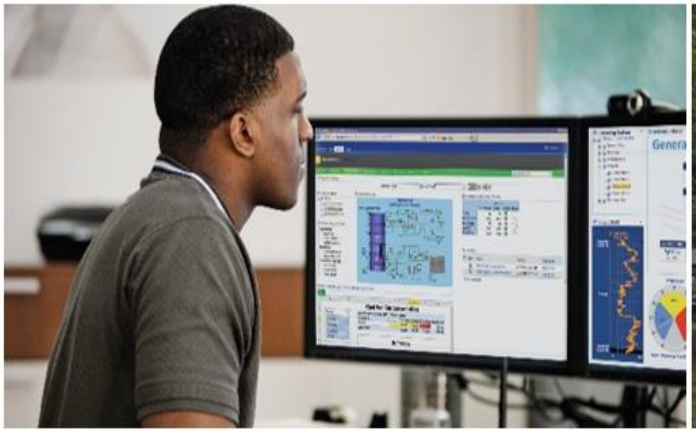
OSIsoft PI System Usage For Microgrids associated with the Academia Program

Mike Mihuc OSIsoft - Academic Principal
Farshogar Umrigar IIT - Graduate Student
Chuck Wells OSIsoft - Microgrid Specialist

OSIsoft.

August 18, 2016

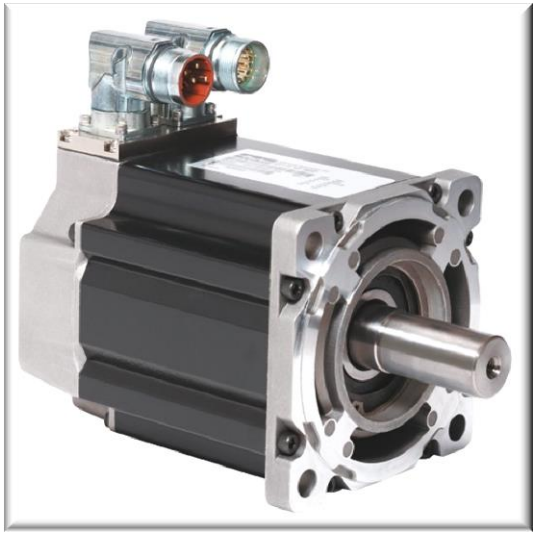




OSIsoft Academic Engagement Program

What is OSIsoft's Academic Program?

- Assisting students in understanding the power of data for engineering lab work and for data science (analytics) work
- Ready students for data storage and data analysis practices in industry
- Stronger collaboration through shared data
  - ✓ Within the university
  - ✓ Among the university campuses
  - ✓ With industry leading companies and government using PI
- Grant research partnering using the PI System software
- PI for commercial operations, holistically analyzing facilities and reducing campus energy consumption
- YouTube Learning – about 2,000 lessons each 2-10 min long

PMUs for Microgrid Control



- Low inertia (Battery, PV, and EV)
- Real and Reactive power coupling
- Island detection and disconnection
- Reconnection to main grid
- Large disturbances (HVAC, Equipment loads)
- Control of demand (lower demand charges and energy use)
- Ancillary services
- Meet IEEE 2030.7 and 2030.8 Microgrid standards

Standard Hardware/Software

- SEL 3355

- SEL 2400 Axion with remote PMU modules
- PI System with AF and standard visual clients
- Microsoft Windows 2012R2
- IEC 61850 Goose outputs
- Analog outputs
- IEEE C37.118 inputs

OSIsoft.

