MEMO CP - C/14

Date: July 7, 1977

From: V. Mc Lane

Subject: Proposed Manual Update

As suggested in a letter from H.D. Lemmel, I am enclosing a proposal for revised Sections IV, V and VI of the EXFOR Manual, including changes to bring manuals up-to-date with present agreements.

The main changes are as follows:

1) Sections V and VI have been combined into one section V, including Numerical Data Formats (from LEXFOR) and Repetition of Data-headings (from Section VIII).

2) A new section VI, 'Links between BIB, COMMON, and DATA Sections' has been added, which includes Pointers (from page IV.3) and a reworking Section VIII.4 as proposed in Memo CP-D/23. This section needs some thought and should, perhaps, include everything a programmer needs for checking or manipulation of the data.
   The manual Updates for Sections I, II, III and IX will be sent out within the next week.

A proposal for Sections VII and VIII (based on memos CP-D/15,20,23) will be sent out shortly. I have restructured parts of Section VIII and included agreements reached at the Kiev meeting.

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BIB   SECTION

This section is identified on a transmission tape as that information between the system-identifiers BIB and ENDBIB. Although it is called 'BIB-section' it contains information other than the strictly bibliographic. That is, information required to describe an experiment (e.g. neutron-source, method, facility, etc.) and administrative information (e.g. HISTORY) are also included in this section.

A BIB record consists of up to four parts: keyword, machine retrievable information, free text and identification. The identification has been described in Section II and will not be dealt with further.

(1)   Keyword (Information Identifier)

The keyword is used to define the significance of the information given in columns 12-66. The keyword must be left adjusted to begin in Col. 1, and must not exceed a length of 10 characters (this will insure that it is followed by at least one blank or one pointer, see below). (See Dictionary 2 for a list of all keywords. For further details see Section VIII).

Within any one BIB-section a keyword must not be repeated, columns 1-10 of continuation cards must be blank and Col. 11 must be blank or contain a pointer. The pointer should be given in the first record of the information to which it is attached and should not be repeated on continuation records. The pointer is assumed to refer to all BIB - information until either another pointer is encountered or until a new keyword is encountered. This implies that pointer-independent information for each keyword appears first. (See Section VI for use of pointers).

(2)   Machine Retrievable Information

Machine retrievable information may be used to define the actual BIB-information or as a link to the CØMMØN and DATA sections. The machine retrievable information must be enclosed in parentheses and left adjusted so that the opening parenthesis appears in Col. 12. More than one piece of machine retrievable information may be associated with a keyword. (See Section VIII for formats and coding rules. See page VII.10 for maximum length of codes).

For some keywords a restriction is placed upon the maximum length of the associated machine retrievable information. It may be continued onto

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successive records. Information on continuation records must not begin
before Col. 12 (Cols. 1-10 must be blank and Col. 11 must be blank or
contain a pointer (see (1) Keyword, above). The machine retrievable in-
formation should be kept as concise as possible if it is to be used
efficiently.

Note that some keywords have no machine retrievable information associated
with them and that, for many keywords that may have machine retrievable
information associated with them, it need not always be present.

(3) Free Text

Under each of the keywords in the BIB-section free text may be entered
either starting in column 12 or following the closing parenthesis of the
machine retrievable information. The free text may be continued on to any
number of records. Free text on continuation records must not begin before
Col. 12 (Cols. 1-10 must be blank and Column 11 must be blank or contain a
pointer). The free text may include parentheses if necessary, although, in
order to avoid confusion a left parenthesis in text should not be placed in
col. 12 (as this implies the opening parenthesis of machine retrievable
information).

The free text must use clear English phrasing and no codes should be
used within the free text.

