MonPE26

Simulation of Space Charge Compensation in a multibeamlet negative ion beam

E. Sartori*[a], T. J. Maceina[a], P. Veltri[a], M. Cavenago[b], G. Serianni[a]

[a]*Consorzio RFX (CNR, ENEA, INFN, UNIPD, Acciaierie Venete SpA), Corso Stati Uniti 4 – 35127 Padova, Italy.*
[b]*INFN-LNL, viale dell'Università n. 2, 35020 Legnaro, Italy*

**emanuele.sartori@igi.cnr.it*

Space charge compensation (SCC) is a typical phenomenon of ion beam physics [1]: the beam space charge is compensated for by accumulating, in the beam potential well, charges having opposite polarity, usually generated by collisional processes.
In this paper we investigate the case of the drift of a H- ion beam, in a bi-dimensional approximation of the NIO1 negative ion source [2]. H- beam ion transport and plasma formation are studied via particle-in-cell simulations. Differential cross sections are sampled to determine the velocity distribution of secondary particles generated by ionization of the residual gas (electrons and slow H2+ ions) or by stripping of the beam ions (electrons, H, H+). The simulation includes three beamlets of a horizontal section, so that multibeamlet space charge and secondary particle diffusion between the three separate generation regions are considered.
Simulations show that the beam space charge is effectively screened by the secondary plasma, with a characteristic time for potential compensation around 3μs in agreement with theoretical expectations. As expected in the case of negative ions, a slight overcompensation of the electric potential is verified. Effects on the beamlet emittance are discussed.

This work was set up in collaboration and financial support of F4E.

References:

[1] P. Spädtke, The role of space charge compensation for ion beam extraction and ion beam transport, Rev. Sci. Instrum. 85, 02A744 (2014)
[2] M. Cavenago et al., Design of a versatile multiaperture negative ion source, Rev. Sci. Instrum. 81, 02A713 (2010)