Data Set with Several Variable Nuclei

(N. Otsuka and O. Schwerer, 2019-10-12, Memo CP-D/984;
N. Otsuka, 2020-06-03, Memo CP-D/1012)

Note added to this Working Paper:

Memo CP-D/984 discusses compilation of fission yields specified by several mass and/or atomic numbers of the fragments and propose addition. Its also summarizes presence of headings (e.g., ELEMENT, MASS) and proposes addition of coding rules in LEXFOR.

Memo CP-D/1012 reports illegal repetition of ELEMENT and MASS seen in the EXFOR Master.

Memo CP-D/984

1. Total ternary fission charge yield for fragment pair specified

Recently ^{252}Cf(sf) ternary fission charge yields measured with the US Gammasphere spectrometry have been transmitted in PRELIM.1457 (14331.008 to 010, which will replace 41464.004 to 005). These data sets give charge yields characterized by the charges of all three fragments before β decay without mass specification (though the authors assume the majority of are from ^{4}He for Z=2, ^{10}Be for Z=4, and ^{14}C for Z=6). The data table should be like

```
COMMON              2          3                              14331  8    9
ELEM2                                                         14331  8   10
NO-DIM                                                        14331  8   11
 2.                                                           14331  8   12
ENDCOMMON           3          0                              14331  8   13
DATA                3         10                              14331  8   14
ELEM1      DATA       DATA-ERR                                14331  8   15
NO-DIM     PC/FIS     PC/FIS                                  14331  8   16
    38.     3.3       1.0                                     14331  8   17
    40.    14.        3.                                      14331  8   18
    42.    13.        2.6                                     14331  8   19
    44.     3.2       0.4                                     14331  8   20
    46.     0.18      0.025                                   14331  8   21
…
ENDDATA            12          0                              14331  8   27
ENDSUBENT          26          0                              14331  899999
```

(N.B. It is redundant to give the charge or yield of the third fragment since the total charge of the three fragments are always 98.).

Dict. 236 defines IND/TER/CRN,FY for FY(Z1,A1,Z2,A2,Z3,A3) before β decay (c.f. EXFOR 13751.003). EXFOR 14331.008 to 010 gives FY(Z1,Z2,Z3) before β decay, and we propose a new quantity code CHG/TER/CRN,FY. To be consistent with these quantity codes, we also propose replacing TER/CHG,FY with CHG/TER,FY in Dict.236 (11 data setts in 4 entries are affected.)

Dictionary 236 (Quantities)

CHG/TER/CRN,FY	Total element yield of ternary fission product pair specified
TER/CHG,FY	(*Obsolete*)
CHG/TER,FY	Total element yield of ternary fission product

Quantity	Reaction Type	Dimension	Subentry
CHG/TER/CRN,FY	FY	NO	14331.008,009,010
CHG/TER,FY	FY	NO	30317.003

2. Charge yield coded without CHG in REACTION SF5

We extracted all fission yield (SF6= *FY*) data sets where REACTION SF4=ELEM but CHG is not in SF5. CHG must replace IND in several subentries:

Subent #	REACTION	Remark
13648.008	98-CF-252(0,F)ELEM,IND/CRN,FY	IND/CRN -> CHG. Delete ELEM1 or ELEM2 (redundant)
21743.006	98-CF-252(0,F)ELEM,IND,FY	IND -> CHG
21743.007	90-TH-229(N,F)ELEM,IND,FY,,MXW	IND -> CHG
21919.002	90-TH-229(N,F)ELEM,IND,FY/DE,,MXW/REL	IND -> CHG
21919.003	90-TH-229(N,F)ELEM,IND,FY,,MXW	IND -> CHG
21919.004	92-U-232(N,F)ELEM,IND,FY/DE,,MXW/REL	IND -> CHG
21919.005	92-U-232(N,F)ELEM,IND,FY,,MXW	IND -> CHG
30418.003.2	98-CF-252(0,F)ELEM,IND/TER,FY	Add SF8=MSC. PC/FIS -> ARB-UNITS for DATA and DATA-ERR (charge yield per ternary fission).
O1012.002	82-PB-208(92-U-238,F)ELEM,IND,FY	IND -> CHG
O1012.004	4-BE-9(92-U-238,F)ELEM,IND,FY	IND -> CHG

N.B. CHG is used only when FY in SF6. When a production *cross section* is characterized with a Z number and the product is before β-decay or stable, CHG is omitted (like IND).

