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Plume properties measurement of an Electron Cyclotron Resonance Accelerator SARA CORREYERO, THEO VIALIS, JULIEN JARRIGE, DENIS PACKAN, ONERA — Some emergent technologies for Electric Propulsion, such as the Electron Cyclotron Resonance Accelerator (ECRA), include magnetic nozzles to guide and expand the plasma. The advantages of this concept are well known: wall-plasma contact is avoided, it provides a current-free plume, it can allow to control thrust by modifying the magnetic field geometry, etc. However, their industrial application requires the understanding of the physical mechanisms involved, such as the electron thermodynamics at the plasma plume expansion, which is crucial to determine propulsive performances.

This work presents a detailed characterization of the plasma plume axial profile in an ECR plasma thruster developed at ONERA. Langmuir, emissive, Faraday and ion energy probes are used to measure the electric potential space evolution, the current and electron energy distribution function in the plume, from the near field to the far field.

The experimental results are compared with a quasi-1D (paraxial) steady-state kinetic model of a quasineutral collisionless magnetized plasma which is able to determine consistently the axial evolution of the electric potential and the electron and ion distribution functions with their associated properties.

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