

Recent development of “EXFOR-CINDA-ENDF-IBANDL” Web database retrieval system, PDF database, Web tools and software

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Part I.

News in NDS Web systems

News in EXFOR-ENDF-IBANDL. Summary.

1. EXFOR:

- 1) Fission product yield plotting via C4/C5
- 2) “native” EXFOR plotting: additional data plotting, F(Z,A)
- 3) C5: added relative uncertainties and monitor data; archive of monitors: +8 datasets (A77), internal Dictionary-709 (compounds)
- 4) 2D-calibration: (a) distorting ZVView plots and (b) recovering user’s images
- 5) flag showing #datasets in IBANDL

2. ENDF:

- 1) new and updated evaluated libraries in the ENDF database:
 - JENDL/AD-2017, JENDL Activation Cross Section File for Nuclear Decommissioning 2017
 - TENDL-2017: TALYS-based Evaluated Nuclear Data Library
 - MINSK-ACT, Minsk Actinides Library (Maslov et al.), 2011
 - IAEA/PD-1999, IAEA Photonuclear Data Library, 1999
- 2) software news: plotting MF8/MT454/MT459 FY(Z,A)
- 3) calculations of production cross sections MT=9000 (via ENDVER package)

3. IBANDL:

- 1) plotting data considering systematic uncertainties

4. Web-ZVView:

- 1) Extended “marker”
- 2) Output plotted data: column with relative uncertainties

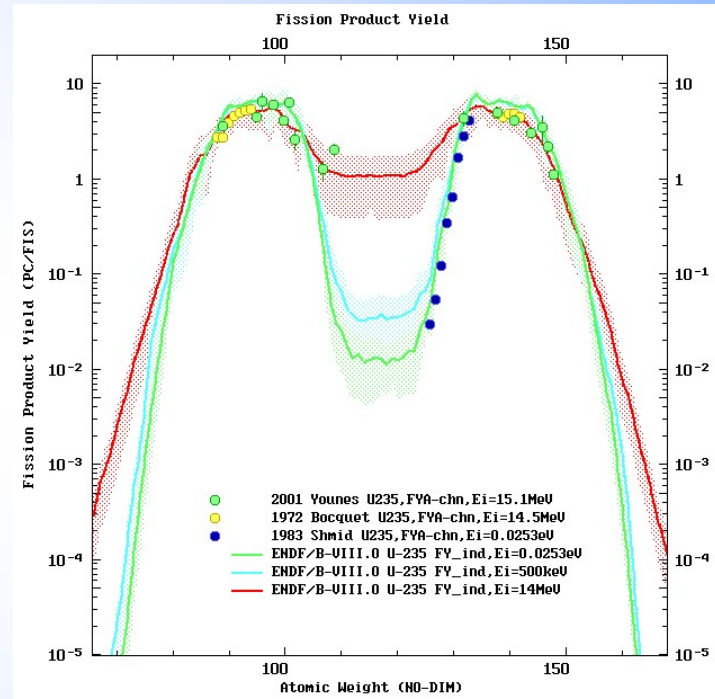
Fission product yield via “Advanced plotting via C4/C5”

FY(A)

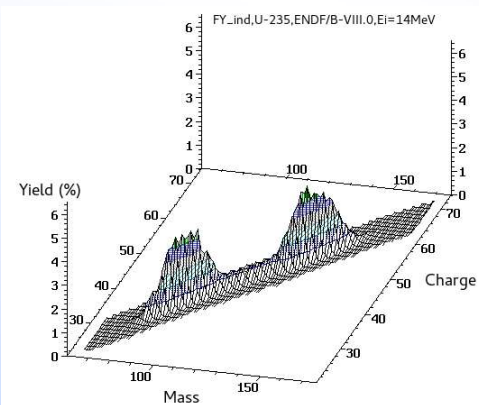
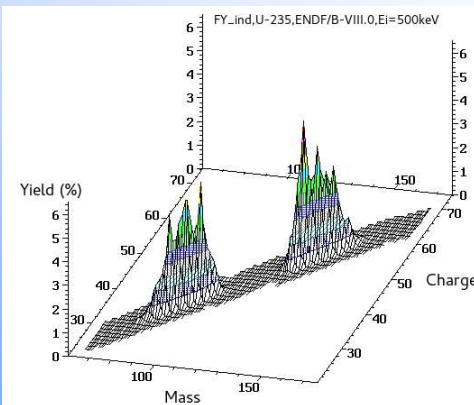
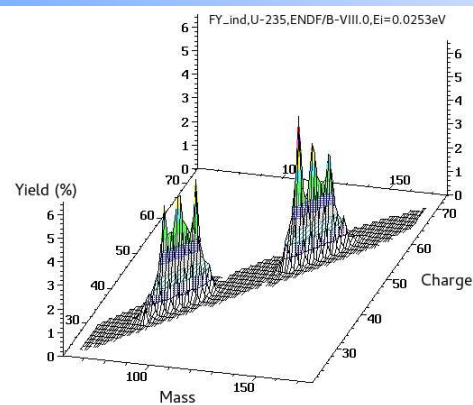
EXFOR $*(*,F)ELEM/MASS,*,FY$

vs.

