^{235}U(n,f) cross section between 10 and 30 keV

Presented by:
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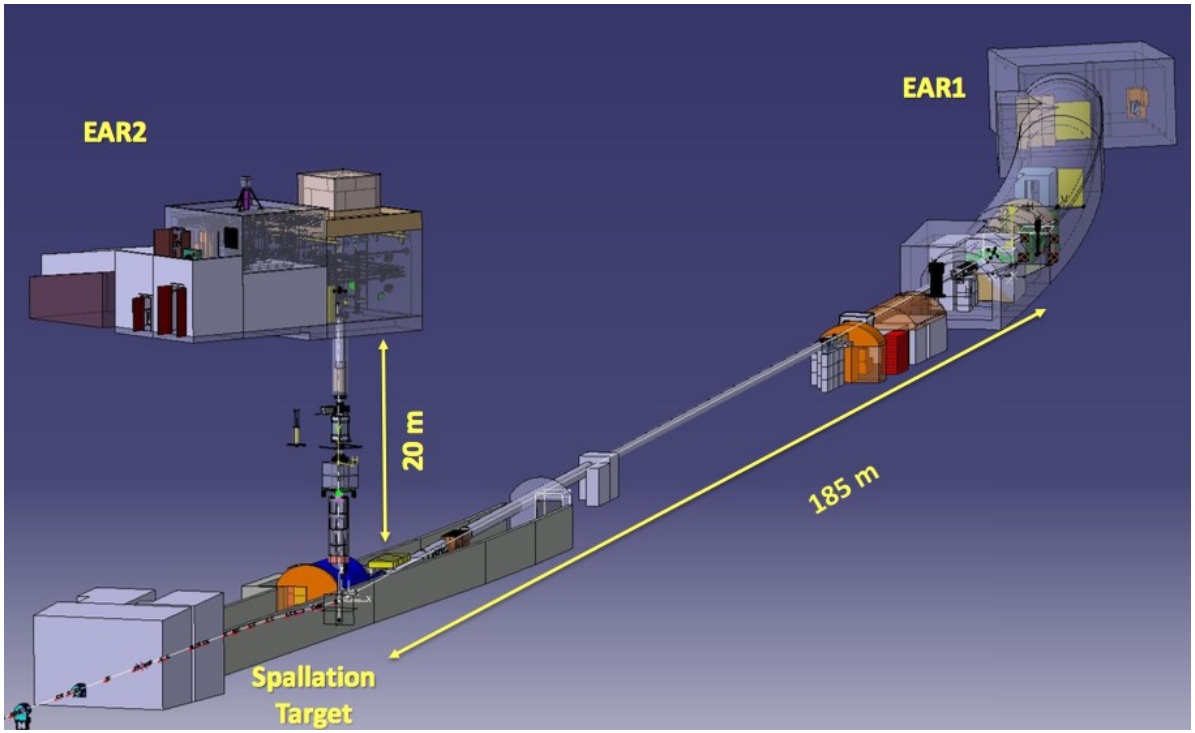
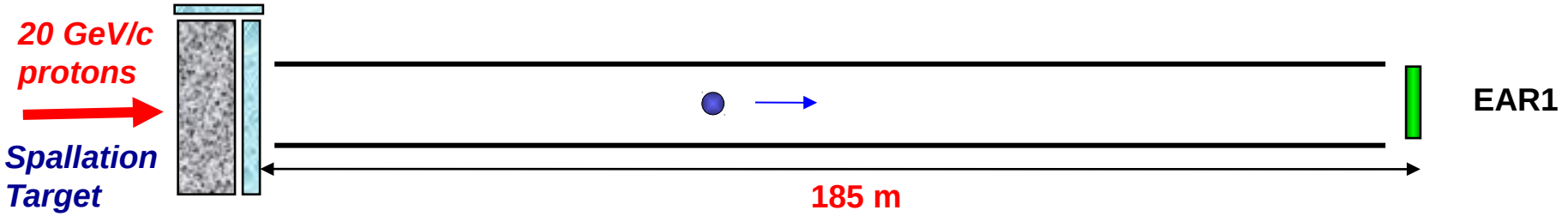
n_TOF facility

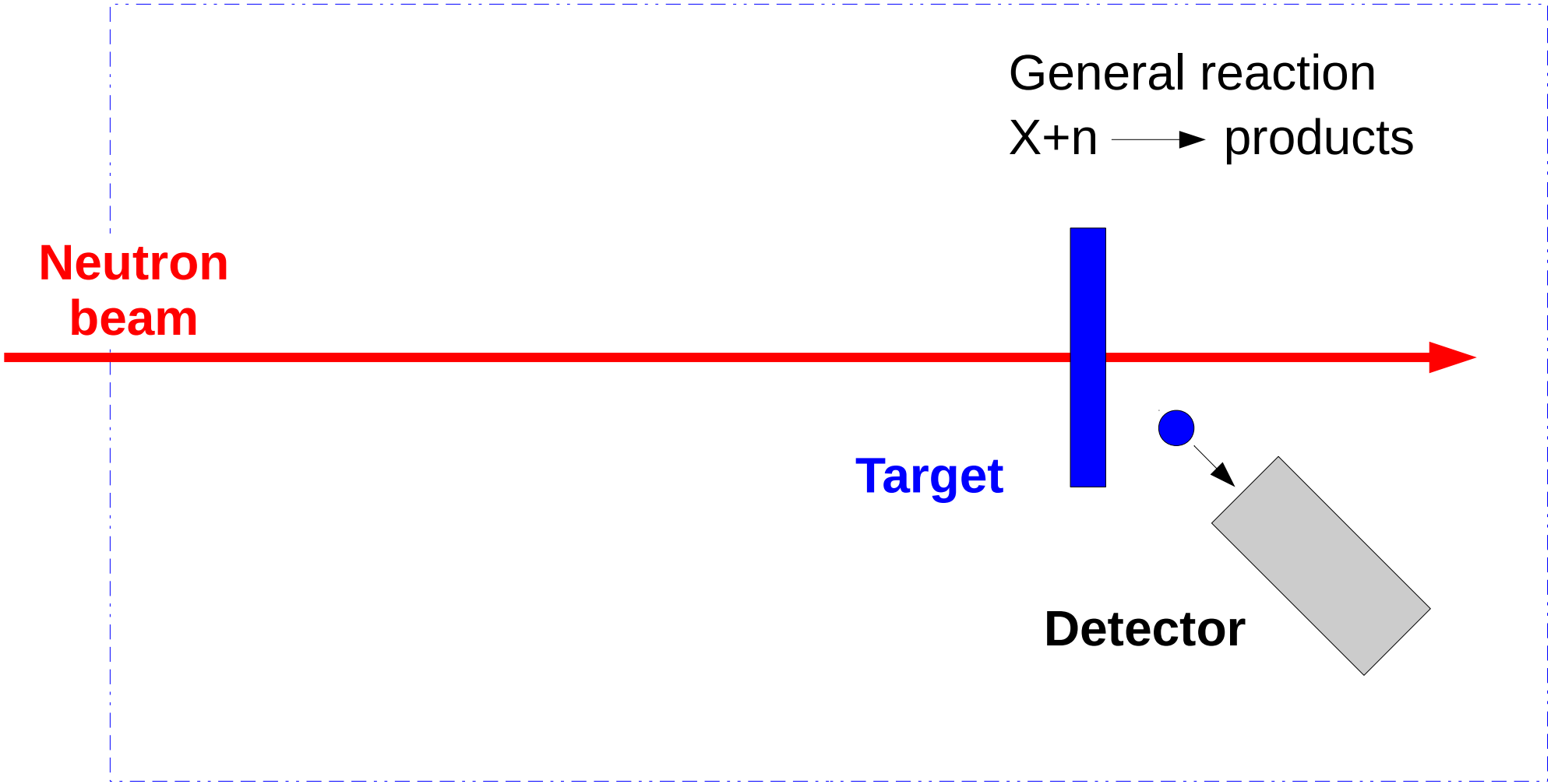
neutron Time Of Flight

- Neutrons produced through a spallation process
- Extremely high instantaneous flux
- High neutron energy resolution
- Wide neutron energy range (from thermal to GeV)

