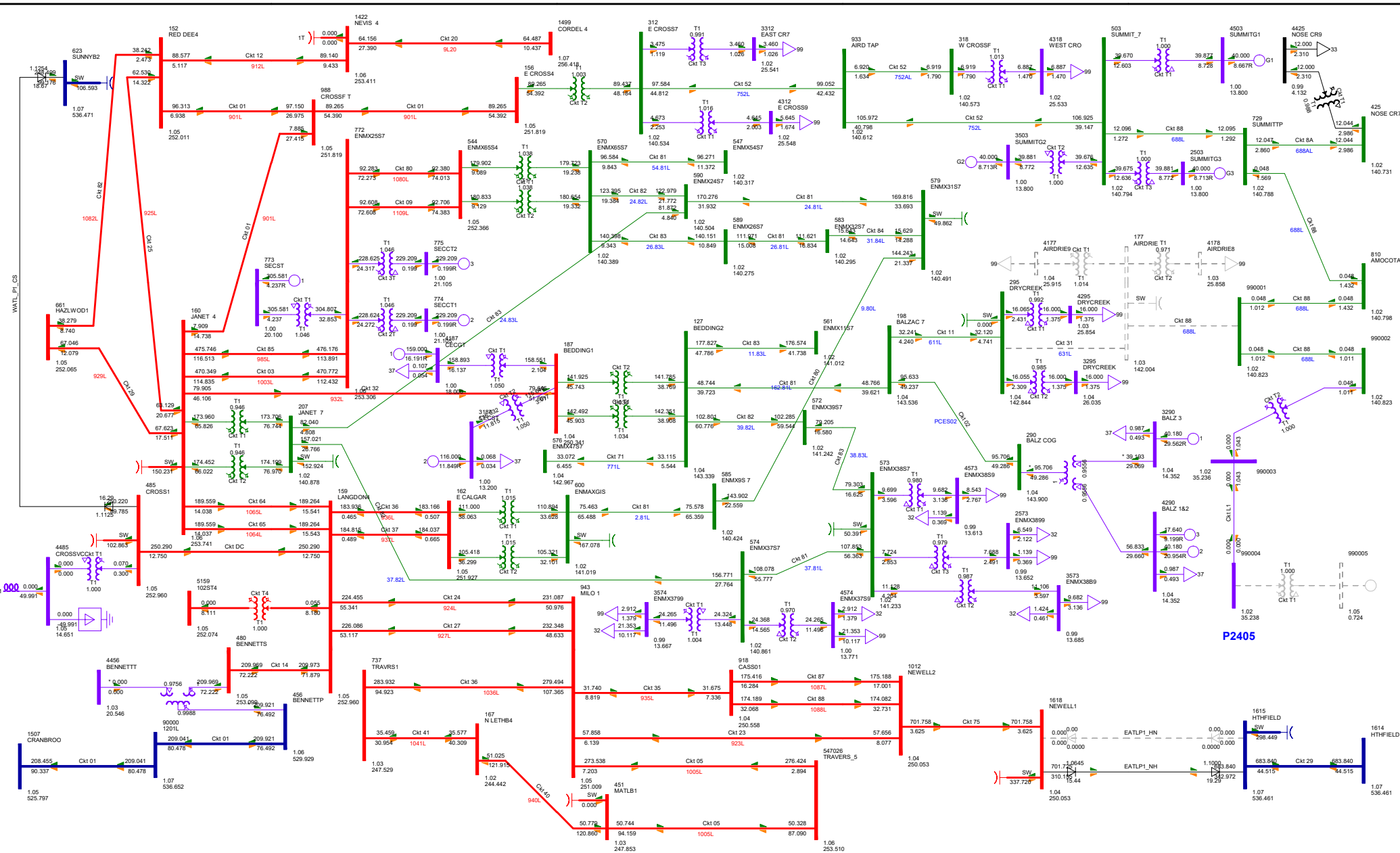


P2405 Sollair MPC Solar

**FIGURE A6.2-5 N-1: 752L (EAST CROSSFIED 64S TO SUMMIT 653S) WITH RAS
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:260.793 MW Ssk Import:-0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p) (n)
Branch - MW (p) (n)
Equipment - MW (p) (n)
1.000 (0.000) (0.000)
MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000

