The meeting of the ICRM Gamma and Beta Spectrometry Working Group was held in Paris, in the building of the Laboratoire National d'Essais, on February 23-24, 2009.

Twenty participants attended this workshop (List of participants) and the meeting went off according to the proposed agenda:

Monday February 23th

09:30 Welcome and presentation of the workshop schedule *M.-C. Lépy*
09:45 Introduction: Accuracy of results of emission probabilities *M.-M. Bé*
10:00 **Questions about efficiency calibration**
1. Efficiency calibration using experimental approach
Example of PTB (Fitting using Spline functions) *R. Dersch*
Example of LNHB (Fitting using logarithm polynomial) *M.-C. Lépy*
10:30 2. Efficiency calibration using Monte Carlo calculation
Example of CMI *P. Dryak*
10:45 Coffee break
11:15 2. Efficiency calibration using Monte Carlo calculation (continuation)
Example of Sevilla University *S. Hurtado*
Efficiency calibration of an extended-range detector
by MC simulation at CIEMAT *V. Peyres Medina*
Other presentations about problems of efficiency calibrations
11:45 3. Discussion about efficiency calibration
What minimum uncertainty can be obtained?
What about correlations between input data?
Calibration in the low-energy range
12:30 Lunch

14:00 **Coincidence summing action** - Introduction *M.-C. Lépy and L. Ferreux*
14:15 Presentation of the methods used for computing the coincidence summing corrections
O. Sima (GESPECOR)
O. Ott (KORSUM)
T. Altzitzoglou
A. Svec
M.-C. Lépy (ETNA)
S. Hurtado
P. De Felice
A. Ceccatelli
S. Klemola
P. Kovar
T. Vidmar
Other participants
15:30 Coffee break
16:00 Presentation of the results of the exercise *M.-C. Lépy*
16:15 General discussion
17:30 End of the discussion

Tuesday February 24th

09:00 Continuation of the discussion about **coincidence summing**
Following of the action
ICRM abstract
Content of the ICRM paper
Extension to volume sources?

10:00 **Detection limit – Decision threshold**: Application of ISO 11929
P. De Felice
A. Luca
L.-E. De Geer

10:30 Coffee break

11:00 Further discussion about detection limits
Include some practical recommendation to the ICRM WG web page

12:00 Lunch

13:30 Information or questions from participants (10' each)
L. Pibida (^{82}Sr half-life, digital-analog electronics)
J. Saegusa
T. Vidmar (AIEA Environment action – Monte Carlo action)
L.-E. De Geer (VGSL)
P. Cassette (Beta spectrometry)

14:30 **Final uncertainties**:
Establish a list of the terms to be taken onto account
Minimum achievable uncertainties
Computing absolute emission intensities
Computing relative uncertainties (for the evaluators' practical use)
Include some practical recommendation to the ICRM WG web page?

15:00 Coffee break

15:30 Further discussions

17:00 Conclusion

The presentations are included as pdf files.

1. Questions about efficiency calibration

After a general introduction with questions from the point of view of evaluations, presentations of different approaches for efficiency calibration followed; some remarks went out from the discussion:

1.1 Experimental calibration plus mathematical fitting:
Take care of K Ge discontinuity for N-type detectors
Correlation between input data (source activity – decay scheme)

1.2 Monte Carlo approach: difficulty to obtain accurate geometrical data: what about the density of Ge at 77 K ?
Due to the difference between cross section used, the fitted geometrical data are valid for one specific program
Significant differences can be obtained depending if atomic relaxation of L vacancies are taken into account or not.
Uncertainties in Monte Carlo simulation are often only the statistical results: it should also include and reflect the uncertainties on the input parameters.

