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# Characterization of the fields inside the CO2-laser-driven wakefield accelerators using relativistic electron beams

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The $CO_2$ laser at the Accelerator Test Facility of Brookhaven National Laboratory is a unique source generating 2 ps-long, multi-TW pulses in the mid-IR regime. This rapidly evolving system opens an opportunity for generation of large bubbles in low density plasmas (~$10^{16}$ $cm^{-3}$) that are ideal for acceleration of externally injected electron beams. A new generation of diagnostic tools is needed to characterize the fields inside such structures and to improve the means of external injection. In recent years, the electron beam probing technique has shown to be successful in direct visualization of the plasma wakefields. Here we present a new method utilizing the electron beam probing and Transmission Electron Microscopy (TEM) grids that will allow us to selectively illuminate different portions of the wake and to characterize the electric field strength within the wake based on the location of the focal point of the probe beamlets. The analytical evaluation of the approach, supporting simulation results, and recent experimental progress will be presented and discussed.

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