International Synchrophasor Symposium
March 22-24, 2016

Marriott Marquis Hotel
265 Peachtree Center Ave
Atlanta, Georgia 30303 USA
1-404-521-0000

For this meeting, the North American Synchrophasor Initiative joins with the International Energy Agency's International Smart Grid Action Network, Transmission & Distribution Annex 6, to host the first International Synchrophasor Symposium. This meeting will feature several nations' synchrophasor projects and accomplishments, and focus on the use of synchrophasor technology for system protection, wide-area monitoring and situational awareness, and emerging applications for electric distribution. There will be a vendor and exhibit show on the afternoon and evening of Wednesday, March 23.

There will be a $625 registration fee to cover meeting costs, refreshments and lunch on the three meeting days. The fee for student registrations will be $150 and the fee for exhibitors will be $1,000 (which will include full attendance for one exhibitor).   **All registration fees will rise by $100 starting on March 5, 2016.** The Symposium registration link is here.

The International Symposium and the Technical Workshop will be held at the Marriott Marquis Hotel in downtown Atlanta, which is served by Atlanta's Hartsfield-Jackson International Airport. Here is the reservation link for the Symposium room block (if you phone in, ask for the International Symposium or NASPI group rate). We also have some rooms available at the government rate for the symposium dates.

NASPI will host a technical workshop on data quality for synchrophasor measurements and data flows on the afternoon of March 21, 2016. You can register for that workshop here; this requires a separate registration apart from the Symposium registration.

Final Agenda (3/17/16)

Tuesday, March 22, 2016		
7:00 - 8:00 am	Registration and networking – Atrium Ballroom Foyer	
	Breakfast – Atrium B Ballroom	
	Meeting in Atrium A Ballroom	
8:00 - 8:15 am	Welcome, introductions, and logistics review	Jeff Dagle (PNNL) Alison Silverstein (NASPI)
8:15 - 8:30 am	Welcome to Atlanta	Billy Ball (EVP and Chief Transmission Officer, Southern Company)

Time	Session	Speaker
8:30 - 9:00 am	Perspectives from the U.S. Department of Energy	Dr. Adam Cohen (Deputy Under Secretary for Science, U.S. DOE)
9:00 - 9:25am	Perspectives from the Electric Power Research Institute	Mark McGranaghan (Vice President, EPRI)
9:25 - 9:50 am	Perspectives from the Clean Energy Ministerial and the International Smart Grid Action Network	Daniel Noll (Policy Fellow, U.S. DOE)
9:50 - 10:10 am	**Break & refreshments (sponsored by OSIsoft) – Atrium Foyer** 	
10:10 am - 12:00 pm	Session 1 – Cascading outages • IEEE-PES Cascading Failures Working Group analysis and recommendations – Dr. Milorad Papic (Idaho Power) and Marianna Vaiman (V&R Energy) • Cascading outage prevention in the Western Interconnection – Hongming Zhang & Brett Wangen (Peak Reliability) • Cascading outage prevention in Colombia – Ramón León (XM Colombia) • Cascading outage prevention in ISO-New England – Slava Maslennikov (ISO-NE) • Cascading outages: monitoring and detection scheme using synchrophasors – Rahul Anilkumar, Ali Daneshpooy, Boza Avarmovic & Dino Lelic (Quanta Technology) (5 minutes) • Formulating actionable information from synchrophasors to forestall cascading outages – Dr. Ian Dobson (Iowa State University) (10 minutes)	
12:00 - 1:00 pm	**Lunch (provided) – Atrium B Ballroom**	
1:00 - 3:10 pm	Session 2 – Synchrophasors for system protection Moderator – Dr. Kjetil Uhlen (Norwegian University of Science & Technology) • Remedial action scheme based on synchrophasor measurements and system angle difference for Peru's 500 kV grid -- Yofre Jacome (Comité de Operación Económica del Sistema Interconectado Nacional, Peru), Eduardo Palma (SEL Latin America) & Luis Figuieroa (Freeport McMoran, Inc.) • Performance evaluation and review of System Protection Scheme design with the help of synchrophasor measurement in India -- Prithwish Mukhopadhyay, V. Pandey, Srinivas Chitturi, Chandan Kumar, Rajkumar, Sunil Patil & Malla Mahendranath (Power System Operation Corporation, India) • NASPI System Protection Survey findings, NASPI Engineering Applications Task Team – Matthew Rhodes (Salt River Project) • Dynamic state estimation-based protection (a.k.a. setting-less protection) – Dr. Sakis Meliopoulos (Georgia Institute of Technology), Paul Myrda (EPRI), Bruce Fardanesh & George Stefopoulos (New York Power Authority) • Real-time voltage stability monitoring: detection, extrapolation and prediction in Malaysia – Bozidar Avramovic, Rahul Anilkumar, Muhidin Lelic, Damir Novosel & Tony Jiang (Quanta Technology), Nik Sofizan B Nik Yusuf, Sheikh Kamar Sheikh Abdullah, Muhammad Tarmizi Azmi & Mohd Khairun Nizam Mohd Sarmin (Tenaga Nasional Berhad, Malaysia) • Using wide area measurements to improve situational awareness and power system analytics in Finnish power system - Antti-Juhani Nikkilä, Mikko Kuivaniemi, Janne Seppänen (Fingrid Oyj)	

