

# Updates on requirements from previous TF meetings

Geant4 Technical Forum  
March 30th, 2010

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on behalf of Geant4 collaboration

# Outline and links

## Outline

- Update on requirements for which the status has recently changed
- Open requirements: previous **update** March 2009
- Long-term requirements: previous **update** July 2008

## Some links

- Previous updates at Technical Forums can be found at [http://cern.ch/geant4/technical\\_forum/](http://cern.ch/geant4/technical_forum/)
- Updated work plans and expected release schedules available at [http://cern.ch/geant4/support/planned\\_features.shtml](http://cern.ch/geant4/support/planned_features.shtml)

Recent updates

# Req.1202: Alternative models for intermediate energies

Responsible (new): D.Wright (hadronics)

Requestor: HARP

Description: "HARP requests additional hadronic models in the energy range of 1-15 GeV, as alternative to the parameterised (LEP) models.

Status (July 2008)

-June 2008:The **FTFP** model was extended and refined for proton and pion-incident interactions starting from **~3 GeV**

- **Re-parameterization of the LEP models is suspended**

- New name: **RPG = Re-Parameterised Gheisha models.**
  - Development stopped due to lack of resources
  - Not seen as 1st or high priority - currently.

**Update (March 2010)**

- New **CHIPS** hadronic interaction developed (validation underway).
- Further improvement of **FTF** model undertaken in 2009
  - Improved model included in Geant4 9.3

# 1504: Improved final-state isotope spectrum

Requester: Scott Messenger (SFA Inc. and US Naval Research Lab)

Responsible: D. Wright / G. Folger / J.-M. Quesada

Use case: neutron induced radiation on photo-cells.

- Request to improve final state isotope mass spectrum in Bertini and Binary cascade models

## Previous Status

- A [first validation](#) was undertaken in 2006
- For Binary, results depend largely on nuclear de-excitation models ( pre-compound + excitation handler )
- Improvements in pre-compound and equilibrium de-excitation models are ongoing.
  - Will request feedback when de-excitation improvements are ready (in monthly dev or public release)

## Update (March 2010)

- Fixes and improvements of pre-compound and evaporation models have improved the performance of binary cascade.
  - Significant improvements in Geant4 9.3 for isotope spectra are seen as a result (comparison for IAEA spallation benchmarks demonstrate improvements)

From Space Users meeting (Nov 2006)

# 1503: Packaged physics lists with low energy EM processes

- **Requester: Dennis Haggerty** (Johns Hopkins U. Appl. Phys. Lab.)
- **Responsible: S. Incerti** (since June 08)
  - Suggested to base them on ones in advanced examples

## Update (Mar 2009)

- The convergence of low-energy and standard EM processes to a common design is underway.
- Plans in 2009 are to create new, packaged physics lists incorporating standard and low-energy processes
  - And to start validating key aspects

## Status (Sep 2009, S. Incerti & V. Ivantchenko)

- **Migration** of all low energy EM processes and models to standard EM software design has been performed (including Livermore un-polarized and polarized, Penelope, Geant4-DNA physics lists)
- Three new physics lists are available in **three physics builders** showing how to combine (Livermore unpolarized or polarized + Standard EM) or (Penelope + Standard EM) :  
[G4EmLivermorePhysics](#), [G4EmLivermorePolarizedPhysics](#), [G4EmPenelopePhysics](#)

## Update (March 2010)

- They are available in release **9.3** in [geant4.9.3/source/physics\\_lists/builders](#).
- The transition energy between standard and low energy has been **set to 1 GeV for now**. Extensive validation is needed to confirm this value. The user has the possibility to **change this value** directly in the physics builder itself.
- A similar builder for very low energy processes (Geant4-DNA) is under development
- **Propose to close issue**

From Space Users meeting (Nov 2006)

# 1502 – Support multi-core processing

Requested by Francisco Garcia (HIP).

Responsible: G. Cooperman

- Support for running multiple events simultaneously utilizing two or more cores, utilizing fewer resources (memory) than two separate processes.

