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Interpretation and implementation of an ion sensitive probe (ISP) as a plasma potential diagnostic.[1] ROMAN OCHOUKOV, DENNIS WHYTE, BRUCE LIPSCHULTZ, BRIAN LABOMBARD, PSFC MIT — An ISP is being developed as a robust diagnostic capable of measuring space potentials (Φ_P) in the boundary plasma of tokamaks. The ISP relies on the large difference between the ion and electron gyroradii ($\rho_i/\rho_e \sim 60$) to reduce electron collection at a collector which is oriented parallel to the magnetic field, and recessed behind the ISP shield a distance of $\sim \rho_i$. The shield is independently biased. By sweeping the collector voltage, while maintaining a constant voltage difference of a few volts between the shield and the collector (with $V_{WALL} < V_{COLLECTOR}$), we obtain only ion current. The ISP was studied in a magnetized plasma chamber (DIONISOS, B = 0.04 T, $n_e = 10^{16}$-10^{18} m^{-3}, $\rho_e = 0.2$ mm) at MIT. A model of the ISP potential shows that the collected ion current should reach zero for $V_{WALL} \geq \Phi_P$ and that space-charge effects are critical to the probe operation. The plasma potentials obtained from the ISP match well the plasma potentials measured with an emissive probe over a wide range of plasma conditions in DIONISOS, yet with a more robust physical design than the emissive probe.

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