3:10 - 3:30 pm	**Break (refreshments and networking) – Atrium Ballroom Foyer**
3:30 - 5:30 pm	Session 3 – Technical standards and synchrophasor technology Moderator – Dr. Damir Novosel, IEEE • Overview of synchrophasor standards – Ken Martin (EPG) • Scottish Power's synchrophasor pilot, standards and roadmap – Priyanka Mohapatra (Scottish Power) • PMU standards, testing, and their applications in China – Dr. Tianshu Bi (North China Electric Power University) • Interoperability test method for IEEE C37.118 standard-based PMUs – Eugene Song (NIST) • Report from IEEE Standards Association & Consumers Energy Laboratory Services – Ravi Subramanian (IEEE Standards Assn.) (15 minutes)

Wednesday, March 23, 2016		
7:00 - 8:00 am	**Refreshments and networking – Marquis B**	
8:00 - 8:30 am	Perspectives from the North American Electric Reliability Corporation – Synchrophasor technology and reliability	Gerry Cauley (NERC)
8:30 – 10:00 am	Session 4 – Synchrophasors for system operations • Implementation of a Wide Area Monitoring System for Austria's Grid -- Michael Weixelbraun (Austrian Power Grid) & Eduardo Palma (SEL Latin America) • Angle characterization using PMUs for control centers in Colombia – Tatiana Belalcázar Rincón, Juan David Durán-Hernández & Lina Ramirez (XM Compañia de Expertos en Marcados, S.A. E.S.P.) • Taking synchrophasor technology to ERCOT operations – Dr. Sarma Nuthalapati, Bill Blevins, Patrick Gravois, Sidharth Rajagopalan, Wei Liu & Isobel Flores (ERCOT) & Kris Koellner (LCRA) • Planning a new synchrophasor system for operations support – Cody Parker & Srinivas Kolluru (Southwest Power Pool)	
10:00 – 10:15 am	**Break (refreshments and networking) -- Atrium Foyer**	
10:15 am – 12:00 pm	Session 5A – Synchrophasor technology for distribution – **Atrium A Ballroom** • Distribution synchrophasors: Overview of applications, lessons learned to date and opportunities for future research – Dr. Alexandra von Meier (California Institute for Energy and Environment (CIEE) and UC Berkeley) • Micro-synchrophasors for distribution grids: instrumentation lessons learned (so far!) – Alex McEachern (Power Standards Lab) • Disaggregation of behind-the-meter distributed energy resources using micro-synchrophasor data and distribution system anomaly detection using micro-synchrophasors – Emma Stewart, Ciaran Roberts, Emre Kara & Anna Liao (Lawrence Berkeley National Laboratory), Dr. Sascha von Meier (CIEE), Ed Cortez (Riverside Public Utility) & Alex McEachern (Power Standards Laboratory) • Enabling micro-synchrophasor data analytics -- Dr. Omid Ardakanian (University of California, Berkeley) • Cyber-physical intrusion detection Incorporating microPMU measurements in Automated Distribution Systems -- Mahdi Jamei & Anna Scaglione (Arizona State University), Emma Stewart, Sean Peisert, Chuck McParland (Lawrence Berkeley National Laboratory) & Alex McEachern (Power Standards Lab)	

