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Implementation of an Active Laser-Beam Stabilization System for Laser-Plasma Electron Accelerator Improvement

Tuesday, 23 July 2024 18:00 (1h 30m)

The Hundred Terawatt Thomson (HTT) laser system at the LBNL BELLA Center operates a laser-plasma accelerator to produce high energy (~100s MeV) electron beams. A second high-intensity laser beam is scattered off of these electrons, boosting the photon energies from the eV to MeV range, in order to produce a tunable source of gamma rays for applications in security and the probing of high-Z or high-density materials [1, 2]. This requires a stable beam of electrons in terms of pointing and position, which in turn necessitates that the laser beam driving the acceleration process is also stable. This presentation will give details on the work towards improving the position and pointing stability of the laser beam driving the electrons, which makes use of commercially available equipment, and builds on previous projects at the LBNL BELLA Center [3, 4]. An overview of the implementation of the system will be presented, and the improvement to the LPA-produced electron beams will be shown in terms of the stability of the spectrum, beam divergence, and beam pointing.

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[1] C. Geddes et al., Impact of monoenergetic photon sources on nonproliferation applications final report, Technical Report, 2017
[2] C. Thornton et al., arXiv:2404.09270v1, 2024
[3] F. Isono et al., High Power Laser Science and Engineering, 9, e25, 2021
[4] C. Berger et al., Physical Review Accelerators and Beams, 26, 032801, 2023

Working group

WG1 : Laser-driven plasma wakefield acceleration

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