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VISUAL:
A SOFTWARE PACKAGE FOR PLOTTING DATA IN THE RADHEAT-V4 CODE SYSTEM

March 1984

Toshihiko SASAKI* and Naoki YAMANO

日 本 原 子 力 研 究 所
Japan Atomic Energy Research Institute

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VISUAL:
A Software Package for Plotting Data in the RADHEAT-V4 Code System.

Toshihiko SASAKI* and Naoki YAMANO
Department of Nuclear Safety Evaluation,
Tokai Research Establishment, JAERI

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In this report, the features, the capabilities and the constitution of the VISUAL Software Package are presented. The one of the features is that the VISUAL provides a versatile graphic display tool to plot a wide variety of data of the RADHEAT-V4 code system. And the other is to enable a user to handle easily the executing data in the Conversational Management Mode named "CMM". The program adopts the adjustable dimension system to increase its flexibility. VISUAL generates two-dimensional drawing, contour line map and three dimensional drawing on TSS (Time Sharing System) digital graphic equipment , NLP (Nihongo Laser Printer) or COM(Computer Output Microfilm). It is easily possible to display the calculated and experimental data in a DATA-POOL by using these functions. The purpose of this report is to describe sufficient information to enable a user to use VISUAL profitabily.

Keywords: Graph, Two-Dimensional Drawing, Contour Line Map, Three-Dimensional Drawing, DATA-POOL, RADHEAT-V4, Computer Code, VISUAL

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* On leave from I.S.L. Ltd.

RADHEAT－V4コードシステムの図形表示ソフトウエアーパッケージ：VISUAL

日本原子力研究所東海研究所安全解析部
佐々木敏彦*・山野　直樹

（1984年2月16日受理）

本報告は，ソフトウエアーパッケージVISUALの特徴，機能及び構成について述べたものである。その特徴の一つは，RADHEAT－V4コードシステムの多種・大量のデータを多様な形式で図形表示できることであり，さらに，ユーザーが実行データを会話処理において容易に取扱えることにある。また，本プログラムは機能の柔軟性を考慮して，可変ディメンション化されている。

VISUALは，2次元図，等高線図及び3次元図をTSS端末，NLPあるいはCOMに作図することができる。VISUALの機能を利用することにより，データプールに作成されている計算データ及び実験データを容易に図形化することが可能である。

本報告では，ユーザーがVISUALを有効に利用できるよう多くの情報を記述している。

* 出向職員；㈱アイ・エス・エル

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1. Introduction

A modular code system RADHEAT-V4[1] has been developed for performing precisely neutron and photon transport calculations and shielding safety analyses. A great amount of various data has been produced by the RADHEAT-V4 code system and stored in a direct access data-base named DATA-POOL[2]. The data contained in a DATA-POOL consist of the cross sections (the ultra - fine group cross sections, the fine group cross sections, the self-shielding factors, the secondary gamma-ray production cross sections, the effective macroscopic cross sections and the few-group cross sections), the one- and two dimensional neutron and gamma-ray fluxes and the response data (the detector response functions and the dose rate conversion factors).

It is not an easy task for users to analyze and evaluate the huge data mentioned above, so that the computer code VISUAL has been developed to plot the data on display system using TSS terminal of TEKTRONIX-T4014 and to evaluate radiation shielding safety analyses. The hierarchy of VISUAL in the RADHEAT-V4 code system is shown in Fig. 1.1.

The features of VISUAL are; (1) it is possible to plot a graph concisely and promptly by using Conversational Management MODE named "CMM" on TSS (Time Sharing System), (2) it is possible to plot easily a graph of the two-dimension (MODE-1), contour line map (MODE-2) and three-dimension (MODE-3), (3) it is possible to display experimental data with their error bars and calculated values on the same graph and (4) this code adopts the programming with adjustable dimension system to make a maximum use of the available memory. The general flow diagram of VISUAL is shown in Fig. 1.2.

The VISUAL code consists of the three major parts; i.e., MODE1, MODE-2 and MODE-3. The data for plotting are read and updated in the Conversatinal Management Mode (CMM). The CMM controls the various functions in the VISUAL code. The various commands are defined in the program and the process flow can be changed by the user. The title, the caption and the comment of the data are processed by the Text Management Mode named "TMM". In the CMM, the various plotting variables defined in the program can be set and updated by the following manner;e.g.,

XMIN = 1.0-5; YMAX = 6.0E5; ECODE = 906;

In this sample, XMIN, YMAX and ECODE show the names of the variables defined in the program and 1.0-5 means the value of 1.0×10^{-5}. The semicolon means a period of the data. The order of the variables can be given arbitrarily by the user. The documents of the title, the caption and the comment can be set by the following manner;e.g.,

Variable Name = Document;

The special characters and symbols are capable of plotting in the document.

The details of the functions for CMM, MODE-1 MODE-2, MODE-3 and TMM are described in Chapt. 2. The executing variables for the common data, MODE-1, MODE-2 and MODE-3 are explained in Chapt. 3. The Job control languages of CMM and the batch job are described in Chapt. 4. In Chapt. 5, samples of the input and the output are provided for MODE-1, MODE-2 and MODE-3. In Appendix A, the summary of an application for plotting DDX data is described. The constitution of VISUAL and the calculation for the maximum use of the available memory are noted in Appendices B and C respectively. The subroutine information of VISUAL is described in Appendix D, and in Appendix E, the structure of DATA-POOL and the record format are shown. Appendix F explains the record format of experimental data file. The computer code abstract of VISUAL is given in Appendix G.

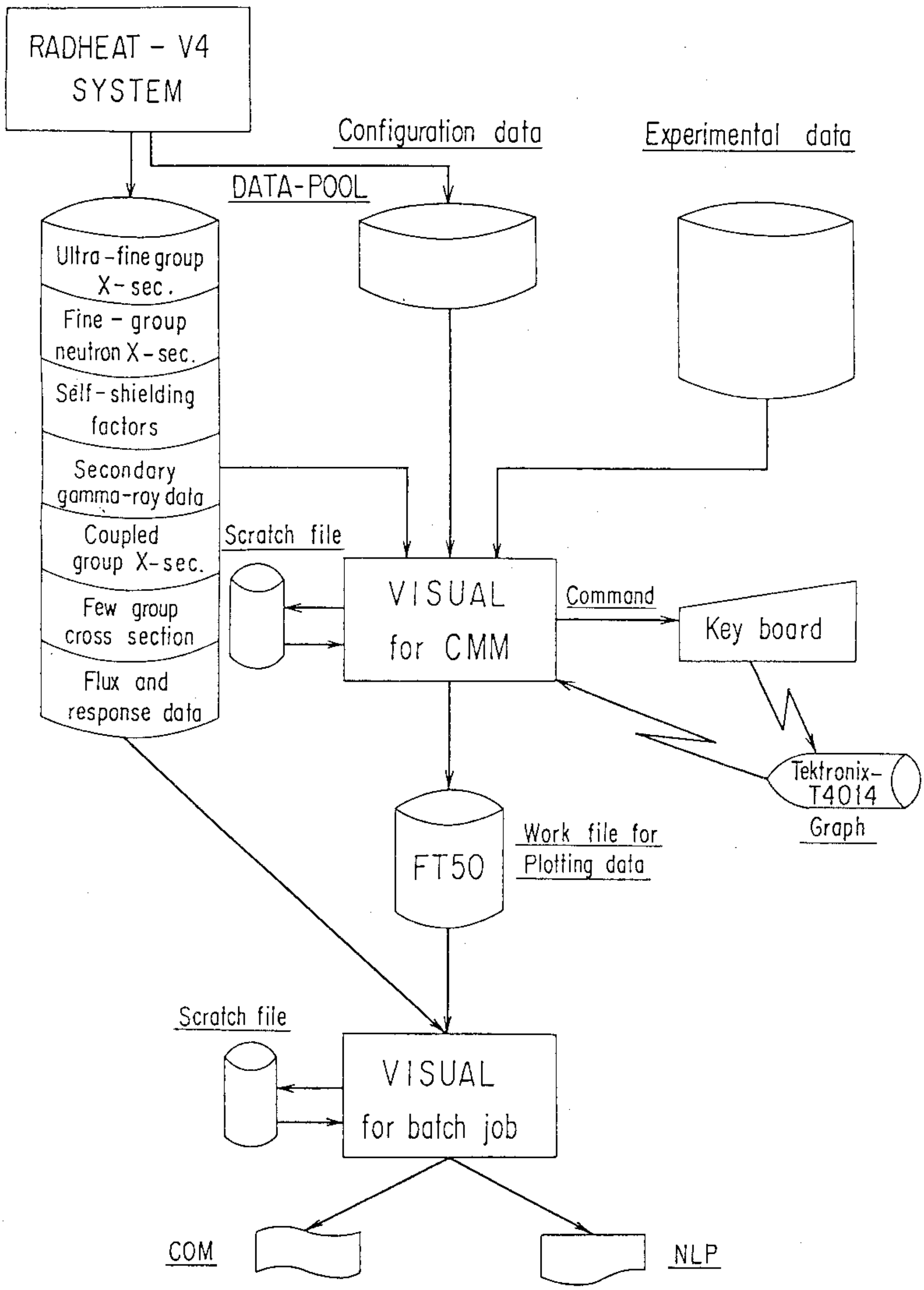


Fig. 1.1 Hierarchy of VISUAL

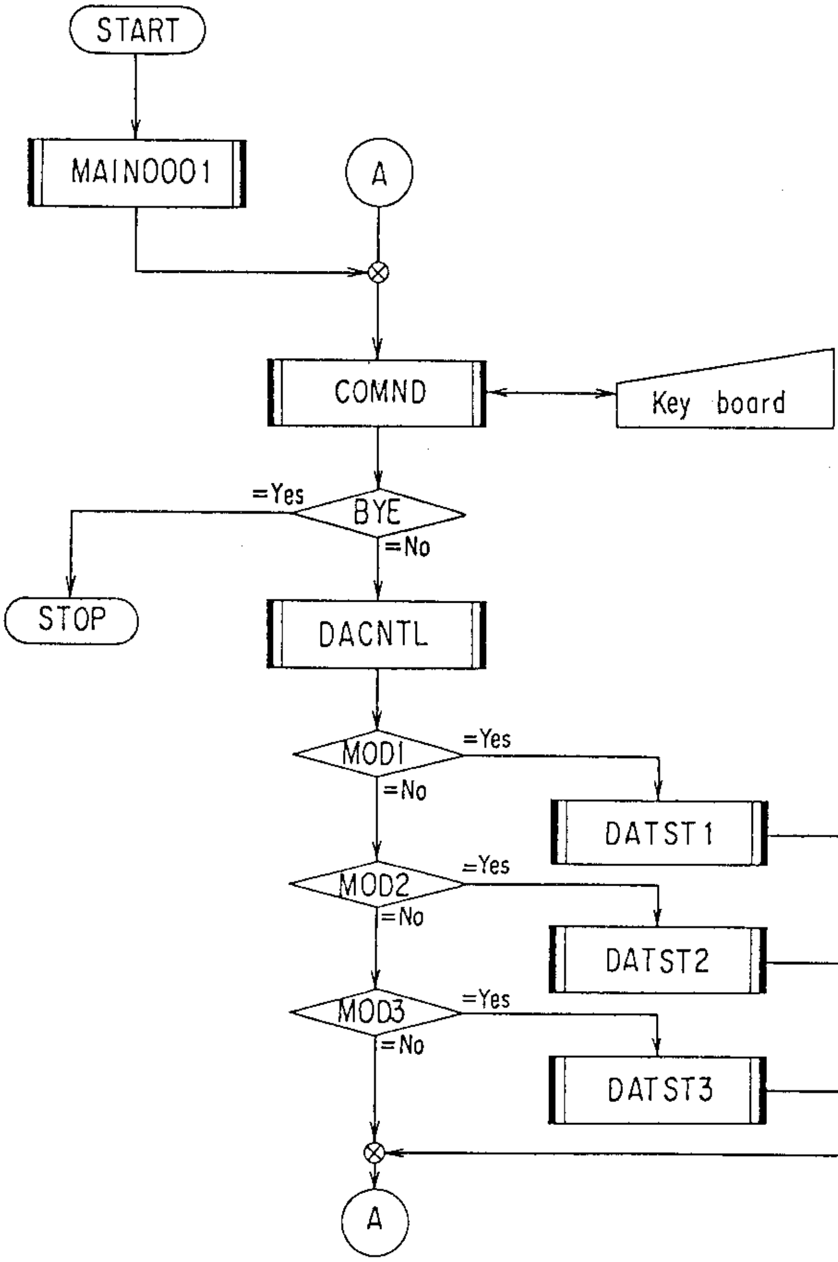


Fig. 1.2 General flow diagram of VISUAL

2. Function of VISUAL

2.1 Conversational Management Mode (CMM)

The Conversational Management Mode (CMM) controls the process flow of VISUAL by using various control commands of 28 types. All of the executing data can be updated with a simple procedure by using "UPDATE*x*" command on TSS terminal. The default values of the each mode can be set by using "DEFAULT*x*" command. The executing data lists of the each mode can be displayed by "LIST*x*" command. The functions of all variables can be shown by using "TABLE*x*" command. If user types the command "END", the system will pass through the mode, and it easily enables the user to choose the other mode. If user types the command "TIME", the used CPU time will be displayed on TSS terminal. If user types the command "HELP", the functions of all commands are displayed on TSS terminal. If user types the command "NLPW", after plotting a graph on TSS terminal, all of the executing data are written in a sequential file for NLP in succession. The system terminates soon after the command "BYE".

The flow diagram of CMM is shown in Fig. 2.1.1 and the functions of the commands are described below.

(a) Command to enter into the MODE-*x*

MOD1 —— Entry command for MODE-1.
MOD2 —— Entry command for MODE-2.
MOD3 —— Entry command for MODE-3.
END —— Terminate to execute the MODE.

(b) Command to set the default values

DEFAULTC —— Set the default values for the common variables.
DEFAULT1 —— Set the default values for MODE-1.
DEFAULT2 —— Set the default values for MODE-2.
DEFAULT3 —— Set the default values for MODE-3.
(see Chapt. 3 for the default values)

(c) Command to display the executing variables

LISTC —— Display the executing common variables.
LIST1 —— Display the executing variables for MODE-1.
LIST2 —— Display the executing variables for MODE-2.

LIST3 —— Display the executing variables for MODE-3.
(Sample outputs are shown in Tables 2.1.1, 2.1.2, 2.1.3 and 2.1.4)

(d) Command to describe the functions of the executing variables

TABLEC —— Describe the functions of the common variables.

TABLE1 —— Describe the functions of the MODE-1 variables.

TABLE2 —— Describe the functions of the MODE-2 variables.

TABLE3 —— Describe the functions of the MODE-3 variables.
(Sample outputs are shown in Tables 2.1.5, 2.1.6, 2.1.7 and 2.1.8)

(e) Command to update the executing variables

UPDATEC —— Update the executing common variables.

UPDATE1 —— Update the executing variables for MODE-1.

UPDATE2 —— Update the executing variables for MODE-2.

UPDATE3 —— Update the executing variables for MODE-3.

ENDU —— Terminate to update the executing variables.
This command must be used after UPDATEC, UPDATE1, UPDATE2 and UPDATE3 commands.

(f) Command to execute plotting

RUN1 —— Execute MODE-1 plot.

RUN2 —— Execute MODE-2 plot.

RUN3 —— Execute MODE-3 plot.

(g)

HELP —— Display the functions of all commands.
(Sample output is shown in Table 2.1.9)

(h)

TIME —— Show the used CPU time.

(i)

NLPW —— Write the executing data in the sequential file on logical unit FT50F001 for plotting with NLP.

(j)

BYE —— Terminate to execute VISUAL.

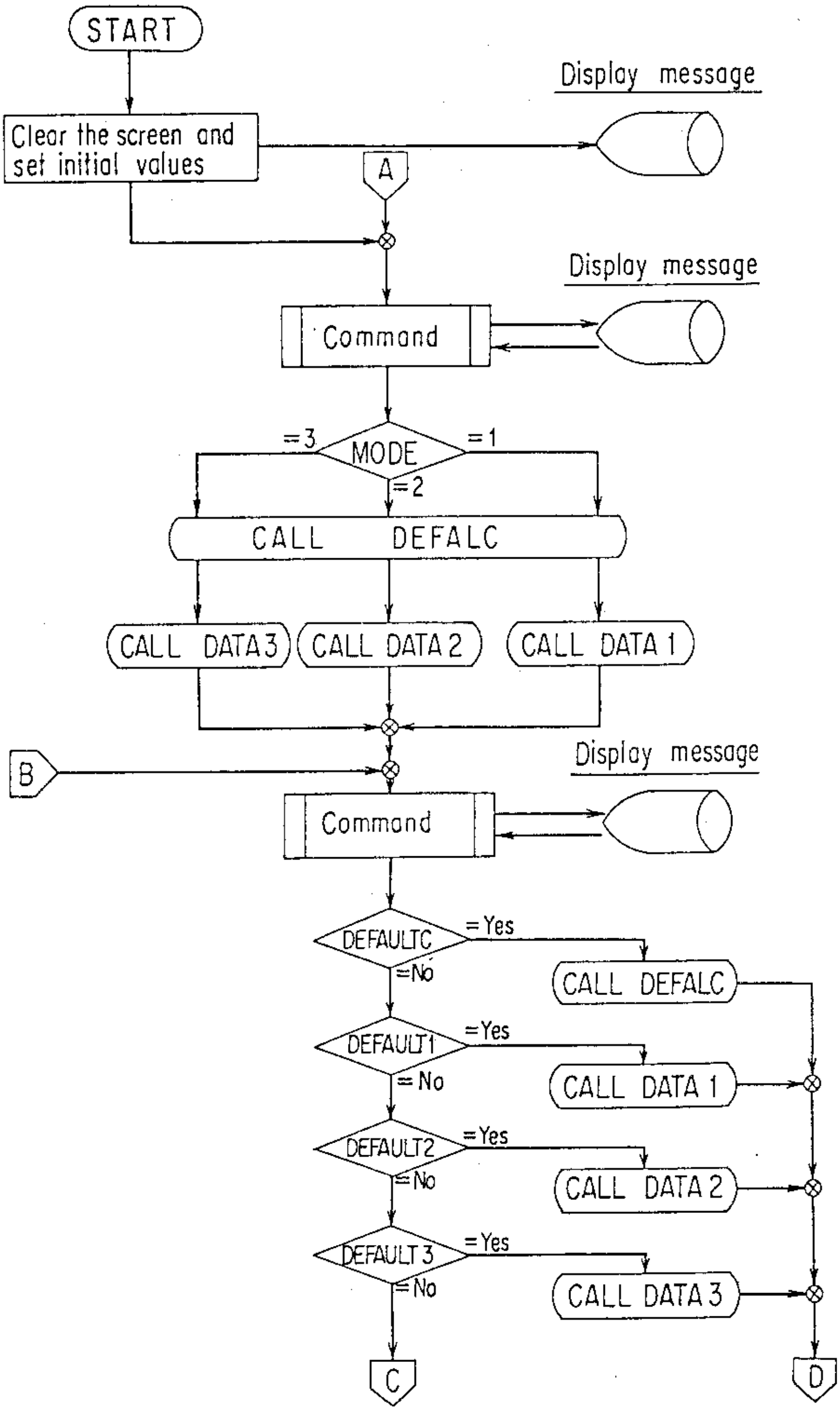
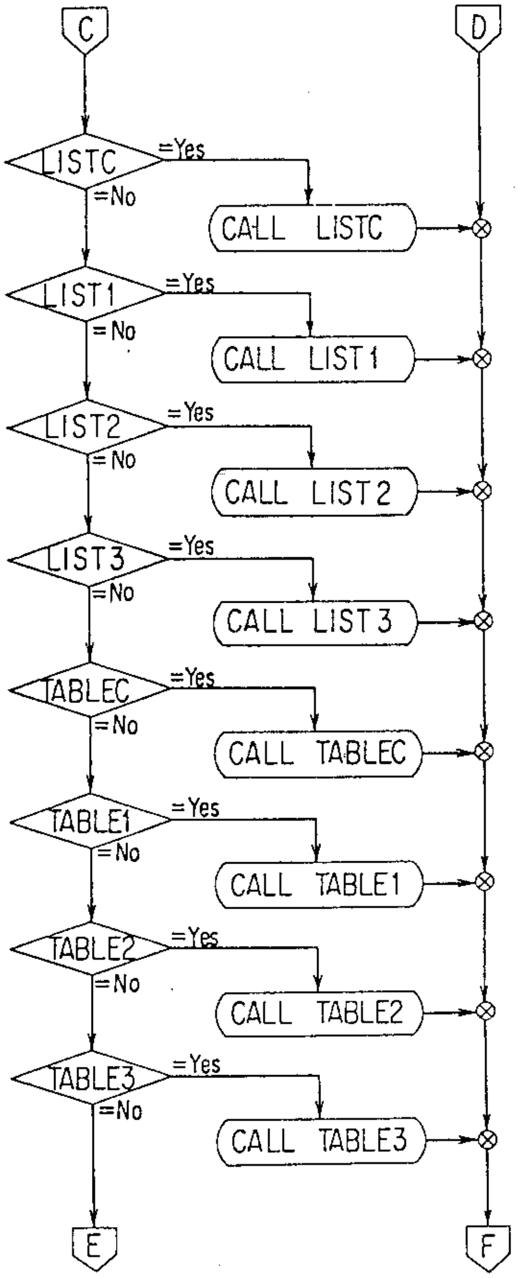
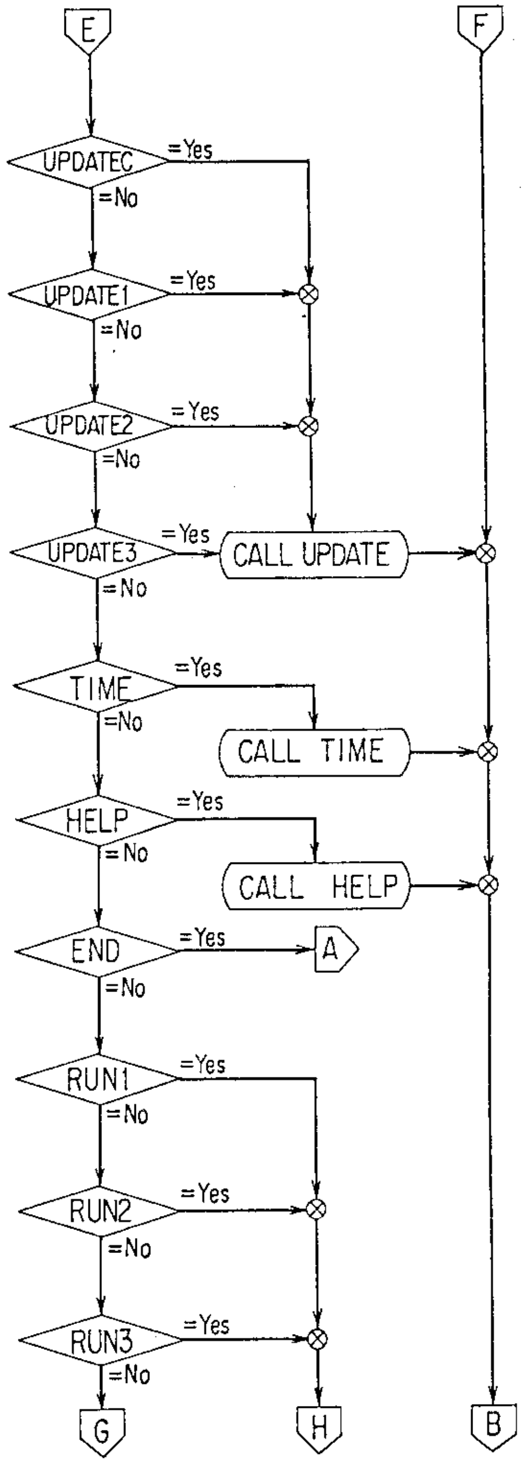


Fig. 2.1.1 Flow diagram of CMM

CMM (Cont.)


C
D
LISTC
=Yes
=No
CALL LISTC
LIST1
=Yes
=No
CALL LIST1
LIST2
=Yes
=No
CALL LIST2
LIST3
=Yes
=No
CALL LIST3
TABLEC
=Yes
=No
CALL TABLEC
TABLE1
=Yes
=No
CALL TABLE1
TABLE2
=Yes
=No
CALL TABLE2
TABLE3
=Yes
=No
CALL TABLE3
E
F

CMM (Cont.)


E
F
UPDATEC
=Yes
=No
UPDATE1
=Yes
=No
UPDATE2
=Yes
=No
UPDATE3
=Yes
=No
CALL UPDATE
TIME
=Yes
=No
CALL TIME
HELP
=Yes
=No
CALL HELP
END
=Yes
=No
A
RUN1
=Yes
=No
RUN2
=Yes
=No
RUN3
=Yes
=No
G
H
B

CMM (Cont.)

