3D Isosurface visualization of electron density and temperature distribution in a magnetized sheet plasma ion source

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A 3D visualization of argon and nitrogen-argon plasma electron density (n_e) and effective temperature (T_e) distributions were constructed using the I-V curves from Langmuir probe traces at specific discrete positions in the extraction region of a magnetized sheet plasma ion source. Argon and mixed N_2-Ar sheet plasmas are characterized using the calculation of the electron energy distribution function (EEDF). The calculation of the EEDF involves the second derivative of the measurements of the probe. Matlab 7.0's eight-term Gaussian function curve fitting tool facility was utilized to smooth the probe characteristic. By taking the current vs. voltage reading of a single probe in 68 discrete locations of the plasma, a 3-dimensional map of the electron density and electron temperature were constructed. To elucidate the effects of changing plasma parameters, slices of the n_e and T_e space were taken. Regions of non-uniformity of n_e and T_e along the sheet plane were observed and related to operating conditions The map was constructed to understand the global condition of the extraction region of the source. The technique can be applied to the determination and understanding of edge plasma parameters in magnetic confinement devices.

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