Neutral Helium Flow in a Helicon Plasma Source
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Motivation/Objectives
We report spatially resolved measurement of metastable helium density, temperature, and flow velocities in the WVC helicon plasma source (WVC). While in situ diagnostics are crucial to understanding plasma characteristics such as density and temperature, they are frequently neglected in low temperature plasmas and are needed to be spatially uniform. Measurement of the neutral flow is also important; specifically for research where one has integrated spontaneous emission, since flows along the line of sight can artificially enhance the line width of emission lines. Recent work by Bihain et al. on spontaneous flow shear illustrates the need for spatially resolved measurement profiles of the neutral particle parameters. Inclusion of a spatially varying neutral spontaneous emission parameter to theoretical models would not only give a more complete understanding of the physics, but could lead to increased shear profile measurements were made using the 2D stage described in Haddad et al.


Impact of Lock-In Amplifier's Integration Time Constant on Flows and Temperature

Flow Correction for Lock-In Amplifiers Effects

Summary
- LIF has been used to obtain radial and 2D maps of density, impact rates, and flow profiles of neutral metastable Helium.
- Comparison of the LIF neutral metastable density and temperature with that of the electron density and temperature measured by a Langmuir probe shows similar profiles with a peak on axis in a helicon mode.
- The spatial non-uniformity of density and temperature leads to significantly different spatial profiles of metastable collision frequency and ionization density than those assumed in the Holland et al. (2004) study.
- Radical electric fields of ~500 V/m are present in the discharge, possibly creating a rotating plasma column, but no momentum coupling to neutrals is observed.
- After compensation for the lock-in effects, the radial flow of metastable is negligible (Flow Velocity ~0 m/s) for flow experimental parameters.