	Session 5B – Synchrophasor technology for oscillation and voltage monitoring – **Atrium B Ballroom**
	• Analysis of eastern interconnection modes and forced oscillations using SEL archived PMU data – Dr. Mani Venkatasubramanian & Tianying Wu (Washington State University), Jared Bestebreur, Ellery Blood & Greg Zweigle (Schweitzer Engineering Laboratories, Inc.)
	• A Test Cases Library for methods locating the sources of sustained oscillations – Kai Sun & Bin Wang (University of Tennessee, Knoxville), Slava Maslennikov, Qiang "Frankie" Zhang & Xiaochuan Luo (ISO-New England)
	• PMU applications prioritization methodology based on wide-area disturbance events and its implementation in the Colombian electric power system -- Leydi Zora & David Elizondo (Quanta Technology), Santiago Mesa Jaramillo & Jorge Enrique Gómez Castro (XM Colombia), Ramon Leon Candela ISA Colombia; presented by Dino Lelic
	• Linear state estimation for synchrophasor data quality – implementation and performance at BPA -- Tony Faris (Bonneville Power Administration) & Lin Zhang (Electric Power Group)
	• Inter-area resonance from forced oscillations in power systems – Dr. Mani V. Venkatasubramanian (Washington State University), Seyed Arash Sarmadi (National Grid) & Armando Salazar (SCE)
12:00 – 1:00 pm	**Lunch (provided, sponsored by IEEE-SA) – Marquis B**
1:00 - 3:00 pm	Session 6A – Synchrophasor technology for distribution, part 2 – **Atrium A Ballroom**
	• Synchrophasors from distribution networks and micro-grids for improving reliability – Alex Flueck (Illinois Institute of Technology)
	• Distribution PMU scoping study – Dr. Harold Kirkham & Frank Tuffner (Pacific Northwest National Laboratory), Joe Eto & Emma Stewart (Lawrence Berkeley National Laboratory), David Schoenwald (Sandia National Laboratory), & T.M. Smith
	• Synchrophasor applications for distribution networks enhancing T&D operation and information exchange – Dr. Luigi Vanfretti, Hossein Hooshyar, Farhan Mahmood, Ravi Shankar Singh, Ali Bidadfar & Narender Singh (KTH Royal Institute of Technology) & Mehdi Monadi (Polytechnic University of Catalonia, Spain)
	• Where micro-synchrophasors and machine leaning meet: deep learning method for data-driven operation of distribution networks using microPMUs – Dr. Reza Arghandeh (Florida State University)
	Session 6B – System security and time – **Atrium B Ballroom**
	• Discovering geomagnetic disturbance patterns for synchrophasor-based event prediction in Quebec -- Sébastien Guillon (Hydro-Québec TransÉnergie), Luc Cauchon, Martin De Montigny & Innocent Kamwa (Hydro-Québec, Institut de Recherche d'Hydro-Québec), Chumki Basu (IBM Research, Thomas J. Watson Research Center) & Manikandan Padmanaban (IBM Research, India Research Lab)
	• From the sun to central Maine, a data-driven investigation into GMD's impact on operational assets -- Sean Murphy (PingThings) & Justin Michlig (Central Maine Power)
	• Anti-spoofing synchrophasor technologies – Michael Cohen & Kevin Skey (The Mitre Corp.)

