

Tiny PhD update

AMR Multigrid using Trilinos

Matthias Frey

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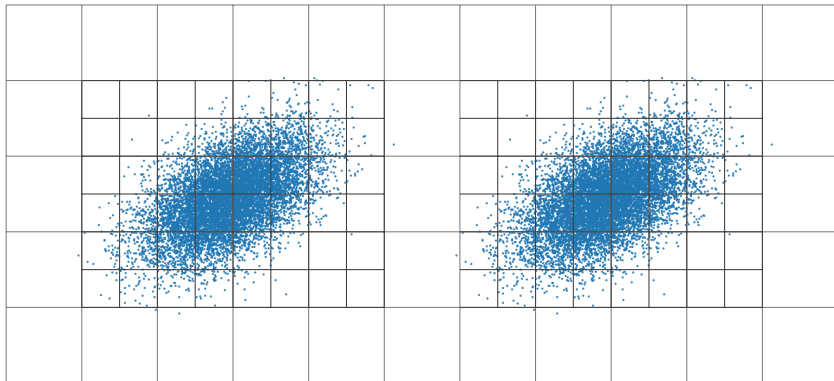
Outline

- 1 PhD project reminder
- 2 AMR Multigrid Solver
- 3 Outlook

PhD project reminder

Precise Simulations of Multi Bunches in High Intensity Cyclotrons

- Adaptive Mesh Refinement (AMR): *AMReX* (formerly: *BoxLib*)
 - Poisson equation: $\Delta\phi = -\frac{\rho}{\epsilon_0}$
 - Mesh-based space charge computation



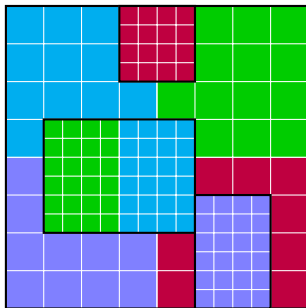
AMR Multigrid Solver

- **Activity:** Implementing an AMR multigrid solver based on Cartwright's algorithm using Trilinos.
- **Motivation:**
 - AMReX multigrid solver only **Dirichlet** and **Neumann BCs**
→ **Open BC**
 - Including **beam-pipe geometry** in computation like **SAAMG** in OPAL (term project?)
 - Something new.

AMR Multigrid Solver (cont.)

- **Challenges:**

- Interface between AMReX and Trilinos:
Setting up all matrices correctly, i.e. restriction matrix, interpolation matrix, boundary matrix, Poisson matrix (w.r.t. boundaries)
- Covered grids may **not** belong to same process as refined grids.

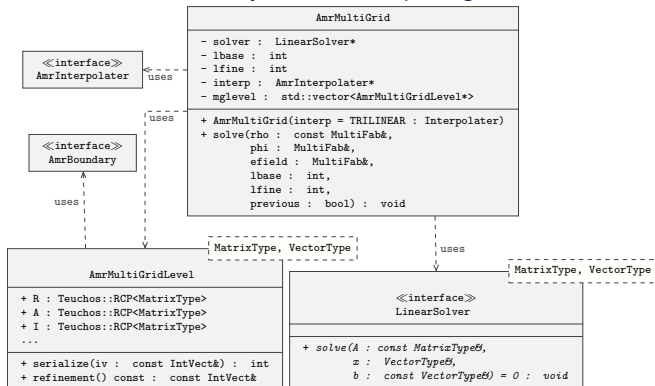


Example of a domain decomposition by cores. E.g. P_0 , P_1 , P_2 , P_3 .

AMR Multigrid Solver (cont.)

Challenges:

- Make an extendable code w.r.t. interpolation scheme, boundary conditions, base solver, maybe also AMR package, ...



Incomplete UML diagram for the multigrid algorithm.

Outlook

- Testing 2D solver and then 3D solver
- Moving standalone code into AMR-OPAL
- Benchmarking of new solver (strong and weak scaling)
- OPAL → OPALeX :P