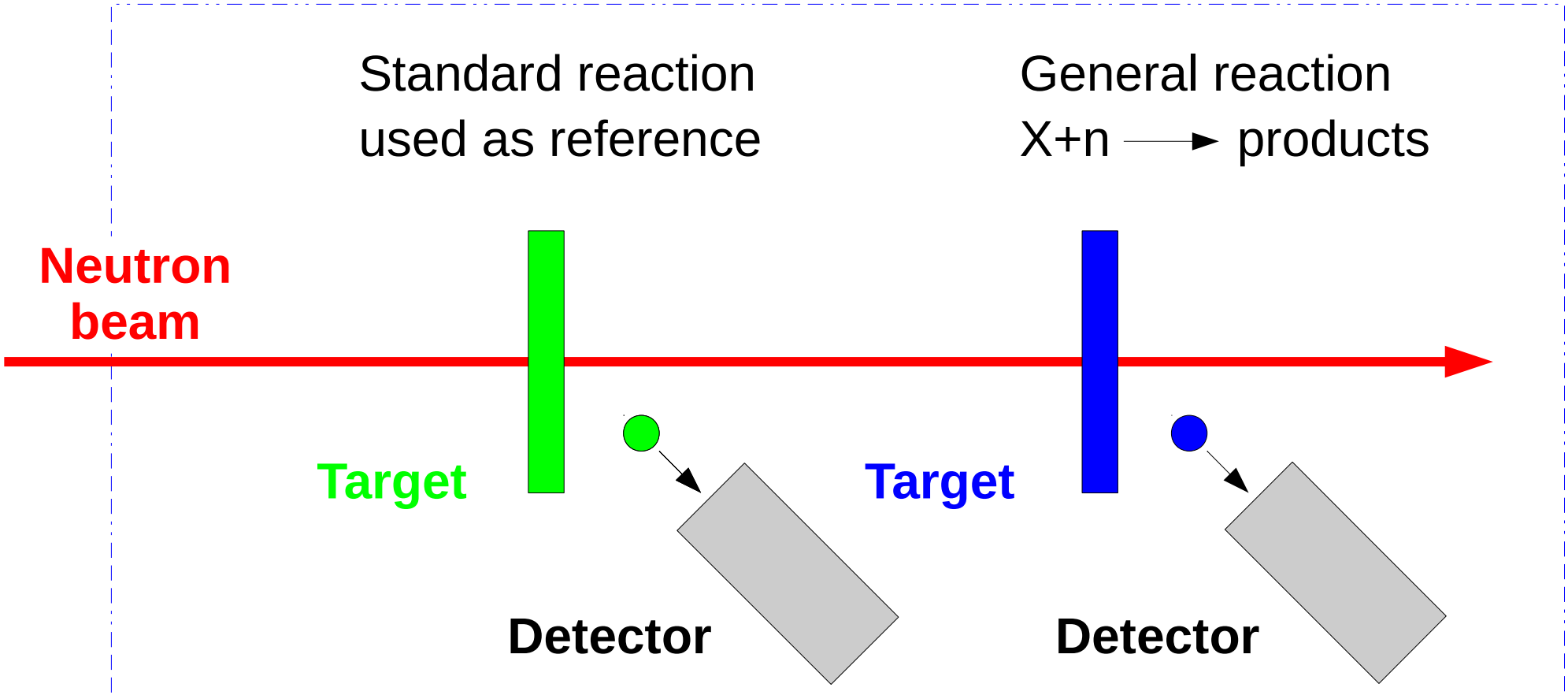




n_TOF facility



n_TOF facility

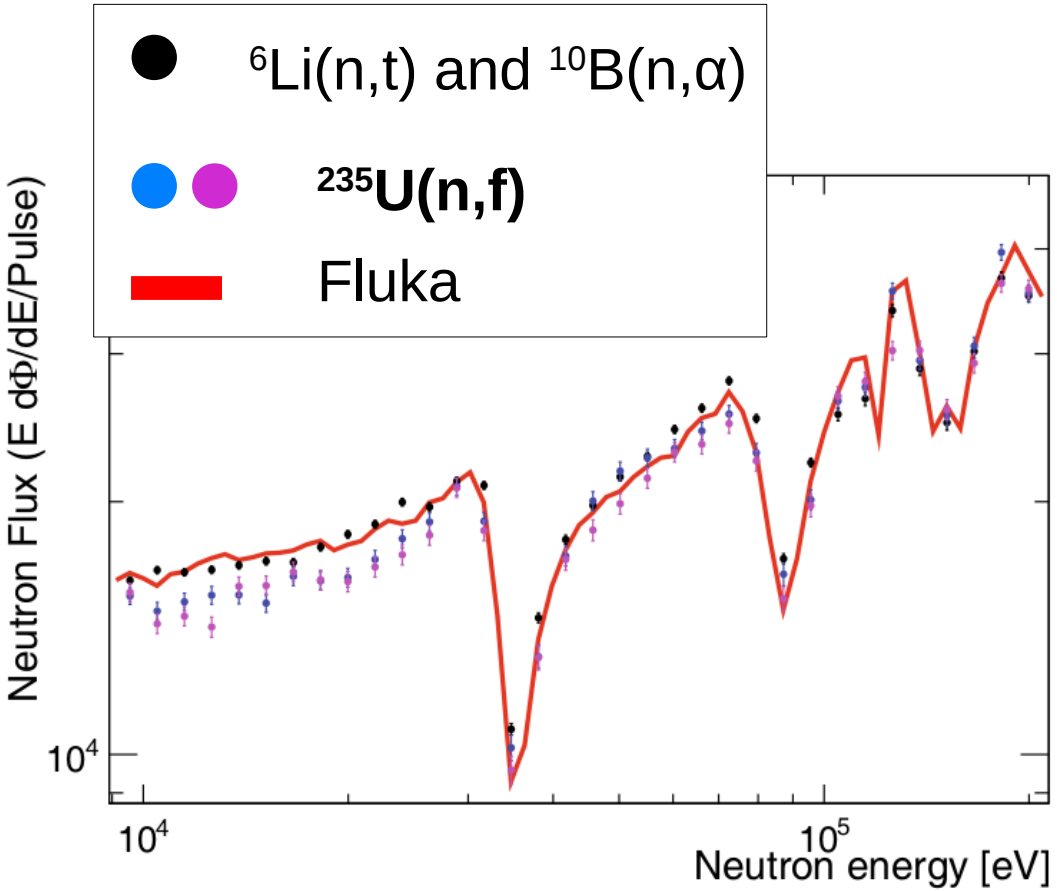


Main used standards: H(n,p) ^{6}Li(n,t)^{4}He

^{10}B(n,α)^{7}Li ^{197}Au(n,γ) **^{235}U(n,f)**

Motivations

- Discrepances (6-8%) in the n_TOF flux measure between detectors using fission and the ones using ^{6}Li(n,t) and ^{10}B(n,α)
- Discrepances in the ^{235}U(n,γ) measure at DANCE (fission used as reference)

