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EXFOR Formats Description for Users (EXFOR Basics)

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Abstract: EXFOR is the exchange format for the transmission of experimental nuclear reaction data between national and international nuclear data centres for the benefit of nuclear data users in all countries. This report contains a general introduction to EXFOR, a detailed description of the exchange format, a brief description of the computational format C4, and tables of the dictionaries of most important abbreviations used in EXFOR.

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Citation guideline:

When quoting EXFOR data in a publication this should be done in the following way:

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

PREFACE

EXFOR is the database for experimental nuclear reaction data maintained by the international Network of Nuclear Reaction Data Centres (NRDC) co-ordinated by the IAEA Nuclear Data Section. This manual describes the main principles of the database and the most important features of the EXFOR exchange format of interest to database users. A description of the computational format C4 and brief examples of other output formats are also included.

This manual is not intended as a complete guide to the EXFOR system. NRDC staff and other experts involved in database input (compilation) and/or related software development should consult the following relevant manuals:

Name	**Report code**	**Topics**	**Intended readership**
EXFOR Exchange Formats Manual	IAEA-NDS-207	Description of EXFOR exchange formats	Compilers, software developers
LEXFOR	IAEA-NDS-208	Quantity definitions and compilation guidelines	Compilers
EXFOR/CINDA Dictionary Manual	IAEA-NDS-213	Description of dictionary formats	Compilers, software developers
NRDC Protocol	NRDC Protocol	Procedures for EXFOR exchange between NRDC centres	Compilers, centre heads
NRDC Network document	INDC(NDS)-401	Scope of activities and cooperation of NRDC centres	Centre heads

How to use this manual

Chapter I (A Quick Guide to EXFOR) explains the basic ideas of EXFOR; it can also be used as a stand-alone introduction which may be sufficient as a guide for the occasional user.

Chapter II gives a detailed overview of the exchange format, containing all details which may be important for users, but excluding technical details which are of significance only for data centre staff and external EXFOR compilers.

Chapter III describes the computational format C4 in some detail and also shows several examples of other user output formats.

The **appendix** lists the most important codes (abbreviations) from the EXFOR dictionaries which users may need to interpret EXFOR retrievals.

Acknowledgements

This manual is partly based on earlier work by former NRDC staff. In particular the contributions of V. McLane (National Nuclear Data Center, Brookhaven National Laboratory, USA) and H.D. Lemmel (IAEA Nuclear Data Section, Vienna, Austria) to earlier versions of this manual and other documents related to EXFOR are gratefully acknowledged.

O.S., June 2008

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I. A Quick Guide to EXFOR

What is EXFOR?

EXFOR is the library and format for the collection, storage, exchange and retrieval of experimental nuclear reaction data. The library is the product of a worldwide co-operation, namely the international Network of Nuclear Reaction Data Centres (NRDC) which is co-ordinated by the IAEA Nuclear Data Section (NDS).

At present (May 2008), the EXFOR database contains about 17,000 works with around 129,000 data tables, representing

- a "complete" compilation of low-energy experimental neutron-induced reaction data,
- a less complete compilation of charged-particle-induced reaction data,
- a selected compilation of photon-induced, heavy-ion-induced, and high energy neutron-induced reaction data.

At present, compilation efforts concentrate on complete coverage of newly published data as well as, depending on the available manpower, on filling gaps in old measurements which are important for certain applications.

Selective retrievals from the database are available in various formats from the web sites of the IAEA Nuclear Data Section and other cooperating NRDC centres. The output formats include the original EXFOR (Exchange) format (described in detail in Chapter II) as well as various other “user” formats which may differ at various data centres (examples of several user output formats are given in Chapter III).

The basic unit of EXFOR is an **entry**, which corresponds to **one experiment** which is usually described in one or more bibliographic references (journal articles, laboratory reports, conference proceedings etc.). An entry contains the numerical data and their definition as measured by the authors, along with the related bibliographic information and a brief description of the experimental method. An entry is typically divided in several subentries containing the various data tables resulting from the experiment.

EXFOR is, unlike bibliographic systems, primarily work-oriented, not publication-oriented, and contains many data which have never been published in numerical form, and it is regularly updated (e.g. when authors revise their data after publication).

Principles of EXFOR

- EXFOR is not a bibliographic system but contains numerical nuclear data with cross-references to pertinent publications
- EXFOR contains many data that have never been published in numerical form. It is therefore a publication medium supplementary to conventional, formal publications.
- EXFOR data are currently updated. When authors revise their data after publication, the EXFOR files are kept up-to-date accordingly.
- The numerical data in EXFOR are supplemented by explanatory text giving essential information on meaning and quality of the data including summaries on measurement techniques, corrections and error analysis, standard reference values used, etc.
- An EXFOR "entry" represents the results of a work performed at a given laboratory at a given time; an EXFOR "entry" does not necessarily correspond to the information found in one particular publication. Very often, a "work" is reported in several – formal or informal – publications, typically in one or more progress reports, a conference paper with preliminary results, a lab report, and a final but often less detailed article in a refereed international journal. The EXFOR compiler extracts the essential information from all these sources and, in addition, contacts the author in order to obtain additional information (e.g. details on the error analysis) and/or tabular data for results published only in graphical form, and to verify that the data compiled are the author's final results. This makes EXFOR entirely different from any bibliographic system, which may or may not include all the relevant publications, but will never tell the user whether they describe actually the same work or not. (The only exception to this is CINDA, a bibliography also maintained by the NRDC and closely related to EXFOR, where publications describing the same experiment are listed together in one block).
- EXFOR contains also numerical data which were digitized from results published only in graphical form, and where the original tabulated data could not be obtained from the authors.
- An EXFOR "entry" is identified by an accession number and a date (meaning the date of compilation or of the last revision of the entry). If an entry is revised, nature and reason of the revision are documented within the entry.
- Each EXFOR entry is divided into a number of subentries (data sets) containing the data tables from this particular work. A subentry is identified by a subaccession number, consisting of the accession number and a subentry number.
- EXFOR is designed for flexibility, to meet the diverse needs of the nuclear reaction data centers and to allow the compilation of very diverse type of quantities while making computerized processing of the data possible.

- Compilations are done following as much as possible the author's representations of the quantities and the originally published data units, to avoid mistakes during data input and to facilitate comparison with the original publication. Computerized processing and plotting of the data therefore do not use the basic EXFOR exchange format but one of the available computational formats which are offered as additional output options in the data centres's retrieval systems.
- EXFOR may include also preliminary data (labelled as such) or (with consent of the author) pre-publication data. Preliminary data will be routinely replaced by the final data once they become available, and any new bibliographic references describing the results will be added.
- EXFOR is a compilation of the author's original published experimental data. While the format allows the inclusion of data renormalized to up-to-date standard values (with proper documentation), this task is normally left to data evaluators who systematically review the experimental works.
- EXFOR is not a collection of recommended values for each reaction but will usually contain results from different authors for the same reaction which may or may not be in agreement. The task of recommending best evaluated cross section data is the task of data evaluators. Their work is largely based on the experimental data from EXFOR and their results are collected in various evaluated data files such as ENDF/B, JEFF, JENDL, etc., most of them also available from the IAEA Nuclear Data Section. The retrieval software allows to make comparison plots of evaluated data with experiments retrieved from EXFOR.

Data types included in EXFOR

Quantities

All types of microscopic cross sections and related data, in particular:

- Integral and partial cross sections (including excitation functions, spectrum-averaged data, ratios etc.)
- Differential cross sections of many types, including angular distributions and Legendre coefficients, secondary particle spectra, double-differential cross sections, polarization data, etc.
- Resonance parameters
- Fission product yields, $\bar{\nu}$ (Nu-bar), fission quantities
- Product yields and thick target yields
- Reaction rates, resonance integrals

Projectiles

- Regular compilation for projectile energies up to 1 GeV; selected data for higher energies may be included also
- Neutrons (Note that the neutron files include also some data with projectile ‘0’, e.g. fission product yields from spontaneous fission)
- Charged particles (regular compilation up to A=12)
- Heavy ions with A>12 (selected coverage)
- Photons

Basic structure of the EXFOR format

EXFOR (EXchange FORmat for experimental numerical nuclear reaction data) presents in a convenient compact form numerical data as well as physical information necessary to understand the experiment and interpret the data.

Keywords and **codes** make the information computer intelligible, while English “free text” gives additional information for the human user.

The basic unit of EXFOR is an **entry**, which corresponds to **one experiment** which is usually described in one or more bibliographic references (journal articles, laboratory reports, conference proceedings etc.). As the results may consist of several data tables (e.g. cross sections σ(E) for several nuclides), 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 accession numbers are associated with a particular work throughout the life of the EXFOR system.

The subentries are further divided into:

- a text part containing bibliographic, descriptive and bookkeeping information (usually called "BIB" information),
- common data that applies to all data throughout the subentry (called “COMMON” section), and
- a data table (“DATA” section).

The **first subentry** contains the information which is **common** to the whole entry, i.e. usually the bibliographic reference(s), essentials about the experimental method, and any common data (common parameters for the whole work). The first subentry does not contain any numerical results.

The **following subentries** contain the actual experimental results (tables), plus any bibliographic and experimental information or common parameters specific to the individual subentry (table). Therefore, any entry consists of at least two subentries:

the first subentry with the general information, and one or more following subentries with data tables.

The **text part** (bibliographic, experimental and bookkeeping information) is specified in variable length fields whose content is defined by **keywords**. An entry contains only those keywords relevant for the particular work. The information attached to a keyword may consist of "**codes**" (standard abbreviations taken from a "dictionary") and/or unstructured English "**free text**".

The table below gives a list of the information identifier keywords. For many of these there is a specific dictionary of permitted standard abbreviations (codes). These dictionaries are open ended in the sense that new codes may be added whenever need arises. The keywords given in **bold** in the table below will appear in every entry. Some of the keywords describing the experiment (such as FACILITY, METHOD, DETECTOR) will also appear in every entry.

ADD-RES	DETECTOR	**INSTITUTE**	**REFERENCE**
ANALYSIS	EN-SEC	LEVEL-PROP	REL-REF
ASSUMED	ERR-ANALYS	METHOD	RESULT
AUTHOR	EXP-YEAR	MISC-COL	SAMPLE
COMMENT	FACILITY	MOM-SEC	**STATUS**
CORRECTION	FLAG	MONIT-REF	**TITLE**
COVARIANCE	HALF-LIFE	MONITOR	
CRITIQUE	**HISTORY**	PART-DET	
DECAY-DATA	INC-SOURCE	RAD-DET	
DECAY-MON	INC-SPECT	**REACTION**	

Data definition

The data of each table in a subentry are defined in the keyword **REACTION** which defines both the **nuclear reaction** as such (e.g. neutron-induced fission on ^{235}U, or the microscopic production cross section of a certain radionuclide by bombarding a lead target with protons) and the **quantity measured** (e.g. integral or differential cross section, fission product yield, resonance parameters, etc.) The REACTION code therefore consists of up to 9 subfields, subfield 1 through 4 for defining the **nuclear reaction**, and subfields 5 through 9 for a detailed definition of the **quantity measured and its representation**.

Subfields 1 through 4 are usually self-explanatory:

`1-H-1(N,G)1-H-2`	=	$^{1}H(n,\gamma)^{2}H$
`92-U-235(N,F)`	=	$^{235}U(n,f)$
`26-FE-56(N,INL)26-FE-56`	=	$^{56}Fe(n,n')$
`28-NI-0(P,X)11-NA-24`	=	$^{nat}Ni(p,x)^{24}Na$ production

Subfields 5 through 8 define the quantity measured. They are separated by commas; only subfield 6 is always present. Simple examples for complete REACTION codes are:

`REACTION (92-U-235(N,F),,SIG)` = fission cross section $\sigma_{n,f}$ for ^{235}U

`REACTION (28-NI-60(N,P)29-CU-60,,DA)` =
$d\sigma/d\Omega$ for the reaction $^{60}Ni(n,p)^{60}Cu$

The **numerical part** of a subentry consists of the data table itself (DATA section) and, most often, of one or more constant parameters given in the COMMON section. In both cases, it is structured in columns with a constant field length of 11 characters. All numerical columns are headed and defined by

- **column headings**, for example
  - EN for incident particle energy
  - DATA for the actual data defined under the keyword REACTION
  - DATA-ERR for the uncertainty of the data, etc.

- **data units**, such as
  - EV for electron-Volts
  - MB for millibarns, etc.

EXFOR examples

The following pages show examples of two EXFOR entries. The examples are given in two formats, the basic **EXFOR Exchange format**, and the **Interpreted "Exfor+"** format, where many of the abbreviations used for bibliographic references, quantities, detectors,etc., are expanded to full English text. These explanatory lines added by the "Interepreted EXFOR" output program are **labelled with a # sign** at the beginning.

(For examples of other user output formats see Chapter III.)

Both example entries contain **constant parameters** in COMMON sections. Note that a COMMON parameter given in subentry 2 is valid only for this particular subentry, while a COMMON parameter given in subentry 1 is valid for all of the following subentries.

In any retrieval, **always subentry 1**, which contains the information common to the whole entry, is output together with all those other subentries which satisfy the retrieval criteria. One of the examples shown here (accession number 31439) contains subentries 1, 5, and 6, which is sufficient to demonstrate a complete set of information output for a typical retrieval.

Subentry 31439.006 has a **more complex structure** in two respects:

- The table has **data for 3 reactions** (quantities). (This is possible if the data are integrally related to each other and depend on the same independent variables; here it is the cross sections for production of the ground state and for the metastable state of the same product, and the related isomeric ratio). In such cases, the 3 REACTION codes are linked with the appropriate DATA columns by means of **"pointers"**, in this case the flags "1", "2" and "3". Such pointers may appear in EXFOR also in other places to link related peaces of information.
- The data table has **8 columns** (the data for all 3 reactions and the monitor reaction, each with its related uncertainty). Since the Exchange format allows only 6 physical columns per line, the "logical lines" are broken – in this case into a first line of 6 columns and a second line with the remaining 2 columns. This is inconvenient for the human reader, and the Interpreted EXFOR+ format outputs all 8 columns side by side.

EXFOR Example 1 *(Exchange Format)*

Accession number

```
ENTRY            C1582   20071127   20080305   20080228       C083C1582000    1
SUBENT        C1582001   20071127   20080305   20080228       C083C1582001    1
BIB                 10         20                                 C1582001    2
TITLE      Astrophysically important 31S states studied with      C1582001    3
           the 32S(p,d)31S reaction                               C1582001    4
AUTHOR     (Z.Ma,D.W.Bardayan,J.C.Blackmon,R.P.Fitzgerald,        C1582001    5
           M.W. Guidry,W.R.Hix,K.L.Jones,R.L.Kozub, R.J.Livesay,  C1582001    6
           M.S.Smith,J.S.Thomas,And D.W.Visser)                   C1582001    7
INSTITUTE  (1USATEN,1USAORL,1USANCA,1USATTU,1USACSM)              C1582001    8
           (1USAUSA) Rutgers University, Piscataway, New Jersey   C1582001    9
REFERENCE  (J,PR/C,76,15803,2007)                                 C1582001   10
FACILITY   (VDGT,1USAORL) HRIBF Facility                          C1582001   11
SAMPLE     ZnS target with a thickness of 285 microgram/cm2       C1582001   12
           deposited on 1 microgram/cm2 carbon for measurements   C1582001   13
           at laboratory angles 17-48 deg. ZnS target with a      C1582001   14
           thickness of 280 microgram/cm2 on 5 microgram/cm2      C1582001   15
           carbon backing at laboratory angles 31-75 deg          C1582001   16
DETECTOR   (SISD) Silicon detector array SIDAR operated in        C1582001   17
           telescope mode with 300-micron-thick dE detectors      C1582001   18
           backed by 500-micron-thick E detectors                 C1582001   19
METHOD     (EDE)                                                  C1582001   20
ERR-ANALYS (DATA-ERR) No information                              C1582001   21
HISTORY    (20071127C) compiled by S.H.                           C1582001   22
ENDBIB              20                                            C1582001   23
COMMON               1          2                                 C1582001   24
EN                                                                C1582001   25
MEV                                                               C1582001   26
32.0                                                              C1582001   27
ENDCOMMON            3                                            C1582001   28
ENDSUBENT           27                                            C158200199999
```

Common parameter for whole entry

Subaccession number

```
SUBENT        C1582002   20071127   20080305   20080228       C083C1582002    1
BIB                  2          2                                 C1582002    2
REACTION   (16-S-32(P,D)16-S-31,PAR,DA)                           C1582002    3
STATUS     (CURVE) Data taken from Fig 3 in the reference         C1582002    4
ENDBIB               2                                            C1582002    5
COMMON               1          3                                 C1582002    6
E-EXC                                                             C1582002    7
KEV                                                               C1582002    8
4085.0                                                            C1582002    9
ENDCOMMON            3                                            C1582002   10
DATA                 3          2                                 C1582002   11
ANG        DATA       DATA-ERR                                    C1582002   12
ADEG       B/SR       B/SR                                        C1582002   13
  1.857E+01  6.427E-04  8.978E-05                                 C1582002   14
  2.196E+01  5.616E-04  8.567E-05                                 C1582002   15
ENDDATA              4                                            C1582002   16
ENDSUBENT           15                                            C158200299999
```

Common parameter for subentry 2

Data defined under REACTION

```
SUBENT        C1582003   20071127   20080305   20080228       C083C1582003    1
BIB                  2          2                                 C1582003    2
REACTION   (16-S-32(P,D)16-S-31,PAR,DA)                           C1582003    3
STATUS     (CURVE) Data taken from Fig 3 in the reference         C1582003    4
ENDBIB               2                                            C1582003    5
COMMON               1          3                                 C1582003    6
E-EXC                                                             C1582003    7
KEV                                                               C1582003    8
4451.0                                                            C1582003    9
ENDCOMMON            3                                            C1582003   10
DATA                 3          8                                 C1582003   11
ANG        DATA       DATA-ERR                                    C1582003   12
ADEG       B/SR       B/SR                                        C1582003   13
  1.869E+01  4.963E-05  7.643E-06                                 C1582003   14
  2.042E+01  6.343E-05  7.943E-06                                 C1582003   15
```

