NASPI Control Room Solutions Task Team Monthly Meeting

May 26, 2020

Agenda

- Introductions
- Review CRSTT Mission, Goals and Objectives
- Discuss status of CRSTT work products
  - ➢ Focus Area Documents
  - ➢ Video Event Files
  - ➢ Use Case Documents
- Update from last meeting (25th Feb 2020)
- Short Brainstorming Session
  - ➢ Monitoring and alarming criteria for Inverter Based resources
  - ➢ "Real-time identification of non-modeled behavior
  - ➢ Inertia monitoring
- Adjourn

CRSTT Mission, Goals, and Objectives

- CRSTT's mission, goals, and objectives can be found on the NASPI CRSTT webpage: https://www.naspi.org/crstt

- Other items on the CRSTT web page:
  - CRSTT Work Plan
  - Use case document, mis-operations with PMU Data Summary Table
  - PMU versus SCADA video events summary video

Focus Area Documents

1. **[System Islanding Detection and Blackstart Restoration](#) – Posted June 2015.**

   ➢ (Kleitsch – ATC, Cassiadoro – TRS)

2. **[Using Synchrophasor Data for Voltage Stability Assessment](#) – Posted Nov. 2015.**

   ➢ **(**Farantatos – EPRI, Vaiman – V&R Energy)

3. **[Using Synchrophasor Data for Phase Angle Monitoring](#) – Posted May 2016.**

   (Cassiadoro – TRS, Nuthalapati – LCRA)

   ➢ **Response received from very few (3)**

   ➢ **NDR will follow-up again. Please provide responses so we can update the document.**

4. **Enhanced State Estimation Survey –Preliminary responses received; more analysis needed.**

   (Vaiman – V&R Energy, Kleitsch – ATC)

Focus Area Documents (cont'd)

5. **Using Synchrophasor Data for Oscillation Detection** – Posted Feb. 2018.

    (Nuthalapati –LCRA, Dyer –EPG, Blevins and Rjagopalan –ERCOT, Patel -EPRI)

6. **Using Synchrophasor Data to Determine Disturbance Location** – Posted Feb. 2019.

    (Nuthalapati – LCRA, Zweigle –SEL Inc., Cassiadoro –TRS)

7. **Using Synchrophasor Data to Monitor Reactive Power Balancing – FUTURE? May develop use case document instead**

    (Cassiadoro -TRS, Peak –Zhang, Vaiman –V&R Energy)

We will continue to update these documents but do not expect to develop any new documents in this format.

Video Event Files

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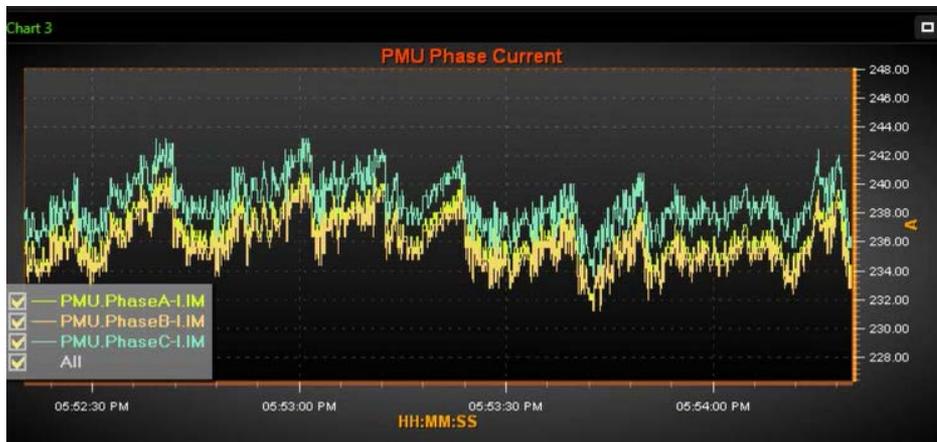
Video

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 Case Documents

Objective – Develop docs that demonstrate ways that grid operators and electric utilities are using synchrophasor data to provide operational value.

