Progress in EXFOR-ENDF databases, retrieval systems, tools and software

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Main online news. Summary

1. EXFOR

1) section “Evaluator” on EXFOR Web Request page: search for ENDF users by <Target, Projectile, MF, MT>
2) automatic renormalization using decay data (intensity of AR, DG) given in DECAY-DATA and DECAY-MON
3) option: “cm2lab” for angular distributions

2. ENDF

1) radioactive decay data (MF8.MT457): output to JSON, plot, comparison to ENSDF and DDEP-2021
2) plotting groupwise data running on the fly: GROUPIE (175, 640, 725, 765 groups)
3) new evaluated libraries in the ENDF database:

1.	*JENDL-5*	*Japanese evaluated nuclear data library 2021 (incl. Errata March-2022)*
2.	*JENDL/DDF-2015*	*JENDL Decay Data File 2015, Japan*
3.	*FENDL-3.2b*	*Fusion Evaluated Nuclear Data Library, IAEA, 2022*
4.	*IRDFF-II/DD*	*decay data sub-library of International Reactor Dosimetry and Fusion File, IAEA 2019*
5.	*INDEN-Feb2022*	*evaluations produced by International Nuclear Data Evaluators Network (coordinated by the IAEA)*
6.	*IAEA-Std17*	*IAEA Standard and Reference Cross Sections, 2017*
7.	*UKDD-2020*	*UK Decay Data Library, UK, 2020*

3. EXFOR-NSR PDF database

1. updates: 85, added 3,092 PDF files
2. ready to open public Web access to Lab reports of JINR, Dubna (via INIS)
3. database content (PDF files):
    1. total: +3,092 => 223,350
    2. EXFOR-PDF: +1,081 => 26,904 (77.1% of 34,876)
    3. NSR-PDF: +1,837 => 188,903 (~79.2% of 238,544)

