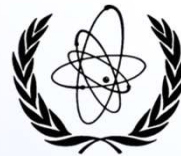


# EXFOR offline distribution

/Archive, X5json, C5: concept and options/

Viktor Zerkin



International Atomic Energy Agency,  
Nuclear Data Section, 1999-2023

# NRDC-2023: Implementation of data versioning: options

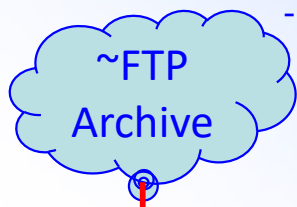
## Option-1



Implemented in 2014  
includes PRELIM

Web  
interface

## Option-2



- Fixed: EXFOR, Dictionaries, Documentation, Interpreted: JSON/XML/C4/C5/C5M X4Pro, [Janis], etc.
- setup DOI

Web  
interface

## Option-3



- Structure:  
123/12345.x4  
1/123/12345.x4  
12/123/12345.x4
- Entry or Subentry
- Timestamp (real)
- Comment (informative)

Web  
interface

n	Acc#	1st	Author	Year	Ref
1)	A1495	[9]	1956 J.P.Schiffer+		
1) [pdf]+ Jour: Physical Review, Vol.104, Study of the Reaction Mechanism for J.P.Schiffer, T.W.Bonner, R.H.Davis, F.					
1	A1495002		Info	X4	X4+ T4 Pt:

EXFOR-Archive			
Name	Last modified	Size	Description
Parent Directory		-	
EXFOR-2005-09-14/	2023-03-28 09:42	-	
EXFOR-2023-03-15/	2023-03-30 08:36	-	
EXFOR-2023-04-29/	2023-05-03 16:48	-	
LICENSE.TXT	2023-03-08 15:27	516	
README.TXT	2023-03-08 15:26	2.4K	

## EXFOR Updates and Archives

ENTRY: A1495

#	Entry	Entry-N2	nsub:lines:data
(1)	A1495	20140226	7:990:834
(2)	A1495	20120410	11:1440:1214
(3)	A1495	20031013	11:1434:1214
Archival data			
(4)	A1495	20031013	11:1434:1214
(5)	A1495	19990324	11:1431:1214
(6)	A1495	970822	11:1433:1214
(7)	A1495	20031013	11:1434:1214
(8)	A1495	970822	11:1433:1214
(9)	A1495	19990324	11:1431:1214

Parent Directory		-	
EXFOR-NRDC/	2023-04-29 16:35	-	
EXFOR-x4/	2023-05-02 16:40	-	
EXFOR-x5json/	2023-05-03 08:02	-	
EXFOR-xc4/	2023-05-03 08:06	-	
EXFOR-xc5/	2023-05-03 16:40	-	
X4Pro/	2023-05-04 08:25	-	

Parent Directory		-	
commit2git.sh	2023-03-08 00:00	2.8M	
EXFOR-20230429-x4.tto.txt	2023-05-02 15:34	5.0M	
EXFOR-20230429-x4.zip	2023-05-02 15:38	214M	
EXFOR-Entries.csv	2023-03-08 00:00	5.4M	
EXFOR-Entries.js	2023-03-08 00:00	7.6M	
EXFOR-Entries.json	2023-03-08 00:00	7.6M	

# Versions from EXFOR-Relational database Arvhive

## EXFOR Updates and Archives

SUBENT: A1495004

#	File-ID	Upd	Comment
(1)	<input checked="" type="checkbox"/> TRANS-A078	232	Official TRANS file
(2)	<input checked="" type="checkbox"/> Master-0		Initial Common EXFOR Master file, 2005
(3)	<input checked="" type="checkbox"/> TRANS-A057		TRANS file before merging (NDS,VMS)
(4)	<input checked="" type="checkbox"/> TRANS-A009		TRANS file before merging (NDS,VMS)
(5)	<input checked="" type="checkbox"/> TRANS-A041		TRANS file before merging (NDS,VMS)
(6)	<input checked="" type="checkbox"/> BNL2005		Merge-project, NNDC-BNL, 2005-03-15
(7)	<input checked="" type="checkbox"/> RU2002		Merge-project, F.Chukreev, CAJaD, Area:A, 2002-06-07
(8)	<input checked="" type="checkbox"/> CD2001		IAEA-NDS, CD-ROM, 2001.01.09

