NEA Data Bank
Progress report 2016-2017

O. Cabellos
OECD/NEA Data Bank

NRDC 2017, 23-26 May 2017
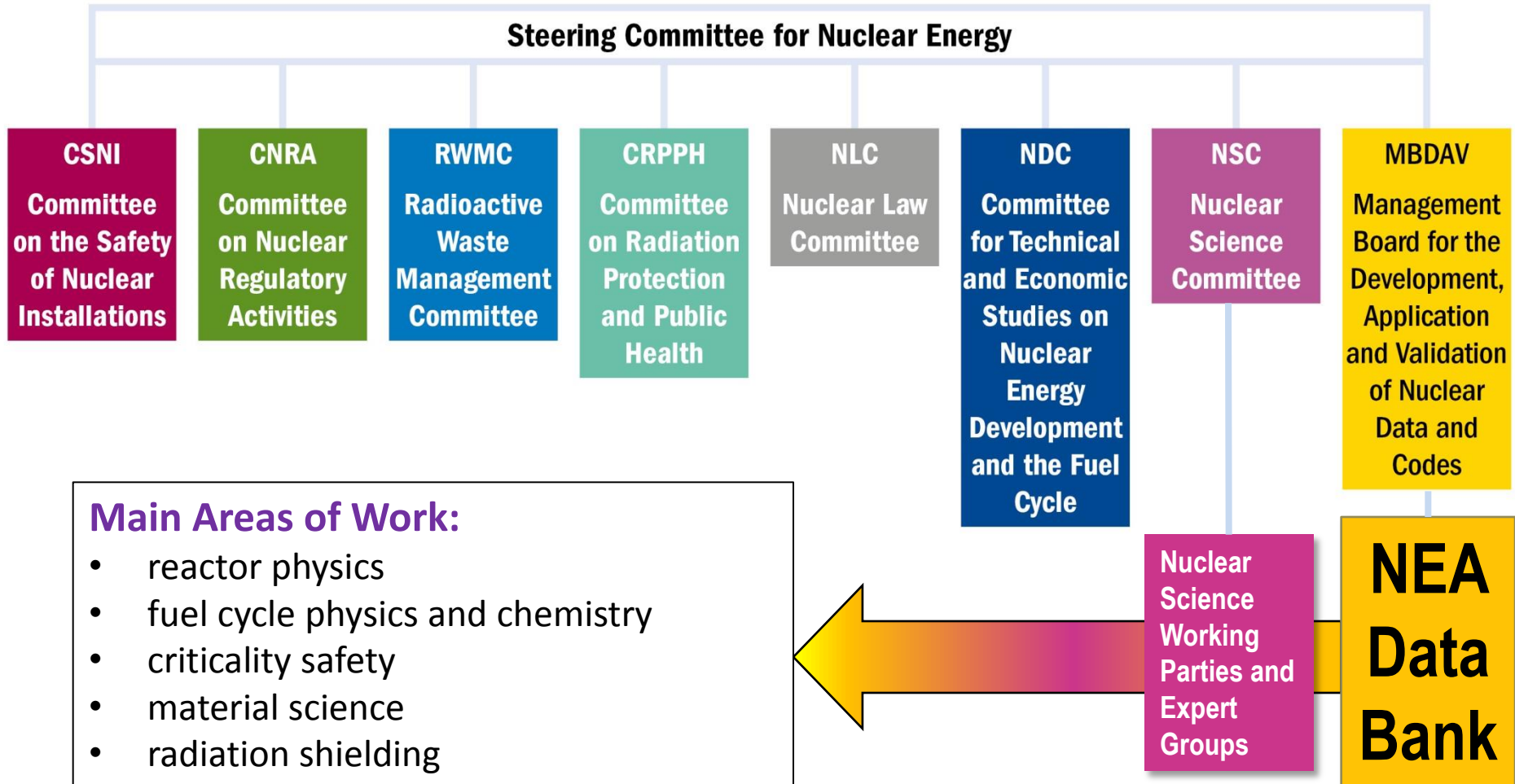*IAEA Headquarters (Room C0234), Vienna, Austria*

1. Organization and Staff

❑ **K. Matsumoto** leaves NEA at the end of August after 5 years of service. In September 2016, **Jim Gulliford** new Head of Data Bank

❑ **Manpower** allocated to nuclear data (ND) activities is shared among 4/5 staff:

- ▪ DB Nuclear Data Services & JEFF : F. Michel-Sendis, O. Cabellos, C. J. Diez (leaves NEA September 2016)

- ▪ DB Software : N. Soppera, M. Bossant

- ▪ WPEC : O. Cabellos

❑ **DB Task Force (TF)** was established to discuss future NEA DB activities and prepare the next NEA strategic plan 2017-2022.