2. Coincidence summing action

The goal of this action was to calculate the corrective factors for ^{152}Eu and ^{134}Cs, for several energies and 3 source-to-detector distances (10, 5 and 2cm). Eighteen laboratories are participating in this action and provided about 26 series of results, using 12 different methods

Monday afternoon was dedicated to the presentation of the different methods used by the participants:

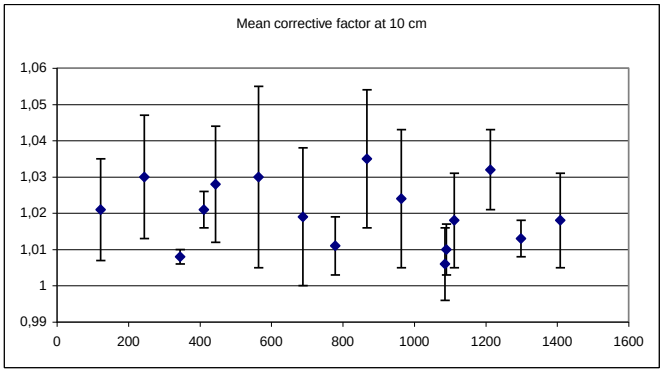
GESPECOR
KORSUM
ETNA
GEANT4
ENEA (6 different approaches)
A. Ceccatelli
S. Klemola "Sinkko-Aaltonen "
P. Kovar
T. Vidmar

It was mentioned that ETNA was used by two more laboratories (KRISS (K.B. Lee and J.B. Han) and Vietnam (Tran Thien Thanh, Chau Van Tao)) and other participants to the action used other methods. In particular, TRUECOINC developed by Sándor SUDÁR (Institute of Experimental Physics – University of Debrecen) was used by himself and by National Technical University of Athens (K.L. Karfopolos and M.J. Anagnostakis). Finally, Istituto Superiore per la Protezione e la Ricerca Ambientale (R. Ocone) used Genie2000 Rev 3.1 Cascade Summing correction algorithm (using the LABSOCS routine based on MCNP simulation).

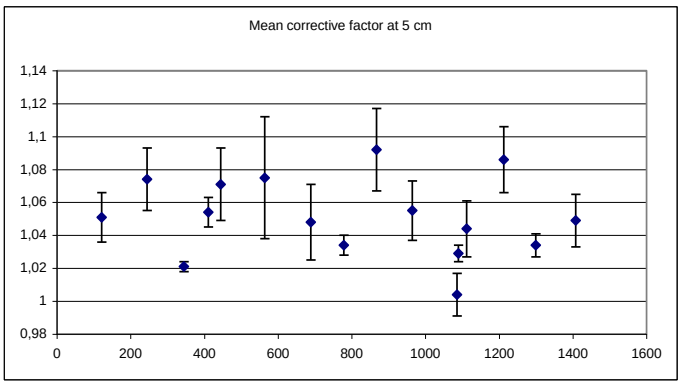
2.1 Results and discussion
The raw results were then presented: they are quoted anonymously, as correction factor for each energy and each source-to-detector distance.

The next two tables include the mean value of the corrective factor computed by the participants per energy and per distance for ^{152}Eu and ^{134}Cs, respectively.

10 cm Energy	Mean value	Standard deviation	Relative deviation (%)
121,8	1,021	0,014	1,37
244,7	1,030	0,017	1,65
344,3	1,008	0,002	0,20
411,1	1,021	0,005	0,49
444	1,028	0,016	1,56
564	1,030	0,025	2,43
688,6	1,019	0,019	1,86
778,9	1,011	0,008	0,79
867,4	1,035	0,019	1,84
964,1	1,024	0,019	1,86
1085,8	1,006	0,010	0,99
1089,7	1,010	0,007	0,69
1112,1	1,018	0,013	1,28
1212,9	1,032	0,011	1,07
1299,1	1,013	0,005	0,49
1408	1,018	0,013	1,28



5 cm Energy	Mean value	Standard deviation	Relative deviation (%)
121,8	1,051	0,015	1,43
244,7	1,074	0,019	1,77
344,3	1,021	0,003	0,29
411,1	1,054	0,009	0,85
444	1,071	0,022	2,05
564	1,075	0,037	3,44
688,6	1,048	0,023	2,19
778,9	1,034	0,006	0,58
867,4	1,092	0,025	2,29
964,1	1,055	0,018	1,71
1085,8	1,004	0,013	1,29
1089,7	1,029	0,005	0,49
1112,1	1,044	0,017	1,63
1212,9	1,086	0,020	1,84
1299,1	1,034	0,007	0,68
1408	1,049	0,016	1,53



