Memo 4C-3/126

To: Distribution

From: H.D.Lemmel *Lemmel* 1 July 1975

Subject: Exfor Manual Update

Please, find attached, for your information, the new update pages of the NDS Exfor Manual. This is a follow-up of the NDS Exfor Manual update of 74-11-15, of which you received information copies.

The present update includes the NNCSC updates of Nov 1974, Feb 1975 and May 1975 and some additional pages marked NDS-X4 75-7-1. The NNCSC updates of Nov 1974 and Feb 1975 are included in the NDS update only now, because much of their contents was included in the NDS Manual already earlier. In some of the NNCSC update pages we found more or less trivial errors, omissions or inconsistencies which were corrected; some other changes have a more cosmetic nature. In some cases, two NNCSC pages were combined to one in order to reduce the volume of the Manual as much as possible. The pages concerned are marked with a prime behind the date of issue, e.g. May 1975'. These corrections, as well as the pages marked NDS-X4..., are submitted for consideration for the next NNCSC update.

The alteration marks in the left-hand margin may be found a bit confusing, since some of them refer to the latest version of the NDS Manual, others to the latest version of the official NNCSC Manual.

NDS Staff: Please, update your Exfor Manual with the attached pages. Check your Manual copy against the "List of valid pages" included in the present update. Suggestions to be included in the next Manual update are welcome.

Distribution: L.Lesca (NDCC) 2*
V.Manokhin (CJD) 2
S.Pearlstein (NNCSC) 2
NDS: see next page

*due to large volume and inofficial nature only 2 copies per center.

Clearance: [signature]

NDS EXFOR MANUAL

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Distribution:

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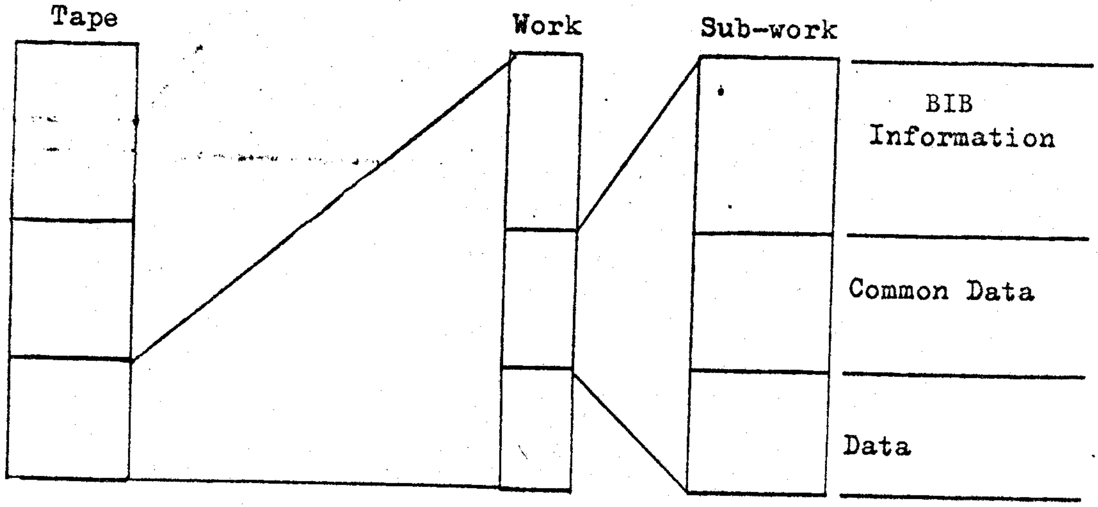
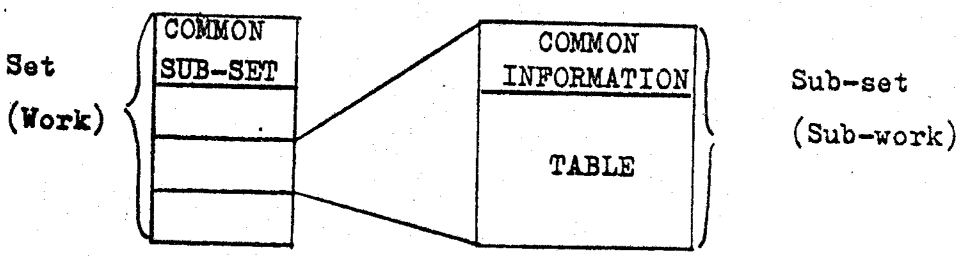
Summary of exchange tape format

The exchange tape will contain a number of works. Each work will be divided into a number of sub-works. The sub-works will be further subdivided into BIB information, common data that applies to all lines of a data table in a sub-work and finally a data table. In order to guarantee that all of the information on the tape is meaningful, dictionaries may also be transmitted. The tape may therefore be considered to be of the following form:



A number of system identifiers are used to define the beginning and end of each of the above units.

In order to avoid repetition of information that is common to all sub-sets within a set or to all lines within a sub-set, information may be associated with an entire set or with an entire sub-set. In order to accomplish this the first sub-set of each set which is given sub-accession number 1 must only contain information that applies to all other sub-sets, and within each sub-set the information common to all lines of the table simply precede the table. Two levels of hierarchy are thereby established to avoid repetition of information:



The common information (or common sub-set) is further subdivided into common BIB information (alphanumerio) and common data (numeric) information.

November 1974

DEFINITION OF A SUB-WORK

In order to avoid duplication of effort and to ensure that the identification scheme will be universally applicable, each centre will divide works into appropriate sub-works prior to transmission. This will ensure that a work has been divided into sub-works in a unique manner (by the originating centre) which may be referenced by all centers (i.e., avoids the possibility of two centers decomposing a work into different constituent sub-works, thus voiding the applicability of the universal identification scheme).

A sub-work will be defined as:

(1) A table of function of one or more independent variables: i.e., X, X' vs Y with associated errors for X, X' and Y and ~~a~~ possible flag (standard, misc. etc) (e.g., X = energy; X' = angle; Y = differential cross section)

(2) Independent variables will precede dependent variables and will be monotonic in the left-most independent variable. Values in following independent-variable columns must ~~increase~~ be monotonic~~ally~~ until the value in the preceding independent-variable column changes.

(3) When more than one representation of Y is present, the table may be X vs. Y and Y', with associated errors for X, Y and Y' and a possible flag (e.g., X = energy; Y = absolute cross-section Y' = relative cross-section). The criteria for grouping a Y with a Y' is that they both be derived from the same experimental information by the author of the data.

(4) When a normalization is given, it may appear either in the COMMON portion of a sub-work (when uniformly applied to all points) or as an additional column of the data table (when applied pointwise).

(5) For some data the data-table does not have an independent variable X but only the function Y. (Examples: spontaneous nu-bar; resonance-energies without resonance-parameters; etc.)

(6) If the function Y is given for a single value of the variable X, and if this value of X is common for all sub-works in a given work, then X may be entered in the COMMON portion of the first sub-work. The following sub-works may then contain under DATA the value of Y only.

ORIGINATING CENTRE IDENTIFICATION (COLUMN 67)

This column contains a number to indicate the centre at which the information originated. The following numbers are assigned:

0	Users, center-internal or preliminary	
1	NNCSC	(Brookhaven)
2	CCDN	(Saclay)
3	NDS	(Vienna)
4	CJD	(Obninsk)

Entries with the center-identification zero (0) are not part of the normal center-to-center transmission. The identification zero (0) may be assigned by users in order to allow them to transmit information to the centers in the exchange format, etc., or by centers for their internal use. Data sets which a data center may wish to compile from outside its own service area could get, preliminarily, an accession-number with the center-identification zero. Such data sets should not be included in the normal transmission tapes but should be sent to the responsible center for assigning a final accession-number, entering the data sets into their files and submitting them on a normal transmission tape.

The identifications 5 - 9 will be assigned as the need requires. They should not be used by centres in EXFOR transmissions until they are assigned.* This will avoid confusion and incompatibility when these identifications are assigned.

*Note: The identifications 5 - ~~9~~ 8 are presently being used by NNCSC for data translated from SCISRS-I to indicate the area to which the data translated belong, as follows:

5	NNCSC
6	CCDN
7	NDS
8	CJD

CENTRE ASSIGNED ACCESSION NUMBER (COLUMNS 68 - 71)

These columns contain a four digit accession number assigned by the originating centre. Columns 67 - 71 (originating centre identification and centre assigned accession number) may be considered a five digit universal accession number. Therefore the significance of the originating centre identifications as described previously is that the following universal accession numbers are assigned:

00,000 - 09,999	Users, center-internal or preliminary	
10,000 - 19,999	NNCSC	(Brookhaven)
20,000 - 29,999	CCDN	(Saclay)
30,000 - 39,999	NDS	(Vienna)
40,000 - 49,999	CJD	(Obninsk)

Each centre (or user) thus has 10,000 centre assigned accession numbers available. The originating centre identification numbers 5-9 will be used for expansion if the needs of a centre exceed the number of centre assigned accession numbers available (i.e. 10,000). Therefore the universal accession number system (Columns 67-71) allows for a unique identification of up to 100,000 works. This limit will certainly not be exceeded in the foreseeable future.

The same accession number must be associated with a work throughout the life of the EXFOR system. If a work is deleted from the system the accession number may not be assigned to a different work. This is the only manner in which the accession number may be used universally to reference a work over an extended period of time.

The methods of assigning accession numbers may be different at each centre. That is to say, some people may wish to assign them manually, others automatically, by computer. The accession numbers need not be assigned sequentially, however the works must appear on the exchange tape in ascending numerical order. A centre may assign accession numbers only to works originating from its service area.

SEQUENTIAL NUMBERING WITHIN A SUB-ACCESSION NUMBER (Cols.75-79)

These columns will contain a five-digit sequential number. The sequential number will be used to divide a sub-work (sub-accession number) into uniquely defined records associated with the sub-work (all records within a sub-work contain the same sub-accession number).

Up to 99,999 records may be associated with each sub-work (sub-accession number). The sequential numbering within each sub-work MUST begin at 1 and sequentially increase toward 99,999. Sub-works with more than 99,999 records will simply use two or more sub-accession numbers (i.e. the record following the 99,999-th will be allowed to "overflow" from the 75-th to the 74-th column). Continuation sequential numbers should start at one (1), not zero (0)*. The continuation sub-accession numbers will be associated with a single work by:

(1) A change in sub-accession number without an ENDDATA or ENDSUBENT card and in which the last record count was 99,999.

(2) Omitting the SUBENT, BIB, and COMMON that normally precedes the DATA after a change in sub-accession number (i.e., simply continue the DATA table from one sub-accession number to the next).

