

FLUKA work for AARM

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AARM meeting August 5 2014

Status - Quick Update

- On the website we have the Fluka results up for all the targets at all the energies.
- The Fluka version has been stable throughout the study but we are expecting a new release for the end of the year -> updating website
- We have a write up on the mono-energetic muon beam approximation
 - intend to place this on the website in the arxiv
- Also preparing a write up describing what is available from the website with some comparison with Geant4 especially with the isotopes

Review of the Geometry

Very simple geometry of a cylinder in which the dimensions change according to the density of the target.

Interested Targets:

Liquid Scintillator

Water

Calcium Carbonate

Iron

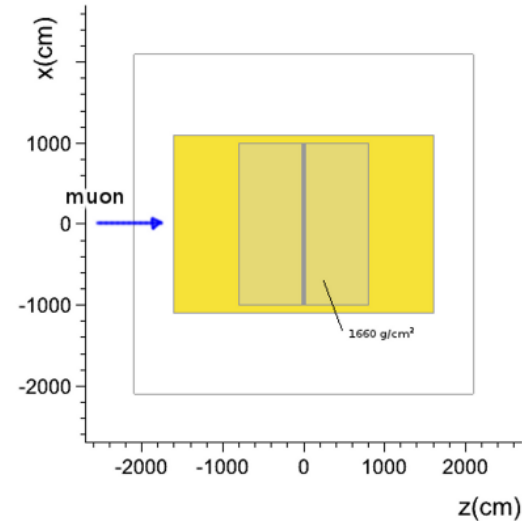
Lead

Greenstone

Interested Energies:

30, 100, 280 and 1000 GeV

cylindrical, along Z axis, with total length = 3200 g/cm^2

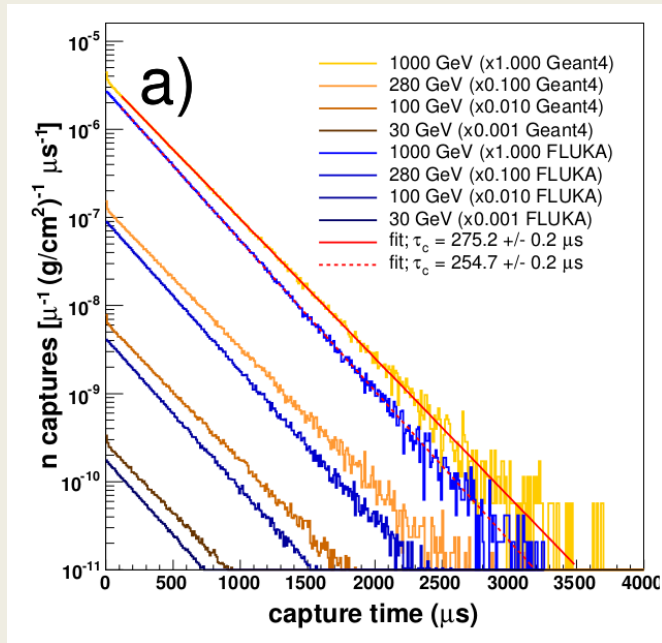


Motivation

- Very little information about muon induced reactions underground
- There is data available for neutron absorption time spectrum, the neutron absorption lateral distance, the neutron capture multiplicity and the cosmogenic isotope production.
 - Mainly from Borexino and KamLand
- Our task is to compare the predictions of Fluka and Geant4
 - Because of the complexities in prediction the isotope production rates and the large variation in the production rates, an agreement with data and between the code by a factor of 2 is acceptable

