

**NASPI Control Room Solutions Task Team
NASPI Work Group Meeting – San Diego, CA**

**Presenters: Mike Cassiadoro & Jim Kleitsch
April 17, 2019**



Agenda

- Introductions
- CRSTT Mission and Goals
- CRSTT Work Products
 - Focus area documents
 - Use Case Documents
 - Video event data
- Further discussion about Use of Time-Synchronized Measurements in Real-time Ops Horizon training course
- Wrap Up

Our Mission

CRSTT will work collectively with other NASPI task teams to advance the use of real-time synchrophasor apps for the purpose of improving control room operations and grid reliability.

CRSTT will utilize its experience and regional diversity to provide advice, direction, support and guidance to NASPI stakeholders and other organizations involved in the development and implementation of real-time synchrophasor apps.

Our Goals

- Develop a series of use case summary docs that define how entities are using synchrophasor data to provide operational value.
- Create additional video event files for use cases and simulated events.
- Gather operator feedback on synchrophasor-based apps (best practices).

Our Goals (Cont.)

- Support the design, development and delivery of synchrophasor-related training for ops staff.
- Develop a series of Lessons Learned docs related to the use of synchrophasor technology in the operations environment.
- Draft new and update existing focus area documents as the need arises.

Focus Area Docs – Strategy & Approach

- Survey the industry to see what is being done related to a specific topic
- Collect information on the use of the technology and summarize so others have a one stop shop to see what is being done or planned by others
- A lot of good information available but hard to maintain and concerns about the document size deterring people from using the information

Focus Area Document List

- Using Synchrophasor Data for Oscillation Detection
- Using Synchrophasor Data for Phase Angle Monitoring
- Using Synchrophasor Data for Voltage Stability Assessment
- Using Synchrophasor Data during System Islanding Events and Blackstart Restoration

Work Products: Use Case Documents

- Documents demonstrate ways that entities are using synchrophasor data to provide operational value.
- 1-2 pages related to a specific topic that can be quickly shared.

Current posted documents:

- EA001 - Using Synchrophasor Data to Analyze Fault Event Causes Oct 2017
- EA002 - Using Synchrophasor Data to Analyze Concurrent Fault Events Oct 2017
- EA003 - Using Synchrophasor Data to Identify a Failing Potential Transformer Jan 2018
- EA004 - Using Synchrophasor Data to Identify System Voltage Oscillations Jan 2018
- EA005 - Using Synchrophasor Data to Analyze HVDC and SVC Response to Events Feb 2019
- EA006 - Post-Event Analysis of a Compound Event Using Synchrophasor Data Feb 2019
- GEN-03 – Automatic Voltage Regulator (AVR) Malfunction Jul 2017
- GEN-05 – Nuclear Plant Voltage Oscillations Jul 2017

Work Product Location

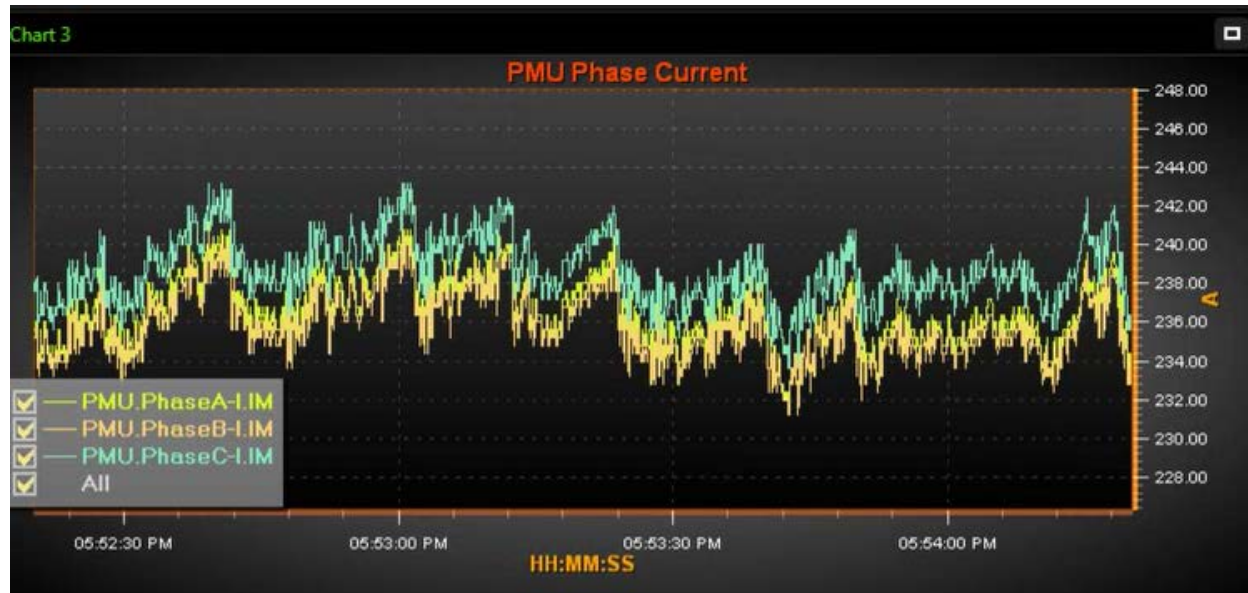
Links available to all the above mentioned documents under the NASPI CRSTT web site:

