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Expanding Non-solenoidal Startup with Local Helicity Injection to Increased Toroidal Field and Helicity Injection Rate[1] J.M. PERRY, J.L. BARR, G.M. BODNER, M.W. BONGARD, M.G. BURKE, R.J. FONCK, E.T. HINSON, B.T. LEWICKI, J.A. REUSCH, D.J. SCHLOSSBERG, G.R. WINZ, University of Wisconsin-Madison — Local helicity injection (LHI) is a non-solenoidal startup technique under development on the Pegasus ST. Plasma currents up to 0.18 MA have been initiated by LHI in conjunction with poloidal field induction. A 0-D power balance model has been developed to predict plasma current evolution by balancing helicity input against resistive dissipation. The model is being validated against a set of experimental measurements and magnetic reconstructions with radically varied plasma geometric evolutions. Outstanding physics issues with LHI startup are the scalings of confinement and MHD activity with helicity injection rate and toroidal field strength, as well as injector behavior at high field. Preliminary results from the newly-installed Thomson scattering system suggest core temperatures of a few hundred eV during LHI startup. Measurements are being expanded to multiple spatial points for ongoing confinement studies. A set of larger-area injectors is being installed in the lower divertor region, where increased toroidal field will provide a helicity injection rate over 3 times that of outboard injectors. In this regime helicity injection will be the dominant current drive. Experiments with divertor injectors will permit experimental differentiation of several possible confinement models, and demonstrate the feasibility of LHI startup at high field.

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