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Electron Temperature and Ion Beam Scaling with RF Input Power in an Argon Helicon Plasma[1] MATT WIEBOLD, JOHN SCHARER, YUNG-TA SUNG, University of Wisconsin - Madison — A flowing argon helicon plasma is formed in a 10 cm diameter, 1.5 m long Pyrex chamber with an axial magnetic field in nozzle or flat configuration, variable up to 1 kG in the source region. A new expansion chamber has been constructed and initial laser induced fluorescence (LIF) results including ion velocities and temperatures are presented. Microwave interferometry (105 GHz), collisional radiative spectroscopic codes and diamagnetic loops are used to measure electron density and temperature during pulsed (5 ms) RF operation. Calculated variation of the RF frequency (from 12 MHz to 15 MHz) during the pulse allows for low (<5%) reflected powers during the gas breakdown and the approach to and formation of the steady state plasma. The scaling of electron temperature with RF power is also examined for high (>3 kW) RF powers. The effect of different flow rates, magnetic field expansion variation and pressures are measured to observe the variation of the ion distribution function via LIF and the axial variation of acceleration due to neutral depletion. Possible double layer creation and sustainment in the downstream (relative to the RF antenna) transition to the expansion chamber is also examined at low flow rates and high RF powers.

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