Microsoft

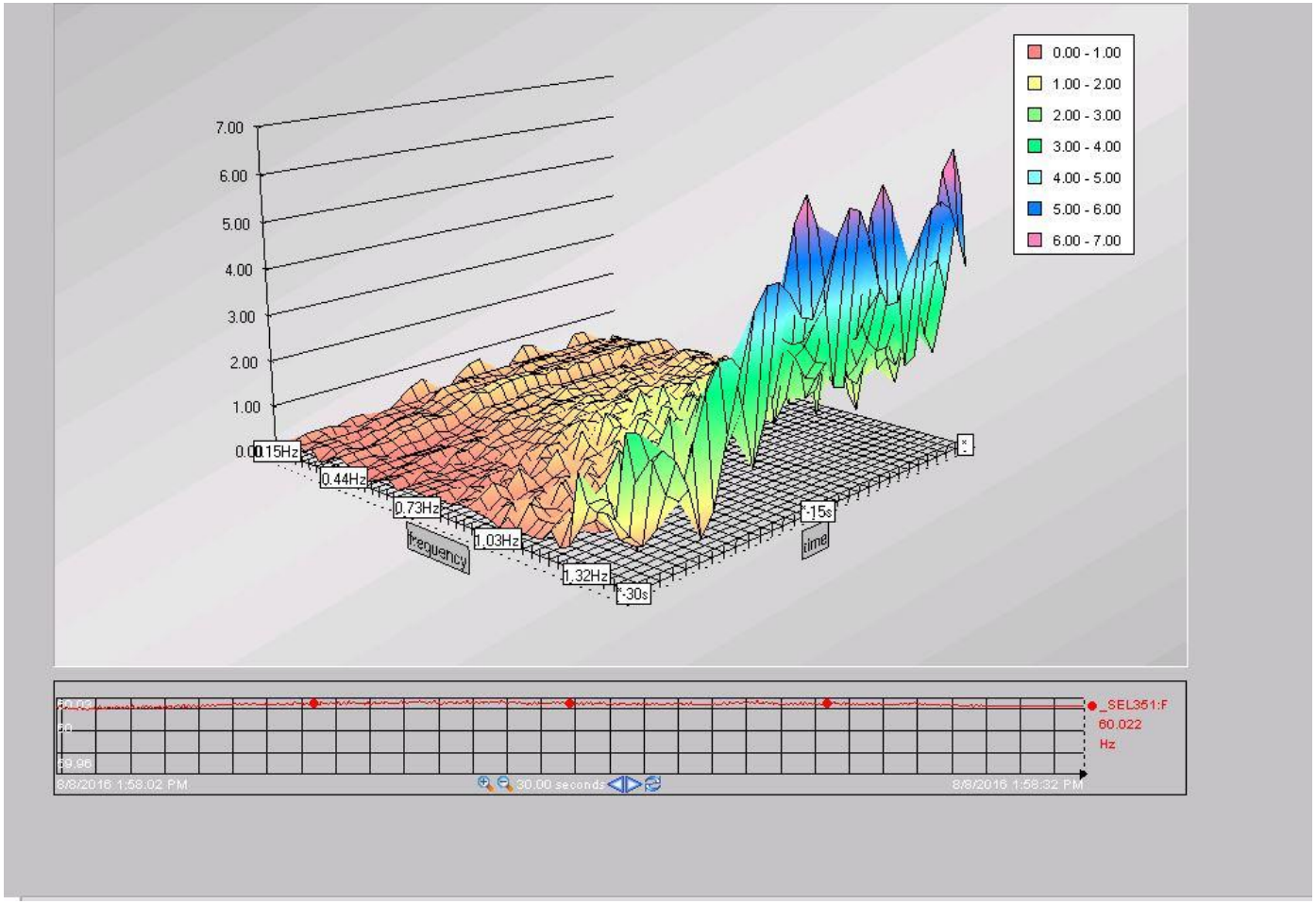
IEC

IEEE

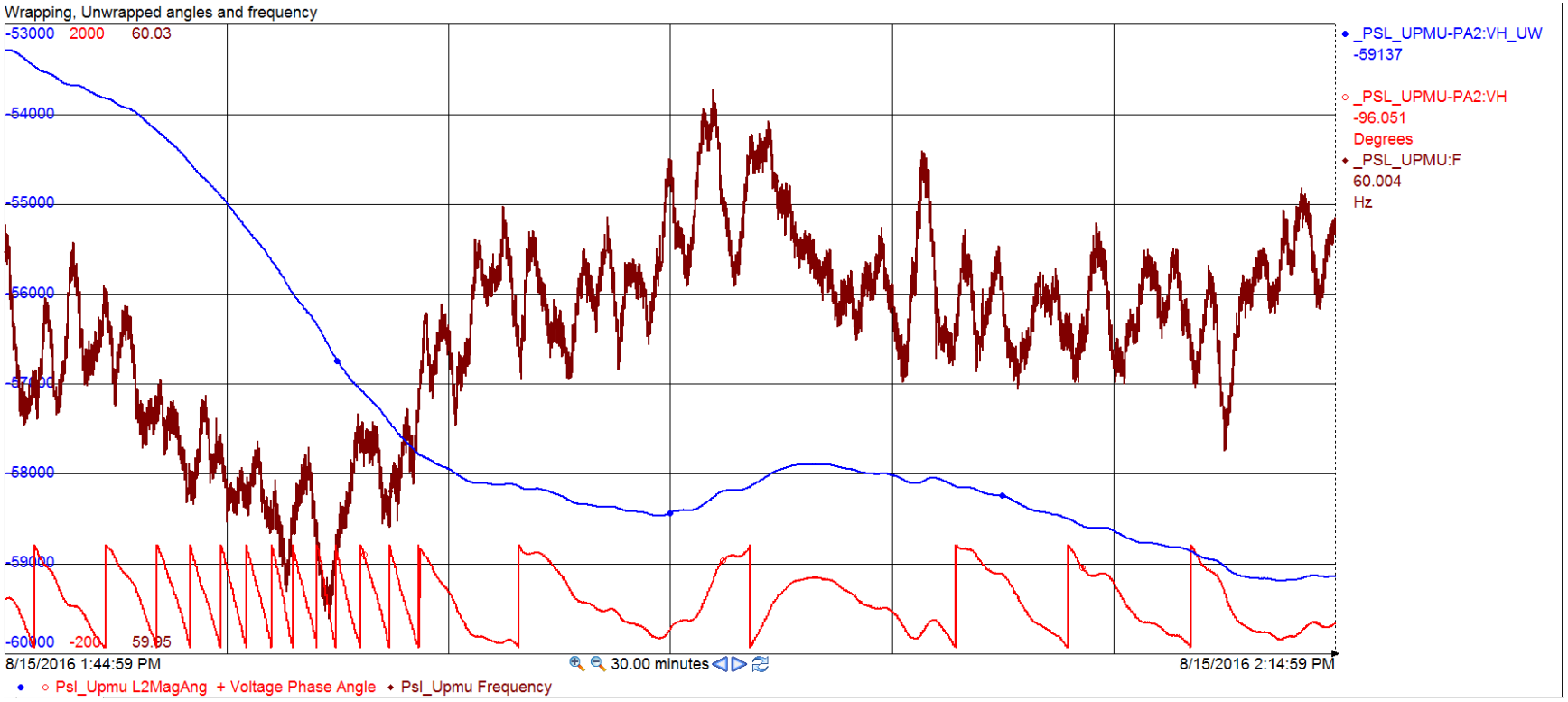
IIT PMU

- Data captured up to 60 frames per second
- PMUs configured for angle unwrapping, event detection, and differencing
- Grid Failure detection using ProcessBook waterfall display
- Configuring rest of the relays to PMUs

Water Fall


0.00 - 1.00
1.00 - 2.00
2.00 - 3.00
3.00 - 4.00
4.00 - 5.00
5.00 - 6.00
6.00 - 7.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.15Hz
0.44Hz
0.73Hz
1.03Hz
1.32Hz
frequency
-30s
-15s
time
_SEL351:F
60.022
Hz
8/8/2016 1:58:02 PM
30.00 seconds
8/8/2016 1:58:32 PM

