



**MICROGRID
KNOWLEDGE**

CONFERENCE SERIES

Microgrid 2019
CONFERENCE

Hardware-in-the-Loop (HIL) testing in Microgrid Engineering

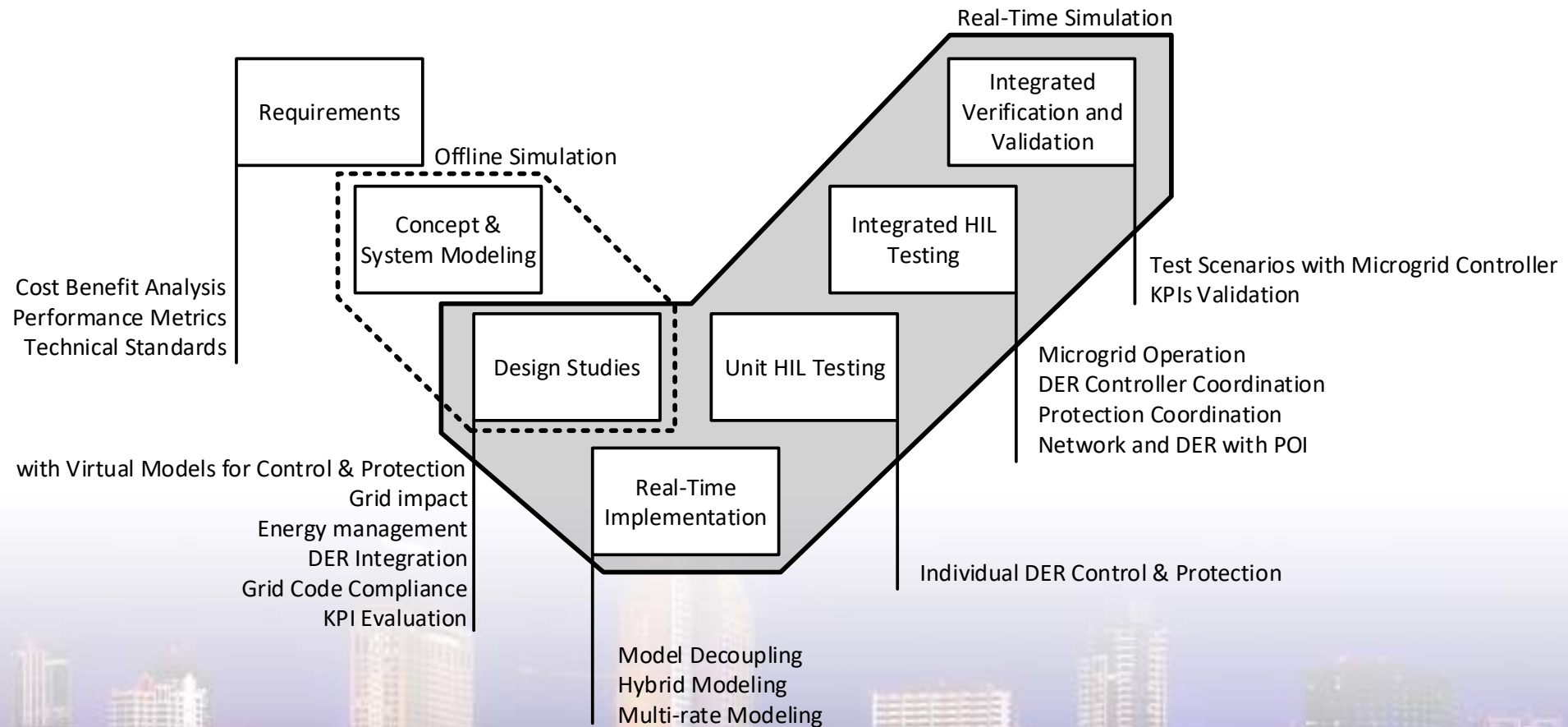
