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Accurate modeling of plasma accelerators with arbitrary order pseudo-spectral solvers

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Numerical Cherenkov radiation (NCR) is a numerical artefact in PIC codes which results from inaccurate modeling of the electromagnetic dispersion relation. It can be a dominant source of spurious beam quality degradation in terms of emittance and energy spread. As a result of their high spectral precision pseudo-spectral solvers suppress NCR. However, due to the global nature of these solvers they are unsuited for parallelisation by domain decomposition. Arbitrary order pseudo-spectral solvers can provide the needed locality for parallelisation, but they can again suffer from NCR. Here we show at the example of the PIC code FBPIC, that even for problems of plasma accelerators with high beam charge, low grid resolution and long propagation distance already low orders of these solvers are sufficient to correctly model the physics of interest while also offering the locality needed for parallelisation.

Primary author: Mr JALAS, Soeren (Center for Free-Electron Laser Science and Department of Physics, University of Hamburg)

Co-authors: MAIER, Andreas (CFEL/UHH); Dr VINCENTI, Henri (Lawrence Berkeley National Laboratory); DORNMAIR, Irene (University of Hamburg); VAY, Jean-Luc (Berkeley Lab); Mr KIRCHEN, Manuel (University of Hamburg); Dr LEHE, Remi (Lawrence Berkeley National Laboratory)

Presenter: Mr JALAS, Soeren (Center for Free-Electron Laser Science and Department of Physics, University of Hamburg)

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