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Installation of Pyhton3 for ForEX

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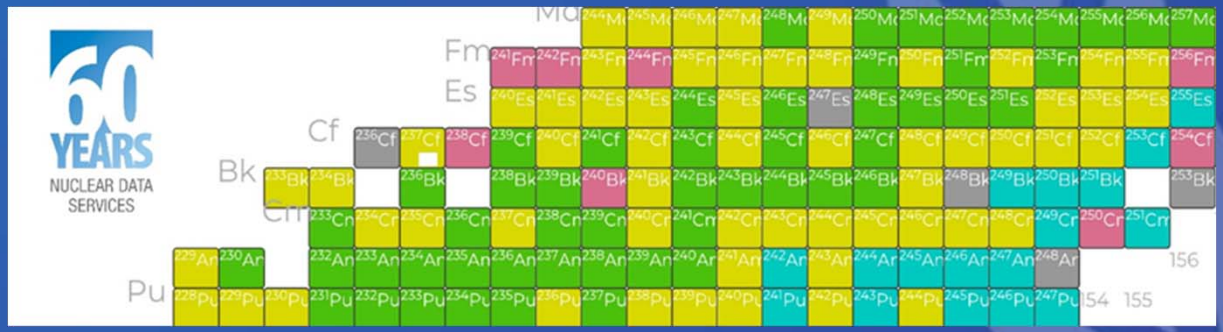

Installation of Python3 and pyspellchecker

Instruction for Windows users:

- **Python 3 (https://www.python.org/downloads/windows/)**
  - Ver. **3.13.0**: Stable release for Windows 8, 10, and 11
  - Ver. **3.8.20**: Stable release for Windows Vista and 7

- **pyspellchecker (for SPELLS)**

```
C: py -m pip install pyspellchecker

Defaulting to user installation because normal site-packages is not
writeable
Collecting pyspellchecker
  Downloading pyspellchecker-0.8.1-py3-none-any.whl.metadata (9.4 kB)
Downloading pyspellchecker-0.8.1-py3-none-any.whl (6.8 MB)
   ---------------------------------------- 6.8/6.8 MB 919.6 kB/s eta
0:00:00
Installing collected packages: pyspellchecker
Successfully installed pyspellchecker-0.8.1
```

(On Linux, use “pip” instead of “py –m”.)

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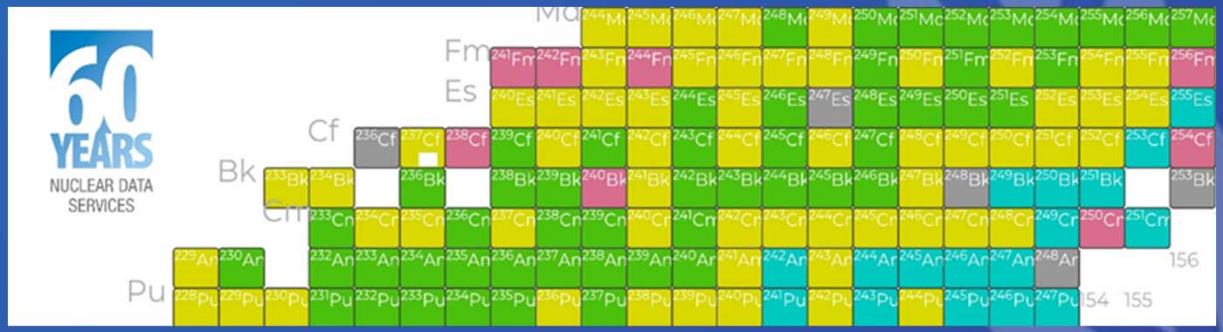
ForEX: Utility Codes for EXFOR

