Preparing for the Future Power System - Now

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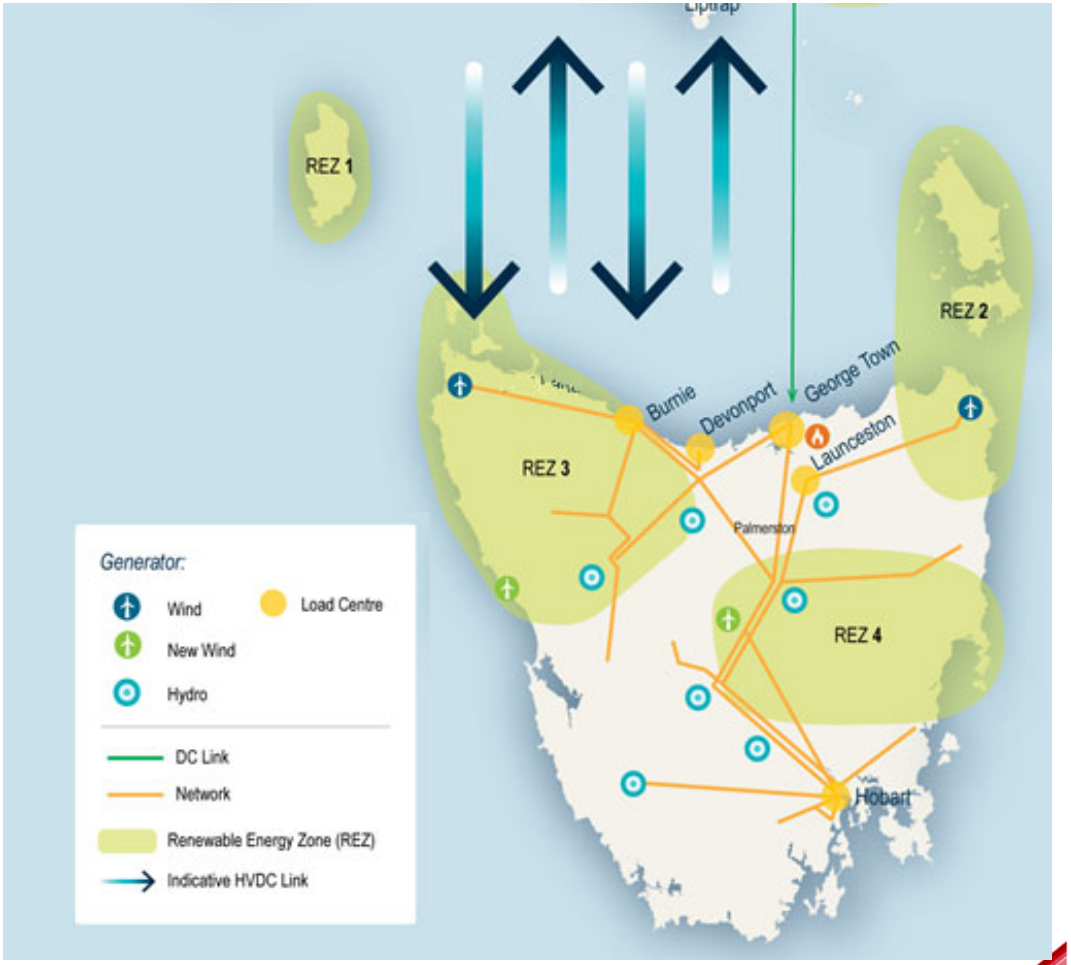
Why Real Time Simulation?

- Large HVDC systems were always tested on RTS and other large Power Electronic Converters (PEC), e.g. solar and wind will benefit from this approach.
- Largescale integration of PEC into many power grids is already causing significant system impacts.
- Fast NEM uptake of Renewable Energy (RE) presents escalating challenges in power system management.
- TasNetworks recognised the high risk posed to its network by additional PEC and now has its own RTDS to test them.
- RTDS allows "hardware-in-the-loop" testing and TasNetworks has developed highly accurate models of the power system for this.
- Real time testing of large disturbance response is necessary.

What Challenges drove TasNetworks?

TasNetworks has many future integration and coordination challenges (see AEMO's Integrated System Plan):

- the new HVDC Interconnector(s) (Project Marinus)
- large inverter connected energy sources (windfarms) > 2000 MW
- large inverter connected loads (pumped storage) > 1000 MW



The RTDS will enable TasNetworks to assess the proposed solutions to these challenges.

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What did TasNetworks' get?

