



IAEA

International Atomic Energy Agency
Atoms for Peace and Development

IAEA-Nuclear Data Section Report

NSDD Scientific Secretary:
Paraskevi (Vivian) Dimitriou

Nuclear Data Section Efforts



- Coordination
- Organisation of meetings (NSDD, Technical and Consultant Meetings)
- Training
- Technical support: codes, editors, web tools (Codes/Formats sessions)
- Financial support
- Dissemination tools (Live Chart, Isotope Browser, Decay Data Portal)
- Bibliography access (NSR+EXFOR PDF database)
- Coordinated Research Projects

Coordination: 23rd TM of the NSDD network, 1-5 April 2019, IAEA, Vienna



- Structure of the meeting
 - reporting sessions (5' – reports submitted prior to meeting)
 - technical issues/proposals
 - advanced workshop (exercises)

Coordination: Data Centers



- Japan: JAEA (Iimura retirement)
- INDIA (Jain retirement)
- *China – organize a meeting at ND2019?*
- *Europe – invite representatives from experimental facilities (GANIL, ISOLDE, JYVASKYLA)?*

Joint ICTP-IAEA Workshop on Nuclear Structure and Decay Data: Experiment, Theory and Evaluation, 15 -26 Oct. 2018, Trieste



- Lectures on experimental techniques, nuclear models, shell model practical (code)
- Hands-on exercises: XUNDL datasets, evaluation of mass chain A=218

Lecturers:

P. Regan (Surrey)
 P. Van Isacker (GANIL)
 S. Lenzi (LNL)

E. McCutchan (BNL) (DIR) M. Martin (ORNL)
 F. Kondev (ANL)
 B. Singh (McMaster)
 T. Kibedi (ANU)
 S. Basunia (LBL)

IAEA:

M. Verpelli
 V. Zerkin
 P. Dimitriou (DIR)

Joint ICTP-IAEA Workshop on Nuclear Structure and Decay Data: Theory, Experiment and Evaluation

15 - 26 October 2018
 Trieste, Italy

ICTP

Director:
 P. DIMITRIOU (Surrey University, UK) &
 V. ZERKIN (IAEA, Austria)

Local Organizer:
 M. VERPELLI

Speakers:
 P. REGAN (Surrey, UK)
 E. MCCUTCHAN (BNL, USA)
 & M. MARTIN (ORNL, USA)
 F. KONDEV (ANL, USA)
 B. SINGH (McMaster, CAN)
 T. KIBEDI (ANU, AUS)
 S. BASUNIA (LBL, USA)
 P. VAN ISACKER (GANIL, CAN)
 & S. LENZI (LNL, ITA)
 V. ZERKIN (IAEA, Austria) &
 P. DIMITRIOU (Surrey University, UK)

Deadline:
 30 June 2018

How to apply:
 Applications should be submitted to: workshop@iaea.org

Grants:
 Applicants should look at www.iaea.org for information on grants and travel arrangements.

IAEA:
 International Atomic Energy Agency

ICTP:
 International Centre for Theoretical Physics

Participants of ICTP-IAEA Workshop on NSDD, 15-26 Oct. 2018



1 Africa	Algeria	Algeria	KAIM Samra
2 Africa	Tunisia	Tunisia	DERBALI Ezzeddine
3 Asia	Bangladesh	Bangladesh	KOBRA Monira
4 Asia	India	India	BALA Indu
5 Asia	India	India	BONDYOPADHAYA Debasmita
6 Asia	India	India	CHAKRABARTI Ritwika
7 Asia	India	India	NANDI Soumen
8 Asia	India	France	SINGH Abhilasha
9 Asia	India	India	SINGH Papinder
10 Asia	Japan	Japan	KOURA Hiroyuki
11 Asia	Malaysia	Australia	TEE Bryan
13 Europe	Romania	Romania	OLACEL Adina-Adriana
14 Europe	Spain	Canada	CABALLERO FOLCH Roger
15 Europe	Ukraine	Ukraine	CHEKHOVSKA Anastasiia
16 Europe	Ukraine	Ukraine	KASPEROVYCH Dmytro
17 Europe	United Kingdom	United Kingdom	CANAVAN Rhiann
18 North America	USA	USA	GRINDER Mara

Participants of ICTP-IAEA Workshop on NSDD, 15-26 Oct. 2018



1 Africa			M Samra
2 Africa			BALI Ezzeddine
3 Asia			RA Monira
4 Asia			A Indu
5 Asia	India	India	INDYOPADHAYA
6 Asia			asmita
7 Asia			KRABARTI Ritwika
8 Asia			DI Soumen
9 Asia			H Abhilasha
10 Asia			H Papinder
11 Asia			RA Hiroyuki
13 Europe			Bryan
14 Europe			CEL Adina-Adriana
15 Europe	Ukraine	Ukraine	ALLERO FOLCH
16 Europe			er
17 Europe			CHEKHOVSKA Anastasiia
18 North A			PEROVYCH Dmytro
			AVAN Rhiann
			NDER Mara

6 participants from developed countries: Australia, Canada, France, Japan, UK, USA

Majority: female (59%)

Age: early PhD to young research scientists (22 to 20 years old)

Good background in nuclear physics (structure & reactions): no prior knowledge of XUNDL/ENSDF

Week 1: XUNDL



- Split in groups of 2: 9 groups
- Compilation of 1 article per group in XUNDL dataset
- Group supervisors: Filip Kondev (coordinator), Murray Martin, Tibor Kibedi

Week 2: ENSDF Exercise



IAEA

Evaluation of nuclides of $A=218$ for ENSDF database

Experimentally **11** nuclides of $A=218$ are known ($Z=82-92$, $N=136-126$).
Current data in ENSDF/NDS: January 2006 update (~13 years old).