Syed Qaseem Ali, PhD

Team Leader T&D-DER

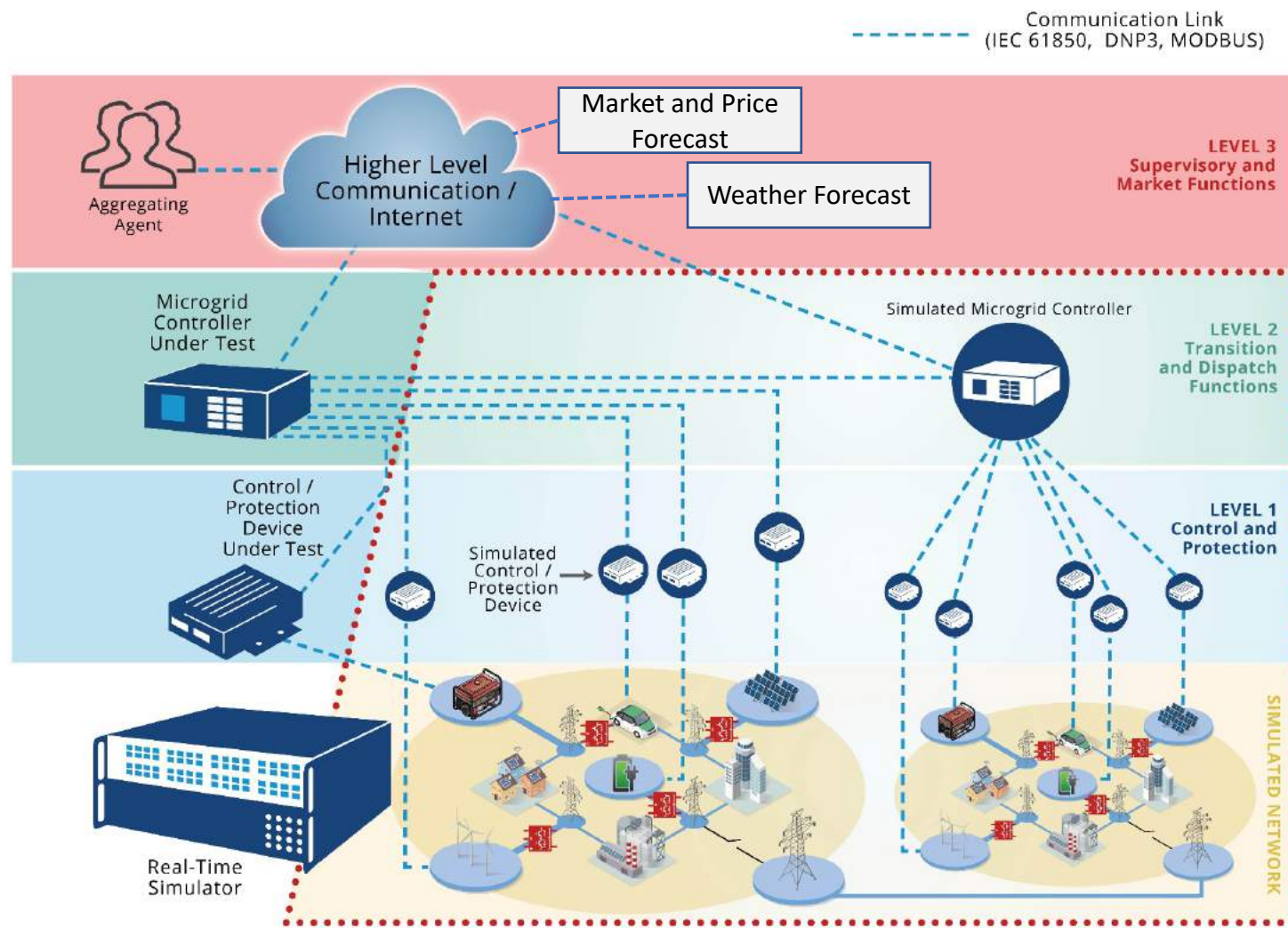
Application eXpertise and Electrical Simulation (AXES) Division

