PRELIMINARY CALIBRATION & PEAK ASSIGNMENT ON ^{136}Ba (OFF-LINE)

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^{152}Eu SPECTRA FOR CALIBRATION (OFF-LINE)

- 18 Oct 2021 – 6 x 1 hour (before ^{nat}Ba)
- 28 Oct 2021 – 6 x 30 s (before ^{136}Ba, supposed to be 6 x 30 mins)
- 12 Nov 2021 – 1 x 30 mins (after ^{76}Se)

PRELIMINARY CALIBRATION USING GENIE2K

- Utilise the full energy calibration function in Genie2K (energy + FWHM calibration)
- The peak is fitted using Gaussian + linear function (no tail)

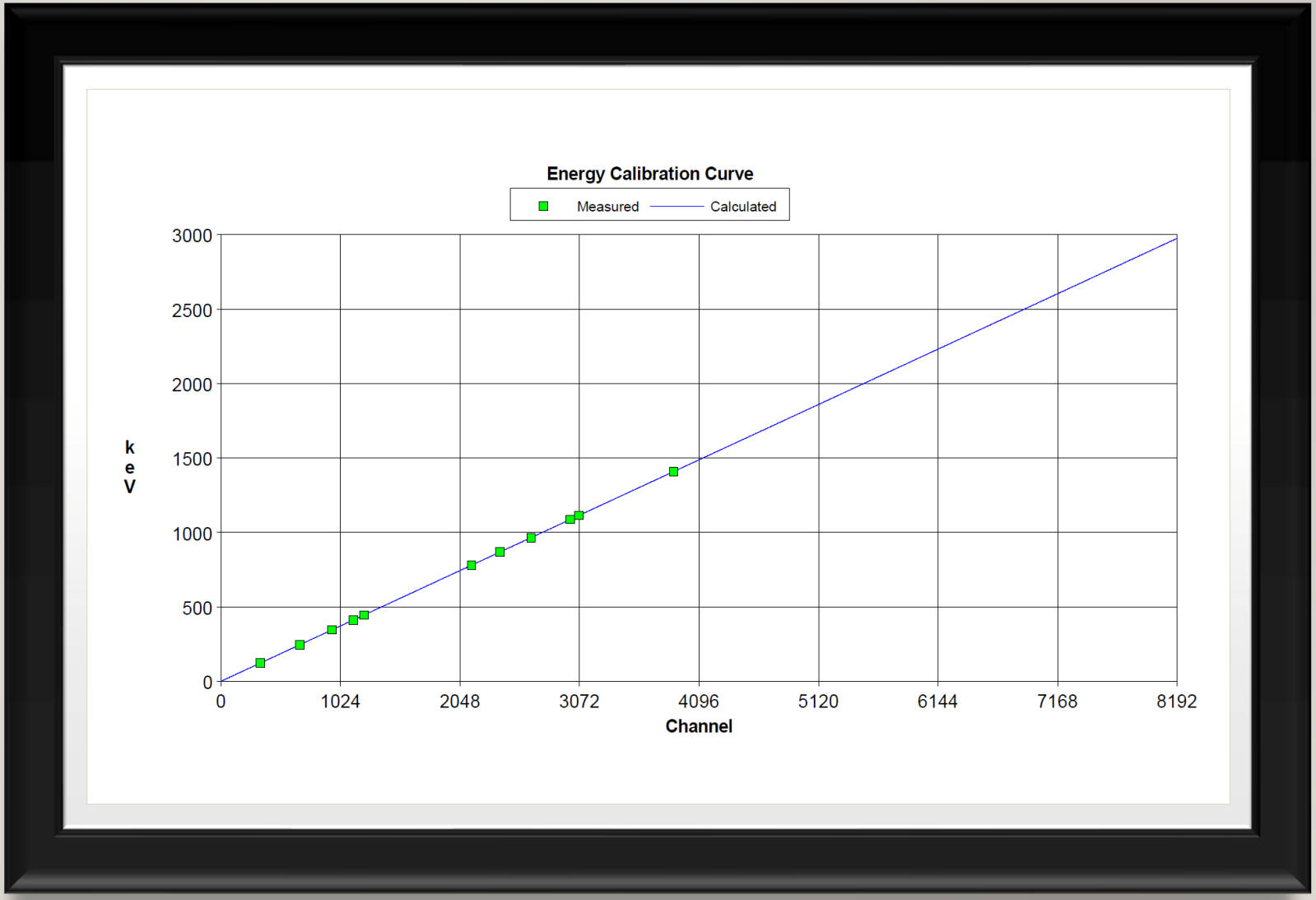
COMPARISON BETWEEN FIRST AND LAST ^{152}Eu SPECTRA

- There's a difference of 10 channels for the peak at 1407.95 keV between first and last ^{152}Eu spectra
- The ^{152}Eu spectra on 28 Oct is similar with the last spectrum.
- Jump to the conclusion, all the spectra since the beginning of ^{nat}Ba measurement have different energy-to-channel ratio from the 1st calibration run

