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[ ] Theory [X] Experiment

Optimization of the Current Ramp-up Phase in DIII-D via Physics-model-based Control of Plasma Safety Factor Profile Dynamics,* J.E. Barton, W.P. Wehner, E. Schuster, *Lehigh University*; T.C. Luce, G.L. Jackson, J.R. Ferron, D.A. Humphreys, A.W. Hyatt, *General Atomics* – Simulations and experimental results in DIII-D are presented to demonstrate the potential of physics-model-based control of the q profile to improve the reproducibility of plasma startup conditions by achieving a specified target q profile at the end of the current ramp-up. Three different q profiles (q_{min} of 1.3, 1.65, 2.1 and q_{95} of 4.4, 5.0, 6.2, respectively) were specified as targets. A feedforward + feedback scheme is utilized to control the q profile and is constructed by embedding a nonlinear, physics-based model of the q profile dynamics into the control design process. A unique characteristic of the feedforward trajectories obtained by solving the optimization problem is the regulation of the plasma current ramp-up rate to achieve the target q profiles. The feedback controller is employed to add robustness to the control scheme and account for drifts due to external plasma disturbances.

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