EXFOR Data Correction System: Progress in 2011-2012

Viktor Zerkin

International Atomic Energy Agency, Nuclear Data Section

Nuclear Reactions Data Centers Meeting 2012

OECD Nuclear Energy Agency, Issy-les-Moulineaux, France

Paris, 16-19 April 2012

EXFOR DATA Correction System
(EXFOR re-normalization system)

Goal.

To create tools for re-calculation absolute values from EXFOR according to today's knowledge (new standards, decay data, abundance), and based on additional information about experiments and evaluators' experience, etc.

Background (history)

1. Re-normalization has foreseen in EXFOR more than 30 years ago (keywords MONITOR and MONIT-REF last updated in 1982)
2. K.Zolotarev has implemented his "corrections" >10 years (used for RRDF-1998, IRDF-2002, etc.)
3. A.Trkov (IAEA) has proposed to extend EXFOR by ratios to Monitor when possible 2002-2007
4. NRDC-2005: D.Rochman (NNDC) has proposed "flagging" system
5. R.Forrest: "EASY" system has modification factors
6. WPEC SG-30 initially had task to create "evaluated" EXFOR with flags
7. R.Capote re-normalized "manually" EXFOR data used for evaluations (2008..2010)

EXFOR Correction System
(EXFOR re-normalization system)

Tasks (stages of development)

1. Define concept of the system, basic algorithms
2. Invent syntax describing corrections
3. Define structure and implement programs
4. Collect archive of old monitors used in EXFOR works and modern data
5. Collect corrections applied by experienced evaluators, create database of corrections
6. Create software for automatic re-normalization
7. Create database with corrections

2012 ▶

8. Create Web interface for using correction-database
9. Create software to generate re-normalized XC4 for full EXFOR in C4
10. Start distributing renormalized RXC4 to former SG30 members
11. Etc.

Project started: November 2009

Correction System: Paradigm

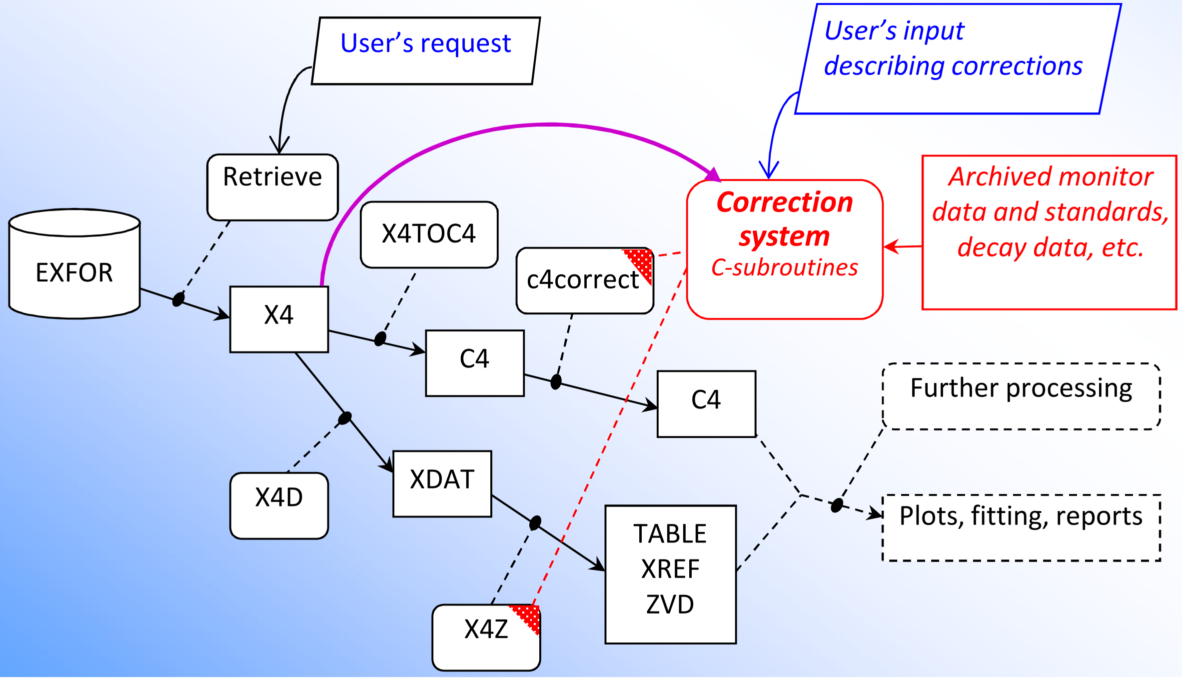
- **We <u>DO NOT</u> change EXFOR data.**

  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



Principles, functions, extensions

a) the system allows to re-calculate any values present in computational format (data, energies, angles, uncertainties)

b) any manipulations can be limited by an energy range

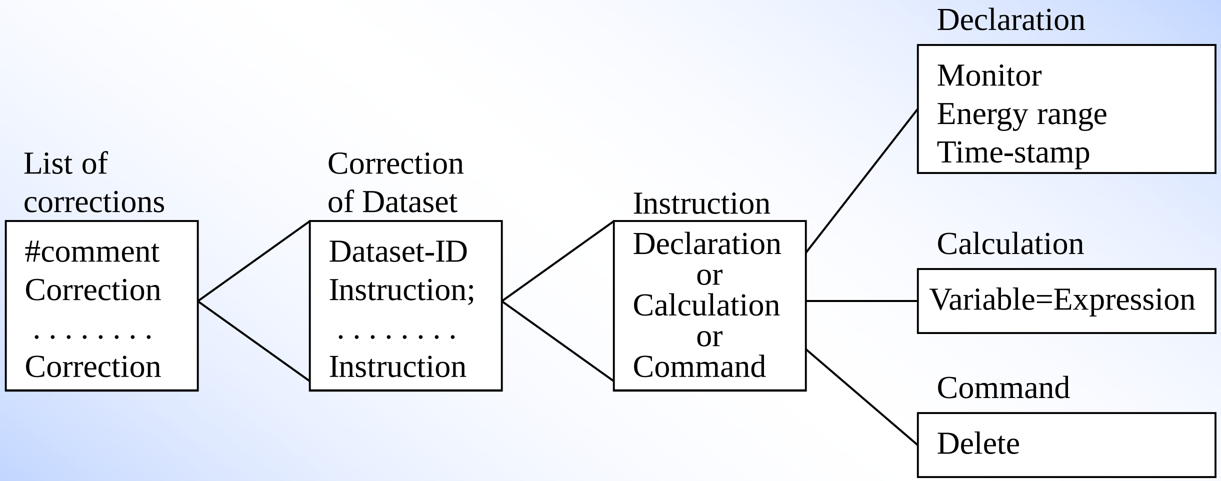
1) simple re-calculation using given factor (e.g. modify data, correct wrong units)
2) re-normalize data using monitors from archive and recent standards;
3) re-normalize data using monitor data coded in EXFOR and recent standards;
4) re-normalize data using isotopes abundances;
5) set up uncertainties if they are not given;
6) delete part of a data set;
7) convert ratios to absolute numbers (and reverse);
8) calculate ratios to archival monitors and to monitors coded in EXFOR;

Automatic corrections based on EXFOR information: started in December 2011

Plan: collecting database of corrections done by evaluators (plan)

Syntax. 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.

mf mt e de y dy a da e2 de2 dSys

C4 file

```
Proj.TargetM MF MT PXC  Energy  dEnergy  Data      dData   Cos/LO   dCos/LO   LVL/HL  dLVL/HL I78 Refer (YY)              EntrySubP
----><---->o<-><-->ooo<-------><-------><-------><-------><-------><-------><-------><-------><-><----------------------><---><->o
    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:

+ - * / **

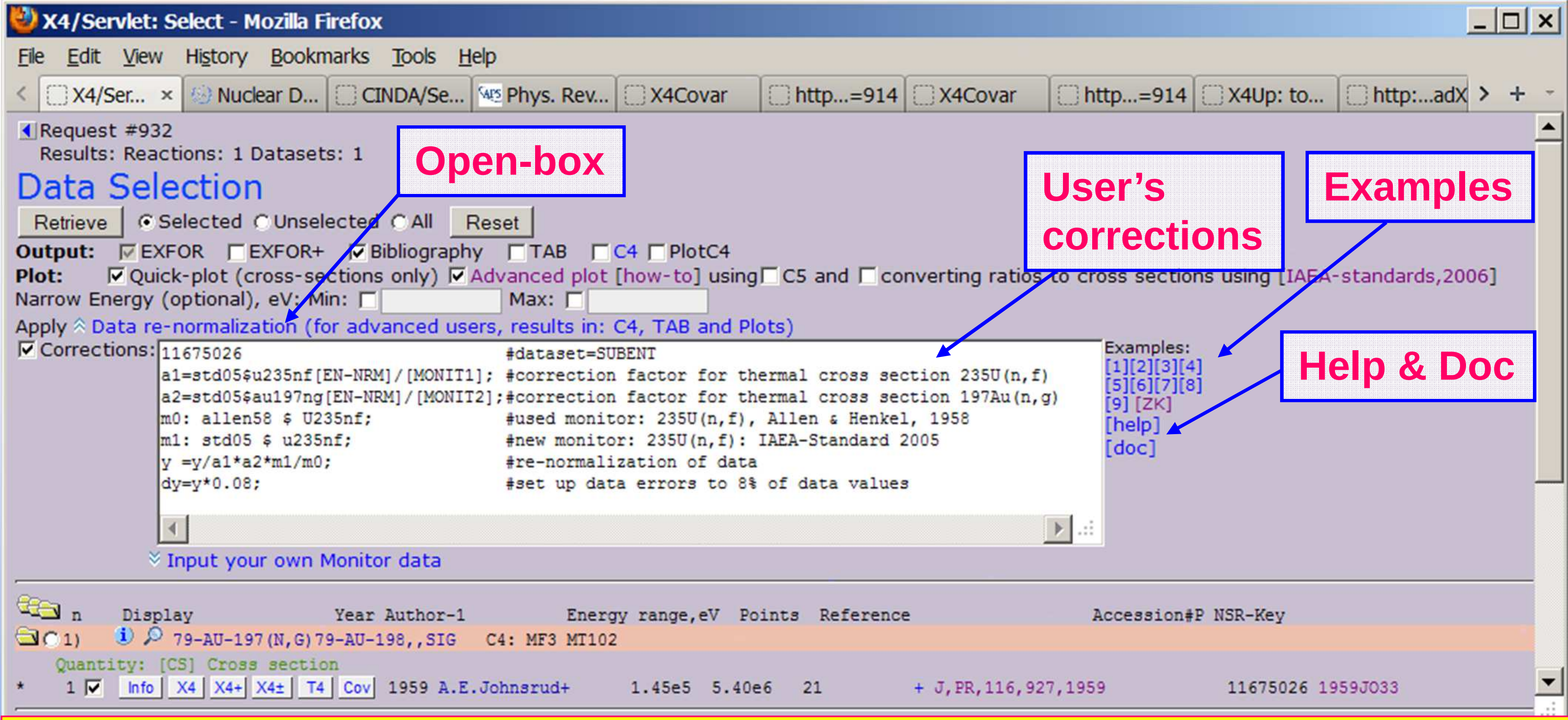
parentheses () change order of operations

Calculations

syntax: variable=expression;

Traditional for programming languages

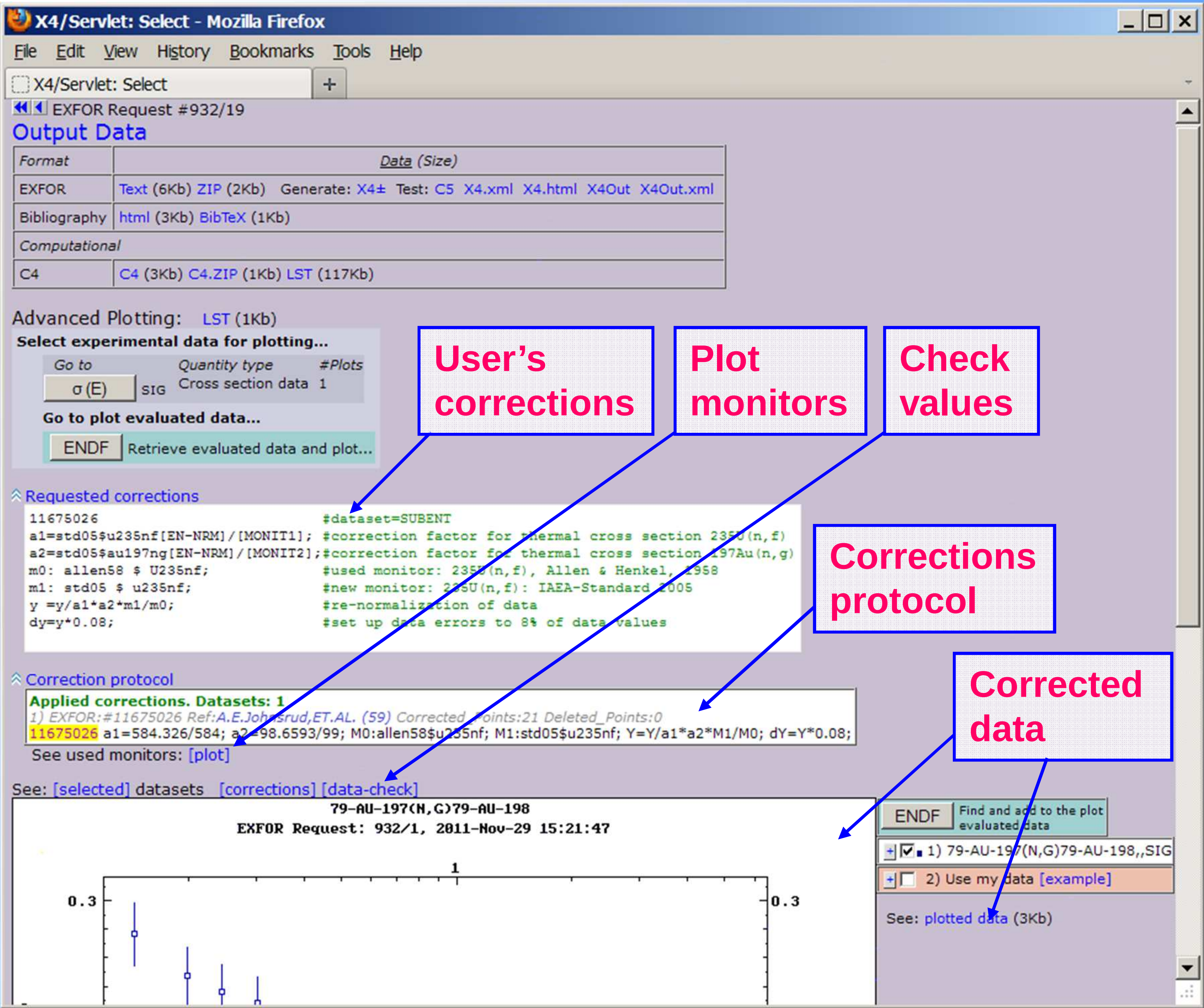
Using Correction System



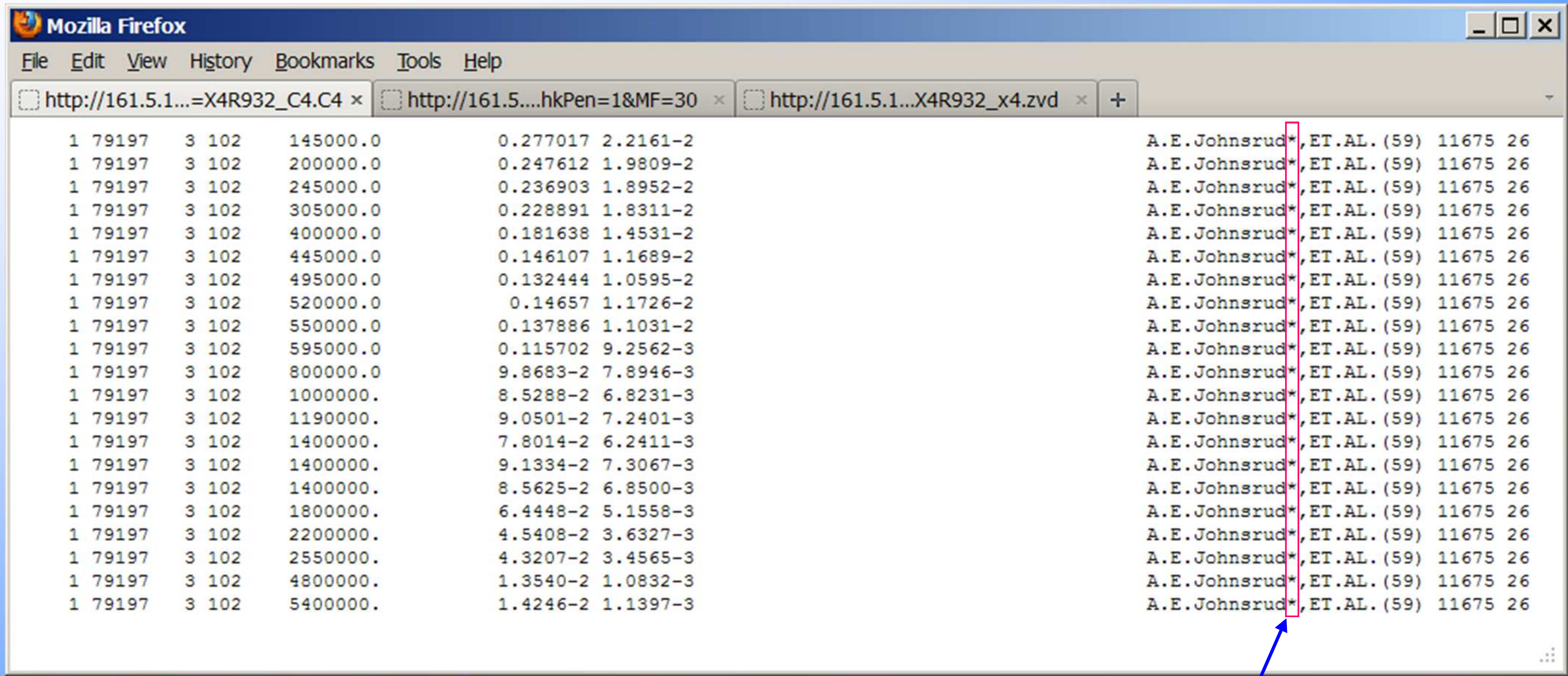
Two monitoring points (given in EXFOR COMMON blocks) were used together with energy dependent monitor. Re-normalize absolute cross section data.

