

# **System Impact Study**

## **Shiprock 345/115-kV Transformer Project**



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### Executive Summary

Western Area Power Administration (Western) received an interconnection request from Colorado River Storage Project Management Center (CRSP MC) to install a new 345/115-kV transformer at Shiprock substation. The purpose of this transformer is to provide transformation redundancy from 345-kV to 115-kV, and to unload the existing schedules across the existing 345/230-kV transformer. The proposed size is 400~500 MVA and the in-service date would be summer/fall of 2015. A system impact study was completed to evaluate potential impacts of the proposed interconnection on Western's transmission system and identify upgrades required to mitigate any system criteria violations.

A modified Western Electricity Coordinating Council (WECC) 2012 Heavy Summer approved operating case was utilized, but with load, generation, and system topologies modified in order to represent the summer peak loading and the autumn off-peak loading system conditions for year 2015. Power flow, short circuit studies, and transient stability studies were performed on the study case. Contingencies were simulated in the study region to assess the project impact. The WECC System Performance Criteria for transmission system planning was used to determine power flow thermal and post contingent voltage deviation violations, and the Western Planning Criteria was used to determine the pre- and post-contingent voltage level violations. Power flow thermal overloads were evaluated using the ratings of existing circuit breakers. Transient stability criterion was based on the North American Electric Reliability Corporation (NERC)/WECC Stability and Post-transient Analysis Evaluation Criteria.

The Study results concluded that the addition of the new Shiprock 345/115-kV transformer had no new system performance violations on Western's transmission system when compared to the corresponding pre-project case. The project did not cause any steady-state power flow, voltage, or transient stability violations. The addition of this project increased fault duty on the Shiprock 115-kV bus and required breaker upgrades on the 115-kV bus.

The preliminary cost estimate for this interconnection request is approximately \$16 million~\$19 million dollars. The cost estimate is in 2015 US Dollars. This cost estimate includes the cost for the new transformer(s), bay additions, and related bus work. Cost estimates do not include any costs for lands and rights, environmental, surveys, geological investigations, designs and specifications, or construction supervision associated with required system upgrades.

## 1. Introduction

CRSP MC's request desires an addition of a 345/115-kV transformer at Western's Shiprock substation. The purpose of this transformer addition is to provide transformation redundancy from 345-kV to 115-kV, and to unload the existing schedules across the 345/230-kV transformer at Shiprock. The planned in-service date is summer/fall of 2015. The steady-state power flow analysis was performed using the WECC approved 2012 Heavy Summer operating case (12hs4ap), with load, generation, and system topologies modified to represent the summer peak loading condition and the autumn off peak loading conditions for year 2015. The new transformer and associated transmission lines are configured as shown in **Figure 1**. The project was modeled as 2-250 MVA transformers in parallel configuration for this system impact study.

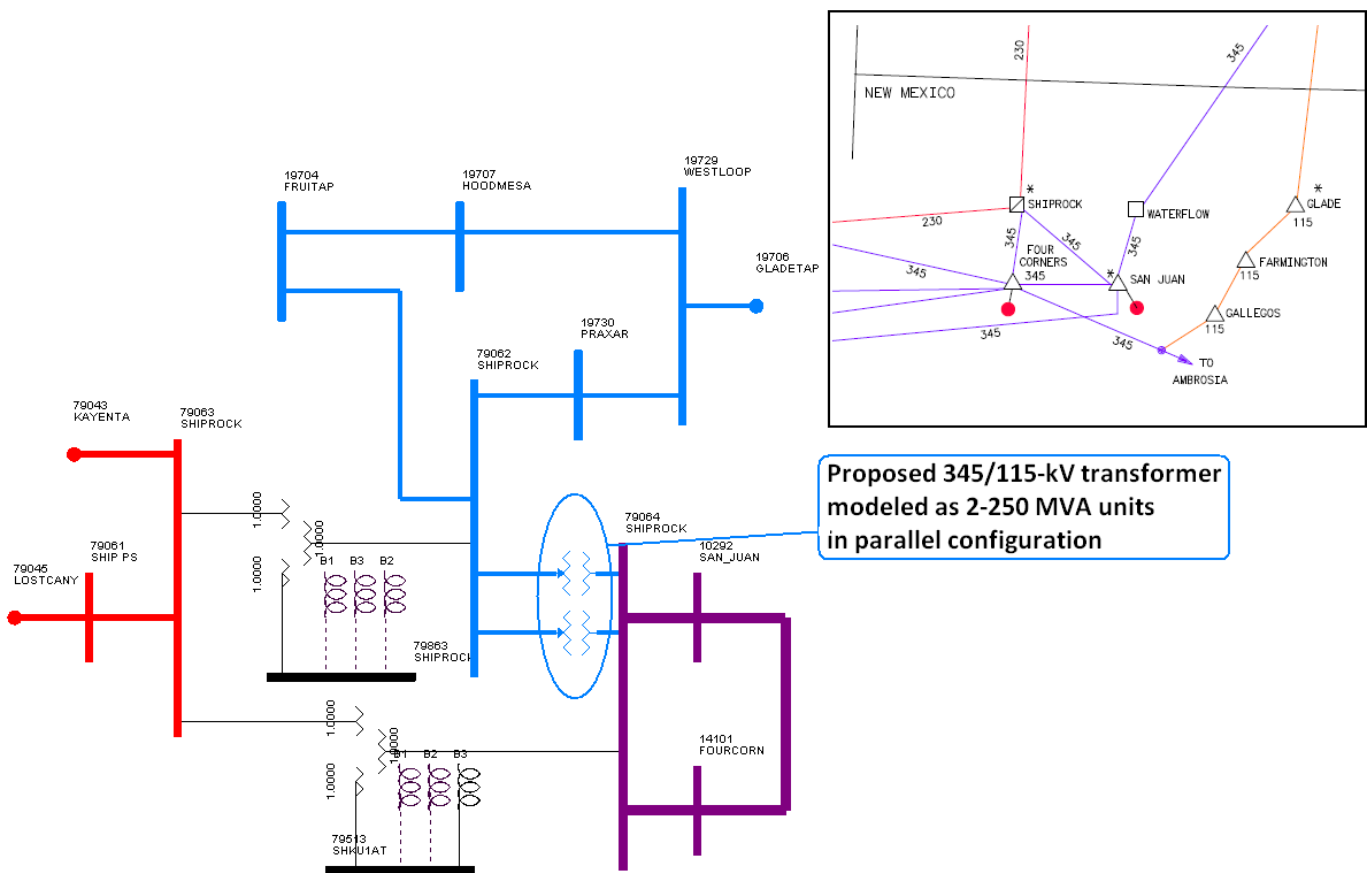


Figure 1: Project Interconnection Point

## 2. Methodology

### Objectives

The objective of this study is to evaluate the potential impact of the proposed interconnection on Western's transmission system and identify upgrades required to mitigate any performance criteria violations.

### Base Case Setup

A WECC 2012 Heavy Summer approved operating case was utilized for analysis. Load and generation levels were scaled to reflect the peak loading and the off peak loading conditions for year 2015 in area 10, New Mexico; area 14, Arizona; area 65, PACE; area 70, PSCO-Colorado; and area 73, WAPA-RMR. System topologies were updated to accurately represent the system at the time of the interconnection.

The following is a list of changes made to the working case:

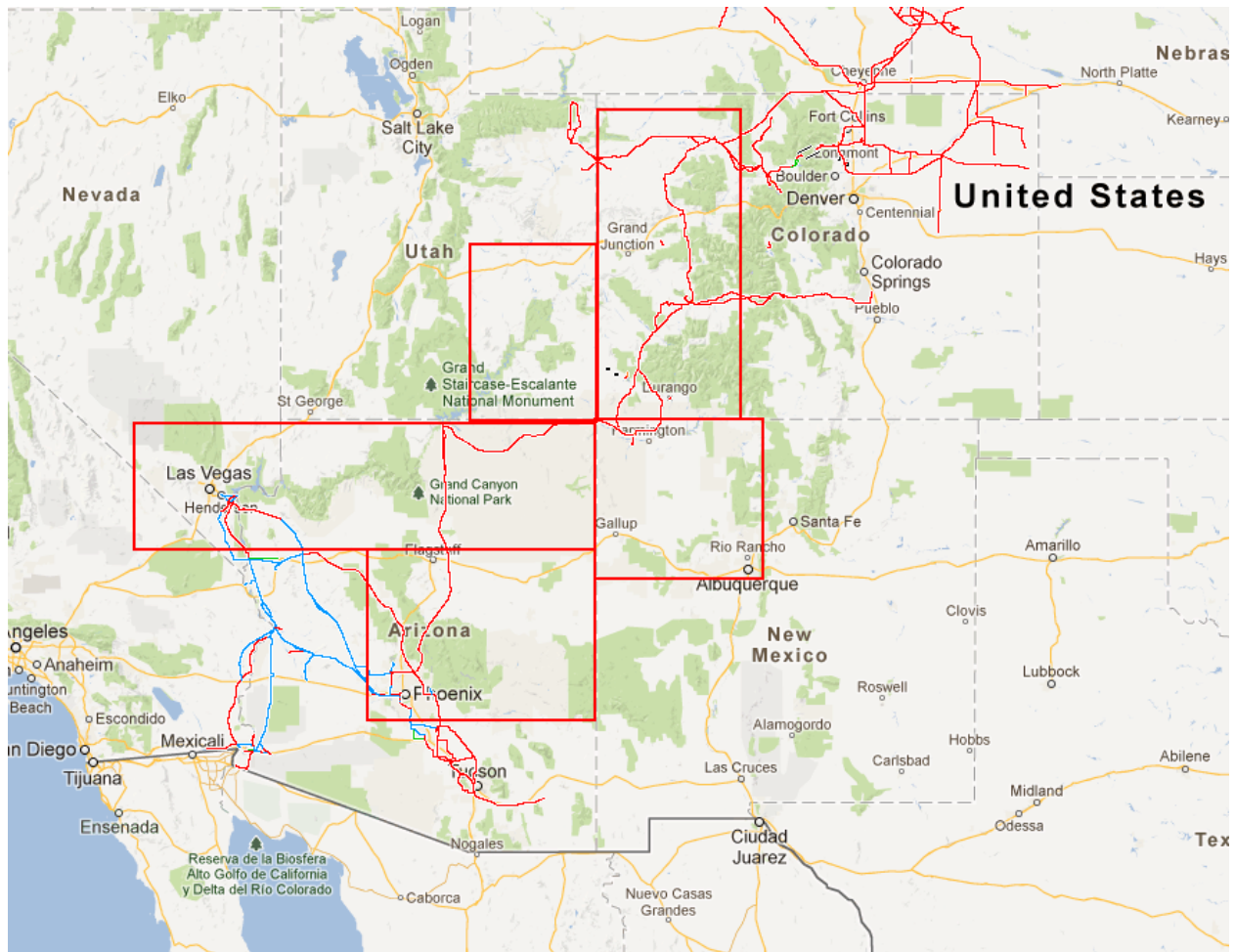
- The Craig-Rifle 230-kV and Cameo-Grand Junction 230-kV transmission lines are the current limiting elements for TOT2A (WECC Path 31) due to a series of de-rating issues on these transmission lines. Western and Public Service Company of Colorado (PSCO) are targeting the year 2013 to have these transmission lines back to their normal operating rating; therefore, a 637 MVA nominal rating has been applied to the Craig-Rifle 230-kV transmission line and a 478 MVA nominal rating has been applied to the Cameo-Grand Junction 230-kV transmission line for this study.
- The Grand Junction 138/115-kV, 50 MVA, transformer has historically been determined as the limiting element for TOT2A for the outage of the Rifle Ute-Grand Junction 345-kV transmission line. As the equipment owner, PSCO has a plan to double the transformation capacity by either adding a second 50 MVA unit or replacing the existing unit with a 100 MVA unit. In this study, a 100 MVA nominal rating has been applied to this transformer.
- The Meeker-Rifle 345-kV transmission line was de-rated to 598 MVA due to limits on CTs and the wavetrap in the Rifle Ute 345-kV substation. PSCO is planning to have this line back to its 956 MVA nominal rating by the end of 2012. Therefore, a 956 MVA nominal rating has been applied to this transmission line.
- The existing Curecanti 230/115-kV, 75 MVA, transformer will be replaced by the existing Hayden 230/138-kV, 150 MVA, transformer KZ2A to increase the transformation capacity and system reliability. The Hayden KZ2A transformer has dual low-side voltage windings capable of 138-kV and 115-kV. Western is targeting year 2015 to finish the Curecanti transformer upgrade; therefore, the corresponding transformer rating, impedance, and settings have been applied to the study case.
- The Tri-State's San Juan Major Project has an in-service date of 2017; thus, it is not included in this system impact study.

## SIS – Shiprock 345/115-kV Transformer Project

- Due to the recent phase shifting transformer failure at the Waterflow substation, all phase shifting transformers at Waterflow and Shiprock substations are bypassed for this system impact study.
- TOT2A is stressed to 470 MW north to south with a corresponding SW Colorado load of 336 MW. See **Appendix C** for details on the TOT2A operating curve.

### Area of Study

As highlighted in regional map below, this system impact study monitors transmission facilities operated at 69-kV and above in the western Colorado, northeastern New Mexico, and northwestern Arizona area. The contingency list used for this study consists of N-0 (system intact, WECC Category A) and N-1 (WECC Category B) contingencies for transmission lines operated at 69-kV and above and transformers with high side voltage at 69-kV and above in the study area mentioned above.



**Figure 2: Regional Map**

## SIS – Shiprock 345/115-kV Transformer Project

### Proposed Transformer Modeling

Transformer model used for this study is the TAOS 345/115-kV, 235 MVA, unit #1 with the following characteristics:

- $R=0.0012$  p.u.
- $X=0.053$  p.u.
- $G=B=0$  p.u.
- Winding I/O code: winding voltage kV
- Impedance I/O code: Z pu (winding kV, winding MVA)
- Admittance I/O code: Y pu (system base)

Since the impedance of this model transformer and the proposed Shiprock transformer are calculated on a base of 100 MVA, we are able to model the new Shiprock transformer as 250 MVA units while using the same R and X value. This project will be modeled as 2-250 MVA units in parallel configuration for this system impact study.

### Operating Procedures

A WECC approved transfer trip scheme is used to trip the Montrose-Nucla 115-kV transmission line in the event of a Montrose-Hesperus 345-kV contingency. This transfer trip scheme is included in the study process.

The Hopkins – Basalt 115-kV transmission line would be switched out of service manually when the line flows exceed its 60 MVA nominal rating.

### 3. Criteria

The WECC Reliability Criteria for Transmission System Planning will apply. The exceptions to the criteria for post transient voltage deviations are several buses in Southwest Colorado which are allowed to exceed 5% per their listing within the *Accepted Voltage and Frequency Exceptions to the WECC Reliability Criteria for Transmission System Planning*. A list of these buses is provided in **Appendix A**. Specific voltage and transmission element thermal criteria follow:

#### System Normal Condition:

- Line loading will not exceed 100 percent of the continuous seasonal rating, the established equipment rating, or applicable operating limits.
- Transformer loading will be limited to not exceed the highest name plate rating or appropriate owner's top rating.
- Transmission bus voltages will be maintained between 0.95 p.u. and 1.05 p.u. of nominal system voltage.

#### Post-Fault System Conditions:

- Line loading will not exceed 100 percent of the continuous seasonal rating, or an established emergency equipment rating.
- Transformer loading will not exceed 120 percent of the system normal rating or an established emergency rating.
- Transmission bus voltages will be maintained between 0.90 p.u. and 1.10 p.u. of nominal system voltage.

#### Transient Stability Analysis:

- Transient voltage deviations will not exceed 25% at load buses or 30% at non-load buses. Also, transient voltage deviations will not exceed 20% for more than 20 cycles at load buses. Frequencies are not allowed to be less than 59.6 Hz for 6 cycles or more at load buses. These criteria are applicable to single contingency events.
- Transient voltage deviations will not exceed 30% at any bus. Also, transient voltage deviations will not exceed 20% for more than 40 cycles at load buses. Frequencies are not allowed to be less than 59.0 Hz for 6 cycles or more at load buses. The criterion is applicable to multiple contingency events.



## 4. Results

### Stead State Power Flow Analysis:

The following tables summarized loading conditions on the transmission lines and transformers affected by the project.

2015 Light Autumn				
Affected Element	Nominal Rating (MVA)	Pre-Project Loading (%)	Post-Project Loading (%)	Δ (%)
San Juan-Shiprock 345-kV	1075	21.0	21.8	0.8
Four Corners-Shiprock 345-kV	1200	16.2	16.0	-0.2
Shiprock-Kayenta 230kV	442	31.1	31.3	0.2
Shiprock-Lost Canyon 230-kV	442	32.4	32.1	-0.3
Shiprock 230/115-kV transformer	400	8.7	3.4	-5.3
Shiprock 345/230-kV transformer	600	5.5	2.3	-3.2
Hesperus-Waterflow 345-kV	1619	20.2	20.3	0.1
Shiprock 345/115-kV transformer T1	235	n/a	6.4	n/a
Shiprock 345/115-kV transformer T2	235	n/a	6.4	n/a

2015 Heavy Summer				
Affected Element	Nominal Rating (MVA)	Pre-Project Loading (%)	Post-Project Loading (%)	Δ (%)
San Juan-Shiprock 345-kV	1075	12.6	13.4	0.8
Four Corners-Shiprock 345-kV	1200	9.1	8.9	-0.2
Shiprock-Kayenta 230kV	442	28.8	29.0	0.2
Shiprock-Lost Canyon 230-kV	442	33.5	33.3	-0.2
Shiprock 230/115-kV transformer	400	8.8	3.9	-4.9
Shiprock 345/230-kV transformer	600	5.8	3.6	-2.2
Hesperus-Waterflow 345-kV	1619	20.1	20.2	0.1
Shiprock 345/115-kV transformer T1	235	n/a	6.1	n/a
Shiprock 345/115-kV transformer T2	235	n/a	6.1	n/a

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### 2015 Light Autumn – Thermal Overload:

Under a stressed TOT2A scenario, the loss of the Montrose – Hesperus 345-kV transmission line overloaded the Montrose – Nucla 115-kV transmission line. This overload existed in the pre-project study. The project did not worsen the overload, and this overload can be alleviated by the Nucla transfer trip scheme mentioned in **Section 2**.

X--- MONITORED ELEMENT ---X	X---LABEL--X	Pre Project	Post Project
79048 MONTROSE 115.00	MTR-HSP	105.8%	105.7%
79052 NUCLA 115.00 1		84MVA (1x)	84MVA (1x)

CONTINGENCY LEGEND:  
 X--LABEL---X EVENTS  
 MTR-HSP : TRIP LINE FROM BUS 79049 [MONTROSE 345.00] TO BUS 79072 [HESPERUS 345.00] CKT 1

### 2015 Light Autumn – Voltage Violations:

High post contingent voltage violations were observed in the pre-project case on the Liberty 345-kV bus for the loss of the Liberty 345/230/24-kV, 3-winding transformer. There are four reactors installed on the 24-kV tertiary winding to control the voltage. The outage of the transformer will cause losing the voltage support from the reactors and will result in high voltages on the Liberty 345-kV bus. Western Desert Southwest Region (WAPA-DSW) has an operating procedure to trip the Liberty-Peacock 345-kV transmission and the Liberty 230-kV phase shifting transformer for the loss of the Liberty 345/230/24-kV transformer to alleviate the high post-contingent voltages. The study results showed the project did not worsen the high voltages on the Liberty 345-kV bus.

X----- BUS -----X	X---LABEL--X	Pre Project	Post Project
19053 LIBERTY 345.00	SINGL1 104	1.12110 (1x)	1.12111 (1x)

CONTINGENCY LEGEND:  
 X--LABEL---X EVENTS  
 SINGL1 104 : OPEN LINE FROM BUS 19053 [LIBERTY 345.00] TO BUS 19054 [LIBITYPHS 230.00] TO BUS 19091 [LIBERTY 24.000] CKT 1

### 2015 Heavy Summer – Thermal Overload:

Under a stressed TOT2A scenario, the loss of the Basalt 230/115-kV transformer (contingency single 137) overloaded the Hopkins-Basalt 115-kV transmission line in the pre-project case. The project did not worsen the overload, and this overload can be alleviated by the Hopkins-Basalt 115-kV tripping scheme mentioned in **Section 2**.

The Cahone-Nucla 115-kV transmission line overloaded for the loss of the Lost Canyon- Curecanti 230-kV transmission line in the pre-project case. The project caused the limiting outage to shift to the

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Montrose-Hesperus 345-kV transmission line with the same amount of overloading on the Cahone-Nucla 115-kV transmission line. This limiting outage shifting is caused by the project stressing the 345-kV system while off-loading the 230-kV system. However, the project did not worsen the overload on the Cahone-Nucla 115-kV transmission line, and this overload can be alleviated by the Nucla transfer trip scheme mentioned in **Section 2**.

The Curecanti-South Canal 115-kV transmission line overloaded to 1.023 p.u. for the loss of the Grand Junction-Montrose 345-kV transmission line in the pre-project case. This transmission line has a 30-minute emergency rating of 156 MVA (1.14 p.u.), thus this overload is allowed. The project alleviated the overload in the post-project case by strengthening the 115-kV system.

The Collbran 138/115-kV transformer (14 MVA nominal rating) overloaded to 1.027 p.u. for the loss of the Craig-Meeker 345-kV transmission line in both pre-project and post-project case. The project did not worsen the overload on the transformer. This transformer has a 30-minute emergency of 16 MVA (summer)/ 18 MVA (winter), thus this overload is allowed.

The Montrose-Nucla 115-kV transmission line overloaded to 1.137 p.u. for the loss of the Montrose-Hesperus 345-kV transmission line in both pre-project and post-project case. The project did not worsen the overload on the Montrose-Nucla 115-kV line, and this overload can be alleviated by the Nucla transfer trip scheme mentioned in **Section 2**.

X--- MONITORED ELEMENT ----X	X---LABEL---X	Pre Project	Post Project
70231 HOPKINS 115.00 79003 BASALT 115.00 1	SINGL1 237	131.7% 79MVA (1x)	131.7% 79MVA (1x)
79011 CAHONE 115.00 79052 NUCLA 115.00 1	MTR-HSP		106.1% 82MVA (2x)
79011 CAHONE 115.00 79052 NUCLA 115.00 1	CCI-LCN	106.4% 82MVA (2x)	
79020 CURECANT 115.00 79192 SOCANAL 115.00 1	GJT-MTR	102.3% 140MVA (1x)	
79047 COLBRAN 138.00 79173 COLBRAN 115.00 T2	CRG-MKR	102.7% 14MVA (3x)	102.7% 14MVA (3x)
79048 MONTROSE 115.00 79052 NUCLA 115.00 1	MTR-HSP	113.7% 89MVA (1x)	113.7% 89MVA (1x)

### CONTINGENCY LEGEND:

X--LABEL---X EVENTS  
 CRG-MKR : TRIP LINE FROM BUS 79014 [CRAIG 345.00] TO BUS 79266 [MEEKER 345.00] CKT 1  
 GJT-MTR : TRIP LINE FROM BUS 79036 [GRANDJCT 345.00] TO BUS 79049 [MONTROSE 345.00] CKT 1  
 MTR-HSP : TRIP LINE FROM BUS 79049 [MONTROSE 345.00] TO BUS 79072 [HESPERUS 345.00] CKT 1  
 CCI-LCN : TRIP LINE FROM BUS 79021 [CURECANT 230.00] TO BUS 79045 [LOSTCANY 230.00] CKT 1  
 SINGL1 237 : OPEN LINE FROM BUS 79003 [BASALT 115.00] TO BUS 79004 [BASALT 230.00] CKT T2

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2015 Heavy Summer – Voltage Violations:

As mentioned above, the high voltages occurred on the Liberty 345-kV bus is a result of losing the reactors installed on the tertiary winding of the Liberty 3-winding transformer. As the path operator, WAPA-DSW has an operating procedure to alleviate the high voltages. The project did not worsen these violations.

X----- BUS -----X	X---LABEL---X	Pre Project	Pre Project
19053 LIBERTY 345.00	SINGL1 105	1.12151 (1x)	1.12151 (1x)

CONTINGENCY LEGEND:  
X--LABEL---X EVENTS  
SINGL1 105 : OPEN LINE FROM BUS 19053 [LIBERTY 345.00] TO BUS 19054 [LIBTYPHS 230.00] TO BUS 19091 [LIBERTY 24.000] CKT 1

### Transient Stability

Transient stability simulations were performed for 2015 summer peak loading with the addition of the project. The transient stability simulation is a time-based simulation that assesses performance of the power system during (and shortly following) a contingency.

The following 3-phase faults were studied for this interconnection request:

- Montrose-Hesperus 345-kV transmission line, 4 cycle
- Waterflow-Hesperus 345-kV transmission line, 4 cycle
- Curecanti-Lost Canyon 230-kV transmission line, 5 cycle
- Lost Canyon-Shiprock 230-kV transmission line, 5 cycle
- Montrose-Nucla 115-kV transmission line, 6 cycle
- Lost Canyon-Durango 115-kV transmission line, 6 cycle
- Shiprock-Kayenta 230-kV transmission line, 5 cycle
- San Juan-Four Corners 345-kV transmission line, 4 cycle
- Shiprock 345/115-kV transformer T1, 6 cycle
- Shiprock 345/115-kV transformers T1 and T2, 6 cycle
- Shiprock-Fruitland 115-kV transmission line, 6 cycle

The following load/generator buses were monitored during this simulation:

For bus voltage:

Bus Name	Bus Number	Voltage (kV)
Lost Canyon	79045	230
Shiprock	79063	230
Shiprock	79062	115
Shiprock	79064	345
Four Corners	14101	345

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<b>San Juan</b>	10292	345
<b>Glen Canyon</b>	79031	230
<b>Hesperus</b>	79072	345
<b>Curecanti</b>	79021	230
<b>Nucla</b>	79052	115
<b>Glade Tap</b>	19706	115
<b>Montrose</b>	79049	345

For bus frequency:

Bus Name	Bus Number	Voltage (kV)
<b>Shiprock</b>	79063	230
<b>San Juan</b>	10292	345
<b>Four Corners</b>	14101	345
<b>Glen Canyon</b>	79031	230
<b>Curecanti</b>	79021	230
<b>Nucla</b>	79052	115

For machine angle:

Bus Name	Bus Number	Voltage (kV)
<b>Nucla #4</b>	79161	13.8
<b>Morrow Point #1</b>	79019	12.5
<b>Blue Mesa #1</b>	79157	11.0
<b>Glen Canyon #7</b>	79153	13.8
<b>San Juan #1</b>	10318	22.0
<b>Four Corners</b>	14914	22.0

All of the transient stability simulations met WECC Disturbance Performance Criteria. The stability analysis for the above faults produced no stability violations and showed acceptable damping of the power system. Transient stability simulation plots can be found in **Appendix E**.

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### Short Circuit Analysis

#### **Shiprock transformers (2 x 250MVA) addition**

KU2A and KU4A will be the assumed names as the addition to Shiprock 345kV bus:  
141/188/250 MVA each

$Z_{345-115} = 7.47\%$  on 141 MVA (5.3% on 100MVA base)

Estimated minimum values of other impedances, also on a 141 MVA base:

$Z_{345-13.8} = 15\%$

$Z_{115-13.8} = 6\%$

Estimated values are based on Westinghouse method.

From ASPEN, bus fault currents before and after transformer replacements using estimated impedances are shown in the table below.

Fault #	Fault type and location	Bus fault currents (A)		% change
		Existing	Post addition	
1	345-kV SLG	29,455	30,573	3.8
2	345-kV 3P	29,471	29,721	0.85
3	230-kV SLG	16,022	17,344	8.25
4	230-kV 3P	15,039	16,050	6.72
5	115-kV SLG	13,385	31,259	133.5
6	115-kV 3P	11,987	24,961	108.2

#### **345-kV bus:**

Fault current increases a maximum of 3.8% (SLG fault). Based on equipment fault interrupting ratings, the minimum capability of 40-kA (SHR 0001-1, REV.E) is adequately above the maximum new fault level of 30,573 amps. (76% margin)

Conclusion: No 345-kV breaker impacts

#### **230-kV bus:**

Fault current increases a maximum of 8.25%. The interrupting rating of PCBs 1382, 1482, 1582, and 1682 is 37,653 amps (estimated based on previous breaker asymmetrical rating method of 15,000MVA). The interrupting rating of PCB 1982 is 31,500 amps. The interrupting rating of PCB 1182 is 40,000 amps (SHR 0001-2, REV.D). All of these ratings are adequately above the maximum new fault level of 17,344 amps.

Conclusion: No 230-kV breaker impacts (Please see the note on the following page)

#### **115-kV bus:**

Fault current increases a maximum of 133% to 31,259 amps. The interrupting ratings of all 115-kV breakers are 25,100 amps (5,000 MVA).

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The 115-kV PCBs must be replaced to meet the new short circuit interrupting duty.  
(Please see the note below)

Note:

As indicated in the previous text, several of the existing breakers are rated on the previous rating basis known variously as “total current” or “asymmetrical”. This rating method was based on accounting for the peak current attainable at the onset of a fault, and considered the X/R ratio at the fault location, breaker operating time, and several other factors. Since these calculations were site-specific, it is virtually impossible to make an exact correlation between the total-current rating method (which used units of MVA) and the present method using symmetrical interrupting ratings. A conservative correlation factor used in the past is 1.6. If this factor is applied to the 230-kV breakers rated 15,000 MVA, the “equivalent” symmetrical rating is  $37,653A/1.6 \approx 23,500A$ . Using this current to evaluate the interrupting margin,  $17,400A/23,500A = 74\%$ .

Since the 115-kV breakers rated 5,000 MVA are beyond their duties without applying any correlation factor, it is not necessary to calculate a correlated symmetrical rating.

### 5. Cost Estimate:

Interconnecting the project to Western’s transmission system as 2-250 MVA units in parallel configuration will require the following addition in the Shiprock substation:

Item	Quality	Per Unit Cost	Total Cost
<b>345/115-kV, 250 MVA, transformer</b>	2	\$ 5,000,000	\$ 10,000,000
<b>345-kV, 2000 Amps, Breaker and A Half Bay</b>	1	\$ 5,000,000	\$ 5,000,000
<b>115-kV, 1600 Amps, Main and Transfer Bay</b>	2	\$ 1,500,000	\$ 3,000,000
<b>Replace 115-kV breakers to meet the required fault duty</b>	4	\$ 250,000	\$ 1,000,000
<b>Total=</b>			<b>\$ 19,000,000</b>

Interconnecting this project to Western’s transmission system as 1-500 MVA unit will require the following addition in the Shiprock substation:

Item	Quality	Per Unit Cost	Total Cost
<b>345/115-kV, 500 MVA, transformer</b>	1	\$ 7,500,000	\$ 7,500,000
<b>345-kV, 2000 Amps, Breaker and A Half Bay</b>	1	\$ 5,000,000	\$ 5,000,000
<b>115-kV, 3000 Amps, Main and Transfer Bay</b>	1	\$ 1,500,000	\$ 1,500,000
<b>Rebuild Shiprock 115-kV bus to accommodate the new 500 MVA transformer (2510 A @ 115kV)</b>	1	\$ 1,000,000	\$ 1,000,000
<b>Replace 115-kV breakers to meet the required fault duty</b>	4	\$ 250,000	\$ 1,000,000
<b>Total=</b>			<b>\$ 16,000,000</b>

This estimate is in 2015 US dollars. Cost estimates do not include any costs for lands and rights, environmental, surveys, geological investigations, designs and specifications, or construction supervision

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associated with required system upgrades. These additional costs as well as refinement of estimates provided in this report will be determined in the Facility Study.

### **6. Conclusions:**

Contingencies were evaluated on the study case to analyze the impact of the Shiprock 345/115-kV Transformer Project on Western's transmission system. The interconnection of the project did not cause any thermal overloads, voltage violations, or transient instability violations. The short circuit analysis indicates breakers on the 115-kV bus need to be upgraded to meet the required fault. The total cost for this interconnection is \$19 million for the 2-250 MVA transformers in parallel configuration, or \$16 million dollars for the 1-500 MVA unit configuration. All cost estimates are in 2015 US dollars.



**Appendix A - Exception List of Buses Whose Voltage Deviation May Exceed 5%**

79079	BULLOCK
79190	DALLASCR
79181	DOUGHSPN
79182	DOUGHSPN
79103	GARNET M
79138	GARNET M
79104	GARNETAP
79184	GUNVAL
79082	HAPPYCAN
79135	HAPPYCAN
79042	HOTCHKIS
79137	HOTCHKIS
79083	JUANITA
79136	JUANITA
79193	MCKENZIX
79048	MONTROSE
79049	MONTROSE
79050	NORTHFRK
79085	NORTHMSA
79192	SOCANAL
79115	SPRCKTAP
79183	STRNELSN
79127	SYLVSTGU
79076	AM EAST
79257	AMES
79077	BAYFIELD
79073	BLUEDOOR
79078	BODO
79194	BURROBDG
79011	CAHONE
79080	CASCADEL
79262	CEMNT CK
79254	COALBANK
79012	CORTEZ
79191	COYOTE G
79023	DURANGO
79074	E.CORTEZ
79260	ELPASOTP
79075	EMPIRETS
79099	FLOR.RIV
79180	GRCUT TP
79178	GRT CUT
79179	GRT CUT

## SIS – Shiprock 345/115-kV Transformer Project

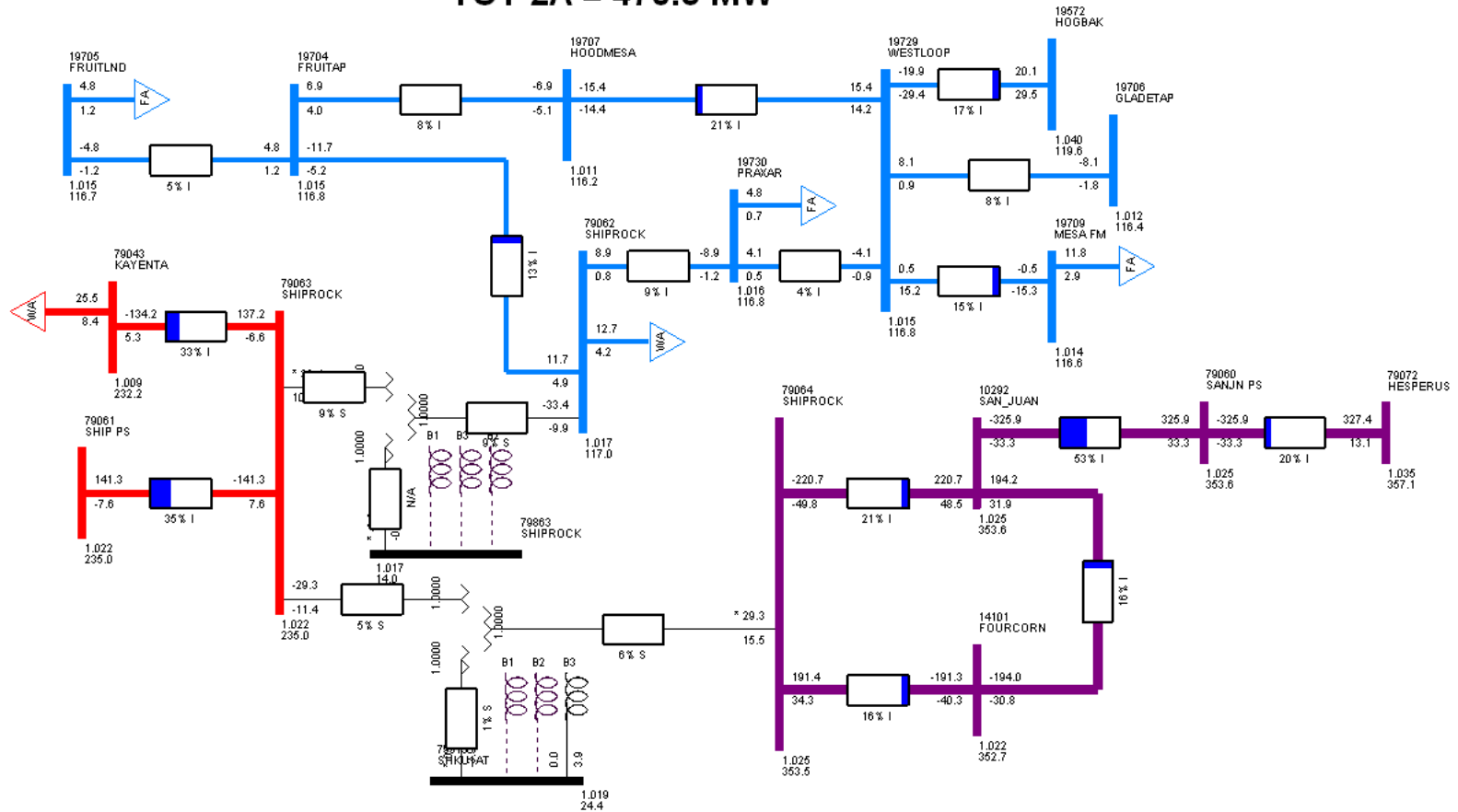
79071	HESPERUS
79072	HESPERUS
79108	HOVENWEP
79044	LOSTCANY
79045	LOSTCANY
79110	MAIN CO
79111	MANCOSTP
79255	MOLASTP
79120	MOQUI C
79187	NORWOOD
79052	NUCLA
79086	PAGOSA
79088	ROCKWOOD
79121	SANDCANY
79089	SHENDOAH
79256	SILVERTN
79189	SUNSH SM
79188	TELLURID
79122	TOWAOC
79117	Y.JACK 2
79118	Y.JACK W

# Appendix B – System Diagrams

## 2015 Light Autumn Pre-Project Case

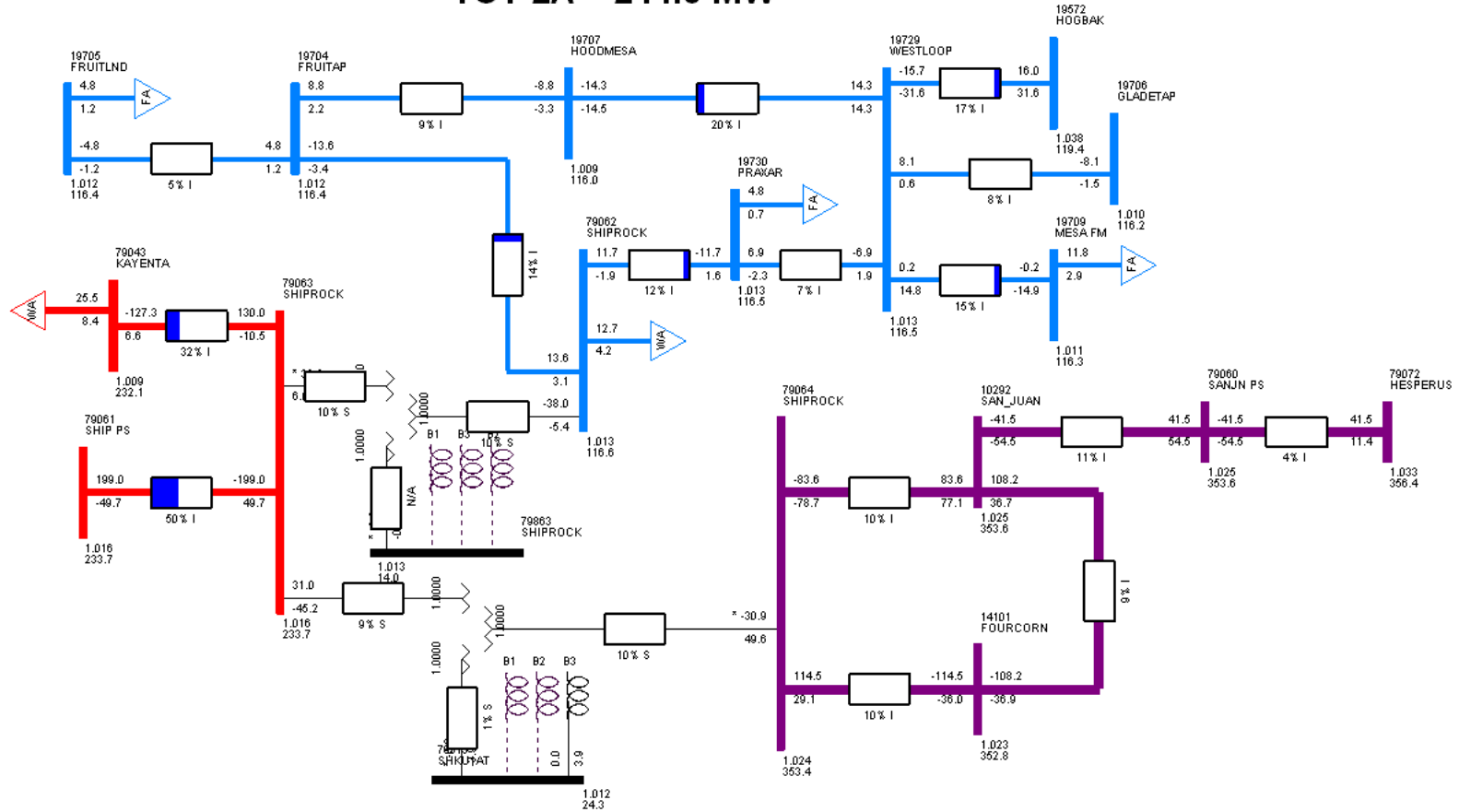
### Shiprock 345/115-kV Transformer SIS 2015 Light Autumn Pre-Project Case System Intact

TOT 2A = 470.3 MW



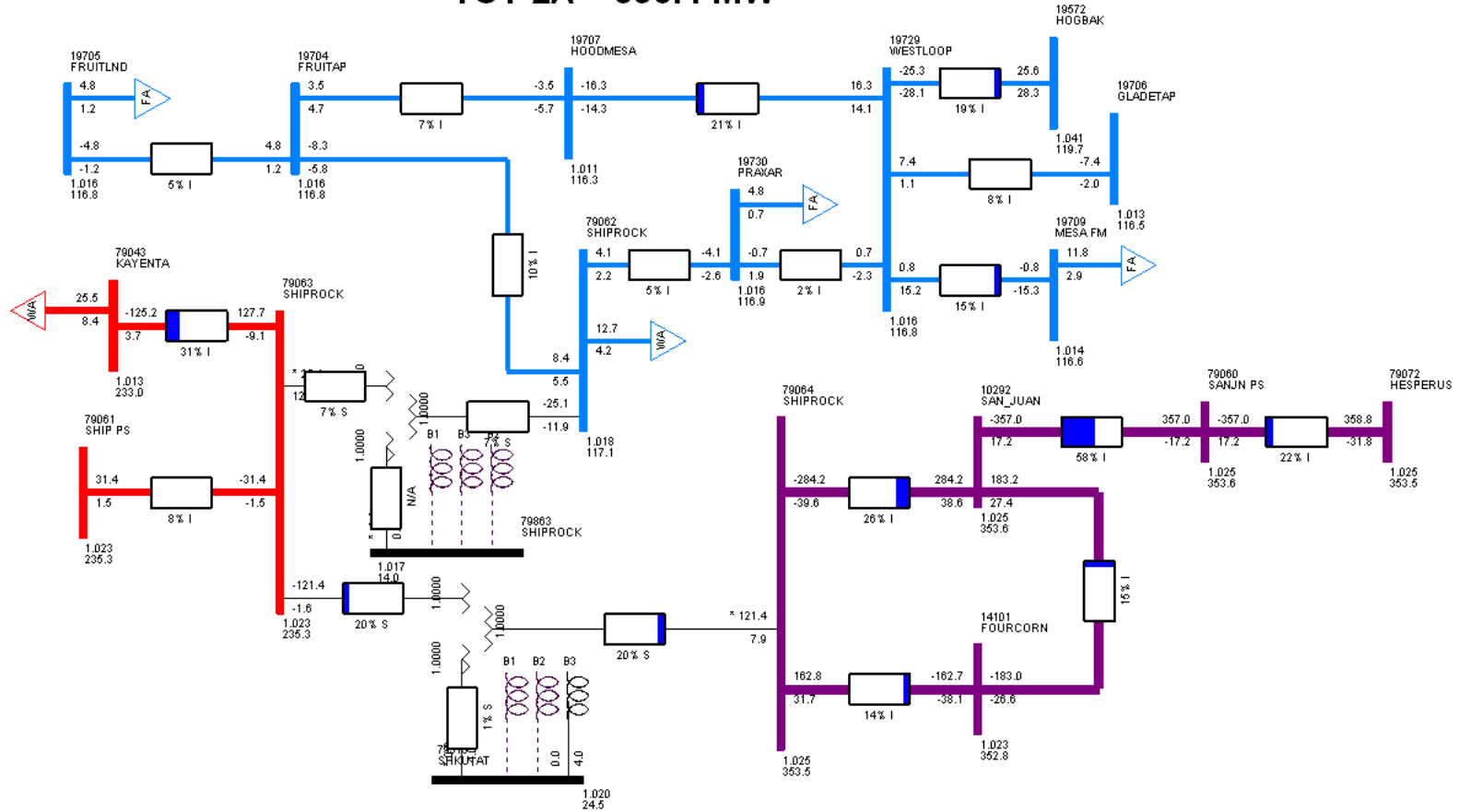
Shiprock 345/115-kV Transformer SIS  
2015 Light Autumn Pre-Project Case  
Contingency: Montrose-Hesperus 345-kV