Status (March 2010):

- Parallelism at event level available since 2002 (using TopC)
- Multi-process and multi-threaded prototype of Geant4 is being evaluated. A first public beta release is planned soon

**Newest requests/requirements**



# 2501: Choices of physics processes (or options) per region

- **Originators:** (CMS, Fabio Cossutti)
- **Responsible:** V. Ivantchenko
  - Refinements of physics lists by G4Region
  - Use case: a mixture of homogeneous (e.g. ECAL) and sampling (e.g. HCAL) calorimeters
    - The optimal balance between EM physics accuracy and performance is different
      - QGSP\_BERT\_EMV (ECAL) vs QGSP\_BERT (HCAL)
    - At present only one choice (physics list, in particular EM ‘option’) can be made for the whole setup
- **Status (Sept 2009)**
  - Specific use case for EM processes demonstrated with existing G4 toolkit code – and CMS guided in its use.
    - Example provided in G4 distribution which uses PAI model for gases.
  - General case: under analysis (preliminary stage)
- **Update (March 2010) – EM part is part of plan of 2010**
  - Are there use cases which require full-flexibility (beyond EM options) or benefit significantly from it?
    - Potential impact of new degree(s) of freedom for varying (pseudo-tuning) the physics results.

# 2502: Fluctuation of energy deposition in gas

Requestor: T2K - C. Giganti (CEA/Saclay)

Responsible: V. Ivantchenko/L. Urban

- Dependence of energy deposition on the imposed step size – and the size of gas volume.
  - Leads to discrepancy of energy resolution for monochromatic muons in T2K TPC

Status:

- Fix provided to T2K (March 2009) - revised April ?
  - It is included Geant4 9.3
    - G4UniversalFluctuation: modification in width correction, the dependence of the correction on energy deposition at previous steps is now fixed.
    - Addresses report from T2K setup
- Update (March 2010)
  - Fixed in 9.3
  - Not included to 9.2.p03 - due to small effect on mean energy deposition in sampling calorimeters
- Propose to close (March 2010)

# 2503: Steering field tracking by region

Originators: (CMS, Fabio Cossutti)

Responsible: J. Apostolakis

- Which developments are foreseen for tracking in magnetic field?
- Use case:
  - homogeneity of B-field and accuracy needed for tracking differ widely in different regions
- Potential solution
  - local field managers and step integrators defined by geometry region

Status (Mar. 2010)

- Implementation of local magnetic fields per region included in Geant4 9.3
- Propose to close

# Longer term requirements

1. Closed or proposed to close

# 1501: Categorize deposited energy by process.

Requesters: Vanderbilt Univ., seconded by ESA and NASA – for Single Event Effects.

Categorize deposited energy in G4Step by process or separate energy into ionizing and non-ionizing parts

Context: Convert energy deposition into electron-hole pairs and simulate the output pulse from semiconductor devices in the space environment.

- G4Step used to have only total energy deposition for step
  - Energy lost by post step actions are not contributing to electron-hole pairs.

## Status (Feb 2008)

Dec 2007: EM physics process to contribute to this.

Feb 2008: Fixes to GEANT4 released (9.1 patch 1), and pending - in upcoming 9.1 ref-02

Mar 2009: Propose to **close**.

From Space Users meeting (Nov 2006), Pasadena

# Req.0401: Extend of Ion hadronics interaction to cover cosmic ray range in (A,Z) and energy

- Responsible: D. Wright / T. Koi (new)
- Requestor: ESA (G. Santin)
- Status (mid-2005)
  - EM dissociation: Released in G4 6.2
  - Inelastic reactions
    - $E < 10 \text{ GeV} / A$ : Xsec (G4 6.0), model 4 light ions ( $\leq C$ ) in G4 6.1
- Update (July 2008)
  - New native-G4 Quantum Molecular Dynamics (QMD) model:
    - First release including reaction to  $\sim 500 \text{ MeV}$  (TBC): 9.1 (Dec07)
    - extension to few GeV/c provided in 9.2 beta (June 2008)
  - Interface to DPMJET II.5 under development (funded by ESA)
- Update (March 2010)
  - Interface to DPMjet II.5 model is available
  - Ion-ion collision models development proposed in FTF and CHIPS models

# Req.0402: “Intuitive” documentation of the physics lists

Responsible(s): D. Wright / G. Folger

Requestor: ESA (G. Santin)

Date of request: May 2004

Description: “Intuitive documentation (maybe in graphical form) for each physics list to show, for a given particle, which model is active over which energy range. It could also be printed out by the list in ASCII format, with a loop over inserted models.”

