Muon Induced Isotopes in Multiple Targets

Geant4/FLUKA Simulation Comparison

AARM Collaboration Meeting at Fermi National Lab

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Motivation

- Very little information about muon induced reactions underground
- There is data available on comsogenic isotope production

  Kamland and Borexino (motivated by ^{11}C production)

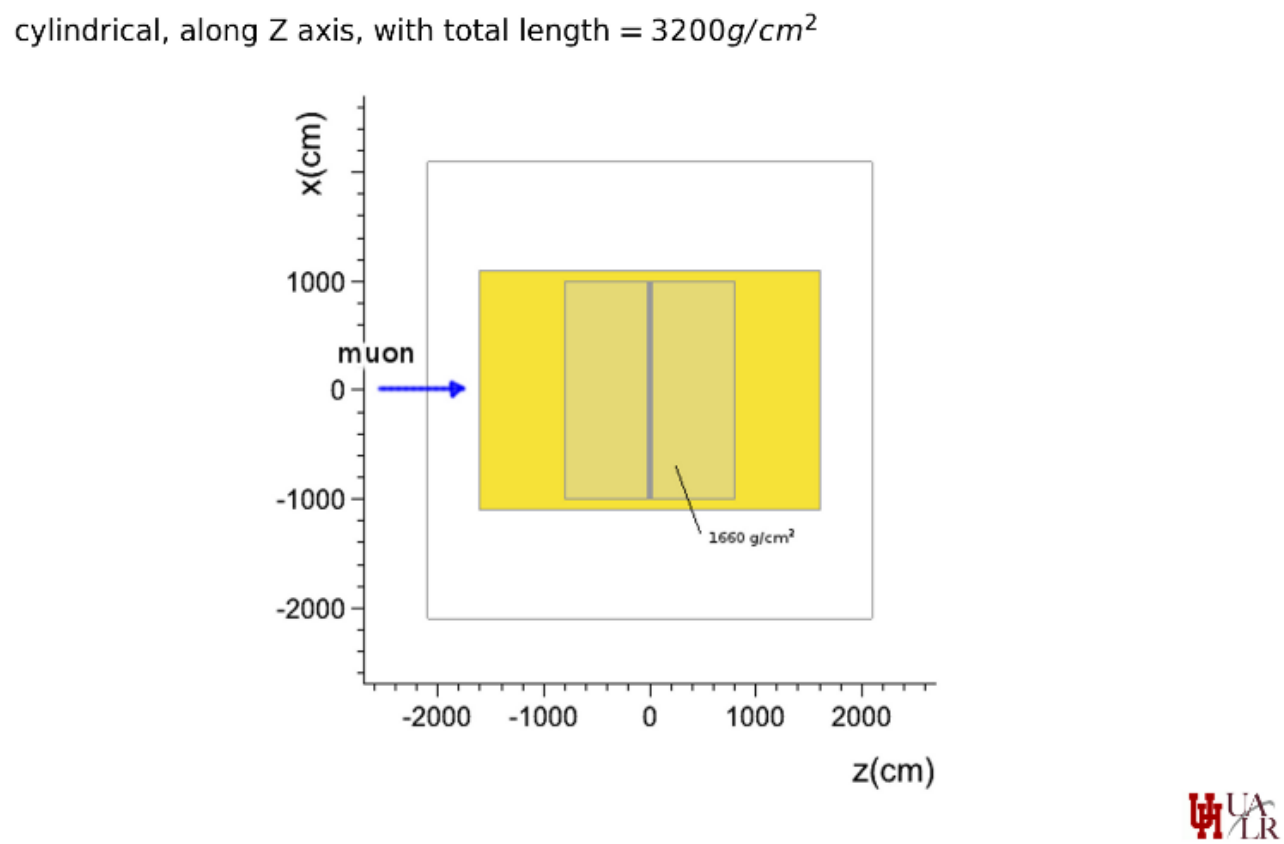
- Our task is to compare predictions of Geant4 and Fluka

  Because of the complexities in predicting isotope production rates and the large variation in the production rates, an agreement with data and between the codes by a factor of 2 is acceptable

