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Non-solenoidal startup in Pegasus discharges[1] A.J. REDD, D.J. BATTAGLIA, M.W. BONGARD, E.T. HINSON, B.A. KUJAK-FORD, B.T. LEWICKI, A.C. SONTAG, G.R. WINZ, University of Wisconsin - Madison — Recent Pegasus experimental studies are directed at developing non-solenoidal startup techniques for ST and tokamak applications. High-field-side magnetic helicity injection with washer-stack current-sources (plasma guns) produces discharges with toroidal current I_p up to 50 kA, using static coil currents and only 3 kA of injected current I_{inj}. Discharges driven by low-field-side injection typically require outer-PF ramps for radial force balance, also providing inductive current drive, and have achieved I_p=80 kA using $I_{inj} \leq 2$ kA. In either injection geometry, I_p persists for a significant interval after gun shutoff, while the plasmas relax into typical tokamak equilibria with well-defined edges. According to a semi-empirical model, the maximum gun-driven I_p is determined by the helicity injection rate, radial force balance, kink stability, and the Taylor relaxation criterion. Higher helicity injection rates will extend the Pegasus operating space, allowing higher I_p and normalized current I_N, and enabling both flux amplification studies and predictive testing of the I_p model.

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