Ongoing developments at the Decay Data Evaluation Project

S. Leblond

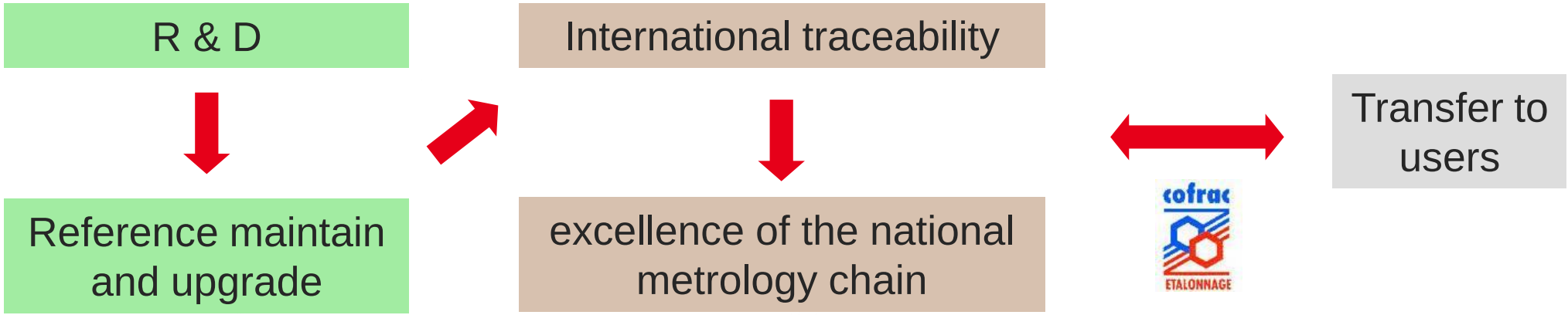
C. Dulieu, M.A. Kellett, X. Mougeot

1. The Decay Data Project at LNHB

Laboratoire National Henri Becquerel

- LNHB is the French national metrology laboratory for ionising radiation: radioactivity and dosimetry of photons and charged particles

- Provide metrological references to users through a strict traceability chain



- Standards and measurements for:
  - Radiotherapy
  - Nuclear medicine
  - Diagnostics
  - Health protection
  - Nuclear industry
  - Environmental studies
  - Defense
  - Research

At the origin of DDEP

- Within the metrology community, in the early 1990s, there was a specific need identified for evaluated decay scheme data for use in absolute activity measurements, including important atomic data, e.g. conversion electrons, X-rays, Auger-electrons.

- During international inter-comparison exercises, differences in recommended activity values were seen to be dependent upon the decay scheme data used.

- A group dedicated to decay scheme evaluation was formed in 1993 between LNHB (France) & PTB (Germany), quickly followed by USA and others in 1994

- Hence, the international DDEP group was established in 1995, in which a common evaluation methodology was defined and adopted, including a comprehensive review process.

- The Bureau International des Poids et Mesures (BIPM), which, through the Consultative Committee on Ionising Radiation, oversees the international metrology community inter-comparison exercises recommended that the DDEP evaluated decay scheme data should be used by all metrology institutes.

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DDEP is complementary to ENSDF decay data

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DDEP missions

- Provide recommended decay data to non-specialists
  - Metrology
  - Fundamental physics (detector calibration)
  - Nuclear medicine
  - Nuclear industry

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  - Metrology
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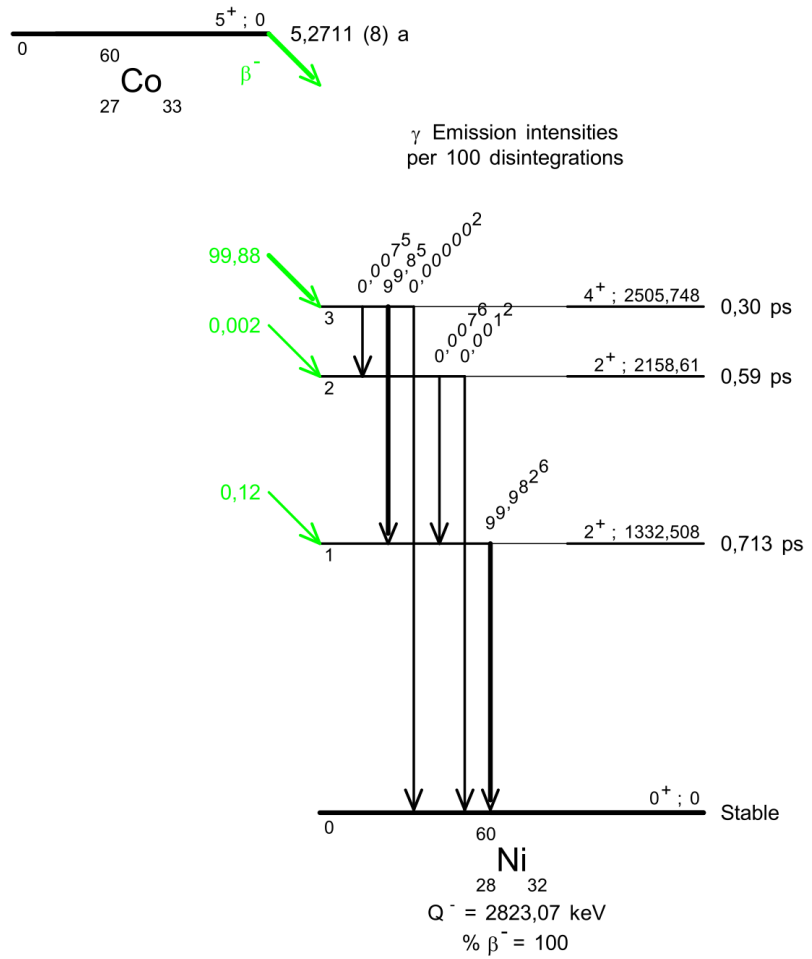
- Main information of interest:
  - Half-life, Q-value
  - Decay scheme
  - Intensity and energies of
    - Alpha / beta / electron capture
    - Gamma and internal conversion
    - X-rays & Auger electrons

Decay properties

Emitted particles



DDEP members

- DDEP Coordination: Xavier Mougeot

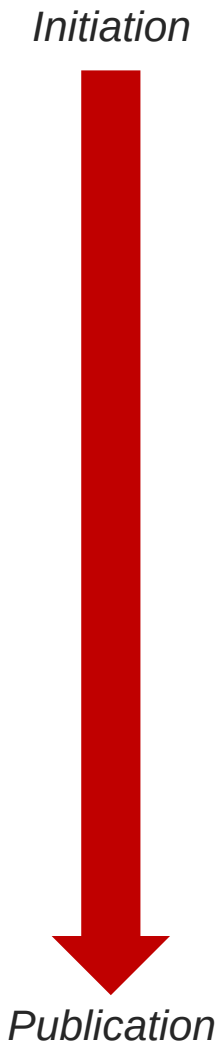
- LNHB Local team (evaluation, review, edition, publication)
  - Sylvain Leblond
  - Xavier Mougeot
  - Mark A. Kellett (Special advisor)
  - Christophe Dulieu (IT support)

- Decay data evaluators
  - Alan L. Nichols (Surrey University, UK)
  - Aurelian Luca (IFIN, Romania)
  - Brian E. Zimmerman (NIST, USA)
  - Rob Shearman (NPL, UK)
  - Xialong Huang (CIAE, China)
  - Nikolai Kuzmenko (KRI, Russia)

- Additional support
  - Tibor Kibédi (BrIcc and BrIccMixing codes)
  - Balraj Singh (ENSDF collaboration)

DDEP evaluation pipeline

1. Initiation of a evaluation
   - Need from a project / collaboration
   - Following a user request
   - Evaluator initiative



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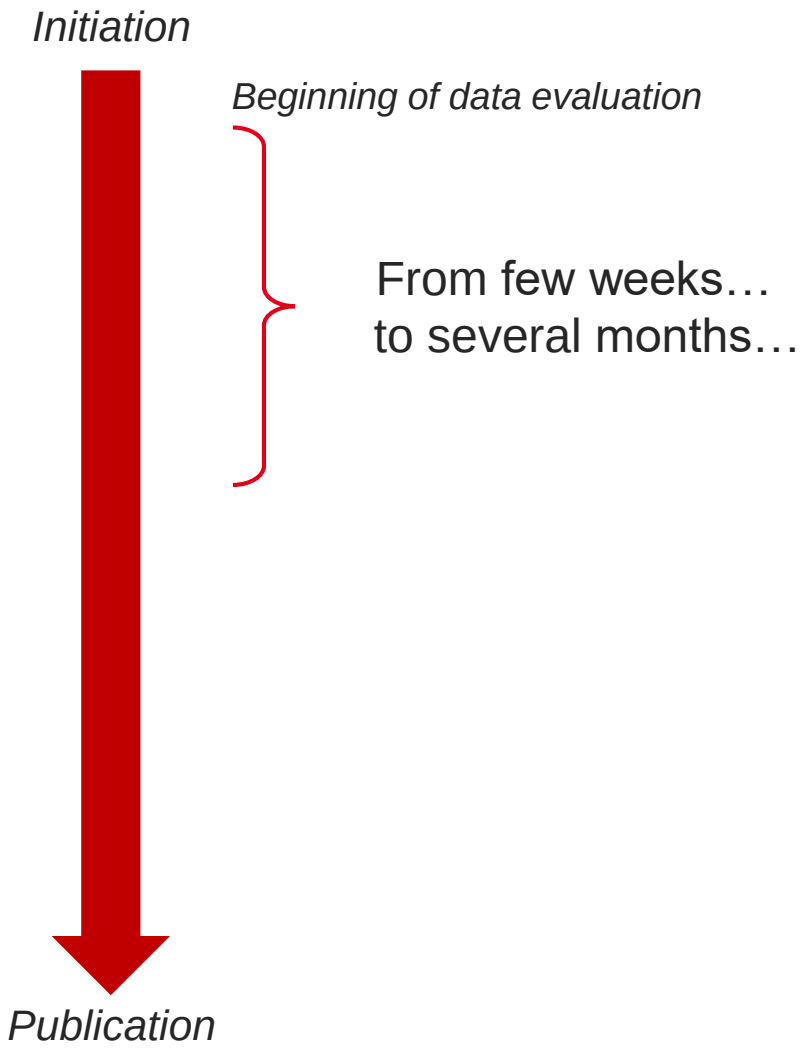

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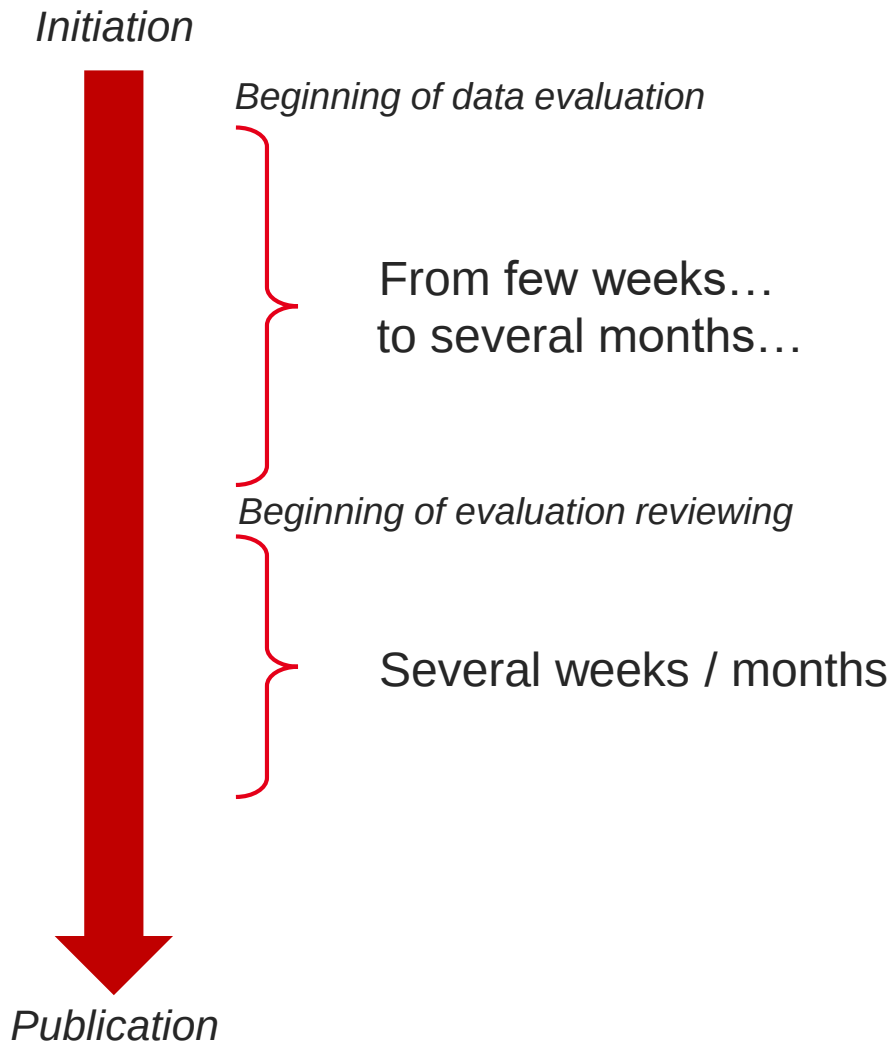
   - One DDEP reviewer is assigned
   - Complete verification of the evaluation
   - Discussion with evaluator until agreement



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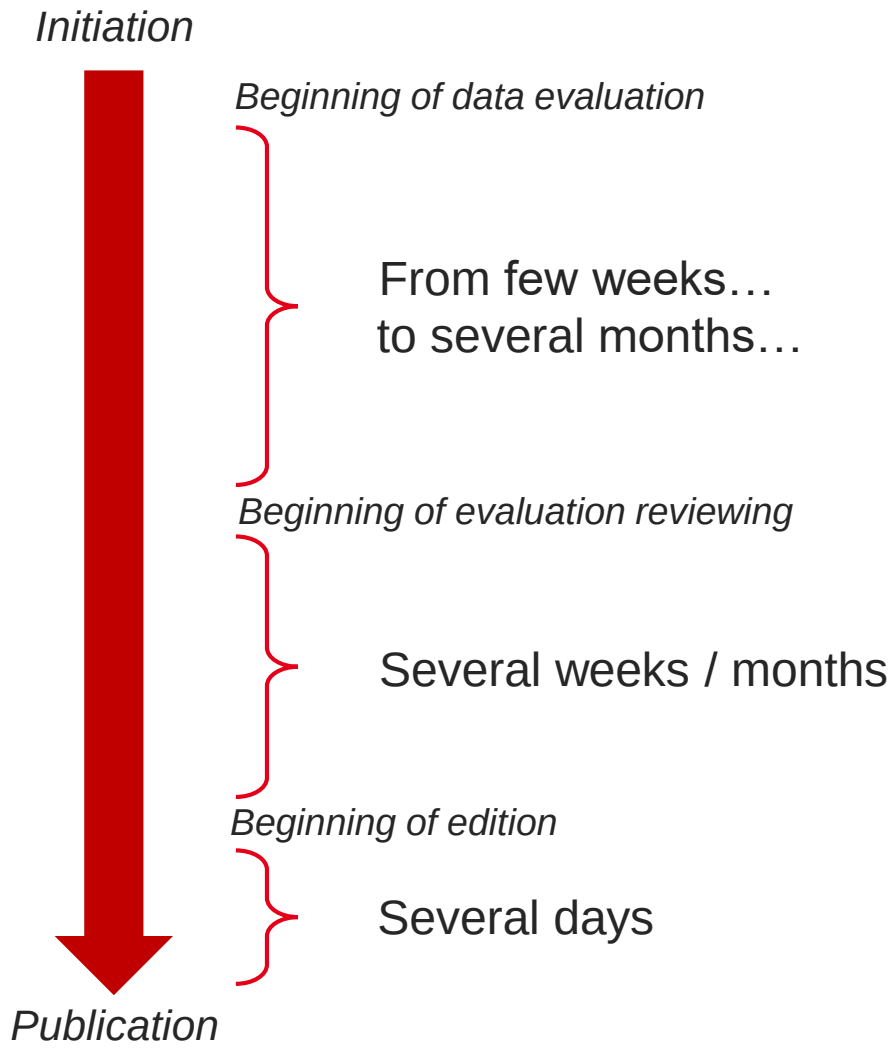
4. Edition and publication



DDEP various collaborations

- IAEA Coordinated Research Projects (CRP)
  - 2019: *Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production*
  - 2013: *Library of Recommended Actinide Decay Data*
  - 2007: *Update of X Ray and Gamma Ray Decay Data Standards for Detector Calibration and Other Applications*

- Evaluations for Comprehensive Nuclear-Test-Ban Treaty Organisation (Mónica Galán: Xe and I isotopes)

- European Research Project (EMPIR Euramet)

- CEA INSNU project (Reactor safety)

- Joint Evaluated Fission and Fusion file (JEFF) European library

JEFF-3.3 NEA NUCLEAR ENERGY AGENCY

The Joint Evaluated Fission and Fusion File (JEFF) is an evaluated library produced via an international collaboration of NEA Data Bank participating countries.