An example is shown below:

11	22	67	72	75 80
6.3172E-3	2.1234E+5	1 1213	004	99998
6.3245E-3	2.8714E+5	1 1213	004	99999
6.3560E-3	5.6796E+5	1 1213	005	00001
6.3781E-3	3.7210E+5	1 1213	005	00002

The function of the sequential numbering within each sub-work (sub-accession number) is to allow for reference at the record level during the ALTER procedure and to allow for personnel and machine checking the card sequence (e.g., check for cards out of order or for missing cards). Therefore, a given sequence number need not be associated with a given record over an extended period of time. As such, the records within a sub-work should be re-numbered sequentially following an ALTER procedure. Alterations on a work may be transmitted only by the origination centre.

THE RECORDS WITHIN A SUB-WORK MUST ALWAYS BE MAINTAINED IN SEQUENTIAL ORDER.

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* A zero in the record count field has special significance during the ALTER process.

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III. SYSTEM IDENTIFIERS III.1

TRANS, ENDTRANS III.3

DICTION, ENDDICTION, NODICTION III.4

ENTRY, ENDENTRY, NOENTRY III.5

SUBENT, ENDSUBENT, NOSUBENT III.6

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COMMON, ENDCOMMON, NOCOMMON III.8

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SYSTEM IDENTIFIERS

Seven basic system identifiers and two modifiers are defined. These basic system identifiers and modifiers used in combination allow a potential vocabulary of 21 system identifiers. The basic system identifiers and modifiers are:

Modifiers	Basic System Identifiers
NO	TRANS
END	DICTION
	ENTRY
	SUBENT
	BIB
	COMMON
	DATA

Each of these basic system identifiers refers to one of the hierarchy of units contained on a transmission tape. These units and corresponding basic system identifiers are:

TRANS		A transmission tape is the unit
DICTION	-	A dictionary is the unit
ENTRY	-	A work (accession number) is the unit
SUBENT	-	A sub-work (sub-accession number) is the unit
BIB	-	The BIB-section of a complete work or sub-work is the unit
COMMON	-	The common data section of a complete work or sub-work is the unit
DATA	-	The data table section of a sub-work is the unit

The system identifiers will be used to indicate three conditions:

(1.) The beginning of a unit (basic system identifier only)

(2.) The end of a unit (modifier END preceding the basic system identifier)

(3.) A positive indication that a unit is intentionally omitted (modifier NO preceding the basic system identifier)

The format of all system identifier records will be identical:

1–11	22	33	66
/System Identifier/	N_1	N_2	Free Text

(1.) TRANS N_1 N_2

This record must be the first one on the transmission tape.

N_1 and N_2 are interpreted as:

N_1 - A four-digit transmission tape number and originating centre identification. Following the convention established for originating centre identification in the universal accession number system, the following tape numbers are assigned:

0001 - 999	Users		(Leading 0)
1001 - 1999	NNCSC	(Brookhaven)	(Leading 1)
2001 - 2999	CCDN	(Saclay)	(Leading 2)
3001 - 3999	NDS	(Vienna)	(Leading 3)
4001 - 4999	CJD	(Obninsk)	(Leading 4)

These numbers should be sequentially assigned. This will allow other centres a simple means of determining whether or not they have received all tapes transmitted.

N_2 - A six-digit number containing the date (year, month, and day) on which the transmission tape was generated. The format should be: YYMMDD.

The record identification (Cols. 67-79) should contain the originating centre number in Col. 67 and zeroes (not blanks) in Cols. 68-79.

(2.) ENDTRANS N_1 N_2

This record must be the last one on the transmission tape.

N_1 and N_2 are interpreted as:

N_1 - The number of works (accession numbers) on the tape.

N_2 - Number of dictionaries.

The record identification should contain 9's in Cols. 67-79. There should be no rule that Col. 67 should be identical throughout a transmission tape. This convention will then permit the mixing of entries from different centres for transmission to users, without violating rules laid down in the EXFOR Manual. However, it is clear that exchange tapes between centres will contain only the originating centre code in col. 67, except on the ENDTRANS record.

(9.) SUBENT N_1 N_2

This record must be the first one of each sub-work. N_1 and N_2 are interpreted as:

N_1 - An eight digit universal sub-accession number (originating centre identification, centre assigned accession and sub-accession number).

N_2 - Date of last alter (or date of entry if never altered) (year, month, date).

The record identification (Cols. 67-79) should contain the universal accession and sub-accession numbers (Cols. 67-74) and the sequence number one (00001) (Col. 75-79).

(10.) ENDSUBENT N_1 N_2

This record must be the last one of each sub-work. N_1 and N_2 are interpreted as:

N_1 - The number of records within the sub-work.

N_2 - Presently unused (may be blank or zero).

The record identification (Cols. 67-79) should contain the universal accession and sub-accession numbers (Cols. 67-74) and the sequence number 99999 (Cols. 75-79).

(11.) NOSUBENT N_1 N_2

This record indicates that a sub-accession number has been assigned by the centre but that either the information associated with it was not ready at the time the tape was transmitted by the centre, or that the subentry has been ~~deleted~~. combined into another subentry according to page IX.3.
N_1 and N_2 are interpreted as:

N_1 - An eight-digit universal sub-accession number (originating centre identification, centre assigned accession and sub-accession number).

N_2 - Date of last alter or blank (if merely assigned and not yet used).

The record identification (Cols. 67-79) is the same as on a SUBENT card.

(18.) DATA N_1 N_2

This record must be the first one of each data table section if one is present. N_1 and N_2 are interpreted as:

N_1 - Number of columns (variables) associated with each line of a data table

N_2 - Number of lines in the table, excluding the lines with headings and units

(19.) ENDDATA N_1 N_2

This record must be the last one of each data table section if one is present. N_1 and N_2 are interpreted as:

N_1 - Number of records in the data section

N_2 - Presently unused (may be zero or blank)

(20.) NODATA N_1 N_2

Positive indication that there is no data table associated with the work or sub-work. N_1 and N_2 are interpreted as:

N_1 - Presently unused (may be zero or blank)

N_2 - Presently unused (may be zero or blank)

(21.) XDATA N_1 N_2

This record may be used to replace the DATA record when transmitting an altered subentry in which the DATA-section remains unaltered. (See Section IX for details.)

N_1 = No. of columns in data-section.

N_2 = 2

NOTE: (1) The record identification (cols. 67-79) for these system-identifiers should contain the universal accession and sub-accession numbers of the sub-entry in which they are located, and the sequence number should naturally be assigned sequentially within the sub-entry.

(2) The above 4 system-identifiers may not appear in the first (all common) sub-accession section of a work.

SYSTEM IDENTIFIER	LEGAL FOLLOWING RECORD
(1) TRANS	DICTION+, NODICTION+, ENTRY, NOENTRY
(2) ENDTRANS	(no information follows ENDTRANS)
(3) DICTION+	(a dictionary record)
(4) ENDDICTION+	DICTION+, ENTRY, ENDTRANS*, NODICTION+, NOENTRY
(5) NODICTION+	DICTION+, ENTRY, ENDTRANS*, NODICTION+, NOENTRY
(6) ENTRY	SUBENT, NOSUBENT
(7) ENDENTRY	ENTRY, ENDTRANS, NOENTRY
(8) NOENTRY	ENTRY, ENDTRANS, NOENTRY
(9) SUBENT	BIB, NOBIB
(10) ENDSUBENT	SUBENT, ENDENTRY, NOSUBENT
(11) NOSUBENT	SUBENT, ENDENTRY, NOSUBENT
(12) BIB	(a bibliographic record)
(13) ENDBIB	COMMON, NOCOMMON
(14) NOBIB	COMMON, NOCOMMON
(15) COMMON	(a common data record)
(16) ENDCOMMON	DATA#, NODATA#, ENDSUBENT**, XDATA#
(17) NOCOMMON	DATA#, NODATA#, ENDSUBENT**, XDATA#
(18) DATA	(a point data record)
(19) ENDDATA	ENDSUBENT
(20) NODATA	ENDSUBENT
(21) XDATA	(a point data record)

* If only dictionaries are transmitted.

** In first sub-work only (i.e., sub-acc.number = 001) where no data section is present.

\# Not in the first sub-work (i.e., sub-acc.number = 001), where no data section is present.

\+ The keywords DICTION, ENDDICTION, NODICTION are not used in a normal center-to-center transmission tape. They may be used in a center-to-customer tape.

		Page
IV.	BIB SECTION	IV.1
	Keyword (Information Identifier)	IV.1
	Machine retrievable information	IV.1
	Free text	IV.2
	Codes and Free text	IV.2
	Pointers	IV.3
	Examples	IV.4

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.) is 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 bibliographic entry. The keyword must be left adjusted to begin in Col. 1, and must be totally contained within the first information field (Cols. 1-11).

Keywords must not exceed a length of 10 characters (this will insure they are followed by at least one blank or one pointer, see below). 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.

(2) Machine Retrievable Information

The machine retrievable information is used to define the actual bibliographic information. 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 bibliographic entry. These may be entered in two ways: either within one set of parentheses, each piece of machine retrievable information being separated by a comma; or with each piece of machine retrievable information between separate parentheses, in which case each set must have its opening parenthesis in Col. 12, although they may be separated by free text. For some keywords a
IV.1a restriction is placed upon the maximum length of the associated machine retrievable information; it may be continued onto 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 KEYWORD above.

The machine retrievable information 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.

(3) Free Text

Used to describe the bibliographic information. It may immediately follow the closing parenthesis of the machine retrievable information (if this is not present, it may begin immediately in Col. 12). 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 col. 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 <u>should</u> <u>not</u> be placed in col. 12 (as this implies the opening parenthesis of machine retrievable information).

(4) Codes and Free Text

Free text following the codes must be completely self explanatory, and the codes must not be considered as part of the free text. The code is a retrievable abstract of the free text. The entering center should provide all free text associated with each code. The coded information serves only as a means for retrieval and not for output expansion. This implies that any coded information must be followed by free text repeating or specifying further the coded information.

The only <u>exceptions</u> to this rule are information associated with the keywords INSTITUTE, REFERENCE and ISØ-/CMPD-/NUC-QUANT, STANDARD, where the coded information should <u>not</u> be repeated in the free text. This means, one should not, for example, include the full name of the institute following the 7-character code; however, any additional information may follow in free text.

~~Note: If coded information is given under the key word STANDARD, this need not be repeated in the free text.~~

~~Obviously,~~ The keywords AUTHOR, EXP-YEAR, HISTORY, HALF-LIFE, MISC-COL, ERR-ANALYS, FLAG, ~~TABLE~~ NR are cases to which the above rules do not apply.