- ▪ Recommendations: "improving client services, adapting to new technical developments, enhancing scientific expertise, and enhancing governance"

❑ The **Executive Group of the NSC** has been renamed "Management Board on the Development, Application and Validation of Nuclear Data and Codes" (**MBDAV**)

- ▪ MBDAV reports directly to the NEA Steering Committee
- ▪ First step towards enhancing the Data Bank's governance structure and visibility

NEA Committees

Steering Committee for Nuclear Energy

CSNI	CNRA	RWMC	CRPPH	NLC	NDC	NSC	MBDAV
Committee on the Safety of Nuclear Installations	Committee on Nuclear Regulatory Activities	Radioactive Waste Management Committee	Committee on Radiation Protection and Public Health	Nuclear Law Committee	Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle	Nuclear Science Committee	Management Board for the Development, Application and Validation of Nuclear Data and Codes

Nuclear Science Working Parties and Expert Groups

NEA Data Bank

Main Areas of Work:
- reactor physics
- fuel cycle physics and chemistry
- criticality safety
- material science
- radiation shielding

2. Compilation & dissemination of EXFOR

❑ **Update and maintain the EXFOR database (NEA DB areas)**

- ▪ NEA DB is a founding member of the NRDC network
- ▪ Full coverage of experimental results published in open literature
- ▪ Update and maintenance of the EXFOR database (areas 2 and O)
- ▪ Revision of old entries is a significant part of the activity
- ▪ NEA DB contributes about 300 new/updated entries every year

ATOMKI	CAJaD	CDFE	CJD	CNDC	CNPD	JCPRG	KCPDG	KNDC	NDPCI	NDS	NEA-DB	NNDC	RIKEN	UkrNDC	Sum
347	878	917	1607	272	1988	1136	180	63	342	2254	5396	6826	52	210	22468
1.5%	3.9%	4.1%	7.2%	1.2%	8.8%	5.1%	0.8%	0.3%	1.5%	10.0%	24.0%	30.4%	0.2%	0.9%	100.0%

Information updated: 16-Dec-2016
https://www-nds.iaea.org/exfor-master/x4compil/exfor_input.htm

❑ **NEA effort**

- ▪ NEA/DB&IT: O. Cabellos (DB), N. Soppera (IT), M. Bossant (IT)
- ▪ Consultants: S. Dunaeva, S. Babykina, M. Milhiaukova

2. Compilation & dissemination of EXFOR

- *"EXFOR compilation effort is complex and well-organized"*

- *"EXFOR contractors are essential for the current operation"*

- *"We address compilation of current articles, correct previous entries and add missing article"*

- *"It is a team effort that is conducted in close cooperation with the IAEA"*

B. Pritychenko
CSEWG-Nov 2016 meeting

Year	Trans	Entry	
		New	Updated
2016	2243 (Feb 2016)	0	40
	2244 (Feb 2016)	15	5
	2245 (May 2016)	0	51
	2246 (May 2016)	0	33
	2247 (May 2016)	4	20
	2248 (May 2016)	12	3
	2249 (Aug 2016)	9	14
	2250 (Aug 2016)	2	7
	2251 (Sep 2016)	0	14
	o055 (May 2016)	20	6
	o056 (May 2016)	0	75
	o057 (May 2016)	2	3
	o058 (Oct 2016)	0	13
	TOTAL	**64**	**284**

2. Compilation & dissemination of EXFOR

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B. Pritychenko
CSEWG–Nov 2016 meeting

Year	Trans	Entry	
		New	Updated
2017	2252 (Jan 2017)	0	40
	2253 (Jan 2017)	36	0
	2254 (Feb 2017)	9	8
	2255 (Feb 2017)	3	24
	2256 (Mar 2017)	12	3
	2257 (Mar 2017)	0	20
	2258*	5	16
	2259*	5	22
	o059 (Jan 2017)	0	2
	o060*	43	2
	o061*	0	52
	TOTAL	**113**	**189**

* Status=PRELIM

3. Efforts to provide completeness of EXFOR

❑ **Neutron reaction data for WPEC/CIELO project**

    ▪ Prioritize measurements for CIELO : new data ($^{16}O(n,a)^{13}C$), old literature…

❑ **Compilation of published experimental kerma data**

❑ **Data for delayed neutrons emitted from the fission products**

❑ **Neutron resonance data from TOF facilities**

    ▪ E. Dupont (CEA) & N. Otsuka (IAEA/NDS)

❑ **Compilation of thermal neutron scattering data**

    ▪ IAEA/CRP, WPEC, …

❑ **…**

4. Efforts to maintain highest level of quality

❑ **Checking & Verification**

- ▪ Peer-review of all NRDC prelim files

- ▪ "<u>JANIS Trans Checker</u>" tool developed by NEA/IT
  - o A stand-alone web version
  - o Integrated in JCPRG and VNIIEF tools

