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Using Quasi-3D OSIRIS simulations of LWFA to study generating high brightness electron beams using ionization and density downramp injection[1] THAMINE DALICHAOUCH, ASHER DAVIDSON, XINLU XU, PEICHENG YU, FRANK TSUNG, WARREN MORI, UCLA, FEI LI, CHAOJIE ZHANG, WEI LU, Tsinghua University, JORGE VIEIRA, RICARDO FONSECA, IST Portugal — In the past few decades, there has been much progress in theory, simulation, and experiment towards using Laser wakefield acceleration (LWFA) as the basis for designing and building compact x-ray free-electron-lasers (XFEL) as well as a next generation linear collider. Recently, ionization injection and density downramp injection have been proposed and demonstrated as a controllable injection scheme for creating higher quality and ultra-bright relativistic electron beams using LWFA. However, full-3D simulations of plasma-based accelerators are computationally intensive, sometimes taking 100 millions of core-hours on todays computers. A more efficient quasi-3D algorithm was developed and implemented into OSIRIS using a particle-in-cell description with a charge conserving current deposition scheme in $r - z$ and a gridless Fourier expansion in ϕ. Due to the azimuthal symmetry in LWFA, quasi-3D simulations are computationally more efficient than 3D cartesian simulations since only the first few harmonics in are needed ϕ to capture the 3D physics of LWFA. Using the quasi-3D approach, we present preliminary results of ionization and down ramp triggered injection and compare the results against 3D LWFA simulations.

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