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THz-driven acceleration of sub-relativistic electrons in tapered rectangular dielectric-lined waveguides

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We have designed a tapered dielectric-lined waveguide for the acceleration of sub-relativistic electron bunches with THz-frequency electromagnetic pulses. We consider an example design based on a commercial 100keV electron gun and a THz generation scheme driven by a mJ-level regenerative amplifier laser system. With a 12μJ THz pulse we simulated acceleration of a 100keV electron bunch to 162keV with very low energy spread. A second example design shows energy doubling from 100keV to 205keV using a 22.5μJ pulse. The former of these two designs has been assembled for experimental testing. We also discuss methods to improve the efficiency of the design process using 1D particle tracking to provide better estimates of the initial geometry before optimization.

Footnotes

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Primary author: NIX, Laurence (Cockcroft Institute)

Co-authors: BRADBURY, Joe (Cockcroft Institute); SHAW, Christopher (Cockcroft Institute); APPLEBY, Robert (Cockcroft Institute); BURT, Graeme (Lancaster University); LETIZIA, Rosa (Lancaster University); GRAHAM, Darren (The University of Manchester); HIBBERD, Morgan (The University of Manchester); JAMISON, Steven (Lancaster University)

Presenter: NIX, Laurence (Cockcroft Institute)

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