

Memo 4C-3/88

To: Distribution

20 August 1973

From: H.D. Lemmel Lemmel

Subject: EXFOR Tables - Reply to Memos 4C-2/41, 4C-2/42, 4C-1/38, and 4C-1/39

The proposals in the above Memos have been discussed by all concerned at NDS. NDS accepts in principle the proposal outlined in 4C-2/41. However, some important technical points need modification or clarification before the proposal can be implemented. The modifications which NDS wishes to see adopted are given below and are based on the contents of 4C-2/41. We do not see a need for the concept of "hierarchy" in Memo 4C-2/42 and think it should not be implemented.

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1. Types of numerical data information:

We suggest that the text in the middle of page 1 of 4C-2/41 be changed and the remainder of the MEMO be modified to agree with the following definitions:

The most general table in EXFOR consists of

1. Independent Variables. These are columns with headings like EN, ANGLE, EN-MIN, EN-CM, E, E-LVL, NUMBER, etc. These are marked in dictionary 24 with a star (*) in column 66.
2. Dependent Variables. These are columns with headings like DATA, RATIO, DATA-MIN, DATA-APPRX, DATA-CM, etc., that is all headings starting with "DATA" or "RATIO" except errors and resolution.
3. Additional Information.* These are columns with headings like STAND, MISC, FLAG, HL, etc.
 - a. Some of these, e.g. HL, can appear either as independent variables or as additional information. These are marked in dictionary 24 with a plus (+) in column 66.
 - b. The remaining ones, which are not marked with a plus in dictionary 24, can only appear as additional information, not as independent variables.
4. Error Information. These are columns with headings that include "-ERR" or "-RSL".

In the "COMMON" section all column headings except Dependent Variables can appear."

*(We have not yet considered which ones belong under 3.a. or 3.b.)

2. Pointers

- a. The definition of pointers in the middle of page 4 of 4C-2/41 should be revised; it should not be linked to the serial number of a column. The definition of pointers should be changed to: "A pointer links pieces of information in an EXFOR entry together, for example:
 - one of several Iso-quants with its DATA column (Example 3 of 4C-2/41)
 - one of several Iso-quants with a specific piece of information in the BIB-section (e.g. ANALYSIS), and with a value in the COMMON-section, and with a column in the DATA-section (Example 5 of 4C-2/41)
 - a value in the COMMON-section with any column in the DATA-section (Example 7 of 4C-2/41)
 - a column with Additional Information with a Dependent Variable.

A pointer must be unique in the entire EXFOR entry, since it may well be attached to information in subentry 001."

An example for the last item is: Resonance-parameters are given for several nuclides in several subentries. In such a case, pointers under ANALYSIS in subentry 001 are to refer to all following subentries of the entry.

In Example 3 of 4C-2/41 "DATA-ERR 2" should be replaced by "DATA-ERR 1"; All information referring to ISO-QUANT must carry the pointer 1.

b. The following should also be added:

"Column headings of Error Information need not have pointers if no ambiguity can arise.

Example 3a

```
COMMON
EN-ERR      EN-RSL      E-LVL-ERR 1E-LVL-ERR 2DATA-ERR
```

⋮

```
DATA
EN          E-LVL      1E-LVL      2DATA
```

Here the level errors must have pointers to avoid ambiguity. The errors of DATA and EN, and the resolution need not have pointers in this case.

Example 3b

*) ISO-QUANT 1(Z-S-A,Q1)
 2(Z-S-A,Q2)
 3(Z-S-A,Q3)

⋮

```
COMMON
DATA-ERR 1DATA-ERR 2
```

⋮

```
DATA
EN          DATA      1DATA      2DATA      3DATA-ERR 3
```

Here the errors for DATA 1 and DATA 2 must have pointers to avoid ambiguity. The error of DATA 3 need not have a pointer, but the compiler may give it a pointer for consistency with the other errors.

c. In 4C-2/41, page 7, the entry under ANALYSIS is misleading. Most of us understood it as: "No ANALYSIS information for iso-quant 2 and iso-quant 3". What was meant should be written as:

```
ANALYSIS 1(SHAPE,MLA)MULE CODE
          2(SHAPE,MLA)MULE CODE
          3(SHAPE,MLA)MULE CODE
          4(AREA,SLA)TACASI CODE
```

The repetition of information under the pointers 1,2 and 3 is little harm and need not be avoided by adding an extra rule.

