

Simulations/neutron Working Group Meeting

Dennis Notes:

1. Geant4/FLUKA differences
 - update to G4.10.1 and upcoming FLUKA public release
2. Revisiting cosmogenics
3. Required/improved models
 - a. spontaneous fission with fragments
 - Just neutrons? but fragments help for residual radioactivity
 - cant think of use for tracking of prompt fragments
 - gammas are probably important though , perhaps for vetoing for neutron events
 - MCNP-POLIMI has implemented gammas after SF, perhaps port this version
 - Author of MCNP-POLIMI interested in putting the correlations in for example Cd is close to correct etc.
 - b. radioactive decay improvements
 - c. mu-nuclear models
 - see triton production note below
 - d. neutron capture improvements
 - Gd gamma spectrum improvements based on Yu and Daya Bay
 - IC inclusion into spectrum?
 - energies and multiplicities of gammas , but that seems hard: what elements are most relevant? Boron (ENDF), Cd (?), 3He (ENDF), Li
4. Tritium reactions and decay
 - tritium reactions are really important according to Anthony for example $^{30}\text{Si}(t,n)^{32}\text{Si}$ (maybe more important to think about the triton production rate to begin with)
 - tritium decay is a very significant background
5. Low energy EM models (<10 keV)
 - atomic physics at ultra low energy? Might be necessary for very low threshold detectors related to gamma /Compton backgrounds.
6. Specialized Geant4 physics list: do we need one?
 - Perhaps instead better documented models and cross sections.

Anthony Notes:

1. alpha,n reactions in Geant4?

-- Generally tracking might not be important for large bulk material but can be near boundary, and its there that we might want to simulate these all the way from alpha to neutron within Geant4

-- It might, however, be good for including/vetting nuclear reactions in general

-- Existing tools inadequate: SOURCES is difficult to license, USD source code is unavailable.

-- Event biasing for the alpha,n may be useful and/or the ability to throw the neutron spectrum from a volume

-- Possibly rewrite the Sources code to go into Geant for this,

-- Silvia: prefer to use the combined data/calculation for alpha cross section. Calculations coming from EMPIRE which is the code recommended by IAEA

-- Input to Geant4: what volume? how many alphas? bias factor for cross sections?

--Potentially need more measurements , like Ti , to improve the cross section evaluations. Perhaps steel is also spotty...

--Sources has licensing issues but the code that is "important" is rewritable

-- what about the alpha,alpha+n reaction ? --> perhaps a sub-dominant branch

-- Silvia: surface sources are crucial

--stopping cross section and alpha-n cross sections inherited from the good parts of Sources/USD

Alan: we would want to think of a systematic way to incorporate cross section errors in the final estimates

--Possible spectral uncertainties: how do we assess that?

--ACTION --ACTION: get a good list of cross sections that "work"