

# NERC

NORTH AMERICAN ELECTRIC  
RELIABILITY CORPORATION

## EI Oscillation Event

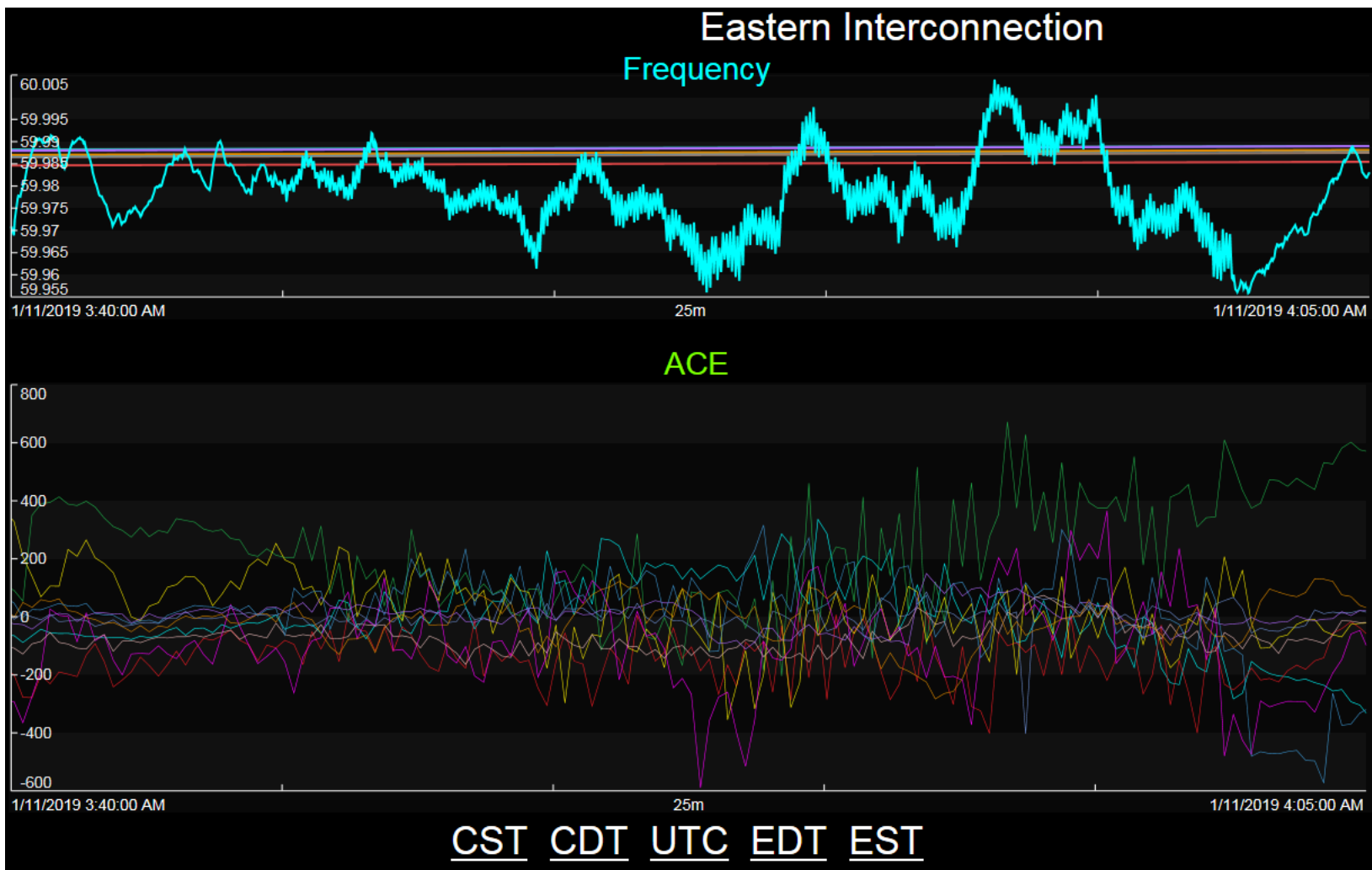
January 11, 2019 Event

Tim Fritch, SMS Vice-Chair  
NASPI Meeting, April 17, 2019

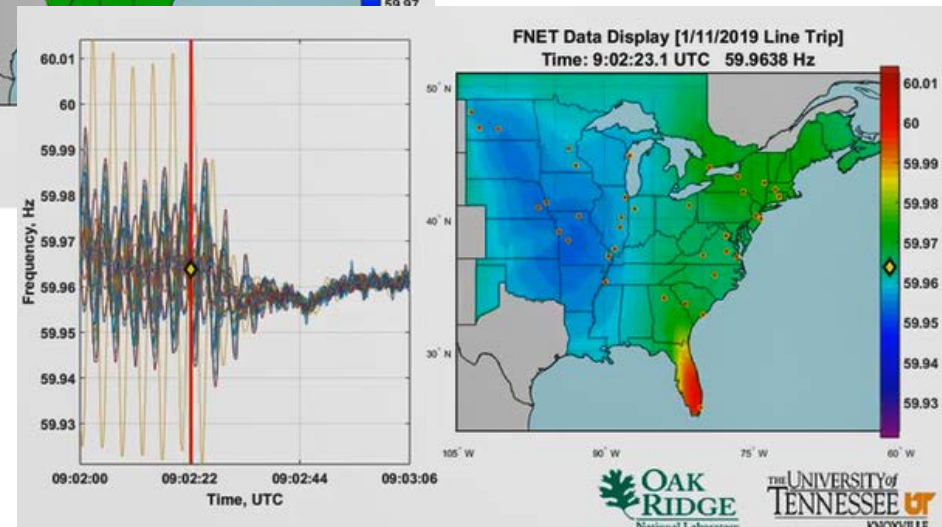
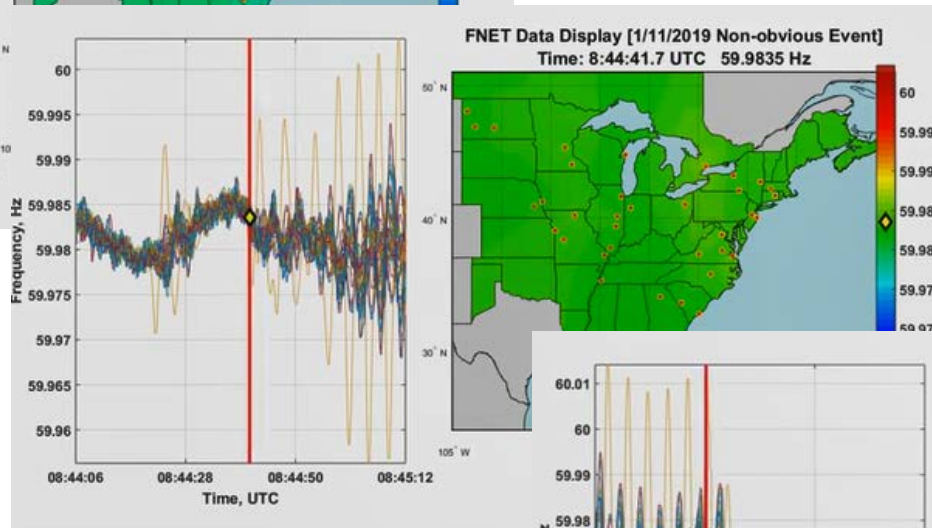
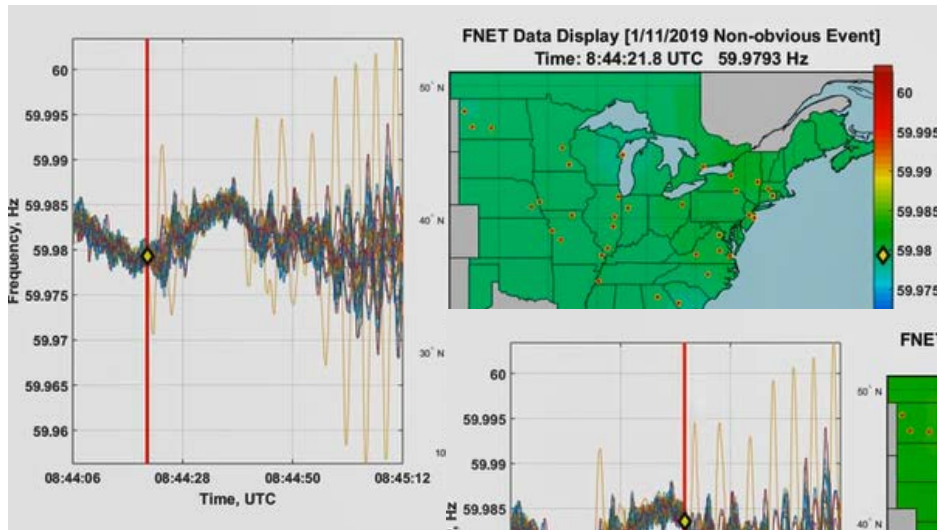
**RELIABILITY | ACCOUNTABILITY**



