Memo CP-D/193

23 June 1989

To: Distribution

From: O. Schwerer

Subject: Dictionary additions proposed in Memo CP-M/10, in particular modifiers CA,CB,CC,RBA,RCB,RCA

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1. We agree to the dictionary additions proposed in memo CP-M/10 of 10 March 1989, with the following exceptions:

   - Modifiers CA,CB,CC,RBA,RCB,RCA and related quantities in dictionary 36: see our counter-proposal below (item 2.)

   - ,DA/PRE in dictionary 36: should be coded PRE,DA,FF.

2. The modifiers CA,CB,CC,RBA,RCB,RCA are not consistent with the way existing coefficients for angular distributions are coded. The coefficients for one representation are always coded with the same REACTION code; the coefficients are distinguished by an index which is then used in the DATA section as independent variable under the heading NUMBER.

   Using this method, only one or two new codes will be needed in dictionary 34 rather than the 6 proposed in CP-M/10.

   For the following compare also our comments on TRANS-M006 in memo CP-D/184.

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2.1 Representation of angular distributions in the form

$$d\sigma/d\Omega = A + B * \sin^2\vartheta + C * \sin^2(2\vartheta)$$
$$= a_0 + a_1 \sin^2\vartheta + a_2 \sin^2(2\vartheta)$$

Proposal for dictionary 34:

S2T Modifier for coefficients of the form
D-SIG/D-OMEGA = A(0)+A(1)*SIN**2(THETA)
+ A(2)*SIN**2(2*THETA)

Dictionary 36:

,DA,FF,S2T (ANG. DIST. OF FISSION FRAGMENTS,
COEFF.OF THE FORM ... (as above))

As an example for the usage, subentries M0175.009,10,11 should then be combined into <u>one</u> subentry in the following way:

REACTION (92-U-238(G,F),,DA,FF,S2T,EXP)
...
DATA

EN-MAX MEV	NUMBER NO-DIM	DATA MB/SR *)	DATA-ERR MB/SR *)
5.2	0.	0.042	0.035
5.2	1.	0.958	0.050
5.2	2.	1.018	0.068
5.4	0.	0.038	0.009
5.4	1.	0.962	0.017
5.4	2.	0.155	0.021
5.65	0.	0.034	0.005
5.65	1.	0.966	0.011
5.65	2.	0.040	0.010
etc.			

The same applies to subentries M0176.002-7 and M0190.002-16. In subentries M0193.002-5 only the coefficients A and C (or a_0 and a_2) are given. I assume that B=0 there; just give the data for NUMBER=0 and NUMBER=2.

*) Coefficients have in general the units of the differential cross section (MB/SR or B/SR etc.), unless an additional modifier like REL (or RS0) indicates that it is a ratio with units NO-DIM. CDFE is asked to check the units for the subentries mentioned above and, if necessary, to add the modifier REL.

2.2 Representation in the form $d\sigma/d\Omega = A + B \sin^2\vartheta$

giving the ratio B/A (see e.g. subentry M0179.002).

Since $A = d\sigma/d\Omega$ at 0°:

$$\frac{d\sigma/d\Omega}{d\sigma/d\Omega(0°)} = 1 + \frac{B}{A}\sin^2\vartheta$$

which is a special case of the existing representation in powers of $\sin^2$:

$$d\sigma/d\Omega = \sum_{\ell} a_{\ell} \sin^{2\ell}\vartheta$$

(existing modifier SN2 in dictionary 34).

New code in dictionary 36:

```
,DA,FF,SN2/RS0     (ANG.DIST.OF FISSION FRAGMENTS,
                    COEFF.OF THE FORM
                    (D-SIG/D-OMEGA)/D-SIG/D-OMEGA AT 0 DEG) =
                    = 1+SUM(A(L)*SIN**(2L)(THETA)))
```

For our special case, we actually need only 1 coefficient (NUMBER=1).

