VALIDATION OF GEANT4 10.6P01 AND PLANS FOR 2020

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Outline

- Recent validation results
- Destruction of physics at exit
- Hadronic physics list components
n + Co59 \rightarrow n + X, \ E = 9 \ MeV, \ \theta = 0^\circ

\theta = 30^\circ

\theta = 60^\circ

\theta = 90^\circ

\theta = 120^\circ

\theta = 150^\circ

\frac{d\sigma}{dE\Omega} (mb/sr/MeV)

E (MeV)
BERP options is recovered

\[ n + Bi \rightarrow p + X, \ E = 63 \text{ MeV} \]
Switch from HE model to parameterized should be done via kinetic energy, not momentum threshold

The basic parameterisation is competitive to CHIPS

Diffuse elastic requires much more work
HE model applicable for $E > 400$ MeV better described data

Parameterisation is fine for the main diffraction peak but does not well describe 1$^{\text{st}}$ maximum

Diffuse and CHIPS models have qualitatively correct shapes but not fit the data
Destruction of physics at exit

- Why we need full destruction of physics at exit?
  - Users have trouble using debug tools like valgrind
  - Users may have problem in their application code when destruct Geant4
  - Developers have problem to identify memory leaks

- Complete destruction of hadronics end of session significantly improved in 10.6
  - Some fixes are ongoing these days
  - We use register/de-register mechanism allowing safely delete cross sections, models, and processes

- Recommendations:
  - cross sections, models, and processes should be instantiated via pointers not be part of any other objects
  - no private destruction of these objects is allowed
  - We should not use G4THREAD_LOCAL data members
    - Both in hadronics and in Physics Lists constructors

- The most important pending updates:
  - Simplified instantiation of FTF and QGS model
    - Builders should not instantiate Lund fragmentation and Participants
      - This can be done without interface change
  - Provide correct destruction of HP and AllHP models and cross sections
  - Finally provide correct destruction of all physics
Hadronic physics list components

- Requirement to have a possibility defining of cross sections on top of any Physics Lists requires redesign of hadron inelastic constructors
  - We should subdivide process/models builders and cross section assigning
    - Cross sections better to taken out of builders?

- Introduction of hadron elastic and inelastic interactions of b- and c-baryons and mesons
  - Will increase number of line of identical code if we will follow the same design of builders
  - Some re-design efforts would be useful

- I would propose to base an update in G4HadronicParameters class introduced recently by Alberto
  - We may also a class G4HadParticles with the list of hadrons for which we can provide elastic or inelastic interaction
  - Extra methods may provide sub-lists of particles for which the same set of models/cross sections are used