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RADIONUCLIDES DECAY DATA

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Marie-Christine Lépy
Laboratoire National Henri Becquerel
CEA Saclay – F-91191 GIF-SUR-YVETTE Cedex
France
E-mail: marie-christine.lepy@cea.fr

LNE
Le progrès, une passion à partager

RADIONUCLIDE DECAY DATA

International cooperation (Decay Data Evaluation Project) (DDEP)

initiated and coordinated by LNHB since 1994

LNHB (France), PTB (Germany), INEEL and LBNL (USA), KRI (Russia)

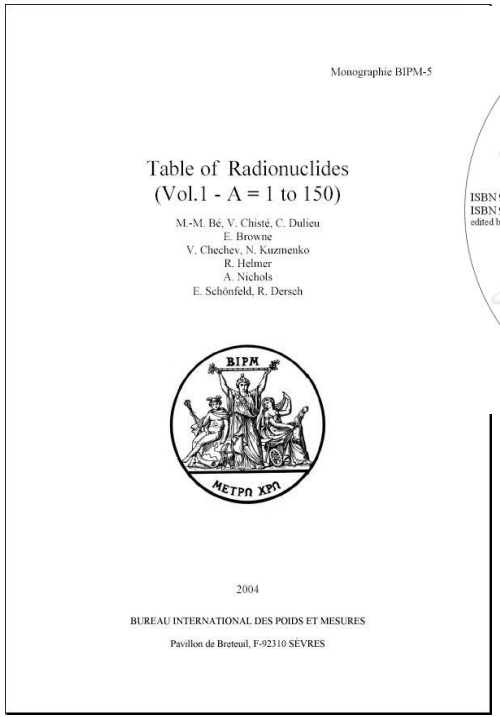
with the objective of providing carefully recommended data in the field of nuclear and associated atomic data related to the nuclear disintegration for use in applied research and detector calibrations

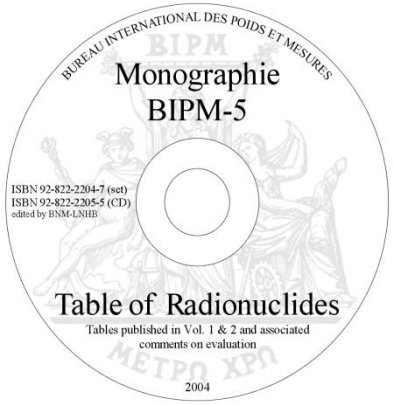
- defined methodology to be used in the evaluations,
- for specific data like Q-values or Internal Conversion Coefficients, to select a recommended set of values established by specialists in this field,
- written documentation of all data used and all decisions and calculations done during the evaluation process
- reviewing of each new evaluation by several members of the group.

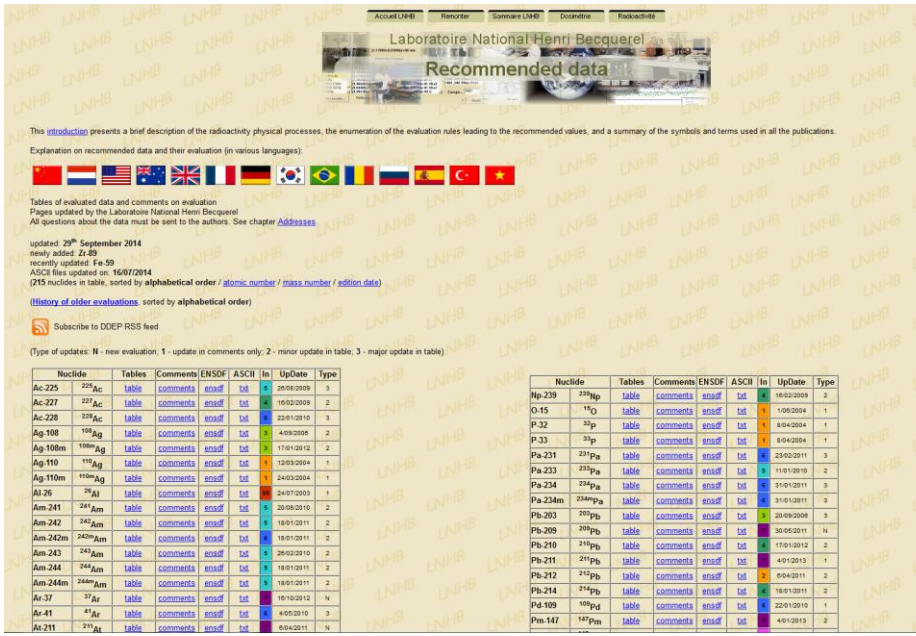
The results of these DDEP evaluations are compiled and edited by the LNHB as a Monographie published under the auspice of the Bureau International des Poids et Mesures (BIPM).

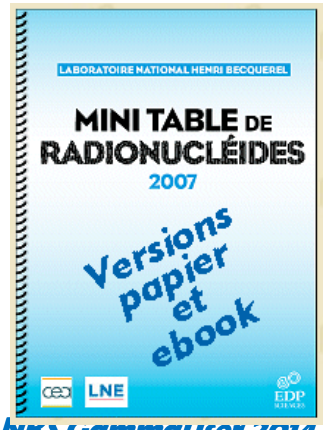
Moreover the *International Committee for Radionuclide Metrology* (ICRM) formally approved the recommendation made by the Nuclear Data Working Group of using the DDEP evaluated decay data in all future nuclear data studies.

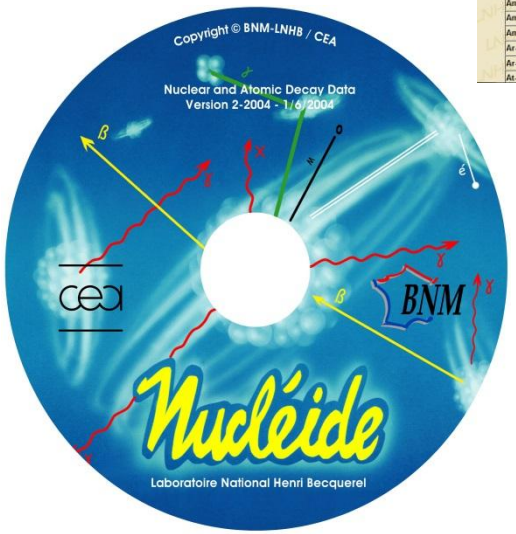
LNHB Publications











Web site :
www.nucleide.org

Web site: www.nucleide.org

http://www.nucleide.org/NucData.htm

DDEP works

Recommended data

Au-195	^{195}Au	table	comments	ensdf	txt	7	4/01/2013	1
Au-198	^{198}Au	table	comments	ensdf	txt	8	24/03/2014	3
Ba-133	^{133}Ba	table	comments	ensdf	txt	1	9/07/2014	2
Ba-137m	^{137m}Ba	table	comments	ensdf	txt	99	24/07/2003	1
Ba-140	^{140}Ba	table	comments	ensdf	txt	1	19/06/2008	2
Be-7	^{7}Be	table	comments	ensdf	txt	1	18/02/2004	1

Comments on evaluation ^{133}**Ba**

^{133}Ba - Comments on evaluation of decay data

by V. P. Chechev and N. K. Kuzmenko

This evaluation was done in May 1999, and revised in April 2000. The literature available by April 2000 was included. The half-life was revised in January 2004 using new references available by 2004.

Comment on ^{133}Ba half-life

The ^{133}Ba half-life values available from 1961 are, in days:

3908(73) 1961Wy01
2849(37) 1968La10 Rejected, large deviation from mean
3894(44) 1968Re04
3781(15) 1970Wa19 Rejected, revised in 1983Wa26
3981(37) 1972Em01 Rejected by Chauvenet's criterion
4127(260) 1973Ll01 Rejected by Chauvenet's criterion
3850(55) 1979HaYC
3785(27) 1980RuZY
3848.0(11) 1980Ho17
3828(11) 1982HoZJ Rejected, revised in 1992Un01
3885.9(43) 1983Ki08
3842(18) 1983Wa26
3853.6(36) 1992Un01 Rejected, revised in 2002Un02
3848.9(7) 1997Ma75
3854.7(28) 2002Un02
3840.5(65) 2003Schrader

3849.7(22) Mean value

Comment on ^{133}Ba photon emission intensities

Comments on evaluation **^{133}Ba**

Table 1. The experimental and evaluated values for γ-ray relative emission probabilities