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An example of several BIB information entries is given below:

```
1            11 12                                                    66
ENTRY              00001
SUBENT          00001001
BIB
AUTHOR         (J.W.DOW,M.F.JONES) THIS SPACE MAY CONTAIN ANY FREE
               TEXT. THE BEGINNING OF A NEW BIB ENTRY IS INDICATED
               BY A NON-BLANK IN THE KEYWORD FIELD COLS. 1 - 10.
INSTITUTE      (3AAABBB) SINCE THE KEYWORD FIELD IS NON-BLANK, THIS
               IS CONSIDERED A NEW BIB ENTRY.
N-SOURCE       (ABC,WXYZ) THIS IS AN EXAMPLE OF A BIB ENTRY WITH MORE
               THAN ONE PIECE OF MACHINE-RETRIEVABLE INFORMATION IN
               ONE SET OF PARENTHESES. THE ABSENCE OF A POINTER IN
               COLUMN 11 SHOWS THAT THIS INFORMATION REFERS TO ALL
               DATA.
COMMENT        THIS IS AN EXAMPLE OF A BIB ENTRY WITHOUT MACHINE-
               RETRIEVABLE INFORMATION.
              1THE POINTER IN COLUMN 11 INDICATES THAT THIS RECORD,
               AND THE FOLLOWING RECORDS UNTIL A NEW POINTER IS
               ENCOUNTERED, REFER TO ALL DATA WITH THE SAME POINTER
               IN ALL FOLLOWING SUBENTRIES.
ENDBIB
NOCOMMON
ENDSUBENT
SUBENT          00001002
BIB
ISO-QUANT     1(92-U-235,EL/WID) THIS IS AN EXAMPLE OF MULTIPLE
              2(92-U-235,NF/WID) ISO-QUANTS WITH POINTERS
ANALYSIS      1(CDEFG).   THIS IS AN EXAMPLE OF A BIB ENTRY WITH MORE
                          THAN ONE PIECE OF MACHINE-RETRIEVABLE
              2(HIJ).     INFORMATION EACH CODED IN ITS OWN SET OF
                          PARENTHESES. EACH PART OF THE BIB ENTRY IS
                          LINKED BY A POINTER IN COLUMN 11 TO OTHER
                          INFORMATION IN THIS SUBENTRY AND IN SUBENTRY
                          1 WITH THE SAME POINTER.
                            THE POINT AFTER THE CLOSING PARENTHESIS
                          INDICATES THAT THE CONTENTS OF THE PARENTHESES
                          IS NOT REPEATED IN FREE TEXT, AS WOULD BE
                          REQUIRED IF THE POINT WERE ABSENT.
ENDBIB
NOCOMMON
DATA
EN             DATA       1DATA-ERR   1DATA        2
EV             MILLI-EV    MILLI-EV    MILLI-EV
----           ----        ----        ----
ENDDATA
ENDSUBENT
ENDENTRY
```

The list of permissible keywords for the BIB section is given in Dictionary 2.

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COMMON AND POINT DATA SECTIONS - General

The format of the common and point data sections is identical. However,
the significance of the content is different. Each section looks like a table
of data with a heading and units associated with each column. The only dif-
ferences between the common data table and the point data table is that the
common data table contains all data that apply to each line of a point data
table, and the entries need not be related (e.g., initial energy and secondary
energy for a table of double differential data). The point data table contains
rows of information; each row contains all the information associated with a
data point (e.g., angle, angular error, cross section, cross section error).

     Since each record contains six information fields, each 11 columns wide,
up to six columns of information may be contained on a record without resorting
to a continuation card. If more than six columns must be used, the remaining
information should be contained on the following records. (See example on page
V.4). The number of columns is unrestricted.

     Records should not be packed; rather, individual point information should
be kept on individual records (i.e., if only four columns are associated with
a point value, the remaining two columns should be left blank, and, in the case
of the data point table, the information for the next point should begin on the
following record. Similarly, if eight columns are used, the remaining four
columns on the second record should remain blank. These rules apply not
only to the data, but also to the headings and units associated with each
column. (See example on page V.5).

     The content of the COMMON and DATA sections are as follows:

     (1) Data headings for each column (if more than six columns are needed,
         the headings should be continued on to successive cards). The
         data heading shall be left adjusted to the beginning of each
         field (Cols. 1, 12, 23, 34, 45, 56). See Dictionary 24 for
         permissible data-heading keywords.

