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Model validation and numerical study of reactor scalability for spheromaks sustained by inductive helicity injection drivers[1] CHRIS HANSEN, THOMAS BENEDETT, ALAN KAPTANOGLU, AARON HOSSACK, KYLE MORGAN, University of Washington, DEREK SUTHERLAND, CTFusion, Inc. — Numerical investigation of inductive helicity injection drivers, as developed on the HIT-SI family of experiments at the University of Washington, is underway with a focus on developing validated models of relevant driver physics to support exploration and optimization of possible injector configurations for sustainment of spheromak plasmas toward reactor scale. Two extended MHD codes are used: NIMROD (K. Morgan et al., Phys. Plasmas 2017), where the injectors are approximated through boundary conditions on an axisymmetric domain, and PSI-Tet (T. Benedett et al., Phys. Plasmas 2020; A. Kaptanoglu et al., Phys. Plasmas 2020), where the full plasma volume is simulated. Simulations are benchmarked against experimental data from the HIT-SI (two injector), HIT-SI3 (three injector), and HIT-SIU (four injector manifold) devices. Development of a self-consistent external circuit boundary condition in PSI-Tet will be presented. Validated models will be used to explore candidate designs to optimize the effect of toroidal/poloidal mode content, frequency, phasing, and other parameters on resulting sustained spheromak equilibria.

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