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Tomographic Reconstruction of Plasma Emissivity in HIT-SI3 KUANWEI LEE, AARON HOSSACK, CHRISTOPHER HANSEN, University of Washington, DEREK SUTHERLAND, CTFusion Inc. — HIT-SI3 is a plasma physics experiment built for studying magnetic confinement of a fusion plasma for eventual clean energy production. HIT-SI3 utilizes steady inductive helicity injection to form and sustain spheromak equilibria. A tomography system has been installed to assess the symmetry of plasma density in HIT-SI3 spheromak plasmas. The tomography diagnostic consists of four toroidal chord fans and three sets of three poloidal fans that provide 3D plasma emission information. Each fan expands from a wide-angle lens with a 130 degree field of view coupled to bundles of fiber optics. The light collected by the fiber optics is split into two paths, filtered at 668 nm and 728 nm He-I emission lines, and imaged by a high-speed camera. The reconstruction of emissivity profiles constitutes a highly underdetermined and ill-posed inversion problem and the basis function method was chosen to find the most physically informed solution. Fifteen basis functions that were used to approximate emissivity profiles were generated by adding radial and angular dependence to the magnetic flux surfaces of the Taylor states. The reconstruction algorithm was tested with synthetic profiles and the algorithm was able to provide accurate reconstructions. The spatial profiles of both He-I emission lines have a hollow shape that is consistent with the results of HIT-SI3 Extended-MHD -simulations. Emissivity profiles of both He-I lines in individual time frames were also reconstructed and the profiles did not vary drastically from frame to frame.

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