INTERNATIONAL ATOMIC ENERGY AGENCY

NUCLEAR DATA SERVICES

DOCUMENTATION SERIES OF THE IAEA NUCLEAR DATA SECTION

IAEA-NDS-79
Rev. 2

PROGRAM PLOTC4

(Version 2001-3)

Plot evaluated data from the ENDF/B format and/or
Experimental data which is in a computational format

by

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Abstract: Experimental and evaluated nuclear reaction data are world-wide compiled in EXFOR format (see document IAEA-NDS-1) and ENDF format (see document IAEA-NDS-10), respectively. The computer program PLOTC4 described in the present document plots data from both formats; EXFOR data must be converted first to a "computation format" (see document IAEA-NDS-80). The main enhancement from the previous version 87-1 is the capability to plot differential and double differential data from ENDF files. Some pre-processing of the files in ENDF data is required before plotting. The ENDF Pre-Processing codes are used for the purpose (see document IAEA-NDS-39).

The program is available upon request cost free from the IAEA Nuclear Data Section.

March 2001

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PROGRAM PLOTC4

(Version 2001-3)

Plot evaluated data from the ENDF/B format and/or
Experimental data which is in a computational format

Introduction

Enclosed is the documentation for program PLOTC4. The program is designed to plot evaluated data from the ENDF formatted files and/or experimental data, which are in computation format.

The enclosed documentation includes,

1) A listing of the comment cards from the beginning of the program.

2) A listing of the software characters used by the program.

3) A listing of the three translation dictionaries used by the program.

4) A listing of an example output report.

5) A listing of example data in the computation format.

6) Plots of the data

The enclosed documentation is up to date as of March 2001. The program documentation on the comment cards at the beginning of the program and the translation dictionaries are continuously updated. Before using this program the user is advised to consult the comment cards at the beginning of the program and the translation dictionaries for the latest documentation.

Version 2001-3

The comments can be extracted using system search routines by copying to "plotc4.man" all records beginning with "C-". For example:

```
Unix:   grep   C-M  plotc4.f   >plotc4.man
VMS     search plotc4.f  C-M   /out=plotc4.man
Dos     find   C-M  plotc4.for >plotc4.man
```

Compared to earlier versions of this code (87-1 and earlier) this version 2001-3 has the capability to plot differential and double differential data from ENDF files. The graphics interface is compatible with the Pre-Pro-2000 series of codes and is not described separately. It includes plotter independent characters.

Program PLOTC4

Comment cards

USERS' GUIDE FOR PROGRAM PLOTC4
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PURPOSE

The function of the PLOTC4 program is to plot and compare experimental data, which are in a computation format with evaluated data in ENDF format.

This program has been designed to use the computation format and conventions which are used by program X4TOC4 to translate experimentally measured data from the EXFOR to a computation format.

The evaluated data in ENDF format need some pre-processing to reduce the complexity of format representations, which are allowed in the general ENDF format. The codes of the Pre-Pro sequence are used for this purpose. It is recommended that the following are executed:

LINEAR	to convert all cross sections to linearly interpolable form.
RECENT	to reconstruct the resonances from resonance parameters.
SIGMA1	to Doppler broaden the cross sections to room temperature (optional but recommended when comparing to experimental data since measurements are usually done at room temperature).
ACTIVATE	to generate cross sections for excitation into discrete excited state (file MF10) from the data in files MF3 and MF9.
LEGEND	to convert angular distributions in arbitrary ENDF representation into tabular ENDF representation.
SIXTAB	to convert doubel differential data in arbitrary ENDF representation into tabular (law-7) ENDF representation.

GRAPHICS INTERFACE

This program uses a simple CALCOMP like graphics interface which requires only 3 subroutines...PLOTS, PLOT and PEN (described in detail below). All characters and symbols are drawn using tables of pen strokes (supplied with this program). Using this method the program should be simple to interface to virtually any plotter or graphics terminal and the appearance and layout of the plots should be independent of which plotter is used.

WHAT CAN BE PLOTTED

At the present time the following types of data can be plotted:

(1) MF = 3 - Cross sections. ENDF and EXFOR data can be compared (only MF = 3 ENDF data can be compared).
(2) MF = 4 - Angular distributions. ENDF and EXFOR data can be compared.
(3) MF = 5 - Energy distributions. ENDF and EXFOR data can be compared.
(4) MF = 6 - Double differential cross sections. ENDF and EXFOR data can be compared.

(5) MF = 154 - Legendre coefficients (only EXFOR).
(6) MF = 203 - Cross section ratios (only EXFOR).
(7) MF = 402 - Resonance parameters (only EXFOR).
(8) MF = 801 - Fission yield data (only EXFOR).

All other data will be skipped.

WHAT DATA WILL BE PLOTTED

Based on input options the user may specify whether the program should plot only EXFOR data or EXFOR and ENDF data. In addition the user may specify up to 100 ZA/MF/MT ranges to select data.

HOW MUCH DATA CAN BE PLOTTED

ENDF DATA

Each section of ENDF cross sections (MF =3, any MT) may contain any number of data points. If a section contains MXPNT or fewer points all of the data will be in core. If the section contains more than MXPNT points the data will be written to a scratch file and read as needed.
Parameter MXPNT is currently set at 90000.

EXFOR DATA

Based on input parameters the user may control how much EXFOR data will appear on each plot. This program allows the user to specify that up to MXPGP data points may appear on each plot. If there are more physically comparable points (e.g., same ZA, MF, MT) than specified by the user the program will create a series of plots each containing not more than the maximum number of points per plot specified by the user.
Parameter MXPGP is currently set at 10000.

WHAT COMPUTERS WILL THE PROGRAM RUN ON

The program has been implemented on a variety of computers from Cray and IBM mainframe to Sun workstations to a PC. THE program is small enough to run on virtually any computer.

The program uses a simple Calcomp-like graphics interface (described below) and allows the user specify the physical size of the plotter being used, by input parameters. Using these conventions this program can be easily interfaced to virtually any plotter.

For special considerations see the sections below on,
(1) Computer dependent coding.
(2) Plotter/graphics terminal interface.

COMPUTATION FORMAT

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 = superceded), 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)

```
  6- 11   Target ZA (e.g. 26-Fe-56 =  26056)
     12   Target metastable state (e.g. 26-FE-56m = M)
 13- 15   MF (ENDF conventions, plus additions).
 16- 19   MT (ENDF conventions, plus additions).
     20   Product metastable state (e.g. 26-FE-56M = M)
     21   EXFOR status
     22   Center-of-mass flag (C=center-of-mass, blank=lab)
 23- 94   8 data fields (each in E9.3 format). defined below.
 95- 97   Identification of data fields 7 and 8
          (e.g., LVL=level, HL=half-life, etc.)
 98-122   Reference (first author and year)
123-127   EXFOR accession number
128-130   EXFOR sub-accession number
    131   Multi-dimension table flag
```

DEFINITION OF 8 COMPUTATION FORMAT DATA FIELDS
In order to plot data this program assumes that the following conventions have been used for data in the computation format.

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 E, half-life)
8	Identified by columns 95-97 (e.g.,level E, uncertainty)

The physical significance of the first 6 data fields is defined by the MF (data type). The physical significance of fields 7 and 8 are defined by columns 95 through 97 (e.g. LVL = level energy and its uncertainty).

SPECIAL CONVENTIONS
The above conventions are appropriate for most types of data in the ENDF system. In order to allow this program to plot additional types of data the following special conventions have been adopted,

```
Cross section ratios  - Field 5 = MT of denominator.
(MF = 203)              Field 6 = ZA of denominator.
Fission yield data    - Field 5 = ZA of fission fragment.
(MF = 801)              Field 6 = mass of fission fragment.
Production            - Field 6 = ZA of product.
(MT = 9000-9999)
```

See, remarks below on metastable state flags.

BLANK VS. ZERO DATA FIELDS
The 8 data fields on each computation format line are read as characters and internally converted to floating point numbers (see, subroutine FLOAT9). By testing before converting this program can determine whether any given field is blank (no data given) as opposed to zero. It is often important to make this distinction, particularly for fields 7 and 8, e.g. the difference between 0.0 indicating ground state as opposed to no data given. The EXFOR to computation format conversion program X4TOC4 also makes this distinction and leaves undefined fields blank (not zero). Therefore, any data converted to the computation format format using program X4TOC4 will follow the correct conventions.

However, if the user of this program directly codes data in the computation format it is important to maintain this convention. Remember---any undefined fields should be left blank and not set to zero.

