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1.3 A combined interferometer/phase contrast imaging diagnostic for multiscale fluctuation measurements

Monday, 16 April 2018 09:45 (30)

A novel combined diagnostic capable of measuring multiscale density fluctuations that extend from MHD to the lower-ETG range has been designed, installed, and operated at DIII-D. The combined diagnostic was constructed by adding a heterodyne interferometer to the pre-existing phase contrast imaging (PCI) system, both of which measure line-integrated electron-density fluctuations. The port-space footprint is minimized by using a single CO2 laser and a single beampath. With temporal bandwidths in excess of 1 MHz, the PCI measures high-k (1.5 cm^{-1} < |k_R| < 25 cm^{-1}) fluctuations with sensitivity 3e13 m^{-2} / \sqrt{kHz}, while the interferometer simultaneously measures low-k (|k_R| < 5 cm^{-1}) fluctuations with sensitivity 3e14 m^{-2} / \sqrt{kHz}. The intentional mid-k overlap has been empirically verified with sound-wave calibrations and has allowed quantitative investigation of the cross-scale coupling predicted to be significant in the reactor-relevant T_e T_i regime. Further, via toroidal correlation with DIII-D's primary interferometer, the toroidal mode numbers of core-localized MHD have been measured. *Work supported by USDOE under DE-FG02-94ER54235, DE-FC02-04ER54698, and DE-FC02-99ER54512.

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