GENQEJ Proposal

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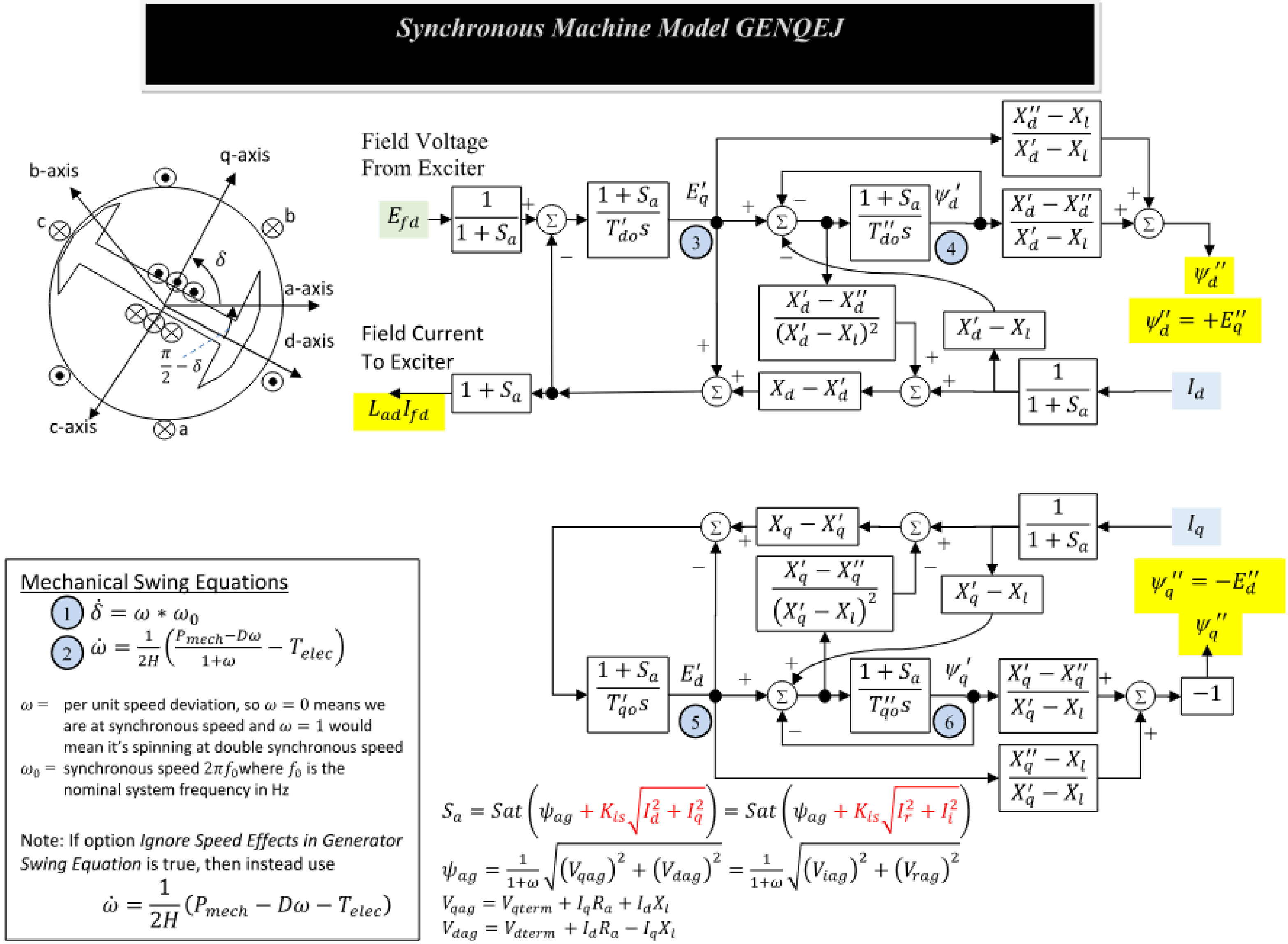
Background/Summary

