XDATAP

Los Alamos

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Prepared by Helen M. Byers, Group X-6

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XDATAP

Harl'O M. Fisher

CONTENTS

I. INTRODUCTION	1
1.1 Purpose	3
1.2 Audience	3
1.3 What is XDATAP?	3
1.4 What are the Capabilities of XDATAP?	4
1.5 How do I Use XDATAP?	4
1.6 What is an XDATAP Command File?	5
1.7 Processing XDATAP to Generate Graphics Output	5
1.8 Acceptable Values for Control Parameters	11
1.9 Available Cross-Section Data	12
1.10 Availability of XDATAP	12
II. XDATAP EXAMPLES	12
2.1 One Isotope — One MT or Reaction Type	12
2.2 Three Isotopes — One MT	17
2.3 Discrete Reaction vs- CE Plot for ${}^7\text{Li}$	17
2.4 Random Multigroup-vs-Continuous Energy	17
2.5 User Points-vs-Cross-Section Curve	17
2.6 Nubar Plots for Uranium-235	26
2.7 Command File to Produce ${}^{238}\text{U}$ Plots	26
2.8 User Input File Employing Multiple MTs	35
2.9 Using a Standard File to Generate ${}^{88}\text{Y}$ Plots	35
2.10 Yttrium-88 Pie Diagram Plots	41
2.11 Beryllium $S(\alpha, \beta)$ Thermal Plots	41
2.12 Photon Cross Sections for Natural Lead	48
2.13 Multiple Cross-Section Plots with Change in Plot Axis Designation	50
2.14 Generating Color Plots	59
III. USING XDATAP WITH CGS	67
3.1 Other Useful Documents	67
3.2 Usage Notes	67
3.3 Preliminaries—Before You Can Use XDATAP	68
3.4 Using a Text Editor	68
3.5 What is CFS?	69

3.6	File Manipulation	70
3.7	Graphics Initialization and Termination	70
3.7.1	Initializing and Terminating Graphics	71
3.8	Initializing XDATAP (Call to LIBDISP)	73
3.9	Terminating Graphics (Call to GDONE)	73
3.10	Postprocessing Metafiles	73
3.11	Classified Graphics	73
3.12	Using Color With XDATAP	73
REFERENCES		74
APPENDIX A		75

In the event that several cross-section sets are available for the same nuclide, we **strongly recommend** that you use the default cross section set unless there exist prevailing reasons to do otherwise.

In addition to the directory file, the user also has at his disposal a master-file (XSLIST) that lists all of the nuclear data tables available for a particular nuclide or isotope. The current version of XSLIST is stored on CFS under /X6XS/CTSS/XSLIST. An earlier version of this file may be found in Appendix F of the MCNP¹ manual. The arrow in this file (pointing to a specific data set) indicates the recommended and what we consider to be (in the majority of cases) the best representation of these data currently available.

The code contains a variety of user options. Included among these are color plotting, the ability to read instructions from an input file, the printing of questions and information to an output file, plots generated without labels, user modification of plot labels, plotting of the Los Alamos Logo, the ability to title the plot and label the respective axes plus a host of others. Additionally, the data may be represented as a series of points, a histogram plot, a smooth curve, pie charts, etc., having one or more plots per page, and up to nine different energy ranges. The code may be run interactively or from an XDATAP command file. It is very user friendly and talkative thus allowing even the novice user the ability to produce quality graphics with a minimum of time and effort.

1.1 Purpose

The purpose of this document is to assist the user in the understanding and expeditious application of XDATAP. The user is also introduced to the methods used to produce plots of cross-section data as well as plots of user supplied data.

1.2 Audience

The intended audience includes anyone who is interested in using XDATAP to produce graphics (especially cross-section plots). One need not be a FORTRAN programmer to use XDATAP. However, you must be validated to use one of the Network Computers at Los Alamos (contact OS-4 if you need to be validated). XDATAP is sufficiently straightforward that 20-30 minutes of study is usually all the time required by the typical user to begin producing quality graphics. Finally, make sure you know how to sign on (log on) to one of the Network computers at Los Alamos. If you need help signing on, call the Consulting Office (7-5745).

1.3 What is XDATAP?

XDATAP is a versatile, interactive graphics utility written by Robert C. Little of the X-6 Data Team to facilitate the review, examination, comparison, and plotting of cross-section data. In its purest sense, XDATAP is a cross-section plotting code. It is based on DISSPLA Graphics and may also be run using an XDATAP Command file. While the original intent of the code was to compare cross sections

in A Compact ENDF format with ENDF Evaluated Nuclear Data Files, presently the code is useful not only for that purpose, but also for providing quality graphics for user supplied data.

1.4 What Are the Capabilities of XDATAP?

XDATAP is strictly a plotting utility. It has approximately 20 options, most of which can be used either singularly or concurrently to produce a broad spectrum of cross-section or user-supplied plots that exhibit the characteristics of a specified set of data. The code is capable of producing plots of neutron cross-sections, photon cross-sections, photon production cross-sections, heating data, nubar data, user-supplied data, comparing data from different cross-section libraries, producing color plots, generating and comparing up to nine different plots on a single plotting frame, each of which may have a different data regime or energy range. The data may be represented by a smooth curve, a series of points connected by line segments, a histogram plot, or a series of points with associated error bars. The relationships between cross-section reactions and the identifying MT numbers are specified in detail in Appendix A. Plots may be automatically submitted to microfiche, the electrostatic plotter, or to 35-mm slides. XDATAP can also compare data from different user-supplied data files, generate the Los Alamos Logo on a plot, allow the user to label and title his plot, produce a plot without a label as well as produce plots in a linear-linear, linear-log, log-linear, or log-log mode. XDATAP also produces a CGS Metafile to be used with any of the CGS Metafile Postprocessors (PCAED, PCBT, PESP, PFILM, PSCAN, PTEKT, PVERS, PZETA, PRPP, ...).

1.5 How Do I Use XDATAP?

Begin the procedure to generate XDATAP graphics output by deciding what you want XDATAP to do for you and whether or not you want to generate this output interactively or using an XDATAP Command File. Perhaps at this juncture, it is important to digress for a moment and indicate the effects of running XDATAP interactively or using a command file. XDATAP runs much faster (a factor of 2) from a user command file than it does in the interactive mode; however, the former method is less flexible and requires that the user be thoroughly familiar with the code. The latter method on the other hand, although admittedly slower, is much easier to use in that it practically guides the user from one step to the next.

Write the necessary XDATAP commands on paper if you plan to use an XDATAP Command file. Then execute this file with the XDATAP utility. By this, we mean that after typing XDATAP to initiate program execution, you will indicate that a command file is being used by entering **input** as one of the options. From this point forward, XDATAP responds only to commands in the input file (that is, one cannot manually override program execution) and will either run to completion if no errors are found or stop immediately upon detecting an error in the input file. If you are generating graphics output interactively, respond to the prompts (?) tendered by XDATAP subsequent to the commencement of program execution.

1.6 What is an XDATAP Command File?

An XDATAP command file is a group of commands contained on a file called **input** that tells XDATAP what to do. The command file is created with a text editor (in this document we will refer to the FRED text editor, although there are many others to choose from). XDATAP performs each command as it is read from the file (from the top downward).

1.7 Processing XDATAP to Generate Graphics Output

To tell the computer you want to use XDATAP (subsequent to getting the utility into your local file space), simply type in XDATAP and respond to the prompts as they are presented when generating output in an interactive mode. If you are using a command file to generate output, first create a command file using a text editor and input the desired commands. Next, copy the XDATAP command file to the file **input**. Now type in XDATAP to let the computer know that you want to use the utility. The code will respond as follows:

enter any options (type help for list of available options)

?

At this point, you should enter “input” and/or any other options you feel that are necessary to completely define and characterize your output.

Example 1.7.1 uses the FRED text editor and runs on the Tektronix 4014-1 under the CTSS system and illustrates the procedure mentioned above. Example 1.7.2 displays the terminal session that used the command file shown in Example 1.7.1. Figures 1.7a-1.7c are the graphic output generated from the terminal session shown in Example 1.7.2.

In fact, throughout this document, the examples and figures adhere to the same pattern as the one given above, that is, the terminal session used to generate a given graphic output is first shown in an example immediately followed by the figure(s) containing that graphic output.

