



Updates
on requirements
from previous TF meetings

Geant4 Technical Forum
November 16th, 2004

Makoto Asai (SLAC)
on behalf of Geant4 collaboration



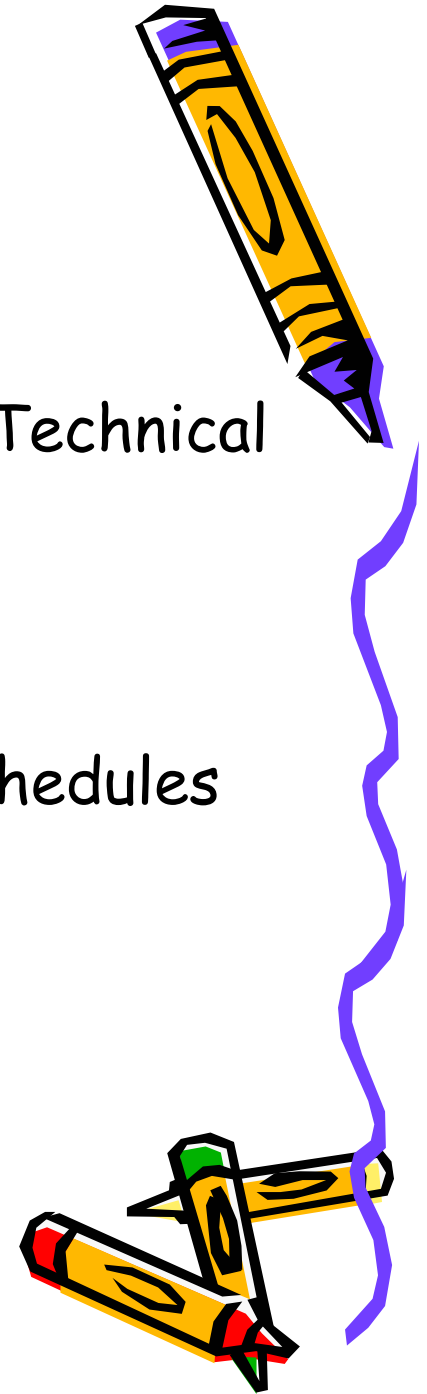
Some links

- Minutes and presented materials of former Technical Forums can be found at

http://cern.ch/geant4/technical_forum/

- Updated work plans and expected release schedules can be found at

http://cern.ch/geant4/source/planned_features.html



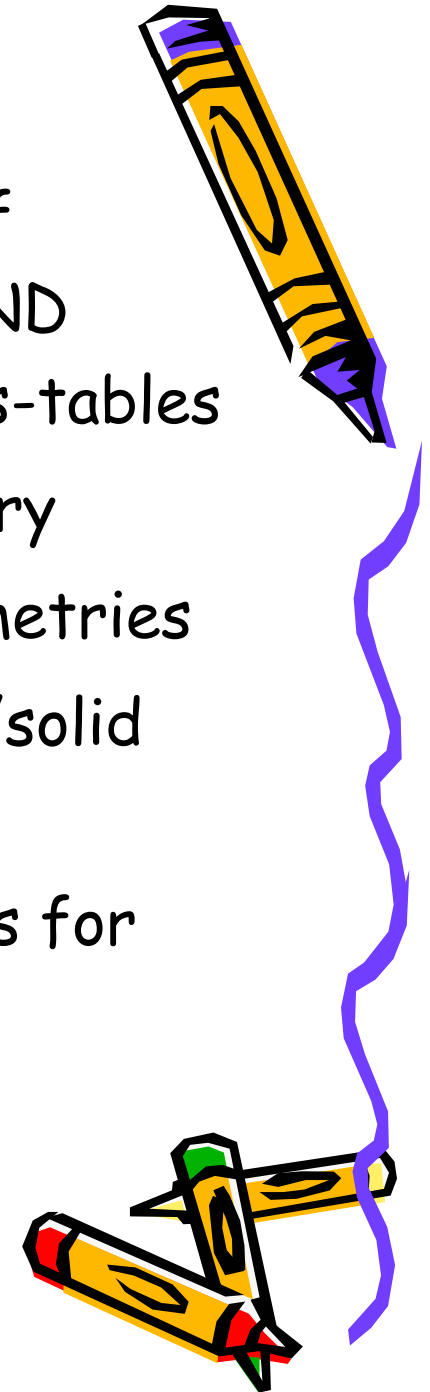
Recently-closed requirements

- Req.0201 : Killing the primary in (electron) Bremsstrahlung
 - Feature released with G4 6.2
- Req.0301: Robustness of G4 and improved diagnostics to give more handles to solve problems
 - Feature released with G4 6.1
- Req.0302: Reproducibility when resuming of runs at an event different from the first one
 - Fix has been made at G4 6.1
- Req.0305: Ability to release the memory of an Allocator 'stack' on request
 - Feature released with G4 6.2
- Req.0308: Creating a new daughter particle AND
Req.0310: Consistent behavior across use cases
 - Feature released with G4 6.2



Requirements to be met by G4 7.0

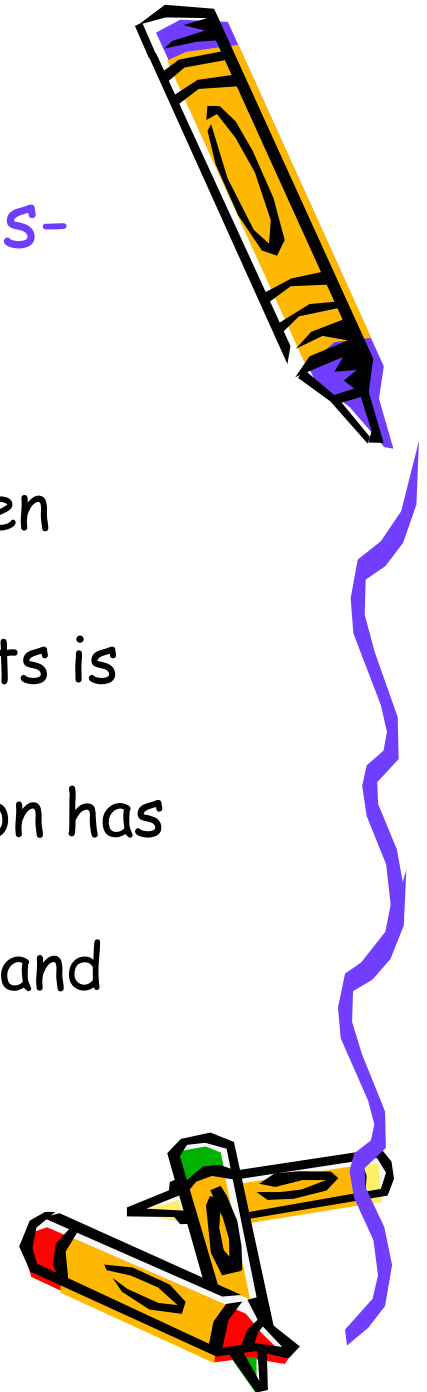
- Req.0208 : Enhanced saving and restoring of selected processes' cross-section tables AND Req.0306: Storage retrieval of cuts/physics-tables
- Req.0304: Exchange format for the geometry
- Req.0307: Region settings in reflected geometries
- Req.0312: Possibility of customizing volume/solid creation step
- Req.0503: Possibility of adding new particles for searches of new physics



Req.0208 : Enhanced saving and restoring of selected processes' cross-section tables

Responsible: M. Asai, H. Kurashige

- Some enhanced verbiages have already been released with Geant4 6.0 and 6.1.
 - Reshuffling of the order of materials/cuts is included in 6.1.
- Design study and some partial implementation has been done.
 - Picking up some usable tables from a file and calculate only unavailable tables.
 - Work is in progress and expect to be released at 7.0.
- Requirement to be closed.

