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Spatiotemporally Resolved Ion Velocity Distribution Measurements in the 12.5 kW HERMeS Hall Thruster VERNON H. CHAPLIN, ROBERT B. LOBBIA, ALEJANDRO LOPEZ ORTEGA, IOANNIS G. MIKELLIDES, RICHARD R. HOFER, NASA Jet Propulsion Laboratory — Non-invasive measurements of the ion velocity distribution function (IVDF) obtained using laser-induced fluorescence (LIF) are playing a critical role in the life qualification of NASAs 12.5 kW Hall Effect Rocket with Magnetic Shielding (HERMeS), which will be accomplished through a combination of limited duration wear testing and computational modeling validated by experiments. Previous LIF measurements on HERMeS have revealed bimodal time-averaged IVDFs in the acceleration region of the thruster, suggestive of oscillations in the acceleration regions position, as well as time-averaged velocity vectors that are difficult to reproduce in simulations. In order to understand these phenomena in more detail, we are making time-resolved LIF measurements using the transfer function averaging technique, which employs phase-sensitive detection and averaging in Fourier space to enable measurements resolving both periodic and aperiodic oscillations at typically Hall thruster breathing mode frequencies (10-60 kHz). The first time-resolved IVDFs measured in HERMeS will be presented, along with time-averaged 2D velocity vector maps spanning a finer spatial mesh than in previous studies. Implications for performance and life modeling of HERMeS using the Hall2De code will be discussed.

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