

Covariance data in EXFOR: coding, examples, software support

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Workshop: EXFOR Compilation
IAEA-NDS, Vienna, August 30 – September 3, 2010

Covariance data in EXFOR: coding, examples, software

Covariance data in EXFOR today:

Entries with keyword COVARIANCE

```
Entries:43; Subentries:135
1) 10047 1971 Foster Jr
2) 13113 1987 Meadows
3) 13134 1988 Meadows
4) 13176 1989 Mannhart
5) 21968 1984 Bastian
6) 22140 1989 Horibe
7) 22148 1990 Ryves
8) 22211 1990 Iwasaki
9) 22214 1990 Kimura
10) 22282 1988 Fumitoshi Manabe
11) 22403 1994 Schmidt
12) 22404 1991 Boerker
13) 22407 1996 Schmidt
14) 22408 1998 Schmidt
15) 22409 1997 Schmidt
16) 22410 1997 Schmidt
17) 22411 1997 Schmidt
18) 22412 1997 Schmidt
19) 22666 2002 Schmidt
20) 22733 1998 Tsabaris
21) 22741 2008 Mihailescu
22) 22806 2003 Schmidt
23) 22870 2007 Mihailescu
24) 22875 2006 Borella
25) 22961 2006 Schmidt
26) 22962 2006 Schmidt
27) 22973 2007 Schmidt
28) 22974 2006 Schmidt
29) 22975 2007 Schmidt
30) 22976 2007 Mannhart
31) 22988 2007 Poenitz
32) 23039 2008 Mihailescu
33) 23067 2008 Massimi
34) 23077 2009 Kopecky
35) 30660 1983 Ribansky
36) 30811 1985 Ribansky
37) 30812 1985 Ribansky
38) 31447 1992 Geraldo
39) 31448 1994 Dias
40) 40915 1986 Kazakov
41) 41322 1998 Piksaykin
42) V0042 1986 Axton
43) V0043 1987 Ryves
```

Entries with code (COVAR)

```
1) 13176 1989 Mannhart
2) 22403 1994 Schmidt
3) 22404 1991 Boerker
4) 22407 1996 Schmidt
5) 22408 1998 Schmidt
6) 41322 1998 Piksaykin
```

*Files *.cov
not found...*

Current status:

- *We have lost files *.COV (?)*
- *We have covariance data as Free text only - without real coding rules*
- *We have some real covariance data in EXFOR*

As result:

- *We do not have any software support of covariance data in EXFOR system*

Questions today:

- *Do EXFOR-users need covariance data?*
- *Should compilers to pay more attention to these data?*
- *Should we have proper coding and software support?*

Example-1: SUBENT 22211003

REACTION ((94-PU-242(N,F),,SIG)/(92-U-235(N,F),,SIG))

Proposal:
“cosmetic additions”
+ unified data structure

Today in EXFOR

```
COVARIANCE .Covariation matrix in percent
Energy,MeV
0.597      100
0.797      46 100
0.898      40 32 100
0.906      56 43 37 100
1.010      37 29 25 34 100
1.098      56 44 38 53 35 100
1.117      37 30 26 35 24 35 100
1.193      40 32 28 37 26 38 26
1.376      55 44 38 51 35 52 35 38 100
1.390      57 45 38 53 35 54 36 38 53 100
1.693      57 45 39 54 35 55 36 39 53 55 100
2.144      52 41 36 49 33 50 33 36 49 51 52->
3.908      58 45 39 54 35 54 36 38 53 55 55->
5.182      49 38 33 46 30 47 31 33 46 47 48->
5.700      46 36 31 44 29 44 29 31 43 45 45->
6.195      43 34 29 10 27 41 27 29 40 42 42->
6.759      39 31 26 37 24 38 25 26 37 38 39->
2.144      ... .. 100
3.908      ... .. 51 100
5.182      ... .. 44 48 100
5.700      ... .. 42 45 39 100
6.195      ... .. 39 42 37 35 100
6.759      ... .. 36 38 34 32 30 100
```

```
COVARIANCE .Covariation matrix in percent
(DATA)
(XY,17,EN,MEV)
0.597 0.797 0.898 0.906 1.01 1.098 1.117 1.193 1.376
1.39 1.693 2.144 3.908 5.182 5.7 6.195 6.759
(Z,153,CORR,PER-CENT)
100
46 100
40 32 100
56 43 37 100
37 29 25 34 100
56 44 38 53 35 100
37 30 26 35 24 35 100
40 32 28 37 26 38 26 100
55 44 38 51 35 52 35 38 100
57 45 38 53 35 54 36 38 53 100
57 45 39 54 35 55 36 39 53 55 100
52 41 36 49 33 50 33 36 49 51 52 100
58 45 39 54 35 54 36 38 53 55 51 100
49 38 33 46 30 47 31 33 46 47 48 48
100
46 36 31 44 29 44 29 31 43 45 45 42 45
39 100
43 34 29 10 27 41 27 29 40 42 42 39 42
37 35 100
39 31 26 37 24 38 25 26 37 38 39 36 38
34 32 30 100
```

