Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Stability Research of High Beta and High Non-inductive Fraction Plasmas on KSTAR[1] S.A. SABBAGH, Y.S. PARK, J. BERKERY, J.H. AHN, Y. JIANG, J.D. RIQUEZES, Columbia U., J.G. BAK, S.H. HAHN, H.S. HAN, Y. JEON, J. KIM, H.S. KIM, J.S. KANG, J. KO, W.H. KO, J. LEE, B. PARK, S.W. YOON, NFRI, A.H. GLASSER, FTC, Inc., N. FERRARO, Z. WANG, PPPL — KSTAR has exceeded the ideal $n = 1$ no-wall MHD stability limit, has transiently exceeded $\beta_N = 4$, and research now turns to sustainment. TRANSP analysis shows plasma non-inductive current fraction has reached 75 percent. Kinetic equilibrium reconstructions with MSE data for local magnetic field pitch angle constraint are used to evaluate ideal and resistive stability. Tearing modes are observed to limit β_N. The linear stability of $m/n = 2/1$ modes is computed using resistive DCON and M3D-C[1] and are linearly unstable with positive Δ' throughout the long pulse duration. The bootstrap current contribution to neoclassical tearing mode stability is computed using TRANSP. Predictive TRANSP is used to analyze the impact of the new second NBI system. At usual energy confinement quality and Greenwald density fraction, 100 percent non-inductive plasmas are found in the range $\beta_N = 3.5$–5.0. The Generalized NTV Offset rotation produced record values of co-I_p plasma rotation by this 3D field effect reaching 40 km/s, or 2.8 kHz (8.9 times faster than ITER modeling in the pedestal region) and is envisioned as a disruption avoidance tool. An RWM active control system has been completed for use including required sensor compensation of the applied and induced AC fields from the passive stabilizers.

[1]Supported by US DOE grant DE-SC0016614.

Steven Sabbagh
Columbia U.

Date submitted: 08 Jul 2019 Electronic form version 1.4