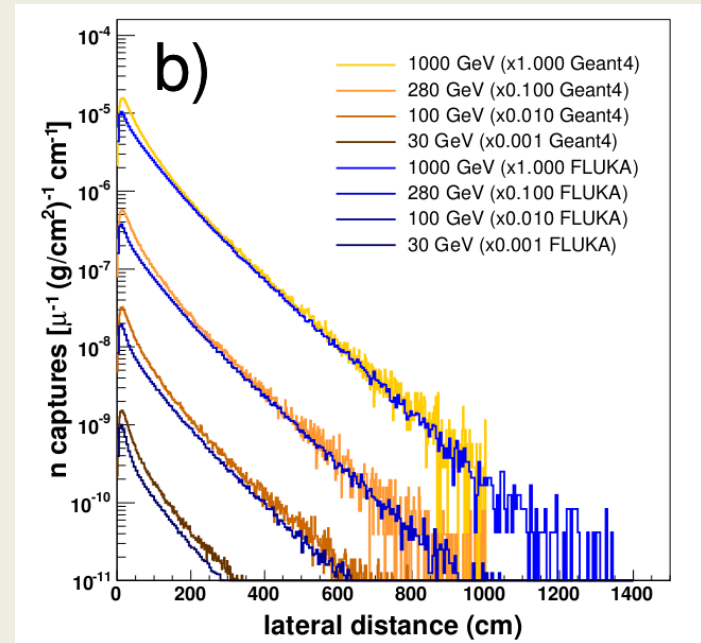
Neutron Capture Time and Lateral Distance

Neutron Capture Time



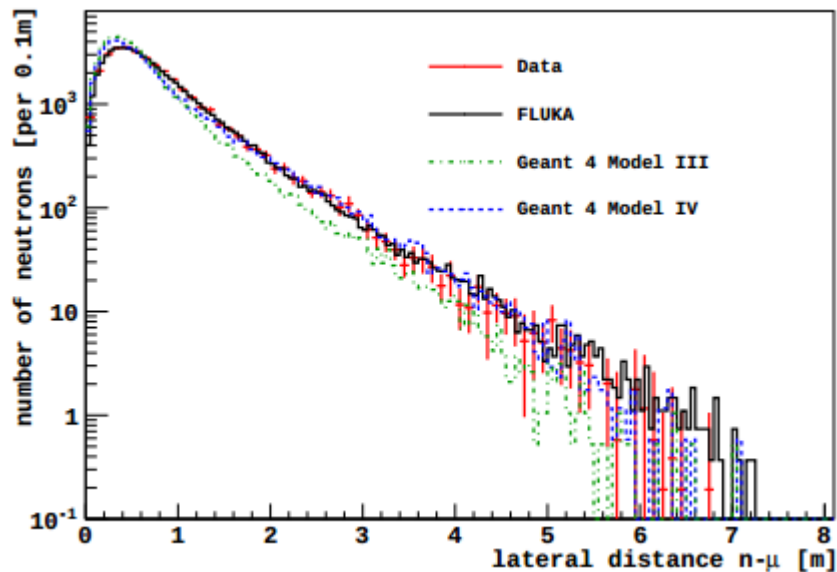
Fluka and Geant4 results for Liquid Scintillator