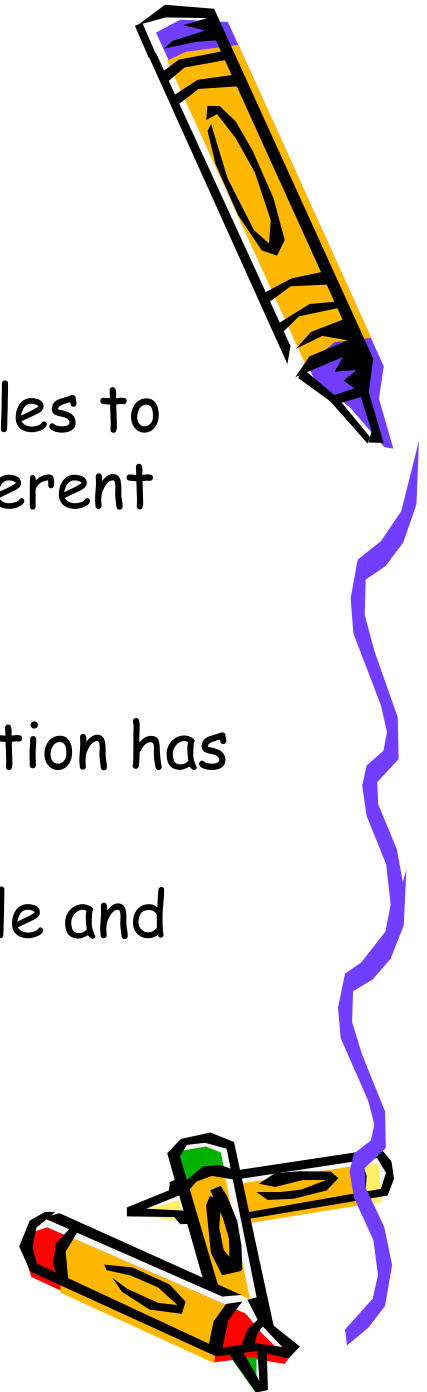


Req.0306: Storage retrieval of cuts/physics-tables

Responsible: M. Asai, H. Kurashige

Description: Extend retrieval of physics tables to case where the geometry is built in a different order than at storage.

- Note: this is related to Req.0208
- Design study and some partial implementation has been done.
 - Picking up some usable tables from a file and calculate only unavailable tables.
 - Work is in progress and expect to be released at 7.0 with an example.
- Requirement to be closed.

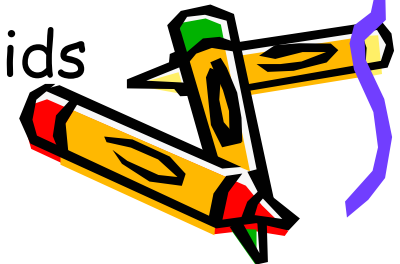


Req.0304: Exchange format for the geometry

Responsible: G. Cosmo

Description: Enable use of an external file for exchanging geometry description. Potential options: GDML, DDD, other (?).

- The solution G4 proposes is GDML in the framework of the LCG project. The GDML implementation is already partially done (the input part).
- First version of the GDML writer released in June, and available with GDML 2.0.0.
- Data model extended to cover parameterized volumes and replicas.
 - Currently under testing.
- Model has been extended to cover missing solids (polycone, polyhedra,...).
- Coming with 7.0.

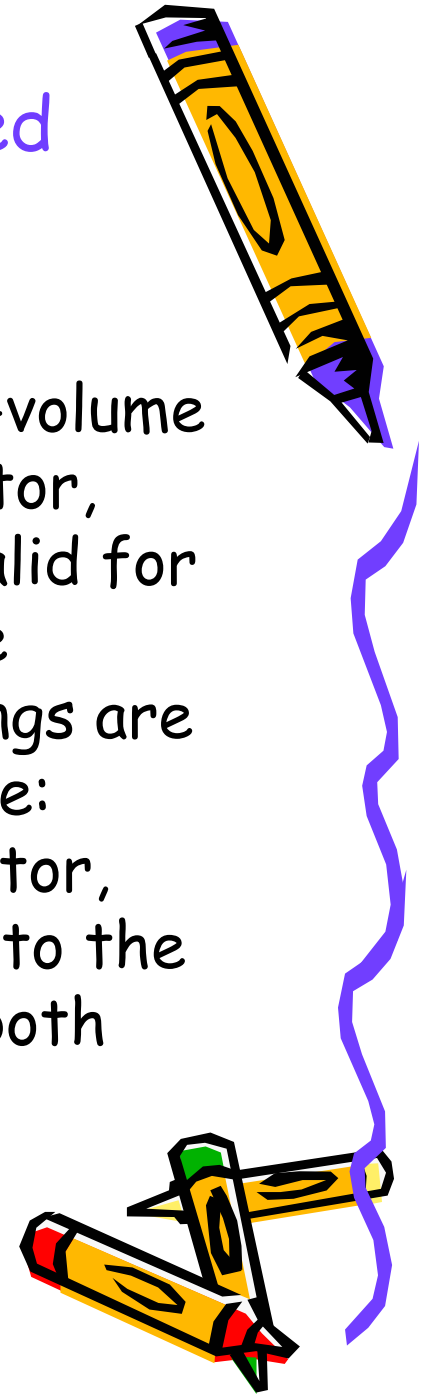


Req.0307: Region settings in reflected geometries

Responsible: G. Cosmo

Description: "If a region is assigned to a logical-volume and the volume is placed n-times in the detector, the region cuts are applied to all n-regions (valid for all daughter volumes recursively). If the same volume is reflected m-times, the region settings are not applied to the reflected volumes." Example: when reflecting a whole endcap of a subdetector, we need to have the same region cuts applied to the reflected volume hierarchy (same physics in both endcaps).

- It has been implemented and to be released with 7.0.

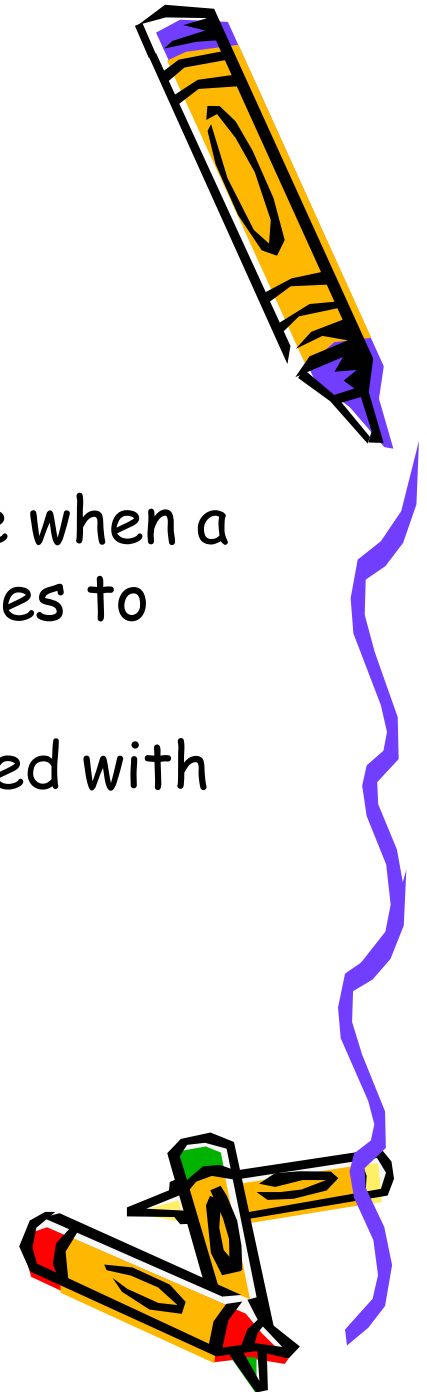


Req.0312: Possibility of customizing volume/solid creation step

Responsible: G. Cosmo

Description: "E.g. add a call to a user routine when a volume is created in order to add attributes to the volume (detectorName::, other?) "

- It has been implemented and to be released with 7.0.



