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Field mapping of blowout regime CO₂-laser-driven LWFA at low density using electron beam probing

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Laser wakefield accelerators (LWFAs) have been successful in experimentally producing sustained gradients of tens of GeV/m over tens of centimeters. While the strength of these fields has been demonstrated, a direct measurement of the field configurations inside an LWFA especially at low densities is a huge challenge. Here, we report on the results of transverse electron beam probing of the fields inside an LWFA at densities of 10^{15} — 10^{17} cm^{-3} , corresponding to plasma wavelengths in the range of several hundred microns. The LWFA is driven by BNL Accelerator Test Facility's unique long-wave-infrared CO₂ laser (9.2 μm) pulse, which currently generates 2 ps long pulses at 2-3 TW. The linac-produced electron beam has an energy of 50-60 MeV and about a 200 fs long bunch length. A YAG:Ce scintillator placed on a translation stage records the electron beam density profile at distances of up to 10 cm from the plasma. Particle-In-Cell Simulations using OSIRIS are used to corroborate the results of the experiment.

Working group

WG1 : Laser-driven plasma wakefield acceleration

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