GEANT4:
Release 9.2 Beta

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for the Geant4 Collaboration

Outline

- Relevant developments since release 9.1.p02
- Highlights of developments & fixes in
  - Kernel
  - Physics Lists
  - Physics Processes
- Not all fixes introduced are treated here

Notes:

- Full details in notes which will be posted in:
  - *http://cern.ch/geant4/support/download_beta.shtml*

Disclaimer

- Geant4 9.2-Beta is Beta software
  - It is distributed "as is"; full support cannot be provided
  - Some code may be new or enhanced, therefore still experimental and not fully tested
    - Some interfaces may have changed since the previous version
    - Interfaces of new features may change in the final public version (9.2)
  - Detailed notes on changes are available in the directory `ReleaseNotes/development/` provided with the source code distribution
  - User documentation are not updated (only for regular releases)
  - Only source code and no pre-built libraries are provided from the web site

External libraries & Platforms

- 9.2-Beta requires
  - CLHEP 2.0.3.3
    - (updated units & PDG-2006 compliant physical constants)
  - New EM low-energy data set: G4EMLOW6.1
- Platforms:
  - SLC4 – gcc 3.4.6 (32/64 bits)
  - MacOS X 10.5 (Leopard) – gcc 4.0.1/4.2.1
  - Windows/XP – VC++ 9.0 (Visual Studio 2008)

More verified platforms:

- SLC4 – gcc 4.3.1
- SLC4 – Intel icc 10.1.015

Geometry & Transportation

- Fixed problem report #990
  - Corrected handling of optimisation for regular geometries (phantoms parameterisation)
- Fix in **`G4Tubs::DitanceToIn(p,v,…)`**
  - Rare cases of faulty reply for point with direction tangent on surface, responsible for stuck tracks with zero step
- Fix in **`G4Sphere::DistanceToOut(p,v, …)`**
  - Calculation of roots for theta-conical surface intersections, responsible for miscomputation of distance on half-sphere constructs
- Enhanced implementation of **`GetPointOnSurface()`** for **`G4Polycone`** and **`G4Polyhedra`** made through generic construct

Particles, materials & run management

- Updated relevant (remaining) particle constants
  - To match PDG-2006 as in CLHEP 2.0.3.3
    - **`proton_mass_c2`** (10 **`eV`** difference)
- Added UI command for setting verbosity to particle table
- Automatically delete particles defined in user application
- Fixed problem report #1013
  - Added missing accessors to **`G4SPSAngDistribution`**
- Fixed problem report #1014
  - Added missing virtual destructor to **`G4SurfaceProperty`**
- Implemented more safe consistency check for **`Z`** and **`A`** in **`G4Element`** constructor
- Provide unique name for each isotope of an element when using the NIST data-base

Interfaces & Persistency

- ***Interfaces & UI***
  - Improved layout for Qt driver
  - Added new function in **`G4UICommandTree`** to find a subtree
- ***GDML***
  - New Writer module, supporting all features
  - Completed reader to support: material properties (temperature, pressure, state, …); parameterised volumes, division volumes; border/skin surface properties
  - Enhanced naming convention for volumes
  - Added support for modular files, extra volume properties and handling of schema extensions
  - Added handling of precision for imported/exported values

Physics Lists

- Updated **`FTF*`** lists and physics NOT to use quasi-elastic from CHIPS
  - FTF now has quasi-elastic included in the FTF model itself
- Updated **`option2`** EM physics (EMX) and added **`option3`**
  - now defined **`linLossLimit`** per particle type
  - added hadron induced Bremsstrahlung and Pair Production
  - using Spline interpolation for physics tables
- New helper class **`G4PhysListFactory`** for building physics lists
- Removed obsolete storage class **`G4HadronProcessStore`**

EM Physics - 1

- High Energy
  - Added new Bremsstrahlung and pair-production models for hadrons
- Muons
  - Further developments for **`G4Mu*`** models and processes
- Standard
  - New alternative multiple-scattering model **`G4WentzelVIModel`** used in **`G4Mu*`** processes. Freezed `G4UrbanMscModel`; development version renamed to **`G4UrbanMscModel2`**
  - New process **`G4eMultipleScattering`** specialized for e+,e-
  - New model **`G4eBremsstrahlungHEModel`**, an extension of the standard Bremsstrahlung model but using a more sophisticated LPM approach
  - Fixes in **`G4IonGasIonisation`**, **`G4IonFluctuations`**, **`G4BetheBlochModel`**
- Added initialisation of **`SubType`** for all processes
- Added scintillation with Birk's law to **`G4Scintillation`**

EM Physics - 2

- Low Energy
  - Added Doppler broadening to **`G4LowEnergyCompton`**
  - Added PIXE cross-sections, L-shells for protons projectiles
  - New data set **`G4EMLOW-6.1`**
- More on utilities …
  - Added base class **`G4VMscModel`** for handling general multiple-scattering parameters
  - New helper class **`G4EmElementSelector`** to sample random elements in a compound material
  - Introduced new correction methods for smooth transition between low-energy parameterisation and Bethe-Bloch model; added new helper class **`G4EmSaturation`**
  - Fixed computation of NIEL at the last step of a particle in **`G4VEnergyLossProcess`**
  - Fixed logic in computing **`dEdx`** table for an inactive process in **`G4LossTableManager`**

Hadronic Physics

- *De-excitation*
  - No longer apply atomic relaxation model in **`G4PhotonEvaporation`** according to internal electron conversion; use the radioactive decay model instead for vacant shell index
- *High Energy*
  - Fixed problem of abnormally high **`pt`** secondaries due to incident strange particles in **`G4HEInelastic`** process (report by CMS)
- *High Precision Neutrons*
  - Improved energy and angular distributions for both scattered neutro and recoil targets. Fixed missing inelastic gamma-ray lines. Addresses problem report #1008
- *Parton String*
  - Revised string fragmentation and tuned parameters in **`FTF`** model for **`Pi+P`** and pion-nucleon interactions. Affects fragmentation for **`QGS`**
  - Implemented quasi-elastic hadron-nucleus scattering in **`FTF`** and formation time; tuned string tension
- *Radioactive decay*
  - Changes in **`G4NuclearDecayChannel`**, using the correct shell index in applying ARM and switching on Auger electron production
- *Qmd, rpg models*
  - Several fixes and developments …

More … User Interactivity

- Visualization
  - Developments in Qt visualization driver
- Environments
  - Fixes in Python module for steering Geant4 applications
- Cuts
  - Added UI messenger for handling the production cuts table

Schedule …

- Date for release 9.2-beta: July 4th, 2008
- Final public release 9.2: December 12th, 2008