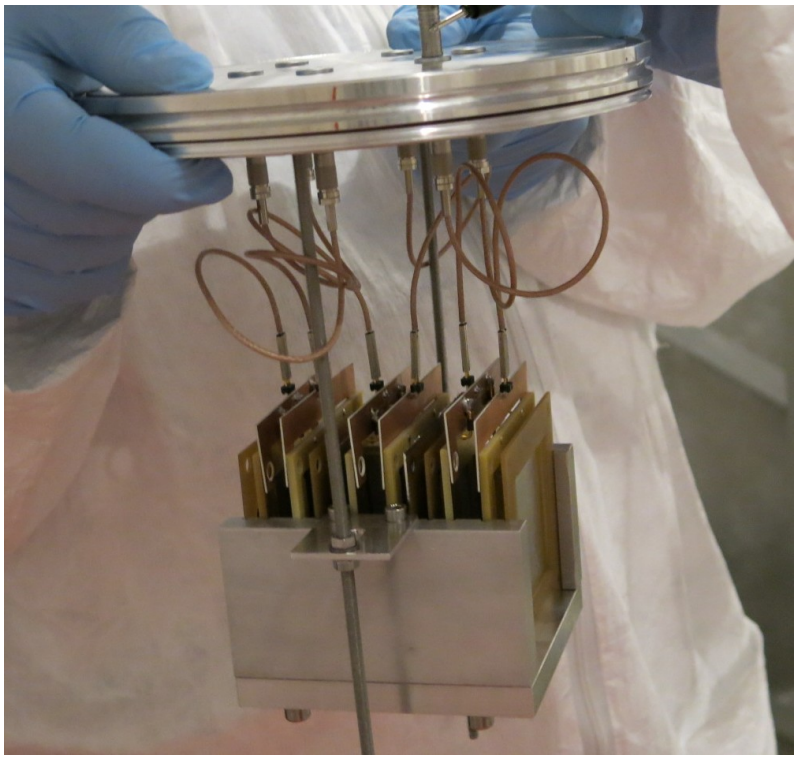


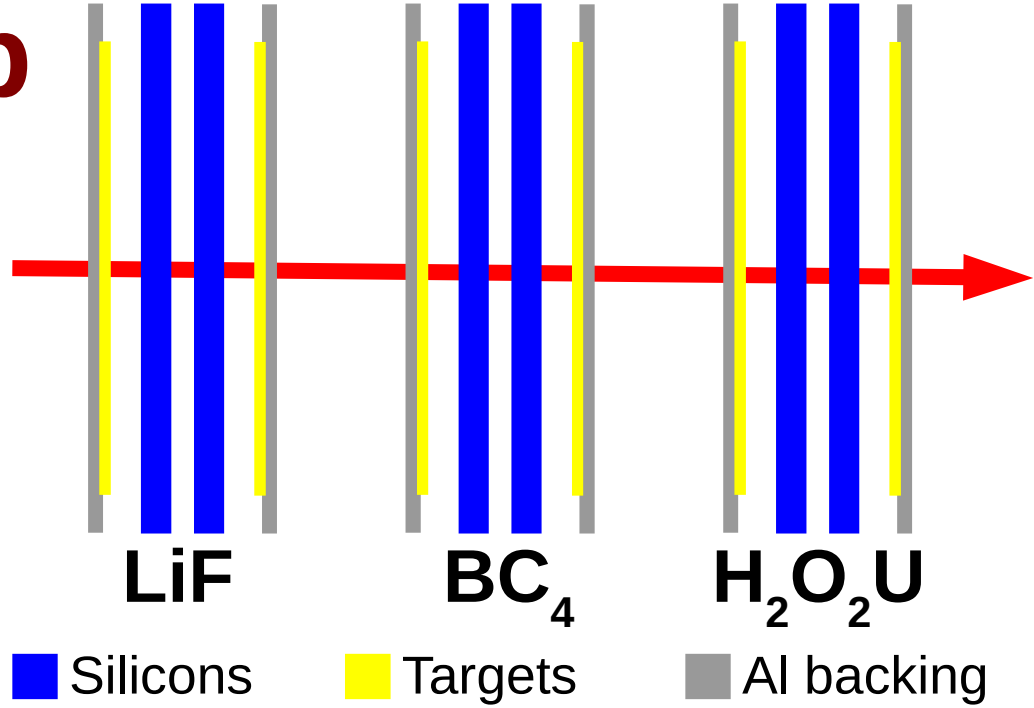
Interest

- Improve the standard ^{235}U(n,f) and extend its range (at present 150 keV – 200 MeV)
- Fission reactors of new generation
- Update libraries

Experimental setup

- Stack of 6 silicon detectors 5x5 cm^2 single pad 200 μm in beam
- We measured product emitted forward and backward