Energy (keV)	Channel	
	18 Oct 2021	12 Nov 2021
121.78	337.75	337.26
244.69	677.13	675.83
344.27	952.05	950.07
411.11	1136.68	1134.16
443.98	1227.29	1224.60
778.89	2151.94	2146.85
867.32	2396.19	2390.38
964.01	2663.07	2656.57
1085.78	2999.04	2991.64
1112.02	3071.66	3064.01
1407.95	3888.56	3878.62

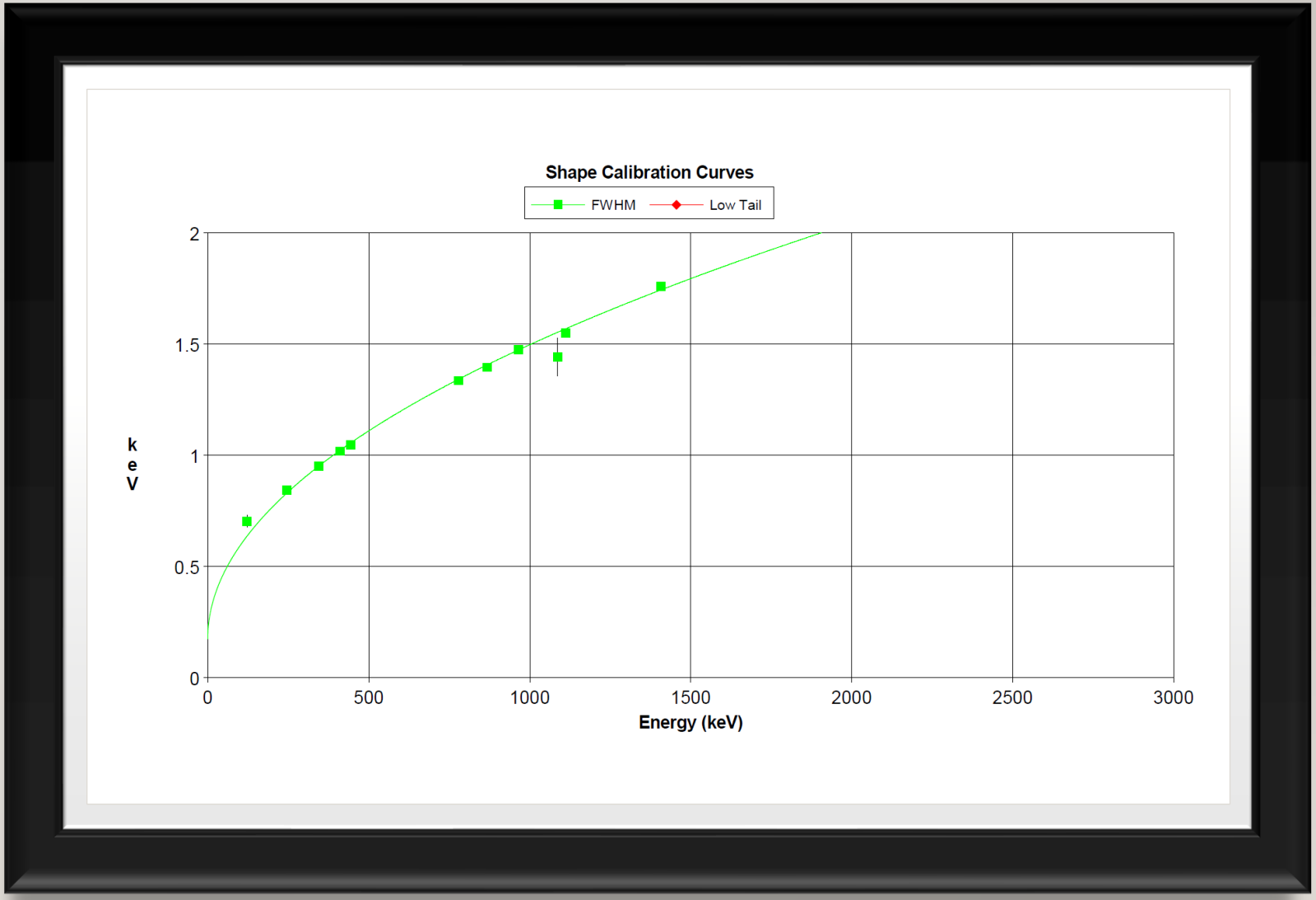
ENERGY CALIBRATION CURVE OF ^{152}Eu SPECTRUM (12 NOV)

