



Dynamic Model Improvement Proposals – Continued Discussion

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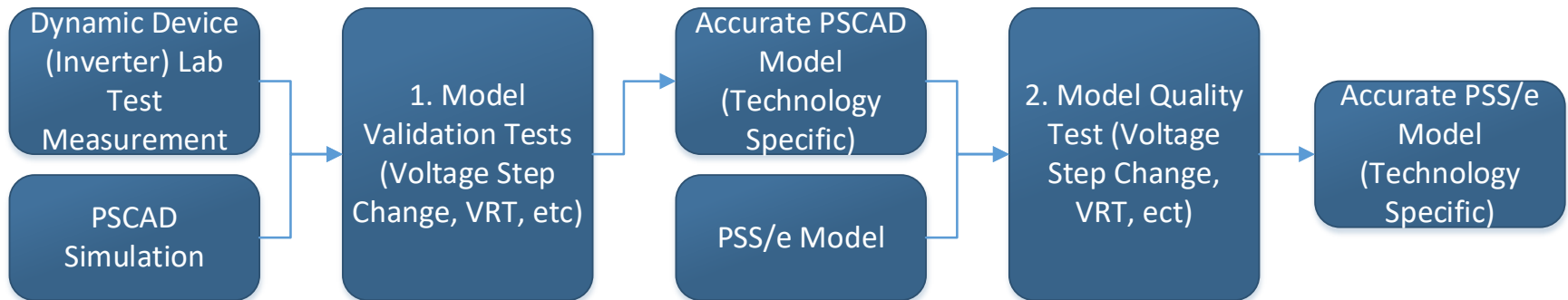
Resource Integration Workshop
June 23, 2020

Outline

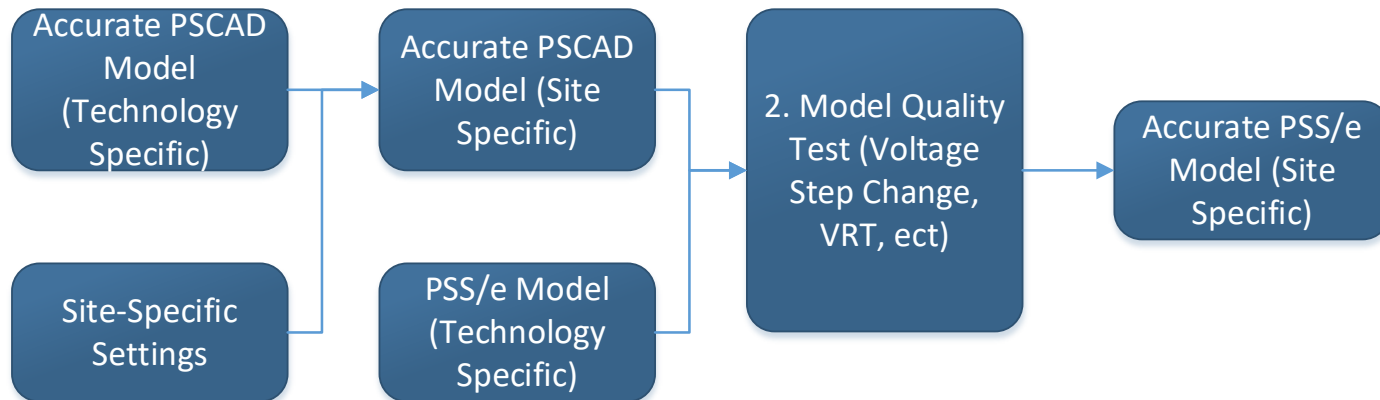
1. Recap from last RI workshop:
 - Model Quality Improvement proposal
2. Minor change to LVRT methodology
 - Update on lead/lag power factor test

Model Validation and Verification Overview

1. Unit Model Validation (e.g. Resource Interconnection)



2. Plant Model Verification (e.g. Commissioning and Operation)



Recap – May 22 RI Workshop

- ERCOT presented Model Quality Improvement proposals
 - Propose Model Quality tests for PSCAD model to benchmark PSSE model
 - Propose verification of key settings every two years
 - Propose verification of PSCAD model against actual hardware
- Stakeholders voiced concerns about two proposals:
 - The PSCAD model / hardware verification creates an obstacle if the project plans to utilize **hardware that does not exist yet**
 - The “Key Setting Verification every two years” potentially creates ongoing expense charge by the manufacturer, and potentially impacts the NERC MOD 26/27 process

We appreciate your feedback!