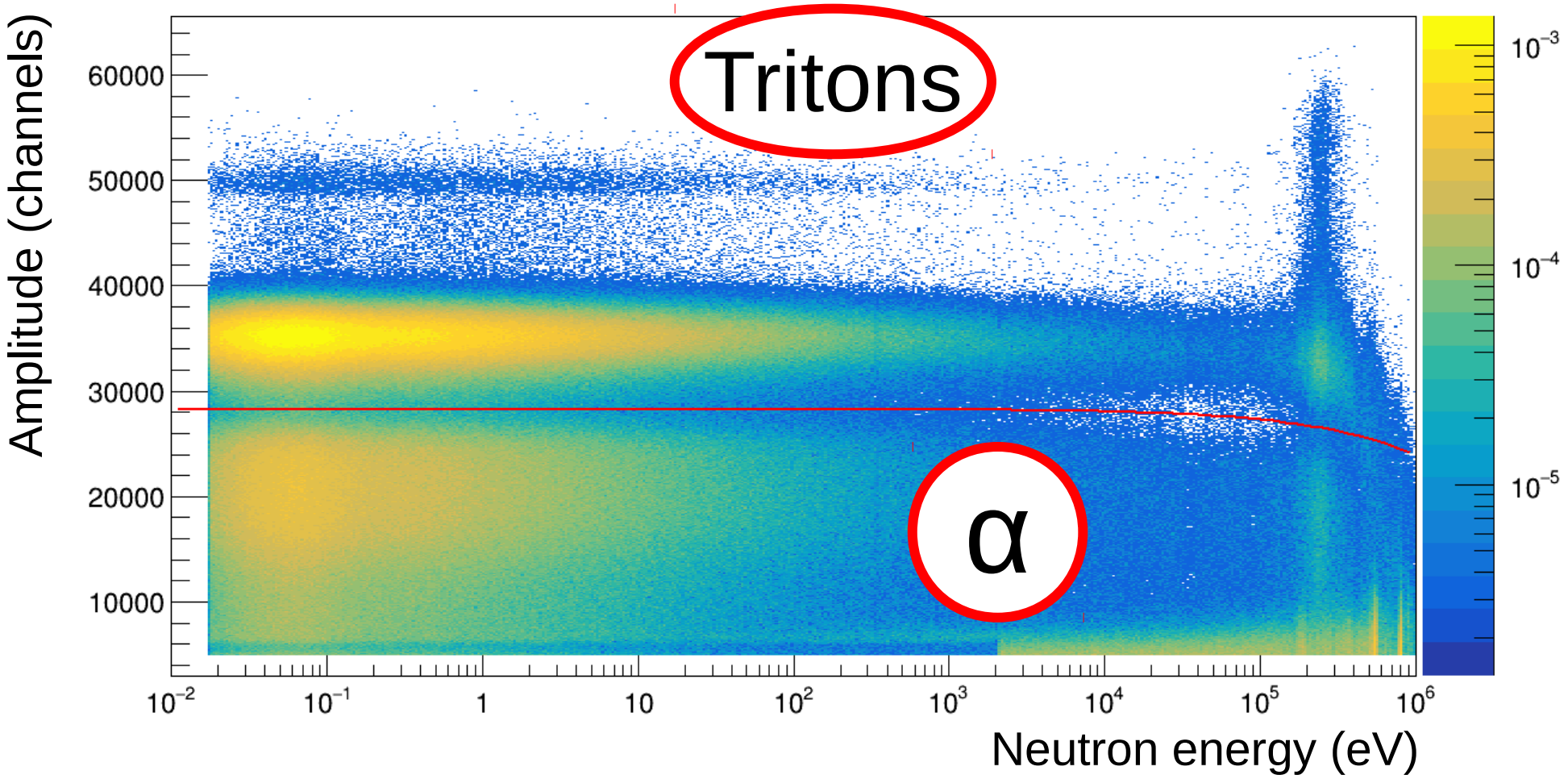




Target	Thickness (μm)	Al backing (μm)
LiF	1.89	50
BC_4	0.08	18
^{235}U	0.145	250

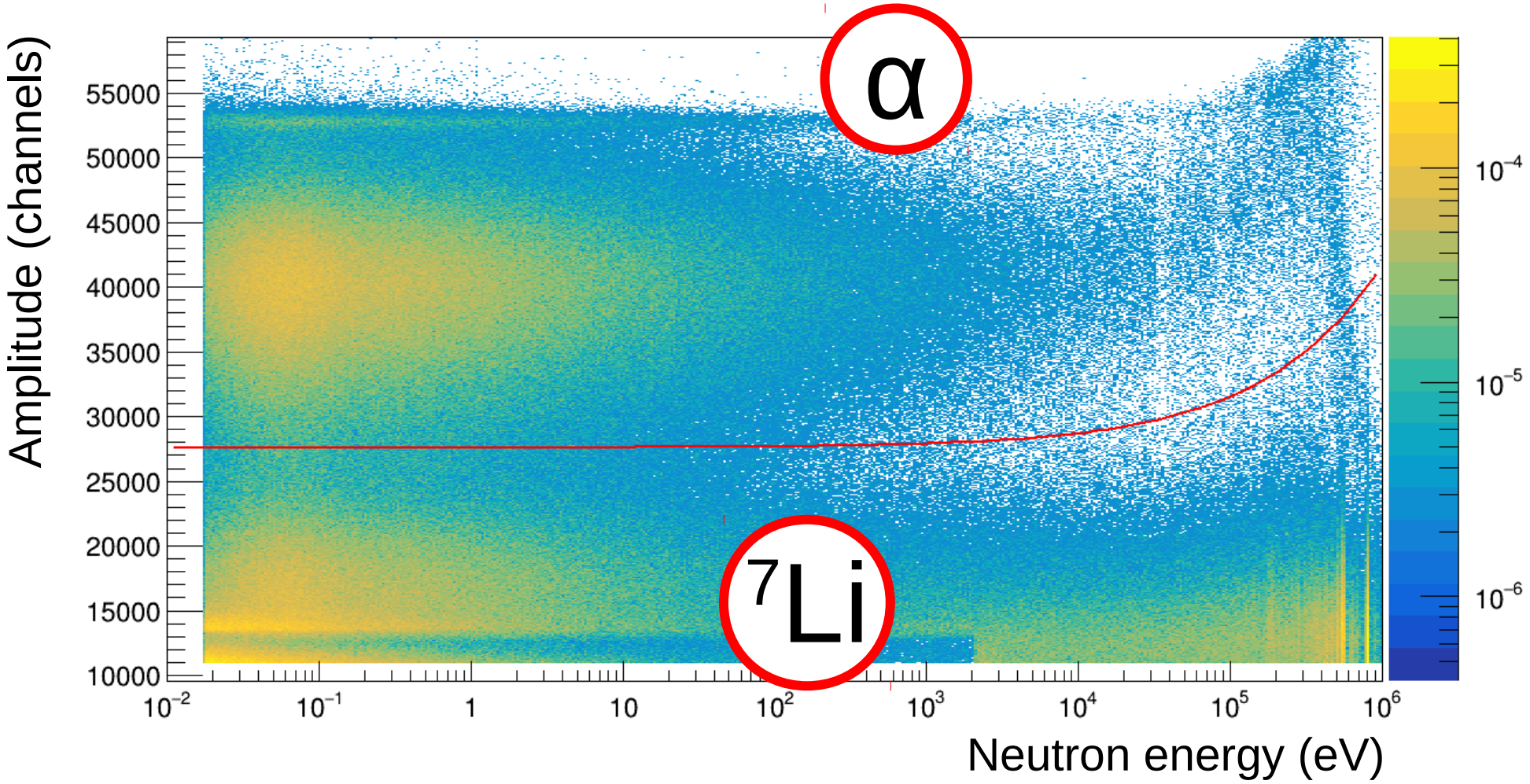
Events selection – $^{6}Li(n,t)^{4}He$

It's based on signals amplitude using a function which depends on neutron kinetic energy. Tritons are selected in $^{6}Li(n,t)^{4}He$ reaction.



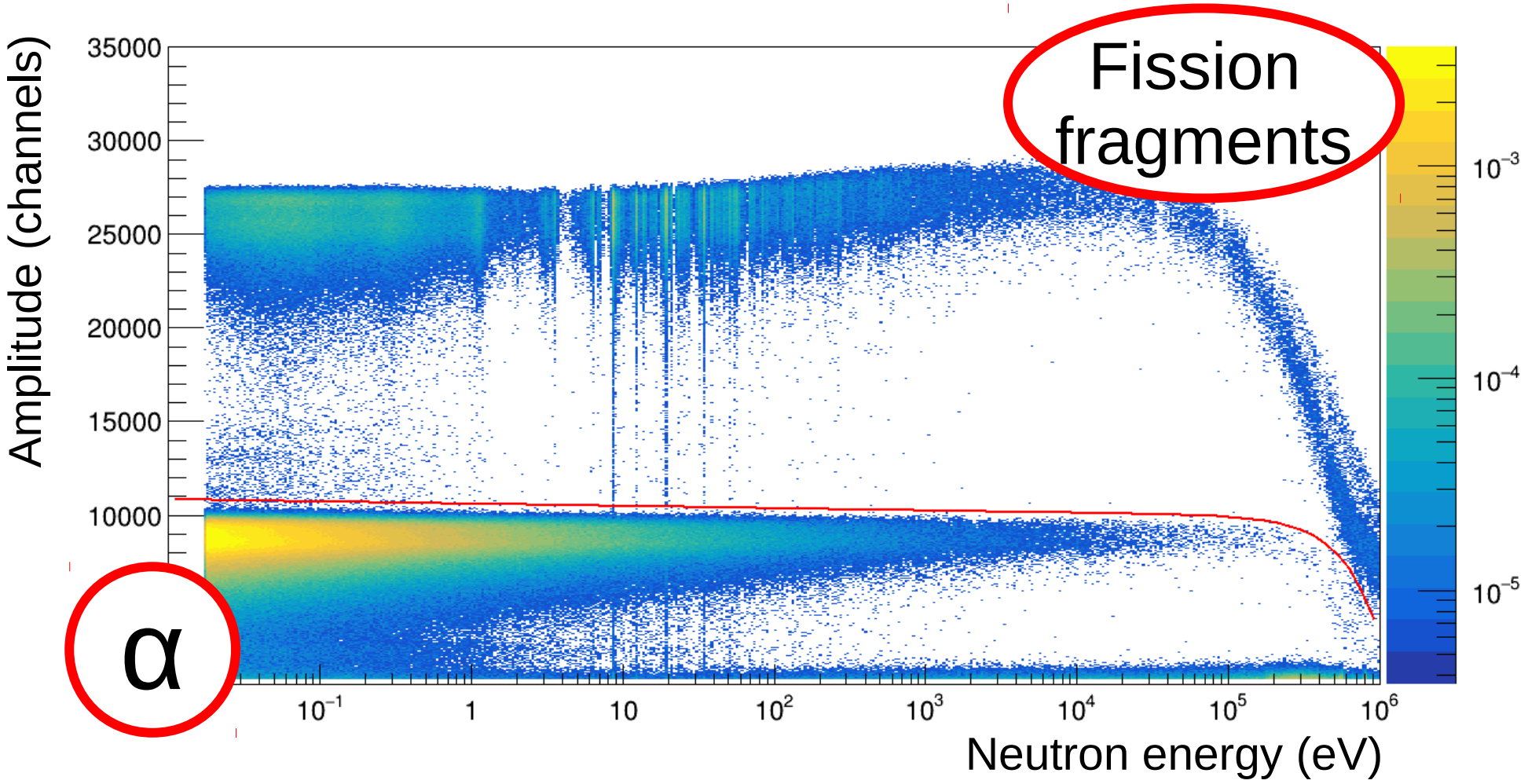
Events selection – $^{10}B(n,\alpha)^{7}Li$

Alpha particles are selected in $^{10}B(n,\alpha)^{7}Li$ reaction.

