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Study of electron density in capillary discharge plasma for laser plasma accelerator

Tuesday 3 June 2025 16:00 (2 hours)

Laser-plasma accelerators have demonstrated the ability to accelerate high-energy electrons but require improved beam stability and repeatability for practical applications. Pre-formed plasma channels enhance the stability in Laser-Wakefield Accelerators by maintaining laser focus over longer distances, increasing energy transfer efficiency. The characteristics of such channels are highly dependent on capillary geometry, gas parameters, discharge setup, and repetition rate. This study investigates the electron density profiles in plasma from gas-filled capillary discharges. Using interferometry and Stark broadening, we measured profiles under varying conditions, achieving densities of (2-6)×10ˆ18 cmˆ-3. In this presentation, we showcase the stability and uniformity of the plasma, highlighting its capability to preserve beam quality in high-energy, high-repetition-rate applications. This type of plasma source is a crucial technology for the plasma accelerator-based Free Electron Laser developed at ELI-ERIC as well as for the EuPRAXIA project. Also, we discuss the conceptual design of plasma diagnostics for providing 'real-time' information in high-repetition-rate applications.

Footnotes

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