- CONCERN:
 - The PSCAD model / hardware verification creates an obstacle if the project plans to utilize hardware that does not exist yet
- ALTERNATIVE OPTION:
 - Rather than provide the verification at the start of the FIS, provide the verification before the PSCAD model is needed
 - Either before launch of SSR study or before QSA, whichever is earlier. This would provide additional time to perform the verification test.

We appreciate your feedback!

- CONCERN:
 - A key model setting verification every two years creates ongoing expense and may impact NERC MOD 26/27 testing
- ALTERNATIVE OPTION:
 - New generators:
 - Verify key settings during commissioning
 - Verify key settings two years after commissioning
 - Verify key settings every 10 years or after settings change
 - Existing generators:
 - Verify key settings within 2 years of the language being approved
 - Verify key settings every 10 years or after setting change
 - Benefit: Aligns well with the MOD 26/27 10 year timeline

Please provide your feedback

- Original draft language is posted on the May 22 RI workshop meeting page

Comments are welcome to:

Shun Hsien (Fred) Huang shuang@ercot.com

John Schmall, John.Schmall@ercot.com

Next steps:

- Consider modifications based on stakeholder feedback
- Submit Guides revision requests in Q3, 2020

LVRT Lead/Lag Proposal Update

- Updating documents to clarify that LVRT tests should be run at both 0.95 leading and lagging power factor initial conditions (similar to HVRT)
 - Model Quality Test guidelines in the DWG Procedure Manual
 - FIS pre-kickoff email template
- Market participants encouraged to begin performing LVRT tests for 0.95 leading/lagging power factor conditions right away
- Why?
 - 0.95 leading and lagging power factor are valid operating conditions for resources
 - Model testing provides better assurance that the model accurately reflects that a resource will ride through an LVRT event
- Feedback? muhammad.khan@ercot.com

Questions?



Slides from May 22 RI Workshop

Proposal is all about ensuring model quality

Planning Guide 6.2 (1)

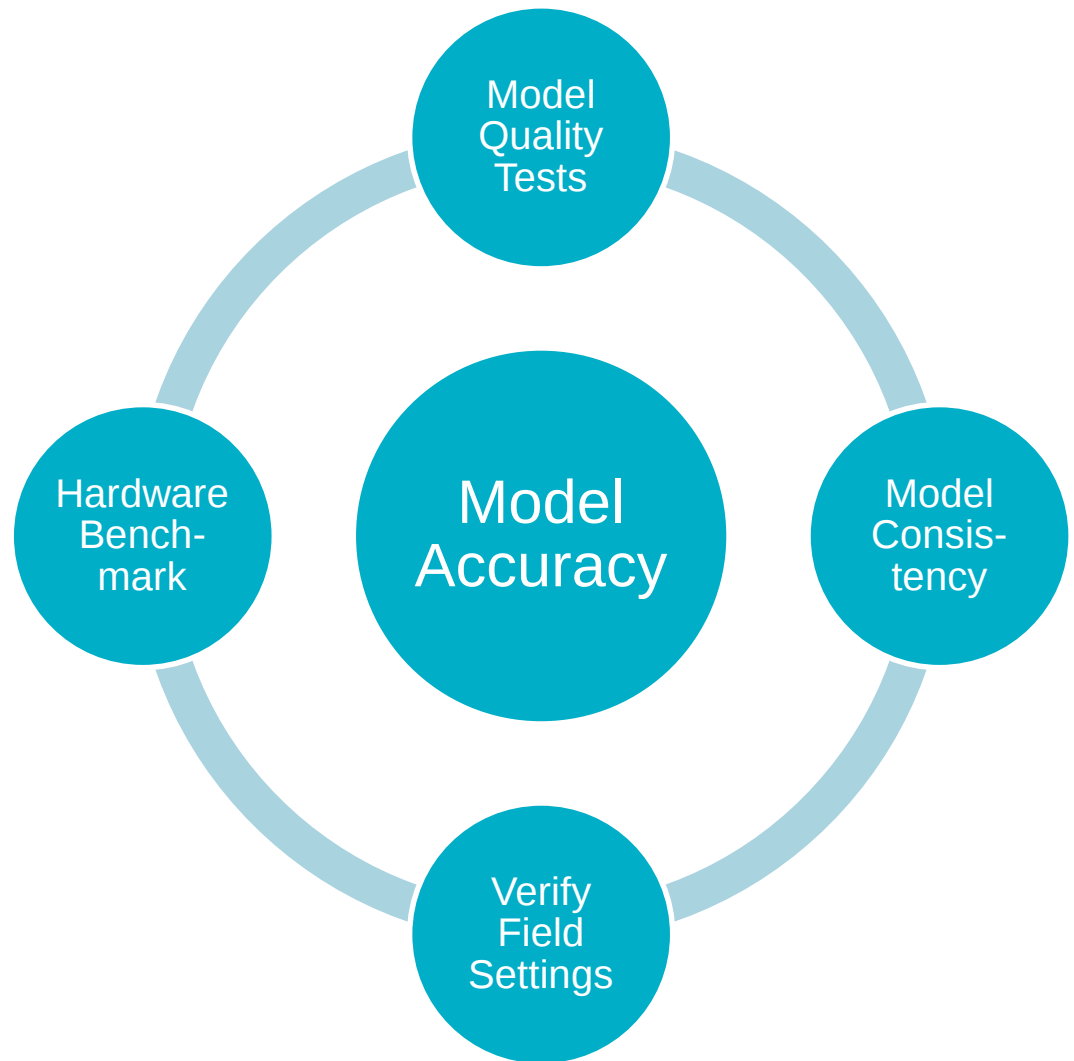
To adequately simulate dynamic and transient events in the ERCOT System, it is necessary to establish and maintain dynamics data and simulation-ready study cases representing the dynamic capability and frequency characteristics of machines and equipment connected to the ERCOT System.