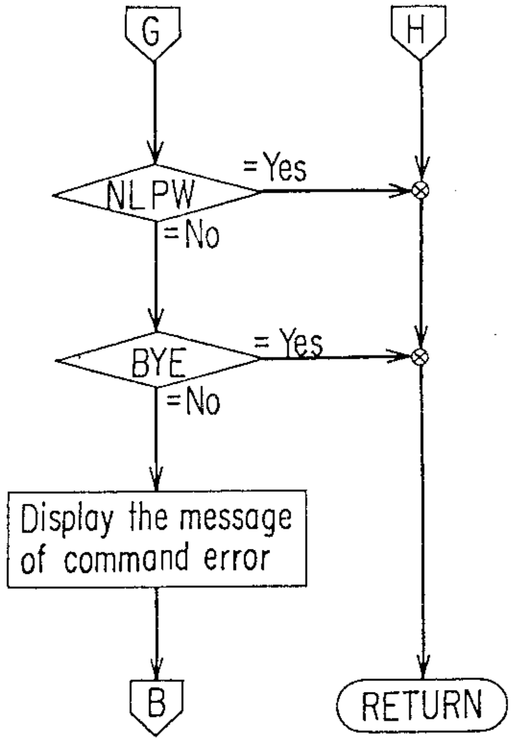

G
H
NLPW
=Yes
=No
BYE
= Yes
=No
Display the message of command error
B
RETURN

Table 2.1.1 Display of the executing values by LISTC

```
============================================================

>TITLE  =
        : MAIN TITLE OF THE GRAPH
>XTITL  =
        : X-AXIS CAPTION
>YTITL  =
        : Y-AXIS CAPTION
>ZTITL  =
        : Z-AXIS CAPTION
        : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
        : FILE NAME OF THE NUMAL DATA POOL
        : NODE NAME OF THE CALCULATION DATA
        : CODE NUMBER OF THE PLOTTING DATA
>XW     =220.00
        : X-AXIS LENGTH(MM)
>YW     =190.00
        : Y-AXIS LENGTH(MM)

============================================================
```

Table 2.1.2 Display of the executing values by LIST1

```
============================================================

>NPL     =  1       : NUMBER OF PLOTTING LINE IN A GRAPH
>TRANS   = A        : TRANSFORM TYPE OF THE PLOTTING DATA
>ALPHA   =    1.00  : CONSTANT NUMBER TO TRANSFORM
>OPERA   = /        : TRANSFORM FORMAT OF THE DATA
>COMP    =  1       : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
>COMT    =
         : COMMENT FOR ALL DATA
         : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------

>TPO     = L : GRAPHIC FORM
>PAT     = S : GRAPHIC PATTERN
>SYMBOL  =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA
>ESIZE   =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
>SSIZE   =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
>XN      =        0.0 : INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
>YN      =        0.0 : INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
>GRID    = 0        : OPTION FOR GRID LINE
>XSCALE  = 0        : SCALING OPTION FOR X-AXIS COORDINATE
>YSCALE  = 0        : SCALING OPTION FOR Y-AXIS COORDINATE
>SCALE   = 0        : METHOD OF SCALING TYPE
>XMIN    =    0.0          : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
>XMAX    =    0.0          : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
>YMIN    =    0.0          : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
>YMAX    =    0.0          : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
>YDMIN   =    0.0          : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
>YDMAX   =    0.0          : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
============================================================
```

Table 2.1.3 Display of the executing values of LIST2

```
=================================================================

>NPL     =  0      : NUMBER OF PLOTTING DATA IN A GRAPH
>IOP     =  1      : OPTION OF THE SCREEN SIZE
>XSC     = 297.00  : HORIZONTAL LENGTH OF THE SCREEN ( MM )
>YSC     = 210.00  : VERTICAL LENGTH OF THE SCREEN ( MM )
>LFR     =  1      : OPTION OF THE SCREEN TYPE
>IFRAM   =  1      : OPTION OF THE FRAME TYPE
>XW      = 200.00  : HORIZONTAL LENGTH OF THE FRAME ( MM )
>YW      = 150.00  : VERTICAL LENGTH OF THE FRAME ( MM )
>XO      =  30.00  : INITIAL COORDINATE FOR X-AXIS ( MM )
>YO      =  10.00  : INITIAL COORDINATE FOR Y-AXIS ( MM )

>ZMIN    =   0.0   : MINIMUM VALUE FOR Z-AXIS
>ZMAX    =   0.0   : MAXIMUM VALUE FOR Z-AXIS
>KA      =  5      : GRADUATION TYPE
>SIZE    =   3.00  : HEIGHT OF GRADUATION NMBER (  MM )
>NCNV    =  1      : OPTION TO TRANSFORM THE DATA
>LFG     =  2      : OPTION OF GRADUATION TYPE
>IGRID   =  0      : GRID TYPE
>MX      =  0      : NUMBER OF GRID FOR X-AXIS
>MY      =  0      : NUMBER OF GRID FOR Y-AXIS
>INTER   =  0      : OPTION OF INTERPOLATION TYPE
>NCONTR  =   1     : NUMBER OF CONTOUR LINE

>CONTV   = -1.000E+00
         : CONTOUR VALUE

>KIND    =       1
         : KIND OF CONTOUR LINE

>LCVOP   =  1      : OPTION TO PLOT CONTOUR VALUE
>ISTL    =  1      : FIRST LINE NUMBER TO PLOT CONTOUR VALUE
>ML      =  1      : INTERVAL TO PLOT CONTOUR VALUE
>ICMT    =
         : COMMENT FOR THE CONTOUR-LINE MAP
>XST     =   0.0   : INITIAL COORDINATE OF X-AXIS COMMENT ( MM )
>YST     =   0.0   : INITIAL COORDINATE OF Y-AXIS COMMENT ( MM )
>THETA   =   0.0   : ANGLE OF CHARACTER ( DEG. )
>CHIGH   =   4.00  : HEIGHT OF CHARACTOR ( MM )
>IREAL   =  0      : OPTION FOR FIGURE SIZE
>ID      =         : I.D. SIGN FOR THE FIGURE
=================================================================
```

Table 2.1.4 Display of the executing values of LIST3

```
=========================================================

>XSCALE =  0      : SCALING OPTION FOR X-AXIS COORDINATE
>YSCALE =  0      : SCALING OPTION FOR Y-AXIS COORDINATE
>ZSCALE =  0      : SCALING OPTION FOR Z-AXIS COORDINATE
>NSTEP  =  0      : READ OR WRITE OPTION OF ORIGINAL DATA
>THETA  =  30.00  : GRADIENT OF Y-AXIS ( DEG. )

>DELTA  =  10.00  : GRADIENT OF X-AXIS ( DEG. )
>BETA   =   1.00  : (Y-AXIS LENGTH)/(X-AXIS LENGTH)

>MGRAPH =  1      : GRAPHIC TYPE OPTION
>NXCH   =  0      : OPTION TO CHANGE X-AXIS DATA ARRAY
>NYCH   =  0      : OPTION TO CHANGE Y-AXIS DATA ARRAY
>NVALUE =  0      : INPUT OPTION OF THE THRESHOLD VALUE
>ALPHA  =   0.0   : THRESHOLD VALUE OF Z-AXIS
>LIMIT  =  0      : INTERPOLATED POINT NUMBER
>PRINT  =  0      : PRINT OPTION OF INPUT DATA
>DDXY   =   0.10  : MINIMUM MESH WIDTH ( MM )

=========================================================
```

Table 2.1.5 Display of the functions by TABLEC

VARIABLE	ARRAY	DESCRIPTION OF THE DATA
TITLE	(20)	MAIN TITLE OF THE GRAPH
XTITL	(20)	CAPTION OF X-AXIS COORDINATE
YTITL	(20)	CAPTION OF Y-AXIS COORDINATE
ZTITL	(20)	CAPTION OF Z-AXIS COORDINATE
UNIT	(10)	LOGICAL UNIT NUMBER OF THE DATA
FNAME	(4,10)	FILE-NAME OF THE NUMAL DATA POOL
NODE	(10,10)*8	NODE STRUCTURE OF THE DATA POOL
CODE	(10,10)	CODE NUMBER OF THE PLOTTING DATA
XW		X-AXIS LENGTH (MM)
YW		Y-AXIS LENGTH (MM)

Table 2.1.6 Display of the functions by TABLE1

VARIABLE	ARRAY	DESCRIPRION OF THE DATA
NPL		NUMBER OF THE PLOTTING LINE IN A GRAPH
TRANS		TRANSFORM TYPE OF THE PLOTTING DATA = A : ABSOLUTE = C : ALPHA-TRANSFORM = O : "+","-","/" TRANSFORM
ALPHA		CONSTANT NUMBER TO TRANSFORM ENTER IF TRANS = C
OPERA		TRANSFORM FORMAT OF THE PLOTTING DATA ENTER IF TRANS = O = + : ADD ,= - : SUBTRACT ,= / : DIVIDE
COMP		DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
EUNIT	(5)	LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
COMT	(10)	COMMENT FOR ALL DATA
SUBT	(10,10)	COMMENT FOR EACH DATA
TPO		OPTION FOR GRAPHIC FORM = H : HISTGRAM LINE FORM = L : LINEAR LINE FORM
PAT		GRAPHIC PATTERN = S : SINGLE GRAPH ,= D : DOUBLE GRAPH
SYMBOL		PLOTTING OPTION OF SYMBOL FOR CALCULATION DATA = 0 : NOT PLOT = N : PLOT SYMBOL TO EVERY N+1 POINTS
SCODE	(10)	SYMBOL CODE OF THE CALCULATION DATA
ECODE	(10)	SYMBOL CODE OF THE EXPERIMENTAL DATA
EID	(5)	PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA
ESIZE		HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA (MM)
SSIZE		HEIGHT OF CHARACTER FOR THE COMMENT (MM)
XN		INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
YN		INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
GRID		OPTION FOR GRID LINE = 0 ,1 ,2 ,3 (SEE MANUAL FOR DETAIL)
XSCALE		SCALING OPTION FOR X-AXIS COORDINATE = 0 : LINEAR SCALE ,= 1 : LOGARITHM SCALE
YSCALE		SCALING OPTION FOR Y-AXIS COORDINATE (SAME AS ABOVE)
SCALE		METHOD OF SCALING TYPE = 0 : AUTOMATIC SCALE ,= 1 : MANUAL SCALE
XMIN		MINIMUM VALUE FOR X-AXIS COORDINATE IF SCALE = 1
XMAX		MAXIMUM VALUE FOR X-AXIS COORDINATE (SAME AS ABOVE)
YMIN		MINIMUM VALUE FOR Y-AXIS COORDINATE (SAME AS ABOVE)
YMAX		MAXIMUM VALUE FOR Y-AXIS COORDINATE (SAME AS ABOVE)
YDMIN		MINIMUM VALUE FOR Y-AXIS COORDINATE IF SCALE =1 AND PAT = D
YDMAX		MAXIMUM VALUE FOR Y-AXIS COORDINATE (SAME AS ABOVE)

Table 2.1.7 Display of the executing values of TABLE2

VARIABLE	ARRAY	DESCRIPTION OF THE DATA
NPL		NUMBER OF PLOTTING LINE IN A GRAPH
IOP		OPTION OF THE SCREEN SIZE = 1 : A4 ,= 2 : B5 ,=3 : A3 ,=4 : B4 (EXCEPT FOR THESE,DEFINE XSC AND YSC
XSC		HORIZONTAL LENGTH OF THE SCREEN (MM)
YSC		VERTICAL LENGTH OF THE SCREEN (MM)
LFR		OPTION OF THE SCREEN TYPE = 1 ,2 ,3 ,4 ,5 ,6 (SEE MANUAL FOR DETAIL)
IFRAM		OPTION TO PLOT THE FRAME
XW		HORIZONTAL LENGTH OF THE FRAME (MM)
YW		VERTICAL LENGTH OF THE FRAME (MM)
XO		INITIAL COORDINATE FOR X-AXIS (MM)
YO		INITIAL COORDINATE FOR Y-AXIS (MM)
ZMIN		MINIMUM VALUE FOR Z-AXIS
ZMAX		MAXIMUM VALUE FOR Z-AXIS
KA		OPTION FOR GRADUATION TYPE = 1, 2 ,3, 4, (SEE MANUAL FOR DETAIL)
SIZE		HEIGHT OF GRADUATION NUMBER (MM) = 0.0 : SET DEFAULT VALUE
NCONV		OPTION TO TRANSFORM THE DATA
LFG		OPTION OF GRADUATION TYPE = 1 ,2 ,3 (SEE MANUAL FOR DETAIL)
IGRID		OPTION OF GRID TYPE = 0 ,1 ,2 (SEE MANUAL FOR DETAIL)
MX		NUMBER OF GRID FOR X-AXIS < 0 : NO ,= 0 : AUTO ,> 0 : MANUAL
MY		NUMBER OF GRID FOR Y-AXIS (SAME AS ABOVE)
INTER		APPROXIMATION TYPE OF CONTOUR VALUE = 0 : LINEAR-LINE = 1 : SPLINE-FITTING
NCONTR		NUMBER OF CONTOUR LINE = 1 : AUTO ,= N : N LINES
CONTV	NCONTR	CONTOUR VALUES FOR LINES
KIND	NCONTR	KIND OF CONTOUR LINE
LCVOP		OPTION TO PLOT CONTOUR VALUE = 0 : CONTOUR VALUE ,= 1 : SEQUENTIAL NUMBER
ISTL		FIRST LINE NUMBER FOR PLOTTING CONTOUR VALUE
ML		INTERVAL TO PLOT CONTOUR VALUE
ICMT	(20)	COMMENT FOR THE CONTOUR-LINE MAP
XST		INITIAL COORDINATE FOR X-AXIS COMMENT (MM)
YST		INITIAL COORDINATE FOR Y-AXIS COMMENT (MM)
THETA		ANGLE OF CHARACTER (DEG.)
CHIGH		HEIGHT OF CHARACTER (MM)
IREAL		OPTION FOR FIGURE SIZE (SEE MANUAL FOR DETAIL)
ID	(2)	IDENTIFICATION SIGN FOR THE FIGURE

Table 2.1.8 Display of the executing values of TABLE3

VARIABLE	ARRAY	DESCRIPTION OF THE DATA
XSCALE		SCALING OPTION FOR X-AXIS COORDINATE = 0 : LINEAR SCALE ,= 1 : LOGARITHM SCALE
YSCALE		SCALING OPTION FOR Y-AXIS COORDINATE (SAME AS ABOVE)
ZSCALE		SCALING OPTION FOR Z-AXIS COORDINATE (SAME AS ABOVE)
NSTEP		READING OR WRITING OPTION OF ORIGINAL DATA = 0 : WRITE TO WORK FILE ,= 1 : READ FROM WORK FILE
THETA		ANGLE OF X-AXIS COORDINATE FOR HOLIZONTAL DIRECTION(DEG)
DELTA		ANGLE OF Y-AXIS COORDINATE FOR HOLIZONTAL DIRECTION(DEG)
BETA		(Y-AXIS LENGTH)/(X-AXIS LENGTH)
MGRAPH		GRAPHIC TYPE OPTION = 0 ,1 ,2 ,3 (SEE MANUAL FOR DETAIL)
NXCH		OPTION TO CHANGE X-AXIS DATA ARRAY = 0 : NO ,= 1 : CHANGE
NYCH		OPTION TO CHANGE Y-AXIS DATA ARRAY (SAME AS ABOVE)
NVALUE		INPUT OPTION OF THE THRESHOLD VALUE = 0 : NO ,=1 : INPUT
ALPHA		THRESHOLD VALUE FOR Z-AXIS COORDINATE ,IF NVALUE = 1
LIMIT		INTERPOLATED POINT-NUMBER = 0 : CONNECT WITH ALL POINTS = N : CONNECT WITH EVERY N+1 POINTS
PRINT		PRINT OPTION OF INPUT DATA = 0 : NO ,= 1 : PRINT
DDXY		MINIMUM MESH WIDTH (MM)

Table 2.1.9 Display of the functions of all commands by HELP

```
 (COMMAND)          (DESCRIPTION)
==================================================================
 >DEFAULTC----> SET DEFAULT VALUE OF COMMON DATA
 >DEFAULT1----> SET DEFAULT VALUE OF MODE-1 DATA
 >DEFAULT2----> SET DEFAULT VALUE OF MODE-2 DATA
 >DEFAULT3----> SET DEFAULT VALUE OF MODE-3 DATA

-------------------------------------------------------

 >LISTC    ----> DISPLAY THE TABLE OF COMMON DATA
 >LIST1    ----> DISPLAY THE TABLE OF MODE-1 DATA
 >LIST2    ----> DISPLAY THE TABLE OF MODE-2 DATA
 >LIST3    ----> DISPLAY THE TABLE OF MODE-3 DATA

-------------------------------------------------------

 >UPDATEC ----> UPDATE THE TABLE OF COMMON DATA
 >UPDATE1 ----> UPDATE THE TABLE OF MODE-1 DATA
 >UPDATE2 ----> UPDATE THE TABLE OF MODE-2 DATA
 >UPDATE3 ----> UPDATE THE TABLE OF MODE-3 DATA
 >ENDU    ----> TERMINATE TO UPDATE THE DATA

-------------------------------------------------------

 >TABLEC  ----> DESCRIBE THE FUNCTION OF COMMON DATA
 >TABLE1  ----> DESCRIBE THE FUNCTION OF MODE-1 DATA
 >TABLE2  ----> DESCRIBE THE FUNCTION OF MODE-2 DATA
 >TABLE3  ----> DESCRIBE THE FUNCTION OF MODE-3 DATA

-------------------------------------------------------

 >RUN1    ----> EXECUTE MODE-1
 >RUN2    ----> EXECUTE MODE-2
 >RUN3    ----> EXECUTE MODE-3
 >END     ----> TERMINATE TO EXECUTE THE MODE

-------------------------------------------------------

 >NLPW    ----> WRITE PLOTTING DATA IN THE FILE FOR NLP
 >HELP    ----> DESCRIBE THE FUNCTION OF COMMAND
 >TIME    ----> DISPLAY CPU TIME
 >BYE     ----> TERMINATE TO EXECUTE THE "VISUAL"
==================================================================
```

2.2 MODE-1

This mode is possible to plot two-dimensional data on a graph. The data plotted in this mode are the cross section, the self-shielding factor, the ultra-fine group cross section, the one- and two- dimensional flux and angular flux etc. These data are possible to display a step-line or a linear-line assigned by TPO in the MODE-1. Examples are shown in Fig. 3.2.1 and section 5.1 in detail. In the MODE-1, it is possible to plot the data "X" that are transformed as follows:

$$X = B - A,$$
$$X = B + A,$$
$$X = B/A,$$
$$X = C \times B,$$

where

A : specified basic data as a reference,
B : variable data,
C : constant value.

These parameters are assigned by TRANS, ALPHA and OPERA.

It is possible to plot a single pattern graph or a double pattern graph for the Y-axis coordinate by selecting PAT in the MODE-1. Examples are shown in Fig. 3.2.2. The plotting of linear - linear, linear-log, log-linear and log-log scalings assigned by XSCALE and YSCALE and automatic scaling or a manual scaling assigned by SCALE for the X and Y axes can be selected.

The experimental data with the error bars and the calculated data are plotted on a same graph with optional symbols by pointing out the code number assigned by SCODE and ECODE in the CMM. The symbols for the calculated and the experimental data are shown in Fig. 3.2.3 and Fig. 3.2.4. The plotting sample is shown in section 5.1. It is possible to plot the comments and the sub-titles of the data on the arbitrary X-Y coordinates assigned by XN and YN by using Cross Hair-line Cursors on the TEKTRONIX-T4014 terminal. The usage of the Cursors is shown in section 2.6 in detail. The grid can be plotted by selecting GRID. Samples are shown in Fig. 3.2.5. The height of the character for the comment and the symbol for the experimental data are assigned by SSIZE and ESIZE.

2.3 MODE-2

The mode is possible to plot the contour-line map of the flux and the calculational lattice data of ESPRIT[1] on a same graph. The size and the kind of the plotting screen can be chosen by the parameters IOP, XSC and YSC. It enables a user to scale the contour value manually or automatically assigned by NCONTR and CONTV and to plot contour map with linear or 3-th spline fitting assigned by INTER. Users can be chosen optionally the kind of contour line and blanking area assigned by KIND and the kind of grid assigned by IGRID (see Figs. 3.3.4 and 3.3.5), and the graduation type and the height of the graduation number assigned by KA and SIZE. (see Fig. 3.3.2)

If the contour value's option LCVOP equals 0, the contour values are written on the contour lines, and LCVOP equals 1, they are written out of the contour map.

2.4 MODE-3

It enables a user to plot the data, as a three-dimensional coordinates graph, that are defined as follows:

(DY(J),J=1,JM) : data array for the Y-axis coordinate,
(NX(J),J=1,JM) : number of the X-axis data points for the Y-axis coordinate,
((DX(I,J),I=1,NX(J)),J=1,JM) : data array for the X-axis coordinate,
((DZ(I,J),I=1,NX(J)),J=1,JM) : data array for the Z-axis coordinate,

where

JM : number of the Y-axis data points.

Hidden portions of the surface can be eliminated from the drawing. According to change the order of going up and down for the X-axis coordinate and the Y-axis coordinate assigned by NXCH and NYCH, it is possible to plot the bird's - eye view that are viewed from the four directions. (See Fig. 3.4.3) It is possible to rotate the azimuthal angle to left assigned by THETA for the X-axis, to right assigned by DELTA for the Y-axis. (See Fig. 3.4.1) A gridless drawing can be possible for the X-axis of digitized X, Y and Z-axes data. Four kind of graphic patterns can be plotted by the parameter MGRAPH. (See Fig. 3.4.2)

It is possible to plot a graph by linear-linear-linear, linear-linear-log, linear-log-linear, log-linear-linear, log-log-linear, log-linear-log, linear-log-log and log-log-log scalings for the X, Y and Z axes assigned by XSCALE, YSCALE and ZSCALE. A threshold value assigned by ALPHA for the Z-axis can be set.

2.5 Text Management Mode (TMM)

The VISUAL code is possible to plot the main title, the captions of the X-, Y- and Z-axes, the status board using Greek characters and the other special symbols according as the following procedure. The text consists of the character control command and the character lines. The plotting symbols written with a capital letter treated by TMM are shown in Table 2.5.1 and written with a small letter are shown in Table 2.5.2.

(a) Character Control Command

The commands control the form of the character lines. Usually, the text are written with a small letter of English and a numeral used in FORTRAN language. The character control command changes the character form of the following character lines. The character control commands are as follows:

(i) $

The character lines after this command are written with a captial letter until "?" command appears.

(ii) ?

After this command, the functions of all commands are reset and the character lines are written with a small letter of English and a numeral.

Otherwise, this is used to reset the function of super-or sub-script.

(iii) @

After this command, all of the character lines are plotted as the super-script until "?" command appears.

(iv) "

After this command, all of the character lines are plotted as the sub-script until "?" command appears.

(v) !

This command is used to plot Greek letter or the other special characters that are defined by the code number written in three digits. After this command, the code number of the three digits is given as a character line. The code numbers of the special characters are described in Tables 2.5.1 and 2.5.2.

Examples using these functions are as follows:

$N?EUTRON YIELDS OF @239?$P?U$-B?E$(?!042107?N$) ?SOURCES
is displayed as
Neutron yields of ^{239}Pu-Be(α,n) sources

$B?OUCHER@26)? DETERMINED THIS TO BE $1.23!023?$0.05?FOR $C?M"2?$0?"3?
is displayed as
Boucher[26)] determined this to be 1.23±0.05for Cm_2O_3

As shown in these examples, the character control command is possible to write in succession. It is noted that a user should not write a blank after the command "!", because it causes a error.

Examples are as follows:

(i) $@

After these commands, the character lines are plotted as super-script with a capital letter.

(ii) ?"!035

After these commands, π is plotted as sub-script with a small letter.

(iii) $@!034061043

After these commands, $\mu\times\delta$ is plotted as super-script with a capital letter.

Once a character control command is given, the function continues until the reset command "?" appears.

The plot symbols of Text Management are generated in the subroutine

LETTER that is a part of the CALCOMP[3] Functional Software, so that, it is possible to change the form and the width of the character and the space between two characters by using next three parameters.

(i) ASPECT

This parameter determines the ratio of height to wide of a character defined as follow:

$$\text{ASPECT} = H / W ,$$

where

H : height of character,

W : width of character.