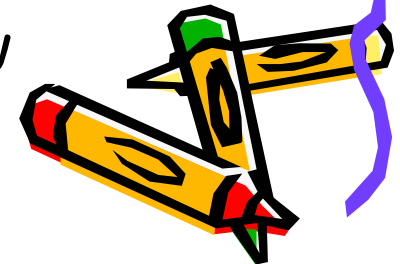
Req.0503: Possibility of adding new particles for searches of new physics

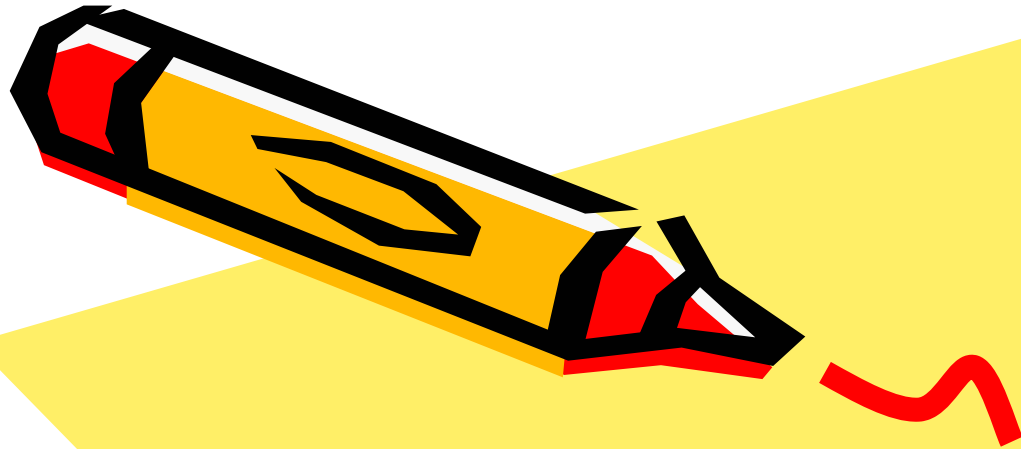
Responsible: M. Asai

Requestor: ILC, CMS, Atlas

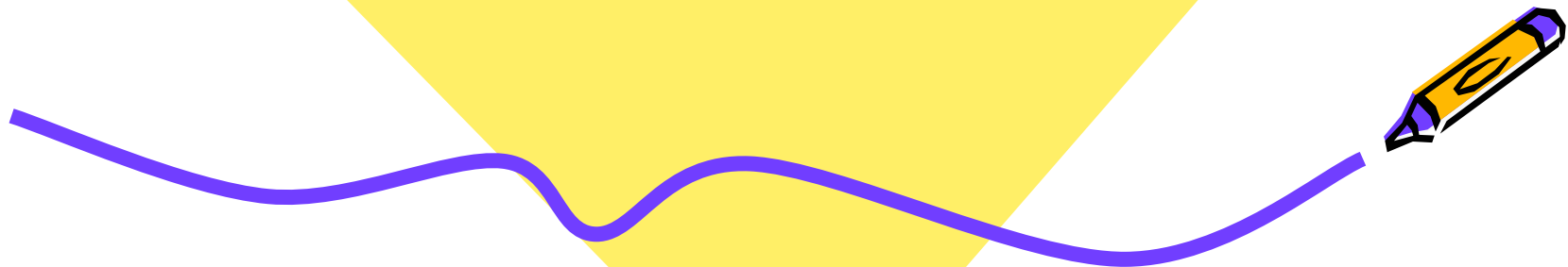
Description: "In searches for new physics where the particles have peculiar interaction, e.g. SUSY, some of these new models need to be benchmarked. How can we modify G4 to do this?"

- *G4UnknownParticle*, *G4UnknownParticleDecay* classes are introduced. *G4PrimaryTransformer* class becomes abstract to enable the user to add new particle types which are exotic to G4.
- Features are to be released at 7.0 with a new extended example.





