# Long-Pulse Stability Limits of the ITER Baseline Scenario

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**Abstract.** DIII-D has made significant progress in developing the techniques required to operate ITER, and in understanding their impact on performance when integrated into operational scenarios at ITER relevant parameters. Long duration plasmas, stable to m/n =2/1 tearing modes (TMs), with an ITER similar shape and $I_p/aB_T$, have been demonstrated in DIII-D, that evolve to stationary conditions. The operating region most likely to reach stable conditions has normalized pressure, $\beta_N \approx 1.9–2.1$ (compared to the ITER baseline design of 1.6 – 1.8), and a Greenwald normalized density fraction, $f_{GW}$ 0.42 – 0.70 (the ITER design is $f_{GW} \approx 0.8$). The evolution of the current profile, using internal inductance ($l_i$) as an indicator, is found to produce a smaller fraction of stable pulses when $l_i$ is increased above ≈ 1.1 at the beginning of $\beta_N$ flattop. Stable discharges with co-neutral beam injection (NBI) are generally accompanied with a benign n=2 MHD mode. However if this mode exceeds ≈ 10 G, the onset of a m/n=2/1 tearing mode occurs with a loss of confinement. In addition, stable operation with low applied external torque, at or below the extrapolated value expected for ITER has also been demonstrated. With electron cyclotron (EC) injection, the operating region of stable discharges has been further extended at ITER equivalent levels of torque and to ELM free discharges at higher torque but with the addition of an n=3 magnetic perturbation from the DIII-D internal coil set. The characterization of the ITER baseline scenario evolution for long pulse duration, extension to more ITER relevant values of torque and electron heating, and suppression of ELMs have significantly advanced the physics basis of this scenario, although significant effort remains in the simultaneous integration of all these requirements.

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