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# EXFOR Basics

## A Short Guide to the Nuclear Reaction Data Exchange Format

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**Abstract:** EXFOR is the agreed exchange format for the transmission of experimental nuclear reaction data between national and international nuclear data centers for the benefit of nuclear data users in all countries. This report is intended as a guide to data users. For a complete guide to the EXFOR system see: EXFOR Systems Manual, IAEA-NDS-207 (BNL-NCS-63330-00/04-Rev.)

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96/11

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"A.B. Author et al.: Data file EXFOR-12345.002 dated 1980-04-05, compare J. Nucl. Phys. 12, 345, (1979). EXFOR data received from the IAEA Nuclear Data Section, Vienna."

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INFORMAL REPORT

# EXFOR Basics
# A Short Guide to the
# Nuclear Reaction Data Exchange Format

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**on behalf of the**
**Nuclear Data Center Network**

**May 2000**

**Brookhaven National Laboratory**
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# Table of Contents

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# INTRODUCTION

This manual is intended as a guide to users of nuclear reaction data compiled in the EXFOR format, and is not intended as a complete guide to the EXFOR System.[1]

EXFOR is the exchange format designed to allow transmission of nuclear reaction data between the Nuclear Reaction Data Centers.[2] In addition to storing the data and its' bibliographic information, experimental information is also compiled. The status (*e.g.*, the source of the data) and history (*e.g.*, date of last update) of the data set is also included.

EXFOR is designed for flexibility in order to meet the diverse needs of the nuclear reaction data centers. It was originally conceived for the exchange of neutron data and was developed through discussions among personnel from centers situated in Saclay, Vienna, Livermore and Brookhaven. It was accepted as the official exchange format of the neutron data centers at Saclay, Vienna, Brookhaven and Obninsk, at a meeting held in November 1969.[3] As a result of two meetings held in 1975 and 1976[4] and attended by several charged-particle data centers, the format was further developed and adapted to cover all nuclear reaction data.

The exchange format should not be confused with a center-to-user format. Although users may obtain data from the centers in the EXFOR format, other center-to-user formats have been developed to meet the needs of the users within each center's own sphere of responsibility.

The EXFOR format, as outlined, allows a large variety of numerical data tables with explanatory and bibliographic information to be transmitted in a format:
- that is machine-readable (for checking and indicating possible errors);
- that can be read by personnel (for passing judgement on and correcting errors).

The data presently included in the EXFOR exchange file include:
- a "complete" compilation of experimental neutron-induced reaction data,
- a selected compilation of charged-particle-induced reaction data,
- a selected compilation of photon-induced reaction data.

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[1] For a complete guide to the EXFOR System, see EXFOR Systems Manual, Brookhaven National Laboratory report BNL-NCS-63330 (1999).

[2] See Appendix A for a list of the Nuclear Reaction Data Centers and their areas of responsibilities.

[3] See IAEA report INDC(NDS)-16/N (December 1969).

[4] See IAEA report INDC(NDS)-69 (December 1975) and INDC(NDS)-77 (October 1976).

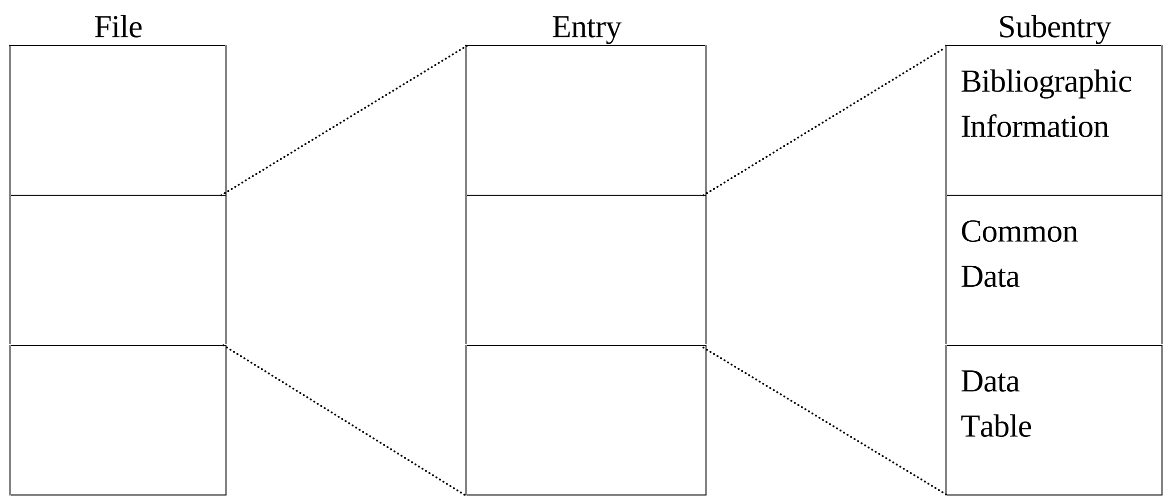
## EXCHANGE FILE FORMAT

An exchange file contains a number of entries (works). Each entry is divided into a number of subentries (data sets). Each entry is assigned an accession number; each subentry is assigned a subaccession number (the accession number plus a subentry number). The subaccession numbers are associated with a data table throughout the life of the EXFOR system.

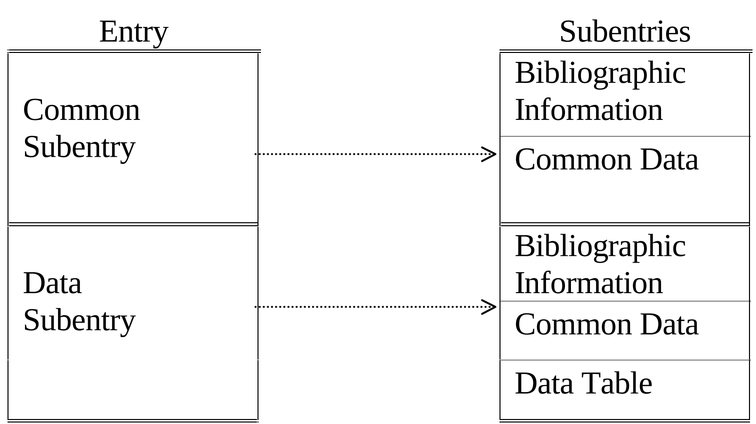
The subentries are further divided into:

- bibliographic, descriptive and bookkeeping information (hereafter called BIB information),
- common data that applies to all data throughout the subentry , and
- a data table.

The file may, therefore, be considered to be of the following form:




In order to avoid repetition of information that is common to all subentries within an entry or to all lines within a subentry, information may be associated with an entire entry or with an entire subentry. To accomplish this, the first subentry of each work contains only information that applies to all other subentries. Within each subentry, the information common to all lines of the table precedes the table. Two levels of hierarchy are thereby established:



**Permitted Character Set**. The following characters are permitted for use in the exchange format:

All Roman characters, A to Z and a to z
All numbers, 0 to 9
The special characters:

| | | | |
|---|---|---|---|
| + | (plus) | > | (greater than) |
| - | (minus) | : | (colon) |
| . | (decimal point/full stop) | ; | (semi-colon) |
| ) | (right parenthesis) | ! | (exclamation mark) |
| ( | (left parenthesis) | ? | (question mark) |
| * | (asterisk) | & | (ampersand) |
| / | (slash) | # | (number symbol) |
| = | (equals) | [ | (opening bracket) |
| ’ | (apostrophe) | ] | (closing bracket) |
| , | (comma) | " | (quotation mark) |
| % | (percent) | ~ | (varies as sign) |
| < | (less than) | @ | (at symbol) |

## EXFOR Records

EXFOR Exchange files consist of 80 character ASCII records. The format of columns 1-66 varies according to the record type as outlined in the following chapters. Columns 67-79 is used to uniquely identify a record within the file. The records on the file are in ascending order according to the record identification. Column 80 is reserved for an alteration flag.

Record identification. The record identification is divided into three fields: the accession number (entry), subaccession number (subentry), and record number within the subentry. The format of these fields is as follows.

| | | |
|---|---|---|
| Columns | 67-71 | Center-assigned accession number |
| | 72-74 | Subaccession number |
| | 75-79 | Sequence number |

Alteration flag (column 80). The last column of each record contains the alteration flag which is used to indicate that a record and/or following records has been altered (*i.e.*, added, deleted or modified) since the work was last transmitted. The flag field will normally contain a blank to indicate an unaltered record.

## System Identifiers

Each of the sections of an EXFOR file begins and ends with a system identifier. Each of the following system identifiers indicates the beginning of one of these sections.

| | |
|---|---|
| **TRANS** | - A file is the unit |
| **ENTRY** | - An entry is the unit |
| **SUBENT** | - A subentry is the unit |
| **BIB** | - A BIB Information section is the unit |
| **COMMON** | - A common data section is the unit |
| **DATA** | - A data table section is the unit |

- The end of unit is signaled by modifier END preceding the basic system identifier, *e.g.*, NODATA.
- A positive indication that a unit is intentionally omitted is signaled by the modifier NO preceding the basic system identifier, *e.g.*, NOSUBENT.

The following system identifiers are defined.

1. A file is:

Headed by: **TRANS** *cxxx* *yyyymmdd*

*CXXX* = the center-identification character,[5]

*yyyymmdd* = date (year, month, and day) on which the file was generated.

Ended by: **ENDTRANS** N1

N1 = number of entries (accession numbers) on the file.

2. An entry is:

Headed by: **ENTRY** N1 N2

N1 = 5-character accession number

N2 = Date of last update (or date of entry if never updated) (*yyyymmdd*)

Ended by: **ENDENTRY** N1

N1 - The number of subentries in the work.[6]

N2 - Presently unused (may be blank or zero).

3. A subentry is:

Headed by: **SUBENT** N1 N2

N1 = 8-character subaccession number (accession number and subentry number).

N2 = Date of last update (or date of entry if never updated) (yyyymmdd).

Ended by: **ENDSUBENT** N1

N1 - The number of records within the subentry.

If a subentry has been deleted, the following record is included in the file

**NOSUBENT N1 N2**

N1 = 8-character subaccession number.

N2 = Date of last alter.

[5] On files that contain entries with different file-identification characters, column 67 is assigned such that the record sorts at the beginning of the file.

[6] NOSUBENT records are counted as subentries when computing the number of subentries in an entry.

4. **A BIB** section is:
   Headed by BIB N1 N2
   N1 =Number of information-identifier keywords in the BIB section.
   N2 = Number of records in the BIB section.
   Ended by : **ENDBIB** N1
   N1 - Number of records in BIB section.
   If no BIB section is given the following record is included:
   **NOBIB**

5. A COMMON section is:
   Headed by: **COMMON** N1 N2
   N1 = Number of common data fields.
   N2 = Number of records within the common section.
   Ended by: **ENDCOMMON** N1
   N1 = Number of records within the common section.
   If no COMMON section is given, the following record is included:
   **NOCOMMON**

6. A DATA section is:
   Headed by: **DATA** N1 N2
   N1 = Number of fields (variables) associated with each line of a data table.
   N2 = Number of data lines within the table (excluding headings and units).
   Ended by: **ENDDATA** N1
   N1 - Number of records within the data section.
   If no DATA section is given, the following record is included:
   **NODATA**

## POINTERS

Different pieces of EXFOR information may be linked together by pointers. A pointer is a numeric or alphabetic character (1,2...9,A,B,...Z) placed in the eleventh column of the information-identifier keyword field in the BIB section and in the field headings in the COMMON or DATA section.

Pointers may link, for example,

- one of several reactions with its data field;
- one of several reactions 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 field in the DATA section;
- a value in the COMMON section with any field in the DATA section.

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

## BIB SECTION

The BIB section contains the bibliographic information (*e.g.*, reference, authors), descriptive information (*e.g.*, neutron source, method, facility), and administrative information (*e.g.*, history) associated with the data presented. It is identified on an exchange file as that information between the system identifiers BIB and ENDBIB.

A BIB record consists of three parts:

| | |
|---|---|
| columns 1-11: | information-identifier keyword field, |
| columns 12-66: | information field, which may contain coded information and/or free text, |
| columns 67-80: | record identification and alteration flag fields. |

BIB information for a given data set consists of the information contained in the BIB section of its subentry together with the BIB information in subentry 001. That is, information coded in subentry 001 applies to all other subentries in the same entry. A specific information-identifier keyword may be included in either subentry or both.

### Information-identifier keywords

The information-identifier keyword is used to define the significance of the information given in columns 12-66. The keyword is left adjusted to begin in column 1, and does not exceed a length of 10 characters (column 11 is either blank, or contains a pointer, see Chapter 5).

These keywords may, in general, appear in any order within the BIB section, however, an information-identifier keyword is not repeated within any one BIB section. If pointers are present, they appear on the first record of the information to which they are attached and are not repeated on continuation records. A pointer is assumed to refer to all BIB information until either another pointer or a new keyword is encountered. As this implies, pointer-independent information for each keyword appears first.

### Coded (machine-retrievable) information

Coded information may be used:
- to define the actual BIB information,
- as a link to the COMMON and DATA section,
- to enter associated numerical data.

Coded information is enclosed in parentheses and left adjusted so that the opening parenthesis appears in column 12. Several pieces of coded information may be associated with a given information-identifier keyword.

Codes for use with a specific keyword are found in the relevant dictionary. However, for some keywords, the code string may include retrievable information other than a code from one of the dictionaries.

In general, codes given in the dictionaries may be used singly or in conjunction with one or more codes from the same dictionary. Two options exist if more than one code is used:

a) two or more codes within the same set of parenthesis, separated by a comma;
   ***Example:*** (SOLST,NAICR)
b) each code on a separate record, enclosed in it's own set of parenthesis starting in column 12, followed by free text.
   ***Example:*** (SOLST) *free text*
   (NAICR) *free text*

For some cases, the information may be continued onto successive records. Information on continuation records does not begin before column 12 (columns 1-10 are blank and column 11 is blank or contains a pointer).

Note that some information-identifier keywords have no coded information associated with them and that, for many keywords which may have coded information associated with them, it need not always be present.

## Free text

Free text may be entered in columns 12-66 under each of the information-identifier keywords in the BIB section. The text follows any coded information on the record or may begin on a separate record; it may be continued onto any number of records.

The language of the free text is English.