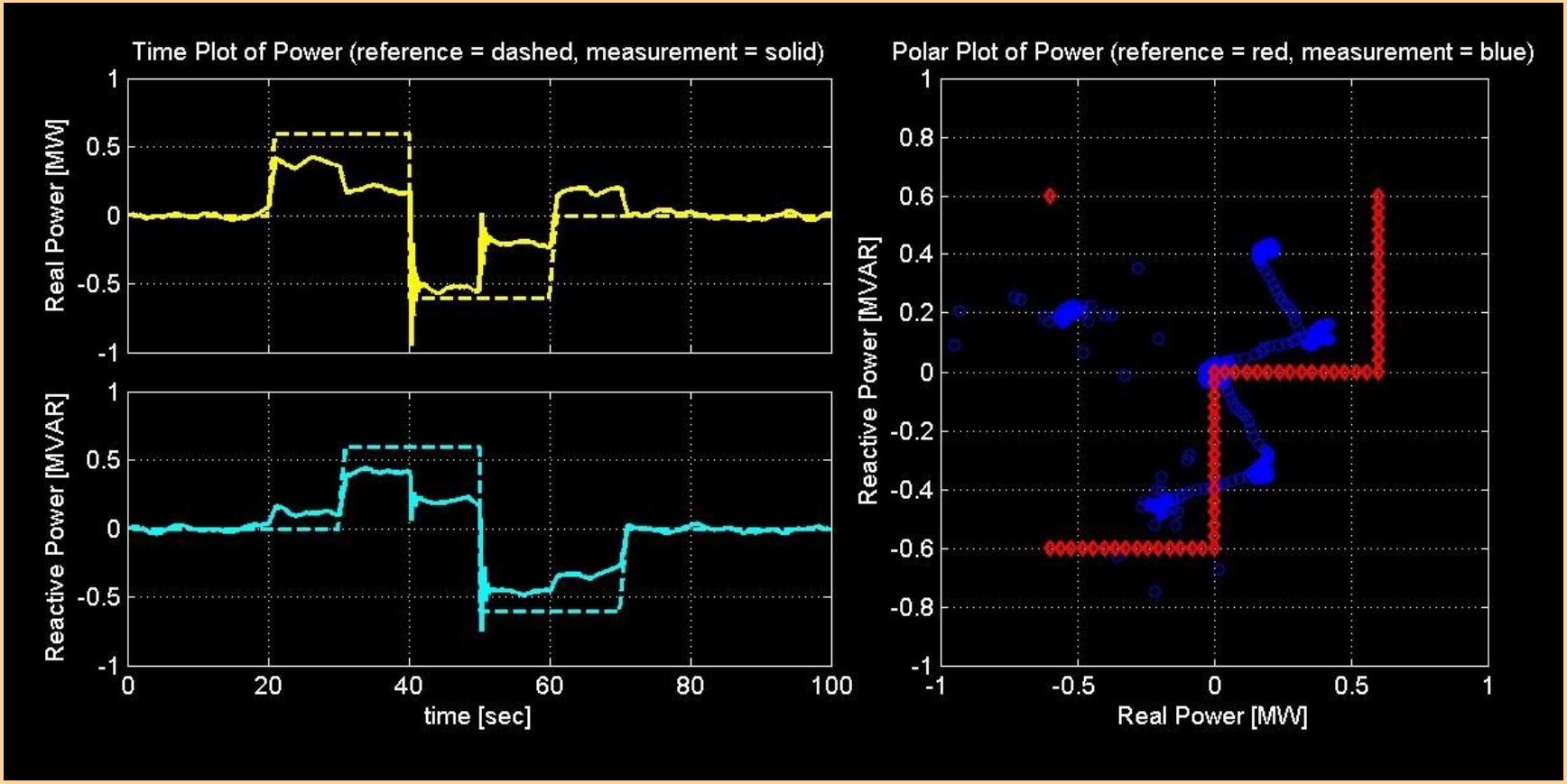
Angle Unwrapping



Sempra/OSIsoft Advanced Control Technology

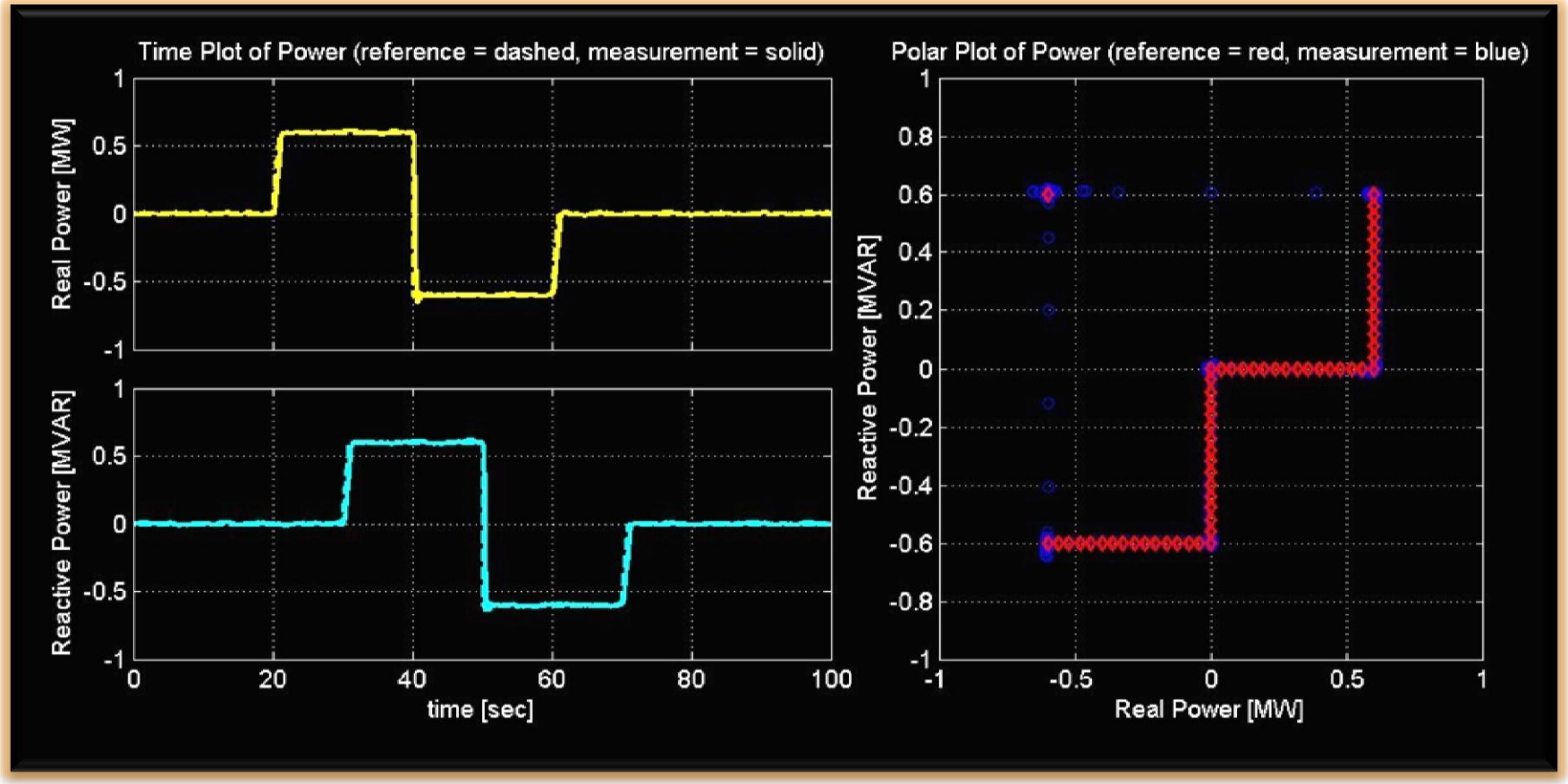
- Fast control (60 Hz)
- Two input two output decoupled control
- Fast tracking (servo system)
- Disturbance mitigation
- Multiple DERs with one controller
- Configured using IEC 61970 CIM
- Automatic performance calculations
- Optimal demand control

