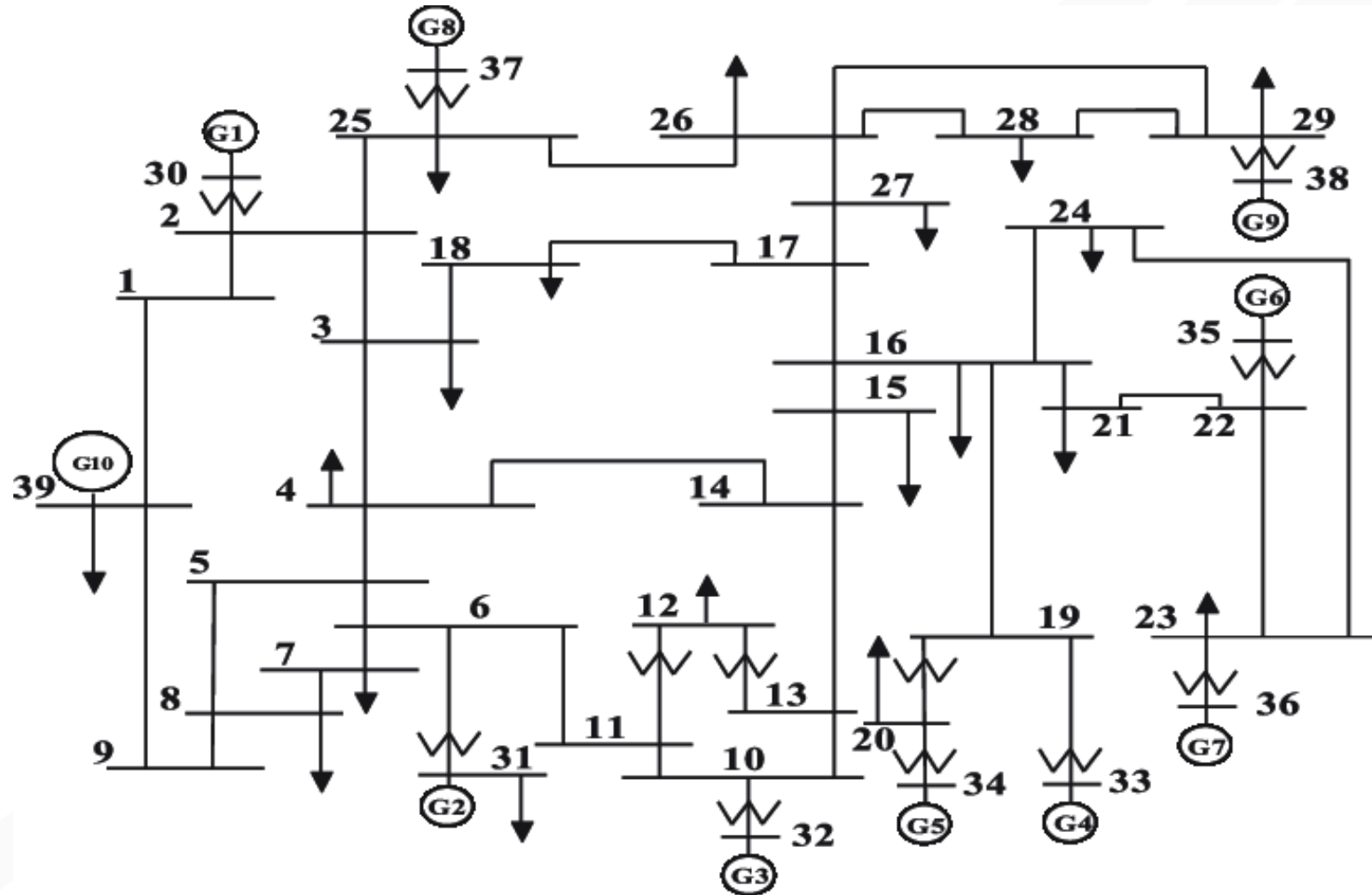


Hands-on Session Outline – EMTP for 9/14/2023

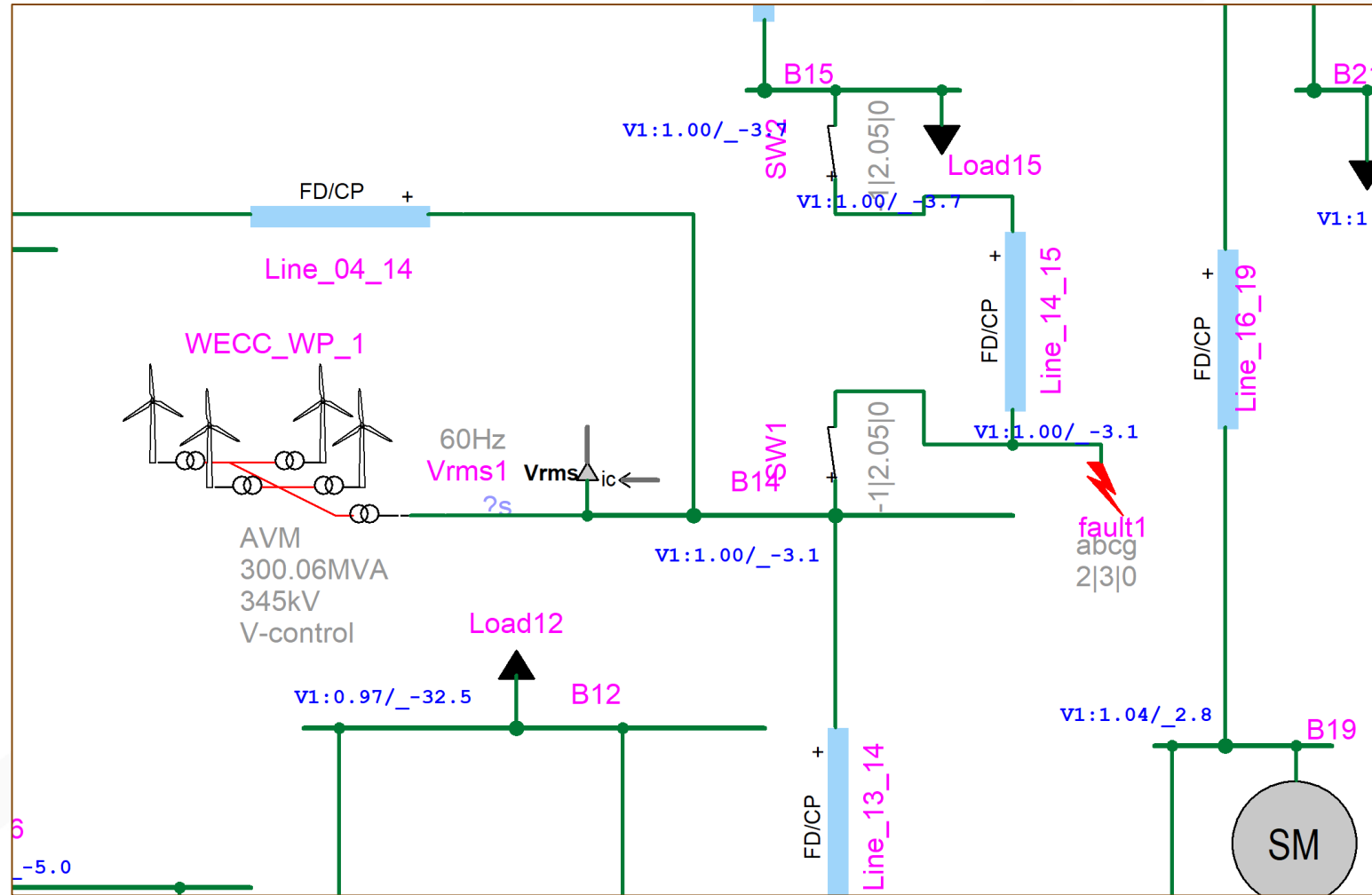
- Extract *SystemLevel.zip* to *c:\temp\i2x\emt2*
- Show the IEEE 39-bus diagram and hosting capacity analysis results to support choice of bus 14
- Modify *WindSystem.ecf* with breakers, rms meters (scope), and fault near bus 14
- Check the load flow with machines, then run a fault with machines
- Add a 300-MW wind plant at bus 14. Set 345-kV voltage on the general and park transformer tabs, 180 turbines, voltage control mode, $V_{ref}=1$, $P_{ref}=0.8$, init. Q from load flow, scope P, Q, PLL, and FRT outputs.
- Run load flow again, the slack bus should generate 240 MW less
- Run the fault again and notice the FRT flag picks up. Change park transformer tap ratio to 1.15 or MVA rating to 300 and run again.
- As time permits, try other fault scenarios, lines out, control modes, dispatch, audience suggestions, etc.
- ===== 15-minute break =====
- Examine *Wind2.ecf* for choices of DM (10 μ s), AVM (20 μ s), REGC_A (100 μ s), odd time step (7 μ s)
- Show DM vs. AVM harmonics in *cplot3.ipynb*
- Examine and run *FaultScript.dwj* on *Wind4.ecf* as an automation example
