TIME-RESOLVED PLASMA PROPERTIES AND EEDFS FROM A RAPIDLY SWEPT 1-MHZ LANGMUIR PROBE*

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Using direct back-to-back high-speed swept Langmuir probe biasing and current measurement, the plasma properties of electron density, electron temperature, plasma potential, floating potential, and the electron energy distribution function are all acquired at a rate of 1-MHz for seamless records in excess of 1-sec. A unique high-speed dual Langmuir probe configuration,[1] consisting of a single Langmuir probe (exposed to plasma) and a null probe (insulated from plasma), enables compensation of the rapidly swept probe signals, thereby permitting probe bias sweep rates in excess of 1-MHz. The time-resolved EEDF data presented are unique from the vast majority of previously published so-called "time-resolved EEDF" data that are actually acquired through phase-averaging and reconstruction of I-V space data (an approach that can only capture one cycle of a periodic plasma process). Thus, the presented approach and data accurately capture the detailed plasma properties (including the EEDF via the Druyvesteyn method) of broadband turbulent plasma behavior inherent to many common laboratory plasmas that exhibit non-quiescent discharges.

1. R. B. Lobbia and A. D. Gallimore, "High-speed Dual Langmuir Probe," submitted for publication, Review of Scientific Instruments, 2009.

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