

Research Directions on the Pegasus Toroidal Experiment

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In recent years, the Pegasus research program has focused on developing the physics basis and predictive models for non-solenoidal tokamak startup using Local Helicity Injection (LHI). This has resulted in demonstrating solenoid-free ST plasma startup to ~ 0.2 MA. An expansion of the scope of this activity to enable a comprehensive examination of non-solenoidal startup is planned. This will include the deployment and direct comparison of leading startup techniques in a single experiment. Proposed new capabilities include: increasing B_T $4\times$ to 0.6 T to support critical scaling tests to near-NSTX-U field levels; deploying impurity and internal plasma kinetics diagnostics; advanced LHI injectors with shaped electrodes and active control of the helicity injection rate; sustained and transient coaxial helicity injection; tailored poloidal field induction; and a modest (200–400 kW) EBW RF heating and current drive capability. These efforts will address scaling of LHI to higher I_p and B_T , comparative studies of helicity injection techniques, and the use of EBW to improve target plasmas for subsequent non-inductive sustainment. The ultimate goal is to validate techniques for producing a ~ 1 MA plasma in NSTX-U and beyond.

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