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Achieving Steady-State Conditions in the High-Beta Hybrid Scenarios in DIII-D[1] C.C. PETTY, T.C. LUCE, J.R. FERRON, A.M. GAROFALO, A.W. HYATT, G.L. JACKSON, GA, F. TURCO, Columbia U., C.T. HOLCOMB, LLNL, E.J. DOYLE, UCLA — The natural attributes of the hybrid scenario, especially the anomalously broad current profile, with $q_{min} \gtrsim 1$, allows steady-state conditions with zero surface loop voltage to be achieved at 1 MA plasma current in DIII-D. Using efficient central current drive, the surface loop voltage is driven down to zero for $> 1\tau_R$, with $\sim 50\%$ bootstrap current fraction when β_P is increased above 1.9. Interestingly, good alignment between the current drive and plasma current profiles is not necessary as the hybrid regime self-organizes the current density profile. Steady-state hybrid plasmas can achieve $\beta_N = 3.6$ for the full duration of the NB pulse ($> 1\tau_R$) without exciting the m/n=2/1 tearing mode, corresponding to β_T up to 3.4%. The thermal energy confinement time is excellent, with confinement factors up to $H_{98y2} = 1.6$ even during strong EC heating. A 0-D physics model demonstrates that attractive scenarios with Q_{fus}=3.5-3.8 exist for steady-state operation in ITER and FNSF.

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