COMPUTATION FORMAT UNITS
In order to plot data this program assumes that the following units have been used for data in the computation format.

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

For example double differential data (MF=6) will be in,

barns/eV/steradian

METASTABLE STATE
The computation format allows the metastable state of the target and residual nucleus to be identified. For ratio data metastable state of both numerator and denominator of the ratio should 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 having the denominator ZA and MT in the form ZA.m AND MT.m (e.g., 26056.9 and 102.1). Columns 12 and 20 may 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 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	Plotted as
ground	G	0	-G
m1	1	1	-M1
m2	2	2	-M2
m3	3	3	-M3
m4	4	4	-M4
m5	5	5	-M5
unknown	?	6	-M?
m	M	7	-M
more than 1	+	8	-M+
all or total	T	9	blank
all or total	blank	9	blank

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 to the following characters,

Column 21	Definition
U	Unnormalized (has priority over EXFOR status and is used to indicate that the data is not in standard output units. y axis label will say..UNNORMALIZED..).
A	Approved by author
C-M	Correlated
D	Dependent
O	Outdated

P	Preliminary
R	Renormalized
S	Superceded

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

CONTROL OF PLOTTING

The user has control over how data in the computation format is interpreted by this program.

Data on each plot is identified by plotting a character equivalent of target za and metastable state (ZA), data type (MF), reaction (MT) and residual metastable state. The ZA, MF and MT may be interpreted in any manner that the user chooses.

This is accomplished by using three dictionaries which control the plotting. All three of these dictionaries are distributed with this program. Each dictionary is a simple card image file which may be modified by the user at any time to meet specific needs. The three dictionaries are:

(1) INTERPRETATION OF SPECIAL ZA
    For all target or residual nuclei this program will use the ENDF convention of assuming ZA = 1000*Z + A. For special materials which do not easily fit into this scheme (e.g., water) the ENDF convention is to define Z =0 and to assign a numerical equivalent for each special material. For normal materials this program will use ZA to define the material or isotope. For special material (Z=0) this program will use this dictionary to define the material. As distributed this dictionary contains all of the special materials defined in the ENDF system. The user may code data for any special material in the computation format and assign it a special ZA. By adding the definition to this dictionary the user may obtain plots on which the special material is properly identified.

(2) INTERPRETATION OF MF
    This dictionary defines the titles that will appear for each MF read from the computation format. In addition this dictionary allows the user to specify different titles for the same MF and different MT ranges, e.g.:

```
MF =3, MT =  251 - 253 = parameters (used for MU, XI, GAMMA)
MF =3, MT = 9000       = neutron induced (used for production)
MF =3, MT = other      = cross section
```

    If the user does not like the titles normally output by this program it is merely necessary to modify this dictionary.

(3) INTERPRETATION OF MT
    This dictionary defines the titles that will appear for each MT read from the computation format, e.g.:

```
MT  =    1 = total
    = 9000 = production
```

    If the user does not like the titles normally output by this program it is merely necessary to modify this dictionary.

Used in combination with the translation of the ZA, MF and MT serve to identify the data being plotted. By using the dictionaries described above the user has complete control over how ZA, MF and MT are interpreted and as such may select any form to identify data.

PROGRAM OPERATION

EXFOR DATA INDEX TABLE

The entire computation format file will first be read and compared to the requested ZA/MF/MT ranges specified by the user. If no comparable data is found the program will terminate execution. If comparable data is found the program will create an index table specifying (1) ZA, (2) MF, (3) MT, (4) starting record number, (5) ending record number, (6) number of data points with this ZA, MF and MT. During execution this index table will be used to, (1) select the next ZA, MF, MT to be plotted if only plotting EXFOR data, or (2) to determine whether or not there is comparable EXFOR data (without again searching the EXFOR data file) when comparing EXFOR and ENDF data. Once it has been decided to plot EXFOR data which has a given ZA, MF and MT the starting record index is used to quickly position to the first record to read and the ending record index is used to define when to stop reading (instead of reading the entire computation format data file).

ONLY PLOTTING EXFOR DATA

The program will use the index table to define the ZA, MF and MT of the next set of data to plot. Based on user input the program will then plot either one reference (reference = author, year, EXFOR accession and sub-accession number) per plot or all comparable references on the same plot. The cycle of reading data and producing plots will be continued until all data defined in the index table have been plotted.

COMPARING ENDF/B AND EXFOR DATA

In the comparison mode the program will only plot data if there is comparable data (same ZA, MF, MT) on both the ENDF formatted and computation formatted files.

Based on the plotting requests (see below) the program will first search the ENDF data file to find an acceptable section of cross sections (MF=3,4,5,6). The program will then use the EXFOR index to determine if there is comparable EXFOR data (same ZA, MF, MT). If there is no comparable data the program will ignore the current section of ENDF data and search for the next requested section of ENDF data. The cycle of reading ENDF data and comparing to the EXFOR index table will be continued until comparable ENDF and EXFOR data are found. Only after the EXFOR index table shows that the computation format file contains comparable data will the file be read. As described above while reading EXFOR data the program will use the starting and ending record number to quickly position to the data to read and to stop reading when all required data has been read.

Experimentally measured differential cross sections are seldom measured for a particular reaction as defined in ENDF. Usually they are "particle production cross sections", therefore summation over several ENDF reactions is necessary. Differential data in an ENDF file are marked available for comparison if file MF4, 5 or 6 are found, but no action is taken until the differential data are also found in the EXFOR file. At this point the emitted particle, the incident particle energy, the outgoing particle energy and/or angle are known. At this point the differential data retrieval routine is activated, extracting the normalised distributions, multiplying by the appropriate cross sections from file MF3 and summing contributions from all reactions that produce that outgoing particle.

To simplify coding a restriction on the formats of the differential data exists. The retrieval routine only accepts tabular representation. ENDF files in other format representations can be converted using codes LEGEND for the angular distributions and SIXTAB for the double differential data.

At present the assembly of the differential data is limited to the neutron production reactions.

ONE REFERENCE PER PLOT
When plotting one reference per plot the program will use the EXFOR index table to determine where to start reading. After one data point has been read the program will continue to read data points until (1) a point is found with a different ZA, MF, MT or reference, (2) the index table last record number indicates that the last point has been read, or (3) the maximum number of points per plot have been read.

WARNING...When plotting one reference per plot in order to produce a plot the program must find at least the minimum number of points required (see, input description below) on suceessive records. therefore the computation format should be sorted to insure that all data with the same ZA, MF, MT, reference appear on successive records.

ALL COMPARABLE EXFOR DATA ON SAME PLOT
When plotting all comparable data on the same plot the program will use the EXFOR index table to define where to start reading. The program will continue to read data until (1) the index table last record number indicates that the last point has been read, or (2) the maximum number of points per plot have been read.

In this mode the EXFOR data need not be sorted by ZA, MF, MT, reference since the EXFOR index table will define where all comparable data are located on the computation format data file. However, to minimize the time required to search the computation format file the user should sort the data by ZA, MF, MT.

OPTIMIZING PROGRAM OPERATION

Program operation can be optimized by minimizing the size of the ENDF and computation formatted files. If you wish to compare a limited number of reactions it is suggested that you first prepare ENDF and computation formatted data files that only contain the data which will be plotted, i.e., never use this program to try to compare two enormous files of ENDF and EXFOR data unless you are willing to spend a correspondingly enormous amount of computer time. In addition the EXFOR data file should be sorted by ZA, MF, MT, reference.

SCALING OF PLOTS

ENDF/B AND/OR EXFOR
If only plotting EXFOR data this program will scale the X and Y range of each plot to include only EXFOR data. If plotting EXFOR and ENDF data the user may specify by input (input described below) to scale plots to include all ENDF and EXFOR data or only all ENDF data or only all EXFOR data. Although this option may be used for special purposes to obtain special scaling it is recommended that the user always scale plots to include all ENDF and EXFOR data.

ENERGY RANGE
Regardless of the energy range specified by plotting requests (see description of requests below) this program will never extend the energy range of plots beyond where there are data. For example to plot (n,2n) over the entire energy range where there are data the user can specify 0.0 to 100 MeV. This program will produce plots from threshold up to the highest energy below 100 MeV where data are given.

COSINE RANGE
For angular (MF=4) and double differential (MF=6) distributions where the X variable is cosine, plots will always be produced over

the cosine range -1.0 to 1.0.

INPUT LOGICAL FILE UNITS

Note that input instructions for PLOTC4 are on unit 4, rather than the usual Fortran unit 5. This is so for historic reasons to allow the program to be used on an IBM-PC where unit 5 was reserved for keyboard interaction.

