Abstract Submitted
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Characterization and Optimization of a Plasma Window for Reducing Gas Flow from High Pressure[1] ANDREW LAJOIE, National Superconducting Cyclotron Lab, Michigan State University, JIAN GAO, FELIX MARTI, Facility for Rare Isotope Beams, Michigan State University — The plasma window is a DC cascaded arc, in argon or helium, which restricts gas flow from a high pressure cell (order 10^2 torr). This has applications in instances where a vacuum-atmosphere interface is present, for example as a component of a high pressure gas charge stripper in a high intensity ion accelerator such as the Facility for Rare Isotope Beams (FRIB) [1]. The factor by which flow is restricted is up to about 20 due to dramatically increased temperature and viscosity. A relation is developed for the flow rate from the gas cell as a function of pressure, current, and channel geometry. Insights are given on how the flow rate is related to basic plasma quantities such as electron density (in argon, about 10^{16} cm^{-3}) and temperature (in argon, about 1.5 eV), determined via Stark broadening and relative emission intensities respectively. Results are compared with a cascaded arc model in PLASIMO, which has yielded comparable properties to measurements [2]. This work can serve as a guide with which the geometry of the plasma window can be optimized, maximizing gas pressure while minimizing escaping gas flow. [1] A. LaJoie et al., Trans. Plas. Sci. 2019. [2] G. M. W. Kroesen et al., Plas. Chem. & Plas. Proc. 1990.

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