HYBRID SCENARIO DEVELOPMENT IN DIII-D

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ABSTRACT: Experiments in the DIII-D tokamak have demonstrated the ability to sustain ELMing H-mode discharges with high β and good confinement quality under stationary conditions. These experiments have shown the ability to sustain normalized fusion performance (in terms of $\beta_N H_{89P} / q_{95}^2$) at or above that projected for $Q_{fus} = 10$ operation in the International Thermonuclear Experimental Reactor (ITER) design over a wide range in operating parameters. In the best cases, operation is maintained at the free boundary, $n = 1$ stability limit. Confinement is found to be better than standard H–mode confinement scalings over a wide range in operation space and experimentally measured transport is consistent with predictions from the GLF23 transport code. Projections using the standard ITER H-mode scaling laws based on these discharges indicate that $Q_{fus} = 5$

can be maintained for >5400 s in ITER at $q_{95} = 4.5$ while $Q_{fus} = 40$ can be obtained for ~2400 s at $q_{95} = 3.2$. These projected performance levels further validate the ITER design and suggests long-pulse, high neutron fluence operation as well as very high fusion gain operation may be possible in next-generation tokamaks.