(ii) TALIC

This parameter determines the inclination of a character. If this parameter equals to 0.0, the character is plotted perpendicularly. When the value is less than 0.0, the character leans toward the right.

(iii) SPACE

This parameter means the space between two characters. This only changes the space between two characters, not the form of them. If this parameters equals to 0.0, the two characters are plotted at the same place, more than 1.0, the space between two characters extends and less than 0.0, the characters are plotted from right to left. The width of all characters is defined defined as follows:

$$(\text{SPACE}) \times (\text{ASPECT}) \times (\text{height of character}).$$

In the case of using the symbols of CALCOMP shown in Tables 2.5.1 and 2.5.2 (code number 000 to 014), ASPECT usually equals to 1.0. The three parameters are set in the subroutine SYMBLL as follows:

ASPECT = 1.0,

TALIC = 0.0,

SPACE = 0.85.

These functions enable a user to change the form and the size of a character. Sample outputs are shown in Table 2.5.3.

Table 2.5.1 Capital letters treated by TMM

0	⊡	16	|	32	}	48	∑	64		80	&	96	—	112	0
1	⦶	17		33	{	49	÷	65	A	81	J	97	/	113	1
2	△	18	∧	34	μ	50	≤	66	B	82	K	98	S	114	2
3	+	19	≡	35	π	51	≥	67	C	83	L	99	T	115	3
4	╳	20	→	36	Φ	52	Δ	68	D	84	M	100	U	116	4
5	◇	21		37	θ	53	[	69	E	85	N	101	V	117	5
6	⍏	22	≠	38	ψ	54	]	70	F	86	Ø	102	W	118	6
7	⧗	23	±	39	χ	55	\	71	G	87	P	103	X	119	7
8	Z	24	_	40	ω	56	⌈	72	H	88	Q	104	Y	120	8
9	Y	25		41	λ	57	⌠	73	|	89	R	105	Z	121	9
10	⊠	26	‾	42	∝	58	⎮	74	¢	90	!	106	∞	122	:
11	✳	27	∫	43	δ	59	⌡	75	.	91	$	107	,	123	#
12	⧖	28	⊃	44	∈	60	←	76	<	92	*	108	%	124	@
13	|	29	∨	45	η	61	×	77	(	93	)	109	—	125	'
14	✡	30 E	~	46		62	↑	78	+	94	;	110	>	126	=
15	_	31	≈	47		63	↓	79	|	95	¬	111	?	127	"

Table 2.5.2 Small letters treated by TMM

0	□	16	|	32	}	48	Σ	64		80	&	96	-	112	0
1	○	17		33	{	49	÷	65	a	81	j	97	/	113	1
2	△	18	∧	34	μ	50	≤	66	b	82	k	98	s	114	2
3	+	19	≡	35	π	51	≥	67	c	83	l	99	t	115	3
4	×	20	→	36	Φ	52	Δ	68	d	84	m	100	u	116	4
5	◇	21		37	θ	53	[	69	e	85	n	101	v	117	5
6	↑	22	≠	38	ψ	54	]	70	f	86	o	102	w	118	6
7	⧖	23	±	39	χ	55	\	71	g	87	p	103	x	119	7
8	Z	24	_	40	ω	56	⌈	72	h	88	q	104	y	120	8
9	Y	25		41	λ	57	⌊	73	i	89	r	105	z	121	9
10	⊠	26	‾	42	∝	58	↕	74	¢	90	!	106	∞	122	:
11	✳	27	∫	43	δ	59	↕	75	.	91	$	107	,	123	#
12	⧗	28	⊃	44	∈	60	←	76	<	92	*	108	%	124	@
13	|	29	∨	45	η	61	×	77	(	93	)	109	—	125	'
14	✡	30	~	46		62	↑	78	+	94	;	110	>	126	=
15	_	31	≈	47		63	↓	79	|	95	¬	111	?	127	"

Table 2.5.3 Sample outputs by changing ASPECT, TALIC and SPACE

	Talic =-1.00	Talic =0.00	Talic =1.00
Space =1.25 Aspct =0.50	Sample	Sample	*Sample*
Aspct =1.00	Sample	Sample	*Sample*
Aspct =1.50	Sample	Sample	*Sample*
Aspct =2.00	Sample	Sample	*Sample*
Space =1.00 Aspct =0.50	Sample	Sample	*Sample*
Aspct =1.00	Sample	Sample	*Sample*
Aspct =1.50	Sample	Sample	*Sample*
Aspct =2.00	Sample	Sample	*Sample*
Space =0.75 Aspct =0.50	Sample	Sample	*Sample*
Aspct =1.00	Sample	Sample	*Sample*
Aspct =1.50	Sample	Sample	*Sample*
Aspct =2.00	Sample	Sample	*Sample*

2.6 Usage of Command

In this section, the detail usage of CMM is described. In the description, the sentence written with a underline shows user's input and <re> means carriage return and "b" indicates blank column.

(a) Command to enter into the MODE-x

After the message of the function for each MODE is displayed, this command must be entered, and then the message that is to be set default values for common variables and the mode's variables is displayed. (See section 4.1 in detail)

(b) Command to display and update the executing variables

User may as well enter LIST command after (a), because all of the default values are shown by using these commands. And the user is able to update the executing variables exactly in succession by refering these values. The variables names defined in Chapt. 3 and their values called "UPDATE TERM" must be given as follows:

variable name = value-1bvalue-2bvalue-3b ------ ;

The successive UPDATE TERMs must be punctuated with semicolon ";" each other and a group of them is called "UPDATE STRING". A variable with single array of English and a numeral must be less than 80 characters, and the number of the values with plural arrays must be less equal than the arrays. The total number of the characters of all UPDATE STRINGs is less than 3996. The update command "ENDU" must be entered from 1 column after the end of UPDATE STRING. A blank column may be inserted more than 1 optionally in the type of numeral. Example is shown as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6
    *** PLEASE KEY IN COMMAND ***
(1) ?LISTC    <re>



   *** PLEASE KEY IN COMMAND ***
```

(In "(1) ?LISTC", the text LISTC is underlined as user input.)

(2) ? UPDATEC <re>

*** PLEASE KEY IN UPDATE STRING (UPDATEC) ***

(3) ? XTITL=$N?EUTRON $E?NERGY $(?E$V); <re>

? YTITL=$C?ROSS $S?ECTION $(?BARN/SR/$M?E$V); <re>

(4) ? UNIT(1)=91;UNIT(2)=91;UNIT(3)=91; <re>

(5) ? NODE(1)=EXPbbbbb0000bbbbbb92; <re>

? NODE(2)=102G; <re>

? NODE(3)=102GbbbbDDXbbbbb1001bbbbbb33; <re>

(6) ? CODE(1)=0b7b7b7b7; <re>

? CODE(2)=0b1b2b3b4; <re>

? XW=150.0;YW=130.0; <re>

(7) ? ENDU <re>

<The screen is cleared automatically>

*** PLEASE KEY IN COMMAND ***

(8) ? LISTC <re>

where

(1) : The table of the default values for the common variables is displayed. (See Table 2.1.1)

(2) : The command to update the executing data for the common variables is entered.

(3) : This indicates a update term for XTITL.

(4) : This indicates a update string.

(5) : The variable name NODE is declared double-precision, and so that 8 characters are stored in a word.

(6) : A blank column is inserted in the type of numeral.

(7) : This indicates the end of updating.

(8) : The table of updated variables is shown in Table 2.6.1.

(c) How to plot comment and sub title

After plotting a graph, when XN=0.0 and YN=0.0 (See section 3.2) are given, hair-line cursours are displayed. User sets them to the arbitrary initial X-Y coordinates and key in carriage return after a space-bar, and then the comment and the sub title are plotted on the them.

If the hair-line cursours are set on the X and Y axes within 5 millimeters and key in carriage return after a space-bar, the plotting graph is cleared and the hair-line cursours are displayed again. Then, the comment is plotted on the next page in the same way as above. In this case, after the command "NLPW", XN and YN are given negative values and written in a work file on logical unit FT50F001. If XN and YN are greater than 0.0, the comment and the sub-title are plotted from the coordinates after plotting the lines.

(d) Command to write the executing data

When the command "NLPW" is given after plotting a graph, all of the executing data are stored in the sequential file on logical unit FT50F001 for NLP or COM in succession. By using the executing data that are stored in the file, the graph is reproduced with RUN command on NLP or COM.

(e) Command to terminate the MODE

Command "END" is used to execute the other mode. After plotting a graph, if user inputs the command "END", the system urges to enter the modal option.

Example is as follow:

```
     ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
      < Plot a graph of MODE-1 >

  *** PLEASE KEY IN COMMAND ***
? END     <re>
  *** PLEASE KEY IN MODAL OPTION ***
? MOD2    <re>
  *** DEFAULT VALUE SET FOR COMMON DATA ***
  *** DEFAULT VALUE SET FOR MODE-2 DATA ***
  *** PLEASE KEY IN COMMAND ***
```

(f) Command to set default values

It is possible that the user sets the default values for the common variables, MODE-1, MODE-2 or MODE-3 variables respectively by using the command DEFAULTC, DEFAULT1, DEFAULT2 and DEFAULT3.

Table 2.6.1 Display of the executing values by LISTC

```
==========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITL  = $N?EUTRON $E?NERGY $(?E$V)
         : X-AXIS CAPTION
 >YTITL  = $C?ROSS $S?ECTION $(?BARN/SR/$M?E$V)
         : Y-AXIS CAPTION
 >ZTITL  =
         : Z-AXIS CAPTION



 >UNIT( 1)=91
 >UNIT( 2)=91
 >UNIT( 3)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EXP        0000        92
 >NODE(2)=102G
 >NODE(3)=102G       DDX       1001        33
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  0   7   7   7   7   0   0   0   0   0
 >CODE( 2)=  0   1   2   3   4   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =150.00
         : X-AXIS LENGTH(MM)
 >YW     =130.00
         : Y-AXIS LENGTH(MM)