Common parameter for subentry 3

```
  2.241E+01  5.487E-05  7.930E-06                                   C1582003   16
  2.440E+01  5.132E-05  6.427E-06                                   C1582003   17
  2.663E+01  5.075E-05  5.858E-06                                   C1582003   18
  2.837E+01  5.548E-05  5.854E-06                                   C1582003   19
  4.798E+01  5.306E-05  5.066E-06                                   C1582003   20
  5.071E+01  4.800E-05  4.583E-06                                   C1582003   21
ENDDATA             10                                              C1582003   22
ENDSUBENT           21                                              C158200399999
ENDENTRY             3                                              C158299999999
```

EXFOR Example 1 *(EXFOR+ format)*

Lines starting with # are explanatory lines added by the "Interpreted EXFOR" output program

```
ENTRY             C1582   20071127   20080305   20080228       C083
SUBENT         C1582001   20071127   20080305   20080228       C083
BIB                  10         20
TITLE      Astrophysically important 31S states studied with
           the 32S(p,d)31S reaction
AUTHOR     (Z.Ma,D.W.Bardayan,J.C.Blackmon,R.P.Fitzgerald,
           M.W. Guidry,W.R.Hix,K.L.Jones,R.L.Kozub, R.J.Livesay,
           M.S.Smith,J.S.Thomas,And D.W.Visser)
INSTITUTE  (1USATEN,1USAORL,1USANCA,1USATTU,1USACSM)
           (1USAUSA) Rutgers University, Piscataway, New Jersey
           #(1USACSM) Colorado School of Mines, Golden, CO, USA
           #(1USANCA) University of North Carolina, Chapel Hill, NC, USA
           #(1USAORL) Oak Ridge National Laboratory, Oak Ridge, TN, USA
           #(1USATEN) University of Tennessee, Knoxville, TN, USA
           #(1USATTU) Tennessee Technical Univ., Cookeville, TN, USA
           #(1USAUSA) United States of America, USA
```

Interpreted abbreviations

```
REFERENCE  (J,PR/C,76,15803,2007)
           # (J,PR/C,76,15803,2007)  Journ.: Physical Review, Part C, Nuclear Physics, Vol.76, p.15803
(2007)  USA
           #+      #URL=http://publish.aps.org/abstract/PRC/v76/p15803
```

URL of electronic journal article

```
FACILITY   (VDGT,1USAORL) HRIBF Facility
           #(VDGT) Tandem van de Graaff
           #(1USAORL) Oak Ridge National Laboratory, Oak Ridge, TN, USA
```

Interpreted abbreviations

```
SAMPLE     ZnS target with a thickness of 285 microgram/cm2
           deposited on 1 microgram/cm2 carbon for measurements
           at laboratory angles 17-48 deg. ZnS target with a
           thickness of 280 microgram/cm2 on 5 microgram/cm2
           carbon backing at laboratory angles 31-75 deg
DETECTOR   (SISD) Silicon detector array SIDAR operated in
           telescope mode with 300-micron-thick dE detectors
           backed by 500-micron-thick E detectors
           #(SISD) Silicon strip detector
METHOD     (EDE)
           #(EDE) Particle identification by `E/Delta E` measurement
ERR-ANALYS (DATA-ERR) No information
HISTORY    (20071127C) compiled by S.H.
ENDBIB               20
COMMON                1          3
EN
MEV
32.
ENDCOMMON             3
ENDSUBENT            27
SUBENT         C1582002   20071127   20080305   20080228       C083
BIB                   2          2
REACTION   (16-S-32(P,D)16-S-31,PAR,DA)
           #(16-S-32(P,D)16-S-31,PAR,DA)  Quantity: [DAP] Partial differential cross section d/dA
STATUS     (CURVE) Data taken from Fig 3 in the reference
ENDBIB                2
COMMON                1          3
E-EXC
KEV
4085.
ENDCOMMON             3
DATA                  3          2
ANG        DATA       DATA-ERR
ADEG       B/SR       B/SR
18.57      6.427E-4   8.978E-5
21.96      5.616E-4   8.567E-5
ENDDATA               4
ENDSUBENT            15
SUBENT         C1582003   20071127   20080305   20080228       C083
BIB                   2          2
REACTION   (16-S-32(P,D)16-S-31,PAR,DA)
           #(16-S-32(P,D)16-S-31,PAR,DA)  Quantity: [DAP] Partial differential cross section d/dA
STATUS     (CURVE) Data taken from Fig 3 in the reference
ENDBIB                2
```

Interpreted abbreviation of quantity

```
COMMON                1          3
E-EXC
KEV
4451.
ENDCOMMON             3
DATA                  3          8
ANG        DATA       DATA-ERR
ADEG       B/SR       B/SR
18.69      4.963E-5   7.643E-6
20.42      6.343E-5   7.943E-6
22.41      5.487E-5   7.93E-6
24.4       5.132E-5   6.427E-6
26.63      5.075E-5   5.858E-6
28.37      5.548E-5   5.854E-6
47.98      5.306E-5   5.066E-6
50.71      4.8E-5     4.583E-6
ENDDATA              10
ENDSUBENT            21
ENDENTRY              3
```

EXFOR Example 2 *(Exchange format)*

Accession number

```
ENTRY           31439     940712              2005026        000031439000    1
SUBENT       31439001     940712              20050926       000031439001    1
BIB                11         14                                 31439001    2
TITLE      Activation cross sections and isomeric ratios in reac- 31439001    3
           tions induced by 14.5 MeV neutrons in Sm-152, Sm-154   31439001    4
           and Hf-178.                                            31439001    5
AUTHOR     (A.KIROV,N.NENOFF,E.GEORGIEVA,C.NECHEVA,I.EPHTIMOV)    31439001    6
INSTITUTE  (3BULSOF)                                              31439001    7
REFERENCE  (J,ZP/A,245,(3),285,9305)                              31439001    8
FACILITY   (CCW)                                                  31439001    9
INC-SOURCE (D-T)                                                  31439001   10
METHOD     (ACTIV)                                                31439001   11
DETECTOR   (HPGE)                                                 31439001   12
ERR-ANALYS No error analysis given.                               31439001   13
STATUS     Data are from table 1 of Z. Phys. A, vol. 345, no. 3,  31439001   14
           pp. 285-292.                                           31439001   15
HISTORY    (940610C)  HW                                          31439001   16
ENDBIB             14                                             31439001   17
COMMON              2          3                                  31439001   18
EN         EN-ERR                                                 31439001   19
MEV        MEV                                                    31439001   20
14.54      0.24                                                   31439001   21
ENDCOMMON           3                                            31439001   22
ENDSUBENT          21                                             3143900199999
SUBENT       31439005     940712                 50926           000031439005    1
BIB                 6         14                                  31439005    2
REACTION   (62-SM-154(N,D)61-PM-153,,SIG)                         31439005    3
DECAY-DATA (61-PM-153,5.3MIN,DG,127.3,.14)                        31439005    4
SAMPLE     Samariumoxide powder enriched to 99.2% Sm-154, mixed   31439005    5
           with ironoxide powder in precise measured weight       31439005    6
           ratio. 200 mg of the mixture was placed and sealed in  31439005    7
           polyethylene capsules in the form of cylinders 10 mm   31439005    8
           in diameter and few mm high.                           31439005    9
MONITOR    (62-SM-154(N,A)60-ND-151,,SIG)                         31439005   10
MONIT-REF  (,S.M.QAIM+,B,HB.SPEC,3,141,81)                        31439005   11
CORRECTION Corrections have been made for coincidence summing     31439005   12
           and ranged between 2 and 48%. The coincidence summing  31439005   13
           correction factors for the lines of interest were ob-  31439005   14
           tained from the known decay schemes and the total      31439005   15
           efficiency of the detector.                            31439005   16
ENDBIB             14                                             31439005   17
NOCOMMON                                                          31439005   18
DATA                4          1                                  31439005   19
DATA       ERR-T      MONIT      MONIT-ERR                        31439005   20
MB         MB         MB         MB                               31439005   21
.43        .08        1.9        0.4                              31439005   22
ENDDATA             3                                             31439005   23
ENDSUBENT          22                                             3143900599999
SUBENT       31439006     940712              20050926       000031439006    1
BIB                 6         21                                  31439006    2
REACTION  1(72-HF-178(N,P)71-LU-178-G,,SIG)                       31439006    3
          2(72-HF-178(N,P)71-LU-178-M,,SIG)
          3(72-HF-178(N,P)71-LU-178-M/G,,SIG/RAT)
```

Common parameters for whole entry

Subaccession number

3 reactions (quantities) given in one subentry, labelled with "pointers" 1, 2, 3

```
DECAY-DATA (71-LU-178-M,22.9MIN,DG,213.4,.809,
                             DG,325.6,.939,                       31439006    7
                             DG,426.4,.969,                       31439006    8
                             DG,331.7,.116)                       31439006    9
           (71-LU-178-G,28.1MIN,DG,1340.8,.0474)                  31439006   10
SAMPLE     Hafniumoxide powder enriched to 92.4% Hf-178, mixed    31439006   11
           with ironoxide powder in precise measured weight       31439006   12
```

```
           ratio. 200 mg of the mixture was placed and sealed in 31439006   13
           polyethylene capsules in the form of cylinders 10 mm  31439006   14
           in diameter and few mm high.                          31439006   15
MONITOR    (26-FE-56(N,P)25-MN-56,,SIG)                          31439006   16
MONIT-REF  (30675002,A.ANTOV+,J,BJP,10,(6),601,83)               31439006   17
           (,N.NENOFF+,J,GUS,78,35,84)                           31439006   18
CORRECTION Corrections have been made for coincidence summing    31439006   19
           and ranged between 2 and 48%. The coincidence summing 31439006   20
           correction factors for the lines of interest were ob- 31439006   21
                fro                                              31439006   22
           efficiency of the detector.                           31439006   23
ENDBIB             21                                            31439006   24
NOCOMMON                                                         31439006   25
DATA                8          1                                 31439006   26
DATA      1ERR-T      1DATA      2ERR-T      2DATA      3ERR-T      331439006   27
MONIT      MONIT-ERR                                             31439006   28
MB         MB         MB         MB         NO-DIM     NO-DIM    31439006   29
MB         MB                                                    31439006   30
1.8        0.4         .98        .08       0.54       0.13      31439006   31
110.9      2.8                                                   31439006   32
ENDDATA             6                                            31439006   33
ENDSUBENT          32                                            3143900699999
ENDENTRY            3                                            3143999999999
```

Data for REACTION 1 — ***Data for REACTION 2*** — ***Data for REACTION 3***

DATA table with 8 fields (columns). Since the format allows only 6 columns per line, each logical line is split into two physical lines, one with 6 fields and another one with the remaining 2 fields. The format allows tables with up to 18 fields.
Compare display of the same entry in EXFOR+ format on following pages.

EXFOR Example 2 *(EXFOR+ format)*

Lines starting with # are explanatory lines added by the "Interpreted EXFOR" output program

```
ENTRY            31439      940712              20050926       0000
SUBENT        31439001      940712              20050926       0000
BIB                 11          14
TITLE      Activation cross sections and isomeric ratios in reac-
           tions induced by 14.5 MeV neutrons in Sm-152, Sm-154
           and Hf-178.
AUTHOR     (A.KIROV,N.NENOFF,E.GEORGIEVA,C.NECHEVA,I.EPHTIMOV)
INSTITUTE  (3BULSOF)
           #(3BULSOF) Univ.of Sofia, Bulgaria
REFERENCE  (J,ZP/A,245,(3),285,9305)
           # (J,ZP/A,245,(3),285,9305)  Journ.: Zeitschrift fuer Physik, Section A, Vol.245, Issue.3, p.285
(1993)  Germany
FACILITY   (CCW)
           #(CCW) Cockcroft-Walton accelerator
INC-SOURCE (D-T)
METHOD     (ACTIV)
           #(ACTIV) Activation
DETECTOR   (HPGE)
           #(HPGE) Hyperpure Germanium detector
ERR-ANALYS No error analysis given.
STATUS     Data are from table 1 of Z. Phys. A, vol. 345, no. 3,
           pp. 285-292.
HISTORY    (940610C)  HW
ENDBIB              14
COMMON               2          3
EN         EN-ERR
MEV        MEV
14.54      0.24
ENDCOMMON            3
ENDSUBENT           21
SUBENT        31439005      940712              20050926       0000
BIB                  6          14
REACTION   (62-SM-154(N,D)61-PM-153,,SIG)
           #(62-SM-154(N,D)61-PM-153,,SIG)  Quantity: [CS] Cross section
DECAY-DATA (61-PM-153,5.3MIN,DG,127.3,.14)
SAMPLE     Samariumoxide powder enriched to 99.2% Sm-154, mixed
           with ironoxide powder in precise measured weight
           ratio. 200 mg of the mixture was placed and sealed in
           polyethylene capsules in the form of cylinders 10 mm
           in diameter and few mm high.
MONITOR    (62-SM-154(N,A)60-ND-151,,SIG)
MONIT-REF  (,S.M.QAIM+,B,HB.SPEC,3,141,81)
CORRECTION Corrections have been made for coincidence summing
           and ranged between 2 and 48%. The coincidence summing
           correction factors for the lines of interest were ob-
           tained from the known decay schemes and the total
           efficiency of the detector.
ENDBIB              14
NOCOMMON
DATA                 4          1
DATA       ERR-T      MONIT      MONIT-ERR
MB         MB         MB         MB
.43        .08        1.9        0.4
ENDDATA              3
ENDSUBENT           22
SUBENT        31439006      940712              20050926       0000
BIB                  6          21
REACTION  1(72-HF-178(N,P)71-LU-178-G,,SIG)
          2(72-HF-178(N,P)71-LU-178-M,,SIG)
          3(72-HF-178(N,P)71-LU-178-M/G,,SIG/RAT)
           #(72-HF-178(N,P)71-LU-178-G,,SIG)   Quantity: [CS] Cross section
           #(72-HF-178(N,P)71-LU-178-M,,SIG)   Quantity: [CS] Cross section
           #(72-HF-178(N,P)71-LU-178-M/G,,SIG/RAT)   Quantity: [CS] Cross section ratio
DECAY-DATA (71-LU-178-M,22.9MIN,DG,213.4,.809,
                                DG,325.6,.939,
                                DG,426.4,.969,
                                DG,331.7,.116)
           (71-LU-178-G,28.1MIN,DG,1340.8,.0474)
```

Interpreted abbreviations (pointing to the # lines for REFERENCE, FACILITY and DETECTOR)

Interpreted abbreviation of quantity (pointing to the # line of REACTION in SUBENT 31439005)

Interpreted abbreviations of quantities (pointing to the # lines of REACTION in SUBENT 31439006)

```
SAMPLE     Hafniumoxide powder enriched to 92.4% Hf-178, mixed
           with ironoxide powder in precise measured weight
           ratio. 200 mg of the mixture was placed and sealed in
           polyethylene capsules in the form of cylinders 10 mm
           in diameter and few mm high.
MONITOR    (26-FE-56(N,P)25-MN-56,,SIG)
MONIT-REF  (30675002,A.ANTOV+,J,BJP,10,(6),601,83)
           (,N.NENOFF+,J,GUS,78,35,84)
CORRECTION Corrections have been made for coincidence summing
           and ranged between 2 and 48%. The coincidence summing
           correction factors for the lines of interest were ob-
           tained from the known decay schemes and the total
           efficiency of the detector.
ENDBIB              21
NOCOMMON
DATA                 8          1          8
DATA       1ERR-T     1DATA      2ERR-T     2DATA      3ERR-T     3MONIT      MONIT-ERR
MB         MB         MB         MB          NO-DIM     NO-DIM     MB          MB
1.8        0.4         .98        .08        0.54       0.13       110.9       2.8
ENDDATA              6
ENDSUBENT           32
ENDENTRY             3
```

Proper display of table with more than 6 columns

History of EXFOR

Systematic collection of experimental neutron nuclear data started in the 1960s at four data centres, each using its own data storage and retrieval system:

- Brookhaven National Laboratory (BNL), USA (formerly Sigma Center, now NNDC - National Nuclear Data Center), using “SCISRS”;
- OECD Nuclear Energy Agency, France (formerly Neutron Nuclear Data Centre, Saclay, now NEA Data Bank, Gif-sur-Yvette), using “NEUDADA”;
- International Atomic Energy Agency (IAEA), Vienna, Austria (formerly Nuclear Data Unit, now Nuclear Data Section), using “DASTAR”;
- Fiziko-Energeticheskij Institut (IPPE) Obninsk, Russia, (Center Jadernykh Dannykh), using a USSR computer system incompatible to Western computers.

It became obvious that these activities required coordination, and through discussions held between software experts and physicists from Saclay, Vienna, Livermore and Brookhaven, a joint nuclear data **exchange format** “EXFOR” was formulated in its initial form at a panel meeting in Brookhaven in February 1969. It was accepted at an IAEA Consultant’s Meeting in Moscow in November 1969, and in 1970 the system went into operation, including the Obninsk Center, which solved the compatibility problem to USSR computers. Thus an East-West information exchange on magnetic tapes was initiated for the first time. Data compiled at any one of the centres were speedily transmitted to the other centres, making them available to the fast increasing community of data users throughout the world.

As the name suggests, EXFOR was designed to be the format of data exchange between centres. The centres were free to use different formats for internal storage and/or for output retrievals made available to users.

Subsequently, data compiled earlier were converted to EXFOR, and in the 1970s, the scope was widened to include also charged-particle induced nuclear data and photonuclear data. For this purpose, the original format was modified, and additional nuclear data centres joined the network. A list of the cooperating data centres is given on the following page.

The data retrieval services to users were, for many years, done centrally by data centre staff who received specific data retrieval requests by mail and in turn mailed output listings on paper or magnetic tapes back to the users. From the late 1980s, online retrieval systems, using Telnet or other remote access systems, started to be used for nuclear data in parallel to the central retrieval services, including EXFOR (1988 - NNDC, 1992 – IAEA-NDS). In the late 1990s, web-based retrieval systems were introduced (starting 1997 at IAEA-NDS) and are continuously being refined.