<https://www.naspi.org/crstt>

Documents		
Title	Description	Date
EA006 - Post-Event Analysis of a Compound Event Using Synchrophasor Data	<p>A post-event analysis was conducted by ERCOT engineers for a compound event on the grid. In the process of analyzing a loss-of-generation event using PMU data, ERCOT engineers discovered other disturbances immediately before the loss of generation. This triggered a more in-depth analysis of these disturbances.</p> <p>The event began with a phase-to-ground fault (determined by PMU frequency and voltage), which was followed by three separate frequency ramps. Since SCADA telemetry indicated that only the third frequency ramp was caused by a generator going offline, ERCOT requested information from the operator of the power plant about a possible load rejection/imbalance event. The operator confirmed that the load imbalance had indeed happened while the TSP in the area confirmed the occurrence of the fault as well as a relay mis-operation in response to the fault at the Point of Interconnection (POI) of the generating station.</p>	Feb 20 2019
EA005 - Using Synchrophasor Data to Analyze HVDC and SVC Response to Events	<p>ATC implemented a back to back HVDC system in 2014 and a Static Var Compensation [SVC] system in 2017. We have SCADA data available from each site scanning every 4 seconds and we also have high speed fault recording at both sites but neither of these data sources provided a picture of the dynamic response of the devices to system events that was readily available.</p> <p>Phasor Measurement Units were installed at both of these facilities to monitor the net output for each. As events occur the equipment response is reviewed, and oddities are investigated. The following plots show the response of each device to a significant double circuit trip event on the system as reference. Note that the SCADA data for each is also included and while it provides information on the general operation of the device the dynamic attributes are hidden.</p>	Feb 20 2019
CRSTT: Using Synchrophasor Data for Oscillation Detection	<p>This paper describes certain functional entity roles and responsibilities related to oscillation detection monitoring, considers how synchrophasor technology may be used to identify actual oscillation events or issues, and describes some of the related commercial applications that are currently available to the industry to perform these tasks. This paper describes applications for which the NASPI CRSTT received information from application users or vendors and may be updated to include additional applications as new information is provided.</p>	Feb 1 2018

Video Event Files

Objective – Continue building library of events to demonstrate value PMU data provides when analyzing abnormal events and disturbances.



