Status update on the analysis of ^{80}Se(n,g), ^{56}Fe(n,g) & ^{93}Nb(n,g)

Víctor Babiano Suárez

Luis Caballero, David Calvo, Cesar Domingo, Ion Ladarescu, Pablo Olleros, José Luis Taín
IFIC (Universitat de València – CSIC)

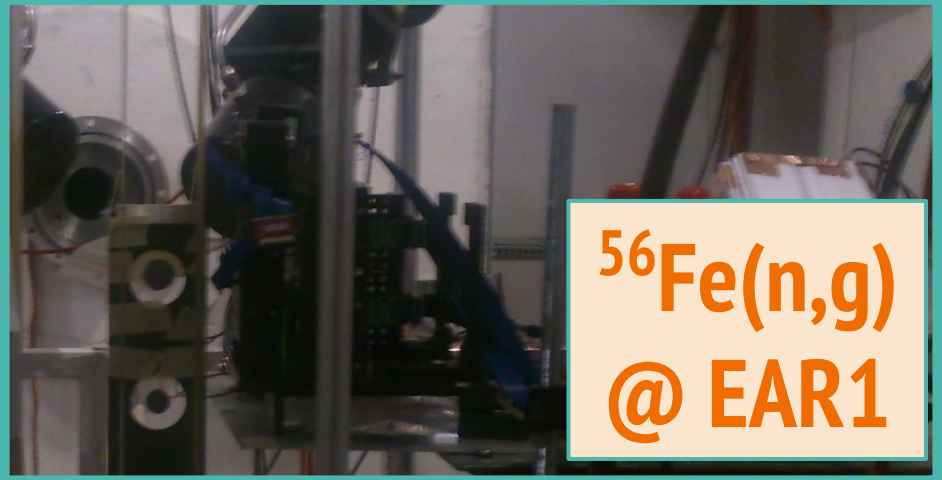
Francisco Calviño, Adria Casanovas, Ariel Tarifeño (UPC)

Victor Alcayne (CIEMAT)

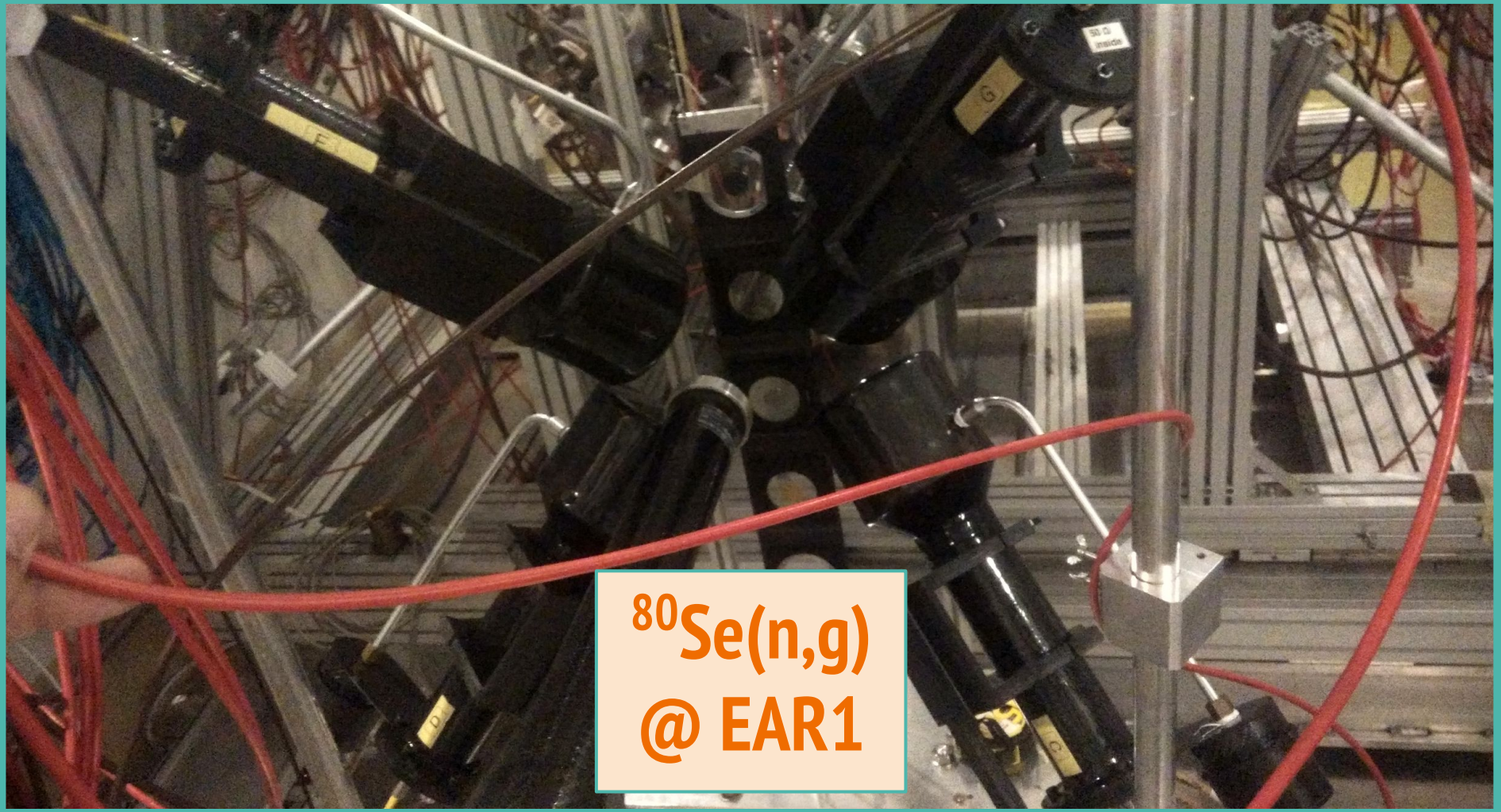
Carlos Guerrero, Mª Ángeles Millán, Mª Teresa Rodríguez (US)

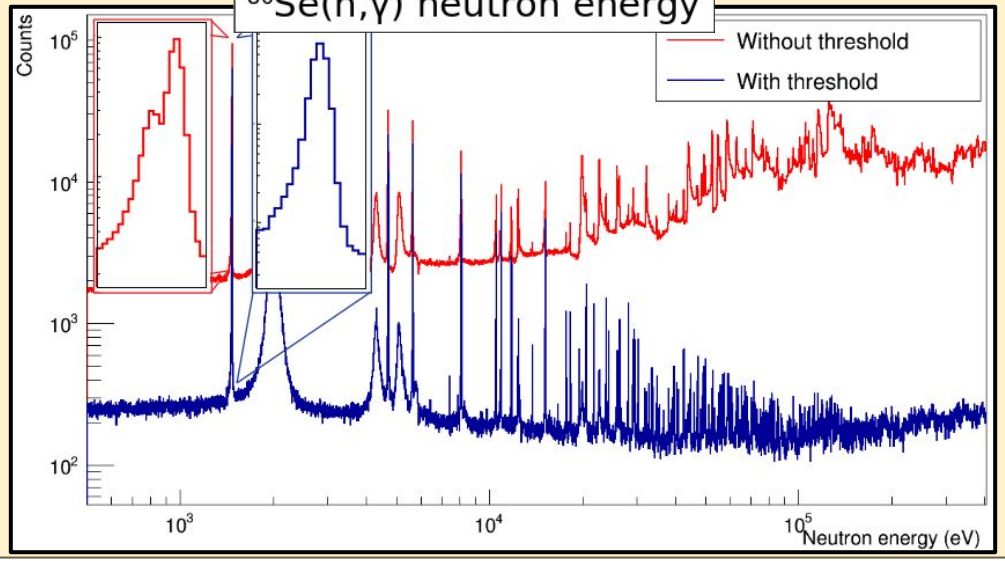
n_TOF local team and the n_TOF Collaboration

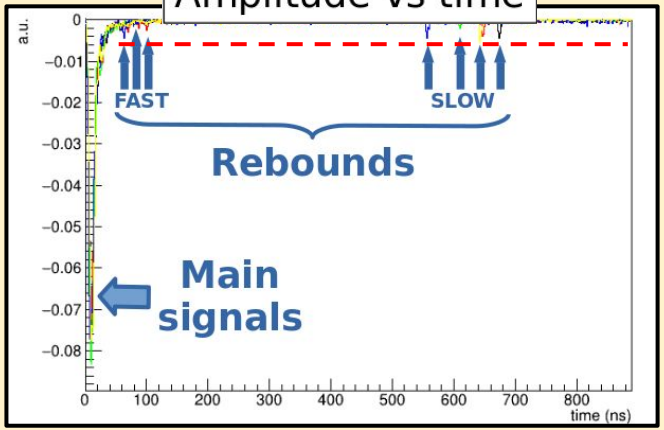

^{80}Se(n,g)
@ EAR1

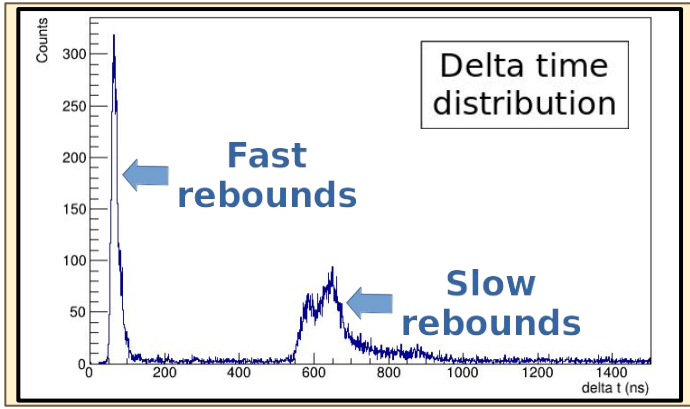

^{56}Fe(n,g)
@ EAR1


^{93}Nb(n,g)
@ EAR2

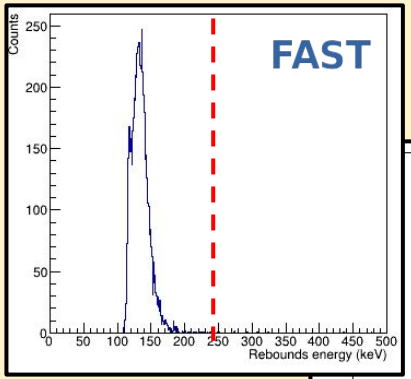

^{80}Se(n,g)
@ EAR1



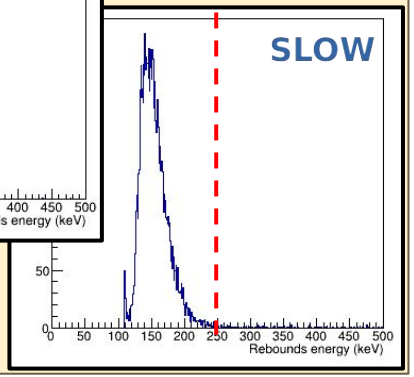




^{80}Se(n,g) @ EAR1

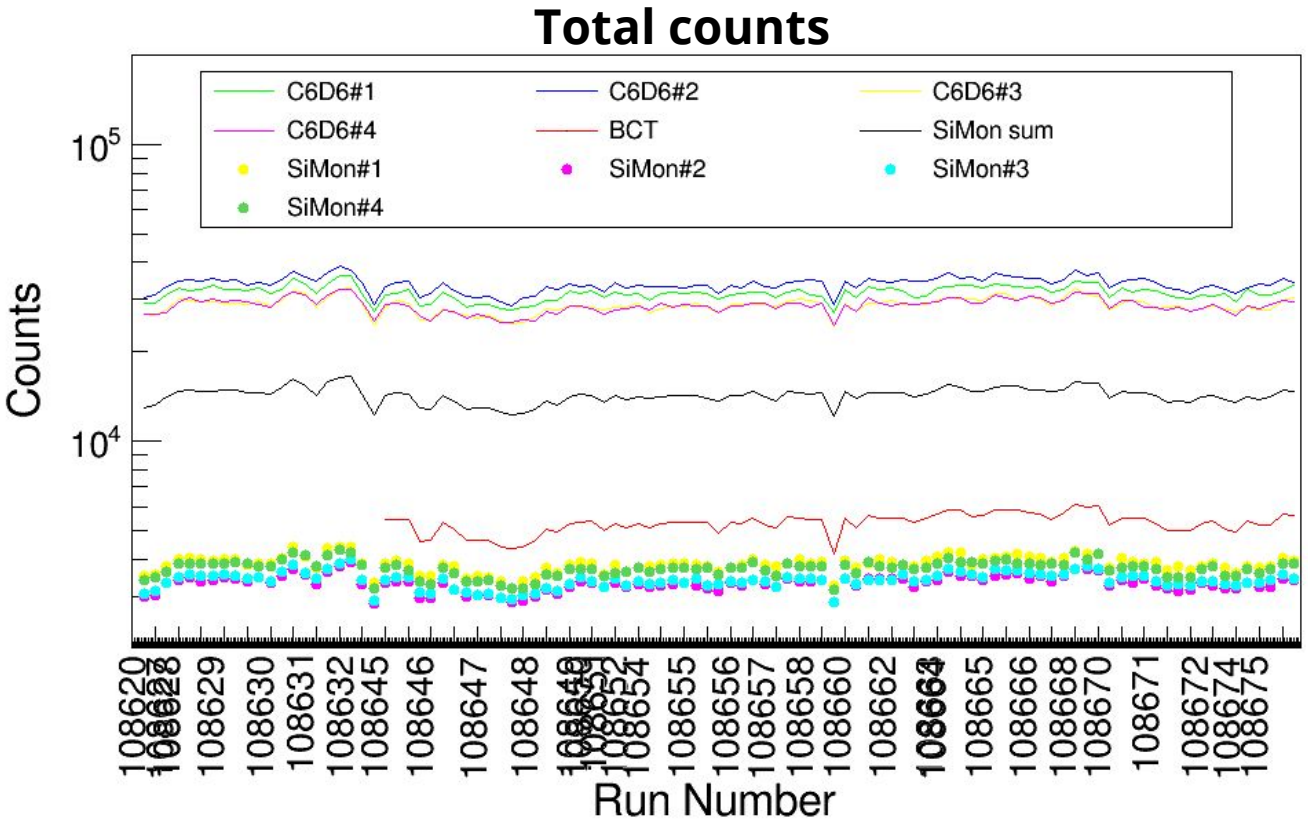


Deposited energy



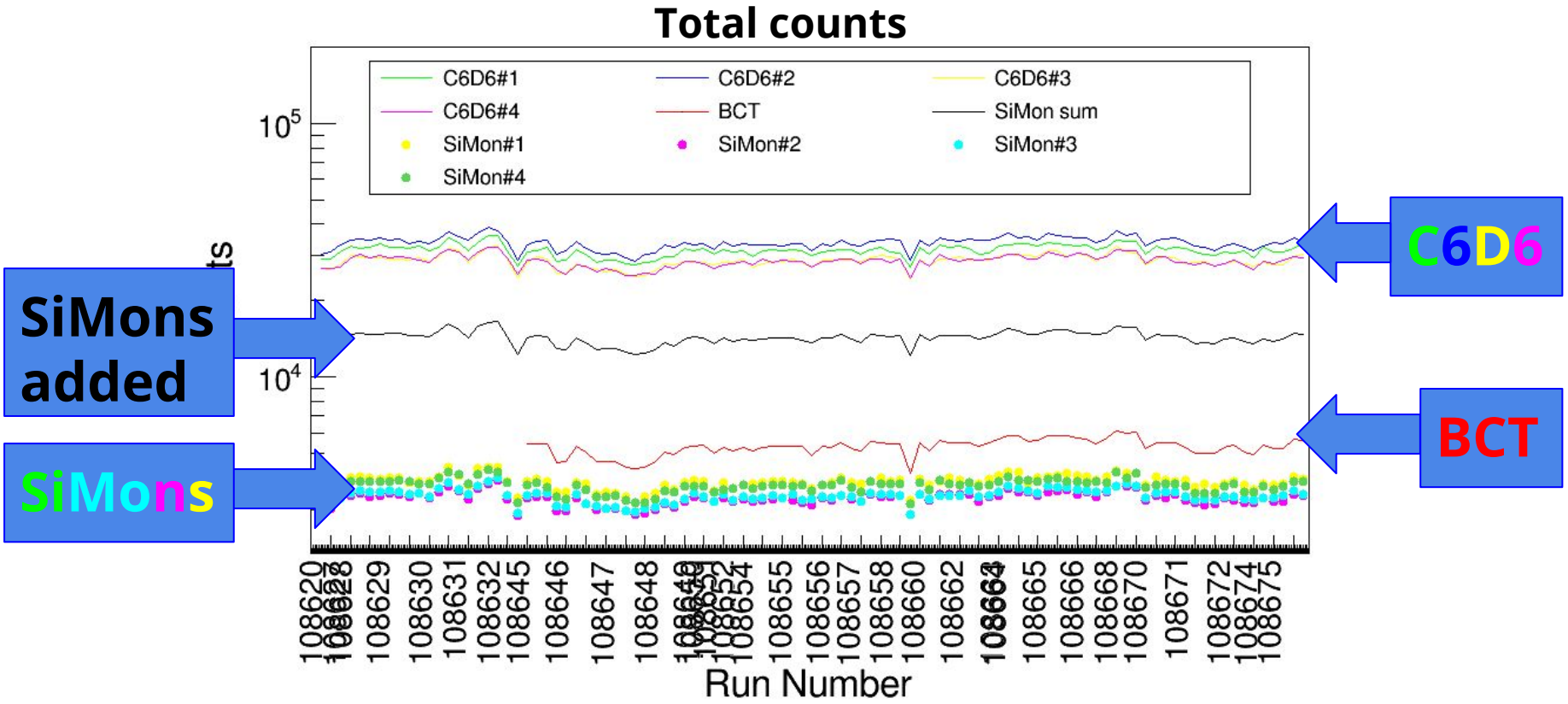
Detectors count rate consistency study

^{80}Se(n,g)