- ▪ EXFOR checking ("post-SG30" activities)
  - o In-depth review of all threshold reaction cross-sections (2014) and non- threshold (2017)
  - o Assessing the quality of EXFOR data using a statistical approach

Data Bank
NEA/DB/DOC(2014)3
www.oecd-nea.org

Statistical Verification and Validation of the EXFOR database: (n,n'), (n,2n), (n,p), (n,α) and other neutron-induced threshold reaction cross-sections
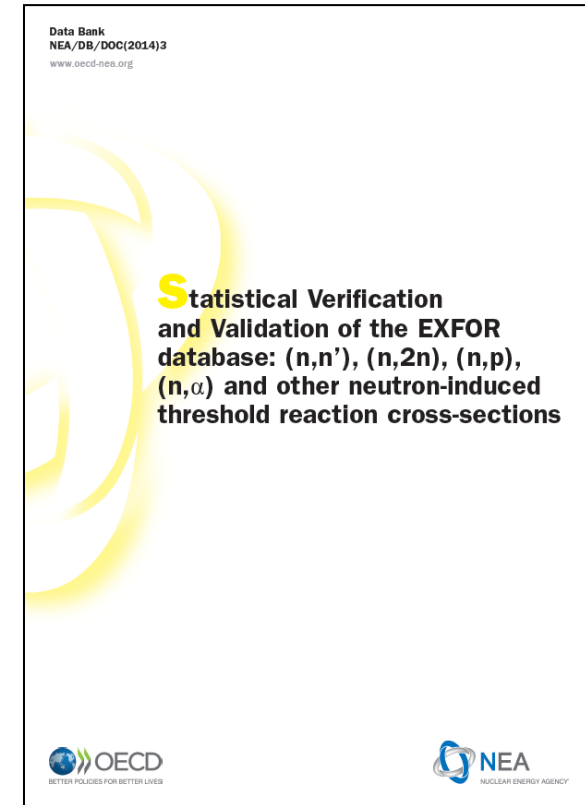
Available online at www.sciencedirect.com

ScienceDirect

ELSEVIER   CrossMark

Nuclear Data Sheets 120 (2014) 277–280

Nuclear Data Sheets

www.elsevier.com/locate/nds

Cross-checking of Large Evaluated and Experimental Nuclear Reaction Databases

O. Zeydina,[1] A.J. Koning,[2] N. Soppera,[3] D. Raffanel,[1] M. Bossant,[3] E. Dupont,[3,*] and B. Beauzamy[1]

[1] Société de Calcul Mathématique, Paris, France
[2] Nuclear Research and Consultancy Group, Petten, The Netherlands
[3] OECD Nuclear Energy Agency Data Bank, Issy-les-Moulineaux, France

Automated methods are presented for the verification of large experimental and evaluated nuclear reaction databases (e.g. EXFOR, JEFF, TENDL). These methods allow an assessment of the overall consistency of the data and detect aberrant values in both evaluated and experimental databases.

NEW "Statistical verification and validation of the EXFOR database: (n,γ), (n,n'), (n,2n), (n,p), (n,α) and other neutron-induced reaction cross-sections", A. Koning, NEA/DB/DOC(2016)1, to be available in 2017
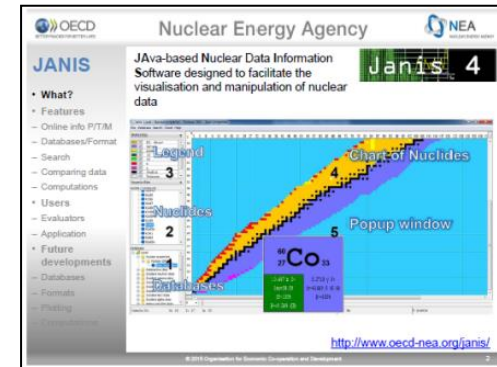
5.NEA DB / Dissemination of Nuclear data

❑ **JANIS 4.0 released online (Webstart) and on DVD**

  ▪ TENDL2014, TENDL2015…

  ▪ **BROND-3.1, FENDL3.1b, IRDFF-1.05**

❑ **JANIS 4.1/5.0 starting activities in 2017**

  ▪ Complete ENDF coverage

  ▪ Easy update new data

  ▪ New plotting capabilities

  ▪ New format (coverx, … **GND**)

  ▪ Automated plots generation via command line

  ▪ Recent developments rely on JANIS features to access nuclear data, e.g. Nuclear Data Sensitivity Tool (NDaST)