- Hardware
  - One cubicle, two NovaCor chassis
  - Licensed 20/20 cores
  - Standard i/o capability

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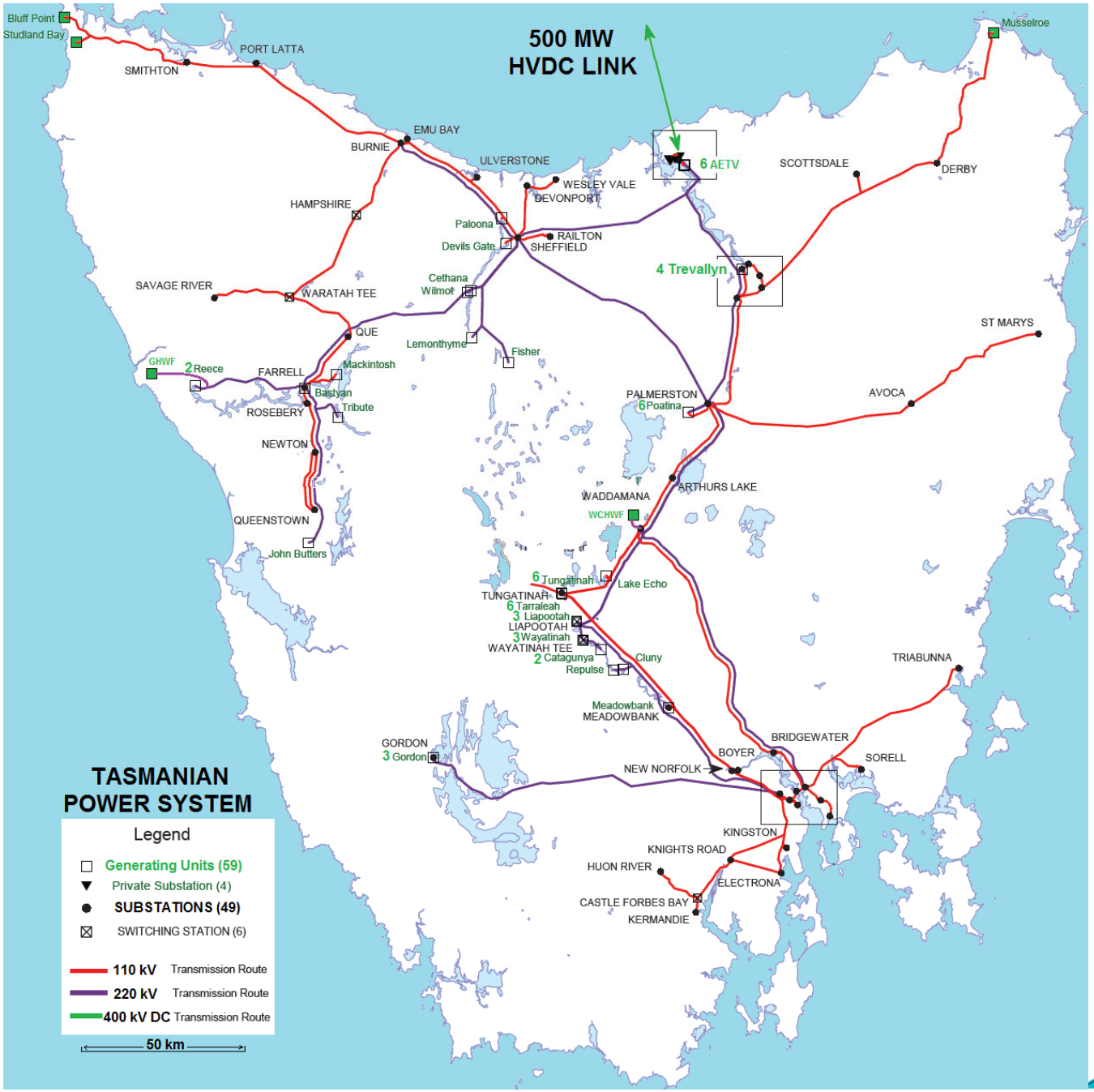
RTDS Implementation Challenges - Tasmania



What part of existing TAS system is modelled?