Planning Guide 6.2 (5)

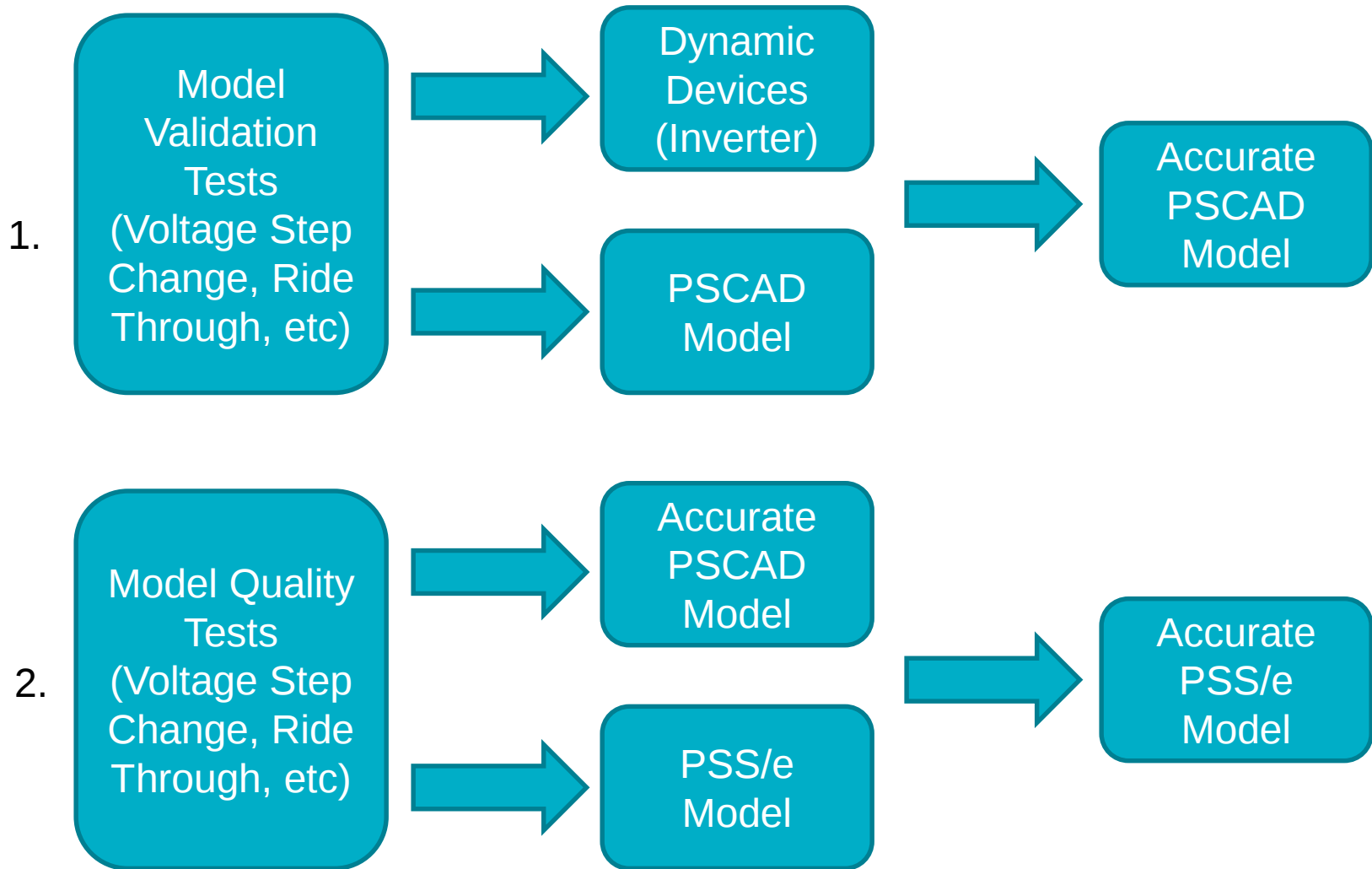
(a) A model with parameters that accurately represent the dynamics of the device and that is compatible with the current version of the planning and operations model software as described in the Dynamics Working Group Procedure Manual....

