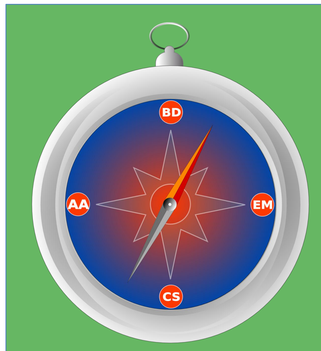
Accelerator Simulation and Parallel Computing

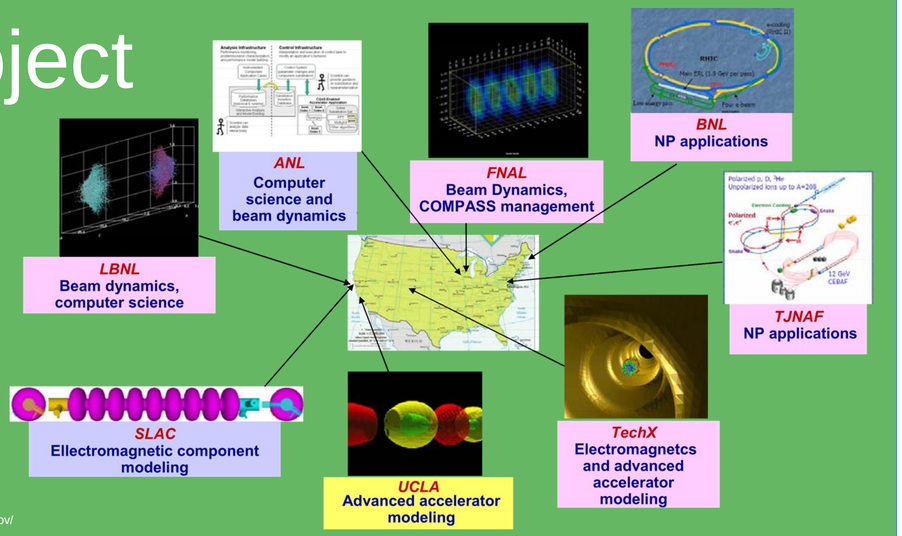


COMPASS – a SciDAC2 Project

Led by Fermilab, the community Petascale for Accelerator Science and Simulation project, funded by the Offices of High Energy Physics, Nuclear Physics, basic Energy Sciences and the Office of Advanced Scientific Computing Research, will develop a comprehensive computational infrastructure for accelerator modeling and optimization.

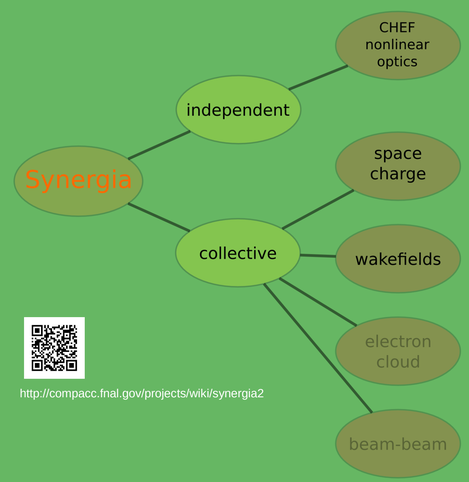
SciDAC
Scientific Discovery through Advanced Computing

https://compass.fnal.gov/



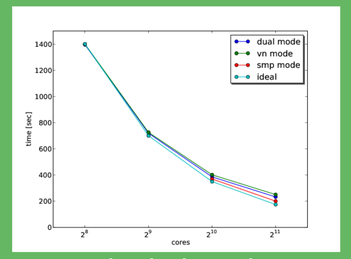
Synergia2

Developed at Fermilab, Synergia2 is a parallel framework for simulation of collective effects in accelerator physics. The code is C++ and Python for optimum performance and flexibility.

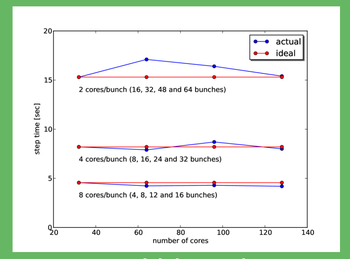


http://compacc.fnal.gov/projects/wiki/synergia2

Existing Synergia2 Pure MPI Implementation



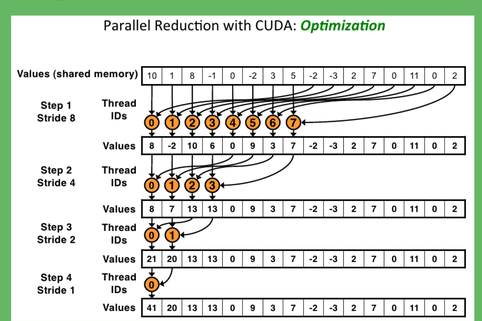
single bunch
strong scaling

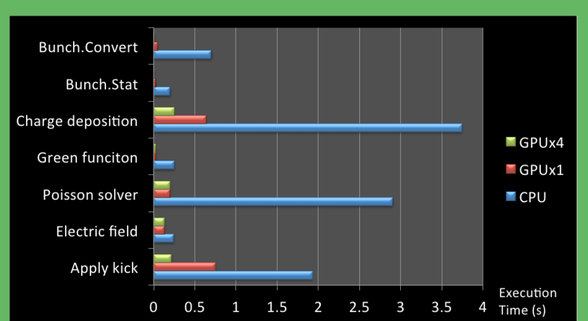


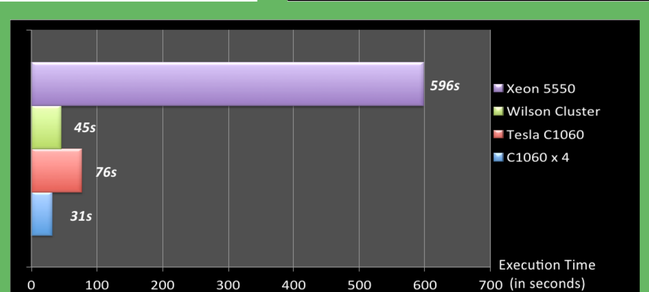
multi-bunch
weak scaling

Preparing Synergia2 for Exascale

Hybrid MPI-CUDA Version Under Development

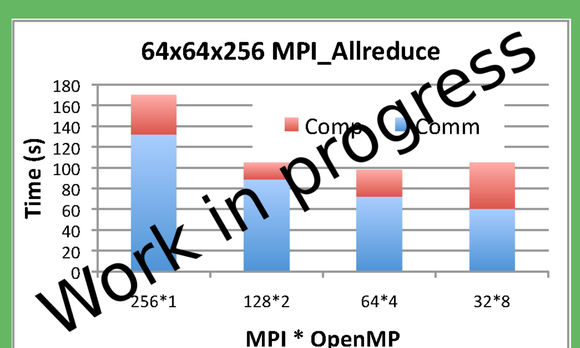






Both approaches utilize communication avoidance for improved scalability in multi-level parallelism

Hybrid MPI-OpenMP Version In Progress



The hybrid MPI-OpenMP version of Synergia2 is a work in progress. The above results display the speedup vs. plain MPI in a preliminary implementation.