Real Time Applications Using Linear State Estimation Technology (RTA/LSE) Project Update

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NASPI Meeting

Neeraj Nayak, Ken Martin, Lin Zhang, Iknoor Singh, Vikram Chiluka and Kevin Chen, EPG

Tony Faris and Thong Trinh, BPA

Atena Darvishi and Alan Ettlinger, NYPA

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Acknowledgement and Disclaimer

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Presentation Outline

- Project Introduction
- RTCA application
- Area Angle application
- Voltage Corridor application
- Q&A

Project Introduction

Background

- **Power system faced with increasing complexity**
  - > Renewable resources
  - > Distributed generation
  - > Market driven power exchanges
- **Phasor measurement offers**
  - > Increased visibility
  - > Faster response
  - > More reliable state estimation
- **EMS/SCADA and Conventional SE**
  - > May fail to converge
  - > Slow response time
- **New applications based on phasor measurement can help address these problems**

Project Objective

- **Develop Real Time Applications Using Phasor Data and Linear State Estimator Technology**
  - Provide operators with actionable intelligence on contingencies, voltage margins, & phase angle limits
- **Applications include**
  - Real Time Contingency Analysis
  - Area Angle Limit Monitoring
  - Voltage Stability Monitoring
- **Project sponsored by the US Department of Energy, Office of Electric Power Systems**

Technical Merit

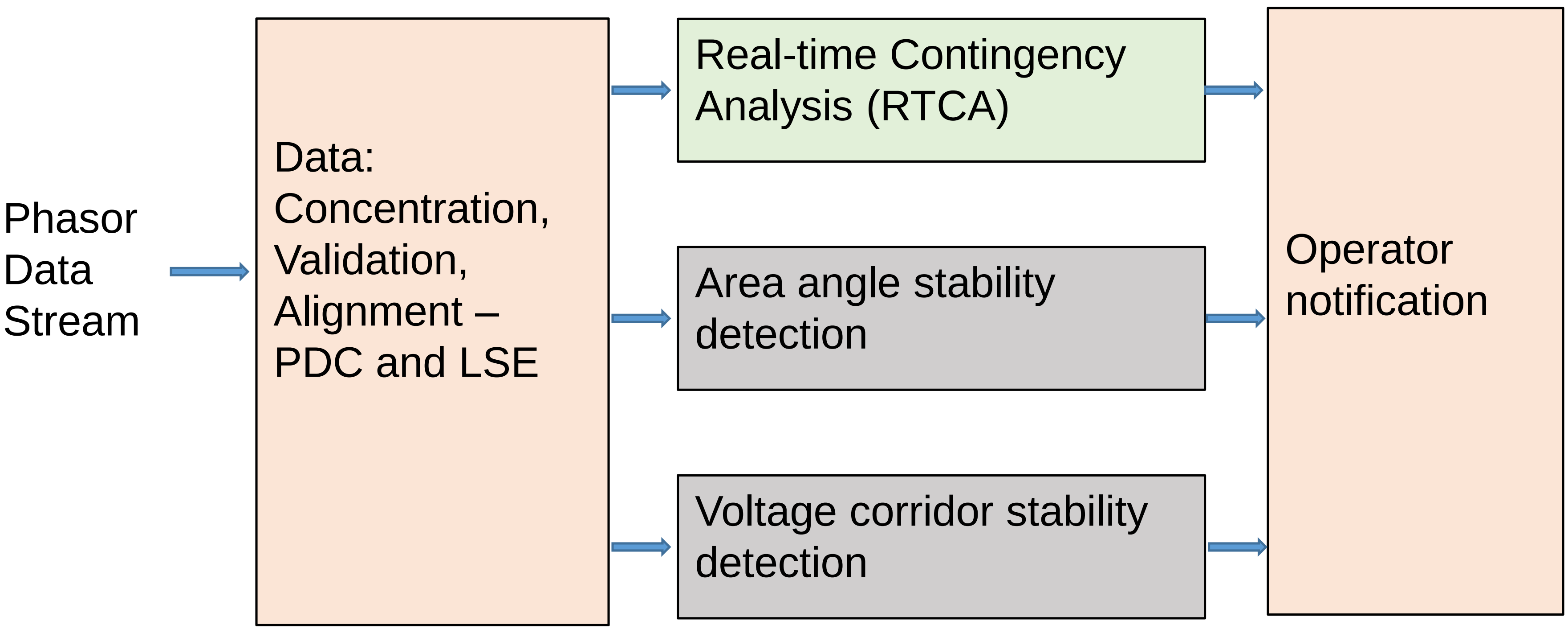
- Assess steady state conditions in real-time under current and what-if conditions.
- Provide timely information about impending grid problems to system operators.
- Allow operators to test switching and dispatch actions to validate system security before taking those actions.
- Test ability to survive the next contingency (NERC N-1 criteria requirement).
- Fast detection of line outages and stressed conditions.
- Fast determination of proximity of the system state to voltage collapse conditions.
- Backup for EMS security violation and contingency assessment

Participants

- DOE/OE and DOE/NETL
  - Phil Overholt, Program Manager and Walter Yamben, Project Manager
- Bonneville Power Administration – cost-share partner
  - Project Manager – Tony Faris and Thong Trinh
- New York Power Authority – cost-share partner
  - Project Manager – Alan Ettlinger and Atena Darvishi
- Technical Advisors
  - Dejan Sobajic, Ian Dobson, Anjan Bose & Anurag Srivastava
- Electric Power Group, LLC
  - Principal Investigators – Ken Martin, Lin Zhang
  - Key Project Personnel –Simon Mo, Neeraj Nayak, Iknoor Singh, Vikram Chiluka, Kevin Chen
- Industry advisors
  - PEAK, PJM, Duke Energy, Dominion

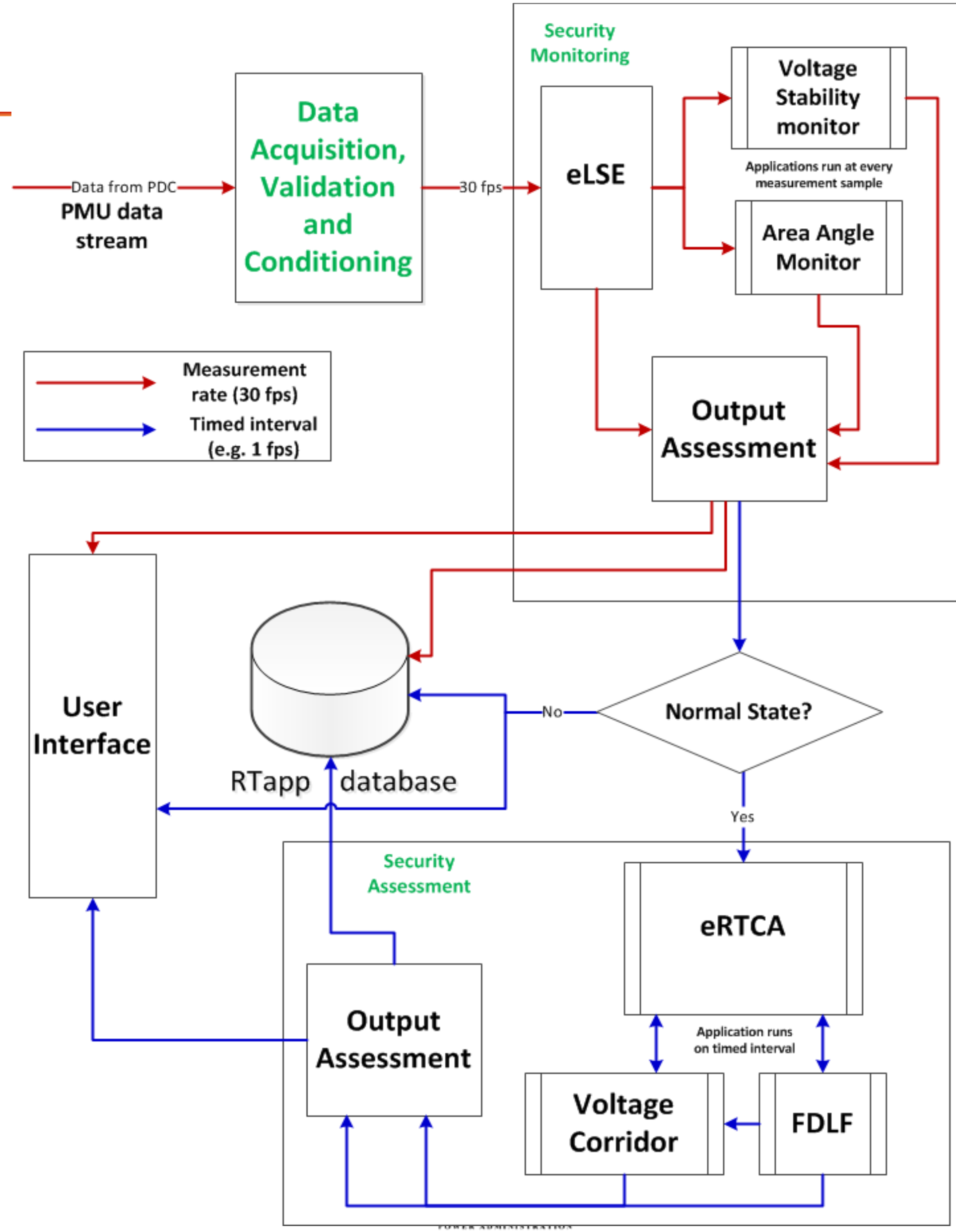
Project approach

- Implement 3 applications to monitor power system
- Test with simulated and recorded data
- Demonstrate at host utilities



Project data flow

- **Phasor Data from system**
- **At measurement speed (30/sec):**
  - > Validation and LSE Conditioning
  - > Area angle test
  - > Voltage corridor stability
- **At application speed (1-10/sec):**
  - > RTCA including voltage stability



Real-time Contingency Analysis (RTCA)