The free text must use clear English phrasing and no codes are permitted within the free text.

(5) 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 information-identifier keyword fields 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; except a pointer used in the first subentry which must have a unique meaning throughout the entire entry.

[See Implementation Schedule p. VI.8]

An example of several bibliographic entries illustrating the use of pointers follows.

The page number IV.3 and IV.4 of the original proposal were changed in the NNCSC updates to IV.2a and IV.3 creating inconsistencies (see e.g. pages IV, V.2, etc). NDS therefore keeps the original page numbers.

An example of several ~~BIB~~ items of BIB information ~~entries~~ is given below:

```
1         11 12                                                    66
↓          ↓ ↓
AUTHOR       (J.W.DOW,M.P.JONES) This space may contain any free
             form text. The beginning of a new BIB
             entry is indicated by a non-blank keyword field -
             Cols. 1-10.

INSTITUTE    (3AAABBB). Since the keyword field is non-blank,
             this will be considered a new BIB entry

COMMENT      This is an example of a BIB entry without machine-
             retrievable information. This comment refers to all
             pieces of information in the subentry.
          1  The pointer in column 11 indicates that this comment
             refers to those other pieces of information in the entry
             which are equally labeled.

HISTORY      (671102R) This is an example of a BIB entry
             with more than one piece of machine retrievable
             information.
             (680415) Further free text associated with this code
             is written here.

N-Source  1  (ABC,WXYZ) This is an example of a BIB
             entry, with more than one piece of machine re-
             trievable information in one set of parentheses. The
             pointer in column 11 shows that this information belongs
             to those other pieces in the entry which are labeled
             with the same pointer.

          3  (DEF) This information belongs to those other pieces
             in the entry which are labeled with the same pointer.

ENDBIB
.
.
.
DATA
EN        3  DATA          1 DATA-ERR
EV           BARN            BARN
.
.
.
ENDDATA
```

makes no sense

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

COMMON DATA SECTION

This section is identified on the transmission tape as that information between the system identifiers COMMON and ENDCOMMON.

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 difference 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 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 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.

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. Similarly, if eight columns are used, the remaining four columns on the second record should remain blank). These rules will apply not only to the data, but also to the headings and units associated with each column. (See example on page V.2)

The number of common data columns in the common data section is defined by N_1 on the COMMON card. The common data table consists of:

(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.

(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.

(3) The common data which shall be fortran readable using an 'E' format [see LEXFOR Numerical Data Formats] . If more than six columns are needed, data are continued on successive cards.

clarified

In the common data section 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						
EN	EN-ERR	E	E-ERR			
MEV	MEV	MEV	MEV			
2.73	0.16	1.38	0.21			
ENDCOMMON						

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						

(4) A one-character pointer may be placed in the last (eleventh) column of any Data-heading field if the common quantity is to be linked to some other part of the same subentry or subentry 001. (see p. IV.3 under (5) Pointers).

See Implementation Schedule p. VI.8.

Example for the use of pointers in the COMMON section:

```
.
.
.
BIB
ISO-QUANT 1(92-U-235,EN,RES)
          2(92-U-235,J)
          3(92-U-235,TOT/WID)
          4(92-U-235,NF/WID)
.
.
.
ENDBIB
.
.
.
COMMON
MOMENTUM L | DATA-ERR   3 | DATA-ERR   4 |
NO-DIM     | PER-CENT     | PER-CENT     |
0.         | 8.           | 10.          |
ENDCOMMON
.
.
.
DATA     1 | DATA     2 | DATA       3 | DATA       4 |
EV         | NO-DIM     | MILLI-EV     | MILLI-EV     |
.          |            |              |              |
.          |            |              |              |
.          |            |              |              |
ENDDATA
```

SUMMARY OF COMMON DATA TABLE

The common data table is written as a table with associated titles and units for each column of the table. The common table is only one row long (i.e., only one datum appears in each column). If more than six columns are needed, the information should be continued on to the next records. All alphanumeric information (column titles and units) should be left adjusted, and all data must be FORTRAN readable according to an "E" format.

Delete page V.4 of 74-5-10

DATA TABLE SECTION

This section is identified on the transmission tape as that information between the system identifiers DATA and ENDDATA.

The format of the common and point data section is identical. However, the significance of the content is different. Each section looks like a table of data with a title and units associated with each column. The only difference between the common data table and the point data table is that the common data table contains all information that applies 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 point (e.g., angle, angular error, cross section, cross section error).

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 heading E-LVL or E-LVL-MIN, E-LVL-MAX, see example on page VI.5) 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.

Since each record contains six information fields, each 11 characters 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 cards. (see example on page V.2) 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 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 will apply not only to the data, but also to the headings and units associated with each column. (See example on page V.2)

The number of point data columns in the data table is defined by N_1 on the DATA card. The number of rows (points) is defined by N_2 on the DATA card. The DATA table consists of:

(1) Data headings for each column (if more than six columns are needed, the headings should be continued on to successive cards). The column headings 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.

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

(3) The numerical data which must be Fortran readable using an 'E' format. [see LEXFOR Numerical Data Formats]

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.)

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
```

(4) As explained on P.IV.~~2a~~ 3 under "(5) 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 corresponding column-heading fields in the COMMON and DATA section as shown in the example of p.V.3. *

(5) The example on p.VI.2 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 two - and more - 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 the Data heading keyword dictionary. (see VIII.21)

DATA tables must be arranged as follows:

- All columns with <u>independent variables</u> precede the columns with <u>dependent variables</u>. 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 <u>additional information</u> are preferably placed after the last dependent-variable column but if they refer to a specific column they may be placed next to it.
  <u>Note</u>: Some data-heading keywords may be used either as independent variables or as addtional 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.

* See Implementation Schedule on page VI.8

** page numbering kept in NDS Manual as in original Potters proposal, since too tedious to change all cross-referencing, and since NNCSC page numbering is not consistent (see e.g. p. VI.8, VIII.12, VIII.21a).

```
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 needed they are to be arranged so that the rate with which the numbers change within each column increases from lift 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.

Example See also Example 13.

```
.
:
DATA
EN      EN-ERR     ANGLE     ANGLE-ERR    DATA
MEV     MEV        ADEG      ADEG         MB/SR
1.      .02        35.       10.            -
1.      .02        60.       10.            -
1.      .02        90.       10.            -
2.      .02        30.        5.            -
2.      .02        60.        5.            -
2.      .02        90.        5.            -
3.      .03        30.        5.            -
3.      .03        60.        5.            -
3.      .03        90.        5.            -
:
.
ENDDATA
```

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 monotonically rule applies to the sequence of numbers consisting of the first (left-most) non-blank value within the group on each line.

Example

.
:

DATA

EN	E-LVL	E-LVL	E-LVL	E-LVL-MIN	E-LVL-MAX	DATA
MEV	MEV	MEV	MEV	MEV	MEV	B
3.0	0.405					-
3.0	0.506					-
3.0	0.720	0.725				-
3.0	0.81					-
3.0	0.990	0.998	1.02			-
3.0	1.202	1.215				-
3.0				1.250	1.300	-
3.0	1.400	1.412				-
4.5	0.405					-

:
.

ENDDATA

Two-dimensional tables can be coded in different ways if pointers are used. The following examples illustrate this.

First alternative

```
.
:
DATA
EN        ANG       DATA
MEV       ADEG      MB/SR
1.        10.       11.
1.        20.       12.
1.        30.       13.
2.        10.       21.
2.        20.       22.
2.        30.       23.
3.        10.       31.
3.        20.       32.
3.        30.       33.
:
.
ENDDATA
```

See also Example 13a

Second alternative

See Implementation Schedule page VI.8

```
.
:
ISO-QUANT  (...)
:
COMMON
ANG       1ANG      2ANG      3
ADEG      ADEG      ADEG
10.       20.       30.
ENDCOMMON
DATA
EN        DATA      1DATA     2DATA     3
MEV       MB/SR     MB/SR     MB/SR
1.        11.       12.       13.
2.        21.       22.       23.
3.        31.       32.       33
ENDDATA
```

Implementation Schedule of Table Formats

Ready to receive tables in the format indicated:

Table Format:	NNCSC	NDCC	NDS*	CJD	Conclusion
Conventional multidimensional tables with two or more independent-variables columns, without pointers (cf.pp.VI.4, VI.5, Example 13)	1974+	1974x	1974	1974	can be transmitted
Unrestricted number of columns (cf.p. VI.1)	1974+	1974x	1974	1975	can be transmitted
Multiple Iso-Quant with pointers					
a) only resonance parameters of same isotope (compare pp.V.3, VIII.15)	1974+	1974x	1974	1974	can be transmitted
b) multiple representations of the same quantity, such as relative and normalized data, or ratios and absolute data (compare p.VIII.15)	1974+	1974x	1974	1974	can be transmitted
c) all quantities, and different ZA's	≥1976	1974x	1974	1974	postponed
Vector common data with pointers (cf.p. VI.6)	end of 1975 ?	1974x	1974	1974	postponed
Z and A as variables (cf.p. VIII.12)	≥1976	≥1976	1974	≥1976	postponed

* Note: Under NDS, the year 1974 was entered throughout; this expresses that NDS is willing to receive tables in any of these formats, even if they could not immediately be computer-processed.

+ Implemented at NNCSC by 74-10-8 4C-1/49

x Implemented at NDCC by 74-8-28 4C-2/55

<u>Notes</u>:

1) Cards may be in any order, except for the ALTER and ENDALTER cards, which must be first and last, respectively; also, for a multiple insertion, the cards must be in the correct order, by continuation-number.
2) The date-field on the ALTER-card will normally be blank. The facility for inserting a date here, was only included, in case of emergency. (Such as the master file being destroyed.) In such a case an identical master can be re-generated, by inserting the date of the previous updates in this field and using the previous update-cards.
3) If a specific <u>code</u> (as opposed to its associated text) is to be changed, the record must be deleted and the new code and text inserted. (Changes of code should rarely happen.)
4) In order to remove an obsolete code the record must be deleted, and the same record inserted, without the Ø.
5) A record cannot be inserted and obsoleted at the same time. It must be inserted and then obsoleted at the next update run.