Unit	Description	
4	Input options	(BCD - 80 columns/record)
10	Computation formatted data	(BCD - 131 columns/record)
11	ENDF formatted data	(BCD - 80 columns/record)
12	Special ZA definitions	(BCD - 80 columns/record)
14	MF definitions	(BCD - 80 columns/record)
15	MT definitions	(BCD - 80 columns/record)
17	Software characters	(BCD - 80 columns/record)

OUTPUT UNITS

Unit	Description	
6	Output report	(BCD - 120 columns/record)

SCRATCH UNITS

UNIT	DESCRIPTION	
18	ENDF data paging unit	(Binary - 6000 words/record)

INPUT CARDS

The user must input at least one card to specify plotting options. In the simplest case this first card can be completely blank (see Example input No. 1 below). To select data by ZA/MF/MT/Incident energy range the user may input up to 100 additional cards.

Card	Columns	Format	Description
1	1- 5	I5	Compare EXFOR data to ENDF 0 = No 1 = Yes 2 = Yes (identify ENDF points by plotting a small diamond round each point). NOTE: If comparing data plots will only be produced if comparable data is found on both the ENDF and computation format files.
	6-10	I5	All comparable exfor data on same plot 0 = No <0 = Yes, each reference on a seperate plot >O = Yes, the value entered is the maximum number of references per plot (current upper limit=48).
	11-15	I5	Plot scaling 0 = ENDF and EXFOR (recommended) 1 = ENDF 2 = EXFOR (automatically set to 2 if not comparing)
	16-20	I5	Plot X error bars (energy, cosine, etc.) 0 = No, 1 = Yes
	21-25	I5	Plot Y error bars (cross section, etc.) 0 = No, 1 = Yes
	26-30	I5	Identify all references by symbol 0 = No, 1 = Yes (0 = If only one reference on plot do not plot box and reference symbol around each

			data point...recommended).
	31-35	I5	Allow variable E2 on same plot 0 = No, 1 = Yes (Normally only data with same ZA/MF/MT/E2 will appear on same plot. 1 = collect data from 1 reference for same ZA/MF/MT and a number of values of E2. Identify data on plot by each value of E2).
	36-40	I5	Minimum EXFOR points per plot (If there are fewer comparable EXFOR points they will be skipped...default 8, minimum valid entry 2).
	41-45	I5	Maximum number of EXFOR points per plot (Minimum defined by columns 36-40 up to MXPGP...DEFAULT MXPGP1000). Currently parameter MXPGP is set to 10000. HINT: The limit applies to the total number of points extracted from the EXFOR file. If plots are defined by explicitly requested ranges (see the next input line) and all comparable points are to be displayed on the same plot, use the default value.
	46-50	I5	Grid type = 0 - Tick marks on each axis..recommended. = 1 - Full grid.
	51-55	I5	Plot size = 0 - Full size plots. = 1 - Half size (4 sub-plots per plot).
	56-70	3A4,A3	ENDF library identification. e.g., ENDF/B-V (only used if comparing).
2-N	1- 7	I7	Lower ZA limit
	8-11	I4	Lower MF limit
	12-15	I4	Lower MT limit
	16-26	E11.4	Lower incident energy limit (eV)
	27-33	I7	Upper ZA limit
	34-37	I4	Upper MF limit
	38-41	I4	Upper MT limit
	42-52	E11.4	Upper incident energy limit (eV)
	53-55	I3	Plot scales (ENDF convention): 2 Linear abscisa and ordinate 3 Logarithmic abscisa and linear ordinate 4 Linear abscisa and logarithmic ordinate 5 Logarithmic abscisa and ordinate
	56-66	E11.4	Smearing parameter for elastic and discrete level inelastic scattering energy distributions given in terms of a fractional energy increment at which a gaussian curve is half maximum. This is only used to simulate resolution broadening of the distributions, which are ideally delta-functions (e.g. elastic and discrete inelastic scattering reactions when assembling total neutron emission energy distribution).

The request list is terminated by a blank line. The remainder of the input file will be ignored.

There may be up to 100 ZA/MF/MT/Energy range requests. If there are more than 100 requests only the first 100 will be used. Each request independently specifies a range of ZA/MF/MT/Energy to be plotted.
For each set of data, ZA must be between the lower and upper ZA limit, MF must be between the lower and upper MF limit, MT must be between the lower and upper mt limit and the incident energy must be between the lower and upper energy limit.
e.g., Z=1 to 90000, MF=3 to 3, MT=1 TO 1, E=0.0 to 2.0E+7 eV

will select all ZA between 1 to 90000 which have MF=3 and MT=1
and data points with incident energy between 0 and 20 MeV.
If there are no request cards all data will be plotted.

EXAMPLE INPUT NO. 1
....
To plot all EXFOR data without comparison to ENDF and without
error bars the user need only enter a single blank card, or,

```
    0    0    0    0    0    0    0    0    0    0    0
```

EXAMPLE INPUT NO. 2
....
Plot all EXFOR data 1 reference per plot with X and Y error bars.
Do not plot data unless there are 8 or more points. Plot a full
grid. Input the following 1 card,

```
    0    0    0    1    1    0    1    8    0    1    0
```

NOTE: This is a good set of input parameters to use in order to
produce all possible plots of all EXFOR data translated from a
given EXFOR tape. It is recommended to specify 8 as the minimum
number of points per plot in order to avoid obtaining a large
number of plots each containing only 1 or 2 data points.

EXAMPLE INPUT NO. 3
....
Plot Co-59 (n,2n) ENDF cross sections and all comparable
EXFOR data on the same plot with cross section error bars, one
plot from 0.0 eV (scaled to threshold) to 20.0 MeV and a second
plot from 12.0 to 15.0 MeV. Do not plot data unless there are at
least 8 experimental data points. Only tick marks on axis. ENDL84
is the identification for the ENDF library. Input the following
3 cards.

```
    1    1    0    0    1    0    0    8    0    0    0  ENDL84
  27059   3  16 0.00000+ 0  27059   3  16 2.00000+ 7
  27059   3  16 1.20000+ 7  27059   3  16 1.50000+ 7
```

REPORTING ERRORS

In order to improve this code and make future versions more
compatible for use on as many different types of computers as
possible please report all compiler diagnostics and/or operating
problems to the author at the above address.

Please remember if you simply report "I'VE GOT A PROBLEM" and do
not adequately describe exactly how you were using the program
it will be impossible for the author to help you. When a problem
arises please write to the author, describe the problem in as much
detail as possible, identify the version of the program that you
are using (e.g. Version 2001-3) and send the following information
in computer-readable form (e-mail, floppy disc, etc.) to the author:

(1) A copy of the program you are using
(2) A copy of compiler diagnostics (if any)
(3) A copy of the jcl deck you used to execute the program
(4) A copy of the 3 translation dictionaries you are using
(5) A copy of the computation format data you using
(6) A copy of the output report from the program.

Also send copies of any plots which you have obtained as output
from this program, if possible and/or applicable.

Without all of this information it is impossible to exactly
simulate the problem that you ran and to determine the source

of your problem.

RETRIEVAL OF DIFFERENTIAL AND DOUBLE DIFFERENTIAL DATA

Retrieval of differential and double differential data is done through the DXSEND package, which is provided as a separate module. It is called by:

```
   CALL DXSEND(LEF,ZA0,ZAP,MT0,KEA,EIN,PAR,EPS,ENR,DXS
  1           ,RWO,NEN,MEN,MRW,LTT)
```

The DXSEND module reads an ENDF file and extract cross sections (KEA=0), differential cross section (angular distributions KEA=1 or energy spectra KEA=2, parameter PAR < -2) and double differential cross sections (correlated energy/angle distributions with the same conventions for KEA. Parameter PAR is the requested outgoing particle energy when the correlated angular distribution are requested. Similarly, PAR is the cosine of the scattering angle when the spectrum at a particular scattering angle is requested. Differential cross sections are output in the Lab co-ordinate system.

If a special MT number is requested (for example, MT=5 for particle emission where particle is defined by its ZA designation in ZAP), the retrieval is done recursively for all neutron emission reactions and all contributions are summed.

Formal parameters are:

LEF - File unit number from which the ENDF file is read.

ZA0 - Requested nuclide identification number. If ZA>0 it is given in terms of Z*1000+A+LIS0/10 where Z is the atomic number, A the mass number and LIS0 the metastable state number. When ZA<0 it implies the ENDF material MAT number.