Tasks: addition of new papers, update for decay Q values in AME-2016, revision of internal conversion coefficients from BrIcc code, $\log ft$, HF, etc.

Pb-218, Bi-218, At-218, Pa-218, U-218: nuclear data available for only the ground states, and a high-spin isomer in U-218: already updated by Balraj Singh

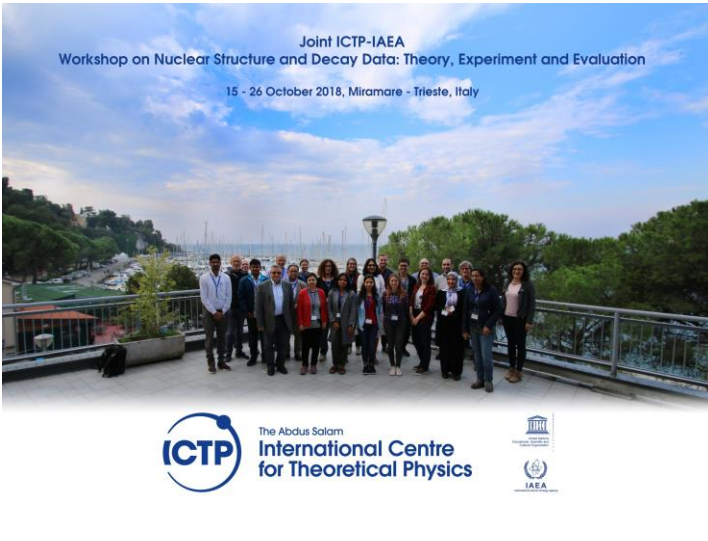
Po-218, Rn-218: Libby McCutchan.

Ra-218 Murray Martin.

Ac-218: Shamsu Basunia

Fr-218, Th-218: Balraj Singh.

ICTP-IAEA Workshop on NSDD, 15-26 Oct. 2018



Feedback:

VERY VERY POSITIVE

- Useful webtools
- Excellent lectures on theory and experiment
- Better understanding of their own research work
- Learned to be CRITICAL of published work
- Appreciated the networking with their peers from all over the world

SOME USEFUL SUGGESTIONS TOO:

- All XUNDL/ENSDF lectures should be HANDS-ON
- Always more effective to give exercises even on retrieving data
- Analysis/checking codes could be run from Myensdf

Training cont'd



- Advanced Workshop for NSDD Evaluators, IAEA, 2019
 - To be merged with NSDD meeting 2019
 - 2 (OR 1.5) last days on Thu-Fri with hands-on exercises for active evaluators AND/OR live demo of new software tools

Technical Support



- TM on Improvement of Analysis Codes for NSDD evaluations, 3-7 Dec. 2018, IAEA

- ENSDF codes, editor, web tools
 - dissemination of codes
 - correct bugs, maintain codes
 - new developments

Participants: Sonzogni, Singh, Kibedi, Kondev, Hurst, Rodionov, Mougeot



IAEA Project on Improvement of Analysis and Checking Codes for NSDD Evaluations

Scientific Secretary: [Paraskevi Demetriou](#)

Project on Improvement of Codes used for NSDD Evaluations: Introduction

The ENSDF Analysis and Utility codes are essential tools for evaluators' work and for that reason it is important that they are maintained, i.e. that they are continuously checked for bugs, kept up-to-date with developments in physics models, statistical methods and error analysis, and evaluation methods/policies in general. To make sure 'maintenance' of these codes is kept up by future generations of programmers and evaluators, these codes need to be reviewed and most likely re-written using modern programming tools.

The Nuclear Data Section has begun a Data Development Project to address all the problems that are encountered in the utilization of the existing ENSDF codes in view of the overall need to re-structure and/or re-write them using modern programming tools. The kick-off Technical Meeting was held at IAEA headquarters in Vienna, from 10 to 13 June 2014. The output of this meeting was a priority list of codes that need to be improved, and a list of assignments/tasks to be delivered within a given period. A summary report of the meeting is available [INDC\(NDS\)-0665](#). Presentations

Access to full EXFOR-NSR PDF Database



<http://www-nds.iaea.org/exfor/myensdf.htm>

Web tools for ENSDF evaluators

Web server: www-nds.iaea.org

Guest

Evaluator:

Name or e-mail: Viktor
Password:

1) Enter to MyEnsdf as Evaluator

MyEnsdf: Web tools for ENSDF evaluators

by V.Zerkin, IAEA-NDS, 2004-2017, ver.2017-05-15

Upload your ENSDF dataset and run remotely ENSDF codes: FMTCHK, chk_ENSDF, PREPRO, XPQCHK, ALPHAD, GTOL, BrIcc, BrIccMixing, GABS, LOGFT, PANDORA, RADLST, RULER, BARON, NDSPUB, etc.

