IAEA-NDS- 1

INTERNATIONAL ATOMIC ENERGY AGENCY

Rev. 5

NUCLEAR DATA SERVICES

DOCUMENTATION SERIES OF THE IAEA NUCLEAR DATA SECTION

SHORT GUIDE TO EXFOR

EXFOR is a computerized system for the storage, retrieval and international exchange of experimental nuclear reaction data induced by neutrons, photons, charged particles and heavy ions. The data file in an agreed "EXchange FORmat" is produced and maintained by a network of national and regional nuclear data centers. The present document gives an introduction to EXFOR and describes the products available from the IAEA Nuclear Data section. Data retrievals in different output formats are available costfree upon request.

Contents

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What is EXFOR?

EXFOR is a unified computerized system by which national and regional data analysis centers, coordinated by the IAEA Nuclear Data Section, exchange numerical data tables for all kinds of nuclear reaction data.

At present, the EXFOR system contains more than 3 million data records representing

- a world-wide complete compilation of experimental neutron induced nuclear reaction data, and

- a selective compilation of the more important data of nuclear reactions induced by charged particles and photons.

Selective retrievals from the EXFOR files are available to everybody upon request in a variety of formats on magnetic tape or on paper. Such retrievals are provided free of charge.

History of EXFOR

In 1965, systematic collection of experimental neutron nuclear data was done at

- Brookhaven National Laboratory, USA, (formerly Sigma Center, now National Nuclear Data Center) using the data storage and retrieval system SCISRS;

- OECD Nuclear Energy Agency at Saclay, France, (formerly Neutron Nuclear Data Centre, now NEA Data Bank) using the system NEUDADA;

- International Atomic Energy Agency, Vienna, Austria, (formerly Nuclear Data Unit, now Nuclear Data Section) using the system DASTAR;

- Fiziko-Energeticheskij Institut Obninsk, USSR, (Centr po Jadernym Dannym) using a USSR computer incompatible to Western computers.

It became obvious that these activities required coordination. Through discussions held between programming staff and physicists (from Saclay, Vienna, Livermore and Brookhaven) a joint nuclear data exchange format "EXFOR" was formulated and accepted in its initial form at an IAEA Consultants' Meeting held in Moscow in November 1969. In 1970, the system was in operation, including the Obninsk Center, which solved the compatibility problem to USSR computers and, for the first time, initiated an East-West information exchange on magnetic tapes. Data compiled at one of the cooperating data centers, were speedily transmitted to the other centers, thus making them available to the fast increasing community of data users throughout the world.

Subsequently, data compiled earlier were converted to EXFOR, the scope of EXFOR was widened, and additional data analysis centers joined.

The network of Nuclear Reaction Data Centers

National and regional nuclear reaction data centers, co-ordinated by the International Atomic Energy Agency, co-operate in the compilation, exchange and dissemination of nuclear reaction data, in order to meet the requirements of nuclear data users in all countries. A brief summary of the data centers network is given below.

The nuclear reaction data centers:

NNDC	- US National Nuclear Data Center, Brookhaven, USA
NEA-DB	- OECD/NEA Nuclear Data Bank, Saclay, France
NDS	- IAEA Nuclear Data Section
CJD	- USSR Centr po Jadernym Dannym (= Nuclear Data Centre), Obninsk, USSR
CAJaD	- USSR Centr po Dannym o Stroenii Atomnogo Jadra i Jadernykh Reakcikh (= Nuclear Structure and Nuclear Reaction Data Centre), Moscow, USSR
CDFE	- Centr Dannykh Fotojad. Eksp. (= Centre for Experimental Photonuclear Data), Moscow, USSR
RIKEN	- Nuclear Data Group, RIKEN Inst. of Phys. and Chem. Res., Wako-Shi, Japan
CNDC	- Chinese Nuclear Data Centre, Beijing, P.R. of China
KACHAPAG	- Karlsruhe Charged Particle Group, Karlsruhe, FRG*)
FIZ	- Fachinformationszentrum Karlsruhe, FRG*)
PhDC	- Photonuclear Data Center, Washington, USA

These data centres cooperate on the following projects:

1. Neutron Nuclear Data

1.a Bibliography and Data Index "CINDA":
Input prepared by NEA-DB, NNDC, NDS, CJD
Handbooks published by IAEA

1.b Experimental data exchanged in EXFOR format:
Input prepared by NNDC, NEA-DB, NDS, CJD

1.c Data Handbooks based on EXFOR published by NNDC

1.d Evaluated data exchanged in ENDF/B format:
NNDC, NEA-DB, NDS, CJD and others

1.e Computer retrieval services upon request of customers:
NNDC, NEA-DB, NDS, CJD

1.f WRENDA: compilation of requested data that are known with insufficient accuracy. Compiled by NNDC, NEA-DB, NDS, CJD, published by IAEA

2. Charged Particle Nuclear Data (including heavy-ion reaction data)

2.a Bibliography published by NNDC

2.b Numerical data exchanged in EXFOR format:
Input prepared by CAJaD, RIKEN, CNDC, NDS, NNDC, KACHAPAG*)

2.c Data Handbooks based on EXFOR published by FIZ/KACHAPAG*)

2.d Computer retrieval services upon request of customers:
NNDC, NEA-DB, NDS, CAJaD

3. Photonuclear Data

3.a Numerical data exchanged in EXFOR format:
Input prepared by CDFE, occasional contributions from NNDC(PhDC), NDS

3.b. Bibliography published by CDFE

3.c Computer retrieval services upon request of customers:
NNDC, NEA-DB, NDS, CAJaD

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*) Discontinued in 1982. Since then CAJaD has increased its compilation activities.

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 publications. As in the case of conventional publications, authors receive proof-copies of their data as compiled in EXFOR.

- EXFOR data are currently updated. Experience shows that authors frequently revise their data after publication, and EXFOR data files are kept up-to-date accordingly.

- EXFOR numerical data 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.

- EXFOR is flexible enough that all kinds of data can be included, but it is sufficiently structured that computer-processing of data is possible. However, EXFOR is not optimized for computer-processing of data but rather optimized for international data exchange suitable for a large variety of computers.

- An EXFOR "entry" represents the results of a work performed at a given laboratory in a given time (experiment, theory or evaluation); an EXFOR "entry" does not correspond to the information found in a given publication. Usually, a "work" is reported in several publications, typically one or more progress-reports, a conference paper with preliminary results, a lab report, an article in a local journal and a final but often less detailed article in an international journal. The EXFOR compiler extracts the essential information from all of these sources and, in addition, contacts the author in order to obtain additional information (in particular details on the error analysis) and to verify that the data compiled are the author's final results.

- An EXFOR "entry" is identified by an accession number and a date (giving the date of compilation or the date of the last revision of the entry). If an entry is revised, nature and reason of the revision are documented within the revised entry. Attempts are made to ensure that customers who received the earlier version, are notified of the revision.

Brief description of EXFOR

EXFOR - a computerized EXchange FORmat - presents in a convenient compact form experimental numerical data as well as physical information necessary to understand the experiment and interpret the data. Keywords and codes make the information computer intelligible. The structure of EXFOR is briefly described in the following.

An EXFOR "entry" usually contains the results of "one experiment" made at a given laboratory in a given time. As the results may consist of several data tables (e.g. cross-sections $\sigma(E)$ for several isotopes), an EXFOR "entry" consists of several "subentries". As a rule, the first "subentry" of an "entry" does not contain a data table but rather all that information, in particular bibliographic text information, which is common to all "subentries" of the given "entry".

As no numerical data table can be meaningful without a minimum of explanatory text, each EXFOR "entry" consists of

- text information, and
- numerical information.