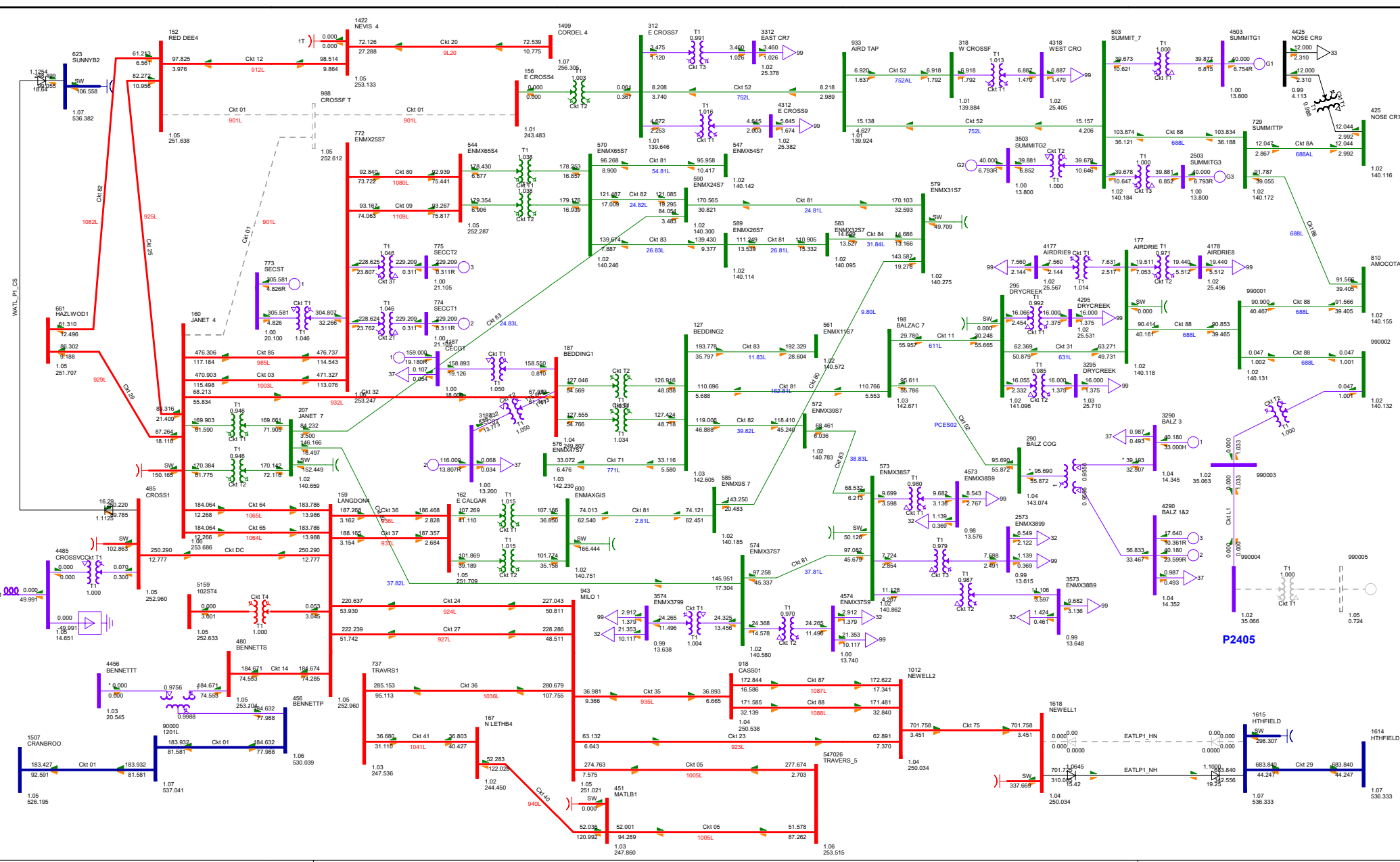


P2405 Sollair MPC Solar

**FIGURE A6.2-6 N-1: 199S2 (EAST AIRDRIE 199S TRANSFORMER T2) WITH RAS
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:292.864 MW Sask Import:-0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