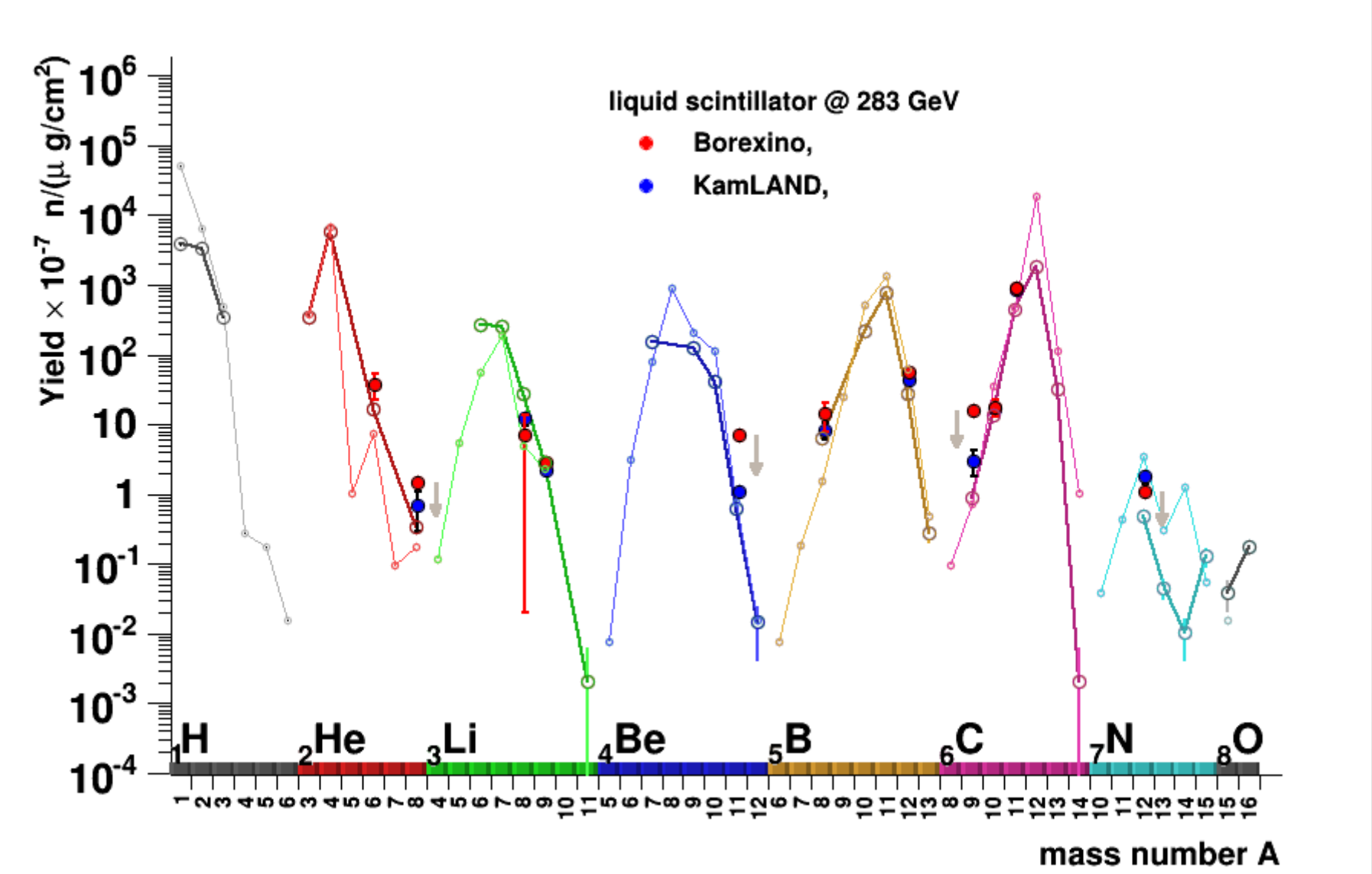
Geometry of Simulation

<u>Targets of Interest:</u>
Liquid Scintillator
Water
Calcium Carbonate
Greenstone
Iron
Lead

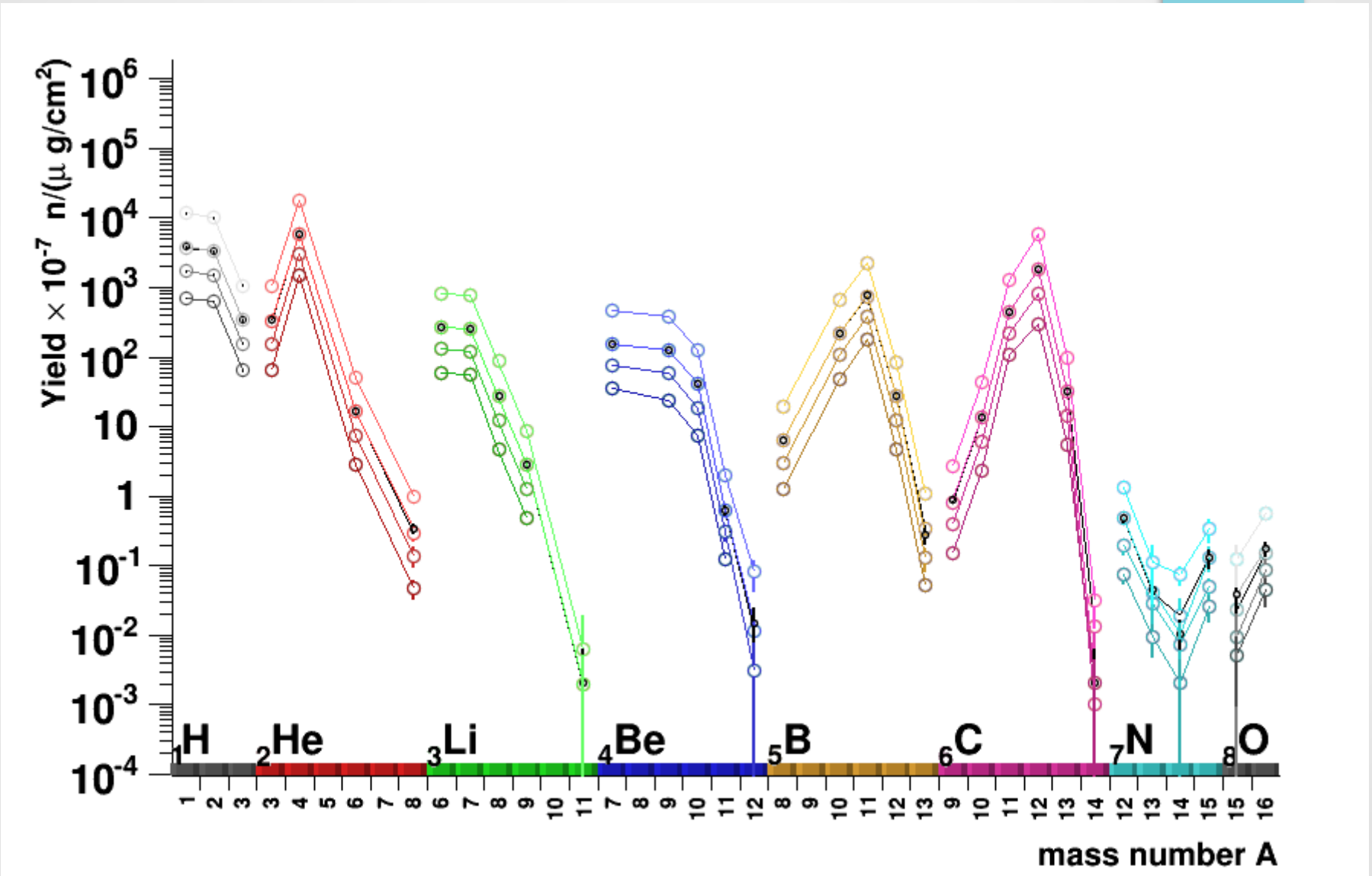
<u>Interested Muon Energies:</u>
30 GeV
100 GeV
200 GeV for Greenstone
280 GeV
1 TeV