While the network of nuclear reaction data centres has been coordinated by the IAEA Nuclear Data Section since its start, each participating centre independently maintained and updated its EXFOR master file. This sometimes led to occasional differences in the database contents due to differences in the synchronisation of updates or other reasons. Therefore, a common global EXFOR master file has been introduced in 2005 which is maintained centrally by IAEA-NDS and is the basis for the worldwide EXFOR operations and services.

The Network of Nuclear Reaction Data Centres

National, regional and specialized nuclear reaction data centres, coordinated by the International Atomic Energy Agency, cooperate in the compilation, exchange and dissemination of nuclear reaction data, in order to meet the requirements of nuclear data users in all countries. At present, the following data centres participate in the network:

NNDC	US National Nuclear Data Center, Brookhaven, USA
NEA-DB	OECD/NEA Nuclear Data Bank, Issy-les-Moulineaux, France
NDS	IAEA Nuclear Data Section
CJD	Centr Jadernykh Dannykh (= Nuclear Data Centre), Obninsk, Russia
CAJaD	Russian Nuclear Structure and Reaction Data Centre, Moscow, Russia
CDFE	Centr Dannykh Fotojadernykh Eksperimentov (= Centre for Photonuclear Experiments Data), Moscow, Russia
CNDC	China Nuclear Data Center, Beijing, China
JAEA	Nuclear Data Center of the Japan Atomic Energy Agency (formerly Japan Atomic Energy Research Institute, JAERI), Tokai-Mura, Japan
JCPRG	Japan Charged-Particle Nuclear Reaction Data Group, Hokkaido University, Sapporo, Japan
ATOMKI	ATOMKI Charged-Particle Nuclear Reaction Data Group, Debrecen, Hungary
UkrNDC	Ukrainian Nuclear Data Center, Institute for Nuclear Research, Kyiv, Ukraine
CNPD	Center of Nuclear Physics Data, Russian Federal Nuclear Center, RFNC-VNIIEF, Sarov, Russia
KAERI/NDEL	Nuclear Data Evaluation Laboratory, Korea Atomic Energy Research Institute, Yusong, Taejon, Republic of Korea

A detailed description of the objectives of the network and the contributions of each Centre to these activities are given in INDC(NDS)-401 (Rev.4), "The Nuclear Reaction Data Centres Network".

A summary of the network's objectives, and hyperlinks to all participating centres can be found on the NRDC web page, see http://www-nds.iaea.org/nrdc/.

EXFOR Retrieval Websites

- IAEA-NDS, Vienna, Austria (maintains global master file):
  http://www-nds.iaea.org/exfor/exfor00.htm

- NNDC (Brookhaven, USA):
  http://www.nndc.bnl.gov/exfor/exfor00.htm

- NEA Data Bank (Issy-les-Moulineaux, France):
  http://www.nea.fr/html/dbdata/x4/

- CDFE (Moscow, Russia):
  http://cdfe.sinp.msu.ru/exfor/index.php

- JCPRG (Sapporo, Japan):
  http://www.jcprg.org/exfor/

Citation Guidelines

When citing data extracted from EXFOR, always both, the original reference, and the EXFOR dataset with its retrieval source should be cited.

Example:

A.B. Author, et al., ***J. Nucl. Phys.*** 12, *345* (1979). Data taken from the EXFOR database, file EXFOR 12345.002 dated April 5, 1980, retrieved from the IAEA Nuclear Data Services website.

To reference the EXFOR database in general, the present report (IAEA-NDS-206, June 2008) may be used.

II. Overview of the EXFOR Exchange Format

General Structure of the Exchange Format

Nuclear reaction data is exchanged within the EXFOR System on EXFOR exchange files (transmissions), sometimes also called TRANS files.

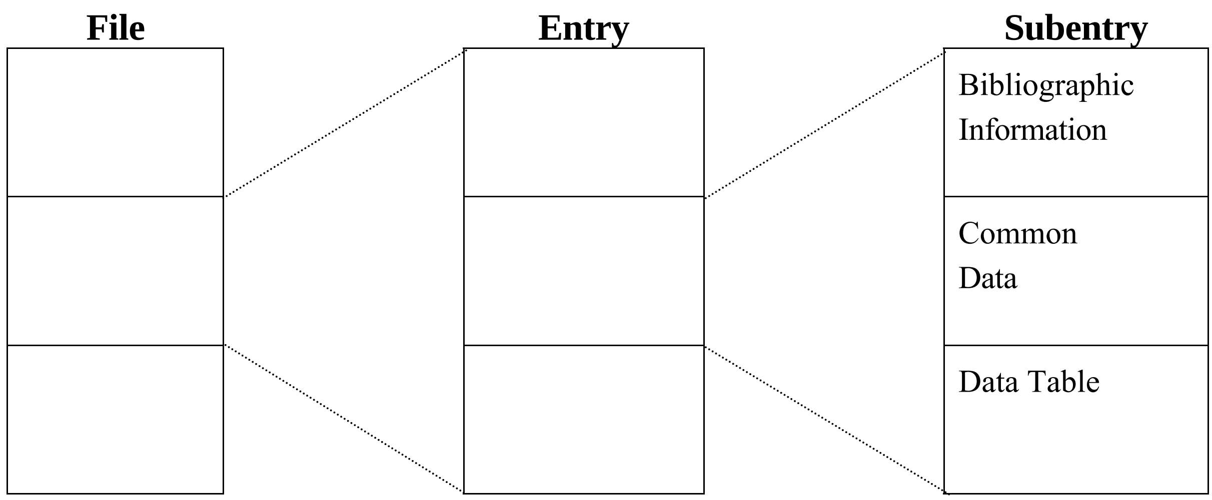
This section describes the general structure and the general format of an EXFOR exchange file. More specific information may be found in the following sections.

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:

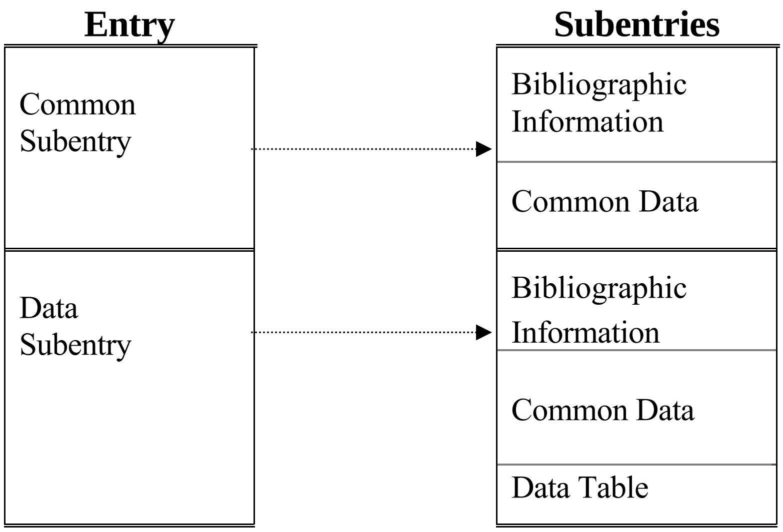
- bibliographic, descriptive and bookkeeping information (hereafter called BIB information),
- common data that applies to all data throughout the subentry , and
- a data table.

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

Identification of Files, Entries, and Subentries

In order to track, access, and identify data within the EXFOR Exchange System, the following labelling systems have been adopted for files, entries and subentries.

- An EXFOR Exchange File is labelled using a four-character file identification *(only in files for exchange between data centres, not for user retrievals)*
- An entry is labelled using a five-character accession number.
- A subentry is labelled using an eight-character subaccession number.

Each of these labels includes a **center-identification character** as the first character in the string. The table below lists the center-identification characters that have been assigned. These characters define both the center at which the information was compiled and the type of data compiled. (Neutron, charged-particle, and photonuclear reaction data are compiled in separate entries with appropriate identification, even if they were reported in the same reference.)

Center Identification Characters		
1	NNDC (Brookhaven)	Neutron nuclear data
2	NEA-DB (Paris)	Neutron nuclear data
3	NDS (Vienna)	Neutron nuclear data, including also compilations from CNDC, UkrNDC and India
4	CJD (Obninsk)	Neutron nuclear data
A	CAJaD (Moscow)	Charged-particle nuclear data, including also earlier compilations from CNPD
B	KaChaPaG (Karlsruhe)	Charged-particle nuclear data (extinct centre)
C	NNDC (Brookhaven)	Charged-particle nuclear data
D	NDS (Vienna)	Charged-particle nuclear data, including also compilations from ATOMKI, UkrNDC and India
E	JCPRG (Sapporo)	Charged-particle nuclear data
F	CNPD (Sarov)	Charged-particle nuclear data
G	NDS (Vienna)	Photonuclear data, including also compilations from UkrNDC
J	JCPRG (Sapporo)	Charged-particle nuclear data for projectiles with nonpositive baryon number
K	JCPRG (Sapporo)	Photonuclear data
L	NNDC (Brookhaven)	Photonuclear data
M	CDFE (Moscow)	Photonuclear data
O	NEA-DB (Paris)	Charged-particle nuclear data
P	NNDC (Brookhaven)	Charged-particle nuclear data from MacGowen file
R	RIKEN (Wako, Japan)	Charged-particle nuclear data (extinct centre)
S	CNDC (Beijing)	Charged-particle nuclear data
T	CNPD/NNDC	Charged-particle nuclear data
V	NDS (Vienna)	Special use for selected evaluated neutron data 'VIEN' file (extinct series)

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 sections. 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 presently not used.

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

System Identifiers

Each of the following basic system identifiers refers to one of the hierarchy of units contained on an exchange file. Each of the following system identifiers indicates the beginning of one of these sections.

TRANS	- A file is the unit *(only on files for exchange between data centres. In user retrieval files this identifier may be missing or be replaced by another keyword such as 'REQUEST')*
ENTRY	- An entry (work) is the unit
SUBENT	- A subentry (data set) is the unit
BIB	- The Bibliographic Information section (hereafter referred to as the BIB section) of a complete work or sub-work is the unit
COMMON	- The Common Data section of a complete work or sub-work is the unit
DATA	- The Data Table section of a sub-work is the unit

These basic system identifiers may be combined with the modifiers

NO
END

to indicate three conditions:

- The beginning of a unit (basic system identifier only)
- The end of a unit (modifier **END** preceding the basic system identifier)
- A positive indication that a unit is intentionally omitted (modifier **NO** preceding the basic system identifier)

The following system identifiers are defined.

1. **A file is:**

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

c = the center-identification character,
xxx = 3-digit sequence number for centre-to-centre transmission files,
yyyymmdd = date on which the transmission 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.

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 may be included in the file *(should appear only on centre-to-centre transmission files)*:

NOSUBENT N1 N2

N1 = 8-character subaccession number.

N2 = Date of last alter.

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

BIB, COMMON and DATA Sections

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 67-79:	record identification field.

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 page 29).

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 (see page 29) are present, they appear on the first record of the information to which they are attached and are not repeated on continuation records.

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 that 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.

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.

<u>COMMON Section</u>

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 below). 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						

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.

Pointers applied to a BIB keyword 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.

Nuclide and reaction specification

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
- *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; may sometimes be omitted)
  - M if only one metastable state is regarded
  - M1 for the first metastable state
  - M2 for the second, *etc.*
  - L if only one quasi-metastable state[1] is regarded
  - L1 for the first quasi-metastable state, *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 a special compounds dictionary, or the general code for a compound of the form *Z*-*S*-CMP. The element coded is the major component of the compound.

Examples:

`26-FE-CMP`	Iron compound (details given in free text)
`1-H-WTR`	Water

Reaction Specification

The reaction and quantity for the data coded in the data table is specified using the information-identifier keyword REACTION, therefore, this keyword must always be present in a data set. The keyword REACTION defines the data given in the DATA section under the heading DATA or a similar heading such as DATA-MIN, DATA-MAX, etc. The general format of the code is **(reaction, quantity, data-type)**.

[1] These are states with a measurable half-life of less than 0.1 seconds

Reaction field. The reaction field consists of 4 subfields.

SF1. Target nucleus. Contains either:

a) a nuclide code.
   A = 0 denotes natural isotopic mixture
   -G for ground state is **not** used in this field
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 33
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 particle code from Dictionary 33 which may be preceded by a multiplicity factor, whose value may be 2→99, *e.g.*, 4A.
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`
   `X+N`

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

SF4. Reaction Product. 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 (if the product is not defined, as for sum reactions such as absorption or total, or for resonance parameters)
  Example: `(26-FE-56(N,EL),,WID)`

- or a nuclide code
  Examples: `(51-SB-123(N,G)51-SB-124-M1+M2/T)`
  `(28-NI-0(N,X)0-G-0,,SIG)` γ production cross section (for total production of gammas or light particles, the particles are written in SF4 using the Z-S-A formalism)

- or, a variable nucleus code:
  Example: `(92-U-235(N,F)ELEM/MASS,CUM,FY)`
  (Z and A of the various products are given in the DATA table under the headings ELEMENT and MASS.)

- or, if the number of particles emitted is entered into the data table using the data heading PART-OUT, it contains the code NPART.

  Example: `(79-AU-197(92-U-238,X)NPART,NUM,SIG,HF)` Cross section for a given number of heavy fragments emitted; the number of fragments is given in the DATA section under the heading PART-OUT.

Quantity consists of four subfields, each separated by a comma. All combinations of codes allowed in the quantity field are given in Dictionary 236.

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

SF6 Parameter. Indicates the reaction parameter given, *e.g.*, differential cross section.

SF7 Particle Considered. Indicates to which of several outgoing particles the quantity refers.[2] When more than one particle or nuclide is entered, they are separated by a slash; if they are correlated particles, they are separated by a plus sign.

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. The default value is 'experimental', therefore this field is very often omitted.

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.

[2] 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.

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.[3]

Example:

```
BIB
REACTION     (…(…,F)ELEM/MASS,IND,FY)
DECAY-DATA   ((1.)60-ND-138,5.04HR,DG,328.,0.65)
             ((2.)60-ND-141,2.49HR,DG,……………………)
ENDBIB
NOCOMMON
DATA
EN           ELEMENT     MASS        ISOMER     DATA        DECAY-FLAG
MEV          NO-DIM      NO-DIM      NO-DIM     PC/FIS      NO-DIM
              60.         138.                   …           1.
              60.         140.                   …           2.
 …            61.         148.         0.        …
 …            61.         148.         1.        …
 …            61.         149.                   …
 …            62.         149.                   …
```

Variable Number of Emitted Particles

If the data table contains yields or production cross sections as a function of the number of secondary particles, and the number of particles is entered as a variable in the data table, SF4 of the REACTION keyword contains the code NPART, SF5 contains the code NUM, and SF7 contains the particle considered.

Example:

```
BIB
REACTION     (…(…,X)NPART,NUM,P)
…
ENDBIB
NOCOMMON
DATA
EN           PART-OUT    DATA
MEV          NO-DIM      B
…
…
…
ENDDATA
```

[3] 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.

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.
((------)-(-----))	Difference between 2 or more quantities.
((------)*(-----))	Product of 2 or more quantities.
((------)/(-----))	Ratio of 2 or more quantities.
((------)//(-----))	Ratio of 2 quantities, where the numerator and denominator refer to different values for one or more independent variables.
((------)=(-----))	Tautologies.

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
```

Information Identifier Keywords

This section 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.

COVARIANCE. Gives covariance information provided by the experimentalist, or to flag the existence of a covariance data file. See page 44 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[4]. 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 is omitted, its parentheses are also omitted.

Nuclide field. A nuclide code. For ground states, the use of the extension G is optional.

Half-life field. The half-life of the nuclide specified, coded as a floating-point number, followed by a unit code with the dimension 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 33. 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 below).

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)

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

```
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)
```

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, instead of the flag field, there may be a heading field which links the data to the heading of the monitor value, if more than one monitors are given.

Example:

```
DECAY-MON  ((MONIT1)26-SC-46-G,83.81D,DG,889.3,0.99984,
                                     DG,1120.5,0.99870)
           ((MONIT2)26-SC-47,3.345D,DG,159.4,0.683)
```

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)`

Similarly, the code `PS` (position-sensitive detector) will be followed by a specific detector code.

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[5] 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
```

EXP-YEAR. 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)`

FACILITY. 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)
```

FLAG. Provides information to specific lines in a data table, similar to a footnote.

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
```

HALF-LIFE. 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)
```

[5] Root means that the data heading given also defines the heading preceded by + or -.

HISTORY. 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.
```

INC-SOURCE. 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))
```

INC-SPECT. 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, level 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.

Isobaric analog state number. The level identifier IAS-NUMB= followed by the level number of the isobaric analog state, *n*, where *n* has a numerical value which also appears in the data section under the data heading IAS-NUMB.

Level properties. Properties for the excited state, each preceded by a subfield identification. At least one of the subfields must be present.

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 its 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[6] 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 33.
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 when only the reaction is known.

Example:

```
MONITOR   (92-U-235(N,F),,SIG)
```

If more than one monitor is given, they are linked to the respective columns in the COMMON or DATA section either with pointers, or using the heading field.

---

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

Example:
```
MONITOR ((MONIT1)1-H-1(N,EL),,SIG)
        ((MONIT2)13-AL-27(N,A)11-NA-24,,SIG))
```

<u>MONIT-REF</u>. 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)

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

<u>Subaccession Number Field</u>: 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. This field may be omitted.

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

<u>Reference Field</u>. May contain up to 6 subfields, coded as under REFERENCE. References to evaluated data libraries are coded

(…,3,code-version,,date) or
(…,3,code-version,MAT-number,date)
with a code from Dictionary 144 (Data Libraries).

Examples:
```
MONIT-REF  ((MONIT1)BOO17005,J.GOSHAL,J,PR,80,939,1950)
           ((MONIT2),A.G.PANONTIN+,J,JIN,30,2017,1968)
MONIT-REF  (,L.W.Weston+,3,JEFF-3.1,9228,2005)
```

<u>PART-DET</u>. 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 33, 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)
```

<u>RAD-DET</u>. 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).

<u>Flag</u> 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.

<u>Nuclide</u> contains a nuclide code.

<u>Radiation</u> 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 or a similar heading such as DATA-MAX, DATA-MIN. **See preceding Chapter for details.**

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 (Conferences) or 207 (Books).
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 or K: Journals or Journal Abstracts.