4. IBANDL

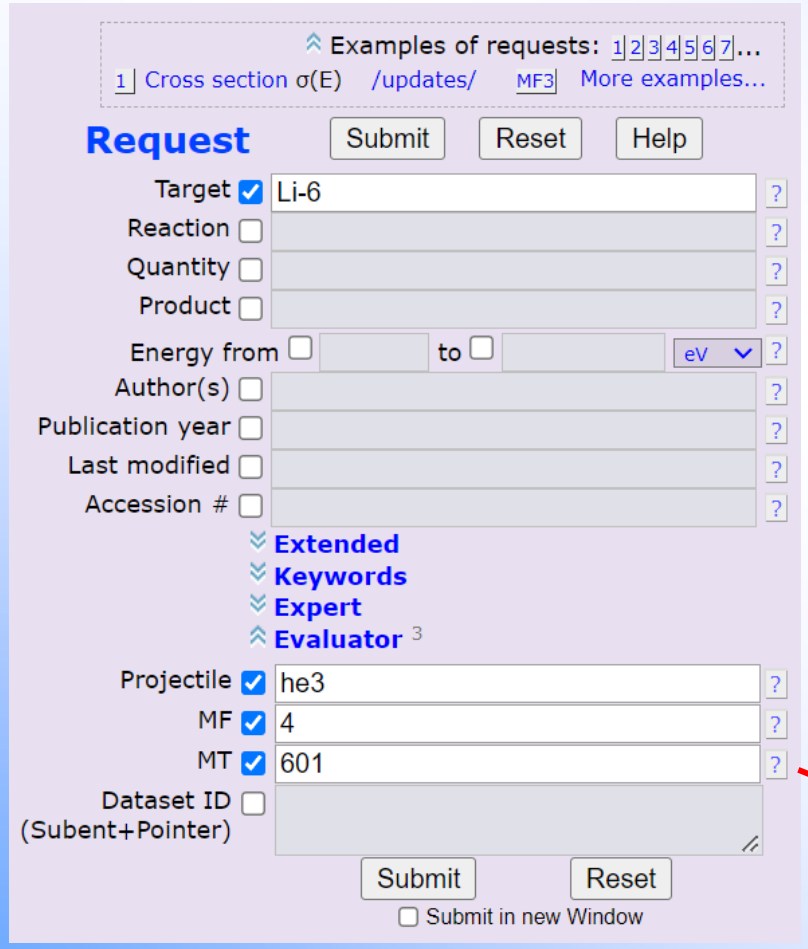
1) 4 database updates

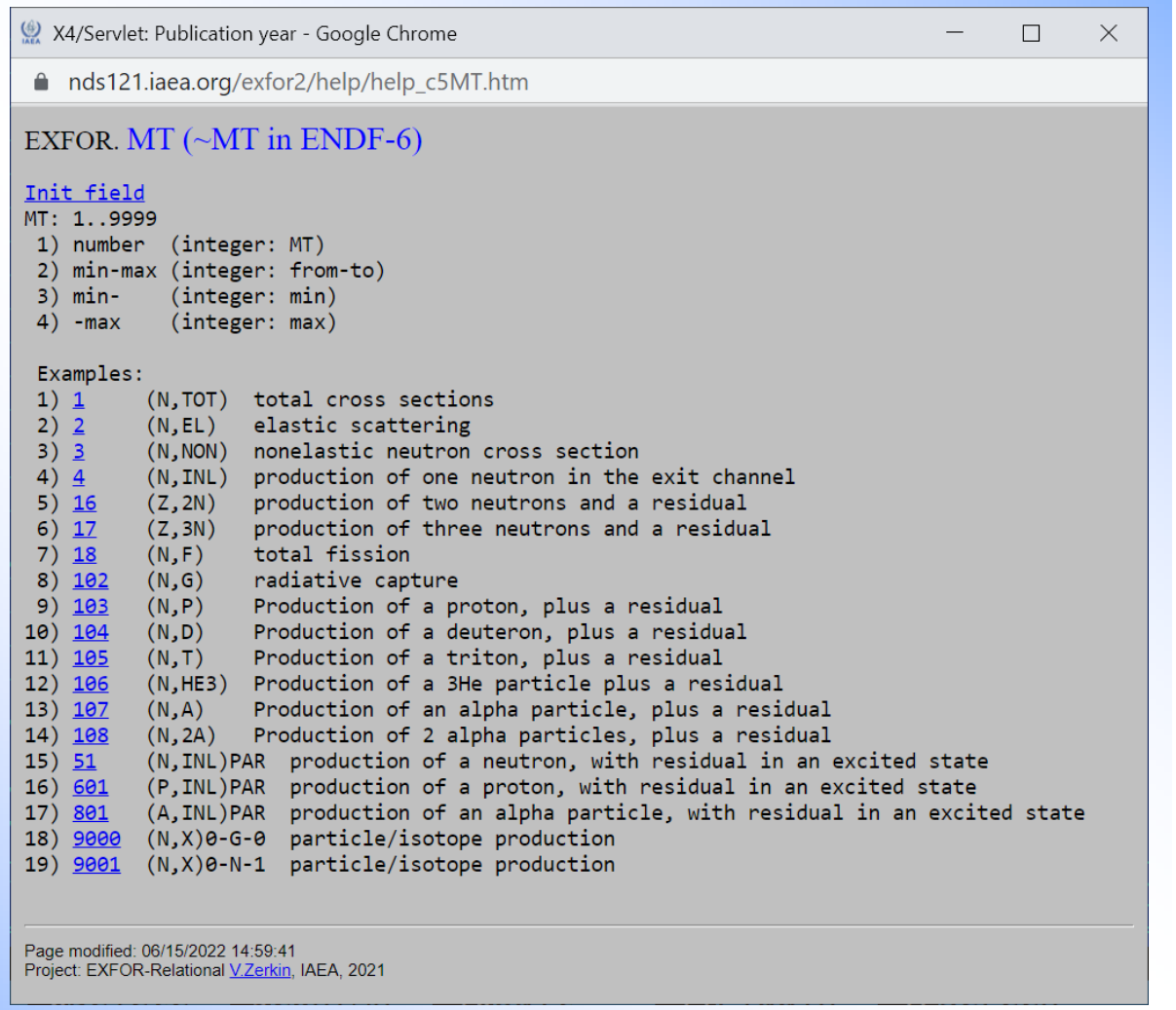
5. Web-ZVView

1) ZVView → JSON → Plotly: implemented on all Web plotting

EXFOR online

New section “Evaluator”