```
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



Corrected C4 file



1	79197	3	102	145000.0	0.277017	2.2161-2	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	200000.0	0.247612	1.9809-2	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	245000.0	0.236903	1.8952-2	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	305000.0	0.228891	1.8311-2	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	400000.0	0.181638	1.4531-2	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	445000.0	0.146107	1.1689-2	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	495000.0	0.132444	1.0595-2	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	520000.0	0.14657	1.1726-2	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	550000.0	0.137886	1.1031-2	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	595000.0	0.115702	9.2562-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	800000.0	9.8683-2	7.8946-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	1000000.	8.5288-2	6.8231-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	1190000.	9.0501-2	7.2401-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	1400000.	7.8014-2	6.2411-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	1400000.	9.1334-2	7.3067-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	1400000.	8.5625-2	6.8500-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	1800000.	6.4448-2	5.1558-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	2200000.	4.5408-2	3.6327-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	2550000.	4.3207-2	3.4565-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	4800000.	1.3540-2	1.0832-3	A.E.Johnsrud*,ET.AL.(59)	11675	26
1	79197	3	102	5400000.	1.4246-2	1.1397-3	A.E.Johnsrud*,ET.AL.(59)	11675	26

*** Flag: corrected data**

Checking data values and uncertainties

Data before | Data after | Uncert. before | Uncert. after | Final correction factor

Mozilla Firefox

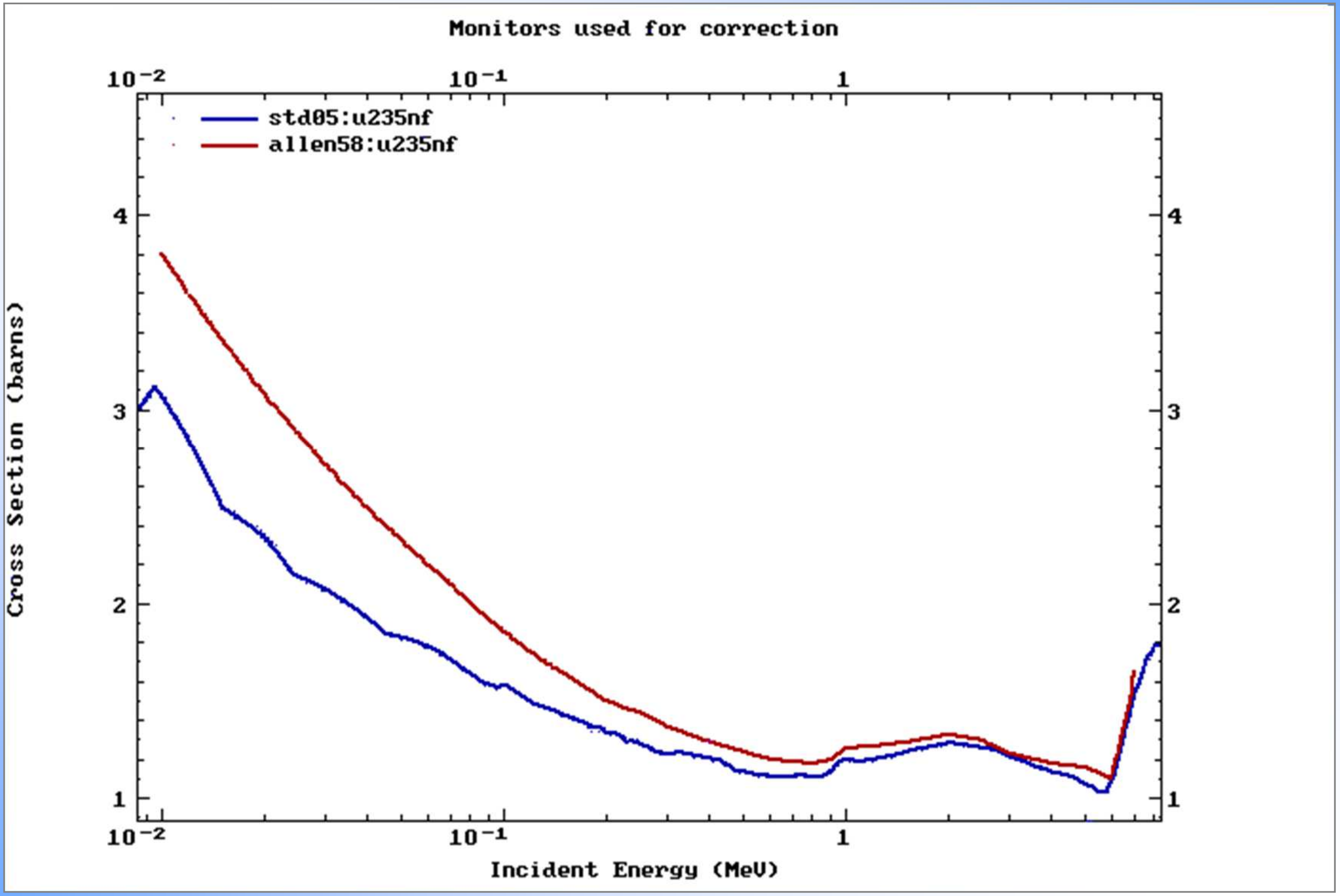
File Edit View History Bookmarks Tools Help

X4/Servlet: Select | http://161.5.1..._x4.c4.datamod

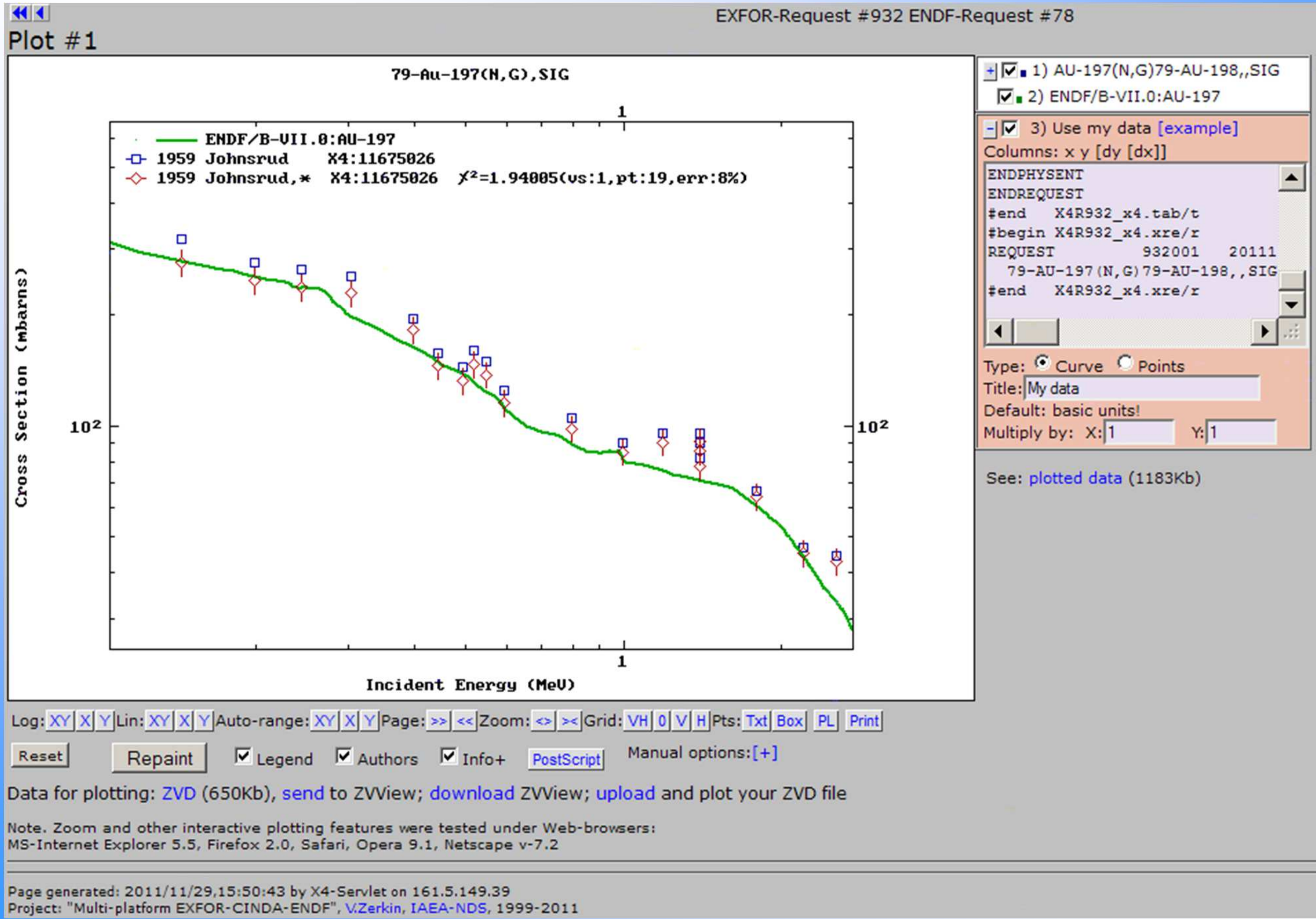
-1	En(MeV)=0.145	Y(mb)=320	dY(mb)=0	(0.00%)	11675026	A.E.Johnsrud,ET.AL. (59)
+1		Y(mb)=277.017	dY(mb)=22.1614	(8.00%)	11675026	*Fc=0.865679
-2	En(MeV)=0.2	Y(mb)=278	dY(mb)=0	(0.00%)	11675026	A.E.Johnsrud,ET.AL. (59)
+2		Y(mb)=247.612	dY(mb)=19.8089	(8.00%)	11675026	*Fc=0.890689
-3	En(MeV)=0.245	Y(mb)=266	dY(mb)=0	(0.00%)	11675026	A.E.Johnsrud,ET.AL. (59)
+3		Y(mb)=236.903	dY(mb)=18.9523	(8.00%)	11675026	*Fc=0.890615
-4	En(MeV)=0.305	Y(mb)=255	dY(mb)=0	(0.00%)	11675026	A.E.Johnsrud,ET.AL. (59)
+4		Y(mb)=228.891	dY(mb)=18.3113	(8.00%)	11675026	*Fc=0.897611
-5	En(MeV)=0.4	Y(mb)=195	dY(mb)=0	(0.00%)	11675026	A.E.Johnsrud,ET.AL. (59)
+5		Y(mb)=181.638	dY(mb)=14.5311	(8.00%)	11675026	*Fc=0.931479
-6	En(MeV)=					
+6						
-7	En(MeV)=					
+7						
-8	En(MeV)=					
+8						
-9	En(MeV)=					
+9						
-10	En(MeV)=					
+10						
-11	En(MeV)=					
+11						
-12	En(MeV)=					
+12						
-13	En(MeV)=					
+13						
-14	En(MeV)=					
+14						
-15	En(MeV)=					
+15						
-16	En(MeV)=					
+16						

