Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Development of a Technique for Measuring Local Electric Field Fluctuations in High Temperature Plasmas[1] M.G. BURKE, M.R. BAKKEN, R.J. FONCK, B.T. LEWICKI, A.T. RHODES, G.R. WINZ, University of Wisconsin-Madison — A novel diagnostic for measuring local electric field fluctuations in high temperature plasmas is being developed. It employs high-speed measurements of the spectral separation and/or line intensities of the motional Stark effect (MSE) H_α multiplet emitted from a low divergence, 80 keV diagnostic neutral beam. A spatial heterodyne spectrometer (SHS) coupled to a 500 kHz CMOS camera provides the high resolution ($\approx$0.025 nm) and throughput ($\leq$0.1 cm^{2}str) required for the measurement. The Fizeau fringe pattern produced by the SHS provides the Fourier transform of the input spectrum. Line broadening due to the large collection lens at the tokamak can be compensated by phase correcting the resulting fringe pattern. Based on simple tokamak turbulence scalings, $\tilde{E}/E_{MSE} \approx 10^{-3}$ is expected for the core plasma in present experiments. To observe these low fluctuation levels, cross-correlation between adjacent spatial points and/or simultaneously measured $\tilde{n}$ will be employed to suppress photon noise that is comparable to the turbulent signal. The SHS Littrow wavenumber and grating constant can be chosen to reduce the number of detectors needed to resolve changes in the input spectrum. This allows multi-spatial point measurements using 4–6 discrete photodiodes each, with no loss in sensitivity to $\tilde{E}/E_{MSE}$. To validate this diagnostic concept, the diagnostic neutral beam will be fired into a magnetized target plasma (B$\leq$0.5 T) comparable to a tokamak edge, with $\tilde{E}$ applied parallel or perpendicular to E_{MSE} via biased electrodes.

[1]Work supported by US DOE grant DE-FG02-89ER53296.

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Date submitted: 13 Jul 2016 Electronic form version 1.4