Longer term requirements
- Under development
- Under study

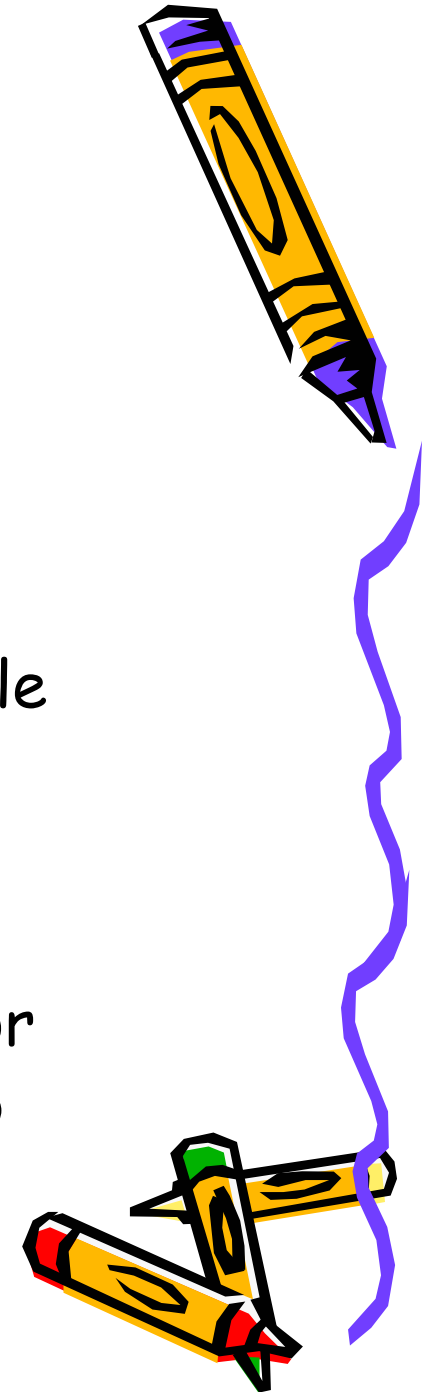


Req.0103 : Geometry construction - input from external models

Responsible: G. Cosmo

Two aspects of this 'multi-request' are under consideration

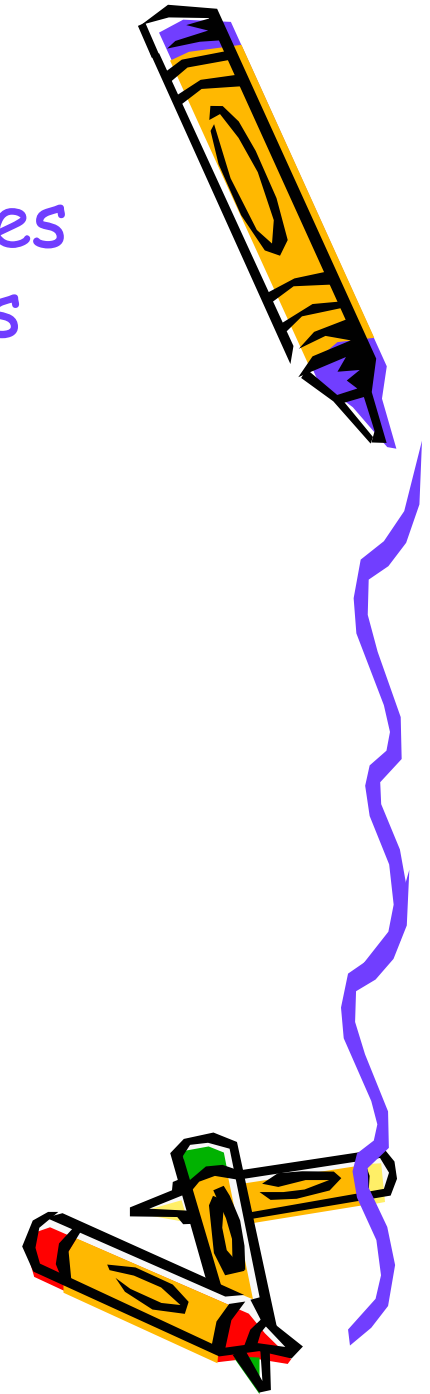
- GDML:
 - adding output capability
 - including it as an I/O persistency module
 - extensions to data model
 - More comments on Req.0304.
- CAD interface:
 - in the process of identifying objectives for
 - BREPs extensions and interface to CAD
 - We are discussing with NASA/GSFC for taking care of this.



Req.0106 : Setup statistical test suites
for most sensitive physics quantities

Responsible: J. Apostolakis

- JA to comment on 2004 activities

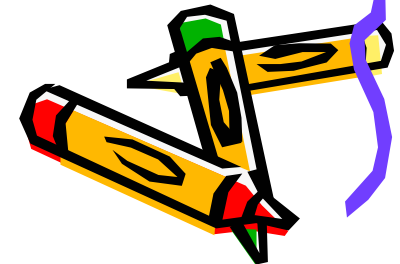


Req.0303: Performance of G4

Responsible: J. Apostolakis / G. Cosmo

Description: "Compared to G3 simulation, under similar circumstances G4 is reported by the LHC experiments, to be a factor 1.5-2 slower. A study group started last year to address this issue, and should continue with more priority. This is expected to be a collaboration between G4 and the users."

- JA to comment on 2004 activities

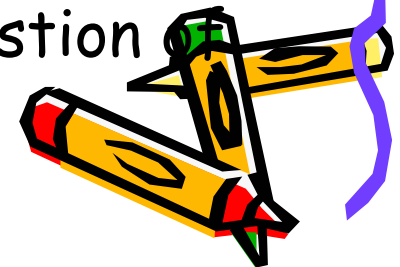


Req.0309: Provide documentation on the technical aspects of all available physics processes

Responsible: M. Maire / M.G. Pia / H.-P. Wellisch

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.??).
- Physics group coordinators are open to suggestion concrete issues and potential improvements.



Req.0311: Parameters used in physics list should be well document and under user control

Responsible: H.-P. Wellisch

Description: "When the behavior of a specific physics list depends on parameters (for example on a momentum threshold) this should be clearly documented, specifying if such parameters are fixed or under user control."

- Note (from discussion): Major user modifications, such as these, would reduce the value of comparisons of the same physics list between users and experiments.
 - Physics list is free of user-tunable parameters except production thresholds.

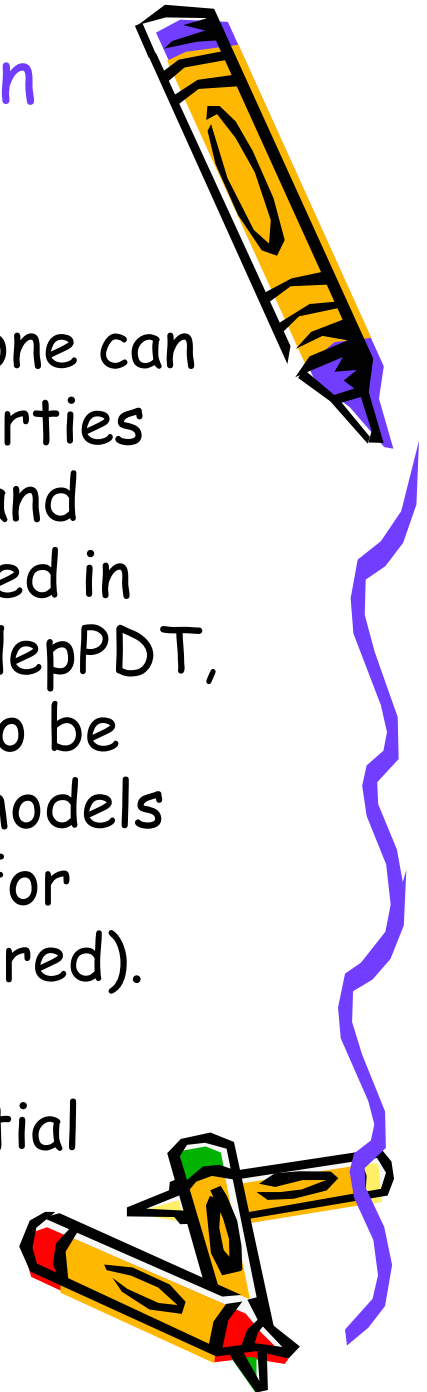


Req.0313: Particle properties from an external source

Responsible: M. Asai, H. Kurashige

Description: "The request is to study whether one can have a unique definition of the particle properties throughout all the physics models within G4 and preferably also consistent with the values used in generators. A candidate catalogue could be HepPDT, extracted from the PDG tables. This needs to be studied however, since some of the physics models assume explicitly certain mass/width values for certain resonances (in generally poorly measured).

- Design study, preliminary implementation, performance tests, and assessment of potential effects onto user's code are achieved.
 - Further studies should continue in 2005.

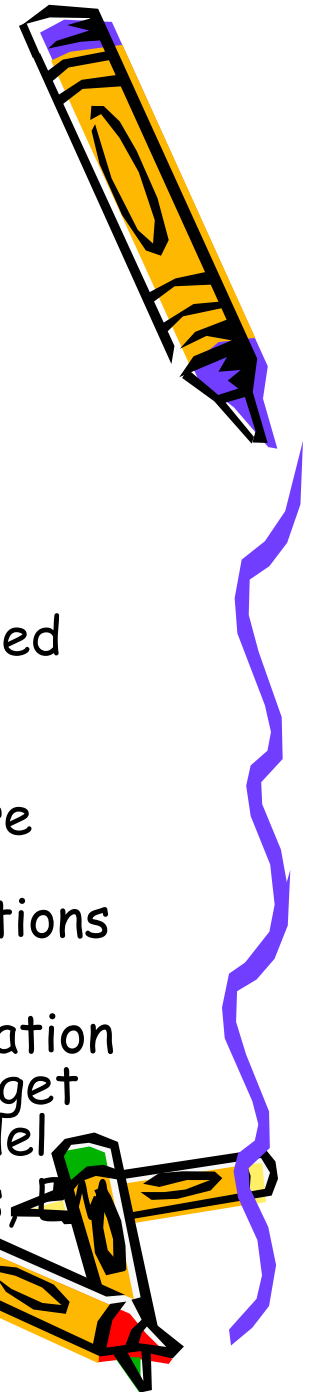


Req.0401: Extension of Ion hadronics interaction to cover a good part of the cosmic ray range in (A,Z) and energy

Responsible: H.-P. Wellisch

Requestor: ESA (G. Santin)

- EM dissociation: Released in G4 6.2
- Inelastic reactions
 - Below 10 GeV per nucleon: Released Xsec in 6.0, extended models in 6.1 for light ions ($\leq C$)
 - Above 10GeV/nucleon
 - Evaluated existing Xsec parameterisations - they are now good to about 20%. Extended QGSM to predict these Xsec and made a systematics of these predictions at $O(\%)$ level.
 - Prototype extension of QGSM for final state generation in central rapidity for all ions and projectile and target fragmentation based on exciton pre-equilibrium model
 - Work to be done: radioactive decay for relativistic ions, dissociation for higher excitations than quadropole resonance.