Energy = -8.084e-001 keV + 3.632e-001 keV

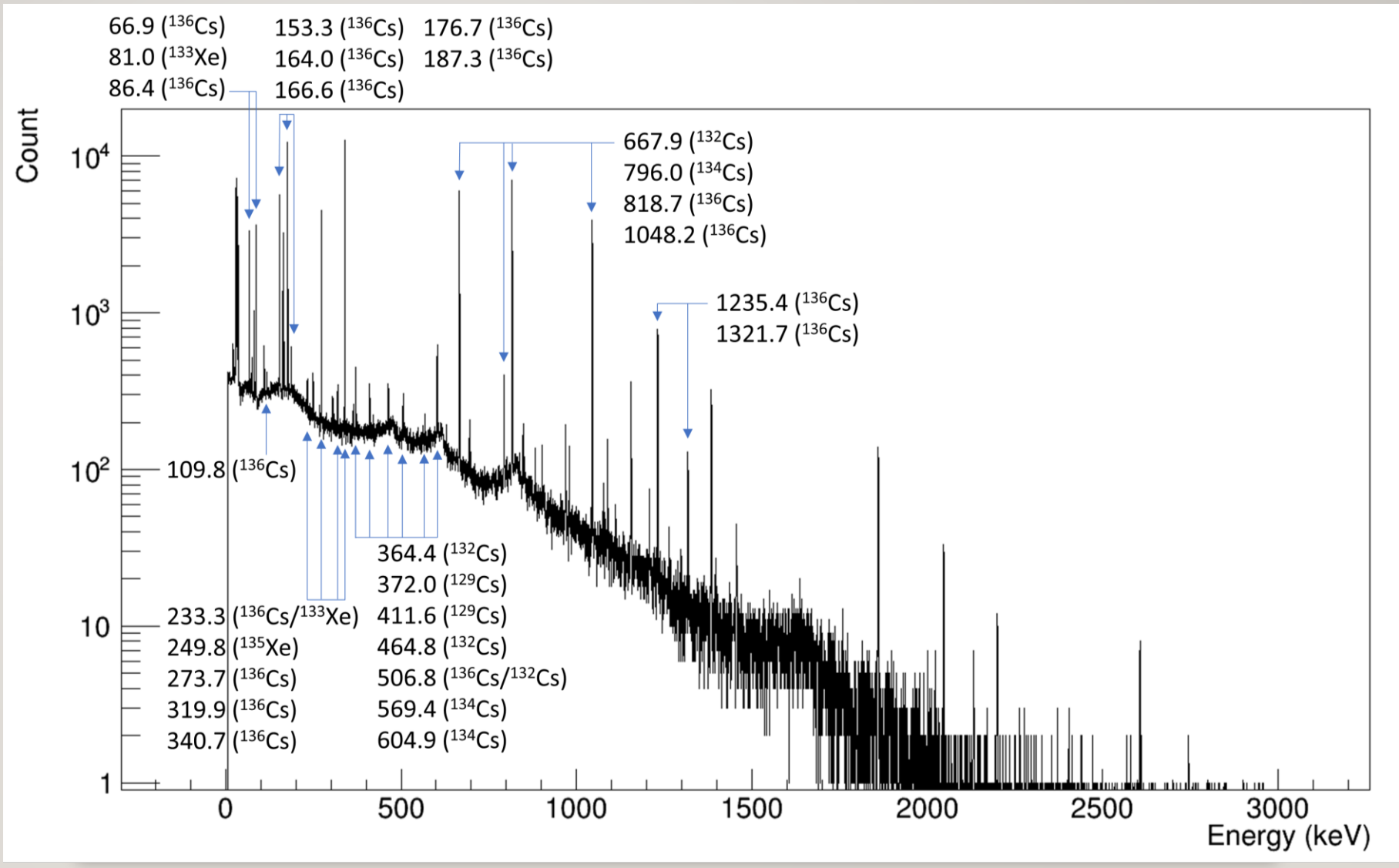


SHAPE CALIBRATION CURVE OF ^{152}Eu SPECTRUM (12 NOV)