The text part includes bibliographic information, bookkeeping information (e.g. origin of the data, date of compilation), definition of the data given in the numerical part, and related physics information such as error-analysis, standard reference data used, etc.

Each item of text information is identified by keywords such as

TITLE
AUTHOR
INSTITUTE
REFERENCE

REACTION
METHOD
STANDARD
DECAY-DATA
ERR-ANALYS
and others

The information given under these keywords may be unstructured free text, or structured information enclosed in parentheses using agreed codes and coding rules to be accessible by computer programs. Of particular importance is the keyword "REACTION". Under this keyword the DATA given in the data table are defined, as for example

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

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

(In old EXFOR entries the keyword "ISO-QUANT" was used instead of "REACTION" with somewhat different coding rules. Similarly, the keywords "STANDARD" and "MONITOR" are equivalent.)

The numerical part of a subentry consists of the data table itself (also referred to as "DATA section") and, most often, of one or more constant parameters (also referred to as "COMMON section"). The numerical part is structured in six columns with a constant field length of 11 characters. All numerical columns are headed and defined by

- column heading keywords, for example

EN	for incident particle energy
DATA	for the actual data defined above under the keyword REACTION
DATA-ERR	for the uncertainty of the data etc.

A list of column-heading keywords is given on page 11.

- data-units, such as

EV	for electron-Volts
MB	for milli-barns, etc.

The complete lists of keywords and abbreviations used in EXFOR can be found in the document IAEA-NDS-2, the detailed EXFOR MANUAL in the document IAEA-NDS-3. Both are also available on microfiche from the IAEA INIS Microfiche Service. The codes used for bibliographic references and for the institutes can also be found in the CINDA handbooks.

EXFOR examples

The following pages show examples of EXFOR entries. The examples are given in two formats:

- the "standard format" primarily designed for the international exchange of data in computer processable form, and

- the "edited format" in which coded information and data tables are edited in an easily legible form.

The EXFOR structure, the standard and edited formats are illustrated in example 1. For simplicity, the actual data tables given in the second and third subentry consist here of only one line (they may consist of 100 or 1000 lines!). The "constant parameters" (resp. COMMON values) given in subentry 002 refer to this subentry only; whereas the "constant parameters" given in subentry 001 refer to all of the following subentries.

Some data tables may have a more complex structure, for example there may be several REACTION (resp. ISO-QUANT) codes per subentry; in this case each of them is connected to its pertinent column in the DATA TABLE by means of a "pointer", as illustrated in example 2. More generally a pointer can be used to connect related pieces of information (see example 3).

EXFOR ENTRY 30282.

"EDITED" LISTING

```
NUCLEAR DATA SECTION, INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA.      ACCESSION NUMBER  EXFOR 30282.

BIBLIOGRAPHY, EXPERIMENTAL DESCRIPTION, EXPLANATIONS
     ********************************************************************************
     TITLE       ACTIVATION CROSS-SECTIONS OF PT-198 WITH FAST NEUTRONS
     AUTHOR      (I.URAY,A.SZALAY)
     INSTITUTE   ATOMKI, DEBRECEN, HUNGARY
                 (3HUNDEB)
     EXP-YEAR    (73)
     REFERENCE   ATOMKI(ATOMMAG KUT.INTEZ.)KOZLEM., 15, (3), 161 (MAR.1973) :  FULL INFORMATION.
                 PROG.REPT. INDC(HUN)-11, 14 (SEP.1973) :   ABSTRACT ONLY
     SAMPLE      MEASUREMENTS WERE MADE SIMULTANEOUSLY WITH NATURAL AND
                 ENRICHED PT SAMPLES (87.68 PERCENT PT-198).
     STANDARD    --------------------------------------------------------------------
                 | 78-PT-198      PARTIAL (N,2N) CS POPULATING A METASTABLE         |
                 |                STATE OF THE RESIDUAL NUCLEUS                     |
                 --------------------------------------------------------------------
                 (78-PT-198,N2N,,MS) NUMERICAL VALUE FROM P.WINIWARTER,
                 NUCL.PHYS.A 158(1970)77. BRANCHING RATIOS AND CONVER-
                 SION COEFFICIENT WERE TAKEN FROM M.E.LEWIS.NUCL.DATA
                 SHEETS B7(1972) 129.
     HALF-LIFE   (HL1,78-PT-197-M) THE HALF-LIFE OF THE STANDARD 346
                 KEV ISOMERIC TRANSITION WAS MEASURED BY AUTHOR.
     FACILITY    240 KV NEUTRON GENERATOR OF ATOMKI
     N-SOURCE    (D-T)  T(D,N)ALPHA REACTION. THE NEUTRON YIELD WAS
                 ABOUT 5*10**9 NEUTRONS/SEC.
     METHOD      (ACTIV) ACTIVATION METHOD
     DETECTOR    (GELI) 12 CM3 GE(LI) DETECTOR WITH A RESOLUTION (FWHM)
                 OF 3.5 KEV AT 661 KEV. ENERGY CALIBRATION WAS PERFORMED
                 WITH AIEA STANDARD SOURCES.
     STATUS      DATA TAKEN FROM ATOMKI KOEZLEMENYEK 15(1973)161.
     HISTORY     (741125C) CA.
     ********************************************************************************

CONSTANT PARAMETERS
         EN          = 15.0         MEV
         EN-RSL      = 0.4          MEV
         STAND       = 894.         MB                    STAND DEFINED ABOVE UNDER STANDARD.
         STAND-ERR   = 101.         MB
         HL1         = 94.4         MIN
         HL1-ERR     = 0.8          MIN
     ********************************************************************************

      THE ABOVE INFORMATION APPLIES TO ALL SUB-ACCESSION NUMBERS STARTING WITH 30282.
```

FIRST SUBENTRY 30282.001

INFORMATION COMMON TO THE ENTIRE ENTRY

KEYWORDS

CODES

CONSTANT PARAMETERS TO ALL SUBENTRIES IN ENTRY 30282

```
BIBLIOGRAPHY, EXPERIMENTAL DESCRIPTION, EXPLANATIONS          SUB-ACCESSION NUMBER  EXFOR 30282.002
     ********************************************************************************
     ISO-QUANT   --------------------------------------------------------------------
                 | 78-PT-198      PARTL.(N,GAMMA) CS TO METASTABLE STATE            |
                 --------------------------------------------------------------------
                  (78-PT-198,NG,,MS)
     HALF-LIFE   (HL1,78-PT-199-M) MEASURED BY AUTHOR
     PART-DET    (DG) THE TOTAL INTERNAL CONVERSION COEFFICIENT OF THE
                 392 KEV TRANSITION IS ABOUT 0.14 (FROM M.A.WAHLGREN,
                 W.W.MEINKE, PHYS.REV.115(1959)191)
     ********************************************************************************

CONSTANT PARAMETERS
         HL1         = 13.3         SEC
         HL1-ERR     = 0.2          SEC
     ********************************************************************************

DATA TABLE
     DATA DEFINED ABOVE UNDER ISO-QUANT
      DATA          DATA-ERR
      MB            MB
   1  0.9           0.4
     ********************************************************************************
```