ENDF MF8 MT454,MT459



FY(Z,A) ENDF MF8



“Native” EXFOR plot: recent extension

EXFOR #21095008:1967,E.E.Maslin+

6) 92-U-235(N,F)MASS,PR/FRG,NU/TKE C4: MF=1 MT=?
 Quantity: [MFQ] Mult.of pr.neut.from the frag.spec.at given TKE

8 [X4] [X4+] [X4+] [T4] 1967 E.E.Maslin+ 2.53e-2 1904 [pdf]+ R,AWRE-O-43/67,196706 21095008 [1] E2[28]=1e8.2.4e8
 [21095008] [X4] [X4Info] [X4Out.txt] [X4Out.xml] [Bib] [X4Plot] [x]

DatasetID=21095008
 Author1: E.E.Maslin+
 Reference1: Rept: A.W.R.E. Aldermaston Reports, No.43/67 (1967)
 X4Reaction: 92-U-235(N,F)MASS,PR/FRG,NU/TKE
 Quantity: Mult.of pr.neut.from the frag.spec.at given TKE
 Formula: Y = Y(X1,X2,X3)
 X4Columns: 7 Data points: 1904

EXFOR Data Columns

No.	Plot: f(x), f(x,y)					Group by	Header	Units	What	Given	Values			What:Expansion
	f	Δf	x	Δx	y						Number	Min	Max	
1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		DATA	PRT/FIS	Y.Value		775	-4.278	8.2663	Data: data
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	EN-DUMMY	EV	X1.Value		1	0.0253	0.0253	Incident energy: spectrum energy
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	E	MEV	X2.Value		28	103.	238.	Secondary energy: particle energy
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		E-ERR	MEV	X2.Err+-		1	2.5	2.5	Uncertainty: +-error
5	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		MASS	NO-DIM	X3.Value		68	51.	185.	Product mass
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		MASS-RSL	NO-DIM	X3.Resl+-		1	0.2	0.2	Uncertainty: +-resolution
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		MISC	NO-DIM	ZZZ		297	0.	4209.	Flags, etc.

Select EXFOR columns and [plot]

Since 2018, additional data are included to the list of variables for plotting

EXFOR Data Columns

No.	Plot: f(x), f(x,y)					Group by	Header	Units	What	Given	Values			What:Expansion
	f	Δf	x	Δx	y						Number	Min	Max	
1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		DATA	PRT/FIS	Y.Value		775	-4.278	8.2663	Data: data
2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	EN-DUMMY	EV	X1.Value		1	0.0253	0.0253	Incident energy: spectrum energy
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	E	MEV	X2.Value		28	103.	238.	Secondary energy: particle energy
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		E-ERR	MEV	X2.Err+-		1	2.5	2.5	Uncertainty: +-error
5	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		MASS	NO-DIM	X3.Value		68	51.	185.	Product mass
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		MASS-RSL	NO-DIM	X3.Resl+-		1	0.2	0.2	Uncertainty: +-resolution
7	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		MISC	NO-DIM	ZZZ		297	0.	4209.	Flags, etc.

Select EXFOR columns and [plot]

"Native" EXFOR plot: recent extension

Report: A.W.R.E. Aldermaston Reports, No.43/67 (1967)

[PDF]

EXFOR #21095008

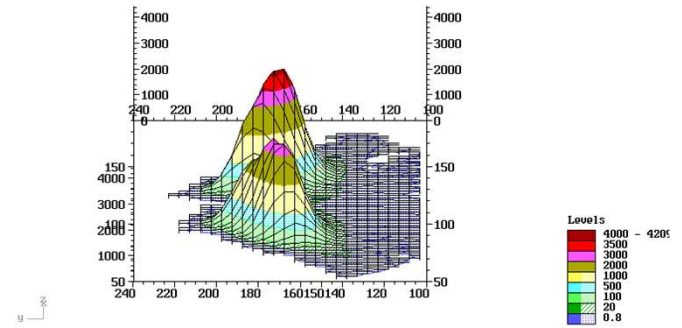
Plot: MISC(MASS,E,EN-DUMMY)

