Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

3D Disruption Mitigation Modeling with M3D-C1[1] B.C. LYONS, General Atomics, N.M. FERRARO, S.C. JARDIN, Princeton Plasma Physics Laboratory, C.C. KIM, SLS2 Consulting, J. MCCLENAGHAN, P.B. PARKS, General Atomics, R. SAMULYAK, Stony Brook University, L.L. LAO, General Atomics
— Future tokamaks will require robust disruption-mitigation techniques, the most promising of which use impurity injection to radiate stored energy. We simulate pellet mitigation using the M3D-C1 extended-MHD code coupled to the KPRAD ionization/radiation code. Three-dimensional, nonlinear modeling shows that, with an axisymmetric, on-axis impurity source, the plasma remains stable throughout the thermal quench. Increased resistivity on-axis causes plasma current to diffuse into a thin shell. This shell eventually goes unstable, resulting in a pronounced current spike, the first seen of its magnitude in 3D MHD disruption modeling. Results of a 3D, nonlinear benchmark with NIMROD simulations will be presented. Simulations with a moving, ablating pellet will also be presented, with particular focus on the effect of increased toroidal localization of the deposited impurities. Results will be validated against DIII-D shattered-pellet-injection (SPI) experiments. Finally, we will present progress on using more-sophisticated pellet models, including multiple impurity sources (for multiple toroidal injection and/or SPI modeling) and coupling to a Lagrangian particle code for pellet ablation.

[1]Supported by the US DOE grant numbers DE-FG02-95ER54309, DE-FC02-04ER54698, and DE-SC0018109.

Brendan Lyons
General Atomics

Date submitted: 03 Jul 2019 Electronic form version 1.4