2) Go to PDF database:
- NSR PDF database
- Joined EXFOR-NSR database

Evaluator: Viktor
Working area: 172
Session: 176
Use existing ENSDF file: No file chosen

or ENSDF, e.g. [text](#) tests: [alphad](#) [fntchk](#) [gabs](#) [gtol](#) [newgtol](#) [logft](#) [pandora](#) [radlst](#) [ruler](#) [xpqchk](#) [1-5](#) [152](#) [aa](#) [177Lu](#) [235Pa](#) [221Fr](#)

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Useful links:

- NSDD
- NuDat2
- LiveChart
- ENSDF:
 - web-retrieval
 - manual
 - programs
 - data archive
- XUNDL:
 - web-retrieval
 - data archive
- x4pdf-nsr
- x4pdf-all

Login: Viktor 2017/05/17:13:59:40 161.5.149.211::Austria Access level=2

Web Design and Programming: Viktor Zerkin, NDS, International Atomic Energy Agency (V.Zerkin@iaea.org)

Last updated: 05/17/2017 13:59:38

X4-NSR PDF collection.

Database updated: 2017-10-25. Files: 121796 from 2000-04-19 to 2017-10-23.

-	-	-	-	-	-	1896.3	-	1898.4	1899.1	[1890-1899]:8
1910.4	1911.2	1912.1	-	-	-	-	-	1918.2	1919.1	[1910-1919]:10
1920.2	1921.2	-	-	1924.1	-	-	-	1928.4	1929.4	[1920-1929]:13
1930.2	1931.3	1932.5	1933.2	1934.4	1935.20	1936.18	1937.31	1938.29	1939.58	[1930-1939]:172
1940.52	1941.40	1942.18	1943.14	1944.19	1945.24	1946.78	1947.152	1948.161	1949.287	[1940-1949]:845
1950.397	1951.428	1952.387	1953.493	1954.561	1955.621	1956.681	1957.899	1958.958	1959.917	[1950-1959]:8142
1960.1034	1961.1046	1962.1251	1963.1576	1964.1424	1965.1647	1966.1787	1967.1386	1968.1447	1969.2314	[1960-1969]:14892
1970.2714	1971.2885	1972.3257	1973.3323	1974.2898	1975.2541	1976.2533	1977.2446	1978.2414	1979.2167	[1970-1979]:27158
1980.1973	1981.1986	1982.1993	1983.2039	1984.2119	1985.1943	1986.1871	1987.1985	1988.1509	1989.1669	[1980-1989]:19067
1990.1531	1991.1257	1992.1326	1993.1640	1994.1549	1995.2157	1996.2057	1997.2140	1998.2210	1999.2406	[1990-1999]:18273
2000.2565	2001.1818	2002.1949	2003.1857	2004.2339	2005.2423	2006.2518	2007.3040	2008.2152	2009.1943	[2000-2009]:22604
2010.1917	2011.2142	2012.2086	2013.1927	2014.1758	2015.1725	2016.792	2017.265			[2010-2017]:12612

Years: 101 Publications: 121796

Full volumes: [\[conferences and books\]](#) [\[theses\]](#) [\[reports\]](#)

Contributions:

1) 201200_Totans /3610/	16) 201703_Shulyak /303/
2) 201300_Totans /991/	17) 201703_Totans /370/
3) 201400_Totans /549/	18) 201704_Totans /116/
4) 201500_Totans /622/	19) 201704_Zerkin /132/
5) 201510_Balraj /260/	20) 201705_Kondev /44/
6) 201510_Rodionov /2470/	21) 201705_Totans /820/
7) 201512_Audi /2609/	22) 201705_Zerkin /31/
8) 201600_Totans /2050/	23) 201706_Totans /1/
9) 201603_Rodionov /295/	24) 201708_Totans /175/
10) 201603_Shulyak /13425/	25) 201709_Pritychenko /1208/
11) 201604_Kondev /1098/	26) 201710_PNPI /18736/
12) 201611_PNPI /31657/	27) 201710_Totans /175/
13) 201701_Totans /275/	28) 201710_Zerkin /74/
14) 201702_Totans /176/	
15) 201703_PNPI /11151/	
Sum: /93423/	

Contributors:

1	PNPI	61544	65.9%
2	Shulyak	13728	14.7%
3	Totans	9930	10.7%
4	Rodionov	2765	2.96%
5	Audi	2609	2.8%
6	Pritychenko	1208	1.3%
7	Kondev	1142	1.23%
8	Balraj	260	0.28%
9	Zerkin	237	0.26%
	Total	93423	

PDF Statistics:

DB	#PDF/References	#PDF+	Total #PDF
NSR:	93379/225841 ~42%	+7419 from EXFOR	100798
EXFOR:	21913/30804 ~72%	+689 from NSR	22602

