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Power Balance Modeling of Local Helicity Injection for Non-Solenoidal ST Startup[1] J.D. WEBERSKI, J.L. BARR, M.W. BONGARD, R.J. FONCK, J.M. PERRY, J.A. REUSCH, University of Wisconsin-Madison — A zero-dimensional power balance model for predicting $I_p(t)$ for Local Helicity Injection (LHI) discharges has been used to interpret experimental results from recent experimental campaigns using high-field-side (HFS) helicity injection. This model quantifies LHI's effective drive (V_{eff}) through helicity balance while enforcing the Taylor relaxation current limit and tracking inductive effects to determine $I_p(t)$. Recent analysis of HFS LHI discharges indicate LHI is the dominant source of drive and provides V_{eff} up to 1.3 V while geometric effects and inductive drive provide < 0.1 V throughout much of the discharge. In contrast to previous analysis of low-field-side (LFS) LHI discharges, which were driven by $V_{eff} = 0.3$ V and 2.0 V from geometric effects and inductive drive. A significant remaining uncertainty in the model is the resistive dissipation of LHI discharges. This requires greater understanding of LHI confinement scaling and impurity content, which are currently under investigation. However, the model and experimental $I_p(t)$ exhibit good agreement for parameters consistent with previous experimental findings. Extrapolation of plasma parameters and shaping from recent experiments allow for the model to project the performance of LHI systems. These projections indicate $I_p \sim 0.3$ MA can be accessed on Pegasus via HFS LHI through changes to injector geometry to provide more V_{eff}. This regime can be accessed via a LFS system by increasing the Taylor relaxation current limit early in the discharge.

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