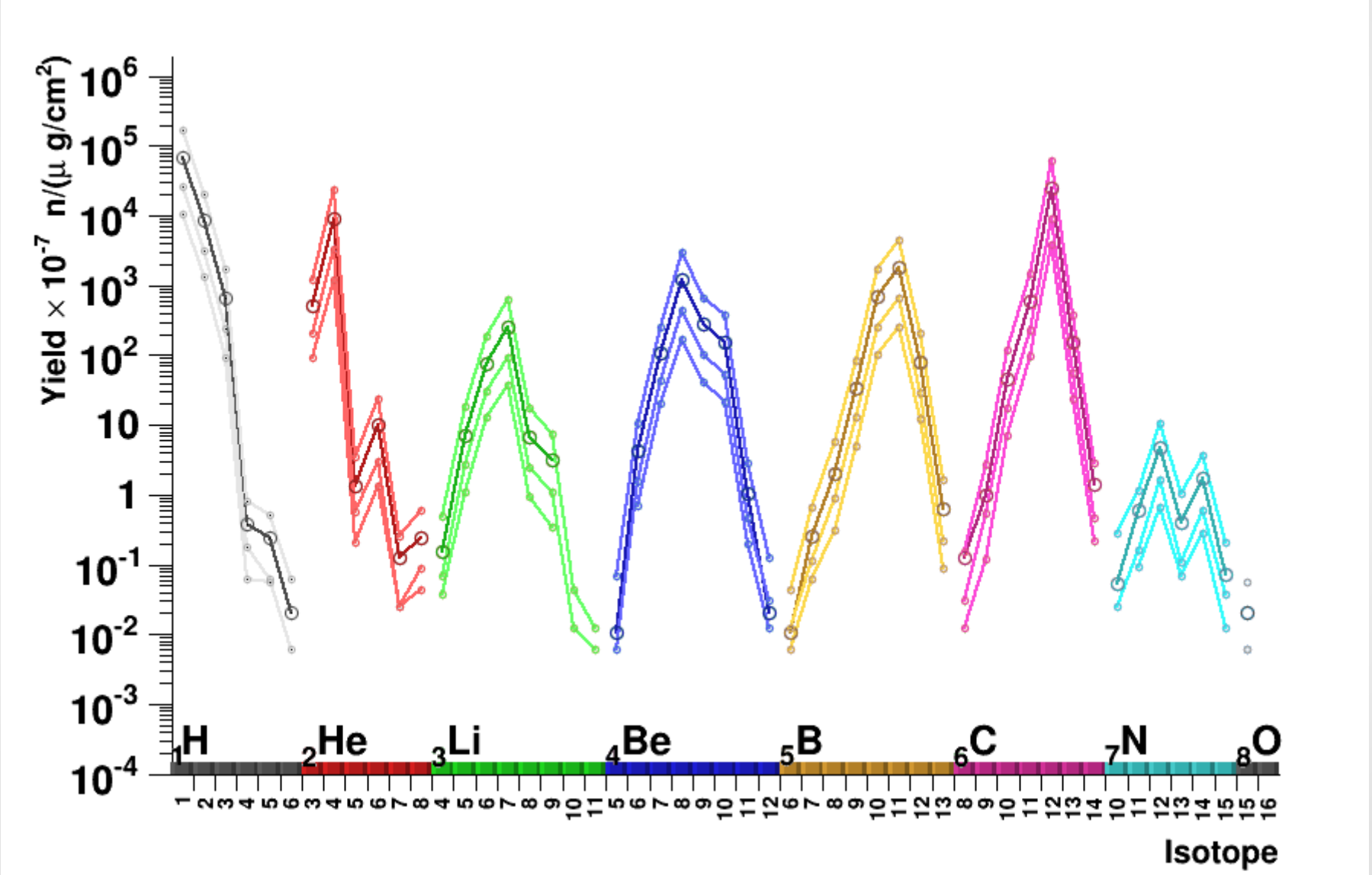
Fluka/Geant4 Liquid Scintillator @ 280 GeV