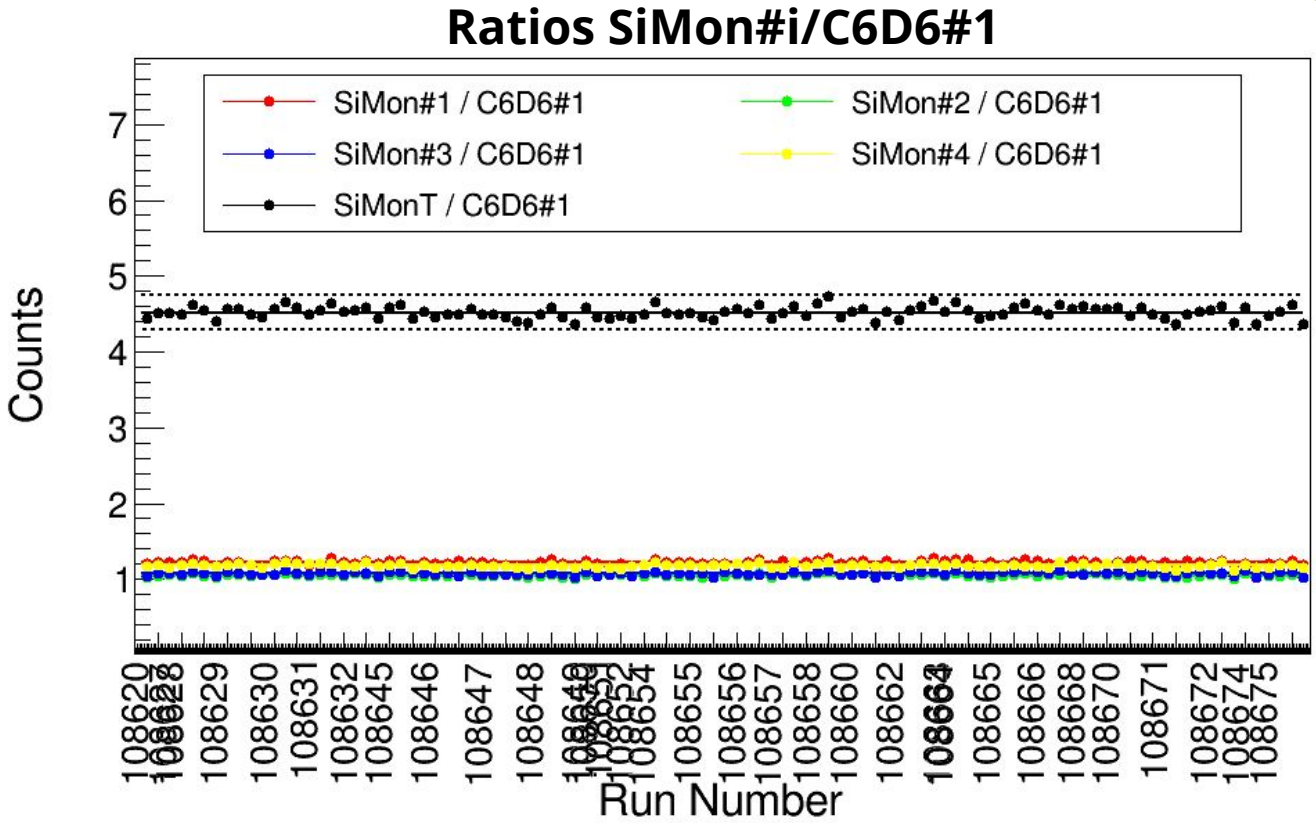
Detectors count rate consistency study

^{80}Se(n,g)



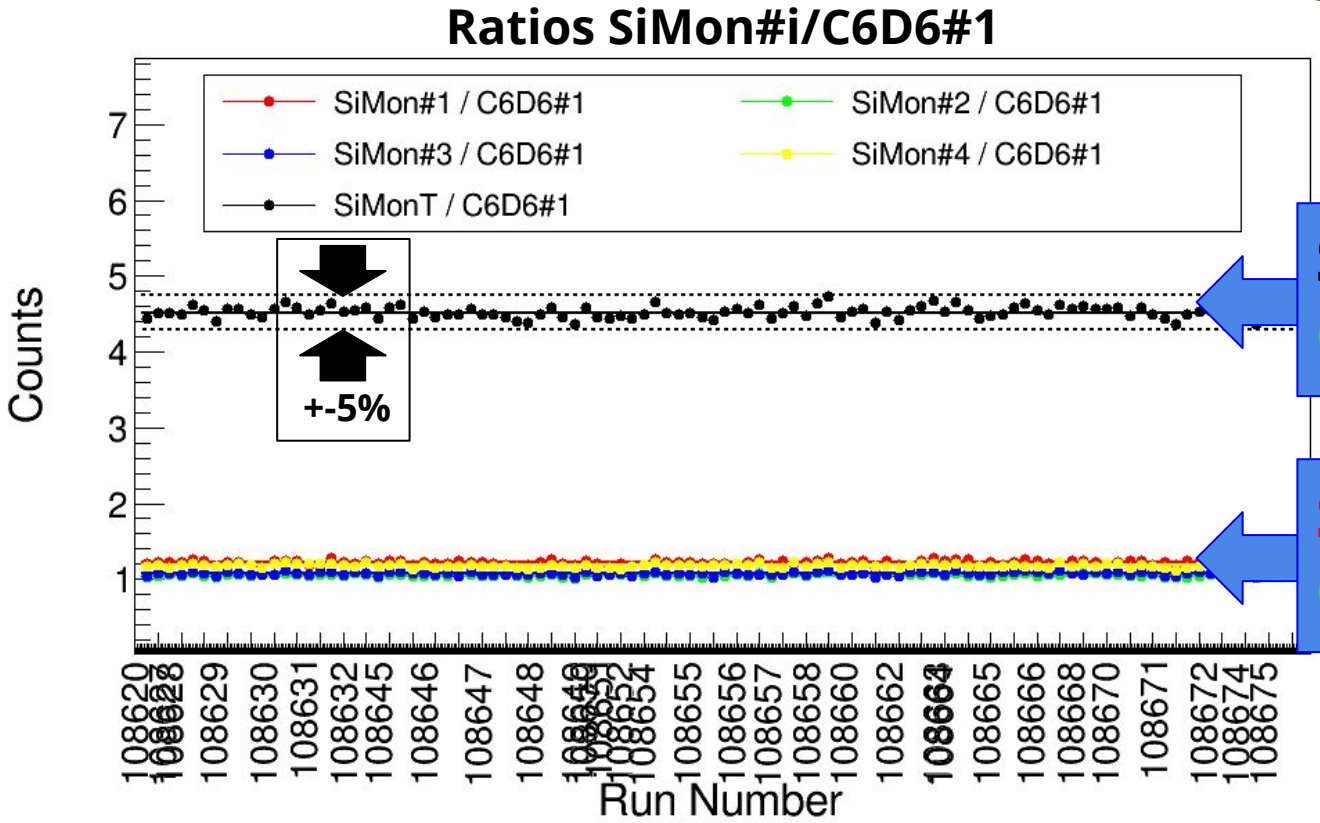
Detectors count rate consistency study

^{80}Se(n,g)



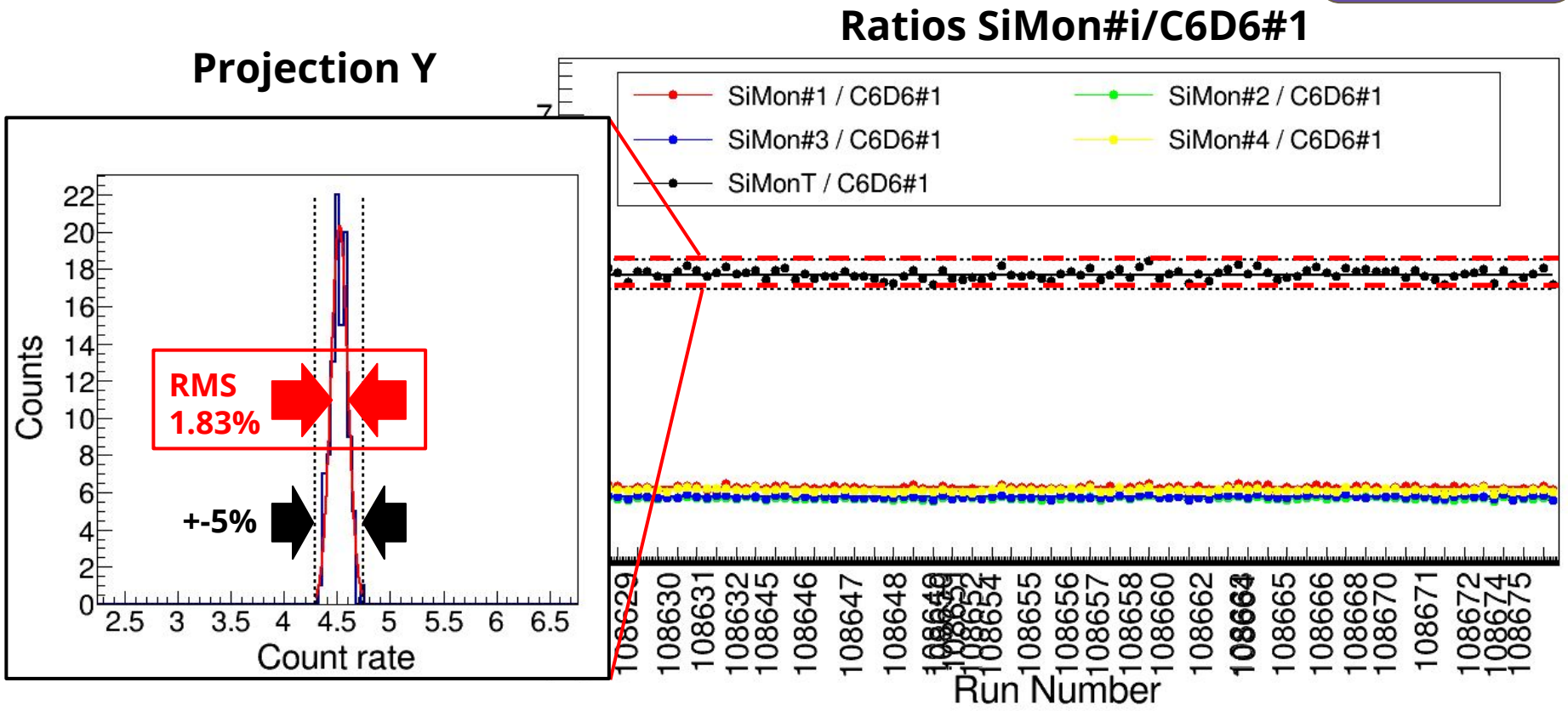
Detectors count rate consistency study

^{80}Se(n,g)



Detectors count rate consistency study

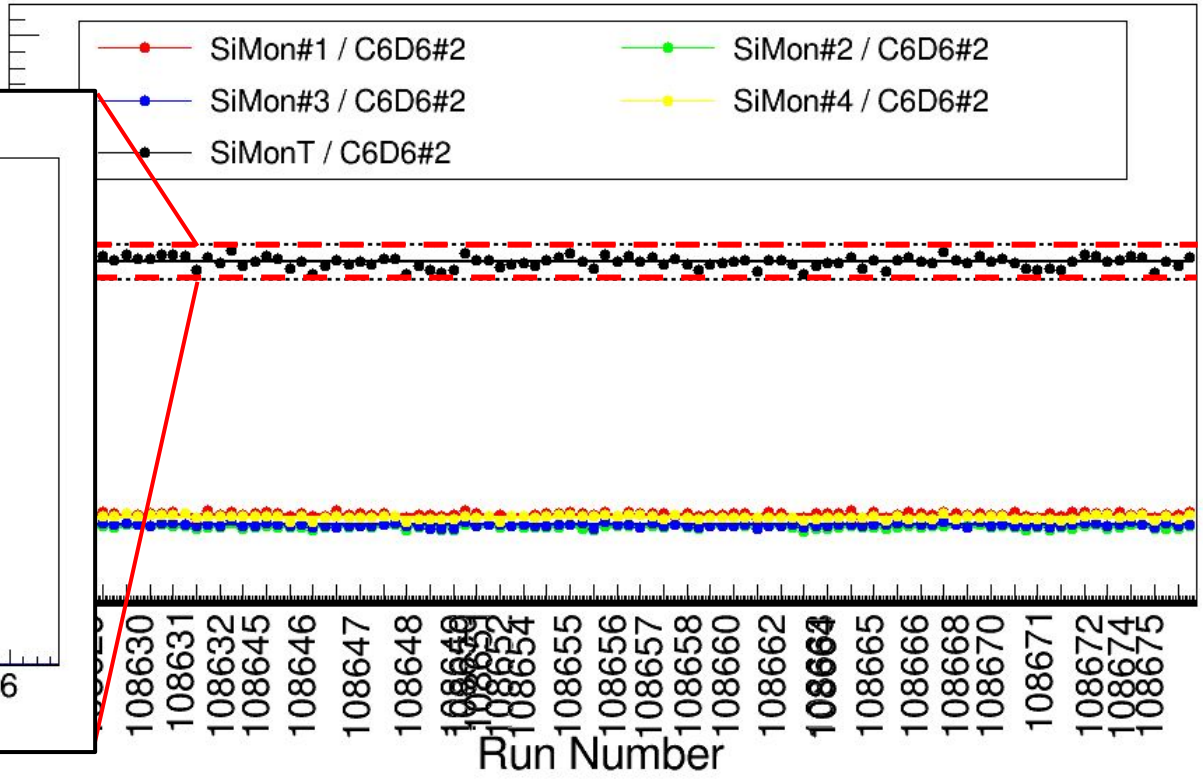
^{80}Se(n,g)



