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Simulation studies on externally injected CO2 driven LWFA

Tuesday, 23 July 2024 18:00 (1h 30m)

We explore the possibility of using a CO2-laser driven, self-guided wakefield accelerator as a stage for the acceleration of externally injected electron beams.

Optimal conditions for acceleration were explored through 2d and quasi-3D PIC simulations with FBPIC and WarpX. Parameters and regimes are specified by linear accelerator and CO2 laser at ATF facility in Brookhaven National Lab (BNL) [1]. Comparison studies are conducted between 800nm and 9200nm with same externally injected Gaussian beams. Multiple regimes have been explored, including : matched-laser-spot blown-out regimes (with no self-injection), quasi-nonlinear regime (1<a0<4) with matched-electron beam, and possible "re-phasing" scheme.

We look at the emittance, energy spread and divergence to determine the optimal external injection scheme. Injection misalignments between beam and laser are also considered for a robust external-injection system. Lastly, we started a machine learning initiative to guide future external-injection experiments.

[1] Zgadzaj, R., Welch, J., Cao, Y. et al. Plasma electron acceleration driven by a long-wave-infrared laser. Nat Commun 15, 4037 (2024).https://doi.org/10.1038/s41467-024-48413-y

Working group

WG1 : Laser-driven plasma wakefield acceleration

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