New option: “cm2lab” for angular distributions

Data Selection

Retrieve ◉ Selected ○ Unselected ○ All Reset ☐ in new Window

Output: ☑ X4+ ☑ EXFOR ☑ Bibliography ☐ TAB ☑ C4 ☐ PlotC4

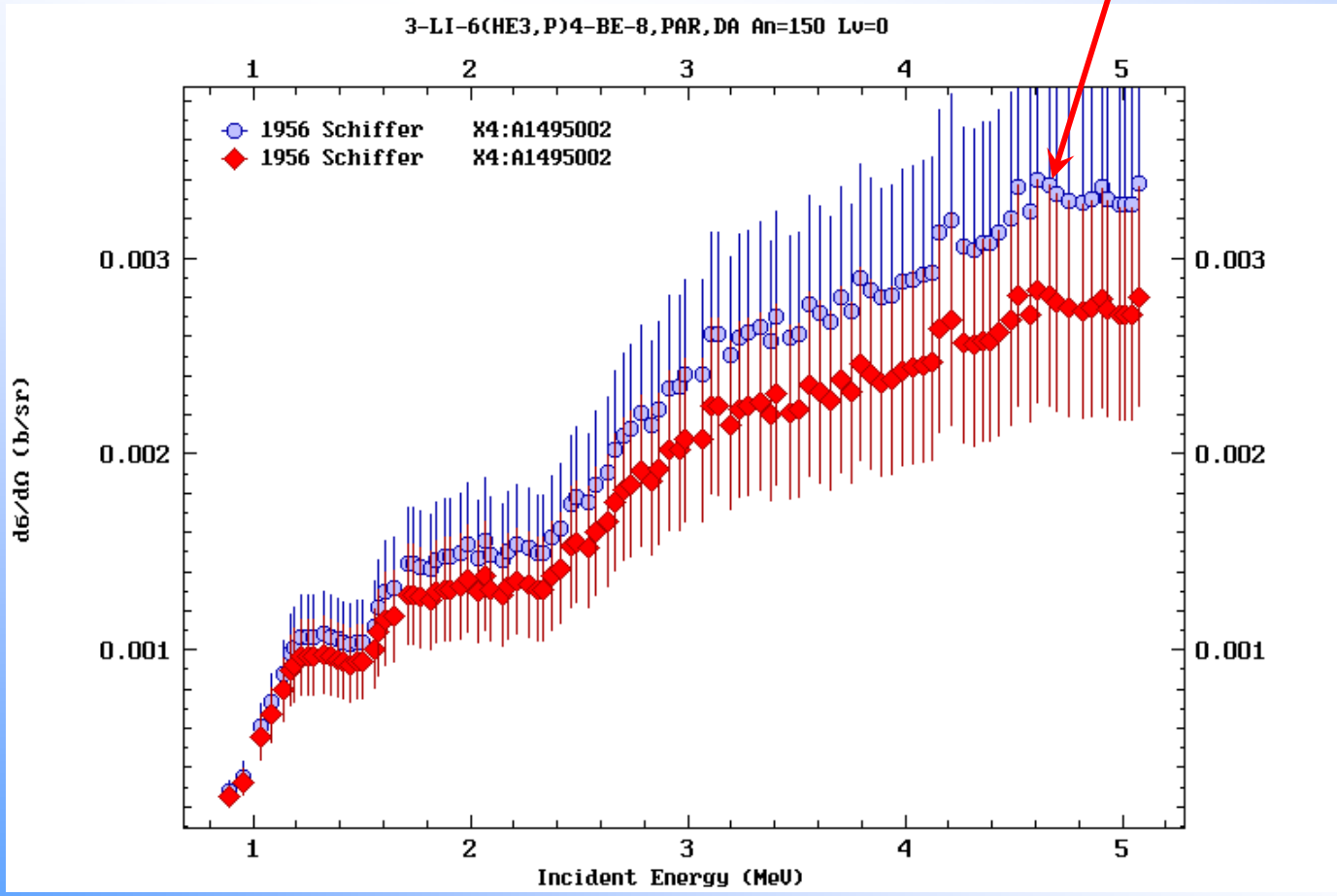
Plot: ☐ Quick-plot (cross-sections) ☐ ungroup /product: ☑ Advanced plot [how-to] using ☑ C5 with ☐ cm2lab; convert ☐ ratios to σ

Narrow incident energy (optional), eV: Min: ☐ Max: ☐

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

n	Display	Year	Author-1	Energy range,eV	Points	Reference	Su
○ 1)	3-LI-6(HE3,P)4-BE-8,PAR,DA		Q(keV)=16787.45	C4: MF=4	MT=601	☐ Invert data to reaction 4-BE-8(P,HE3)3-LI-6,,DA	

