Abstract Submitted
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Local Helicity Injection Systems for Non-solenoidal Startup in the Pegasus Toroidal Experiment[1] J.M. PERRY, J.L. BARR, M.W. BONGARD, R.J. FONCK, E.T. HINSON, B.T. LEWICKI, A.J. REDD, University of Wisconsin-Madison — Local helicity injection is being developed in the PEGASUS Toroidal Experiment for non-solenoidal startup in spherical tokamaks. The effective loop voltage due to helicity injection scales with the area of the injectors, requiring the development of electron current injectors with areas much larger than the 2 cm^2 plasma arc injectors used to date. Solid and gas-effused metallic electrodes were found to be unusable due to reduced injector area utilization from localized cathode spots and narrow operational regimes. An integrated array of 8 compact plasma arc sources is thus being developed for high current startup. It employs two monolithic power systems, for the plasma arc sources and the bias current extraction system. The array effectively eliminates impurity fueling from plasma-material interaction by incorporating a local scraper-limiter and conical-frustum bias electrodes to mitigate the effects of cathode spots. An energy balance model of helicity injection indicates that the resulting 20 cm^2 of total injection area should provide sufficient current drive to reach 0.3 MA. At that level, helicity injection drive exceeds that from poloidal induction, which is the relevant operational regime for large-scale spherical tokamaks. Future placement of the injector array near an expanded boundary divertor region will test simultaneous optimization of helicity drive and the Taylor relaxation current limit.

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