



Demonstration of a Synchrophasor based Wide Area Situational Awareness System

**DOE Advanced Synchrophasor Research
Project (Grant # DE-OE0000128)**

Kai Sun

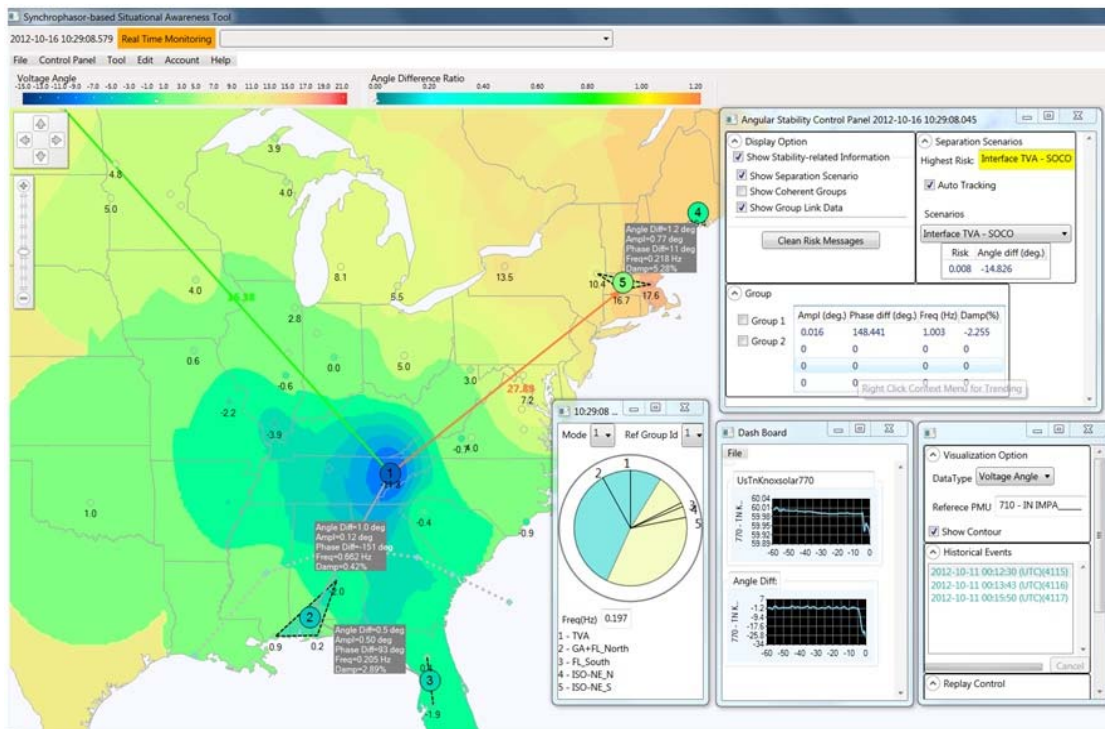
on behalf of EPRI PM Alberto Del Rosso

NASPI meeting at Atlanta

Oct 18, 2012

Overview of the Project

- Funding:
 - \$750K from DOE
- Objective:
 - Develop and demonstrate a synchrophasor based wide-area situational awareness toolbox for grid operators at TO/ISO/RTO/RC



- Functions
 - Real-time wide-area visualization
 - Contour and trending chart on voltage, angle or frequency data
 - Online event detection and location
 - Triggered by change of frequency
 - Location, magnitude and type
 - Event Replay
 - Event replayed in few seconds (near real time)
 - Offline post event analysis
 - Inter-area Oscillation Monitoring & Early Warning
 - Monitoring inter-area oscillations
 - Estimating the real-time risk on angle separation

