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Plasma Flow Characterization of a mini-Helicon Thruster NAREG SINENIAN, OLEG BATISHCHEV, MANUEL MARTINEZ-SANCHEZ, MIT, Cambridge, MA 02139, USA — We present experimental analysis of the plasma flow produced by the mini-Helicon Thruster Experiment, currently under development at the MIT Space Propulsion Laboratory. It can efficiently ionize ∼1mg of Ar or N at a nominal 1kW RF power. Possible electric propulsion applications require high (∼20-30km/s) exhaust velocity. Our current goal is to optimize thruster design and beam efficiency. Plasma flow is primarily measured using 2-pin Mach probes and Retarding Potential Analyzers. Several issues are addressed including RF-compensation, the effects of non-equilibrated plasma and very high energy fluxes ($4MW/m^2$). Measurement results from these diagnostics over the radius of the plasma jet are presented and yield an indirect measurement of the total axial thrust force. A direct measurement of the thermal component of the total axial thrust force is accomplished using a feedback controlled thrust balance, capable of measurements within a range of 0.1-20mN with a resolution of approximately .1mN. Comparison of the indirect measurements of the total axial thrust and direct measurements of the thermal component of the total axial thrust yields the magnetic component of the total thrust. The latter originates from the magnetic nozzle effect and can be varied by altering the topology of the field in the rear exhaust region.

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