  ▪ JANIS libraries processed with the new NEA tool: **NDEC**

Number of requests per month to the remote JANIS database since 2003
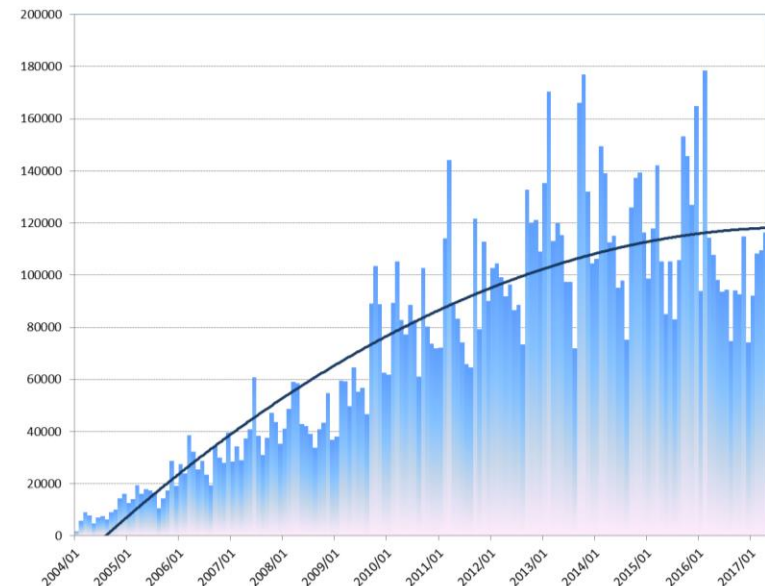
5.NEA DB / Dissemination of Nuclear data

❑ **Processing nuclear data**

- ▪ Close collaboration with JEFF-WG P&V

- ▪ Close collaboration with NJOY team (LANL)

    - ○ NEA/NJOY repository

      https://www.oecd-nea.org/dbprog/njoy-links.html

    - ○ NJOY Mailing list

      http://www.oecd-nea.org/sympa/info/njoy

❑ The new NEA tool: <u>NDEC</u> (*Nuclear Data Evaluation Cycle*)

- ○ It aims at improving the transparency and visibility of the whole process of the production of a well-documented nuclear data library.

❑ The new ND-tracker system

- ○ Sub-versioning system to keep traceability of submitted files

5.NEA DB / Dissemination of Nuclear data

Life-cycle of Nuclear Data
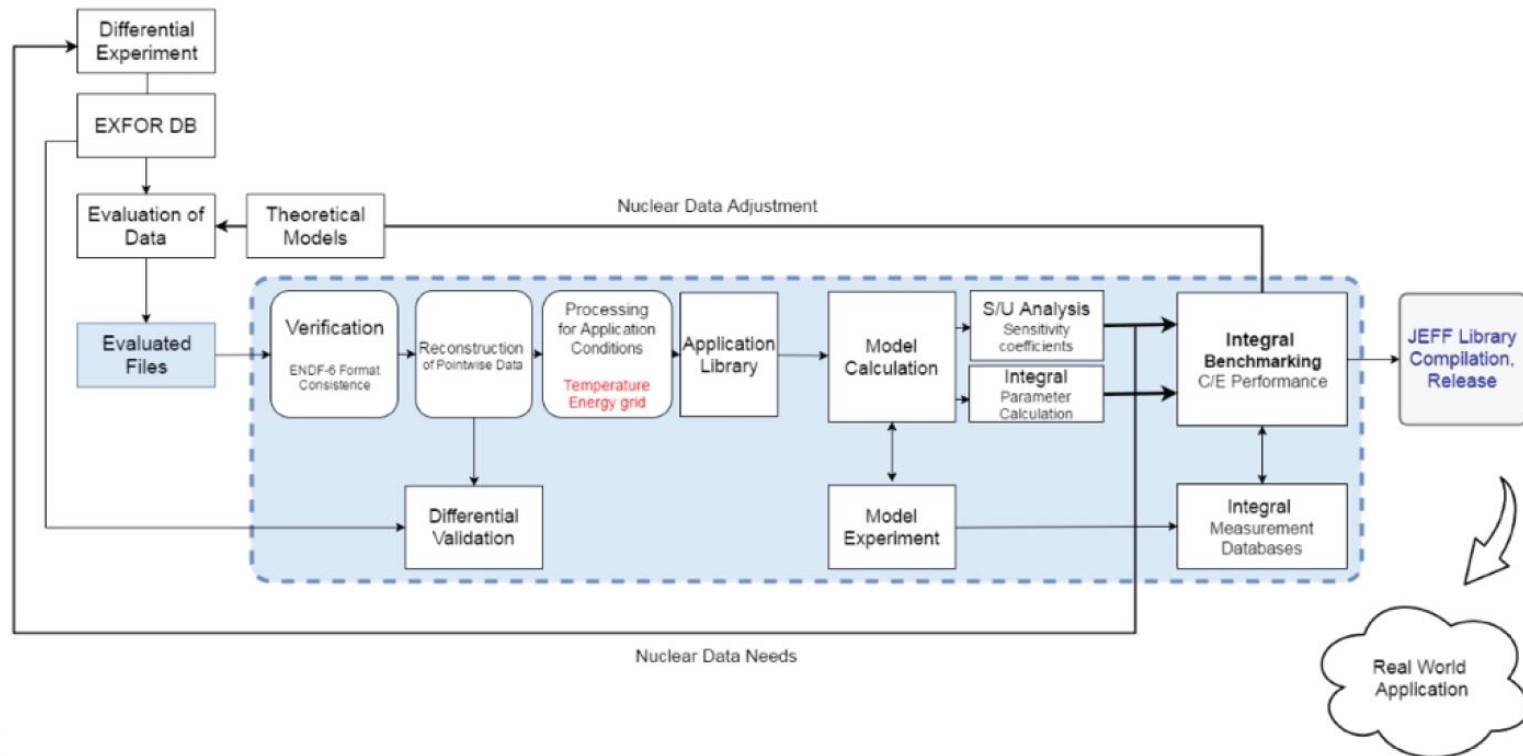
6. JEFF Project