3. ELEM and/or MASS for several variable nuclei

Headings like ELEM1, ELEM2, MASS1 or MASS2 are used when there are two or more variable nuclei. We propose requirement of such headings depending on the codes in REACTION SF4 and SF5 as follows:

	CRN is not in SF5			CRN is in SF5		
SF4	ELEM	MASS	ELEM/MASS	ELEM	MASS	ELEM/MASS
ELEM	X		X			
MASS		X				
ELEM1				X		X
MASS1					X	
ELEM2				X		X
MASS2					X	
ELEM3				(X)		(X)
MASS3					(X)	

X: Presence is obligatory. (X): Presence is optional.

All data sets using the heading ELEMn or MASSn (n=1,2 or 3) are listed in the appendix of this memo. Proper use of such headings is seen only when SF6=FY except for a few cases, and we propose to limit their use only when SF6=FY.

Update of LEXFOR and EXFOR Formats Manual are proposed below:

Proposed update of the LEXFOR "**Fission Yields**"

Yields of Correlated Fragment Pairs (*Revised*)
The independent yield of a correlated pair is entered under the field headings such as ELEM1, MASS1, ELEM2 or MASS2.

REACTION coding: IND/CRN in SF5.

Examples:
(1) Independent yield of a correlated fragment pair

```
BIB
REACTION (...(N,F)ELEM/MASS,IND/CRN,FY)
...
ENDBIB
COMMON
ELEM1      ELEM2
NO-DIM     NO-DIM
 56.        42.
ENDCOMMON
DATA
MASS1      MASS2      DATA
NO-DIM     NO-DIM     PC/FIS
 138.       104.       ...
 138.       105.       ...
 ... ... ...
ENDDATA
```

(2) Independent yield of a correlated fragment pair (ternary fission)

```
BIB
REACTION (...(N,F)ELEM/MASS,IND/TER/CRN,FY)
...
ENDBIB
COMMON
ELEM1      ELEM2      ELEM3      MASS3
NO-DIM     NO-DIM     NO-DIM     NO-DIM
 56.        42.        2.         4.
ENDCOMMON
DATA
MASS1      MASS2      DATA
NO-DIM     NO-DIM     PC/FIS
 138.       104.       ...
 138.       105.       ...
 ... ... ...
ENDDATA
```

(3) Charge yield of a correlated fragment pair (ternary fission)

```
BIB
REACTION (...(N,F)ELEM,CHG/TER/CRN,FY)
...
ENDBIB
COMMON
ELEM1
NO-DIM
 2.
ENDCOMMON
DATA
ELEM2       DATA
NO-DIM      PC/FIS
 56.         ...
 56.         ...
 ... ...  ...
ENDDATA
```

Note:
The mass and charge numbers are given without redundancy. For example, (1) MASS1 and MASS2 are not used when the mass of one fragment can be determined by the mass of the other fragment for the primary fission yield in a binary fission, (2) ELEM1 and ELEM2 are not used when the charge of one fragment can be determined by the charge of the other fragment for the charge yield in a binary fission.

Proposed addition to LEXFOR "**Reaction Product**"

Variable Product

The reaction product maybe a variable of the data table (See EXFOR Formats Manual Chapter 6: Variable nucleus). When the quantity is for a correlated pair of reaction products, they are entered under headings such as ELEM1 and MASS1 with CRN in REACTION SF5. The following table summarises presence of the headings characterizing variable product depending on REACTION SF4 and SF5:

	CRN is not in SF5			CRN is in SF5		
SF4	ELEM	MASS	ELEM/MASS	ELEM	MASS	ELEM/MASS
ELEM	X		X			
MASS		X				
ELEM1				X		X
MASS1					X	
ELEM2				X		X
MASS2					X	
ELEM3				(X)		(X)
MASS3					(X)	

X: Presence is obligatory. (X): Presence is optional

Use of CRN in REACTION SF5 is allowed only for fission yields (i.e., FY is in SF6).

Presence of ELEM1, ELEM2, ELEM3, MASS1, MASS2 or MASS3 in EXFOR Master Ver. 2019-09-19

(Z1 = ELEM1, A1 = MASS1 etc.)