Software support of covariance data under EXFOR Uploading System (trial)

EXFOR-uploading system

by V.Zerkin, IAEA-NDS, February 2009 - August 2010

Request #685

Uploading...

Reading remote file: <http://161.5.149.76/exfor1/x4guide/x4formats/22211.x4>

Remote file: <http://161.5.149.76/exfor1/x4guide/x4formats/22211.x4>

EXFOR file copy: XX4up00685.txt size:9Kb (8262 bytes)

...ENTRY:1 SUBENT:2 Lines:163

Simple syntax checking...

Open/Close output from checking program... ..finished OK.

See: [\[your EXFOR File\]](#) [X4±]

See: [\[working EXFOR File\]](#) [X4±]

Run external utilities

EXFOR Entries in your file:

Your EXFOR file							EXFOR-database	
Alt	Entry	Date	X4±	Nick	Reference1	Author1	Entry	Entries with Reference
_	22211	20071016	x4±	X0001	J,NST,27,(10),885,199010	T. Iwasaki	22211	

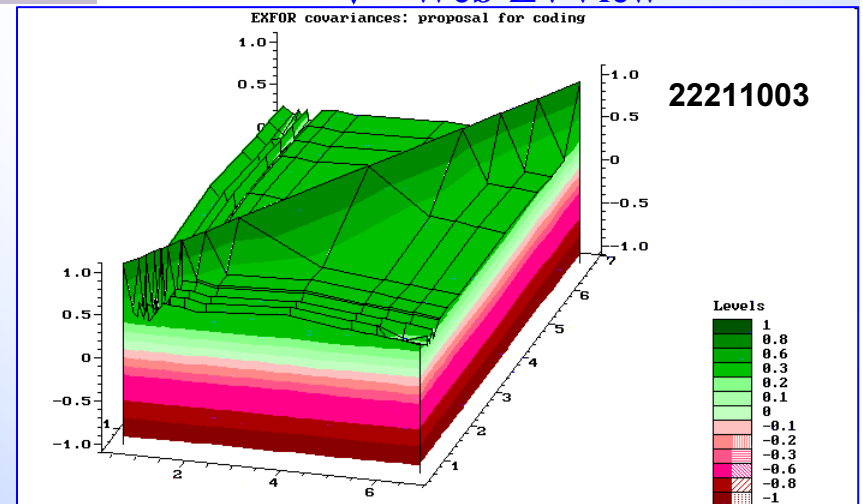
New: ...See EXFOR Covariances by ZVView: [\[plot\]](#)

See EXFOR Covariances by ZVView: [\[plot\]](#)

Search in EXFOR database together with uploaded file

#	Weak-search: by target, reaction, web-quantity	Strong-search: by full reaction-code	Datasets: list, display and search similar data of 1-st author
1	Pu-242(n,f),,CS	(94-PU-242(N,F),,SIG)/(92-U-235(N,F),,SIG)	1) 22211003 1990 T.Iwasaki+ pt: 17