TOT 2A = 244.0 MW



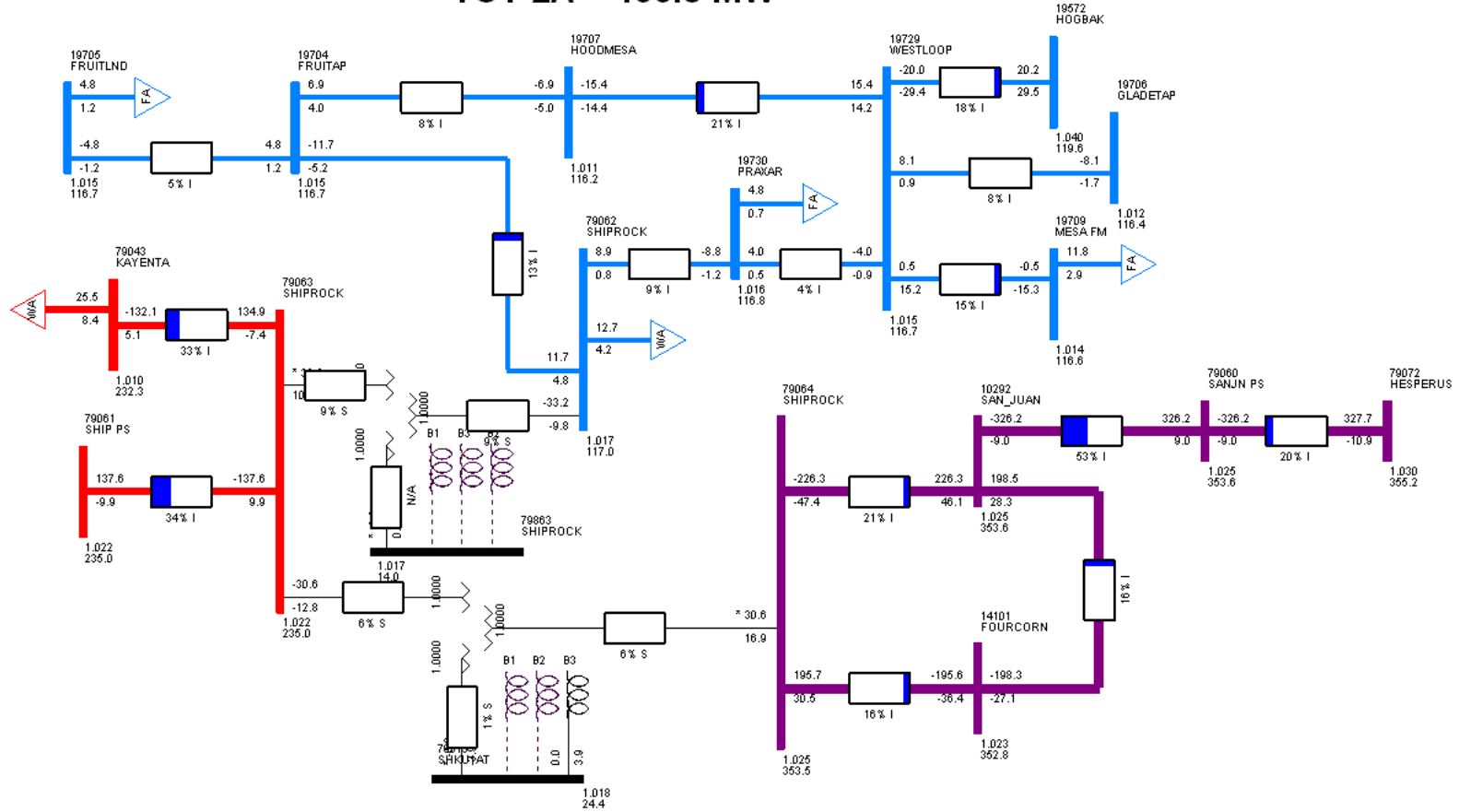
Shiprock 345/115-kV Transformer SIS  
2015 Light Autumn Pre-Project Case  
Contingency: Lost Canyon-Curecanti 230-kV

TOT 2A = 390.4 MW



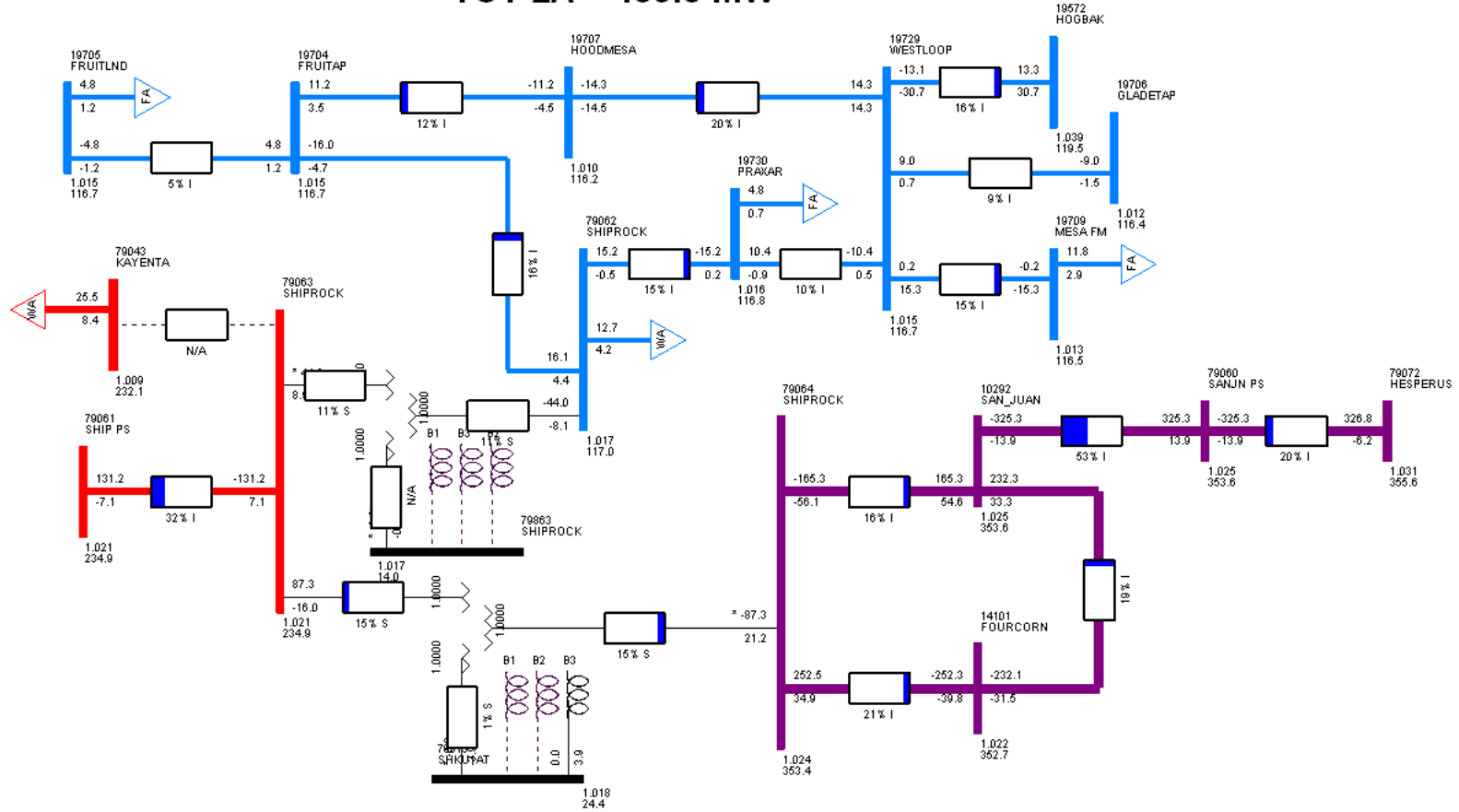
Shiprock 345/115-kV Transformer SIS  
 2015 Light Autumn Pre-Project Case  
 Contingency: Montrose-Nucla 115-kV

TOT 2A = 466.8 MW



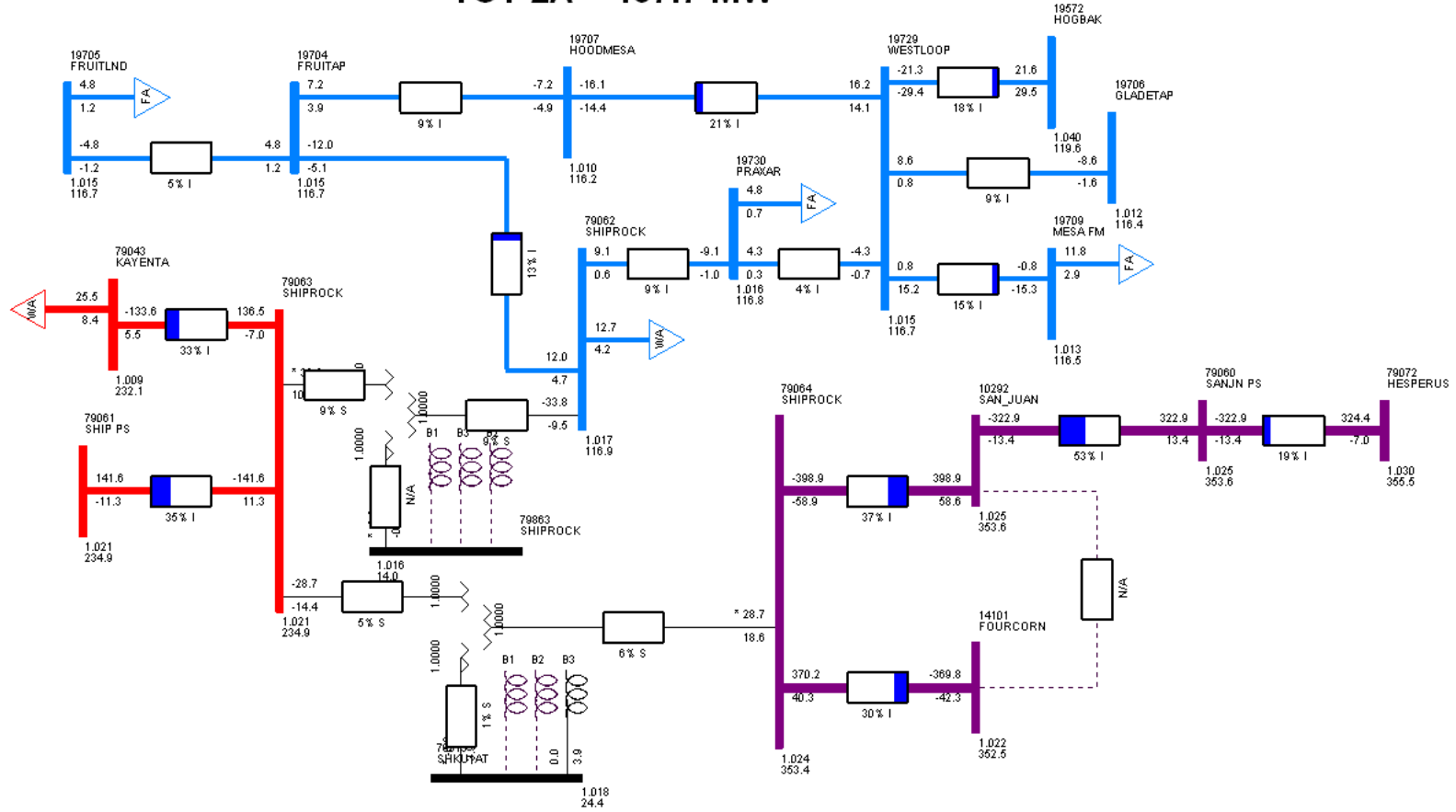
Shiprock 345/115-kV Transformer SIS  
2015 Light Autumn Pre-Project Case  
Contingency: Shiprock-Kayenta 230-kV

TOT 2A = 459.5 MW



Shiprock 345/115-kV Transformer SIS  
 2015 Light Autumn Pre-Project Case  
 Contingency: San Juan-Four Corners 345-kV

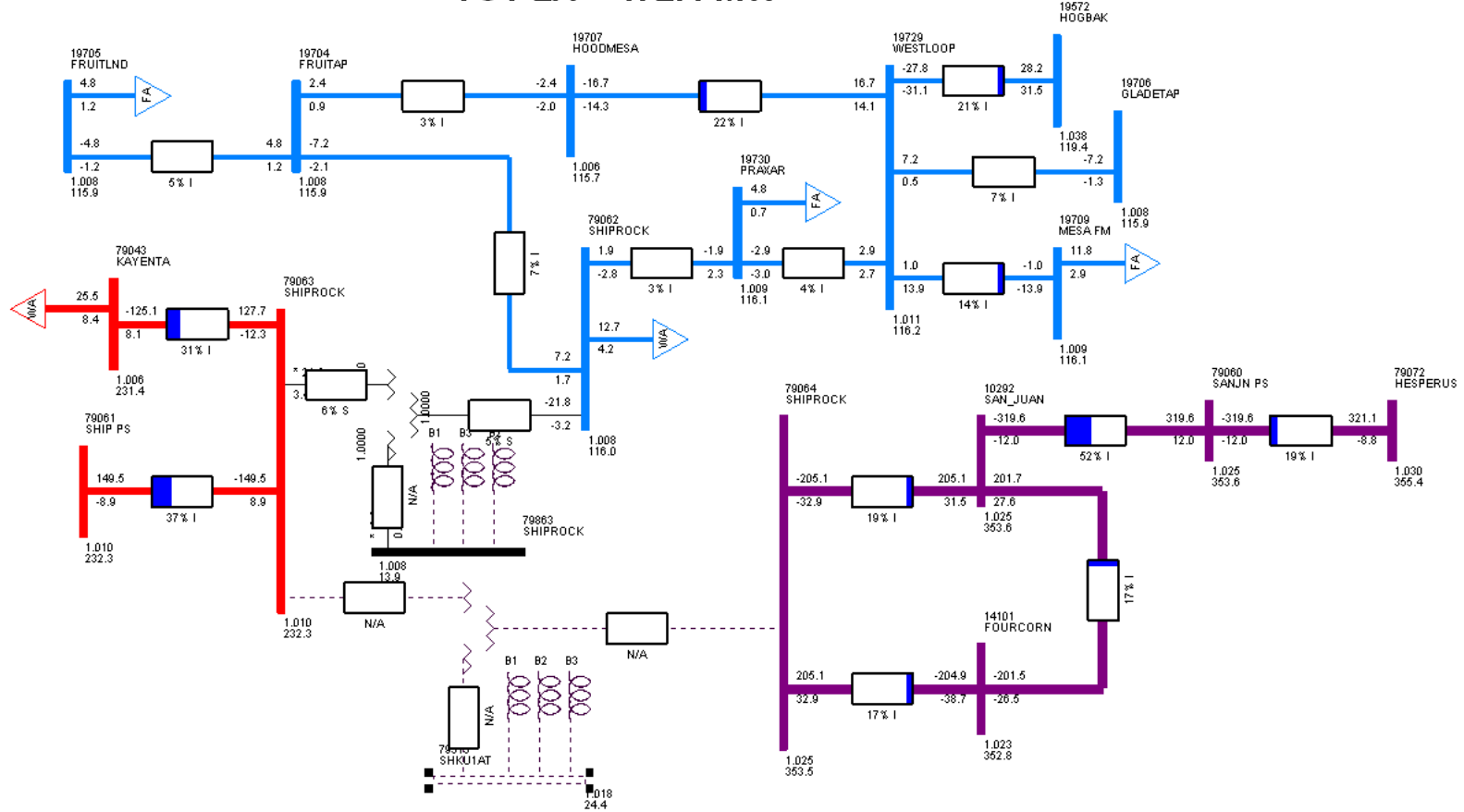
TOT 2A = 467.7 MW





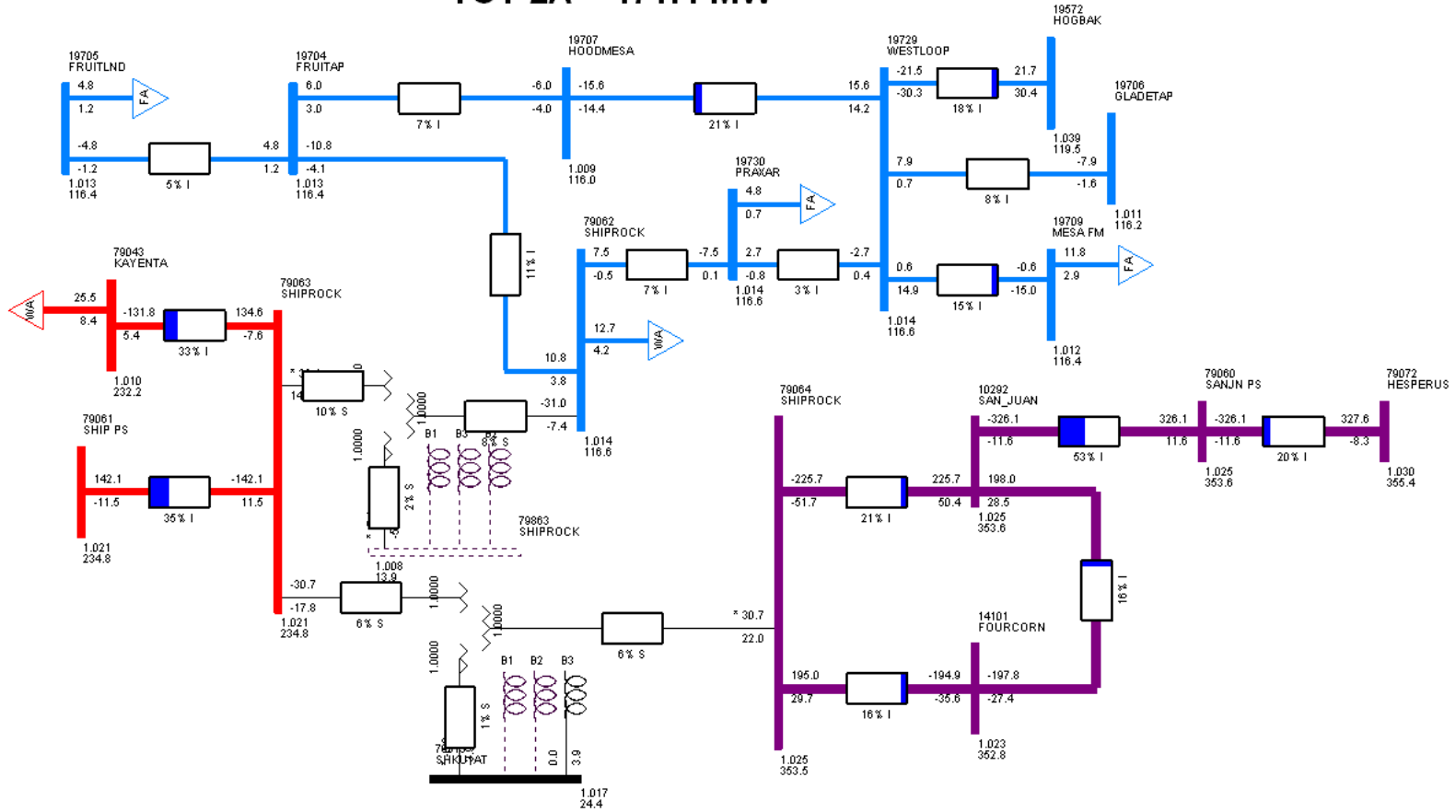
# Shiprock 345/115-kV Transformer SIS 2015 Light Autumn Pre-Project Case Contingency: Shiprock 345/230-kV Xfmr

## TOT 2A = 472.4 MW



Shiprock 345/115-kV Transformer SIS  
2015 Light Autumn Pre-Project Case  
Contingency: Shiprock 230/115-kV Xfmr

TOT 2A = 471.4 MW

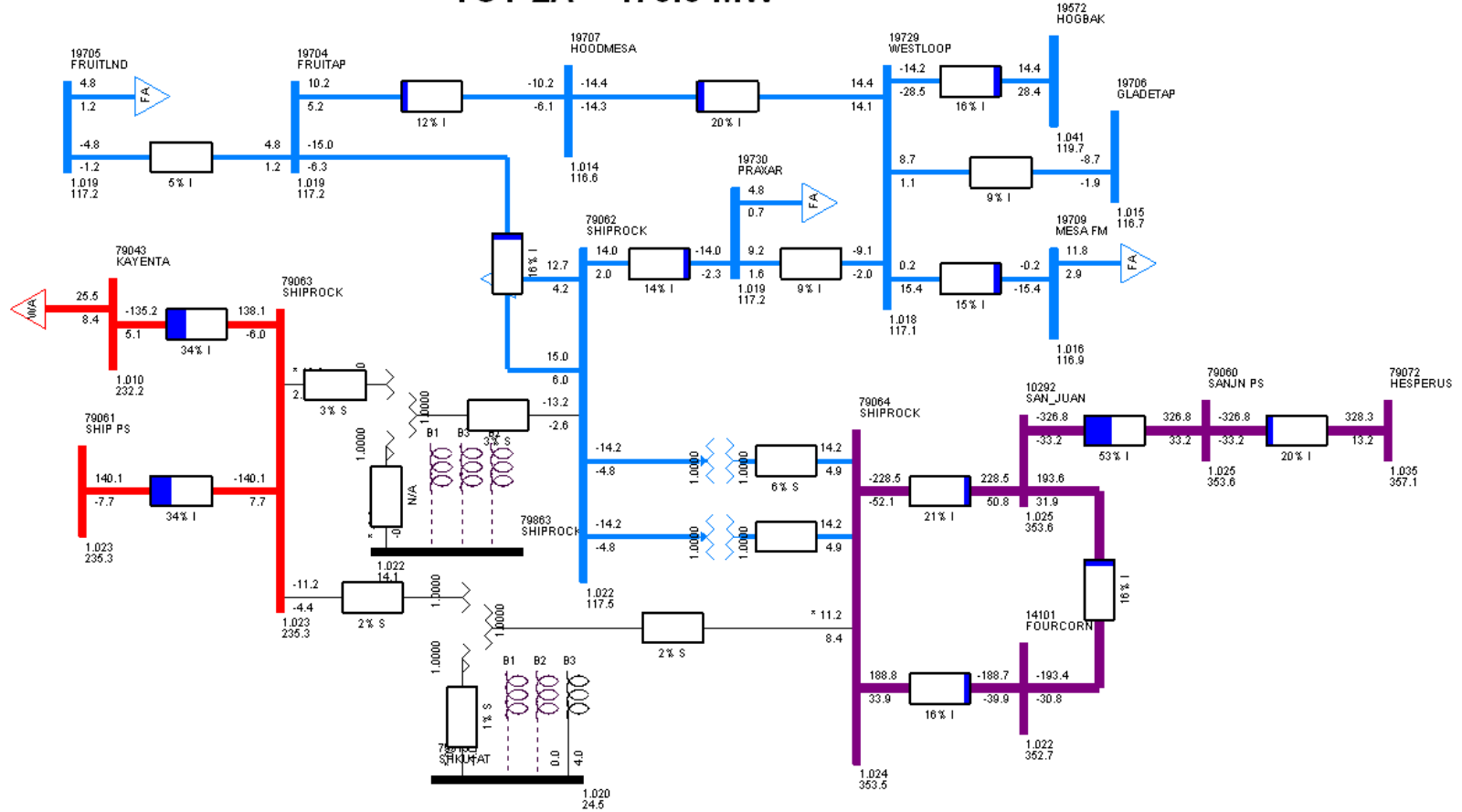


SIS – Shiprock 345/115-kV Transformer Project

2015 Light Autumn Post-Project Case

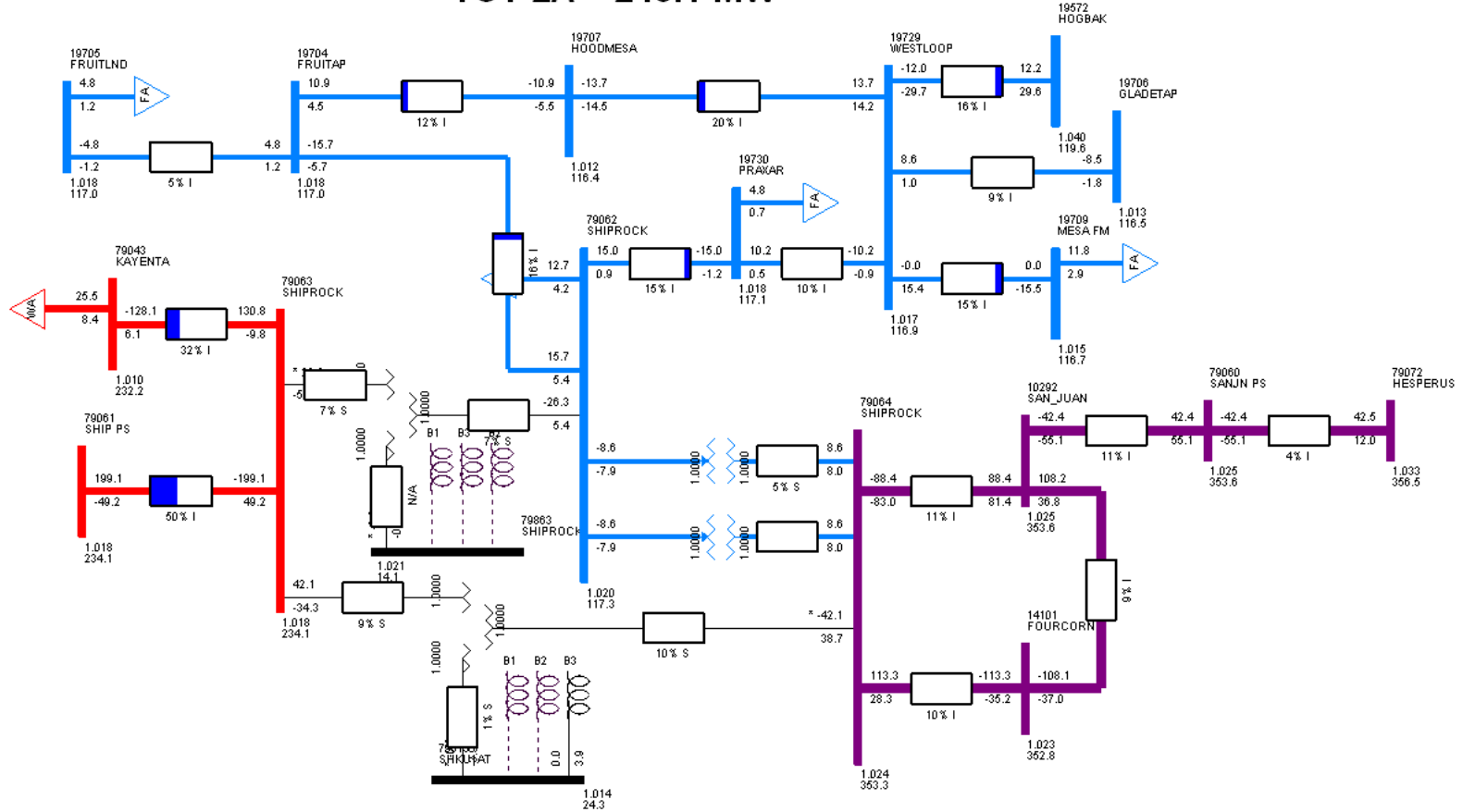
Shiprock 345/115-kV Transformer SIS  
2015 Light Autumn Post-Project Case  
System Intact

TOT 2A = 470.0 MW



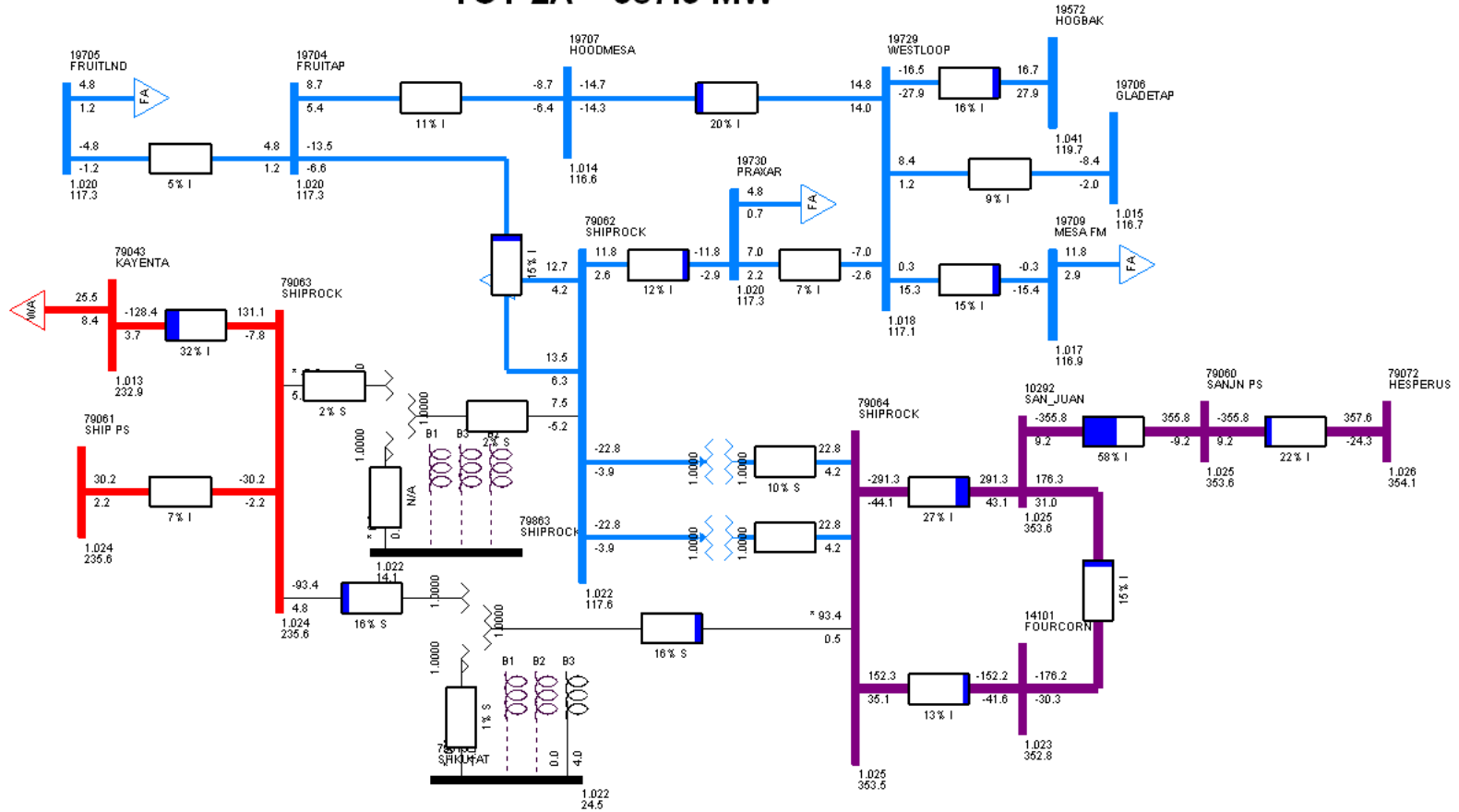
Shiprock 345/115-kV Transformer SIS  
 2015 Light Autumn Post-Project Case  
 Contingency: Montrose-Hesperus 345-kV

TOT 2A = 245.1 MW



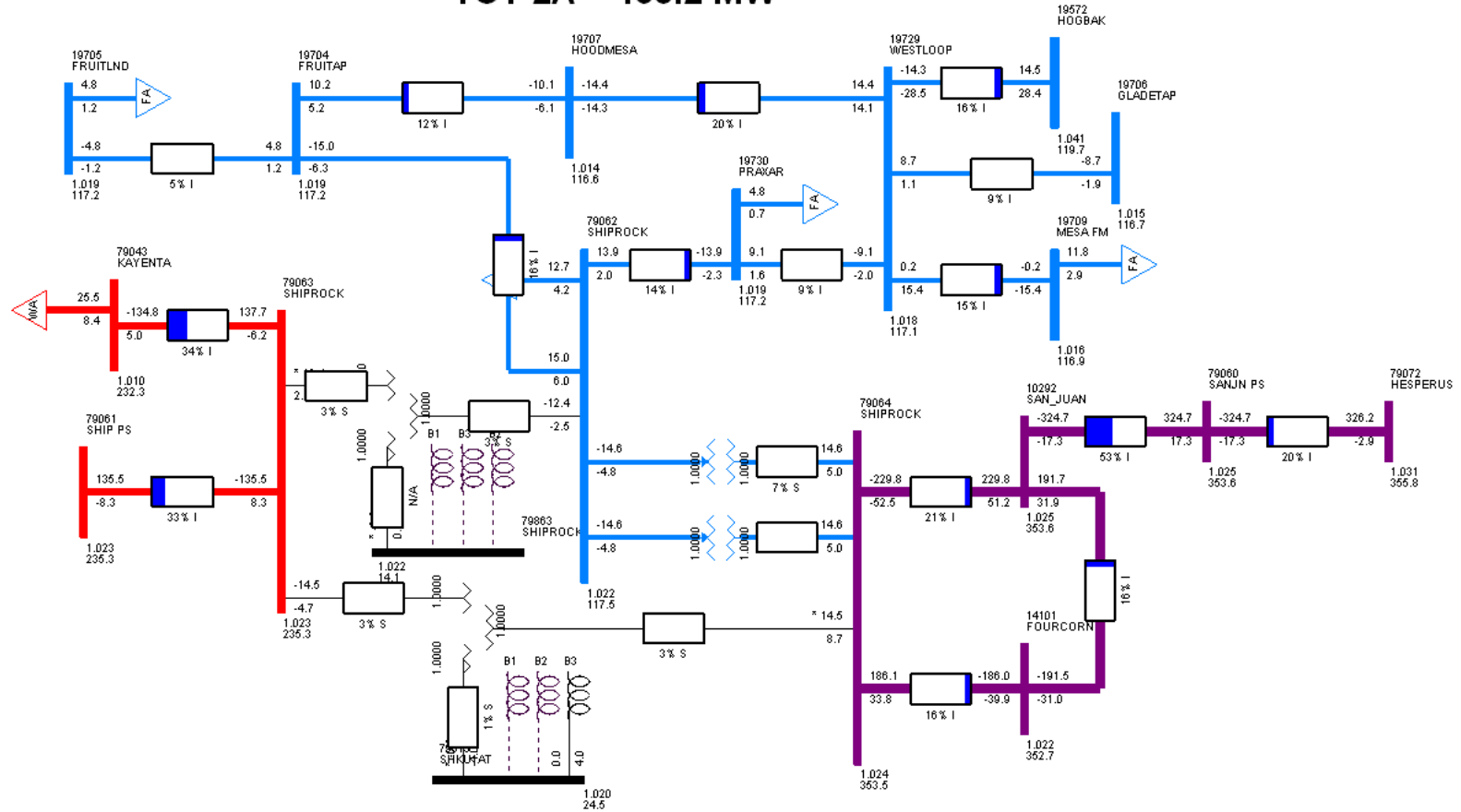
Shiprock 345/115-kV Transformer SIS  
 2015 Light Autumn Post-Project Case  
 Contingency: Lost Canyon-Curecanti 230-kV

TOT 2A = 387.9 MW



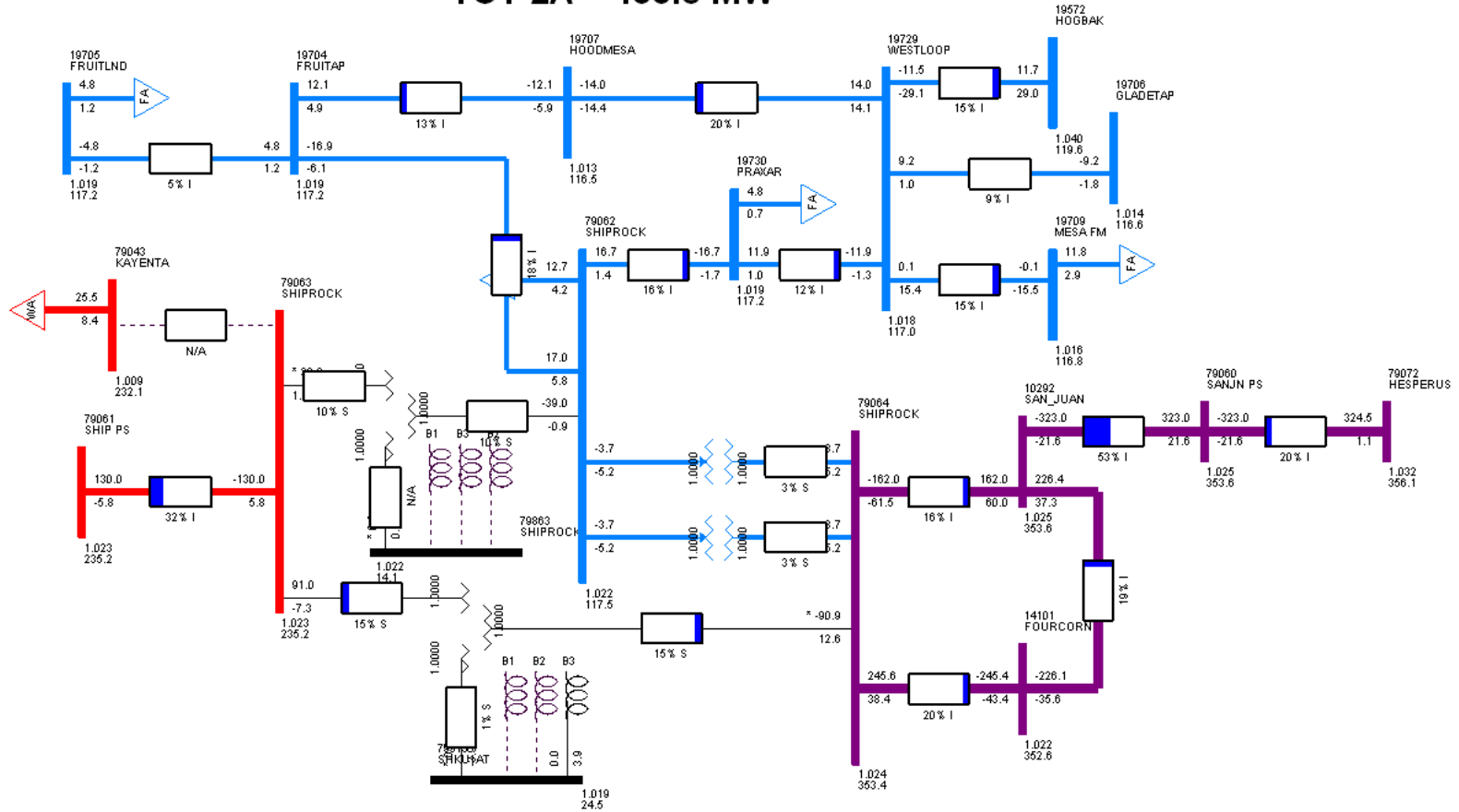
### Shiprock 345/115-kV Transformer SIS 2015 Light Autumn Post-Project Case Contingency: Montrose-Nucla 115-kV

TOT 2A = 463.2 MW



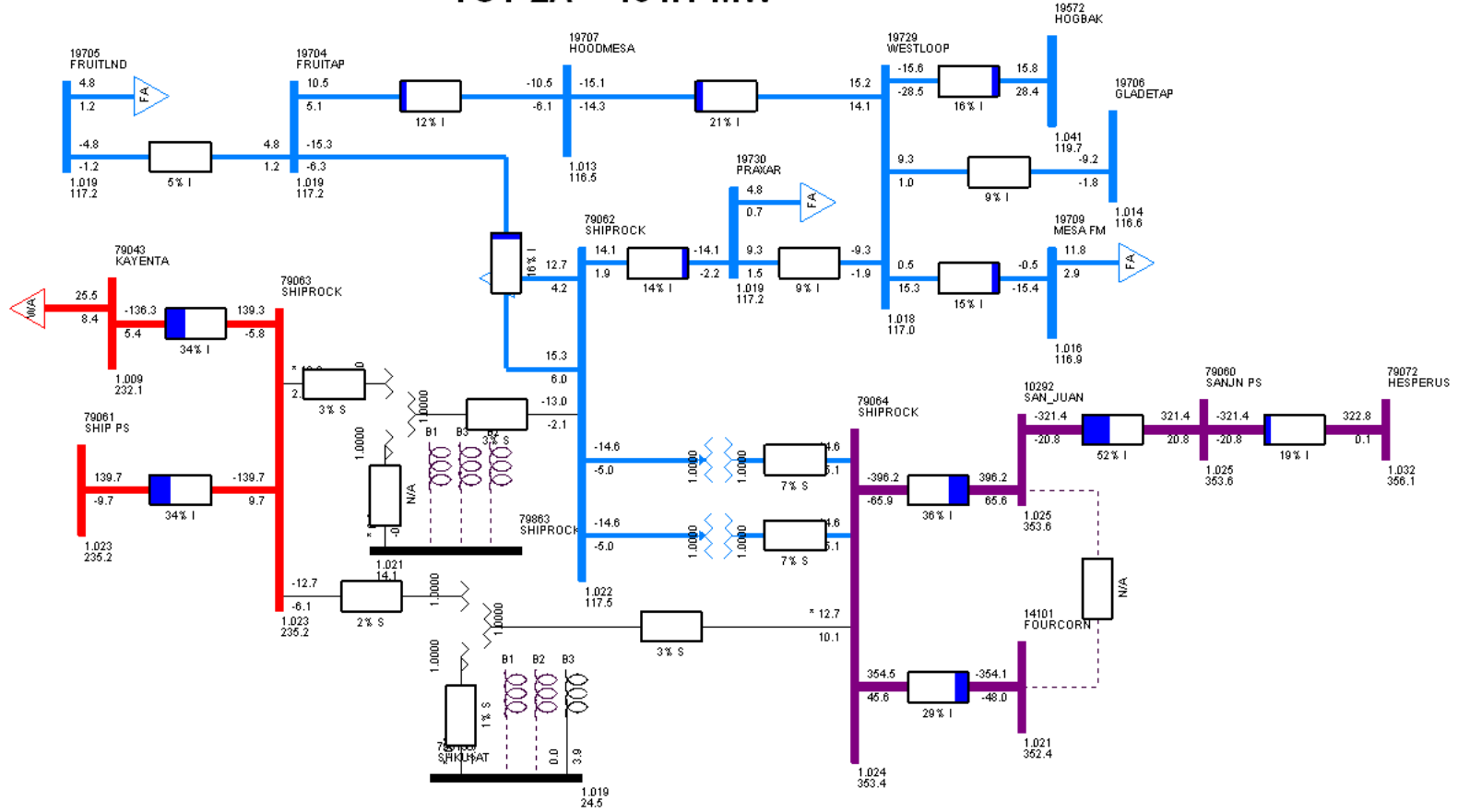
## Shiprock 345/115-kV Transformer SIS 2015 Light Autumn Post-Project Case Contingency: Shiprock-Kayenta 230-kV

