IAEA
International Atomic Energy Agency
Atoms for Peace and Development

IAEA status report 2021-2022

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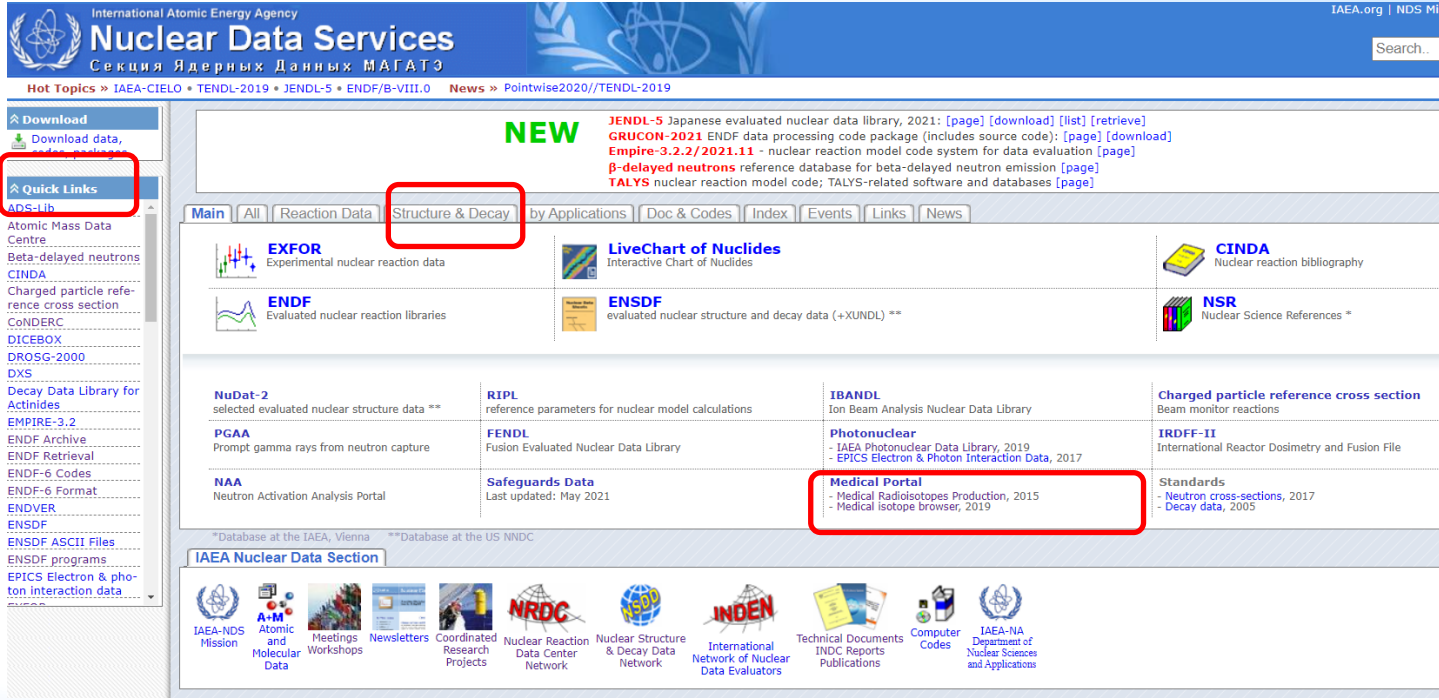
Status

- IAEA NSDD website – continuously updated
- Nuclear structure and decay databases –
  - Nuclear moments
  - Beta-delayed neutrons
  - Decay data portal
  - LiveChart/Nubase interactive chart (M. Verpelli)
  - MyEnsdf Webtools, X4-NSR pdf database (V. Zerkin)
- Financial support
- Decay Data for Monitoring
- Training / meetings
- International contribution