- Oscillation observed across entire Eastern Interconnection from 08:44:41 UTC (03:44:41 EDT) to 09:02:23 UTC (04:02:23 EDT)
  - Oscillation frequency of 0.25 Hz
    - Aligns with inter-area mode frequency across EI
  - Power swings around Florida of 200 MW, around ISO-NE of 50 MW
- RCs identified oscillation on PMU data, notified RC Hotline
- UTK provided videos of oscillation event
- GOs noticed oscillation on power plants across EI
- Source tentatively identified in Florida
- NERC issued PMU data request, working with possible source
- NERC will perform oscillation analysis on wide-area data set
- NERC working with industry to study event, develop mitigating actions



- Strange oscillation in Florida around 08:44:21 UTC (03:44:21 EDT)



- Oscillation strengthens at 08:44:41 UTC (03:44:41 EDT)
- Oscillation ends at 09:02:23 UTC (04:02:23 EDT)

- Video of onset of oscillation:

- [https://www.youtube.com/channel/UC40n2KTjwRhC9\\_CvtlasaWA/videos](https://www.youtube.com/channel/UC40n2KTjwRhC9_CvtlasaWA/videos)
- <https://www.youtube.com/watch?v=xilfYKxqEDo>
- <https://www.youtube.com/watch?v=VDsKAe9p9f0>
- <https://www.youtube.com/watch?v=pnSRKI9sLWY>
- <https://www.youtube.com/watch?v=j0I2ezmlRXM>
- <https://www.youtube.com/watch?v=Zfc-UcEn3Fw>
- <https://www.youtube.com/watch?v=doPgbh8PedQ>
- [https://www.youtube.com/watch?v=E9\\_5DPx85bc](https://www.youtube.com/watch?v=E9_5DPx85bc)

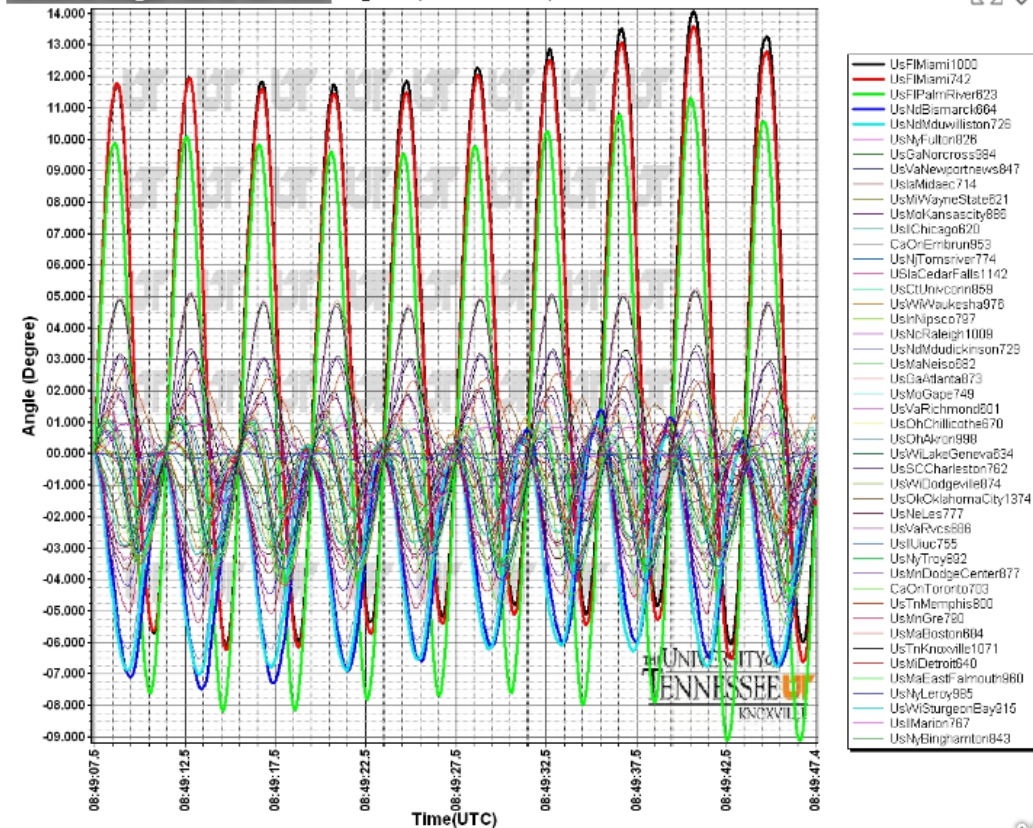
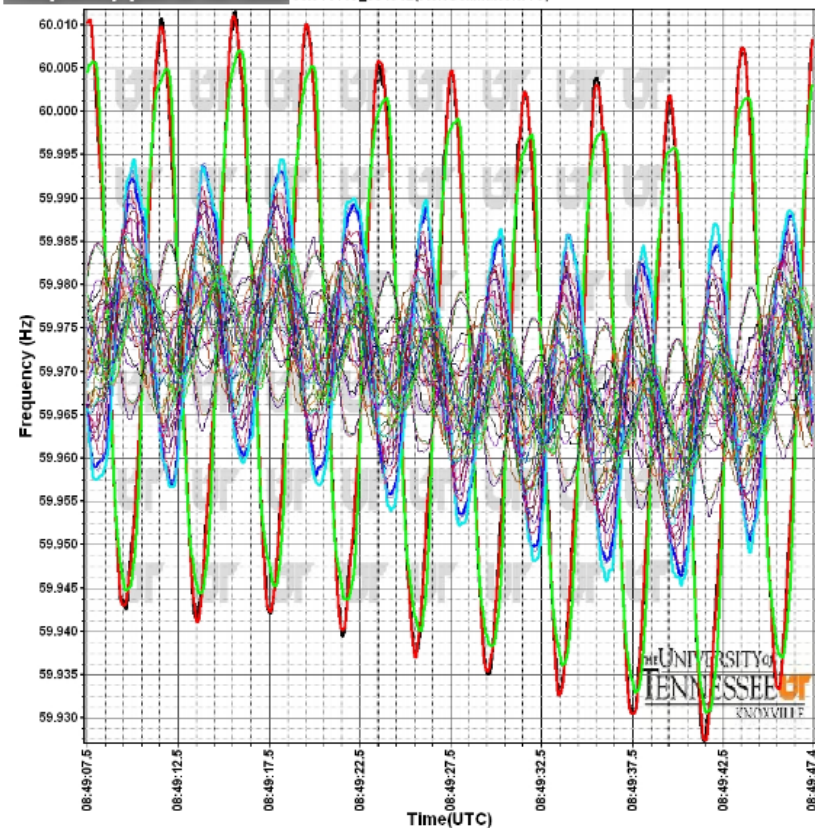
## Oscillation Mode Shapes (Using Matrix Pencil algorithm)