- *Using real-time PMU data*

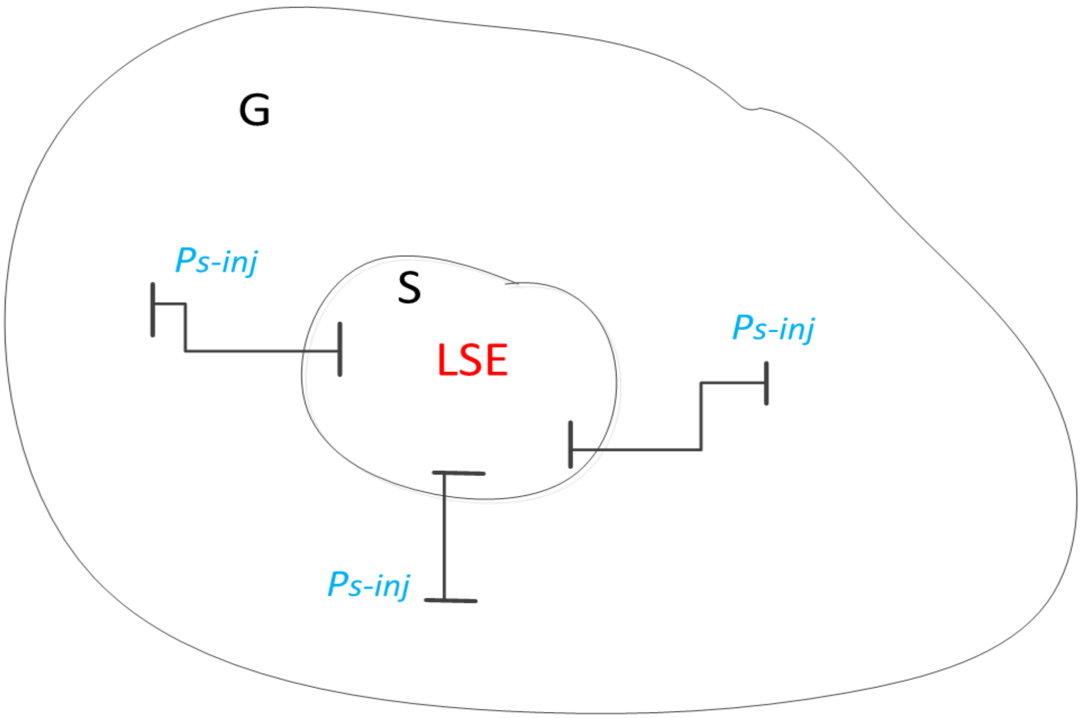
RTCA Operation

- **Study What if Contingency Scenarios**
- **RTCA Engine**
  - Uses PMU and LSE data to initialize the system model and solve for contingencies
  - Sequence through all contingencies in the list and solves using Power Flow Methods – NR/ FDLF
  - Applies RTCA solution to the voltage stability application
  - Provides list of violations (voltage levels, power flow, voltage stability)
- **Automatic operation or Manual Operation (Study Mode)**
- **Outputs**
  - Tabular lists including all affected components, severity
  - One-line displays
  - Alarms on application & sent to other systems

RTCA development

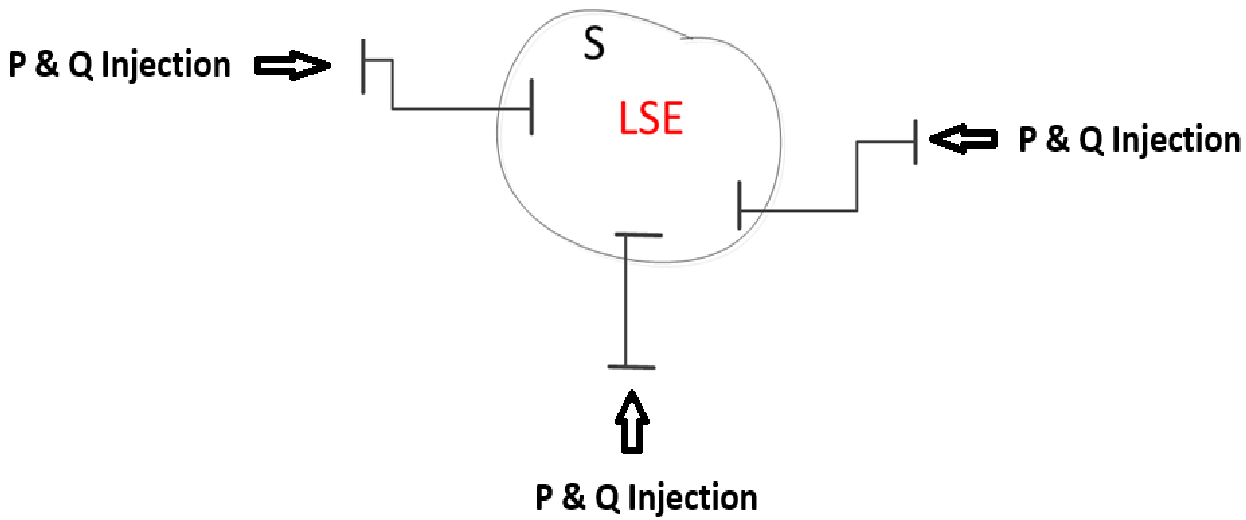
- **PMU observable is small subset of system**
- **Challenges:**
  - > PMU data and LSE provide data for a portion of the system. The rest of the system needs to be equivalenced/reduced or represented fully in the system.
  - > Rest of the system includes: a) Lower voltage levels not observed by PMU/LSE b) Buses geographically adjacent and outside of the boundaries of the system being considered
- **How to account for unobservable part?**
  - > Using base case for whole system
  - > Update case with latest measurements and topology information

Methodology



- Entire Network = G
- LSE observable subnetwork = S
- Ps-inj = Power Injection at Boundary Buses

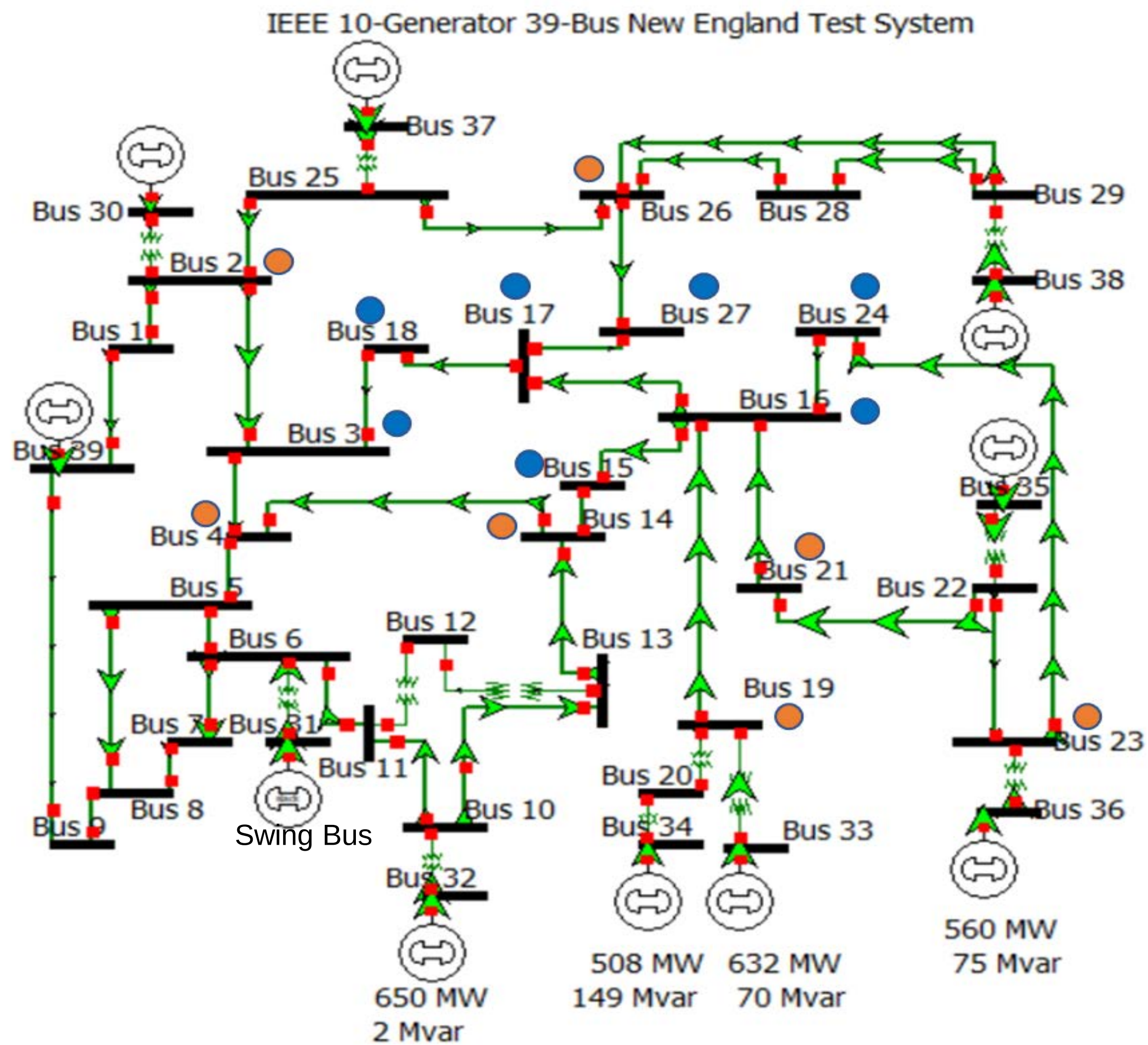
Method 1



- External System is not considered
- Boundary buses are represented by constant Power Injections

Method 1Example - IEEE 39 Test System

- 7 PMU buses
- 7 LSE Derived buses
- Total 14 Buses in Subnetwork S



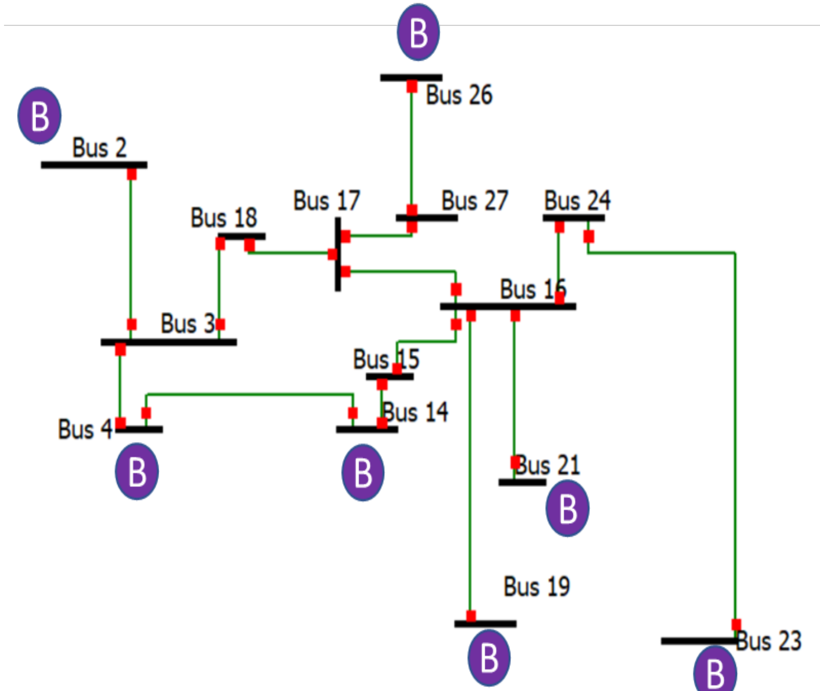
PMU

LSE Derived

Steps

- Create/Setup the base case

    1. Initialize the model with LSE solution results (full system solution) for Voltage and Angle
    2. Treat all buses within network S as swing buses with Voltage and Angle as estimated by LSE
        - Add swing generators, Change Bus Type
    3. Solve power flow to get P,Q injections at all buses
    4. Use P,Q injections as new bus injections
    5. Revert back all buses to load buses
        - Remove swing generators, Change Bus Type
    6. Make sure there is at least 1 Swing bus in the system*
    7. Solve power flow
    8. Save case as base case

