Cosmogenic Activities Update and Simulation Breakout

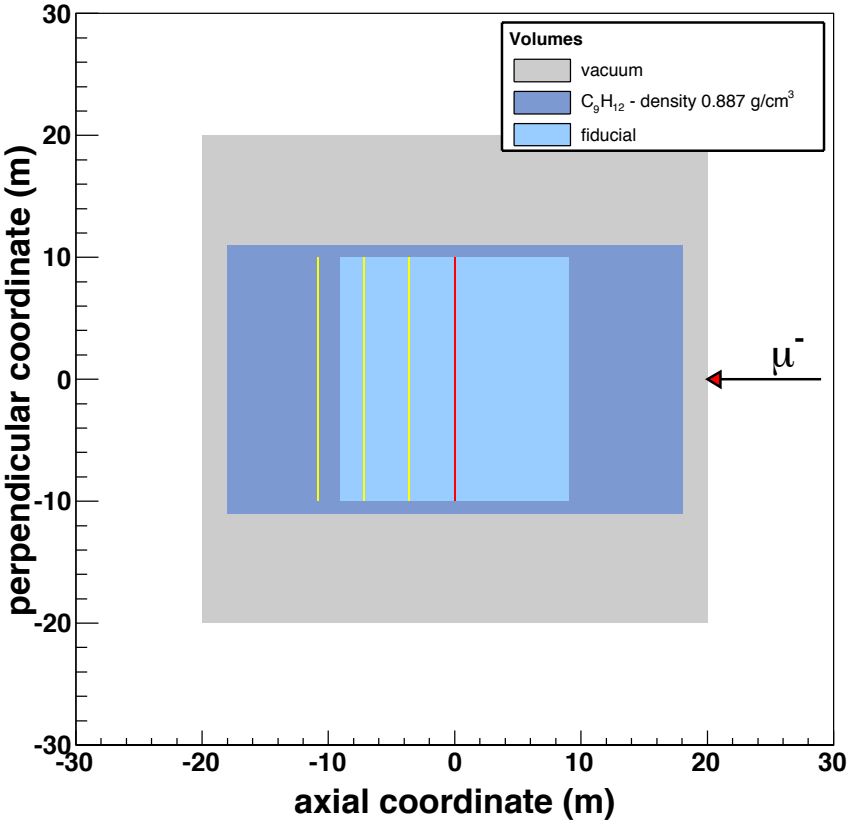
A.N. Villano

University of Minnesota

Geant4/FLUKA Comparison

Goal: Using a simple geometry, compare Geant4 and FLUKA observables related to neutron production. Further find the most efficient subset of observables which constrain microscopic physics while allowing comparison to experiments.

