

Advancing US Non-Solenoidal Tokamak Startup Studies with a Proposed Upgraded Pegasus Experiment

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Developing attractive means of initiating plasma current without using magnetic induction from a central solenoid benefits both the ST and AT concepts. Research on the Pegasus ST is developing the physics and technology basis for non-solenoidal startup using Local Helicity Injection (LHI). LHI employs strong edge current sources that can produce high- I_p tokamak plasmas (0.2 MA to date). An expansion of the non-solenoidal research on Pegasus to compare most startup candidates in a single experiment will provide guidance on scalable methods for future, larger experiments. These include: DC helicity injection, with LHI, sustained and transient Coaxial Helicity Injection (CHI); RF electron heating/current drive; and poloidal field induction. Future additions may include removable iron core induction and/or neutral beam current drive. Plans and status of the physics mission, facility, and diagnostic upgrades are reported, including: a new, solenoid-free centerstack, increasing B_T 4× to 0.6 T; new divertor coils; improved magnet power systems; LHI injectors with advanced geometry and active control of the helicity input rate; a CHI system; EBW auxiliary heating; diagnostic neutral beam and VUV spectroscopy; and radiation diagnostics.

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