2. Dissemination of DDEP recommendations

Publications

- Tables of Radionuclides
  - published by BIPM
  - 8 volumes from 2004 to 2016
  - Around 40 isotopes per volume

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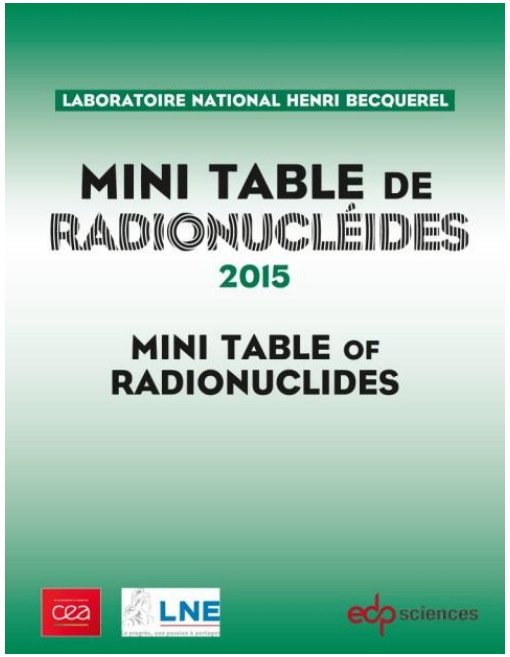
  - 8 volumes from 2004 to 2016
  - Around 40 isotopes per volume

- Mini Table of Radionuclides
  - Published by EDP Sciences
  - Price: 25 €
  - 1884 units sold (paper + digital)
  - Around 300 isotopes
  - Small and compact



LNHB website

- Download available
  - BIPM Monographies
  - Nucleus Evaluation
  - Comments file
  - ENSDF file
  - PenNuc input file
  - BetaShape file

This introduction presents a brief description of the radioactivity physical processes, the enumeration of the evaluation rules leading to the recommended values, and a summary of the symbols and terms used in all the publications.

Explanation on recommended data and their evaluation (in various languages):

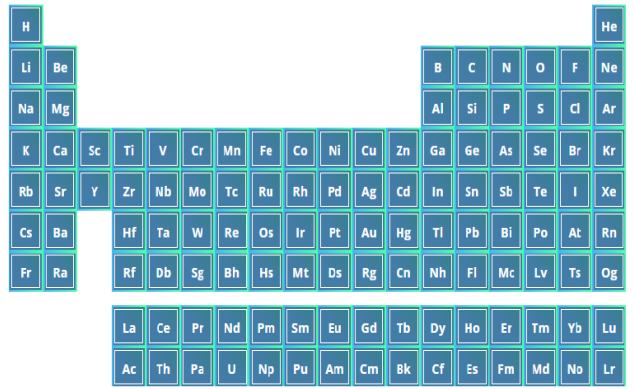
Please cite our evaluations using the following references:

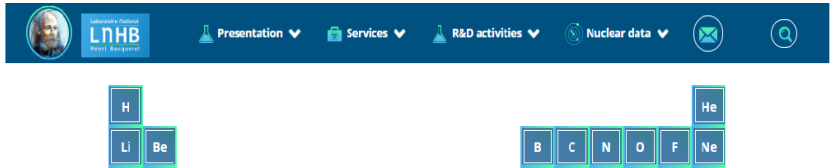
Vol.	Publication	Year	ISBN	NSR	BibTeX
99	CEA Report – Table de Radionucléides	1999	2-7272-0200-3	1999BeZO	TabRad_v0.bib
1	Monographie BIPM-5 – Table of Radionuclides, vol. 1	2004	92-822-2206-3	2004BeZR	TabRad_v1.bib
2	Monographie BIPM-5 – Table of Radionuclides, vol. 2	2004	92-822-2207-1	2004BeZQ	TabRad_v2.bib
3	Monographie BIPM-5 – Table of Radionuclides, vol. 3	2006	92-822-2218-7	2006BeZL	TabRad_v3.bib
4	Monographie BIPM-5 – Table of Radionuclides, vol. 4	2008	92-822-2231-4	2008BeZV	TabRad_v4.bib
5	Monographie BIPM-5 – Table of Radionuclides, vol. 5	2010	978-92-822-2234-8	2010BeZQ	TabRad_v5.bib
6	Monographie BIPM-5 – Table of Radionuclides, vol. 6	2011	978-92-822-2242-3	2011BeZW	TabRad_v6.bib
7	Monographie BIPM-5 – Table of Radionuclides, vol. 7	2013	978-92-822-2248-5	2013BeZP	TabRad_v7.bib
8	Monographie BIPM-5 – Table of Radionuclides, vol. 8	2016	978-92-822-2264-5	2016BeZK	TabRad_v8.bib
9	Monographie BIPM-5 – Table of Radionuclides, vol. 9	2020	to be published	-	-

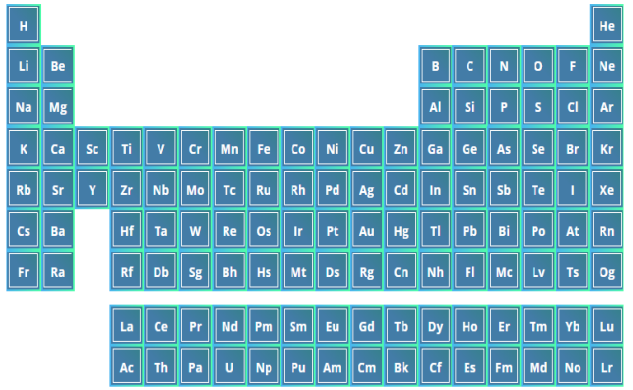
Filter data:

Enter value

by Element by Atomic number (Z) by Mass number (A)







Sort by:

Atomic number

Nuclide		Z	Vol. (?)	UpDate	Type (?)	Table (?)	Comments (?)	ASCII files (?)
H-3	^{3}H	1	3	04/09/2006	1	T	C	E P L B
Be-7	^{7}Be	4	1	18/02/2004	1	T	C	E P L B
C-11	^{11}C	6	1	03/11/2011	2	T	C	E P L B
C-14	^{14}C	6	7	22/11/2012	1	T	C	E P L B
N-13	^{13}N	7	1	08/04/2004	1	T	C	E P L B
O-15	^{15}O	8	1	01/06/2004	1	T	C	E P L B
F-18	^{18}F	9	1	01/09/2014	2	T	C	E P L B
Na-22	^{22}Na	11	5	06/08/2009	3	T	C	E P L B
Na-24	^{24}Na	11	1	16/06/2014	2	T	C	E P L B
Al-26	^{26}Al	13	99	24/07/2003	1	T	C	E P L B
P-32	^{32}P	15	1	08/04/2004	1	T	C	E P L B
P-33	^{33}P	15	1	08/04/2004	1	T	C	E P L B

http://www.lnhb.fr/nuclear-data/nuclear-data-table/

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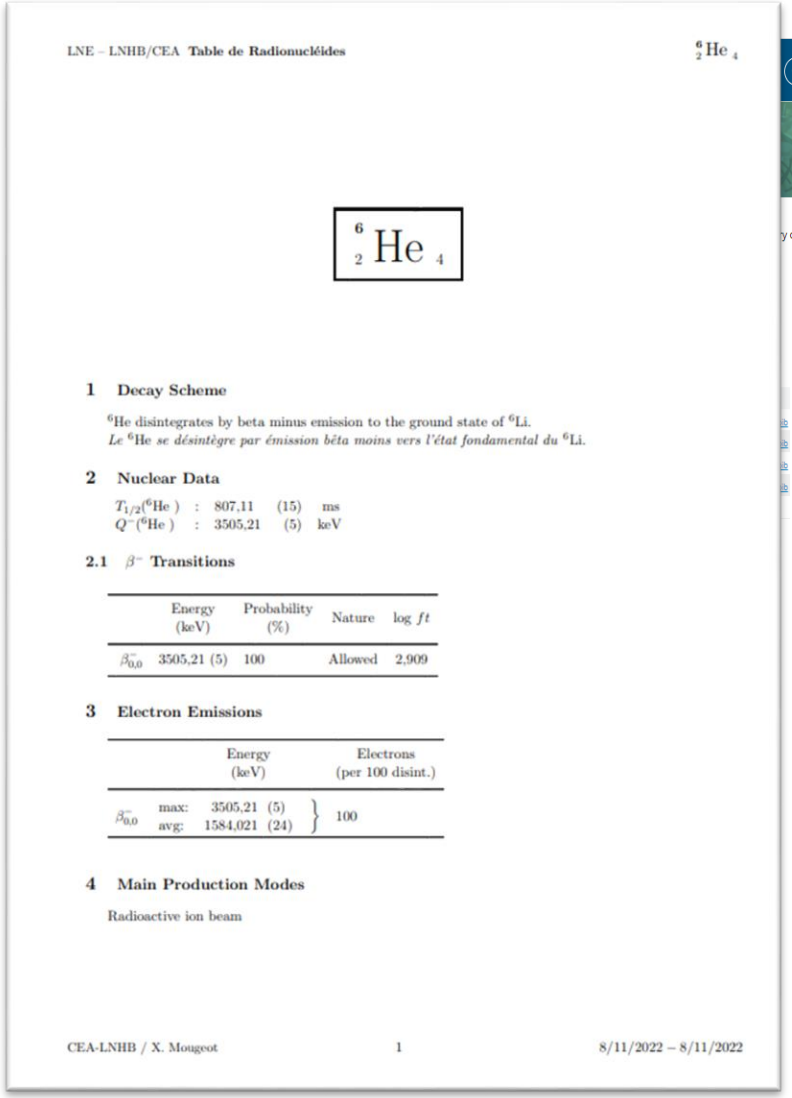

LNE – LNHB/CEA **Table de Radionucléides** $^{6}_{2}He_{4}$

$^{6}_{2}He_{4}$

1 Decay Scheme

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Le ^{6}He se désintègre par émission bêta moins vers l'état fondamental du ^{6}Li.

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$T_{1/2}(^{6}He)$: 807,11 (15) ms
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	Energy (keV)	Probability (%)	Nature	log ft
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3 Electron Emissions

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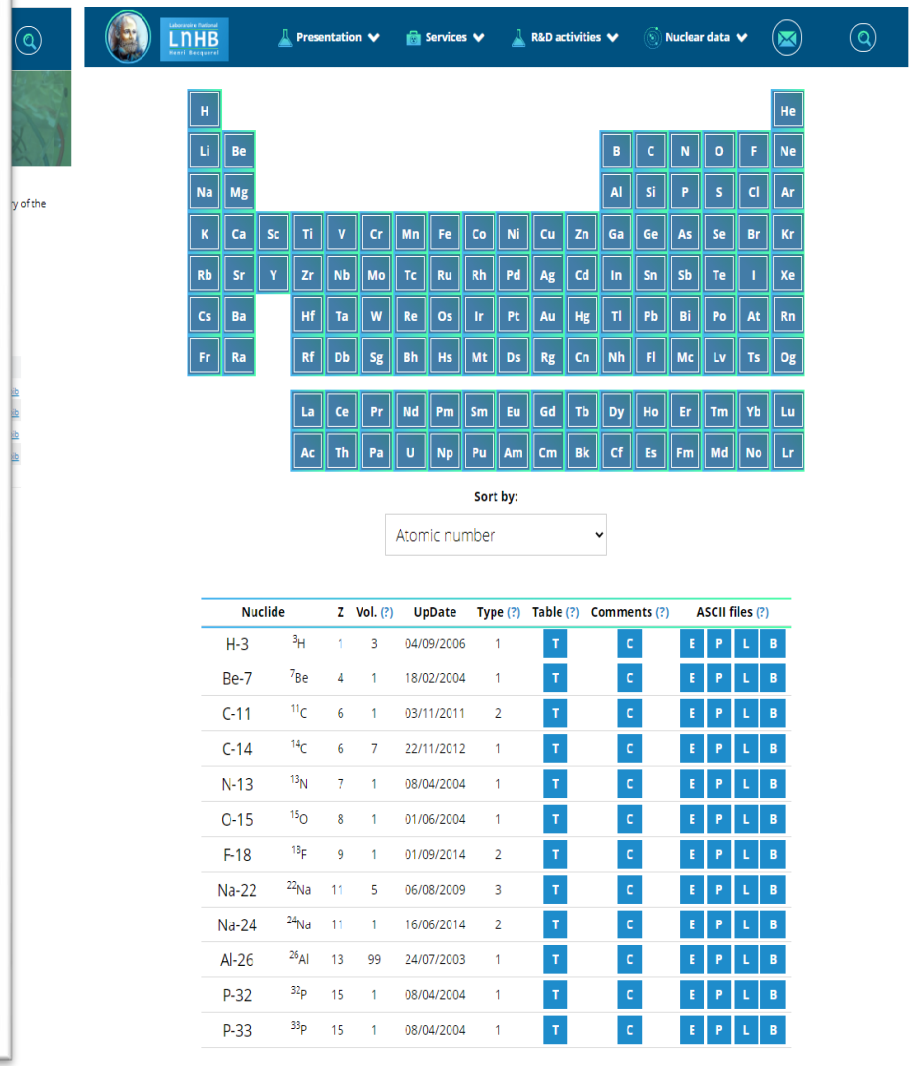
CEA-LNHB / X. Mougeot 1 8/11/2022 – 8/11/2022



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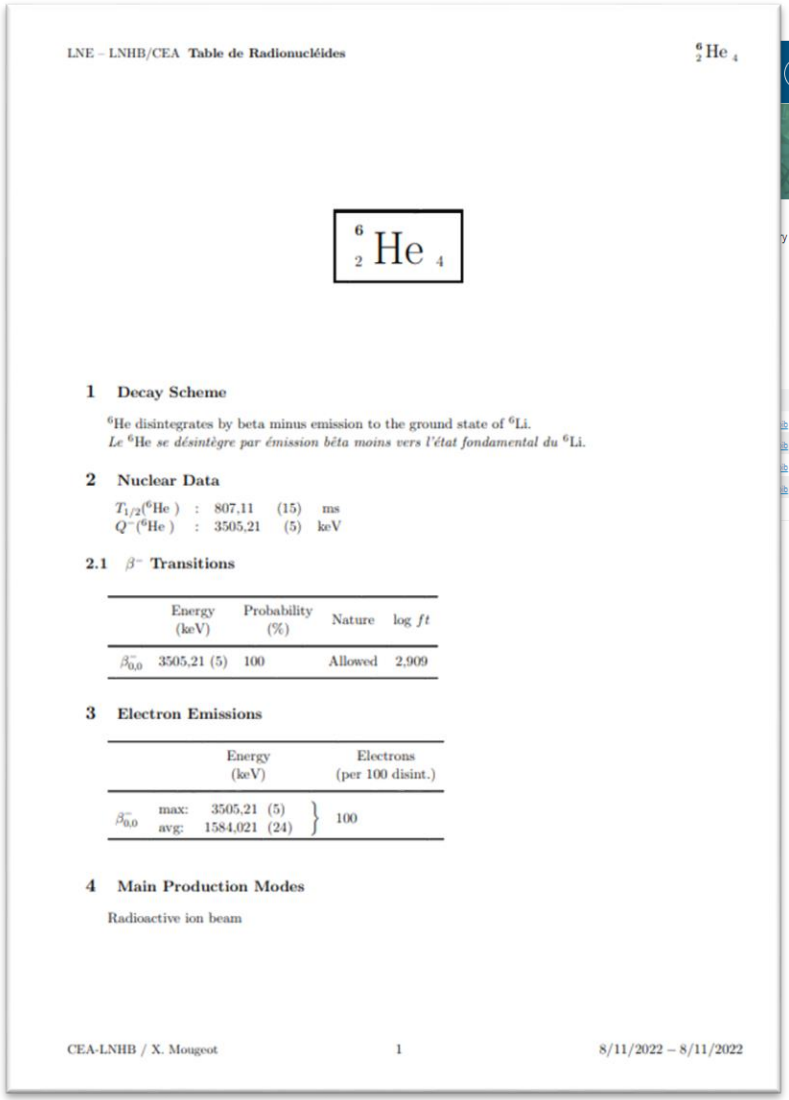