Dissemination tools

- Live Chart (M. VerPELLI)



- New 2017 masses correctly inserted with proper treatment/calculation of uncertainties
- **New code to calculate atomic radiation data (using EADL database)**

- Isotope Browser (M. VerPELLI)

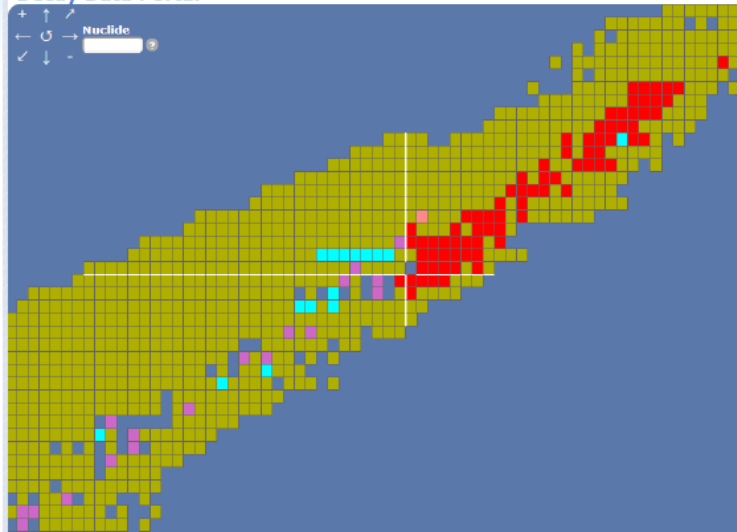


- Translated in 5 UN official languages (french, spanish, chinese, arabic, russian) + italian, slovenian, traditional chinese

Dissemination tools: Decay Data Portal



Decay Data Portal



Color Code

- ENSDF
- IAEA IRDFF
- IAEA Actinides
- DDEP

Library	# Nuclides
ENSDF	2527
IAEA IRDFF	57
IAEA Actinides	78
DDEP	91

^{238}U α decay to ^{234}Th

Half-life		Level energy		Branching ratio		Q value		Authors		Cut-off date	
ENSDF	IAEA	ENSDF	IAEA	ENSDF	IAEA	ENSDF	IAEA	ENSDF	IAEA	ENSDF	IAEA
4.468E+9 Y	4.468E9 5 Y	0.0	0.0	1 0	1 0	4269.7 29	4269.7 29	E. BROWNE, J. K. TULI	V. Chist	1-Jun-2006	01-APR-2006

γ

E_γ		$I_\gamma(\text{abs})$		δ		σ_T	
ENSDF	IAEA	ENSDF	IAEA	ENSDF	IAEA	ENSDF	IAEA
49.55 6	49.55 6	0.064 8	0.0697 26			326.4	321 10
113.5 1	113.5 1	0.0102 15	0.0174 47			6.63	6.47 19

α

E_α		$I_\alpha(\text{abs})$		HF	
ENSDF	IAEA	ENSDF	IAEA	ENSDF	IAEA
4038 5	4038 5	0.078 12	0.13 3	40	24
4151 5	4151 5	20.9 27	22.3 5	1.4	1.33
4198 3	4198 3	79.0 27	77.5 5	1.0	1

c/o: M. Verpelli

Statistics

Overall IAEA web statistics on Google-Analytics (running since 2013)

May 1, 2018 - May 31, 2018

Custom Variable	Pageviews
1. NAPC/NDS	231,595 (75.36%)
2. MTCD	61,264 (19.94%)
3. NSNI	8,967 (2.92%)
4. MTIT	4,900 (1.59%)
5. NAEL/MESL	556 (0.18%)

