

Power Plant Model Validation

NASPI Conference

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BPA

Disturbance-Based Model Verification

Periodic model verification is required by NERC MOD-026 and 027 Reliability Standards

PMU-based model validation is an acceptable and cost-effective method to comply with NERC MOD Standards

PMU-based model validation can be used by TPs to independently verify that the models provided by GOs are accurate

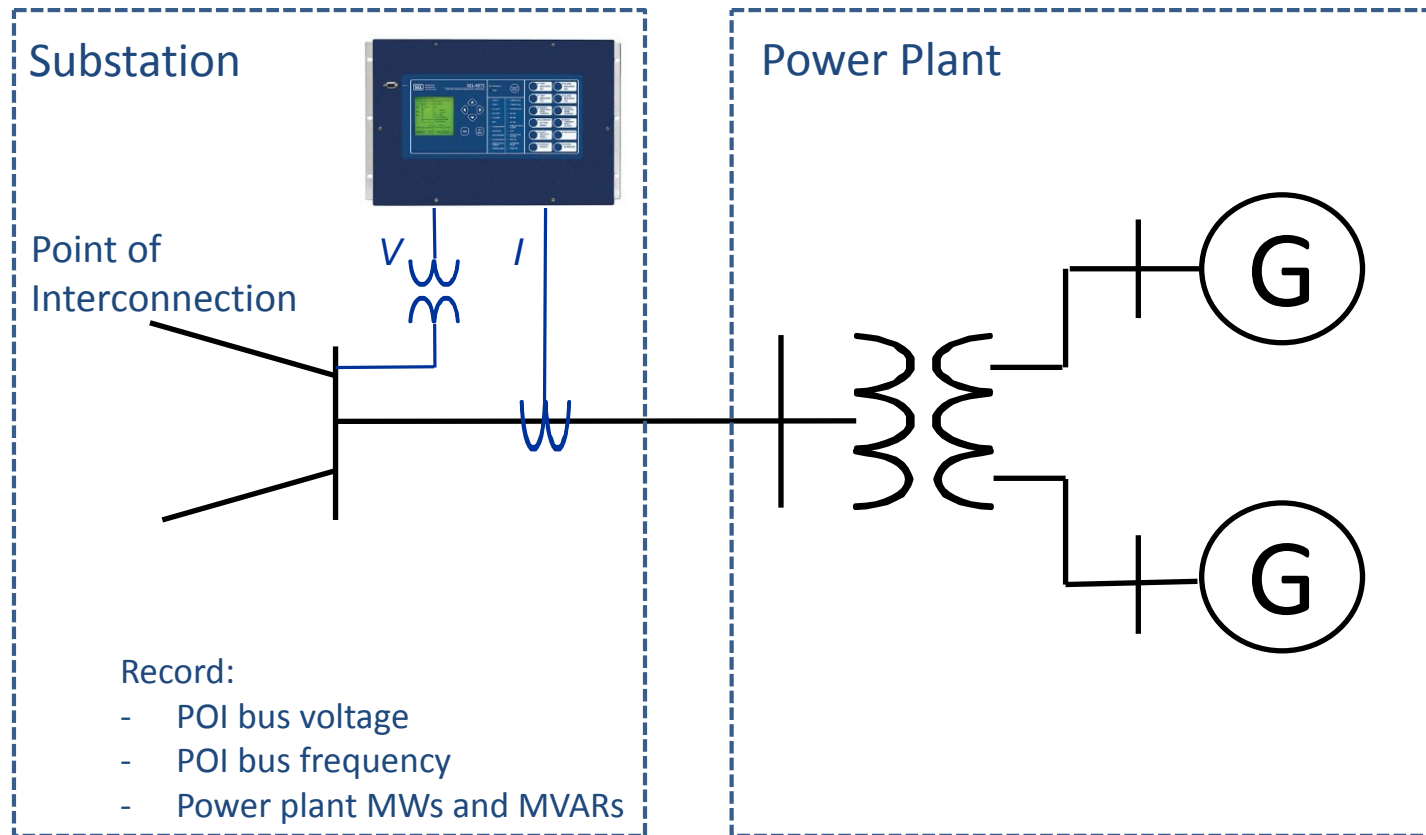
PMU-based model validation allows more frequent model verification and detection of control failures than once every 10 years (per NERC) or 5 years (per WECC)

