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Advanced Accelerator Simulation Project

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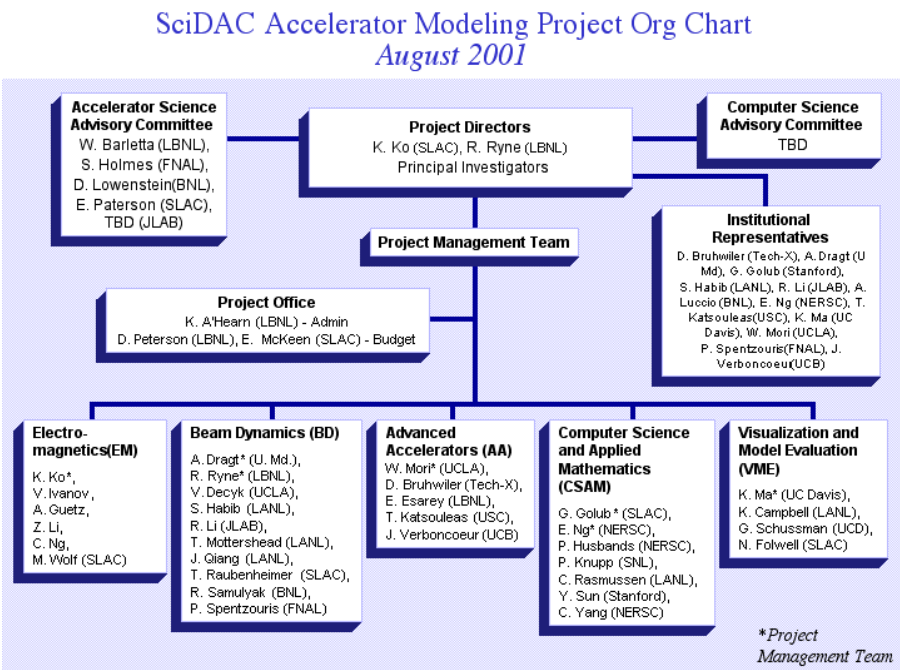
http://www-cpd.fnal.gov/Advanced_Accelerator_Simulation.html



Multi-Institution Collaboration to develop the next generation of beam dynamics modeling tools

SciDAC funded project

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Objectives

- Create Beam Dynamics code with the ability to model collective beam effects
  - Utilize power of parallel computing
  - Model future and operating accelerators
- The code should
  - Integrate existing packages
  - Be easily distributable

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Achievements To Date

- First 3D space-charge code for circular accelerators
  - Re-use existing beam dynamics packages: mxyzptlk & Impact
  - Provide build system and code distribution tools
  - Human interface & standard accelerator lattice description
  - Code performs x 10 better than anticipated

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Booster Studies

- Booster required to run x 5 more protons/hr for MiniBooNE+Run II, x 25 when NUMI turns on
  - Will become bottleneck when NUMI starts
  - Losses will lead to longer downtimes
  - Booster emittance affects TeV performance
- Booster losses @ 1ms due to space charge
  - Study and help eliminate effect
- But first:
  - Understand instrumentation & validate code