Subentry M0179.002 would be changed in the following way:

```
REACTION    (94-PU-239(G,F),,DA,FF,SN2/RS0,EXP)
...
COMMON
NUMBER
NO-DIM
  1.
ENDCOMMON
DATA
(DATA section unchanged)
```

This coding also applies to subentries M0184.002-5, M0191.002 and M0200.015. Subentries M0188.002-6 also give the coefficient B/A but, in the free text explanation, include also the term C*(SIN(2*THETA))**2. I assume that here C=0 and that the above formalism also applies here, because otherwise the data given would be incomplete.

2.3 Coefficient ratios C/B, B/A, C/A

for representation $d\sigma/d\Omega = A+B*\sin^2\vartheta + C*\sin^2(2\vartheta)$.

"General note": This case, as found in entry M0186 of TRANS-M006 (giving ratios B/A and C/B) seems to be a very special situation, which would probably require introduction of a new code (see b) below). Unless this very same representation is expected to be used more often, we would like to ask CDFE to first try to solve this problem by obtaining the data from the authors in another, more common representation, or at a common set of incident energies so that solution a) below can be used. Only if this is not possible, we should resort to our proposal b) below, because such a special formalism will probably never be foreseen in any programs or computational formats, so that the data can hardly be used. In that case it might be questionable whether such "exotic" representations should be compiled in Exfor.

If the coefficients B/A and C/A are given, such data could be coded simply by combining the modifier S2T proposed above under 2.1 with RS0:

$$\frac{d\sigma/d\Omega}{d\sigma/d\Omega(0°)} = 1 + \frac{B}{A}\sin^2\vartheta + \frac{C}{A}\sin^2(2\vartheta)$$

$$= 1 + a_1 \sin^2\vartheta + a_2 \sin^2(2\vartheta)$$

However, subentries M0186.012-21 (the only subentries giving 2 such ratios) give B/A and C/B. This problem could be solved in 2 ways:

a) Replace in the DATA table the second coefficient given by the product of both coefficients

$$\frac{B}{A} \cdot \frac{C}{B} = \frac{C}{A}$$

and use the modifier S2T/RS0 as described above.

b) introduce a new modifier (e.g. RS1) for the representation

$$\frac{d\sigma/d\Omega}{d\sigma/d\Omega(0°)} = 1 + a_1 \sin^2\vartheta + a_1 . a_2 . \sin^2(2\vartheta)$$

with $a_1 = \frac{B}{A}$ and $a_2 = \frac{C}{B}$ as given in entry M0186.

In principle we would prefer solution a). However, the incident energy values for the coefficients given in M0186 do not coincide, so it is not possible to calculate the products of the coefficients at all individual energies.

Solution b) would look like this: Subentries M0186.012-016:

```
REACTION    (...(G,F),,DA,FF,S2T/RS1,EXP)
...
COMMON
NUMBER
NO-DIM
  2.
ENDCOMMON
DATA
EN-MAX   DATA
MEV      NO-DIM
(numbers unchanged)
```

Subentries 17-21: as above, but NUMBER=1.

Proposal for dictionary 34:

RS1 Modifier for diff. cross sections of the form
(D-SIG/D-OMEGA)/(D-SIG/D-OMEGA AT 0 DEG) =
= 1 + A(1)*SIN**2(THETA)+A(1)*A(2)*SIN**2(2*THETA)

Proposal for dictionary 36:

```
,DA,FF,S2T/RS1   (ANG.DIST.OF FISSION FRAGMENTS,
                  COEFF.OF THE FORM ... (as above))
```

Subentry M0182.005 could, formally, be coded like M0186.012 ff., but only the coefficient C/B is given (a_2 in solution b) above). Although it is formally possible to compile the data only for NUMBER=2, no angular distribution can be calculated from these data. (In this representation, putting a_1=0 makes no sense either, it would mean the data are isotropic). These data are either incomplete, or the explanation under MISC-COL is incorrect.