Status of Geant4 in CMS

CMS offline group

2 April 2015

CMS simulation status

- Production version for 2015 run
  - Geant4 10.0p02 gcc4.8.1 static sequential build
  - Already about 0.5B events are produced
  - In processing of producing several billion events during 2015
- Current development version
  - Geant4 10.0p03 + CMS private patch of Geant4e
    - gcc4.9.1 static MT build
    - Good technical performance in MT mode
    - Problem of non-reproducibility exits
      - Random seeds from the hard scattering events at 13 TeV are stored for the first run
      - A replay mode for one event per run starts from each saved seed
      - Event history in the replay mode is not fully reproduced with probability ~5%
- First test of Geant4 10.1 has been done (M. Kortelainen)
  - Geant4 10.1p01 will be tested in MT mode
- Geant4 10.2 is CMS target release for 2017 production if available in time for our validation process to be completed
  - New features of significant interest for CMS:
    - Usolid geometry
    - More fast navigation and tracking in field
  - Release should be available around end of 2015

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Problems – open issues

- There are some problems which do not stop CMSSW work and are not strong requirements
  - Possible technical improvements
    - Provide complete destruction at exit for Geant4 objects
    - Understand and remove non-reproducibility
    - Review implementation of G4VERBOSE compile option (~2% CPU)
      - Currently CMSSW is build with G4VERBOSE enabled
    - Substitute remaining std::log by G4Log (1-2% of CPU)
  - Physics studies
    - Evaluate accuracy of simulation of high energy interactions (>100 GeV)
    - Evaluate accuracy of time of flight simulation (down to 10 ps)
      - CMS upgrade may include time of flight feature in side calorimeter