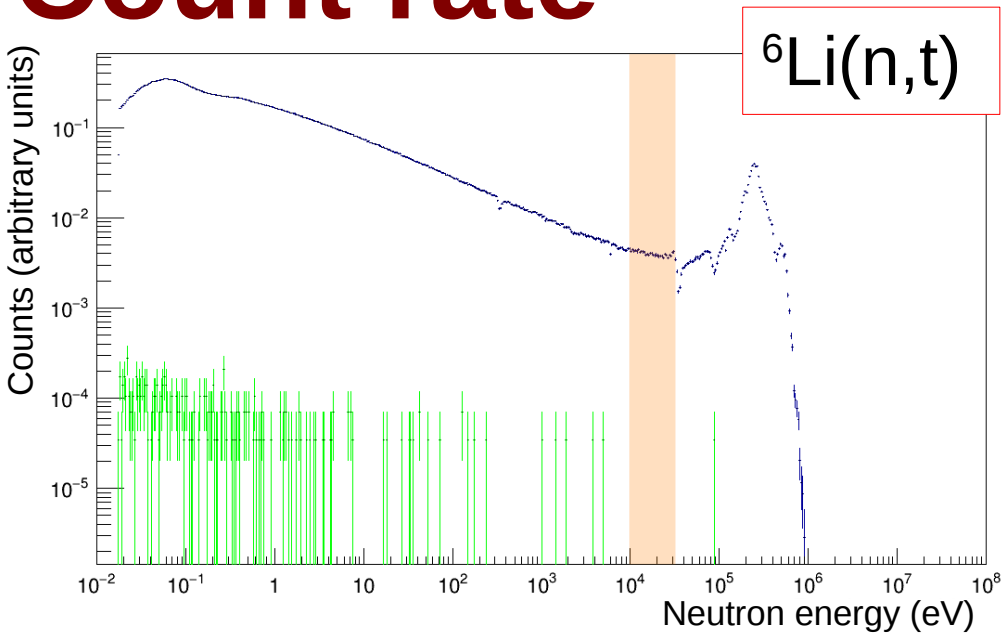


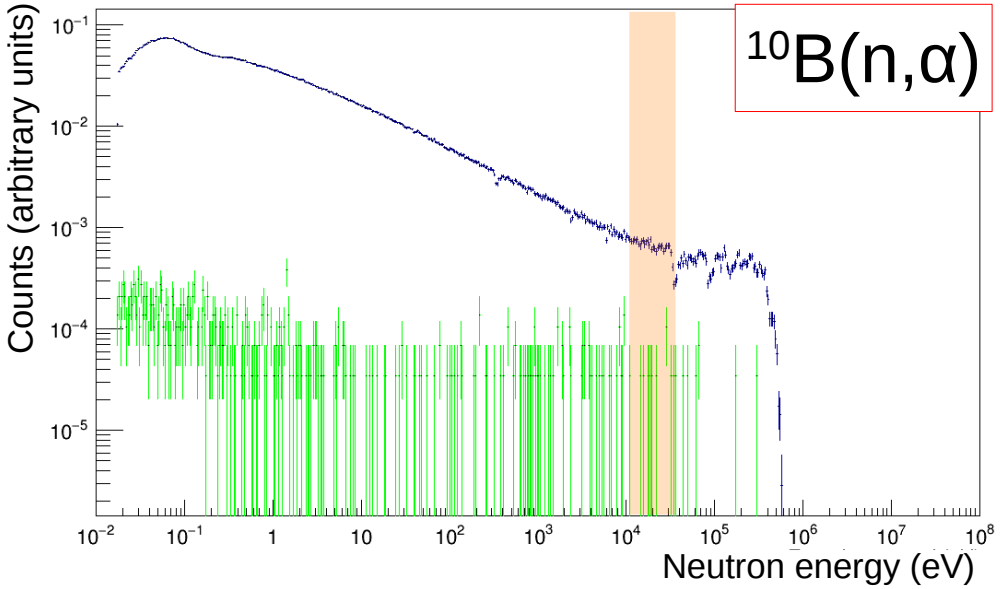
Events selection – ^{235}U(n,f)

For ^{235}U(n,f) the fission fragments are selected, in this case the discrimination is very effective.



