International Atomic Energy Agency

User services for nuclear reaction data

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Nuclear Data Section

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Presentation Scope

I. Online news

- Main news in Web EXFOR-ENDF-CINDA-IBANDL systems
- JSON in Web EXFOR, ENDF, ZVView
- EXFOR: computational formats C4, XC4, C5, C5M; “native plotting” of 2D-data; online versioning of Entry/Subentry; “evaluators’ flags” system
- ENDF: MF8/MF457 radioactive decay data online plot, JSON, html-comparison; plotting running GROUPIE code online
- Web-ZVView: new options, online smoothing

II. Integrated databases

- CINDA = old CINDA + current EXFOR + NSR(2018)
- EXFOR-NSR PDF database

III. Local databases and retrieval tools

/Modernization of “CD-ROM” packages, pilot projects/

- Databases MySQL/Access → SQLite (Windows, Linux, MacOS)
- X4Lite package: database + retrieval code + converters to X4+, C5, JSON, XML
- API: scripts for access (a) local and (b) remote Web databases

Concluding remarks

IAEA 60 Years Atoms for Peace and Development

Part I.

Online news

1.1 Main news in Web EXFOR-ENDF-CINDA-IBANDL

1. EXFOR

1) systematic/statistical/partial uncertainties in C5, R33
2) extended search by authors (+statistics); “native plotting” of 2D-data
3) online versioning of Entry/Subent (+comparison)
4) new output of datasets: JSON-X4, JSON-FY (computational values)

2. ENDF

1) radioactive decay data (MF8.MT457): output to JSON, plot, comparison
2) plotting groupwise data running on the fly: GROUPIE (725 groups)
3) new and updated evaluated libraries in the ENDF database (2018-2020):

1.	*JENDL/DEU-2020*	*Deuteron Reaction Data File, Japan, 2020*
2.	*FENDL-3.2-beta*	*Fusion Evaluated Nuclear Data Library, IAEA, 2021*
3.	*UKDD-12*	*UK Decay Data Library, 2012*
4.	*TENDL-2015.s60*	*TALYS-based Nuclear Data Library (selected materials), 2015*
5.	*ADS-HE*	*High energy library for accelerator driven systems, IAEA, 2013*
6.	*ADS-2.0*	*Accelerator driven systems nuclear data library, IAEA, 2008*
7.	*JENDL/PD-2016.1*	*Photonuclear Data File 2016 revision 1, Japan, 2020*
8.	*JENDL/ImPACT-2018*	*JENDL LLFP Transmutation Cross Section File, Japan*
9.	*INDEN-2020-beta*	*evaluations produced by International Nuclear Data Evaluators Network (coord. by the IAEA)*
10.	*IAEA-PD-2019*	*IAEA-Photonuclear Data Library, 2019*
11.	*W3000*	*Proton activation cross section data on W (up to 3 GeV), KIT, Germany, 2012*
12.	*CENDL-3.2*	*Chinese evaluated neutron data library, issued in 2020*
13.	*TENDL-2019*	*TALYS-based Evaluated Nuclear Data Library, 2019*
14.	*IRDFF-II*	*International Reactor Dosimetry and Fusion File, IAEA 2019*
15.	*MINKS-ACT*	*Minsk Actinides Library (Maslov et al.), 2011*
16.	*IAEA/PD-1999*	*IAEA Photonuclear Data Library, 1999*
17.	*TENDL-2017*	*TALYS-based Evaluated Nuclear Data Library, 2017 [page]*
18.	*JENDL/AD-2017*	*JENDL Activation Cross Section File for Nuclear Decommissioning 2017 [page]*
19.	*ENDF/B-VIII.0*	*U.S. Evaluated Nuclear Data Library, 2018*
20.	*JEFF-3.3*	*Evaluated nuclear data library of the OECD Nuclear Energy Agency, 2017*

3. CINDA

1) import from NSR frozen by NNDC since 2018-11-30

4. IBANDL

1) quarterly updates since V.Semkova has left IAEA

IAEA 60 Years Atoms for Peace and Development

1.2 Usage of JSON in EXFOR, ENDF, ZVView

JSON = JavaScript Object Notation //form for data based on: name/value pairs + ordered lists of values; can be used as an "IT framework" for nuclear data formats; simpler then XML; supported and used by modern programming languages and IT systems; popular among young generation

Why JSON?
Easy for programming.

EXFOR

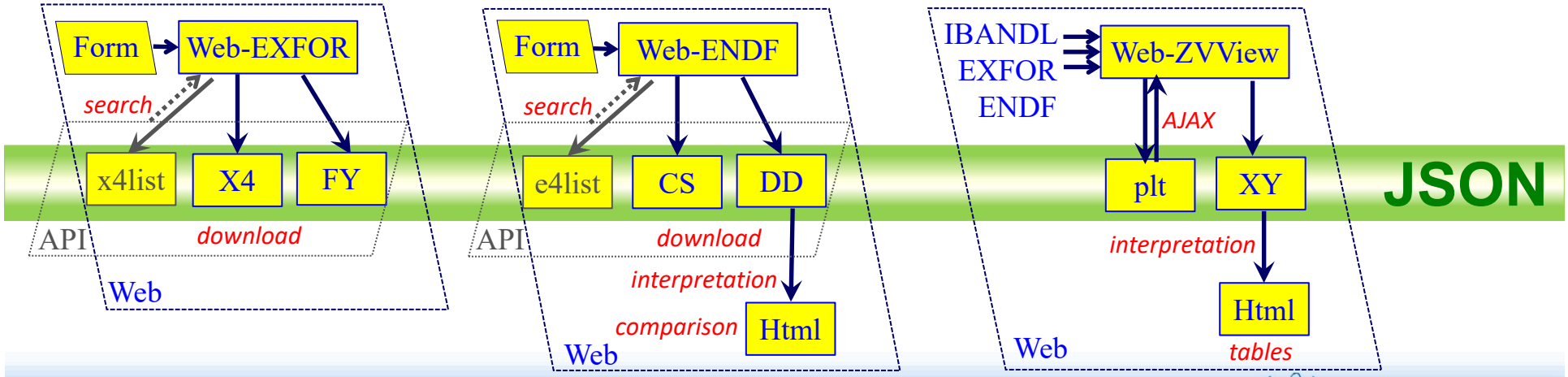
- JSON-X4: Datasets + Dictionaries; 3 versions with diff. set of Keywords, ~stdOut
- JSON-FY: Datasets, computational values (~C5), coop. with NNDC
- x4list: list of Datasets generated by search in online database (API)

ENDF

- JSON-CS: cross sections (MF3) with uncertainties (from MF33) for ENDF, PENDF
- JSON-DD: radioactive decay data (MF8.MT457)
- e4list: list of Datasets generated by search in online database (API)

Web-ZVView

- JSON-XY: copy of plotted data (for selected area)
- JSON-plt: plotted data – for implementation of Marker via AJAX -> Html-5



1.3. EXFOR news

1.3 Computational formats C4, XC4, C5, C5M

C4 file

```
Proj.TargetM MF MT PXC  Energy  dEnergy  Data      dData    Cos/LO   dCos/LO   LVL/HL  dLVL/HL I78 Refer (YY)              EntrySubP
----><----><><--><---><-------><-------><-------><-------><-------><-------><-------><-------><-><----------------------><---><->
   1  9019   69000    1.4830+7 150000.0 1.3600-8 1.2000-9 0.939692      1.9 1.5900+7 100000.0 E2A.Takahashi,ET.AL. (83)  21875 42
   1  9019   69000    1.4830+7 150000.0 4.1600-8 2.0000-9 0.939692      1.9 1.5700+7 100000.0 E2A.Takahashi,ET.AL. (83)  21875 42
   1  9019   69000    1.4830+7 150000.0 9.3400-8 3.0000-9 0.939692      1.9 1.5500+7 100000.0 E2A.Takahashi,ET.AL. (83)  21875 42
   1  9019   69000    1.4830+7 150000.0 2.1200-7 5.0000-9 0.939692      1.9 1.5300+7 100000.0 E2A.Takahashi,ET.AL. (83)  21875 42
   1  9019   69000    1.4830+7 150000.0 3.8400-7 6.0000-9 0.939692      1.9 1.5100+7 100000.0 E2A.Takahashi,ET.AL. (83)  21875 42
   1  9019   69000    1.4830+7 150000.0 5.8700-7 8.0000-9 0.939692      1.9 1.4900+7 100000.0 E2A.Takahashi,ET.AL. (83)  21875 42
   1  9019   69000    1.4830+7 150000.0 7.5100-7 9.0000-9 0.939692      1.9 1.4700+7 100000.0 E2A.Takahashi,ET.AL. (83)  21875 42
```

COLUMNS	TITLE	MEANING	
1 - 5	Proj	Projectile ZA (e.g. neutron =1, proton =1001)	C4
6 - 11	Targ	Target ZA (e.g. 26-Fe-56 = 26056)	
12	M	Target metastable state (e.g. 26-FE-56m = M)	
13 - 15	MF	MF (ENDF conventions: 1-40, plus additions: 1-999)	
16 - 19	MT	MT (ENDF conventions 1-999, plus additions: 1-9999)	
20	P	Product metastable state (e.g. 26-FE-56M = M)	
21	X	EXFOR status	
22	C	Center-of-mass flag (C=center-of-mass, blank=lab)	
23 - 94	{Array}	8 data fields (each in E9.3 format)	
23 - 31	Energy	Projectile incident energy	
32 - 40	dEnergy	Projectile incident energy uncertainty	
41 - 49	Data	Data, e.g., cross section, angular distribution, etc.	
50 - 58	dData	Data uncertainty	
59 - 67	Cos/LO/ZP	Cosine or legendre order or Z-Product	
68 - 76	dCos/LO/AP	Cosine uncertainty or A-Product	
77 - 85	LVL/HL	Identified by columns 95-97 (e.g.,level E, half-life)	
86 - 94	dLVL/HL	Identified by columns 95-97 (e.g.,level E, uncertainty)	
95 - 97	I78	Identification of data fields 7,8(LVL:level, HL:half-life, etc.)	
98 - 122	Refer	Reference (first author and year)	
123 - 127	ENTRY	EXFOR accession number	
128 - 130	Sub	sub-accession number	
131	P	Multi-dimension table flag (Pointer)	
132-140	dSys	Systematic uncertainty	C5
141-149	dStat	Statistical uncertainty	
150-158	dOther	Other partial uncertainty	
159-167	dTot	Total uncertainty given in EXFOR file	
168-176	dSysPro	Systematic uncertainty, relative in per-cent	
177-185	dStatPro	Statistical uncertainty, relative in per-cent	
186-194	dOthePro	Other partial uncertainty, relative in per-cent	
195-203	dTotPro	Total uncertainty given in EXFOR file, relative in per-cent	

2020

C4: computational format for EXFOR data, 132 column fixed width file, unified units, based on MF/MT, designed by D.Cullen, 1986; converter: X4TOC4.Fortran (D.Cullen, A.Trkov) using 3 X4TOC4 Dictionaries; EXFOR coverage: ~65%

XC4 = C4 + meta data from EXFOR: lines beginning with <#>; converter: X4TOC4 + x4retr2.java (V.Zerkin, 2003); XC4 for full EXFOR generated for WPEC-SG30 (2007-2021)

C5 = XC4 + data lines extended after 132 column with partial errors and other data (e.g. monitor data); converter: x4toc5.java (V.Zerkin, 2011-2020) using EXFOR Dictionaries, X4TOC4 Dictionaries and Dict.715: SF2-SF7=>MF-MT-LR (V.Pronyaev, 2010); options: DA: RR-B/SR, CM-Lab, recalculate data to inverse reaction, etc.; EXFOR coverage: ~75%

C5M = C5 + covariance section - lines describing algorithm (grouping for large datasets), energy groups, std. deviations, correlation matrix

1.3 Computational formats C4, XC4, C5, C5M

Data extensions: C4 → XC4 → C5 → C5M

XC4

```
#DATASET        23114002    20130924
#ENTRY          23114       20170322
#TITLE          High resolution measurements of the 241Am(n,2n)
#+              reaction cross section
#AUTHORS        C.Sage, V.Semkova, O.Bouland, P.Dessagne, A.Fernandez,
#+              F.Gunsing, C.Naestren, G.Noguere, H.Ottmar,
#+              A.J.M.Plompen, P.Romain, G.Rudolf, J.Somers, F.Wastin
#AUTHOR1        C.Sage+
#YEAR           2010
#X4REF1         J,PR/C,81,064604,2010
#REFERENCE1     Jour: Physical Review, Part C, Nuclear Physics, Vol.81, p.064604 (2010)
#METHOD         ACTIV,GSPEC
#REACTION       95-AM-241(N,2N)95-AM-240,,SIG
#C4Reaction     (N,2N),SIG
#ReactionType   CS
#MF             3
#MT             16
```