Project Team

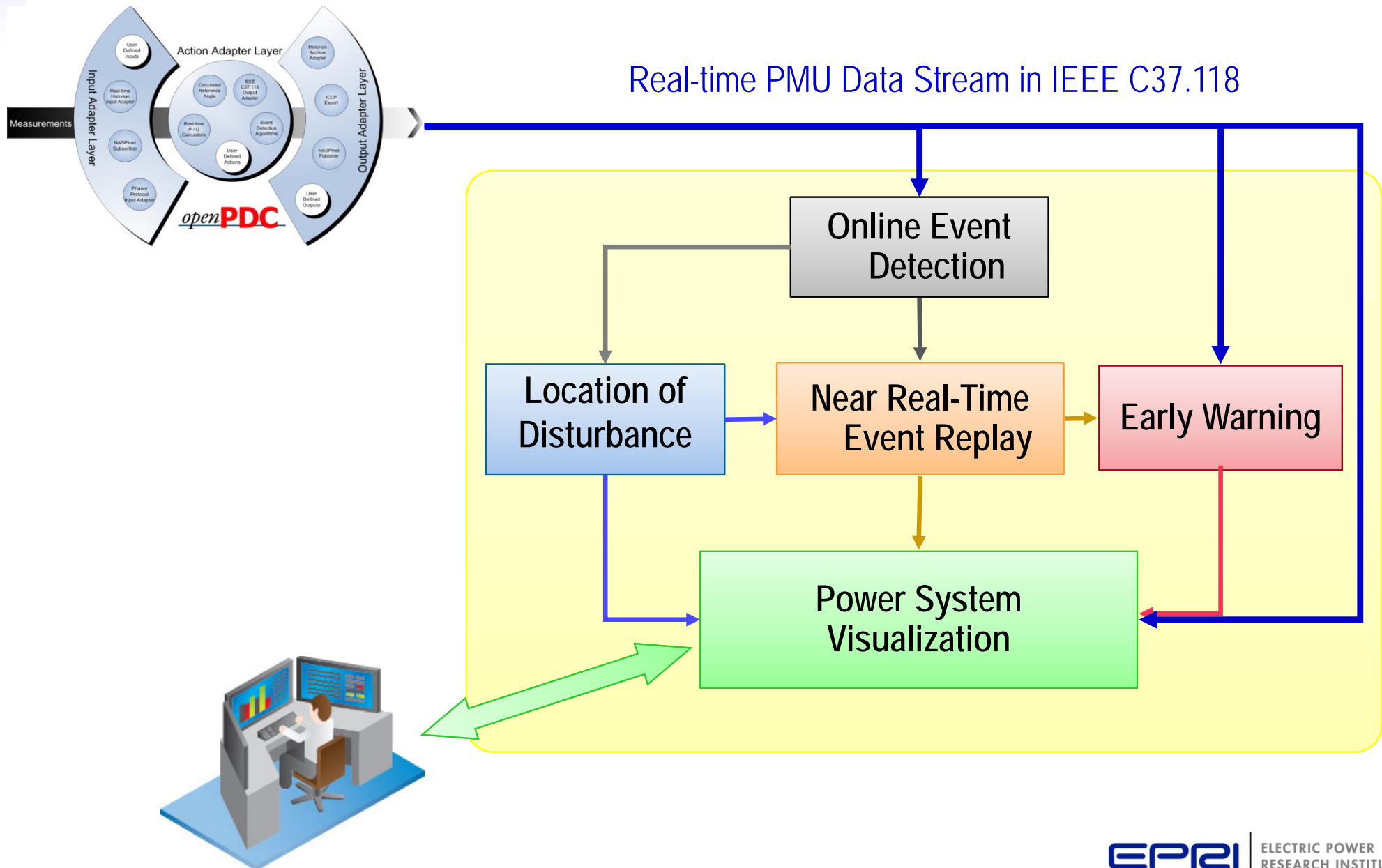
- EPRI
 - Near real-time event replay, inter-area oscillation and early warning functions
- TVA
 - Software installation, integration and demonstration (supported by GPA)
- University of Tennessee, Knoxville
 - Location of Disturbance
- HTC Tech
 - Software development
- Quanta Technology
 - Consulting for software integration and training
- ISO New England & Con Edison
 - Providing advice and cost shares through EPRI supplemental projects



People involved:

Brian Mollohan (DOE PM), Alberto Del Rosso (EPRI), DeJim Lowe, Paul Trachian, Josh Shultz (TVA), Yilu Liu, Kai Sun (UTK), Guorui Zhang (Quanta Tech), Hongtao Chen (HTC Tech), Fred Elmendorf, Ritchie Carroll (GPA), Xiaochuan Luo, Qiang Zhang (ISO-NE) and Jade Wong (Con Ed)