FWHM = 1.737e-001 keV + 4.184e-002*E^1/2



^{136}Ba FIRST HOUR SPECTRUM



PEAK ASSIGNMENT ON ^{136}Ba SPECTRA

- $^{136}Ba(\mu^-, \nu)^{136}Cs$ ($T_{1/2}$ = 13.01 days)

E_{true} (keV)	E_{data} (keV)	$E_{data} - E_{true}$ (keV)
66.88	66.88	0
86.36	86.35	- 0.01
109.68	109.83	+ 0.15
153.25	153.29	+ 0.04
163.92	163.96	+ 0.04
166.58	166.64	+ 0.06
176.60	176.65	+ 0.05
187.29	187.34	+ 0.05
233.50	233.32	- 0.18

E_{true} (keV)	E_{data} (keV)	$E_{data} - E_{true}$ (keV)	
273.65	273.70	+ 0.05	
319.91	319.93	+ 0.02	
340.55	340.65	+ 0.10	
507.19	506.78	- 0.41	(overlap)
818.51	818.67	+ 0.16	
1048.07	1048.19	+ 0.12	
1235.36	1235.43	+ 0.07	
1321.58	1321.69	+ 0.11	

PEAK ASSIGNMENT ON ^{136}Ba SPECTRA

- ^{136}Ba(μ^-, νn)^{135}Cs → extremely long $T_{1/2}$ (2.3 x 10^6 years),
  isomeric transition, IT has short $T_{1/2}$ (53 mins)

- ^{136}Ba(μ^-, $\nu 2n$)^{134}Cs ($T_{1/2}$ = 2.0652 years)

E_{true} (keV)	E_{data} (keV)	E_{data} - E_{true} (keV)
569.33	569.44	+ 0.11
604.72	604.86	+ 0.14
795.86	795.97	+ 0.11

PEAK ASSIGNMENT ON ^{136}Ba SPECTRA

- ^{136}Ba(μ^-, $\nu 3n$)^{133}Cs → stable

- ^{136}Ba(μ^-, $\nu 4n$)^{132}Cs ($T_{1/2}$ = 6.48 days)

E_{true} (keV)	E_{data} (keV)	E_{data} - E_{true} (keV)	
363.34	364.44	+ 1.10	(overlap)
464.47	464.81	+ 0.04	
505.79	506.78	+ 0.99	(overlap)
667.71	667.85	+ 0.14	

PEAK ASSIGNMENT ON ^{136}Ba SPECTRA

- ^{136}Ba(μ^-, $\nu 5n$)^{131}Cs → no gamma emission from EC decay
- ^{136}Ba(μ^-, $\nu 6n$)^{130}Cs → short $T_{1/2}$ (29.21 mins or 3.46 mins)
- ^{136}Ba(μ^-, $\nu 7n$)^{129}Cs ($T_{1/2}$ = 32.06 hours)

E_{true} (keV)	E_{data} (keV)	E_{data} - E_{true} (keV)
371.92	371.96	+ 0.04
411.49	411.55	+ 0.06

PEAK ASSIGNMENT ON ^{136}Ba SPECTRA

- ^{136}Ba(μ^-, νp)^{135}Xe ($T_{1/2}$ = 9.14 hours)

E_{true} (keV)	E_{data} (keV)	E_{data} - E_{true} (keV)
249.79	249.79	0

- ^{136}Ba(μ^-, νpn)^{134}Xe → stable, IT has extremely short $T_{1/2}$ (290 ms or 5 μs)

PEAK ASSIGNMENT ON ^{136}Ba SPECTRA

- ^{136}Ba(μ^-, $\nu p2n$)^{133}Xe

E_{true} (keV)	E_{data} (keV)	E_{data} - E_{true} (keV)	$T_{1/2}$ (day)	
81.00	80.99	- 0.01	5.2475	
233.22	233.32	+ 0.10	2.198	(overlap)

- ^{136}Ba(μ^-, $\nu p3n$)^{132}Xe → stable, IT has extremely short $T_{1/2}$ (8.39 ms)

THINGS TO DO

- Try the calibration using local Gaussian + linear + tail + erfc fit
- Calculate number of isotopes, $N(X')$ produced per hour for each assigned peak
- Plot $N(X')$ vs irradiation time, then obtain $N_0(X')$ and isotopic lifetime
- Repeat all procedures for ^{nat}Ba

THANK YOU