**TOT 2A = 455.8 MW**



Shiprock 345/115-kV Transformer SIS  
 2015 Light Autumn Post-Project Case  
 Contingency: San Juan-Four Corners 345-kV

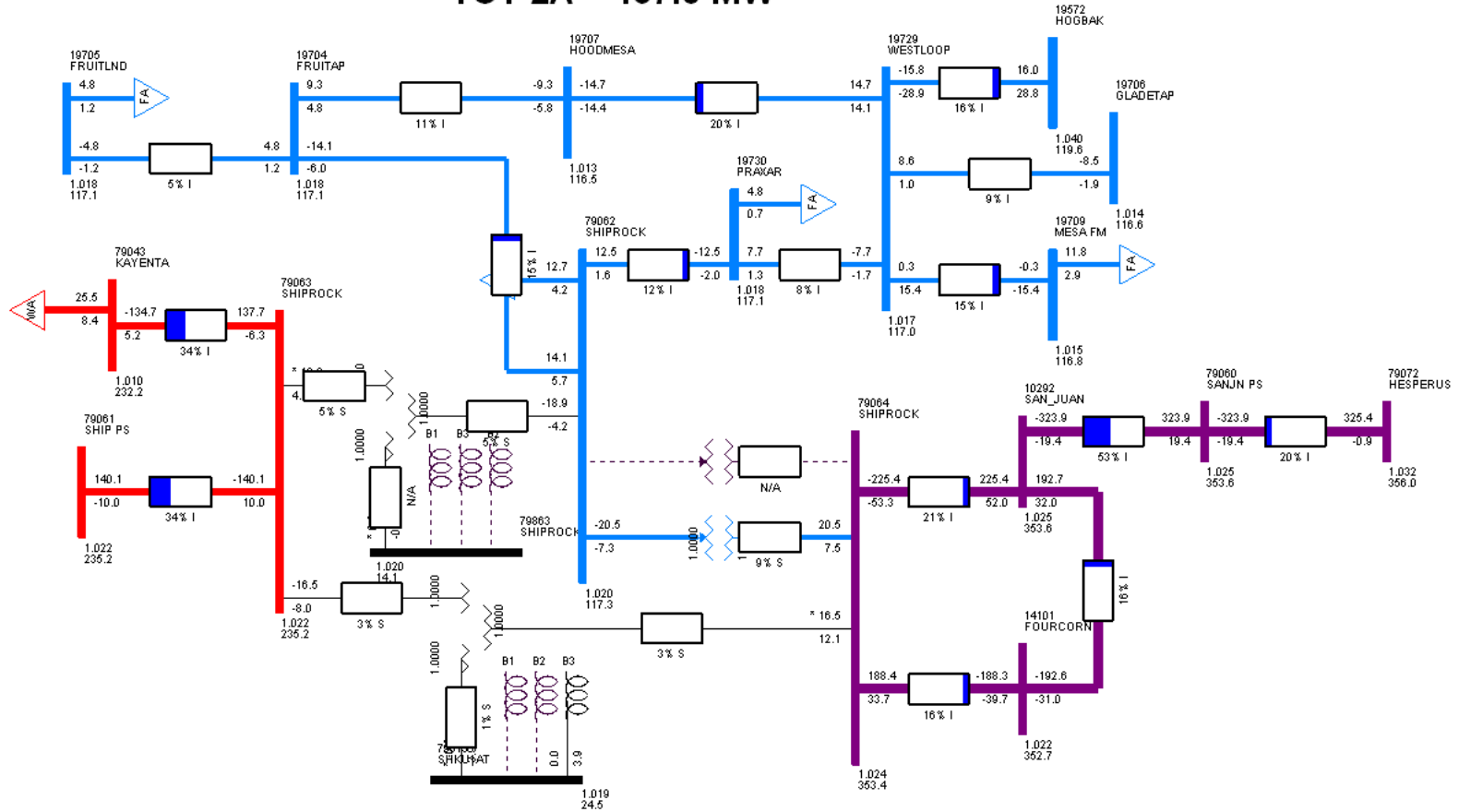
TOT 2A = 464.1 MW





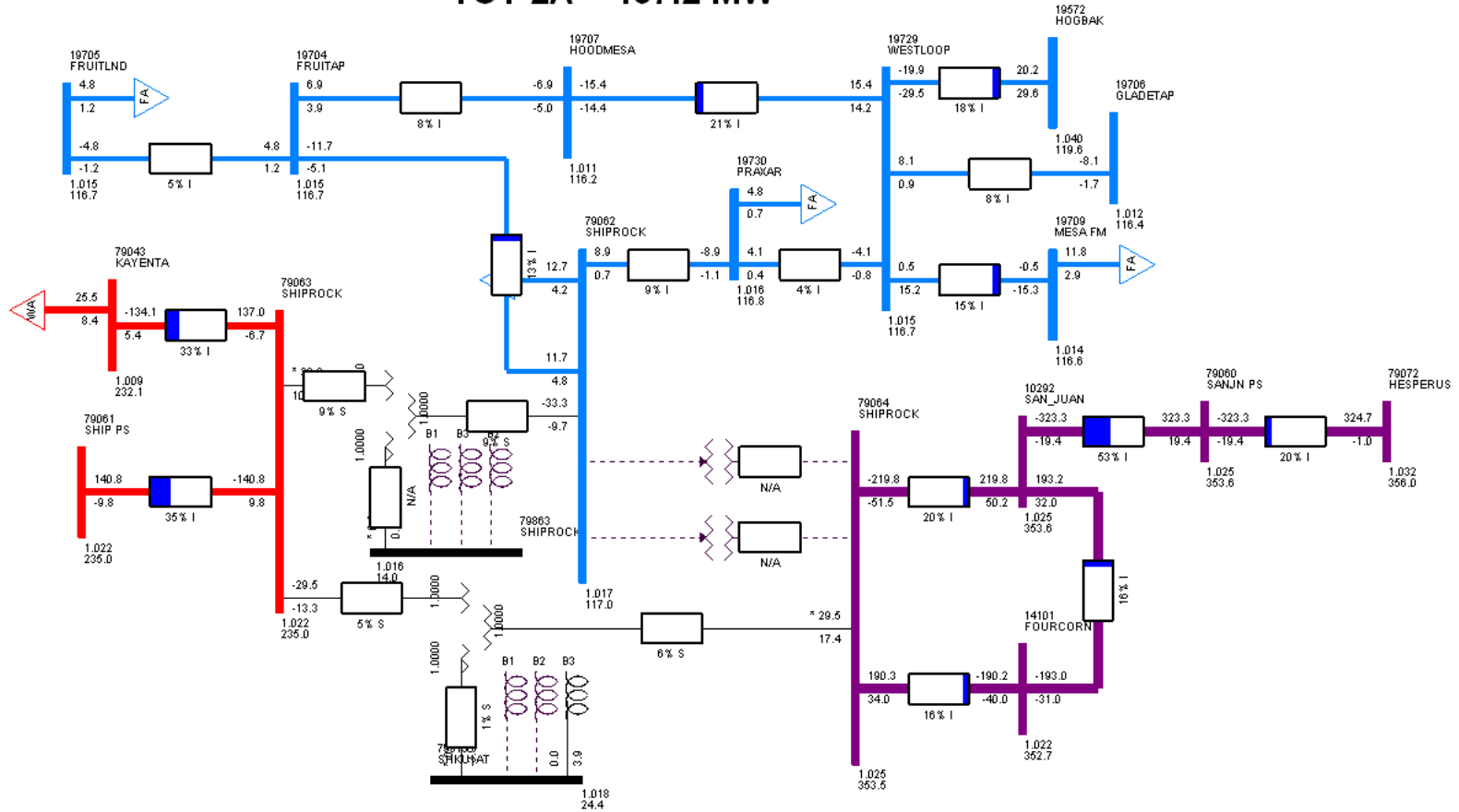
Shiprock 345/115-kV Transformer SIS  
 2015 Light Autumn Post-Project Case  
 Contingency: Shiprock 345/115-kV Xmfr T1

TOT 2A = 467.0 MW



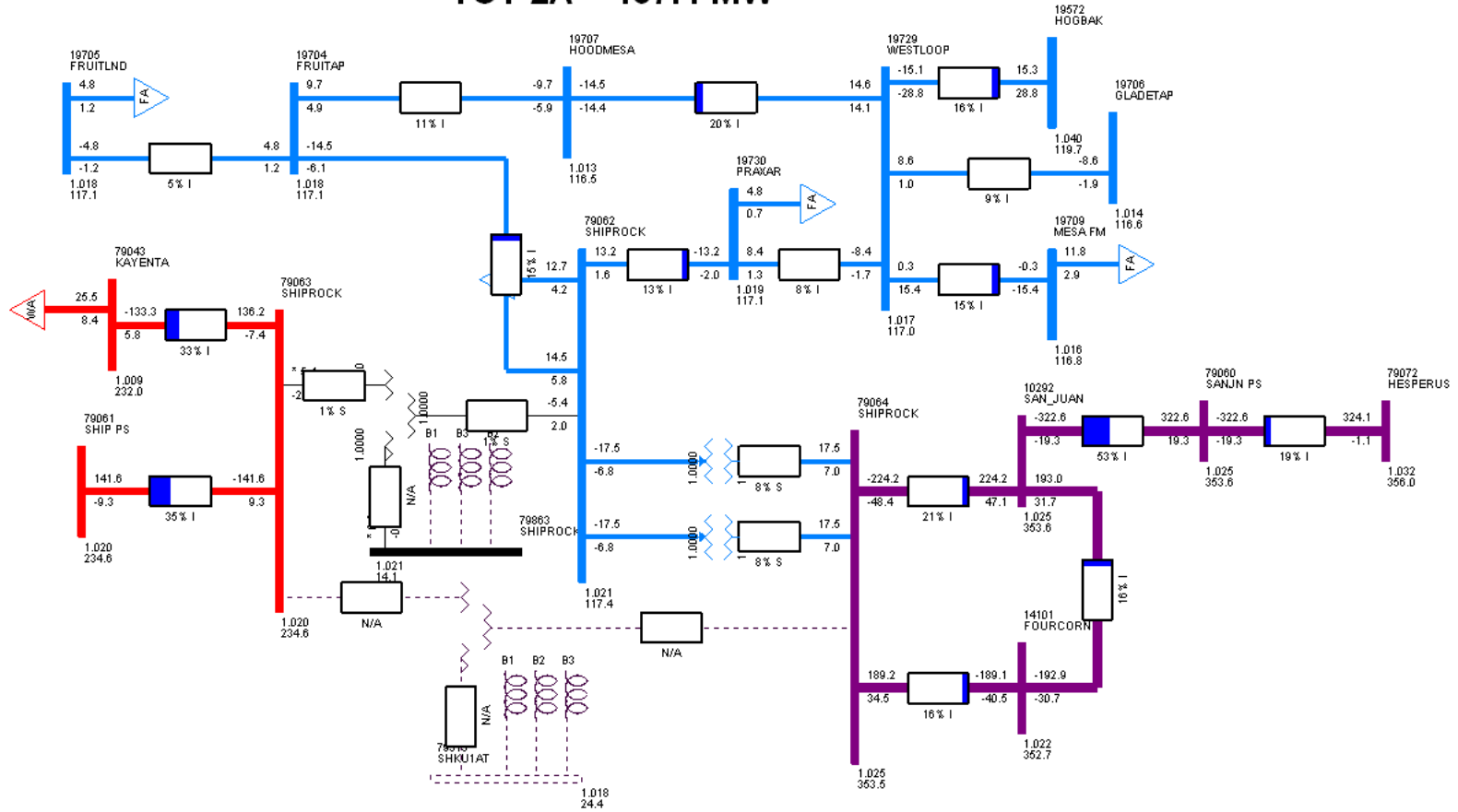
### Shiprock 345/115-kV Transformer SIS 2015 Light Autumn Post-Project Case Contingency: Shiprock 345/115-kV Xmfr T1 & T2

**TOT 2A = 467.2 MW**



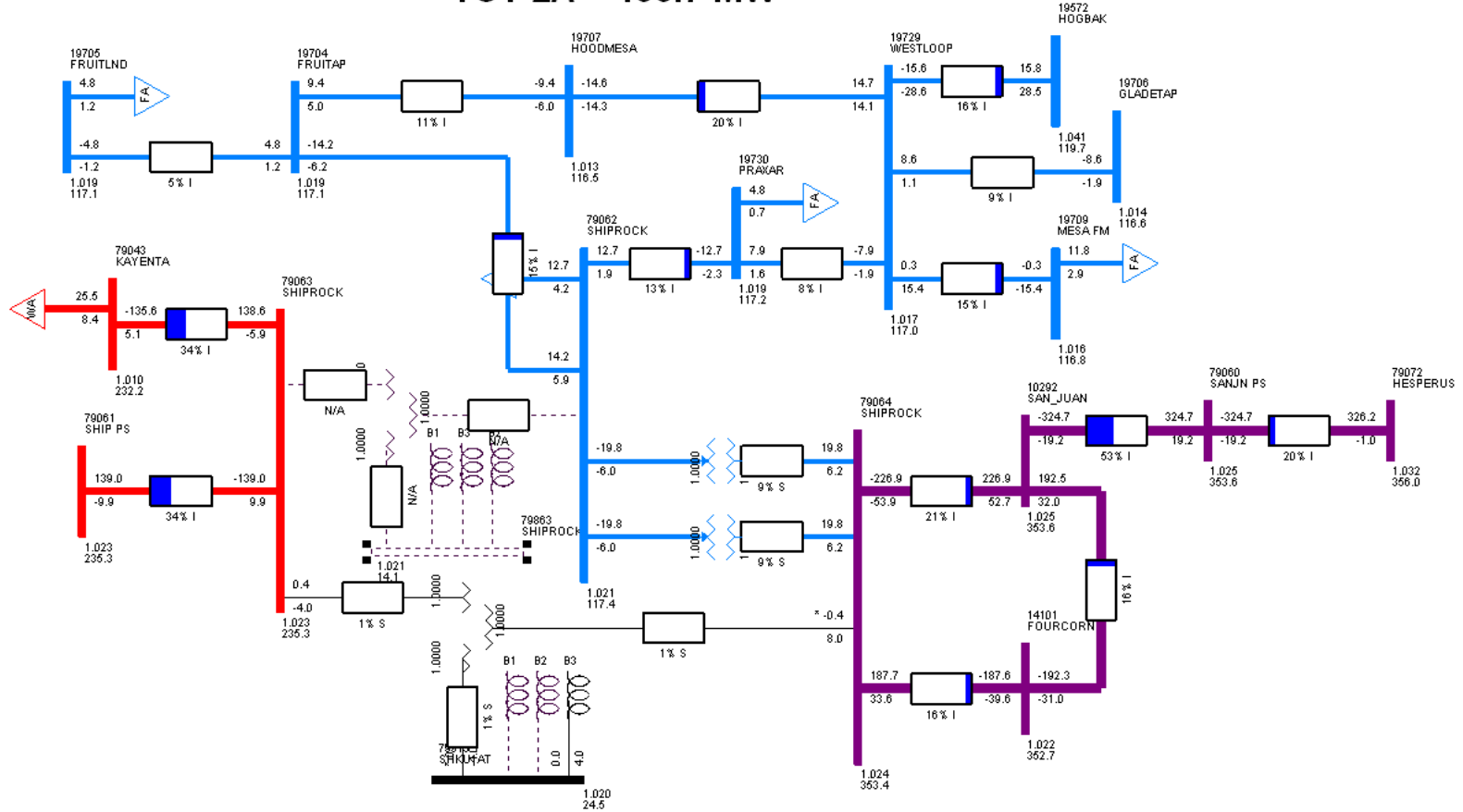
### Shiprock 345/115-kV Transformer SIS 2015 Light Autumn Post-Project Case Contingency: Shiprock 345/230-kV Xfmr

**TOT 2A = 467.4 MW**



### Shiprock 345/115-kV Transformer SIS 2015 Light Autumn Post-Project Case Contingency: Shiprock 230/115-kV Xfmr

TOT 2A = 466.7 MW

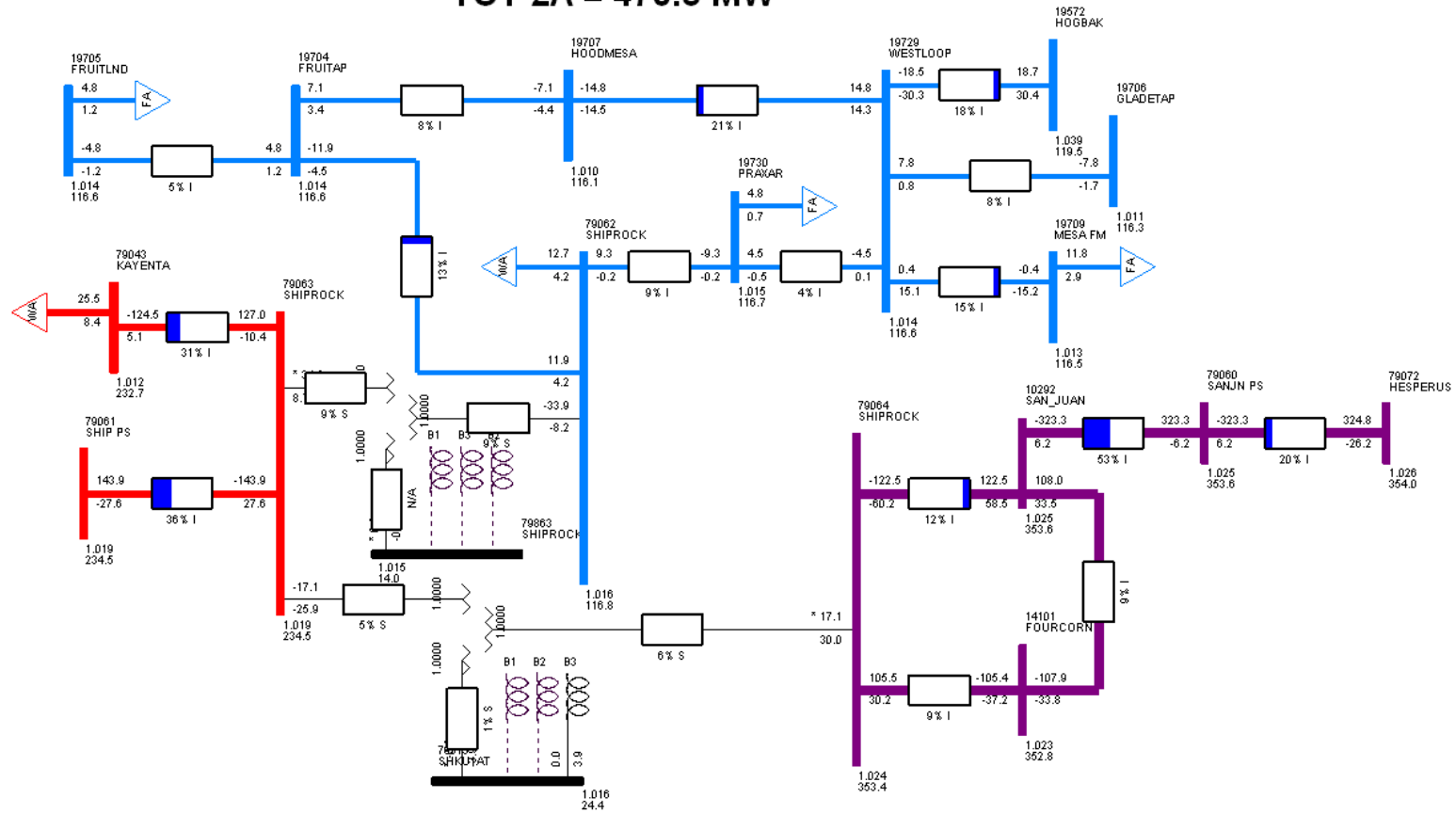


SIS – Shiprock 345/115-kV Transformer Project

2015 Heavy Summer Pre-Project Case

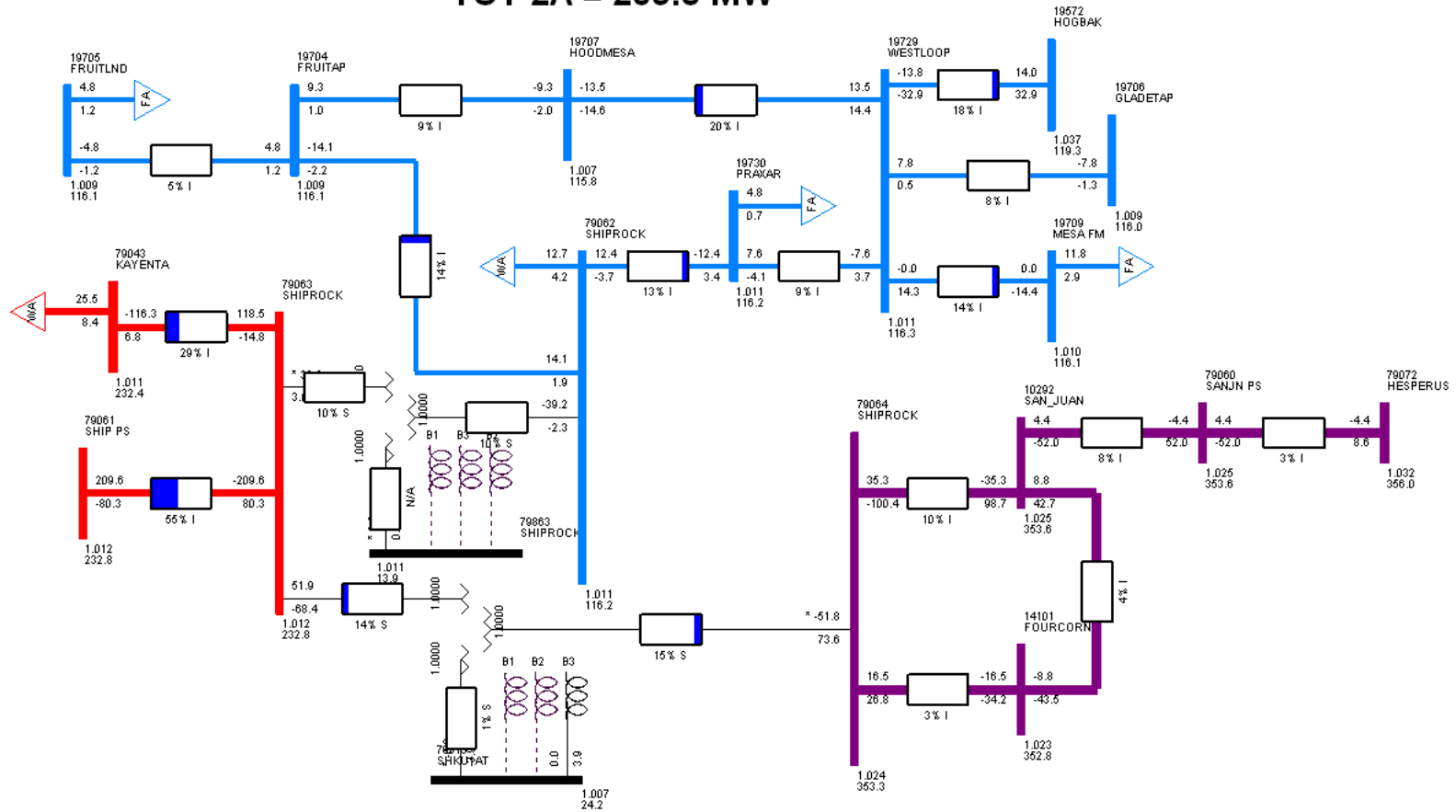
Shiprock 345/115-kV Transformer SIS  
2015 Heavy Summer Pre-Project Case  
System Intact

TOT 2A = 470.5 MW



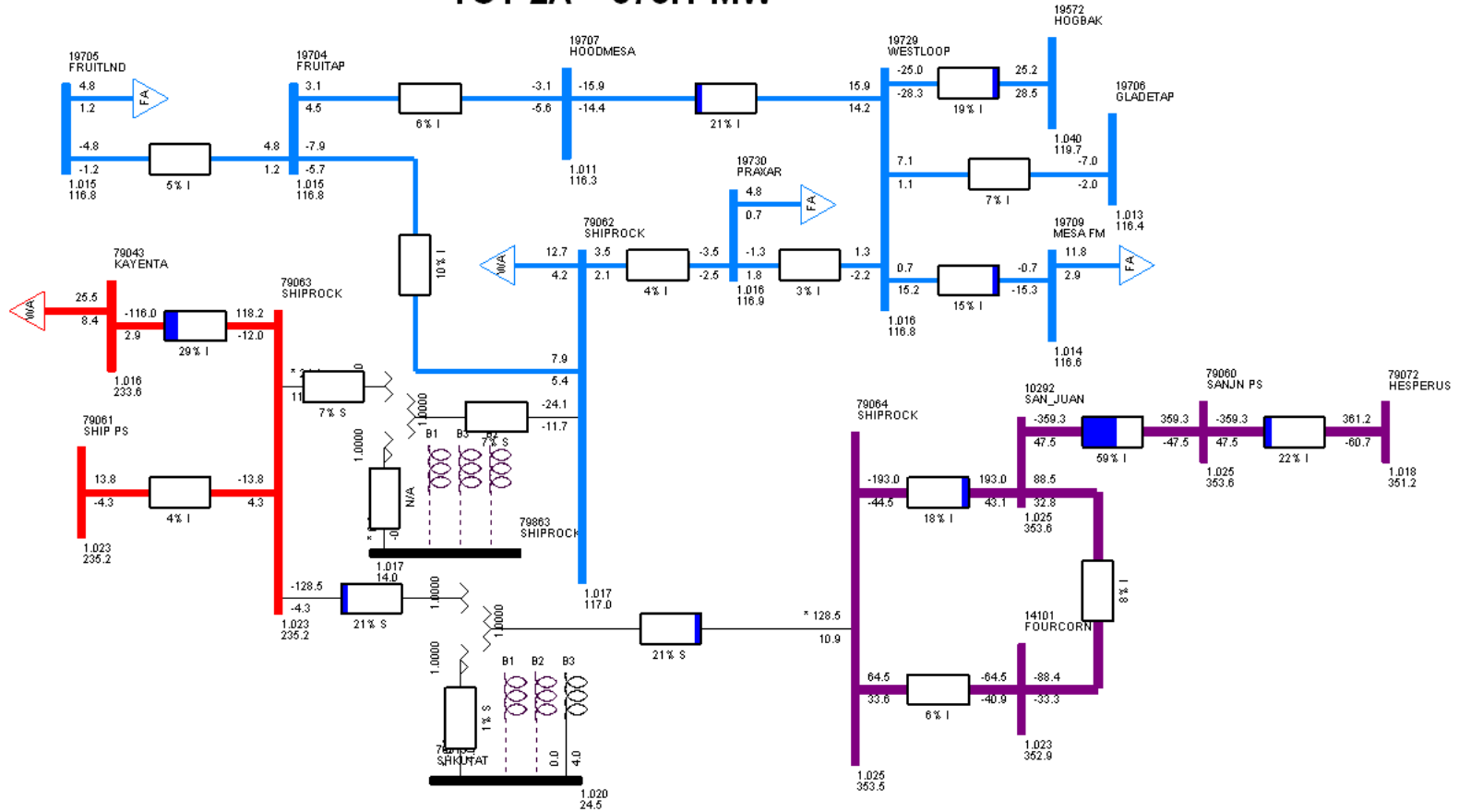
## Shiprock 345/115-kV Transformer SIS 2015 Heavy Summer Pre-Project Case Contingency: Montrose-Hesperus 345-kV

**TOT 2A = 209.5 MW**



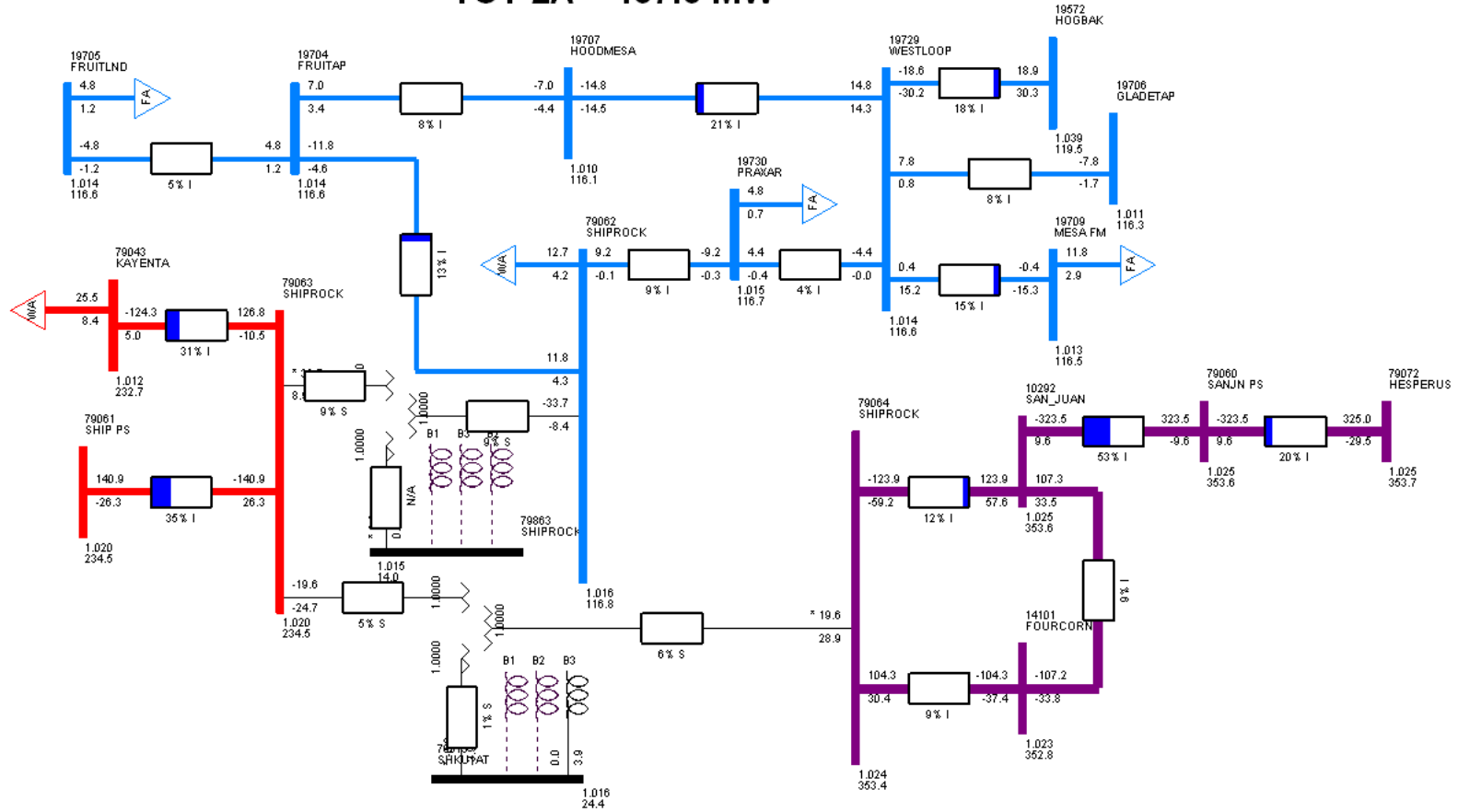
Shiprock 345/115-kV Transformer SIS  
 2015 Heavy Summer Pre-Project Case  
 Contingency: Lost Canyon-Curecanti 230-kV

TOT 2A = 375.1 MW



## Shiprock 345/115-kV Transformer SIS 2015 Heavy Summer Pre-Project Case Contingency: Montrose-Nucla 115-kV

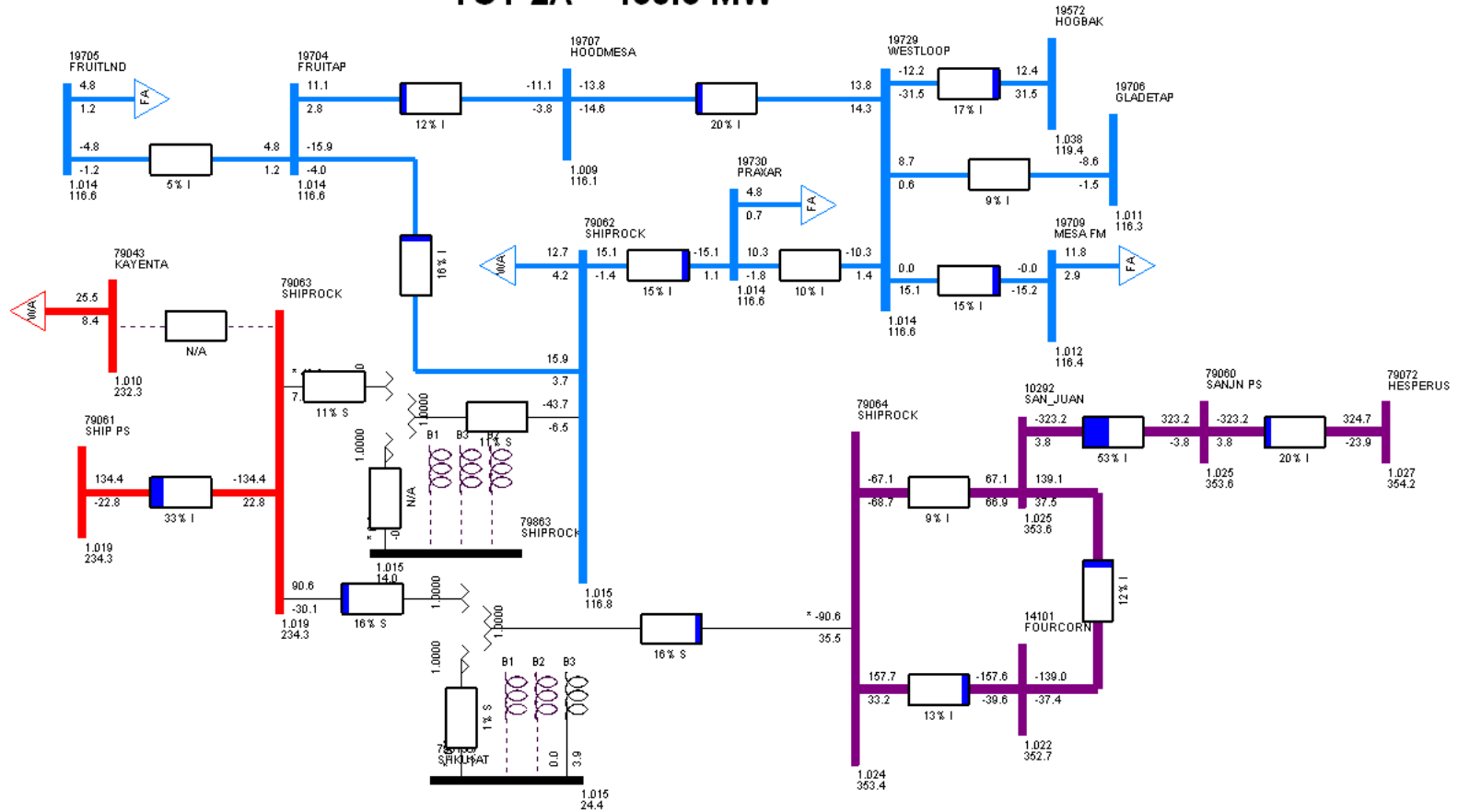
**TOT 2A = 467.6 MW**





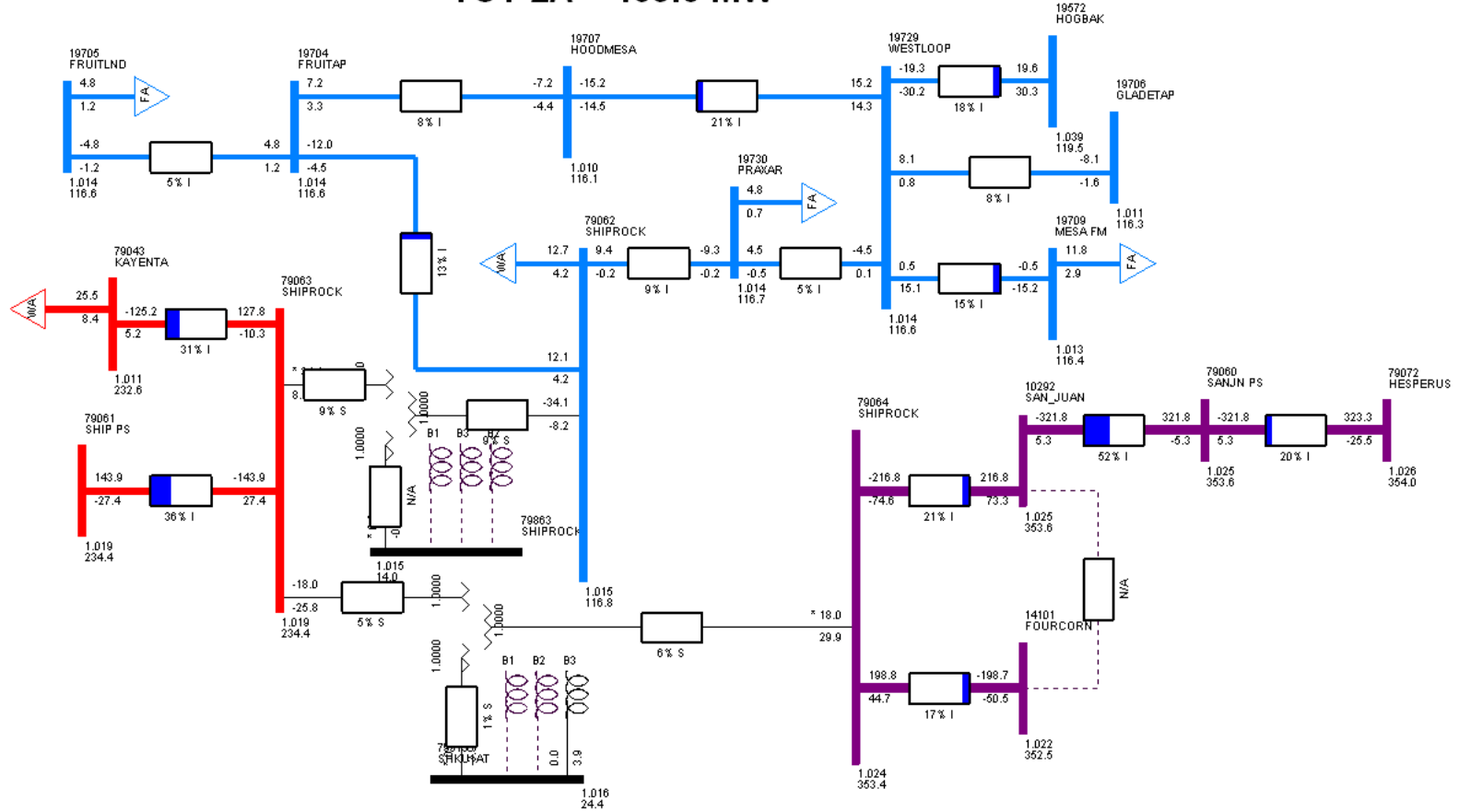
Shiprock 345/115-kV Transformer SIS  
 2015 Heavy Summer Pre-Project Case  
 Contingency: Shiprock-Kayenta 230-kV

TOT 2A = 460.6 MW



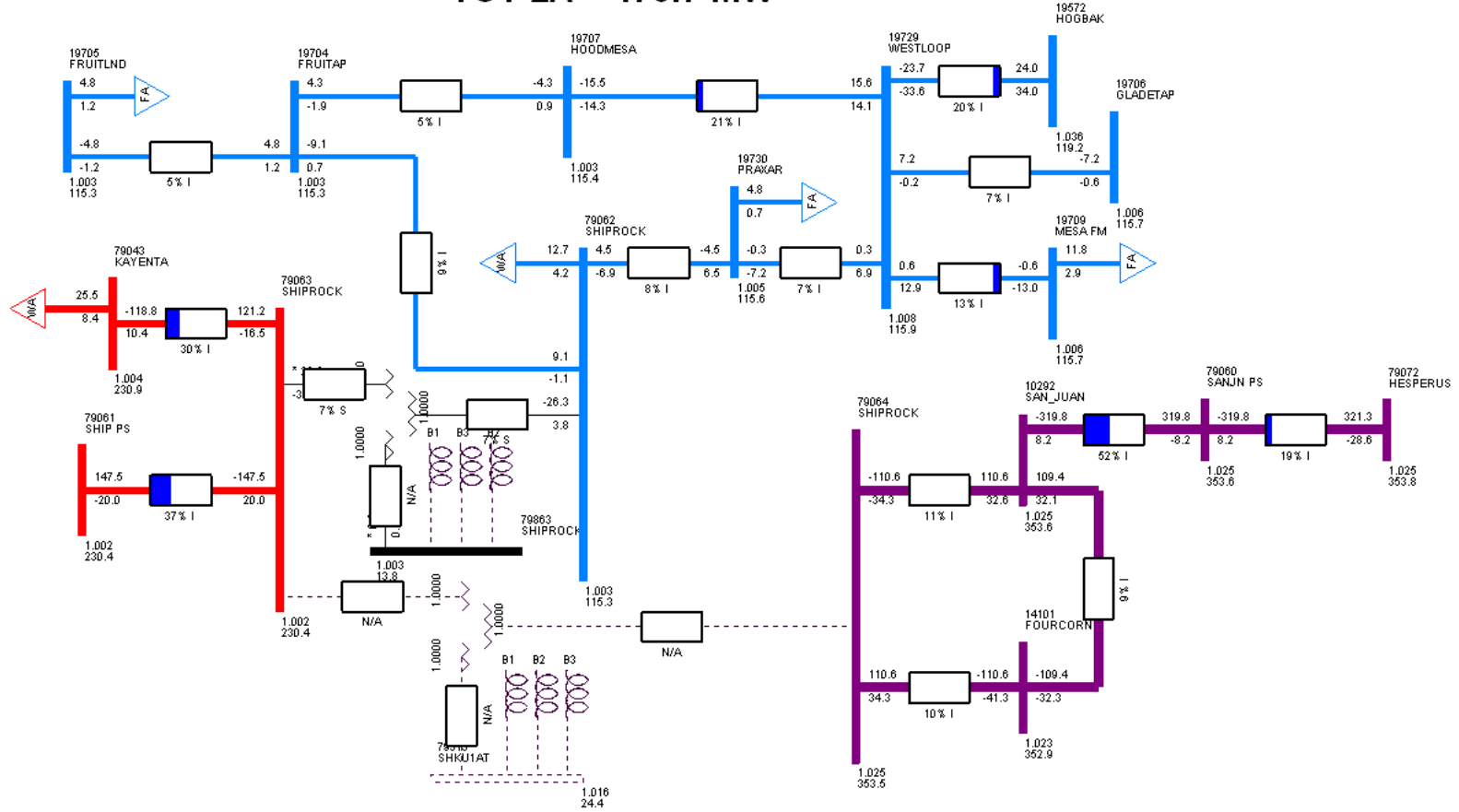
Shiprock 345/115-kV Transformer SIS  
 2015 Heavy Summer Pre-Project Case  
 Contingency: San Juan-Four Corners 345-kV