Example 1.7.1:
Create A XDATAP Command File to Produce Pie Diagrams

FRED U238

U238 0 lines

*b11

&0	Plot neutron cross sections	Command Entry
&\$	Use cross sections from XSDIR	Command Entry
&92238.50C	Specify the nuclide or ZAID	Command Entry
&3	Number of energies	Command Entry
&14	Energy for plot # 1	Command Entry
&1	Energy for plot # 2	Command Entry
&2.53E-08	Energy for plot # 3	Command Entry
&-18.9	Density (g/cm ³)	Command Entry
&0	EOF	Command Entry

```

Fred u238
u238 0 lines
*bill
&0
&1
&92238.50c
&3
&14
&1
&2.53e-08
&-18.9
&0
&.
  1 0
  2 1
  3 92238.50c
  4 3
  5 14
  6 1
  7 2.53e-08
  8 -18.9
  9 0
*end
u238 9 lines

all done
copy u238 input

all done
xdatap3
enter any options (type help for list of available options)
? pie mfp no label input
enter 0 to plot neutron cross sections
      5 to plot photon cross sections
      6 to plot photon-production cross sections
enter input library for curve #1 (#8) -8 for xedir-
enter the zaid to plot (#18)
the following at's are available for zaid 92238.508
  1      2      181      381      10      382      4      16      17      19
 20      21      38      51      52      53      54      55      56      57
 58      59      68      61      62      63      64      65      66      67
 68      69      78      71      72      73      74      75      76      77
 91      182
how many energies do you want plotted? (1-9)
enter energy (eev) for plot # 1
enter energy (eev) for plot # 2
enter energy (eev) for plot # 3
enter density >8 atom/b cm , <8 g/cm3
if you want to do more, enter 1; otherwise hit return
plot done. pages = 4. words = 4277
graphics cl = u
stop
xdatap3 ctss time 3.256 seconds
cpus .801 l/oc 1.565 mem= .089

all done

```

Example 1.7.2. Terminal session utilizing the command file of Example 1.7.1.

Figure 1.7a. U-238 (14 MeV) pie plot file from Example 1.7.2.

Figure 1.7b. U-238 (1.0 MeV) pie plot file from Example 1.7.2.

THERMAL
SIGTOT = 11.63 barns
MFP = 1.80 cm

Figure 1.7c. U-238 (thermal energy) pie plot file from Example 1.7.2.

1.8 Acceptable Values for Control Parameters

XDATAP does not use control parameters, at least not in the traditional sense. By this we mean that the input file name, type of output, output device, speed, classification, etc., are not stated on the XDATAP execution line. Rather, these parameters are either implicit in the code or set with the options command within XDATAP.

Control Parameters in the XDATAP Options Package

filename	=	The name of a local input file (Input) containing XDATAP commands [Input is the only option] CTSS—limited to 8 characters
*device	=	The output device name [device independent] Metafiles: CGS Metafile for the postprocessors PCAED, PCBT, PESP, PFILM, PSCAN, PTEKT, PVERS, PRPP and PZETA are automatically generated [Implicit]
*terminal device		esp: automatic output to the electrostatic plotter (11-inch or 36-inch electrostatic plotter on bond paper image sizes=10.56" × 8.5" and 32.5" × 27.67" respectively [Option] fiche: automatic output to fiche 105-mm microfiche (image size=7.15mm × 5.62mm) 105-mm microfiche (105A)(image size=7.75mm × 6.09mm) [Option] slide: automatic output to 35-mm slides in color or black-and-white. 35-mm black-and-white slides (imagesize=24.19mm × 19.01mm) 35-mm color slides (35A)(image size=18.82mm × 4.79mm) 35-mm color slides (35C)(image size=24.19mm × 19.01mm) [Option]
Classification	=	The job classification [default: sign-on classification]

1.9 Available Cross-Section Data

We have already made mention of the fact that many of you are probably interested in examining the data contained on the MCNP Library since it is often used by many of the codes here at Los Alamos. In addition to the data on the MCNP Library, XDATAP can also access and plot data from ENDF data files, the Livermore ENDL Library, Random Multigroup Libraries, Photon libraries, Dosimetry Tables, as well as from libraries containing older cross-section evaluations that are still made available to users of MCNP and various other processing codes. See Ref. 1, Appendix F, for details on most of the data libraries and files mentioned above. Reference 2 contains information on the standard Multigroup Libraries MENDF5 and MENDF5G maintained by the X-6 (Radiation Transport Group) Data Team.

1.10 Availability of XDATAP

The XDATAP utility is available on machines 1, W, and Y in the “open” or green partition and on machines 2, 3, and 4 in the “closed” or red partition. The code is readily accessible as follows:

Machine	CFS Files
1	/MYREDSTUFF /PLOT /XDATAP1
2	/MYREDSTUFF /PLOT /XDATAP2
3	/MYREDSTUFF /PLOT /XDATAP3
4	/MYREDSTUFF /PLOT /XDATAP4
Y	/MYREDSTUFF /PLOT /XDATAPY
W	/MYREDSTUFF /PLOT /XDATAPW

II. XDATAP EXAMPLES

All of the examples in this section were produced with XDATAP under the CTSS system. The commands used to generate a plot in a given terminal session are generally included as an example that precedes the plot. In those cases in which XDATAP is run using a command file the FRED text editor was used to create the file.

2.1 One Isotope—One MT or Reaction Type

The single isotope-single MT or reaction type plot is the simplest kind of cross-section plot practiced by XDATAP. The terminal session for this particular case is shown in Example 2.1. Notice that there are no options given, thereby allowing the code to automatically label the plot. Figure 2.1 is an illustration of the one

isotope-one MT plot. In Example 2.1a two input options (nolabel, labelaxis) are given in addition to the single MT specification. The plot for the latter case is displayed in Fig. 2.1a. Notice the difference between the plot in Fig. 2.1a in which the nolabel and labelaxis options are given and Fig. 2.1 in which no options are given. In the latter case, the plot is larger and the user is allowed to label the plot as well as the X and Y axes.

```

xdatap3
enter any options (type help for list of available options)
?
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
? 0
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
? 1
enter input library for curve #1 (a0) -s for xsdir-
? s
enter the zaid to plot (a10)
? 8016.50c
the following mt's are available for zaid 8016.500
      1      2      101      301      302      4      51      52      53      54
      55      56      57      58      59      60      61      62      63      64
      65      66      67      68      69      70      71      72      73      74
      75      76      77      78      79      80      81      82      83      84
      85      86      87      88      89      102      103      104      107      203
      204      207
enter the mt numbers to plot (1017) **17**
? 0000001
now many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
? 1
enter emin and emax (mev) for energy range # 1
? 1e-01 10
if you want to do more, enter 1; otherwise hit return
?
plot done. pages = 2. words = 2012
graphics c) = u
stop
xdatap3 ctss time 7.496 seconds
cpu: .327 1/0= 4.798 mem= 2.379

all done

```

Example 2.1. Interactive Terminal Session for One Isotope-One MT Plot.

Figure 2.1. Plot File from Example 2.1.

```

xdatap3
enter any options (type help for list of available options)
? nolabel labelaxis
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
? 0
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
? 1
enter input library for curve #1 (a0) -s for xsdir-
? s
enter the zaid to plot (a10)
? 8016.50c
the following mt's are available for zaid 8016.508
      1      2      101      381      382      4      51      52      53      54
      55      56      57      58      59      60      61      62      63      64
      65      66      67      68      69      70      71      72      73      74
      75      76      77      78      79      80      81      82      83      84
      85      86      87      88      89      102      103      104      107      203
      204      207
enter the mt numbers to plot (1017) **17**
? 0000001
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
? 1
enter emin and emax (mev) for energy range # 1
? 1e-01 10
enter the label for the plot
? total cross sectio plot for oxygen
enter the label for the x-axis
? neutron energy (MeV)
enter the label for the y-axis
? cross section (barns)
if you want to do more, enter 1; otherwise hit return
?
plot done. pages = 2. words = 1832
graphics cl = u
stop
xdatap3 ctss time 9.733 seconds
cpu= .314 1/c= 6.288 mem= 3.132
all done

```

Example 2.1a. Interactive Terminal Session for One Isotope–One MT Plot (2 Input Options).

TOTAL CROSS SECTION PLOT FOR OXYGEN

Figure 2.1a. Plot File from Example 2.1a.

2.2 Three Isotopes—One MT

Example 2.2 is the result of an interactive terminal session in which the plots of the elastic cross sections (MT=2) of three different nuclides are compared over their entire energy range. Figure 2.2 is the graphic output generated from the interactive terminal session.

2.3 Discrete Reaction-vs-CE Plot for ${}^7\text{Li}$

Example 2.3 is the product of an interactive session in which the discrete reaction and continuous energy cross sections for MT=1 are compared for ${}^7_3\text{Li}$ over a limited energy range. The ${}^7_3\text{Li}$ plot generated by this interactive terminal session is contained in Fig. 2.3.

2.4 Random Multigroup-vs-Continuous Energy

Example 2.4 is the result of an interactive session that generates a ${}^{14}\text{N}$ plot in which the elastic scattering data from the random multigroup library MENDF5X is compared to the continuous energy data from the MCNP Library in the energy range from 10^{-3} -to-10 MeV. The ${}^{14}\text{N}$ plot comparing the elastic scattering data from the MENDF5X library with that from the MCNP library is contained in Fig. 2.4.