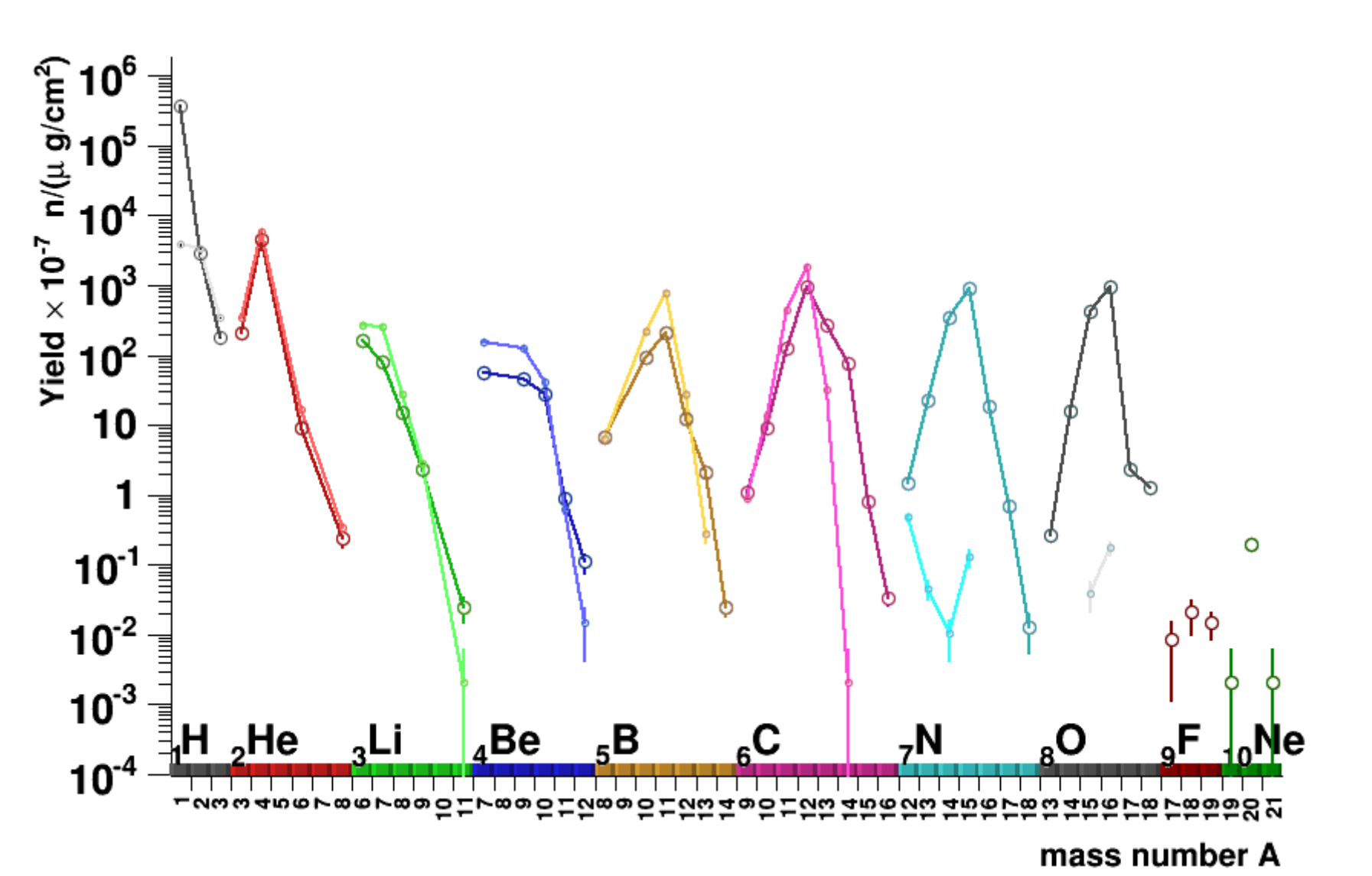
Liquid Scintillator @ All Energies for Fluka



