Update on Requirements

41th Geant4 Technical Forum
December 9th 2015

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On behalf of the Geant4 Collaboration

Requirements Tracking System Page:
https://jira-geant4.kek.jp/secure/Dashboard.jspa?selectPageId=10000

NEW REQUIREMENTS

FROM 40TH TF @ FNAL, FOLLOWING COLLABORATION MEETING

40th TF @ FNAL : Intensity Frontier & Low Background Experiments

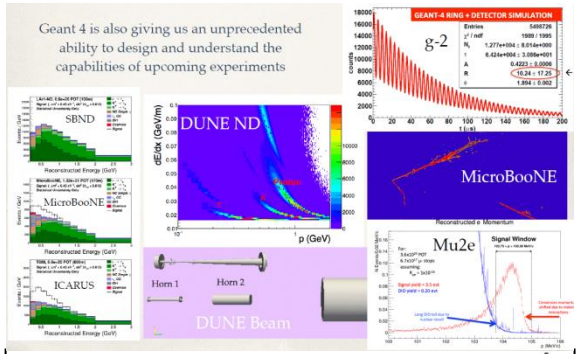
Welcome	*Tim MEYER*	
Wilson Hall - One West		13:30 - 13:40
General status report and prospects	*Dr. Makoto ASAI*	
Wilson Hall - One West		13:40 - 13:50
Physics status report and prospects	*Dr. Dennis WRIGHT*	
Wilson Hall - One West		13:50 - 14:00
Requirements of Intensity Frontier experiments	*Dr. Laura FIELDS*	
Wilson Hall - One West		14:00 - 14:30
Requirements from LZ experiment	*Dr. Carl VUOSALO*	
Wilson Hall - One West		14:30 - 14:40
Requirements from CDMS experiment	*Dr. Dennis WRIGHT*	
Wilson Hall - One West		14:40 - 14:50
Open discussion		
Wilson Hall - One West		14:50 - 15:00

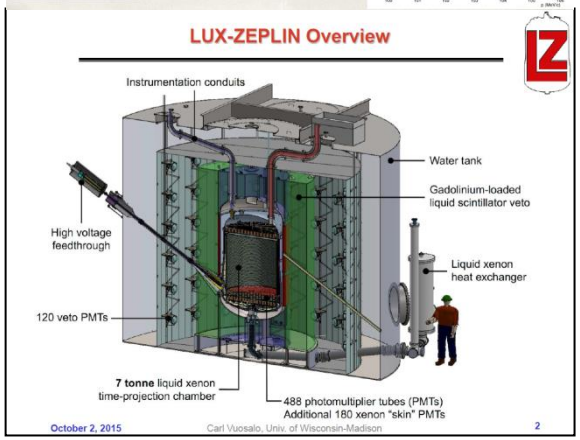
- Variety of wishes expressed (some on next slide)
- Together with large number of them:
  - Next to 30 !
- Range from actual requirements, to clarifications in using existing functionalities, or better ways to provide information in difference in physics content between releases, validate geometries, etc.

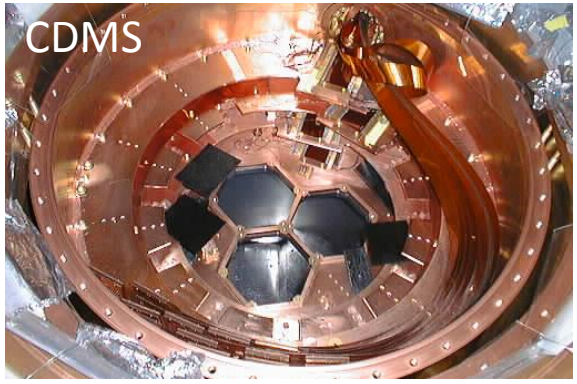
⇒ **Dedicated meeting @ FNAL in January between FNAL experiment members and Geant4 ones.**

Highlights of Wish Lists

- Reweightable uncertainties for systematic uncertainties estimation
  - Suggested from usability with GENIE Neutrino MC Generator
    - Allows estimation of model uncertainties with a single MC sample
- Time step precision of 28 significant figures
  - To support ns accuracy over billions of years for radioactive decays
- UV / photon :
  - UV reflectivity data at cryogenics temperatures : complicated profiles of reflectivity as functions of angle and wavelength
  - Fast UV propagation : O(10^6) photons created by calibration events (O(100) keV) due to electroluminescence in the gas
- Neutrons:
  - Gamma cascades after neutron capture (Gd, Xe)
  - Production in muon showers at the %-level
- Phonon and charge carrier physics
  - Complete work on phonon and e/h model in Ge at 0K, extension to Si, …
- Radioactive decay physics
  - General improvement : missing levels and lifetimes, …
  - New channels : β–delayed n emission, spontaneous fission (eg Cf source) …
- Neutrino interaction (interface to GENIE)
- …