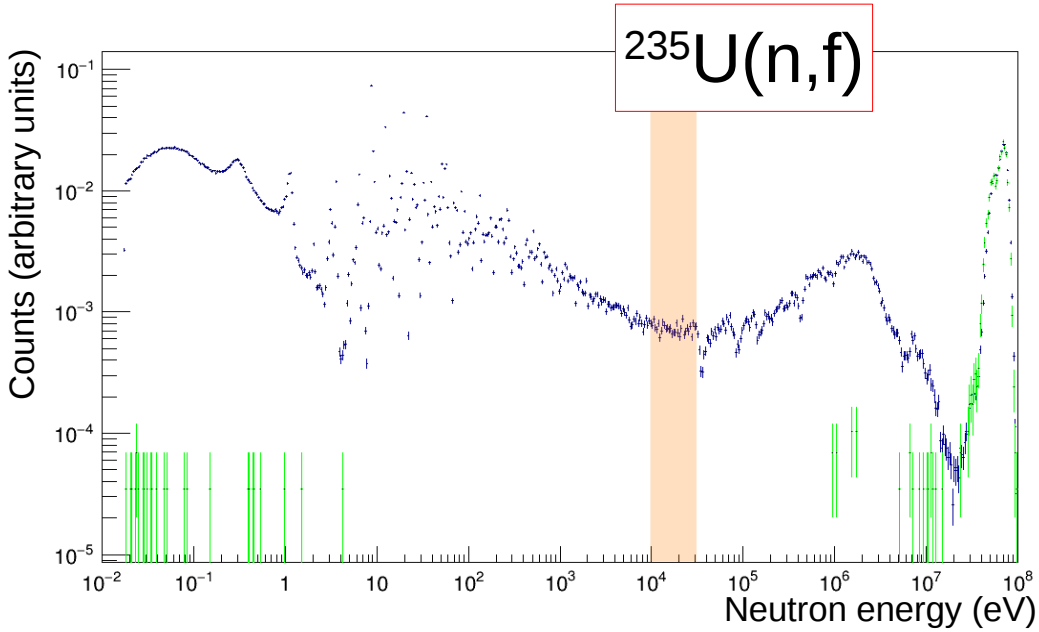
Count rate





Signals
Background

Flight path
with SAMMY

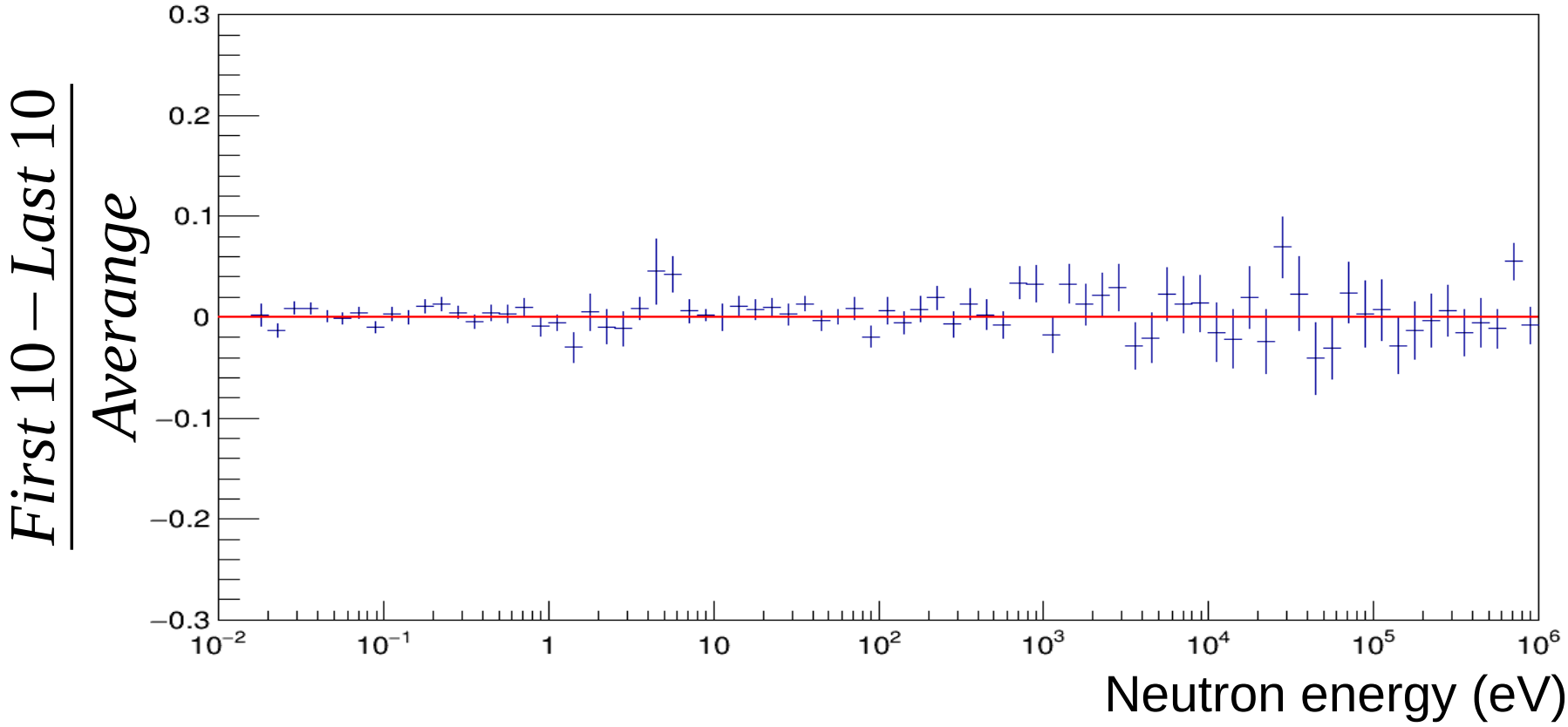


Good ratio
Signal / Background

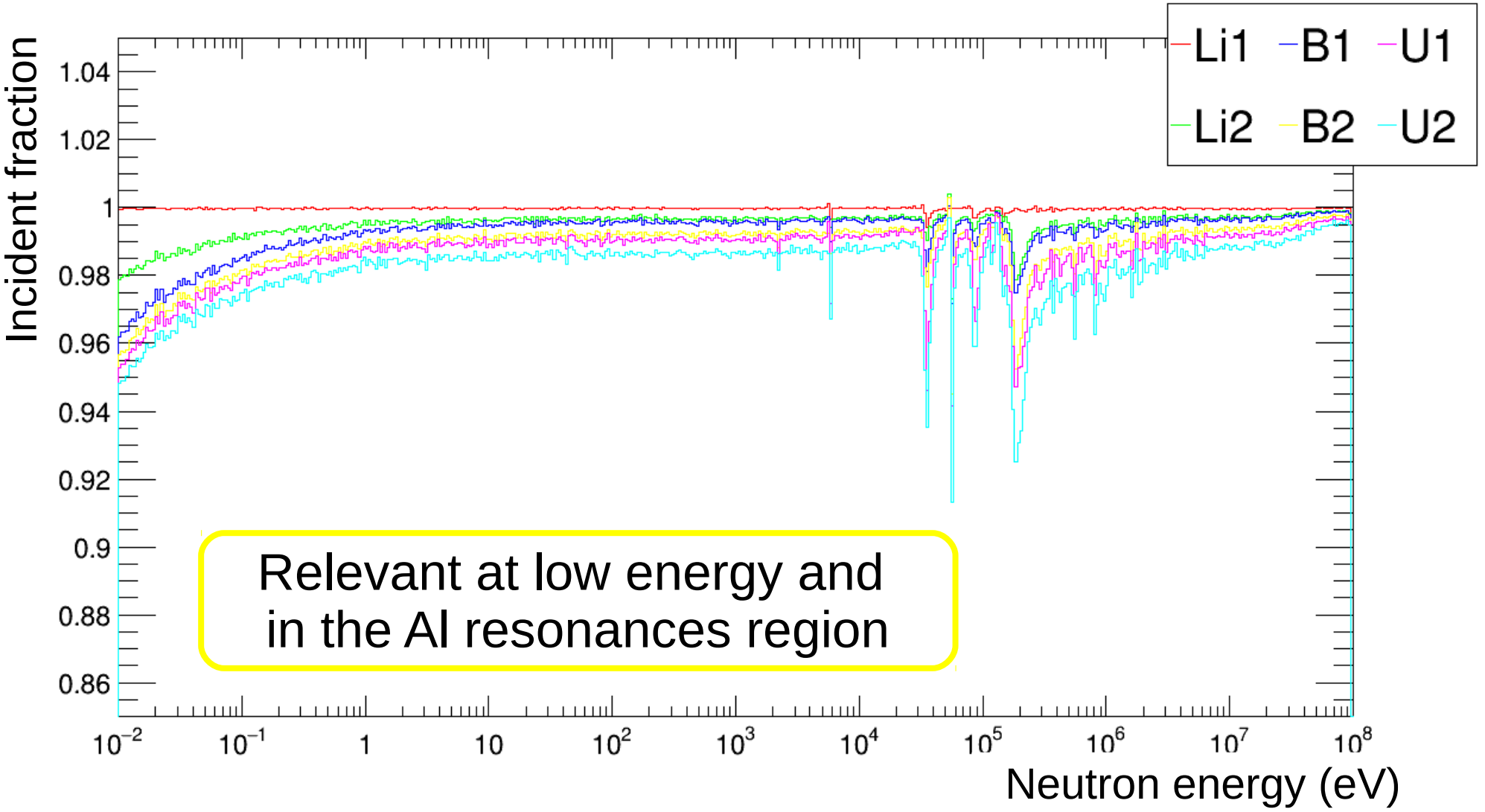
Detectors Stability

Silicons demonstrated a great resistence to damage due to incident neutron flux and fission fragments during the measurement.

No significant differences has been observed comparing first and last 10 runs.

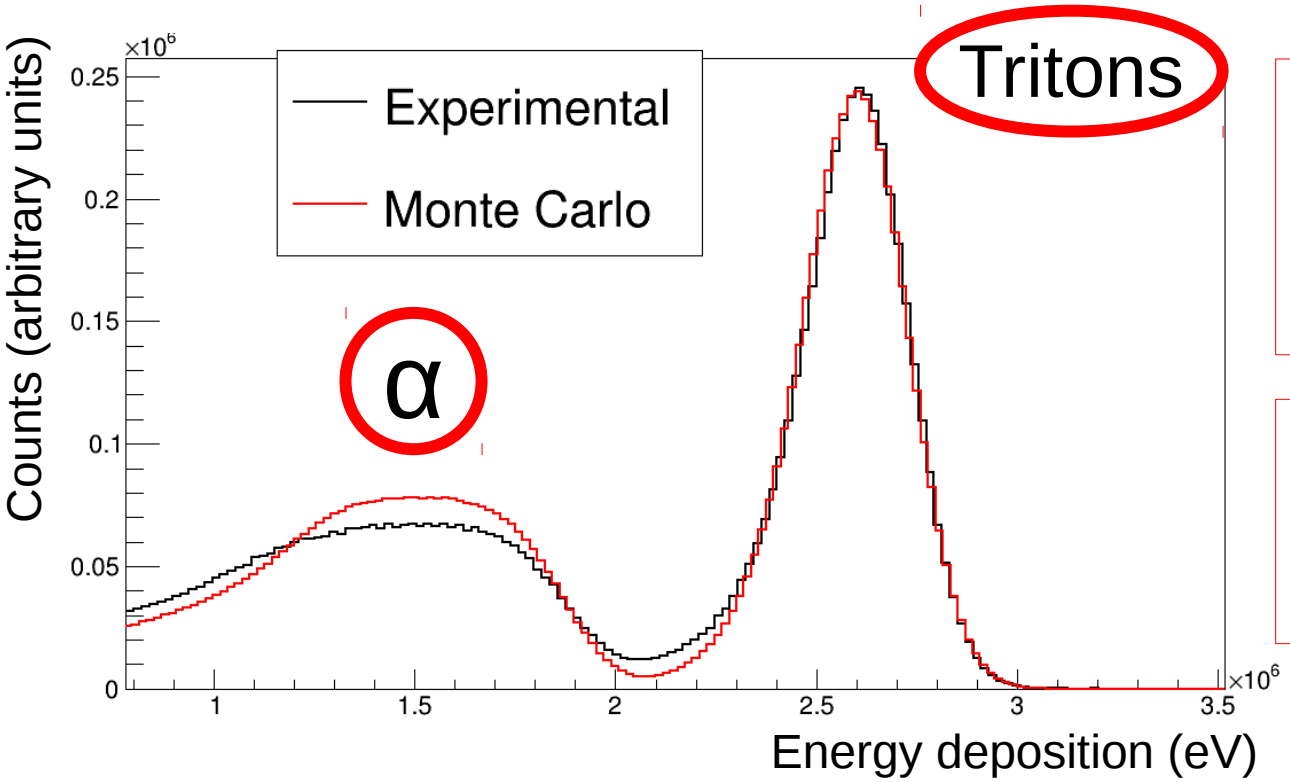


Absorption correction - MC



Detector efficiency - MC

The combination of **geometrical** and **detection** efficiency is estimated using Monte Carlo simulations. A preliminary calibration for the energy deposited and application of the experimental resolution is needed.