C4

```
#PrjTarg M MF MT PXC   Energy  dEnergy     Data    dData I78 Refer (YY) EntrySubP  dSys    dStat   dOther   dTot  dSys% dStat% dOthr% dTot% dData%
#-><----><-><--><-><--------><--------><--------><--------><-><-----------><---><-><-------><-------><-------><-------><-----><-----><-----><----><-----
  1 95241   3  16 A 8340000.0 150000.0.09680001 0.006292   C.Sage, (10)23114   2  .00324680.0049368 0.001862 0.006292 3.35  5.10  1.92  6.50  6.50
  1 95241   3  16 A 9150000.0 150000.0   0.16290.0092853   C.Sage, (10)23114   2  .00535340.00671850.00313340.0092853 3.29  4.12  1.92  5.70  5.70
  1 95241   3  16 A   1.333E7 150000.0   0.24180.0111228   C.Sage, (10)23114   2  .00787240.00655540.00393620.0111228 3.26  2.71  1.63  4.60  4.60
  1 95241   3  16 A    1.61E7 150000.0   0.15240.0070104   C.Sage, (10)23114   2  .00500840.00357730.00308210.0070104 3.29  2.35  2.02  4.60  4.60
  1 95241   3  16 A   1.716E7  30000.0   0.11610.0051084   C.Sage, (10)23114   2  .0038154 0.002125 0.0023480.0051084 3.29  1.83  2.02  4.40  4.40
  1 95241   3  16 A    1.79E7 100000.0   0.10570.0046508   C.Sage, (10)23114   2  .0034945 0.0015960.00234690.0046508 3.31  1.51  2.22  4.40  4.40
  1 95241   3  16 A   1.936E7 150000.0   0.0895 0.007339   C.Sage, (10)23114   2  .002941270.00602980.0027875 0.007339 3.29  6.74  3.11  8.20  8.20
  1 95241   3  16 A   1.995E7  70000.0   0.10210.0059218   C.Sage, (10)23114   2  .0033553 0.0022670.00419730.0059218 3.29  2.22  4.11  5.80  5.80
  1 95241   3  16 A   2.061E7  40000.0.077900010.0068552   C.Sage, (10)23114   2  .00256010.00473980.00421310.0068552 3.29  6.08  5.41  8.80  8.80
#/C4DATA        0
```

C5

```
#COVARIANCE     2               Generated
#COMMENT        Default2. EXFOR software ver.2020-09-24, by V.Zerkin@iaea.org (IAEA-NDS)
#+      1) If only total uncertainties are given, assume uncertainties: statistical/systematic=50/50.
#+      2) Statistical uncertainties are added to covariance matrix as uncorrelated components
#+      3) If Other uncertainties are not given (ALGORITHM=2): split total systematic uncertainties: fully/partially correcated=50/50 (LERC/MERC)
#+         else (ALGORITHM=3): assume total systematic uncertainties fully correlated (LERC), Other - partially correcated (MERC)
#+      4) LERC-correlated uncertainties are added to covariance matrix as fully correlated
#+      5) MERC-correlated uncertainties are added as partially correlated using parameters:
#ALGORITHM      3           1           100.        100.        100.        0           8340000.0   2.061E7     0.5
#+              Type        Grouping    Stat.SERC   Sys.LERC    Other.MERC  Log/Lin     En-Min      En-Max      Length
#COVARDATA      1           9           9
#EnMin(eV)  EnMax(eV)   Data(b)     Std.dev.(%) Correlations(%)
#----------><----------><----------><----------><---Values: separated by space; line length: unlimited....
8340000.    8340000.    0.0968      6.4         100
9150000.    9150000.    0.1629      5.61        40 100
1.333E7     1.333E7     0.2418      4.54        40 46 100
1.61E7      1.61E7      0.1524      4.52        38 43 61 100
1.716E7     1.716E7     0.1161      4.27        40 45 62 74 100
1.79E7      1.79E7      0.1057      4.26        41 45 60 73 81 100
1.936E7     1.936E7     0.0895      8.12        21 24 29 38 43 47 100
1.995E7     1.995E7     0.1021      5.71        30 34 41 54 63 70 48 100
2.061E7     2.061E7     0.0779      8.78        20 22 27 35 42 47 34 61 100
#/COVARDATA
#/COVARIANCE
#/DATASET       23114002
```

C5M

1.3 EXFOR online news: “native” 2D plotting

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 - i 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	✔						DATA	PRT/FIS	Y.Value		775	-4.278	8.2663	Data: data
2						✔	EN-DUMMY	EV	X1.Value		1	0.0253	0.0253	Incident energy: spectrum energy
3					✔	✔	E	MEV	X2.Value		28	103.	238.	Secondary energy: particle energy
4							E-ERR	MEV	X2.Err+-		1	2.5	2.5	Uncertainty: +-error
5			✔				MASS	NO-DIM	X3.Value		68	51.	185.	Product mass
6				✔			MASS-RSL	NO-DIM	X3.Resl+-		1	0.2	0.2	Uncertainty: +-resolution
7							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							DATA	PRT/FIS	Y.Value		775	-4.278	8.2663	Data: data
2							EN-DUMMY	EV	X1.Value		1	0.0253	0.0253	Incident energy: spectrum energy
3						✔	E	MEV	X2.Value		28	103.	238.	Secondary energy: particle energy
4							E-ERR	MEV	X2.Err+-		1	2.5	2.5	Uncertainty: +-error
5			✔				MASS	NO-DIM	X3.Value		68	51.	185.	Product mass
6				✔			MASS-RSL	NO-DIM	X3.Resl+-		1	0.2	0.2	Uncertainty: +-resolution
7	✔						MISC	NO-DIM	ZZZ		297	0.	4209.	Flags, etc.

Select EXFOR columns and [plot]

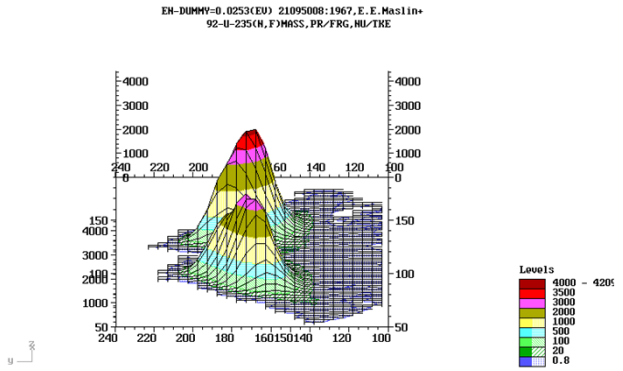
1.3 EXFOR online news: “native” 2D plotting

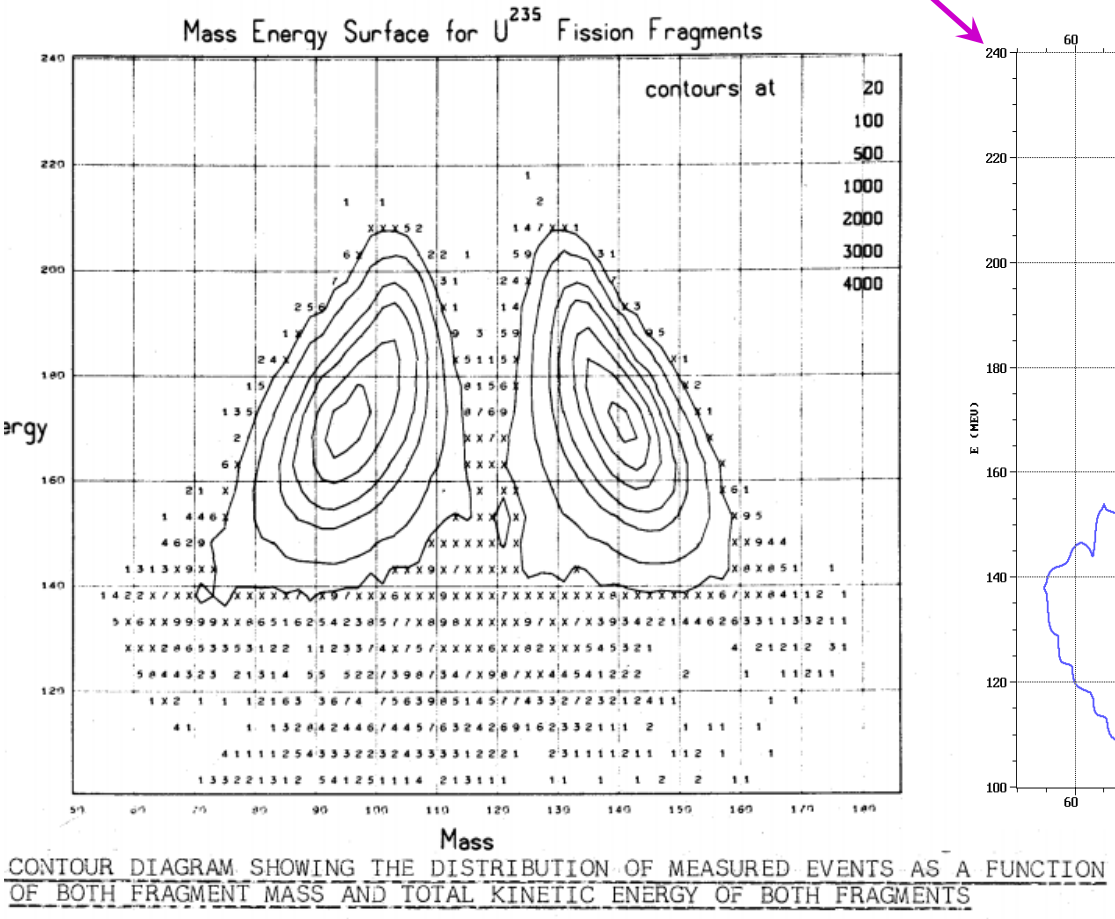
Report: A.W.R.E. Aldermaston Reports, No.43/67 (1967)
[PDF]

EXFOR #21095008

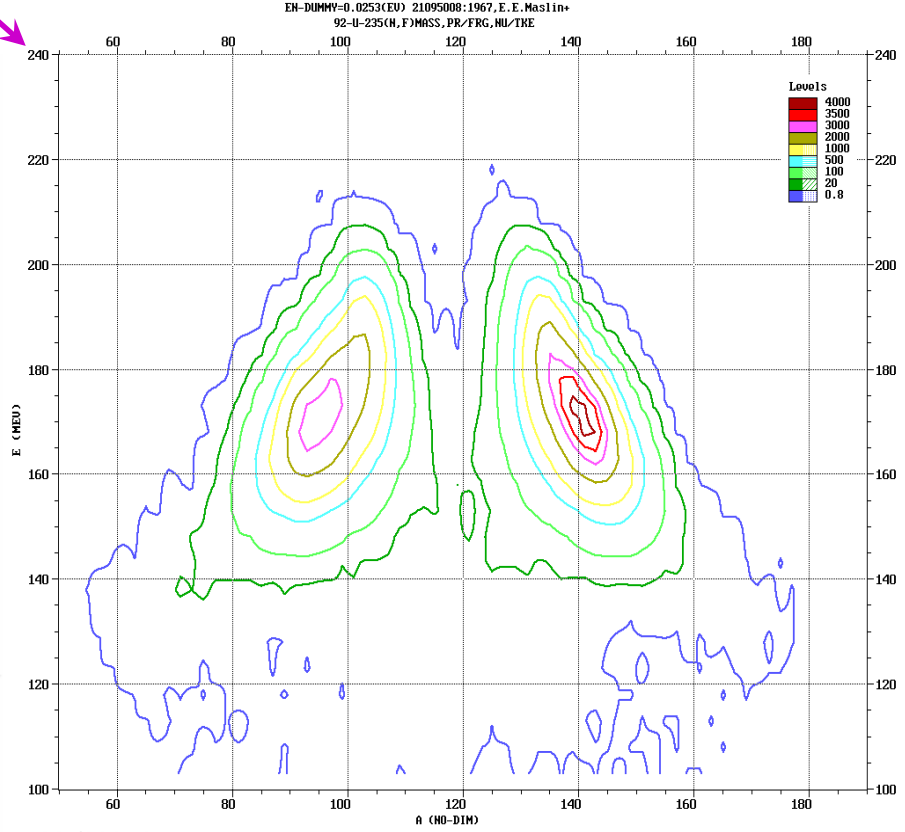
Plot: MISC(MASS,E,EN-DUMMY)

MISC(NO-DIM):Number of events detected
MASS(NO-DIM):Atomic mass of nuclide
E(MEV):Energy of outgoing particle, lab. system





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



1.3 EXFOR online news: versions

Quantity: [FY] Independent fission-product yield

1 ☐ + i X4 X4+ X4± T4 1994 A.V.R.Reddy+ 9.60e7 6 [pdf]+ J,RCA,64,149,1994 D6063002 [3] 1994RE23 Prod=^{130}I...^{135}I

Link to versions

EXFOR Updates and Archives

SUBENT: D6063002

Select versions

#	File-ID	Upd	Comment
(1)	☑ TRANS-D129	508	Official TRANS file
(2)	☑ TRANS-D087	232	Official TRANS file
(3)	☑ TRANS-D070	165	Official TRANS file

Compare only selected items [here]

Legend

Legend:

Line	Next version	Previous version
Same line:	Same text* →	← Same TEXT*
Diff. line:	Same text, different text →	← Same text; another text

*Note. Text is treated as case-insensative.

