Preparation of the experimental data before evaluation using online tools

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Joint ICTP-IAEA Workshop on Nuclear Reaction Data for Nuclear Power Applications
Trieste, Italy, 22 - 26 September 2014

International Atomic Energy Agency

Nuclear Data Services

Provided by the Nuclear Data Section

EXFOR Web retrieval systems:

http://www-nds.iaea.org/exfor/

http://www.nndc.bnl.gov/exfor/

http://www-nds.indcentre.org.in/exfor/

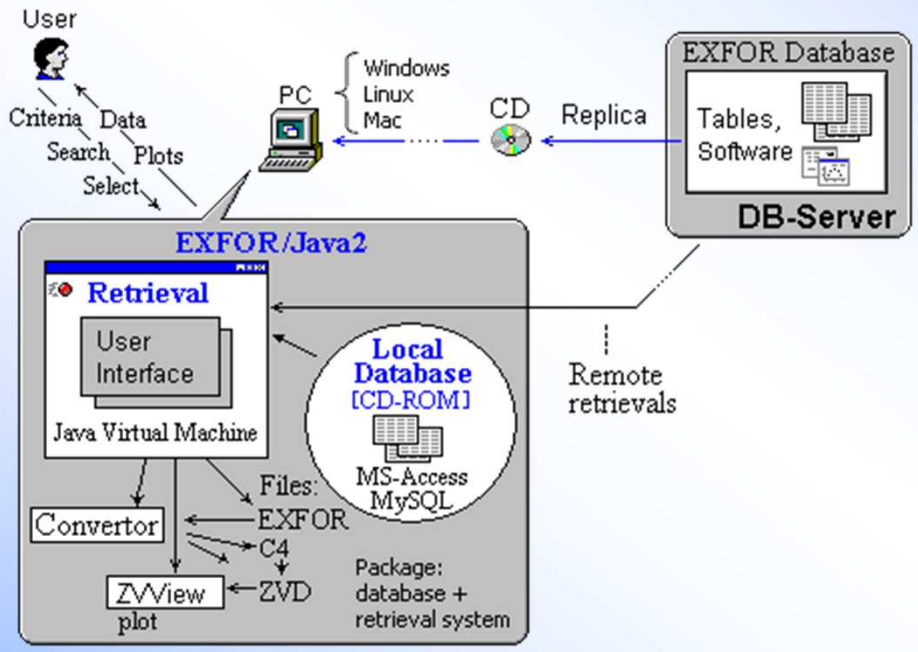
http://www-nds.ciae.ac.cn/exfor/

Also available on CD-ROM and FTP:

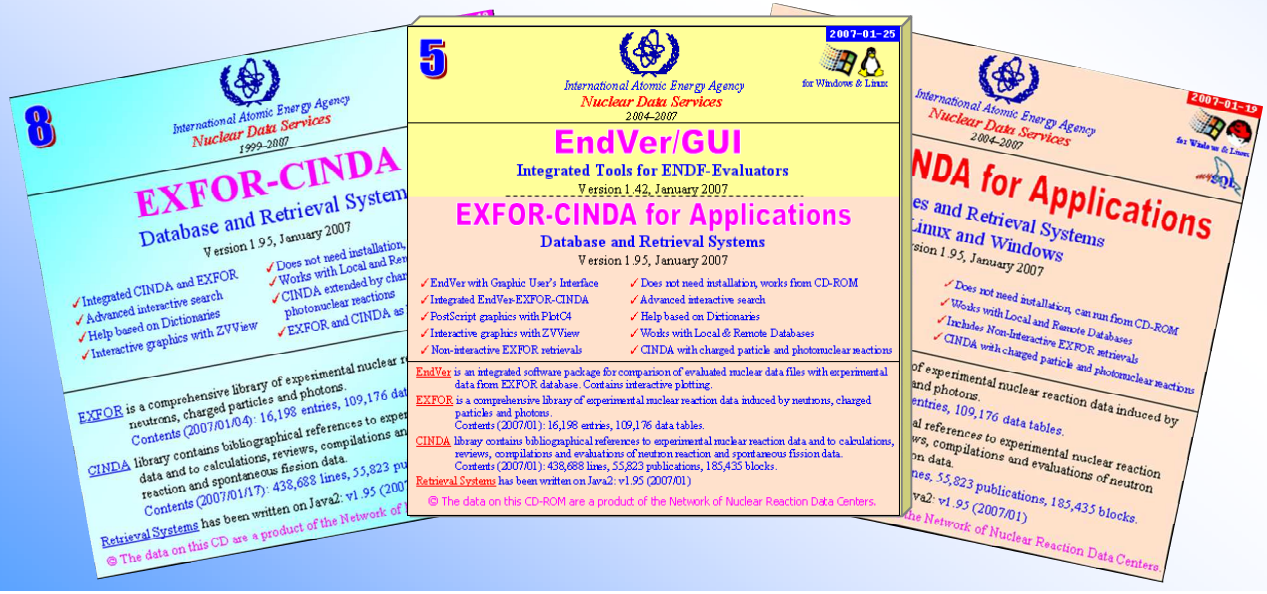
CD-ROM EXFOR for Applications:
http://www-nds.iaea.org/cdroms/#EXFOR/App

Full EXFOR in XC4 format:
https://www-nds.iaea.org/x4toc4-master/

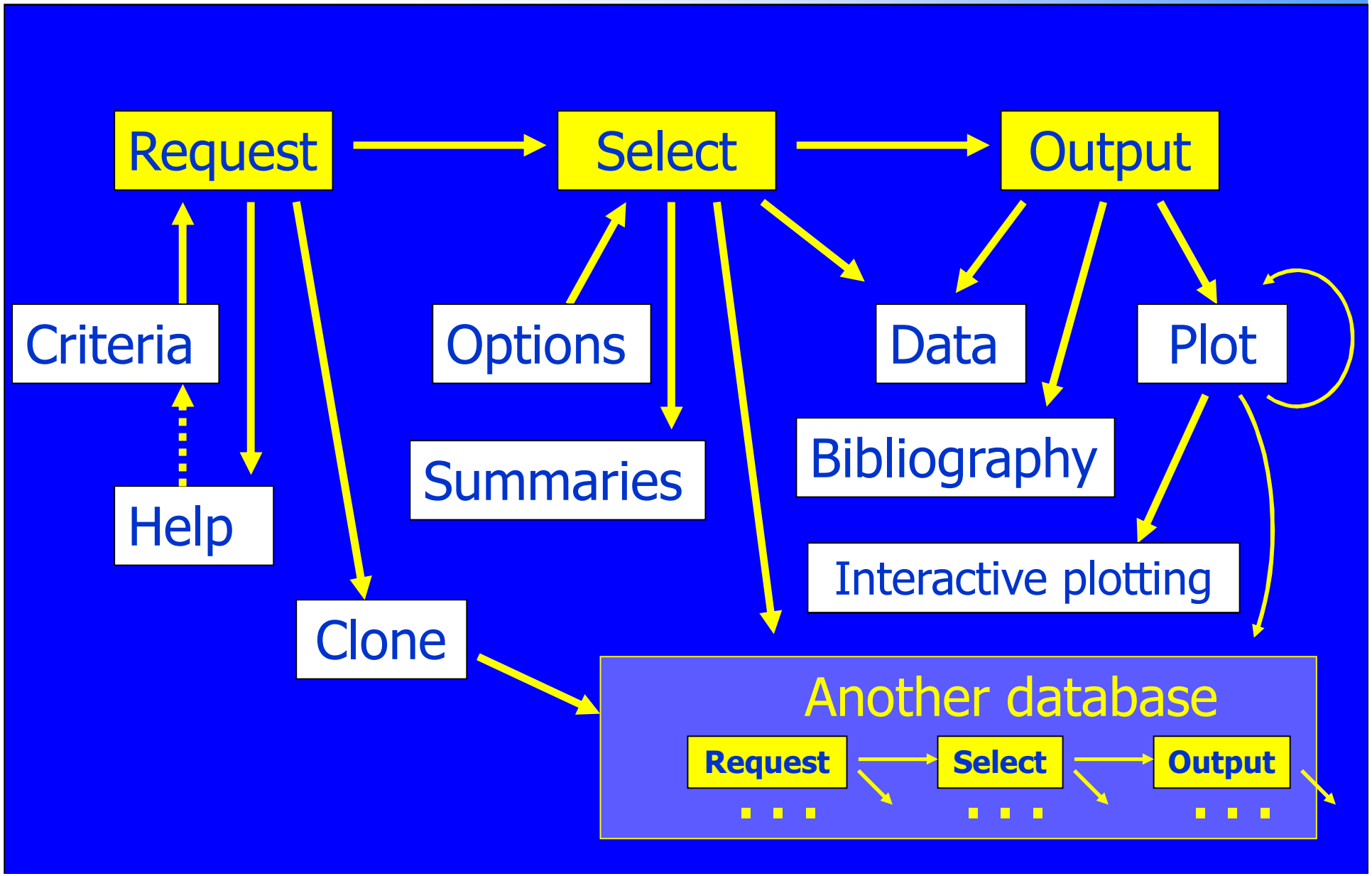
IAEA-NDS CD-ROM Database Retrieval Systems



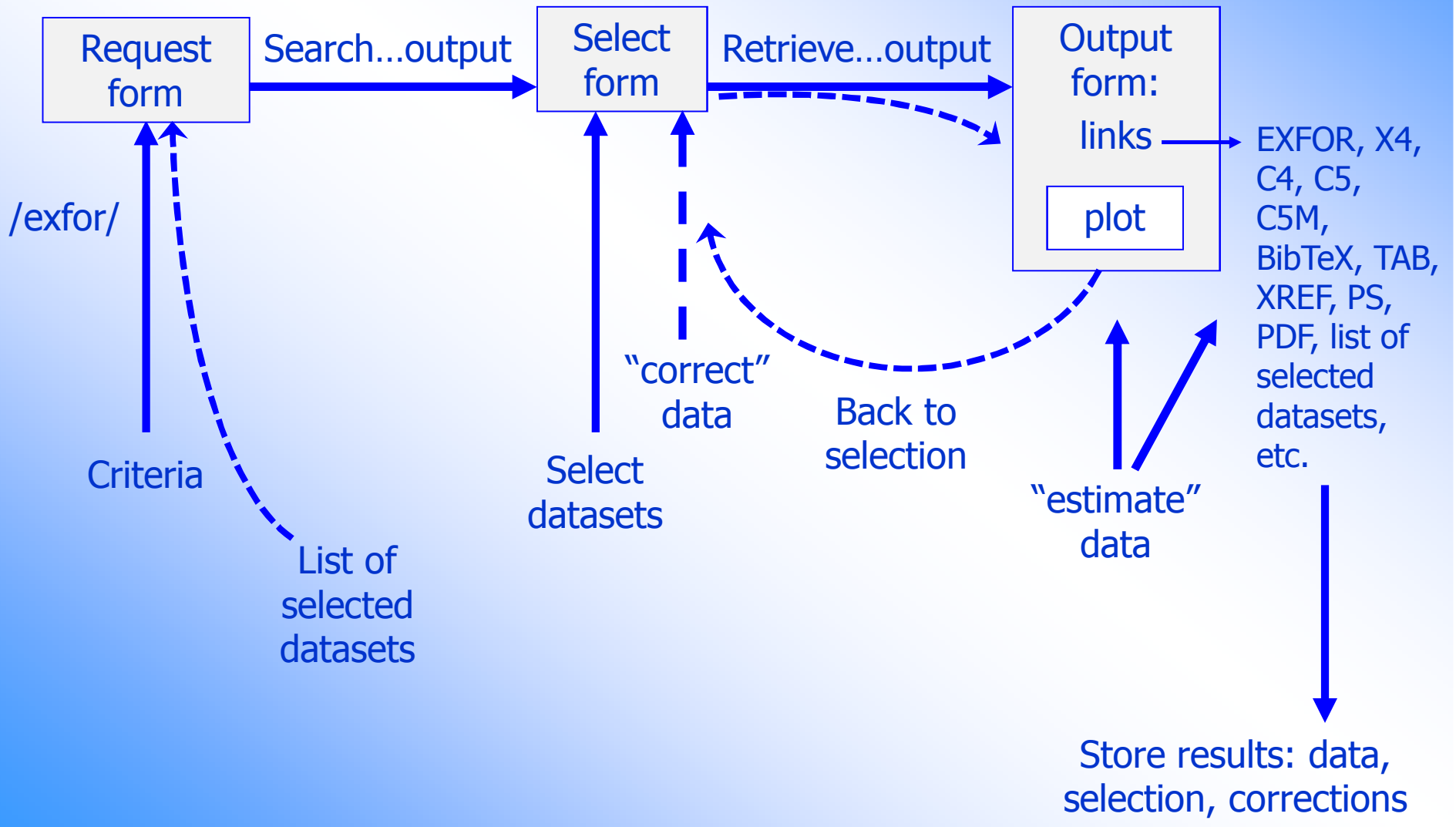
- For Windows, Linux and Mac
- Does not need installation
- Can run from CD-ROM (DBMS on CD)
- Can work with remote databases
- Integrated EXFOR and CINDA
- Help with Dictionaries
- Advanced search (+users' SQL)
- Interactive plotting with ZVView
- EndVer/GUI with integrated PrePro and EXFOR
- Includes non-interactive retrievals to build new user's applications
- Used by Applications: Empire, EndVer, GANDR, expandable…