Nuclear Data Section

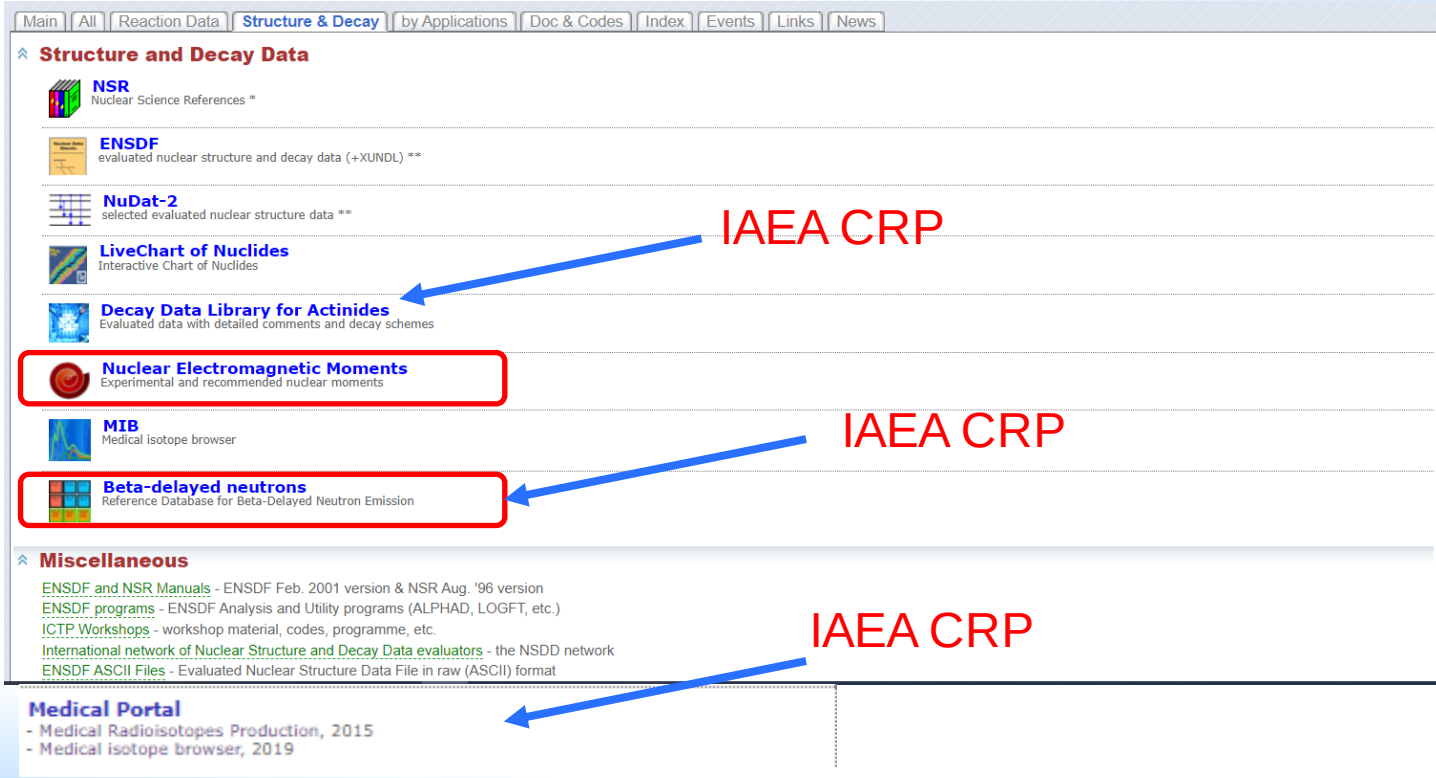
- Major overhaul of Nuclear Data web services
- New: web platform, back-end organization, structure and programming
- New front-end design
- Major databases shall not be touched (EXFOR, ENDF-interface, Live Chart, beta-delayed neutron, etc)
- Coming soon….

Nuclear Structure & Decay Database



Nuclear Moments Database

http://www-nds.iaea.org/nuclearmoments



Nuclear Moments Database

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NUCLEAR ELECTROMAGNETIC MOMENTS

The present compilation includes experimental information on nuclear magnetic dipole and electric quadrupole moments found in print compilations (such as INDC(NDS)-0650, INDC(NDS)-0658 etc), the ENSDF nuclear database, peer-reviewed journals, international conferences and other resources. The online interface was created by Theo J. Mertzimekis under the IAEA auspices.

New: Recommended magnetic dipole moments for long-lived states (INDC(NDS)-0794) and short-lived states (INDC(NDS)-0816), and recommended electric quadrupole moments (INDC(NDS)-0833) are available on the database. The recommended tables have been produced by N.J. Stone. Detailed discussion with Karel Jackowski (diamagnetism), Pekka Pyykko (electric field gradient computation data) and Andrew Stuchbery (transient field calibration) is gratefully acknowledged.

