Geant4 10.3 highlights

kernel modules

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for the Geant4 Collaboration

Outline

- Features and fixes introduced in release 10.3
  - Kernel modules
  - EM Physics (see talk by V.Ivantchenko)
  - Hadronic physics (see talk by A.Ribon)

➢ *Detailed release notes:*

- **http://cern.ch/geant4/support/download.shtml**

➢ *List of planned features for 2016:*

- **http://geant4.cern.ch/support/planned_features.shtml**

Geometry

Geometrical primitives

- Updated VecGeom library (USolids)
  - Optional replacement of original Geant4 solids
  - Selection made at configuration
  - External library VecGeom v00.03.00
    - https://gitlab.cern.ch/VecGeom/VecGeom/tree/v00.03.00
  - Possibility to choose replacement of all available shapes or only selected primitives
    - Selection specified at configuration by shape name
  - Available shapes for replacement:
    - Box, Trapezoid (Trap), Simple Trapezoid (Trd), Orb, Sphere (+ sphere section), Tube (+ cylindrical section) , Cone (+ conical section), Generic Trapezoid (Arb8), Polycone (PCon), Polyhedron (PGon), Paraboloid, Torus (+ torus section)
- Added ability to scale dimensions of a shape along Cartesian axes

Geometry

Volumes, Field transport

- Reviewed algorithms for computation of extent of shapes
  - Providing more precise and efficient voxelisation and memory reduction
- Revised and simplified implementation of G4ReflectedSolid
- Improved algorithms for computation of geometrical volume and surface area for GenericTrap and TessellatedSolid
- New magnetic-field stepper classes implementing 3rd (BS23) and 5th (BS45, DP45) order embedded RK
- New stepper classes implementing embedded RK method with interpolation and introduced first version of FSAL-capable integrator drivers and steppers

Analysis & Persistency

- Analysis:
  - Renamed classes *G4Parameter<T>*, *G4VParameter* and *G4ParameterManager* to *G4Accumulable<T>*, *G4VAccumulable* and *G4AccumulableManager* respectively, to better reflect the meaning of *accumulable* objects; extended and improved implementation
  - Implemented merging of n-tuples in MT mode
  - Stopped support of HBOOK output format
- Persistency
  - New GDML schema version 3.1.4
  - Added ability to automatically export names of sensitive detectors as auxiliary information
  - Added ability to import and export scaled shapes. Extended GDML schema by adding "scaledSolid" tag supporting scaled shapes

Materials, Particles, Tracking, Biasing

- Materials:
  - Introduced *G4ExtendedMaterial* and *G4VMaterialExtension* for specific extensions to *G4Material*; added *G4CrystalExtension* concrete class for the description of crystals
- Particles:
  - Updated properties according to PDG-2015
  - Introduced new floating level base to ions and related classes; adapted nuclide table to conform to the new scheme
- Tracking:
  - New *G4Multi{Stepping,Tracking}Action* classes to allow for multiple user-actions in the same job
- Biasing:
  - Introducing parallel geometry capability in generic biasing

Global, Run, Sensitive-detectors

- Global:
  - Added 'us' and 'ps' units symbols for microsecond and picosecond. Requiring new CLHEP library version 2.3.4.2
  - Converted all units and constants from to *static constexpr*
  - Introduced new utility class *G4MTBarrier* implementing a synchronization point between threads
- Run:
  - Added handling of multiple actions to be instantiated and handled in the user code. Added *G4MultiRunAction* class to allow for multiple run actions in a single job; added *G4MultiPrimaryAction* to allow for multiple user-primary generation actions in a single job
- Sensitive-detectors:
  - Migration note: an explicit call to *G4SDManager::AddNewDetector()* must now be added in order to register a sensitive-detector. The use of *G4VUserDetectorConstruction::SetSensitiveDetector()* no longer does this

Visualization & Data sets

- Visualization:
  - Significant improvements in the Qt interface and graphics: significant speed-up for OpenGL viewers (including Qt) on some platforms due to better use of the graphics pipeline; added associated UI command to control events
  - New *fly-through* feature for saved views with associated UI command */vis/viewer/interpolate*
  - Default icon toolbar for the Qt driver (*icons.mac* scripts no longer needed); new UI command to manage default toolbar
  - Improved command line completion in the Qt driver
- Data sets:
  - New versions: **`G4EMLOW-6.50, G4ENSDFSTATE-2.1, G4RadioactiveDecay-5.1, G4PhotonEvaporation-4.3`**
  - New <u>optional</u> data set **`G4TENDL-1.3`** for high-precision incident particles

Configuration & Externals

- Cmake:
  - Requiring CMake v3.3 or higher
  - Changed default build type to *Release* when using single mode tools like Make/Ninja; updated optimisation options
  - Provided placeholder variable for adding setting of XercesC library path when needed
- CLHEP:
  - New version 2.3.4.3 required
  - Correction on MixMax random engine
  - Optional setting/unsetting of thread-local storage

Platforms for 10.3

- Linux, gcc-4.8.5, 4.9.X, 5.3.X, 6.2.X, 64 bits
- MacOSX 10.12, clang-3.8 (XCode 8.x), 64 bits
- Windows 10, Visual C++ 14.0 (Visual Studio 2015)
- Also tested:
  - Linux SLC6/CentOS7, icc-16, clang-3.9
  - Linux Ubuntu 14, gcc-4.8
  - Linux for Intel Xeon Phi with Intel-icc 16.0 (gcc-4.9 compatibility layer)
  - MacOSX 10.10/10.11, clang-3.6/3.7
  - Windows 7, VC++14.0 (no MT support on Windows yet)

Thanks!