Subent #	Z1	Z2	Z3	A1	A2	A3	REACTION	Remark
13066.003	x	x		x	x		(((92-U-235(N,F)ELEM/MASS,CUM,FY,,SPA)/ (92-U-235(N,F)42-MO-99,CUM,FY,,SPA))// ((92-U-235(N,F)ELEM/MASS,CUM,FY,,MXW)/ (92-U-235(N,F)42-MO-99,CUM,FY,,MXW))	Delete. Average of R-values of (Z1,A1) and (Z2,A2).
13066.004	x	x	x	x	x	x	(((92-U-235(N,F)ELEM/MASS,CUM,FY,,SPA)/ (92-U-235(N,F)42-MO-99,CUM,FY,,SPA))// ((92-U-235(N,F)ELEM/MASS,CUM,FY,,MXW)/ (92-U-235(N,F)42-MO-99,CUM,FY,,MXW))	Delete. Average of R-values of (Z1,A1), (Z2,A2) and (Z3,A3).
13092.002	x	x		x	x		((92-U-235(N,F)ELEM/MASS,CUM,FY)/ (92-U-235(N,F)42-MO-99,CUM,FY))// ((92-U-235(N,F)ELEM/MASS,CUM,FY,,MXW)/ (92-U-235(N,F)42-MO-99,CUM,FY,,MXW))	Delete. Average of R-values of (Z1,A1) and (Z2,A2).
13599.002	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13599.003	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	
13648.002	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13648.003	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13648.004	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13648.005	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13648.006	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13648.008	x	x					(98-CF-252(0,F)ELEM,IND/CRN,FY)	Z1 or Z2 is redundant (Z(L)+Z(H)=98). Use CHG instead of IND/CRN?
13648.009	x	x					(98-CF-252(0,F)ELEM,PR,NU)	Z1 or Z2 is redundant (Z(L)+Z(H)=98).
13698.002	x	x	x	x	x	x	(98-CF-252(0,F)ELEM/MASS,IND/TER/CRN,FY)	Ok
13698.003.1	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13698.003.2	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13698.004.1	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13698.004.2	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13698.005.1	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13698.005.2	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13698.006.1	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok

13698.006.2	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13747.002	x	x		x	x		(94-PU-242(0,F)ELEM/MASS,IND/CRN,FY,,REL)	Ok
13747.003	x	x		x	x		(94-PU-242(0,F)ELEM/MASS,IND/CRN,FY,,REL)	
13749.002	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13751.002	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
13751.003	x	x	x	x	x	x	(98-CF-252(0,F)ELEM/MASS,IND/TER/CRN,FY)	
13751.004	x	x	x	x	x	x	(98-CF-252(0,F)ELEM/MASS,IND/TER/CRN,FY)	
13807.002	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,IND/CRN,FY)	Ok
14197.003				x	x		(92-U-235(N,F)MASS,PRE,MLT,G,MXW)	A1 or A2 is redundant (A(L)+A(H)=236). SF6 must be FY.
14197.004				x	x		(92-U-235(N,F)MASS,PRE,KE,G,MXW)	A1 or A2 is redundant (A(L)+A(H)=236).
14286.004	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,NUM,FY,G)	Two fragments are specified. Add MSC in SF8.
14286.005	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,NUM,FY,G)	
14331.002	x	x	x	x	x		(98-CF-252(0,F)ELEM/MASS,IND/TER/CRN,FY)	Delete CRN in SF5, but add MSC in SF8. A of LCP is not specified.
14331.003	x	x	x	x	x		(98-CF-252(0,F)ELEM/MASS,IND/TER/CRN,FY)	
14331.004	x	x	x	x	x		(98-CF-252(0,F)ELEM/MASS,IND/TER/CRN,FY)	
14331.005	x	x	x	x	x		(98-CF-252(0,F)ELEM/MASS,IND/TER/CRN,FY)	
14331.006	x	x		x			(98-CF-252(0,F)ELEM/MASS,IND/TER/CRN,FY)	
14331.007	x	x		x			(98-CF-252(0,F)ELEM/MASS,IND/TER/CRN,FY)	
22925.003	x	x		x	x		((98-CF-252(0,F)ELEM/MASS,QTR,FY)/(98-CF-252(0,F)2-HE-4,TER,FY))	Delete these data sets. It involves LCP break-up products, and cannot be defined well within the current EXFOR rule.
22925.005	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,QTR,KE)	
22925.007	x	x		x	x		((92-U-233(N,F)ELEM/MASS,QTR,FY,,MXW)/(92-U-233(N,F)2-HE-4,TER,FY,,MXW))	
22925.009	x	x		x	x		(92-U-233(N,F)ELEM/MASS,QTR,KE,,MXW)	
22925.011	x	x		x	x		((92-U-235(N,F)ELEM/MASS,QTR,FY,,MXW)/(92-U-235(N,F)2-HE-4,TER,FY,,MXW))	
22925.013	x	x		x	x		(92-U-235(N,F)ELEM/MASS,QTR,KE,,MXW)	
22925.014	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,QTR,FY)	
23213.009		x		x	x		(98-CF-252(0,F)MASS,,KE,LF+HF,MSC)	Add SF5=SEC (c.f. footnote of Table 1). α and A(L) specified.
23213.011		x		x	x		(98-CF-252(0,F)MASS,TER,KE,G,MSC)	Ok. α and A(L) specified.