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(2) As explained in Section VI under 'Pointers', a one-character
pointer can be placed in the last (eleventh) column of any
column-heading field if the corresponding column is to be
linked to some other part of the same subentry or subentry 001.
For example, if one of the quantities in COMMON is common to
all values in a particular column in the DATA section, the
same pointer should appear in the last column of the correspond-
ing column-heading fields in the COMMON and DATA section.
(See Example XIII.b).

(2) Data units for each column (if more than six columns are needed,
the units should be continued on to successive cards). The
data units shall be left adjusted to the beginning of each field
(Cols. 1, 12, 23, 34, 45, 56). See Dictionary 25 for permissible
data-units keywords.

(4) The data which shall be Fortran readable using an 'E' format.
See following, Numerical Data Formats. If more than six columns
are needed, the data shall be continued on successive records.

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Numerical Data Formats

The prescribed format of numerical data entered in the COMMON or DATA section
of an EXFOR-entry is defined as "FORTRAN readable according to an E-format".

That means in detail:

- A decimal-point is always required, also for integers.
- A decimal number without an exponent can have any position within
  the 11-characters field.

- No blank is allowed behind a sign (+ or -).
- A plus sign can be omitted, except that of an exponent when there
  is no E.

- In an exponential notation, the exponent must be right-adjusted
  within the 11-characters field. The mantissa can have any position.

All the following examples are valid entries:

0.14		+0.0014E+02
0.14		0.0014E+2
0.14		0.0014E2
+0.14		.0014+2
-0.140		-0.140E+00
-.14		-.14E0
		1.4E-1
		1.4-1
		1.40 -01 *
		1.40 E 00 *

*Note: Centers using PL/1 may have to apply special manipulation when
        numerical fields include embedded blanks.

Compilers should aim at a nice-looking and easily-readable arrangement of
the numbers.

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COMMON DATA SECTION

This section is identified on the transmission tape as that information between the system identifiers COMMON AND ENDCOMMON. (See page III.8 for explanation of numerical fields on COMMON and ENDCOMMON records).

In the common data table only one number may be entered in a given column, and successive columns are not integrally associated with one another.

An example of a common data table is shown below with its associated COMMON and ENDCOMMON card.

1	12	23	34	45	56	66
COMMON		4	3			
EN	EN-ERR	E	E-ERR			
MEV	MEV	MEV	MEV			
2.73	0.16	1.38	0.21			
ENDCOMMON		3				

An example of a common data table with more than 6 columns

1	12	23	34	45	56	66
CØMMØN						
EN	EN-ERR	EN-RSL	E-LVL	E-LVL	ANG	
ANG-ERR						
MEV	MEV	MEV	MEV	MEV	ADEG	
ADEG						
4.1	0.05	0.1	3.124	3.175	90.	
10.						
ENDCØMMØN						

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DATA TABLE SECTION

This section is identified on the transmission tape as that information between the system identifiers DATA and ENDDATA. (See page III.9 for explanation of numerical fields on DATA and ENDDATA records).

In the point data table all entries of a record are integrally associated with an individual point. If more than six columns are needed, the point data should be continued on to successive cards. The following record or records (over six columns) are then associated with the next point. (See Example 13b).

Every line in a data table must give data information. This means for example that a blank in a column headed DATA is only permitted when another column contains the data information on the same line, e.g. under DATA-MAX. In the same way, each independent variable should occur at least once in each line (e.g. either under column headings E-LVL or E-LVL-MIN, E-LVL-MAX, see example on page V.8). Supplementary information such as resolution or standard values must not be given in a line of a data table which has no data information. In all fields blanks are permitted.

.   An example of a point data table is shown below with its associated DATA and ENDDATA cards.