==========================================================
```

3. Executing Variables

In this chapter, the functions of the executing variables for common data, MODE-1, MODE-2 and MODE-3 are described. In the description, Size means the size of array and Default means the default value of the variable. In the term of Size, a blank column indicates 1 word and in the term of Default, a blank column means a blank area.

3.1 Common Executing Variable

In this section, the functions of executing variables for common data that consist of titles and informations to access DATA-POOL and length of X-axis and Y-axis are summarized.

Variable	Size	Default	Description of the Data
TITLE	(20)		Main title of the graph.
XTITL	(20)		Caption of X-axis coordinate.
YTITL	(20)		Caption of Y-ais coordinate.
ZTITL	(20)		Caption of Z-axis coordinate.
UNIT	(10)	0	Logical unit number of DATA-POOL.
FNAME	(4,10)		File name of the NUMAL data base.
NODE	(10,10)×8		Node structure of the data in DATA-POOL.
			(See section 5.1 in detail.)
CODE	(10,10)	0	Code number of the plotting data
			(See section 5.1 in detail.)
XW		220.0	X-axis length (mm).
YW		190.0	Y-axis length (mm).

3.2 Executing Variable for MODE-1

In this section, the functions of executing variables for MODE-1 data are summarized as follows:

Variable	Size	Default	Description of the data
NPL		1	Number of the plotting lines in a graph.
			($\leq$ 15)

			Number of lines for calculation data is limited to 10 and number of lines for experimental data is less than 5.
TRANS		A	Transformation type of the plotting data. = A ; absolute representation, = C ; alpha-transformation, = O ; +, - or / transformation. (See section 2.2 in detail.)
ALPHA		1.0	Constant number to transform. If TRANS = C, the plotting data are multiplied by ALPHA. (See section 2.2 in detail.)
OPERA		/	Transformation operator of the plotting data. If TRANS = O, enter next operands. = + ; add, = - ; subtract, = / ; divide. (See section 2.2 in detail.)
COMP		1	Data number as the denominator to transform. If TRANS = O, then enter. (See section 2.2 in detail.)
EUNIT	(5)	0	Logical unit number (from 41 to 45) of sequential data set for experimental data.
COMT	(10)		Common comment for all data.
SUBT	(10,10)		Comment for each data.
TPO		L	Option for line form. = H; step-line form, = L; linear-line form. (See Fig. 3.2.1 in detail)
PAT		S	Graphic pattern. = S ; single graph, = D ; double graph. (See Fig. 3.2.2 in detail)
SYMBOL		0	Plotting option of symbol for calculation data. = 0 ; not plot, = N ; plot symbols to every N+1 data points.
SCODE	(10)	0	Symbol code of the calculation data. (See Fig. 3.2.3 in detail.)

ECODE	(5)	0	Symbol code of the experimental data.
			(See Fig. 3.2.4 in detail.)
EID	(5)	0	Plotting identification number of the
			experimental data in the sequential
			data set. (See Appendix F in detail)
ESIZE		2.0	Height of symbol for the experimental
			data (mm). Enter as ESIZE = 3.5.
SSIZE		4.0	Height of character for the comment (mm).
			Enter as SSIZE = 4.5.
XN		0.0	Starting coordinate of X-axis to plot
			the comment (mm).
YN			Starting coordinate of Y-axis to plot
			the comment (mm).
			(See section 2.6 in detail.)
GRID		0	Option for grid pattern.
			= 0, 1, 2 or 3.
			(See Fig. 3.2.5 in detail.)
XSCALE		0	Scaling option for X-axis coordinate.
			=0 ; linear scale, = 1 ; log scale.
YSCALE		0	Scaling option for Y-axis coordinate.
			(Same as XSCALE.)
SCALE		0	Method of scaling type.
			= 0 ; automatic scaling,
			= 1 ; manual scaling.
XMIN		0.0	Minimum value for X-axis coordinate.
			If SCALE = 1, enter as XMIN = 1.0E-6.
XMAX		0.0	Maximum value for X-axis coordinate.
			(Same as XMIN.)
YMIN		0.0	Minimum value for Y-axis coordinate.
			(Same as XMIN.)
YMAX		0.0	Maximum value for Y-axis coordinate.
			(Same as XMIN.)
YDMIN		0.0	Minimum value for Y-axis coordinate for
			the double graph.
			When SCALE=1 and PAT=D are given, enter
			this value.

YDMAX	:	:	: Maximum value for Y-axis coordinate for
	:	:	: the double graph.
	:	:	: (Same as YDMIN.)

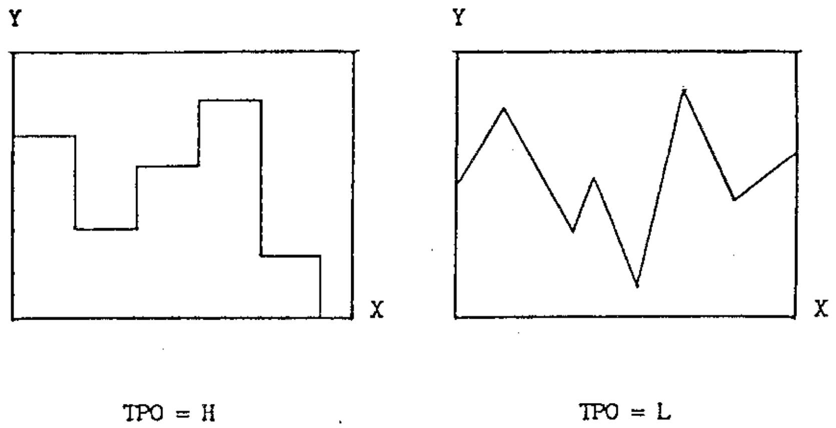


Fig. 3.2.1 Step-line and linear-line pattern assigned by TPO

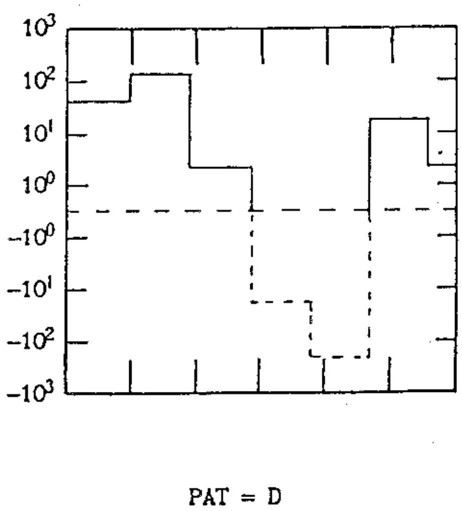


Fig. 3.2.2 Double graphic pattern assigned by PAT

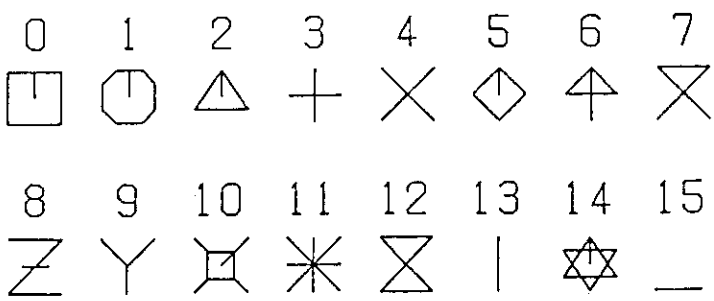


Fig. 3.2.3 Symbol code for calculated data

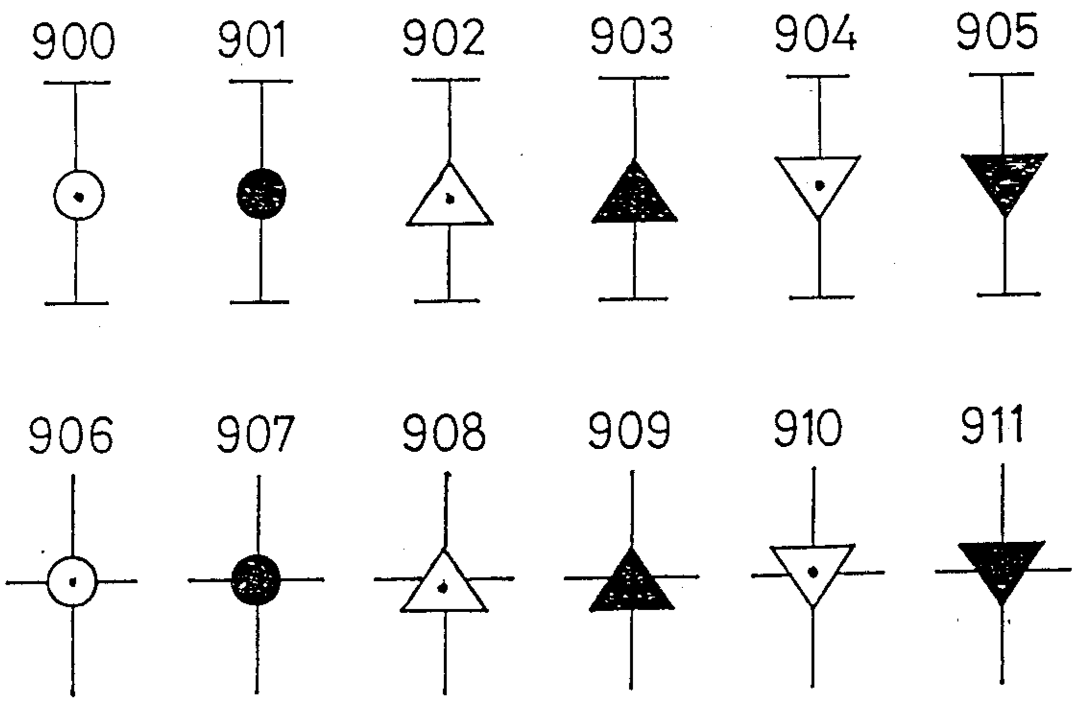


Fig. 3.2.4 Symbol code for experimental data

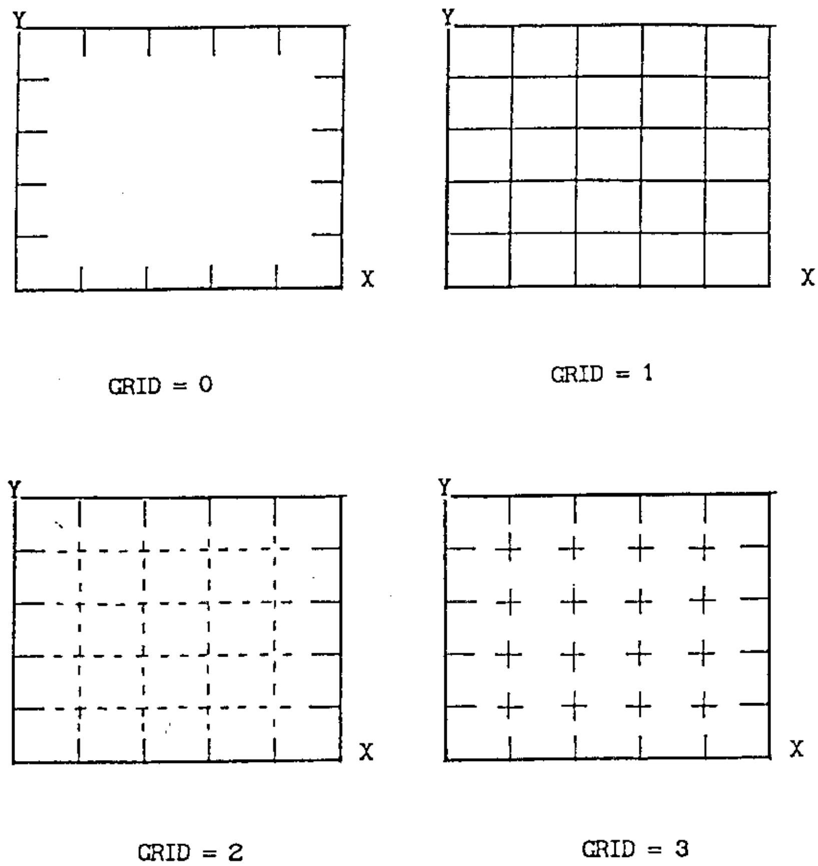


Fig. 3.2.5 Grid pattern assigned by GRID

3.3 Executing Variable for MODE-2

In this section, the functions of executing variables for MODE-2 data are summarized follows:

Variable	Size	Default	Description of the data
IOP		1	Option of the screen size.
			= 1 ; A4, = 2 ; B5, = 3 ; A3, = 4 ; B4,
			(Except for these, the size is defined
			by XSC and YSC.)
XSC		297.0	Horizontal length of the screen (mm).
YSC		210.0	Vertical length of the screen (mm).
			If IOP = 1,2,3 or 4, these are dummy.
LFR		1	Option of the screen type.
			= 1, 2, 3, 4, 5, 6.
			(Samples are shown in Fig. 3.3.1)
IFRAM		1	Option to plot a frame.
			= 1 ; plot, = 0 ; no effect.
XO		30.0	Initial coordinate for X-axis (mm).
YO		10.0	Initial coordinate for Y-axis (mm).
ZMIN		0.0	Minimum value for Z-axis.
			Enter as ZMIN=3.0E-6.
ZMAX		0.0	Maximum value for Z-axis.
			Enter as ZMAX=6.0E+8.
KA		5	Option for graduation type.
			= 1, 2, 3, 4, 5, 6.
			(Samples are shown in Fig. 3.3.2)
SIZE		3.0	Height of graduation number (mm).
			If SIZE > 0.0, plot with this size.
			If SIZE = 0.0, plot with default value.
NCONV		1	Option to transform the data.
LFG		2	Option of graduation position.
			= 1, 2, 3,
			(Samples are shown in Fig. 3.3.3)
IGRID		0	Option of grid type.
			= 0 ; no effect,
			= 1, 2. (Samples are shown in Fig. 3.3.4)

MX			Number of grid for X-axis.
		0	< 0 ; no effect, = 0 ; auto,
			> 0 ; manual.
MY		0	Number of grid for Y-axis.
			(Same as MX.)
INTER		0	Approximation type for contour value.
			= 0 ; linear-interpolation,
			= 1 ; spline-fitting.
			(Samples are shown in Section 5.2)
NCONTR		-1	Number of contour line.
			< 0 : AUTO, + N ; N lines, = 0 ; Initial
			value (CONTV(1)), increasing value (CONT
			V(2)) and final value (CONTV(3)) must be
			given, then number of contour line and
			contour values are calculated in the program.
CONTV	NCONTR	-1.0	Contour values for lines.
			NCONTR < 0 ; no effect,
			NCONTR = 0 ; set initial, increasing and final values,
			NCONTR = N ; set contour values up to N.
KIND	NCONTR	1	Kind of contour line.
			NCONTR ≦ 0 ; no effect,
			NCONTR > 0 ; set next value.
			= 0 ; no effect, = 1 ; solid,
			= 2 ; thick solid, = 3 ; dot,
			= 4 ; dash, = 5 ; chain dot.
			(See Fig. 3.3.5 in detail)
LCVOP		1	Option to plot contour value.
			= 0 ; plot contour value on the line,
			= 1 ; plot sequential number on the line
			(Samples are shown in section 5.2)
ISTL		1	First line number for plotting contour
			value.
			LCVOP = 1 ; no effect.
ML		1	Interval for plotting contour value.
			Plot contour values to every ML-1 lines
			from ISTL.

ICMT	(20)		:	Comment for the contour map.
XST		0.0	:	Starting coordinate of X-axis to plot
			:	the comment (mm).
YST		0.0	:	Starting coordinate of Y-axis to plot the
			:	comment (mm).
THETA		0.0	:	Angle of character (degree).
CHIGH		4.0	:	Height of character (mm).
IREAL		0	:	Option for figure size.
ID	(2)		:	Identification for the figure.
			:	Fixed "CONTOUR1".
COMT	(10)		:	Common comment for all data.
SUBT	(10,10)		:	Comment for each data.

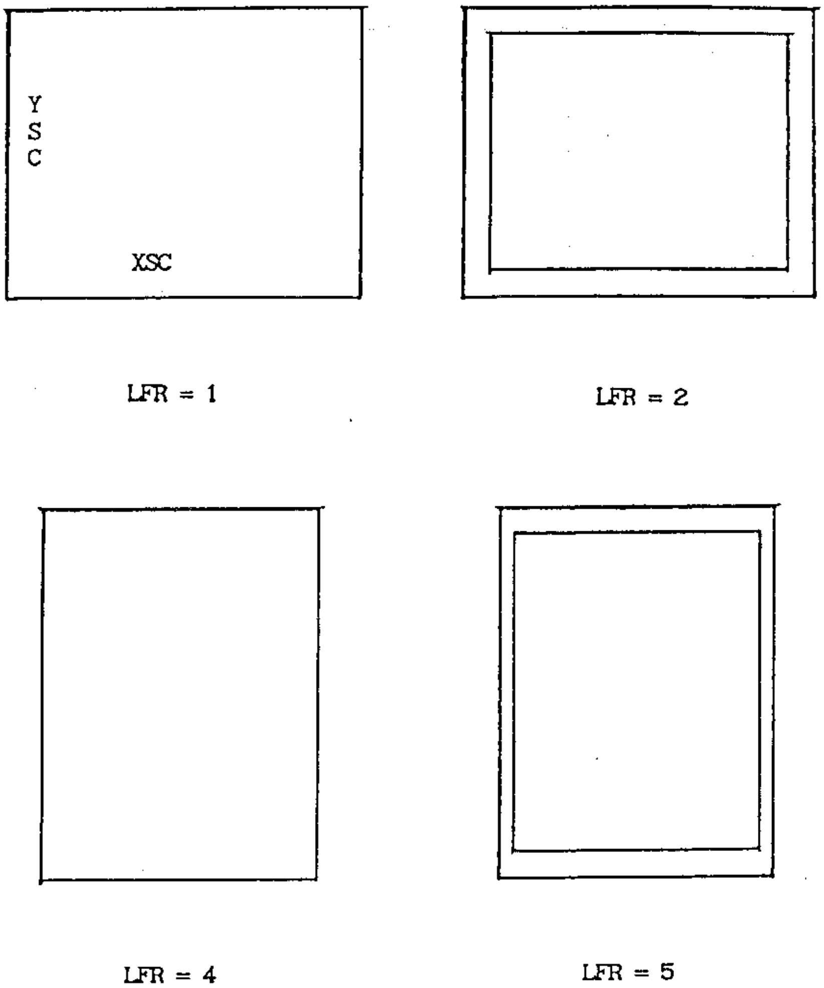


Fig. 3.3.1 Frame pattern assigned by LFR

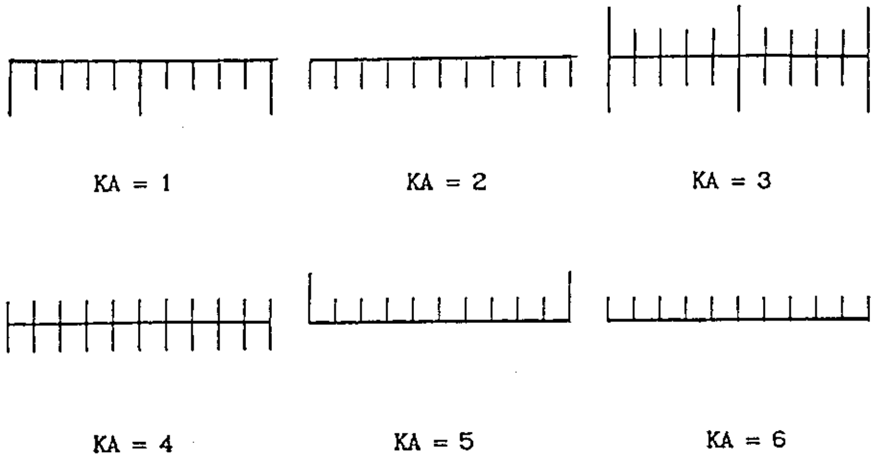
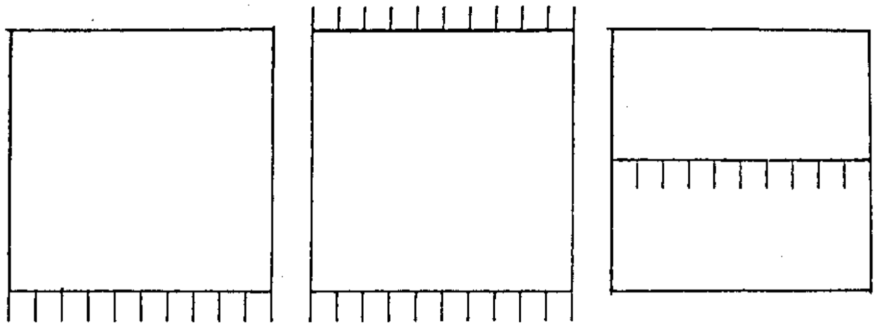
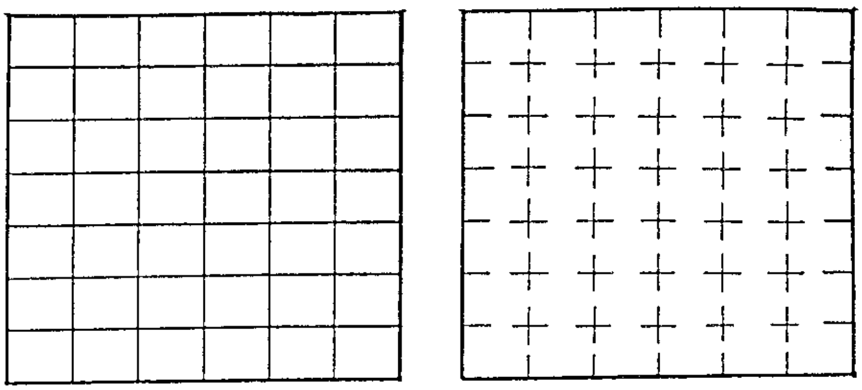


Fig. 3.3.2 Graduation type assigned by KA



LFG = 1 LFG = 2 LFG = 3

Fig. 3.3.3 Position of graduation assigned by LFG



IGRID = 1 IGRID = 2

Fig. 3.3.4 Grid pattern assigned by IGRID

No blanking	Blanking of inner area of contour line	Blanking of outer area of contour line	Kind of contour line
1	- 1	- 101	(solid line)
2	- 2	- 102	(thick solid line)
3	- 3	- 103	(dot line)
4	- 4	- 104	(dash line)
5	- 5	- 105	(chain dot line)

Fig. 3.3.5 Kind of contour line and option of blanking area

3.4 Executing Variable for MODE-3

In this section, the function of executing variables for MODE-3 data are summarized as follows:

Variable	Size	Default	Description of the data
XSCALE		0	Scaling option for X-axis coordinate.
			= 0 ; linear scaling, = 1 ; log scaling.
YSCALE		0	Scaling option for Y-axis coordinate.
			(Same as XSCALE)
ZSCALE		0	Scaling option for Z-axis coordinate.
			(Same as XSCALE)
NSTEP		0	Reading or writing option for original data.
			= 0 ; write to work file,
			= 1 ; read from work file.
THETA		30.0	Angle of X-axis coordinate for holizontal
			direction. (degree)
			(See Fig. 3.4.1 in detail)
DELTA		10.0	Angle of Y-axis coordinate for holizontal
			direction. (degree)
			(See Fig. 3.4.1 indetail)
BETA		1.0	Ratio of Y-axis length for X-axis length.
MGRAPH		1	Graphic type option.
			= 0, 1, 2, 3.
			(Examples are shown in Fig. 3.4.2)
NXCH		0	Option to change the order of going up
			and down for X-axis data array.
			= 0 ; no effect, = 1 ; change.
NYCH		0	Option to change the order of going up
			and down for Y-axis data arry.
			(Same as NXCH.)
			(Examples for NXCH and NYCH are shown in Fig. 3.4.3)
NVALUE		0	Input option for the threshold value.
			= 0 ; no effect, = 1 ; input.

ALPHA :	: 0.0	:	Threshold value for Z-axis coordinate.
:	:	:	If NVALUE = 1, then input.
LIMIT :	: 0	:	Interpolated point number.
:	:	:	= 0 ; interpolate all points,
:	:	:	= N ; interpolate every N+1 data points.
PRINT :	: 0	:	Print option of input data.
:	:	:	= 0 ; no effect, = 1 ; print.
DDXY :	: 0.1	:	Minimum mesh width for interpolation (mm).

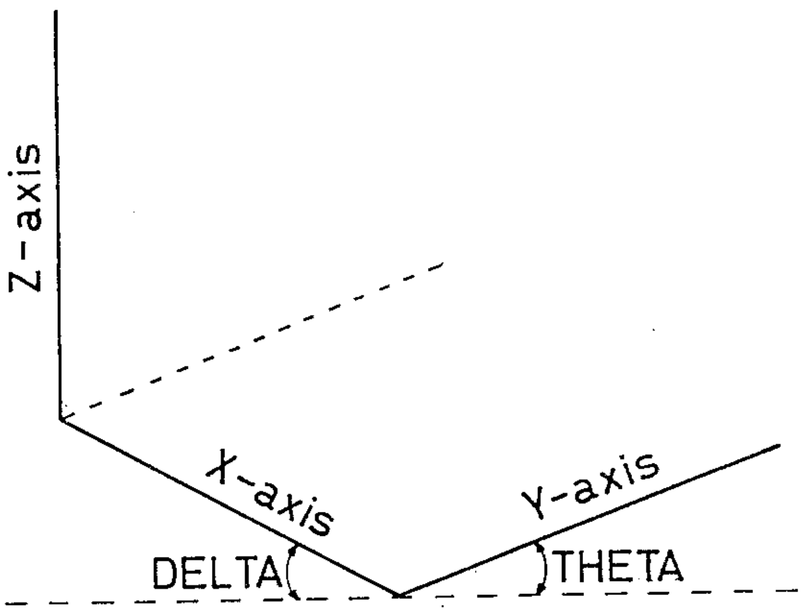


Fig. 3.4.1 Definition of THETA and DELTA

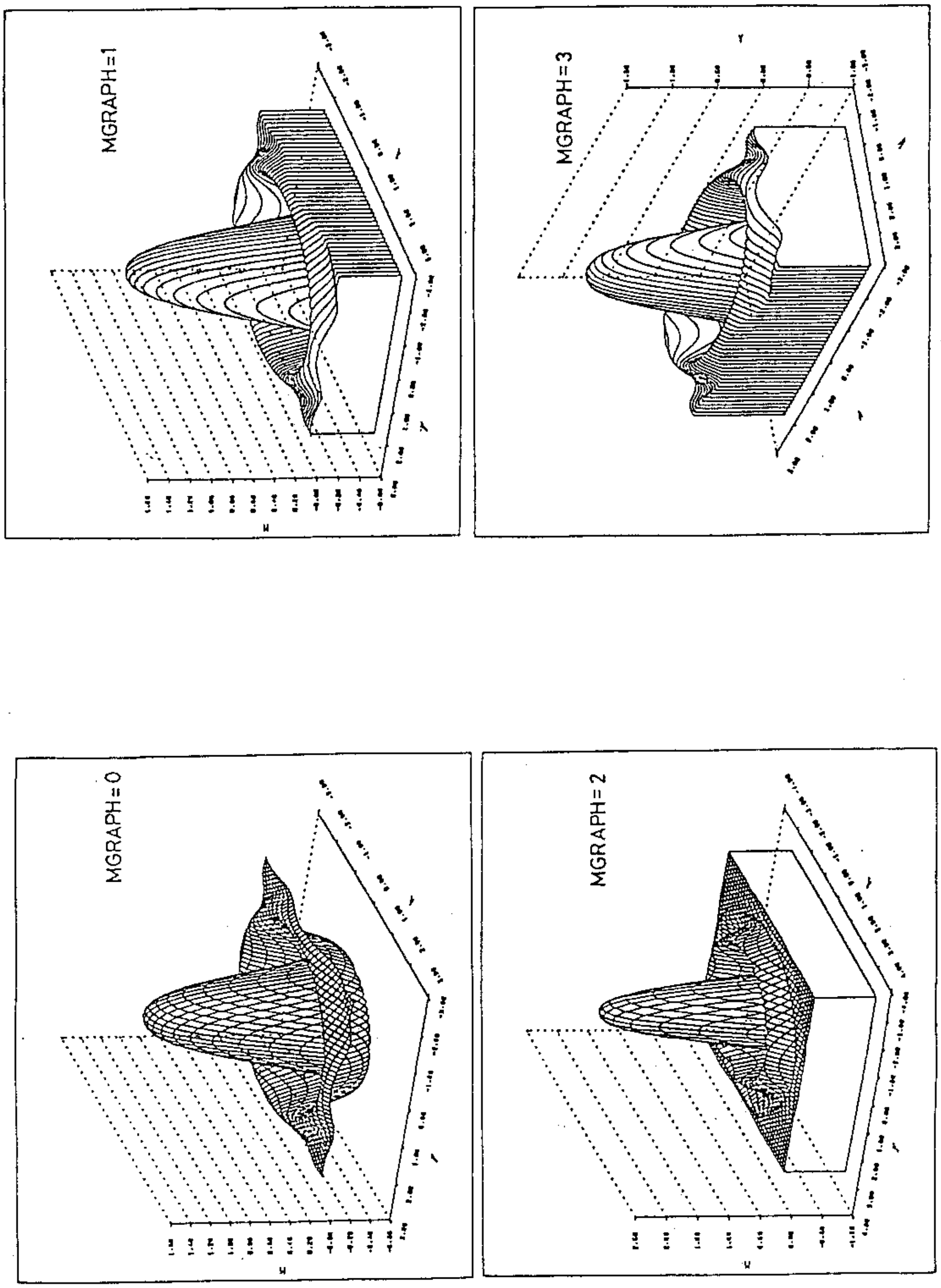


Fig. 3.4.2 Type of graph assigned by MGRAPH

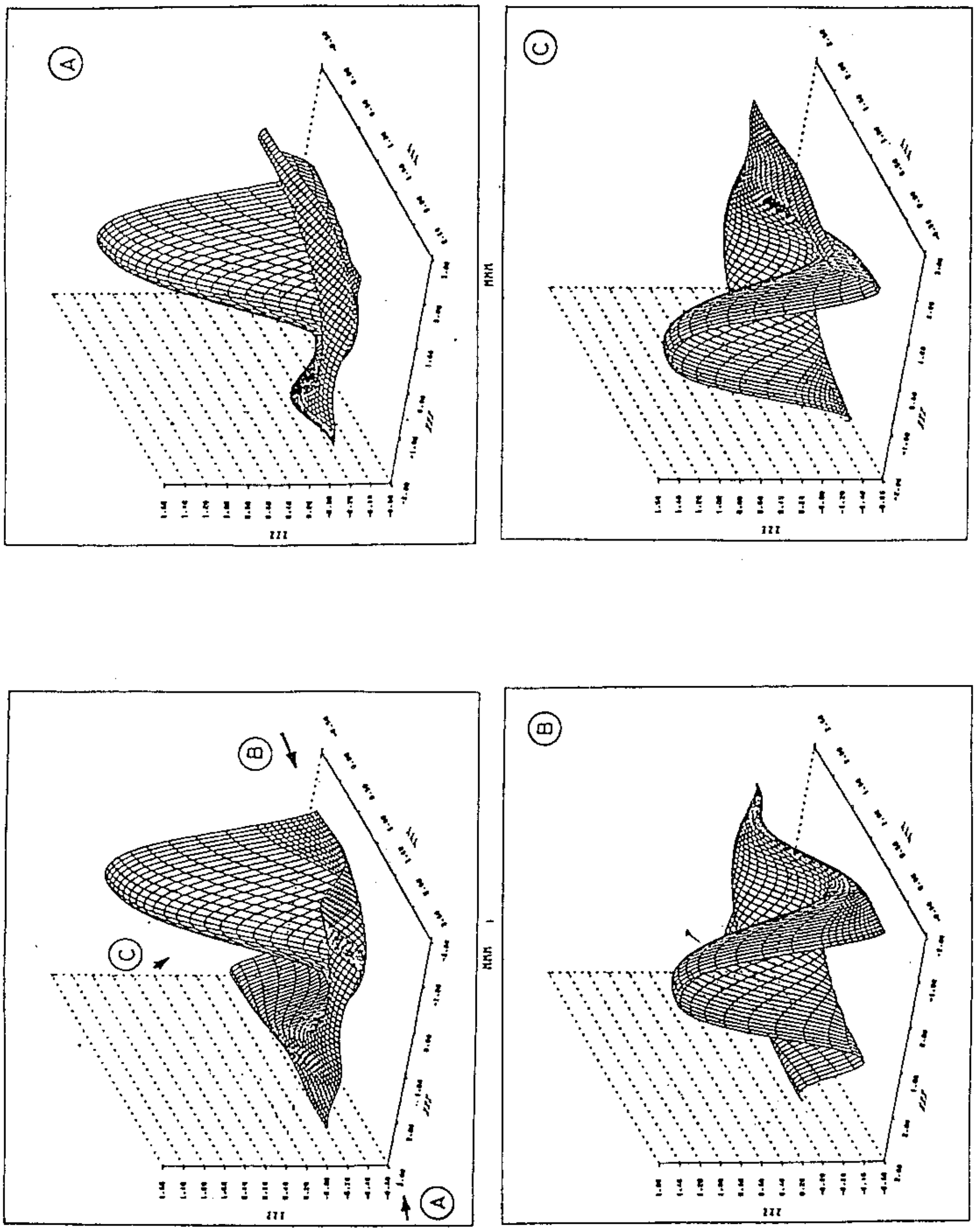


Fig. 3.4.3 Graphic patterns viewed from four directions

4. Job Control Language

4.1 Input Procedures of CMM

The input procedures of VISUAL for Conversational Management Mode on TSS at JAERI are described in this section. In the description, the sentence written with under line shows user's input and <re> means carriage return.

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++8
    PLEASE LOGON
(a) LOGON TSS J$$$$/???? S(1024)    <re>

       <Session open messages are displayed.>

    READY
(b) .PTSIO    <re>
(c) .DISKTO DD(FT91F001) DSN('J$$$$.AAAA.DATA')    <re>

(d)    <Key in the procedures to allocate DATA-POOL as same as above.>

(e) ALLOC F(FT50F001) DA('J$$$$.BBBB.DATA")    <re>

(f)   <Key in the procedures to allocate the work files according to
      MODE option. (Logical units are described in Table 4.1.1)>

    READY
(g) CALL 'J9338.VISUAL.LOAD'    <re>

    VISUAL START
(h) A screen for PTS is displaced.

     <VISUAL opening messages are displayed.>

(i) *** PLEASE KEY IN MODAL OPTION ***

     <A message of function for each MODE is displayed.>

    ? MOD1 (or MOD2 or MOD3)    <re>
```

*** DEFAULT VALUE SET FOR COMMON DATA ***

*** DEFAULT VALUE SET FOR MODE-1 DATA ***

<A message accepted user's choice is represented.>

(j) *** PLEASE KEY IN COMMAND ***

(k) ? UPDATEC <re>

(l) *** PLEASE KEY IN UPDATE STRING (UPDATEC) ***

(m)

(n) ? ENDU <re>

*** PLEASE KEY IN COMMAND ***

(o) ? UPDATE1 <re>

**** PLEASE KEY IN UPDATE STRING (UPDATE1) ***

(p)

? ENDU <re>

*** PLEASE KEY IN COMMAND ***

(q) ? LISTC <re>

(r) ? LIST1 <re>

*** PLEASE KEY IN COMMAND ***

(s) ? RUN1 <re>

(t)

*** PLEASE KEY IN COMMAND ***

(u) ? NLPW <re>

*** PLOTTING COMMON DATA ARE WRITTEN IN THE FILE ***

*** PLOTTING MODE-1 DATA ARE WRITTEN IN THE FILE ***

*** PLEASE KEY IN COMMAND ***

(v) ? HELP <re>

*** PLEASE KEY IN COMMAND ***

(w) ? TIME <re>

*** PLEASE KEY IN COMMAND ***

(x) ? END <re>

(y) *** PLEASE KEY IN MODAL OPTION ***

(z) ? MOD2 (or MOD1 or MOD3) <re>

*** DEFAULT VALUE SET FOR COMMON DATA ***

*** DEFAULT VALUE SET FOR MODE-2 DATA ***

*** PLEASE KEY IN COMMAND ***

(α) ? BYE <re>

(β)

READY

(γ) LOGOFF <re>

Descriptions of the input procedures are as follows:

(a) ; Open the user's session

(b) ; Assign logical units for PTSLIB[4] on TSS.

(c) ; DATA-POOL is allocated on logical unit FT91F001.

(d) ; Allocate another DATA-POOL in which plotting data are stored.

(e) ; The logical unit F50F001 must be assigned as work file to store the executing data for NLP.

(f) ; The logical units (shown in Table 4.1.1) must be assigned as temporary files.

(g) ; Enter into VISUAL.

(h) ; Represent the open message of PTS screen.

(i) ; Select plotting MODE.

(j) ; The message urges a user to key in command.

(k) ; Command to update the common executing variables.

(l) ; Urge to key in the updating terms.

(m) ; Key in the updating terms for common variables in succession. (See section 2.6 in detai)

(n) ; Terminate the updating mode for common variables.

(o) ; Command to update the executing variables for MODE-1.

(p) ; Key in the updating terms for MODE-1 in succession.

(q) ; Command to display the executing values for common variables.

(r) ; Command to display the executing values for MODE-1 variables.

(s) ; Command to execute the plotting for MODE-1.

(t) ; Plot graph.

(u) ; Command to store the executing values in a work file for NLP.

(v) ; Command to display the functions of all Commands.

(w) ; Command to display used CPU time.

(x) ; Command to select the other MODE.

(y) ; Same as (i).

(z) ; Command to execute the plotting for MODE-2.

(α) ; Command to terminate VISUAL.

(β) ; Display a farewell message.

(γ) ; Close the user's session.

Table 4.1.1 Input/output file assignment for VISUAL

	Logical unit No.	Comment
COMMON	FT91 | FT93	Input of the DATA-POOL file
	FT50	Output of the executing data Input of the executing data for batch job
	FT05	Input
	FT06	Print output
MODE-1	FT41 | FT45	Input of the experimental data file.
	from FT10	Scratch file to plot matrix data (EGRP - INFX - Mat. No. - INS (N2N or ELA)) Allocate number for node structure from FT10
MODE-2	FT01	Scratch file
	FT96	Scratch file
	FT97	Scratch file
	FT98	Scratch file
	FT99	Scratch file
MODE-3	FT01	Output of the plotting data
	FT02	Input of the plotting data
	FT10	Scratch file to plot matrix data (EGRP - INFX - Mat. No. - INS (N2N or ELA))

4.2 Job Control Language for Batch Job

Job control language of VISUAL for NLP or COM on FACCM M-380, at JAERI is as follow:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
    //JCLG JOB
    //EXEC JCLG
    //SYSIN DD DATA,DLM='++'
(a) //JUSER *****************************
(b)   C.4 T.n1 I.n2 W.n3 OPN GRP
(c)  OPTP PASSWORD=????,NOTIFY=J$$$$
(d) //EXEC LMGO,LM='J9338.VISUALNL'
(e) // EXPAND GRNLP
    // EXPAND DISKTO, DDN=FT91F001, DSN='J$$$$.AAAA', Q='.DATA'
     |
(f)  |
     |
(g) // EXPAND DISKTO, DDN=FT50F001, DSN='J$$$$.DATA'. Q='.DATA'
     |
(h)  |
     |
    //SYSIN DD *
(i) RUN1
     |
(j)  |
     |
(k) BYE
(1) /*
    ++
    //
```

Descriptions of the JCL cards of VISUAL for NLP or COM are as follows:

(a) ; User's card of the job.

(b) ; System's resources of the job. Usually, C.4(1536 KBytes) and GRP must be set for NLP and C35 for COM.

(c) ; Description of optional parameters. Usually, PASSWORD must be written.

(d) ; Specify the load module name to execute VISUAL.

(e) ; Assign the graphic library for NLP.
In the case of COM, GCOM35 is assigned.

(f) ; Allocate the data set of DATA-POOL in which plotting data are stored.

(g) ; Allocate the data set of work file in which executing data are stored.

(h) ; Allocate the logical unit according to the respective MODE.

(i) ; Input data to execute MODE-1.

(j) ; Specify the RUN (RUN1, RUN2 and RUN3) command in the order of plotting figure.

(k) ; Terminate to execute VISUAL.

(l) ; Indicate the end of input data.

A Sample is shown in Fig. 4.2.1. When a user will execute the commands shown in section 2.1 on the batch job, the user may input the procedures from (i)-modal option to (α)-terminate command shown in section 4.1. Example is shown in Fig. 4.2.2. In this case, if XN and YN are greater than 0.0, comment and sub title are plotted on these coordinates and if less than 0.0, they are plotted on the absolute coordinates in the next page.