Event ID	Event	Event Category	Entities Involved	Event Description	Extended Description in Related NASPI Technical Paper	Safety Impact	Reliability Impact	Budgetary Impact
TE02	Failing potential transformer	Transmission Equipment	ATC	Abnormal voltage signature found while reviewing PMU data led to discovery of a failing potential transformer which was subsequently isolated and replaced.	p.38	The utility avoided safety risk to personnel that might have been in close proximity to the PT during its failure.		Utility avoided costs associated with customer minutes of interruption that would have resulted from the potential transformer's failure had the condition not been identified and a mobile transformer placed in service to facilitate the outages necessary for its replacement.
TE03	Loose connections in potential circuits	Transmission Equipment	OG&E	Fluctuations observed in positive sequence voltage data collected from PMUs led to discovery of a loose fuse connection in a CCVT safety switch. PMU data has been used in a similar fashion to reveal faulty terminations, animal-damaged conductor and contact corrosion.	p.40			Utility avoided costs associated with equipment damage and customer minutes of interruption that might have resulted had the issues not been addressed.

Time-Synched Measures Training Update

2019: TRS and PNNL collaborated to develop a *Use of Time-Synchronized Measurements in the Real-time Ops Horizon* training course (8 CEH).

2020: TRS and PNNL to build on existing training by developing a *Time-Synchronized Measurements Simulation Training* course (8 CEH).

Related Objective: Work with industry to develop improved operational use cases that clearly demonstrate how synchrophasor technology can be used to perform reliability-related tasks.

Ops Use Cases – General Strategy & Approach

➢ Engage Industry – Collaborate with grid operators and electric utilities, vendors and others to develop cases.

➢ Focus on Reliability-Related Tasks – Build cases that highlight use of synchrophasor technology to perform reliability-related tasks.

➢ Apply Consistent Structure – Create a common framework for presenting cases.

➢ Present All Pertinent Info – Expand beyond sub-set of PMU data trends presented in most current cases.

➢ Introduce Enhanced Visualizations – Make it easier access info and understand how it can be used to inform operational decisions.

Meetings Minutes – February 25, 2020

CRSTT

- Please reference the agenda for more details.
- Mission, goals, and objectives can be found on the CRSTT webpage. Feel free to reach out to Mike, Jim, or NDR with any questions you might have on this topic.
- CRSTT is in the process updating the "Using Synchrophasor Data for Phase Angle Monitoring", requests were sent on 2/17/2020 by NDR. Please respond by 3/20/20 so we can update the document prior to the April NASPI Work Group meeting.
- Video event files are educational. Please let us know if you have an event that you would like to share, let Jim know as he can help you make a video of your event.
- Use Case Documents; help you identity and solve problems at a high level. These documents are great resources to help you with a sales pitch when needed.
- Brainstorming session; open discussion about what we should be doing to prepare the change in generation profile to provide situational awareness to Operators of the system.
    - System monitoring and renewable resources; wind plants in the system, solar will be added. Fault in the area, unit output dropped about 50% in the area, 1 plant, 1% covering load in the system. What happens when you have a big fault, huge swing in generation? For the person in the control room what information can/should we

      provide to them? Do they need to know this? What is the value? Do we provide this information in real-time? (The agenda shows the 45 second plot, slide 8).