1	12	23	34	45	56	66
DATA		4	7			
ANG	ANG-ERR	DATA	DATA-ERR			
ADEG	ADEG	MB/SR	MB/SR			
10.4	0.8	243.	8.7			
22.9	1.2	127.,	4.2			
39.1	0.9	83.2	3.7			
59.1	0.7	14.8	2.9			
83.0	1.0	19.2	3.4			
112.	1.3	21.2	4.1			
173.	1.1	16.8	3.8			
ENDDATA		9				

The preceding example illustrates the simplest type of table representing the dependent variable DATA as a function of the independent variable ANG (one-dimensional table). The rules for multi-dimensional tables require distinction between four data categories occurring in data tables, namely

- independent variables (EN, EN-MIN, EN-RES, E, ANG,...);
- dependent variables (DATA, RATIO,...);
- associated quantities (EN-ERR, ANG-RSL, DATA-ERR,...);
- additional information (STAND, MISC, FLAG, HL,...).

The division between different categories and families within categories are defined in Dictionary 24 (Data-heading keyword dictionary). (See page VII.14).

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DATA tables must be arranged as follows:

- All columns with independent variables precede the columns with
  dependent variables. Columns on the left-hand side of the first
  dependent-variable column are considered as independent-variable
  columns, except those with associated quantities.

- Columns with additional information are preferably placed after the
  last dependent-variable column but if they refer to a specific column
  they may be placed next to it.

  Note: Some data-heading keywords may be used either as independent
  variables or as additional information.

- Columns with associated quantities are placed right after the column
  they refer to.
  If the COMMON section is included for EXFOR table must then look as
  follows.

```
┌──────────────────────────────────────────────────────────────────┐
│                                                                    │
│   COMMON                                                           │
│     •                                                              │
│     •                                                              │
│     •                                                              │
│   ENDCOMMON                                                        │
├──────────────────────────────────────────────────────────────────┤
│                                                                    │
│   DATA                                                             │
│      independent          │        dependent                       │
│        variable(s)        │          variable(s)                   │
│    +  associated          │      +  associated                     │
│        quantities         │          quantities                    │
│                           │      +  additional                     │
│                           │          information                   │
│   ENDDATA                 │                                        │
└──────────────────────────────────────────────────────────────────┘
```

  If columns for more than one independent variable are neede they are to
be arranged so that the rate with which the numbers change within each column
increases from left to right. Obviously this rule cannot apply to associated-
quantity columns. Values in a given independent-variable column must increase
or decrease monotonically until the value in the preceding independent-variable
column changes or the end of the table is reached.

See Example 13a

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Repetition of column-headings

Within the three sections: COMMON section of subentry nnn ≠ 001,

                            DATA section of subentry nnn ≠ 001,

                            COMMON section of subentry 001 of same entry,

no column-heading* (data-heading keyword plus pointer) may be repeated
except for the following cases. (Any further case of repeated column-
headings which the centers may agree to accept, must be described here).

Any columns with identical column-heading must be adjacent and may appear
within only one of the three sections mentioned above.

1.) <u>Two or more unresolved energy levels</u> (given as level energies or Q-
    values) should be entered as follows:

E-LVL	E-LVL	E-LVL
MEV	MEV	MEV
.0.077	0.107	0.177

Similarly, the column-heading EN-RES may be repeated in the case of
unresolved resonance energies.

2.) <u>An angle given in degrees and minutes</u> must be entered in two separate
    columns with the data heading ANG repeated; as follows:

ANG	ANG
ADEG	AMIN
90.	47.

Similarly, other keywords beginning with ANG-.... may be repeated in
the same way.

3.) <u>Half-life values in different units</u>, such as SEC, D, YR, may be entered
    as follows:

HL	H1	HL
SEC	D	YR
	15.	
		28.3
4.8		

Similarly, any other data-heading keyword starting with HL... may be re-
peated in the same way. This case cannot occur in a COMMON section.

*<u>Note</u>: The actual column-heading consists of a data-heading keyword and

perhaps a pointer. (See page V.2).