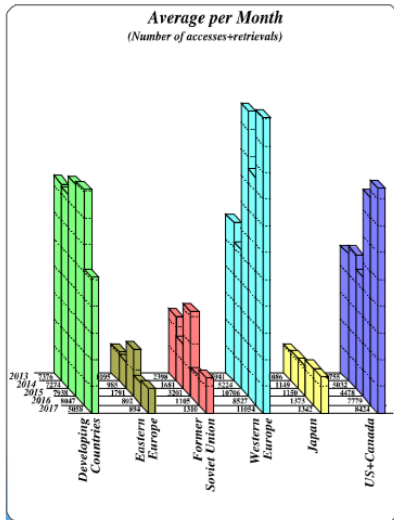
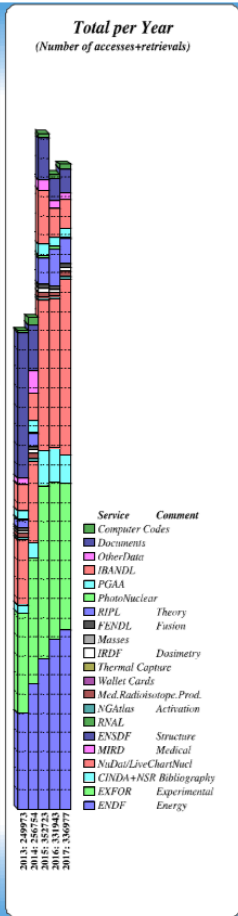
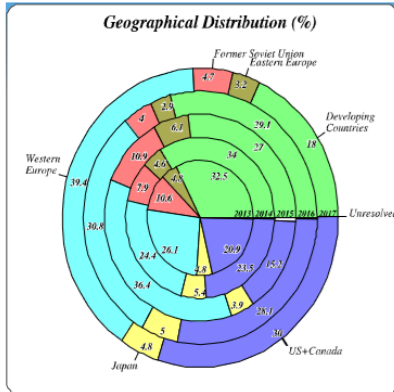
Custom Variable (Value 01)	Custom Variable (Value 02) ?	Pageviews ? ↓	Users ?
1. NAPC/NDS	NDS/x4service	99,984 (32.54%)	3,280 (13.84%)
2. NAPC/NDS	NDS/livechart	81,423 (26.50%)	6,771 (28.58%)
3. MTCD	Indico	61,264 (19.94%)	2,794 (11.79%)
4. NAPC/NDS	US/x4service	25,303 (8.23%)	1,090 (4.60%)
5. NSNI	IRS	7,443 (2.42%)	299 (1.26%)
6. NAPC/NDS	NDS/	6,715 (2.19%)	2,680 (11.31%)
7. MTIT	NUCLEUS	4,900 (1.59%)	597 (2.52%)
8. NAPC/NDS	NDS/AMDIS	2,779 (0.90%)	884 (3.73%)
9. NAPC/NDS	NDS/nrdc/	2,022 (0.66%)	314 (1.33%)
10. NAPC/NDS	NDS/stopping/	1,835 (0.60%)	235 (0.99%)
13. NAPC/NDS	NDS/safeguards/	1,007 (0.33%)	470 (1.98%)
14. NAPC/NDS	NDS/amdc/	782 (0.25%)	496 (2.09%)
15. NAPC/NDS	NDS/AMDIS/ALADDIN	753 (0.25%)	138 (0.58%)
16. NAPC/NDS	NDS/public/download-endf/	706 (0.23%)	150 (0.63%)
19. NAPC/NDS	CN/x4service	474 (0.15%)	18 (0.08%)
23. NAPC/NDS	IN/x4service	277 (0.09%)	130 (0.55%)
60. NAPC/NDS	RU/x4service	25 (0.01%)	7 (0.03%)

Inspecting usage of features of our web systems.

Examples:

#.Product	Function	Page views	Users
1.ENDF	Search	23,225(18.42%)	1,754(10.51%)
2.EXFOR	Search	19,110(15.15%)	1,491(8.94%)
4.ENDF	Retrieve	12,422(9.85%)	1,268(7.60%)
5.ENDF	Plot	10,093(8.00%)	1,160(6.95%)
7.EXFOR	Retrieve	5,459(4.33%)	697(4.18%)
9.EXFOR	Plot	3,388(2.69%)	529(3.17%)
19.IBANDL	Plot	793(0.63%)	110(0.66%)
23.EXFOR	goto:Web-Publisher	614(0.49%)	174(1.04%)
28.EXFOR	download:x4pdf	440(0.35%)	38(0.23%)
29.CINDA	Search	418(0.33%)	177(1.06%)
42.EXFOR	X4Construct-Covar	110(0.09%)	72(0.43%)
58.ENDF	download:Mat2gnd	45(0.04%)	31(0.19%)
62.EXFOR	x4corr	42(0.03%)	9(0.05%)

Statistics cont'd



V. NDS Web statistics

- ### Observed tendencies:
- 2013-2017: +35% (5 years)
 - 2012-2013: migration to cloud-server
2015 → 2016 → 2017
 - LiveChart: +85% -1% +17%
 - EXFOR: +39% -9% -7%
 - ENDF: +20% +12% +6%
 - Total: +37% -6% +1.5%

- ### Leaders of downloads (2016, 2017)
- ENDF 27%, 28%
 - LiveChart 24%, 27%
 - EXFOR 25%, 23%
 - CINDA/NSR 5%, 4%
 - IBANDL/Sigmacalc 4%, 4%
 - Documents 3%, 4%

- ### Dissemination geography (2016,2017)
- Western Europe ≈ 31-39%
 - US + Canada ≈ 28-30%
 - Developing countries ≈ 29-18%
 - former USSR ≈ 4-5%

c/o: V. Zerkin

Financial support



- Mass chain evaluations:
 - Pascu (ROM): 2017-2020
- Horizontal evaluations:
 - Stone (2017- 2018): Tables of Evaluated Nuclear Moments
 - Nichols (2017-2018): Assessment of decay data for decay heat calculations
 - Yoshida (2017): Assessment of decay data for decay heat calculations

Coordinated Research Projects



- Reference database for Beta-delayed neutrons (2013-2018)
 - Evaluation of $Z > 28$ nuclides + new systematics submitted to NDS (Liang et al)
 - Comparison with theory
 - Validation/benchmarking of microscopic ($T_{1/2}, P_n$) complete (delayed nu-bar, reactivity, 6- and 8-group constants, benchmark experiments)
 - Final CRP publication in Nuclear Data Sheets: in preparation
 - Online Reference Database available