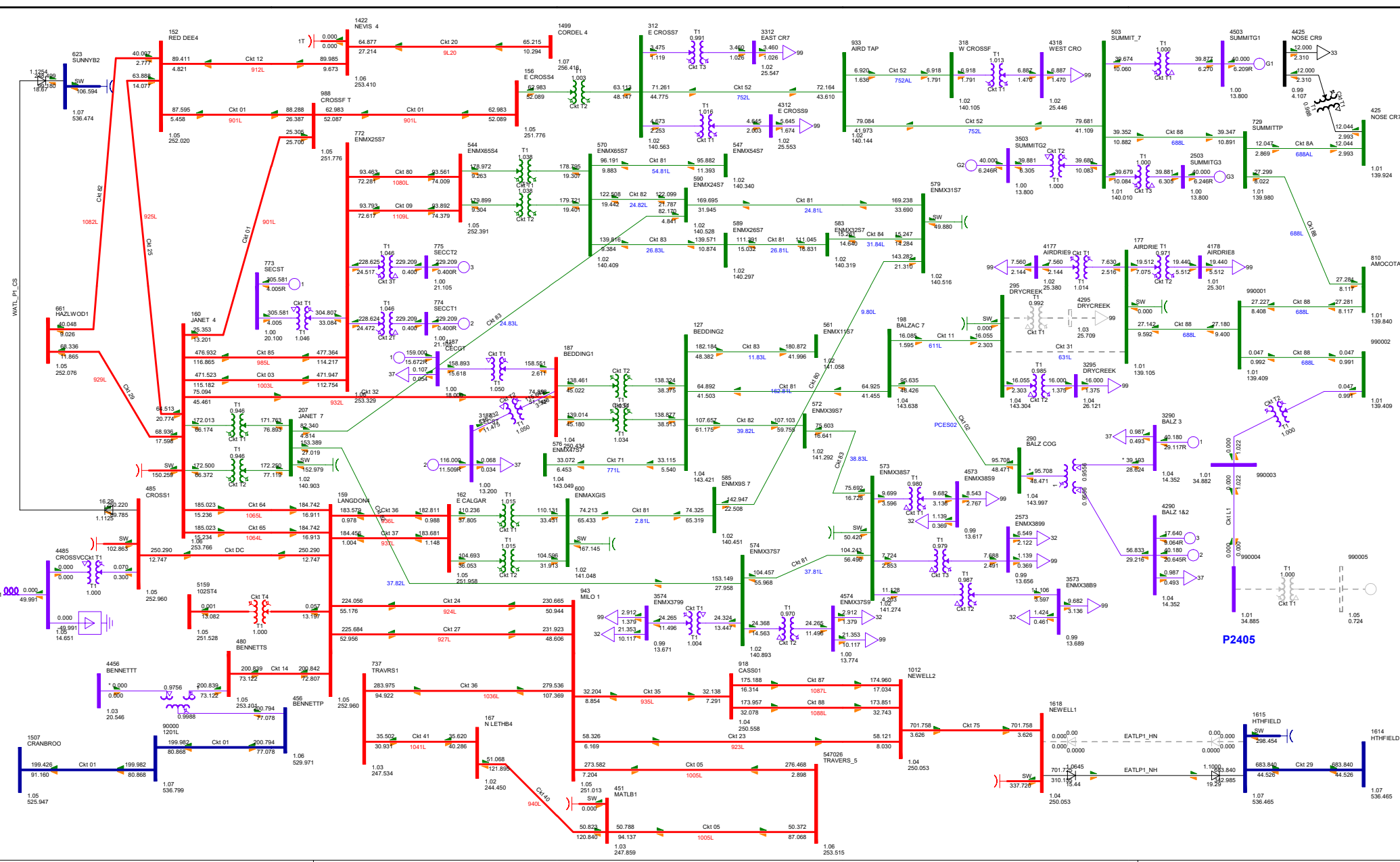
Bus - Voltage (kV) (p.u.)
Branch - MW/Mvar
Equipment - MW/Mvar
1.000 (0.00000)
MW = 0.000+0.000+0.000+138.000+240.000+500.000+500.000