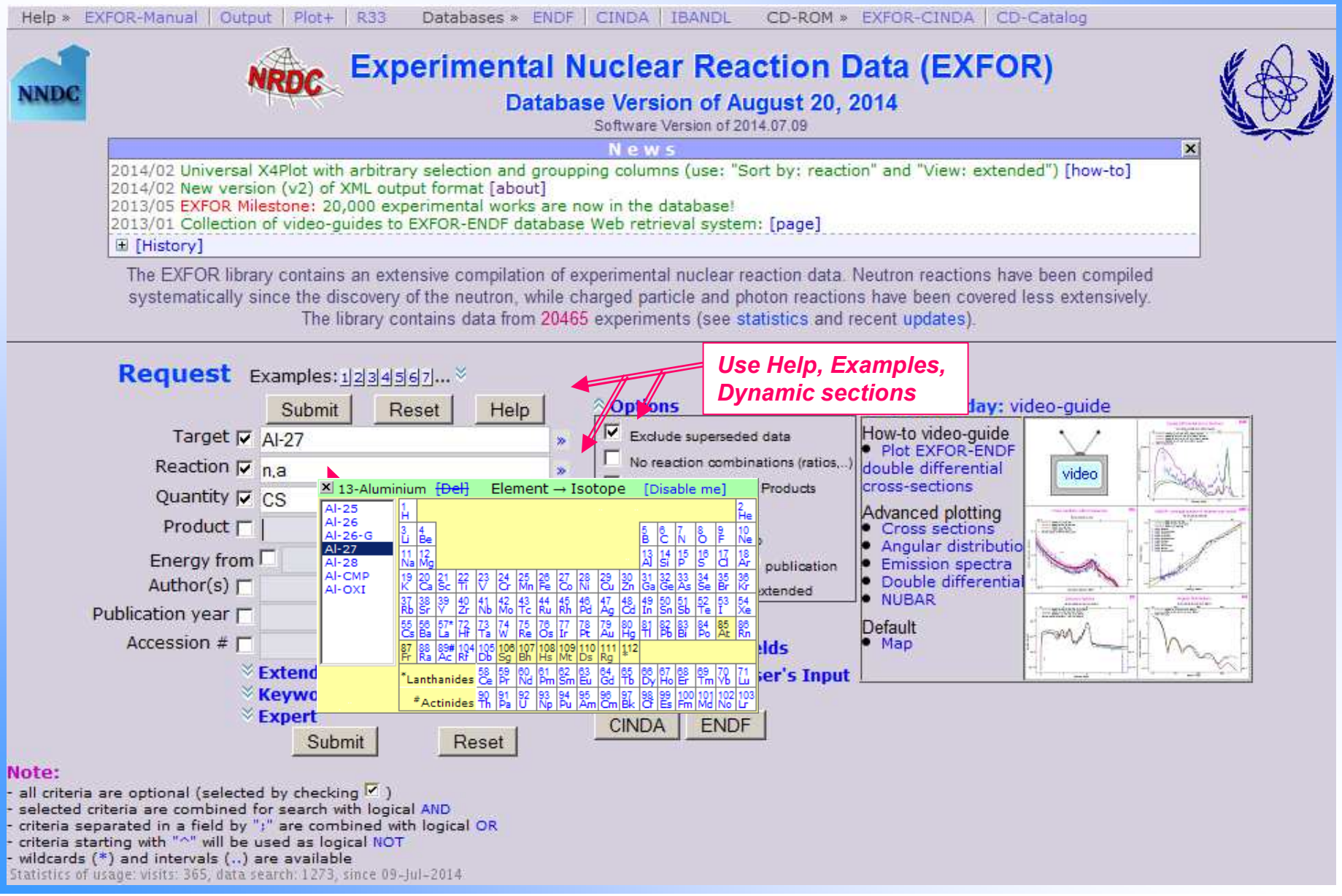
Retrieval System: main stream of users' interactions



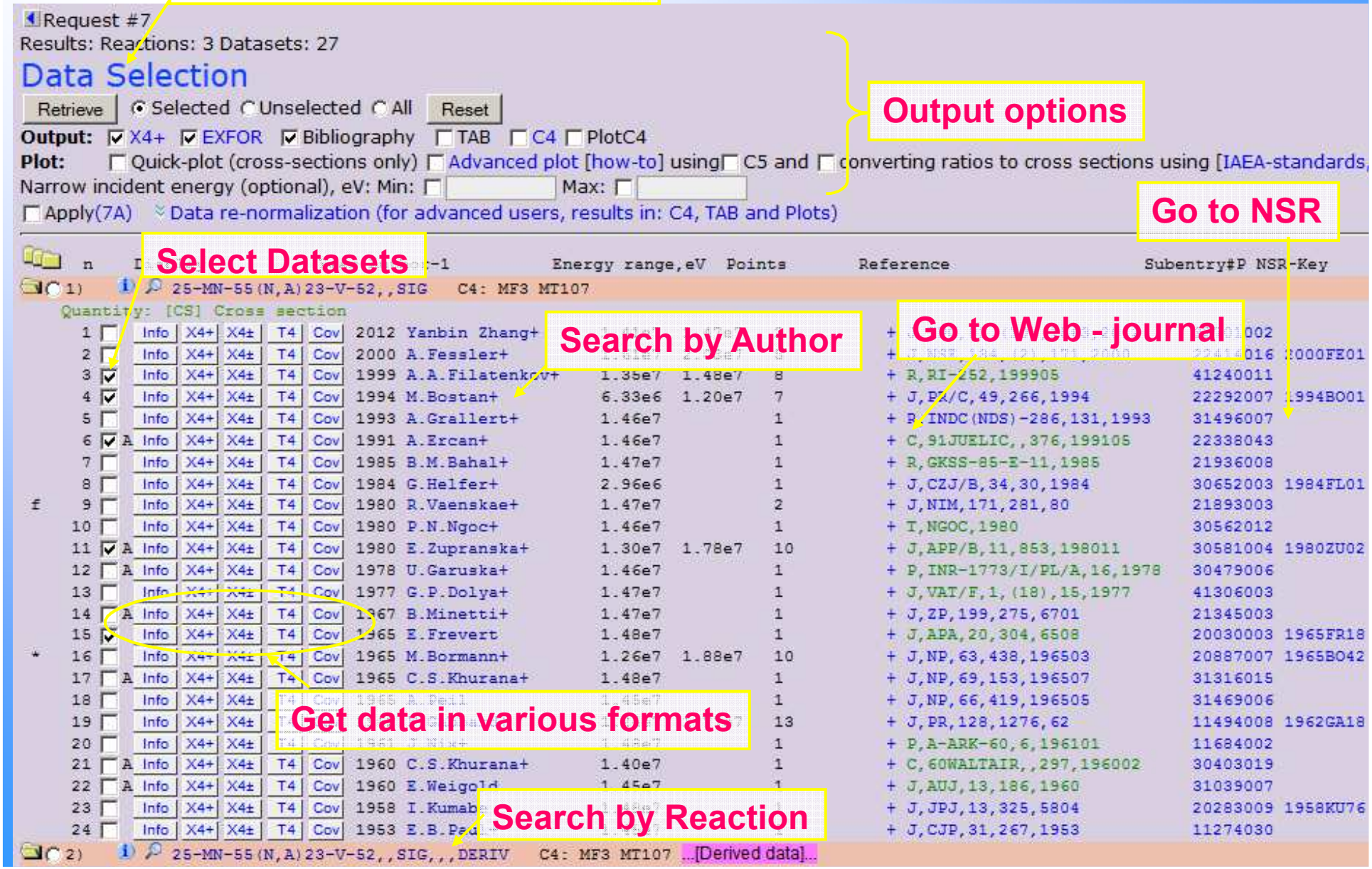
Using EXFOR Web retrieval system for data preparation



EXFOR Request Form



EXFOR Select Form



EXFOR Output Form

EXFOR Request #7/2

Output Data

Format	*Data (Size)*
EXFOR Interpreted	X4+ (61Kb) Generate: X4± XML:: v1: X4.xml X4.html v2: X4.xml X4.html
EXFOR Output	X4Out X4Out.xml Test: C5 C5M:see:[doc]
Raw EXFOR (original)	EXFOR (35Kb) zip (9Kb)
Bibliography	html (13Kb) BibTeX (4Kb)
Computational	
TAB	TAB (3Kb) TABLE.ZIP (1Kb) XREF (1Kb) BIB (25Kb)
C4	C5->C4 (4Kb) C4.ZIP (1Kb) PS (167Kb)

Advanced Plotting: LST (1Kb)

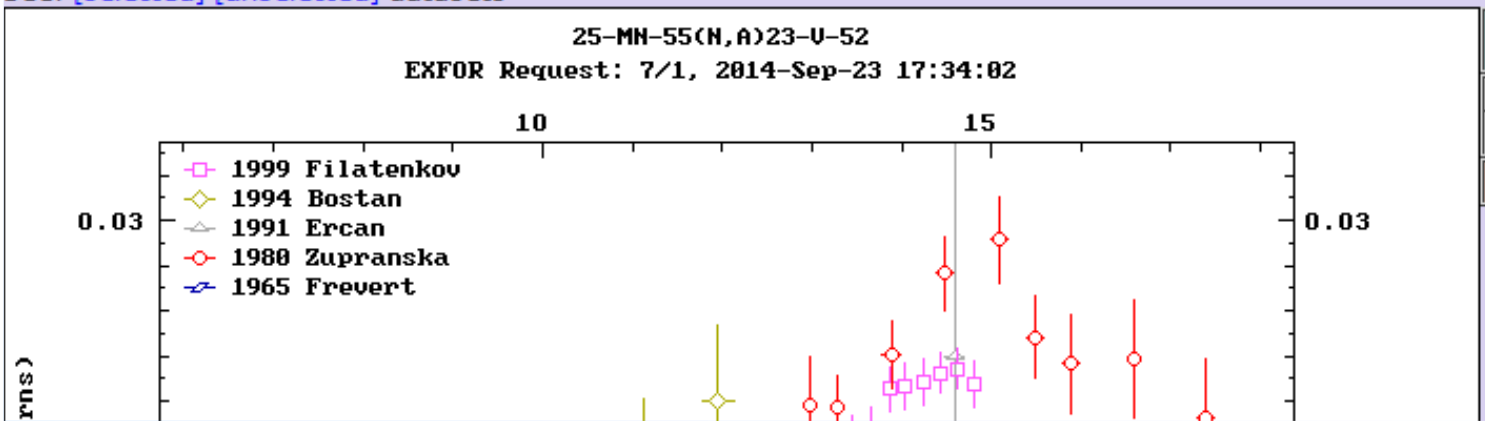
Select experimental data for plotting...

Go to	*Quantity type*	*#Plots*
σ (E) SIG	Cross section data	1

Go to plot evaluated data...

ENDF Retrieve evaluated data and plot...

See: [selected] [unselected] datasets



ENDF Find and add to the plot evaluated data

Select data for plotting [all] [none

1) 25-MN-55(N,A)23-V-52,,SI

2) Use my data [example]

See: plotted data (3Kb)

Output from EXFOR retrieval system

How it works

EXFOR Request Form

Search in EXFOR Database

EXFOR Select

Link R33 Single SUBENT

EXFOR Database

Multiple or single choice of data/formats

Retrieve EXFOR files and convert to:

Internal Dictionary

EXFOR14A.DAT

Levels, masses

Bibliography

Info

BibTeX

Table

T4

X4+

X4±

X4

C4

R33

C5

C5M

XML

HTML

External programs

Java Servlet

Retrieve EXFOR

X4

X4TOC4

(R.Cullen, A.Trkov)

C4

C4TOR33

R33

Download R33 as text

IBANDL

ENDF. Evaluated database retrieval system

ENDF: search, plot

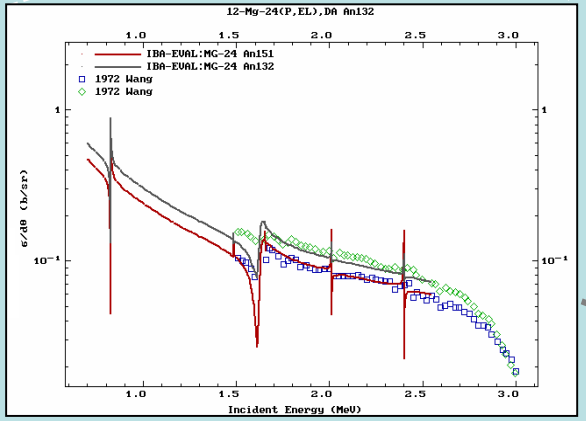
ENDF

Link

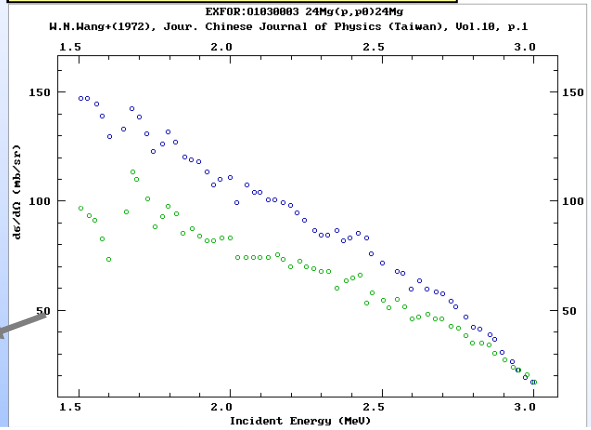
ENDF

Plot by Web-ZVView and other service

Data from one SUBENT (many Θ)



ZVView output



Output formats vocabulary

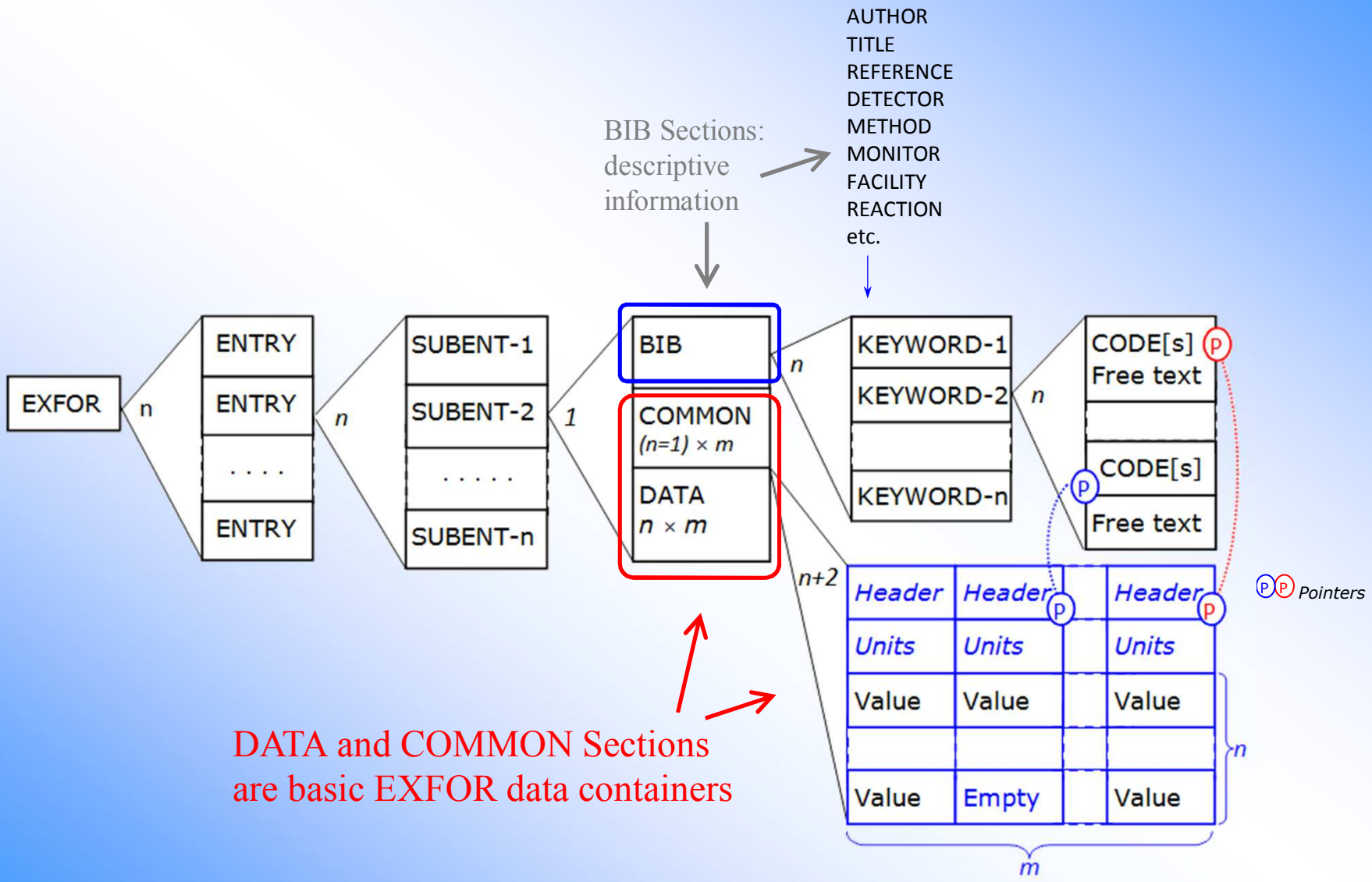
- X4 EXFOR original format
- X4+ EXFOR interpreted (with explanation of codes)
- X4± EXFOR interpreted presented as interactive tree
- C4 Computational format (ENDF like: MF-MT)
- XC4 C4 with comment lines (starting with #)
- C5 XC4 with systematic and statistical uncertainties
- C5M C5 with Ei×Ei correlation matrix (by default-2)
- TABLE, XREF, BIB old NNDC computational formats
- T4 Simple column format ("for students"): CS only
- ZVD Input for ZVView plotting package
- X4Std "Standard" EXFOR output
- X4.xml EXFOR interpreted in XML (unofficial: v1, v2)
- X4.xml.html X4.xml transformed to interactive html
- ZVView-copy columns' text copy of the plotted data
- R33 format of data dσ/dΩ in Ion Beam Analysis Data Library

```
ENTRY            41323   20050902
SUBENT        41323001   20050902
BIB                  7         12
INSTITUTE   (4RUSMIF)
REFERENCE   (J,AE,50,(5),350,198105) M
            (J,SJA,50,325,1981)  ENGLI
AUTHOR      (V.E.ZHITAREV,A.M.MOTORIN,
TITLE       .INTERACTION CROSS SECTION
             WITH COLD NEUTRONS
FACILITY    (REAC)
ERR-ANALYS  (EN-ERR)    WAVE-LENGTH RES
                        TIMES 100 (IN P
HISTORY     (19981121C)  + +  COMPILED
            (20050902A)  . .  Correcte
                        Data-heading
ENDBIB              12
COMMON               3         3
EN-ERR      TEMP        TEMP-ERR
PER-CENT    DEG-C       DEG-C
   3.         22.         3.
ENDCOMMON           3
ENDSUBENT          19
SUBENT        41323002   20050902
BIB                  5         8
REACTION    (13-AL-27(N,TOT),,SIG)
SAMPLE      .ALUMINIUM MONOCRYSTAL, PU
             96 MM, DENSITY 2.70 GRAM/
             MACROCRISTALLINE ALUMINIU
             THICKNESS 50 MM, DENSITY
ERR-ANALYS  (DATA-ERR) NO INFORMATION
STATUS      (TABLE)  DATA ARE TAKEN FR
HISTORY     (19981121T)  + + CONVERTED
ENDBIB               8
NOCOMMON             0         0
DATA                 3         8
WVE-LN      DATA        DATA-ERR
ANGSTROM    B           B
 1.3000E+01 1.9300E+00 1.3000E-01
 1.4000E+01 2.1200E+00 9.0000E-02
 1.5000E+01 2.2500E+00 8.0000E-02
 1.6000E+01 2.3800E+00 7.0000E-02
 1.7000E+01 2.5400E+00 6.0000E-02
 1.8000E+01 2.6100E+00 6.0000E-02
 1.9000E+01 2.8200E+00 8.0000E-02
 2.0000E+01 3.1500E+00 6.0000E-02
ENDDATA             10
ENDSUBENT           23
ENDENTRY             2
```

