Rapport BIPM-84/5

# International comparison of activity measurements of a solution of $^{133}$Ba (March 1984)

Preliminary report

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August 1984

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In this report we present a list of the participants (Table 1) having submitted their results by the 3rd of August 1984. Table 2 contains the most important data needed for comparing the results. Figure 1 is a graphical representation of the results with their uncertainties, including those of the three preceding trial comparisons.

A full report with a thorough analysis of all the results received will be published at a later date.

Table 1

List of participants

| | |
|---|---|
| AAEC | Australian Atomic Energy Commission, Sutherland, Australia |
| AECL | Atomic Energy of Canada Limited, Chalk River, Canada |
| ASMW | Amt für Standardisierung, Messwesen und Warenprüfung, Berlin, German Democratic Republic |
| BCMN | Central Bureau for Nuclear Measurements, Geel, Belgium |
| BIPM | Bureau International des Poids et Mesures, Sèvres, France |
| ETL | Electrotechnical Laboratory, Ibaraki, Japan |
| IER | Institut d'électrochimie et radiochimie de l'EPFL, Lausanne, Switzerland |
| IMM | Institut de Métrologie D.I. Mendéléev, Leningrad, USSR |
| IPEN | Instituto de Pesquisas Energeticas e Nucleares, São Paulo, Brazil |
| IRK | Institut für Radiumforschung und Kernphysik, Vienna, Austria |
| KSRI | Korea Standards Research Institute, Taejon, Korea |
| LMRI | Laboratoire de Métrologie des Rayonnements Ionisants, Saclay, France |
| NAC | National Accelerator Centre, Faure, South Africa |
| NBS | National Bureau of Standards, Gaithersburg, U.S.A. |
| NPL | National Physical Laboratory, Teddington, U.K. |
| NRC | National Research Council, Ottawa, Canada |
| OMH | Országos Mérésügyi Hivatal, Budapest, Hungary |
| PTB | Physikalisch-Technische Bundesanstalt, Braunschweig, Federal Republic of Germany |
| UVVVR | Institute for research, production and application of radioisotopes, Prague, Czechoslovakia |

Table 2 - Summary of the results

| Laboratory | Methods used | Approximate dilution factor | γ-channel window (keV) | Number of sources measured | Number of data points | Range of efficiency parameter, $N_c/N_\gamma$ (%) | Order of polynomial | Reduced $\chi^2$ | Intercept (1984-03-15) | Final result with combined uncertainty (Bq $mg^{-1}$; 1 σ) |
|---|---|---|---|---|---|---|---|---|---|---|
| AAEC | 4π(PC)-γ | 2.8 | > 200 | 9 | 15 | 83.3 to 65.5 | 1 * | 1.1 | 1 162.7 | 1 162.7 ± 4.4 |
| AECL | " | 3.1 | 250 to 490 | 14 | 42 | 70 to 43 | 1 | 15.0 | 1 162.2 | 1 163.7 ± 19.4 |
| | | | | 12 | 46 | 70 to 42 | 1 | 23.6 | 1 159.9 | |
| | | | | 1 | 15 | 69 to 51 | 1 | 1.0 | 1 168.6 | |
| ASMW | " | 1 | 240 to 470 | 7 | 45 | 70 to 50 | 1 | 7.0 | 1 163.5 | 1 161.7 ± 2.2 |
| BCMN | " | 1 | > 250 | 11 | ≈ 170 | 65 to 40 | 1 | 1.6 | 1 163 | 1 163.1 ± 1.6 |
| BIPM | " | 1 | > 250 | 4 | 37 | 67.4 to 25.5 | 1 | 25 | 1 158.7 coinc. | 1 159.0 ± 1.3 |
| | + selective sampling | | | | | | 1 | 5.2 | 1 159.5 sel. sampl. | |
| | | | | | | | 2 | 5.2 | 1 158.0 " | |
| ETL | 4π(PC)-γ | 1 | 230 to 470 | 22 | 44 | 68 to 17 | 1 | 3.65 | 1 160.8 | 1 160.6 ± 5.2 |
| | | | | | | | 2 | 3.70 | 1 160.4 | |
| IER | " | 1 | > 240 | 12 | 28 | 70.2 to 24.4 | 2 | 1.0 | 1 162.5 | 1 162.7 ± 2.1 |
| | | | > 114 | 12 | 27 | 70.2 to 24.4 | 2 | 1.4 | 1 162.8 | |
| IMM | " | 1 | 200 to 410 | 5 | 18 | 72 to 29 | 1 | 1.1 | 1 170 | 1 170 ± 4 |
| IPEN | " | 12 to 18 | 220 to 420 | 3 | 43 | 79 to 46 | 2 | 2.1 | 1 159.9 | 1 157.3 ± 1.9 |
| IRK | 4π(NaI)γ | 63 to 169 | | 24 | | | | | | 1 157.5 ± 3.5 |
| KSRI | 4π(PPC)-γ | 1 | 325 to 415 | 7 | 66 | 70 to 65 | 1 | 0.08 | 1 141 to 1 159 | 1 151.0 ± 3.0 |
| IMRI | 4π(NaI)γ | | | 9 | | | | | | 1 160.1 ± 0.7 |
| | 4π(PC)-γ ** | 1 | 270 to 500 | 10 | 33 | 69.1 to 21.8 | 1 | 1.4 | 1 156.4 | 1 160.1 ± 0.8 |
| NAC | 4π(LS)-γ | 1 | > 240 | 10 | 15 | 79 to 32 | 1 | 0.25 | 1 162.8 | 1 162.8 ± 3.7 |
| | | | 315 to 400 | 10 | 15 | 77 to 29 | 2 | 0.31 | 1 157.9 | |

