Preliminary Zn(n,p)Cu Data

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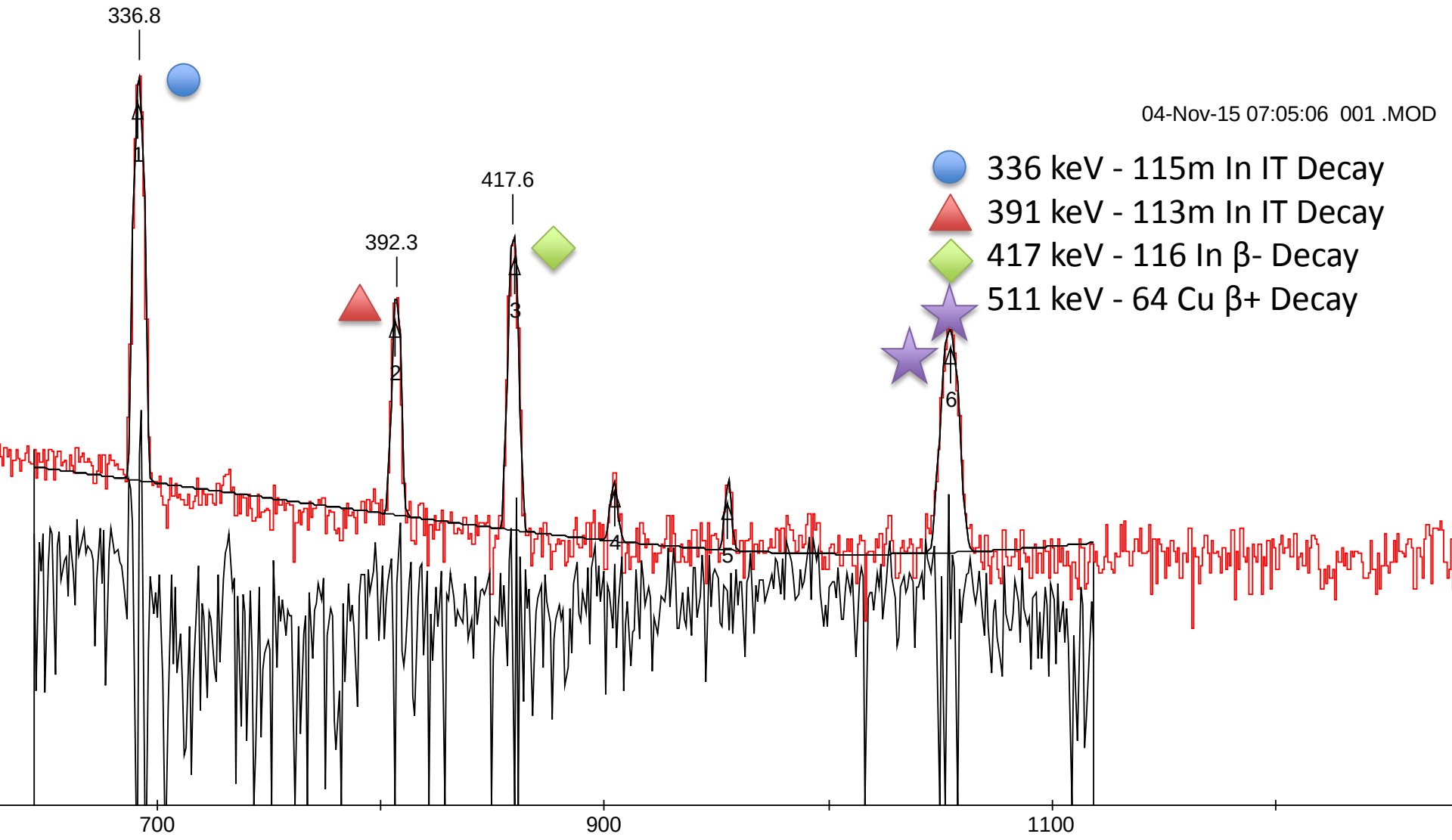
22 February 2016

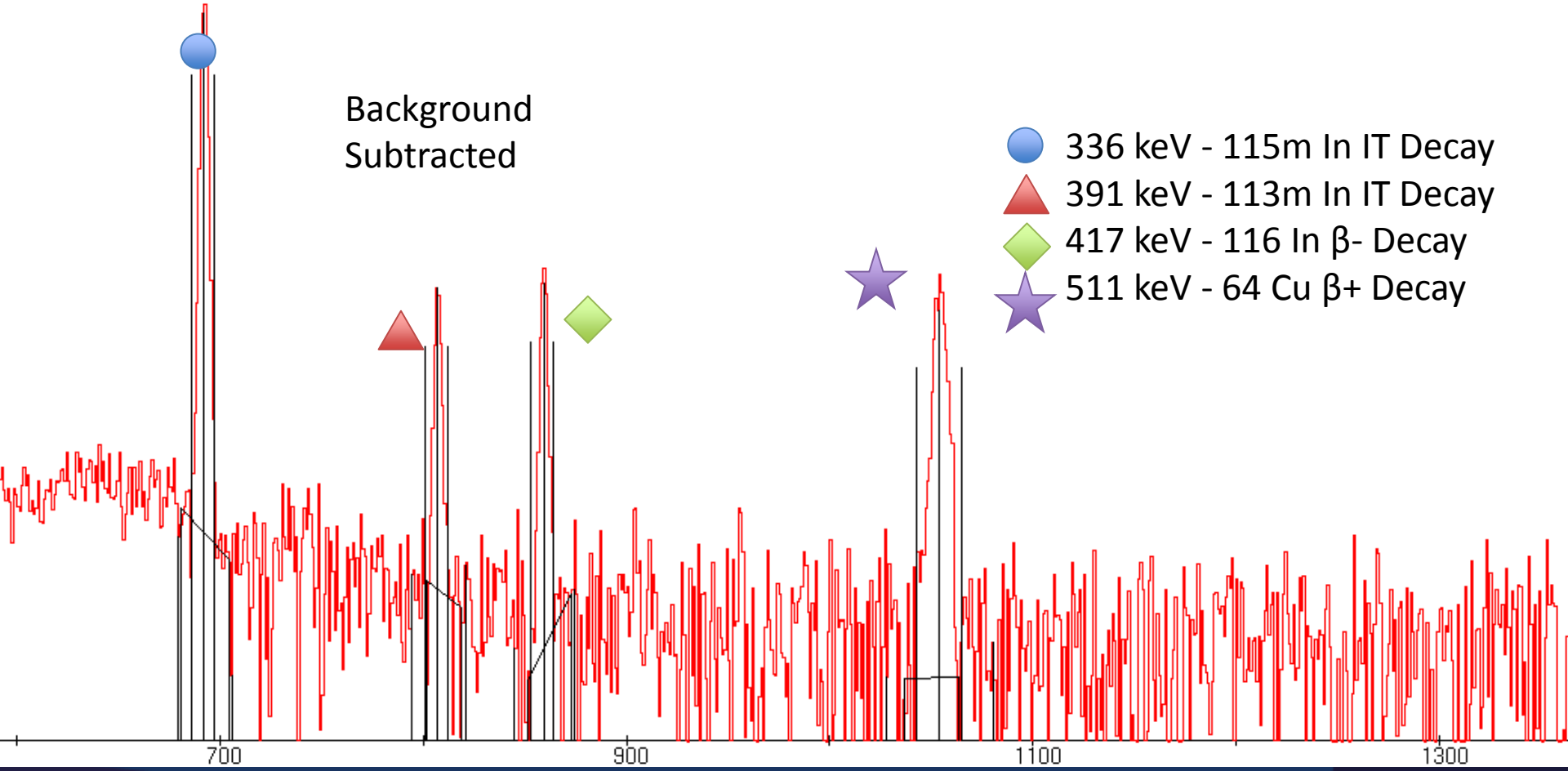
Berkeley
UNIVERSITY OF CALIFORNIA

Experimental Setup – 03 Nov 2015

- Zinc
  - Thickness: 1.03 ± 0.01 mm
  - Diameter: 9.90 ± 0.15 mm
  - Weight: 0.5375 ± 0.0001 g
- Indium
  - Thickness: 0.48 ± 0.02 mm
  - Diameter: 9.77 ± 0.12 mm
  - Weight: 0.2475 ± 0.0001 g
- Beam On: 2:13:16 PM
- Beam Off: 5:13:16 PM
- Start of Counting: 5:43:01 PM