VIII. DICTIONARIES - Details

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Keyword categories:

In the following list of information-identifying keywords certain flags indicate which keywords must, or need not, be present and which keywords must, or need not, be followed by coded information:

```
0  TITLE
*  AUTHOR     ((  ))
*  INSTITUTE  (( 3))
   EXP-YEAR   ((  ))
*  REFERENCE  ((4,5/6/7))
*  ISO-QUANT  ((Z-S-A,14))
*  NUC-QUANT  ((Z-S-A,14))
*  CMPD-QUANT ((Z-S-9,14))
0  STANDARD (Z-S-A,14)
0  METHOD (21)+
0  FACILITY (18)+
0  DETECTOR (22)+
0  ANALYSIS (23)+
   N-SOURCE (19)+
   INC-SPECT
   SAMPLE
   PART-DET ((13))
   EN-SEC
   RESID-NUC (Z-S-A)
   CORRECTION
0  ERR-ANALYS (DATA-ERR)
   COMMENT
   HALF-LIFE (HL,Z-S-A-M)
   MISC-CØL ((MISC1))
   FLAG ((1.))
0  STATUS (16)+
*  HISTORY ((see 2))
```

Explanations:

* This keyword must always be present. (Incidentally, all of these keywords must always be followed by coded information in parantheses as indicated by (( )).)

0 This keyword must always be present except when it is not relevant. For explanation of "not relevant" see in LEXFOR. For example: ERR-ANALYS is "not relevant" for quantum-numbers.

(( )) If the keyword is present, coded information in parentheses must be given. ((3)) refers to the relevant dictionary, No. 3. In other cases an example of coded information is shown in the table.

(19)+ Either free text or coded information in parentheses plus possibly free text may be given. The number refers to the relevant dictionary. If a pertinent code in the relevant dictionary exists, then keyword and code should be given. The "+" sign indicates that the coded information in parentheses must be repeated in the free text. For details see the following pages and in LEXFOR.

Special cases:

ISO-QUANT NUC-QUANT CMPD-QUANT	One of these three keywords must be present; they are mutually exclusive.
METHOD FACILITY DETECTOR ANALYSIS	At least one of these keywords must be present; if a pertinent code in the relevant dictionary exists, then keyword and code should be given. It is advisable that all four of these keywords be given except when not relevant. For example: FACILITY is "not relevant" for spontaneous fission data.
PART-DET	The particle detected must be evident either from ISO-QUANT or from PART-DET. Examples: a proton detected in an NP reaction is regarded as evident from the ISO-QUANT; a proton from an NNP reaction is not. For details see the the LEXFOR entry "Particles".
STATUS	The keyword STATUS is not relevant, only when the source of the data is given under REFERENCE and no other STATUS information applies. (In NDS entries this keyword is always present.)
STANDARD and ERR-ANALYSIS	The compiler should treat these items with special care, and whenever necessary, he should request further information from the author.
(GEOMETRY)	This keyword is obsolete but may still exist in old entries.
(TABLE-NR)	This keyword is obsolete but may still exist in old entries.

REFERENCE*. Each reference is coded separately with the opening parentheses in col.12. An effort should be made to have the main reference the first in the list. The coding consists of up to 6 sub-fields, each separated by a comma, and with no embedded blanks allowed.

- The first subfield contains the "type of reference" one-character code, see Dictionary 4 for codes.

- The second subfield contains the reference code, see Dictionaries 5, 6, and 7 for codes.

- Up to 3 subfields between the second and last subfield, depending on type of reference, giving volume, part or number, and page; see examples below.

- Last subfield contains the reference date, coded in the form yymmdd (year, month, day, two digits each). The year should always be present; the month should be present, if known; the day may be omitted at the discretion of the compiler.

Examples for each type of reference are given on the following pages.

2. REPORTS (Dictionary 6)

The report codes are based on CINDA.

Each code in the dictionary consists of the alphanumeric character string which precedes the actual report number. The final character of the codes given in the dictionary is always a hyphen (-), except in the three cases where the report codes were 11 characters and the 12th character a hyphen. In these cases the hyphen has been dropped in the dictionary, but must be included in the report code entered by the compiler under REFERENCE.

These codes are used as the second subfield of the coding under the keyword REFERENCE, when the type-of-reference code is R or P.

The dictionary has been sorted by area, country, institute and report code. The area, country and institute codes appear in columns 60 to 66.

Up to 11 characters in the code.

General coding form: (R,Code-Number,(Volume or Part),page,date)
or (P,Code-Number,(Volume or Part),page,date)

(Note: the report code must be connected to the number by a dash.)

a) (R,UCRL-5341,5806) = UCRL report number 5351, published in June 1958.

b) (R,JINR-P-2713,6605) = Dubna report, series P, number 2713, published in May 1966.

c) (R,AERE-C/R-159,6403) = AERE-C/R report number 159, published in March 1964.

d) (P,WASH-1068,185,6603) = WASH progress report number 1068, page 185, published in March 1966.

General coding form: (C,Code,Volume, Page or (Paper Number), Date)

or (B,Code,Volume,(Part),Page,Date)

Note: The general rule for conference codes is to write the year of the conference followed by the city in which the conference took place, in a string of not more than 10 characters. For books the code consists of either the family name of the first author or a concise title of the book, abbreviated to a maximum length of 10 characters.

a) (C,67KHARKOV,,(56),6702) = 1967 Kharkov Conference proceedings, paper number 56, February 1967.

b) (C,66WASH,1,456,6603) = 1966 Washington Conference proceedings, Volume No. 1, page 456, March 1966.

c) (B,ABAGJAN,,123,64) = Book by Abagjan, page 123, published in 1964.

d) (B,MARION,4,(1),157,60) = Book by Marion, Volume 4, part 1, page 157, published in 1960.

4. PRIVATE COMMUNICATIONS or THESES

No dictionary is used for this reference type, the convention is to use the family name of the author and date for private communication or thesis, plus the page number if necessary.

General coding form: (W,Author,page,date)

or (T,Author,page,date)

a) (W,BENZI,661104) = private communication from Benzi received in November 4, 1966.

b) (T,ANONYMOUS,58,6802) = Page 58 of thesis by Anonymous, published in February 1968.

ISØ-QUANT*

This keyword is used to specify the isotope and the quantity which is presented by the compiled data set. This is a starred item and must be present, unless CMPD-QUANT or NUC-QUANT is used. The coding is divided into 5 subfields, each separated by a comma. Blanks within an **ISØ-QUANT are not allowed.**

First Subfield: Isotope

This consists of the atomic number Z, the element symbol S, the atomic weight A, and an isomer code, which are combined in a string of flexible length, each separated by a hyphen (-). If Z and A are unique for the whole subentry, then Z and A are 1 to 3 digit numbers without leading zeros. If Z and/or A occurs as a variable in the data table, the characters Z and/or A are to be used. If Z is a variable, element symbol EL should be used. A = 0 means natural isotopic composition. For isotopes in ground-state no isomer code is given; the codes for metastable states are: M1 or M2, etc. These isomer codes should only be used if they are associated with a clear definition in free text. See Dictionary 8 for the accepted element codes.

Examples of isotope field coding:

1-H-1
1-H-2
6-C-12
40-ZR-90
92-U-234
94-PU-239
95-AM-242-M1
Z-EL-A
Z-EL-0
54-XE-A
} Z,A ~~vectors~~ variables, see implementation schedule on page VI.8

Second Subfield: Process/Parameter Designator.

Nuclear (or collective) process under study and/or parametric quantity derived for nucleus under study by experiment. 1 to 3 character code. See Dictionary 10 for the list of process and parameter codes.

Third Subfield: Function Designator.

Aspect of process or parameter studied, or useful collective term. 1 to 3 character code. See Dictionary 11 for the list of Function codes.

Fourth Subfield: Modifier Designator.

Flag to indicate departure from standard meaning of second and third subfields or combination of Process-Parameters and Functions. 1 to 3 character code. See Dictionary 12 for the list of Modifier codes.

Fifth Subfield: Particle Designator.

Particle code(s) indicating which of several outgoing particles the quantity refers to. 1 to 3 character code. The dictionary for this subfield is a subset of Dictionary 13 which is for use with the keyword PART-DET.

The particle-designator can be omitted if there is no ambiguity. For a quantity describing the correlation between outgoing particles, two particle-designators are entered, separated by a slash (/) (see "slash" convention described below).

(Mistakes in Nov. 1974 update of NNCSC!)

Rules for the ISO-QUANT Subfield 1 (isotope):

1. The isotope compiled is the target-nucleus.

Rules for the ISO-QUANT Subfields 2 through 5:

1. Any subfield may contain more than 1 code from the same dictionary separated by a slash. If the quantity code dictionary (14) gives an agreed upon sequence, this must be used. Other quantity code combinations may be ~~given in any sequence.~~ submitted for inclusion in Dict. 14.

   Example: INL,DA/DE
   (= double differential inelastic scattering cross section)
   (INL,DE/DA is illegal)

2. Redundant subfield codes are omitted.

3. If the information (code) in a given subfield, which is both followed and preceded by a code, is omitted, its following comma must always be present.

   Example: NNP,DA,,P (angular distribution of protons from (n,np) reaction).

4. No trailing commas need to be given behind the last given subfield code.

   Examples: TOT (total cross section)

   EL,DA (angular distribution of neutrons from elastic scattering)

5. Only certain combinations of codes in the quantity-subfields are meaningful. These are listed in Dictionary 14 "QUANTITY CODES"; it includes: code of quantity, permissible units, and a brief definition.

2) The energy range of a measurement may extend beyond a threshold.

EXAMPLE: $\sigma_{tot\ scat} = \sigma_{el}$ for $E < E_{th}$

$\sigma_{tot\ scat} = \sigma_{el} + \sigma_{inel}$ for $E > E_{th}$

In this case the wider definition, total scattering, must be used.

3) In old papers obsolete designations like "inelastic collision cross-section" for nonelastic or "absorption" for (n,γ) may have been used.
In these cases the presently valid definition should be used and the author's designation may be given in free text.

3. More than one isotope and more than one reaction. (Not necessarily a mathematical sum.)

((28-NI-58,NP)+(28-NI-60,NT))

4. Ratio followed by derived values. *No longer used at NDS. Use Multiple ISO-QUANT instead!*

(((79-AU-197,NG)/(5-B-10,NA)),(79-AU-197,NG))
(Note the comma following the ratio, which separates the ratio measured from the values derived.)

5. Multiple ISØ-QUANT
More than one ISØ-QUANT *or iso-quants* combination can occur, distinguished by pointers in Column 11. (See IV.3) This is presently restricted (see Implementation Schedule, p.VI.8) to:

a) resonance parameters of the same isotope; for example
ISO-QUANT 1(92-U-235, TOT/WID)
2(92-U-235,EL/WID,,2G)
3(92-U-235,J,RES)

with the pointers being repeated in the data-headings DATA 1, DATA 2, DATA 3, respectively, and perhaps elsewhere.

b) multiple representations of the same quantity, for example
ISO-QUANT 1(92-U-235,NF,,REL)
2(92-U-235,NF)

with the pointers being repeated in the data-headings DATA 1 and DATA 2, and perhaps elsewhere.

or:
ISO-QUANT 1((92-U-235,NF)/(79-AU-197,NG))
2(92-U-235,NF)

with the pointers being repeated in the data-headings RATIO 1 and DATA 2, and perhaps elsewhere.