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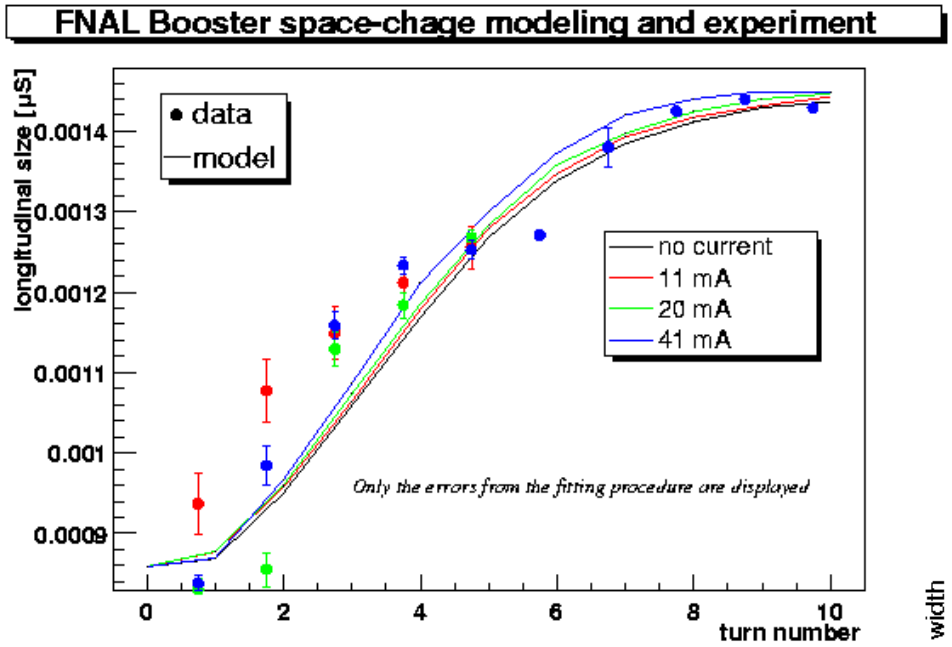
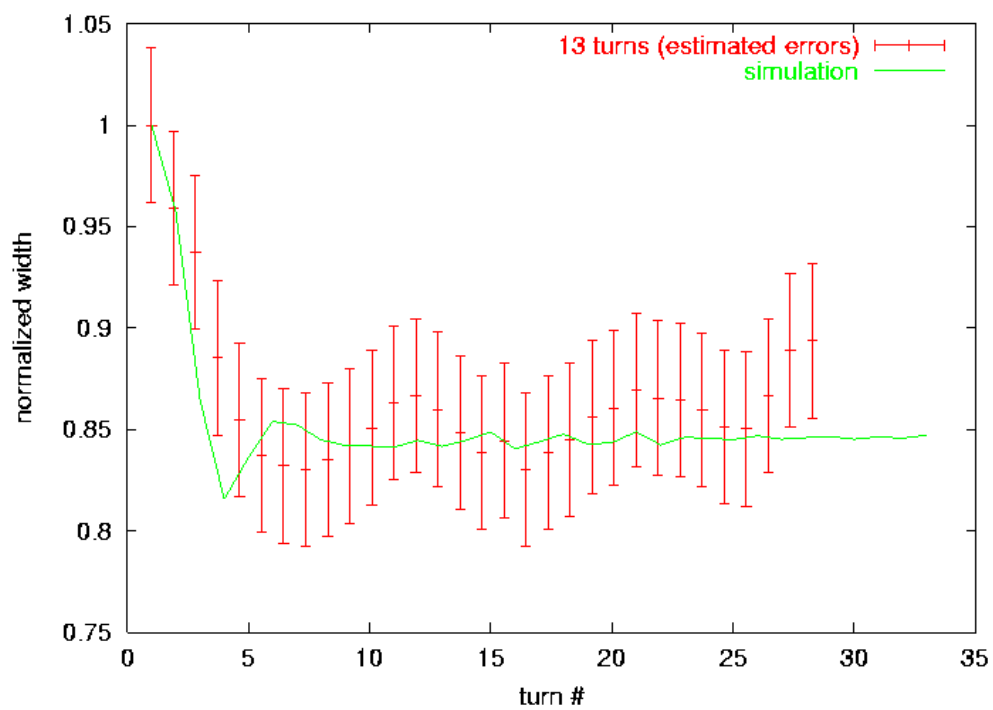
Data (Booster)/Model comparisons



Model validation effort:

Data/MC comparison, a rare phenomenon in Beams Physics!