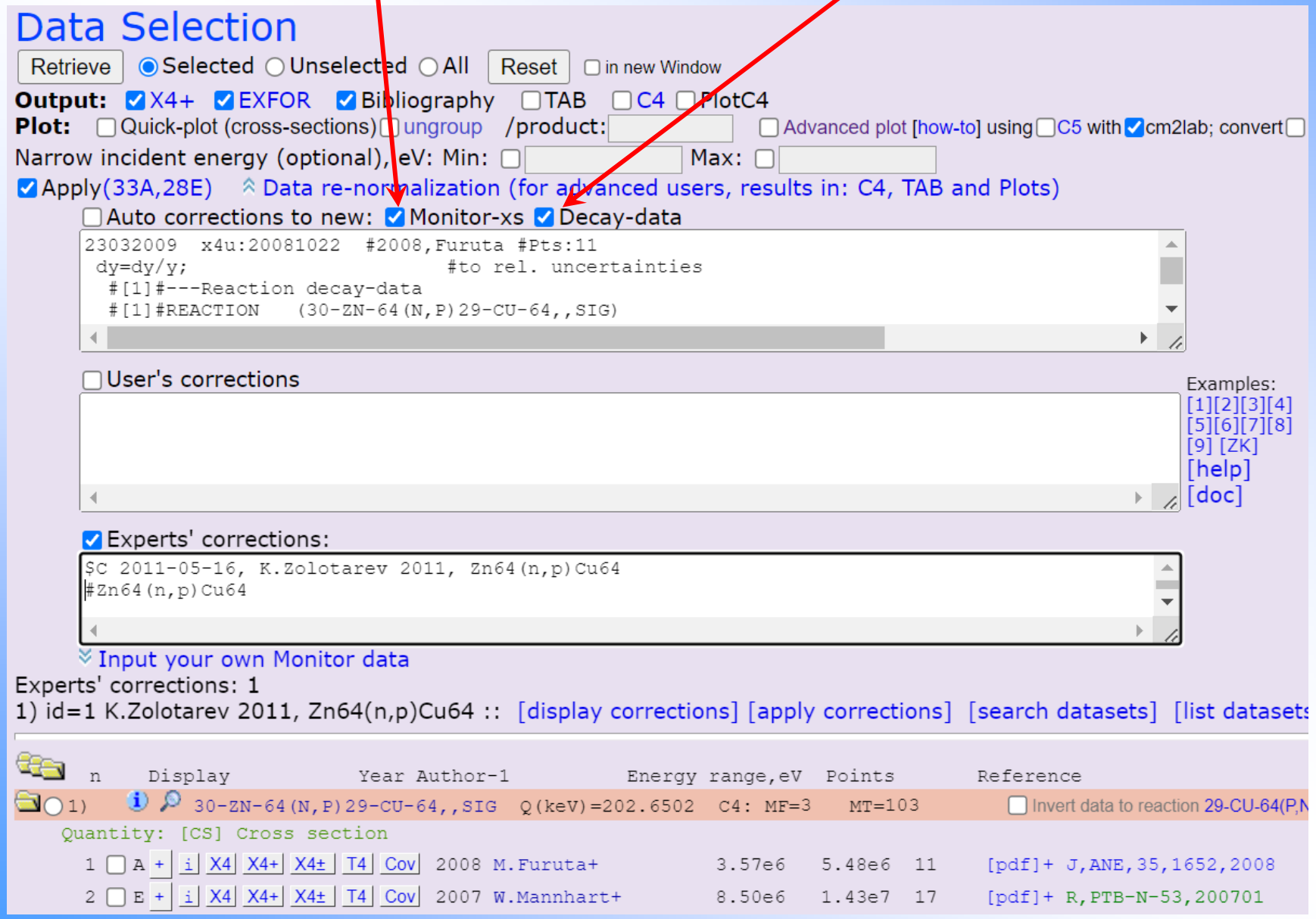
Quantity: [DAP] Partial differential cross section d/dA



Progress in EXFOR data automatic renormalization system

1. Renormalization of EXFOR data using new Decay data
   - "AR" 511 keV annihilation decay data (intensity)
   - "DR" gamma line intensity
   - EXFOR keywords: DECAY-DATA and DECAY-MON
   - Data renormalized to the current ENSDF data - thanks to M.Verpelli
2. New data types available for automatic renormalization
   - "SIG", "DA", "DE", "DAE", "FY"
3. Implementation for whole EXFOR database
   - Now automatic renormalization includes 3 types of flagged corrections: MONITOR [0], DECAY-DATA [1], DECAY-MON [2]
   - Datasets with automatic corrections: 17,025 (9.4% of total 181,398)
4. Renormalized C5 and C5M
   - x4toc5 extended by option for automatic renormalization (-ren:mon,decay)
5. Usage in Web EXFOR Web retrieval system
   - Check-box for automatic renormalization for "Monitor-xs" and "Decay-data"

New flag: automatic renormalization by new (a) Monitor-xs and (b) Decay-data



Automatic vs. expert's correction

```
$A 2021-09-21 10:01:17, x4auto, V.Zerkin
13597002  x4u:19950217  #1995,Ghorai #Pts:4
 #[0]#---Monitor xs-data
 #[0]#Reaction: 30-ZN-64(N,P)29-CU-64,,SIG
 #[0]#Monitor:  13-AL-27(N,A)11-NA-24,,SIG
 m0: [EN,MONIT,MONIT-ERR]; #[0]#old monitor(energy)
 m1: recom$al27na;         #[0]#new monitor(energy)
 dy=dy/y;                  #to rel. uncertainties
 y=y/m0*m1;                #[0]#renormalizing CS
 dy=(dy**2-dm0**2+dm1**2)**0.5; #[0]#replace monitor uncertainties
 #[1]#---Reaction decay-data
 #[1]#REACTION    (30-ZN-64(N,P)29-CU-64,,SIG)
 #[1]#DECAY-DATA (29-CU-64,12.7HR,AR,511.,0.386) #Ix_old=0.386
 a1=0.386/0.352;           #[1]#DECAY-DATA: correction to new 511 keV gamma-yield per decay Cu-64 Ix_new=0.352
 y=y*a1;                   #[1]#Renorm.factor: a1=1.0965909
 #[2]#---Monitor decay-data
 #[2]#MONITOR    (13-AL-27(N,A)11-NA-24,,SIG)
 #[2]#DECAY-MON  (11-NA-24,15.02HR,DG,1369.,1.00) #Im_old=1.0
 a2=0.999936/1.0;          #[2]#DECAY-MON: correction to new 1368.626 keV gamma-yield per decay Na-24 Im_new=0.999936
 y=y*a2;                   #[2]#Renorm.factor: a2=0.999936
 dy=dy*y;                  #to abs. uncertainties
```