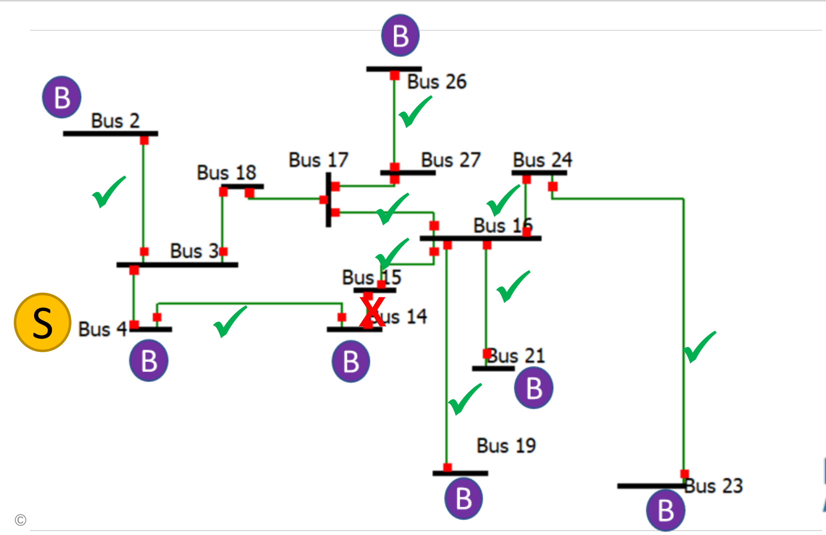


Results – Base Case Solution

	Base Case Solution								
	Voltage Mag (pu)	Voltage Mag (pu)					Power Flow (MW)	Power Flow (MW)	
Bus No	Reduced	Full System	% Error		From Bus	To Bus	Reduced	Full System	% Error
2	1.059897162	1.059875365	0.002056536		2	3	364.7000002	364.7178982	-0.004907355
3	1.056566851	1.056547571	0.001824899		3	4	75.23039813	75.24008624	-0.012876272
4	1.0592	1.059186538	0.001270998		3	18	-34.06958144	-34.06158543	0.023475173
14	1.056149045	1.056139691	0.000885716		4	14	-261.3162533	-261.3055234	0.004106279
15	1.04090898	1.040893101	0.001525528		14	15	30.38219651	30.388844	-0.021874761
16	1.04854909	1.048530679	0.001755968		15	16	-289.7156875	-289.7091189	0.002267317
17	1.051766292	1.051745458	0.001980893		16	17	204.1605379	204.1156302	0.022001116
18	1.052347969	1.052327672	0.001928706		16	19	-451.5297642	-451.5075439	0.004921368
19	1.056021074	1.055994337	0.002531914		16	21	-329.7778375	-329.7364886	0.01253999
21	1.043568056	1.043552449	0.001495576		16	24	-42.68949457	-42.70155209	-0.028236709
23	1.051332757	1.051323814	0.000850651		17	18	192.3313617	192.3233575	0.004161813
24	1.052601512	1.052584399	0.001625837		17	27	11.54644338	11.50966775	0.319519458
26	1.062324284	1.062293381	0.002909055		23	24	353.8000004	353.8122782	-0.003470163
27	1.051759806	1.051733088	0.002540327		26	27	270.4000002	270.4370214	-0.013689385

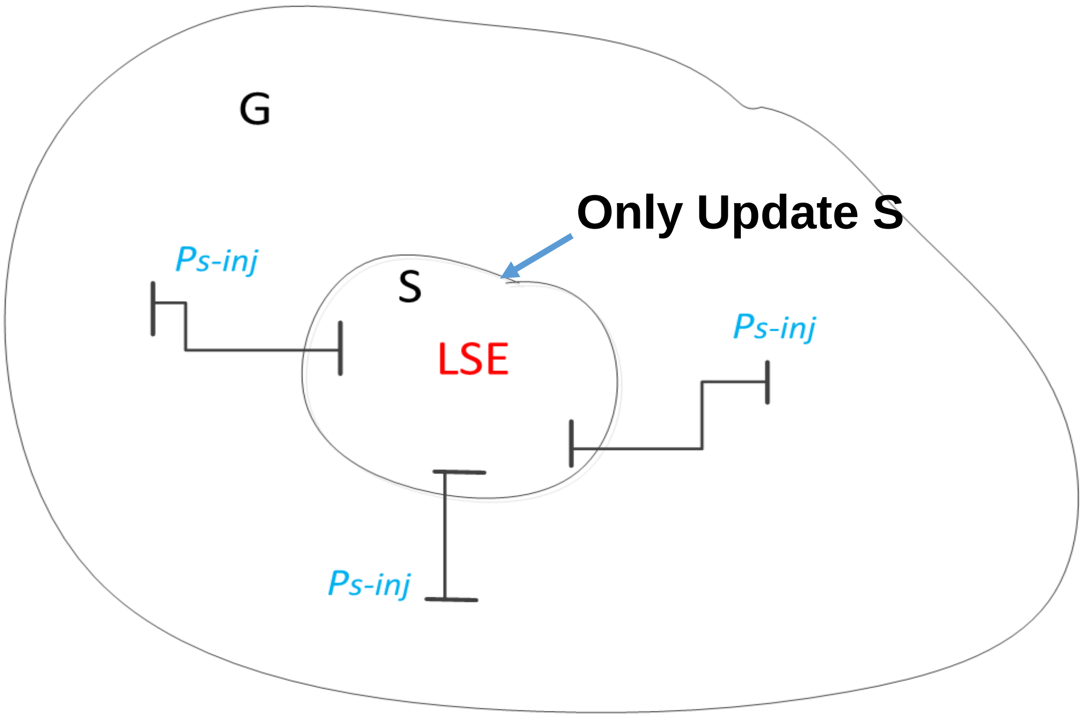
Results – Contingency Line 14 -15

	Bus Results	Voltage Mag					Branch Results		
	Contingency 2 Bus 14 - 15	(pu)					Power Flow (MW)		
Bus No	Reduced System	Full System	% Error		From Bus	To Bus	Reduced System	Full System	% Error
2	1.027010036	1.059447239	-3.06171015		2	3	364.7	363.0725709	0.44823796
3	1.023789346	1.055846923	-3.036195531		3	4	42.4831694	49.29227898	-13.81374471
4	1.0592	1.062935917	-0.351471507		3	18	-1.422496109	-9.746567777	-85.40515859
14	1.062533496	1.063305921	-0.072643758		4	14	-291.5935573	-283.6447089	2.802396143
15	0.953271098	1.023334859	-6.8466114		14	15	0	0	
16	0.971082324	1.039761297	-6.605263381		15	16	-319.9999999	-320	-2.20319E-08
17	0.98671413	1.045953383	-5.663660919		16	17	172.3145521	173.3111191	-0.575016243
18	0.999458311	1.048486797	-4.676118641		16	19	-451.0390324	-451.4075396	-0.081635165
19	0.978065487	1.052769621	-7.09596216		16	21	-329.6372206	-329.6683994	-0.009457649
21	0.965255079	1.037382101	-6.952792206		16	24	-42.2613597	-42.69355382	-1.012317038
23	0.970995841	1.047904287	-7.339262504		17	18	160.1732015	167.975956	-4.645161549
24	0.974659765	1.04459146	-6.694645504		17	27	11.67372254	5.094286941	129.1532195
26	0.996450441	1.05959623	-5.959419897		23	24	353.7999999	353.8270726	-0.007651393
27	0.985522236	1.047546314	-5.920891182		26	27	270.4	276.9166377	-2.353285022



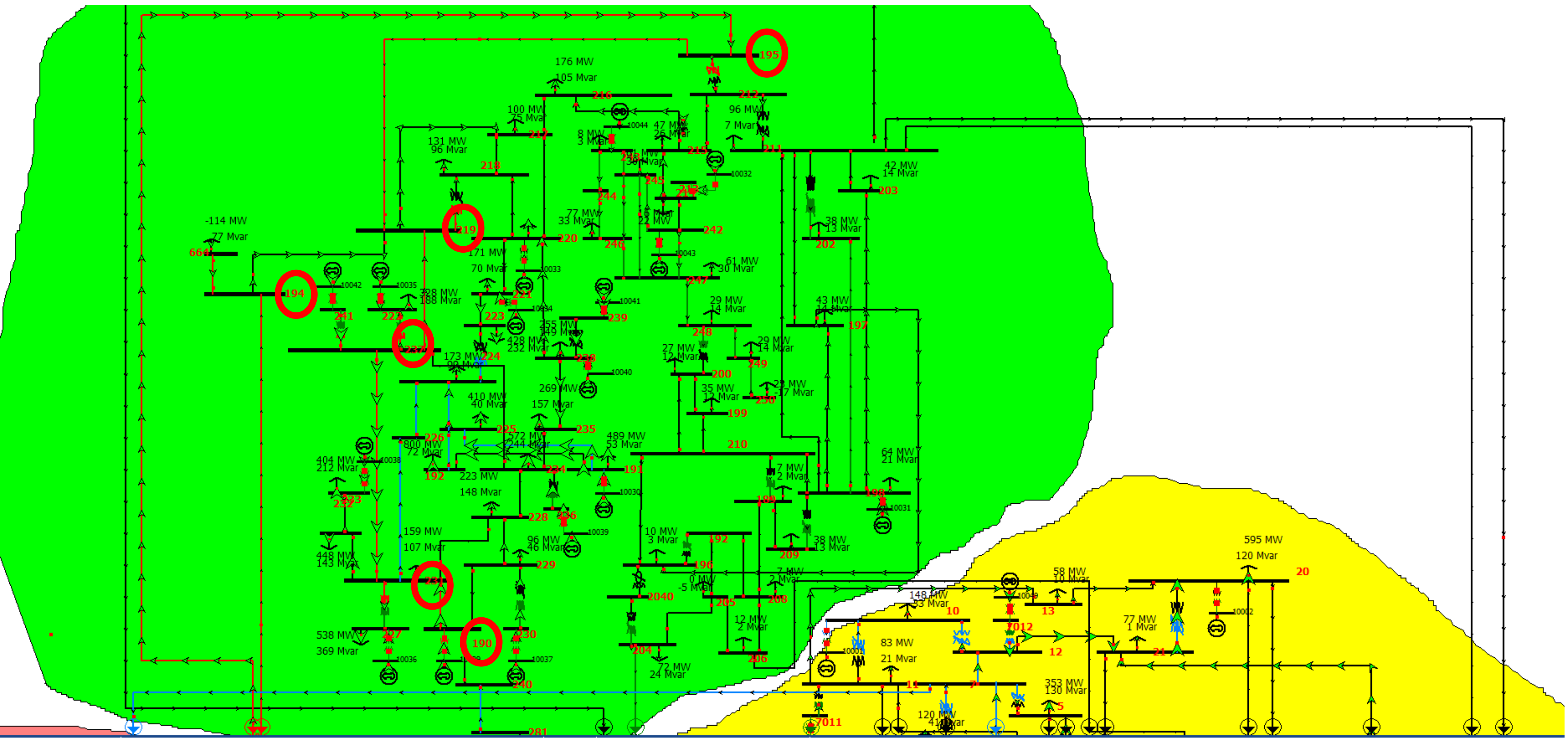
Swing Bus = Bus 4

Method 2



- Use the entire system G, keeping rest of the system outside of S also in the model
- However, only S is updated based on LSE results

