Impurity Characterization in LHI-Driven Discharges on the Pegasus Spherical Tokamak

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Small, high power current sources are employed in the Pegasus ST to inject helicity at the plasma edge and create high I_p (~0.2 MA) tokamak plasmas without a central solenoid. The characterization of plasma impurities and radiated power losses is particularly important in these Local Helicity Injection (LHI) discharges because helicity input is balanced by the resistive dissipation, and the current injectors lie in the scrapeoff layer ~1 cm from the plasma boundary. Three diagnostics are being deployed for use in Pegasus. Two 16-channel AXUV photodiodes estimate the radiated power across the midplane, spanning the whole plasma volume. Visible Bremsstrahlung (VB) spectroscopy and Thomson scattering profiles are used to obtain $<Z_{eff}>$. Impurity species are identified by a SPRED VUV spectrometer with a temporal resolution of ~0.75 ms. Low-Z impurities are observed to dominate the spectrum when the injector arc plasma sources are turned on. When helicity injection is terminated, initial VB estimates find $<Z_{eff}> < 2.5$, with O and N the dominant impurity species. Planned upgrades to the diagnostics include: a new thermistor bolometer array; an imaging VB array with higher spatial resolution; and a high-resolution grating for SPRED.

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