Opal-RT Technologies

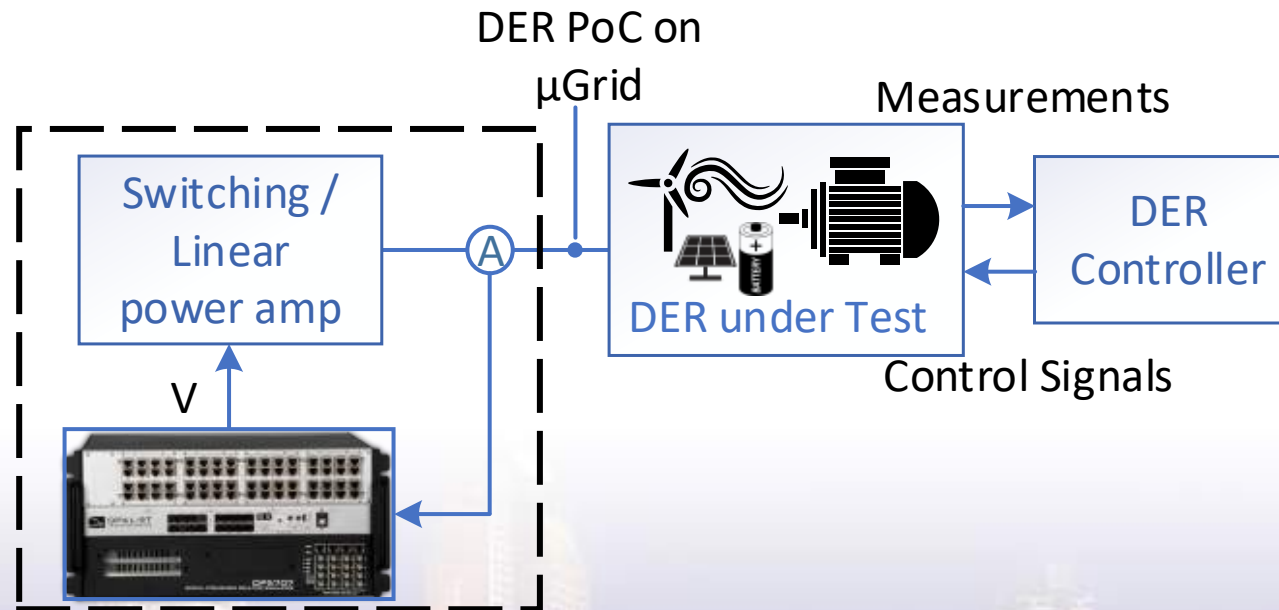
HIL in the Microgrid Development Cycle



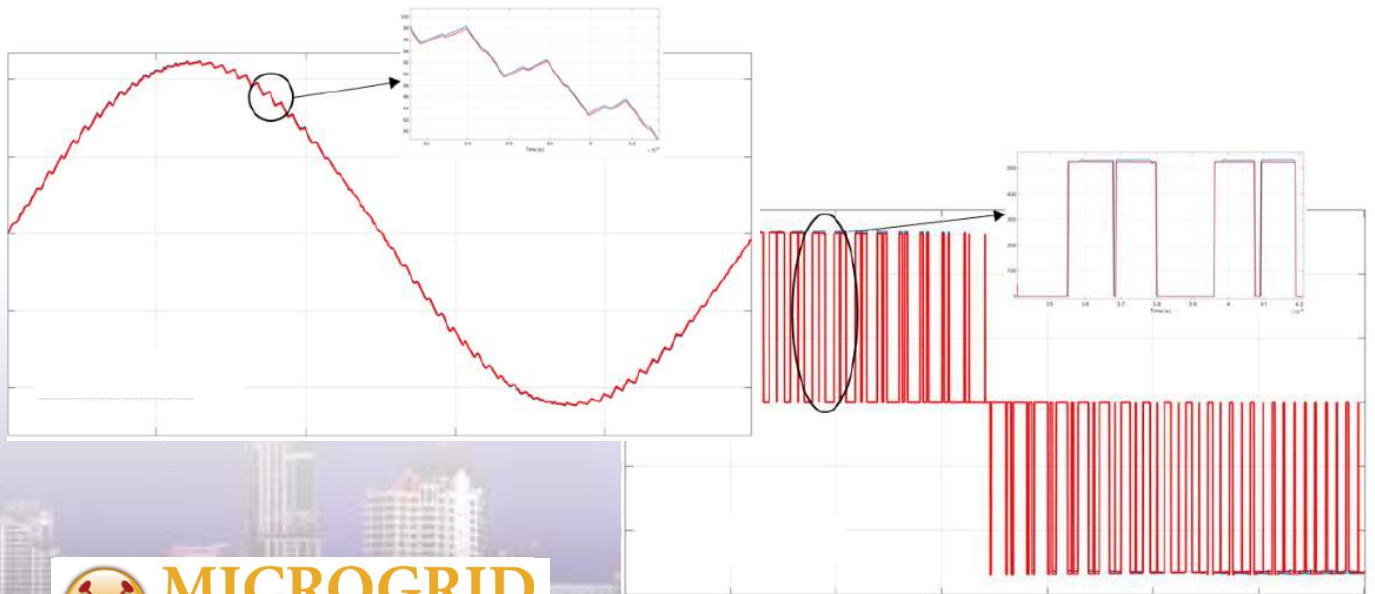
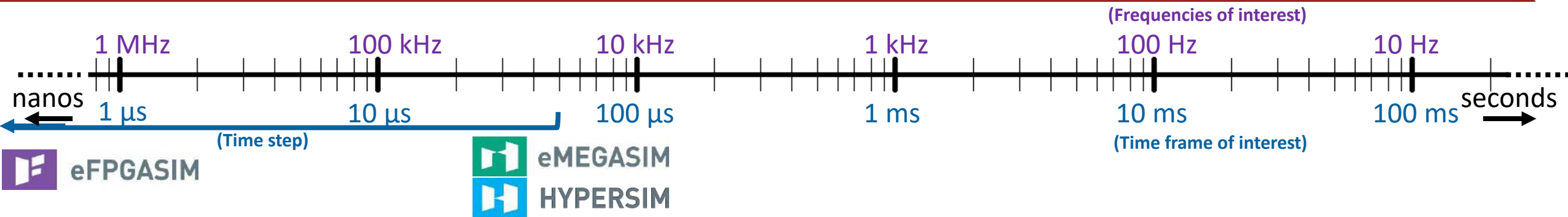
Controller HIL (CHIL) Testbeds for Microgrid Applications



