

# Update on Requirements

42<sup>th</sup> Geant4 Technical Forum  
March 23<sup>rd</sup> 2016

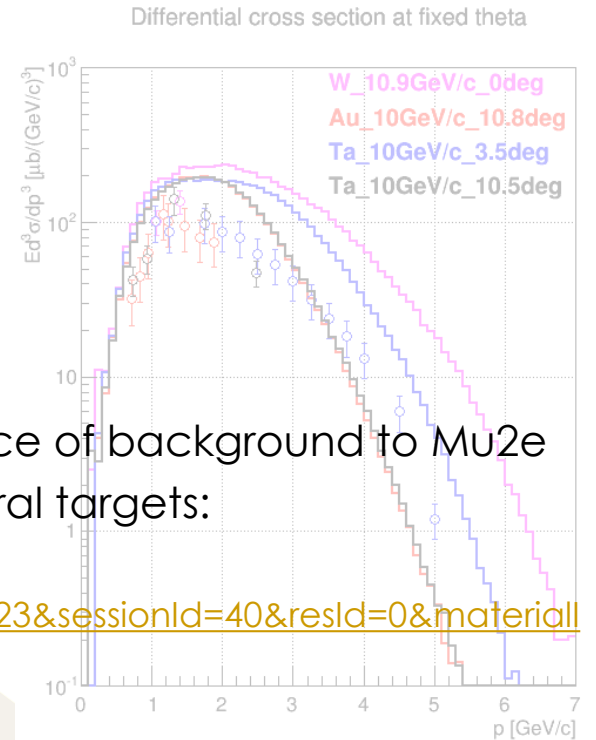
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On behalf of the Geant4 Collaboration

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

# New Requirements

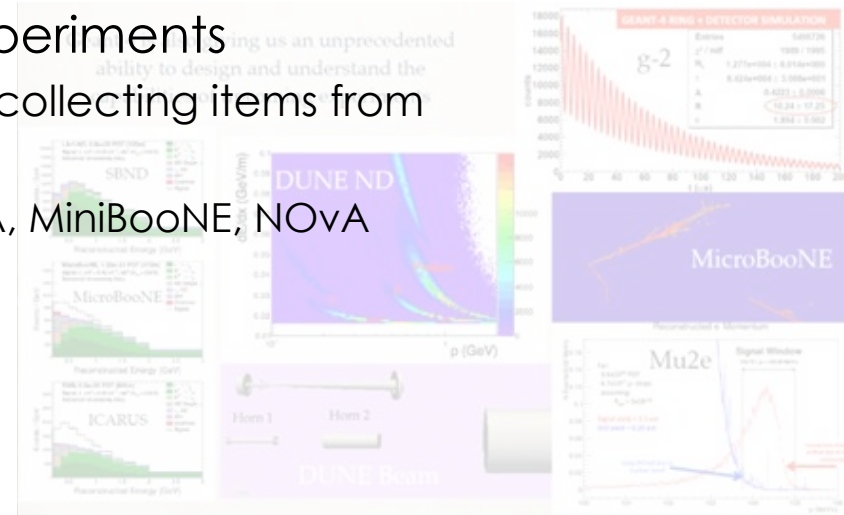
# 4001 : Anti-proton production from proton beam

- Requester :
  - Mu2e
  - Request made at 40<sup>th</sup> TF @ FNAL ([link](#))
- Responsible:
  - Alberto Ribon
- Scope:
  - Anti-proton production is the third dominant source of background to Mu2e
  - Discrepancy observed for 10 GeV beam on several targets:
    - see page 18 of:
      - <https://indico.fnal.gov/getFile.py/access?contribId=123&sessionId=40&resId=0&materialId=slides&confId=9717>
    - and validation plots:
      - [http://g4validation.fnal.gov:8080/G4WebAppNG/DisplayTest\\_1.xhtml?selectedTestDescription=47](http://g4validation.fnal.gov:8080/G4WebAppNG/DisplayTest_1.xhtml?selectedTestDescription=47)
- Status:
  - Lack of resources to work on this item, no fast progress expected.
  - Open.