Video
PMU versus SCADA Video Events Summary . Please refer to EPG's template and the Synchrophasor Data File Format .CSV when creating a video event.
Video 1 - Current and voltage oscillations observed on the 138 kV system during testing of new generator controls (65 MW gas turbine). RTDMS PMU vs. SCADA Video 1
Video 2 - Voltage oscillations observed on the 230 kV system when a water pump was taken offline. RTDMS PMU vs. SCADA Video 2
Video 3 - Voltage oscillations observed following the loss of a 345 kV line during a period of high wind generation. RTDMS PMU vs. SCADA Video 3
Video 4 - Real and Reactive Power oscillations observed on the 69 kV system during a period of high wind generation with the plant radially connected (i.e. one of two normal source lines out of service). RTDMS PMU vs. SCADA Video 4
Video 5 - Real and Reactive Power oscillations observed during a period of high wind generation. RTDMS PMU vs. SCADA Video 5
Video 6 - Real Power and voltage oscillations observed following the loss of a large generator. RTDMS PMU vs. SCADA Video 6
Video 7 - Wind farm Oscillation Detection and Mitigation using Synchrophasor Technology Wind Farm Oscillation Detection and Mitigation
Video 8 - A 230kV fault followed by a loss of a large generation plant caused system frequency to drop approximately 72mHz momentarily, while having an impact on nearby system voltages and online generators (Clip 1 , Clip 2 , Clip 3)
Video 9 - Please be patient with the download, the video is very large. This video captures the actual synchronization of a large generator to the electric grid. The windows in the visualization tool capture frequency, output power, voltage angle, and voltage magnitude of the generator and at a reference point on the electric grid.



Use of Time-Synchronized Measurements in the Operations Horizon

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Current State of Synchrophasor-Based Applications:

- Widely deployed for use in the Operations Planning and Operations Assessment Horizons.
- Limited integration into the control room environment for use in the Same-day and Real-time Operations Horizon.

Solution: Develop training for System Operators and Operations Support staff to demonstrate how synchrophasor measurements can be used to support the performance of reliability-related tasks.

Training Course Description



TRS and PNNL are collaborating to develop a *Use of Time-Synchronized Measurements in the Real-time Ops Horizon* training course (8 CEH).

Course Summary: Provide an introduction to synchrophasor technology, describe the value it can provide in the Real-time Ops Horizon, and demonstrate how synchrophasor-based apps can be used by grid operators and electric utilities to improve wide-area situational awareness and grid reliability.

Intended Audience: RC, BA and TOP System Operators and Ops Support staff tasked with monitoring and controlling the BES.

Training Course Description (Cont.)



Training Location: Train-the-Trainer sessions and operator training classes to be held at PNNL and select offsite locations in Spring/Summer 2019.

Training Cost: No registration fee (entities responsible for travel costs only).



Overreaching Training Goals



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- Increase knowledge and advance use of synchrophasor technology by creating training materials that grid operators and electric utilities can integrate into their respective training programs.
- Provide train-the-trainer workshops to help electric industry trainers meet the underlying knowledge requirements before delivering company-specific training on the topic.



Training Course Outline



- Lesson 1: Intro to Synchrophasor Technology
- Lesson 2: NERC Functional Roles & Responsibilities
- Lesson 3: Recognizing Power System Oscillations
- Lesson 4: Monitoring Frequency, Voltage & Real/Reactive Power
- Lesson 5: Monitoring Phase Angle Deltas

Design & Development – Lessons Learned



- **Demonstrating Value in the Control Room** – Developing content that will help entities build business cases.
- **Strong Operational Use Cases** – Defining specific uses of time-synched measurements to perform operational tasks.
- **Flexible Assessment Methods** – Designing a training course that allows for different assessment methods.
- **Advanced Training Options** – Considering additional training classes to address more advanced uses of the technology (enhanced state estimation, system islanding/blackstart restoration)

Are PNNL and TRS in search of industry partners to assist with the design and development of training materials?

Yes, all grid operators and electric utilities that wish to participate in the design and development of course materials are invited to do so. A generic version of the training materials will be made available to industry upon completion of the project.

Who has agreed to participate so far?

ATC, ERCOT, ISO-NE, LCRA, Peak Reliability, SCE, Southern Company and WAPA have agreed to support this effort so far.

Contact Information



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Wrap Up

- Monthly conference calls the third Wednesday of each month
 - Review work products
 - Updates from members
 - Share info on interesting system events if any observed
- Always looking for ideas for video event files, use case documents, and focus area documents. (You don't need to be a CRSTT member to send us your ideas!)

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Next NASPI CRSTT Conference Call: May 15, 2019
(regularly scheduled for third Wednesday of the month)