n_TOF Analysis Meeting (Bologna 2013)

Status on $^{33}S(n,\alpha)$ with MGAS

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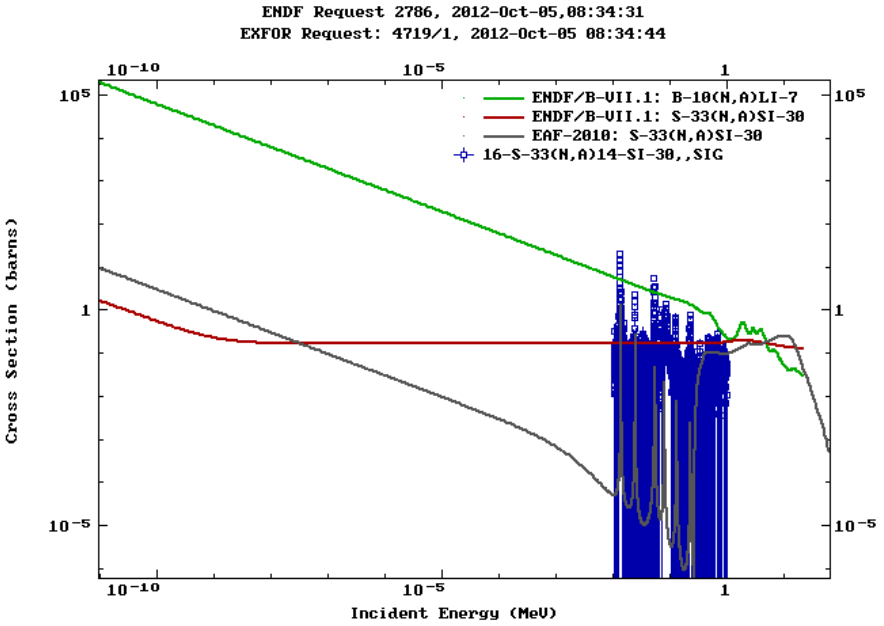
Overview

- Purpose of this experiment
- Experimental set-up
- Preliminary results
- Conclusions and work to do

Purpose of this experiment

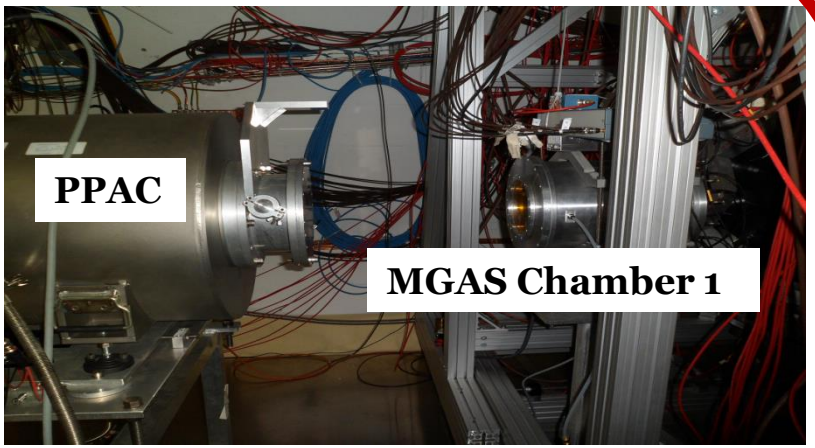
- Clarify the existing discrepancy for resonance parameters between different evaluations and EXFOR data.

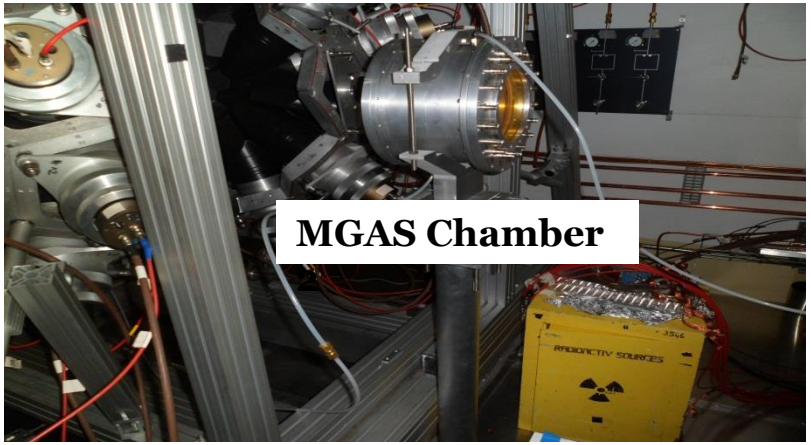
- Extend the experimental data available below 10 keV.



- Application: Include the results in some NCT dosimetry simulations with MCNPX code. Astrophysics (M. Pignatari)

Experimental set-up

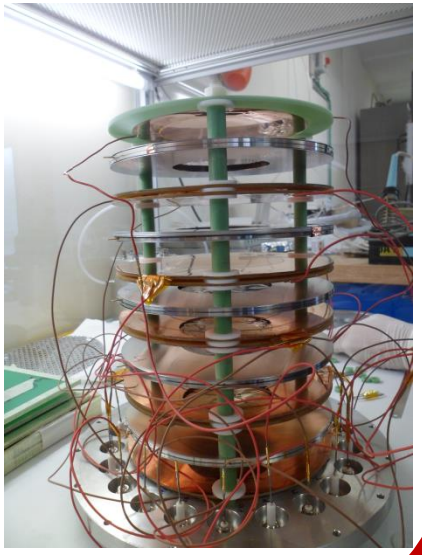


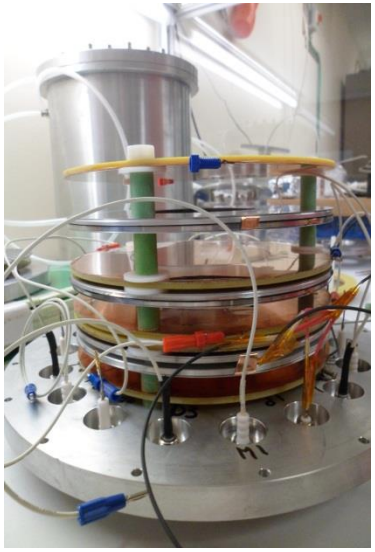


CHAMBER 1

10 MGAS detectors
10 Samples back-to-back:

- 4 – $Cu_{2?}{}^{33}S$ thin
- 2 – $Cu_{2?}{}^{33}S$ thick
- 2 – blanks-Cu
- 2 – $^{10}B_4C$





CHAMBER 2

4 MGAS detectors
4 Samples:

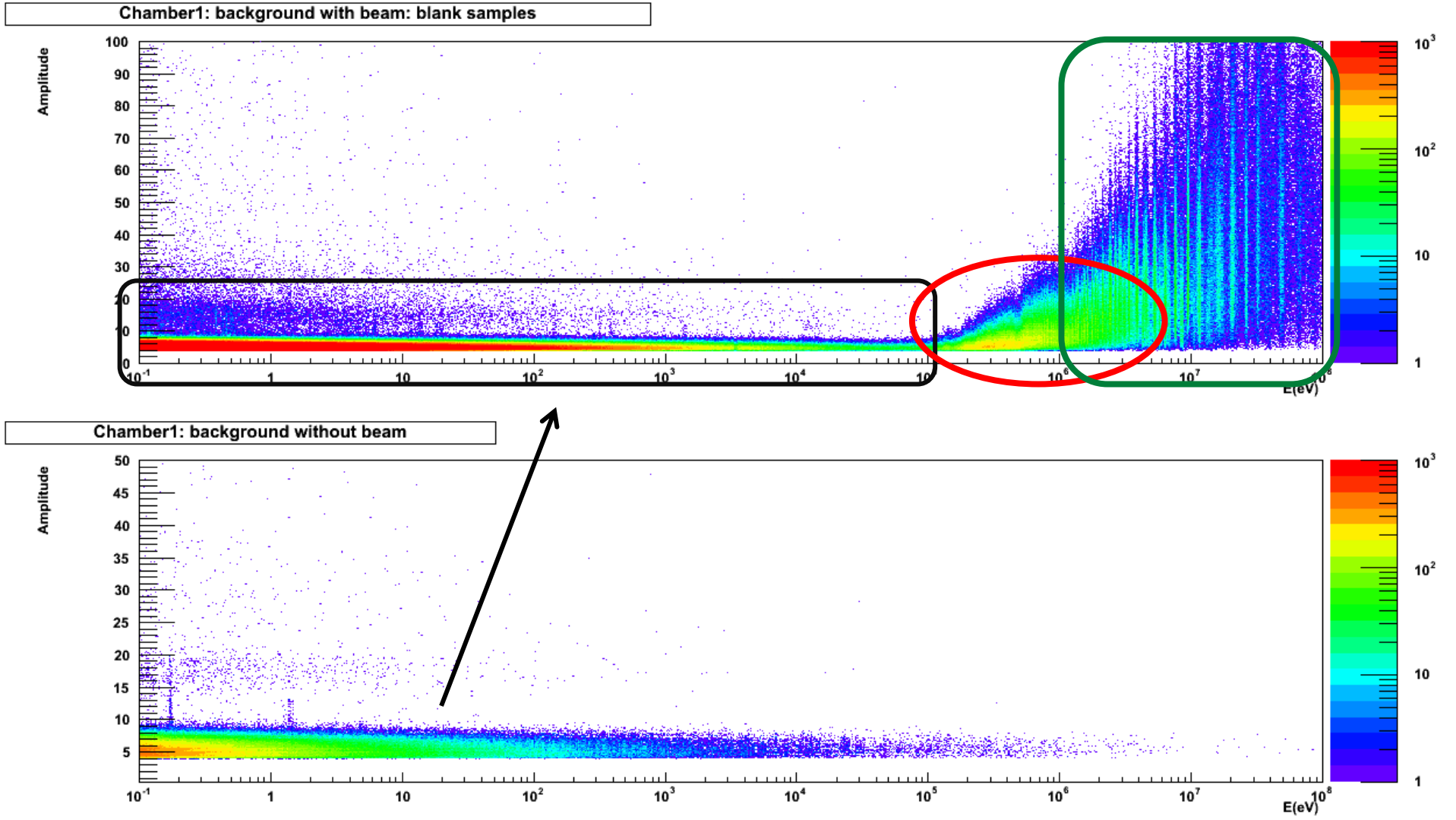
2 – $Cu_{2?}{}^{33}S$ thick back to back
1 – $^{10}B_4C$
1 – ^{6}LiF