2 cm Energy	Mean value	Standard deviation	Relative deviation (%)
121,8	1,157	0,049	4,24
244,7	1,245	0,071	5,70
344,3	1,061	0,011	1,04
411,1	1,164	0,031	2,66
444	1,227	0,084	6,85
564	1,240	0,136	10,97
688,6	1,152	0,071	6,16
778,9	1,096	0,022	2,01
867,4	1,301	0,081	6,23
964,1	1,180	0,062	5,25
1085,8	1,012	0,042	4,15
1089,7	1,086	0,019	1,75
1112,1	1,148	0,059	5,14
1212,9	1,284	0,078	6,07
1299,1	1,099	0,019	1,73
1408	1,155	0,059	5,11

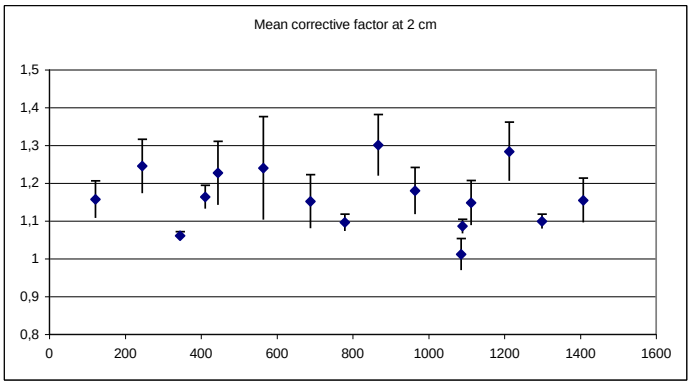
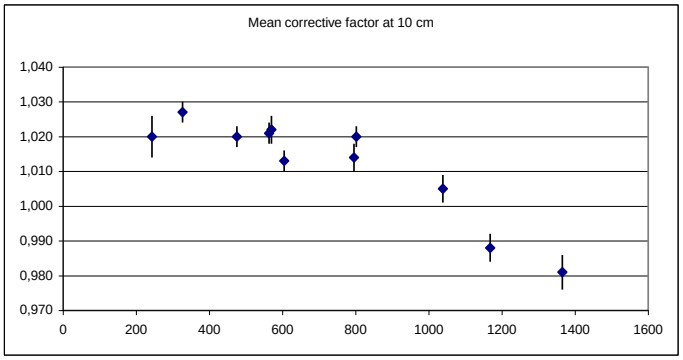


Table 1: Mean corrective factors for the main energies of ^{152}Eu

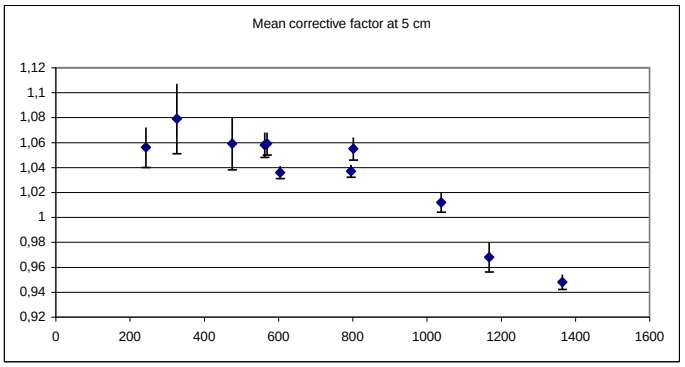
10 cm

Energy	Mean value	Standard deviation	Relative deviation (%)
242,8	1,020	0,006	0,59
326,5	1,027	0,003	0,29
475,3	1,020	0,003	0,29
563,2	1,021	0,003	0,29
569,3	1,022	0,004	0,39
604,7	1,013	0,003	0,30
795,8	1,014	0,004	0,39
801,9	1,020	0,003	0,29
1038,6	1,005	0,004	0,40
1167,9	0,988	0,004	0,40
1365,2	0,981	0,005	0,51