* multiparametric extrapolation ** Ge(Li) detector *** for those sources which were used to define the efficiency function

Table 2 (cont'd)

| Laboratory | Methods used | Approximate dilution factor | γ-channel window (keV) | Number of sources measured | Number of data points | Range of efficiency parameter, $N_c/N_\gamma$ (%) | Order of polynomial | Reduced $\chi^2$ | Intercept (1984-03-15) | Final result with combined uncertainty (Bq $mg^{-1}$; 1 σ) |
|---|---|---|---|---|---|---|---|---|---|---|
| NBS | 4π(PPC)-γ | 12 | 260 to 395 | 4 | 50 | 80 to 31 | 1 | 0.007 | 1 158.1 | 1 158.4 ± 2.5 |
| | | | 260 to 480 | 2 | 27 | 78 to 24 | 1 | 0.006 | 1 158.8 | |
| NPL | 4π(PC)-γ | 8.1 | > 250 | 10 | 18 *** | 70 to 35 | 1 * | | 1 176 ± 4 | |
| | | | 250 to 450 | 10 | | 75 to 38 | 2 | | 1 114 ± 4 | |
| | | | 52 to 100 | 10 | | 48 to 21 | 1 * | | 1 171 ± 4 | Not communicated |
| | | | >250 | | | 70 to 35 | 1 | | | (intercepts are |
| | | | 52 to 100 | 10 | | 48 to 21 | * | | 1 130 ± 4 | preliminary |
| | | | 250 to 450 | | | 75 to 38 | | | | and subject to |
| | 4π(LS)-γ | 8.1 | 85 to 100 | | | 65 to 27 | 1 * | | | later changes) |
| | | | 285 to 320 | 12 | 40 *** | 90.5 to 60 | 1 | 1 to 1.25 | 1 140 ± 3 | |
| | | | 350 to 400 | | | 77 to 32 | 1 | | | |
| | | | 55 to 100 | 12 | 40 *** | 65 to 25 | 1 | 1.1 to 3.5 | 1 162 ± 8 | |
| | | | 130 to 380 | | | 86 to 38 | 1 | | | |
| NRC | 4π(PPC)-γ anticoinc., coincidence | 2.5 | 250 to 490 | 10 | 150 | 74 to 67 | 1 * | 0.51 | 1 159.1 | 1 159.9 ± 1.3 |
| | | | | 2 | 30 | 74 to 67 | 1 * | 0.67 | 1 160.9 | |
| OMH | 4π(PPC)-γ | 1 | 100 to 490 | 14 | 14 | 79 to 63 | 1 | 0.27 | 1 161.6 | 1 160.6 ± 1.4 |
| | | | 240 to 490 | 14 | 14 | 79 to 63 | 1 | 0.15 | 1 159.5 | |
| PTB | 4π(PC)-γ 4π(PPC)-γ | 1 | >250 | 12 | >100 | 74 to 67 | 1 | ? | 1 157.7 | 1 157.7 ± 1.2 |
| UVVVR | 4π(PC)-γ | 4 | >251 | 30 | 120 | 70 to 20 | 1 | 0.014 | 1 152.7 | 1 167.4 ± 0.77 |
| | | | 251 to 518 | 30 | 120 | 70 to 20 | 1 | 0.015 | 1 152.5 | |