ZAP0 - Outgoing particle ZA designation (ZAP0=1 for neutrons).

MT0 - Requested reaction MT number. Broadly this follows the ENDF conventions.

KEA - Control flag to select retrieval of cross section (KEA=0) angular distributions (KEA=1) of energy spectra (KEA=2).

EIN - Incident particle energy (eV).

PAR - Fixed parameter when requesting differential data:
KEA=1, PAR is the requested outgoing particle energy. A value PAR <= -2 implies integrated distribution over all angles.
KEA=2, PAR is the requested scattering angle (cosine). A value PAR <= -2 implies angle integrated energy distribution.

EPS - Resolution broadening parameter is used for the two-body scattering reactions like the elastic and discrete inelastic cross sections where in principle the energy distribution is a delta function. For such reactions the energy distribution is displayed as a Gaussian distribution where EPS the fractional half-width at half-maximum. Such representation is convenient for comparison with measured data.

ENR - Argument vector of the assembled output cross section.

DXS - Function vector of the assembled output cross section.

RWO - Work array of length MRW.

NEN - Number of points in the assembled output cross section vector.

MEN - Available size of ENR and DXS arrays.

MRW - Available size of the RWO work array.

IER - Error flag, which is zero on exit if data assembly is completed successfully.

External routines called:
DXSEN1,SKIPSC,FINDMT,RDTAB1,RDTAB2,RDLIST,FINT2D,YTGEOU,FNGAUS,
FYTG2D,UNIGRD,FITGRD

OMPUTER DEPENDENT CODING

This program is designed to be used with a Fortran-77 or Fortran-90 compiler.

The only compiler dependent format statements involve,
(1) CHARACTER*1 and CHARACTER*4
(2) Testing for errors and end of file during reads.

It is assumed that characters are stored in successive storage locations and that characters may be treated as continuous strings of characters in either CHARACTER*4 or CHARACTER*1 format.

For example, if one subroutine contains,

```
CHARACTER*4 BCD
DIMENSION BCD(10)
```

the array BCD is assumed to be an array of 40 characters in successive byte locations.

It is assumed that this array can be passed as an argument to another subroutine and used as CHARACTER*1, e.g.,

```
CALL DUMMY(BCD)

SUBROUTINE DUMMY(BCD)
CHARACTER*1 BCD
DIMENSION BCD(40)
```

This convention will work on all 32 bit per word computers (e.g., IBM or IBM compatible computers).

For longer word length computers (e.g., CDC or CRAY) it is suggested that before implementing and using this program the user first verify that character strings can be treated as described above, e.g., write a simple program to read a character string of 40 characters in CHARACTER*4 format, pass it to a subroutine which uses the character string in CHARACTER*1 format and print the character string in the subroutine. If the character string is printed as a continuous string you will be able to use this program. If the character string is not printed as a continuous string it is not recommended that you use this program.

This program using the Fortran-77 convention for testing for reading errors and end of file during reads, e.g.,

```
READ(10,1000,END=100,ERR=200) A,B,C,D
```

PLOTTER/GRAPHICS TERMINAL INTERFACE

This program uses a simple Calcomp-like interface involving only 3 subroutines,

```
PLOTS(BUF,IBUF,IPLOT) - Initialize plotter
      BUF    - Plotter buffer
      IBUF   - Size of plotting buffer (5000 words used)
      IPLOT  - Plotter unit (16)...usually a dummy unit

PLOT(X,Y,IPEN)        - Draw or move from last location to (X,Y),
                        end of current plot or end of plotting.
      IPEN =   2 - Draw
           =   3 - Move
```

```
            =  -1 - End of current plot...advance by X,Y
            = 999 - End of plotting.

 PEN(IPEN)             - Select color.
      IPEN- Color = 1 to N (N = Any positive integer)
```

In order to interface this program for use on any plotter which does not use the above conventions it is merely necessary for the the user to write 3 subroutines with the names PLOTS, PLOT and PEN with the subroutine arguments described above and to then call the local equivalent routines.

AVAILABLE PLOTTER INTERFACES

This program has available plotter interfaces to operate as follows,

(1) Mainframe - hardcopy plots in black and white.
(2) Mainframe - screen plots in 7 colors on IBM graphics terminal.
(3) PC - hardcopy plots in 6 colors on a Hewlett-Packard 7475a plotter.

Contact the author to obtain copies of any of the above plotter interfaces.

COLOR PLOTS

To select plotting colors subroutine PEN (described above) is used to select one of the available colors. When running on a mainframe using an IBM graphics terminal or on a PC using a Hewlett-Packard plotter the graphics interface (described above) will produce color plots.

BLACK AND WHITE PLOTS

When producing black and white hardcopy on a mainframe the user should add a dummy subroutine PEN to the end of the program to ignore attempts to change color. Add the following subroutine:

```
SUBROUTINE PEN(IPEN)
RETURN
END
```

CHARACTER SET

This program uses computer and plotter device independent software characters. This program comes with a file that defines the pen strokes required to draw all characters on the keyboard (upper and lower case characters, numbers, etc.) plus an alternate set of all upper and lower case greek characters and additional special symbols.

The software character table contains X and Y and pen positions to draw each character. If you wish to draw any additional characters or to modify the font of the existing characters you need only modify this table.

CONTROL CHARACTERS

In the software character table all characters to be plotted will have pen position = 2 (draw) or = 3 (move). In addition the table currently contains 4 control characters:

PEN POSITION = 0
Shift the next printed character by X and Y. 3 control characters are presently included in the software character table to allow shifting.

```
{   = Shift up (for superscripts.............X= 0.0, Y= 0.5)
}   = Shift down (for subscripts.............X= 0.0, Y=-0.5)
```

\   = Shift left 1 character (for backspace...X=-1.0, Y= 0.0)

PEN POSITION =-1
Select the next printed character from the alternate character set. At present this control character is,

]   = Switch to alternate character set

These 4 control characters are only defined by the value of the pen position in the software character table (i.e., they are not hard wired into this program). As such by modifying the software character table the user has the option of defining any control characters to meet specific needs.

These characters may be used in character strings to produce special effects. For example, to plot subscript 5, B, superscript 10 use the string,

}5B{1{0

To plot B, subscript 5 and superscript 10 with the 5 directly below the 1 of the 10 use the string,

B}5\{1{0

To plot upper case greek gamma followed by the words "Total Width" use the string,

]G Total Width

NOTE: When these control characters are used they only effect the next 1 printed character (see, above example of plotting super-script 10 where the shift up control character was used before the 1 and then again before the 0).

If these 4 control characters are not available on your computer you can modify the software character table to use any other 4 characters that you do not normally use in character strings (for details see the software character table).

STANDARD/ALTERNATE CHARACTER SETS
The software character table contains 2 sets of characters, which are a standard set (all characters on an IBM keyboard) and an alternate set (upper and lower case greek characters and special characters). To draw a character from the alternate character set put a vertical stroke character (]) before a character (see the above example and the software character table for details). This control character will only effect the next 1 plotted character.

SUB AND SUPER SCRIPTS
To draw subscript preceed a character by }. To draw superscript preceed a character by { (see the above example and the software character table for details). These control character will only effect the next 1 plotted character.

BACKSPACING
To backspace one character preceed a character by \ (see, the above example and the software character table for details). This control character will perform a true backspace and will effect all following characters in the same character string.

Software characters

The 87-1 and later versions of this program use a table of plotter independent characters. The following page list all of the characters used by this program. The first block lists the standard characters and the second block the alternate characters (see comment cards from the program for details).

The data on the character symbol file are the public domain Hershey fonts, tabulated by Gian Carlo Panini and incorporated into the code by Red Cullen. Additional information on Hershey fonts can be found on “http://sources.isc.org/utils/misc/hershey-font.txt”.