EXFOR Logic

```
ENTRY            41323   20050902
  SUBENT        41323001   20050902
    BIB                  7         12
      INSTITUTE   (4RUSMIF)
      REFERENCE   (J,AE,50,(5),350,198105) MAIN REFERENCE, DATA ARE GIVEN
                  (J,SJA,50,325,1981)  ENGLISH TRANSLATION
      AUTHOR      (V.E.ZHITAREV,A.M.MOTORIN,S.B.STEPANOV)
      TITLE       .INTERACTION CROSS SECTIONS OF CERTAIN METALS
                   WITH COLD NEUTRONS
      FACILITY    (REAC)
      ERR-ANALYS  (EN-ERR)    WAVE-LENGTH RESOLUTION DELTA-LAMBDA/LAMBDA
                              TIMES 100 (IN PERCENT)
      HISTORY     (19981121C)  + +  COMPILED AT THE CJD + +
                  (20050902A)  . .  Corrected at the CJD + +
                                Data-heading "EN" changed to "WVE-LN"
    ENDBIB              12
    COMMON               3         3
      EN-ERR      TEMP        TEMP-ERR
      PER-CENT    DEG-C       DEG-C
         3.         22.         3.
      ENDCOMMON           3
    ENDSUBENT          19
  SUBENT        41323002   20050902
    BIB                  5         8
      REACTION    (13-AL-27(N,TOT),,SIG)
      SAMPLE      .ALUMINIUM MONOCRYSTAL, PURITY 99.99 PC, THICKNESS
                   96 MM, DENSITY 2.70 GRAM/CM3 AND
                   MACROCRISTALLINE ALUMINIUM, PURITY 99.99 PC,
                   THICKNESS 50 MM, DENSITY 2.70 GRAM/CM3
      ERR-ANALYS  (DATA-ERR) NO INFORMATION GIVEN
      STATUS      (TABLE)  DATA ARE TAKEN FROM TABLE 1 OF MAIN REF.
      HISTORY     (19981121T)  + + CONVERTED FROM SUBENT 88023002
    ENDBIB               8
    NOCOMMON             0         0
    DATA                 3         8
      WVE-LN      DATA        DATA-ERR
      ANGSTROM    B           B
       1.3000E+01 1.9300E+00 1.3000E-01
       1.4000E+01 2.1200E+00 9.0000E-02
       1.5000E+01 2.2500E+00 8.0000E-02
       1.6000E+01 2.3800E+00 7.0000E-02
       1.7000E+01 2.5400E+00 6.0000E-02
       1.8000E+01 2.6100E+00 6.0000E-02
       1.9000E+01 2.8200E+00 8.0000E-02
       2.0000E+01 3.1500E+00 6.0000E-02
    ENDDATA             10
  ENDSUBENT           23
ENDENTRY             2
```

Why do we need so many output data formats?
Structure of an EXFOR file



Data tables in EXFOR structure

EXFOR:

- Descriptive part (BIB Section) = *structured text*
- Common parameters (COMMON Section) = *data table 1×m*
- Data table (DATA Section) = *data table n×m*

Data table:

- Description of dimensions: n m
- Description of data columns: 2×m
  <Header, Units, Pointer> for every column
- Data values: n×m
  2-dimensional array of floating-point numbers, fixed width, empty values are allowed
- End statement

Regulations of Data table content:

- Columns correspond to Reaction type
- Headers and Units are regulated by EXFOR Dictionaries
- Can contain data for several reactions having common columns
- Columns for different reactions are flagged by Pointers
- Can have special flags separating data obtained in different conditions

Original EXFOR file. Columns are not in particular order, width is limited, universal reading code needs time for development

```
SUBENT         12528018   19991005   20060315   20060313       133812528018    1
BIB                 2          5                                    12528018    2
REACTION  1(94-PU-241(N,0),,EN)                                     12528018    3
          2(94-PU-241(N,TOT),,WID)                                  12528018    4
          3(94-PU-241(N,TOT),,SIG,,RES)                             12528018    5
          4(94-PU-241(N,EL),,WID,,2G)                               12528018    6
ANALYSIS   (SLA) Single-level Breit-Wigner analysis.                12528018    7
ENDBIB              5                                               12528018    8
NOCOMMON            0          0                                    12528018    9
DATA                8         12                                    12528018   10
DATA      1DATA-ERR  1DATA      2DATA-ERR  2DATA      3DATA-ERR  312528018   11
DATA      4DATA-ERR  4                                              12528018   12
EV         EV         EV         EV         B          B          12528018   13
MILLI-EV   MILLI-EV                                                12528018   14
 14.74      0.05       0.15       0.05     3660.       120.       12528018   15
  6.2       1.                                                     12528018   16
 15.96      0.08       0.60       0.15      245.        25.       12528018   17
  1.8                                                            12528018   18
 16.70      0.08       0.25       0.1       360.        20.       12528018   19
  1.2                                                            12528018   20
 17.85      0.05       0.05       0.09     4670.       250.       12528018   21
  3.2       0.8
 20.75      0.17       0.09       0.1       2
  0.32
 21.99      0.24       0.20       0.1
  0.13
 23.04      0.3        0.60       0.25      1
  1.5
 24.12      0.16       0.22       0.14      3
  1.4       0.9
 26.45      0.17       0.34       0.10      6
  4.3       1.3
 28.97      0.22       0.72       0.1       3
  5.0
 29.57      0.25       0.05       0.05      3
  0.36
 31.03      0.21       0.36       0.10      2
  2.4       0.6
ENDDATA            28
ENDSUBENT          38
```

Interpretation of EXFOR file: no 80-columns limit, no right (control) columns

```
SUBENT         12528018   19991005   20060315   20060313       1338
BIB                 2          5
REACTION  1(94-PU-241(N,0),,EN)
          2(94-PU-241(N,TOT),,WID)
          3(94-PU-241(N,TOT),,SIG,,RES)
          4(94-PU-241(N,EL),,WID,,2G)
ANALYSIS   (SLA) Single-level Breit-Wigner analysis.
ENDBIB              5
NOCOMMON            0          0
DATA                8         12
DATA      1DATA-ERR  1DATA      2DATA-ERR  2DATA      3DATA-ERR  3DATA      4DATA-ERR  4
EV         EV         EV         EV         B          B          MILLI-EV   MILLI-EV
14.74      0.05       0.15       0.05     3660.       120.       6.2        1.
15.96      0.08       0.6        0.15      245.        25.       1.8
16.7       0.08       0.25       0.1       360.        20.       1.2
17.85      0.05       0.05       0.09     4670.       250.       3.2        0.8
20.75      0.17       0.09       0.1       222.        50.       0.32
21.99      0.24       0.2        0.1        37.        15.       0.13
23.04      0.3        0.6        0.25      142.        20.       1.5
24.12      0.16       0.22       0.14      346.        25.       1.4        0.9
26.45      0.17       0.34       0.1       625.        35.       4.3        1.3
28.97      0.22       0.72       0.1       310.        25.       5.
29.57      0.25       0.05       0.05      320.       100.       0.36
31.03      0.21       0.36       0.1       278.        25.       2.4        0.6
ENDDATA            28
```

EXFOR Interpreted: X4+, XML, X4±

EXFOR data: http://www-
Data retrieved from the EX

```
ENTRY            41323
SUBENT        41323001
BIB                  7
INSTITUTE    (4RUSMIF)
             #(4RUSMIF) Mo
REFERENCE    (J,AE,50,(5),
             (J,SJA,50,325
             # (J,AE,50,(5),
             # (J,SJA,50,325
AUTHOR       (V.E.ZHITAREV
TITLE        .INTERACTION
              WITH COLD NE
FACILITY     (REAC)
             #(REAC) React
ERR-ANALYS   (EN-ERR)    WI
                         TI
HISTORY      (19981121C)
             (20050902A)

ENDBIB              12
COMMON               3
EN-ERR       TEMP       TI
PER-CENT     DEG-C      DI
3.           22.         3
ENDCOMMON            3
ENDSUBENT           19
SUBENT        41323002
BIB                  5
REACTION     (13-AL-27(N,T
             #(13-AL-27(N,T
             #         Proce
SAMPLE       .ALUMINIUM MO
              96 MM, DENSI
              MACROCRISTAL
              THICKNESS 5(
ERR-ANALYS   (DATA-ERR) NO
STATUS       (TABLE)   DATA
HISTORY      (19981121T)
ENDBIB               8
NOCOMMON             0
DATA                 3
WVE-LN       DATA       DA
ANGSTROM     B          B
13.          1.93       0
14.          2.12       0
15.          2.25       0
16.          2.38       0
17.          2.54       0
18.          2.61       0
19.          2.82       0
20.          3.15       0
ENDDATA             10
ENDSUBENT           23
ENDENTRY             2
```

```
<?xml version="1.0" encoding="WINDOWS-1251"?>
<x4files>
 - <x4entry Author="V.E.Zhitarev+" Ref1Year="1981" accnum="41323"
   - <x4subent N2="20050902" subacc="41323001">
     - <bib nKw="12">
       - <keyword subacc="41323001" nCodes="1" kw="INSTITU
         - <kwCode iCode="0" pointer=" ">
           - <x4code type="INSTITUTE">
               <x4code1 expansion="Moscow Inst.of Engine
                 dictionary="INSTITUTE">4RUSMIF</x4co
             </x4code>
           </kwCode>
         </keyword>
       - <keyword subacc="41323001" nCodes="2" kw="REFEREN
         - <kwCode iCode="0" pointer=" ">
           - <x4code type="REFERENCE">
               <x4code1 expansion="Jour: Atomnaya Energi
                 dictionary="REFERENCE" Year="1981" pag
                 Type="J">J,AE,50,(5),350,198105</x4co
             </x4code>
             <Free type="1" ln="1"> MAIN REFERENCE, DATA
           </kwCode>
         - <kwCode iCode="1" pointer=" ">
           - <x4code type="REFERENCE">
               <x4code1 expansion="Jour: Soviet Atomic Ene
                 dictionary="REFERENCE" Year="1981" pag
                 Type="J">J,SJA,50,325,1981</x4code1>
             </x4code>
             <Free type="1" ln="1"> ENGLISH TRANSLATION
           </kwCode>
         </keyword>
       - <keyword subacc="41323001" nCodes="1" kw="AUTHOR
         - <kwCode iCode="0" pointer=" ">
           - <x4code type="AUTHOR">
             - <authors a1ini="V.E." a1="Zhitarev" nn="3">
                 <author ii="1">V.E.ZHITAREV</author>
                 <author ii="2">A.M.MOTORIN</author>
                 <author ii="3">S.B.STEPANOV</author>
               </authors>
             </x4code>
           </kwCode>
         </keyword>
       - <keyword subacc="41323001" nCodes="1" kw="TITLE">
         - <kwCode iCode="0" pointer=" ">
             <Free type="1" ln="2">.INTERACTION CROSS SE
               NEUTRONS</Free>
           </kwCode>
         </keyword>
       - <keyword subacc="41323001" nCodes="1" kw="FACILITY
         - <kwCode iCode="0" pointer=" ">
           - <x4code type="FACILITY">
               <x4code1 expansion="Reactor" dictionary="FA
             </x4code>
           </kwCode>
         </keyword>
       - <keyword subacc="41323001" nCodes="1" kw="ERR-ANA
         - <kwCode iCode="0" pointer=" ">
             <Code type="0">EN-ERR</Code>
             <Free type="1" ln="2"> WAVE-LENGTH RESOLUT
               (IN PERCENT)</Free>
           </kwCode>
```

- EXFOR file
  - ENTRY 41323 1981, V.E.Zhitarev+ last-updated: 2005-09-02
    - SUBENT 41323001 last-updated: 2005-09-02
      - BIB #bibliographic and descriptive information
        - INSTITUTE
          - (4RUSMIF) #Moscow Inst.of Engineering Physics, Moscow, Russia
        - REFERENCE
          - (J,AE,50,(5),350,198105) #Jour: Atomnaya Energiya, Vol.50, Issue.5, p.350 (1981), Russia
            MAIN REFERENCE, DATA ARE GIVEN
          - (J,SJA,50,325,1981) #Jour: Soviet Atomic Energy, Vol.50, p.325 (1981), USA
            ENGLISH TRANSLATION
        - AUTHOR
          - (V.E.ZHITAREV, A.M.MOTORIN, S.B.STEPANOV)
        - TITLE
          - .INTERACTION CROSS SECTIONS OF CERTAIN METALS WITH COLD NEUTRONS
        - FACILITY
        - ERR-ANALYS
        - HISTORY
      - COMMON 3x1 #Constant parameters
        - Legend

EN-ERR	Uncertainty in incident projectile energy	PER-CENT	per-cent
TEMP	Sample temperature	DEG-C	degrees Celsius, Centigrad
TEMP-ERR	Error in sample temperature	DEG-C	degrees Celsius, Centigrad

        - Data

EN-ERR	TEMP	TEMP-ERR
PER-CENT	DEG-C	DEG-C
3.0	22.0	3.0

    - SUBENT 41323002 last-updated: 2005-09-02
      - BIB #bibliographic and descriptive information
        - REACTION
          - (13-AL-27(N,TOT),,SIG)
            #Target:AL-27 #Projectile:N #Reaction:N,TOT #Process:TOT:Total #Quantity:,SIG:CS:
        - SAMPLE
          - .ALUMINIUM MONOCRYSTAL, PURITY 99.99 PC, THICKNESS 96 MM, DENSITY 2.70 GRAM/CM3 AND MACROCRISTALLINE ALUMINIUM, PURITY 99.99 PC, THICKNESS 50 MM, DENSITY 2.70 GRAM/CM3
        - ERR-ANALYS
        - STATUS
        - HISTORY
      - NOCOMMON
      - DATA 3x8
        - Legend

WVE-LN	Wave length of incident particle	ANGSTROM	Angstroms
DATA	Cross section 13-AL-27(N,TOT),,SIG	B	barns
DATA-ERR	Error in value of quantity, defined under ERR-ANALYS	B	barns

        - Data

WVE-LN	DATA	DATA-ERR
ANGSTROM	B	B
13.0	1.93	0.13
14.0	2.12	0.09
15.0	2.25	0.08
16.0	2.38	0.07

There is a regular need in simple computational format for data from EXFOR from evaluators (and their programs), preferably compatible with evaluated data (MF-MT).