# 4002 : Reweightable uncertainties for systematic uncertainties estimation

- Requester: Intensity Frontier FNAL experiments
  - Request made at 40<sup>th</sup> TF @ FNAL ([link](#)) , collecting items from
    - Muon : g-2, Mu2e
    - Neutrino : DUNE, MicroBooNE, MINERvA, MiniBooNE, NOvA
    - Fixed Target : SeaQuest
    - Test Beam : LArIAT
- Responsible:
  - Makoto Asai
- Scope:
  - The technique allows to estimate the effect of model uncertainties on observables with a single MC sample
    - Model uncertainties provided under guidance of experts
    - Suggested from usability of GENIE Neutrino MC Generator
- Status:
  - Very big item, need further discussions.
  - Open.

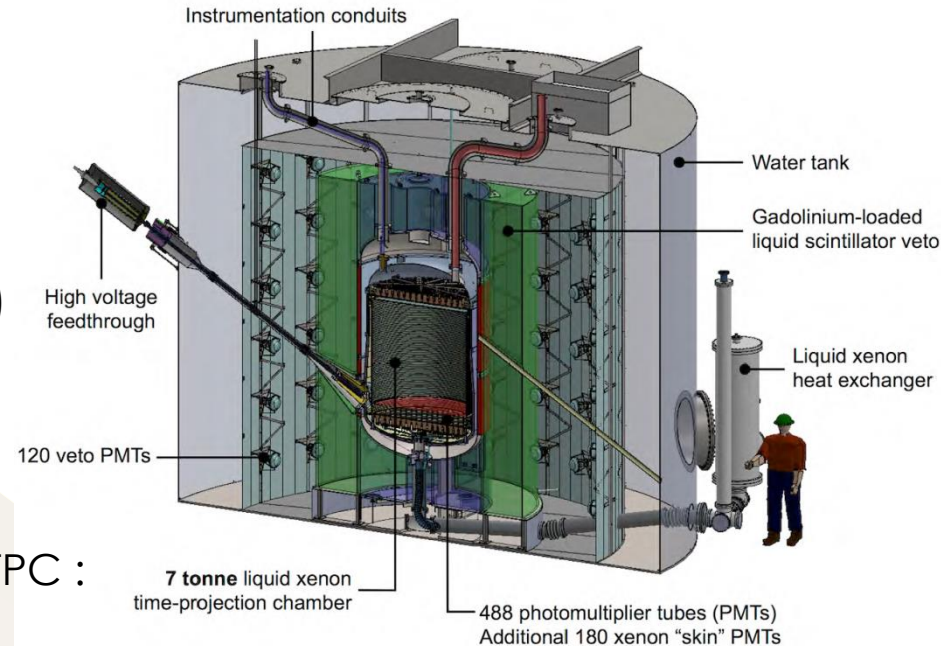


# 4003 : Validation of new versions of Geant4

- ◉ Requester: Intensity Frontier FNAL experiments
  - > Request made at 40<sup>th</sup> TF @ FNAL ([link](#)) , collecting items from:
    - Muon : g-2, Mu2e
    - Neutrino : DUNE, MicroBooNE, MINERvA, MiniBooNE, NOvA
    - Fixed Target : SeaQuest
    - Test Beam : LArIAT
- ◉ Responsible:
  - > Andrea Dotti
- ◉ Scope:
  - > Tool to understand differences between any two versions of Geant4
    - not just incremental changes of each release
- ◉ Status:
  - > Reminder : Geant4 validation database and website available at:
    - <http://g4validation.fnal.gov:8080/G4WebAppNG/>
    - Note that a re-design with extension to new data and features is being carried on.
  - > Proposal for now : StatTest utility used for regression testing could be provided in a public form
    - if requester wants to compare a same plot from his application, using two different versions of G4.
  - > **Open.**