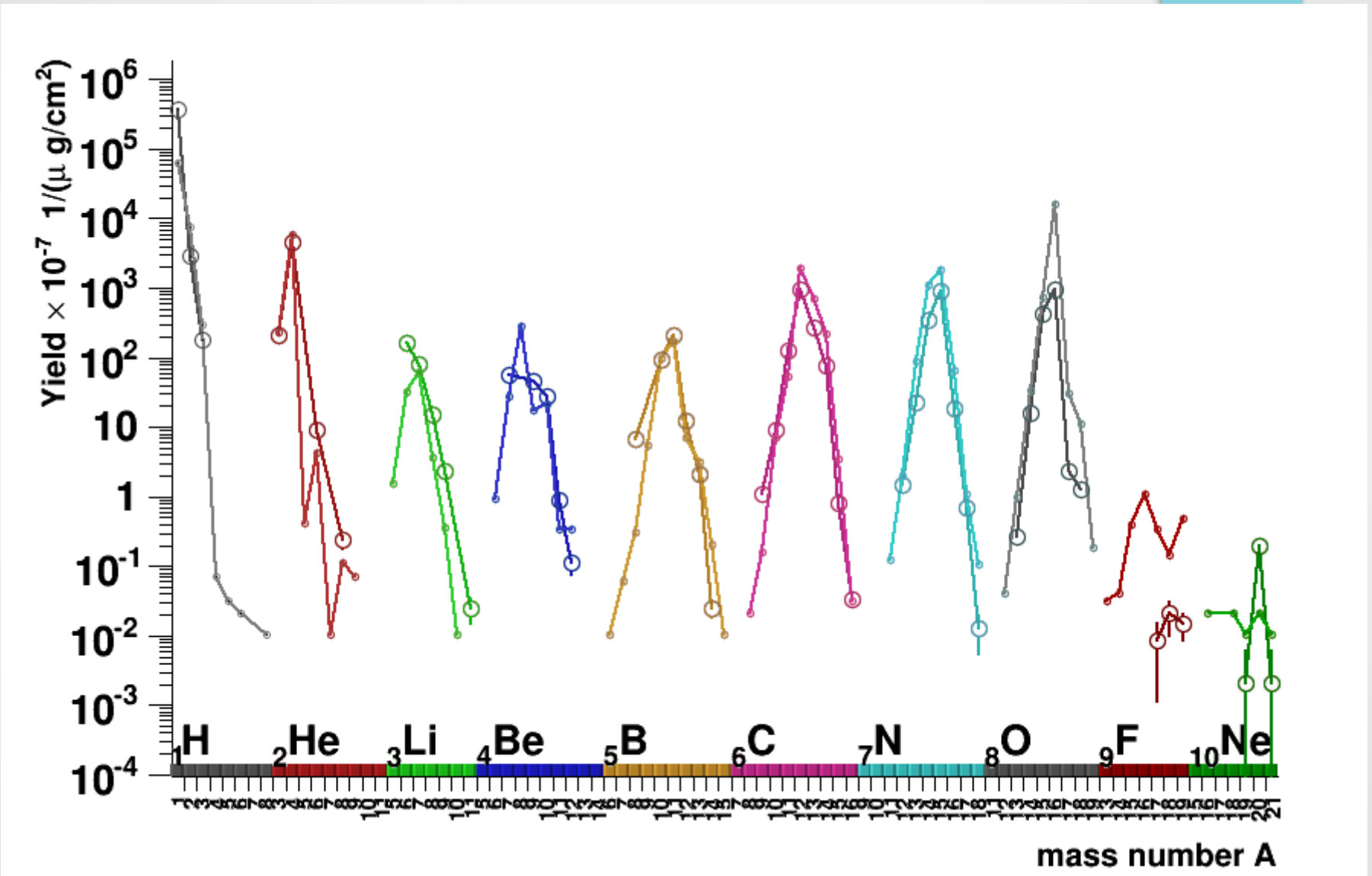
Liquid Scintillator @ All Energies for Geant4