*) For Multiple Iso-quant see further below in Section 6.

3. Hierarchy

We disagree with the table of hierarchies presented in 4C-2/42, page 2. The hierarchy of independent variables must remain flexible. Example: The hierarchy of the variables E and ANGLE would be assigned differently

- a. When a double-differential cross-section is given at 20 angles for 2 outgoing particle energies, or
- b. When the same quantity is given at 2 angles for 6 outgoing particle energies.

Although it is the same quantity, the one would be presented as angular distribution for 2 outgoing particle-groups, whereas the other would be presented as energy-spectrum of outgoing particles at 2 angles.

Example 9a

E	ANG	DATA
KEV	A-DEG	:
1.	5.	:
1.	10.	
1.	15.	
1.	20.	
	etc	
2.	5.	
2.	10.	
2.	15.	
2.	20.	
	etc	

Example 9b

ANG	E	DATA
A-DEG	KEV	:
80.	1.	:
80.	2.	
80.	3.	
80.	4.	
	etc	
120.	1.	
120	2.	
120	3.	
120	4.	
	etc	

Example 10a

COMMON			
E	1E	2	
KEV	KEV		
1.	2.		
ENDCOMMON			
DATA			
ANG	DATA	1DATA	2
A-DEG	:	:	
5.	:	:	
10.			
15.			
20.			
etc			

Example 10b

COMMON			
ANG	1ANG	2	
A-DEG	A-DEG		
80.	120.		
ENDCOMMON			
DATA			
E	DATA	1DATA	2
KEV	:	:	
1.	:	:	
2.			
3.			
4.			
etc			

In these examples the hierarchy of the independent variables is defined in a natural way by their position in the table. It is left to the discretion of the originating center which hierarchy is chosen. We do not believe that this flexibility will cause problems at any of the receiving centers.

4. Two-dimensional tables

- a. We agree to pages 8-10 of 4C-2/41. It should be stated explicitly that the four representations of the same quantity as given above in Examples 9a + b, 10a + b are legal.
- b. We believe that tables of the type of Examples 9a and 9b can be implemented immediately by all four centers, if not more than 10 columns are used. Therefore, centers could discontinue to enter such data in the earlier way of a series of subentries, but could as well continue to use this way if the compiler considers this as appropriate. Quite a number of pages in both Manuals referring to two-dimensional tables need be changed.
- c. The previous concept using the keyword TABLE-NR could become obsolete, although it may continue to exist in old entries. Did one of the centers make use of the TABLE-NR concept for any computer programs?

5. Sorting of columns in the DATA section

a. We suggest the addition of the following:

"All columns with Independent Variables precede the columns with Dependent Variables. All columns on the left-hand side of the first Dependent-Variable column are considered as Independent Variables, except for columns with Error Information.

Columns with Additional Information are preferably placed after the last Dependent Variable; but if they refer to a specific column, they may be placed next to this column. They should not precede the first Dependent Variable except if they are to be considered as an Independent Variable.

Columns with Error Information are placed right after the column they refer to."

