

All-optical GeV electron bunch generation in a laser-plasma accelerator via truncated-channel injection

martedì 19 settembre 2023 16:25 (20 minuti)

We describe a simple scheme, truncated-channel injection, to inject electrons directly into the wakefield driven by a drive pulse guided by an all-optical plasma channel. We use this approach to generate dark-current-free 1.2 GeV, 4.5% relative energy spread electron bunches with 120 TW laser pulses guided in a 110 mm-long hydrodynamic optical-field-ionized (HOFI) plasma channel. Our experiments and particle-in-cell simulations show that high-quality electron bunches were only obtained when the drive pulse was closely aligned with the channel axis, and was focused close to the density down-ramp formed at the channel entrance. Start-to-end simulations of the channel formation, and electron injection and acceleration show that increasing the channel length to 410 mm would yield 3.65 GeV bunches, with a slice energy spread $5E-4$. We will also present initial results of a follow-up experiment in which a second, perpendicular HOFI channel was used to enhance the control of injection of electrons into the plasma wave driven in an approximately 40 mm-long HOFI channel.

Autori principali: Dr. PICKSLEY, Alex (Lawrence Berkeley National Laboratory); Dr. CHAPPELL, James (John Adams Institute for Accelerator Science and Department of Physics); Sig.na ARCHER, Emily (John Adams Institute for Accelerator Science and Department of Physics); Dr. BOURGEOIS, Nicolas (Central Laser Facility, STFC Rutherford Appleton Laboratory.); Dr. COWLEY, James (John Adams Institute for Accelerator Science and Department of Physics); Prof. EMERSON, David R. (Scientific Computing Department, STFC Daresbury Laboratory); Dr. FEDER, Linus (John Adams Institute for Accelerator Science and Department of Physics); Dr. GU, Xiao-Jun (Scientific Computing Department, STFC Daresbury Laboratory); Sig. JAKOBSSON, Oscar (John Adams Institute for Accelerator Science and Department of Physics); Dr. ROSS, Aimee J. (John Adams Institute for Accelerator Science and Department of Physics); Sig. WANG, Warren (John Adams Institute for Accelerator Science and Department of Physics); Prof. WALCZAK, Roman (John Adams Institute for Accelerator Science and Department of Physics); Prof. HOOKER, Simon (John Adams Institute for Accelerator Science and Department of Physics)

Relatore: Sig.na ARCHER, Emily (John Adams Institute for Accelerator Science and Department of Physics)

Classifica Sessioni: WG1: Plasma-based accelerators and ancillary components

Classificazione della track: WG1: Plasma-based accelerators and ancillary components