Power HIL (PHIL) Testbeds for Microgrid Applications

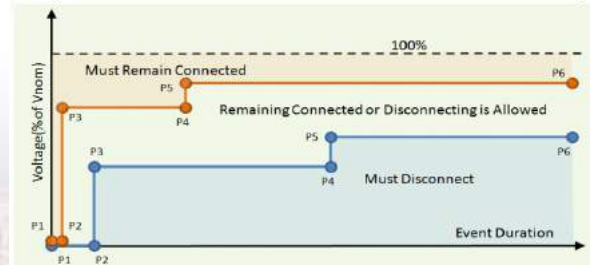
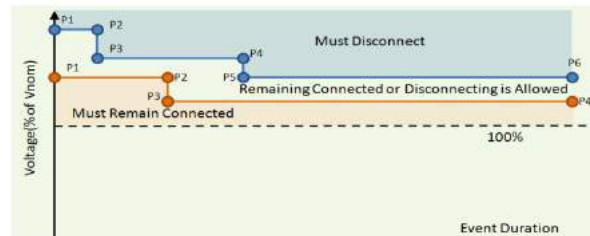
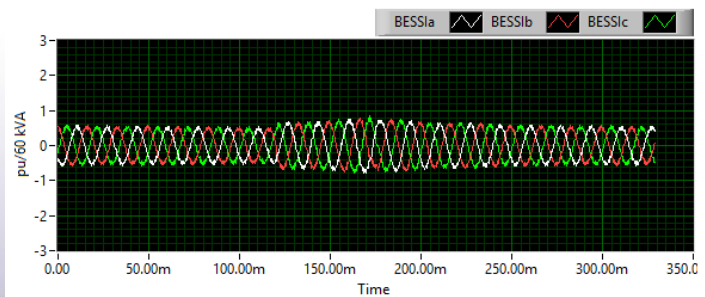
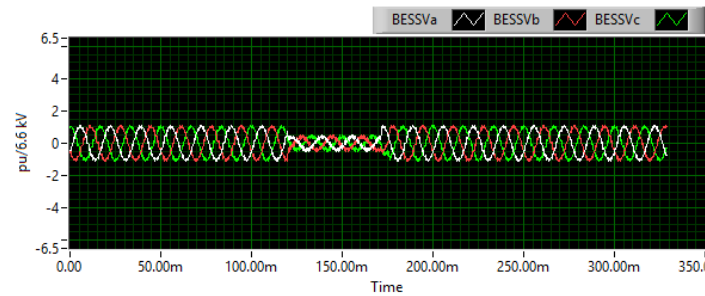
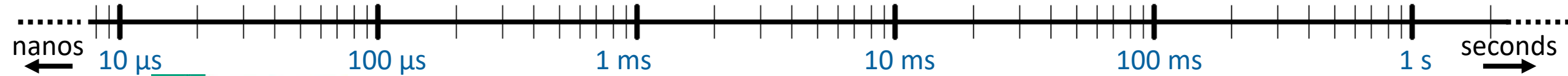