Analysis

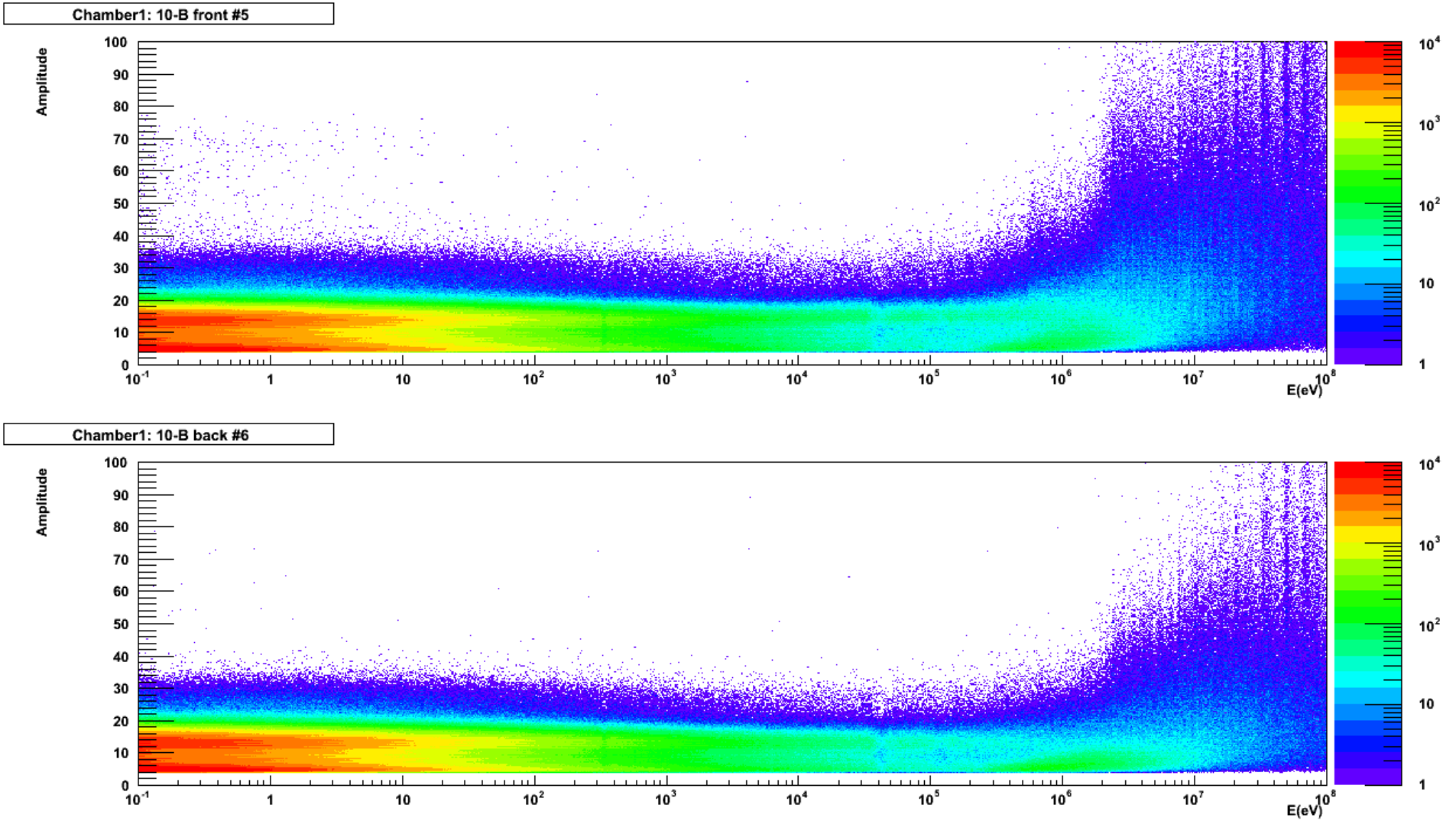
- TOF to E: $\mathrm{E} = \left(72{,}29 \cdot \frac{L}{t}\right)^2$
- Graphical cut may needed to extract the background.
- Cross section from TOF measurement:

$$\sigma^{tof} = \frac{C^m}{\varepsilon \cdot \phi \cdot n_{atm}} \quad \rightarrow \quad \sigma_{33S} = \frac{\sigma_{33S}^{exp}}{\sigma_{10B}^{exp}} \sigma_{10B}^{ENDF}$$

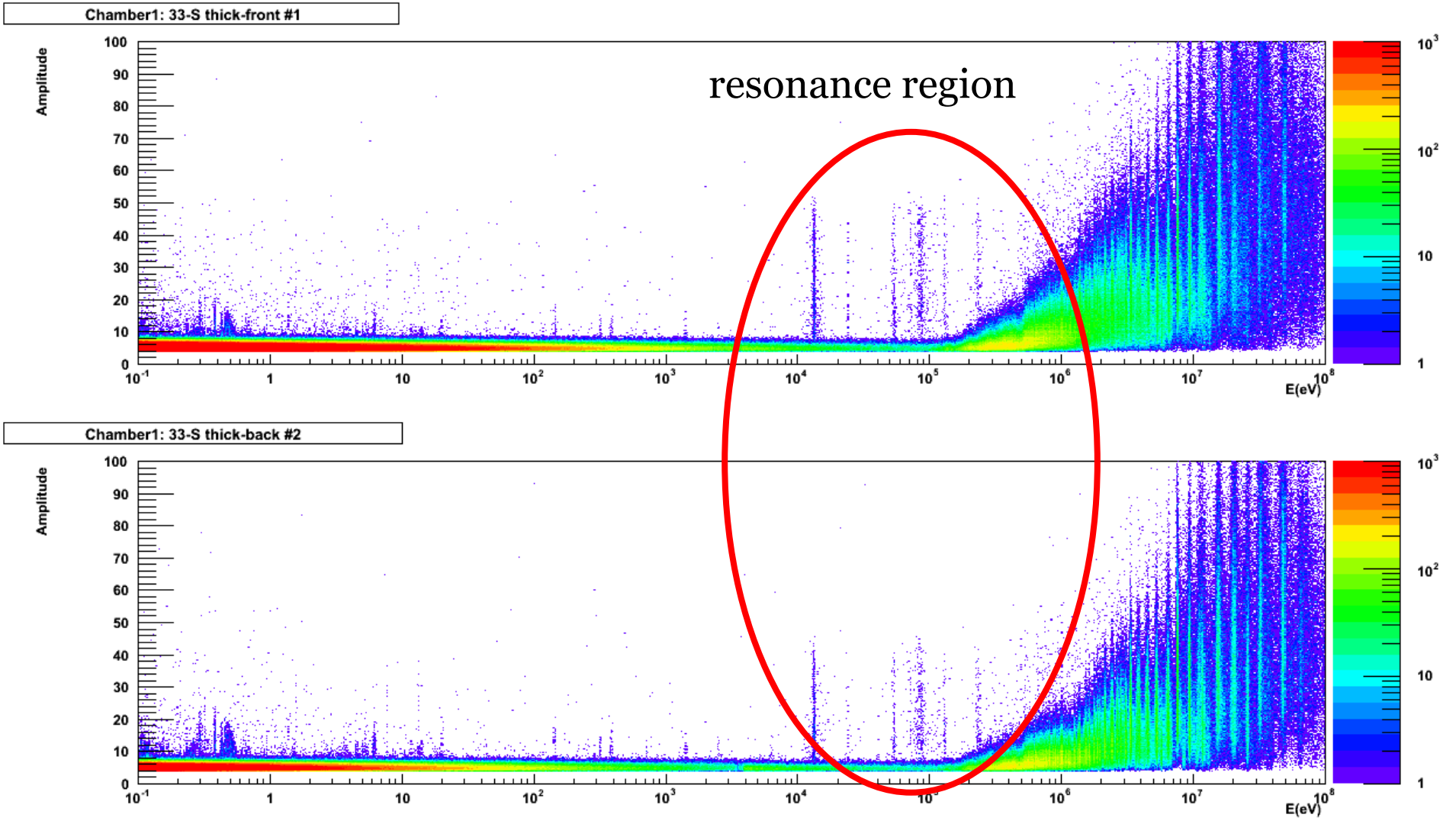
Background


Chamber1: background with beam: blank samples
Amplitude
E(eV)
Chamber1: background without beam
Amplitude
E(eV)