-1	En(MeV)=1.83	Y(mb)=4.4	dY(mb)=1	(22.73%)	10224002	D.C.SANTRY,ET.AL.(72)
+1		Y(mb)=4.02961	dY(mb)=0.932792	(23.15%)	10224002	*Fc=0.91582
-2	En(MeV)=2.01	Y(mb)=8.2	dY(mb)=1.7	(20.73%)	10224002	D.C.SANTRY,ET.AL.(72)
+2		Y(mb)=7.50972	dY(mb)=1.59151	(21.19%)	10224002	*Fc=0.91582
-3	En(MeV)=2.2	Y(mb)=17.4	dY(mb)=1.4	(8.05%)	10224002	D.C.SANTRY,ET.AL.(72)
+3		Y(mb)=15.9353	dY(mb)=1.46102	(9.17%)	10224002	*Fc=0.91582
-4	En(MeV)=2.36	Y(mb)=26.2	dY(mb)=2.5	(9.54%)	10224002	D.C.SANTRY,ET.AL.(72)
+4		Y(mb)=23.9945	dY(mb)=2.52081	(10.51%)	10224002	*Fc=0.91582
-5	En(MeV)=2.5	Y(mb)=38.9	dY(mb)=3.1	(7.97%)	10224002	D.C.SANTRY,ET.AL.(72)
+5		Y(mb)=35.6254	dY(mb)=3.2423	(9.10%)	10224002	*Fc=0.91582
-6	En(MeV)=2.81	Y(mb)=67.6	dY(mb)=2.8	(4.14%)	10224002	D.C.SANTRY,ET.AL.(72)
+6		Y(mb)=61.9094	dY(mb)=3.73918	(6.04%)	10224002	*Fc=0.91582
-7	En(MeV)=3.01	Y(mb)=92	dY(mb)=4.1	(4.46%)	10224002	D.C.SANTRY,ET.AL.(72)
+7		Y(mb)=84.2554	dY(mb)=5.27409	(6.26%)	10224002	*Fc=0.91582
-8	En(MeV)=3.1	Y(mb)=100	dY(mb)=4	(4.00%)	10224002	D.C.SANTRY,ET.AL.(72)
+8		Y(mb)=91.582	dY(mb)=5.44297	(5.94%)	10224002	*Fc=0.91582
-9	En(MeV)=3.18	Y(mb)=113	dY(mb)=4	(3.54%)	10224002	D.C.SANTRY,ET.AL.(72)
+9		Y(mb)=103.488	dY(mb)=5.84067	(5.64%)	10224002	*Fc=0.91582
-10	En(MeV)=3.21	Y(mb)=119	dY(mb)=7	(5.88%)	10224002	D.C.SANTRY,ET.AL.(72)
+10		Y(mb)=108.983	dY(mb)=8.00296	(7.34%)	10224002	*Fc=0.91582

Checking used monitors



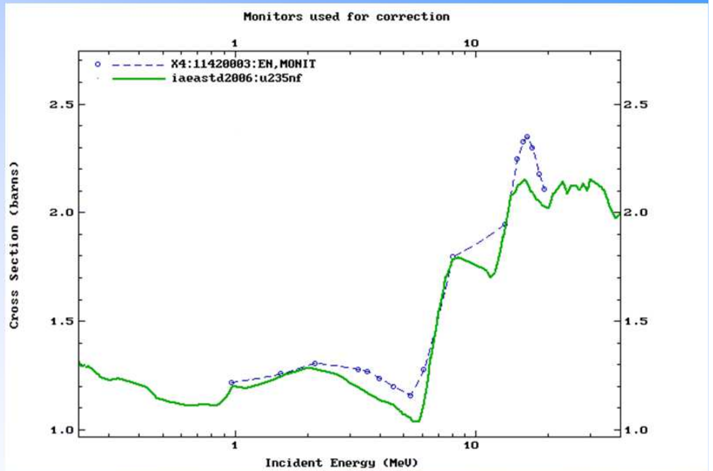
Original EXFOR data vs. corrected data and evaluated data



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

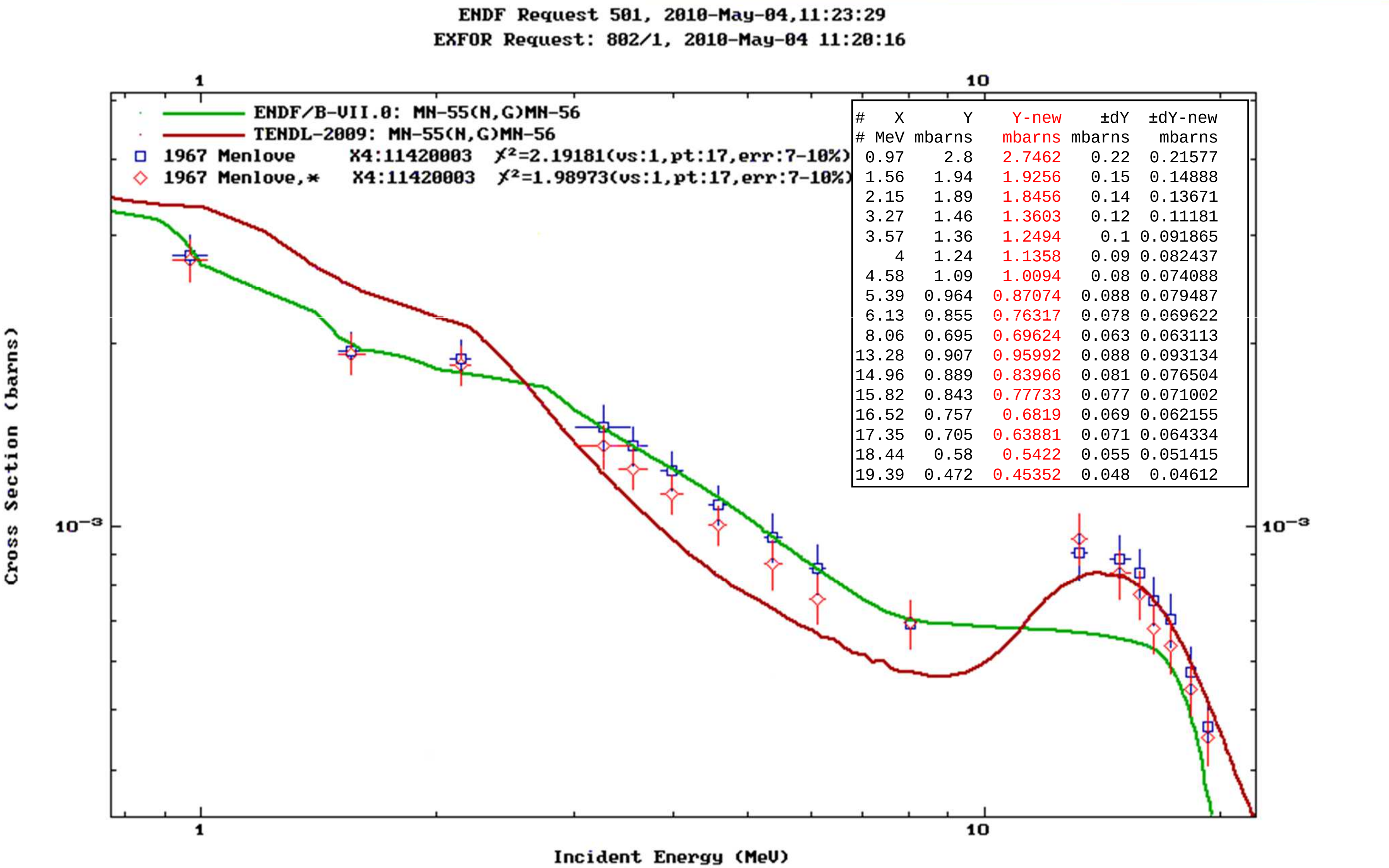


IAEA Standards (2006)

```
#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;



# 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

X4/Servlet: Help Title - Mozilla Firefox

Available monitor reactions (standards):

1. Library: IAEA-standards, 2006
    1. m1: iaeastd2006 $ h01nn
    2. m1: iaeastd2006 $ li6nt
    3. m1: iaeastd2006 $ b10na
    4. m1: iaeastd2006 $ au197ng
    5. m1: iaeastd2006 $ u235nf
    6. m1: iaeastd2006 $ u238nf
2. Library: RRDF-2010
    1. m1: rrdf10 $ al27na
    2. m1: rrdf10 $ al27np
    3. m1: rrdf10 $ au197n2n
    4. m1: rrdf10 $ cu63n2n
    5. m1: rrdf10 $ cu65n2n
    6. m1: rrdf10 $ fe56np
    7. m1: rrdf10 $ in115nnm
    8. m1: rrdf10 $ nb93nnm
    9. m1: rrdf10 $ nb93n2nm
    10. m1: rrdf10 $ ni58np
    11. m1: rrdf10 $ s32np
    12. m1: rrdf10 $ as75n2n
    13. m1: rrdf10 $ ti49nx
3. Library: JENDL/D99
    1. m0: jendl99 $ in115nnm
4. Library: ENDF-B/VI
    1. m0: endfb6 $ u235nf
    2. m0: endfb6 $ u238nf
5. Library: ENDF-B/V
    1. m0: endfb5 $ fe56np
    2. m0: endfb5 $ in115nnm
    3. m0: endfb5 $ li6nt
    4. m0: endfb5 $ u235nf
6. Library: ENDF-B/IV
    1. m0: endfb4 $ fe56np
    2. m0: endfb4 $ ni58np
    3. m0: endfb4 $ u235nf
7. Library: IRK-90 (Vienna, H.Vonach, 1990)
    1. m0: irk90 $ al27na
    2. m0: irk90 $ nb93n2nm
    3. m0: irk90 $ au197n2n
8. Monitors used in the past
    1. m0: gammel60 $ h01nn
       J.L.Gammel, Fast Neutron Physics, Vol II, p.2185, Interscience Pub., Inc., New York, 1960
    2. m0: sowerbay73 $ u238nf
       M.G.Sowerby et al. Report AERE-R-7373, 1973
    3. m0: allen58 $ u235nf
       W.D.Allen, R.Henkel
       Fast Neutron on the Isotopes of Thorium, Uranium and Pluttonium.
       Progress in Nuclear Energy. Pergamon Press, New York, 1958, series 1, vol.2, pp. 1-50
    4. m0: smith57 $ u238nf
       R.K.Smith, R.L.Henkel, R.A.Nobles
       Neutron-Induced Fission Cross Sections for U233, U235, U238 and Pu241 from 2 To 10 MeV.
       Bulletin of the American Physical Society; Vol.2, p.196(K4), 1957
    5. m0: vonach83 $ al27na
       H.Vonach
       The Al-27(n,a)Na-24 Cross Section. Nuclear Data Standards for Nuclear Measurements. Technical Reports Series No.227, IAEA, Vienna, 1983, pp.59-63

Status. Monitors.

- Organized in two level structure: library / monitor == directory / file
- Data are stored in 3-col. text files
- Monitor-covariance: not yet
- Total: 47 data files
- Source: IRDF-2002 project (K.Zolotarev, IPPE, Russia)

Results in 2011: "manual system"

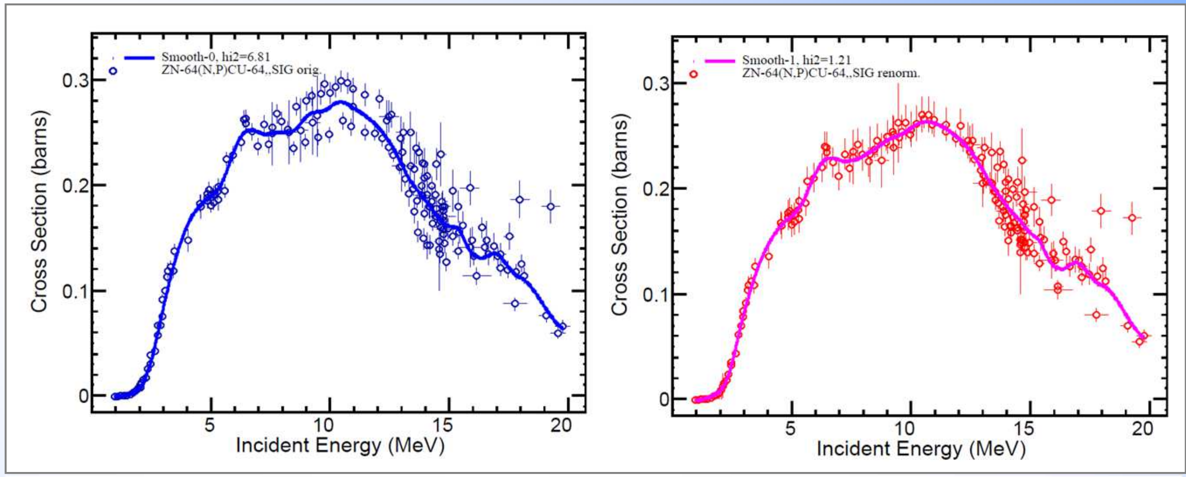
- expert K.Zolotarev (physicist from IPPE, Russia) uses the system to prepare corrections and test the system (2 weeks visit in May 2011): 33 dataset for the reaction Zn-64(n,p) were analysed, correction file was prepared
- Zolotarev's collection of monitors was adopted to archive and tested
- functions of the Web system were extended (precise data checking, uploading user's monitor, etc.)
- syntax was extended to include parentheses and monitor data errors

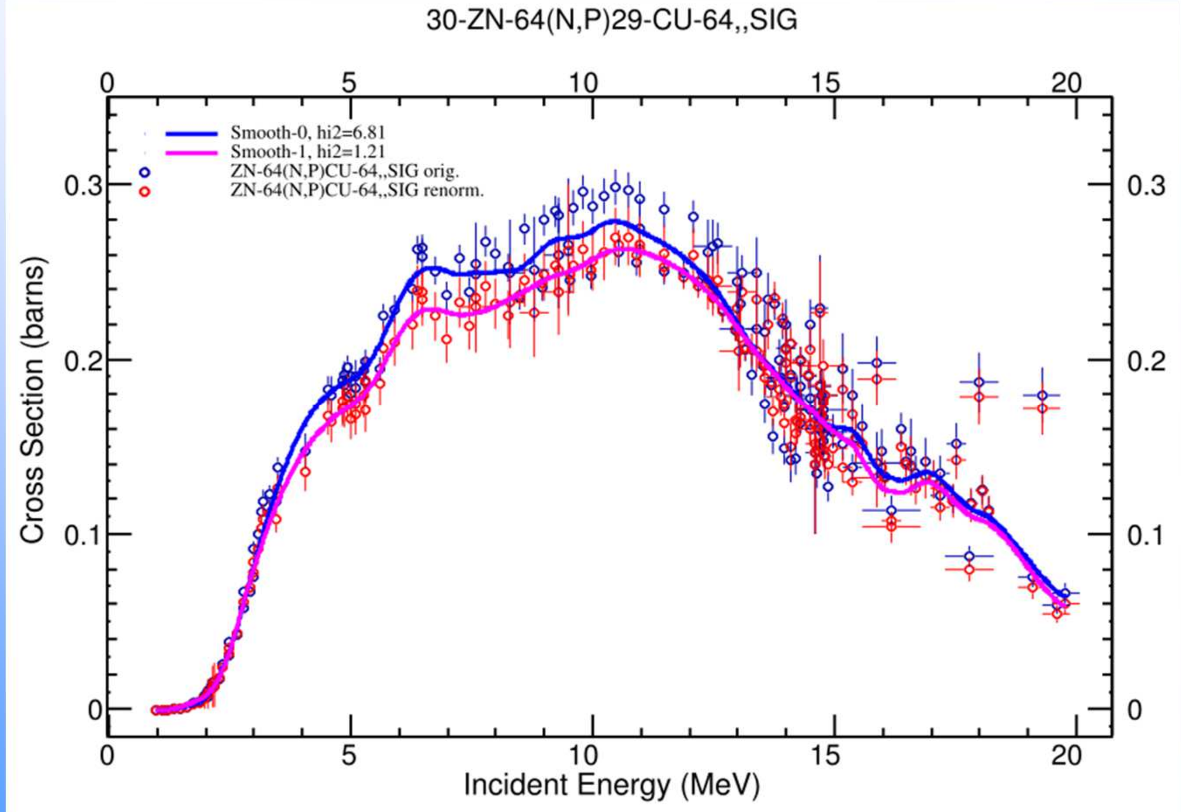
Example of Zolotarev's corrections:

```
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
```

Before corrections   After corrections



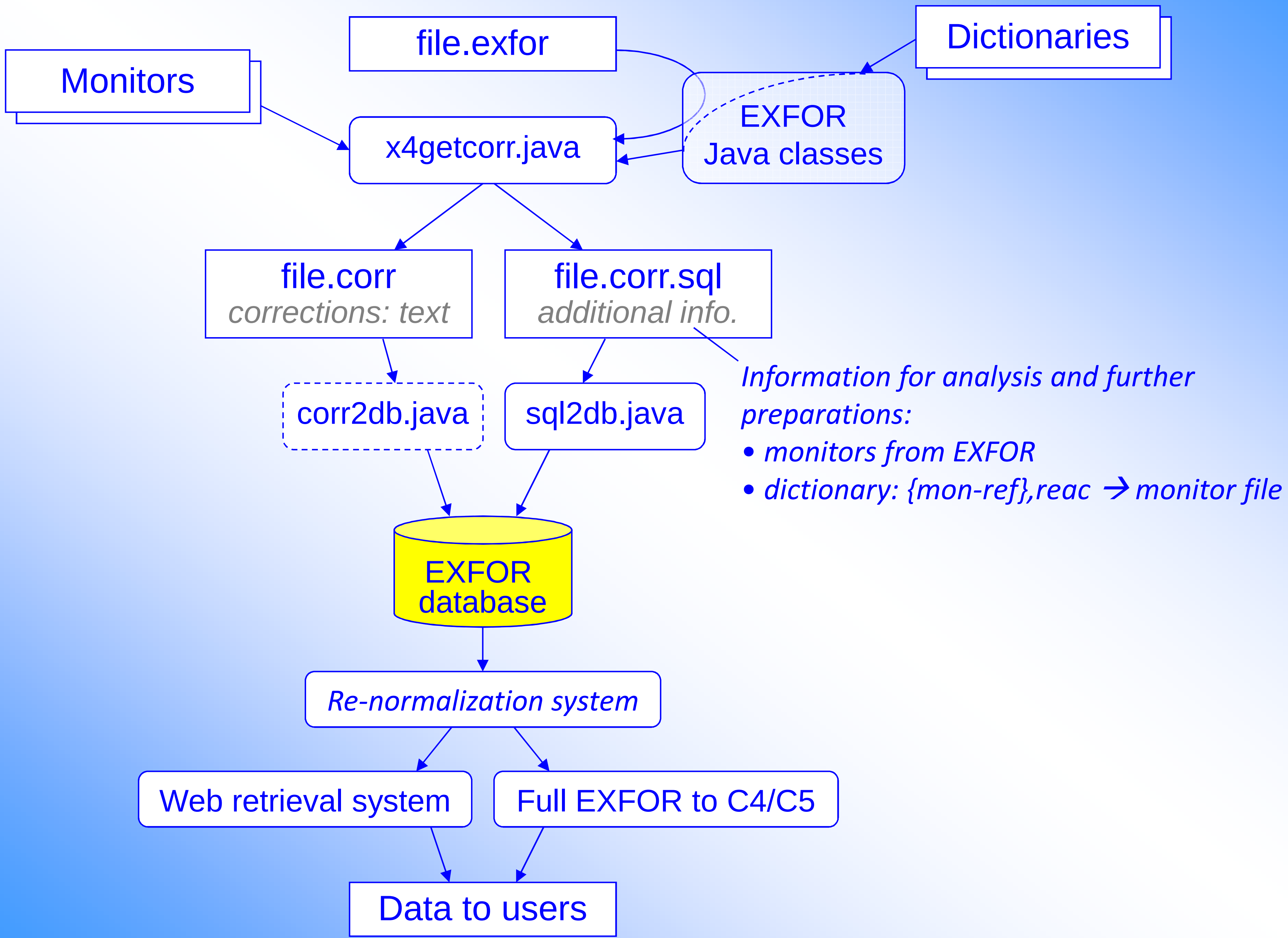


General plan

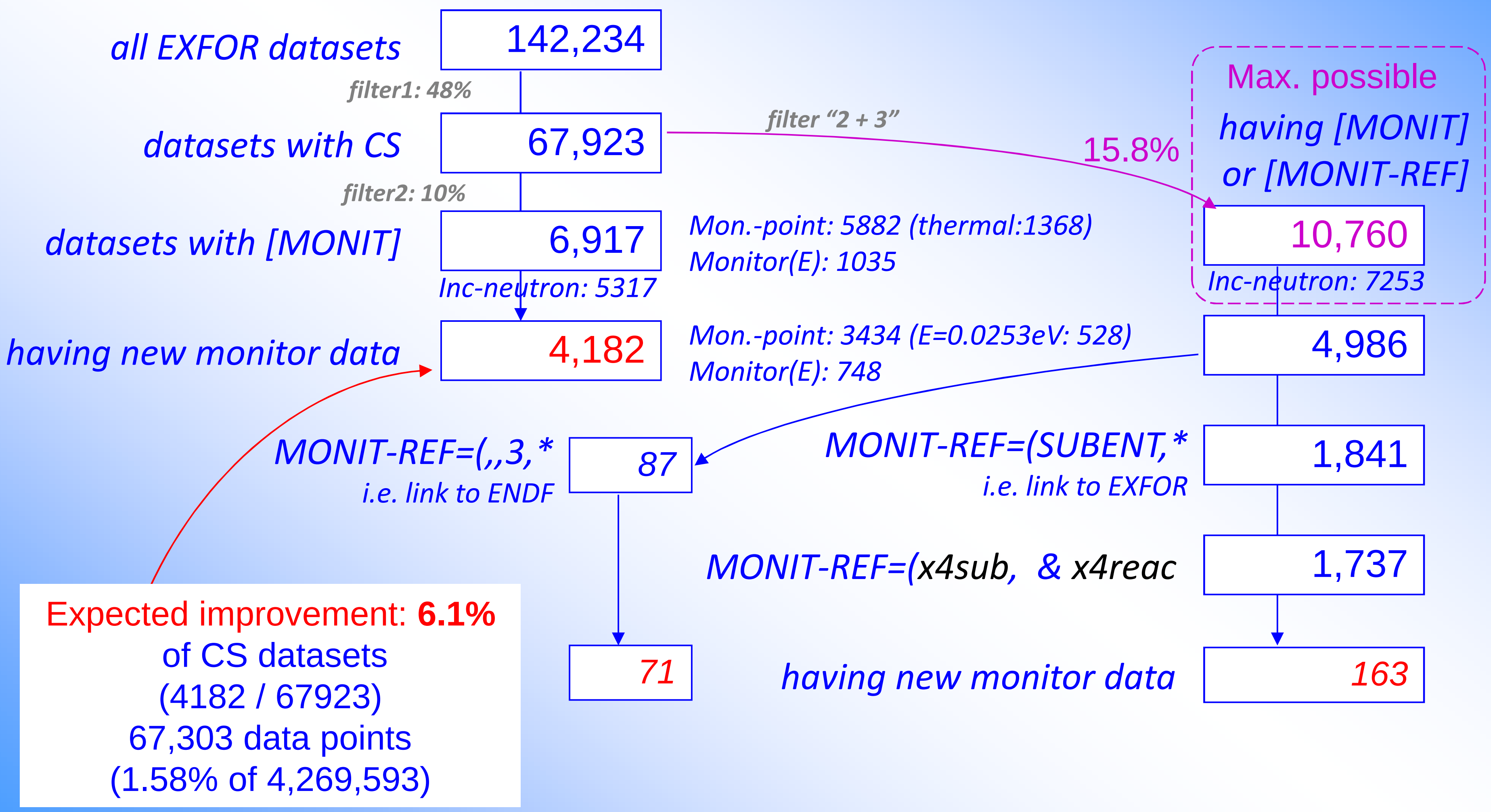
April-2012

1. Automatic corrections based on EXFOR information
   1. Possible for some types EXFOR data, difficult for others
   2. Need unifications in EXFOR coding (MON-REF)
   3. May need to extend EXFOR format (e.g. energy intervals for MON-REF)
2. All corrections → database → Web retrieval system
3. EXFOR + automatic corrections → corrected C4/C5
4. Improve service support (e.g. common plot: original vs. corrected)
5. Extend syntax (to solve problems using original EXFOR columns)
6. Collecting database of corrections done by evaluators
   1. Personal opinion
   2. Arguing (?)
   3. Web support
   4. People and time

Automatic corrections based on EXFOR information



Automatic correction: types of EXFOR data and expected results



Example-1: Energy dependent monitor given in DATA section

```
SUBENT        10421001   20030221
REFERENCE  (J,NSE,57,300,197508)
AUTHOR     (W.P.Poenitz)
TITLE      Measurements of the Neutron Capture Cross Sections of
           Gold-197 and Uranium-238 Between 20 and 3500 keV
SUBENT        10421003   20030221
REACTION   (92-U-238(N,G)92-U-239,,SIG)
MONITOR    (79-AU-197(N,G)79-AU-198,,SIG) Relative standard
DATA                 6         44
EN         EN-RSL     DATA       DATA-ERR   MONIT      MONIT-ERR
KEV        KEV        MB         MB         MB         PER-CENT
 20.         4.        631.        54.       720.         2.
 24.                   550.        47.       655.         2.
 28.                   490.        42.       600.         2.
 32.                   459.        39.       552.         2.
 36.                   434.        37.       518.         2.
 40.                   425.        37.       488.         2.
 44.                   389.        33.       464.         2.
 48.                   353.        30.       446.         2.
 52.                   315.        27.       430.         2.
 56.                   305.        26.       412.         2.
```

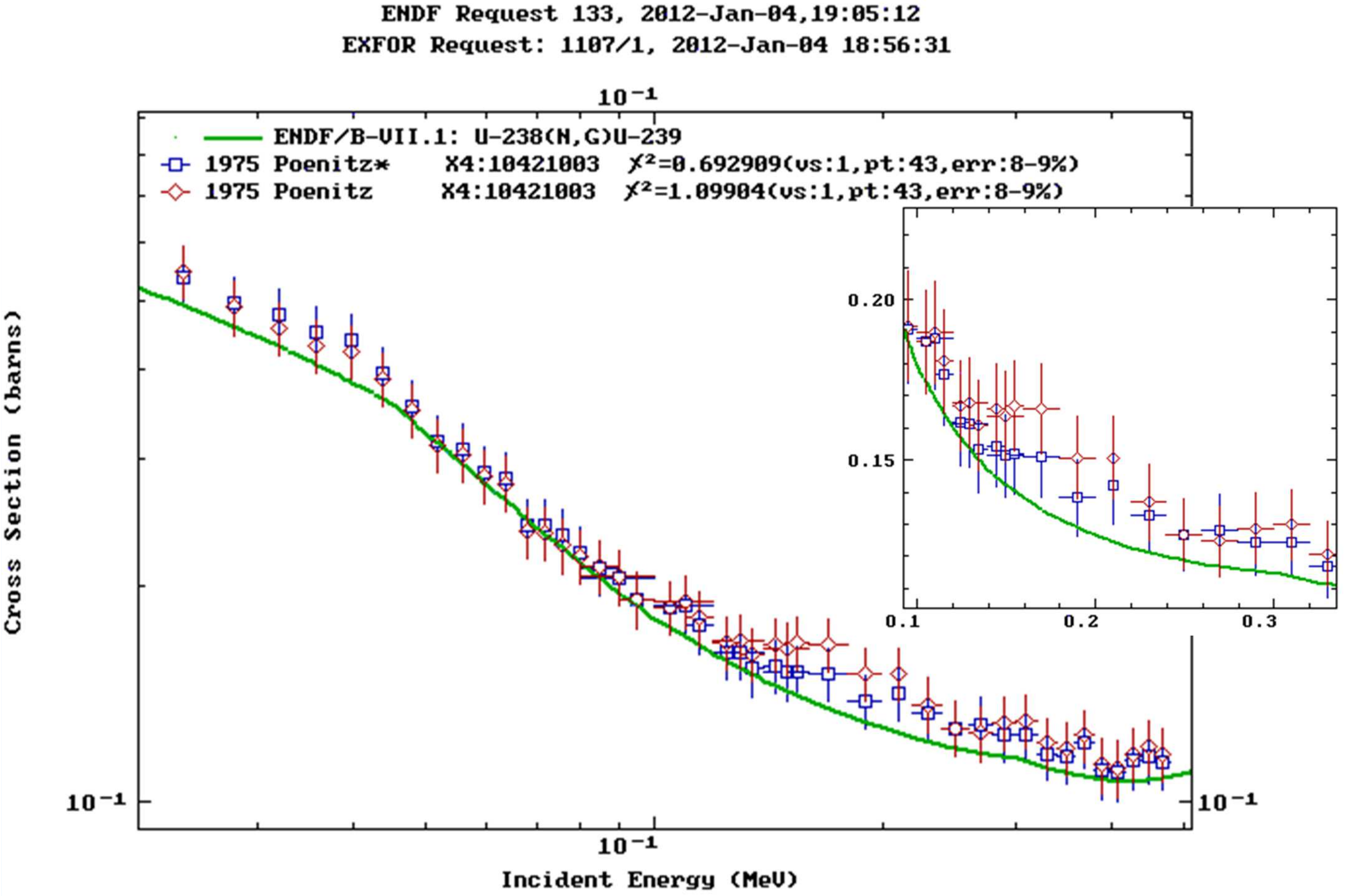
Automatically generated by x4getcorr.java

```
10421003  x4u:20030221
#Reaction: 92-U-238(N,G)92-U-239,,SIG
#Monitor:  79-AU-197(N,G)79-AU-198,,SIG
m0: [EN,MONIT,MONIT-ERR];       #old monitor(energy)
m1: best$au197ng;               #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 uncertainti
dy=dy*y;                        #to abs. uncertainties
```

Generated by x4-correction system on Web

