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A 3D PIC simulation study of lwfa for ∼50fs lasers: 5-1000tw MICHAIL TZOUFRAS, WEI LU, FRANK TSUNG, CHANDRASHEKHAR JOSHI, WARREN MORI, UCLA, RICARDO FONSECA, LUIS SILVA, IST Portugal — In light of the exciting recent progress in demonstrating the potential of laser plasma interaction to generate monoenergetic electron beams [1]-[4] and the development of a kinetic theory for the blowout regime [6] we have carried out a simulation study for current and near future lasers. Hence we present a series of 3D PIC simulations with the code OSIRIS for electron acceleration via LWFA. The simulations scan the SMLWFA regime to the ultra-relativistic blowout regime. We first compare the simulation results with the experiments [2]-[5] and argue that quantitative predictions using simulations are reliable. Our simulations indicate that the generation of GeV, nC monoenergetic electron beams with no external guiding requires laser power higher than 100TW. The differences between using a channel or a uniform plasma and additional phenomena that were observed in the simulations and affect the resulting electron beam quality are discussed. [1] F.S.Tsung et al, Phys. Rev. Lett., 93, 185002 (2004). [2] Mangles et al, Nature, 431, 535 (2004) [3] Geddes et al., Nature, 431, 538 (2004) [4] Faure et al., Nature, 431, 541 (2004) [5] V.Malka Phys. Plasmas 8, 2605 (2001) [6] W.Lu et al. Phys. Rev. Lett., submitted. Simulations performed at the Dawson cluster under support by nsf grant nsf phy-0321345. Work supported by de-fg02-er54721.

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