Stability Limits in High Performance, Negative Central Shear Discharges, * J.M. Hanson, J. Bialek, G.A. Navratil, K.E.J. Olofsson, F. Turco, Columbia U; M. Clement, UCSD; J.R. Ferron, A.M. Garofalo, R.J. La Haye, M.J. Lanctot, E.J. Strait, GA; C.T. Holcomb, LLNL – Exploration of negative central shear equilibria in DIII-D has yielded discharges that transiently achieve $\beta_N \approx 4$. The discharges exhibit broad current density profiles, leading to a significant separation in the no- and with-wall ideal kink stability limits predicted by MHD theory. As the no-wall limit is approached and exceeded in experiments, performance is often limited by $n=1$ resistive wall mode (RWM) instabilities that lead to abrupt collapses of the plasma stored energy. In addition, instabilities with $n=1$ rotating tearing precursors are observed when minimum $q$ value drops below 2. Theoretical calculations predict that magnetic feedback control using the in-vessel coils (internal coils) can provide RWM stabilization to $\beta_N$ values approaching the $n=1$ ideal-wall limit. In experiments, applying I-coil control indeed facilitates access to increased $\beta_N$ values above the no-wall limit.

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