Summary of Session 4A
Hadronic Models: Development and Valdation – Part I

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22nd Geant4 Collaboration Meeting

09/29/2016

Hadronic Models: Development and Validation Part I

Update on High Energy Hadronic Models   *Alberto Ribon*   📎

Building 32, room G01   *14:00 - 14:15*

Highlights from Cascade Models   *Jason Hirtz*   📎

Building 32, room G01   *14:15 - 14:30*

Highlights from Precompound and Deexcitation Models   *Vladimir Ivantchenko*   📎

Validation of Geant4 Physics List using CMS Data   *Sunanda Banerjee*   📎

Discussion

Building 32, room G01   *15:00 - 15:30*

J.Yarba - Technical Aspects of Varying Hadronic Model Parameters

Update on High Energy Hadronic Models presented by A.Ribon for V.Uzhinsky

- Rotation of the fragmenting string
  - Improves agreement with 158GeV/c p+p data
- Cross-comparison of FTF and Bertini vs HARP data in the overlap region, with the focus on the forward hadron production
- Benchmarking FTF results for pi- on C at 158GeV/c or 350 GeV/c vs recent data from SHINE/NA61
  - Pion, kaon, proton, antiproton production
  - Production of resonances
  - (Visual) comparison vs predictions of other popular generators
- QGS
  - In the process of upgrade - work has resumed
  - Benchmarking vs FTF w/o diffraction vs data on 158GeV/c pi- on C

J.Yarba - Technical Aspects of Varying Hadronic Model Parameters

Highlights from Cascade Models
J.Hirtz

- Bertini
  - Extending use of Bertini to higher energies (up to 16GeV) indicated a bug in partial cross sections
  - Modeling of recoil is oversimplified in Bertini because reaction is forced to be on-shell for the energy conservation
  - Fixed large memory increase in coalescence model observed in 10.3-cycle
- INCL++
  - Added production of strange particles (kaons, Sigma, Lambda) through the addition of new channels
    - Although the Delta-induced interactions appear problematic
  - Illustrated with plenty of results on K+, K0s, Lambda production on light or heavy targets, with comparison to experimental data and to other generators
  - Improvement in one-nucleon removal channels which leads to better agreement with experimental data over a wide range of targets
  - Plans to include the updated version of ABLA which will improve de-excitation by emission of a larger variety of particles
  - Work on studying error propagation and model parameters optimization

J.Yarba - Technical Aspects of Varying
Hadronic Model Parameters

Highlights from PreCompound and Deexcitation
V.Ivanchenko

- Model configuration interface – overview and usage example
- Nuclear level data
  - Infrastructure: only one singleton (elimination of thread-local data)
  - New datafile G4PhotonEvaporation5.1
  - Configurable options for internal conversion data
- Isomer production
  - Configurable deexcitation of any excited nuclear fragment
  - Added production of floating level isomers
- Correlated gamma decay
  - Work for most important isotopes
    - But there are still certain technical issues
- Components of PreCompound and Deexcitation have migrated to the new infrastructure, but GEM has not

Validation of Geant4 Physics Lists Using CMS Data presented by V.Ivanchenko for S.Banerjee

- Benchmarking Geant4 results from recent releases 10.2.p02, 10.3.p01, and 10.4.beta01 vs CMS Test Beam 2006 data and zero bias or minimum bias collision data from run 2016B
  - Custom FTFP_BERT_EMM physics list (detailed mult.scatt. for HCAL, simplified model for other detectors)
- Results included
  - Response to pions, protons/antiprotons, kaons
  - Energy resolution for pions and protons
  - Energy measured in calorimetric matrices (ECAL, HCAL, ECAL+HCAL) for isolated tracks
  - All simulated results show reasonable agreement with the data and little variations from one release to the other
- Critical for transitioning CMS simulation to Geant4.10.4
- Q: if we release 10.4 with the updated FTF version (different from 10.4.beta01), will CMS be able to accept it ?

J.Yarba - Technical Aspects of Varying Hadronic Model Parameters