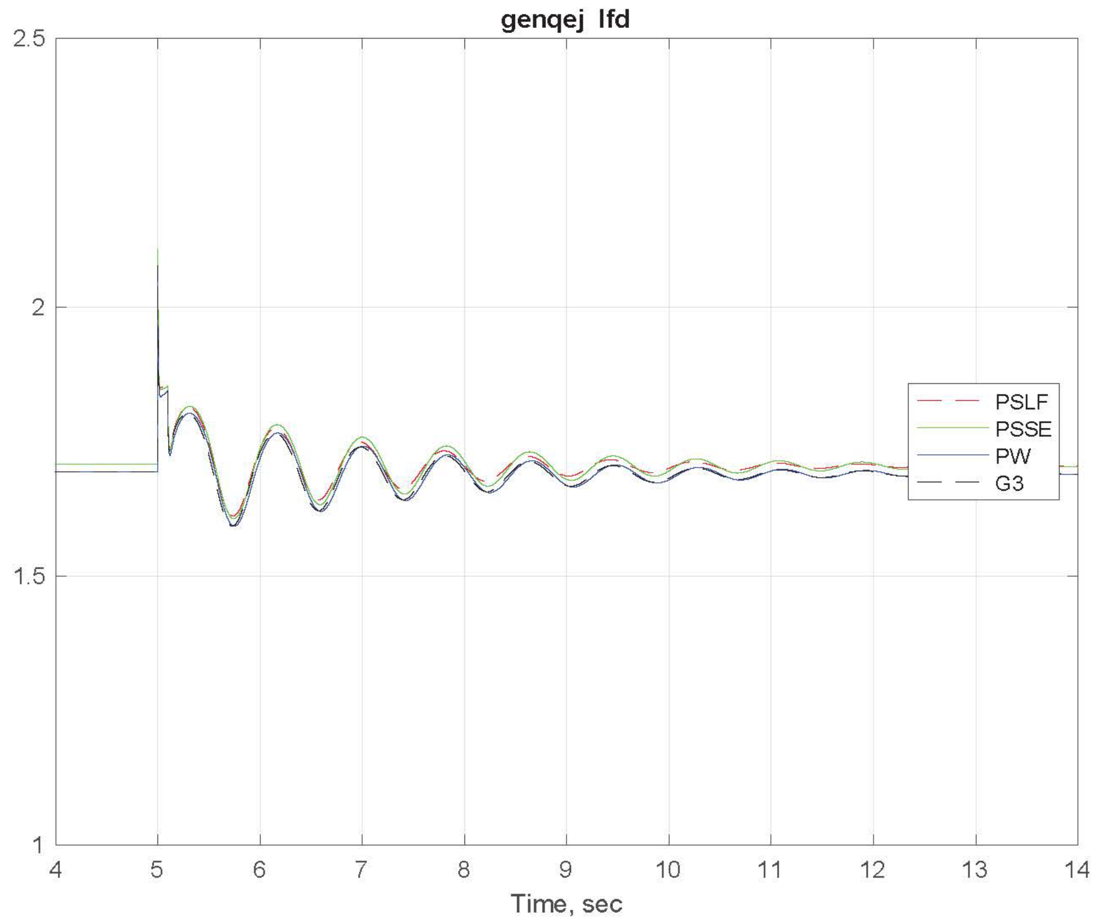
- In the September MVS Meeting, GENQEJ was introduced. GENQEJ uses the saturation treatment (Kis) that was introduced with GENTPJ but GENQEJ uses the same transfer function topology as GENQEC. Kis acts upon the hypot(stator current).
- When saturation is ignored GENQEC, GENQEJ, and GENROU are identical and correspond to the same ‘second order’ generator rotor flux dynamics. As was illustrated by the current interruption simulation presented previously.
- During that meeting it a motion was made for the approval to be placed on this meeting’s agenda for approval.
- Since that presentation more cases have been simulated with GENQEJ which show stability as well excellent correlation with test data.
- This presentation will briefly review and summarize the need for GENQEJ as an alternative for some generators.