	• Do you know what time it really is? A look into the cyber-security concerns of time synchronization -- Rich Corrigan (Sempra Utilities) & Gerardo Trevino (Southwest Research Institute) • Encounter with leap second - experiences in Indian WAMS – P.K. Agarwal, Harish Kumar Rathour, Puneet Maurya, Rajkumar Anumasula & Sudeep Mohan (Power System Operation Corporation, India) (10 minutes) • NIST monitoring of PMUs handling the June 2015 leap second – Dr. Allen Goldstein (National Institute for Standards & Technology) (10 minutes) • NASPI summary of reported synchrophasor system experience with the 2015 leap second – Jeff Dagle (Pacific Northwest National Laboratory) (10 minutes)
3:00 - 3:20 pm	**Break (refreshments and networking) – A 601/602**
3:20 – 6:00 pm Task Team break-out sessions	**Control Room Solutions Task Team – Room A704** • A software tool for real-time prediction of potential transient instabilities using synchrophasor measurements -- Dinesh Rangana Gurusinghe, Yaojie Cai & Dr. Athula D. Rajapakse (University of Manitoba) (15 minutes) • Real Time Path Transfer Limit Computation -- Rahul Anilkumar, Dino Lelic, and Ali Daneshpooy (Quanta Technology) (15 minutes) • Real-time closed-loop test-bed for a synchrophasor voltage/VAR controller – Backer Abu-Jaradeh (SCE) (15 minutes) • CRSTT business
	Data & Network Management Task Team – Room A703 • An IEC 61850-90-5 gateway for IEEE C37.118.2 synchrophasor data transfer -- Seyed Reza Firouzi, Farhan Mahmood, Hossein Hooshyar & Dr. Luigi Vanfretti (SmarTS Lab, KTH Royal Institute of Technology, Sweden) (15 minutes) • Edge processing of phasor data at the UCSD phasor lab – Dr. Ray deCallafon (University of California, San Diego) & Dr. Chuck Wells (OSIsoft) • DNMTT business
	Engineering Analysis Task Team – Atrium B Ballroom • Performance comparison between dual-blinder and phasor-based out-of-step detection functions using hardware-in-the-loop simulation -- Mustafa A. Saad (Patterson Power Engineers), Dr. Ahmed Eltom, Gary Kobet & Raga Ahmed (University of Tennessee - Chattanooga) (15 minutes) • Novel methods to assess secure power transfer capabilities -- Emil Hillberg (STRI) (15 minutes) • Situational awareness in generation/system control centers of synchronous generators' damping performance -- Paranietharan Arunagirinathan & Dr. G. Kumar Venayagamoorthy (Clemson University) (15 minutes) • EATT business
	Performance Requirements, Standards & Verification Task Team – Atrium A Ballroom • Making dynamic simulations output comparable to synchrophasor measurements of PMUs – Dr. Anurag Srivastava, H. Lee, M. Zhou & P. Banerjee (Washington State University), Dr. Evangelos Farantatos and Mahendra Patel (EPRI) (15 minutes) • A smart PMU with edge processing – Dr. Charles H. Wells (OSIsoft, LLC), Sushrutha Ravish (National Instruments) and Dr. Raymond de Callafon (UCSD) (15 minutes) • Goodness of fit – Dr. Harold Kirkham (PNNL) (15 minutes) • PRSVTT business

6:00 - 8:00 pm	**Reception & Exhibits – A 601/602** • Ametek, Inc. • Consumers Energy Laboratory Services • ERLPhase Power Technologies, Ltd. • GE Grid Solutions, LLC • IEEE Standards Association • Opal-RT Technologies • OSIsoft LLC • Power Sensors, Ltd. • RTDS Technologies • Schweitzer Engineering Laboratories, Inc. • SISCO, Inc. • V&R Energy • VIZIMAX

Thursday, March 24, 2016		
7:00 - 8:00 am	**Refreshments and networking – Imperial B**	
	Meeting in Atrium A Ballroom	
8:00 - 8:45 am	Task Team report-outs	
8:45 - 9:00 am	Update from U.S. Department of Energy	Phil Overholt (U.S. DOE)
9:00 - 10:00 am	Session 7 – Synchrophasor technology and generation – **Atrium A Ballroom** • On-line identification of the moment of inertia of generator units by PMU -- LI Haifeng (State Grid Jiangsu Electric Power Company), Duan Gang, Wu Erke, Yang Dong (Beijing Sifang Automation Co., Ltd.) & Su Hangli (School of Information Engineering, Nanjing University of Finance & Economics) • Simultaneous real-time analysis of rotor angle and generator terminal angles –Tariq Rahman, Subbu Sankaran (SDG&E), Charles Wells (OSIsoft) & Dr. Raymond de Callafon (University of California San Diego) • Generator model validation & tools – Dr. Ryan Quint (North American Electric Reliability Corporation)	
10:00 - 10:15 am	**Break & refreshments – Atrium Foyer and Imperial Foyer**	