NUC-QUANT *

The keyword "NUC-QUANT" is to be used instead of the keyword "ISO-QUANT," when the quantity defined does not refer to a target-nucleus. These quantities are:

SF = spontaneous fission
LDP = level-density parameter
TEM = nuclear temperature
SCO = spin-cut-off factor

as well as any other quantities having one of the above codes in the first quantity-subfield, e.g., SF/NU; compare Dictionary 14. The formalism for the coding of NUC-QUANT information is the same as that of ISO-QUANT, see page VIII.12 - 20, except that the isotope-field should not contain the target-nucleus but rather the nucleus to which the data is pertinent.

One of the three keywords, ISO-QUANT, CMPD-QUANT, or NUC-QUANT, must be present; they are mutually exclusive.

(In the NNCSC manual above info is given on p. VIII.15a together with some more info which rather belongs to Lexfor.)

CMPD-QUANT *

Quantities referring to chemical compounds, alloys, or mixtures, are entered under the keyword "CMPD-QUANT" and the A-number within the isotope is replaced by a 3 character compound code. Example: (26-FE-CMP, TØT). The more precise name and/or composition of the compound may be given in free text under the keyword "SAMPLE." Example: FE2-Ø3.

The CMP-QUANT consists of 5 subfields, each separated by a comma. The structure of the compound quantity is the same as of isotopes except that the A number is replaced by a three character compound code. (See Dictionary 9 for codes.) For the coding of subfields 2 to 5, see ISØ-QUANT.

One of the three keywords, ISØ-QUANT, NUC-QUANT, or CMPD-QUANT, must be present; they are mutually exclusive.

For coding rules see LEXFOR Compound codes.

Dictionary 14. Quantity Codes

Superseded history

This dictionary gives in three columns:

1. the quantity code
2. the dimension
3. the expansion for output.

1. The quantity code is composed of the codes for the quantity-subfields given in dictionaries 10 - 13. The present list gives all meaningful combinations of the subfield-codes, that are in use. As with all other dictionaries, this list is open-ended, and other quantity codes may be added at the time when such data are entered into EXFOR.

   In principle, the length of the quantity code is limited by the rules for its structure: 4 subfields separated by commas with up to two 3-character-codes per subfield separated by a slash, comes up to 31 characters. In practice, however, the codes are shorter. The longest code encountered in this list has 17 characters. The format of this list allows a maximum length of 18 characters, which is believed to be sufficient.

   Because the character string for the quantities is longer than 11 characters, the format of this dictionary is different from all others. The expansion begins in column 23 and the dimension is given, starting in column 19.

   To any of the listed quantity codes, the general quantity modifiers REL, AV,FCT, FIS, MXW, SPA, RAW, can be added, without entry in dictionary 14. If more than one of these modifiers apply, their sequence is arbitrary: MXW/REL or REL/MXW. Compare beginning of dictionary 12.

   The underlined is missing in NNCSC update.

2. The dimension-code has the purpose to link the quantities-dictionary with the units-dictionary, in order to facilitate computer checks whether, in a data table, quantities and units are consistent.

3. The expansion is a short definition of the quantity. ~~up to 42 characters long.~~ It may be used for the output-format for customers.

   More precise definitions of quantities are given in LEXFOR.

For the expansion, some conventions have been adopted:

1) "differential cross-section" means differential with respect to angle of outgoing particle.

2) "double differential" means differential with respect to angle and energy of outgoing particle.

3) "energy distribution" or "spectrum" means differential with respect to energy of outgoing particle.

4) * means "times"

   / means "division".

STANDARD

Information under this keyword is given either in free text or in computer-intelligible form with or without free text. In the latter case the isotope(s) and quantity(ies) used as standards for the experiment are coded following the rules for ISO-QUANT (see page VIII.12). However, Z or A as variables are not permitted under STANDARD. When two or more standards are to be given in computer-readable form, pointers are used according to the rules on page IV.3. For all further details see Lexfor under STANDARD.

The keywords STAND1 and STAND2 are no longer used at NDS but may still be used by the other centers; they exist also in earlier entries.

For rules concerning the sequence of columns see page VI.~~2a~~3. For checking purposes, a series of flags is given in Dictionary 24, Column 66, which defines the category and the family within each category, according to the scheme in the following table.

	FLAGS		
Family	Variables	Associated Quantities	Class
EN	A	B	
EN-RES	C	D	
E	E	F	1
ANG	G	H	
F. Prod.	I	*	
FLAG	*	Z	
TEMP	8	9	
HL	6	7	2
J	4	*	
L	2	*	
Parity	0	*	

* No headings exist.

Class 1 pertains to independent variables.

Class 2 pertains to additional information which in certain cases may act as an independent variable (cf. VI.3 point (5)).

Dictionary 24. Data-Heading Keywords

These keywords are used in the COMMON and DATA sections, as column headings for defining the contents of these columns.

The data-heading keywords include items such as:

- independent variables (energy, angle, etc.)
- parameters (temperature, spin, etc.)
- coefficient numbers
- errors, resolution, etc.
- centre-of-mass indicator.

The data-heading keywords may be composed of certain modifiers, which are separated by hyphens. All possible combinations are given in Dictionary 24. The length of the keywords is restricted to 10 characters.

Note on unresolved energy levels.

A column heading may be used more than once, where appropriate. Unresolved energy levels should, therefore, be entered as follows:

```
COMMON
E-LVL       E-LVL       E-LVL
MEV         MEV         MEV
0.077       0.107       0.177
ENDCOMMON
```

Note on angles given in degrees and minutes.

An angle given in degrees and minutes must be entered in two separate columns with the data heading ANG repeated; as follows:

```
COMMON
ANG     ANG
ADEG    AMIN
90.     47.
ENDCOMMON
```

Note on fitting coefficients

The column heading NUMBER-CM will be used when a fit has been deduced from an angular distribution in which the angles are given in the Center-of-Mass System.

Dictionary 25. Data-Unit Keywords

The data units are entered in the "COMMON" and "DATA" section below the data heading to define the units of the contents of each column. For example:

```
COMMON
ANG            ANG-ERR    TEMP
ADEG           PER-CENT   DEG-C
90.            3.         23.
ENDCOMMON
DATA
EN             EN-ERR     RATIØ     STAND    DATA
MEV            KEV        NØ-DIM    MB       B
7.             300.       1.3       110.     0.143
...            ...        ...       ...      ...
```

The data-unit codes may have 1 to 10 characters.

The listing gives in 4 columns:

1. The unit code.
2. The explanation, where necessary. Most codes are self-explanatory.
3. The dimension.
4. A factor by means of which the computer may compare the various units of the same dimension and transform them into each other.

The dimension code provides a cross-link with the dictionary of quantities, where the dimension-code is also given. This facilitates computerized cross-checks, whether quantities and units given in a table are consistent.

Links between numerical data and BIB section

The data-heading keywords DATA, DATA-CM, DATA-MIN, DATA-MAX, RATIO are defined under "ISO-QUANT."

The data-heading keywords STAND, STAND1, STAND2 are defined under "STANDARD."

Additional links can be established with the help of pointers, as explained on page IV.3.

Care must be taken that no ambiguities can arise.

ERR-ANALYS. Free text explanation of the sources of errors and of the values given under DATA and/or COMMON where the heading has the modifier -ERR. In order to link the explanations to the numerical data given, it is suggested that the relevant "error-headings" be given in parentheses, starting in column 12, followed by free text. For example:

```
BIB
...
ERR-ANALYS    (EN-ERR) followed by explanation of energy error
              (DATA-ERR1) followed by explanation of first error,
              perhaps a statistical error.
              (DATA-ERR2) followed by explanation of second error,
...           perhaps a systematic error.
ENDBIB
....
....
DATA
EN            EN-ERR     DATA     DATA-ERR1     DATA-ERR2
MEV           MEV        MB       MB            PER-CENT
...           ...        ...      ...           ...
ENDDATA
```

When only one data-error is given, which is the most frequent case, the code (DATA-ERR) need not be given under the keyword "ERR-ANALYS". Free text should contain a statement of error-types included in the quoted error, and also those error-types which are not included in the quoted error. Do not confuse EN-ERR with energy resolution EN-RSL. Note, that explanatory information on the energy-resolution is given under INC-SPECT.

No dictionary.

HALF-LIFE This keyword is used to explain, to which nucleus a half-life value refers which may be given in the COMMON or DATA section. The coded information given under this keyword in parentheses, repeats the data-heading keyword used in the COMMON or DATA section, and specifies the relevant nucleus (see Example 17).

If more than one half-life is given, the relevant nuclei must be coded under this keyword. If only one half-life value is given under the data-heading keyword HL and no explanation is given under this keyword, then the half-life of the residual nucleus is meant.

See also in Lexfor under Metastable States.

The free text must include the source of the half-life value.

FLAG. This is used to explain the meaning of flags used in the data table. The actual flags are given in parentheses (each on a separate line, starting in Column 12), followed by free text explanation, as in the following example:

```
BIB
...
FLAG        (1.) Data averaged from 2 runs
            (2.) Modified detector used at this energy
...
ENDBIB
...
DATA
EN          DATA        FLAG
KEV         MB          NO-DIM
1.2         123.        1.
2.3         234.
3.4         456.        2.
ENDDATA
```

This keyword must be present if flags are used in the data table. No dictionary. Flags should only be used to supply information on single points (not entire sub-work).

MISC-COL This keyword is used to explain the meaning of the miscellaneous column headings. In order to link explanations when more than one miscellaneous column is given, see the recommended form under ERR-ANALYS.

NDS-X4 75-17-11
4C-3/97 p.4 NRDC text item to be complete.
4C-3/95 item 8

IX. UPDATING AND ALTERATIONS

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Alterations to EXFOR-entries

4C-1/43 p.15

1. Alterations to EXFOR-entries may be transmitted only by the originating center. They are included in the regular Exfor transmission.

2. If an entry is altered, those subentries which have been altered should be transmitted to all other centers accompanied by the retransmission of the first subentry. The minimum unit transmitted should be a subentry (NOT just the altered records). If individual altered subentries are transmitted, the appropriate ENTRY and ENDENTRY records should be included. All corrections should be documented by an appropriate entry under HISTORY.

   *The altered subentries should have a "C" in Column 80 of the SUBENT record.