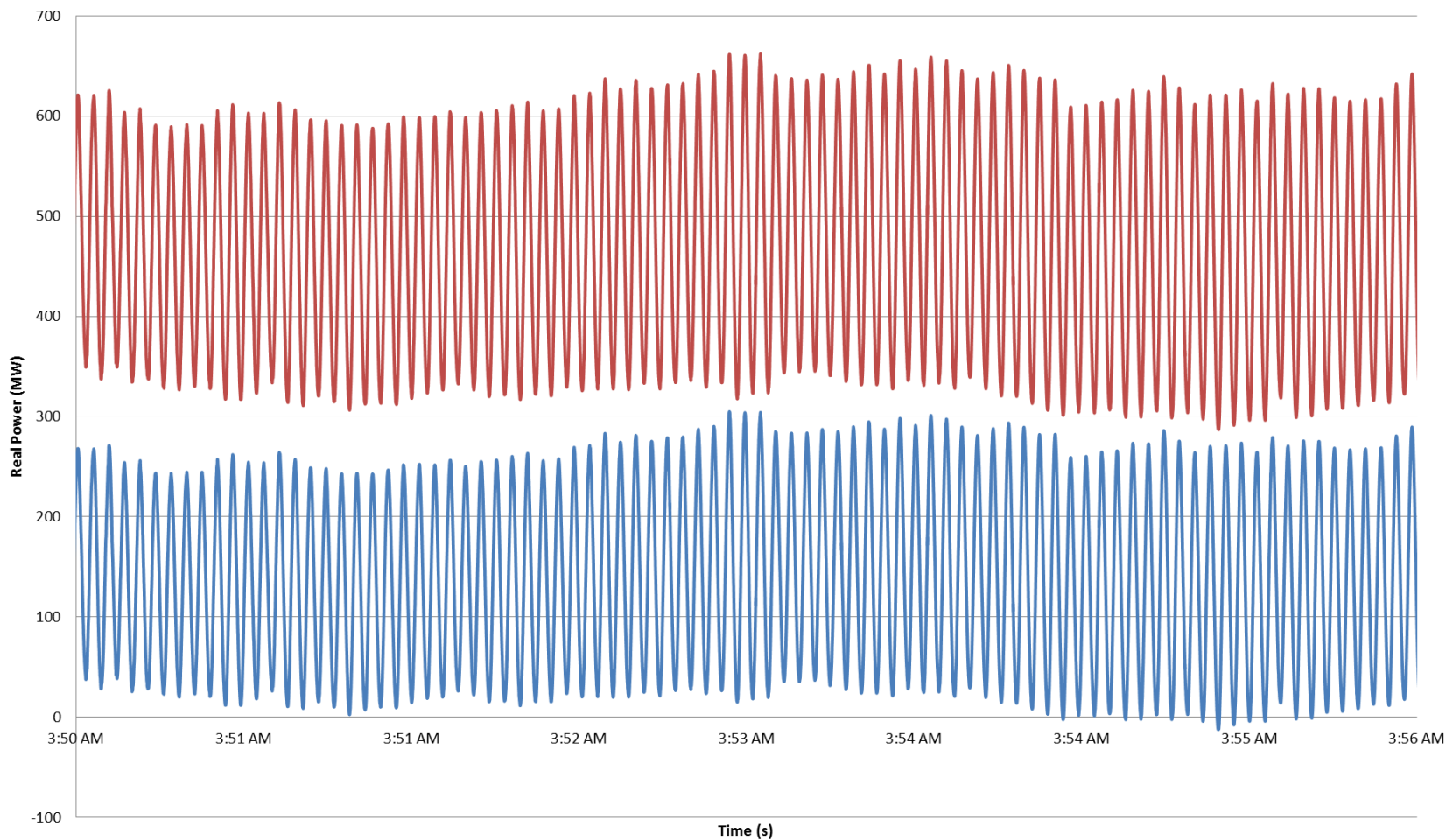
Mode #1: Frequency: 0.25 Hz, Damping Ratio: 0.16 %, Amplitude: 2.38 °

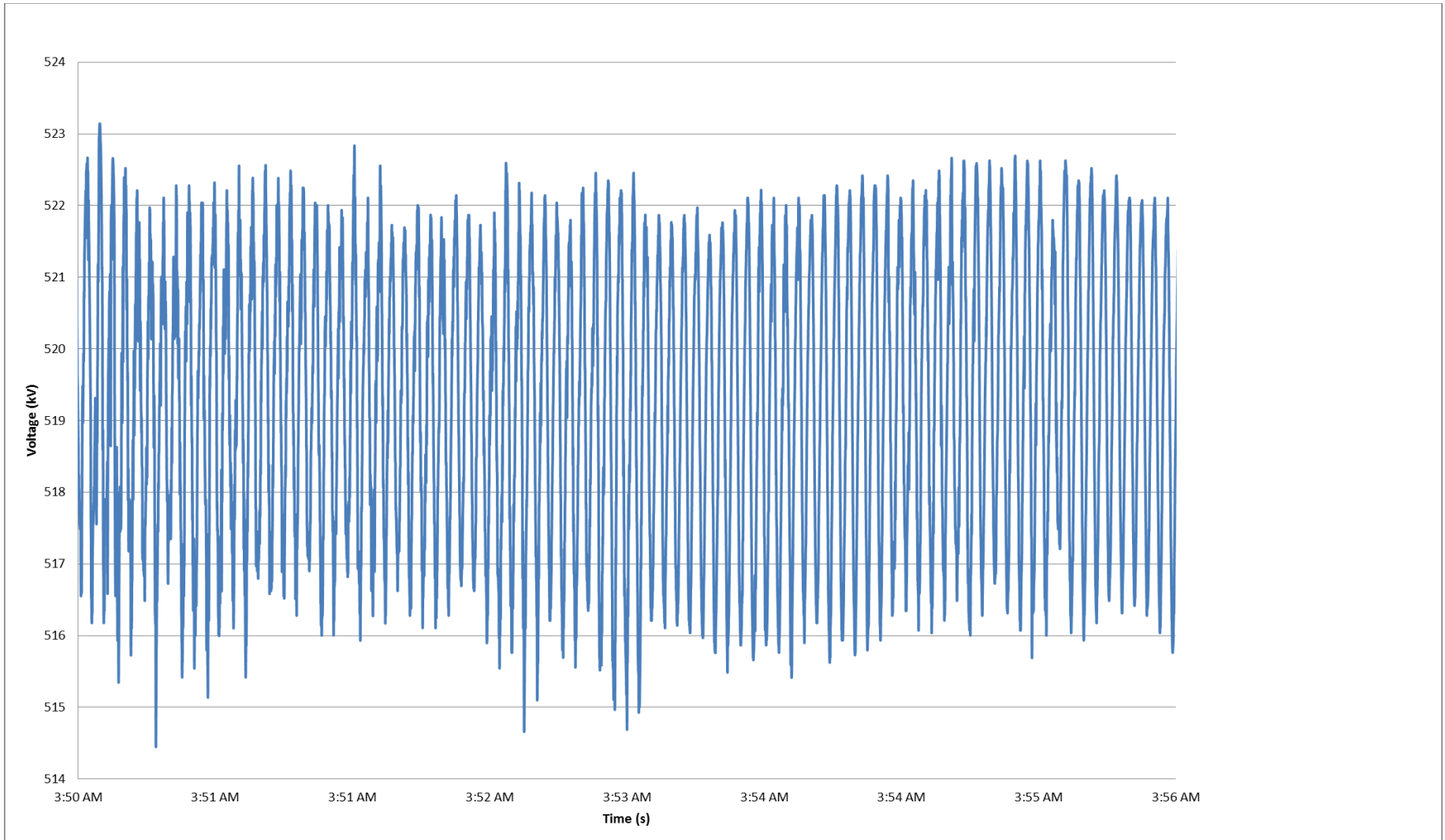
UnitName	Frequency(Hz)	Damping Ratio(%)	Phase (Degree)	Amplitude(Degree)
UsNyFulton826	0.25	0.92	0.64	2.18
UsGaNorcross984	0.25	0.39	-72.11	3.44
UsVaNewportnews847	0.25	0.75	-57.24	1.81
UsFIMiami742	0.25	0.33	-64.35	9.26