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, Dec. 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 (Progress, Lab, Conference 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 or X: Thesis or Private Communication or Preprint

General code format:

(W or T or X,author,page,date)

The page field may be omitted, in which case the following comma is also omitted.
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. Codes from Dictionary 37.

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. Gives 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.

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

TITLE. Gives the title for the work referenced.

Covariance Data File Format

Covariance data may be stored on a separate covariance file. This is mandatory if

a) the file is too big to be included conveniently as free text within the EXFOR entry (under the keyword COVARIANCE); and/or
b) the file is in a format which does not fit within columns 12 - 66 available for free text (e.g. ENDF-6 File 33 format).

The covariance file is named

aaaaasss.cov

with *aaaaa* being the accesssion number, *sss* the subentry number of the corresponding subentry (e.g. 35001002.cov).

There are three record types in the covariance file:

- comment records,
- data records,
- end records.

The actual covariance data can be given either in a free format, defined in the comment records, or in ENDF-6 File 33 format. In the latter case, the cross section may be included also (in File 3 format) for easy processing.

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

a) Free format:

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

b) ENDF 6 File 3/33 format:

First record:

Column	1	F
	2 - 9	Data set number (subaccession number)
	10	(blank)
	11 - 14	MAT number used
	15	(blank)
	16 - 25	File numbers given, separated by commas (e.g. 3,33)
	26 - 80	Comment

Following records:

Column	1 - 80	As in ENDF-6

End record format

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

Example 1: Covariance data in free format as defined in comment records

```
C10034002  Values given only for elements below diagonal of
C10034002  symmetric matrix on same energy grid as data
C10034002  format.
C10034002  FORMAT(9E5.2)
D10034002   1.0
D10034002   0.98  1.0
D10034002   0.90  0.97  1.0
D10034002   0.70  0.82  0.93  1.0
D10034002   0.54  0.68  0.83  0.96  1.0
D10034002   0.64  0.75  0.85  0.92  0.95  1.0
E10034002
```

Example 2: Cross section and Covariance data in ENDF-6 File 3/33 format

```
C35001002 Covariance file for subentry 35001002
C35001002  The file is in ENDF File 33 format, also cross section as File 3
F35001002 6210 3,33      Cross section and covariances in ENDF-6 format
 0.000000+0 0.000000+0          0          0          0          06210 0  0    0
 6.215100+4 1.496234+2          0          0          0          06210 3102    1
 8.256831+6 8.256831+6          0          0          1         316210 3102    2
         31          2                                            6210 3102    3
 0.110000+4 0.244474+2 0.135000+4 0.236065+2 0.162500+4 0.218757+26210 3102    4
 0.187500+4 0.196988+2 0.225000+4 0.153861+2 0.275000+4 0.153043+26210 3102    5
 0.350000+4 0.127367+2 0.450000+4 0.100073+2 0.625000+4 0.865960+16210 3102    6
 0.875000+4 0.656557+1 0.112500+5 0.501474+1 0.137500+5 0.457034+16210 3102    7
 0.175000+5 0.387133+1 0.225000+5 0.394818+1 0.275000+5 0.314252+16210 3102    8
 0.350000+5 0.258191+1 0.450000+5 0.232481+1 0.550000+5 0.184880+16210 3102    9
 0.700000+5 0.157094+1 0.900000+5 0.117749+1 0.110000+6 0.997426+06210 3102   10
 0.135000+6 0.992993+0 0.162500+6 0.757935+0 0.187500+6 0.734009+06210 3102   11
 0.225000+6 0.678500+0 0.275000+6 0.492988+0 0.350000+6 0.418481+06210 3102   12
 0.450000+6 0.372564+0 0.550000+6 0.284066+0 0.700000+6 0.247658+06210 3102   13
 0.900000+6 0.194466+0 0.000000+0 0.000000+0 0.000000+0 0.000000+06210 3102   14
 0.000000+0 0.000000+0          0          0          0          06210 0  0   15
 6.215100+4 1.496234+2          0          0          0          0621033102   16
 0.000000+0 0.000000+0          0          1          0          0621033102   17
 0.000000+0 0.000000+0          1          5        528        32621033102   18
 0.100000+4 0.120000+4 0.150000+4 0.175000+4 0.200000+4 0.250000+4621033102   19
 0.300000+4 0.400000+4 0.500000+4 0.750000+4 0.100000+5 0.125000+5621033102   20
 0.150000+5 0.200000+5 0.250000+5 0.300000+5 0.400000+5 0.500000+5621033102   21
 0.600000+5 0.800000+5 0.100000+6 0.120000+6 0.150000+6 0.175000+6621033102   22
 0.200000+6 0.250000+6 0.300000+6 0.400000+6 0.500000+6 0.600000+6621033102   23
 0.800000+6 0.100000+7 0.000000+0 0.000000+0 0.000000+0 0.000000+0621033102   24
……………..
………………
 0.300769-2 0.190133-2 0.194659-2 0.199179-2 0.196701-2 0.199724-2621033102  103
 0.208640-2 0.362495-2 0.197938-2 0.202161-2 0.201359-2 0.205954-2621033102  104
 0.216937-2 0.302796-2 0.208438-2 0.207471-2 0.212723-2 0.225324-2621033102  105
 0.345695-2 0.212488-2 0.218017-2 0.231748-2 0.376135-2 0.218460-2621033102  106
 0.232702-2 0.326855-2 0.242255-2 0.444583-2                                  107
 0.000000+0 0.000000+0          0          0          0          06210 0  0  108
E 35001002
```

III. User Output Formats

This chapter describes the various output formats available to users who retrieve EXFOR data. Not all formats mentioned here are necessarily available from all EXFOR sites, and some data centres may offer additional formats not described here.

- **EXFOR Exchange format**: available from all EXFOR sites. Described in general in Chapter I and in more detail in Chapter II.
- **EXFOR+ format**: Interpreted EXFOR. User friendly output for human reader. See examples in Chapter I. Will be refined further to give expanded output for more keywords.
- **Computational format C4**. This is the format mainly in use for plotting and processing EXFOR data. See following pages for a description

Merely as an illustration, examples of other user output formats are shown also, on pages 54 ff. Since these are not part of the NRDC exchange agreements and are not necessarily available from all EXFOR centres, they are not described in detail. The examples included here are:

- Tabular formats:
  - T4
  - TABLE with XREF and BIB
- R33 format (for Ion Beam Analysis community)
- Extended C4 computational format
- Bibliographic output
- Plots

Computational Format C4

This is the computational format mainly in use for plotting and processing of EXFOR data, which is available from IAEA-NDS and some of the other data centres. Its main features are described below.

(The following is an edited extract from: *Dermott E. Cullen and Andrej Trkov, "Program X4TOC4", report IAEA-NDS-80, Rev.1, March 2001*)

The C4 computation format is designed to present experimental data in a fixed set of units and column order. By starting from data in the EXFOR format and translating data to the computation format it is possible to combine the advantages of the improved reliability of the data coded in the EXFOR format with the advantages of a fixed unit and column order format for use in subsequent applications.

In addition, the computation format is point oriented (as opposed to the table oriented EXFOR format). Each line of the computation format represents a single data point. This makes it possible to sort data in the computation format into any desired order for use in application, e.g., sort 26-Fe-26 (n,2n) data from a number of measurements together into energy order to simplify comparisons.

Relationship to ENDF

It is assumed that one of the major uses of this format will be to prepare data for subsequent use in evaluation and/or to compare available evaluated and experimental data. As such the computation format has been designed to allow data to be reduced to a form in which data are classified in a manner similar to ENDF data[7].

In particular the EXFOR classification of data by the EXFOR keyword REACTION is replaced by classifying the data by (1) projectile, (2) target - ZA, (3) type of data (ENDF MF number), (4) reaction (ENDF MT number). In addition the standard units used by the translation program were selected to be the same as the units used by ENDF (e.g., eV, barns, etc.).

The result of putting data into the computation format is that it is easy to decide if the data is comparable to evaluated data (e.g. same ZA, MF, MT) and once it is decided that data is comparable, evaluation and/or comparison is simplified because the data is in the same units as ENDF (e.g., eV vs. barns).

Extensions of ENDF conventions

For all types of data which are physically comparable to data which can be included in the ENDF data, C4 uses the ENDF definitions of (1) type of data (ENDF MF number), (2) reaction (ENDF MT number). For example all cross sections are represented by MF=3, angular distributions by MF=4, energy distributions by MF=5 and double differential distributions by MF=6. Similarly for simple reactions such as total, elastic etc., the data are translated into corresponding MT=1,2, etc., respectively.

Since many types of data which appear in EXFOR do not have a one to one correspondence to data which appear in ENDF, the ENDF classification of type of data (MF) and reaction (MT) have been extended to allow additional types of data and reactions to be translated (e.g., define MF numbers for ratios, define MT numbers for (n,np)+(n,na) reactions).

The ENDF MF is a 2 digit number and the MT is a 3 digit number. In the computation format MF has been extended to 3 digits and the MT has been expanded to 4 digits. These extensions allow the user the flexibility to translate virtually any EXFOR data to a fixed set of units and column order for subsequent use in applications.

---

[7] For a description of the ENDF format and, in particular, tables of the ENDF MF and MT numbers, see: M. Herman (ed.), ENDF-6 Formats Manual, report ENDF-102, http://www-nds.iaea.org/ndspub/documents/endf/endf102/

Since EXFOR contains a very large variety of data types, not all EXFOR data can be automatically translated into C4 format. Tools for handling such cases, i.e. for translating additional data types into C4 format on a case-to-case basis, are available in the translation program X4TOC4 which is distributed as part of the ENDVER program package[8]. This program allows the user also to change other parameters of the translation to C4. The following pages describe the default options the user will get when retrieving C4 data directly.

Computation format units

All EXFOR units are converted to ENDF units:

eV	= energy
barns	= cross section
steradians	= solid angle
seconds	= time
kelvin	= temperature

Computation format fields

The computation format uses a classification system and units which are compatible with ENDF. Data is classified by

(1) ZA of projectile,
(2) ZA of target,
(3) metastable state of target,
(4) MF - type of data,
(5) MT - reaction,
(6) metastable state of residual nucleus.

To identify the source of the data the first author and year and the EXFOR accession and sub-accession number are included in the format. In addition, fields are assigned to define the status of the EXFOR data (e.g., S = superseded), whether data is in the laboratory or center-of-mass frame of reference, and the physical significance of the last 2 output fields (LVL = level energy, HL = half-life). Finally the format includes 8 fields in which the output data are contained (e.g., incident energy, data, cosine, uncertainties, etc.)

Columns	Description
1- 5	Projectile ZA (e.g. neutron =1, proton =1001) (defined by reaction dictionary).
6- 11	Target ZA (e.g. 26-Fe-56 = 26056) (defined by EXFOR reaction).
12	Target metastable state (e.g. 26-FE-56m = M) (defined by EXFOR reaction).
13- 15	MF (ENDF conventions, plus additions) (defined by reaction dictionary).
16- 19	MT (ENDF conventions, plus additions) (defined by reaction dictionary).
20	Product metastable state (e.g. 26-FE-56M = M) (defined by EXFOR reaction).
21	EXFOR status (defined by EXFOR keyword status).
22	Center-of-mass flag (C=center-of-mass, blank=lab) (defined by EXFOR title dictionary).
23- 94	8 data fields (each in E9.3 format defined below) (defined by MF and title dictionary).

[8] See: ENDVER, ENDF File Verification Support Package, http://www-nds.iaea.org/ndspub/endf/endver/ and D.E. Cullen and A. Trkov, Program X4TOC4, report IAEA-NDS-80, Rev.1, March 2001

95- 97	Identification of data fields 7 and 8 (e.g., LVL=level, HL=half-life, etc.).
98-122	Reference (first author and year) (defined by EXFOR keywords title and reference).
123-127	EXFOR accession number (defined by EXFOR format).
128-130	EXFOR sub-accession number (defined by EXFOR format).
131	Multi-dimension table flag (EXFOR pointer) (defined by EXFOR keyword reaction or common fields).

Definition of 8 computation format data fields

The general definitions of the 8 computation format data fields are:

Data field	Definition
1	Projectile incident energy
2	Projectile incident energy uncertainty
3	Data, e.g., cross section, angular distribution, etc.
4	Data uncertainty
5	Cosine or Legendre order
6	Cosine uncertainty
7	Identified by columns 95-97 (e.g., level energy, half-life)
8	Identified by columns 95-97 (e.g., level energy, uncertainty)

The physical significance of each field is defined by the assigned MF number. For example, for MF =3 (cross sections), columns 1 and 2 contain the incident projectile energy and its uncertainty in eV, respectively and columns 3 - 4 contain the cross section and its uncertainty in barns, respectively and columns 7 and 8 may contain a level energy and its uncertainty in eV or a half-life and its uncertainty in seconds.

Special conventions

The above conventions are appropriate for most types of data in the ENDF system. In order to process additional types of data the following special conventions have been adopted:

Cross section ratios - (MF = 203)	Field 5 = MT of denominator. Field 6 = ZA of denominator.
Resonance integrals - (MF = 213)	Field 1 = lower energy limit. Field 2 = upper energy limit.
Spectrum averages - (MF = 223)	Field 1 = lower energy limit. Field 2 = upper energy limit.
Fission yield data - (MF = 801)	Field 5 = ZA of fission fragment. Field 6 = mass of fission fragment.
Production data - (MT = 9000-9999)	Field 6 = ZA of product.

Metastable states

The computation format allows the metastable state of the target and residual nucleus to be identified. For ratio data, the Metastable state of both numerator and denominator of the ratio may be defined.

The metastable state of the target is identified in column 12 and the metastable state of the residual nuclues in column 20. For ratio data the metastable state of the denominator target and residual nucleus are identified by output the denominator ZA and MT in the form ZA.M and MT.M (e.g., 26056.9 and 102.1). Columns 12 and 20 could contain characters such as M, but to maintain the eight output fields in strictly numerical form the denominator ZA.M and MT.M will be output in numerical form. The possible characters that may appear in columns 12 or 20 and their numerical equivalents used with ratio denominator ZA and MT include:

Definition	Column 12 or 20	Equivalent
ground	G	0
m1	1	1
m2	2	2
m3	3	3
m4	4	4
m5	5	5
unknown	?	6
m	M	7
more than 1	+	8
all or total	T	9
all or total	blank	9

By convention, if an EXFOR reaction does not specify a Metastable state the state is defined in the computation format to be..ALL.. (i.e., blank in column 12 or 20, 9 in ratio ZA or MT).

For example, for a ratio if the ZA.m and MT.m are output as 26056.9 and 102.1, respectively the ratio denominator target is 26-Fe-56 (all) and the reaction is capture (MT=102) leaving the residual nucleus in the m1 state.

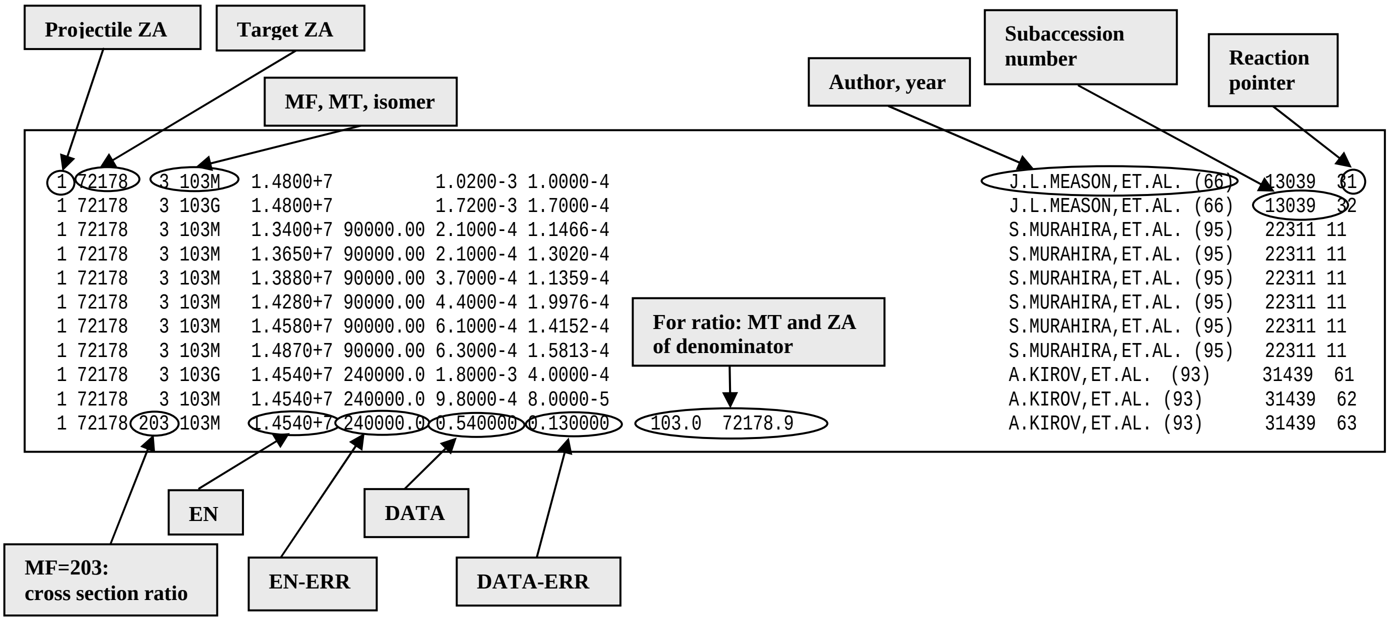
EXFOR Status

Column 21 of each computation format record may contain blank (status not specified) or one of the following characters:

Column 21	Definition
U	Un-normalized (indicated by unit translation dictionary) This condition has priority over the EXFOR status and is used to indicate that the data is not in standard output units).
A	Approved by author
C	Correlated
D	Dependent
O	Outdated
P	Preliminary
R	Re-normalized
S	Superseded

If data has any other EXFOR status (e.g., translated from SCISRS), it will be ignored and the status field will be output as blank.