```
----*----1----*----2----*----3----*----4----*----5----*----6----*

//JCLG JOB
// EXEC JCLG
//SYSIN DD DATA,DLM='++'
// JUSER [redacted]
        T.2 C.4 W.4 I.3 OPN GRP
 OPTP PASSWORD=[redacted],NOTIFY=[redacted]
// EXEC LMGO,LM='J9338.VISUALNL'
// EXPAND GRNLP
// EXPAND DISKTO,DDN=FT91F001,DSN='J3679.RADHDP06',Q='.DATA'
// EXPAND DISKTO,DDN=FT50F001,DSN='J9338.VWORK1',Q='.DATA'
//SYSIN DD *
RUN1
LISTC
LIST1
TIME
RUN1
TIME
LISTC
LIST1
BYE
/*
++
//
```

Fig. 4.2.1 Sample JCL of batch job for NLP with commands

```
----*----1----*----2----*----3----*----4----*----5----*----6----*

//JCLG JOB
// EXEC JCLG
//SYSIN DD DATA,DLM='++'
// JUSER
        T.1 C.4 W.4 I.3 OPN GRP NLP
 OPTP PASSWORD=????,NOTIFY=JXXXX
// EXEC LMGO,LM='J9338.VISUALNL'
// EXPAND GRNLP
// EXPAND DISKTO,DDN=FT91F001,DSN='JXXXX.$$$$',Q='.DATA'
//SYSIN DD *
MOD1
UPDATEC
XTITL=$N?EUTRON $E?NERGY $(?E$V);
YTITL=$C?ROSS $S?ECTION $(?BARN/SR/$M?E$V);
UNIT(1)=91;UNIT(2)=91;UNIT(3)=91;
NODE(1)=EXP      0000       92;
NODE(2)=102G;
NODE(3)=102G     DDX      9204       33;
CODE(1)=0 7 7 7 7;
CODE(2)=0 1 2 3 4;
ENDU
UPDATE1
NPL=5;
COMT=$DDX ?AT $139 ?DEGREE;
SUBT(1)= CALCULATED TOTAL VALUE;
SUBT(2)= CALCULATED INELA. VALUE;
SUBT(3)= CALCULATED INS. CONT. VALUE;
SUBT(4)= CALCULATED (N.$2?N) VALUE;
SUBT(5)= EXPERIMENTAL DATA $N?0.$499;
TPO=H;ECODE(1)=906;SSIZE=3.0;YSCALE=1;
XN=-100.0;
YN=-180.0;
ENDU
RUN1
LISTC
LIST1
TIME
BYE
/*
++
//
```

Fig. 4.2.2 Sample JCL of batch job for NLP with executing data

5. Sample Input and Output

In this chapter, the samples of inputs and outputs of VISUAL are described in detail. User may as well refers the input data in this chapter, because the input patterns of the common executing variables are different from each other.

Usually UNIT(n) means the logical unit number of the DATA-POOL in which the plotting data are stored. (See section 3.1 in detail) The data which are stored in the last node name of the node structure assigned by NODE(n) are read and set into the variable array in the subroutine DACNTL and the plotting data are stored with the code number assigned by CODE(n) and stored to the plotting module.

The sample inputs and outputs are described for each MODE. User may as well refer Appendix E about data form and record format of DATA-POOL.

5.1 MODE-1

(i) ULTX-Mat.no.-TMPi-SIGj

This form contains the ultra-fine energy group cross section. Sample input to access DATA-POOL is as follows:

```
     ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=ULTX;
(2): UNIT(2)=91;NODE(2)=ULTX     1190     TMP1     SIG1;
(3): UNIT(3)=91;NODE(3)=ULTX     1192     TMP1     SIG1;
(4): CODE(1)=-1 -1;
(5): CODE(2)=-4 -4;
(6): CODE(3)=-4 -4;
```

where

(1): UNIT(1)=91 means that DATA-POOL allocated by logical unit number 91 is used in the job and NODE(1)=ULTX means that the ultra-fine energy structure and the informations are read in DATA-POOL.

(2): The sentence indicates that the DATA-POOL allocated by logical unit number 91 is assigned and the ultra-fine group cross sections of material number 1190 (Ni) and the informations are read by using the node structure assigned by NODE(2) in DATA-POOL.

(3): The ultra-fine group cross sections of material number 1192 (Fe) and the informations of the node structure assigned by NODE(3) are read as same as (2) in order to compare the data of 1190 (Ni) with the data of 1192 (Fe).

(4): The code number of ultra-fine energy group structure is 1 and the energy group structures of the node structures assigned by NODE(2) and NODE(3) are the same. If the code number is greater than 0, X-axis data are scaled with the energy structures, and less than 0, they are scaled with the number of the energy group.

The storage address number is calculated as follows: The number of the sub-data sets stored in the level 1 assigned by NODE(1)=ULTX is 1 and stored in the level 4 assigned by NODE(2) is (2+2×MTMA×2). According to the record format shown in Appendix E.3.(a), the number of the sub-data sets is counted with n of PREADn. Where if MTMAX2 equals 4 and the energy group structure of NODE(3) is different from NODE(2), the second code number assigned by CODE(1) is 12 as follows:

FEGRP	MTYPE2	W	NDATA	GCS	FEGRP	
1	2	3	2 × 4		12	code number
			Repeat MTMAX2 times			

(5): The absolute number assigned by CODE(2) is means the reaction type number equivalent to the material number defined in ENDF/B format. (See Table 5.1.1) If the number is greater than 0, the cross sections are compared with the reaction types in a same node structure, less than 0, they are comared with node structures (Mat. no., TMPn or SIGn) in a same reaction type.

(6): In the plotting ultra-fine group cross sections, -4 must be set to CODE(3).

The node structure and the record format are shown in Appendix E.2.(a) and E.3.(a). Sample input and output for the data form are shown in Figs. 5.1.1 and 5.1.2 and the figure zoomed between 2500 and 3000 energy groups is shown in Fig. 5.1.4 and the input data are shown in Fig. 5.1.3.

(ii) **EGRP-INFX-Mat.no.-SMT**

This form contains the infinitely diluted cross sections with the fine-group structure. Sample input to access DATA-POOL is as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP;
(2): UNIT(2)=91;NODE(2)=EGRP    INFX    1192    SMT;
(3): CODE(1)=1 1;
(4): CODE(2)=5 5;
(5): CODE(3)=10 10;
(6): CODE(4)=-1 -8;
```

where

(1): UNIT(1)=91 is same as the ULTX data form and NODE(1)=EGRP means that the fine-energy group structure and the informations are read in DATA-POOL allocated by logical unit number 91.

(2): The sentence indicates that the DATA-POOL allocated by logical unit number 91 is assigned and the smooth cross sections of 1192 (Fe) and the informations are read by using the node structure assigned by NODE(2) in DATA-POOL.

(3): The code number is same as the ULTX data form.

(4): The numbef of sub-data sets stored in the level 1 assigned by NODE(1)=EGRP is 1 (neutron or gamma-ray only) or 2 (both of them), and stored in the level 4 assigned by NODE(2) is 4 as shown in Appendix E.3.(b).
If neutron energy group is only stored in the level 1, the location number for the smooth cross sections is 5. The code number must be set to CODE(2).

(5): In the plotting smooth cross sections, 10 must be set in CODE(3) as the number of reactions types.

(6): The code number of CODE(4) indicates the reaction type as follow:

Number	-1	-2	-3	-4	-5
Type	total	capture	fission	ν	(n,p)
Number	-6	-7	-8	-9	-10
Type	(n,α)	(n,γ)	elastic	inelastic	(n,2n)

In this sample, total and elastic cross sections are plotted in a graph. The node structure and the record format are shown in Appendix E.2.(b) and E.3.(b). Sample input and output compared with the reaction types are shown in Figs. 5.1.5 and 5.1.6 and compared with the materials are shown in Figs. 5.1.7 and 5.1.8. The figure zoomed between 10^3 and 10^7 (eV) neutron energy is shown in Fig. 5.1.10 and the input data are shown in Fig. 5.1.9.

(iii) **EGRP-INFX-Mat.no.-FTB**

This form contains the self-shielding factors of each σ_0 values. Sample input to access DATA-POOL is as follows:

```
     ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP;
(2): UNIT(2)=91;NODE(2)=EGRP    INFX     1192     FTB;
(3): UNIT(3)=91;NODE(3)=EGRP    INFX     1190     FRB;
(4): CODE(1)=1 1;
(5): CODE(2)=6 13;
(6): CODE(3)=6 6;
(7): CODE(4)=-1 -1;
```

where

(1): UNIT(1)=91 is same as the ULTX data form and NODE(1)=EGRP means same as the SMT data form.

(2): The sentence indicates that DATA-POOL allocated by logical unit number 91 is assigned and the sub-data sets and the informations of the material number 1192 (Fe) in the level 4 are read by using the node structure assigned by NODE(2).

(3): The sentence indicates that DATA-POOL allocated by logical unit number 91 is assigned and the sub-data sets and the informations of the material number 1190 (Ni) in the level 4 are read by using the node structure assigned by NODE(3).

(4): The code number is as same as the ULTX data form.

(5): The number of sub-data sets stored in the level 1 assigned by NODE(1)=EGRP is 1 (neutron or gamma-ray only) or 2 (both of them) and stored in the level 4 assigned by NODE(2) is (3+4×NTMP), as shown in Appendix E.3.(c). If neutron and gamma-ray energy groups are stored in the level 1 and NTMP equals 1, the location number of the F-table for total reaction of Fe is 6. The code number 13 means the location of the F-table for total reaction of Ni.

(6): The code number means the number of σ_0 values.

(7): The absolute value means the location of the number of σ_0 values for plotting. The number must be less than 0.

The node structure and the record format are shown in Appendix E.2.(c) and E.3.(c) in detail. Sample input and output are shown in Figs. 5.1.11 and 5.1.12.

(iv) **EGRP-INFX-Mat.no.-ELA**

This form contains the scattering matrix of elastic reaction. Sample input to access DATA-POOL is as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP    INFX     1190     ELA;
(2): UNIT(2)=91;NODE(2)=EGRP    INFX     1192     ELA;
(3): CODE(1)=8 8;
(4): CODE(2)=1 1;
(5): CODE(3)=30 30;
(6): CODE(4)=20 20;
(7): CODE(5)=10 10;
```

where

(1): UNIT(1)=91 means that DATA-POOL allocated by logical unit number 91 is assigned and the sub-data sets and the informations of the material number 1190 (Ni) in the level 4 are read by using the node structure assigned by NODE(1).

(2): UNIT(2)=91 means that DATA-POOL allocated by logical unit number 91 is assigned and the sub-data sets and the informations of the material number 1192 (Fe) in the level 4 are read by using the node structure assigned by NODE(2).

(3): The code number means the source group number of the scattering matrix of elastic reaction.

(4): The code number is fixed in CODE(2) for plotting the data.

(5): The code number means the sink group number of the scattering matrix of elastic reaction. Therefore, the group-to-group cross section of elastic reaction from 8 group assigned by CODE(1) to 30 group assigned by CODE(3) is plotted in the sample.

(6): The code number must be greater than the maximum number of angular points.

(7): The code number must be greater than the number of lines.

In the plotting of the data form, scratch files must be allocated from logical unit 10 as same as the number of lines. In this sample, two scratch files of logical units 10 and 11 must be allocated. The node structure and the record format are shown in Appendix E.2.(d) and E.3.(d) in detail. Sample input and output are shown in Figs.5.1.13 and 5.1.14.

(v) **EGRP-INFX-Mat.no.-INS**

This form contains the scattering matrix of inelastic reaction. Smaple input to access DATA-POOL is as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP    INFX    1192    INS;
(2): CODE(1)=18 19;
(3): CODE(2)= 1 1;
(4): CODE(3)=20 20;
(5): CODE(4)=20 20;
(6): CODE(5)=10 10;
```

where

(1): The input data is same as the ELA data form.

(2): The code number means the source group number of the scattering matrix of inelastic reaction.

(3): The input data is same as the ELA data form.

(4): The code number means the sink group number of the scattering matrix of inelastic reaction. Therefore, the group-to-group cross section of inelastic reaction from 18 and 19 groups assigned by CODE(1) to 20 group assigned by CODE(3) are plotted in the sample.

(5): The input data is same as the ELA data form.

(6): The input data is same as the ELA data form.

In the plotting of the data form, the number of scratch files is same as the ELA data form. The node structure and the record format in Appendix E.2.(e) and E.3.(e) in detail. Sample input and output are shown in Figs.5.1.15 and 5.1.16.

(vi) **EGRP-INFX-Mat.no.-N2N**

This form contains the scattering matrix of (n,2n) reaction. Sample input to access DATA-POOL is as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP    INFX    1192    N2N;
(2): CODE(1)=18 19;
(3): CODE(2)=1 1;
(4): CODE(3)=20 20;
(5): CODE(4)=20 20;
(6): CODE(5)=10 10;
```

where

(1): The input data is same as the ELA data form.

(2): The code number means the source group number of the scattering matrix of (n,2n) reaction.

(3): The input data is same as the ELA data form.

(4): The code number means the sink group number of the scattering matrix of (n,2n) reaction. Therefore, the group-to-group cross section of (n,2n) reaction from 18 to 19 groups assigned by CODE(1) to 20 group assigned by CODE(3) are plotted in the sample.

(5): The input data is same as the ELA data form.

(6): The input data is same as the ELA data form.

In the plotting of the data form, the number of scratch files is same as the ELA data form. The node structure and the record format are shown in Appendix E.2.(f) and E.3.(f). Sample input and output are shown in Figs.5.1.17 and 5.1.18.

(vii) **EGRP-INFX-Mat.no.-H+D**

This form contains the energy deposition factor and atomic displacement cross sections. Sample input to access DATA-POOL is as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP;
(2): UNIT(2)=91;NODE(2)=EGRP    INFX    1192    H+D;
(3): CODE(1)=1 1;
(4): CODE(2)=5 5;
```

(5): CODE(3)=13 13;

(6): CODE(4)=-5 -6;

where

(1): The input data is same as the SMT data form.

(2): The sentence indicates that DATA-POOL allocated by logical unit number 91 is assigned, and the energy deposition factor, atomic displacement cross section and the informations are read by using the node structure assigned by NODE(2) in DATA-POOL.

(3): The code number is same as the ULTX data form.

(4): The code number is same as the SMT data form.

(5): In the plotting the atomic displacement cross sections, 13 must be set in CODE(3) as the number of the reaction types.

(6): The code number of CODE(4) indicates the reaction types shown below:

number	reaction type	number	reaction type
-1	H - fission	-8	D - (n,p)
-2	H - (n,p)	-9	D - (n,α)
-3	H - (n,α)	-10	D - (n,γ)
-4	H - (n,γ)	-11	D - elastic
-5	H - elastic	-12	D - inelastic
-6	H - inelastic	-13	D - (n,2n)
-7	H - (n,2n)		

In the sample, heat generation cross sections of elastic and inelastic reactions are plotted in a graph. The node structure and the record format are shown in Appendix E.2.(g) and E.3.(g). Sample input and output for heat generation are shown in Figs. 5.1.19 and 5.1.20, and for atomic displacement are shown in Figs. 5.1.19 and 5.1.20, and for atomic displacement are shown in Figs. 5.1.21 and 5.1.22.

(viii) **EGRP-SGRX-Mat.no.-Ncode**

This form contains the secondary gamma-ray production cross sections of each reaction. Sample input to access DATA-POOL is as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP;
(2): unit(2)=91;NODE(2)=EGRP    SGRX    1272    303;
```

(3): UNIT(3)=92;NODE(3)=EGRP SGRX 1269 193;
(4): CODE(1)=-1 -1;
(5): CODE(2)=3 6;
(6): CODE(3)=-1 -1;
(7): CODE(4)=n1 n2;

where

(1): The input data is same as the SMT data form.

(2): The input data indicate that DATA-POOL allocated by logical unit number 91 is assigned, and the neutron interaction cross sections, the yields, the probabilities and the informations of the material number 1272 (Li) are read by using the node structure assigned by NODE(2) in DATA-POOL.

(3): The input data indicate that DATA-POOL allocated by logical unit number 92 is assigned, and the neutron interaction cross sections, the yields, the probabilities and the informations of the material number 1269 (H) are read by using the node structure assigned by NODE(3) in DATA-POOL.

(4): The code number is same as the ULTX data form.

(5): The number of the sub-data sets stored in the level 1 assigned by NODE(1) =EGRP is 1 (neutron or gamma-ray only) or 2 (both of them) and stored in the level 4 assigned by NODE(2) or NODE(3) is 3 as shown in Appendix E.3.(h), because the number of sub-data sets is counted with n of PREADn.
If the neutron energy group and the gamma-ray energy group are stored in the level 1, the location number of the neutron interaction cross sections, the yields, and the probabilities assigned by NODE(2) are 3, 4 and 5. These code numbers must be set to CODE(2). In this sample, the neutron interaction cross sections of Li and H are plotted in a graph.

(6): In the plotting of SGRX data form, the number must be set fixed in CODE(3).

(7): The code number must be set to plot the probability. When the number is greater than 0, it indicates the fixed neutron energy groups and the probabilities are plotted by the gamma-ray energy structure and less than 0, it indicates the fixed gamma-ray energy groups and the probabilities are plotted by the neutron energy structure.

The node structure and the record format are shown in Appendix E.2.(h) and E.3.(h). Sample input and output of the neutron interaction cross sections are shown in Figs. 5.1.23 and 5.1.24, the yields are shown in Figs. 5.1.25 and 5.1.26.

(ix) **EGRP-FXSN-Mat.id.**

This form contains the effective macroscopic cross sections. Sample input to access DATA-POOL is as follows:

```
     ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP;
(2): UNIT(2)=91;NODE(2)=EGRP     FX16     OFEE;
(3): UNIT(3)=91;NODE(3)=SB28;
(4): UNIT(4)=91;NODE(4)=SB28     FX16     FEE2;
(5): CODE(1)=1 206;
(6): CODE(2)=6 211;
(7): CODE(3)=-3 -3;
(8): CODE(4)=100 28;
```

where

(1): The input data is same as the SMT data form.

(2): The input data indicate that DATA-POOL allocated by logical unit number 91 is assigned, and the Sn macroscopic cross sections and the informations are read by using the node structure assigned by NODE(2) in DATA-POOL.

(3): The sentence indicates that DATA-POOL allocated by logical unit number 91 is assigned, and the few-energy group structure and the informations are read in DATA-POOL.

(4): The sentence indicates that DATA-POOL allocated by logical unit number 91 is assigned, and the few-group macroscopic cross sections and the informations are read by using the node structure assigned by NODE(4) in DATA-POOL.

(5): The code number is same as the ULTX data form.

(6): The number of the sub-data sets stored in the level 1 assigned by NODE(1) or NODE(3) is 1 (neutron or gamma-ray only) or 2 (both of them) and stored in the level 4 assigned by NODE(2) or NODE(4) is 4+2×(ING+IGG) according to the record format shown in Appendix E.3.(i), because the number of sub-data sets is counted with n of PREADn. Where ING means neutron energy group and IGG means gamma-ray energy group.

If only the neutron energy group structure is stored in the level 1, the location number of fine-group cross sections assigned by NODE(2) is 6. The location number of few-group cross sections assigned by NODE (4) is (11+2×ING).

(7): In the plotting the data of FXSN data form, the number must be set to CODE(3).

(8): The code number means the group number of neutron or gamma-ray.

In the sample, the 100- and 28- groups cross sections of total reaction are plotted in a graph. In the data form, the node name stored the energy group structure corresponded to the FXSN data must be input in the order of odd number. The node structure and the record format are shown in Appendix E.2.(i) and E.3.(i). Sample input and output are shown in Figs. 5.1.27 and 5.1.28.

(x) EGRP-SELF-Mat.id.-Mat.no.

This form contains the self-shielding factors of each nuclide in the material defined by the Mat.id. in the SELF data form. Sample input to access DATA-POOL is as follows:

```
     ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP;
(2): UNIT(2)=91;NODE(2)=EGRP    SELF    1276    1276;
(3): UNIT(3)=92;NODE(3)=EGRP    SELF    1192    1192;
(4): CODE(1)=1 1;
(5): CODE(2)=3 7;
```

where

(1): The input data is same as the SMT data form.

(2): The sentence indicates that DATA-POOL allocated by logical unit number 91 is assigned, and the self-shielding factors of each nuclide in the material 1276 (O) are read by using the node structure assigned by NODE(2) in DATA-POOL.

(3): The sentence indicates that DATA-POOL allocated by logical unit mumber 92 is assigned, and the self-shielding factors of each nuclide in the material 1192 (Fe) are read by using the node structure assigned by NODE(3) in DATA-POOL.

(4): The code number is same as the ULTX data form.

(5): The number of the sub-data sets stored in the level 1 assigned by NODE(1)

=EGRP is 1 (neutron or gamma-ray only) or 2(both of them), and stored in the level 4 assigned by NODE(2) or NODE(3) is 4 as shown in Appendix E.3.(j), because the number of the sub-data sets is counted with n of PREADn. If the neutron and gamma-ray energy grops are stored in the level 1, the location numbers of the self-shielding factors of total, elastic, fission and capture reactions assigned by NODE(2) are 3,4,5 and 6. These code numbers must be set to CODE(2).

In this sample, the self-shielding factors of total reaction in the materials O and Fe are plotted in a graph. The node structure and the record format are shown in Appendix E.2.(j) and E.3.(j). Sample input and output are shown in Figs. 5.1.29 and 5.1.30.

(xi) **EGRP-Id.-SFX0 or SFX1** (calculated by DIAC)[1)]

This form contains one dimensional foward scalar flux or adjoint scalar flux calculated by DIAC. Sample input to access DATA-POOL is as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP;
(2): UNIT(2)=91;NODE(2)=EGRP    TEST;
(3): UNIT(3)=91;NODE(3)=EGRP    TEST    SFXO;
(4): CODE(1)=n1;CODE(2)=n2;
```

where

(1): The input data is same as the SMT data form.

(2): The data indicate that DATA-POOL allocated by logical unit number 91 is assigned, and the mesh distance from the center, the region number and their material number are read by using the node structure assigned by NODE(2) in DATA-POOL.

(3): The data indicate that DATA-POOL allocated by logical unit number 91 is assigned, and the foward scalar flux is read by using the node structure assigned by NODE(3) in DATA-POOL.

(4): The code number shows the option of plotting type. If n1 equals 1, the flux is plotted by the energy structure, equals -1 they are plotted by the energy group number at the mesh point n2 assigned by CODE(2). If n1 equals 2, they are plotted by the mesh distance from the center for the energy group number n2 assigned by CODE(2). In this case, user must not input the data (1).

The node structure and the record format are shown in Appendix E.2.(k) and E.3.(k). Sample inputs and outputs are shown in Figs. 5.1.31, 5.1.32, 5.1.33 and 5.1.34.

(xii) **EGRP-Id.-SFX2** or **SFX3** (calculated by ESPRIT)[1)]

This form contains the two dimensional foward scalar flux or adjoint scaler flux calculated by ESPRIT. Sample input to access DATA-POOL is as follows:

```
++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP1
(2): UNIT(2)=91;NODE(2)=EGRP     TEST;
(3): UNIT(3)=91;NODE(3)=EGRP     TEST     SFX2;
(4): CODE(1)=n1;CODE(2)=n2;CODE(3)=03;
```

where

(1): The input data is same as the SMT data form.

(2): The input data is same as the (xi)-(2) data form.

(3): The input data is same as the (xi)-(3) data form.