```
-1  En(MeV)=0.02   Y(mb)=631      dY(mb)=54      (8.56%) 10421003 W.P.Poenitz (75)
+1                 Y(mb)=614.184  dY(mb)=52.107  (8.48%) 10421003 *Fc=0.973351
-2  En(MeV)=0.024  Y(mb)=550      dY(mb)=47      (8.55%) 10421003 W.P.Poenitz (75)
+2                 Y(mb)=540.62   dY(mb)=45.7459 (8.46%) 10421003 *Fc=0.982946
-3  En(MeV)=0.028  Y(mb)=490      dY(mb)=42      (8.57%) 10421003 W.P.Poenitz (75)
+3                 Y(mb)=497.788  dY(mb)=42.3081 (8.50%) 10421003 *Fc=1.01589
-4  En(MeV)=0.032  Y(mb)=459      dY(mb)=39      (8.50%) 10421003 W.P.Poenitz (75)
+4                 Y(mb)=478.342  dY(mb)=40.3473 (8.43%) 10421003 *Fc=1.04214
-5  En(MeV)=0.036  Y(mb)=434      dY(mb)=37      (8.53%) 10421003 W.P.Poenitz (75)
+5                 Y(mb)=453.274  dY(mb)=38.4025 (8.47%) 10421003 *Fc=1.04441
-6  En(MeV)=0.04   Y(mb)=425      dY(mb)=37      (8.71%) 10421003 W.P.Poenitz (75)
+6                 Y(mb)=441.328  dY(mb)=38.2229 (8.66%) 10421003 *Fc=1.03842
-7  En(MeV)=0.044  Y(mb)=389      dY(mb)=33      (8.48%) 10421003 W.P.Poenitz (75)
+7                 Y(mb)=396.12   dY(mb)=33.4425 (8.44%) 10421003 *Fc=1.0183
-8  En(MeV)=0.048  Y(mb)=353      dY(mb)=30      (8.50%) 10421003 W.P.Poenitz (75)
+8                 Y(mb)=357.414  dY(mb)=30.2427 (8.46%) 10421003 *Fc=1.0125
-9  En(MeV)=0.052  Y(mb)=315      dY(mb)=27      (8.57%) 10421003 W.P.Poenitz (75)
+9                 Y(mb)=318.742  dY(mb)=27.2133 (8.54%) 10421003 *Fc=1.01188
-10 En(MeV)=0.056  Y(mb)=305      dY(mb)=26      (8.52%) 10421003 W.P.Poenitz (75)
+10                Y(mb)=310.399  dY(mb)=26.3649 (8.49%) 10421003 *Fc=1.0177
```

Example-1: Energy dependent monitor given in DATA section (cont.)



Example-2: using monitor point given in COMMON block

```
ENTRY            20835      840208
SUBENT        20835001      840208
REFERENCE  (J,NP/A,130,195,6906) GRAPHS.
           (P,EANDC(E)-115U,,6903) TABLES.
AUTHOR     (M.BORMANN,B.LAMMERS)
TITLE      -EXCITATION FUNCTIONS OF (N,P) AND (N,2N) REACTIONS
            FOR SOME ISOTOPES OF K,MN,ZN AND CU-.
MONITOR    (1-H-1(N,EL)1-H-1,,SIG) STILBENE PROTON RECOIL
COMMON               3          3
EN-NRM     MONIT      MONIT-ERR
MEV        MB         MB
 1.4100E+01 6.8900E+02 5.0000E+00
ENDCOMMON            3
SUBENT        20835003      840208
REACTION   (25-MN-55(N,2N)25-MN-54,,SIG)
DATA                 4          8
EN         EN-ERR     DATA       ERR-S
MEV        MEV        MB         MB
 1.2990E+01 1.0000E-01 6.0000E+02 7.8000E+01
 1.4100E+01 1.5000E-01 7.9800E+02 7.8000E+01
 1.5030E+01 1.4000E-01 8.3400E+02 8.2000E+01
 1.5570E+01 1.5000E-01 8.4400E+02 6.6000E+01
 1.6160E+01 1.5000E-01 8.0300E+02 7.9000E+01
 1.6660E+01 1.5000E-01 8.2000E+02 8.0000E+01
 1.7120E+01 1.4000E-01 8.8100E+02 8.6000E+01
 1.8060E+01 1.3000E-01 8.6100E+02 8.4000E+01
ENDDATA             10
```

Automatically generated by x4getcorr.java

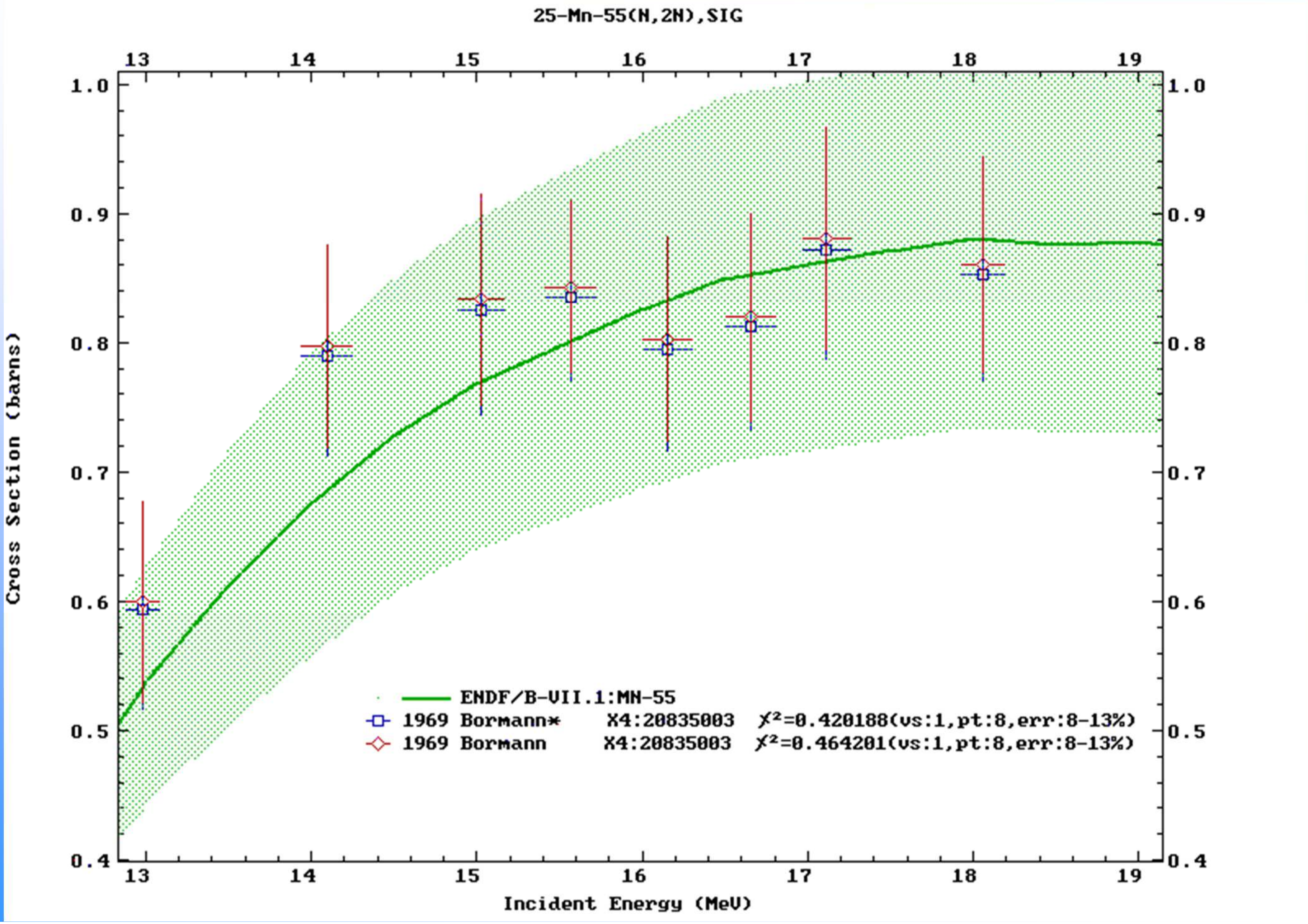
```
20835003  x4u:19840208
 #Reaction: 25-MN-55(N,2N)25-MN-54,,SIG
 #Monitor:  1-H-1(N,EL)1-H-1,,SIG
 #En=1.41E7
 a0=[MONIT];             #old monitor point
 a1=best$h1nel[EN-NRM];#new monitor point
 dy=dy/y;                #to rel. uncertainties
 y=y*a1/a0;              #corrected CS
 dy=dy*y;                #to abs. uncertainties
```

Generated by x4-correction system on Web

```
-1 En(MeV)=12.99 Y(mb)=600      dY(mb)=78      (13.00%)20835003  M.BORMANN,ET.AL.(69)
+1               Y(mb)=594.415  dY(mb)=77.274  (13.00%)20835003  *Fc=0.990692
-2 En(MeV)=14.1  Y(mb)=798      dY(mb)=78      (9.77%) 20835003  M.BORMANN,ET.AL.(69)
+2               Y(mb)=790.572  dY(mb)=77.274  (9.77%) 20835003  *Fc=0.990692
-3 En(MeV)=15.03 Y(mb)=834      dY(mb)=82      (9.83%) 20835003  M.BORMANN,ET.AL.(69)
+3               Y(mb)=826.237  dY(mb)=81.2368 (9.83%) 20835003  *Fc=0.990692
-4 En(MeV)=15.57 Y(mb)=844      dY(mb)=66      (7.82%) 20835003  M.BORMANN,ET.AL.(69)
+4               Y(mb)=836.144  dY(mb)=65.3857 (7.82%) 20835003  *Fc=0.990692
-5 En(MeV)=16.16 Y(mb)=803      dY(mb)=79      (9.84%) 20835003  M.BORMANN,ET.AL.(69)
+5               Y(mb)=795.526  dY(mb)=78.2647 (9.84%) 20835003  *Fc=0.990692
-6 En(MeV)=16.66 Y(mb)=820      dY(mb)=80      (9.76%) 20835003  M.BORMANN,ET.AL.(69)
+6               Y(mb)=812.368  dY(mb)=79.2554 (9.76%) 20835003  *Fc=0.990692
-7 En(MeV)=17.12 Y(mb)=881      dY(mb)=86      (9.76%) 20835003  M.BORMANN,ET.AL.(69)
+7               Y(mb)=872.8    dY(mb)=85.1995 (9.76%) 20835003  *Fc=0.990692
-8 En(MeV)=18.06 Y(mb)=861      dY(mb)=84      (9.76%) 20835003  M.BORMANN,ET.AL.(69)
+8               Y(mb)=852.986  dY(mb)=83.2182 (9.76%) 20835003  *Fc=0.990692
```

Example-2: using monitor point given in COMMON block (cont.)

*Fc=0.990692 (constant)



Example-3: monitor given in MONIT-REF pointing to EXFOR

```
ENTRY            30581   20090506
REFERENCE   (J,APP/B,11,853,198011) Final
AUTHOR      (E.Zupranska,K.Rusek,J.Turkiewicz,P.Zupranski)
TITLE       Excitation functions for (n,a) reactions in the neutron
            energy range from 13 to 18 MeV.
MONITOR     (26-FE-56(N,P)25-MN-56,,SIG)
MONIT-REF   (20377002,H.LISKIEN+,J,JNE/AB,19,73,196502)
STATUS      (APRVD) Approved with corrections, by M.Herman,81/06/15
SUBENT         30581004   20090506
REACTION    (25-MN-55(N,A)23-V-52,,SIG)
DATA                    4         10
EN          EN-RSL      DATA        ERR-T
MEV         MEV         MB          MB
 1.3000E+01 1.0000E-01 2.1900E+01 2.1000E+00
 1.3300E+01 1.0000E-01 2.1800E+01 1.4000E+00
 1.3900E+01 2.0000E-01 2.4100E+01 1.5000E+00
 1.4500E+01 2.0000E-01 2.7700E+01 1.6000E+00
 1.5100E+01 2.0000E-01 2.9200E+01 1.9000E+00
 1.5500E+01 2.0000E-01 2.4900E+01 1.8000E+00
 1.5900E+01 2.0000E-01 2.3700E+01 2.2000E+00
 1.6600E+01 1.0000E-01 2.3900E+01 2.6000E+00
 1.7400E+01 2.0000E-01 2.1300E+01 2.6000E+00
 1.7800E+01 1.0000E-01 1.8100E+01 2.4000E+00
ENDDATA                12
```

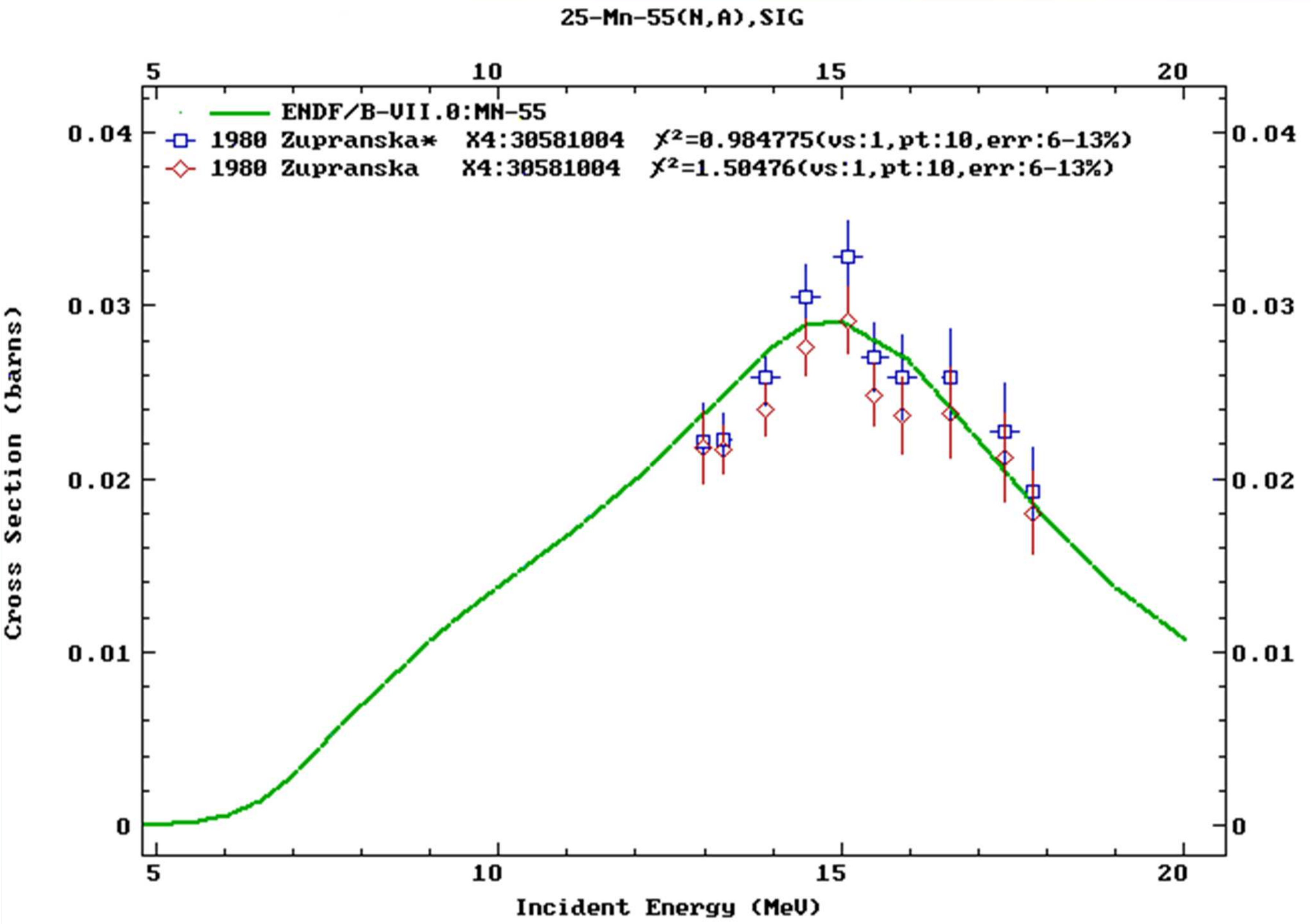
Automatically generated by x4getcorr.java

