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Low noise particle in cell simulations of laser plasma accelerator stages[1] ESTELLE CORMIER-MICHEL, D.L. BRUHWILER, B.M. COWAN, J.R. CARY, Tech-X Corporation, C.G.R. GEDDES, E. ESAREY, C.B. SCHROEDER, W.P. LEEMANS, Lawrence Berkeley National Laboratory — Because of their ultra-high accelerating gradient, laser plasma accelerators (LPA) are contemplated for the next generation of high-energy colliders and light sources. The upcoming BELLA project will explore acceleration of electron bunches to 10 GeV in a meter long plasma. Particle-in-cell (PIC) of experiments get more challenging as applications require lower energy spread and emittance beams, and particle noise artificially increases those quantities. We show that calculating the beam self-fields using a static Poisson solve in the beam frame dramatically reduces noise, allowing for more accurate simulation of the beam evolution. In particular, this method gets correct cancellation of the beam transverse fields, eliminating artificial self-forces usually present in the PIC algorithm. This method is used to simulate high efficiency BELLA relevant LPA stages, where methods such as plasma tapering or high-order laser modes are explored.

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Estelle Cormier-Michel
Tech-X Corporation

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