

# Enhancing Electron Beam Quality Through Customized Density Gradients in Laser Wakefield Acceleration

The quality of electron beams produced by Laser Wakefield Acceleration (LWFA), is controlled through laser parameters and plasma density distribution during the injection and acceleration phases, and in some cases, a specific device providing beam selection or shaping to achieve the electron beam quality needed the envisaged application.

A major challenge in the generation of LWFA electron sources is reducing energy and transverse momentum spread to enhance spectral brightness, requiring advanced techniques to optimize beam quality.

We design plasma density profiles to control electron injection and acceleration, specifically to improve the electron beam phase space characteristics in a compact way. This poster presents our numerical study using Computational Fluid Dynamics (CFD) and Particle-In-Cell (PIC) simulations. These simulation results are in good agreement with experimental results obtained at Helmholtz-Zentrum Dresden-Rossendorf.

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