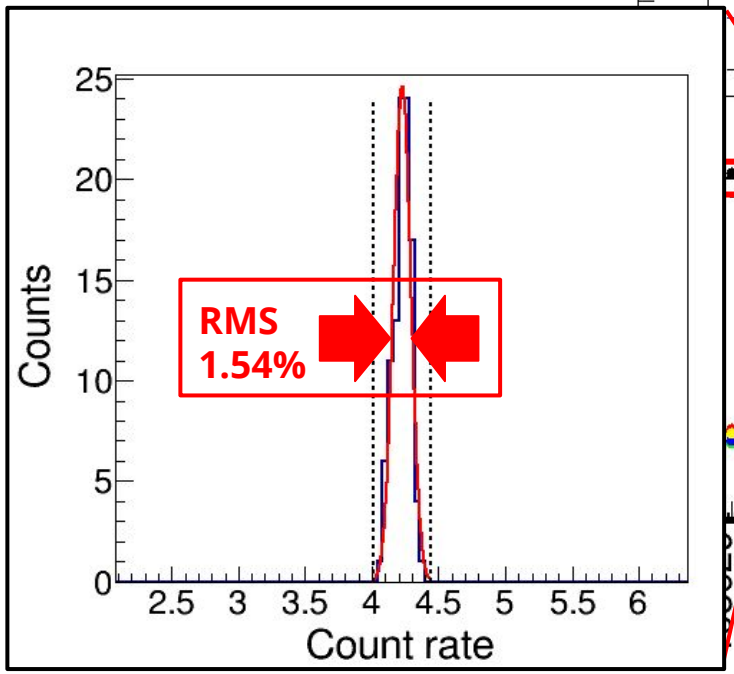
Detectors count rate consistency study

^{80}Se(n,g)

Ratios SiMon#i/C6D6#2

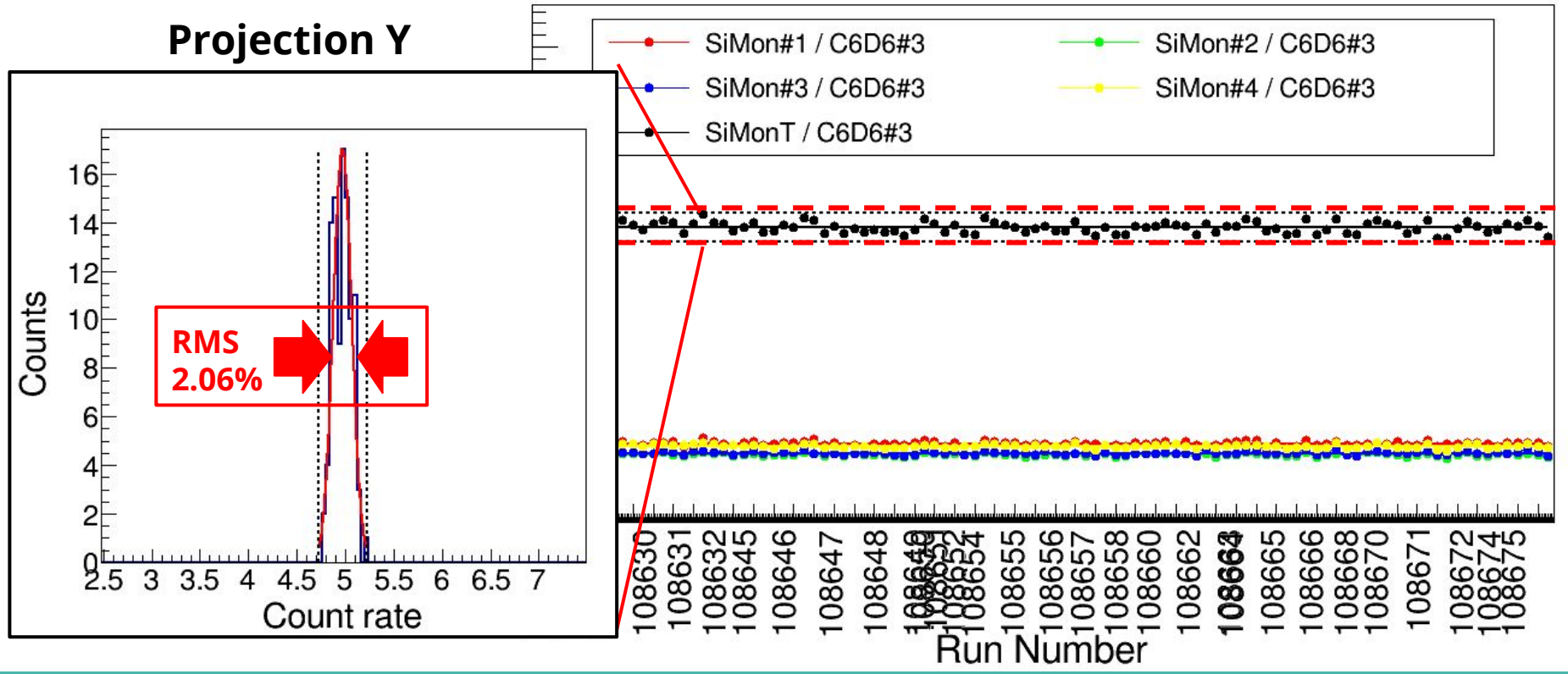


Projection Y



Detectors count rate consistency study

^{80}Se(n,g)

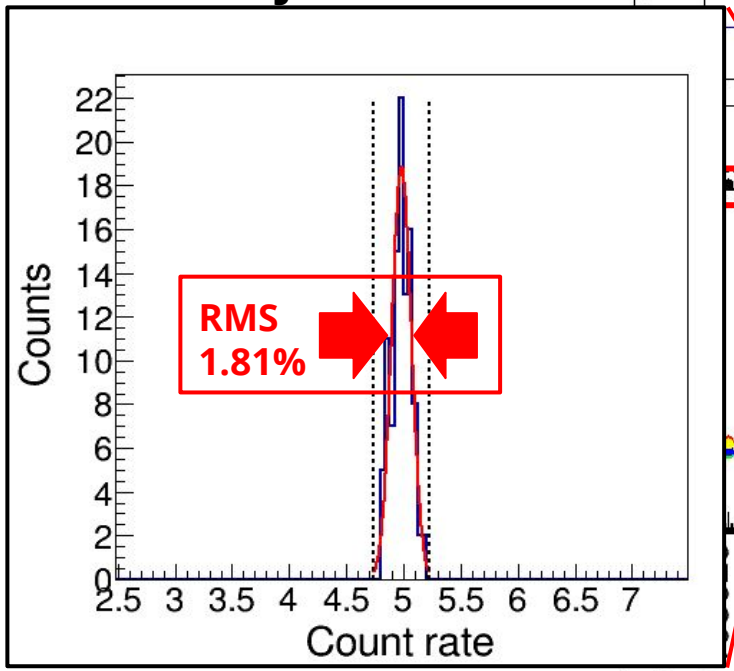


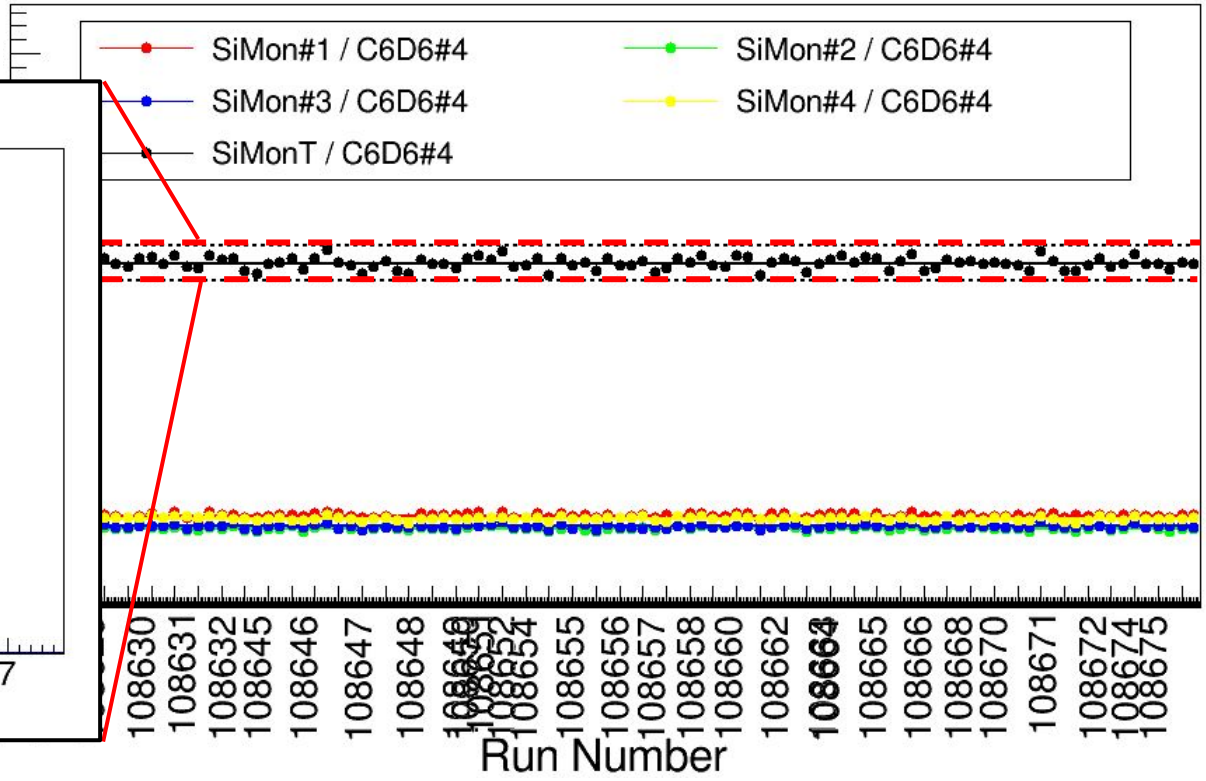
Detectors count rate consistency study

^{80}Se(n,g)

