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NIMROD Simulations of the HIT-SI and HIT-SI3 Devices[1] KYLE MORGAN, TOM JARBOE, AARON HOSSACK, RIAN CHANDRA, CHRIS EVERSON, University of Washington — The Helicity Injected Torus with Steady Inductive helicity injection (HIT-SI) experiment uses a set of inductively driven helicity injectors to apply non-axisymmetric current drive on the edge of the plasma, driving an axisymmetric spheromak equilibrium in a central confinement volume. Significant improvements have been made to extended MHD modeling of HIT-SI, with both the resolution of disagreement at high injector frequencies in HIT-SI in addition to successes with the new upgraded HIT-SI3 device. Previous numerical studies of HIT-SI, using a zero-beta eMHD model, focused on operations with a drive frequency of 14.5 kHz, and found reduced agreement with both the magnetic profile and current amplification at higher frequencies (30-70 kHz). HIT-SI3 has three helicity injectors which are able to operate with different mode structures of perturbations through the different relative temporal phasing of the injectors. Simulations that allow for pressure gradients have been performed in the parameter regimes of both devices using the NIMROD code and show improved agreement with experimental results, most notably capturing the observed Shafranov-shift due to increased beta observed at higher f_{inj} in HIT-SI and the variety of toroidal perturbation spectra available in HIT-SI3.

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