$V_{\text{eff}}$ Scaling of $T_e$ and $n_e$ Measurements During Local Helicity Injection on the Pegasus Toroidal Experiment

G.M. BODNER, M.W. BONGARD, R.J. FONCK, J.M. PERRY, J.A. REUSCH, C. RODRIGUEZ SANCHEZ, University of Wisconsin-Madison — Understanding the electron confinement of local helicity injection (LHI) is critical in order to evaluate its scalability as a startup technique to MA-class devices. Electron confinement in the Pegasus Toroidal Experiment is investigated using multi-point Thomson scattering (TS). The Pegasus TS system utilizes a set of high-throughput transmission gratings and intensified CCDs to measure $T_e$ and $n_e$ profiles. Previous TS measurements indicated peaked $T_e$ profiles $\sim 120$ eV in outboard injector discharges characterized by strong inductive drive and low LHI drive. Injectors designed to have dominant non-inductive drive have recently been installed in the divertor region of Pegasus to understand the relationship between effective drive voltage, $V_{\text{eff}}$, and plasma performance. At low $V_{\text{eff}}$ and reduced plasma current, $I_p \sim 60$ kA, TS measurements reveal a flat $T_e$ profile $\sim 50$ eV, with a peaked $n_e$ profile $\sim 1 \times 10^{19}$ m$^{-3}$, resulting in a slightly peaked $p_e$ profile. As current drive is increased, the $T_e$ profiles become hollow with a core $T_e \sim 50$ eV and an edge $T_e \sim 120$–$150$ eV. These hollow profiles appear after the start of the $I_p$ flattop and are sustained until the discharge terminates. The $n_e$ profiles drop in magnitude to $< 1 \times 10^{19}$ m$^{-3}$ but remain somewhat peaked. Initial results suggest a weak scaling between input power and core $T_e$. Additional studies are planned to identify the mechanisms behind the anomalous profile features.

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