- SG - 2600 MW
- AG - 564 MW
- LCC - 500 MW

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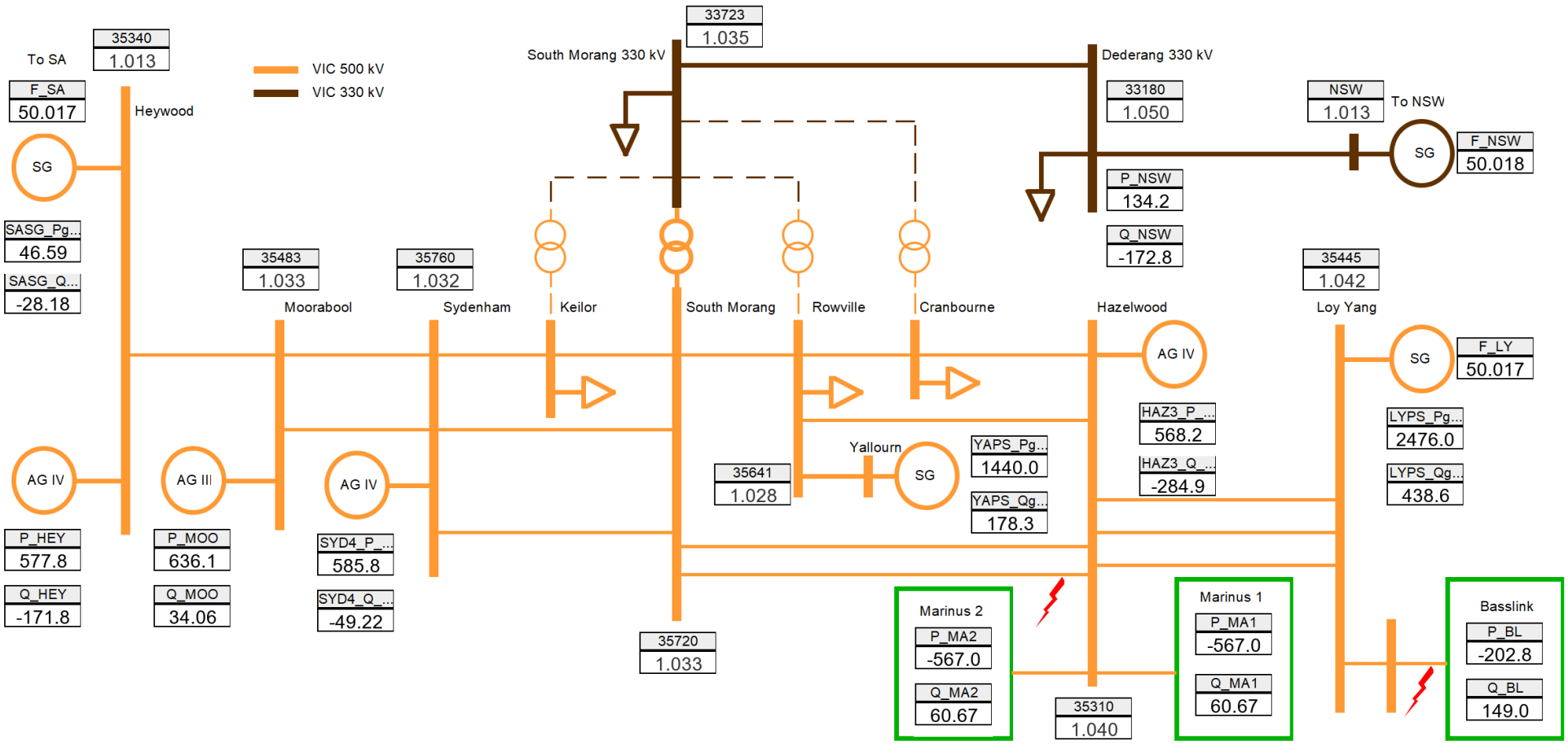
RTDS Implementation - Victoria



RTDS model of the VIC system (so far)

