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Lorentz boosted frame simulation of Laser wakefield acceleration in quasi-3D geometry[1] PEICHENG YU, XINLU XU, ASHER DAVIDSON, ADAM TABLEMAN, MICHAEL MEYERS, THAMINE DALICHAOUCH, FRANK TSUNG, VIKTOR DECYK, UCLA, FREDERICO FIUZA, SLAC, JORGE VIEIRA, RICARDO FONSECA, IST, Portugal, WEI LU, Tsinghua Univ., Beijing, LUIS SILVA, IST, Portugal, WARREN MORI, UCLA — We present results on a systematic study of Particle-In-Cell simulation of Laser Wakefield Acceleration (LWFA) by combining the Lorentz boosted frame technique with the quasi-3D algorithm, in which fields are expanded into azimuthal harmonics and solved on an $r-z$ PIC grid keeping only a few harmonics. The studies emphasize on LWFA in the nonlinear blowout regime, which is more challenging from a computational standpoint. We first discuss strategies for eliminating the numerical Cerenkov instability (NCI) that inevitably arises due to the presence of plasma drifting across the grid with relativistic speeds in quasi-3D geometry. These strategies work for FFT based Maxwell solvers. We have incorporated these mitigation strategies into our PIC code OSIRIS by adding a new hybrid Yee-FFT Maxwell solver. With these strategies, OSIRIS can now be used to combine the quasi-3D algorithm and Lorentz boosted frame technique, and carry out high fidelity LWFA boosted frame simulation with no evidence of the NCI in the quasi-3D geometry, leading to unprecedented speedups.

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