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4.) <u>Two or more flags</u> defined under the BIB keyword FLAG which apply to the same line of the data table, may be entered as follows:

FLAG	FLAG
NO-DIM	NO-DIM
1.	
3.	
2.	3.
1.	2.

<u>Note</u>: The data-heading keyword FLAG cannot occur in a COMMON section

5.) <u>Errors or resolutions given in different units</u> over an energy range may be entered as follow:

EN-RSL	EN-RSL
KEV	PER-CENT
20.	
20.	
	10.
20,	

A slight complication arises with families of independent variables referring to basically the same quantity, as for instance the columns referring to excitation energies of the residual nucleus in the following example. In this case the monotonicity rule applies to the sequence of numbers consisting of the first (left-most) non-blank value within the group on each line.

<u>Example</u>

.
.

DATA EN MEV	E-LVL MEV	E-LVL. MEV	E-LVL MEV	E-LVL-MIN MEV	E-LVL-MAX MEV	DATA B -
3.0	0.506					-
3.0	0.720	0.725				-
3.0	0.81					-
3.0	0.990	0.998	1.02			-
3.0				1.250	1.300	-
3.0						-
3.0	.1.400	1.412				-
4.5	0.405					

.
.

ENDDATA

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VI

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Pointers

Different pieces of EXFOR information can be linked together by
pointers. These are numeric or alphabetic characters (1,2,...9,A,B,...Z)
placed in the eleventh column of the information-identifier keyword in the
BIB section in the data-heading keywords in the COMMON or DATA section.
Pointers can link, for example,

- one of several iso-quants with its DATA column;
- one of several iso-quants with a specific piece of information
  in the BIB section (e.g. ANALYSIS), and/or with a value in the
  COMMON section, and/or with a column in the DATA section;
- a value in the COMMON section with any column in the DATA section; etc.

In general, a pointer is valid for one subentry only. A pointer used in
the first subentry must apply to all subentries and must have a unique meaning
throughout the entire entry.

A pointer in the BIB-Section refers not only to the record which contains
the pointer, but also to all following records until another pointer or
another keyword is encountered.

The use of pointers is restricted to the cases of:

1) multiple iso-quants (see page VIII.3.3)
2) vector common data (see page V.2)

Pointers used for one of these cases may also be used elsewhere in the
BIB-Section in order to link, for example, certain information under
STANDARD, ANALYSIS, COMMENT, etc, to one of the multiple 'QUANTS' or
'REACTIONS' or to one of the vector common data. Example:

```
            REACTION   1(.....)
                       2(.....)
            PART-DET   1(G).
                       2(N).
            DETECTOR   1(ABCDE).
                       2(FGHIJ).
```

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3.) pointers linking pieces of BIB information, but all referring to the
    same REACTION (or ISO-QUANT).

    Example:

           REACTION   (.....)
           PART-DET 1(G).
                    2(N).
           DETECTOR 1(ABCDE).
                    2(FGHIJ).

Note: NNDC can accept this formalism but does not recommend using it;
        instead NNDC prefers to code this example as follows:

           ISO-QUANT (.....)
           PART-DET (G,N).
           DETECTOR (ABCDE). FOR GAMMAS
                     (FGHIJ). FOR NEUTRONS

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Links between Information-Identifier Keywords and Data Heading Keywords

Certain Information-Identifier Keywords and their codes require specific entries in the data (COMMON and DATA Sections), and vice versa. These cases are listed, below, according to the Information-Identifier Keyword. [See Section VIII for details on the coding of Information-Identifier Keywords].

The following shorthand is used throughout this section.

- Particle is used to mean particle, nuclide or radiation.

- QUANTS is used as a shorthand for the Data-Specification Keywords ISO-QUANT, NUC-QUAN, CMPD-QUANT

- Data-heading Keywords as given are understood to include their derivatives (e.g., if DATA is given, DATA-CM, DATA-APRX, etc. are also included).