2.5 User Points-vs-Cross-Section Curve

Example 2.5 is a case in which a user input file is utilized to plot cross-section data; more specifically, user points from the Koehler experimental data for ${}^7\text{Be}$ with relative errors are compared to the EDA prediction. An XDATAP user input file has free-field input and the number of points to be plotted must be indicated on the first line of the input file (preceding the entry of any input data). X and Y values can be entered either as one row of Xs and one row of Ys or as pairs of Xs and Ys. However, if errorbars are to be included in the input data, the combination must be X, Y, errorbar. User input data can also be nested. By this we mean that data for several plots may be contained in the same input file pursuant to the adherence to the proper data entry format discussed above. Also notice the effect of using the errorbar, nolabel, and labelaxis options for this case. Figure 2.5 is the result of the interactive terminal session discussed in Section 2.5 and listed in Example 2.5 in which a user input file is used to plot cross-section data.

```

xdatap3
enter any options (type help for list of available options)
?
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
? 0
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
? 2
how many curves on the next plot? enter 1-9
? 3
enter input library for curve #1 (a8) -$ for xsdir-
? $
enter the zaid to plot (a10)
? 1001.50c
the following mt's are available for zaid 1001.500
      1      2      101      301      302      102      204
how many mt's to plot for this material?
? 1
enter the 1 mt's to plot for this material
? 2
enter input library for curve #2 (a8) -$ for xsdir-
? $
enter the zaid to plot (a10)
? 2003.50c
the following mt's are available for zaid 2003.500
      1      2      101      301      103      104      203      204      205
how many mt's to plot for this material?
? 1
enter the 1 mt's to plot for this material
? 2
enter input library for curve #3 (a8) -$ for xsdir-
? $
enter the zaid to plot (a10)
? 5010.50c
the following mt's are available for zaid 5010.500
      1      2      101      301      302      4      51      52      53      54
      55      56      57      58      59      60      61      62      63      64
      65      66      67      68      69      70      71      72      73      74
      75      76      77      78      79      80      81      82      83      84
      85      102      103      104      107      113      203      204      205      207
      701
enter the 1 mt's to plot for this material
? 2
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
? *
if you want to do more, enter 1; otherwise hit return
?
plot done. pages = 2. words = 3152
graphics cl = u
stop

```

Example 2.2. Interactive Terminal Session for Three Isotopes-One MT Plot.

Figure 2.2 Plot File from Example 2.2.

```

xdatap3
enter any options (type help for list of available options)
?
enter    0 to plot neutron cross sections
         3 to compare
         4 to plot nubars
         5 to plot photon cross sections
         6 to plot photon-production cross sections
? 0
mode 0 plots all at's for a particular
isotope(one per page). mode 1 plots a subset of all at's
for a particular isotope(one per page). mode 2
plots more than one at or isotope per page.
enter 0,1,or 2 for the mode you desire.
? 2
how many curves on the next plot? enter 1-9
? 2
enter input library for curve #1 (a0) -$ for xsdir-
? $
enter the zaid to plot    (a10)
? 3007.55c
the following at's are available for zaid    3007.550
      1      2      101      301      302      4      16      24      25      51
      52      53      54      55      56      57      58      59      60      61
      62      63      64      65      66      67      68      69      70      71
      72      73      74      75      76      77      78      79      80      81
      82      102      104      203      204      205      207
how many at's to plot for this material?
? 1
enter the 1 at's to plot for this material
? 1
enter input library for curve #2 (a0) -$ for xsdir-
? $
enter the zaid to plot    (a10)
? 3007.55d
the following at's are available for zaid    3007.550
      1      2      101      301      302      4      16      24      25      51
      52      53      54      55      56      57      58      59      60      61
      62      63      64      65      66      67      68      69      70      71
      72      73      74      75      76      77      78      79      80      81
      82      102      104      203      204      205      207
enter the 1 at's to plot for this material
? 1
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
? 1
enter emin and emax (kev) for energy range # 1
? 2e-01 8e-01
if you want to do more, enter 1; otherwise hit return
?
plot    done.    pages =    2.    words =    2117
graphics cl = u
stop
xdatap3  ctss time    11.396    seconds
cpu=    .321    i/o=    7.331    mem=    3.743

all done

```

Example 2.3. Interactive Terminal Session for ${}^3_7\text{Li}$ Discrete Reaction-vs-Continuous Energy Plot.

Figure 2.3. Plot File from Example 2.3.


```

xdatap3
enter any options (type help for list of available options)
?
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
? 0
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
? 2
how many curves on the next plot? enter 1-9
? 2
enter input library for curve #1 (a0) -$ for xsdir-
? $
enter the zaid to plot (a10)
? 7014.50c
the following mt's are available for zaid 7014.500
      1      2      101      301      302      4      16      51      52      53
      54      55      56      57      58      59      60      61      62      63
      64      65      66      67      68      69      70      71      72      73
      74      75      76      77      78      79      80      81      82      102
      103      104      105      107      108      203      204      205      207
how many mt's to plot for this material?
? 1
enter the 1 mt's to plot for this material
? 2
enter input library for curve #2 (a0) -$ for xsdir-
? mendlf5x
is mendlf5x a standard, ace, endf, dosimetry, user-provided,
endl, random multigroup, or alpine library? (0=standard, 1=ace,
2=endf, 3=dos., 4=user, 5=endl, 6=random mg, 7=alpine)
? 6
the following zaids are available on mendlf5x
      1001.500      1002.550      1003.500      2003.500      2004.500      3006.500
      3007.550      4007.350      4008.500      5010.500      5011.560      6000.500
      6012.500      7014.500      7015.550      8016.500      9019.500      11023.500
      12000.500      13027.500      14000.500      15031.500      16032.500      17000.500
      18000.350      19000.500      20000.500      22000.500      23000.500      24000.500
      25055.500      26000.550      27059.500      28000.500      29000.500      31000.500
      33075.350      36078.500      36080.500      36082.500      36083.500      36084.500
      36086.500      39089.500      40000.500      41093.500      42000.500      45103.500
      45117.900      46119.900      47000.550      47107.500      47109.500      48080.500
      50120.350      50998.990      50999.990      54000.350      56138.500      58140.500
      58142.500      63000.350      63151.550      63153.550      64000.350      67165.550
      69169.550      73181.500      74000.550      74182.550      74183.550      74184.550
      74186.550      75185.500      75187.500      77000.550      78000.350      79197.560
      82000.500      83209.500      90232.500      91233.500      92233.500      92234.500
      92235.500      92236.500      92237.500      92238.500      92239.350      93236.990
      93237.550      93238.990      94237.350      94238.500      94239.550      94240.500
      94241.500      94242.500      95241.500      95242.500      95243.500      96242.500
      96244.500
which zaid would you like to plot?
? 7014.50
the following mt's are available for zaid 7014.500
      2      4      16      17      102      107      103      1
enter the 1 mt's to plot for this material
? 2
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
? 1
enter emin and emax (mev) for energy range # 1
? 1e-03 10
? if you want to do more, enter 1; otherwise hit return
?
plot done. pages = 2. words = 2687
graphics cl = u
stop
xdatap3 ctss time 12.862 seconds
cpu= .408 i/o= 8.329 mem= 4.125
all done

```

Example 2.4. Interactive Terminal Session for Random Multigroup-vs-Continuous Energy Plot.

Figure 2.4. Plot File from Example 2.4.

```

xdatap3
enter any options (type help for list of available options)
? no label labelaxis errorbar
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
? 3
what do you want to compare? enter 0 for neutron xs
5 for photon interaction xs, or 6 for photon-prod xs
? 0
how many curves on the next plot? enter 1-9
? 2
enter input library for curve #1 (a8) -$ for xsdir-
? ff1
is ff1 a standard, ace, endf, dosimetry, user-provided,
endf, random multigroup, or alpine library? (0=standard, 1=ace,
2=endf, 3=dos., 4=user, 5=endf, 6=random mg, 7=alpine)
? 4
enter the zaid for this isotope
? 4007
enter the number of mt's to read in from ff1
? 1
enter the 1 mt's to read
? 1
enter input library for curve #2 (a8) -$ for xsdir-
? ff2
is ff2 a standard, ace, endf, dosimetry, user-provided,
endf, random multigroup, or alpine library? (0=standard, 1=ace,
2=endf, 3=dos., 4=user, 5=endf, 6=random mg, 7=alpine)
? 4
enter the zaid for this isotope
? 4007
enter the number of mt's to read in from ff2
? 1
enter the 1 mt's to read
? 1
you will get plots of each mt available
for each material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
? *
enter 0 if the data on ff1 are pointwise
      1 if the data are histograms
      2 if the data are points only
      3 if the data are points, but you want them connected
? 2
enter 0 if no errorbars on ff1
      1 if errorbars are given fractionally
      2 if errorbars are given absolutely
      3 if errorbars are given as percents
? 2
data must be given as triplets of x,y,delta-y
enter 0 if the data on ff2 are pointwise
      1 if the data are histograms
      2 if the data are points only
      3 if the data are points, but you want them connected
? 2
enter 0 if no errorbars on ff2
      1 if errorbars are given fractionally
      2 if errorbars are given absolutely
      3 if errorbars are given as percents
? 0
enter the label for the plot
? cross section with relative errors vs eca prediction
enter the label for the x-axis
? laboratory neutron energy (eV)
enter the label for the y-axis
? reduced cross section barns/sqrt(eV)
if you want to do more, enter 1; otherwise hit return
?
plot done. pages = 2. words = 3422
graphics cl = u
stop
xdatap3 ctss time 18.096 seconds
cpu= .471 i/o= 11.715 mem= 5.909

all done

```

Example 2.5. Interactive Terminal Session Comparing User Points for ^7Be With Cross-Section Curve.