Linear calibration

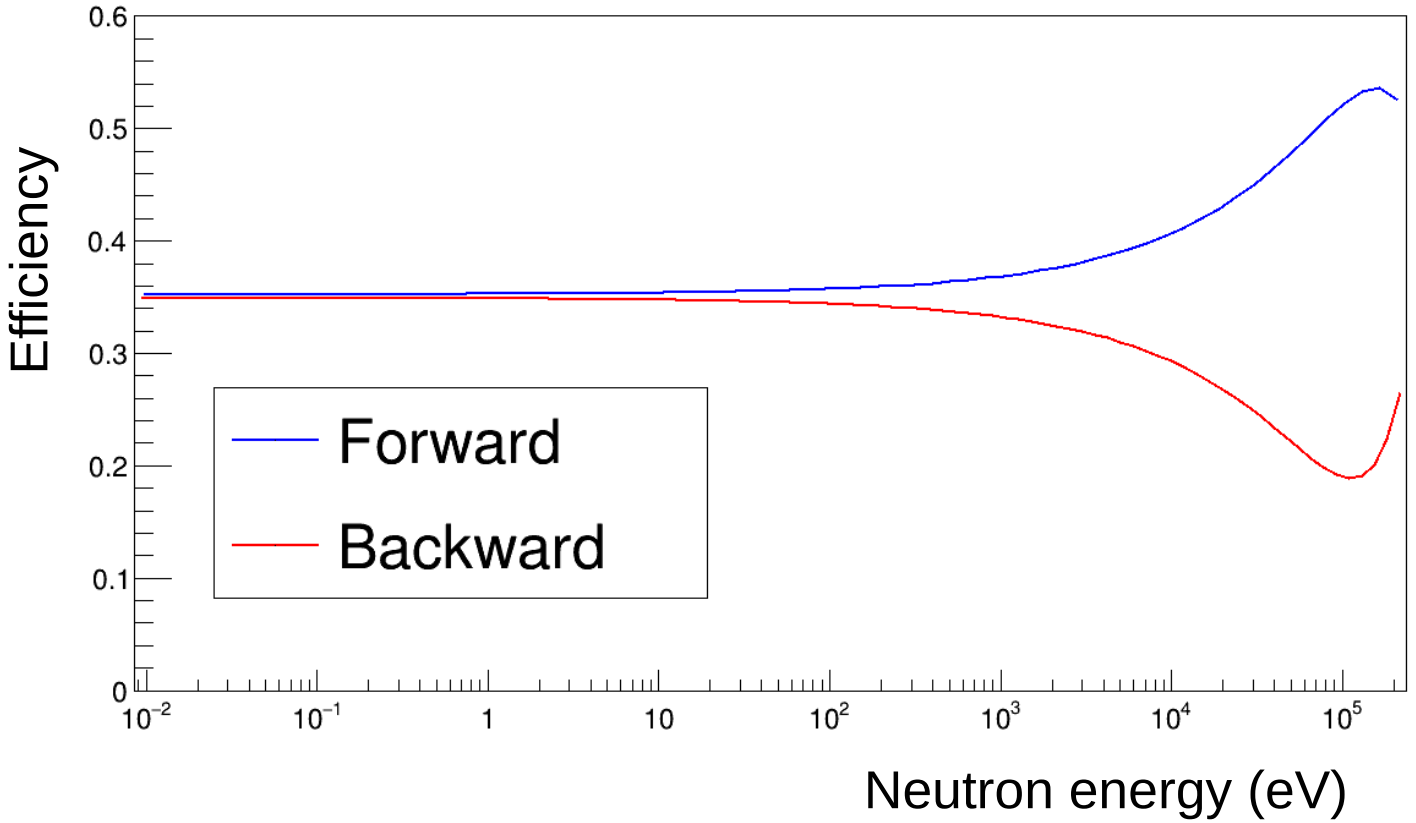
$$E_{dep} = m \cdot Amplitude + q$$

Exp. resolution

$$\Delta E = a \cdot \sqrt{(E)}$$

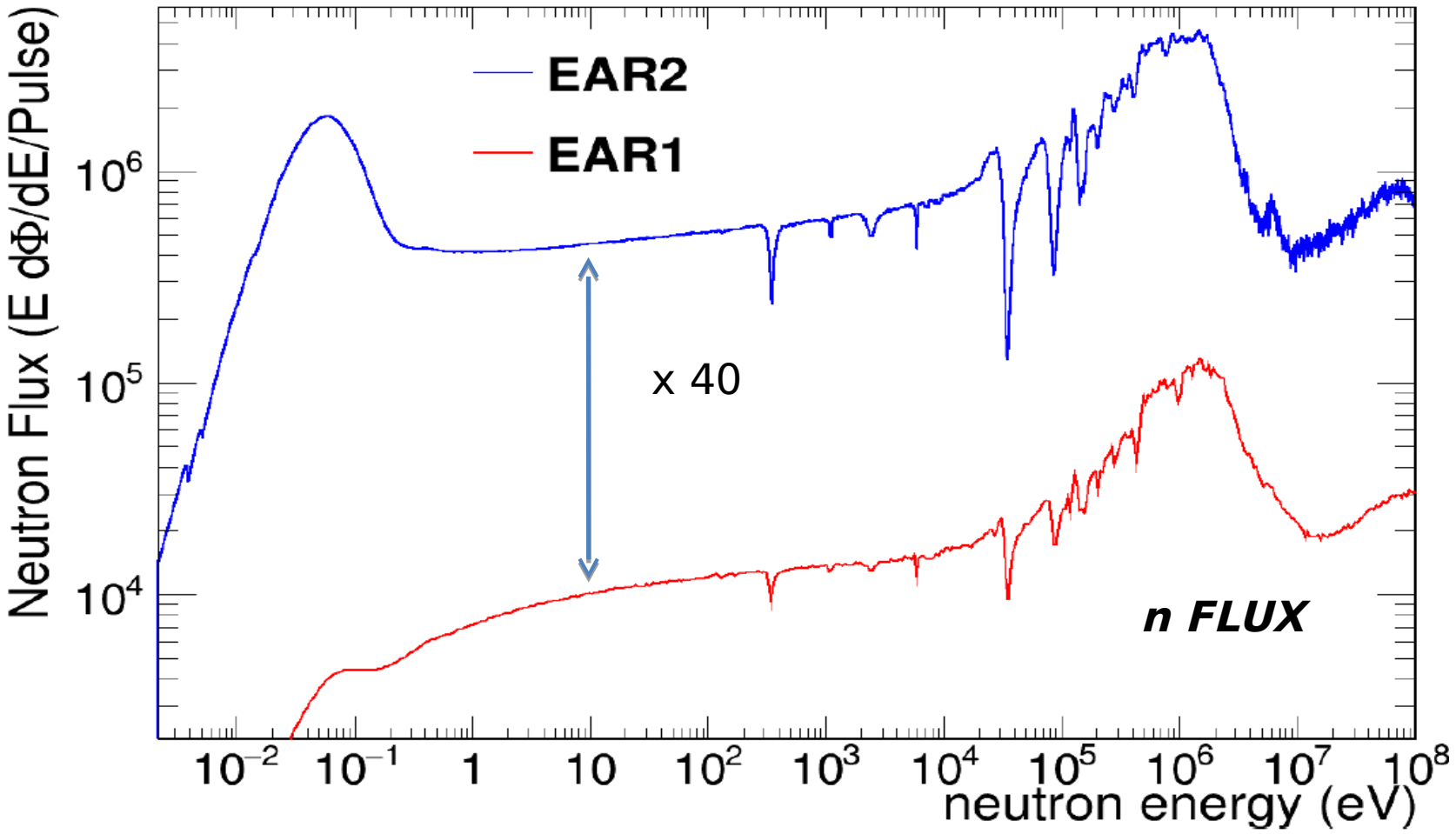
Detector efficiency - MC

To evaluate efficiency for the first 4 detectors their reaction products are generated in corresponding targets volumes according to a Gaussian neutron beam profile (σ = 0.7 cm) and their momentum angular distribution.