JEFF-3.3: Review of Test Library releases		
JEFF-3.3T0	February 25, 2016	JEFF-3.2 (March 2014) http://www.oecd-nea.org/dbforms/data/eva/evatapes/jeff_32/
JEFF-3.3T1	March 1, 2016	Only change from T0 is the Cr-52 file reverted to JEFF-3.2 version http://www.oecd-nea.org/dbdata/jeff-beta/JEFF33T1/neutrons/
JEFF-3.3T2	July 1, 2016	No important changes for reactivity calculations http://www.oecd-nea.org/dbdata/jeff-beta/JEFF33T2/neutrons/
JEFF-3.3T2+	October, 2016	U238-RRR-Geel, Luiz's O16, TSLs – H2O and D2O http://www.oecd-nea.org/dbdata/jeff-beta/JEFF33T-repo/
JEFF-3.3T3	April, 20017	http://www.oecd-nea.org/dbdata/jeff-beta/JEFF33T3/neutrons/ o Neutron Interaction o Decay Data o Fission Yield Data

6.1 NEA DB - Supporting JEFF Project

JEFF-3.3 Test Library:

- ❑ Download ENDF-6 format files
- ❑ Download (JEFF-3.3-T2) JANIS database
- ❑ Download NJOY2012 input files
- ❑ Download ACEs files
- ❑ NDEC outputs
- ❑ Benchmarking: criticality - ICSBEP

Data Bank > Nuclear Data Services > JEFF and EFF Projects

JEFF-3.3-T2 Test Library

The Joint Evaluated Fission and Fusion File is an evaluated library produced via an international collabo... under the auspices of the NEA Data Bank.

JEFF-3.3-T2 neutron **test library** includes the following proposed changes and candidate files:

July 1, 2016
JEFF-3.3-T2 distributed

Download ENDF-6 format files (incident neutron data only: 559 individual MAT files, one .zip file):

▸ JEFF33T2N (424 MB)

(New!) Download JEFF-3.3-T2 JANIS database

▸ JEFF33T2N_JANIS_database (935 MB)

- Contains : HENDF (PENDF) files, BOXER files and INTER results
- To view using JANIS :
  - Use "JANIS toolbar -> Database -> Load" function:
  - Set ".h2.db file" to select the downloaded h2.db file
  - Set "Root folder" to the folder where the h2.db is located
  - (Leave the other default options as they are)

Download NJOY2012 input files for each ENDF-6 format file:

▸ JEFF33T2N_NJOY2012_inputs (1.01 MB)

Download ACEs files for each ENDF-6 format file, processed with previous NJOY2012 inputs, with NJ...