Neutron Lateral Distance



Fluka and Geant4 results for Liquid Scintillator

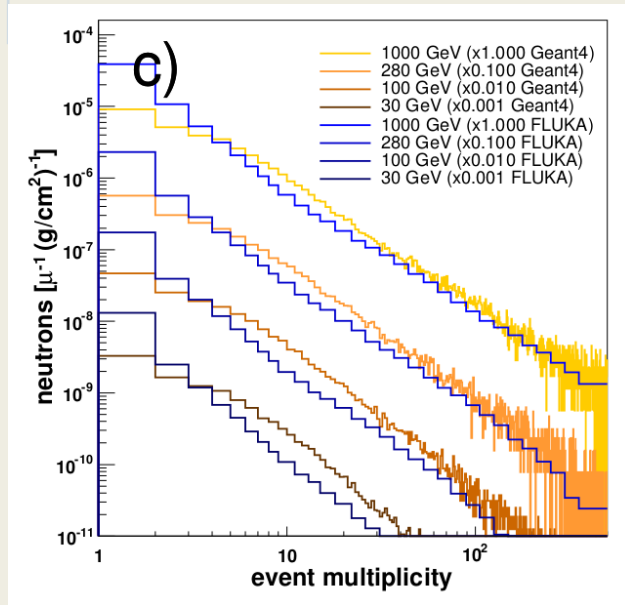
Lateral Distance Comparison



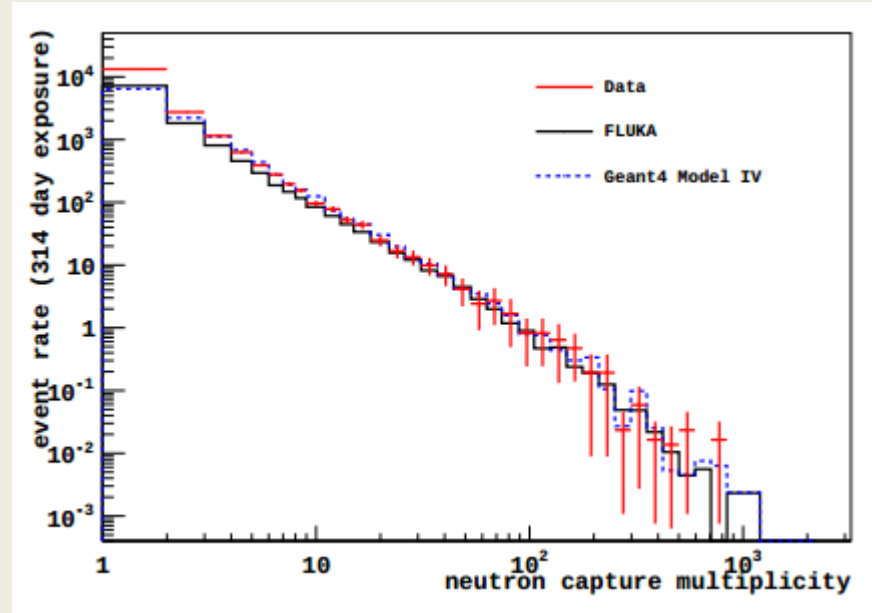
Comparison of the Fluka and Geant4
results to available Borenix data at around
280 GeV

arXiv:1304.7381 - JCAP 08 (2913) 049
Note difference for Geant4 models III and IV

