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Hybrid LWFA-driven PWFA as a test platform for staged plasma acceleration

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Staging, sequencing plasma accelerator modules, is an important concept for the further development of plasma-based acceleration methods to reach the energy level required for high energy physics applications. In- and out-coupling of drive laser beams as well as matching of the electron beam into the plasma cavity of a subsequent energy booster stage require spatio-temporal control to achieve quality-preserving acceleration. This demands extremely tight tolerance in pointing stability and the ability to precisely monitor the process. In our recent hybrid LPWFA experiments some of these aspects are addressed, using the multibeam capability of the DRACO laser system. Here, one arm (150TW) generates high peak current electron beams in an LWFA stage, which are transported into a downstream plasma module to excite plasma waves. To consistently inject electrons, a synchronized injector laser extracted from the other arm (1PW line) is used, which requires stable spatio (micrometer scale) and temporal (fs scale) overlap with respect to the accelerating plasma cavity. Besides for high quality beam generation, this demonstrates the ability to control positioning of the injector laser aided by ultrafast optical probing. Our unique infrastructure is also applicable for multiple LWFA stages, thus providing a testbed for staging.

Available for oral presentation in a session

Yes

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