C4 is de-facto standard computational format from EXFOR library since D.E. Cullen designed it (~80's) and released his code X4TOC4 for translation EXFOR data file to C4 format.

C4 format and X4TOC4 code are widely used in: Empire, Talys, EndVer, Web plotting, X4 renormalization system, etc.

Modern extensions of C4: XC4 for full EXFOR (used in WPEC SG30 group).

New Java code x4toc5 translates EXFOR to C5, C5M

Structure of C4 file

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	NAME	MEANING
1- 5	Prj	Projectile ZA (e.g. neutron =1, proton =1001)
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, plus additions)
16- 19	MT	MT (ENDF conventions, plus additions)
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	.....	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	Cosine or legendre order
68- 76	dCos/LO	Cosine uncertainty
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 and 8 (e.g., 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)

EXFOR data correction system
(re-normalization system)

Main ideas:

1) to re-normalize data using old monitors and new standards
2) to re-normalize data using decay data
3) to create a convenient tool for data modifications: multiply data to a factor, correct wrong units, set up uncertainties, delete part of a data set, recalculate data using isotope abundances, etc.

Final goals:

1) to re-normalize data from EXFOR automatically (using EXFOR information)
2) to collect experts' corrections to a database
3) to re-normalize data using experts' corrections database
4) to have Web system offering and implementing automatic, experts' and user's corrections in optional, semi-automatic and interactive modes
5) to generate and distribute renormalized data of whole EXFOR database

EXFOR data correction system
(re-normalization system)

Stages of development

1. Start: November 2009
2. Define concept of the system, basic algorithms
3. Invent syntax describing corrections
4. Define structure and implement programs
5. Collect archive of old monitors used in EXFOR works and modern data
6. Collect corrections applied by experienced evaluators, create database of corrections
7. Create software for automatic re-normalization
8. Create database with corrections
9. Create Web interface for using automatic correction-database
10. Extend Web interface to use experts' correction-database

2014

11. Create software to generate re-normalized XC4 for full EXFOR in C4
12. Start distributing renormalized RXC4 to former SG30 members
13. Etc.

“Manual” and “automatic” corrections

“Manual” corrections are based user’s knowledge and experience – therefore can include subjective judgment.

We are going to collect database of experts’ corrections.

“Automatic” corrections are based on the information given in EXFOR file: keywords MONITOR and MONIT-REF, monitor data in the DATA and COMMON sections.

This method is objective.

It needs “clever” EXFOR software.

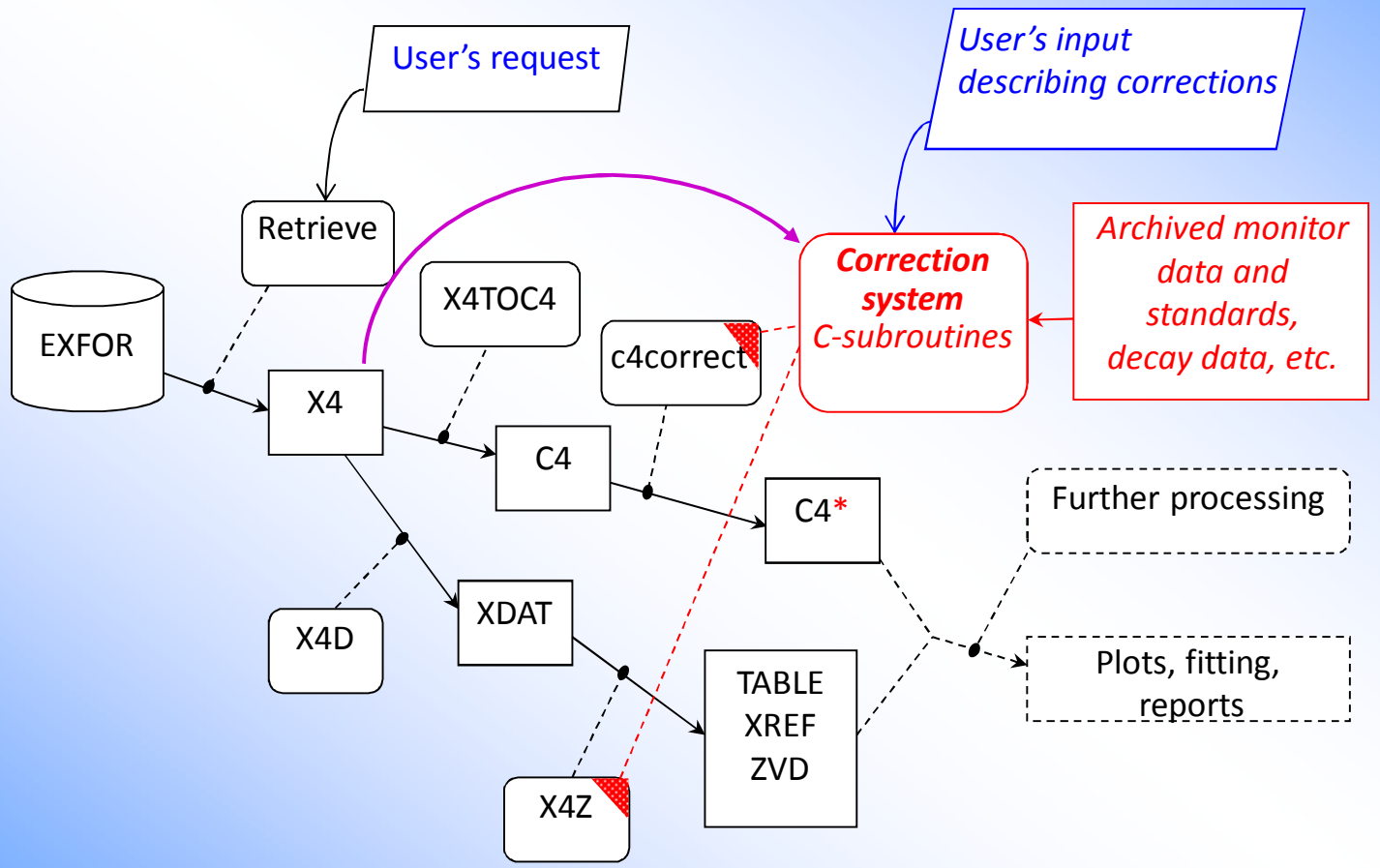
Both methods need:

- archive of old monitors
- library of “recommended” monitors (standards)
- software, database, information, Web support
- participation of nuclear data experts

Correction System: Paradigm

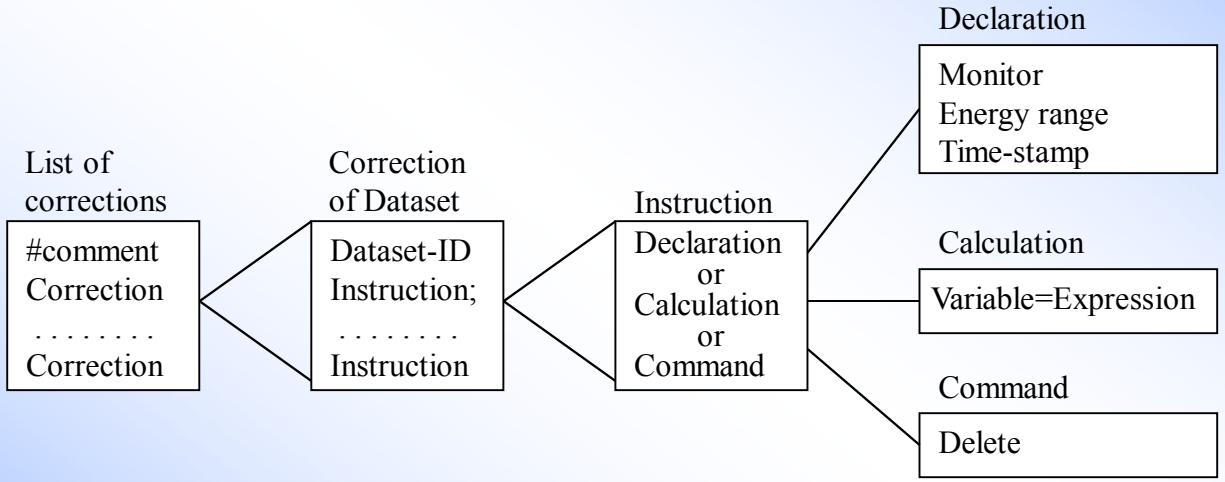
- **We DO NOT change EXFOR data.**
  We re-normalize output from EXFOR system.
  i.e. we modify data extracted from EXFOR:
  - computational format C4
  - TABLE, XREF (NNDC computational formats)
  - XDAT (intermediate format used for plotting)
    Results can be plotted as:
    - Quick plots
    - Advanced plots … + comparison to evaluated data (ENDF)

Software structure and data flow



Syntax. File structure.

Corrections (data modifications) are described in a text file with following structure



Datasets from EXFOR are identified by the DatasetID := SubentryPointer

All operations described in the list of corrections will be applied to the current dataset.

First examples

40274002A y=y*0.85

This means: take data from Subentry 40274.002 having Pointer=<A>,
and for every data point perform action: multiply data value (y) by factor 0.85

10221039 dSys=y*0.02;

This means: set systematic uncertainties equal to 2% of data for Subentry 10221039

```
10221039 m0:endfb4 $ u235nf;    #old monitor
         m1:iaeastd2006 $ u235nf; #new monitor
         dy=dy/y;                #abs. to relative uncertainty
         y=y/m0*m1;              #re-normalize data value
         dy=dy**2 -(dm0/m0)**2 +(dm1/m1)**2;   #re-calc.errors
         dy=dy**0.5*y;           #back to abs. uncertainty
```

Monitor data used for measurements: CS from ENDF-B/IV, reaction U-235(n,f). We define for renormalization old and new monitors: data from ENDF-B/IV, U-235(n,f) and modern data from IAEA Standards-2006 library; re-calculate data values and uncertainty using old and new monitors for every data point.

Syntax. Declarations.

Energy dependent monitor from the Archive.

Energy dependent monitor must be “declared” before first time used.

syntax: m0:Library$Reaction;
the same for m1,m2,m3,..,m7

example: m0:allen58$u235nf;
m1:std05$u235nf;

Use value interpolated for the current energy in the variable m1 and dm1

example: y=y*m1/m0;

Energy dependent monitor from EXFOR file.

Energy dependent monitor must be “declared” before first time used.

syntax1: m0:[EN, MONIT];
where EN and MONIT are headers of EXFOR data columns

syntax2: m0:[EN-MIN ! EN-MAX, MONIT];
energy value will be average between two columns: EN-MIN and EN-MAX

syntax3: m0:[EN, MONIT, MONIT-ERR];
to describe column with monitor uncertainties (after that, dm0 will have a value)

syntax4: m0:[EN, MONIT:2];
to describe column having pointer

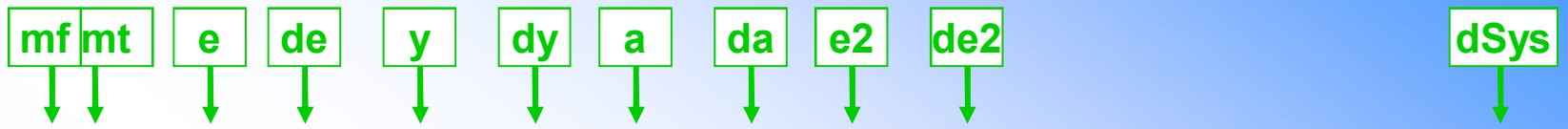
Use value interpolated for the current energy in the variable m0 and dm0

example: y=y*m1/m0;

After you declare monitor (as m0, m1, etc.), you can use variable m0 (or m1, etc.) in your expressions

Example: y=y*m1/m0;
dy=((dy/y)**2 -(dm0/m0)**2 +(dm1/m1)**2)**0.5*y;

Syntax. Variables. Data.



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	NAME	VARIABLE	MEANING
1- 5	Prj		Projectile ZA (e.g. neutron =1, proton =1001)
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	MF (ENDF conventions, plus additions)
16- 19	MT	MT	MT (ENDF conventions, plus additions)
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	.....		8 data fields (each in E9.3 format)
23- 31	Energy	E	Projectile incident energy
32- 40	dEnergy	dE	Projectile incident energy uncertainty
41- 49	Data	Y	Data, e.g., cross section, angular distribution, etc.
50- 58	dData	dY	Data uncertainty
59- 67	Cos/LO	A	Cosine or legendre order
68- 76	dCos/LO	dA	Cosine uncertainty
77- 85	LVL/HL	E2	Identified by columns 95-97 (e.g.,level E, half-life)
86- 94	dLVL/HL	dE2	Identified by columns 95-97 (e.g.,level E, uncertainty)
95- 97	I78		Identification of data fields 7 and 8 (e.g., 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	dSys	Multi-dimension table flag (Pointer)
141-149	dStat	dStat	Multi-dimension table flag (Pointer)

Other variables and constants.

