Contribution ID: **90** Type: **Poster (student)**

Optimization of Laser Wakefield Acceleration for High-Quality Electron Beams: Simulations and Experimental Results in Collaboration with HZDR

Monday, 14 April 2025 17:10 (1h 30m)

Laser Wakefield acceleration (LWFA) has been demonstrated as a mechanism to accelerate electrons to very high energies over a few millimeters. A high-intensity laser ionizes the atoms in a gas mixture, and excites plasma waves with accelerating gradients reaching up to 100 GV/m –far exceeding those in conventional accelerators. Enhancing the electron beam charge and energy while minimizing its divergence and energy spread are fundamental objectives and ongoing challenges in advancing these accelerators for various applications, including radiation therapy, free electron lasers, and future compact colliders.
In the context of LWFA experiments at Helmholtz-Zentrum Dresden-Rossendorf (HZDR), we are developing tailored plasma density profiles, and utilizing the ionization injection method to efficiently trap, and accelerate electrons. To refine our approach, numerical Particle-in-Cell (PIC) simulations are conducted using SMILEI to optimize the laser and plasma parameters for the experiment.
The primary goal is to develop a high-quality electron source suitable for advanced applications, such as free-electron lasers and compact accelerators. This poster illustrates the role of key mechanisms through the comparison of experimental results and numerical simulations with SMILEI.

Primary author: MASCKALA, Mohamad

Co-authors: IRMAN, Arie (Helmholtz Zentrum Dresden Rossendorf); CROS, Brigitte (LPGP-CNRS-UP11); MASSIMO, Francesco (LPGP - CNRS); SCHRAMM, Ulrich (Helmholtz Zentrum Dresden Rossendorf)

Presenter: MASCKALA, Mohamad

Session Classification: Poster Session

Track Classification: Electron acceleration