(4): The code number shows the option of plotting type. If n1 equals 1, the flux is plotted by the energy structure, equals -1, they are plotted by the energy group number at the radial mesh point n2 and the axial mesh point n3 assigned by CODE(2) and CODE(3). If n1 equals 2, they are plotted by the axial mesh distance at the radial mesh point n2 assigned by OCDE(2) for the energy group number n3 assigned by CODE(3). If n1 equals 3, they are plotted by the radial mesh distance at the axial mesh point n2 assigned by CODE(2) for the energy group number n3 assigned by CODE(3). In these cases, user must not input the data (1).

The node structure and the record format are shown in Appendix E.2.(1) and E.3.(1). Sample inputs and outputs are shown in Figs. 5.1.35, 5.1.36, 5.1.37, 5.1.38, 5.1.39 and 5.1.40.

Table 5.1.1 Identification number of reaction type in the ultra-fine group cross section.

Reaction type	Reaction I.D. No.
Total	1
Elastic scattering	2
Total inelastic scattering	4
Total (n,2n) scattering	16
Excited (n,2n) scattering	6-9 , 46-49
Fission	18
Neutrons per fission	452
(n,n'α) scattering	22
(n,n'3α) scattering	23
(n,2np) scattering	24
(n,n'p) scattering	28
Absorption	27
Inelastic discrete level	51-90
Inelastic continuum level	91
(n,γ)	102
(n,p)	103
(n,d)	104
(n,t)	105
(n,He)	106
(n,α)	107
(n,2α)	108

```
              <<< COMMON EXECUTING DATA >>>

=========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥U?LTRA-FINE ¥E?NERGY ¥G?ROUP
         : X-AXIS CAPTION
 >YTITLE = ¥C?ROSS ¥S?ECTION ( BARN )
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=ULTX
 >NODE(2)=ULTX      1192      TMP1      SIG1
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)= -1   0   0   0   0   0   0   0   0   0
 >CODE( 2)= -1   0   0   0   0   0   0   0   0   0
 >CODE( 3)= -4   0   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW      =220.00
         : X-AXIS LENGTH(MM)
 >YW      =160.00
         : Y-AXIS LENGTH(MM)

=========================================================

              <<< EXECUTING DATA FOR MODE-1 >>>


==================================================================

 >NPL     =  1       : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS   = A        : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA   =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA   = /        : TRANSFORM FORMAT OF THE DATA
 >COMP    =  1       : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT    = ¥T?OTAL AT 300(DEG.¥K) ENDF/B-IV
         : COMMENT FOR ALL DATA
 >SUBT( 1) = 1192 (¥F?E)
         : COMMENT FOR EACH DATA


---------*** PLOTTING TYPE OPTION ***----------------------

 >TPO     = L : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL  =   0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE   =    2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE   =    4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN      =       59.38: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN      =      224.19: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID    = 0        : OPTION FOR GRID LINE
 >XSCALE  = 0        : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE  = 1        : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE   = 0        : METHOD OF SCALING TYPE
 >XMIN    =     0.100E+01   : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX    =     0.382E+04   : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN    =     0.329E+00   : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX    =     0.905E+02   : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN   =     0.0         : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX   =     0.0         : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
==================================================================
```

Fig. 5.1.1 Input data of ULTX data form for Fig. 5.1.2

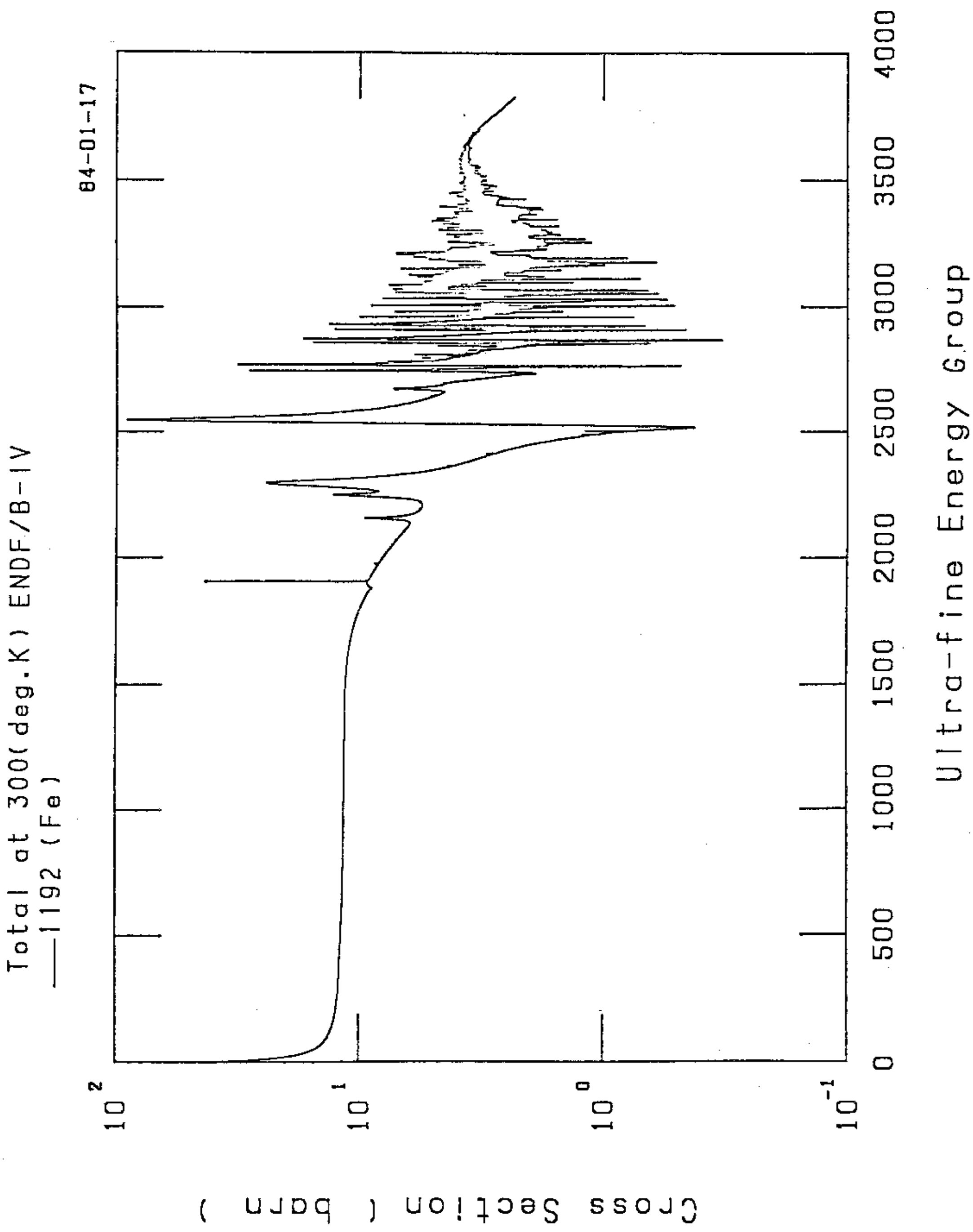


Fig. 5.1.2 Ultra-fine group cross section

```
                <<< COMMON EXECUTING DATA >>>

==========================================================

 >TITLE   =
          : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥U?LTRA-FINE ¥E?NERGY ¥G?ROUP
          : X-AXIS CAPTION
 >YTITLE = ¥C?ROSS ¥S?ECTION ( BARN )
          : Y-AXIS CAPTION
 >ZTITLE =
          : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
          : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
          : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=ULTX
 >NODE(2)=ULTX      1192      TMP1     SIG1
          : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)= -1   0   0   0   0   0   0   0   0   0
 >CODE( 2)= -1   0   0   0   0   0   0   0   0   0
 >CODE( 3)= -4   0   0   0   0   0   0   0   0   0
          : CODE NUMBER OF THE PLOTTING DATA
 >XW      =220.00
          : X-AXIS LENGTH(MM)
 >YW      =160.00
          : Y-AXIS LENGTH(MM)

==========================================================

               <<< EXECUTING DATA FOR MODE-1 >>>

===================================================================

>NPL     =  1      : NUMBER OF PLOTTING LINE IN A GRAPH
>TRANS   = A       : TRANSFORM TYPE OF THE PLOTTING DATA
>ALPHA   =    1.00 : CONSTANT NUMBER TO TRANSFORM
>OPERA   = /       : TRANSFORM FORMAT OF THE DATA
>COMP    =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
>COMT    = ¥T?OTAL AT 300(DEG.¥K) ENDF/B-IV
         : COMMENT FOR ALL DATA
>SUBT( 1) = 1192 (¥F?E)
         : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------

>TPO     = L : GRAPHIC FORM
>PAT     = S : GRAPHIC PATTERN
>SYMBOL =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA S
>ESIZE   =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
>SSIZE   =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
>XN      =      59.38: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
>YN      =     224.19: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
>GRID    = 0       : OPTION FOR GRID LINE
>XSCALE = 0        : SCALING OPTION FOR X-AXIS COORDINATE
>YSCALE = 1        : SCALING OPTION FOR Y-AXIS COORDINATE
>SCALE   = 1       : METHOD OF SCALING TYPE
>XMIN    =     0.251E+04  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
>XMAX    =     0.299E+04  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
>YMIN    =     0.329E+00  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
>YMAX    =     0.905E+02  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
>YDMIN   =     0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
>YDMAX   =     0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1

===================================================================
```

Fig. 5.1.3 Input data of ULTX data form for Fig. 5.1.4

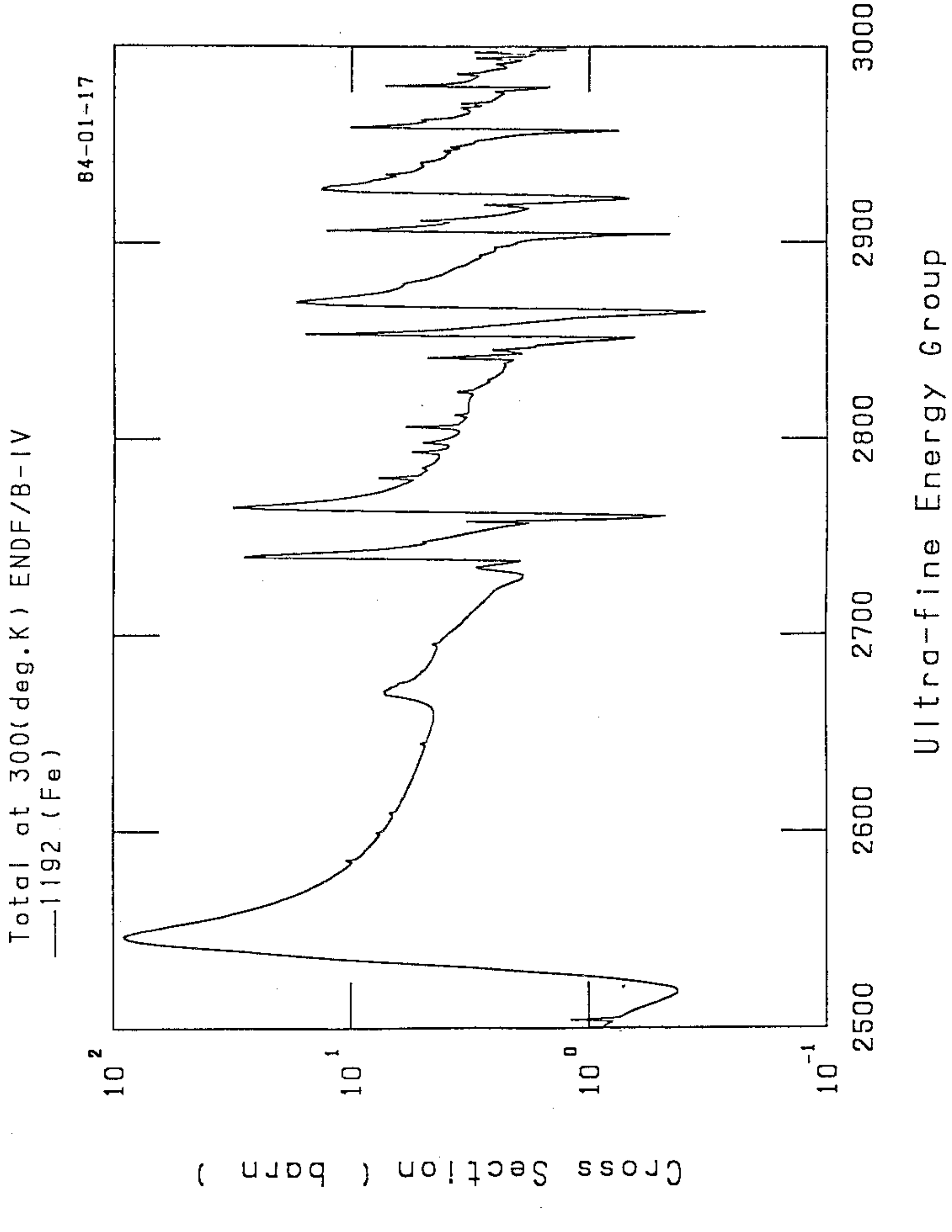


Fig. 5.1.4 Zooming figure of ULTX data form

```
            <<< COMMON EXECUTING DATA >>>

=========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥N?EUTRON ¥E?NERGY ¥( ?E¥V )
         : X-AXIS CAPTION
 >YTITLE = ¥C?ROSS ¥S?ECTION  ( BARN )
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=92
 >UNIT( 2)=92
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP
 >NODE(2)=EGRP      INFX      1192      SMT
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1   1   0   0   0   0   0   0   0   0
 >CODE( 2)=  6   6   0   0   0   0   0   0   0   0
 >CODE( 3)= 10  10   0   0   0   0   0   0   0   0
 >CODE( 4)= -1  -8   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =160.00
         : Y-AXIS LENGTH(MM)

=========================================================


            <<< EXECUTING DATA FOR MODE-1 >>>

==================================================================

 >NPL     =  2      : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS   = A       : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA   =   1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA   = /       : TRANSFORM FORMAT OF THE DATA
 >COMP    =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT    = ¥S?MOOTH CROSS SECTION OF 1192 (¥F?E)
         : COMMENT FOR ALL DATA
 >SUBT( 1) = TOTAL
 >SUBT( 2) = ELASTIC
         : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------

 >TPO     = H : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL  =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE   =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE   =   3.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN      =      68.96: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN      =     188.72: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID    = 0       : OPTION FOR GRID LINE
 >XSCALE  = 1       : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE  = 1       : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE   = 0       : METHOD OF SCALING TYPE
 >XMIN    =    0.352E-03  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX    =    0.165E+08  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN    =    0.650E+00  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX    =    0.382E+02  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN   =    0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX   =    0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
==================================================================
```

Fig. 5.1.5 Input data of SMT data form for Fig. 5.1.6

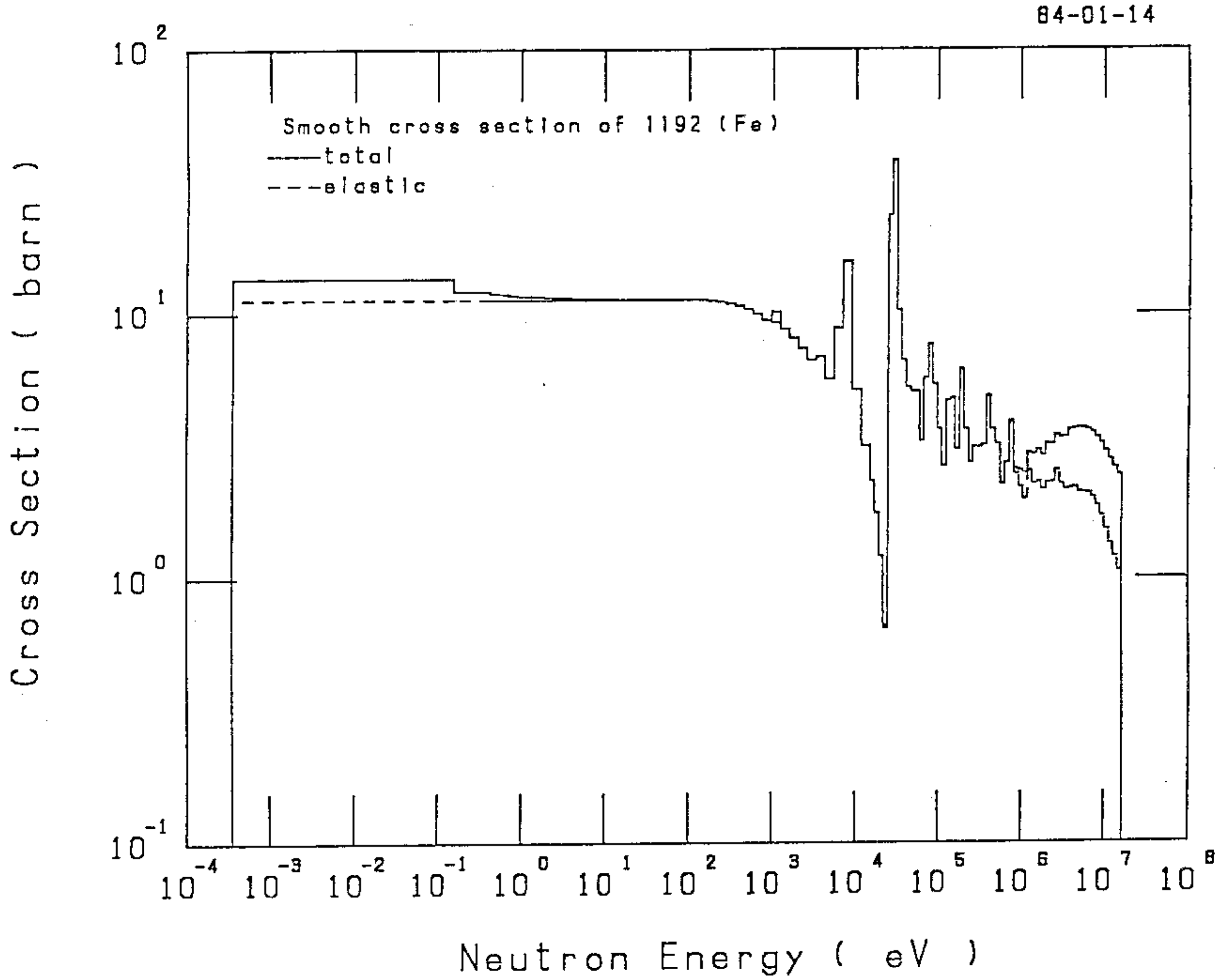


Fig. 5.1.6 Smooth cross section compared with reaction

```
          <<< COMMON EXECUTING DATA >>>

=============================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥N?EUTRON ¥E?NERGY ( E¥V )
         : X-AXIS CAPTION
 >YTITLE = ¥C?ROSS ¥S?ECTION  ( BARN )
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=92
 >UNIT( 2)=92
 >UNIT( 3)=92
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP
 >NODE(2)=EGRP      INFX      1192      SMT
 >NODE(3)=EGRP      INFX      1190      SMT
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1   1   0   0   0   0   0   0   0   0
 >CODE( 2)=  6  10   0   0   0   0   0   0   0   0
 >CODE( 3)= 10  10   0   0   0   0   0   0   0   0
 >CODE( 4)= -1  -1   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW      =200.00
         : X-AXIS LENGTH(MM)
 >YW      =160.00
         : Y-AXIS LENGTH(MM)

=============================================================

              <<< EXECUTING DATA FOR MODE-1 >>>

=======================================================================

 >NPL     =  2      : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS   = A       : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA   =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA   = /       : TRANSFORM FORMAT OF THE DATA
 >COMP    =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
          : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT    = ¥T?OTAL CROSS SECTION

          : COMMENT FOR ALL DATA
 >SUBT( 1) = ¥1192 (¥F?E)
 >SUBT( 2) = 1190 (¥N?I)
          : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------

 >TPO     = H : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL  =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
           : SYMBOL CODE OF THE CALCULATION DATA
           : SYMBOL CODE OF THE EXPERIMENTAL DATA
           : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE   =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE   =   3.50 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN      =      68.25: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN      =     113.53: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID    = 0         : OPTION FOR GRID LINE
 >XSCALE  = 1         : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE  = 1         : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE   = 0         : METHOD OF SCALING TYPE
 >XMIN    =     0.352E-03  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX    =     0.165E+08  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN    =     0.665E+00  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX    =     0.966E+02  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN   =     0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX   =     0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
=======================================================================
```

Fig. 5.1.7 Input data of SMT data form for Fig. 5.1.8

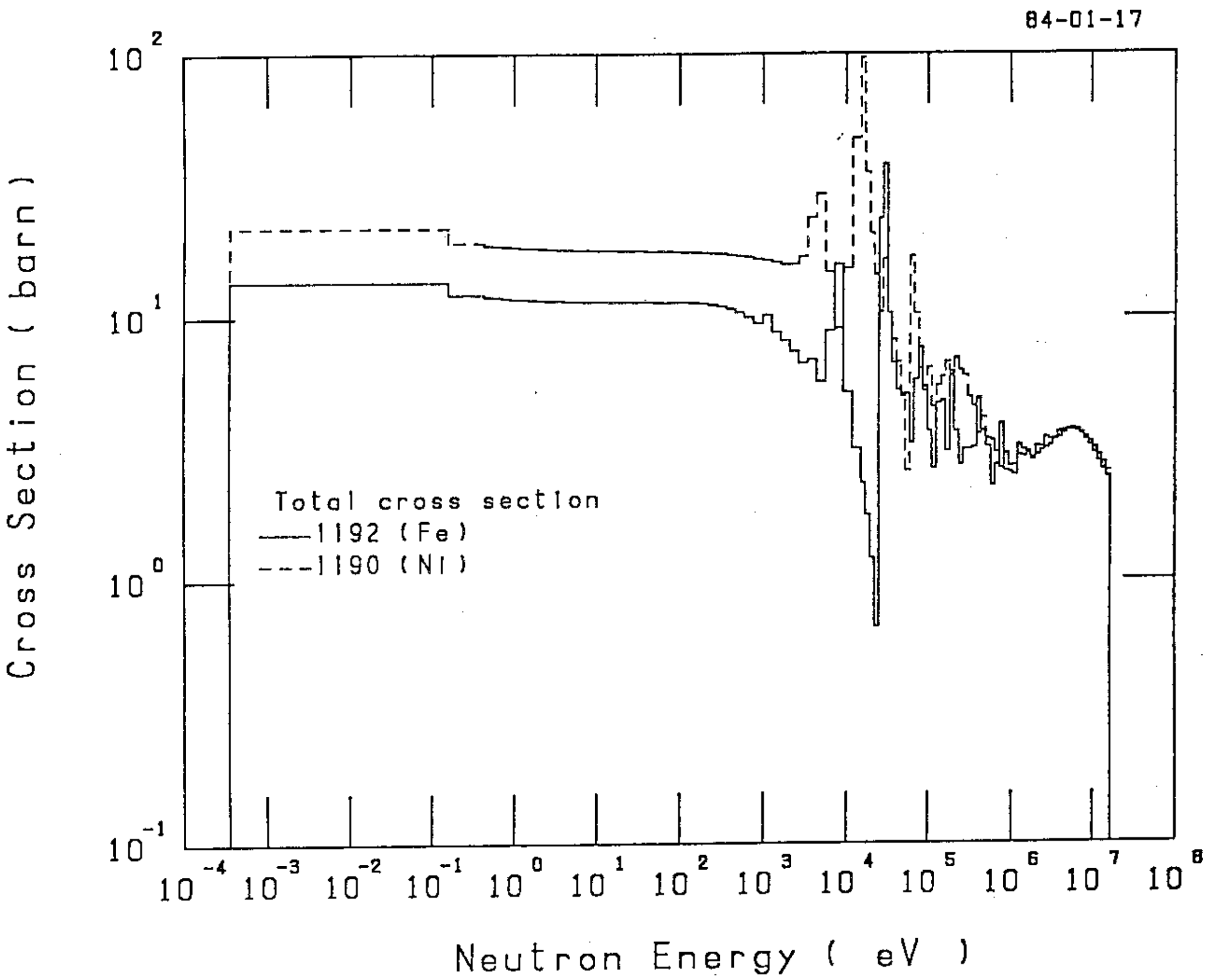


Fig. 5.1.8 Smooth cross section compared with material

```
               <<< COMMON EXECUTING DATA >>>

==========================================================

 >TITLE   =
          : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥N?EUTRON ¥E?NERGY ( E¥V )
          : X-AXIS CAPTION
 >YTITLE = ¥C?ROSS ¥S?ECTION ( BARN )
          : Y-AXIS CAPTION
 >ZTITLE =
          : Z-AXIS CAPTION
 >UNIT( 1)=92
 >UNIT( 2)=92
 >UNIT( 3)=92
          : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
          : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP
 >NODE(2)=EGRP      INFX      1192      SMT
 >NODE(3)=EGRP      INFX      1190      SMT
          : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1   1   0   0   0   0   0   0   0   0
 >CODE( 2)=  6  10   0   0   0   0   0   0   0   0
 >CODE( 3)= 10  10   0   0   0   0   0   0   0   0
 >CODE( 4)= -1  -1   0   0   0   0   0   0   0   0
          : CODE NUMBER OF THE PLOTTING DATA
 >XW      =200.00
          : X-AXIS LENGTH(MM)
 >YW      =160.00
          : Y-AXIS LENGTH(MM)

==========================================================

               <<< EXECUTING DATA FOR MODE-1 >>>

==================================================================

 >NPL    =  2      : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS  = A       : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA  =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA  = /       : TRANSFORM FORMAT OF THE DATA
 >COMP   =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
          : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT   = ¥T?OTAL CROSS SECTION
          : COMMENT FOR ALL DATA
 >SUBT( 1) = ¥1192 (¥F?E)
 >SUBT( 2) = 1190 (¥N?I)
          : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------

 >TPO     = H : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
           : SYMBOL CODE OF THE CALCULATION DATA
           : SYMBOL CODE OF THE EXPERIMENTAL DATA
           : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE  =    2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE  =    3.50 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN     =      149.12: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN     =      182.34: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID    = 0       : OPTION FOR GRID LINE
 >XSCALE = 1        : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE = 1        : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE   = 1       : METHOD OF SCALING TYPE
 >XMIN   =     0.100E+04  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX   =     0.100E+07  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN   =     0.665E+00  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX   =     0.966E+02  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN  =     0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX  =     0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1

==================================================================
```