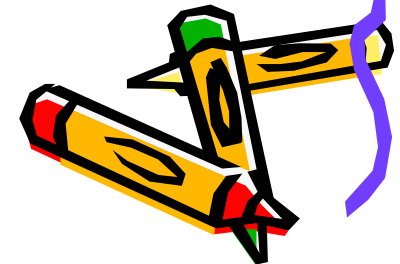
Req.0402: "Intuitive" documentation of the physics lists

Responsible: M. Maire / M.G. Pia / H.-P. Wellisch

Requestor: ESA (G. Santin)

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."

Hadronics: accepted, open.



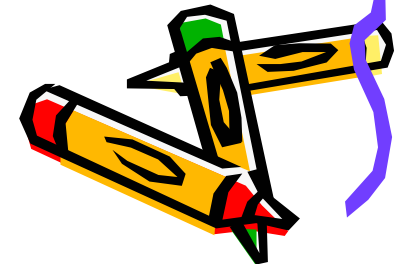
Req.0403: Unique set of physics lists

Responsible: M. Maire / M.G. Pia / H.-P. Wellisch

Requestor: ESA (G. Santin)

Description: "Unique set of physics lists (by use-case) and not two sets as now, one for EM and one for hadronics."

Studying possibility to allow user to overwrite the EM physics constructor in a hadronic physics list by their choice of EM physics constructor.



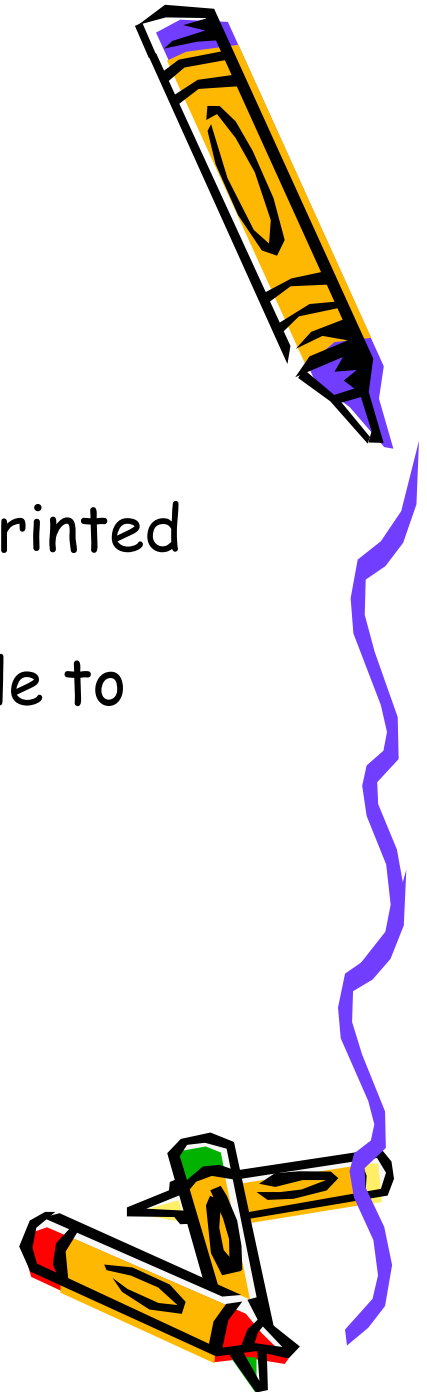
Req.0501: Print-out of created processes should be optional

Responsible: M. Maire / M.G. Pia / J.P. Wellisch

Requestor: LHCb, Atlas

Description: "The list of created processes is printed out at the beginning. Though it is useful for development and verification, it should be able to switch-off for mass production run."

Under study.



Req.0502: Treatment of particles that get stuck during simulation

Responsible: G. Cosmo, J. Apostolakis

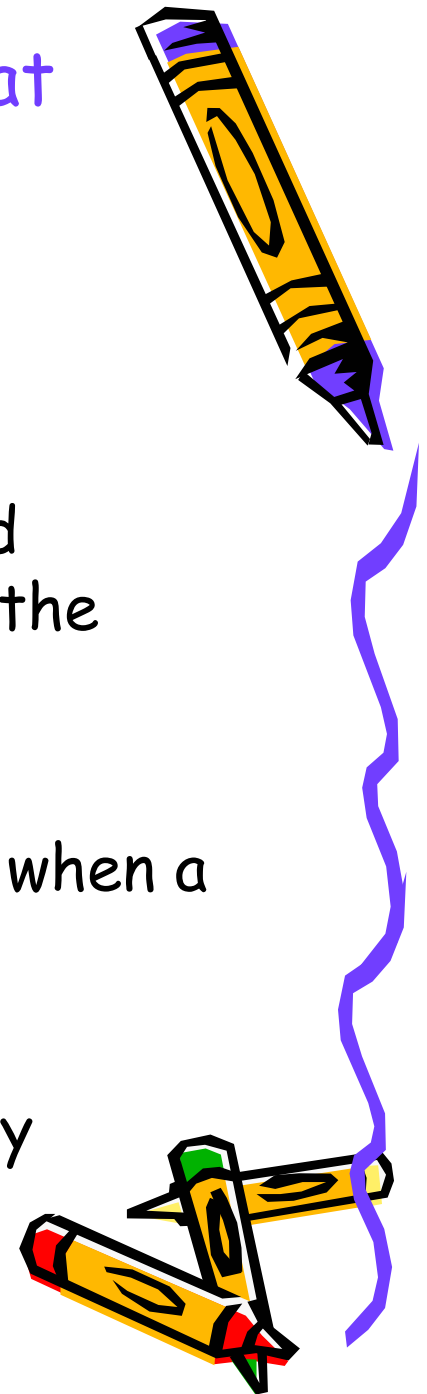
Requestor: LHCb

Description: "CMS drops a track if it stacks and continues the event. G4 by default abandons the event. Neither is good."

As a first measure, Geant4 6.2 aborts an event when a particle is stuck.

We are working on improving this:

- To make additional effort to keep high energy particles (> 500 MeV)
- To kill only the problematic 'stuck' track.



Req.0504: Geant4 release should be tested by Valgrind

Responsible: G. Cosmo, S. Sadilov

Requestor: LHCb

- Usage of Valgrind has been part of the release procedure since over two years
 - previously Insure++ was used for memory leaks & runtime error reports.
- Selected system tests are checked.

Problems are reported to developers.