P2405 Sollair MPC Solar
 BC Import:264.693 MW Ssk Import:0.000 MW MATL Import:0.016 MW
 MH Export: 27.199 MW

FIGURE A6.2-7 N-1: 901L (JANET 74S TO RED DEER 63S) WITH RAS
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022

Bus - Voltage (kV) (p) (n)
 Branch - MW (M) (W)
 Equipment - MW (M) (W)
 1.000 (0.000) (0.000)
 MW = 0.000 + 0.000 + 138.000 + 240.000 + 500.000 + 500.000

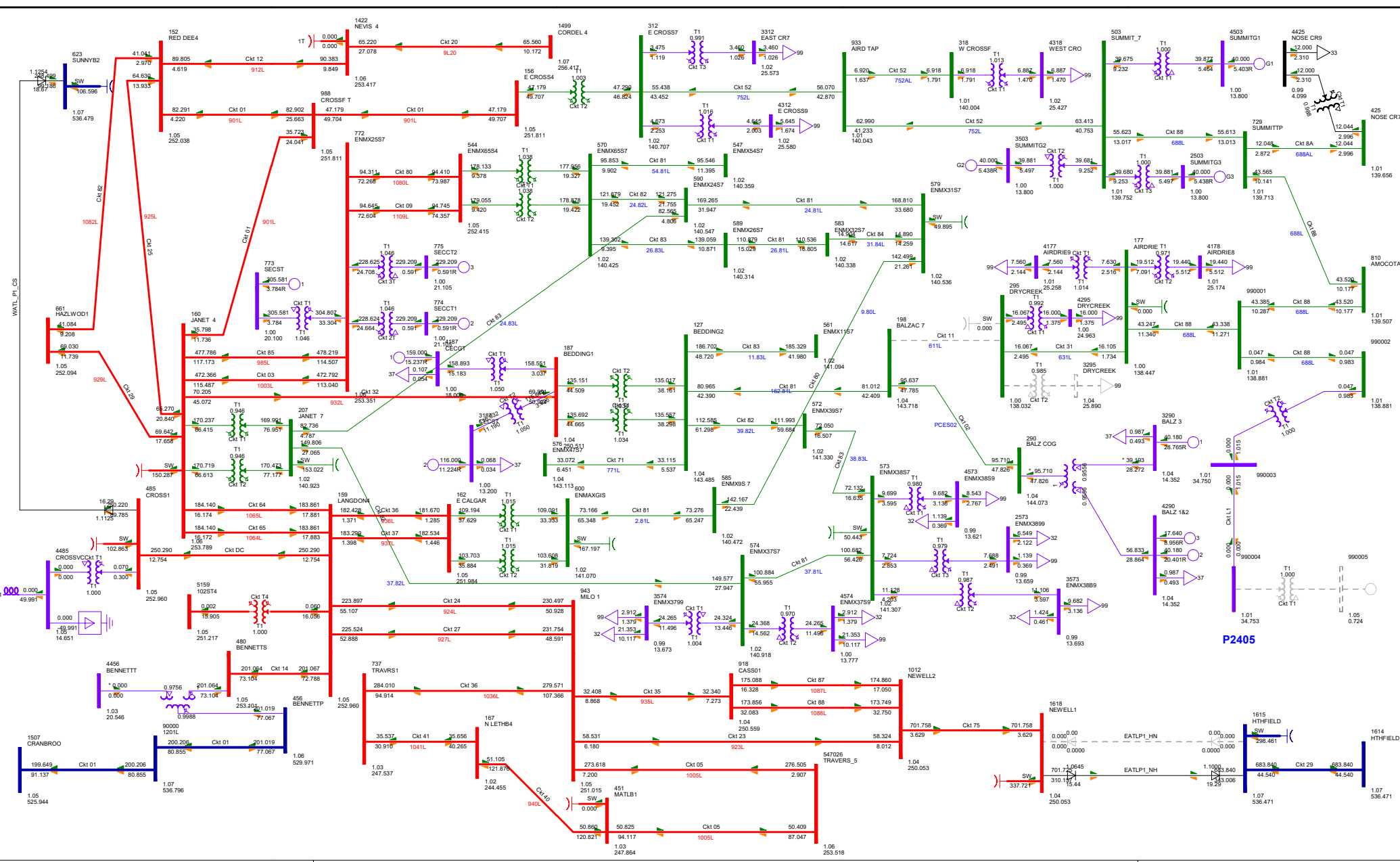


P2405 Sollair MPC Solar

**FIGURE A6.2-8 N-1: 186ST1 (DRY CREEK 186S TRANSFORMER T1) WITH RAS
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:282.810 MW Ssk Import:0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p.u.)
Branch - MW/MVA
Equipment - MW/MVA
1.000 (0.000000)
MW = 0.000+0.000+0.000+138.000+240.000+500.000+500.000



P2405 Sollair MPC Solar

**FIGURE A6.2-9 N-1: 186S2 (DRY CREEK 186S TRANSFORMER T2) WITH RAS
2023 SUMMER PEAK (POST-CONNECTION) - A1
PRINTED ON WEDNESDAY 30. MARCH 2022**

BC Import:283.096 MW Ssk Import:0.000 MW MATL Import:0.016 MW
MH Export: 27.199 MW

Bus - Voltage (kV) (p.u.)
Branch - MW/Mvar
Equipment - MW/Mvar
1.000 (1.000000)
MW = 0.000+0.000+0.000+138.000+240.000+500.000+500.000