Frequency plot of All FDRs sci011119\_084912(Ref:UsIllMatton778)

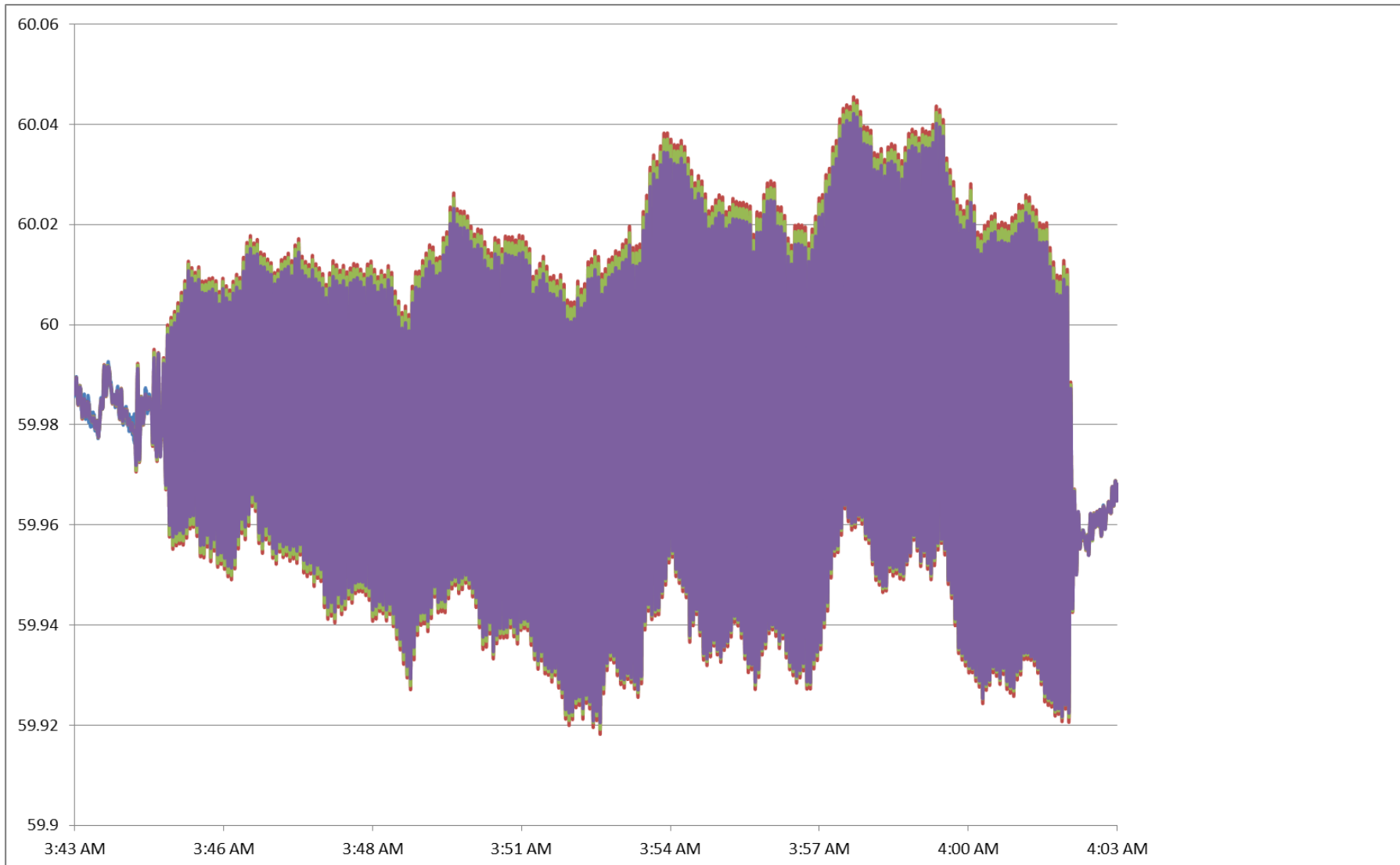
Relative Angle Plot of All FDRs 1119\_084912(Ref:UsIllMatton778)