Interactive plot by
Web-ZVView

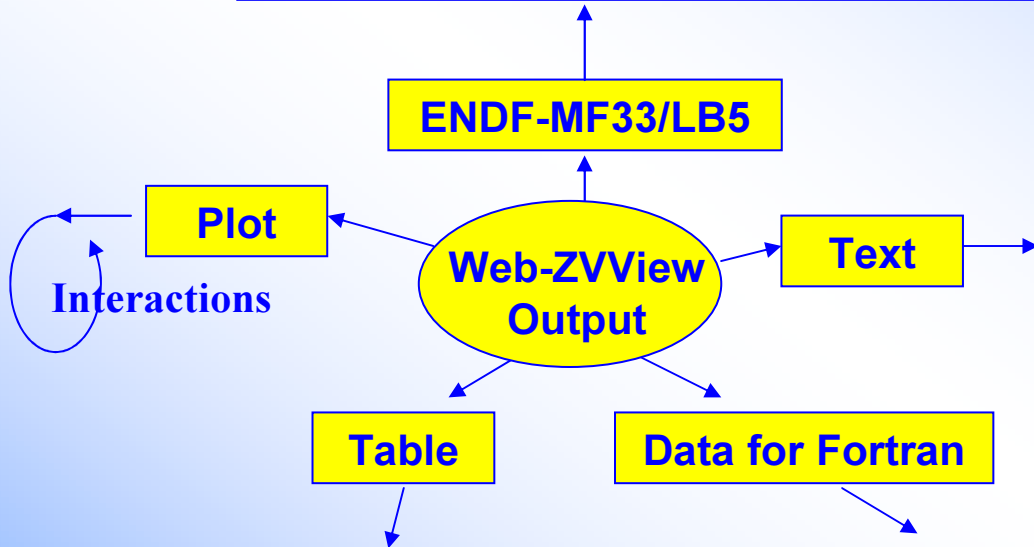


Output formats from Web-ZVView plotting

94242.0000	239.979400	0	0	0	1944633	18	1
0.0	0.0	0	18	0	1944633	18	2
0.0	0.0	1	5	171	18944633	18	3
1.00000-05	5.97000+05	7.97000+05	8.98000+05	9.06000+05	1.01000+06	944633	18
1.09800+06	1.11700+06	1.19300+06	1.37600+06	1.39000+06	1.69300+06	944633	18
2.14400+06	3.90800+06	5.18200+06	5.70000+06	6.19500+06	6.75900+06	944633	18

```

100
46 100
40 32 100
56 43 37 100
37 29 25 34 100
56 44 38 53 35 100
37 30 26 35 24 35 100
40 32 28 37 26 38 26 100
55 44 38 51 35 52 35 38 100
57 45 38 53 35 54 36 38 53 100
57 45 39 54 35 55 36 39 53 55 100
52 41 36 49 33 50 33 36 49 51 52 100
58 45 39 54 35 54 36 38 53 55 51 100
49 38 33 46 30 47 31 33 46 47 48 44 48 100
46 36 31 44 29 44 29 31 43 45 45 42 45 39 100
43 34 29 10 27 41 27 29 40 42 42 39 42 37 35 100
39 31 26 37 24 38 25 26 37 38 39 36 38 34 32 30 100
    
```



#ZVview-data-copy: 27-Aug-2010 19:28:22

#

#22211.CORR

Z(17x17): $Z_{i,j} = \text{Cor}(\sigma_{xi}, \sigma_{yj}) * 100$

	X (MEV)																	
Y (MEV)	0.597	0.797	0.898	0.906	1.01	1.098	1.117	1.193	1.376	1.39	1.693	2.144	3.908	5.182	5.7	6.195	6.759	j
0.597	100	46	40	56	37	56	37	40	55	57	57	52	58	49	46	43	39	1
0.797	46	100	32	43	29	44	30	32	44	45	45	41	45	38	36	34	31	2
0.898	40	32	100	37	25	38	26	28	38	38	39	36	39	33	31	29	26	3
0.906	56	43	37	100	34	53	35	37	51	53	54	49	54	46	44	10	37	4
1.01	37	29	25	34	100	35	24	26	35	35	35	33	35	30	29	27	24	5
1.098	56	44	38	53	35	100	35	38	52	54	55	50	54	47	44	41	38	6
1.117	37	30	26	35	24	35	100	26	35	36	36	33	36	31	29	27	25	7
1.193	40	32	28	37	26	38	26	100	38	38	39	36	38	33	31	29	26	8
1.376	55	44	38	51	35	52	35	38	100	53	53	49	53	46	43	40	37	9
1.39	57	45	38	53	35	54	36	38	53	100	55	51	55	47	45	42	38	10
1.693	57	45	39	54	35	55	36	39	53	55	100	52	55	48	45	42	39	11
2.144	52	41	36	49	33	50	33	36	49	51	52	100	51	44	42	39	36	12
3.908	58	45	39	54	35	54	36	38	53	55	55	51	100	48	45	42	38	13
5.182	49	38	33	46	30	47	31	33	46	47	48	44	48	100	39	37	34	14
5.7	46	36	31	44	29	44	29	31	43	45	45	42	45	39	100	35	32	15
6.195	43	34	29	10	27	41	27	29	40	42	42	39	42	37	35	100	30	16
6.759	39	31	26	37	24	38	25	26	37	38	39	36	38	34	32	30	100	17
i	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	

```

#LX2:      17
#LY2:      17
#LZ2:      289
#DATA-X:   17      ENE  EV
597000    797000    898000    906000    1.01e+6    1.098e+6
1.117e+6  1.193e+6    1.376e+6  1.39e+6    1.693e+6  2.144e+6
3.908e+6  5.182e+6    5.7e+6    6.195e+6  6.759e+6
#DATA-Y:   17      ENE  EV
597000    797000    898000    906000    1.01e+6    1.098e+6
1.117e+6  1.193e+6    1.376e+6  1.39e+6    1.693e+6  2.144e+6
3.908e+6  5.182e+6    5.7e+6    6.195e+6  6.759e+6
#DATA-Z:   289      COR  1
1          0.46    0.4    0.56    0.37    0.56
0.37       0.4    0.55    0.57    0.57    0.52
0.58       0.49    0.46    0.43    0.39    0.46
1          0.32    0.43    0.29    0.44    0.3
0.32       0.44    0.45    0.45    0.41    0.45
0.38       0.36    0.34    0.31    0.4    0.32
1          0.37    0.25    0.38    0.26    0.28
    
```