**Update (March 2010):**

- print out is now generated by all hadronic models and processes (of the current physics list) at initialization time
  - Activated by []
- Future: extend to cross sections.

# Requirements recently closed

Proposed to close Mar 2009 – now closed

- 704: Neutron data for additional elements
- 1102: Identifying a process efficiently

*Closed in March – after proposal to close July 2008 -*

*Delivered:*

- *0304, 0502, 0601, 0605*

*Improved:*

- *0303: Performance of G4*
  - *Note: Ongoing process of improvement underway*



# 1302: Message processes in physics list

Requestor: M. Stavrianakou, CMS

Responsible: G. Folger (tbc) Update (March 2010) - in 9.3 the list of hadronic models and processes is printed out VI

Context: Wish to message physics list or its processes, to control some aspect.

- Control via messenger handles is not enough.
- Example: verbosity control in hadronics. Provide ability to tune controls (threshold, cut setting etc)

Old title: Making available process/physics lists “controls”.

Status (July 2008): Partially done. Remainder not scheduled

- Verbosity level can be set in constructor.
- EM cut is tunable via `G4VModularPhysicsList::SetCuts()`
- Threshold for switching models is NOT tunable parameters!
  - Would break ability to compare btwn users
  - Users must create variant PL to change parameters

**Question to users** (Jul 2008) : Are **handles** to PL & its processes still required (and why?)

Propose to **CLOSE** - March 2010 : no feedback received

# Req.0309: Document the technical aspects of all physics processes

Responsible: D. Wright / V. Ivantchenko / S. Incerti

Description: "All available physics processes, models, cross-sections, etc., should provide documentation of the technical aspects of the implementation:

- details of the expected behavior of a model should be provided (for example how incoming and outgoing particles are handled). This applies to both hadronic and electromagnetic processes."
  - Concrete requirement for behavior of secondaries of hadronic process was fulfilled (Req.??).
  - We are open to suggestion of concrete issues and potential improvements.
  - Status: concrete issues addressed – general request beyond G4 resources
  - Proposal (July 2008):
    - Propose guideline to clarify new or unusual technical features of models;
    - If a guideline is agreed, close this requirement
  - Update (March 2010)
    - ADM and PRM were updated, new web pages are added
- VI

# A guide to the 'Status'

- Potential status of long-term requirements:
  - Under study
    - Impact not yet understood
  - Under development
    - Ongoing
  - Not resourced
    - Awaiting / lacking resources
  - Not scheduled
  - Conflicting

Older  
requirements / requests

# Requests from Underground Experiments

Requests collected at  
Technical Forum Sept.15.2007  
(Meeting 20)  
@ Hebden Bridge

# 2001: Missing from Neutron\_HP

Requested by H. Araújo (Imperial Collage) & Luciano Pandola (INFN/LNGS)

Responsible: T. Koi (SLAC)

- E + p conserved event-by-event in NeutronHPInelastic
- Residual nucleus should always be emitted (when it exists)
  - e.g. Ge(n,2n), capture (n,>1gamma)
- NeutronHPInelastic produces no gammas in some channels
  - E.g. (n,alpha) and (n,p)

Status (Nov 2007)

- In neutron\_HP E/p conservation
  - is good in HPElastic;
  - A simple improvement has been suggested for (n,n'g).
    - TK will look into this, since it is the probably the most important case for the community.
  - For the general case the data is not adequate to provide E/p conservation.
- Other reports regarding the missing residual nuclei will be investigated (along with bug reports).

# 2002: Improve Neutron HP database & its doc.

Requestors: [H. Araújo \(Imperial Collage\)](#) & [Luciano Pandola \(INFN/LNGS\)](#) - for 'underground' users

Responsible: T. Koi (SLAC)

- Can we avoid natural abundance elements in database?
- Clarify HP database format (especially final state)
  - Document format used
    - Users want to extend database, and they need to understand it!
    - Independent database management tool?