	γ53	γ80	γ81	γ161	γ223	γ276	γ303	γ356	γ384
1967Bl15	3,8(8)	3,8(4)	53(4)	1,1(3)	0,7(3)	11,0(7)†	30(2)	100	14,5(1)
1968Al16	3,3(5)	-	-	1,20(6)†	0,74(6)	12,0(4)†	30,6(9)†	100	14,2(5)
1968Bo04	4,2(2)†	4,0(4)	58,2(15)	1,07(5)	0,78(6)	11,8(3)	29,8(8)	100	14,3(10)
1968Do10	3,2(4)	5,5(7)†	52(7)	0,99(10)	0,72(8)	11,6(8)	29,4(2)	100	14,3(10)
1968No01	3,78(9)	4,9(6)	60(7)	1,21(5)†	0,80(3)†	11,61(17)	29,75(29)	100	14,18(26)
1969Gu15	2,91(5)	4,54(7)	53,7(17)	1,13(15)	-	11,2(3)	29,3(5)	100	14,03(26)†
1972Sc08	3,54(5)	3,9(2)	52,6(10)	1,16(5)	0,74(4)	11,4(3)	30,2(6)	100	14,4(3)
1973In06	-	-	-	0,98(7)	0,76(5)	11,6(5)	29,6(11)	100	14,9(6)†
1973Legrand	-	3,7(4)	56(6)	1,4(2)†	0,66(2)†	11,35(25)	29,4(6)	100	14,3(3)
1973Mc18	-	-	-	-	-	11,43(23)	29,3(6)	100	14,5(3)
1977Ge12	3,0(4)	5,6(15)†	52(4)	1,12(8)	0,85(7)†	11,7(8)	29,87(21)	100	14,4(11)
1977Sc31	3,49(8)	4,29(12)	55,8(16)	0,97(3)	0,73(3)	11,41(16)	29,4(3)	100	14,33(21)
1978He21	3,54(18)	3,1(3)†	49,2(26)	1,08(4)	0,745(25)	11,7(4)	29,8(4)	100	14,36(20)
1978Vylov	3,57(12)	4,16(18)	54,6(17)	0,98(8)	0,71(4)	11,4(3)	28,8(8)†	100	14,3(5)
1980Ro22	-	-	-	1,03(7)	0,72(5)	11,69(16)	29,9(4)	100	14,79(27)†
1983Yo03	-	-	-	1,035(28)	0,756(16)	11,57(7)	29,55(18)	100	14,36(9)
1987Lakshn	2,96(9)	4,67(14)	55,3(16)	-	-	-	-	100	-
1989Da11	3,6(5)	3,7(5)	52,3(7)	1,032(10)	0,713(8)	11,51(8)	29,51(23)	100	13,99(9)†
1990Me15	3,48(7)	3,77(9)	51,2(4)	1,05(3)	0,71(2)	11,3(2)	29,2(3)	100	14,5(2)
1998Hw07	-	-	-	0,950(18)	0,715(10)	11,64(13)	29,31(40)	100	14,52(17)
CRP-1	-	-	-	1,11(9)	0,85(5)†	11,7(4)	29,9(11)	100	14,5(5)
CRP-2	3,56(14)	-	53,1(19)	0,99(4)	0,729(28)	11,7(3)	30,1(9)	100	14,4(5)
CRP-3	3,53(8)	4,20(12)	54,8(12)	1,031(24)	0,69(3)	11,51(14)	29,5(3)	100	14,37(16)
CRP-4	3,53(7)	4,18(11)	54,6(12)	1,037(20)	0,730(22)	11,48(14)	29,5(4)	100	14,41(16)
CRP-5	3,9(7)	4,00(15)	51,5(19)	1,020(27)	0,728(22)	11,5(3)	29,5(9)	100	14,2(5)
CRP-6	3,45(8)	4,73(12)	57,6(14)	1,020(25)	0,728(18)	11,68(28)	29,7(7)	100	14,5(4)
CRP-7	3,56(8)	4,73(12)	58,9(15)	1,070(27)	0,738(18)	11,50(28)	29,6(7)	100	14,3(4)
CRP-8	-	-	-	-	-	11,22(27)	29,3(6)	100	14,53(28)
CRP-9	-	-	-	-	-	11,22(24)	29,3(5)	100	14,26(25)
CRP-10	-	-	-	-	-	11,48(25)	29,3(5)	100	14,20(22)
CRP-11	-	-	-	-	-	11,57(19)	29,4(4)	100	14,34(26)
CRP-12	3,69(18)	4,37(16)	55,3(18)	1,050(19)	0,741(15)	11,53(16)	29,5(4)	100	14,36(20)
CRP-13	2,92(16)	-	-	-	0,75(3)	11,9(4)	30,2(11)	100	14,6(5)
CRP-14	3,53(8)	4,39(11)	55,9(12)	1,015(20)	0,735(10)	11,61(13)	29,6(4)	100	14,34(18)

KRI/V. P. Chechev, N. K. Kuzmenko Jan. 2004

Comments on evaluation **^{133}Ba**

1998Hw07	-	-	-	0,950(18)	0,715(10)	11,64(13)	29,31(40)	100	14,52(17)
CRP-1	-	-	-	1,11(9)	0,85(5)†	11,7(4)	29,9(11)	100	14,5(5)
CRP-2	3,56(14)	-	53,1(19)	0,99(4)	0,729(28)	11,7(3)	30,1(9)	100	14,4(5)
CRP-3	3,53(8)	4,20(12)	54,8(12)	1,031(24)	0,69(3)	11,51(14)	29,5(3)	100	14,37(16)
CRP-4	3,53(7)	4,18(17)	54,6(12)	1,057(22)	0,719(22)	11,48(14)	29,5(4)	100	14,41(15)
CRP-5	3,6(1)	4,0(1)	51,3(19)	1,020(27)	0,718(20)	11,5(3)	29,5(9)	100	14,3(5)
CRP-6	3,45(8)	4,73(12)	57,6(14)	1,020(25)	0,728(18)	11,68(28)	29,7(7)	100	14,5(4)
CRP-7	3,56(8)	4,73(12)	58,9(15)	1,070(27)	0,738(18)	11,50(28)	29,6(7)	100	14,3(4)
CRP-8	-	-	-	-	-	11,22(27)	29,3(6)	100	14,53(28)
CRP-9	-	-	-	-	-	11,22(24)	29,3(5)	100	14,26(25)
CRP-10	-	-	-	-	-	11,48(25)	29,3(5)	100	14,20(22)
CRP-11	-	-	-	-	-	11,57(19)	29,4(4)	100	14,34(26)
CRP-12	3,69(18)	4,37(16)	55,3(18)	1,050(19)	0,741(15)	11,53(16)	29,5(4)	100	14,36(20)
CRP-13	2,92(16)	-	-	-	0,75(3)	11,9(4)	30,2(11)	100	14,6(5)
CRP-14	3,53(8)	4,39(11)	55,9(12)	1,015(20)	0,735(10)	11,61(13)	29,6(4)	100	14,34(18)

KRI/V. P. Chechev, N. K. Kuzmenko Jan. 2004

Comments on evaluation ^{133}Ba

	γ53	γ80	γ81	γ161	γ223	γ276	γ303	γ356	γ384
CRP-15	3,36(18)	-	-	1,05(4)	0,758(28)	11,7(5)	29,6(10)	100	14,3(4)
CRP-16	3,26(17)	-	-	1,05(4)	0,764(26)	11,7(4)	29,7(6)	100	14,3(3)
CRP-19	3,53(5)	-	-	1,063(17)	0,725(17)	11,61(12)	29,7(3)	100	14,53(13)
CRP-20	3,53(6)	4,05(8)	55,1(9)	1,05(5)	0,72(4)	11,49(21)	29,4(6)	100	14,51(22)
CRP-21	3,62(6)	4,15(12)	55,8(9)	1,039(15)	0,705(11)	11,57(17)	29,5(4)	100	14,40(20)
Nunber of input values	27	20	24	29	28	36	36		34
Reduced χ^2	7,21	5,54	4,08	1,68	0,79	0,37	0,29		0,20
Weighted average	3,45	4,27	53,4	1,032	0,726	11,54	29,55		14,41
Internal uncertainty	0,017	0,029	0,23	0,0048	0,0035	0,030	0,064		0,037
External uncertainty	0,046	0,068	0,47	0,0062	0,0031	0,018	0,035		0,016
Adopted value	3,45(5)[a]	4,27(8)[a]	53,1(5)[b]	1,028(8)[c]	0,730(5)[c]	11,54(7)[a]	29,55(18)[a]	100	14,41(9)[a]

† Omitted as outliers

[a] The least uncertainty of experimental values

[b] Adopted value has been changed slightly from the weighted average for a precise ground state intensity balance to get. Such a small change only for one gamma-ray supports the adopted experimental value of 62,05(19) % for the 356 keV γ-ray absolute emission probability and confirms the decay scheme. The adopted uncertainty of 0,5 is external.

[c] Computed using the absolute emission probability measured in 1996Mi26.
In that work a special precise measurements of the absolute emission probabilities only for the two weak 161 and 223 keV gamma-rays were made by using a 4πβ(ppc)-γ(HPGe) coincidence system.

$$^{133}_{56}\mathrm{Ba}_{77}$$

1 Decay Scheme

Ba-133 disintegrates by electron capture to Cs-133 via the excited states of 437 keV (86.1%) and of 383 keV (13.9%).

Le baryum 133 se désintègre par capture électronique vers des niveaux excités de 437 et 383 keV du césium 133.

