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Sub-fs beam generation at the UCLA Pegasus Laboratory

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We present the design of an experiment aiming at the generation of a moderate energy (4 MeV) single sub-fs electron beam from an RF photoinjector for application in UED and injection in advanced accelerators. The design is based on an envelope equation-based approach to obtain analytical scaling laws for the shortest pulse length achievable using radiofrequency (RF) based bunch compression. The derived formulas elucidate the dependencies on the electron beam energy and beam charge and reveal how relativistic energies are strongly desirable to obtain bunches containing 1 million electrons with single-digit fs pulse lengths. An additional higher frequency RF cavity is implemented, which linearizes the bunch compression, enabling the generation of ultrashort beams in the sub-femtosecond regime. A range of options to measure the sub-fs bunch length will be discussed.

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