SECOND SUBENTRY 30282.002

CONSTANT PARAMETERS VALID FOR SUBENTRY 30282.002 ONLY

"DATA" DEFINED UNDER ISO-QUANT OF SUBENTRY 30282.002

```
BIBLIOGRAPHY, EXPERIMENTAL DESCRIPTION, EXPLANATIONS          SUB-ACCESSION NUMBER  EXFOR 30282.003
     ********************************************************************************
     ISO-QUANT   --------------------------------------------------------------------
                 | 78-PT-198      (N,GAMMA) CROSS-SECTION                           |
                 --------------------------------------------------------------------
                  (78-PT-198,NG)
     HALF-LIFE   (HL1,78-PT-199) GIVEN BY COMPILER
     PART-DET    (DG) THE 316, 493 AND 542 KEV TRANSITIONS WERE MEASURED
                 FOR THE DETERMINATION OF THE TOTAL (N,GAMMA) CROSS-SEC-
                 TION.
     ********************************************************************************

CONSTANT PARAMETERS
         HL1         = 30.          MIN
     ********************************************************************************

DATA TABLE
     DATA DEFINED ABOVE UNDER ISO-QUANT
      DATA          DATA-ERR
      MB            MB
   1  12.           2.
     ********************************************************************************
```

THIRD SUBENTRY 30282.003

CONSTANT PARAMETERS VALID FOR SUBENTRY 30282.003 ONLY

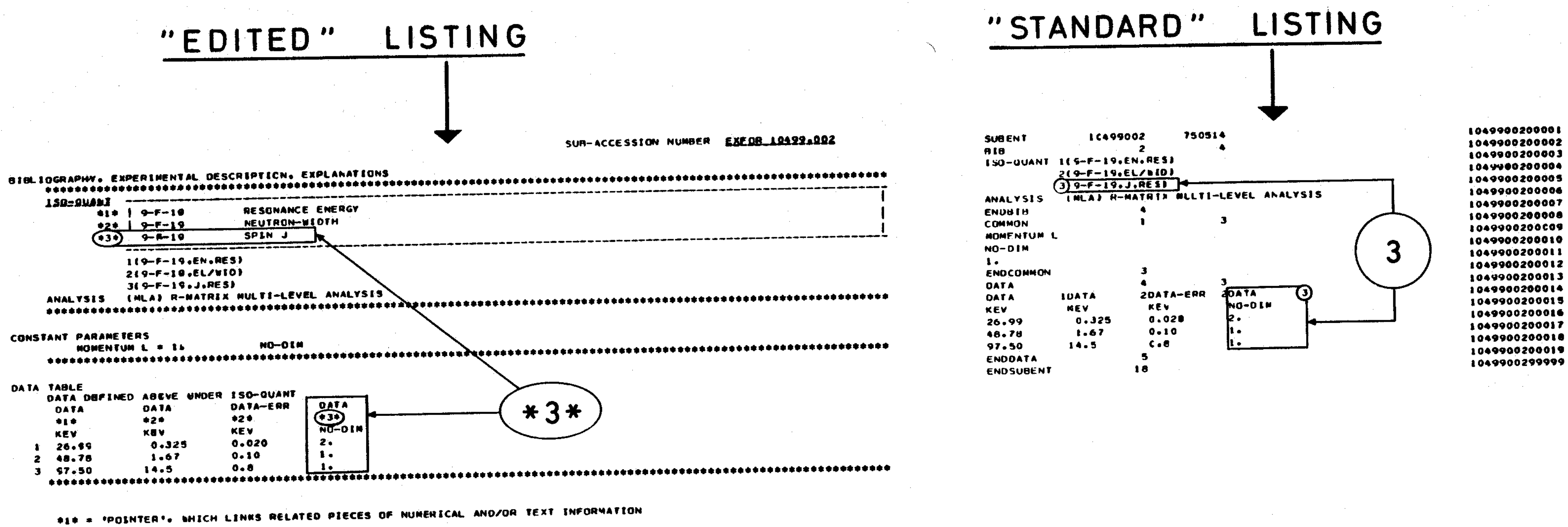
"DATA" DEFINED UNDER ISO-QUANT OF SUBENTRY 30282.003.

"STANDARD" LISTING

```
SUBENT        30282001       741205                                          3028200100001
BIB                 14           23                                          3028200100002
TITLE       ACTIVATION CROSS-SECTIONS OF PT-198 WITH FAST NEUTRONS           3028200100003
AUTHOR      (I.URAY,A.SZALAY)                                                3028200100004
INSTITUTE   (3HUNDEB)                                                        3028200100005
EXP-YEAR    (73)                                                             3028200100006
REFERENCE   (J,AK,15,(3),161,7303) FULL INFORMATION.                         3028200100007
            (P,INDC(HUN)-11,14,7309)  ABSTRACT ONLY                          3028200100008
SAMPLE      MEASUREMENTS WERE MADE SIMULTANEOUSLY WITH NATURAL AND           3028200100009
            ENRICHED PT SAMPLES (87.68 PERCENT PT-198).                      3028200100010
STANDARD    (78-PT-198,N2N,,MS) NUMERICAL VALUE FROM P.WINIWARTER,           3028200100011
            NUCL.PHYS.A 158(1970)77. BRANCHING RATIOS AND CONVER-            3028200100012
            SION COEFFICIENT WERE TAKEN FROM M.B.LEWIS.NUCL.DATA             3028200100013
            SHEETS B7(1972) 129.                                             3028200100014
HALF-LIFE   (HL1,78-PT-197-M) THE HALF-LIFE OF THE STANDARD 346              3028200100015
            KEV ISOMERIC TRANSITION WAS MEASURED BY AUTHOR.                  3028200100016
FACILITY    240 KV NEUTRON GENERATOR OF ATOMKI                               3028200100017
N-SOURCE    (D-T)  T(D,N)ALPHA REACTION. THE NEUTRON YIELD WAS               3028200100018
            ABOUT 5*10**9 NEUTRONS/SEC.                                      3028200100019
METHOD      (ACTIV) ACTIVATION METHOD                                        3028200100020
DETECTOR    (GELI) 12 CM3 GE(LI) DETECTOR WITH A RESOLUTION (FWHM)           3028200100021
            OF 3.5 KEV AT 661 KEV. ENERGY CALIBRATION WAS PERFORMED3028200100022
            WITH AIEA STANDARD SOURCES.                                      3028200100023
STATUS      DATA TAKEN FROM ATOMKI KOEZLEMENYEK 15(1973)161.                 3028200100024
HISTORY     (741125C) CA.                                                    3028200100025
ENDBIB              23                                                       3028200100026
COMMON               6            3                                          3028200100027
EN          EN-RSL     STAND      STAND-ERR   HL1        HL1-ERR             3028200100028
MEV         MEV        MB         MB          MIN        MIN                 3028200100029
15.0        0.4        894.       101.        94.4       0.8                 3028200100030
ENDCOMMON            3                                                       3028200100031
ENDSUBENT           30                                                       3028200199999
```

```
SUBENT        30282002       741205                                          3028200200001
BIB                  3            5                                          3028200200002
ISO-QUANT   (78-PT-198,NG,,MS)                                               3028200200003
HALF-LIFE   (HL1,78-PT-199-M) MEASURED BY AUTHOR                             3028200200004
PART-DET    (DG) THE TOTAL INTERNAL CONVERSION COEFFICIENT OF THE            3028200200005
            392 KEV TRANSITION IS ABOUT 0.14 (FROM M.A.WAHLGREN,             3028200200006
            W.W.MEINKE, PHYS.REV.115(1959)191)                               3028200200007
ENDBIB               5                                                       3028200200008
COMMON               2            3                                          3028200200009
HL1         HL1-ERR                                                          3028200200010
SEC         SEC                                                              3028200200011
13.3        0.2                                                              3028200200012
ENDCOMMON            3                                                       3028200200013
DATA                 2            1                                          3028200200014
DATA        DATA-ERR                                                         3028200200015
MB          MB                                                               3028200200016
0.9         0.4                                                              3028200200017
ENDDATA              3                                                       3028200200018
ENDSUBENT           17                                                       3028200299999
```

```
SUBENT        30282003       741205                                          3028200300001
BIB                  3            5                                          3028200300002
ISO-QUANT   (78-PT-198,NG)                                                   3028200300003
HALF-LIFE   (HL1,78-PT-199) GIVEN BY COMPILER                                3028200300004
PART-DET    (DG) THE 316, 493 AND 542 KEV TRANSITIONS WERE MEASURED3028200300005
            FOR THE DETERMINATION OF THE TOTAL (N,GAMMA) CROSS-SEC-3028200300006
            TION.                                                            3028200300007
ENDBIB               5                                                       3028200300008
COMMON               1            3                                          3028200300009
HL1                                                                          3028200300010
MIN                                                                          3028200300011
30.                                                                          3028200300012
ENDCOMMON            3                                                       3028200300013
DATA                 2            1                                          3028200300014
DATA        DATA-ERR                                                         3028200300015
MB          MB                                                               3028200300016
12.         2.                                                               3028200300017
ENDDATA              3                                                       3028200300018
ENDSUBENT           17                                                       3028200399999
```