Functional Modules



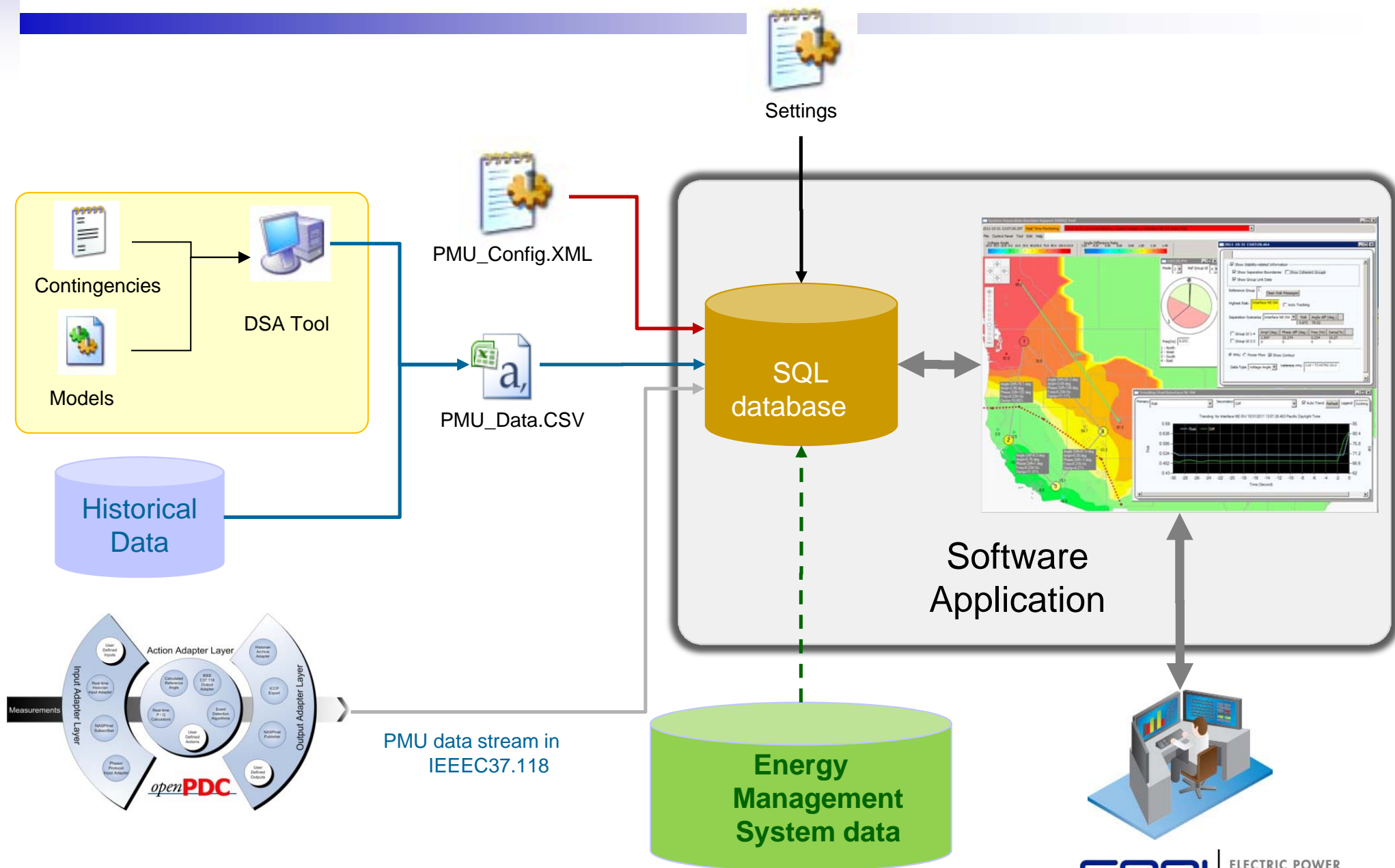
DOE Project - Project Schedule

Phases	Tasks	Periods
Phase 1: Analytical Study (Research)	1 – Research on early warning of stability problems 2 - Development of efficient methods on data processing and transfer for visualization	10/01/2009 ~ 07/31/2010
Phase 2: Pilot Study (Development)	3 - Functional specification 4 - Software development 5 - System integration and offline testing using historical or simulated data	07/01/2010 ~ 12/31/2011
Phase 3: Large Scale Demonstration	6 - Installation and demonstration at TVA 7 - Technical training and documentation 8 - Technical support for 6 months	01/01/2012 ~ 12/31/2012

Where are we?