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Serious corrections (for example those involving the COMMON or DATA section, or essential BIB-keywords such as ISO-QUANT, STANDARD, etc.) should be transmitted as quickly as possible. Less serious corrections could be made and transmitted as workloads permit.

(Compare in Lexfor under "HISTORY").

The ENTRY record should include the revised date in the N2 field and the alter flag "C" in Column 80.

3. Subentries to be added to a previously transmitted entry may be transmitted accompanied only by the retransmission of the first subentry; other unchanged subentries need not be retransmitted. (This supersedes a statement in item D.1 of the Protocol.)

   *The subentries to be inserted should have an "I" in Column 80 of the SUBENT record.

~~4. When a subentry is altered, the following are always sent:~~

1) Subentry 1 from the same entry
2) BIB-section complete (or NOBIB, if applicable);
3) COMMON-section complete (or NOCOMMON, if applicable);
4) DATA-section complete (or NODATA, if applicable), if altered, OR if the DATA-section remains unaltered, then transmit:

```
XDATA          N1        N2
  Data-heading record(s)
  Data-units record(s)
  First data-line
  Last data-line
ENDDATA
```

Where XDATA (meaning except data) obviously replaces DATA; N1 and N2 are assigned the same as on the normal DATA record transmission. (i.e., N1 = No. of coulmsn, N2 = 2).

(Note: if only 1 or 2 data lines, then transmit with normal DATA and ENDDATA.)

X

5. In special cases, the Four Centers could agree bilaterally to transmit corrections at less than a subentry level. It is the responsibility of the originating center to correct its archives and to provide any center who requests it with the complete corrected subentry with alter flags. In such special cases, the originating center shall notify the other centers of the corrections being made via 4-Center Memos. The memos should include the new data on the archive subentry and an indication of what corrections have been made, e.g., the new card images of those records to be corrected.

---

*Centers will comply as their programming schedule permits.

Deletion of Entries and Sub-entries

1. Any entry or subentry for deletion must have * in Column 80 of the relevant ENTRY or SUBENT record.

2. The following keywords must be included in the BIB-section of entry or subentry to be deleted:

   REFERENCE
   TITLE
   AUTHOR
   INSTITUTE
   ISO-QUANT
   HISTORY

The ENDBIB record will be followed by NOCOMMON, NODATA.

3. A mnemonic D to be attached to the date under HISTORY, will indicate the date of the deletion. Free text must be with this justifying the deletion.

4. Column 80 alter-flags must be used throughout the "deleted" entry or subentry as usual.

5. The accession number of the deleted entry (subentry) should not be used for another entry (subentry).

Retransmission of Subentries which have been combined into one subentry

In the case of a retransmission of a series of subentries (X through Y) which have been combined into one table, the following simplified flagging system may be used:

1. Enter under ~~history~~ HISTORY in the combined subentry: (yymmddA) Subentries X through Y combined

2. For subentries X+1 through Y, transmit NØSUBENT records containing the subentry number in the N_1 field and * in Col. 80.

Four-centre Memos

Four-centre memos should conform to the following general procedure:

1) Contents of each memo should be summarized in a covering-page index;
2) Each subject should begin on a new page to facilitate distribution to the appropriate staff at each center for action;
3) Items requiring 4C agreement should be flagged with a special symbol in the index and on the appropriate subject page;
4) The 4C Memo Number should appear on each page.
5) All proposed changes and additions to the dictionaries, EXFOR Manual, and LEXFOR should contain (where possible) a revised entry in the format of the appropriate document in addition to usual documentation.
6) In case of discussion the originating center is responsible for collecting the points of agreement and issuing a final wording in the format of the appropriate document(s).
7) Proposals which do not evoke discussion should be entered after 4 weeks by the Center responsible for maintenance of manuals, dictionaries, etc.
8. Updated manual pages documenting changes and additions should be issued to all Centers immediately.

Absorption

Definition: The sum of all energetically possible interactions, excluding elastic and inelastic scattering.

Quantity Code: ABS = absorption cross-section

Sum rules: ABS = TOT - SCT = total minus scattering
= NON - INL = nonelastic minus inelastic

Fissile isotopes at thermal energies below a reaction (e.g. n,2n) threshold: ABS = NG + NF = capture plus fission

Note: Absorption is a sum cross-section. It should only be used where two or more reactions are energetically possible. Where absorption is, throughout an experimental data set, identical with the (n,gamma)-reaction, the quantity should be called NG.

Examples:

1. The frequently so-called "hydrogen absorption cross-section" must clearly be coded as NG, because no other neutron-absorbing reaction besides (n,gamma) is possible.

2. The thermal "absorption cross-section" for gold may well be coded as NG since the energetically possible (n,p) and (n,alpha) cross-sections are negligeable in comparison with the measurement uncertainty of the (n,gamma) cross-section. However, this cannot be considered a general guide since there is no Au(n,p) measurement to prove it.

Adler

Delete this page.
It is included now
in "Multilevel".

Also

Iso-quant-separator, code: =
For the coding-rules of this separator see page VIII.14. In general it is to be used when a data set can equally well be described by two or more quantity codes, whih are identical in the energy-range considered. Two or more iso-quants can be given separated by equal-signs. The consequence is that this data set will be indexed and retrieved under both iso-quants. The sequence of the iso-quants should be such that the narrower quantity or the one which is entered in CINDA is given in the first position, when such criteria apply.

Not to be used in the following cases:

1. When a data set extends beyond a known threshold, the quantity-code that is valid above the threshold-energy should be used. See under Threshold.

2. When the compiler has doubts whether the one or the other quantity is actually given in the table, the compiler must decide in favour of one of the possible quantity-codes.

3. Sum-quantities, like "absorption", should only be used when two or more reactions are energetically possible: The iso-quant (1-H-1,NG) is only entered as such and (1-H-1,ABS) must not be added using the "also"-separator, although this quantity is often called "absorption".

Note: NDS will probably not use this iso-quant separator at all. An example where NNCSC will probably use this separator can be found under Inelastic Gamma-Emission.

FIS-YLD-STAND

NDS-LX4 TS-7-1 from 4C-3/122 (75-5-14)

DRAFT, NOT YET APPROVED!

Fission-Yield Standards

1.) Often yields of some specific nuclei are given in arbitrary units. Add the REL modifier to the iso-quant and give the unit ARB-UNITS.

2.) Yields of some specific nuclei (58-CE-144, 60-ND-147, etc.) may be given relative to the yield of another nucleus (42-MO-99). This can be entered as:

ELEMENT	MASS	DATA
NØ-DIM	NØ-DIM	ARB-UNITS
42.	99.	1.
58.	144.	0.977
60.	147.	0.423
etc.		

3.) Same as 2.) above, but a reference value for the yield of 42-MO-99 is assumed:

```
ISO-QUANT   (92-U-235,NF,YLD,CUM)
STANDARD    (92-U-235,NF,YLD,CUM)
...
...
DATA
```

ELEMENT	MASS	DATA	STANDARD
NO-DIM	NO-DIM	NUC/100F	NUC/100F
42.	99.		6.14
58.	144.	5.2	
60.	147.	2.45	
etc.			

4.) Same as 3.) above, but U-238 yield data in a fission spectrum are given relative to a U-235 yield in a thermal spectrum.

```
ISO-QUANT   (92-U-238,NF,YLD,CUM/FIS)
STANDARD    (92-U-235,NF,YLD,CUM/MXW)
...
...
DATA
```

EN-DUMMY	ELEMENT	MASS	DATA	STANDARD
EV	NO-DIM	NO-DIM	NUC/100F	NUC/100F
0.0253	42.	99.		6.14
2.0E+6	42.	99.	6.2	
2.0E+6	58.	144.	4.2	
2.0E+6	60.	147.	2.75	
etc.				

5.) The R value is given. (compare in Lexfor under Fission-Yield-Methods).

$$R = \frac{(\text{Activity Ce-144 from fast U-238}) * (\text{Activity Mo-99 from thermal U-235})}{(\text{Activity Ce-144 from thermal U-235}) * (\text{Activity Mo-99 from fast U-238})}$$

R is measured in order to determine the Ce-144 yield from fast U-238 assuming the other three yields as known, i.e.

$$(\text{Yield Ce-144 from fast U-238}) = R * (\text{Yield Ce-144 from thermal U-235}) * \frac{(\text{Yield Mo-99 from fast U-238})}{(\text{Yield Mo-99 from thermal U-235})}$$

<u>First solution:</u>

```
ISO-QUANT   (92-U-238,NF,YLD,CUM/FIS/FCT)
COMMENT     UNDER DATA THE R-VALUE IS GIVEN WHICH IS DEFINED AS ...
...
...
DATA
```

EN-DUMMY	ELEMENT	MASS	DATA
	NO-DIM	NO-DIM	NØ-DIM
2.0E+6	58.	144.	1.234

<u>Second solution:</u>

```
ISO-QUANT     (92-U-238,NF,YLD,CUM/FIS)
STANDARD    1 (92-U-235,NF,YLD,CUM/MXW)
            2 (92-U-238,NF,YLD,CUM/FIS)
METHOD      R-VALUE METHOD. R-VALUE OBTAINED WAS ....
...
...
DATA
```

EN-DUMMY	ELEMENT	MASS	DATA	STAND 1	STAND 2
EV	NO-DIM	NO-DIM	NUC/100F	NUC/100F	NUC/100F
0.0253	42.	99.		6.14	
0.0253	58.	144.		5.2	
2.E+6	42.	99.			6.2
2.E+6	58.	144.	3.6		

Disapproved by NNCSC! 4C-1/61 → Note: In some of these cases blank fields under DATA cannot be avoided.

1-2-54 4X7-50N

Metastable States

1. If the target-nucleus of a neutron-induced reaction is in a metastable state, this is indicated in the iso-quant with the codes "M1" for the first and "M2" for the second metastable state in the form:

ISO-QUANT (95-AM-242-M1,NF). For target-nuclei in ground-state no isomer-code is given. The isomer-codes should only be used if they are associated with a clear definition in free text.

The half-life of the target nucleus in a metastable state should be entered under the bibliographic keyword HALF-LIFE and the numerical value given in CØMMØN or DATA.

HALF-LIFE (HL,95-AM-242-M1). Free text. (see example 17)

2. If the residual nucleus is in a metastable state, this may be indicated under the BIB keyword "RESID-NUC" either in parentheses or in free text:

either RESID-NUC (95-AM-242-M) plus any other free text

or RESID-NUC 95-AM-242M plus any other free text.

When the residual nucleus is coded in parentheses:
- the isomer code G for the ground-state is only given, when the nuclide has a metastable state,
- no isomer code is given for an unspecified state.