## Coding of nuclides and compounds.

**Nuclides** appear in the coding of many keywords. The general code format is *Z-S-A-X*, where:

- *Z* is the charge number; up to 3 digits, no leading zeros
- *S* is the element symbol; 1 or 2 characters (Dictionary 8)
- *A* is the mass number; up to 3 digits, no leading zeroes. A single zero denotes natural isotopic composition.
- *X* is an isomer code denoting the isomeric state; this subfield is not used if there are no known isomeric states.
  *X* may have the following values:
  - G for ground state (of a nucleus which has a metastable state)
  - M if only one metastable state is regarded
  - M1 for the first metastable state
  - M2 for the second, *etc.*
  - T for sum of all isomers (limited to use within an isomeric ratio in SF4 of the reaction string)

***Examples***:
```
92-U-235
49-IN-115-M/T
```

Compounds may in some cases replace the nuclide code. The general format for coding compounds is either the specific compound code, taken from Dictionary 9, or the general code for a compound of the form *Z-S*-CMP.

***Example***: `26-FE-CMP`

## COMMON AND DATA SECTIONS

A data table is, generally, a function of one or more independent variables, *e.g.*,

- *X* vs. *Y*, *e.g.*, energy, cross section
- *X*, *X′* and *Y*, *e.g.*, energy and angle; differential cross section
- *X*, *X′* and *X″* vs. *Y*, e.g., energy, secondary energy, angle, partial angular distribution.

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′* (*e.g.*, *X* = energy, *Y* = absolute cross section, *Y′* = relative cross section), and possible associated information. The criteria for grouping *Y* with *Y′* are that they both be derived from the same experimental information by the author of the data.

For some data, the data table does not have an independent variable *X* but only a function *Y*. (*Examples*: Spontaneous $\bar{\nu}$; resonance energies without resonance parameters)

Additional variables may be associated with the data, *e.g.*, errors, standards.

The format of the common data (COMMON) and data table (DATA) sections is identical. Each section is a table of data containing the data headings and units associated with each field. The difference between the common data and data table is:

- The common data contains constant parameters that apply to each line of a point data table;
- The data table contains fields of information; each field, generally, contains values as a function of one or more independent variables (*e.g.*, angle, angular error, cross section, cross section error), *i.e.*, one or more lines of data.

Each physical record may contain up to six information fields, each 11 columns wide. If more than six fields are used, the remaining information is contained on the following records. Therefore, a data line consists of up to three physical records. The number of fields in a data line is restricted to 18.

Records are not packed; rather, individual point information is kept on individual records; *i.e.*, if only four fields are associated with a data line, the remaining two fields are left blank, and, in the case of the data table, the information for the next line begins on the following record. These rules also apply to the headings and units associated with each field.

The <u>content of the COMMON and DATA sections</u> are as follows:

- <u>Field headings</u>: a data heading left adjusted to the beginning of each field (columns 1, 12, 23, 34, 45, 56), plus, perhaps, a pointer placed in the last ($11^{th}$) column of a field.
- <u>Data units</u>: left adjusted to the beginning of each field (columns 1, 12, 23, 34, 45, 56).
- <u>Numerical data</u>: FORTRAN-readable using a floating-point format, as follows.
  - A decimal point is always present, even for integers.
  - A decimal number without an exponent can have any position within the 11-character field.
  - No blank is allowed following a sign (+ or -).
  - A plus sign may be omitted, except that of an exponent when there is no E.

- In an exponential notation, the exponent is right adjusted within the 11-character field. The mantissa may have any position.

The values are either zero or have absolute values between 1.0000E-38 and 9.999E+38.

## COMMON Section

The COMMON section is identified as that information between the system identifiers COMMON and ENDCOMMON. In the common data table, only one value is entered for a given field, and successive fields are not integrally associated with one another.

An example of a common data table with more than 6 fields:

| 1 | 12 | 23 | 34 | 45 | 56 66 |
|---|---|---|---|---|---|
| COMMON | | | | | |
| EN | EN-ERR | EN-RSL | E-LVL | E-LVL | MONIT |
| MONIT-ERR | | | | | |
| MEV | MEV | MEV | MEV | MEV | MB |
| MB | | | | | |
| 2.73 | 0.02 | 0.05 | 2.73 | 2.78 | 3.456 |
| 0.123 | | | | | |
| ENDCOMMON | | | | | |

## DATA Section

The DATA section is identified as that information between the system identifiers DATA and ENDDATA. In the DATA table, all entries on a record are integrally associated with an individual point. Independent variables precede dependent variables, and are monotonic until the value of the preceding independent variable, if any exist, changes.

Every line in a data table gives data information. This means, for example, that a blank in a field headed DATA is permitted only when another field contains the data information on the same line, e.g., under DATA-MAX. In the same way, each independent variable occurs at least once in each line (*e.g.*, either under data headings E-LVL or E-LVL-MIN, E-LVL-MAX, see example following). Supplementary information, such as resolution or standard values, is not given on a line of a data table unless the line includes data information. Blanks are permitted in all fields.

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

| 1 | 12 | 23 | 34 | 45 | 56 | 66 |
|---|---|---|---|---|---|---|
| DATA | | | | | | |
| ANG | ANG-ERR | DATA | DATA-ERR | DATA-MAX | | |
| ADEG | ADEG | MB/SR | MB/SR | MB/SR | | |
| 10.7 | 1.8 | 138. | 8.5 | | | |
| 22.9 | 1.2 | 127. | 4.2 | | | |
| 39.1 | 0.9 | | | 83.2 | | |
| 46.7 | 0.7 | 14.8 | 2.9 | | | |
| ENDDATA | | | | | | |

# Appendix A

## Nuclear Reaction Data Centers

This appendix contains a list of the members of the Nuclear Data Center Network, along with information on how to contact them. Also list are the entry series for which each of the data centers is responsible.

## Principal Centers and their services areas.[1]

| United States and Canada | |
|---|---|
| National Nuclear Data Center,<br>Bldg. 197D<br>Brookhaven National Laboratory<br>Upton, NY, 11973-5000 U.S.A. | Center codes: 1, C, L, P, T<br>Telephone: +1 631-344-2902<br>Fax: +1 631-344-2806<br>Email: nndc@bnl.gov<br>or nndc*nn*@bnl.gov[2]<br>www.nndc.bnl.gov |
| O. E. C. D. Nuclear Energy Agency Member Countries | |
| NEA Data Bank<br>12, boulevard des Iles<br>92130 Issy-les-Moulineaux,<br>FRANCE | Center codes: 2, O<br>Telephone: +33 (1) 4524 1071<br>Fax: +33 (1) 4524 1110<br>Email:nea@nea.fr<br>or *name*@nea.fr<br>www.nea.fr |
| Countries of the former Soviet Union | |
| Federal Research Center IPPE<br>Centr Yadernykh Dannykh<br>Ploschad Bondarenko<br>249 020 Obninsk, Kaluga Region,<br>RUSSIA | Center codes: 4, Q<br>Telephone: +7 084-399-8982<br>Fax: +7 095-883-3112<br>Email: *name*@cjd.obninsk.ru<br>rndc.ippe.obninsk.ru |
| Remaining countries | |
| IAEA Nuclear Data Section<br>Wagramerstr. 5, P.O.Box 100<br>A-1400 Vienna, AUSTRIA | Center codes: 3, D, G, V.<br>Telephone: +43 (1) 2360 1709<br>Fax: +43 (1) 234 564<br>Email: *name*@iaeand.iaea.or.at<br>www-nds.iaea.or.at |

## Other participating centers.

| | |
|---|---|
| National Scientific Research Center<br>Kurchatov Institute<br>Russia Nuclear Center<br>46 Ulitsa Kurchatova<br>123 182 Moscow, RUSSIA | Center codes: A, B<br>Email: feliks@polyn.kiae.su |
| Institute of Nuclear Physics<br>Moskovskiy Gos. Universitet<br>Vorob'evy Gory<br>119 899 Moscow, RUSSIA | Center code: M<br>Email: varlamov@cdfe.npi.msu.ru |

[1] The four principal centers are responsible for maintaining customer services for the area given.
[2] *nn* = first and last initial of person to be contacted, *e.g.*, NNDCCD@BNL.GOV.

| | |
|---|---|
| China Nuclear Data Center<br>China Institute of Atomic Energy<br>P.O. BOX 275 (41)<br>Beijing 102413, CHINA | Center code: S<br>Email: cndc@mipsa.ciae.ac.cn |
| Japan Charged Particle Reaction Group<br>Dept. of Physics<br>Hokkaido University<br>Kita-10 Nisha-8, Kita-ku<br>Sapporo 060, JAPAN | Center code: E, R<br>Email: kato@nucl.phys.hokaido.ac.jp |
| Dr. F. T. Tárkányi<br>Cyclotron Application Department<br>ATOMKI, Institute of Nuclear Research<br>Bem Tér 18/c, P. O. Box 51<br>H-4001 Debrecen, HUNGARY | Contributes data under center code D<br>Email: tarkanyi@atomki.hu |
| Russian Federal Center - VNIIEF<br>Sarov, Nizhni Novgorod Region<br>607 190 pr. Mira 37, RUSSIA | Center code: F<br>Email: dunaeva@expd.vniief.ru |

# Appendix B

## Information Identifier Keywords

This appendix provides a listing of all information-identifier keywords, along with details about their use. The keywords appear in alphabetical order.

**ADD-RES**. Gives information about any additional results obtained in the experiment, but which are not compiled in the data tables. Codes are given in Dictionary 20.

***Example***: `ADD-RES     (RANGE) Range of recoils measured.`

**ANALYSIS**. Gives information as to how the experimental results have been analyzed to obtain the values given under the heading DATA which actually represent the results of the analysis. Codes are found in Dictionary 23.

***Example***: `ANLAYSIS    (MLA) Breit-Wigner multilevel analysis`

**ASSUMED** Gives information about values assumed in the analysis of the data, and about COMMON or DATA fields headed by ASSUM or its derivatives. The format of the code is:

(heading,reaction,quantity)

Heading field: data heading to be defined.

Reaction field and quantity field: coded as under the keyword REACTION.

***Example:***

```
ASSUMED    (ASSUM,6-C-12(N,TOT),,SIG)
```

**AUTHOR**. Gives the authors of the work reported.

***Example:***

```
AUTHOR   (R.W.McNally Jr,A.B.JONES)
```

**COMMENT**. Gives pertinent information which cannot logically be entered under any other of the keywords available.

**CORRECTION**. Gives information about corrections applied to the data in order to obtain the values given under DATA. See also **LEXFOR, Correction**.

**COVARIANCE**. Gives covariance information provided by the experimentalist, or to flag the existence of a covariance data file. See Appendix C for covariance file format.

***Example***:
```
COVARIANCE  (COVAR) COVARIANCE FILE EXISTS AND MAY BE OBTAINED ON
            REQUEST.
```

**CRITIQUE**. Gives comments on the quality of the data presented in the data table.

**DECAY-DATA**. Gives the decay data for any nuclide occurring in the reaction measured as assumed or measured by the author for obtaining the data given[1]. The general format of the coding string consists of three major fields which may be preceded by a decay flag:

((decay flag)nuclide,half-life,radiation).

Flag. A fixed-point number that also appears in the data section under the data heading DECAY-FLAG. If the flag may be omitted, its parentheses are also omitted.

Nuclide field. A nuclide code.

Half-life field. The half-life of the nuclide specified, coded as a floating-point number, followed by a unit code with the dimensions of TIME.

Radiation field. Consists of three subfields: (type of radiation, energy, abundance) This field may be omitted, or repeated (each radiation field being separated by a comma). The absence of any subfield is indicated by a comma; trailing commas are not included.

SF1. Type-of-radiation. A code from Dictionary 13. Where two or more different decay modes are possible and are not distinguished in the measurement, two or more codes are given; each separated by a slash. (See Example b, following).

SF2. Energy. The energy of the radiation in keV, coded as a floating-point number. In the case of two or more unresolved decays, two or more energies, or a lower and upper energy limit, are given, each separated by a slash. (See Example e).

SF3. Abundance. The abundance of the observed per decay, coded as a floating-point number.

***Examples***

a) `DECAY-DATA  (60-ND-140,3.3D)` (radiation field omitted)

b) `DECAY-DATA  (59-PR-140,,B+/EC,,0.500)` (half-life and decay energy omitted)

c) `DECAY-DATA  (25-MN-50-G,0.286SEC,B+,6610.)` (abundance omitted)

d) `DECAY-DATA  ((1.)60-ND-138,5.04HR,DG,328.,0.065)` (decay flag, all fields present)

e) `DECAY-DATA  (60-ND-139-M,5.5HR,DG,708./738.,0.64)` (the abundance given is the total abundance of both γ rays)

```
f) DECAY-DATA  (60-ND-139-G,30.0MIN,B+,,0.257,
                                    DG,405.,0.055)
               (60-ND-139-M,5.5HR,  DG,738.,0.37,
                                    DG,982.,0.29,
                                    DG,708.,0.27,
                                    DG,403.,0.03,
                                    B+,,0.006)
```

[1] Decay data relevant to the monitor reaction are coded under the keyword DECAY-MON and not under DECAY-DATA.

**DECAY-MON**. Gives the decay data assumed by the author for any nuclide occurring in the monitor reaction used. The coding rules are the same as those for DECAY-DATA, except that there is no flag field.

**DETECTOR**. Gives information about the detector(s) used in the experiment. Codes are found in Dictionary 22. If the code COIN is used, then the codes for the detectors used in coincidence follow within the same parenthesis;

***Example***:
```
DETECTOR   (COIN,NAICR,NAICR)
```

**EMS-SEC**. Gives information about secondary squared effective mass of a particle or particle system, and to define secondary-mass fields given in the data table. The format of the coded information is: (heading, particle).

Heading Field contains the data heading or the root[2] of the data heading to be defined. Particle Field contains the particle or nuclide to which the data heading refers. The code is:
either a particle code from Dictionary 13.
or a nuclide code.

***Example:***
```
EMS-SEC    (EMS1,N)
           (EMS2,P+D)
```

**EN-SEC**. Gives information about secondary energies, and to define secondary-energy fields given in the data table. The format of the coded information is: (heading,particle).

Heading Field. Contains the data heading or the root of the data heading to be defined.

Particle Field. Contains the particle or nuclide to which the data heading refers. The code is:
either a particle code from Dictionary 13.
or a nuclide code.