Neutron Capture Multiplicity

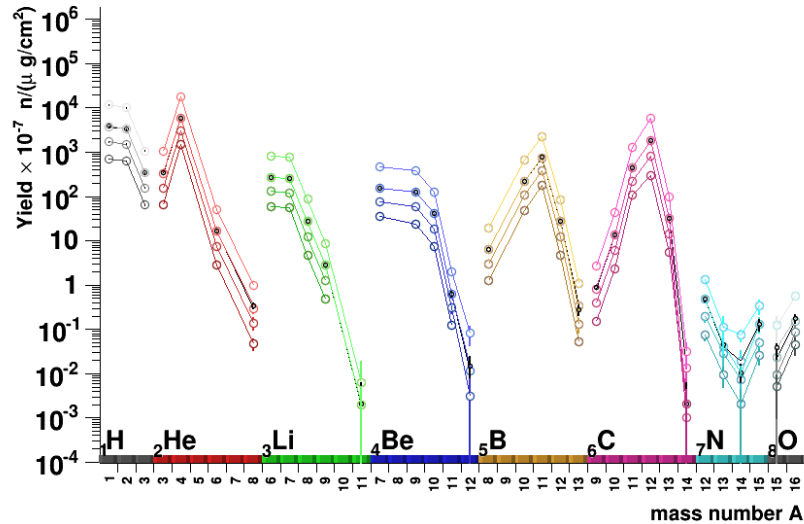


Neutron Capture multiplicity for Fluka and Geant 4

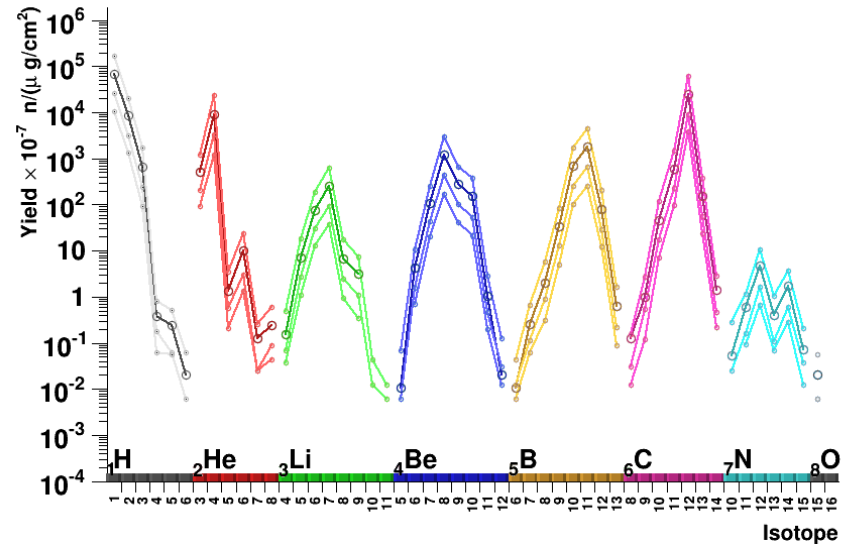


Comparison of multiplicity with available Borenix Data

Isotope Production Liquid Scintillator