Polyethylene


336.8
392.3
417.6
1
2
3
4
5
6
04-Nov-15 07:05:06 001 .MOD
336 keV - 115m In IT Decay
391 keV - 113m In IT Decay
417 keV - 116 In β- Decay
511 keV - 64 Cu β+ Decay
700
900
1100



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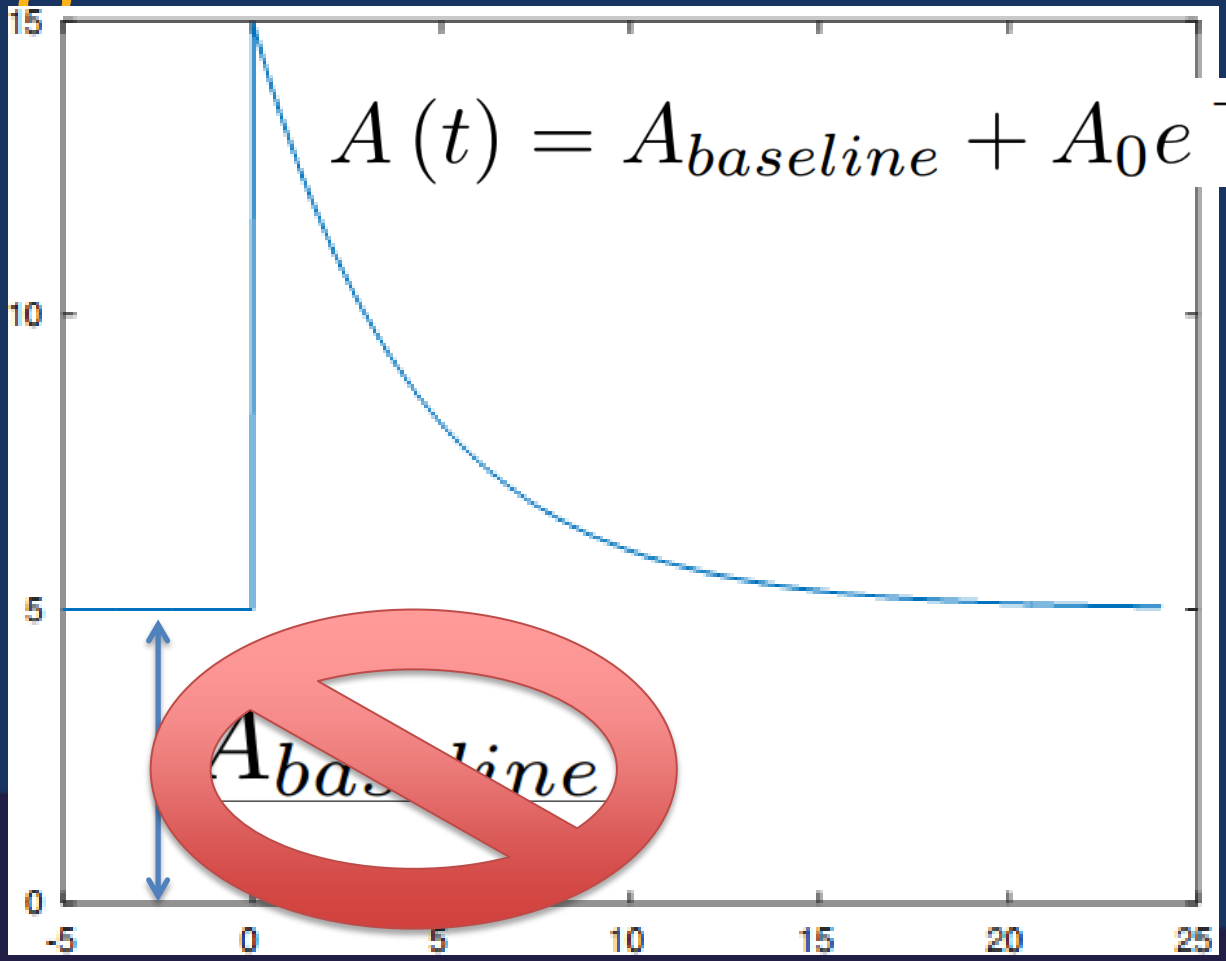
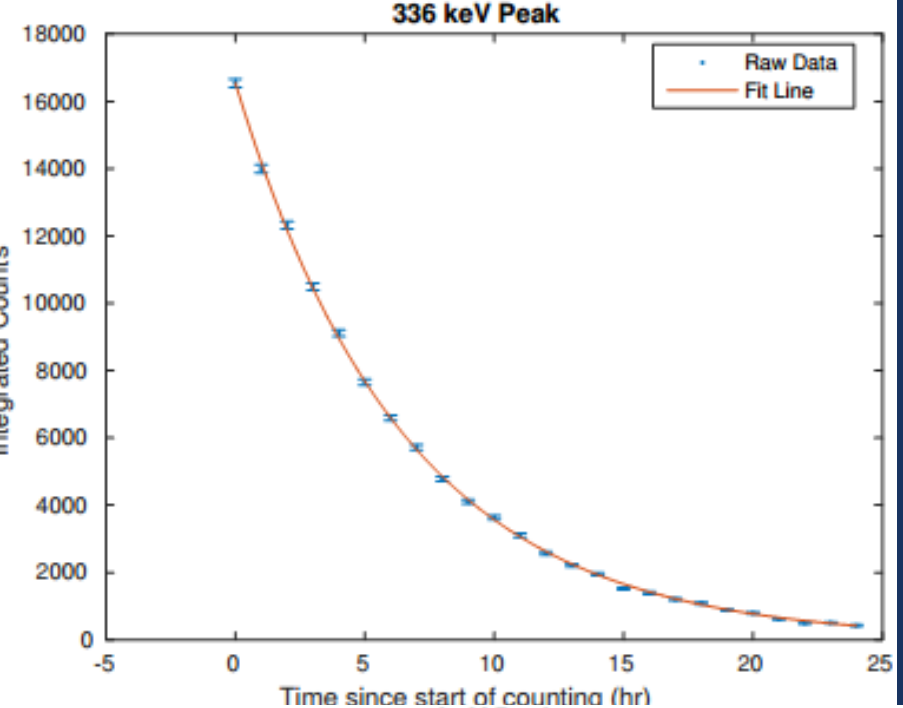
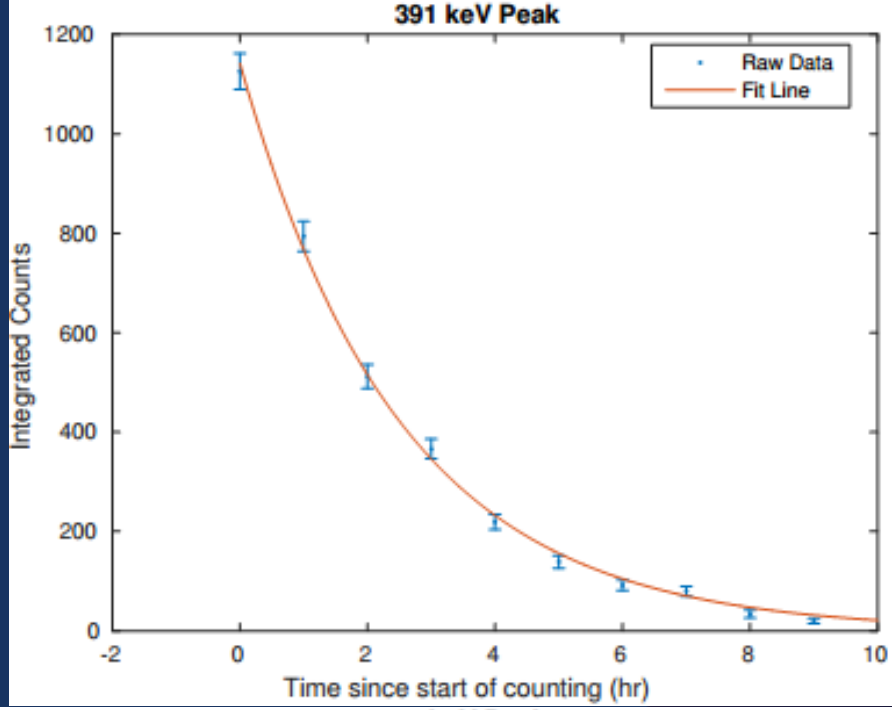
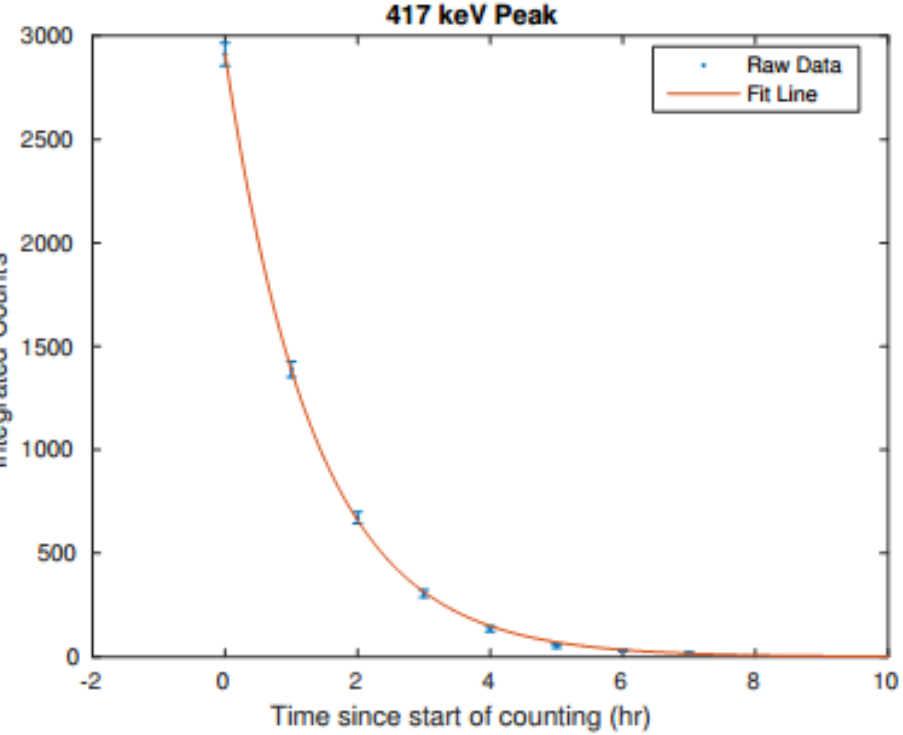
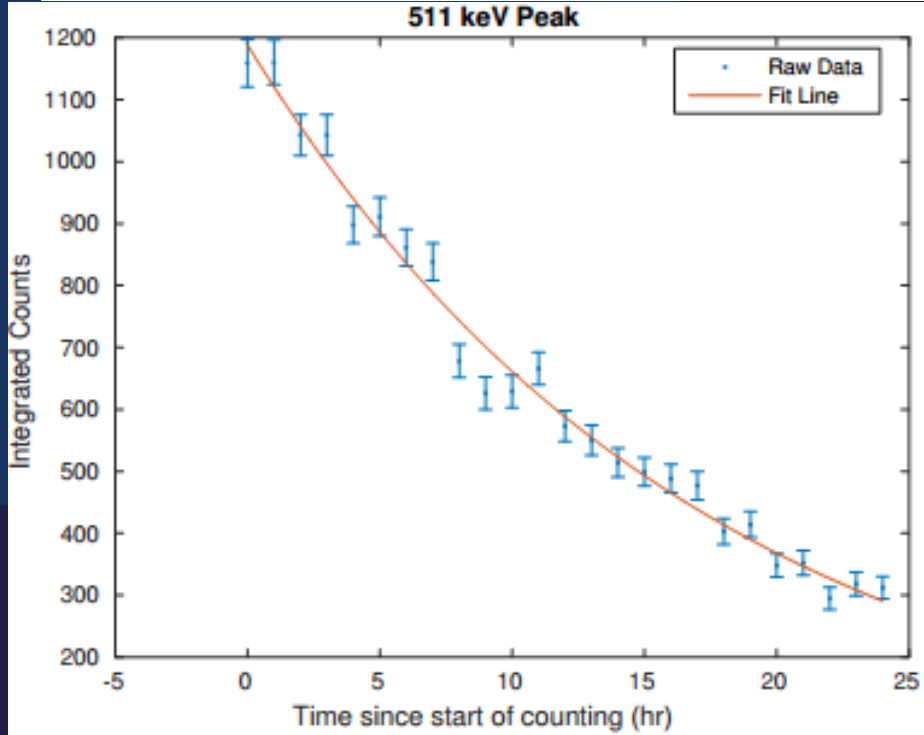
Fitting to Model