    - Line trip near generator. If this isn't normal, how do we alert? Jim would like to be more proactive than reactive when it comes to the issues. Need more tools to help do the analysis work. Panos asserted we can try to create libraries and papers for lessons learned (simulation data) and describing the situation at hand, put together a point of reference for example, when you see these measurement X, Y, and Z this may happen. Teresa has Panos' email if Jim or Mike would like to connect with him.
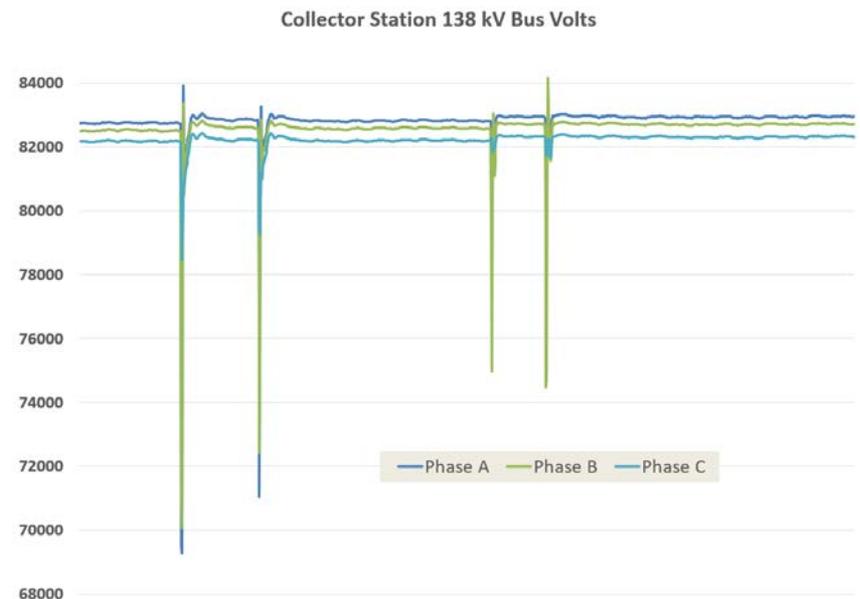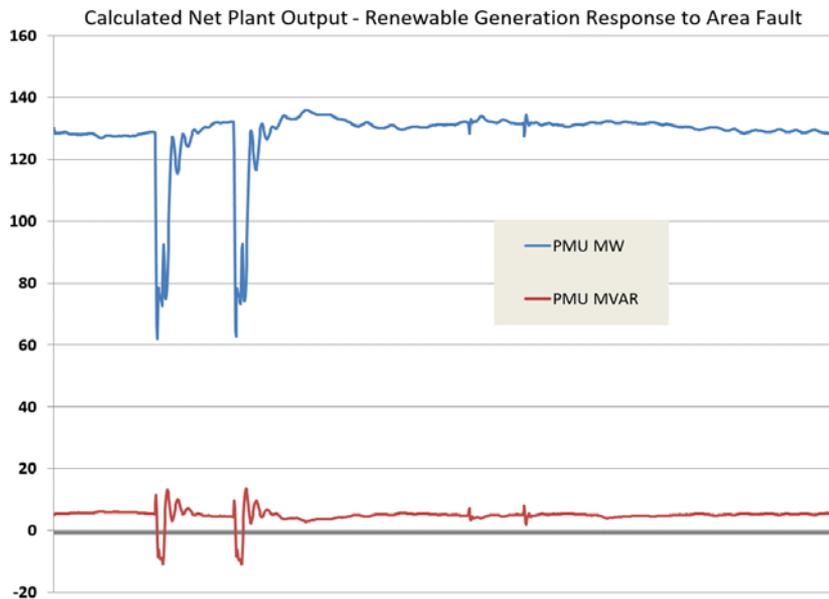
Feb. 25, 2020 Mtg. Minutes (Cont.)

