

Update muX meeting 22/02

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^{60}Co - 3202keV & 3253keV lines



^{56}Co - 3202keV & 3253keV lines

Five sets of measurements were made spanning the energy regions 600–870 keV, 800–1200 keV, 1000–1300 keV, 1300–1800 keV, and 1700–2250 keV. High disper-

Table 2
Previous energy values [7] and relative intensities [6] for the ^{56}Co γ -rays of interest in the present measurements. The last column labels γ -rays as measured or used as a reference standard in the present work

E_γ [keV]	Relative intensity	Status
733.72(15)	0.193(12)	measured
787.88(7)	0.305(13)	measured
846.764(6)	100.0(3)	measured
896.56(20)	0.095(18)	measured
977.48(6)	1.435(16)	measured
997.33(16)	0.129(14)	measured
1037.844(4)	14.16(5)	reference
1140.28(10)	0.131(21)	measured
1160.08(16)	0.095(14)	measured
1175.099(5)	2.241(12)	measured
1335.56(8)	0.130(6)	measured
1360.206(6)	4.265(17)	reference
1640.54(13)	0.070(11)	measured
1771.350(15)	15.49(5)	ref. & meas.
1810.772(17)	0.657(23)	measured
2034.759(11)	7.766(28)	measured
2113.107(12)	0.363(7)	measured
2212.922(10)	0.389(8)	measured

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commercially available, was adopted as a standard. As seen in fig. 6, the double-escape peak of the ^{56}Co 3202.0 keV γ -ray lies close to the ^{144}Ce 2185.7 keV line. However, the separation is sufficient so that the two peaks could be treated as a doublet without generating much added uncertainty. Ten runs were made, each of

The 3202keV line was determined from the double escape peak energy \rightarrow The uncertainty (especially the systematic contribution) that they quote is too small to be determined like this

E_γ [eV]	ΔE_γ [eV]		$I_\gamma(\text{rel})$ ^{a)}
	meas.	total	
3201953	12	15	3.04(3) ^{b)}