Standard Character Set

*	4	>	H	R		f	p	z	
!	+	5	?	I	S		g	q	
"	,	6	@	J	T		h	r	|
#	−	7	A	K	U	_	i	s	
$	.	8	B	L	V		j	t	~
%	/	9	C	M	W	a	k	u	
&	0	:	D	N	X	b	l	v	
'	1	;	E	O	Y	c	m	w	
(	2	<	F	P	Z	d	n	x	
)	3	=	G	Q		e	o	y	

Alternate Character Set

	∇	≠		H	P		φ	π	ζ
	∝	≡		I	Σ		γ	ϑ	
		≦			T		η	ρ	
	∂	≧	A	K	ϒ		ι	σ	
∫		∞	B	Λ				τ	
	√	∈	X	M	Ω	α	κ	υ	
	→		Δ	N	Ξ	β	λ		
	↑		E	O	Ψ	χ	μ	ω	
[	←		Φ	Π	Z	δ	ν	ξ	
]	↓		Γ	Θ		ε	ο	ψ	

Special ZA Dictionary

```
  0 GAMMA        *  DEFINITION OF SPECIAL ZA (ZA LESS THAN 1000)
  1 NEUTRON      *  ...TRKOV-CHANGED FROM : 1/V ABSORBER
  2 SCATTERER    *  FORMAT
100 WATER        *  ======
101 HEAVY WATER  *  COLUMNS  DESCRIPTION
102 C12H10       *  =======  ===========
103 NAOH         *    1- 5   ZA
104 C18H14       *    7-18   DEFINITION (E.G., ZA=1 - 1/V ABSORBER)
105 DOWTHERM-A   *
106 BENZENE      *  ONLY THE FIRST 18 COLUMNS ARE READ. THE REMAINDER OF
200 BEO          *  EACH LINE MAY CONTAIN ANY TEXT, E.G., THIS TEXT.
201 BE2C         *
202 BEF2         *  ADDING DEFINITIONS
203 ZRHX         *  ==================
204 (CH)N        *  TO ADD DEFINITIONS TO THIS TABLE, THEY MUST BE ADDED
205 (CH2)N       *  IN ASCENDING ZA ORDER.
207 UO2          *
301 ZIRCALLOY-1  *  MAXIMUM TABLE SIZE
302 ZIRCALLOY-2  *  ==================
304 STAINLESS    *  UP TO 200 ZA MAY BE INCLUDED IN THIS TABLE.
310 UO2          *  IF THE TABLE CONTAINS OVER 200 ZA ONLY THE FIRST 200
315 UC           *  WILL BE READ AND USED.
400 U-233 RSTR   *
401 U-235 RSTR   *  ENDF/B CONVENTIONS
402 U-239 RSTR   *  ==================
403 PU-241 RSTR  *  THE INITIAL TABLE CONTAINS ALL OF THE SPECIAL ZA
404 TH-232 RSTR  *  DEFINED IN THE ENDF/B SYSTEM.
405 U-238 RSTR   *
406 PU-240 RSTR  *
410 U-233 SSTR   *
411 U-235 SSTR   *
412 U-239 SSTR   *
413 PU-241 SSTR  *
414 TH-232 SSTR  *
415 U-238 SSTR   *
416 PU-240 SSTR  *
420 U-233 NSTR   *
421 U-235 NSTR   *
422 U-239 NSTR   *
423 PU-241 NSTR  *
424 TH-232 NSTR  *
425 U-238 NSTR   *
426 PU-240 NSTR  *
430 U-233 RSFR   *
431 U-235 RSFR   *
432 U-239 RSFR   *
433 PU-241 RSFR  *
434 TH-232 RSFR  *
435 U-238 RSFR   *
436 PU-240 RSFR  *
440 U-233 SSFR   *
441 U-235 SSFR   *
442 U-239 SSFR   *
443 PU-241 SSFR  *
444 TH-232 SSFR  *
445 U-238 SSFR   *
446 PU-240 SSFR  *
450 U-233 NSFR   *
451 U-235 NSFR   *
452 U-239 NSFR   *
453 PU-241 NSFR  *
454 TH-232 NSFR  *
455 U-238 NSFR   *
456 PU-240 NSFR  *
```

MF Dictionary

```
  3  251  253 Parameters                    * MF - DATA TYPE
  3 9000 9000 Neutron Induced               * EQUIVALENCE TABLE
  3 9001 9001 Proton Induced                *
  3 9002 9002 Deuteron Induced              *
  3 9003 9003 Triton Induced                *
  3 9004 9004 2-He-3 Induced                *
  3 9005 9005 ]a Induced                    *
  3    1 9999 Cross Sections                *
  4 9000 9000 Neutron Induced               * FORMAT
  4    1 9999 Angular Distribution          * ======
  5    1 9999 Energy Distribution           * COLUMNS  DESCRIPTION
  6    1 9999 Double Differential           * =======  ===========
154    1 9999 Legendre Coefficients         *   1- 5   MF
203    1 9999 Ratio                         *   6-10   LOWER MT
402    1 9999 Resonance Parameters          *  11-15   UPPER MT
801    1 9999 Yield Data                    *  17-48   DEFINITION
900    1 9999 Level Density Parameters      *
                                            *
                                            * BLANK LINES IGNORED
```

MT Dictionary

1	1	Total
2	2	Elastic
3	3	Nonelastic
4	4	Inelastic
6	15	(n,2n) Level
16	16	(n,2n)
17	17	(n,3n)
18	18	Fission
19	19	(n,f) First Change
20	20	(n,nf) Second Chance
21	21	(n,2nf) Third Chance
22	22	(n,n')]a
23	23	(n,n') 3]a
24	24	(n,2n)]a
25	25	(n,3n)]a
26	26	(n,2n) Isomer
27	27	Absorption
28	28	(n,n') p
29	29	(n,n') 2]a
30	30	(n,2n) 2]a
32	32	(n,n') d
33	33	(n,n') t
34	34	(n,n') He-3
35	35	(n,n') d,2]a
36	36	(n,n') t,2]a
37	37	(n,4n)
38	38	(n,3nf) Fourth Chance
41	50	(n,2n) Level
51	90	(n,n') Level
91	91	(n,n') Continuum
102	102	(N,]g)
103	103	(n,p)
104	104	(n,d)
105	105	(n,t)
106	106	(n,He-3)
107	107	(n,]a)
108	108	(n,]a)
109	109	(n,3]a)
111	111	(n,2p)
112	112	(n,p)]a
113	113	(n,t) 2]a
114	114	(n,d) 2]a
120	120	Target Destruction
203	203	Hydrogen Production
204	204	Deuterium Production
205	205	Tritium Production
206	206	He-3 Production
207	207	He-4 Production
251	251	]m-bar (Lab)
252	252	Xi
253	253	Gamma
452	452	Total]n-bar
455	455	Delayed]n-bar
456	456	Prompt]n-bar
700	719	(n,p') Level
720	739	(n,d') Level
740	759	(n,t') Level
760	779	(n,He-3') Level
780	799	(n,]a') Level
800	800	Damage (ASTM)
801	801	Damage (EUR)
1001	1001	(n,n+p)
1002	1002	(n,n+p)+(n,p)

```
* MT - REACTION
* EQUIVALENCE TABLE
*
* FORMAT
* ======
* COLUMNS DESCRIPTION
* ======= ===========
*   1- 5  LOWER MT
*   6-10  UPPER MT
*  12-51  REACTION
*         DESCRIPTION
*
*  ONLY THE FIRST 50
*  COLUMNS A LINE ARE
*  READ. ANY TEXT MAY
*  BE ADDED IN COLUMNS
*  51-80 (E.G. THIS
*  TEXT).
*
*  ADDING REACTIONS
*  ================
*  TO ADD REACTIONS TO
*  THIS TABLE THEY
*  MUST BE INSERTED IN
*  ASCENDING ORDER AND
*  MT RANGES MUST NOT
*  OVERLAP
*
*  MAXIMUM TABLE SIZE
*  ==================
*  UP TO 300 REACTIONS
*  MAY BE INCLUDED IN
*  THIS TABLE. IF MORE
*  THAN 300 ONLY THE
*  FIRST 300 WILL BE
*  READ AND USED.
*
*  ENDF/B CONVENTIONS
*  ==================
*  ARE USED FOR
*  MT=1 - 999.
*
*
*
```

```
1003 1003 (n,n+p)+(n,d)                          *
1004 1004 (n,n+]a)+(n,]a)                        *
1016 1016 Fission Fragments                      *
1018 1018 Photofission                           *
1019 1019 Photofission Fragments                 *
1103 1103 (n,p) Level                            *
1108 1108 (n,2]a) Level                          *
1113 1113 (n,t) 2]a Level                        *
1200 1200 (n,3-Li-7)                             *
1800 1800                                        * (LEVEL DENSITY)
2103 2103 (n,p) Direct                           *  DIRECT = MT +2000
3103 3103 (n,p) Compound                         *  COMPOUND = MT +3000
6002 6002 l value                                *  RESONANCE PARAM.  0
6003 6003 j value                                *================    0
6004 6004 Level Spacing                          *                   0
6010 6010 ]G}t                                   * 6000 - GENERAL    0
6021 6021 ]G}n                                   * 6010 - TOTAL      0
6022 6022 g]G}n                                  * 6020 - ELASTIC    0
6023 6023 Reduced ]G}n                           * 6030 - CAPTURE    0
6024 6024 Reduced g]G}n                          * 6040 - FISSION    0
6031 6031 ]G}]g                                  * 6050 - RATIOS     0
6032 6032 g]G}]g                                 *                   0
6051 6051 g]G}n]G}]g/]G}t                        *                   0
8001 8001 (p,n)                                  *  CHARGED PARTICLE
8002 8002 (d,n)                                  *  INDUCED REACTIONS
8003 8003 (t,n)                                  *  USE MT=8001 - 8999
8004 8004 (]a,n)                                 *
9000 9999 Production                             *
```

