Abstract Submitted
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Development of Novel Computational Methods for Plasma-Based Particle Accelerators Modeling[1] OLGA SHAPOVAL, JEAN-LUC VAY, REMI LEHE, MAXENCE THEVENET, Lawrence Berkeley National Laboratory, HENRI VINCENTI, CEA, France — High-fidelity modeling and high-performance computing are essential components for advancing state-of-the-art experimental plasma-based particle accelerators. WarpX is a new tool for exascale Particle-In-Cell (PIC) simulation of plasma-based accelerators. It is being developed by a collaboration of researchers from LBNL, SLAC and LLNL within the U.S. Department of Energy's Exascale Computing Project. WarpX combines the most advanced numerical algorithms that include ultrahigher-order Pseudo-Spectral Analytical Time-Domain (PSATD) Maxwell solvers. The spectral solver offers arbitrary order with low numerical dispersion at any wavelength and angle and becomes dispersion-free at infinite order. It also enables efficient algorithms for mesh refinement and PIC algorithms with large time steps. However, it required the development of a novel algorithm for the application of Perfectly Matched Layers (PML) for open boundary problems. We present a novel two-step PML formulation that can be applied to any type of Maxwell solvers, including the PSATD solver. We will discuss the efficiency and performance of the algorithm, and provide examples of its application. We will also discuss a novel algorithm for PIC algorithms with large time steps.

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