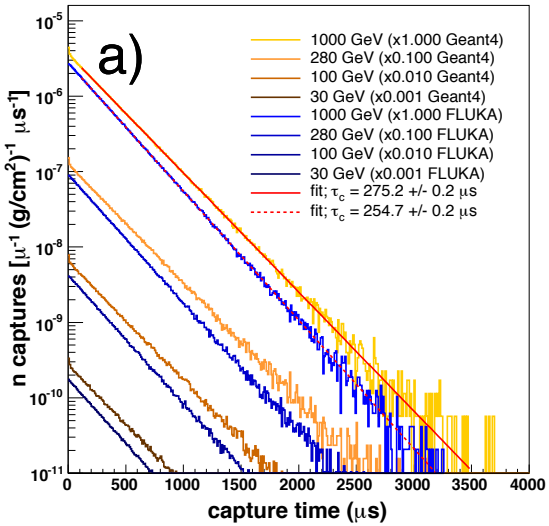
Geant4/FLUKA Comparison

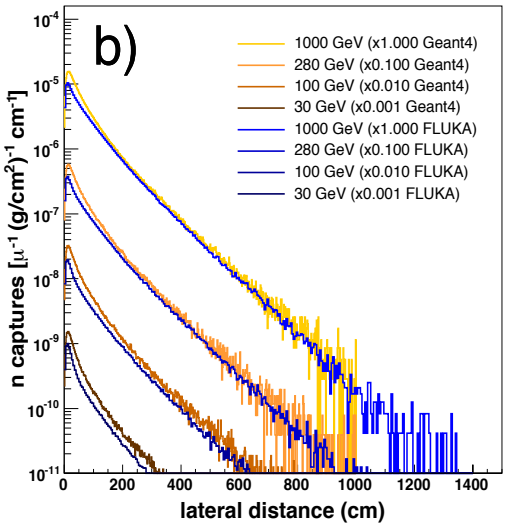


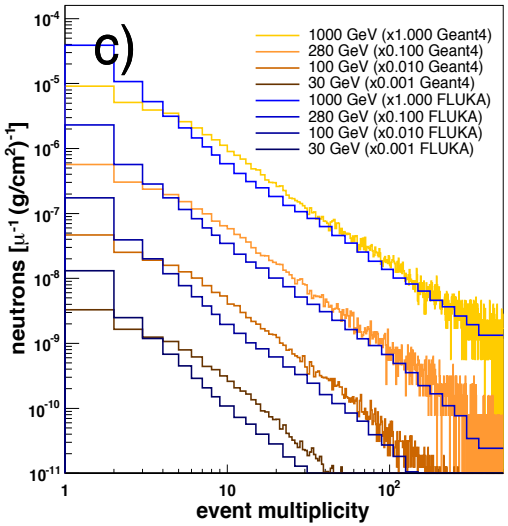
- Fiducialized slab geometry 1600 g/cm^2
- Mostly muon primaries so far
- Use a central plane to calculate neutron fluxes
  - Comparison over many decades of neutron energy
- Get statistics on captures
- Find cosmo. produced isotopes
- Total neutron yield