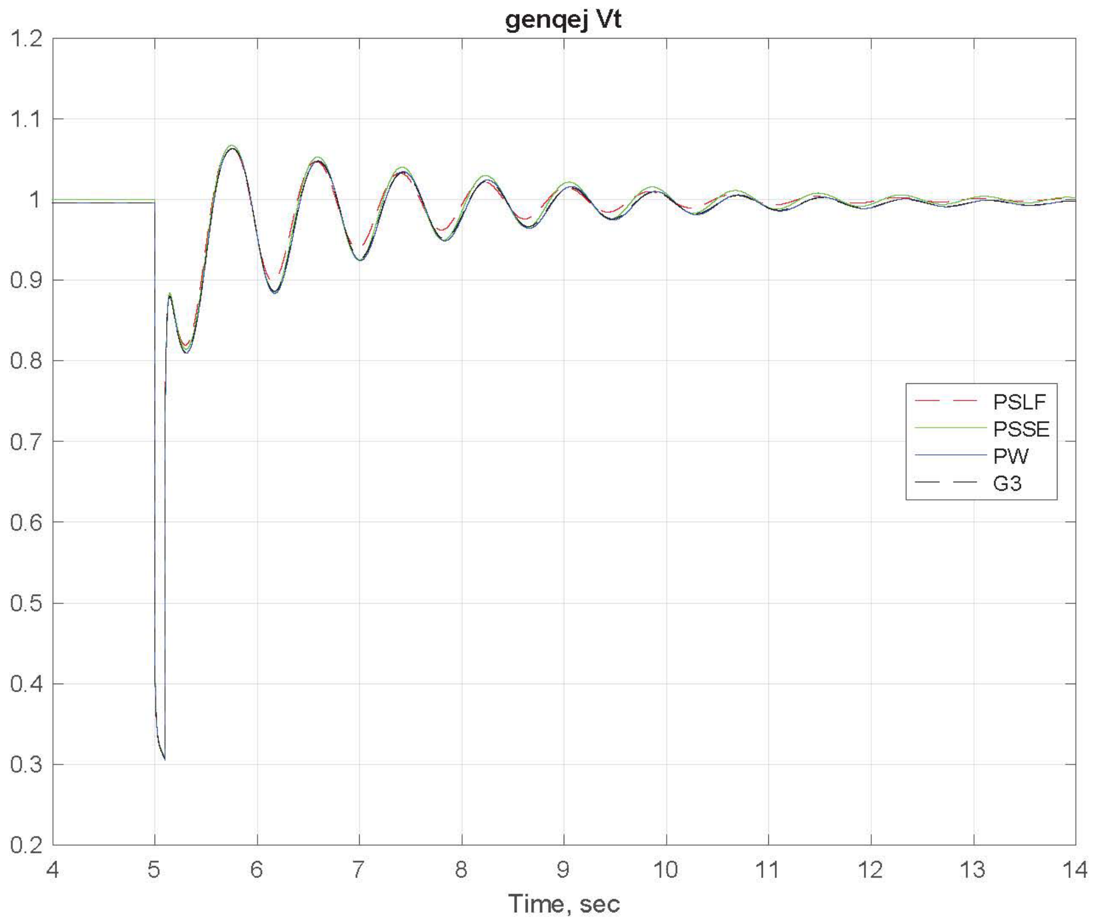
GENQEJ matches the dynamic of GENQEC but makes a different approximation of saturation effects using Kis.

Machine Model GENQEJ



https://www.powerworld.com/WebHelp/Default.htm#TransientModels_HTML/Machine%20Model%20GENQEJ.htm





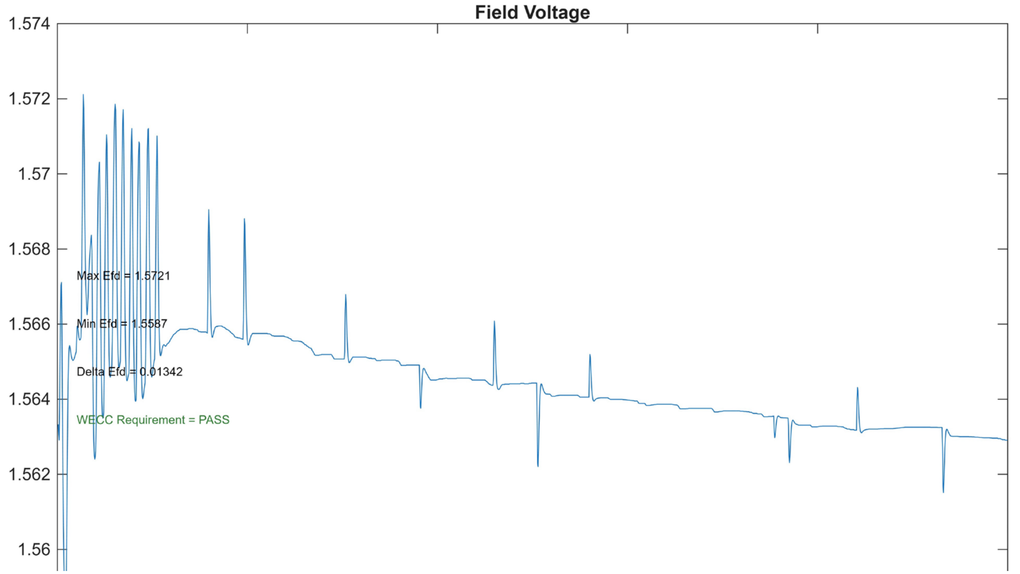
PSLF, PSSE, and Power World have all implemented the model and made it available in the current version. They have been baseline tested to confirm the implementations are consistent.