C4 Example 1: ^{178}Hf(n,p) cross section



C4 Example 2: Partial differential cross section for ^{56}Fe(n,n')

```
1 26056   4  51 AC 5050000. 10000.00 0.030000 5.0000-3 0.902585     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5[illegible].019000 6.0000-3 0.812083     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5[illegible].022000 5.0000-3 0.758134     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5050000. 10000.00 0.020000 2.0000-3 0.560638     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5050000. 10000.00 0.018000 2.0000-3 0.290701     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5050000. [illegible]18000 2.0000-3-0.019200     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5050000. 10000.00 0.022000 2.0000-3-0.359999     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 2[illegible] AC 5050000. 10000.00 0.023000 2.0000-3-0.586375     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5050000. 10000.00 0.020000 2.0000-3-0.853553     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5580000. 1[illegible]00-3 0.902585     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5580000. 10000.[illegible]000-3 0.860742     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5580000. 10000.00 0.026000 5.0000-3 0.812083     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5580000. 10000.00 0.020000 2.0000-3 0.758134     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5580000. 10000.00 0.019000 1.0000-3 0.560638     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5580000. 10000.00 0.016000 2.0000-3 0.290701     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5580000. 10000.00 0.013000 1.0000-3-0.019200     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5580000. 10000.00 0.015000 2.0000-3-0.359999     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5580000. 10000.00 0.014000 1.0000-3-0.586375     846000.0           LVLP.BOSCHUNG,ET.AL. (71)   10037 47
1 26056   4  51 AC 5580000. 10000.00 0.014000 1.0000-3-0.853553     846000.0           [illegible]ET.AL. (71)   10037 47
1 26056   4  51 AC 5050000. 10000.00 0.017000 3.0000-3 0.902585     2085000.           [illegible].AL. (71)   10037 49
1 26056   4  51 AC 5050000. 10000.00 6.0000-3 2.0000-3 0.812083     2085000.           [illegible].AL. (71)   10037 49
1 26056   4  51 AC 5050000. 10000.00 0.011000 1.0000-3 0.758134     2085000.           [illegible]ET.AL. (71)   10037 49
1 26056   4  51 AC 5050000. 10000.00 6.0000-3 1.0000-3 0.560638     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5050000. 10000.00 8.0000-3 1.0000-3 0.290701     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5050000. 10000.00 9.0000-3 1.0000-3-0.019200     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5050000. 10000.00 7.0000-3 1.0000-3-0.359999     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5050000. 10000.00 6.0000-3 1.0000-3-0.586375     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5050000. 10000.00 7.0000-3 1.0000-3-0.853553     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5580000. 10000.00 0.013000 2.0000-3 0.902585     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5580000. 10000.00 9.0000-3 1.0000-3 0.860742     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5580000. 10000.00 8.0000-3 2.0000-3 0.812083     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5580000. 10000.00 7.0000-3 1.0000-3 0.758134     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5580000. 10000.00 7.0000-3 1.0000-3 0.560638     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5580000. 10000.00 9.0000-3 1.0000-3 0.290701     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5580000. 10000.00 7.0000-3 1.0000-3-0.019200     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5580000. 10000.00 6.0000-3 1.0000-3-0.359999     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5580000. 10000.00 4.0000-3 1.0000-3-0.586375     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5580000. 10000.00 5.0000-3 1.0000-3-0.853553     2085000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 49
1 26056   4  51 AC 5050000. 10000.00 0.011000 1.0000-3 0.901832     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5050000. 10000.00 9.0000-3 1.0000-3 0.810041     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5050000. 10000.00 9.0000-3 1.0000-3 0.754709     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5050000. 10000.00 7.0000-3 1.0000-3 0.556294     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5050000. 10000.00 7.0000-3 1.0000-3 0.285687     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5050000. 10000.00 7.0000-3 1.0000-3-0.026179     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5050000. 10000.00 7.0000-3 1.0000-3-0.364879     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5050000. 10000.00 8.0000-3 1.0000-3-0.590608     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5050000. 10000.00 9.0000-3 1.0000-3-0.855366     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5580000. 10000.00 0.011000 1.0000-3 0.901832     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5580000. 10000.00 0.011000 1.0000-3 0.860742     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5580000. 10000.00 8.0000-3 1.0000-3 0.810041     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5580000. 10000.00 7.0000-3 1.0000-3 0.754709     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5580000. 10000.00 8.0000-3 1.0000-3 0.556294     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5580000. 10000.00 6.0000-3 1.0000-3 0.285687     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5580000. 10000.00 6.0000-3 1.0000-3-0.026179     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5580000. 10000.00 6.0000-3 1.0000-3-0.364879     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5580000. 10000.00 6.0000-3 1.0000-3-0.590608     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
1 26056   4  51 AC 5580000. 10000.00 6.0000-3 1.0000-3-0.855366     2658000.           LVLP.BOSCHUNG,ET.AL. (71)   10037 51
```

Projectile ZA

Target ZA

MF=4: angular distribution

MT=51: partial inelastic cs

cos

Level energy

Author, year

Subaccession number

EN

EN-ERR

Next EN value

Next level energy

Approved by author

Center-of-mass system

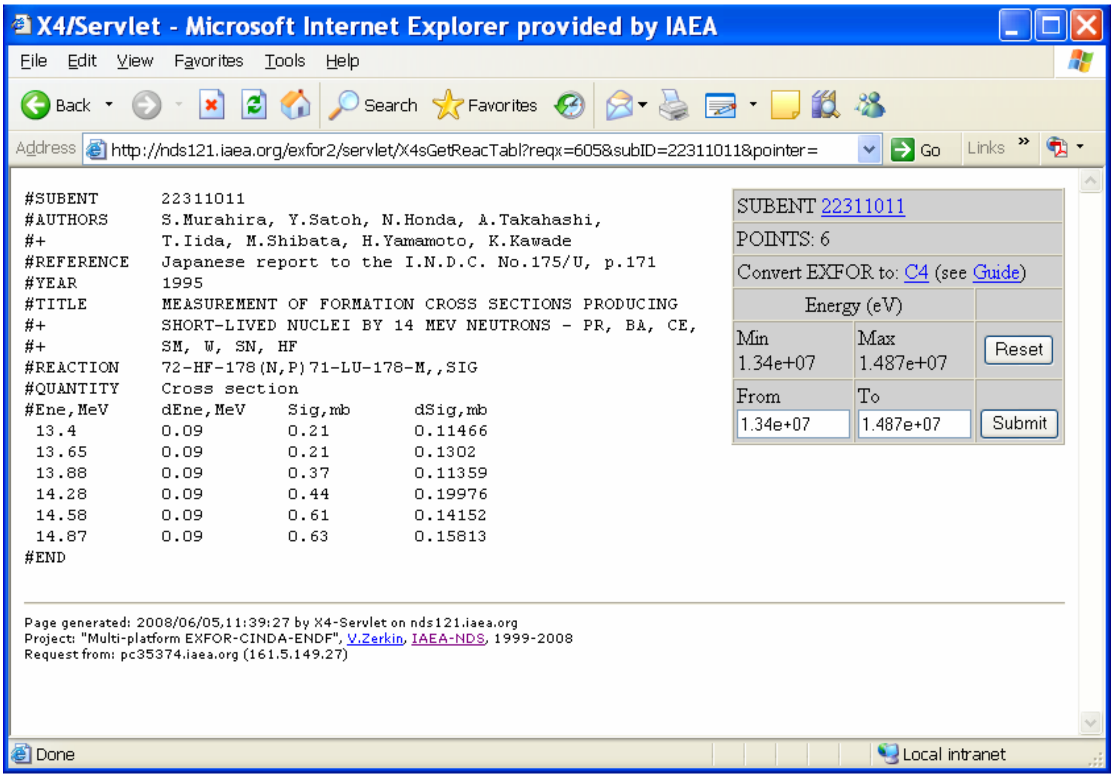
DATA

DATA-ERR

Examples of other output formats

Example: T4 format

Simple tabulated cross sections with short bibliography, for single datasets


X4/Servlet - Microsoft Internet Explorer provided by IAEA

http://nds121.iaea.org/exfor2/servlet/X4sGetReacTabl?reqx=605&subID=22311011&pointer=

```
#SUBENT      22311011
#AUTHORS     S.Murahira, Y.Satoh, N.Honda, A.Takahashi,
#+           T.Iida, M.Shibata, H.Yamamoto, K.Kawade
#REFERENCE   Japanese report to the I.N.D.C. No.175/U, p.171
#YEAR        1995
#TITLE       MEASUREMENT OF FORMATION CROSS SECTIONS PRODUCING
#+           SHORT-LIVED NUCLEI BY 14 MEV NEUTRONS - PR, BA, CE,
#+           SM, W, SN, HF
#REACTION    72-HF-178(N,P)71-LU-178-M,,SIG
#QUANTITY    Cross section
#Ene,MeV     dEne,MeV    Sig,mb      dSig,mb
 13.4        0.09        0.21        0.11466
 13.65       0.09        0.21        0.1302
 13.88       0.09        0.37        0.11359
 14.28       0.09        0.44        0.19976
 14.58       0.09        0.61        0.14152
 14.87       0.09        0.63        0.15813
#END
```

SUBENT 22311011

POINTS: 6

Convert EXFOR to: C4 (see Guide)

Energy (eV)		
Min 1.34e+07	Max 1.487e+07	Reset
From 1.34e+07	To 1.487e+07	Submit

Page generated: 2008/06/05,11:39:27 by X4-Servlet on nds121.iaea.org
Project: "Multi-platform EXFOR-CINDA-ENDF", V.Zerkin, IAEA-NDS, 1999-2008
Request from: pc35374.iaea.org (161.5.149.27)

Example: TAB format

Computational format introduced in the 1980s for the CSISRS/EXFOR system in use at NNDC (USA), still available for backwards compatibility. Separate output of tables, reference (XREF) and BIB files.

Table

```
REQUEST         605001   20080605          3     114654                0  0    0
PHYSENT              1          0          6 1.3400E+07 1.4870E+07     1  0    0
 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00     1  0    0
 1.3400E+07 9.0000E+04 9.0000E+04 4.6500E-03 7.3470E-04 7.3470E-04     1  1    1
 1.3650E+07 9.0000E+04 9.0000E+04 6.9500E-03 9.9385E-04 9.9385E-04     1  1    1
 1.3880E+07 9.0000E+04 9.0000E+04 6.6700E-03 9.2046E-04 9.2046E-04     1  1    1
 1.4280E+07 9.0000E+04 9.0000E+04 8.2200E-03 1.0193E-03 1.0193E-03     1  1    1
 1.4580E+07 9.0000E+04 9.0000E+04 1.1100E-02 1.3986E-03 1.3986E-03     1  1    1
 1.4870E+07 9.0000E+04 9.0000E+04 9.7500E-03 1.2675E-03 1.2675E-03     1  1    1
ENDPHYSENT                                                             199999999
PHYSENT              1          0          6 1.3400E+07 1.4870E+07     2  0    0
 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00 0.0000E+00     2  0    0
 1.3400E+07 9.0000E+04 9.0000E+04 2.1000E-04 1.1466E-04 1.1466E-04     2  1    1
 1.3650E+07 9.0000E+04 9.0000E+04 2.1000E-04 1.3020E-04 1.3020E-04     2  1    1
 1.3880E+07 9.0000E+04 9.0000E+04 3.7000E-04 1.1359E-04 1.1359E-04     2  1    1
 1.4280E+07 9.0000E+04 9.0000E+04 4.4000E-04 1.9976E-04 1.9976E-04     2  1    1
 1.4580E+07 9.0000E+04 9.0000E+04 6.1000E-04 1.4152E-04 1.4152E-04     2  1    1
 1.4870E+07 9.0000E+04 9.0000E+04 6.3000E-04 1.5813E-04 1.5813E-04     2  1    1
ENDPHYSENT                                                             199999999
ENDREQUEST                                                         9999999999999
```

XREF

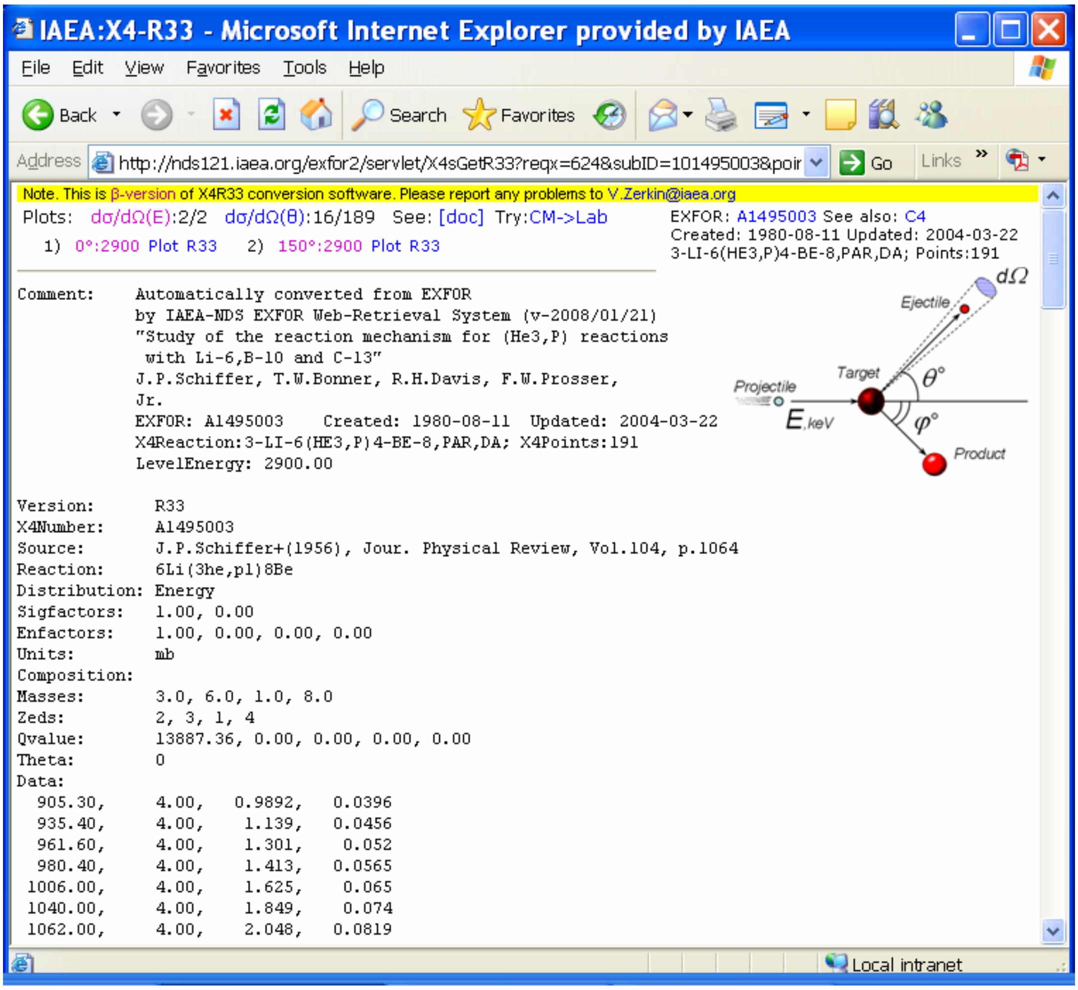
```
REQUEST         605001   20080605          3     112903              0  0    0
  50-SN-118(N,P)49-IN-118-M1+M2,,SIG     1.3+07 1.5+07    6 2JPNNAG       S,INDC(JPN)-175/U,171,   9511 S.Murahira,       22311002
  72-HF-178(N,P)71-LU-178-M,,SIG         1.3+07 1.5+07    6 2JPNNAG       S,INDC(JPN)-175/U,171,   9511 S.Murahira,       22311011
```

BIB

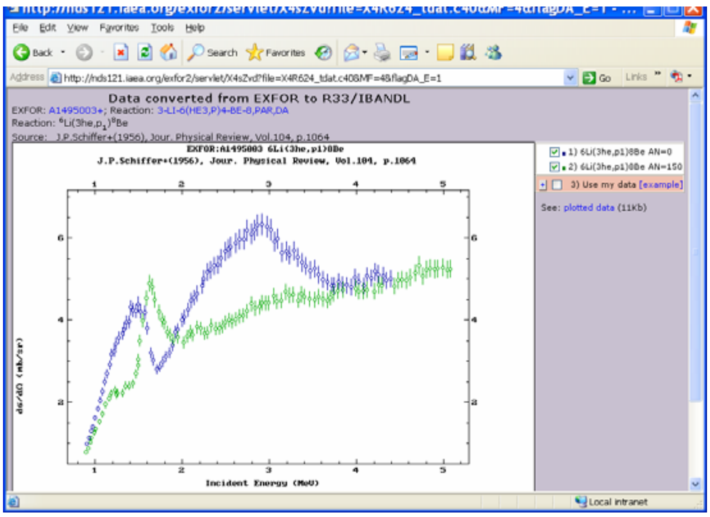
```
BIBFILE         605001   20080605          3     112903                0  0    0
BIB            22311002        102                                     1  0    1
INSTITUTE  (2JPNNAG) S.MURAHIRA, Y.SATOH, N.HONDA, M.SYIBATA,          1  0    1
                     H.YAMAMOTO, K.KAWADE                              1  0    1
           (2JPNOSA) A.TAKAHASHI, T.IIDA AND EXPERIMENTAL SITE         1  0    1
TITLE      -MEASUREMENT OF FORMATION CROSS SECTIONS PRODUCING          1  0    1
            SHORT-LIVED NUCLEI BY 14 MEV NEUTRONS - PR, BA, CE,        1  0    1
            SM, W, SN, HF                                              1  0    1
AUTHOR     (S.MURAHIRA,Y.SATOH,N.HONDA,A.TAKAHASHI,T.IIDA,             1  0    1
           M.SHIBATA,H.YAMAMOTO,K.KAWADE)                              1  0    1
REFERENCE  (S,INDC(JPN)-175/U,171,9511) PROCEEDINGS OF THE 1995        1  0    1
               SYMPOSIUM ON NUCLEAR DATA, NOV. 16-17, JAERI,TOKAI      1  0    1
           (S,JAERI-M-92-027,268,9203) EXPERIMENTAL DETAILS            1  0    1
           (S,INDC(JPN)-157,268,9203)  EXPERIMENTAL DETAILS            1  0    1
FACILITY   (CCW,2JPNOSA) THE INTENSE 14 MEV NEUTRON SOURCE             1  0    1
                         OKTAVIAN AT OSAKA UNIVERSITY.                 1  0    1
METHOD     (ACTIV)  ACTIVATION                                         1  0    1
INC-SOURCE (D-T  ) THE D-BEAM ENERGY WAS 300 KEV AND THE INTENSIT      1  0    1
            WAS 5 MILLIAMPS. A SAMPLE TRANSPORT SYSTEM OF SIX          1  0    1
            PNEUMATIC TUBES AT ANGLES OF 0, 50, 75, 105, 125 AND       1  0    1
```

Example: R33 format

This format was developed for the ion beam analysis (IBA) community and is used e.g. in the IBANDL database. For the data types relevant for IBA (mainly charged-particle induced differential cross sections at fixed angles dependent on projectile energy) it is available as EXFOR output format.

