Συνεργεια

Advanced Accelerator Simulation Project Status & Plans

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9/20/05

http://cepa.fnal.gov/psm/aas/Advanced_Accelerator_Simulation.html

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Goals *(from 04/05/05)*

- Synergia v2.0 (full Python steering)
  - implement new physics modules
  - implement new solvers
  - sync with the "gourmet libraries" (mxyzptlk, etc)
- New Applications
  - Beam-beam @ Tevatron (implement model; first results)
  - MI electron cloud (generation & dynamics)
- "Old" applications (space-charge, using Synergia v1.0)
  - FNAL Booster, ILC damping ring (new "old" application)

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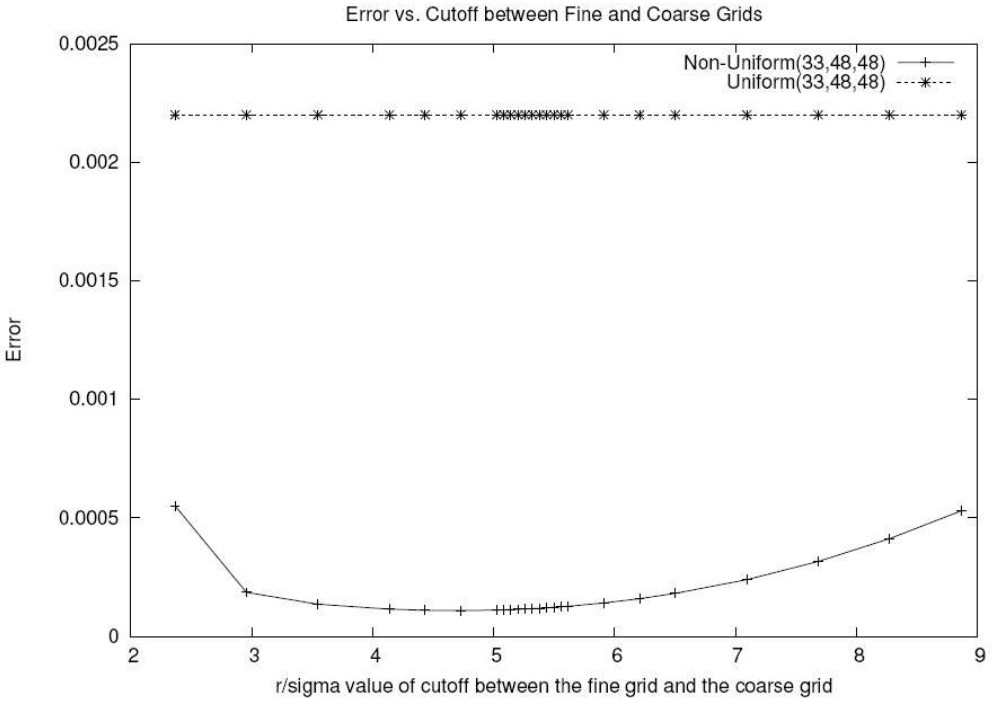
Synergia v2.0

- Fully functional framework a few weeks away
  - Wrapped space-charge module -FFT solver- (F90/Python bindings) -- TechX
  - Build system complications worked out
  - "gourmet" libraries (C++) Python bindings OK
  - sync development with current "gourmet" repository

➧ need to put everything together

v2.0 related activities

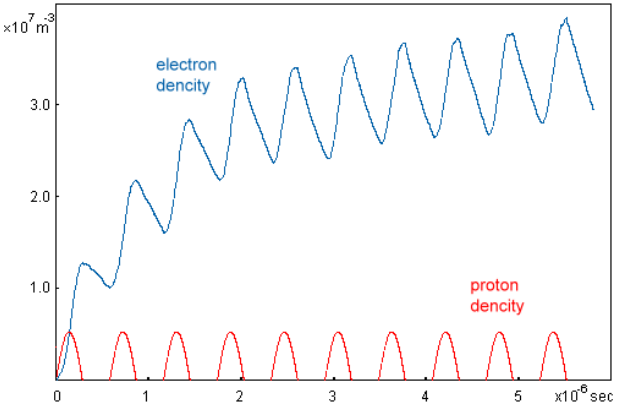
- multi-scale mesh solver (smart man's adaptive) for asymmetric beams (ILC DR)
  utilize SciDAC tools: PETSc multi-grid library
- Prototype solver implemented (Megan Smedinghoff – summer student)