Status (Nov 2007)

- The issue of natural abundance isotopes will be looked at
  - it is suggested that it should generate a warning (missing isotopes already do).
- Currently planning to replace the existing module and the G4NDL format.
  - Moving to new LLNL 'module' for neutrons based on ENDL database (instead of ENDF-VI). This is expected to utilise the full range of data provided in this format
    - new elastic model is planned for 2H 2008 (second half), and
    - the inelastic model predicted for 1H 2009.

## 2003: Muon induced neutrons

Requested by H. Araújo (Imperial Collage) & Luciano Pandola (INFN/LNGS)

Improve and validate muon-nucleus models

Responsible(s): D. Wright, M. Kosov (new)

Original Input:

- Continue development & validation of muon-nucleus models
  - QCollision + QCaptureAtRest – maybe produces those missing neutrons!
  - Validate inelastic XS, underground muon spectra, depth-intensity relation, etc
- Consider testing for neutron yields with release
  - Disseminate validation results
    - Hadron cascade models – too many gammas, too few fragments?
    - Ion cascade models – to cope with more fragments

Update (March 2010)

- improvements in mu-nuclear model with CHIPS were targeted for these problems



# 2004: Radioactive decay module

- Requested by H. Araújo (Imperial Collage) & Luciano Pandola (INFN/LNGS)
- Responsible: N/A
- Radioactive decay module
  - Refine interface to atomic de-excitation (x-rays and Auger)
  - New event generators ( $2\pi$  decay, non-trivial sources)
  - Small BR decay probabilities
  - Shape of beta spectrum for forbidden transitions (e.g. Ar-39)
  - Status (March 2010, JA)
    - Requirements found to be specific to this domain
    - Development not foreseen by Geant4 collaboration – due to constraints
      - Willingness to advise others about technical issues regarding how to create this as a contribution

# 2005: Radioactivity

Requested by H. Araújo (Imperial Collage) & Luciano Pandola (INFN/LNGS)

Responsible: D. Wright (new)

Request:

- Support Metastable states
  - “The time is right in light of PDG discussion”

Update (March 2010)

- Nothing to report

## 2006: Data driven ( $\alpha, n$ ) and (p,n) reactions

Requested by H. Araújo (Imperial Collage) & Luciano Pandola (INFN/LNGS)

- ( $\alpha, n$ ), (p,n) reactions – e.g. data-driven (HP-type model)
  - Main neutron production mechanism in most experiments (background, calibrations)

## 2007: Gamma cascades

Requested by H. Araújo (Imperial Collage) & Luciano Pandola (INFN/LNGS)

Responsible(s):

- Provide Angular correlation in gamma cascades

# 1505: Process for x-ray specular reflection

Requestor: N/A (communicated by G. Santin)

Responsibles: G. Santin (ESA) / V. Ivantchenko

Add process for x-ray specular reflection

- Notes:
  - More information likely required
  - Can capabilities be borrowed from optical package?

Status

- Willing to review and integrate contributed process.
- Note: a [basic implementation](#) was created for CAST
- Further news awaited from ESA.
- Update (March 2010) - No information from ESA VI

# 1506: Documentation of physics lists

Requestor(s): Space users, HEP users

Responsible: G. Folger / PL 'task-force'

- Note: this is in progress, but more effort is required.
- What physics list (PL) should I be using ?
  - How do you go from use case to PL ?
  - Can dialog with users (online forum) aid this?

Analysis

- Given diversity of application domains, need to involve and work with users to document requirements from use cases

Status (July 2008): Ongoing

- Improving of PL documentation is progressing
- Online forum is active

From Space Users mtg (Nov 06) & G4 Workshop (Oct 06)

# 1403: Forcing decay in tunnel

Requester: GDR neutrino experiments (via Marc V., Oct 2006)

Responsible(s): M. Verderi (NEW)

- Ability to force decay of pions in decay tunnel

Status (Nov 2007):

An overview of various forced interaction techniques is at:

<http://geant4.slac.stanford.edu/EBMS/material/InteractionForcing.pdf>

Prototypes are currently being developed for the techniques shown in the overview

Will appreciate further, more detailed information on request from the user(s).