23213.013		x		x	x		(98-CF-252(0,F)MASS,PR/TER,NU,,MSC)	Ok. α and A(L) specified.
23213.015		x		x	x		(98-CF-252(0,F)MASS,PR/FRG,NU,,MSC)	Ok. α and A(L or H) specified.
23213.017		x		x	x		(98-CF-252(0,F)MASS,PRE,FY,,MSC)	Ok. α and A(L or H) specified.
23213.028		x		x	x		(98-CF-252(0,F)MASS,PR/TER,NU,,MSC)	Ok. α and A(L) specified.
41030.018		x		x	x		(98-CF-252(0,F)MASS,CHN,FY,,MSC)	Ok. t and A(L or H) specified.
41030.019		x		x	x		(98-CF-252(0,F)MASS,CHN,FY,,MSC)	Ok. α and A(L or H) specified.
41030.020		x		x	x		(98-CF-252(0,F)MASS,CHN,FY,,MSC)	Ok. ^{6}He and A(L or H) specified.
41084.004	x	x					(94-PU-239(N,F)ELEM/MASS,CUM,FY,,FST)	ELEM1, ELEM2 -> ELEMENT
41084.007	x	x					(92-U-235(N,F)ELEM/MASS,CUM,FY,,FST)	
41464.004	x	x			x		(98-CF-252(0,F)ELEM,TER/CHG,FY)	Delete this data set. US data in 14331.008.
41464.005	x	x			x		(98-CF-252(0,F)ELEM,TER/CHG,FY)	Delete this data set. US data in 14331.009.
41464.006	x	x			x		(98-CF-252(0,F)ELEM,TER/CHG,FY)	Delete this data set. US data in 14331.010.
41536.002	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,QTR,FY,,REL)	? A and Z of two LCP specified.
41536.003	x	x		x	x		(96-CM-248(0,F)ELEM/MASS,QTR,FY,,REL)	? A and Z of two LCP specified.
41536.004	x	x		x	x		(98-CF-252(0,F)ELEM/MASS,QTR,FY)	? A and Z of two LCP specified.
41536.005	x	x		x	x		(96-CM-248(0,F)ELEM/MASS,QTR,FY)	? A and Z of two LCP specified.
41610.005	x	x		x	x		((98-CF-252(0,F)ELEM/MASS,QTR,FY,,MSC)/ (98-CF-252(0,F)2-HE-4,TER,FY))	Ok. A and Z of two LCP specified.
C1581.010	x	x					(1-H-1(6-C-12,X)ELEM,,SIG)	ELEM1, ELEM2 -> ELEMENT
C1581.011	x	x					(6-C-0(6-C-12,X)ELEM,,SIG)	
C1581.012	x	x					(13-AL-27(6-C-12,X)ELEM,,SIG)	
C1581.013	x	x					(29-CU-0(6-C-12,X)ELEM,,SIG)	
C1581.014	x	x					(50-SN-0(6-C-12,X)ELEM,,SIG)	
C1581.015	x	x					(82-PB-0(6-C-12,X)ELEM,,SIG)	
C1581.016	x	x					(1-H-1(6-C-12,X)ELEM,,SIG)	
C1581.017	x	x					(6-C-0(6-C-12,X)ELEM,,SIG)	
C1581.018	x	x					(13-AL-27(6-C-12,X)ELEM,,SIG)	
C1581.019	x	x					(29-CU-0(6-C-12,X)ELEM,,SIG)	
C1581.020	x	x					(50-SN-0(6-C-12,X)ELEM,,SIG)	
C1581.021	x	x					(82-PB-0(6-C-12,X)ELEM,,SIG)	