Compare only selected items [\[here\]](#)

SUBENT: A1495004

TRANS-A078			
ENTRY	A1495	20120410	
SUBENT	C A1495001	20120410	
BIB	10	16	
TITLE	Study of the reaction mechanism for (He3,P) reactions with Li-6,B-10 and C-13		
AUTHOR	(J.P.Schiffer,T.W.Bonner,R.H.Davis,F.W.Prosser Jr)		
INSTITUTE	(IUSARIC)		
REFERENCE	(J,PR,104,1064,1956)		
FACILITY	(VDG,IUSARIC)		
SAMPLE	Target materials were evaporated on 2-mil foil backing, thick enough to stop the He-3 beam yet thin compared to the range of the proton groups studied		
METHOD	(PHD)		
DETECTOR	(SCIN) Thallium-activated CsI crystals mounted on DuMont 6291 photomultiplier tubes.		
INC-SOURCE	*EN-RSL*.The pulse-height resolution of the detectors		
HISTORY	(19800811C) Compilation produced by Arzamas RFNC-VNIIEF (20120410A).Corrections were made according Naohiko comments and new exfor rules-SB		
ENDBIB	16	0	
COMMON	1	3	
EN-RSL			
PER-CENT			
PER-CENT	4.		
ENDCOMMON	3	0	
ENDSUBENT	23	0	

SUBENT	C A1495004	20120410	
BIB	4	5	
REACTION	(3-LI-6(HE3,P)4-BE-8,PAR,DA,,REL)		
ERR-ANALYS	(ANG-ERR-D) Digitizing error (ERR-DIG) Digitizing error (CURVE) Fig 2 of J,PR,104,1064,1956		
EN-SEC	(E-LVL,4-BE-8)		
ENDBIB	5	0	
COMMON	1	3	
E-LVL			
MEV			
MEV	1	10 13	1 323 3 643 0 1457

Master-0			
ENTRY	A1495	20031013	20040322
SUBENT	A1495001	20031013	20040322
BIB	10	15	
TITLE	Study of the reaction mechanism for (He3,P) reactions with Li-6,B-10 and C-13		
AUTHOR	(J.P.Schiffer,T.W.Bonner,R.H.Davis,F.W.Prosser, Jr.)		
INSTITUTE	(IUSARIC)		
REFERENCE	(J,PR,104,1064,195611)		
FACILITY	(VDG)		
SAMPLE	Target materials were evaporated on 2-mil foil backing, thick enough to stop the He-3 beam yet thin compared to the range of the proton groups studied		
METHOD	(PHD)		
DETECTOR	(SCIN) Thallium-activated CsI crystals mounted on DuMont 6291 photomultiplier tubes.		
ERR-ANALYS	(DATA-ERR2)The pulse-height resolution of the detectors		
HISTORY	(19800811C) Compilation produced by Arzamas RFNC-VNIIEF (20031013U) Last checking has been done.		
ENDBIB	15		
COMMON	1	3	
DATA-ERR2			
PER-CENT			
PER-CENT	4.		
ENDCOMMON	3		
ENDSUBENT	22		

SUBENT	A1495004	20031013	20040322
BIB	3	4	
REACTION	(3-LI-6(HE3,P)4-BE-8,,DA,,REL)		
ERR-ANALYS	(ANG-ERR) Digitizing error (DATA-ERR) Digitizing error (CURVE) Fig 2		
STATUS	(CURVE) Fig 2		
ENDBIB	4		
NOCOMMON			
DATA	5	95	
EN	ANG-CM	ANG-ERR	DATA-CM DATA-ERR
MEV	ADEG	ADEG	ARB-UNITS ARB-UNITS
MEV	1	10 13	1 323 3 643 0 1457