***Example***:
```
EN-SEC     (E1,G)
           (E2,N)
           (E-EXC,3-LI-7
```

**ERR-ANALYS**. Explains the sources of uncertainties and the values given in the COMMON or DATA sections under data headings of the type ERR- or -ERR. The general code format is (heading,correlation factor) free text

Heading Field. Contains the data heading or the root[3] of the data heading to be defined.

Correlation Factor Field contains the correlation factor, coded as a floating point number.

***Example:***
```
BIB
…
ERR-ANALYS  (EN-ERR) followed by explanation of energy error
            (ERR-T)  followed by explanation of total uncertainty
            (ERR-S)  followed by explanation of statistical uncertainty
```

[2] Root means that the data heading given will also define the same heading followed by -MIN, -MAX or -APRX.
[3] Root means that the data heading given also defines the heading preceded by + or -.

**<u>EXP-YEAR</u>**. Defines the year in which the experiment was performed when it differs significantly from the data of the references given (*e.g.*, classified data published years later).

***Example***:
```
EXP-YEAR   (1965)
```

**<u>FACILITY</u>**. Defines the main apparatus used in the experiment. The facility code from Dictionary 18 may be followed by an institute code from Dictionary 3, which specifies the location of the facility.

***Example***:
```
FACILITY   (CHOPF,1USACOL)
           (SPECC,1USABNL)
```

**<u>FLAG</u>**. Provides information to specific lines in a data table. See also **LEXFOR, Flags**.

***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 | | |

**<u>HALF-LIFE</u>**. Gives information about half-life values and defines half-life fields given in the data table. The general coding format is: (heading,nuclide)

***Example***:
```
HALF-LIFE (HL1,41-NB-94-G)
          (HL2,41-NB-94-M)
```

**<u>HISTORY</u>**. Documents the handling of an entry or subentry. The general format of the code is: (*yyyymmddx*), where *yyyymmdd* is the date (year,month,day) and *x* is a code from Dictionary 15.

***Example***:
```
HISTORY    (19940312C)
           (19960711A) Data units corrected.
```

**<u>INC-SOURCE</u>**. Gives information on the source of the incident particle beam used in the experiment. Codes are found in Dictionary 19.

***Example***:
```
INC-SOURCE (POLNS,D-T)
INC-SOURCE (MPH=13-AL-27(N,A)11-NA-24)
```

**<u>INC-SPECT</u>**. Provides free text information on the characteristics and resolution of the incident-projectile beam.

**INSTITUTE**. Designates the laboratory, institute, or university at which the experiment was performed, or with which the authors are affiliated. Codes are given in Dictionary 3.

***Examples:***
```
INSTITUTE (1USAGA, 1USALAS)
INSTITUTE (2FR SAC)
```

**LEVEL-PROP**. Gives information on the spin and parity of excited states. The general format of the code is ((flag) nuclide, level identification, lever properties)

Flag. Coded as a fixed-point number that appears in the data section under the data heading LVL-FLAG. When the flag is omitted, its parentheses are also omitted.

Nuclide. Coded is a nuclide, except that the use of the extension G is optional.

Level identification. Identification of the level whose properties are specified, given as either a level energy or level number. If the field omitted, its separating comma is omitted.

Level Energy. The field identifier E-LVL= followed by the excited state energy in MeV, coded as a floating-point number which also appears in the data section under the data heading E-LVL.

Level Number. The field identifier LVL-NUMB= followed by the level number of the excited state, coded as a fixed-point number which also appears in the data section under the data heading LVL-NUMB.

Level properties. Properties for the excited state, each preceded by a subfield identification. At least one of the fields must be present. If the field is omitted, its separating comma is omitted.

Spin. The field identifier SPIN=, followed by the level spin coded as a floating point number. For an uncertain spin assignment, two or more spins may be given, each separated by a slash.

Parity. The field identifier PARITY=, followed by the level parity, coded as *e.g.*, +1. or -1.

***Examples:***
```
LEVEL-PROP (82-PB-206,E-LVL=0.,SPIN=0./1.,PARITY=+1.)
           (82-PB-206,E-LVL-1.34,SPIN+3.,PARITY=+1.)
LEVEL-PROP ((1.)82-PB-206,,SPIN=0./1.,PARITY=+1.)
           ((2.)82-PB-206,,SPIN=3.,PARITY=+1.)
LEVEL-PROP (82-PB-207,LVL-NUMB=2.,SPIN=1.5,PARITY=-1)
```

**METHOD**. Describes the experimental technique(s) employed in the experiment. Codes are found in Dictionary 21.

***Example:***
```
METHOD    (RCHEM) Radiochemical separation
```

**MISC-COL**. Defines fields in the COMMON or DATA sections headed by MISC and it derivatives.

***Example***:
```
MISC-COL  (MISC1) Free text describing 1st miscellaneous field
          (MISC2) Free text describing 2nd miscellaneous field
```

**MOM-SEC**. Gives information about secondary linear momentum, and defines secondary-momentum fields given in the data table. The general code format is: (heading,particle)

Heading Field: the data heading or root[4] of the data heading to be defined.

Particle Field: the particle or nuclide to which the data heading refers. The code is:
either a particle code from Dictionary 13.
or a nuclide code.

***Example***:
```
MOM-SEC   (MOM-SEC1,26-FE-56)
          (MOM-SEC2,26-FE-57)
```

**MONITOR**. Gives information about the standard reference data (standard, monitor) used in the experiment and defines information coded in the COMMON and DATA sections under the data heading MONIT, *etc*. The general coding format is ((heading) reaction)

Heading Field. Contains the data heading of the field in which the monitor value is given. If the heading is omitted, its parenthesis is omitted.

Reaction Field. The coding rules are identical to those for REACTION, except that subfields 5 to 9 may be omitted if the reaction is known.

***Example***:
```
|REACTION   |1|(AAAAA)     |            |            |            |
|            2|(BBBBB)     |            |            |            |
|MONITOR    |1|(CCCCC)     |            |            |            |
|            2|(DDDDD)     |            |            |            |
|…            |            |            |            |            |
|DATA         |            |            |            |            |
|EN           |DATA      | 1|DATA      | 2|MONIT     | 1|MONIT     | 2|
|…            |            |            |            |            |
```

**MONIT-REF**. Gives information about the source reference for the standard (or monitor) data used in the experiment.

The general code format is ((heading)subaccession#,author,reference)

Heading Field: Data heading of the field in which the standard value is given. If the heading is omitted, its parentheses are also omitted.

Subaccession Number Field: Subaccession number for the monitor data, if the data is given in an EXFOR entry. C*nnnn*001 refers to the entire entry; C*nnnn*000 refers to a yet unknown subentry.

Author Field. The first author, followed by "+" when more than one author exists.

Reference Field. May contain up to 6 subfields, coded as under REFERENCE.

***Example***:
```
MONIT-REF  ((MONIT1)BOO17005,J.GOSHAL,J,PR,80,939,1950)
           ((MONIT2),A.G.PANONTIN+,J,JIN,30,2017,1968)
```

[4] Root means that the data heading given will also define the same heading followed by -MIN, -MAX or -APRX.

**PART-DET**. Gives information about the particles detected directly in the experiment. Particles detected in a standard/monitor reaction are not coded under this keyword. The code is either a code from Dictionary 13, or, for particles heavier than α particles, a nuclide code. Particles detected pertaining to different reaction units within a reaction combination are coded on separate records in the same order as the corresponding reaction units.

***Example:***
```
PART-DET   (A)
PART-DET   (3-LI-6)
```

**RAD-DET**. Gives information about the decay radiations (or particles) and nuclides observed in the reaction measured. The general format of the code is ((flag)nuclide, radiation).

Flag is a fixed-point number which appears in the data section under the data heading DECAY-FLAG. If the field is omitted, its parentheses are also omitted.

Nuclide contains a nuclide code.

Radiation contains one or more codes from Dictionary 33, each separated by a comma.

***Examples***:
```
RAD-DET    (25-MN-52-M,DG,B+)
RAD-DET    (48-CD-115-G,B-)
           (49-IN-115-M,DG)
RAD-DET    ((1.)48-CD-115-G,B-)
           ((2.)49-IN-115-M,DG)
```

**REACTION**. Specifies the data presented in the DATA section in fields headed by DATA.[5] The general format of the code is (reaction, quantity, data-type).

**Reaction field**. The reaction field consists of 4 subfields.

SF1. Target nucleus. Contains either:
a) a nuclide code.
   A = 0 denotes natural isotopic abundance.
b) a compound code.
c) a variable nucleus code ELEM and/or MASS
   ***Example***: `(ELEM/MASS(0,B-),,PN)`

SF2. Incident projectile. Contains one of the following:

a) a particle code from Dictionary 28.
b) for particles heavier than an α, a nuclide code.

SF3. Process. Contains one of the following:

a) a process code from Dictionary 30, *e.g.*, TOT.
b) a article code from Dictionary 29 which may be preceded by a multiplicity factor, whose value may be 2→99.[6], *e.g.*, 4A.

[5] And similar headings such as DATA-MIN, DATA-MAX, *etc*.
[6] In the few cases where the multiplicity factor may exceed 99, the ***Variable Number of Emitted Nucleons Formalism*** may be used, see page 6.7.

c) for particles heavier than α, a nuclide code.
   ***Examples***: `8-O-16`
   `8-O-16+8-O-16`
d) combinations of a), b) and c), with the codes connected by '+'.
   ***Examples***: `HE3+8-0-16`
   `A+XN+YP`

If SF5 contains the branch code UND[7] (undefined), the particle codes given in SF3 represent only the sum of emitted nucleons, implying that the product nucleus coded in SF4 has been formed via different reaction channels. The code (DEF) in SF5 denotes that it is not evident from the publication whether the reaction channel is undefined or defined.

<u>SF4. Reaction Product</u>. In general, the heaviest of the products is defined as the reaction product (also called residual nucleus). In the case of two reaction products with equal mass, the one with the larger *Z* is considered as the *heavier* product. Exceptions or special cases are:

- If SF5 contains the code SEQ, indicating that the sequence of several outgoing particles and/or processes coded in SF3 is meaningful, the nuclide to be coded in SF4 is the heaviest of the final products.

  ***Example***: `(5-B-10(N,A+T)2-HE-4,SEQ,SIG)`

- Where emission cross sections, production cross sections, product yields, *etc*., are given for specified nuclides, particles, or gammas, the product considered is defined as the reaction product (even if it is not the heaviest of several reaction products).

This subfield contains:
either a blank,
***Example:*** `(26-FE-56(N,EL),,WID)`
or a nuclide code.
***Example:*** `(51-SB-123(N,G)51-SB-124-M1+M2/T)`
or, a variable nucleus codes:
***Example***: `(92-U-235(N,F)ELEM/MASS,CUM,FY)`

**Quantity** consists of four subfields, each separated by a comma. All combinations of codes allowed in the quantity field are given in Dictionary 36.

<u>SF5 Branch</u>. Indicates a partial reaction, *e.g.*, to one of several energy levels.

<u>SF6 Parameter</u>. Indicates the reaction parameter given, *e.g.*, differential cross section.

[7] The code UND is presently used only for charged particle reaction data.

SF7 Particle Considered. Indicates to which of several outgoing particles the quantity refers.[8] Multiple codes, *e.g.*, for the correlation between outgoing particles, all particles are separated by a slash.

SF8 Modifier. Contains information on the representation of the data, *e.g.*, relative data.

**Data Type Field**. Indicates whether the data are experimental, theoretical, evaluated, *etc*. Codes are found in Dictionary 35.

**Variable Nucleus**. For certain processes, the data table may contain yield or production cross sections for several nuclei which are entered as variables in the data table. In this case, either SF1 or SF4 of the REACTION keyword contain one of the following codes:

- ELEM - if the Z (charge number) of the nuclide is given in the data table.
- MASS - if the A (mass number) of the nuclide is given in the data table.
- ELEM/MASS - if the Z and A of the nuclide are given in the data table.

The nuclei are entered in the common data or data table as variables under the data headings ELEMENT and/or MASS with the units NO-DIM.

If the data headings ELEMENT and MASS are used, a third field with the data heading ISOMER is used when isomer states are specified:

0. = ground state (used only if nuclide has also an isomeric state),
1. = first metastable state (or the metastable state when only one is known),
2. = second metastable state, *etc*.

Decay data for each entry under ELEMENT/MASS(ISOMER) and their related parent or daughter nuclides may be given in the usual way under the information-identifier keyword DECAY-DATA. Entries under the data headings ELEMENT/MASS(ISOMER) are linked to entries under DECAY-DATA (and RAD-DET, if present) by means of a decay flag.[9]

***Example***:

```
BIB
REACTION     (…(…,F)ELEM/MASS,…)
ENDBIB
NOCOMMON
DATA
EN           ELEM         MASS         ISOMER      DATA
MEV          NO-DIM       NO-DIM       NO-DIM      B
 …            61.          148.         0.          …
 …            61.          148.         1.          …
 …            61.          149.                     …
 …            62.          149.                     …
```

[8] Note that the particle considered is not necessarily identical to the particle detected, *e.g.*, the angular distribution of an outgoing particle which has been deduced from a recoil particle detected.

[9] If the half-life is the only decay data given, this may be entered in the data table under the data heading HL, although this is not recommended.

**Variable Number of Emitted Nucleons**. Where mass and element distributions of product nuclei have been measured, the sum of outgoing neutrons and protons may be entered as variables in the data table. In this case SF3 of the REACTION keyword contains at least one of the following codes:

XN - variable number of neutrons given in the data table.
YP - variable number of protons given in the data table.

The numerical values of the multiplicity factors *X* and *Y* are entered in the data table under the data headings N-OUT and P-OUT, respectively.

***Example:***

```
BIB
REACTION     (…(…,XN+YP)…)
…
ENDBIB
NOCOMMON
DATA
EN           N-OUT        P-OUT       DATA
MEV          NO-DIM       NO-DIM      B
…
…
…
ENDDATA
```

**Reaction Combinations.** For experimental data sets referring to complex combinations of materials and reactions, the code units defined in this section can be connected into a single machine-retrievable field, with appropriate separators and properly balanced parentheses. The complete reaction combination is enclosed in parentheses.