PLOTC4.INP

The input data set requests:

- Plot EXFOR and ENDF data.
- Use EXFOR and ENDF data to determine scaling.
- Plot as many references on the same plot as possible.
- Plot EXFOR data that have at least two points per plot.
- Plot everything from ENDF file MF1.
- Plot on separate plots the range 0-20 eV and 20 eV to 20 MeV for the total, elastic and capture cross sections. Plot all other cross sections on the same plot.
- Plot the differential and double differential cross sections using lin-log scale with a resolution broadening factor of 0.03.

```
      0        12          0          9
 1   99    0    1    1    0    0    2    0    0    0   ENDF
   0   1   1 0.00000+ 0  99999   19999 2.00000+07
   0   3   2 0.00000+ 0  99999   3   2 2.00000+01
   0   3   2 2.00000+ 1  99999   3   2 2.00000+07
   0   3   3 0.00000+ 0  99999   3  99 2.00000+07
   0   3 102 0.00000+ 0  99999   3 102 2.00000+01
   0   3 102 2.00000+ 1  99999   3 102 2.00000+07
   0   3 103 0.00000+ 0  99999   39999 2.00000+07
   0   4   1 0.00000+ 0  99999   59999 2.00000+07  4    0.03
   0   6   1 0.00000+ 0  9999999999999 2.00000+07  4    0.03


--- All input below is ignored
      0   0   0 0.00000+ 0  9999999999999 2.00000+07

      0 4026020 0.00000+ 0  99999 4026099 2.00000+07
      0 801   1 0.00000+ 0  99999 8019999 2.00000+07
```

Example Output Listing

```
PLOT ENDF/B AND/OR EXFOR DATA (PLOTC4 Version 2001-3)
================================================================================
READING TRANSLATION TABLES
================================================================================
SPECIAL ZA TITLES----------   64(  200 ALLOWED)
MF TITLES-----------------   17(  100 ALLOWED)
MT TITLES-----------------   91(  300 ALLOWED)
================================================================================
READING INPUT PARAMETERS
================================================================================
COMPARE EXFOR DATA TO ENDF/B DATA----------              YES
ALL COMPARABLE EXFOR DATA ON SAME PLOT-----              YES
SCALE PLOTS ACCORDING TO------------------    ENDF + EXFOR
PLOT X ERROR BARS--------------------------              YES
PLOT Y ERROR BARS--------------------------              YES
IDENTIFY ALL REFERENCES BY SYMBOL----------               NO
ALLOW VARIABLE E2 ON SAME PLOT-------------               NO
MINIMUM EXFOR POINTS PER PLOT--------------              2
MAXIMUM EXFOR POINTS PER PLOT--------------          10000
GRID TYPE----------------------------------      TICK MARKS
PLOT SIZE----------------------------------             FULL
EVALUATED DATA I.D.-----------------------ENDF
COMPUTER TYPE------------------------------          IBM-PC
================================================================================
PLOT THE FOLLOWING DATA
================================================================================
          LOWER LIMIT                UPPER LIMIT
     ZA  MF  MT  ENERGY-EV     ZA  MF  MT  ENERGY-EV
================================================================================
      0   3   2 0.0000E+00  99999   3   2 2.0000E+01
      0   3   2 2.0000E+01  99999   3   2 2.0000E+07
      0   3   3 0.0000E+00  99999   3  99 2.0000E+07
      0   3 102 0.0000E+00  99999   3 102 2.0000E+01
      0   3 102 2.0000E+01  99999   3 102 2.0000E+07
      0   3 103 0.0000E+00  99999   39999 2.0000E+07
      0   4   1 0.0000E+00  99999   59999 2.0000E+07
      0   6   1 0.0000E+00  99999   69999 2.0000E+07
================================================================================
PROCESSING
================================================================================
MATERIAL     MAT  MF   MT  EVAL. EXPR. EXPR.   EN-INC ANG-OUT    EN-OUT IDX
                          PNTS. PNTS.  REF.       EV     DEG        EV
================================================================================
14-Si-28    1425   3    2  4880     6     4                                  1
14-Si-28    1425   3    4   213   258     1                                  2
14-Si-28    1425   3   16     2     5     1                                  3
14-Si-28    1425   3  102  7990     8     3                                  4
14-Si-28    1425   3  103   158   398    28                                  5
14-Si-28    1425   3  103   158     5     5                                  6
14-Si-28    1425   3  107   178   125     3                                  7
14-Si-28    1425   4    2   162    18     2 1.420E+07                        8
14-Si-28    1425   4    2   101    13     1 1.407E+07                        9
14-Si-28    1425   4    2    45    16     1 5.950E+06                       10
14-Si-28    1425   4    2    82    30     2 1.410E+07                       11
14-Si-28    1425   4    2    63    28     1 9.760E+06                       12
14-Si-28    1425   4    2   162    28     1 1.483E+07                       13
14-Si-28    1425   4    2   113    26     1 1.016E+07                       14
14-Si-28    1425   4    2    39    12     1 3.400E+06                       15
14-Si-28    1425   6 9000   571    76     1 1.420E+07   25.00               16
14-Si-28    1425   6 9000   571    76     1 1.420E+07   30.00               17
14-Si-28    1425   6 9000   571    73     1 1.420E+07   45.00               18
14-Si-28    1425   6 9000   571    74     1 1.420E+07   60.00               19
14-Si-28    1425   6 9000   571    73     1 1.420E+07   75.00               20
```

14-Si-28	1425	6	9000	571	72	1	1.420E+07	80.00	21
14-Si-28	1425	6	9000	571	69	1	1.420E+07	105.00	22
14-Si-28	1425	6	9000	571	69	1	1.420E+07	120.00	23
14-Si-28	1425	6	9000	571	68	1	1.420E+07	135.00	24
14-Si-28	1425	6	9000	571	65	1	1.420E+07	150.00	25
14-Si-28	1425	6	9000	625	60	1	1.484E+07	15.00	26
14-Si-28	1425	6	9000	625	74	1	1.480E+07	30.00	27
14-Si-28	1425	6	9000	625	70	1	1.470E+07	42.00	28
14-Si-28	1425	6	9000	625	68	1	1.453E+07	60.00	29
14-Si-28	1425	6	9000	571	68	1	1.425E+07	80.00	30
14-Si-28	1425	6	9000	571	63	1	1.378E+07	117.00	31
14-Si-28	1425	6	9000	571	57	1	1.350E+07	140.00	32
14-Si-28	1425	6	9000	729	92	1	1.800E+07	45.00	33
14-Si-28	1425	6	9000	729	92	1	1.800E+07	60.00	34
14-Si-28	1425	6	9000	729	87	1	1.800E+07	75.00	35
14-Si-28	1425	6	9000	729	84	1	1.800E+07	90.00	36
14-Si-28	1425	6	9000	729	83	1	1.800E+07	120.00	37
14-Si-28	1425	6	9000	729	78	1	1.800E+07	150.00	38