MISC(NO-DIM):Number of events detected

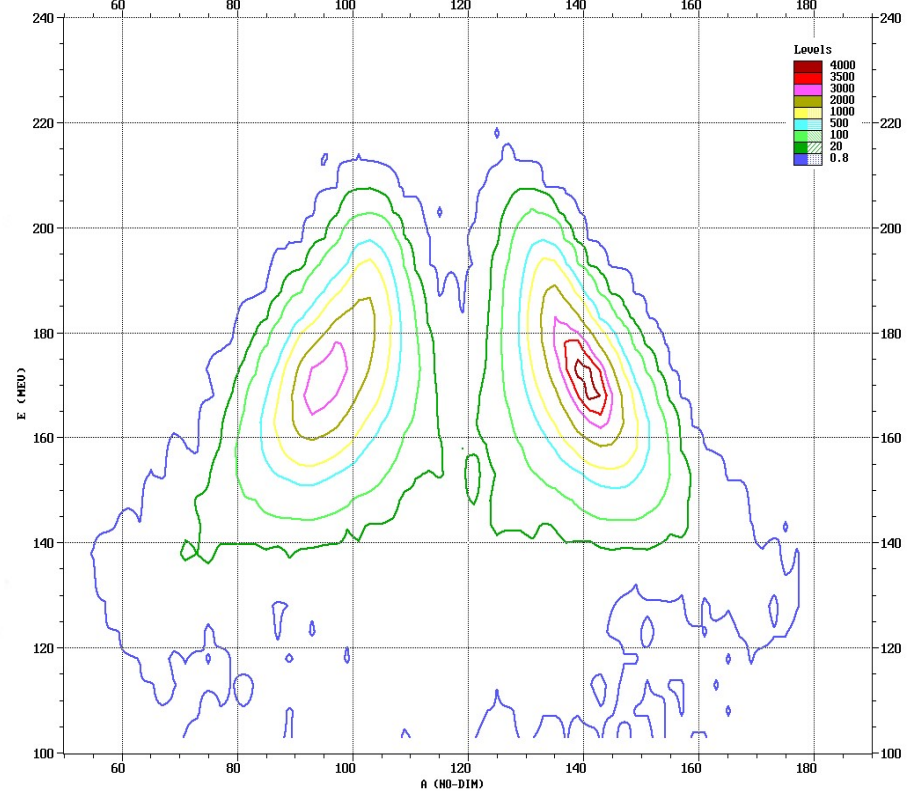
MASS(NO-DIM):Atomic mass of nuclide

E(MEV):Energy of outgoing particle, lab. system

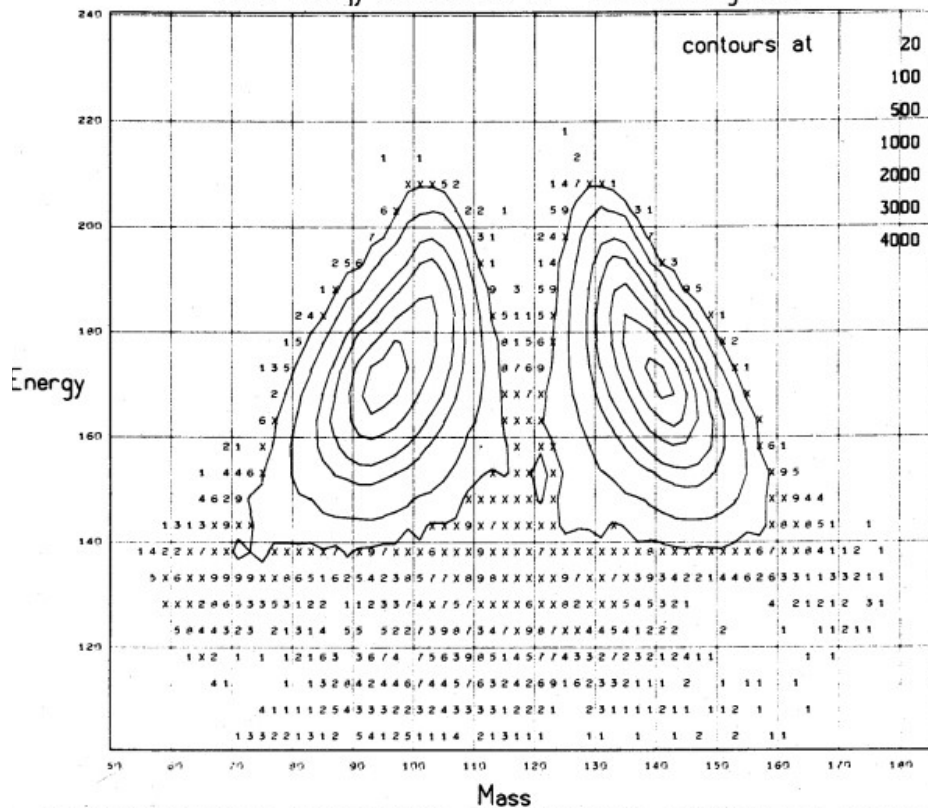
EH-DUMMY=0.0253(EU) 21095008:1967, E. E. Maslin
92-U-235(H, F)MASS, PR/FRG, NU/TRE