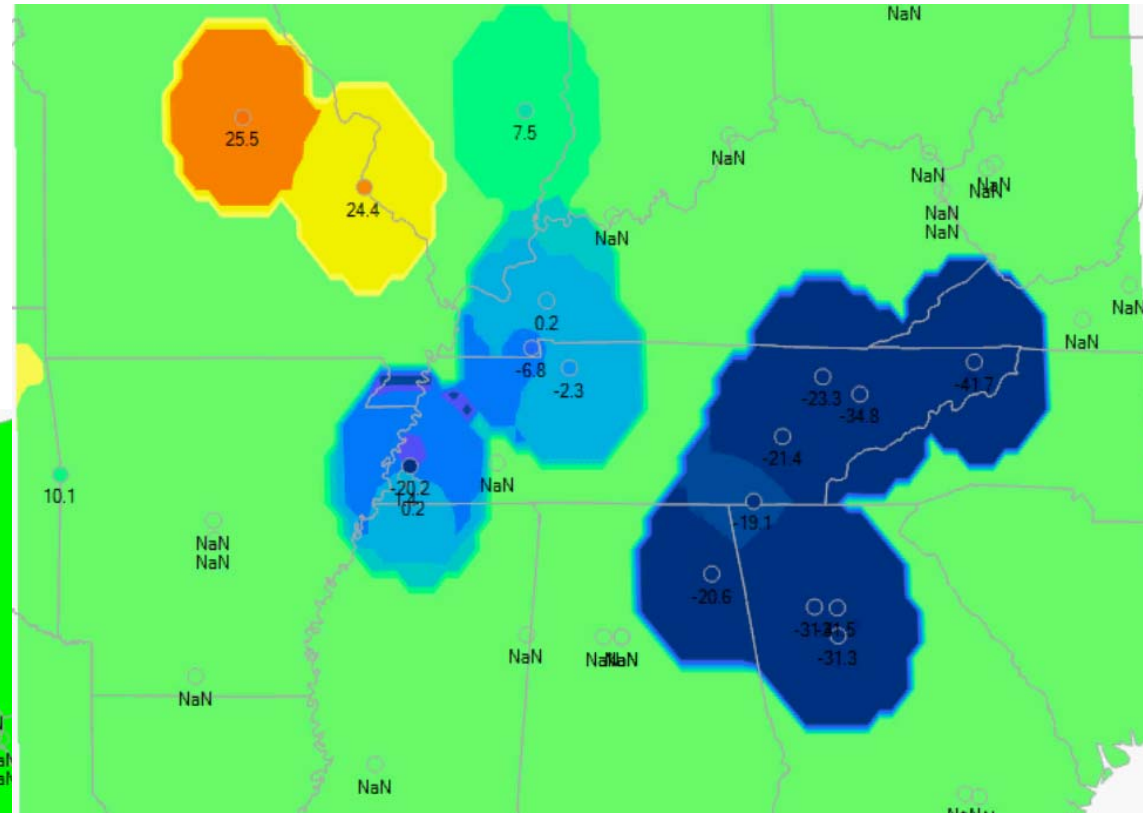
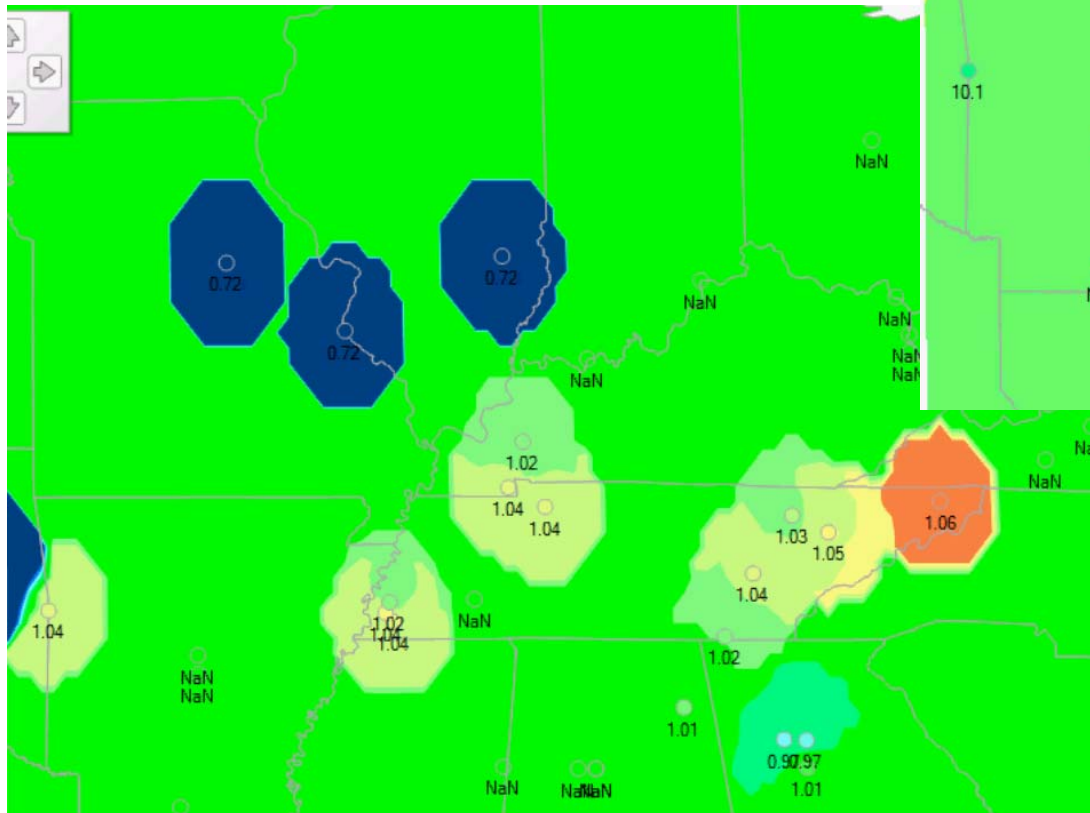
- Worked with TVA and GPA to test the software toolbox integrated with openPDC
- Software is running and being tested on a TVA server with real-time data stream (up to 70 PMUs in EI)
- Hold a DOE Project Demonstration Workshop at TVA Chattanooga office on Oct 23rd
- Accomplish the project before the end of 2012:
 - Submit the final project report to DOE
 - Deliver final version software to TVA and funders
 - Provide software trainings for users