Goal: Improved Model Accuracy & Confidence

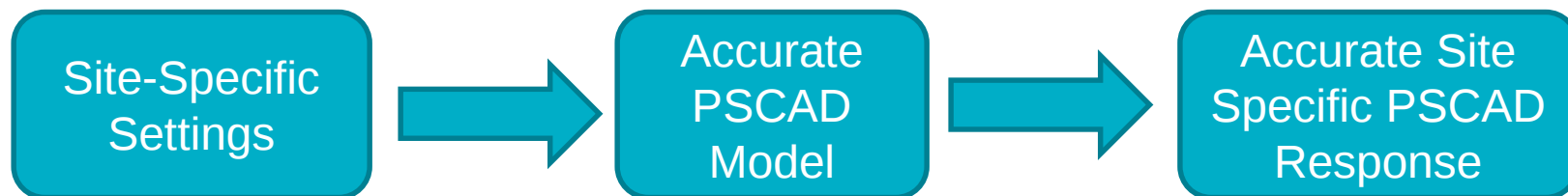
Challenge
<i>Model performance</i>
<i>PSCAD and PSSE model fidelity</i>
<i>Model settings do not match settings applied in the field</i>
<i>Consistency between PSSE and PSCAD models</i>



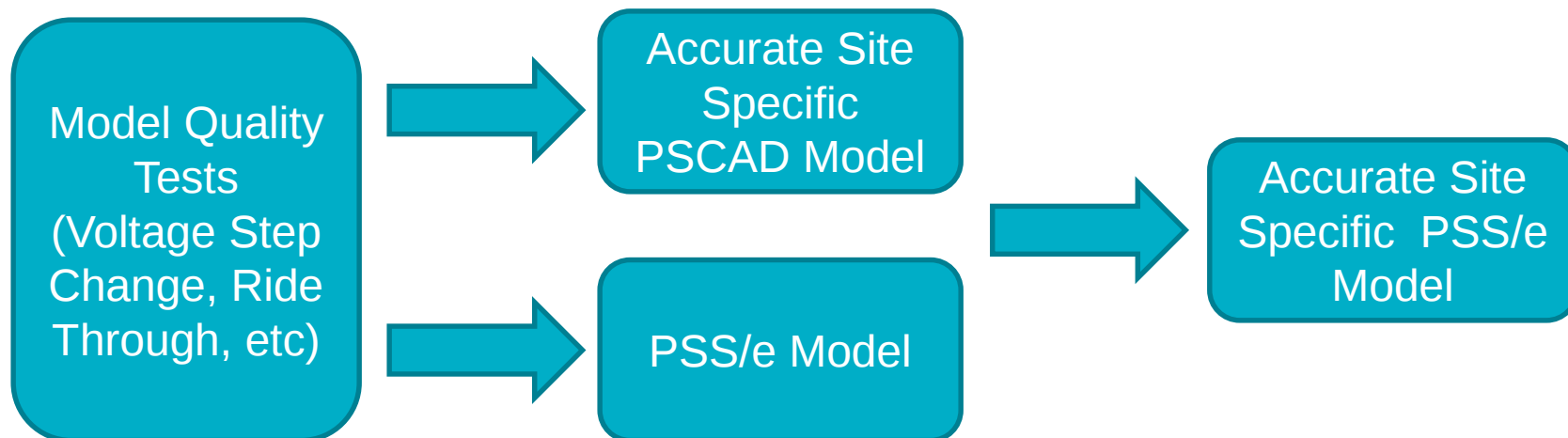
How Proposal Achieves Goals



3.



4.



Leveraging to Reduce Additional Work

Challenge	Proposed Solution
<i>Model performance</i>	Model quality tests (PGRR75 for PSSE)
<i>PSCAD model fidelity</i>	Hardware benchmark (unit validation)
<i>Model settings do not match settings applied in the field</i>	Plant verification (periodic setting check)
<i>Consistency between PSSE and PSCAD models</i>	Model quality tests

Ways we are trying to economize:

- **Hardware benchmark:** Not site-specific and only requires testing the inverter/dynamic device not the entire plant. Benchmark is good for a type of inverter hardware & controls; possible to perform once and use for several sites with the same inverter.
- **Plant verification** is just a setting check. No testing required!
- **Consistency check** leverages already-performed model quality tests!

Language Proposals

- Hardware Benchmark (“Unit Model Validation”)
 - (For IBR / PSCAD models only)
 - Hardware specific not site specific
- PSCAD model quality tests
 - Similar to PSSE model quality tests
- Plant Model Verification
 - Periodically verify key parameters & settings
 - No physical testing required; just verification
 - At commissioning and every two years