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TasNetworks Developments

PSS/e to RSCAD User model conversion tool

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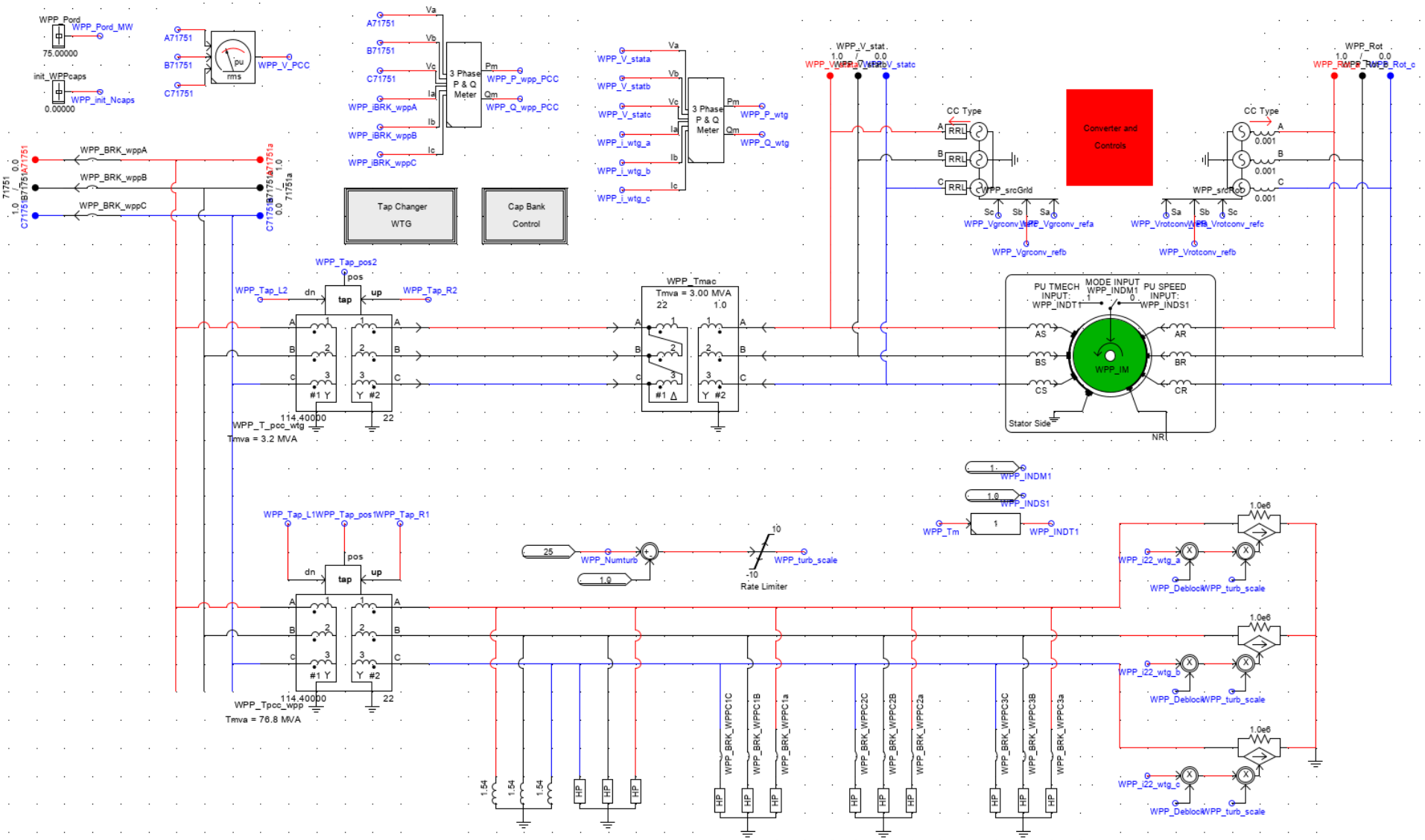
TasNetworks Developments