N. Otuka

Nuclear Data Section, IAEA, Vienna, Austria



EXFOR command line processing codes

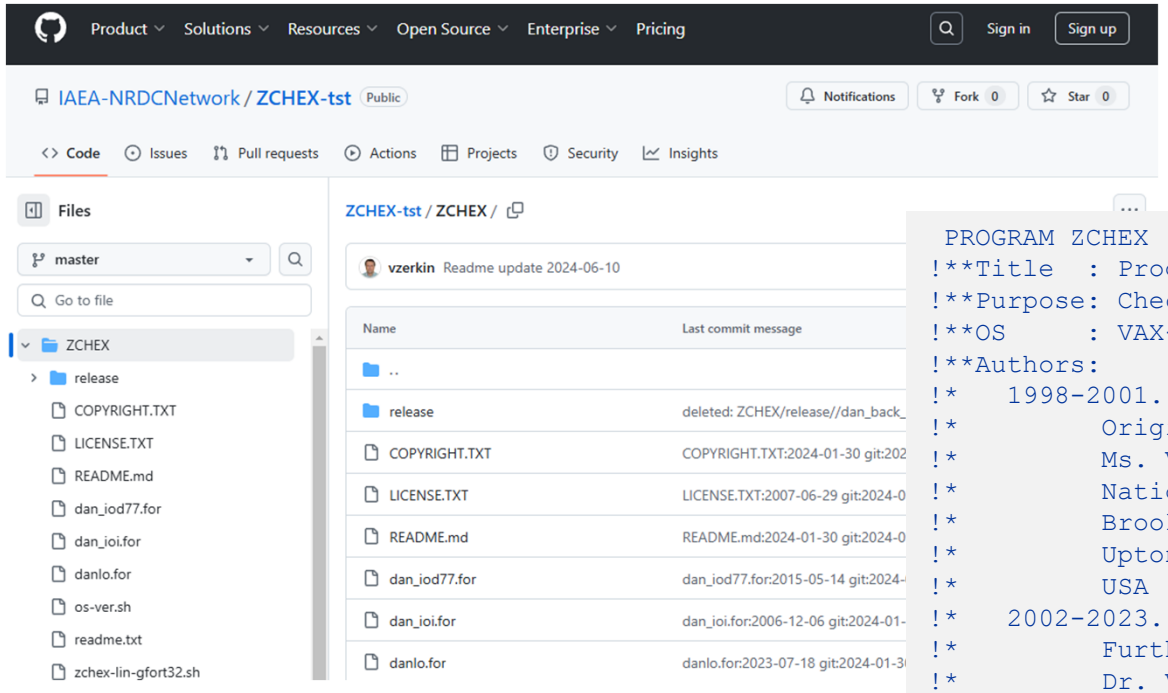
- **NNDC origin**
  - **ZCHEX**: Checking of an EXFOR file against format and physics rules
  - **ZORDER**: Assignment record identification (col.67-71) and (N1,N2) of system identifiers (e.g., BIB)
  - **NUC_DICT**: Production of Dict. 227 (Nuclides) from Nuclear Wallet Cards
  - **DAN2X4**: Production of TRANS dictionary from Archive dictionary
  - **MAKE_BACK**: Production of Backup dictionary from Archive dictionary
  - **DANLO**: Production of ZVV dictionary from Backup dictionary
  - **XTRACT**: Indexing of EXFOR file

- **NEA DB origin (Java)**
  - **JANIS Trans Checker:** Checking of an EXFOR file against format rules

Anything else?

NNDC origin Fortran codes on GitHub

Viktor released Fortran sources of ZCHEX, ZORDER and DANLO on GitHub (https://github.com/IAEA-NRDCNetwork/ZCHEX-tst/tree/master/ZCHEX)