Periodic Table | Z-Helix | Elementary Particles | CSV file with recommended nuclear dipole moments | CSV file with compiled nuclear moments | DISCLAIMER | Help

Z: Search

A: Reset

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	1 n																	
Period 1	1 H																	2 He
2	3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
3	11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
6	55 Cs	56 Ba *	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra **	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og

*Lanthanides	*	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb
**Actinides	**	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No

Nuclear Moments Database

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Chromium (Z=24)

^{49}Cr | ^{50}Cr | ^{51}Cr | ^{52}Cr | ^{53}Cr | ^{54}Cr

Recommended† magnetic dipole moments

Isotope	Energy [keV]	$t_{1/2}$	Spin/Parity	μ [nm]	Method	Recommended Tables
^{52}Cr	1434	0.783 ps	2+	+2.4(4)	TF	INDC(NDS)-0816

Recommended† electric quadrupole moments

Isotope	Energy [keV]	$t_{1/2}$	Spin/Parity	Q [b]	Method	Recommended Tables
^{52}Cr	1434	0.783 ps	2+	-0.08(2)	ES	INDC(NDS)-0833

Currently: compiled tables are being updated
More from Nick Stone

Compiled‡ magnetic dipole and electric quadrupole moments from published articles

Isotope	Energy [keV]	$t_{1/2}$	Spin/Parity	μ [nm]	Q [b]	Ref. Std	Method	NSR keyword	doi
^{52}Cr	1434.	0.707 ps	2^+	+2.41(13)			TF	2000ER06	10.1103/PhysRevC.62.024305
				+3.0(5)		[^{56}Fe 847.]	TF	1987ST07	10.1007/BF02396850
				+3.2(22)			TF	1987PA28	10.1103/PhysRevC.36.2088
					-0.08(2)		ES	1989RA17 2013STZZ	10.1016/0092-640X(89)90008-9

† Recommended magnetic moments are for the bare nucleus with published results corrected consistently for diamagnetism (including error estimate).
Where appropriate published results are also adjusted to the most recent adopted half-life for the state.
Recommended quadrupole moments are adjusted using the best electric field gradient calculation for the system concerned.
For details see the Reports referenced.

‡ In this listing published results are given without adjustment or correction.

Reference Database for Beta-Delayed Neutron Emission

Produced by IAEA Coordinated Research Project (2013-2018): CRP Publication

Microscopic Database

Contains compiled experimental beta-decay half-lives, beta-delayed neutron emission probabilities and beta-delayed neutron emission spectra for individual precursors. Provides recommended values, and results from systematics and global models.

Individual Precursors

Publication on $Z \leq 28$
Publication on $Z > 28$

Macroscopic Database

Contains compiled and evaluated total delayed neutron yields (nubar), composite delayed neutron spectra, compiled and recommended 6- and 8-group parameters.

Total Delayed Neutron Yields | Group Spectra

Delayed Neutron Spectra | Group Parameters

Publication on integral delayed neutron spectra
Publication on new total delayed-neutron yields

Documents and Links

INDC reports	CRPs/DDPs webpages
INDC(NDS)-0735	Reference Database for Beta-Delayed Neutron Emission (2013-2018)
INDC(NDS)-0683	Total Absorption Gamma-ray Spectroscopy Meeting 2018
INDC(NDS)-0643	Fission Product Yields Meeting 2016
INDC(NDS)-0599	Total Absorption Gamma-ray Spectroscopy Meeting 2014
INDC(NDS)-0107/G	CRP on Updating the fission yield data for applications (Ongoing)

Beta-delayed neutron microscopic database: update Feb. 2022

- Z>28 data from Liang et al. 2020 (2020Li32)
- Z>28 new published data in period Aug. 2020 – Jan. 2022 (B. Singh):
  - PRL, PRC, PL-B, EPJ-A, NP-A, JP-G, ARI
  - Revised $T_{1/2}$, P_n values for 56 bDN emitters

1. 2021Ha19: O. Hall et al., Phys. Lett. B **816**, 136266 (2021): B-RIKEN: 115,116Tc, 116-121Ru, 118-124Rh, 121-128Pd, 124-129Ag, 127-130Cd: 33 nuclides: half-lives and Pn.
2. 2021Su01: T. Sumikama et al., Phys. Rev. C **103**, 014614 (2021): RIKEN: 101Br, 102Kr, 105,106Rb, 108Sr, 110,111Y, 114Zr, 117Nb: nine new neutron-rich nuclides identified, no half-lives available, expected to be B-n emitters.
3. 2021Mi07: A.J. Mitchell et al, Phys. Rev. C **103**, 024323 (2021): CARIBU-ANL: 106Nb: T1/2.
4. 2021Mo10: B. Moon et al., Phys. Rev. C **103**, 034320 (2021): RIKEN: 137,138Sb: half-lives, Pn and P2n.
5. 2021Ga10: F.H. Garcia et al., Phys. Rev. C **103**, 024310 (2021): TRIUMF: 129In: g.s. and three isomers: half-lives of all the four activities; B-n decay mode seen but no Pn value extracted
6. 2021Pi11: M. Piersa-Silkowska et al., Phys. Rev. C **104**, 044328 (2021): ISOLDE-CERN: 134,135In: half-lives, Pn, P2n, possible observation of B-3n for 135In decay.
7. 2021Ba34: J.C. Batchelder et al., Phys. Rev. C **104**, 024308 (2021): ORNL: 125,125mAg: half-life, Pn.
8. 2021Wa49: H. Watanabe et al., Phys. Lett. B **823**, 136766 (2021): RIKEN: 127mAg: half-life.
9. 2021Te02: D.A. Testov et al., Eur. Phys. Jour. A 57, 59 (2021): TETRA-ALTO: 123Ag: half-life, Pn.
10. 2020Ju02: A. Jungclaus et al., Phys. Rev. C **102**, 034324 (2020): RIKEN: 136,137,138Sn: half-lives, Pn.
11. 2020Wh02: K. Whitmore et al., Phys. Rev. C **102**, 024327 (2020): TRIUMF: 132In: half-life, Pn.