PQ coupling– Ohms Law



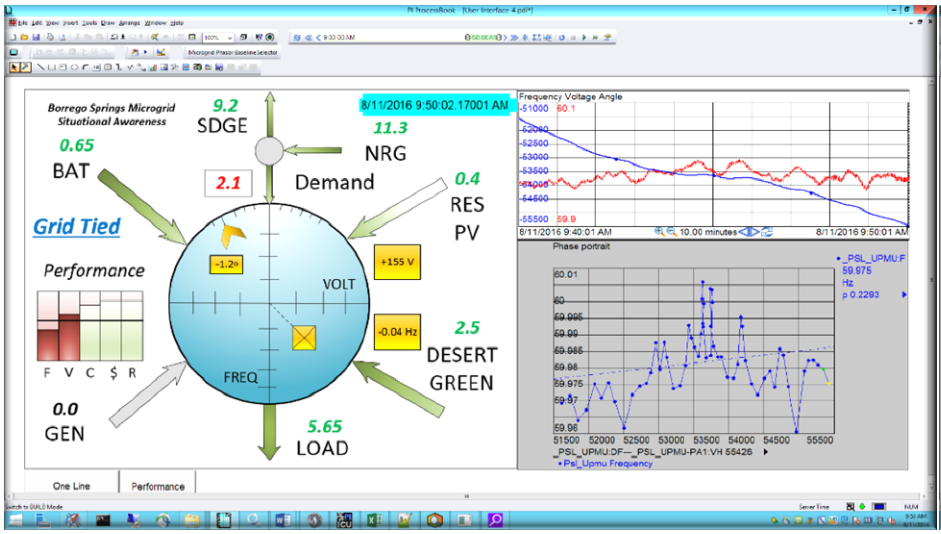
Video

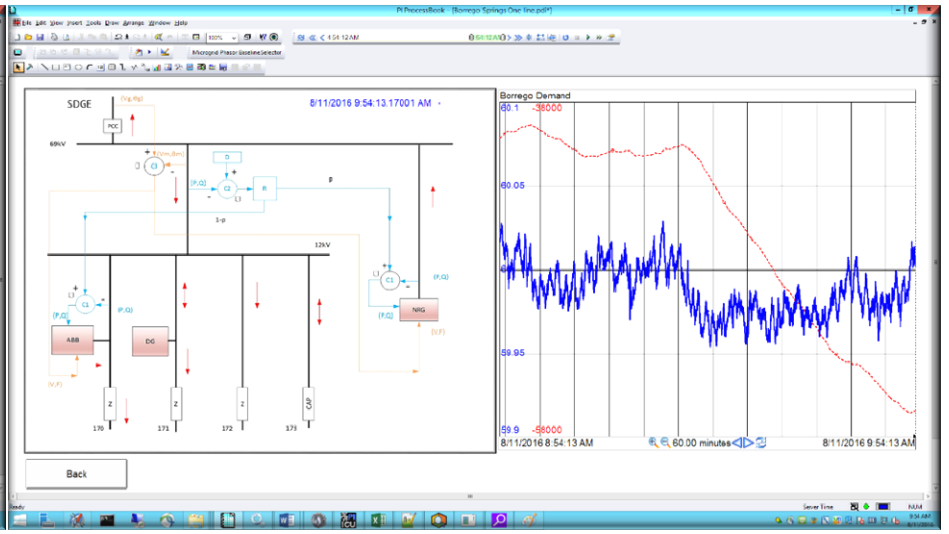
Decoupling with feedback

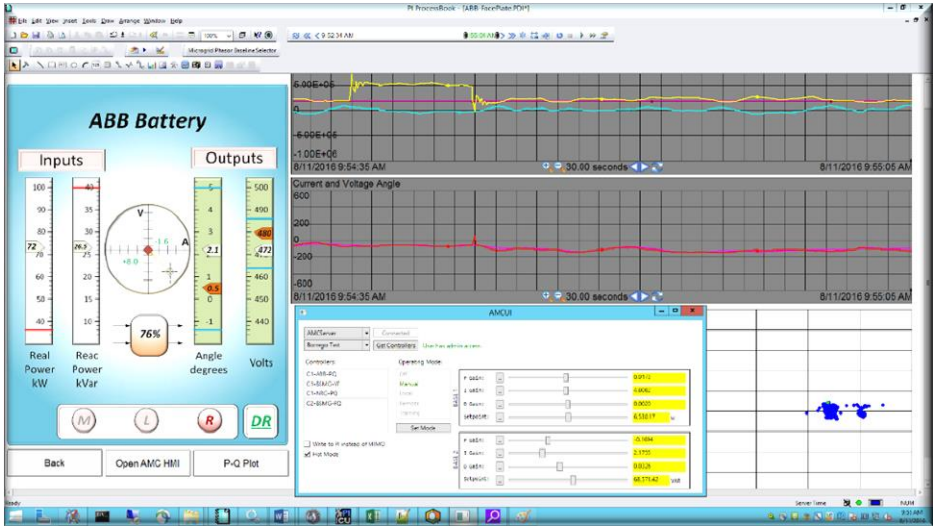


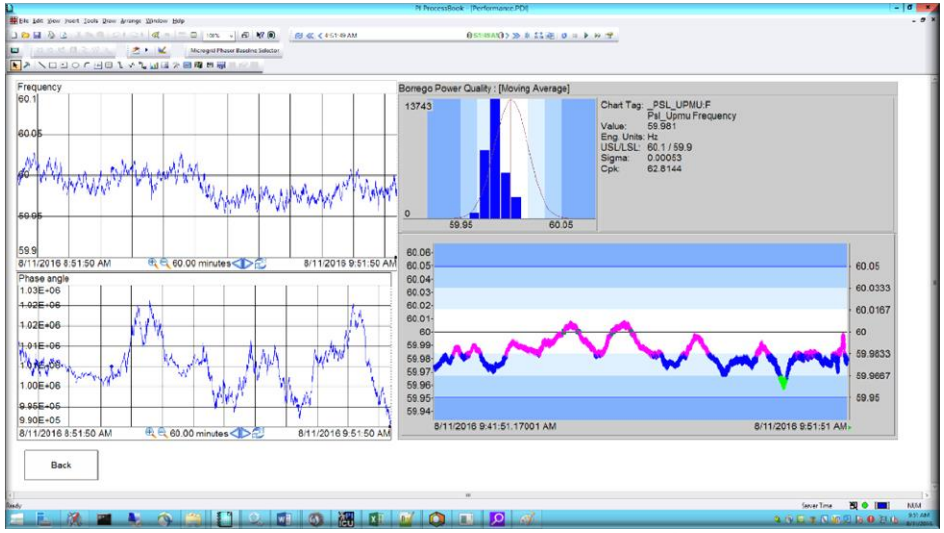
Video

ACT Controller User Interface









ACT Hardware

SEL 3350
PI HA configuration

SEL 2240 Axion
2245-4 PMUs

Takeaways

- Microgrids need fast decoupled controllers
- Reconnection needs PMU angle data
- PMUs are low cost instruments
- Fast control can be done with standard commercial hardware and software
- Benefits of microgrids are:
  - Energy surety, lower cost of power, income from ancillary services

Thank You

The PI System for:

-- Academic research

-- Students: data analysis proficiency

-- Grant partnership Microgrids

Learn more at:

https://pisquare.osisoft.com/community/all-things-pi/academic

OSIsoft®