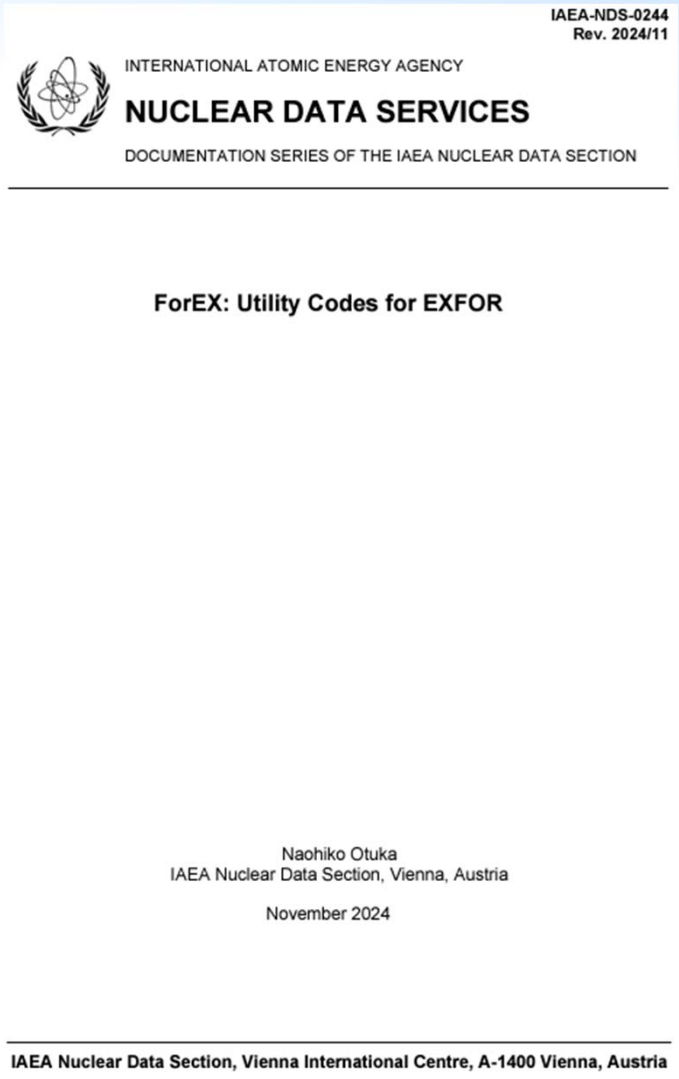

```
 PROGRAM ZCHEX
!**Title  : Program ZCHEX
!**Purpose: Checking EXFOR file: format and content
!**OS     : VAX-VMS, Windows, Linux, MacOS
!**Authors:
!*   1998-2001. DEC-Fortran
!*         Originally written on VMS by:
!*         Ms. Victoria McLane
!*         National Nuclear Data Center
!*         Brookhaven National Laboratory
!*         Upton, NY 11973
!*         USA
!*   2002-2023. MS-Windows, Linux, MacOS
!*         Further development by:
!*         Dr. Viktor Zerkin, v.zerkin@iaea.org
!*         Nuclear Data Section
!*         International Atomic Energy Agency
!*         A-1400 Vienna
!*         Austria
!_____________________________________________________________________
_____________
!
!**Updates since 2002
!*         2023-12-27   V.Zerkin
…
```

Capabilities for future

- Impossible for me to update the Fortran codes (due to my limited expertise of Fortran…)
- Future revision of formats, dictionaries and coding rules should not be constrained by the existing tools.
- Short-term plan
  - Checking code (**ZCHEX**):
    Keep it! (Not trivial to develop an equivalent one covering all check items)
  - Dictionary maintenance codes (**NUC_DICT, DAN2X4, MAKE_BACK**):
    Develop similar ones from scratch.
  - Rewrite and release some of my “private” small Perl scripts (e.g., for EXFOR Master File production)

ForEX: Utility Codes for EXFOR

- Collection of Python3 scripts
- Distributed from the NRDC Software website
- Contains 15 tools (scripts)
- For addition to the NRDC GitHub?


IAEA-NDS-0244
Rev. 2024/11

INTERNATIONAL ATOMIC ENERGY AGENCY

NUCLEAR DATA SERVICES

DOCUMENTATION SERIES OF THE IAEA NUCLEAR DATA SECTION

ForEX: Utility Codes for EXFOR

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November 2024

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Manual (IAEA-NDS-0244)

ForEX family

- DIC227: Produce Archive Dictionary 227 from a NUBASE file.
- DICA2J: Convert Archive dictionaries to a JSON Dictionary.
- DICDIS: Prepare Archive and Backup dictionaries for distribution.
- DICJ2A: Convert a JSON Dictionary to Archive dictionaries.
- DICJ2T: Convert a JSON Dictionary to a Transmission dictionary.
- DIRINI: Split an EXFOR library tape into EXFOR entry files.
- DIRUPD: Update the EXFOR entry files with an EXFOR transmission tape.
- EXTMUL: Extraction of a dataset from a multiple reaction formalism subentry.
- J4TOX4: Convert a J4 file to an EXFOR file.
- MAKCOV: Produce a data table and covariance matrix from a J4 file.
- MAKLIB: Merge EXFOR entry files into a single library tape.
- POIPOI: Remove pointers from a J4 file.
- SEQADD: Add record identification to an EXFOR file.
- SPELLS: Check English spell in free text in EXFOR format.
- X4TOJ4: Convert an EXFOR file to a J4 file.