TOT 2A = 469.0 MW



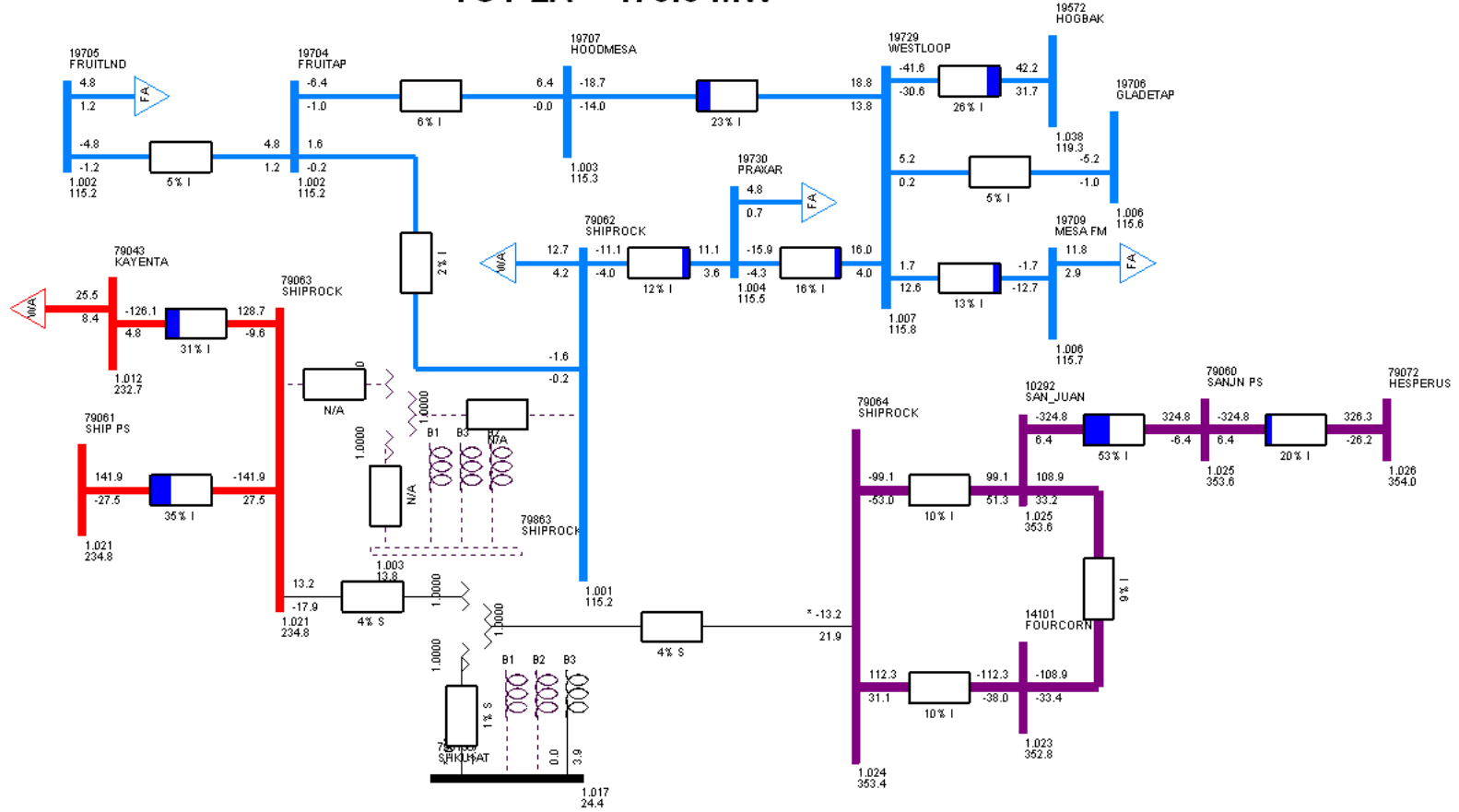
Shiprock 345/115-kV Transformer SIS  
 2015 Heavy Summer Pre-Project Case  
 Contingency: Shiprock 345/230-kV Xfmr

TOT 2A = 470.7 MW



Shiprock 345/115-kV Transformer SIS  
 2015 Heavy Summer Pre-Project Case  
 Contingency: Shiprock 230/115-kV Xfmr

TOT 2A = 470.0 MW

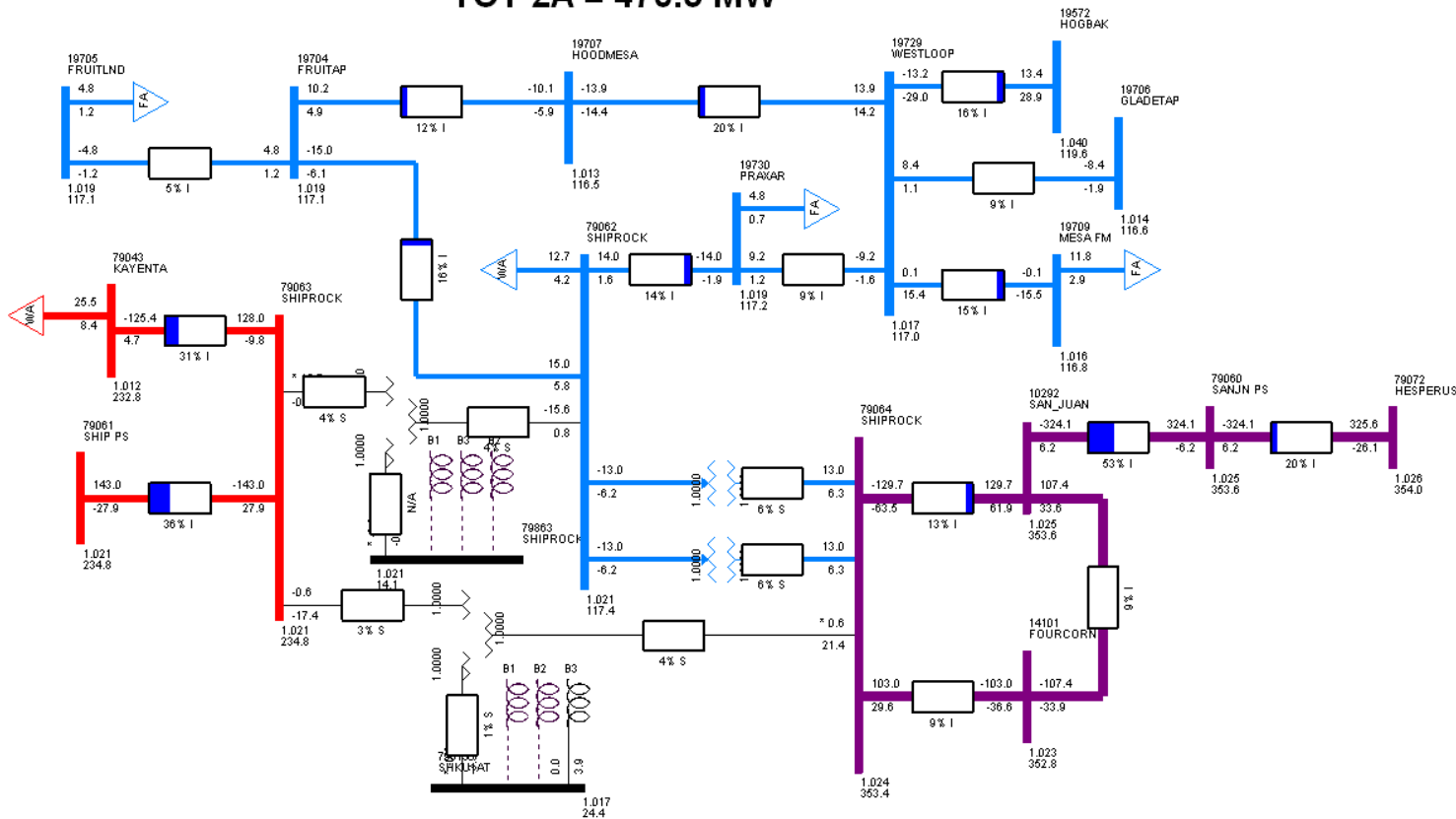


# SIS – Shiprock 345/115-kV Transformer Project

## 2015 Heavy Summer Post Project Case

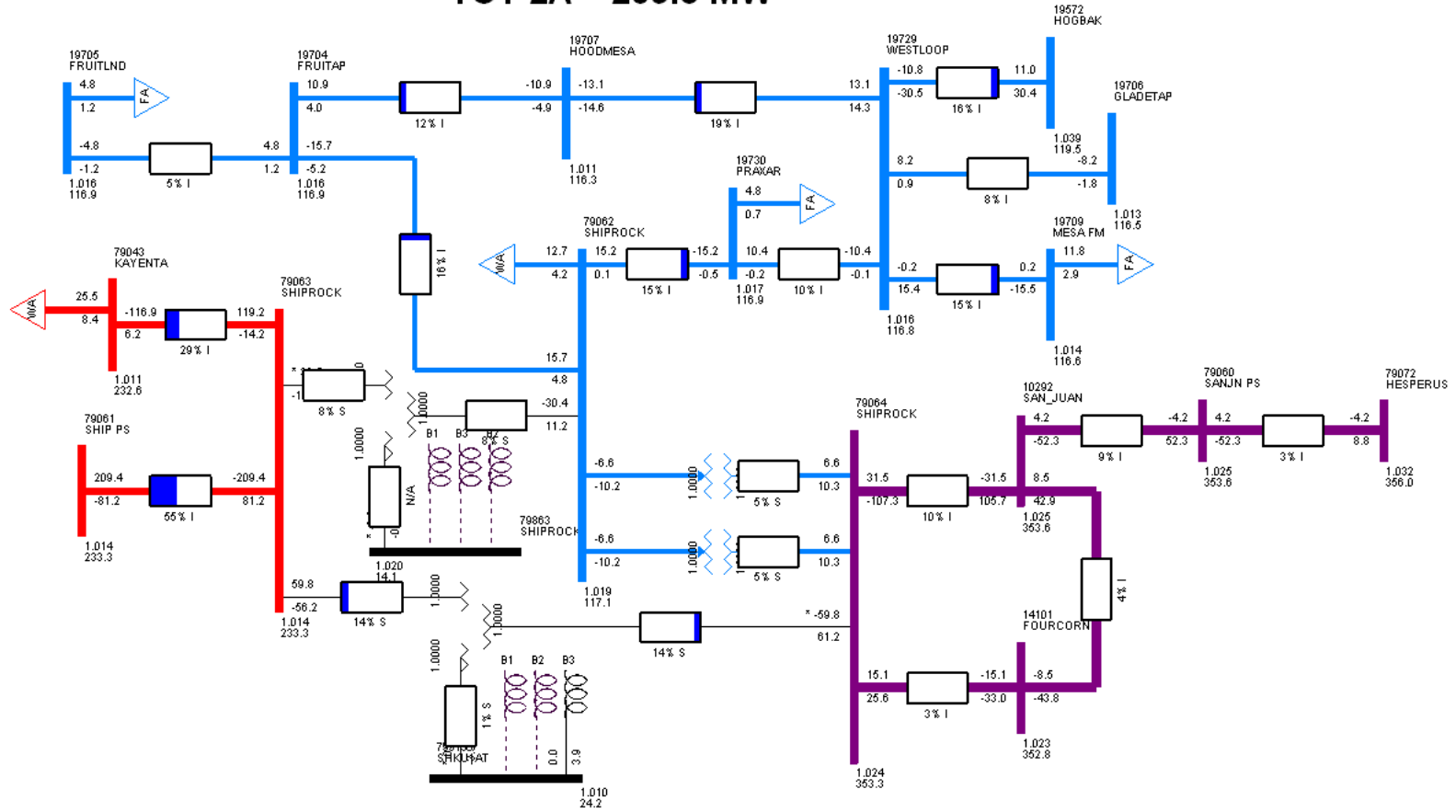
### Shiprock 345/115-kV Transformer SIS 2015 Heavy Summer Post-Project Case System Intact

TOT 2A = 470.3 MW



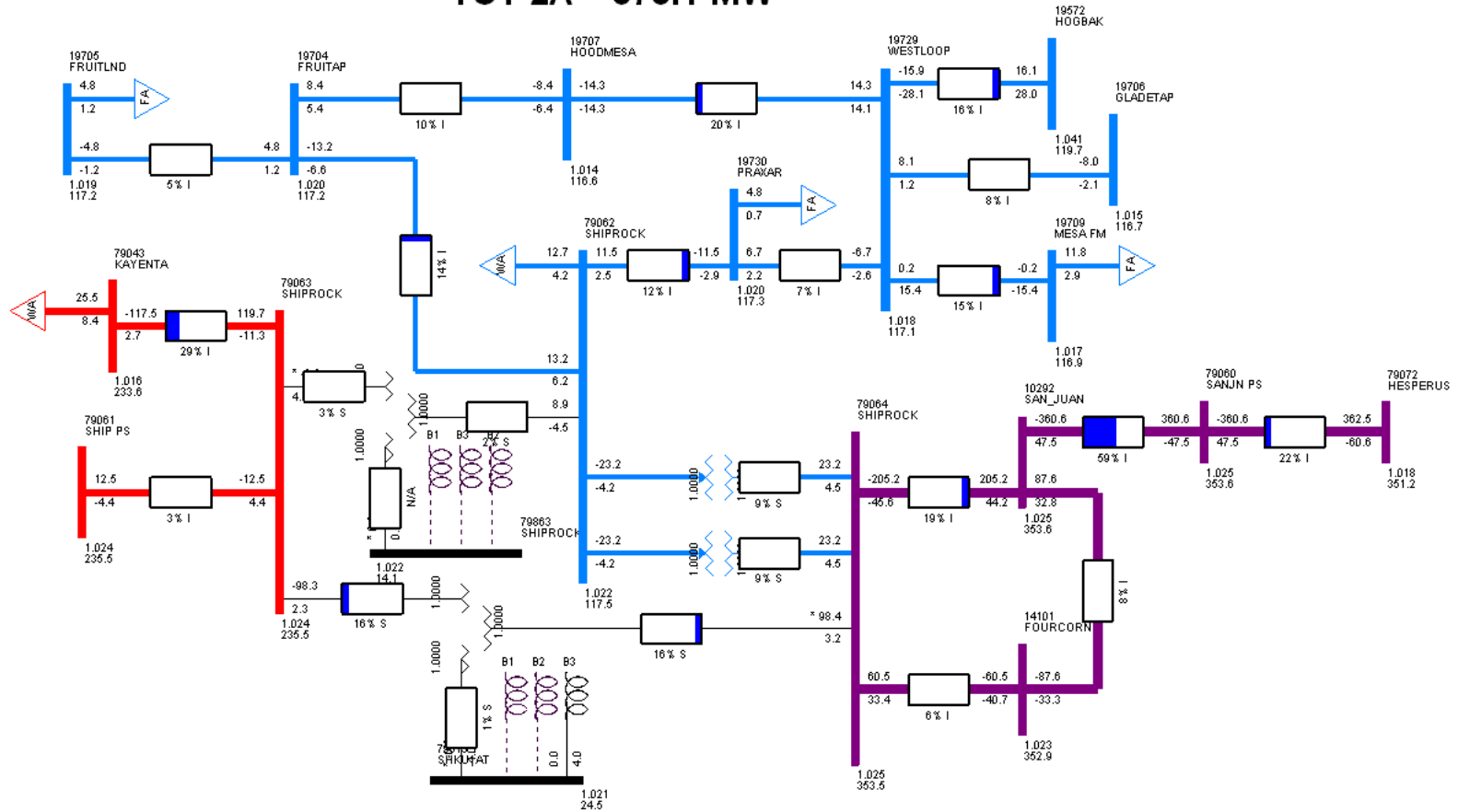
### Shiprock 345/115-kV Transformer SIS 2015 Heavy Summer Post-Project Case Contingency: Montrose-Hesperus 345-kV

**TOT 2A = 209.5 MW**



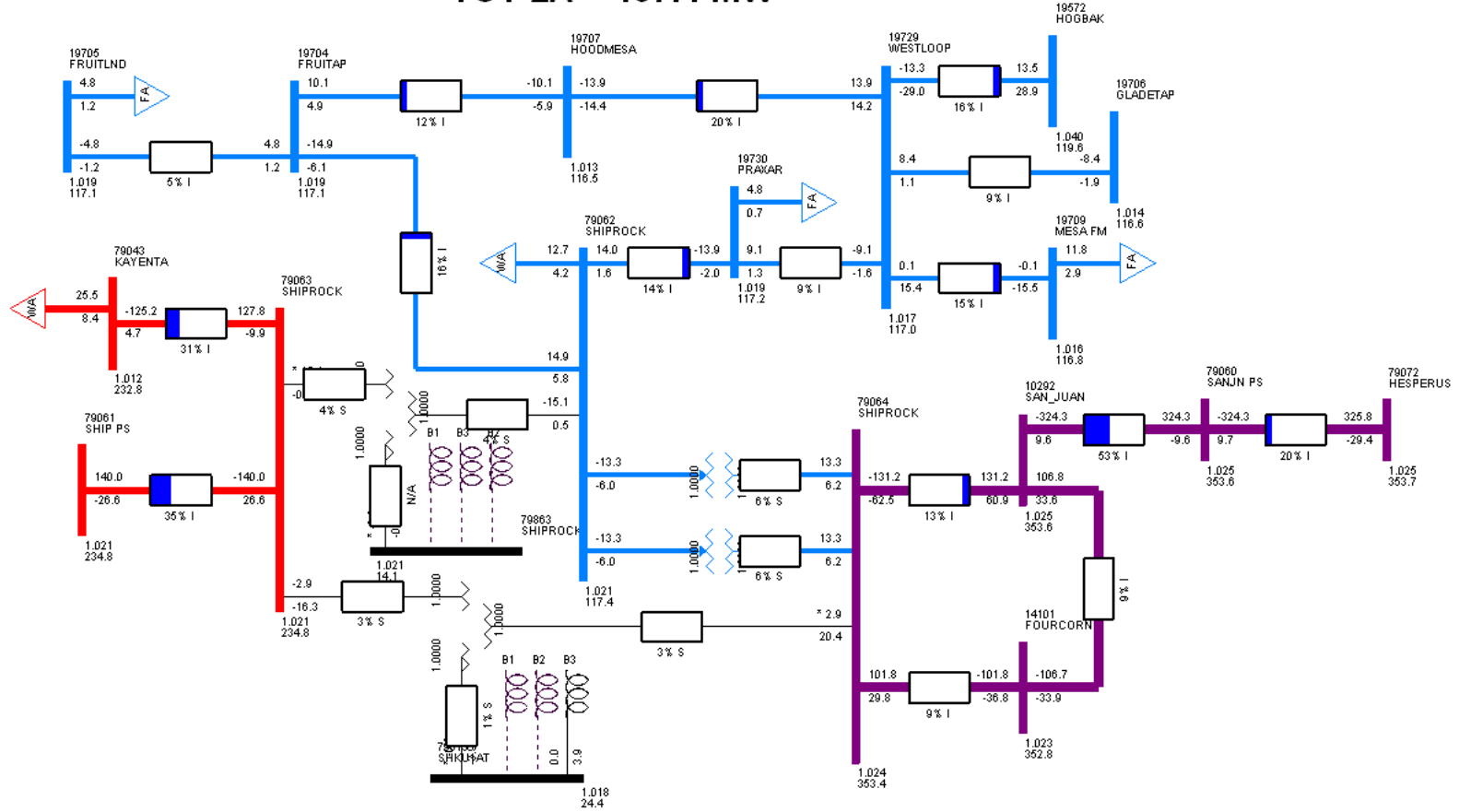
### Shiprock 345/115-kV Transformer SIS 2015 Heavy Summer Post-Project Case Contingency: Lost Canyon-Curecanti 230-kV

**TOT 2A = 375.1 MW**



## Shiprock 345/115-kV Transformer SIS 2015 Heavy Summer Post-Project Case Contingency: Montrose-Nucla 115-kV

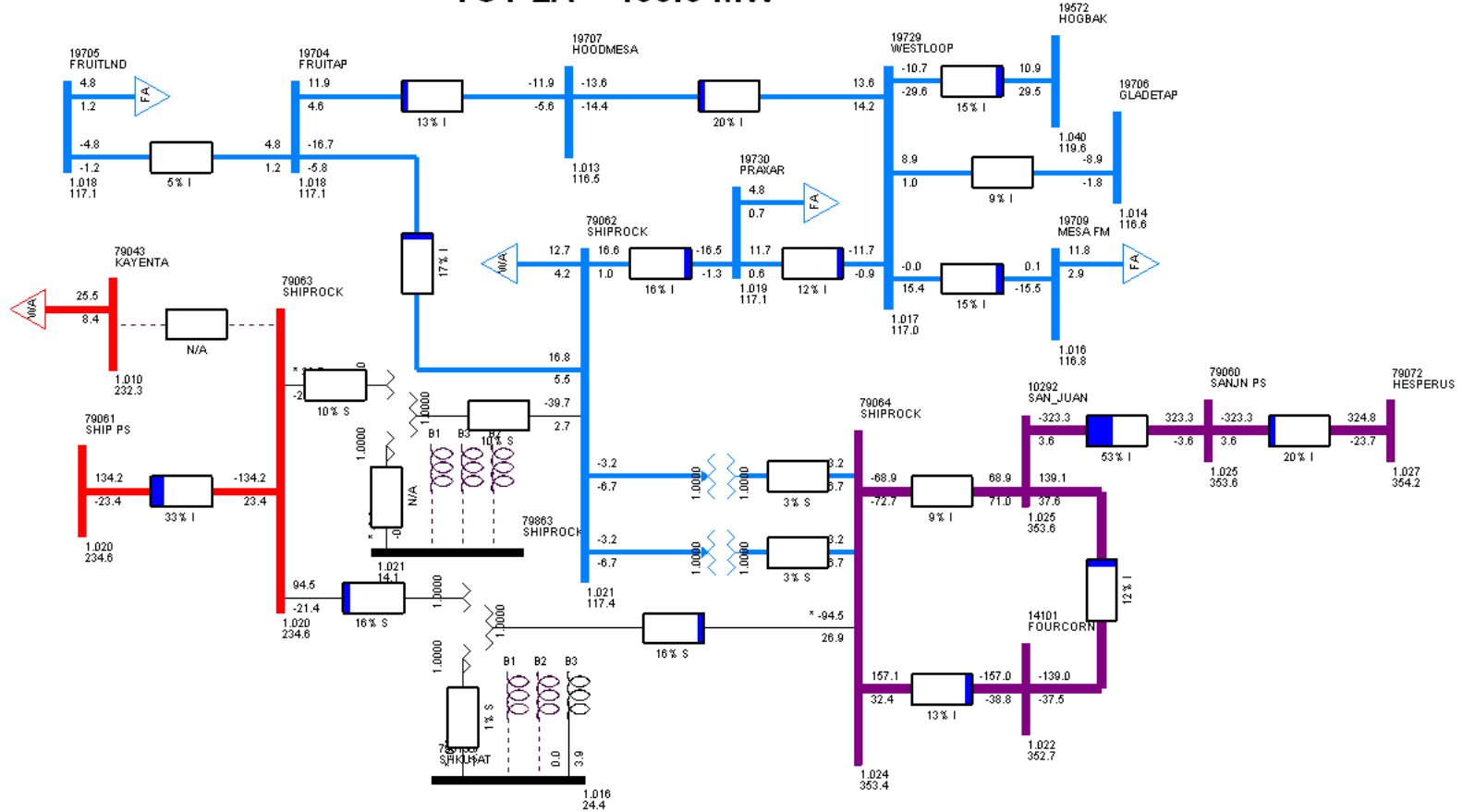
**TOT 2A = 467.4 MW**





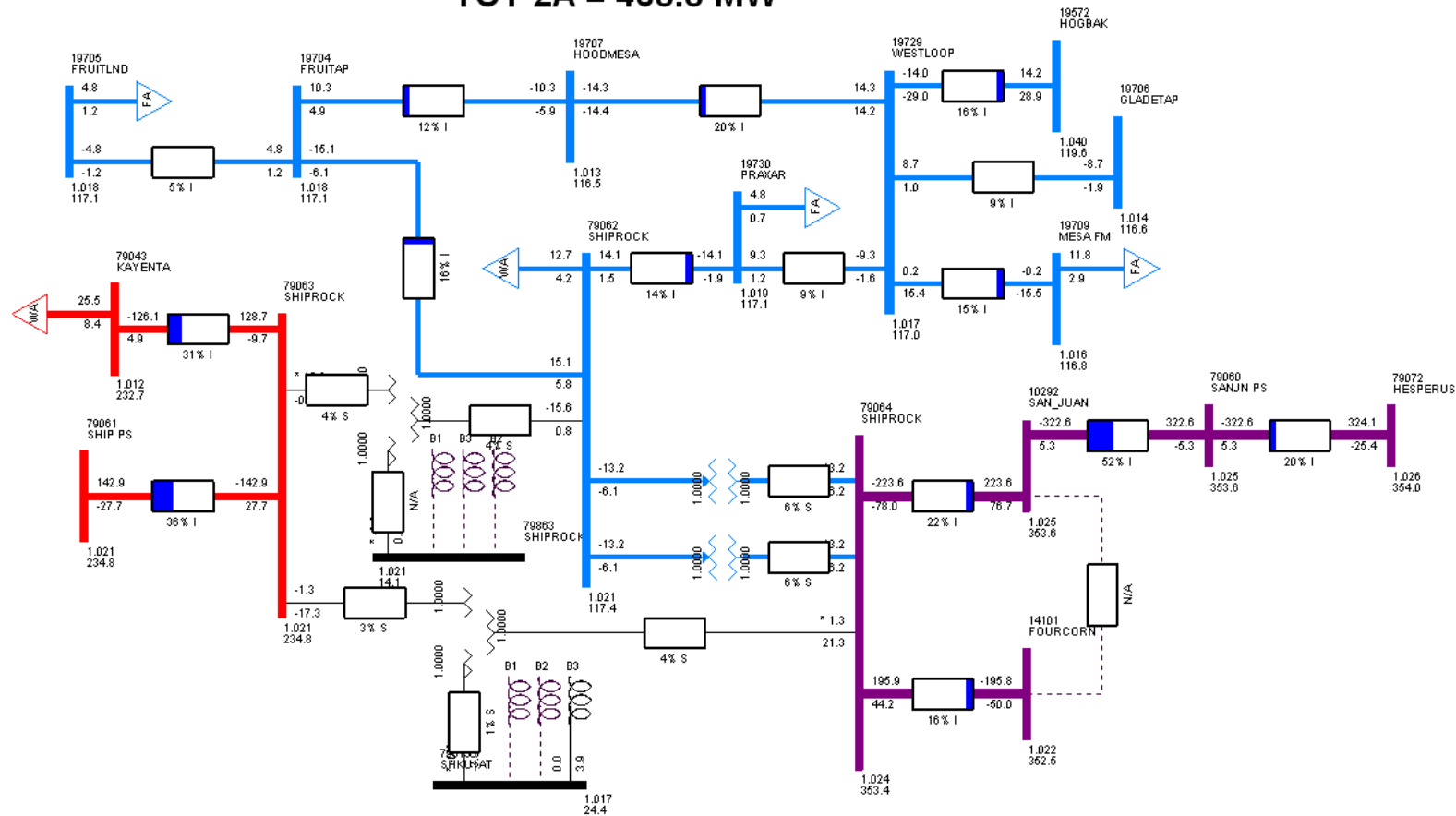
Shiprock 345/115-kV Transformer SIS  
 2015 Heavy Summer Post-Project Case  
 Contingency: Shiprock-Kayenta 230-kV

TOT 2A = 460.6 MW



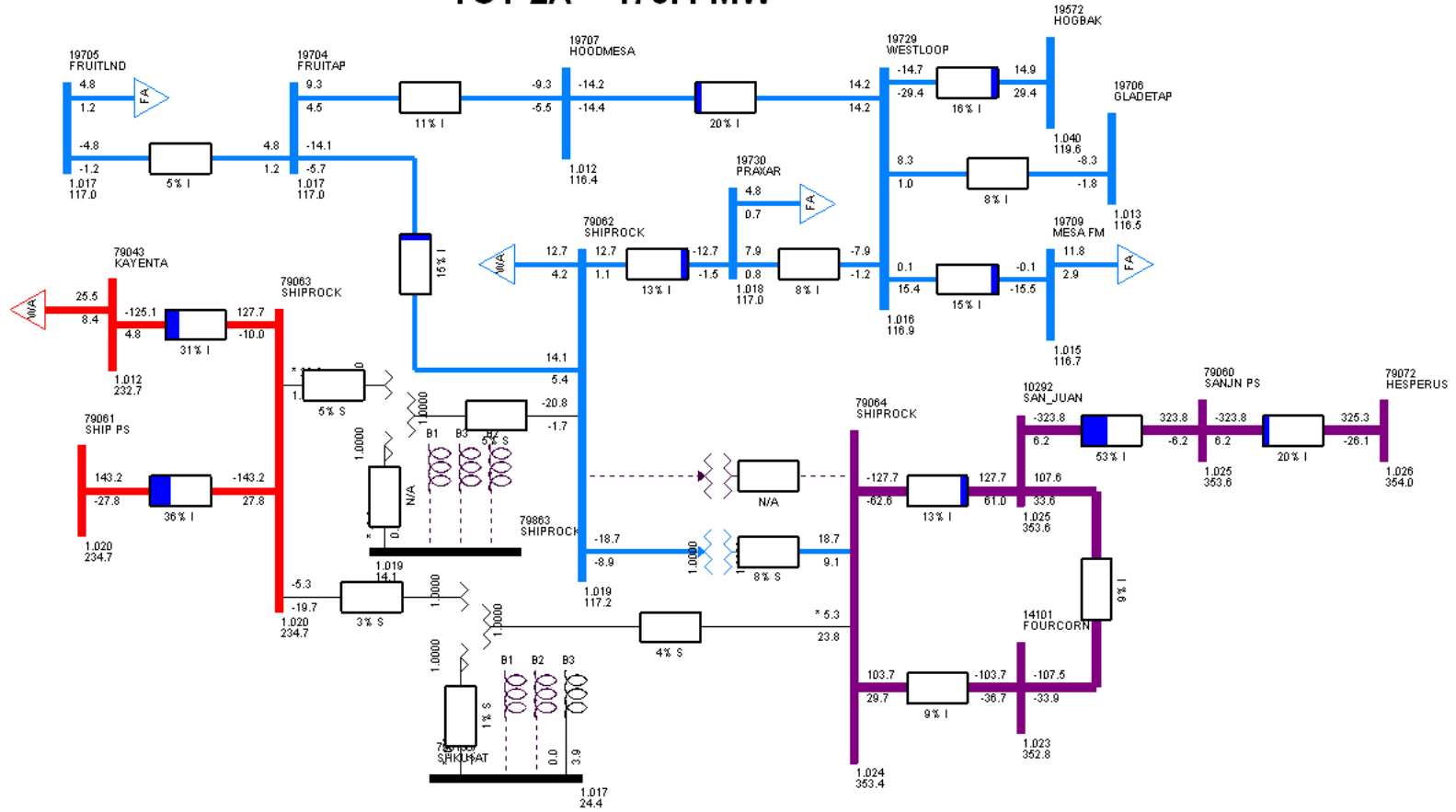
**Shiprock 345/115-kV Transformer SIS  
2015 Heavy Summer Post-Project Case  
Contingency: San Juan-Four Corners 345-kV**

**TOT 2A = 468.8 MW**



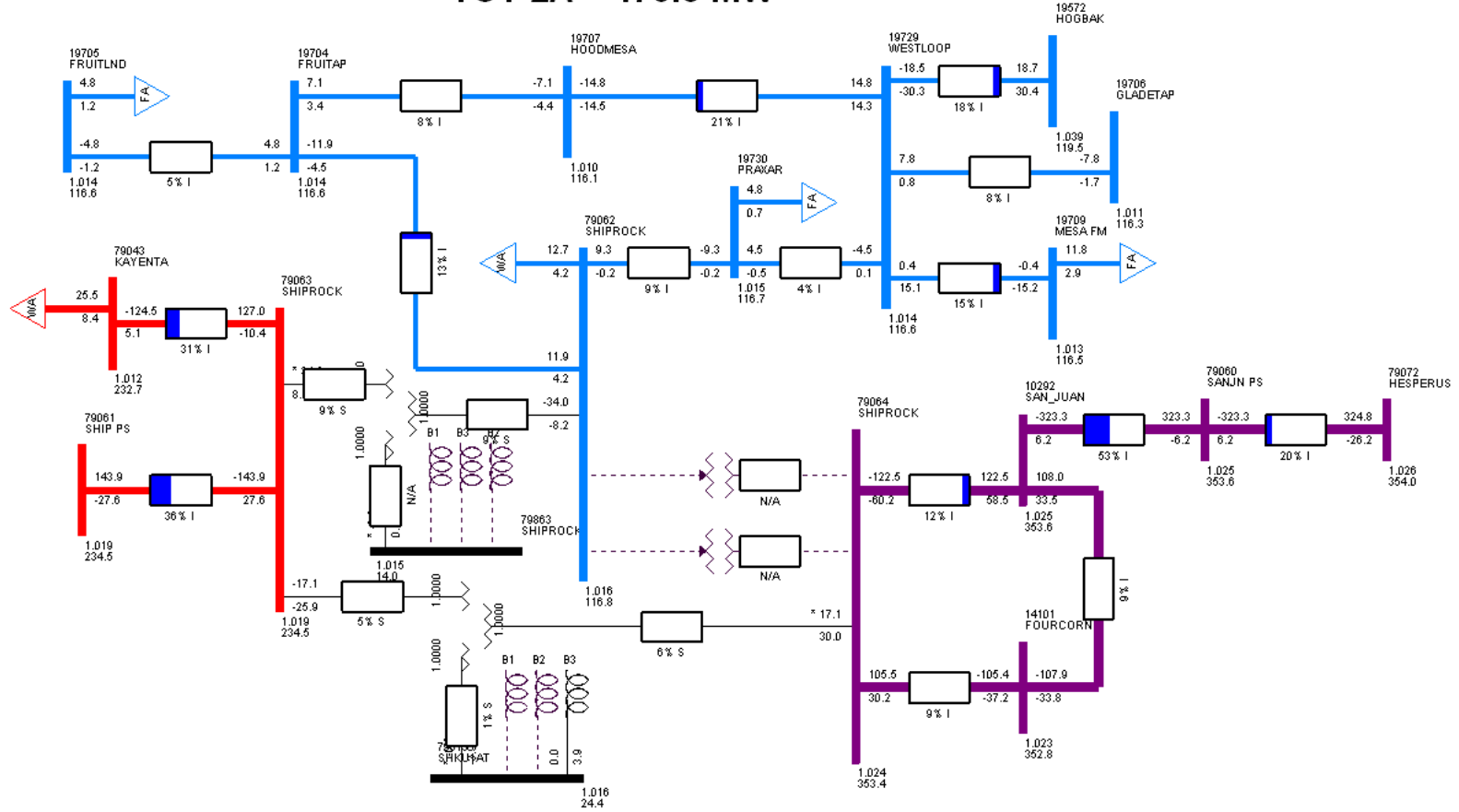
Shiprock 345/115-kV Transformer SIS  
 2015 Heavy Summer Post-Project Case  
 Contingency: Shiprock 345/115-kV Xfmr T1

TOT 2A = 470.4 MW



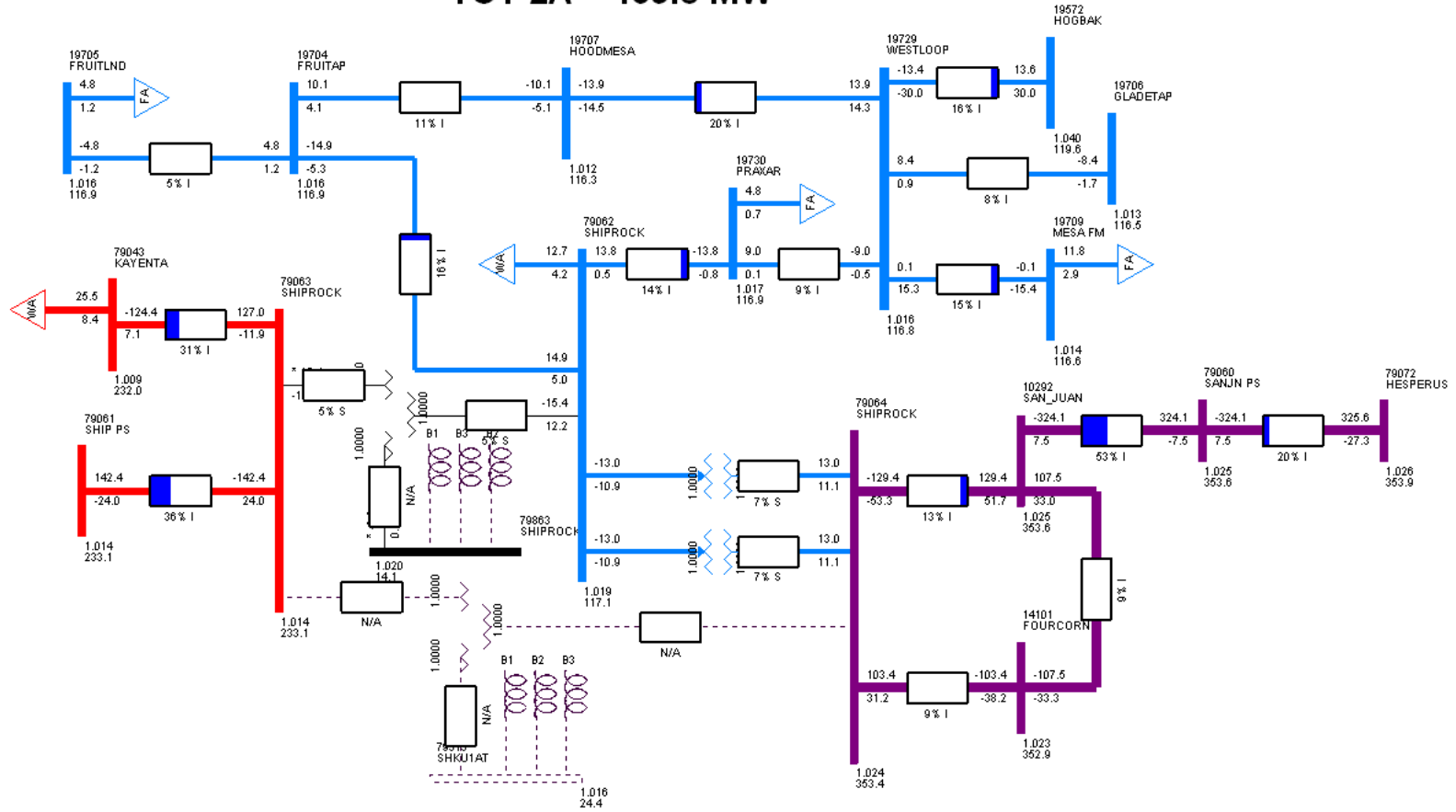
Shiprock 345/115-kV Transformer SIS  
 2015 Heavy Summer Post-Project Case  
 Contingency: Shiprock 345/115-kV Xfmr T1 & T2

TOT 2A = 470.5 MW



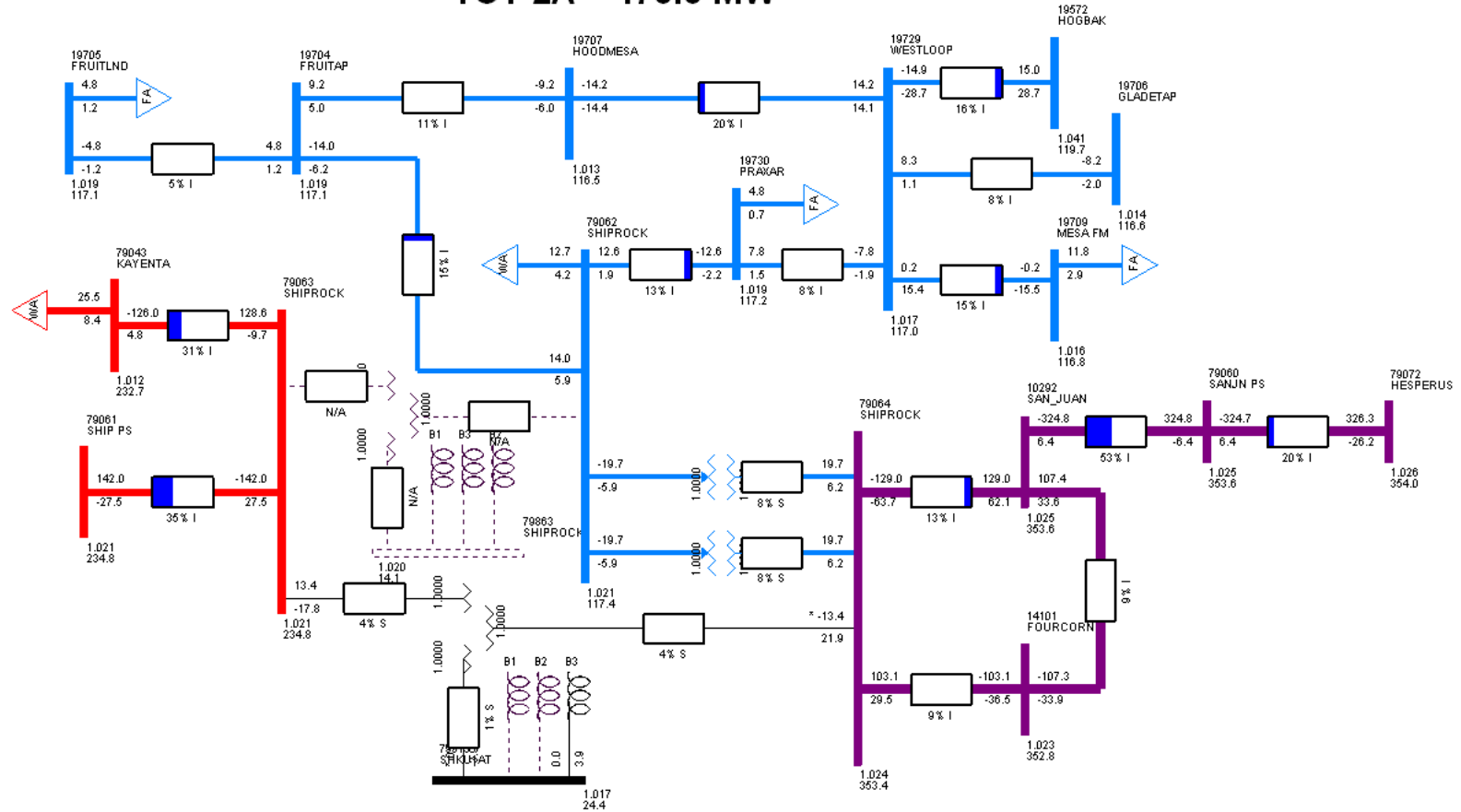
Shiprock 345/115-kV Transformer SIS  
 2015 Heavy Summer Post-Project Case  
 Contingency: Shiprock 345/230-kV Xfmr