The half-life of the residual nucleus should be entered under the bibliographic keyword HALF-LIFE and the numerical value given in CØMMØN or DATA. For a residual nucleus in the ground state, the isomer code 'G' is given. (see example 17)

3. If a partial cross-section is given leaving the residual nucleus in its ground-state or in a metastable state, this is indicated by a quantity-modifier; examples:

NP,,GND partial (n,p) cross section populating the ground-state of the residual nucleus; to be used only, when a metastable state exists, otherwise use NP,,PAR.

NP,,MS partial (n,p) cross section populating a metastable state of the residual nucleus; if the author notes that more than one metastable state exists, this should be specified under "RESID-NUC".

4. Isomeric ratios are coded as iso-quant ratios, for example:

ISO-QUANT ((Z-S-A,NP,,MS)/(Z-S-A,NP,,GND)), or

ISO-QUANT ((Z-S-A,NP,,MS)/(Z-S-A,NP)), etc.

In the Feb. 1975 update item 2. above, which needed modification, was wrongly omitted.

MISC

Miscellaneous

A data-column with supplementary information for which no data-heading keyword has been defined, is given the heading "MISC", respectively "MISC1" and "MISC2" if more than one is given. These may be entered in the "COMMON" section or the "DATA" section. The meaning of these data-headings is explained under the keyword "MISC-COL". In order to link explanations when more than one miscellaneous column is given, the data-heading is repeated under "MISC-COL", in parentheses starting in column 12, followed by the free text explanation. This formalism is the same as for error-columns; see Example 7.

If the information under MISC is given in a unit for which no unit-code exists, the unit "SEE TEXT" is entered and axplanation is given in free text under the keyword MISC-COL. This is to avoid introducing too many unit codes which are unlikely to occur more often. The unit "SEE TEXT" must not be used for an independent variable or for a DATA or RATIO column.

Multilevel Resonance Parameters

Adler-Adler Resonance-Parameters

Adler-Adler coefficients are entered under the quantity-codes

AMU,RES	μ_λ	Resonance energy, with the dimensions of an energy
ANU,RES	ν_λ	corresponding to half the total width, with the dimension of an energy
AGF,RES	$G_{\lambda f}$	fission symmetry coefficient, with the unit B*EV*RT-EV
AHF,RES	$H_{\lambda f}$	fission asymmetry coefficient with the unit B*EV*RT-EV
AGG,RES	G_λ^γ	capture symmetry coefficient in B*EV*RT-EV
AHG,RES	H_λ^γ	capture symmetry in B*EV*RT-EV
AGT,RES	G_λ	total symmetry coefficient
AHT,RES	H_λ	total asymmetry coefficient

The parameters are functions of μ, which corresponds to the resonance-energy. Since this representation of the energy causes trouble in a data retrieval by energy, the energy-limits of the Adler-Adler fit must be entered explicitly in the "COMMON" data section under the data-heading keywords "EN-MIN" and "EN-MAX".

1. Total Cross Section

$$\sigma_T(E) = \frac{2C}{E}(1-\cos\omega) + \frac{C}{\sqrt{E}}\sum_{R=1}^{NRS} \frac{\nu_R^T\left[G_R^T\cos\omega + H_R^T\sin\omega\right] + \left(\mu_R^T - E\right)\left[H_R^T\cos\omega - G_R^T\sin\omega\right]}{\left(\mu_R^T - E\right)^2 + \left(\nu_R^T\right)^2}$$

$$+ \frac{C}{\sqrt{E}}\left(AT_1 + AT_2/E + AT_3/E^2 + AT_4/E^3 + BT_1 * E + BT_2 * E^2\right)$$

2. Captive Cross Section

$$\sigma_{n,\gamma}(E) = \frac{C}{\sqrt{E}}\sum_{R=1}^{NRS} \frac{\nu_R^\gamma\left[G_R^\gamma\cos\omega + H_R^\gamma\sin\omega\right] + \left(\mu_R^\gamma - E\right)\left[H_R^\gamma\cos\omega - G_R^\gamma\sin\omega\right]}{\left(\mu_R^\gamma - E\right)^2 + \left(\nu_R^\gamma\right)^2}$$

$$+ \frac{C}{\sqrt{E}}\left(AC_1 + AC_2/E + AC_3/E^2 + AC_1/E^3 + BC_1 * E + BC_2 * E^2\right)$$ $\omega \equiv 0$

3. Fission Cross Section

$$\sigma_{n,f}(E) = \frac{C}{\sqrt{E}}\sum_{R=1}^{NRS} \frac{\nu_R^f\left[G_R^f\cos\omega + H_R^f\sin\omega\right] + \left(\mu_R^f - E\right)\left[H_R^f\cos\omega - G_R^f\sin\omega\right]}{\left(\mu_R^f - E\right)^2 + \left(\nu_R^f\right)^2}$$

$$+ \frac{C}{\sqrt{E}}\left(AF_1 + AF_2/E + AF_3/E^2 + AF_4/E^3 + BF_1 * E + BF_2 * E^2\right)$$ $\omega \equiv 0$

$\omega = 2k\hat{a}$

where k is the neutron wave number

$$k = 2.196771\left(\frac{AWRI}{AWR + 1.0}\right) \times 10^{-3}\sqrt{E(eV)}$$

and

$\hat{a}$ = AP = effective scattering radius

$$\frac{C}{E} = \pi\bar{\lambda}^2 = \frac{\pi}{k^2}$$

Reich-Moore Resonance Parameters

EN,RES	E_λ	Resonance energy in EV
RGT/WID	Γ_λ	Total width in EV
RGG/WID	$\Gamma_{\lambda\gamma}$	Capture-width in EV including all primary gamma decays not followed by a neutron or charged-particle emmission.
RF1/WID	$\Gamma_{\lambda f_1}$	Fission width for channel 1 in EV
RF2/WID	$\Gamma_{\lambda f_2}$	Fission width for channel 2 in EV
RGN/WID	$\Gamma_{\lambda n}$	Elastic neutron width in EV
RNR/WID	$\Gamma^{(\ell)}_{\lambda n}$	Reduced neutron width in (see reduced neutron width)
RPI,RES	$\theta^\lambda_{nf_1}$	Relative phase of $\Gamma_{\lambda n}$ and $\Gamma_{\lambda f_1}$ in radians (see Reich-Moore phases)
RPI,RES	$\theta^\lambda_{nf_2}$	Relative phase of $\Gamma_{\lambda n}$ and $\Gamma_{\lambda f_2}$ in radians (See Reich-Moore phases)
RFT,RES	$\Gamma_{\lambda f}$	Total fission width (See Reich-Moore phases)

Reich-Moore Phases

$\Gamma_{\lambda n} = 2\beta^2_{\lambda n}$ $\qquad$ $\beta_{\lambda n}$ is taken positive

$\Gamma_{\lambda f_1} = 2\beta^2_{\lambda f_1}$; $\quad$ $\beta^2_{\lambda f_1}$ is real: positive or negative

$\Gamma_{\lambda f_2} = 2\beta^2_{\lambda f_2}$; $\quad$ $\beta^2_{\lambda f_2}$ is real: positive or negative

$$\Gamma_{\lambda f} = 2(|\beta_{\lambda f_1}|^2 + |\beta_{\lambda f_2}|^2)$$
$$= |\Gamma_{\lambda f_1}| + |\Gamma_{\lambda f_2}|$$

$$\theta^\lambda_{\lambda f_1} = \cos^{-1}\left[\frac{\vec{\beta}_{\lambda n}\cdot\vec{\beta}_{\lambda f_1}}{|\beta_{\lambda n}|\,|\beta_{\lambda f_1}|}\right]$$

$$\theta^\lambda_{nf_2} = \cos^{-1}\left[\frac{\vec{\beta}_{\lambda n}\cdot\vec{\beta}_{\lambda f_2}}{|\beta_{\lambda n}|\,|\beta_{\lambda f_2}|}\right]$$

$\vec{\beta}_{\lambda n}$ and $\vec{\beta}_{\lambda f_1}$ are either parallel or antiparallel likewise $\vec{\beta}_{\lambda n}$ and $\vec{\beta}_{\lambda f_2}$. Therefore $\theta^\lambda_{\lambda f_1}$ and $\theta^\lambda_{\lambda f_2}$ are either 0° or 180°. Alternatively the parameter values for $\Gamma_{\lambda f_1}$ and $\Gamma_{\lambda f_2}$ are given positive or negative signs.

NOTE: β is resonance amplitude

Vogt Resonance-Parameters

EN,RES	E_λ	Resonance Energy in EV
VGT/WID	Γ_λ	Total width in EV
VGG/WID	$\Gamma_{\lambda\gamma}$	Capture-width in EV including all primary gamma decays not followed by a neutron or charged-particle emission.
VF1/WID	$\Gamma_{\lambda f_1}$	Fission width for channel 1 in EV
VF2/WID	$\Gamma_{\lambda f_2}$	Fission width for channel 2 in EV
VGN/WID	$\Gamma_{\lambda n}$	Elastic neutron width in.EV
VNR/WID	$\Gamma^{(\ell)}_{\lambda n}$	Neutron reduced width in EV*RT-EV = 2g $\Gamma_{\lambda n}$ (E)$^{1/2}\nu_\ell$
VIJ/WID	$\theta_{\lambda i\lambda j}$	Relative phase of channel λ_i and λ_j (see Vogt phases)

Vogt phases

$$\Gamma_{\lambda_2 f} = g_{\lambda i f}{}^2$$

$$\theta_{\lambda i\lambda j} = \frac{\vec{g}_{\lambda i f}\cdot\vec{g}_{\lambda i f}}{|g_{\lambda i f}|\,|g_{\lambda i f}|}$$

NOTE: g is resonance amplitude

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NUC

NUC-QUANT

The keyword "NUC-QUANT" is to be used instead of the keyword "ISO-QUANT", when the quantity defined does not refer to a target-nucleus. These quantities are:

SF = spontaneous fission
LDP = level-density parameter
TEM = nuclear temperature
SCO = spin-cut-off factor

as well as any other quantities having one of the above codes in the first quantity-subfield, e.g. SF/NU; compare dictionary 14. The formalism for the coding of NUC-QUANT information is the same as that of ISO-QUANT, see page VIII.12 - 20, except that the isotope-field should not contain the target-nucleus but rather the nucleus to which the data is pertinent.

One of the three keywords, ISO-QUANT, CMPD-QUANT or NUC-QUANT, must be present; they are mutually exclusive.