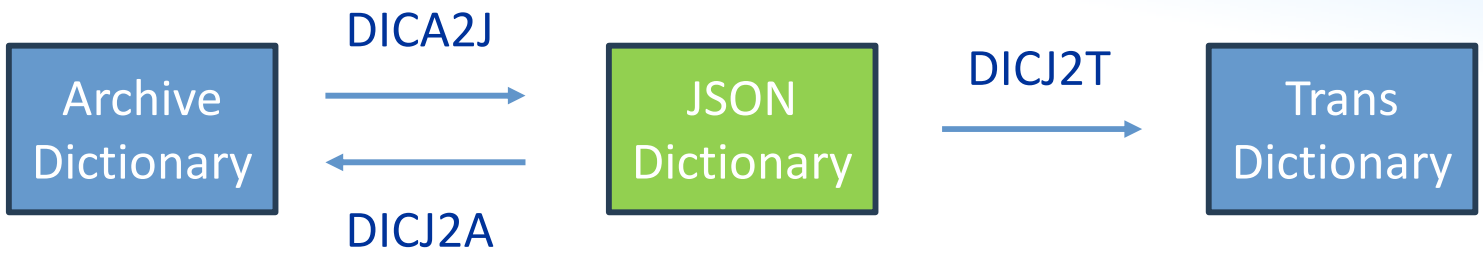
(black for dictionary managers, green for EXFOR library managers,
red for EXFOR compilers, blue for EXFOR processing, purple for EXFOR users)

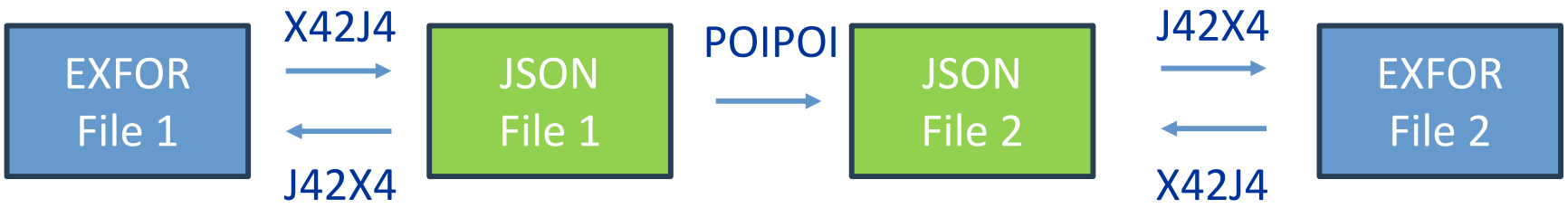
NNDC origin tools and ForEX tools

NNDC	ForEX
ZCHEX	N/A
ZORDER	SEQADD
NUC_DICT	DIC227
DAN2X4	DICJ2T
MAKE_BACK	DICDIS
DANLO	N/A
XTRACT	N/A

N/A: Not available

JSON as Intermediate File in ForEX





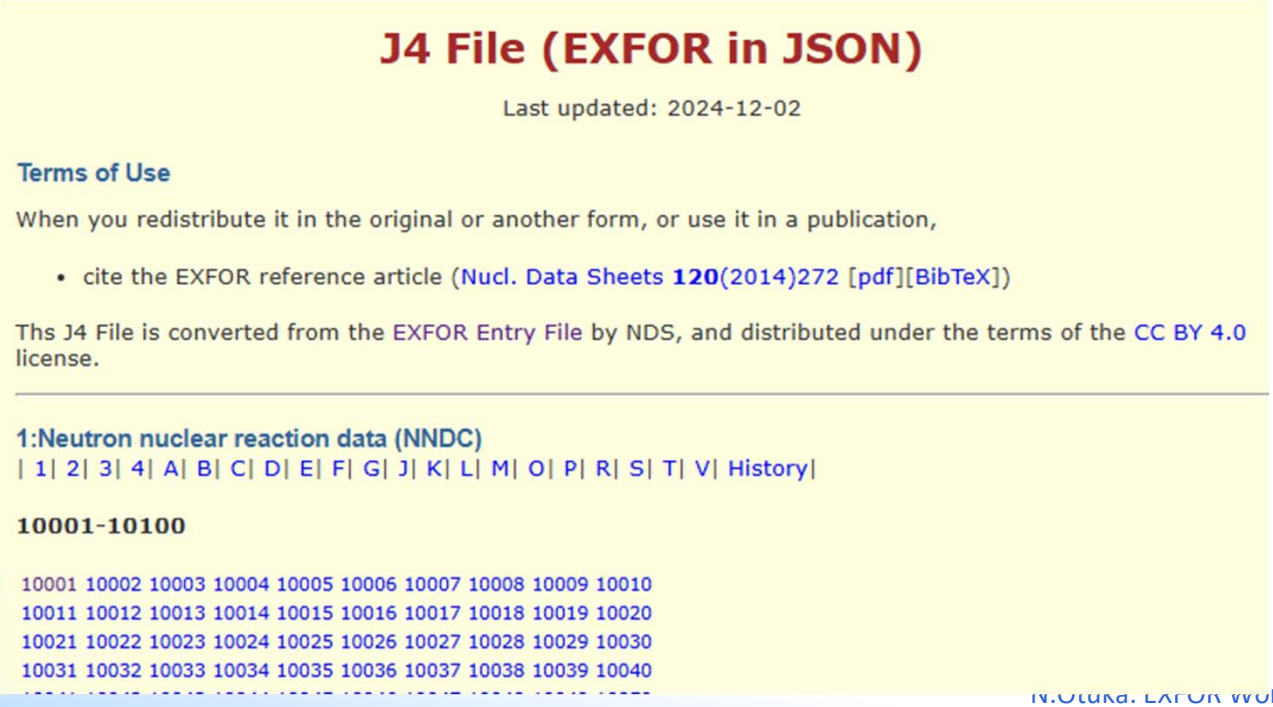
(POIPOI is for extraction of a dataset from a subentry with the multiple reaction formalism.)

