Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Sorting Category: 6.23 (E)

Initiatives in Non-Solenoidal Startup and H-mode Physics at Near-Unity A

M.W. BONGARD, J.L. BARR, M.G. BURKE, R.J. FONCK, E.T. HINSON, B.T. LEWICKI, J.M. PERRY, A.J. REDD, D.J. SCHLOSSBERG, K.E. THOME, G.R. WINZ, University of Wisconsin-Madison — Research on the $A \sim 1$ Pegasus ST is advancing the physics of non-solenoidal tokamak startup and the H-mode confinement regime. Local helicity injection (LHI) uses current sources in the plasma edge to initiate and drive $I_p$ via DC helicity injection, subject to constraints from helicity conservation and Taylor relaxation. To date, $I_p \sim 0.18$ MA has been initiated with $I_{\text{inj}} \sim 6$ kA. A predictive 0-D power balance model of LHI $I_p(t)$ evolution matches present discharges with strong PF induction. It projects $I_p \sim 0.3$ MA operation in Pegasus will achieve the LHI-dominated physics regime expected for 1 MA NSTX-U startup. Ohmic H-mode plasmas are routinely attained, due to the low $P_{th}$ at the low $B_T$ of $A \rightarrow 1$ plasmas. However, both limited and favorable $\nabla B$ SN plasmas have $P_{th} \sim 11$ times higher than expected from high-$A$ scalings. They have improved $\tau_e$ ($H_{98} \sim 1$) and a quiescent $J_{\text{edge}}$ pedestal between edge localized modes (ELMs). Unique $J_{\text{edge}}(t)$ measurements through a single Type I ELM show a complex, multimodal pedestal collapse and filament ejection. A proposed Pegasus-U initiative will upgrade the centerstack assembly and LHI injector systems, increasing $B_T$ to 1 T, Ohmic V-s by $\times 6$, and pulse length to 100 ms at $A = 1.2$. This allows the physics and technology of LHI to be validated at NSTX-U relevant parameters, supports studies of nonlinear ELM dynamics, and will test high-$\beta_T$ tokamak stability.

$^1$Work supported by US DOE grant DE-FG02-96ER54375.

M.W. Bongard
mbongard@wisc.edu
University of Wisconsin-Madison

Special instructions: Please place as poster 1 within the Pegasus presentations.

Date submitted: 11 Jul 2014