New database

CRP Meetings

[RCM-3 2017](#)
[RCM-2 2015](#)
[RCM-1 2013](#)
[CM 2011](#)

IAEA Docs

[INDC\(NDS\)-0735](#)
[INDC\(NDS\)-0683](#)
[INDC\(NDS\)-0643](#)
[INDC\(NDS\)-0599](#)
[INDC\(NDS\)-0107/G](#)

CRPs/DDPs

[Reference Database for Beta-Delayed Neutron Emission](#)
[Total Absorption Gamma-ray Spectroscopy Meeting 2018](#)
[Fission Product Yields Meeting 2016](#)
[Total Absorption Gamma-ray Spectroscopy Meeting 2014](#)

Links

[ENPDF](#)
[EXFOR](#)
[AME+NUBASE](#)
[IAEA Nuclear Data Services](#)
[IAEA Nuclear Data Section](#)

Reference Database for Beta-Delayed Neutron Emission

The overall objective of the Coordinated Research Project (2013-2018) was to create a Reference Database for Beta-Delayed Neutron Emission that contains an organised compilation of existing experimental, evaluated and theoretical data on beta-delayed neutron emission, and is readily available.

Microscopic Database

The database includes a compilation of all existing measured beta-decay half-lives and delayed-neutron emission probabilities of individual precursors, and the recommended values based on evaluations performed by the CRP evaluators. Where a delayed-neutron spectrum has been measured there is a link to the corresponding spectrum file. The database also provides access to theoretical models and systematic parameterizations.

[Individual Precursors](#)

Macroscopic Database

The macroscopic database includes all published experimental and evaluated total delayed neutron yields (nubars), delayed neutron decay parameters ($\lambda_i, T_{1/2}$), and composite delayed neutron spectra for various fissioning systems. New recommendations for 6- and 8-group parameters are also provided.

[Total Delayed Neutron Yields](#)

[Group parameters](#)

[Delayed Neutron Spectra](#)

Decay Data for Decay heat & other applications



- **OECD/WPEC-SG25 (2006)**
 - Thermal fission of U-235
 - Priority List of potential pandemonium nuclides
- **IAEA CM on TAGS (2009): Determination of Beta and Gamma decay Components of Fission Products for Decay heat Calculations**
 - Follow-up progress since WPEC-SG25 (2006)
- **IAEA CM on TAGS (2014)**
 - Assess impact of new TAGS measurements on decay heat and anti-neutrino spectra calculations
 - Produce TOP PRIORITY LIST of potential pandemonium nuclides for U/Pu cycle, Th/U cycle and anti-neutrino spectra (4-5 MeV)
 - *Action: perform decay heat calculations for all available fissioning systems*

Nuclear Data for Decay Heat & Anti-neutrino spectra calculations



- **CM on Updating data needs for TAGS measurements, 19-21 February 2018, IAEA**
 - Update tables of high-priority nuclides for TAGS measurements based on recent comprehensive inventory calculations (UKAEA reports) on a variety of fuel cycles and energies and irradiation times
 - 15 fuel systems at different irradiations and cooling times were analysed to obtain top 20 contributing fission products
 - Over 100 top contributing FPs had their evaluated decay data assessed
 - Recommendations TAGS measurements, high-resolution GS measurements and re-evaluation of decay data were made

Nuclear Data for Decay Heat & Anti-neutrino spectra calculations



- CM on Updating data needs for TAGS measurements, 19-21 February 2018, IAEA
 - Assess impact of new TAGS measurements on decay heat calculations, anti-neutrino spectra and beta-delayed neutron yields
 - New published TAGS data were identified and submitted to NNDC for XUNDL
 - Decay heat and anti-neutrino spectra calculations using these new TAGS data are performed to assess their impact (using new evaluated DD and FY libraries)
 - Publication in preparation



Consultant's Meeting on Updating Data Needs for Total Absorption Gamma-ray Spectroscopy (TAGS)

19-21 February 2018, IAEA Headquarters, Vienna, Austria

Objective

The objective of the meeting is to review the current state of affairs regarding TAGS facilities & measurements, TAGS data and decay data libraries, impact of new TAGS data on decay heat calculations, anti-neutrino spectra, etc, discuss new emerging data needs and make recommendations for the future.

Presentations and discussions will focus on the following items:

- new TAGS measurements and results for beta feedings (available since the last meeting in Dec. 2014)
- current status of decay data libraries wrt TAGS data
- impact of recent TAGS data (made available since last meeting in 2014) on decay heat calculations, anti-neutrino spectra
- assessments of main fission product contributors to decay heat and antineutrino spectra
- new priority tables for total absorption and high-resolution gamma-ray spectroscopy measurements
- TAGS facilities and future perspectives
- repository of measured decay heat data

Agenda

The adopted Agenda is available [here](#).

Actions List

The list of Actions adopted at the meeting is available [here](#).

The summary report of the meeting will be made available as soon as it is published.