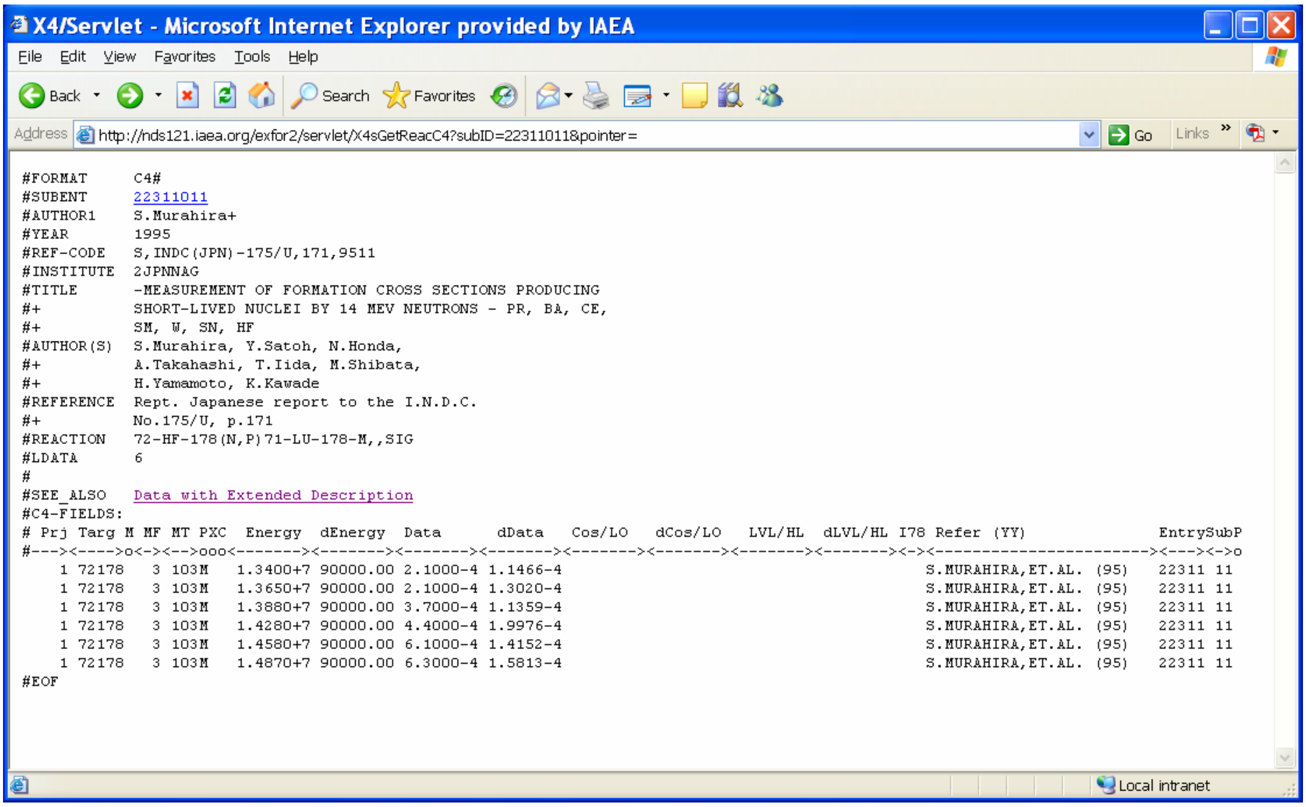


Plotting option from R33 output



Example: Extended C4 format

Computational format (C4) output with explanatory text lines (labelled with #) added for better readability.



X4/Servlet - Microsoft Internet Explorer provided by IAEA

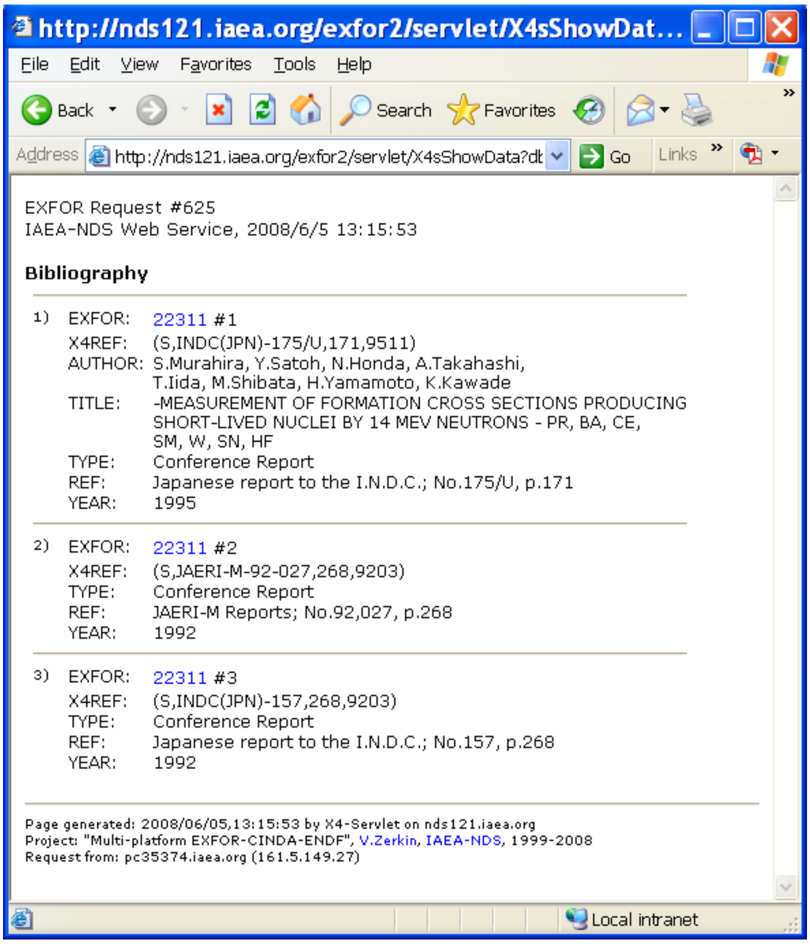
Address http://nds121.iaea.org/exfor2/servlet/X4sGetReacC4?subID=22311011&pointer=

```
#FORMAT      C4#
#SUBENT      22311011
#AUTHOR1     S.Murahira+
#YEAR        1995
#REF-CODE    S,INDC(JPN)-175/U,171,9511
#INSTITUTE   2JPNNAG
#TITLE       -MEASUREMENT OF FORMATION CROSS SECTIONS PRODUCING
#+           SHORT-LIVED NUCLEI BY 14 MEV NEUTRONS - PR, BA, CE,
#+           SM, W, SN, HF
#AUTHOR(S)   S.Murahira, Y.Satoh, N.Honda,
#+           A.Takahashi, T.Iida, M.Shibata,
#+           H.Yamamoto, K.Kawade
#REFERENCE   Rept. Japanese report to the I.N.D.C.
#+           No.175/U, p.171
#REACTION    72-HF-178(N,P)71-LU-178-M,,SIG
#LDATA       6
#
#SEE_ALSO    Data with Extended Description
#C4-FIELDS:
# Prj Targ M MF MT PXC  Energy  dEnergy  Data      dData   Cos/LO   dCos/LO   LVL/HL  dLVL/HL I78 Refer (YY)              EntrySubP
#---><---->o<-><-->ooo<-------><-------><-------><-------><-------><-------><-------><-------><-><-----------------------><---><->o
    1 72178   3 103M   1.3400+7 90000.00 2.1000-4 1.1466-4                                         S.MURAHIRA,ET.AL. (95)   22311 11
    1 72178   3 103M   1.3650+7 90000.00 2.1000-4 1.3020-4                                         S.MURAHIRA,ET.AL. (95)   22311 11
    1 72178   3 103M   1.3880+7 90000.00 3.7000-4 1.1359-4                                         S.MURAHIRA,ET.AL. (95)   22311 11
    1 72178   3 103M   1.4280+7 90000.00 4.4000-4 1.9976-4                                         S.MURAHIRA,ET.AL. (95)   22311 11
    1 72178   3 103M   1.4580+7 90000.00 6.1000-4 1.4152-4                                         S.MURAHIRA,ET.AL. (95)   22311 11
    1 72178   3 103M   1.4870+7 90000.00 6.3000-4 1.5813-4                                         S.MURAHIRA,ET.AL. (95)   22311 11
#EOF
```

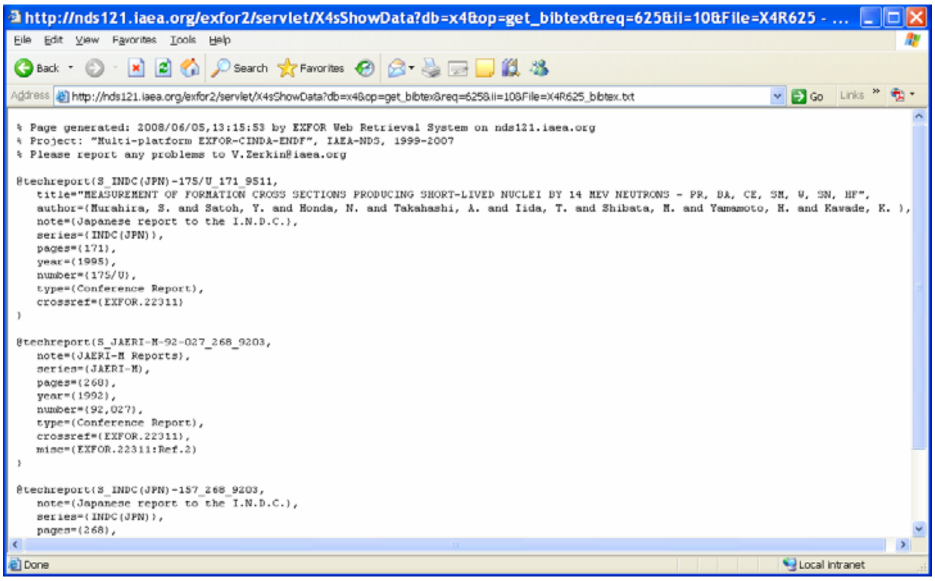
Local intranet

Example: Bibliographic output

Summary of bibliographic information belonging to an EXFOR retrieval. Available as html bibliography and in BibTex format.

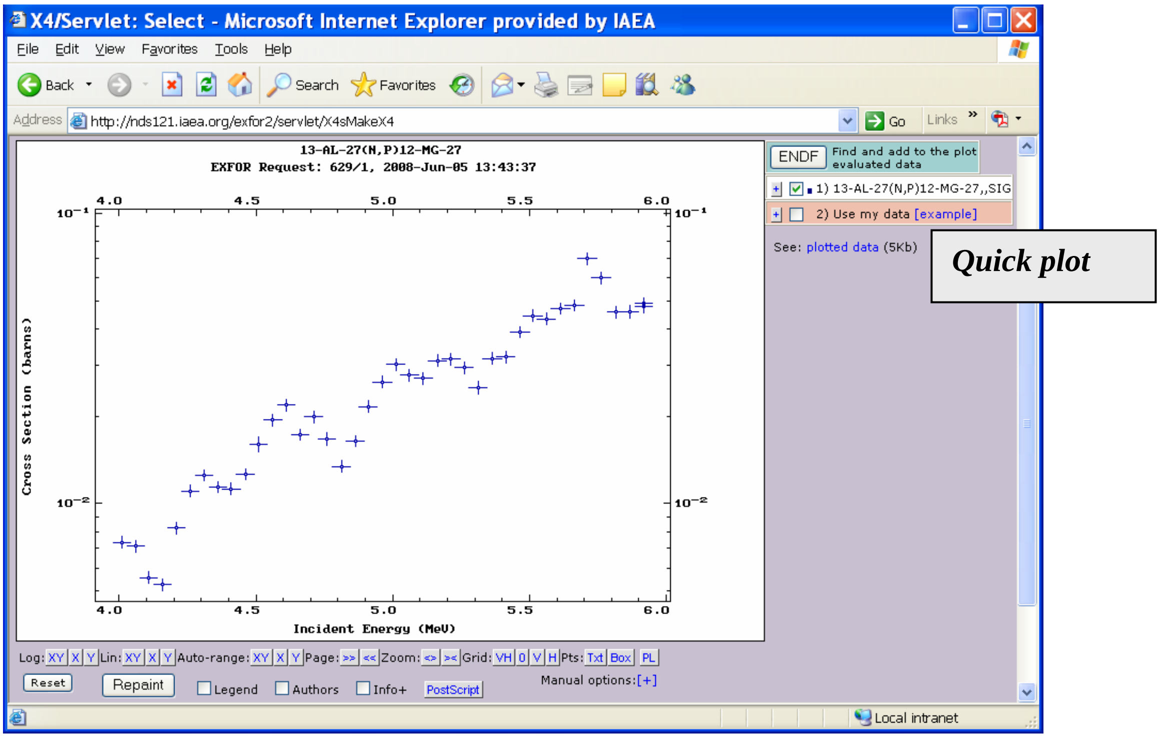


BibTex

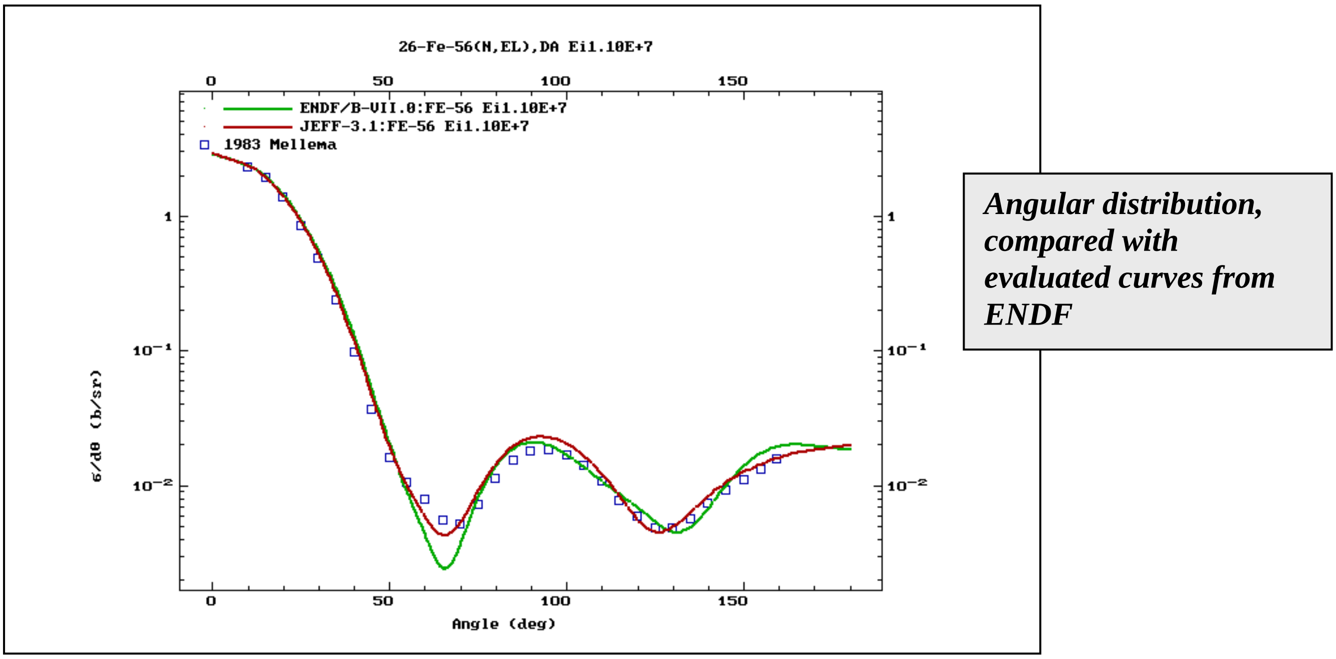


Example: Plots

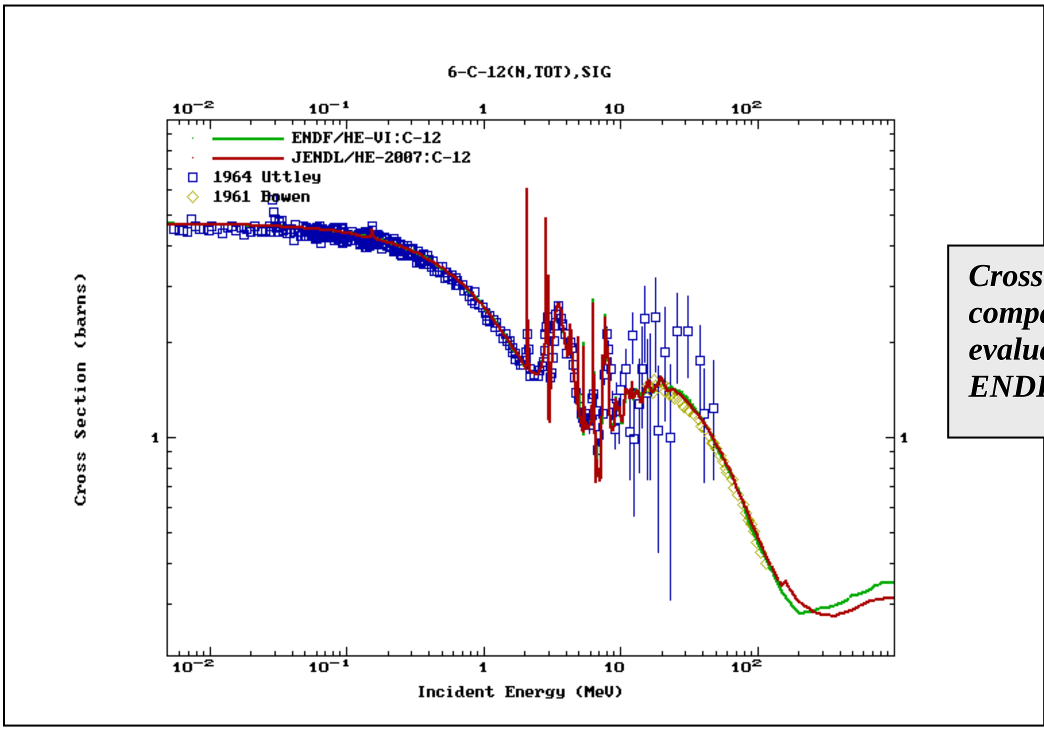
Several options for plotting data directly from EXFOR retrievals are available, including comparisons with evaluated data from the ENDF database which can be retrieved together with EXFOR data.