Files proposed

#	MAT	ZZZAAAM	Z	SYM	A	State	File	original	comments	ENDF C&U	PREPRO	NJOY2012	Feedback
1	125	10010	1	H	1	g	1-H-1g.jeff33t2	endfb71		0 / 1	0 / 7	0 / 7	No feedback
2	128	10020	1	H	2	g	1-H-2g.jeff33t2	jeff33t2_update		0 / 1	0 / 6	0 / 5	No feedback
3	131	10030	1	H	3	g	1-H-3g.jeff33t2	endfb71		0 / 0	0 / 6	0 / 5	No feedback
4	225	20030	2	He	3	g	2-He-3g.jeff33t2	jeff33t2_update		0 / 0	0 / 5	0 / 3	No feedback
5	228	20040	2	He	4	g	2-He-4g.jeff33t2	jendl40		0 / 0	0 / 7	0 / 3	No feedback
6	325	30060	3	Li	6	g	3-Li-6g.jeff33t2	endfb71		0 / 1	0 / 4	0 / 9	No feedback
7	328	30070	3	Li	7	g	3-Li-7g.jeff33t2	endfb71		0 / 0	0 / 4	0 / 9	No feedback
8	425	40090	4	Be	9	g	4-Be-9g.jeff33t2	jeff32		0 / 2	0 / 2	0 / 12	No feedback
9	525	50100	5	B	10	g	5-B-10g.jeff33t2	endfb71		0 / 0	0 / 3	0 / 19	No feedback
10	528	50110	5	B	11	g	5-B-11g.jeff33t2	endfb71		0 / 0	0 / 2	0 / 17	No feedback
11	600	60000	6	C	0	g	6-C-0g.jeff33t2	jeff32		0 / 0	0 / 3	0 / 14	No feedback
12	628	60130	6	C	13	g	6-C-13g.jeff33t2	tendl2015_mf32_corrected_20160607		0 / 0	0 / 5	0 / 396	No feedback
13	725	70140	7	N	14	g	7-N-14g.jeff33t2	endfb71		0 / 0	0 / 1	0 / 72	No feedback
14	728	70150	7	N	15	g	7-N-15g.jeff33t2	endfb71		0 / 0	0 / 1	0 / 13	No feedback
15	825	80160	8	O	16	g	8-O-16g.jeff33t2	endfb71		0 / 1	0 / 1	0 / 1389	No feedback

6.1 NEA DB – Supporting JEFF Project

DICE tool: "Load Personal-keff"
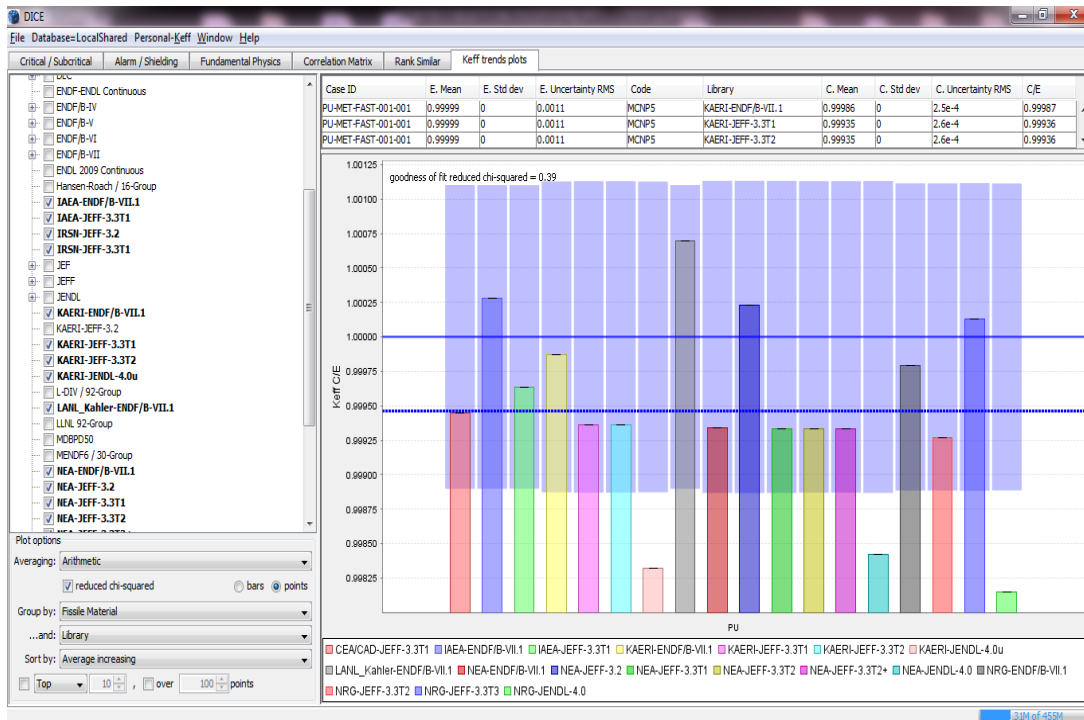
Institution	Library	Number cases
CEA/CAD	JEFF-3.3T1	228
IAEA	ENDF/B-VII.1	435
	JEFF-3.3T1	435
IRSN	JEFF-3.2	19
	JEFF-3.3T1	19
KAERI	ENDF/B-VII.1	119
	JEFF-3.2	119
	JEFF-3.3T1	119
	JEFF-3.3T2	119
	JENDL-4.0u	119
LANL	ENDF/B-VII.1	1104
NEA	**ENDF/B-VII.1**	**123**
	JEFF-3.1.1	**123**
	JEFF-3.1.1	**123**
	JEFF-3.2	**123**
	JEFF-3.3T1	**123**
	JEFF-3.3T2	**123**
	JEFF-3.3T2+	**123**
	JEFF-3.3T2-Skip_INP	**119**
	JENDL-4.0	**123**
NRG	ENDF/B-VII.1	2445
	JEFF-3.3T2	2439
	JEFF-3.3T2+	2439
	JENDL-4.0	2445
PSI	JEFF-3.2	149
	JEFF-3.3T1	339
Total		**14194**

