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Category Number and Subject: 5.6.2. DIII-D Tokamak

Theory Experiment

Studies in DIII-D of High Beta Discharge Scenarios Appropriate for Steady-state Tokamak Operation With Burning Plasmas,* J.R. Ferron, J.C. DeBoo, T.C. Luce, T.W. Petrie, C.C. Petty, P.A. Politzer, GA H. Reimerdes, *Columbia U.*, M. Schneider, *CEA*, T.A. Casper, C.T. Holcomb, *LLNL*, J.M. Park, M. Murakami, *ORNL*, Y. Ou, E. Schuster, *Lehigh U.*, E.J. Doyle, *UCLA* – In the DIII-D steady-state scenario with $q_{\min} = 1.5-2.0$, the duration with the noninductive current fraction (f_{NI}) near 1 has been extended to 70% of the resistive time. To extend duration, ECCD is deposited with a broad profile in order to avoid the 2/1 tearing mode, enabling reliable operation at $\beta_{\text{N}} = 3.6-3.7$. These discharges have double-null shape biased in the direction opposite the ∇B drift, in order to simultaneously optimize confinement and divertor pumping, and ECCD power up to 3 MW. An alternate scenario with internal inductance increased to 1.1-1.4 is under study, motivated by the possibility of steady-state operation at $\beta_{\text{N}} = 4-5$ without wall stabilization. Thus far, $\beta_{\text{N}} = 4.6$, just below the calculated $n=1$ and $n = \infty$ stability limits, has been achieved transiently with $f_{\text{NI}} = 0.85$.

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