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Comparison of quasi-3D and full-3D laser wakefield PIC simulations using azimuthal mode decomposition THAMINE DALICHAOUCH, PEICHENG YU, ASHER DAVIDSON, WARREN MORI, University of California Los Angeles, JORGE VIEIRA, RICARDO FONSECA, IST Portugal — Laser wakefield acceleration (LWFA) has attracted a lot of interest as a possible compact particle accelerator. However, 3D simulations of plasma-based accelerators are computationally intensive, sometimes taking millions of core hours on today's computers. A quasi-3D particle-In-cell (PIC) approach has been developed to take advantage of azimuthal symmetry in LWFA (and PWFA) simulations by using a particle-in-cell description in r-z and a Fourier description in φ. Quasi-3D simulations of LWFA are computationally more efficient and faster than Full-3D simulations because only first few azimuthal harmonics are needed to capture the physics of the problem. We have developed a cylindrical mode decomposition diagnostic for 3D Cartesian geometry simulations to analyze the agreement between full-3D and quasi-3D PIC simulations of laser and beam-plasma interactions. The diagnostic interpolates field data from Full-3D PIC simulations onto an irregular cylindrical grid (r, φ, z). A Fourier decomposition is then performed on the interpolated 3D simulation data along the azimuthal direction. This diagnostic has the added advantage of separating out the wakefields from the laser field. Preliminary results for this diagnostic of LWFA and PWFA simulations with symmetric and nearly symmetric spot sizes as well as of laser-plasma interactions using lasers with orbital angular momentum (higher order Laguerre-Gaussian modes) will be presented.

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