336 keV Peak
Raw Data
Fit Line
Integrated Counts
Time since start of counting (hr)

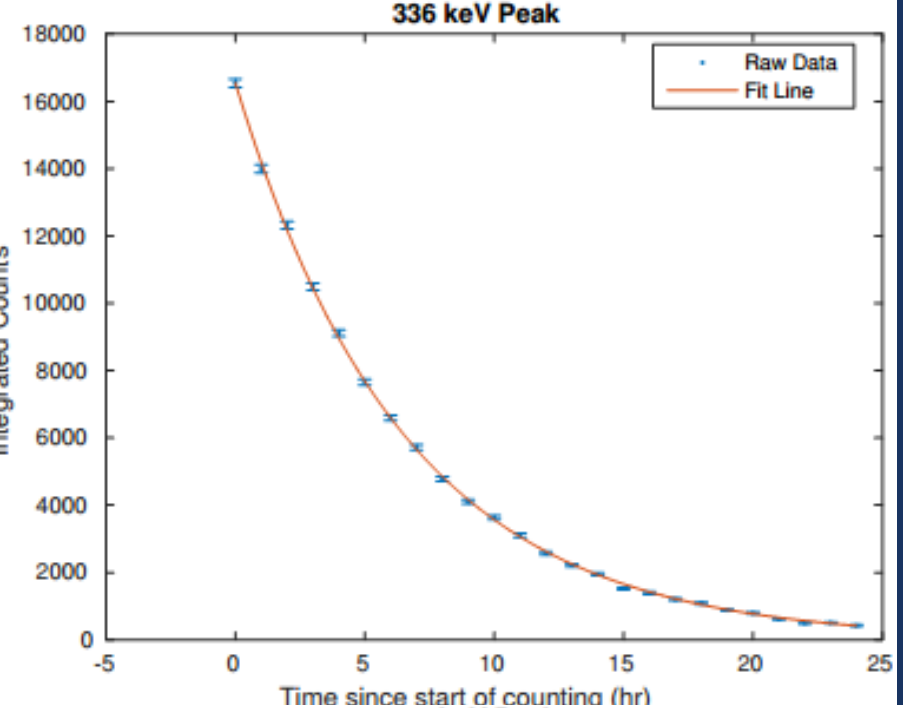

391 keV Peak
Raw Data
Fit Line
Integrated Counts
Time since start of counting (hr)