Liquid Scintillator vs. Water Fluka @ 280 GeV



Fluka/Geant4 Water @ 280 GeV

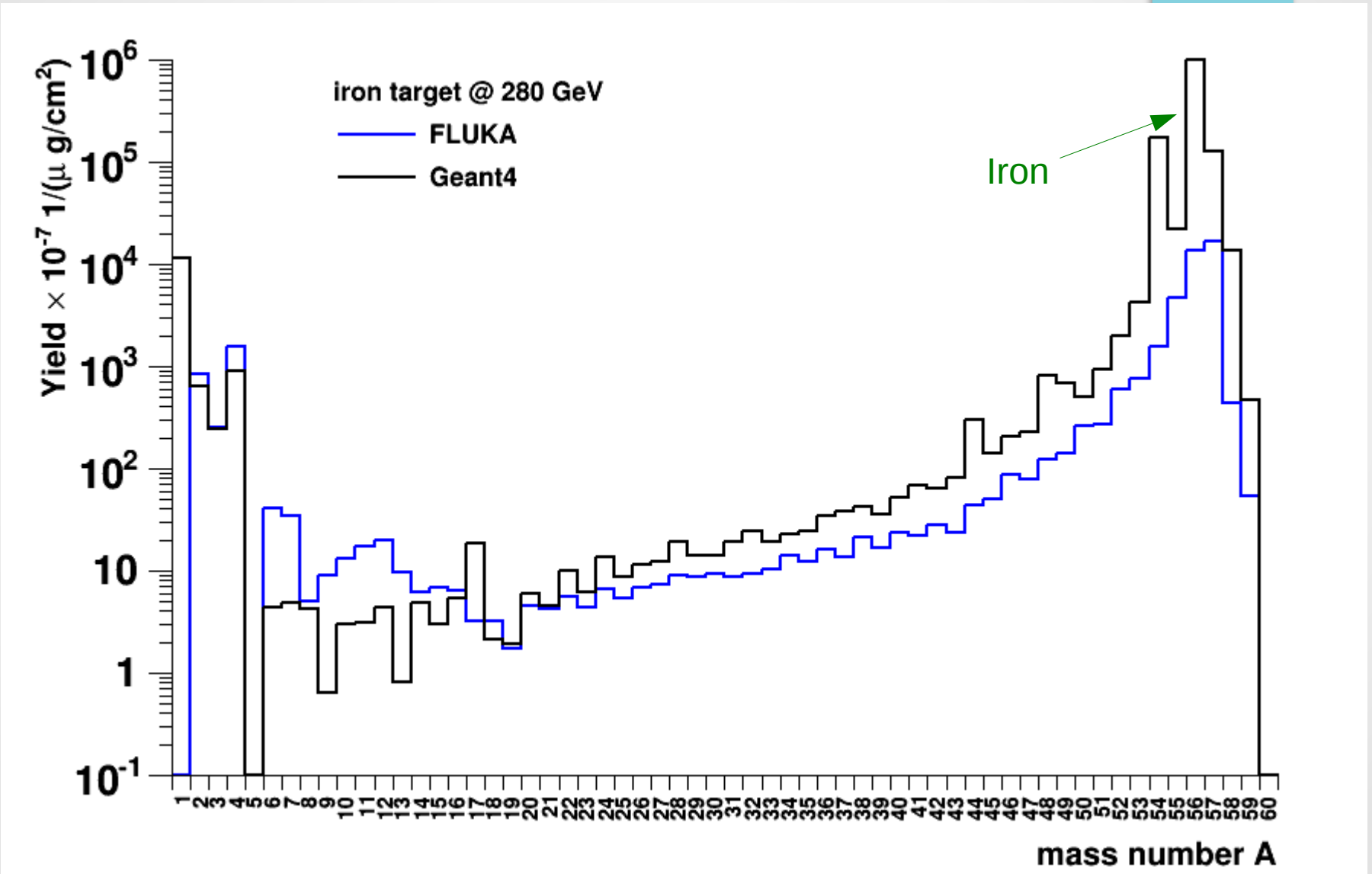


- Recently we have looked at comparisons of these muon induced isotopes in our heavier targets.

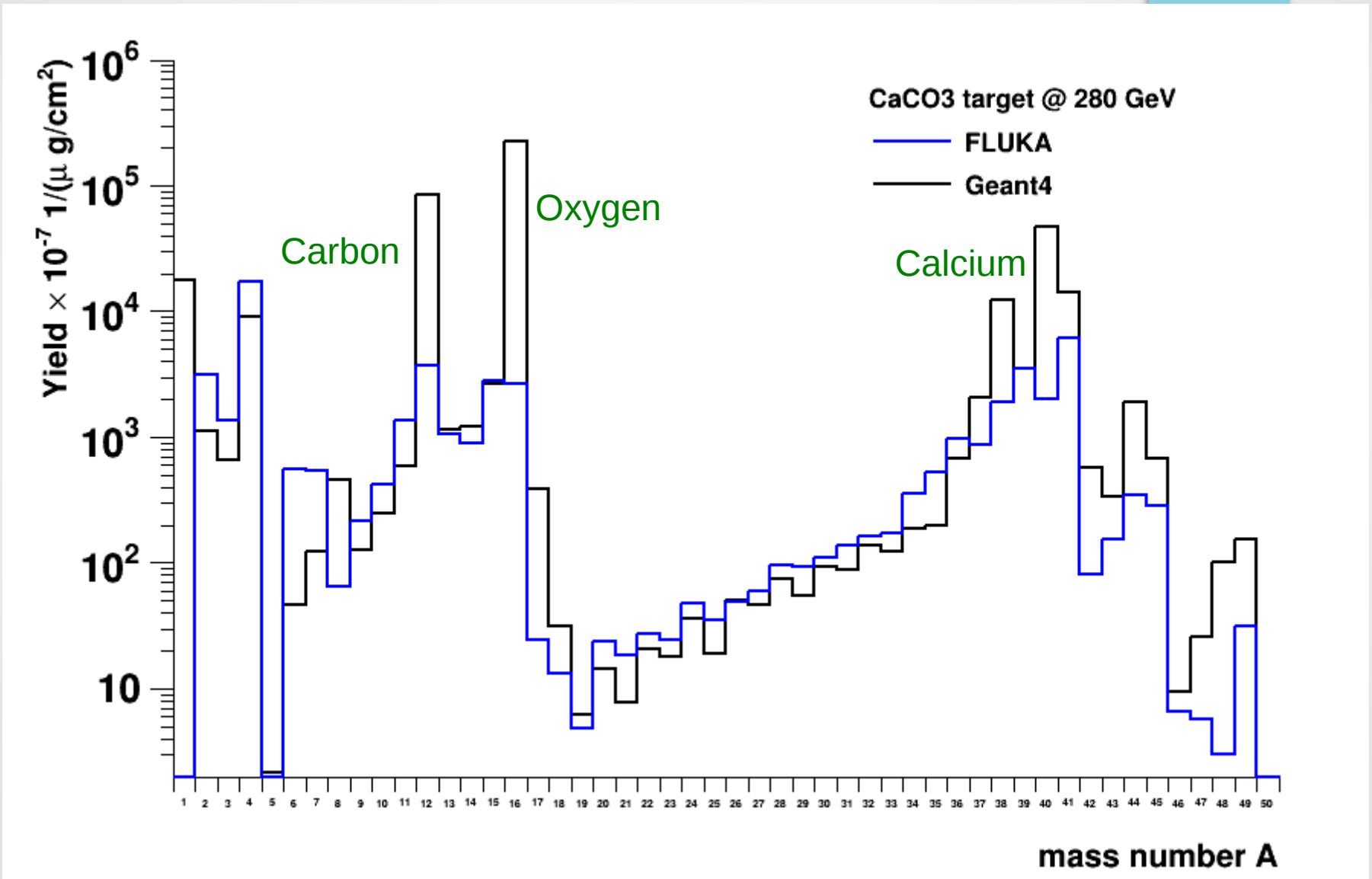
- It is not completely understood why there are such large discrepancies in some of the produced isotopes

  Our first thoughts are that there is an elastic scattering threshold that is different in the two codes especially in isotopes that are present in the targets