- o Does inertia monitoring need to happen in the control room? Do operators need to know about normal/abnormal inertia? Can synchronized measurement data be used to monitor inertia? Sascha asserted that inertia might not be the variable that we need and was curios if we might need more academic research in this area to apply to this subject or does that research already exist? Jim asserted that perhaps the correct question needs to be formed and Sascha see this as having two actionable directions 1) provide grid operators will real-time information in situational awareness, 2) direct design and programming of the renewable resources, to say hey "we need you to do X" to be aggregated. Need better behavior to become easier to manage. Tom Rizy asserted that there have been studies in the past regarding the loss of inertia, historical trend, information is out there, not sure if inertia is the measurement we need. Maybe pounding at something that might not be a real issue. Tom also commented on the pattern Jim observed saying that the focus should be more on more signature pattern recognition, future for quick analysis on the fly. Jim is going to reach out to Evangelos at the recommendation of Panos. NDR suggested reaching out ERCOT.
- o Jim would like to have a placeholder on the agenda for people who are facing issues and would like to share the information to help solve problems.
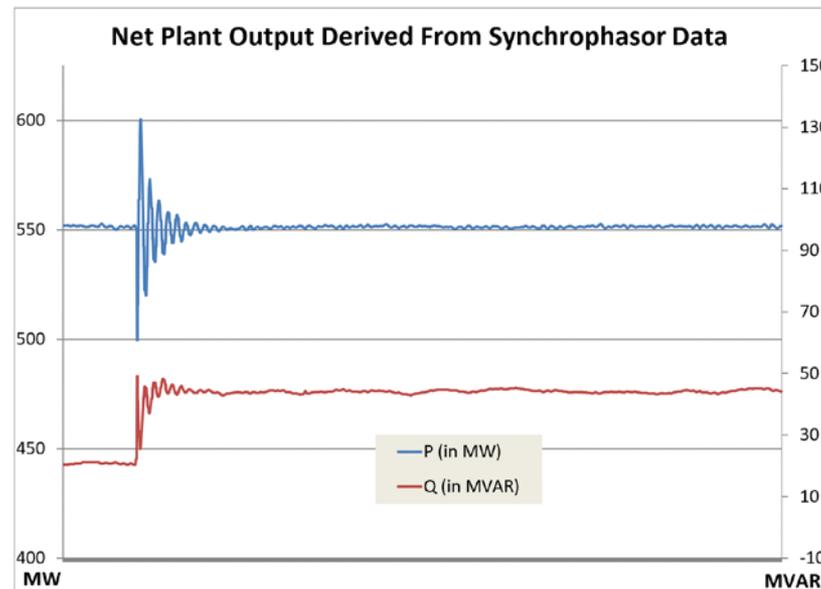
Brainstorming Session

Objective – Open discussion about what we should be doing to prepare for the change in generation profile to provide situational awareness to System Operators

- Monitoring and alarming criteria for Inverter-Based Resources
    - Example response for one plant on our system. Compare to Blue Cut fire (NERC SMS report) with 2 GWs lost.
    - What do Operators (T&D) need to know in real-time to respond to these events when penetration levels reach 40% - 50% - ….

Calculated Net Plant Output - Renewable Generation Response to Area Fault

Collector Station 138 kV Bus Volts

Brainstorming Session (cont'd)

- "Real-time identification of responses that don't match modeled responses
    - Now that we can see the dynamic response of resources on the system, how do we let the right people know when those responses don't look "right"
    - What tools do we need to compare modeled behavior to actual so we can flag when equipment doesn't respond as expected
    - Do we need real time identification or is post event acceptable?
    - Example plant response to breaker open with 25 degree phase angle

Net Plant Output Derived From Synchrophasor Data

Brainstorming Session (cont'd)

- Inertia monitoring
  - Concerns being expressed regarding the loss of system inertia as we replace spinning mass with inverter-based facilities
  - How do we determine what normal inertia levels are if we don't monitor them?
  - What, if any tools are needed to track and possibly make inertia information visible in real time to support real time operations?
    - Impacts to system protection operation
    - Stability impacts
    - Is this a synchrophasor problem or can other data be used to calculate?

- Other problems we need to think about solving in the 2-5 year time frame that synchrophasor data can help with?

Other Miscellaneous

- Update on Webinar Panel Sessions held in April 14-15, 2020

NASPI North American Synchrophasor Initiative

Webinar Panelists Discussions

**Use of Synchrophasor Technology in Control Rooms:
Opportunities and Challenges**

Moderator: Sarma NDR Nuthalapati
Co-Chair, NASPI Control Room Solutions Task Team

Description: There are significant efforts taking place in using Synchrophasor Technology in control room operations. This panel will discuss some of the opportunities and challenges in taking technology to the control room.