Note: We believe that practically all entries transmitted and practically all tables in the literature concur to these rules.

b. On page 5 of 4C-2/41 delete the first sentence under Flags. Such a restriction, namely to allow flags only at the right hand side of the table, seems to be unnecessary. A FLAG column is to be treated like any other column with Additional Information. That means that a FLAG column referring to only one of several DATA columns may be placed next to it and may get a pointer, if this seems appropriate:

Example 4a

```
DATA
DATA      1FLAG      1DATA      2
```

c. A more general example for columns with Additional Information is:

Example 4b

```
ISO-QUANT 1(Z-S-A,Q1)
           2(Z-S-A,Q2)
           3(Z-S-A,Q3)
FLAG      1(1.)FREE TEXT
           1(2.)FREE TEXT
           (3.)FREE TEXT
MISC-COL  3(MISC)FREE TEXT
STANDARD  2(Z2-S2-A2,Q2)FREE TEXT
           3(Z3-S3-A3,Q3)FREE TEXT
```

⋮

```
DATA
DATA      1FLAG      1DATA      2STAND      2DATA      3MISC      3STAND      3FLAG
```

(For the first FLAG column and the MISC column the pointers need not be given but can.)

6. Multiple Iso-quant in one subentry

- a. On page 4 of 4C-2/41 under item 3 in the fourth line, omit "separated by commas and enclosed in parentheses". Drop these commas and parentheses in all following examples. Reason: they are not needed because the pointers in column 11 give sufficient information for computer programming; furthermore they are not consistent with the treatment of other information identifying keywords (compare Example 5) and they are disturbing in the following generalized example which should replace the example 3 on page 4:

```
"ISO-QUANT 1(Z-S-A,Q)FREE TEXT
      FREE TEXT CONTINUED
      2((Z-S-A,Q1)*(Z-S-A,Q2)/
      (Z-S-A,Q3))FREE TEXT
      3(Z-S-A,Q4)FREE TEXT"
```

As in conventional ISO-QUANT entries there should be the provision of having free text behind each iso-quant and of having an iso-quant combination spilling over into the next line.

- b. On top of page 5 of 4C-2/41 replace the first paragraph by:

"Limitation in the use of the Multiple Iso-quant: This formalism should only be used for data that form a logical unit, such as: resonance-parameters; elastic and partial inelastic data when these were simultaneously determined and analyzed; and perhaps a few others. Integral cross-sections $\sigma(E)$ such as (n, γ) and (n, α) cross-sections, should not be merged into a single subentry, even when they were published in the same article and measured at the same energies.

Usually, all Iso-quant in one subentry refer to the same nuclide; but if appropriate, the Iso-quant in one subentry may refer to different isotopes, as shown in Example 3c. The conventional way of giving RATIO and DATA in one subentry by means of an Iso-quant combination as shown in LEXFOR, Example 2, remains valid; but should not be used when pointers are used.

Example 3c

```
BIB
ISO-QUANT 1(Z-S-0,TOT/WID) ISOTOPE NOT ASSIGNED
          2(Z-S-58,TOT/WID)
          3(Z-S-59,TOT/WID)
          4(Z-S-60,TOT/WID)

SAMPLE   NATURAL ISOTOPIC COMPOSITION
:
:
DATA
EN-RES   DATA      1DATA      2DATA      3DATA      4"
```

7. Resonance-Energies

Change on the bottom of page 4 of 4C-2/41 to read:

"Resonance-energies shall be entered as an Iso-quant (Z-S-A,EN,RES) under the column heading "DATA", if they were determined in the experiment the results of which are given in the same subentry. If the values of the resonance-energies were taken from another source, they shall be entered as an independent variable under the column-heading EN-RES."

Note, however, that the resonance-energy cannot be entered as an Iso-quant if Example 3a (see above under Multiple Iso-quant) is accepted. If one prefers, in this example, to enter the resonance-energy as an Iso-quant, one would better split the table into four separate sub-entries.