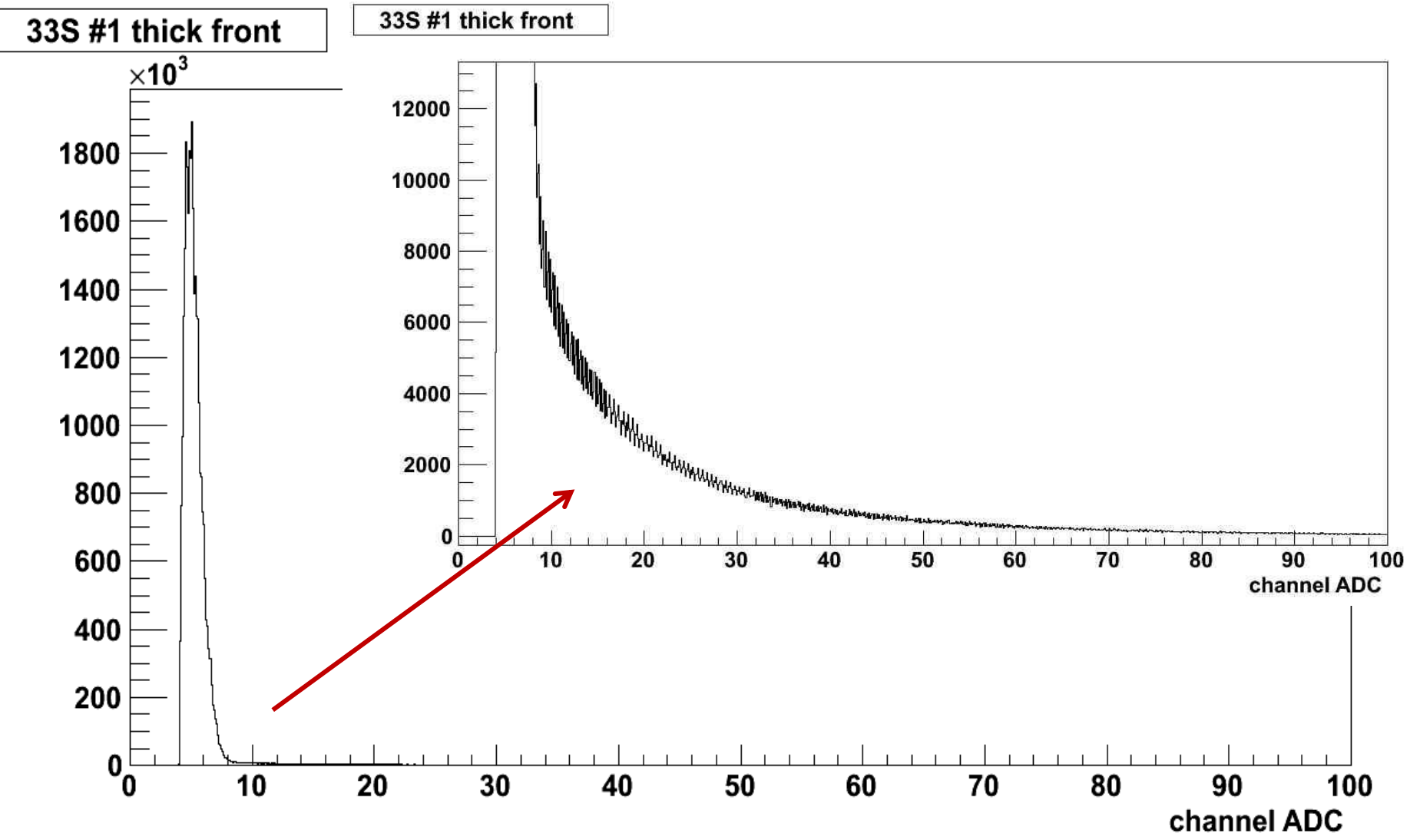
^{10}B samples: $^{10}B(n,\alpha)^{7}Li$



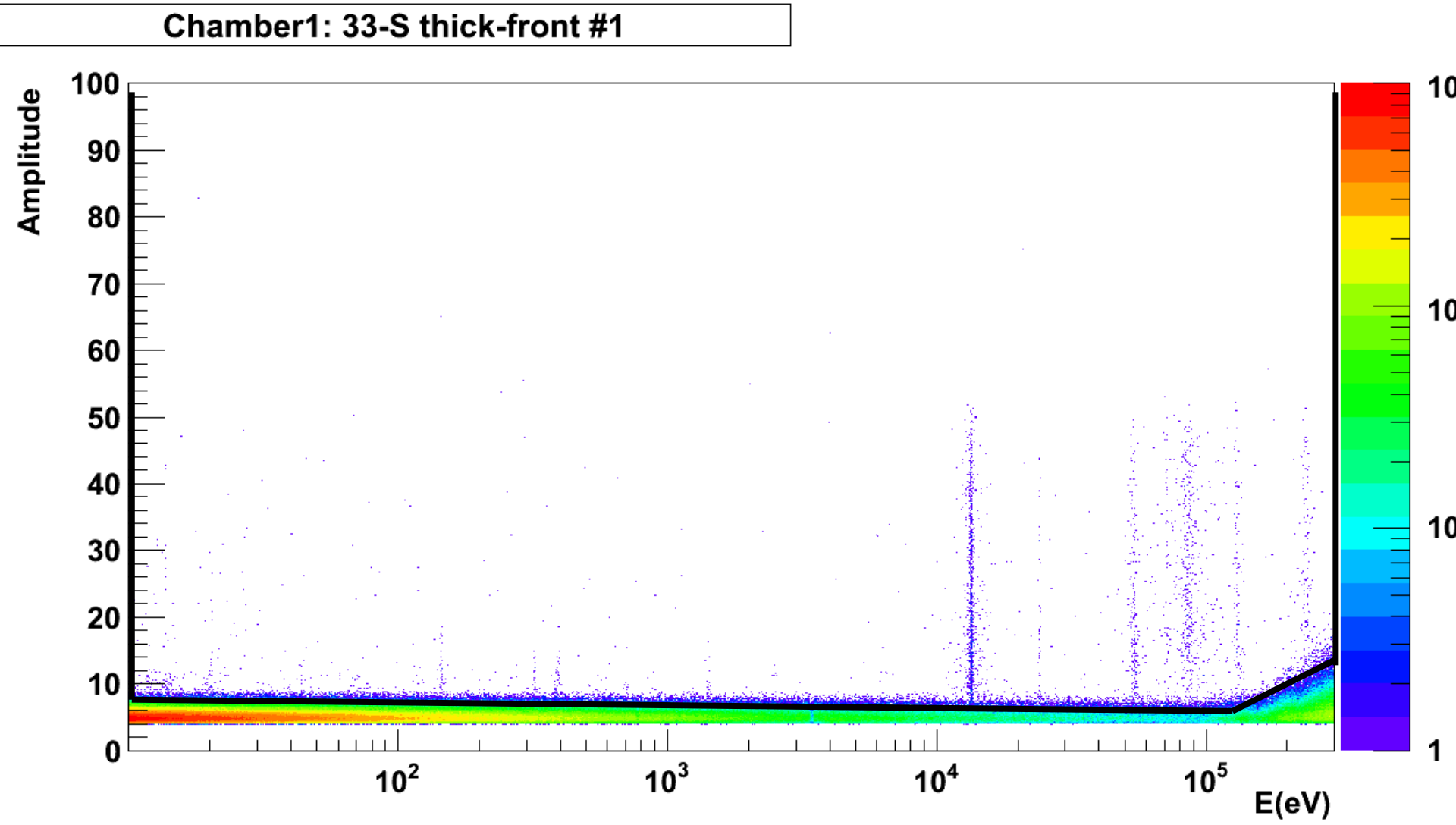
^{33}S thick samples: $^{33}S(n,\alpha)^{30}Si$



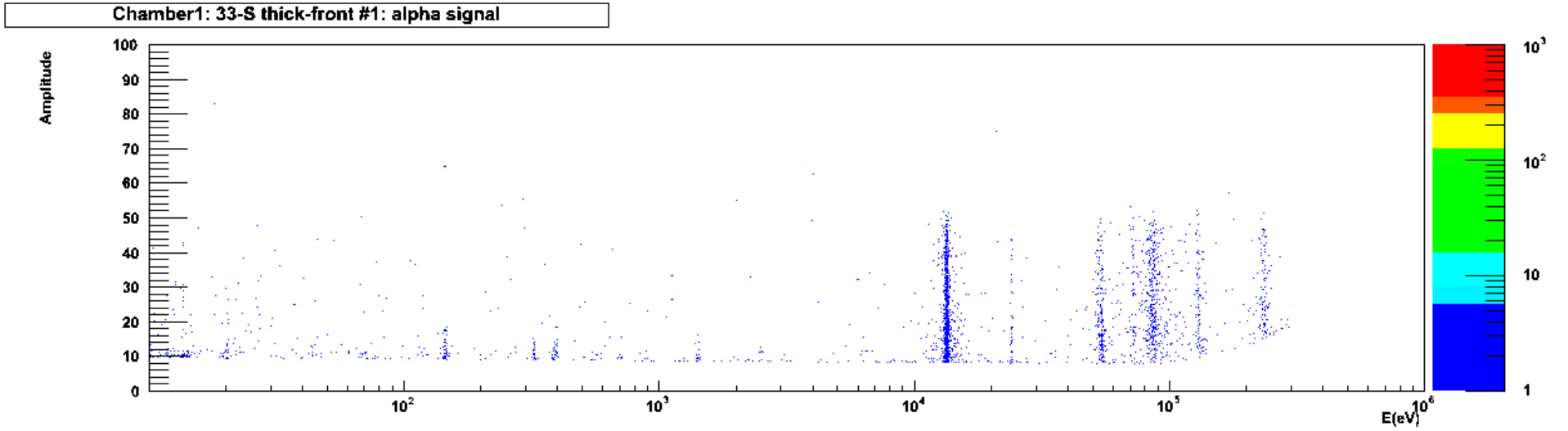
Background subtraction (1/4)