POINTERS LINK RELATED PIECES OF NUMERICAL AND/OR TEXT INFORMATION. IN THIS EXAMPLE, A POINTER (E.G. 3) LINKS AN ISO-QUANT WITH ITS CORRESPONDING DATA COLUMN.

"EDITED" LISTING

```
                                                       SUB-ACCESSION NUMBER  EXFOR 30275.045

BIBLIOGRAPHY, EXPERIMENTAL DESCRIPTICN, EXPLANATIONS ****************************************
    ****************************************************************************************
    ISO-QUANT  ---------------------------------------------------------------------------
               | 22-TI-0        DIFF.PARTL.NEUTRCN-EMISSION CROSS-SECTION                  |
               ---------------------------------------------------------------------------
                (22-TI-0.NEM.DA.PAR)
    STATUS     DATA WERE OBTAINED BY INTEGRATING OVER A 1 MEV INTERVAL
               FROM 2 TO 11 MEV THE DOUBLE DIFFERENTIAL CROSS-SECTION
               GIVEN IN SUBENTRY 11.
    ****************************************************************************************

CONSTANT PARAMETERS
    *1* ANG        = 40.        ADEG
    *2* ANG        = 60.        ADEG
    *3* ANG        = 90.        ADEG
    *4* ANG        = 120.       ADEG
    *5* ANG        = 150.       ADEG
        EN-APRX    = 14.6       MEV
    ****************************************************************************************

DATA TABLE
    DATA DEFINED ABOVE UNDER ISO-QUANT
      1        2        3         4         5         6         7         8         9         10
    E-MIN    E-MAX   DATA-CM  DATA-ERR  DATA-CM  DATA-ERR  DATA-CM  DATA-ERR  DATA-CM  DATA-ERR
                      *1*       *1*       *2*       *2*       *3*       *3*       *4*       *4*
     MEV      MEV    MB/SR     MB/SR     MB/SR     MB/SR     MB/SR     MB/SR     MB/SR     MB/SR
1     2.       3.    30.88     0.57      24.60     0.25      26.88     0.39      25.19     0.44
2     3.       4.    22.61     0.50      14.99     0.20      14.50     0.24      13.60     0.27
3     4.       5.    13.92     0.30       9.30     0.14       7.94     0.15       6.14     0.13
4     5.       6.    10.17     0.25       7.02     0.11       6.12     0.13       2.79     0.06
5     6.       7.     8.53     0.23       5.73     0.10       4.45     0.12       2.35     0.06
6     7.       8.     7.47     0.22       5.27     0.09       3.43     0.11       1.94     0.06
7     8.       9.     5.94     0.17       4.18     0.08       2.50     0.09       1.04     0.05
8     9.      10.     3.98     0.11       3.02     0.06       1.76     0.06       0.47     0.02
9    10.      11.     2.94     0.08       2.10     0.05       0.95     0.04       0.27     0.01
--------------------------------------------------------------------------------------------
     11        12
   DATA-CM  DATA-ERR
     *5*      *5*
    MB/SR    MB/SR
1   18.06     0.69
2    8.92     0.56
3    3.11     0.40
4    2.56     0.28
5    2.76     0.36
6    1.46     0.14
7    2.46     0.28
8    1.96     0.21
9    0.42     0.10
    ****************************************************************************************

*1* = 'POINTER', WHICH LINKS RELATED PIECES OF NUMERICAL AND/OR TEXT INFORMATION
```

2

"STANDARD" LISTING

```
SUBENT          30275045      750521                                      3027504500001
BIB                    2           4                                      3027504500002
ISO-QUANT  (22-TI-0.NEM.DA.PAR)                                           3027504500003
STATUS     DATA WERE OBTAINED BY INTEGRATING OVER A 1 MEV INTERVAL        3027504500004
           FROM 2 TO 11 MEV THE DOUBLE DIFFERENTIAL CROSS-SECTION         3027504500005
           GIVEN IN SUBENTRY 11.                                          3027504500006
ENDBIB                 4                                                  3027504500007
COMMON                 6           3                                      3027504500008
ANG        1ANG       2ANG        3ANG        4ANG        5EN-APRX        3027504500009
ADEG       ADEG       ADEG        ADEG        ADEG        MEV             3027504500010
40.        60.        90.         120.        150.        14.6            3027504500011
ENDCOMMON              3                                                  3027504500012
DATA                  12           9                                      3027504500013
E-MIN      E-MAX      DATA-CM     1DATA-ERR   1DATA-CM    2DATA-ERR      23027504500014
DATA-CM    3DATA-ERR  3DATA-CM    4DATA-ERR   4DATA-CM    5DATA-ERR      53027504500015
MEV        MEV        MB/SR       MB/SR       MB/SR       MB/SR           3027504500016
MB/SR      MB/SR      MB/SR       MB/SR       MB/SR       MB/SR           3027504500017
 2.         3.        30.88       0.57        24.60       0.25            3027504500018
26.88       0.39      25.19       0.44        18.06       0.69            3027504500019
 3.         4.        22.61       0.50        14.99       0.20            3027504500020
14.50       3.24      13.60       0.27         8.92       0.56            3027504500021
 4.         5.        13.92       0.30         9.30       0.14            3027504500022
 7.94       0.15       6.14       0.13         3.11       0.40            3027504500023
 5.         6.        10.17       0.25         7.02       0.11            3027504500024
 6.12       0.13       2.79       0.06         2.56       0.28            3027504500025
 6.         7.         8.53       0.23         5.73       0.10            3027504500026
 4.45       0.12       2.35       0.06         2.76       0.36            3027504500027
 7.         8.         7.47       0.22         5.27       0.09            3027504500028
 3.43       0.11       1.94       0.06         1.46       0.14            3027504500029
 8.         9.         5.94       0.17         4.18       0.08            3027504500030
 2.50       0.09       1.04       0.05         2.46       0.28            3027504500031
 9.        10.         3.98       0.11         3.02       0.06            3027504500032
 1.76       0.06       0.47       0.02         1.96       0.21            3027504500033
10.        11.         2.94       0.08         2.10       0.05            3027504500034
 0.95       0.04       0.27       0.01         0.42       0.10            3027504500035
ENDDATA               22                                                  3027504500036
ENDSUBENT             35                                                  3027504599999
ENDENTRY               2                                                  3027599999999
```

2

IN THIS EXAMPLE, A POINTER LINKS AN ANGLE AND THE CORRESPONDING DIFFERENTIAL CROSS - SECTION. ALSO NOTE THAT TABLES WITH MORE THAN 6 COLUMNS WHICH ARE TEDIOUS TO DECIPHER IN "STANDARD" FORMAT, ARE CLEARLY PRESENTED IN THE "EDITED" LISTING.