C1581.022	x	x					(1-H-1(6-C-12,X)ELEM,,SIG)	
C1581.023	x	x					(6-C-0(6-C-12,X)ELEM,,SIG)	
C1581.024	x	x					(13-AL-27(6-C-12,X)ELEM,,SIG)	
C1581.025	x	x					(29-CU-0(6-C-12,X)ELEM,,SIG)	
C1581.026	x	x					(50-SN-0(6-C-12,X)ELEM,,SIG)	
C1581.027	x	x					(82-PB-0(6-C-12,X)ELEM,,SIG)	
C1581.028	x	x					(1-H-1(6-C-12,X)ELEM,,SIG)	
C1581.029	x	x					(6-C-0(6-C-12,X)ELEM,,SIG)	
C1581.030	x	x					(13-AL-27(6-C-12,X)ELEM,,SIG)	
C1581.031	x	x					(29-CU-0(6-C-12,X)ELEM,,SIG)	
C1581.032	x	x					(50-SN-0(6-C-12,X)ELEM,,SIG)	
C1581.033	x	x					(82-PB-0(6-C-12,X)ELEM,,SIG)	
C1581.034	x	x					(1-H-1(6-C-12,X)ELEM,,SIG)	
C1581.035	x	x					(6-C-0(6-C-12,X)ELEM,,SIG)	
C1581.036	x	x					(13-AL-27(6-C-12,X)ELEM,,SIG)	
C1581.037	x	x					(29-CU-0(6-C-12,X)ELEM,,SIG)	
C1581.038	x	x					(50-SN-0(6-C-12,X)ELEM,,SIG)	
C1581.039	x	x					(82-PB-0(6-C-12,X)ELEM,,SIG)	
C1581.040	x	x					(1-H-1(6-C-12,X)ELEM,,SIG)	
C1581.041	x	x					(6-C-0(6-C-12,X)ELEM,,SIG)	
C1581.042	x	x					(13-AL-27(6-C-12,X)ELEM,,SIG)	
C1581.043	x	x					(29-CU-0(6-C-12,X)ELEM,,SIG)	
C1581.044	x	x					(50-SN-0(6-C-12,X)ELEM,,SIG)	
C1581.045	x	x					(82-PB-0(6-C-12,X)ELEM,,SIG)	
D0545.003	x	x		x	x		(6-C-12(6-C-16,X)ELEM/MASS,,SIG)	Add MSC in SF8. SF6 is not FY.

Memo CP-D/1012

Multiple appearance of an independent variable heading is allowed when the dataset is for the sum of two independent variable value. However, some repetitions are originated from coding errors.

***Example*:**

MASS in the COMMON section must be MASS-NRM. "(MONIT)" must be added to the second code string under the keyword MONITOR.

```
SUBENT        22073002     880805
BIB                  5         12
REACTION    (95-AM-241(N,F)MASS,CHN,FY,,SPA)
MONITOR     (92-U-235(N,F)MASS,CHN,FY,,SPA) USED FOR RELATIVE
             DETERMINATION OF FISSION YIELDS.
            (95-AM-241(N,F)MASS,CHN,FY,,SPA) USED FOR ABSOLUTE
             NORMALIZATION OF FISSION YIELDS.
…
ENDBIB              12
COMMON               2          3
MASS        MONIT
NO-DIM      PC/FIS
 1.4000E+02 6.0000E+00
ENDCOMMON            3
DATA                 3         35
MASS        DATA        DATA-ERR
NO-DIM      PC/FIS      PC/FIS
 8.8000E+01 7.5000E-01 9.0000E-02
 8.9000E+01 1.0000E+00 2.0000E-01
 9.1000E+01 1.7200E+00 2.1000E-01
…
 1.3900E+02 6.2100E+00 2.9000E-01
 1.4000E+02 6.0000E+00 1.5000E-01
 1.4100E+02 5.1500E+00 3.1000E-01
…
```

I checked multiple appearance of MASS, ELEMENT and ISOMER in EXFOR Master (Ver.2021-04-06), and the result is appended to this memo.

Repetition of both ELEMENT and MASS (41300.002)

During this review, I found it is not trivial to express the quantity summed over several nuclides in the ELEM/MASS formalism (41300.002):

Table 1.

Comparison of relative DN yields data related to individual precursors for neutron induced fission of ^{237}Np

