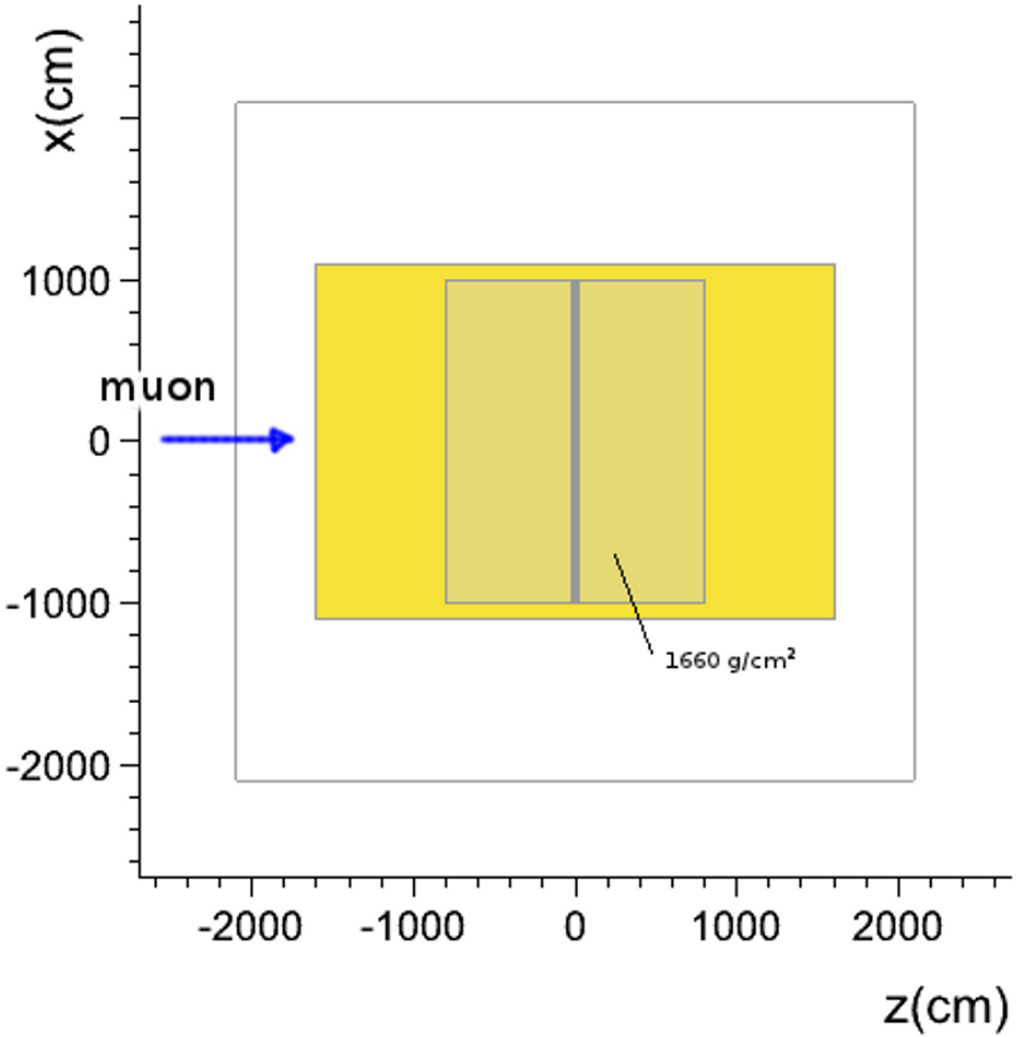
current geometry setup

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



status

at this point the full list of suggested muon kinetic energy settings was processed for H_2O as target: 10, 30, 100, 280 and 1000 GeV
order 3e6 events per setting, got rates BUT ...