EH-DUMMY=0.0253(EU) 21095008:1967, E. E. Maslin
92-U-235(H, F)MASS, PR/FRG, NU/TRE

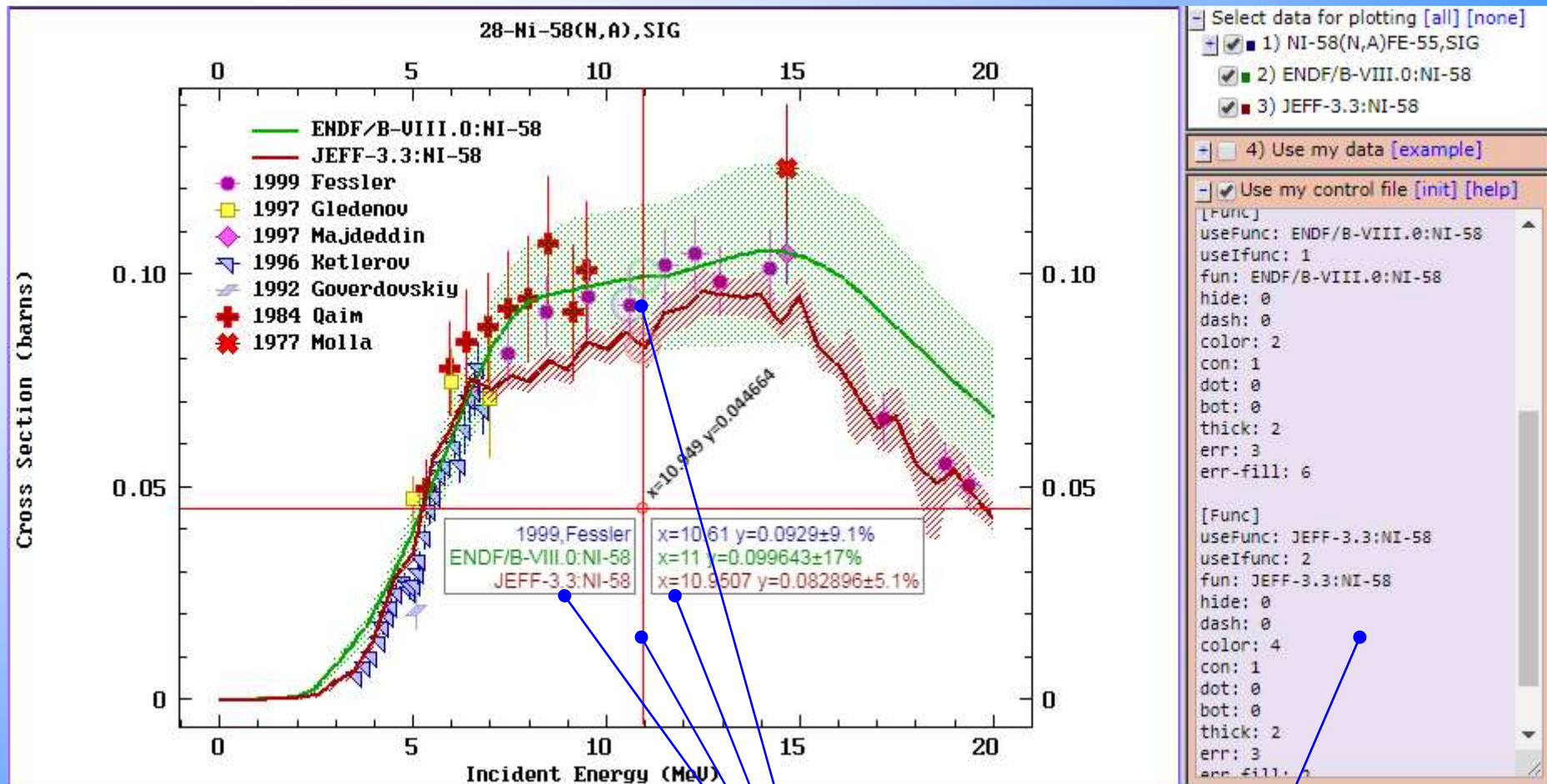


Mass Energy Surface for U²³⁵ Fission Fragments



CONTOUR DIAGRAM SHOWING THE DISTRIBUTION OF MEASURED EVENTS AS A FUNCTION OF BOTH FRAGMENT MASS AND TOTAL KINETIC ENERGY OF BOTH FRAGMENTS

News in Web-ZVView plotting



New element: "Marker"

New option: "Control file"

