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Optimal scaling for LWFA in the ultra-relativistic blowout regime: efficient generation of 1Gev+ mono-energetic beams WEI LU, MICHAIL TZOUFRAS, FRANK S. TSUNG, CHAN. JOSHI, WARREN B. MORI, UCLA, LUIS O. SILVA, RICARDO FONSECA, IST Portugal, UCLA COLLABORATION, IST PORTUGAL COLLABORATION — Last year, both simulations [1] and experiments [2,3,4] showed that 100∼200 MeV mono-energetic electron beams can be produced when 10∼30 TW lasers were sent through mm's of plasma. PIC simulations show that all the experiments just reach the margin of a new regime of LWFA (Ultra-relativistic blowout regime or bubble regime) which has the following characteristics: spherical ion cannel, electron self-injection and self-guided laser propagation. In this poster, we will clarify the conditions for this regime to be reached and give scaling laws for the output beam energy, charge and energy conversion efficiency based on a nonlinear wakefield theory in the blowout regime. Optimal scaling laws for laser and plasma parameters are described which suggest that this regime can be scaled towards Gev or even Tev energies. Recently, we have verified this scaling law by simulating 0.1∼1GeV stages using a 30∼50fs 10∼200TW lasers. Details of the theory and simulations will be presented. Work supported by DOE de-fg03-92er40727, de-fc02-01er41179, de-fg02-er54721and NSF nsf phy-0321345. Simulations are done on Dawson cluster. [1] F.S.Tsung et al., *PRL*, **93**, 185002 (2004) [2] Mangles et al., *Nature*, **431**, 535 (2004) [3] Geddes et al., *Nature*, **431**, 538 (2004) [4] Fauve et al., *Nature*, **431**, 541 (2004)

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