Studying Power Electronics and Fast Transient Phenomenon



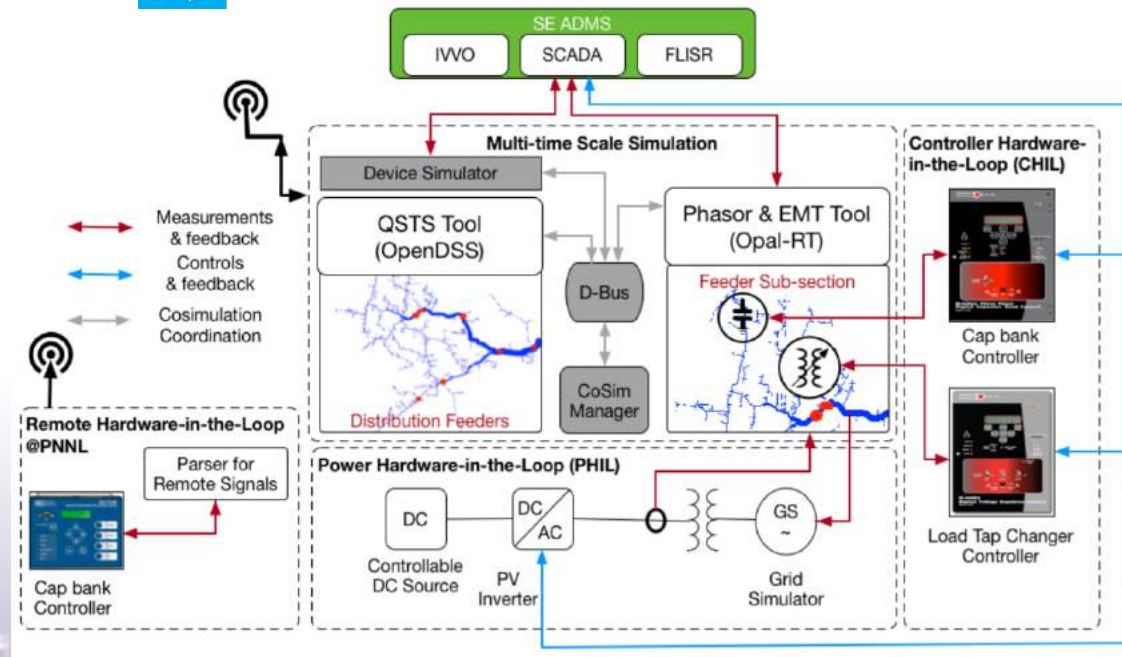
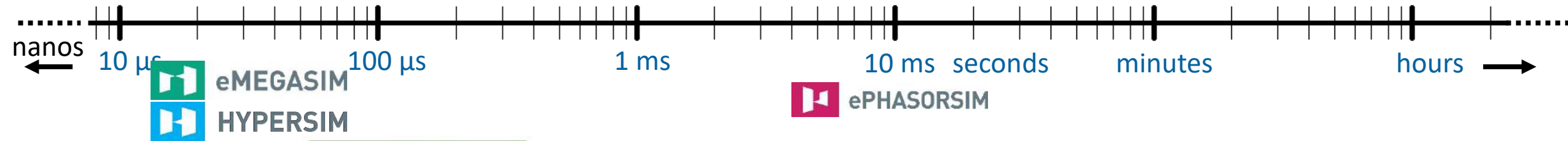
- Assets controller interactions
- Fault response of DERs
- Simulate accurately the effect of commutation dead-times and study harmonics
- Test DER fault-ride through and converter protections