Ratios SiMon#i/C6D6#4

Projection Y

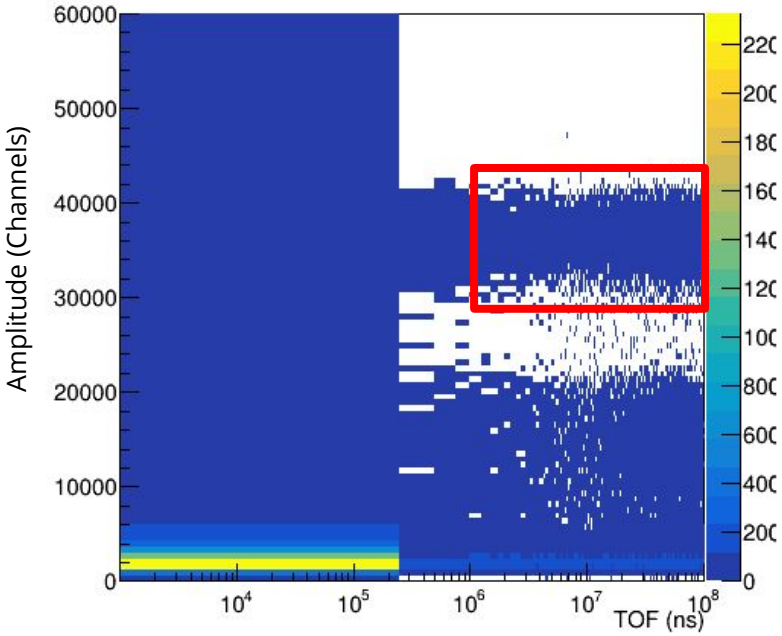


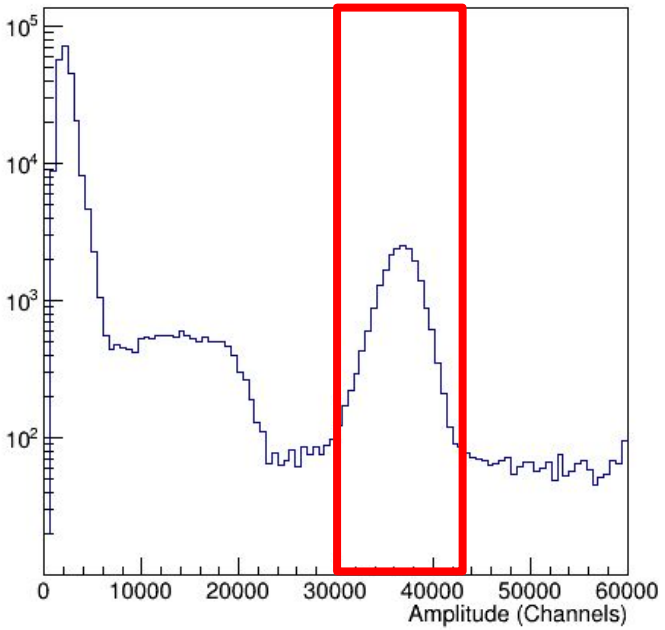


Detectors count rate consiste

30000 < Amp (ch) < 45000
1e6 < tof (ns) < 1e8

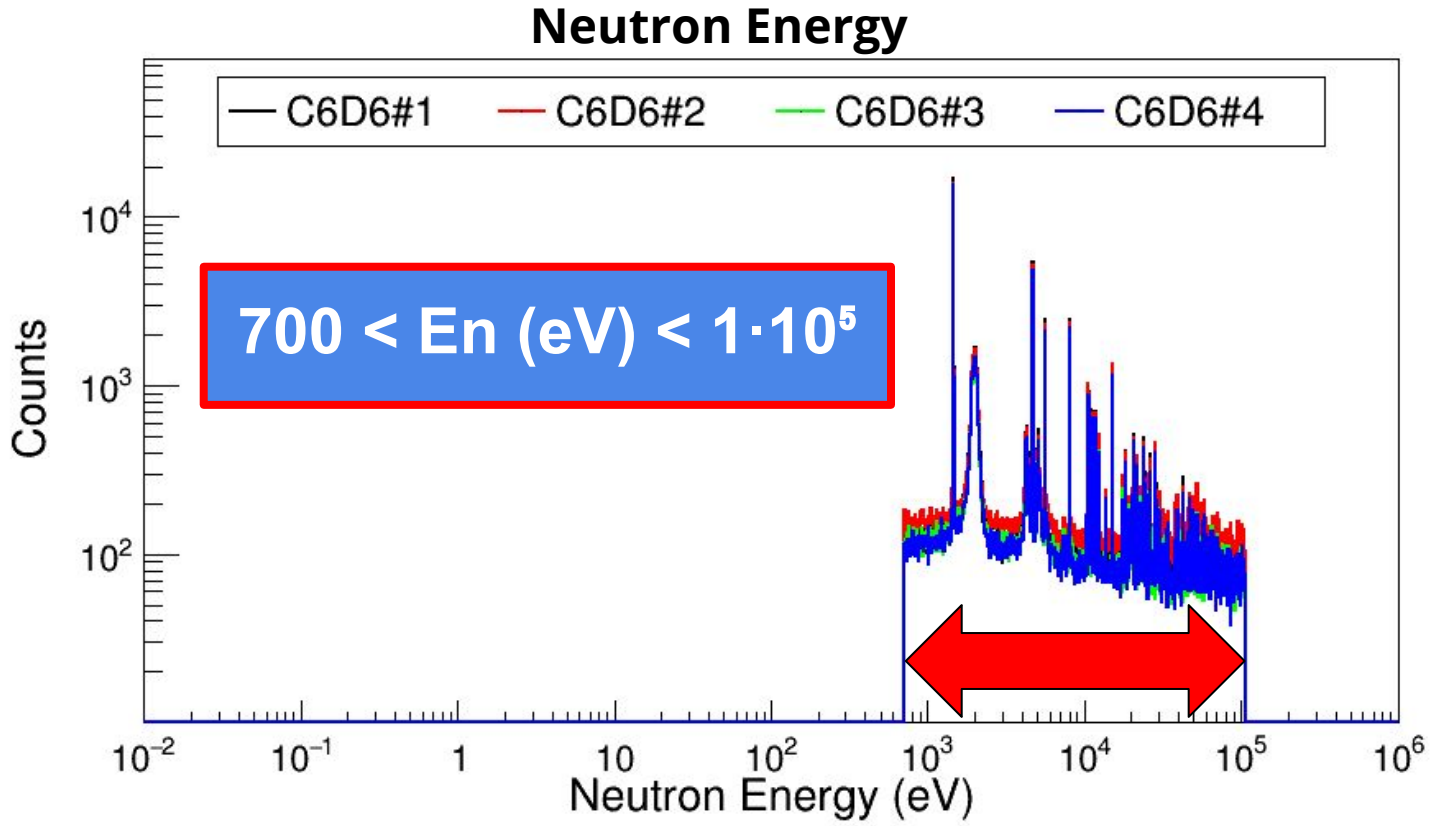
- All SiMons added





Detectors count rate consistency study

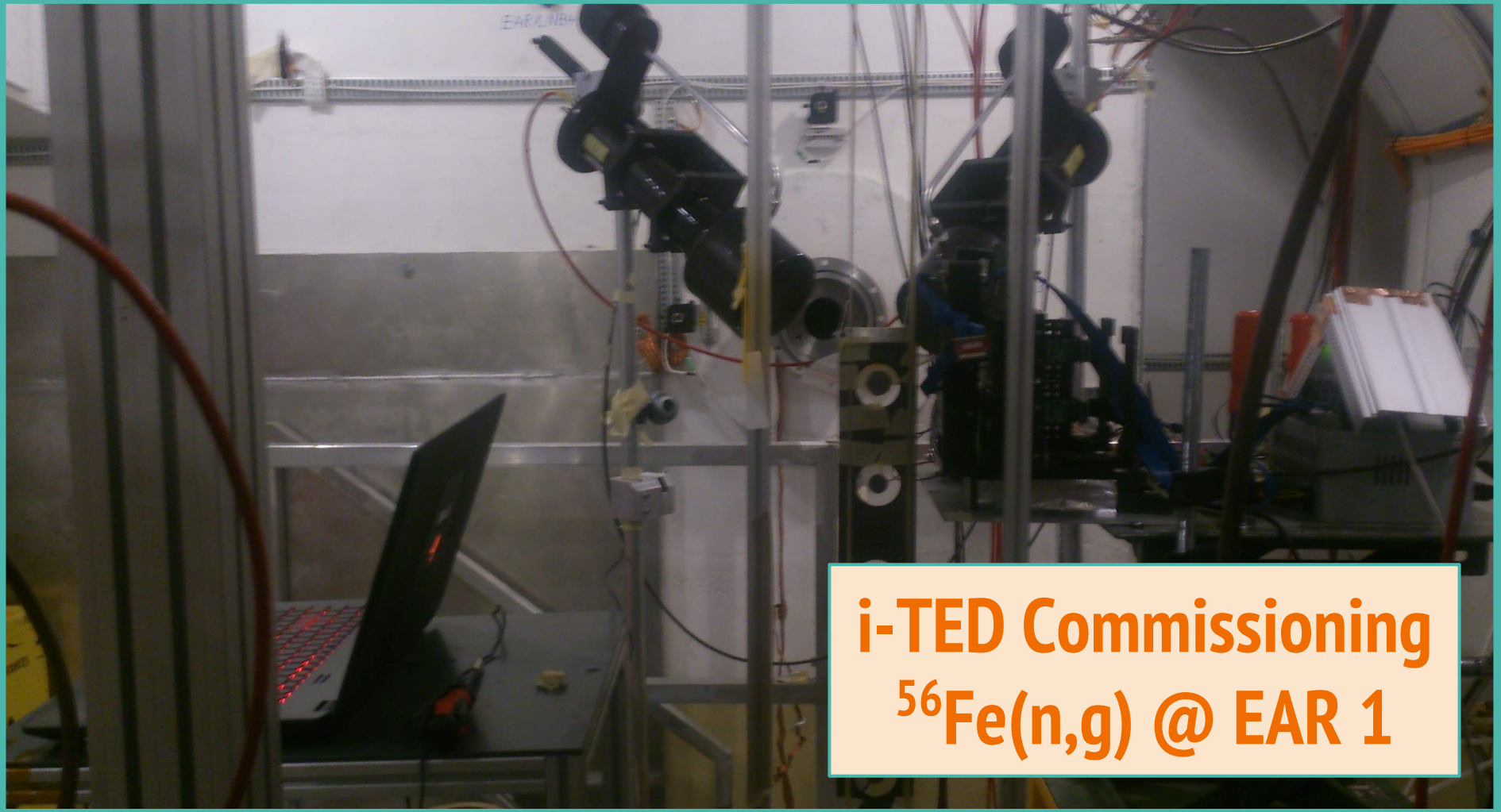
^{80}Se(n,g)



Detectors count rate consistency study

- Summary of ^{80}Se(n,g) experiment at EAR 1

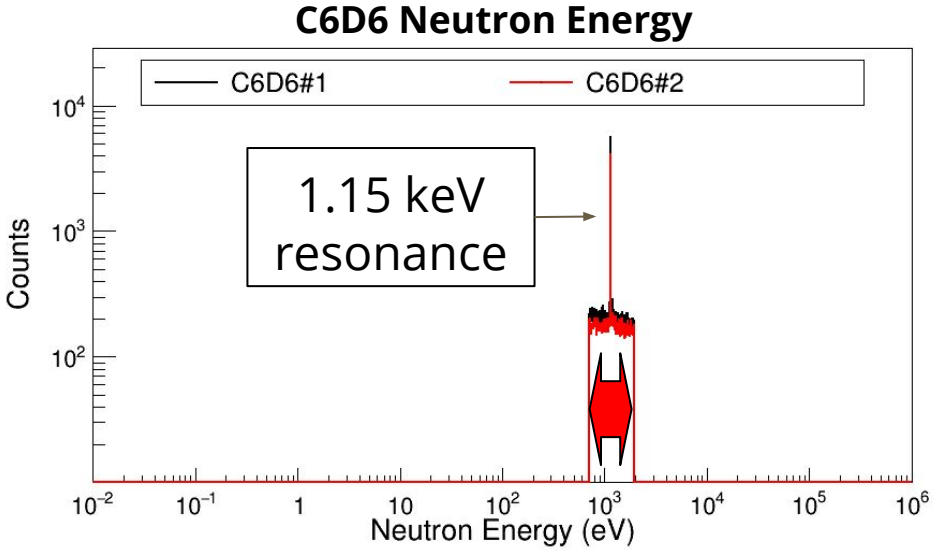
Sample	Total	Good	%
Au	2.136e17	2.136e17	**100**
Empty	1.512e17	1.512e17	**100**
Empty + Filters	3.579e17	3.579e17	**100**
Se Thick	1.732e18	1.732e18	**100**
Se Thick + F	1.109e17	1.109e17	**100**
Se Thin	9.618e16	9.618e16	**100**

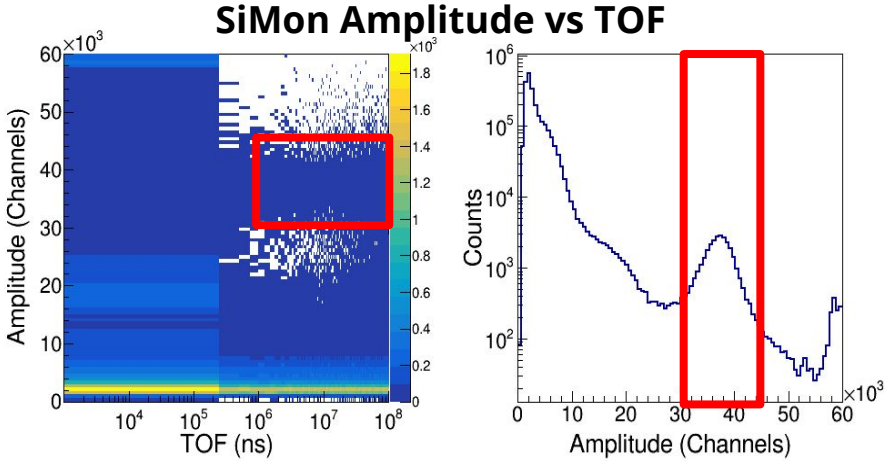


i-TED Commissioning
^{56}Fe(n,g) @ EAR 1

Detectors count rate consistency study

^{56}Fe(n,g)





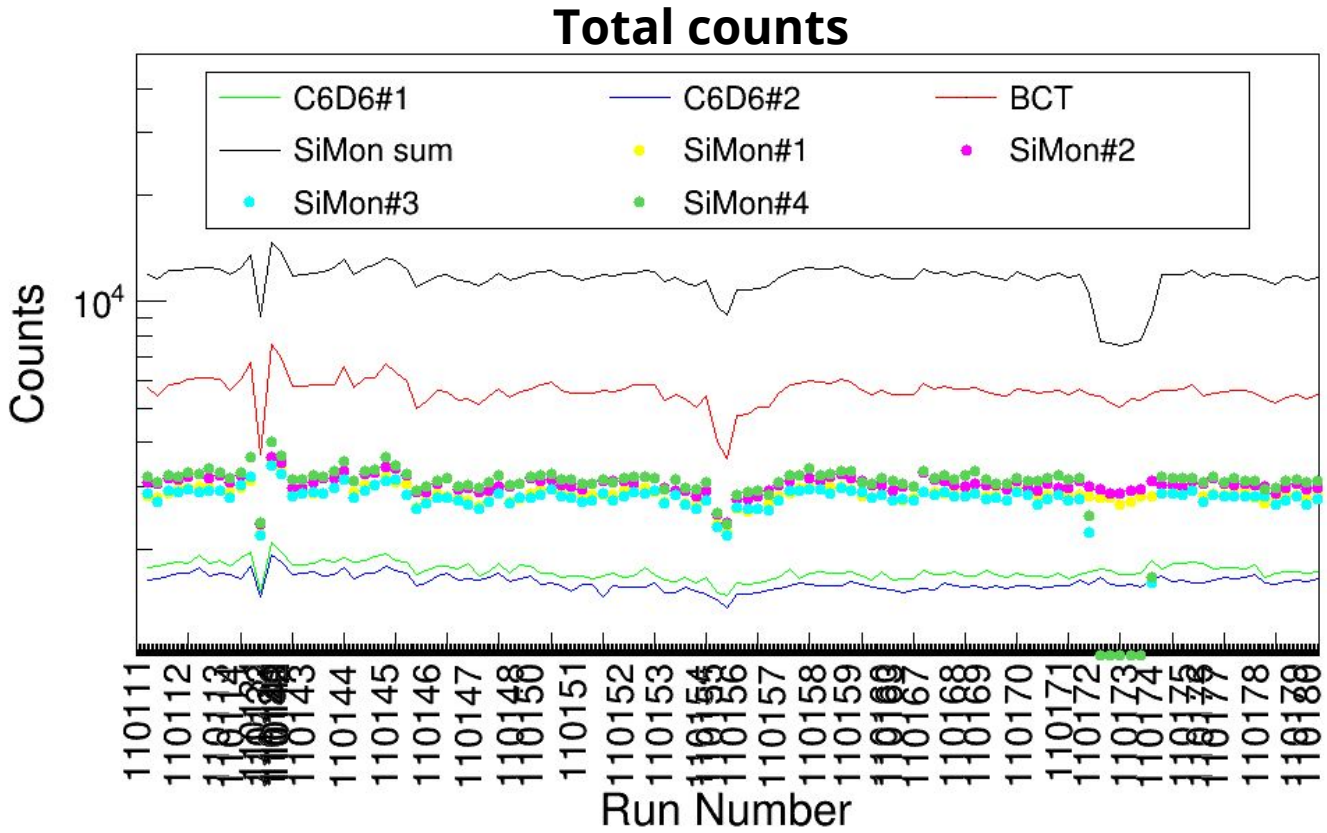
700 < En (eV) < 2000

30e3 < Amp (ch) < 45e3

1e6 < tof (ns) < 1e8

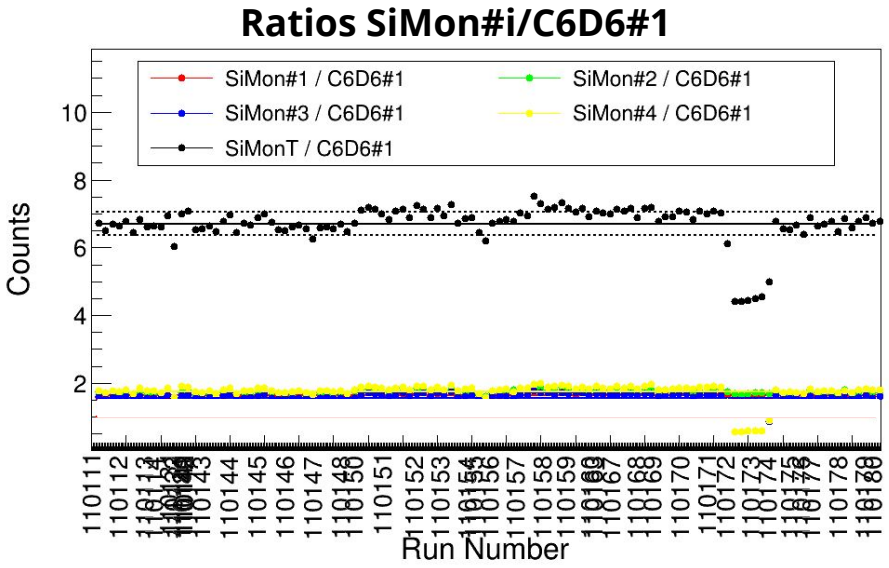
Detectors count rate consistency study

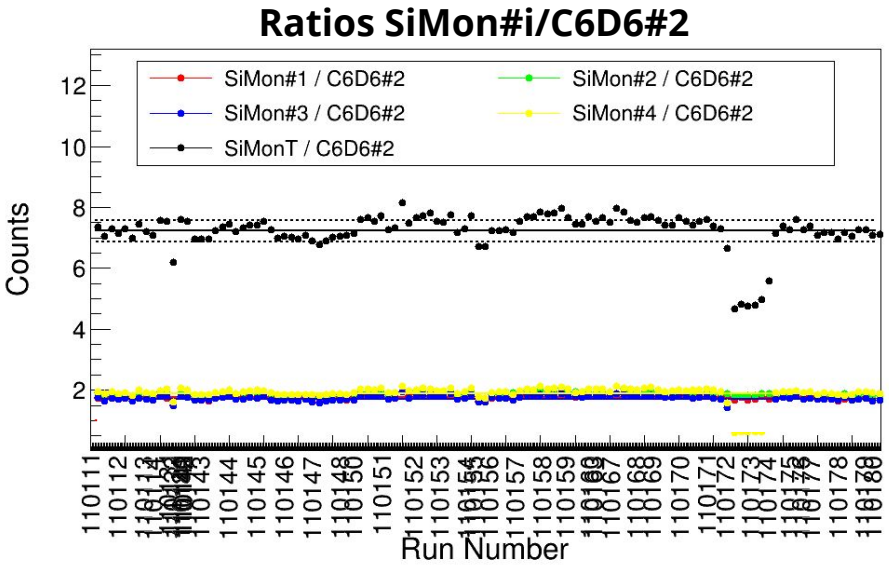
^{56}Fe(n,g)