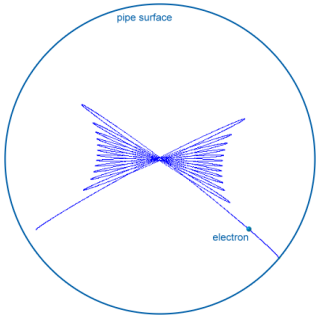


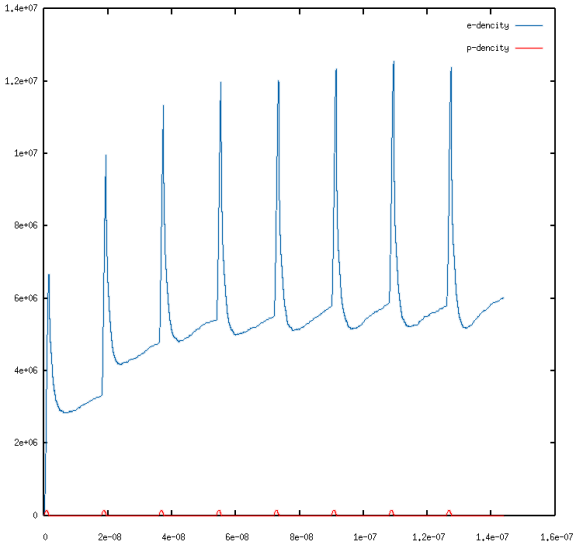
http://cepa.fnal.gov/psm/aas/publications_presentations.html

v2.0 activities

- Electron cloud generation
  - use M. Furman's library TechX packaged
  - Ivan Sadovsky (summer student) prototype to model cloud generation
- Electron cloud effect on primary beam (next)
  - SciDAC module (plasma)







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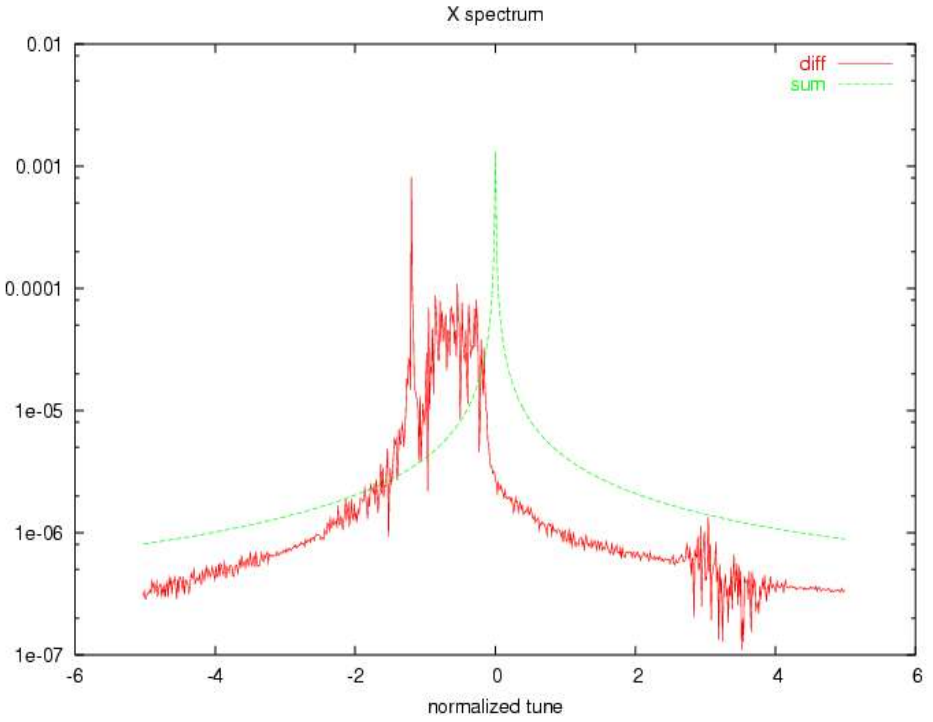
Beam beam