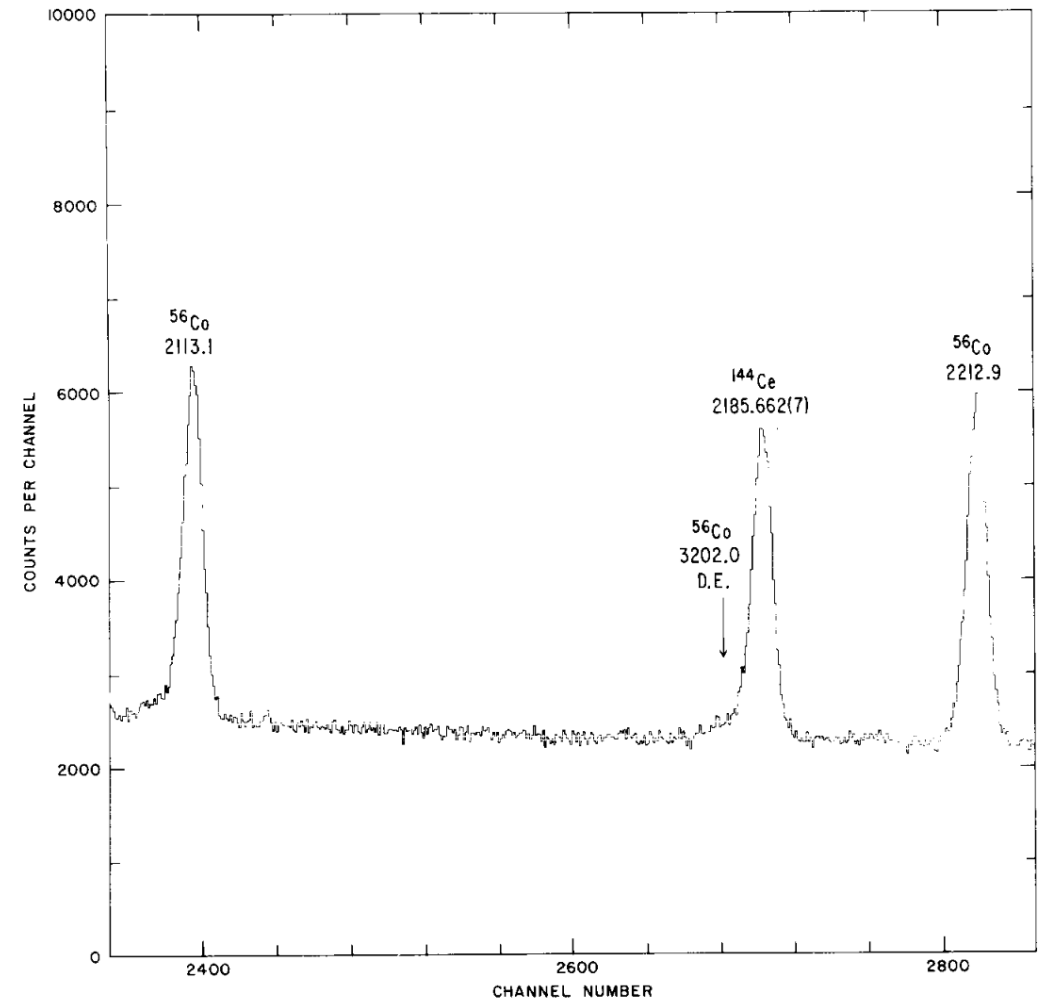


Fig. 6. Typical run in measurements of the ^{56}Co γ -rays of 2113 and 2213 keV relative to the 2186 keV γ -ray of ^{144}Ce .

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Table 6

Recommended ^{56}Co γ -ray calibration energies from a least-squares adjustment of the energies of table 5. The energies are associated with the level scheme of fig. 7

E_γ [eV]	ΔE_γ [eV]		$I_\gamma(\text{rel})^{\text{a)}}$
	meas.	total	
733516	5	5	0.193(12)
787742	6	6	0.305(13)
846769	4	5	100.0(3)
896510	8	8	0.095(18)
977368	5	6	1.435(16)
996947	7	7	0.129(14)
1037842	3	4	14.16(5)
1140361	8	8	0.131(21)
1159940	9	9	0.095(14)
1175097	5	6	2.241(12)
1238286	5	6	66.06(21)
1335389	30	30	0.130(6)
1360206	5	6	4.265(17)
1640461	8	9	0.070(11)
1771344	5	7	15.49(5)
1810745	7	8	0.657(23)
1963714	11	12	0.707(11)
2015190	6	8	3.026(14)
2034769	7	9	7.766(28)
2113113	7	9	0.363(7)
2212915	5	8	0.389(8)
2598459	6	9	16.96(6)
3009587	7	10	1.00(1) ^{b)}
3201953	12	15	3.04(3) ^{b)}
3253428	7	11	7.41(7) ^{b)}
3273006	8	12	1.75(2) ^{b)}
3451148	7	11	0.875(10) ^{b)}

They do not mention how the 3253.402keV line was measured, but supposedly also the double escape peak was used...

\rightarrow I do not really trust these values...

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TABLE 1
Gamma-ray energy and intensity measurements on ^{56}Co

