MHD simulations of massive gas injection into Alcator C-Mod and DIII-D plasmas

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Abstract. Disruption mitigation experiments using massive gas injection (MGI) on Alcator C-Mod [I.H. Hutchinson, *et al.*, Phys. Plasmas **1,** 1511 (1994)] and DIII-D [J.L. Luxon and L.G. Davis, Fusion Technol. **8,** 441 (1985)] have shown that MHD plays an important role. The 3D MHD code NIMROD [C.R. Sovinec, *et al.,* J. Computational Physics **195,** 355 (2004)] has been extended to include atomic physics taken from the KPRAD code to perform simulations of MGI. Considerable benchmarking of the code has been done against Alcator C-Mod for neon and helium gas jet experiments. The code successfully captures the qualitative sequence of events observed in MGI experiments up to the end of the thermal quench. Neon jet simulations also show quantitative agreement with the experimental thermal quench onset time. For helium gas jets, we show that a small percent boron density can significantly alter the results even in the presence of a helium jet with three orders of magnitude higher density. The thermal quench onset time is considerably over-predicted unless boron radiation is included. A DIII-D helium jet simulation shows a faster rise time for total radiated power than the experiment, but comparable amplitude. Similar to the important role of boron in C-Mod, carbon radiation is a significant factor in DIII-D helium jet simulations and experiments.