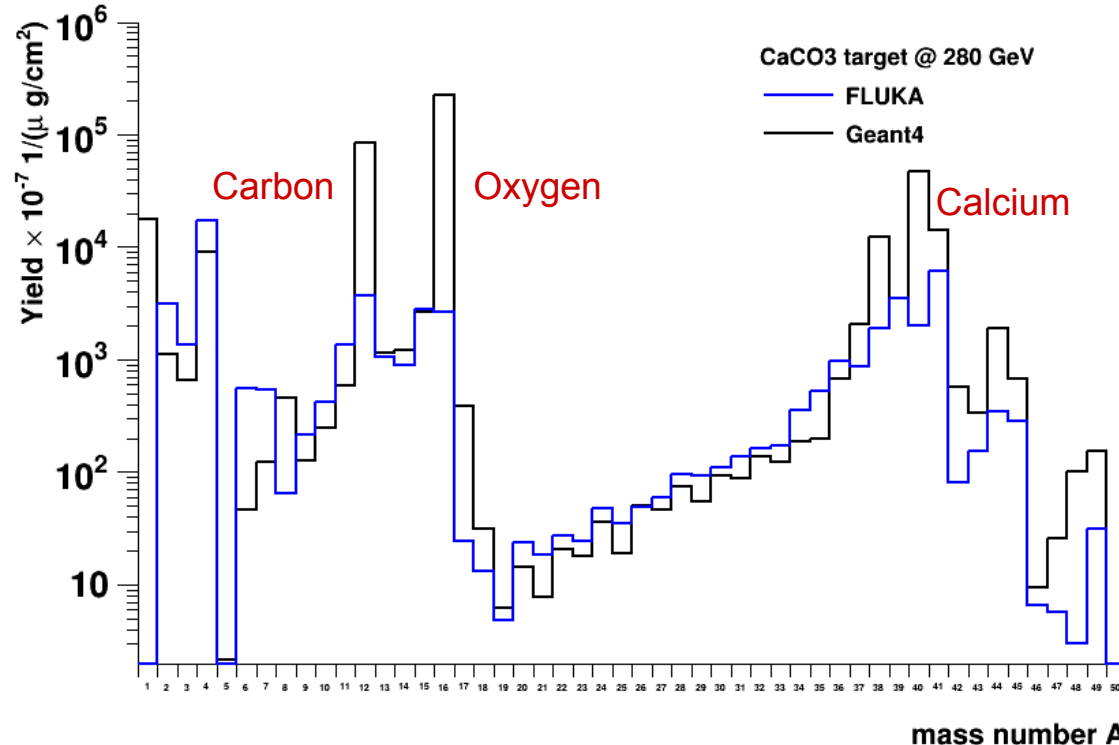


Fluka at all energy levels



Geant4 at all energy levels

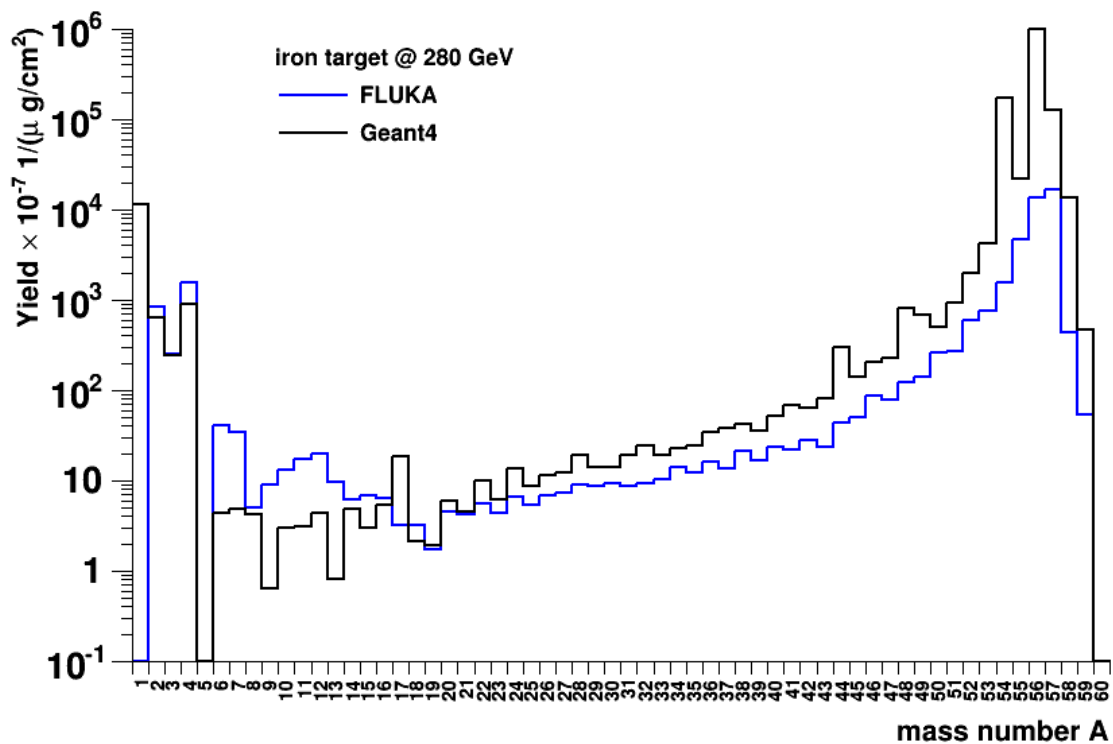
Isotope Production In Calcium Carbonate



The large discrepancies between the codes is visible at the naturally occurring isotopes in the targets.