x4auto-corr.java, 2021

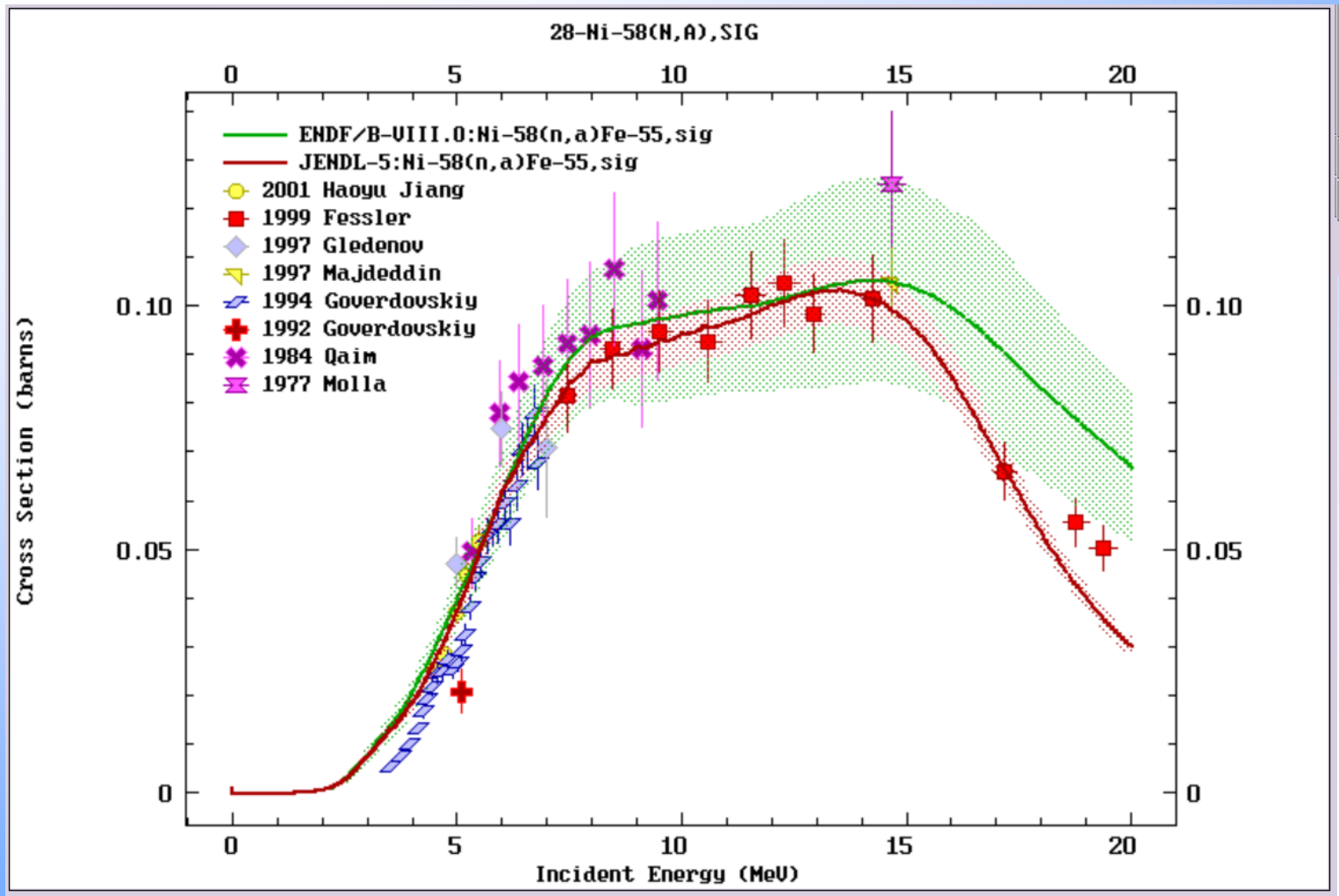
1 2 3

K.Zolotarev,2011

```
$C 2011-05-16, K.Zolotarev 2011, Zn64(n,p)Cu64
13597002              #1994 S.K.Ghorai+
a0=0.386/0.348;       #correction to new  511 keV gamma-yield per decay Cu-64
a1=0.999936/1.0;      #correction to new 1368 keV gamma-yield per decay Na24
a2=0.84351;           #renorm.factor to the preliminary evaluated integral of cs
                      #in the neutron energy interval 14.2-16.2 MeV.
a3=a0*a1*a2;          #total energy independent correction factor
c2=0.0115             #added error in 511keV gamma-yield per decay Cu-64 - 1.15%
c3=0.02               #added error in remorm. factor - 2%
m0: [en, monit];      #old cs for Al27(n,a)Na24 monitor reaction
m2: [en, monit-err];#abs. error in old cs for Al27(n,a) monitor reaction
c0=m2/m0;             #rel. error in old cs for Al27(n,a) monitor reaction
m1: rrdf10 $ al27na;#new cs for Al27(n,a)Na24 monitor reaction
c1=dm1/m1;            #relative error in new cs for Al27(n,a) monitor reaction
dy=dy/y;              #relative error in original cs for Zn64(n,p)Cu64 reaction
fc=m1/m0*a3;          #total correction factor
y=y*fc;               #correction exp. cs
dy=dy^2-c0^2+c1^2+c2^2+c3^2; #determination the quadrature of new total error
dy=dy^0.5*y;          #determination the absolute value of new total error
```

```
ENTRY            13597   20140415
AUTHOR      (S.K.Ghorai,...)
MONITOR     (13-AL-27(N,A)11-NA-24,,SIG)
DECAY-MON (11-NA-24,15.02HR,DG,1369.,1.00)
SUBENT         13597002      950217
REACTION    (30-ZN-64(N,P)29-CU-64,,SIG)
DECAY-DATA (29-CU-64,12.7HR,AR,511.,0.386)
DATA
EN      DATA    DATA-ERR   MONIT    MONIT-ERR
MEV     MB      MB         MB       MB
14.2    180.    10.        122.0    0.65
15.2    152.    9.         108.0    1.96
16.2    116.    6.         90.0     1.75
17.2    122.    8.         72.0     1.41
ENDDATA
```

Web-ZVView plotting: new option Plotly



Log: XY X Y Lin: XY X Y Auto-range: XY X Y Page: >> << Zoom: <> >< Grid: VH 0 V H Pts: Txt Box PL Print

Reset Repaint Legend Authors Info+ PostScript Plotting options: [+] Clipboard: Copy Paste

Shift legend: x= 10 y= 10 Split: 0 1:xy;2:y Marker: Plot data or ratio: 0 0:data; 1:ratio to dataset-1; 2:ratio to 2-nd, etc.

- Select data for plotting [all] [none]
  - 1) NI-58(N,A)FE-55,SIG
  - 2) ENDF/B-VIII.0:Ni-58(n,a)Fe-55,sig
  - 3) JENDL-5:Ni-58(n,a)Fe-55,sig
- 4) Use my data [example][2]
- Use my control file [init] [help]