IEEE 300 Bus Test System - Observable Buses



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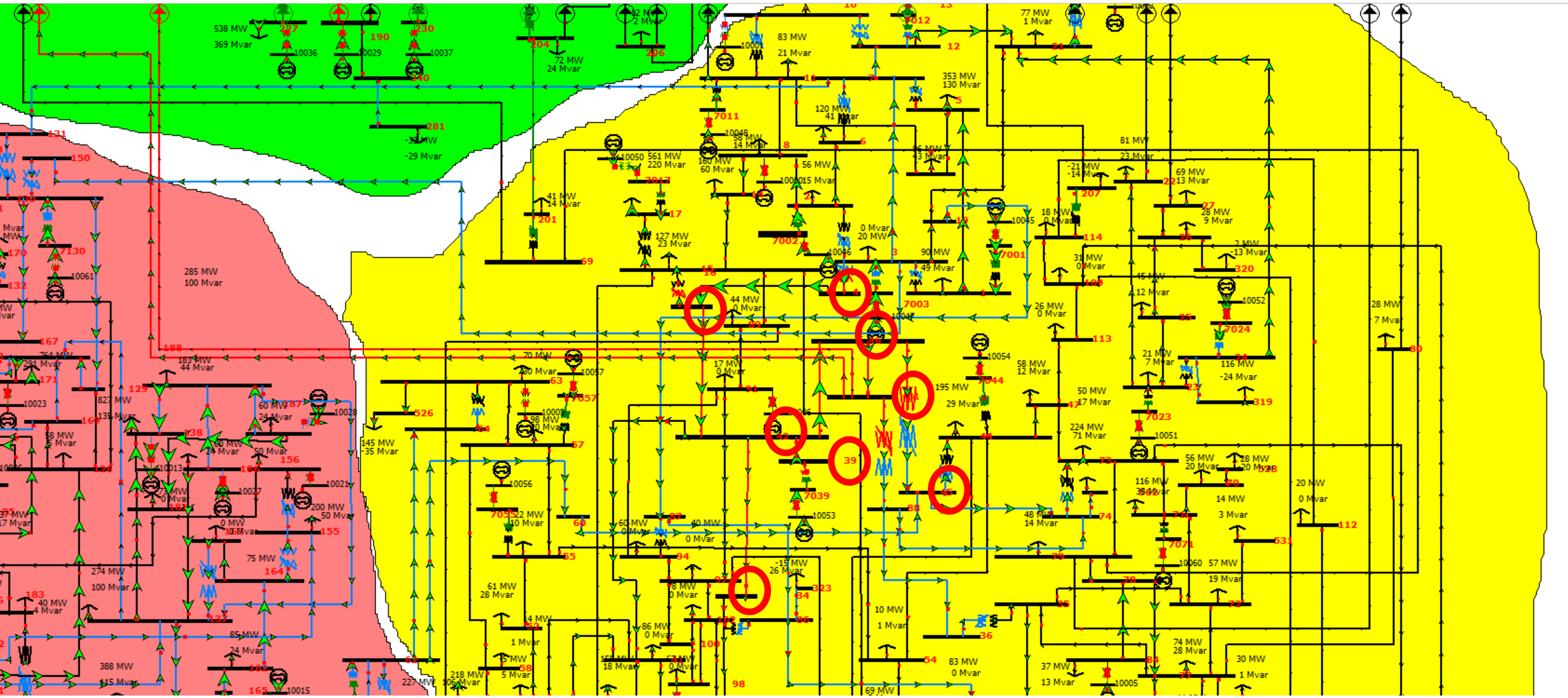
NETL

New York Power Authority

IEEE 300 Bus Test System - Observable Buses



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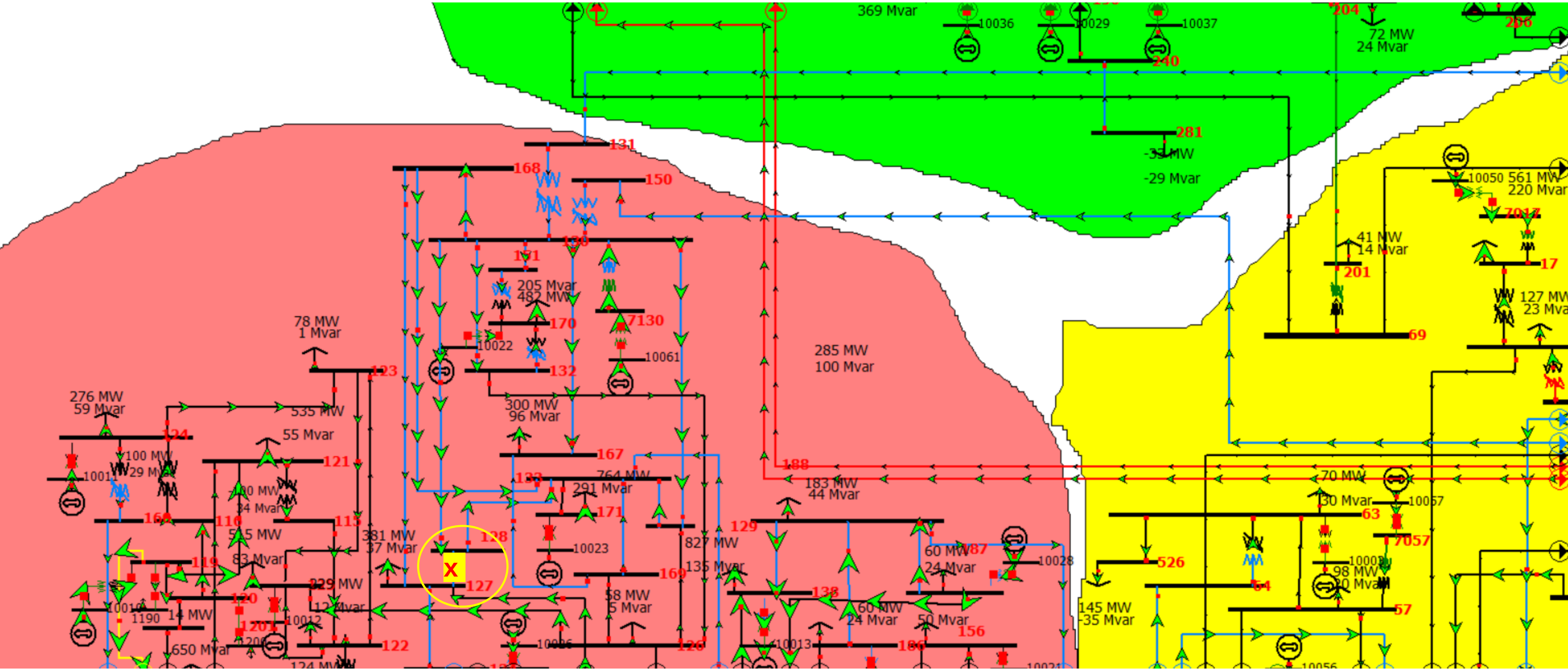
Contingency Line 127 - 128



Results

- **Base Case Solution – 10 % Scaled Base Case**
- **Contingency 127-128**

Contingency line 127_128

	Bus Results					Branch Results		
	Original	10 % Scaled				Original	10% Scaled	
Bus No.	VM (pu)	VM(pu)	Error (%)	From	To	Power(M	Power(M	Error (%)
1.00	1.03	1.03	-0.28	37.00	9,001.00	79.63	87.65	10.07
2.00	1.04	1.03	-0.12	9,001.00	9,005.00	36.20	39.89	10.19
3.00	1.00	1.00	-0.16	9,001.00	9,006.00	26.43	29.05	9.91
4.00	1.03	1.03	0.01	9,001.00	9,012.00	16.99	18.70	10.06
5.00	1.02	1.02	-0.37	9,005.00	9,051.00	36.04	39.67	10.07
6.00	1.03	1.03	-0.18	9,005.00	9,052.00	30.24	33.29	10.12
7.00	0.99	0.99	-0.20	9,005.00	9,053.00	27.92	30.72	10.02
8.00	1.02	1.02	0.00	9,005.00	9,054.00	-50.00	-55.00	10.00
9.00	1.00	1.00	-0.34	9,005.00	9,055.00	-8.00	-8.80	10.00
10.00	1.02	1.02	0.00	9,006.00	9,007.00	9.47	10.40	9.78
11.00	1.01	1.00	-0.12	9,006.00	9,003.00	8.39	9.22	9.80
12.00	1.00	1.00	-0.18	9,006.00	9,003.00	8.39	9.22	9.80
13.00	1.00	1.00	-0.13	9,012.00	9,002.00	6.52	7.17	9.97
14.00	1.00	0.99	-0.45	9,012.00	9,002.00	6.52	7.17	9.97
15.00	1.03	1.03	-0.27	9,002.00	9,021.00	7.35	8.08	9.93
16.00	1.03	1.03	0.00	9,021.00	9,023.00	0.95	1.05	9.76
17.00	1.06	1.06	-0.50	9,021.00	9,022.00	1.62	1.77	9.60
19.00	0.98	0.98	-0.28	9,002.00	9,024.00	1.43	1.57	9.60
20.00	1.00	1.00	0.00	9,023.00	9,025.00	0.47	0.52	9.62
21.00	0.98	0.97	-0.22	9,023.00	9,026.00	0.47	0.52	9.62
22.00	1.00	0.99	-0.21	9,007.00	9,071.00	1.07	1.18	9.47
23.00	1.05	1.05	-0.07	9,007.00	9,072.00	1.07	1.17	9.45
24.00	1.01	1.00	-0.14	9,007.00	9,003.00	7.27	7.98	9.75
25.00	1.02	1.02	-0.37	9,003.00	9,031.00	1.96	2.15	9.61
26.00	1.00	0.99	-0.63	9,003.00	9,032.00	1.47	1.61	9.59
27.00	0.98	0.97	-0.75	9,003.00	9,033.00	2.01	2.21	9.65
33.00	1.02	1.02	-0.28	9,003.00	9,044.00	4.41	4.84	9.89
34.00	1.04	1.04	0.00	9,044.00	9,004.00	4.39	4.82	9.83
35.00	0.98	0.97	-0.09	9,004.00	9,041.00	1.06	1.16	9.45
36.00	1.00	1.00	-0.20	9,004.00	9,042.00	0.86	0.94	9.55
37.00	1.02	1.02	-0.38	9,004.00	9,043.00	1.60	1.77	10.05
38.00	1.02	1.02	-0.34	9,003.00	9,034.00	1.63	1.79	9.33
39.00	1.05	1.05	0.00	9,003.00	9,035.00	1.76	1.93	9.50
40.00	1.02	1.02	-0.32	9,003.00	9,036.00	3.05	3.35	10.09
41.00	1.03	1.03	-0.22	9,003.00	9,037.00	1.97	2.16	9.47
42.00	1.04	1.04	0.00	9,003.00	9,038.00	2.74	3.01	9.56
43.00	1.00	1.00	-0.56	9,012.00	9,121.00	3.84	4.23	10.12
44.00	1.01	1.00	-0.42	9,053.00	9,533.00	1.30	1.42	9.16
45.00	1.02	1.02	-0.31	1.00	5.00	402.05	441.48	9.81
46.00	1.03	1.03	0.00	2.00	6.00	158.72	176.90	11.46
47.00	0.98	0.97	-0.74	2.00	8.00	364.76	396.33	8.66
48.00	1.00	1.00	-0.46	3.00	7.00	260.94	285.79	9.53
49.00	1.05	1.05	-0.10	3.00	19.00	138.99	151.19	8.78
51.00	1.03	1.02	-0.35	3.00	150.00	94.73	108.62	14.66
52.00	1.00	0.99	-0.71	4.00	16.00	710.22	712.55	0.33
53.00	1.00	0.99	-0.64	5.00	9.00	119.22	129.25	8.41
54.00	1.01	1.00	-0.55	7.00	12.00	180.15	196.23	8.93