- Developers are requested to fix the reported problems
 - in particular those reported by Valgrind involving errors at runtime.



Req.0505: Improvements in hadronics

Responsible: H.-P. Wellicsh

Requestor: HARP

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

- Bertini Cascade robustness to be used in production
- Binary Cascade extension to work with pion incidents
- CHIPS be available as alternative
- QGS model improvement to provide a smooth inclusive theta distribution in forward direction < 1 degree
- Patch 2 (of 6.2) included fix for a Bertini problem.
- Pion projectiles for BC enabled in 6.0
 - Approach limited up to 1.5 GeV due to resonance data
- Improvements to QGS model theta distributions in forward direction (< 1 degree) underway.



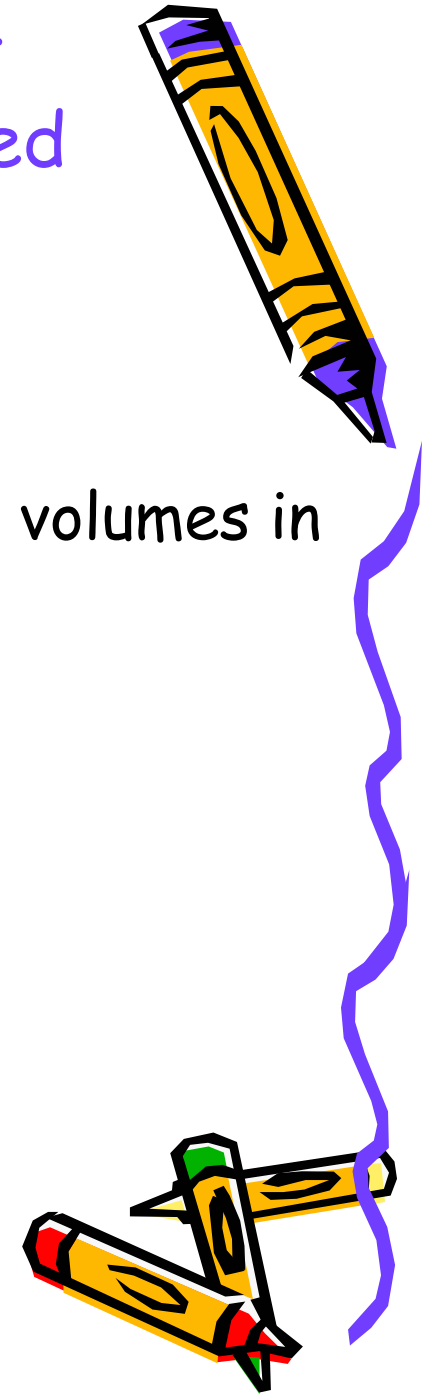
Req.0506: Optical photon transport with parameterized/replicated/divided volume

Responsible: P. Gumplinger

Requestor: TRIUMF (P. Gumplinger)

Revisions underway to enable use of 'replicated' volumes in
optical processes.

Status: Underway (?)



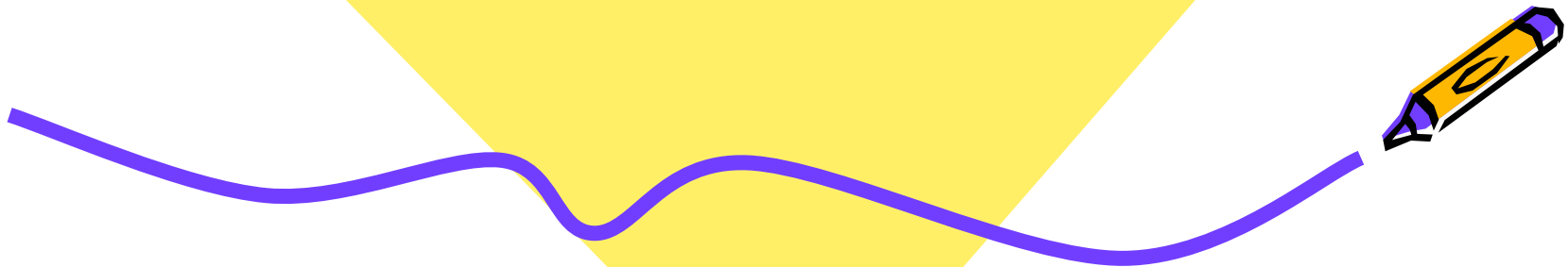
New requirements

1. Access to a touchable from "Compute" methods in *G4VPVParameterisation* class
 - Position, material, etc., could be parameterized with copy numbers of not only itself but its mother
2. Touchable should be always attached for all secondaries
 - Currently, only EM processes set it.
 - Should it be done by individual physics processes, or taken care by *G4SteppingManager*?
3. "Suspend" status set by a physics process should be optional.





Requirements closed by
October 2004

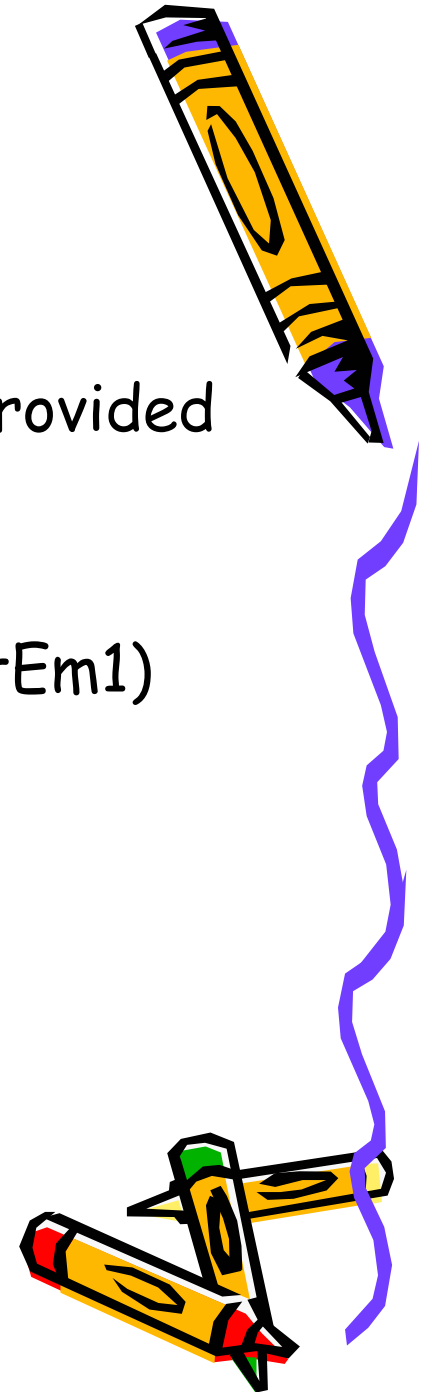


Req.0201 : Killing the primary in (electron) Bremsstrahlung

Responsible: V. Ivantchenko

- Concrete process for this purpose has been provided to the requestor.
 - And being publicly released with 6.2.
- For potential 'general case', an example (TestEm1) includes the implementation class.

Closed

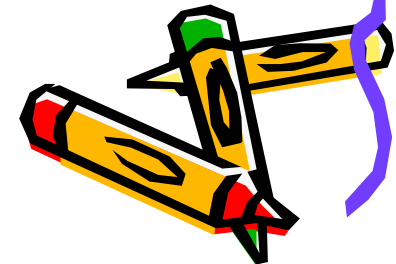


Req.0301: Robustness of G4 and improved diagnostics to give more handles to solve problems

Responsible: H.-P. Wellisch / G. Cosmo

Description: The LHC experiments CMS and LHCb are entering production now. Occasional crashes are seen in simulations of files containing several hundred events. These problems will have to be tackled and removed. Additional information given/printed during the abort will help to localize the problem.