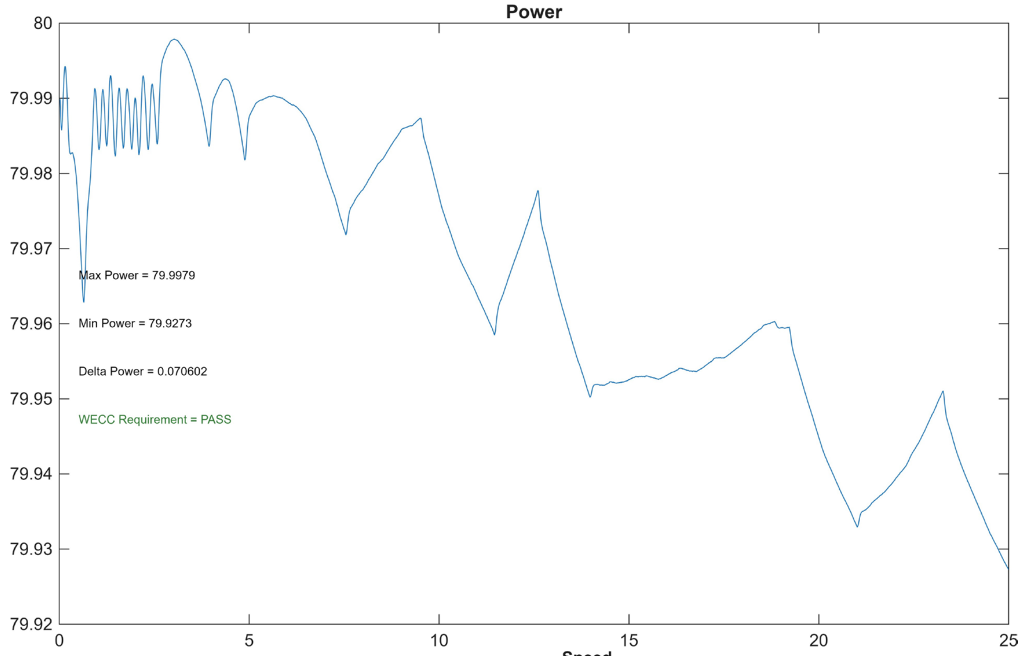
WECC Example

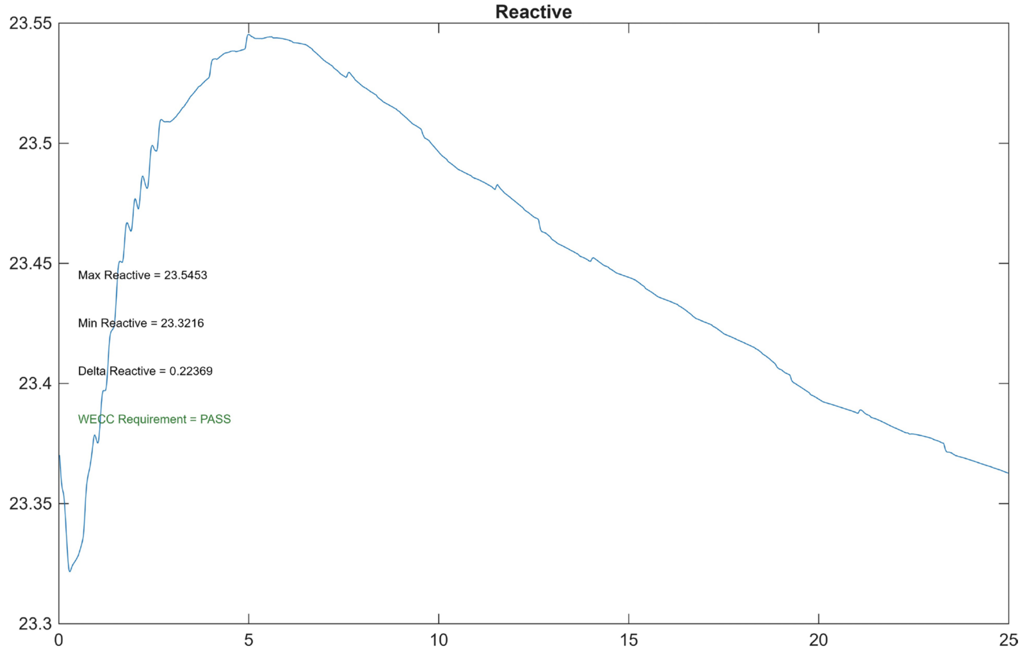
WECC Model Initialization

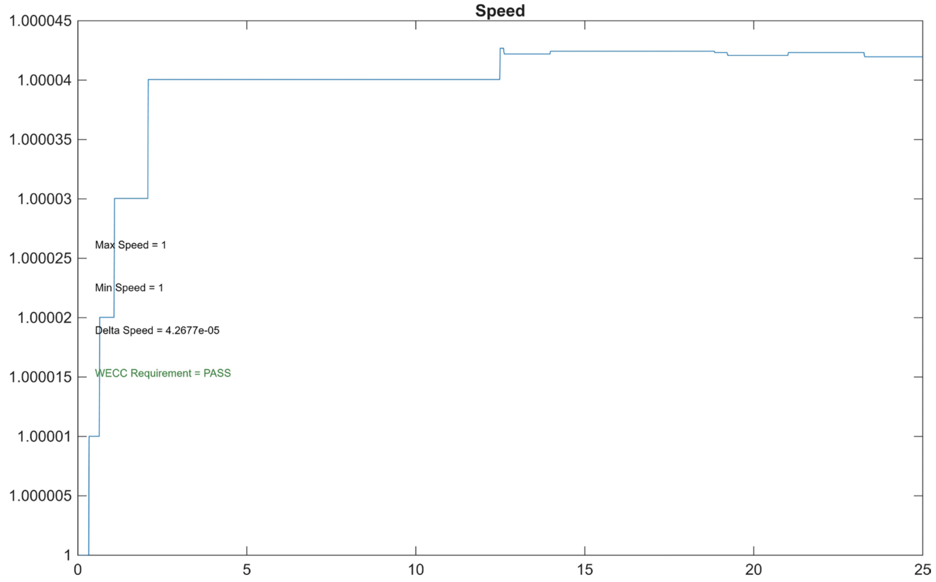
- Model initialization: Using the WECC case, a 30 second run was simulated with the unit online and outputting a pgen as close to the MVA rating as possible and the deltas were examined. The following plots show that the unit initialized as expected.