.dft for Generic (type III WPP) model

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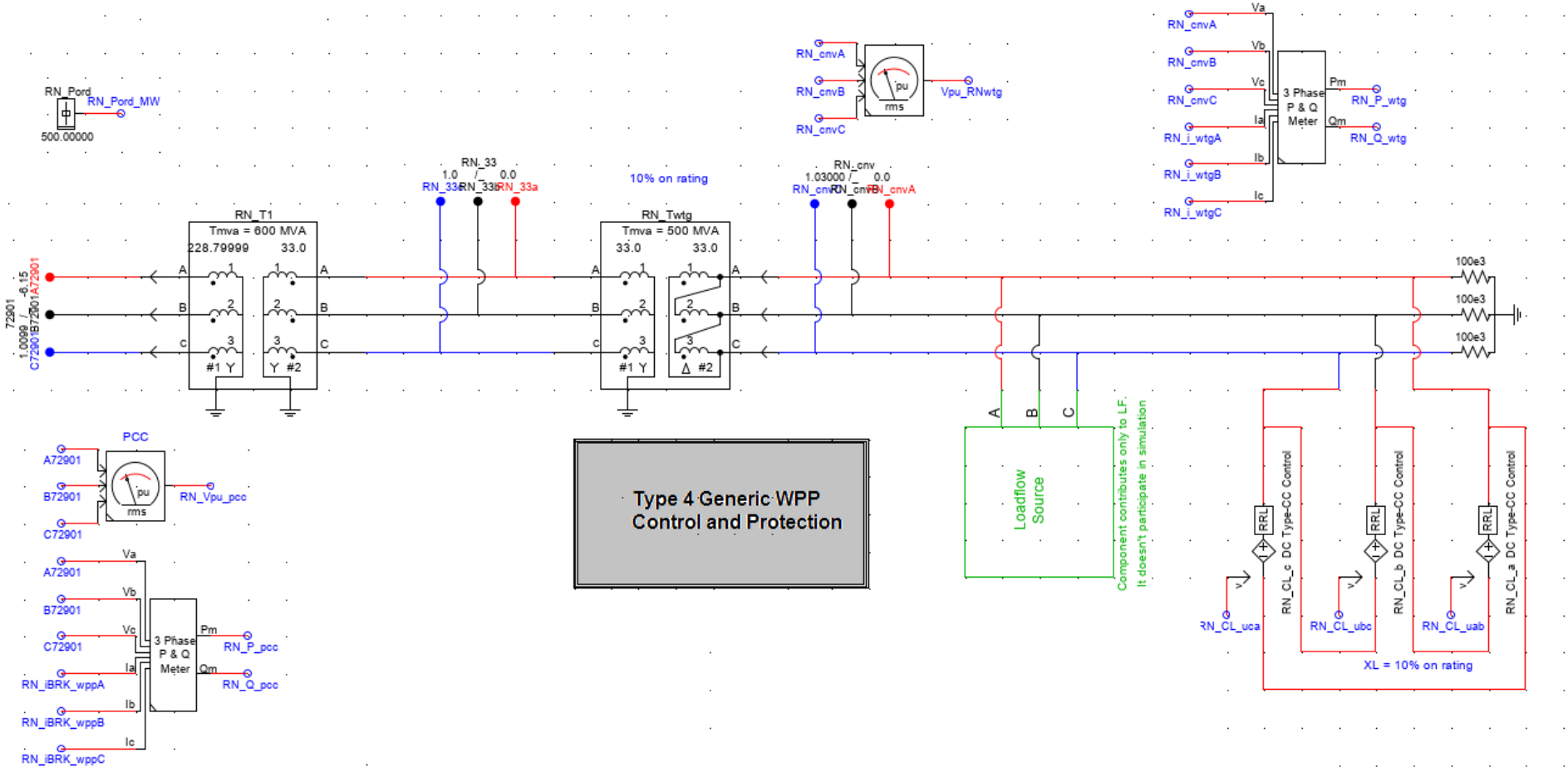

.dft for Generic (type IV WPP) model

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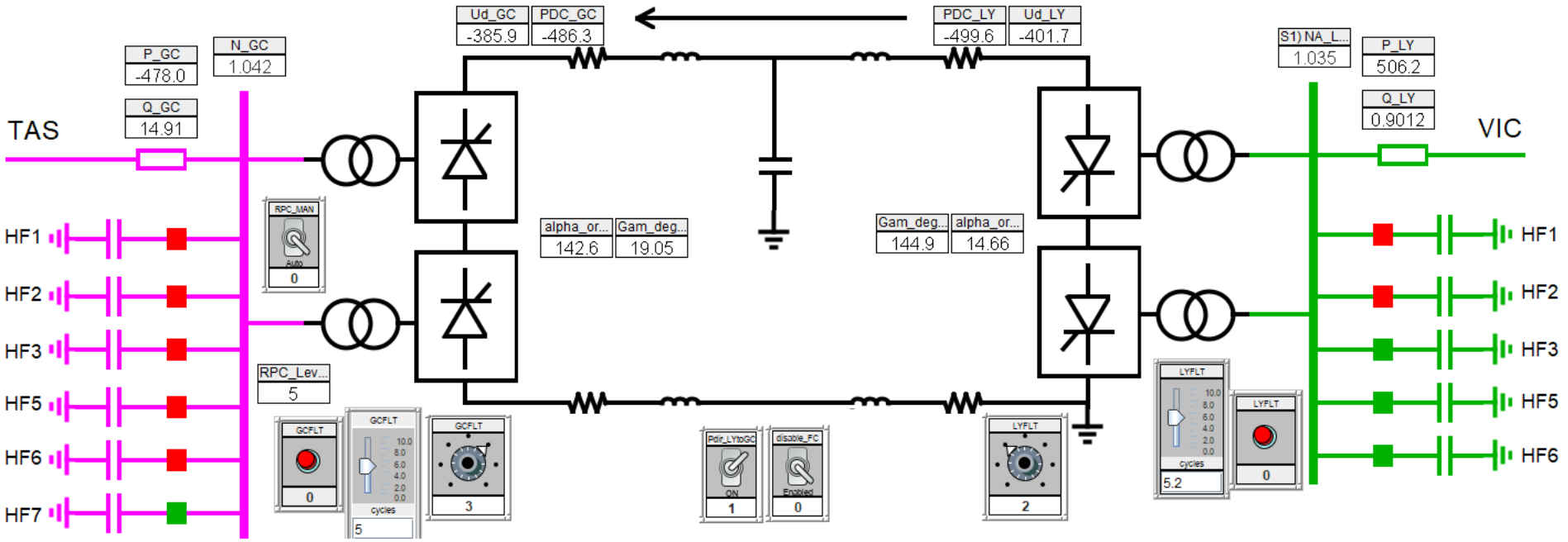