Studying Protection and Control



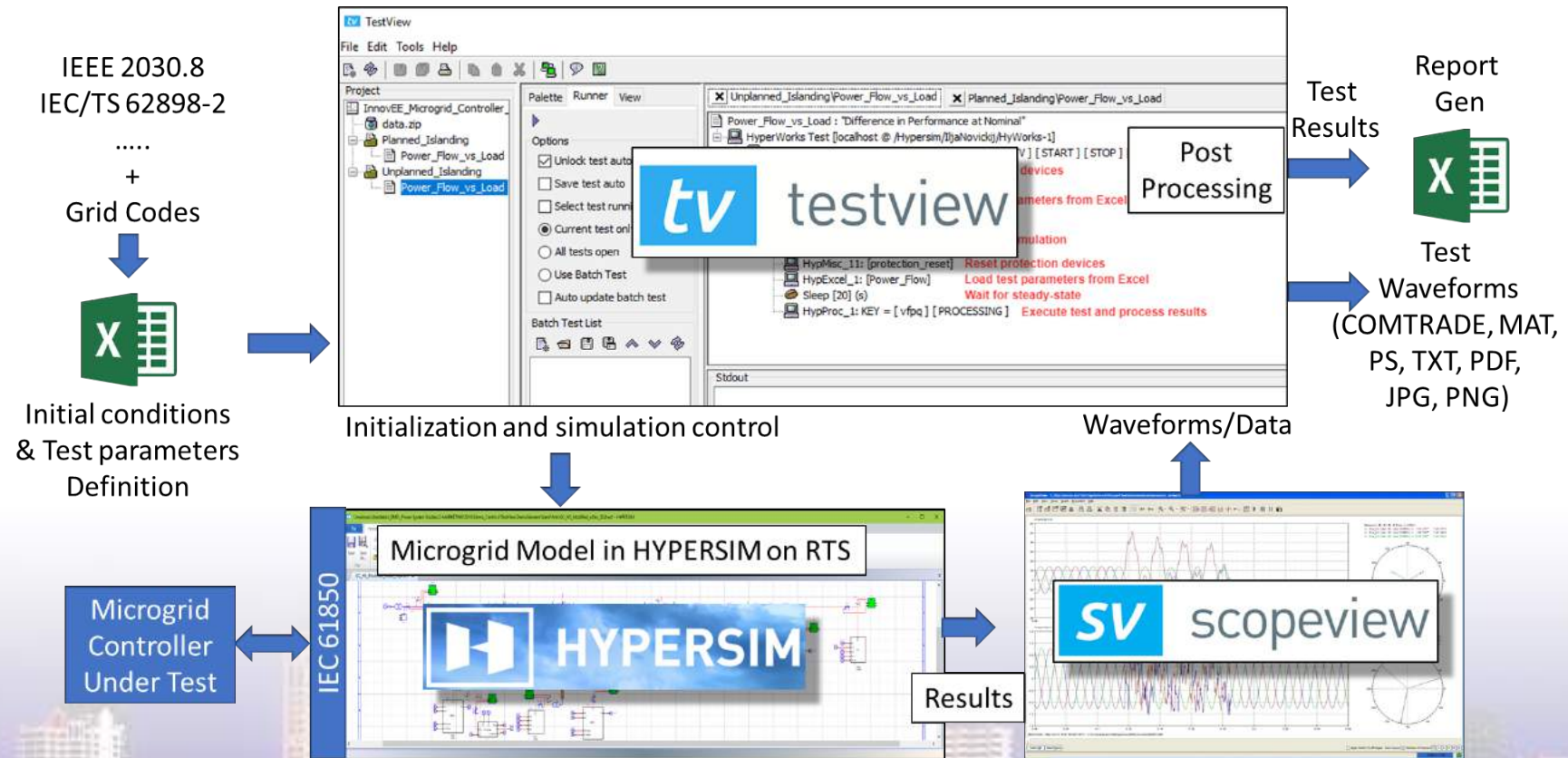
- Test islanding and reconnection transitions
- Islanding detection
- Inertial response within a microgrid
- Test the reliability of the integrated control and protection systems from design studies
- Tune generator controllers and protection system coordination

