7th European Advanced Accelerator Conference

EAAC2025

Contribution ID: **714** Type: **Invited Talk**

Observation of improved electron beam quality from a LPA by post acceleration beam shaping.

Tuesday 23 September 2025 11:30 (30 minutes)

Achieving high-quality electron beams from laser-plasma accelerators (LPAs) is critical for advancing applications such as Free-Electron Lasers and compact accelerators. We report on the observation of electron beams with low transverse momentum spread. This is achieved by using a gas cell to tailor the plasma density profile including an plateau, where acceleration occurs. This is followed by an exponential decay and then by a 10-mm long, low-density plasma tail. The post acceleration plasma acts as a combined plasma lens and dechirper, actively shaping the electron beam in three dimensions. The measured beams exhibit exceptional properties: 40 pC charge (FWHM) at 190 MeV, a low 1.9% energy spread, and a rms divergence of 0.54 mrad. Supported by numerical simulations using both Particle-in-Cell (PIC) and Computational Fluid Dynamics (CFD) codes, our results reveal that a self-driven wakefield within the low-density plasma tail effectively rotates the beam's phase space, leading to a significant increase in intensity. This suggests interesting possibilities to manipulate electron beams phase space in an integrated plasma device.

Author: STEYN, Lodewyk (LPGP - Universite Paris Saclay)

Co-authors: PANCHAL, Abhishek (CEA Paris-Saclay); IRMAN, Arie (Helmholtz Zentrum Dresden Rossendorf); CROS, Brigitte (CNRS - LPGP - Universite Paris Saclay); BALLAGE, Charles (CNRS - LPGP - Universite Paris Saclay); MASSIMO, Francesco (LPGP - CNRS); HERRMANN, Franziska Marie (Helmholtz-Zentrum Dresden-Rossendorf); MOULANIER, Ioaquin (Laboratoire de Physique des Gaz et Plamas); Dr LABERGE, Maxwell (Helmholtz-Zentrum Dresden-Rossendorf); MASCKALA, Mohamad (CNRS - LPGP - Universite Paris Saclay); KHOMYSHYN, Oleksandra; VASILOVICI, Ovidiu (CNRS - LPGP - Universite Paris Saclay); UFER, Patrick (Helmholtz-Zentrum Dresden-Rossendorf); SCHOEBEL, Susanne (Helmholtz-Zentrum Dresden-Rossendorf); SCHRAMM, Ulrich (Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Radiation Physics); CHANG, Yen-Yu (Helmholtz Zentrum Dresden Rossendorf); DOBOSZ DUFRÉNOY, sandrine (CEA-Saclay)

Presenter: STEYN, Lodewyk (LPGP - Universite Paris Saclay)

Session Classification: Plenary Session

Track Classification: Invited Talk