Krzysztof Genser, Fermilab

with the input from R. Hatcher, R. Kutschke, K. Lynch, A. Lyon et al.

18th Geant4 Collaboration Meeting
Seville, September, 2013

Fermilab Intensity Frontier Experiments and Geant4

ArgoNeuT, LBNE, microBooNE, MINERvA, MINOS+, Mu2e, Muon g-2, NOvA

Outline

- Introduction/Geant4 Application Areas
- Some Specific Wishes/Comments
- Concluding Remarks

Usage

- Several general areas
  - Detector response to Signal and Background processes
  - Simulations of beam interactions with the primary target and tracking resulting particles
    - 120 or 8 GeV protons on Be, C, W target
    - Importance of secondary particle production spectra
      - including but not limited to backward hemisphere (pions in the case of Mu2e)
    - as well as secondary and tertiary decay product simulation
      - protons -> pions/kaons/muons -> neutrinos (in case of neutrino experiments)
  - Beamline simulations
- Experiments put emphasis on the details and accuracy of processes and models

Usage cont'd

- Wide spectrum of Geant4 versions in use
  - from v9.2… through v9.5.p01,v9.6.p01 to v9.6.p02
- Physics list: predominantly QGSP_BERT (_HP) with FTFP_BERT and Shielding being looked at
- Most experiments use FNAL art framework with Geant4 encapsulated in a module
  - other Monte Carlo packages are used as well

Specific (new?) Wishes/Suggestions/ Comments

- (Somewhat) configurable Physics Lists
  - e.g. allow to slide the energy overlap region between models to allow customization or at least studies
    - quite common request from several groups
- "Complete", recommended(?) visualization module
  - each is good at some aspects, but not so good at others
- Field visualization tool
- Ability to use different integrators for different particle types (e.g. track with spin some particle types only in case of Muon g-2)
- Correct neutron production in various processes
  - e.g. both pion and muon capture neutron spectra are too soft

Concluding Remarks

- Working more closely with the experiments
  - created a physics list related documentation page:
    https://sharepoint.fnal.gov/project/geant4-pub/SitePages/ComposeG4PL.aspx
    - should be complementary to the Geant4 documentation
  - creating an infrastructure to create/test physics lists
    - e.g. created a Shielding derived physics list for Mu2e with the transition from FTFP to BERT moved above 8GeV (the beam energy) to make it more similar to QGSP_BERT_HP
- Expecting more questions/feedback regarding Geant4/simulations
  - possible new experimental/test beam data useful for validation and fine tuning of the processes/models important to the experiments