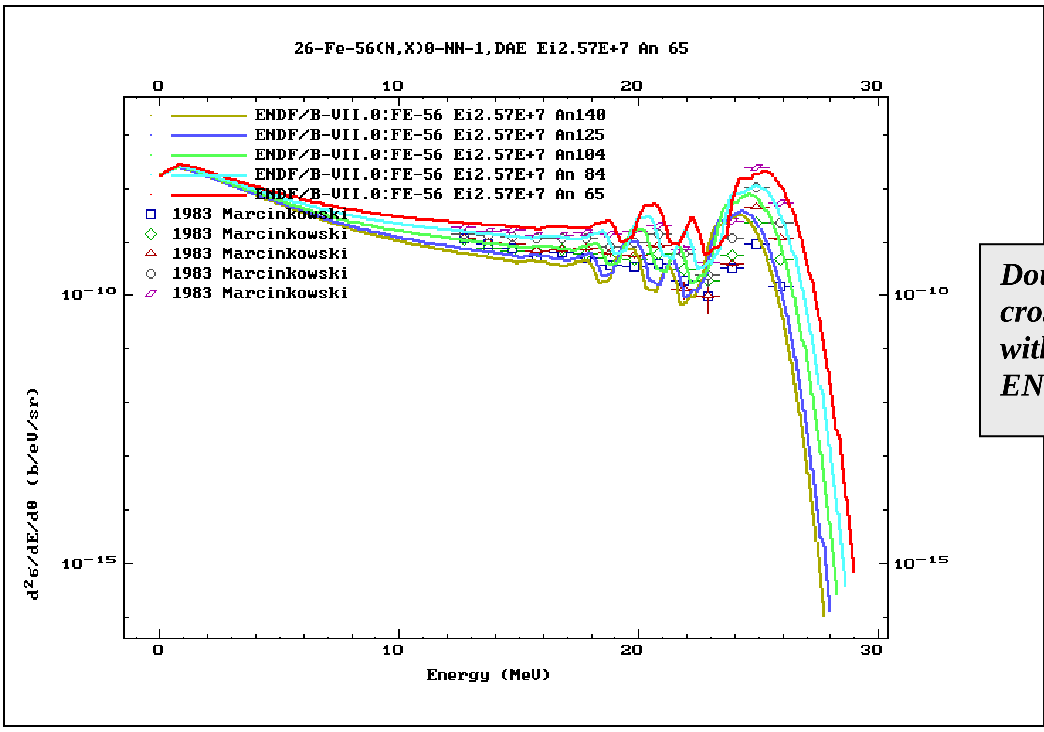
Advanced plots



Advanced plots (cont.)



Cross section, compared with evaluated curves from ENDF



Double-differential cross section, compared with evaluated data from ENDF/B-VII

Appendix: Tables 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 the IAEA Nuclear Data Section or any other of the Nuclear Reaction Data Centers.

Dictionary 3.	Institutes
Dictionary 4.	Reference Type
Dictionary 5.	Journals
Dictionary 7.	Conferences
Dictionary 15.	History
Dictionary 16.	Status
Dictionary 17.	Related Reference
Dictionary 18.	Facility
Dictionary 19.	Incident Source
Dictionary 20.	Additional Results
Dictionary 21.	Method
Dictionary 22.	Detectors
Dictionary 23.	Analysis
Dictionary 24.	Data Headings
Dictionary 30.	Process
Dictionary 33.	Particles
Dictionary 34.	Modifiers (REACTION SF8)
Dictionary 35.	Data-Type (REACTION SF9)
Dictionary 37.	Result
Dictionary 207.	Books
Dictionary 236.	Quantities (REACTION SF5-7)

Dictionary 3. Institutes: used with the keywords INSTITUTE and FACILITY. The first character of the codes designates the nuclear data centres' area of responsibility – related to the compilation responsibilities for neutron data - , 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.

International Institutes	
2ZZZCER	CERN, Geneva, Switzerland
2ZZZGEL	Inst. for Ref. Mat. and Meas. (IRNM), Geel, Belgium
2ZZZISP	E.C. Joint Research Center (JRC), Ispra, Italy
2ZZZITU	CEC Institute for Transuranium Elements, Karlsruhe, Germany
2ZZZNDC	NEA Data Bank, Paris, France
3ZZZIAE	IAEA, Vienna, Austria
4ZZZDUB	Joint Inst.for Nucl.Res., Dubna, Russia
Argentina	
3ARGCAB	Inst.Balseiro y Centro Atomico Bariloche, Bariloche
3ARGCNE	Comision Nacional de Energia Atomica, Buenos Aires
Armenia	
4ARMJER	Inst. Fiziki Armenian A.N., Jerevan
Australia	
3AULAML	Univ. of Melbourne, Melbourne
3AULAUA	Australian Nucl. Sci. and Techn.Org., Lucas Heights, SW
3AULCBR	Australian National Univ., Canberra
Austria	
2AUSIRK	Inst. fuer Isotopenforschung und Kernphysik, Vienna
Bangladesh	
3BANDAC	Dhaka, University
3BANRAM	Dhaka, Atomic Energy Centre, Ramna
Belarus	
4BLRIJE	Inst. Yad. Energetiki A.N.Byeloruss.SSR, Minsk
Belgium	
2BLGMOL	C.E.N., Mol
Brazil	
3BZLIPE	Inst.de Pesquisas Energeticas e Nucleares, Sao Paulo
3BZLUSP	Univ.de Sao Paulo, Sao Paulo
Bulgaria	
3BULBLA	Sofia, Inst. of Nuclear Res. and Nuclear Energy
3BULSOF	Univ.of Sofia
Canada	
1CANCRC	A.E.C.L., Chalk River, Ontario
1CANMCM	McMaster University, Hamilton, Ontario
1CANTMF	Tri University Meson Facility, Vancouver, B.C.
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
Czech Republic	
3CZRUJV	Inst. of Nuclear Research, Rez i Prahy
Denmark	
2DENRIS	Riso, Roskilde

Finland	
2SF ABA	Abo Akademi, Turku
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
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
3INDPOO	Poona, University
3INDSAH	Saha Institute, Calcutta
3INDTAT	Tata Institute, Bombay
3INDTRM	Bhabha Atom.Res.Centre, Trombay
3INDURJ	Univ.of Rajestan, Jaipur
Israel	
3ISLNEG	Ben Gurion Univ. of the Negev, Beer-Sheva
3ISLWEI	Weizmann Inst., Rehovoth
Italy	
2ITYBOL	ENEA Centro Ricerche Energia di Bologna
2ITYCAT	Univ. of Catania
2ITYPAD	Padua, University and Lab. Nat. Legnaro
Japan	
2JPNIPC	Inst.of Physical and Chemical Res. (RIKEN), Wakou
2JPNJAE	Japan Atomic Energy Agency (JAEA)
2JPNKEK	High Energy Accelerator Res. Org. (KEK), Tsukuba
2JPNKTO	Kyoto Univ., Kyoto
2JPNKYU	Kyushu Univ., Dept.of Nucl.Eng., Fukuoka
2JPNLEP	Nat.lab.for High Energy Physics, Oho, Ibaraki
2JPNOSA	Osaka Univ., Osaka
2JPNTIT	Tokyo Inst.of Technology, Tokyo
2JPNTOH	Tohoku Univ., Sendai
2JPNTOK	Tokyo Univ., Tokyo
2JPNTSU	Univ. of Tsukuba, Tsukuba
Kazakhstan	
4KASKAZ	Inst.Yadernoi Fiziki, Alma-Ata
Republic of Korea	
3KORDAU	Donga University, Pusan
3KORKAE	Korean Atomic Energy Res. Inst., Yusong, Taejon
3KORKNU	Kyungpook National University
3KORKRM	Korea Inst.Radiol.and Med.Sci.(KIRAMS), Seoul

3KORNSU	Natl.Seoul Univ., Seoul
3KORPNU	Pusan National University, Pusan
3KORPUE	Pohang Univ. of Science and Technology, Pohang
Latvia	
4LATIFL	Inst. Fiziki Latviyskoi A.N., Riga
Mexico	
3MEXUMX	Univ. Nacionale Autonoma de Mexico, Mexico City
The Netherlands	
2NEDGRN	Groningen
2NEDRCN	Netherland's Energy Research Foundation, Petten
Norway	
2NORKJL	Inst. foer Atomenergi, Kjeller
New Zealand	
3NZLNZH	Inst.of Nuclear Sciences, Lower Hutt
Pakistan	
3PAKNIL	PINSTECH, Nilore, Rawalpindi
Poland	
3POLIPJ	Soltan Inst.Probl.Jadr., Swierk+Warszawa
3POLWWA	Warszawa, University
Romania	
3RUMBUC	Inst. de Fizica si Inginerie Nucleara, Bucharest
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
Slovakia	
3SLKSLO	Slovak Academy of Sciences, Physics Inst., Bratislava
3SLKUB	Komenskeho (Comenius) Univ., Bratislava
Slovenia	
3SLNIJS	Inst. Jozef Stefan, Ljubljana
South Africa	
3SAFITH	iThemba LABS, Somerset West
3SAFPEL	Atomic Energy Corp.of South Africa, Pelindaba
Spain	
2SPNSAU	Univ.de Santiago de Compostela
2SPNSEU	Sevilla University
2SPNVAL	Valencia, University
Sweden	
2SWDAE	Studsvik Energiteknik AB
2SWDFOA	Research Inst. for National Defence, Stockholm
Switzerland	
2SWTETH	Eidgenossische Technische Hochschule, Zuerich
2SWTPSI	Paul Scherrer Inst., Villigen
Ukraine	
4UKRIJI	Inst. Yadernykh Issledovaniy Acad. Sct. Ukraine, Kiev
4UKRKFT	Kharkovskii Fiziko-Tekhnicheskii Inst., Kharkov
4UKRKGU	Gosudarstvennyi Univ.(State Univ.), Kiev
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
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 Institiute 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
Vietnam	
3VN DAL	Nuclear Research Inst., Dalat
3VN IPH	Inst.of Phys.and Electronics, Acad. Sci., Hanoi

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

A	Abstract of conference
B	Book
C	Conference
J	Journal
K	Abstract of journal
P	Progress report
R	Report other than progress report
S	Report containing conference proceedings
T	Thesis or dissertation
W	Private communication
X	Preprint

Dictionary 5: Journal codes: used as the second subfield for the keyword REFERENCE, when the reference type is given as J or K; 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
ANE	Annals of Nuclear Energy
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
CPL	Chinese Physics Letters
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
JNRS	Journal of Nuclear and Radiochemical Sciences
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
KPS	Journal of the Korean Physical Society
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
PRM	Pramana (India)
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: Conferences: used as the second subfield for the keyword REFERENCE, when the reference type is given as A or C, and similarly, for MONIT-REF, and REL-REF. A **subset** containing some of the most frequently used codes is given here.

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
99BUCHAR	Symp.on Adv.in Nucl.Phys., Bucharest, Romania, 1999
99HABAY	Sem.on Fission, Habay-la-Neuve, Belgium, 1999
99PRAHA	Conf.on Accelerator Driven Transmutation, Prague 1999
99RAB	Conf.Cluster.Aspects of Nucl.Struct.& Dynam.,Rab 1999
99SANTA	Symp.on Capt.Gamma Ray Spectroscopy, Santa Fe,NM 1999
99SARAT	Workshop on Beam Dynamics and Optimiz, Saratov 1999
99ST.AND	Conf.on Fission+Neutron-Rich Nucl.,St.Andrews, 1999
99TSUKUB	Conf.on Radi9ation Shielding, Tsukuba, Japan, 1999
99VANCOU	Int.Conf.on Isotopes (3ICI), Vancouver, Sept.1999
2000PITTSB	PHYSOR 2000, Pittsburgh, PA, 2000
2000STPETR	Conf.Nucl.Spectr.Nucl.Struct.,St.Petersbg.,June 2000
2001BERKEL	Nucl.Physics in the 21st Cent.,Berkeley, CA,USA,2001
2001CASTAP	Dyn.Aspects of Nucl.Fiss.,Casta-Papiernicka 2001

2001DUBNA	Interaction of Neutrons with Nuclei, Dubna 2001
2001SARAT	Workshop on Beam Dynamics and Optimiz, Saratov 2001
2001SAROV	Conf.Nucl.Spectrosc.Nucl.Struct.,Sarov, Russia,2001
2001TSUKUB	Conf.on Nucl.Data for Sci.and Techn., Tsukuba 2001
2002BERKEL	Conf. on Frontier of Nuclear Physics, Berkeley 2002
2002DUBNA	Int.Sem.Interaction of Neutrons w.Nuclei,Moscow,2002
2002MOSCOW	Conf.Nucl.Spectrosc.Nucl.Struct.,Moscow,Russia,2002
2002PRUHON	Symp.on Capt.Gamma Ray Spectroscopy, Pruhonice, 2002
2002SANIB	Fission,Prop.of Neutron-Rich Nucl.,Sanibel,USA,2002
2002SANTA	Meeting on Radiation Shielding,Santa Fe,NM,USA, 2002
2002SEOUL	PHYSOR 2002, Physics of Reactors, Seoul, Korea, 2002
2003DARMST	Worksh.Nucl.Data for Transmutation, Darmstadt, 2003
2003HABAY	Sem.on Fission, Habay-la-Neuve, Belgium, 2003
2003MOSCOW	Conf.Nucl.Spectrosc.Nucl.Struct.,Moscow,Russia,2003
2003SDIEGO	Int.Meet.on Nucl.Appl.of Accel.Tech., San Diego 2003
2004ARGON	Conf.on Nuclei at the Limits, Argonne, July 2004
2004BELGOR	Conf.Nucl.Spectrosc.Nucl.Struct.,Belgorod,Russia,2004
2004BORMIO	Int.Meeting on Nucl.Physics, Bormio, Italy, 2004
2004EURAD	Conf.Manag.and Disposal of Rad.Waste,Luxembourg 2004
2004SANTA	Conf.on Nucl.Data for Sci.and Techn., Santa Fe 2004
2005BRUSS	Int.Conf.on Isotopes (5ICI), Brussels, April 2005
2005KOS	Frontiers in Nucl.Structure,Kos,Greece,Sept.2005
2005NOTRED	Symp.on Capt.Gamma Ray Spectroscopy, Notre Dame 2005
2005PAVIA	Nucl.Phys.Divisional Conf., Pavia, Italy, Sept.2005
2005SANTA	Int.Collab.on Adv.Neutron Sources,Santa Fe,April 2005
2005SEVILL	Int.Conf.on Ion Beam Analysis, Sevilla, 2005
2006BOROVE	Workshop Neutron Meas., Eval.& Appl., Borovets, 2006
2006CERN	9.Int.Symp.Nuclei in the Cosmos, CERN, Geneva, 2006
2006MANGAL	Nucl.Data f.Adv.Nucl.Systems, Mangalore, India, 2006
2006VANCOU	Advances in Nucl.Analysis and Simul.,Vancouver 2006
2007NICE	Conf.on Nucl.Data for Sci. and Technology, Nice 2007
2007TOKAI	Symp.on Nuclear Data, Tokai, Japan, Jan. 2007

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
S	Data restored from archive
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
NACRE	Converted from NACRE files
NCHKD	Original reference not checked
NDD	Data converted from NEUDADA file
OUTDT	Normalization out-of-date
PRELM	Preliminary data
RCALC	Ratio to standard calculated by other than author
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
FNS	Fusion neutron source
FRS	Fragment separator
ICTR	Insulated core transformer accelerator
INTFM	Interferometer
ISOCY	Isochronous cyclotron
LASER	Laser system
LINAC	Linear accelerator
MESON	Meson facility
MICRT	Microtron
OLMS	On-line mass separator
OSCIP	Pile oscillator
PRJFS	Secondary beam from projectile fragment separator
REAC	Reactor
SELVE	Velocity selector
SPECC	Crystal spectrometer
SPECD	Double mass spectrometer
SPECM	Mass spectrometer
SRING	Storage ring
SYNCH	Synchrotron
SYNCY	Synchro cyclotron
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-N14	Deuteron-14N
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
LCS	Laser Compton scattered photons
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
PU242	Spont. fission of 242Pu
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
ANC	Asymptotic normalization constant
ASEP	Separation by mass-separator
ASPEC	Alpha spectrometry
ASSOP	Associated particle
BCINT	Beam current integrated
BGCT	Beta-gamma coincidence technique
BSPEC	Beta ray spectrometry
BURN	Burn-up
CADMB	Cadmium bath
CHARG	Measurements in gas discharge
CHRFL	Christiansen filter
CHSEP	Chemical separation
COINC	Coincidence
DIFFR	Diffraction
DSCAT	Double scattering
EDE	Particle identification by 'E/Delta E' measurement
EDEG	Energy degradation by foils
EXTB	Irradiation with external beam
FISCT	Absolute fission counting
FLUX	Neutron flux monitoring
FNB	Filtered neutron beam
FPGAM	Direct gamma-ray spectrometry
GSPEC	Gamma ray spectrometry
HADT	Heavy atom difference technique
HATOM	Hot atom method
HE-AC	Helium accumulation 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 of a product
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
RINGR	Ring ratio method
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
THERM	Gas thermochromatographic separation
TOF	Time-of-flight
TRN	Transmission method
TROJA	Trojan-horse method
TTM	Thick-target method
XSPEC	X-ray spectrometry