CROSS SECTION WITH RELATIVE ERRORS VS EDA PREDICTION

Figure 2.5. Plot File from Example 2.5.

2.6 Nubar Plots for ^{235}U

Example 2.6 displays the use of the mode 4 plot option in which prompt and total nubar (neutrons/fission) for a specified nuclide or isotope are plotted (one per page). In this particular case prompt and total nubar plots for ^{235}U are generated using the data from the MCNP Library. These plots are contained in Figs. 2.6a and 2.6b, respectively.

2.7 Command File to Produce ^{238}U Plots

In this example, the FRED text editor is used to create an XDATAP command file called 'input.' The input and output options are invoked upon program execution causing XDATAP to read its instructions from the file 'input' and write the questions and information to a file called output. Notice that once the input option is invoked there is no further interaction between XDATAP and the user. The major advantage of using this mode of execution is that XDATAP runs much more rapidly (usually by a factor of 2.5–3) in this mode than in the interactive mode. Conversely, XDATAP is much more unforgiving and rigid when using a command file. The input commands are listed on Example 2.7a; the information written to the output file is contained in Example 2.7b. The plots generated by Example 2.7a are included in Figs. 2.7a through 2.7c, respectively.

```

xdatap3
enter any options (type help for list of available options)
?
enter  0 to plot neutron cross sections
        3 to compare
        4 to plot nubar
        5 to plot photon cross sections
        6 to plot photon-production cross sections
? 4
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
? 0
enter input library for curve #1 (#8) -s for xsdir-
? s
enter the zaid to plot  (a18)
? 92235.50c
the following mt's are available for 92235.50c
456 452
you will get plots of each mt available
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
? *
if you want to do more, enter 1; otherwise hit return
?
plot done. pages = 3. words = 5282
graphics cl = u
stop
xdatap3 ctss time 6.458 seconds
cpu= .622 i/o= 3.839 mem= 1.997

all done

```

Example 2.6. Prompt and Total Nubar Plots for ^{235}U .

Figure 2.6a. Plot File from Example 2.6.

Figure 2.6b. Plot File from Example 2.6. (continued).


```

fred input
input 28 lines
*tl,1
1 0
2 2
3 4
4 $
5 92238.50c
6 4
7 1 2 101 18
8 1
9 1e-08 20
10 1
11 0
12 2
13 1
14 $
15 92238.50c
16 301
17 1
18 1e-08 20
19 1
20 0
21 2
22 1
23 $
24 92238.50c
25 302
26 1
27 1e-08 20
28 0
*end

all done
xdatap3
enter any options (type help for list of available options)
? input output
plot done. pages = 4. words = 35432
graphics cl = u
stop
xdatap3 ctes time 11.891 seconds
cpu= 0.938 i/o= 1.278 mem= 1.675

all done

```

Example 2.7a. Command File Input for ^{238}U Plots.

```

fred output
output 73 lines
*1,50
1 enter 0 to plot neutron cross sections
2 3 to compare
3 4 to plot nubars
4 5 to plot photon cross sections
5 6 to plot photon-production cross sections
6 mode 0 plots all at's for a particular
7 isotope(one per page). mode 1 plots a subset of all at's
8 for a particular isotope(one per page). mode 2
9 plots more than one at or isotope per page.
10 enter 0,1,or 2 for the mode you desire.
11 how many curves on the next plot? enter 1-9
12 enter input library for curve #1 (a8) -$ for xsdir-
13 enter the zaid to plot (a10)
14 the following at's are available for zaid 92238.500
15 1 2 101 301 18 302 4 16 17 19
16 20 21 30 51 52 53 54 55 56 57
17 58 59 60 61 62 63 64 65 66 67
18 68 69 70 71 72 73 74 75 76 77
19 91 102
20 how many at's to plot for this material?
21 enter the 4 at's to plot for this material
22 how many energy ranges do you want plotted? (1-9)
23 or enter * for 1 plot of entire energy range
24 enter emin and emax (kev) for energy range # 1
25 if you want to do more, enter 1; otherwise hit return
26 enter 0 to plot neutron cross sections
27 3 to compare
28 4 to plot nubars
29 5 to plot photon cross sections
30 6 to plot photon-production cross sections
31 mode 0 plots all at's for a particular
32 isotope(one per page). mode 1 plots a subset of all at's
33 for a particular isotope(one per page). mode 2
34 plots more than one at or isotope per page.
35 enter 0,1,or 2 for the mode you desire.
36 how many curves on the next plot? enter 1-9
37 enter input library for curve #1 (a8) -$ for xsdir-
38 enter the zaid to plot (a10)
39 the following at's are available for zaid 92238.500
40 1 2 101 301 18 302 4 16 17 19
41 20 21 30 51 52 53 54 55 56 57
42 58 59 60 61 62 63 64 65 66 67
43 68 69 70 71 72 73 74 75 76 77
44 91 102
45 enter the 1 at's to plot for this material
46 how many energy ranges do you want plotted? (1-9)
47 or enter * for 1 plot of entire energy range
48 enter emin and emax (kev) for energy range # 1
49 if you want to do more, enter 1; otherwise hit return
50 enter 0 to plot neutron cross sections

51 3 to compare
52 4 to plot nubars
53 5 to plot photon cross sections
54 6 to plot photon-production cross sections
55 mode 0 plots all at's for a particular
56 isotope(one per page). mode 1 plots a subset of all at's
57 for a particular isotope(one per page). mode 2
58 plots more than one at or isotope per page.
59 enter 0,1,or 2 for the mode you desire.
60 how many curves on the next plot? enter 1-9
61 enter input library for curve #1 (a8) -$ for xsdir-
62 enter the zaid to plot (a10)
63 the following at's are available for zaid 92238.500
64 1 2 101 301 18 302 4 16 17 19
65 20 21 30 51 52 53 54 55 56 57
66 58 59 60 61 62 63 64 65 66 67
67 68 69 70 71 72 73 74 75 76 77
68 91 102
69 enter the 1 at's to plot for this material
70 how many energy ranges do you want plotted? (1-9)
71 or enter * for 1 plot of entire energy range
72 enter emin and emax (kev) for energy range # 1
73 if you want to do more, enter 1; otherwise hit return
*end

all done

```

Example 2.7b. XDATAP Output File for ^{238}U Plots.

Figure 2.7a. Plot File from Example 2.7.

Figure 2.7b. Plot File for Example 2.7. (continued).

Figure 2.7c. Plot File for Example 2.7. (continued).

2.8 User Input File Employing Multiple MTs

Example 2.8 demonstrates how XDATAP handles multiple MTs contained in a user input file. The `nolabel` and `labelaxis` entries are invoked as options; however, the factor of real import here is that the input file containing the data to be plotted is entered when the code queries for the input library name (Leadspec 1 in this case). Additionally, an entry of 2 for the number of MTs (there are no reaction types in these cases) indicates to XDATAP that we wish to plot two sets of data. Figures 2.8a and 2.8b contain the plots generated by Example 2.8.

