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Laser-Ionized Plasma Sources for Plasma Wakefield Accelerators: Alignment Technique, Tolerance, and Applications

Wednesday 13 August 2025 16:00 (2 hours)

Plasma wakefield accelerators (PWFA) are promising candidates for next-generation colliders due to their ability to sustain extremely high acceleration gradients. Laser-ionized plasma sources offer key advantages for PWFA, including precise control over the transverse and longitudinal plasma density profiles for emittance preservation, tunable plasma column widths suited for positron acceleration, and resilience to heat deposition. A critical experimental challenge, however, is the precise alignment of the plasma source to the electron beam and maintaining that alignment over time. We report on a novel alignment technique developed at the Facility for Advanced Accelerator Experimental Tests II (FACET-II), enabling high-precision alignment of a 1-meter-long laser-ionized plasma source to a 10 GeV, 1.6 nC electron beam with a transverse accuracy better than 10 μm, limited primarily by laser pointing jitter. We present our methodology, discuss the alignment tolerances between the drive beam and the laser-ionized plasma, and explore future opportunities for using narrow plasma columns for positron acceleration.

Please consider my poster for contributed oral presentation

Yes

Would you like to submit this poster in student poster session on Sunday (August 10th)

Yes

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: LEE, Valentina (University of Colorado Boulder)

Co-authors: ARINIELLO, Robert (SLAC National Accelerator Laboratory); STOREY, Douglas (SLAC National Accelerator Laboratory); CORDE, Sebastien (SLAC National Accelerator Laboratory); EMMA, Claudio (SLAC National Accelerator Laboratory); GESSNER, Spencer (SLAC National Accelerator Laboratory); HOGAN, Mark (SLAC National Accelerator Laboratory); KNETSCH, Alexander (Laboratoire d'Optique Appliquée); MAJERNIK, Nathan (SLAC National Accelerator Laboratory); O'SHEA, Brendan (SLAC National Accelerator Laboratory); LITOS, Michael (University of Colorado Boulder)

Presenter: LEE, Valentina (University of Colorado Boulder)

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