Disturbance-Based Model Validation

BPA has PMU disturbance monitoring:

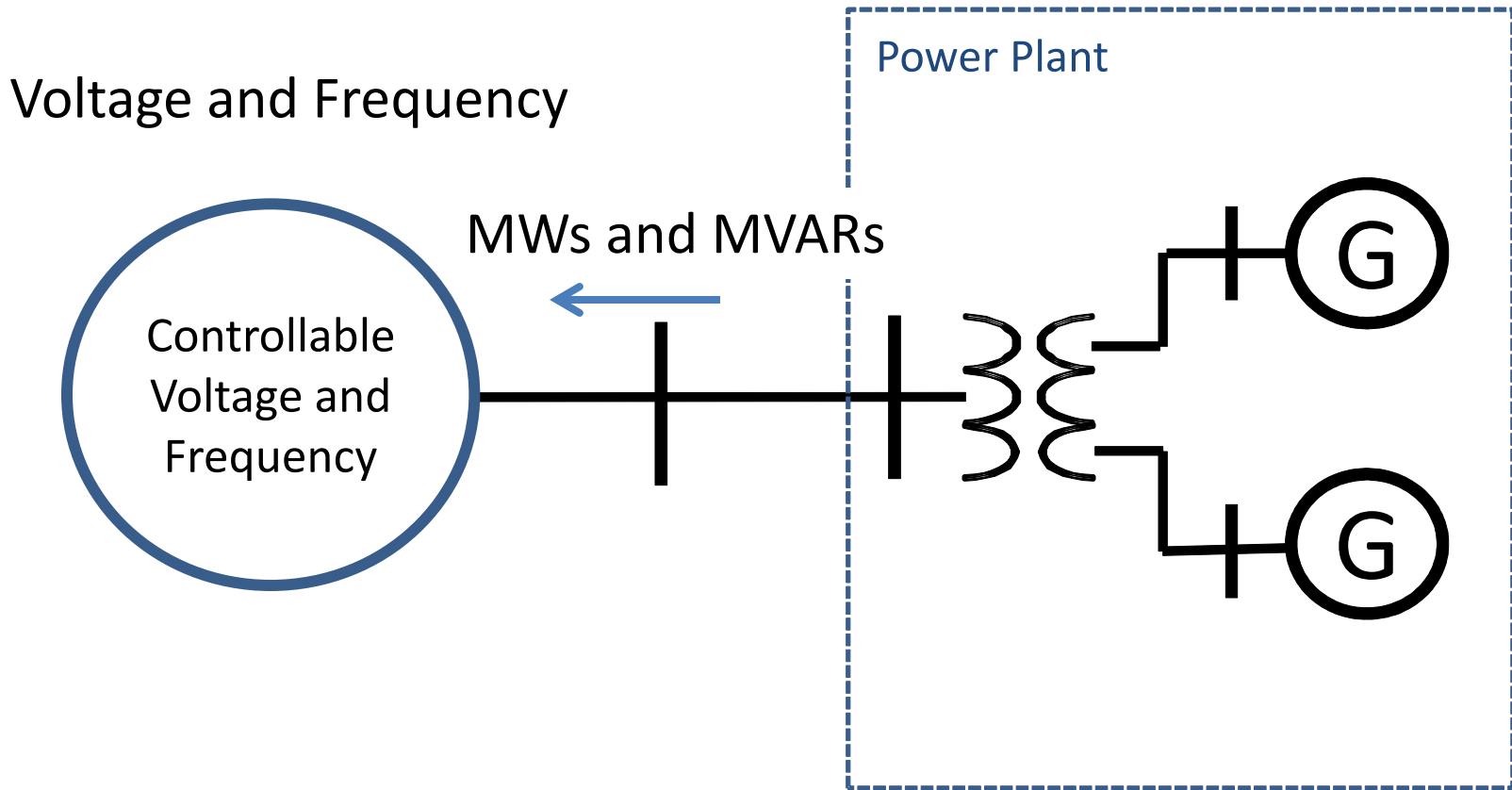
- Conventional –
 - 12 plants,
 - 130 generators,
 - 21,145 MW of generation
- Wind –
 - 11 plants
 - 1,200 MW of generation
- Review model performance annually, integrated business practice