- Tevatron model implemented (E.Stern)
- First "reality checks" OK
- Collaboration with AD (OK, but...)

sigma and pi modes from one on one head-on bunches



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Comments

- We are a couple of months behind schedule for v2.0 and beam-beam
  - my bad planning (summer effect && appreciate difficulty of all details)
- Need to push Tev detailed studies
- Need wakefields for Booster
  - expected to be important by some (not me...)

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Synergia v1.0 activities

- Booster, detailed studies of injection parameters (D.McCarron, IIT)
- Performance analysis (Z.Lan & student, CS, IIT)
  - this really studies the FFT solver, valid for v2.0 too
  - port to NCSA clusters BlueGene/L

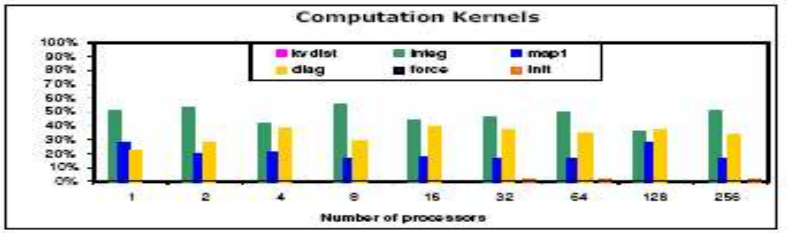

Figure 3. Relative Percentage of Computational Kernels

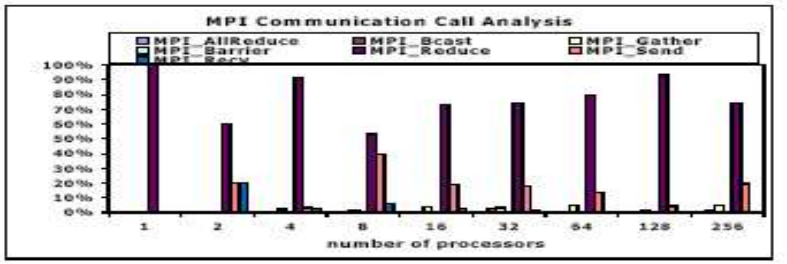

Figure 4. Relative Percentage of Communication Calls

SC05 poster

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Plans/current activities

- Detailed Tev beam-beam (next 2 months)
- e-cloud MI (include dynamic effects 3 months)
- First v2.0 application (2 months)
  - Wakefields (semi-analytical) and space-charge in Booster
  - ILC damping ring (will be first self consistent simulation); use new solver

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Plans/current activities

- CHEF ("Collaborative Hierarchical Expansible Framework") -L. Michelotti
  - continue development
  - tutorial sessions
  - objective is to create "the" interactive design tool for single particle optics, to be used by both ILC and LHC

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Plans (ambitious)

- Implement realistic wakefields based on detailed geometry (prime ILC application)
  - simple implementation:
    - need to run detailed EM codes (F.Ostiguy?, SciDAC?)
    - parameterize result (moments?)
    - implement as a "kick" in tracking

» a possibility for ILC involvement

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Fermilab Resources

- Currently using lqcdib (added 2 head nodes)
  - will lose space @ New Muon Lab; lqcdib will be packed && stored
- Thanks to LQCD group, will run on lqcd until room for lqcdib available
- Upgrade lqcdib to 2.4 Ghz (from 2.0 Ghz) using retired lqcd hardware (better reliability)
  - with 8x$500 (NIC) plus $10k (switch), could go to 40 nodes from 32