EXFOR in JSON (J4) of full EXFOR library

J4 files of all EXFOR entries are seen on
https://nds.iaea.org/nrdc/exfor-master/j4/ .
(Regularly updated and currently shared within the network only).

You can reproduce them by processing all EXFOR Entry Files (https://nds.iaea.org/nrdc/exfor-master/entry/) with X4toJ4.

I designed J4 for intermediate files of my EXFOR management tools. I do not know if this is good for dissemination …



J4 File (EXFOR in JSON)

Last updated: 2024-12-02

Terms of Use

When you redistribute it in the original or another form, or use it in a publication,

- cite the EXFOR reference article (Nucl. Data Sheets **120**(2014)272 [pdf][BibTeX])

Ths J4 File is converted from the EXFOR Entry File by NDS, and distributed under the terms of the CC BY 4.0 license.

1:Neutron nuclear reaction data (NNDC)
| 1| 2| 3| 4| A| B| C| D| E| F| G| J| K| L| M| O| P| R| S| T| V| History|

10001-10100

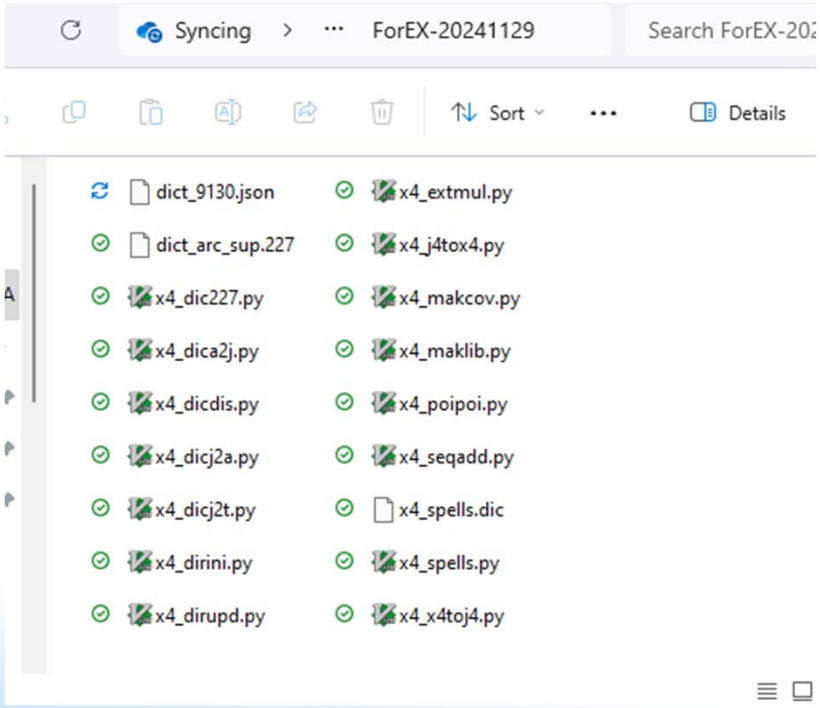
10001 10002 10003 10004 10005 10006 10007 10008 10009 10010
10011 10012 10013 10014 10015 10016 10017 10018 10019 10020
10021 10022 10023 10024 10025 10026 10027 10028 10029 10030
10031 10032 10033 10034 10035 10036 10037 10038 10039 10040

Exercise with ForEX

- Download ForEX
- Test run
- Download EXFOR B0101.003
- Spell checking (SPELL)
- Addition of sequential numbers (SEQADD)
- Removal of pointers (EXTMUL)

Exercise 1: Download ForEX

- Go to NRDC Software website. (https://nds.iaea.org/nrdc/nrdc_sft/)
- Download ForEX-2024-11-29.zip.
- Unzip.