The following reaction combinations are defined:

| | |
|---|---|
| ((------)+(-----)) | Sum of 2 or more quantities (see **LEXFOR, Sums**). |
| ((------)-(-----)) | Difference between 2 or more quantities. |
| ((------)*(-----)) | Product of 2 or more quantities (see **LEXFOR, Products**). |
| ((------)/(-----)) | Ratio of 2 or more quantities (see **LEXFOR, Ratios**). |
| ((------)//(-----)) | Ratio of 2 quantities, where the numerator and denominator refer to different values for one or more independent variables (see **LEXFOR, Ratios**). |
| ((------)=(-----)) | Tautologies (see **LEXFOR, Tautologies** for usage). |

When a reaction combination contains the separator "//", the data table will contain at least one independent variable pair with the data heading extensions -NM and -DN.

***Example:***

```
BIB
REACTION      (((92-U-238(N,F)ELEM/MASS,CUM,FY,,FIS)/
              (92-U-238(N,F)42-MO-99,CUM,FY,,FIS))//
              ((92-U-235(N,F)ELEM/MASS,CUM,FY,,MXW)/
              (92-U-235(N,F)42-MO-99,CUM,FY,,MXW)))
RESULT        (RVAL)
…
ENDBIB
COMMON
EN-DUM-NM     EN-DUM-DN
MEV           EV
 1.0           0.0253
ENDCOMMON
DATA
ELEMENT       MASS          DATA
…
ENDDATA
```

**REFERENCE**. Gives information on references that contain information about the data coded. Other related references are not coded under this keyword (see REL-REF, MONIT-REF). The general coding format is (reference type, reference, date).

The format of the reference field is dependent on the reference type. The general format for each reference type follows.

Type of Reference = B or C; Books and Conferences.
General code format: (B or C,code,volume,(part),page(paper #),date). Codes from Dictionary 7.
***Examples***:

| | |
|---|---|
| `(C,67KHARKOV,,(56),196702)` | Kharkov Conference Proceedings, paper #56, February 1967. |
| `(C,66WASH,1,456,196603)` | Washington Conference Proceedings, Volume 1, page 456, March 1966 |
| `(B,ABAGJAN,,123,1964)` | Book by Abagjan, page 123, published in 1964. |

Type of Reference = J: Journals.
General code format is (J,code,volume,(issue #),page,date). Codes are from Dictionary 5.
***Examples***:

| | |
|---|---|
| `(J,PR,104,1319,195612)` | Phys. Rev. Volume 104, page 1319, December 1956 |
| `(J,XYZ,5,(2),89,196602)` | Journals XYZ, Volume 5, issue #2, page 89, February 1966 |

Type of Reference = P or R or S; Reports.
General code format: (P or R or S,code-number,date). Codes from Dictionary 6.
***Examples***:

| | |
|---|---|
| `(R,JINR-P-2713,196605)` | Dubna report, series P, number 2713, May 1966. |
| `(P,WASH-1068,185,196603)` | WASH progress report number 1068, page 185, March 1966. |

Type of Reference = T, or W; Thesis or Private Communication.
General code format: (W or T,author,page,date)
***Examples***:

| | |
|---|---|
| `(W,BENZI,19661104)` | private communication from Benzi, November 4, 1966. |
| `(T,ANONYMOUS,58,196802)` | thesis by Anonymous, page 58, February 1968. |

**REL-REF**. Gives information on references related to, but not directly pertaining to, the work coded. The general code format is: (code,subaccession#,author,reference).

Code: code from Dictionary 17.

Subaccession #: EXFOR subaccession number for the reference given, if it exists. C*nnnn*001 refers to the entire entry C*nnnn*. C*nnnn*000 refers to a yet unassigned subentry within the entry C*nnnn*.

Author: first author, coded as under AUTHOR, followed by + when more than one author exists.

Reference: coded as for REFERENCE.

***Example:***

`(C,B9999001,A.B.NAME+,J,XYZ,5,(2),90,197701)` Critical remarks by A.B.Name, *et al*., in journal XYZ, volume 5, issue #2, p. 90, January 1977.

**RESULT**. Describes commonly used quantities that are coded as REACTION combinations.

***Example:***

```
REACTION   ((Z-S-A(N,F)ELEM/MASS,CUM,FY)/
           (Z-S-A(N,F)MASS,CHN,FY))
RESULT     (FRCUM)
```

**SAMPLE**. Used to give information on the structure, composition, shape, *etc.*, of the measurement sample.

**STATUS**. Givews information on the status of the data presented. Entered in one of the general code formats, or for cross reference to another data set, the general code format is: (code,subaccession#)

Code: code from Dictionary 16.

- Subaccession# Field: cross-reference to an EXFOR subaccession number, see REL-REF.

***Example***:

`STATUS (SPSDD,10048009)` - this subentry is superseded by subentry 10048009.

**TITLE**. Gives the title for the work referenced.

# Appendix C

## COVARIANCE DATA FILE FORMAT

Where covariance files are large, the covariance data may be stored in a separate covariance file. The existance of the file will be indicated in the corresponding EXFOR data set under the information-identifier keyword COVARIANCE, see Appendix B, COVARIANCE.

There are three record types in the covariance file:
- comment records,
- data records,
- end records.

**Comment record format**

| | | |
|---|---|---|
| Column | 1 | C |
| | 2 – 9 | Data set number (subaccession number) |
| | 10 | (blank) |
| | 11 - 80 | Comment which includes covariance type and format |

**Data record format**

| | | |
|---|---|---|
| Column | 1 | D |
| | 2 - 9 | Data set number (subaccession number) |
| | 10 | (blank) |
| | 11 - 80 | Data in format given on comment record |

**End record format**

| | | |
|---|---|---|
| Column | 1 | E |
| | 2 - 9 | Data set number (subaccession number) |
| | 10 - 80 | (blank) |

# Appendix D

## Table of Dictionaries

The EXFOR System Dictionaries list all keywords and codes used in the EXFOR entries. Listings are included for the following dictionaries. Where the dictionary is large, the most used codes are given. A complete listing of all dictionaries and codes is available from any of the Nuclear Reaction Data Centers.

**Dictionary 3. Institutes**: used with the keywords INSTITUTE and FACILITY. The first character of the codes designates the area of responsibility (see Appendix A), the next three characters designate the country, and the last three characters specify the institute. A subset containing some of the most frequently used codes is given here.

Area 1: United States and Canada

Canada

| | |
|---|---|
| 1CANCRC | A.E.C.L., Chalk River, Ontario |
| 1CANMCM | McMaster University, Hamilton, Ontario |
| 1CANTMF | Tri University Meson Facility, Vancouver, B.C. |

United States

| | |
|---|---|
| 1USAANL | Argonne National Laboratory, Argonne, IL |
| 1USAARK | Univ. of Arkansas, Fayetteville, AR |
| 1USABNL | Brookhaven National Laboratory, Upton, NY |
| 1USABNW | Pacific Northwest Laboratories, Richland, WA |
| 1USABRK | Univ. of Calif. Lawrence Berkeley Lab., Berkeley, CA |
| 1USACOL | Columbia University, New York, NY |
| 1USADAV | University of California, Davis, CA |
| 1USADKE | Duke University, Durham, NC |
| 1USAFSU | Florida State University, Tallahasse, FL |
| 1USAGEO | University of Georgia, Athens, GA |
| 1USAGGA | Gulf General Atomic, San Diego, CA |
| 1USAGIT | Georgia Instiitute of Technology, Atlanta, GA |
| 1USAHAN | Hanford Atomic Products, Richland, WA |
| 1USAINL | Idaho Nuclear Engineering Lab., Idaho Falls, ID |
| 1USAINU | Indiana University, Bloomington, IN |
| 1USAKAP | Knolls Atomic Power Laboratory, Schenectady, NY |
| 1USAKTY | University of Kentucky, Lexington, KY |
| 1USALAS | Los Alamos National Laboratory, NM |
| 1USALRL | Lawrence Livermore National Laboratory, Livermore, CA |
| 1USALTI | University of Lowell, Lowell, MA |
| 1USAMHG | University of Michigan, Ann Arbor, MI |
| 1USAMIT | Massachusetts Institute of Technology, Cambridge, MA |
| 1USAMRY | University of Maryland, College Park, MD |
| 1USANBS | National Bureau of Standards, Washington, DC |
| 1USANIS | National Inst.of Standards & Techn., Gaithersburg, MD |
| 1USANOT | Univ. of Notre Dame, Notre Dame, IN |
| 1USAOHO | Ohio University, Athens, OH |
| 1USAORL | Oak Ridge National Laboratory, Oak Ridge, TN |
| 1USARPI | Rensselaer Polytechnic Institute, Troy, NY |
| 1USATEX | Univ. of Texas, Austin, TX |
| 1USATNL | Triangle Universities Nuclear Lab., Durham, NC |
| 1USAWIS | University of Wisconsin, Madison, WI |

Area 2: OECD Countries

Austria

| | |
|---|---|
| 2AUSIRK | Inst. fuer Radiumforschung und Kernphysik, Vienna |

Belgium

| | |
|---|---|
| 2BLGMOL | C.E.N., Mol |

Denmark

| | |
|---|---|
| 2DENRIS | Riso, Roskilde |

Finland

| | |
|---|---|
| 2SF JYV | Jyvaeskylae Univ., Jyvaeskylae |

France

| | |
|---|---|
| 2FR BRC | CEN Bruyere-le-Chatel |
| 2FR CAD | C.E.N. Cadarache |
| 2FR FAR | CEA Fontenay-aux-Roses, Seine |
| 2FR GRE | Grenoble, Isere, (CEA and Univ.) |
| 2FR PAR | Univ. of Paris, (incl.Orsay), Paris |
| 2FR SAC | C.E.N. Saclay |

Germany

| | |
|---|---|
| 2GERFRK | J.W.Goethe Univ.,Frankfurt |
| 2GERGSI | Gesellschaft fuer Schwerionenforschung, Darmstadt |
| 2GERHAM | Hamburg, Universitaet |
| 2GERJUL | Kernforschungsanlage Juelich |
| 2GERKFK | Kernforschungszentrum, Karlsruhe |
| 2GERKIL | Univ. of Kiel, Kiel |
| 2GERMUN | Technische Universitaet Muenchen |
| 2GERPTB | Phys.Techn.Bundesanst., Braunschweig |
| 2GERZFK | Zentralinst.f.Kernforschung, Rossendorf |

Greece

| | |
|---|---|
| 2GRCATH | CNRC Demokritos, Athens |

Italy

| | |
|---|---|
| 2ITYBOL | ENEA Centro Ricerche Energia di Bologna |
| 2ITYCAT | Univ. of Catania |
| 2ITYPAD | Padua, University and Lab. Nat. Legnaro |

Japan

| | |
|---|---|
| 2JPNJAE | JAERI, Tokai |
| 2JPNKTO | Kyoto Univ., Kyoto |
| 2JPNKYU | Kyushu Univ., Dept.of Nucl.Eng., Fukuoka |
| 2JPNOSA | Osaka Univ., Osaka |
| 2JPNTIT | Tokyo Inst.of Technology, Tokyo |
| 2JPNTOH | Tohoku Univ., Sendai |
| 2JPNTOK | Tokyo Univ., Tokyo |

The Netherlands

| | |
|---|---|
| 2NEDGRN | Groningen |
| 2NEDRCN | Netherland's Energy Research Foundation, Petten |

Norway

| | |
|---|---|
| 2NORKJL | Inst. foer Atomenergi, Kjeller |

Sweden

| | |
|---|---|
| 2SWDAE | Studsvik Energiteknik AB |
| 2SWDFOA | Research Inst. for National Defence, Stockholm |

Switzerland

| | |
|---|---|
| 2SWTETH | Eidgenossische Technische Hochschule, Zuerich |
| 2SWTPSI | Paul Scherrer Inst., Villigen |

United Kingdom

| | |
|---|---|
| 2UK ALD | Awre, Aldermaston, England |
| 2UK DOU | Dounreay Experimental Reactor Establishment, England |
| 2UK HAR | AERE, Harwell, Berks, England |
| 2UK NPL | National Phys.Lab., Teddington, England |
| 2UK OXF | Univ. of Oxford, Oxford, England |

<u>Area 3: Remaining countries outside other 3 areas</u>

Australia

| | |
|---|---|
| 3AULAML | Univ. of Melbourne, Melbourne |
| 3AULAUA | Australian Nucl. Sci. and Techn.Org., Lucas Heights, SW |
| 3AULCBR | Australian National Univ., Canberra |

China

| | |
|---|---|
| 3CPRAEP | Inst. of Atomic Energy, Beijing |
| 3CPRBJG | Beijing Univ., Beijing |
| 3CPRLNZ | Lanzhou Univ., Lanzhou |
| 3CPRNIX | Northwest Inst.of Nucl.Technology, Xian |
| 3CPRNRS | Inst.of Nucl.Research, Acad.Sinica, Shanghai |
| 3CPRSST | Shanghai Univ. of Science and Technology |
| 3CPRTSI | Tsinghua Univ., Beijing |

Croatia

| | |
|---|---|
| 3CRORBZ | Inst.Rudjer Boskovic, Zagreb |
| 3CROZAG | Univ. of Zagreb, Zagreb |

Czechoslovakia

| | |
|---|---|
| 3CZRUJV | Inst. of Nuclear Research, Rez i Prahy |

Hungary

| | |
|---|---|
| 3HUNDEB | Inst.of Nuclear Research, ATOMKI, Debrecen |
| 3HUNKFI | Central Research Inst. for Physics, KFKI, Budapest |
| 3HUNKOS | Inst. for Experimental Physics, Kossuth U., Debrecen |

India

| | |
|---|---|
| 3INDBOS | Bose Institute, Calcutta |
| 3INDMUA | Muslim Univ., Aligarh |
| 3INDSAH | Saha Institute, Calcutta |
| 3INDTAT | Tata Institute, Bombay |
| 3INDTRM | Bhabha Atom.Res.Centre, Trombay |

Israel

| | |
|---|---|
| 3ISLNEG | Ben Gurion Univ. of the Negev, Beer-Sheva |
| 3ISLWEI | Weizmann Inst., Rehovoth |

| | |
|---|---|
| Mexico | |
| 3MEXUMX | Univ. Nacionale Autonoma de Mexico, Mexico City |
| New Zealand | |
| 3NZLNZH | Inst.of Nuclear Sciences, Lower Hutt |
| Poland | |
| 3POLIPJ | Soltan Inst.Probl.Jadr., Swierk+Warszawa |
| 3POLWWA | Warszawa, University |
| Romania | |
| 3RUMBUC | Inst. de Fizica si Inginerie Nucleara, Bucharest |
| South Africa | |
| 3SAFPEL | Atomic Energy Corp.of South Africa, Pelindaba |

