Technical Visit on

Coincidence summing and geometry correction in gamma spectrometry

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Coincidence summing correction

Canberra Genie 2000

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Empirical Method – 1/2

Based on experimental determination of peak-to-total ratios → creation of a P/T calibration curve

1. Measurement of a set of single photon emitters (^{54}Mn, ^{57}Co, ^{65}Zn, ^{109}Cd, ^{113}Sn, ^{137}Cs, ^{241}Am)
2. Peak analysis results file generated and used by the Peak-to-Total Efficiency Generation programme (PTEG)
3. List of P/T ratios generated for the main and side peaks of each calibration nuclide
4. P/T calibration curve generated by the Peak-to-Total Calibration Curve programme (PTCC) with an iterative procedures → resolution of contribution of the side peak to the "total" value from the contribution of main peak

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Empirical Method – 2/2

- **The total number of counts is calculated by:**

$$\text{TOTAL} = \sum_{i=ETZ}^{R} Ci + \text{Avg}CETZ \cdot \text{ETZ}$$

Where:

R = channel number corresponding to right boundary of FEP
C_i = count at the i-th channel
ETZ = "extrapolation to zero" cut-off channel
AvgC_{ETZ} = average count at the ETZ cut off channel

- **The full energy peak area is obtained using Genie 2000 peak analysis**

Analytical Method using LABSOCS – 1/3

- Total efficiencies are calculated by **LABSOCS** software
- FEP efficiencies can be determined either experimentally or analytically **(LABSOCS)**

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Analytical Method using LABSOCS – 2/3

Eu-152

Source-to-detector distance = 0.5 cm

Detector size:
d = 10.16 cm
L = 13.34 cm

60 % rel. eff.

E (keV)	1/Ci
121.78	1.4045
244.69	1.6051
344.27	1.2107
411.11	1.6611
443.98	1.5552
778.89	1.3755
867.32	1.9342
964.01	1.3736
1085.78	0.9488
1112.02	1.2422
1407.95	1.3055

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Analytical Method using LABSOCS – 3/3

Source-to-detector distance = 5 cm
Different detectors !

Eu-152

	LABSOCS	Simplified procedure	
E (keV)	1/Ci_5 cm	1/Ci_5 cm	
121.8	1.0764	1.0722	
244.7	1.1086	1.0910	
344.3	1.0417	1.0231	
411.1	1.1111	1.0549	
444.0	1.0977	1.0865	
778.9	1.0672	1.0324	
867.3	1.1442	1.1066	
964.0	1.0730	1.0698	
1085.8	0.9823	1.0061	
1112.0	1.0482	1.0428	
1408.0	1.0604	1.0519	

Cs-134

	LABSOCS	Simplified procedure	
E (keV)	1/Ci_5 cm	1/Ci_5 cm	
563.2	1.1123	1.0659	
569.3	1.1223	1.0654	
604.7	1.0707	1.0388	
795.8	1.0730	1.0390	
801.9	1.1136	1.0605	
1365.2	0.8666	0.9515	

LABSOCS: 101.6 mm diameter, 133.4 length
Simplified procedure: 49.8 mm diameter, 47.8 mm length
20 % rel. eff.

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References

[1] R. Venkataraman, S. Croft, W. R. Russ *Calculation of peak-to-total ratios for high purity germanium detectors using Monte-Carlo modeling* J. Radioanal. Nucl. Chem, Vol. 264, No. 1 (2005) 183-191

[2] V. P. Kolotov, M. J. Koskelo *Testing of different true coincidence correction approaches for gamma-ray spectrometry of voluminous sources* J. Radioanal. Nucl. Chem, Vol. 233, Nos 1 2 (1998) 95-100

[3] F. De Corte, C. Frietas J. Radioanal. Nucl. Chem, 160:253 (1992)

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Thank you

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