See: plotted data (368Kb) out: e6 json:+ plotly2

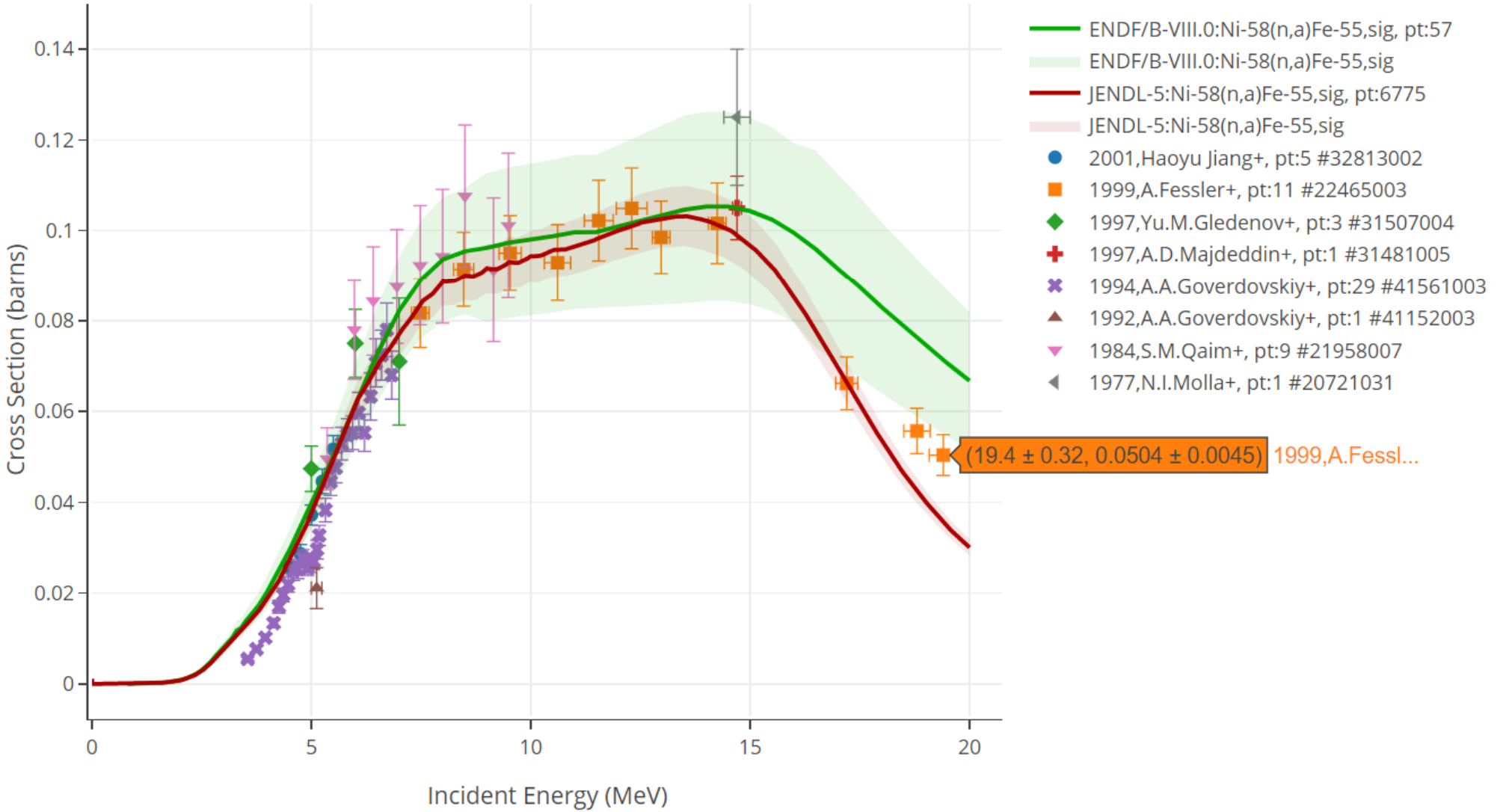
Go to Plotly

Implementation: ZVView → JSON → Plotly

ZVView to Plotly-2.2

ZVView-JSON to Plotly /experimental/
by V.Zerkin, 2021-2022, ver.2022-05-16
JSON file generated by: ZVView, ver. 2021-09-16

Axis x:☐log y:☐log Range x: 1e-11 20.75789 y: -0.007 0.15 Size: 920 550 Repaint



Part II.

