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Simulations of an energy dechirper based on dielectric lined waveguides

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THz wakefields can be excited by ultra-short relativistic electron bunches travelling through the dielectric lined waveguide (DLW) structures. These wakefields can either accelerate a witness bunch with gradient two or three orders of magnitude larger than that in the conventional RF linear accelerators, or introduce energy modulation within the driving bunch itself. In this paper, we study a dechirper based on the DLW to compensate the correlated energy spread of the bunches accelerated by the laser plasma wakefield accelerator (LWFA). A rectangular waveguide structure is employed taking advantage of its continuously tunable gap during operation. The assumed 200 MeV driving bunch has a Gaussian distribution with a bunch length of 3.0 μm, a relative correlated energy spread of 1%, and a total charge of 10 pC. Both of the CST Wakefield Solver and PIC Solver are used to simulate and optimize such a dechirper. The effects of the time-dependent self-wake on the driving bunch will be analyzed in terms of the energy modulation and the transverse phase space.

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