8. Nomenclature

a. If our interpretation is correct we believe that throughout the text the expressions

- "associated columns" should be replaced by "error columns" (e.g. 4C-2/41, bottom of page 1)
- "associated variables" should be replaced by "error information" (e.g. 4C-2/42, top of page 2), in order to avoid confusion with "Additional Information".
- "main column" should be replaced by "independent-variable column" (e.g. 4C-2/41, bottom of page 1)
- "DATA headings" should be replaced by "data headings" or perhaps better "column headings (the Manual uses both). "DATA heading" can be confused with "DATA columns" which means columns with Dependent Variables. (e.g. 4C-2/41, top of page 6)

b. In many parts of the Manuals it was aimed at

- writing ISO-QUANT if the keyword ISO-QUANT was meant.
- writing Iso-quant if an actual Z-S-A,Q was meant.

It may be useful to continue this practice.

c. In 4C-2/41, page 6, change line 6 to:

- "- numeric values common to individual DATA (or RATIO) columns of the table".

9. Possible future extensions

We notice that the "possible future extensions" on pages 11-12 of 4C-2/41 were only included to prove that the proposed schemes do not block possible future developments. We do therefore not comment on these extensions, and their discussion should be referred to a later date.

10. Extension to more than 10 columns per line

- a. Pointers, multiple Iso-quants, two-dimensional tables could well be started without an extension to more than 10 columns per line, which is a rather separate problem. The presently existing restriction to 10 columns was imposed by the width of the printout-paper.

The introduction of the new features would soon create a strong demand for more than 10 columns, and the discussion of this matter was still insufficient.

There were two proposals:

1. The proposal in Memo 4C-1/33 by S. Pearlstein, 13 April 1973.
2. The "DATA-CONT" proposal of the draft "2-dimensional tables, etc" by Attree/Lemmel/May/Potters, 1 June 1973. (This is attached, because it was not yet distributed as 4C-Memo.)

In both proposals, one should only consider the way of giving more than 10 columns; some other features are meanwhile superseded.

The Pearlstein proposal is perhaps more suitable for automated data processing, but is not immediately readable. The Vienna proposal is immediately readable but perhaps less suitable for automated data processing.

It is evident that all centers must produce a readable output listing of an Exfor entry, which can be obtained easier from the Vienna proposal. Automated data processing of, for example, resonance-parameters has a much lower priority at some of the centers. This consideration would make the Vienna proposal more favorable. Readability was always a recognized argument in EXFOR discussions.

Multi-column entries in the "DATA-CONT" formalism of the Vienna proposal could be implemented rather soon, because the transmitted table is immediately readable in this form. It can therefore more easily be received by all four centers, even before all four centers are prepared to send out data in this form.

The Pearlstein proposal would delay the implementation considerably, because special editing programs had to be written by all four centers, before the first entry could be transmitted in the new form. This delay of implementation could be quite substantial !

In any case, corresponding Manual entries are required in order to obtain agreement between the programmers for handling such data.

11. Implementation

- a. We suggest that Hans Potters formulates the proposal in the form of Manuals' pages and submits these for final approval by the four centers. Consistency with other parts of the Manuals must be checked and implemented. For example, the rules established about blank fields in the data table may have to be modified.
- b. Some of the new features can become effective only after all four centers have finished some adjustments of the EXFOR programs. Therefore, the procedure of implementation must be fixed.
- c. The above can be done under the preliminary restriction to 10 columns in a line. Meanwhile the programmers can discuss and work out the extensions to more than 10 columns along the lines of one of the two proposals.
- d. After the distribution of the final Manuals' pages the centers should communicate to each other
 - from which date on they will be able to receive
 - a) EXFOR entries containing pointers
 - b) EXFOR entries containing Multiple Iso-quants
 - from which date on they will be able to
 - a) send EXFOR entries containing pointers
 - b) send EXFOR entries containing Multiple Iso-quants
- e. Meanwhile the centers will discuss and agree upon a solution for more than 10 columns. After the final Manuals' pages on this subject have been distributed, the centers should communicate to each other
 - from which date on they will be able to receive EXFOR entries containing more than 10 columns,
 - from which date on they will be able to send out EXFOR entries containing more than 10 columns.