Data Interfaces



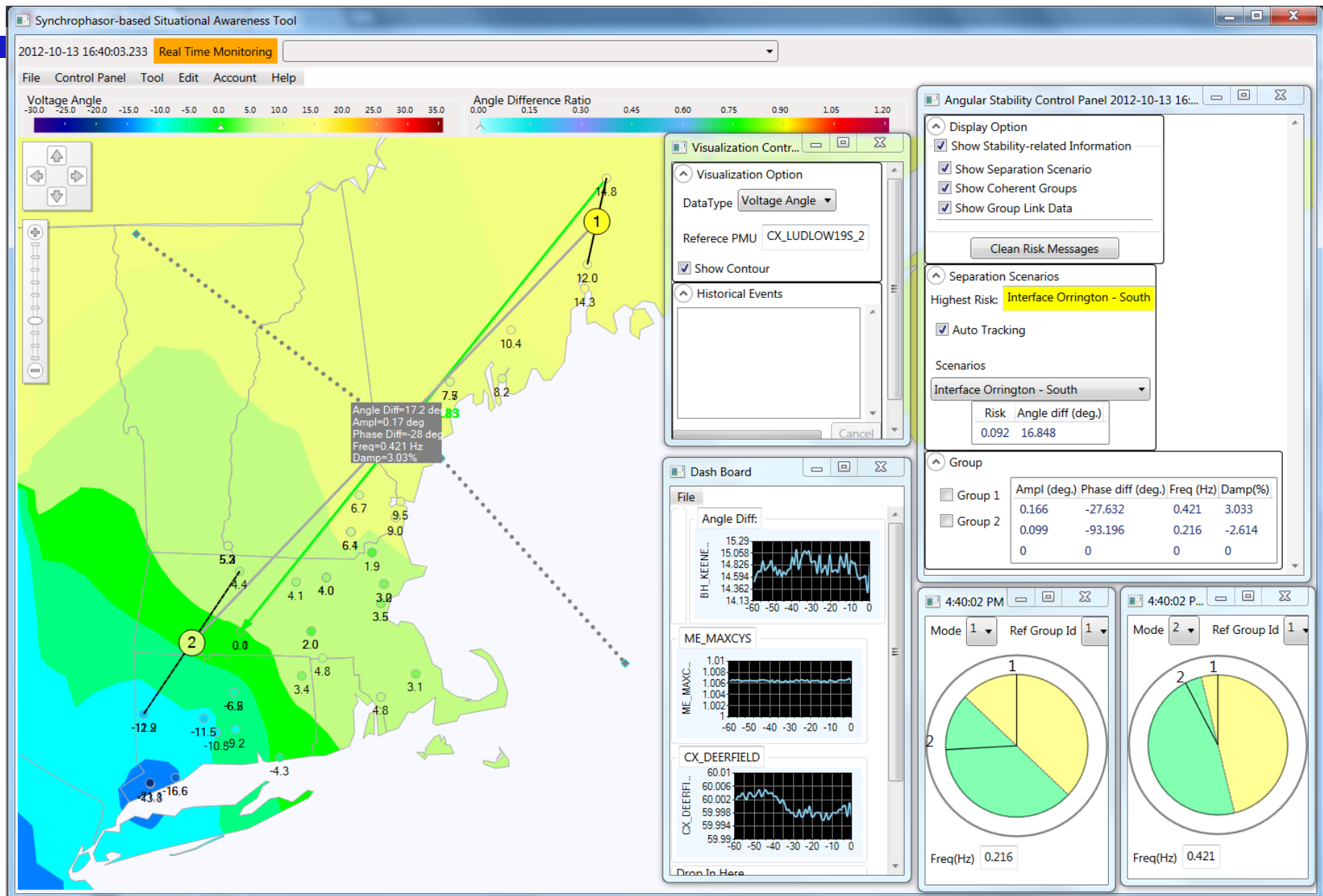
Snapshots from early tests with real-time PMU data from TVA PDC

