Abstract Submitted
for the GEC10 Meeting of
The American Physical Society

Performance Improvement of a Particle-in-Cell Simulation Using Graphic Processing Units SEOK WON HWANG, SANG-YOUNG CHUNG, HAE JUNE LEE, Pusan National University — Millions or of time steps are needed to reach a steady state in a conventional plasma discharge simulations or to simulate electron beam acceleration to the energy of several hundred MeV in a laser-plasma interaction. A graphic processing unit (GPU) has several hundred arithmetic logic units (ALUs), and thus it is adequate to solve problems with a single instruction multiple data (SIMD) algorithm. To improve the performance of particle-in-cell (PIC) simulations using GPUs, particle push algorithms as well as the field solver must be parallelized in a simulation. In parallel codes using GPUs, most of calculation time is allocated at the memory access between GPU processors and GPU memory. Therefore, removal of the bottleneck of memory access is an important factor for a performance improvement. To reduce the bottleneck, the information of simulation particles is needed to be rearranged in memory. In this work, the methods to reduce simulation times in the parallelization with GPU are suggested, and the comparison of performance improvement are presented for various factors.

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Date submitted: 11 Jun 2010 Electronic form version 1.4