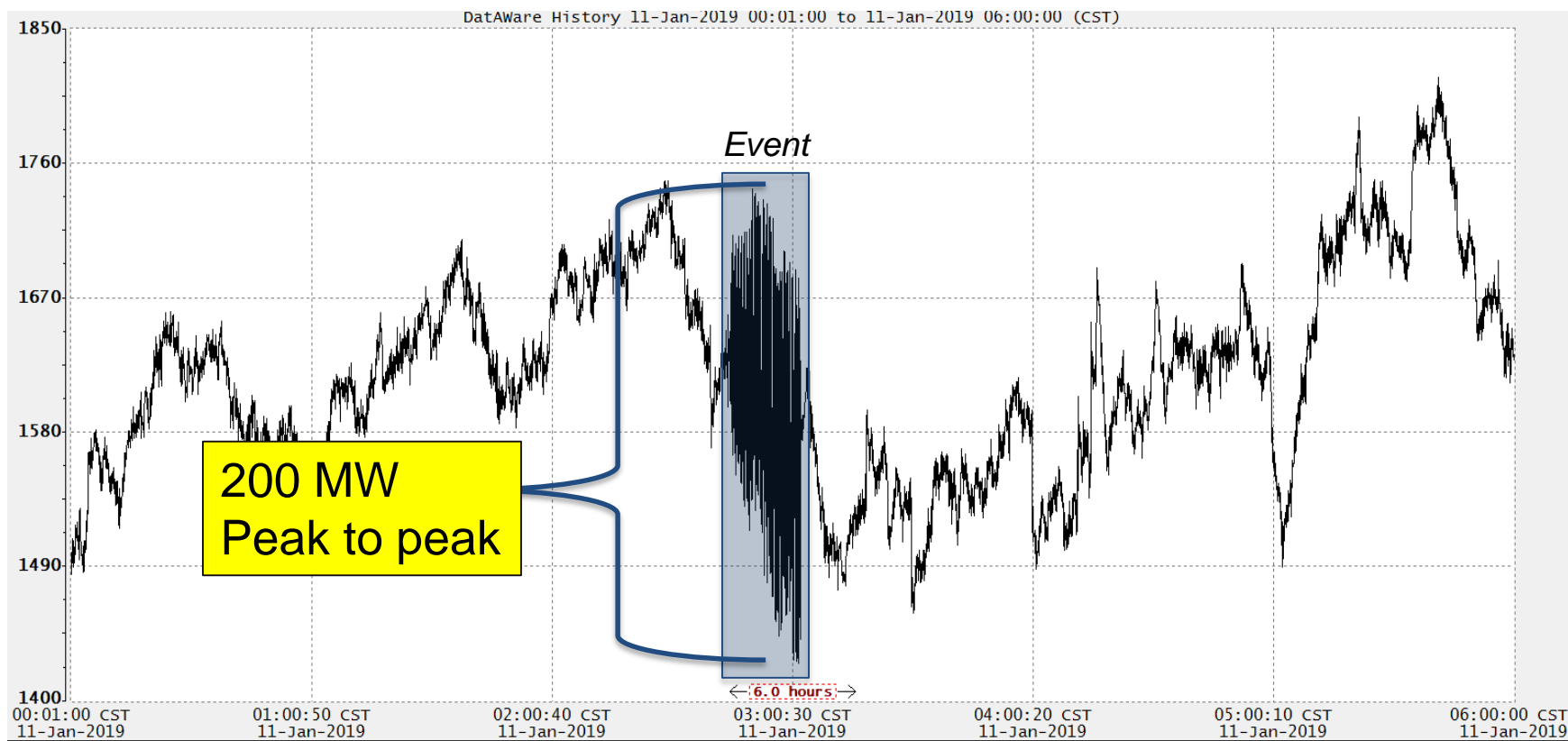


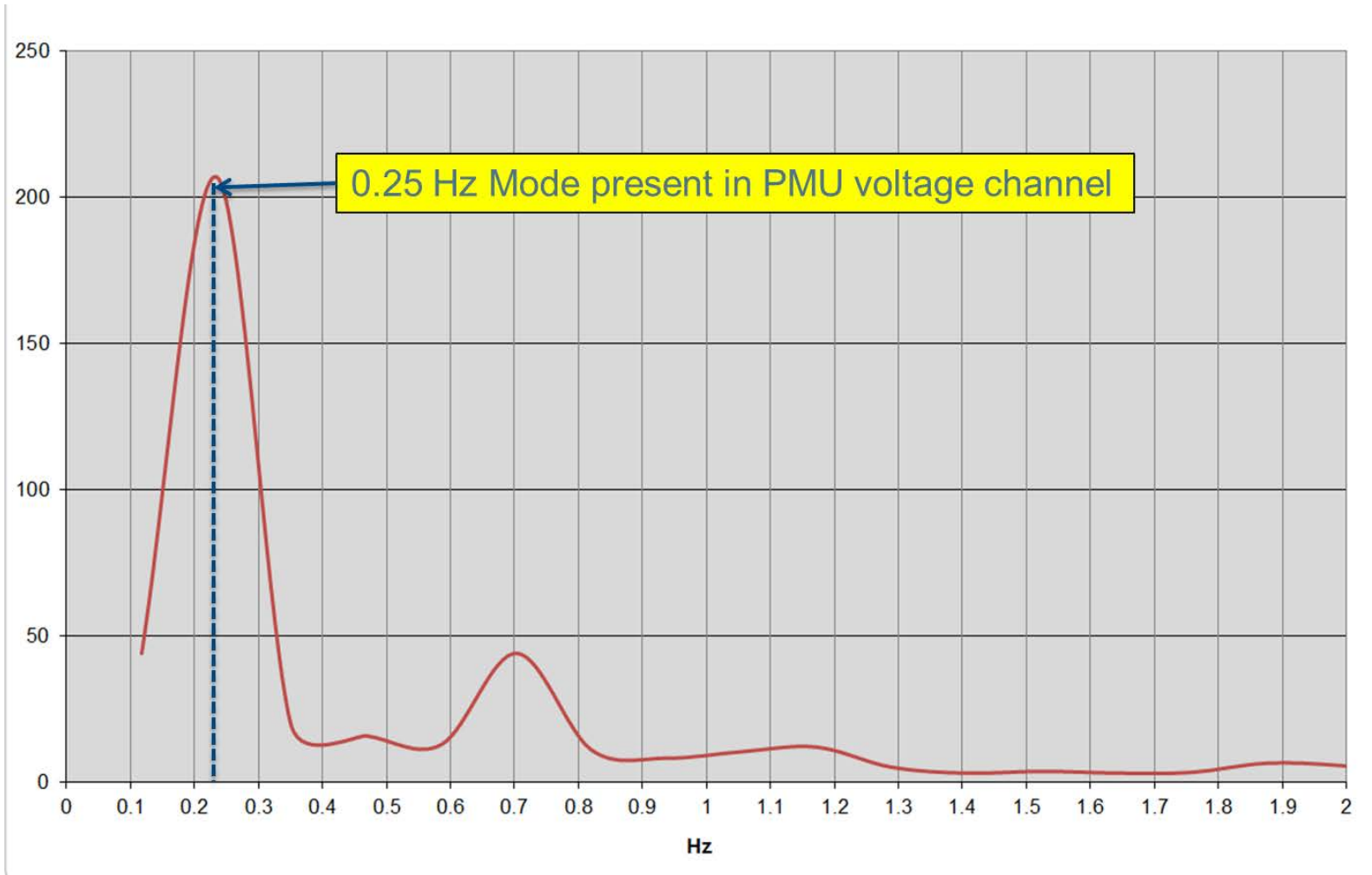




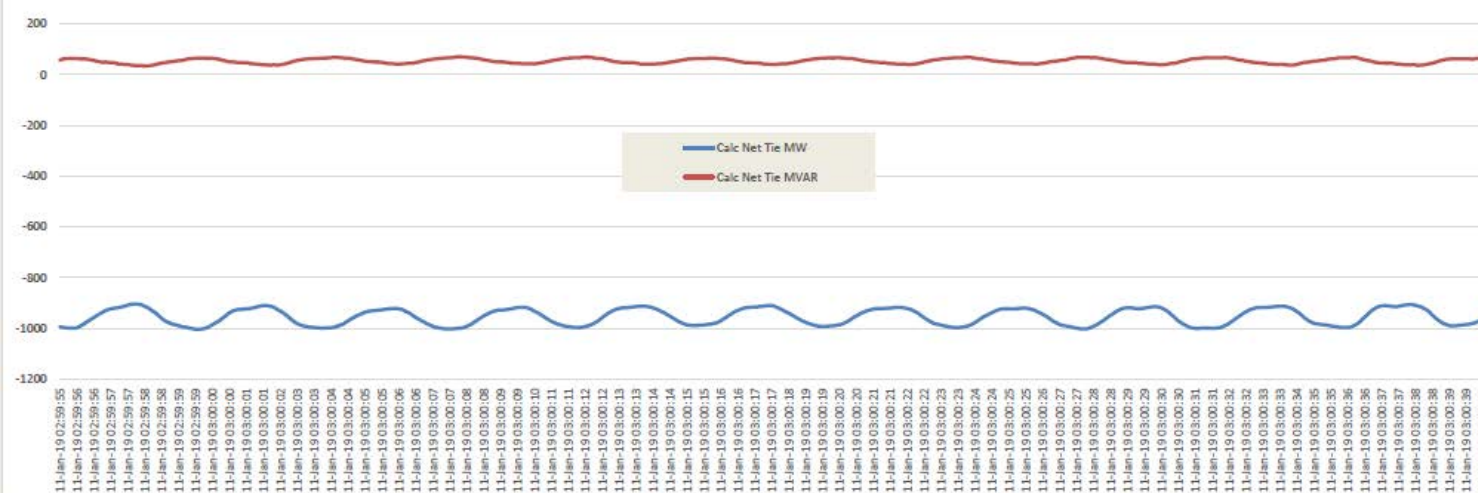


## SCADA Data – Flow on 500 kV tie