Numerical values

These values can be used in expressions in the format of REAL numbers in Fortran. It is assumed that values without units are presented in "basic" units (e.g. 20 means 20eV). Expressions allow also usage of units (which must be presented in special working dictionary), then units will be replaced by factor, e.g. 2hr will be replaced by (2*3600)., 2% will be replaced by (2*0.01), 20kev will be replaced by (20*1e3).

Intermediate variables.

syntax: a0, a1, a2, a3, a4, a5, a6, a7, c0, c1, c2, c3, c4, c5, c6, Fc
default value=0

Monitor point.

Monitor value for given point (e.g. thermal cross section) can be used in any expression:

syntax: Library$Reaction[Energy]
example: a1=iaea05$au197ng[0.0253];

It is also possible to use energy value from COMMON block:

a1=iaea05$au197ng[EN-NRM];

Monitor point from EXFOR.

Single monitor value is usually given in EXFOR file in COMMON block. This value can be used in an expression referring to Header of the column in the COMMON block by using [Header], e.g.

a0=[MONIT1];

So, renormalization by single point can also be described without using intermediate variables, e.g.:

y = y * iaea05$au197ng[0.0253] / [MONIT1];

Other constants and operations.

Abundance

When necessary, cross sections can be corrected by using natural abundance of isotopes and cross section of competing reaction. Abundance is coded as abu[isotope], can be used in expressions and will be replaced by value taken from internal library. For example:

```
20388002   m2:rrdf07$ni61nnp;
           y = y - abu[ni61]/abu[ni60]*m2;
```

Half-life

If necessary (for long-lived residuals), cross sections can be corrected by using new half-life value, which is coded as t12[isotope]. It can be used in expressions and will be replaced by value taken from internal library. For example:

```
30449003   y=y*t12[bi207]/38yr;     # converted to y=y*32.9yr/38yr;
```

Operations.

Traditional operations:

```
+   -   *   /   **
```

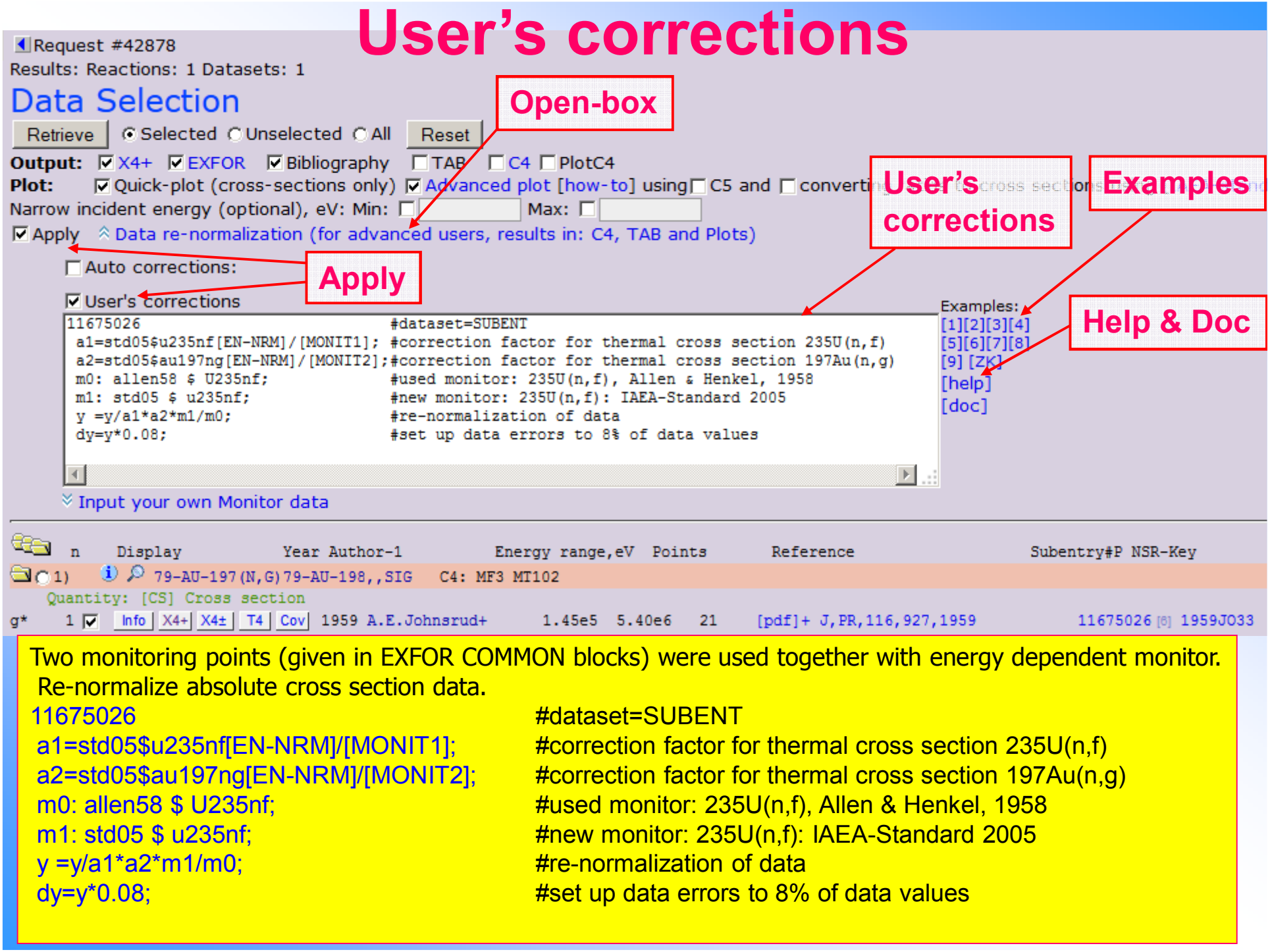
parentheses () change order of operations

Calculations

syntax: variable=expression;

Traditional for programming languages

User's corrections



Two monitoring points (given in EXFOR COMMON blocks) were used together with energy dependent monitor. Re-normalize absolute cross section data.

```
11675026                                  #dataset=SUBENT
 a1=std05$u235nf[EN-NRM]/[MONIT1];        #correction factor for thermal cross section 235U(n,f)
 a2=std05$au197ng[EN-NRM]/[MONIT2];       #correction factor for thermal cross section 197Au(n,g)
 m0: allen58 $ U235nf;                    #used monitor: 235U(n,f), Allen & Henkel, 1958
 m1: std05 $ u235nf;                      #new monitor: 235U(n,f): IAEA-Standard 2005
 y =y/a1*a2*m1/m0;                        #re-normalization of data
 dy=y*0.08;                               #set up data errors to 8% of data values
```

Apply corrections

Output Data

Format	*Data (Size)*
EXFOR Interpreted	X4+ (11Kb) Generate: X4± XML:: v1: X4.xml X4.html v2: X4.xml X4.html
EXFOR Output	X4Out X4Out.xml Test: C5 C5M:see:[doc]
Raw EXFOR (original)	EXFOR (6Kb) zip (2Kb)
Bibliography	html (3Kb) BibTeX (1Kb)
Computational	
C4	C4 (3Kb) C4.ZIP (1Kb) LST (128Kb)

Advanced Plotting: LST (1Kb)

Select experimental data for plotting...

Go to		*Quantity type*	*#Plots*
σ (E)	SIG	Cross section data	1

Go to plot evaluated data...

ENDF Retrieve evaluated data and plot...

User's C4 file

User's corrections

Plot monitors

Check values

Corrections protocol

Corrected data

Requested corrections

```
11675026                          #dataset=SUBENT
 a1=std05$u235nf[EN-NRM]/[MONIT1]; #correction factor for thermal cross section 235U(n,f)
 a2=std05$au197ng[EN-NRM]/[MONIT2];#correction factor for thermal cross section 197Au(n,g)
 m0: allen58 $ U235nf;            #used monitor: 235U(n,f), Allen & Henkel, 1958
 m1: std05 $ u235nf;              #new monitor: 235U(n,f): IAEA-Standard 2005
 y =y/a1*a2*m1/m0;                #re-normalization of data
 dy=y*0.08;                       #set up data errors to 8% of data values
```

Correction protocol

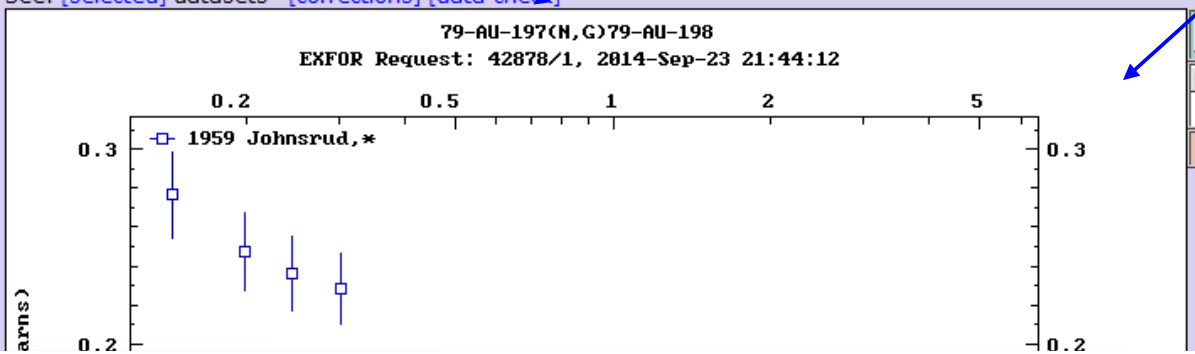
Applied corrections. Datasets: 1

1) EXFOR:#11675026 Ref:A.E.Johnsrud ET.AL. (59) Corrected_Points:21 yFactor_Ave:0.929112 yFactor_Min:0.865679 yFactor_Max:0.970536

11675026 a1=584.326/584; a2=98.6593/99; M0:allen58$u235nf; M1:std05$u235nf; Y=Y/a1*a2*M1/M0; dY=Y*0.08;

See used monitors: [plot]

See: [selected] datasets [corrections] [data-check]



ENDF Find and add to the plot evaluated data

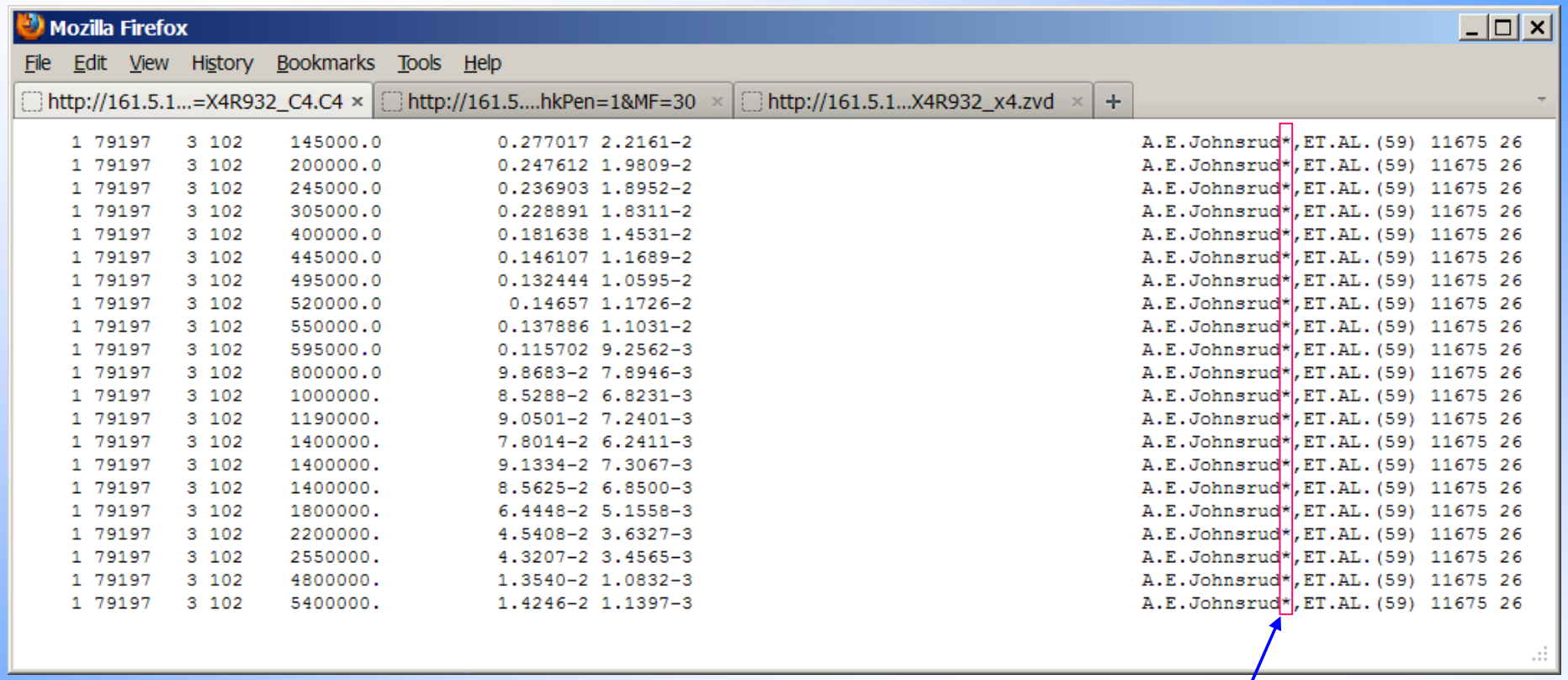
Select data for plotting [all] [none]

1) 79-AU-197(N,G)79-AU-198,,SIG

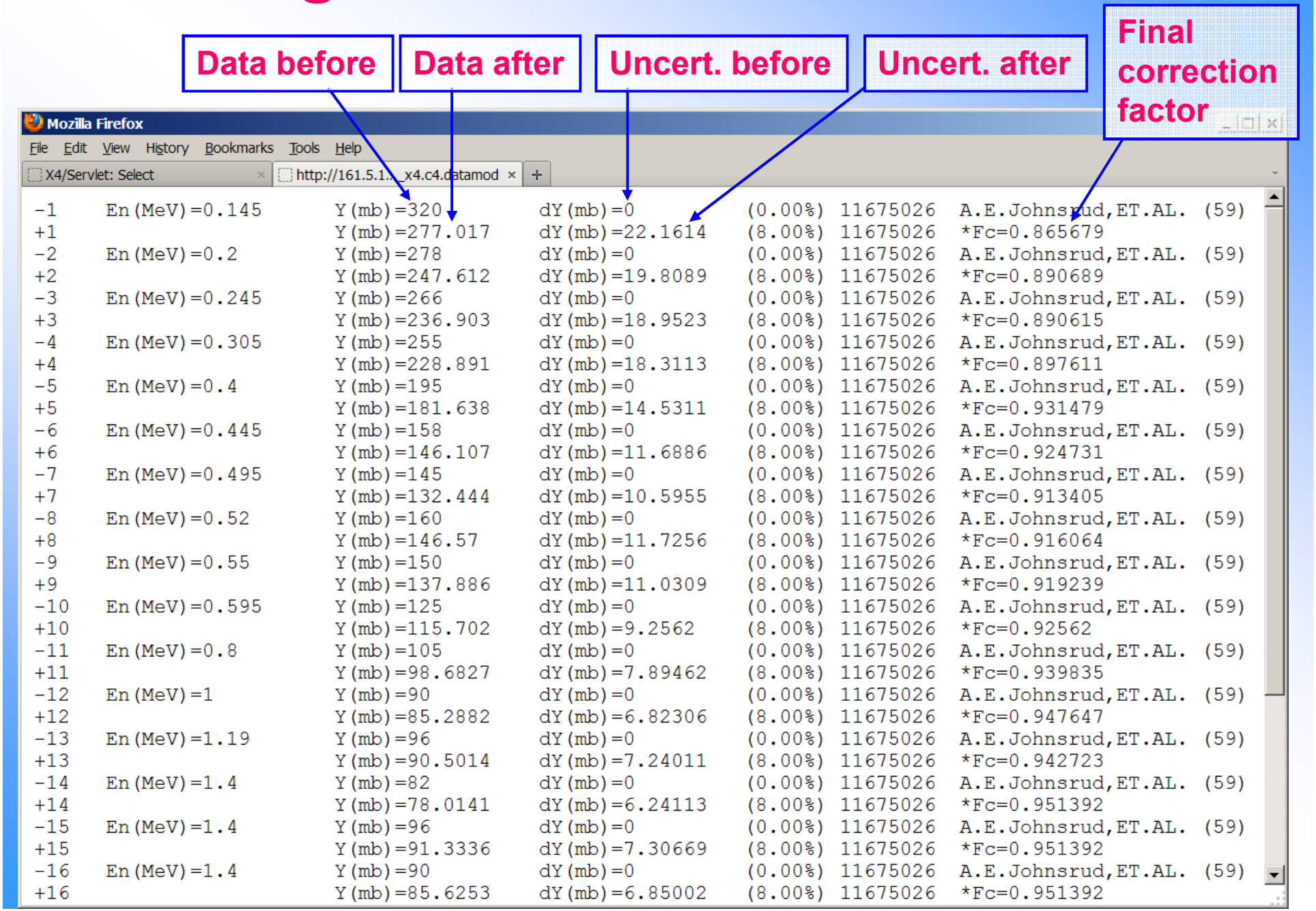
2) Use my data [example]