7. Activities for NEA/Nuclear Science WPEC

Working Party on International Nuclear Data Evaluation Co-operation

WPEC is a forum to exchange information and a framework for co-operating activities between nuclear data file evaluation projects, aiming to

- Improve the quality and completeness of evaluated nuclear data libraries
- Promote the exchange of information on nuclear data evaluations, measurements, nuclear model calculations, validation, and related topics
- Assess ND improvement needs and address these needs by initiating joint efforts

- ❑ **WPEC in numbers:**
  - ❑ **29th WPEC meeting, May 2017 (~ 70 participants)**
  - ❑ Co-operation between major evaluation projects: ENDF, JENDL, JEFF (JEF, EFF/EAF), BROND, CENDL, TENDL, FENDL (& other IAEA projects)
  - ❑ **Close collaboration with the IAEA Nuclear Data Section**
  - ❑ Hundreds of participants from Europe, US, Japan, Korea, Russia, China
  - ❑ Over 43 short-term Subgroups: SG1, SG2, …, SG42, SG43

7. Activities for NEA/Nuclear Science WPEC

NEA/WPEC/SGs	IAEA/NDS/CRP-TM
WPEC/SG37: Improved fission product yield evaluation methodologies	**TM** on Fission Yield Data: current status and perspectives in measurements, theory and evaluations, May 2016
WPEC/SG38: Beyond the ENDF format: A modern nuclear database structure	**CM** on New Evaluated Data File Processing Capabilities, October 2015
WPEC/SG39: Methods and approaches to provide feedback from nuclear and covariance data adjustment for improvement of ND files	**CM** on Compensating Effects due to Nuclear Reaction and Material Cross Correlations in Integral Benchmarks, October 2015
WPEC/SG40: Collaborative International Evaluated Library Organisation Pilot Project	**CM** on Inelastic Scattering Data of Major Actinides, June 2015
WPEC/SG42: Thermal Scattering Kernel S(a,b): Measurement, Evaluation and Application	**CM** on the EXFOR Compilation of Thermal Neutron Scattering Data, November 2015
WPEC-SGC: NEA Nuclear Data High Priority Request List	

7. Activities for NEA/Nuclear Science WPEC

NEA/WPEC/SGs

New WPEC/SG proposals

☐ **WPEC/SG43:** "Code Infrastructure to Support a General Nuclear Database Structure"

☐ **WPEC Expert Group :** "Recommended Definition of a General Nuclear Database Structure"

☐ **SG44:** "Investigation of Covariance Data in General Purpose Nuclear Data Libraries"

☐ **SG45:** "The Validation of Nuclear Data Libraries (VaNDaL) project"

☐ **SG46:** "Efficient and Effective Use of Integral Experiments for Nuclear Data Validation"

Future proposal, a joint effort between NEA-IAEA

☐ **WPEC/SG40:** Collaborative International Evaluated Library Organisation Pilot Project
- Bring together the world's experts to work in a collaborative framework ✓
- Focus on 6 important nuclides: 235U, 238U, 239Pu, 56Fe, 16O and 1H ✓
- Provide recommendations on how to resolve these discrepancies, produce working files for testing ✓

8. NEA DB – working on Training

<u>7FP GENTLE intersemester course on "Nuclear data processing and use in nuclear applications", 14-18 Nov 2106. EC-JRC, Geel, Belgium</u>

o Introduction to JANIS software", O. Cabellos

o NDEC (Nuclear Data Evaluation Cycle), C.J. Díez

o DICE/IDAT, Ian Hill

o NDaST, James Dyrda

o ND activities at NEA, Franco Michel-Sendis

<u>Training in NJOY processing code</u>

o <u>7FP GENTLE intersemester course:</u> "NJOY : HEATR, GASPR, MIXR, LEAPR and THERMR", November 2016

o <u>JEFF Meeting Nov.2016:</u>"Processing and using the new D2O Thermal Scattering Libraries", November 2016

o <u>WPEC/SG39:</u> "An NJOY Processing Caution when Doppler Broadening", February 2017

9. NEA DB / Collaboration with ND centres

❑ **EXFOR**

  ▪ NRDC centres

❑ **JEFF**

  ▪ Processing: LANL, IAEA, … JEFF-V&V WG

  ▪ Evaluation: JRC, IRSN, KIT,… JEFF-Evaluation WG

  ▪ Benchmarking: IAEA, LANL,…. JEFF-B&V WG

❑ **WPEC**

  ▪ ENDF, JENDL, CENDL, BROND, TENDL, JEFF … IAEA

Thank you for your attention

NEA DB – Visibility of NEA/DB work on EXFOR

ND2016 Meeting, 11-16 September 2016, Bruges, Belgium.

o   R493: "Dissemination of data measured at the CERN nTOF facility", E. Dupont et al.

o   R494: "EXFOR - a global experimental nuclear reaction data repository: status and new developments", V. Semkova et al.

o   S502: "Verification of the databases EXFOR and ENDF", G. Berton et al.

