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High β_N steady state scenario development on DIII-D[1] C.T. HOLCOMB, M.J. LANCTOT, Lawrence Livermore National Laboratory, T.C. LUCE, J.R. FERRON, R.J. BUTTERY, General Atomics, J.M. PARK, ORNL, F. TURCO, J.M. HANSON, Columbia U., M. OKABAYASHI, PPPL — On DIII-D, on- and off-axis neutral beams and electron cyclotron heating have expanded access to a wide range of q-profiles. Plasmas have been sustained with $q_{min} = 1.3 - 2.5$ to evaluate the suitability for high β_N, high performance steady state operation. Nearly stationary plasmas were sustained for two current profile relaxation timescales (3 s), with $q_{min} = 1.5$, $\beta_N = 3.5$, and performance that projects to $Q = 5$ in ITER. The duration of the high β_N phase is limited only by the available NBI energy. Low-order tearing modes are absent and the predicted ideal-wall $n = 1$ kink β_N limit is >4. To achieve a steady state, higher β_N is needed to increase the bootstrap current. Higher q_{min} decreases the required external current drive near the axis and can increase the stability β_N limit. Experiments to produce $\beta_N = 4-5$ and $q_{min} \geq 2$ with $B_T = 1.75-2$ T were limited to $\beta_N < 3.3$ by relatively low energy confinement ($H_{89} < 2$) rather than tearing modes. Low H_{89} is likely due to a combination of increased thermal transport at high q_{min} (low poloidal flux), and depositing more power at larger radius. We will discuss upcoming experiments to achieve higher β_N and improved confinement.

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