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Progress in Non-solenoidal Startup via Local Helicity Injection in the Pegasus Experiment[1] R.J. FONCK, J.L. BARR, M.W. BONGARD, M.G. BURKE, E.T. HINSON, J.M. PERRY, A.J. REDD, D.J. SCHLOSSBERG, N.L. SCHOENBECK, P.C. SHRIWISE, K.E. THOME, University of Wisconsin-Madison
— The operating space for localized helicity injection for non-solenoidal startup is constrained by helicity input and dissipation rates and a geometric limit on plasma current set by Taylor relaxation. To test the understanding of dissipation mechanisms during helicity-driven startup, the helicity injection startup and growth is being expanded to ∼0.3 MA plasma currents and longer pulse lengths on the Pegasus experiment. Following initiation via active current sources, passive electrodes can be used to grow discharges for relatively long pulse lengths. Bursts of MHD activity are observed during helicity injection, and correlate with rapid equilibrium changes, including inward motion of the magnetic axis, redistribution of the toroidal current, and strong ion heating with ion temperatures ∼1 keV observed. The plasma arc injector impedance and the associated helicity injection rate appear to be constrained by a double-layer space charge limit at low currents and by the Alfvén-Lawson limit for strong electron beams at high currents. Additions to the experiment include an expanded poloidal field coil system for added plasma control, new divertor coils, new plasma gun-electrode injector assemblies, expanded gas fueling techniques, and eventually a doubling of the toroidal field.

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