Area 4: Countries of the former Soviet Union

| | |
|---|---|
| Armenia | |
| 4ARMJER | Inst. Fiziki Armenian A.N., Jerevan |
| Belorus | |
| 4BLRIJE | Inst. Yad. Energetiki A.N.Byeloruss.SSR, Minsk |
| Kazakhstan | |
| 4KASKAZ | Inst.Yadernoi Fiziki, Alma-Ata |
| Latvia | |
| 4LATIFL | Inst. Fiziki Latviyskoi A.N., Riga |
| Russia | |
| 4RUSEPA | Experimental Physics Inst., Arzamas |
| 4RUSFEI | Fiziko-Energeticheskii Inst., Obninsk |
| 4RUSFTI | Fiz.-Tekhnicheskiy Inst.Ioffe, St.Petersburg+Gatchina |
| 4RUSICP | Inst.of Chemical Phys., Moscow |
| 4RUSITE | Inst.Teoret.+ Experiment. Fiziki, Moscow |
| 4RUSJIA | Inst.Yadernych Issledovaniy Russian Acad. Sci. |
| 4RUSKUR | Inst.At.En. I.V.Kurchatova, Moscow |
| 4RUSLEB | Fiz.Inst. Lebedev (FIAN), Moscow |
| 4RUSLIN | Leningrad Inst.Nucl.Phys., Russian Acad.Sci., Gatchina |
| 4RUSMOS | Moscow State Univ., Nuclear Physics Inst., Moscow |
| 4RUSNIR | NIIAR Dimitrovgrad |
| 4RUSRI | Khlopin Radiev.Inst., Leningrad |
| Ukraine | |
| 4UKRIJI | Inst. Yadernykh Issledovaniy Acad. Sct. Ukraine, Kiev |
| 4UKRKFT | Kharkovskii Fiziko-Tekhnicheskii Inst., Kharkov |
| 4UKRKGU | Gosudarstvennyi Univ.(State Univ.), Kiev |
| International | |
| 4ZZZDUB | Joint Inst.for Nucl.Res., Dubna |

**Dictionary 4: Reference type**: used as the first subfield for the keyword REFERENCE, and, similarly, for MONIT-REF, and REL-REF.

| | |
|---|---|
| B | Book |
| C | Conference |
| J | Journal |
| P | Progress report |
| R | Report other than progress report |
| S | Report containing conference proceedings |
| T | Thesis or dissertation |
| W | Private communication |

**Dictionary 5: Journal codes**: used as the second subfield for the keyword REFERENCE, when the reference type is given as J; similarly, for MONIT-REF, and REL-REF. A subset containing some of the most frequently used codes is given here. The code may have an extension delimited by a slash; these extensions have the following meanings:

| | |
|---|---|
| /A, /B,..., /G | section or series |
| /L | letters section |
| /S | supplement |

| | |
|---|---|
| ACR | Acta Crystallographica |
| ADP | Annalen der Physik |
| AE | Atomnaya Energiya |
| AEJ | Journal of the Atomic Energy Society of Japan |
| AF | Arkiv foer Fysik |
| AHP | Acta Physica Hungarica |
| AJ | Astrophysical Journal |
| AK | Atomki Kozlemenyek |
| AKE | Atomkernenergie |
| ANP | Annalen der Physik (Leipzig) |
| ANS | Transactions of the American Nuclear Society |
| AP | Annals of Physics (New York) |
| APA | Acta Physica Austriaca |
| APP | Acta Physica Polonica |
| ARI | Applied Radiation and Isotopes |
| AUJ | Australian Journal of Physics |
| BAP | Bulletin of the American Physical Society |
| BAS | Bull.Russian Academy of Sciences - Physics |
| CHP | Chinese Journal of Physics (Taiwan) |
| CJP | Canadian Journal of Physics |
| CR | Comptes Rendus |
| CZJ | Czechoslovak Journal of Physics |
| DOK | Doklady Akademii Nauk |
| EPJ | European Physics Journal |
| FIZ | Fizika |

| | |
|---|---|
| HPA | Helvetica Physica Acta |
| IJP | Indian Journal of Physics |
| INC | Inorganic and Nuclear Chemistry Letters |
| ISP | Israel J.of Physics |
| IZV | Izv.Rossiiskoi Akademii Nauk,Ser.Fiz. |
| JAE | Yadernaya Energetika |
| JEL | Soviet Physics - JETP Letters |
| JET | Soviet Physics - JETP |
| JIN | Journal of Inorganic and Nuclear Chemistry |
| JNE | Journal of Nuclear Energy |
| JP | Jour. of Physics |
| JPJ | Journal of the Physical Society of Japan |
| JPR | Journal de Physique (Paris) |
| JRC | J.of Radioanalytical Chemistry |
| JRN | J.of Radioanalytical and Nuclear Chemistry |
| KFI | KFKI Kozlemenyek |
| NC | Nuovo Cimento |
| NCL | Lettere al Nuovo Cimento |
| NCR | Rivista del Nuovo Cimento |
| NCS | Nuovo Cimento, Suppl. |
| NIM | Nuclear Instrum.and Methods in Physics Res. |
| NKA | Nukleonika |
| NP | Nuclear Physics |
| NSE | Nuclear Science and Engineering |
| NST | J.of Nuclear Science and Technology, Tokyo |
| NWS | Naturwissenschaften |
| PAN | Physics of Atomic Nuclei |
| PCJ | Journal of Physical Chemistry |
| PHE | High Energy Physics and Nucl.Physics,Chinese ed. |
| PHY | Physica (Utrecht) |
| PL | Physics Letters |
| PNE | Progress in Nuclear Energy |
| PPS | Proceedings of the Physical Society (London) |
| PR | Physical Review |
| PRL | Physical Review Letters |
| PRS | Proc. of the Royal Society (London) |
| PS | Physica Scripta |
| PTE | Pribory i Tekhnika Eksperimenta |
| RCA | Radiochimica Acta |
| RJP | Romanian Journal of Physics |
| RRL | Radiochem.and Radioanal.Letters |
| RRP | Revue Roumaine de Physique |
| SJA | Soviet Atomic Energy |
| SJPN | Soviet Journal of Particles and Nuclei |
| SPC | Soviet Physics-Cristallography |

| | |
|---|---|
| SPD | Soviet Physics-Doklady |
| UFZ | Ukrainskii Fizichnii Zhurnal |
| UPJ | Ukrainian Physics Journal |
| YF | Yadernaya Fizika |
| YK | Vop. At.Nauki i Tekhn.,Ser.Yadernye Konstanty |
| ZEP | Zhurnal Eksper. i Teoret. Fiz., Pisma v Redakt. |
| ZET | Zhurnal Eksperimental'noi i Teoret. Fiziki |
| ZP | Zeitschrift fuer Physik |

**Dictionary 7: Books and Conferences**: used as the second subfield for the keyword REFERENCE, when the reference type is given as B or C, and similarly, for MONIT-REF, and REL-REF. A subset containing some of the most frequently used codes is given here.

Books

| | |
|---|---|
| ACT.EL | Actinide Elements |
| EXP.NUC.P. | Experimental Nuclear Physics |
| FAST N.PH. | Fast Neutron Physics |
| NB.GS.COMP | Noble Gas Compounds, Chicago Press 1963 |
| NEJTRONFIZ | Neitronnaya Fizika, Moskva 1961 |
| PR.NUC.EN. | Progress in Nucl.Energy |
| RCS | Radiochemical Studies, Fission Products |
| SPN | Sov.Progr.in Neutr.Phys.,New York 1961 |
| TRANSU.EL. | Transuranium Elements |

Conferences

| | |
|---|---|
| 55GENEVA | 1st Conf. on Peaceful Uses Atomic Energy, Geneva 1955 |
| 55MOSCOW | USSR Conf. Peaceful Uses of Atomic Energy, Moscow 1955 |
| 56KIEV | Kiev Conf., Kiev 1956 |
| 58GENEVA | 2nd Conf. on Peaceful Uses Atomic Energy, Geneva 1958 |
| 58PARIS | Nuclear Physics Congress, Paris 1958 |
| 59CALCUTTA | Low Energy Nuclear Physics Symp., Calcutta 1959 |
| 59LONDON | Conf.Nuclear Forces and Few-Nucleon Problem, London 1959 |
| 60BASEL | Conf. on Polarization Phenom. in Nuclear Reactions, Basel 1960 |
| 60VIENNA | Pile Neutron Research Symp., Vienna 1960 |
| 60WIEN | Neutron Inelastic Scattering Symp., Vienna 1960 |
| 61BOMBAY | Nuclear Physics Symp., Bombay 1961 |
| 61BRUSSELS | Neutron Time-of-Flight Colloquium, Brussels 1961 |
| 61DUBNA | Slow Neutron Physics Conf., Dubna 1961 |
| 61MANCH | Rutherford Conf., Manchester 1961 |
| 61RPI | Neutron Physics Symp., Rensselaer Polytech 1961 |
| 61SACLAY | Time of Flight Methods Conf., Saclay 1961 |
| 62PADUA | Nucl. Reaction Mechanisms Conf., Padua 1962 |
| 63BOMBAY | Nuclear and Solid State Physics Symp., Bombay 1963 |
| 63KRLSRH | Neutron Physics Conf., Karlsruhe 1963 |
| 64BOMBAY | Neutron Inelastic Scattering Symp., Bombay 1964 |
| 64GENEVA | 3rd Conf. on Peaceful Uses Atomic Energy, Geneva 1964 |
| 64PARIS | Nuclear Physics Congress, Paris 1964 |
| 65CALCUTTA | Nuclear and Solid State Phys.Symp., Calcutta 1965 |
| 65KRLSRH | Pulsed Neutron Symp., Karlsruhe 1965 |
| 65SALZBURG | Physics and Chemistry of Fission Conf., Salzburg 1965 |
| 66BOMBAY | Nuclear and Solid State Physics Symp., Bombay 1966 |
| 66GATLNBG | Int. Conf. on Nuclear Physics, Gatlinburg, 1966 |
| 66MOSCOW | Nuclear Spectroscopy Conf., Moscow 1966 |
| 66PARIS | Nuclear Data For Reactors Conf., Paris 1966 |

| | |
|---|---|
| 66WASH | Neutron Cross-Section Technology Conf., Washington 1966 |
| 67BRELA | Light Nuclei Symp., Brela 1967 |
| 67JUELICH | Neutron Physics at Reactors Conf., Juelich 1967 |
| 67KARLSR | Symp. on Fast Reactor Physics,Karlsruhe 1967 |
| 68BOMBAY | Nuclear and Solid State Physics Symp., Bombay 1968 |
| 68COPENHGN | Neutron Inelastic Scattering Symp., Copenhagen 1968 |
| 68MADRAS | Nuclear and Solid State Physics Symp., Madras 1968 |
| 68WASH | Nuclear Cross-Sections & Technology Conf., Washington 1968 |
| 69ROORKEE | Nuclear and Solid State Physics Symp., Roorkee 1969 |
| 69VIENNA | Physics and Chemistry of Fission Symp., Vienna 1969 |
| 70ANL | Neutron Standards Symp., Argonne 1970 |
| 70HELSINKI | Nuclear Data for Reactors Conf., Helsinki 1970 |
| 70MADISON | Polarization Phenomena Conf., Madison 1970 |
| 70MADURAI | Nuclear and Solid State Physics Symp., Madurai 1970 |
| 71KIEV | Neutron Physics Conf., Kiev 1971 |
| 71KNOX | Conf. Neutron Cross Sections & Techology, Knoxville 1971 |
| 72BOMBAY | Nuclear and Solid State Physics Symp, Bombay 1972 |
| 72GRENOBLE | Neutron Inelastic Scattering Symp., Grenoble 1972 |
| 72KIEV | Nuclear Spectroscopy Conf, Kiev 1972 |
| 73BANGLO | Nuclear and Solid State Physics Symp.,Bangalore,1973 |
| 73KIEV | Conf.on Neutron Physics, Kiev 1973 |
| 73MUNICH | Conf. on Nuclear Physics,Munich 1973 |
| 73PACIFI | Conf. on Photonuclear Reactions, Pacific Grove 1973 |
| 73PARIS | Applications of Nuclear Data Symp., Paris 1973 |
| 74BOMBAY | Nuclear and Solid State Physics Symp., Bombay 1974 |
| 74PETTEN | Symp. on Neutron Capture Gamma Ray Spectroscopy, Petten 1974 |
| 75CALCUTTA | Nuclear and Solid State Physics Symp.,Calcutta,1975 |
| 75KIEV | Conf. on Neutron Phys., Kiev 1975 |
| 75WASH | Conf. on Nuclear Cross Sections and Technology, Washington 1975 |
| 75ZURICH | Symp. on Polarization Phenomena, Zuerich 1975 |
| 76AHMEDABA | Nuclear Physics & Solid State Physics Symp., Ahmedabad,1976 |
| 76LOWELL | Conf. on Interaction of Neutrons with Nuclei, Lowell 1976 |
| 77BNL | Symp. on Neutron Cross Sections at 10 - 40 Mev, Brookhaven 1977 |
| 77KIEV | Conf. on Neutron Physics, Kiev 1977 |
| 77NBS | Symp.on Neutron Standards, Gaithersburg 1977 |
| 77VIENNA | Symp. on Neutron Inelastic Scattering, Vienna 1977 |
| 78BNL | Symp. on Neutron Capture Gamma Ray Spectroscopy, Brookhaven 1978 |
| 78BOMBAY | Nuclear Physics and Solid State Physics Symp., Bombay 1978 |
| 78HARWELL | Conf. on Neutron Physics and Nuclear Data, Harwell 1978 |
| 79JUELICH | Symp. on Physics and Chemistry of Fission, Juelich 1979 |
| 79KNOX | Conf. on Nuclear Cross Sections fro Technology, Knoxville 1979 |
| 79MADRAS | Nuclear Physics and Solid State Physics Symp., Madras 1979 |
| 79SMOLENIC | Symp. on Neutron Induced Reactions, Smolenice 1979 |
| 80BERKELEY | Conf. on Nuclear Physics, Berkeley 1980 |
| 80BNL | Symp. on Neutron Cross Sections at 10-50 MeV, Brookhaven 1980 |

