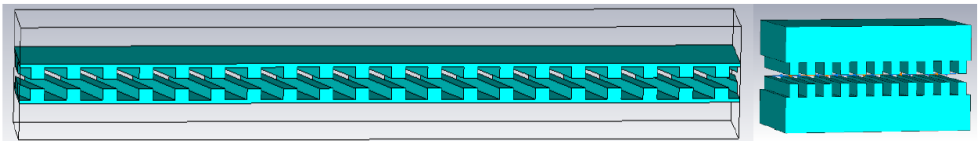
Computation of Radiation from Laser Driven Micro-Undulators

Master Thesis
Accelerator Physics / Computational Engineering
Start: as soon as possible

TECHNISCHE UNIVERSITÄT DARMSTADT



Tilted DLA structure (left) and straight DLA (right)

Motivation / Setting

Tilted Dielectric Laser Acceleraton structures (DLAs) allow transverse deflection of ultrashort electron pulses. They can also be used to deflect the beam periodically, thereby creating electromagnetic radiation in the forward direction (undulator radiation). The goal of this MSc project is to use the existing tracking code DLAtrack6D (Matlab or Python version available) for tilted DLA structures and extend it with a module that implements the Liendard-Wiechert potentials

$$\Phi(\vec{r},t) = \frac{1}{4\pi\varepsilon_0}\frac{q}{[|\vec{r}-\vec{r}'|][1-\vec{n}\cdot\vec{v}/c]}$$
$$\vec{A}(\vec{r},t) = \frac{\mu_0}{4\pi}\frac{q[\vec{v}]}{[|\vec{r}-\vec{r}'|][1-\vec{n}\cdot\vec{v}/c]}$$

where [...] denotes temporal retardation. The resulting fields can then be further analyzed to obtain properties of the radiation as e.g. wavelength spectrum, divergence, etc.

Aims of a MSc thesis

- Introduction to accelerated charges and radiation generation
- Implementation of Lienard-Wiechert potentials in DLAtrack6D
- Simulation of radiation generation process
- Optimization of electron beam, laser, and dielectric structure parameters

Requirements

Knowledge of electrodynamics, charged particle dynamics, numerical methods.

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