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Laser plasma wakefield accelerators with external injection for soft X-ray free electron laser at PAL-eLABs

Laser-plasma wakefield accelerators (LWFA) have been proposed as a potential solution for compact and high-energy free-electron lasers (FELs). However, the electron beam quality generated by LWFA may not meet the requirements for X-ray FELs. To overcome this challenge, one promising approach is to use an external seed beam from a radiofrequency (RF) photocathode with LWFA. Recently, the Injector Test Facility (PAL-ITF) was reconfigured to include two beam lines, GUN-I and GUN-II, and renamed as the Electron Linear Accelerator for Basic Science (e-LABs). The GUN-I beam line is dedicated to ultrafast electron diffraction (UED) experiments, while the GUN-II beamline is optimized for advanced accelerator experiments with an electron beam featuring an energy of 70 MeV, low emittance, and a jitter in the range of a few tens of femtoseconds. At the GUN-II beamline, we plan to conduct experiments involving LWFA that are injected with an electron beam from the RF gun. This presentation highlights our ongoing research and development plans and presents simulation results for generating soft X-ray FEL pulses using LWFA based on the electron beam generated by the external seed beam from GUN-II at PAL-eLABs.

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