| | |
|---|---|
| 80KIEV | All-Union Conf. on Neutron Physics, Kiev 1980 |
| 80SANTA FE | Symp. on Polarization Phenomena in Nuclear Physics, Santa Fe 1980 |
| 81ANL | Neutron Scattering Conf., Argonne 1981 |
| 81BOMBAY | Nuclear Physics and Solid State Physics .Symp., Bombay 1981 |
| 81GRENOB | Symp. on Neutron Capture Gamma-Ray Spectroscopy, Grenoble 1981 |
| 82ANTWER | Conf. on Nuclear Data for Science and Technology, Antwerp 1982 |
| 82SMOLEN | Conf. on Neutron Induced Reactions, Smolenice 1982 |
| 83KIEV | All-Union Conf. on Neutron Physics, Kiev 1983 |
| 83MYSORE | Nuclear Physics and Solid State Physics Symp., Mysore 1983 |
| 84GAUSSIG | Symp. on Nuclear Physics, Gaussig 1984 |
| 84KNOX | Symp. on Capture Gamma Ray Spectroscopy, Knoxville 1984 |
| 85JUELIC | Conf. on Neutron Scattering in the Nineties, Juelich 1985 |
| 85SANTA | Conf.on Nuclesar Data for Basic and Applied Science, Santa Fe 1985 |
| 86DUBROV | Conf. on Fast Neutron Phys., Dubrovnik 1986 |
| 86HARROG | Nuclear Physics Conf., Harrogate 1986 |
| 87KIEV | Conf. on Neutron Physics, Kiev 1987 |
| 88BOMBAY | Nuclear Physics Symp., Bombay 1988 |
| 88MITO | Conf. on Nuclear Data for Science and Technology, Mito 1988 |
| 89LENING | 50th Anniversary of Nuclear Fission, Leningrad 1989 |
| 89WASH | 50 Years of Nuclear Fission, Washington D.C. 1989 |
| 91BEIJIN | Symp. on Fast Neutron Physics, Beijing 1991 |
| 91JUELIC | Conf. on Nuclear Data for Science and Technology, Juelich 1991 |
| 92BOMBAY | Nuclear Physics Symp., Bombay 1992 |
| 94GATLIN | Nuclear Data for Science & Technology, Gatlinburg 1994 |
| 96BUDA | Symp. on Capture Gamma Ray Spectroscopy, Budapest, 1996 |
| 96NOTRED | Nuclei in the Cosmos IV, Notre Dame, IN, 1996 |
| 97TRIEST | Nuclear Data for Science & Technology, Trieste, Italy, 1997 |
| 98VOLOS | Nuclei in the Cosmos V, Volos, Greece, 1998 |

**Dictionary 15: History codes**:: used with the keyword HISTORY.

| | |
|---|---|
| A | Important alterations |
| C | Complied at the data center |
| D | Entry or subentry deleted |
| E | Transmitted to other data centers |
| L | Entered into data library |
| R | Data received at the data center |
| T | Converted from previous compilation |
| U | Unimportant alterations |

**Dictionary 16: Status codes**: used with the keyword STATUS.

| | |
|---|---|
| APRVD | Approved by author |
| COREL | Data correlated with another data set |
| CPX | Data taken from data file of McGowan, et al. |
| CURVE | Data read from a curve |
| DEP | Dependent data |
| NCHKD | Original reference not checked |
| NDD | Data converted from NEUDADA file |
| OUTDT | Normalization out-of-date |
| PRELM | Preliminary data |
| RIDER | Data converted from file of B.F. Rider |
| RNORM | Data renormalized by other than author |
| SCSRS | Data converted from SCISRS file |
| SPSDD | Data superseded |
| TABLE | Data received by center in tabular form |
| UNOBT | Data unobtainable from author |

**Dictionary 17: Related Reference codes**: used with the keyword REL-REF.

| | |
|---|---|
| A | Reference with which data agree |
| C | Critical remarks |
| D | Reference with which data disagree |
| E | Reference used in the evaluation |
| N | - |
| R | Reference from which data were used |

**Dictionary 18: Facility codes**: used with the keyword FACILITY.

| | |
|---|---|
| ACCEL | Accelerator |
| BETAT | Betatron |
| CCW | Cockcroft-Walton accelerator |
| CHOPF | Fast chopper |
| CHOPS | Slow chopper |
| CYCLO | Cyclotron |
| CYCTM | Tandem cyclotrons |
| CYGFF | Cyclograaff |
| DYNAM | Dynamitron |
| ESTRG | Electron storage ring |
| ICTR | Insulated core transformer accelerator |
| ISOCY | Isochronous cyclotron |
| LINAC | Linear accelerator |
| MESON | Meson facility |
| MICRT | Microtron |
| OLMS | On-line mass separator |
| OSCIP | Pile oscillator |
| REAC | Reactor |
| SELVE | Velocity selector |
| SPECC | Crystal spectrometer |
| SPECD | Double mass spectrometer |
| SPECM | Mass spectrometer |
| SYNCH | Synchrotron |
| SYNCY | Synchrocyclotron |
| VDG | Van de Graaff |
| VDGT | Tandem Van de Graaff |

**Dictionary 19: Incident Source codes**: used with the keyword INC-SOURCE.

| | |
|---|---|
| A-BE | Alpha-Beryllium |
| ARAD | Annihilation radiation |
| ATOMI | Atomic beam source |
| BRST | Bremsstrahlung |
| CF252 | Spontaneous fission of 252Cf |
| CM244 | Spontaneous fission of 244Cm |
| CM246 | Spontaneous fission of 246Cm |
| CM248 | Spontaneous fission of 248Cm |
| COMPT | Compton scattering |
| D-BE | Deuteron-Beryllium |
| D-C12 | Deuteron-12C |
| D-C14 | Deuteron-14C |
| D-D | Deuteron-Deuterium |
| D-LI | Deuteron-Lithium |
| D-LI7 | Deuteron-7Li |
| D-N15 | Deuteron-15N |
| D-T | Deuteron-Tritium |
| EVAP | Evaporation neutrons |
| EXPLO | Nuclear explosive device |
| HARD | Hardened |
| KINDT | Kinematically determined |
| LAMB | Lamb-shift source |
| LASER | Laser scattering |
| MPH | Monoenergetic photons |
| P-BE | Proton-Beryllium |
| P-D | Proton-Deuterium |
| P-LI7 | Proton-7Li |
| P-T | Proton-Tritium |
| PHOTO | Photo-neutron |
| POLIS | Polarized ion source |
| POLNS | Polarized neutron source |
| POLTR | Polarized target |
| PU240 | Spont.fission of 240Pu |
| QMPH | Quasi-monoenergetic photons |
| REAC | Reactor |
| SPALL | Spallation |
| TAGD | Electron tagged |
| THCOL | Thermal column |
| THRDT | Determined by threshold technique |
| VPH | Virtual photons |

**Dictionary 20: Additional Result Codes**: used with the keyword ADD-RES.

| | |
|---|---|
| A-DIS | Mass distribution |
| AMFF | Angular momentum of fission fragments |
| ANGD | Angular distribution |
| COMP | Comparison with calculated values |
| DECAY | Decay properties investigated |
| E-DIS | Energy distribution |
| G-SPC | Gamma spectra |
| LD | Level density |
| N-SPEC | Neutron spectra |
| P-SPEC | Proton spectra |
| POT | Parameters of nuclear potential |
| RANGE | Range of recoils measured |
| RECIP | Reciprocal data |
| STRUC | Nuclear structure data |
| THEO | Theory |
| TRCS | Total reaction cross section |
| TTY-C | Calculated thick target yield |
| Z-DIS | Charge distribution |

**Dictionary 21: Method Codes**: used with the keyword METHOD.

| | |
|---|---|
| ABSFY | Absolute fission yield measurement |
| ACTIV | Activation |
| AMS | Accelerator mass spectrometry |
| ASEP | Separation by mass separator |
| ASSOP | Associated particle |
| BCINT | Beam current integrated |
| BGCT | ß-? coincidence technique |
| BSPEC | ß-ray spectrometry |
| BURN | Burn-up |
| CADMB | Cadmium bath |
| CHRFL | Christiansen filter |
| CHSEP | Chemical separation |
| COINC | Coincidence |
| DIFFR | Diffraction |
| DSCAT | Double scattering |
| EDE | Particle identification by ‘E/ΔE’ measurement |
| EDEG | Energy degradation by foils |
| EXTB | Irradiation with external beam |
| FISCT | Absolute fission counting |
| FLUX | Neutron flux monitoring |
| FPGAM | Direct ?-ray spectrometry |
| GSPEC | γ- ray spectrometry |
| HADT | Heavy atom difference technique |
| HATOM | Hot atom method |
| HEJET | Collection by He jet |
| INTB | Irradiation with internal beam |
| JET | Collection by gas jet |
| LRASY | Left-right asymmetry |
| MAGFR | Magnetic field rotation |
| MANGB | Manganese bath |
| MASSP | Mass spectrometry |
| MOMIX | Mixed monitor |
| MOSEP | Separate monitor foil |
| OLMS | On-line mass separation |
| PHD | Pulse-height discrimination |
| PLSED | Pulse die-away |
| PSD | Pulse-shape discrimination |
| RCHEM | Radiochemical separation |
| REAC | Reactivity measurement |
| REC | Collection of recoils |
| REFL | Total reflection from mirrors |
| RELFY | Relative fission yield measurement |
| RVAL | R-value measurement |
| SFLIP | Spin flip |

| | |
|---|---|
| SHELT | Shell transmission |
| SITA | Single target irradiation |
| SLODT | Slowing-down time |
| STATD | Statistically determined |
| STTA | Stacked target irradiation |
| TOF | Time-of-flight |

**Dictionary 22: Detector Codes**: used with the keyword DETECTOR.

| | |
|---|---|
| BF3 | BF3 neutron detector |
| BGO | Bismuth-germanate crystal detector |
| BPAIR | Electron-pair spectrometer |
| CEREN | Cerenkov detector |
| COIN | Coincidence counter arrangement |
| CSICR | Cesium-Iodide crystal |
| D4PI | 4p detector |
| FISCH | Fission chamber |
| GE-IN | Germanium intrinsic detector |
| GELI | Ge(Li) detector |
| GEMUC | Geiger-Mueller counter |
| GLASD | Glass detector |
| HE3SP | 3He spectrometer |
| HORBU | Hornyak button detector |
| HPGE | Hyperpure Germanium detector |
| IOCH | Ionization chamber |
| LONGC | Long counter |
| MAGSP | Magnetic spectrometer |
| MOXR | Moxon-Rae detector |
| MTANK | Moderating tank detector |
| MWPC | Position sensitive multi-wire proportional counter |
| NAICR | NaI(Tl) crystal |
| PLATE | Nuclear plates |
| PROPC | Proportional counter |
| PSSCN | Position sensitive scintillator |
| PSSSD | Position sensitive solid state detector |
| SCIN | Scintillation detector |
| SILI | Si(Li) detector |
| SOLST | Solid-state detector |
| STANK | Scintillator tank |
| SWPC | Position sensitive single-wire proportional counter |
| TELES | Counter telescope |
| THRES | Threshold detector |
| TRD | Track detector |

**Dictionary 23: Analysis Codes**: used under the keyword ANALYSIS.

| | |
|---|---|
| 4PI1A | 4p times differential cross section at one angle |
| AREA | Area analysis |
| CORAB | Correction for isotopic abundance |
| DECAY | Decay curve analysis |
| DIFFR | Difference spectrum |
| DTBAL | Detailed balance |
| INTAD | Integration of angular distribution |
| INTED | Integration of energy distribution |
| LEAST | Least-structure method |
| MLA | Multilevel analysis |
| PHDIF | Photon difference |
| PLA | Penfold-Leiss method |
| REDUC | Reduction method |
| REGUL | Regularization method |
| RFN | R-function formalism |
| SHAPE | Shape analysis |
| SLA | Single level analysis |
| THIES | Thies's method |
| UNFLD | Unfolding procedure |
| WSP | Woods-Saxon potential |

**Dictionary 24: Data Headings**: used at the beginning of the COMMON and DATA fields to indicate the significance of the variable given; also used under the keywords ASSUMED, MONITOR, HALF-LIFE, MISC, and ERR-ANALYS as links to the data field.