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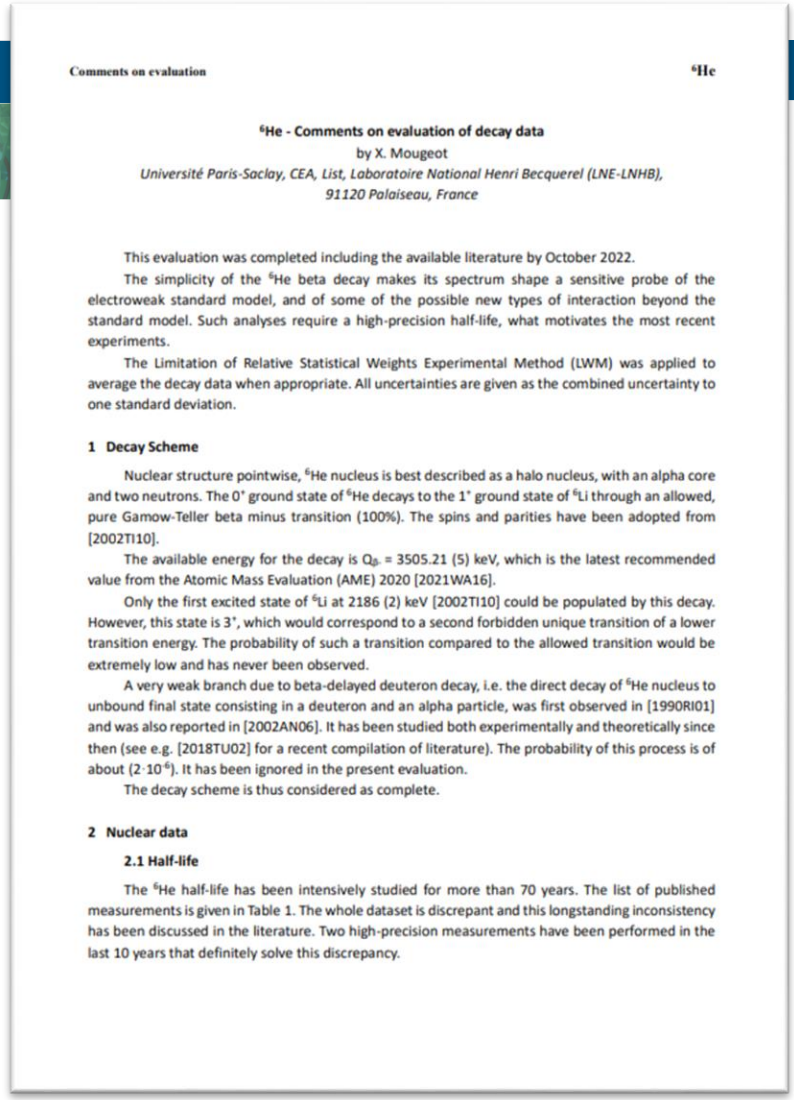
CEA-LNHB / X. Mougeot 1 8/11/2022 – 8/11/2022



Comments on evaluation ^{6}He

^{6}He - Comments on evaluation of decay data

by X. Mougeot

Université Paris-Saclay, CEA, List, Laboratoire National Henri Becquerel (LNE-LNHB), 91120 Palaiseau, France

This evaluation was completed including the available literature by October 2022.

The simplicity of the ^{6}He beta decay makes its spectrum shape a sensitive probe of the electroweak standard model, and of some of the possible new types of interaction beyond the standard model. Such analyses require a high-precision half-life, what motivates the most recent experiments.

The Limitation of Relative Statistical Weights Experimental Method (LWM) was applied to average the decay data when appropriate. All uncertainties are given as the combined uncertainty to one standard deviation.

1 Decay Scheme

Nuclear structure pointwise, ^{6}He nucleus is best described as a halo nucleus, with an alpha core and two neutrons. The 0^{+} ground state of ^{6}He decays to the 1^{+} ground state of ^{6}Li through an allowed, pure Gamow-Teller beta minus transition (100%). The spins and parities have been adopted from [2002TI10].

The available energy for the decay is $Q_{\beta^{-}}$ = 3505.21 (5) keV, which is the latest recommended value from the Atomic Mass Evaluation (AME) 2020 [2021WA16].

Only the first excited state of ^{6}Li at 2186 (2) keV [2002TI10] could be populated by this decay. However, this state is 3^{+}, which would correspond to a second forbidden unique transition of a lower transition energy. The probability of such a transition compared to the allowed transition would be extremely low and has never been observed.

A very weak branch due to beta-delayed deuteron decay, i.e. the direct decay of ^{6}He nucleus to unbound final state consisting in a deuteron and an alpha particle, was first observed in [1990RI01] and was also reported in [2002AN06]. It has been studied both experimentally and theoretically since then (see e.g. [2018TU02] for a recent compilation of literature). The probability of this process is of about ($2 \cdot 10^{-6}$). It has been ignored in the present evaluation.

The decay scheme is thus considered as complete.

2 Nuclear data

2.1 Half-life

The ^{6}He half-life has been intensively studied for more than 70 years. The list of published measurements is given in Table 1. The whole dataset is discrepant and this longstanding inconsistency has been discussed in the literature. Two high-precision measurements have been performed in the last 10 years that definitely solve this discrepancy.

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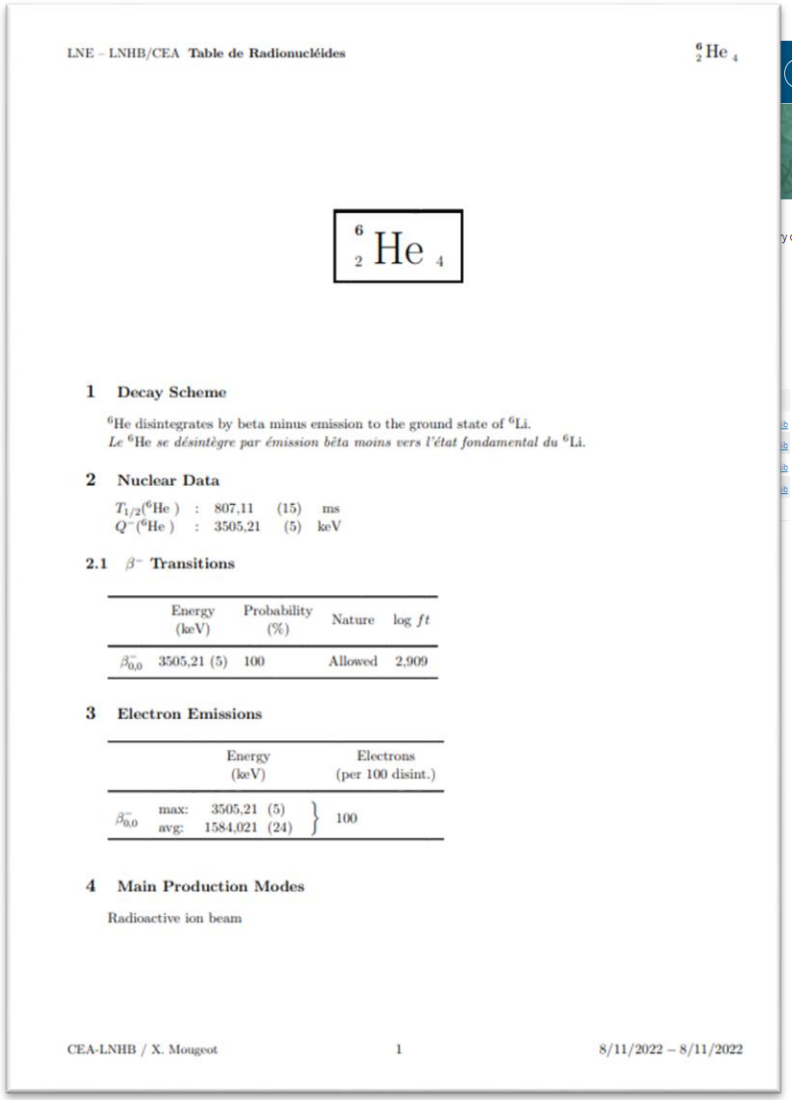
- Access in 2022
  - ~ 130 access per day
  - ~ 20 downloads per day
  - ~ 20 countries
  - ~ 7 times more views in 5 years



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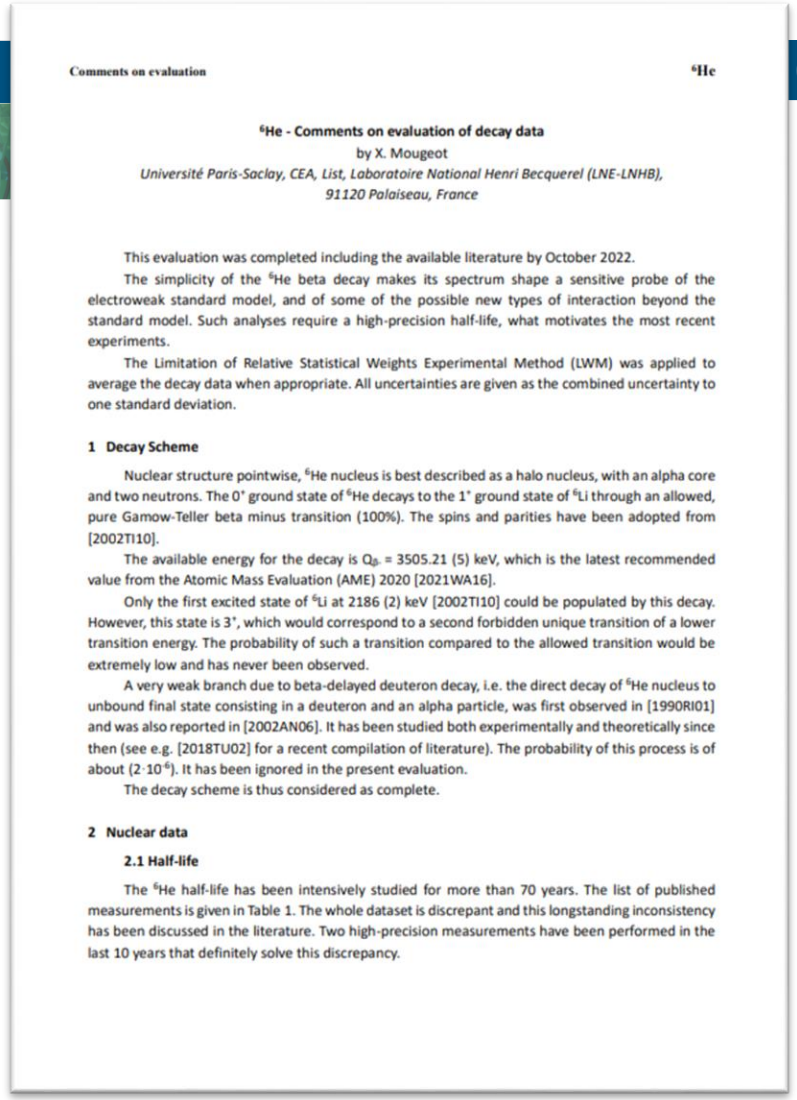

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http://www.lnhb.fr/nuclear-data/nuclear-data-table/

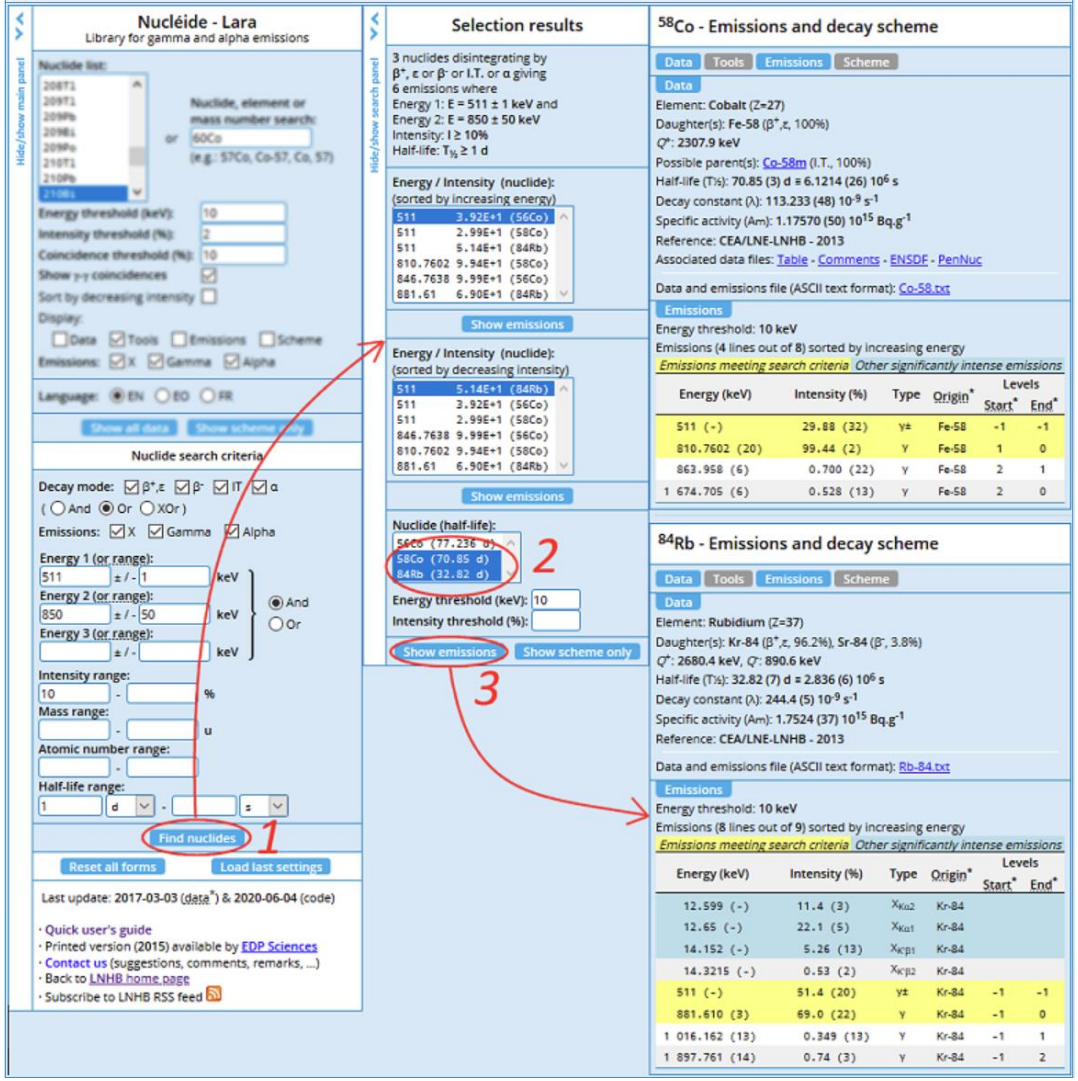
Laraweb online tool

- Laraweb online interface
  - Easy access to decay data
  - Decay scheme
  - Direct access to Tables & recommendations
  - Various tools (activity calculation, mass…)
  - Energy / intensity queries