Panelists:
- **Dr. Aftab Alam**, CAISO
- **Dr. Hongming Zhang**, Joint Synchronized Information Subcommitte (JSIS), WECC
- **Jim Kleitsch**, American Transmission Co (ATC)

15th April 2020

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  - **Presentations available at https://www.naspi.org/webinars**

Title	Date
Let's Talk About Synchrophasors, PMUs & Applications - Evangelos Farantatos	Mar 18 2020
NASPI Webinar Panelist Discussion: April 15, 2020 (Session 1)	Apr 15 2020
NASPI Webinar Panelist Discussion: April 16, 2020 (Session 2)	Apr 16 2020
Phasors, the Next Generation - Terry Boston and Russell Robertson	May 6 2020
Real-Time Oscillation Analysis: Technology Readiness, and a Vision for Future Needs and Applications - Jim Follum	Jun 24 2020

- Future Webinar Topics
  - CIP Vs PMUs
  - PMU Placement criteria for ISOs
  - …….

THE NORTH AMERICAN SYNCHROPHASOR INITIATIVE

WEBINAR SERIES

Jim Follum, Ph.D.
Pacific Northwest National Laboratory (PNNL)

Real-Time Oscillation Analysis: Technology Readiness, and a Vision for Future Needs and Applications

Power system operators have made significant progress detecting and mitigating oscillations using synchrophasor measurements. Commercial and custom-made software is used to monitor stability margins, detect sustained oscillations, and identify underlying problems. Despite the progress, recent wide-area oscillation events have highlighted the need for improved coordination among grid operators and wider use of oscillation detection and source localization tools. Grid operators have also identified the need to better understand changes in system dynamics related to the rapidly changing generation mix. During this webinar, panelists will first present success stories from oscillation analysis technology deployments and provide an overview of efforts to address current and emerging challenges. These will focus on activities among the WECC Oscillation Analysis Working Group (OAWG), NERC Synchronized Measurement Subcommittee (SMS), and DOE-funded research teams.

Jim Follum received the B.S. and Ph.D. degrees in electrical engineering from the University of Wyoming in 2011 and 2014, respectively. He joined the Department of Energy's Pacific Northwest National Laboratory (PNNL) in 2014 as a Power System Research Engineer. His research focuses on the application of signal processing techniques to problems of power system dynamics. He is the co-chair of the Oscillation Analysis Working Group (OAWG) under WECC's Joint Synchronized Information Subcommittee (JSIS) and a member of the IEEE Oscillation Source Localization Task Force.

Register:
www.naspi.org/node/831

Wednesday, June 24, 2020
10:00am Pacific / 1:00pm Eastern (1 hr.)
Please share with colleagues

CRSTT – Primary Contacts

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If you want to be added to the CRSTT or DisTT email list please contact teresa.carlon@pnnl.gov

NASPI Distribution Task Team Monthly Meeting

May 26, 2020

Agenda

Introductions – anyone new?

Mission Statement

DisTT Report progress update

Gaps and questions

Round Table

Mission Statement

The mission of the NASPI Distribution Task Team is to foster the use and capabilities of networked PMUs at the medium-voltage distribution level, beyond the substation.

This group will share information in support of effective research, development and deployment of distribution PMUs.

We aim to create a community to solve technical and other challenges specific to distribution PMU technology and applications.

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DisTT Report progress update

1. Second draft has been sent to DisTT email list.

2. Document is now in Overleaf (Latex).

3. A few more contributions/references have been received and are being incorporated into the document.

Timeline:

- ~~Formatted draft for circulation at WG meeting 4/10/20~~ DONE

- ~~Second draft to DisTT 5/22/20~~ DONE

- Final deadline for input and comments Friday, 5/29/20.

- Review by NASPI Leadership Team, post to NASPI website in June.

DisTT Report: Gaps and Questions

- Some initially envisioned sections will need to be omitted, since nobody stepped forward to write them – that's okay; we can save those topics for next time.

- One important topic we've had difficulty addressing:
  Explicit performance requirements for distribution PMUs.
  Why is this so hard?
    a) Requirements vary a lot by specific application, so it's hard to generalize.
    b) There's not enough field experience yet to really know the requirements.
    c) None of us feel qualified to make grand proclamations.
    d) Other?

- Hot topic: Wildfire mitigation. Who is working in this area? Any interest in having a focused group discussion on this topic?

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Round Table Discussion

DisTT Contacts

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