High bandwidth electron temperature measurements in DIII-D divertor*

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For the first time electron temperature (T_e) fluctuations have been measured in different regions of a tokamak divertor using a fast (100 kHz bandwidth) Langmuir probe based diagnostic. The diagnostic, recently installed on the fast reciprocating probe in the lower divertor [1], is based on the digital detection of harmonics in a single probe current spectrum, and is similar to that used on the mid-plane reciprocating probe in DIII-D [2]. Here we report the initial measurements of T_e fluctuations in the divertor and compare their properties to those measured in the outboard SOL by the pre-existing diagnostic.

Measurements were performed at the outboard divertor scrape-off layer (SOL) radially outside of the Outer Strike Point (OSP), private flux region, and inboard divertor SOL (inboard of the inner divertor leg) of Lower Single Null discharges. For this initial work, results concentrate on low-density low-confinement (L-mode) discharges with attached OSP, where the T_e data from the new harmonic diagnostic are in reasonable agreement with the Divertor Thomson Scattering measurements.

In all cases the relative (root-mean-square to mean) T_e fluctuation levels in the divertor were between 0.3 – 1.0, which is higher than 0.2 – 0.5 measured in the same discharges in the outboard SOL by the mid-plane probe. Spectral characteristics of T_e fluctuations vary with position in the SOL; comparisons between the divertor and outboard SOL are presented and discussed. The fluctuation spectra have measurable energy up to the bandwidth of the diagnostics (100 kHz) in both regions, while the frequency roll-off tends to be slower in the divertor compared to the outboard SOL.

[1] J.G. Watkins, *et al.,* Rev. Sci. Instrum. **68**, 373 (1997)
[2] D.L. Rudakov*, et al.,* Rev. Sci. Instrum. **72**, 453 (2001)

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