Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Progress on Disruption Event Characterization and Forecasting in Tokamaks[1] Y.S. PARK, S.A. SABBAGH, J.W. BERKERY, J.H. AHN, J.M. BIALEK, Y. JIANG, J.D. RIQUEZES, Columbia U., J.G. BAK, S.H. HAHN, J. KIM, J.S. KO, J.H. LEE, S.W. YOON, NFRI, C. HAM, A. KIRK, L. KOGAN, D. RYAN, A. THORNTON, CCFE, M. BOYER, K. ERICKSON, Z. WANG, PPPL — Disruption prediction and avoidance is critical in ITER and reactor-scale tokamaks. Results from the disruption event characterization and forecasting (DECAF) research effort are shown for multiple tokamaks. Analysis of KSTAR, MAST, and NSTX databases shows low disruptivity paths to high beta operation. DECAF analysis of a ~10^4 plasma database with only 5 DECAF events predicts disruptions with 91.2% true positives and 8.7% false negatives. Automated analysis of rotating MHD modes allows identification of disruption event chains including coupling, bifurcation, locking, and potential triggering by other events. DECAF can provide an early disruption forecast (on transport timescales) allowing disruption avoidance through profile control. New hardware to evaluate this analysis in real-time is now being configured for installation on KSTAR. TRANSP predictive analyses with as few as 4 (of 6) NBI sources computes plasmas at β_N >3.5 with 100% non-inductive current drive - a novel operating regime for KSTAR disruption prediction studies. Analysis of MAST has uncovered resistive wall modes at high β_{N}. Mode shape and growth rate are significantly altered by conducting structure differences compared to NSTX. Wall stabilization is computed to increase in MAST-U due to new divertor plates.

[1]Supported by US DOE grants DE-SC0016614 and DE-SC0018623.

Young-Seok Park
Columbia U.

Date submitted: 04 Jul 2019