Abstract Submitted for the 54th Annual Meeting
Division of Plasma Physics
October 29 through November 2, 2012
Providence, Rhode Island

Category Number and Subject: 5.6.2. DIII-D Tokamak

[ ] Theory [X] Experiment

High β_N Steady state Scenario Development on DIII-D,*
C.T. Holcomb, M.J. Lanctot, *LLNL*; T.C. Luce, J.R. Ferron, R.J. Buttery, *GA*; 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, β_{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 β_{N}=4–5 and q_{min}≥2 with B_{T}=1.75–2 T were limited to β_{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.

*Supported by the US DOE under DE-AC52-07NA27344, DE-FC02-04ER54698, DE-AC05-00OR22725, DE-FG02-04ER54761 and DE-AC02-09CH11466.