

Abstract Submitted
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Dynamics of Ion Beam Charge Neutralization by Ferroelectric Plasma Sources.¹ ANTON D. STEPANOV, ERIK P. GILSON, LARRY R. GRISHAM, IGOR D. KAGANOVICH, RONALD C. DAVIDSON, Princeton Plasma Physics Laboratory, QING JI, ARUN PERSAUD, PETER A. SEIDL, THOMAS SCHENKEL, Lawrence Berkeley National Laboratory — Ferroelectric Plasma Sources (FEPSs) can generate plasma that provides effective space-charge neutralization of intense high-perveance ion beams. Here we present experimental results on charge neutralization of a high-perveance 38 keV Ar⁺ beam by a FEPS plasma. By comparing the measured beam radius with the envelope model for space-charge expansion, it is shown that a charge neutralization fraction of 98% is attainable. The transverse electrostatic potential of the ion beam is reduced from 15 V before neutralization to 0.3 V, implying that the energy of the neutralizing electrons is below 0.3 eV. Near-complete charge neutralization is established $\sim 5\mu\text{s}$ after the driving pulse is applied to the FEPS, and can last for 35 μs . It is argued that the duration of neutralization is much longer than a reasonable lifetime of the plasma produced in the sub- μs surface discharge. Measurements of current flow in the driving circuit of the FEPS suggest that plasma can be generated for tens of μs after the high voltage pulse is applied. This is confirmed by fast photography of the plasma in the 1-meter long FEPS on NDCX-II, where effective charge neutralization of the beam was achieved with the optimized FEPS timing.

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