2 Nuclear Data

$T_{1/2}(^{133}\mathrm{Ba}\ )$: 10,540 (6) a
$Q^{+}(^{133}\mathrm{Ba}\ )$: 517,4 (10) keV

2.1 Electron Capture Transitions

	Energy (keV)	Probability (%)	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,4}$	80,4 (10)	86,2 (5)	Allowed	6,68	0,672 (5)	0,252 (4)	0,0612 (13)
$\epsilon_{0,3}$	133,6 (10)	13,7 (4)	Allowed	8,07	0,7734 (21)	0,1761 (15)	0,0408 (8)
$\epsilon_{0,2}$	356,8 (10)	< 0,3	2nd Forbidden	> 10,6	0,79 (3)		
$\epsilon_{0,1}$	436,4 (10)	< 0,7	2nd Forbidden	> 10,6	0,88 (4)		
$\epsilon_{0,0}$	517,4 (10)	< 0,0005	Uniq. 2ndForbidden	> 13,9			

5 Photon Emissions

5.1 X-Ray Emissions

		Energy (keV)	Photons (per 100 disint.)	
XL	(Cs)	3,8 - 5,7	16,0 (8)	
$XK\alpha_2$	(Cs)	30,625	34,0 (4)	Kα
$XK\alpha_1$	(Cs)	30,973	62,8 (7)	Kα
$XK\beta_3$	(Cs)	34,92	18,2 (2)	$K'\beta_1$
$XK\beta_1$	(Cs)	34,987		$K'\beta_1$
$XK\beta_5''$	(Cs)	35,245		$K'\beta_1$
$XK\beta_5'$	(Cs)	35,259		$K'\beta_1$
$XK\beta_2$	(Cs)	35,818	4,6 (1)	$K'\beta_2$
$XK\beta_4$	(Cs)	35,907		$K'\beta_2$
$XKO_{2,3}$	(Cs)	35,972		$K'\beta_2$

5.2 Gamma Emissions

	Energy (keV)	Photons (per 100 disint.)
$\gamma_{4,3}$(Cs)	53,1622 (6)	2,14 (3)
$\gamma_{2,1}$(Cs)	79,6142 (12)	2,65 (5)
$\gamma_{1,0}$(Cs)	80,9979 (11)	32,9 (3)
$\gamma_{2,0}$(Cs)	160,6121 (16)	0,638 (4)
$\gamma_{3,2}$(Cs)	223,2368 (13)	0,453 (3)
$\gamma_{4,2}$(Cs)	276,3989 (12)	7,16 (5)
$\gamma_{3,1}$(Cs)	302,8508 (5)	18,34 (13)
$\gamma_{4,1}$(Cs)	356,0129 (7)	62,05 (19)
$\gamma_{3,0}$(Cs)	383,8485 (12)	8,94 (6)

LARA DATABASE

Gamma and Alpha Library

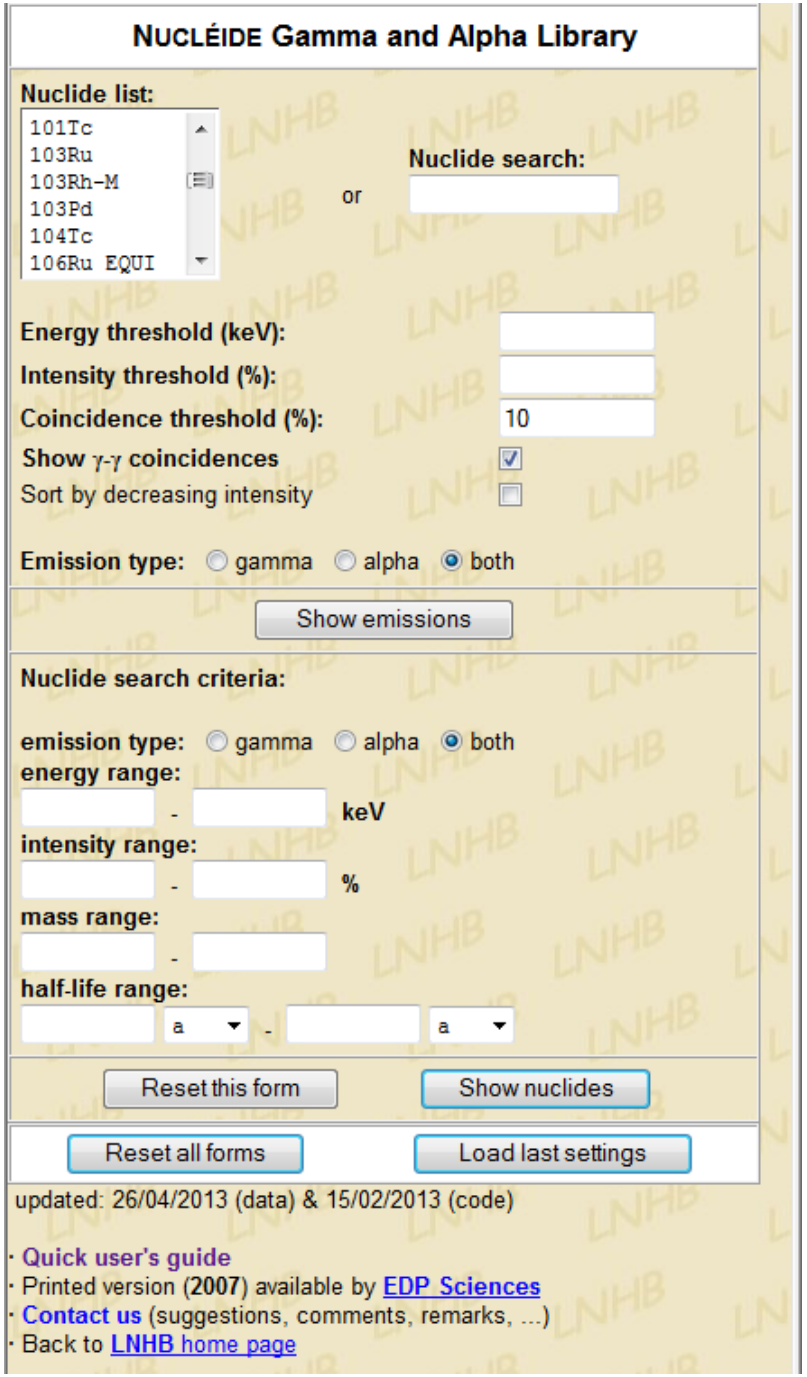
http://laraweb.free.fr/

http://laraweb.free.fr/

- Practical tool for gamma and alpha spectrometry

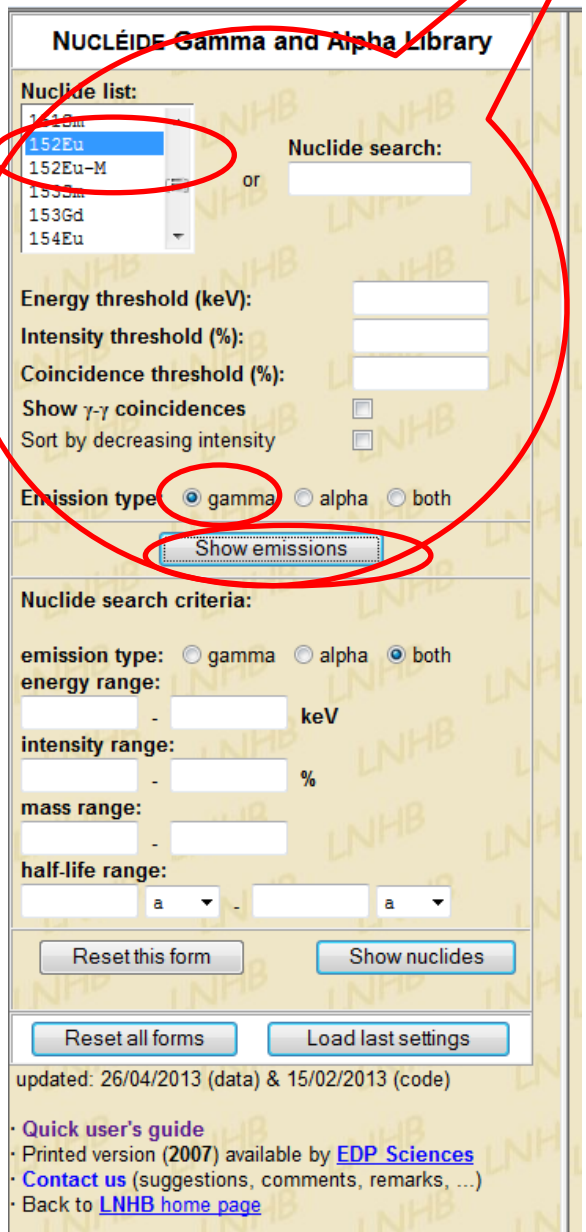
- List of 400 nuclides

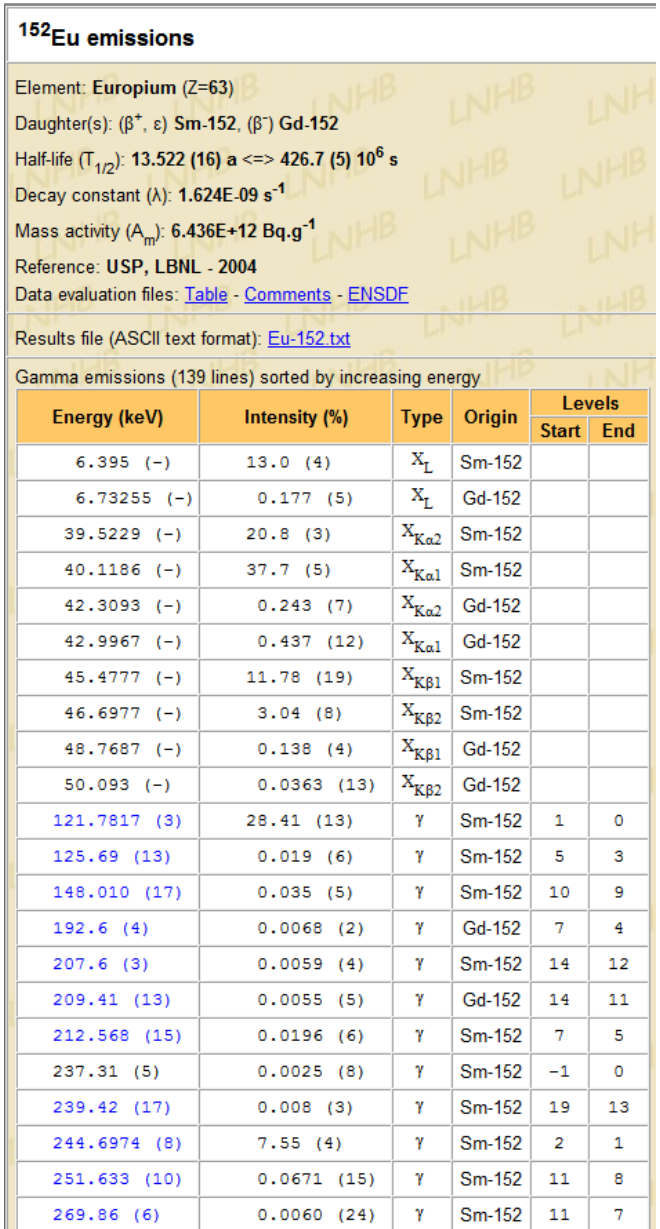
(Nucleide database + NDS…)