Related to data for scintillator: Borexino, Kamland, LVD

G4/FLUKA Scintillator Distributions

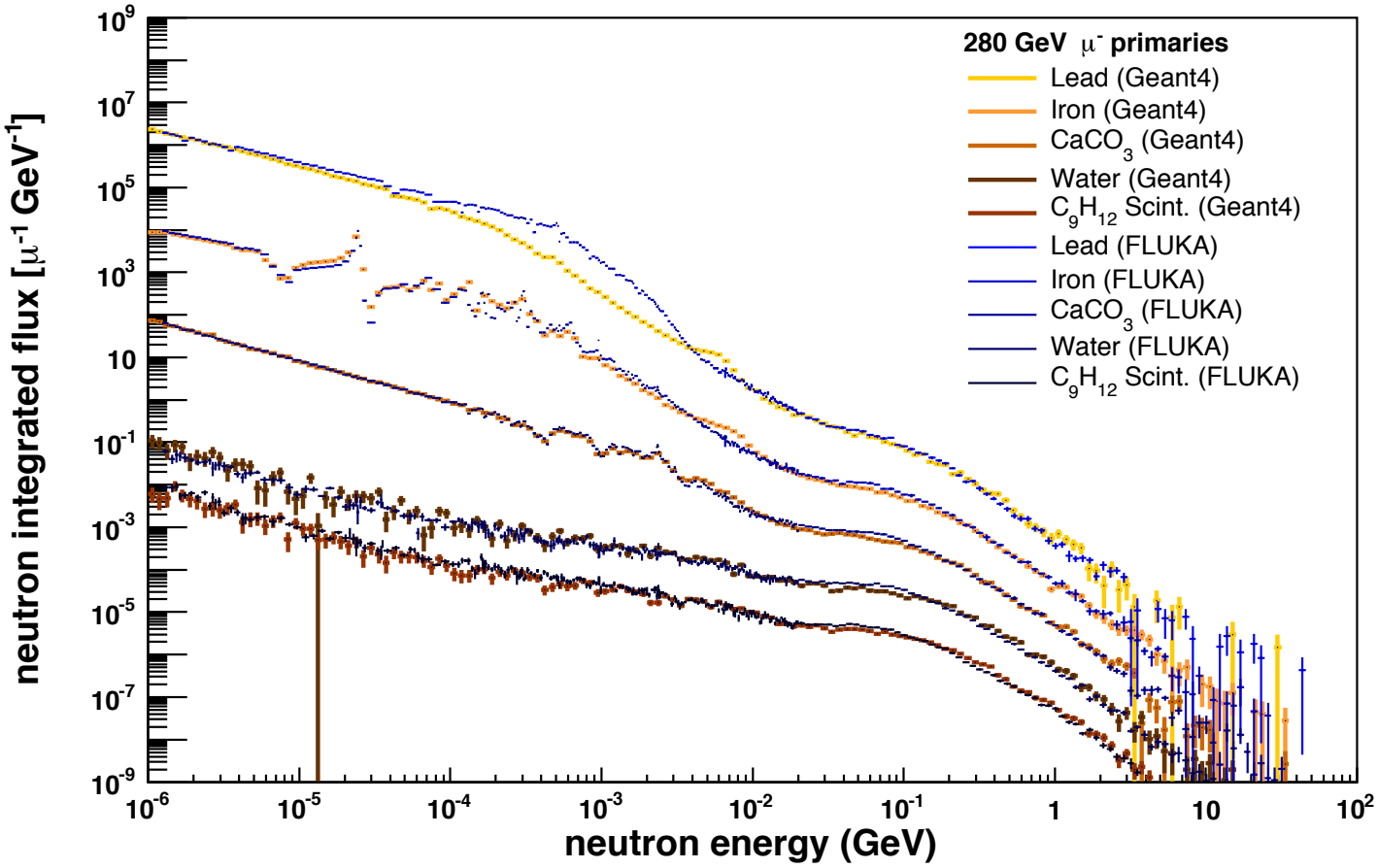






- Distributions related to data from Borexino, Kamland
- Qualitative agreement between Geant4/FLUKA but important differences
- Timing spectrum for neutron captures suggests slight difference in transport
- Multiplicity dist. suggest difference in single neut. processes

G4/FLUKA Energy Flux / LRT Paper



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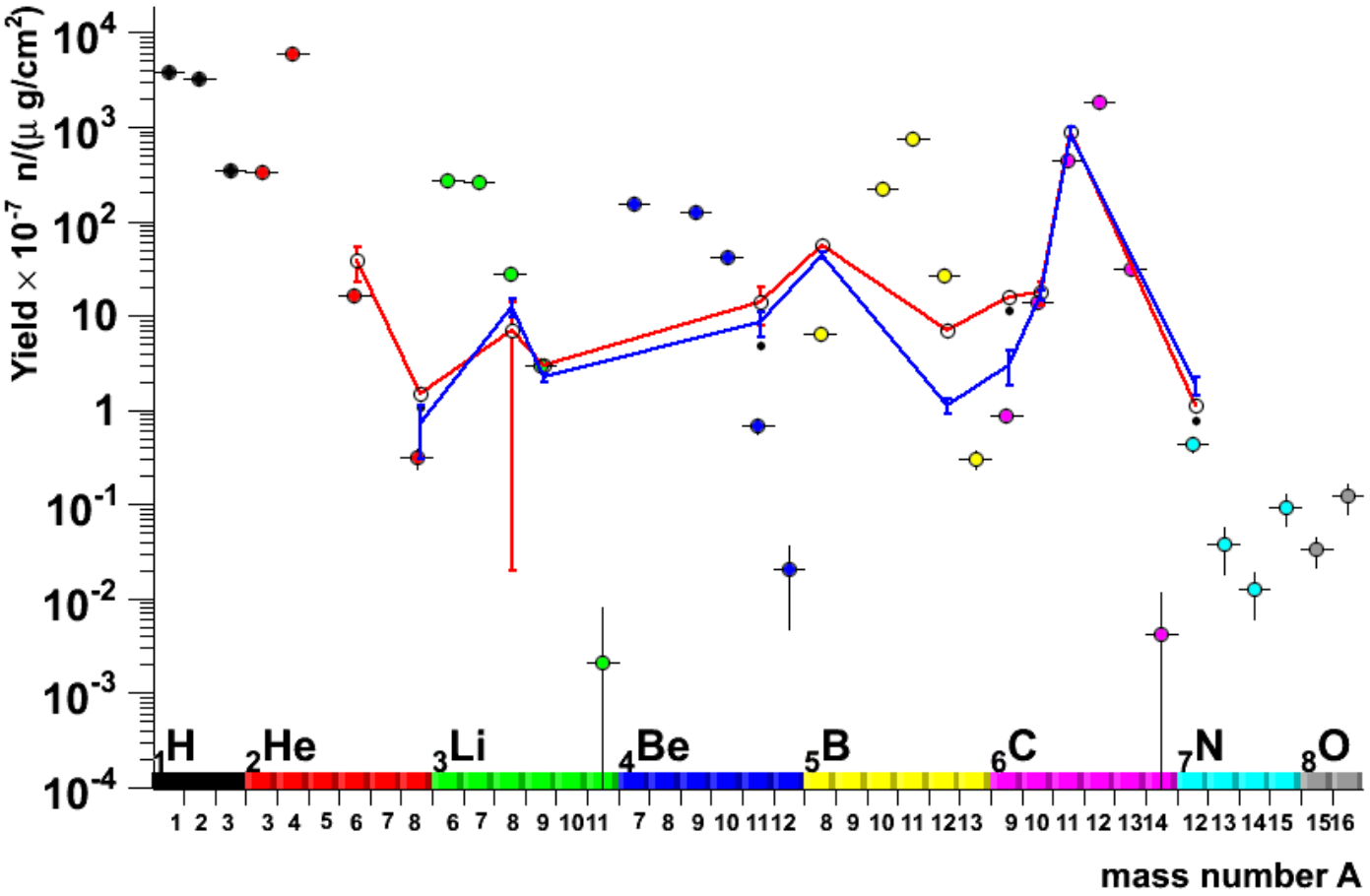
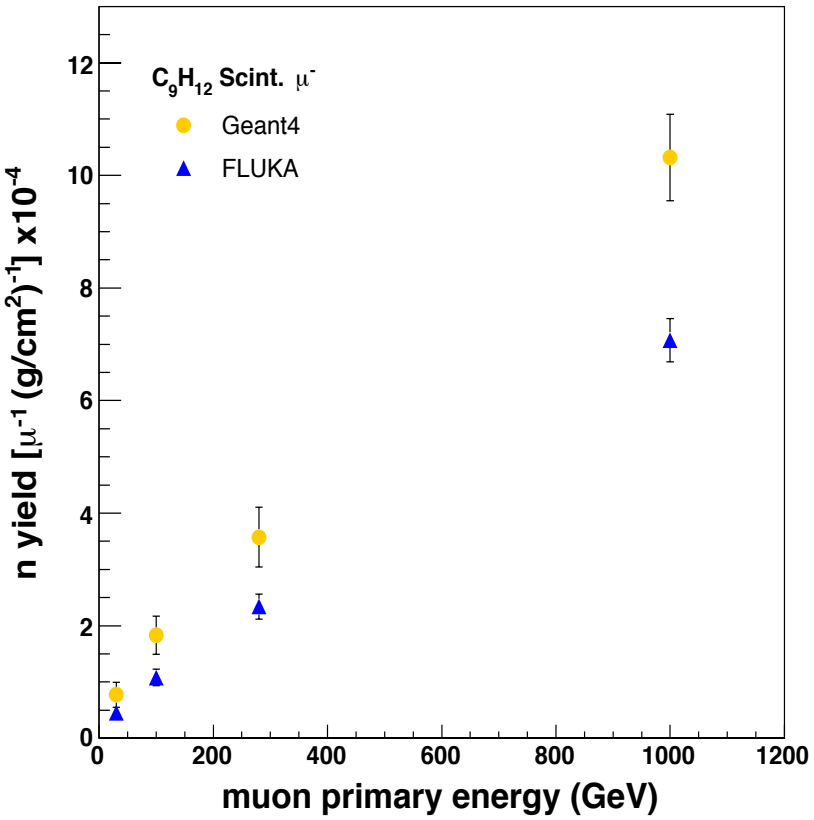
G4/FLUKA Next Steps (Isotopes)



