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Simulation of tapered co-propagating structures for dielectric laser accelerator

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One of the key aspects to provide on chip acceleration in Dielectric Laser Accelerators (DLA) from tens of keV up to MeV energies is the phase velocity tapering.
This paper presents the simulated performance of sub-relativistic structures, based on tapered slot waveguides. We engineered channel/defect modification in order to obtain a variable phase velocity matched to the increasing velocity of the accelerated particles. Additionally, we present a hollow-core relativistic electromagnetic band gap (EGB) accelerating waveguide. In DLA structures co-propagating schemes are employed for higher efficiency and smaller footprint compared to the cross-propagating schemes. In this respect, we envisage tapered continuous copropagating structures that simultaneously allow wave launching/coupling, beam acceleration, and transverse focusing. The main figures of merit, such as the accelerating gradient, the total energy gain, and the transverse focusing/defocusing forces, are evaluated and used to guide the optimization of the channel/defect modification.

Index terms: Dielectric Laser Accelerators (DLA), Photonic Crystal, Dielectric Waveguides

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