- Relayed from mtg with neutrino experiments (M. Verderi, Oct 2006)

# Meeting at G4 workshop (Oct 2006, Lisbon)

- Issues reported from meeting with neutrino experiments (M. Verderi, Oct 2006), which require clarification:
    - Issue with pion production from proton on Pb (at 10-50 GeV)
    - Problems encountered with Boolean solids
      - Wish to see smooth surfaces without additional edges
  - Issues discussed:
    - How to communicate the ongoing validation work?
- 
- Relayed from mtg with neutrino experiments (M. Verderi, Oct 2006)



## Meeting at G4 workshop (Oct 2006) – cont.

- Issues discussed:
  - How to communicate the ongoing validation work?
- User question:
  - What physics list (PL) should I be using ?
    - How do you go from use case to PL
    - Can dialog with users (online forum) aid this?
    - Need to involve users to document requirements from Use Case(s)

Requiring user feedback

# Awaiting user feedback

- Req.702: Selective verbosity
- Req.707: Python UI
- 1404: Composite external fields

# Req.702: Selective verbosity

Originator: LHCb (G. Corti)

Responsible : T. Sasaki

- “We would like more configurable debugging features.
  - It is possible to follow in details various aspects of the simulation by setting verbose levels.
  - This is very hard to use when tracking complete pp events because millions of G4Track are produced.
- It would be very useful to be able to selectively turn on such verbose for a single G4Track, a single region of the detector, or a combination of the two.”

Status

- New flag in G4VSteppingVerbose was introduced in v8.1
  - `/afs/cern.ch/sw/geant4/dev/QA_tools/VaGrind/3.0.0` allows the user to toggle the verbosity on and off for each track and/or step
  - the user has to create his/her own stepping verbose class deriving from G4SteppingVerbose default verbosity class and implement this toggling.
  - Other virtual methods of actual verbosity can be kept unchanged.
- **If this satisfies the requirement, we propose to close this.**

# Req.707: Python UI

Originator : ATLAS (A. Dell'Acqua, A. Nairz)

Responsible: H. Yoshida

- More support for a python UI in G4 (not only the current UI/macro version).

## Status

- A development version now includes the a G4-Python interface
  - First implementation was released at v8.1
- Python classes provide access public methods of key classes (implementation uses Boost)
  - Currently evaluating the protection of key quantities during a run from being changed.
- **Users' feedback requested.**

# 1404: Composite external fields

- Requestor: P. Gumplinger (on behalf of users)
- Responsible: P.G. volunteered
- Request for 'composite' external fields Ability to add multiple 'sources' of fields
  - Gravitational field
- Status (Feb 2007):
  - New example with a composite external field created
    - Utilised capabilities from G4beamline tool (muons.com)
- **Propose to close** (March 2010)

Updates: July 2008

# 1401 Recoil ions

Requester: G. Santin – relay from Leuven Space Wrk, Fall 2005

Responsible: V. Ivantchenko

- Producing recoil ions

Status (July 2008)

- **Released** single scattering process, for ion incident in 9.1 (Dec 2007) providing recoil ions
  - contributed by R. Veller, M. Mendelhall (Vanderbilt Univ.)
  - Fix in 9.1p01
  - Classes are G4ScreenNuclearRecoil, G4CoulombScattering and G4UHadronElasticProcess

- **Open issue**

- The definition (interface and physical value) of threshold on the recoil energy require extra discussion

January: Requested **feedback** from users

- If all is well, had proposed to **close** this at next meeting.



# 1402: Scintillation

Requester: GDR neutrino experiments (via Marc V.)

Date: Oct 2006

Responsible(s): Peter Gumplinger

- Improve scintillation process
  - Currently when using mean material, the correct description of the process is lost

Status

- Need more information
  - Scintillation properties can be attached to materials

Update (July 2008)

- G4Scintillation updated, now using Birks and other material parameters from G4Material

- Relayed from mtg with neutrino experiments (M. Verderi, Oct 2006)

# 1602: Primary ionisations

Requestor: Andreas Morsch for ALICE

Responsible: V. Ivantchenko

- Having the possibility to get for each step the number of primary ionisations, their locations and the kinetic energy of the electrons.
  - This is needed for the accurate simulation of the TPC resolution.