line with Southern Company

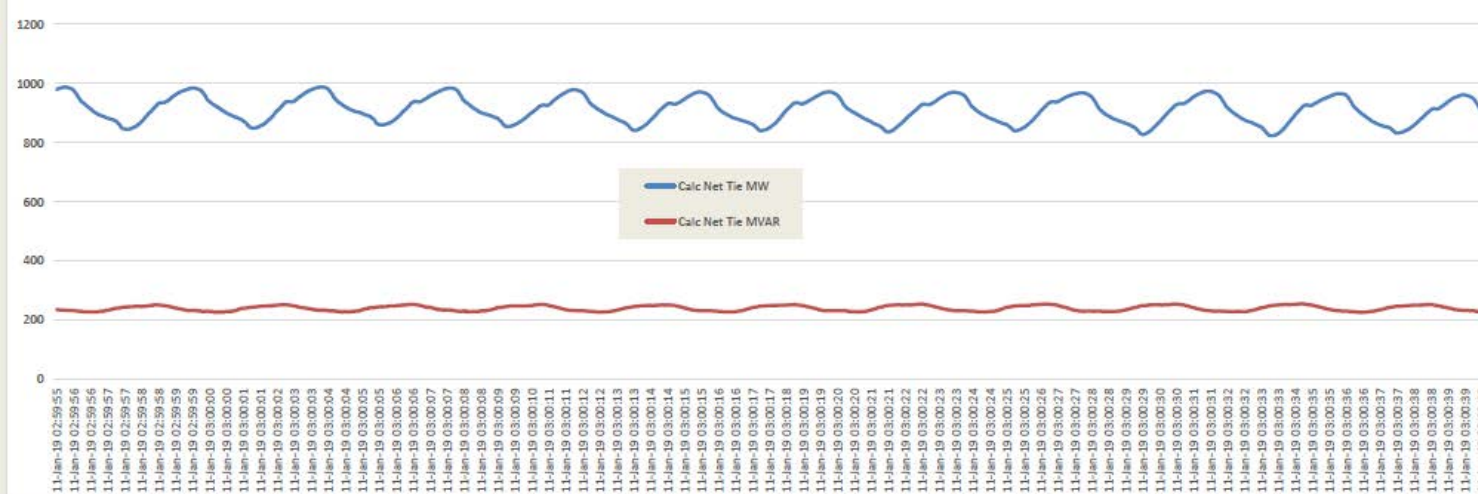




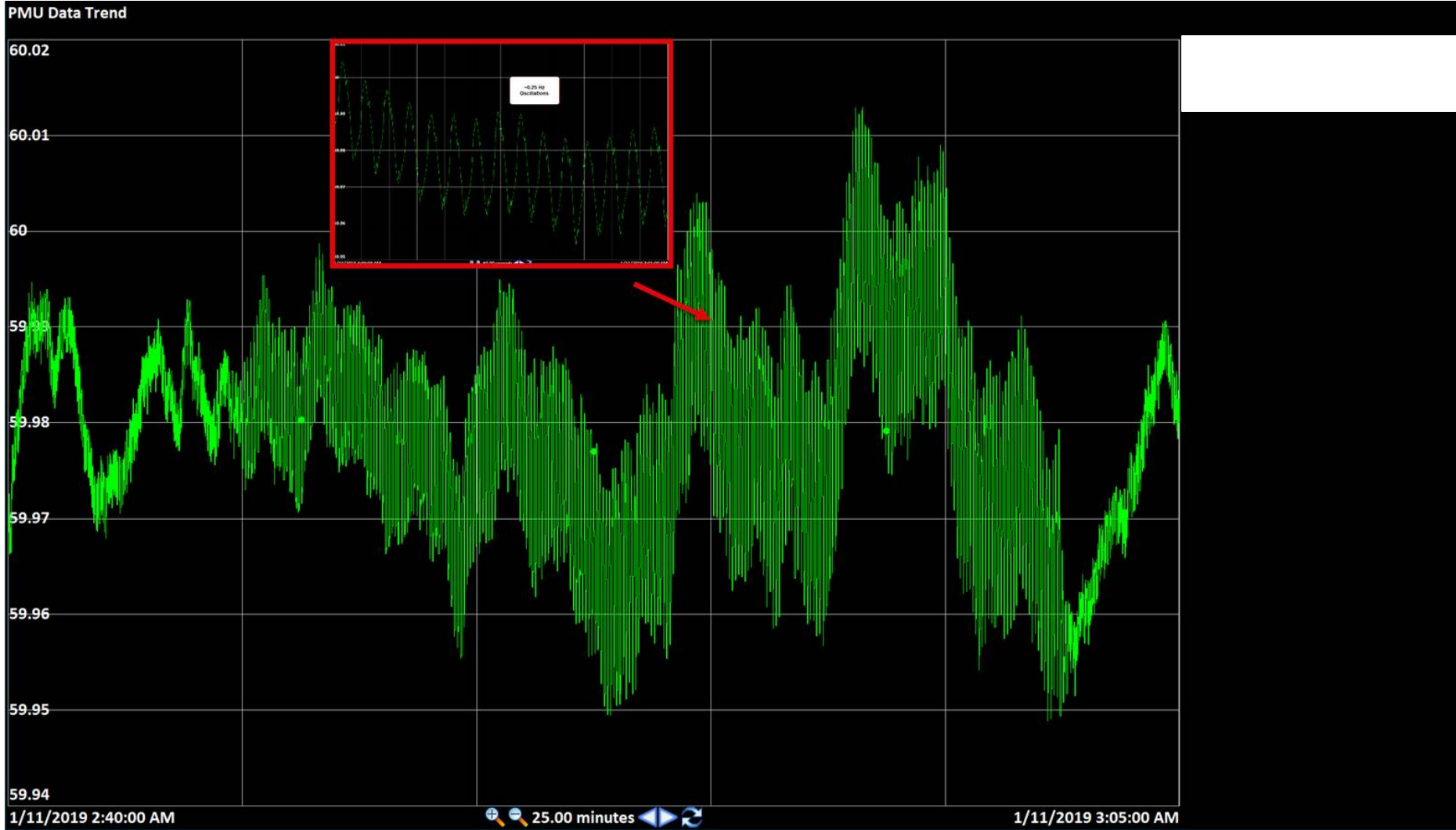
Net Western Tie Line Flows



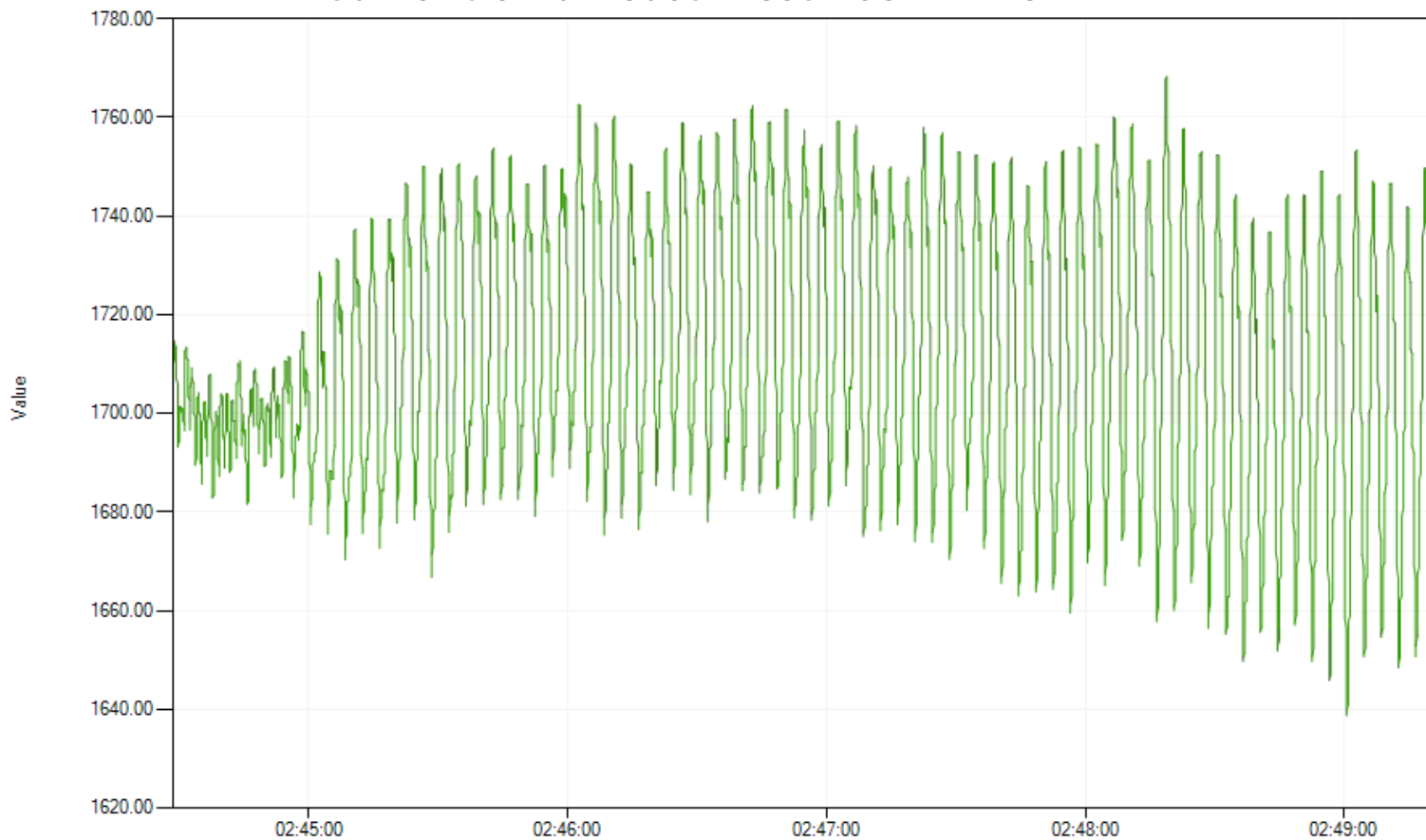
