2011 Development Plan

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on behalf of the Geant4 Collaboration

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See also the detailed draft plan:

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

Collaboration-wide developments

1. Multi-threaded prototype

- First prototype release based on v9.4
  - Prototype is ready
  - Documentation/examples underway
- Second prototype release based on v9.5
  - End of the year / early 2012
- We request users for feedback, in particular on identified bottlenecks.

2. Variable density materials

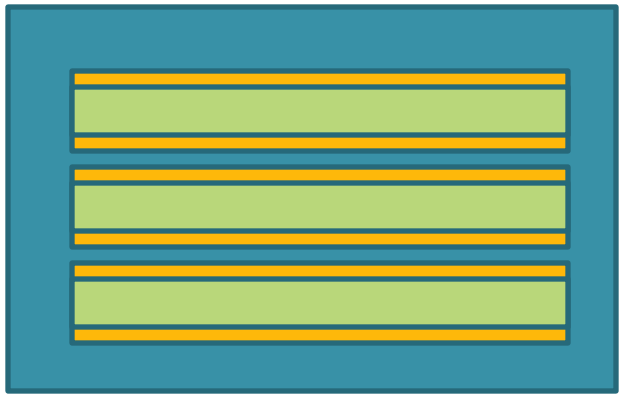
- Allows to define a base reference material.
  - Density of each volume is used to scale the cross-sections at the tracking time
- Reduction of number of materials and corresponding cross-section tables
  - Example for air shower: a user may define one "air" of standard density, and density is defined in the parameterized volumes as "atmosphere layers".

3. Improvement of easiness in physics list

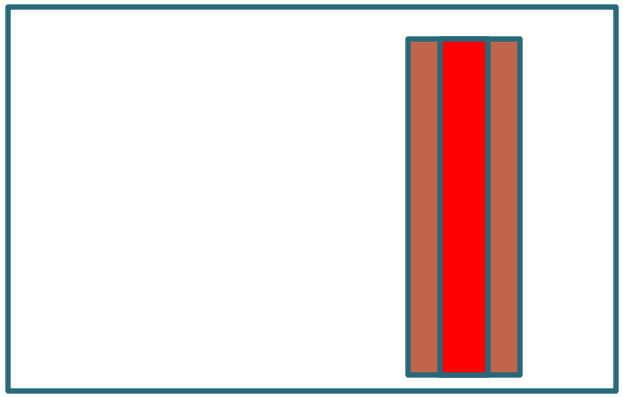
- Removal of "magic" ordering numbers in physics list
- Automatic consistency check
  - Current user's P.L. will be kept valid, but may cause error messages in case of problems
- Easiness of adding a process to "pre-packaged" physics list
  - Documents, examples

4. Layered mass geometries in parallel worlds

- Parallel geometry may be stacked on top of mass geometry or other parallel world geometry, allowing a user to define more than one worlds with materials (and region/cuts).
  - Track will see the material of top-layer, if it is null, then one layer beneath.
  - Alternative way of implementing a complicated geometry



Mass world



Parallel world

4. Layered mass geometries in parallel worlds - continued

- A parallel world may be associated only to some limited types of particles.
  - May allow defining geometries of different details for different particle types
  - Example for sampling calorimeter: the mass world defines only the crude geometry with averaged material, while a parallel world with all the detailed geometry and real materials is associated with all particle types except e+, e- and gamma.
    - e+, e- and gamma do not see volume boundaries defined in the parallel world, i.e. their steps won't be limited

5. Enrich event biasing options

- Review and unify existing biasing options
- Provide minimal statistics tools to monitor the conversion of the simulation results
- Systematic documents

6. Reorganization of novice and extended examples

- Simple novice examples with clear guidance to extended examples for the way of extending each individual functionality
- Improving the maintenance of extended examples
- New working group was recently formed and Ivana Hrivnacova (IN2P3/IPN Orsay) is the WG coordinator.

7. Unifying format of warning/error messages

- Addressing requirement from LHCb experiment (seconded by other LHC experiments)
- Enables automated detection of warning/error messages embedded in output files of massive production runs.

Highlights of other developments

See also the detailed draft plan:

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Kernel

- Implementation of new scheme for GetVelocity() in G4Track
- Finalize implementation of precise ComputeSafety() in navigation
- Feasibility study and first prototype of a unified library for solids
- Review and possible extension of GDML schema for material attributes
- Introduction of spherical mesh for command-based scoring

Standard EM physics

- New interface to differential cross sections
- Extend G4EmCalculator to provide range computations
- Update bremsstrahlung model for e+- for energies E < 1 GeV
- Update gamma-conversion model at low-energies
- New model of delta-electron production based on ICRU52 data
- Hadron multiple scattering coherent with hadron diffuse model
- Review of design and implementation of the interface to geometry for treatment of lateral displacement
- Implementation of spin precession in magnetic field using Stokes vectors representation

Low-E EM physics

- Complete upgrade to Penelope 2008
- Complete implementation of Livermore polarized photon processes and triple conversion
- Prototype of full DNA processes
  - Alternative models for electrons and ions in liquid water and biological materials
  - Prototype processes for water radiolysis modeling (as an advanced example)
- New microdosimetry processes for Si

Hadronic physics

- Implementation of Propagate() method in Bertini cascade for use with FTF
- Accurate cross sections and multiplicities for kaons, p/p-bar and lambda/lambda-bar
- Implementation of anti-baryon-nucleus and anti-ion-nucleus interactions in FTF model
- Complete interface to ENDL high precision neutron database for low energy neutron models
- Addition of coalescence model in cascade stage of Bertini and precompound/evaporation stages
- Update of Geant4 ENDSF to 2011 version for radioactive decay

GUI / Visualization

- Run-time selection of UI session
- Update DAWN to work on latest versions of Windows
- New driver OGLFile, using OpenGL to make PS, EPS, JPG without graphics window
- Enable easy visualization of GPS sources
- Integrate the Inventor viewers within the QtUI environment

Changes

Release dates in 2011

- Upon the LHC experiments' request, we will make the next public release (version 9.5) on December 2nd, which is two weeks earlier than past years.
  - Candidate tag(s) will be available to our major customers by the middle of November
  - We will also release a beta version (version 9.5-beta) on June 30th

In addition…

- Forming physics validation task
  - Offers a unified contact point for physics validation issues
  - Maintains updated portal to validation results
- Launching a new requirement tracking system
  - Transfer requirements from Technical Forum, HyperNews, etc. and keep them in the new system
  - Users can track the progress of these requirements