

Abstract Submitted  
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**Optimization of the Current Ramp-up Phase in DIII-D via  
Physics-model-based Control of Plasma Safety Factor Profile Dynamics<sup>1</sup>**

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Atomics — Simulations and experimental results in DIII-D are presented to demon-  
strate 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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