EXFOR tapes sent out to customers

General

An EXFOR tape contains the EXFOR entries that were retrieved from the master library according to the data request specifications; the entries are sorted in the sequence of increasing entry-numbers. The tape is accompanied by an EXFOR index listing sorted primarily by target nucleus and including quantity, lab of origin, reference, entry-numbers, etc. (Note: The terms "entry-number" or "accession-number" are equivalent.)

STANDARD EXFOR

EXFOR data in STANDARD format have a record length of 80. A printed sticker on the tape gives the information about blocksize, density, 7 or 9 tracks, etc. A specific EXFOR entry can easily be retrieved from the EXFOR tape by means of the entry-number or subentry-number which can be looked up in the EXFOR index listing. The entry-number is included in every record in cols. 67-71, the subentry-number in cols. 67-74.

EDITED EXFOR

EXFOR data in EDITED format are usually provided in form of printed listings; if so requested, they are also provided on tape. A printed sticker on the tape gives the necessary information for listing the tape. The record length is 133 of which

- col. 1 is an ANS printer control character,
- cols. 2-3 are blank,
- cols. 4-124 contain the 120-char. print field,
- cols. 125-133 are blank.

EXFOR tapes in edited format serve the only purpose of providing easily readable listings. They are not suitable for further computer-processing of the data.

To retrieve a specific EXFOR entry (or subentry) from an EDITED EXFOR tape by means of the entry number nnnnn. (or subentry number nnnnn.nnn) requires a program searching for

- the headline of an entry which is identified by "EXFOR nnnnn." in cols. 98-109;

- or the headline of a subentry which is identified by "EXFOR nnnnn.nnn blanks" in cols. 102-124. (Note that "EXFOR nnnnn.nnn (CONT)" occurs as headline of a continuation page.)

The end of an entry is identified by "EXFOR" in cols. 98-102 (which in fact marks the beginning of the next entry).

The end of a subentry, unless it is the last of an entry, is identified by "EXFOR" in cols. 102-106 (which in fact marks the beginning of the next subentry).

UPDATE TAPES

A customer having a long-term interest in a given data area may request, subsequent to a one-off EXFOR retrieval, update retrievals at regular intervals. Such EXFOR UPDATE tapes will contain all EXFOR entries that have been added or revised since the last retrieval, within the scope of interest of the requestor.

EXFOR-INDEX

An EXFOR-INDEX is available, listing one line per data set, including the data definition (target nucleus, reaction etc.), energy range of incident projectile, reference, EXFOR accession-number, number of data records, etc. The entire index (close to 100 000 records) is available on tape; selective retrievals from the index are available on tape or printed.

For further details of the EXFOR-INDEX see the document IAEA-NDS-66.

EXFOR Dictionaries

The EXFOR Dictionaries containing all abbreviations and codes used in EXFOR and CINDA, are available on tape, or in printed form in the document IAEA-NDS-2.

Printed Products

The EXFOR data base is continuously updated. Consequently, individual retrievals for a given data scope are the primary product.

EXFOR Manual

For a detailed description of the EXFOR coding rules see "NDS EXFOR Manual", document IAEA-NDS-3.

Neutron Cross-Sections

The U.S. National Nuclear Data Center operates the CSISRS data base the contents of which is identical to EXFOR. Derived from CSISRS is the handbook series "Neutron Cross Sections" published by Academic Press (1981 ff). It is a successor to the earlier series well-known under the report-code BNL-325.

Neutron Data Index

CINDA, the index to literature and computer files on microscopic neutron data, is published regularly by the IAEA on behalf of the cooperating data centers. For a given bibliographic reference CINDA includes EXFOR accession-numbers under which the pertinent numerical cross-section data can be obtained.

Charged-Particle Data

The charged-particle reaction data contained in EXFOR had been published by the Karlsruhe Charged Particle Group and the Fachinformationszentrum Karlsruhe in the series Physik Daten/Physics Data Nr. 15. This series has been dicontinued and is no longer up-to-date.

List of Data-heading Keywords (Column-headings)

ANG	Angle
ASSUM	assumed value of the quantity defined under the Keyword ASSUMED
COS	cosine of angle
DATA	data of the quantity defined under the keyword REACTION (or ISO-QUANT, NUC-QUANT, CNPD-QUANT respectively)
DATA-ERR	uncertainty of "DATA"; for further explanation see under the keyword "ERR-ANALYS"
DECAY-FLAG	flag pointing to information given under the keyword DECAY-DATA
E	energy of a secondary particle, not of the incident particle
E-DGD	degredation in neutron energy
E-EXC	excitation energy
E-GAIN	gain in neutron energy
E-LVL	level energy (-INI = initial, -FIN = final)
ELEMENT	Z-number of product yield elements
EN	energy of incident particle
EN-DUMMY	equivalent energy for an incident-particle spectrum
EN-RES	resonance energy
ERR-1	a systematic one-sigma error
ERR-S	the statistical one-sigma error
ERR-T	the total one-sigma error
FLAG	flag pointing to information given under the keyword FLAG
HL	half-life
ISOMER	isomer of nuclide specified in the preceding columns under ELEMENT and MASS
KT	spectrum temperature
LVL-NUMB	level number
MASS	A-number of product yield isotopes
MISC	miscellaneous information defined under the keyword MISC-COL
MOM	linear momentum of incident particles
MOMENTUM L	angular momentum for resonances
MONIT	data of the standard or monitor reaction defined under the keyword MONITOR
MU-ADLER	resonance energy in Adler-Adler resonance analysis
NUMBER	coefficient number of cosine or Legendre coefficients

N-OUT	number of emitted neutrons, e.g. by spallation
P-OUT	number of emitted protons, e.g. by spallation
PARITY	parity of resonance
Q-VAL	Q-value
RATIO	data of the ratio defined under the keyword REACTION (or ISO-QUANT)
SPIN J	spin of resonances
STAND	data of the standard or monitor reaction defined under the keyword STANDARD
STAT-W G	statistical weight factor
SUM	data of the sum defined under the keyword REACTION (or ISO-QUANT)
TEMP	sample temperature
THICKNESS	sample thickness

Above codes can be modified by the following suffixes:

-APRX	approximate value
-CM	center-of-mass system. Absence of this code indicates lab-system
-ERR	uncertainty, error
-MAX	upper limit
-MEAN	mean value
-MIN	low limit
-NRM	normalization value
-RSL	resolution

Unsymmetric errors are given in two columns headed +DATA-ERR and -DATA-ERR.

Several columns with same headings may be distinguished with numbers such as

DATA-ERR1	DATA-ERR2
ANG1	ANG2

This concept is supplementary to that of "pointers" illustrated in Examples 2 and 3.

(Note: Above list is only a summary for EXFOR users. EXFOR compilers must observe more specific rules.)

Coding elements for DATA definitions

The DATA given in the EXFOR data tables are defined under the keyword REACTION (or in older entries under ISO-QUANT, CMPD-QUANT, or NUC-QUANT, which are equivalent but have different coding rules). Quite often, the coding under these keywords is self-explanatory; examples:

REACTION (78-PT-198(N,2N)78-PT-197-M,,SIG)

ISO-QUANT (78-PT-198,N2N,,MS)

Both of these coding examples are equivalent. They are expanded into a more readable text in the "edited" version of EXFOR. For those EXFOR users who receive only the "standard" EXFOR, the following table may be helpful. It lists all the coding elements that are used under the keywords REACTION or ISO-QUANT. If a code occurs twice in this list, its exact meaning depends on its position within the coding string.