See: plotted data (3Kb)

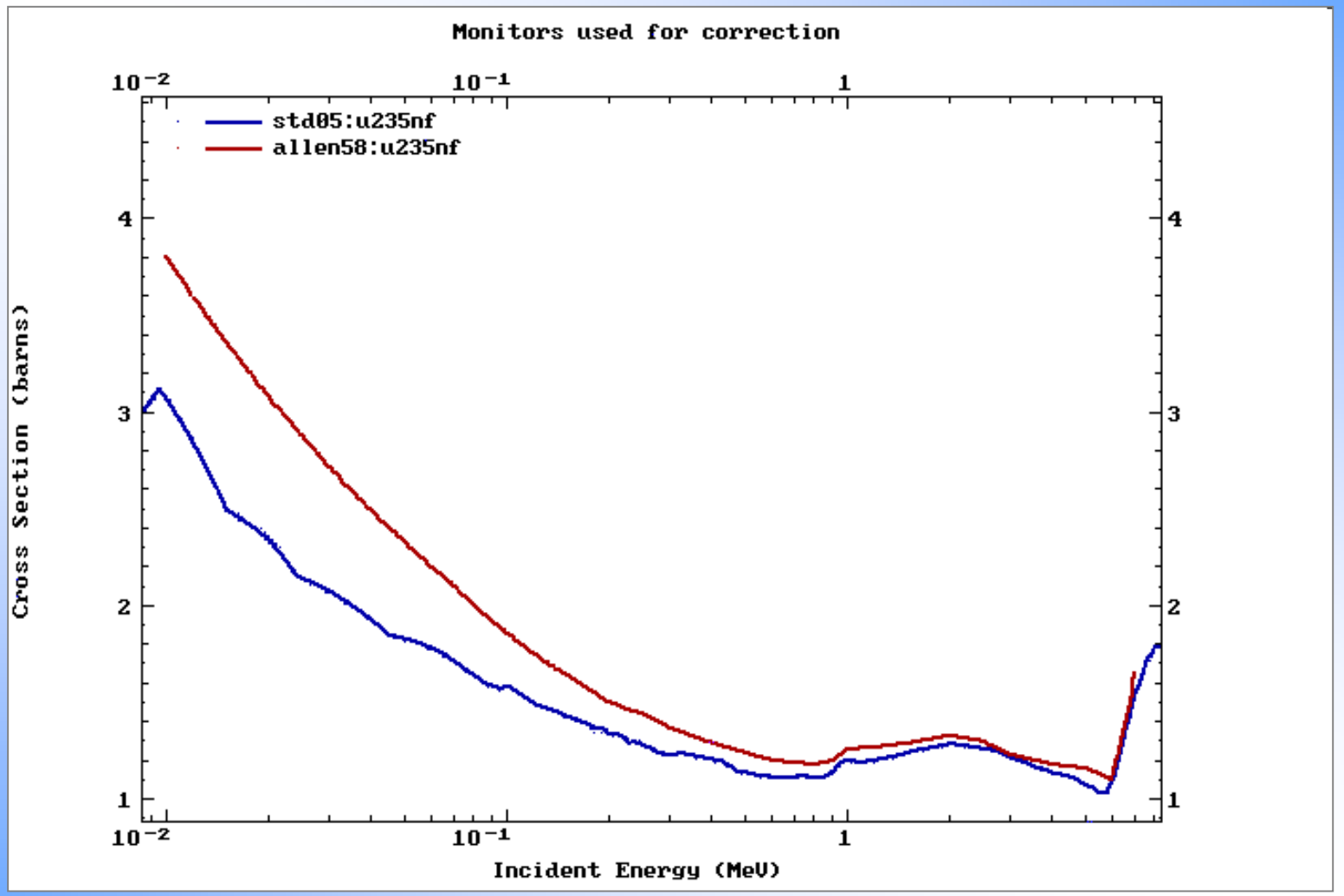
Corrected C4 file



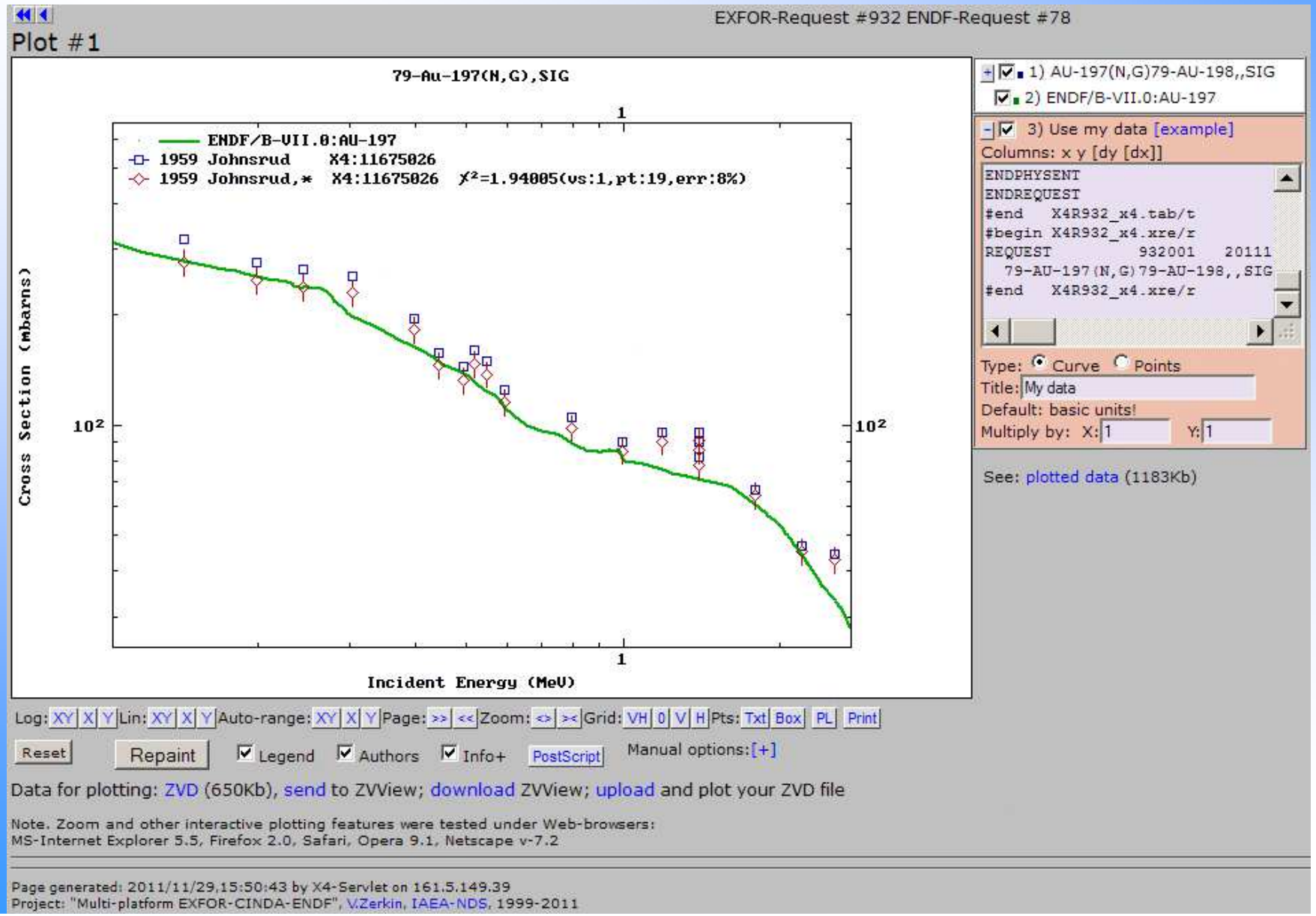
Checking data values and uncertainties



Checking used monitors



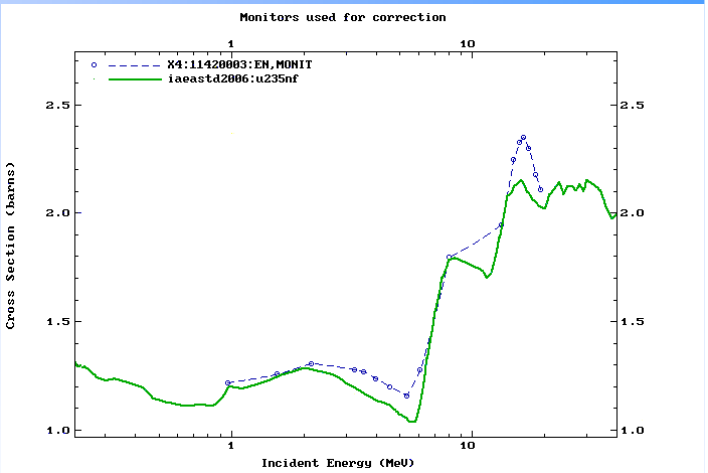
Original EXFOR data vs. corrected data and evaluated data



EXFOR 1142003 25-MN-55(N,G)25-MN-56,,SIG Menlove, 1967

```
SUBENT          11420001      860612
BIB                   11          19
INSTITUTE    (1USALOK)
REFERENCE    (J,PR,163,1299,67)
             (C,66WASH,2,746,6603)
AUTHOR       (H.O.MENLOVE,K.L.COOP,H.A.GRENCH,R.SHER)
TITLE        NEUTRON RADIATIVE CAPTURE CROSS SECTIONS FOR NA23,
             MN55, IN115, AND HO165 IN THE ENERGY REGION 1.0 TO 19.4
             MEV.
FACILITY     (VDG)
INC-SOURCE   (P-T) 1.0-2.2 MEV.
             (D-D) 3.3-6.1 MEV.
             (A-BE) 13.3-19.4 MEV.
             (D-T) 13.3-19.4 MEV.
MONITOR      (92-U-235(N,F),,SIG)
DETECTOR     (NAICR)
METHOD       (ACTIV)
STATUS       (SCSRS)
HISTORY      (760715T) TRANSLATED FROM SCISRS
             (820813A) CONVERTED TO REACTION FORMALISM
             (860612A) BIB UPDATE.
ENDBIB                19
NOCOMMON               0           0
ENDSUBENT             22
SUBENT          11420003      860612
BIB                    2           2
REACTION     (25-MN-55(N,G)25-MN-56,,SIG)
DECAY-DATA   (25-MN-56,2.58HR,DG)
ENDBIB                 2
NOCOMMON               0           0
DATA                   5          17
EN           EN-RSL      DATA        DATA-ERR    MONIT
MEV          MEV         B           B           B
 9.70   -01 1.00    -01 2.80    -03 2.2     -04 1.22
 1.56   +00 1.2     -01 1.94    -03 1.5     -04 1.26
 2.15   +00 1.3     -01 1.89    -03 1.4     -04 1.31
 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
 1.735  +01 3.2     -01 7.05    -04 7.1     -05 2.30
 1.844  +01 3.3     -01 5.80    -04 5.5     -05 2.18
 1.939  +01 3.5     -01 4.72    -04 4.8     -05 2.11
ENDDATA                19
ENDSUBENT              26
```

Monitors used for re-normalization



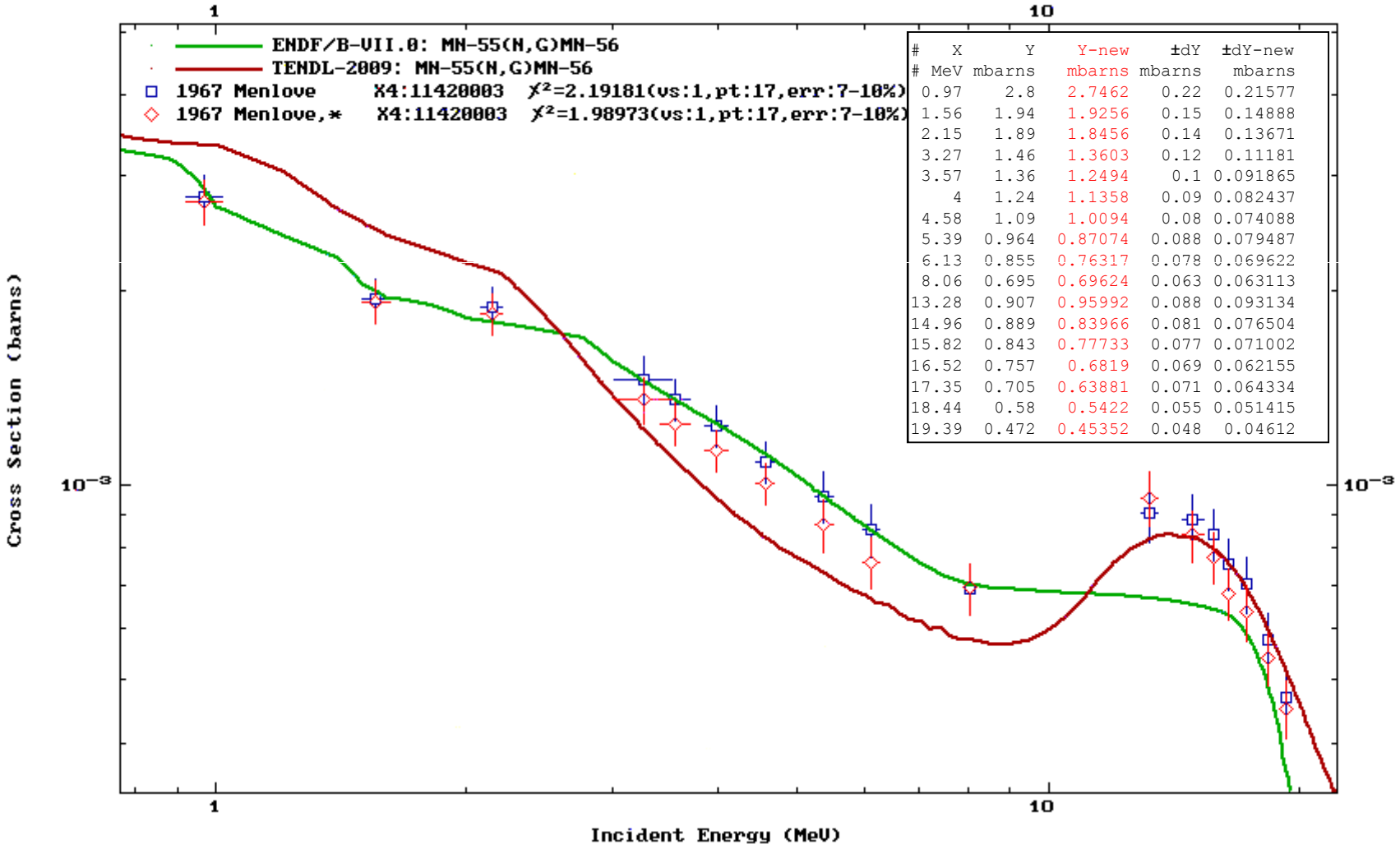
IAEA Standards (2006)

```
#Corrections:
11420003
        m0: [EN,MONIT];
        m1: iaeastd2006 $ u235nf;
        y =y*m1/m0;
        dy=dy*m1/m0;
```