Detectors count rate consistency study

^{56}Fe(n,g)

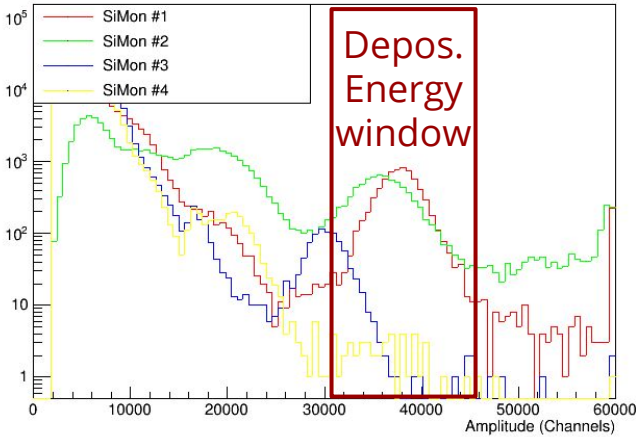




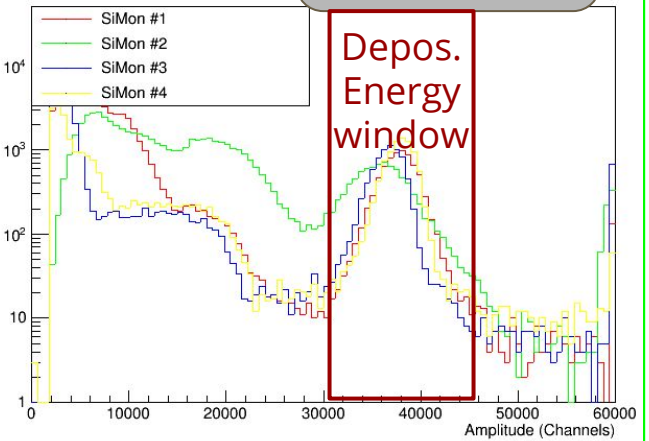
Detectors count rate consistency study

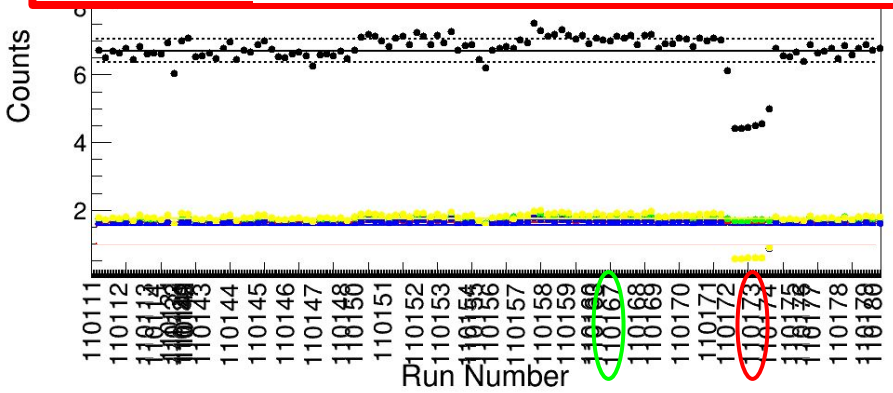
^{56}Fe(n,g)

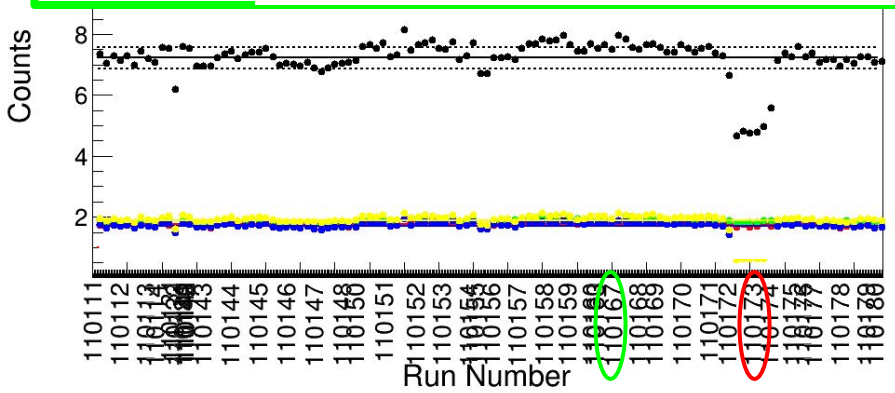
Strange run



Regular run

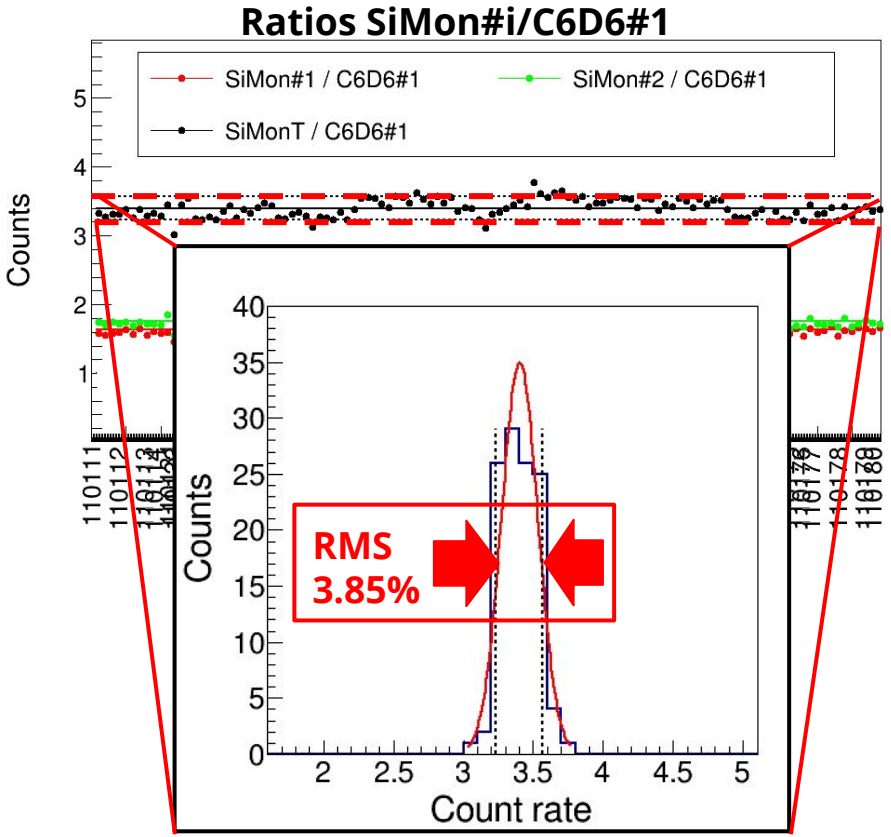


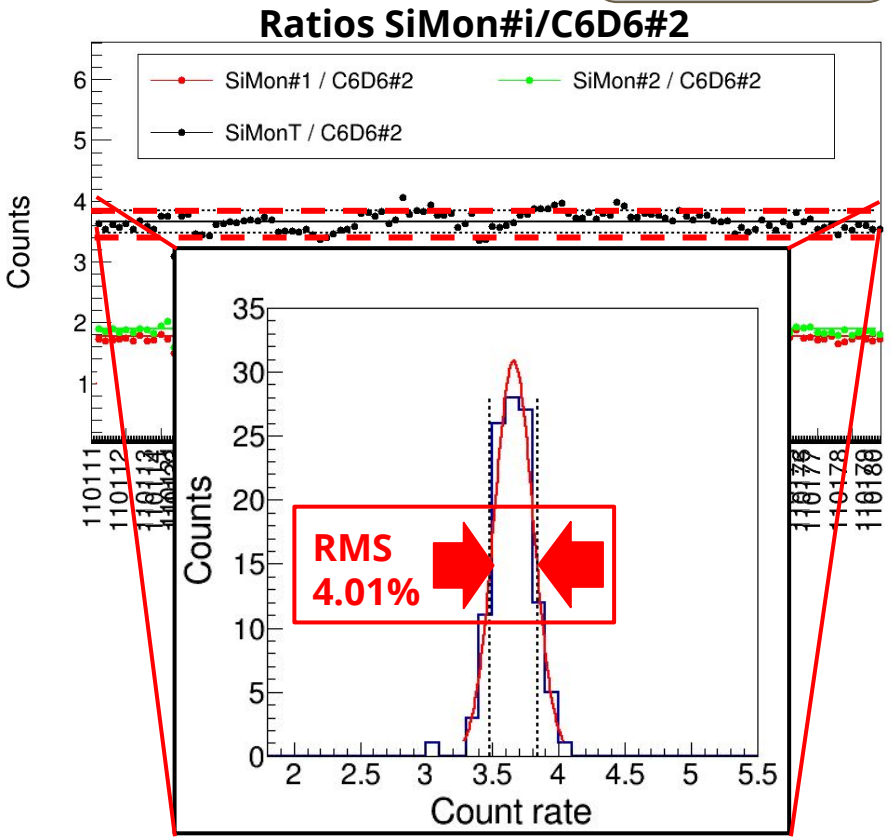




Detectors count rate consistency study

^{56}Fe(n,g)

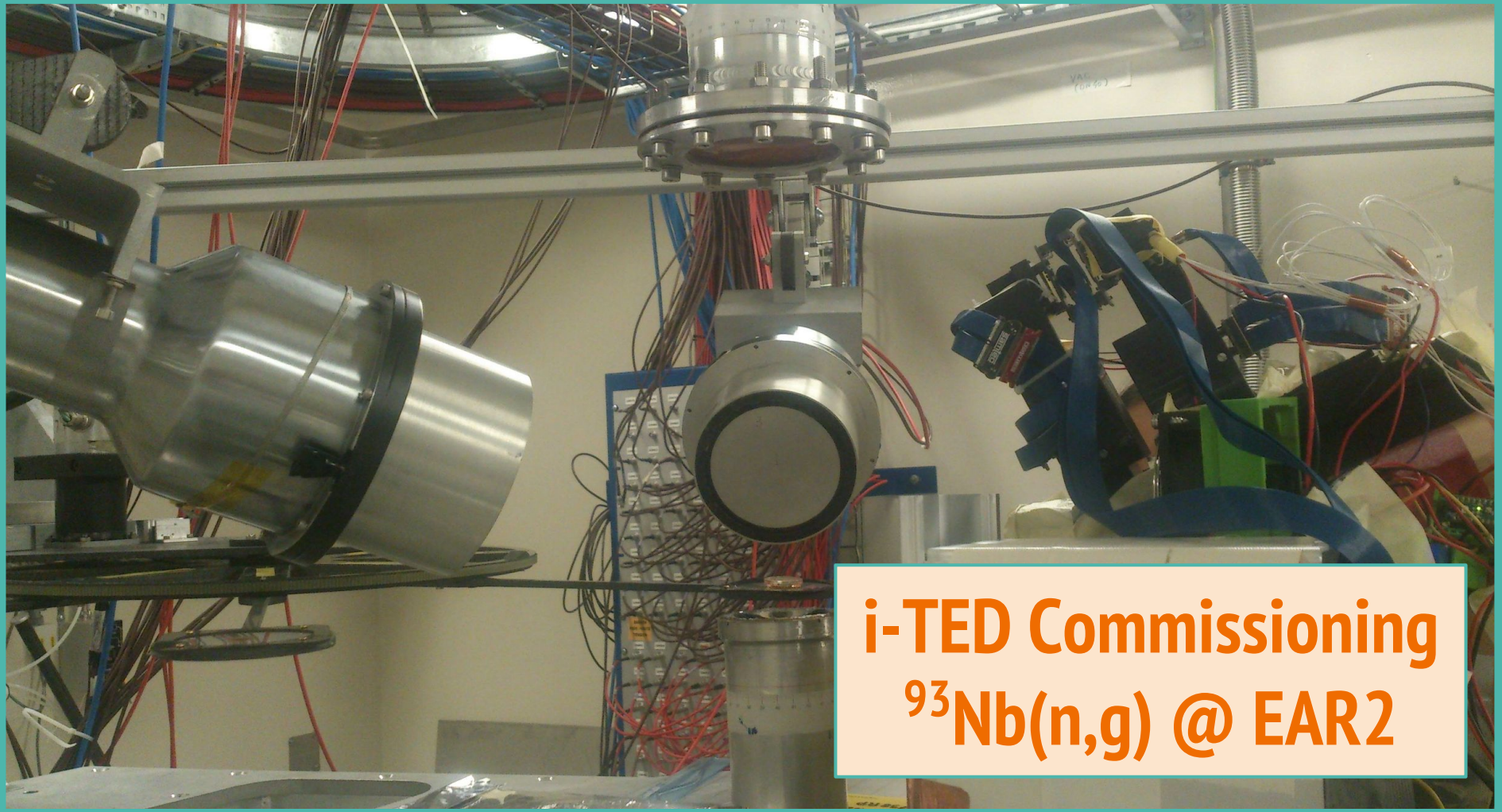




Detectors count rate consistency study

- Summary of ^{56}Fe(n,g) experiment at EAR 1 under i-TED Commissioning framework.

Sample	Total	Good	%
Au	7.5e16	7.21e16	**96**
Fe	1.14e18	1.14e18	**100**
Pb	2.37e17	2.13e17	**90**
Empty	3.05e17	3.05e17	**100**

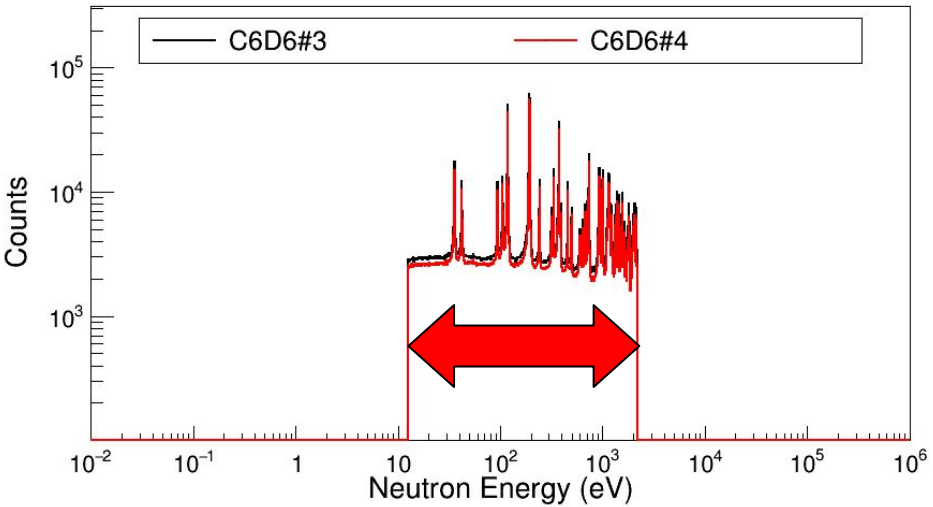


i-TED Commissioning
^{93}Nb(n,g) @ EAR2

Detectors count rate consistency study

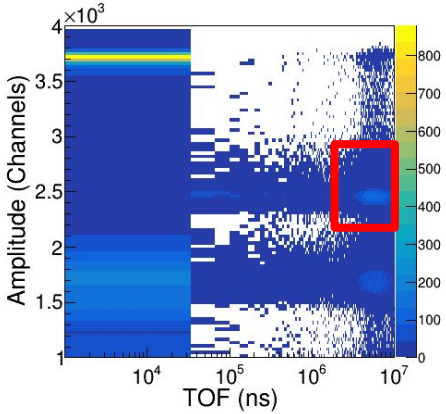
^{93}Nb(n,g)