Disturbance-Based Model Validation



One thing you can do today: Make PMU functionality a requirement in your generator interconnection standards

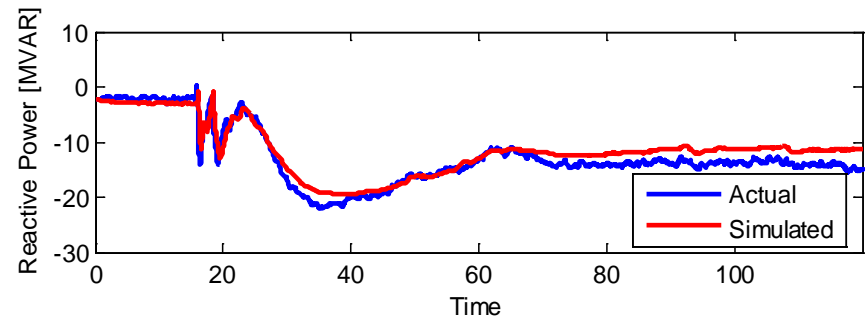
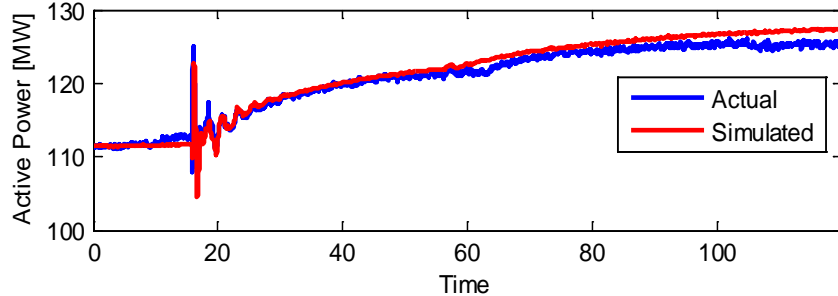
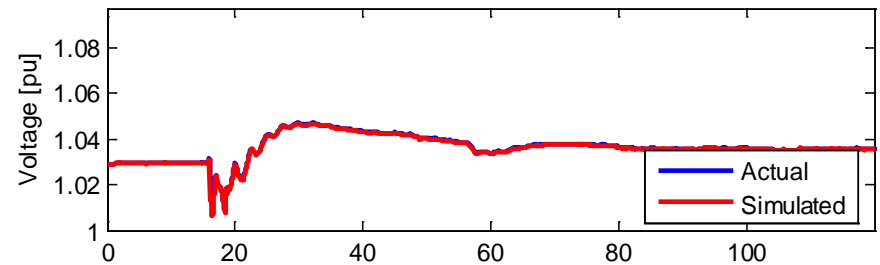
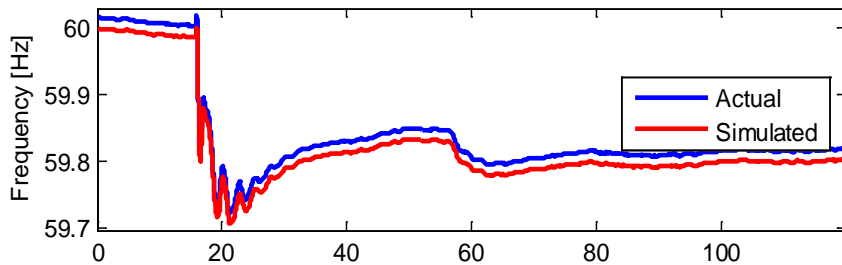
MODEL