WECC Model Initialization







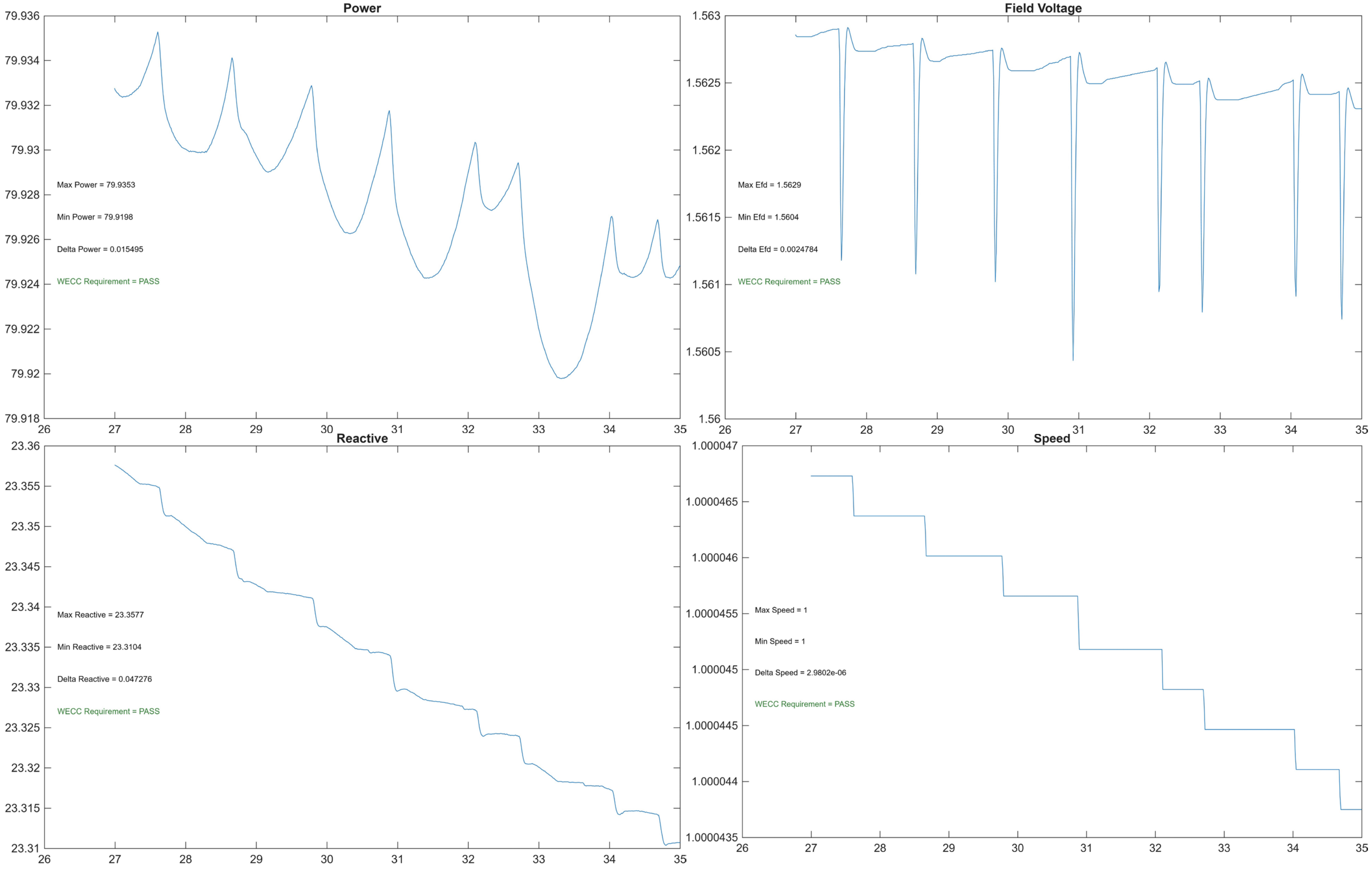


Modeled by: Yuriy Komlev (BOR)

WECC Model Stability

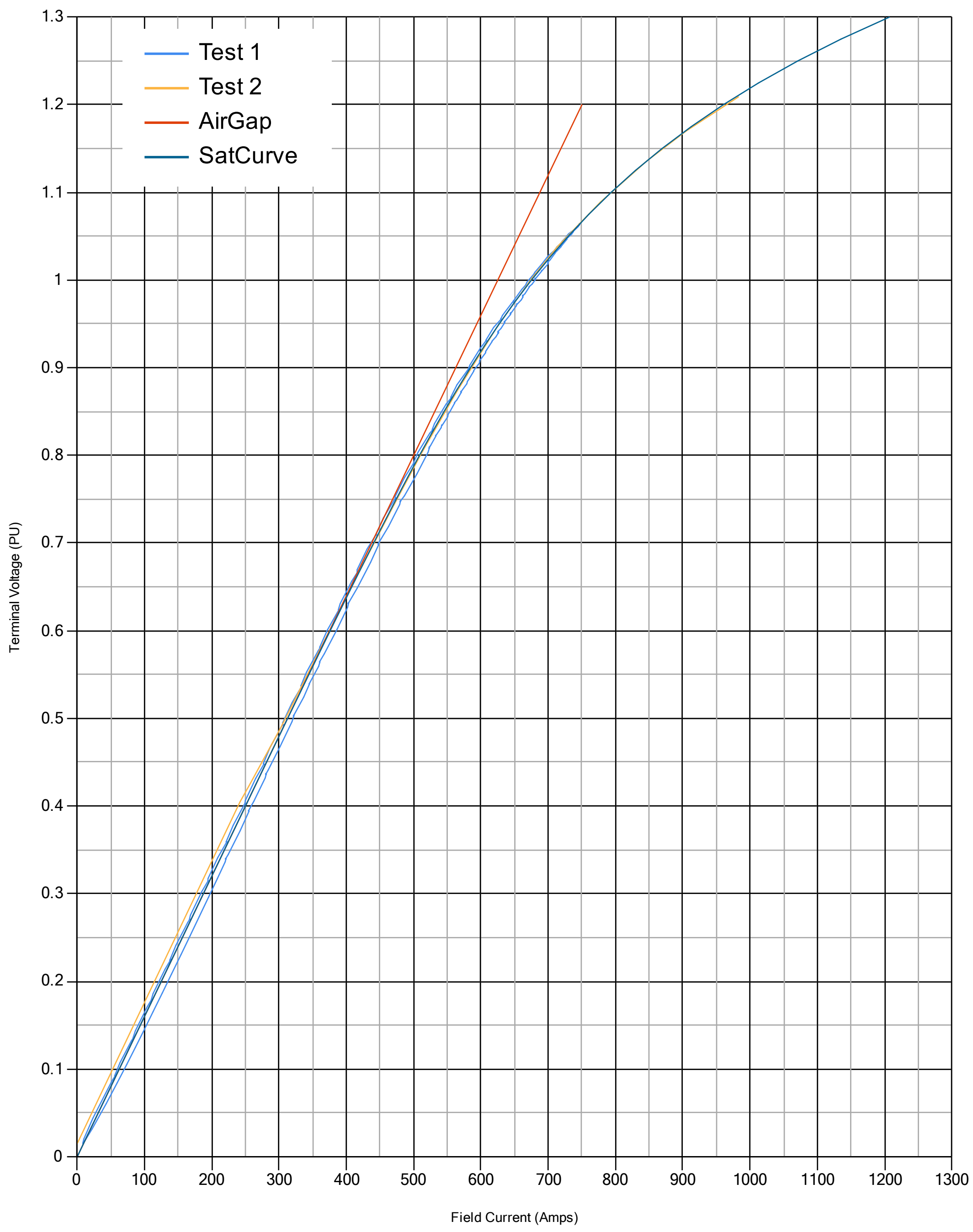
- Model stability: With the unit online and outputting a pgen as close to the MVA rating as possible, run the full case for 1 second, then run a 0.1 second 3- phase bolted bus fault at the generator’s high side bus, then run until 35 seconds. This was done individually at each unique high side bus. The following plots show that the unit stabilizes as required.