Attachment A7

Constraint Effective Factors Table



Case
2023SL_Post-Project.sav

Contingency	Line	Power Plant					
		P2405	Shepard	Crossfield Energy Center	Calgary Energy Center	Nexen Inc#1	U of C
162.81L (Beddington to Balzac 391S)	East Crossfield 64S T2	0.9517	-0.0021	0.9796	-0.0018	0.9575	0.0000
162.81L (Beddington to Balzac 391S)	752L (East Crossfield 64S to 752AL Tap)	0.8897	-0.0013	0.9231	-0.0011	0.8946	0.0000
162.81L (Beddington to Balzac 391S)	752L (Summit 653S to 752AL Tap)	0.9442	-0.0007	0.9842	-0.0006	0.9491	0.0000
64ST2 (East Crossfield 64S Transformer T2)	631L (Dry Creek 186S to East Airdrie 199S)	0.9835	-0.0015	0.9882	-0.0016	-0.0003	0.0015
64ST2 (East Crossfield 64S Transformer T2)	688L (East Airdrie 199S to P2405 Tap)	0.9866	-0.0013	0.9919	-0.0014	-0.0003	0.0014
64ST2 (East Crossfield 64S Transformer T2)	611L (Balzac 391S to Dry Creek 186S)	0.9789	-0.0019	0.9823	-0.0020	-0.0004	0.0019
631L (East Airdrie 199S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	0.9184	-0.0015	0.9418	-0.0013	-0.0007	0.0000
631L (East Airdrie 199S to Dry Creek 186S)	752L (Summit 653S to 752AL Tap)	0.9541	-0.0011	0.9823	-0.0009	-0.0005	0.0000
611L (Balzac 391S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	0.9256	-0.0014	0.9470	-0.0012	-0.0007	0.0000
611L (Balzac 391S to Dry Creek 186S)	752L (Summit 653S to 752AL Tap)	0.9577	-0.0011	0.9833	-0.0009	-0.0005	0.0000
East Crossfield 64S Transformer T1	631L (Dry Creek 186S to East Airdrie 199S)	0.9836	-0.0015	0.9880	-0.0015	-0.0003	0.0015
East Crossfield 64S Transformer T1	688L (East Airdrie 199S to P2405 Tap)	0.9864	-0.0013	0.9914	-0.0014	-0.0003	0.0014
East Crossfield 64S Transformer T1	611L (Balzac 391S to Dry Creek 186S)	0.9786	-0.0019	0.9817	-0.0019	-0.0004	0.0019
752L (East Crossfield 64S to Summit 653S)	631L (Dry Creek 186S to East Airdrie 199S)	0.9826	-0.0015	0.9862	-0.0015	-0.0004	0.0015
752L (East Crossfield 64S to Summit 653S)	688L (East Airdrie 199S to P2405 Tap)	0.9851	-0.0013	0.9892	-0.0014	-0.0004	0.0013
752L (East Crossfield 64S to Summit 653S)	611L (Balzac 391S to Dry Creek 186S)	0.9772	-0.0019	0.9795	-0.0020	-0.0005	0.0019
199ST2 (East Airdrie 199S Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	0.9118	-0.0014	0.9373	-0.0012	-0.0007	0.0000
199ST2 (East Airdrie 199S Transformer T2)	752L (Summit 653S to 752AL Tap)	0.9514	-0.0010	0.9823	-0.0008	-0.0005	0.0000
901L (Janet 74S to Red Deer 63S)	631L (Dry Creek 186S to East Airdrie 199S)	0.9835	-0.0017	0.9883	-0.0017	-0.0005	0.0014
901L (Janet 74S to Red Deer 63S)	688L (East Airdrie 199S to P2405 Tap)	0.9865	-0.0015	0.9919	-0.0015	-0.0004	0.0013
901L (Janet 74S to Red Deer 63S)	611L (Balzac 391S to Dry Creek 186S)	0.9787	-0.0022	0.9821	-0.0022	-0.0006	0.0018
186ST1 (Dry Creek 186S Transformer T1)	752L (East Crossfield 64S to 752AL Tap)	0.9183	-0.0015	0.9417	-0.0013	-0.0007	0.0000
186ST1 (Dry Creek 186S Transformer T1)	752L (Summit 653S to 752AL Tap)	0.9540	-0.0010	0.9822	-0.0009	-0.0005	0.0000
186ST2 (Dry Creek 186S Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	0.9222	-0.0015	0.9446	-0.0013	-0.0008	0.0000
186ST2 (Dry Creek 186S Transformer T2)	752L (Summit 653S to 752AL Tap)	0.9561	-0.0011	0.9830	-0.0009	-0.0005	0.0000

