



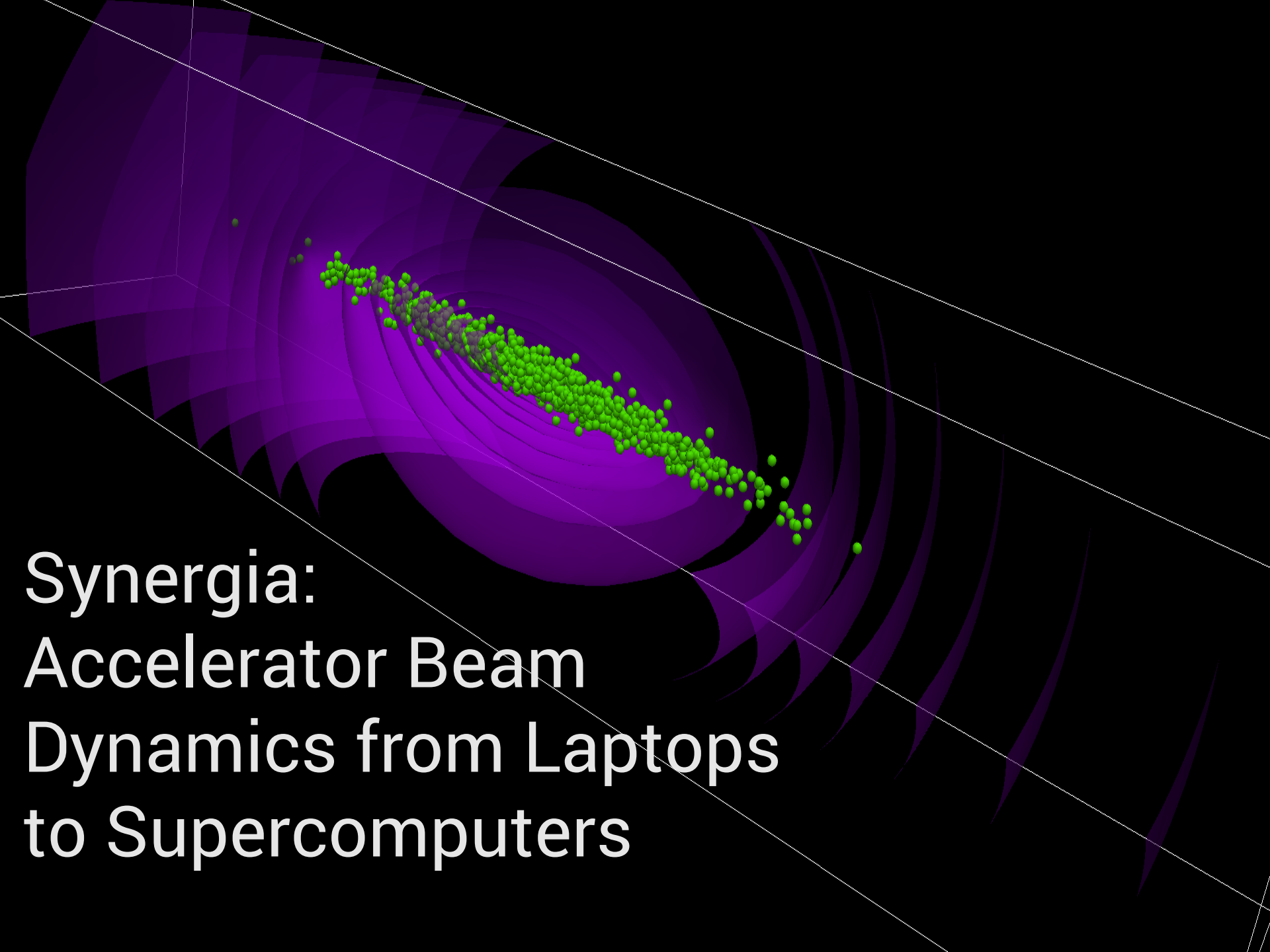
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Build and Release Issues in Accelerator Modeling

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HSF Packaging

2015-06-23



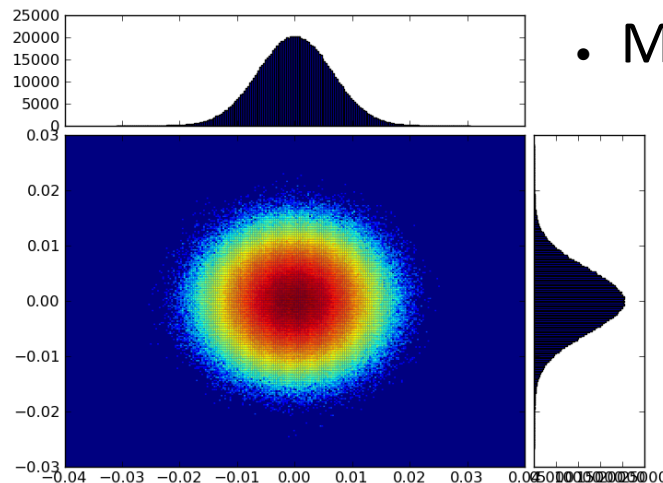
Synergia:
Accelerator Beam
Dynamics from Laptops
to Supercomputers

???