- Statistics
  - ~ 2000 users per day
  - ~ 3000 requests per day
  - ~ 60 countries
  - Common queries: ^{241}Am, ^{137}Cs, ^{152}Eu…

http://www.lnhb.fr/Laraweb

Fig.2: Advanced use (search)



Decay data for Monte-Carlo

- Monte-Carlo simulations
  - Rely on many databases
  - Strongly dependent on the quality of the latter
  - Need for a complete inclusion of DDEP data
- PENELOPE
  - PENNUC module
- GEANT4
  - Nuclide++ module

Computer Physics Communications 245 (2019) 106849

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/cpc

PENNUC: Monte Carlo simulation of the decay of radionuclides☆

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[b] Facultat de Física (FQA and ICC), Universitat de Barcelona, Diagonal 645, 08028 Barcelona, Catalonia, Spain

Applied Radiation and Isotopes 156 (2020) 108964

Contents lists available at ScienceDirect

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journal homepage: http://www.elsevier.com/locate/apradiso

Nuclide++: A C++ module to include DDEP recommended radioactive decay Data in Geant4

C. Thiam [a,*], C. Dulieu [a], X. Mougeot [a], A. Nair [b], C. Bobin [a], M.A. Kellett [a]

3. Ongoing developments

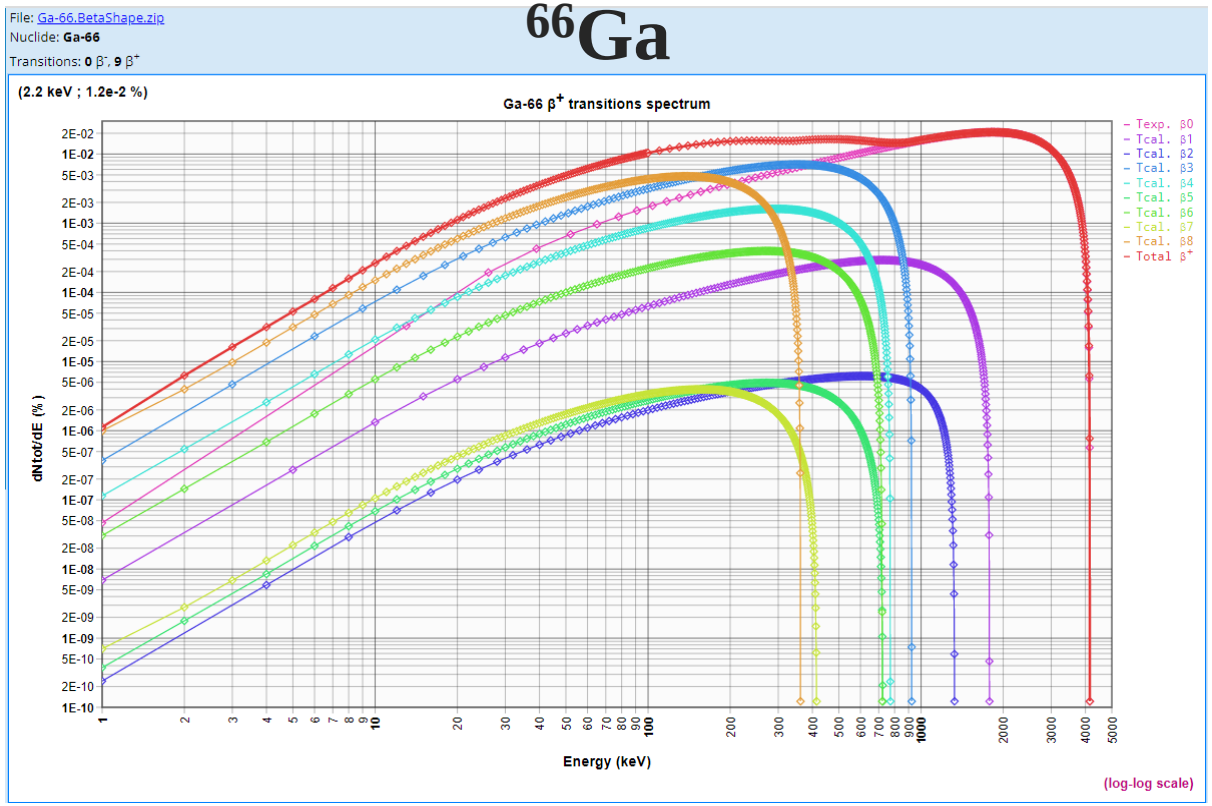
Laraweb continuous development

- Decay chain tools
  - Parent / Daughters activity calculation
  - Calculation of radiation emission intensities
  - Decay chains visualisation (in process)

- BetaShape on the web (released recently)

http://www.lnhb.fr/Laraweb/BetaShape_web/

- Any suggestion?
  - Contact: Christophe.DULIEU@cea.fr



Increasing the number of evaluators

- DDEP workforce remains limited
  - 7th to 9th of March 2022: Organisation of a DDEP workshop dedicated to evaluator training

    - Vanessa VALLET (CEA Cadarache)
    - David BERNARD (CEA Cadarache)
    - Muriel FALLOT (SUBATECH)
    - Amanda PORTA (SUBATECH)
    - Lydie GIOT (SUBATECH)
    - Alejandro ALGORA (Instituto de Física Corpuscular)
    - Philippe CASSETTE (Sofia University)

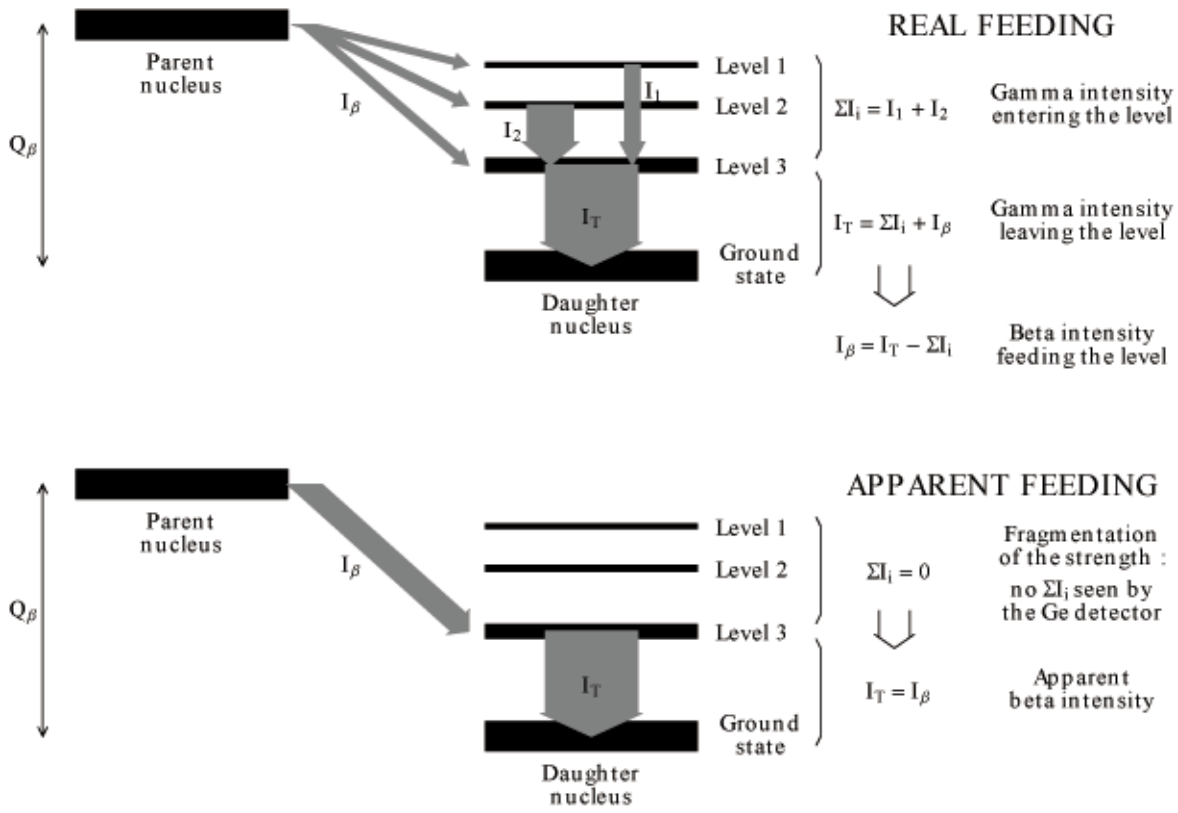
Increasing the number of evaluators

Enroll today !

orkshop dedicated to evaluator training

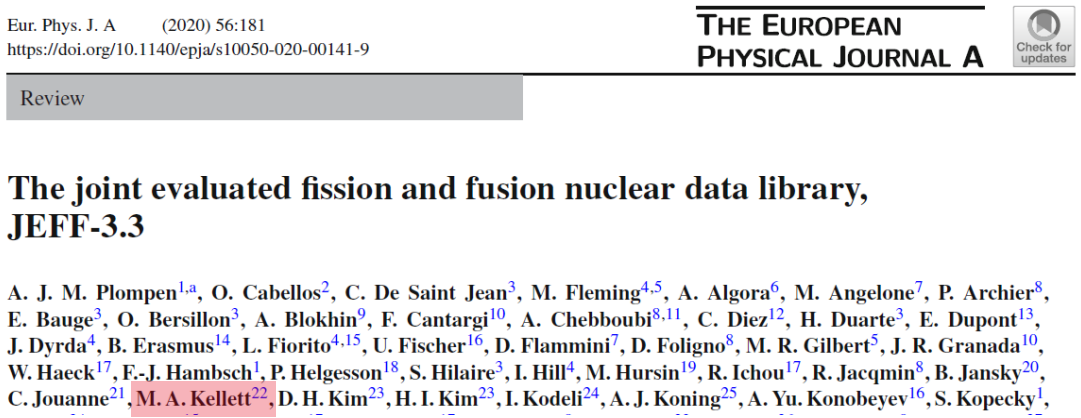
TAGS measurements

- Pandemonium effect
  - First discover by J. Hardy in 1977
  - Lead to inaccurate estimation of beta feeding
- TAGS measurements
  - Gamma calorimeters
  - New level scheme including pseudo levels
- Inclusion of TAGS data in DDEP
  - Discussions with TAGS community
  - Procedure to be defined
  - Requires support and expertise



JEFF 4

- Historical link between DDEP and the JEFF database
  - Inclusion of DDEP decay data in JEFF 3.3 by M.A. Kellett



Eur. Phys. J. A (2020) 56:181
https://doi.org/10.1140/epja/s10050-020-00141-9

THE EUROPEAN PHYSICAL JOURNAL A

Review

The joint evaluated fission and fusion nuclear data library, JEFF-3.3

A. J. M. Plompen[1,a], O. Cabellos[2], C. De Saint Jean[3], M. Fleming[4,5], A. Algora[6], M. Angelone[7], P. Archier[8], E. Bauge[3], O. Bersillon[3], A. Blokhin[9], F. Cantargi[10], A. Chebboubi[8,11], C. Diez[12], H. Duarte[3], E. Dupont[13], J. Dyrda[4], B. Erasmus[14], L. Fiorito[4,15], U. Fischer[16], D. Flammini[7], D. Foligno[8], M. R. Gilbert[5], J. R. Granada[10], W. Haeck[17], F.-J. Hambsch[1], P. Helgesson[18], S. Hilaire[3], I. Hill[4], M. Hursin[19], R. Ichou[17], R. Jacqmin[8], B. Jansky[20], C. Jouanne[21], M. A. Kellett[22], D. H. Kim[23], H. I. Kim[23], I. Kodeli[24], A. J. Koning[25], A. Yu. Konobeyev[16], S. Kopecky[1],

- Possible involvement of DDEP in JEFF 4
  - Update of the decay data library
  - Addition of the BetaShape calculations
    - Beta decay electrons spectra
    - Antineutrino spectra
    - LogFT value
- Limited by available manpower

4. Conclusion

DDEP project at LNHB

- Evaluations of decay data
  - Since 1993
  - For non-specialist
- Recommendations available
  - Online on LNHB website
  - Through LNHB web tool
  - For Monte-Carlo simulation
- On-going evolutions
  - Software & website
  - Recruitment of new evaluators
  - Inclusion of TAGS data ?
  - Update of JEFF 4?

This introduction presents a brief description of the radioactivity physical processes, the enumeration of the evaluation rules leading to the recommended values, and a summary of the symbols and terms used in all the publications.

Explanation on recommended data and their evaluation (in various languages):

Please cite our evaluations using the following references:

Vol.	Publication	Year	ISBN	NSR	BibTeX
99	CEA Report – Table de Radionucléides	1999	2-7272-0200-3	1999BeZQ	TabRad_v0.bib
1	Monographie BIPM-5 – Table of Radionuclides, vol. 1	2004	92-822-2206-3	2004BeZR	TabRad_v1.bib
2	Monographie BIPM-5 – Table of Radionuclides, vol. 2	2004	92-822-2207-1	2004BeZQ	TabRad_v2.bib
3	Monographie BIPM-5 – Table of Radionuclides, vol. 3	2006	92-822-2218-7	2006BeZL	TabRad_v3.bib
4	Monographie BIPM-5 – Table of Radionuclides, vol. 4	2008	92-822-2231-4	2008BeZV	TabRad_v4.bib

Vol.	Publication	Year	ISBN	NSR	BibTeX
5	Monographie BIPM-5 – Table of Radionuclides, vol. 5	2010	978-92-821-2234-8	2010BeZQ	TabRad_v5.bib
6	Monographie BIPM-5 – Table of Radionuclides, vol. 6	2011	978-92-821-2242-3	2011BeZW	TabRad_v6.bib
7	Monographie BIPM-5 – Table of Radionuclides, vol. 7	2013	978-92-821-2248-5	2013BeZP	TabRad_v7.bib
8	Monographie BIPM-5 – Table of Radionuclides, vol. 8	2016	978-92-821-2264-5	2016BeZX	TabRad_v8.bib
9	Monographie BIPM-5 – Table of Radionuclides, vol. 9	2020	to be published	-	-