- Some enhancements have been released at 6.1.
- Proposed to be closed.

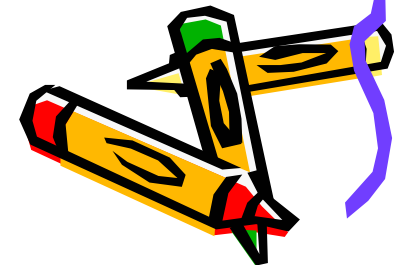


Req.0302: Reproducibility when resuming of runs at an event different from the first one

Responsible: G. Cosmo

Description: For debugging purposes, it is required that one can reproduce a particular event exactly, when one starts the simulation from that event.

- Some fixes for uninitialized variable were in G4 6.0 and experiment programs.
- It should be checked again, in a common effort between the experiments and G4 whether it works with the present G4 6.1.

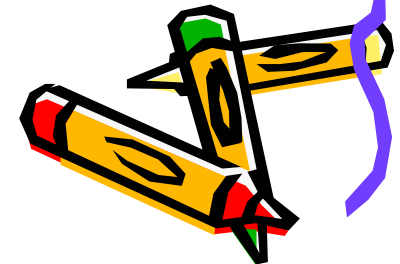


Req.0305: Ability to release the memory of an Allocator 'stack' on request

Responsible: G. Cosmo

Use case: "Step behavior is seen in the memory usage during event file simulation"

- New G4Allocator and related classes have been worked out and released with 6.2 p01.
- Requirements to be closed.



Closed

Req.0308: Creating a new daughter particle

Responsible: H.-P. Wellisch

Description: The possibility to assign a new track ID (creating new particle) to a hadron undergoing inelastic scattering, in all physics lists, and steerable from the physics lists. The choice should be under user control since it depends on specific studies. This is necessary to understand the behavior of the tracking for example where if the leading outgoing particle has very different kinematics from the incoming particle it can be misleading [to reconstruction programs to see this] as a single particle.

- New feature is released with 6.2.
- Requirements to be closed after verification.

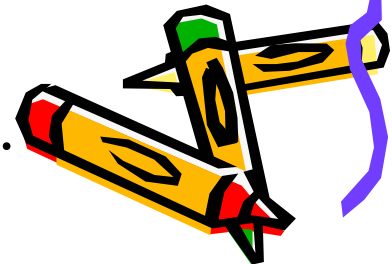


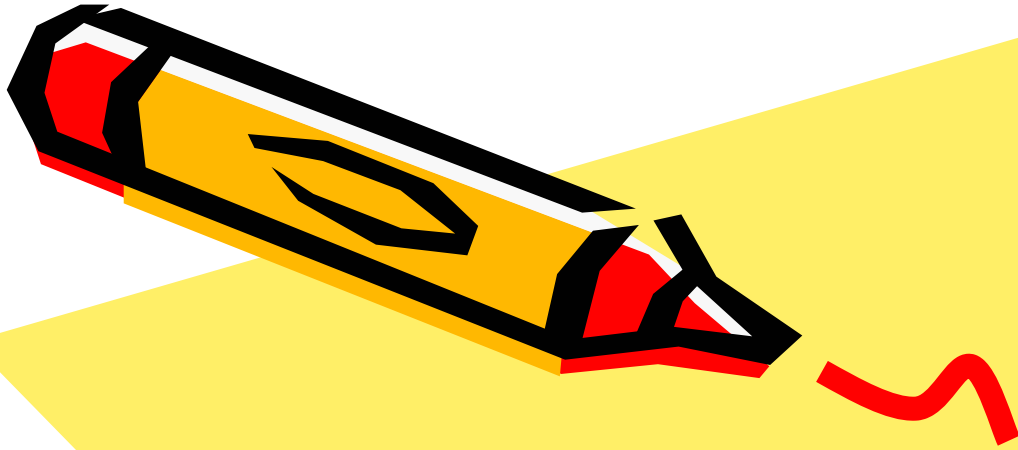
Req.0310: Consistent behavior across use cases

Responsible: H.-P. Wellisch

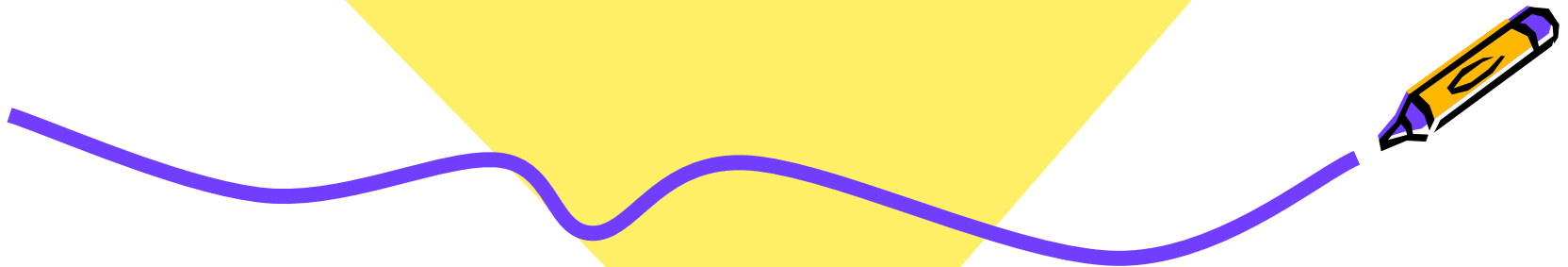
Description: "A physics list should be implemented in a coordinated way regarding the output of the models' behavior, so that such behavior would be consistent as much as possible. For example an incoming particle should always be (or not be) killed in all inelastic scattering models of a given physics list. In the cases where this is not possible (due to specific characteristics of the models) the difference should be clearly described."

- This requirement is identified to be identical with Req.0308.
- New feature is released with 6.2.
- Requirements to be closed after verification.



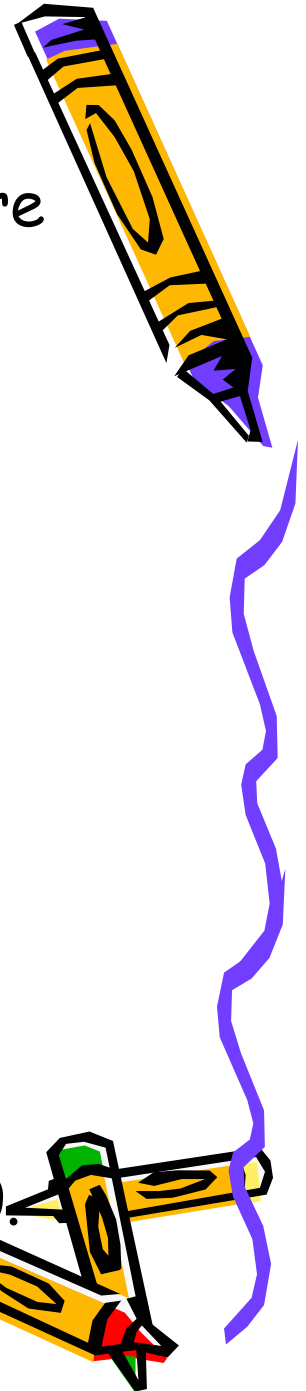


Requirements closed by May 2004



Recently closed requirements

- Req.0101 : Access to the Track properties before hadronic processes are invoked
 - Feature released with G4 6.1
- Req.0107 : Installation kit which contains all packages
 - <http://geant4.slac.stanford.edu/g4cd/>
- Req.0203 : Pre-defined decay products
- Req.0204 : User-defined MC truth
- Req.0205 : Maintaining event generator information
- Req.0207 : Depositing additional information in calorimeter hit
 - All of required features released with G4 6.0.