still developing the *post-processing* facilities

- investigate single FLUKA option which changes neutron production by 8%

first attempt to compare to results obtained previously with FLUKA by Vitaly
Pb with muons of 100 GeV

not official yet: we are to be involved in the analysis of muon induced neutrons in the Borexino detector - again concentrating on FLUKA - very similar to the KamLAND work which was reported at the Berkeley workshop
there is a good chance that we can benefit from this analysis

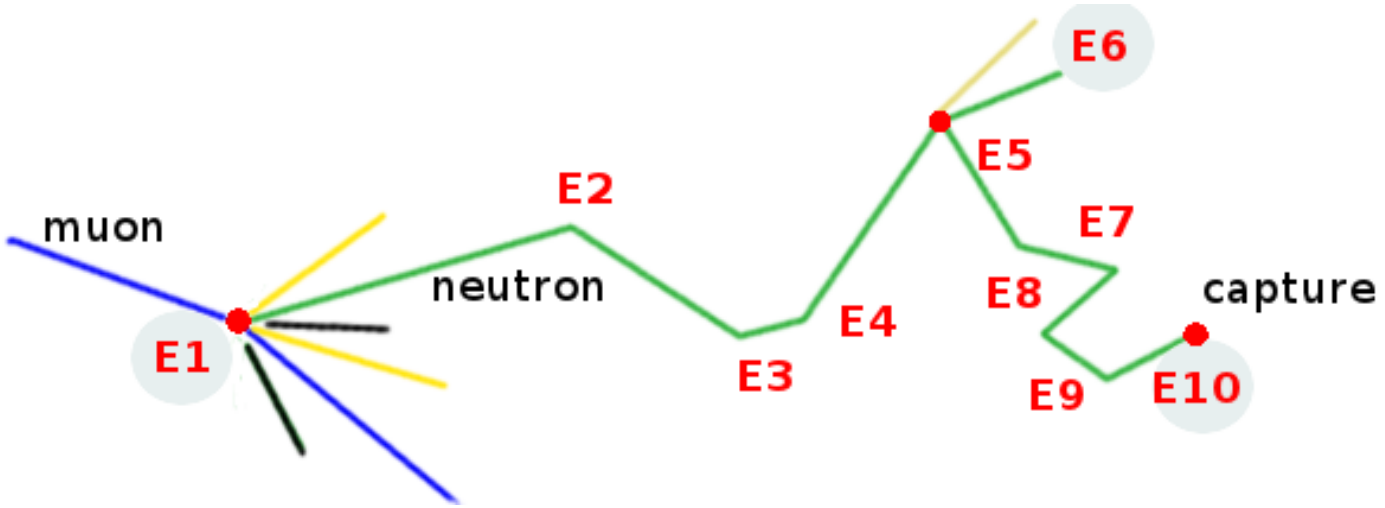
- we should include studying neutron capture in liquid scintillator
  really what is usually measured anyways
  comes with its own set of challenges but helps 'counting'
  we agreed on a liquid scintillator

counting neutrons

"*FLUKA and GEANT4 count all neutrons produced in inelastic collisions as 'new' neutrons. This leads to the double counting of neutrons in (n,an) reactions, where a in a positive integer. Basically, all neutrons in the final state are considered as 'new', whereas in fact, one of them is an 'old' one which initiated the reaction. To avoid this double counting, the number of neutrons in the initial state should be subtracted from that in the final state. ... It is usually assumed the highest energy neutron in the final state is the one which caused the reaction.*"