More studies underway in collaboration with BD

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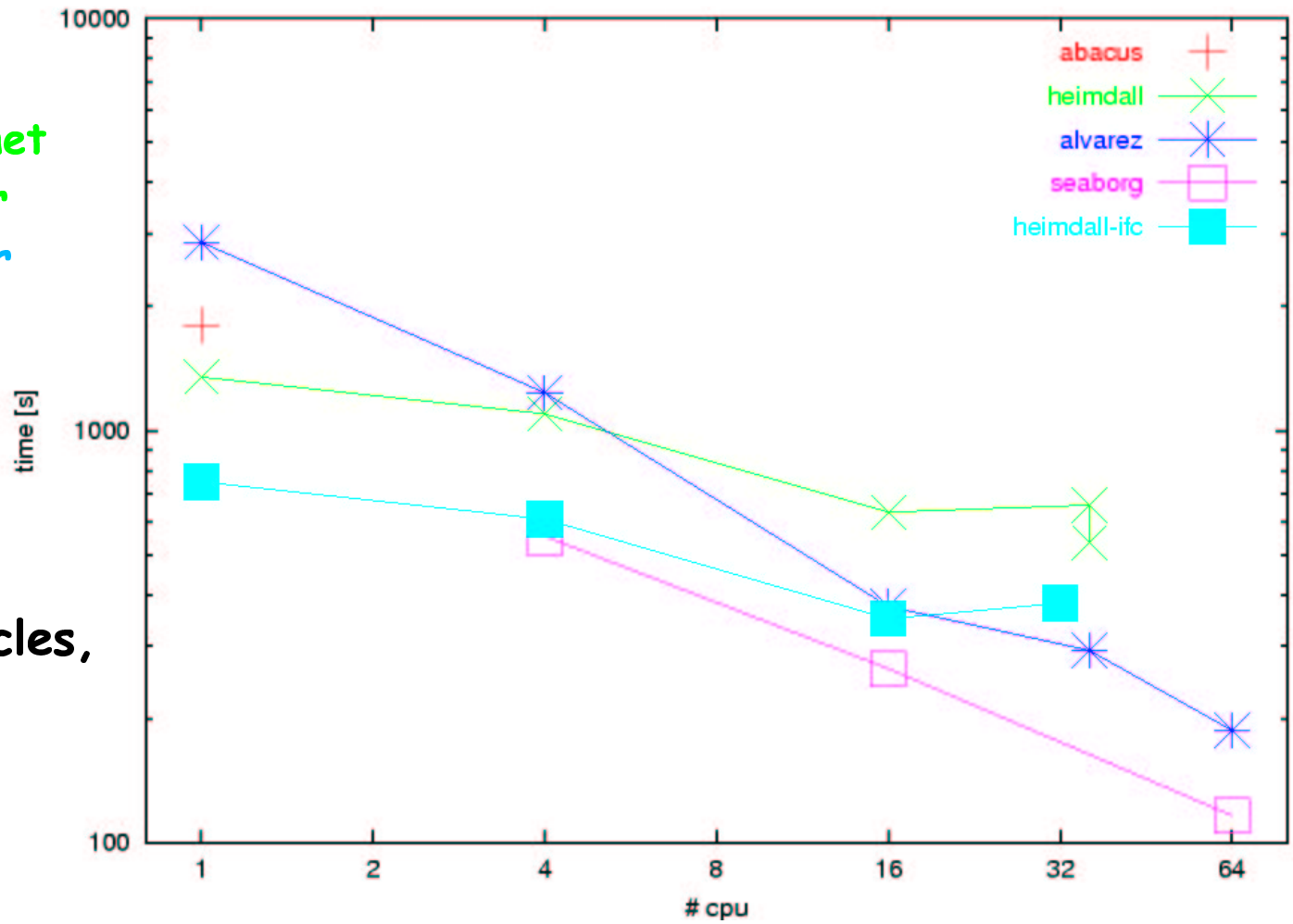
Code performance

800 Mhz PIII
Linux cluster, 1.4 Mhz
Athlon, 100 Mb Ethernet
Portland Group compiler
same but Intel compiler
Linux cluster 866 Mhz
PIII with Myrinet
IBM SP with 375 Mhz
POWER3 processors



Modeling 2.7M particles, with a 65^3 grid for 1 Booster turn

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Other Responsibilities

- Act as liaison between FNAL and the collaboration
  - Organize meetings
  - Coordinate exchange of information
  - ➔ Model collective effects at the TeV
    - ✔ Beam-Beam effects modeled at LBNL & SLAC
    - ✔ Linac design work