.sib for Generic LCC HVDC model

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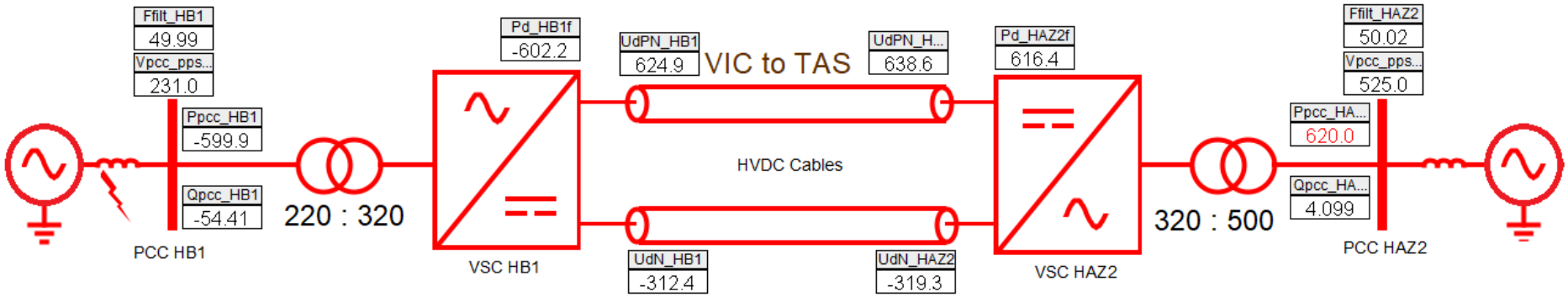
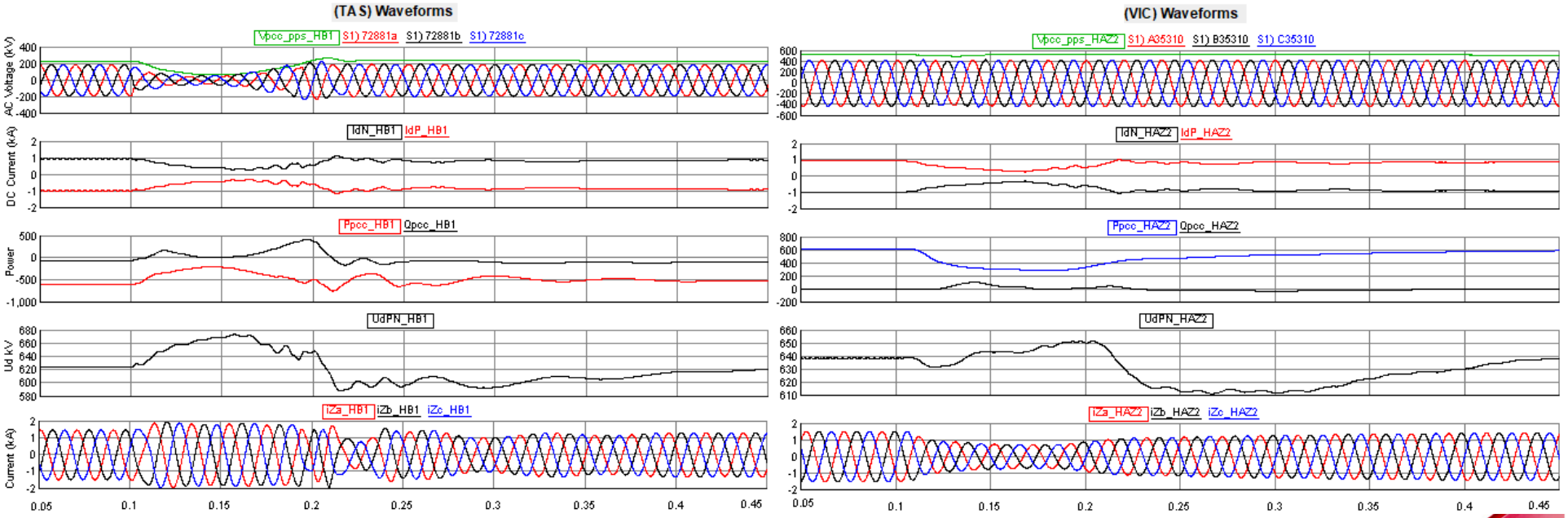
TasNetworks Developments





