Local Helicity Injection (LHI) is a non-solenoidal startup technique that utilizes electron current injectors to initiate a tokamak-like plasma. LHI startup in Pegasus employs a low-field-side (LFS) injector set on the outboard midplane, and/or a high-field side (HFS) injector set in the lower divertor region. HFS injection is of interest due to the dominance of helicity drive in sustaining $I_p$. This drive term increases with decreased injector radius ($R_{inj}$). To evaluate scalability of LHI to larger machines, operation at full field ($B_{T,0} = 0.15$ T) is necessary. Previous HFS-only operation at full $B_T$ ($R_{inj} = 27$ cm) was restricted due to stream pitch angle constraints impeding relaxation. Additionally, increased susceptibility to cathode spots that markedly reduce LHI drive was observed. These issues are mitigated by first using the LFS injectors to initialize the plasma and then handing off to the HFS system for $I_p$ growth and sustainment. $I_p \sim 0.2$ MA is achieved at full $B_T$ with this new scenario. Thomson scattering measurements in these plasmas show centrally-peaked pressure, with $T_e \sim 125$ eV and $n_e \sim 1\times10^{19}$ m$^{-3}$. This LFS to HFS handoff scenario enables HFS injection at lower $R_{inj}$, and thus increased current drive potential.

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