Abstract Submitted
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Predictions for Non-Solenoidal Startup in Pegasus with Lower Divertor Helicity Injectors[1] J.M. PERRY, J.L. BARR, M.W. BONGARD, R.J. FONCK, B.T. LEWICKI, University of Wisconsin-Madison — Non-solenoidal startup in Pegasus has focused on using arrays of local helicity injectors situated on the outboard midplane to leverage PF induction. In contrast, injector assemblies located in the lower divertor region can provide improved performance. Higher toroidal field at the injector increases the helicity injection rate, providing a higher effective loop voltage. Poloidal flux expansion in the divertor region will increase the Taylor relaxation current limit. Radial position control requirements are lessened, as plasma expansion naturally couples to injectors in the divertor region. Advances in cathode design and plasma-facing guard rings allow operation at bias voltages over 1.5 kV, three times higher than previously available. This results in increased effective loop voltage and reduced impurity generation. Operation of helicity injectors in the high field side elevates the current requirements for relaxation to a tokamak-like state, but these are met through the improved injector design and increased control over the poloidal field structure via the addition of new coil sets. These advances, combined with the relocation of the injectors to the divertor region, will allow access to the operational regime where helicity injection current drive, rather the poloidal induction, dominates the discharge—a prerequisite for scaling to larger devices. Initial estimates indicate that plasma currents of 0.25–0.30 MA are attainable at full toroidal field with 4 injectors of 2 cm^2 each and 8 kA total injected current.

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