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Coherent THz Emission Enhanced by Coherent Synchrotron Radiation Wakefield

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We demonstrate that emission of coherent transition radiation by a 1 GeV energy-electron beam is enhanced in intensity and extended in frequency, by the energy correlation established along the beam by coherent synchrotron radiation (CSR), in the presence of a proper electron optics in the beam delivery system. Analytical and numerical models, based on experimental electron beam parameters collected at the FERMI free electron laser (FEL), predict transition radiation with two intensity peaks at 0.3 THz and 1.5 THz, and extending up to 8.5 THz with intensity above 20 dB w.r.t. the main peak. Up to 80- μ J pulse energy integrated over the full bandwidth is expected, in agreement with experimental pulse energy measurements. A description of the CSR-based scheme for enhanced THz emission parasitic to the FEL is given, together with an outlook of possible upgrades for improving further the TeraFERMI performance.

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