Status of CMS Full Monte Carlo

Geant4 Technical Forum

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Status of Production

- 2011:
  - 7 TeV Monte Carlo production $2.7 \cdot 10^9$ events
  - Geant4 9.4 (+ few fixes)
  - Slc5_amd64_gcc434
- 2012 :
  - 7 TeV Monte Carlo production $0.24 \cdot 10^9$ events
    - Geant4 9.4p03
    - Slc5_amd64_gcc434
  - 8 TeV Monte Carlo production
    - $6.5 \cdot 10^9$ events produced
    - Started with Geant4 9.4p03 and slc5_amd64_gcc434
    - Continues with slc5_amd64_gcc462 and CHIPS stopping fix
- Production Physics List QGSP_FTFP_BERT_EML
  - Few alternative Physics Lists are available with bremsstrahlung and multiple scattering backported from Geant4 9.5

Current Developments

- Current Geant4 production version for CMS 9.5p02
  - Similar physics and CPU performance as in 2012
  - slc5_amd64_gcc472
  - is used for upgrade studies
- Geant4 9.6p01 is integrated as a development version
- Validation of Geant4 9.6p01 is ongoing
  - Some differences with Geant4 9.5 are seen in tracker (momentum resolution singnificantly worse) and in jet spectra
  - CMS needs to know results of Geant4 internal tests for trackers

Current Simulation Activity in CMS

- New challenges for 14 TeV run:
  - higher energy, higher multiplicity, higher pileup
- CPU speedup of Geant4 simulation is needed
  - Calorimeter simulation
  - Tracking in field
- Currently standard math library takes significant part of CPU
  - From today CMSSW includes new VDT fast math library
  - CMS strongly needs validation results of Geant4 with VDT
    - In nightly build
    - Simlified calorimeter and other tests
- CMS has interest in more fast random number generators and algorithms
  - Gauss and Poisson distributions are of concern,
    - frequently used at DIGI step and FastSim
  - CMS uses CLHEP for random number generators
- There are number of Geant4 physics classes which require optimisations of algorithms:
  - Fluctuation of energy loss
  - Hadronic cross sections
  - Others from profiler analysis list
- Plan to have a production version of CMSSW for the 14 TeV run in mid 2014
  - Thread safety of Genat4 is desired but is not an ultimative requirement