TOT 2A = 469.8 MW

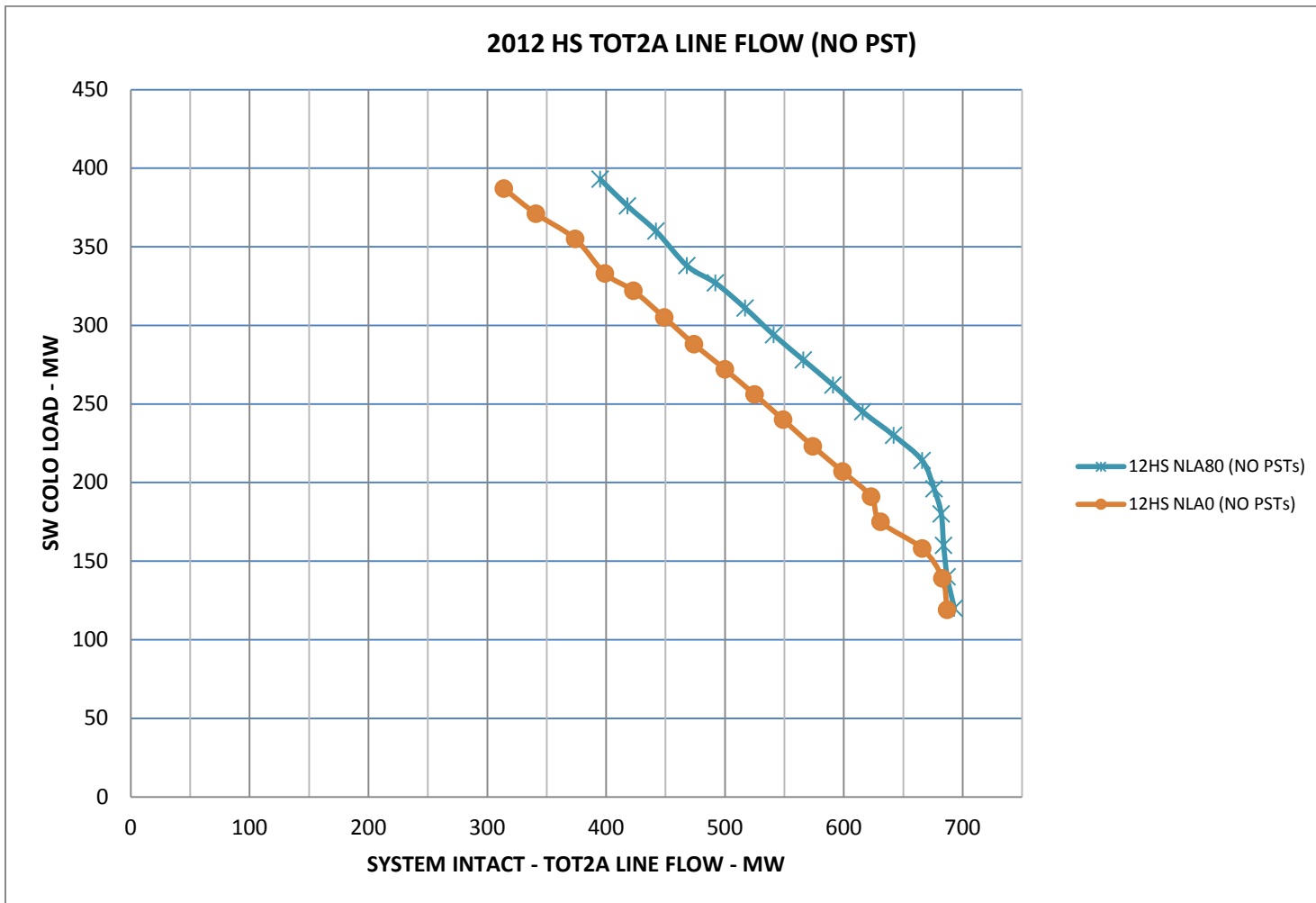


Shiprock 345/115-kV Transformer SIS  
 2015 Heavy Summer Post-Project Case  
 Contingency: Shiprock 230/115-kV Xfmr

TOT 2A = 470.0 MW



Appendix C – TOT2A Operating Curve (as of 2012 Heavy Summer)



## Appendix D – Contingency List (Full)

CRG-MKR	: TRIP LINE FROM BUS 79014	[CRAIG	345.00]	TO BUS 79266	[MEEKER	345.00]	CKT 1
MKR-RFL	: TRIP LINE FROM BUS 79266	[MEEKER	345.00]	TO BUS 79058	[RIFLE_CU	345.00]	CKT 1
RFL-GJT	: TRIP LINE FROM BUS 79058	[RIFLE_CU	345.00]	TO BUS 79036	[GRANDJCT	345.00]	CKT 1
GJT-MTR	: TRIP LINE FROM BUS 79036	[GRANDJCT	345.00]	TO BUS 79049	[MONTROSE	345.00]	CKT 1
MTR-HSP	: TRIP LINE FROM BUS 79049	[MONTROSE	345.00]	TO BUS 79072	[HESPERUS	345.00]	CKT 1
WTF-HSP	: TRIP LINE FROM BUS 79060	[SANJN PS	345.00]	TO BUS 79072	[HESPERUS	345.00]	CKT 1
CCI-LCN	: TRIP LINE FROM BUS 79021	[CURECANT	230.00]	TO BUS 79045	[LOSTCANY	230.00]	CKT 1
CCI-PON	: TRIP LINE FROM BUS 79021	[CURECANT	230.00]	TO BUS 79054	[PONCHABR	230.00]	CKT 1
CCI-NFK	: TRIP LINE FROM BUS 79021	[CURECANT	230.00]	TO BUS 79070	[NORTHFRK	230.00]	CKT 1
RFL-NFK	: TRIP LINE FROM BUS 79059	[RIFLE WA	230.00]	TO BUS 79070	[NORTHFRK	230.00]	CKT 1
LCN-SHR	: TRIP LINE FROM BUS 79045	[LOSTCANY	230.00]	TO BUS 79061	[SHIP PS	230.00]	CKT 1
NLA-CAH	: TRIP LINE FROM BUS 79052	[NUCLA	115.00]	TO BUS 79011	[CAHONE	115.00]	CKT 1
MTR-NLA	: TRIP LINE FROM BUS 79048	[MONTROSE	115.00]	TO BUS 79052	[NUCLA	115.00]	CKT 1
LCN-EMP	: TRIP LINE FROM BUS 79044	[LOSTCANY	115.00]	TO BUS 79075	[EMPIRETS	115.00]	CKT 1
GJT-MTR	: OPEN LINE FROM BUS 79183	[STRNELSN	115.00]	TO BUS 79034	[GRANDJCT	115.00]	CKT 1
	: OPEN LINE FROM BUS 79183	[STRNELSN	115.00]	TO BUS 79048	[MONTROSE	115.00]	CKT 1
	: OPEN LINE FROM BUS 79183	[STRNELSN	115.00]	TO BUS 79182	[DOUGHSPN	115.00]	CKT 1
	: OPEN LINE FROM BUS 79182	[DOUGHSPN	115.00]	TO BUS 79181	[DOUGHSPN	46.000]	CKT 1
LCN-DRO	: OPEN LINE FROM BUS 79111	[MANCOSTP	115.00]	TO BUS 79044	[LOSTCANY	115.00]	CKT 1
	: OPEN LINE FROM BUS 79111	[MANCOSTP	115.00]	TO BUS 79089	[SHENDOAH	115.00]	CKT 1
	: OPEN LINE FROM BUS 79089	[SHENDOAH	115.00]	TO BUS 79023	[DURANGO	115.00]	CKT 1
CAH-EMP	: OPEN LINE FROM BUS 79180	[GRCUT TP	115.00]	TO BUS 79011	[CAHONE	115.00]	CKT 1
	: OPEN LINE FROM BUS 79180	[GRCUT TP	115.00]	TO BUS 79075	[EMPIRETS	115.00]	CKT 1
	: OPEN LINE FROM BUS 79180	[GRCUT TP	115.00]	TO BUS 79179	[GRT CUT	115.00]	CKT 1
	: OPEN LINE FROM BUS 79179	[GRT CUT	115.00]	TO BUS 79178	[GRT CUT	12.470]	CKT 1
	: OPEN LINE FROM BUS 79178	[GRT CUT	12.470]	TO BUS 79177	[MCPHEE	12.470]	CKT 1
	: OPEN LINE FROM BUS 79177	[MCPHEE	12.470]	TO BUS 79176	[MCPHEE	2.4000]	CKT 1
NLA-NRD	: TRIP LINE FROM BUS 79052	[NUCLA	115.00]	TO BUS 72789	[NORWOOD	115.00]	CKT 1
NRD-WLN	: TRIP LINE FROM BUS 72789	[NORWOOD	115.00]	TO BUS 72794	[WILSNMSA	115.00]	CKT 1
WLN-SUN	: TRIP LINE FROM BUS 72794	[WILSNMSA	115.00]	TO BUS 79189	[SUNSH SM	115.00]	CKT 1
UIN-GJT	: OPEN LINE FROM BUS 70268	[ADOBE	230.00]	TO BUS 70438	[UINTAH	230.00]	CKT 1
	: OPEN LINE FROM BUS 70268	[ADOBE	230.00]	TO BUS 70233	[HORIZON	230.00]	CKT 1
	: OPEN LINE FROM BUS 70233	[HORIZON	230.00]	TO BUS 70206	[GRANDJPS	230.00]	CKT 1
CCI786BF	: TRIP LINE FROM BUS 79021	[CURECANT	230.00]	TO BUS 79070	[NORTHFRK	230.00]	CKT 1
	: TRIP LINE FROM BUS 79021	[CURECANT	230.00]	TO BUS 79054	[PONCHABR	230.00]	CKT 1
SHR-XFMR	: TRIP LINE FROM BUS 79064	[SHIPROCK	345.00]	TO BUS 79062	[SHIPROCK	115.00]	CKT T1
SHR-XFMR	: TRIP LINE FROM BUS 79064	[SHIPROCK	345.00]	TO BUS 79062	[SHIPROCK	115.00]	CKT T2
SINGL1 1	: OPEN LINE FROM BUS 10011	[AMBROSIA	230.00]	TO BUS 10368	[WESTMESA	230.00]	CKT 1
SINGL1 2	: OPEN LINE FROM BUS 10025	[B-A	345.00]	TO BUS 10116	[GUADLUPE	345.00]	CKT 1
SINGL1 3	: OPEN LINE FROM BUS 10025	[B-A	345.00]	TO BUS 10229	[NORTON	345.00]	CKT 1
SINGL1 4	: OPEN LINE FROM BUS 10025	[B-A	345.00]	TO BUS 10292	[SAN_JUAN	345.00]	CKT & 1
SINGL1 5	: OPEN LINE FROM BUS 10025	[B-A	345.00]	TO BUS 10390	[RIOPUERCA	345.00]	CKT 1
SINGL1 6	: OPEN LINE FROM BUS 10116	[GUADLUPE	345.00]	TO BUS 10991	[ARGONNE4	138.00]	CKT 1
SINGL1 7	: OPEN LINE FROM BUS 10116	[GUADLUPE	345.00]	TO BUS 10999	[TAIBANMS	345.00]	CKT 1
SINGL1 8	: OPEN LINE FROM BUS 10232	[OJO	345.00]	TO BUS 10292	[SAN_JUAN	345.00]	CKT 1
SINGL1 9	: OPEN LINE FROM BUS 10291	[SAN_JUAN	230.00]	TO BUS 10292	[SAN_JUAN	345.00]	CKT 1
SINGL1 10	: OPEN LINE FROM BUS 10294	[SANDIA	345.00]	TO BUS 10369	[WESTMESA	345.00]	CKT 1
SINGL1 11	: OPEN LINE FROM BUS 10369	[WESTMESA	345.00]	TO BUS 10390	[RIOPUERCA	345.00]	CKT 1
SINGL1 12	: OPEN LINE FROM BUS 10393	[LEF	345.00]	TO BUS 10394	[LEF_G1	18.000]	CKT 1
SINGL1 13	: OPEN LINE FROM BUS 10393	[LEF	345.00]	TO BUS 10395	[LEF_G2	18.000]	CKT 1
SINGL1 14	: OPEN LINE FROM BUS 10393	[LEF	345.00]	TO BUS 10396	[LEF_S1	18.000]	CKT 1
SINGL1 15	: OPEN LINE FROM BUS 10899	[VEF	115.00]	TO BUS 10903	[VEF	18.000]	CKT 1
SINGL1 16	: OPEN LINE FROM BUS 10906	[REDMESA	115.00]	TO BUS 10907	[REDMESA2	34.500]	CKT 1
SINGL1 17	: OPEN LINE FROM BUS 10907	[REDMESA2	34.500]	TO BUS 10908	[REDMESA3	34.500]	CKT 1
SINGL1 18	: OPEN LINE FROM BUS 10908	[REDMESA3	34.500]	TO BUS 10909	[REDMESA4	0.6900]	CKT 1
SINGL1 19	: OPEN LINE FROM BUS 10930	[HLWR_1	115.00]	TO BUS 10931	[HLWR_2	34.500]	CKT 1
SINGL1 20	: OPEN LINE FROM BUS 10931	[HLWR_2	34.500]	TO BUS 10932	[HLWR_3	34.500]	CKT 1
SINGL1 21	: OPEN LINE FROM BUS 10932	[HLWR_3	34.500]	TO BUS 10933	[HLWR_4	0.6900]	CKT 1
SINGL1 22	: OPEN LINE FROM BUS 10991	[ARGONNE4	138.00]	TO BUS 10992	[ARGONNE3	138.00]	CKT 1
SINGL1 23	: OPEN LINE FROM BUS 10992	[ARGONNE3	138.00]	TO BUS 10993	[ARGONNE2	34.500]	CKT 1
SINGL1 24	: OPEN LINE FROM BUS 10993	[ARGONNE2	34.500]	TO BUS 10994	[ARGONNE1	34.500]	CKT 1
SINGL1 25	: OPEN LINE FROM BUS 10994	[ARGONNE1	34.500]	TO BUS 10995	[ARGONNEG	0.6000]	CKT 1
SINGL1 26	: OPEN LINE FROM BUS 10996	[LONEMS	34.500]	TO BUS 10997	[LONEMS	0.5700]	CKT 1
SINGL1 27	: OPEN LINE FROM BUS 10996	[LONEMS	34.500]	TO BUS 10998	[TAIBANMS	34.500]	CKT 1
SINGL1 28	: OPEN LINE FROM BUS 10998	[TAIBANMS	34.500]	TO BUS 10999	[TAIBANMS	345.00]	CKT 1
SINGL1 29	: OPEN LINE FROM BUS 19001	[DAVISG1	13.800]	TO BUS 19022	[DAVIS	230.00]	CKT 1
SINGL1 30	: OPEN LINE FROM BUS 19002	[DAVISG2	13.800]	TO BUS 19022	[DAVIS	230.00]	CKT 1
SINGL1 31	: OPEN LINE FROM BUS 19003	[DAVISG3	13.800]	TO BUS 19022	[DAVIS	230.00]	CKT 1
SINGL1 32	: OPEN LINE FROM BUS 19004	[DAVISG4	13.800]	TO BUS 19022	[DAVIS	230.00]	CKT 1
SINGL1 33	: OPEN LINE FROM BUS 19005	[DAVISG5	13.800]	TO BUS 19022	[DAVIS	230.00]	CKT 1
SINGL1 34	: OPEN LINE FROM BUS 19006	[PARKERG1	6.9000]	TO BUS 19041	[PARKER	161.00]	CKT 1
SINGL1 35	: OPEN LINE FROM BUS 19007	[PARKERG2	6.9000]	TO BUS 19041	[PARKER	161.00]	CKT 1
SINGL1 36	: OPEN LINE FROM BUS 19008	[PARKERG3	6.9000]	TO BUS 19041	[PARKER	161.00]	CKT 1
SINGL1 37	: OPEN LINE FROM BUS 19009	[PARKERG4	6.9000]	TO BUS 19041	[PARKER	161.00]	CKT 1
SINGL1 38	: OPEN LINE FROM BUS 19011	[MEAD N	230.00]	TO BUS 19012	[MEAD S	230.00]	CKT 1
SINGL1 39	: OPEN LINE FROM BUS 19011	[MEAD N	230.00]	TO BUS 19022	[DAVIS	230.00]	CKT 1
SINGL1 40	: OPEN LINE FROM BUS 19011	[MEAD N	230.00]	TO BUS 19038	[MEAD	500.00]	CKT 1
SINGL1 41	: OPEN LINE FROM BUS 19011	[MEAD N	230.00]	TO BUS 19038	[MEAD	500.00]	CKT 2
SINGL1 42	: OPEN LINE FROM BUS 19011	[MEAD N	230.00]	TO BUS 19043	[HVRA3A4	230.00]	CKT 1
SINGL1 43	: OPEN LINE FROM BUS 19011	[MEAD N	230.00]	TO BUS 19037	[MEAD	345.00]	TO BUS 19036
[MEAD	24.000]	CKT 1					
SINGL1 44	: OPEN LINE FROM BUS 19012	[MEAD S	230.00]	TO BUS 19029	[HOVRA5A6	230.00]	CKT 1
SINGL1 45	: OPEN LINE FROM BUS 19012	[MEAD S	230.00]	TO BUS 19030	[HOVRA7-9	230.00]	CKT 1
SINGL1 46	: OPEN LINE FROM BUS 19012	[MEAD S	230.00]	TO BUS 19079	[HOVRN7N8	230.00]	CKT 1
SINGL1 47	: OPEN LINE FROM BUS 19012	[MEAD S	230.00]	TO BUS 19080	[HOVRN5N6	230.00]	CKT 1



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SINGL1 48	: OPEN LINE FROM BUS 19012	[MEAD S	230.00]	TO BUS 19081	[HOVRN3N4	230.00]	CKT 1
SINGL1 49	: OPEN LINE FROM BUS 19012	[MEAD S	230.00]	TO BUS 19082	[HOVRN1N2	230.00]	CKT 1
SINGL1 50	: OPEN LINE FROM BUS 19012	[MEAD S	230.00]	TO BUS 19083	[HOVRA1A2	230.00]	CKT 1
SINGL1 51	: OPEN LINE FROM BUS 19019	[BLK MESA	230.00]	TO BUS 19042	[PARKER	230.00]	CKT 1
SINGL1 52	: OPEN LINE FROM BUS 19019	[BLK MESA	230.00]	TO BUS 19320	[TOPOCK	230.00]	CKT 1
SINGL1 53	: OPEN LINE FROM BUS 19020	[BLYTHE	161.00]	TO BUS 19041	[PARKER	161.00]	CKT 1
SINGL1 54	: OPEN LINE FROM BUS 19020	[BLYTHE	161.00]	TO BUS 19105	[GLT TAP	161.00]	CKT 1
SINGL1 55	: OPEN LINE FROM BUS 19020	[BLYTHE	161.00]	TO BUS 19206	[HEADGATE	161.00]	CKT 1
SINGL1 56	: OPEN LINE FROM BUS 19022	[DAVIS	230.00]	TO BUS 19056	[MCCONICO	230.00]	CKT 1
SINGL1 57	: OPEN LINE FROM BUS 19022	[DAVIS	230.00]	TO BUS 19109	[DAVIS	69.000]	CKT 1
SINGL1 58	: OPEN LINE FROM BUS 19022	[DAVIS	230.00]	TO BUS 19109	[DAVIS	69.000]	CKT 2
SINGL1 59	: OPEN LINE FROM BUS 19022	[DAVIS	230.00]	TO BUS 19320	[TOPOCK	230.00]	CKT 1
SINGL1 60	: OPEN LINE FROM BUS 19022	[DAVIS	230.00]	TO BUS 19320	[TOPOCK	230.00]	CKT 2
SINGL1 61	: OPEN LINE FROM BUS 19023	[HOOVERA3	16.500]	TO BUS 19043	[HVRA3A4	230.00]	CKT 1
SINGL1 62	: OPEN LINE FROM BUS 19024	[HOOVERA4	16.500]	TO BUS 19043	[HVRA3A4	230.00]	CKT 1
SINGL1 63	: OPEN LINE FROM BUS 19025	[HOOVERA5	16.500]	TO BUS 19029	[HOVRA5A6	230.00]	CKT 1
SINGL1 64	: OPEN LINE FROM BUS 19026	[HOOVERA6	16.500]	TO BUS 19029	[HOVRA5A6	230.00]	CKT 1
SINGL1 65	: OPEN LINE FROM BUS 19027	[HOOVERA7	16.500]	TO BUS 19030	[HOVRA7-9	230.00]	CKT 1
SINGL1 66	: OPEN LINE FROM BUS 19028	[HOVRA1A2	16.500]	TO BUS 19083	[HOVRA1A2	230.00]	CKT 1
SINGL1 67	: OPEN LINE FROM BUS 19030	[HOVRA7-9	230.00]	TO BUS 19031	[HOVRA8A9	16.500]	CKT 1
SINGL1 68	: OPEN LINE FROM BUS 19032	[HOVRN1N2	16.500]	TO BUS 19082	[HOVRN1N2	230.00]	CKT 1
SINGL1 69	: OPEN LINE FROM BUS 19033	[HOVRN3N4	16.500]	TO BUS 19081	[HOVRN3N4	230.00]	CKT 1
SINGL1 70	: OPEN LINE FROM BUS 19034	[HOVRN5N6	16.500]	TO BUS 19080	[HOVRN5N6	230.00]	CKT 1
SINGL1 71	: OPEN LINE FROM BUS 19035	[HOVRN7N8	16.500]	TO BUS 19079	[HOVRN7N8	230.00]	CKT 1
SINGL1 72	: OPEN LINE FROM BUS 19037	[MEAD	345.00]	TO BUS 19315	[PEACOCK	345.00]	CKT &1
SINGL1 73	: OPEN LINE FROM BUS 19041	[PARKER	161.00]	TO BUS 19042	[PARKER	230.00]	CKT 1
SINGL1 74	: OPEN LINE FROM BUS 19041	[PARKER	161.00]	TO BUS 19042	[PARKER	230.00]	CKT 2
SINGL1 75	: OPEN LINE FROM BUS 19041	[PARKER	161.00]	TO BUS 19046	[BOUSE	161.00]	CKT 1
SINGL1 76	: OPEN LINE FROM BUS 19041	[PARKER	161.00]	TO BUS 19206	[HEADGATE	161.00]	CKT 1
SINGL1 77	: OPEN LINE FROM BUS 19042	[PARKER	230.00]	TO BUS 19074	[N.HAVASU	230.00]	CKT 1
SINGL1 78	: OPEN LINE FROM BUS 19042	[PARKER	230.00]	TO BUS 19075	[HAVASU	230.00]	CKT 1
SINGL1 79	: OPEN LINE FROM BUS 19042	[PARKER	230.00]	TO BUS 19204	[HARCUIVAR	230.00]	CKT 1
SINGL1 80	: OPEN LINE FROM BUS 19044	[COOLIDGE	115.00]	TO BUS 19045	[COOLIDGE	230.00]	CKT 1
SINGL1 81	: OPEN LINE FROM BUS 19044	[COOLIDGE	115.00]	TO BUS 19045	[COOLIDGE	230.00]	CKT 2
SINGL1 82	: OPEN LINE FROM BUS 19044	[COOLIDGE	115.00]	TO BUS 19065	[ED-2	115.00]	CKT 1
SINGL1 83	: OPEN LINE FROM BUS 19044	[COOLIDGE	115.00]	TO BUS 19066	[SIGNAL	115.00]	CKT 1
SINGL1 84	: OPEN LINE FROM BUS 19045	[COOLIDGE	230.00]	TO BUS 19215	[SPKHILTP	230.00]	CKT 1
SINGL1 85	: OPEN LINE FROM BUS 19045	[COOLIDGE	230.00]	TO BUS 19410	[SUN ARIZ	230.00]	CKT 1
SINGL1 86	: OPEN LINE FROM BUS 19045	[COOLIDGE	230.00]	TO BUS 19410	[SUN ARIZ	230.00]	CKT 2
SINGL1 87	: OPEN LINE FROM BUS 19046	[BOUSE	161.00]	TO BUS 19100	[KOFA	161.00]	CKT 1
SINGL1 88	: OPEN LINE FROM BUS 19047	[DEL BAC	115.00]	TO BUS 19064	[TUCSON	115.00]	CKT 1
SINGL1 89	: OPEN LINE FROM BUS 19047	[DEL BAC	115.00]	TO BUS 19221	[NOGALES	115.00]	CKT 1
SINGL1 90	: OPEN LINE FROM BUS 19048	[EMPIRE	115.00]	TO BUS 19069	[ED-5B	115.00]	CKT 1
SINGL1 91	: OPEN LINE FROM BUS 19048	[EMPIRE	115.00]	TO BUS 19222	[CASAGRND	115.00]	CKT 1
SINGL1 92	: OPEN LINE FROM BUS 19049	[GILA	69.000]	TO BUS 19050	[GILA	161.00]	CKT 1
SINGL1 93	: OPEN LINE FROM BUS 19049	[GILA	69.000]	TO BUS 19050	[GILA	161.00]	CKT 2
SINGL1 94	: OPEN LINE FROM BUS 19049	[GILA	69.000]	TO BUS 19229	[SONORA	69.000]	CKT 1
SINGL1 95	: OPEN LINE FROM BUS 19050	[GILA	161.00]	TO BUS 19051	[KNOB	161.00]	CKT 1
SINGL1 96	: OPEN LINE FROM BUS 19050	[GILA	161.00]	TO BUS 19063	[WLTNMOHK	161.00]	CKT 1
SINGL1 97	: OPEN LINE FROM BUS 19050	[GILA	161.00]	TO BUS 19070	[DOME TAP	161.00]	CKT 1
SINGL1 98	: OPEN LINE FROM BUS 19051	[KNOB	161.00]	TO BUS 19105	[GLT TAP	161.00]	CKT 1
SINGL1 99	: OPEN LINE FROM BUS 19052	[LIBERTY	230.00]	TO BUS 19054	[LIBTYPHS	230.00]	CKT 1
SINGL1 100	: OPEN LINE FROM BUS 19052	[LIBERTY	230.00]	TO BUS 19054	[LIBTYPHS	230.00]	CKT 2
SINGL1 101	: OPEN LINE FROM BUS 19052	[LIBERTY	230.00]	TO BUS 19055	[LONE BUT	230.00]	CKT 1
SINGL1 102	: OPEN LINE FROM BUS 19052	[LIBERTY	230.00]	TO BUS 19061	[PHXWAPA	230.00]	CKT 1
SINGL1 103	: OPEN LINE FROM BUS 19052	[LIBERTY	230.00]	TO BUS 19500	[HASSYTAP	230.00]	CKT 1
SINGL1 104	: OPEN LINE FROM BUS 19053	[LIBERTY	345.00]	TO BUS 19315	[PEACOCK	345.00]	CKT &1
SINGL1 105	: OPEN LINE FROM BUS 19053	[LIBERTY	345.00]	TO BUS 19054	[LIBTYPHS	230.00]	TO BUS 19091
[LIBERTY	24.000]	CKT 1					
SINGL1 106	: OPEN LINE FROM BUS 19055	[LONE BUT	230.00]	TO BUS 19061	[PHXWAPA	230.00]	CKT 1
SINGL1 107	: OPEN LINE FROM BUS 19055	[LONE BUT	230.00]	TO BUS 19068	[TESTTRAK	230.00]	CKT 1
SINGL1 108	: OPEN LINE FROM BUS 19055	[LONE BUT	230.00]	TO BUS 19226	[LONE BUT	69.000]	CKT 1
SINGL1 109	: OPEN LINE FROM BUS 19055	[LONE BUT	230.00]	TO BUS 19410	[SUN ARIZ	230.00]	CKT 1
SINGL1 110	: OPEN LINE FROM BUS 19056	[MCCONICO	230.00]	TO BUS 19072	[HILLTOP	230.00]	CKT 1
SINGL1 111	: OPEN LINE FROM BUS 19056	[MCCONICO	230.00]	TO BUS 19310	[GRIFFITH	230.00]	CKT 1
SINGL1 112	: OPEN LINE FROM BUS 19057	[ORACLE	115.00]	TO BUS 19064	[TUCSON	115.00]	CKT 1
SINGL1 113	: OPEN LINE FROM BUS 19060	[ADAMSTAP	115.00]	TO BUS 19221	[NOGALES	115.00]	CKT 1
SINGL1 114	: OPEN LINE FROM BUS 19062	[PINPK	230.00]	TO BUS 19107	[GAVLINWA	230.00]	CKT 1
SINGL1 115	: OPEN LINE FROM BUS 19062	[PINPK	230.00]	TO BUS 19502	[ROGSWAPA	230.00]	CKT 1
SINGL1 116	: OPEN LINE FROM BUS 19062	[PINPK	230.00]	TO BUS 19502	[ROGSWAPA	230.00]	CKT 2
SINGL1 117	: OPEN LINE FROM BUS 19062	[PINPK	230.00]	TO BUS 79053	[PINPKBRB	345.00]	TO BUS 19084
[PPKDSW-1	24.000]	CKT 1					
SINGL1 118	: OPEN LINE FROM BUS 19062	[PINPK	230.00]	TO BUS 79053	[PINPKBRB	345.00]	TO BUS 19086
[PPKDSW-2	24.000]	CKT 2					
SINGL1 119	: OPEN LINE FROM BUS 19062	[PINPK	230.00]	TO BUS 79053	[PINPKBRB	345.00]	TO BUS 19088
[PPKDSW-3	24.000]	CKT 3					
SINGL1 120	: OPEN LINE FROM BUS 19063	[WLTNMOHK	161.00]	TO BUS 19070	[DOME TAP	161.00]	CKT 1
SINGL1 121	: OPEN LINE FROM BUS 19064	[TUCSON	115.00]	TO BUS 19210	[RATTLNSK	115.00]	CKT 1
SINGL1 122	: OPEN LINE FROM BUS 19065	[ED-2	115.00]	TO BUS 19066	[SIGNAL	115.00]	CKT 1
SINGL1 123	: OPEN LINE FROM BUS 19065	[ED-2	115.00]	TO BUS 19071	[ED-4	115.00]	CKT 1
SINGL1 124	: OPEN LINE FROM BUS 19065	[ED-2	115.00]	TO BUS 19202	[BRADY	115.00]	CKT 1
SINGL1 125	: OPEN LINE FROM BUS 19067	[ED-5	115.00]	TO BUS 19071	[ED-4	115.00]	CKT 1
SINGL1 126	: OPEN LINE FROM BUS 19068	[TESTTRAK	230.00]	TO BUS 19217	[TESTTRAK	69.000]	CKT 1
SINGL1 127	: OPEN LINE FROM BUS 19068	[TESTTRAK	230.00]	TO BUS 19218	[CASAGRND	230.00]	CKT 1
SINGL1 128	: OPEN LINE FROM BUS 19070	[DOME TAP	161.00]	TO BUS 19100	[KOFA	161.00]	CKT 1
SINGL1 129	: OPEN LINE FROM BUS 19072	[HILLTOP	230.00]	TO BUS 19314	[PEACOCK	230.00]	CKT 1
SINGL1 130	: OPEN LINE FROM BUS 19074	[N.HAVASU	230.00]	TO BUS 19320	[TOPOCK	230.00]	CKT 1
SINGL1 131	: OPEN LINE FROM BUS 19100	[KOFA	161.00]	TO BUS 19102	[KOFA	69.000]	CKT 1
SINGL1 132	: OPEN LINE FROM BUS 19106	[PRSCOTWA	230.00]	TO BUS 19107	[GAVLINWA	230.00]	CKT 1
SINGL1 133	: OPEN LINE FROM BUS 19106	[PRSCOTWA	230.00]	TO BUS 19501	[RNDVLYTP	230.00]	CKT 1
SINGL1 134	: OPEN LINE FROM BUS 19115	[RACEWYWA	230.00]	TO BUS 19208	[N.WADDEL	230.00]	CKT 1
SINGL1 135	: OPEN LINE FROM BUS 19201	[BLACKMTN	115.00]	TO BUS 19214	[SNYDHILL	115.00]	CKT 1

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SINGL1 136	: OPEN LINE FROM BUS 19202	[BRADY	115.00]	TO BUS 19209	[PICACHOW	115.00]	CKT 1
SINGL1 137	: OPEN LINE FROM BUS 19203	[BRAWLEY	115.00]	TO BUS 19212	[SANDARIO	115.00]	CKT 1
SINGL1 138	: OPEN LINE FROM BUS 19203	[BRAWLEY	115.00]	TO BUS 19213	[SANKAVER	115.00]	CKT 1
SINGL1 139	: OPEN LINE FROM BUS 19204	[HARCUIVAR	230.00]	TO BUS 19500	[HASSYTAP	230.00]	CKT 1
SINGL1 140	: OPEN LINE FROM BUS 19206	[HEADGATE	161.00]	TO BUS 19304	[HEADGATE	69.000]	CKT 1
SINGL1 141	: OPEN LINE FROM BUS 19206	[HEADGATE	161.00]	TO BUS 19304	[HEADGATE	69.000]	CKT 2
SINGL1 142	: OPEN LINE FROM BUS 19209	[PICACHOW	115.00]	TO BUS 19211	[RED ROCK	115.00]	CKT 1
SINGL1 143	: OPEN LINE FROM BUS 19210	[RATTL5NKN	115.00]	TO BUS 19216	[TWINPEAK	115.00]	CKT 1
SINGL1 144	: OPEN LINE FROM BUS 19212	[SANDARIO	115.00]	TO BUS 19216	[TWINPEAK	115.00]	CKT 1
SINGL1 145	: OPEN LINE FROM BUS 19213	[SANKAVER	115.00]	TO BUS 19214	[SNYDHILL	115.00]	CKT 1
SINGL1 146	: OPEN LINE FROM BUS 19215	[SPKHILTP	230.00]	TO BUS 19502	[ROGSWAPA	230.00]	CKT 1
SINGL1 147	: OPEN LINE FROM BUS 19218	[CASAGRND	230.00]	TO BUS 19222	[CASAGRND	115.00]	CKT 1
SINGL1 148	: OPEN LINE FROM BUS 19229	[SONORA	69.000]	TO BUS 19230	[SONORA	34.500]	CKT 1
SINGL1 149	: OPEN LINE FROM BUS 19230	[SONORA	34.500]	TO BUS 19231	[WF_EQLD1	34.500]	CKT 1
SINGL1 150	: OPEN LINE FROM BUS 19231	[WF_EQLD1	34.500]	TO BUS 19232	[MEX TAP	34.500]	CKT 1
SINGL1 151	: OPEN LINE FROM BUS 19232	[MEX TAP	34.500]	TO BUS 19233	[WF_EQLD2	34.500]	CKT 1
SINGL1 152	: OPEN LINE FROM BUS 19233	[WF_EQLD2	34.500]	TO BUS 19234	[SNL-WALC	34.500]	CKT 1
SINGL1 153	: OPEN LINE FROM BUS 19304	[HEADGATE	69.000]	TO BUS 19305	[HEADGAT1	4.1600]	CKT 1
SINGL1 154	: OPEN LINE FROM BUS 19304	[HEADGATE	69.000]	TO BUS 19306	[HEADGAT2	4.1600]	CKT 1
SINGL1 155	: OPEN LINE FROM BUS 19304	[HEADGATE	69.000]	TO BUS 19307	[HEADGAT3	4.1600]	CKT 1
SINGL1 156	: OPEN LINE FROM BUS 19310	[GRIFFITH	230.00]	TO BUS 19311	[GRIFFTH1	18.000]	CKT 1
SINGL1 157	: OPEN LINE FROM BUS 19310	[GRIFFITH	230.00]	TO BUS 19312	[GRIFFTH2	18.000]	CKT 2
SINGL1 158	: OPEN LINE FROM BUS 19310	[GRIFFITH	230.00]	TO BUS 19313	[GRIFFTH3	18.000]	CKT 3
SINGL1 159	: OPEN LINE FROM BUS 19310	[GRIFFITH	230.00]	TO BUS 19314	[PEACOCK	230.00]	CKT 1
SINGL1 160	: OPEN LINE FROM BUS 19314	[PEACOCK	230.00]	TO BUS 19315	[PEACOCK	345.00]	CKT 1
SINGL1 161	: OPEN LINE FROM BUS 19314	[PEACOCK	230.00]	TO BUS 19501	[RNDVLYTP	230.00]	CKT 1
SINGL1 162	: OPEN LINE FROM BUS 19316	[SOPOINT	230.00]	TO BUS 19317	[SOPOINT1	16.000]	CKT 1
SINGL1 163	: OPEN LINE FROM BUS 19316	[SOPOINT	230.00]	TO BUS 19318	[SOPOINT2	16.000]	CKT 2
SINGL1 164	: OPEN LINE FROM BUS 19316	[SOPOINT	230.00]	TO BUS 19319	[SOPOINT3	16.000]	CKT 3
SINGL1 165	: OPEN LINE FROM BUS 19316	[SOPOINT	230.00]	TO BUS 19320	[TOPOCK	230.00]	CKT 1
SINGL1 166	: OPEN LINE FROM BUS 19316	[SOPOINT	230.00]	TO BUS 19320	[TOPOCK	230.00]	CKT 2
SINGL1 167	: OPEN LINE FROM BUS 79024	[FLAGSTAF	345.00]	TO BUS 79032	[GLENCANY	345.00]	CKT &1
SINGL1 168	: OPEN LINE FROM BUS 79024	[FLAGSTAF	345.00]	TO BUS 79032	[GLENCANY	345.00]	CKT &2
SINGL1 169	: OPEN LINE FROM BUS 79024	[FLAGSTAF	345.00]	TO BUS 79053	[PINPKBRB	345.00]	CKT &1
SINGL1 170	: OPEN LINE FROM BUS 79024	[FLAGSTAF	345.00]	TO BUS 79053	[PINPKBRB	345.00]	CKT &2
SINGL1 171	: OPEN LINE FROM BUS 79028	[GLEN PS	230.00]	TO BUS 79031	[GLENCANY	230.00]	CKT 1
SINGL1 172	: OPEN LINE FROM BUS 79028	[GLEN PS	230.00]	TO BUS 79093	[NAVAJO	230.00]	CKT 1
SINGL1 173	: OPEN LINE FROM BUS 79031	[GLENCANY	230.00]	TO BUS 79032	[GLENCANY	345.00]	CKT 1
SINGL1 174	: OPEN LINE FROM BUS 79031	[GLENCANY	230.00]	TO BUS 79032	[GLENCANY	345.00]	CKT 2
SINGL1 175	: OPEN LINE FROM BUS 79031	[GLENCANY	230.00]	TO BUS 79153	[GLENC7-8	13.800]	CKT 1
SINGL1 176	: OPEN LINE FROM BUS 79032	[GLENCANY	345.00]	TO BUS 79150	[GLENC1-2	13.800]	CKT 1
SINGL1 177	: OPEN LINE FROM BUS 79032	[GLENCANY	345.00]	TO BUS 79151	[GLENC3-4	13.800]	CKT 1
SINGL1 178	: OPEN LINE FROM BUS 79032	[GLENCANY	345.00]	TO BUS 79152	[GLENC5-6	13.800]	CKT 1
SINGL1 179	: OPEN LINE FROM BUS 79043	[KAYENTA	230.00]	TO BUS 79063	[SHIPROCK	230.00]	CKT &1
SINGL1 180	: OPEN LINE FROM BUS 79043	[KAYENTA	230.00]	TO BUS 79096	[LNHOUSE	230.00]	CKT &1
SINGL1 183	: OPEN LINE FROM BUS 79062	[SHIPROCK	115.00]	TO BUS 79063	[SHIPROCK	230.00]	TO BUS 79863
[SHIPROCK	13.800]	CKT 1					
SINGL1 184	: OPEN LINE FROM BUS 79063	[SHIPROCK	230.00]	TO BUS 79064	[SHIPROCK	345.00]	TO BUS 79513
[SHKULAT	24.000]	CKT 1					
SINGL1 185	: OPEN LINE FROM BUS 79093	[NAVAJO	230.00]	TO BUS 79096	[LNHOUSE	230.00]	CKT 1
SINGL1 186	: OPEN LINE FROM BUS 70076	[CAMEO	69.000]	TO BUS 70078	[CAMEO	230.00]	CKT T5
SINGL1 187	: OPEN LINE FROM BUS 70076	[CAMEO	69.000]	TO BUS 70140	[DEBEQUE	69.000]	CKT 1
SINGL1 188	: OPEN LINE FROM BUS 70076	[CAMEO	69.000]	TO BUS 70454	[VINELAND	69.000]	CKT 1
SINGL1 189	: OPEN LINE FROM BUS 70078	[CAMEO	230.00]	TO BUS 70309	[PARACHUT	230.00]	CKT 1
SINGL1 190	: OPEN LINE FROM BUS 70078	[CAMEO	230.00]	TO BUS 70438	[UINTAH	230.00]	CKT 1
SINGL1 191	: OPEN LINE FROM BUS 70082	[CAMP	69.000]	TO BUS 70207	[GRANDVLY	69.000]	CKT 1
SINGL1 192	: OPEN LINE FROM BUS 70082	[CAMP	69.000]	TO BUS 70440	[UNIONOIL	69.000]	CKT 1
SINGL1 193	: OPEN LINE FROM BUS 70089	[CARNDAL	115.00]	TO BUS 70231	[HOPKINS	115.00]	CKT 1
SINGL1 194	: OPEN LINE FROM BUS 70109	[UNA_ORCH	69.000]	TO BUS 70140	[DEBEQUE	69.000]	CKT 1
SINGL1 195	: OPEN LINE FROM BUS 70109	[UNA_ORCH	69.000]	TO BUS 70207	[GRANDVLY	69.000]	CKT 1
SINGL1 196	: OPEN LINE FROM BUS 70113	[CLIFTON	230.00]	TO BUS 70205	[GRANDJCT	230.00]	CKT 1
SINGL1 197	: OPEN LINE FROM BUS 70113	[CLIFTON	230.00]	TO BUS 70206	[GRANDJPS	230.00]	CKT 1
SINGL1 198	: OPEN LINE FROM BUS 70180	[FRUITA	13.800]	TO BUS 70183	[FRUITA	69.000]	CKT U1
SINGL1 199	: OPEN LINE FROM BUS 70183	[FRUITA	69.000]	TO BUS 70436	[UINTAH	69.000]	CKT 1
SINGL1 200	: OPEN LINE FROM BUS 70201	[GLENNWD	69.000]	TO BUS 70288	[MITCHLCR	69.000]	CKT 1
SINGL1 201	: OPEN LINE FROM BUS 70201	[GLENNWD	69.000]	TO BUS 70363	[ROARNGFK	69.000]	CKT 1
SINGL1 202	: OPEN LINE FROM BUS 70201	[GLENNWD	69.000]	TO BUS 70386	[SHOSHONE	69.000]	CKT 1
SINGL1 203	: OPEN LINE FROM BUS 70206	[GRANDJPS	230.00]	TO BUS 70233	[HORIZON	230.00]	CKT 1
SINGL1 204	: OPEN LINE FROM BUS 70207	[GRANDVLY	69.000]	TO BUS 70302	[OILSHALE	69.000]	CKT 1
SINGL1 205	: OPEN LINE FROM BUS 70214	[GRANDJCT	69.000]	TO BUS 70454	[VINELAND	69.000]	CKT 1
SINGL1 206	: OPEN LINE FROM BUS 70214	[GRANDJCT	69.000]	TO BUS 79034	[GRANDJCT	115.00]	CKT T1
SINGL1 207	: OPEN LINE FROM BUS 70231	[HOPKINS	115.00]	TO BUS 70232	[HOPKINS	230.00]	CKT T1
SINGL1 208	: OPEN LINE FROM BUS 70231	[HOPKINS	115.00]	TO BUS 70232	[HOPKINS	230.00]	CKT T2
SINGL1 209	: OPEN LINE FROM BUS 70231	[HOPKINS	115.00]	TO BUS 70267	[HOPKINS	69.000]	CKT T1
SINGL1 210	: OPEN LINE FROM BUS 70231	[HOPKINS	115.00]	TO BUS 70387	[SHOSHONE	115.00]	CKT 1
SINGL1 211	: OPEN LINE FROM BUS 70231	[HOPKINS	115.00]	TO BUS 79003	[BASALT	115.00]	CKT 1
SINGL1 212	: OPEN LINE FROM BUS 70232	[HOPKINS	230.00]	TO BUS 70358	[RIFLE_PS	230.00]	CKT 1
SINGL1 213	: OPEN LINE FROM BUS 70233	[HORIZON	230.00]	TO BUS 70268	[ADOBE	230.00]	CKT 1
SINGL1 214	: OPEN LINE FROM BUS 70267	[HOPKINS	69.000]	TO BUS 70363	[ROARNGFK	69.000]	CKT 1
SINGL1 215	: OPEN LINE FROM BUS 70268	[ADOBE	230.00]	TO BUS 70438	[UINTAH	230.00]	CKT 1
SINGL1 216	: OPEN LINE FROM BUS 70288	[MITCHLCR	69.000]	TO BUS 70296	[NEWCASTL	69.000]	CKT 1
SINGL1 217	: OPEN LINE FROM BUS 70296	[NEWCASTL	69.000]	TO BUS 70388	[SILTUSBR	69.000]	CKT 1
SINGL1 218	: OPEN LINE FROM BUS 70299	[STKGULCH	230.00]	TO BUS 70309	[PARACHUT	230.00]	CKT 1
SINGL1 219	: OPEN LINE FROM BUS 70302	[OILSHALE	69.000]	TO BUS 70359	[RIFLE_CU	69.000]	CKT 1
SINGL1 220	: OPEN LINE FROM BUS 70309	[PARACHUT	230.00]	TO BUS 70356	[WEELERPS	230.00]	CKT 1
SINGL1 221	: OPEN LINE FROM BUS 70309	[PARACHUT	230.00]	TO BUS 70358	[RIFLE_PS	230.00]	CKT 1
SINGL1 222	: OPEN LINE FROM BUS 70349	[RAMSEY	25.000]	TO BUS 79056	[RIFLE_CU	138.00]	CKT T1
SINGL1 223	: OPEN LINE FROM BUS 70356	[WEELERPS	230.00]	TO BUS 70357	[BENCH	230.00]	CKT 1
SINGL1 224	: OPEN LINE FROM BUS 70359	[RIFLE_CU	69.000]	TO BUS 70388	[SILTUSBR	69.000]	CKT 1
SINGL1 225	: OPEN LINE FROM BUS 70359	[RIFLE_CU	69.000]	TO BUS 79056	[RIFLE_CU	138.00]	CKT T2
SINGL1 226	: OPEN LINE FROM BUS 70385	[SHOSHA&B	4.0000]	TO BUS 70386	[SHOSHONE	69.000]	CKT U1
SINGL1 227	: OPEN LINE FROM BUS 70385	[SHOSHA&B	4.0000]	TO BUS 70386	[SHOSHONE	69.000]	CKT U2



