Update on Requirements

47th 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

Follow-up of Wollongong and last TF meetings

- From Wollongong workshop:
  - "*Investigation of Geant4-DNA Chemical Yields and Comparison with RITRACKS and Experimental Observations*"
    - Request:
      - Dylan Peukert (Adelaide U.)
      - Was suggested to extend the chemistry simulation beyond 1 µs
        - To allow for complete reactive oxygen species recombination or reaching steady state
    - Response:
      - Can not be addressed for now, more a long term issue, and would require at least use of GPU
      - But collaboration established between G4DNA, Adelaide U. and Wollongong U.
        - evaluate current G4DNA chemistry performance, assess interest of going beyond 1 µs (~loss of correlations)
  - "*Geant4 modelling of MRI-guided proton therapy hardware concepts*"
    - Request:
      - Brad Oborn (Centre for Medical Radiation Physics, University of Wollongong)
      - Suggestion for a tool to create B-maps directly from 'node/points' files
    - Response:
      - low priority item, if manpower permits, will be provided as an example.
- From last TF:
  - From ATLAS presentation:
    - "Lots of interest with ATLAS in simulating particles with pre-determined decays specified by generators. Mainly when these particles would decay outside the beam-pipe."
  - Response:
    - Mechanism exists in Geant4, essentially requires a discussion for clarification.

Open requirements

4302 - 4305 : Series of Requirements from Radioprotection and Radiophysics

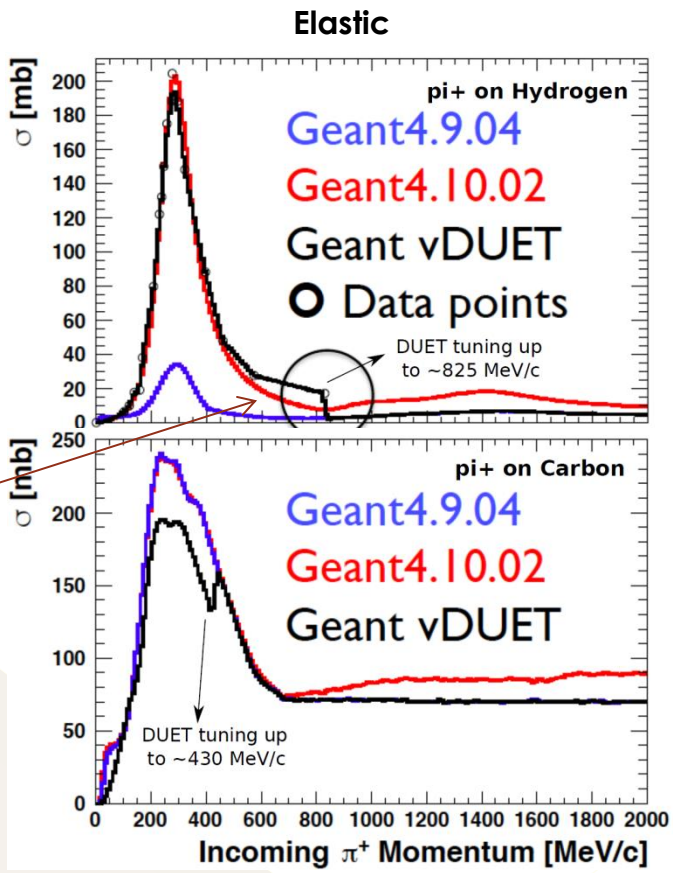
- Requester: Laurent Desorgher
  - And is also responsible or co-responsible for responding to these requests.

- **4302** : *Tallying of the ambient dose equivalent H*(10) (value + error or tally)*
  - Needed in activation and dose calculation studies
  - **Request for having H*(10) tally value *and* its (stat.) error**
  - Co-resp: Makoto
- **4303** : *Requirements from radioprotection and radiophysics : activation and dose calculation*
  - **Dose H*(10) resulting from radioactive decay at different time windows**
  - Co-resp: Dennis
- **4304** : *Computation of activation in bunker therapy by protons, neutrons, and gammas*
  - **Correct production of activated nuclei by nuclear spallation**
  - Note : Laurent D. agrees to participate to validation
- **4305** : *Definition of irradiation profile for radiation therapy*
  - Radiation therapy involves time dependent beam profile
    - Related activation needs to be simulated
  - Hence request ability for **User defined irradiation profile**

- Status:
  - Work in progress.
  - Items are part of the related working group work plan.
  - Open

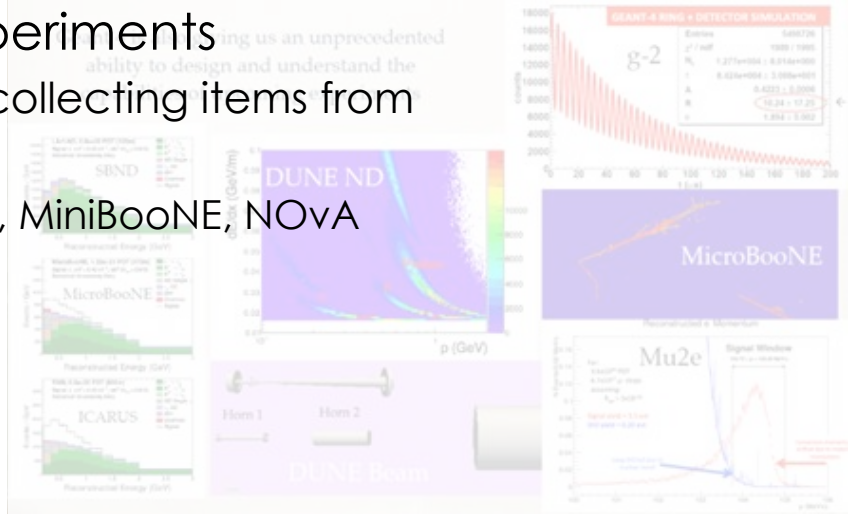
4301 : Need of correct pion elastic model for T2K

- 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 > 1pi).
    - 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 MeV/c
  - pi + C : some differences
  - Phys Rev C 92, 035205 (2015)
- **Requests/questions:**
  - **Need correct pion elastic model**
  - Communication with T2K re-stablished.
  - Hydrogen factor 10 problem in cross section resolved by release 10.0 & verified using 10.2.
  - Additional work required to improve C pi+ elastic cross-section and angular distribution needed.
    - Possible to try CHIPS cross section class.
  - Quasi-elastic is currently part of inelastic process in Geant4. Substantial effort required to change that.
  - Detailed report available at https://jira-geant4.kek.jp/secure/attachment/11810/UR33.pdf
  - Open



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 : 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:
  - Work made by Julia & Robert (FNAL) and Dennis & Tatsumi (SLAC)
  - In progress
  - Open.



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:
  - Next to completion.
  - Open.

Recently closed requirements

4003 : Validation of new versions of Geant4

- 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 : 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/DoSSiER/
    - Note that a re-design with extension to new data and features is being carried on.
  - First proposal : tool used for regression testing (StatTest) can be provided in a public form
    - Will allow to compare a same plot from an application, using two different versions of G4.
  - Andrea Dotti (SLAC) and Hans Wenzel (FNAL) working on it.
  - Completed.
  - Closed.