Section

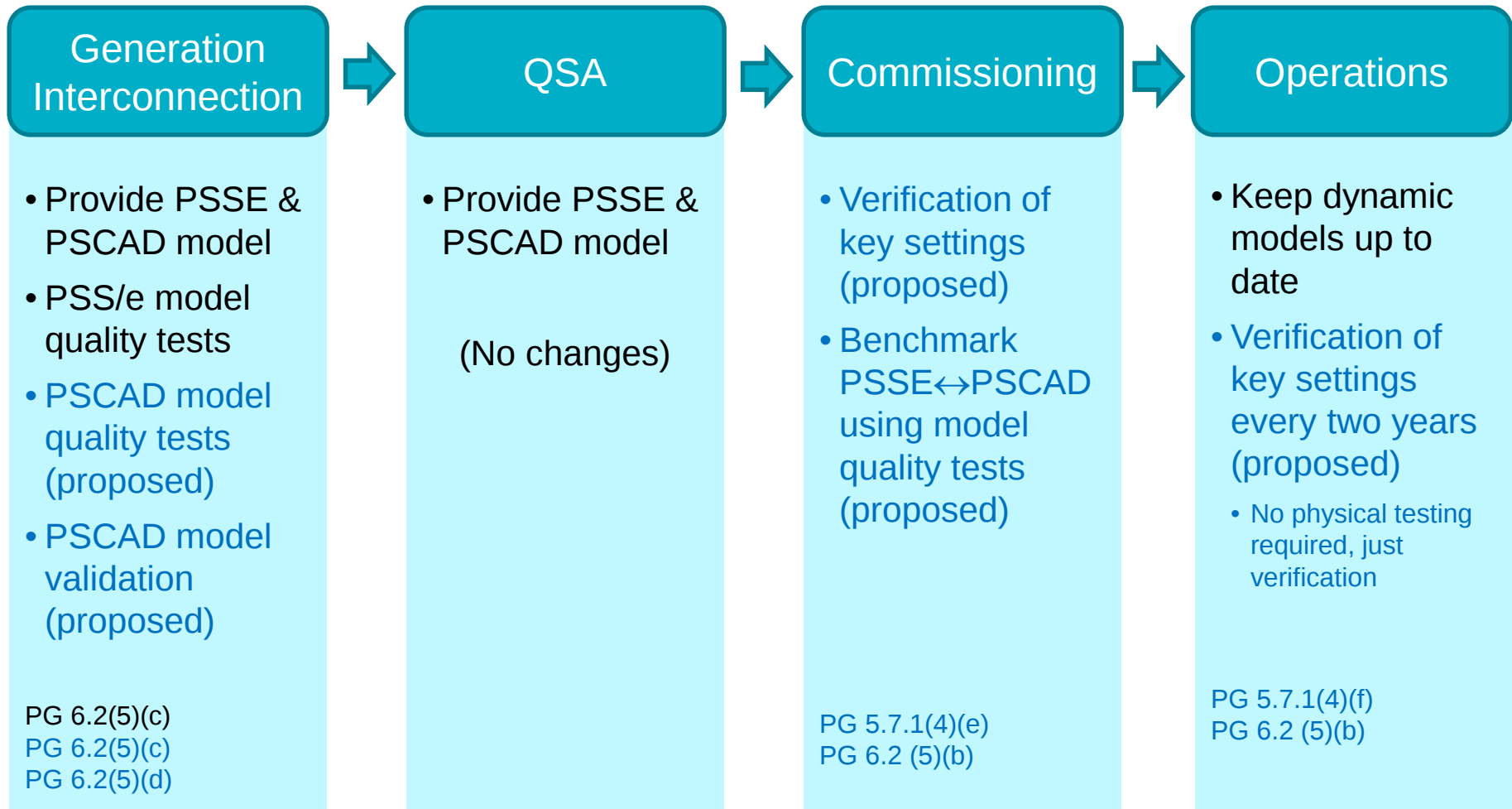
PG 6.2(5)(d)

PG 6.2(5)(c)

PG 5.7.1(4)
PG 6.2 (5)(b)

Process for Generators

Blue = new
Black = existing



- Goal is to verify model fidelity against actual hardware
- PSCAD models only required for inverter-based resources

What about model updates? (IBRs)

Blue = new
Black = existing

- If updating model parameters (settings), then:
 - ✓ Update PSSE model
 - ✓ Provide PSSE model quality report
 - ✓ Update PSCAD model
 - ✓ Provide PSCAD model quality report (proposed)

- If updating model structure (e.g. control/hardware changes) then:
 - ✓ Update PSSE & model quality report
 - ✓ Update PSCAD model & quality report (proposed)
 - ✓ Unit model validation (hardware benchmarking) (proposed)

What about model updates? (conventional)

- If updating model parameters (settings), then:
 - ✓ Update PSSE model
 - ✓ Provide PSSE model quality report

- If updating model structure then:
 - ✓ Update PSSE
 - ✓ Provide PSSE model quality report

Parameter Verification (all resources)

- Periodically verify key parameters (proposed)
 - During commissioning, within 30 days of approval for commercial operations
 - Periodically every two years
- What it requires
 - Verify site key parameter settings match model settings
 - For example, screenshots, commissioning / delivery reports, manufacturer attestation, etc.
- What it doesn't require
 - Testing

Miscellaneous Improvements

- Similar testing requirements for each situation (PSSE model quality, PSCAD model quality, hardware validation)
 - HVRT, LVRT, Step Change, SCR (existing model quality tests)
 - A few differences:
 - Add Phase Angle Step test for PSCAD model quality
 - Add SSR Frequency Scan for IBR hardware validation
- UDM Model Manuals shall contain:
 - Control block diagrams and parameter descriptions
 - Listing of parameters which are commonly tuned (proposed)
- DWG Procedure Manual definition of planning model
 - References PSSE, now add PSCAD

Next Steps and Tentative Schedules

- Draft language and discuss with RIW and DWG
- Submit Guides revision requests in Q2, 2020

Comments are welcome to:

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LVRT Initial Conditions

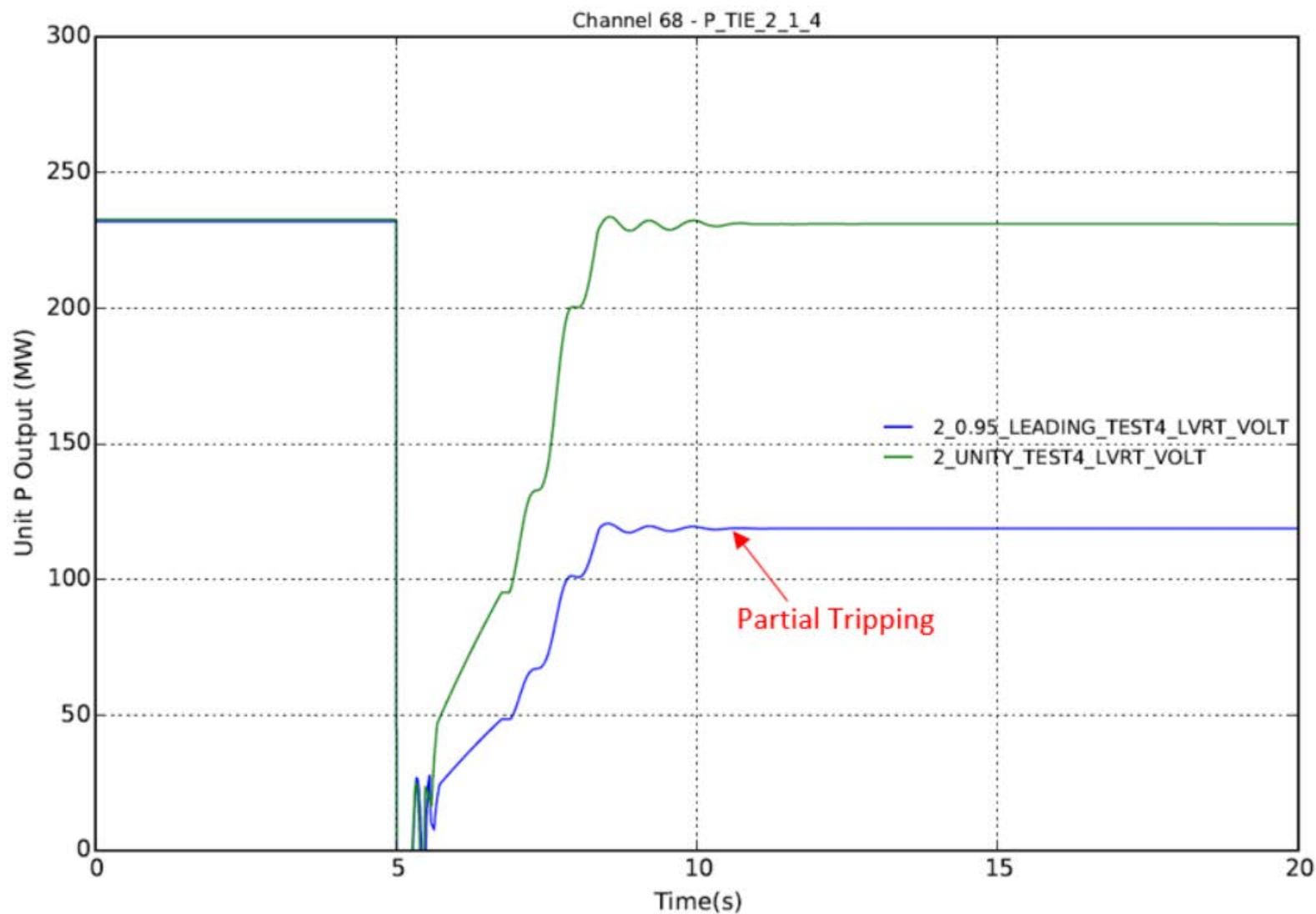
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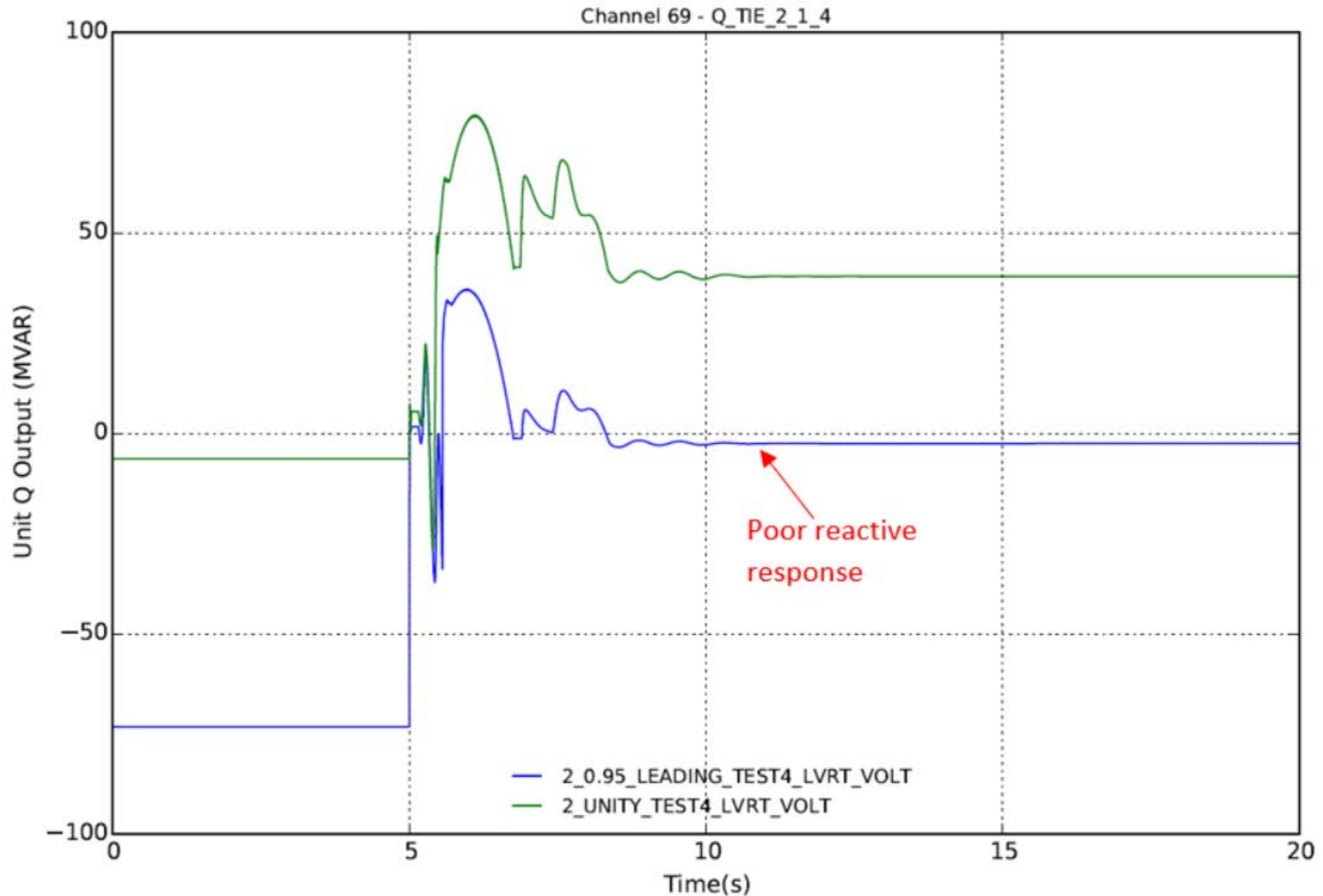
Overview

- Currently HVRT test is performed for two initial conditions: 0.95 lagging and 0.95 leading
- TSPs usually run LVRT for unity power factor conditions during FIS
- PGRR-075 was aligned with this practice
- Model testing has shown that initial power flow conditions can impact the LVRT response

Example 1: LVRT Real Power Response



Example 2: LVRT Reactive Power Response



Proposal

- Run both HVRT and LVRT tests for the same initial conditions: 0.95 lagging and 0.95 leading
- Applicability:
 - FIS studies
 - PGRR-075 model quality tests
- DWG supports moving forward with this proposal based on discussion at May 14 meeting