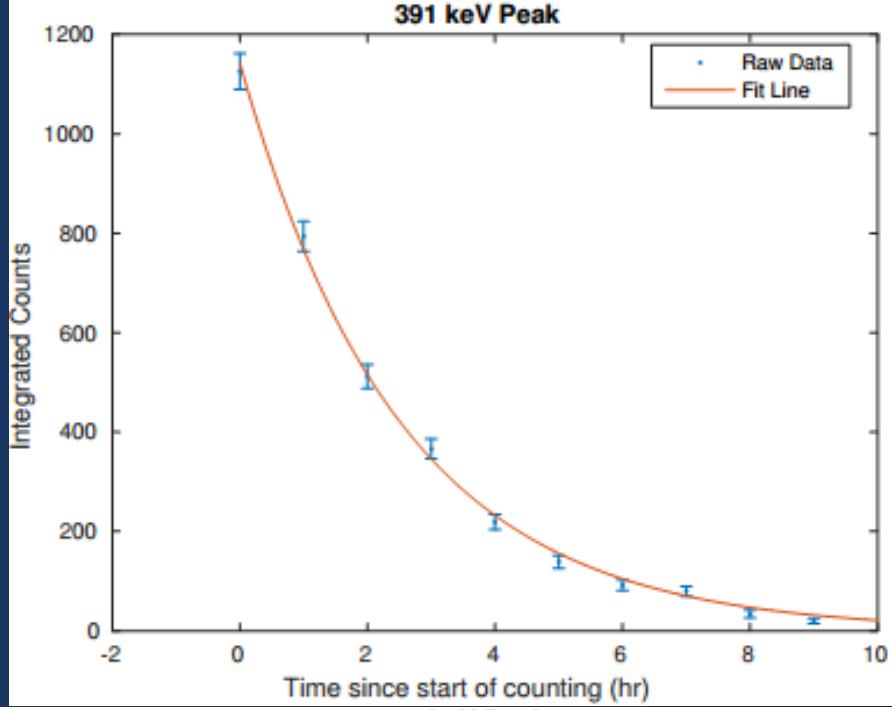

417 keV Peak
Raw Data
Fit Line
Integrated Counts
Time since start of counting (hr)

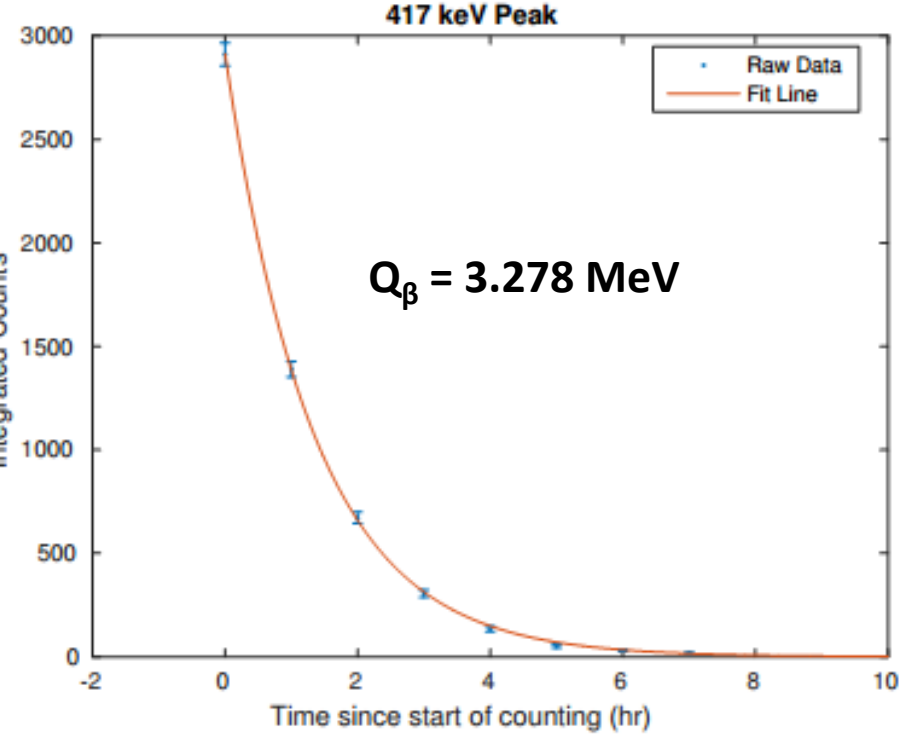

511 keV Peak
Raw Data
Fit Line
Integrated Counts
Time since start of counting (hr)

Results

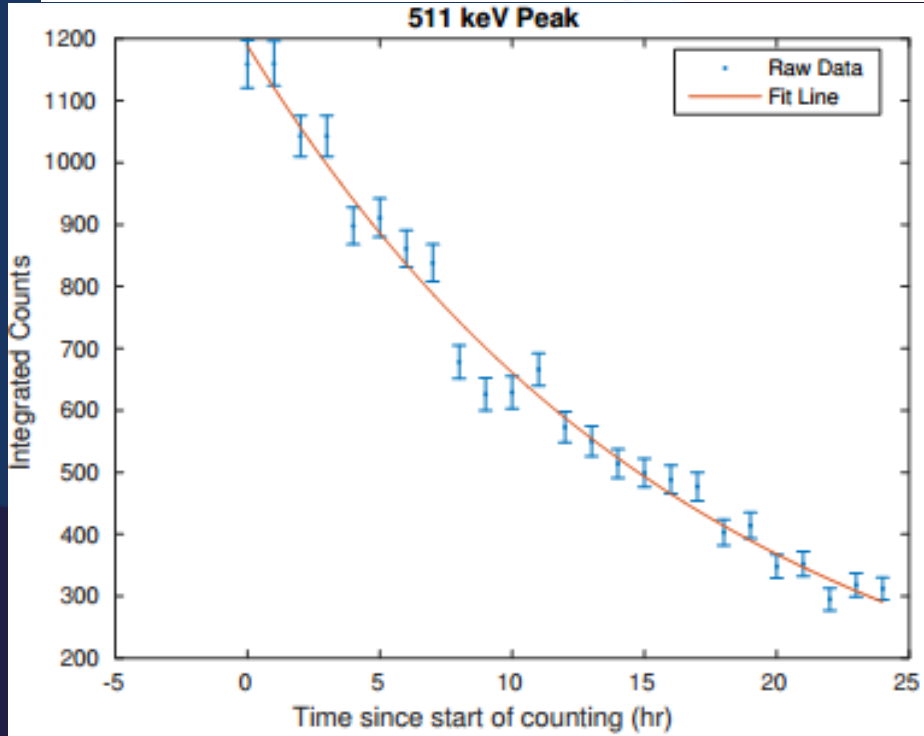
	T ½ (ENSDF)	T ½ (Measured)				X^2/DoF	#σ above ENSDF
Counts (336 keV)	**4.486 h**	**4.519**	**±**	**0.0457**	**h**	**1.7286**	0.722
Counts (391 keV)	**99.476 m**	**104.5208**	**±**	**5.6701**	**m**	**1.721**	0.890
Counts (417 keV)	**54.29 m**	**52.0074**	**±**	**2.6139**	m	**1.021**	-0.873
Counts (511 keV)	**12.701 h**	**11.8183**	**±**	**0.7027**	**h**	**1.6785**	-1.256





