

# DOE/OE Transmission Reliability Program

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PNNL-SA-103064

## Spectral Analysis Baselining

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# Project Objective

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## Objective

Utilize spectral analysis methods to investigate underlying oscillations in the power system and provide a means to detect them

## Motivation

Explore and investigate other oscillatory behaviors on the power system beyond normal small signal stability, to help diagnose grid issues and increase the overall understanding of power system dynamics



# Spectral Analysis for Oscillation Detection

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- MATLAB-based tool and analysis
- Utilize spectral analysis techniques to extract information from phasor measurement unit data
- Determine existence of persistent oscillations
- Generate report summarizing events



# PNNL Approach

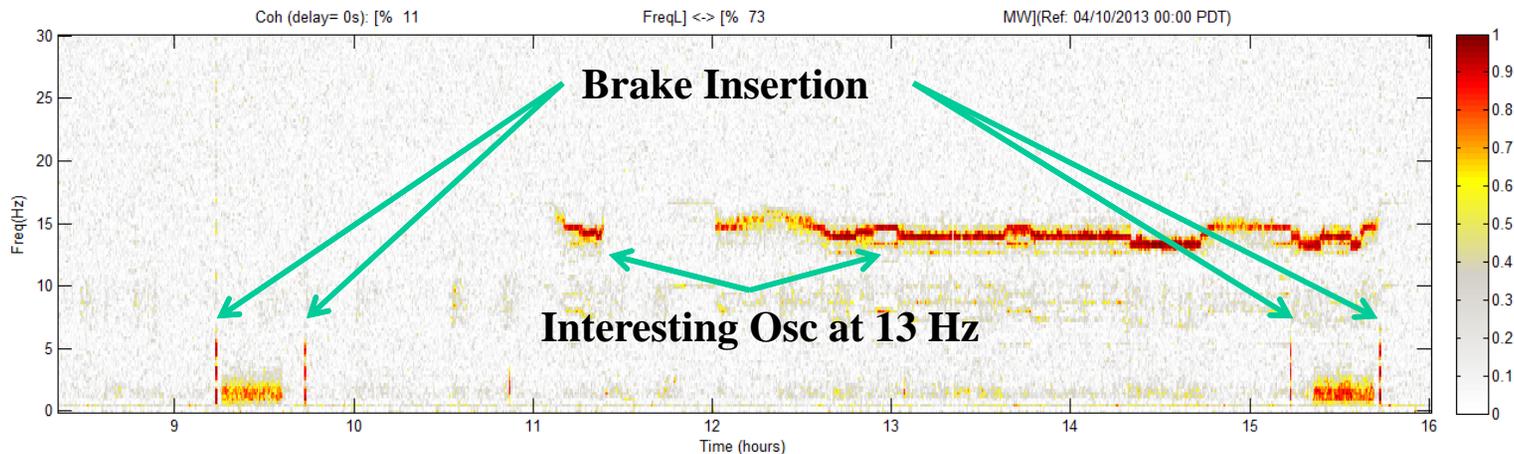
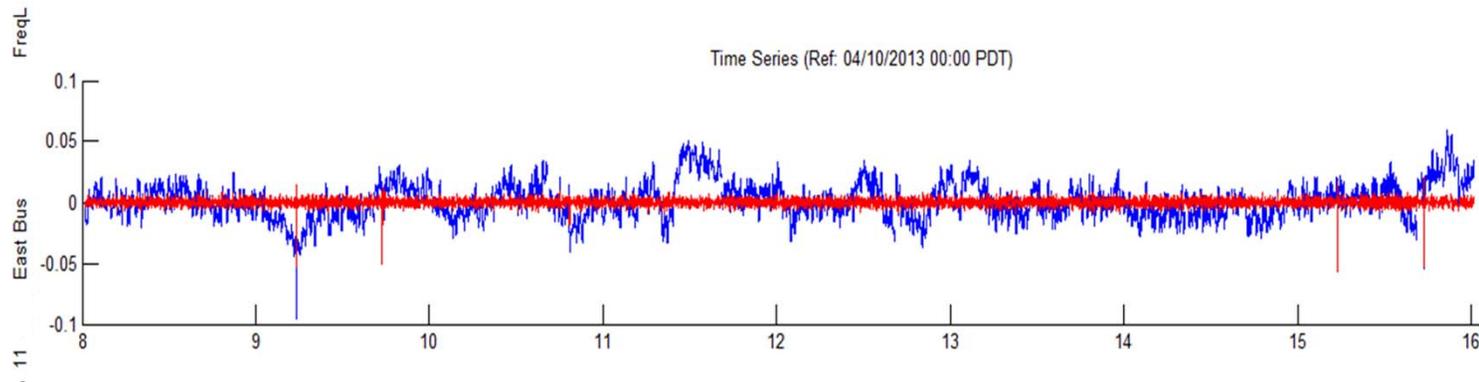
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- Off-line or “delayed online” approach
  - Post event analysis and follow-up
  - Operations engineer and planning engineer tool, not direct operator tool
- Detect oscillations that may be of interest
  - Spectral-based estimation method
  - Dynamic thresholds
- Output results to follow up on or investigate further



# Spectral Coherence Analysis Tool

## April 2013 Probing Test



Pseudo-random Probing

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# Major Technical Accomplishments for FY14

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- Evaluated initial version with Bonneville Power Administration
  - Feedback on algorithm robustness
  - Feedback on data output results



# Deliverables and Schedule for FY14

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- June 2014
  - Complete algorithm adjustments to increase reliability
  - Complete report output changes
  - Complete thresholding implementation
- August 2014
  - Complete report of study results and plan for future study



# Risk Factors

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- Scenarios that cause algorithm instability may be missed
  - Insure testing occurs on a variety of data sets and settings
  - Promote external testing
- Output report format may not be useful
  - Engage external collaborators for feedback and suggestions
  - Promote shorter reports to reduce “data overload”



# Follow-on Work for FY15+

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- Incorporation of algorithm into Data Integrity Situational Awareness Tool (DISAT)
- Further industry feedback
- Refinement of detection algorithm
- Transition final algorithm into commercial software tools



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# Questions?



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