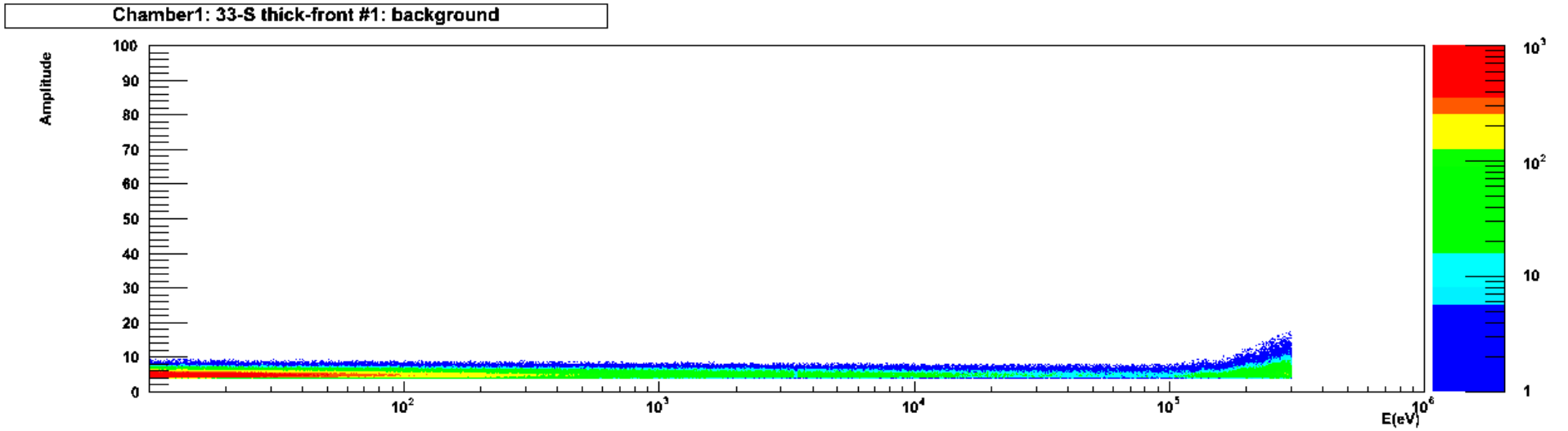


Background subtraction (2/4)

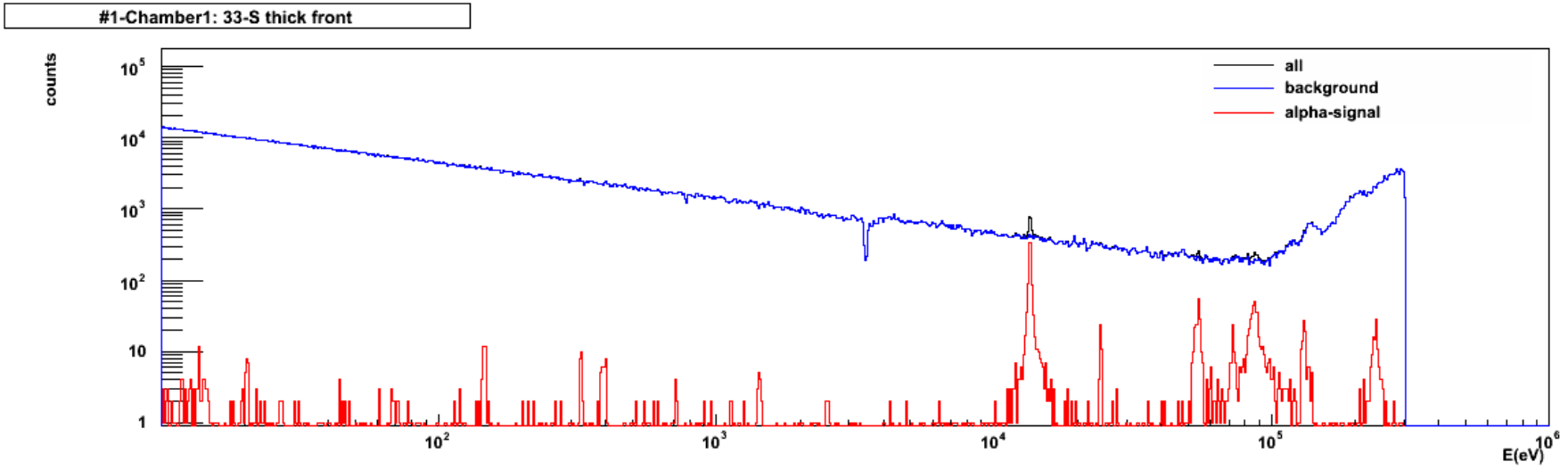


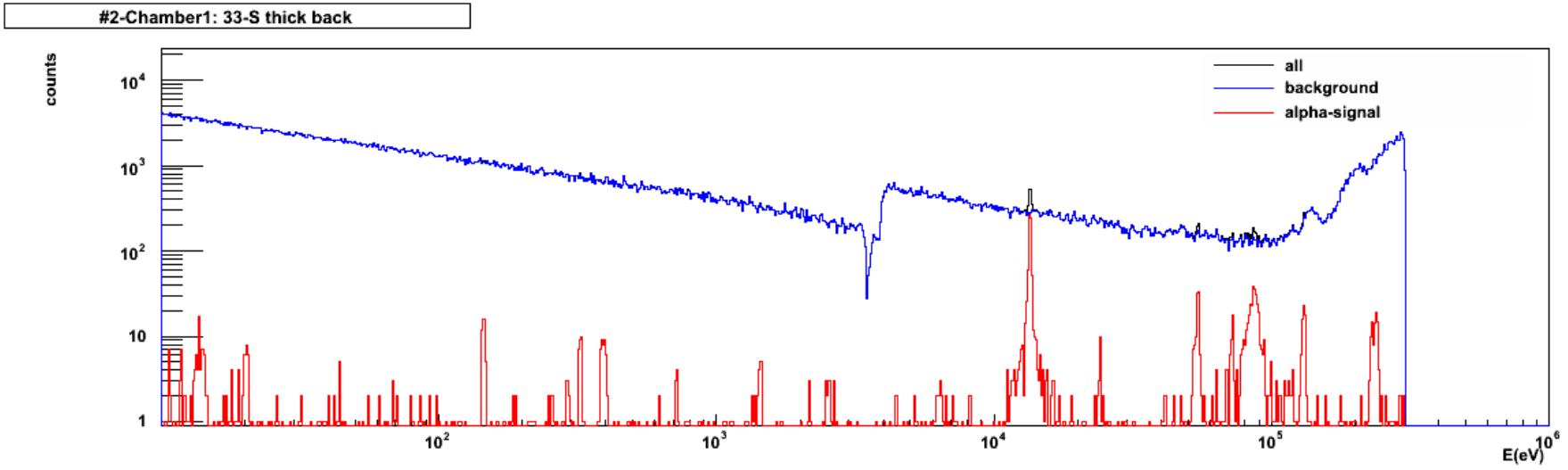
Background subtraction (3/4)