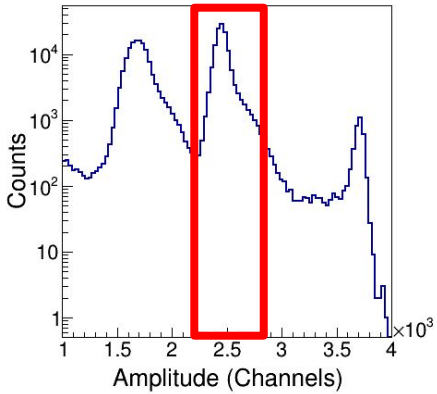
C6D6 Neutron Energy



10 < En (eV) < 2000

SiMon Amplitude vs TOF



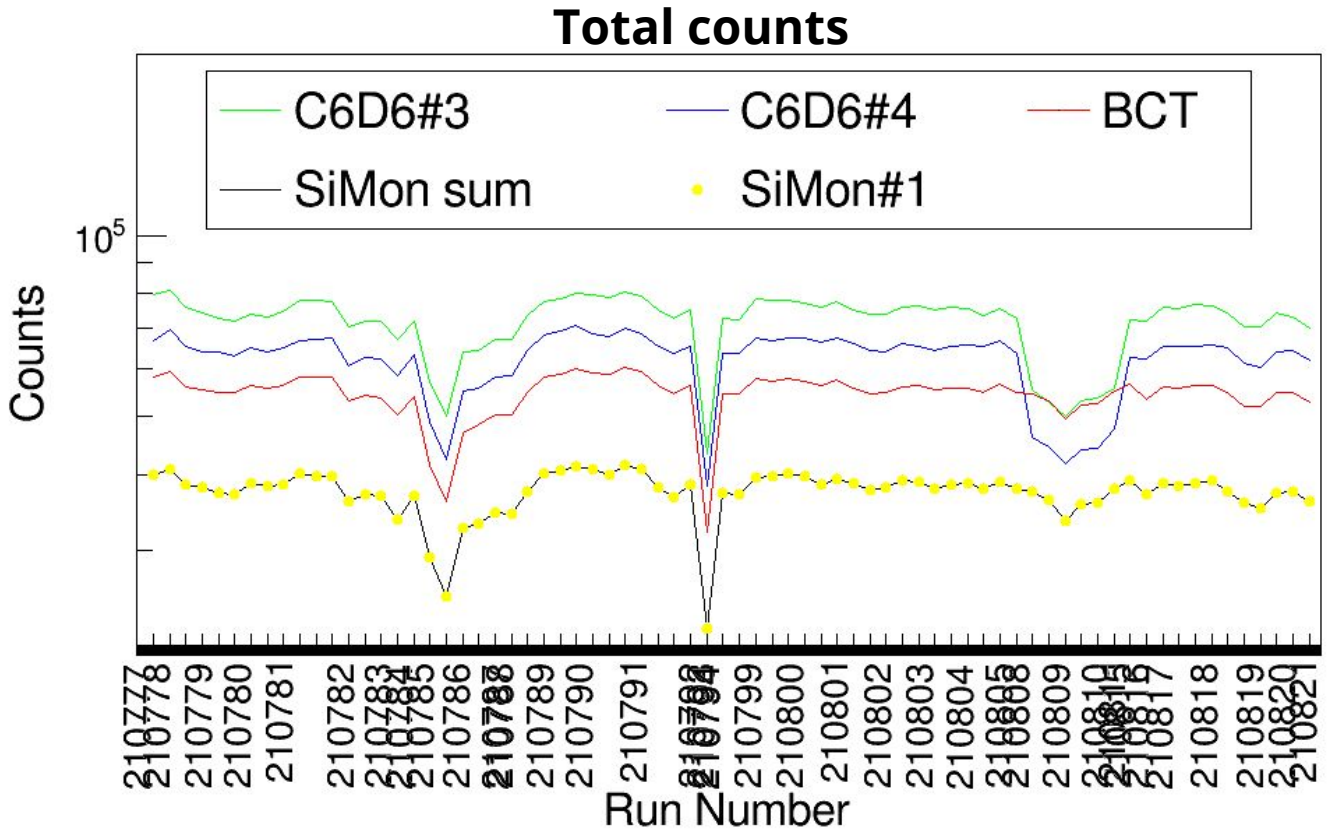


2200 < Amp (ch) < 2800

3e6 < tof (ns) < 1e7

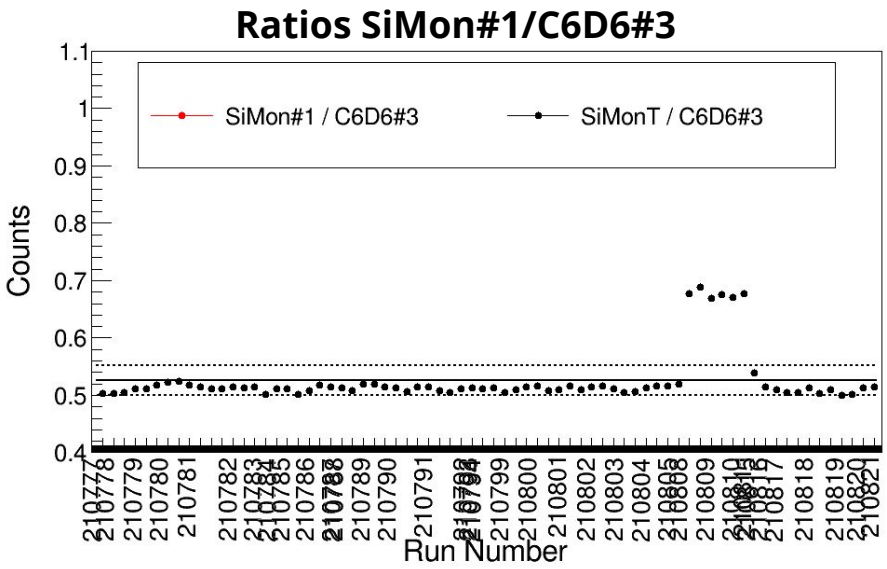
Detectors count rate consistency study

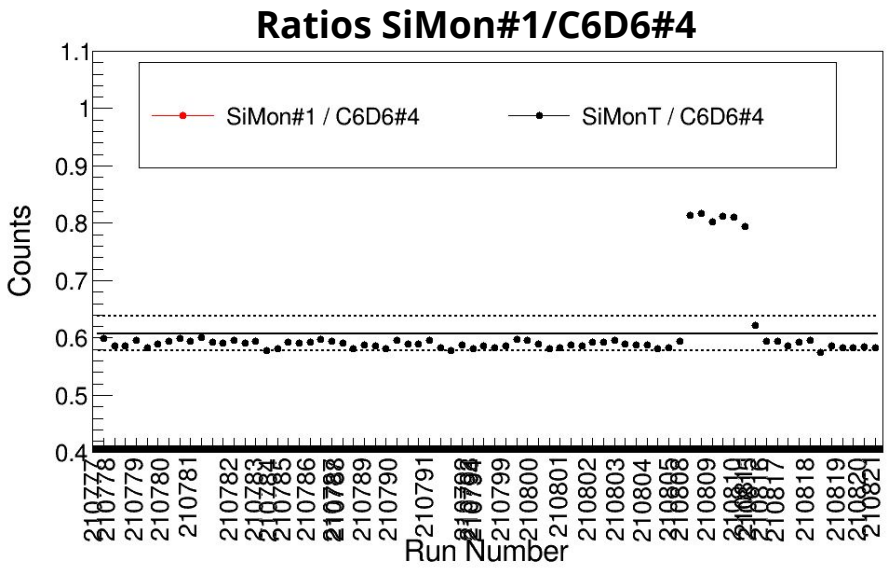
^{93}Nb(n,g)



Detectors count rate consistency study

^{93}Nb(n,g)

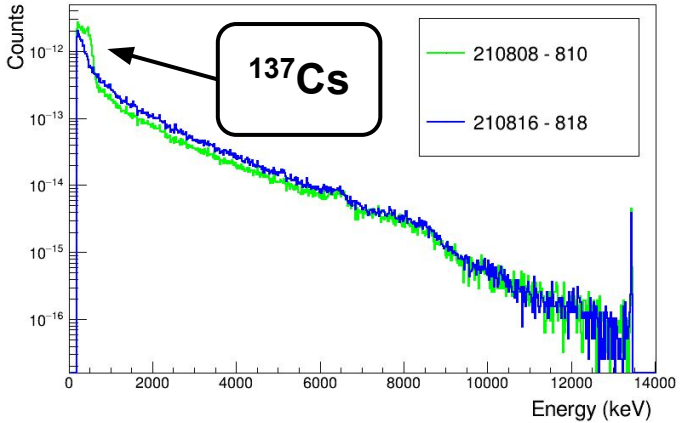




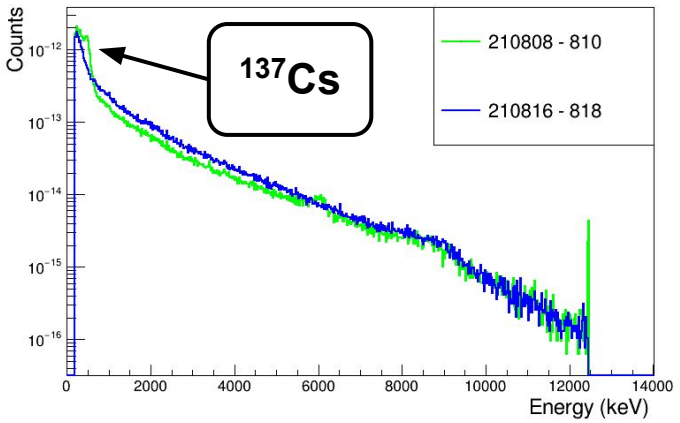
Detectors count rate consistency study

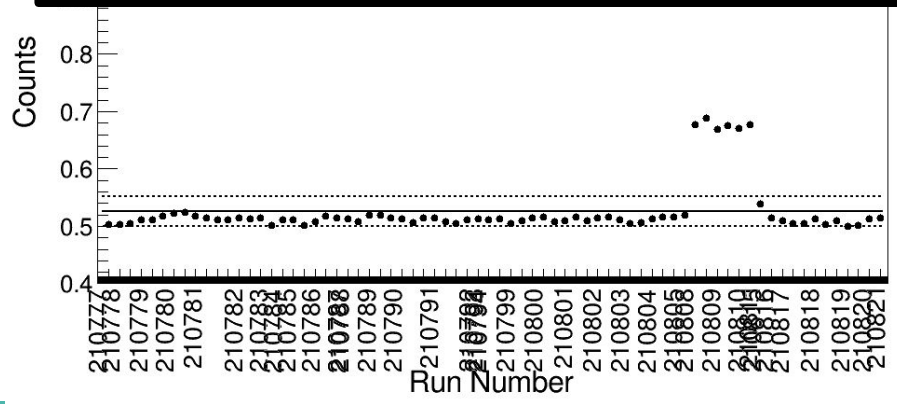
^{93}Nb(n,g)

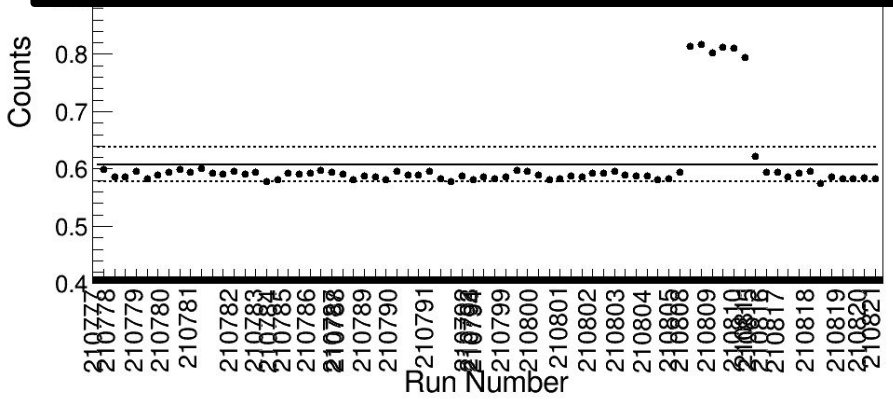
C6D6#3



C6D6#4

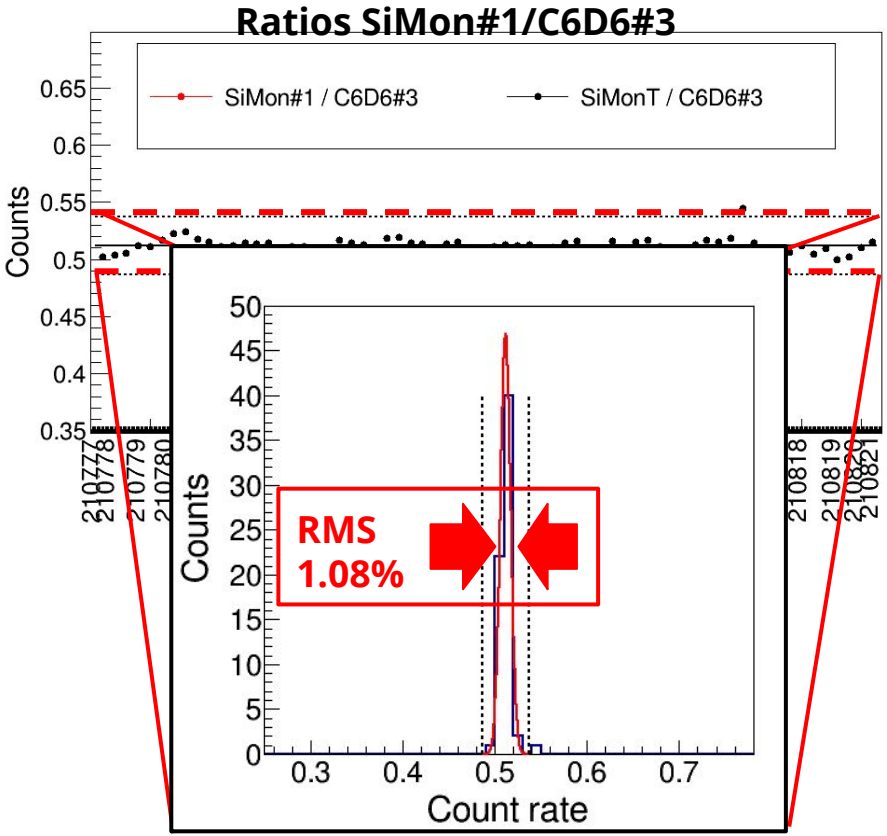


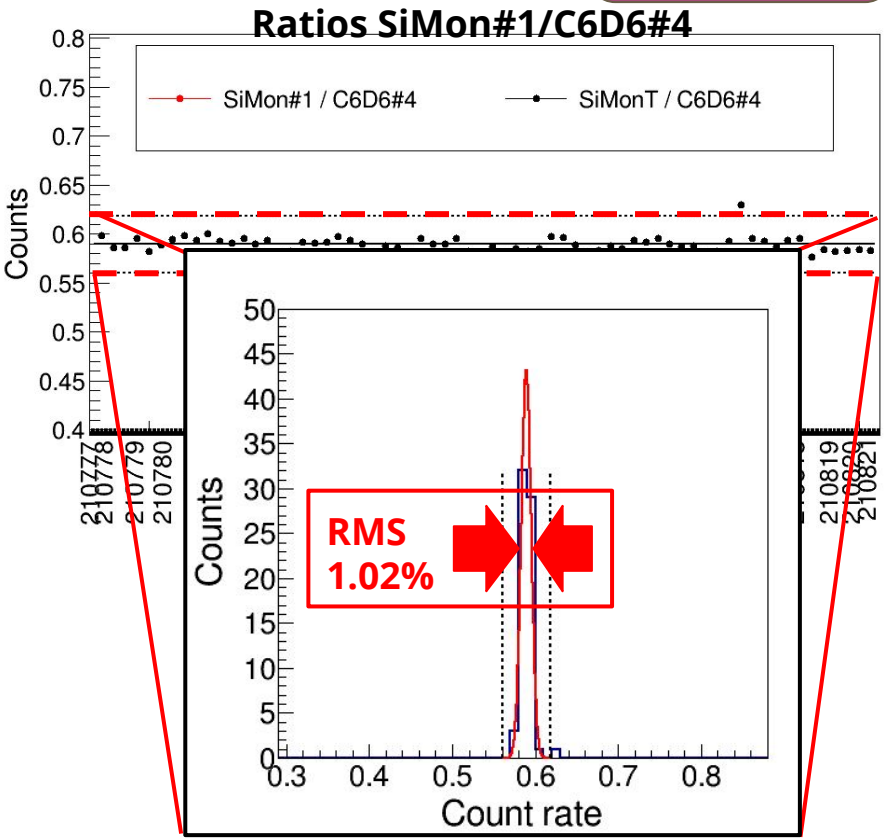




Detectors count rate consistency study

^{93}Nb(n,g)





Detectors count rate consistency study

- Summary of ^{93}Nb(n,g) experiment at EAR 2 under i-TED Commissioning framework.

