APPLICATION OF ADAPTIVE MESH REFINEMENT TO PIC SIMULATIONS IN INERTIAL FUSION*

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We have recently merged AMR with the Particle-In-Cell (PIC) method for simulation of plasmas and particle beams. The application of AMR to plasma modeling poses significant challenges, including the introduction of spurious forces on simulation particles. We have carried out a detailed analysis of the coupling of the two methods and, in collaboration with the developers of the popular Chombo package for AMR, have developed practical methods and demonstrated their effectiveness on electrostatic Particle-In-Cell simulations of intense ion beams [1]. Initial successes include major savings of computational effort in simulations of time-dependent space-charge-limited flow (in a 5-D phase space); and demonstrations of numerical convergence. Most recently, the merger of the PIC code WARP (developed for Heavy Ion Fusion studies) and Chombo has been accomplished. The application of AMR to electromagnetic plasma modeling is even more challenging; we have introduced a new methodology using recently developed Absorbing Boundary Conditions, and are beginning to employ it on laser-plasma interaction in the context of fast-ignition.

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1 J.-L. Vay et al, Mesh refinement for particle-in-cell plasma simulations: Applications to and benefits for heavy ion fusion, Laser and Particle Beams **20** (2002) 569-575.