Contribution ID: **78** Type: **Poster (student)**

# Ultra-Short Laser Pulses: A Parameter Study for Laser Wakefield Acceleration

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

The overarching goal of EuPRAXIA is to pioneer the development of next-generation compact particle accelerators using advanced plasma-based technology. Among the most promising methods for achieving this vision is laser wakefield acceleration (LWFA), which enables the generation of high-energy electron beams within a compact setup.

This work explores the effect of ultrashort laser pulses and tailored plasma density profiles on the injector parameter space, with the aim of optimizing electron injection and acceleration, a step toward meeting EuPRAXIA's requirements.

The study focuses on leveraging a new high-energy, short-pulse laser system developed at the Lund Laser Center. This system, based on Optical Parametric Chirped Pulse Amplification (OPCPA), features dual outputs capable of simultaneous operation at 100 Hz and 10 Hz, delivering peak powers of 6 TW and 30 TW, respectively. The 10 Hz, 250 mJ laser arm, with its ultrashort pulse duration of 9 fs, is particularly suited for exploring LWFA.

These exceptional parameters open new possibilities to study how laser pulse properties influence key factors such as acceleration length and electron energy gain. Using the Fourier-Bessel Particle-in-Cell (FBPIC) code, this work examines the interplay between laser and plasma parameters, comparing the results against established scaling laws, and proposing experimental configurations.

**Primary authors:** Mr D'SOUZA, Flanish (Lund University); Dr LUNDH, Olle (Lund University)

**Presenter:** Mr D'SOUZA, Flanish (Lund University)

**Session Classification:** Poster Session

**Track Classification:** Electron acceleration