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Central Safety Factor and Normalized Beta Control Under Near-Zero Input Torque Constraints in DIII-D[1] ANDRES PAJARES, WILLIAM WEHNER, EUGENIO SCHUSTER, Lehigh University, KEITH BURRELL, JOHN FERRON, MICHAEL WALKER, DAVID HUMPHREYS, General Atomics, LEHIGH UNIVERSITY TEAM, GENERAL ATOMICS TEAM — DIII-D experiments have assessed the capability of combined central safety factor (q_0) and normalized beta (β_N) control under near-zero net torque to facilitate access to QH-mode with reverse I_p and normal B_t. Regulation of q_0 and β_N can prevent magneto-hydrodynamic instabilities that deteriorate plasma performance in discharges with a monotonically increasing safety-factor profile. Zero-input-torque scenarios are of special interest because future burning plasma tokamaks such as ITER will most likely operate with very low input torque, which makes these scenarios more susceptible to locked modes. To support studies of such scenarios, a controller for simultaneous regulation of q_0 and β_N has been developed using near-zero net input torque actuators including balanced neutral beam injection (NBI) and electron-cyclotron heating & current drive (ECH/ECCD). Experimental results show that in spite of the presence of locked modes the use of feedback control resulted in good tracking of the commanded q_0 and β_N when both ECCD/ECH and NBI were available.

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