The New PEGASUS-III Experiment

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Minimizing or eliminating the need for induction from a central solenoid during startup, ramp-up and sustainment of a tokamak plasma is a critical challenge in magnetic fusion. Solenoid-free startup potentially simplifies the cost and complexity of reactor-class devices by reducing the technical requirements of, or the need for, a central solenoid. The PEGASUS-III Experiment is a new solenoid-free, low aspect ratio ST ($A \geq 1.22$, $I_p \leq 0.3$ MA, $B_T \leq 0.6$ T, pulse length ~ 100 ms) focused on studying innovative non-solenoidal tokamak startup techniques. It is equipped with: a new local helicity injection (LHI) system capable of $I_p \sim 0.3$ MA; sustained and transient coaxial helicity injection (CHI) systems; and an RF system for initial electron Bernstein wave (EBW) and electron cyclotron (EC) heating. Initial experiments will establish high-I_p LHI scenarios, followed by deployment of transient CHI, modest sustained CHI, and low-power RF studies. PEGASUS-III will provide key enabling reactor relevant technology to directly test proposed plasma startup, ramp-up scenarios envisioned for larger scale STs, investigating methods to synergistically improve the target plasma for consequent bootstrap and NBI current sustainment.

Work supported by US DOE grants DE-SC0019008 and DE-SC0020402.