Status (Feb 2008):

- Was included in 2007 work plans
  - Not achieved for December 9.1 release
- Scheduled for 9.2 release (Dec 2008)
- Update (March 2010) - the helper class G4EctronIonPair based on ICRU'31 report is implemented and available with 9.3 VI
- Propose to close

Requests / requirements Nov 2006

# Problem report issues (from underground)

Address open bugs:

- Radioactivity:
  - #952: Fix in G4 9.1 (Thanks Luciano Pandola)
  - #956: Responses provided
    - Support for isomeric states would be significant **extension**
    - Workaround identified
    - Neutron\_HP:
      - Feb 2008: an alternative model is scheduled for Summer 2008. Due to limited manpower, we plan not fix the existing model - as it is a large job.
  - #821: Missing inelastic recoils from NeutronHP
    - A first, temporary fix is in preparation.
      - Not all conservation laws will be respected
  - #675: No boost from CM->Lab for G4NeutronHPInelastic
    - Initial fix in 9.2 beta, and further efforts ongoing

Recent or revised  
requirements / requests

# Other requests / requirements from Mar 2006

- AUTOCAD input – (CMS / D. Stickland)
  - Input of CAD file geometry
  - potential additional issue for level of detail

UNCLEAR

- Neutron shower parameterization
- Possibility to import CAD geometries to tessellated shapes with specified resolution exists since release 8.1

**Propose to close** (March 2010)

# Req 1103: Composite User Actions

Requestor: Atlas (A. Dell'Acqua), LHCb (G. Corti)

Responsible: M. Asai

- Provide a 'composite' action of each user action type (Run, Event, Tracking, Stepping) that can call a set of registered sub-actions.
  - These sub-actions shall be called in the order in which they are registered.

## Status

- Asked for feedback & more information on requirements (April 06).
  - for the stepping action, instead of making it modular, alternative design could be allowing each G4Region to have a dedicated stepping action.
  - For event and tracking action, one modular action can kill the event/track. We need Subsequent actions likely should not be called.
- After new communication, first feedback recently obtained (G. Corti, A. Dell'Acqua)
  - Stepping action per region probably not ideal
  - Propose for calling of event/tracking action to depend on boolean return flag.
- Implemented in release 9.1
- **Propose to close** (March 2010)

# Req. 1104 Providing interaction snapshot

Requestor: Atlas, CMS, LHCb (W. Pokorski)

Responsible: T Sasaki (tbc)

- The simulation system shall provide to a "truth holder" class a snapshot of the interaction including position, incoming particle, all secondaries created (available as single entity, eg vector)
  - Requestor: Atlas, CMS, LHCb (W. Pokorski)
- **Status**
  - Since release 8.2, G4Step has a vector which has pointers of secondaries created in this particular step.
  - We propose to **close** this request.

# Req. 1105 Global verbosity

Requestor: LHCb (F. Ranjard), other?

Responsible: M Asai

- Provide a 'global' verbosity setting, which the user can use to request minimum verbosity from all verbose Geant4 components.
- New information
  - Key interest is to avoid printing during Initialisation
  - Want to keep information on difficulties, warning in event simulation
- **Status**
  - Under study.



# Longer term requirements

2. Requirements assigned “long-term” status before end  
2006

# Req.1201: Improvements QGSP angular distributions

Responsible (new): G. Folger

Requestor: HARP (V. Ivantchenko)

Description: "HARP needs following improvements in the energy range of 1-15 GeV."

- QGS model improvement to provide a smooth inclusive theta distribution in forward direction  $< 1$  degree

Status (July 2008): Resource limited

- Difficulty due to model applicability which starts around 15 GeV
  - Issue under investigation

# Req.0506: Optical photon transport in setups with repeated volumes

Responsible: P. Gumplinger

Requestor: TRIUMF (P. Gumplinger)

Date of request: Oct. 2004

Enable optical photon transport in setups with parameterized/replicated/divided volume

Status (July 2008): to be verified

We expect that it already works for replicated volumes

- Remains to be positively verified by the developer.