Base Case Solution Comparison

	Bus Results					Branch Results		
	Original Syst	10 % Scaled				Original	10% Scaled	
Bus No	VM (pu)	VM(pu)	Error (%)	From	To	Power(M	Power(M	Error (%)
1.00	1.03	1.03	-0.28	37.00	9,001.00	79.63	87.65	10.07
2.00	1.04	1.03	-0.12	9,001.00	9,005.00	36.20	39.89	10.19
3.00	1.00	1.00	-0.16	9,001.00	9,006.00	26.43	29.05	9.91
4.00	1.03	1.03	0.00	9,001.00	9,012.00	16.99	18.70	10.06
5.00	1.02	1.02	-0.37	9,005.00	9,051.00	36.04	39.67	10.08
6.00	1.03	1.03	-0.18	9,005.00	9,052.00	30.24	33.29	10.12
7.00	0.99	0.99	-0.20	9,005.00	9,053.00	27.92	30.72	10.02
8.00	1.02	1.02	0.00	9,005.00	9,054.00	-50.00	-55.00	10.00
9.00	1.00	1.00	-0.34	9,005.00	9,055.00	-8.00	-8.80	10.00
10.00	1.02	1.02	0.00	9,006.00	9,007.00	9.47	10.40	9.78
11.00	1.01	1.00	-0.12	9,006.00	9,003.00	8.39	9.22	9.80
12.00	1.00	1.00	-0.18	9,006.00	9,003.00	8.39	9.22	9.80
13.00	1.00	1.00	-0.13	9,012.00	9,002.00	6.52	7.17	9.97
14.00	1.00	0.99	-0.45	9,012.00	9,002.00	6.52	7.17	9.97
15.00	1.03	1.03	-0.27	9,002.00	9,021.00	7.35	8.08	9.93
16.00	1.03	1.03	0.00	9,021.00	9,023.00	0.95	1.05	9.76
17.00	1.06	1.06	-0.50	9,021.00	9,022.00	1.62	1.77	9.60
19.00	0.98	0.98	-0.28	9,002.00	9,024.00	1.43	1.57	9.60
20.00	1.00	1.00	0.00	9,023.00	9,025.00	0.47	0.52	9.62
21.00	0.98	0.97	-0.22	9,023.00	9,026.00	0.47	0.52	9.62
22.00	1.00	0.99	-0.21	9,007.00	9,071.00	1.07	1.18	9.47
23.00	1.05	1.05	-0.07	9,007.00	9,072.00	1.07	1.17	9.44
24.00	1.01	1.00	-0.14	9,007.00	9,003.00	7.27	7.98	9.75
25.00	1.02	1.02	-0.37	9,003.00	9,031.00	1.96	2.15	9.61
26.00	1.00	0.99	-0.63	9,003.00	9,032.00	1.47	1.61	9.59
27.00	0.98	0.97	-0.75	9,003.00	9,033.00	2.01	2.21	9.65
33.00	1.02	1.02	-0.29	9,003.00	9,044.00	4.41	4.84	9.89
34.00	1.04	1.04	0.00	9,044.00	9,004.00	4.39	4.82	9.83
35.00	0.98	0.97	-0.09	9,004.00	9,041.00	1.06	1.16	9.45
36.00	1.00	1.00	-0.20	9,004.00	9,042.00	0.86	0.94	9.55
37.00	1.02	1.02	-0.39	9,004.00	9,043.00	1.60	1.77	10.05
38.00	1.02	1.02	-0.35	9,003.00	9,034.00	1.63	1.79	9.32
39.00	1.05	1.05	0.00	9,003.00	9,035.00	1.76	1.93	9.50
40.00	1.02	1.02	-0.33	9,003.00	9,036.00	3.05	3.35	10.09
41.00	1.03	1.03	-0.23	9,003.00	9,037.00	1.97	2.16	9.47
42.00	1.04	1.04	0.00	9,003.00	9,038.00	2.74	3.01	9.56
43.00	1.00	1.00	-0.57	9,012.00	9,121.00	3.84	4.23	10.12
44.00	1.01	1.00	-0.42	9,053.00	9,533.00	1.30	1.42	9.16
45.00	1.02	1.02	-0.31	1.00	5.00	402.07	441.43	9.79
46.00	1.03	1.03	0.00	2.00	6.00	158.51	176.79	11.54
47.00	0.98	0.97	-0.75	2.00	8.00	365.11	396.43	8.58
48.00	1.00	1.00	-0.47	3.00	7.00	260.14	284.09	9.21
49.00	1.05	1.05	-0.10	3.00	19.00	139.13	151.18	8.66
51.00	1.03	1.02	-0.36	3.00	150.00	92.90	105.97	14.07
52.00	1.00	0.99	-0.72	4.00	16.00	712.55	712.55	0.00
53.00	1.00	0.99	-0.65	5.00	9.00	119.33	129.28	8.33
54.00	1.01	1.00	-0.56	7.00	12.00	180.49	196.36	8.79

E 300 B
results

Applying Methods to BPA system

- WECC Planning Case 2020 HS (~ 20,000 Buses)
- Subnetwork – 500 kV BPA System
  - > Buses – 162
  - > Branches – 196

Observations

1. Results for observable buses are accurate
2. Results for external system buses and lines have around the same % error as the initial base case and is proportional to the mismatch between the base case and real-time solution
3. Contingencies near boundary buses may not give accurate results at the boundary especially when boundary conditions are different in the base case
4. Adding more measurements and/or including lower voltage measurements improves the accuracy of the results
5. Results with the larger system (300 buses) are in general better than 39 buses

Next Steps

- Test with BPA System
  - Method 1
  - Method 2
- Test Different scenarios for Method 2
  - Base case with different loading than real-time scenario
  - Base case with different topology in external system
  - Base case with different topology in subnetwork S
- Integrate with LSE and run in real-time
- Work on output result displays

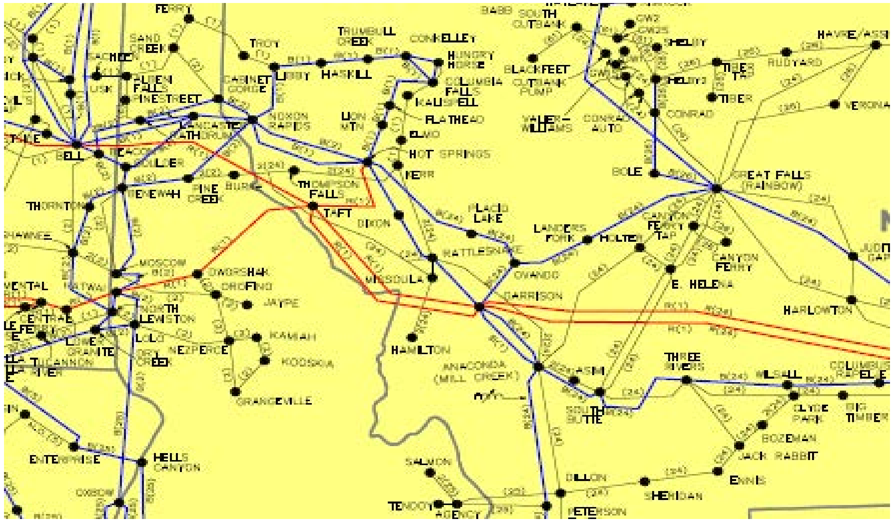
Area Angle Limit Monitoring

- *Monitoring multiple line outages inside an area using synchrophasors*

Area-angle application

- Power flow creates a phase angle
- Higher angles result from
  - Higher power flow
  - Higher impedance (fewer lines carrying flow)
- Angle can indicate excessive stress or a lost transmission line
- Area angle indicates transmission failure or overloads