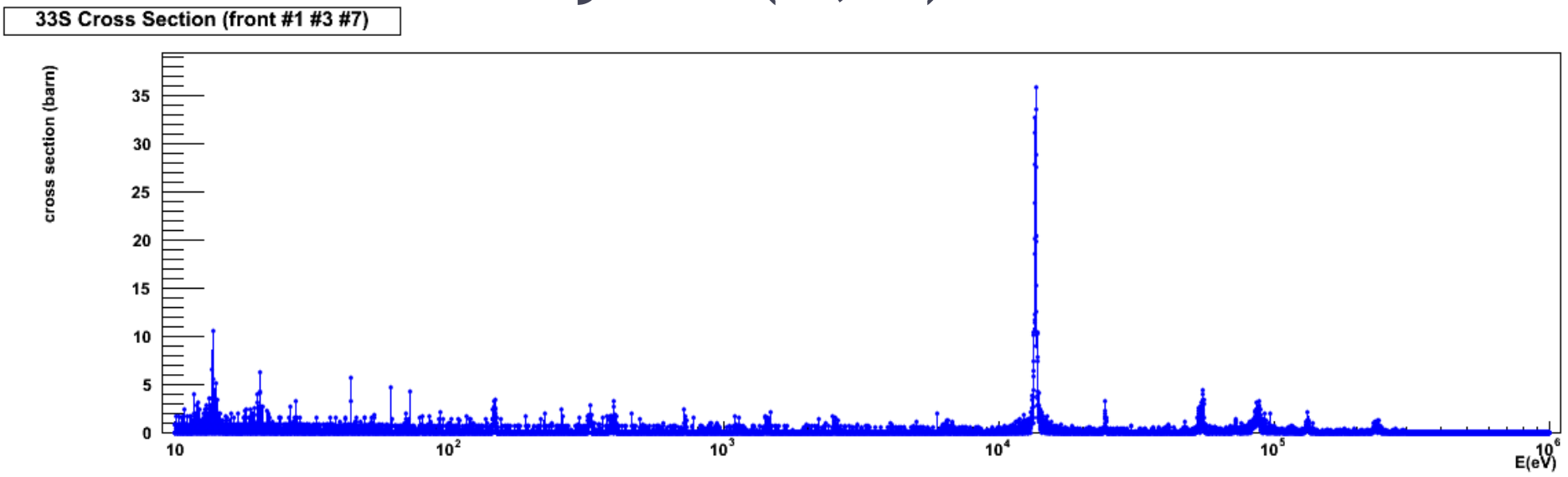


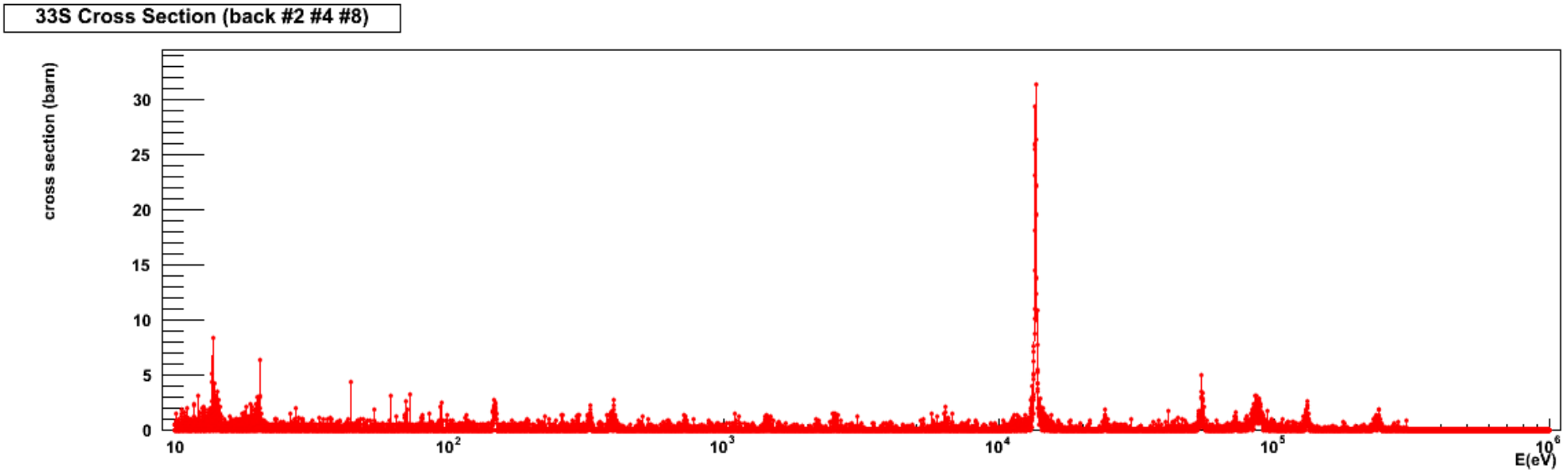
Background subtraction (4/4)



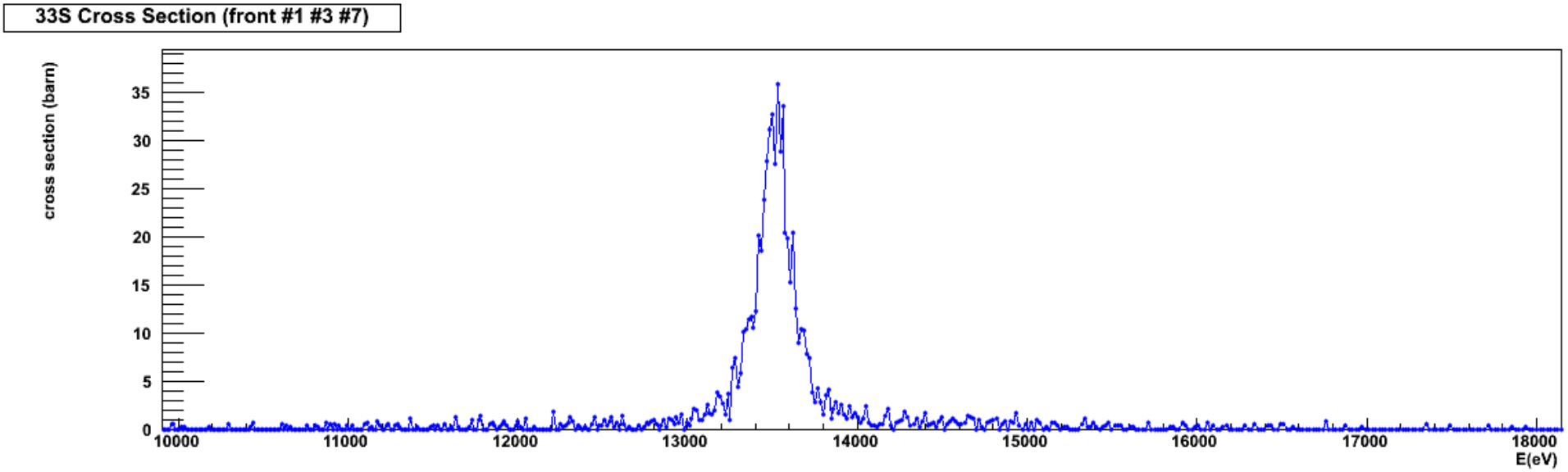


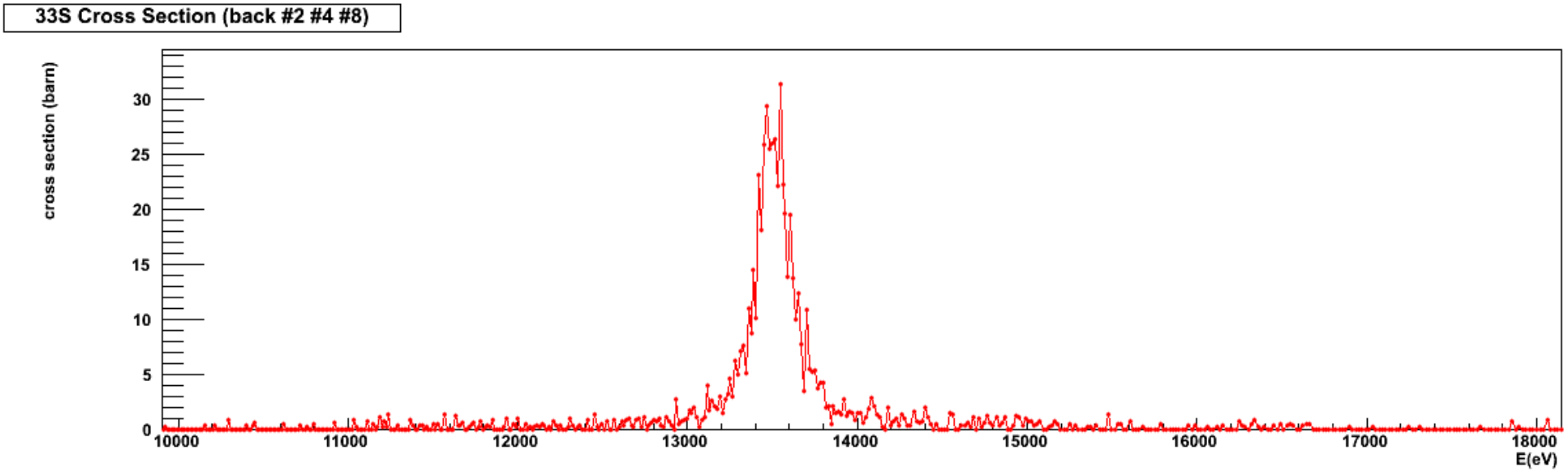
Preliminary $^{33}S(n,\alpha)$ cross section