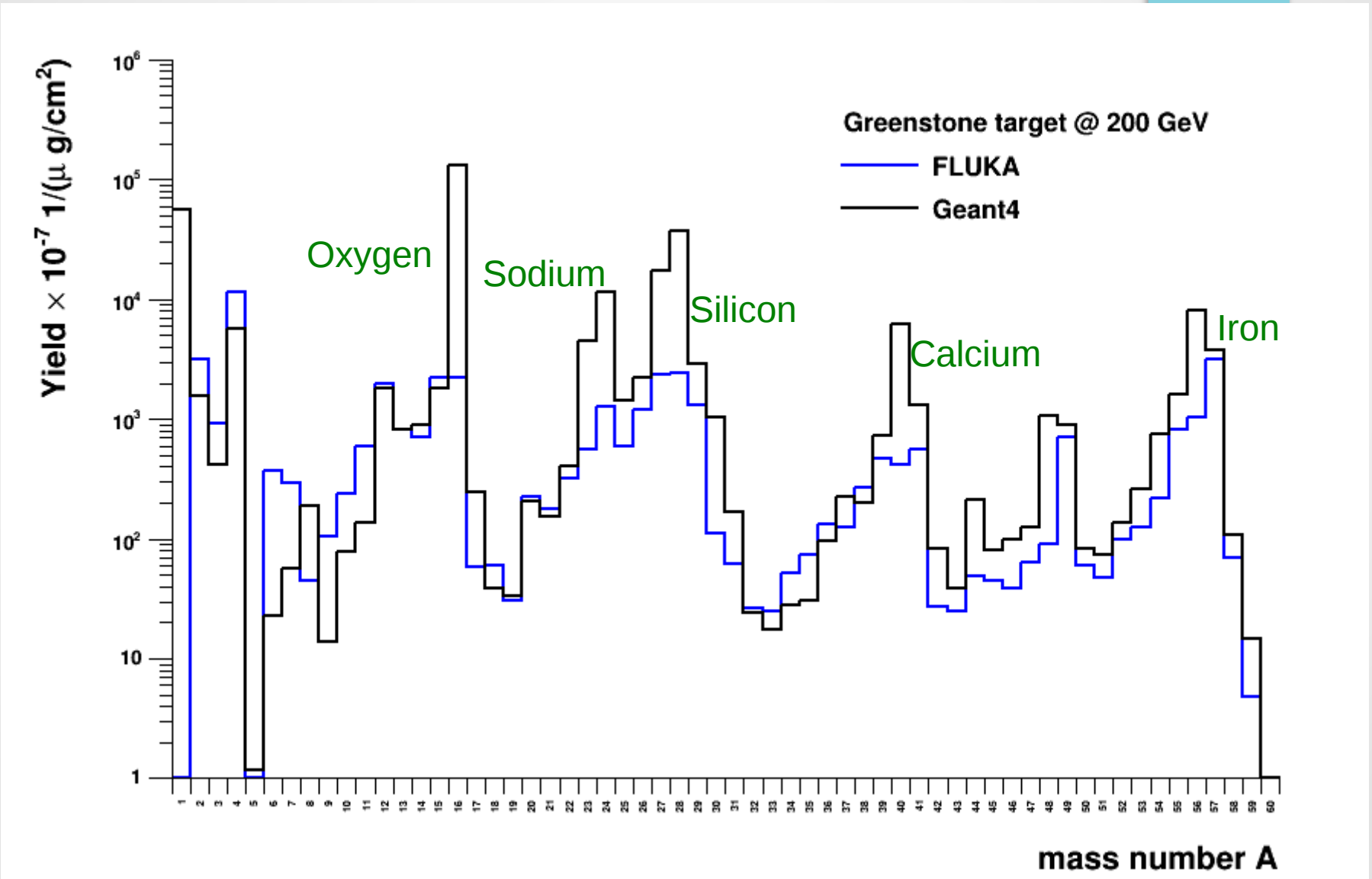
Geant4/Fluka for Iron @ 280 GeV



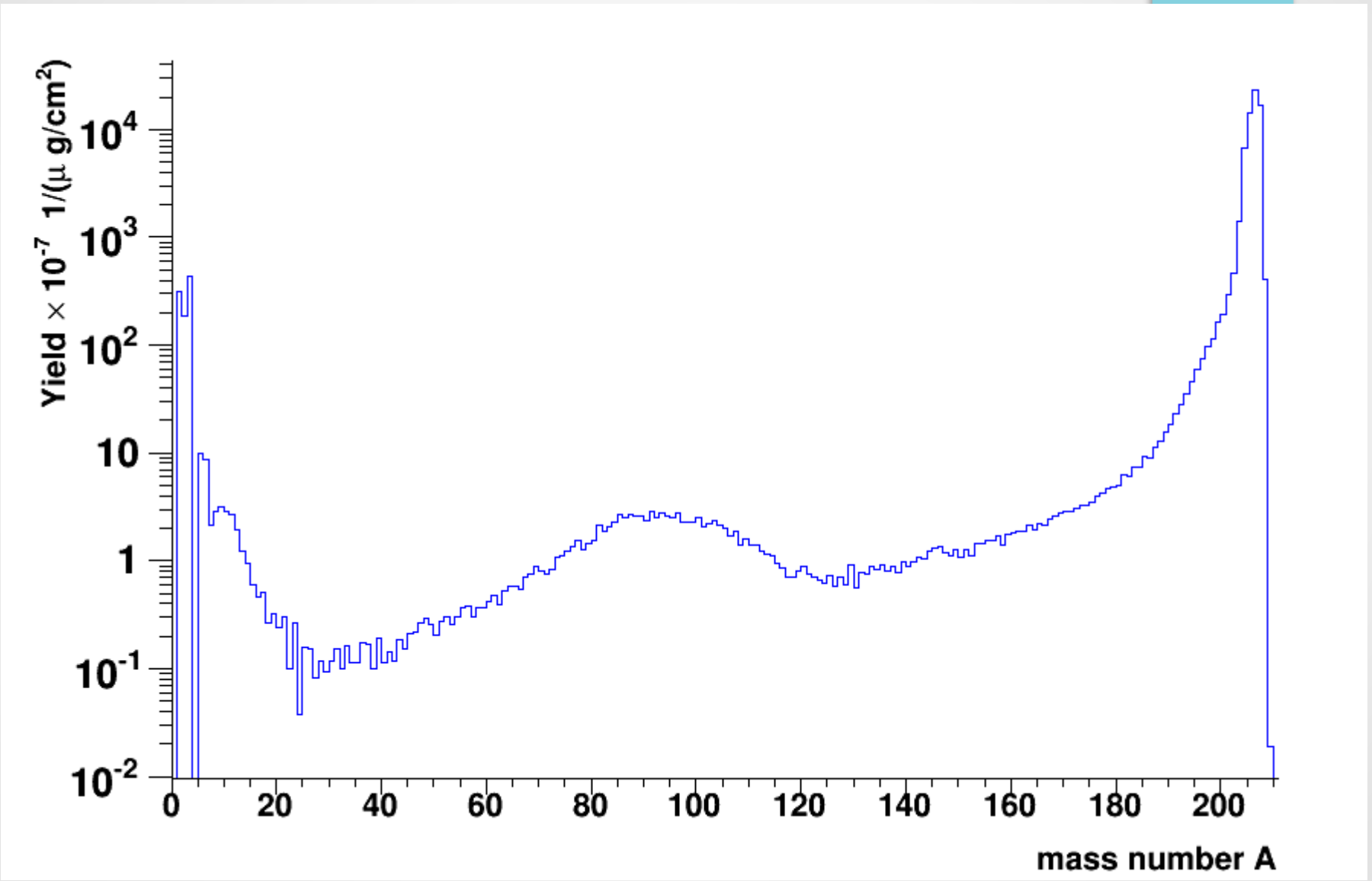
Geant4/Fluka for $CaCO_3$ @ 280 GeV



Geant4/Fluka for Greenstone @ 200 GeV

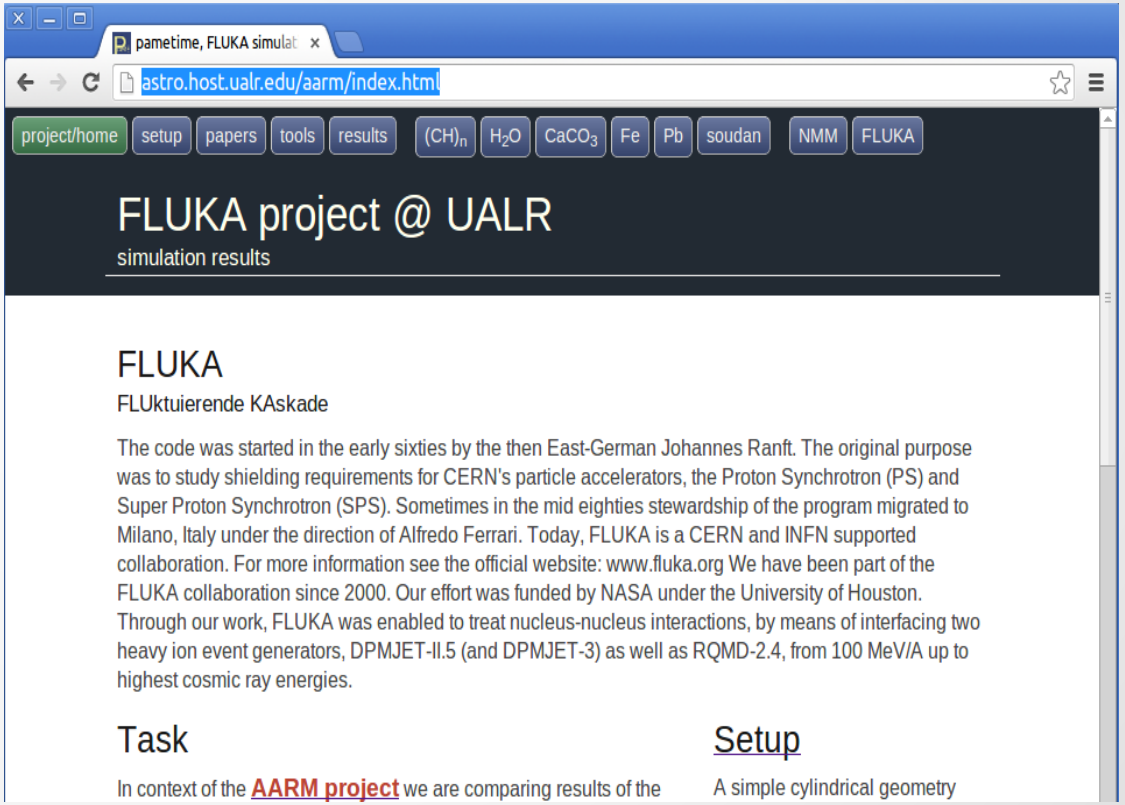


Fluka for Lead @ 280 GeV



Website for FLUKA related data:

astro.host.ualr.edu/aarm



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Summary and Future Work

- Carbon 11 backgrounds in detectors
- Need to look at the spikes in the isotopes that occur in the natural form of isotope in all targets

- On the Fluka side: need to update the website with a tools section

Water @ All Energies for Fluka