Power flow into area



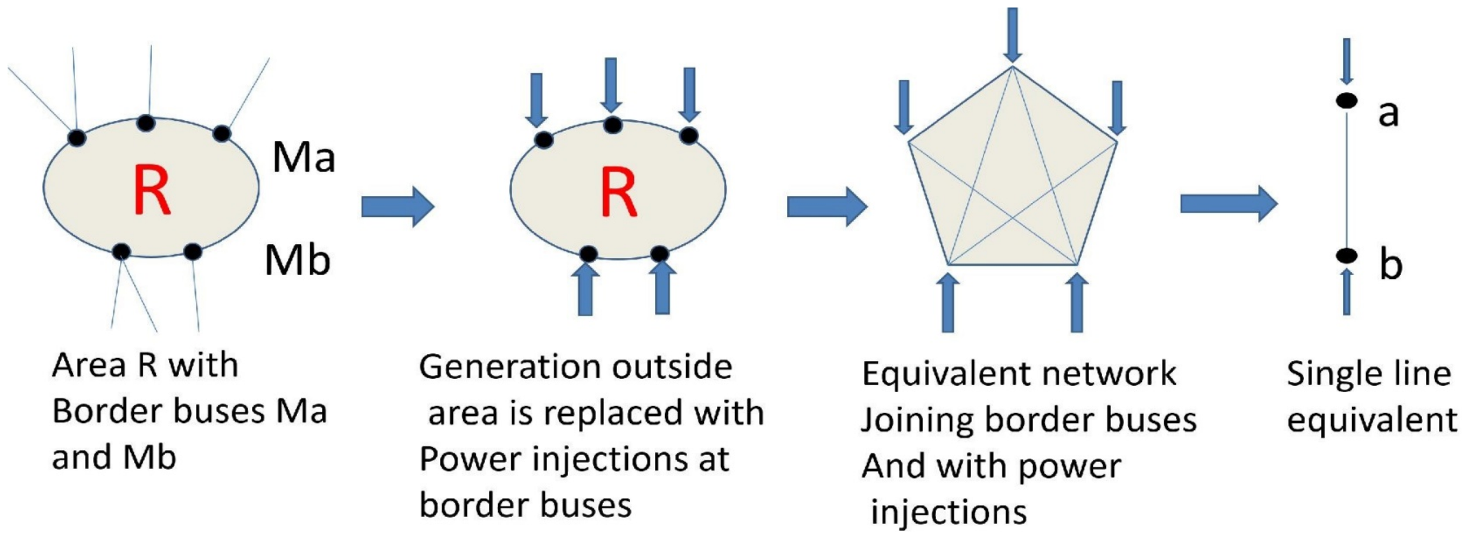
Power flow out of area

Procedure to monitor the multiple line contingencies

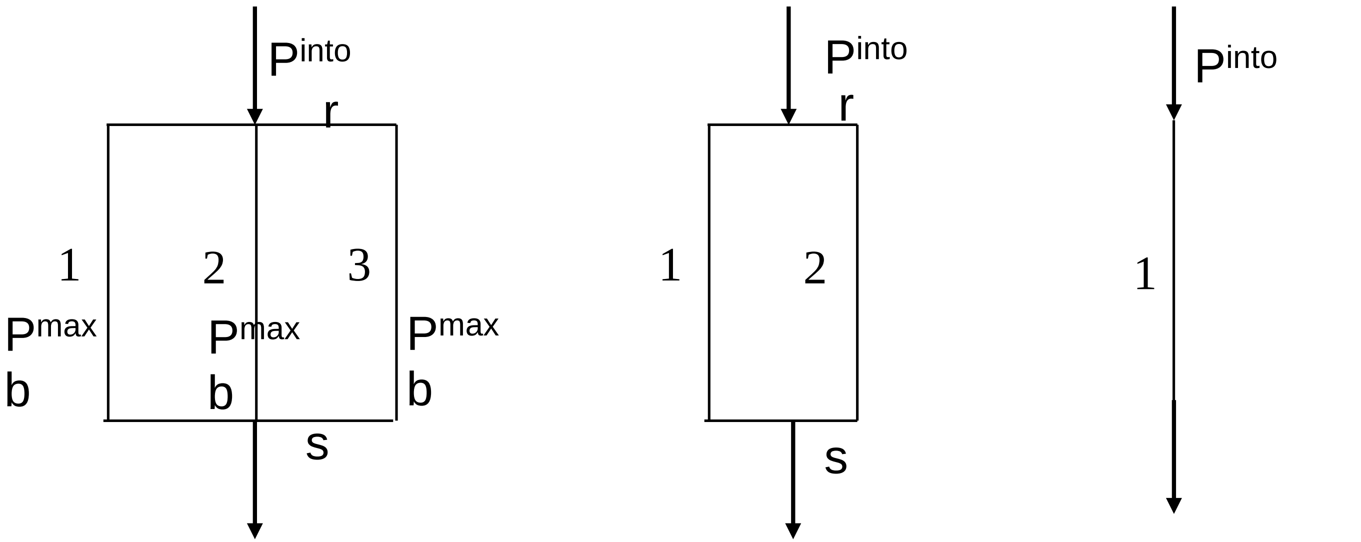
- Different types of areas – Generation, Load and transfer path. The method is tested on load and transfer path areas.
- Select boundary buses such that they form a cutset (Cutset buses when removed separate the area from the network).
- Reduction of the area gives the weights at the boundary buses. (weights are scalar and are related to the impedance of the reduced area).
- Run the single line contingencies to get the thresholds (Offline computations).
- In real time get the PMU measurement of voltage angle at the border buses and compute the area angle. Compare this area angle with thresholds to monitor the multiple contingencies.
- The method can monitor multiple line contingencies inside the area but do not reveal which lines are outaged.

Methodology: Reduction of an Area

- Any area with properly chosen border bus cutset can be reduced to a single line equivalent.



Monitoring multiple outages using area angle



$$P_{rs}^{\max(0)} = 3P^{\max}$$

$$\theta^{rs(0)} = \frac{P^{into}}{3b}$$

$$P_{rs}^{\max(1)} = 2P^{\max}$$

$$\theta^{rs(1)} = \frac{P^{into}}{2b}$$

$$P_{rs}^{\max(2)} = P^{\max}$$

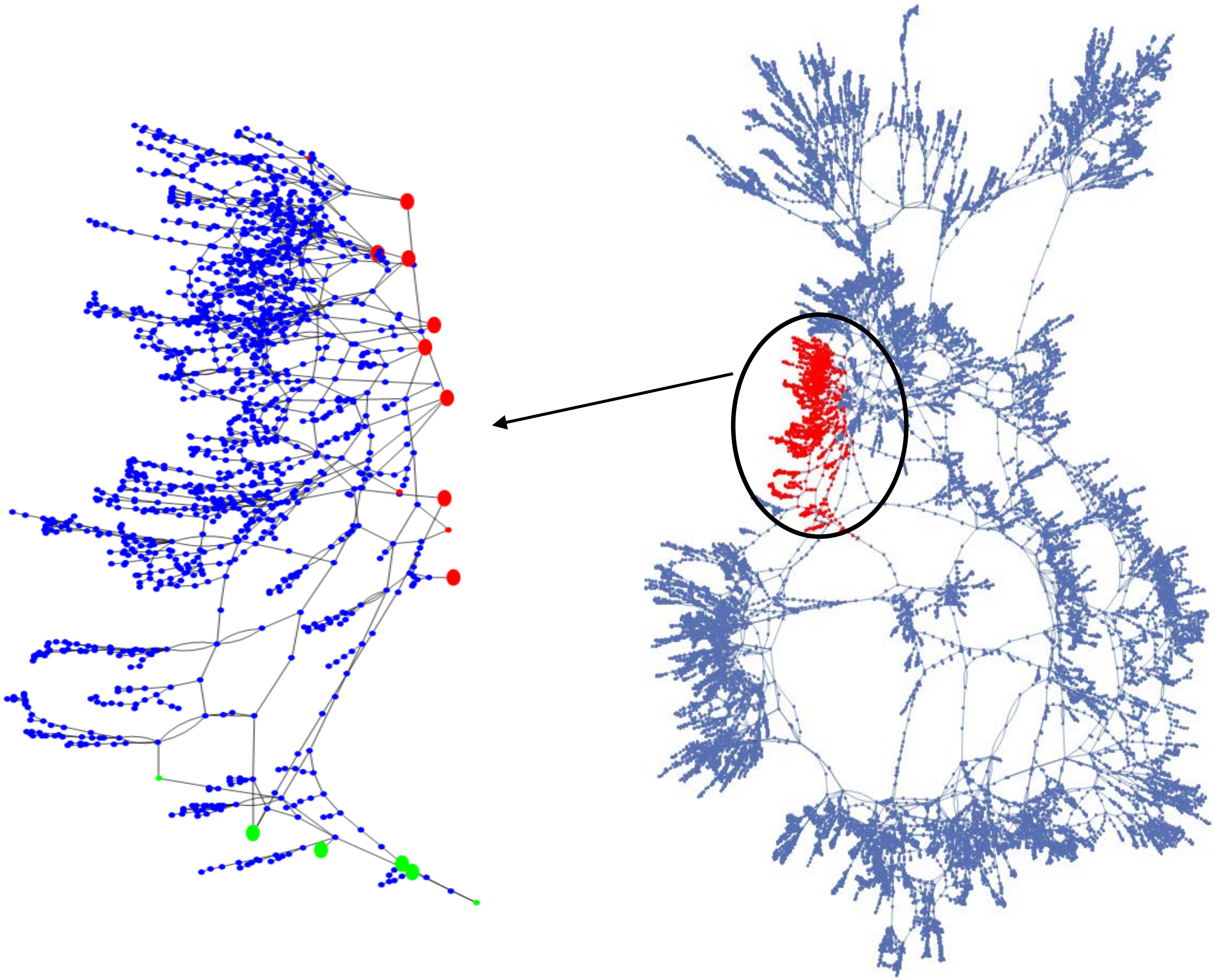
$$\theta^{rs(2)} = \frac{P^{into}}{b}$$

$$P_{rs}^{\max(2)} < P_{rs}^{\max(1)} < P_{rs}^{\max(0)}$$

$$\theta^{rs(2)} > \theta^{rs(1)} > \theta^{rs(0)}$$

- The power entering into the area remains constant after outages
- Maximum power that can enter into the area decreases and area angle increases
- Area angle is a better indicator of stress
- Thresholds can be setup on area angle to monitor the multiple outages

Area Selection at BPA



- Area chosen is a part of BPA system – Mostly part of Oregon
- Single line diagram has 1377 buses and 1607 lines
- Red buses – Northern part and green buses are southern part which form a cutset
- Out of 17 border buses, 12 have PMU measurements available, 5 do not.

Challenges

- Not all the border buses of the cutset have PMUs (12/17)
- Power flowing through the area is small – When a contingency happens the change in the area angle is small
- Parallel paths have low impedance – When a contingency happens inside the area, the power flowing through the area is not the same as in base case.

Current progress & Next steps

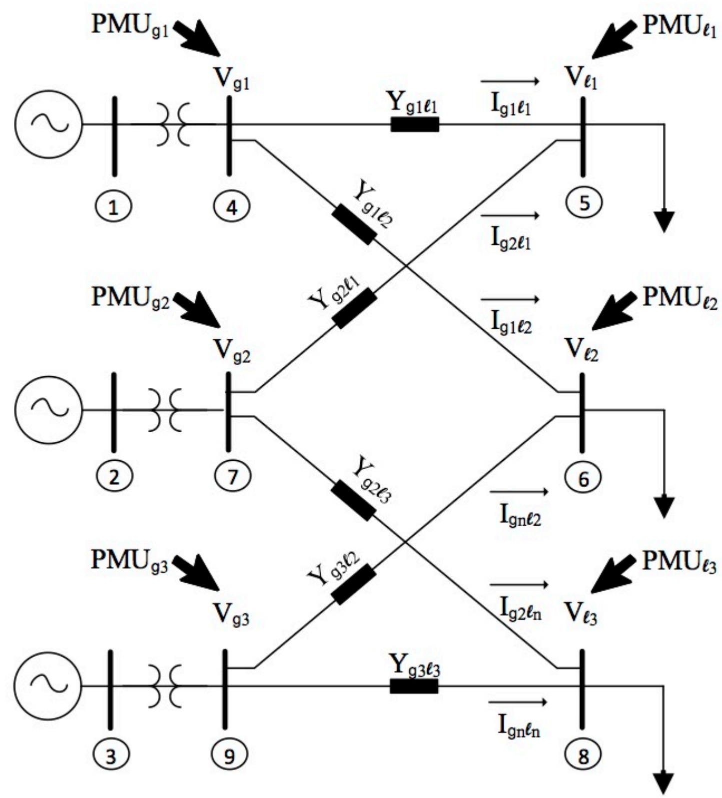
- BPA area setup
- The code for offline computations to setup thresholds has been optimized to run from few hours to few minutes depending upon the size of the area
- Choosing a different area to minimize the effect of parallel paths
- Scaling the power injections such that power flowing through the area is large to increase the area angle under contingencies
- Minimizing the area angle error due to unavailability of PMUs at all the border bus cutset – 0 angle vs nearby border buses where we have PMUs
- Testing the thresholds with live PMU data

Voltage Stability

- *For a transmission corridor*

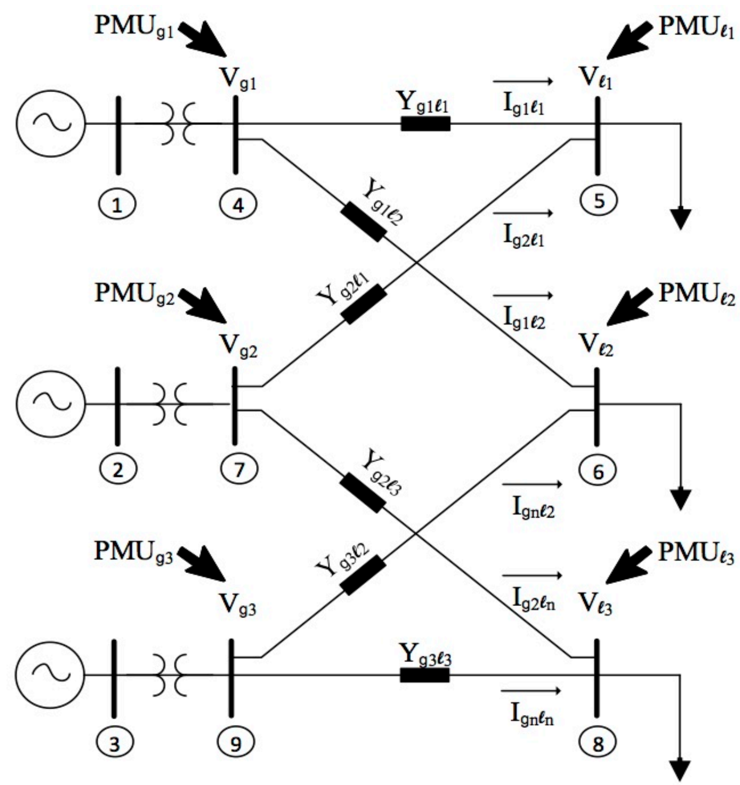
Transmission Corridor voltage index

- Most VSI applications apply to a single line or corridor
- This application computes an stability index across a corridor that may consist of a number of lines.
- It uses PMU measurements at both ends of the corridor to compute the voltage across the corridor



