Combined Magnetic and Kinetic Control of Advanced Tokamak Steady State Scenarios

A. Good linear control-oriented models can be identified from fast non-linear METIS simulations based on DIII-D AT discharges

B. Robust q-profile and $\beta_N$ control demonstrated on closed-loop simulations using i) On-axis NBI, ii) Off-axis NBI, iii) Off-axis ECCD, iv) Loop voltage = 0

Applied Disturbances
@ $t=8$ s: H-factor $\downarrow$ 30%
@ $t=14$ s: $n_e \uparrow$ 25%
@ $t=20$ s: $Z_{\text{eff}} \uparrow$ 25%