See Also: Sarah Lindsay's talk Friday

G4/FLUKA Next Steps (Yields)

See Also: Allison Kennedy's talk Friday



- Geant4 produces more neutrons in scintillator for monoenergetic muon primaries in scintillator
- The yield is one of the more possible experimental measurements
- Experimentally, however the yield is plotted vs. mean energy at a site, so currently including simulations with non-monoenergetic primaries

Streamlined Benchmarking

- Current comparisons use Geant4.9.5/FLUKA 2011.2.17
- Want to converge on a small set of telling observables which track code 'quality'
- Can set up benchmark simulations with standard geometry inputs, for users to check local simulation versions/options for correctness for underground physics

“Simulation” Breakout Sessions

Specialized Detector Physics Simulation (*Thu 3:30 – 5:00 pm)*

- Specialized detector physics
- Specific benchmarking with specialized geometry
- Microscopic data for vetting specialized detector physics

“Simulation” Breakout Sessions

Cross-Collab. with Neutron Benchmarking (*Thu 5:00 – 6:00 pm)*

- Useful experimental datasets
  - Gran Sasso (LVD, Borexino)
  - Soudan (LBCF, MINOS, Soudan 2)
  - CERN (HE muon spallation)

- Simulation physics constraint schemes
  - Directly measure spallation cross sections?
  - Cavern measurements (delayed n’s w/o energy) … etc

“Simulation” Breakout Sessions

Simulation Codes (*Fri 4:00 – 5:00 pm)*

- Simulation packages for low-bknd physics (Geant4,FLUKA,MCNP)
- Processes in each simulation package
  - Model for adding to each package
  - Relevant processes which exist in each package
  - Specific models used by all the processes – and for different versions of the packages

“Simulation” Breakout Sessions

Cross-Collab. with Radiogenics (*Fri 5:00 – 6:00 pm)*

- Cross sections data for microscopic (e.g. (alpha,n)) events
  - Need help fleshing this out, for me I have more questions than answers here
  - Where do the (alpha,n) cross section data come from?
  - Are the databases “complete?”

- Specific small scale cross section data (e.g. (alpha,n))
  - Can we constrain cross sections from low-bknd counting measurements?
  - How can we implement a simulation of these events most effectively – throw alphas or throw resulting n’s?