- We have a different set of requirements than HEP experiments
 - Some of our current issues are your future issues (supercomputers)
- We represent two collaborations
 - ComPASS: Community Project for Accelerator Science and Simulation <https://web.fnal.gov/collaboration/compass/SitePages/Home.aspx>
 - Focus on research and development
 - CAMPA: Consortium for Advanced Modeling of Particle Accelerators <http://hepfce.org/consortium-for-advanced-modeling-of-particle-accelerators-campa/>
 - Focus on development and support
- HEP relies on accelerators...

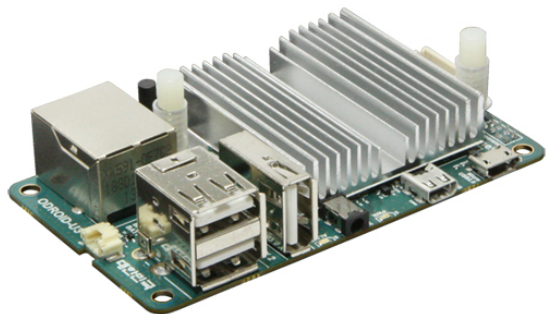
Accelerator Modeling

- Existing and planned accelerators
 - 1,000s of elements
 - 10s of *types* of elements
 - 1,000s to 1,000,000s of revolutions
 - 1-1000s of bunches of $O(10^{12})$ particles
- 50-1000 steps/revolution
- Internal and external fields
 - External field calculations trivially parallelizable
 - Internal field calculations require PIC
- Minimal bunch/field structure



Platforms

- Synergia runs on a wide variety of platforms



ODROID-U3
(ARM A9)



Linux clusters



Cray



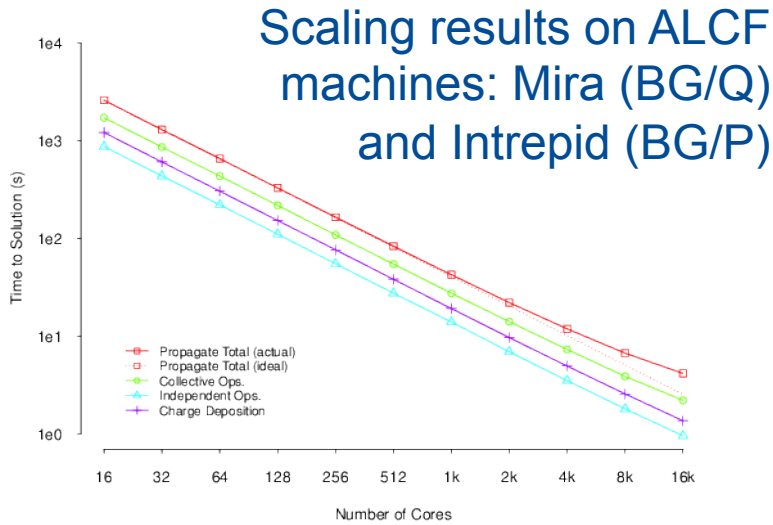
laptops and desktops



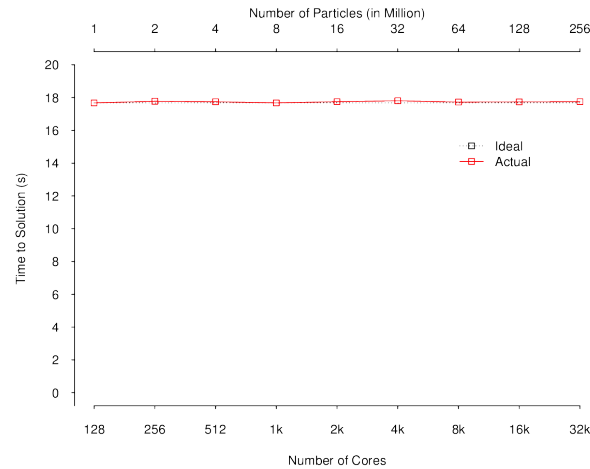
Blue Gene

Scaling

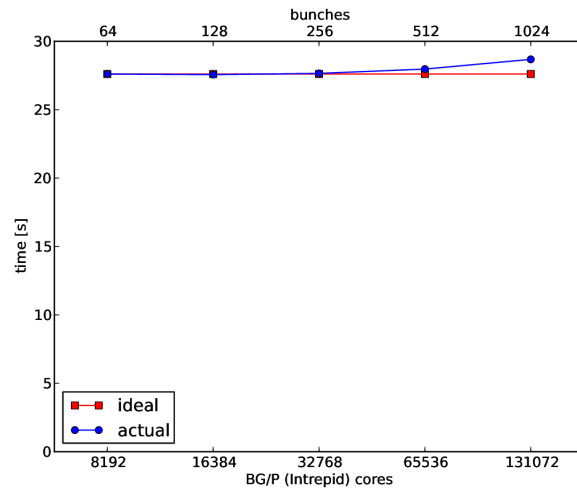
- Synergia
 - Single- and multiple-bunch simulations



