Dominion Energy®

TOWARDS A LARGE-SCALE MODEL OF THE DOMINION ENERGY TRANSMISSION SYSTEM

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RTDS Technologies AMETEK

OVERVIEW

- Dominion Energy RTDS Laboratory
- The use of RTDS at Dominion
- Towards a complete transmission model
  - Data pipeline
  - Model
- Conclusions

DOMINION ENERGY RTDS LABORATORY

- Lab started in 2012
- Upgraded and relocated over the years
- Recently moved to new purpose-built facility

DOMINION ENERGY RTDS LABORATORY

- 4 cubicles
- 10 Novacor racks
- ~85 licensed cores
- Multiple power relays and amplifiers
- FACTS controller replicas
  - STATCOMs
  - SVC
  - Fixed series capacitor
  - More coming soon

PROJECTS AND USE CASE SCENARIOS

- Harmonics and power quality
- FACTS devices
- Root cause analysis
- Blackstart and system restoration
- Protection HIL
- Inverter-based resources

Mobile STACOM

FACTS Controller

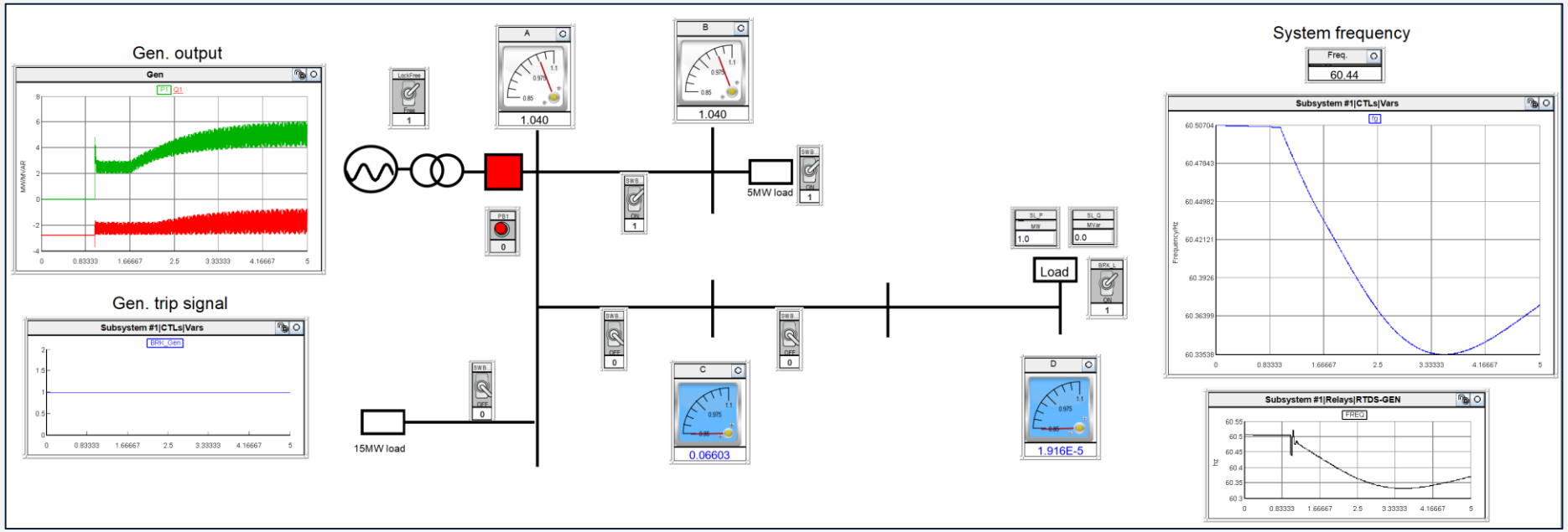
Offshore Wind

Solar

PROJECTS AND USE CASE SCENARIOS

Operator training – Frequency response

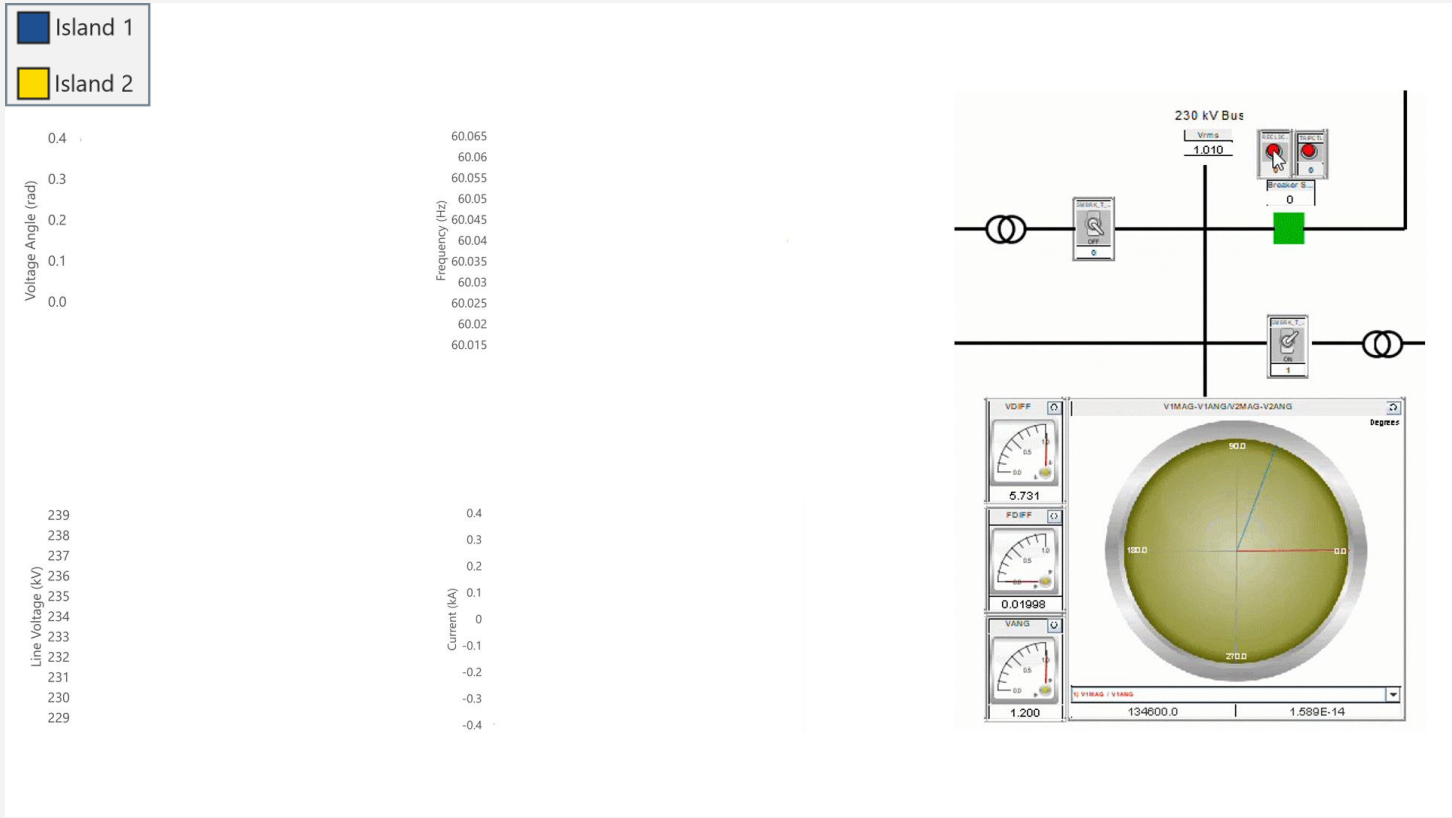
- System restoration training
- Testing of load pickup capability
- Simulations showing frequency response
- Underfrequency relay tripping
- Comparison between different units