# SIS – Shiprock 345/115-kV Transformer Project

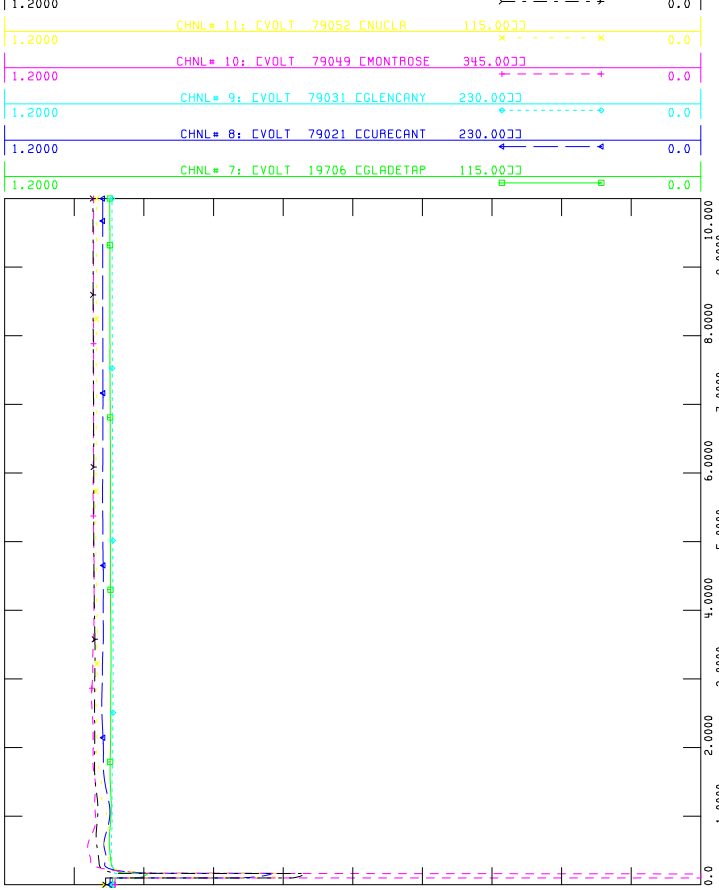
SINGL1 327	:	OPEN LINE FROM BUS 79250	[AMATLAS	230.00]	TO BUS 79251	[QFATLAS1	13.800]	CKT 1
SINGL1 328	:	OPEN LINE FROM BUS 79250	[AMATLAS	230.00]	TO BUS 79252	[QFATLAS2	13.800]	CKT 1
SINGL1 329	:	OPEN LINE FROM BUS 79254	[COALBANK	115.00]	TO BUS 79255	[MOLASTAP	115.00]	CKT 1
SINGL1 330	:	OPEN LINE FROM BUS 79255	[MOLASTAP	115.00]	TO BUS 79256	[SILVERTN	115.00]	CKT 1
SINGL1 331	:	OPEN LINE FROM BUS 72475	[ALKALI_TS	115.00]	TO BUS 79081	[CRSTBUTT	115.00]	CKT 1
SINGL1 332	:	OPEN LINE FROM BUS 72475	[ALKALI_TS	115.00]	TO BUS 79090	[SKITO	115.00]	CKT 1
SINGL1 333	:	OPEN LINE FROM BUS 72750	[GRANDVW	115.00]	TO BUS 79077	[BAYFIELD	115.00]	CKT 1
SINGL1 334	:	OPEN LINE FROM BUS 72751	[BAYFIELD	69.000]	TO BUS 79077	[BAYFIELD	115.00]	CKT 1
SINGL1 335	:	OPEN LINE FROM BUS 72752	[SUNYSIDE_TS	115.00]	TO BUS 79099	[FLOR_RIV	115.00]	CKT 1
SINGL1 336	:	OPEN LINE FROM BUS 72753	[RCKCREEK	115.00]	TO BUS 72755	[IRONHRS	115.00]	CKT 1
SINGL1 337	:	OPEN LINE FROM BUS 72753	[RCKCREEK	115.00]	TO BUS 79076	[AM EAST	115.00]	CKT 1
SINGL1 338	:	OPEN LINE FROM BUS 72755	[IRONHRS	115.00]	TO BUS 72764	[MCCAWTAP	115.00]	CKT 1
SINGL1 339	:	OPEN LINE FROM BUS 72755	[IRONHRS	115.00]	TO BUS 72765	[LABOCATP	115.00]	CKT 1
SINGL1 340	:	OPEN LINE FROM BUS 72757	[SALVADOR	115.00]	TO BUS 72765	[LABOCATP	115.00]	CKT 1
SINGL1 341	:	OPEN LINE FROM BUS 72764	[MCCAWTAP	115.00]	TO BUS 79099	[FLOR_RIV	115.00]	CKT 1
SINGL1 342	:	OPEN LINE FROM BUS 72783	[CORTZPIP	115.00]	TO BUS 79110	[MAIN CO	115.00]	CKT 1
SINGL1 344	:	OPEN LINE FROM BUS 73551	[W CANON	230.00]	TO BUS 79054	[PONCHABR	230.00]	CKT 1
SINGL1 345	:	OPEN LINE FROM BUS 73616	[NORTH PARK	230.00]	TO BUS 79039	[HAYDEN	230.00]	CKT 1
SINGL1 347	:	OPEN LINE FROM BUS 79038	[HAYDEN	138.00]	TO BUS 79039	[HAYDEN	230.00]	CKT 2
SINGL1 348	:	OPEN LINE FROM BUS 79038	[HAYDEN	138.00]	TO BUS 79039	[HAYDEN	230.00]	TO BUS 79139
[HAYDEN	13.800]	CKT 1						
SINGL1 349	:	OPEN LINE FROM BUS 79076	[AM EAST	115.00]	TO BUS 79077	[BAYFIELD	115.00]	CKT 1
SINGL1 350	:	OPEN LINE FROM BUS 79077	[BAYFIELD	115.00]	TO BUS 79086	[PAGOSA	115.00]	CKT 1
SINGL1 351	:	OPEN LINE FROM BUS 79079	[BULLOCK	115.00]	TO BUS 79082	[HAPPYCAN	115.00]	CKT 1
SINGL1 352	:	OPEN LINE FROM BUS 79079	[BULLOCK	115.00]	TO BUS 79115	[SPRCKTAP	115.00]	CKT 1
SINGL1 353	:	OPEN LINE FROM BUS 79080	[CASCADEL	115.00]	TO BUS 79088	[ROCKWOOD	115.00]	CKT 1
SINGL1 354	:	OPEN LINE FROM BUS 79082	[HAPPYCAN	115.00]	TO BUS 79135	[HAPPYCAN	46.000]	CKT 1
SINGL1 355	:	OPEN LINE FROM BUS 79083	[JUANITA	115.00]	TO BUS 79127	[SYLVSTGU	115.00]	CKT 1
SINGL1 356	:	OPEN LINE FROM BUS 79083	[JUANITA	115.00]	TO BUS 79136	[JUANITA	46.000]	CKT 1
SINGL1 357	:	OPEN LINE FROM BUS 79085	[NORTHMSA	115.00]	TO BUS 79104	[GARNETAP	115.00]	CKT 1
SINGL1 358	:	OPEN LINE FROM BUS 79085	[NORTHMSA	115.00]	TO BUS 79115	[SPRCKTAP	115.00]	CKT 1
SINGL1 359	:	OPEN LINE FROM BUS 79089	[SHENDOAH	115.00]	TO BUS 79111	[MANCOSTP	115.00]	CKT 1
SINGL1 360	:	OPEN LINE FROM BUS 79090	[SKITO	115.00]	TO BUS 79197	[GUNNISTP	115.00]	CKT 1
SINGL1 361	:	OPEN LINE FROM BUS 79103	[GARNET M	115.00]	TO BUS 79104	[GARNETAP	115.00]	CKT 1
SINGL1 362	:	OPEN LINE FROM BUS 79103	[GARNET M	115.00]	TO BUS 79138	[GARNET M	46.000]	CKT 1
SINGL1 363	:	OPEN LINE FROM BUS 79108	[HOVENWEP	115.00]	TO BUS 79117	[Y.JACK 2	115.00]	CKT 1
SINGL1 364	:	OPEN LINE FROM BUS 79110	[MAIN CO	115.00]	TO BUS 79118	[Y.JACK W	115.00]	CKT 1
SINGL1 365	:	OPEN LINE FROM BUS 79117	[Y.JACK 2	115.00]	TO BUS 79118	[Y.JACK W	115.00]	CKT 1
SINGL1 366	:	OPEN LINE FROM BUS 79181	[DOUGHSPN	46.000]	TO BUS 79182	[DOUGHSPN	115.00]	CKT 1
SINGL1 367	:	OPEN LINE FROM BUS 79182	[DOUGHSPN	115.00]	TO BUS 79183	[STRNELSN	115.00]	CKT 1
SINGL1 368	:	OPEN LINE FROM BUS 79191	[COYOTE G	115.00]	TO BUS 79260	[ELPASOTP	115.00]	CKT 1
SINGL1 369	:	OPEN LINE FROM BUS 79196	[N.GUNNSN	115.00]	TO BUS 79197	[GUNNISTP	115.00]	CKT 1
SINGL1 370	:	OPEN LINE FROM BUS 79264	[W.RV.CTY	138.00]	TO BUS 79265	[CALAMRDG	138.00]	CKT 1
SINGL1 371	:	OPEN LINE FROM BUS 79265	[CALAMRDG	138.00]	TO BUS 79312	[C-A	138.00]	CKT 1
SINGL1 372	:	OPEN LINE FROM BUS 79265	[CALAMRDG	138.00]	TO BUS 79400	[DES.MINE	138.00]	CKT 1
SINGL1 373	:	OPEN LINE FROM BUS 79266	[MEEKER	345.00]	TO BUS 79356	[MCBRYDE	345.00]	CKT 1
SINGL1 374	:	OPEN LINE FROM BUS 79350	[C-B	138.00]	TO BUS 79352	[PICEANCE	138.00]	CKT 1
SINGL1 375	:	OPEN LINE FROM BUS 79354	[MCBRYDE	138.00]	TO BUS 79356	[MCBRYDE	345.00]	CKT 1
SINGL1 376	:	OPEN LINE FROM BUS 79354	[MCBRYDE	138.00]	TO BUS 79356	[MCBRYDE	345.00]	CKT 2

## Appendix E – Transient Stability Simulations Plots



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\1-MTR-HSP-345-3P4C.out  
CHNL= 12: EVOLT 79072 [HESPERUS 345.00]]

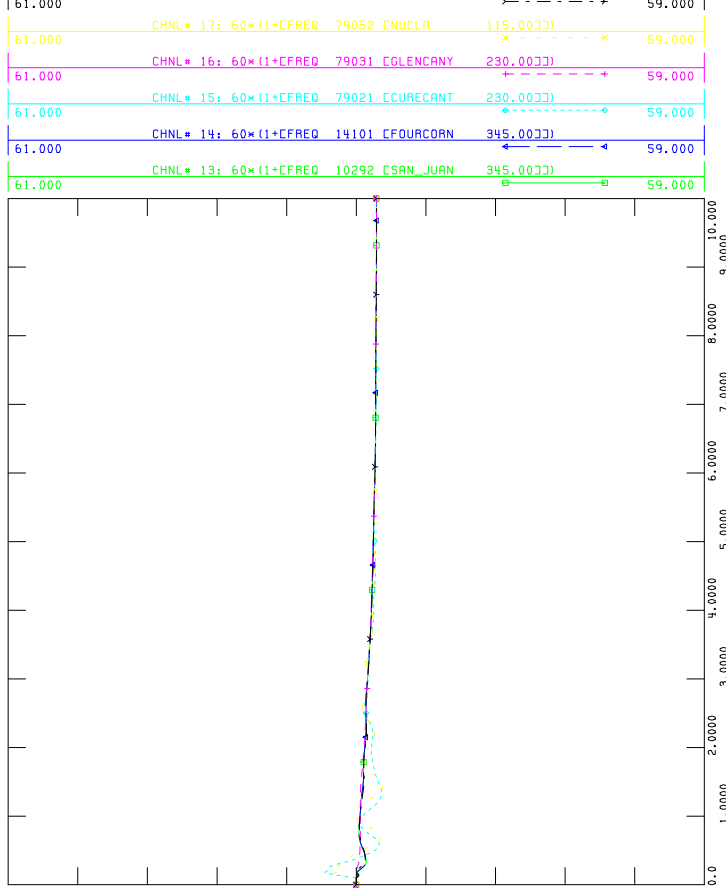


THU, NOV 29 2012 14:50  
1-MTR-HSP 345 3P4C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\1-MTR-HSP-345-3P4C.out  
CHNL= 18: 60\*(1+CFREQ 79063 [SHIPROCK 230.00]]

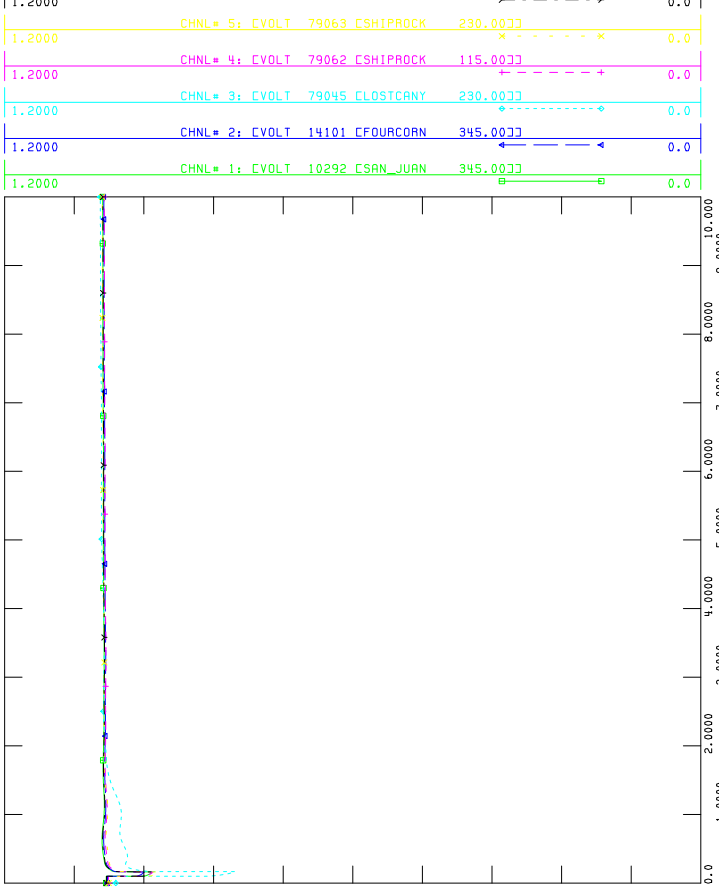


THU, NOV 29 2012 14:50  
1-MTR-HSP 345 3P4C FREQ



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\1-MTR-HSP-345-3P4C.out  
CHNL= 6: EVOLT 79064 [SHIPROCK 345.00]]

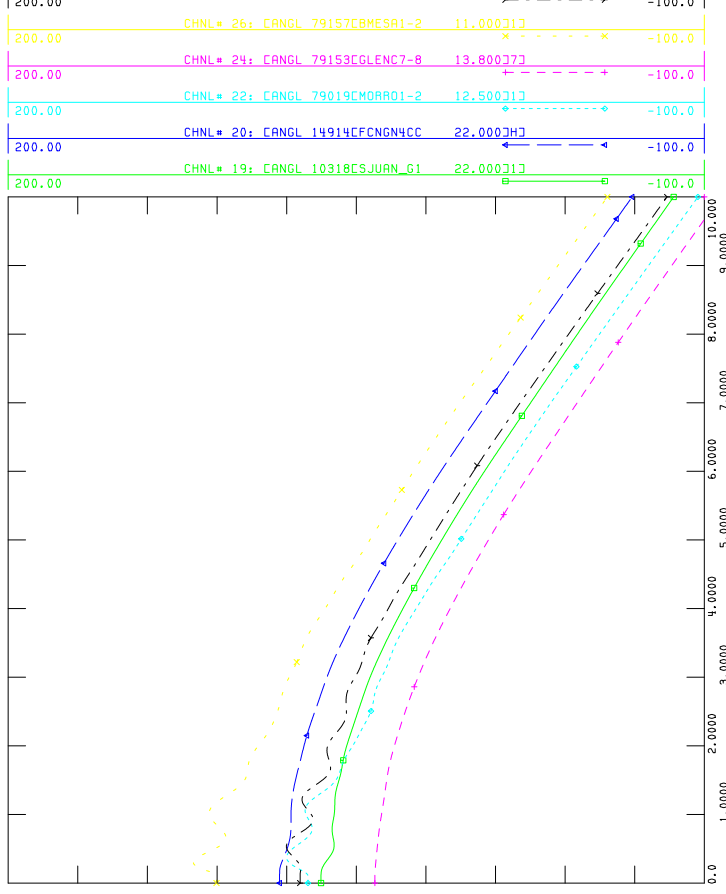


THU, NOV 29 2012 14:50  
1-MTR-HSP 345 3P4C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\1-MTR-HSP-345-3P4C.out  
CHNL= 28: C[ANGL 79161[NUCLA 4 13.800]]



THU, NOV 29 2012 14:50  
1-MTR-HSP 345 3P4C ANGL

LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
3	VOLT 79045 [LOSTCANY 230.00]	0.9666	0.1833
11	VOLT 79052 [NUCLA 115.00]	0.9696	0.1833
10	VOLT 79049 [MONTROSE 345.00]	0.9772	0.1833
8	VOLT 79021 [CURECANT 230.00]	0.9821	0.1833
7	VOLT 19706 [GLADETAP 115.00]	1.003	0.1833
5	VOLT 79063 [SHIPROCK 230.00]	1.008	0.1833
4	VOLT 79062 [SHIPROCK 115.00]	1.010	0.1833
9	VOLT 79031 [GLENCANY 230.00]	1.011	0.1833
2	VOLT 14101 [FOURCORN 345.00]	1.014	0.1833
6	VOLT 79064 [SHIPROCK 345.00]	1.015	0.1833
1	VOLT 10292 [SAN_JUAN 345.00]	1.016	0.1833
12	VOLT 79072 [HESPERUS 345.00]	1.018	0.1833

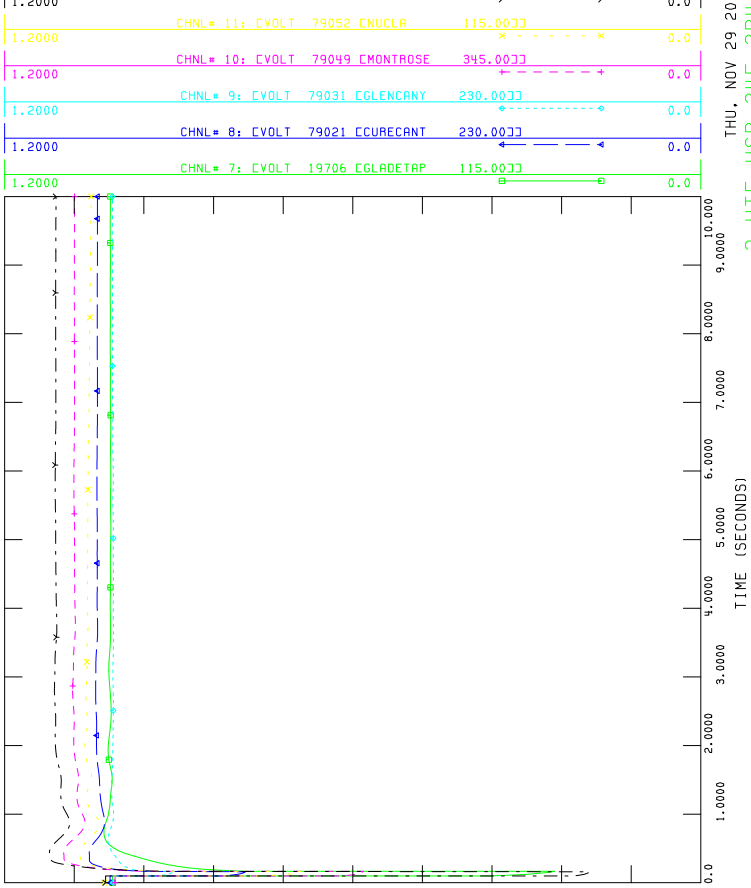
LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
17	FREQ 79052 [NUCLA 115.00]	-0.1261E-02	1.4333
15	FREQ 79021 [CURECANT 230.00]	-0.1214E-02	1.3367
18	FREQ 79063 [SHIPROCK 230.00]	-0.9701E-03	9.2663
13	FREQ 10292 [SAN_JUAN 345.00]	-0.9694E-03	9.2563
14	FREQ 14101 [FOURCORN 345.00]	-0.9692E-03	9.2529
16	FREQ 79031 [GLENCANY 230.00]	-0.9676E-03	9.4863



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\2-WTF-HSP-345-3P4C.out  
CHNL= 12: EVOLT 79072 [HESPERUS 345.00]]

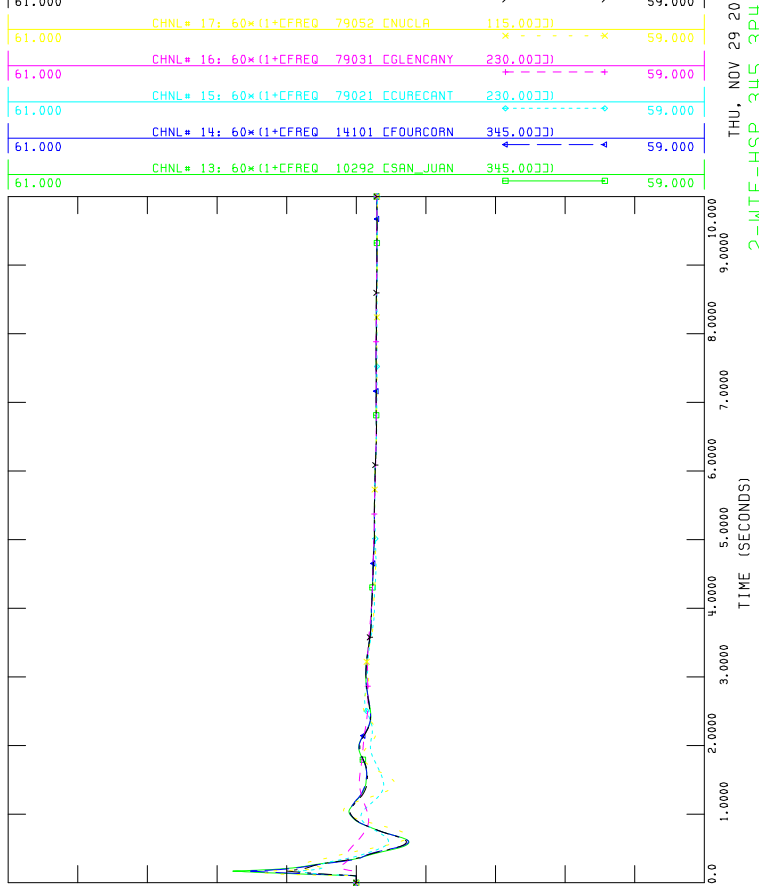


THU, NOV 29 2012 14:52  
2-WTF-HSP 345 3P4C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

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CHNL= 18: 60\*(1+CFREQ 79063 [SHIPROCK 230.00]]

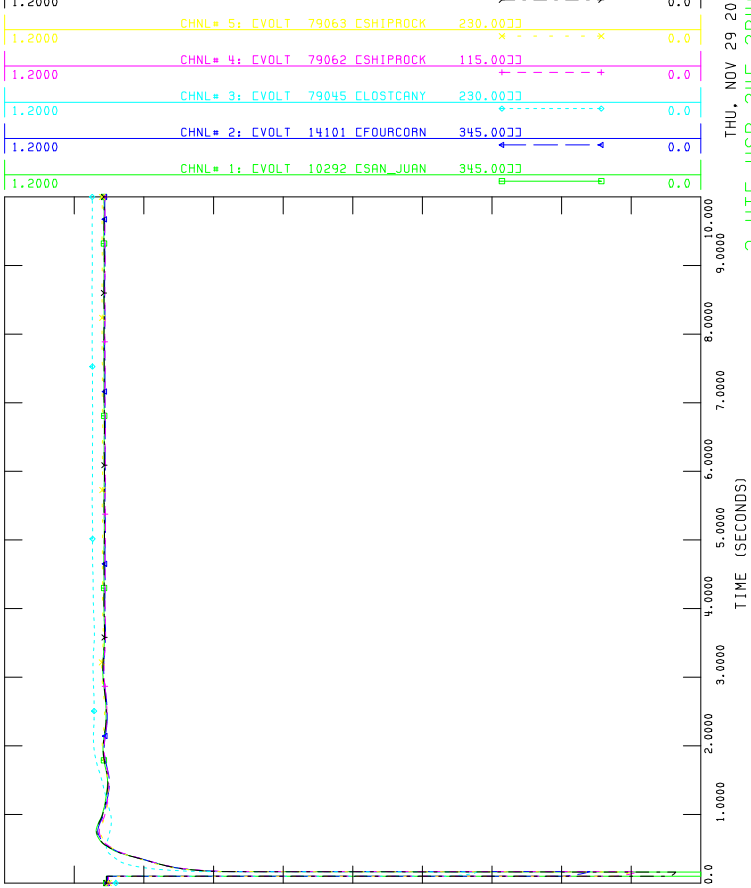


THU, NOV 29 2012 14:52  
2-WTF-HSP 345 3P4C FREQ



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\2-WTF-HSP-345-3P4C.out  
CHNL= 6: EVOLT 79064 [SHIPROCK 345.00]]

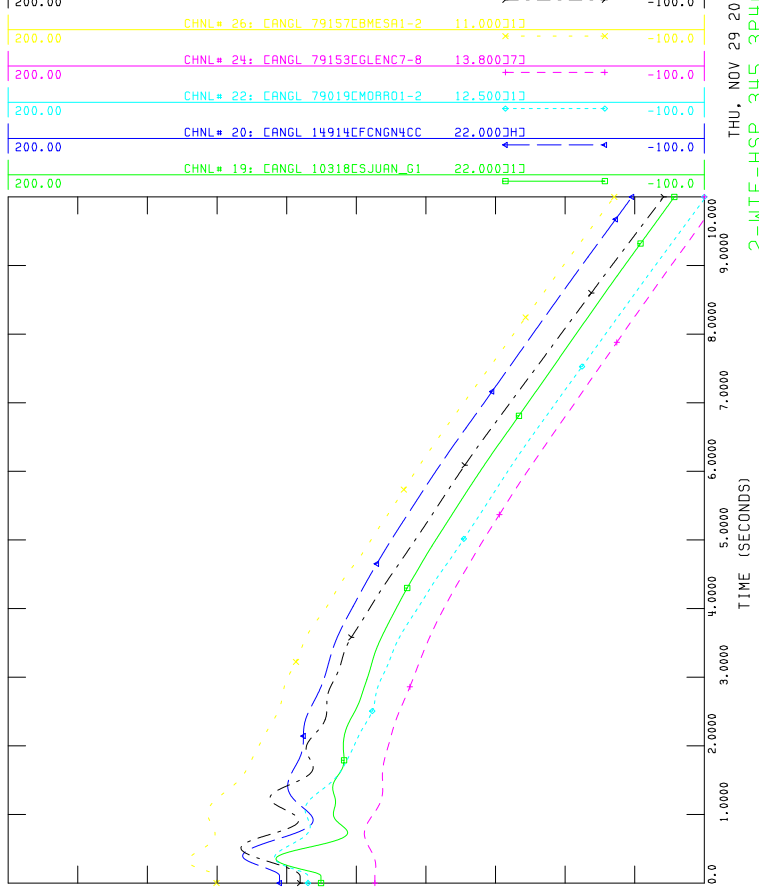


THU, NOV 29 2012 14:52  
2-WTF-HSP 345 3P4C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\2-WTF-HSP-345-3P4C.out  
CHNL= 28: CANGI 79161[NUCLA 4 13.800]]



THU, NOV 29 2012 14:52  
2-WTF-HSP 345 3P4C ANGL



LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
7 VOLT	19706 [GLADETAP 115.00]	0.8296	0.1833
4 VOLT	79062 [SHIPROCK 115.00]	0.8554	0.1833
2 VOLT	14101 [FOURCORN 345.00]	0.8618	0.1833
6 VOLT	79064 [SHIPROCK 345.00]	0.8627	0.1833
1 VOLT	10292 [SAN_JUAN 345.00]	0.8629	0.1833
5 VOLT	79063 [SHIPROCK 230.00]	0.8662	0.1833
3 VOLT	79045 [LOSTCANY 230.00]	0.9070	0.1833
11 VOLT	79052 [NUCLA 115.00]	0.9713	0.1833
9 VOLT	79031 [GLENCANY 230.00]	0.9745	0.1833
12 VOLT	79072 [HESPERUS 345.00]	0.9905	0.1833
8 VOLT	79021 [CURECANT 230.00]	0.9936	0.1833
10 VOLT	79049 [MONTROSE 345.00]	1.004	0.1833

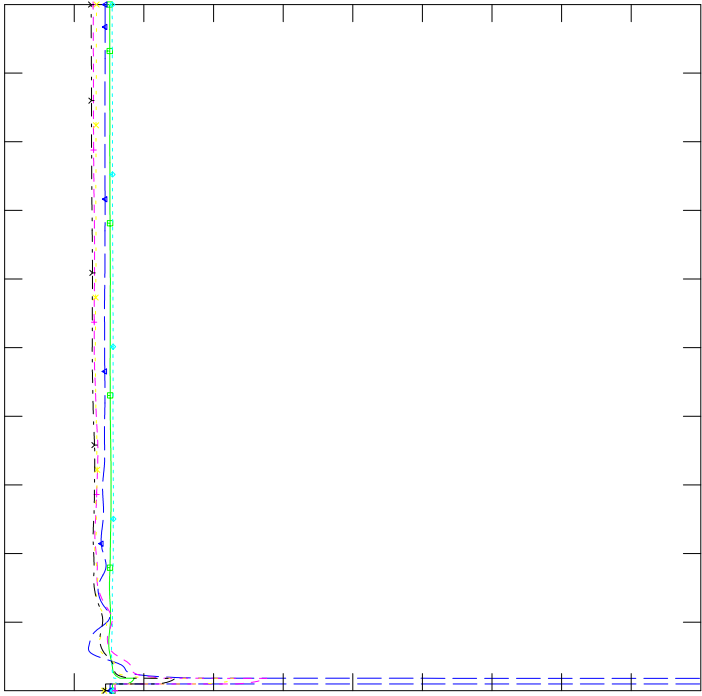
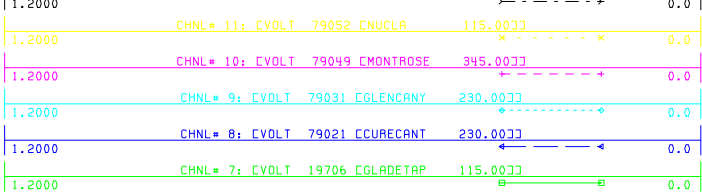
LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
13 FREQ	10292 [SAN_JUAN 345.00]	-0.2526E-02	0.5933
14 FREQ	14101 [FOURCORN 345.00]	-0.2500E-02	0.5967
17 FREQ	79052 [NUCLA 115.00]	-0.2467E-02	0.6733
18 FREQ	79063 [SHIPROCK 230.00]	-0.2401E-02	0.5967
15 FREQ	79021 [CURECANT 230.00]	-0.1546E-02	0.6033
16 FREQ	79031 [GLENCANY 230.00]	-0.9896E-03	9.0296



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

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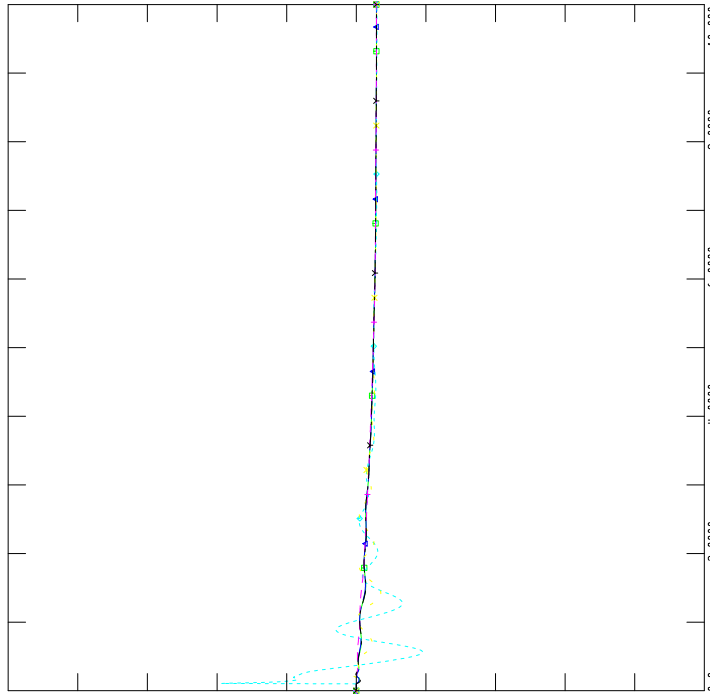
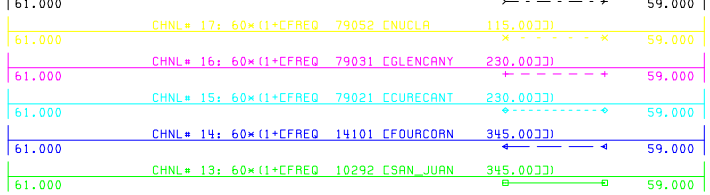
THU, NOV 29 2012 14:53

3-CCI-LCN 230 3P5C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

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CHNL= 18: 60\*(1+CFREQ 79063 [SHIPROCK 230.00]]



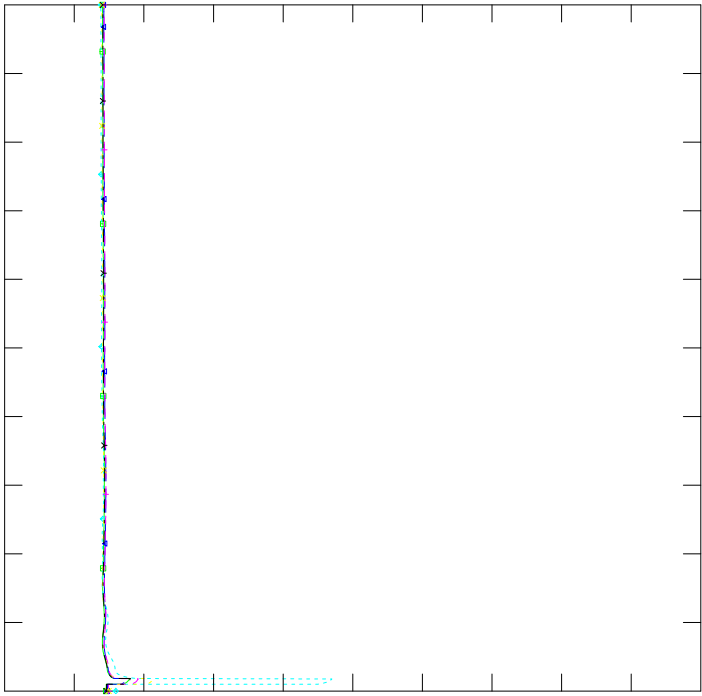
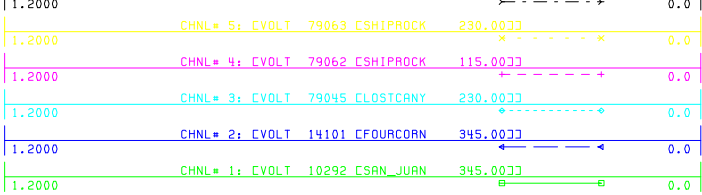
THU, NOV 29 2012 14:53

3-CCI-LCN 230 3P5C FREQ



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

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CHNL= 6: EVOLT 79064 [SHIPROCK 345.00]]



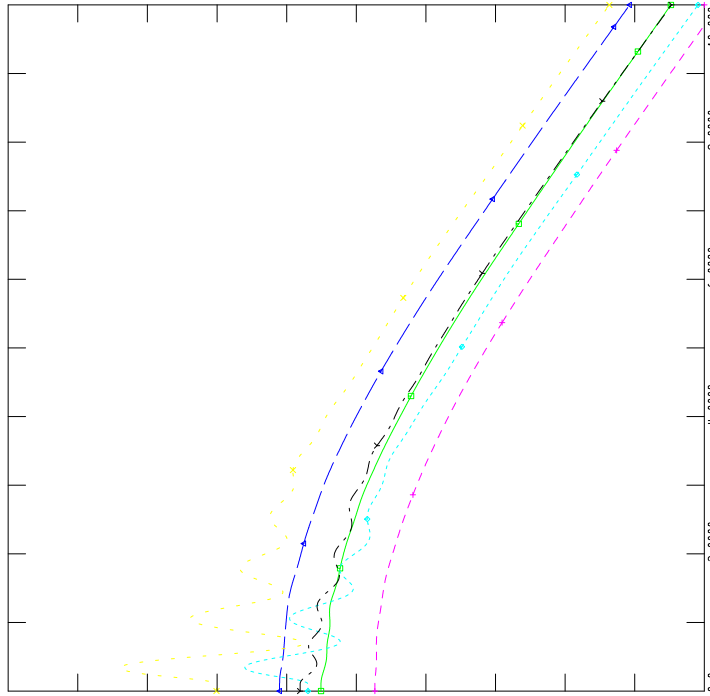
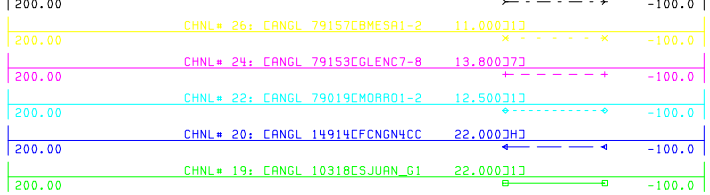
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3-CCI-LCN 230 3P5C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\3-CCI-LCN-230-3P5C.out  
CHNL= 28: CANGI 79161[NUCLA 4 13.800]]



THU, NOV 29 2012 14:53

3-CCI-LCN 230 3P5C ANGL

LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
8 VOLT	79021 [CURECANT 230.00]	0.1201E-05	0.1833
3 VOLT	79045 [LOSTCANY 230.00]	0.6354	0.1833
10 VOLT	79049 [MONTROSE 345.00]	0.7470	0.1833
11 VOLT	79052 [NUCLA 115.00]	0.8005	0.1833
12 VOLT	79072 [HESPERUS 345.00]	0.9058	0.1833
5 VOLT	79063 [SHIPROCK 230.00]	0.9436	0.1833
4 VOLT	79062 [SHIPROCK 115.00]	0.9696	0.1833
7 VOLT	19706 [GLADETAP 115.00]	0.9765	0.1833
6 VOLT	79064 [SHIPROCK 345.00]	0.9833	0.1833
1 VOLT	10292 [SAN_JUAN 345.00]	0.9847	0.1833
2 VOLT	14101 [FOURCORN 345.00]	0.9893	0.1833
9 VOLT	79031 [GLENCANY 230.00]	1.007	0.1833

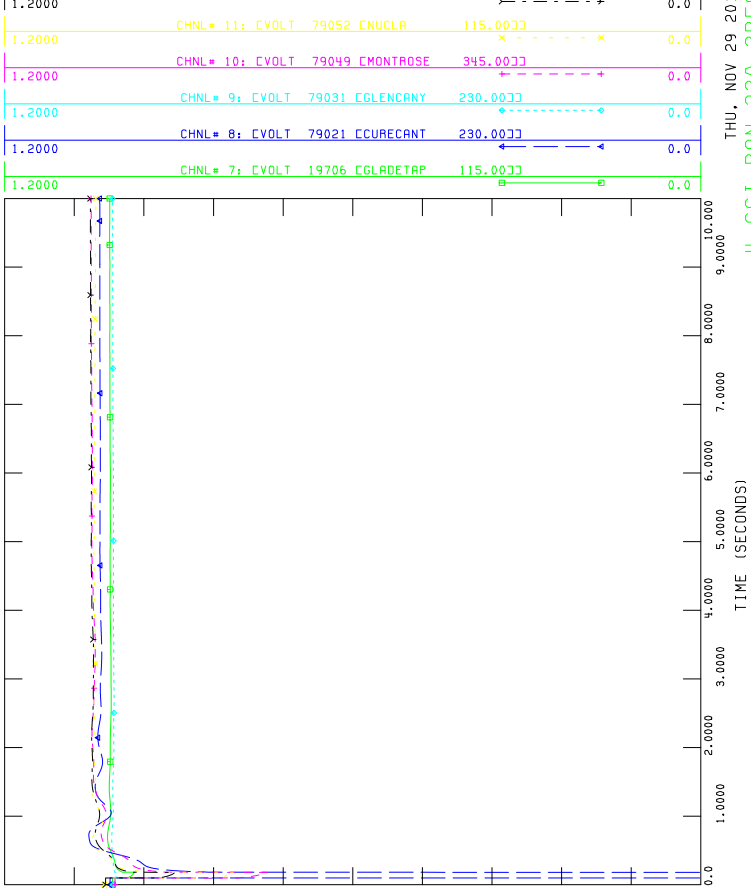
LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
15 FREQ	79021 [CURECANT 230.00]	-0.3179E-02	0.5633
17 FREQ	79052 [NUCLA 115.00]	-0.1176E-02	1.4267
18 FREQ	79063 [SHIPROCK 230.00]	-0.9690E-03	9.7096
13 FREQ	10292 [SAN_JUAN 345.00]	-0.9690E-03	9.6996
14 FREQ	14101 [FOURCORN 345.00]	-0.9686E-03	9.7162
16 FREQ	79031 [GLENCANY 230.00]	-0.9656E-03	9.2596



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\4-CCI-PON-230-3P5C.out  
CHNL= 12: EVOLT 79072 [HESPERUS 345.00]]

