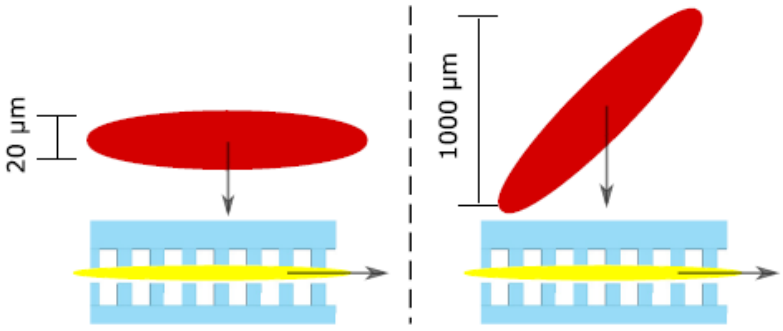
Machine Learning for Laser Pulse Shaping

Bachelor / Master Thesis
Accelerator Physics / Computational Engineering
Start: variable

TECHNISCHE UNIVERSITÄT DARMSTADT

Motivation

Scalable dielectric laser accelerators (accelerators on the microchip) rely on accurately shaped laser pulses that drive them. The knowledge on how the laser pulse arrives on each cell of the chip is however limited. In this project, a virtual diagnostics approach is to be pursued, running a simplified and fast simulation program in parallel to the continuously running experiment. By matching all inputs and and outputs of the physical and digital twins, previously hidden parameters can be obtained heuristically, which helps tuning experiments with high dimensions of input parameters.



Dielectric Laser Accelerator (DLA) structures driven by a tilted laser pulse. Optimization goals are to ensure the phase fronts are flat or that the electron pulse in injected in the center. Picture from D. Cesar et al. NIM A 909 (2018) 252–256.

Aim of the Bachelor / Master thesis

- Modeling and Simulation DLAs with the existing code DLAtrack6D
- Setup of a machine learning tool for the required input data
- Optimization for maximal charge throughput in the DLA

Requirements

Basic knowledge of accelerator physics, numerics, machine learning is advantageous.

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