Comparing

SUBENT: D6063002

TRANS-D129

```
ENTRY          D6063   20201208
SUBENT    C    D6063001   20201208
BIB               11         19
TITLE          Charge distribution in 96 MeV 16O induced fission of
                238U
AUTHOR         (A.V.R.Reddy, A.Goswami, B.S.Tomar, S.B.Manohar,
                S.K.Das, P.P.Burte, Satya Prakash)
INSTITUTE      (3INDTRM)
REFERENCE      (J,RCA,64,149,1994)
FACILITY       (VDGT,3INDTRM) 96 MeV 16O ion beam at BARC-TIFR
SAMPLE         Electrodeposited targets of uranium (300 ug/cm2) on
                Al backing (2 mg/cm2) were covered with 6.75 ug/cm2
                Al foil
DETECTOR       (HPGE) 60 cc HPGe detector coupled to a PC based 4k MCA
```

TRANS-D087

```
ENTRY          D6063   20130129
SUBENT    C    D6063001   20130129
BIB               11         19
TITLE          Charge distribution in 96 MeV 16O induced fission of
                238U
AUTHOR         (A.V.R.Reddy, A.Goswami, B.S.Tomar, S.B.Manohar,
                S.K.Das, P.P.Burte, Satya Prakash)
INSTITUTE      (3INDTRM)
REFERENCE      (J,RCA,64,149,1994)
FACILITY       (ACCEL,3INDTRM) 96 MeV 16O ion beam at BARC-TIFR
SAMPLE         Electrodeposited targets of uranium (300 ug/cm2) on
                aluminium backing (2 mg/cm2) were covered with
                6.75 ug/cm2 aluminium foil
DETECTOR       (HPGE) 60 cc HPGe detector coupled to a PC based 4k MCA
```

TRANS-D070

```
ENTRY          D6063   20091105
SUBENT         D6063001   20091105
BIB               11         19
TITLE          Charge distribution in 96 MeV 16O induced
                                  fission o
AUTHOR         (A.V.R.Reddy,A.Goswami,B.S.Tomar,S.B.Manoh
               S.K.Das,P.P.Burte,Satya Prakash)
INSTITUTE      (3INDTRM)
REFERENCE      (J,RCA,64,149,1994)
FACILITY       (ACCEL,3INDTRM) 96 MeV 16O ion beam at BAR
               Pelletron accelerator facility.
SAMPLE         Electrodeposited targets of uranium (300 m
               aluminium backing (2 mg/cm2) were covered
               6.75 mu-g/cm2 aluminium foil
```

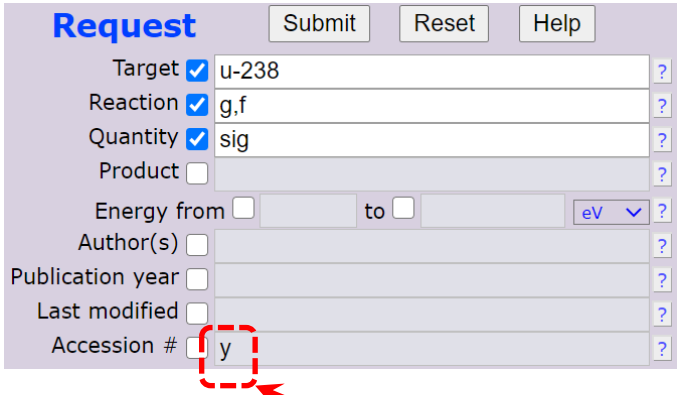
```
SUBENT    C    D6063002   20201208
BIB               3         14
REACTION       ((92-U-238(8-O-16,F)ELEM/MASS,IND,FY)/
                (92-U-238(8-O-16,F)53-I-128,IND,FY))
DECAY-DATA     (53-I-128,24.99MIN,DG,442.9,0.162)
                (53-I-130-M,9.0MIN,DG,536.1,0.167)
                (53-I-130-G,12.36HR,DG,536.1,0.99)
                (53-I-131,8.04D,DG,364.5,0.812)
                (53-I-132-M,1.39HR,DG,175.0,0.0832)
                (53-I-132-G,2.284HR,DG,772.6,0.764)
                (53-I-133-G,20.8HR,DG,529.9,0.87)
                (53-I-134-G,52.6MIN,DG,847.0,0.954)
                (53-I-134-M,3.5MIN,DG,847.0,0.0227)
                (53-I-135,6.55HR,DG,1260.4,0.286)
HISTORY        (20130129A) On. REACTION(denom.): SF5=IND added
               (20201208A) On. DECAY-DATA (132mI) revised.
```

```
SUBENT    C    D6063002   20130129
BIB               3         13
REACTION       ((92-U-238(8-O-16,F)ELEM/MASS,IND,FY)/
                (92-U-238(8-O-16,F)53-I-128,IND,FY))
DECAY-DATA     (53-I-128,24.99MIN,DG,442.9,0.162)
                (53-I-130-M,9.0MIN,DG,536.1,0.167)
                (53-I-130-G,12.36HR,DG,536.1,0.99)
                (53-I-131,8.04D,DG,364.5,0.812)
                (53-I-132-M,1.39HR,DG,0.175)
                (53-I-132-G,2.284HR,DG,772.6,0.764)
                (53-I-133,20.8HR,DG,529.9,0.87)
                (53-I-134-G,52.6MIN,DG,847.0,0.954)
                (53-I-134-M,3.5MIN,DG,847.0,0.0227)
                (53-I-135,6.55HR,DG,1260.4,0.286)
HISTORY        (20130129A) On. REACTION(denom.): SF5=IND added
ENDBIB            13          0
```

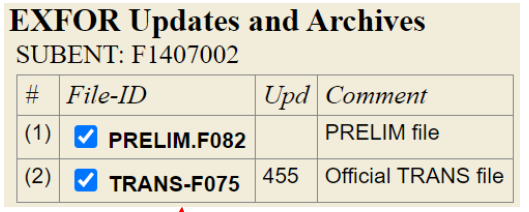
IAEA 60 Years Atoms for Peace and Development

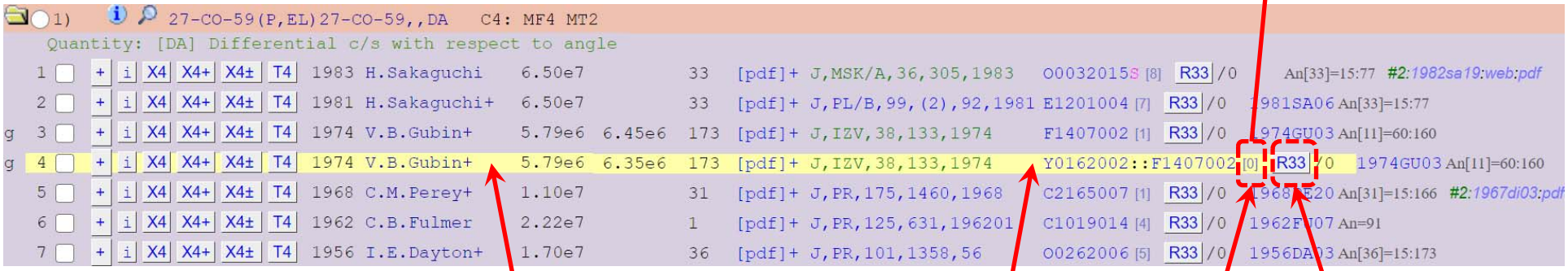
1.3 EXFOR online news: PRELIM versions

Since 2019 PRELIM files are stored in EXFOR database with temporary ID (Y series) → PRELIM data are immediately available for search, presentation in output formats, conversion to other formats, plotting, comparison with other experimental and evaluated data, etc.
This feature can be used by compilers communicating with authors.



Flag for search incl. PRELIM data





Preliminary Dataset ID: Y0162002 (updated F1407002)

Versions

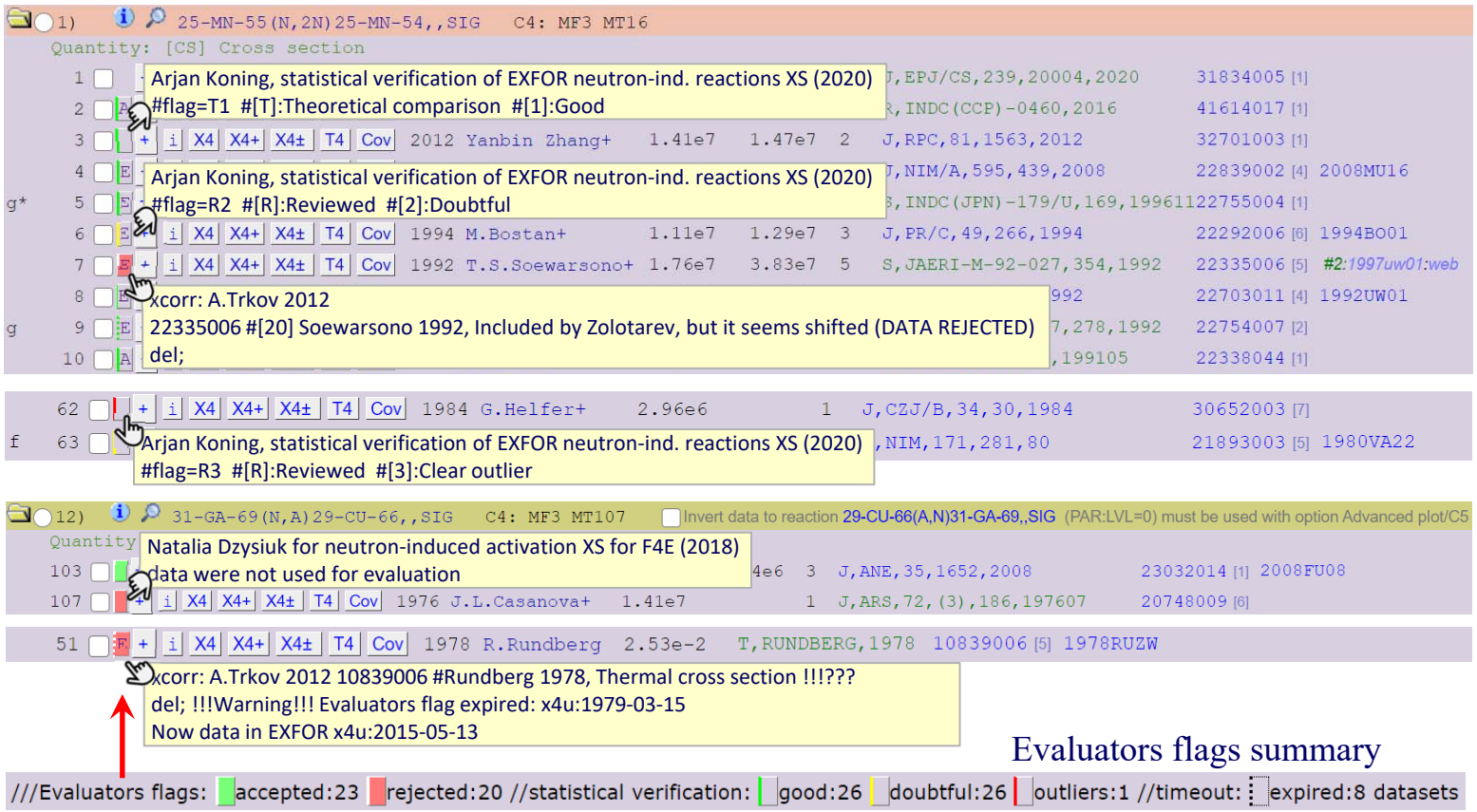
Convert to R33 (for IBANDL)

IAEA 60 Years Atoms for Peace and Development

1.3 EXFOR online. Evaluators' flags system

/under development/

Evaluator indicates which datasets were selected/unselected from evaluation process and describes reasons. This information (evaluator's flags) is submitted to NDS to be shared with other evaluators. Optionally, the system can also include and operate with "statistical verification scores" indicating difference between a dataset and other experimental/evaluated data.



Evaluators flags summary

Options

Show evaluators flags

Evaluators comments appear as popup tooltip on top of evaluator flag on "mouseover" event

Evaluators flags:
- accepted
- rejected

Statistical verification:
- good
- doubtful
- outliers

Timeout:
- expired

Correction flags:
- A: Automatic data renormalization is available
- E: Expert's data correction is available

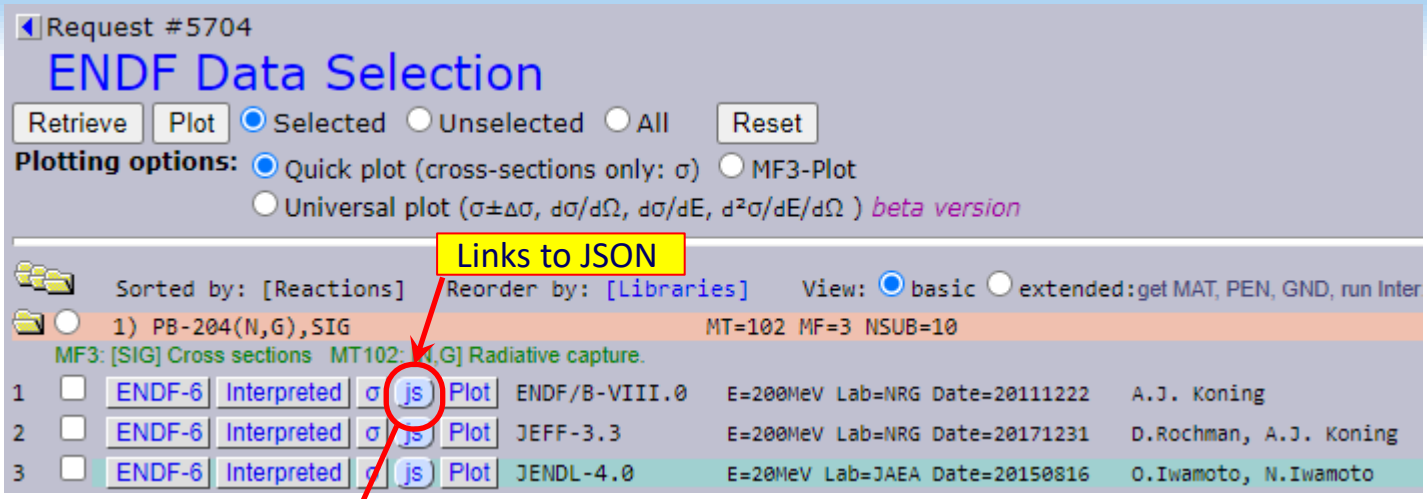
Source of currently available evaluators flags

id	File Name	Datasets	Type	Title
0	Erwin-Alhassan_2018.yaml	166	select	Erwin Alhassan for protons on Co59 and Cd111 (2018)
1	Natalia-Dzysiuk_2018.yaml	1,768	select	Natalia Dzysiuk for neutron-induced activation XS for F4E (2018)
2	Natalia-Dzysiuk_2019.yaml	570	select	Natalia Dzysiuk for neutron-induced activation XS on Ni isotopes (2019)
3	Natalie-Gaughan_2019.yaml	90	select	Natalie Gaughan for proton induced reactions (2019)
4	Arjan-Koning_2020.yaml	19,145	stat-ver	Arjan Koning, statistical verification of EXFOR neutron-ind. reactions XS (2020)
5	trkov2013mn55n2n.txt	21	x4corr	x4corr: A.Trkov 2012
6	capote2010mn55ng.txt	42	x4corr	x4corr: D.Smith and R.Capote 2010
7	Sjoestrand-2018-09-07.txt	3	x4corr	x4corr: H.Sjoestrand 2018, Ni59(n,*)

