



Contribution ID: 40

Type: **Poster (student)**

Plasma Wakefield Acceleration: a parametric model for fast beam dynamics integration.

Tuesday, September 20, 2022 7:20 PM (1 hour)

The state of the art in terms of Plasma Wakefield Acceleration simulation accuracy are Particle in Cell (PIC) codes, based on a kinetic model which requires hard numerical integration and execution times of hundreds of hours on processors clusters for centimetre-long simulations. During my Master's thesis a computationally lighter model was developed, able to accurately reproduce the most significant aspects of the process in shorter execution times, setting a starting line for identification of work points and optimal beam injection conditions. The code lays on a multi-fluid superposition plasma model (Lu, Dalichaouch et al.): charge density and currents are calculated via continuity equation through a semi-empirical parametrization of fluid regions ratios, tuned by fit on PIC simulation results. Under quasi-static approximation, plasma response and wakefields are calculated at each time step for a given beam profile and used to compute beam slices evolution. Beam energy, emittance and energy spread evolution were validated on PIC simulation results, featuring high accuracy and showing model ability to reproduce nonlinearities and to range in different plasma response regimes. The code is able to run on a laptop, giving execution times four orders of magnitude shorter than a PIC code executed on a processors cluster.

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Session Classification: Poster Session