Example-2: ENTRY 21140

Correlations between data of different reactions, given in different Subentries

Proposal:

Today in EXFOR

```

COVARIANCE .CORRELATIONS BETWEEN THE RESULTS FOR
ARE IN THE FOLLOWING MATRIX, WHICH INCLUDE COVARIANCES
IN DETECTION EFFICIENCIES AND RATIO MEASUREMENTS. THE
ORDER OF THE ROWS/COLUMNS CORRESPONDS TO THE ORDER OF
THE SUBENTRIES, WITH THE MONITOR REACTION FIRST. THE
MATRIX ELEMENTS ARE GIVEN IN PERCENT.
100
96 100
99 96 100
94 91 95 100
99 96 99 95 100
99 96 99 95 99 100
99 96 99 96 99 99 100
99 96 99 96 100 99 100 100
88 85 88 84 88 88 88 88 100
89 87 90 88 90 90 90 91 79 100
26 25 26 25 26 26 26 26 23 23 100
70 68 71 69 71 71 71 72 63 66 18 100
54 52 55 53 55 55 55 55 48 51 15 39 100
83 80 82 78 83 82 82 83 74 74 22 59 45
100
71 69 71 68 71 71 71 71 63 64 19 51 39
60 100
69 68 70 68 70 70 70 70 62 64 18 51 39
57 50 100
    
```

```

COVARIANCE .CORRELATIONS BETWEEN THE RESULTS FOR THE 34 REACTIONS
ARE IN THE FOLLOWING MATRIX, WHICH INCLUDE COVARIANCES
IN DETECTION EFFICIENCIES AND RATIO MEASUREMENTS. THE
ORDER OF THE ROWS/COLUMNS CORRESPONDS TO THE ORDER OF
THE SUBENTRIES, WITH THE MONITOR REACTION FIRST. THE
MATRIX ELEMENTS ARE GIVEN IN PERCENT.
    
```

(DATA)

(XY, 34, Reaction, N)

```

N Reaction
1 Al-27 (n,a) Na-24
2 Mg-24 (n,p) Na-24
3 Ti-46 (n,p) Sc-46
4 Ti-47 (n,p) Sc-47
5 Ti-48 (n,p) Sc-48
    
```