(For a more detailed explanation of the coding of DATA definitions see the Dictionaries 36 resp. 14 in the document IAEA-NDS-2, which contains all the codes and abbreviations used in EXFOR and which is available from IAEA-INIS as microfiche or from IAEA-NDS as full size copy.)

A	ALPHAS, HE-4
A	TIMES NATURAL ISOTOPIC ABUNDANCE
(A)	UNCLEAR WHETHER CORRECTED FOR NATURAL ISOTOPIC ABUNDANCE OF TARGET
AA	ADLER-ADLER RESONANCE PARAMETERS
ABS	ABSORPTION
AEM	ALPHA-PRODUCTION
AG	SYMMETRY COEFFICIENT
AG	TIMES ISOTOPIC ABUNDANCE AND STATISTICAL WEIGHT FACTOR
AGC	ADLER-ADLER CAPTURE SYMMETRY COEFFICIENT
AGF	ADLER-ADLER FISSION SYMMETRY COEFFICIENT
AGT	ADLER-ADLER TOTAL SYMMETRY COEFFICIENT
AH	ASYMMETRY COEFFICIENT
AHC	ADLER-ADLER CAPTURE ASYMMETRY COEFFICIENT
AHF	ADLER-ADLER FISSION ASYMMETRY COEFFICIENT
AHT	ADLER-ADLER TOTAL ASYMMETRY COEFFICIENT
AKE	AVERAGE KINETIC ENERGY
ALF	ALPHA = CAPTURE/FISSION CROSS-SECTION RATIO
AL1	COEFFICIENTS FOR FIRST-ORDER ASSOCIATED LEGENDRE FUNCTIONS OF THE FIRST KIND
AMP	SCATTERING AMPLITUDE
ANA	ANALYZING POWER
ANU	ADLER-ADLER NU (EQUIVALENT TO HALF TOTAL WIDTH)
AP	MOST PROBABLE MASS
ARE	RESONANCE AREA
ASY	ASYMMETRY
AV	AVERAGE
AYY	SPIN-CORRELATION FUNCTION, OUTGOING PARTICLE SPINS NORMAL TO SCATTERING PLANE
BA	BOUND ATOM
BAS	BOUND-ATOM SCATTERING
BIN	BINARY FISSION
CALC	CALCULATED
CHG	TOTAL ELEMENT YIELD (OF FISSION PRODUCTS)
CHN	TOTAL CHAIN
CN	PARTIAL CROSS-SECTION VIA COMPOUND NUCLEUS

COH	COHERENT SCATTERING
COR	CORRELATION
COS	COSINE COEFFICIENTS
CUM	CUMULATIVE
(CUM)	UNCLEAR WHETHER CUMULATIVE
D	DEUTERONS
D	AVERAGE LEVEL-SPACING
DA	DIFFERENTIAL WITH ANGLE OF OUTGOING PARTICLE
DE	DIFFERENTIAL WITH ENERGY OF OUTGOING PARTICLE
(DEF)	UNCLEAR WHICH REACTION CHANNEL
DERIV	DERIVED
DI	PARTIAL CROSS-SECTION VIA DIRECT INTERACTION
DL	DELAYED, IN FISSION
E	ELECTRONS
EL	ELASTIC SCATTERING
EM	EMISSION CROSS-SECTION EXCLUDING ELASTIC SCATTERING
EN	ENERGY
ETA	AVERAGE NEUTRON YIELD PER NONELASTIC EVENT FOR FISSILE ISOTOPES
EVAL	EVALUATED
EXP	EXPERIMENTAL
F	FISSION
FA	FREE ATOM
FAS	FREE ATOM SCATTERING
FCT	TIMES A FACTOR
FF	FISSION FRAGMENTS
FIS	FISSION SPECTRUM AVERAGE
FY	FISSION-PRODUCT YIELD
G	TIMES STATISTICAL WEIGHT-FACTOR
G	GAMMAS
GEM	GAMMA-PRODUCTION
GND	PARTIAL CROSS-SECTION POPULATING THE GROUND STATE
HE3	HE-3
HE6	HE-6
HF	HEAVY FRAGMENT
INC	INCOHERENT SCATTERING
IND	INDEPENDENT
ING	INELASTIC GAMMA
INL	INELASTIC SCATTERING
INT	CROSS-SECTION INTEGRAL
J	SPIN J
KE	KINETIC ENERGY
L	ANGULAR MOMENTUM L
LCP	LIGHT CHARGED PARTICLE (Z LESS THAN 7)
LDP	LEVEL-DENSITY PARAMETER
LEG	LEGENDRE COEFFICIENTS
LF	LIGHT FRAGMENT
LIM	LIMITED ENERGY RANGE
L4P	MODIFIER FOR LEGENDRE OR COS COEFFICIENTS OF THE FORM 4PI*D-SIG/D-OMEGA = SUM((2L+1)*A(L)*P(L))
M+	INCLUDING FORMATION VIA ISOMERIC TRANSITION
M-	EXCLUDING FORMATION VIA ISOMERIC TRANSITION
(M)	UNCLEAR WHETHER ISOMERIC TRANSITION INCLUDED
MLT	MULTIPLICITY
MS	PARTIAL CROSS-SECTION POPULATING A METASTABLE STATE
MXW	MAXWELLIAN AVERAGE
N	NEUTRONS
NA	N,ALPHA
ND	N,D
NEM	NEUTRON-EMISSION
NF	N,FISSION

NG	N,GAMMA
NNA	N,N ALPHA
NND	N,ND
NNP	N,NP
NNT	N,NT
NN3	N,N HE3
NON	NONELASTIC
NP	N,P
NPA	N,P ALPHA
NPR	NEUTRON-PRODUCTION
NT	N,T
NTX	TRITON-PRODUCTION
NU	FISSION-NEUTRON YIELD, NU-BAR
NX	CHARGED-PARTICLES PRODUCTION
N2A	N,2ALPHA
N2G	N,2GAMMA
N2N	N,2N
N2P	N,2P
N3	N,HE3
N3N	N,3N
N4N	N,4N
O	SEE UNDER '0' (ZERO)
ORI	ORIENTATION
P	PROTONS
PAR	PARTIAL
PCS	PEAK CROSS-SECTION AT RESONANCE
PEM	PROTON-PRODUCTION
PHS	REICH-MOORE PHASE
POL	POLARIZATION
POT	POTENTIAL
PR	PROMPT, IN FISSION
PRE	PRIMARY FOR FISSION PRODUCT YIELDS
PTY	PARITY OF RESONANCE
PY	PRODUCT YIELD
RAD	SCATTERING RADIUS
RAT	RATIO
RAW	RAW DATA
RBT	BINARY/TERNARY RATIO
RECOM	RECOMMENDED AT DATE OF COMPILATION
RED	REDUCED
REL	RELATIVE
RES	AT RESONANCE ENERGY
RFT	REICH-MOORE TOTAL FISSION WIDTH
RF1	REICH-MOORE FISSION WIDTH FOR CHANNEL 1
RF2	REICH-MOORE FISSION WIDTH FOR CHANNEL 2
RF3	REICH-MOORE FISSION WIDTH FOR CHANNEL 3
RF4	REICH-MOORE FISSION WIDTH FOR CHANNEL 4
RGG	REICH-MOORE GAMMA WIDTH
RGN	REICH-MOORE NEUTRON WIDTH
RGT	REICH-MOORE TOTAL WIDTH
RI	RESONANCE INTEGRAL
RM	REICH-MOORE RESONANCE PARAMETERS
RMT	R-MATRIX RESONANCE PARAMETERS
RNR	REICH-MOORE REDUCED NEUTRON-WIDTH
RNV	NON-1/V PART OF CROSS-SECTION OR RESONANCE-INTEGRAL
RS	TIMES 4PI/SIGMA
RS	MODIFIER FOR DIFF. CROSS-SECTIONS 4PI/SIG D-SIG/D-OMEGA AND FOR LEGENDRE OR COSINE COEFFICIENTS OF THE FORM (4PI/SIG)*(D-SIG/D-OMEGA) = SUM(A(L)*P(L))