EXFOR 1142003 25-MN-55(N,G)25-MN-56,,SIG Menlove, 1967

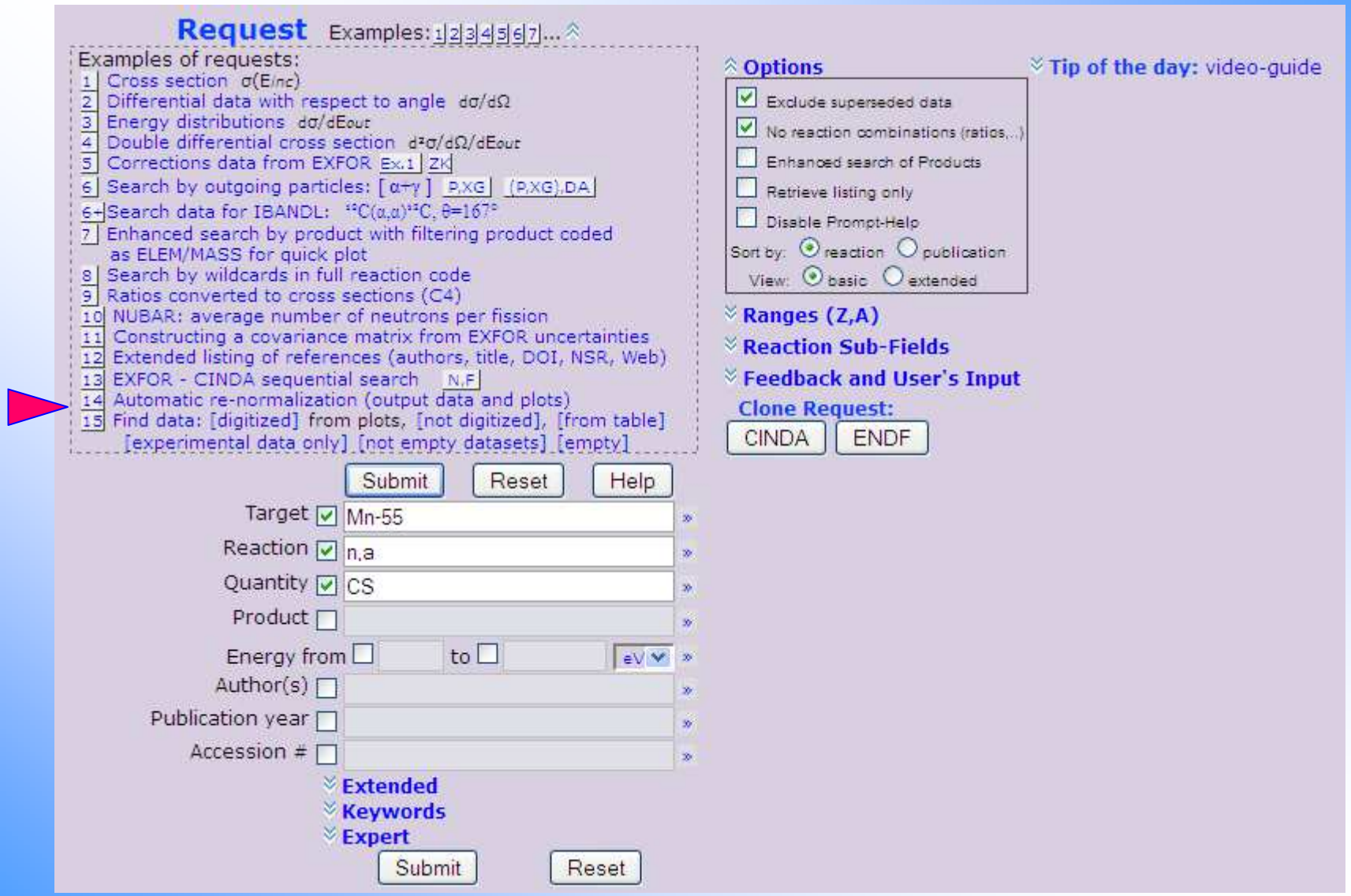
Applied corrections. Datasets: 1
1) EXFOR:#11420003 Corrected_Points:17
11420003 M0:[EN,MONIT]; M1:iaeastd2006$u235nf; Y=Y*M1/M0; dY=dY*M1/M0;

ENDF Request 501, 2010-May-04,11:23:29
EXFOR Request: 802/1, 2010-May-04 11:20:16



# X	Y	Y-new	±dY	±dY-new
# MeV	mbarns	mbarns	mbarns	mbarns
0.97	2.8	2.7462	0.22	0.21577
1.56	1.94	1.9256	0.15	0.14888
2.15	1.89	1.8456	0.14	0.13671
3.27	1.46	1.3603	0.12	0.11181
3.57	1.36	1.2494	0.1	0.091865
4	1.24	1.1358	0.09	0.082437
4.58	1.09	1.0094	0.08	0.074088
5.39	0.964	0.87074	0.088	0.079487
6.13	0.855	0.76317	0.078	0.069622
8.06	0.695	0.69624	0.063	0.063113
13.28	0.907	0.95992	0.088	0.093134
14.96	0.889	0.83966	0.081	0.076504
15.82	0.843	0.77733	0.077	0.071002
16.52	0.757	0.6819	0.069	0.062155
17.35	0.705	0.63881	0.071	0.064334
18.44	0.58	0.5422	0.055	0.051415
19.39	0.472	0.45352	0.048	0.04612

Automatic data re-normalization: an example



Data Selection

Retrieve | Selected | Unselected | All | Reset

Output: X4+ EXFOR Bibliography TAB C4 PlotC4

Plot: Quick-plot (cross-sections only) Advanced plot [how-to] using C5 and converting ratios to cross sections using [IAEA-standards,2006]

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

Apply(7A) Data re-normalization (for advanced users, results in: C4, TAB and Plots)

	n	Display	Year	Author-1	Energy range,eV		Points	Reference	Subentry#P	NSR-Key
	1)	25-MN-55(N,A)23-V-52,,SIG C4: MF3 MT107								
		Quantity: [CS] Cross section								
	1	Info X4+ X4± T4 Cov	2012	Yanbin Zhang+	1.41e7	1.47e7	2	+ J,IPC,81,(10),1563,2012	32701002	
	2	Info X4+ X4± T4 Cov	2000	A.Fessler+	1.61e7	2.03e7	5	+ J,NSE,134,(2),171,2000	22414016	2000FE01
	3	Info X4+ X4± T4 Cov	1999	A.A.Filatenkov+	1.35e7	1.48e7	8	+ R,RI-252,199905	41240011	
	4	Info X4+ X4± T4 Cov	1999	A.A.Filatenkov+	1.41e7		1	+ R,RI-252,199905	41298010	
	5	Info X4+ X4± T4 Cov	1994	M.Bostan+	6.33e6	1.20e7	7	+ J,PR/C,49,266,1994	22292007	1994BO01
	6	Info X4+ X4± T4 Cov	1993	A.Grallert+	1.46e7		1	+ R,INDC(NDS)-286,131,1993	31496007	
	7 A	Info X4+ X4± T4 Cov	1991	A.Ercan+	1.46e7		1	+ C,91JUELIC,,376,199105	22338043	
	8	Info X4+ X4± T4 Cov	1985	B.M.Bahal+	1.47e7		1	+ R,GKSS-85-E-11,1985	21936008	
	9	Info X4+ X4± T4 Cov	1984	G.Helfer+	2.96e6		1	+ J,CZJ/B,34,30,1984	30652003	1984FL01
f	10	Info X4+ X4± T4 Cov	1980	R.Vaenskae+	1.47e7		2	+ J,NIM,171,281,80	21893003	
	11	Info X4+ X4± T4 Cov	1980	P.N.Ngoc+	1.46e7		1	+ T,NGOC,1980	30562012	
	12 A	Info X4+ X4± T4 Cov	1980	E.Zupranska+	1.30e7	1.78e7	10	+ J,APP/B,11,853,198011	30581004	1980ZU02
	13 A	Info X4+ X4± T4 Cov	1978	U.Garuska+	1.46e7		1	+ P,INR-1773/I/PL/A,16,1978	30479006	
	14	Info X4+ X4± T4 Cov	1977	G.P.Dolya+	1.47e7		1	+ J,VAT/F,1,(18),15,1977	41306003	
	15 A	Info X4+ X4± T4 Cov	1967	B.Minetti+	1.47e7		1	+ J,ZP,199,275,6701	21345003	
	16	Info X4+ X4± T4 Cov	1965	E.Frevert	1.48e7		1	+ J,APA,20,304,6508	20030003	1965FR18
*	17	Info X4+ X4± T4 Cov	1965	M.Bormann+	1.26e7	1.88e7	10	+ J,NP,63,438,196503	20887007	1965BO42
	18 A	Info X4+ X4± T4 Cov	1965	C.S.Khurana+	1.48e7		1	+ J,NP,69,153,196507	31316015	
	19	Info X4+ X4± T4 Cov	1965	A.Peil	1.45e7		1	+ J,NP,66,419,196505	31469006	
	20	Info X4+ X4± T4 Cov	1962	F.Gabbard+	1.24e7	1.77e7	13	+ J,PR,128,1276,62	11494008	1962GA18
	21	Info X4+ X4± T4 Cov	1961	J.Nix+	1.48e7		1	+ P,A-ARK-60,6,196101	11684002	
	22 A	Info X4+ X4± T4 Cov	1960	C.S.Khurana+	1.40e7		1	+ C,60WALTAIR,,297,196002	30403019	
	23 A	Info X4+ X4± T4 Cov	1960	E.Weigold	1.45e7		1	+ J,AUJ,13,186,1960	31039007	
	24	Info X4+ X4± T4 Cov	1958	I.Kumabe	1.48e7		1	+ J,JPJ,13,325,5804	20283009	1958KU76
	25	Info X4+ X4± T4 Cov	1953	E.B.Paul+	1.45e7		1	+ J,CJP,31,267,1953	11274030	
	2)	25-MN-55(N,A)23-V-52,,SIG,,SPA C4: MF=3 MT=?								
		Quantity: [CS] Cross section								
	26	Info X4+ X4± T4 Cov	1979	C.H.Wu+	2.25e7		1	+ J,NP/A,329,63,197910	21009015	1979WU11
	27	Info X4+ X4± T4 Cov	1965	J.E.Strain+	1.40e7		1	+ R,ORNL-3672,196501	11263043	

Output Data

Format	Data (Size)
EXFOR Interpreted	X4+ (13Kb) Generate: X4± XML: X4.xml X4.html
EXFOR Output	X4Out X4Out.xml Test: C5 C5M:see:[doc]
Raw EXFOR (original)	EXFOR (7Kb) zip (3Kb)
Bibliography	html (4Kb) BibTeX (2Kb)
Computational	
C4	C4 (2Kb) C4.ZIP (1Kb) LST (128Kb)

C5M file = C5 & correlation matrix (default-2)

C5 file = C4 & systematic & statistical uncertainties

Corrected C4 file

Advanced Plotting: LST (1Kb)

Select experimental data for plotting...

Go to	Quantity type	#Plots
σ (E) SIG	Cross section data	1

Go to plot evaluated data...

ENDF Retrieve evaluated data and plot...

Requested corrections

Requested corrections

```
30581004  x4u:20090506  #1980 Zupranska
 #Reaction: 25-MN-55(N,A)23-V-52,,SIG
 #Monitor:  26-FE-56(N,P)25-MN-56,,SIG
 #m0: {20377002,H.LISKIEN+,J,JNE/AB,19,73,196502} $ fe56np;#old monit-ref
 m0: exfor$20377002_fe56np;     #old monitor(energy) in EXFOR
 m1: recom$fe56np;              #new monitor(energy)
 dy=dy/y;                       #to rel. uncertainties----
 y=y/m0*m1;                     #renormalized CS
 dy=(dy**2-dm0**2+dm1**2)**0.5;#replace monitor uncertainties
 dy=dy*y;                       #to abs. uncertainties
```

Applied corrections

Correction protocol

Applied corrections. Datasets: 1

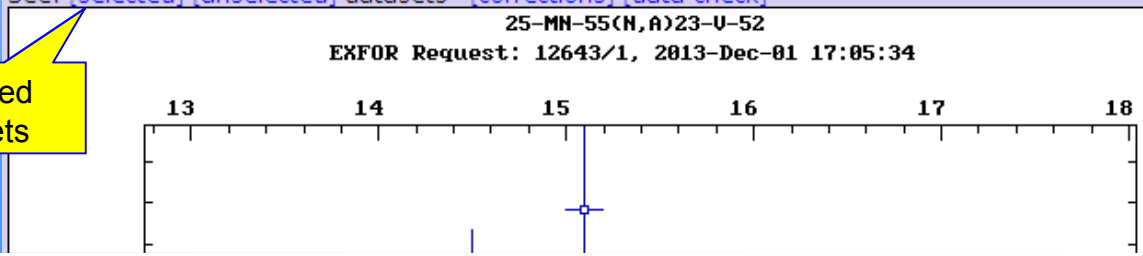
1) EXFOR:#30581004 Ref:E.Zupranska,ET.AL. (80) Corrected_Points:10 Deleted_Points:0

30581004 X4U:20090506; M0:exfor$20377002_fe56np; M1:recom$fe56np; dY=dY/Y; Y=Y/M0*M1; tmp0=dY^2-dM0^2+dM1^2; dY=tmp0^0.5; dY=dY*Y;

See used monitors: [plot]

See: [selected] [unselected] datasets [corrections] [data-check]