Present work		Auble <i>et al.</i> ⁷⁾		Pettersen <i>et al.</i> ¹⁰⁾		Dolan <i>et al.</i> ⁸⁾	
E_γ (keV)	$I_{\text{rel}}^{\text{b)}$	E_γ (keV)	$I_{\text{rel}}^{\text{b)}$	E_γ (keV)	$I_{\text{rel}}^{\text{b)}$	E_γ (keV)	$I_{\text{rel}}^{\text{b)}$
732.2±0.5	0.13±0.06	732.2±2.0	0.1 ±0.05	733.80±0.19	≈0.3		
788.6±0.5	0.2 ±0.1 ^{a)}	788.2±2.0	0.4 ±0.2	787.91±0.15	1.04±0.21		
	0.4 ±0.2						
846.6±0.5	100	846.6±0.5	100	846.82±0.09	100	846.5±0.2	100
977.7±0.5	1.01±0.3	977.8±1.0	1.36±0.36	977.46±0.14	1.73±0.35		
1037.6±0.5	12.1 ±0.8	1038.9±1.0	12.8 ±0.9	1038.02±0.11	14.1 ±1.5	1038.1±0.2	12.4±0.5
1175.3±0.5	2.2 ±0.1	1175.2±1.0	2.4 ±0.2	1175.25±0.14	2.1 ±0.6		
1238.0±0.5	70.2 ±2.5	1238.2±0.5	69.5 ±3.5	1238.56±0.14	66.8 ±4.0	1238.6±0.2	71.2±2.6
1359.8±0.5	4.2 ±0.4	1359.2±1.0	4.5 ±0.3	1360.58±0.14	4.0 ±0.8	1359.9±0.3	3.8±0.3
1771.4±0.5	16.7 ±1.0	1771.2±1.0	16.1 ±0.8	1771.90±0.22	16.2 ±1.4	1770.8±0.4	15.6±1.3
1810.7±0.5	0.5 ±0.3	1811 ±2	0.4 ±0.2				
1963.4±0.5	0.63±0.2	1965.4±1.0	0.59±0.09	1964.8 ±0.6	0.75±0.27		
2015.3±0.5	2.9 ±0.4	2015.3±1.0	2.7 ±0.2	2015.60±0.35	4.1 ±1.2	2015.6±0.7	3.8±0.7
2034.9±0.5	7.7 ±0.5	2035.2±0.5	7.4 ±0.6	2035.50±0.29	9.2 ±1.7	2034.7±0.3	7.8±1.0
2112.8±0.5	0.32±0.15	2113.2±2.0	0.29±0.05				
2213.0±0.5	0.2 ±0.02						
2598.4±0.5	17.0 ±0.6	2598.5±0.5	17.3 ±0.9	2599.7 ±0.5	17.4 ±1.5	2598.9±0.3	16.0±2.7
3009.8±0.5	1.0 ±0.1	3009.9±1.0	0.9 ±0.2	3010.4 ±0.8	1.3 ±0.4	3009.5±0.4	1.9±0.8
3202.3±0.5	2.8 ±0.4	3202.6±1.0	3.4 ±0.2	3202.3 ±0.5	3.2 ±0.5	3202.3±0.5	2.9±1.1
3253.6±0.5	7.3 ±0.5	3254.5±1.0	7.8 ±0.4	3254.0 ±0.5	8.5 ±0.6	3254.0±0.5	5.8±2.2
3273.1±0.5	1.5 ±0.4	3274.1±1.0	1.5 ±0.3	3272.8 ±0.6	1.5 ±0.4	3273.6±0.4	1.2±0.5
3451.3±0.5	0.83±0.1	3451.1±1.0	0.87±0.09	3452.5 ±1.0	0.95±0.15	3452.6±0.5	0.7±0.3
3548.2±0.5	0.15±0.05	3547.6±0.2	0.15±0.03			3548.3±0.6	0.2±0.1
3598.7±0.5	0.02±0.01						

^{a)} Corrected for contribution of 1811-D.E..

^{b)} Intensity relative to that of 847 keV γ -ray.