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

BAF2	Scintillator BaF2
BF3	Boron Trifluoride neutron detector
BGO	Bismuth-Germanate crystal detector
BPAIR	Electron-pair spectrometer
BUBLC	Bubble chamber
CEREN	Cerenkov detector
COIN	Coincidence counter arrangement
COMPL	Compton Polarimeter
CSICR	Cesium-Iodide crystal
D4PI	4pi detector
DRFTC	Drift chamber
FISCH	Fission chamber
GE	Germanium detector
GE-IN	Germanium intrinsic detector
GELI	Germanium-Lithium detector
GEMUC	Geiger-Mueller counter
GLASD	Glass detector
HE3SP	He-3 spectrometer
HORBU	Hornyak button detector
HPGE	Hyperpure Germanium detector
IMPSI	Passivated implanted planar Si detector
IOCH	onization chamber
LEGE	Low energy Germanium Detector
LONGC	Long counter
MAGSP	Magnetic spectrometer
MCPLT	Microchannel plate
MOXR	Moxon-Rae detector
MTANK	Moderating tank detector
MWDC	Multi-wire drift chamber
MWPC	Multi-wire proportional counter
MWSC	Multi-wire spark counter
NAICR	Sodium-Iodide crystal
PGAC	Parallel-grid avalanche detector
PHVC	Photovoltaic Cell
PLATE	Nuclear plates
PPAC	Parallel plate avalanche counter
PROPC	Proportional counter
PS	Position sensitive detector
SCIN	Scintillation detector
SIBAR	Silicon surface barrier detector
SILI	Silicon-Lithium detector
SI	Silicon detector
SISD	Silicon strip detector
SOLST	Solid-state detector
SPEC	Large spectrometer system
STANK	Scintillator tank
SWPC	Single-wire proportional counter
TELES	Counter telescope
TFBC	Threshold detector
TRD	Track detector
XHPGE	Extended range Germanium gamma 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
TTUNF	Calculated from thick target using unfolding proced.
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*.	1st, 2nd, *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
-ERR-DIG, -ERR-D	Digitizing error
-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
ANG-AZ	Azimuthal Angle
ANG-RL	Relative 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
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-DIG	Digitizing error (of DATA)
ERR-EDD	Error of energy value given under DECAY-DATA
ERR-IDD	Error of intensity value given under DECAY-DATA
ERR-HL	Error of half-life value given under DECAY-DATA
ERR-S	Statistical uncertainty (1 s)
ERR-SYS	Total Systematic Uncertainty
ERR-T	Total uncertainty (1 s)
FLAG	Flag, link to information under FLAG
GRP-NUM	Group number (of delayed neutrons)
HL	Half-life of nuclide specified
IAS-NUMB	Level Number of Isobaric Analog State
ISOMER	Isomeric state for nuclide given
KT	Spectrum temperature
LVL	Level Energy as additional information
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
MOM-TR	Momentum transfer (in units MeV/c or equiv.)
MOMENTUM L	Angular momentum (*l*) of resonance
MONIT	Normalization value, for reaction given under MONITOR
MU-ADLER	μ (for Adler-Adler resonance parameters)
NUMBER	Fitting coefficient number
PARITY	Parity (p) of resonance
PART-OUT	Number of Emitted Particles
POL-BM	Beam polarization
POL-TR	Target polarization
POLAR	Polarity
q	Momentum transfer, q
Q-VAL	Q-value
S	Distance along S-curve for range of E1 and E2
SPIN J	Spin (J) of resonance
STAT-W G	Statistical-weight factor (g)
-t	4-momentum transfer squared
TEMP	Sample temperature
THICKNESS	Sample thickness
WVE-LN	Wave length of incident particle

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

ABS	Absorption
EL	Elastic scattering
F	Fission
FUS	Total fusion
INL	Inelastic scattering
NON	Nonelastic (= total minus elastic)
PAI	Pair production (for photonuclear reactions)
SCT	Total scattering (elastic + inelastic)
TCC	Total charge changing
THS	Thermal neutron scattering
TOT	Total
X	Process unspecified

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 incoming/outgoing particle)
A	α
AN	Antineutrons
AP	Antiprotons
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
ER	Evaporation Residues
ETA	Eta mesons
FF	Fission fragments
G	γ
HCP	Heavy Charged Particle
HE2	^{2}He
HE3	^{3}He
HE6	^{6}He
HF	Heavy fragment
ICE	Internal-conversion electrons
K	Kaons,unspecified
KN	Kaons,negative
KP	Kaons,positive
LCP	Light charged particle (Z<7)
LF	Light fragment
N	Neutrons
P	Protons
PI	π, unspecified
PI0	π, neutral
PIN	π-
PIP	π+
PN	Prompt neutrons
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 4π
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
AMP	Amplitude (for resonance parameters)
ANA	analyzing power
ASY	asymmetry of polarization of outgoing particles
AV	average
BRA	Bremsstrahlung spectrum average
BRS	average over part of Bremsstrahlung spectrum
C	Spin correlation parameter
COS	Cosine coefficients
CS2	form: $a_0 + a_1*\sin^2 + a_2*\sin^2*\cos + a_3*\sin2*\cos^2$
D	Spin rotation parameter
DSP	Difference for spins parallel - antiparallel
DT	production thick/thin target yield
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
K	Spin transfer parameter
L4P	form: $4\pi\ ds/d\Omega = \Sigma\ (2L+1)*a(L)*p(L)$
LEG	Legendre coefficients
LIM	given for a limited energy range
MOT	relative to Mott scattering
MSC	approximate definition only (see text)
MXW	Maxwellian average
NCP	Non-coplanar
NSF	Non-spin-flip
PHY	Physical yield
PP	Incident projectile parallel/perpendicular to reaction plane
RAW	raw data (see text)
REL	relative data
RES	at peak of resonance
RG	times (2J(i)+1) * (2J(j)+1)
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: $d\sigma/d\Omega = a_0 + a_1*\sin^2(T) + a_2*\sin^2(2*T)$
SF	Spin flip
SFC	S-factor
SN2	sum in the power of $\sin^2$
SPA	spectrum average
SQ	quantity squared
SS	spin-spin
TAP	Tensor analyzing power, spherical coordinates
TM	per 1 MeV target thickness (for thick target yields)
TST	Total spin transfer
TT	measured for thick target
VAP	Vector analyzing power, spherical coordinates
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 *(default)*
RECOM	Recommended data

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

DFRCT	Delayed neutron fraction
FRCUM	Fractional cumulative yield
FRIND	Fractional independent yield
RVAL	R-value

Dictionary 207: Books: used as the second subfield for the keyword REFERENCE, when the reference type is given as B, and similarly, for MONIT-REF, and REL-REF. A **subset** containing some of the most frequently used codes is given here.

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

Dictionary 236: Quantity Codes: used for quantity (REACTION subfields 5-7), and simarlarly under ASSUMED and MONITOR. They may be combined with modifier codes from Dictionary 34 to form the complete quantity string; if more than one code applies, they are separated by / (slash). The code * in the 3rd field (SF7) signifies that any particle code from Dictionary 33 may be 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
IND	independent formation of product
M+	including decay from metastable state
M-	excluding decay from metastable state
(M)	uncertain if decay from metastable state included.
PAR	partial
SEQ	given for reaction sequence specified
UND	reaction is undefined, only the sum of outgoing nucleons is known.
(DEF)	Compiler is uncertain whether the reaction is defined.

Branch codes used for analyzing power / polarization:

20,21,22,31,32,33	Coefficients $T_{20,}$ $T_{21,}$ $T_{22,}$ etc., for analyzing power
LL	Longitudinal-longitudinal (zz) component
LS	Longitudinal-sideward (zx) component
NL	Normal-longitudinal (yz) component
NN	Normal-normal (yy) component
SL	Sideward-longitudinal (xz) component
SS	Sideward-sideward (xx) component

,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/CRL	Angular correlation
,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/TMP,*	Differential cross section, temperature dependent
,DA/TYA,P	Differential cross section with respect to Treiman-Yang angle

,DA2/DE2,*/*	Quadruple differential cross section
,DE	Energy spectrum of outgoing particles
,DE,*	Energy spectrum of particle specified
,DP	Diff. cross section with respect to linear momentum
,EN	Resonance energy
,ETA	Neutron yield (η)
,ETA/NU	η / $\bar{\nu}$
,FM/DA	Angular distribution, of 1st kind
,FM2/DA	Spin-polarization probability of 1st kind
,INT	Cross-section integral over incident energy
,IPA	Diff.cs integrated over partial angular range
,IPA/DE	Double-diff.cs integr.over partial ang.range
,IPA/DP	Double-diff.cs d2/dp/dA integr.over partial ang.range
,IPP/DA	Double-diff.cs d2/dp/dA int.over part.mom.range
,J	Spin J
,KE,*	Kinetic energy of fission fragments specified
,KE/CRL,LF/HF	Total kinetic energy of light/heavy frag. pair
,KEM,*	Temp.of Maxwell.distr.of outgoing particles
,KEP,*	Most probable kinetic energy of outgoing particles
,KER	Kerma factor
,L	Momentum *l*
,LDP	Level density parameter
,MCO	Linear momentum correlation
,MLT	Multiplicity of outgoing particle
,MLT,*	Multiplicity of particle specified
,MLT/DA	Particle multiplicity d/dA
,MLT/DE	Particle multiplicity d/dE
,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
,POL/DA/DA/DE,,ANA	Analyzing power dA1/dA2/dE1
,POL/DA/DE	Diff.spin-pol.probab.w.resp.to angle and energy
,POL/DA/DE,,ANA	Analyzing power / dE
,POL/DA2/DE2,*/*,ANA	Analyzing power d4/dA(*)/dA(*)/dE(*)/dE(*)
,POL/DT,,ANA	Analyzing power with respect to 4-momentum transfer
,PTY	Parity
,PY	Product yield
,PY/DA	Differential product yield d/dA
,PY/DA/DE	Differential product yield d/dA/dE
,PY/IPA	Product yield d/dA, integrated over partial angular range
,RAD	Scattering radius
,RI	Resonance integral
,SCO	Spin-cut-off factor
,SGV	Reaction rate (s*velocity)
,SIF	Self-indication function
,SIF/TMP	Temperature-dependent self-indication function
,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
,TRN	Transmission

,TRN/TMP	Transmission, temperature dependent
,TTT	Thick-target yield per unit time
,TTT/DA	Thick-target yield per unit time dY/dΩ
,TTY	Thick-target yield
,TTY/DA	Differential thick target yield dY/dΩ
,TTY/DA/DE	Differential thick target yield dY/dΩ/dE
,TTY/DE	Differential thick target yield dY/dE
,TTY/MLT	Particle multiplicity for thick target, as fct. of beam current
,TTY/MLT/DA	Thick target particle multiplicity d/dA, as fct. of beam current
,TTY/MLT/DA/DE	Thick target particle multiplicity d2/dA/dE, as fct. of beam current
,TTY/MLT/DE	Thick target particle multiplicity d/dE, as fct. of beam current
,TTY/PY	Thick-target product yield, as fct. of beam current
,TTY/PY/DA	Thick-target product yield d/dA, as fct. of beam current
,TTY/PY/DA/DE	Thick-target product yield d2/dA/dE, as fct. of beam current
,WID	Resonance width, Γ
,WID/RED	Reduced width, Γ_0
,WID/STR	Resonance strength
,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,SIG/TMP	Bound-atom cross section, temperature dependent
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. dσ/dΩ 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)
CHN,SIG	Total chain yield cross section f. fission products
CN,DA	Differential cross section dσ/dΩ, 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
CON,SIG	Production cross section for continuous gammas
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 dσ/dΩ, direct interaction contribution
DI,DA/DE	Double diff. c/s $d^2\sigma/d\Omega/dE$, direct interaction contribution
DI,DE	Energy spectrum of outgoing particles, direct interaction contrib..
DI,SIG	Cross section, direct interaction contribution
DIS,SIG	Production cross section for discrete gammas
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/GRP,AKE,N	Average kinetic energy for specific delayed neutron group
DL/GRP,DE,N	Energy spectrum for specific delayed neutron group
DL/GRP,NU	Delayed neutron yield for given half-life group
DL/GRP,SIG,N	Delayed neutron emission cs for given half-life group
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,POL/DA/DE,,ANA	Analyzing power / dE for particle emission
EM,SIG	Emission cross section (excluding elastic scattering)
EM/PAR,POL/DA	Partial emission diff.spin-polar.prob.
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
FA,AMP	Free-atom scattering amplitude
FA,SIG	Free-atom cross section
FA,SIG/TMP	Free-atom cross section, temperature dependent
FA/COH,SIG	Free-atom coherent scattering cross section
FA/INC,SIG	Free-atom incoherent scattering cross section
FIS,AKE	Avg.kin.energy of outg.part.for high en.fission
FIS,SIG	Partial cross section due to high-energy fission
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
LON,POL,,DSP/ASY	Spin-spin asymmetry for longitud. spin states
LON,POL/DA,,ANA	Longitudinal analyzing power A(z)
LON,SIG,,DSP	Cs diff.(longit.spins, parallel - antiparallel)
LON,SIG,,SS	Spin-spin cs, longitudinal to beam direction
LP,DP	Diff. cs with respect to longitudinal secondary momentum
LP,IPA/DP	Cross section diff.by long.sec.lin.mom.,integr.over part. ang.range
MAS,FY	Mass yield of fission fragments as sum of independent yields
MP,SIG	Cross section for magnetic polarity given
MP,STF	Strength function for magnetic polarity given
NUM,NU	Probability for emission of N neutrons
NUM,PY	Probab. for the production of N product particles
NUM,SIG,*	Cross section for production of specified no. of particle specified
PAR,DP,*+*	Diff.cs with respect to secondary momentum of particle pair
PAR,FY/DE,LF/HF	Fission product yield at given light and heavy fragment energy
PAR,INT/DA,*	Integral over incident en. of partial diff. c/s, $d\sigma/d\Omega$, of particle specified
POT,RAD	Potential scattering radius
POT,SIG	Potential scattering cross section
PR,AKE,N	Average kinetic energy of prompt neutrons
PR,AKE/DE,N/FF	Average energy of prompt neutrons dep.on fiss.fragment energy
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,*	Differential cross section, $d\sigma/d\Omega$ of prompt particles
PR,DA/DE,N	Double differential cross section of prompt neutrons, d2σ/dΩ/dE
PR,DE,N	Energy spectrum of prompt fission neutrons
PR,KE/CRL,N/HF	Energy correlation neutron / heavy fission fragment
PR,KEM,N	Temperature of Maxwellian distribution of prompt neutrons
PR,NU	Prompt neutron yield ($\bar{\nu}$)

PR,NU/DE,FF	No.of prompt neutrons emitted by fiss. fragments of given E
PR/NUM,NU	Probability for emission of N prompt neutrons
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,AKE/DA,FF	Average kinetic energy of primary fragm., function of angle
PRE,AP,*	Most probable mass, pre-neutron-emission, of fragment specified
PRE,AP/DA,FF	Centr.of mass distr. of primary fiss.fragm.,dep. on angle
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,DA/TMP,FF	Ang. distr. of primary fiss. fragm., temperature dependent
PRE,DE,*	Energy spectrum of primary fragments specified
PRE,FY	Primary fission yield
PRE,FY/CRL	Primary fission product yield of correlated fragment pairs
PRE,FY/DE	Primary fission yield dY/d(kinetic energy)
PRE,KE,*	Kinetic energy of primary fragments specified
PRE,KE/CRL,*/*	Total kinetic energy of primary fragment pair
PRE/BIN,FY	Primary fission yield, binary fission
PRE/TER,AKE/CRL,A/FF	Avg.kin.energy of ternary alphas correl.with prim.fragm.energy
PRE/TER,FY	Primary fission yield, ternary fission
PRE/TER,KE/CRL,FF/A	Energy correlation prim.fragment/tern.alphas
PRE/TER,KEP/CRL,A/FF	Most probable energy of alphas correl.with prim.fragm.energy
PRE/TER/PAR,FY/CRL,A/FF	Yield of alphas of giv.energy correl.w.prim.fragm.energy
QTR,FY	Fission-product yield, quaternary fission
QTR,KE	Kinetic energy for quaternary 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,FY/CRL	Post-neutron-emission yield of correl.fragm.pairs
SEC,FY/DE,HF	Post-neutr.emiss.heavy fiss.fragm.yield ,diff.w.fragm.kinet.energy
SEC,ZP	Most probable charge of fission fragment, post-neutron-emission
SEC/CHN,FY	Pre-delayed-neutron chain yield
SEC/CHN,FY/DE	Pre-delayed-neutron chain yield dY/d(kinetic energy)
SPL,AKE	Average kinetic energy of spallation products
SPL,SIG	Partial cross section due to spallation
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-diff. cross sect. $d^2\sigma/d\Omega/dE$ of particle spec., ternary fission
TER,DA/KE,*	Kinetic energy distrib., $dE_{kin}/d\Omega$, 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,FY/CRL,*/*F	(particle)/(fragment) correl., ternary fission
TER,KE	Kinetic energy for ternary fission
TER,KEP,*	Most probable kin.energy of ternary fission particle
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,FY/RAT,*	Ternary/binary fission particle yield ratio
TER/BIN,SIG/RAT	Ternary/binary fission cross section ratio
TER/CHG,FY	Total element yield of fiss.prod.,ternary fiss.
TER/PAR,MLT,G/LCP	Gamma mult.,tern.fiss.with light charged part.energy given

TP,DP	Diff.cs w.resp.to transv.secondary momentum
TRS,POL/DA,,ANA	Transverse vector analyzing power, A(x)
TRS,SIG,,DSP	Cs difference (transv.spins, parallel - antiparallel)
UNW,INT	Unweighted prod.cs integral over incid.energy
UNW,SIG	Unweighted production cross section