EXFOR-NSR PDF database

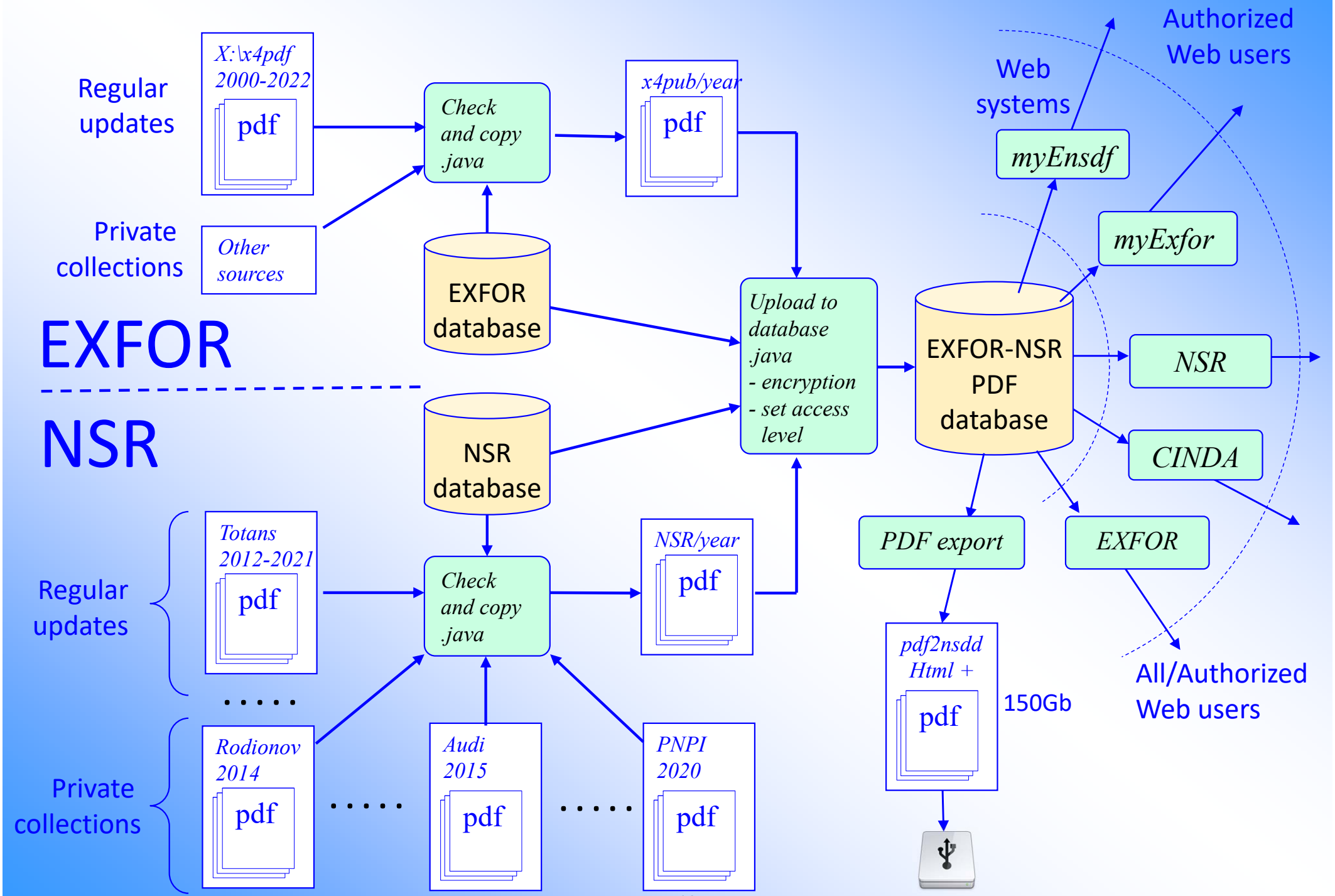
History of EXFOR-NSR PDF database

- Publications: from 1896 to 2022, 124 years
- Content: 223,399 PDF files from 2000 to 2022 (23 years)
- Coverage: EXFOR 26,902 files (76.8%); NSR 188,354 files (79.2%)
- 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 PDF files to 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 retrieval 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 joins 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)
- 2022: 2,639 PDF files are public i.e., ~1.2% from total 222,677 publications
- 2022: paper describing EXFOR-NSR PDF database published in "Journal of Instrumentation"
  DOI: https://doi.org/10.1088/1748-0221/17/03/P03012, NSR: https://www.nndc.bnl.gov/nsr/nsrlink.jsp?2022ZE01
- 2022: discussion and checking with INIS: 1404 preprints JINR (Dubna) //almost ready to open access

NSDD/NRDC Members are welcome to open their Lab reports for public access

Functioning of EXFOR-NSR PDF database



EXFOR-NSR PDF database

Database updated: 2022-06-10. Files: 223399 from 2000-04-19 to 2022-06-09.

-	-	-	-	-	-	1857:1	1858:2	-	-	[1851-1858]:3
-	-	-	-	-	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	1913:4	-	-	-	1917:4	1918:2	1919:3	1920:3	[1911-1920]:19
1921:5	1922:4	1923:3	1924:5	1925:2	1926:1	1927:3	1928:14	1929:8	1930:14	[1921-1930]:59
1931:27	1932:25	1933:30	1934:48	1935:59	1936:58	1937:81	1938:74	1939:127	1940:96	[1931-1940]:625
