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# Geant4 Computing Performance Task

## Contact Person

- Daniel Elvira

## Mission

The G4CPT is not a task force but rather an open ended effort with the following objectives:

1. Profiling to identify bottlenecks in Geant4 based on main stream applications. We need to discuss profiling tools, what we want to measure, metrics. EM, Geometry and hadronics are the areas more involved in CPU usage.
2. Code reviews geared towards improving computing performance and coding practices.
3. Establish computing performance activities with the High Energy Physics, Medical and Space G4 communities.
4. Identify issues in multi-core, multi-thread G4.

## Meetings

We intend to meet every 6-8 weeks. Agendas are available in [indico](#).

## Profiling information

### Geant4 Tool Kit

### HEP Applications

1. ATLAS
  - ◆ Profiling information on ATLAS can be found in the report [CERN-LCGAPP-2010-01](#)
2. CMS
  - ◆ [CMSSW\\_3\\_6\\_0\\_pre4/G4.9.3/slc5\\_amd64\\_gcc434 - 10 event high pT QCD](#)
    - ◇ [igprof perf ticks and Intel PTU Basic Sampling profiles \(annotated\)](#)
    - ◇ [igprof total dynamic memory allocations profile](#)
3. LHCb
  - ◆ [Presentation](#) on performance using the Google memory allocator

### Medical Applications

### Space Applications

## Code Reviews

1. CHIPS
2. Propagation in fields

## List of Top Problems to Investigate

Input received from a number of people in the developers and users communities. The medical community will start profiling applications in a more systematic way in the Fall of 2010. For the space community, speed

is not the biggest issue at the moment but rather simulating small targets (< 1mm), tracking particles inside ~nm volumes, physics.

1. Memory Allocation
  - ◆ Navigation (G. Cosmo working on a fix - ATLAS, CMS testing)
  - ◆ Bertini (Mike Kelsey working on mem/speed improvements, see talk in hadronic meeting on 10-04-38 [↗](#))
2. EM Physics Package
  - ◆ Optimization of parameters in applications
  - ◆ Revisit physics algorithms in Geant4 code: optimizations, approximations
  - ◆ Multiple scattering
  - ◆ Code review
3. Navigation speed and memory use in Voxel geometries and when handling large numbers of materials (brought up by the medical community among others)
4. Ion-ion inelastic models speed and memory use (medical).
5. Propagation in Magnetic Fields
  - ◆ Code review (done - no low hanging fruit from the programming practices side)
  - ◆ Testing, Validation, profiling with new steppers (ATLAS is testing Nystrom)
6. Hadronic cross-sections
  - ◆ Code review
7. Precompound/de-excitation
  - ◆ Code optimization. Many log/power functions are called. Many classes.

-- VDanielElvira - 29-Apr-2010

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This topic: Geant4 > G4CPT

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