Participants

Alejandro Algora
 Muriel Fallot
 Filip Kondev
 Gopal Mukherjee
 Alan Nichols
 Krzysztof Rykaczewski
 Alejandro Sonzogni
 Jose-Luis Tain
 Tadashi Yoshida

Scientific Secretary

P. Dimitriou

Contacts

Jean-Christophe Sublet

Meetings

TM on Fission Yields Data 2016
 CM on TAGS 2014

Documents

CM on TAGS, March 2015
 Decay Heat Calculations for Th/U Fuel, May 2010
 CM on TAGS, February 2009
 OECD-NEA/WPEC-25, 2007

Presentations

#	Author	Title	Link
1	A. Nichols	Total Absorption Gamma-ray Spectroscopy - Radionuclide Assessment	PDF
2	F. Kondev	Assessment of decay data for ⁹¹ Sr, ⁹⁷ Zr, ¹²⁹ Sb, ¹³² I, ¹⁴⁵ Pr, ¹⁴⁹ Nd	PDF
3	F. Kondev	Capabilities and future plans at ANL regarding decay spectroscopy of fission products	PDF
4	K. Rykaczewski	Update on published results and future plans of the ORNL MTAS collaboration (short-term and long-term) Notes on MTAS Uncertainties	PDF PDF
5	J.-L. Tain	TAGS Measurements	PDF
6	A. Algora	Valencia TAGS measurements: recent results and future plans Study of the need for TAGS measurements	PDF PDF
7	G. Mukherjee	Present status and future possibilities of gamma-gamma coincidence and gamma-singles as well as total absorption measurements at VECC	PDF
8	T. Yoshida	Several Learnings from Summation Calculation of Reactor Decay Heat and Antineutrino Spectra TAGS Measurement Priority Required from Thorium /cycle and Cm-245	PDF PDF

Evaluation of Nuclear Moments (ongoing)



- New publication of recommended Q (Pykko, 2018) – to be uploaded in NM database in 2019
- Spins/parities and T1/2 in NM database to be adopted from ENSDF - in 2019
- Tables of evaluated NMs: ongoing – estimated publication early 2019
 - Corrections being implemented
 - Hyperfine corrections insignificant
 - Transient Field methods: require a lot of re-analysis

Participants: Stone, Stuchbery, Jakowski, Persson, Pykko, Kondev, Nuyens, Lloyd, Mertzimekis

Coordinated Research Project (ongoing)



- Photonuclear Data and Photon Strength Functions (2016-2020)
 - Atlas of GDR parameters (new: Plujko et al, ADNDT 2018)
 - New evaluations of photonuclear data (finalized) – CM 25-27 June 2018
 - Atlas of ARC Strength Functions (2017)
 - Atlas of DRC Strength Functions (to be published 2019)
 - New compilation/evaluation of strengths by R. Firestone
 - New global empirical models for PSF: E1 and M1 (spin-flip & scissors)
 - New global QRPA calculations (+ low-energy upbend)
 - Validation of models: ongoing
 - Assessment of exp. PSF: ongoing

R-matrix codes project: ongoing



- CM on R-matrix codes, 27-29 August 2018, IAEA
 - Verification of R-matrix codes through a series of joint exercises: publication to be submitted for publication
 - Next step is to perform an evaluation (7Be) to compare R-matrix fits, uncertainties and covariances
 - Final goal: perform evaluations for dissemination in ENDF libraries
 - Processing codes: develop capability to process charged-particle differential data

Participants: AMUR (JAEA), AZURE2 (Notre-Dame), EDA (LANL), SAMMY (ORNL), SFRESCO (LLNL), RAC (Tsinghua Univ.), GECCOS (TUW)

International Network of Nuclear Data Evaluators (INDEN)



- Follow-up project of CIELO
- Kick-off meeting Dec. 2017
- Purpose to enhance international collaboration on nuclear reaction data evaluation
- Lead to improvements in physics models, statistical analysis and treatment of uncertainties, new measurements and finally new improved evaluations
- Three sub-groups:
 - Actinides
 - Structural material
 - *Light elements (Hale, Thompson, Pigni, Kunieda, Chen, DeBoer, Leeb)*

International Network of Nuclear Data Evaluators (INDEN)



– *Light elements (up to 20 MeV):*

- Be-9 \rightarrow n+⁹Be : extend RRR to break-up threshold
- N-14; 15 \rightarrow n+¹⁴N, n+¹⁵N : RRR and high-energies
- Na-23 \rightarrow n+²³Na : RRR, URR and high-energies
- O-16 \rightarrow n+ ¹⁶O : RRR and high energies

Nuclear structure data:

- ¹⁰Be: ENSDF (2007): cut-off 2004
new XUNDL: 18 datasets (2007-2018)
- ¹⁵N: ENSDF (2002): cut-off 1990
new XUNDL: 8 datasets (2008-2017)
- ¹⁶N: ENSDF (1999): cut-off 1992
new XUNDL: 9 datasets (2008-2018)
- ²⁴Na: ENSDF (2007): cut-off 2006
new XUNDL: 2002, 2014
- ¹⁷O: ENSDF (199): cut-off 1992
new XUNDL: 14 (2007-2017)