1. Data Specification Keywords.

The coded information under the keywords ISO-QUANT, NUC-QUANT, CMPD-QUANT and REACTION:

　　　　　a)　defines the data coded under the Data-Heading Keywords DATA, RATIO, SUM.

　　　　　　　If the keywords RATIO or SUM are used, the Data-Specification Keyword must be of the form ((----)/(----)) or ((----)+(----)), respectively.

　　　　　　　The Data-Heading Keyword DATA may be used for any quantity.

　　　　　b)　requires the presence, or absence, of certain families of independent variables (see also page V.6), as follows:

Incident Particle Energy (Family A) must not be coded with the keyword NUC-QUANT, or with the keyword REACTION when the incident particle is 0 (zero). It must be present in all other cases when resonance energy is not coded.

　　　　　EN-DUMMY must be used when the quantity field contains the modifer MXW, SPA or FIS

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Resonance Energy (Family C) must be coded for resonance parameters (See Dictionaries 14 & 36). The energy may be given either as a quantity or in the data.

Secondary Energy (Family E) must be coded when:
 a) the quantity field contains the modifier PAR
 b) SF2 for QUANTS or SP6 for REACTION contains the code DE or SPC

Angle of Outgoing Particle (Family G) must be used when SF2 for QUANTS or SF6 for REACTION contains the code DA.

NUMBER must be coded when SF2 for QUANTS or SF8 for REACTION contains the code LEG or COS.

Fission Product (Family I) must be coded if SF4 for Reaction contains the codes ELEM and/or MASS. The corresponding codes must be entered in the data.

Half-Life (Family 6) must be coded if SF3 for QUANTS contains the code MS or GND, or if SF4 of the REACTION keyword contain a product with a metastable state extension (See page VIII.3.?), and the half-life is not coded under DECAY-DATA.

Momentum (ℓ) (Family 2) must be coded when SF2 for QUANTS or SF6 for REACTION contains the code RED.

2. STANDARD/MONITOR

STANDARD is used only in combination with the QUANTS and must be present when the Data-Heading Keyword STAND is coded.

If more than one standard is given STAND1, STAND2, etc., STAND1 refers to the first standard coded, STAND2 refers to the second, etc.

MONITOR is used only in combination with the keyword REACTION and must be present when the Data-Heading Keyword MONIT is coded.

If more than one monitor is given MONIT1, MONIT2, etc., MONIT1 refers to the first monitor, MONIT2 to the second, etc.

The Data-Heading Keywords EN-NRM, E-NRM, and ANG-NRM may be used only when the keyword STANDARD is present.

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3. ASSUMED

When assumed values are given in the data under the Data-Heading Keyword ASSUM, they must be defined under the keyword ASSUMED.

4. INC-SPECT

When the Data-Heading Keyword EN-DUMMY is used (i.e., when the quantity contains the modifier MXW, FIS or SPA), the spectrum must be defined in free text under the keyword INC-SPECT.

5. EN-SEC

When the data is a function of the secondary energy of more than one particle (i.e., the headings E1, E2, etc., are used), the particles must be defined in coded form under the keyword EN-SEC.

6. HALF-LIFE

When more than one half-life is coded in the data under the Data-Heading Keywords HL1, HL2, etc., these must be defined in coded form under the keyword HALF-LIFE.

7. ERR-ANALYS

This keyword should always be present when there exists a Data-Heading Keyword having the modifier -ERR.

If there exists more than one Data-Heading Keyword having a modifier of the type -ERR, then the Data-Heading Keyword must always be repeated as a code under the keyword ERR-ANALYS.

8. FLAG

This keyword must always be present when the Data-heading Keyword FLAG is used in the DATA Section.

The DATA columns headed by the keyword FLAG contain fixed point numbers. These must all be repeated as codes under the Information-Identifier Keyword FLAG.

9. MISC-COL

This keyword must always be present when the Data-heading Keyword MISC is used in the data.

If the keywords MISC1, MISC2, etc., are used, they must be repeated as codes under the keyword MISC-COL.

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