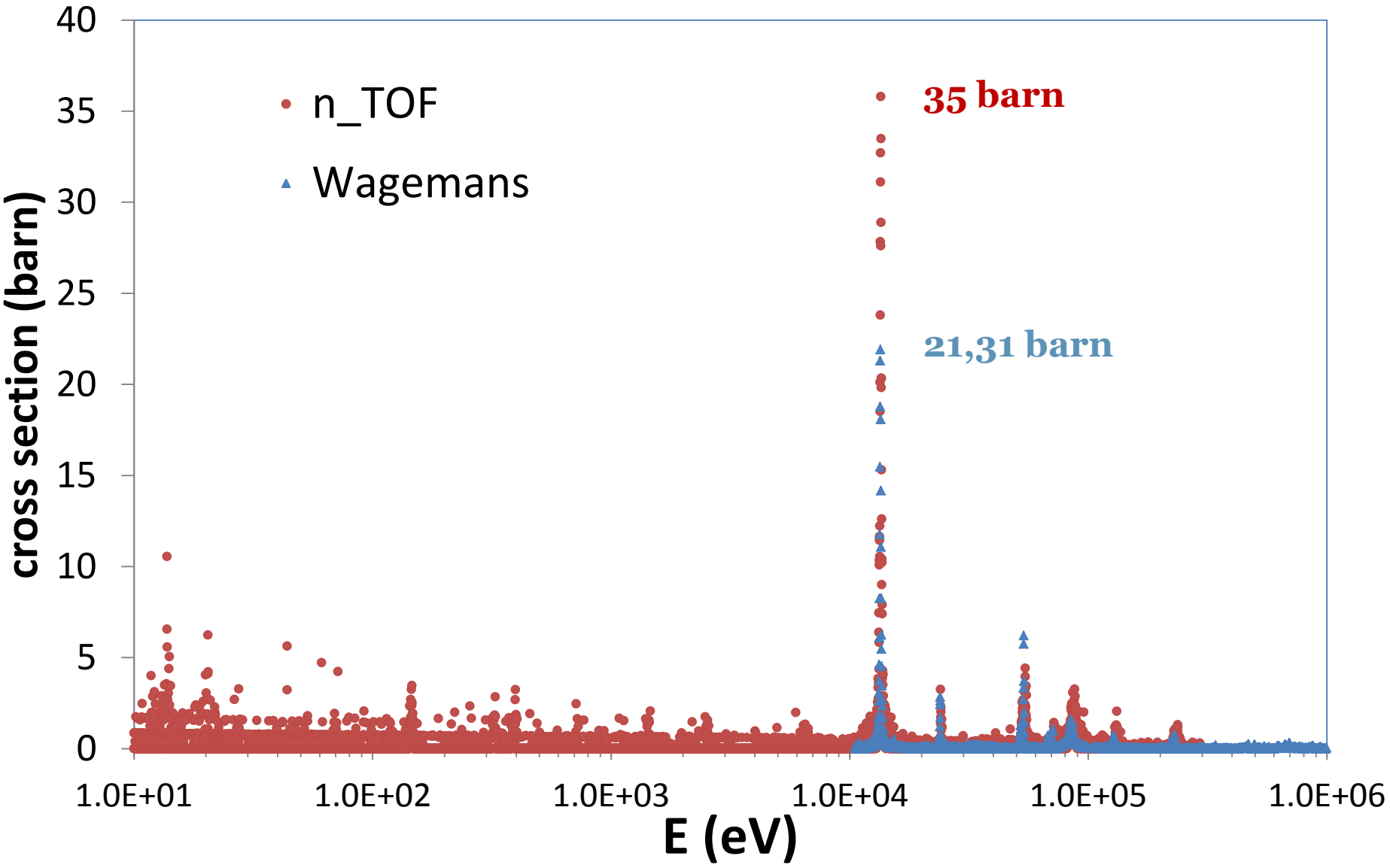
First resonance



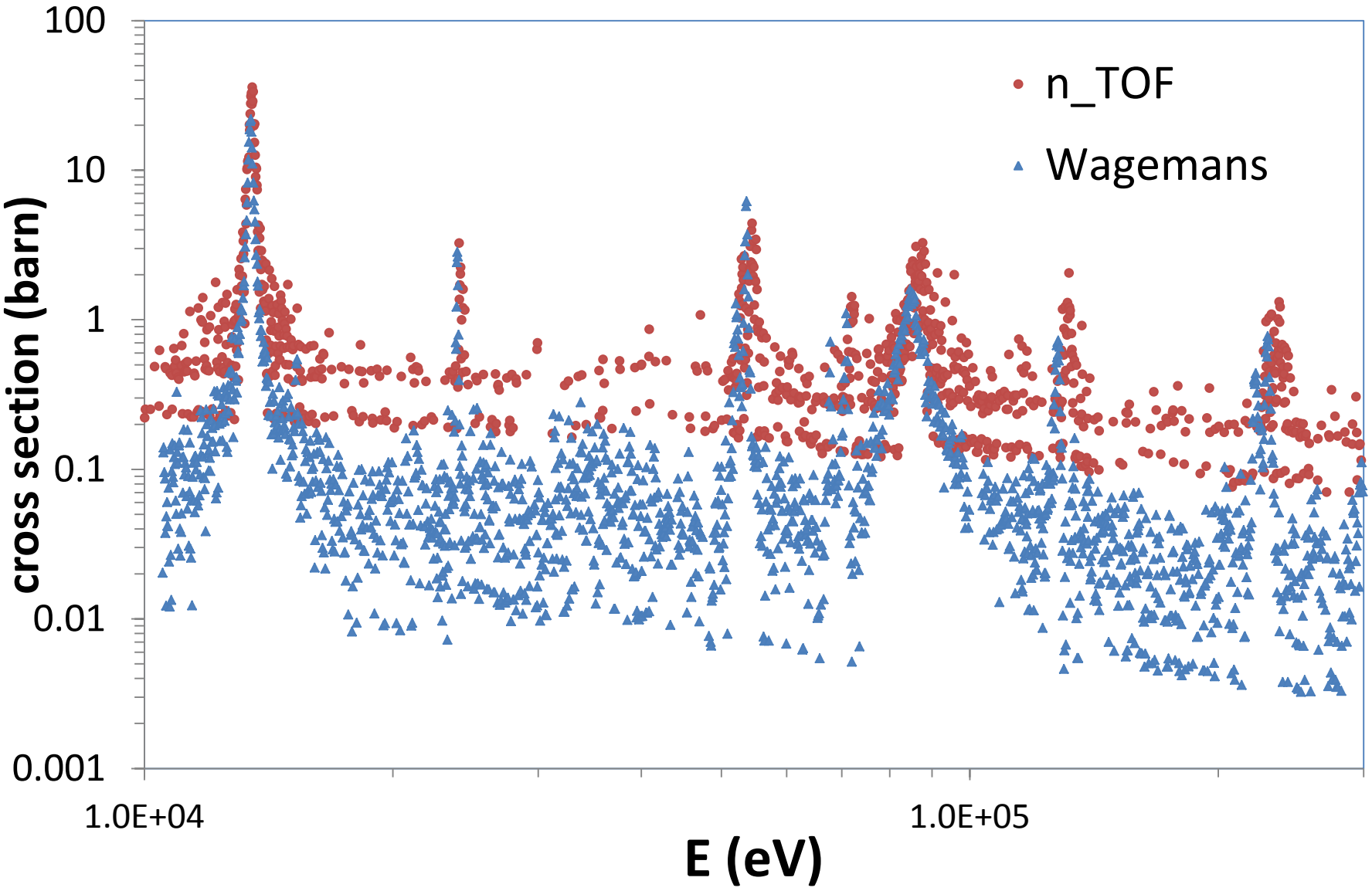


Preliminary results for front samples

$^{33}S(n,\alpha)$ cross section comparative (front)

