Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Ion transport and entrapment in electrostatic virtual cathodes[1]
CHI-SHUNG YIP, NOAH HERSHKOWITZ, University of Wisconsin - Madison, GREG SEVERN, University of San Diego — Axial ion motions in virtual cathodes are studied with Laser Induced Fluorescence. Virtual cathodes are formed using small ($A_{electrode}/A_{loss} < (m_e/m_i)^{1/2}$) electrodes biased at near to or higher than the plasma potential far from the electrode in multi-dipole confined filament discharges of argon gas. The virtual cathodes are electrostatic, with no magnetic fields present near the electrode to confine ions. An emissive probe is employed to measure the full potential profile from the bulk up to the surface of the electrode. A planar Langmuir probe is employed to measure the electron temperature T_e, the plasma density n_e and the Debye length. Reflected ions are not observed in significant amounts unless the electrode is biased at least 1 T_e/e above the bulk plasma potential. When the electrode is biased at at least 1 T_e/e above the plasma potential, significant retardation of ion velocities in much of the potential profile is observed along with reflected ions. Ion temperature rises significantly when retardation occurs. However, such increases in temperature do not account for the full energy that ions gain from the potential drop. The role of pumping by the saddle point electric fields is under investigation.

[1]This work was supported by NSF under Grant No. 1464741 and U.S. DOE under Grant No. DE-SC00114226.

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Date submitted: 28 Jun 2016 Electronic form version 1.4