TRANS-A057			
ENTRY	A1495	20031013	
SUBENT	A1495001	20031013	
BIB	10	15	
TITLE	Study of the reaction mechanism for (He3,P) reactions with Li-6,B-10 and C-13		
AUTHOR	(J.P.Schiffer,T.W.Bonner,R.H.Davis,F.W.Prosser, Jr.)		
INSTITUTE	(IUSARIC)		
REFERENCE	(J,PR,104,1064,195611)		
FACILITY	(VDG)		
SAMPLE	Target materials were evaporated on 2-mil foil backing, thick enough to stop the He-3 beam yet thin compared to the range of the proton groups studied		
METHOD	(PHD)		
DETECTOR	(SCIN) Thallium-activated CsI crystals mounted on DuMont 6291 photomultiplier tubes.		
ERR-ANALYS	(DATA-ERR2)The pulse-height resolution of the detecto		
HISTORY	(19800811C) Compilation produced by Arzamas RFNC-VNII (20031013U) Last checking has been done.		
ENDBIB	15		
COMMON	1	3	
DATA-ERR2			
PER-CENT			
PER-CENT	4.		
ENDCOMMON	3		
ENDSUBENT	22		

SUBENT	A1495004	20031013	
BIB	3	4	
REACTION	(3-LI-6(HE3,P)4-BE-8,,DA,,REL)		
ERR-ANALYS	(ANG-ERR) Digitizing error (DATA-ERR) Digitizing error (CURVE) Fig 2		
STATUS	(CURVE) Fig 2		
ENDBIB	4		
NOCOMMON			
DATA	5	95	
EN	ANG-CM	ANG-ERR	DATA-CM DATA-ERR
MEV	ADEG	ADEG	ARB-UNITS ARB-UNITS
MEV	1	10 13	1 323 3 643 0 1457

TRANS Files before 2005

Multiple comparison

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-insensitive

# Git and GitHub

## 1. Problems

- 1) Preserve timestamp of the files when “commit”
- 2) Restore timestamps of the files after “clone”
- 3) GitHub: limitation of 100MiB /unpleasant/






## 2. Purposes (?)

- 1) materials to make EXFOR quality better
- 2) preserve data (alternative storage)
- 3) provide additional service (to some users)
- 4) satisfy formal/organizational requirements/rules
- 5) oriented to needs compilers/managers/advanced users

## 3. Considered options





- 1) What to be stored
  1. EXFOR Archive/Backup (by ENTRY)
  2. X5json
  3. C5 (Entries/Datasets)
- 2) Dir/Subdir structure 1/2/3 levels
- 3) Meaningful files/folders/commits
- 4) Listing CSV, JSON
- 5) Preserve timestamps of Entry (based on N2 or Trans-N2 or Backup-date)
- 6) Examples (Python) and restructuring (Linux-shell)
  1. search/retrieve/plot
  2. create Master/Backup file (retroactively)
  3. get versions of data (retroactively)


# Data structures and views



 vzerkin Update README.md 2024-05-15,13:26	0b5b775 · now	 46,388 Commits
 EXFOR	File EXFOR/EXFOR.entry.csv committed 2024-05-07,13:36:41	last week
 LICENSE.TXT	initial commit	8 months ago
 README.md	Update README.md 2024-05-15,13:26	now

Hyper-Links

Information propagated: last comment, timestamp

 1	NNDC:1510 14255:20240505 (20240505A) On. Major alteration in 014.	2 weeks ago
 2	NEA-DB:2318 23607:20231208 (20231208C) Compiled by A.Kimura.	5 months ago
 3	CNDC:3211 32618:20240216 (20240216A) On. SAMPLE, INC-SOURCE, METHOD...	3 months ago
 4	CJD:4214 41758:20230828 (20230828C) M.M.	9 months ago

 100	NNDC:1511 10034:20240403 (20240330A) OS. ERR-ANALYS updated in subs.2,3,	last month
 101	NNDC:1507 10100:20230707 (20230523A) OS. Units in sub.4 corrected	10 months ago
 102	NNDC:1508 10264:20230912 (20230817A) OS. REACTIONs corrected, minor B...	8 months ago

 10403.x4	NNDC 10403:20030207 (20030207A) Updated to new date formats, lower case.	22 years ago
 10404.x4	NNDC:1444 10404:20181102 (20181014A) OS. 2nd reference corrected. REA...	6 years ago

# Repositories on GitHub

## 1. EXFOR-Archive, EXFOR-Backup *full EXFOR*

- all versions: Entries 2005-2024
- CSV index of Entries
- script producing complete EXFOR file at any time in history since 2005-06-16

## 2. EXFOR-X5json *full EXFOR translated to X5*

- CSV and JSON index of Entries and Datasets
- 3 Python codes for data search, retrieval and plotting original and automatically renormalized data

