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Staging acceleration to improve an energy spread in laser wakefield acceleration

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Laser acceleration of electrons is now considered to be promising for a compact, high-quality, high-energy accelerator scheme. Indeed, there are a lot of publications showing high reproducibility, small emittance (<1 mm mrad), shot pulse duration (\sim fs), high energy (> 1 GeV). Thus the capability to use such beams for a source of compact X-ray free-electron laser. In order to use laser electron accelerators for XFEL drivers, an energy spread of the electron beam is crucial. We are now designing the system composed of an injector, a phase rotator, and a booster. Our goal beam parameters are an energy of >1 GeV, a pulse duration of < 10 fs, an energy spread of $<1\%$, and an emittance of <1 mm mrad. A whole project system is also discussed including a laser system and an compact undulator system.

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