Simple use (consultation)

Display information on a particular nuclide





^{152}Eu emissions

Element: **Europium** (Z=63)

Daughter(s): (β^+, ε) **Sm-152**, (β^-) **Gd-152**

Half-life ($T_{1/2}$): **13.522 (16) a <=> 426.7 (5) 10^6 s**

Decay constant (λ): **1.624E-09 s^{-1}**

Mass activity (A_m): **6.436E+12 $Bq.g^{-1}$**

Reference: **USP, LBNL - 2004**

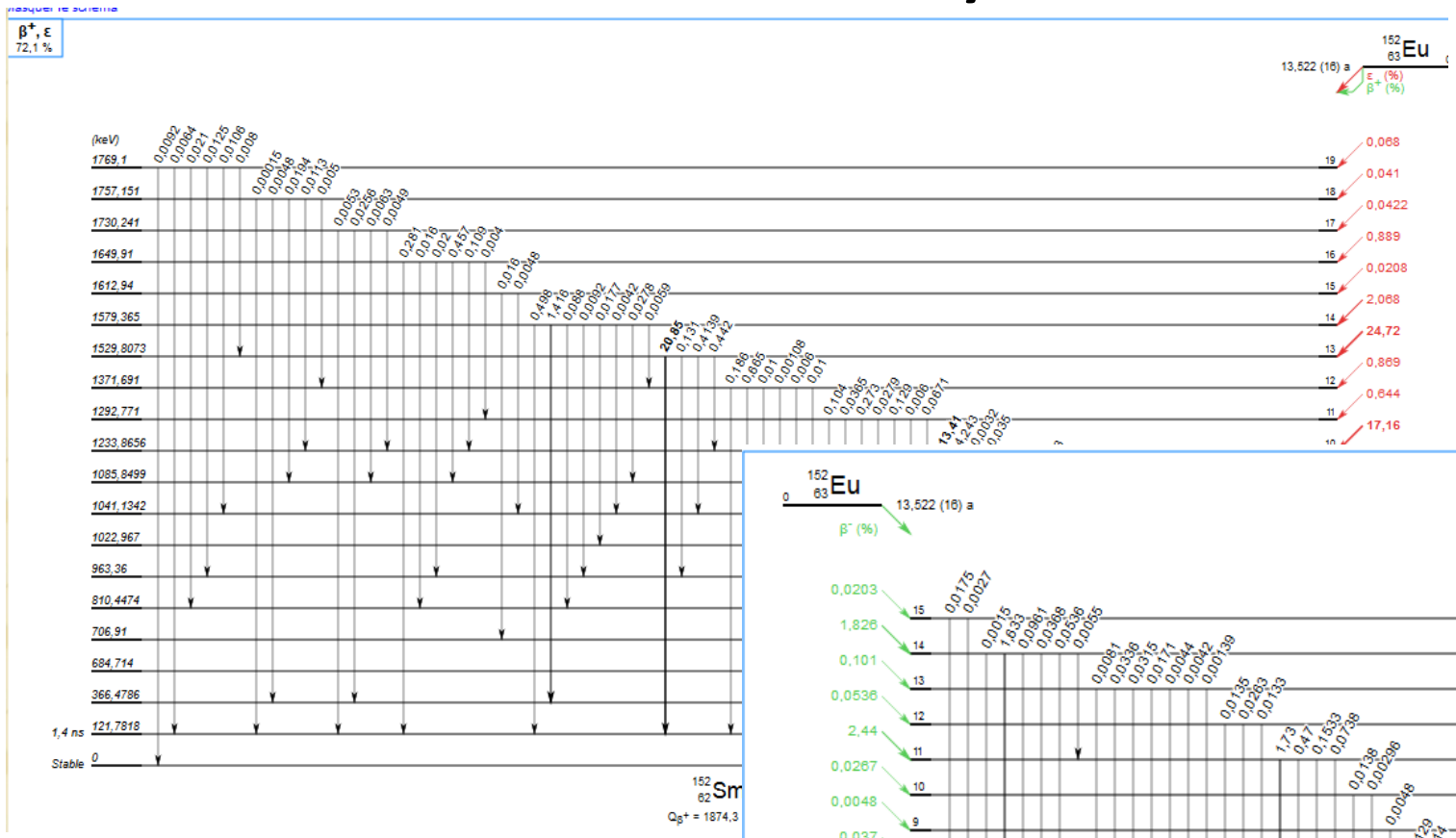
Data evaluation files: Table - Comments - ENSDF

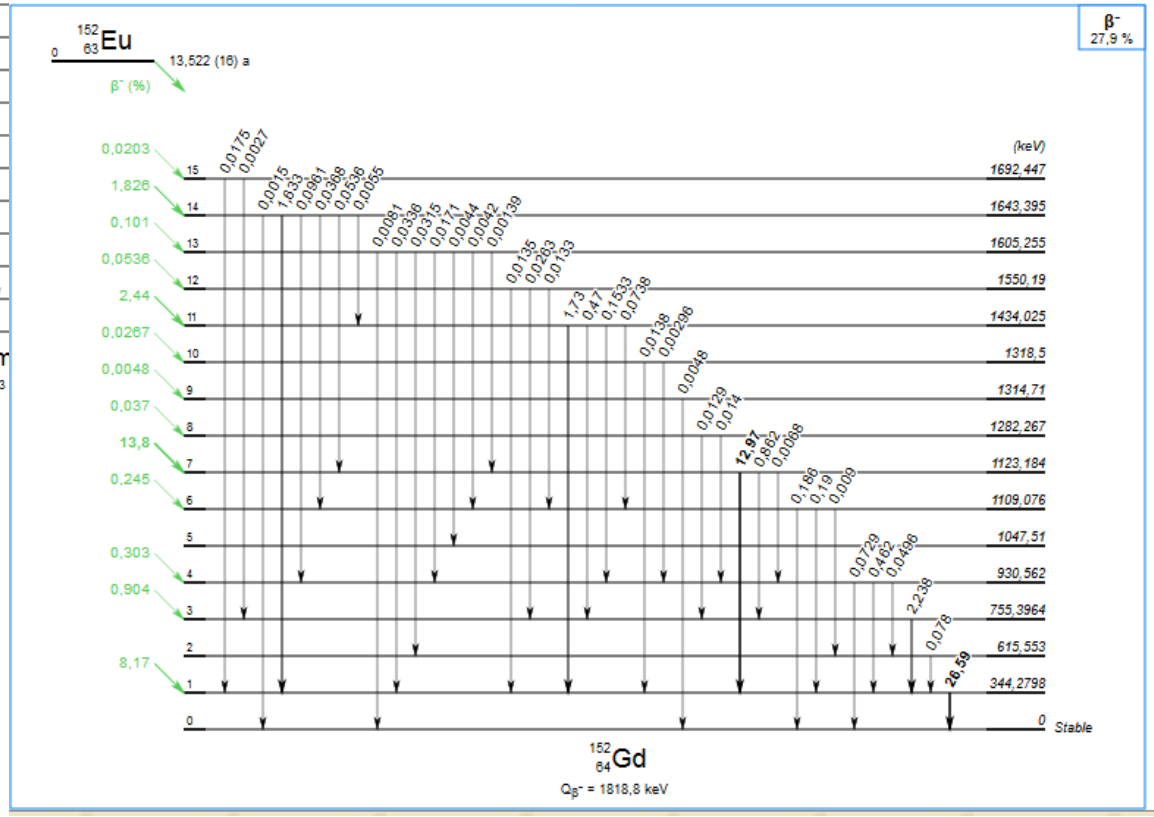
Results file (ASCII text format): Eu-152.txt