## 3. EXFOR-C5 *full EXFOR translated to C5*

- CSV and JSON index of Entries and Datasets
- 4 Python codes for indexing, search, retrieval and plotting original and automatically renormalized data
- bash script producing single C5 file, compatible with XC4 distribution 2007-2022
- versions for downloading:
  - C5v0 - converted incident energy from C.M. to Lab.  
- converted Rutherford-Ratio to B/SR (MF4)
  - C5v1 - options from EXFOR-C5v0 +  
- datasets with unknown MT are included (MF>0, MT=0)
  - C5v2 - options from EXFOR-C5v0 +  
- angle and data: C.M. to Lab. (for MT4)  
- replaced Q-Value by E-Level  
- reset MT51, MT601, by MT+iLevel (for partial reactions)  
- sort data: CS(EN), DA(EN:AN), DE(EN,E2), DAE(EN:AN:E2)
  - C5v3 - options from EXFOR-C5v2 +  
- auto-renormalized using modern monitor CS data
  - C5v4 - options from EXFOR-C5v3 +  
- auto-renormalized using modern Decay-data
  - C5v5 - options from EXFOR-C5v4 +  
- generated correlation matrix (DOI:10.1051/epjconf/20122700009)

# Commit-comments on files/folders

EXFOR-Archive 2005-2024: <https://github.com/vzerkin/EXFOR-Archive>

10403.x4	NNDC 10403:20030207 (20030207A) Updated to new date formats, lower case.	22 years ago
10404.x4	NNDC:1444 10404:20181102 (20181014A) OS. 2nd reference corrected. REA...	6 years ago

Data Center:TRANS ENTRY:N2 Latest HISTORY: Code + FreeText

[2024-05-15] – [2003-02-07] => “22 years ago”

[2024-05-15] – [2005-06-16] => “19 years ago”

EXFOR-Backup 2005-2024: <https://github.com/vzerkin/EXFOR-Backup>

10403.x4	2005-06-16 NNDC 10403:20030207 (20030207A) Updated to new date format...	19 years ago
10404.x4	2019-01-10 NNDC:1444 10404:20181102 (20181014A) OS. 2nd reference cor...	6 years ago

Date of Backup Data Center:TRANS ENTRY:N2 Latest HISTORY: Code + FreeText

# Retrievals/plotting codes and reconstructing scripts

## EXFOR-Backup:

go2date.sh go to selected date: rollback Git state  
list\_exfor\_updates.sh list: EXFOR updates (backup files) according to current Git state  
merge\_entries.sh merge Entries to a single EXFOR file, produce Master/Backup file, can store selected Areas  
get\_entry.sh get EXFOR Entry versions as files with timestamps in the file names  
setdates2clone.sh set timestamp to files cloned from GitHub

## EXFOR-C5:

create1c5file.sh generate single full EXFOR in C5 format compatible with XC4 (2007-2022) used in WPEC-SG30, Empire, Talys  
c5data1.py find datasets by reaction, load C5-file, extract data, plot by Plotly  
c5data2.py find datasets by reaction, select renormalized datasets, load C5-dataset, extract data, recalculate original values, plot by Plotly

## EXFOR-X5json:

x5index2entries.py scan folders recursively, load x5.json, produce Entry-index in JSON and CSV  
x5index2entries.py scan folders recursively, load x5.json, produce Datasets-index in JSON and CSV  
x5data1.py find datasets by reaction, extract data in computational form  
x5data2.py find datasets by reaction, load X5-json, extract computational data, plot by Plotly  
x5data3.py find datasets by reaction, load X5-json, extract data, automatically renormalize cross sections, plot by Plotly  
x5data2pandas.py load X5-json, for each Subent: extract COMMON and DATA to pandas.DataFrame



