

GEANT4 10.3.p01 & 2017 planned developments *kernel modules*

Gabriele Cosmo, CERN EP-SFT
for the [Geant4 Collaboration](#)



Outline

- Fixes introduced in release 10.3.p01
 - Kernel modules
 - Physics (see talks by V.Ivantchenko & A.Ribon)
- Overview of planned developments for 2017
 - Kernel modules
 - Physics (see talks by V.Ivantchenko & A.Ribon)
- *Detailed patch release notes:*
 - <http://cern.ch/geant4/support/Patch4.10.3-1.txt>
- *All planned features for 2017:*
 - http://cern.ch/geant4/support/planned_features.shtml

Bugzilla problem reports addressed

10.3.p01:

[#1864](#), [#1879](#), [#1905](#), [#1921](#), [#1922](#), [#1928](#), [#1929](#), [#1931](#),
[#1933](#), [#1942](#), [#1943](#), [#1944](#)

10.3.p01 - Geometry

Geometrical primitives & navigation

- Fixed SurfaceNormal() in G4SubtractionSolid to consider rare cases when a point is not located on the surface
- Improved precision in computation of distances for G4Torus
 - Problem report [#1931](#)
- Fixed computation of geometric volume and surface area for G4CutTubs to make use of cached values
 - Problem report [#1943](#)
- Fixed signature of CalculateExtent() in G4UExtrudedSolid, correcting issue of undefined symbol if extruded-solid not included in the list of VecGeom wrappers to activate
- Optimisation fix in G4NavigationHistory default constructor to favor reuse of already allocated space from the navigation-history pool

10.3.p01 - Materials & Particles

- Materials:
 - Removed debug printout from G4MaterialPropertiesTable destructor. Problem report [#1944](#)
- Particles:
 - Fixed calculation of neutrino mass in G4MuonRadiativeDecayWithSpin
 - Problem report [#1928](#)

10.3.p01 - Analysis & Interfaces

- Analysis:
 - Fixed handling/clean-up of Root empty files in MT mode
- Interfaces:
 - Fixed case of pointer deletion in Qt UI driver
 - Problem report [#1933](#)

10.3.p01 - More ...

- Global:
 - Removed obsolete and buggy G4SubString code used internally in G4String, as no longer used. Problem report [#1864](#)
- Run, Tracking:
 - Fixed bug in reverse track splitting for reverse-MC
- Intercoms:
 - Added `/control/useDoublePrecision` UI command to extend to 17 digits precision printout for the current parameter values
 - Problem report [#1921](#)
- Data sets:
 - nuclides properties (**G4PhotonEvaporation-4.3.2**): Corrected correlated_gamma files for the incorrect setting of the multi-polarity
 - radioactive-decay (**G4RadioactiveDecay-5.1.1**): corrected values for few data files. Problem report [#1922](#)

2017 Planned Developments

Kernel

Geometry & Transport

- Implement use of C++11/14 constructs in key areas
- Profiling and optimisation of multiple navigation
- Separate safety computation and state from navigator
- Progress in the implementation of the Unified Solids library with progressive adoption of shapes from VecGeom
- Simplify adoption of VecGeom shapes with direct interface to VecGeom from wrappers
- Implement prototype navigator based on VecGeom
- Investigate benefits of FSAL/interpolation in field propagation

Materials & Biasing

- Use newest data for atomic shells and extension to very heavy elements
- Enrich event biasing options
 - leading particle biasing, DXTRAN-like biasing, implicit capture
- Extend generic biasing scheme for at rest case
- Prototype implementation of biasing techniques:
 - biasing of charged particles (with cross-section changing over the step)
 - occurrence biasing (continuous density change inside a same volume)
 - material/isotope biasing; Woodcock tracking
- Consolidated implementation of Reverse MC

Analysis & Persistency

- Implementation of merging n-tuples with Root format
 - preserve row-wise n-tuple access and support MPI mode
- Evaluation for support of HDF5 output format
- Support for parallel geometry in ASCII persistency module

Run & Detector Response

- Multi-threading:
 - Finalize new design of threads, allowing threads to join/leave workers pool
 - Migration from POSIX threads to `std::thread`
 - Porting of material scanner to MT
 - Workspace and memory cleanup in MT
 - Study support of MT on Windows platforms
- Migration to use of MixMax random engine as the default and array interface
- Implementation of a phase-space file to GPS

User and Category Interfaces

- Implementation of a new backend for UI-command distribution using a message-queue service (ZeroMQ)
- Implementation of a new UI frontend for Jupyter
- Support for MPI-3 compliant libraries
- Provide an alternative way for distributing random number seeds with MPI
- Updates to the Wt driver

Visualisation

- OpenGL drivers:
 - New driver OGLFile to produce image files in batch jobs where there is no graphics card present
 - Additional functionalities to supports save and restore viewpoint in OpenGL Qt driver
 - Allow picking on Trajectories in OpenGL Qt driver
- Other drivers:
 - New driver for export to format readable by Paraview
 - Improvements to toolbar by adding more useful icons
 - RayTracer: use current scene (G4Scene) to determine which volumes to draw
 - Updates to gMocrenFile and gMocren to support visualization attributes and other information
 - New driver G4DAE exporter for export in Collada format
 - Development of visualization solutions for iOS and Android devices
 - New PDF3D driver
- Support for visualisation of Boolean shapes
- New tool to support high resolution transparent visualization with ability to rotate and zoom
- Support of user-drawn primitives in multi-threaded mode
- Change from flat format to hierarchical format in VRML
- Visualisation of GPS source
- Integrated visualization of field lines

Novice & Extended Examples

- New extended example showing how to create or use a physics list
- New example illustrating generic biasing for "DXTRAN" MCNP-like option and implicit capture
- Extended biasing examples: fix overlap among B02, B03 and GB03 examples
- New example for DNA simulation demonstrating modeling of neuron cell irradiation
- New example for hadronic activation, demonstrating computation of the activities of an irradiated target as a function of time
- New extended example demonstrating monitoring of steps/tracks
- Update to selected examples with usage of G4Accumulable
- Port of Geant4e and related example to multi-threading
- Extension to the DICOM reader to support RT Dose format
- Finalization of dna/microyz example
- Review of examples macros and tests
- Complete application of coding guidelines & code review

Advanced Examples

- Hadrontherapy: implementation of the LTE/RBE modeling derived by experimental measurements
- Brachytherapy: inclusion of Low Dose Rate verification suite
- Air-shower: addition of capability of simulating and analysing fingerprint at ground
- Introduction of C++11 specific features/utilities

Configuration

- Modularization of Geant4 Libraries
 - Migrate to full use of CMake Imported Targets to ease modularization and allow a Geant4 install to be fully relocatable
 - Analyse dependency graph of Geant4 global libraries and granular modules to identify areas for merging and splitting, including optional libraries that a user may choose to drop/add to the build
- Simplify data library configuration/location using layered lookup via self-location
- Migration path from SVN to Git for Version Control

Thanks!