Implementation: ZVView → JSON → AJAX → HTML5

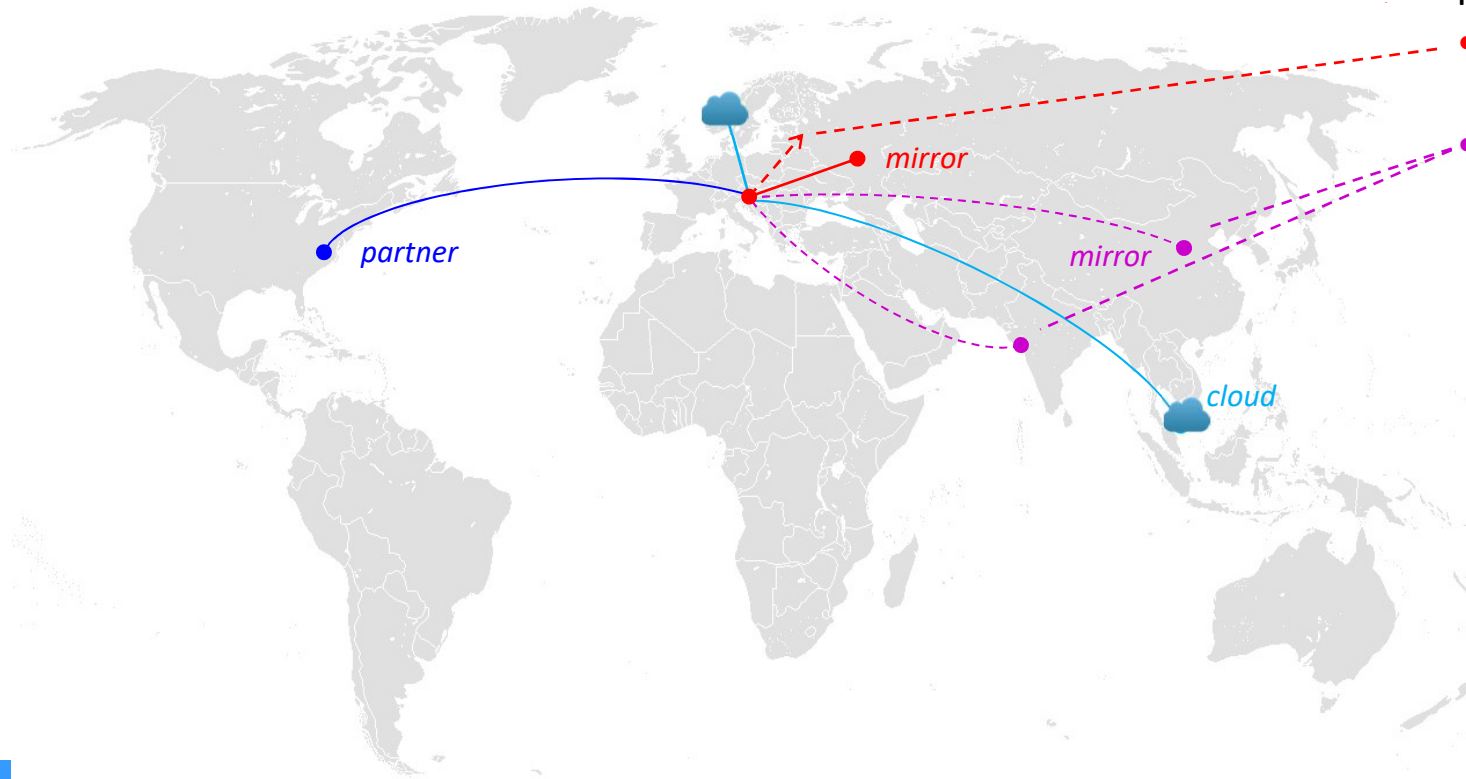
News in Web Mirror-sites

Now EXFOR Web system is functioning with regular update on:

- IAEA-NDS <https://www-nds.iaea.org/exfor/>
- NNDC, USA <http://www.nndc.bnl.gov/exfor/>
- BARC, India <http://www-nds.indcentre.org.in/exfor/> expired, renewing
- CNDC, China <http://www-nds.ciae.ac.cn/exfor/> expired, renewing
- “Atomstandart”, Russia <http://www-nds.atomstandard.ru/exfor/>

Plan:

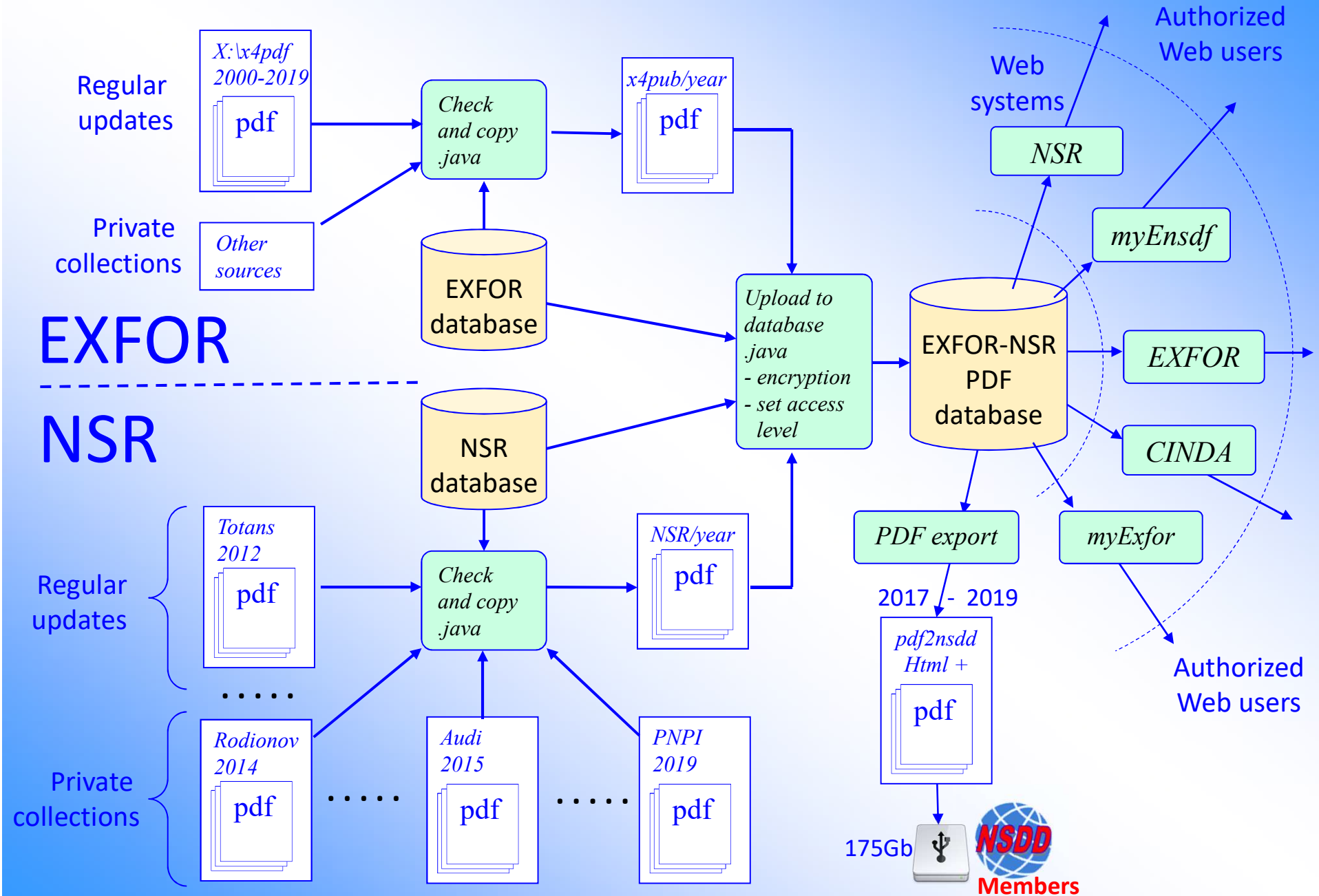
- local Mirror-site (inside organization)
- renew Agreement



Part II.

EXFOR-NSR PDF database

Functioning of EXFOR-NSR PDF database



Access to full EXFOR-NSR PDF database

Request #149
 Access-Level=2 /pdf/
 Results: Reactions: 10 Datasets: 143
 Data Selection

EXFOR-NSR PDF database.