JEFF ND Week-Nov 2016, Paris, France

o   JEFF/DOC-1777:   "EXFOR: status and new developments, overview of NEA activities", O. Cabellos

o   JEFF/DOC-1778:   "Verification of the EXFOR and ENDF Databases", G. Breton et al.

NRDC 2016, 7-10 June 2016, Beijing, China

o   "Provide a list of erroneous and suspicious outliers by using various statistical approaches (A51)", O. Cabellos

o   "Progress in n_TOF Data Compilation", N. Otsuka et al.

o   "NEA Data Bank (DB) Progress report 2015-2016" , K. Matsumoto

NEA DB – Visibility of NEA/DB work on JANIS

ND 2016 Meeting, Bruges, Belgium. 11-16, September 2016

o   S491: "JANIS: NEA java-based nuclear data information system", N. Soppera et al.

7FP GENTLE intersemester course on "Nuclear data processing and use in nuclear applications", 14-18 Nov 2106. EC-JRC, Geel, Belgium

o   "Introduction to JANIS software", O. Cabellos
o   "NJOY : HEATR, GASPR, MIXR, LEAPR and THERMR", O. Cabellos

NEA DB – Visibility of NEA/DB work on JEFF/WPEC

ND 2016 Meeting, Bruges, Belgium. 11-16, September 2016
- 233: "Benchmarking and Validation Activities within JEFF Project", Cabellos O. et al.
- I265: "Towards JEFF-3.3: goals, status and perspectives", A.Plompen et al.
- I369: "Nuclear data for fusion technology - The European approach", U. Fischer et al.
- R026: "NDEC: An NEA platform for nuclear data testing, verification and benchmarking", C.J. Díez et al.

ND 2016 Meeting, Bruges, Belgium. 11-16, September 2016
- I189: "The TENDL library: hope, reality and future", D. Rochamn et al.
- PL499: "The CIELO Collaboration: Progress in International Evaluations of Neutron Reactions on Oxygen, Iron, Uranium and Plutonium", M. Chadwick et al.
- R103: "Evaluation of neutron induced reactions for 238U in the resonance region", P. Schillebeeckx et al.

JEFF ND Week April 2016, Paris, France
- JEF/DOC-1734 : "Origin of files in JEFF-3.3-T1", C.J. Diez et al.
- JEF/DOC-1746 : "Nuclear Data File Management at the NEA", F. Michel-Sendis et al.
- JEF/DOC-1748 : "Summary of processing JEFF-3.3-T1 with NDEC at NEA", C.J. Diez et al.
- JEF/DOC-1756 : "JEFF-3.3-T1 benchmarking at NEA", O. Cabellos
- JEF/DOC-1757 : "Covariance information in JEFF-3.3-T1", O. Cabellos
- JEF/DOC-1772 : "JEFF-3.3T1 processed covariances: unc. propag. analysis and comparison", J. Dyrda et al.

JEFF ND Week November 2016, Paris, France
- JEF/DOC-1796: "Testing JEFF-3.3T2 with ICSBEP benchmarks", O. Cabellos
- JEF/DOC-1797 : "Overview of NEA activities on ICSBEP input verification", I. Enokida et al.

NEA DB – Visibility of NEA/DB work on JEFF/WPEC

<u>JEFF ND Week April 2017, Paris, France</u>
○ JEF/DOC-1834 : "Developments in Nuclear Data Files Testing and Handling tools at NEA", F. Michel-Sendis
○ JEF/DOC-1840 : "JEFF-3.3T13 Processed Covariances: Uncertainty Propagation Analysis and Comparison", J. Dyrda, O. Cabellos
○ JEF/DOC-1842 : "Overview of NEA activities on Processing JEFF-3.3T3", O. Cabellos
○ JEF/DOC-1843 : "Testing JEFF-3.3T3 in ICSBEP Benchmarks", O. Cabellos, F. Michel-Sendis
○ JEF/DOC-1844 : "Testing JEFF-3.3T3 in the Computational PHASE-VII Benchmark", O. Cabellos
○ JEF/DOC-1852 : "Testing JEFF-3.3T3 in TOF Shielding Benchmarks", K. Takise, O. Cabellos