Development of Burning Plasma and Advanced Scenarios in the DIII-D Tokamak

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Abstract. Significant progress in the development of burning plasma scenarios, steady-state scenarios at high fusion performance, and basic tokamak physics has been made by the DIII-D Team. Discharges similar to the ITER baseline scenario have demonstrated normalized fusion performance nearly 50% higher than required for $Q = 10$ in ITER, under stationary conditions. Discharges that extrapolate to $Q \sim 10$ for longer than one hour in ITER at reduced current have also been demonstrated in DIII-D under stationary conditions. Proof of high fusion performance with full noninductive operation has been obtained. Underlying this work are studies validating approaches to confinement extrapolation, disruption avoidance and mitigation, tritium retention, ELM avoidance, and operation above the no-wall pressure limit. In addition, the unique capabilities of the DIII-D facility have advanced studies of the sawtooth instability with unprecedented time and space resolution, threshold behavior in the electron heat transport, and rotation in plasmas in the absence of external torque, measurements in the edge pedestal region, and plasma fueling.

*See Appendix for listing of the DIII-D Team.