EuPRAXIA-DN Camp I: Technologies



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Discharge Plasma Source for Laser Plasma Accelerator at ELI Beamlines

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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 overcoming diffraction effects and 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 Stark broadening, we measured profiles under varying conditions, achieving densities of $(2-3)\times1018$ 🖾-3. In this presentation, we showcase the stability and uniformity of the plasma, and the necessity to use long capillaries with limited apertures to preserve beam quality in high-energy, high-repetition-rate applications. This type of plasma source is a crucial technology for the 100 Hz plasma accelerator based Free Electron Laser developed at ELI-ERIC as well as for the EuPRAXIA project.

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