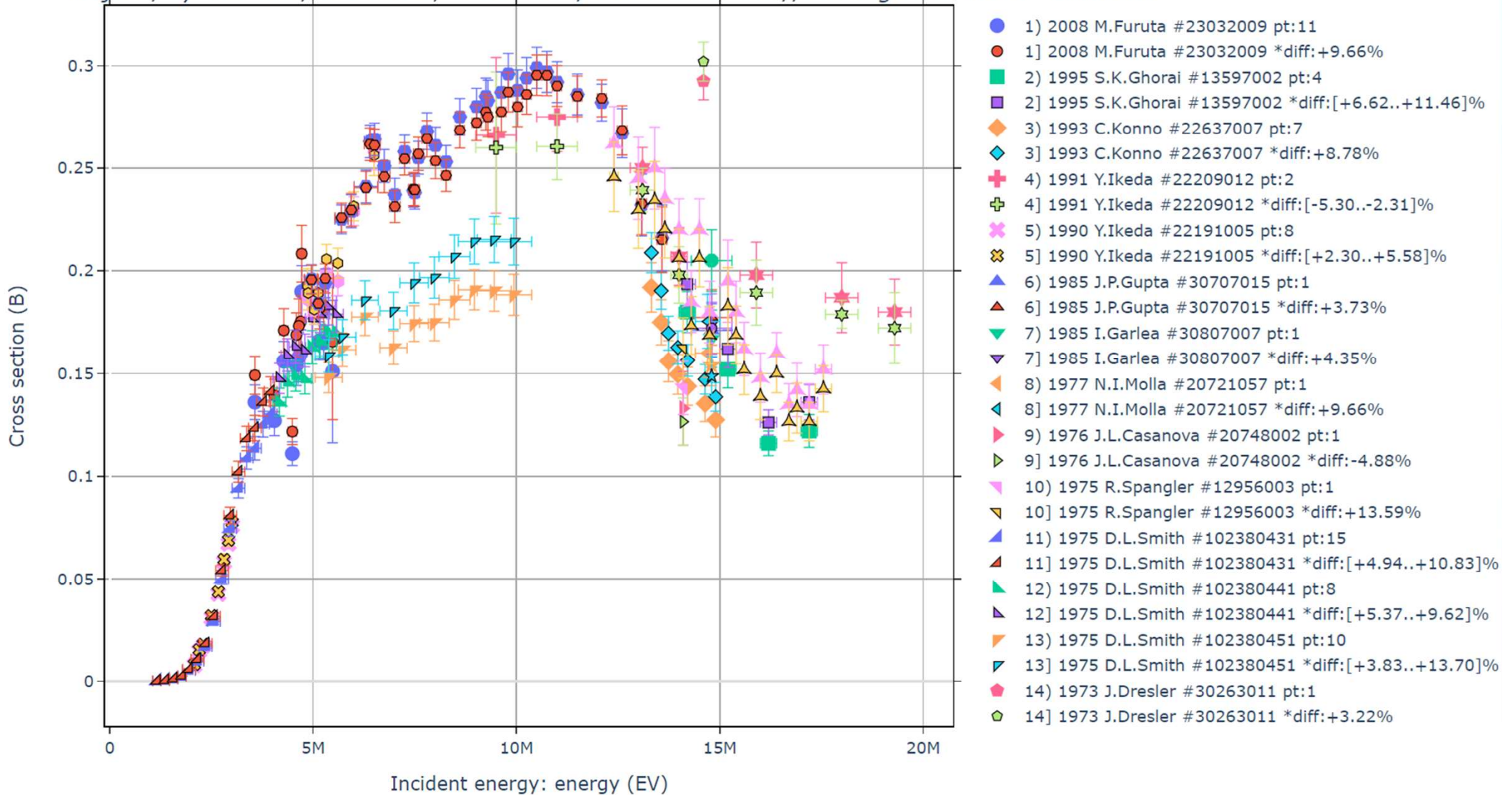
# EXFOR-X5json: Python code example

Retrieve, automatically renormalize and plot cross section data (where difference was >2%)

EXFOR-X5json. Cross sections  $\sigma(E)$ : 30-ZN-64(N,P)29-CU-64,,SIG #Datasets:20/54

Original data vs. automatically renormalized data (diff>2.0%)