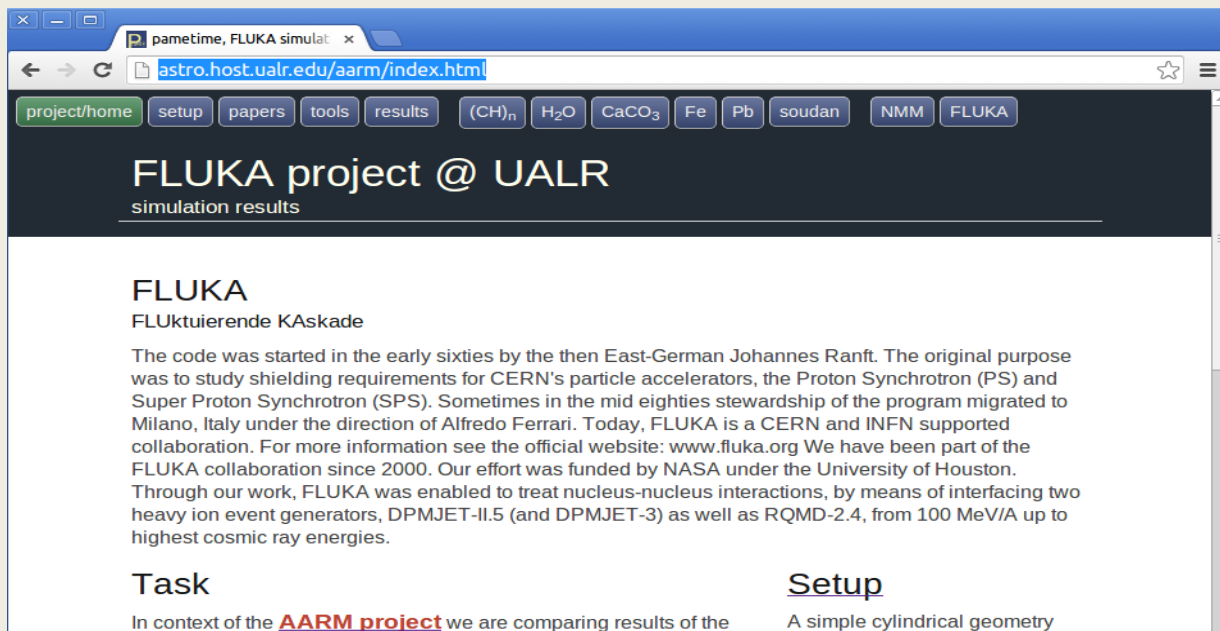
For Fluka low energy elastic scattering is not included in the standard residual isotope count. - but is available through user routines. What is the energy limit for low energy elastic Scattering in Geant4?

Isotope Production in Iron



Website for Fluka Info

The website for all the Fluka related work has changed to: <http://fluka.phys.uh.edu/aarm/>



The screenshot shows a web browser window with the address bar displaying `astro.host.ualr.edu/aarm/index.html`. The page has a dark blue header with a navigation menu containing links: `project/home` (highlighted in green), `setup`, `papers`, `tools`, `results`, `(CH)n`, `H2O`, `CaCO3`, `Fe`, `Pb`, `soudan`, `NMM`, and `FLUKA`. Below the header, the main title is "FLUKA project @ UALR" with the subtitle "simulation results". The content area features a section titled "FLUKA" with the subtitle "FLUKtuierende KAskade". The text describes the history of the FLUKA code, starting in the 1960s and mentioning its use at CERN and INFN. At the bottom, there are two columns: "Task" and "Setup".

FLUKA
FLUKtuierende KAskade

The code was started in the early sixties by the then East-German Johannes Ranft. The original purpose was to study shielding requirements for CERN's particle accelerators, the Proton Synchrotron (PS) and Super Proton Synchrotron (SPS). Sometimes in the mid eighties stewardship of the program migrated to Milano, Italy under the direction of Alfredo Ferrari. Today, FLUKA is a CERN and INFN supported collaboration. For more information see the official website: www.fluka.org We have been part of the FLUKA collaboration since 2000. Our effort was funded by NASA under the University of Houston. Through our work, FLUKA was enabled to treat nucleus-nucleus interactions, by means of interfacing two heavy ion event generators, DPMJET-II.5 (and DPMJET-3) as well as RQMD-2.4, from 100 MeV/A up to highest cosmic ray energies.

Task
In context of the **AARM project** we are comparing results of the

Setup
A simple cylindrical geometry