Voltage contour

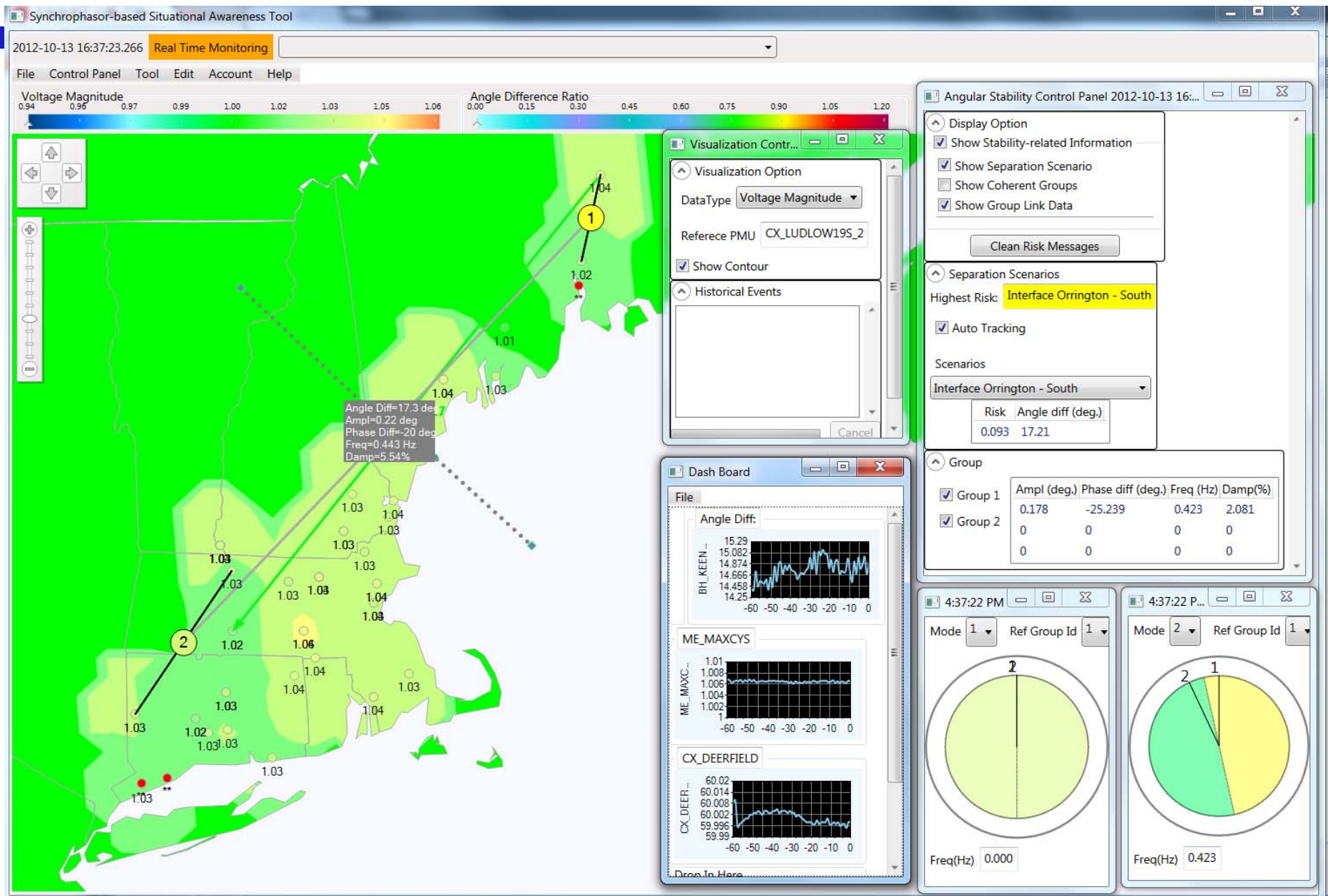


Angle contour

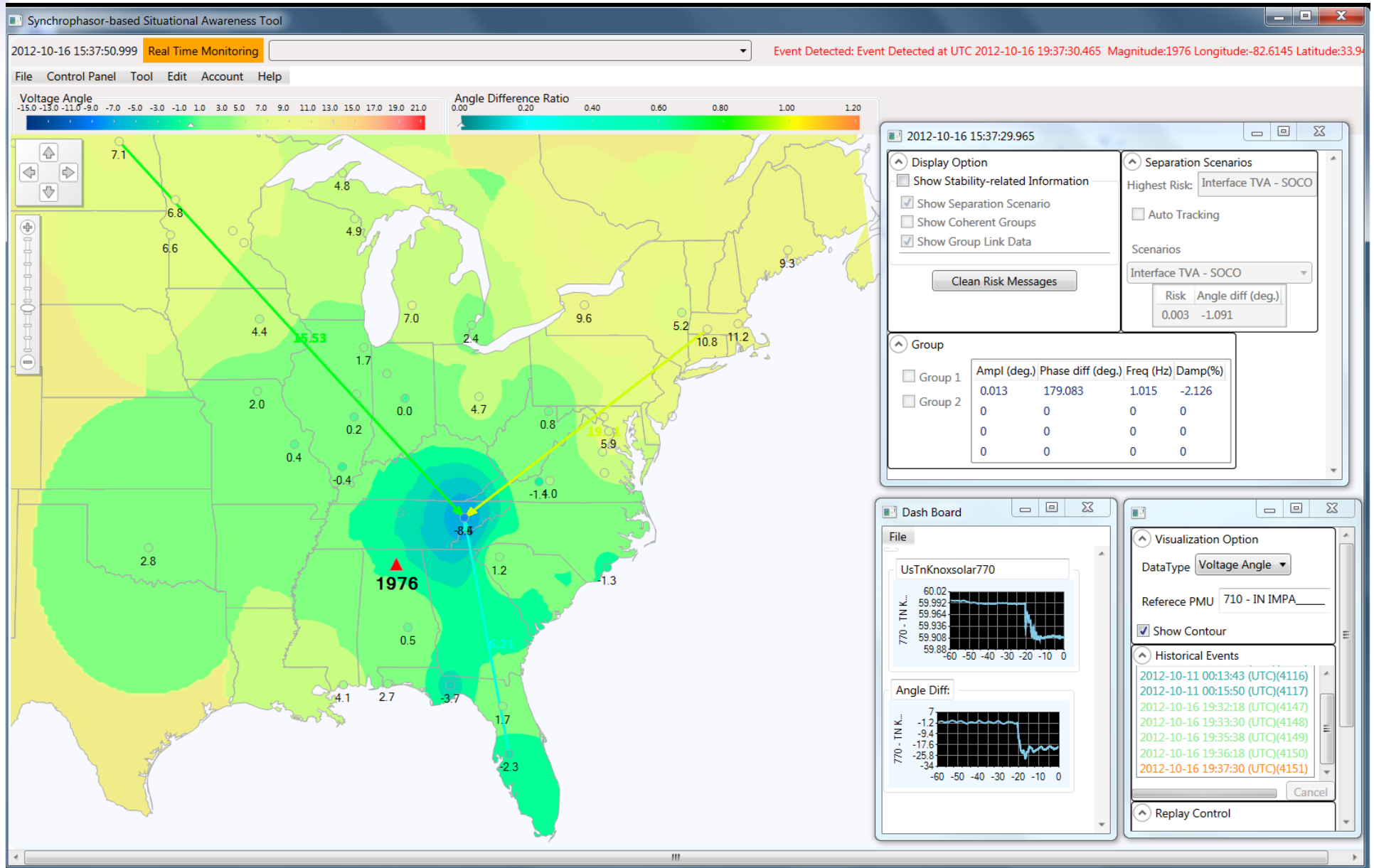