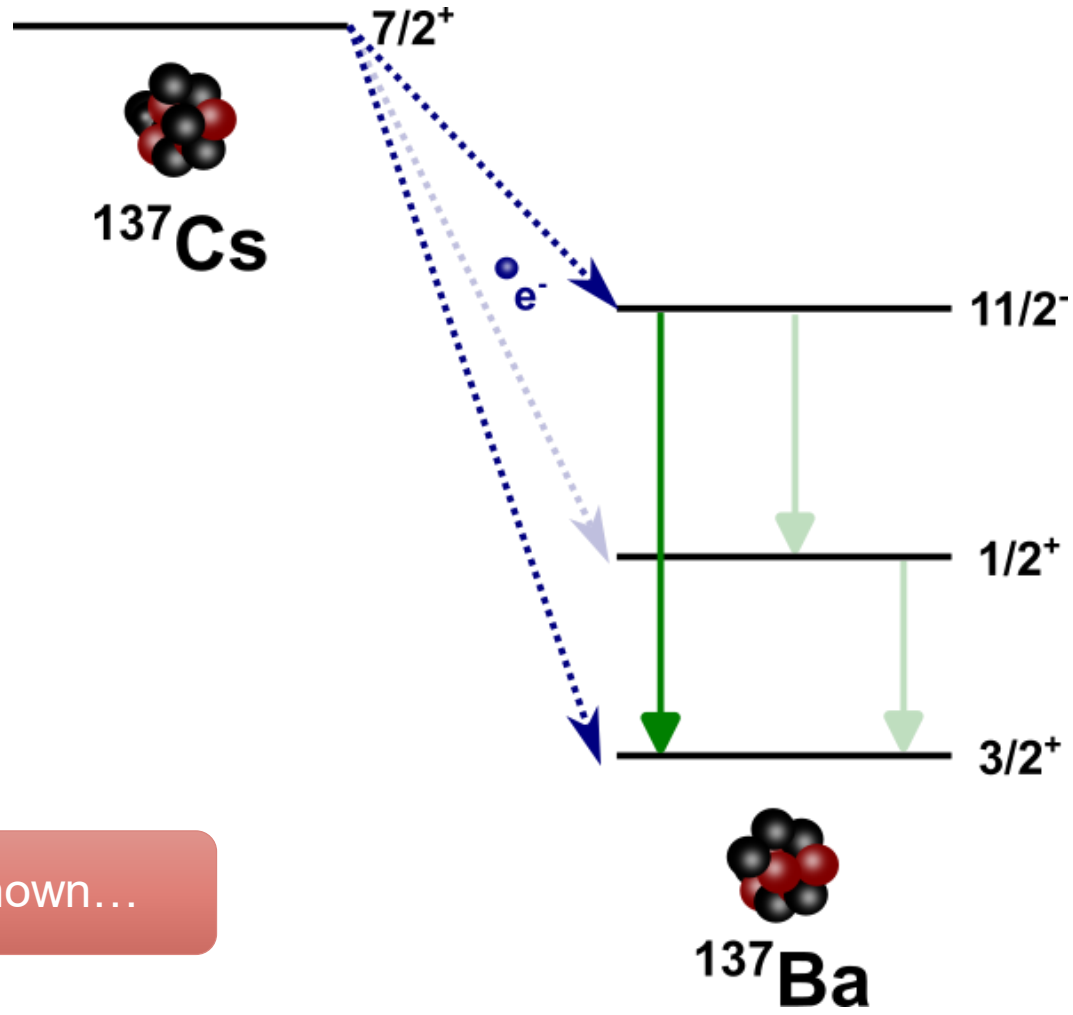
5. Backup

Decay overview of ^{137}Cs

- A β^- decay to ^{137}Ba
  - Populates ground & excited states
  - Half-life around 30 years
  - Total Q-value close to 1176 keV

- Emissions
  - Two main β^- branches
    - Ground state (E_{max} ~ 1176 keV)
    - Second excited state (E_{max} ~ 514 keV)
  - Iconic 662 keV gamma

Surely decay data are well known…

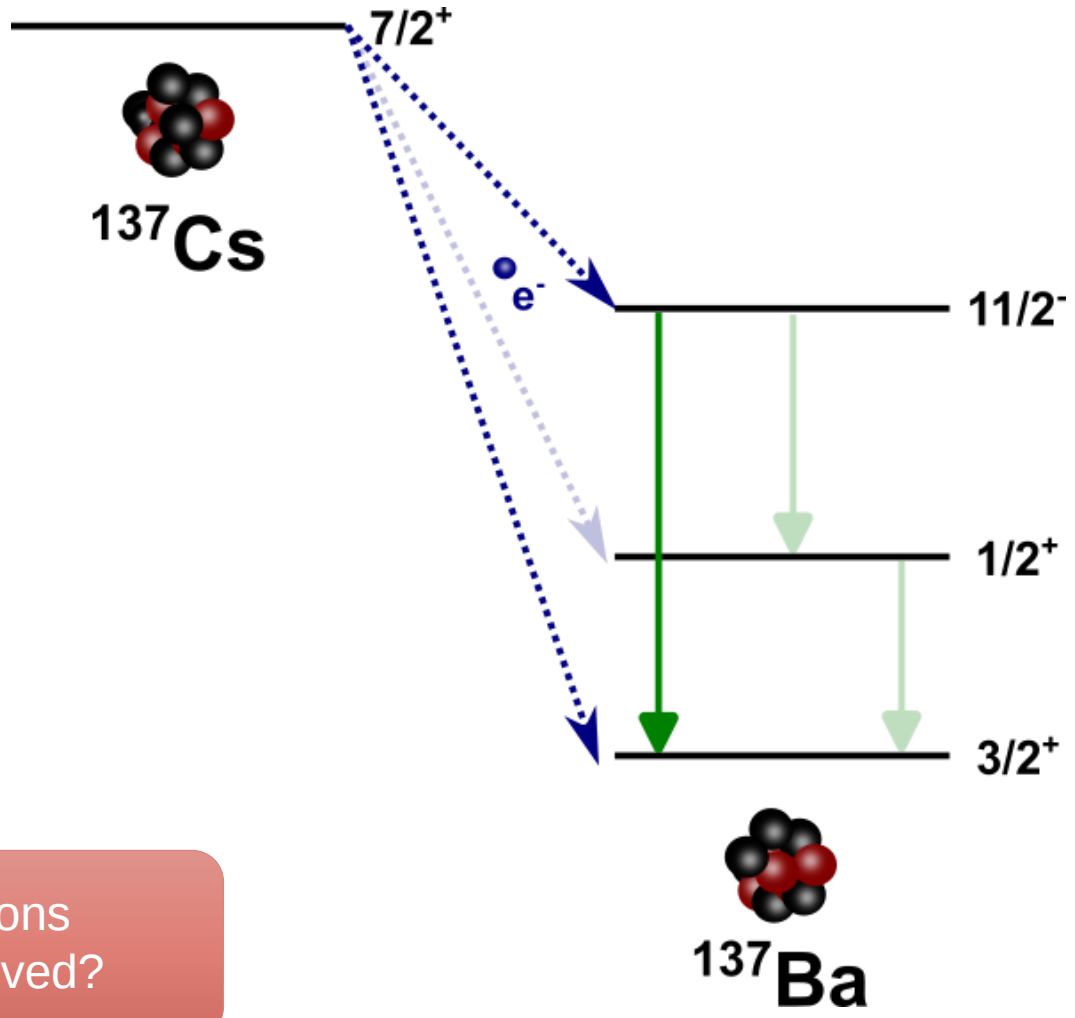


Decay data status

- Latest ^{137}Cs decay data evaluations
  - **DDEP**
    - R.G. Helmer and V.P. Chechev (2006)
  - **ENSDF**
    - E. Browne and J.K. Tuli (2007)

	DDEP	ENSDF
$T_{1/2}$ (y)	30.05 (8)	30.08 (9)
$I_\beta(11/2^-)$ (%)	94.36 (28)	94.7 (2)
$I_\beta(3/2^+)$ (%)	5.64 (28)	5.3 (2)
I_γ (%)	84.99 (20)	85.1 (2)

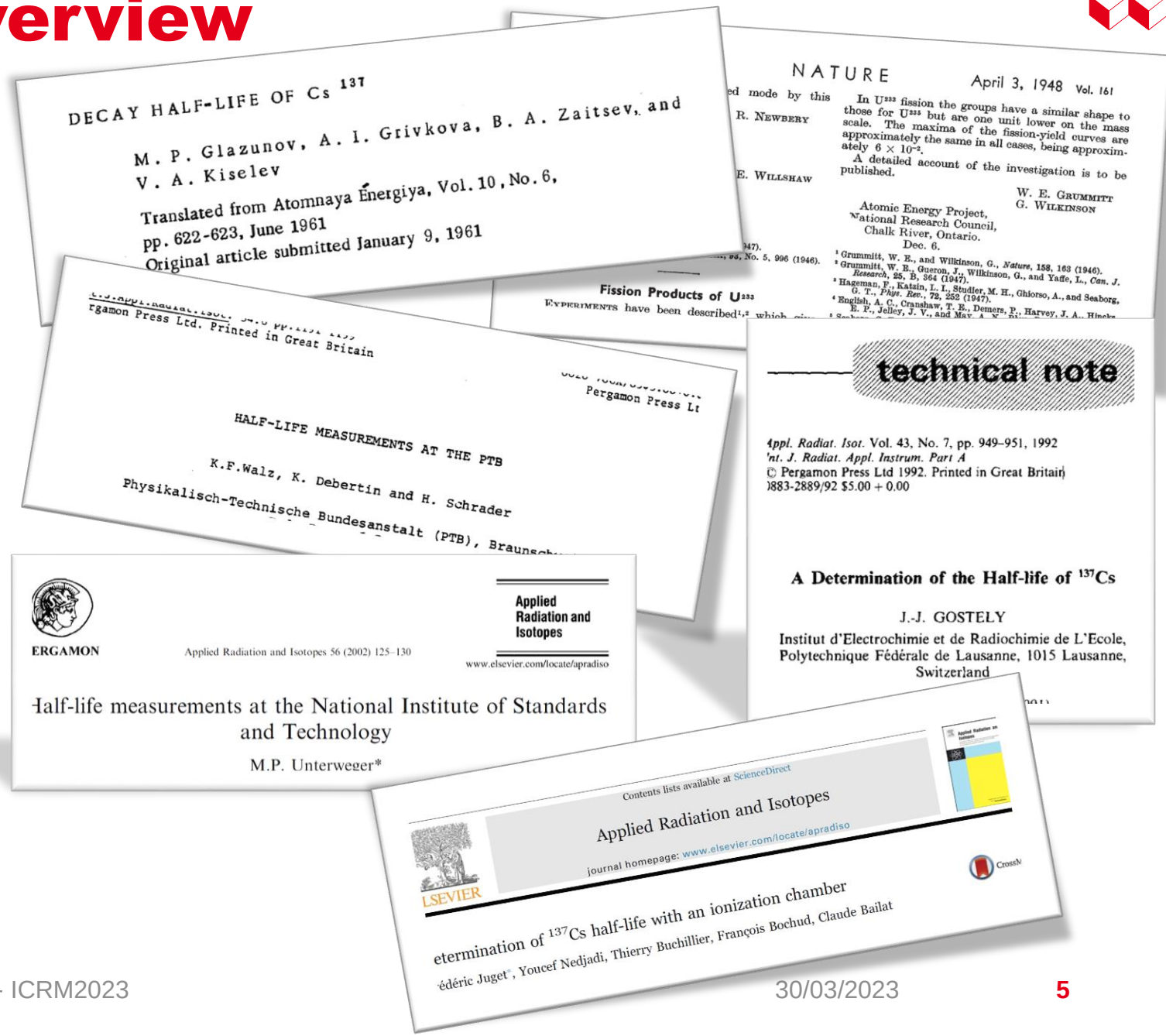
New publications
Can it be improved?



Half-life of ^{137}Cs: overview

- Abundant bibliography
  - More than 75 publications
  - From 1948 to 2016
  - Different experimental methods
  - Many languages

- How to select a meaningful dataset?



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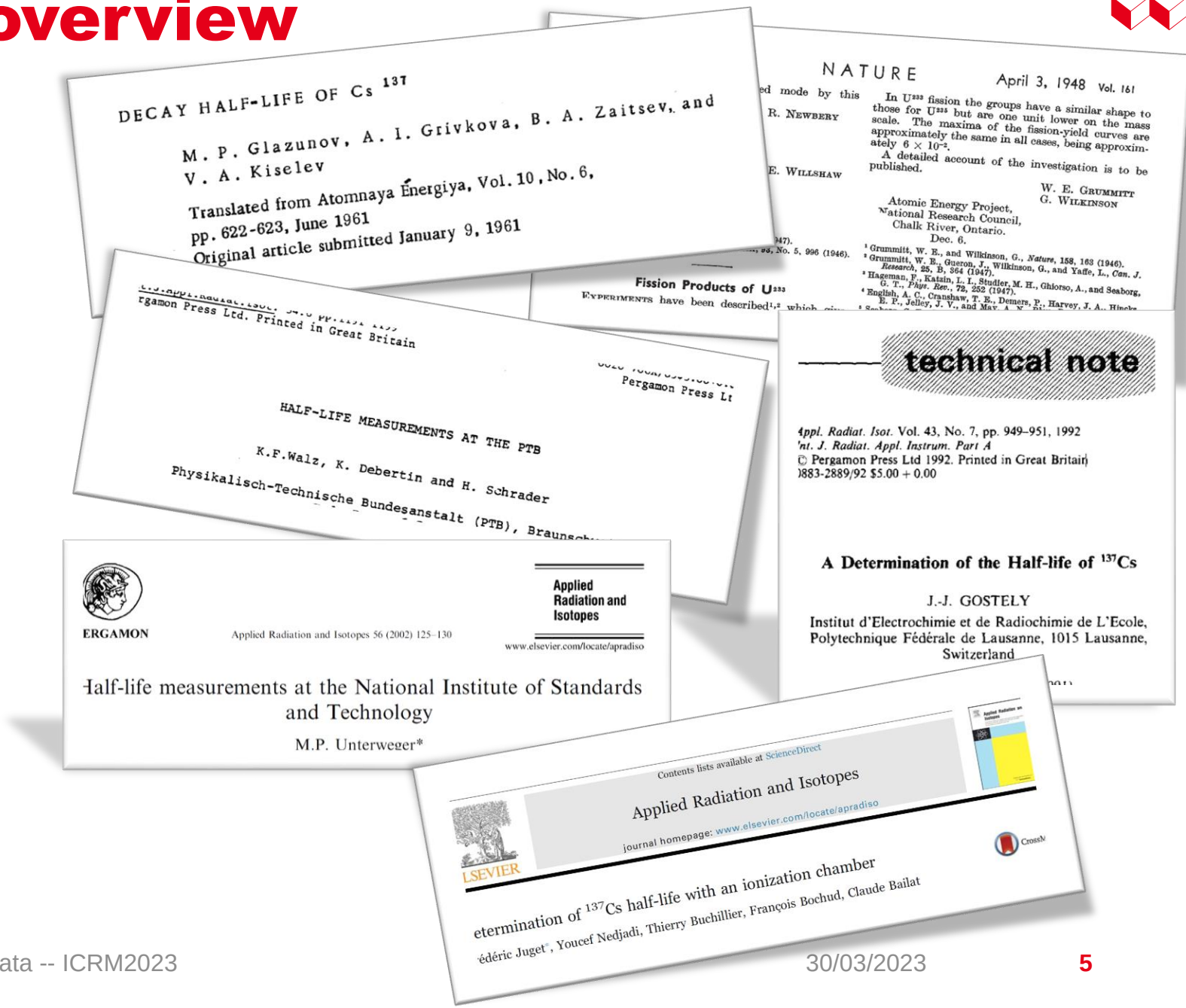
- How to select a meaningful dataset?
  - DDEP guidelines
    - Discard measurements without uncertainty estimation
    - One measurement per author / laboratory