RSD	MODIFIER FOR LEGENDRE OR COS COEFFICIENTS OF THE FORM (D-SIG/D-OMEGA)/(D-SIG/D-OMEGA AT 90 DEG) = 1 + SUM(A(L)*P(L)) ALSO MODIFIER FOR ANGULAR DISTRIBUTIONS OF THE FORM SIG(THETA)/SIG(90DEG) AND FOR THE ANISOTROPY-COEFF SIG(0)/SIG(90DEG)
RSL	MODIFIER FOR LEGENDRE OR COS COEFFICIENTS OF THE FORM (4PI/SIG)*(D-SIG/D-OMEGA) = SUM ((2L+1)*A(L)*P(L))
RSO	MODIFIER FOR LEGENDRE OR COS COEFFICIENTS OF THE FORM (D-SIG/D-OMEGA)/(D-SIG/D-OMEGA AT 0 DEG) = SUM(A(L)*P(L))
RTB	TERNARY/BINARY RATIO
RTE	TIMES SQUARE-ROOT(E)
RV	1/V PART OF CROSS-SECTION ONLY
SCO	SPIN-CUT-OFF FACTOR
SCT	TOTAL SCATTERING
SEC	SECONDARY
SEQ	SEQUENCE OF OUTGOING PARTICLES AS SPECIFIED
SF	SPONTANEOUS FISSION
SGV	REACTION RATE (SIGMA * VELOCITY)
SIG	INTEGRAL CROSS-SECTION SIGMA(E)
SN2	COEFFICIENTS FOR A SUM IN POWER OF SINE**2
SPA	SPECTRUM AVERAGE
SPC	GAMMA-RAY INTENSITY
SQ	SQUARED
STF	STRENGTH-FUNCTION
SUM	SUM
SO	TIMES TOTAL PEAK CROSS-SECTION
T	TRITONS
TEM	NUCLEAR TEMPERATURE
TER	TERNARY FISSION
THS	THERMAL SCATTERING
TOT	TOTAL
TTY	THICK-TARGET YIELD
UND	REACTION CHANNEL UNDEFINED
VF1	VOGT FISSION-WIDTH FOR CHANNEL 1
VF2	VOGT FISSION-WIDTH FOR CHANNEL 2
VGG	VOGT GAMMA WIDTH
VGN	VOGT NEUTRON WIDTH
VGT	VOGT TOTAL WIDTH
VGT	VOGT RESONANCE PARAMETERS
VIJ	VOGT RELATIVE PHASE I/J
VNR	VOGT REDUCED NEUTRON WIDTH
WID	RESONANCE-WIDTH
X	UNSPECIFIED OUTGOING PARTICLES
XN	VARIABLE NUMBER OF EMITTED NEUTRONS
YLD	YIELD
YP	VARIABLE NUMBER OF EMITTED PROTONS
ZP	MOST PROBABLE CHARGE OF FISSION-FRAGMENTS
0	NO INCIDENT PARTICLE = SPONTANEOUS OR NO OUTGOING PARTICLE = NUCLEAR QUANTITY
0-G-0	GAMMAS, WHEN CODED AS REACTION PRODUCT
0-NN-1	NEUTRONS, WHEN CODED AS TARGET OR REACTION PRODUCT
1	CHANNEL NUMBER
1K2	MODIFIER FOR LEGENDRE OR COS COEFFICIENTS OF THE FORM K**2 D-SIG/D-OMEGA = SUM (A(L)*P(L)) WHERE K = WAVE-VECTOR
2	MULTIPLICITY, OR CHANNEL-NUMBER
2AG	TIMES TWICE (AG)
2G	TIMES TWICE (G)
2L2	MODIFIER FOR LEGENDRE OR COS COEFFICIENTS OF THE FORM D-SIG/D-OMEGA = (1/2) SUM((2L+1)*A(L)*P(L))
3	MULTIPLICITY, OR CHANNEL NUMBER
4	MULTIPLICITY, OR CHANNEL NUMBER
4AG	TIMES 4 TIMES (AG)
4PI	TIMES 4 PI

EXFOR System Flow Charts

The EXFOR system as operated at the IAEA consists of 3 computer files:

1. The EXFOR MASTER FILE, containing all EXFOR entries in standard format, sorted by accession-numbers.

2. The EXFOR INDEX, containing for each EXFOR entry in a compact form all that information that is usually needed for a data retrieval.

3. The EXFOR DICTIONARIES, containing all agreed codes and abbreviations.

NDS has chosen, not to have the entire EXFOR library in direct access but only the EXFOR INDEX, for computer-economical reasons. All retrievals are primarily performed in the EXFOR INDEX file, and the sequential EXFOR MASTER FILE is accessed only via the accession numbers.

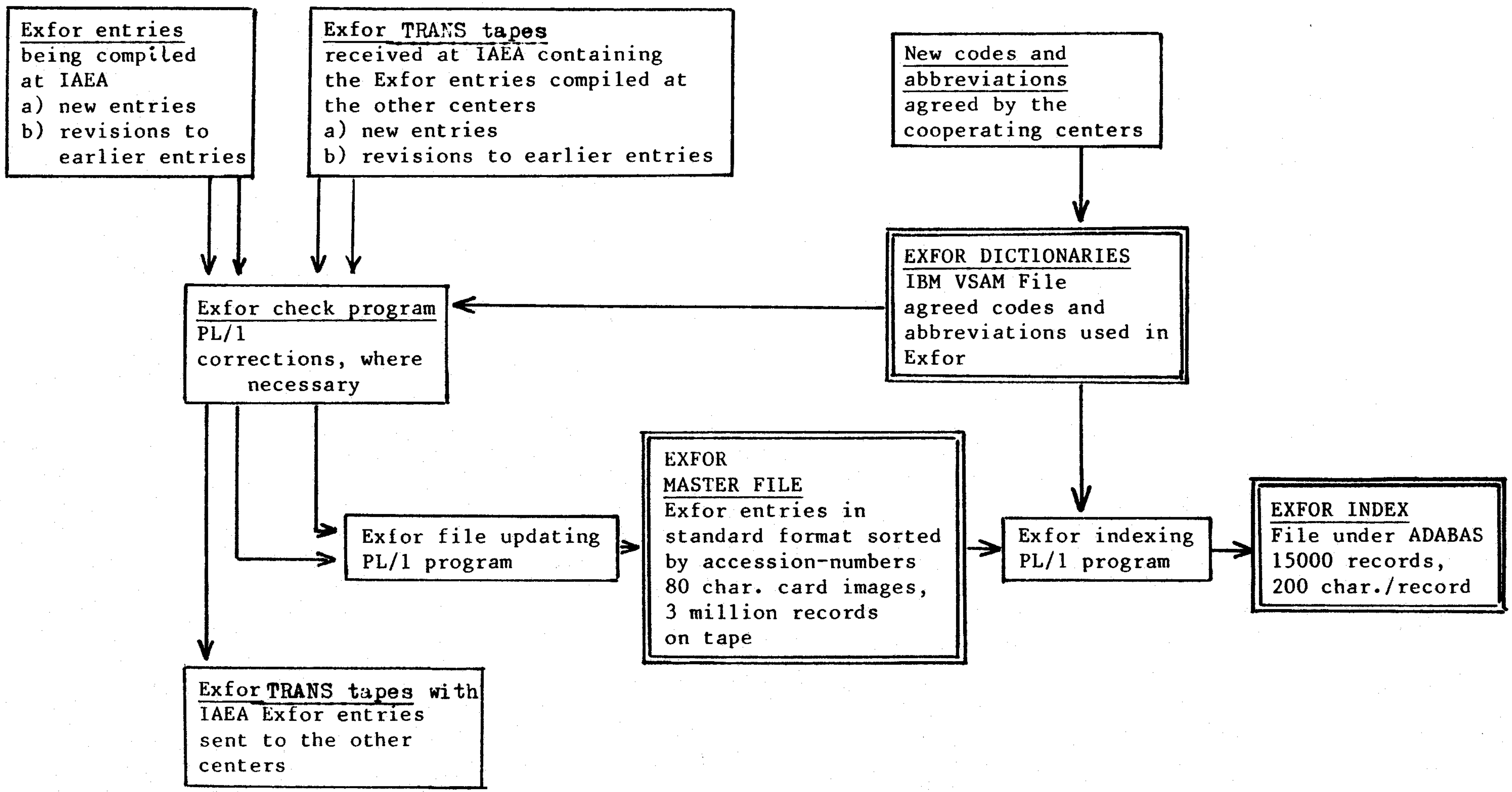
The EXFOR related computer programs at NDS are partly written in PL/1 and are operated under the Data Base Management Systems ADABAS and IBM VSAM, so that they cannot be transferred easily to other computer configurations.