Large Systems and Slow Dynamics

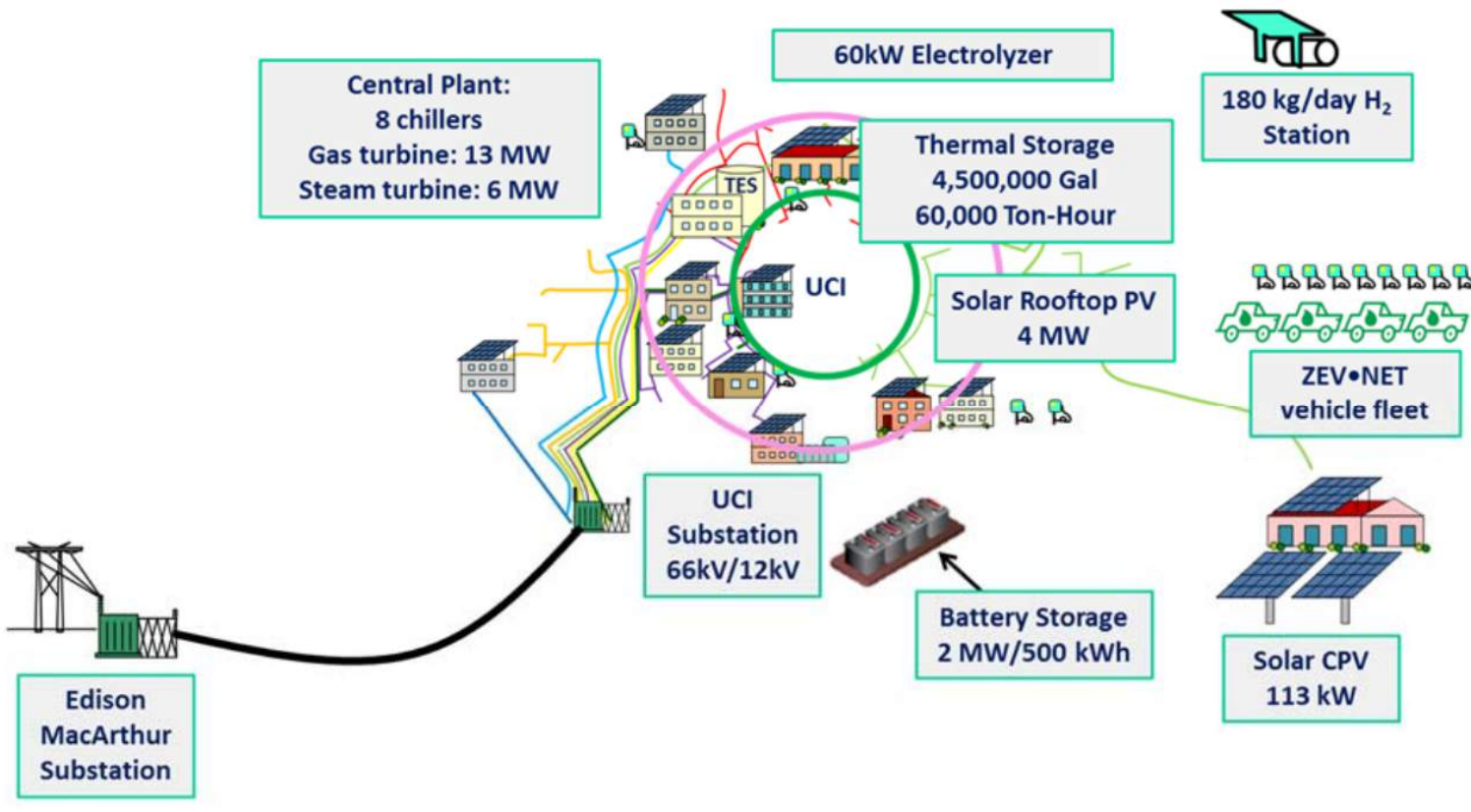


- Impact analysis of microgrids on the grid dynamics
- Integrated testing of microgrid(s) with advanced distribution management systems for large distribution networks
- Use 3-phase unbalanced phasors to simulate large distribution system and study asset dispatch (available with ePHASORSIM)
- Frequency and voltage stability studies with microgrid clusters
- Use EMT or EMT-Phasor hybrid simulations with models using average converter models

Test Automation



Use Case – University of California Irvine



- Performed extensive testing of the microgrid controller with the UCI network model simulated in real-time (phasor).
- Actual testing performed on the 21st Feb 2018 by islanding from the Southern California Edison (SCE) grid.
- Successfully remained islanded for 75 minutes with some loads intentionally turned on and off to test the systems dynamic response.

Thank You

Syed Qaseem Ali, PhD
syed.qaseemali@opal-rt.com

Team Leader T&D-DER
Application eXpertise and Electrical Simulation (AXES) Division
Opal-RT Technologies