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Contingency	Line	P2405	Shepard	Crossfield Energy Center	Calgary Energy Center	Nexen Inc#1	U of C
Base Case	688L (East Airdrie 1995 to P2405 Tap)	0.6034	-0.0124	0.5134	-0.0429	-0.0831	-0.0317
162ST1 (Enmax 162 Transformer T1)	688L (East Airdrie 1995 to P2405 Tap)	0.5949	-0.0127	0.5059	-0.0358	-0.0923	-0.0352
162ST2 (Enmax 162 Transformer T2)	688L (East Airdrie 1995 to P2405 Tap)	0.5949	-0.0127	0.5059	-0.0358	-0.0923	-0.0351
162.81L (Beddington to Balzac 391S)	East Crossfield 64S T2	0.9587	-0.0017	0.9798	-0.0009	0.9622	0.0033
162.81L (Beddington to Balzac 391S)	752L (East Crossfield 64S to 752AL Tap)	0.8931	-0.0011	0.9197	-0.0006	0.8956	0.0022
162.81L (Beddington to Balzac 391S)	752L (Summit 653S to 752AL Tap)	0.9382	-0.0008	0.9711	-0.0004	0.9403	0.0015
64ST2 (East Crossfield 64S Transformer T2)	631L (Dry Creek 186S to East Airdrie 199S)	0.9794	-0.0011	0.9831	-0.0008	0.0002	0.0066
64ST2 (East Crossfield 64S Transformer T2)	688L (East Airdrie 199S to P2405 Tap)	0.9896	-0.0008	0.9943	-0.0006	0.0001	0.0048
64ST2 (East Crossfield 64S Transformer T2)	611L (Balzac 391S to Dry Creek 186S)	0.9612	-0.0016	0.9627	-0.0012	0.0002	0.0099
936L (Langdon 102S to East Calgary 5S)	688L (East Airdrie 199S to P2405 Tap)	0.6028	-0.0116	0.5129	-0.0427	-0.0837	-0.0322
937L (Langdon 102S to East Calgary 5S)	688L (East Airdrie 199S to P2405 Tap)	0.6029	-0.0116	0.5130	-0.0427	-0.0836	-0.0322
932L (Janet 74S to Enmax 162)	688L (East Airdrie 199S to P2405 Tap)	0.5943	-0.0032	0.5064	-0.0724	-0.0971	-0.0329
74ST1 (Janet 74S 240/138 kV Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	0.6035	-0.0116	0.5135	-0.0434	-0.0842	-0.0331
74ST2 (Janet 74S 240/138 kV Transformer T2)	688L (East Airdrie 199S to P2405 Tap)	0.6035	-0.0116	0.5135	-0.0434	-0.0843	-0.0331
631L (East Airdrie 199S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	0.9148	-0.0013	0.9310	-0.0007	0.0002	0.0023
631L (East Airdrie 199S to Dry Creek 186S)	752L (Summit 653S to 752AL Tap)	0.9442	-0.0010	0.9654	-0.0006	0.0001	0.0017
PCES02L (Balzac 391S to PCES02S)	688L (East Airdrie 199S to P2405 Tap)	0.5980	-0.0123	0.5086	-0.0426	0.0000	-0.0319
611L (Balzac 391S to Dry Creek 186S)	752L (East Crossfield 64S to 752AL Tap)	0.9216	-0.0015	0.9310	-0.0009	0.0000	0.0026
611L (Balzac 391S to Dry Creek 186S)	752L (Summit 653S to 752AL Tap)	0.9437	-0.0012	0.9572	-0.0007	0.0000	0.0021
37.82L (Janet 74S to Enmax 37)	688L (East Airdrie 199S to P2405 Tap)	0.5985	-0.0105	0.5092	-0.0466	-0.0910	-0.0341
EnmaxT1 (Enmax 65 Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	0.6032	-0.0120	0.5132	-0.0430	-0.0833	-0.0322
EnmaxT2 (Enmax 65 Transformer T2)	688L (East Airdrie 199S to P2405 Tap)	0.6033	-0.0120	0.5132	-0.0430	-0.0833	-0.0322
38.83L (Enmax 38S to Enmax 39S)	688L (East Airdrie 199S to P2405 Tap)	0.5986	-0.0105	0.5094	-0.0466	-0.0910	-0.0341