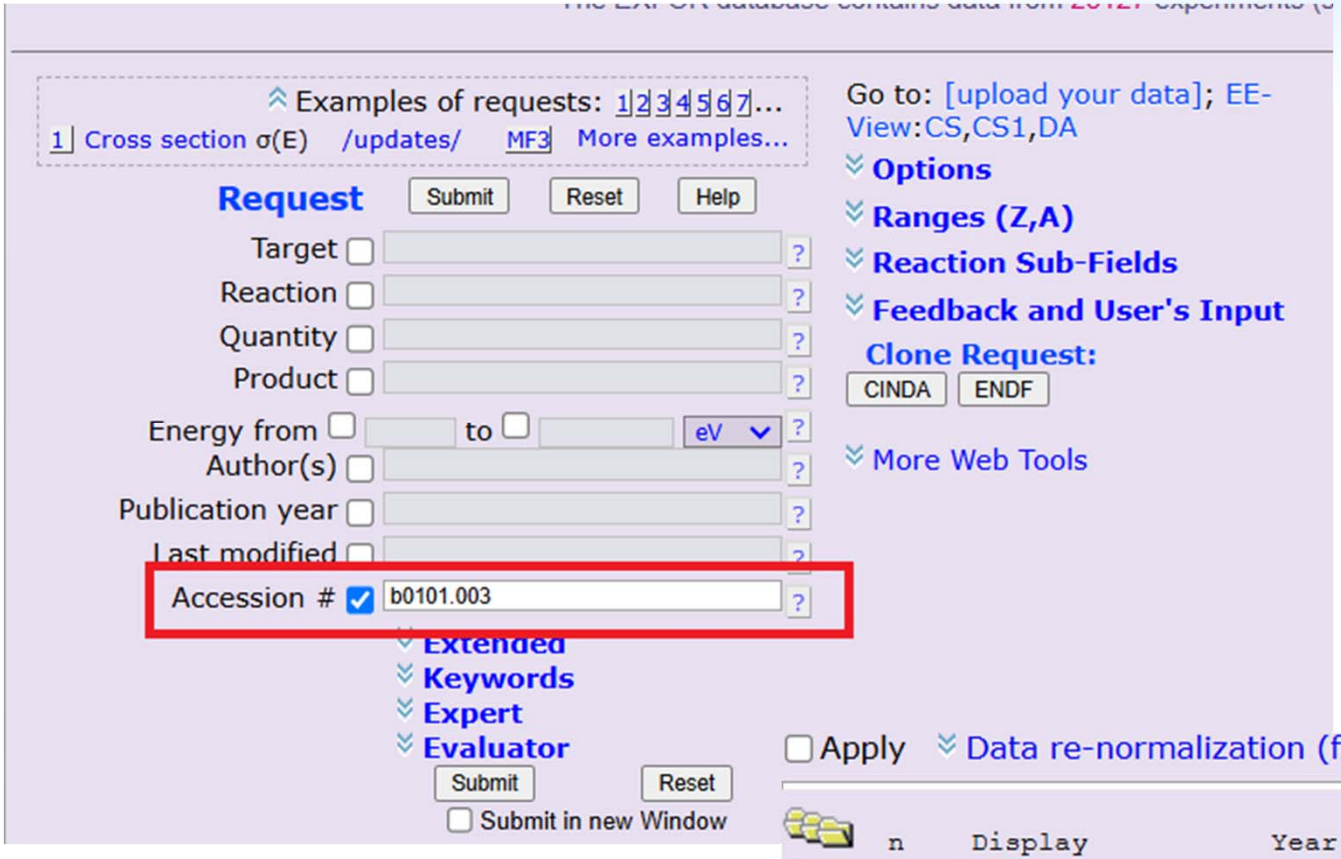
Exercise 2: Test run with SPELLS (Windows)