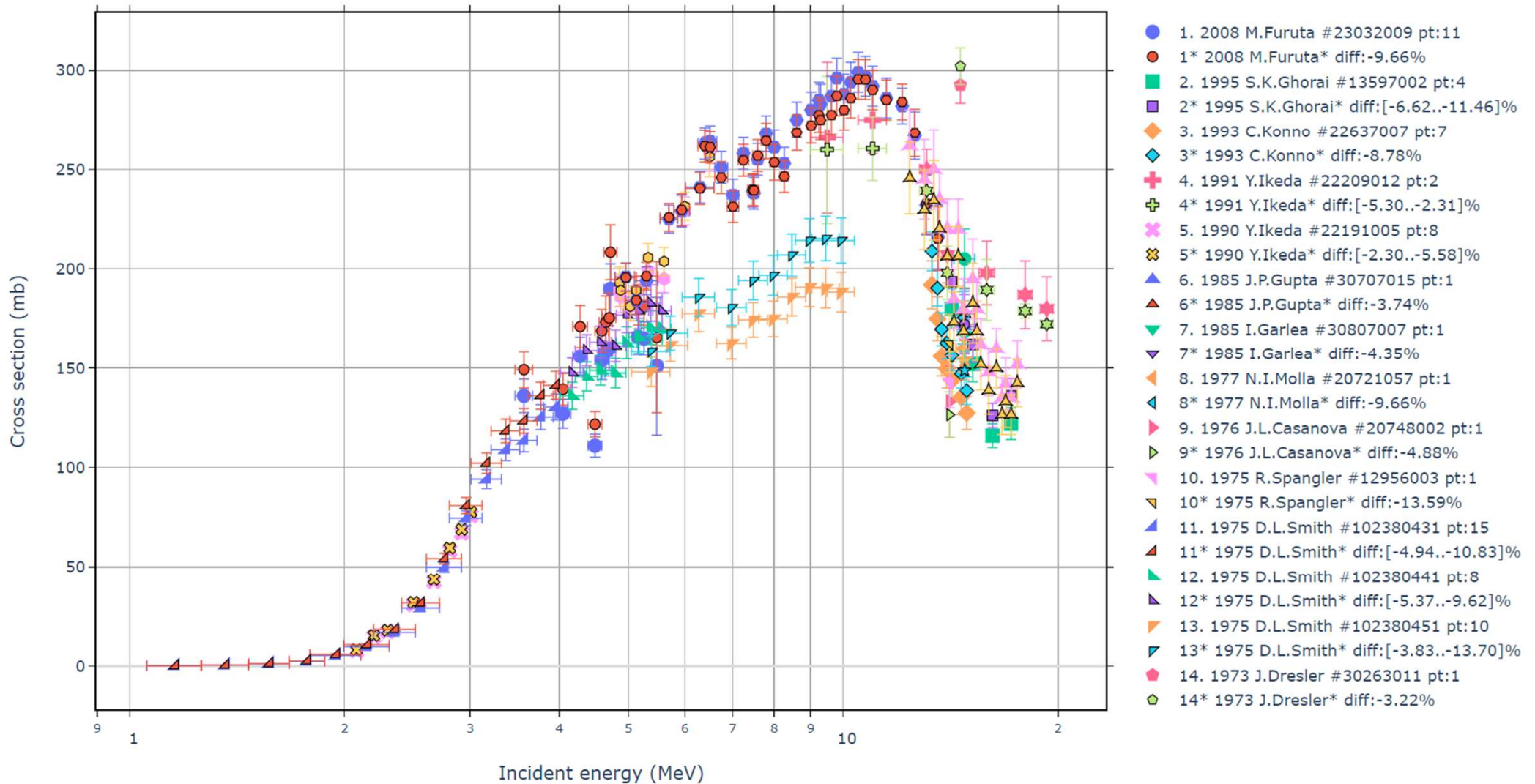
X5json, by V.Zerkin, IAEA-NDS, 2021-2024, ver.2024-04-20 //running:2024-05-07 17:03:16



# EXFOR-C5v4: Python code example

Retrieve, automatically renormalize and plot cross section data (where difference was >2%)

Cross sections  $\sigma(E)$ : 30-ZN-64(N,P)29-CU-64,,SIG -- original vs. automatically renormalized data (diff>2.0%) #Datasets:20/52/54  
EXFOR-C5, by V.Zerkin, IAEA-NDS, 2010-2024, ver.2024-04-18 //running:2024-05-06 08:08:29



# Concluding remarks

1. EXFOR-Archive vs. EXFOR-Backup: define which one to be used
2. Testing within NRDC?
3. Include TRANS files before 2005? (or Web-DB is enough?)
4. NRDC GitHub?

**Thank you.**