## Abstract Submitted for the DPP16 Meeting of The American Physical Society

Overview of Non-Solenoidal Startup Studies in the Pegasus  $ST^1$ M.W. BONGARD, J.L. BARR, G.M. BODNER, M.G. BURKE, R.J. FONCK, J.L. PACHICANO, J.M. PERRY, J.A. REUSCH, N.J. RICHNER, C. RODRIGUEZ SANCHEZ, D.J. SCHLOSSBERG, University of Wisconsin-Madison — Local helicity injection (LHI) is a non-solenoidal startup method pursued on Pegasus utilizing compact, high power current sources  $(A_{inj} \sim 2 - 4 \text{ cm}^2, I_{inj} \sim 10 \text{ kA}, V_{inj} \sim 1 \text{ kV})$ at the plasma edge. Outboard injectors  $(N_{inj} = 4, A_{inj} = 8 \text{ cm}^2)$  produce  $I_p \sim 170$ kA plasmas compatible with Ohmic drive. A 0-D model that treats the plasma as a resistive element with time-varying inductance and enforces  $I_p$  limits from Taylor relaxation is used to interpret experimental  $I_p(t)$  in several scenarios. Strong inductive drive arises from the plasma shape evolution, in addition to poloidal field induction. A new injector system has recently been installed in the lower divertor region  $(N_{inj} = 2, A_{inj} = 8 \text{ cm}^2)$  to explore the implications of geometric placement of the helicity injectors on LHI startup. This geometry supports tests of reconnection dynamics seen in NIMROD simulations, high- $B_T$  effects expected in larger devices, and LHI electron confinement with and without inductive assist. Plasmas with  $I_p > 130$  kA,  $V_{inj} \sim 0.5$  kV,  $\Delta t_{pulse} \sim 8$  ms and  $B_T/B_{T,max} \leq 50\%$  are produced with the inboard system to date, consistent with performance expectations. Higher  $I_p$  is expected with increased  $B_T$ ,  $V_{inj}$ , and  $\Delta t_{pulse}$ . Thomson scattering data in both geometries indicate high  $T_e \geq 100$  eV during LHI, suggesting the confinement is not strongly stochastic. Conceptual design work is exploring the feasibility of coaxial helicity injection and ECH heating on Pegasus in addition to LHI.

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