DIII-D and ITER rapid shutdown with radially uniform deuterium delivery*

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Abstract. Fast shutdowns of DIII-D and ITER plasmas are simulated in 3D with the NIMROD code. The simulations assume uniform deposition of deuterium, raising the total electron density by factors of 100–150. Under these conditions, the plasma is found to be stable to $n = 1$ and $n = 2$ instabilities for the duration of the shutdown. However, 2D effects are significant, particularly in the evolution of the electron density, which tends to drop as recombination occurs in the cold edge plasma. The DIII-D simulation finds that a factor of 100 densification will not enable collisional suppression of runaway electron avalanching. Although the ITER simulation marginally exceeds the threshold for avalanche suppression, ITER is a more promising candidate to remain in the avalanche-free regime given carefully tailored initial conditions.

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