

# Update on Requirements

34<sup>th</sup> Geant4 Technical Forum  
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Requirements Tracking System Page:  
<http://jirageant4.kek.jp/secure/Dashboard.jspa>

# **NEW REQUIREMENTS**

## **FROM LAST TF (MARCH)**

# 3301 : Multithreading processing driven by experiment framework

- Requester: CMS
  - Original request at 33<sup>th</sup> TF ([link](#))
  - Further information at G4 Collaboration meeting ([link](#))
- Responsible: Andrea Dotti, John Apostolakis.
- Scope:
  - To process multiple events simultaneously  $\otimes$  process multiple modules (gen., sim./G4, trg., reco., ana.) for same event simultaneously
    - Geant4 = one of the modules
  - Framework controls modules execution
    - Geant4 to be controlled with proper messages
  - “Threading Building Blocks” (Intel<sup>®</sup> TBB) task model adopted and used as:
    - Single threaded initialization, for modules to setup
      - among-event shared data structures (e.g. physics, geometry)
      - one dedicated data structure / event
    - Process N events simultaneously  $\leq$  M threads, N and M told to the application
    - Processing one event:
      - Module called from a `tbb::task`
      - Module to access : the event, the shared data structure, the dedicated data structure of this event
      - Module is also allowed to create its own TBB tasks
        - » Module must wait for all of its TBB tasks to complete before returning
- Status:
  - G4-CMS discussion ongoing for more accurate requirement definition
    - What are the messages needed to pass to Geant4 module ?

# **OPEN REQUIREMENTS**

# 2901: Lateral displacement in large volume

- Originator: G. Corti (LHCb)
- Issue
  - Bad correlation between displacement and angular deviation when delta rays are turned off (in large volume)
  - Due to displacement lost on steps ending on boundary
  - Proposal to use EM-Opt3 incurs too large CPU cost
- Status (Nov 2011)
  - Limitation for MSC in “default” EM-Opt0 with default value = 20 X0
  - Seemed to fix the issue for muons (G4 team).
  - Other particles less affected as higher probability to interact.
- Status from March 2012:
  - In 9.5 default muon MSC is WentzelVI model, with intrinsic step limitation  $20 \times X_0$ .
  - LHCb: solution looks general, but applied to muon only ?
- Status from today:
  - Note: default multiple scattering for all particles (including e+- above 100 MeV) changed from Urban model to WentzelVI
  - Awaiting for feed-back
  - **Proposed to be closed ?**

# 2902: Displacement in thin volumes

- Originator: S. Miglioranzi (LHCb)
- Issue
  - Displacement lost for steps in thin vol. (Si layers)
  - Need to recover displacement for all charged particles (not just e-, as in EM opt 3)
  - Need to avoid extra CPU cost.
- Status November 2011
  - Customized physics List based on EM Option-0, limiting all charged particles' steps was provided.
  - Since simulation workshop in Oct. 2011: is complicated shape of the RF-foil, in front of the VELO, related to the problem (requires detailed implementation) ?
- Status from March 2012:
  - In 9.5 EM option2 includes WentzelVI MSC model, providing an alternative approach for scattering of hadrons.
  - Suspect discrepancy may be due to imperfect geometry modeling of complicated RF foil.
    - More complete geometry investigated via CAD/STL -> GDML -> G4 geometry
  - LHCb will report when studies conclude
- Status from today:
  - Note: default multiple scattering for all particles (including e+- above 100 MeV) changed from Urban model to WentzelVI
  - Awaiting for feed-back.
  - **Open.**

# 3201: Uniform Signature of Physics Builders

- Originators: (LHCb, Gloria Corti) – Nov. 2011
- Responsible(s) : W. Pokorski
  - In LHCb physics lists built at run time via a templated factory mechanism instantiating the Physics Builders
  - But also wish to configure them at construction time without duplicating instantiation code.
- Request
  - Uniform fixed signature for all physics constructors,
  - As far as the argument types are concerned.
  - e.g. Builder(string, string, int, float, double)
- Status from march 2012:
  - A solution has been proposed (using the constructor with a single string as argument)
  - Solution looks satisfactory to LHCb
- Status from today:
  - Proposed to be closed.

# **RECENTLY CLOSED REQUIREMENTS**



# 2701 : Cross-sections for K<sup>-</sup>/K<sup>+</sup>

- Originators: (LHCb, Gloria Corti) – March 2010
- Responsible(s) : M. Kossov / G. Folger
  - Identified significant differences between charged Kaon cross sections and PDG values. This has impact on LHCb measurements.
  - Physics lists QGSP\_BERT still utilises Geisha cross-section for K<sup>+</sup>/K<sup>-</sup>
- Request
  - Hadronic physics builder with well-modeled Kaon interactions
- Since 9.4-beta (June 2010):
  - Physics builders and QGSP\_BERT\_CHIPS physics list provided in 9.4 beta
  - Kaon cross-sections use revised CHIPS parameterisations
  - Kaon interactions unchanged Bertini < 9.9 GeV, 9.5 < LEP < 25, QGSP > 12
  - Note: K<sup>0</sup>/K<sup>0</sup>bar oscillations not modeled
- Status from November 2011:
  - Can now use Kaon cross-section in FTF, no longer need LEP.
  - Several models can now handle K<sup>+</sup>/K<sup>-</sup> at medium energies.
- Status from March 2012:
  - In 9.5, physics lists free from LEP exist.
  - LHCb will look into.
- Status from today
  - LHCb experiment informed that CHIPS kaon cross sections are better than Geisha ones
    - Available in recommended physics list for high-energy physics, i.e. FTFP\_BERT.
  - **Closed.**

# 2801 : Anti-ion interactions

- Requester: ALICE (A. Morsch)
- Responsibles: D. Wright / V. Uzhinskiy
- Scope :
  - Light anti-ions: anti-deuteron, anti-triton, anti-He3 and anti-He4
  - Energy loss, absorption, (quasi)elastic-scattering
  - Materials: H, C, N, O, Si, Al, ...
  - Momentum range 0.1–4 GeV
- From March & November 2011 TF :
  - $\bar{p}$  cross-section from simplified Glauber approach
  - $\bar{d}$ ,  $\bar{t}$  and  $\overline{\text{He}}$  with full Glauber one
  - Model beta-version introduced in 9.4-ref-02.
- Status from today:
  - Delivered in 9.5.
  - Feed-back from ALICE provided.
  - **Closed.**