END OF RUN 38 PLOTS GENERATED

Example Computation format data

```
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 1 14028   3   2 D  1.4830+7 60000.00 0.646000 0.043928                                  A.VIRDIS             (81)21773 54
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 1 14028   69000    1.4200+7         9.3782-9 1.1417-9 0.866025     1.9 1.1600+7 100000.0 E2M.BABA,ET.AL.       (85)21984109
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 1 14028   69000    1.4200+7          1.3145-7 7.5975-9 0.866025      1.9 1.4400+7 100000.0 E2M.BABA,ET.AL.        (85)21984109
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 1 14028   69000    1.4200+7          4.5255-8 3.0549-9 0.866025      1.9 1.4800+7 100000.0 E2M.BABA,ET.AL.        (85)21984109
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 1 14028   69000    1.4200+7          1.7784-8 1.5261-9 0.866025      1.9 1.5200+7 100000.0 E2M.BABA,ET.AL.        (85)21984109
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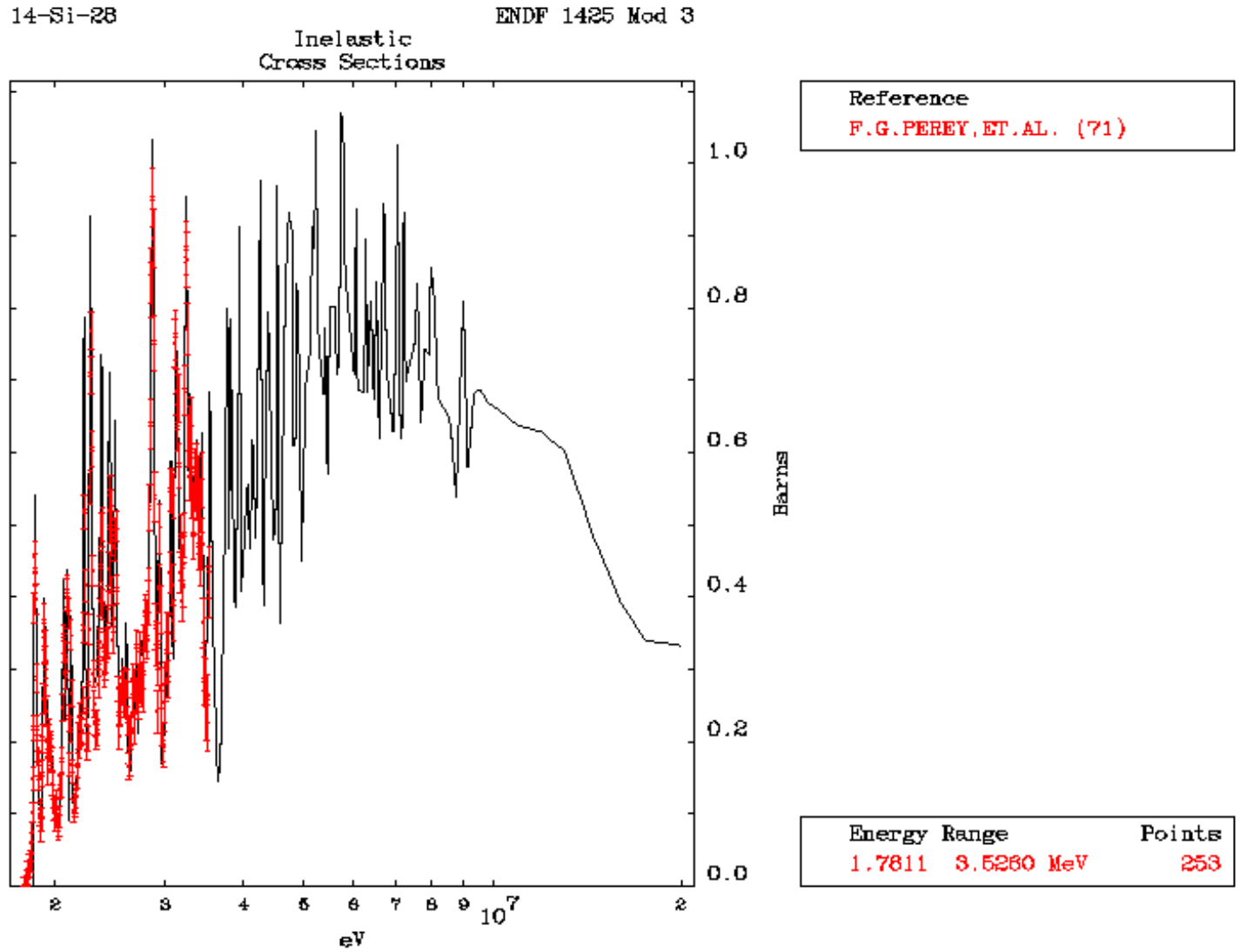
