23. Title: Short bunch effect on tabletop THz FEL amplification

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Abstract: A tabletop THz free-electron laser (FEL) amplifier, which consists of a photocathode radio-frequency gun and an undulator, has been studied at the Institute of Advanced Energy, Kyoto University. The concepts of the THz amplifier are (1) a high peak power of about 1 MW, (2) a whole length of less than 4 m, and (3) a spectral range of 150-300 mu m. For the feasibility study for the conceptual design, a start-to-end simulation was conducted by using Parmela and GENESIS 1.3. The slippage effect and the diffraction loss were taken into account in the FEL simulation. An output power of about 350 kW is expected from the present design scheme. The calculation shows that the short bunch electron beam has an advantage toward obtaining a higher FEL gain because of its small energy spread. Since the slippage effect becomes dominant, however, the FEL gain drops with the excessive short bunch beam.