```
30581004  x4u:20090506
#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 mon-ref
m0: exfor$20377002_fe56np;    #old monitor(energy)
m1: best$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
```

Generated by x4-correction system on Web

```
-1  En(MeV)=13   Y(mb)=21.9     dY(mb)=2.1     (9.59%) 30581004  E.Zupranska,ET.AL.(80)
+1               Y(mb)=22.258   dY(mb)=2.12897 (9.56%) 30581004  *Fc=1.01635
-2  En(MeV)=13.3 Y(mb)=21.8     dY(mb)=1.4     (6.42%) 30581004  E.Zupranska,ET.AL.(80)
+2               Y(mb)=22.3688  dY(mb)=1.42838 (6.39%) 30581004  *Fc=1.02609
-3  En(MeV)=13.9 Y(mb)=24.1     dY(mb)=1.5     (6.22%) 30581004  E.Zupranska,ET.AL.(80)
+3               Y(mb)=25.8839  dY(mb)=1.60114 (6.19%) 30581004  *Fc=1.07402
-4  En(MeV)=14.5 Y(mb)=27.7     dY(mb)=1.6     (5.78%) 30581004  E.Zupranska,ET.AL.(80)
+4               Y(mb)=30.6262  dY(mb)=1.75976 (5.75%) 30581004  *Fc=1.10564
-5  En(MeV)=15.1 Y(mb)=29.2     dY(mb)=1.9     (6.51%) 30581004  E.Zupranska,ET.AL.(80)
+5               Y(mb)=32.8526  dY(mb)=2.12995 (6.48%) 30581004  *Fc=1.12509
-6  En(MeV)=15.5 Y(mb)=24.9     dY(mb)=1.8     (7.23%) 30581004  E.Zupranska,ET.AL.(80)
+6               Y(mb)=27.1053  dY(mb)=1.95423 (7.21%) 30581004  *Fc=1.08857
-7  En(MeV)=15.9 Y(mb)=23.7     dY(mb)=2.2     (9.28%) 30581004  E.Zupranska,ET.AL.(80)
+7               Y(mb)=25.9568  dY(mb)=2.40631 (9.27%) 30581004  *Fc=1.09522
-8  En(MeV)=16.6 Y(mb)=23.9     dY(mb)=2.6     (10.88%)30581004  E.Zupranska,ET.AL.(80)
+8               Y(mb)=25.9387  dY(mb)=2.82001 (10.87%)30581004  *Fc=1.0853
-9  En(MeV)=17.4 Y(mb)=21.3     dY(mb)=2.6     (12.21%)30581004  E.Zupranska,ET.AL.(80)
+9               Y(mb)=22.7836  dY(mb)=2.77977 (12.20%)30581004  *Fc=1.06965
-10 En(MeV)=17.8 Y(mb)=18.1     dY(mb)=2.4     (13.26%)30581004  E.Zupranska,ET.AL.(80)
+10              Y(mb)=19.3299  dY(mb)=2.56225 (13.26%)30581004  *Fc=1.06795
```

Example-3: monitor in MONIT-REF pointing to EXFOR (cont.)



Using monitors given in MONIT-REF pointing to EXFOR

To do:
- collect monitors (+CP)
- check links (Subent.001?)
- sort out reactions

Seems OK for:
- 16 monitors (to finalize)
- 80 datasets can be corrected

link2exfor	monreac	monfile
41240005	13-AL-27(N,P)12-MG-27,,SIG	al27np
20772003	26-FE-56(N,P)25-MN-56,,SIG	fe56np
11274031	26-FE-56(N,P)25-MN-56,,SIG	fe56np
11701004	26-FE-56(N,P)25-MN-56,,SIG	fe56np
20377002	26-FE-56(N,P)25-MN-56,,SIG	fe56np
30483002	26-FE-56(N,P)25-MN-56,,SIG	fe56np
31479002	26-FE-56(N,P)25-MN-56,,SIG	fe56np
22618002	28-NI-58(N,P)27-CO-58,,SIG	ni58np
30612002	29-CU-63(N,2N)29-CU-62,,SIG	cu63n2n
11645007	29-CU-65(N,2N)29-CU-64,,SIG	cu65n2n
30607002	79-AU-197(N,G)79-AU-198,,SIG	au197ng
20358035	79-AU-197(N,G)79-AU-198,,SIG	au197ng
11679023	79-AU-197(N,G)79-AU-198,,SIG	au197ng
22099002	79-AU-197(N,G)79-AU-198,,SIG,,MXW	au197ng
20786006	92-U-235(N,F),,SIG	u235nf
10809002	92-U-235(N,F),,SIG,,FIS	u235nf

Using monitors given in MONIT-REF pointing to ENDF-Libraries

To do:
- collect old monitors
- add new monitors

Can be implemented for:
- 41 datasets (new monitor data exist)
- 56 datasets (if all monitor data will be)

link2endf	monfile	monitorFileExists
ENDF/B-4	fe56ninl	0
ENDF/B-III	b10na	1
ENDF/B-IV	au197ng	1
ENDF/B-V	am242mnf	0
ENDF/B-V	au197ng	1
ENDF/B-V	cm245nf	0
ENDF/B-V	li7ninl	0
ENDF/B-V	pu239nf	0
ENDF/B-V	pu241nf	0
ENDF/B-V	u235nf	1
ENDF/B-VI	au197ng	1
ENDF/B-VI.8	np237nf	0
ENDF/B-VI.8	u235nf	1
ENDF/B-VI.8	b10na	1
ENDF/B-VII.0	au197ng	1
ENDF/B-VII.0	dy160ng	0
ENDF/B-VII.0	dy163ng	0
ENDF/B-VII.0	li6nt	1
ENDF/B-VII.0	pu239nf	0
ENDF/B-VII.0	u235nf	1
ENDF/B-VII.0	u238nf	1
ENDF-B/VII.0	u234nf	0
ENDF-B/VII.0	u235nf	1
IRDF-90	nb93n2n	1

Using monitors given in MONIT-REF pointing to “a publication”

To do:

- build dictionary {<mon-ref>,<mon-file>}
- try to collect old monitors from external experts and other data centers and labs

Finally can be implemented for:

- 554 datasets

List of monitors: 97 (neutrons only)

MONIT-REF	monreac
{,,J,PR,104,1639,56}	u238nf
{,,R,BNL-325,(SUPPL.1),1966}	al27np
{,,R,BNL-325,1965}	u235nf
{,,R,HSJ-77141,197805}	au197ng
{,,R,IAEA-227,1983}	al27na
{,,R,IAEA-227,59,1983}	al27na
{,,R,IAEA-227,83}	b10na
{,,R,IAEA-TECDOC-1285,2002}	ni58np
{,,R,INDC(NDS)-368,1997}	u238nf
{,,R,INDC-36,198105}	u238nf
{,,W,MACKLIN,82}	au197ng
{,A.Carlson,C,2007NICE,1233,2008}	u235nf
{,A.CARLSON+,R,INDC(NDS)-368,23,1997}	u235nf
{,A.D.Carlson+,J,ND/B,110,3215,2009}	u235nf
{,A.D.Carlson+,R,INDC(NDS)-368,199705}	u235nf
{,A.D.Carlson+,R,INDC(NDS)-368,199705}	u238nf
