

Update on Requirements

48th Geant4 Technical Forum
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CERN

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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

4701 : More realistic matrix element for decays $\tau \rightarrow \nu + \text{hadrons}$

- ◉ Originator:
 - > CMS
 - > 47th Technical Forum ([link](#))
- ◉ Scope:
 - > The current implementation of tau decay to hadrons uses phase space decay.
 - > More realistic matrix elements are requested.
- ◉ Responsible:
 - > Vladimir Ivantchenko
- ◉ Status:
 - > Similar requirement expressed by ATLAS earlier
 - With suggestion to use external decayer
 - > But in view of SLHC it would be useful to extend Geant4 decays of heavy particles and in some cases use more accurate final state
 - > Open.

4702 : Inclusion of γ polarization effects in the high energy EM models

- ◉ Originator:
 - > CMS
 - > 47th Technical Forum ([link](#))
- ◉ Scope:
 - > Include Linear Polarization into HE γ Models
 - > This has potential usage in the analysis of $H \rightarrow \gamma \gamma$
 - Polarization planes of scalar (pseudo-scalar) particle to γ 's are parallel (perpendicular)
 - Investigate the effect of polarization in the shower shape of photons
 - May give additional handles to distinguish direct γ 's from H decay from BG
- ◉ Responsible:
 - > Vladimir Ivantchenko
- ◉ Status:
 - > Difficult, development to be included in coming years plans
 - question was first asked from ATLAS, then from CMS
 - > Open.

4703 : Improved light nucleon production in FTFP_BERT

- ◉ Originator:
 - > ALICE
 - > Lund Geant4 CM, requirements session ([link](#))
- ◉ Scope:
 - > ALICE switched to FTFP_INCLXX physics lists
 - Because FTFP_BERT –recommended for calorimetry- has a deficit of light nuclei (d, t, ^3He) production from secondary particles
 - > But FTFP_INCLXX brings a performance penalty
 - > Request to get the light nucleon production in FTFP_BERT improved
 - and keep the support for FTFP_INCLXX physics list, until ALICE can switch back to FTFP_BERT
- ◉ Responsible:
 - > Alberto Ribbon, Dennis Wright
- ◉ Status:
 - > Open.

Open requirements

4002 : Reweightable uncertainties for systematic uncertainties estimation

Requester: Intensity Frontier FNAL experiments

- Request made at 40th TF @ FNAL ([link](#)) , collecting items from

- Muon : g-2, Mu2e
- Neutrino : DUNE, MicroBooNE, MINERvA, MiniBooNE, NOvA
- Fixed Target : SeaQuest
- Test Beam : LArLAT

Responsible:

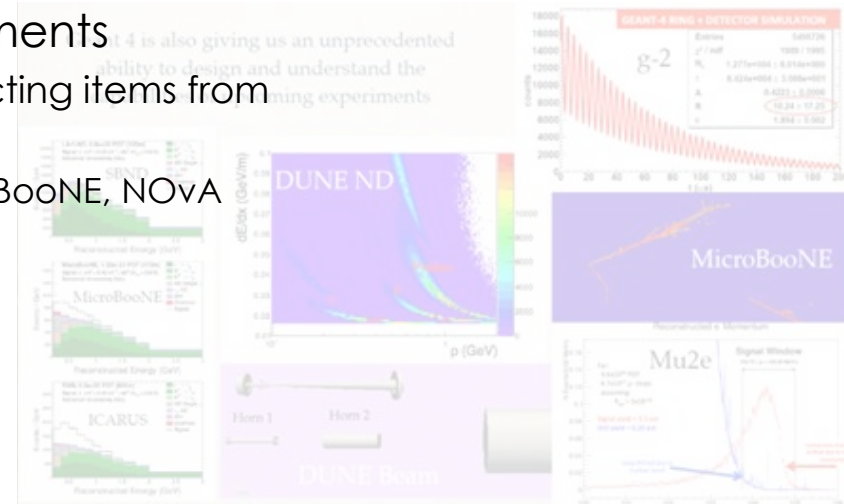
- Soon Yung Jun

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:

- > Sensitivity study for Bertini, Precompound, FTF model parameters are done
- > Professor fits for various data sets are most likely completed for FTF, PreCompound (minimal sets) and almost done for Bertini (extensive data sets)
- > Estimating the uncertainty band on a selected data set is demonstrated
- > A note is in preparation.
- > Open.



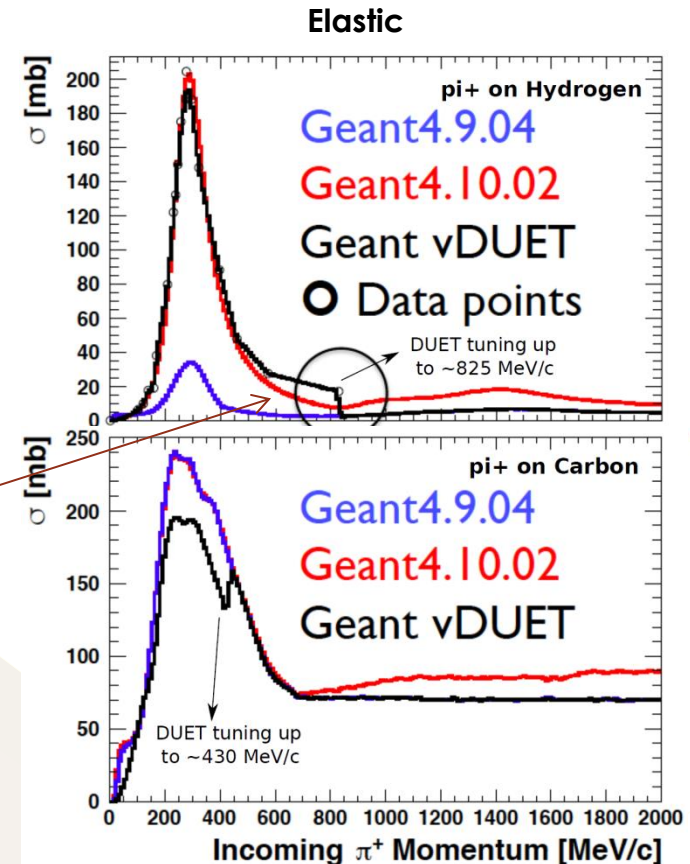
Recently closed requirements

4301 : Need of correct pion elastic model for T2K

- Requester: Tom Feusels for T2K Collaboration
- Responsible:
 - > Dennis Wright
- Context:
 - > T2K Neutrino oscillation exp. uses selections of ν interactions based on the number of detected pions (0, 1, or $> 1\pi$).
 - Detailed understanding of final state interactions and secondary of pions crucial.
 - > DUET experiment at TRIUMF performed in order to improve measurements of pion interactions on carbon and water.
- Observation:
 - > $\pi + H$: wrong by factor 5-10 in 9.4
 - > largely improved in 10.1-p-02
 - even if still problems $> 600 \text{ MeV/c}$
 - > $\pi + C$: some differences
 - > Phys Rev C 92, 035205 (2015)

- Requests/questions:

- > **Need correct pion elastic model**
- > Cross sections are now fixed.
- > Currently there is not enough manpower to develop explicit quasi-elastic channel reactions.
- > It is on the list of hadronic developments for the future.
- > Closed



3901 : Complete destruction of Geant4 objects at exit

- ◉ Originator:
 - > CMS
 - > 39th 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:
 - > Done
 - > Closed.