Integrated plasma control in DIII-D

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Abstract. The integrated plasma control approach provides a systematic method for designing plasma control algorithms with high reliability and for confirming their performance offline prior to experimental implementation. This approach includes construction of plasma and system response models, validation of models against operating experiments, design of integrated controllers which operate in concert with one another as well as with supervisory modules, simulation of control action against off-line and actual machine control platforms, and iteration of the design-test loop to optimize performance. Using this approach, required levels of robustness to model uncertainties and off-normal events can be quantified and incorporated in the design process. The DIII-D digital plasma control system (PCS) enables application of this method by providing a flexible programming environment and an architecture for realtime parallel operation of a set of computers that executes the large set of control algorithms needed

for exploration of the advanced tokamak (AT) regime. The present work describes the DIII-D PCS and the approach, benefits, and progress made in integrated plasma control as applied to the DIII-D tokamak, with implications for the ITER design and other next-generation tokamaks.

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