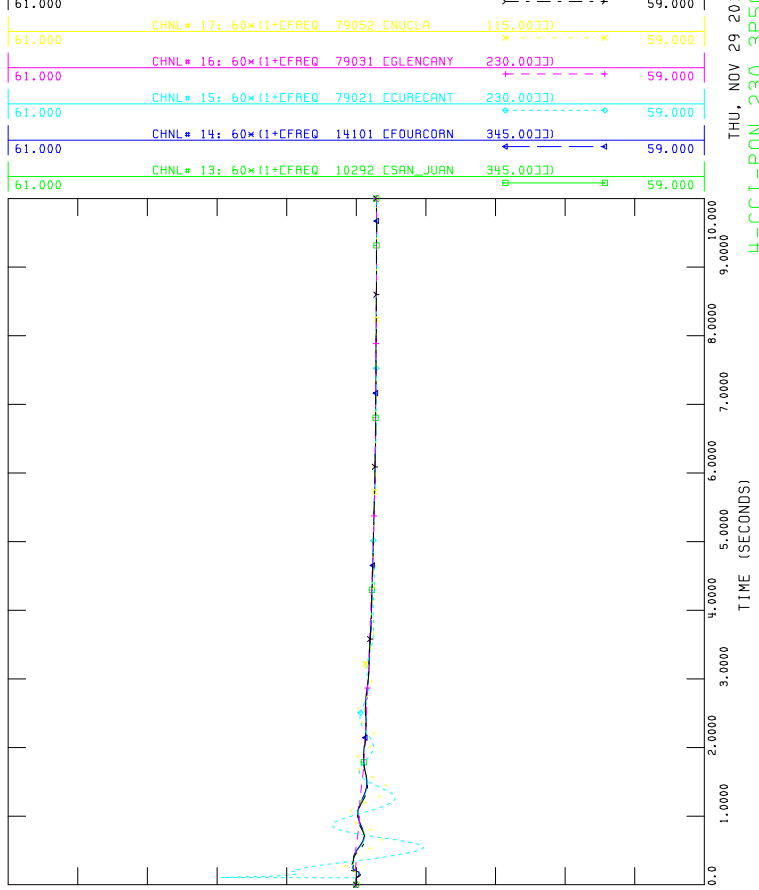


THU, NOV 29 2012 14:54  
4-CCI-PON 230 3P5C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\4-CCI-PON-230-3P5C.out  
CHNL= 18: 60\*(1+CFREQ 79063 [SHIPROCK 230.00]]

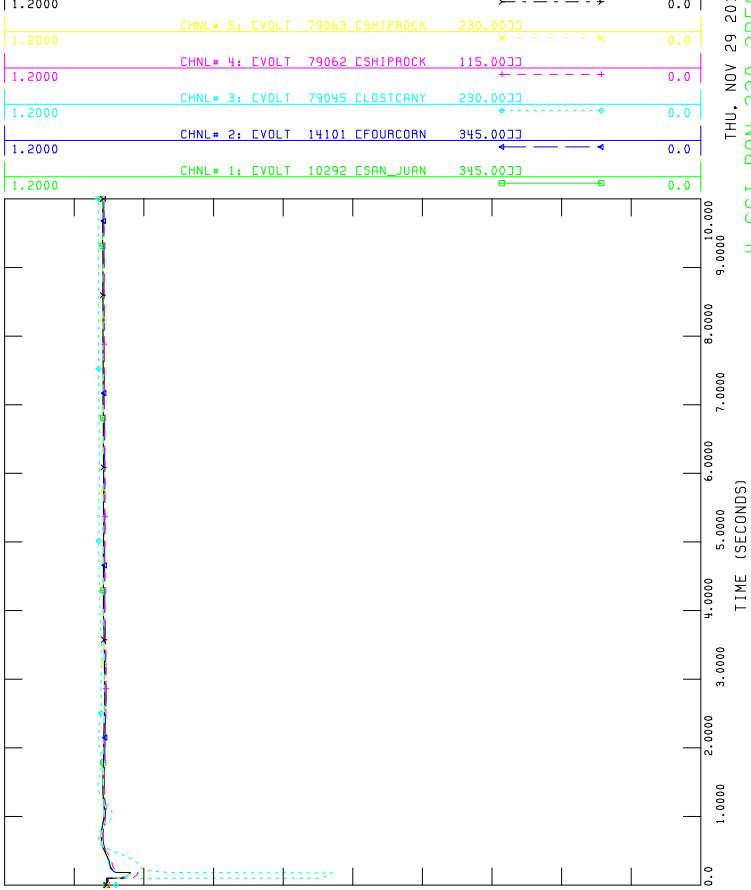


THU, NOV 29 2012 14:54  
4-CCI-PON 230 3P5C FREQ



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\4-CCI-PON-230-3P5C.out  
CHNL= 6: EVOLT 79064 [SHIPROCK 345.00]]

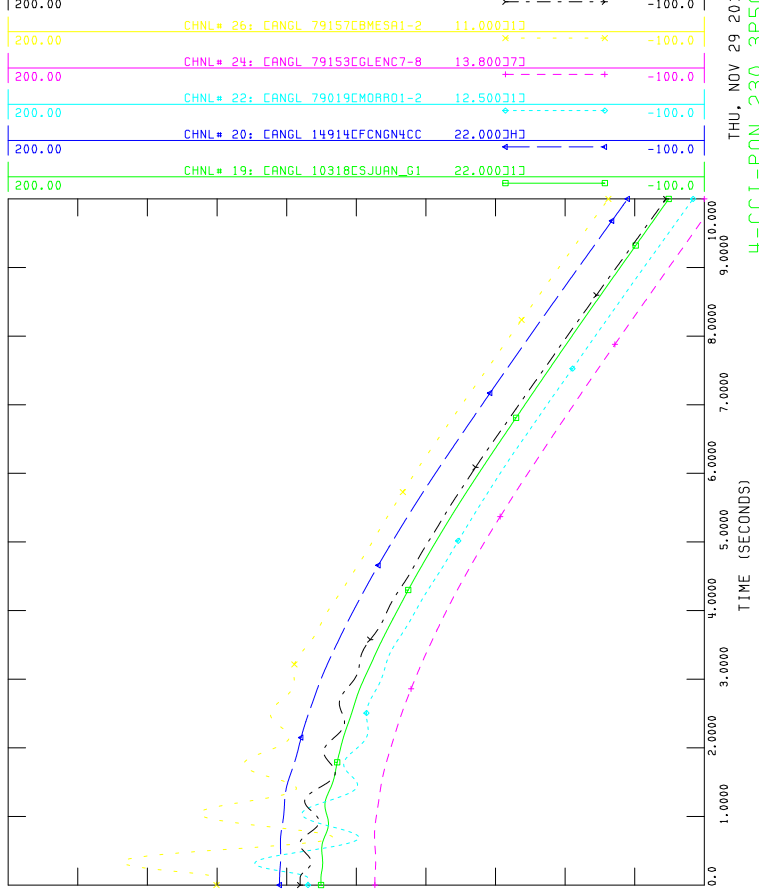


THU, NOV 29 2012 14:54  
4-CCI-PON 230 3P5C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\4-CCI-PON-230-3P5C.out  
CHNL= 28: C[ANGL 79161[NUCLA 4 13.800]]



THU, NOV 29 2012 14:54  
4-CCI-PON 230 3P5C ANGL

LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
8 VOLT	79021 [CURECANT 230.00]	0.1201E-05	0.1833
3 VOLT	79045 [LOSTCANY 230.00]	0.6354	0.1833
10 VOLT	79049 [MONTROSE 345.00]	0.7470	0.1833
11 VOLT	79052 [NUCLA 115.00]	0.8005	0.1833
12 VOLT	79072 [HESPERUS 345.00]	0.9058	0.1833
5 VOLT	79063 [SHIPROCK 230.00]	0.9436	0.1833
4 VOLT	79062 [SHIPROCK 115.00]	0.9696	0.1833
7 VOLT	19706 [GLADETAP 115.00]	0.9765	0.1833
6 VOLT	79064 [SHIPROCK 345.00]	0.9833	0.1833
1 VOLT	10292 [SAN_JUAN 345.00]	0.9847	0.1833
2 VOLT	14101 [FOURCORN 345.00]	0.9893	0.1833
9 VOLT	79031 [GLENCANY 230.00]	1.007	0.1833

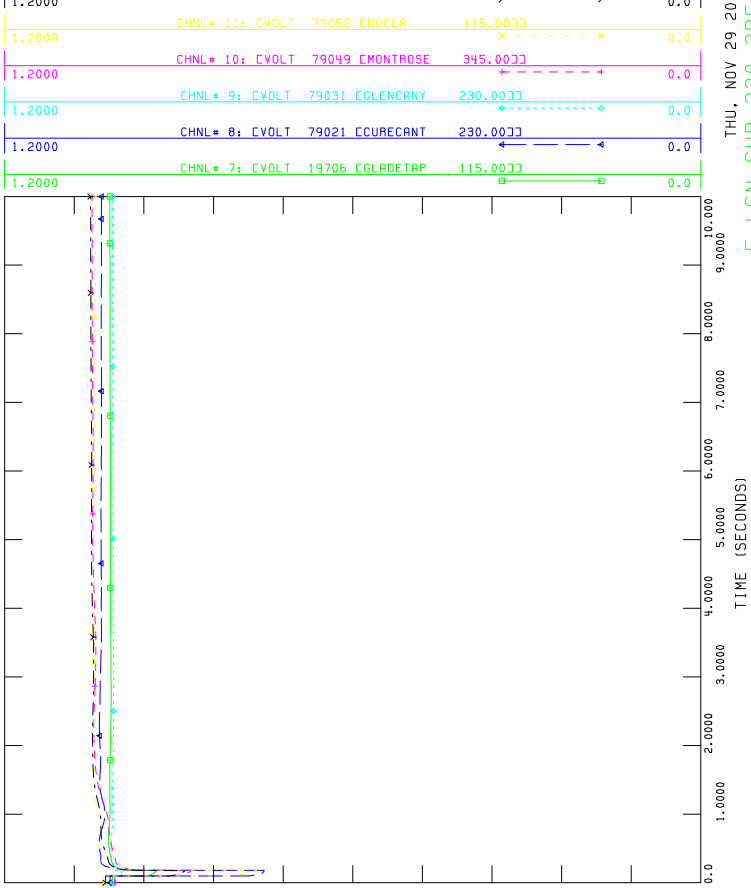
LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
15 FREQ	79021 [CURECANT 230.00]	-0.3222E-02	0.5467
17 FREQ	79052 [NUCLA 115.00]	-0.1505E-02	1.4000
18 FREQ	79063 [SHIPROCK 230.00]	-0.9747E-03	9.6562
13 FREQ	10292 [SAN_JUAN 345.00]	-0.9745E-03	9.6196
14 FREQ	14101 [FOURCORN 345.00]	-0.9739E-03	9.6262
16 FREQ	79031 [GLENCANY 230.00]	-0.9701E-03	9.0330



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\5-LCN-SHR-230-3P5C.out  
CHNL= 12: EVOLT 79072 [HESPERUS 345.00JJ]

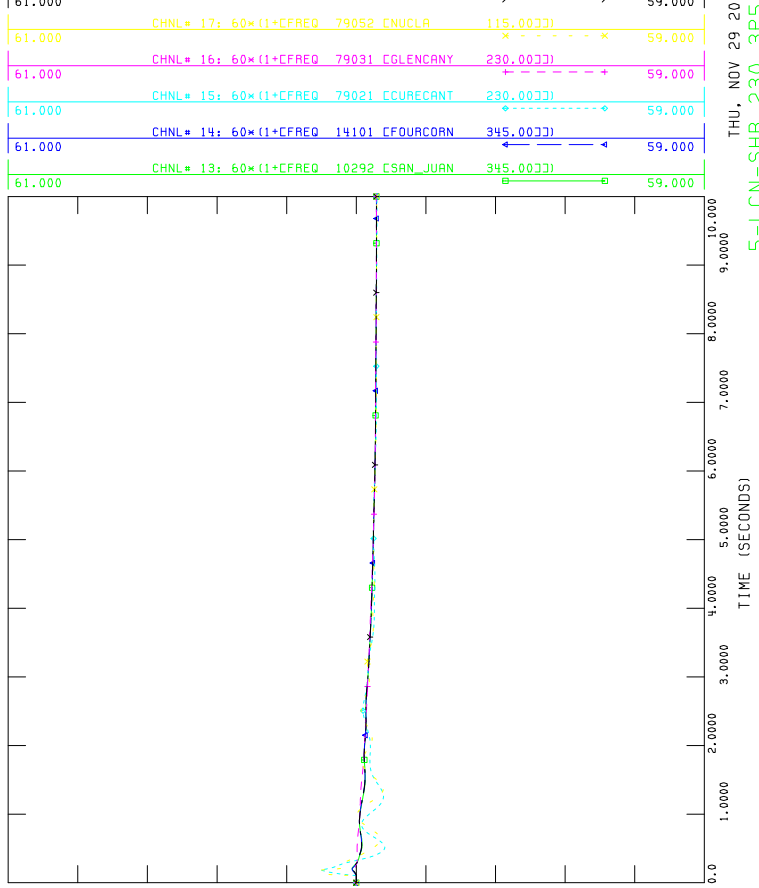


THU, NOV 29 2012 14:57  
5-LCN-SHR 230 3P5C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\5-LCN-SHR-230-3P5C.out  
CHNL= 18: 60\*(1+CFREQ) 79063 [ESHIPROCK 230.00JJ]

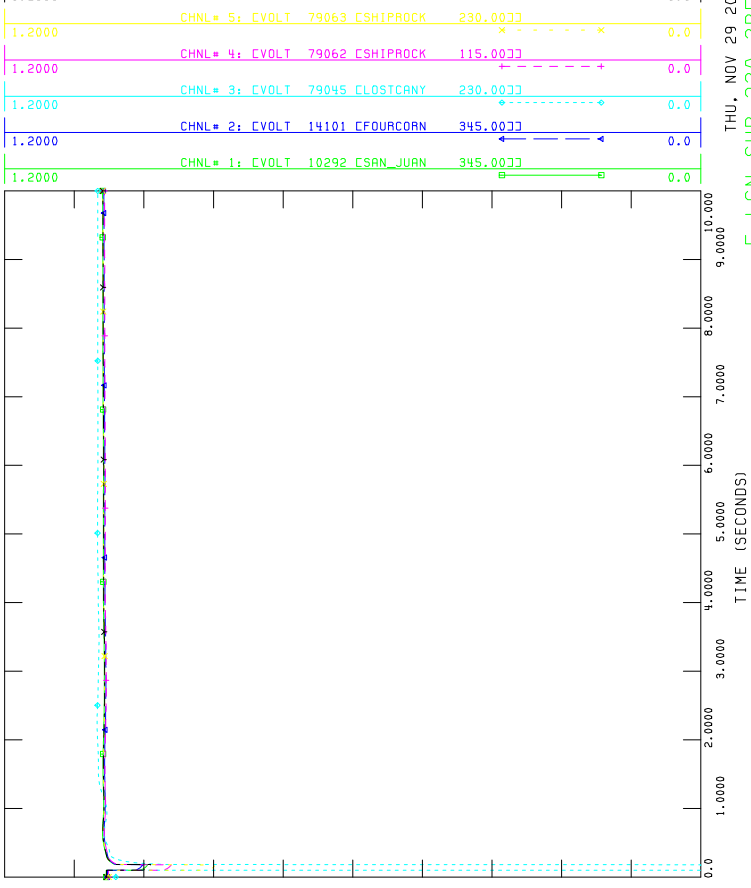


THU, NOV 29 2012 14:57  
5-LCN-SHR 230 3P5C FREQ



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\5-LCN-SHR-230-3P5C.out  
CHNL= 6: EVOLT 79064 [ESHIPROCK 345.00JJ]

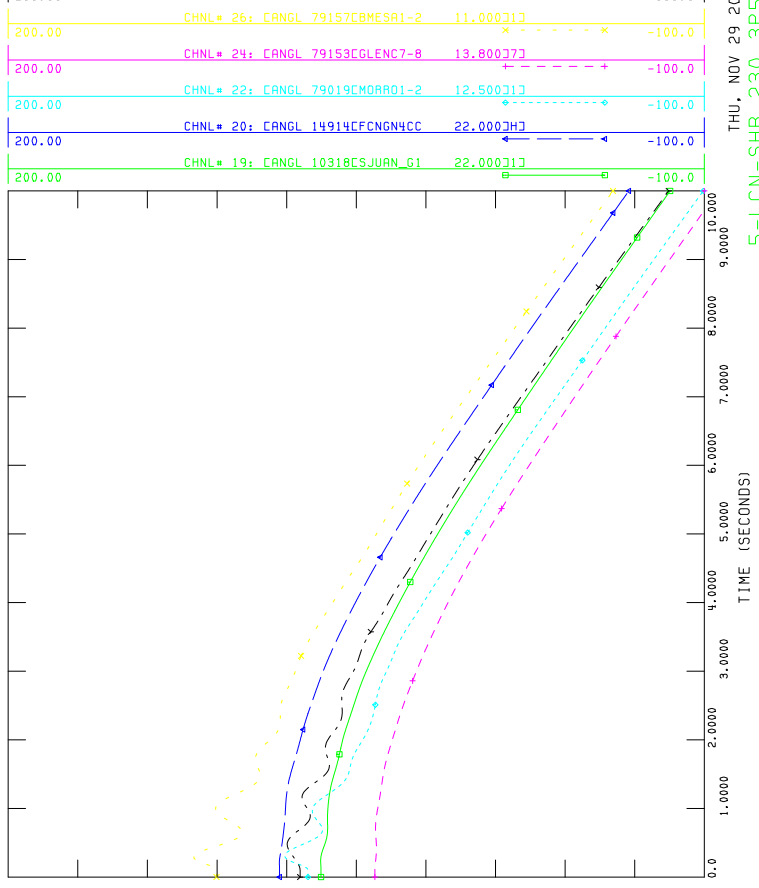


THU, NOV 29 2012 14:57  
5-LCN-SHR 230 3P5C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\5-LCN-SHR-230-3P5C.out  
CHNL= 28: CANGI 79161[ENUCLA 4 13.800JJ]



THU, NOV 29 2012 14:57  
5-LCN-SHR 230 3P5C ANGL

LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	-----X	MIN	TIME (SECONDS)
3	VOLT 79045	[LOSTCANY 230.00]	0.9076E-06	0.1833
8	VOLT 79021	[CURECANT 230.00]	0.7525	0.1833
11	VOLT 79052	[NUCLA 115.00]	0.7655	0.1833
5	VOLT 79063	[SHIPROCK 230.00]	0.8369	0.1833
10	VOLT 79049	[MONTROSE 345.00]	0.8778	0.1833
12	VOLT 79072	[HESPERUS 345.00]	0.8882	0.1833
4	VOLT 79062	[SHIPROCK 115.00]	0.9126	0.1833
7	VOLT 19706	[GLADETAP 115.00]	0.9376	0.1833
6	VOLT 79064	[SHIPROCK 345.00]	0.9484	0.1833
1	VOLT 10292	[SAN_JUAN 345.00]	0.9532	0.1833
2	VOLT 14101	[FOURCORN 345.00]	0.9619	0.1833
9	VOLT 79031	[GLENCANY 230.00]	0.9978	0.1833

LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

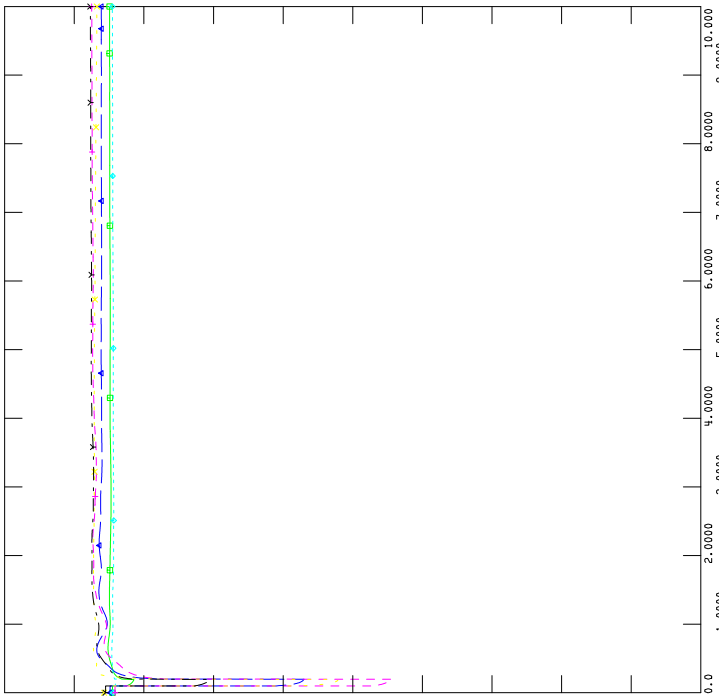
CHANEL X	IDENTIFIER	-----X	MIN	TIME (SECONDS)
15	FREQ 79021	[CURECANT 230.00]	-0.1367E-02	0.5167
17	FREQ 79052	[NUCLA 115.00]	-0.1289E-02	1.3667
13	FREQ 10292	[SAN_JUAN 345.00]	-0.9697E-03	9.4963
18	FREQ 79063	[SHIPROCK 230.00]	-0.9694E-03	9.4929
14	FREQ 14101	[FOURCORN 345.00]	-0.9693E-03	9.4896
16	FREQ 79031	[GLENCANY 230.00]	-0.9656E-03	9.7129



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\6-MTR-NLA-115-3P6C.out  
CHNL= 12: EVOLT 79072 [HESPERUS 345.00JJ]

1.2000	CHNL= 11: EVOLT 79052 [NUCLA 115.00JJ]	0.0
1.2000	CHNL= 10: EVOLT 79049 [MONROSE 345.00JJ]	0.0
1.2000	CHNL= 9: EVOLT 79031 [GLENCANY 230.00JJ]	0.0
1.2000	CHNL= 8: EVOLT 79021 [CURECANT 230.00JJ]	0.0
1.2000	CHNL= 7: EVOLT 19706 [GLADETAP 115.00JJ]	0.0



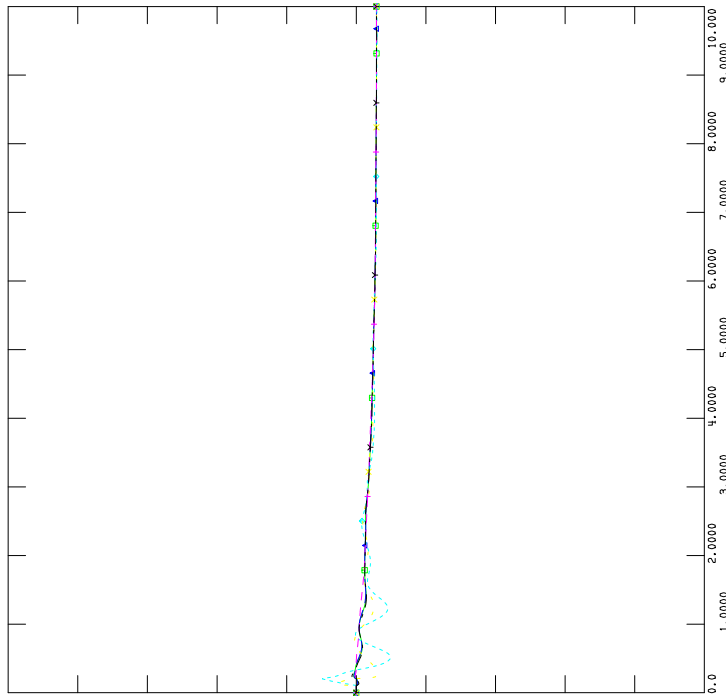
THU, NOV 29 2012 14:58  
6-MTR-NLA 115 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\6-MTR-NLA-115-3P6C.out  
CHNL= 18: 60\*(1+CFREQ) 79063 [SHIPROCK 230.00JJ]

61.0000	CHNL= 17: 60*(1+CFREQ) 79052 [NUCLA 115.00JJ]	59.0000
61.0000	CHNL= 16: 60*(1+CFREQ) 79031 [GLENCANY 230.00JJ]	59.0000
61.0000	CHNL= 15: 60*(1+CFREQ) 79021 [CURECANT 230.00JJ]	59.0000
61.0000	CHNL= 14: 60*(1+CFREQ) 14101 [FOURCORN 345.00JJ]	59.0000
61.0000	CHNL= 13: 60*(1+CFREQ) 10292 [SAN_JUAN 345.00JJ]	59.0000



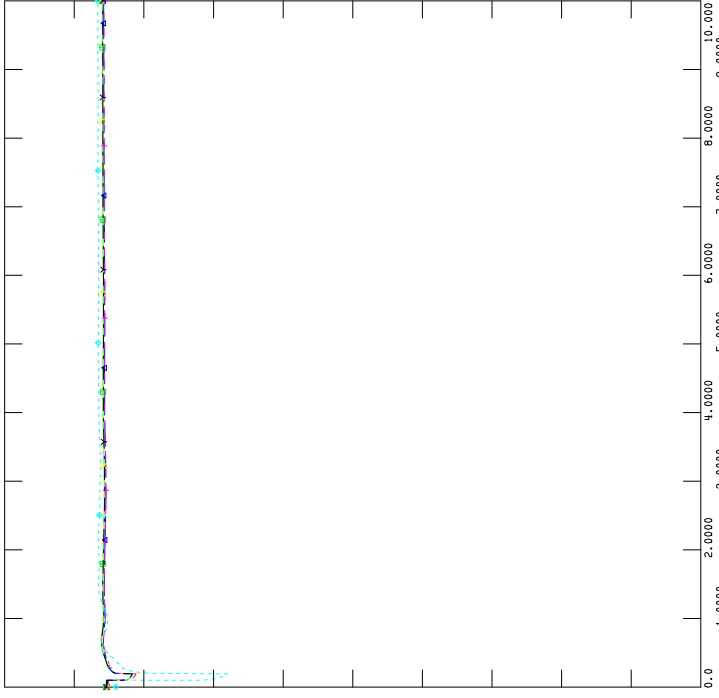
THU, NOV 29 2012 14:58  
6-MTR-NLA 115 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\6-MTR-NLA-115-3P6C.out  
CHNL= 6: EVOLT 79064 [SHIPROCK 345.00JJ]

1.2000	CHNL= 5: EVOLT 79063 [SHIPROCK 230.00JJ]	0.0
1.2000	CHNL= 4: EVOLT 79062 [SHIPROCK 115.00JJ]	0.0
1.2000	CHNL= 3: EVOLT 79045 [CLOSTCANY 230.00JJ]	0.0
1.2000	CHNL= 2: EVOLT 14101 [FOURCORN 345.00JJ]	0.0
1.2000	CHNL= 1: EVOLT 10292 [SAN_JUAN 345.00JJ]	0.0



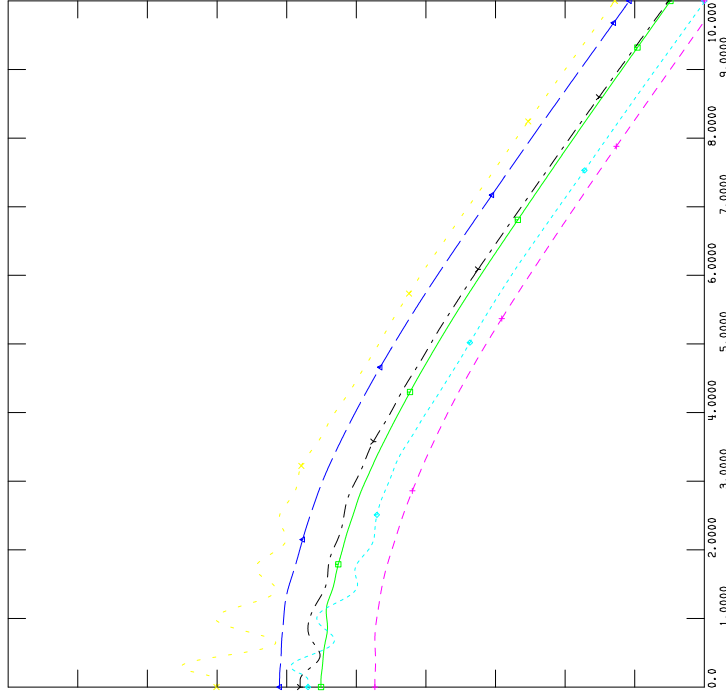
THU, NOV 29 2012 14:58  
6-MTR-NLA 115 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\6-MTR-NLA-115-3P6C.out  
CHNL= 28: CANGI 79161[NUCLA 4 13.800JJ]

200.00	CHNL= 26: CANGI 79157[BMESA1-2 11.000JJ]	-100.0
200.00	CHNL= 24: CANGI 79153[GLENC7-8 13.800JJ]	-100.0
200.00	CHNL= 22: CANGI 79019[EMORR01-2 12.500JJ]	-100.0
200.00	CHNL= 20: CANGI 14914[FCNGN4CC 22.000JJ]	-100.0
200.00	CHNL= 19: CANGI 10318[CSJUAN_61 22.000JJ]	-100.0



THU, NOV 29 2012 14:58  
6-MTR-NLA 115 3P6C ANGL



LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
10 VOLT 79049	[MONTROSE 345.00]	0.5323	0.2000
11 VOLT 79052	[NUCLA 115.00]	0.6239	0.2000
8 VOLT 79021	[CURECANT 230.00]	0.6834	0.2000
3 VOLT 79045	[LOSTCANY 230.00]	0.8156	0.2000
12 VOLT 79072	[HESPERUS 345.00]	0.8459	0.2000
5 VOLT 79063	[SHIPROCK 230.00]	0.9612	0.2000
4 VOLT 79062	[SHIPROCK 115.00]	0.9733	0.2000
7 VOLT 19706	[GLADETAP 115.00]	0.9769	0.2000
1 VOLT 10292	[SAN_JUAN 345.00]	0.9795	0.2000
6 VOLT 79064	[SHIPROCK 345.00]	0.9797	0.2000
2 VOLT 14101	[FOURCORN 345.00]	0.9857	0.2000
9 VOLT 79031	[GLENCANY 230.00]	1.008	0.2000

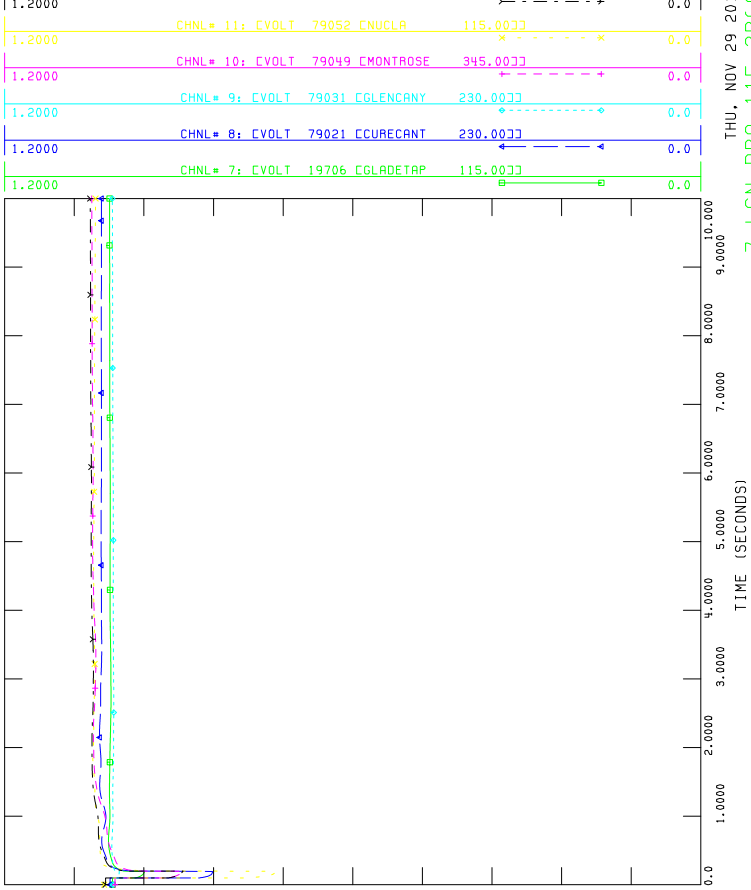
LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
15 FREQ 79021	[CURECANT 230.00]	-0.1644E-02	0.5167
17 FREQ 79052	[NUCLA 115.00]	-0.9789E-03	9.8229
18 FREQ 79063	[SHIPROCK 230.00]	-0.9733E-03	9.5262
13 FREQ 10292	[SAN_JUAN 345.00]	-0.9729E-03	9.5329
14 FREQ 14101	[FOURCORN 345.00]	-0.9724E-03	9.5296
16 FREQ 79031	[GLENCANY 230.00]	-0.9683E-03	9.7496



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\7-LCN-DR0-115-3P6C.out  
CHNL= 12: EVOLT 79072 EHEPERUS 345.00JJ

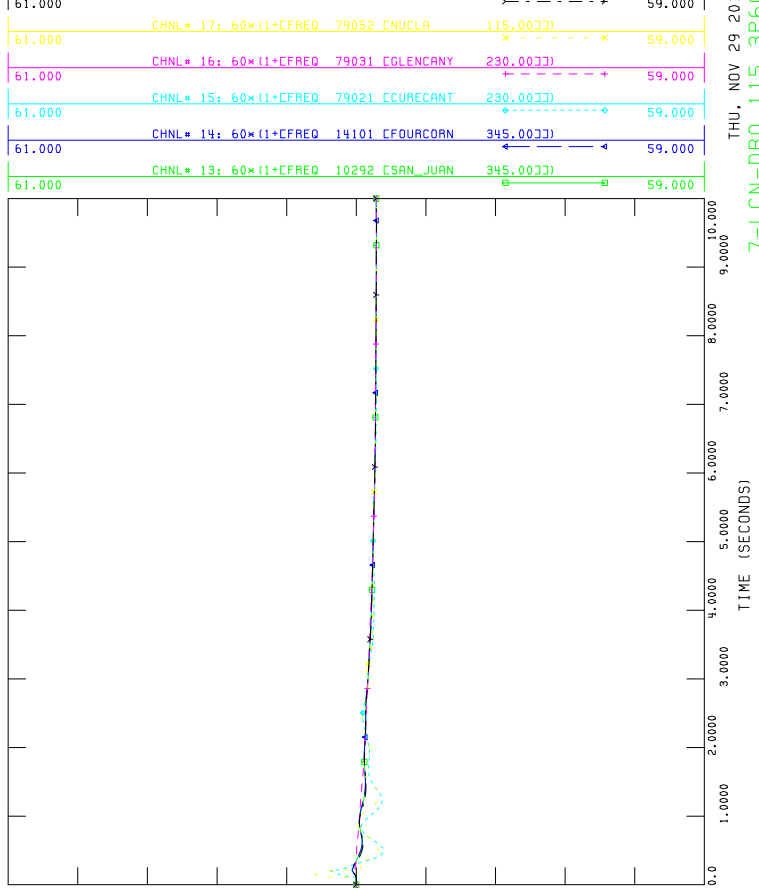


THU, NOV 29 2012 15:36  
7-LCN-DR0 115 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\7-LCN-DR0-115-3P6C.out  
CHNL= 18: 60\*(1+CFREQ) 79063 ESHIPROCK 230.00JJ

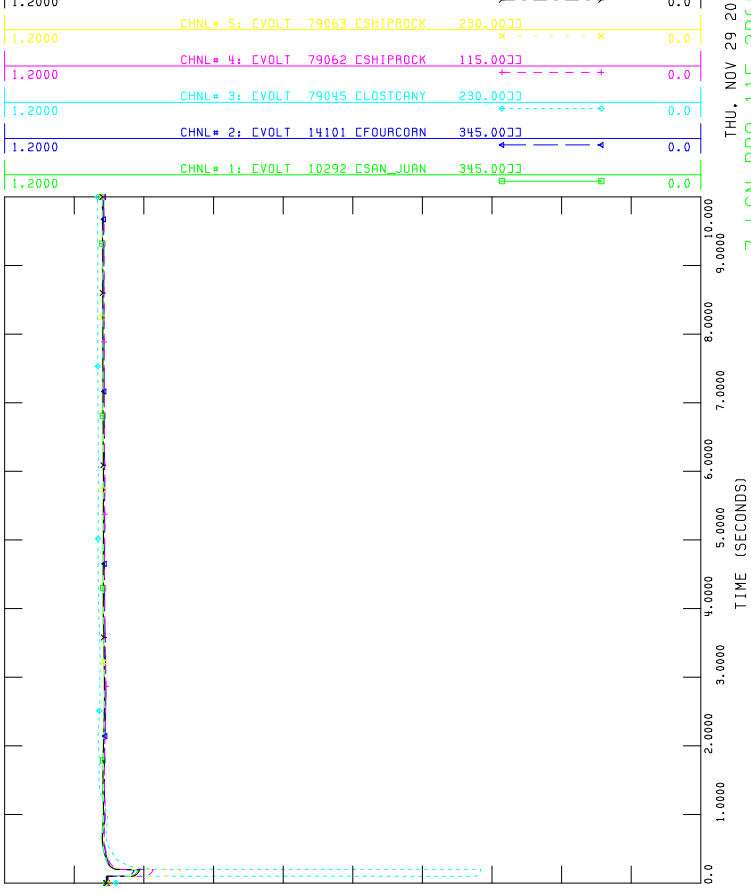


THU, NOV 29 2012 15:36  
7-LCN-DR0 115 3P6C FREQ



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\7-LCN-DR0-115-3P6C.out  
CHNL= 6: EVOLT 79064 CSHIPROCK 345.00JJ

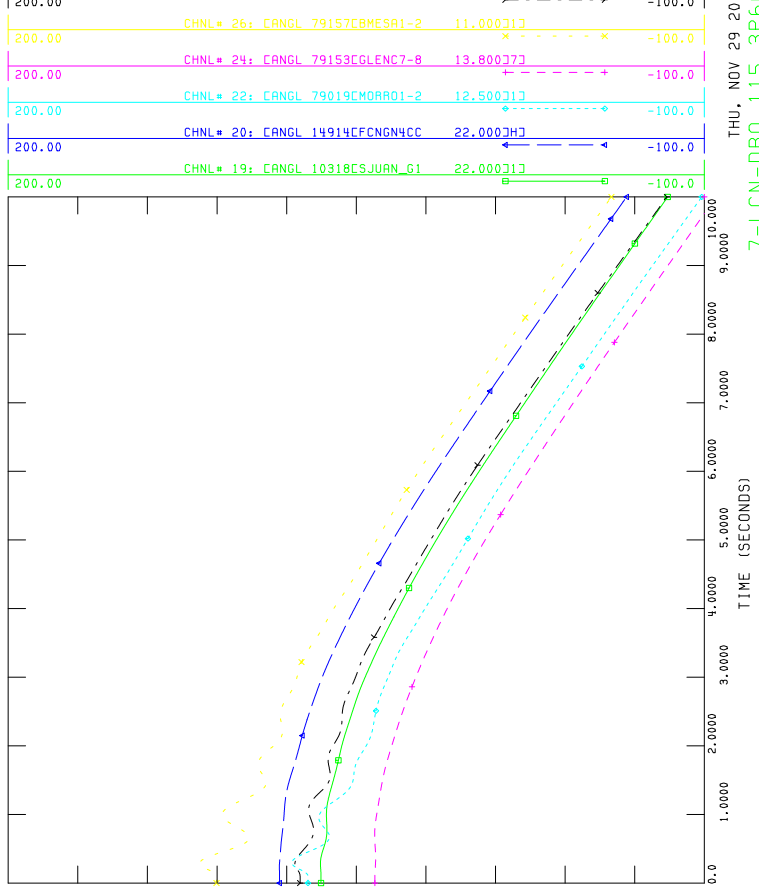


THU, NOV 29 2012 15:36  
7-LCN-DR0 115 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\7-LCN-DR0-115-3P6C.out  
CHNL= 28: CANGI 79161CNUCLA 4 13.800JJ



THU, NOV 29 2012 15:36  
7-LCN-DR0 115 3P6C ANGL

LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
3 VOLT	79045 [LOSTCANY 230.00]	0.3790	0.2000
11 VOLT	79052 [NUCLA 115.00]	0.7333	0.2000
8 VOLT	79021 [CURECANT 230.00]	0.8419	0.1900
12 VOLT	79072 [HESPERUS 345.00]	0.8924	0.2000
10 VOLT	79049 [MONTROSE 345.00]	0.8934	0.2000
5 VOLT	79063 [SHIPROCK 230.00]	0.8965	0.2000
4 VOLT	79062 [SHIPROCK 115.00]	0.9439	0.2000
7 VOLT	19706 [GLADETAP 115.00]	0.9584	0.2000
6 VOLT	79064 [SHIPROCK 345.00]	0.9669	0.2000
1 VOLT	10292 [SAN_JUAN 345.00]	0.9697	0.2000
2 VOLT	14101 [FOURCORN 345.00]	0.9763	0.2000
9 VOLT	79031 [GLENCANY 230.00]	1.002	0.2000

LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

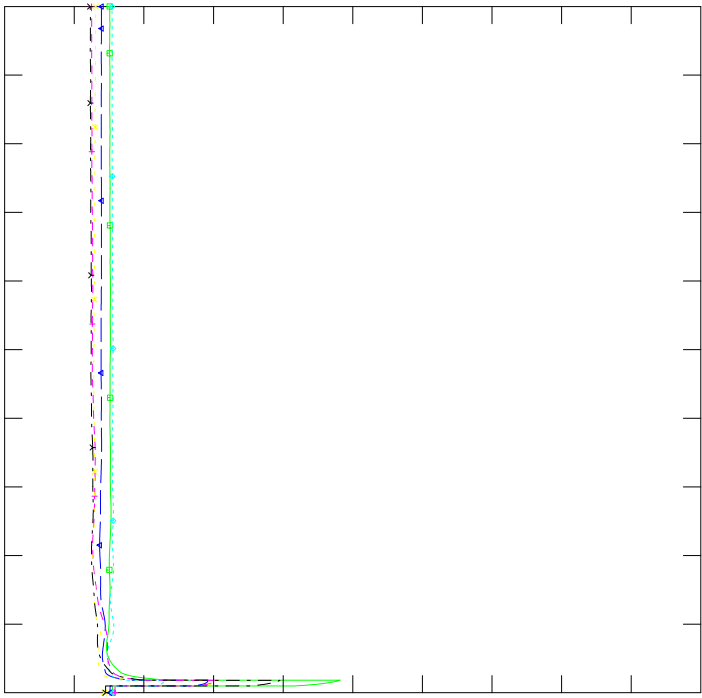
CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
15 FREQ	79021 [CURECANT 230.00]	-0.1304E-02	0.4967
17 FREQ	79052 [NUCLA 115.00]	-0.1091E-02	1.2933
18 FREQ	79063 [SHIPROCK 230.00]	-0.9665E-03	9.5196
13 FREQ	10292 [SAN_JUAN 345.00]	-0.9659E-03	9.5129
14 FREQ	14101 [FOURCORN 345.00]	-0.9654E-03	9.5096
16 FREQ	79031 [GLENCANY 230.00]	-0.9612E-03	9.7229



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\8-SHR-KAY-230-3P5C.out  
CHNL= 12: EVOLT 79072 EHEPERUS 345.00JJ

1.2000	CHNL= 11: EVOLT 79052 CNUCLA	115.00JJ	0.0
1.2000	CHNL= 10: EVOLT 79049 CMONROSE	345.00JJ	0.0
1.2000	CHNL= 9: EVOLT 79031 CGLENCANY	230.00JJ	0.0
1.2000	CHNL= 8: EVOLT 79021 CCURECANT	230.00JJ	0.0
1.2000	CHNL= 7: EVOLT 19706 EGLADETAP	115.00JJ	0.0



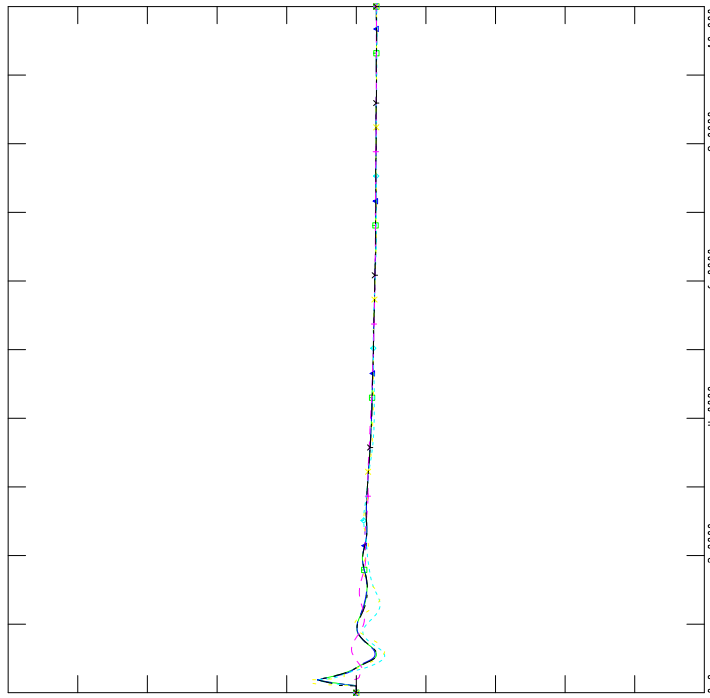
THU, NOV 29 2012 15:48  
8-SHR-KAY 230 3P5C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\8-SHR-KAY-230-3P5C.out  
CHNL= 18: 60\*(1+CFREQ) 79063 ESHIPROCK 230.00JJ