Database updated: 2019-04-01. Files: 206304 from 2000-04-19 to 2019-03-29.

-	-	-	-	-	1896:3	-	1898:4	1899:1	-	[1891-1899]:8
1901:1	1902:1	1903:4	1904:3	1905:2	1906:2	1907:3	1908:2	1909:1	1910:3	[1901-1910]:22
1911:2	1912:1	1913:2	-	-	-	1917:4	1918:2	1919:3	1920:3	[1911-1920]:17
1921:3	1922:4	1923:3	1924:5	1925:2	-	1927:3	1928:11	1929:8	1930:10	[1921-1930]:49
1931:18	1932:22	1933:27	1934:41	1935:49	1936:35	1937:47	1938:44	1939:73	1940:65	[1931-1940]:421
1941:51	1942:24	1943:25	1944:26	1945:26	1946:86	1947:170	1948:180	1949:337	1950:472	[1941-1950]:1397
1951:486	1952:462	1953:575	1954:660	1955:773	1956:825	1957:847	1958:1164	1959:1112	1960:1360	[1951-1960]:8264
1961:1422	1962:1524	1963:1840	1964:1636	1965:1861	1966:2089	1967:2279	1968:2437	1969:2682	1970:3261	[1961-1970]:21031
1971:3567	1972:3963	1973:4223	1974:3632	1975:3296	1976:3193	1977:2996	1978:2959	1979:3244	1980:3100	[1971-1980]:34173
1981:2999	1982:3329	1983:3329	1984:3359	1985:2924	1986:2984	1987:3167	1988:3044	1989:3234	1990:3243	[1981-1990]:31612
1991:2783	1992:2960	1993:3092	1994:4115	1995:3973	1996:3949	1997:3815	1998:4093	1999:4240	2000:4203	[1991-2000]:37223
2001:4505	2002:4795	2003:4457	2004:4745	2005:4977	2006:4260	2007:4908	2008:3959	2009:3828	2010:3611	[2001-2010]:44045
2011:3982	2012:3659	2013:3461	2014:3636	2015:3067	2016:3514	2017:3538	2018:2624	2019:561		[2011-2019]:28042

Years: 118 Publications: 206304

Full volumes: [Conf.proc. & Books] [Theses] [Reports]

Checking mode //contributions to NSR-PDF

PDF Statistics:

DB	#PDF/#References	#PDF+	Total #PDF+	Todo #PDF
NSR:	175259/231266 ~76%	+338 from EXFOR	175597	55669
EXFOR:	23609/32180 ~74%	+1093 from NSR	24702	7478

Contributions to NSR-PDFs

Database updated: 2019-04-01.
PDF files: 206,304 from 2000-04-19 to 2019-03-29

Contributions to NSR PDF database as of 2019-04-08

Contributions:

1) 201200_Totans /3453/	20) 201709_Pritychenko /1192/
2) 201300_Totans /969/	21) 201711_Zerkin /913/
3) 201400_Totans /531/	22) 201800_PNPI /56301/
4) 201500_Totans /596/	23) 201800_Pritychenko /59/
5) 201504_Dimitriou /12/	24) 201800_Totans /1105/
6) 201510_Balraj /257/	25) 201800_Zerkin /408/
7) 201510_Rodionov /2191/	26) 201800_Zerkin_JINR /673/
8) 201512_Audi /2542/	27) 201803_Balraj /1/
9) 201600_Totans /2013/	28) 201803_Pritychenko_RD /532/
10) 201603_Rodionov /189/	29) 201810_Zerkin_KINR /50/
11) 201603_Shulyak /13016/	30) 201901_PNPI /234/
12) 201604_Kondev /1072/	31) 201901_Totans /25/
13) 20161121_PNPI /1/	32) 201901_Zerkin /3/
14) 201611_PNPI /31547/	33) 201902_PNPI /50/
15) 201700_PNPI /50715/	34) 201902_Totans /36/
16) 201700_Totans /2332/	35) 201902_Zerkin /245/
17) 201700_Zerkin /629/	36) 201903_PNPI /1526/
18) 201703_Shulyak /302/	37) 201903_Totans /73/
19) 201705_Kondev /44/	
Sum: /175837/	

Contributors:

1	PNPI	140374	79.8%
2	Shulyak	13318	7.57%
3	Totans	11133	6.33%
4	Zerkin	2921	1.66%
5	Audi	2542	1.45%
6	Rodionov	2380	1.35%
7	Pritychenko	1783	1.01%
8	Kondev	1116	0.63%
9	Balraj	258	0.15%
10	Dimitriou	12	0.01%
	Total	175837	100%

Thanks to external contributors!!!

PDF Statistics:

DB	#PDF/#References	#PDF+	Total #PDF+	Todo #PDF
NSR:	175259/231266 ~76%	+338 from EXFOR	175597	55669
EXFOR:	23609/32180 ~74%	+1093 from NSR	24702	7478

Part III.

