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Plasma generation in capillary discharges simulated with COMSOL for charged particle acceleration

Tuesday 3 June 2025 16:00 (2 hours)

This study develops a gas-filled plasma-discharge capillary system for laser wakefield acceleration (LWFA). Using an external high-voltage source for pre-ionization enhances plasma formation, operational stability, and laser propagation over extended Rayleigh lengths, enabling high-energy electron beams. The uniform plasma environment improves beam charge, consistency, and energy spread, allowing efficient generation of 250 MeV very-high-energy electron (VHEE) pencil beams in a compact system. Designed at the upcoming I-LUCE facility in Catania, Italy, the setup supports VHEE and FLASH radiotherapy (FLASH-RT) research. COMSOL Multiphysics simulations of plasma density variations validate the model's accuracy and its potential for optimizing plasma-based LWFA systems.

Footnotes

Paper preparation format

LaTeX

Region represented

Europe

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