Gamma emissions (139 lines) sorted by increasing energy

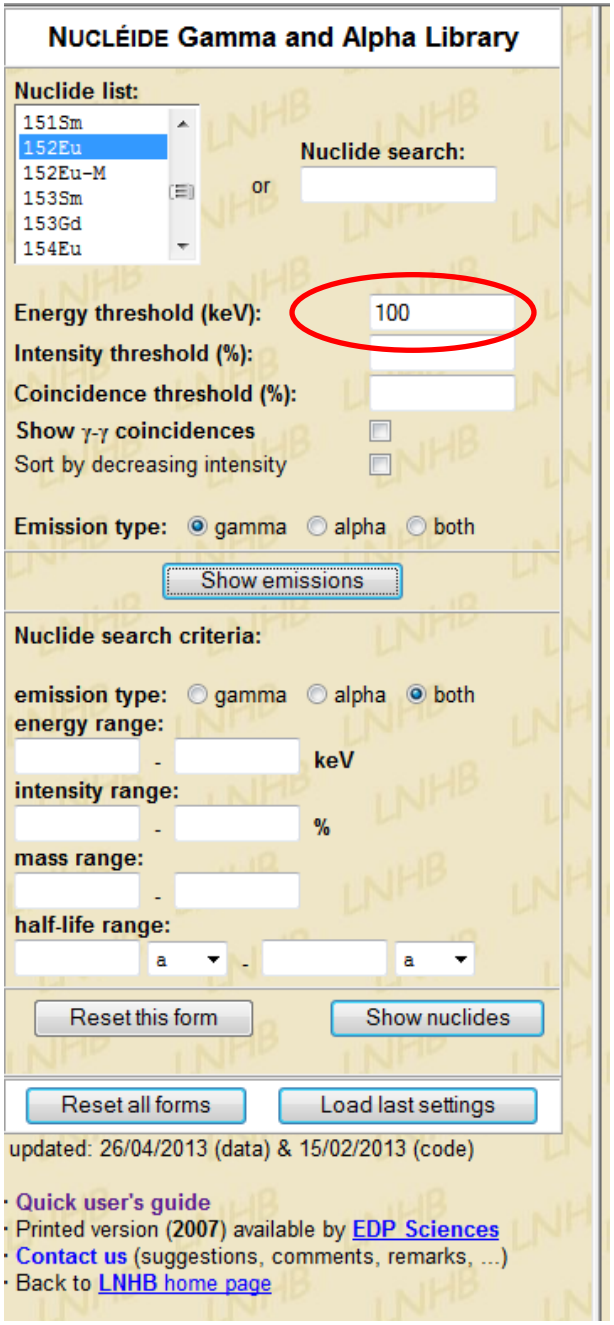
Energy (keV)	Intensity (%)	Type	Origin	Levels	
				Start	End
6.395 (-)	13.0 (4)	X_L	Sm-152		
6.73255 (-)	0.177 (5)	X_L	Gd-152		
39.5229 (-)	20.8 (3)	$X_{K\alpha 2}$	Sm-152		
40.1186 (-)	37.7 (5)	$X_{K\alpha 1}$	Sm-152		
42.3093 (-)	0.243 (7)	$X_{K\alpha 2}$	Gd-152		
42.9967 (-)	0.437 (12)	$X_{K\alpha 1}$	Gd-152		
45.4777 (-)	11.78 (19)	$X_{K\beta 1}$	Sm-152		
46.6977 (-)	3.04 (8)	$X_{K\beta 2}$	Sm-152		
48.7687 (-)	0.138 (4)	$X_{K\beta 1}$	Gd-152		
50.093 (-)	0.0363 (13)	$X_{K\beta 2}$	Gd-152		
121.7817 (3)	28.41 (13)	γ	Sm-152	1	0
125.69 (13)	0.019 (6)	γ	Sm-152	5	3
148.010 (17)	0.035 (5)	γ	Sm-152	10	9
192.6 (4)	0.0068 (2)	γ	Gd-152	7	4
207.6 (3)	0.0059 (4)	γ	Sm-152	14	12
209.41 (13)	0.0055 (5)	γ	Gd-152	14	11
212.568 (15)	0.0196 (6)	γ	Sm-152	7	5
237.31 (5)	0.0025 (8)	γ	Sm-152	-1	0
239.42 (17)	0.008 (3)	γ	Sm-152	19	13
244.6974 (8)	7.55 (4)	γ	Sm-152	2	1
251.633 (10)	0.0671 (15)	γ	Sm-152	11	8
269.86 (6)	0.0060 (24)	γ	Sm-152	11	7

New ! Decay scheme





Energy or Intensity threshold



^{152}Eu emissions

Element: **Europium** (Z=63)

Daughter(s): (β^+, ε) **Sm-152**, (β^-) **Gd-152**

Half-life ($T_{1/2}$): **13.522 (16) a** <=> **426.7 (5) 10^6 s**

Decay constant (λ): **1.624E-09 s^{-1}**

Mass activity (A_m): **6.436E+12 $Bq.g^{-1}$**

Reference: **USP, LBNL - 2004**

Data evaluation files: Table - Comments - ENSDF

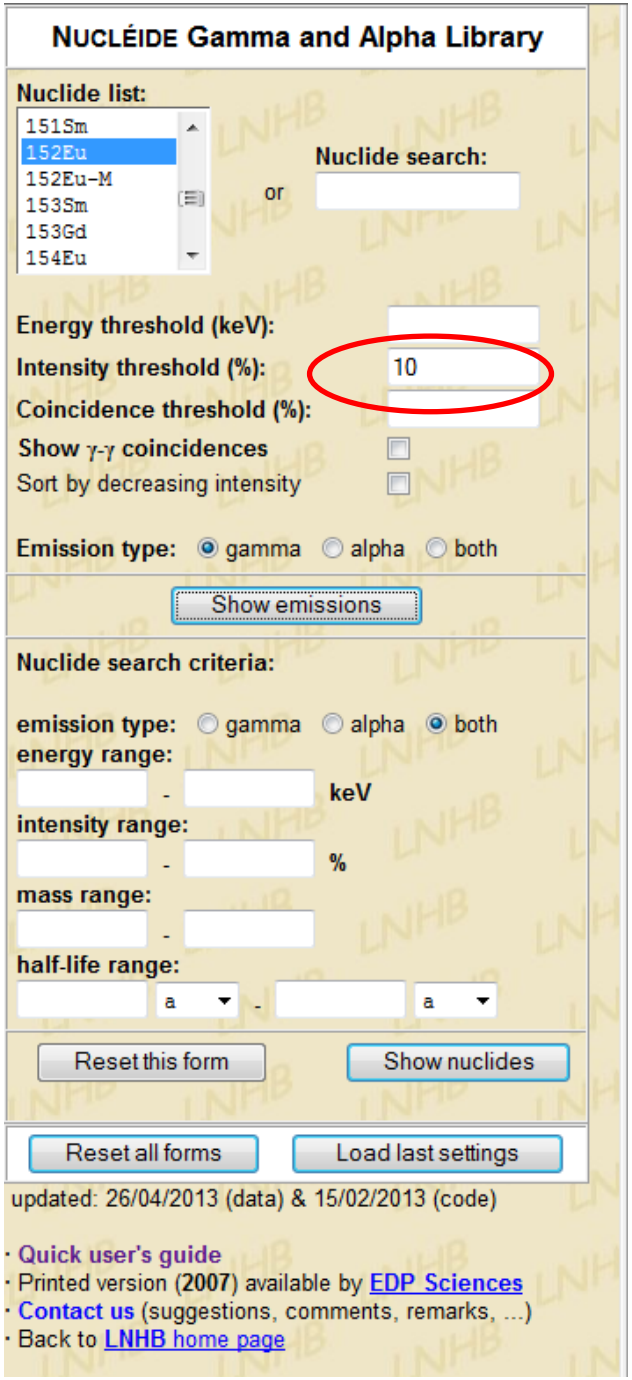
Results file (ASCII text format): Eu-152.txt

Energy threshold: **100 keV**

Gamma emissions (129 lines out of 139) sorted by increasing energy

Energy (keV)	Intensity (%)	Type	Origin	Levels	
				Start	End
121.7817 (3)	28.41 (13)	γ	Sm-152	1	0
125.69 (13)	0.019 (6)	γ	Sm-152	5	3
148.010 (17)	0.035 (5)	γ	Sm-152	10	9
192.6 (4)	0.0068 (2)	γ	Gd-152	7	4
207.6 (3)	0.0059 (4)	γ	Sm-152	14	12
209.41 (13)	0.0055 (5)	γ	Gd-152	14	11
212.568 (15)	0.0196 (6)	γ	Sm-152	7	5
237.31 (5)	0.0025 (8)	γ	Sm-152	-1	0
239.42 (17)	0.008 (3)	γ	Sm-152	19	13
244.6974 (8)	7.55 (4)	γ	Sm-152	2	1
251.633 (10)	0.0671 (15)	γ	Sm-152	11	8
269.86 (6)	0.0060 (24)	γ	Sm-152	11	7
271.131 (8)	0.078 (3)	γ	Gd-152	2	1
275.449 (15)	0.0323 (17)	γ	Sm-152	9	5
285.98 (3)	0.0100 (6)	γ	Sm-152	12	9
295.9387 (17)	0.442 (3)	γ	Sm-152	13	10
315.174 (17)	0.0496 (17)	γ	Gd-152	4	2
316.2 (2)	0.0031 (10)	γ	Sm-152	7	4
320.03 (15)	0.0017 (6)	γ	Sm-152	-1	1
324.83 (3)	0.0738 (15)	γ	Gd-152	11	6
329.425 (21)	0.129 (6)	γ	Sm-152	11	6
330.54 (10)	0.0060 (17)	γ	Sm-152	12	8
340.40 (14)	0.031 (3)	γ	Sm-152	4	2
344.2785 (12)	26.59 (12)	γ	Gd-152	1	0
351.66 (4)	0.0140 (22)	γ	Gd-152	8	4
357.26 (5)	0.0040 (5)	γ	Sm-152	16	11

Energy or Intensity threshold



^{152}Eu emissions

Element: **Europium** (Z=63)

Daughter(s): (β^+, ε) **Sm-152**, (β^-) **Gd-152**

Half-life ($T_{1/2}$): **13.522 (16) a** <=> **426.7 (5) 10^6 s**

Decay constant (λ): **1.624E-09 s^{-1}**

Mass activity (A_m): **6.436E+12 $Bq.g^{-1}$**

Reference: **USP, LBNL - 2004**

Data evaluation files: Table - Comments - ENSDF

Results file (ASCII text format): Eu-152.txt

Intensity threshold: **10 %**

Gamma emissions (11 lines out of 139) sorted by increasing energy

Energy (keV)	Intensity (%)	Type	Origin	Levels	
				Start	End
6.395 (-)	13.0 (4)	X_L	Sm-152		
39.5229 (-)	20.8 (3)	$X_{K\alpha 2}$	Sm-152		
40.1186 (-)	37.7 (5)	$X_{K\alpha 1}$	Sm-152		
45.4777 (-)	11.78 (19)	$X_{K\beta 1}$	Sm-152		
121.7817 (3)	28.41 (13)	γ	Sm-152	1	0
344.2785 (12)	26.59 (12)	γ	Gd-152	1	0
778.9045 (24)	12.97 (6)	γ	Gd-152	7	1
964.079 (18)	14.50 (6)	γ	Sm-152	9	1
1 085.837 (10)	10.13 (6)	γ	Sm-152	9	0
1 112.076 (3)	13.41 (6)	γ	Sm-152	10	1
1 408.013 (3)	20.85 (8)	γ	Sm-152	13	1