{,A.HORSELY,J,ND/A,2,234,1966}	h1nel
{,A.HORSLEY,J,ND/A,2,243,66}	h1nel
{,A.PAULSEN+,J,ZP,238,23,70}	nb93n2n
{,B.T.Shchebolev,J,AE,54,417,1983}	al27np
{,BHAT,R,BNL-NCS-51184,8003}	u235nf
{,C.A.Uttley+,C,71KNOX,,551,1971}	li6nt
{,CARLSON+,R,NISTIR-5177,1993}	li6nt
{,D.E.CULLEN+,R,IAEA-NDS-41,1,1982}	fe56np
{,D.E.CULLEN+,R,IAEA-NDS-41,198201}	fe56np
{,Filatenkov+,R,RI-252,1999}	al27na
{,FUKAHORI+,J,NST,23,(1),91,1986}	al27na
{,G.TRAXLER,T,TRAXLER,1983}	al27na
{,G.Winkkler+,J,ANE,10,601,1983}	cu65n2n
{,G.Winkler+,J,ANE,10,601,1983}	al27na
{,H.LISKIEV,C,76LOWELL,1,1110,1976}	b10na
{,H.Vonach,R,IAEA-227,58,1983}	al27na
{,H.Vonach,R,NEANDC-311-U,1992}	nb93n2n
{,HOPKINS+,J,ND/A,9,137,1971}	h1nel
{,IRDF,R,IAEA-NDS-141,1990}	al27na
{,J.C.Hopkins+,J,ND/A,9,137,1971}	h1nel
{,J.F.Mughabghab,B,NEUT.CS 1B,,1984}	au197ng
{,J.H.GIBBONS+,J,PR,114,571,59}	li6nt
{,J.L.GAMMEL,B,FAST N.PH.,2,2185,1963}	h1nel
{,Jiang+,R,HSJ-81183,1981}	au197ng
{,Kobayashi+,J,JNE,22,741,1973}	in115ninl
{,L.E.Kazakov+,J,YK,1985,(2),44,1985}	au197ng
{,LU+,J,CST,,(2),113,1975}	al27na
{,M.Chadwick+,J,ND/B,107,2931,2006}	u235nf
{,M.SOWERBY,R,INDC(SEC)-01,1992}	u235nf
{,M.Sowerby,R,NEANDC-311,1992}	u235nf
{,M.Sowerby,R,NEANDC-311U,1991}	u235nf
{,M.Wagner+,B,PH-DAT,13,(5),1990}	al27na
{,M.Wagner+,B,PH-DAT,13,(5),1990}	u238nf
{,M.Wagner+,B,PH-DAT,13,5,1990}	al27na
{,M.Wagner+,B,PH-DAT,13-5,1990}	al27na
{,M.Wagner+,B,PH-DAT,13-5,1990}	nb93n2n

{,MACKLIN,W,MACKLIN,82}	au197ng
{,N.D.DUDEY+,R,BNL-NCS-50446,80,1975}	fe56np
{,N.OLSSON+,C,94GATLIN,1,60,199405}	h1nel
{,N.P.Kochelov+,R,IAEA-NDS-141,1990}	al27na
{,N.P.KOCHEROV,R,IAEA-NDS-141,199310}	al27na
{,NAKAGAWA+,J,NST,32,(12),1259,1995}	in115ninl
{,P.F.ROSE,R,BNL-NCS-17541,1991}	b10na
{,P.F.ROSE+,R,ENDF-201,1990}	u238nf
{,P.LISOWSKI+,C,88MITO,,97,198810}	u235nf
{,PAULSEN+,J,JNE,19,907,65}	al27na
{,R.F.ROSE,R,BNL-NCS-17541,1991}	u235nf
{,R.KINSEY,R,BNL-NCS-17541,1979}	au197ng
{,R.KINSEY,R,BNL-NCS-17541,1979}	h1nel
{,R.KINSEY,R,ENDF-201,1979}	al27na
{,R.L.MACKLIN,W,MACKLIN,1982}	au197ng
{,R.L.Macklin,W,MACKLIN,1998}	au197ng
{,R.L.Macklin+,J,PR,159,1007,1967}	au197ng
{,RATYNSKI+,J,PR/C,37,595,1988}	au197ng
{,S.Benck+,J,NP/A,615,220,1997}	h1nel
{,S.F.Mughabghab,R,BNL-325,1973}	au197ng
{,S.F.Mughabghab,R,BNL-NCS-21774,1976}	au197ng
{,S.Tagesen+,B,PH-DAT,,13-1,1981}	al27na
{,S.Tagesen+,B,PH-DAT,,13-1,1989}	al27na
{,SCHRACK+,J,NSE,114,352,93}	b10na
{,SCHRAK,J,NSE,114,352,1993}	b10na
{,SCHWARZ+,J,NP,63,(4),593,196503}	li6nt
{,SOWERBY+,J,JNE,24,323,1970}	b10na
{,SOWERBY+,J,NE,24,323,1970}	b10na
{,T.B.Ryves,J,ANE,16,307,1989}	nb93n2n
{,T.NAKAGAWA+,J,NST,32,(2),1259,1995}	u235nf
{,T.NAKAGAWA+,J,NST,32,1259,1995}	u235nf
{,Tagesen+,B,PH-DAT,,13-1,1989}	al27na
{,V.E.Lewis+,J,NIM,174,141,1980}	nb93n2n
{,V.K.MAJDANYUK+,J,PJS,13,180,1984}	au197n2n
{,V.MCLANE+,B,NEUT.CS 2,,1988}	al27na
{,W.G.Davey,J,NSE,32,35,1968}	u235nf
{,W.G.Davey+,J,NSE,32,35,1968}	u235nf
{,W.RATYNSKI+,J,PR/C,37,595,1988}	au197ng
{,WESTON+,R,ENDF-201,356,1991}	u235nf
{,Y.IKEDA+,J,NST,30,(9),870,1993}	nb93n2n
{,Z.BODY+,B,OKAMOTO,,261,1987}	al27na
{,Z.Boedy,B,OKAMOTO,,29,198704}	fe56np
{,Z.Wenrong+,R,INDC(CPR)-16,55,1989}	nb93n2n
{,Zhao Wenrong,R,INDC(CPR)-16,198908}	nb93n2n
{,Zhao Wenrong,R,INDC(CPR)-16,199005}	nb93n2n

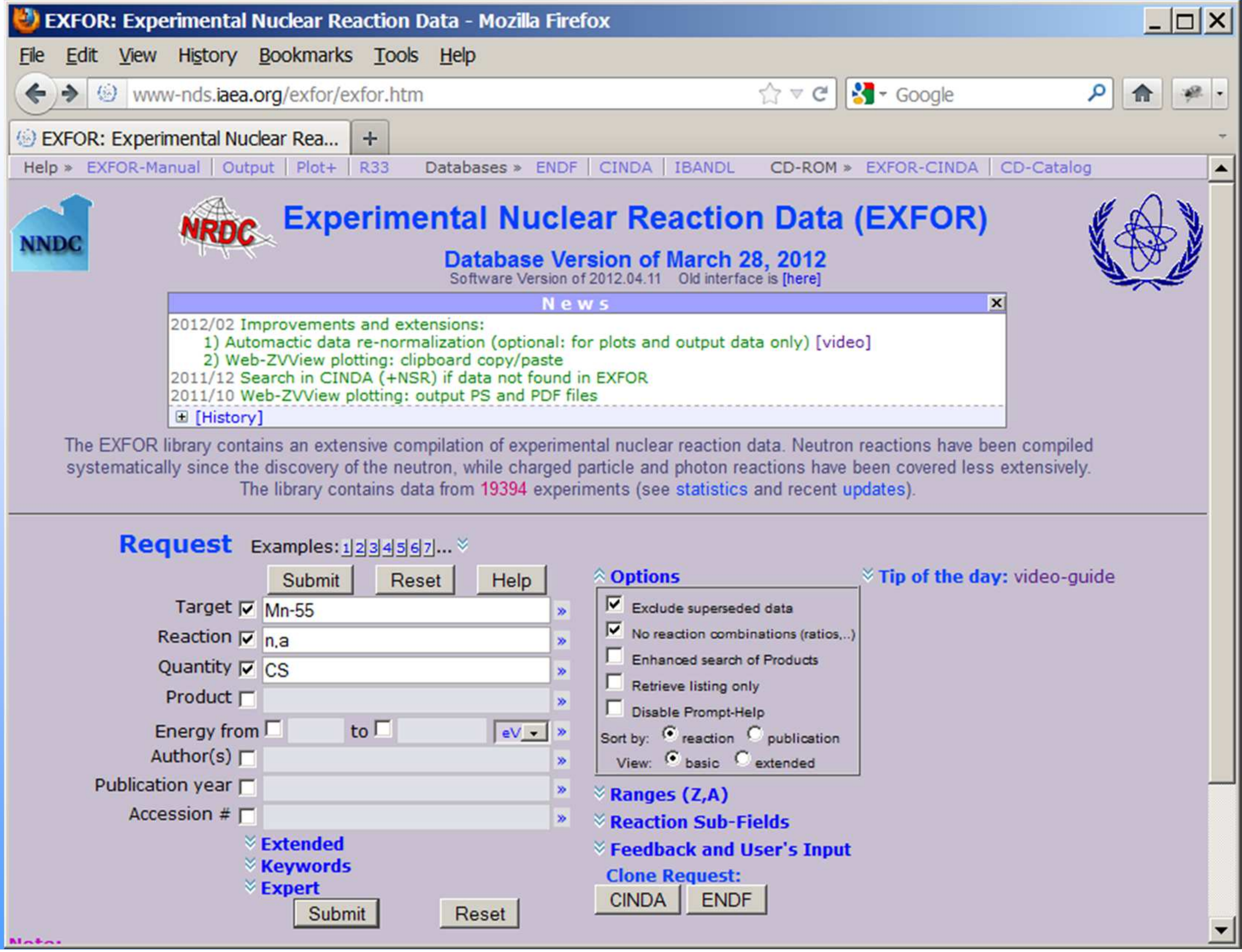
One of the problems: revision old EXFOR Entries with monitor given by MONIT-REF

Example: 8 from 16 (50%) MONIT-REF text
have to be corrected or linked to the same files

n	MONIT-REF	MONITOR	Style of coding
1	(,F.TARKANYI+,R,IAEA-1211,2001)	22-TI-0(D,X)23-V-48,,SIG	1
2	(,F.TARKANYI+,R,IAEA-1211,2001)	29-CU-0(HE3,X)31-GA-66,,SIG	1
3	(,F.TARKANYI+,R,IAEA-NDS-1211,2001)	22-TI-0(A,X)24-CR-51,,SIG	2
1/4	(,F.TARKANYI+,R,IAEA-NDS-1211,2001)	22-TI-0(D,X)23-V-48,,SIG	2
4	(,F.TARKANYI+,R,IAEA-NDS-1211,2001)	22-TI-0(HE3,X)23-V-48,,SIG	2
5	(,F.TARKANYI+,R,IAEA-NDS-1211,2001)	22-TI-0(P,X)23-V-48,,SIG	2
6	(,F.Tarkanyi+,R,IAEA-TECDOC-1065,113,1999)	22-TI-0(D,X)23-V-48,,SIG	3
7	(,F.Tarkanyi+,R,IAEA-TECDOC-1211,2001)	13-AL-27(D,X)11-NA-24,,SIG	3
1/9	(,F.TARKANYI+,R,IAEA-TECDOC-1211,2001)	22-TI-0(D,X)23-V-48,,SIG	3
4/10	(,F.TARKANYI+,R,IAEA-TECDOC-1211,2001)	22-TI-0(HE3,X)23-V-48,,SIG	3
5/11	(,F.Tarkanyi+,R,IAEA-TECDOC-1211,2001)	22-TI-0(P,X)23-V-48,,SIG	3
8	(,F.Tarkanyi+,R,IAEA-TECDOC-1211,2001)	29-CU-0(P,X)30-ZN-62,,SIG	3
3/13	(,F.TARKANYI+,R,IAEA-TECDOC-1211,49,2001)	22-TI-0(A,X)24-CR-51,,SIG	4
1/14	(,F.TARKANYI+,R,IAEA-TECDOC-1211,49,2001)	22-TI-0(D,X)23-V-48,,SIG	4
4/15	(,F.TARKANYI+,R,IAEA-TECDOC-1211,49,2001)	22-TI-0(HE3,X)23-V-48,,SIG	4