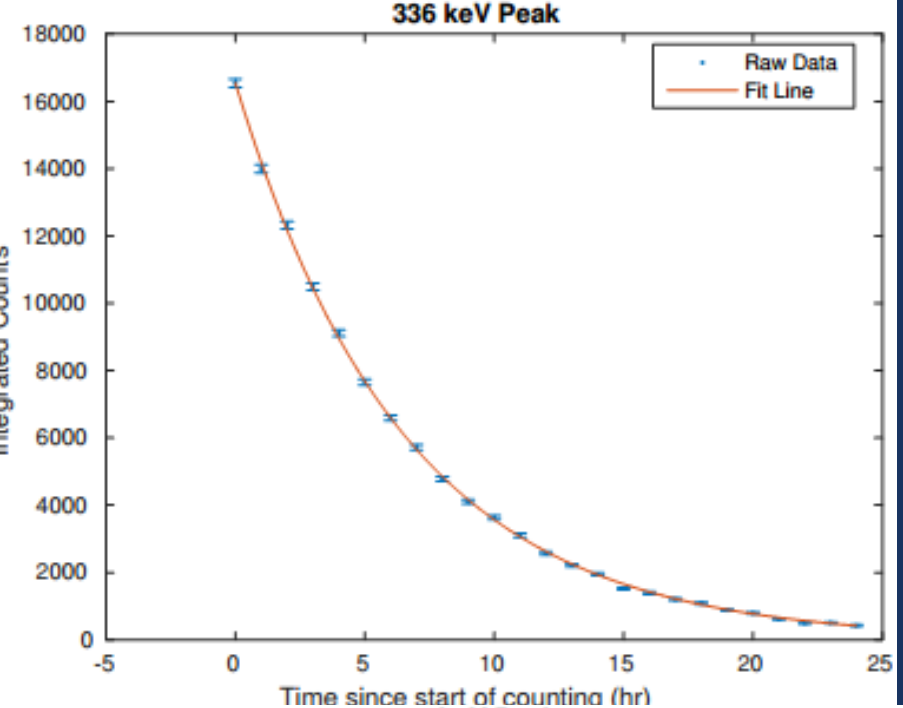


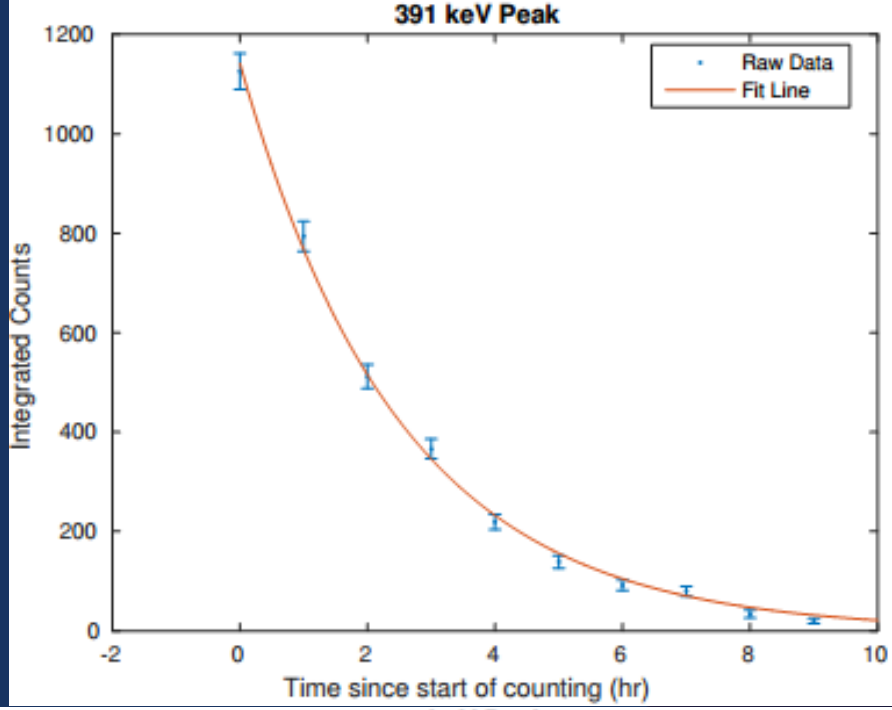
$Q_\beta = 3.278$ MeV

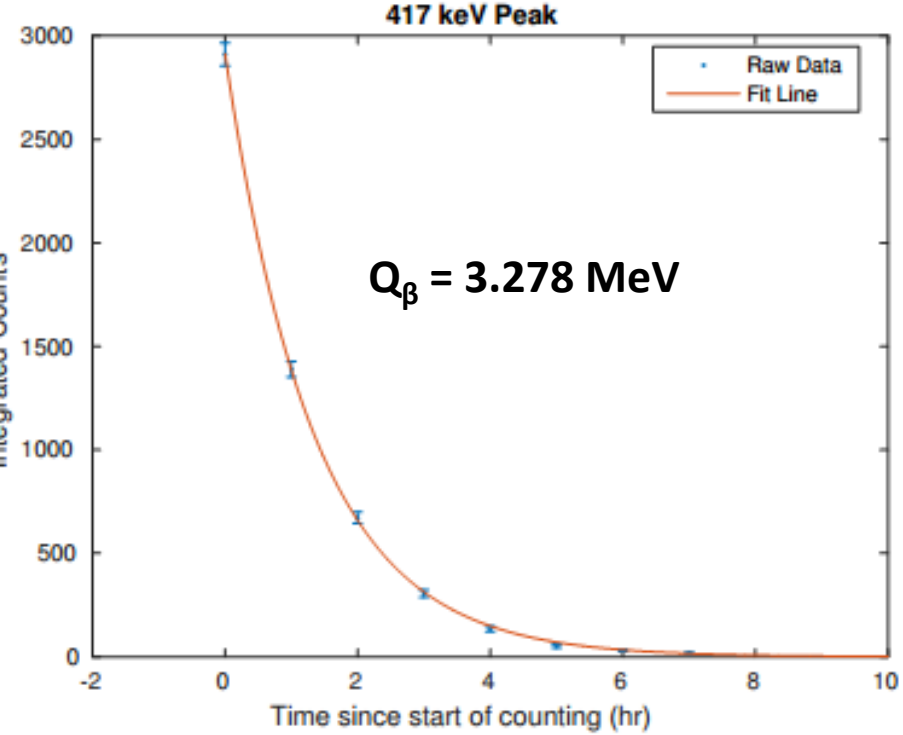


Experimental Setup – 11 Feb 2016

- Zinc
  - Thickness: 1.03 ± 0.01 mm
  - Diameter: 9.85 ± 0.15 mm
  - Weight: 0.4514 ± 0.0001 g
- Indium
  - Thickness: 0.51 ± 0.02 mm
  - Diameter: 9.786± 0.12 mm
  - Weight: 0.2481± 0.0001 g
- Beam On: 2:40:30 PM
- Beam Off: 6:02:00 PM
- Start of Counting: 6:37:25 PM