PROJECTS AND USE CASE SCENARIOS

Operator training – Islands synchronization

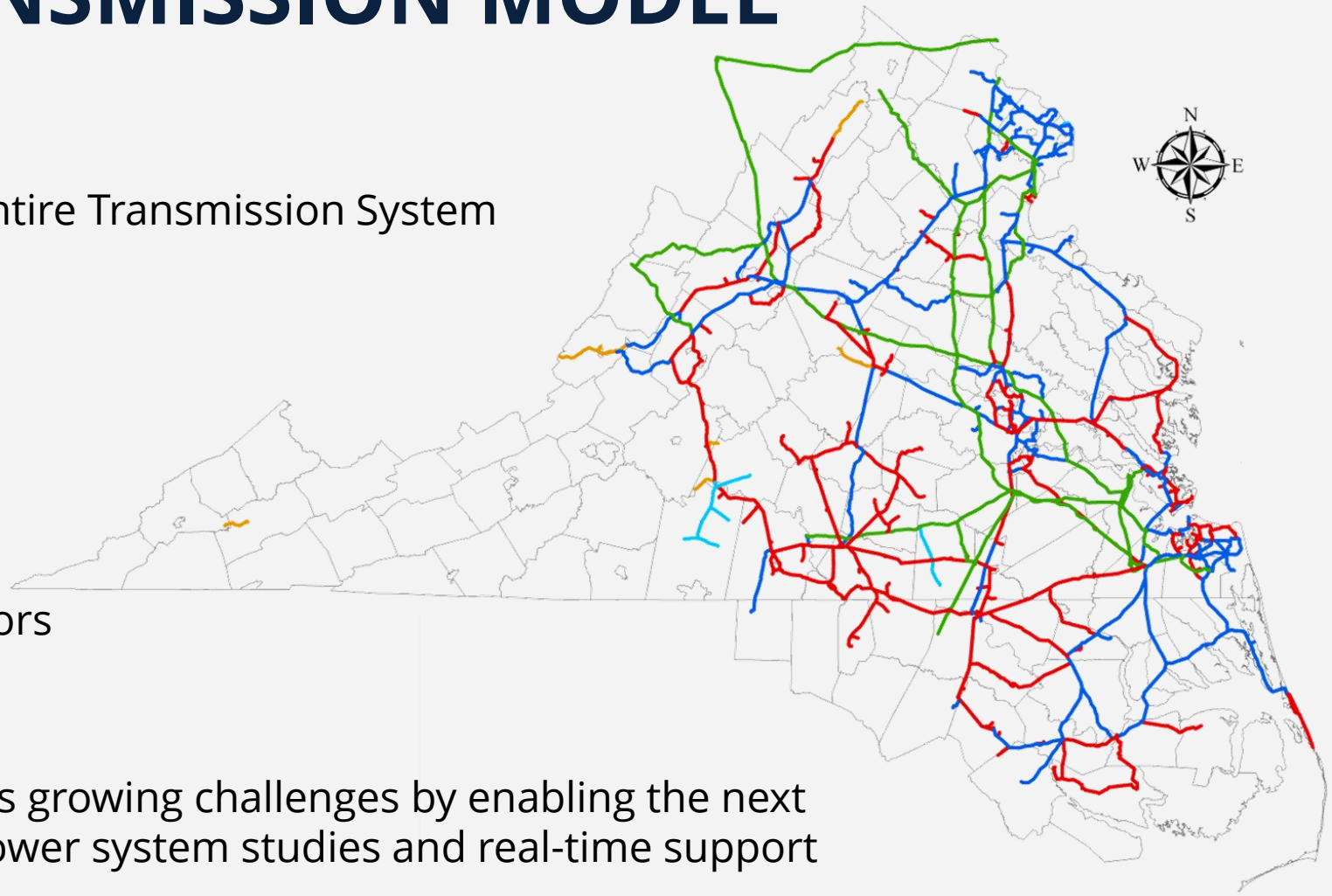
- Synchronizing two islands is one of the most critical restoration steps
- Operators must match voltages and frequency
- Training is controlled via displays and diagrams familiar to the operators



COMPLETE TRANSMISSION MODEL

Overview

- RSCAD model of Dominion's entire Transmission System
- Example use cases:
  - **Inverter based resources** studying oscillatory and harmonic interactions between PV sites
  - **System restoration** providing support to operators during Blackstart events

