

Geant4 Hadronic Physics: Recent Patches and Work Plan for 2017

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Outline

- Recent bug fixes in Geant4 Hadronic Physics
- 2017 Plan of Work for Geant4 Hadronic Physics

RECENT BUG FIXES

G4 10.2.p03

- **G4VScatteringCollision**
 - Fixed memory leak in MT-mode
 - Addressed problem report #1905
- **ParticleHP**
 - Fixed CPU performance penalty introduced in release G4 10.2
 - Reintroduced cache of cross-section in GetIsoCrossSection
- **G4Nucleus::GetThermalNucleus**
 - Fixed computation of relativistic kinematics
 - Addressed problem report #1911
- **Others**
 - LEND
 - UCN

G4 10.3.p01

- **G4VScatteringCollision**
 - Fixed memory leak in MT-mode
 - Addressed problem report #1905
- **De-excitation models**
 - Fixed case of event non-reproducibility due to precision loss in Lorentz transformations. Related fixes also in **G4Fragment**
 - Changed default time limit for isomers: from **10 ms** to **1 μ s**
 - Improved simulation of internal conversions
 - Various other fixes...
- **Radioactive Decay**
 - Temporarily switched off correlated gamma emission, to limit observed event non-reproducibility violations

WORK PLAN 2017

String Models

- **FTF (Fritiof model)**
 - Implementation of rotating strings in FTF model
 - Tuning and validation of FTF model for strange meson and hyperon production in proton and anti-proton interactions with proton and nuclei
 - Extension of the validation test-suite for string models
- **QGS (Quark-Gluon-String model)**
 - Revision and improvement of QGS
 - Additional reggeon exchanges and transverse-mass distribution
 - Tuning and validation of QGS
- Dedicated effort to understand and hopefully solve the tension between thin-target vs. hadronic showers

Cascade Models

- **BERT** (Bertini-like model)
 - Parameter tuning
- **INCL++** (Liege intranuclear cascade model)
 - Extension to strange hadrons

PreCompound / De-excitation Models

- Making the new GEM model the default
- Complete the work on the emission of correlated gammas
- Inclusion of angular-momentum conservation in precompound/de-excitation models
- Tuning of precompound/de-excitation models
- Improve CPU and memory performance of de-excitation
- Extension of validation

Radioactive Decay Model

- Radioactive decay improvements
- Extension to Super Heavy Elements (SHE)
- Beta-delayed emissions of protons and neutrons
- Support and validation of the new nucleon emission channels
- More tests of RDM to be included in system testing
- RDM biasing improvements

High-Precision (HP) Models

- Validation and support of ParticleHP
- Treatment of the reactions: (d, p), (t, p), (t, d), (He3, p), (He3, d), (He3, t), (α , p), (α , d), (α , t), (α , He3)
- Update of LEND package
 - Livermore low-energy nuclear data
- Integration of NCrystal in Geant4
 - Model of \sim meV neutron scattering in both poly- and single-crystals with documentation and a few examples

Cross Sections

- Complete test suite for hadronic cross sections (with data)
- Review (physics & code) of the Glauber-Gribov cross sections
- Review and update G4NEUTRONXS data set
- Review and update of the Barashenkov-Glauber-Gribov (BGG) cross sections
- Inclusion of the fast hadronic cross section system, and its validation

Others

- Improvement of the **photo-nuclear** model
- **Muon capture** code-factorization and introduction of muonic atoms
- Review of hadron elastic diffuse model
- Design interface for accessing hadronic parameters
- Implementation of a Ion Coulomb excitation model
- Validation with **n_TOF**
- Validation of low-energy (< 100 MeV) hadronic models for protons and ions
- **Neutrino** interactions:
 - Complete the Geant4 interface to **GENIE**
 - R&D for neutrino-nucleus final state generator
 - R&D for neutrino-nucleus integral cross section

LPCC

LPCC Detector Simulation Workshop

- The next LPCC Detector Simulation Workshop has been scheduled for **26-27 June, at CERN.**