Net Southern Tie Line Interface Flows



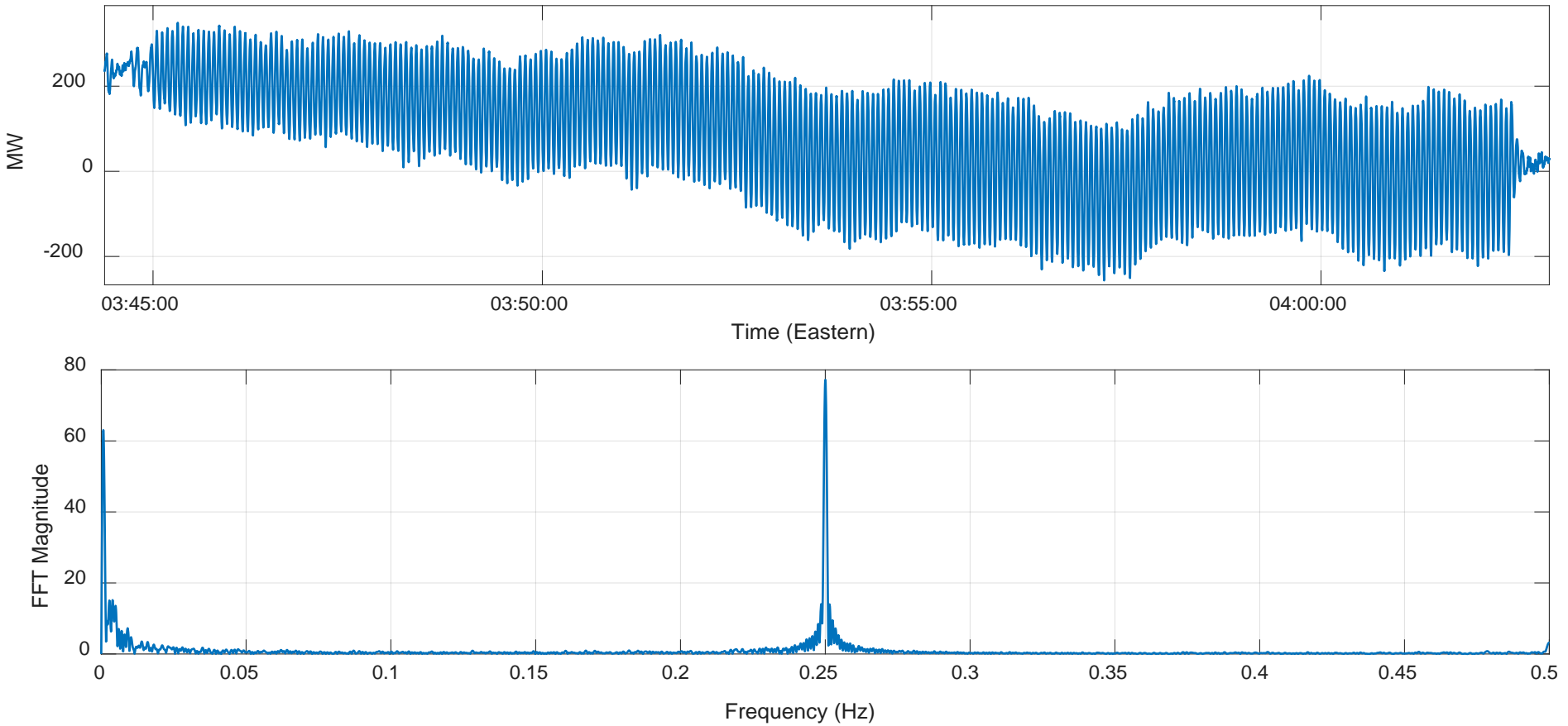
• Plot is sum of EHV lines connecting from Wisconsin to Illinois