CRP on Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production: closed



Category	Radionuclide	Requested/Comments
monitor reactions	⁶¹ Cu	Recommended decay data re-assessed – completed
	⁶² Zn	Recommended decay data – no volunteer/no action
	⁶³ Zn	Recommended decay data – completed
diagnostic γ emitters	⁶⁷ Cu	Recommended decay data – completed
	⁹⁹ Mo- ^{99m} Tc	Recommended ⁹⁹ Mo and pure ^{99m} Tc decay data – completed
	¹¹¹ In	Recommended decay data – completed
β^+ emitters	⁴⁴ Ti	Recommended half-life – completed
	⁵² Fe/ ⁵² Mn, ^{52m} Mn	Recommended decay data – completed
	⁶⁴ Cu	Recommended decay data re-assessed – completed
	⁶⁶ Ga	Recommended decay data – completed
	⁷² As	Recommended decay data – no volunteer/no action
	⁷³ Se	Recommended decay data – completed
	⁷⁶ Br	Recommended decay data – completed
	⁸⁶ Y	Recommended decay data – awaiting measurements
	⁸⁹ Zr	Recommended decay data – completed
	^{94m} Tc	Recommended decay data – completed
¹²⁰ I	Recommended decay data – completed	

Category

Radionuclide

Requested/Comments



IAEA

therapeutic α emitters

^{230}U decay chain:

^{230}U

Recommended decay data – completed

^{226}Th

Recommended decay data – completed

^{222}Ra

Recommended decay data – evaluation underway

^{218}Rn

Recommended decay data – re-assessment completed

^{214}Po

Recommended decay data – re-assessment completed

^{210}Pb

Recommended decay data – re-assessment completed

^{210}Bi

Recommended decay data – completed

^{210}Po

Recommended decay data – completed

Focus on Auger electrons and X-rays: BrIccEmis

$^{99}\text{Tc}^{\text{m}\ddagger}$

Recommended pure $^{99}\text{Tc}^{\text{m}}$ decay scheme – completed

$^{103}\text{Pd}\ddagger$

Recommended decay scheme: Auger-electron benchmark? – completed

$^{111}\text{In}\ddagger$

Recommended decay scheme: Auger-electron benchmark – completed

$^{125}\text{I}\ddagger$

Recommended decay scheme: Auger-electron benchmark – completed

$^{131}\text{Cs}\ddagger$

Recommended decay scheme – completed

$^{178}\text{Ta}\#$

Recommended decay scheme of low-spin (1+) ^{178}Ta

Recommended decay scheme of high-spin 7- ^{178}Ta – completed

therapeutic a

Will be uploaded on Medical Portal

²²⁶Ra

Recommended decay data – evaluation underway

²¹⁸Rn

Recommended decay data – re-assessment completed

- Handbooks
IAEA TRS 473
IAEA TECDOC 1211
- Reference Data
Monitor Reactions
MIRD
- Therapeutic RN
Emerging
Established
- Production Data
Therapeutic
Emerging
Established
- Diagnostic
Gamma emitters
Positron emitters
- Related Reports
INDC(NDS)-0638
INDC(NDS)-0535
INDC(NDS)-0560
INDC(NDS)-0523
- On-going Project
INDC(NDS)-0675
INDC(NDS)-0630
INDC(NDS)-0591
- Links
NAHU
DMRP Section
Previous version

⁹⁹Tc^m
¹⁰³Pd[†]
¹¹¹In[†]
¹²⁵I[†]
¹³¹Cs[†]
¹⁷⁸Ta[†]

Medical Radioisotopes Production



Color zones by ?
 value quantile

main decay mode

- alpha
- EC+ beta+
- beta-
- β
- n
- EC
- SF
- other

Decay data of nuclides denoted by green band were evaluated within IAEA CRPs.

Nuclide	Half-life	Decay %	Emission	Target	Reaction	Product	MIRD
¹¹ ₆ Cs	20.364 min 14	ec β+ 100 (β+ ≈ 99.8)	e ⁺	¹⁴ ₇ N ₇	¹⁴ N(p,a) ¹¹ C	¹¹ ₆ Cs	mird
¹³ ₇ N ₆	9.965 min 4	ec β+ 100 (β+ ≈ 99.8)	e ⁺	¹⁶ ₈ O ₈	¹⁶ O(p,a) ¹³ N	¹³ ₇ N ₆	mird

Future Meetings at IAEA



- TM on Improvement of Analysis Codes for NSDD evaluations, 3-7 Dec.2018
- CM on Uncertainty quantification, 3-7 Dec. 2018
- TM on Nuclear data for Medical Applications, 10-13 Dec. 2018
- 3rd RCM of CRP on Photonuclear Data and Photon Strength Functions, 17-21 Dec. 2018
- 23rd TM of the NSDD network, 1-5 April 2019, IAEA, Vienna
- TM on Decay Data Needs For Anti-neutrino Spectra Applications, 2019, date tba



IAEA

International Atomic Energy Agency
Atoms for Peace and Development

*As this is my last USNDP as IAEA staff:
Thank you for the cooperation and
hospitality!*