Other news for compilers

EXFOR Web Retrieval system: REL-REF *

Request #8435
Access-Level=2 /pdf/
Results: Entries: 1 Subentries: 1 DataSets: 1 DataLines: 927

Data Selection

Data: Selected Unselected All

Output: X4+ EXFOR Bibliography TAB C4 PlotC4

Plot: Quick plot Advanced plot [how-to] using C5 and convert ratios to σ

Narrow Energy (optional), eV: Min: Max:

Apply Data re-normalization (for advanced users, results in: C4, TAB and Plots)

n	Acc#	1st Author	Year	Reference
1)	21926	[6] 1987 M. Ohkubo		[pdf] R, JAERI-M-86-193, 1987 Rept: JAERI-M Reports. No.86-193 (1987)
1)				[pdf]+ Rept: JAERI-M Reports, No.86-193 (1987) NSR: 1987OHZQ [pdf] Neutron total cross section measurements on Oxygen, Aluminum and Carbon below 930 KeV M. Ohkubo
2)				[pdf]+ Conf: Conf. on Nucl. Data f. Basic a. Appl. Sci., Santa Fe 1985, Vol.2, p.1623 (1985)
3)				+ Priv. Comm: Ohkubo (1984)
-[REL-REF] Related references: 3				
1)				+ Rept: JAERI Reports, No.1238 (1975) H. Takekoshi+
2)				[pdf]+ Jour: Jour. of Nuclear Science and Technology, Vol.21, p.254 (1984) Web: http://dx.doi.org/10.3327/jnst.21.254 Neutron Resonance Parameters of Rubidium-85 and Rubidium-87 M. Ohkubo+
3)				+ Jour: Nucl. Instrum. Methods in Physics Res., Sect.A, Vol.253, p.43 (1986) M. Ohkubo

1 21926004 [Info](#) [X4](#) [X4+](#) [T4](#) Pt:927 7.12e2 7.88e4 13-AL-27 (N, TOT) ,, SIG

REL-REF

* Requested by S.Selyankina (2018)

EXFOR Web Retrieval system: REL-REF in “x4+”

EXFOR data: <http://www-nds.iaea.org/EXFOR/21926.004>

Data retrieved from the EXFOR database version of April 05, 2019.

ENTRY	21926001	20140301	20140820	20140807	2238
SUBENT	21926001	20140301	20140820	20140807	2238
BIB	12	33			
INSTITUTE	(2JPNJAE)				
	# (2JPNJAE) Japan Atomic Energy Agency (JAEA), Japan				
REFERENCE	(R, JAERI-M-86-193, 1987)				
	(C, 85SANTA, 2, 1623, 198505) Neutron resonances in Ce-142				
	(W, OHKUBO, 198412) Data on tape.				
	# (R, JAERI-M-86-193, 1987) Rept: JAERI-M Reports, No.86-193 (1987), Japan				
	#+ #NSR=1987OHZQ				
	#+ #Title=Neutron total cross section measurements on Oxygen, Aluminum and Carbon below 930 KeV				
	#+ #Authors=M.Ohkubo				
	# (C, 85SANTA, 2, 1623, 198505) Conf: Conf.on Nucl.Data f.Basic a.Appl.Sci., Santa Fe 1985, Vol.2, p.1623 (1985), USA				
	# (W, OHKUBO, 198412) Priv.Comm: Ohkubo (1984)				
AUTHOR	(M.Ohkubo)				
REL-REF	(I, ,H.Takekoshi+, R, JAERI-1238, 1975) : JAERI electron				
	(I, ,M.Ohkubo+, J, NST, 21, 254, 1984) : linac described				
	(I, ,M.Ohkubo, J, NIM/A, 253, 43, 1986) - The target-				
	moderator system described				
	# (I, ,H.Takekoshi+, R, JAERI-1238, 1975) Rept: JAERI Reports, No.1238 (1975), Japan				
	# (I, ,M.Ohkubo+, J, NST, 21, 254, 1984) Jour: Jour. of Nuclear Science and Technology, Vol.21, p.254 (1984), Japan				
	#+ #URL= http://dx.doi.org/10.3327/jnst.21.254				
	#+ #NSR=1984OH05 #DOI=10.3327/jnst.21.254				
	#+ #Title=Neutron Resonance Parameters of Rubidium-85 and Rubidium-87				
	#+ #Authors=M.Ohkubo, M.Mizumoto, Y.Kawarasaki				
	# (I, ,M.Ohkubo, J, NIM/A, 253, 43, 1986) Jour: Nucl. Instrum. Methods in Physics Res., Sect.A, Vol.253, p.43 (1986), Netherlands				
TITLE	Neutron total cross section measurements on oxygen, aluminum and carbon below 930 keV				
FACILITY	(LINAC, 2JPNJAE) Electron linac, energy 120 MeV, current 5A, pulse length 25ns, pulse rate 600 per sec.				
	# (LINAC Linear accelerator				
	#, 2JPNJAE) Japan Atomic Energy Agency (JAEA), Japan				
INC-SOURCE	(PHOTO) 181-Ta(gamma,n). Pulsed neutrons were produced by the electron beam bombarding on a water cooled tantalum target, and were moderated by a moderator surrounding the target.				
	# (PHOTO) Photo-neutron				

REL-REF

Development of ZCHEX in 2018-2019

A71 Zerkin (Continuing action) Update ZCHEX based on comments from compilers
(e.g., WP2011-36).