1941:73	1942:33	1943:85	1944:166	1945:107	1946:178	1947:253	1948:218	1949:381	1950:508	[1941-1950]:2002
1951:576	1952:569	1953:611	1954:711	1955:821	1956:902	1957:963	1958:1307	1959:1194	1960:1618	[1951-1960]:9272
1961:1606	1962:1680	1963:2029	1964:1752	1965:2005	1966:2222	1967:2413	1968:2626	1969:2885	1970:3566	[1961-1970]:22784
1971:4060	1972:4846	1973:5557	1974:4502	1975:3922	1976:3874	1977:3672	1978:3624	1979:3490	1980:3542	[1971-1980]:41089
1981:3354	1982:3487	1983:3577	1984:3527	1985:3117	1986:3201	1987:3497	1988:3366	1989:3373	1990:3301	[1981-1990]:33800
1991:2817	1992:3077	1993:3273	1994:4241	1995:4003	1996:3969	1997:3854	1998:4169	1999:4311	2000:4296	[1991-2000]:38010
2001:4563	2002:4839	2003:4503	2004:4816	2005:5008	2006:4316	2007:4979	2008:3999	2009:3879	2010:3638	[2001-2010]:44540
2011:4027	2012:3693	2013:3487	2014:3663	2015:3098	2016:3579	2017:3603	2018:2706	2019:2499	2020:403	[2011-2020]:30758
2021:304	2022:95									[2021-2022]:399

Total years:124, files:223399

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

Checking mode //contributions to NSR-PDF

PDF coverage

Database	#PDF/#References	#PDF+	Total #PDF+	Todo #PDF
NSR	188,914/238,544 ~79.2%	+1,574 ~0.7% from EXFOR	190,488 ~79.9%	48,056 ~20.1%
EXFOR	27,062/35,266 ~76.7%	+1,994 ~5.7% from NSR	29,056 ~82.4%	6,210 ~17.6%
CINDA	14,337/39,811 ~36%			
IBANDL	651/802 ~81.2%			

PDF files: 223,399 from 2000-04-19 to 2022-06-10

Thank you.