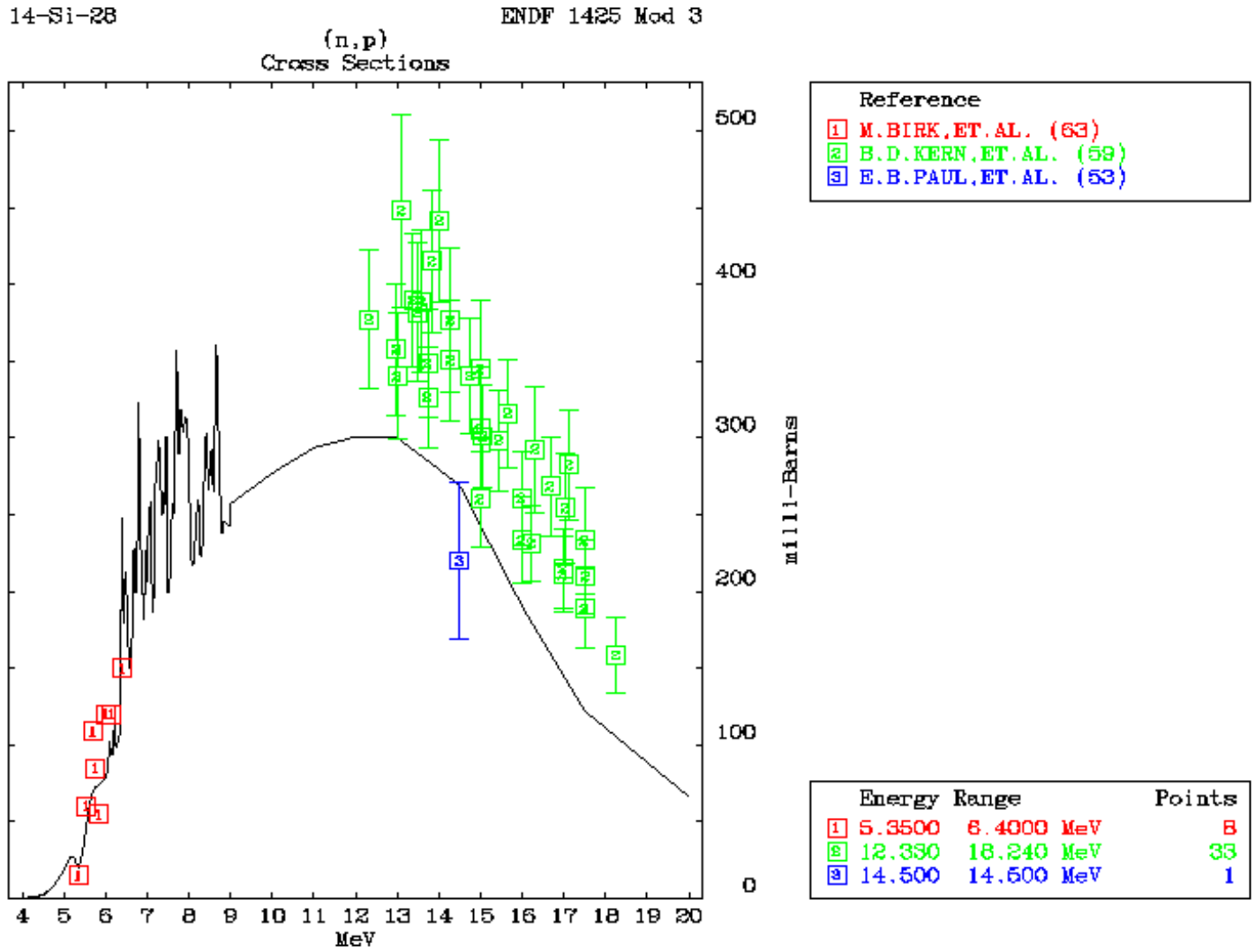
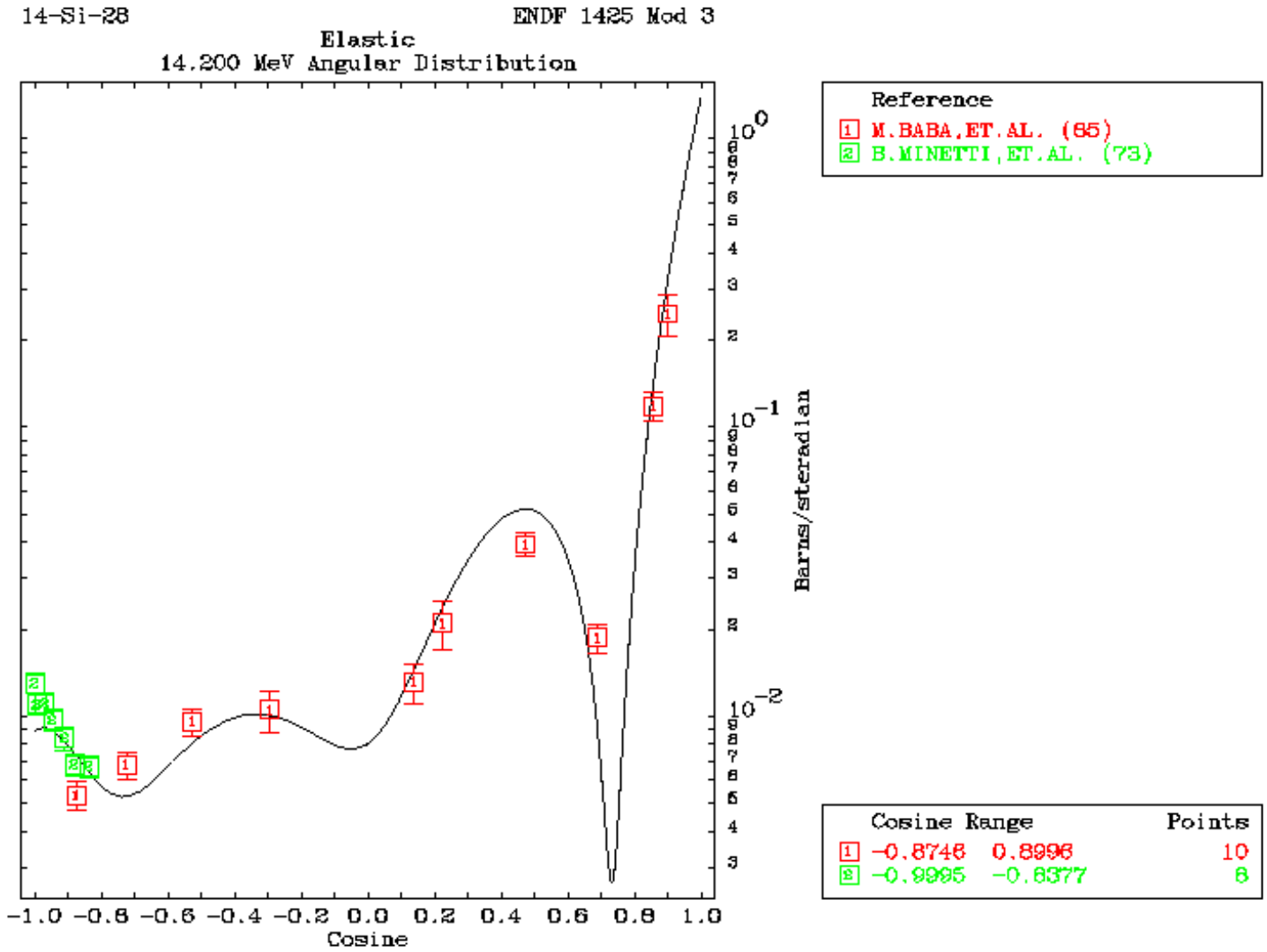
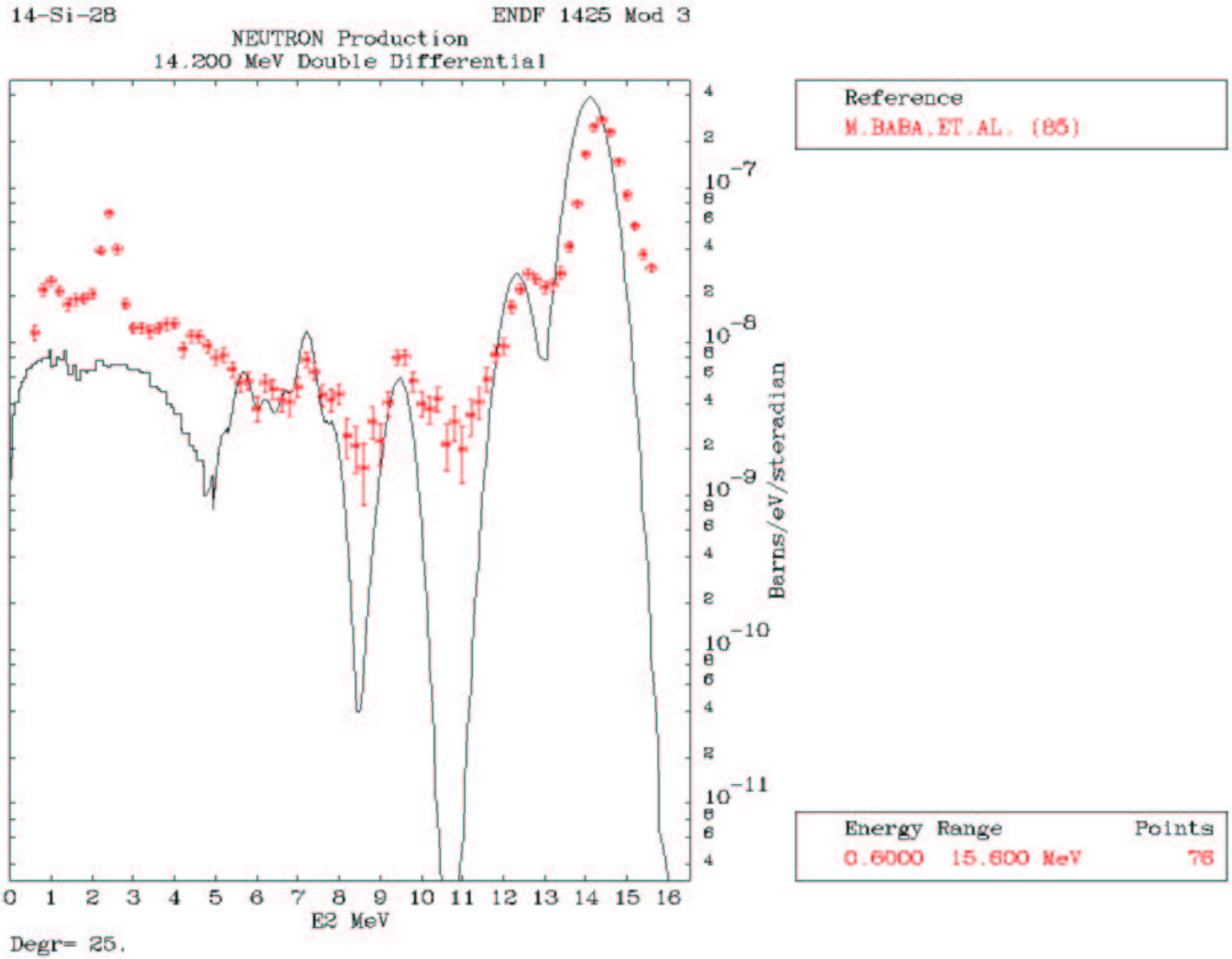
PLOTS of the Data using program PLOTC4


14-Si-28
ENDF 1425 Mod 3
Inelastic
Cross Sections
Reference
F.G.PEREY,ET.AL. (71)
1.0
0.8
0.6
0.4
0.2
0.0
Barns
2
3
4
5
6
7
8
9
10^7
2
eV
Energy Range
Points
1.7811 3.5260 MeV
253


14-Si-28
ENDF 1425 Mod 3
(n,p)
Cross Sections
500
400
300
200
100
0
milli-Barns
4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
MeV
Reference
1 M.BIRK,ET.AL. (63)
2 B.D.KERN,ET.AL. (59)
3 E.B.PAUL,ET.AL. (53)
Energy Range Points
1 5.3500 6.4000 MeV 8
2 12.330 18.240 MeV 33
3 14.500 14.500 MeV 1


14-Si-28
ENDF 1425 Mod 3
Elastic
14.200 MeV Angular Distribution
Barns/steradian
Cosine
-1.0 -0.8 -0.6 -0.4 -0.2 0.0 0.2 0.4 0.6 0.8 1.0
Reference
1 M.BABA,ET.AL. (85)
2 B.MINETTI,ET.AL. (73)
Cosine Range
Points
1 -0.8746 0.8996 10
2 -0.9995 -0.8377 8


14-Si-28
ENDF 1425 Mod 3
NEUTRON Production
14.200 MeV Double Differential
Barns/eV/steradian
E2 MeV
Degr= 25.
Reference
M.BABA,ET.AL. (85)
Energy Range
Points
0.6000 15.600 MeV
76