

Integrated beam physics for the laser wakefield accelerator project EARLI

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Transition to practical laser wakefield accelerator (LWFA) facilities with users, especially for multi-stage LWFA, requires significantly improving the electron beam quality. An integrated study of the beam dynamics is presented, from the electron beam creation in the plasma to the target, including magnetic elements of the transport line. The focus is made on high-charge (more than one hundred pC), low energy spread (three percent std), and low emittance beams at 200 MeV from the ionization-induced injection mechanism. A refined multi-parameter optimisation of laser and plasma profiles is performed to ensure the best beam outputs. Then, a compact transport and focusing line, design with TraceWin is proposed to ensure maintaining the beam quality from given constraints. These outcomes are part of the EARLI project, which focuses on designing a stand-alone LWFA for the AWAKE collaboration. An integrated design of EARLI has been obtained with exit beam parameters meeting the AWAKE requirements.

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