Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Optimizing Stability and Performance in DIII-D and Beyond Using Predictive, Integrated Modeling[1] B.C. LYONS, J. MCCLENAGHAN, O. MENEGHINI, S SAARELMA, S.P. SMITH, GA, T. SLENDEBROEK, ORISE,GA, K.E. THOME, E.A. BELLI, GA, N.C. LOGAN, PPPL, O. SAUTER, EPFL, SPC, P.B. SNYDER, G.M. STAEBLER, A.D. TURNBULL, GA — Tokamak fusion reactors will require predictive, integrated models to optimize performance while maintaining robustness against disruptions. The STEP (Stability, Transport, Equilibrium, & Pedestal) module, developed in OMFIT, predicts stable equilibria self-consistently with core-transport and pedestal calculations by coupling together the following codes: ONETWO, TGYRO, EFIT, CHEASE, EPED, DCON, GATO, and CHEF (a current-drive, heating, & fueling module). Each code reads and writes data from a centralized IMAS data structure, allowing them to be run in arbitrary order and enabling open-loop, feedback, and optimization workflows. Core-pedestal calculations with STEP have been validated against DIII-D, and used to assess performance in ITER and the suppression of turbulence in DIII-D negative-triangularity plasmas. We use STEP to optimize heating and current drive to maximize plasma pressure while maintaining MHD stability. Stability maps are generated and validated against stability limits in DIII-D. Predictive optimization for potential DIII-D upgrades and other next-step devices are performed to assess their capability to explore sustained, high-power-density scenarios.

[1]Work supported by US DOE under DE-FG02-95ER54309 and DE-FC02-04ER54698.

Brendan Lyons
General Atomics

Date submitted: 01 Jul 2020 Electronic form version 1.4