IAEA 60 Years Atoms for Peace and Development

1.4. ENDF online news

1.4 ENDF online news: JSON for CS (MF3+33)



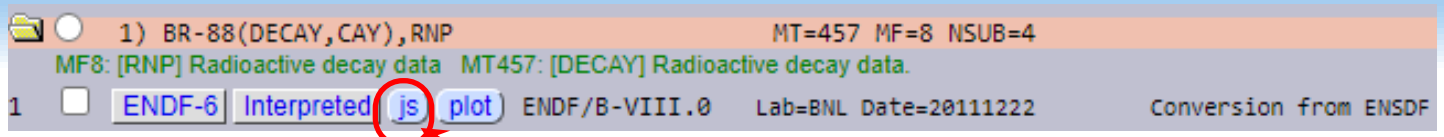
Array:{Energy, Sigma, dSigma} from MF3+MF33 for ENDF, PENDF

JSON


```
{
 "format":"WebEndfTabSect-0.1"
 ,"now":"2021-03-29T22:16:49.000Z"
 ,"program":"E4sGetTabSect, by V.Zerkin, IAEA-NDS, ver.2020-02-11"
 ,"datasets": [
   { "id":"13657869" ,"FILE":"PENDF"
    ,"dataType":"Cross section"
    ,"LIBRARY":"ENDF/B-VIII.0"
    ,"TARGET":"PB-204" ,"TEMP":293.16
    ,"NSUB":10 ,"MAT":8225 ,"MF":3 ,"MT":102
    ,"REACTION":"PB-204(N,G)PB-205,SIG"
    ,"COLUMNS":["E,eV","Sig,b","dSig,b","Int,interpolation-law"]
    ,"defaultInterpolation":"Lin-Lin"
    ,"nPts":16359
    ,"pts":[
        {"E":1.0e-5       ,"Sig":33.2400067 ,"dSig":1.66436 }
       ,{"E":1.103037e-5  ,"Sig":31.6494412 ,"dSig":1.58473 }
       ,{"E":1.216691e-5  ,"Sig":30.1349856 ,"dSig":1.5089  }
       ,{"E":1.342055e-5  ,"Sig":28.692998  ,"dSig":1.4367  }
```


IAEA 60 Years Atoms for Peace and Development

1.4 ENDF online news: JSON for MF8:MT457




```
{ "format":"Endf_MF8_MT457-v0.1",
  "now":"2021-03-10T16:49:06.595Z",
  "program":"EndfSect457, by V.Zerkin, IAEA-NDS, ver.2021-01-08",
  "id":"8931886"
  ,"dataType":"Radioactive decay data","datTyp":"e6mt457"
  ,"Library":"ENDF/B-VIII.0" ,"EDATE":" EVAL-NOV05","AUTH": " Conversion from ENSDF"
  ,"HSUB1":"----ENDF/B-VIII.0","MAT":852 ,"NSUB":"4" ,"Nucleus":"Br-88"
  ,"MF":8 ,"MT":457,"ZA":35088,"AWR":87.16876
  ,"T12s":16.29 ,"dT12s":0.06,"T12":16.29 ,"dT12":0.06 ,"uT12":"s"
  ,"Ebeta":1702.089 ,"dEbeta":50.94862 ,"uEbeta":"keV"
  ,"Egamma":3133.758 ,"dEgamma":57.90383 ,"uEgamma":"keV"
  ,"Ealpha":16.32917 ,"dEalpha":0.0 ,"uEalpha":"keV"
  ,"Spin":2.0,"Parity":"minus","LISO":0,"LIS": 0
  ,"nDecayModes":2,"nRadTypes":5
  ,"DecayModes":[ {"i":1 ,"RTYP":"1" ,"txRTYP":"Beta-"
     ,"DecayQ":8975.33, "dDecayQ":4.106 ,"uDecayQ":"keV"
     ,"Branching":0.9342 ,"dBranching":0.0018 }
   ,{"i":2 ,"RTYP":"1.5" ,"txRTYP":"Beta- --> n"
     ,"DecayQ":1922.25, "dDecayQ":3.18 ,"uDecayQ":"keV"
     ,"Branching":0.0658 ,"dBranching":0.0018
    }
  ]
  ,"RadTypes":[{"i":1 ,"STYP":"0" ,"txSTYP":"Gamma"
     ,"AveDecayEne":3133.8, "dAveDecayEne":57.904 ,"uAveDecayEne":"keV"
     ,"DiscreteSpectrum": {"Normalization":1.0 ,"dNormalization":0.0
       ,"nPts":146 ,"PtsTyp":"line"
       ,"PtsUnit": [ {"E":"keV"} ,{"dE":"keV"} ,{"RI":"no-dim"} ,{"dRI":"no-dim"} ]
       ,"Pts": [
         {"i":1  ,"E":125.9 ,"dE":0.3  ,"RI":3.35E-4 ,"dRI":1.3631E-4,"RTYP":"1" }
. . . . . .
        ,{"i":15 ,"E":775.28,"dE":0.06 ,"RI":0.67    ,"dRI":0.05     ,"RTYP":"1"
         ,"RICC":9.27E-4,"dRICC":1.3E-5,"RICK":8.22E-4,"dRICK":1.2E-5,"RICL":8.88E-5,"dRICL":1.3E-6}
. . . . . .
        ,{"i":146,"E":7000.0,"dE":0.6  ,"RI":0.002948,"dRI":2.9799E-4  ,"RTYP":"1" }
        ]
       ,"Legend": [
          {"RICC":{"any":"Total internal conversion coefficient"}}
         ,{"RICL":{"any":"L-shell internal conversion coefficient"}}
         ,{"RICK":{"any":"K-shell internal conversion coefficient"}}
         ,{"RTYP":{"1":"Beta-"}}
        ]
      }
```


JSON

1.4 ENDF online news: comparing decay data

ENDF Data Selection

Retrieve | Selected | Unselected | All | Reset

Sorted by: [Reactions] Reorder by: [Libraries] View: basic extended: get MAT, PEN, GND

1) BR-88(DECAY,CAY),RNP MT=457 MF=8 NSUB=4

MF8: [RNP] Radioactive decay data MT457: [DECAY] Radioactive decay data.

1	☑	ENDF-6	Interpreted	js	plot	ENDF/B-VIII.0	Lab=BNL Date=20111222 Conversion from ENSDF
2	☐	ENDF-6	Interpreted	js	plot	ENDF/B-VII.1	Lab=BNL Date=20111222 Conversion from ENSDF
3	☑	ENDF-6	Interpreted	js	plot	JEFF-3.3	Lab=HAR+WIN Date=291117 A.L. NICHOLS
4	☐	ENDF-6	Interpreted	js	plot	JEFF-3.1	Lab=HAR+WIN Date=261107 A.L. NICHOLS
5	☑	ENDF-6	Interpreted	js	plot	ENDF/B-VI	Lab=INEL,LANL Date=19910612 C.W.REICH,T.ENGLAND
6	☐	ENDF-6	Interpreted	js	plot	JEF-2.2	Lab=NEADB Date=930715 CONVERSION OF ENSDF
7	☐	ENDF-6	Interpreted	js	plot	UKDD-12	Lab=HAR+WIN Date=261107 A.L. NICHOLS

Select data

Output Data

Format	Data (Size)
ENDF	Text (177Kb) ZIP (27Kb)

Radioactive decay data MT457(3):
- parallel plain text[0][1][2],
- comparison + selective plotting:[go]

ENDF Radioactive decay data /MF8.MT457/

by V.Zerkin, IAEA-NDS, 2020-2021, ver.2021-02-12 /under development/

⊞ Show all spectra. Hide low-intensity lines (≤1%).

Select/unselect data for plotting. Plot data in %: ☑ using normalization: ☑

#1. ENDF/B-VIII.0 Br-88		#2. JEFF-3.3 Br-88	
Nucleus:	Br-88 ZA=35088	Nucleus:	Br-88 ZA=35088
Library:	ENDF/B-VIII.0 NSUB=4 MAT=852	Library:	JEFF-3.3 NSUB=4 MAT=858
AUTH:	Conversion from ENSDF	AUTH:	A.L. NICHOLS
EDATE:	EVAL-NOV05	EDATE:	EVAL-OCT97
Half life:	16.29 ± 0.06(s)	↗Half life:	16.5 ± 0.1(s)
AWR:	87.16876	↗AWR:	87.1688
Isomer number:	LISO=0	Isomer number:	LISO=0
Level number:	LIS=0	Level number:	LIS=0
Spin & Parity:	2-	Spin & Parity:	2-
Ebeta:	1702.089 ± 50.94862 (keV)	↗Ebeta:	1706 ± 35 (keV)
Egamma:	3133.758 ± 57.90383 (keV)	↗Egamma:	4609 ± 70 (keV)
Ealpha:	16.32917 ± 0 (keV)	↘Ealpha:	8.0682 ± 0.965745 (keV)
Decay modes:	2	Decay modes:	2
Radiation types:	5	Radiation types:	5

Legend

#Left	#Right	Ratio of values
Value1	Value2	Value2==Value1
Value1	↗Value2	Value2 > Value1
Value1	↘Value2	Value2 < Value1

1.4 ENDF online news: comparing decay data

ENDF Radioactive decay data /MF8.MT457/

by V.Zerkin, IAEA-NDS, 2020-2021, ver.2021-02-12 /under development/

⊞ Show all spectra. Hide low-intensity lines (≤1%).
Select/unselect data for plotting. Plot data in %: ☑ using normalization: ☑

#1. ENDF/B-VIII.0 Br-88	#2. JEFF-3.3 Br-88	#3. ENDF/B-VI Br-88
Nucleus: Br-88 ZA=35088 Library: ENDF/B-VIII.0 NSUB=4 MAT=852 AUTH: Conversion from ENSDF EDATE: EVAL-NOV05 Half life: 16.29 ± 0.06(s) AWR: 87.16876 Isomer number: LISO=0 Level number: LIS=0 Spin & Parity: 2- Ebeta: 1702.089 ± 50.94862 (keV) Egamma: 3133.758 ± 57.90383 (keV) Ealpha: 16.32917 ± 0 (keV) Decay modes: 2 Radiation types: 5	Nucleus: Br-88 ZA=35088 Library: JEFF-3.3 NSUB=4 MAT=858 AUTH: A.L. NICHOLS EDATE: EVAL-OCT97 ↗Half life: 16.5 ± 0.1(s) ↗AWR: 87.1688 Isomer number: LISO=0 Level number: LIS=0 Spin & Parity: 2- ↗Ebeta: 1706 ± 35 (keV) ↗Egamma: 4609 ± 70 (keV) ↘Ealpha: 8.0682 ± 0.965745 (keV) Decay modes: 2 Radiation types: 5	Nucleus: Br-88 ZA=35088 Library: ENDF/B-VI NSUB=4 MAT=3552 AUTH: C.W.REICH,T.ENGLAND EDATE: EVAL-APR90 Half life: 16.5 ± 0.1(s) ↗AWR: 87.24404 Isomer number: LISO=0 Level number: LIS=0 Spin & Parity: 1- ↗Ebeta: 2565 ± 46 (keV) ↘Egamma: 3300 ± 300 (keV) ↗Ealpha: 16.077 ± 0 (keV) Decay modes: 2 Radiation types: 5
#M1. Decay mode: RTYP=1 β− Decay Q=8975.33 ± 4.106 keV Branching=93.42 ± 0.18 %	#M1. Decay mode: RTYP=1 β− ↘Decay Q=8960 ± 40 keV ↘Branching=93.3 ± 0.2 %	#M1. Decay mode: RTYP=1 β− ↗Decay Q=8970 ± 130 keV ↗Branching=93.63 ± 0.24 %
#M2. Decay mode: RTYP=1.5 β− → n Decay Q=1922.25 ± 3.18 keV Branching=6.58 ± 0.18 %	#M2. Decay mode: RTYP=1.5 β− → n ↘Decay Q=1920 ± 130 keV ↗Branching=6.7 ± 0.2 %	#M2. Decay mode: RTYP=1.5 β− → n Decay Q=1920 ± 130 keV ↘Branching=6.37 ± 0.24 %

#R1. Radiation type: STYP=0 γ
AveDecayEne=3133.8 ± 57.904 keV
⊞ DiscreteSpectrum: 146 lines ☐ plot
	#R1. Radiation type: STYP=0 γ
	↘AveDecayEne=3101.5 ± 299.23 keV
	⊞ DiscreteSpectrum: ↗167 lines ☐ plot
		#R1. Radiation type: STYP=0 γ
		↗AveDecayEne=3300 ± 300 keV
		⊞ DiscreteSpectrum: ↘164 lines ☐ plot

#R2. Radiation type: STYP=1 β−
AveDecayEne=1701.6 ± 50.949 keV
⊞ DiscreteSpectrum: 58 end-points ☐ plot
	#R2. Radiation type: STYP=1 β−
	↗AveDecayEne=2392.9 ± 138.65 keV
	⊞ DiscreteSpectrum: ↗66 end-points ☐ plot
		#R2. Radiation type: STYP=1 β−
		↗AveDecayEne=2564.5 ± 46 keV
		⊞ DiscreteSpectrum: ↘58 end-points ☐ plot

#R3. Radiation type: STYP=5 n
AveDecayEne=16.329 ± 0 keV
⊞ ContinuousSpectrum:178 ☐ plot
	#R3. Radiation type: STYP=5 n
	↘AveDecayEne=8.0682 ± 0.96574 keV
	⊞ DiscreteSpectrum: 2 lines ☐ plot
		#R3. Radiation type: STYP=5 n
		↗AveDecayEne=16.077 ± 0 keV
		⊞ ContinuousSpectrum:181 ☐ plot