2019-01-10 MacOS-10.14.2(Mojave), gfortran-8.2.0, EXFOR Dictionary 9119

2019-03-07 debug under gfortran: MacOS, Linux, Windows

Demo / How to

1. C4/C5 Compounds: [1-H-D2O\(N,TOT\),,SIG](#), Dict-709: ZA, MAT [DICT.709](#)
2. C5: dData%, dSys%, dStat% [41533002](#)
3. C5: Monitor data [23114002](#)
4. REL-REF: [41533002](#) (2: “google-search”: “kerma factor”)
5. Archive of Monitors: [Help](#)
6. EXFOR-NSR PDF List: [exfor](#)
7. Web-ZVView Ni-58(n,a) Marker, Err%
8. “Native” EXFOR plot [21095008](#) ?? MISC(NO-DIM) → HIST(COUNTS)
#begin controll.tit/c
zlevels: 0.8 20 100 500 1000 2000 3000 4000
#end controll.tit/c

Compounds in EXFOR, ENDF, C4/C5

C4 today

#C4-FIELDS IN DETAILS:

```
#C 1- 5 Prj Projectile ZA (e.g. neutron =1, proton =1001)
#C 6- 11 Targ Target ZA (e.g. 26-Fe-56 = 26056)
#C 12 M Target metastable state (e.g. 26-FE-56m = M)
#C 13- 15 MF MF (ENDF conventions, plus additions)
#C 16- 19 MT MT (ENDF conventions, plus additions)
# Prj Targ M MF MT PXC Energy dEnergy Data dData ...EntrySubP
#----><---->o<--><-->ooo<-----><-----><-----><----->...<----><-->o
1 1020 3 1 2.544+10 21.35600 0.840800 23425 3
```

**Heavy water in EXFOR: SF1:1-H-D2O;
in ENDF: MAT=11; PlotC4/Endver: 101
C4 today: 1020 (confusing, wrong)**

The presently recognized MAT assignments for compounds a

Compound	MAT Number
Water	1
Para Hydrogen	2
Ortho Hydrogen	3
H in ZrH	7
Heavy Water	11
Para Deuterium	12
Ortho Deuterium	13
Be	26
BeO	27
Be ₂ C	28
Be in BeO	29
Graphite	31
Liquid Methane	33
Solid methane	34
Polyethylene	37
Benzene	40
O in BeO	46
O in SiO ₂	47
O in UO ₂	48
Al metal	53
Fe metal	56
Zr in ZrH	58
UO ₂	75
UC	76

ENDF6

```
0 GAMMA * DEFINITION OF SPECIAL ZA (ZA LESS THAN 1000)
  1 NEUTRON * ...TRKOV-CHANGED FROM : 1/V ABSORBER
  2 SCATTERER * FORMAT
100 WATER * =====
101 HEAVY WATER * COLUMNS DESCRIPTION
102 C12H10 * =====
103 NAOH * 1- 5 ZA
104 C18H14 * 7-18 DEFINITION (E.G., ZA=1 - 1/V ABSORBER)
105 DOWTHERM-A *
106 BENZENE * ONLY THE FIRST 18 COLUMNS ARE READ. THE REMAINDER OF
200 BEO * EACH LINE MAY CONTAIN ANY TEXT, E.G., THIS TEXT.
201 BE2C *
202 BEF2 * ADDING DEFINITIONS
203 ZRHX * =====
204 (CH)N * TO ADD DEFINITIONS TO THIS TABLE, THEY MUST BE ADDED
205 (CH2)N * IN ASCENDING ZA ORDER.
207 UO2 *
301 ZIRCALLOY-1 * MAXIMUM TABLE SIZE
302 ZIRCALLOY-2 * =====
304 STAINLESS * UP TO 200 ZA MAY BE INCLUDED IN THIS TABLE.
310 UO2 * IF THE TABLE CONTAINS OVER 200 ZA ONLY THE FIRST 200
315 UC * WILL BE READ AND USED.
```

ENDFZA.DAT

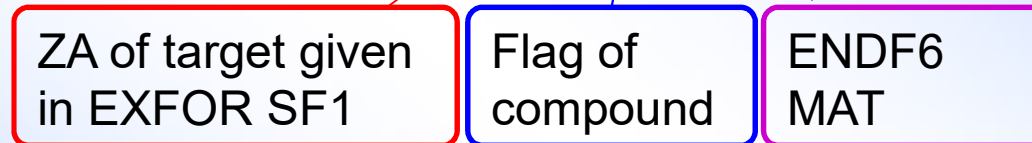
Compounds in EXFOR, ENDF, C4/C5

Chemical compounds DICT-209 (official)

TRA 198407	1-H-D2O	D D2O	13501		Heavy water
TRA 200902	1-H-DXX	D DXX	13601		Deuterium compound

Chemical compounds DICT-709 (ZV: internal, extended 209)

TRA 198407	1-H-D2O	D D2O	13501	001002	w	011	Heavy water
TRA 200902	1-H-DXX	D DXX	13601	001002	c		Deuterium compound



TargetM
<---->o

..1020.

Current C4

.13501.

1) internal id

..1002w

2) ZA(SF1) +Flag//conflicts with Endvev now

..1002.

3) ZA(SF1) //C5 today

....11.

4) ENDF6:MAT

Options to consult with end-users (my proposal)

Concluding remarks/questions

1. Our Web system is improving through years.
All your comments and suggestions to our Web system are very welcome. (+Feedback from your colleagues!)
2. CINDA extended by the contents of EXFOR and NSR is used (GA: +50% in 2019) for searching data missing in EXFOR
3. Desirable: PDF for every new ENTRY in PDF database.
You are welcome to contribute your private PDF collections to EXFOR-NSR PDF database.
4. XC4 is generated quarterly. Q1 to XC4 end-users: XC5?
Q2. to NRDC: extend DICT-209
5. Plan for EXFOR Monitors' Archive (?)

Thank you.