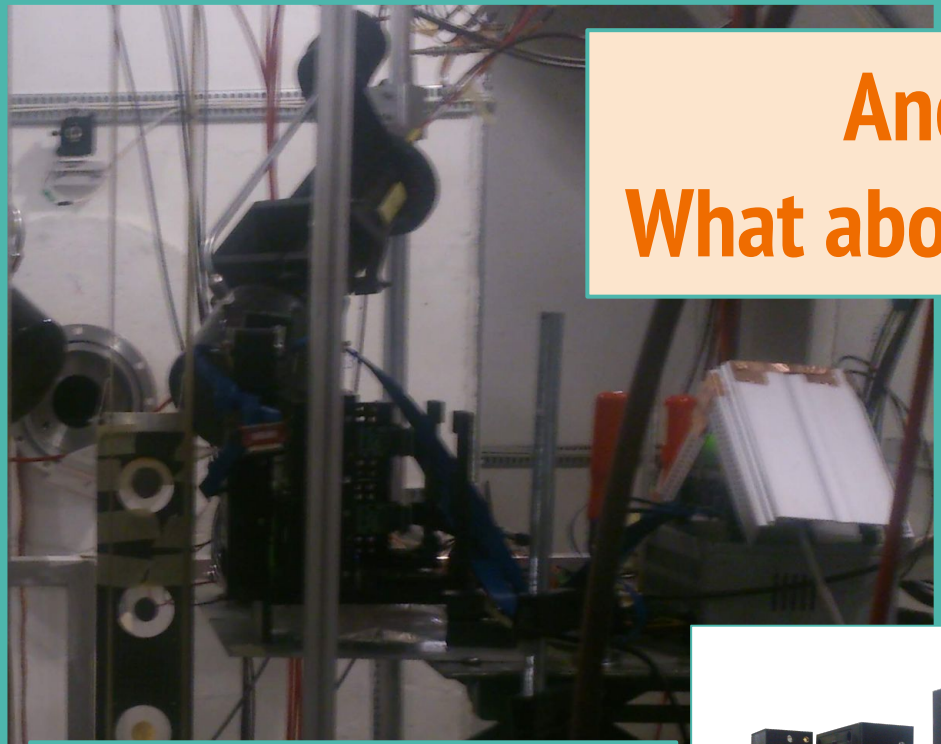
Sample	Total	Good	%
Au	2.117e17	2.117e17	**100**
Fe	5.32e17	5.32e17	**100**
Nb	3.96e17	3.629e17	**92**
Pb	3.36e16	3.36e16	**100**
Empty	1.714e16	1.714e16	**100**

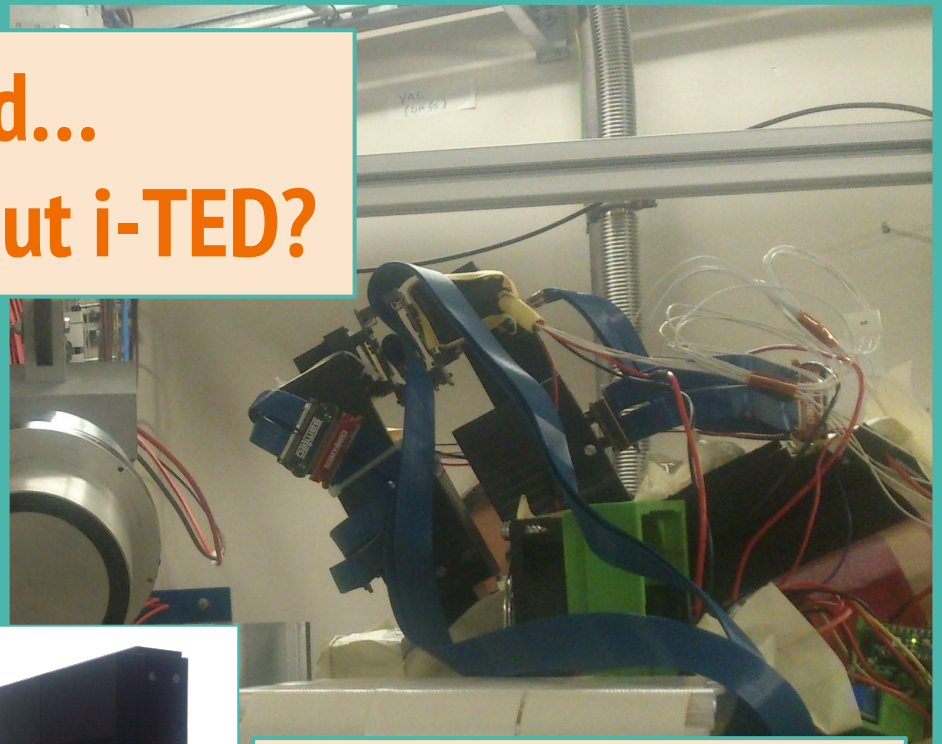
^{80}Se(n,g), ^{56}Fe(n,g) & ^{93}Nb(n,g) experiments C6D6 summary & outlook

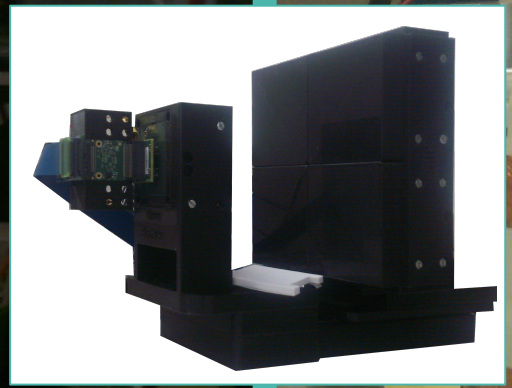
- The **CR consistency** for the **three measurements** 56Fe(n,g), 80Se(n,g) and 93Nb(n,g) **has been checked** and data affected by artifacts have been removed.
- Between **90%** and **100%** of the data taken has been **validated** for further analysis
- Next steps include the following:
  - **MC simulations** and WF calculation.
  - **Background subtraction**.
  - **R-Matrix analysis** with SAMMY

Sample	%
Se	100
Nb	92
Fe	100
Au	99
Pb	91
Empty	100

And...
What about i-TED?



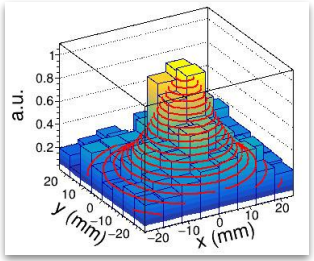




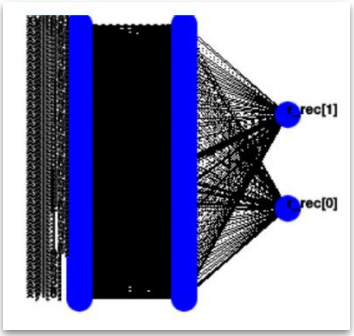
i-TED5.3@EAR1
^{56}Fe(n,g)

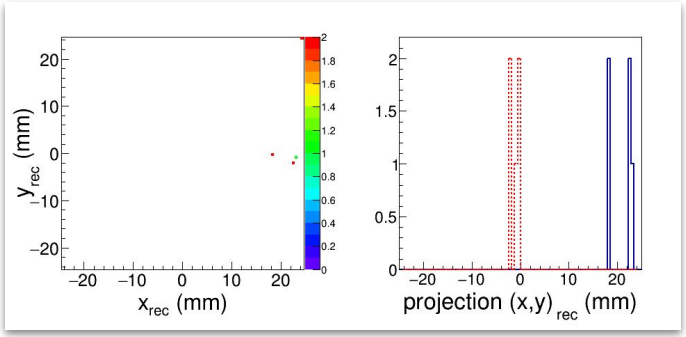
i-TED2@EAR2
^{93}Nb(n,g)

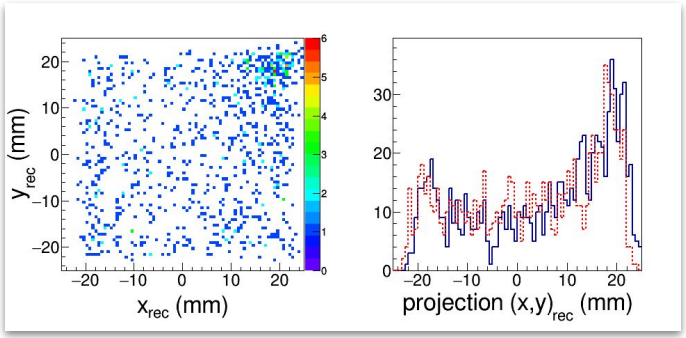
Previous status of the data analysis (Granada,2018)
→ Spatial reconstruction algorithms & characterization

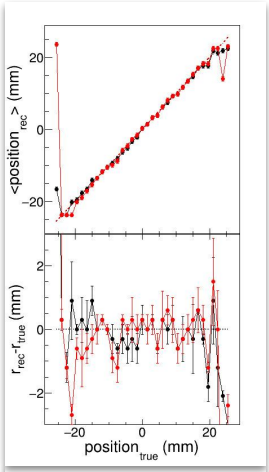


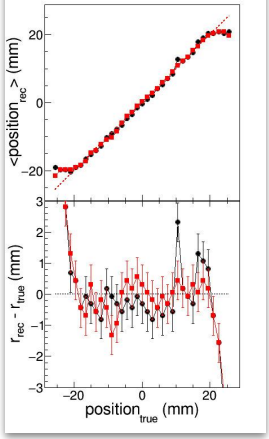
$$L(\vec{r}) \approx \frac{L_0}{(\vec{r}-\vec{r}_0)^2}\alpha e^{-\alpha|\vec{r}-\vec{r}_0|}+\tau, \quad \vec{r}\neq\vec{r}_0$$











i-TED Event Building

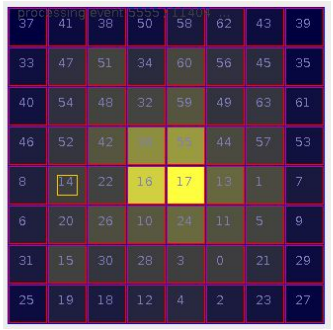
- From raw data (list of t,qdc,pixel#) build spatial distributions, time-distributions and energy distributions

Time stamp	Charge	Channel Id
837615521118	39.307793	314
837615521840	22.796192	269
837615520438	47.001202	290
837615527030	17.206005	291
837615531328	27.408051	308
837615530384	18.038380	296
837615520717	20.365070	270
837615522303	20.798695	272
837615525991	24.875397	299
837615521134	40.175247	305
837615523235	31.679199	300
837615521819	24.025505	257
837615526312	29.457375	319
837615529199	17.035973	293
837615525392	31.773796	303
837615521990	33.147594	311
837615526946	28.818348	313

i-TED Event Building

- From raw data (list of t,qdc,pixel#) build spatial distributions, time-distributions and energy distributions

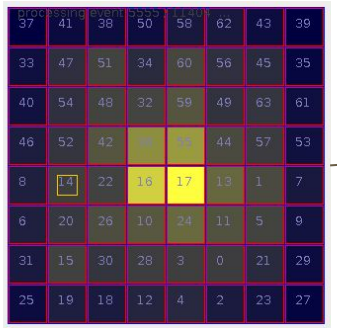
Time stamp	Charge	Channel Id
837615521118	39.307793	314
837615521840	22.796192	269
837615520438	47.001202	290
837615527030	17.206005	291
837615531328	27.408051	308
837615530384	18.038380	296
837615520717	20.365070	270
837615522303	20.798695	272
837615525991	24.875397	299
837615521134	40.175247	305
837615523235	31.679199	300
837615521819	24.025505	257
837615526312	29.457375	319
837615529199	17.035973	293
837615525392	31.773796	303
837615521990	33.147594	311
837615526946	28.818348	313

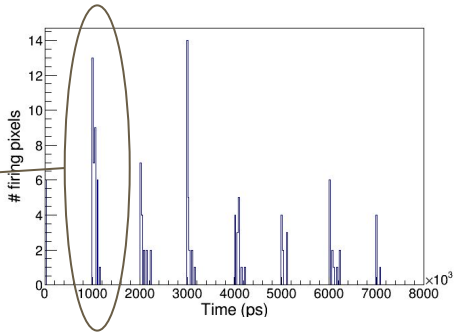


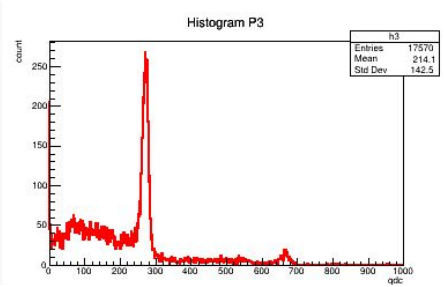
i-TED Event Building

- From raw data (list of t,qdc,pixel#) build spatial distributions, time-distributions and energy distributions

Time stamp	Charge	Channel Id
837615521118	39.307793	314
837615521840	22.796192	269
837615520438	47.001202	290
837615527030	17.206005	291
837615531328	27.408051	308
837615530384	18.038380	296
837615520717	20.365070	270
837615522303	20.798695	272
837615525991	24.875397	299
837615521134	40.175247	305
837615523235	31.679199	300
837615521819	24.025505	257
837615526312	29.457375	319
837615529199	17.035973	293
837615525392	31.773796	303
837615521990	33.147594	311
837615526946	28.818348	313





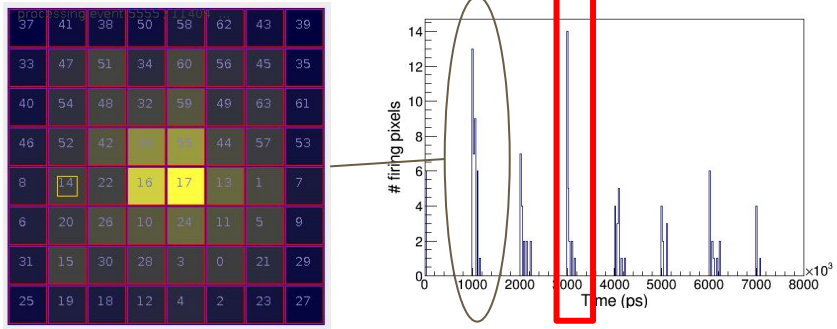


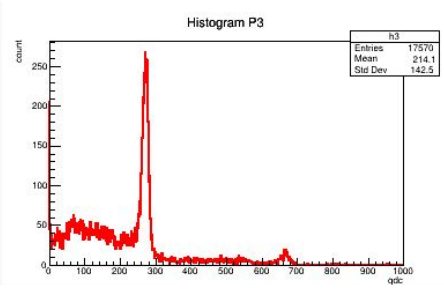
i-TED Event Building

- From raw data (list of t,qdc,pixel#) build spatial distributions, time-distributions and energy distributions

Time stamp	Charge	Channel Id
837615521118	39.307793	314
837615521840	22.796192	269
837615520438	47.001202	290
837615527030	17.206005	291
837615531328	27.408051	308
837615530384	18.038380	296
837615520717	20.365070	270
837615522303	20.798695	272
837615525991	24.875397	299
837615521134	40.175247	305
837615523235	31.679199	300
837615521819	24.025505	257
837615526312	29.457375	319
837615529199	17.035973	293
837615525392	31.773796	303
837615521990	33.147594	311
837615526946	28.818348	313

qdc time-integration window for event building?

