Contribution ID: **1498** Contribution code: **WEPS128** Type: **Poster Presentation**

Low-temperature plasma ion source modeling with accurate plasma chemistry

Wednesday 4 June 2025 16:00 (2 hours)

Simulations of LTP ion sources using Particle-In-Cell (PIC) models provides cost-effective methods for improving source performance and optimizing beam properties. One key element of these models is to accurately model plasma chemistry inside of the plasma chamber. Also, processes outside of the plasma chamber, such as secondary electron production induced from ion collisions with extraction electrodes and charge neutralization via recombination due to residual neutral gas outside can have a large effect on the resultant ion beam. We present detailed simulations LTP ion sources using the plasma simulation software VSim. VSim has unique capabilities including self-consistent plasma formation and evolution inside the chamber, accurate surface interaction models, externally applied magnetic field configuration models, and importantly accurate plasma chemistry models. Our results compare simulated beam properties for a helium source and quantify beam neutralization effects of residual gasses. This work shows both the importance of accurately modeling plasma chemistry and collisions for LTP sources in both the plasma chamber and beam extraction region.

Footnotes

Paper preparation format

LaTeX

Region represented

America

Funding Agency

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Session Classification: Wednesday Poster Session

Track Classification: MC5: Beam Dynamics and EM Fields: MC5.D11 Code Developments and Simulation Techniques