The first diagram illustrates the file maintenance. EXFOR entries compiled either at the IAEA or at the cooperating data centers (including revisions to earlier entries) are checked by a sophisticated check program and corrected where necessary. Approximately four times a month the EXFOR MASTER FILE is updated with new EXFOR entries and revisions to earlier entries. Simultaneously the EXFOR INDEX is updated. EXFOR TRANS tapes are exchanged between the co-operating data centers to ensure that each of them has the identical EXFOR MASTER FILE.

The second diagram illustrates data retrievals. The retrieval specifications as requested by the customer are compared with the EXFOR INDEX; the corresponding EXFOR entries are identified by their accession-numbers and retrieved from the EXFOR MASTER FILE. Various format conversions are then applied as requested by the customer, who will usually receive the retrieved EXFOR entries sorted by accession-numbers (listed or on magnetic tape) together with an index to the retrieved EXFOR entries.

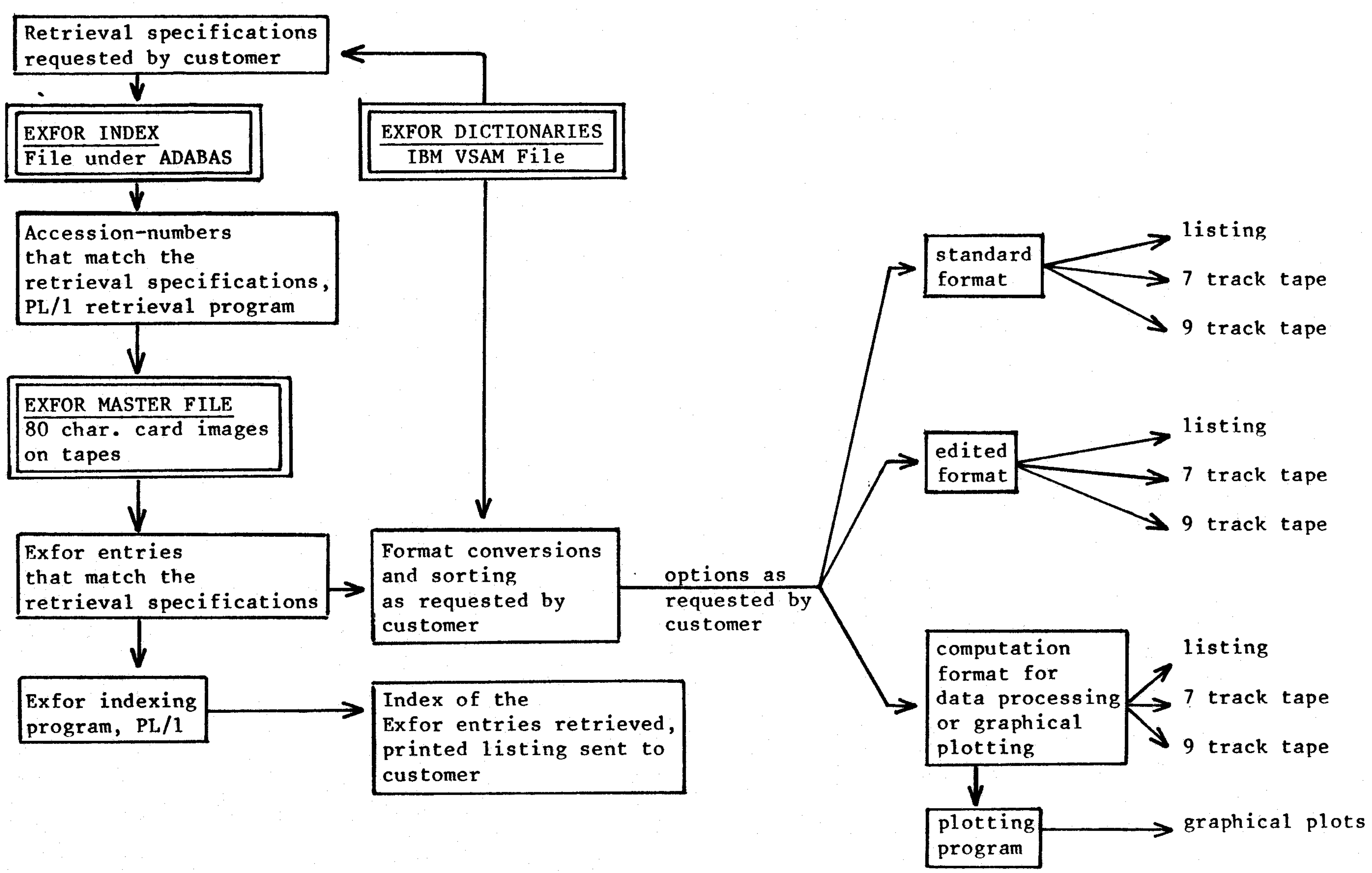
Simplified Diagram of the NDS Exfor System

a) File Maintenance



Simplified Diagram of the NDS Exfor System

b) Data Retrievals



REFERENCE GUIDELINES FOR EXFOR

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 received from IAEA Nuclear Data Section, Vienna."

Explanations

1. The author(s) of an EXFOR entry can always be found under the keyword 'AUTHOR'.

2. EXFOR data are identified by the Data Library Name (i.e. EXFOR) plus the accession-number of the EXFOR entry (e.g. 12345. or 12345.002). It should be realized that authors receive proof-copies of the EXFOR data.

3. Data in EXFOR are often more uptodate than published data. For unique identification of the data used it is therefore necessary to refer primarily to the EXFOR data. However, a related publication should also be quoted. Publications pertinent to an EXFOR entry are always given under the keyword REFERENCE. If more than one reference is given, only the first one needs to be quoted.

4. Many EXFOR entries are updated, sometimes even repeatedly, when the author revises his data or when the EXFOR compiler receives additional information about the data. It is therefore essential to quote also the date which can always be found behind the accession-number of an EXFOR entry or subentry. This is the date of entry or the last revision of the EXFOR data.

Do not use old EXFOR retrievals. In case of doubt check back with the IAEA Nuclear Data Section whether your EXFOR data are still up-to-date and request a new retrieval.