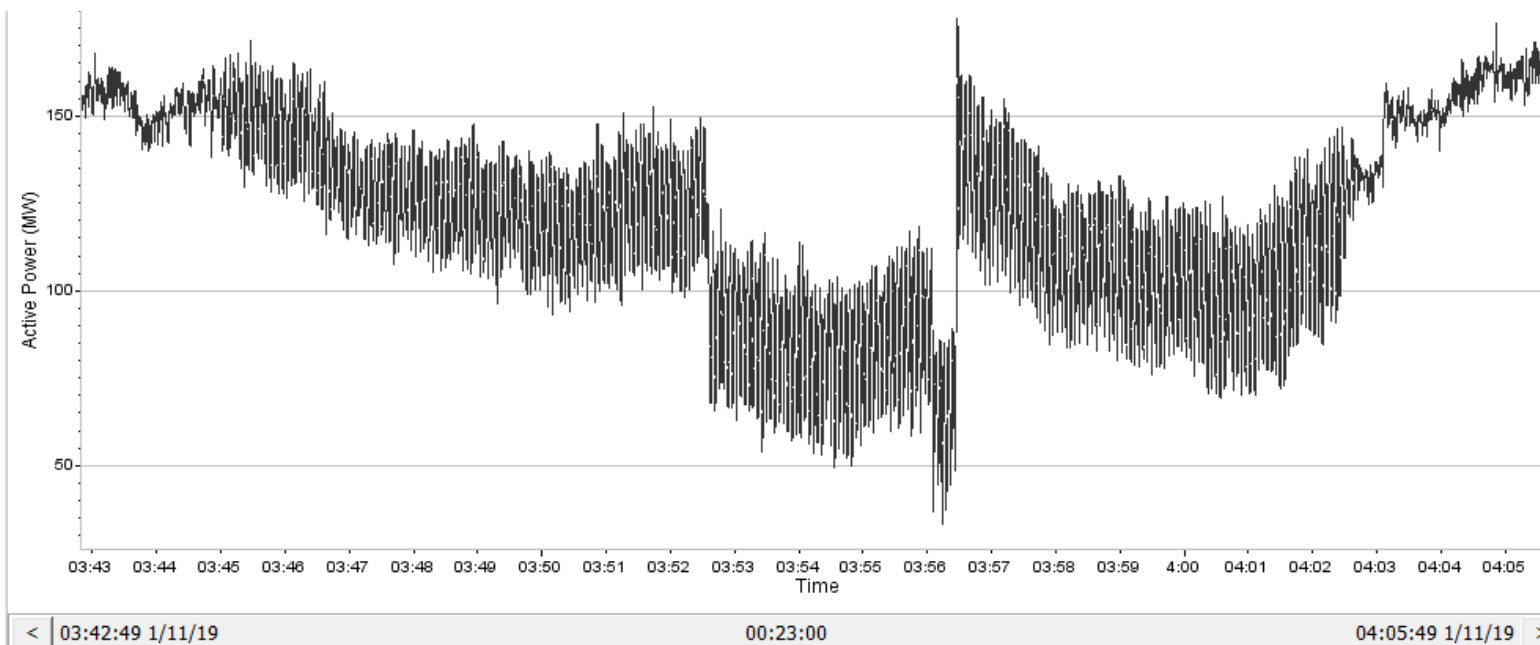
### Current on an east-west 765kV line



Start Time: 2019-01-11 02:44:28.370 End Time: 2019-01-11 02:49:22.407



- ISO-NE Phasorpoint generated 14 alarms (20+ Alerts) from 3:46-4:03 AM, 0.249 Hz oscillation, magnitudes up to 10-15 MW RMS
- OSL application automatically processed Alarms and Alerts, identified source of oscillations located beyond ISO-NE area
- Plot: MW flow on 345KV line between NE and NY.





- NERC issued data request at 9:05 PM EDT on 1-11-2019 to gather PMU data from RCs



attached to this request and posted on the NERC website (links provided above). The event under consideration is a ***forced oscillation observed across the Eastern Interconnection*** during the following time:

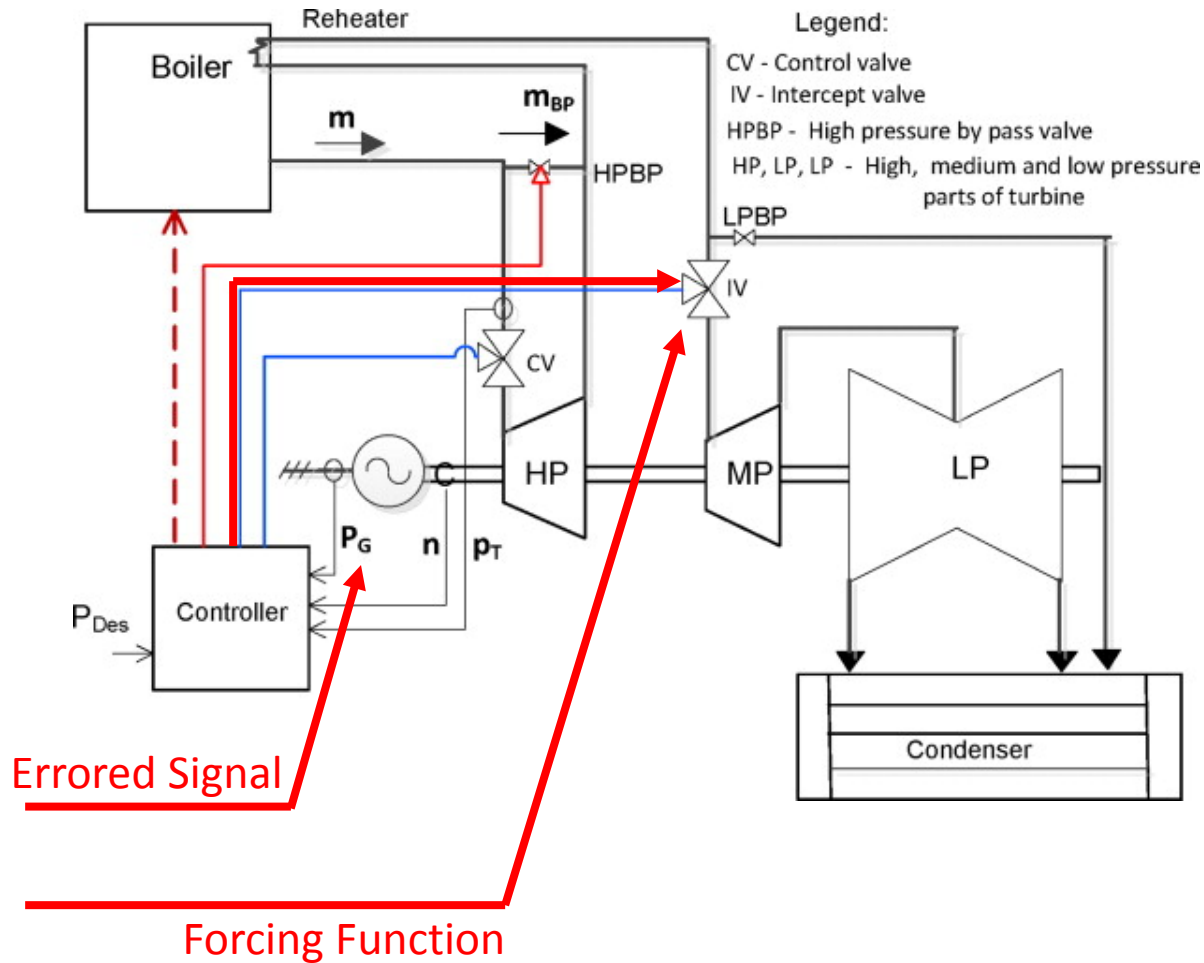
**Start Time:** January 11, 2019 (2019-01-11) 08:35:00 UTC Time (03:35 EST)

**End Time:** January 11, 2019 (2019-01-11) 09:15:00 UTC Time (04:15 EST)

Each Reliability Coordinator should submit the requested data electronically in the required data

- TVA-only data analyzed
- Damping of estimated mode with frequency 0.25 Hz is close to zero.
- Well-damped mode before and after event with frequency of 0.24Hz.
- Appears that well-damped mode is the well-known 0.22 Hz North-South mode of EI
- Conclusion that event caused by forced oscillation with frequency close to system mode.

- Repowered combined cycle plant – steam turbine oscillating
- Power-load imbalance (PLI) controls
- Failed potential input feeding feedback
  - Feedback reading 2/3 power output vs. input – perceived imbalance
- Drives shut intercept valves
- 4 second timer to reopen valves – open/close cycle
- Different potential inputs for relaying and controls/metering
  - Relaying hence did not pick up the imbalance/issue
- Plant manually tripped by operator
- Upon inspection, failed wiring in PT cabinet
- Damaged intercept valves, needed replacement, unit off-line for relatively extended period (couple weeks)



A stylized map of North America, including the United States, Canada, and Mexico. The map is rendered in shades of blue and grey, with the United States and Canada in a darker blue and Mexico in a lighter grey. The map is positioned behind the title and contact information.

# Questions and Answers

**Ryan Quint, PhD, PE**

Senior Manager

Advanced System Analytics and Modeling

North American Electric Reliability Corporation

Office (202) 400-3015

Cell (202) 809-3079

[ryan.quint@nerc.net](mailto:ryan.quint@nerc.net)