37.81L (Enmax 37 Sub to Enmax 38 Sub)	688L (East Airdrie 199S to P2405 Tap)	0.5996	-0.0105	0.5102	-0.0467	-0.0908	-0.0339
Beddington 162S Transformer T2	688L (East Airdrie 199S to P2405 Tap)	0.6029	-0.0124	0.5129	0.0000	-0.0830	-0.0316
CECGT (CEC Generator GT)	688L (East Airdrie 199S to P2405 Tap)	0.6022	-0.0125	0.5122	-0.0428	-0.0834	-0.0313
Balzac Power Station	688L (East Airdrie 199S to P2405 Tap)	0.5981	-0.0123	0.5086	-0.0426	0.0000	-0.0319
316ST1 (West Crossfield 316S Transformer T1)	688L (East Airdrie 199S to P2405 Tap)	0.6030	-0.0124	0.5129	-0.0430	-0.0831	-0.0317
Nose Creek 284S Transformer T1	688L (East Airdrie 199S to P2405 Tap)	0.6027	-0.0124	0.5124	-0.0430	-0.0831	-0.0318
East Crossfield 64S Transformer T1	631L (Dry Creek 186S to East Airdrie 199S)	0.9796	-0.0011	0.9828	-0.0008	0.0000	0.0064
East Crossfield 64S Transformer T1	688L (East Airdrie 199S to P2405 Tap)	0.9886	-0.0008	0.9929	-0.0006	0.0000	0.0047
East Crossfield 64S Transformer T1	611L (Balzac 391S to Dry Creek 186S)	0.9636	-0.0016	0.9648	-0.0012	0.0001	0.0097
688L (Summit 653S to East Airdrie 199S)	752L (Summit 653S to 752AL Tap)	0.0000	-0.0011	0.9663	-0.0006	0.0002	0.0018
752L (East Crossfield 64S to Summit 653S)	631L (Dry Creek 186S to East Airdrie 199S)	0.9793	-0.0010	0.9815	-0.0008	0.0000	0.0062
752L (East Crossfield 64S to Summit 653S)	688L (East Airdrie 199S to P2405 Tap)	0.9869	-0.0008	0.9899	-0.0006	0.0000	0.0046
752L (East Crossfield 64S to Summit 653S)	611L (Balzac 391S to Dry Creek 186S)	0.9667	-0.0016	0.9673	-0.0012	0.0000	0.0094
752L (East Crossfield 64S to Summit 653S)	688L (Summit 653S to 688AL Tap)	-0.0063	-0.0006	0.9926	-0.0005	0.0000	0.0037
199ST2 (East Airdrie 199S Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	0.9055	-0.0011	0.9271	-0.0006	0.0002	0.0020
199ST2 (East Airdrie 199S Transformer T2)	752L (Summit 653S to 752AL Tap)	0.9428	-0.0008	0.9702	-0.0004	0.0001	0.0014
901L (Janet 74S to Red Deer 63S)	631L (Dry Creek 186S to East Airdrie 199S)	0.9791	-0.0013	0.9828	-0.0009	0.0000	0.0065
901L (Janet 74S to Red Deer 63S)	688L (East Airdrie 199S to P2405 Tap)	0.9892	-0.0009	0.9940	-0.0007	0.0000	0.0048
901L (Janet 74S to Red Deer 63S)	611L (Balzac 391S to Dry Creek 186S)	0.9610	-0.0019	0.9625	-0.0014	0.0000	0.0098
186ST1 (Dry Creek 186S Transformer T1)	752L (East Crossfield 64S to 752AL Tap)	0.9148	-0.0013	0.9310	-0.0007	0.0001	0.0022
186ST1 (Dry Creek 186S Transformer T1)	752L (Summit 653S to 752AL Tap)	0.9442	-0.0010	0.9653	-0.0006	0.0001	0.0017
186ST2 (Dry Creek 186S Transformer T2)	752L (East Crossfield 64S to 752AL Tap)	0.9190	-0.0014	0.9320	-0.0008	0.0001	0.0024
186ST2 (Dry Creek 186S Transformer T2)	752L (Summit 653S to 752AL Tap)	0.9444	-0.0011	0.9619	-0.0006	0.0001	0.0019
Enmax 38S Transformer T1 or T2 or T3	688L (East Airdrie 199S to P2405 Tap)	0.5980	-0.0105	0.5089	-0.0466	-0.0916	-0.0339
Enmax37 Transformer T1 or T2	688L (East Airdrie 199S to P2405 Tap)	0.5998	-0.0105	0.5103	-0.0466	-0.0908	-0.0339