5/16	(,F.Tarkanyi+,R,IAEA-TECDOC-1211,49,2001)	22-TI-0(P,X)23-V-48,,SIG	4

Web interface to the EXFOR database with automatic data re-normalization

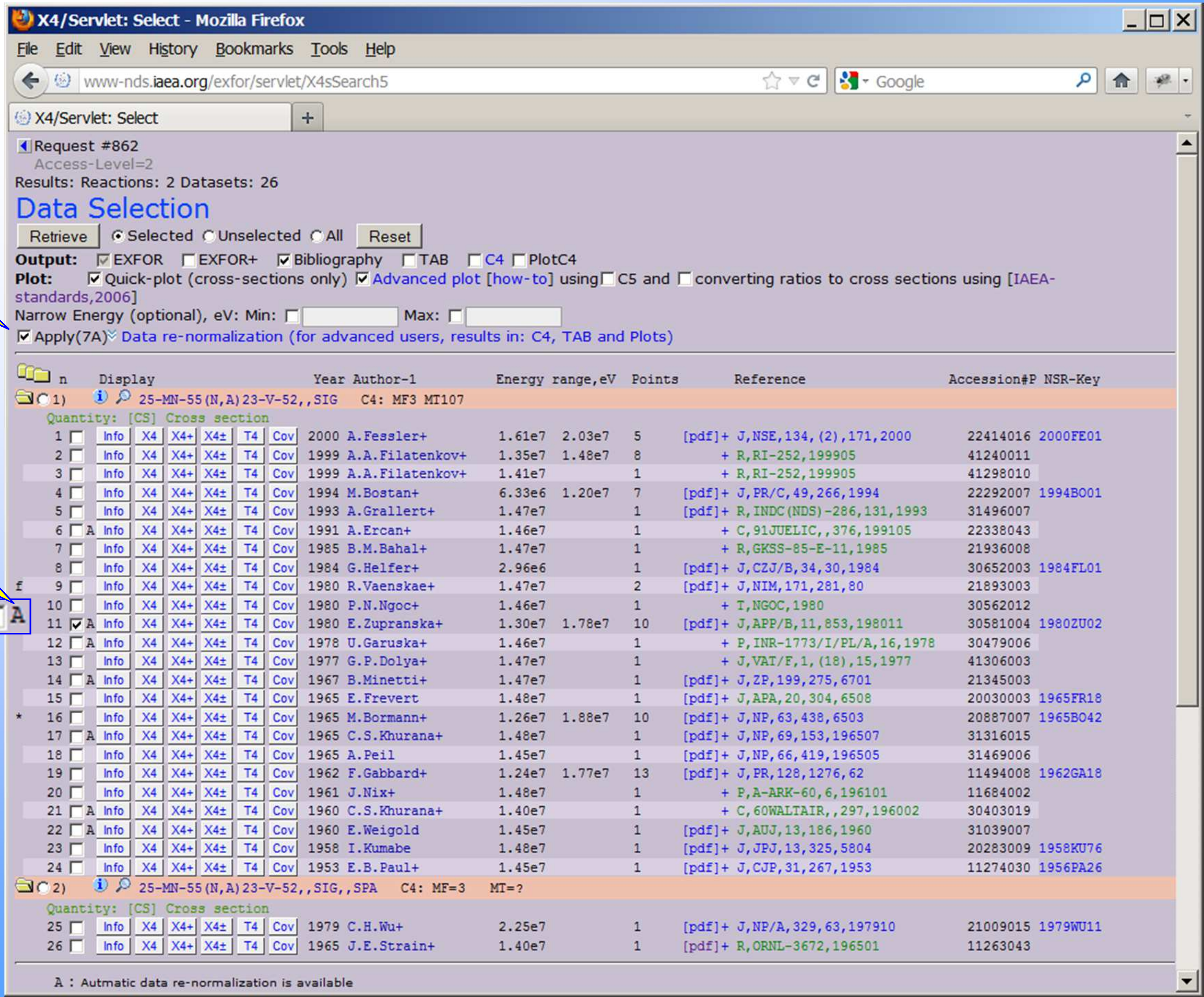
Step-1. Data search



Automatic data re-normalization. Step-2: data selection

Apply corrections

Auto corrections is possible



X4/Servlet: Select - Mozilla Firefox

File Edit View History Bookmarks Tools Help

www-nds.iaea.org/exfor/servlet/X4sSearch5

X4/Servlet: Select

Request #862
Access-Level=2
Results: Reactions: 2 Datasets: 26

Data Selection

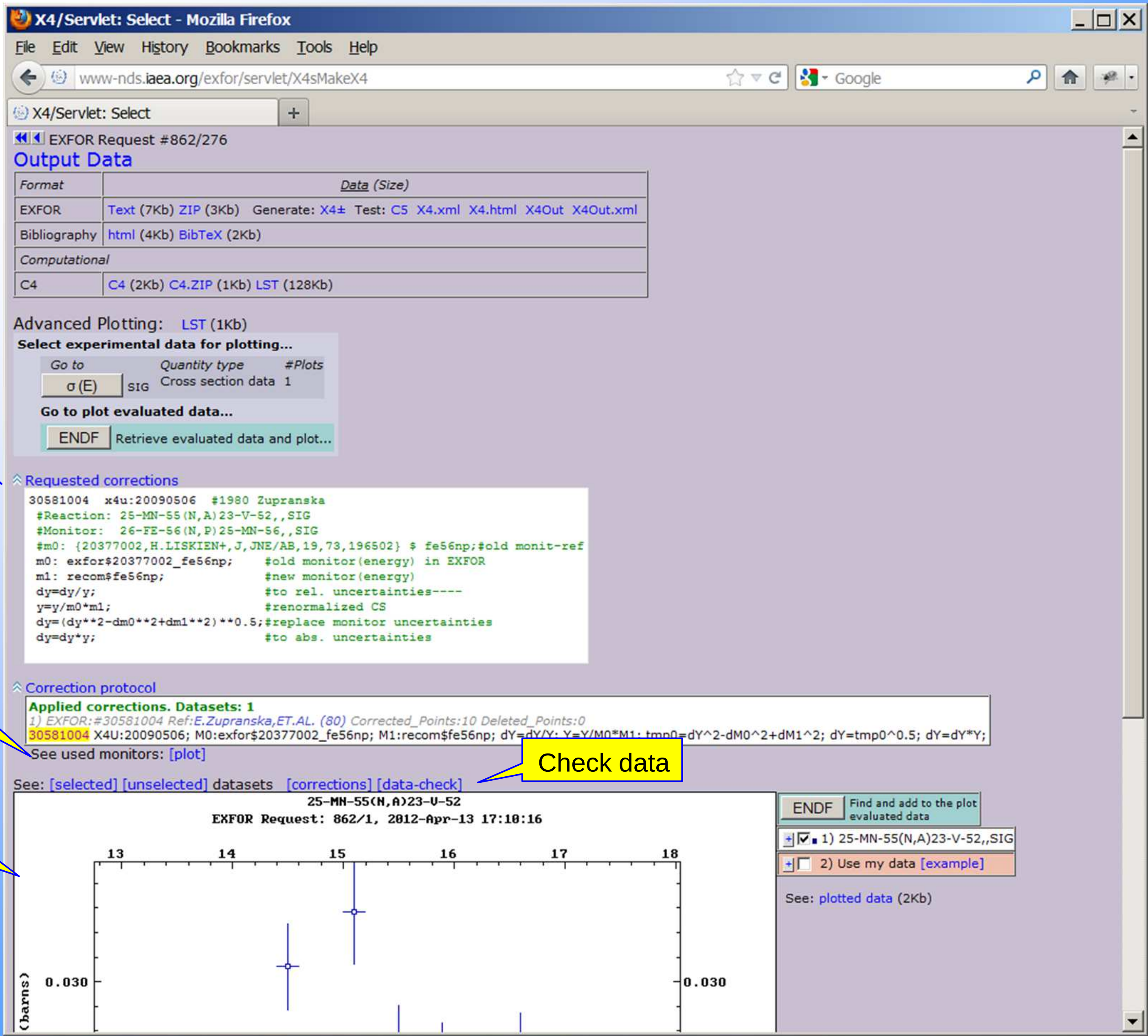
Retrieve | Selected | Unselected | All | Reset

Output: EXFOR | 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	Accession#P	NSR-Key
	1)		25-MN-55(N,A)23-V-52,,SIG C4: MF3 MT107								
			Quantity: [CS] Cross section								
	1		Info X4 X4+ X4± T4 Cov	2000	A.Fessler+	1.61e7	2.03e7	5	[pdf]+ J,NSE,134,(2),171,2000	22414016	2000FE01
	2		Info X4 X4+ X4± T4 Cov	1999	A.A.Filatenkov+	1.35e7	1.48e7	8	+ R,RI-252,199905	41240011	
	3		Info X4 X4+ X4± T4 Cov	1999	A.A.Filatenkov+	1.41e7		1	+ R,RI-252,199905	41298010	
	4		Info X4 X4+ X4± T4 Cov	1994	M.Bostan+	6.33e6	1.20e7	7	[pdf]+ J,PR/C,49,266,1994	22292007	1994BO01
	5		Info X4 X4+ X4± T4 Cov	1993	A.Grallert+	1.47e7		1	[pdf]+ R,INDC(NDS)-286,131,1993	31496007	
	6	A	Info X4 X4+ X4± T4 Cov	1991	A.Ercan+	1.46e7		1	+ C,91JUELIC,,376,199105	22338043	
	7		Info X4 X4+ X4± T4 Cov	1985	B.M.Bahal+	1.47e7		1	+ R,GKSS-85-E-11,1985	21936008	
	8		Info X4 X4+ X4± T4 Cov	1984	G.Helfer+	2.96e6		1	[pdf]+ J,CZJ/B,34,30,1984	30652003	1984FL01
f	9		Info X4 X4+ X4± T4 Cov	1980	R.Vaenskae+	1.47e7		2	[pdf]+ J,NIM,171,281,80	21893003	
	10		Info X4 X4+ X4± T4 Cov	1980	P.N.Ngoc+	1.46e7		1	+ T,NGOC,1980	30562012	
	11	A	Info X4 X4+ X4± T4 Cov	1980	E.Zupranska+	1.30e7	1.78e7	10	[pdf]+ J,APP/B,11,853,198011	30581004	1980ZU02
	12	A	Info X4 X4+ X4± T4 Cov	1978	U.Garuska+	1.46e7		1	+ P,INR-1773/I/PL/A,16,1978	30479006	
	13		Info X4 X4+ X4± T4 Cov	1977	G.P.Dolya+	1.47e7		1	+ J,VAT/F,1,(18),15,1977	41306003	
	14	A	Info X4 X4+ X4± T4 Cov	1967	B.Minetti+	1.47e7		1	[pdf]+ J,ZP,199,275,6701	21345003	
	15		Info X4 X4+ X4± T4 Cov	1965	E.Frevert	1.48e7		1	[pdf]+ J,APA,20,304,6508	20030003	1965FR18
*	16		Info X4 X4+ X4± T4 Cov	1965	M.Bormann+	1.26e7	1.88e7	10	[pdf]+ J,NP,63,438,6503	20887007	1965BO42
	17	A	Info X4 X4+ X4± T4 Cov	1965	C.S.Khurana+	1.48e7		1	[pdf]+ J,NP,69,153,196507	31316015	
	18		Info X4 X4+ X4± T4 Cov	1965	A.Peil	1.45e7		1	[pdf]+ J,NP,66,419,196505	31469006	
	19		Info X4 X4+ X4± T4 Cov	1962	F.Gabbard+	1.24e7	1.77e7	13	[pdf]+ J,PR,128,1276,62	11494008	1962GA18
	20		Info X4 X4+ X4± T4 Cov	1961	J.Nix+	1.48e7		1	+ P,A-ARK-60,6,196101	11684002	
	21	A	Info X4 X4+ X4± T4 Cov	1960	C.S.Khurana+	1.40e7		1	+ C,60WALTAIR,,297,196002	30403019	
	22	A	Info X4 X4+ X4± T4 Cov	1960	E.Weigold	1.45e7		1	[pdf]+ J,AUJ,13,186,1960	31039007	
	23		Info X4 X4+ X4± T4 Cov	1958	I.Kumabe	1.48e7		1	[pdf]+ J,JPJ,13,325,5804	20283009	1958KU76
	24		Info X4 X4+ X4± T4 Cov	1953	E.B.Paul+	1.45e7		1	[pdf]+ J,CJP,31,267,1953	11274030	1956PA26
	2)		25-MN-55(N,A)23-V-52,,SIG,,SPA C4: MF=3 MT=?								
			Quantity: [CS] Cross section								
	25		Info X4 X4+ X4± T4 Cov	1979	C.H.Wu+	2.25e7		1	[pdf]+ J,NP/A,329,63,197910	21009015	1979WU11
	26		Info X4 X4+ X4± T4 Cov	1965	J.E.Strain+	1.40e7		1	[pdf]+ R,ORNL-3672,196501	11263043	

A : Autmatic data re-normalization is available

Automatic data re-normalization. Step-3: simple plot



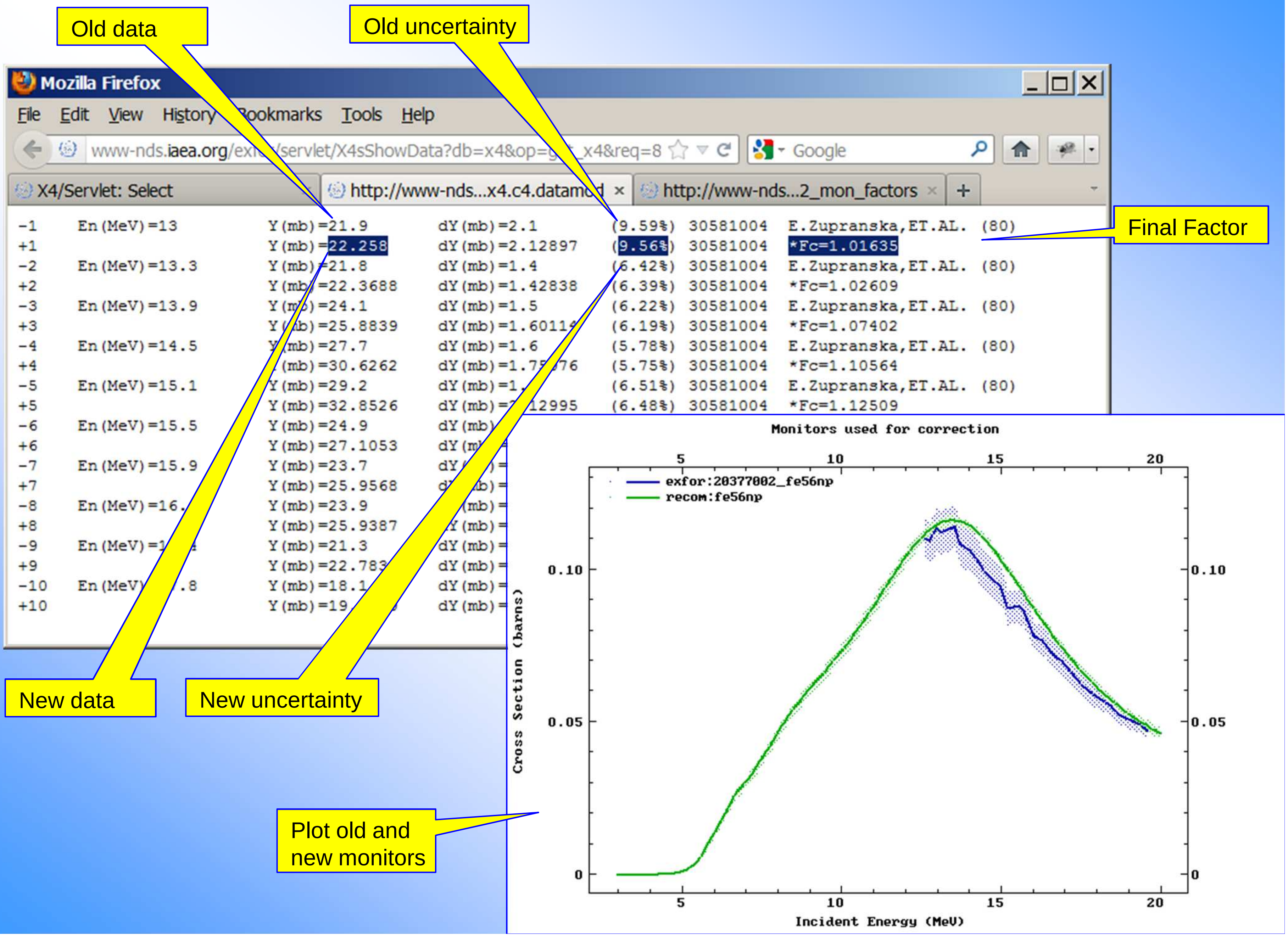
Applied corrections

Check Monitors

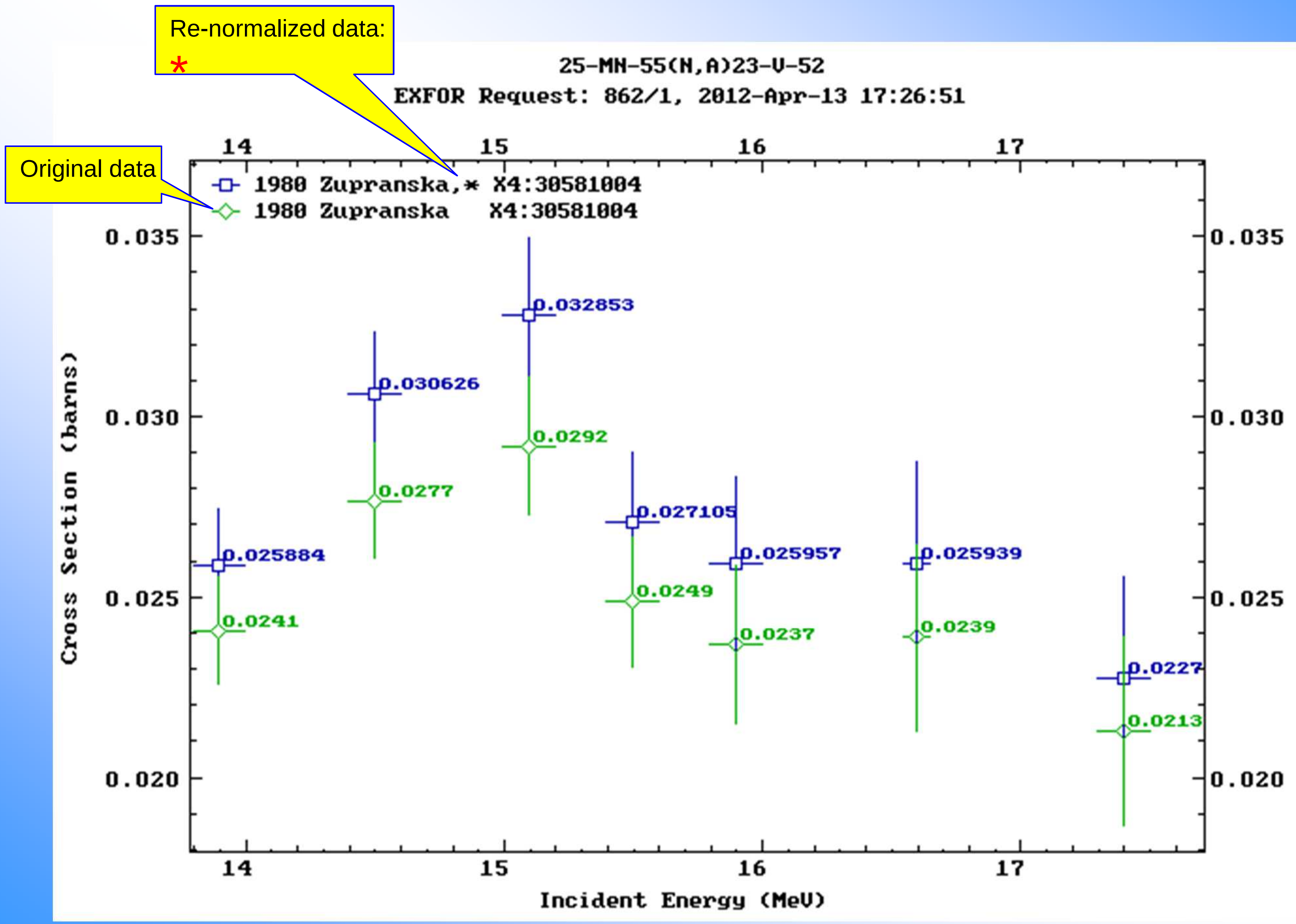
Check data

Plot result of corrections

Automatic data re-normalization. Step-4: checking



Automatic data re-normalization. Step-5: common plot

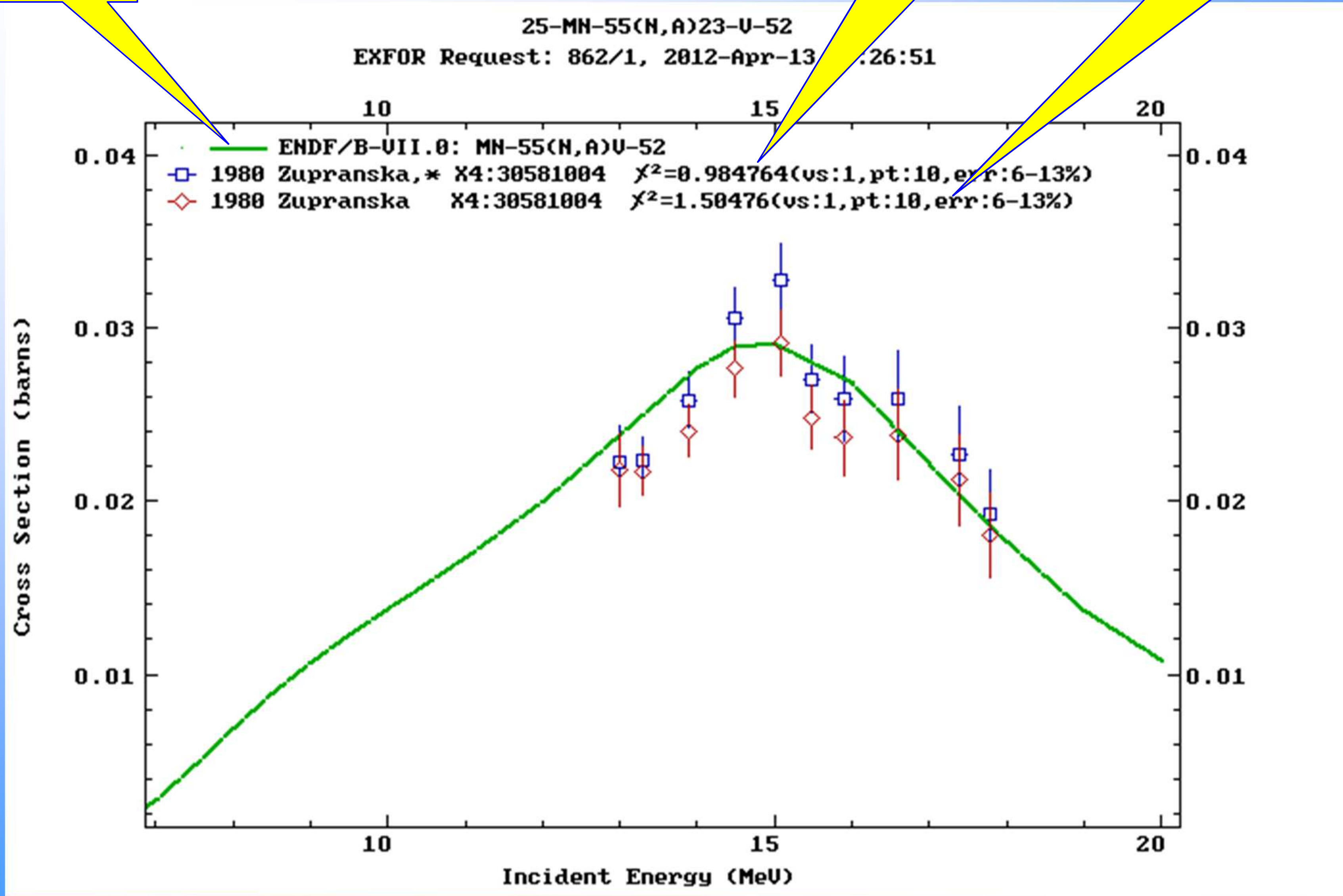


Automatic data re-normalization. Comparing to ENDF

Compare with ENDF-B/VII.0

After re-normalization: χ^2=0.984764

Before re-normalization: χ^2=1.50476



Concluding remarks, short term plans

1. Significant progress in automatic correction system
2. EXFOR Web retrieval system offers automatic correction service (interactive, i.e. semi-automatic)
3. Need debugging stage (time, by external Web-users)
4. Further improvement would need more time and efforts:
   - to check and correct EXFOR MONIT-REF
   - to collect old Monitors
   - etc.

1. To extend EXFOR Web retrieval system by interactive selection of experts' corrections
2. Full EXFOR in C4/C5/corrected (this year, fully-automatic)
3. To extend "Experts' corrections database"

Thank you.