NUCLÉIDE Gamma and Alpha Library

Nuclide list:

151Pm
151Sm
152Eu
152Eu-M
153Sm
153Gd

or **Nuclide search:**

Energy threshold (keV): 100

Intensity threshold (%): 5

Coincidence threshold (%):

Show γ-γ coincidences

Sort by decreasing intensity

Emission type: gamma alpha both

Show emissions

Nuclide search criteria:

emission type: gamma alpha both

energy range: - **keV**

intensity range: - **%**

mass range: -

half-life range: a - a

Reset this form | Show nuclides

^{152}Eu emissions

Element: **Europium** (Z=63)

Daughter(s): (β^+, ε) **Sm-152**, (β^-) **Gd-152**

Half-life ($T_{1/2}$): **13.522 (16) a <=> 426.7 (5) 10^6 s**

Decay constant (λ): **1.624E-09 s^{-1}**

Mass activity (A_m): **6.436E+12 $Bq.g^{-1}$**

Reference: **USP, LBNL - 2004**

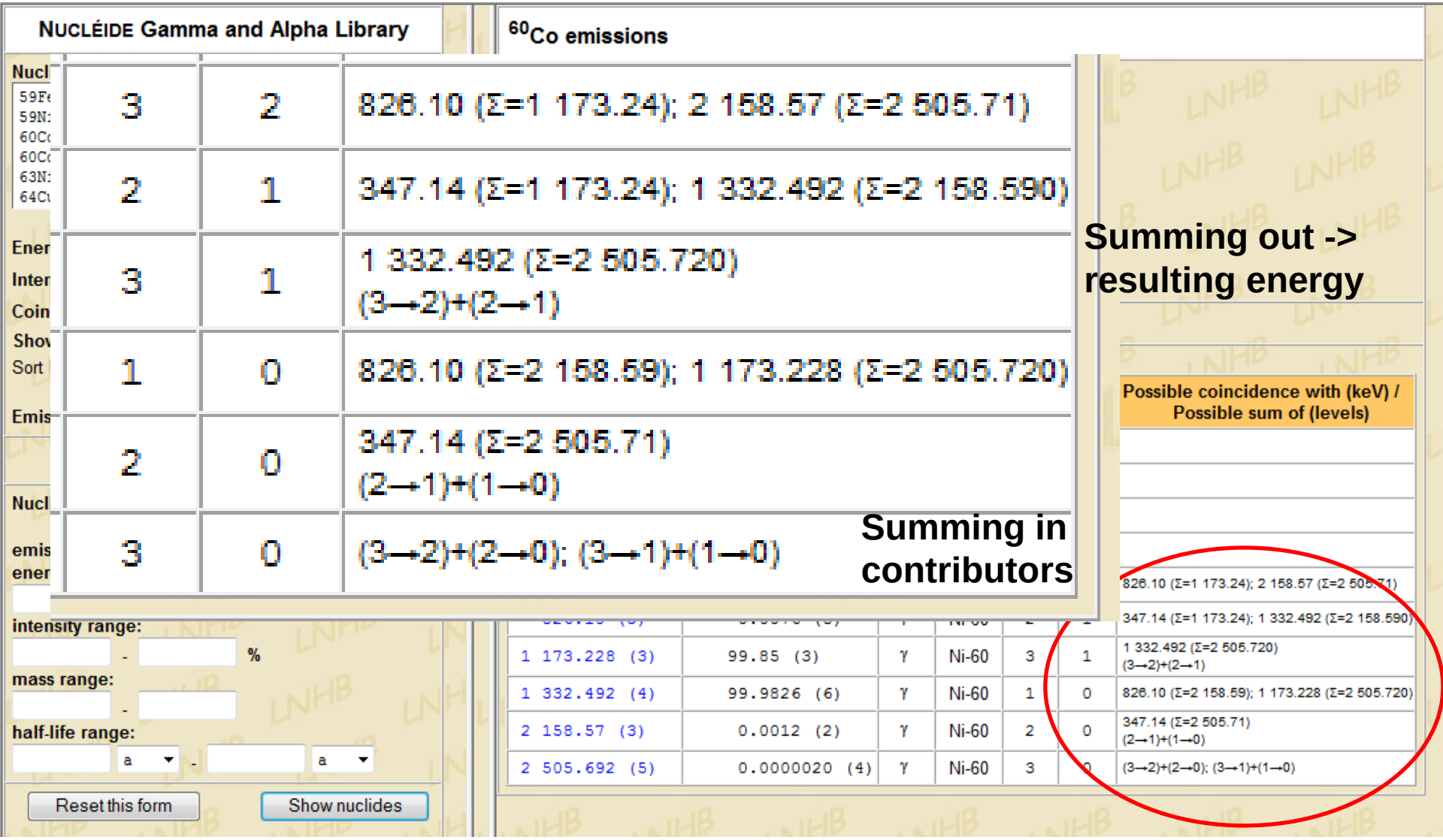
Data evaluation files: Table - Comments - ENSDF

Results file (ASCII text format): Eu-152.txt

Energy threshold: **100 keV**
Intensity threshold: **5 %**
Gamma emissions (8 lines out of 139) sorted by decreasing intensity

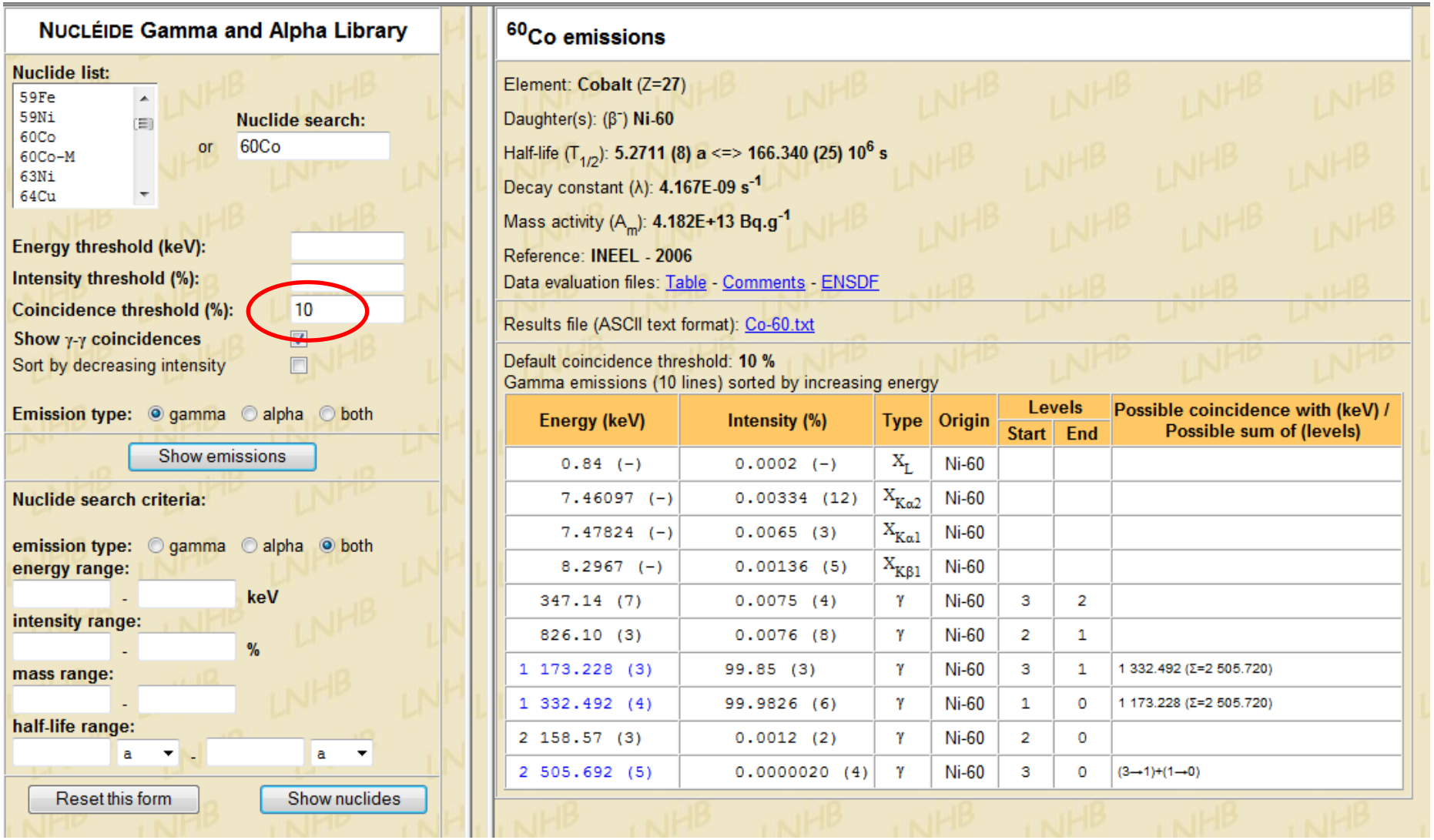
Energy (keV)	Intensity (%)	Type	Origin	Levels	
				Start	End
121.7817 (3)	28.41 (13)	γ	Sm-152	1	0
344.2785 (12)	26.59 (12)	γ	Gd-152	1	0
1 408.013 (3)	20.85 (8)	γ	Sm-152	13	1
964.079 (18)	14.50 (6)	γ	Sm-152	9	1
1 112.076 (3)	13.41 (6)	γ	Sm-152	10	1
778.9045 (24)	12.97 (6)	γ	Gd-152	7	1
1 085.837 (10)	10.13 (6)	γ	Sm-152	9	0
244.6974 (8)	7.55 (4)	γ	Sm-152	2	1