ISO New England PMU Data



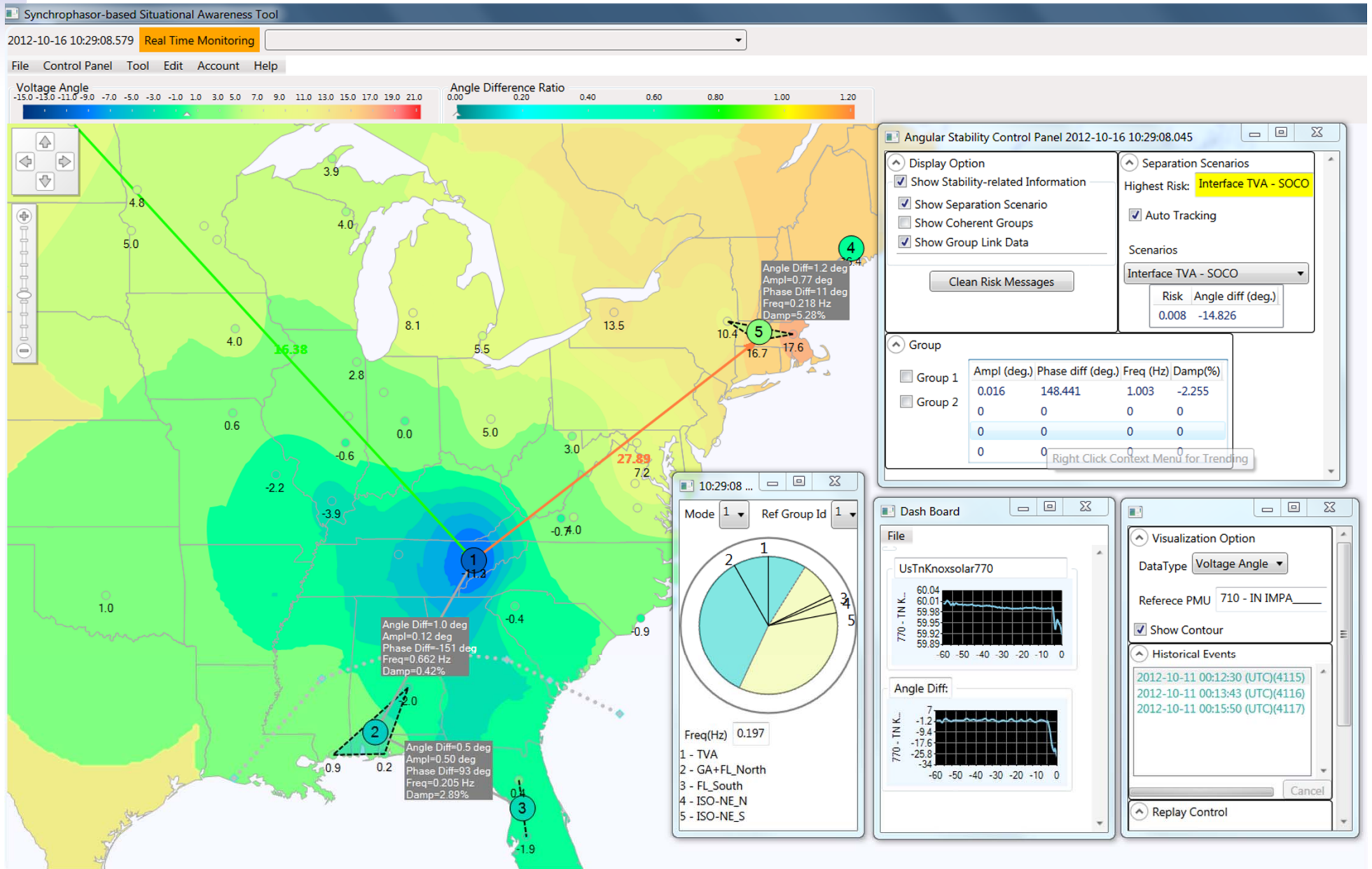
ISO New England PMU Data



Event Detection and Location Using FDR Data on 4/27/2011



Inter-area Oscillation Monitoring Using FDR Data on 4/27/2011



Thank you