# 703. Treat particles with dipole moments

Originator: AD (Bertalan Juhasz)

Responsible: J. Apostolakis, H. Kurashige

- The user should be able to calculate the force acting on the magnetic (and possibly electric) dipole moment of a (neutral or charged) particle in an inhomogeneous magnetic (electric) field [ $F = \mu \cdot \text{grad } B$ ]
  - magnetic dipole moment of a particle should be available for the equation of mot.
- Note: the magnetic moment is not always a vector of constant magnitude,
  - In magnitude and direction it can depend on e.g. the external magnetic field
- the force will be calculated by a user-derived equation of motion class (ok)

Comments/Status: Open

- First proposal for a working solution was communicated (Sept 2006)
- **NEW (Dec 2006)**
  - User created prototype implementation – improved after discussions
    - A first working solution now exists (but has toolkit modifications)
  - Further toolkit improvements planned, to enable better integration
- For a solution 'integrated' in the toolkit: second design study done (Dec 2006)
  - Particle properties for magnetic dipole moment (MDP) needed (planned)
  - Revised field-track to carry MDP (done, June 2006)
  - A revised or derived transportation (tdc)
    - Identify neutral particles with MDP (or EDP), and pass properties
  - A revised equation of motion is needed (user can do – missing only MDP info.)

# 1301 Fixing visualization of boolean solids

Requestor: CMS / Y. Osborne, F. Cossutti

Responsible: J. Perl

Context: G4 Boolean Processor fails to create G4 subtraction solid out of shapes sharing surfaces

## Status (March 2010)

- Improvements implemented in release 9.3; still 4% cases remains problematic
  - Identified potential implementers. Funding to support this not yet found

# Closed by Sept 2009

Longer term requirements

Closed March 2009

- As proposed in July 2008

# Req 1102: Identifying a process efficiently

Requestor: Atlas, CMS, LHCb (W. Pokorski)

Responsible: H. Kurashige, V. Ivantchenko, D.Wright (new)

A process (physical or 'general') must hold an identity (id) that can be used to determine

- To which class of process (EM, hadronic, optical, decay, 'transport', biasing, ..) it belongs
- which physical process it models (eg Compton, photoelectric, Bremsstrahlung ..)
- Currently NOT the identity the particular process (G4Transportation): This part is postponed (Nov 2007)

Status (Dec 2008):

- Design revision to add this information agreed.
  - 'Infrastructure' revisions tested (Mar 2008)
  - Implemented in Standard EM processes (9.2 beta, Jul 08).
  - Included in all processes (9.2, Dec 08)
  - Propose to **close** (Mar 09) - with main requirement fulfilled

# Req.704: Neutron data for additional elements

Originators: (BaBar, Vanderbilt)

Responsible: T. Koi

- BaBar needs Nd (Neodymium) and Sm (Samarium) added to neutron data library.
- Vanderbilt ask for As, In, Ge, Ga, Sb, Hg, Cd, Te, and Gd.

Seconded by ESA.

Status (mid-2006)

- As, In, Ge, Ga, Cd, Te existed already in G4NDL3.7
- Gd (in 3.8, Feb06), Nd, Sm, Sb – also Tc and Hf added
  - Added in G4NDL3.9 (June 2006, with G4 8.1)

Included in release 8.2 (Dec 2006):

- Thermal Scattering files
  - H with H<sub>2</sub>O, Graphite, H with Polyethylene are prepared
- JENDL High Energy files
  - H(1), C(12,13), O(16), Mg(24,25,26), Al(27), Si(28,29,30), K(39,41), Ca(40,42,43,44,46,48), Fe(54,56,57,58), Cu(63,65), Zn(64,66,67,68,70) are prepared for neutron-induced reaction cross sections.

Status (Mar 2009):

- Data for Hg is available since G4NDL3.12 (data from JENDL 3.3)
- Data provided for all available, requested natural elements ( $Z \leq 92$ )
- Propose to **close**



# suites for most sensitive physics quantities

Responsible: J. Apostolakis, A. Ribon

Status (2007):

- A first test suite for calorimetry quantities has been created. It measures longitudinal and lateral shower profiles for hadronics.
  - For several materials taken from LHC calorimeters.
- SLAC is continuously monitoring some variables most sensitive to **BaBar** and **GLAST** experiments.

Update (July 2008)

- Calorimeter regression tests are standard part of release process