.sib for Generic multilevel VSC HVDC model

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Summary of TasNetworks RTDS model

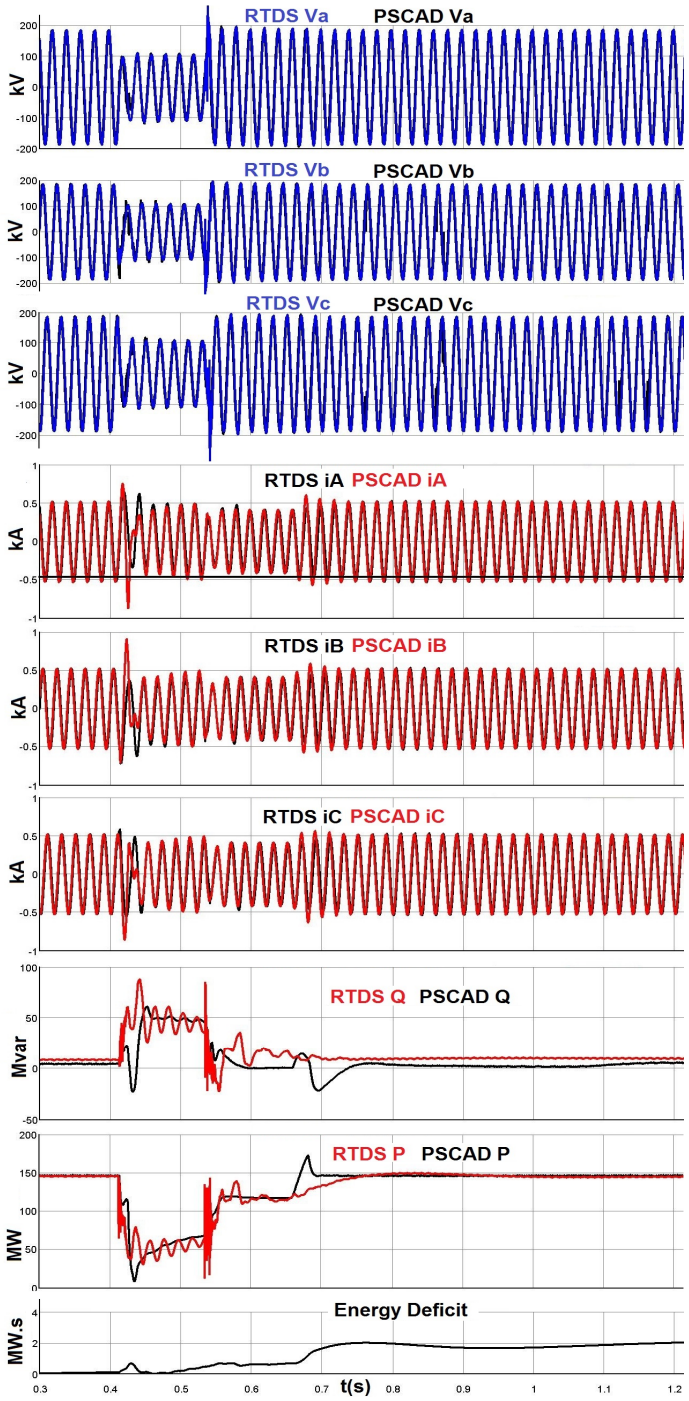
Up to what size power system is being modelled :

- 59 Synchronous and 12 Asynchronous Generating units
- 136 transmission lines: all 220/110 kV (TAS) & 500 kV lines (VIC)
- 78 two-winding + 17 auto-transformers
- 37 capacitor banks (> 10 MVAr)
- 55 substation loads in TAS
- 2 modular multilevel VSC HVDC Interconnectors
- 1 LCC HVDC Interconnector (Basslink)

What capacity of RTDS is being used :

- Two NovaCor chassis 20/20 cores licensed
- Using 5757 RSCAD “Load” units
- Modelling 20846 Control blocks
- For full 3-phase EMT simulation ($\Delta t = 50\ \mu s$) in real time !

Achievements - Benchmarking



Example of discrete benchmarking of a generic windfarm models against an OEM provided PSCAD model.