#R4. Radiation type: STYP=8 disc. e−
AveDecayEne=0.50751 ± 0.084348 keV
⊞ DiscreteSpectrum: 17 lines ☐ plot
	#R4. Radiation type: STYP=8 disc. e−
	↗AveDecayEne=0.62757 ± 0.062757 keV
	⊞ DiscreteSpectrum: ↗75 lines ☐ plot
		#R4. Radiation type: STYP=8 disc. e−
		↘AveDecayEne=0.48 ± 0.03 keV
		⊞ DiscreteSpectrum: ↘5 lines ☐ plot

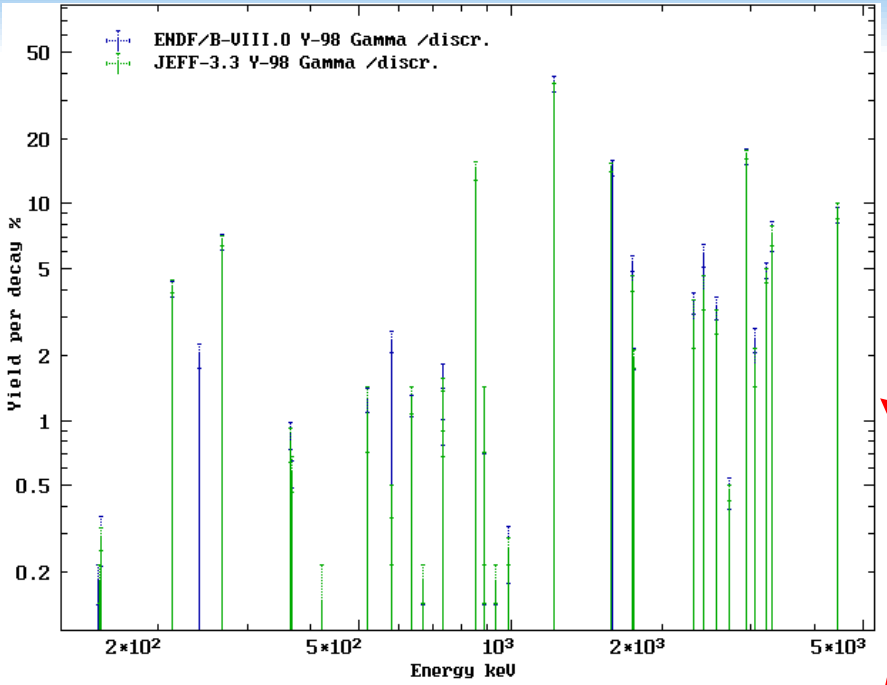
#R5. Radiation type: STYP=9 X-rays
AveDecayEne=4.7821e-3 ± 1.0949e-4 keV
⊟ DiscreteSpectrum: 6 lines ☐ plot
Normalization:1 ± 0
	#R5. Radiation type: STYP=9 X-rays
	↗AveDecayEne=6.7735e-3 ± 6.7735e-4 keV
	⊟ DiscreteSpectrum: 6 lines ☐ plot
	Normalization:1 ± 0
		#R5. Radiation type: STYP=9 X-rays
		↘AveDecayEne=4.6e-3 ± 2e-4 keV
		⊟ DiscreteSpectrum: ↘4 lines ☐ plot
		Normalization:0.0001 ± 0

#	E, keV	Intensity, %	I/Imax, %	RTYP	TYPE
1	1.59 ± 0.01	1.5601e-3 ± 4.3999e-5	7.34 ± 0.21	1 β−	
2	12.598 ± 0.015	0.010968 ± 4.0524e-4	51.6 ± 1.9	1 β−	
3	12.651 ± 0.015	0.021244 ± 7.5277e-4	100 ± 3.5	1 β−	
4	14.104 ± 0.015	1.524e-3 ± 5.7883e-5	7.17 ± 0.27	1 β−	
5	14.111 ± 0.015	2.9557e-3 ± 1.0999e-4	13.9 ± 0.52	1 β−	
6	14.311 ± 0.015	3.9024e-4 ± 1.3897e-5	1.84 ± 0.065	1 β−	

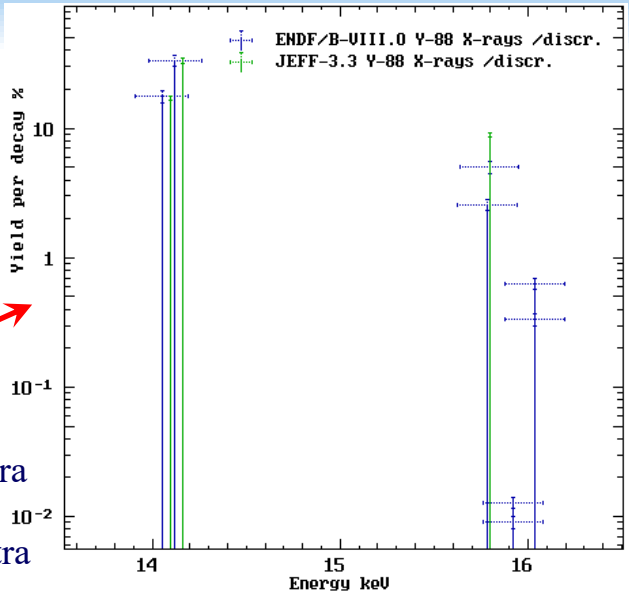
#	E, keV	Intensity, %	I/Imax, %	RTYP	TYPE
1	0.181 ± 0.00362	5.2267e-4 ± 5.2267e-5	1.78 ± 0.18	1 β−	
2	1.577 ± 0.0315	2.981e-3 ± 2.981e-4	10.1 ± 1	1 β−	
3	12.598 ± 0.252	0.015218 ± 1.5218e-3	51.7 ± 5.2	1 β−	
4	12.649 ± 0.253	0.029435 ± 2.9435e-3	100 ± 10	1 β−	
5	14.11 ± 0.282	7.1232e-3 ± 7.1232e-4	24.2 ± 2.4	1 β−	
6	14.32 ± 0.286	5.5926e-4 ± 5.5926e-5	1.9 ± 0.19	1 β−	

#	E, keV	Intensity, %	I/Imax, %	R
1	1.6383 ± 0.001	8.9e-4 ± 7e-5	4.47 ± 0.35	1
2	12.598 ± 0.001	0.0103 ± 8e-4	51.8 ± 4	1
3	12.651 ± 0.001	0.0199 ± 1.6e-3	100 ± 8	1
4	14.107 ± 0.001	5.2e-3 ± 4e-4	26.1 ± 2	1

1.4 ENDF news: decay data plot and comparison

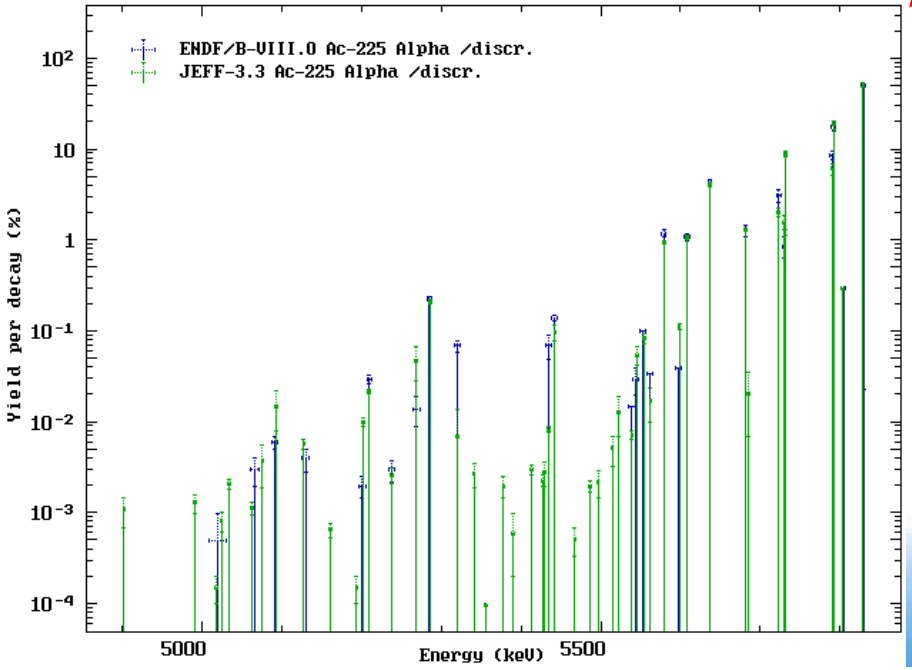


MT457 X-ray discrete spectra

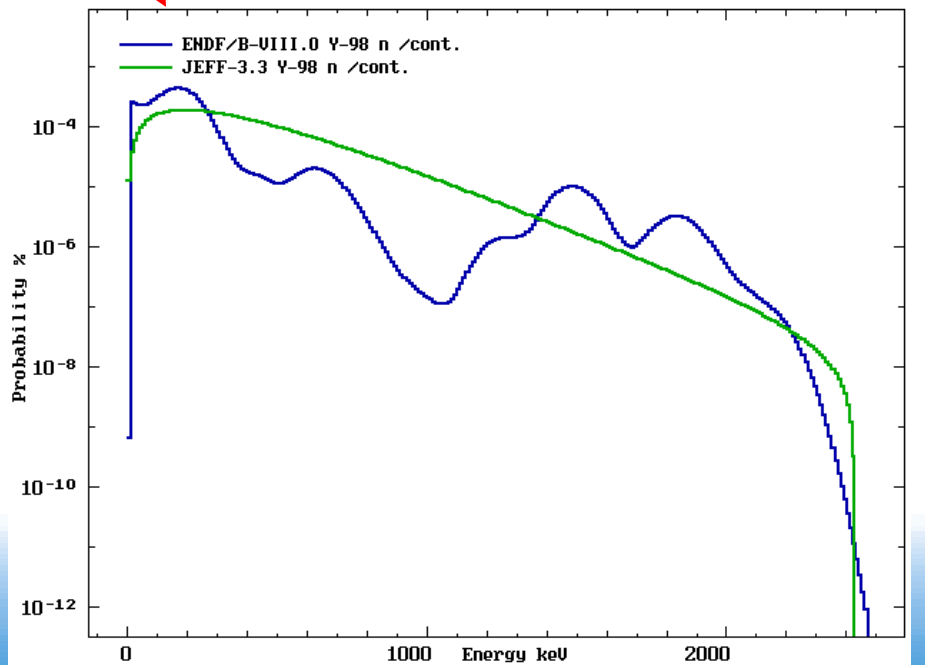


MT457 γ: discrete spectra

MT457 α: discrete spectra



MT457 n: continuous spectra



1.4 ENDF news: DD plot and comparison with EXFOR

/under development/

Plot data in %: ☐ using normalization: ☐

#1. ENDF/B-VIII.0 **Br-88**

Nucleus:	Br-88 ZA=35088
Library:	ENDF/B-VIII.0 NSUB=4 MAT=852
AUTH:	Conversion from ENSDF
EDATE:	EVAL-NOV05
Half life:	16.29 ± 0.06(s)
AWR:	87.16876
Isomer number:	LISO=0
Level number:	LIS=0
Spin & Parity:	2-
Ebeta:	1702.089 ± 50.94862 (keV)
Egamma:	3133.758 ± 57.90383 (keV)
Ealpha:	16.32917 ± 0 (keV)
Decay modes:	2
Radiation types:	5

#M1. Decay mode: RTYP=1 β−
Decay Q=8975.33 ± 4.106 keV
Branching=93.42 ± 0.18 %

#M2. Decay mode: RTYP=1.5 β− → n
Decay Q=1922.25 ± 3.18 keV
Branching=6.58 ± 0.18 %

#R1. Radiation type: STYP=0 γ
AveDecayEne=3133.8 ± 57.904 keV
[+] DiscreteSpectrum: 146 lines ☐ plot

#R2. Radiation type: STYP=1 β−
AveDecayEne=1701.6 ± 50.949 keV
[+] DiscreteSpectrum: 58 end-points ☐ plot

#R3. Radiation type: STYP=5 n
AveDecayEne=16.329 ± 0 keV
[+] ContinuousSpectrum:178 ☑ plot

#R4. Radiation type: STYP=8 disc. e−
AveDecayEne=0.50751 ± 0.084348 keV
[+] DiscreteSpectrum: 17 lines ☐ plot

#R5. Radiation type: STYP=9 X-rays
AveDecayEne=4.7821e-3 ± 1.0949e-4 keV
[+] DiscreteSpectrum: 6 lines ☐ plot

