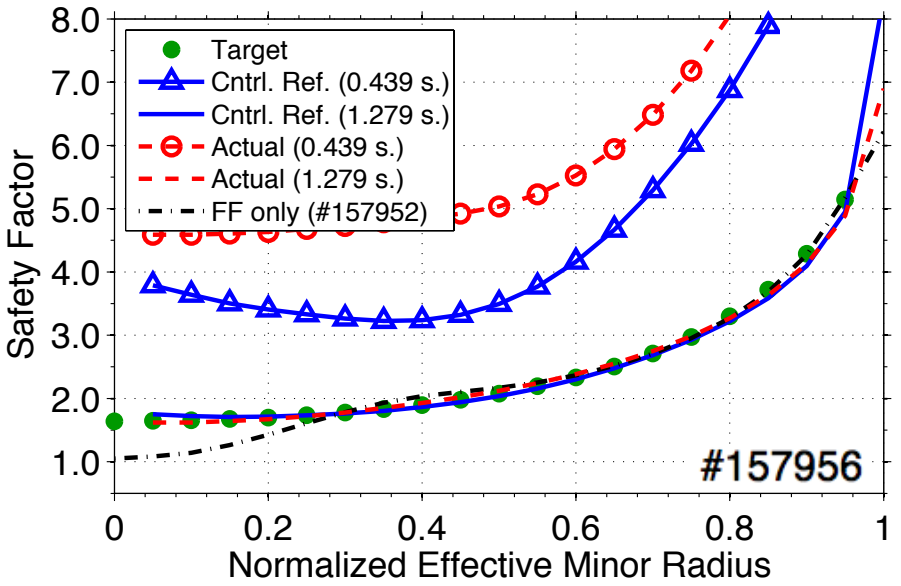
Model-based q-profile Feedback Control Improves Reproducibility of Plasma Discharges in DIII-D

- **Reliable reproduction** of plasma conditions is critical to access **high-q_{min} steady-state scenarios**, which are very sensitive to early changes in the q profile.
- A combined **feedforward + feedback** control scheme is used to **optimize the current ramp-up phase** by consistently achieving target q profiles at prescribed times during the plasma formation phase.



Actual (red) vs. reference (blue) profiles at initial ($\sim$0.4s) and final ($\sim$1.3s) times. FF only (black) at final time. Reference (final time) $\rightarrow$ Target (green).

Target 1: q_{min}=1.3, q_{95}=4.4, t=1.5s; Target 2: q_{min}=1.65, q_{95}=5.0, t=1.3s; (figure) Target 3: q_{min}=2.1, q_{95}=6.2, t=1.0s.

Experiments demonstrate capability of model-based profile control to improve scenario robustness, thereby providing significantly improved main operating regimes for steady- state studies in DIII-D.