2.9 Using a Standard File to Generate ^{88}Y Plots

In most of the examples seen thus far, the cross-section data have been in ACE format and were extracted automatically from the Cross-Section Directory File, XSDIR. The data for Example 2.9 is contained on the Livermore ENDL Library, ENDL852, which is a standard library. Data is extracted from this library for the nuclide yttrium-88. Note that not only are the data not automatically retrieved but that the library name and type must be specifically designated. The ^{88}Y plot generated from data contained on the Livermore ENDL library is shown in Fig. 2.9.

```

xdatap3
enter any options (type help for list of available options)
? no label labelaxis
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
?
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1, or 2 for the mode you desire.
?
enter input library for curve #1 (a8) -$ for xsdir-
? ledspec1
is ledspec1 a standard, ace, endf, dosimetry, user-provided,
endl, random multigroup, or alpine library? (0=standard, 1=ace,
2=endf, 3=dos., 4=user, 5=endl, 6=random mg, 7=alpine)
? 4
enter the zaid for this isotope
? 1
enter the number of mt's to read in from ledspec1
? 2
enter the 2 mt's to read
? 1 2
you will get plots of each mt available
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
? *
enter 0 if the data on ledspec1 are pointwise
      1 if the data are histograms
      2 if the data are points only
      3 if the data are points, but you want them connected
? 3
enter 1 if the data are given in e-sigma pairs,
or 2 if they are given as 1 block of e and 1 block of sigma
? 1
enter the label for the plot
? acnp bathtub curve
enter the label for the x-axis
? ebar
enter the label for the y-axis
? deltae/ebars
enter 0 if the data on ledspec1 are pointwise
      1 if the data are histograms
      2 if the data are points only
      3 if the data are points, but you want them connected
? 3
enter 1 if the data are given in e-sigma pairs,
or 2 if they are given as 1 block of e and 1 block of sigma
? 1
enter the label for the plot
? bergmann bathtub curve
enter the label for the x-axis
? ebar
enter the label for the y-axis
? deltae/ebars
if you want to do more, enter 1; otherwise hit return
?
plot done. pages = 3. words = 2192
graphics cl = u
stop
xdatap3 ctss time 15.695 seconds
cpu= .298 i/o= 10.234 mem= 5.163

all done

```

Example 2.8. Multiple Plot Generation With a User Input File.

MCNP BATHITUB CURVE

Figure 2.8a. Plot File from Example 2.8.

BERGMANN BATHTUB CURVE

Figure 2.8b. Plot File from Example 2.8. (continued).

```

xdatap3
enter any options (type help for list of available options)
? loglog labelaxis
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubars
      5 to plot photon cross sections
      6 to plot photon-production cross sections
? 0
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
? 2
how many curves on the next plot? enter 1-9
? 3
enter input library for curve #1 (a8) -$ for xsdir-
? endl852
is endl852 a standard, ace, endf, dosimetry, user-provided,
endl, random multigroup, or alpine library? (0=standard, 1=ace,
2=endf, 3=dos., 4=user, 5=endl, 6=random ag, 7=alpine)
? 0
enter the zaid to plot (a18)
? 39088.35c
the following mt's are available for zaid 39088.35c
      1      2      101      301      302      91      16      103      107      102
how many mt's to plot for this material?
? 3
enter the 3 mt's to plot for this material
? 1 2 101
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
? 1
enter emin and emax (MeV) for energy range # 1
? 1e-08 20
enter the label for the plot
? yttrium summary reactions
enter the label for the x-axis
? neutron energy(MeV)
enter the label for the y-axis
? cross section (barns)
if you want to do more, enter 1; otherwise hit return
?
plot done. pages = 2. words = 2987
graphics cl = u
stop
xdatap3 ctss time 12.398 seconds
cpu= .693 1/n= 7.886 mem= 3.898
all done

```

Example 2.9. Using a Standard File to Generate ^{88}Y Summary Reaction Plots.

YTTRIUM SUMMARY REACTIONS

01/12/88
ZAID = 39088.35C
Y - 88
From ENDLB52

Figure 2.9. Plot File from Example 2.9.

2.10 Yttrium-88 Pie Diagram Plots

Example 2.10 displays the method used by XDATAP to produce pie-diagram plots for a specified nuclide. In this example, pie plots were generated for ^{88}Y at 14, 1, and 2.53E-08 MeV. Note that the pie option must be specified on the option line in conjunction with any other options one wishes to use, that is, nfp, nolabel, etc. However, the most important thing to remember if one wishes to generate pie-diagram plots is the fact that pie-plots can only be generated from ACE or type 3 files. The ^{88}Y pie-plots at 14, 1 and 2.53E-08 MeV are contained in Figs. 2.10a, 2.10b, and 2.10c, respectively.

2.11 Beryllium $S(\alpha, \beta)$ Thermal Plots

In Example 2.11 the total inelastic thermal cross-section for Beryllium-9 is compared at four different temperatures (300°K, 600°K, 800°K, and 1200°K, respectively) listed on the data table for this nuclide. Perhaps the most unusual characteristics of this example is the manner in which the ZAIDs are specified. Figure 2.11 shows the comparison of the ^9Be cross section data at 300, 600, 800, and 1200°K, respectively.

```

<datap3
enter any options (type help for list of available options)
? pie mfp nolaabel
enter 0 to plot neutron cross sections
      5 to plot photon cross sections
      6 to plot photon-production cross sections
? 0
enter input library for curve #1 (a8) -> for xsdir-
? endl853
is endl853 a standard, ace, endf, dosimetry, user-provided,
endl, random multigroup, or alpine library? (0=standard, 1=ace,
2=endf, 3=dos., 4=user, 5=endl, 6=random mg, 7=alpine)
? 1
the following zalds are available on endl853
1001.350 1002.350 1003.350 2003.350 2004.350 4007.350
5010.350 5011.350 6012.350 6013.350 8016.350 9019.350
11023.350 12000.350 13027.350 14000.350 15031.350 16032.350
17000.350 19000.350 20000.350 22000.350 24000.350 25055.350
26000.350 27059.350 28050.350 29000.350 31000.350 33074.350
39000.350 40000.350 41093.350 42000.350 47107.350 47109.350
48000.350 50000.350 54000.350 54134.350 56138.350 72000.350
73181.350 74000.350 75105.350 75107.350 79197.350 82000.350
83209.350 90231.350 90232.350 90233.350 91233.350 92233.350
92234.350 92236.350 92237.350 92238.350 92240.350 93235.350
93236.350 93237.350 93238.350 94237.350 94238.350 94241.350
94242.350 94243.350 95241.350 95242.350 95243.350 96242.350
96243.350 96244.350 96245.350 96246.350 96247.350 96248.350
97249.350 98249.350 98250.350 98251.350 98252.350
which zald would you like to plot?
? 39000.350
the following mt's are available for zald 39000.350
1 2 101 301 302 4 91 16 103 107
102
how many energies do you want plotted? (1-9)
? 3
enter energy (mev) for plot # 1
? 14
enter energy (mev) for plot # 2
? 1
enter energy (mev) for plot # 3
? 2.53e-08
enter density >0 atom/b cm , <8 g/cm**3
? -3.80
if you want to do more, enter 1; otherwise hit return
?
plot done. pages = 4. words = 3947
graphics cl = u
stop
<datap3 ctss time 10.387 seconds
cpu= .667 l/o= 6.482 mm= 3.238

all done

```

Example 2.10. Pie Diagram Plots for Yttrium-88.

Figure 2.10a. Plot File (a) from Example 2.10.

$E = 1.00 \text{ MeV}$
 $SIGTOT = 7.07 \text{ barns}$
 $MFP = 5.43 \text{ cm}$

Figure 2.10b. Plot File from Example 2.10 (cont).

THERMAL
SIGTOT = 14.22 barns
MFP = 2.70 cm

Figure 2.10c. Plot File from Example 2.10 (cont.).


```

xdatap3
enter any options (type help for list of available options)
?
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nu bers
      5 to plot photon cross sections
      6 to plot photon-production cross sections
? 0
mode 0 plots all at's for a particular
isotope(one per page). mode 1 plots a subset of all at's
for a particular isotope(one per page). mode 2
plots more than one at or isotope per page.
enter 0,1,or 2 for the mode you desire.
? 2
how many curves on the next plot? enter 1-9
? 4
enter input library for curve #1 (a8) -$ for xsdir-
? $
enter the zaid to plot (a18)
? be.01t
the following at's are available for zaid be.01t
      4      2
how many at's to plot for this material?
? 1
enter the 1 at's to plot for this material
? 4
enter input library for curve #2 (a8) -$ for xsdir-
? $
enter the zaid to plot (a18)
? be.04t
the following at's are available for zaid be.04t
      4      2
how many at's to plot for this material?
? 1
enter the 1 at's to plot for this material
? 4
enter input library for curve #3 (a8) -$ for xsdir-
? $
enter the zaid to plot (a18)
? be.05t
the following at's are available for zaid be.05t
      4      2
how many at's to plot for this material?
? 1
enter the 1 at's to plot for this material
? 4
enter input library for curve #4 (a8) -$ for xsdir-
? $
enter the zaid to plot (a18)
? be.06t
the following at's are available for zaid be.06t
      4      2
enter the 1 at's to plot for this material
? 4
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
?
if you want to do more, enter 1; otherwise hit return
?
plot done. pages = 2. words = 2342
graphics cl = u
stop
xdatap3 ctes time 18.499 seconds
cpu= 1.722 i/o= 11.891 mem= 5.687

all done

```

Example 2.11. Interactive Session for ^7Be $S(\alpha\beta)$ Thermal Plots.

Figure 2.11. Plot File from Example 2.11.