Coincidence summing information



Coincidence summing information

Based on decay scheme (energy levels) + photon emission intensities (threshold)



NUCLÉIDE Gamma and Alpha Library

Nuclide list:

59Fe
59Ni
60Co
60Co-M
63Ni
64Cu

Nuclide search: or 60Co

Energy threshold (keV):

Intensity threshold (%):

Coincidence threshold (%): 10

Show γ-γ coincidences

Sort by decreasing intensity

Emission type: gamma alpha both

Show emissions

Nuclide search criteria:

emission type: gamma alpha both

energy range: - keV

intensity range: - %

mass range: -

half-life range: a - a

Reset this form | Show nuclides

^{60}Co emissions

Element: **Cobalt** (Z=27)

Daughter(s): (β^-) **Ni-60**

Half-life ($T_{1/2}$): **5.2711 (8) a <=> 166.340 (25) 10^6 s**

Decay constant (λ): **4.167E-09 s^{-1}**

Mass activity (A_m): **4.182E+13 $Bq.g^{-1}$**

Reference: **INEEL - 2006**

Data evaluation files: Table - Comments - ENSDF

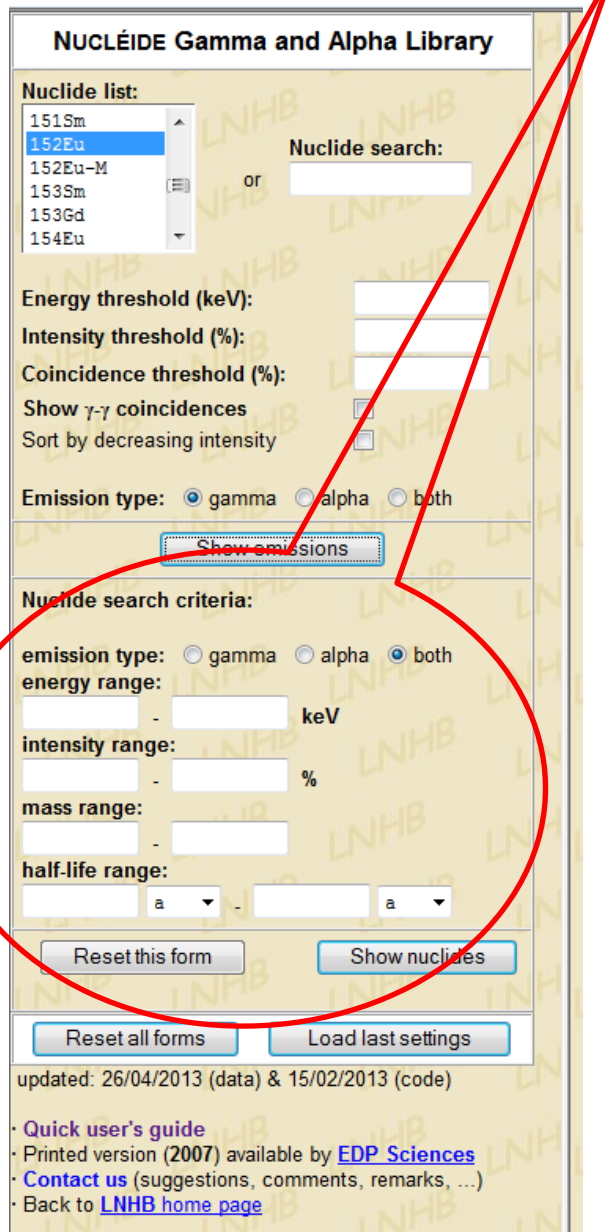
Results file (ASCII text format): Co-60.txt

Default coincidence threshold: **10 %**

Gamma emissions (10 lines) sorted by increasing energy

Energy (keV)	Intensity (%)	Type	Origin	Levels		Possible coincidence with (keV) / Possible sum of (levels)
				Start	End	
0.84 (-)	0.0002 (-)	X_L	Ni-60			
7.46097 (-)	0.00334 (12)	$X_{K\alpha 2}$	Ni-60			
7.47824 (-)	0.0065 (3)	$X_{K\alpha 1}$	Ni-60			
8.2967 (-)	0.00136 (5)	$X_{K\beta 1}$	Ni-60			
347.14 (7)	0.0075 (4)	γ	Ni-60	3	2	
826.10 (3)	0.0076 (8)	γ	Ni-60	2	1	
1 173.228 (3)	99.85 (3)	γ	Ni-60	3	1	1 332.492 (Σ=2 505.720)
1 332.492 (4)	99.9826 (6)	γ	Ni-60	1	0	1 173.228 (Σ=2 505.720)
2 158.57 (3)	0.0012 (2)	γ	Ni-60	2	0	
2 505.692 (5)	0.0000020 (4)	γ	Ni-60	3	0	(3→1)+(1→0)

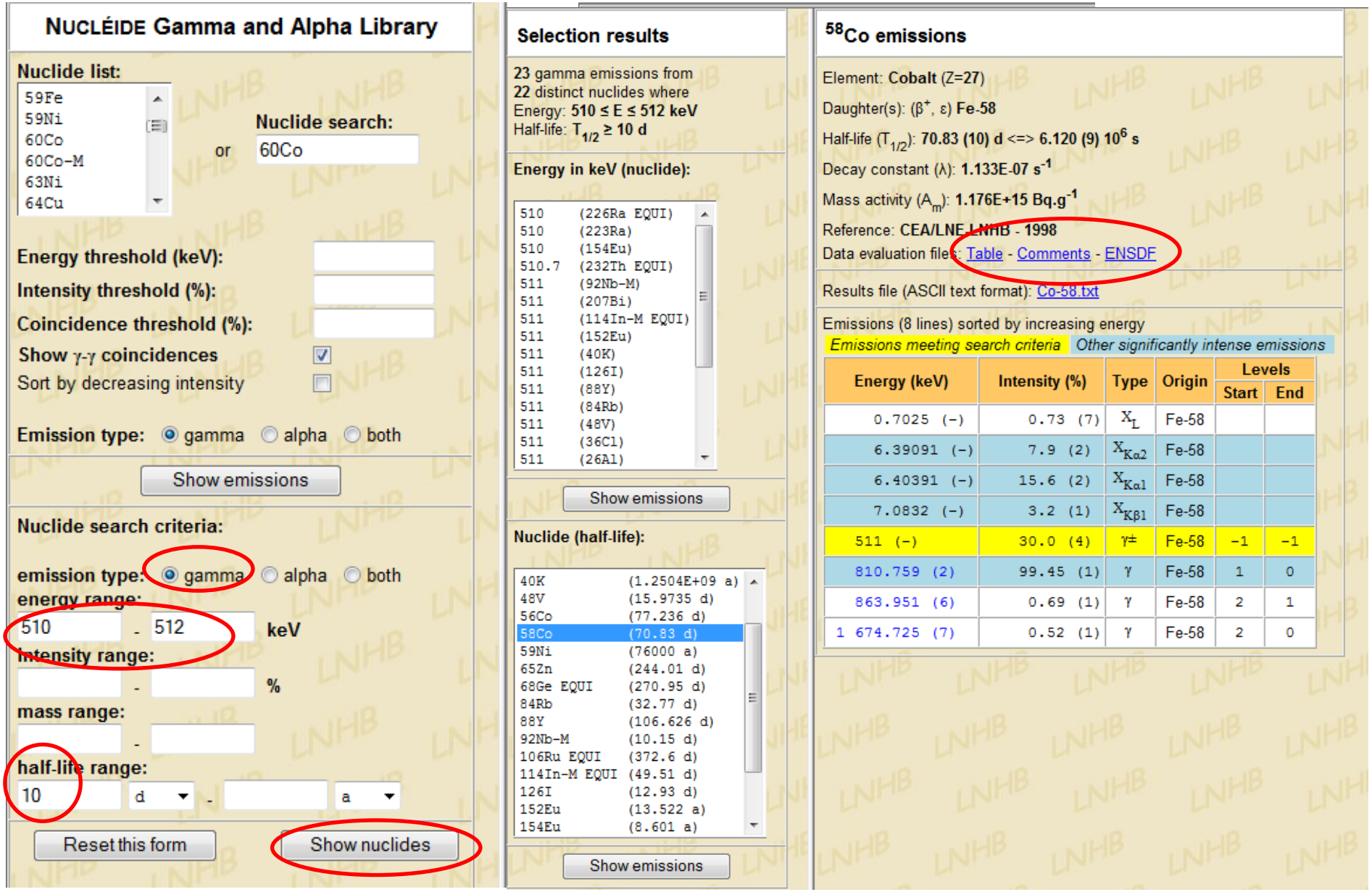
Advanced use (search nuclides)



Find nuclides meeting multiple search criteria:

- Emission type: gamma or alpha,
- Energy range,
- Intensity range,
- Atomic mass range,
- Half-life range.

Advanced use (search): *find nuclides meeting multiple search criteria*



Direct link to the data evaluation files:
Table of radionuclides (full information) and comment ENSDF

$^{58}_{27}\mathrm{Co}_{31}$

1 Decay Scheme

Co-58 disintegrates to Fe-58 excited levels by electron capture or by beta plus emission.
Le Co-58 se désintègre par capture électronique et émission bêta plus vers des niveaux excités de Fe-58.

