

Abstract Submitted  
for the DPP14 Meeting of  
The American Physical Society

**Preparing Plasma Control and Digital Coil Protection for NSTX-U** S.P. GERHARDT, K. ERICKSON, D.A. GATES, R. KAITA, D. MUELLER, PPPL, S.A. SABBAGH, Columbia University, T. STEVENSON, P. TITUS, W. QUE, PPPL — Compared to NSTX, NSTX-Upggrade will have twice the toroidal field ( $B_T$  0.5T  $\rightarrow$  1.0T) and plasma current ( $I_P$  1MA  $\rightarrow$  2MA). These increases in capability have mandated a new digital coil protection system (DCPS). This software computes forces, stresses, and coil heating in real time, and brings down the coil power supplies in a controlled manner when the forces, stresses, heating and currents exceed limits; the algorithms and their numerical implementation will be described. The algorithms have been run on the legacy NSTX database of discharges, motivating a reexamination of some limit values and identification of the plasma control behaviors that lead to large forces and stresses. These and other changes in the conversion to NSTX-U have motivated improvements to the plasma control system (PCS) algorithms. The preliminary design of an architecture for a automated discharge termination system will be presented, motivated by the desire to reduce large current transients during disruptions, thereby reducing stresses and avoiding DCPS faults. Other improvements to the plasma control system include the automation of the TF current rampdown, improvements to the gas delivery algorithms, and the addition of many more flux loops and magnetic pickup (Mirnov) sensors for real time equilibrium reconstruction. This work was sponsored by the U.S. Department of Energy.

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Date submitted: 10 Jul 2014

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