Fig. 5.1.9 Input data of SMT data form for Fig. 5.1.10

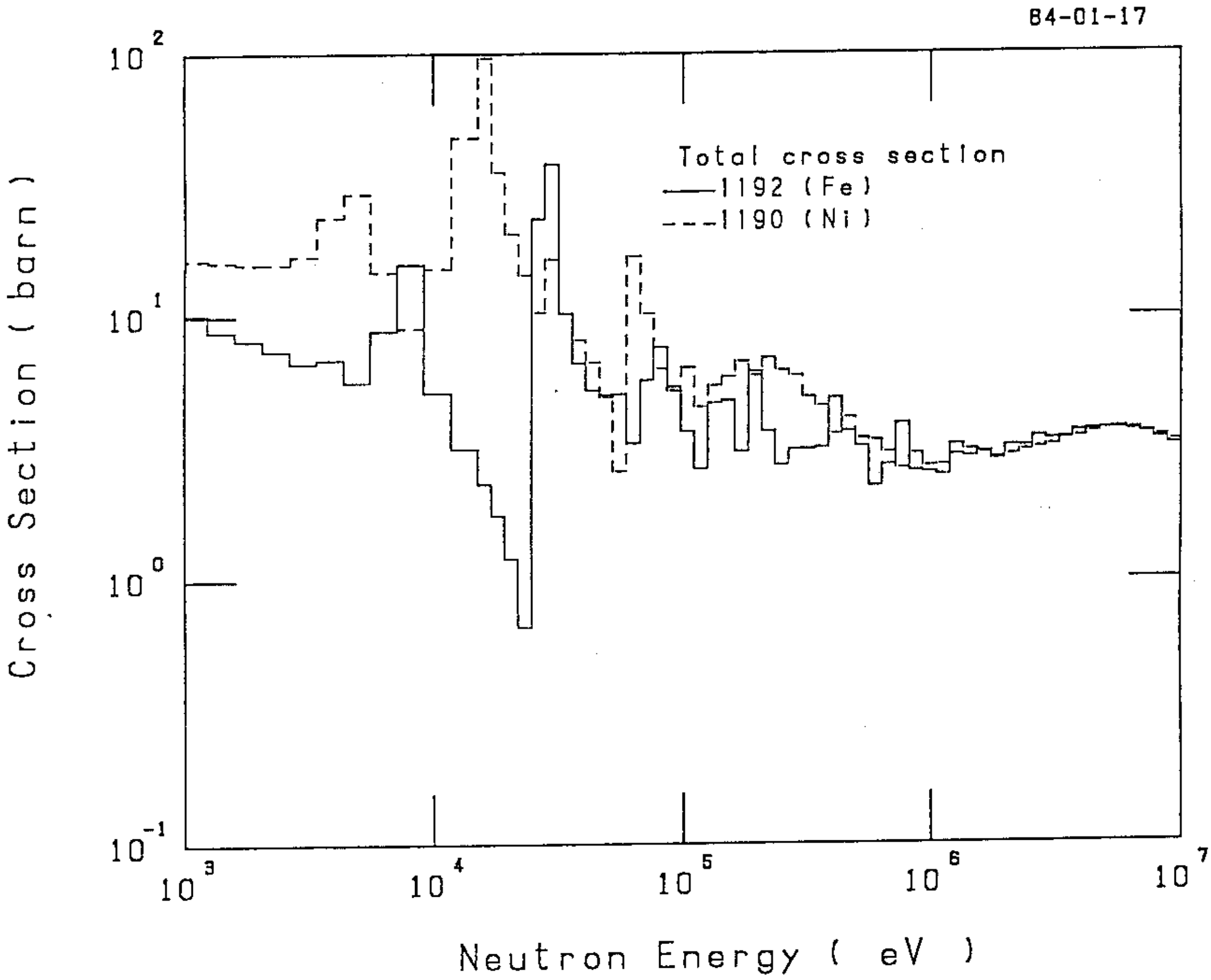


Fig. 5.1.10 Zooming figure of SMT data form

```
          <<< COMMON EXECUTING DATA >>>
============================================================

>TITLE  =
        : MAIN TITLE OF THE GRAPH
>XTITLE = ¥N?EUTRON ¥E?NERGY ( E¥V )
        : X-AXIS CAPTION
>YTITLE = ¥S?ELF-SHIELDING ¥F?ACTOR



        : Y-AXIS CAPTION
>ZTITLE =
        : Z-AXIS CAPTION
>UNIT( 1)=92
>UNIT( 2)=92
>UNIT( 3)=92
        : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
        : FILE NAME OF THE NUMAL DATA POOL
>NODE(1)=EGRP
>NODE(2)=EGRP     INFX     1192     FTB
>NODE(3)=EGRP     INFX     1190     FTB
        : NODE NAME OF THE CALCULATION DATA
>CODE( 1)=  1   1   0   0   0   0   0   0   0   0
>CODE( 2)=  6  13   0   0   0   0   0   0   0   0
>CODE( 3)=  6   6   0   0   0   0   0   0   0   0
>CODE( 4)= -1  -1   0   0   0   0   0   0   0   0
        : CODE NUMBER OF THE PLOTTING DATA
>XW     =200.00
        : X-AXIS LENGTH(MM)
>YW     =160.00
        : Y-AXIS LENGTH(MM)

============================================================

             <<< EXECUTING DATA FOR MODE-1 >>>

======================================================================


>NPL    =  2     : NUMBER OF PLOTTING LINE IN A GRAPH
>TRANS  = A      : TRANSFORM TYPE OF THE PLOTTING DATA
>ALPHA  =   1.00 : CONSTANT NUMBER TO TRANSFORM
>OPERA  = /      : TRANSFORM FORMAT OF THE DATA
>COMP   =  1     : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
        : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
>COMT   = ¥F?-TABLE FOR TOTAL REACTION
        : COMMENT FOR ALL DATA
>SUBT( 1) = ¥1192 (¥F?E)
>SUBT( 2) = 1190 (¥N?I)
        : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------


>TPO    = H : GRAPHIC FORM
>PAT    = S : GRAPHIC PATTERN
>SYMBOL =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
         : SYMBOL CODE OF THE CALCULATION DATA
         : SYMBOL CODE OF THE EXPERIMENTAL DATA
         : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
>ESIZE  =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
>SSIZE  =   3.50 : HEIGHT OF CHARACTER FOR THE COMMENT
>XN     =     116.49: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
>YN     =     190.85: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
>GRID   = 0        : OPTION FOR GRID LINE
>XSCALE = 1        : SCALING OPTION FOR X-AXIS COORDINATE
>YSCALE = 0        : SCALING OPTION FOR Y-AXIS COORDINATE
>SCALE  = 1        : METHOD OF SCALING TYPE
>XMIN   =    0.100E+04  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
>XMAX   =    0.100E+07  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
>YMIN   =    0.971E-01  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
>YMAX   =    0.100E+01  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
>YDMIN  =    0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
>YDMAX  =    0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
======================================================================
```

Fig. 5.1.11 Input data of FTB data form for Fig. 5.1.12

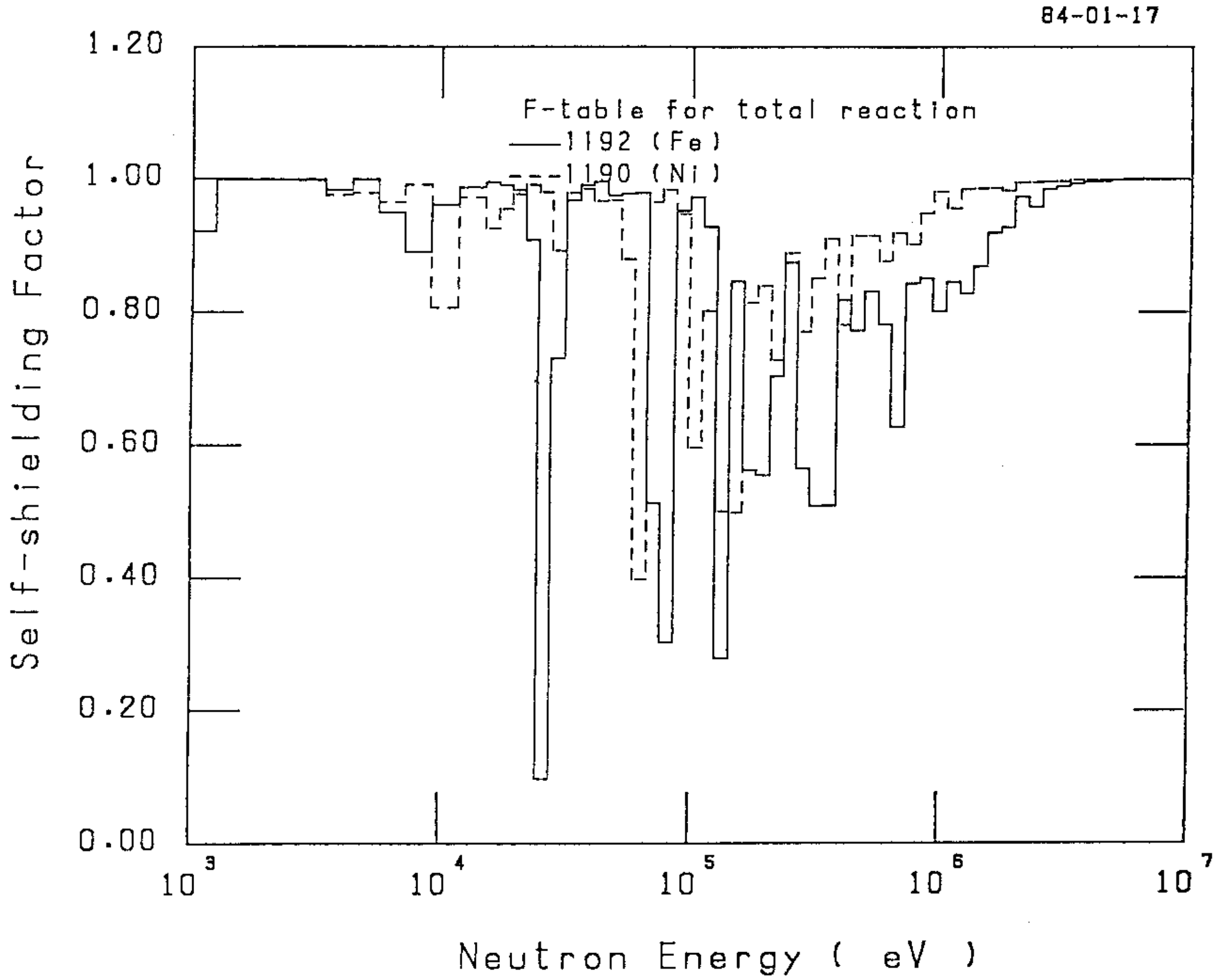


Fig. 5.1.12 Self-shielding factor

```
              <<< COMMON EXECUTING DATA >>>

=========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥C?OSINE OF ¥S?CATTERING ¥A?NGLES
         : X-AXIS CAPTION
 >YTITLE = ¥C?ROSS ¥S?ECTION ( BARN )
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP      INFX      1192      ELA
 >NODE(2)=EGRP      INFX      1192      ELA
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)= 19  20   0   0   0   0   0   0   0   0
 >CODE( 2)=  1   1   0   0   0   0   0   0   0   0
 >CODE( 3)= 20  20   0   0   0   0   0   0   0   0
 >CODE( 4)= 30  30   0   0   0   0   0   0   0   0
 >CODE( 5)= 30  30   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =160.00
         : Y-AXIS LENGTH(MM)


=========================================================

              <<< EXECUTING DATA FOR MODE-1 >>>

=================================================================

 >NPL    =  2      : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS  = A       : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA  =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA  = /       : TRANSFORM FORMAT OF THE DATA
 >COMP   =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT   = ¥E?LASTIC REACTION OF 1192 (¥F?E)
         : COMMENT FOR ALL DATA
 >SUBT( 1) = FROM 19 TO 20 GROUPS
 >SUBT( 2) = FROM 20 TO 20 GROUPS
         : COMMENT FOR EACH DATA


---------*** PLOTTING TYPE OPTION ***---------------------

 >TPO    = L : GRAPHIC FORM
 >PAT    = S : GRAPHIC PATTERN
 >SYMBOL =  1 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
 >CODE ( 1)= 1
 >CODE ( 2)= 2
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE  =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE  =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN     =      87.05: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN     =     181.98: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID   = 0        : OPTION FOR GRID LINE
 >XSCALE = 0        : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE = 1        : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE  = 0        : METHOD OF SCALING TYPE
 >XMIN   =   -0.100E+01  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX   =    0.100E+01  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN   =    0.205E-01  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX   =    0.707E+00  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN  =    0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX  =    0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
=================================================================
```

Fig. 5.1.13 Input data of ELA data form for Fig. 5.1.14

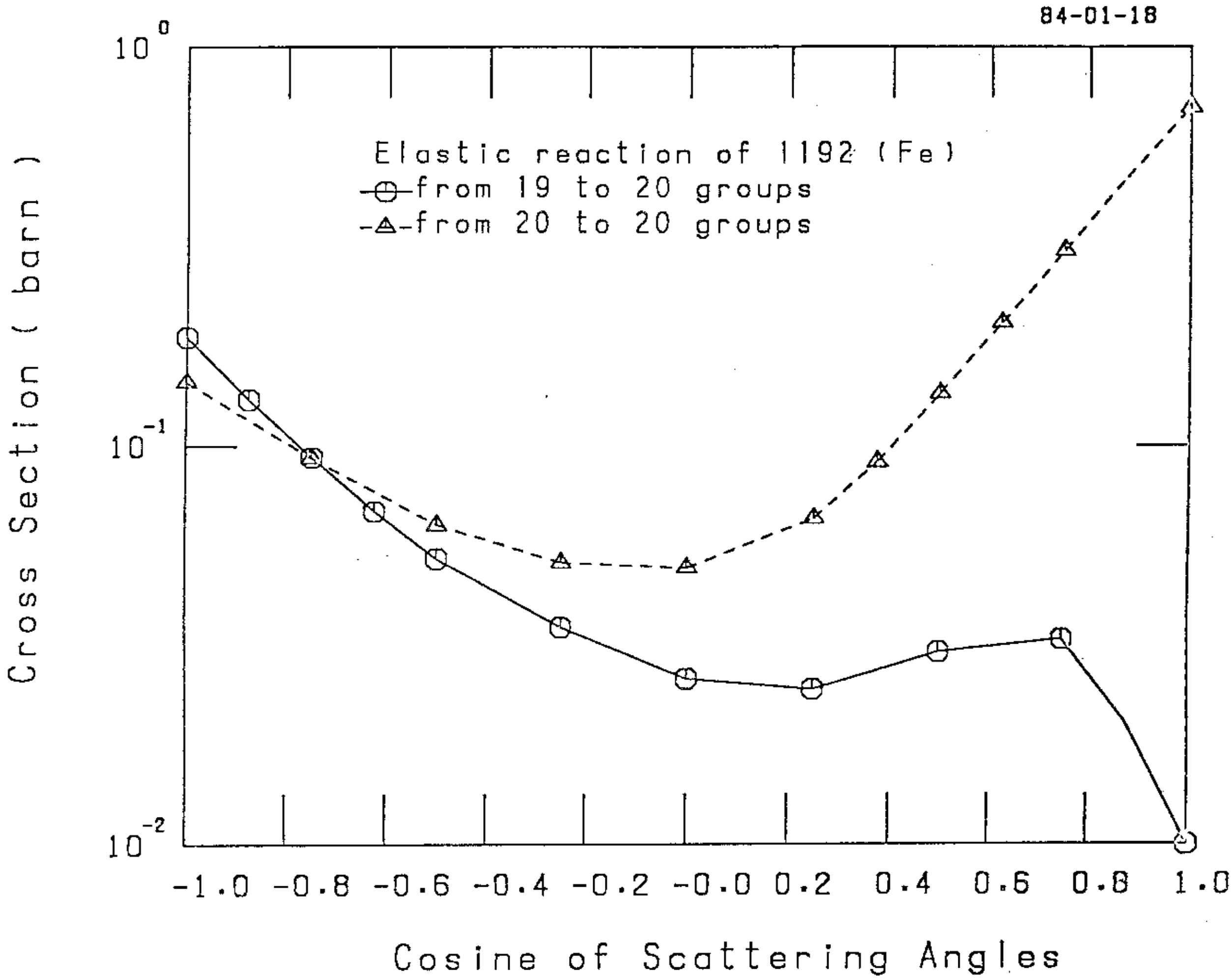


Fig. 5.1.14 Scattering matrix of elastic reaction

```
            <<< COMMON EXECUTING DATA >>>

=========================================================

 >TITLE   =
          : MAIN TITLE OF THE GRAPH
 >XTITLE  = ¥C?OSINE OF ¥S?CATTERING ¥A?NGLES
          : X-AXIS CAPTION
 >YTITLE  = ¥C?ROSS ¥S?ECTION ( BARN )
          : Y-AXIS CAPTION
 >ZTITLE  =
          : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
 >UNIT( 3)=91
          : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
          : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP      INFX      1192       INS
 >NODE(2)=EGRP      INFX      1192       INS
 >NODE(3)=EGRP      INFX      1192       INS
          : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)= 15   16   17    0    0    0    0    0    0    0
 >CODE( 2)=  1    1    1    0    0    0    0    0    0    0
 >CODE( 3)= 20   20   20    0    0    0    0    0    0    0
 >CODE( 4)= 30   30   30    0    0    0    0    0    0    0
 >CODE( 5)= 30   30   30    0    0    0    0    0    0    0
          : CODE NUMBER OF THE PLOTTING DATA
 >XW      =200.00
          : X-AXIS LENGTH(MM)
 >YW      =160.00
          : Y-AXIS LENGTH(MM)

=========================================================
            <<< EXECUTING DATA FOR MODE-1 >>>
==================================================================

 >NPL     =  3      : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS   = A       : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA   =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA   = /       : TRANSFORM FORMAT OF THE DATA
 >COMP    =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
          : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT    = ¥I?NELASTIC REACTION OF 1192 (¥F?E)
          : COMMENT FOR ALL DATA
 >SUBT( 1) = FROM 15 TO 20 GROUPS
 >SUBT( 2) = FROM 16 TO 20 GROUPS
 >SUBT( 3) = FROM 17 TO 20 GROUPS
          : COMMENT FOR EACH DATA


---------*** PLOTTING TYPE OPTION ***---------------------

 >TPO     = L : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL  =  1 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
 >CODE ( 1)= 1
 >CODE ( 2)= 2
 >CODE ( 3)= 3
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE   =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE   =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN      =      87.05: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN      =     164.25: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID    = 0       : OPTION FOR GRID LINE
 >XSCALE  = 0       : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE  = 1       : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE   = 0       : METHOD OF SCALING TYPE
 >XMIN    =   -0.100E+01  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX    =    0.100E+01  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN    =    0.203E-03  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX    =    0.433E-01  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN   =    0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX   =    0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
```

Fig. 5.1.15 Input data of INS data form for Fig. 5.1.16

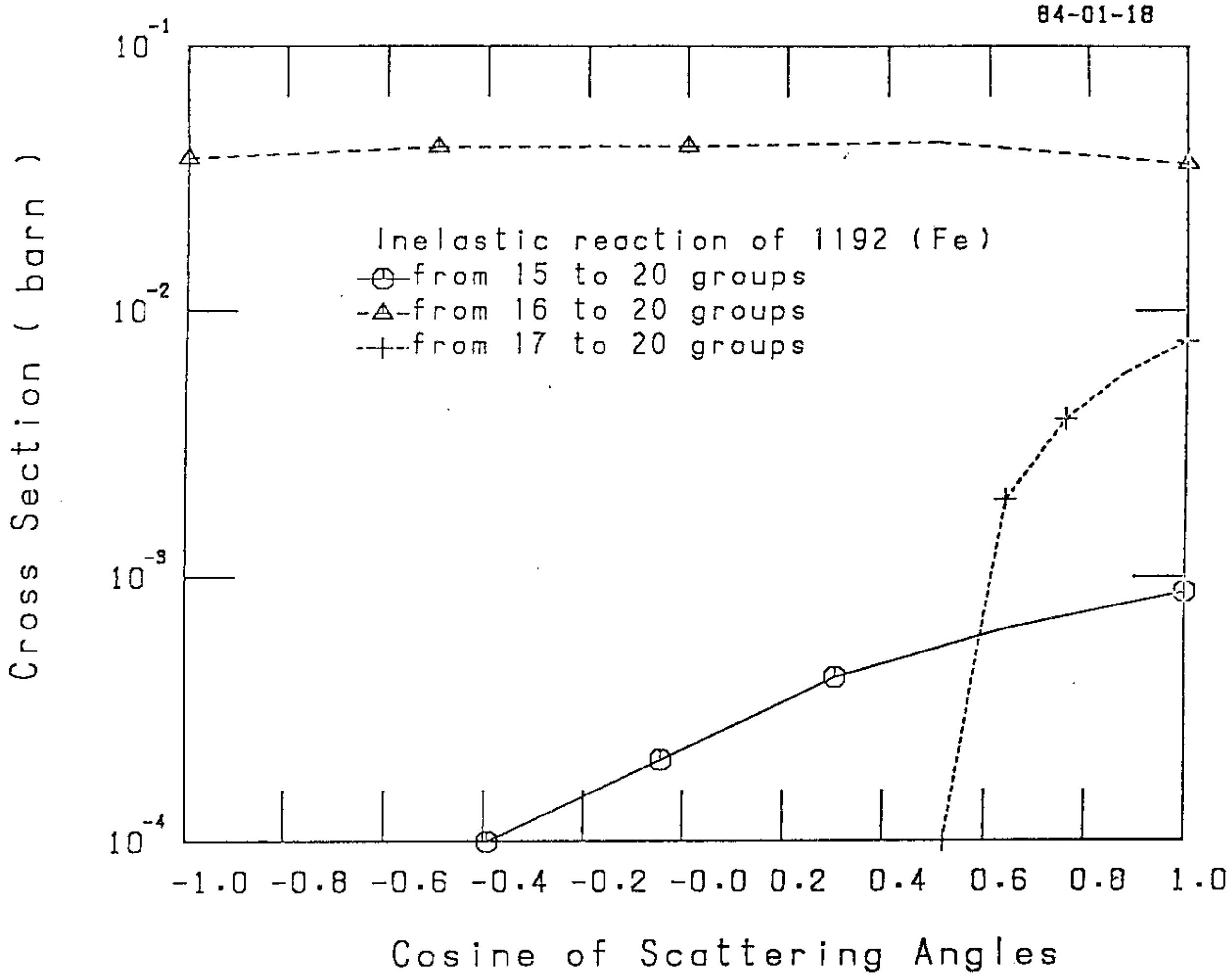


Fig. 5.1.16 Scattering matrix of inelastic reaction

```
            <<< COMMON EXECUTING DATA >>>

==========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥C?OSINE OF ¥S?CATTERING ¥A?NGLES
         : X-AXIS CAPTION
 >YTITLE = ¥C?ROSS ¥S?ECTION  ( BARN )
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
 >UNIT( 3)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP      INFX      1192       N2N
 >NODE(2)=EGRP      INFX      1192       N2N
 >NODE(3)=EGRP      INFX      1192       N2N
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1   2   3   0   0   0   0   0   0   0
 >CODE( 2)=  1   1   1   0   0   0   0   0   0   0
 >CODE( 3)= 40  40  40   0   0   0   0   0   0   0
 >CODE( 4)= 30  30  30   0   0   0   0   0   0   0
 >CODE( 5)= 30  30  30   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =160.00
         : Y-AXIS LENGTH(MM)

==========================================================
            <<< EXECUTING DATA FOR MODE-1 >>>
=================================================================

 >NPL    =  3      : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS  = A       : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA  =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA  = /       : TRANSFORM FORMAT OF THE DATA
 >COMP   =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT   = (N,2N) REACTION OF 1192 (¥F?E)  ?E)
         : COMMENT FOR ALL DATA
 >SUBT( 1) = FROM 1 TO 40 GROUPS
 >SUBT( 2) = FROM 2 TO 40 GROUPS
 >SUBT( 3) = FROM 3 TO 40 GROUPS
         : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------

 >TPO     = L : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL =  1 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
 >CODE ( 1)= 1
 >CODE ( 2)= 2
 >CODE ( 3)= 3
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE  =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE  =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN     =      87.05: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN     =     164.60: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID   = 0       : OPTION FOR GRID LINE
 >XSCALE = 0       : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE = 1       : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE  = 0       : METHOD OF SCALING TYPE
 >XMIN   =    -0.100E+01  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX   =     0.100E+01  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN   =     0.133E-03  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX   =     0.231E-03  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN  =     0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX  =     0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
```