Recently closed requirements

- Req.0206 : Physics modeling options and consistency
 - Feature released with G4 6.1
- Req.0202 : Abstraction of geometry navigation / modeling
 - Feature released with G4 6.0
 - Further requirements awaited
- Req.0209 : Physics lists capabilities and choices
 - Since G4 6.0, physics lists are distributed along the public release.



Req.0101 : Access to the Track properties before hadronic processes are invoked

Responsible: H. Kurashige, H.P. Wellisch

- The solution proposed is to add a new user hook in the hadronics processes to enable the user to inspect the final state for the hadronic processes.
- Design iteration to enable the placement of such a hook implies removal of ParticleChange and G4Track from hadronics except for level 1 framework. This was done in 6.0.
- The user hook is to be seen in the context of new needs of CMS for monitoring, and interests to do microscopic NIEL calculations. The requirement will be closed in the next minor release.

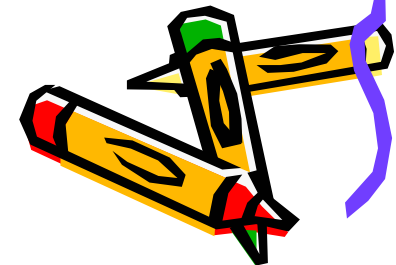


Closed

Req.0107 : Installation kit which contains all packages

Responsible: G. Cosmo / G. Folger

- We could offer it on a best-effort basis
 - as many customers require only current systems
 - new packaging will require additional effort to maintain, document, etc.
- For example, at the moment SLAC is maintaining an installation kit for Linux and Windows
<http://geant4.slac.stanford.edu/g4cd/>

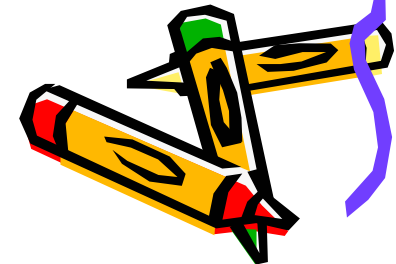


Req.0202 : Abstraction of geometry navigation / modeling

Responsible: G. Cosmo

- First version of abstract G4Navigator provided in Geant4 6.0
 - first simplification/consolidation of interface
 - virtual methods for key functions
 - Feedback awaited (A. Gheata, BaBar)
- The integration of the BaBar transportation code into Geant4 as an alternative to the standard transportation is not yet started. Some progress has been made here, but there are still significant differences between the two codes that prevent them from being packaged together.
- Discussion between G4 Geometry WG and BaBar at workshop.

To be verified
by user



Req.0203 : Pre-defined decay products

Req.0204 : User-defined MC truth

Req.0205 : Maintaining event generator
information

Req.0207 : Depositing additional information in
calorimeter hit

Responsible: M. Asai

- All of required functionalities have already been released with Geant4 6.0.
- A sample code had been distributed to the users who requested these requirements and who expressed interests.

<http://www.slac.stanford.edu/~asai/NLD1.tar.gz>

- A new example (exampleN08) derived from this sample code is under construction and it is expected to be released with the next public release.



Closed

Req.0206 : Physics modeling options and consistency

Responsible H.P. Wellisch

- New set of physics lists based on Geant4 6.0 will be available by the end of March 2004.
- If time permits, at that time the ordering of the tailoring will be (optionally) independent of the G4UI (CMS request).

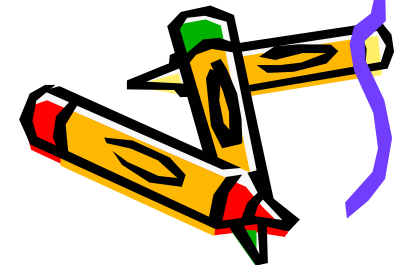
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Req.0209 : Physics lists capabilities and choices

Responsible: H.P. Wellisch

- Since Geant4 6.0, physics lists are distributed along the public release.
- The physics lists will continue to be distributed in major geant4 releases.
 - Release notes were included in the last physics lists update and will be part of the 'standard' maintenance process.
- A physics list, when it is created, will print
 - information as to what physics is included,
 - it will be in the next revision
 - what use-cases it can be used for
 - it will be done once maintenance concerns for correctness are resolved.

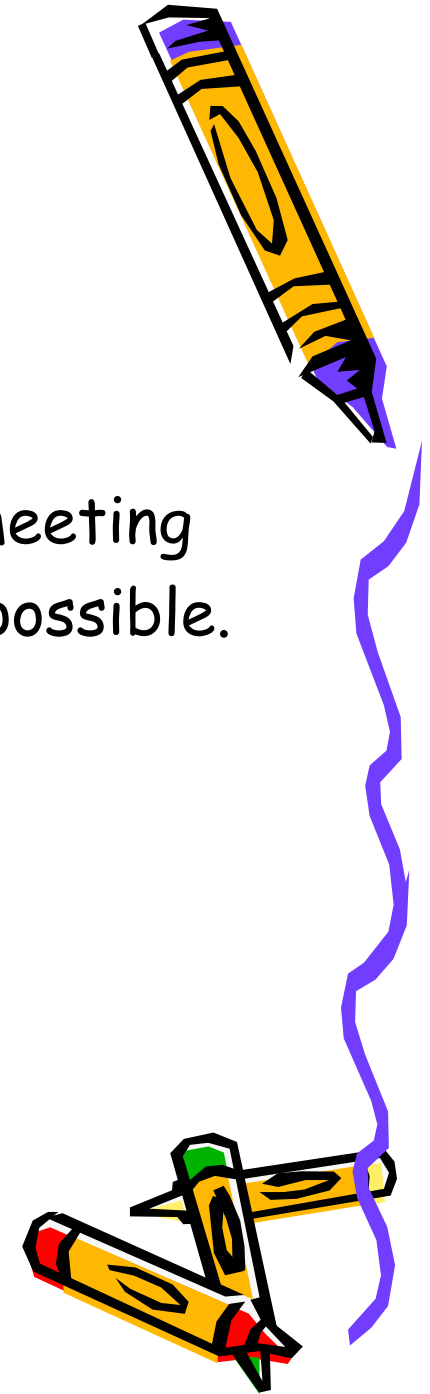


Req.0210 : Correction of known problems

Responsible: J. Apostolakis

- Agreement was reached at the previous meeting
 - to address open issues, to the degree possible.

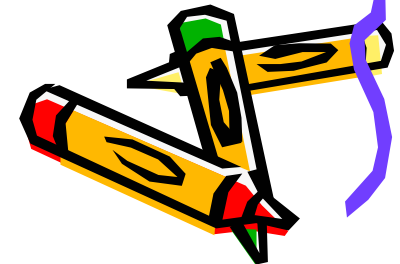
Closed



Req.0211 : Geant4 release type and frequency

Responsible: J. Apostolakis / G. Cosmo

- The proposal was discussed only briefly at last meeting, by common agreement. An explanation of current practice was made.
- G4 is requested early communication of major change requests.
- No further action is currently foreseen.



closed