The codes given in this dictionary may be followed by one of the following suffixes.

| | |
|---|---|
| -1, -2, *etc*. | $1^{st}$, $2^{nd}$, *etc*., value, when more than one defined |
| -APRX | value is approximate |
| -CM | value is in center-of-mass (quantities without this suffix are in the laboratory system |
| -DN | value for denominator of a reaction ratio |
| -ERR | uncertainty on value |
| -MIN | minimum value |
| -MAX | maximum value |
| -MEAN | mean value |
| -NM | value for numerator of a reaction ratio |
| -NRM | value at which data is normalized |
| -RSL | resolution of value |

| | |
|---|---|
| ANAL-STEP | Analysis energy step |
| ANG | Angle |
| ASSUM | Assumed value, defined under ASSUMED |
| COS | Cosine of angle |
| DATA | Value of quantity Specified under REACTION |
| DECAY-FLAG | Decay flag. link to information under DECAY-DATA |
| E | Energy of outgoing particle |
| E-DGD | Degradation in secondary particle energy vs. incident energy |
| E-EXC | Excitation energy |
| E-GAIN | Gain in secondary particle energy vs. incident energy |
| E-LVL | Level energy |
| E-LVL-FIN | Final level of ? transition |
| E-LVL-INI | Initial level of ? transition |
| ELEMENT | Atomic number of element |
| EMS | Effective mass squared |
| EN | Energy of incident projectile |
| EN-DUMMY | Dummy incident projectile energy, for broad spectrum |
| EN-RES | Resonance energy |
| EN-RSL-FW | Incident projectile energy resolution (FWHM) |
| EN-RSL-HW | Incident projectile energy resolution (?? FWHM) |
| ERR | Systematic uncertainty, defined under ERR-ANALYS |
| ERR-S | Statistical uncertainty (1 s) |
| ERR-T | Total uncertainty (1 s) |
| FLAG | Flag, link to information under FLAG |
| HL | Half-life of nuclide specified |
| ISOMER | Isomeric state for nuclide given |
| KT | Spectrum temperature |
| LVL-FLAG | Level flag, link to information under LEVEL-PROP |
| LVL-NUMB | Level number |

| | |
|---|---|
| MASS | Atomic mass of nuclide |
| MASS-RATIO | Ratio of atomic masses of fission fragments |
| MISC | Miscellaneous information, defined under MISC-COL |
| MOM | Linear momentum of incident projectile |
| MOM-SEC | Linear momentum of outgoing particle |
| MOMENTUM L | Angular momentum (*l*) of resonance |
| MONIT | Normalization value, for reaction given under MONITOR |
| MSS-T | Transverse mass of outgoing projectile (relativistic data) |
| MSS-TK | Transverse mass minus rest mass of outgoing projectile (relativistic data) |
| MU-ADLER | μ (for Adler-Adler resonance parameters) |
| N-OUT | Number of emitted neutrons, for variable number of nucleons in reaction |
| NUMBER | Fitting coefficient number |
| P-OUT | Number of emitted protons, for variable number of nucleons in reaction |
| PARITY | Parity (p) of resonance |
| POL-BM | Beam polarization |
| POL-TR | Target polarization |
| POLAR | Polarity |
| Q-VAL | Q-value |
| RAP | Rapidity (relativistic data, function of (energy+mom(?))/(energy-mom(?)) |
| RAP-PS | Pseudo rapidity (relativistic data, function of (mon+mom(?))/(mon-mom(?)) |
| SPIN J | Spin (J) of resonance |
| STAT-W G | Statistical-weight factor (g) |
| TEMP | Sample temperature |
| THICKNESS | Sample thickness |

**Dictionary 30: Process Codes**: used in REACTION subfield 3, and simarly under ASSUMED and MONITOR.

| | |
|---|---|
| ABS | Absorption |
| EL | Elastic scattering |
| F | Fission |
| INL | Inelastic scattering |
| NON | Nonelastic (= total minus elastic) |
| PAI | Pair production (for photonuclear reactions) |
| SCT | Total scattering (elastic + inelastic) |
| THS | Thermal neutron scattering |
| TOT | Total |
| X | Process unspecified |
| XN | Variable number of emitted neutrons |
| YP | Variable number of emitted protons |

**Dictionary 33: Particle Codes**: used in REACTION quantity subfields 2, 3, 7, and simarly under ASSUMED and MONITOR. Also used under the keywords DECAY-DATA, DECAY-MON, PART-DET and RAD-DET, and as the second field under the keywords EN-SEC, EMS-SEC, and MOM-SEC.

| | |
|---|---|
| 0 | (no outgoing particles) |
| A | a particles |
| AR | Annihilation radiation |
| B | Decay β |
| B+ | Decay β+ |
| B- | Decay β- |
| D | Deuterons |
| DG | Decay γ |
| DN | Delayed neutrons |
| E | Electrons |
| EC | Electron capture |
| FF | Fission fragments |
| G | γ |
| HE3 | $^{3}$He |
| HE6 | $^{6}$He |
| HF | Heavy fragment |
| ICE | Internal-conversion electrons |
| LCP | Light charged particle (Z<7) |
| LF | Light fragment |
| N | Neutrons |
| P | Protons |
| PI | π, unspecified |
| PIN | π- |
| PIP | π+ |
| PN | Prompt neutrons |
| RCL | Recoil nucleus |
| RSD | Residual nucleus |
| SF | Fragments from spontaneous fission |
| T | Tritons |
| XR | X-rays |

**Dictionary 34: Modifier Codes**: used in REACTION the 4th quantity subfield (REACTION SF8), and similarly, under ASSUMED and MONITOR.

(A) uncertain if corrected for natural isotopic abundance
1K2 form: $k^2\ d\sigma/d\Omega = \Sigma\ (a(L)*p(L))$
2AG times 2 * isotopic abundance and statistical weight factor
2G times 2 * staistical weight factor
2L2 form: $d\sigma/d\Omega = 1/2\ \Sigma\ (2L+1)*a(L)*p(L)$
2MT times 2p * transverse secondary mass
2PT times 2p* transverse secondary momentum
4AG times 4 * isotopic abundance and statistical weight factor
4PI times $4\pi$
A times natural isotopic abundance
AA Adler-Adler formalism
AG times isotopic abundance and statistical weight factor
AL1 Associated Legendre polynomials of the first kind
ANA analyzing power
ASY asymmetry of polarization of outgoing particles
AV average
AYY spin-correlation function, spins normal to scattering plane
BRA Bremsstrahlung spectrum average
BRS average over part of Bremsstrahlung spectrum
COS Cosine coefficients
CS2 form: $a_0 + a_1*\sin^2 + a_2*\sin^2*\cos + a_3*\sin2*\cos^2$
EPI epi-thermal neutron spectrum average
FCT times a factor (see text)
FIS fission spectrum average
FST fast reactor neutron spectrum average
G times statistical weight factor
L4P form: $4\pi\ ds/d\Omega = \Sigma\ (2L+1)*a(L)*p(L)$
LEG Legendre coefficients
LIM given for a limited energy range
MSC approximate definition only (see text)
MXW Maxwellian average
PP Incident projectile parallel/perpendicular to reaction plane
RAT ratio
RAW raw data (see text)
REL relative data
RES at peak of resonance
RM Reich-Moore formalism
RMT R-matrix formalism
RNV non-1/v part
RS times $4\pi/\sigma$
RS0 $(d\sigma/d\Omega)/(d\sigma/d\Omega \text{ at } 0°) = \Sigma\ a(L)*p(L)$
RSD relative to 90° data
RSL form: $(4p/\sigma)*(d\sigma/d\Omega) = \Sigma\ (2L+1)*a(L)*p(L)$

| | |
|---|---|
| RTE | times square-root(E) |
| RTH | relative to Rutherford scattering |
| RV | 1/v part only |
| S0 | times total peak cross section |
| S2T | form: $d\sigma/d\Omega = a_0 + a_1*\sin^2(T) + a_2*\sin^2(2*T)$ |
| SN2 | sum in the power of $\sin^2$ |
| SPA | spectrum average |
| SQ | quantity squared |
| SS | spin-spin |
| SUM | sum |
| TT | measured for thick target |
| VGT | Vogt formalism |

**Dictionary 35: Data Type Codes**: used in REACTION subfield 9.

| | |
|---|---|
| CALC | Calculated data |
| DERIV | Derived data |
| EVAL | Evaluated data |
| EXP | Experimental data |
| RECOM | Recommended data |

**Dictionary 36: Quantity Codes**: used for quantity (REACTION subfields 5-7), and simarlarly under ASSUMED and MONITOR. They may be combined with modifer codes from Dictionary 34 to form the complete quantity string. The code * in the 3rd field (SF7) signifies that any particle code from Dictionary 33 given in place of the character.

The following branch codes may appear at the beginning of the string:

| | |
|---|---|
| CUM | cumulative |
| (CUM) | uncertain if reaction is cumulative |
| M+ | including decay from metastable state |
| M- | excluding decay from metastable state |
| (M) | uncertain if decay from metastable state included. |
| SEQ | given for reaction sequence specified |
| UND | the reaction is undefined, only the sum of outgoing nucleons is known. |
| (DEF) | Compiler is uncertain whether the reaction is defined. |

| | |
|---|---|
| ,AG,,AA | Adler-Adler symmetry coefficient |
| ,AH,,AA | Adler-Adler asymmetry coefficient |
| ,AKE | Average kinetic energy of outgoing particle |
| ,AKE/DA,* | Avgerage kinetic energy of fission fragment at given angle |
| ,ALF | Capture-to-fission cross section ratio |
| ,AMP | Scattering amplitude |
| ,AP | Most probable mass of fission products |
| ,AP,* | Most probable mass of fragment specified |
| ,ARE | Resonance area |
| ,COR | Angular correlation |
| ,COR,*/* | Angular correlation between particles specified |
| ,COR,*/*/* | Angular correlation between particles specified |
| ,D | Average level spacing |
| ,DA | Differential cross section with respect to angle |
| ,DA,* | Differential cross section with respect to angle for particle specified |
| ,DA/DA | Double differential cross section $d^2\sigma/d\Omega/d\Omega$ |
| ,DA/DA,*/* | Double diff. cross section $d^2\sigma/d\Omega(*1)/d\Omega(*2)$ |
| ,DA/DA/DE | Triple diff.cross section $d^3\sigma/dA/dO/dE$ |
| ,DA/DA/DE,*/*/* | Triple diff.cross section $d^3\sigma/d\Omega(*1)/dO(*2)/dE(*3)$ |
| ,DA/DE | Double diff.cross section $d^2\sigma/d\Omega/dE$ |
| ,DA/DE,* | Double diff.cross section $d^2\sigma/d\Omega/dE$ of particle specified |
| ,DA/DE/DE,*/*/* | Triple diff.cross section $d^3\sigma/d\Omega(*1)/dE(*2)/dE(*3)$ |
| ,DA/KE,* | Kinetic energy of fission fragment specified with respect to angle |
| ,DA/TYA,P | Differential cross section with respect to Treiman-Yang angle |
| ,DE | Energy spectrum of outgoing particles |
| ,DE,* | Energy spectrum of particle specified |
| ,ECO | Energy correlation |
| ,EMC | Effective mass correlation |
| ,EN | Resonance energy |
| ,ETA | Neutron yield ($\eta$) |
| ,ETA/NU | $\eta$ / $\bar{\nu}$ |

| | |
|---|---|
| ,FM/DA | Angular distribution, of 1st kind |
| ,FM2/DA | Spin-polarization probability of 1st kind |
| ,INT | Cross-section integral over incident energy |
| ,J | Spin J |
| ,KE,* | Kinetic energy of fission fragments specified |
| ,KER | Kerma factor |
| ,L | Momentum *l* |
| ,LDP | Level density parameter |
| ,MCO | Linear momentum correlation |
| ,MLT | Multiplicity of outgoing particle |
| ,MLT,* | Multiplicity of particle specified |
| ,NU | Total neutron yield ( $\bar{\nu}$) |
| ,PHS | Relative phase |
| ,PN | Delayed neutron emission probability |
| ,POL | Spin-polarization probability |
| ,POL,* | Spin-polarization probability of particle specified |
| ,POL/DA | Spin-polarization probability $d\sigma/d\Omega$ |
| ,POL/DA,* | Diff. spin-polarization probability $d\sigma/d\Omega$ of particle specified |
| ,PTY | Parity |
| ,PY | Product yield |
| ,RAD | Scattering radius |
| ,RI | Resonance integral |
| ,SCO | Spin-cut-off factor |
| ,SGV | Reaction rate (s*velocity) |
| ,SIG | Cross section |
| ,SIG,* | Cross section for production of particle specified |
| ,SIG/RAT | Cross section ratio |
| ,SIG/TMP | Temperature-dependent cross section |
| ,SPC | Gamma spectrum |
| ,SPC/DA | Gamma spectrum as function of angle |
| ,STF | Strength function |
| ,SWG | Statistical weight factor g |
| ,TEM | Nuclear temperature |
| ,TTT | Thick-target yield per unit time |
| ,TTT/DA | Thick-target yield per unit time $dY/d\Omega$ |
| ,TTY | Thick-target yield |
| ,TTY/DA | Differential thick target yield $dY/d\Omega$ |
| ,TTY/DA/DE | Differential thick target yield $dY/d\Omega/dE$ |
| ,TTY/DE | Differential thick target yield dY/dE |
| ,WID | Resonance width, $\Gamma$ |
| ,WID/RED | Reduced width, $\Gamma_0$ |
| ,ZP | Most probable charge of fission products |
| 1,WID | Resonance width for channel 1 |
| 2,DE | Energy spectrum of 2nd secondary particle |
| 2,WID | Resonance width for channel 2 |
| 3,WID | Resonance width for channel 3 |

| | |
|---|---|
| 4,WID | Resonance width for channel 4 |
| BA,AMP | Bound-atom scattering amplitude |
| BA,SIG | Bound-atom cross section |
| BA/COH,AMP | Bound-atom coherent scattering amplitude |
| BA/PAR,AMP | Partial bound-atom scattering amplitude |
| BIN,AKE,* | Average kinetic energy of fission fragment specified |
| BIN,AP,* | Most prob. mass of fission fragment specified in binary fission |
| BIN,SIG | Binary fission cross section |
| BIN/TER,DA/RAT,* | Binary/ternary differential dist. $d\sigma/d\Omega$ of fission fragment specified |
| BIN/TER,SIG/RAT | Binary/ternary cross section ratio |
| CHG,FY | Total element yield of fission products |
| CHG,FY/DE | Total element fission yield, differential dY/d(fragment energy) |
| CHN,FY | Total chain yield of fission products |
| CHN,FY/DE | Total chain fission yield, differential dY/d(fragment energy) |
| CN,DA | Differential cross section $d\sigma/d\Omega$, compound nucleus contribution |
| CN,FY | Fission-product yield, compound nucleus contribution |
| CN,NU | ?v, compound nucleus contribution |
| CN,PY | Product yield, compound nucleus contribution |
| CN,SIG | Cross section, compound nucleus contribution |
| CN/PAR,SIG | Partial cross section, compound nucleus contribution |
| COH,AMP | Coherent scattering amplitude |
| COH,SIG | Coherent cross section |
| CUM,FY | Cumulative fission-product yield |
| CUM,FY/RAT | Cummulative fission-product yield isomeric ratio |
| CUM/TER,FY | Cumulative fission product yield for ternary fission |
| DI,DA | Differential c/s $d\sigma/d\Omega$, direct interaction contribution |
| DI,DA/DE | Double diff. c/s $d^2\sigma/d\Omega/dE$, direct interaction contribution |
| DI,SIG | Cross section, direct interaction contribution |
| DI/PAR,DA | Partial diff. c/s $d\sigma/d\Omega$, direct interaction contribution |
| DI/PAR,DA/DE | Partial double diff. c/s d2/dA/dE, direct interaction contribution |
| DI/PAR,SIG | Partial cross section, direct interaction contribution |
| DL,AKE,* | Average kinetic energy of delayed particle specified |
| DL,DE,* | Delayed energy spectrum of particle specified |
| DL,NU | Delayed neutron yield |
| DL,SIG,* | Delayed emission cross section of particle specified |
| DL,SPC | Intensity of delayed gammas |
| DL/PAR,AKE,* | Average kinetic energy for specified delayed particle group |
| DL/PAR,DE,* | Energy spectrum for specific delayed particle group |
| DL/PAR,NU | Partial yield of delayed neutrons |
| DL/PAR,SIG,* | Partial delayed emission cross section for particle specified |
| EM,DA | Particle emission angular distribution |
| EM,DA/DE | Double differential emission cross section, $d\sigma/d\Omega/dE$ |
| EM,DE | Particle emission energy spectrum |
| EM,SIG | Emission cross section |
| EM/PAR,DA | Particle emission partial differential cross section, $d\sigma/d\Omega$ |
| EM/PAR,SIG | Partial emission cross section |