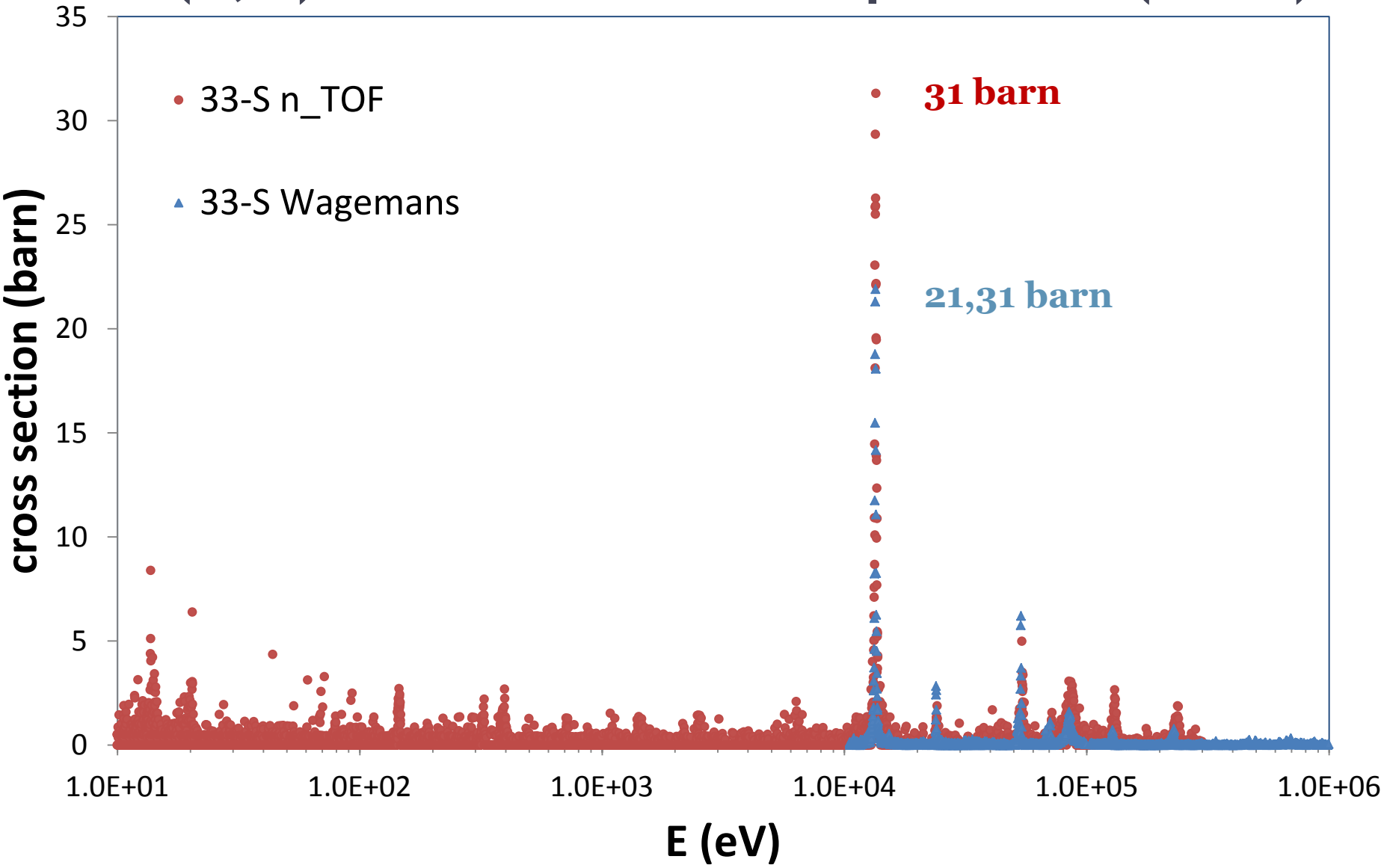


Comparative (front): resonance region

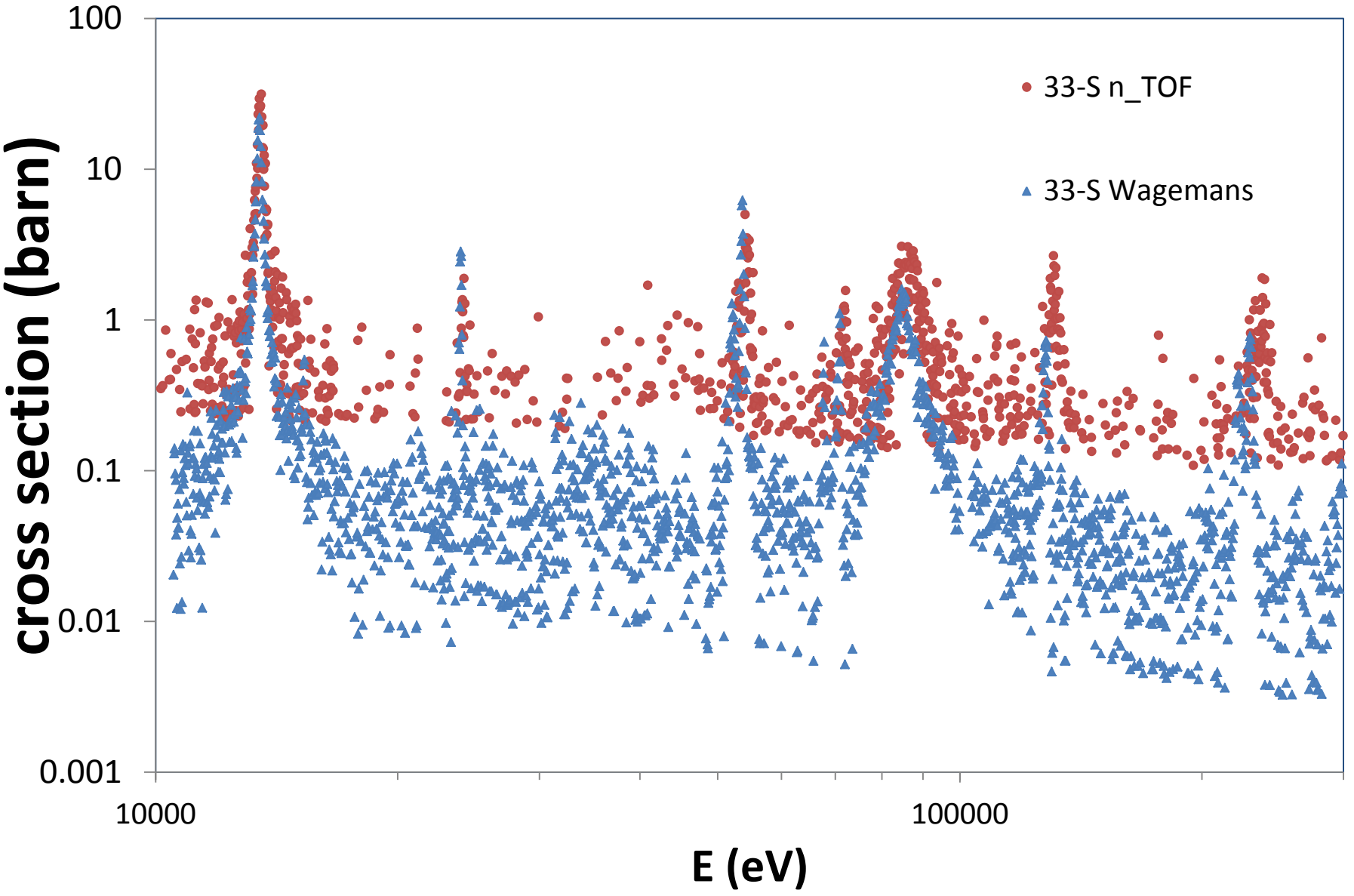


Preliminary results for back samples

$^{33}S(n,\alpha)$ cross section comparative (back)



Comparative (back): resonance region



Conclusions

- We have shown data for the first time below 10 keV but noise at low energy doesn't let us define the behavior for the cross section in the thermal energy range.

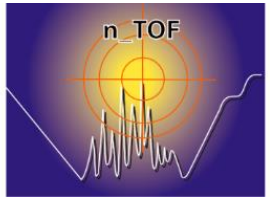
- This is a preliminary result: We have found higher cross section at 13,5 keV in comparison with Wagemans data.

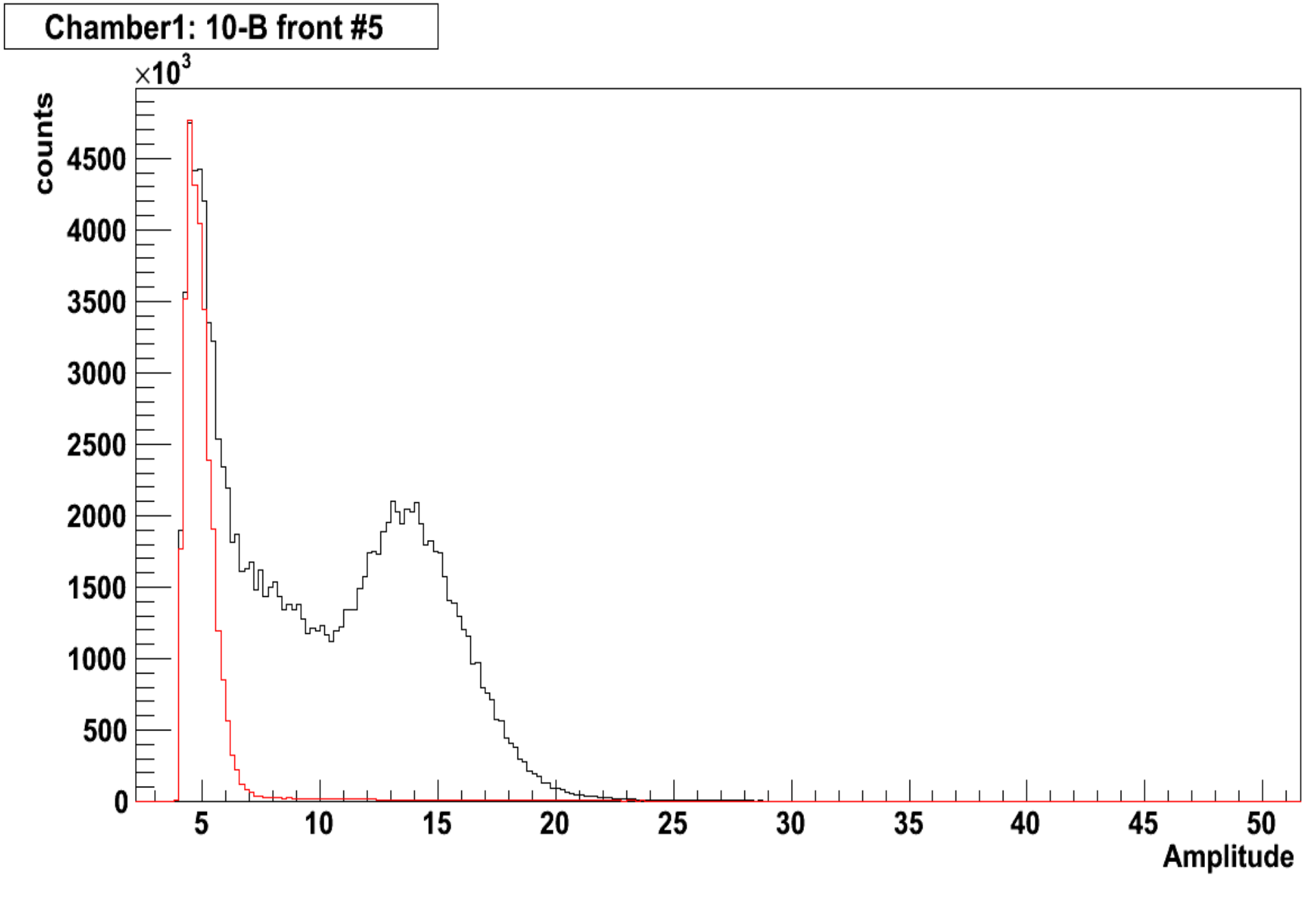
Work to do

- This is a preliminary result.
- Correct by the boron angular distribution and study if $^{33}S(n,\alpha)$ reaction is isotropic.
- Analysis error.
- Samples characterization, ^{33}S and ^{10}B, by means RBS and PIXE technique at CNA.
- Monte Carlo simulations: efficiency and energy deposition.
- Resonance analysis with SAMMY.

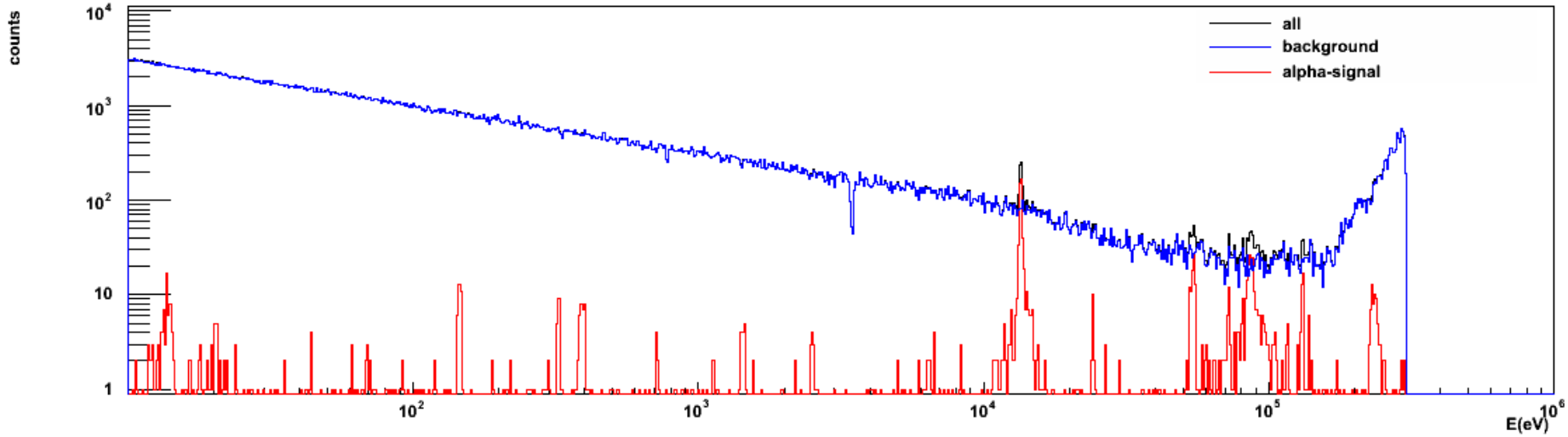
Thank you

for your attention!

