Experiments Simulating ITER Rampdown and Startup Scenarios in the DIII-D Tokamak *

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Successful ITER burning plasma operation requires reliable startup, a burning plasma flattop phase, and disruption-free rampdown. We report on recent experiments to simulate the ITER startup and rampdown phases in the DIII-D tokamak, where ITER discharges were scaled to DIII-D by the ratio of current resistive time (≈50) and either the low field side (LFS) radii (during the limited phase) or the major radius (during the diverted phase) while maintaining the ITER value of I/aB. Rampdown of ITER plasmas is an important consideration because the ITER design allows only for a small number of disruptions. The internal inductance can strongly increase during rampdown, approaching the control limits for vertical stability. By simultaneously decreasing the elongation and plasma current, an ITER-like discharge (baseline H-mode-scenario 2) has been successfully terminated, maintaining H-mode with neutral beam heating in the rampdown phase. We will discuss the implications of various strategies for rampdown, including Ohmic rampdown, the H to L back transition, the effect of elongation, and vertical stability control.

Previous experiments in DIII-D have simulated portions of the ITER startup scenario including low inductive voltage (V_{loop}) startup, as low as 2.2 V (0.21 V/m), with 2nd harmonic X-mode electron cyclotron (EC) assist. In addition, an improved "large-bore" startup was developed and ℓ_i feedback control was successfully demonstrated [1]. Experiments are planned to extend the startup results to include non-radial EC launch (to simulate the ITER EC geometry) and to evaluate the EC power requirements during the burnthrough phase. Plasma initiation in the absence of a good magnetic field null will also be presented.

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