| | |
|---|---|
| EP,DA | Partial differential cross section $d\sigma/d\Omega$ for electric polarity |
| EP,SIG | Cross section for electric polarity |
| EP/PAR,INT | Cross section integral over incident energy for electric polarity |
| EP/PAR,SIG | Partial cross section for electric polarity |
| FA,SIG | Free-atom cross section |
| FA/COH,SIG | Free-atom coherent scattering cross section |
| FA/INC,SIG | Free-atom incoherent scattering cross section |
| FA/PAR,AMP | Partial free-atom scattering amplitude |
| HEN,SIG | ’High-energy’ component of cross section |
| INC,AMP | Incoherent scattering amplitude |
| INC,SIG | Incoherent scattering cross section |
| IND,FY | Independent fission yield |
| IND,FY,* | Independent yield of particle specified from prompt fission prod. |
| IND,FY/DE | Differential independent fission yield dY/d(fragment energy) |
| IND,FY/RA | Independent fission yield ratio |
| IND/TER,FY | Independent fission yield for ternary fission |
| LEN,SIG | ’Low-energy’ component of cross section |
| MP,SIG | Cross section for magnetic polarity given |
| PAR,ARE | Partial resonance area |
| PAR,COR | Partial reaction, angular correlation |
| PAR,DA | Partial differential cross section, $d\sigma/d\Omega$ |
| PAR,DA,* | Partial differential cross section, $d\sigma/d\Omega$, of particle specified |
| PAR,DA/DA | Partial double differential cross section $d^2\sigma/d\Omega/d\Omega$ |
| PAR,DA/DA,*/* | Partial double differential cross section $d^2\sigma/d\Omega(*1)/d\Omega(*2)$ |
| PAR,DA/DA/DE,*/*/* | Partial triple differential cross section $d^3\sigma/d\Omega(*1)/d\Omega(*2)/dE(*3)$ |
| PAR,DA/DE | Partial double differential cross section $d\sigma/d\Omega$ |
| PAR,FM/DA | Partial differential cross section, $d\sigma/d\Omega$, for polynomial of 1st kind |
| PAR,INT/DA,* | Integral over incident en. of partial diff. c/s, $d\sigma/d\Omega$, of particle specified |
| PAR,MLT,* | Partial multiplicity of particle specified |
| PAR,NU | Partial yield of neutrons $\bar{\nu}$ |
| PAR,POL/DA | Differential spin-polarization probability for partial reaction |
| PAR,SIG | Partial cross section |
| PAR,SIG,* | Partial cross section for particle specified |
| PAR,STF | Partial strength function |
| PAR,TTY | Partial thick target yield |
| PAR,TTY,* | Partial thick target yield for particle specified |
| PAR,WID | Partial width |
| POT,RAD | Potential scattering radius |
| POT,SIG | Potential scattering cross section |
| PR,AKE,N | Average kinetic energy of prompt neutrons |
| PR,COR,N/N | Angular correlation of prompt neutrons |
| PR,COR/DE,N/FF | Angle-energy correlation of prompt neutrons with fission fragments |
| PR,DA,N | Differential cross section, $d\sigma/d\Omega$ of prompt neutrons |
| PR,DA/DE,N | Double differential cross section of prompt neutrons, $d2\sigma/d\Omega/dE$ |
| PR,DE,N | Energy spectrum of prompt fission neutrons |
| PR,NU | Prompt neutron yield ($\bar{\nu}$) |

| | |
|---|---|
| PR,SIG | Prompt cross section |
| PR,SPC | Intensity of prompt gammas |
| PR/PAR,NU | Partial prompt neutron yield ( $\bar{\nu}$) |
| PR/TER,DA,N | Ang.dist.of prompt neutrons from ternary fission |
| PR/TER,NU | Prompt $\bar{\nu}$ for ternary fission |
| PR/TER,NU/DE,A | Prompt $\bar{\nu}$ for ternary fission as a function of alpha energy |
| PR/TER,SPC | Prompt gamma spectrum from ternary fission |
| PRE,AKE,* | Average kinetic energy of fragment specified |
| PRE,AP,* | Most probable mass, pre-neutron-emission, of fragment specified |
| PRE,DA,* | Differential cross section, $d\sigma/d\Omega$, of primary fragments specified |
| PRE,DA/KE,* | Kinetic energy distribribution, $d\sigma/d\Omega$, of primary fragment specified |
| PRE,DE,* | Energy spectrum of primary fragments specified |
| PRE,FY | Primary fission yield |
| PRE,FY/DE | Primary fission yield dY/d(kinetic energy) |
| PRE,KE,* | Kinetic energy of primary fragments specified |
| PRE/BIN,FY | Primary fission yield, binary fission |
| PRE/TER,FY | Primary fission yield, ternary fission |
| SEC,AKE,FF | Average kinetic energy of post-neutron-emission fragment |
| SEC,AP,* | Most probable mass of post-neutron-emission fragment specified |
| SEC,FY | Post-neutron-emission fission yield |
| SEC/CHN,FY | Pre-delayed-neutron chain yield |
| SEC/CHN,FY/DE | Pre-delayed-neutron chain yield dY/d(kinetic energy) |
| TER,AKE,* | Average kinetic energy of particle specified, ternary fission |
| TER,AP | Most probable mass of fragment, ternary fission |
| TER,AP,* | Most prob. mass of ternary fission fragment specified |
| TER,COR,*/* | Angular correlation of particle *1 & particle *2, ternary fission |
| TER,DA,* | Differential cross section, $d\sigma/d\Omega$, of particle specified, ternary fission |
| TER,DA/DE,* | Double-differential cross sect. $d^2\sigma/d\Omega/dE$ of particle spec., ternary fission |
| TER,DA/KE,* | Kinetic energy distribution, $dE_{kin}/d\Omega$, of particle specified, ternary fission |
| TER,DE,* | Energy spectrum of particle specified, ternary fission |
| TER,FY | Fission yield, ternary fission |
| TER,FY,* | Fission yield of fragment specified, ternary fission |
| TER,SIG | Cross section, ternary fission |
| TER,SIG,* | Cross section of particle specified, ternary fission |
| TER,ZP | Most probable charge of fragment, ternary fission |
| TER/BIN,SIG/RAT | Ternary/binary fission cross section ratio |

**Dictionary 37: Result Codes**: used with the keyword RESULT.

| | |
|---|---|
| CAPTA | $g\,\Gamma_n\,\Gamma\gamma\,/\,\Gamma$ |
| FRCUM | Fractional cumulative yield |
| FRIND | Fractional independent yield |
| RVAL | R-value |

# Appendix E

# Example of an EXFOR Entry

Attached is an example of a complete entry in the EXFOR format.

```
TRANS            X023   20000424                                 X005500000000
ENTRY           X0055   20000424                                 X005500000001
SUBENT       X0055001   20000424                                 X005500100001
BIB                11         20                                 X005500100002
INSTITUTE  (1USAPEN,4RUSKUR)                                     X005500100003
REFERENCE  (J,PR/C,49,2549,199405)                               X005500100004
AUTHOR     (R.W.ZURMUHLE,Z.LIU,D.R.BENTON,S.BARROW,N.WIMER,      X005500100005
           Y.MIAO,C.LEE,J.T.MURGATROYD,X.LI,V.Z.GOLDBERG,        X005500100006
           M.S.GOLOVKOV)                                         X005500100007
TITLE      Observation of 12C cluster transfer by angular        X005500100008
           correlation measurements                              X005500100009
FACILITY   (VDGT,1USAPEN)                                        X005500100010
SAMPLE     A 30 microg/cm**2 self-supporting 12C target used.    X005500100011
METHOD     (BCINT,SITA)                                          X005500100012
DETECTOR   (MAGSP) Deuterons were momentum analyzed in a double  X005500100013
           focusing magnetic spectrometer.                       X005500100014
           (PSSSD) Deuterons were detected in the focal plane    X005500100015
           with double-sided position sensitive silicon          X005500100016
           detector covered with a Ta foil to stop beam          X005500100017
           particles that otherwise might strike the detector.   X005500100018
ADD-RES    (COMP).Distorted Wave Born Approximation and Hauser   X005500100019
           Feshbach Formalism.                                   X005500100020
STATUS     (APRVD) Approved by author, 5 April 2000.             X005500100021
HISTORY    (20000327C)                                           X005500100022
ENDBIB             22          0                                 X005500100023
NOCOMMON            0          0                                 X005500100024
ENDSUBENT          23          0                                 X005500199999
SUBENT       X0055002   20000424                                 X005500200001
BIB                 6         15                                 X005500200002
REACTION   (6-C-12(7-N-14,D+A)10-NE-20,PAR,DA/CRL)               X005500200003
EN-SEC     (E-EXC1,12-MG-24)                                     X005500200004
           (E-EXC2,10-NE-20)                                     X005500200005
           ANG1 is angle between incident beam and deuterons.    X005500200006
           ANG2 is angle between deuterons and alpha particles.  X005500200007
DETECTOR   An annular detector subdivided into ten segments,     X005500200008
           also used at small angles. Each annulus had a width   X005500200009
           of 12 mm and was separated from adjacent segments     X005500200010
           with 1-mm wide inactive masks.                        X005500200011
ERR-ANALYS (DATA-ERR) Uncertainty read from figures.             X005500200012
           (ANG2-ERR) Data-point reader uncertainty.             X005500200013
FLAG       (1.) Data taken with the annular detector.            X005500200014
           (2.) Data taken with position sensitive strip         X005500200015
           detectors.                                            X005500200016
STATUS     (CURVE) Data scanned from Fig.3 in reference.         X005500200017
ENDBIB             15          0                                 X005500200018
COMMON              4          3                                 X005500200019
ANG1       E-EXC1     E-EXC2     ANG2-ERR                        X005500200020
ADEG       MEV        MEV        ADEG                            X005500200021
  0.       13.45        0.       0.4                             X005500200022
ENDCOMMON           3          0                                 X005500200023
DATA                5         95                                 X005500200024
EN         ANG2-CM    DATA       DATA-ERR   FLAG                 X005500200025
MEV        ADEG       ARB-UNITS  ARB-UNITS  NO-DIM               X005500200026
 33.         8.0       71.        16.          1.                X005500200027
 33.        11.3       34.         8.          1.                X005500200028
 33.        14.5       35.         7.          1.                X005500200029
```

| | | | | | | |
|---|---|---|---|---|---|---|
| 33. | 16.7 | 30. | 4. | 2. | | X005500200030 |
| 33. | 17.3 | 26. | 5. | 1. | | X005500200031 |
| ... | ... | ... | ... | ... | | |
| 33. | 108.0 | 11.0 | 4.0 | 2. | | X005500200075 |
| 42. | 11.4 | 28.0 | 4. | 1. | | X005500200076 |
| 42. | 15.9 | 17.7 | 2. | 1. | | X005500200077 |
| 42. | 17.7 | 18.7 | 2.5 | 2. | | X005500200078 |
| 42. | 19.9 | 16.7 | 1.8 | 1. | | X005500200079 |
| ... | ... | ... | ... | ... | | |
| 42. | 112.7 | 5.9 | 1.5 | 2. | | X005500200122 |
| ENDDATA | 97 | 0 | | | | X005500200123 |
| ENDSUBENT | 122 | 0 | | | | X005500299999 |
| SUBENT | X0055003 | 20000424 | | | | X005500300001 |
| BIB | 3 | 3 | | | | X005500300002 |
| REACTION | (6-C-12(7-N-14,D+A)10-NE-20,PAR,DA,D) | | | | | X005500300003 |
| ERR-ANALYS | (DATA-ERR) Relative uncertainty given. | | | | | X005500300004 |
| STATUS | Data taken from Table III in reference. | | | | | X005500300005 |
| ENDBIB | 3 | | | | | X005500300006 |
| COMMON | 1 | 3 | | | | X005500300007 |
| EN | E-EXC | | | | | X005500300008 |
| MEV | MEV | | | | | X005500300009 |
| 33. | 13.45 | | | | | X005500300010 |
| ENDCOMMON | 3 | | | | | X005500300011 |
| DATA | 3 | 5 | | | | X005500300012 |
| ANG | DATA | DATA-ERR | | | | X005500300013 |
| ADEG | MB/SR | PER-CENT | | | | X005500300014 |
| 6.01 | 0.39 | 10. | | | | X005500300015 |
| 12.3 | 0.40 | 10. | | | | X005500300016 |
| 18.3 | 0.27 | 11. | | | | X005500300017 |
| 30.4 | 0.28 | 11. | | | | X005500300018 |
| 36.5 | 0.27 | 11. | | | | X005500300019 |
| ENDDATA | 7 | | | | | X005500300020 |
| ENDSUBENT | 19 | | | | | X005500399999 |
| SUBENT | X0055004 | 20000424 | | | | X005500400001 |
| BIB | 3 | 3 | | | | X005500400002 |
| REACTION | (6-C-12(7-N-14,D+A)10-NE-20,PAR,SIG) | | | | | X005500400003 |
| ANALYSIS | (INTAD) | | | | | X005500400004 |
| ERR-ANALYS | (DATA-ERR) Absolute uncertainty given. | | | | | X005500400005 |
| STATUS | (DEP,X0055003) Data taken from text in reference. | | | | | X005500400006 |
| ENDBIB | 3 | | | | | X005500400007 |
| NOCOMMON | 0 | 0 | | | | X005500400008 |
| DATA | 3 | 1 | | | | X005500400009 |
| EN | E-LVL | DATA | DATA-ERR | | | X005500400010 |
| MEV | MEV | MB | MB | | | X005500400011 |
| 33. | 13.45 | 3.6 | 0.5 | | | X005500400012 |
| ENDDATA | 3 | | | | | X005500400013 |
| ENDSUBENT | 12 | | | | | X005500499999 |
| ENDENTRY | 3 | | | | | X005599999999 |
| ENDTRANS | 1 | | | | | Z999999999999 |