Selected datasets



ENDF Find and add to the plot evaluated data

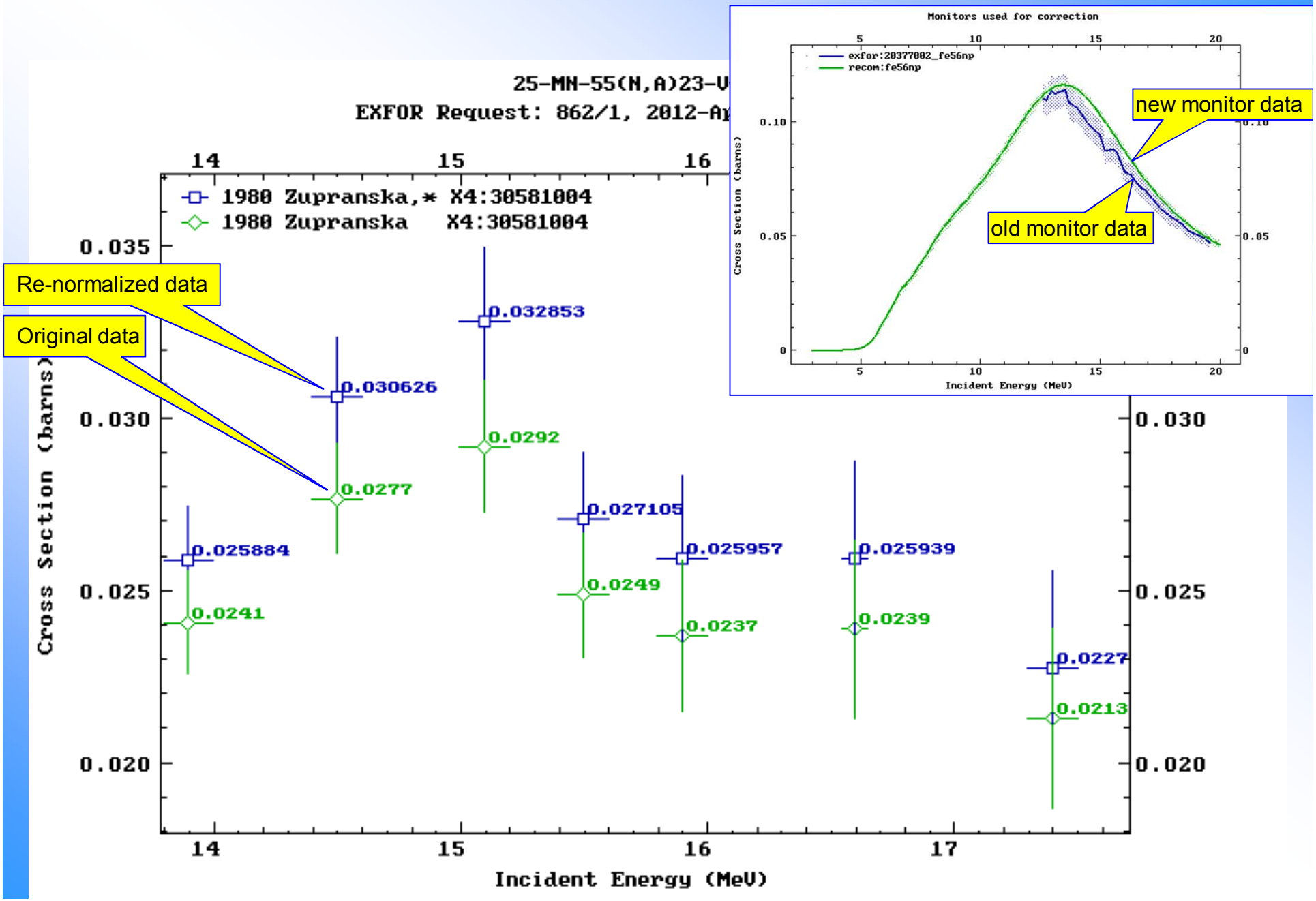
Select data for plotting [all] [none]

1) 25-MN-55(N,A)23-V-52,,SIG

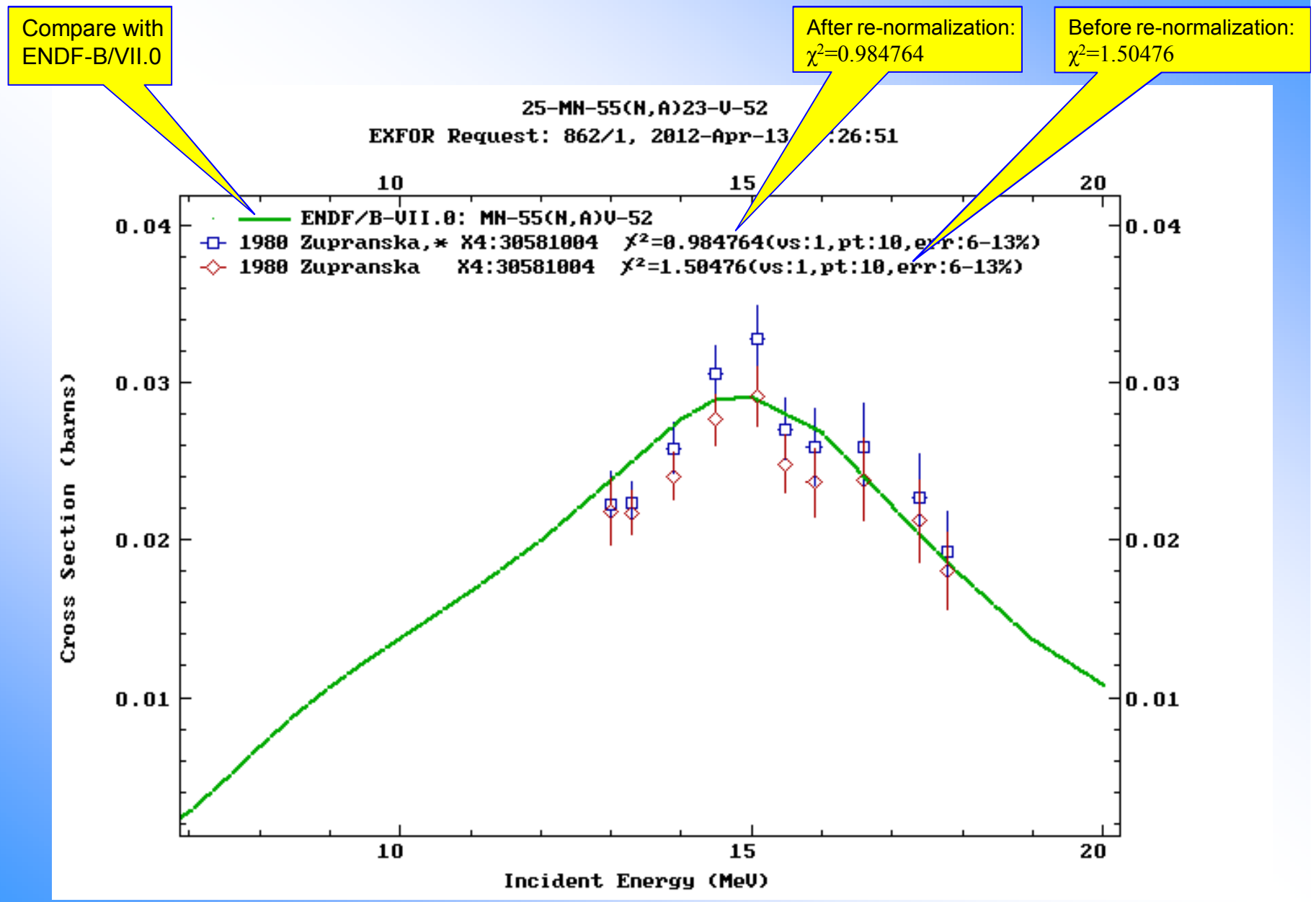
2) Use my data [example]

See: plotted data (2Kb)

Automatic data re-normalization: an example



Automatic data re-normalization: comparing to ENDF



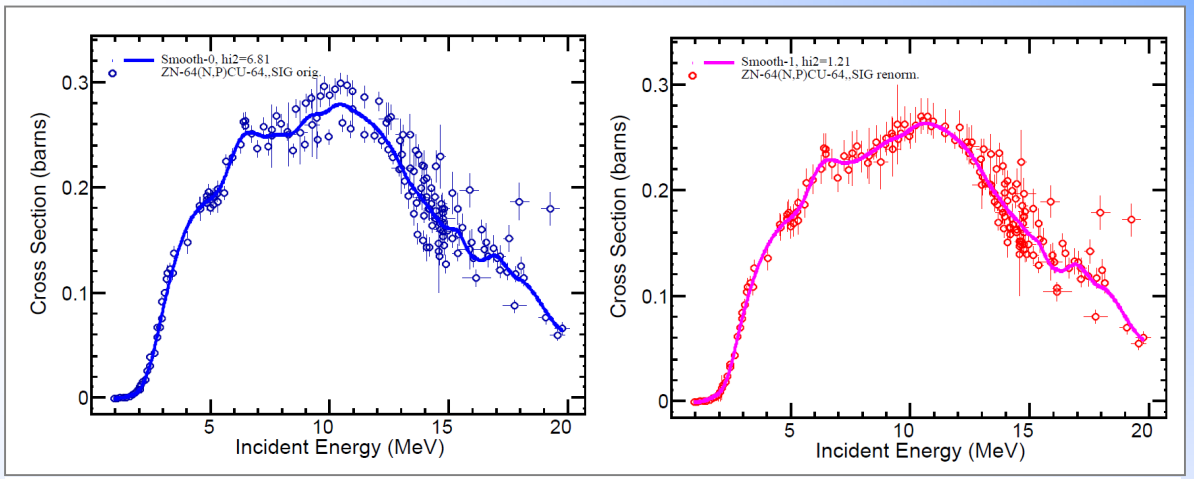
“Manual” corrections. Real example

Example of manual corrections (K. Zolotarev, 2011, IPPE, Russia):

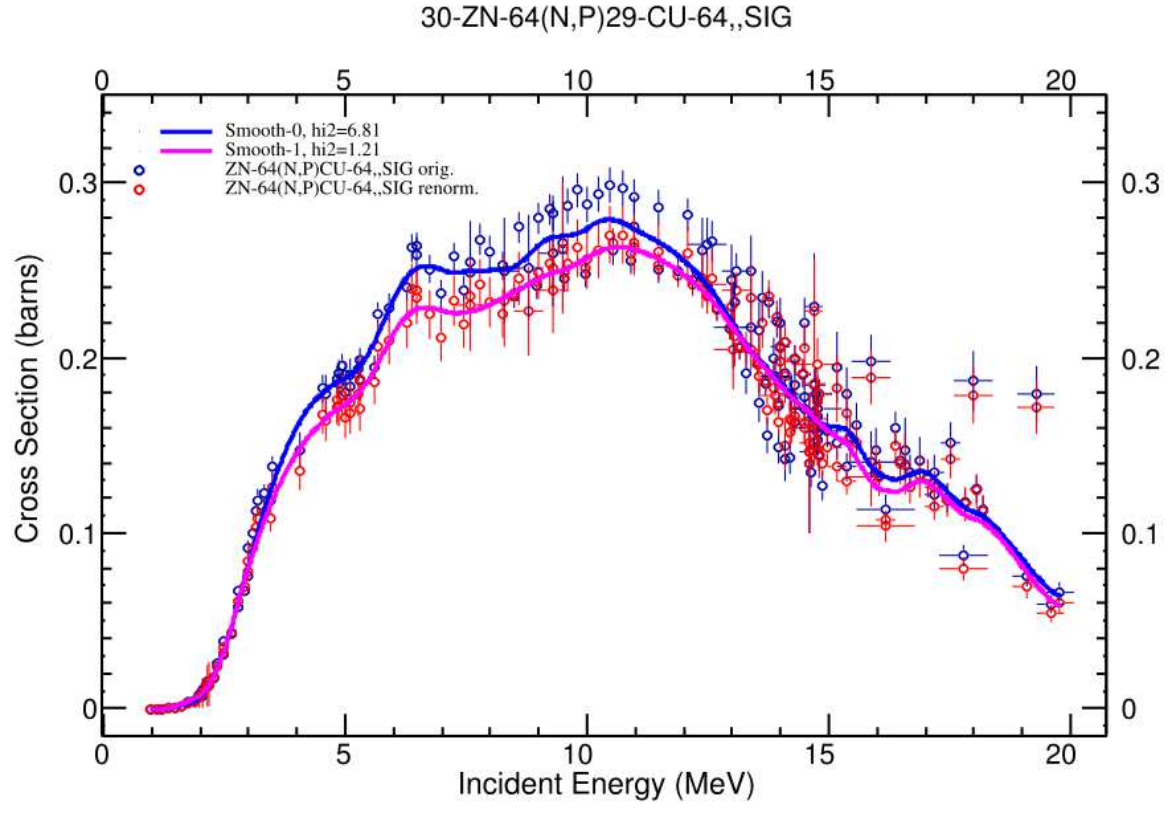
```
10224003                          # 1972 D.C.Santry+
                                  #measurements with T(p,n)He3 neutron source
                                  #monitor S32(n,p)P32 reaction
a0=0.91582;                       #experimental data were renormalized to the integral of
                                  #cross-section calculated from experimental data of Mannhart
                                  #and Schmidt 2007 in the overlapping energy
                                  #range 1.500 - 3.958 MeV, a0=0.91582
a1=0.0115;                        #error in b+ mode in Cu64 decay     - 1.15%
a2=0.03;                          #error in normalization value       - 3%
a3=0.03;                          #error in angular neutron intensity - 3%
m0: [en,monit];                   #old cs for S32(n,p)P32 monitor reaction
m1: rrdf10 $ s32np;               #new cs for S32(n,p)P32 monitor reaction
c1=dm1/m1;                        #relative error in new cs for S32(n,p)P32 monitor reaction
dy=dy/y;                          #relative uncertainty in original cs for Zn64(n,p)Cu64 reaction
fc=m1/m0*a0;                      #total correction factor
y=y*fc;                           #correction exp. cs
dy=dy^2+c1^2+a1^2+a2^2+a3^2;      #determination the quadrature of new total error
dy=dy^0.5*y;                      #determination the absolute error in new Zn64(n,p) cs

12956003                          #1975 R.Spangler+
m0: [en,monit];                   #old cs for Al27(n,a)Na24 monitor reaction
m1: rrdf10 $ al27na;              #new cs for Al27(n,a)Na24 monitor reaction
a=0.380/0.348;                    #correction to new  511 keV gamma-yield per decay Cu-64
fc=m1/m0*a;                       #total correction factor
y=y*fc;                           #correction exp. cs
dy=dy*fc;                         #correction  abs. uncertainty in renorm. cs
```

Example of “manual” corrections results

Before



After



Concluding remarks

1. EXFOR Web retrieval system offers data correction service:
   - trivial to use in automatic mode
   - has expert, interactive, semi-automatic modes
   - provides checking of data and monitors
2. Auto-correction database (datasets):
   - ready: 4,609 (6% of all CS data)
   - monitor' renormalization possible: 11,429 (16% of all CS data)
3. Archive of old and new monitors: 61 files today
4. Experts' database of corrections today: 4 reactions, 170 datasets
   - 4 reactions, 170 datasets
   - contributors: K.Zolotarev, R.Capote, D.Smith, A.Trkov

Thank you.