FLUKA mantra: **do not count neutrons**

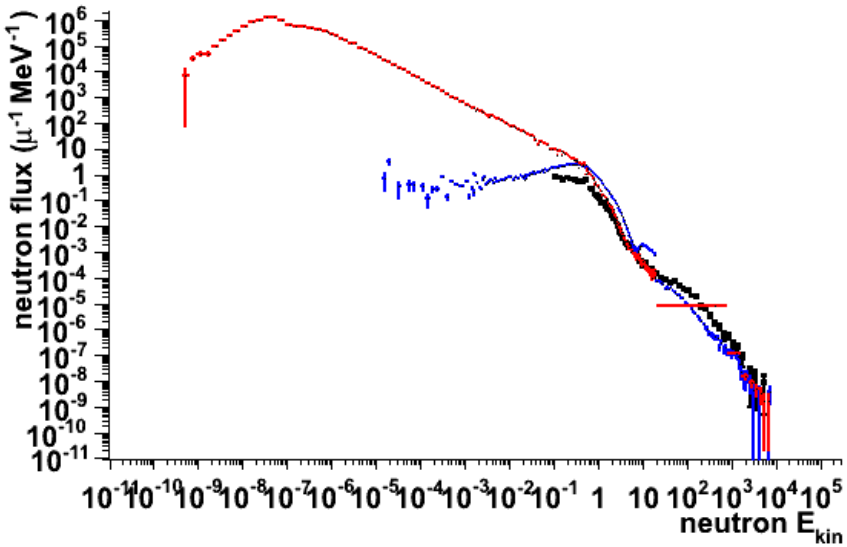
naively, will produce incorrect neutron kinetic energy spectra

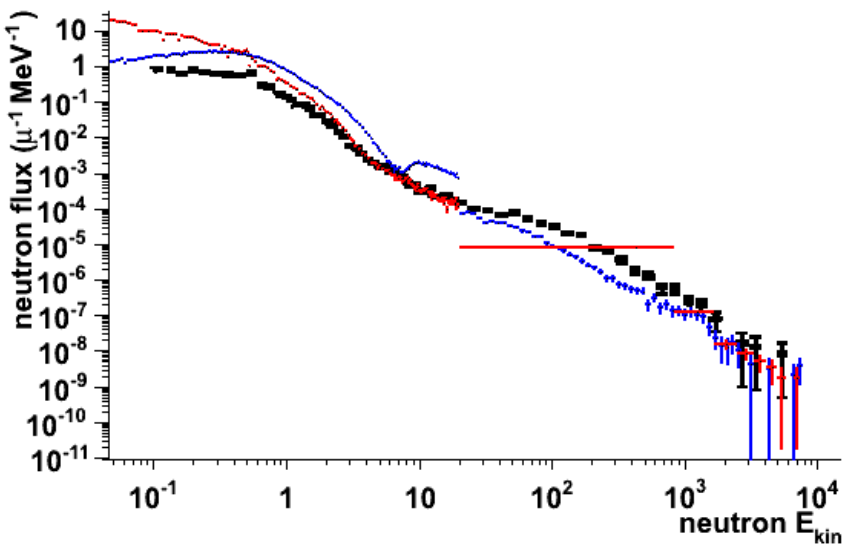


100 GeV muons into lead

Eur. Phys. J. A, 36 (2008) 171b, reference from Vitaly

we tried a first comparison just to see if our setup in FLUKA makes sense





- black symbols were extracted from Vitaly's graph: muons transported through $1500 g/cm^2$ of lead and all neutrons exiting were recorded **(FLUX !)**
- red histogram shows neutron flux at the middle of our lead setup after $1600 g/cm^2$, using FLUKA standard scoring – only few and too large, linear sized bins at high neutron kinetic energies ($E_{kin} > 20 MeV$)
- **trouble** blue histogram derived from 'counting neutrons' mid-range peak ? – should be divided by 141cm ($= 1600 g/cm^2$) ?

outlook

- cast post-processing into a standard, understand and study 'neutron counting' – talk with Vitaly
- neutron capture and isotope production in liquid scintillator
- Borexino collaboration meeting and cosmogenics working group meeting: 11 - 15 July @ Gran Sasso
- continue filling out the matrix asked for by Vitaly
  liquid scintillator (look at KamLAND rates/work) and lead next
  - start to implement standard $20 \times 20 m^3$ rock volume with $6 \times 6 \times 6 m^3$ cavern *maybe*