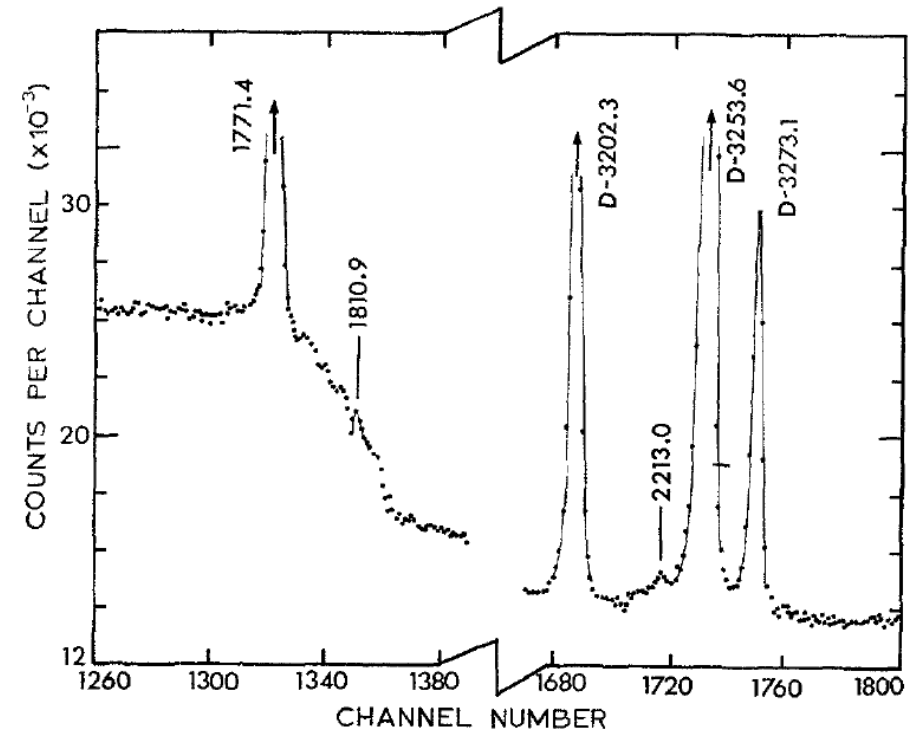
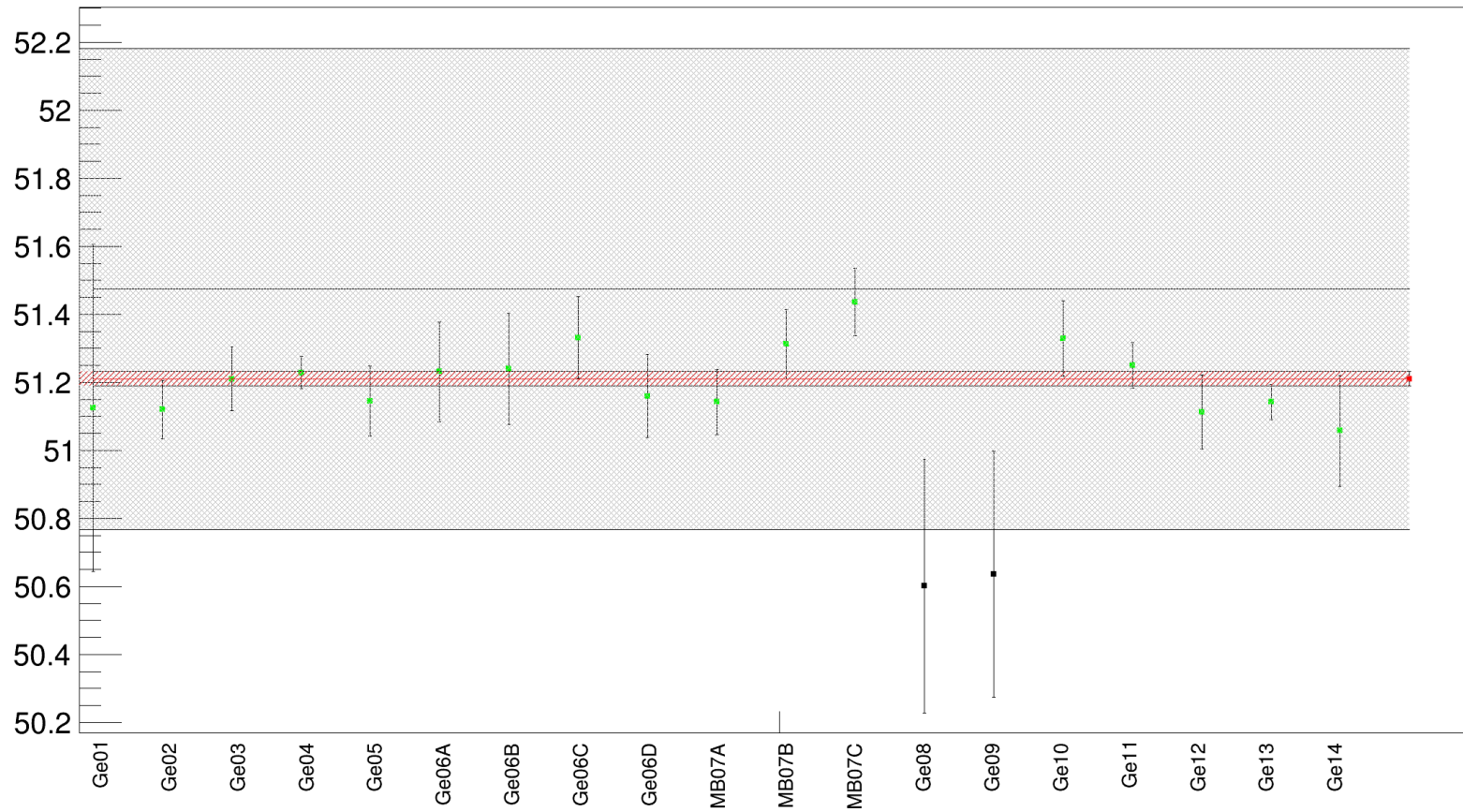
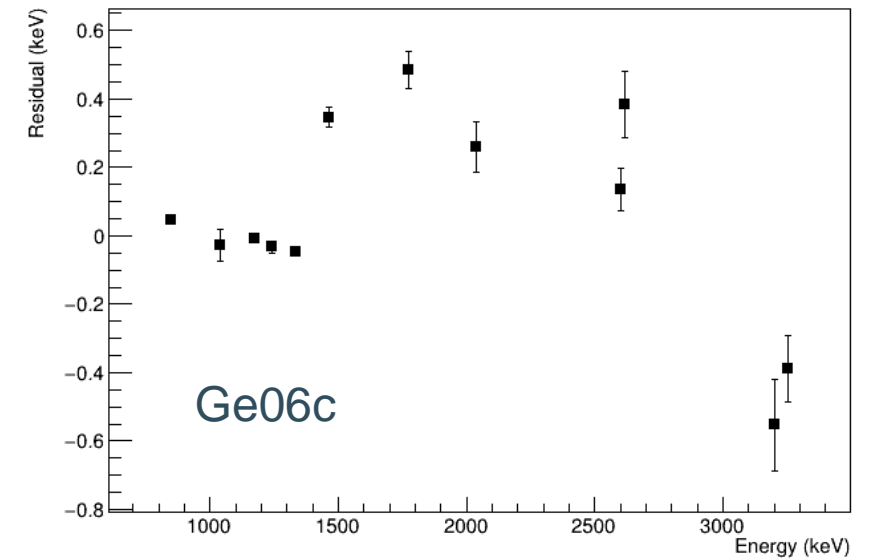
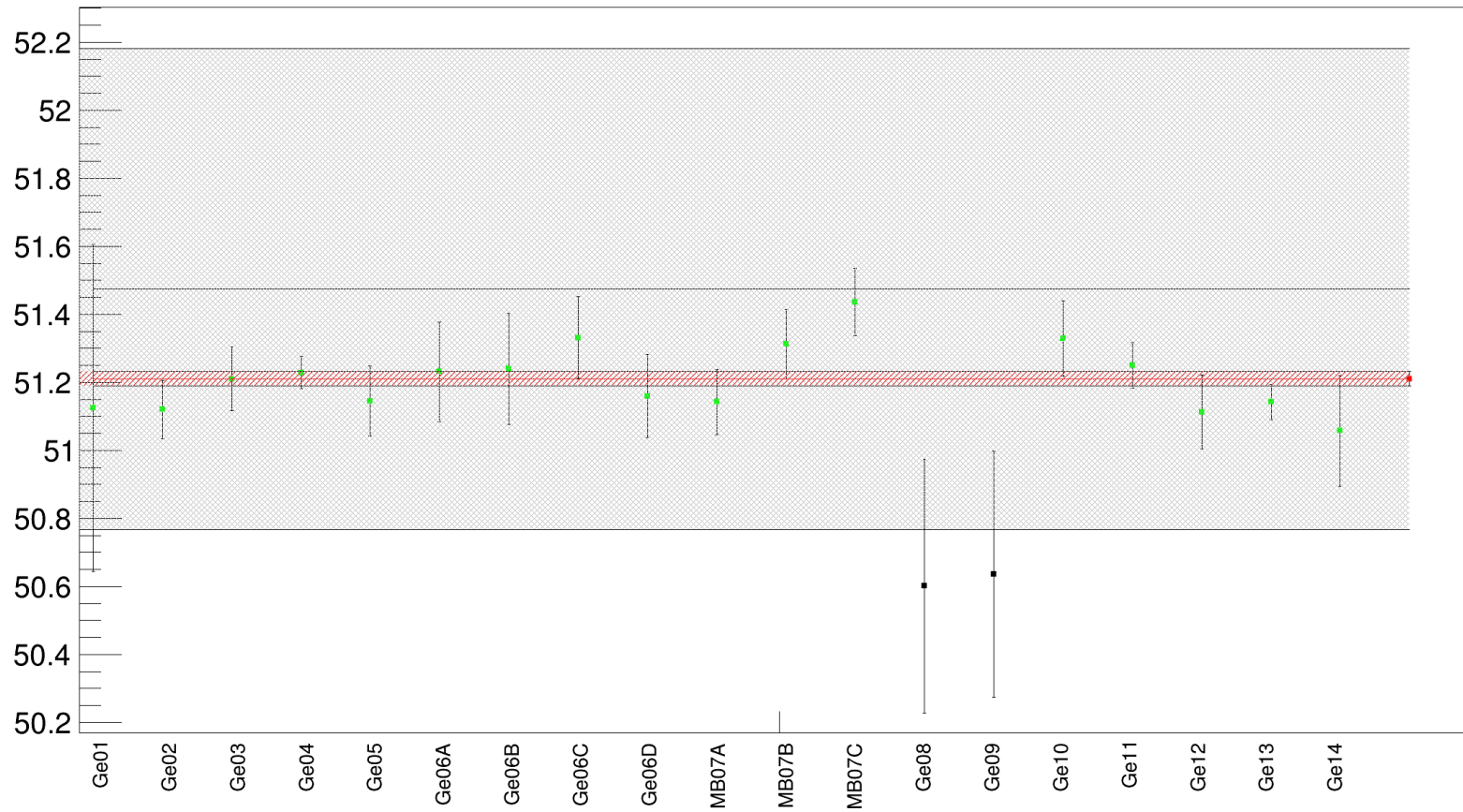


Fig. 2. Portions of ^{56}Co Ge(Li) γ -ray singles spectra showing 1810.9 and 2213.0 keV peaks.

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GEANT4



Status

- Leuven 75%, Leuven 70%, IFIN 100% 1, IFIN 100% 2 detector implemented
- No dead layer simulated
- Comparison to experiment:

60Co at 10 cm		1000000 events		
E	Hilde eff exp	my eff	geant GC7520	deviation
1173	4.79E-03		5.25E-03	1.10
1332	4.47E-03		4.82E-03	1.08

- Managed to simulate the 108mAg isomer

