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8.35 Initial Deployment of a Spatial Heterodyne Spectrometer to Measure Local Electric and Magnetic Field Fluctuations at DIII-D

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Local measurements of electrostatic and magnetic turbulence (˜E and ˜B) in fusion grade plasmas are a critical missing component in advancing our understanding of turbulent transport. A novel diagnostic for measuring these fluctuations is being developed. It employs high-speed measurements of the spectral linewidth of the Motional Stark Effect split neutral beam emission, where the amount of splitting is proportional to local magnetic and electric fields at the emission site. A spatial heterodyne spectroscopy (SHS) technique with high spectral resolution (˜0.025 nm), high throughput (˜0.02 cm^2 sr), and high speed (f ˜ 250 kHz) is used as the MSE spectrum analyzer. A prototype SHS has been deployed to D3D for initial testing in the tokamak environment. A major contributor to loss of fringe contrast and thus SNR is line broadening arising from employing a large etendue collection lens. This is solved by making the collection optic conjugate with the image field containing the interference fringes via a small relay lens system and then tilting the gratings in the SHS. The change in effective groove density with tilt angle imposes a spatial shift in wavelength equal and opposite to that produced by the collection optic. Work supported by US DOE grant DE-FG02-89ER53296.

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