

Laser fields reconstructor for initialization of experimental laser profiles in Particle In Cell simulations

Particle-in-cell (PIC) simulations are a well-established tool to study and predict the outcomes of a Laser Plasma Accelerator experiment, but the results are often hindered by the initialization of highly idealized laser profiles. In this work, we present the development of a *Laser Pulse reconstructor For Particle In Cell simulations* (**LP4PIC**), a Python package to retrieve experimental laser fields to be initialized in a FBPIC simulation. The retrieval of fields from fluence measurements is based on an improved Gerchberg-Saxton algorithm (GSa), taking in input a measurement before the focusing element and a series of focal scan measurements to retrieve the aberration phase. The propagator, on which is based the GSa, simulating the focusing of a given mirror solves the Fourier transformed Helmholtz equation. LP4PIC is also provided with functions to simulate the focusing of an input profile, analytical or from measurements, through phase/absorption plates, eventually providing aberration coefficients, and to give an estimation of aberration coefficients corresponding to the GSa retrieved phase. The so-rebuilt fields are finally initialized in a FBPIC simulation through a proper custom interface. Features and characteristics of LP4PIC will be shown through examples, also in terms of PIC simulations results.

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