ENDF

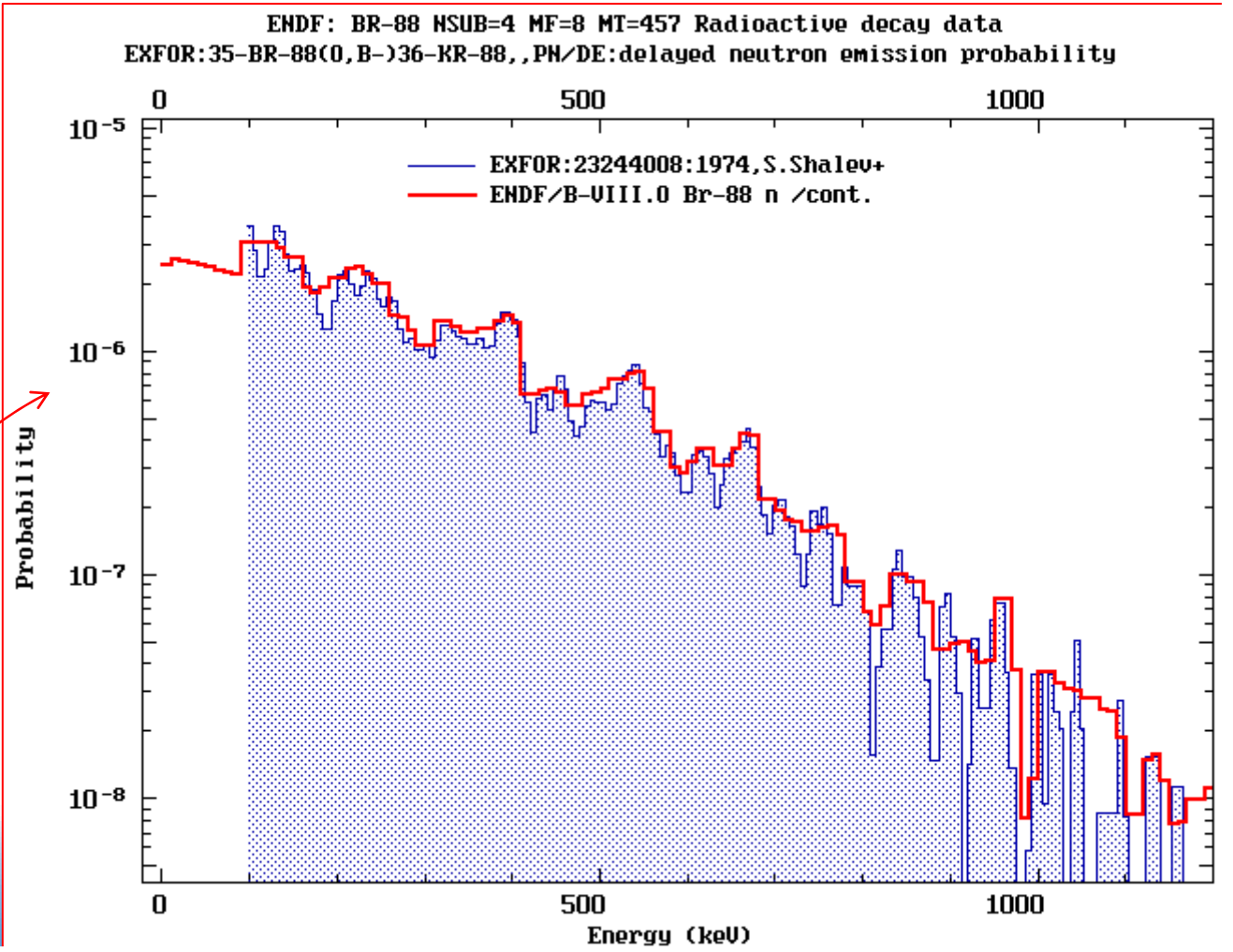
Target ☑ Br-88
Reaction ☑ decay

8.4. RADIOACTIVE DECAY DATA (MT=457)

RTYP	Decay Mode
1.5 β^-,n	Beta decay followed by neutron emission (*delayed neutron decay*)

EXFOR

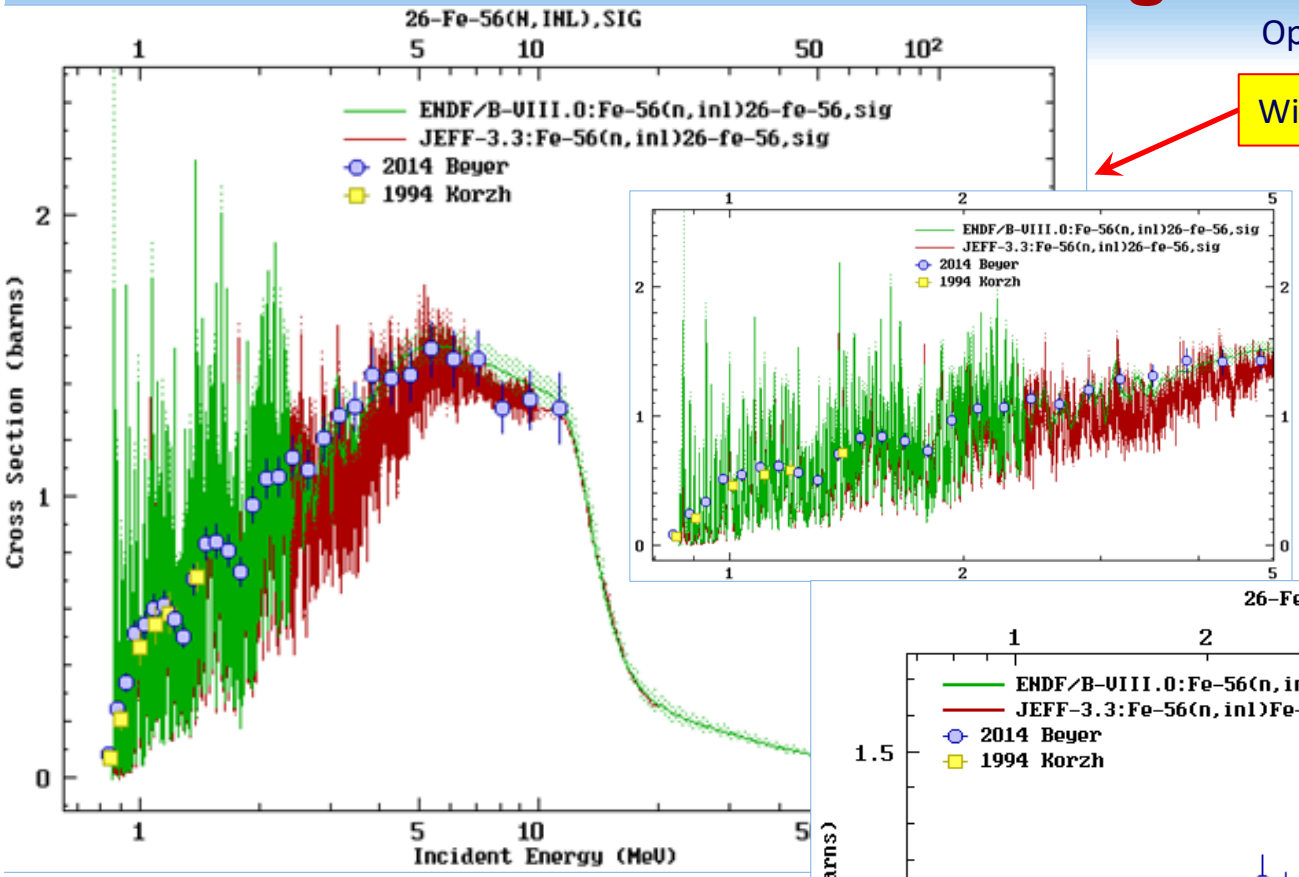
Target ☑ Br-88
Reaction ☑ 0,b-
Quantity ☑ MFQ



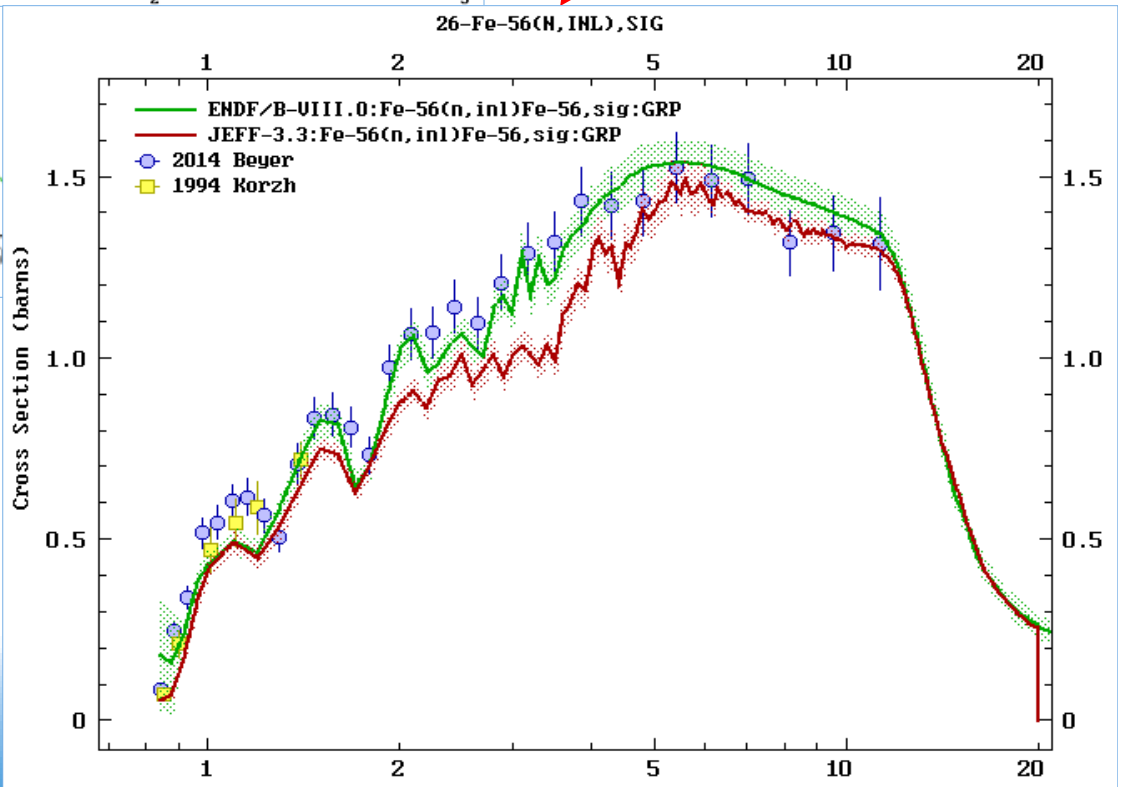
1.4 ENDF online news: using GROUPIE online

Option under “Universal plot”

Without GROUPIE



After running GROUPIE

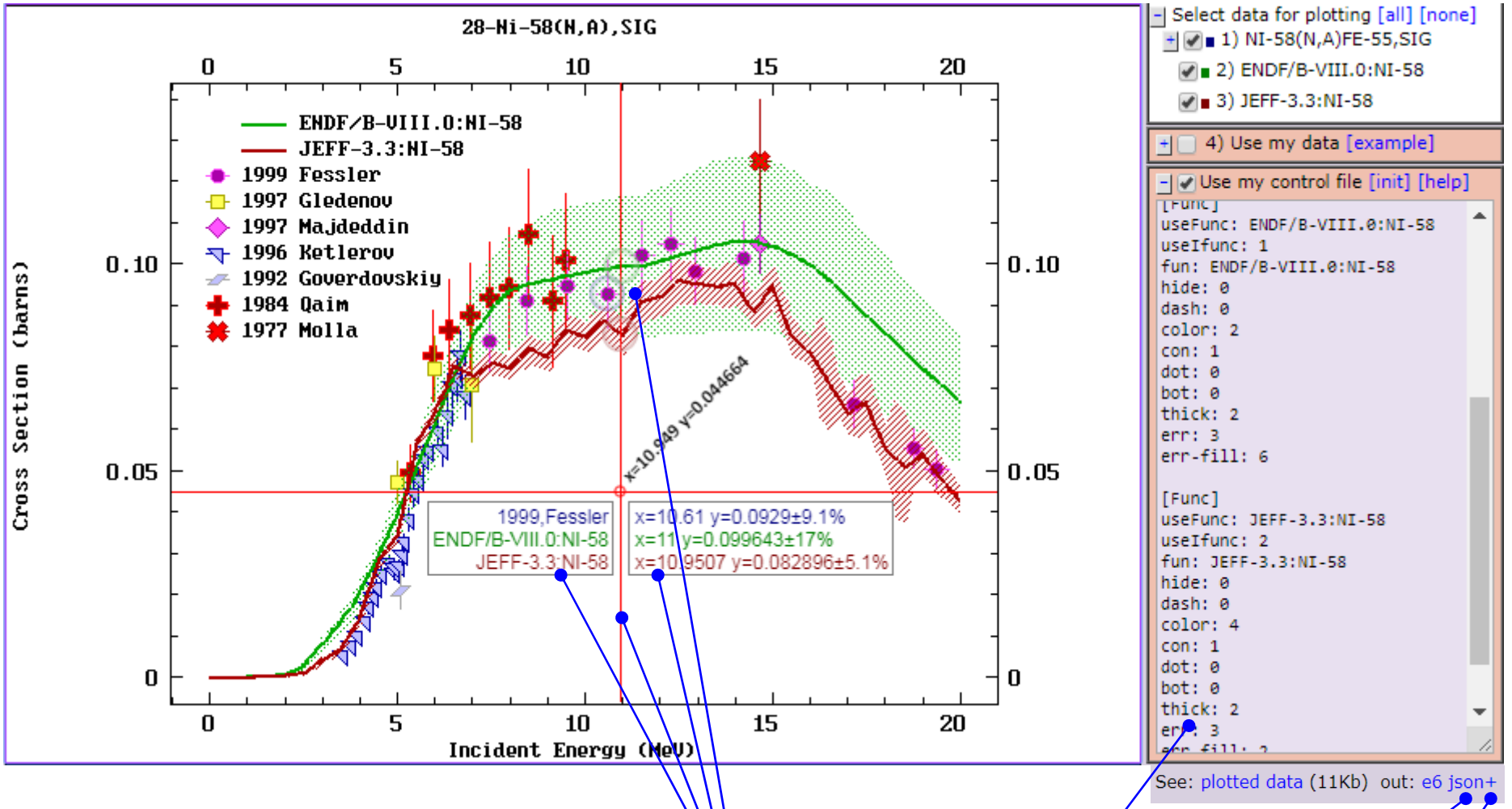


Introduction /written by R.Capote/

Resonance or strongly fluctuating data are very difficult to compare to low-resolution measured or evaluated data (see Fig. above). Therefore, there is an actual need to average data for proper inter-comparison between different evaluations or to low-resolution experimental data (EXFOR). However, data performance in many applications is usually defined by average behaviour rather than by fluctuations. Plotting of group wise data under ENDF Web retrieval system is implemented via running GROUPIE code (D. Cullen, PREPRO codes) online. Default 640 groups were adopted up to 20 MeV (725 up to 60 MeV) to effectively reduce the number of points in the region with fluctuating data while preserving most of low-resolution data structures. PEN linearized files at room temperature were used as input to the GROUPIE code.