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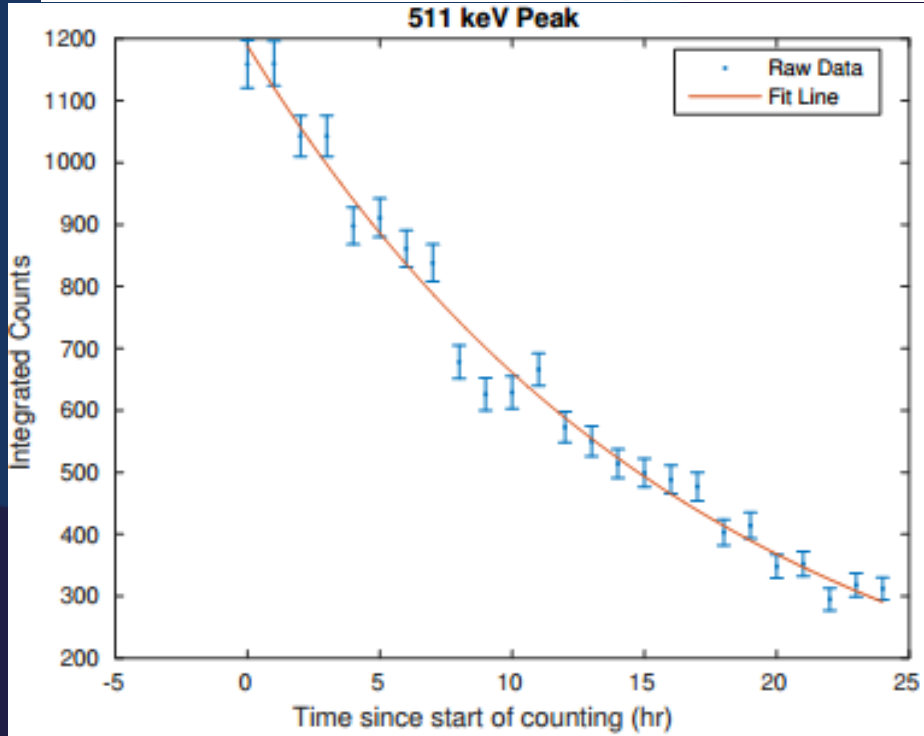

