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# Control Advancements Supporting Long-Pulse Operation on KSTAR

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Control developments, including porting a Proximity Controller [1] to aid in continuous disruption prevention and upgrading the existing Real-Time Feed-Forward algorithm [2] for robust and reliable shape control during long-pulse sustainment and ramp-down, have been implemented to support long-pulse scenarios on KSTAR with its new tungsten divertor. The proximity controller calculates the proximity to known stability limits and guides the plasma state away from those limits. First application of the Proximity Control is for robust vertical displacement event avoidance, with additional use cases to follow. The Real-Time Feed-Forward algorithm updates the feed-forward coil current targets in real-time based on changing plasma conditions, reducing the burden on the shape feedback systems by accounting for accumulated inaccuracies in projected plasma performance. Upgrades to the real-time feed-forward will expand on this work to handle evolving resistivity and target shapes, as well as to aid both scheduled and un-scheduled ramp-downs.

[1] J.L. Barr et al, Nuclear Fusion, 61, 126019 (2021)
[2] M. Walker et al, IEEE Conference on Control Applications, 605 (2016)

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