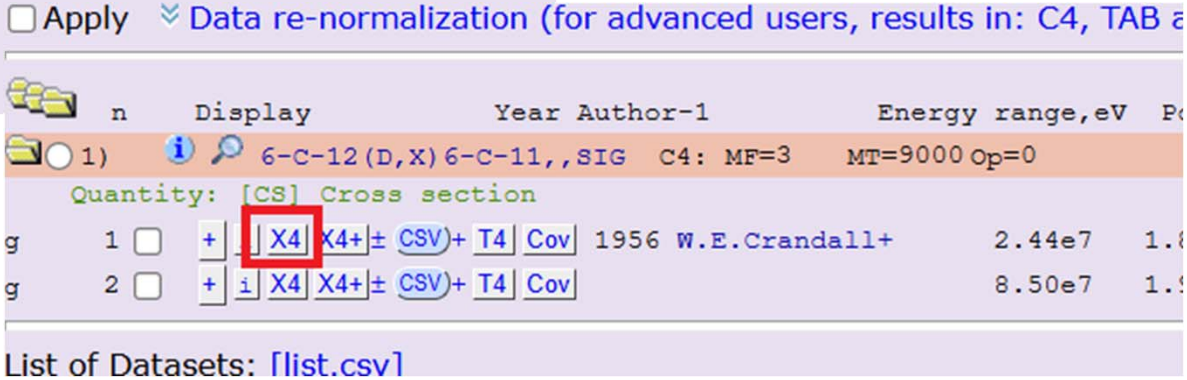
```
c:\> py x4_spells.py

SPELLS (Ver-2024-10-07) run on 01-12-2024
-----------------------------------------
EXFOR file [exfor.txt] ---------------------->
```

(On Linux, use “python3” instead of “py”.)

Exercise 3: Download EXFOR B0101.003





https://nds.iaea.org/exfor/

Save the link target as “b0101003.txt”.

File - b0101003.txt

```
SUBENT         B0101003   20220622   20230117   20230116        B034
BIB                  9         13
REACTION  1(6-C-12(D,X)6-C-11,,SIG)
          2(6-C-12(D,X)6-C-11,,SIG)
DECAY-DATA (6-C-11,20.4MIN,B+)
METHOD     (EXTB,STTA,BCINT,EDEG)
ANALYSIS   Normalized to the 190 MeV point from the 4pi-counter da
…
ENDBIB              13
NOCOMMON             0          0
DATA                 6         23
EN          EN-ERR     DATA      1DATA-ERR  1DATA      2FLAG
MEV         MEV        MB         MB         MB         NO-DIM
  24.4       15.8                             0.5       1.
  34.2       12.8                             2.7       1.
  42.4       10.8                            11.3       1.
  49.4        9.8                            17.6       1.
  58.7        7.7                            35.6       1.
  67.7        8.1                            51.4       1.
  76.1        6.4                            57.        1.
  83.7        7.                             61.8       1.
  85.                   56.9        1.8                 1.
 105.                   60.7        1.                  1.
…
 190.                   61.1        0.6
ENDDATA             25
ENDSUBENT           43
ENDENTRY             2
```

- Record identification absent at Col.67-79.
- Two datasets in one subentry (multiple reaction formalism).

Exercise 4: Spell checking by SPELL

```
c:> py x4_spells.py

SPELLS (Ver-2024-10-07) run on 01-12-2024
-----------------------------------------
EXFOR file [exfor.txt] ---------------------> b0101003.txt
Known word dictionary file [x4_spells.dic] -> (Hit return!)
output log file [x4_spells.log] ------------> (Hit return!)
** File 'x4_spells.log' exists and must be overwritten.

Continue? [Y] --> (Hit return!)
           ------------------------------------------------------------------
           SPELLS report 2024-12-01 16:31:24
             - unrecognized words in b0101003.txt
           ------------------------------------------------------------------
TITLE      12C(x,xn)11C and 27Al(x,x2pn)24Na cross sections at
                 ^^
ANALYSIS   Normalized to the 190 MeV point from the 4pi-counter da
                                                                 ^^
FLAG       (1.) bombrarded in 'poor geometry'
                ^^^^^^^^^^
Unrecognized words:
 bombrarded
 da
 xn
SPELLS: Processing terminated normally.
c:\Projects\ForEX>
```

(On Linux, use “python3” instead of “py”.)

Exercise 5: Addition of line numbers by SEQADD

```
c:> py x4_seqadd.py

SEQADD (Ver-2024-10-07) run on 2024-12-01
-----------------------------------------
input file [exfor.txt] -------> b0101003.txt
output file [exfor_ord.txt] --> (Hit return!)
counting ... B0101
writing ... B0101
SEQADD: Processing terminated normally.
```

(On Linux, use “python3” instead of “py”.)

