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Characterization of Magnetic Structure and Activity in Local Helicity Injection[1] C.E. SCHAEFER, G.M. BODNER, M.W. BONGARD, R.J. FONCK, J.A. REUSCH, N.J. RICHNER, University of Wisconsin-Madison — Local Helicity Injection (LHI) is a non-solenoidal startup technique that initiates a tokamak-like discharge using electron current injectors at the plasma edge. Comparisons on the PEGASUS ST of internal 3D $\mathbf{B}(\mathbf{R},\mathbf{t})$ Hall probe measurements with Thomson pressure profiles show the magnetic boundary is shifted up to 8 cm outward relative to the kinetic pressure edge. In Ohmic-driven discharges this disparity is not present. In comparison to Ohmic, LHI discharges show increased broadband and low-frequency $n = 1$ magnetic activity that is localized to the edge region where the injected current streams presumably exist and the kinetic pressure is near zero. The broadband activity exhibits power law behavior resembling Alfvénic turbulence, while high-frequency activity ($f \approx 2$ MHz) increases with total LHI drive. These observations, plus earlier reports of anomalous ion heating in the edge region, suggest a two-zone confinement structure during LHI consisting of an inner tokamak-like plasma and an outer force-free region of injected current. The outer region appears to be characterized by strong local magnetic and reconnection activity, poor thermal confinement, and presumably strongly stochastic field structures. These measurements are being applied to studies of the spontaneous reduction of low-frequency MHD activity and consequent improvement of LHI current drive.

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