Abstract Submitted
for the GEC05 Meeting of
The American Physical Society

Convergence of particle-in-cell simulations MILES M. TURNER, Dublin City University, Ireland — Particle-in-cell simulations are widely used for benchmarking other simulation methods and other purposes where a highly accurate representation of the physics is desired. In such cases, it is necessary to establish, among other things, that the simulation is fully converged with respect to all numerical parameters. There are generally accepted criteria or rules of thumb for selecting the numerical parameters to be used in particle-in-cell simulation. In this paper, we show that there are cases where the usual rules of thumb do not deliver satisfactory convergence, and indeed that such convergence is difficult to achieve at all. These issues are associated with a degradation of the kinetic properties of the particle-in-cell simulation that occurs when Monte Carlo collisions are introduced. In particular, the rate of numerical thermalization is greatly increased when the frequency of Monte Carlo collisions is large. Since this thermalization rate is a function of the number of simulation particles, it follows that a much greater number of particles may be required than is commonly assumed.

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Date submitted: 10 Jun 2005 Electronic form version 1.4