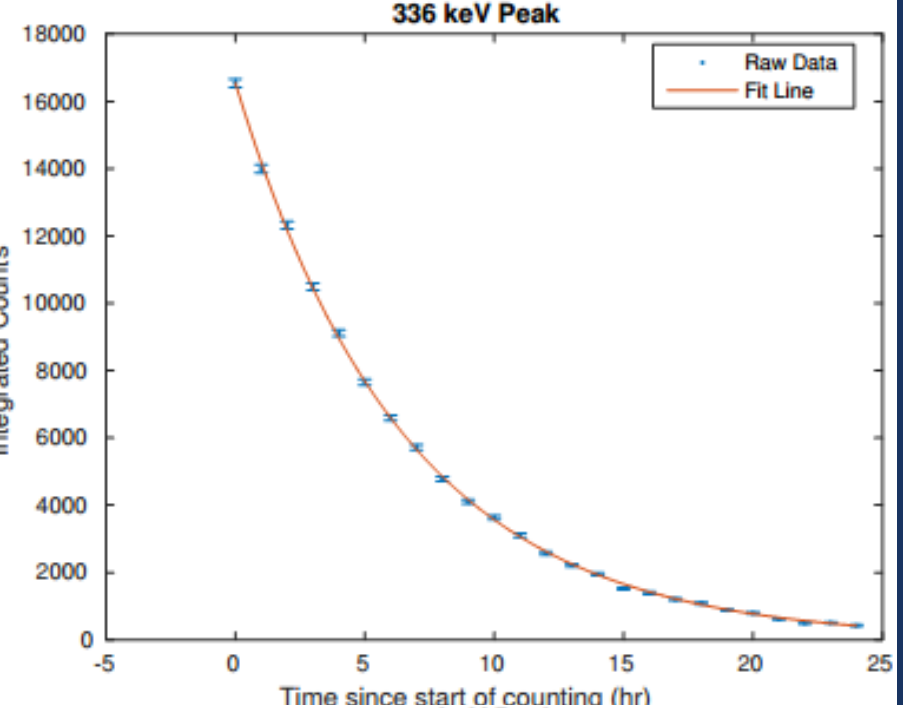

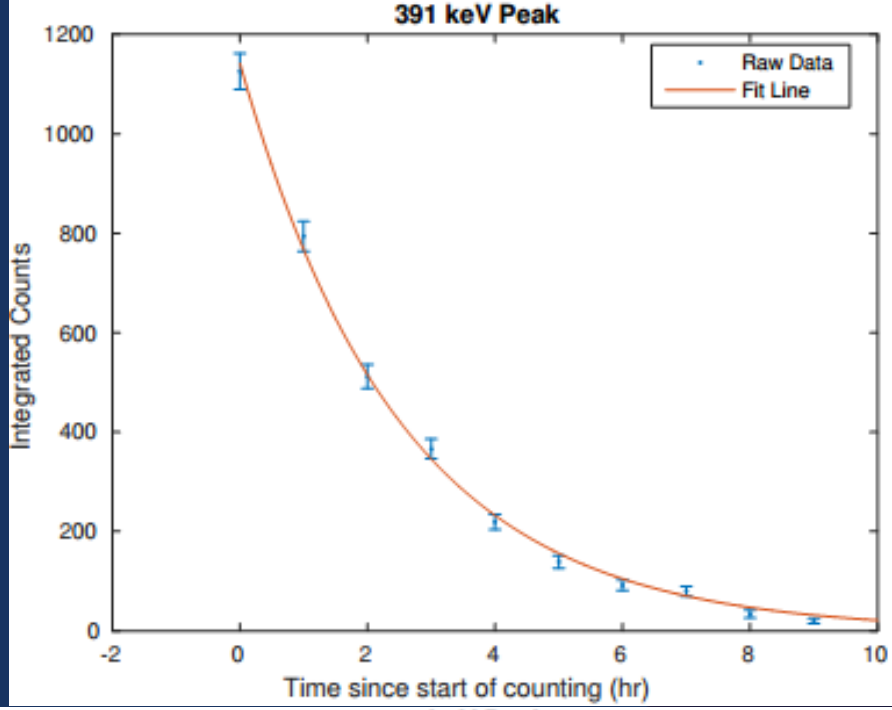

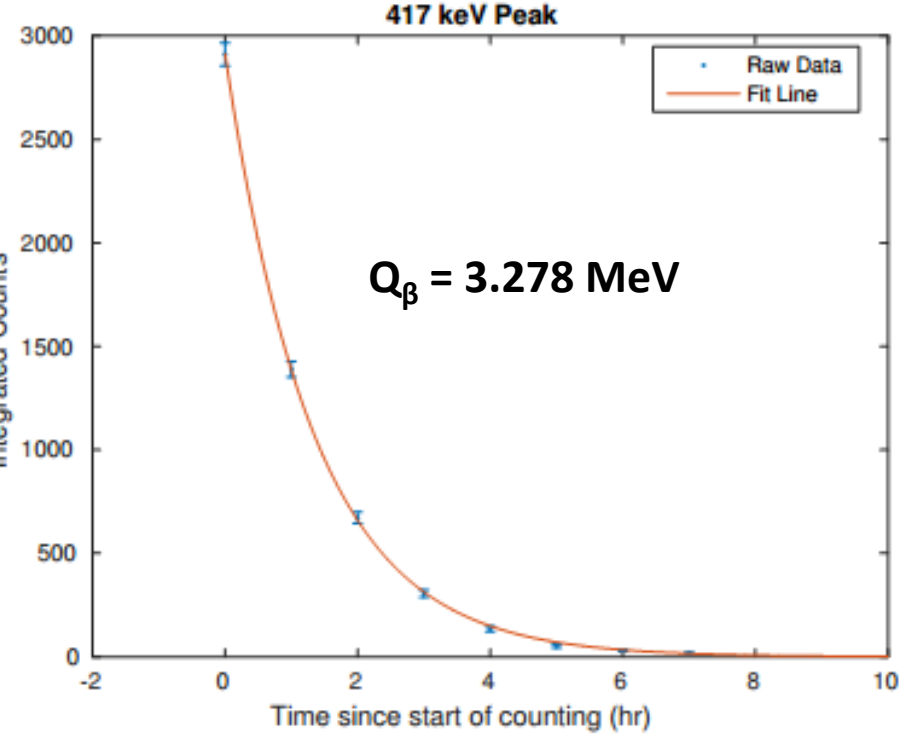

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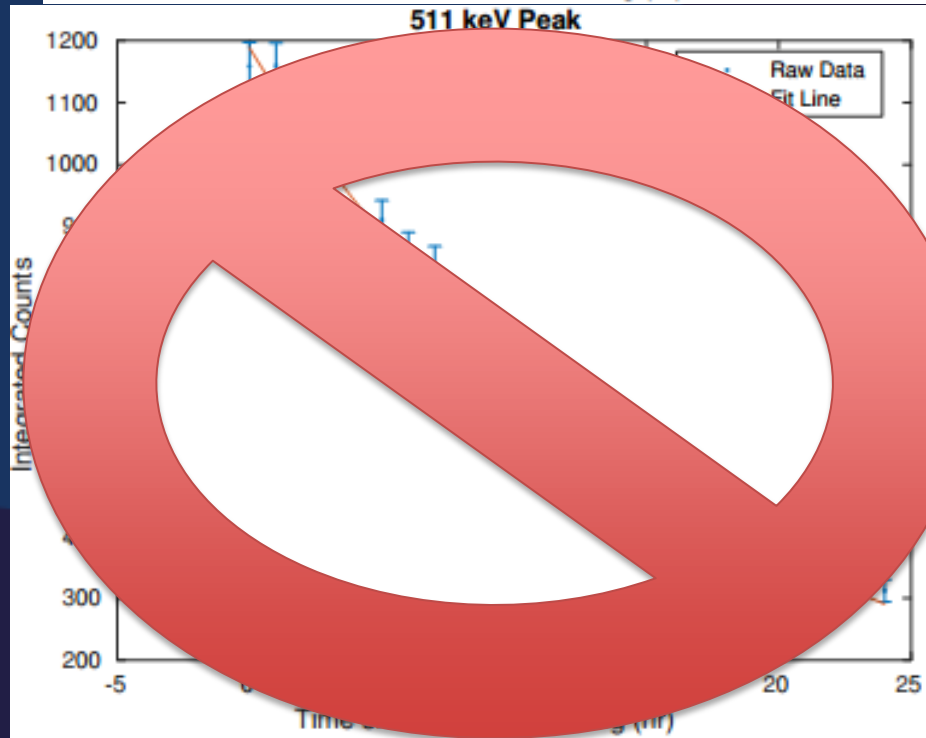