Single-bunch strong scaling from 16 to 16,384 cores
 32x32x1024 grid, 105M particles



Weak scaling from 1M to 256M particles
 128 to 32,768 cores



Weak scaling from 64 to 1024 bunches
 8192 to 131,072 cores
 Up to over 10^{10} particles

Requirements

Our requirements differ in several ways from those of HEP Experiments:

- More like an application (say, LibreOffice) than an environment
 - Casual users don't expect to adapt their configurations
- Portability is key
 - Laptops/desktops are important
 - HPC Linux clusters often have custom configurations
 - Specialized networking
 - Supercomputers are weird
 - We have no control over them
 - Compilers are customized

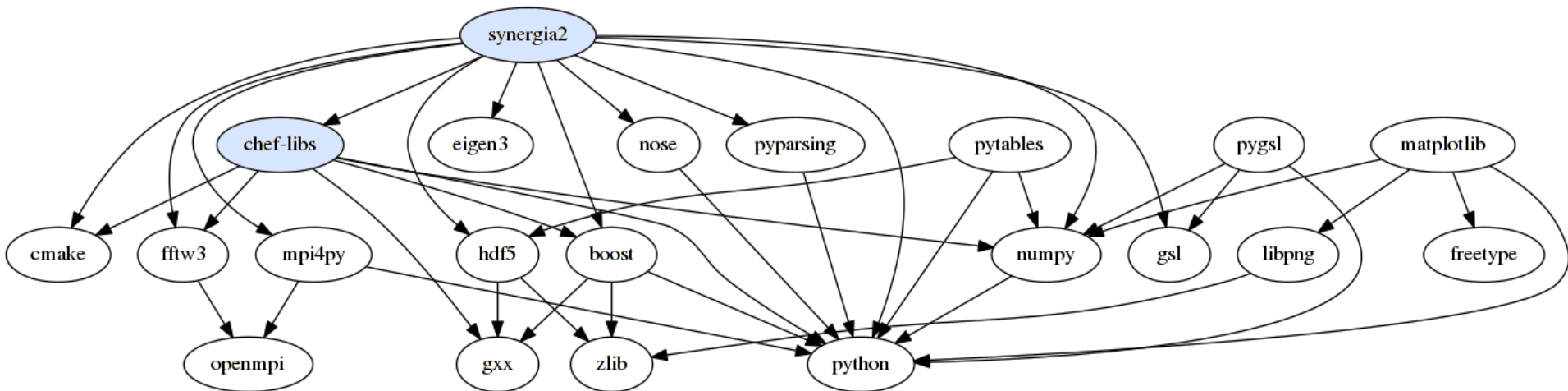
Typical case: Intel would like to run a benchmark of our code on their test hardware. Their engineers want to compile and run on the test system.

System Packages

We use as many system packages as possible, including (especially!) compilers.

- Building your own compiler is rarely an option on supercomputing systems
- Desktop users don't understand why installing Synergia would take 2 Gb of disk space.
- We have a rigorous unit test suite
 - We are confident that we are getting the right answer as long as the tests pass

What we have in common with HEP experiments



Building Synergia

Synergia:

<https://web.fnal.gov/sites/synergia/SitePages/Synergia%20Home.aspx>

Synergia code:

<https://cdcv.s.fnal.gov/redmine/projects/synergia2>

Synergia build instructions:

<https://cdcv.s.fnal.gov/redmine/projects/contract-synergia2/wiki/>

[Download and build the current Synergia release](#)

```
git clone http://cdcv.s.fnal.gov/projects/contract-synergia2 \
synergia2-devel
cd synergia2-devel
git checkout -b devel origin/devel
./bootstrap
./contract.py
```

Contractor

Contractor: <https://cdcv.s.fnal.gov/redmine/projects/contractor/wiki>
Remarkably similar to Worch (entirely unrelated, however)

Very small: < 2700 lines of Python

A few key differences:

- Package descriptions are Python code and can contain logic
- No external build system
 - nodes.py: 235 lines
- Has mechanism for discovering system packages
 - Used for defaults
 - Users can always choose which system packages to use and which to build