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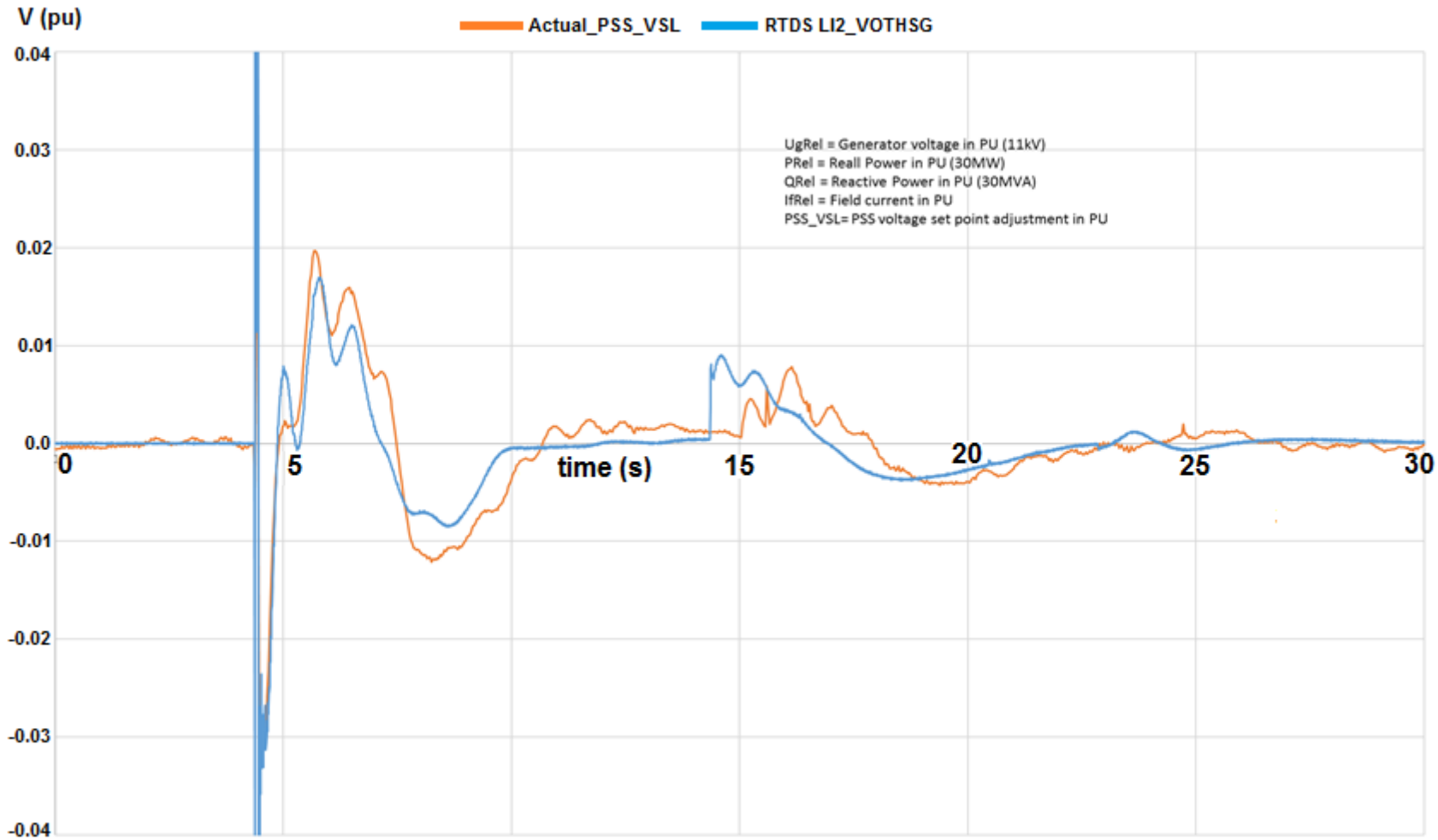
Achievements - Benchmarking



Example of System benchmarking of SG (in full model) against historical contingency event: LI2 PSS outputs for GO-CS 2pg on 25.03.19.

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Insights

- Real time simulation quickly picks up any errors
- OEM control systems use a lot of RTS processing power
- It's easy to build more but better to start with what's "sufficient & necessary"
- The RTDS in house operating systems aid model management
- Simulation is in real time but large model compilation is slow
- RTDS fits with other simulation tools: PSSe (loadflow), PSCAD (OEM interactions), RTDS (HiL - large disturbance validation)
- RTDS for Contingency Analysis – reset/snapshot?

Thank you