Quantities to be entered under "NUC-QUANT" (compare Dictionary 14):

1. Spontaneous fission. see LEXFØR Spontaneous Fission.

2. The Level-Density Parameter, which is proportional to single-particle level-spacing at top of Fermi-sea in the Fermi-gas model of nucleus, in specified formalism, is coded with the quantity-code "LDP".

3. The Nuclear Temperature from the Fermi-gas model of nucleus is coded with the quantity-code "TEM".

4. The Spin-cut-off factor is coded with the quantity-code "SCO".

(In the NNCSC manual above info is on page VIII.15a although much of it clearly belongs into Lexfor.)

QUANT

Quantum-Numbers

Momentum "ℓ" - the orbital angular momentum of neutrons exciting a compound-nucleus resonance

Resonance-Spin "J" - the total spin-value of the compound-nucleus resonance

Parity "π" - the parity of a compound-nucleus resonance

These quantum-numbers can be entered in two different ways:

a) frequently such quantum-numbers are parameters of strength-functions, reduced neutron-widths, or other quantities. Then they are entered as parameters in an additional column of the data table, either in the "COMMON" or in the "DATA" section, under the data-heading keywords (see Example 3):

MOMENTUM L
SPIN J
PARITY .

b) If the quantum-number is the result of the resonance parameter analysis, one of the following quantity-codes is used as part of the iso-quant, which then requires a separate subentry:

L,RES
J,RES
PTY,RES .

In this case the table will have columns with the data-headings "EN-RES" and "DATA". The units under "DATA" will be "NO-DIM".

Note for Renda: Spin, Parity and Energy of levels are grouped together in one Renda category called LQN.

Reduced Neutron-Width

Definition: In practice, the reduced s-wave neutron-width is determined by dividing the neutron-width by the square-root of the resonance-energy in eV (compare BNL-325):

$$\Gamma_n^{(o)} = \frac{\Gamma_n}{\sqrt{E_o/eV}} \qquad (1a)$$

The reduced p-wave neutron width is defined by

$$\Gamma_n^{(1)} = \frac{\Gamma_n}{\sqrt{E_o/eV}} \left(1 + \frac{1}{k_o^2 \; R^2}\right) \qquad (1b)$$

Quantity-code: EL/WID,RED

The s-wave respectively p-wave is specified under the data heading "MOMENTUM L" (see Example 3). The dimension is that of an energy, e.g. eV or meV.

Note: More accurately, the definition is

$$\Gamma_n^{(\ell)} = \frac{\Gamma_n}{v_\ell \sqrt{E_o/eV}} \qquad (2)$$

where v is the penetration-factor of the nucleus.
(Compare: KFK-120 part 1, page B 57).

Note: Some authors give the reduced neutron-width (for s-wave neutrons) as

$$\Gamma_n^{(o)} = \frac{\Gamma_n}{\sqrt{E_o}} \qquad (3)$$

which has the dimension of the square-root of an energy, e.g. $\sqrt{eV}$. (Compare: Hennies, 66PARIS Vol.2, page 333). For consistency, only definition (1) with the dimension of an energy should be used in EXFOR, the numerical values of definitions (3) and (1) being anyway identical except for the dimensions.

NOTE: Vogt defines neutron reduced width as

$$\Gamma_{\lambda n}^{(\ell)} = 2g\Gamma_{\lambda n}(E)^{1/2}\nu_\ell$$

Resonance-Parameters

The following is valid for Breit-Wigner (R-matrix) formalism. See also Reduced Neutron-Width, Average Resonance-Parameters, Quantum-Numbers, Multilevel Resonance Parameters

1. Resonance-widths are coded with "WID" in the first quantity-subfield, following the relevant reaction code:
   - TOT/WID = total width Γ_t
   - EL/WID = neutron-width Γ_n
   - NG/WID = capture-width, gamma-width Γ_γ, including all primary gamma-decays not followed by a neutron- or charged-particle emission.
   - NP/WID = proton-width Γ_p
   - NA/WID = alfa-width Γ_α
   - NF/WID = fission-width Γ_f

   and others as given in dictionary 14.

2. Peak Cross-Sections are defined as cross-section values at peak of compound-nucleus resonance in natural line-shape in a Breit-Wigner formalism, corrected (where important) for instrumental or temperature effects. These are coded with "PCS" in the first quantity-subfield, for example (see dictionary 14):

   TOT/PCS = total peak cross-section
   Eta or Alpha at resonance are coded as ETA,RES or ALF,RES.

3. Special Representations are

NF/WID,SO	$= \sigma_0 \Gamma_f$	
TOT/WID,SQ/SO	$= \sigma_0 \Gamma_t^2$	
EL/WID,,G	$= g\Gamma_n$	
EL/WID,,2G	$= 2g\Gamma_n$	
EL/WID,,AG	$= ag\Gamma_n$	
EL/WID,,2AG	$= 2ag\Gamma_n$	
EL/WID,RED	$= \Gamma_n^{(0)}$	see Reduced Neutron-Width
NG/WID,,AV	$= \langle \Gamma_\gamma \rangle$	see Average Resonance-Width

and others as given in dictionary 14. Some of these data require additional parameters such as the momentum "ℓ" to be given in the data table; see Quantum-Numbers.

4. Resonance-Energy

There are two ways of entering resonance-energies:

a) the resonance-energy may be entered as a parameter of resonance-widths or peak cross-sections under the data-heading keyword "EN-RES". (If the resonance energies are not determined by authors, they should be entered in this manner.)
b) the resonance-energy may be given in a data-table. In this case, the quantity-code "EN,RES" is entered as part of any iso-quant, and the associated data column has the data heading keyword "DATA". (When the resonance energy is determined by the authors, it should be entered in this manner.

5. Resonance-area. The fission resonance area ia defined as

$$\frac{2\pi^2 \lambda\!\!\!^{-2}_0}{\sqrt{E_{res}}} \frac{\Gamma_n^0 \Gamma_f}{\Gamma} \quad [b \cdot eV]$$

This is coded as NF/ARE. Other resonance areas correspondingly.

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Standard information can be entered either in free text under the keyword STANDARD or in computer-intelligible form, with or without free text. In the latter case, the numerical data of the standard used may be entered in the "COMMON" or "DATA" section under the data-heading keyword "STAND". Isotope and quantity of the standard are entered under the keyword "STANDARD" following the same rules as for ISO-QUANT. It is desirable to include in the free text the bibliographic reference pertinent to the standard used.

The keyword "STANDARD" must be present, except when it is not relevant, as for such quantities which are usually obtained without a standard, that is:

* resonance-parameters except resonance areas, peak cross sections and similar quantities (if cross-reference is made to EXFOR subentry containing the data from which the resonance parameters were deduced)
* the quantities STF, D, LDP, TEM, SCO, RAD, TOT
* ISO-QUANT ratios
* if the modifiers RS, RSL, RSD, REL or others which exclude a standard have been used.

For all other quantities that can usually be measured either with a standard or absolutely, the positive statement ABSOLUTE in free text is pertinent information to the user of EXFOR and should therefore be included. It should be noted however, that so-called "absolute" data often nevertheless depend on the assumption of certain numerical values' (e.g., for calibrations or corrections); it is desirable to give such values in free text under STANDARD. The compiler should restrict the use of the term absolute only to those cases in which it is sure there are no 'hidden' standards. For more complicated description of standards or normalization procedures a cross-reference to published literature may be sufficient.

Cases:

1. If the standard values are given at several energies, these are given in the data table as an additional column under the heading "STAND" (see Example 4.a).

2. If a standard value is given only at one energy, there are two possibilities:

   a) Either the standard is entered as in case 1. above; the column headed "STAND" is then blank except at one energy.

   b) Or the standard is entered in the "COMMON"-section under the heading "STAND" together with the normalization-energy under the heading "EN-NRM" (see Example 4.b). ("EN-NRM" is omitted if the data-table includes only one energy-value which is identical with the normalization-energy.)

3. If the originally measured ratio "data/standard" is also given, see Example 2.

4. If a data-set is normalized at two or more energies in an unspecified way, this should be noted in free text in an appropriate place.

5. If two or more standards are given in computer-readable form, the column-heading STAND is repeated in the COMMON or DATA section, and pointers are used to establish the link to the Iso-quants entered in the BIB section under STANDARD. For the rules about pointers see Manual page IV.3. (Note: the keywords STAND1 and STAND2 are no longer used at NDS but still exist in old entries and in new entries from the other centers.)

4-3/05

item 5. was missing in the Feb. 1975 update.

Units

A datum or value is always a combination of a number and a unit. Example: 500 mb and .5b is the same value. mb and b are units of the same dimension or units-group. Units of the same dimension can be converted into each other by multiplication with a numerical (dimensionless) factor. Example: Angström and cm are units of the same dimension. A quantity can have only one dimension. Or: A quantity-code can be combined with only one group of units. Or: Data with different dimensions cannot have the same quantity-code. In dictionary 14 each quantity-code is followed by a code indicating the permissible dimension. Examples: "E" means energy-units (milli-eV, eV, keV, MeV, etc.). "NO" means dimensionless, that is percent or unit "one". The same dimension-codes are also given in the "Units" dictionary 25, so that a computer-check is possible whether in a data table a given quantity-code is combined with a unit which has the correct dimension. For example, the quantity "NF", having the dimension "B", can only be given in the Units KB, B, MB, or MICRO-B. In the "Units" dictionary, for each unit a conversion-factor is given, which allows computerized conversion between different units of the same dimension. The data units are entered in the "COMMON" and "DATA" section below the data-heading to define the units of the contents of each column. See Example 5.

Special cases:

1. An angle given in degrees and minutes must be entered in two separate columns with the data-heading "ANG" repeated.

2. If data are given in arbitrary units, "ARB-UNITS", the quantity-code is marked as "relative" by entering the modifier "REL" in the third quantity-subfield. See Relative.

3. Errors must have the same dimension (not necessarily the same units) as the quantity they refer to, - or percent.

4. PER-CENT is forbidden for use with the data-heading keywords DATA, DATA1, DATA2 etc., and RATIO, RATIO1, RATIO2 etc. Data should be converted to NO-DIM by dividing the results by 100. If the DATA (or RATIO) error is given in per-cent, this always means a percentage of the relevant DATA (resp. RATIO).

5. The unit "SEE TEXT" is used in a MISC column only and is explained in free text under MISC-COL. See Lexfor entry Miscellaneous.

Note: The compiler should avoid any carelessness in the use of units. This would jeopardize any automatic data-processing. It is forbidden to set the light-velocity c = 1 or Planck's constant h = 1 as is usually done in high-energy physics.

The items 3. and 4. under special cases were omitted in the Jan1974 update.