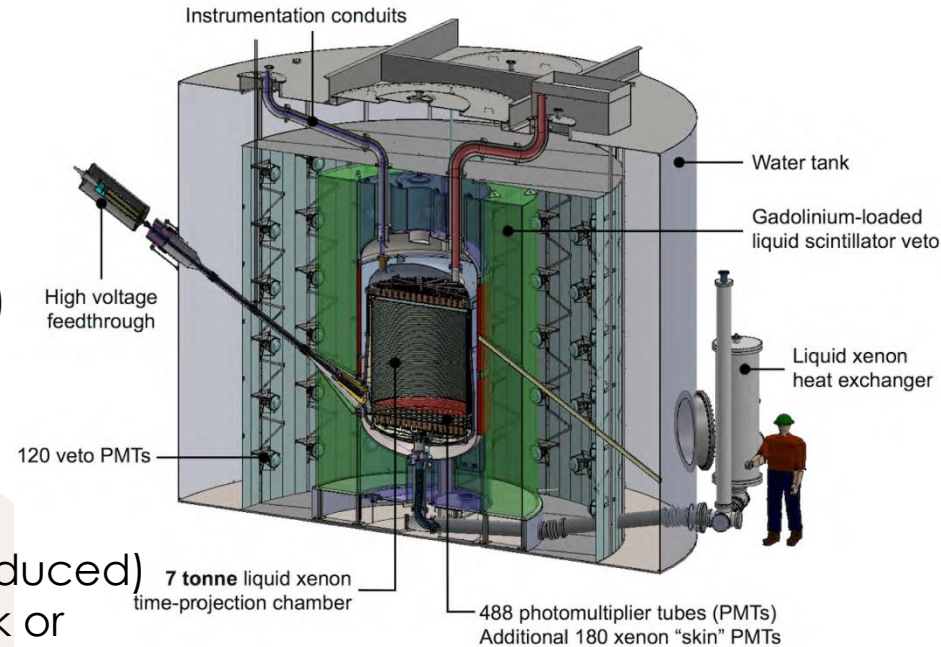
# 4004 : Treatment of gamma cascades after neutron capture (Gd, Xe)

- ◉ Requester: LUX-ZEPLIN (LZ)
  - > 2<sup>nd</sup>-generation dark-matter detector
    - WIMPs detection from few GeV/c<sup>2</sup> to several 100 TeV/c<sup>2</sup>.
  - > Request made at 40<sup>th</sup> TF @ FNAL ([link](#))
- ◉ Responsibles:
  - > Dennis Wright, Makoto Asai
- ◉ Scope:
  - > Gd-loaded liquid scintillator around TPC :
    - Used in veto of background events from PMT themselves
      - that could scatter into detector volume
    - Will be used for detailed understanding of background coming from detector as well
- ◉ Status:
  - > Patch 10.2.p01 released on March 2<sup>nd</sup> should correct.
    - Feed-back from LZ expected.
  - > **Open.**



# 4005 : Neutron production in muon showers at the % level

- Requester: LUX-ZEPLIN (LZ)
  - > 2<sup>nd</sup>-generation dark-matter detector
    - WIMPs detection from few GeV/c<sup>2</sup> to several 100 TeV/c<sup>2</sup>.
  - > Request made at 40<sup>th</sup> TF @ FNAL ([link](#))
- Responsibles:
  - > Alberto Ribon, Vladimir Ivantchenko
- Scope:
  - > Control of the cosmogenic (muon-induced) neutron production (surrounding rock or detector material) as a background source
  - > Control in the detector calibration through Xe activation
- Status:
  - > Very large improvement targeted.
    - Resources needed to address this problem.
  - > Further discussions planned to better understand the criticality of the request.
  - > **Open.**





Open requirements



# 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](#))
- ◉ 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:
  - > Progress expected for 10.3
  - > **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.**

# 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:
  - > Test implementation starting work in the coming month.
  - > **Open.**

# 3901 : Complete destruction of Geant4 objects at exit

- ◉ Originator:
  - > CMS
  - > 39<sup>th</sup> Technical Forum ([link](#))
- ◉ Scope:
  - > Geant4 utilized in framework
    - But Geant4 leaves undeleted objects after completion.
  - > Clean destruction of G4 objects needed
- ◉ Responsible:
  - > Makoto Asai
- ◉ Status:
  - > Progress made on the strategy to destroy physics objects in MT
  - > **Open.**

# Recently closed requirements

# 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 2<sup>nd</sup> 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.
  - > **Closed**