Methodology: Single Line Equivalent for a Transmission Corridor

- The PMU measurements at both ends of a transmission corridor are required
- Complex power is computed from the complex V & I measurements
- Using the complex power through the system and current flow in and out of the corridor, the voltage across the corridor can be computed
- The index is simply the voltage across the system divided by the load voltage
- Has to be set based on local limits



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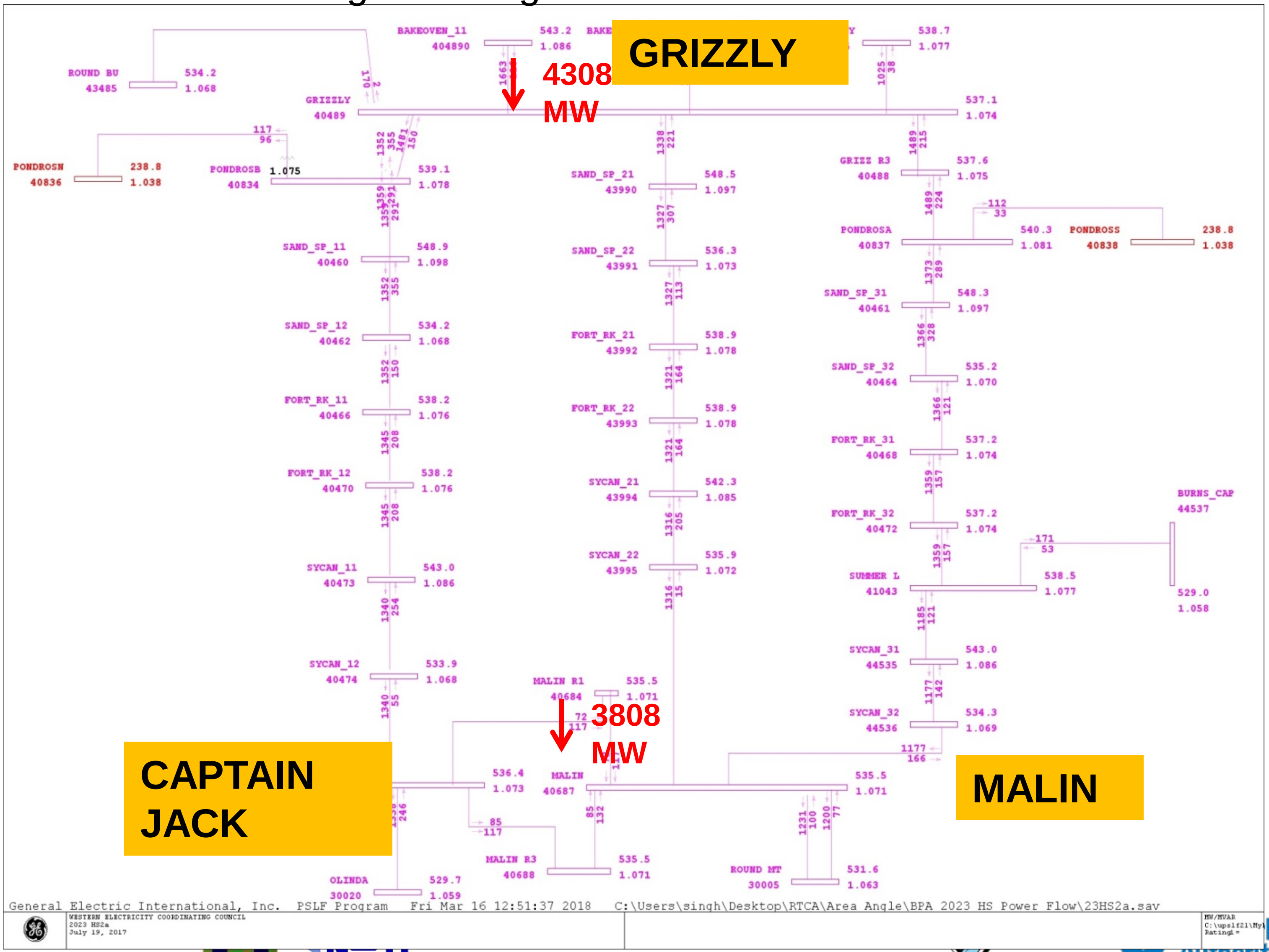
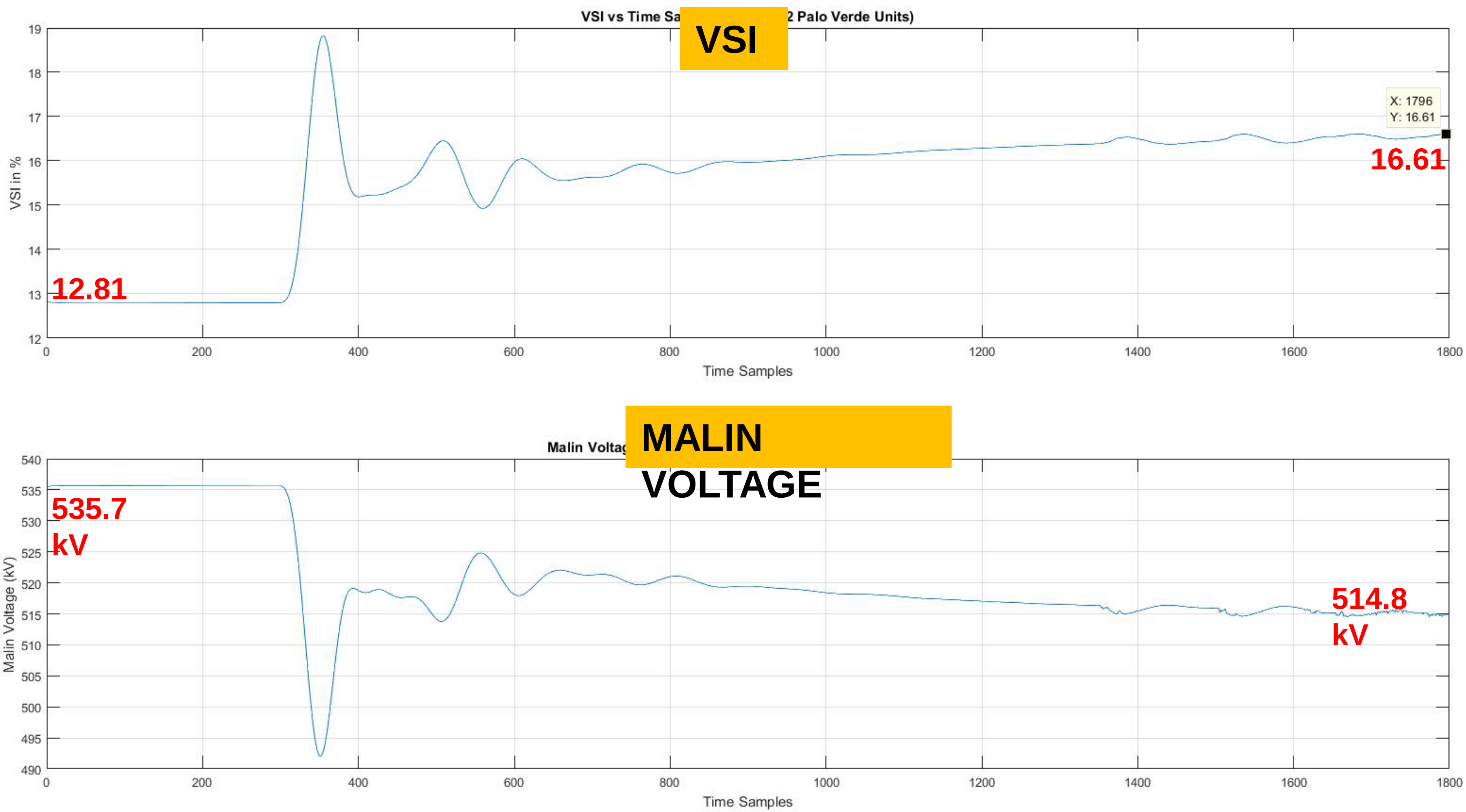
Index test case example

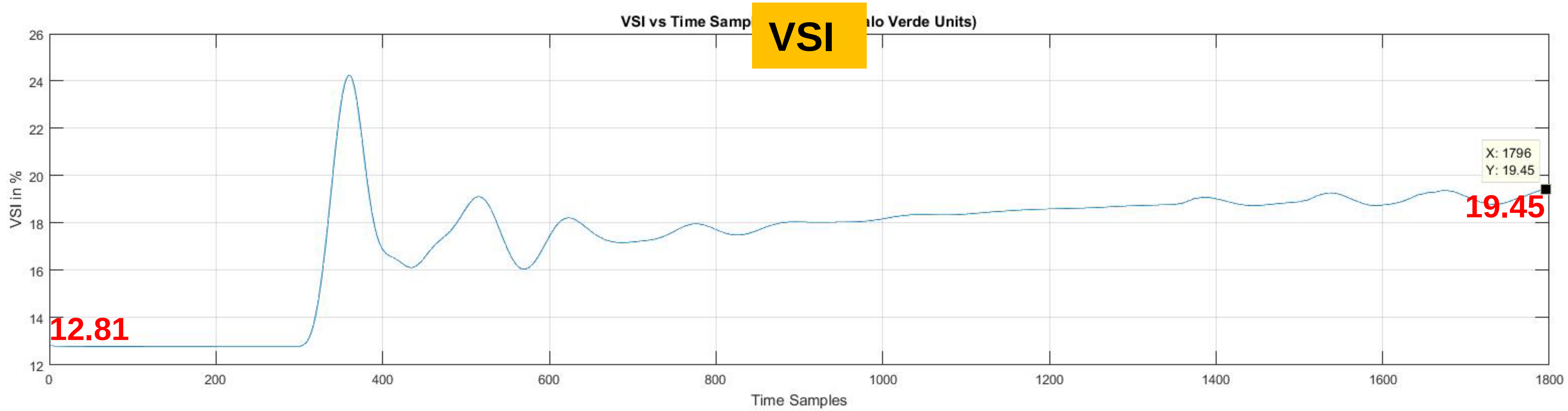
COI Power Flow – using 2023 High Summer Case