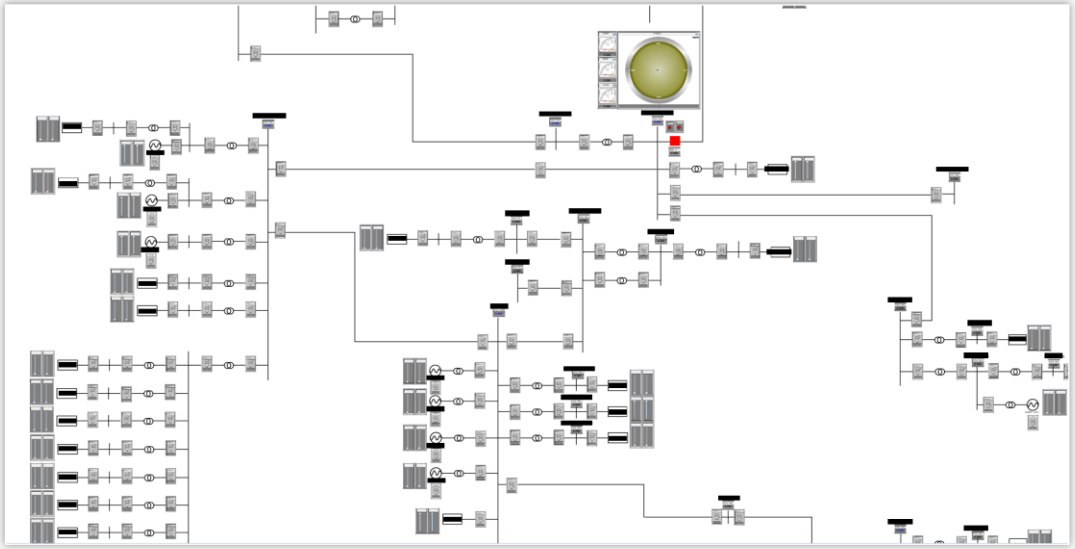


Goal: to address growing challenges by enabling the next generation of power system studies and real-time support

