Abstract

A passive ion temperature polychromator has been deployed on the Pegasus Toroidal Experiment to study power balance and non-thermal ion distributions arising during helicity injection. A single radial viewing chord provides a line averaged ion temperature from Doppler broadening. Nine tangential viewing chords provide a tangential velocity profile, ranging from major radius of 48 to 78 cm. Spectra are recorded from a 1 m F/8.6 Czerny-Turner polychromator whose output is recorded by an intensified high-speed camera. The use of high orders allows for a dispersion of 0.02 Å/mm in 4^{th} order and a bandpass of 0.14 Å (~13 km/s) at 3131 Å in 4^{th} order with 100 um entrance slit. The instrument temperature of the spectrometer is 15 eV. Light from the output of an image intensifier in the spectrometer focal plane is coupled to a high-speed CMOS camera, which records 20 spatial points along the entrance slit at 0.5 ms time resolution. During point-source dc helicity injection, stochastic magnetic fields keep T_e low (~100 eV) and thus low ionization impurities penetrate to the core. Under these conditions, high core ion temperatures are measured ($T_i \approx 1.2$ keV, $T_e \approx 0.1$ keV) using spectral lines from Carbon III, Nitrogen III, and Boron IV.

Work supported by U.S. DOE Grant DE-FG02-96ER54375