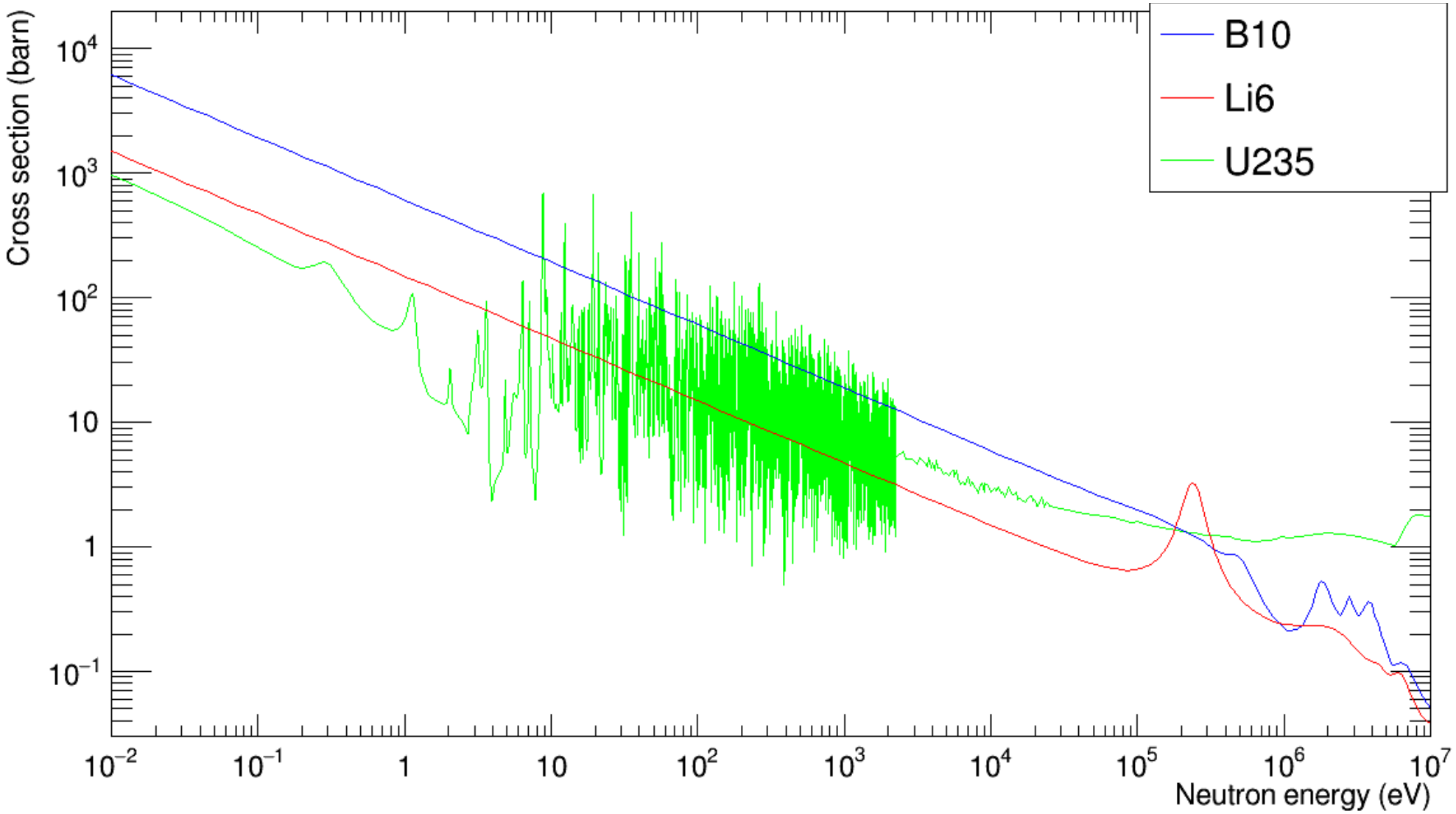


Thank you for your attention

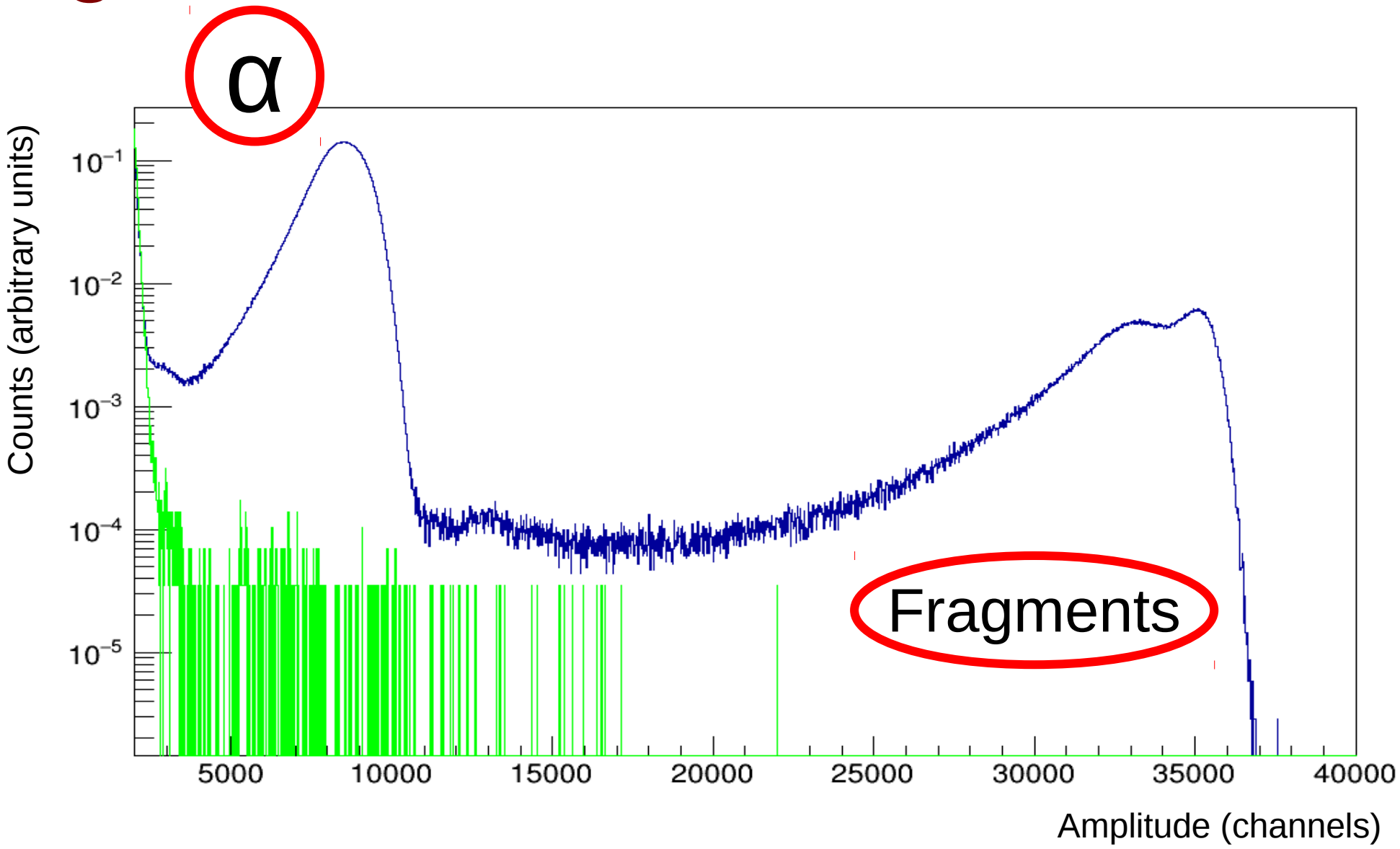
n_TOF flux


EAR2
EAR1
x 40
n FLUX
Neutron Flux (E dΦ/dE/Pulse)
neutron energy (eV)
10^6
10^5
10^4
10^-2
10^-1
1
10
10^2
10^3
10^4
10^5
10^6
10^7
10^8

Backup – Standard cross sections



Signals in SIFI5 – U forward



Backup – Al(n,all) cross section