34 Sc-45 (n,a) K-42

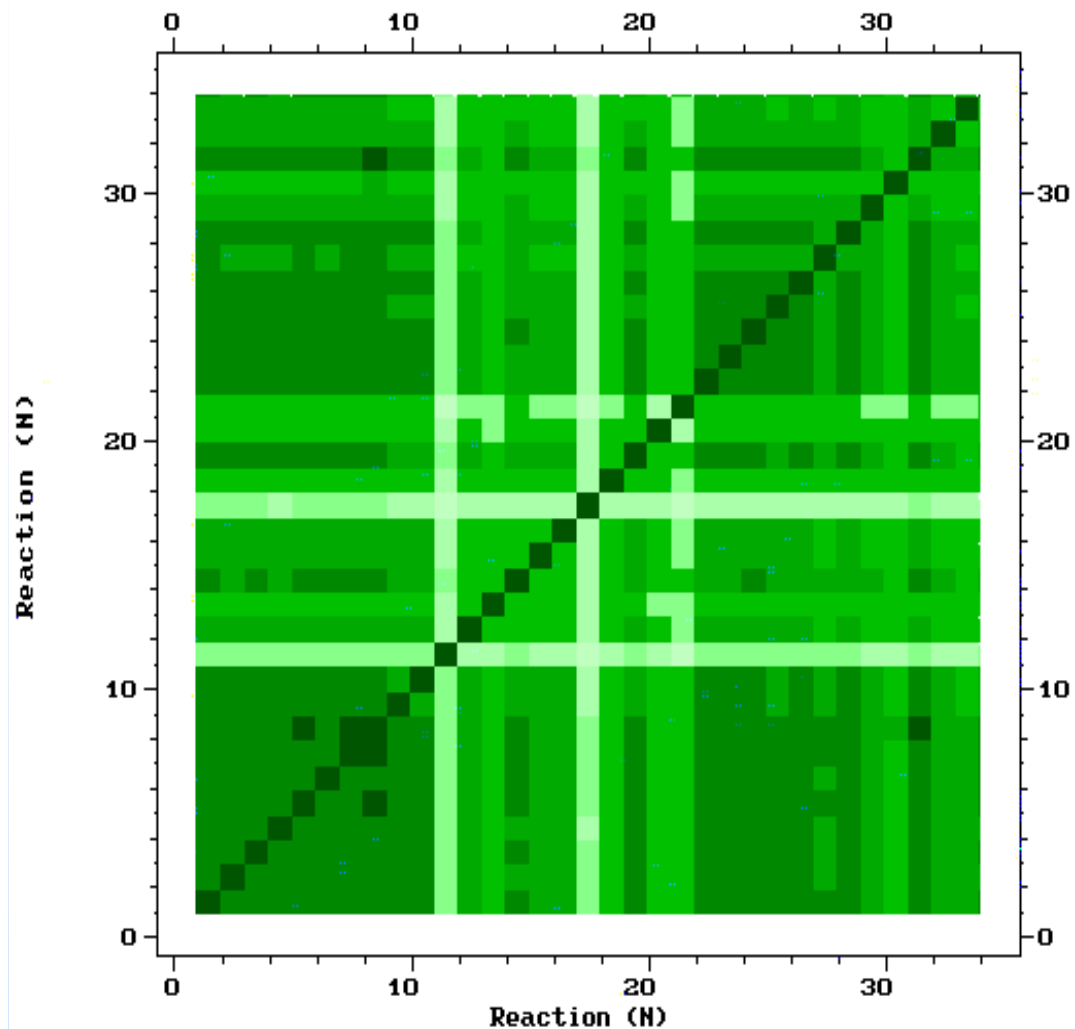
(Z, 595, CORR, PER-CENT)

```

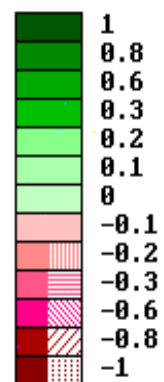
100
96 100
99 96 100
94 91 95 100
99 96 99 95 100
99 96 99 95 99 100
99 96 99 96 99 99 100
    
```

ENTRY 21140 correlations (~ENDF MAT-MAT)

EXFOR covariances: proposal for coding



Levels



1) 22140.CORR

2) Use my data [example]

