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Generating high brightness electron beams using density down ramp injection in nonlinear plasma wakefields[1] THAMINE DALICHAOUCH, XINLU XU, ASHER DAVIDSON, PEICHENG YU, WEIMING AN, CHAN JOSHI, CHAOJIE ZHANG, WARREN MORI, Univ of California - Los Angeles, FEI LI, WEI LU, Tsinghua University, RICARDO FONSECA, IST Portugal — In the past few decades, there has been much progress in theory, simulation, and experiment towards using Plasma wakefield acceleration (PWFA) and 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 controllable injection schemes for generating high quality relativistic electron beams. We present the concepts and full 3D simulation results using OSIRIS which show that downramp injection can generate electron beams with unprecedented brightnesses. However, full-3D simulations of plasma-based acceleration can be computationally intensive, sometimes taking millions of cpu-hours. Due to the near azimuthal symmetry in PWFA and LWFA, quasi-3D simulations using a cylindrical geometry are computationally more efficient than 3D Cartesian simulations since only the first few harmonics are needed in ϕ to capture the 3D physics of most problems. We also present results from the quasi-3D approach on downramp injection and compare the results against full 3D simulations.

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Thamine Dalichaouch
Univ of California - Los Angeles

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