OPEN REQUIREMENTS

3301 : Multithreading processing driven by experiment framework

- Requester: CMS
  - Original request at 33th TF (link)
  - Further information at G4 Collaboration meeting (link)
- Responsibles:
  - Andrea Dotti, Makoto Asai, John Apostolakis.
- Scope:
  - To process multiple events and process multiple modules in same event (gen., sim./G4, trg., reco., ana.) simultaneously
    - Geant4 = one of the modules
  - Framework controls modules execution
    - Geant4 to be controlled with proper messages
  - “Threading Building Blocks” (Intel® TBB) task model adopted
- Status:
  - New features of TBB (task_arena and task_observer) will be illustrated in a new example.
  - Open.

3502 : Correct Kaon asymmetry in cross-sections

- Requester: LHCb
  - LHCb observes a kaon asymmetry which is too low, specially at high energy.
- Responsible:
  - Witold Pokorski
- Proposed solution:
  - LHCb will measure and provide the correct cross-section asymmetry.
- Last TF:
  - Progress advertised at 2nd LPCC workshop :
    - measurement on-going, to appear in arXiv.

- Status:
  - Alternative kaon inelastic cross section (Glauber-Gribov one, instead of Chips one) provided, gave satisfactory results.
    - Note : all physics lists in G4 10.2 use this Glauber-Gribov cross section for inelastic kaon-nucleus interactions.
  - Propose to close (can still be re-opened in case of need).

3602 : Optimize structure of Geant4 libraries

- Originator: CMS
- Issue:
  - Current Geant4 consists of 23 shared libraries of different sizes
    - Process library is 10 times larger than any other library
- Request:
  - To consider alternatives and evaluate their performances:
    - Split process library in several pieces
- Responsible :
  - Physics groups (for specifying meaningful granularity) and Ben Morgan
- Status:
  - Progress presented at the last CM.
  - Important for Windows.
  - Open.

3701 : Use of Geant4e in track fitting

- Originator: CMS
- Issue:
  - Geant4e is being used by CMS for track fitting:
    - With a forward propagation phase, called “fitter”
    - Followed by a backward propagation, called “smoother”
  - Backward tracking requires the momentum to be flipped, changing the error matrix accordingly
- Request:
  - Improve documentation addressing the case of Kalman fitter scenario (forward & backward) propagation.
  - An automated mode to perform backward propagations in Geant4e:
    - Flip momentum
    - Take care of the error matrix transformation
    - Take care of the error handling
- Responsible:
  - Pedro Arce
- Status:
  - Need confirmation for completion.
  - Open.

RECENTLY CLOSED REQUIREMENTS

3404 : Change of AtRest logic for allowing stopped tracks to be accelerated and further tracked

- Requester: Tom Roberts, Muon Inc.
  - Description: Tracks that come at rest are always killed
  - But in presence of an electric field, for example, a stopped charged track maybe accelerated.
- Responsible:
  - Marc Verderi (was Takashi Sasaki).
- Requirement:
  - Allow for AtRest track with fStopButAlive status to be put back as fAlive status.
- Use-cases (so far):
  - ~~Inverse cyclotron: frictional cooling to stop muons before acceleration by electric field.~~ Invalid.
  - Collective tracking: mutually interacting tracks tracked in small time steps. Some may stop at some point and be restarted: not possible with current AtRest logic.
- Investigations:
  - Changes to be made in the stepping manager to avoid AtRest track to be always killed identified.
- Status:
  - No strong case identified for the request.
  - Requirement closed for now, can still be re-opened in case a significant need would be expressed.
  - Closed.

3801 : Physics List option for accurate spin tracking

- Requester : Muon g-2 @ Fermilab
  - Requested at 38th TF
  - Presentation link
- Responsible:
  - Peter Gumplinger
- Scope:
  - Make spin treatment:
    - radiative muon decays with spin
    - tracking with spin
  - As a physics list option, or equivalent.

- Status:
  - Requested functionalities have been confirmed to exist.
  - Have been used in the current pi->e nu experiment at TRIUMF and in the Laboratory for Muon Spin Spectroscopy at PSI.
  - More information in JIRA https://jira-geant4.kek.jp/browse/UR-23

  Closed