Output from SEQADD: exfor_ord.txt

```
SUBENT         B0101003   20220622                                  B010100300001
BIB                    9         13                                  B010100300002
REACTION  1(6-C-12(D,X)6-C-11,,SIG)                                  B010100300003
          2(6-C-12(D,X)6-C-11,,SIG)                                  B010100300004
DECAY-DATA (6-C-11,20.4MIN,B+)                                       B010100300005
METHOD     (EXTB,STTA,BCINT,EDEG)                                    B010100300006
ANALYSIS   Normalized to the 190 MeV point from the 4pi-counter daB010100300007
…
ENDBIB              13          0                                    B010100300016
NOCOMMON             0          0                                    B010100300017
DATA                 6         23                                    B010100300018
EN          EN-ERR     DATA      1DATA-ERR  1DATA      2FLAG         B010100300019
MEV         MEV        MB         MB         MB         NO-DIM       B010100300020
  24.4       15.8                                0.5       1.        B010100300021
  34.2       12.8                                2.7       1.        B010100300022
  42.4       10.8                               11.3       1.        B010100300023
  49.4        9.8                               17.6       1.        B010100300024
  58.7        7.7                               35.6       1.        B010100300025
  67.7        8.1                               51.4       1.        B010100300026
  76.1        6.4                               57.        1.        B010100300027
  83.7        7.                                61.8       1.        B010100300028
  85.                   56.9        1.8                    1.        B010100300029
 105.                   60.7        1.                     1.        B010100300030
…
 190.                   61.1        0.6                              B010100300043
ENDDATA             25          0                                    B010100300044
ENDSUBENT           43          0                                    B010100399999
ENDENTRY             2          0                                    B010199999999
```

- Record identification present at Col.67-79.
- Two datasets in one subentry (multiple reaction formalism).

Exercise 6: Extraction of B0101.005.1

```
c:\>py x4_extmul.py
EXTMUL (Ver-2024-11-21) run on 01-12-2024
-----------------------------------------
EXFOR input file [exfor.txt] -----------> b0101003.txt
EXFOR/CINDA JSON Dict.[dict_9130.json] -> (Hit return!)
EXFOR dataset ID [R0046.002.1] ---------> B0101.003.1
EXFOR output file [exfor_out.txt] ------> (Hit return!)
ENTRY            B0101   20220622   20230117   20230116       B034
X4TOJ4: Processing terminated normally.
** Processing B0101.003.1
POIPOI: Processing terminated normally.
J4TOX4: Processing terminated normally.
EXTMUL: Processing terminated normally.
```

(On Linux, use “python3” instead of “py”.)

Output from EXTMUL: exfor_out.txt

```
SUBENT         B0101???   20220622                              B034
BIB                 9          0
REACTION    (6-C-12(D,X)6-C-11,,SIG)
DECAY-DATA
METHOD      (EXTB,STTA,BCINT,EDEG)
ANALYSIS    Normalized to the 190 MeV point from the 4pi-counter da
…
(20220623A) VT. REACTION corrected.
ENDBIB              0          0
NOCOMMON            0          0
DATA                5         23
EN          EN-ERR     DATA       DATA-ERR    FLAG
MEV         MEV        MB         MB          NO-DIM
  24.4       15.8                              1.
  34.2       12.8                              1.
  42.4       10.8                              1.
  49.4        9.8                              1.
  58.7        7.7                              1.
  67.7        8.1                              1.
  76.1        6.4                              1.
  83.7        7.                               1.
  85.                   56.9         1.8        1.
 105.                   60.7         1.         1.
…
 190.                   61.1         0.6
ENDDATA             0          0
ENDSUBENT           0          0
ENDENTRY            2          0
```

- Data compiled with pointer 1 were extracted.
  (Empty data lines must be deleted manually!)

Exercise 6: Extraction of B0101.005.1

By specifying “all” instead of an EXFOR dataset ID, one can extract all datasets compiled in the multiple reaction formalism.

```
c:\>py x4_extmul.py
EXTMUL (Ver-2024-11-21) run on 01-12-2024
-----------------------------------------
EXFOR input file [exfor.txt] -----------> b0101003.txt
EXFOR/CINDA JSON Dict.[dict_9130.json] -> (Hit return!)
EXFOR dataset ID [R0046.002.1] ---------> all
EXFOR output file [exfor_out.txt] ------> (Hit return!)
ENTRY            B0101   20220622   20230117   20230116       B034
X4TOJ4: Processing terminated normally.
** Processing B0101.003.1
POIPOI: Processing terminated normally.
J4TOX4: Processing terminated normally.
EXTMUL: Processing terminated normally.
```

(On Linux, use “python3” instead of “py”.)

Thank you!

View of Vienna International Centre (VIC) Buildings from Kaiserwasser