61.0000	CHNL= 17: 60*(1+CFREQ) 79052 CNUCLA	115.00JJ	59.0000
61.0000	CHNL= 16: 60*(1+CFREQ) 79031 CGLENCANY	230.00JJ	59.0000
61.0000	CHNL= 15: 60*(1+CFREQ) 79021 CCURECANT	230.00JJ	59.0000
61.0000	CHNL= 14: 60*(1+CFREQ) 14101 CFOURCORN	345.00JJ	59.0000
61.0000	CHNL= 13: 60*(1+CFREQ) 10292 CSAN_JUAN	345.00JJ	59.0000



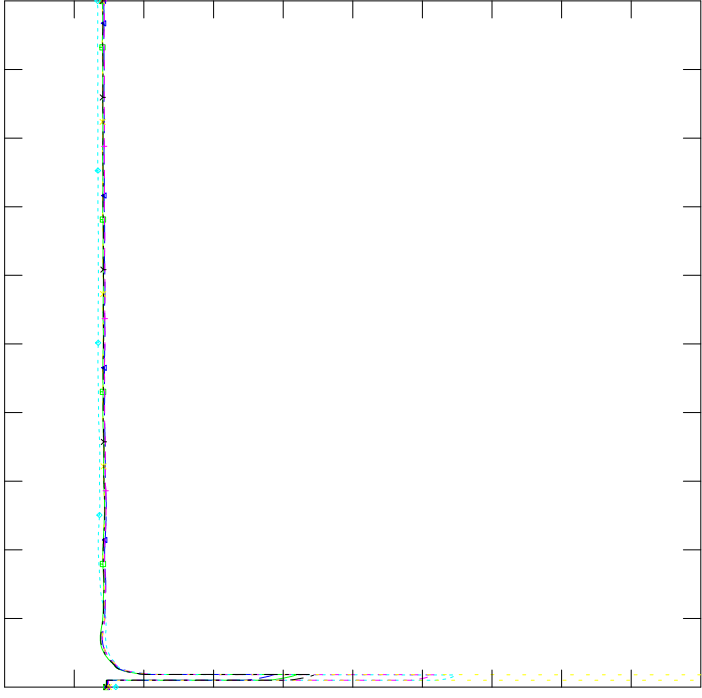
THU, NOV 29 2012 15:48  
8-SHR-KAY 230 3P5C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\8-SHR-KAY-230-3P5C.out  
CHNL= 6: EVOLT 79064 CSHIPROCK 345.00JJ

1.2000	CHNL= 5: EVOLT 79063 CSHIPROCK	230.00JJ	0.0
1.2000	CHNL= 4: EVOLT 79062 CSHIPROCK	115.00JJ	0.0
1.2000	CHNL= 3: EVOLT 79045 CLOSTCANY	230.00JJ	0.0
1.2000	CHNL= 2: EVOLT 14101 CFOURCORN	345.00JJ	0.0
1.2000	CHNL= 1: EVOLT 10292 CSAN_JUAN	345.00JJ	0.0



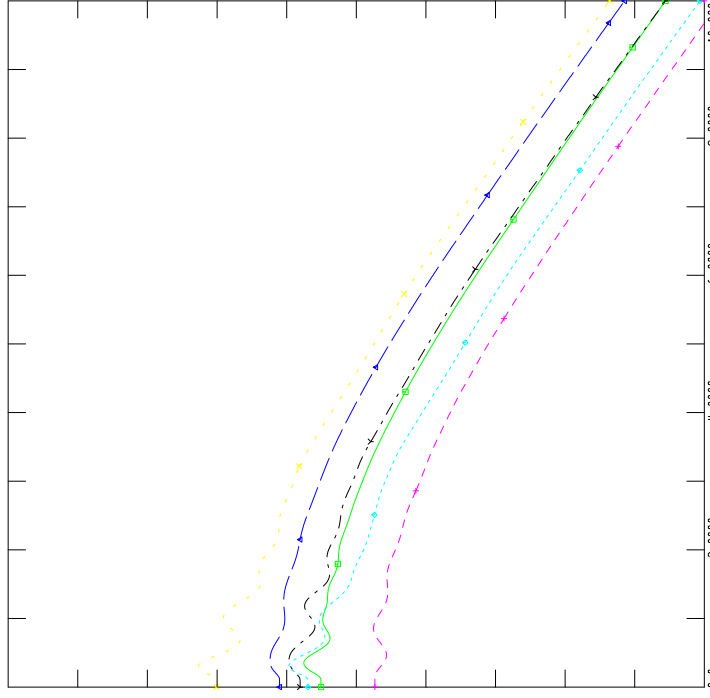
THU, NOV 29 2012 15:48  
8-SHR-KAY 230 3P5C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\8-SHR-KAY-230-3P5C.out  
CHNL= 28: CANGI 79161CNUCLA 4 13.800JJ

200.00	CHNL= 26: CANGI 79157CBMESA1-2	11.000JJ	-100.0
200.00	CHNL= 24: CANGI 79153CGLENC7-8	13.800JJ	-100.0
200.00	CHNL= 22: CANGI 79019CMORRO1-2	12.500JJ	-100.0
200.00	CHNL= 20: CANGI 14914CFCONGN4CC	22.000JJ	-100.0
200.00	CHNL= 19: CANGI 10318CSJUAN_61	22.000JJ	-100.0



THU, NOV 29 2012 15:48  
8-SHR-KAY 230 3P5C ANGL

LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
5 VOLT	79063 [SHIPROCK 230.00]	0.2924E-05	0.1833
3 VOLT	79045 [LOSTCANY 230.00]	0.4230	0.1833
4 VOLT	79062 [SHIPROCK 115.00]	0.4584	0.1833
7 VOLT	19706 [GLADETAP 115.00]	0.6217	0.1833
6 VOLT	79064 [SHIPROCK 345.00]	0.6644	0.1833
1 VOLT	10292 [SAN_JUAN 345.00]	0.6957	0.1833
12 VOLT	79072 [HESPERUS 345.00]	0.7245	0.1833
2 VOLT	14101 [FOURCORN 345.00]	0.7356	0.1833
11 VOLT	79052 [NUCLA 115.00]	0.8271	0.1833
10 VOLT	79049 [MONTROSE 345.00]	0.8343	0.1833
8 VOLT	79021 [CURECANT 230.00]	0.8493	0.1833
9 VOLT	79031 [GLENCANY 230.00]	0.9244	0.1833

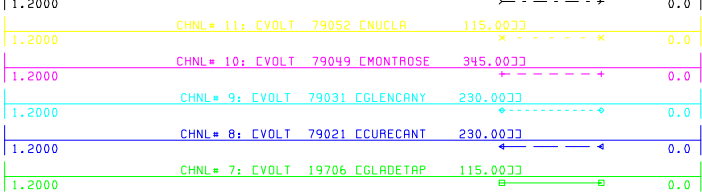
LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
17 FREQ	79052 [NUCLA 115.00]	-0.1363E-02	0.6100
15 FREQ	79021 [CURECANT 230.00]	-0.1360E-02	0.5367
18 FREQ	79063 [SHIPROCK 230.00]	-0.9787E-03	0.5600
13 FREQ	10292 [SAN_JUAN 345.00]	-0.9741E-03	9.5262
14 FREQ	14101 [FOURCORN 345.00]	-0.9732E-03	9.5229
16 FREQ	79031 [GLENCANY 230.00]	-0.9664E-03	9.7129



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\9-SJN-FCN-345-3P4C.out  
CHNL= 12: EVOLT 79072 [HESPERUS 345.00JJ]

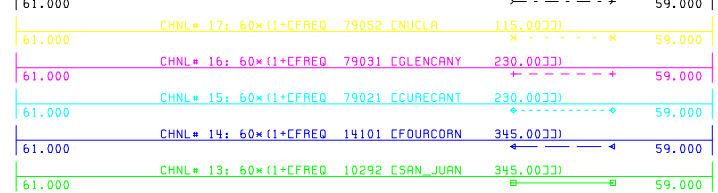


THU, NOV 29 2012 15:49  
9-SJN-FCN 345 3P4C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\9-SJN-FCN-345-3P4C.out  
CHNL= 18: 60\*(1+CFREQ 79063 [SHIPROCK 230.00JJ]

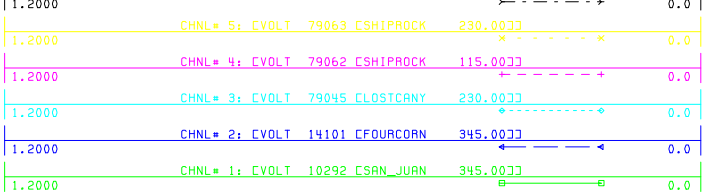


THU, NOV 29 2012 15:49  
9-SJN-FCN 345 3P4C FREQ



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\9-SJN-FCN-345-3P4C.out  
CHNL= 6: EVOLT 79064 [SHIPROCK 345.00JJ]

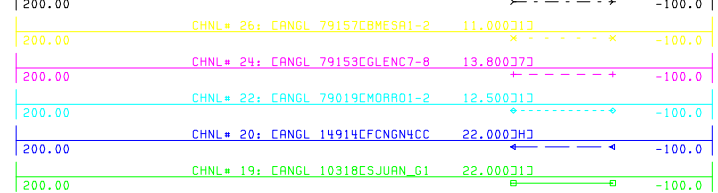


THU, NOV 29 2012 15:49  
9-SJN-FCN 345 3P4C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\9-SJN-FCN-345-3P4C.out  
CHNL= 28: CANGI 79161[NUCLA 4 13.800JJ]



THU, NOV 29 2012 15:49  
9-SJN-FCN 345 3P4C ANGL

LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
7 VOLT	19706 [GLADETAP 115.00]	0.8326	0.1833
4 VOLT	79062 [SHIPROCK 115.00]	0.8591	0.1833
2 VOLT	14101 [FOURCORN 345.00]	0.8643	0.1833
6 VOLT	79064 [SHIPROCK 345.00]	0.8673	0.1833
1 VOLT	10292 [SAN_JUAN 345.00]	0.8680	0.1833
5 VOLT	79063 [SHIPROCK 230.00]	0.8689	0.1833
12 VOLT	79072 [HESPERUS 345.00]	0.8859	0.1833
3 VOLT	79045 [LOSTCANY 230.00]	0.8896	0.1833
10 VOLT	79049 [MONTROSE 345.00]	0.9335	0.1833
11 VOLT	79052 [NUCLA 115.00]	0.9415	0.1833
8 VOLT	79021 [CURECANT 230.00]	0.9704	0.1833
9 VOLT	79031 [GLENCANY 230.00]	0.9745	0.1833

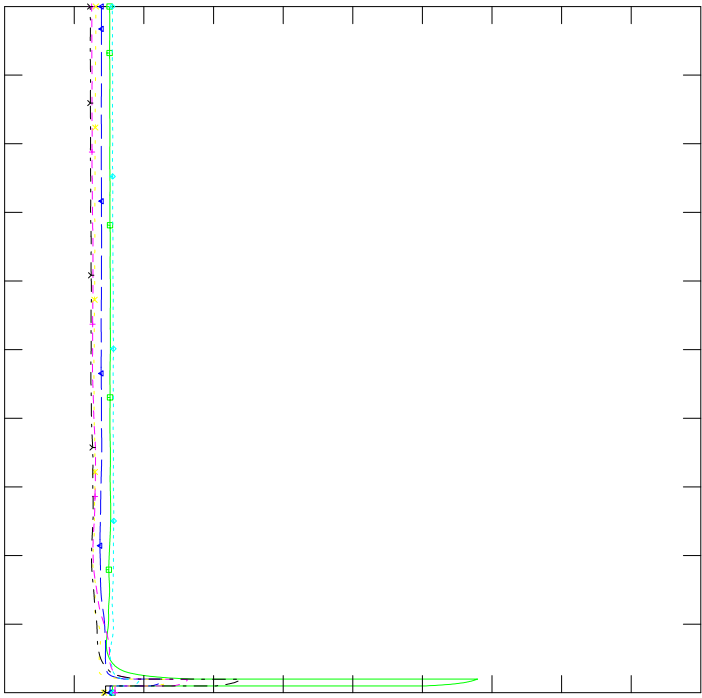
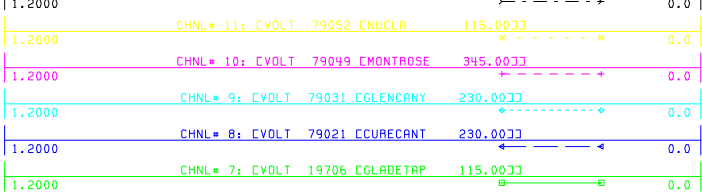
LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
17 FREQ	79052 [NUCLA 115.00]	-0.2701E-02	0.6400
13 FREQ	10292 [SAN_JUAN 345.00]	-0.2396E-02	0.5933
14 FREQ	14101 [FOURCORN 345.00]	-0.2326E-02	0.6000
18 FREQ	79063 [SHIPROCK 230.00]	-0.2299E-02	0.5967
15 FREQ	79021 [CURECANT 230.00]	-0.1997E-02	0.5933
16 FREQ	79031 [GLENCANY 230.00]	-0.9790E-03	9.0296



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\10-SHR-XFMR-1-3P6C.out  
CHNL= 12: EVOLT 79072 [HESPERUS 345.00JJ]

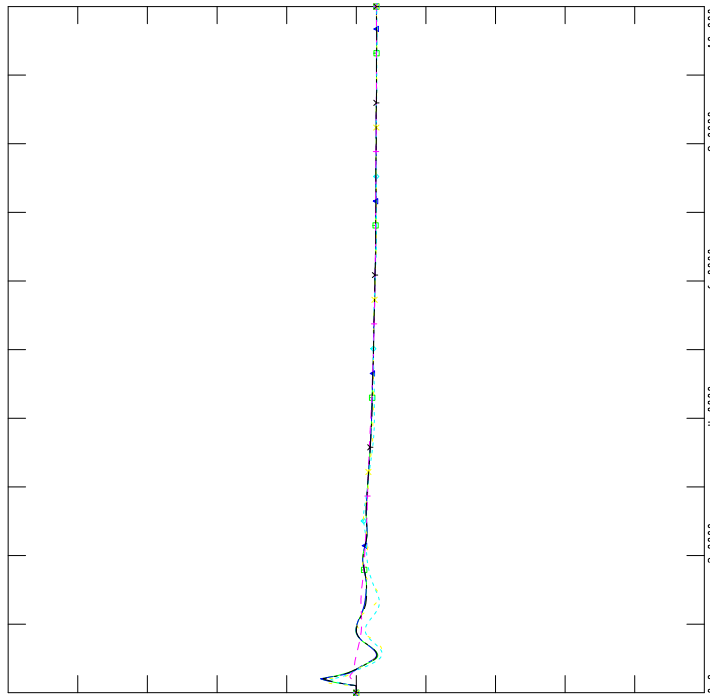
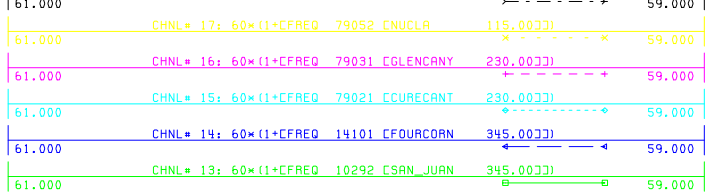


THU, NOV 29 2012 15:50  
10-SHR-XFMR-1 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\10-SHR-XFMR-1-3P6C.out  
CHNL= 18: 60\*(1+CFREQ 79063 [SHIPROCK 230.00JJ]

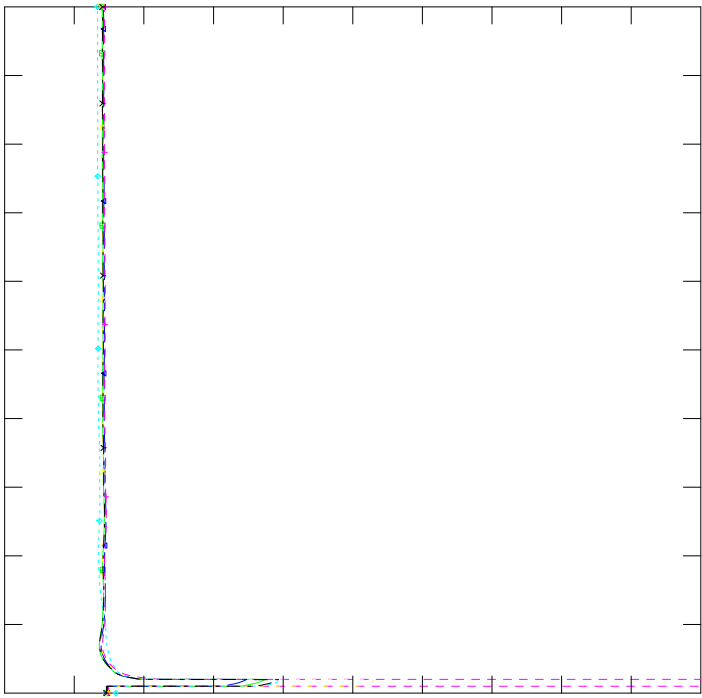
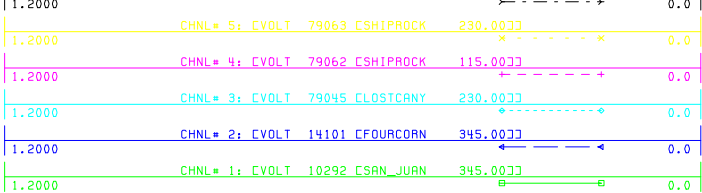


THU, NOV 29 2012 15:50  
10-SHR-XFMR-1 3P6C FREQ



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\10-SHR-XFMR-1-3P6C.out  
CHNL= 6: EVOLT 79064 [SHIPROCK 345.00JJ]

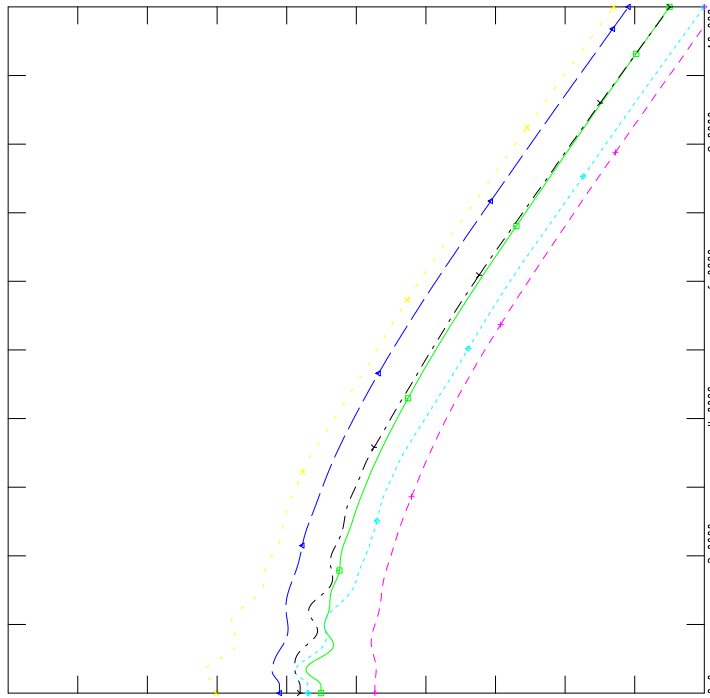
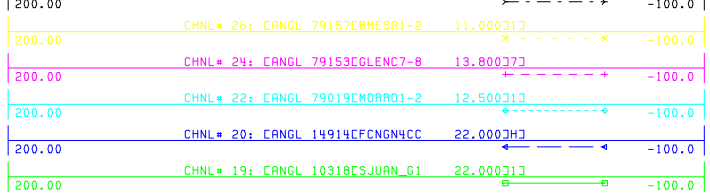


THU, NOV 29 2012 15:50  
10-SHR-XFMR-1 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\10-SHR-XFMR-1-3P6C.out  
CHNL= 28: C[ANGL 79161[NUCLA 4 13.800JJ]



THU, NOV 29 2012 15:50  
10-SHR-XFMR-1 3P6C ANGL



LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
4 VOLT	79062 [SHIPROCK 115.00]	0.2371E-05	0.2000
7 VOLT	19706 [GLADETAP 115.00]	0.3848	0.2000
5 VOLT	79063 [SHIPROCK 230.00]	0.5614	0.2000
3 VOLT	79045 [LOSTCANY 230.00]	0.7252	0.2000
6 VOLT	79064 [SHIPROCK 345.00]	0.7271	0.2000
1 VOLT	10292 [SAN_JUAN 345.00]	0.7511	0.2000
2 VOLT	14101 [FOURCORN 345.00]	0.7835	0.2000
12 VOLT	79072 [HESPERUS 345.00]	0.7922	0.2000
10 VOLT	79049 [MONTROSE 345.00]	0.8848	0.2000
11 VOLT	79052 [NUCLA 115.00]	0.9163	0.1833
8 VOLT	79021 [CURECANT 230.00]	0.9293	0.1867
9 VOLT	79031 [GLENCANY 230.00]	0.9673	0.2000

LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

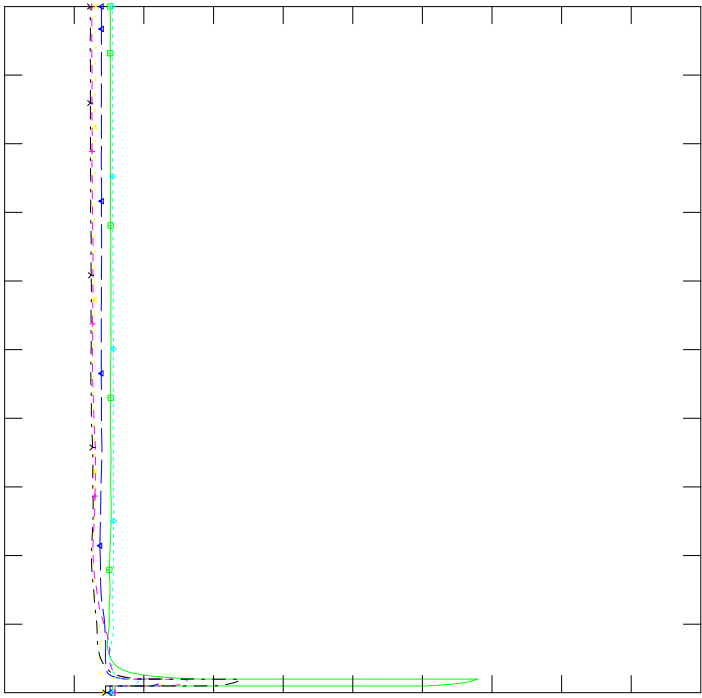
CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
15 FREQ	79021 [CURECANT 230.00]	-0.1236E-02	0.5700
17 FREQ	79052 [NUCLA 115.00]	-0.1221E-02	0.6233
13 FREQ	10292 [SAN_JUAN 345.00]	-0.1028E-02	0.5433
18 FREQ	79063 [SHIPROCK 230.00]	-0.9937E-03	0.5500
14 FREQ	14101 [FOURCORN 345.00]	-0.9775E-03	9.5029
16 FREQ	79031 [GLENCANY 230.00]	-0.9716E-03	9.7129



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\11-SHR-XFMR-2-3P6C.out  
CHNL= 12: EVOLT 79072 [HESPERUS 345.00JJ]

1.2000	CHNL= 11: EVOLT 79052 [NUCLA 115.00JJ]	0.0
1.2000	CHNL= 10: EVOLT 79049 [MONROSE 345.00JJ]	0.0
1.2000	CHNL= 9: EVOLT 79031 [GLENCANY 230.00JJ]	0.0
1.2000	CHNL= 8: EVOLT 79021 [CURECANT 230.00JJ]	0.0
1.2000	CHNL= 7: EVOLT 19706 [GLADETAP 115.00JJ]	0.0



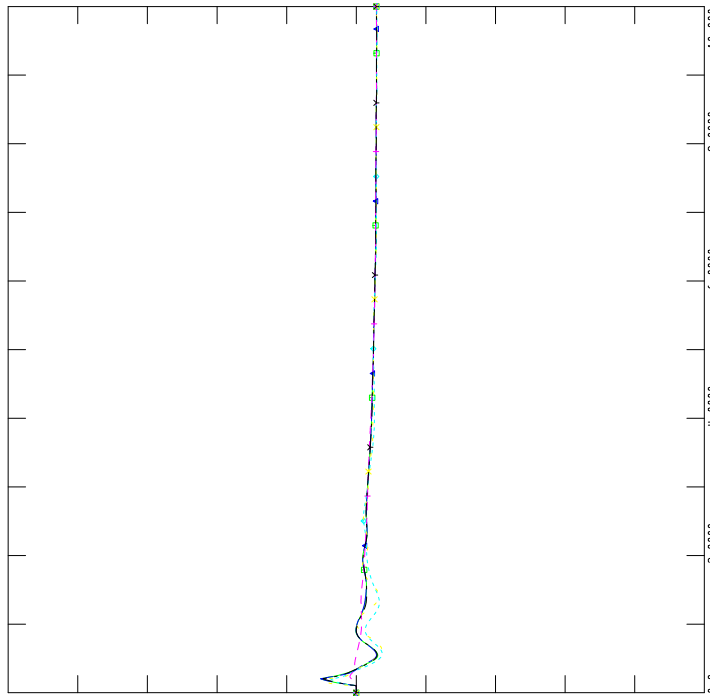
THU, NOV 29 2012 15:52  
11-SHR-XFMR-2 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\11-SHR-XFMR-2-3P6C.out  
CHNL= 18: 60\*(1+CFREQ 79063 [SHIPROCK 230.00JJ]

61.0000	CHNL= 17: 60*(1+CFREQ 79052 [NUCLA 115.00JJ]	59.0000
61.0000	CHNL= 16: 60*(1+CFREQ 79031 [GLENCANY 230.00JJ]	59.0000
61.0000	CHNL= 15: 60*(1+CFREQ 79021 [CURECANT 230.00JJ]	59.0000
61.0000	CHNL= 14: 60*(1+CFREQ 14101 [FOURCORN 345.00JJ]	59.0000
61.0000	CHNL= 13: 60*(1+CFREQ 10292 [SAN_JUAN 345.00JJ]	59.0000



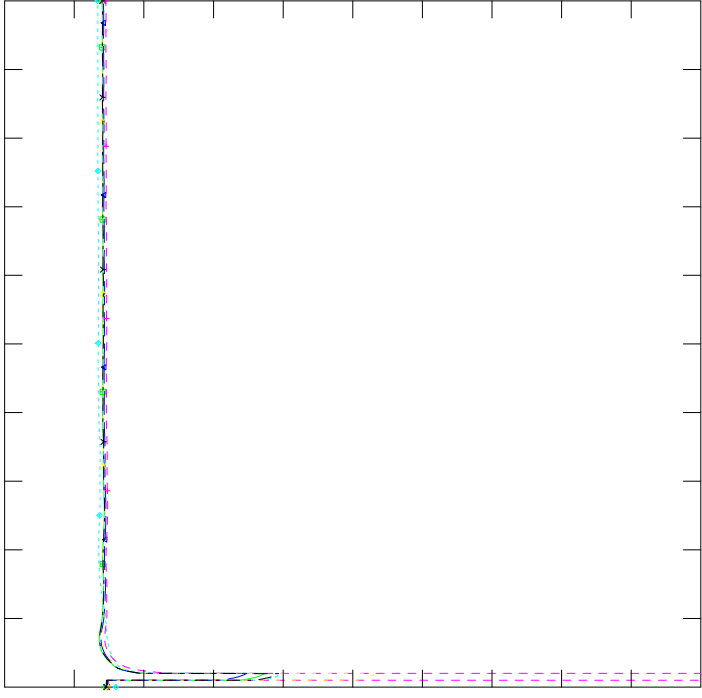
THU, NOV 29 2012 15:52  
11-SHR-XFMR-2 3P6C FREQ



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\11-SHR-XFMR-2-3P6C.out  
CHNL= 6: EVOLT 79064 [SHIPROCK 345.00JJ]

1.2000	CHNL= 5: EVOLT 79063 [SHIPROCK 230.00JJ]	0.0
1.2000	CHNL= 4: EVOLT 79062 [SHIPROCK 115.00JJ]	0.0
1.2000	CHNL= 3: EVOLT 79045 [CLOSTCANY 230.00JJ]	0.0
1.2000	CHNL= 2: EVOLT 14101 [FOURCORN 345.00JJ]	0.0
1.2000	CHNL= 1: EVOLT 10292 [SAN_JUAN 345.00JJ]	0.0



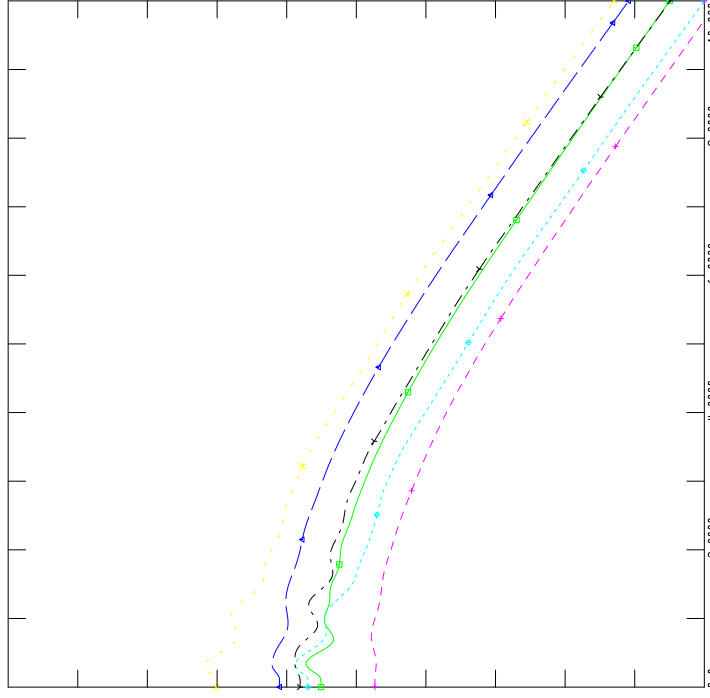
THU, NOV 29 2012 15:52  
11-SHR-XFMR-2 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\11-SHR-XFMR-2-3P6C.out  
CHNL= 28: CANGI 79161[NUCLA 4 13.800JJ]

200.00	CHNL= 26: CANGI 79157[BMESA1-2 11.000JJ]	-100.0
200.00	CHNL= 24: CANGI 79153[GLENC7-8 13.800JJ]	-100.0
200.00	CHNL= 22: CANGI 79019[CMORR01-2 12.500JJ]	-100.0
200.00	CHNL= 20: CANGI 14914[FCNGN4CC 22.000JJ]	-100.0
200.00	CHNL= 19: CANGI 10318[CSJUAN_61 22.000JJ]	-100.0



THU, NOV 29 2012 15:52  
11-SHR-XFMR-2 3P6C ANGL

LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
4 VOLT 79062	[SHIPROCK 115.00]	0.2371E-05	0.2000
7 VOLT 19706	[GLADETAP 115.00]	0.3848	0.2000
5 VOLT 79063	[SHIPROCK 230.00]	0.5614	0.2000
3 VOLT 79045	[LOSTCANY 230.00]	0.7252	0.2000
6 VOLT 79064	[SHIPROCK 345.00]	0.7271	0.2000
1 VOLT 10292	[SAN_JUAN 345.00]	0.7511	0.2000
2 VOLT 14101	[FOURCORN 345.00]	0.7835	0.2000
12 VOLT 79072	[HESPERUS 345.00]	0.7922	0.2000
10 VOLT 79049	[MONTROSE 345.00]	0.8848	0.2000
11 VOLT 79052	[NUCLA 115.00]	0.9163	0.1833
8 VOLT 79021	[CURECANT 230.00]	0.9293	0.1867
9 VOLT 79031	[GLENCANY 230.00]	0.9673	0.2000

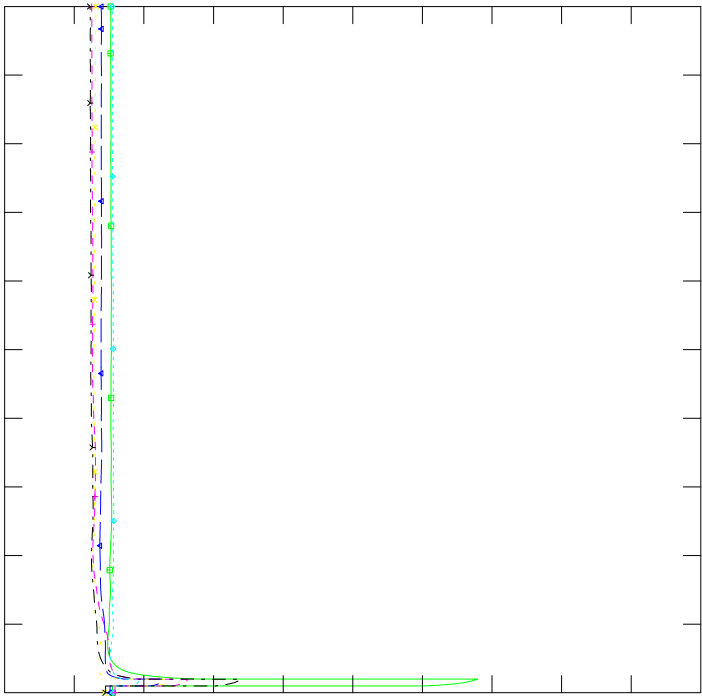
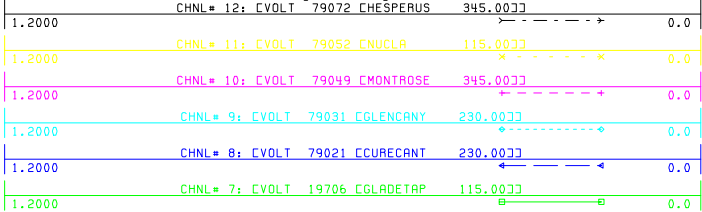
LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
15 FREQ 79021	[CURECANT 230.00]	-0.1239E-02	0.5700
17 FREQ 79052	[NUCLA 115.00]	-0.1225E-02	0.6233
13 FREQ 10292	[SAN_JUAN 345.00]	-0.1028E-02	0.5433
18 FREQ 79063	[SHIPROCK 230.00]	-0.9990E-03	0.5500
14 FREQ 14101	[FOURCORN 345.00]	-0.9783E-03	9.5096
16 FREQ 79031	[GLENCANY 230.00]	-0.9723E-03	9.7129



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\12-SHR-FRU-115-3P6C.out  
CHNL# 12: EVOLT 79072 EHEPERUS 345.00JJ

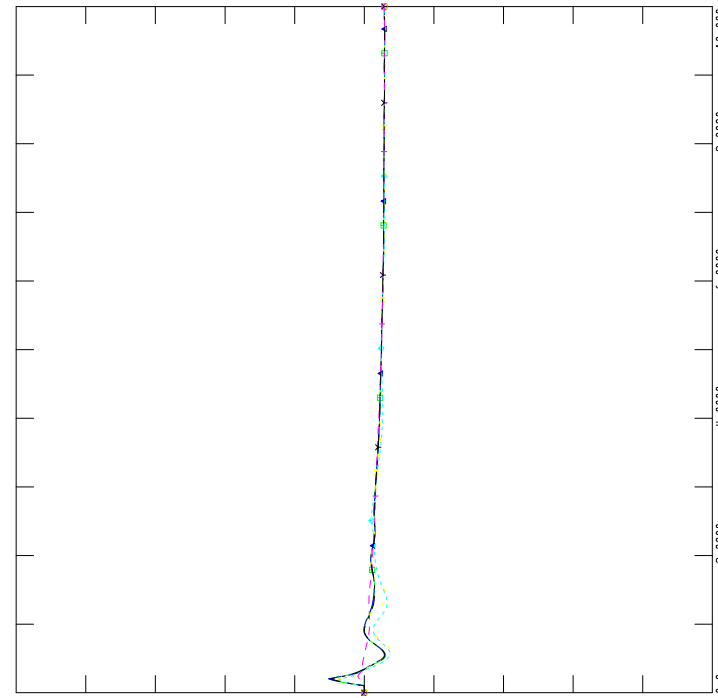
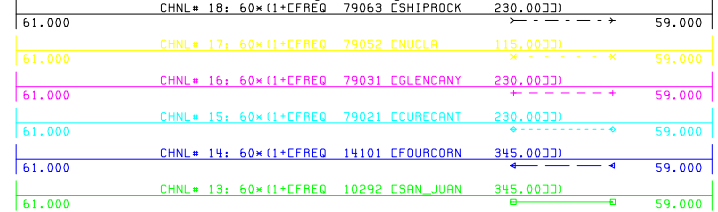


THU, NOV 29 2012 15:53  
12-SHR-FRU 115 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\12-SHR-FRU-115-3P6C.out  
CHNL# 18: 60\*(1+CFREQ) 79063 CSHIPROCK 230.00JJ

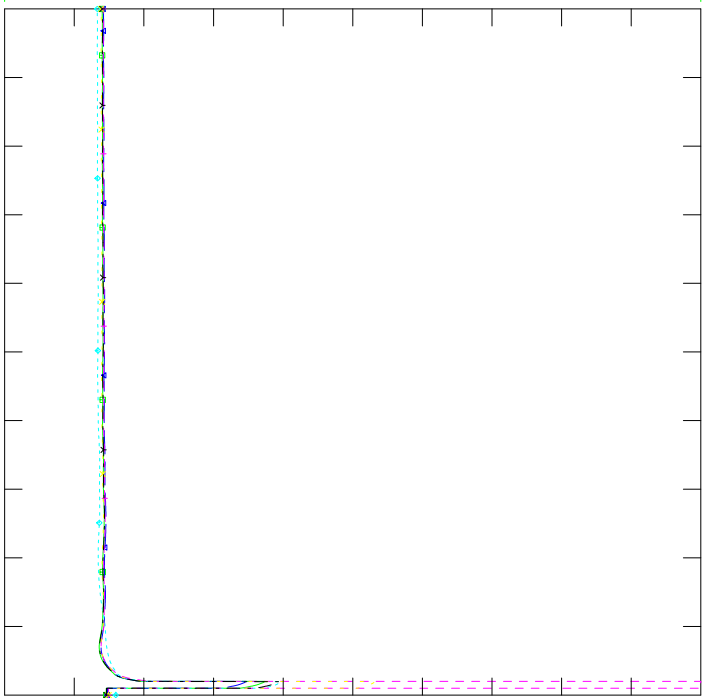
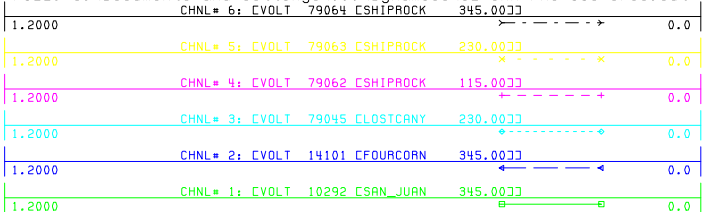


THU, NOV 29 2012 15:53  
12-SHR-FRU 115 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\12-SHR-FRU-115-3P6C.out  
CHNL# 6: EVOLT 79064 CSHIPROCK 345.00JJ

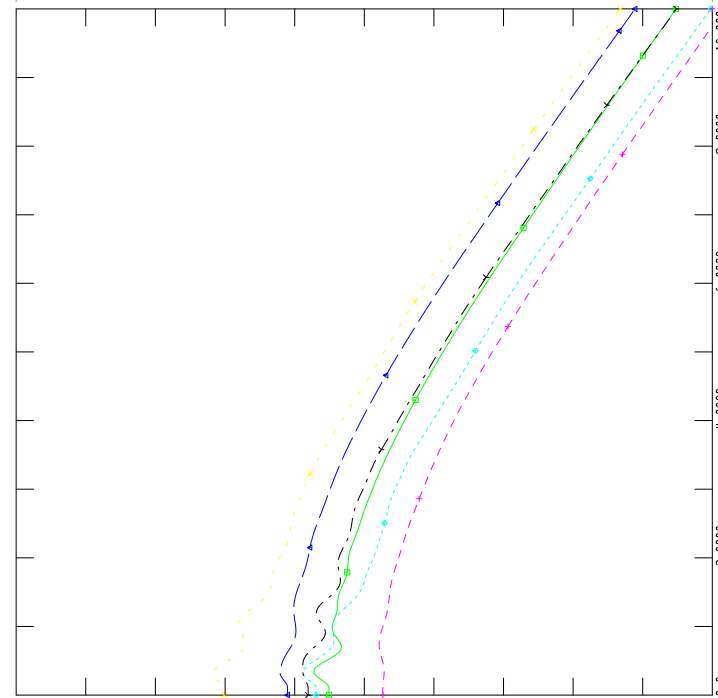
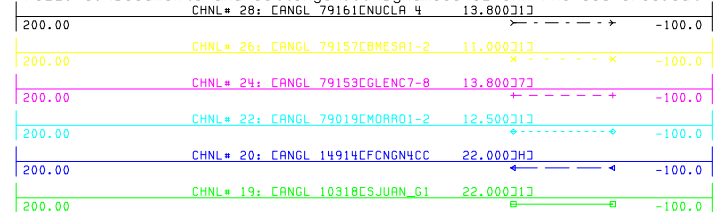


THU, NOV 29 2012 15:52  
12-SHR-FRU 115 3P6C VOLT



WESTERN ELECTRICITY COORDINATING COUNCIL  
2012 HS4A APPROVED OPERATING CASE

FILE: C:\Documents and Settings\...\Dynamics\12-SHR-FRU-115-3P6C.out  
CHNL# 28: CANGI 79161CNUCLA 4 13.800JJ



THU, NOV 29 2012 15:53  
12-SHR-FRU 115 3P6C ANGL

LIST OF 12 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
4 VOLT	79062 [SHIPROCK 115.00]	0.2371E-05	0.2000
7 VOLT	19706 [GLADETAP 115.00]	0.3848	0.2000
5 VOLT	79063 [SHIPROCK 230.00]	0.5614	0.2000
3 VOLT	79045 [LOSTCANY 230.00]	0.7252	0.2000
6 VOLT	79064 [SHIPROCK 345.00]	0.7271	0.2000
1 VOLT	10292 [SAN_JUAN 345.00]	0.7511	0.2000
2 VOLT	14101 [FOURCORN 345.00]	0.7835	0.2000
12 VOLT	79072 [HESPERUS 345.00]	0.7922	0.2000
10 VOLT	79049 [MONTROSE 345.00]	0.8848	0.2000
11 VOLT	79052 [NUCLA 115.00]	0.9163	0.1833
8 VOLT	79021 [CURECANT 230.00]	0.9293	0.1867
9 VOLT	79031 [GLENCANY 230.00]	0.9673	0.2000

LIST OF 6 MINIMUM CHANNEL VALUES  
FROM TIME 0.1830 TO TIME 10.0000

CHANEL X	IDENTIFIER	MIN	TIME (SECONDS)
15 FREQ	79021 [CURECANT 230.00]	-0.1230E-02	0.5700
17 FREQ	79052 [NUCLA 115.00]	-0.1214E-02	0.6233
13 FREQ	10292 [SAN_JUAN 345.00]	-0.1024E-02	0.5467
18 FREQ	79063 [SHIPROCK 230.00]	-0.9866E-03	0.5500
14 FREQ	14101 [FOURCORN 345.00]	-0.9746E-03	9.5063
16 FREQ	79031 [GLENCANY 230.00]	-0.9686E-03	9.7129