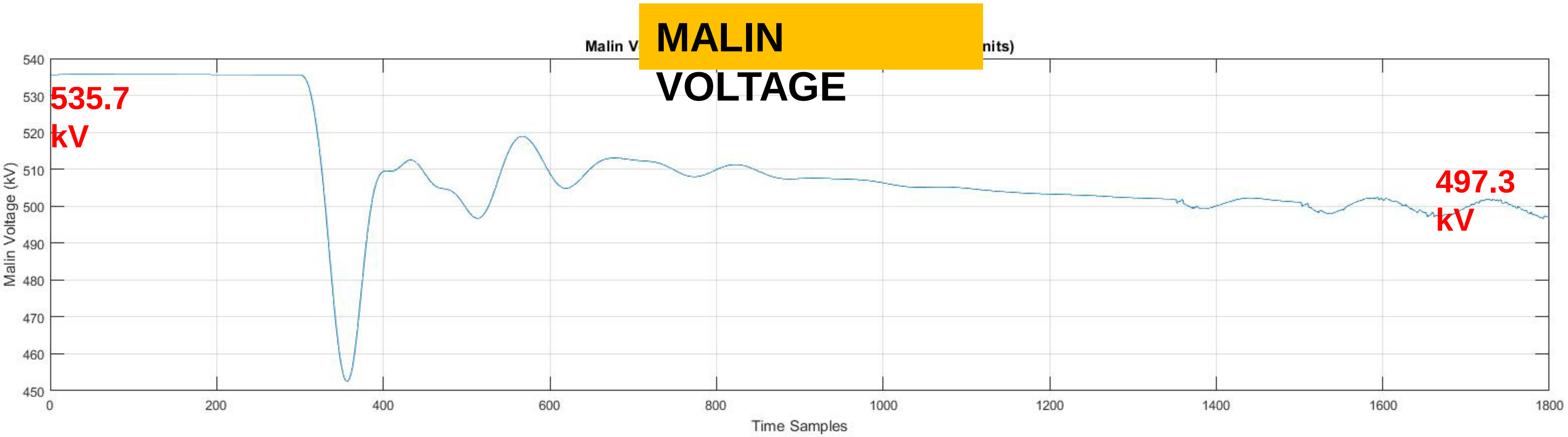


VSI reaction to loss of 2 Palo Verde Units

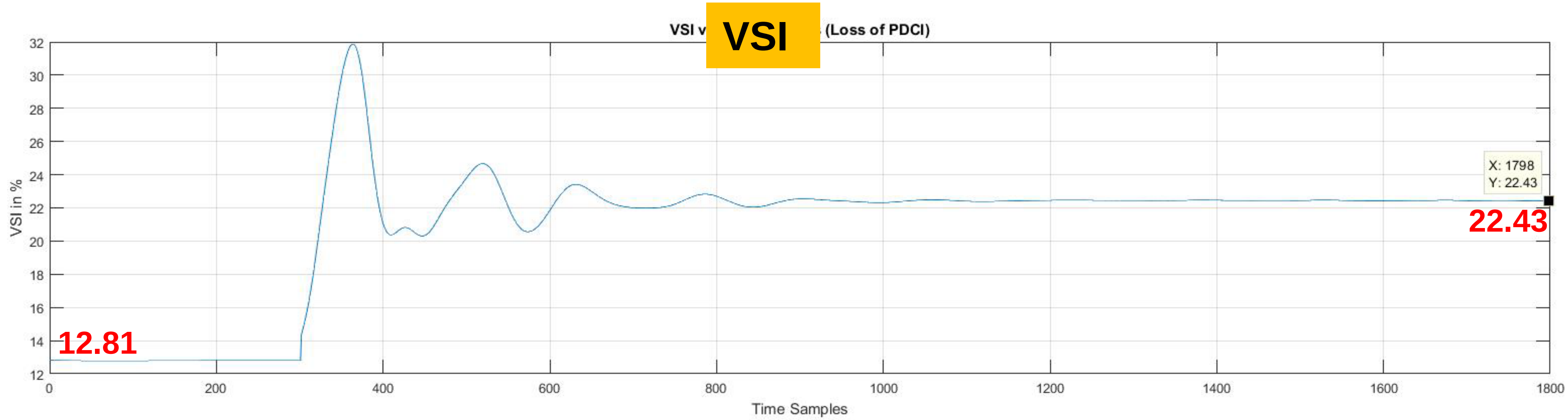


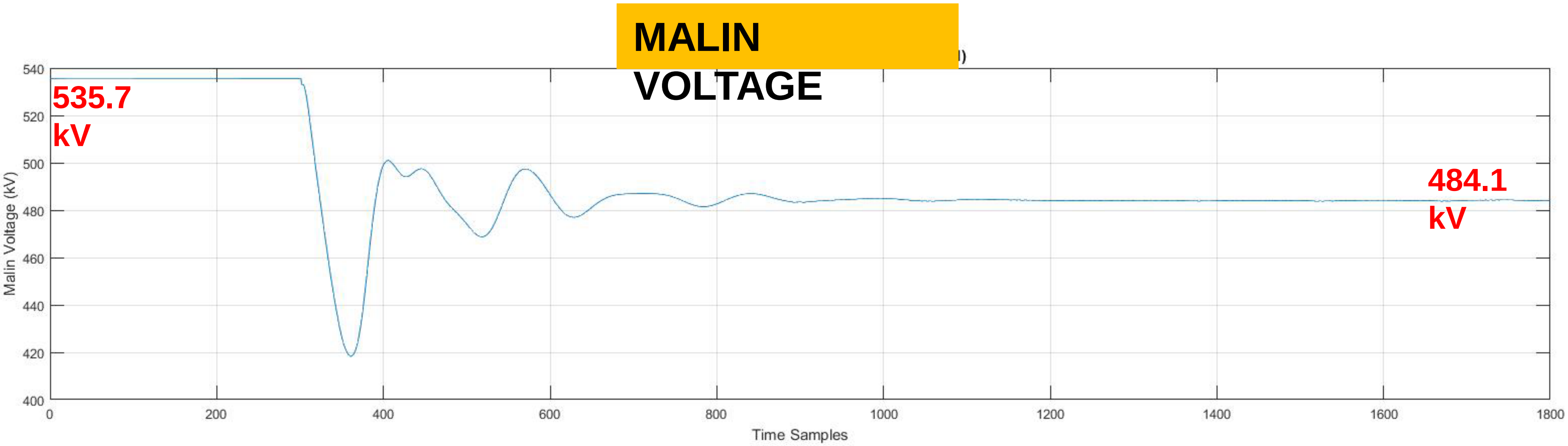
Loss of 3 Palo Verde Units





Loss of PDCI


VSI v
(Loss of PDCI)
VSI
X: 1798
Y: 22.43
22.43
12.81
VSI in %
Time Samples

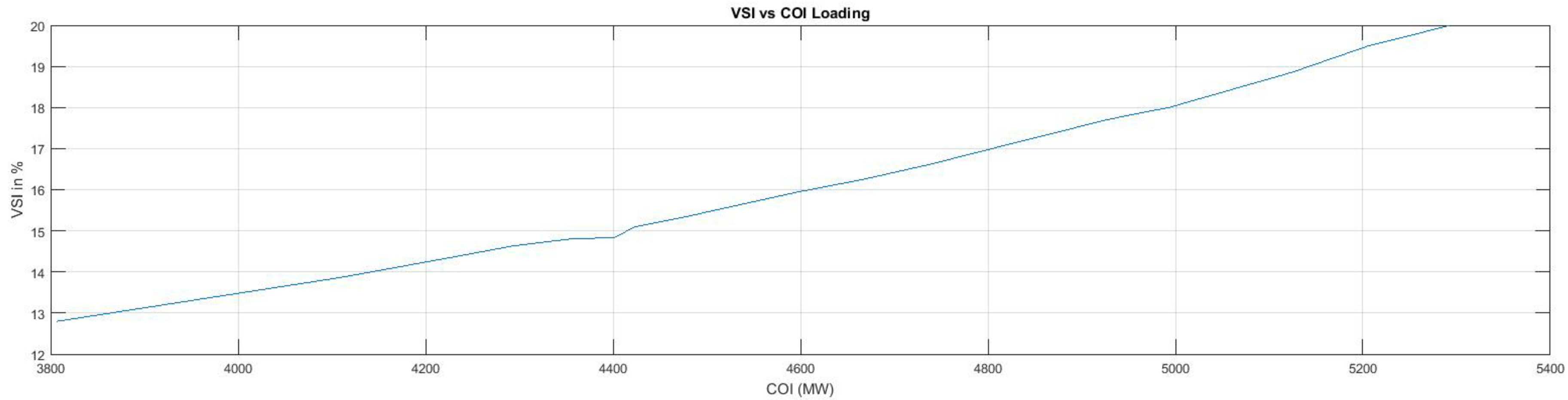

MALIN VOLTAGE
535.7 kV
484.1 kV
Malin Voltage (kV)
Time Samples

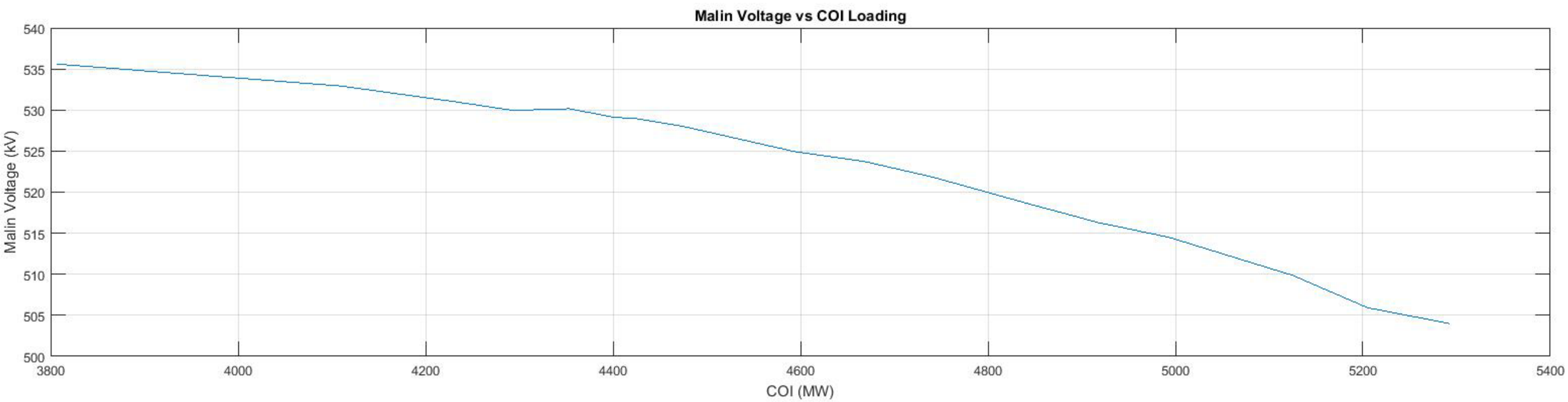
Results Summary

	Case Name	Malin Voltage	VSI (%)
1	Base Case (2023 HS)	535.7 kV	12.81
2	Loss of 2 Palo Verde Units	514.8 kV	16.61
3	Loss of 3 Palo Verde Units	497.3 kV	19.45
4	Loss of PDCI	484.1 kV	22.43

- As expected, VSI increases with increase in event severity (lower voltages)
- Need to perform offline studies to set thresholds

VSI for various loading levels for COI





Next Steps

- Progressively load COI beyond 3808 MW and run VSI for previous contingencies to find:
  - Voltage Collapse Point
  - Set VSI Threshold for alarming
- Validate off-line results in VSI Tool

Current Status & Next Steps

2.3	*Real time applications prototype, and development and testing*	1/19/2018	Test cases and test results documents
2.4	*Prototype Demonstration for DoE and all the participants*	3/16/2018	Demonstration at EPG

- Completed algorithm research, proof of concept, and now move into production application development
- The project is delayed due to the limited PMU coverage challenge
- **It's still not late to participate in this project if interested!**

Q & A

Thank You!

Neeraj Nayak
nayak@electricpowergroup.com

Ken Martin
martin@electricpowergroup.com

Lin Zhang
zhang@electricpowergroup.com

Electric Power Group

NETL

BONNEVILLE POWER ADMINISTRATION

New York Power Authority