2.12 Photon Cross Sections for Natural Lead

In example 2.12 natural lead photon cross sections are plotted for 4 reactions, total (MT=501), coherent (MT=502), incoherent (MT=504), and the photoelectric effect (MT=602). These cross sections were extracted from the MCNP photon cross-section library MCPLIB and are contained on the cross-section directory file XSDIR. The commands used to generate the plot are contained in Example 2.12; the actual plot is displayed in Fig. 2.12.

```
xdatap3
enter any options (type help for list of available options)
? labelaxis
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
1 5
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
1 2
how many curves on the next plot? enter 1-9
2 4
enter input library for curve #1 (a8) -$ for xsdir-
2 $
enter the zaid to plot (a10)
2 82000.01p
the following mt's are available for zaid 82000.01p
501 502 504 516 602 301
how many mt's to plot for this material?
2 4
enter the 4 mt's to plot for this material
2 501 502 504 602
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
2 *
enter the label for the plot
1 photon cross sections for natural lead
enter the label for the x-axis
2 photon energy(MeV)
enter the label for the y-axis
2 cross section(barns)
if you want to do more, enter 1; otherwise hit return
1
plot done. pages = 2. words = 3257
Graphics cl = u
stop
xdatap3 ctss time 11.116 seconds
cpu= .513 i/o= 7.070 mem= 3.534

all done
```

Example 2.12. Interactive Terminal Session for Lead Photon Cross Sections.

PHOTON CROSS SECTIONS FOR NATURAL LEAD

01/14/89
ZAID = 82000.01P
Pb

From MCPLIB

Figure 2.12. Plot File from Example 2.12.

2.13 Multiple Cross-Section Plots with Change in Plot Axis Designation

Cross-section plots for the summary reactions, heating data, gamma production data, fission data, nubar data, and threshold data were generated for Uranium-238. The first 3 plots were generated using a log-log plot scale-axis while the last 3 were generated using a linear-linear scale. This is a good example of the utilization of the XDATAP Command file, that is, when one wants to generate a series of plots, a number of which fall into one specific pattern (plotmode) or another.

Note: Because of the change in the plot axes (from log-log to lin-lin) this task has to be completed in two separate terminal sessions (see Fig. 2.13). XDATAP will not allow you to change plot axes in the same terminal session, that is, a single running of the code. Examples 2.13a and 2.13b exhibit the XDATAP options entered by the user in order to produce the desired output from the two commands. Example 2.13c displays XDATAP's response to the commands contained in the command files, and Example 2.13d contains the actual commands for each of the files used to generate the plots. The first three plots generated using the log-log scale are displayed in Figs. 2.13a-2.13c. The last three plots generated using the linear-linear scale are displayed in Figs. 2.13d-2.13f.

Session 1

FRED U238FIL1

Create XDATAP Command File

Copy U238FIL1 Input

XDATAP

?Options

?Input log-log labelaxis

.

.

.

end

Session 2

```
FRED U238FIL2
Copy U238FIL2 Input
XDATAP
?Options
?Input lin-lin labelaxis
.
.
.
end
```

Example 2.13a. Terminal Sessions to Produce Command Files for ^{238}U Plots.

```

>datasp3
enter any options (type help for list of available options)
? loglog input
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
how many curves on the next plot? enter 1-9
enter input library for curve #1 (a8) -$ for xsdir-
enter the zaid to plot (a10)
the following mt's are available for zaid 92238.500
  1      2      101      301      18      302      4      16      17      19
 20      21      38      51      52      53      54      55      56      57
 58      59      60      61      62      63      64      65      66      67
 68      69      70      71      72      73      74      75      76      77
 91      102
how many mt's to plot for this material?
enter the 4 mt's to plot for this material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
enter emin and emax (mev) for energy range # 1
if you want to do more, enter 1; otherwise hit return
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
how many curves on the next plot? enter 1-9
enter input library for curve #1 (a8) -$ for xsdir-
enter the zaid to plot (a10)
the following mt's are available for zaid 92238.500
  1      2      101      301      18      302      4      16      17      19
 20      21      38      51      52      53      54      55      56      57
 58      59      60      61      62      63      64      65      66      67
 68      69      70      71      72      73      74      75      76      77
 91      102
enter the 1 mt's to plot for this material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
enter emin and emax (mev) for energy range # 1
if you want to do more, enter 1; otherwise hit return
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
how many curves on the next plot? enter 1-9
enter input library for curve #1 (a8) -$ for xsdir-
enter the zaid to plot (a10)
the following mt's are available for zaid 92238.500
  1      2      101      301      18      302      4      16      17      19
 20      21      38      51      52      53      54      55      56      57
 58      59      60      61      62      63      64      65      66      67
 68      69      70      71      72      73      74      75      76      77
 91      102
enter the 1 mt's to plot for this material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
enter emin and emax (mev) for energy range # 1
if you want to do more, enter 1; otherwise hit return
plot done. pages = 4. words = 35432
graphics cl = u
stop
>datasp3 ctss time 12.329 seconds
cpu= 8.930 i/o= 1.365 mem= 2.034

all done

```

Example 2.13b. Command File for ^{238}U Log-Log Plots.

Figure 2.13a. Plot File (a) for Example 2.13b.

Figure 2.13b. Plot File (b) for Example 2.13b.

Figure 2.13c. Plot File (c) for Example 2.13b.

Figure 2.13c. Plot File (c) for Example 2.13b.

```

>datap3
enter any options (type help for list of available options)
? linlin input
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
how many curves on the next plot? enter 1-9
enter input library for curve #1 (a8) -$ for xsdir-
enter the zaid to plot (a10)
the following mt's are available for zaid 92238.508
      1      2      101      301      18      302      4      16      17      19
      20      21      38      51      52      53      54      55      56      57
      58      59      60      61      62      63      64      65      66      67
      68      69      70      71      72      73      74      75      76      77
      91      102
how many mt's to plot for this material?
enter the 4 mt's to plot for this material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
enter emin and emax (mev) for energy range # 1
if you want to do more, enter 1; otherwise hit return
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
how many curves on the next plot? enter 1-9
enter input library for curve #1 (a8) -$ for xsdir-
enter the zaid to plot (a10)
the following mt's are available for zaid 92238.508
      1      2      101      381      18      302      4      16      17      19
      20      21      38      51      52      53      54      55      56      57
      58      59      60      61      62      63      64      65      66      67
      68      69      70      71      72      73      74      75      76      77
      91      102
how many mt's to plot for this material?
enter the 3 mt's to plot for this material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
enter emin and emax (mev) for energy range # 1
if you want to do more, enter 1; otherwise hit return
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
how many curves on the next plot? enter 1-9
enter input library for curve #1 (a8) -$ for xsdir-
enter the zaid to plot (a10)
the following mt's are available for 92238.50c
      456      452
how many mt's to plot for this material?
enter the 2 mt's to plot for this material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
enter emin and emax (mev) for energy range # 1
if you want to do more, enter 1; otherwise hit return
plot done. pages = 4. words = 7082
graphics cl = u
stop
>datap3 ctss time 7.091 seconds
cpu= 3.079 i/o= 2.445 mem= 1.567
all done

```

Example 2.13c. User Command File for ^{238}U Lin-Lin Plots.

Figure 2.13d. Plot File (d) for Example 2.13c.

Figure 2.13e. Plot File (e) for Example 2.13c.

Figure 2.13f. Plot File (f) for Example 2.13c.

and 2.14b are plots of the MCNP and Karzanovskii data, respectively, which are contained in the file leadspec 1. Figure 2.14c is a comparison of the MCNP and Karzanovskii data. Figure 2.14d is a plot of the MCNP data with relative errors included. The data used to generate this plot are stored in the file leadspec.

```

fred input
input 70 lines
*tl,70
1 0
2 2
3 1
4 leadspec1
5 4
6 1001
7 3
8 1 2 101
9 1
10 #
11 3
12 0
13 mcnp bathtub curve
14 ebar
15 deltae/ebars
16 blue
17 white
18 magenta
19 1
20 0
21 2
22 1
23 leadspec1
24 4
25 1002
26 3
27 1 2 101
28 2
29 #
30 3
31 0
32 karzanovskii result
33 ebar
34 deltae/ebars
35 1
36 0
37 2
38 2
39 leadspec1
40 4
41 1003
42 3
43 1 2 101
44 2
45 1 2
46 #
47 3
48 0
49 3
50 0
51 comparison of mcnp and karzanovskii results
52 ebar
53 deltae/ebars
54 green
55 1

56 0
57 2
58 1
59 leadspec
60 4
61 3007
62 1
63 1
64 #
65 3
66 3
67 mcnp bathtub curve II
68 ebar
69 deltae/ebars
70 0
*end

all done