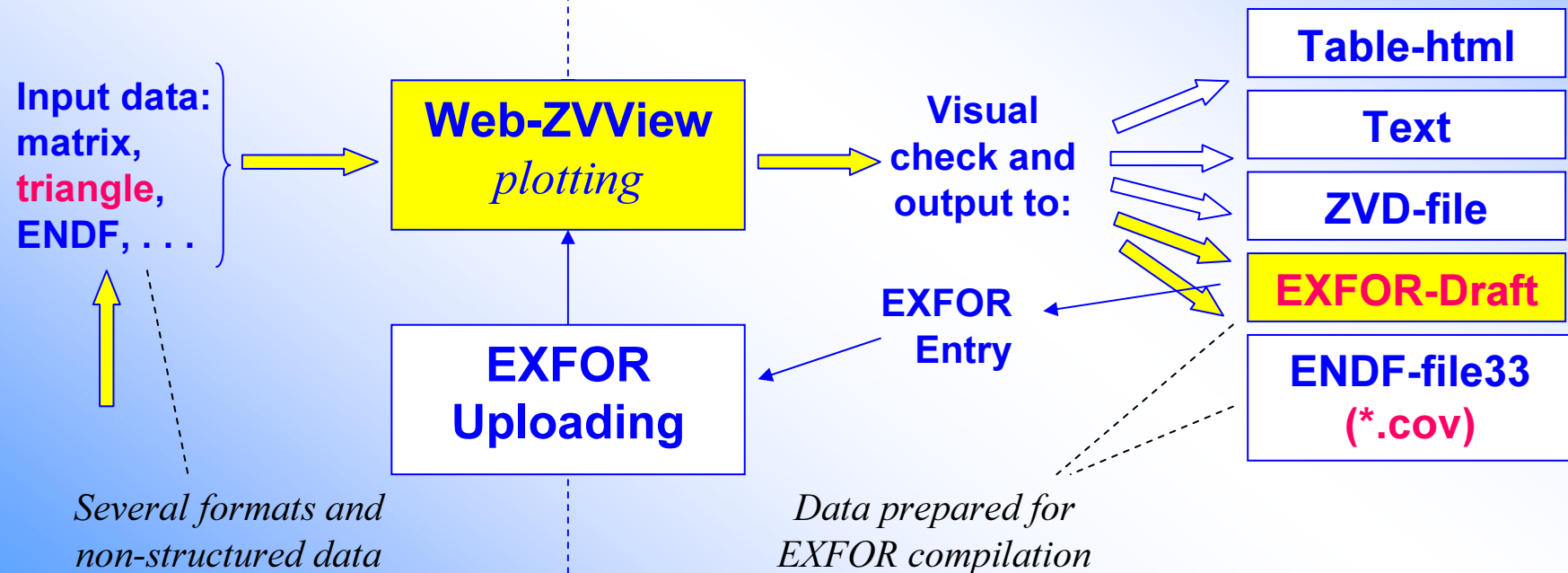
See: [plotted data](#) (23Kb) out:x4,T,F,e6

N Reaction

- 1 Al-27(n,a)Na-24
- 2 Mg-24(n,p)Na-24
- 3 Ti-46(n,p)Sc-46
- 4 Ti-47(n,p)Sc-47
- 5 Ti-48(n,p)Sc-48
- 6 Fe-54(n,p)Mn-54
- 7 Fe-56(n,p)Mn-56
- 8 Ni-58(n,p)Co-58g
- 9 Ni-60(n,p)Co-60g
- 10 Ni-61(n,p)Co-61
- 11 Zn-64(n,p)Cu-64
- 12 Zn-67(n,p)Cu-67
- 13 Rh-103(n,p)Ru-103
- 14 Ce-140(n,p)La-140
- 15 Ti-50(n,a)Ca-47
- 16 Fe-54(n,a)Cr-51
- 17 Zn-68(n,a)Ni-65
- 18 Rh-103(n,in)Rh-103m
- 19 Co-59(n,p)Fe-59
- 20 In-115(n,p)Cd-115g
- 21 In-115(n,p)Cd-115m
- 22 Co-59(n,a)Mn-56
- 23 In-113(n,in)In-113m
- 24 In-115(n,in)In-115m
- 25 Co-59(n,2n)Co-58g
- 26 Al-27(n,p)Mg-27
- 27 Ca-42(n,p)K-42
- 28 Ca-43(n,p)K-43
- 29 Sr-84(n,p)Rb-84g
- 30 Sr-86(n,p)Rb-86g
- 31 Mo-92(n,p)Nb-92m
- 32 Mo-95(n,p)Nb-95g
- 33 Mo-96(n,p)Nb-96
- 34 Sc-45(n,a)K-42

Using Web-ZVView for preparation covariance data for EXFOR compilation

<http://nds121.iaea.org/exfor2/myplot.htm>



<http://nds121.iaea.org/exfor2/x4up1.htm>

Conclusion

1. Covariance data can be better supported in EXFOR system
2. Users' needs in EXFOR covariance data should be investigated

Thank you.