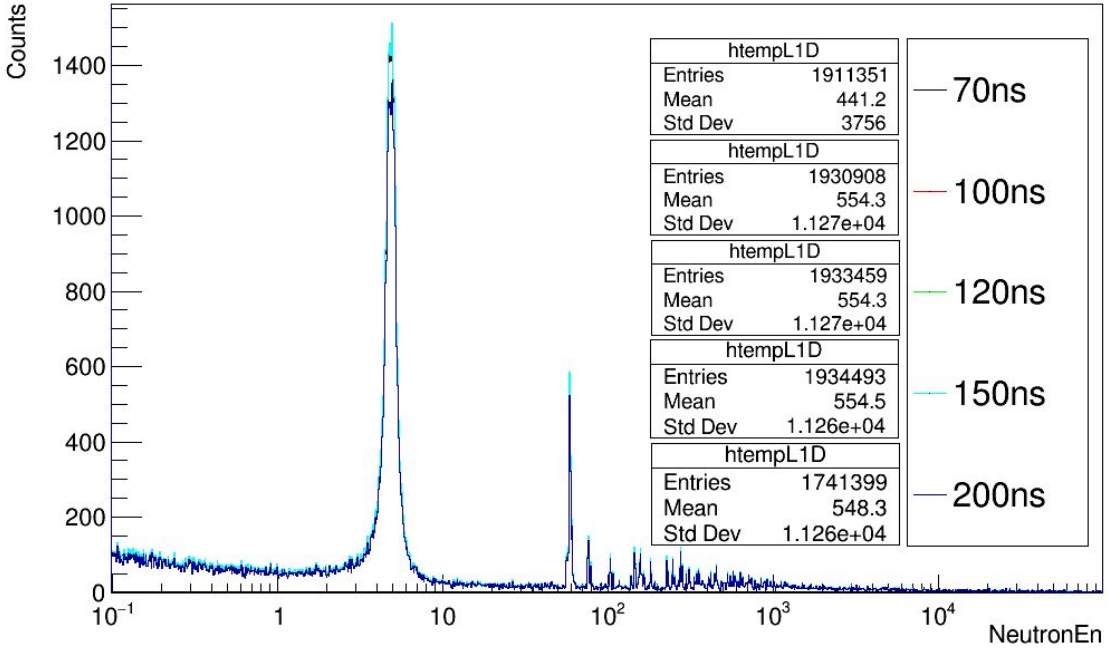




i-TED Event Building

i-TED 5.3 @ EAR1

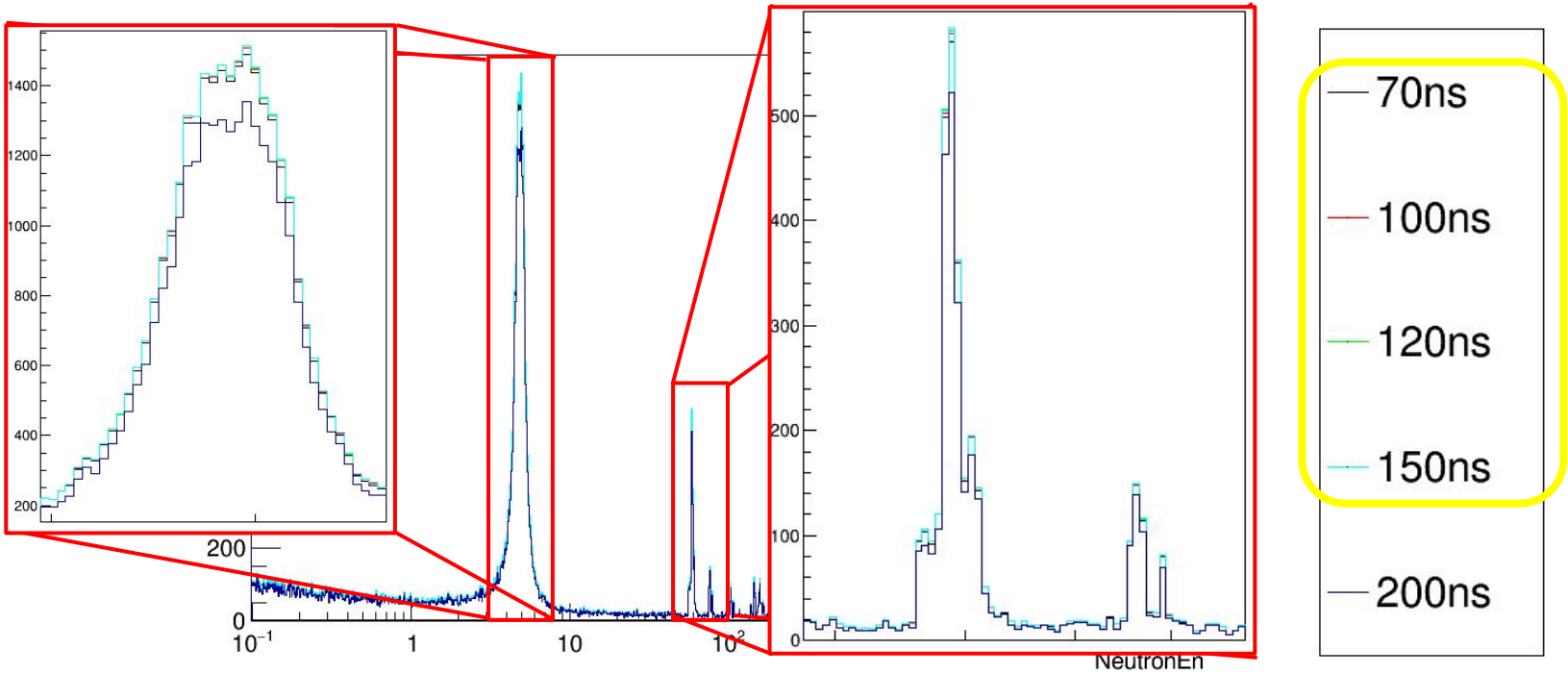
- Attending to the **neutron energy** of the **SCATTERER**:



i-TED Event Building

i-TED 5.3 @ EAR1

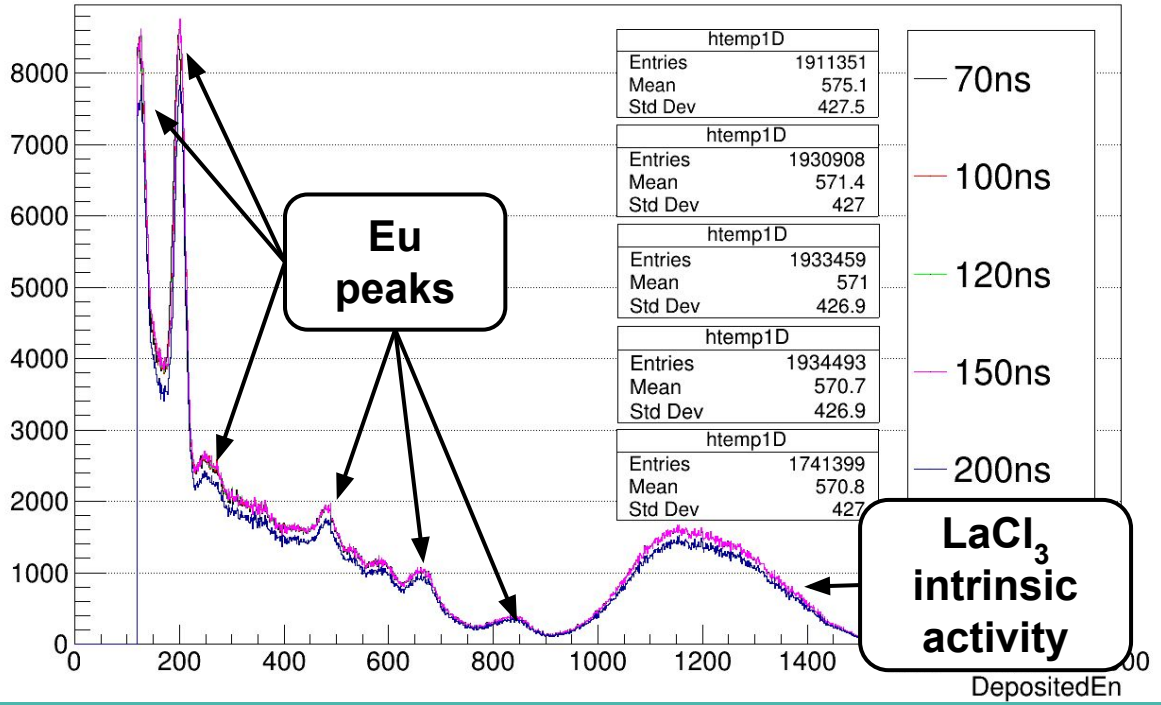
- Attending to the **neutron energy** of the **SCATTERER**:



i-TED Event Building

i-TED 5.3 @ EAR1

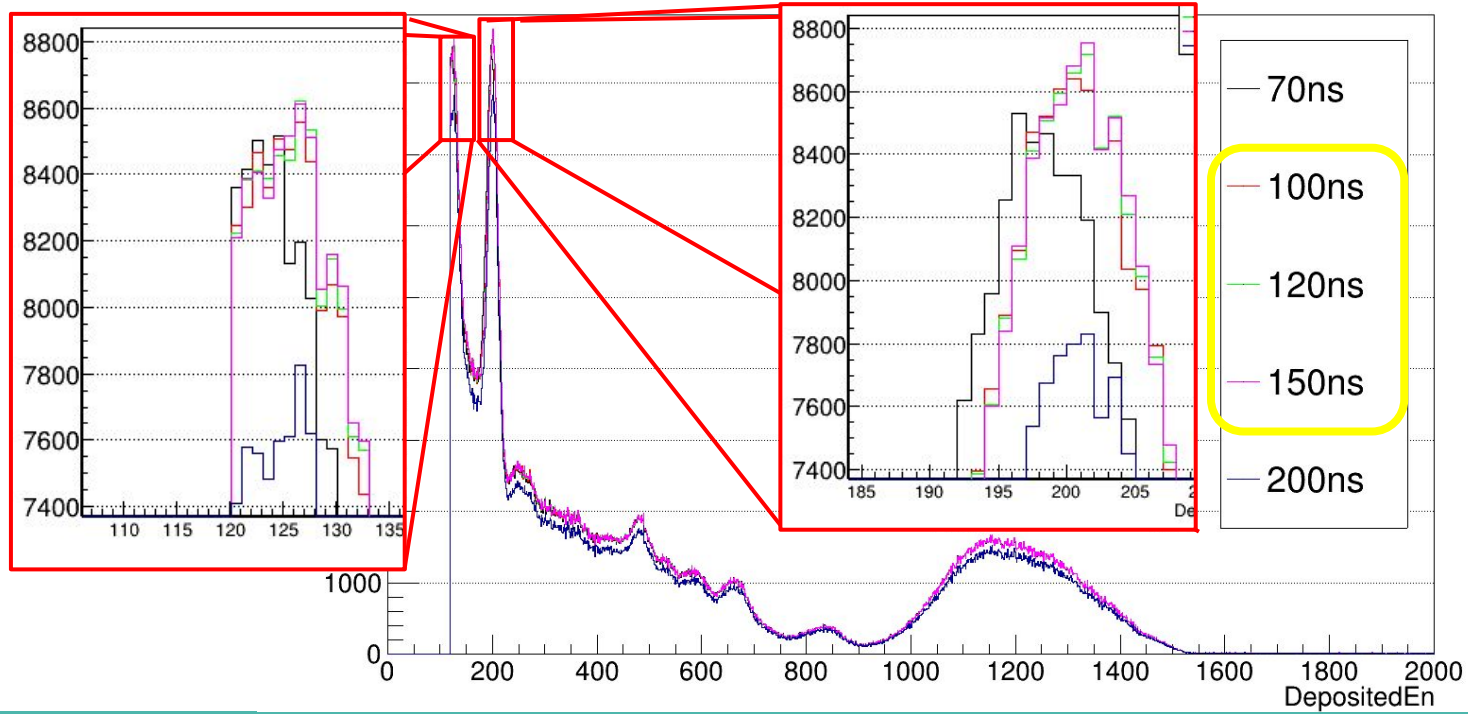
- Attending to the **deposited energy** of the **SCATTERER**:



i-TED Event Building

i-TED 5.3 @ EAR1

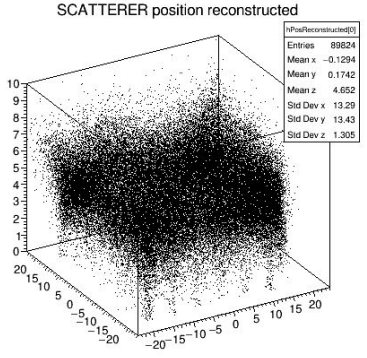
- Attending to the **deposited energy** of the **SCATTERER**:

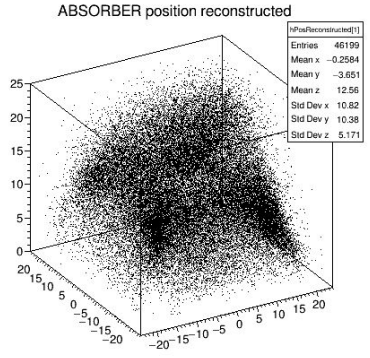


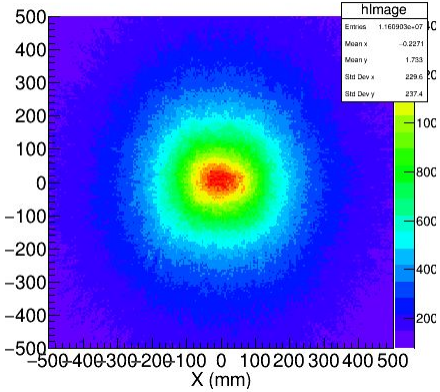
i-TED COINCIDENCE Event Building

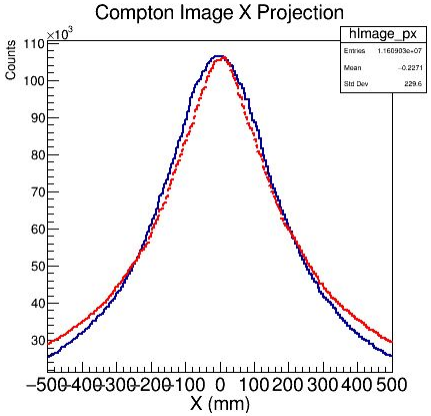
OUTLOOK

- We need to decide which is the best **delta time** value to create the time-**coincidence** events between scatter- and absorber-detector.
- This quantity will be determined taking into account the resolution of the **Compton images**.









i-TED Event Building

SUMMARY

- A systematic study has been carried out with the aim of find the best event-building delta time with i-TED detector.
- For both detectors, the **100 - 150 ns** interval between seems to provide consistent results in terms of En-spectrum and deposited-energy spectra.
- These quantities are comparable with the decay time of the $LaCl_3$(Ce) scintillator crystals.