Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Active resistive wall mode and plasma rotation control for disruption avoidance in NSTX[1] S.A. SABBAGH, J.W. BERKERY, J.M. BIALEK, Y.S. PARK, Columbia U., R.E. BELL, D.A. GATES, S.P. GERHARDT, I. GOUMIRI, PPPL — NSTX has produced high beta plasmas at levels needed for future ST devices. Research turns to understanding how the disruption probability due to global MHD and resistive wall modes (RWM) can be reduced to very low levels. Analysis of present data supports a multi-layered approach including rotation and current profile control for instability avoidance, and active mode control. Experiments using MHD spectroscopy show a decrease in measured n = 1 mode stability as the marginal point is approached, with stability *increasing* when $\beta_{\mathrm{N}}/\mathrm{l_i} > 10$. Experimental results are consistent with the theory that stabilizing kinetic effects can be enhanced at lower collisionality, ν, and that instability can be avoided by steering the rotation profile toward ion precession drift resonance. The database of plasmas using neoclassical toroidal viscosity (NTV) to alter the rotation profile is further analyzed to understand the dependence on key parameters, including ν, for use in active instability avoidance. Results from the active RWM state-space controller used in plasmas exceeding $\beta_N = 6.4$ and $\beta_N/l_i = 13$ are analyzed to determine improvements based on 3D effects. VALEN-3D analysis shows that RWM control is possible near the ideal with-wall stability limit with a planned internal control coil upgrade and proper sensor positioning.

[1]Supported by U.S. DOE grant DE-FG02-99ER54524.

S.A. Sabbagh
Columbia U.

Date submitted: 12 Jul 2013 Electronic form version 1.4