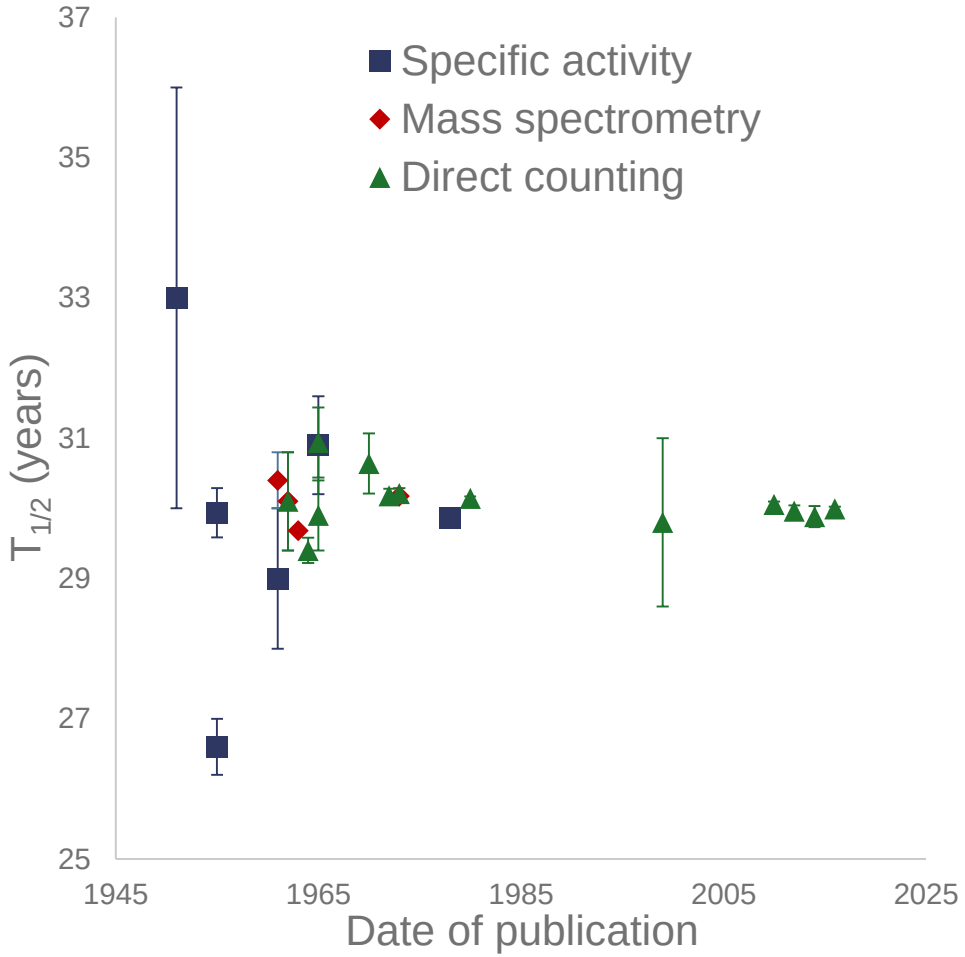


Half-life of ^{137}Cs: a first dataset to work with

- Highly discrepant
  - 23 references considered
  - $T_{1/2}$ varying from 26 to 33 years
  - Uncertainties from 0.011 to 3 years
  - Statistical test of the distribution:

$$\chi^2 \sim 11 \gg \chi^2_{crit} \sim 1.9$$

$$\chi^2 = (n-1)\frac{\sigma^2_{ext}}{\sigma^2_{int}}$$



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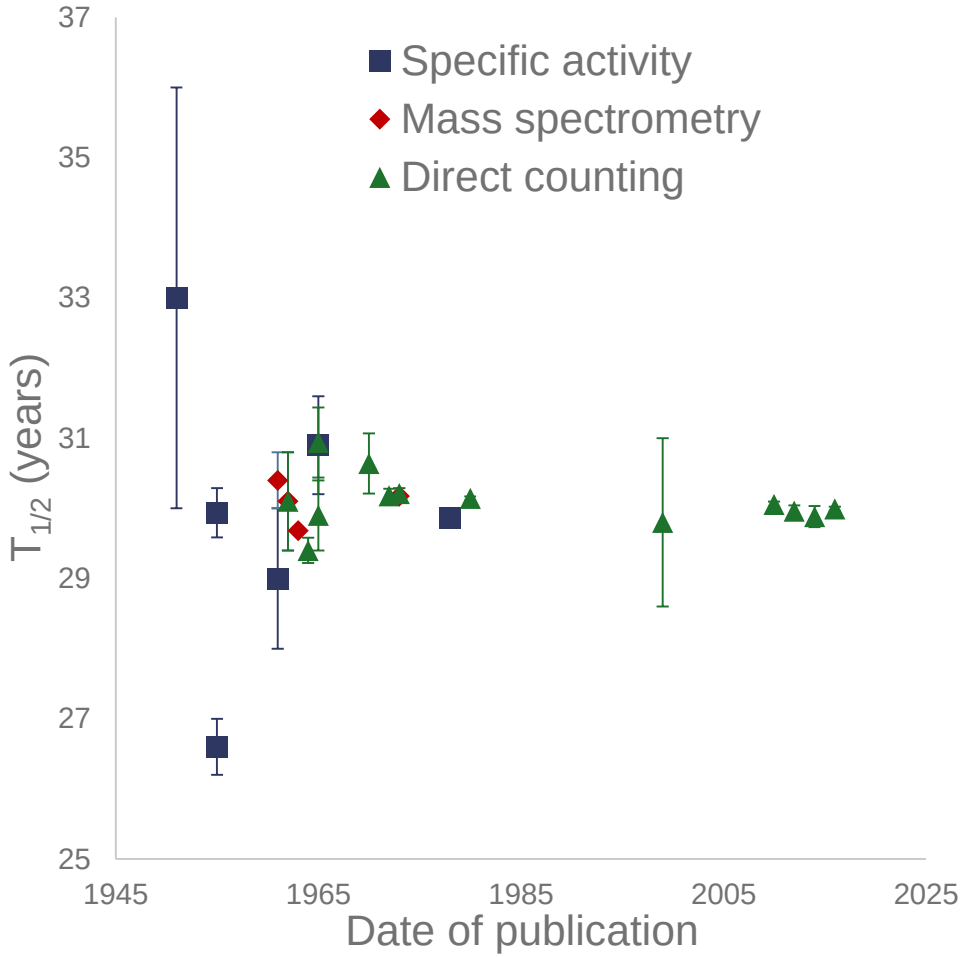
$$\chi^2 = (n-1)\frac{\sigma^2_{ext}}{\sigma^2_{int}}$$

  - Unweighted average $T_{1/2}$ = 30.09 (8) a

Reminder:

	DDEP	ENSDF
$T_{1/2}$ (a)	30.05 (8)	30.08 (9)

How to proceed further?



Cs-137 Half-life: final refinement

- Critical analysis of each publication
  - Evaluate possible experimental bias
  - Evaluate uncertainty budget assessment

- Support from previous works

  M.J. Woods, *The Half-life of ^{137}Cs – A critical Review,* NIM A286 (1990)

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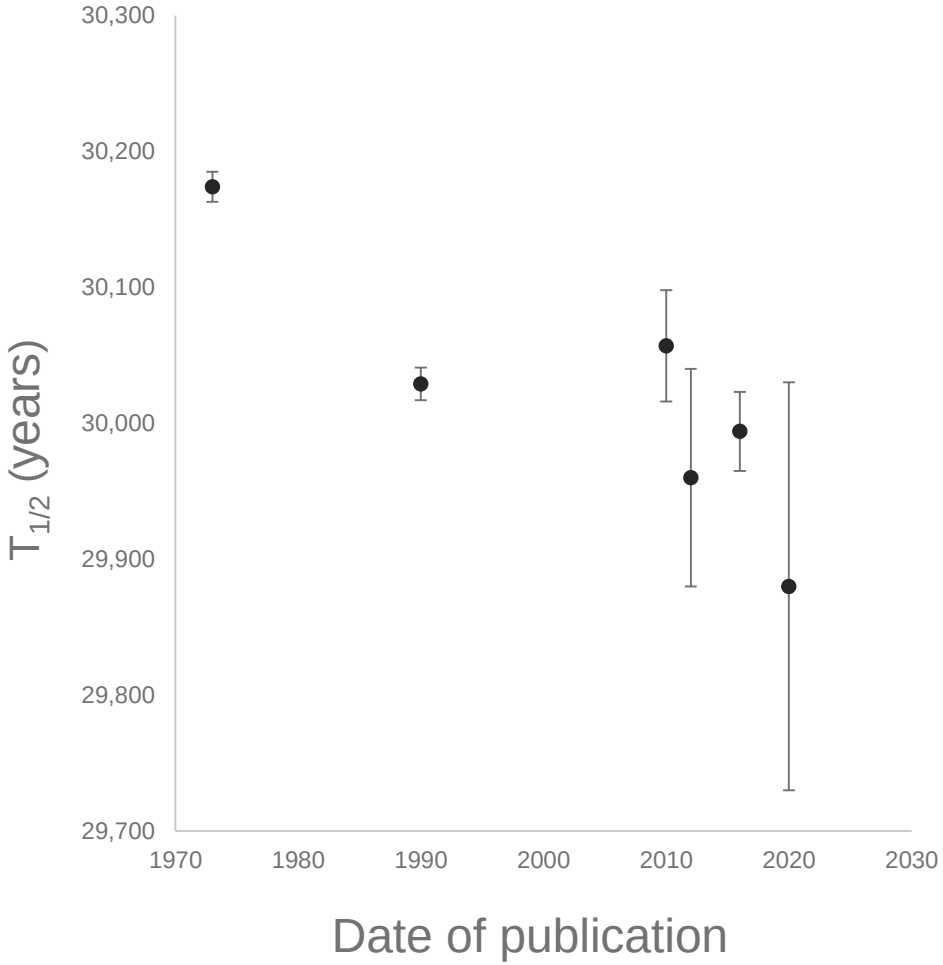
- Selected publications
  - *Dietz et al.*, (1973) GEC $T_{1/2}$ = 30.174 (11) a
  - *Martin et al.*, (1990) CRNL $T_{1/2}$ = 30.029 (12) a
  - *Schrader et al.*, (2010) PTB $T_{1/2}$ = 30.06 (4) a
  - *Bellotti et al.*, (2012) INFN $T_{1/2}$ = 29.96 (8) a
  - *Juget et al.*, (2016), IRP $T_{1/2}$ = 29.994 (29) a
  - *Unterweger et al.*, (2020) NIST $T_{1/2}$ = 29.88 (15) a



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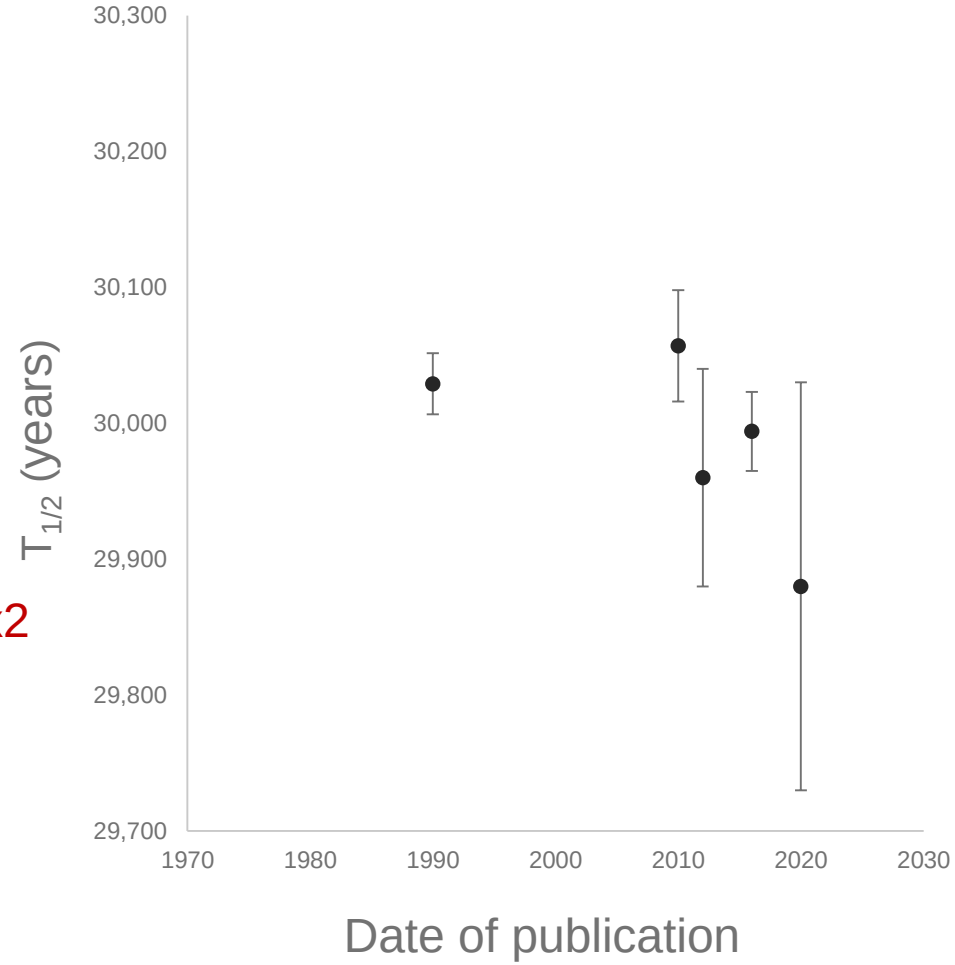

Cs-137 Half-life: new DDEP recommendation

- A final dataset of 5 measurements
  - Consistent: $\chi^2 \sim 0{,}8 < \chi^2_{crit} \sim 3.3$
  - Unweighted mean $T_{1/2}$ = 29.984 (30) a
  - Weighted mean $T_{1/2}$ = 30.018 $(16)_{int}$ $(14)_{ext}$ a
  - Recommended uncertainty extended to match *Martin et al.* (1990)

$T_{1/2}$ = 30.018 (22) a

	DDEP	ENSDF	This work
$T_{1/2}$ (a)	30.05 (8)	30.08 (9)	**30.018 (22)**

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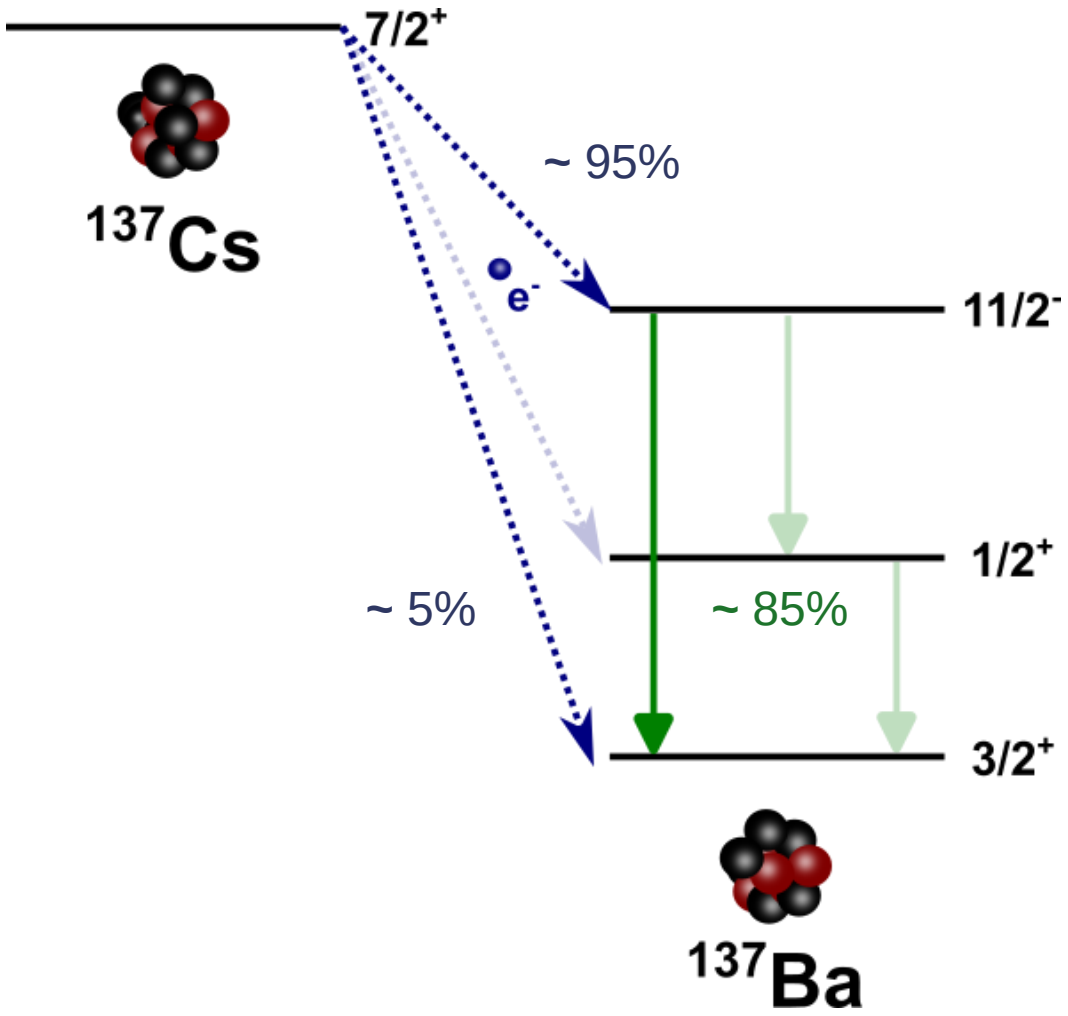
- Outlooks
  - Lower dependency to *Martin et al*.
    - 50% of the weight
  - Need for additional measurements
    - Unpublished results ?
      - PTB (continuation of Schrader works)
      - NRC (IC from 1995 2009)