WECC Model Stability

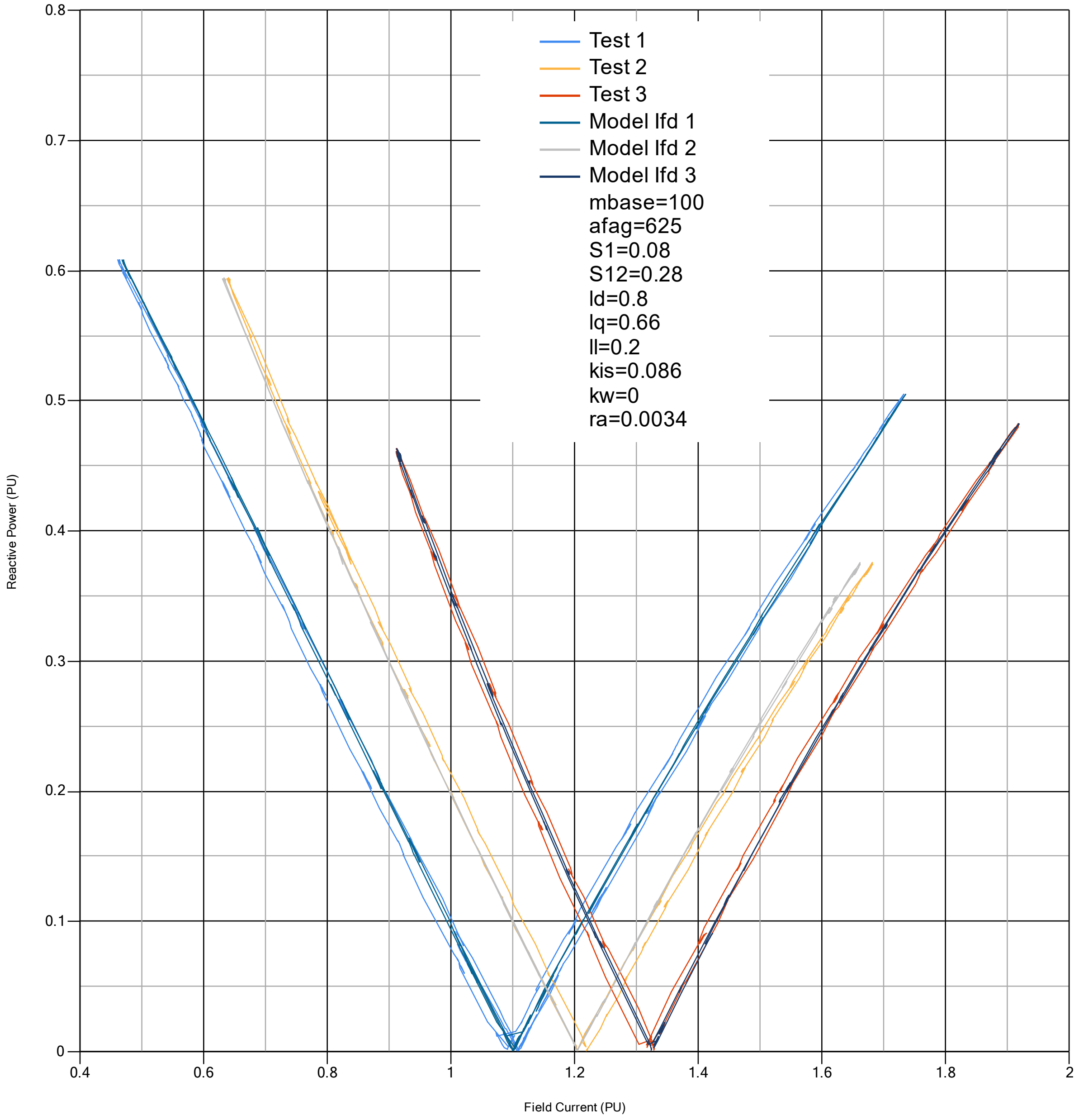


Simulation Comparison

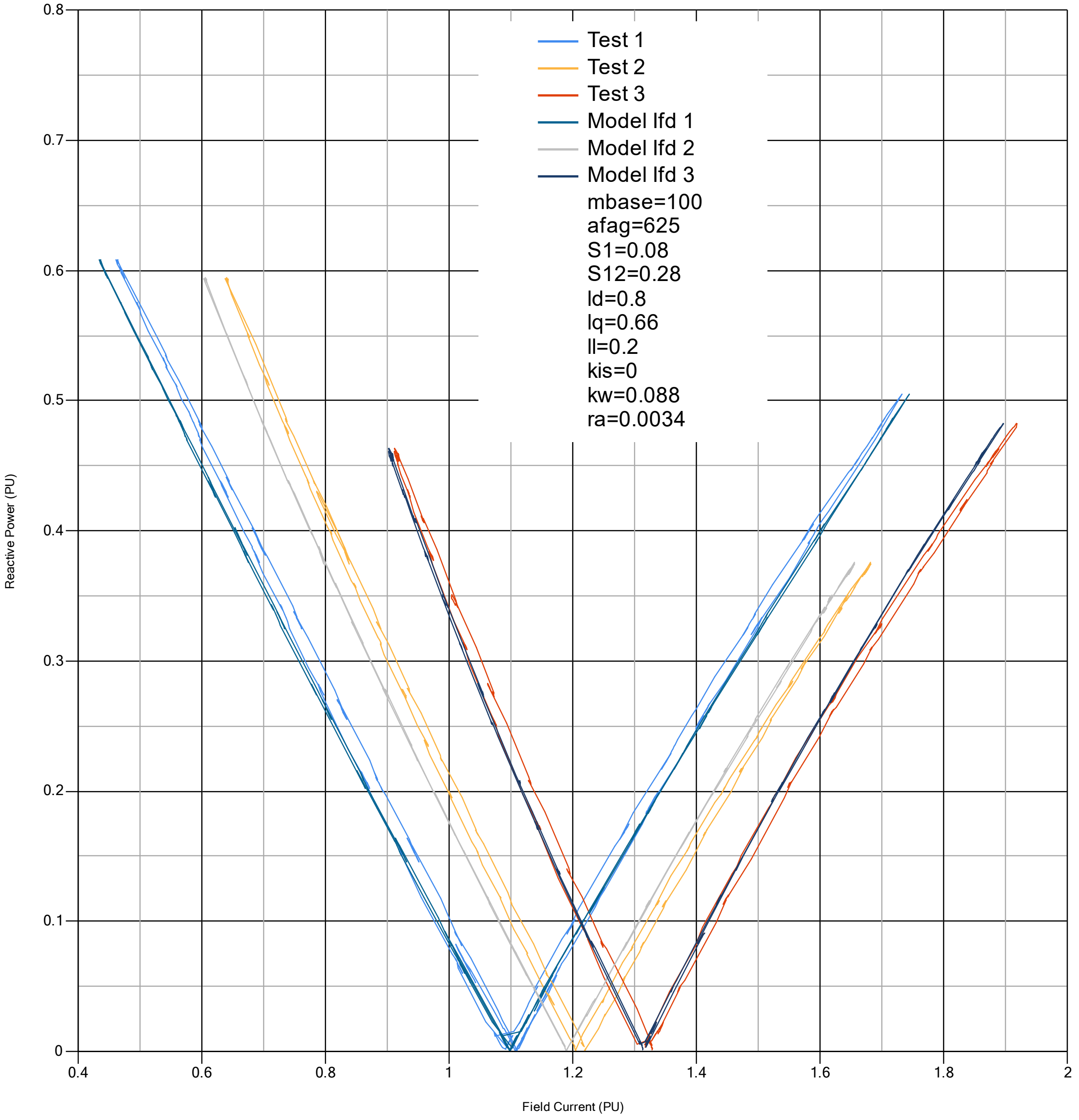
- In the following simulation, S1, S12, Ld, Lq, and afag are all known and held constant. These values were reported in manufacturer commissioning test report data. Bases were adjusted as need to convert our preferred bases in validation tests.
- These values were held constant across the simulations. Only Ll and Kw or Kis were adjusted.


Test 1
Test 2
AirGap
SatCurve
Terminal Voltage (PU)
Field Current (Amps)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300

GENQEJ



GENQEC



Conclusion and Notes on GENQEJ

- GENQEJ provides an alternative model that improves the steady state and dynamic simulations in comparison with recorded data for the machines we have tested.
- We have heard similar results in connection with 3600 and 1800 rpm machines.
- More examples are available for review.
- With more attention coming to the effects field current limits, minimizing error in steady state estimates are important and having an option for modeling that give us a better approximation of steady state field current is important.

Motion for Approval of GENQEJ

- Questions?
- Walla Walla District USACE moves that GENQEJ be added to the list of acceptable models for WECC.