COMPLETE TRANSMISSION MODEL

Two main tasks

Model



Work in progress

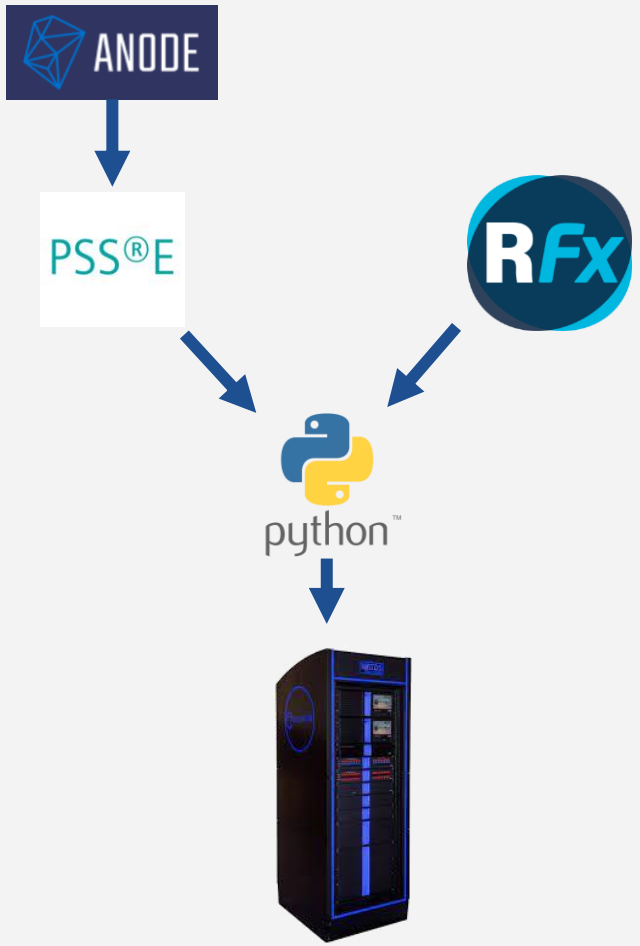
Data

Basic framework has been developed

COMPLETE TRANSMISSION MODEL

EMS data pipeline

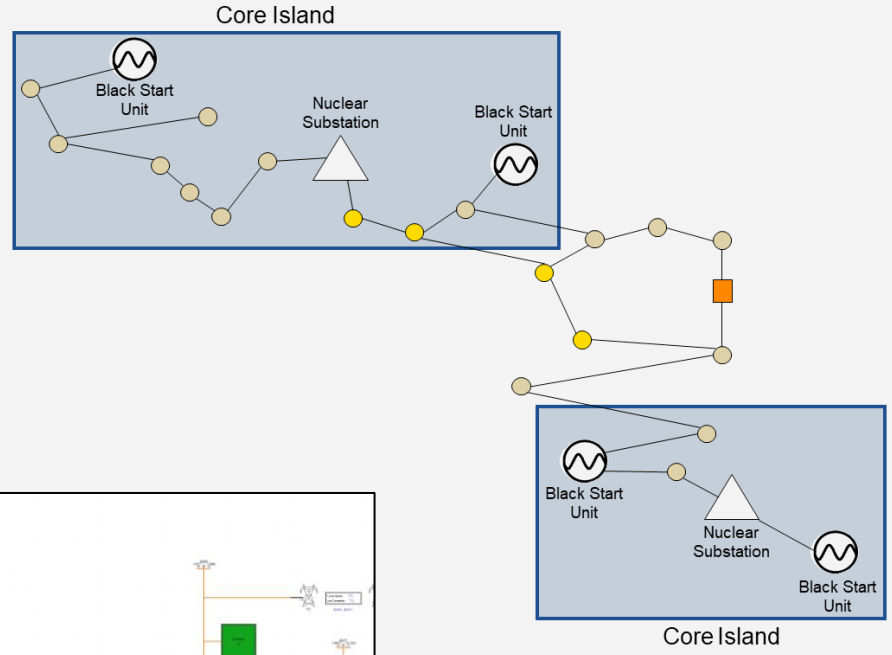
- Analysis On Demand (ANODE)
  - Collects EMS data and creates PSSE snapshots
  - PSSE snapshots every 10 minutes
- RSCAD model topology from .inf file
- Parse and compare imported files using python to determine what components to initialize
- Generate RSCAD RunTime script to initialize model
  - Breaker status
  - Generators setpoints
  - Load values

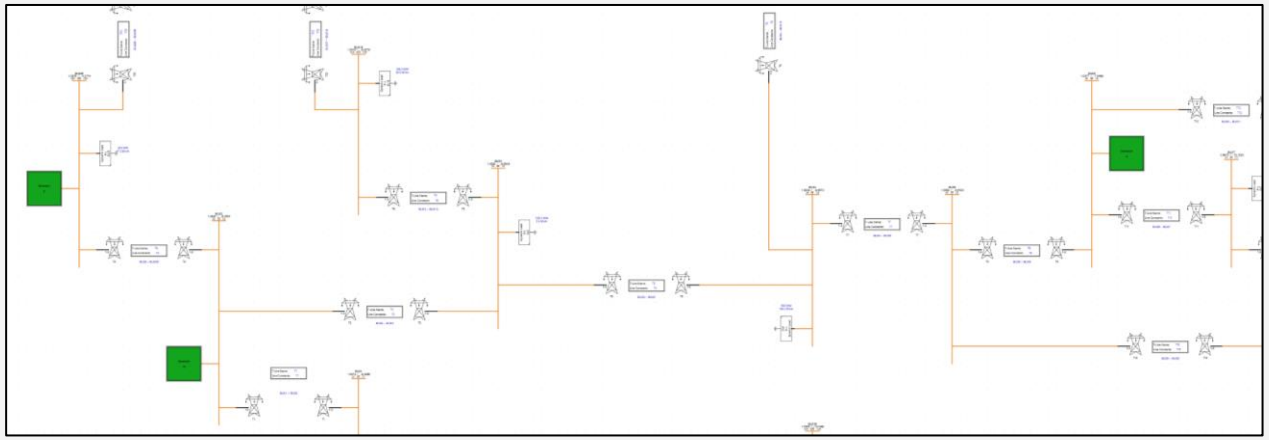


COMPLETE TRANSMISSION MODEL

Building the RSCAD model

- Import from PSSE but manual adjustments required
  - Node-breaker to bus-branch model
- Laying out draft model
- Creating runtime display
- Grid is always changing
  - Crucial to keep model up to date





CONCLUSIONS

- Dominion Energy has relied on RTDS for countless projects over the past 10 years
- These successes justified a significant lab upgrade recently
- Improved capabilities will allow for new and larger use cases
- We are working towards a complete model of our system
    - **Feedback and suggestions on how to best achieve this are welcome**

THANK YOU