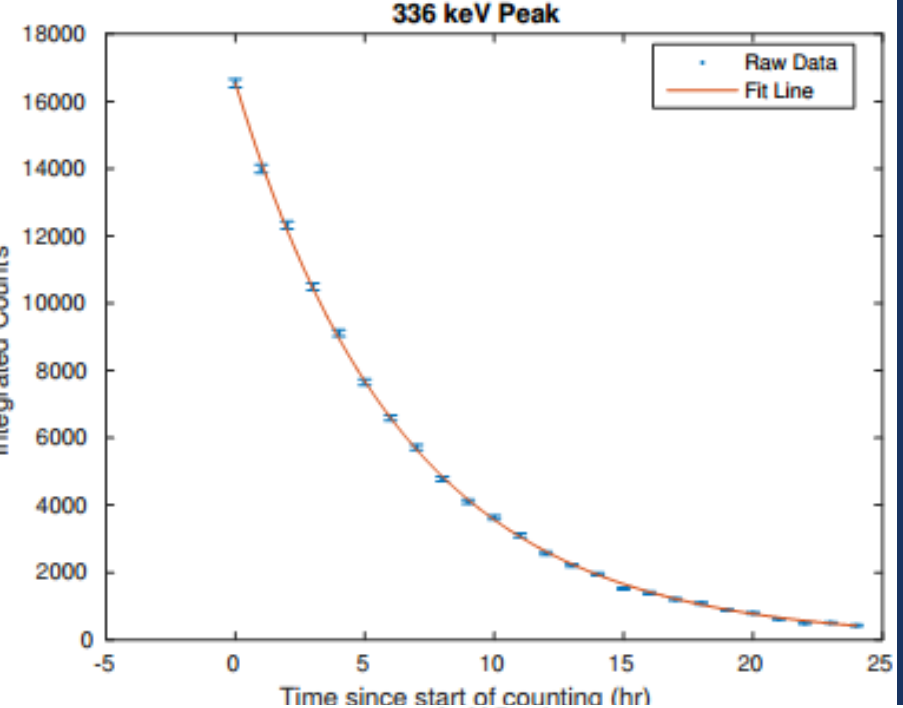

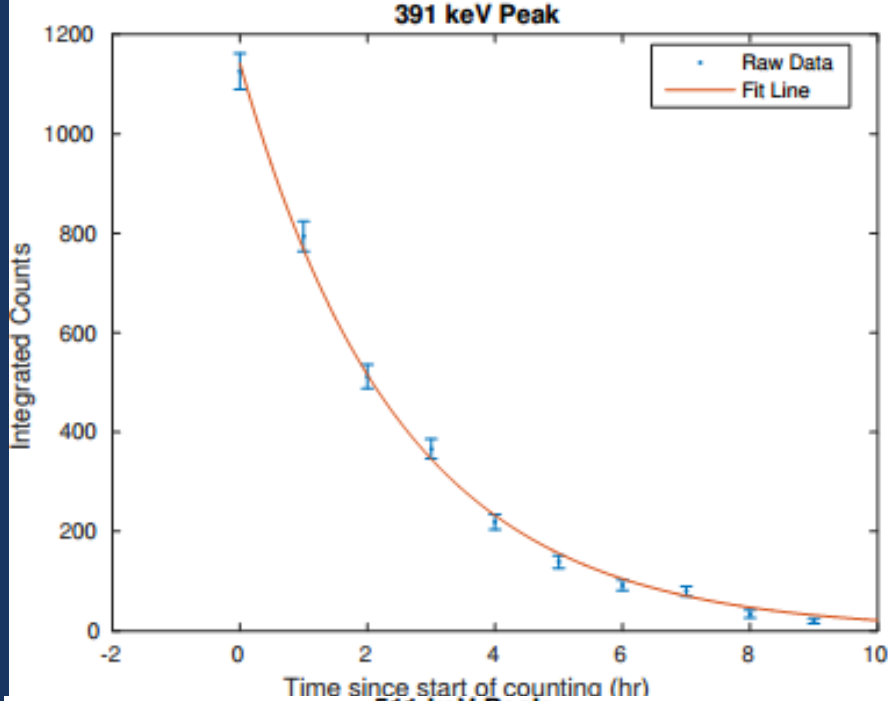

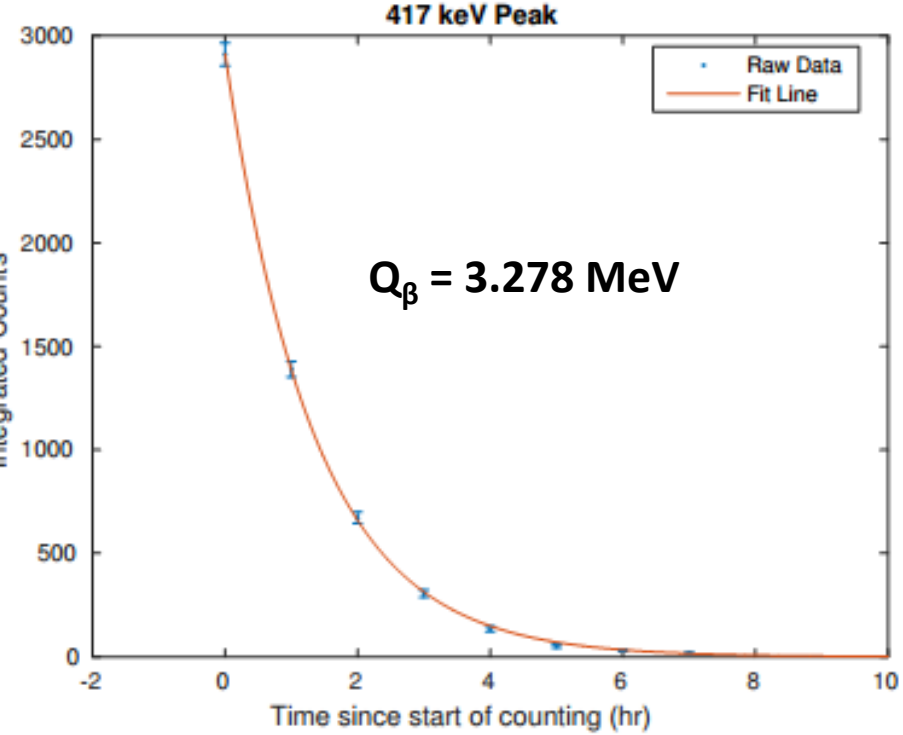

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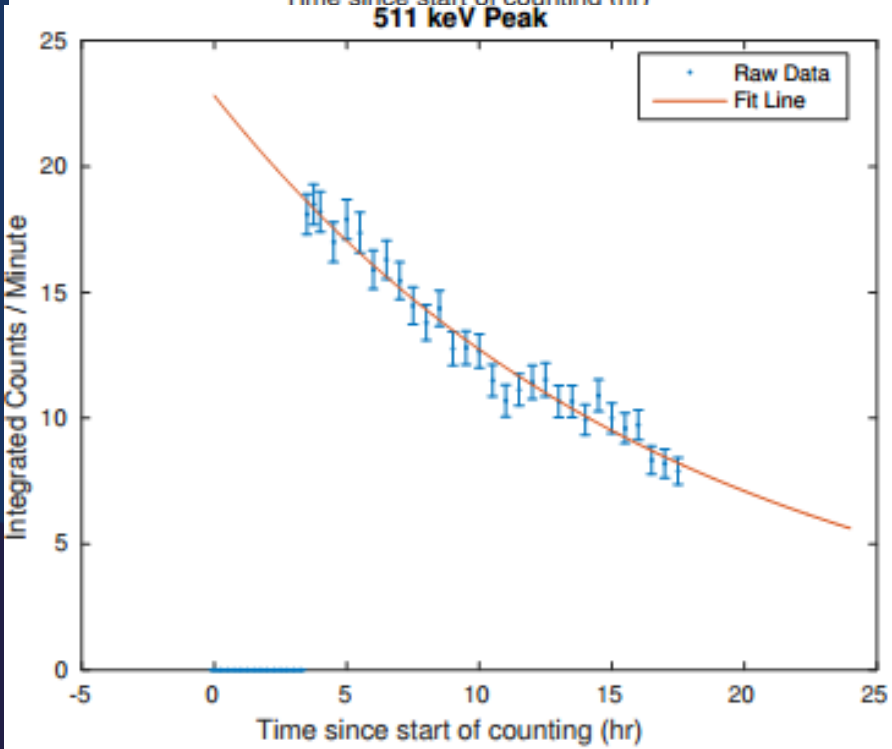
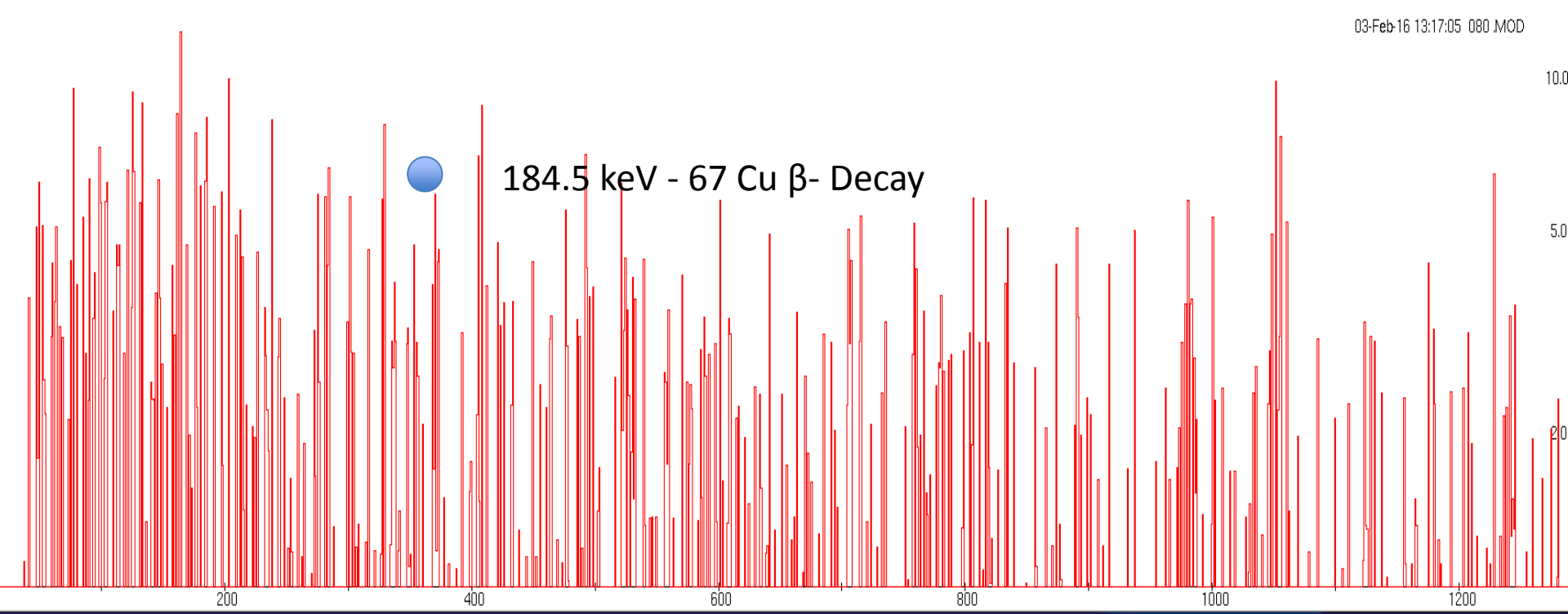


Results – Removal of 511 Contamination

	T ½ (ENSDF)	T ½ (Measured)				X^2/DoF	#σ above ENSDF
Counts (336 keV)	**4.486 h**	**4.519**	**±**	**0.0457**	**h**	**1.7286**	0.722
Counts (391 keV)	**99.476 m**	**104.5208**	**±**	**5.6701**	**m**	**1.721**	0.890
Counts (417 keV)	**54.29 m**	**52.0074**	**±**	**2.6139**	m	**1.021**	-0.873
Counts (511 keV) (cut 1st 4hrs)	**12.701 h**	**12.0791**	**±**	**1.0704**	h	**1.7616**	-0.581
Counts (511 keV) (11 Feb Run)	**12.701 h**	**11.8804**	**±**	**0.8377**	**h**	**1.1299**	-0.980

67Cu Peaks – 80 hrs into count



Next Steps

- Need to apply correct detector efficiency calibration
  - Will not affect half lives of peaks, just XS calculations
  - Calculate ^{64}Cu production XS, relative to In
  - XS appears to be ~50 mb
- Preparing for (n,p) measurements on:
  - 50Ti(n,α),47Ca
  - 105Pd(n,p)105Rh
  - 159Tb(n,p)159Gd
- Extend measurements to $E_n \leq$ ~55 MeV, using 88" Cyclotron ^{7}Li(p,n) quasi-monoenergetic neutron source (currently in development with Jon Engle [LANL])
- Measure ^{67}Cu production cross section using LEPS
  - 184.5 keV peak masked by U/Pb decay chain, Compton background
  - Also inhibited by lower production XS
  - Use enriched ^{67}Zn target?