Decay scheme of ^{137}Cs: overview

- A simple decay scheme
  - Three main transitions
    - ^{137}Cs → ^{137}Ba (11/2$^-$) ~ 95%
    - ^{137}Cs → ^{137}Ba (3/2$^+$) ~ 5%
    - ^{137}Ba (11/2$^-$) → ^{137}Ba (3/2$^+$) ~ 85+10% (γ + EC)
  - Three negligeable transitions
    - ^{137}Cs → ^{137}Ba (1/2$^+$) ~ 6 10^{-4} %
    - ^{137}Ba (11/2$^-$) → ^{137}Ba (1/2$^+$) ~ 1 10^{-5} %
    - ^{137}Ba (1/2$^+$) → ^{137}Ba (3/2$^+$) ~ 6 10^{-4} %



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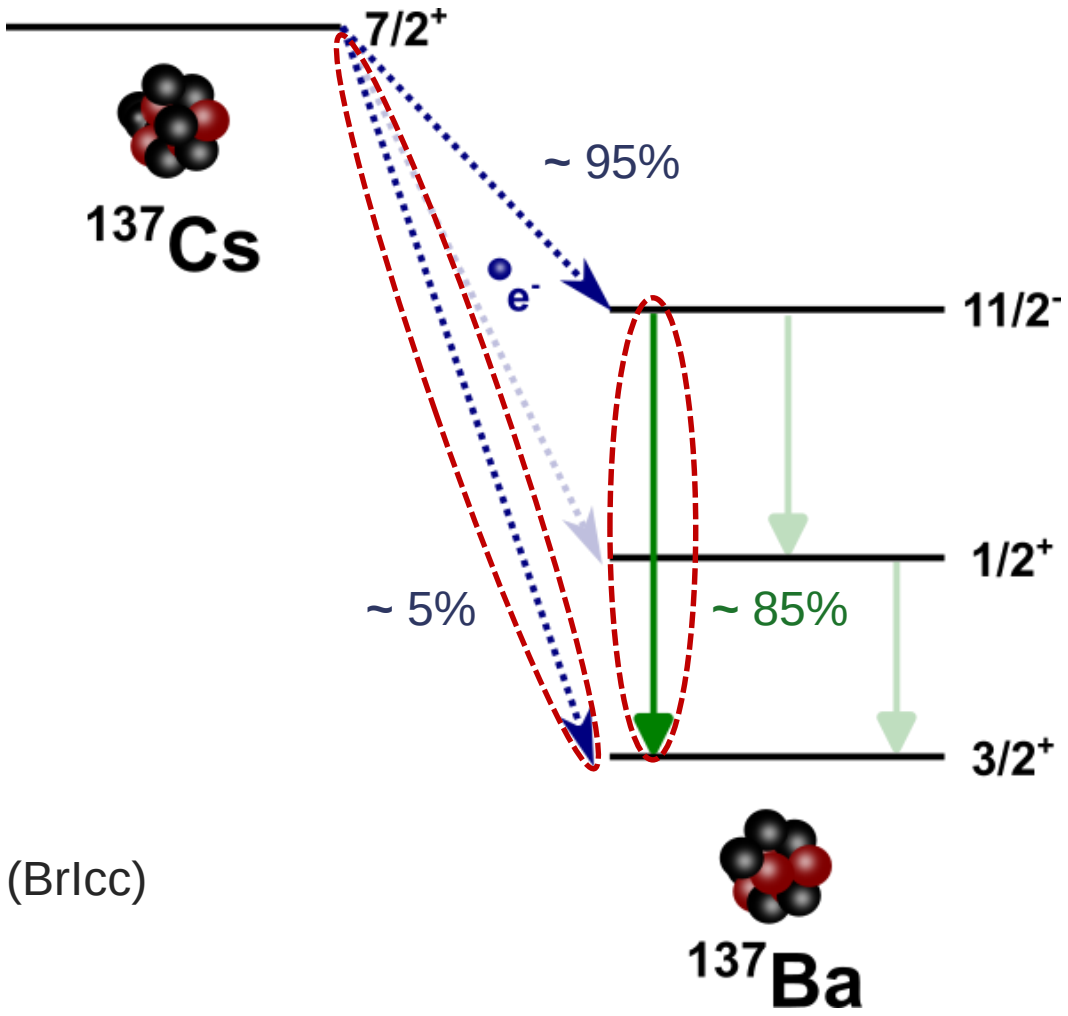
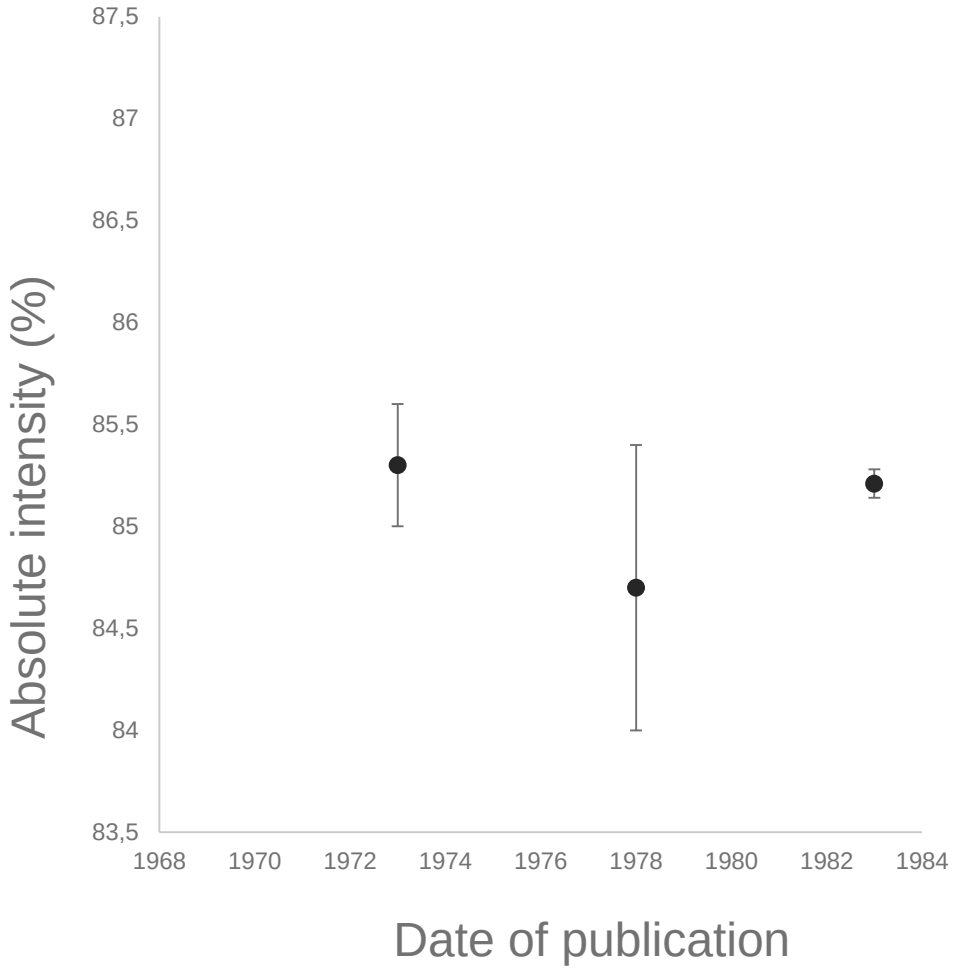


- Knowledge of one of the main transitions is enough
  - Completeness of the decay scheme
  - Assuming knowledge of the α_T conversion coefficient (BrIcc)

Intensity of the 662 keV gamma emission

- A limited dataset
  - Only six publication (from 1965 to 1983)
  - Three remains after applying DDEP criteria
    - *Legrand et al.* (1973) CEA I_γ = 85.3 (3) %
    - *Merritt et al*. (1978) CRNL I_γ = 84.7 (7) %
    - *Behrens et al*. (1983) NPL I_γ = 85.21 (7) %



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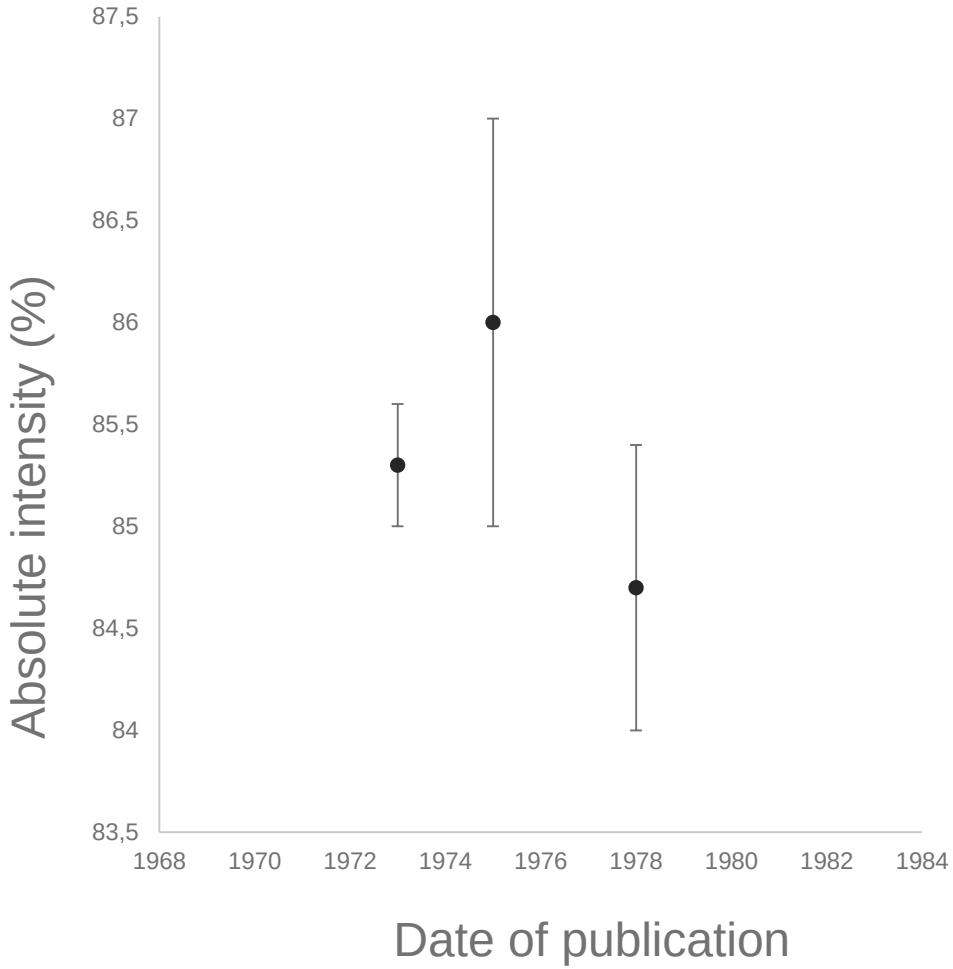
- Consistent dataset but an issue with *Behrens et al.*
  - Estimated using magnetic spectrometer
  - Usage of discrepant α_T conversion coefficient
  - Replaced by Goodier et al. (1975) I_γ = 86 (1) %



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  - Usage of discrepant α_T conversion coefficient
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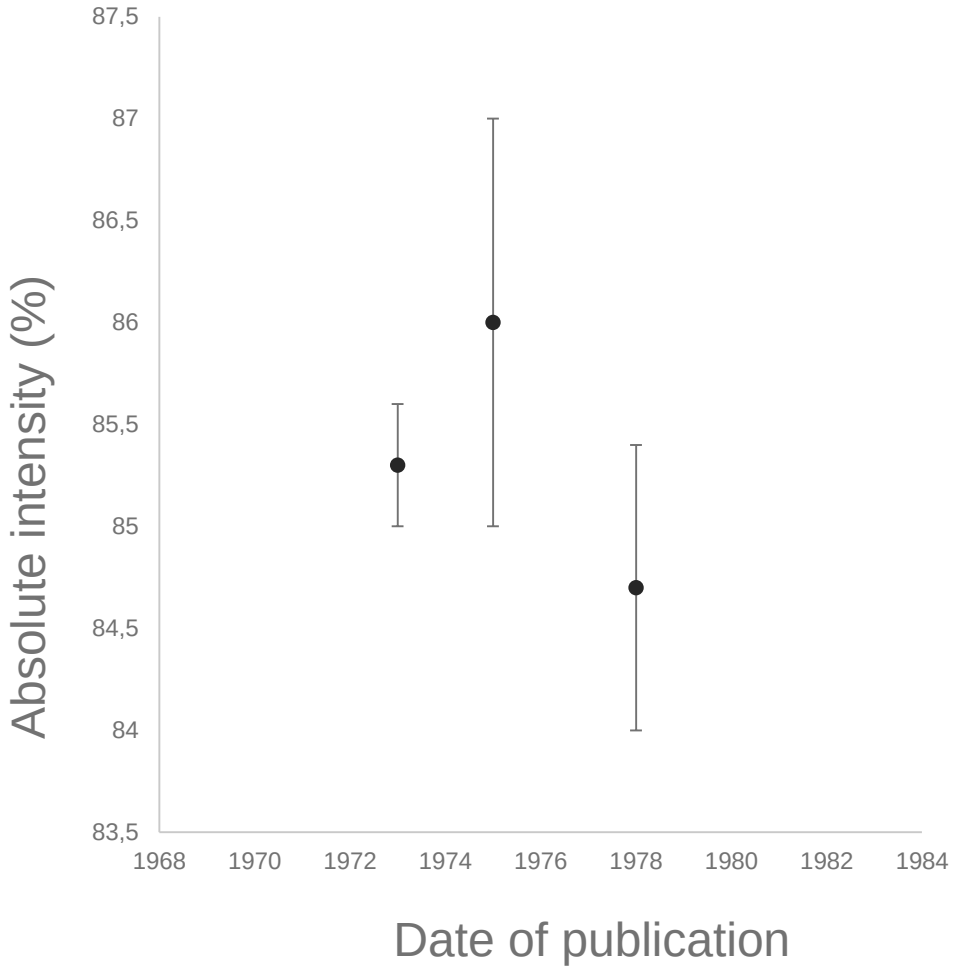
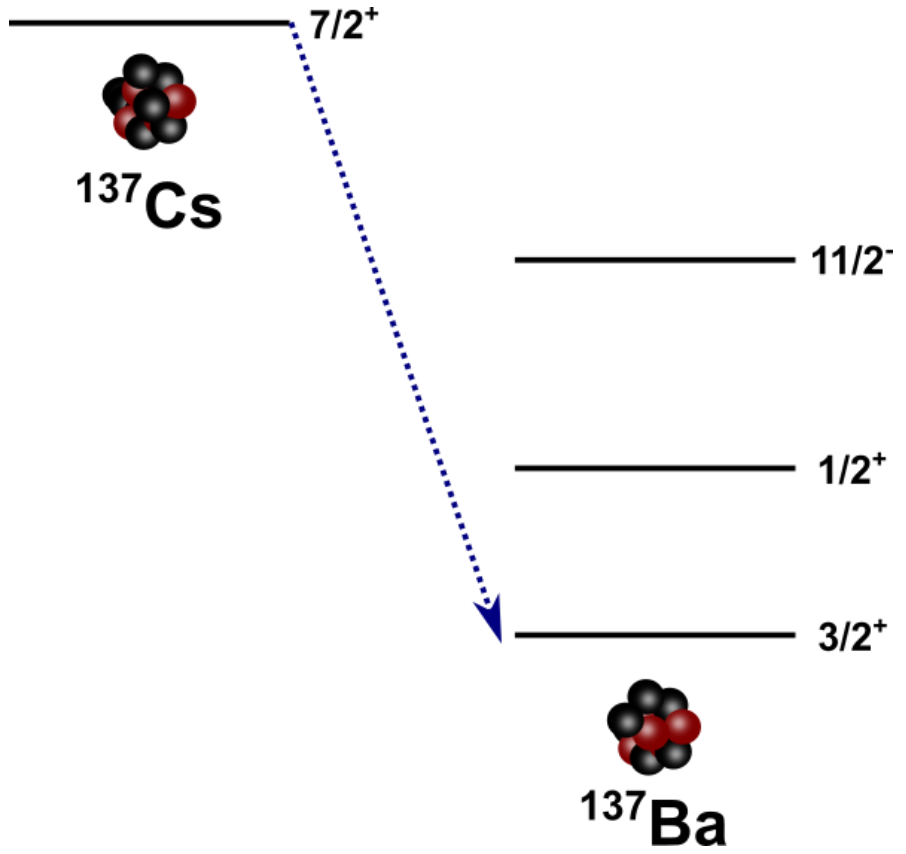
- Weighted mean **I_γ = 85.26(30) %**
  - Weight of *Legrand et al*. 78 %