Beta-delayed neutron microscopic database cont'd

- Future updates:
  - Z>28:
    - Update the numerical file
    - Incorporate new global RHF+QRPA – Hauser-Feshbach calculations: F. Minato et al., PRC 104, 044321 (2021)
  - Z<28
- Plans to engage new evaluator for future updates – first training with Balraj

Beta-delayed neutron macroscopic database

- Recommended constants with correlations:

  Nucl. Data Sheets 173 (2021) 144
  INDC(NDS)-0784 (reference DN data)
  Piksaikin et al., EPJ Nuclear Sci. Technol. 6,54 (2020)

- Include uncertainties in composite DN spectra:

  INDC(NDS)-0849

- Derive DN group spectra from composite spectra:

  INDC(NDS)-0849

Financial support

- Contracts for mass chain evaluations:
  - Sorin Pascu (ROM): mass chain A=130 (post-review), 118 renewed 2019,2020; ended in 2021
  - *Anagha Chakraborty (IND): in preparation*
- Contracts for horizontal evaluations:
  - Nick Stone (2018-2022):
    - Evaluation of Magnetic Dipole Moments for Long-lived states: INDC(NDS)-0794 (2019)
    - Evaluation of Magnetic Dipole Moments for Short-Lived states: INDC(NDS)-0816 (2020)
    - Tables of recommended Electric Quadrupole Moments: INDC(NDS)-0833 (2021)
    - *Updated Compilation Tables of Nuclear Moments: ongoing*
  - Balraj Singh (2022): Updates of beta-delayed-neutron data (Z>28)
    - Uploaded onto database

Meetings

- 24th TM: Canberra, Australia, 2022 (ANU)
  - Host Government agreement; website; nominations-invitations (30 participants; 15 in person); agenda
- Joint IAEA-ICTP NSDD Workshop 2022
  - 2 weeks: 3 – 14 October 2022; student selection; lecturers; program; lecture & exercises supervision; management
- Meeting on Decay Data for Monitoring Applications
  - 18 – 22 July 2022; reports, deadlines
  - Presentation at ND2022

Decay Data for Monitoring Applications, 18 – 22 July 2022

- 3 in-person (Kibedi, Kondev, Tuli, Verpelli); 5 remote (Chen, Negret, Nichols, Singh)
- Report in preparation
- Deadlines for submitting evaluations
- Deadlines for reviews
- Project deadline for evaluations: Dec. 2023
- Publication: 2024
- For 28 priority 1 fission product radionuclides

Decay Data for Monitoring Applications

- Continuous project:
  - CTBTO priority nuclides: 42 fission products + 42 activation products
  - Aim to continue and produce adopted decay data sets for all these radionuclides
  - Revise other decay data files produced by IAEA CRPs (medical, dosimetry)
  - Create IAEA Adopted decay Data Library
  - Data files will be publicly available on GitHub and via interface and APIs
  - Effort will be partially funded

International effort

- Japan support letter sent to Director of Division of Nuclear Fuel Safety
- To do (2023):
  - Webinar on nuclear structure and decay data in
    - Japan
    - Europe
- European Nuclear Structure Long Range Plan
  - Contact made to present nuclear data case

Meetings/workshops 2023

- Technical Meeting on Nuclear Data for Antineutrino Spectra Calculations
  - 16-20 January 2023

- IAEA Advanced Workshop for ENSDF Evaluators
  - Dates to be determined - Doodle

Coordinated Research Projects (ongoing)

- CRP on RIPL Fission Cross Sections
  - Improve input parameters for fission cross-section calculations (masses, fission barriers, saddle-point level densities)
  - 4 meetings; ending in 2024

- CRP on Updating Fission Yield Data for Applications
  - Started: 2020
  - Compilation of all available FY data; modelling of FYs; new evaluations of FYs of major actinides; validation of new evaluated FY files
  - 2nd meeting 19-23 December 2022

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Thank you!