```

Example 2.14a. User Command File for the Generation of Color Plots.


```

>xdatap3
enter any options (type help for list of available options)
? color nolabel labelaxis esp errorbar input
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
how many curves on the next plot? enter 1-9
enter input library for curve #1 (a8) -$ for xsdir-
is ledspec1 a standard, ace, endf, dosimetry, user-provided,
endf, random multigroup, or alpine library? (0=standard, 1=ace,
2=endf, 3=dos., 4=user, 5=endf, 6=random mg, 7=alpine)
enter the zaid for this isotope
enter the number of mt's to read in from ledspec1
enter the 3 mt's to read
enter the 1 mt's to plot for this material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
enter 0 if the data on ledspec1 are pointwise
      1 if the data are histograms
      2 if the data are points only
      3 if the data are points, but you want them connected
enter 0 if no errorbars on ledspec1
      1 if errorbars are given fractionally
      2 if errorbars are given absolutely
      3 if errorbars are given as percents
enter the label for the plot
enter the label for the x-axis
enter the label for the y-axis
enter the background color (a8)
enter the color for the axis system (a8)
enter the color for curve#1 (a8)
if you want to do more, enter 1; otherwise hit return
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1,or 2 for the mode you desire.
how many curves on the next plot? enter 1-9
enter input library for curve #1 (a8) -$ for xsdir-
is ledspec1 a standard, ace, endf, dosimetry, user-provided,
endf, random multigroup, or alpine library? (0=standard, 1=ace,
2=endf, 3=dos., 4=user, 5=endf, 6=random mg, 7=alpine)
enter the zaid for this isotope
enter the number of mt's to read in from ledspec1
enter the 3 mt's to read
enter the 1 mt's to plot for this material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
enter 0 if the data on ledspec1 are pointwise
      1 if the data are histograms
      2 if the data are points only
      3 if the data are points, but you want them connected
enter 0 if no errorbars on ledspec1
      1 if errorbars are given fractionally
      2 if errorbars are given absolutely
      3 if errorbars are given as percents
enter the label for the plot
enter the label for the x-axis
enter the label for the y-axis
if you want to do more, enter 1; otherwise hit return
enter 0 to plot neutron cross sections
      3 to compare
      4 to plot nubar
      5 to plot photon cross sections
      6 to plot photon-production cross sections

```

Example 2.14b. XDATAP Response to Command File Instructions.

```

xdatap3
enter any options (type help for list of available options)
? color nolabel labelaxis esp errorbar input
enter 0 to plot neutron cross sections
    3 to compare
    4 to plot nubar
    5 to plot photon cross sections
    6 to plot photon-production cross sections
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1, or 2 for the mode you desire.
how many curves on the next plot? enter 1-9
enter input library for curve #1 (a8) -$ for xsdir-
is ledspec1 a standard, ace, endf, dosimetry, user-provided,
endl, random multigroup, or alpine library? (0=standard, 1=ace,
2=endf, 3=dos., 4=user, 5=endl, 6=random mg, 7=alpine)
enter the zaid for this isotope
enter the number of mt's to read in from ledspec1
enter the 3 mt's to read
enter the 1 mt's to plot for this material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
enter 0 if the data on ledspec1 are pointwise
    1 if the data are histograms
    2 if the data are points only
    3 if the data are points, but you want them connected
enter 0 if no errorbars on ledspec1
    1 if errorbars are given fractionally
    2 if errorbars are given absolutely
    3 if errorbars are given as percents
enter the label for the plot
enter the label for the x-axis
enter the label for the y-axis
enter the background color (a8)
enter the color for the axis system (a8)
enter the color for curve#1 (a8)
if you want to do more, enter 1; otherwise hit return
enter 0 to plot neutron cross sections
    3 to compare
    4 to plot nubar
    5 to plot photon cross sections
    6 to plot photon-production cross sections
mode 0 plots all mt's for a particular
isotope(one per page). mode 1 plots a subset of all mt's
for a particular isotope(one per page). mode 2
plots more than one mt or isotope per page.
enter 0,1, or 2 for the mode you desire.
how many curves on the next plot? enter 1-9
enter input library for curve #1 (a8) -$ for xsdir-
is ledspec1 a standard, ace, endf, dosimetry, user-provided,
endl, random multigroup, or alpine library? (0=standard, 1=ace,
2=endf, 3=dos., 4=user, 5=endl, 6=random mg, 7=alpine)
enter the zaid for this isotope
enter the number of mt's to read in from ledspec1
enter the 3 mt's to read
enter the 1 mt's to plot for this material
how many energy ranges do you want plotted? (1-9)
or enter * for 1 plot of entire energy range
enter 0 if the data on ledspec1 are pointwise
    1 if the data are histograms
    2 if the data are points only
    3 if the data are points, but you want them connected
enter 0 if no errorbars on ledspec1
    1 if errorbars are given fractionally
    2 if errorbars are given absolutely
    3 if errorbars are given as percents
enter the label for the plot
enter the label for the x-axis
enter the label for the y-axis
if you want to do more, enter 1; otherwise hit return
enter 0 to plot neutron cross sections
    3 to compare
    4 to plot nubar
    5 to plot photon cross sections
    6 to plot photon-production cross sections

```

Example 2.14b. XDATAP Response to Command File Instructions (cont).

MCNP BATHTUB CURVE

Figure 2.14a. Plot File (a) for Example 2.14a.

KARZANOVSKII RESULT

Figure 2.14b. Plot File (b) from Example 2.14a.

COMPARISON OF MCNP AND KARZANOVSKII RESULTS

Figure 2.14c. Plot File (c) from Example 2.14a.

MCNP BATHTUB CURVE II

Figure 2.14d. Plot File (d) from Example 2.14a.

III. USING XDATAP WITH CGS

This chapter includes the computers, compilers, and operating systems used for XDATAP support. Other documents that one might find useful are also listed. XDATAP programming details for the DISSPLA Subroutine Library are also described. For detailed information on programming for the DISSPLA Subroutine Library, obtain documents (GR802) and (GR800) from the Computer Information Center (CIC).

3.1 Other Useful Documents

Other graphics documents that complement XDATAP are described below. You can request these documents from the CIC, (505)667-6992 (FTS 843-6992).

- DISSPLA User's Manual, from ISSCO (current with Version 9.2).
- DISSPLA Pocket Guide, from ISSCO (current with Version 9.2).
- DISSPLA Track, Traps, and Tips, from ISSCO.
- PIM-8, Los Alamos Integrated Graphics System User's Guide describes the basic graphics system concepts such as immediate and deferred graphics, metafiles, and postprocessing. You must be familiar with these concepts to generate graphics using the software and hardware in the Network. This document will help you understand how XDATAP fits in with the other graphics software and hardware in the Graphics System.
- CGS Device Control User Manual (GR800). Describes the Common Graphics System (CGS) subroutines used to generate graphics on graphics terminals and as Metafiles. These subroutines are common to all graphics libraries.
- CGS Graphics User Manual (GR802). Describes the CGS subroutines that provide the graphics primitives (GPAGE, GMOV2, GLINA2, GRGB, GTEXT, (...)) for DISSPLA.
- Metafile Postprocessors (GR860 Series). Describes the options for translating CGS Metafiles for output on supported graphics devices at Los Alamos.
- CTSS Preprimer
- CFS Printer
- FRED Preprimer
- FILES for CTSS
- DESTROY for CTSS

3.2 Usage Notes

Throughout this manual, reference is made to the FRED text editor. However, you may use any editor you wish.

The examples included in this manual have all been generated on a CRAY computer using the CTSS operating system.

XDATAP commands are printed in lower case characters. Commands are delimited by blanks or commas.

XDATAP may be run interactively or from a user command file. The prompt for command entry is always a question mark.

3.3 Preliminaries—Before You Can Use XDATAP

Once you have the XDATAP utility in your local file space you may proceed forthwith to generate graphics output, provided that you are operating in the interactive mode. However, if you wish to use an XDATAP command file to generate graphics output, you must first become familiar with a text editor and with the Common File System.

3.4 Using a Text Editor

A text editor is a computer program that permits you to create a new text file, modify an existing file, add lines of text, delete lines of text, list lines of text, etc.

Use the text editor that you are most familiar with. If you are not familiar with a text editor, we suggest that you obtain a copy of the FRED Preprimer and the FRED Editor Quick Reference from the Computing Information Center.

The following is a summary of basic FRED text editing commands. There are more editing commands than are listed here; however, creating and editing XDATAP graphics files requires only a few of the less complex commands.

al	add text after line
ap	insert text after pattern
bl	add text before line
bp	insert text before pattern
dl	delete line
dp	delete pattern
end	terminate the editing session
o	open an existing local file
rl	replace line
rp	replace pattern
t*	type the whole file
tn	type the next line
tm.n	type a range of lines
w	update the file

On CTSS, the prompt for the FRED editor is an asterisk (*). The prompt for input mode in the FRED editor is an ampersand (&). To exit from input mode, type a period (.). To erase an entire line, use <CTRL-Y>.