10:15 am - 12:00 pm	**Session 8A – Current synchrophasor technology research (part 1) – Atrium A Ballroom** • Real-time phasor-only state estimator with topology processing – Dr. Joe Chow & Christoph Lackner (Rensselaer Polytechnic Institute), Emily R. Fernandes (Vermont Electric Power Company), Scott G. Ghiocel (Mitsubishi Electric Power Products, Inc.), Russell Robertson & Ritchie Carroll (GPA), Qiang Zhang, David B. Bertagnolli & Xiaochuan Luo (ISO-NE), Daniel Ilse & De Tran (NYISO), George Stefopoulos, Bruce Fardanesh, Alan Ettlinger & Saman Babaei (NYPA) • Measurement-based real-time voltage stability monitoring for load areas -- Kai Sun & Fengkai Hu (University of Tennessee – Knoxville), Dr. Alberto Del Rosso, Dr. Evangelos Farantatos, Dr. Navin Bhatt (EPRI) • A synchrophasor-and-active-load-based oscillation damping controller hardware prototype for the Icelandic power system – Guorun Margret Jonsdottir & M. Shoaib Almas (SmarTS Lab, KTH Royal Institute of Technology), & Dr. Luigi Vanfretti (Statnett, Norway) • PMU-based linear state estimator for bad data detection and correction - Anil Jampala & Manu Parashar (GE Grid Solutions), Michael Gilmore, Xiaochuan Luo, J. David Krueger, Qiang Zhang & Slava Maslennikov (ISO-NE), and Anjan Bose (Washington State University)
	Session 8B – Synchrophasor tools (part 1 -- voltage & oscillation management) – Imperial Salon A • Oscillation detection and mitigation at PJM – Jing Liu (PJM) • Damping inter-area oscillations through decoupled modulation by utilizing PMU data -- Renke Huang & Ruisheng Diao (Pacific Northwest National Laboratory) • Cluster analysis of reactive zones in ERCOT – Bill Blevins & Rajagopalan Sidharth (ERCOT), Jim Dyer & Prashant Palayam (EPG) • Fast monitoring of voltage collapse margin with synchrophasors across transmission corridors with multiple lines in Colombia – Lina Ramírez (XM, Compañía de expertos en mercados S.A E.S.P) & Dr. Ian Dobson (Iowa State University
12:00 - 1:00 pm	**Lunch (provided) – Imperial B**
1:00 - 3:00 pm	**Session 9A – Current synchrophasor technology research (part 2) – Atrium A Ballroom** • ExoGENI-WAMS: A cyber-physical test-bed for wide-area monitoring and control of power systems using distributed cloud computing -- Jianhua Zhang, Matthew Weiss, and Dr. Aranya Chakrabortty (North Carolina State University) • Decision Support System: real-time event detection and historical event discovery application for operators -- Mika Takata, Kazutoshi Tsuchiya, Kenta Kirihara, Nao Saito & Yosuke Ishii (Hitachi, Ltd.), Norifumi Nishikawa, Jun Yamazaki & Yutaka Kokai (Hitachi America, Ltd.) & Brett Amidan (Pacific Northwest National Laboratory) • Application of synthetic networks for PMU data synthesis, analysis and visualization -- Komal S. Shetye, Dr. Thomas J. Overbye, Adam Birchfield, Kathleen Gegner & Ti Xu (University of Illinois at Urbana-Champaign) • On-line bad data detection for synchrophasor systems via spatio-temporal correlations -- Meng Wu & Dr. Le Xie (Texas A&M University)

	Session 9B - Synchrophasor tools (part 2) – **Imperial Salon A** • Data Quality Tracker tools – Russell Robertson & Ritchie Carroll (Grid Protection Alliance) • Testing, evaluation and troubleshooting tools for life-cycle management of synchrophasor systems – Dr. Mladen Kezunovic, A. Esmaeilian, T. Becejac, P. Dehghanian, C. Qian & M. Wu (Texas A&M University) • Synchrophasor applications in real-time digital simulators – Thomas Kirk & Jean Nicolas Paquin (Opal-RT) • iTesla RAPID: An open source software for model identification and validation leveraging Modelica and FMI Technologies – Tin Rabuzin and Dr. Luigi Vanfretti (KTH Royal Institute of Technology) • Missing data recovery by exploiting low-dimensionality in synchrophasor measurements – Meng Wang, Pengzhi Gao, Genevieve de Mijolla & Dr. Joe Chow (Rensselaer Polytechnic Institute), Bruce Fardanesh, George Stefopoulos, Saman Babaei & Alan Ettlinger (New York Power Authority), Dan Iles & De Tran (New York ISO) • Towards secure dynamic state estimation Using PMU data under cyber attacks and unknown inputs - Junjian Qi & Jianhui Wang (Argonne National Laboratory), Ahmad F. Taha (University of Texas at San Antonio)
3:00 pm	Symposium adjourns