Disturbance play-in capabilities are available in GE PSLF since 2001 and Siemens PSS[®]E since 2015

Power Plant Model Validation

- What a “good” models looks like:



Voltage and frequency are inputs

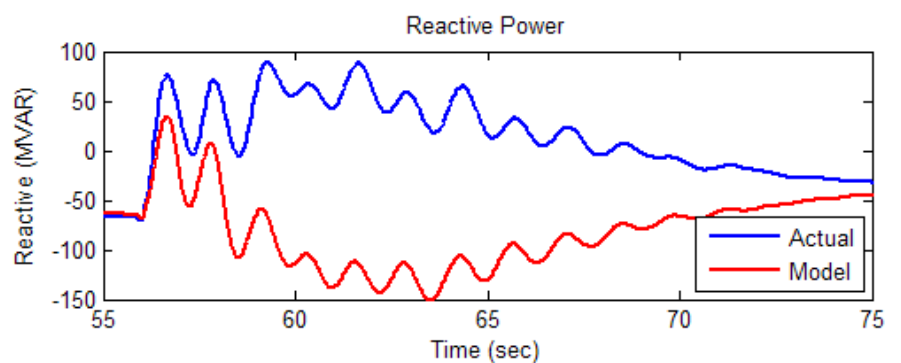
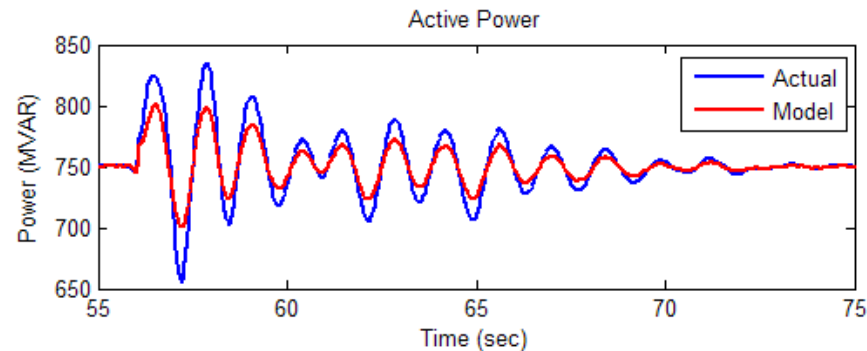
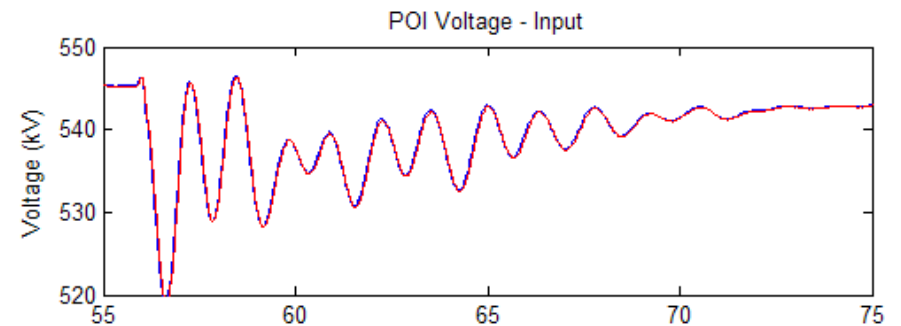
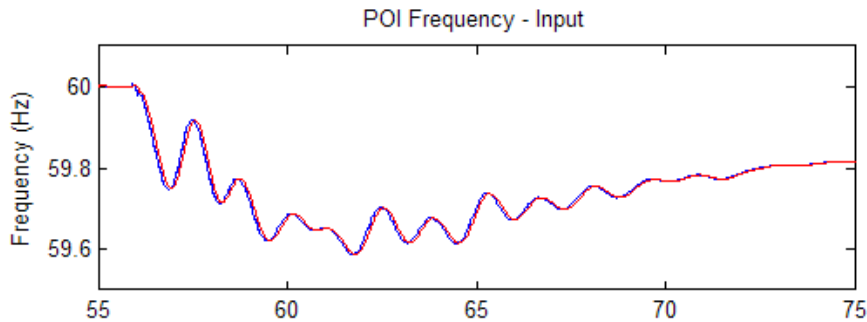
Active and reactive power are “measures of success”

