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Electromagnetic and Beam Dynamics Studies for High Gradient Accelerators at Terahertz Frequencies

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THz radiation is the most important portion of the electromagnetic spectrum in terms of multi disciplinary use in basic science and technology. Beyond the numerous applications, a great interest is its potential for future, compact linear accelerators. Conventional high brightness radio-frequency accelerating structures operate with 30-50 MV/m gradients; terahertz-driven accelerating structures enable high-gradient electron accelerators (potentially up to the GV/m scale) with simple and compact accelerating structures. These compact terahertz accelerators hold great potential to have an impact for free electron lasers, linear colliders. Here we present electromagnetic and beam dynamics studies about the use of a dielectric loaded waveguide to accelerate electron bunches by mean of a narrow-band multi-cycle THz laser pulse. The excitation of the accelerating structure by the THz-pulse and the bunch acceleration in the excited field are investigated using CST Microwave Studio and GPT simulations; a check between different beam dynamics codes (namely CST Particle Studio, GPT and ASTRA) will be also presented.

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