1.5. Web-ZVView: plotting news

1.5 News in Web-ZVView plotting: new options



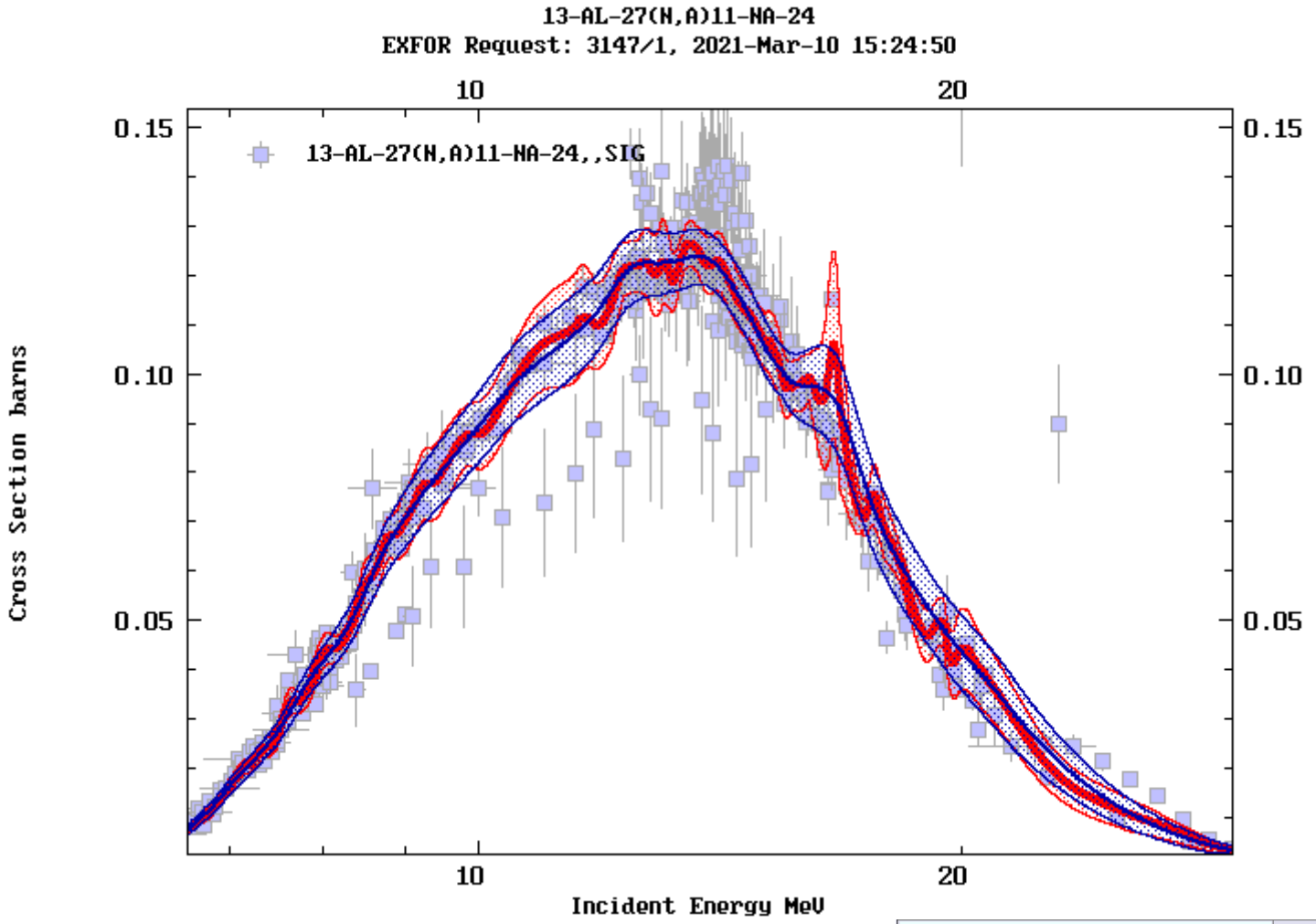
New element: "Marker"

New option: "Control file"

New output: JSON, Table

Implementation: ZVView → JSON → AJAX → HTML5

1.5 News in Web-ZVView plotting: online smoothing



Use my control file [init] [help]

```
#begin control1.tit/c

[Func]
useFunc: 1) X4R3147_x4.tab
useIfunc: 0
fun: 1) X4R3147_x4.tab
hide: 0
dash: 0
color: 7
con: 0
dot: 2
bot: 0
thick: 1
err: 1
err-fill: 0
smooth: 6,2,12,3,3;20,2,1,1,3

#end control1.tit/c
```

Option "smooth" in control file

Smoothing:	smothing [#1],[#2],...	
width:3, polynom x^2, red, thickness:3		[#1] width (~points)
smooth: 3,2,12,3		[#2] polynom degree: 1:x, 2:x^2, 3:x^3
width:6, x^2, magenta, t:2, pipe		[#3] color
smooth: 6,2,13,2,3		[#4] line thickness (1..4)
width:3, x^3, green, t:1, cloud, dash		[#5] display errors (0..3)
smooth: 3,3,10,1,1,2		[#6] solid, dash, etc. (0..3)
two smoothing curves:		[#7] show intervals (0..1)
smooth: 6,2,12,2,3; 3,3,10,1,1,2		

Part II.

Integrated databases

2.1 Integrated databases: CINDA

CINDA

Computer Index of Nuclear Reaction Data

Since 2005, CINDA database is extended by photonuclear and charged particle reaction data.
Since 2010, CINDA is regularly extended by the new information from EXFOR and NSR.
Since 2017, import from EXFOR and NSR to CINDA is done fully automatically.
Since November 2018, import from NSR to CINDA is no longer available.
2020: CINDA maintenance migrated from Windows to Linux.

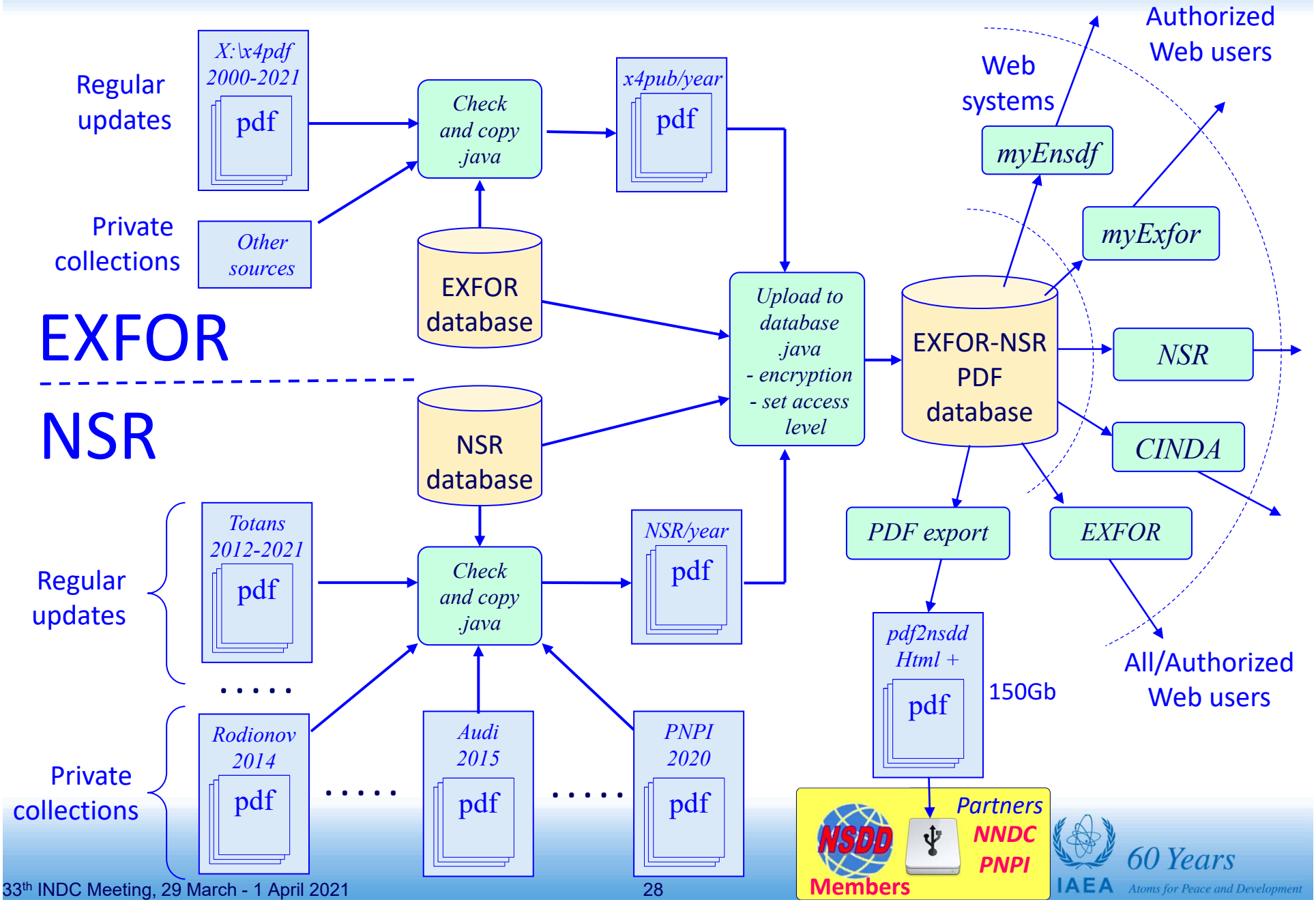
Main purpose of recent extensions of CINDA:
make it more useful for search
candidates for EXFOR
compilation.

2.2 EXFOR-NSR PDF database

- Publications: from 1896 to 2021, 120 years
- Content: 219,855 PDF files from 2000 to 2021 (22 years)
- Coverage: EXFOR 25,758 files (75%); NSR 186,746 files (78%)
- Web access via: EXFOR, NSR, CINDA, myEnsdf on NDS and NNDC sites

- 2005: EXFOR source papers are systematically stored in the IAEA-NDS PDF archive
- 2011: PDF files are included to EXFOR database (common between NNDC and NDS)
- 2011: EXFOR Web retrieval system provides access to PDF files for authorized users on NNDC and NDS Web sites
- 2012: PDF of original papers of NSR are exchanged between NNDC and NDS, and shared between NSR and EXFOR systems
- 2015: ENSDF evaluators donate their PDF collections to common database: A.Rodionov, G.Shulyak, B.Singh, G.Audi, F.Kondev
- 2015: NSR Web retrieval system provides access to PDF files for authorized users
- 2016: PNPI joines regular exchange of PDF files between NNDC and NDS
- 2016: CINDA Web retrieval system provides access to PDF files for authorized users
- 2016: IAEA-INDC reports are publically opened via Web EXFOR and NSR
- 2019: KINR opens lab reports and conference proceedings of Institute for Nuclear Research (Ukraine)
  Note. Now 2,550 PDF files are public, i.e. ~1% from total 219,855 publications

2.2 Functioning of EXFOR-NSR PDF database



2.2 Full EXFOR-NSR PDF database

EXFOR-NSR PDF database.

Database updated: 2021-02-26. Files: 219855 from 2000-04-19 to 2021-02-21.

-	-	-	-	-	1896:3	-	1898:4	1899:1	-	[1891-1899]:8
1901:1	1902:2	1903:5	1904:5	1905:4	1906:2	1907:4	1908:2	1909:1	1910:5	[1901-1910]:31
1911:2	1912:1	1913:3	-	-	-	1917:4	1918:2	1919:3	1920:3	[1911-1920]:18
1921:5	1922:4	1923:3	1924:5	1925:2	-	1927:3	1928:11	1929:8	1930:10	[1921-1930]:51
1931:23	1932:22	1933:27	1934:41	1935:49	1936:36	1937:51	1938:46	1939:96	1940:74	[1931-1940]:465
1941:57	1942:29	1943:38	1944:29	1945:26	1946:94	1947:190	1948:186	1949:346	1950:482	[1941-1950]:1477
1951:531	1952:473	1953:588	1954:679	1955:805	1956:885	1957:909	1958:1255	1959:1176	1960:1446	[1951-1960]:8747
1961:1519	1962:1641	1963:1959	1964:1729	1965:1958	1966:2200	1967:2377	1968:2587	1969:2853	1970:3539	[1961-1970]:22362
1971:3935	1972:4785	1973:5446	1974:4438	1975:3843	1976:3839	1977:3568	1978:3587	1979:3450	1980:3507	[1971-1980]:40398
1981:3331	1982:3479	1983:3567	1984:3508	1985:3087	1986:3185	1987:3455	1988:3294	1989:3349	1990:3277	[1981-1990]:33532
1991:2805	1992:3050	1993:3247	1994:4212	1995:3988	1996:3959	1997:3841	1998:4149	1999:4297	2000:4266	[1991-2000]:37814
2001:4559	2002:4830	2003:4489	2004:4805	2005:4998	2006:4288	2007:4963	2008:3987	2009:3870	2010:3631	[2001-2010]:44420
2011:4015	2012:3688	2013:3480	2014:3657	2015:3084	2016:3565	2017:3570	2018:2691	2019:2446	2020:312	[2011-2020]:30508
2021:24										

Years: 120 Publications: 219855

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

Checking mode //contributions to NSR-PDF

PDF Statistics:

DB	*#PDF/#References*	*#PDF+*	*Total #PDF+*	*Todo #PDF*
NSR:	186746/237539 ~78.7%	+641 from EXFOR	187387	50152 ~21.2%
EXFOR:	25758/34203 ~75.4%	+1436 from NSR	27194	7009 ~20.5%