Intensity of the beta to ground state transition

- Another limited dataset
  - Only six publications (from 1957 to 1983)
  - Four of them are discarded after analysis
  - Only two measurements avalaible
    - *Hansen et al*. (1969) CBNM $I_\beta = 5.4\ (3)\ \%$
    - *Behrens et al*. (1983) NPL $I_\beta = 5.57\ (7)\ \%$



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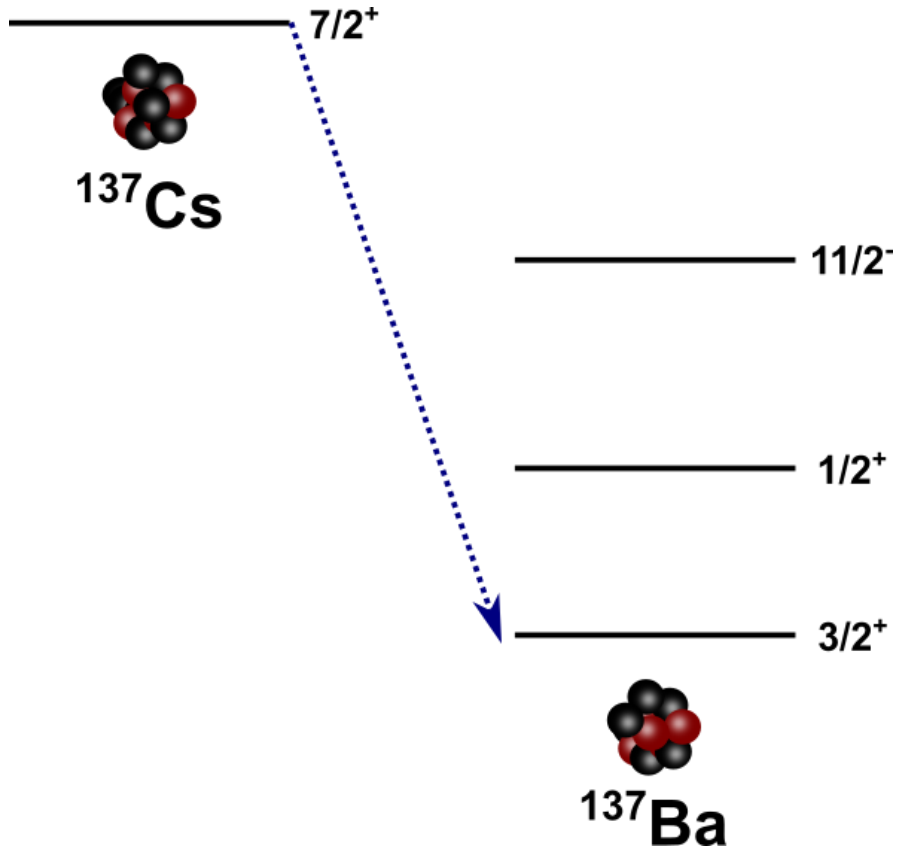
- Question regarding the measurement of *Behrens et al.*
  - Inaccurate measurement of α_T conversion coefficient
  - Limitation of weight of *Behrens et al*. to 50 %
    - *Behrens et al*. (1983) NPL $I_\beta = 5.57\ (30)\ \%$

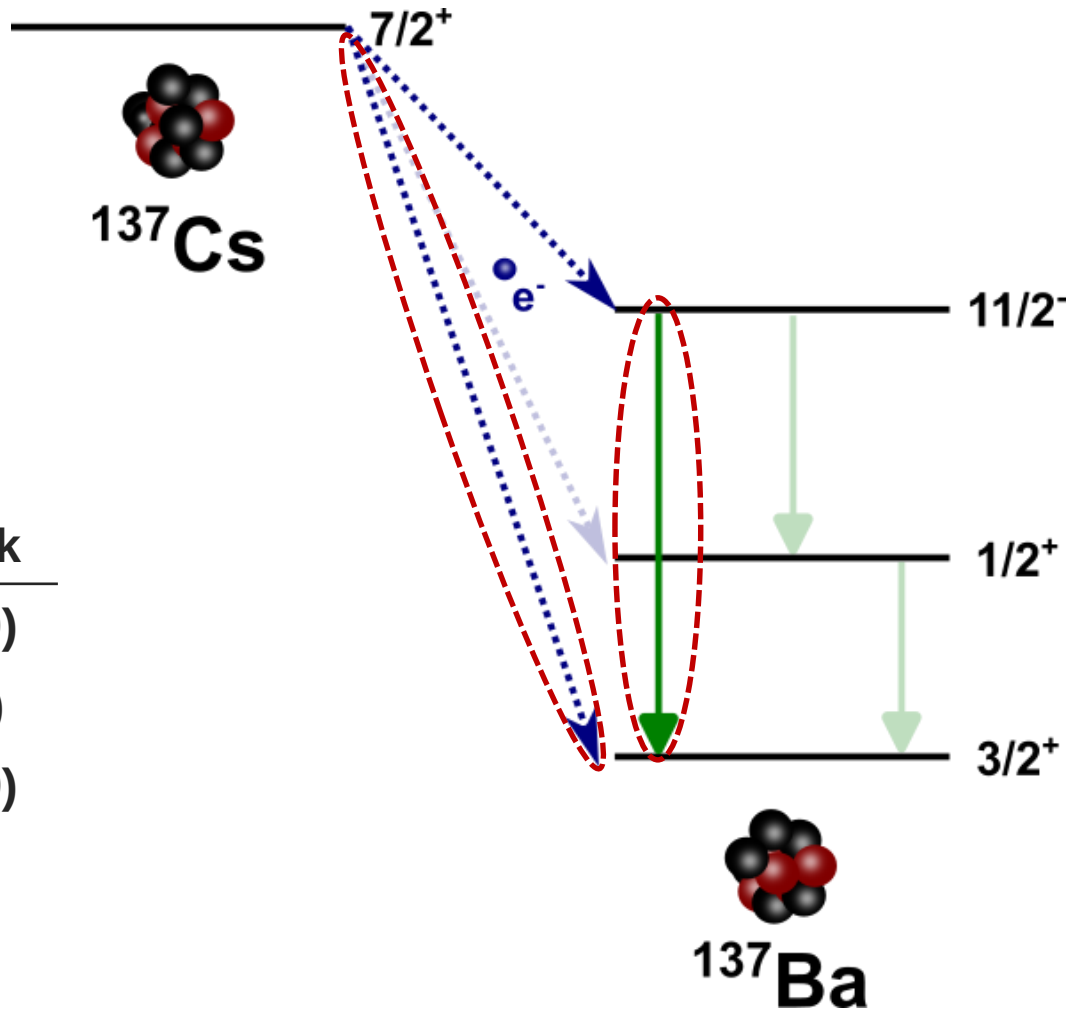
- Average **$I_\beta = 5.48\ (30)\ \%$**



Decay scheme reconstruction

- Two main possibilities
  - From 662 keV gamma intensity
    - **I_γ = 85.26 (30) %**
  - From the beta decay to the ground state of ^{137}Ba
    - **I_β = 5.48 (30) %** corresponds to I_γ = 84.97 (29) %
  - Final recommandation: weighted average of both

	DDEP	ENSDF	**This work**
$I_\beta(11/2^-)$ (%)	94.36 (28)	94.7 (2)	**94.65 (30)**
$I_\beta(3/2^+)$ (%)	5.64 (28)	5.3 (2)	**5.35 (30)**
I_γ (%)	84.99 (20)	85.1 (2)	**85.09 (29)**



Conclusions & outlooks

- A new evaluation of ^{137}Cs has been performed
- Recommendations are consistent with previous evaluations

	DDEP	ENSDF	**This work**
$T_{1/2}$ (a)	30.05 (8)	30.08 (9)	**30.018 (22)**
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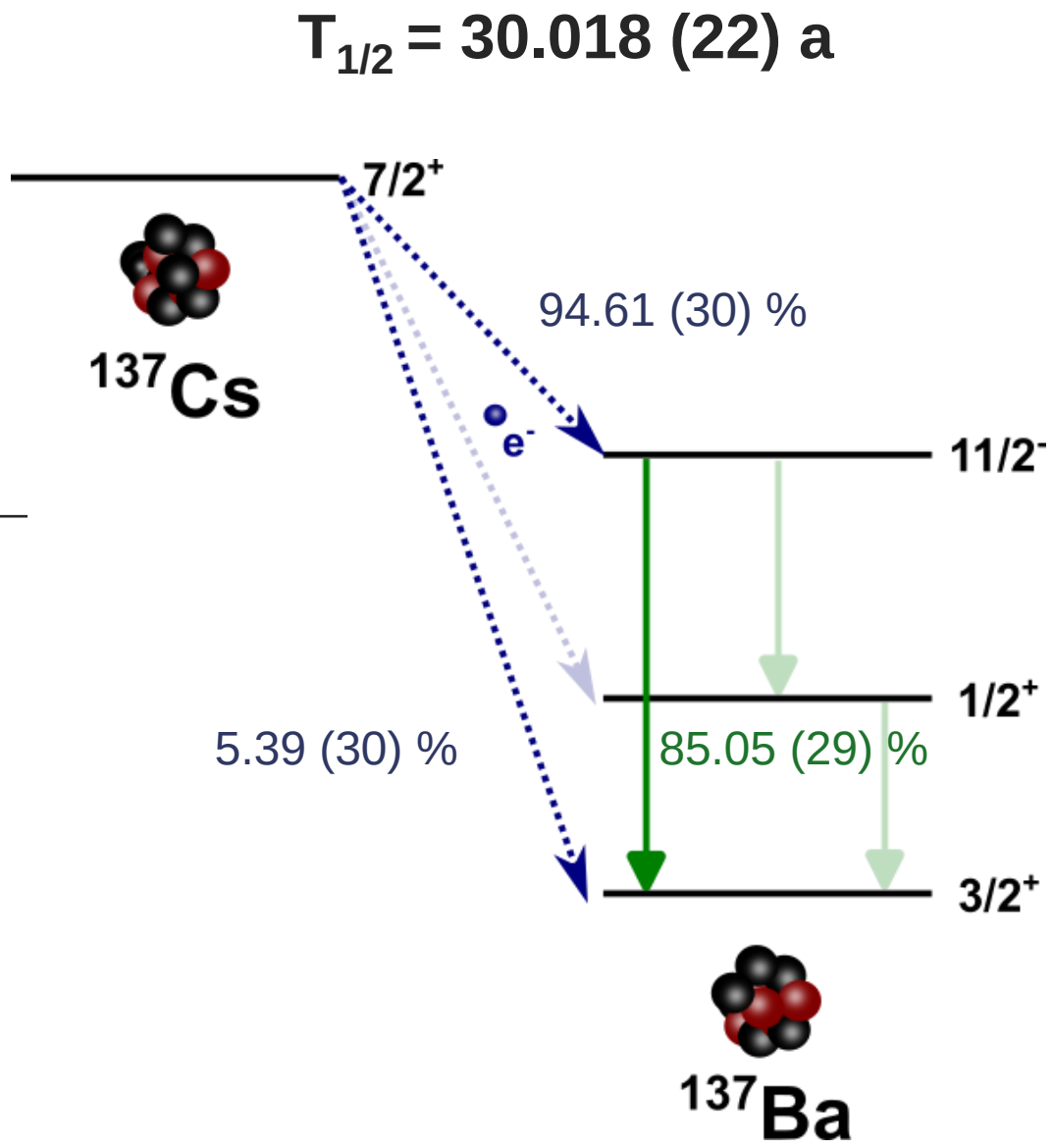

Conclusions & outlooks

$T_{1/2}$ = 30.018 (22) a

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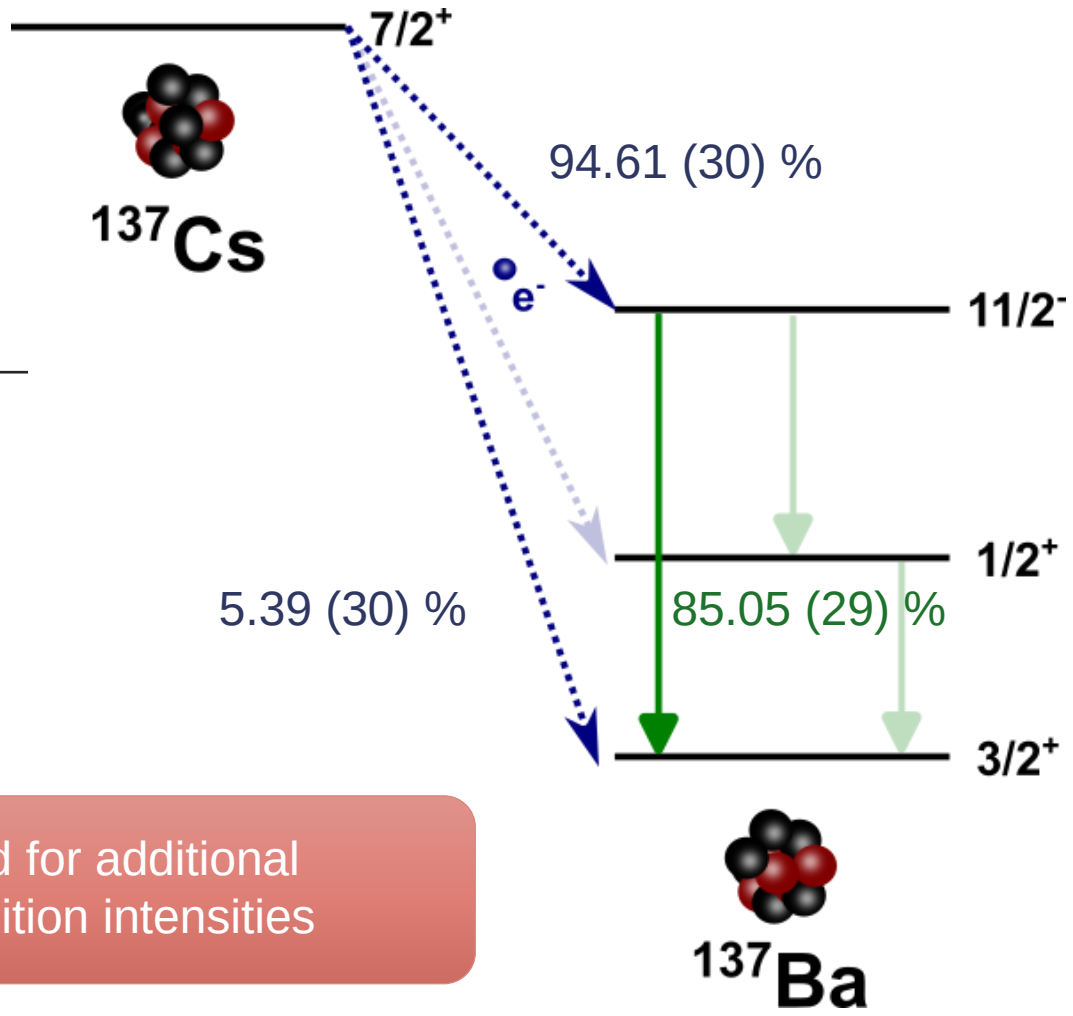

Analysis of datasets has shown the need for additional measurements for both half-life and transition intensities