Precursor	T, s half-life	Rel. DN yields (Present work, E_n=1.008(0.099) *) MeV)	Rel. DN yields, obtained from [2,3] by summation (E_n=FAST)**)	Rel. DN yields, [4] (E_n=FAST)
^{87}Br	55.69	0.031±0.001	0.035	0.0416
^{137}I	24.5	0.176±0.005	0.195	0.1745
^{88}Br	16.3	0.101±0.005	0.072	0.1069
^{138}I, ^{93}Rb	6.37	0.079±0.003	0.106	0.0857
^{89}Br	4.38	0.092±0.007	0.100	0.0860
^{94}Rb	2.76	0.129±0.012	0.157	0.1473
^{139}I, ^{85}As, ^{98m}Y	2.09	0.257±0.011	0.215	0.2346
^{93}Kr	1.289	0.0046±0.0008	0.0058	0.0059
^{144}Cs, ^{140}I	0.942	0.013±0.002	0.015	0.0151
^{91}Br	0.542	0.019±0.004	0.020	0.0198
^{95}Rb	0.384	0.077±0.017	0.052	0.0533
^{96}Rb, ^{97}Rb	0.195	0.023±0.004	0.027	0.0272

*) -values in brackets are standard deviations of incident neutron energy;
**) - fission neutron spectrum.

```
SUBENT         41300002   20191112
BIB                   6         38
REACTION    ((93-NP-237(N,F)ELEM/MASS,DL,NU)/
            (93-NP-237(N,F),DL/IND,NU))
…
ENDBIB                38
NOCOMMON               0          0
DATA                  11         60
EN          EN-ERR      ELEMENT     MASS        ELEMENT     MASS
ISOMER      ELEMENT     MASS        DATA        ERR-T
MEV         MEV         NO-DIM      NO-DIM      NO-DIM      NO-DIM
NO-DIM      NO-DIM      NO-DIM      NO-DIM      NO-DIM
  0.586      0.078        33.         85.         39.         98.
   1.         53.        139.        0.257       0.012
…
```

The compiler tried to express the delayed neutron fraction for the 2.09 sec group by using three pairs of (ELEMENT,MASS) of precursor nuclides (33-AS-85, 39-Y-98-M1, 53-I-139) instead of the half-life (HALF-LIFE). But the above coding would be interpreted as the direct product of ELEMENT and MASS, i.e.,

(ELEMENT,MASS) = (33,39,53)×(85,98,139) = (33,85) + (33,98)+(33,139)+(39,85)+…

As an-hoc solution, I suggest replacement of (ELEMENT, MASS) with HALF-LIFE in 41300.002.

Repetition of ELEMENT – Chain yield? (13332.002, 13969.002, 22064.003, M0202.002-003)

In the tables of these articles, some fission yields are reported with two nuclides (mother and daughter) on the same mass chain. The mother nuclide often has longer half-life. It could be author's intention to report the chain yield instead of the cumulative yield. These cases must be further investigated by the originating centres.

Appendix: Multiple appearance of MASS, ELEMENT and ISOMER in EXFOR Master

MASS	
22073.002	MASS -> MASS-NRM in COMMON. Add (MONIT) to the second MONITOR code string.
41300.002	ELEM/MASS,DL,NU -> ,DL/GRP,NU. Replace (ELEMENT,MASS) with HALF-LIFE. (Unresolved precursors of the group-wise delayed neutron fraction.)
41308.003, 41308.004	(Ok)
C2498.003	Delete the fourth column of the DATA section under MASS. (Digitized masses before rounding?)

ELEMENT	
13332.002	Chain yield? (Delete ELEMENT?) ^{111}Pd+^{111}Ag, ^{129m}Sb-^{129}Te, ^{132}Te+^{132}I, ^{141}Ce+^{141}La. The same notation of the sum is used in 13969.002 measured by Kuroda's group. The two nuclides were isolated and counted separately?
13969.002	Chain yield? (Delete ELEMENT?) ^{143}Ce+^{143}Pr, ^{156}Sm+^{156}Eu. The authors mention the two nuclides were isolated and counted separately.
22064.003	Chain yield? The activity of the short-lived daughter is measured. ^{97}Zr+^{97}Nb, ^{99}Mo+^{99m}Tc. The authors explain their yields as "mass yield" in Table 2.
30787.003.1, 30787.003.2, 30787.004.1, 30787.004.2, 30787.005.1, 30787.005.2	ELEMENT=43 in the common subentry (001) must be deleted.
41300.002	(See above)
M0202.002, M0202.003	Chain yield? (Delete ELEMENT?) Yields are given for ^{88}Kr+^{88}Rb, ^{92}Sr+^{92}Y, ^{95}Zr+^{95}Nb, ^{97}Zr+^{97}Nb, ^{99}Mo+^{99}Tc (^{99m}Tc?), ^{132}Te+^{132}I, ^{140}Ba+^{140}La.

ISOMER	
F1217.004	(Ok)
F1299.002	(Ok)
G0065.002	(Ok)
L0214.003, L0214.004	(Ok)
O0989.002	(Ok)