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HBT-EP Program: Active MHD Mode Dynamics and Control[1]
G.A. NAVRATIL, J. BIALEK, A.H. BOOZER, P.J. BYRNE, G.V. DONALD, P.E. HUGHES, J.P. LEVESQUE, M.E. MAUEL, Q. PENG, D.J. RHODES, C.C. STOAFER, Columbia University, C.J. HANSEN, University of Washington — The HBT-EP active mode control research program aims to: (i) quantify external kink dynamics and multimode response to magnetic perturbations, (ii) understand the relationship between control coil configuration, conducting and ferritic wall effects, and active feedback control, and (iii) explore advanced feedback algorithms. Biorthogonal decomposition is used to observe multiple simultaneous resistive wall modes (RWM). A 512 core GPU-based low latency (14μs) MIMO control system uses 96 inputs and 64 outputs for Adaptive Control of RWMs. An in-vessel adjustable ferritic wall is used to study ferritic RWMs with increased growth rates, RMP response, and disruptivity. A biased electrode in the plasma is used to control the rotation of external kinks and evaluate error fields. A Thomson scattering diagnostic measures T_e and n_e at 3 spatial points, soon to be extended to 10 points. A quasi-linear sharp-boundary model of the plasma's multimode response to error fields is developed to determine harmful error field structures and associated NTV and resonant torques. Upcoming machine upgrades will allow measurements and control of scrape-off-layer currents, and control of kink modes using optical diagnostics.

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