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3D MHD Simulations of Injector Coupling and Current Drive in HIT-SI CHRIS HANSEN, GEORGE MARKLIN, THOMAS JARBOE, University of Washington — A new non-linear reduced MHD code has been developed using the PSI-TET framework, which is capable of modeling the full HIT-SI geometry with consistent boundary conditions for the insulator coated flux conserver. The PSI-TET framework provides general mechanics supporting the development of multi-physics simulation using high order finite methods with a tetrahedral spatial discretization. Using these capabilities an implementation of reduced Hall-MHD was developed where temperature and density are assumed to be uniform and constant, reducing the full MHD equations to the momentum and induction equations. A Nedelec vector basis set is used for the magnetic field, which preserves the divergence free property of the induction equation, and a scalar Lagrange basis is used for each component of the velocity. The equation system is advanced using a time centered implicit scheme, which is solved using a multi-grid preconditioned Newton-Krylov method. Results will be presented focusing on internal injector dynamics and coupling to the Spheromak region. Comparison between this code and experimental data as well as existing NIMROD simulations of HIT-SI, which model the injector operation with boundary conditions on an axisymmetric grid, will also be shown. Work supported by DOE.

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