Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Codesign approach towards an Exascale scalable plasma simulation code J. AMAYA, J. DECA, M.E. INNOCENTI, A. JOHNSON, G. LAPENTA, KU Leuven, S. MARKIDIS, KTH, V. OLSHEVSKY, A. VAPIREV, KU Leuven — Particle in cell simulations represent an excellent paradigm for codesign efforts. PIC codes are simple and flexible with many variants addressing different physics applications (e.g. explicit, implicit, hybrid, gyrokinetic, fluid) and different architecture (e.g. vector, parallel, GPU). It is relatively easy to consider radical changes and test them in a short time. For this reason, the project DEEP funded by the European Commission (www.deep-project.eu) and the Intel Exascience Lab (www.exascience.com) have used PIC as one of their target application for a codesign approach aiming at developing PIC methods for future exascale comupters [1]. The starting point is the iPic3D implicit PIC approach [2]. Here we report on the analysis of code performance, on the use of GPUs and the new MICs (Intel Xeon processors). We describe how the method can be rethinked for hybrid architectures composed of MICs and CPUs (as in the new Deep Supercomputer in Juelich, as well as in others). The focus is on a codesign approach where computer science issue motivate modifications of the algorithms used while physics constraints what should be eventually achieved.

[1] G. Lapenta et al, doi.ieeecomputersociety.org/10.1109/MCSE.2012.86
[2] S. Markidis et al, Math. Comput. Simul. 80.7 (2010): 1509-1519

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Date submitted: 12 Jul 2013 Electronic form version 1.4