5 cm

Energy	Mean value	Standard deviation	Relative deviation (%)
242,8	1,056	0,016	1,52
326,5	1,079	0,028	2,59
475,3	1,059	0,021	1,98
563,2	1,058	0,010	0,95
569,3	1,059	0,009	0,85
604,7	1,036	0,005	0,48
795,8	1,037	0,005	0,48
801,9	1,055	0,009	0,85
1038,6	1,012	0,008	0,79
1167,9	0,968	0,012	1,24
1365,2	0,948	0,006	0,63



2 cm

Energy	Mean value	Standard deviation	Relative deviation (%)
242,8	1,165	0,046	3,95
326,5	1,216	0,060	4,93
475,3	1,165	0,029	2,49
563,2	1,173	0,030	2,56
569,3	1,171	0,029	2,48
604,7	1,098	0,015	1,37
795,8	1,103	0,018	1,63
801,9	1,160	0,029	2,50
1038,6	1,031	0,015	1,45
1167,9	0,922	0,019	2,06
1365,2	0,875	0,025	2,86

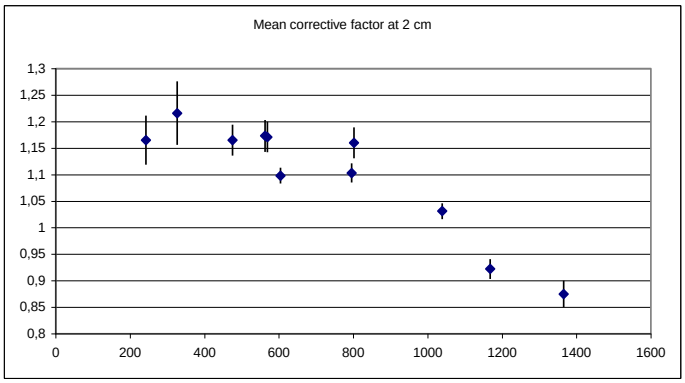


Table 2: Mean corrective factors for the main energies of ^{134}Cs

These results were commented by all the participants and the discussion raised the following points:

- interaction of L X-rays is not negligible
- Beta transport is also significant
- Correction factors are directly linked to efficiency calibration: the efficiency used should be indicated with the corrective factor
- P. De Felice suggests to indicate the ratio of the standard deviation versus the corrective factor

2.2 Continuation of the action

Following the workshop and these discussions, the participants are invited to check their values that have been reported, and eventually to provide updated data by April 15th.
An abstract has been submitted for the next ICRM conference. The presentation will focus on this first set of results. Participants are asked to check if their values have been correctly reported and can provide an updated set of values by April 15th.

Part two of the action will be dedicated to volume samples. The presently used detector is not optimum for this kind of measurements, however, it could be used to record new spectra with volume samples. The geometry is discussed and T. Vidmar proposed to provide some containers as used at Josef Stefan Institute. The continuation of the action will be presented during the next ICRM conference and the exercise will be held in 2010.

3. Detection limit- Decision threshold

Presentations by P. De Felice, A. Luca and L.-E. De Geer.
It was proposed to have a "sub-working group" dedicated to this specific aspect. The output would be a short document (basic guide) with practical recommendations and simple application examples. This should be presented during the Gamma Spectrometry Working Group meeting at the next ICRM conference and then be included in the GS WG web site.

4. Final uncertainties

This topic was not deeply discussed: here again, it would be desirable to create a "sub-working group" to make a list and give the size of order of the uncertainties for the different parameters used to calculate the results in gamma-ray spectrometry. This should also be given in the GS WG web site. Moreover, M. Woods wishes to find there information on how to compute individual uncertainties.

5. Other topics

5.1 Digital electronics
During her presentation, L. Pibida points out the action of the manufacturers to influence the norms.

5.2 GSWG Web page and forum

M.-C. Lépy reminds that this GSWG Web page is the site of the participants of the WG: each one is welcomed to include any useful information, to make any comment. The report of this meeting together with the presentations will be included in the web page as soon as possible.