2 Nuclear Data

$T_{1/2}(^{58}\mathrm{Co}\ )$: 70,83 (10) d
$Q^{+}(^{58}\mathrm{Co}\ )$: 2307,4 (11) keV

2.1 β^{+} Transitions

	Energy keV	Probability × 100	Nature	lg ft
$\beta^{+}_{0,1}$	474,6 (11)	15,0 (2)	Allowed	6,6
$\beta^{+}_{0,0}$	1285,4 (11)	0,00082 (23)	2nd Forbidden	12,7

2.2 Electron Capture Transitions

	Energy keV	Probability × 100	Nature	lg ft	P_K	P_L	P_{M+}

Advanced use (search): *find nuclides meeting multiple search criteria*

NUCLÉIDE Gamma and Alpha Library

Nuclide list:

59Fe
59Ni
60Co
60Co-M
63Ni
64Cu

or **Nuclide search:** 60Co

Energy threshold (keV):

Intensity threshold (%):

Coincidence threshold (%):

Show γ-γ coincidences ☑

Sort by decreasing intensity ☐

Emission type: ◉ gamma ○ alpha ○ both

Show emissions

Nuclide search criteria:

emission type: ◉ gamma ○ alpha ○ both

energy range: 510 - 512 **keV**

intensity range: - **%**

mass range: -

half-life range: 10 d - a

Reset this form | Show nuclides

Selection results

23 gamma emissions from
22 distinct nuclides where
Energy: **510 ≤ E ≤ 512 keV**
Half-life: $T_{1/2}$ **≥ 10 d**

Energy in keV (nuclide):

510 (226Ra EQUI)
510 (223Ra)
510 (154Eu)
510.7 (232Th EQUI)
511 (92Nb-M)
511 (207Bi)
511 (114In-M EQUI)
511 (152Eu)
511 (40K)
511 (126I)
511 (88Y)
511 (84Rb)
511 (48V)
511 (36Cl)
511 (26Al)

Show emissions

Nuclide (half-life):

40K (1.2504E+09 a)
48V (15.9735 d)
56Co (77.236 d)
58Co (70.83 d)
59Ni (76000 a)
65Zn (244.01 d)
68Ge EQUI (270.95 d)
84Rb (32.77 d)
88Y (106.626 d)
92Nb-M (10.15 d)
106Ru EQUI (372.6 d)
114In-M EQUI (49.51 d)
126I (12.93 d)
152Eu (13.522 a)
154Eu (8.601 a)

Show emissions

^{58}Co emissions

Element: **Cobalt** (Z=27)

Daughter(s): (β$^+$, ε) **Fe-58**

Half-life ($T_{1/2}$): **70.83 (10) d <=> 6.120 (9) 10^6 s**

Decay constant (λ): **1.133E-07 s^{-1}**

Mass activity (A_m): **1.176E+15 $Bq.g^{-1}$**

Reference: **CEA/LNE-LNHB - 1998**

Data evaluation files: Table - Comments - ENSDF

Results file (ASCII text format): Co-58.txt

Emissions (6 lines) sorted by increasing energy

Emissions meeting search criteria | *Other significantly intense emissions*

Energy (keV)	Intensity (%)	Type	Origin	Levels	
				Start	End
0.7025 (-)	0.73 (7)	X_L	Fe-58		
6.39091 (-)	7.9 (2)	$X_{K\alpha 2}$	Fe-58		
6.40391 (-)	15.6 (2)	$X_{K\alpha 1}$	Fe-58		
7.0832 (-)	3.2 (1)	$X_{K\beta 1}$	Fe-58		
511 (-)	30.0 (4)	γ±	Fe-58	-1	-1
810.759 (2)	99.45 (1)	γ	Fe-58	1	0
863.951 (6)	0.69 (1)	γ	Fe-58	2	1
1 674.725 (7)	0.52 (1)	γ	Fe-58	2	0

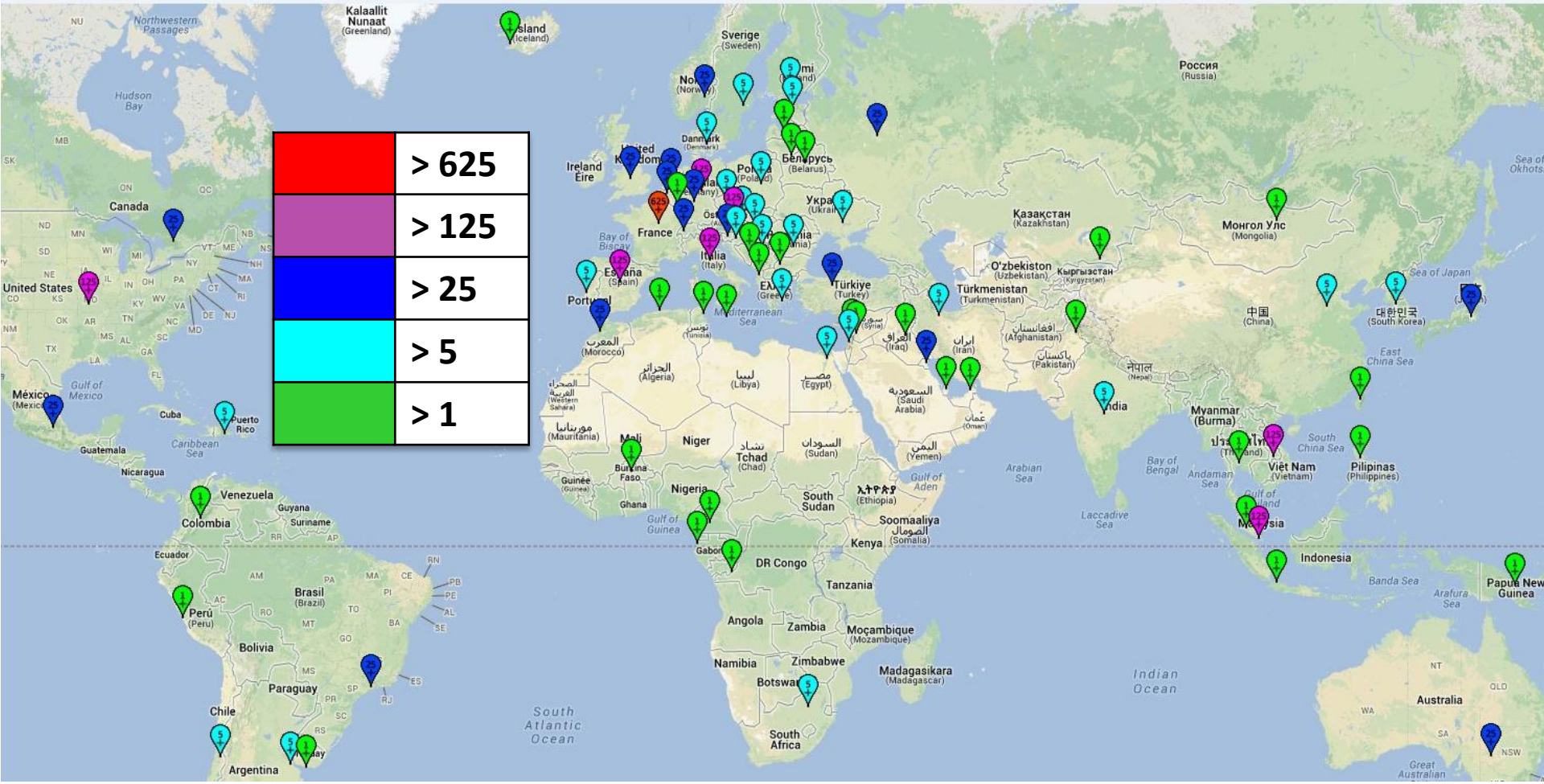
Output of ASCII data

Nuclide ; Co-58
Element ; Cobalt
Z ; 27
Daughter(s) ; (B+, EC) ; Fe-58
Half-life (d) ; 70.83 ; 0.10
Half-life (s) ; 6.120E6 ; 0.009E6
Decay constant (1/s) ; 1.133E-07
Mass activity (Bq/g) ; 1.176E+15
Reference ; CEA/LNE-LNHB - 1998
Emissions (8 lines) sorted by increasing energy

Energy (keV) ; Ener. Unc. (keV) ; Intensity (%) ; Int. Unc. (%) ; Type ; Origin ; Lvl start ; Lvl end
0.7025 ; ; 0.73 ; 0.07 ; XL ; Fe-58 ; ;
6.39091 ; ; 7.9 ; 0.2 ; XKa2 ; Fe-58 ; ;
6.40391 ; ; 15.6 ; 0.2 ; XKa1 ; Fe-58 ; ;
7.0832 ; ; 3.2 ; 0.1 ; XKb1 ; Fe-58 ; ;
511 ; ; 30.0 ; 0.4 ; g511 ; Fe-58 ; -1 ; -1
810.759 ; 0.002 ; 99.45 ; 0.01 ; g ; Fe-58 ; 1 ; 0
863.951 ; 0.006 ; 0.69 ; 0.01 ; g ; Fe-58 ; 2 ; 1
1674.725 ; 0.007 ; 0.52 ; 0.01 ; g ; Fe-58 ; 2 ; 0
==========

> 80 countries ≈ 5000 users

≈ 400 queries (10 new users) per day



Most popular nuclides: ^{152}Eu, ^{137}Cs, ^{60}Co, U, …

Laboratoire National
Henri Becquerel

LNE-LNHB

http://laraweb.free.fr/

Contact us

(suggestions, comments, remarks, ...)

Christophe DULIEU