Contributions to NSR-PDFs

PDF files: 219,855 from 2000-04-19 to 2021-02-21

Contributions to NSR PDF database as of 2021-03-02

Contributions:

1)	201200_Totans	/3404/	23)	201800_Totans	/1041/
2)	201300_Totans	/963/	24)	201800_Zerkin	/406/
3)	201400_Totans	/512/	25)	201800_Zerkin_JINR	/673/
4)	201500_Totans	/584/	26)	201803_Balraj	/1/
5)	201504_Dimitriou	/6/	27)	201803_Pritychenko_RD	/525/
6)	201510_Balraj	/257/	28)	201810_Zerkin_KINR	/50/
7)	201510_Rodionov	/2175/	29)	201900_PNPI	/11228/
8)	201512_Audi	/2539/	30)	201900_Totans	/873/
9)	201600_Totans	/2001/	31)	201900_Zerkin	/357/
10)	201603_Rodionov	/181/	32)	201907_Vrapcenjak	/1/
11)	201603_Shulyak	/13012/	33)	201911_Pritychenko	/1/
12)	201604_Kondev	/1066/	34)	202000_PNPI	/37/
13)	201611_PNPI	/31538/	35)	202000_Pritychenko	/3/
14)	201700_PNPI	/50565/	36)	202000_Totans	/869/
15)	201700_Totans	/2318/	37)	202000_Vrapcenjak	/17/
16)	201700_Zerkin	/629/	38)	202000_Zerkin	/437/
17)	201703_Shulyak	/302/	39)	202101_Totans	/8/
18)	201705_Kondev	/44/	40)	202101_Vrapcenjak	/208/
19)	201709_Pritychenko	/1182/	41)	202101_Zerkin	/8/
20)	201711_Zerkin	/844/	42)	202102_Totans	/78/
21)	201800_PNPI	/56294/	43)	202102_Vrapcenjak	/28/
22)	201800_Pritychenko	/58/			

Contributors:

1	PNPI	149662	79.9%
2	Shulyak	13314	7.11%
3	Totans	12651	6.75%
4	Zerkin	3404	1.82%
5	Audi	2539	1.36%
6	Rodionov	2356	1.26%
7	Pritychenko	1769	0.94%
8	Kondev	1110	0.59%
9	Balraj	258	0.14%
10	Vrapcenjak	254	0.14%
11	Dimitriou	6	0.003%
	Total	187323	100%

Thanks to external contributors!!!

PDF Statistics:

DB	*#PDF/#References*	*#PDF+*	*Total #PDF+*	*Todo #PDF*
NSR:	186746/237539 ~78.7%	+641 from EXFOR	187387	50152 ~21.2%
EXFOR:	25758/34203 ~75.4%	+1436 from NSR	27194	7009 ~20.5%

IAEA 60 Years Atoms for Peace and Development

Part III.

Local databases and new retrieval tools

IAEA 60 Years Atoms for Peace and Development

3.1 Modernization of CD-ROM packages

CD-ROMs

- EXFOR-CINDA for Windows /MSAccess+Java/, 2002-2019 Windows
- EXFOR-CINDA for Applications /MySQL+Java/, 2004-2019 Windows/Linux/Mac
- Endver/GUI+EXFOR for Applications /MySQL+Java+Fortan/, 2005-2019 Windows/Linux/Mac

Problems

- Java: JDBC driver for MS-Access stopped by Oracle since Java-8
- MySQL: requires permissions to run MySQL server (IT security)

Solution /2020/

- Migrate EXFOR and CINDA databases to SQLite*
- Unite 3 CD-ROMs to a single package for Windows/Linux/Mac

**SQLite is a C-language library implementing SQL database engine built into most computers and all mobile phones.*

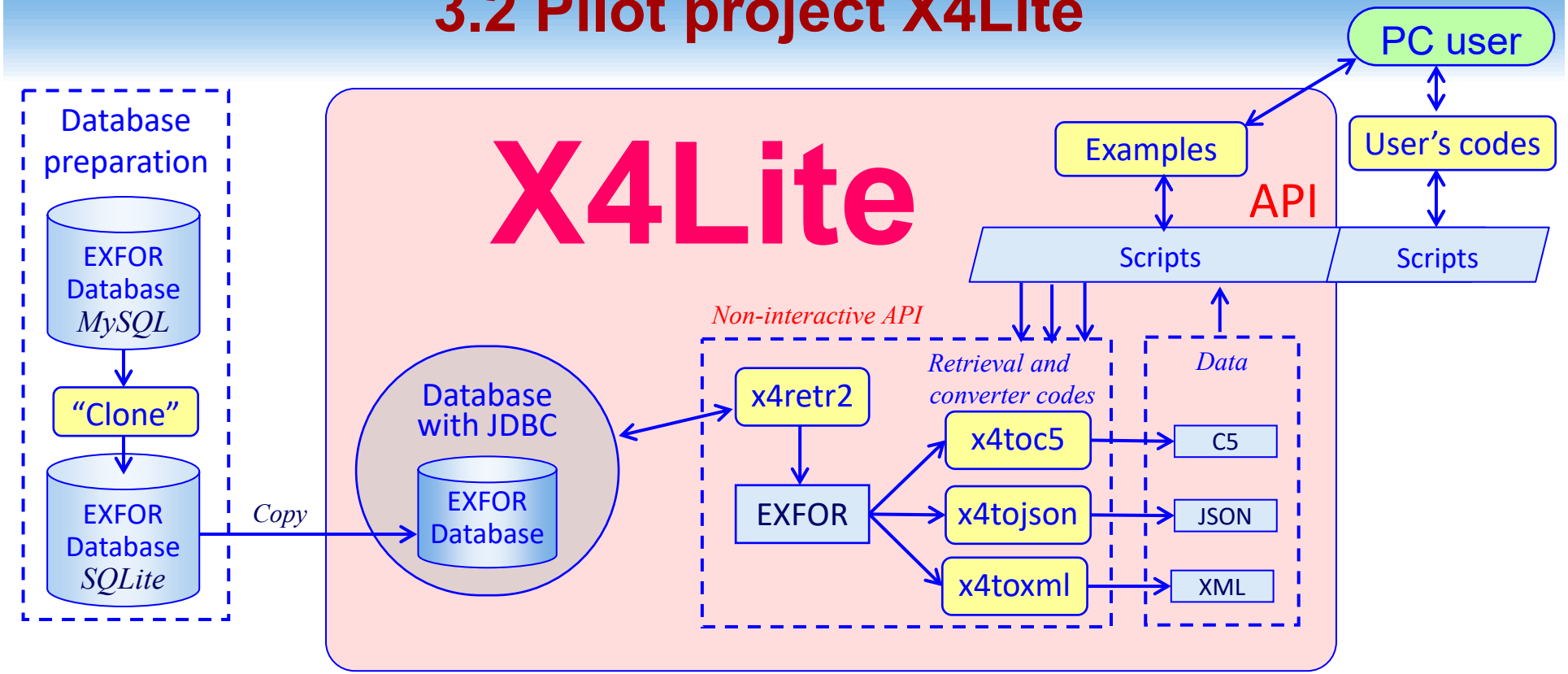
Implementation /2020/

- Java codes exporting EXFOR and CINDA data from MySQL database to SQLite
- Create a new package "X4Apps" based on old CD-ROMs software
- Add new output formats X4+, C5, JSON, XML

X4Lite pilot project /2020/ *(under discussion at NDS and WPEC-SG50)*

- Cut version of "X4Apps", specialized for nuclear data professionals with programming skills building own systems
- Includes EXFOR database, search code and converters to Html, C5, JSON, XML

3.2 Pilot project X4Lite



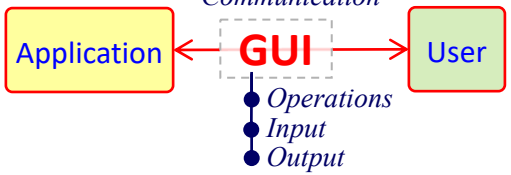
X4Lite preparation is fully automatic. Can be done regularly by the NDS.

X4Lite. Specialized system for usage under other software packages and containing only
1) EXFOR relational database in SQLite: one file for Linux, Windows, MacOS
2) retrieval code producing list of datasets and/or EXFOR file
3) codes converting EXFOR file to X4+, C5, C5M, JSON, XML

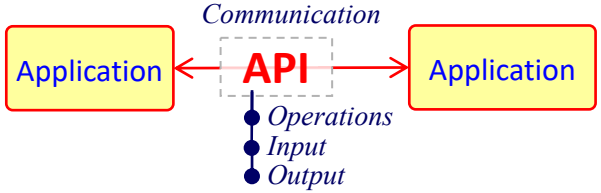
Alternatives to X4Lite:
1) regularly generate C5, JSON, XML for whole EXFOR as it is done for XC4
2) storage computational data (~C5 data) in EXFOR database
3) providing API for remote access of EXFOR and ENDF data in various formats via Web

3.3 API: automatized access to nuclear data

GUI = Graphical User's Interface



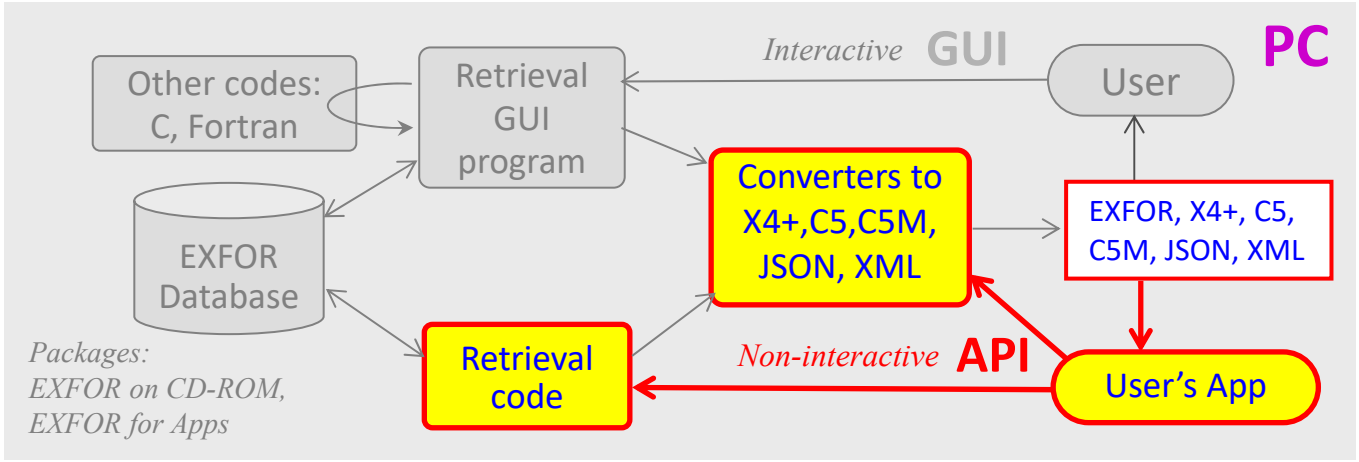
API = Application Programming Interface



Why API? Is GUI not enough?
Automatization level ↗
Programming skills ↗
Requests for API ↗

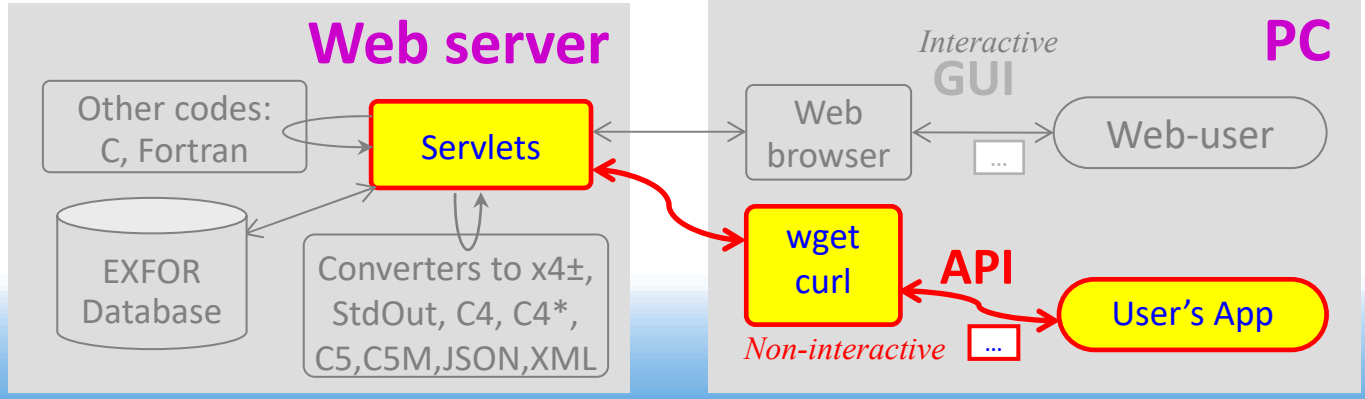
Minimalistic API for EXFOR, ENDF:
- data search (parameters)
- get data (format, options)

Local: PC/LAN



Accessing EXFOR data from local database.
Fast. Known db-version. Reproducibility. More freedom for Apps.
Old data? Installation? Platform compatibility?

Remote: Internet



Accessing EXFOR data from remote database via Web.
Always fresh data.
No installation. Less to store.
Speed? IT security, IT policy?
Database version?
Reproducibility?

Concluding remarks

1) Recent development of “nuclear reaction data service” is mostly oriented to professional needs of advanced users including new data formats based on JSON

2) Development of X4Lite vs. storage computational data in the database, Web-download and Web-API

3) API for access local database vs. API for remote database via Web: investigate possible IT problems

4) Continue development of EXFOR-NSR PDF database and try to open public access to lab reports

Thank you.

Citing of the materials of this presentation should be done with proper acknowledgement of the IAEA and author