* multiparametric extrapolation ** Ge(Li) detector *** for those sources which were used to define the efficiency function

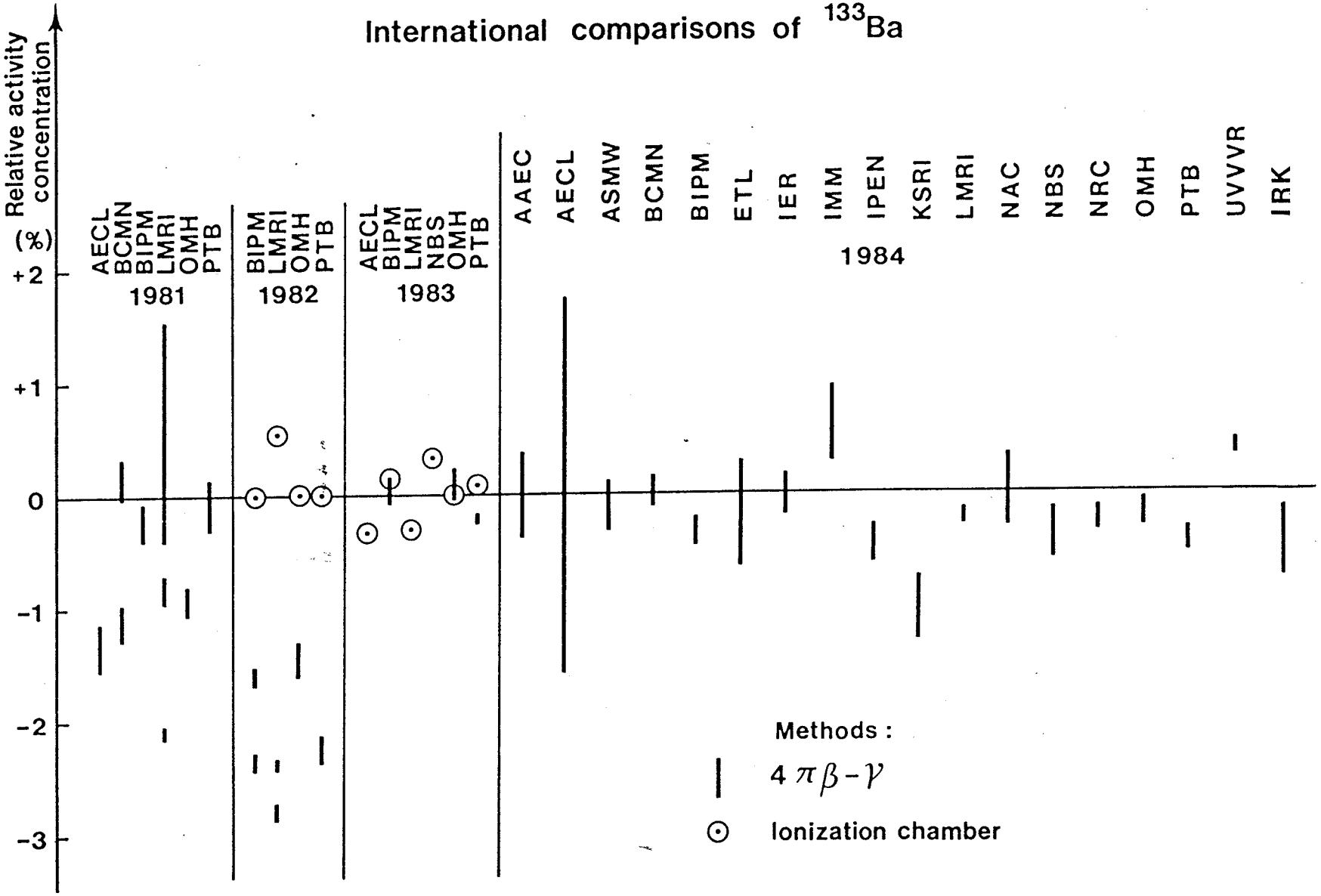
International comparisons of $^{133}Ba$
Relative activity concentration (%)
+2
+1
0
-1
-2
-3
AECL
BCMN
BIPM
LMRI
OMH
PTB
1981
BIPM
LMRI
OMH
PTB
1982
AECL
BIPM
LMRI
NBS
OMH
PTB
1983
AAEC
AECL
ASMW
BCMN
BIPM
ETL
IER
IMM
IPEN
KSRI
LMRI
NAC
NBS
NRC
OMH
PTB
UVVVR
IRK
1984
Methods :
$4\pi\beta-\gamma$
Ionization chamber

Fig.1