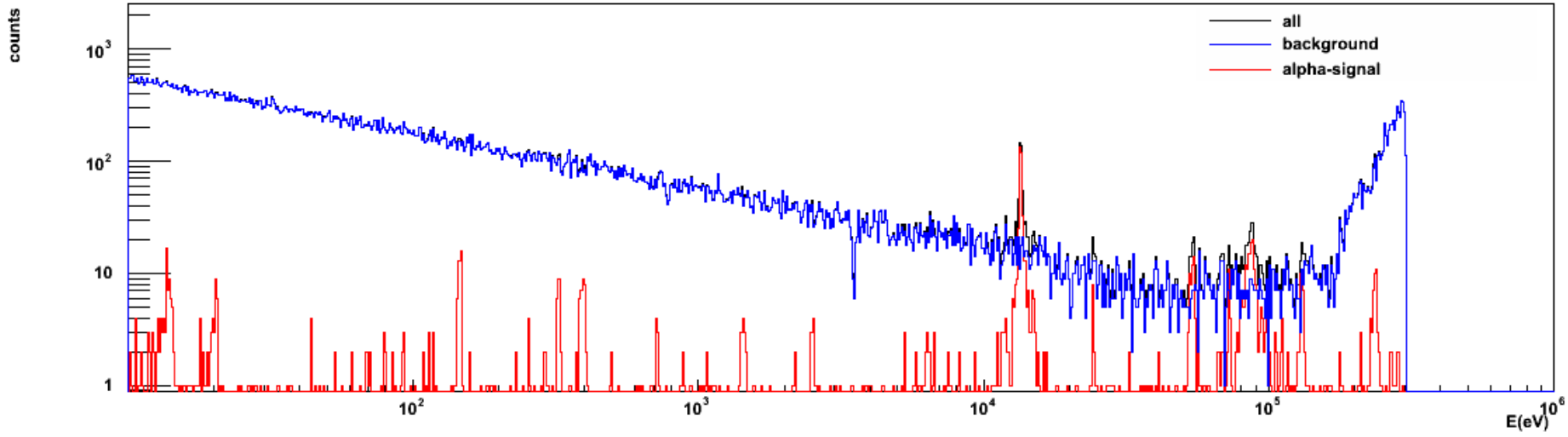



Chamber1: 10-B front #5
×10^3
counts
4500
4000
3500
3000
2500
2000
1500
1000
500
0
5
10
15
20
25
30
35
40
45
50
Amplitude

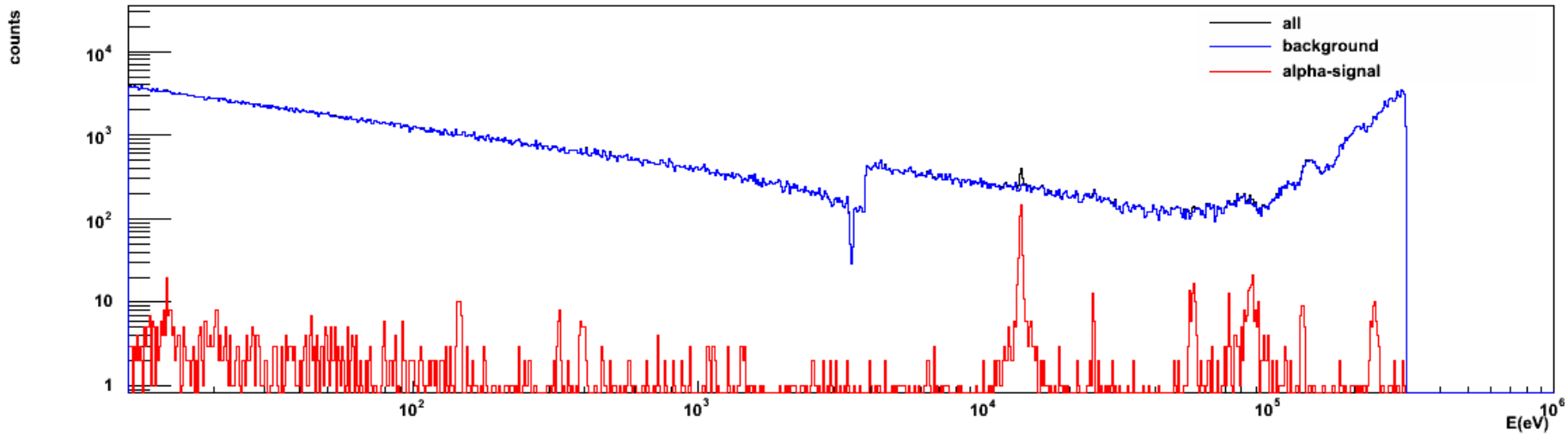
#3-Chamber1: 33-S thin front



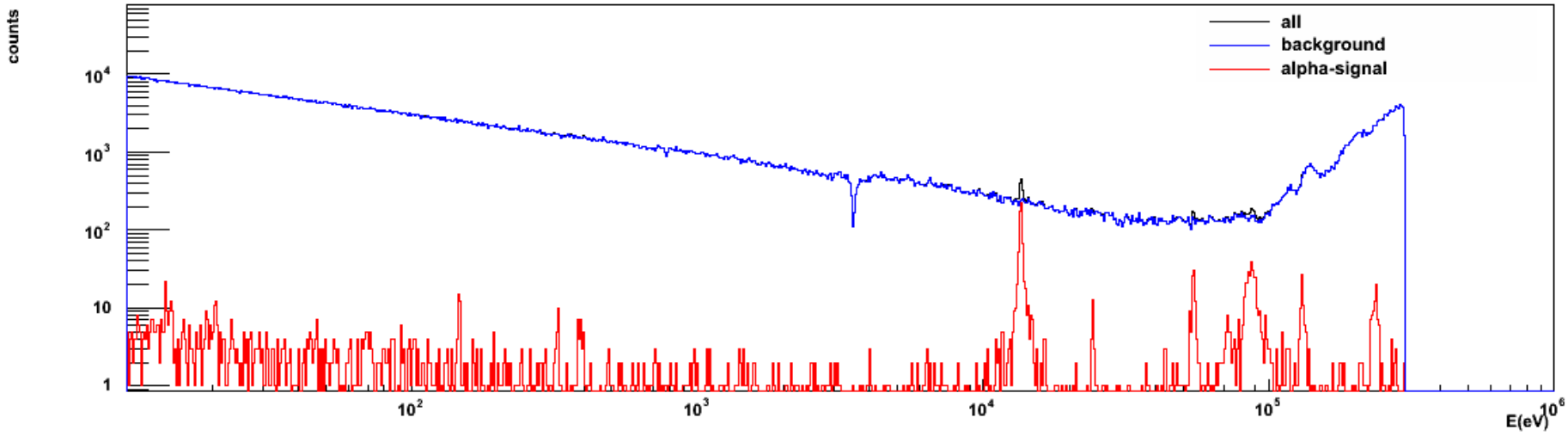
#4-Chamber1: 33-S thin back

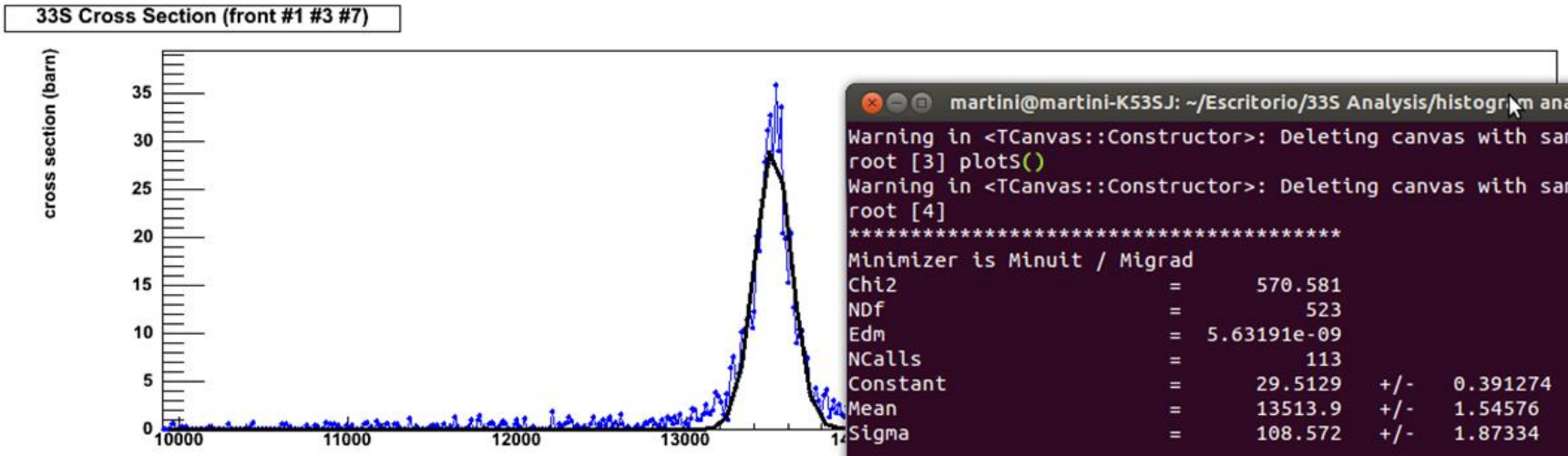


#7-Chamber1: 33-S thin front



#8-Chamber1: 33-S thin back



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martini@martini-K53SJ: ~/Escritorio/33S Analysis/histogram analysis/E_histogram
Warning in <TCanvas::Constructor>: Deleting canvas with same name: cErg1
root [3] plotS()
Warning in <TCanvas::Constructor>: Deleting canvas with same name: cErg1
root [4]
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Minimizer is Minuit / Migrad
Chi2                      =      570.581
NDf                       =          523
Edm                       =  5.63191e-09
NCalls                    =          113
Constant                  =      29.5129   +/-   0.391274
Mean                      =      13513.9   +/-   1.54576
Sigma                     =      108.572   +/-   1.87334      (limited

****************************************
Minimizer is Minuit / Migrad
Chi2                      =      546.773
NDf                       =          523
Edm                       =  9.78873e-07
NCalls                    =           71
Constant                  =      25.5993   +/-   0.372822
Mean                      =      13507.2   +/-   1.78625
Sigma                     =      113.665   +/-   2.14424      (limited
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