Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Non-Solenoidal Startup via Helicity Injection in the Pegasus ST[1]

M.W. BONGARD, G.M. BODNER, M.G. BURKE, R.J. FONCK, J.L. PACHICANO, J.M. PERRY, C. PIERREN, N.J. RICHNER, C. RODRIGUEZ SANCHEZ, D.J. SCHLOSSBERG, J.A. REUSCH, J.D. WEBERSKI, University of Wisconsin-Madison — Research on the $A \sim 1.2$ Pegasus ST is developing the physics and technology basis for optimal non-solenoidal tokamak startup. Recent work explores startup via Local Helicity Injection (LHI) using compact, multi-MW current sources placed at the plasma edge in the lower divertor region. This minimizes inductive drive from poloidal fields and dynamic shaping. Plasmas with $I_p \leq 200$ kA, $\Delta t_{pulse} \sim 20$ ms and $B_T \leq 0.15$ T are produced to date, sustained by two injectors with $A_{inj} = 4$ cm^2, $V_{inj} \sim 1.5$ kV, and $I_{inj} \sim 8$ kA, facilitated by improvements to the injectors, limiters, and divertor plates that mitigate deleterious PMI. These plasmas feature anomalous, reconnection-driven ion heating with $T_i \geq T_e \geq 50 - 100$ eV and large-amplitude MHD activity driven by the injectors. Under some conditions, MHD fluctuations abruptly decrease by over an order of magnitude without loss of LHI drive, improving realized I_p, and suggesting short-wavelength modes may relate to the current drive mechanism. The high $I_N \geq 10$, ion heating, and low ℓ_i driven by LHI, and the favorable stability of $A \sim 1$ STs allows access to record $\beta_t \sim 100\%$ and high $\beta_N \sim 6.5$. Such high-β_t plasmas have a minimum $|B|$ well spanning $\sim 50\%$ of the plasma volume. Enhancements to the Pegasus facility are considered to increase B_T towards NSTX-U levels; establish coaxial helicity injection capabilities; and add auxiliary heating and current drive.

[1]Work supported by US DOE grant DE-FG02-96ER54375.

Michael Bongard
University of Wisconsin-Madison

Date submitted: 13 Jul 2017 Electronic form version 1.4