The following example shows how to create a simple file on CTSS using FRED:

```
fred usrfile
*bll
& This is my user input file.
& I want to plot cross-section data
& This is the last line of my file.
&.
*w
usrfile 3 lines
*tl,3
1 This is my user input file
2 I want to plot cross-section data
3 This is the last line of my file.
*end
```

For complete information, be sure to read the FRED Preprimer.

3.5 What is CFS?

The Common File System (CFS) is a large, centralized file storage space for the computers at Los Alamos.

The CFS is accessed with a utility called MASS. MASS allows you to create new root directories, save files, retrieve files, replace files, delete files, list directories, and check CFS status. A root directory is a directory that CFS uses to identify you as the owner of the files you will save under it.

A summary of basic CFS commands is given below. The prompt for the MASS utility is a question mark (?). You may facilitate your use of MASS by obtaining a MASS Reference Card from the Computing Information Center.

MASS	
? SAVE filename	Save your file in CFS.
? GET filename	Retrieve your file from CFS.
? REPLACE filename	Replace your file.
? DELETE filename	Delete your file from CFS.
? LIST	Type a list of files you have stored on CFS.
?STATUS	Check to see if CFS is running at the present time.
? END	Exit from the MASS utility.

Note: You must have a root directory in order to use CFS.

3.6 File Manipulation

Files that have been created with a text editor, retrieved from MASS storage, or generated during the execution of a program, are all kept in your local file space. It is from this space that files are run, saved in MASS, and edited.

To see what files are currently in your local file space on CTSS, type:
FILES

To destroy files in your local file space on CTSS, type:
DESTROY file1 file2 file3, etc.

3.7 Graphics Initialization and Termination

Programs such as XDATAP which use DISSPLA subroutines to create a CGS Metafile must use CGS Device Control (GR800) to initialize graphics, terminate graphics, and control graphics devices. See Fig. 3.1 for details.

Figure 3.1. XDATAP uses CGS for device control.

XDATAP has the following basic structure:

◦	
◦	
◦	
graphics initialization	CALL GPLBEG
XDATAP initialization	CALL LIBDISP
all XDATAP calls	CALL LIBDISP
graphics termination	CALL GPLEND
◦	
◦	
◦	

3.7.1 Initializing and Terminating Graphics

GSTART initializes graphics. It must be the first graphics call made, except for GOLAY, and cannot be called again until GDONE is called.

FORM:

```
CALL GSTART
CALL GPLBEG
CALL GPLEND
```

3.7.1.1 CGS Metafile to View Surface Assignment and Initialization.

Usage:

GPLBEG and GPLEND are used with GSTART in place of GPLOT when additional capabilities are required which are not available using GPLOT. GPLBEG allows specification of a view surface control block and an associated I/O buffer. This allows for multiple view surfaces (files), for example, two different files could be generated with selected graphics output on each. After GPLBEG is called, various subroutines can be called to override default settings. GPLEND completes initialization for the CGS Metafile view surface. The view surface is now selected and ready for graphics input/output. The defaults established by GPLBEG and the subroutines to override these defaults are listed below.

<u>Option</u>	<u>Default</u>	<u>Subroutines to Override</u>
File Name	4HPLOT	GFNAME
Family file size	Approx. 250000 words	GFSIZE
Classification	Sign-on classification	GCLASS
Title	Blank	

FORM:

```
CALL GPLBEG (IVSCB,IBUFF,ISIZE)
CALL GPLEND (IVSCB)
```

ARGUMENTS FOR GPLBEG AND GPLEND:

IVSCB= View surface control block. This is an array of 300 words used to identify the logical view surface and to store I/O and status information. This array must be preserved until terminated by GDONE or GTERM.

ARGUMENTS FOR GPLBEG:

IBUFF= I/O buffer. This is an integer array of at least 1024 words.

ISIZE= IBUFF size in words. The minimum size of IBUFF is 1024 words. A longer buffer will generally improve efficiency when writing to the file.

EXAMPLE:

The following subroutine initializes the CGS Metafile and is an example of how to use GPLBEG and GPLEND.

SUBROUTINE SETUP

```
COMMON/BUF/BUF1(1028,BUF2(1028),BUF3(1028),BUF4(1028),BUF5(1028)
COMMON/LCM1/IBUFF1(2048)
COMMON/BLK7/IVSCB1(300)
CALL GSTART
CALL GPLBEG(IVSCB1,IBUFF1,2048)
CALL GCLASS(IVSCB1,1HU)
CALL GFNAME(IVSCB1,4HPLOT)
CALL GPLEND(IVSCB1)
CALL LIBDISP
CALL SETDEV(98,99)
RETURN
END
```

3.8 Initializing XDATAP (Call to LIBDISP)

Immediately subsequent to graphics initialization, there must be a call to LIBDISP, which establishes the CGS graphics environment for XDATAP. After the call to LIBDISP, the DISSPLA subroutines can be called.

If LIBDISP is not called, the following error message will be issued and no graphics will be generated.

error: no plotter nomination routine has been called.

XDATAP must stop since it has no means of output.

3.9 Terminating Graphics (Call to GDONE)

After all XDATAP subroutines are called GDONE must be called to terminate graphics. If it is not called, some graphics output may be lost because the buffers are not flushed and output will not be released as requested.

FORM: CALL GDONE

ARGUMENTS: NONE

3.10 Postprocessing Metafiles

The output of XDATAP is a CGS-generated Metafile called PLOT (a local disk file). Consequently, a postprocessor must be used to direct the graphics contained in plot to the desired graphics devices. The processors have already been mentioned and are documented in the GR860-series writeups.

As an example, to use PFILM to send a Metafile to PAGES (Print and Graphics Express Station) for film output, type:

PFILM FORMAT = format

Where format is 105 (for microfiche), 35 for (black-and-white) standard size 35-mm images, 35S (for black-and-white slides), 35C (for color standard size 35-mm images), 35CS (for color slides), or 16 (for color movies).

3.11 Classified Graphics

All of the cross-section data used by XDATAP to generate plots is unclassified; hence, XDATAP does not generate classified graphics as a general rule. However, if a user avails himself of XDATAP to plot classified graphics using a user-supplied data file, then the responsibility of properly identifying (labeling) the classification of the graphics output rests with the user.

3.12 Using Color With XDATAP

XDATAP does not specify colors in terms of a spectrum, but uses user-level color calls to select one of eight possible colors by name. The subroutine SETCLR (LCOLOR) is useful to set colors by keyword and to send color requests through DISSPLA to the respective device.

LCOLOR is the Fortran Hollerith name of a color taken from the table below. This table also gives the corresponding value of hue, saturation, and intensity, which are converted to red, green, and blue intensities and sent to the device.

<u>LCOLOR</u>	<u>HUE</u>	<u>SAT</u>	<u>AINT</u>
5HBLACK	0.0	1.	0.
7HMAGENTA	0.5	1.	1.
3HRED	1.0	1.	1.
6HYELLOW	1.5	1.	1.
5HGREEN	2.0	1.	1.
4HCYAN	2.5	1.	1.
4HBLUE	3.0	1.	1.
5HWHITE	4.0	0.	1.

Although the subroutine SETCLR called by XDATAP gives corresponding values of hue, saturation, and intensity in addition to the basic colors (LCOLOR), XDATAP uses only the basic colors.

REFERENCES

1. "MCNP-A General Monte Carlo Code for Neutron and Photon Transport, Version 3A," Los Alamos National Laboratory manual LA-7396-M, Rev. 2 (September 1986).
2. R. C. Little and R. E. Seamon, "New MENDF5 and MENDF5G," Los Alamos National Laboratory technical memorandum X-6:RCL-86-412 (September 1986).

APPENDIX A

TABLE OF REACTION TYPES

MT	Microscopic Cross-Section Reaction	
1	Total	
2	Elastic scattering	
4	Total inelastic	
16	(n,2n)	
17	(n,3n)	
18	Total fission	
19	(n,f) (first chance fission)	
20	(n,nf) (second chance fission)	
21	(n,2nf) (third chance fission)	
22	(n,n/a)	
38	(n,3nf) (fourth chance fission)	
51	(n,n') to first excited state	
52	(n,n') to second excited state	
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.	.	
.	.	
90	(n,n') to 40 th excited state	
91	(n,n') to continuum	
101	Absorption	
102	(n, γ) radiative capture	
103	(n,p)	
104	(n,d)	
105	(n,t)	
106	(n, ³ He)	
107	(n, α)	
203	Total proton production	germane to ENDF/B-V only
204	Total deuterium production	germane to ENDF/B-V only
205	Total tritium production	germane to ENDF/V-V only
206	Total ³ He production	germane to ENDF/B-V only
207	Total ⁴ He production	germane to ENDF/B-V only
301	Heating data	
302	Gamma production	
452	Total nubar	
456	Prompt nubar	
501	Total photon interaction	
502	Photon coherent scattering	
504	Photon incoherent scattering	
516	Pair production	
602	Photoelectric	