Blue line = actual recording

Red line = model

Power Plant Model Validation

- What a bad model looks like:



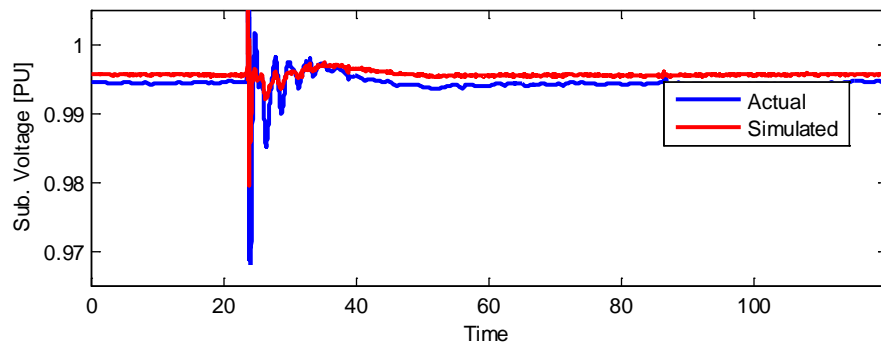
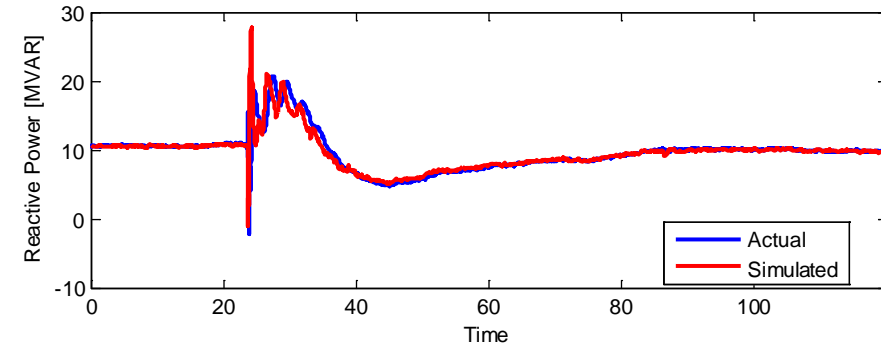
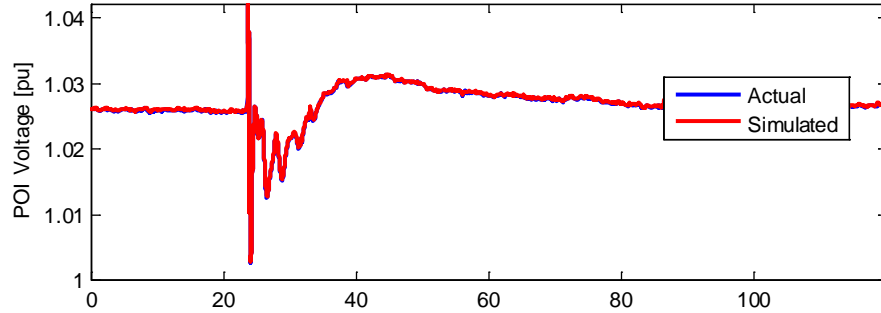
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Wind Power Plant Model Validation



BPA has nearly 4,900 MW of wind generation interconnected to its transmission system

BPA is collaborating with EPRI, UVIG, NREL research on wind power model validation using PMU data

Available Tools

Siemens PTI PSS[®]E, GE PSLF, PowerWorld and PowerTech TSAT have disturbance play-in capabilities

For GE-PSLF users:

- BPA PPMV sequence of GE PSLF EPCLs

For PSS[®]E users:

- Ryan Quint at NERC is developing Python script

BPA-PNNL PPMV

- Stand-alone data management program

NERC and WECC form a user's group on power plant model validation