- Show fault responses in *cplot4.ipynb*
- As time permits, show *Wind5.ecf*, *Wind6.ecf*, and *PlantScript.dwj* to automate P2800.2 test suites (results are not finalized yet).

IEEE 39-Bus Model has 10 generators and 30 candidate buses



Matpower Version of the IEEE 39-bus System: <https://matpower.org/docs/ref/matpower5.0/case39.html>
i2X BES hosting capacity tools: <https://github.com/pnnl/i2x/tree/develop/bes>

Modifications around bus 14 to begin IBR simulations



“WECC Wind Park” Model Feature Summary

| Tab | Options |
|----------------------|---|
| General | # turbines, ratings, grounding, collector circuit, Q/V/pf control |
| Park Transformer | Windings, impedances, saturation, tap ratio for inverter voltage |
| Inverter Transformer | Per-turbine transformer parameters |
| Mechanical | WTGQ_A, WTGP_B, WTGT_B and/or WTGT_A, Inertia, choose Speed/Power control |
| Converter Control | DM+generic, AVM+generic, REGC_A, REGC_C, REEC_D |
| Protections | Sag, overcurrent, ac under/overvoltage, inst. OV, chopper |
| Park Controller | REPC_A, Q/V and P/frequency |
| Harmonics | Inject harmonics for steady-state, time-domain, frequency scan |
| Scopes | Control signals (w/ PLL frequency), protection flags |
| Help | Link to PDF |