Fig. 5.1.17 Input data of N2N data form for Fig. 5.1.18

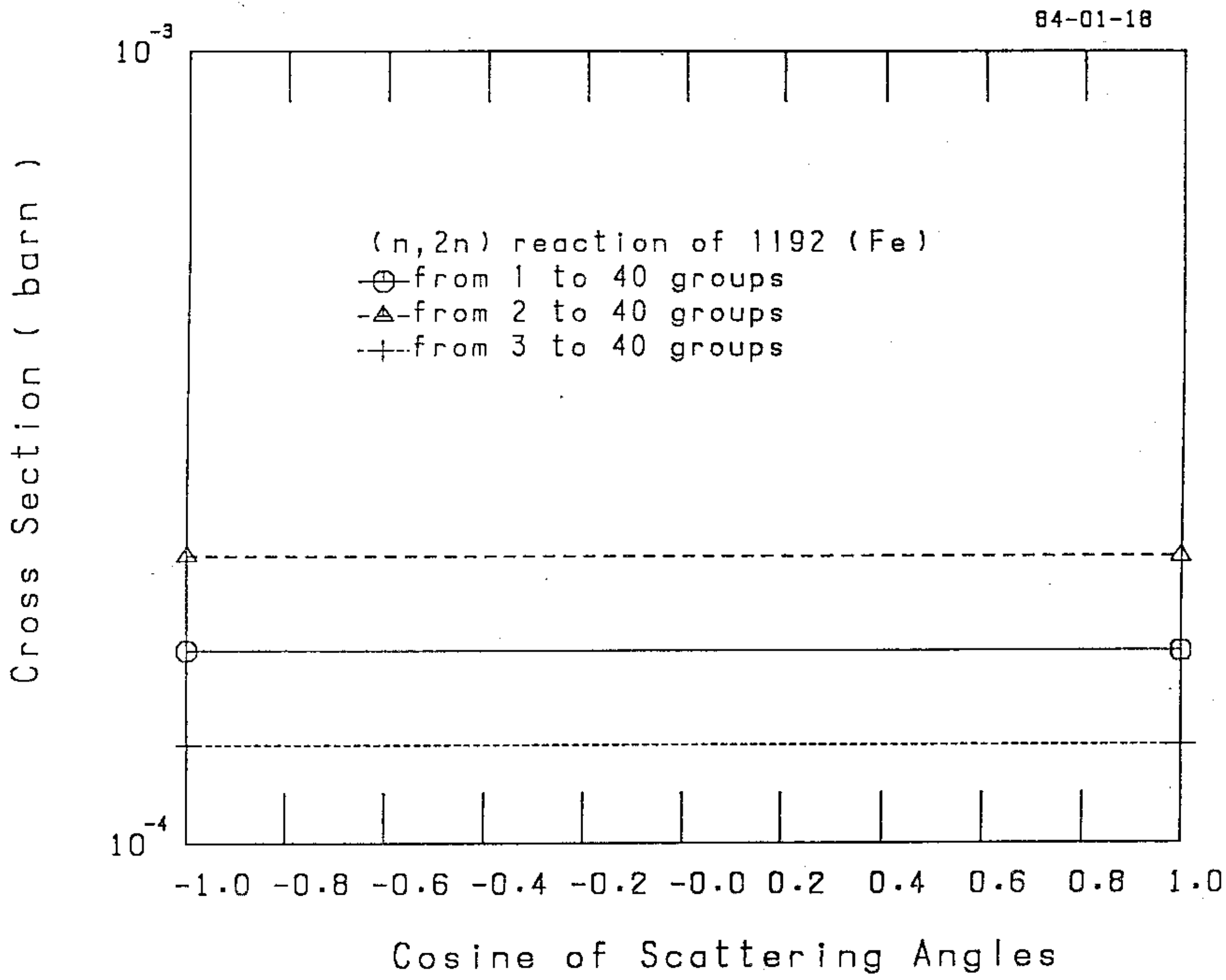


Fig. 5.1.18 Scattering matrix of (n,2n) reaction

```
          <<< COMMON EXECUTING DATA >>>

==========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥N?EUTRON ¥E?NERGY ( E¥V )
         : X-AXIS CAPTION
 >YTITLE = ¥C?ROSS ¥S?ECTION  ( BARN )
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=92
 >UNIT( 2)=92
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP
 >NODE(2)=EGRP      INFX      1192       H+D
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1   1   1   0   0   0   0   0   0   0
 >CODE( 2)=  6   6   6   0   0   0   0   0   0   0
 >CODE( 3)= 13  13  13   0   0   0   0   0   0   0
 >CODE( 4)= -5  -6  -7   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW      =200.00
         : X-AXIS LENGTH(MM)
 >YW      =160.00
         : Y-AXIS LENGTH(MM)

==========================================================


          <<< EXECUTING DATA FOR MODE-1 >>>

==================================================================

 >NPL     =  3      : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS   = A       : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA   =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA   = /       : TRANSFORM FORMAT OF THE DATA
 >COMP    =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT    = ¥H?EAT GENERATION OF 1192 (¥F?E)
         : COMMENT FOR ALL DATA
 >SUBT( 1) = ELASTIC
 >SUBT( 2) = INELASTIC
 >SUBT( 3) = (N,2N)
         : COMMENT FOR EACH DATA


 ---------*** PLOTTING TYPE OPTION ***---------------------

 >TPO     = H : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL  =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
           : SYMBOL CODE OF THE CALCULATION DATA
           : SYMBOL CODE OF THE EXPERIMENTAL DATA
           : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE   =    2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE   =    4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN      =       67.90: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN      =      173.12: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID    = 0       : OPTION FOR GRID LINE
 >XSCALE  = 1       : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE  = 1       : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE   = 0       : METHOD OF SCALING TYPE
 >XMIN    =     0.352E-03  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX    =     0.165E+08  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN    =     0.318E-20  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX    =     0.543E-13  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN   =     0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX   =     0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1

==================================================================
```

Fig. 5.1.19 Input data of H+D data form for Fig. 5.1.20

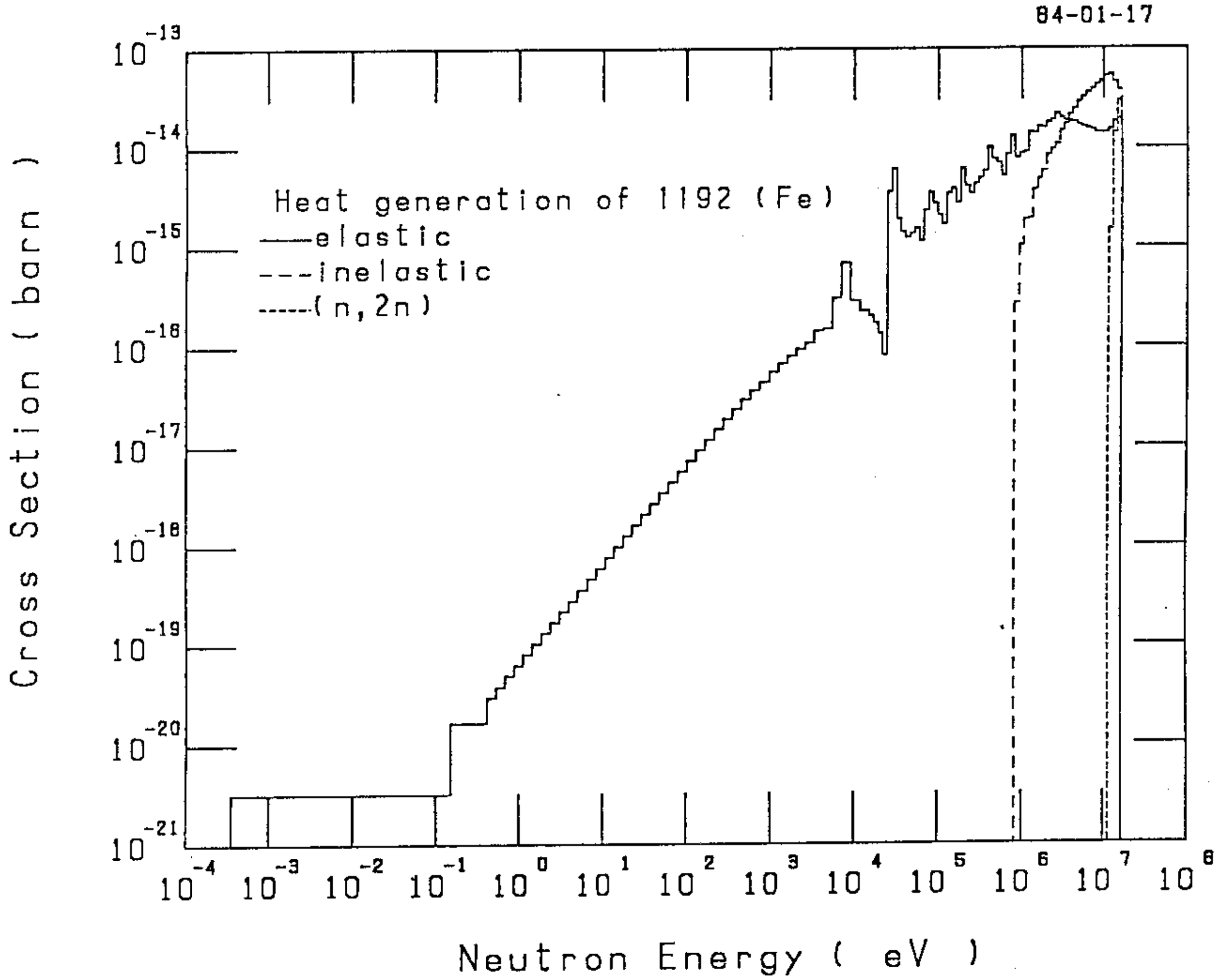


Fig. 5.1.20 Heat generation cross section

```
            <<< COMMON EXECUTING DATA >>>

=============================================================

>TITLE   =
         : MAIN TITLE OF THE GRAPH
>XTITLE = ¥N?EUTRON ¥E?NERGY ( E¥V )
         : X-AXIS CAPTION
>YTITLE = ¥C?ROSS ¥S?ECTION ( BARN )
         : Y-AXIS CAPTION
>ZTITLE =
         : Z-AXIS CAPTION
>UNIT( 1)=92
>UNIT( 2)=92
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
>NODE(1)=EGRP
>NODE(2)=EGRP      INFX      1192      H+D
         : NODE NAME OF THE CALCULATION DATA
>CODE( 1)=  1   1   1   0   0   0   0   0   0   0
>CODE( 2)=  6   6   6   0   0   0   0   0   0   0
>CODE( 3)= 13  13  13   0   0   0   0   0   0   0
>CODE( 4)=-11 -12 -13   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
>XW      =200.00
         : X-AXIS LENGTH(MM)
>YW      =160.00
         : Y-AXIS LENGTH(MM)

=============================================================


            <<< EXECUTING DATA FOR MODE-1 >>>

======================================================================


>NPL     =  3       : NUMBER OF PLOTTING LINE IN A GRAPH
>TRANS   = A        : TRANSFORM TYPE OF THE PLOTTING DATA
>ALPHA   =    1.00 : CONSTANT NUMBER TO TRANSFORM
>OPERA   = /        : TRANSFORM FORMAT OF THE DATA
>COMP    =  1       : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
>COMT    = ¥D?ISPLACEMENT OF 1192 (¥F?E)
         : COMMENT FOR ALL DATA
>SUBT( 1) = ELASTIC
>SUBT( 2) = INELASTIC
>SUBT( 3) = (N,2N)
         : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------


>TPO     = H : GRAPHIC FORM
>PAT     = S : GRAPHIC PATTERN
>SYMBOL =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
>ESIZE  =    2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
>SSIZE  =    4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
>XN     =       74.28: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
>YN     =      173.47: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
>GRID   = 0         : OPTION FOR GRID LINE
>XSCALE = 1         : SCALING OPTION FOR X-AXIS COORDINATE
>YSCALE = 1         : SCALING OPTION FOR Y-AXIS COORDINATE
>SCALE  = 0         : METHOD OF SCALING TYPE
>XMIN   =     0.352E-03  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
>XMAX   =     0.165E+08  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
>YMIN   =     0.671E-01  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
>YMAX   =     0.171E+04  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
>YDMIN  =     0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
>YDMAX  =     0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1

======================================================================
```

Fig. 5.1.21 Input data of H+D data form for Fig. 5.1.22

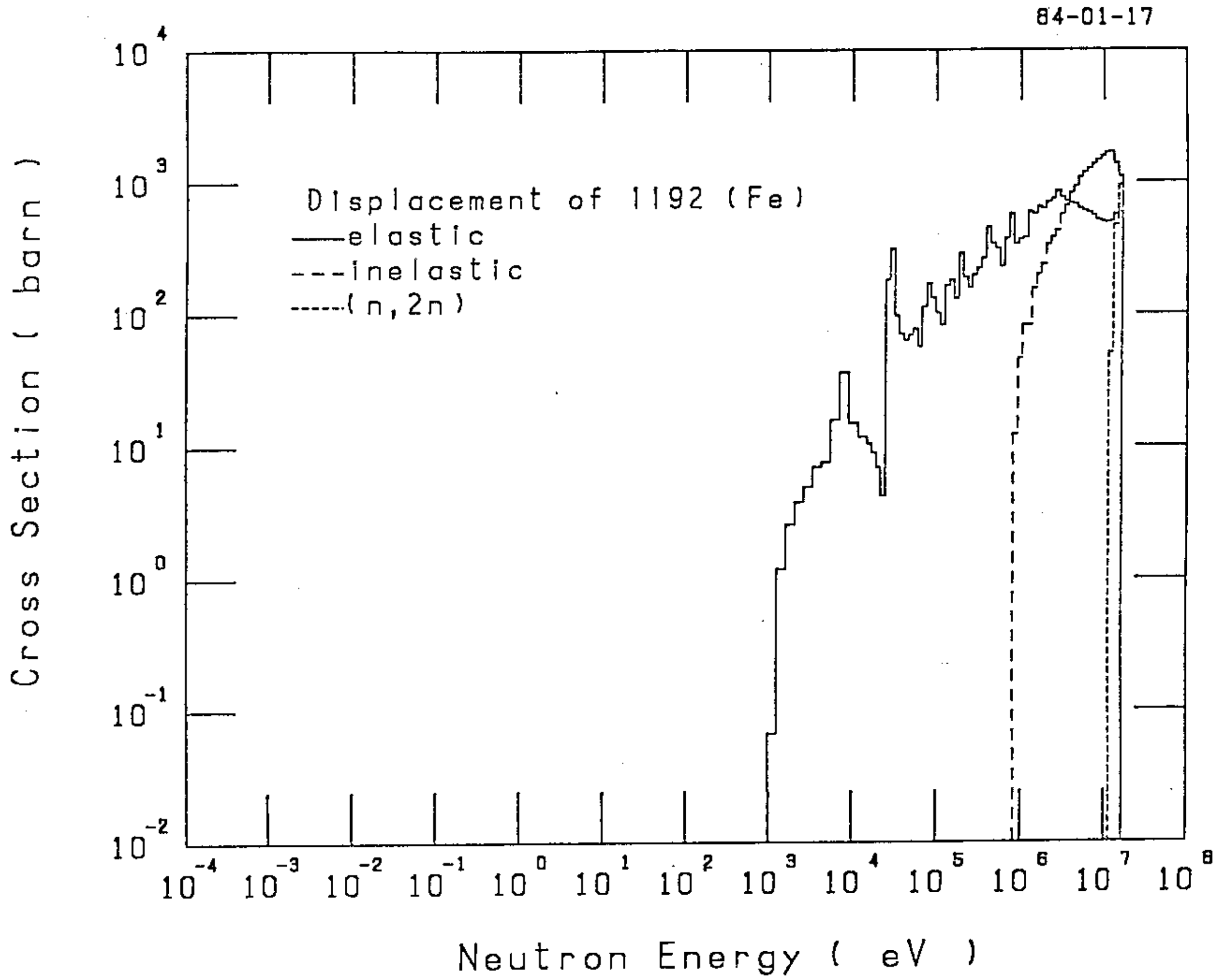


Fig. 5.1.22 Displacement cross section

```
          <<< COMMON EXECUTING DATA >>>

==========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥N?EUTRON ¥E?NERGY ( E¥V )
         : X-AXIS CAPTION
 >YTITLE = ¥C?ROSS ¥S?ECTION ( BARN )
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=93
 >UNIT( 2)=93
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP
 >NODE(2)=EGRP      SGRX      1269      101
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1   0   0   0   0   0   0   0   0   0
 >CODE( 2)=  3   0   0   0   0   0   0   0   0   0
 >CODE( 3)= -1   0   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =160.00
         : Y-AXIS LENGTH(MM)

==========================================================


          <<< EXECUTING DATA FOR MODE-1 >>>


====================================================================

 >NPL    =  1       : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS  = A        : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA  =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA  = /        : TRANSFORM FORMAT OF THE DATA
 >COMP   =  1       : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT   = ¥N?EUTRON INTERACTION OF 1269 (¥H)
         : COMMENT FOR ALL DATA
 >SUBT( 1) = 1269 (¥H)
         : COMMENT FOR EACH DATA


---------*** PLOTTING TYPE OPTION ***---------------------


 >TPO    = H : GRAPHIC FORM
 >PAT    = S : GRAPHIC PATTERN
 >SYMBOL =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE  =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE  =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN     =     110.10: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN     =     185.88: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID   = 0        : OPTION FOR GRID LINE
 >XSCALE = 1        : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE = 1        : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE  = 0        : METHOD OF SCALING TYPE
 >XMIN   =     0.352E-03  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX   =     0.165E+08  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN   =     0.288E-04  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX   =     0.313E+00  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN  =     0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX  =     0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
====================================================================
```

Fig. 5.1.23 Input data of SGRX data form for Fig. 5.1.24

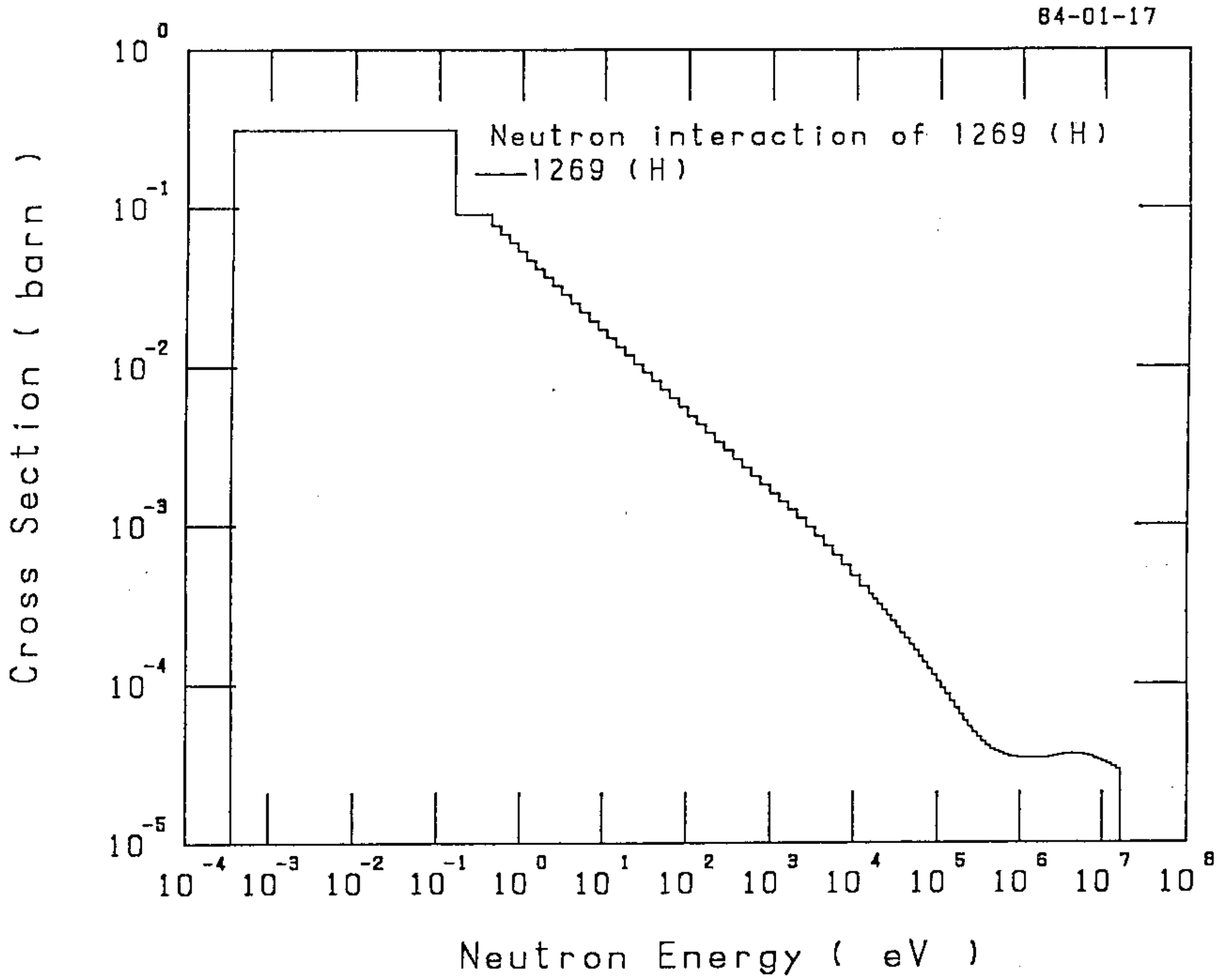


Fig. 5.1.24 Neutron interaction cross section

```
             <<< COMMON EXECUTING DATA >>>

===========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥N?EUTRON ¥E?NERGY ( E¥V )
         : X-AXIS CAPTION
 >YTITLE = ¥Y?IELDS
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP
 >NODE(2)=EGRP     SGRX      1274      106
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1   0   0   0   0   0   0   0   0   0
 >CODE( 2)=  4   0   0   0   0   0   0   0   0   0
 >CODE( 3)= -1   0   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =160.00
         : Y-AXIS LENGTH(MM)

===========================================================

             <<< EXECUTING DATA FOR MODE-1 >>>

====================================================================

 >NPL    =  1       : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS  = A        : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA  =    1.00  : CONSTANT NUMBER TO TRANSFORM
 >OPERA  = /        : TRANSFORM FORMAT OF THE DATA
 >COMP   =  1       : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT   = ¥Y?IELDS OF 1274 (¥C-12)
         : COMMENT FOR ALL DATA
 >SUBT( 1) = 1274-106 (¥C)
         : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------

 >TPO    = H : GRAPHIC FORM
 >PAT    = S : GRAPHIC PATTERN
 >SYMBOL =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE  =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE  =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN     =      83.15: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN     =     175.95: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID   = 0        : OPTION FOR GRID LINE
 >XSCALE = 1        : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE = 0        : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE  = 0        : METHOD OF SCALING TYPE
 >XMIN   =    0.352E-03  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX   =    0.431E+04  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN   =    0.132E+01  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX   =    0.132E+01  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN  =    0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX  =    0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1

====================================================================
```

Fig. 5.1.25 Input data of SGRX data form for Fig. 5.1.26

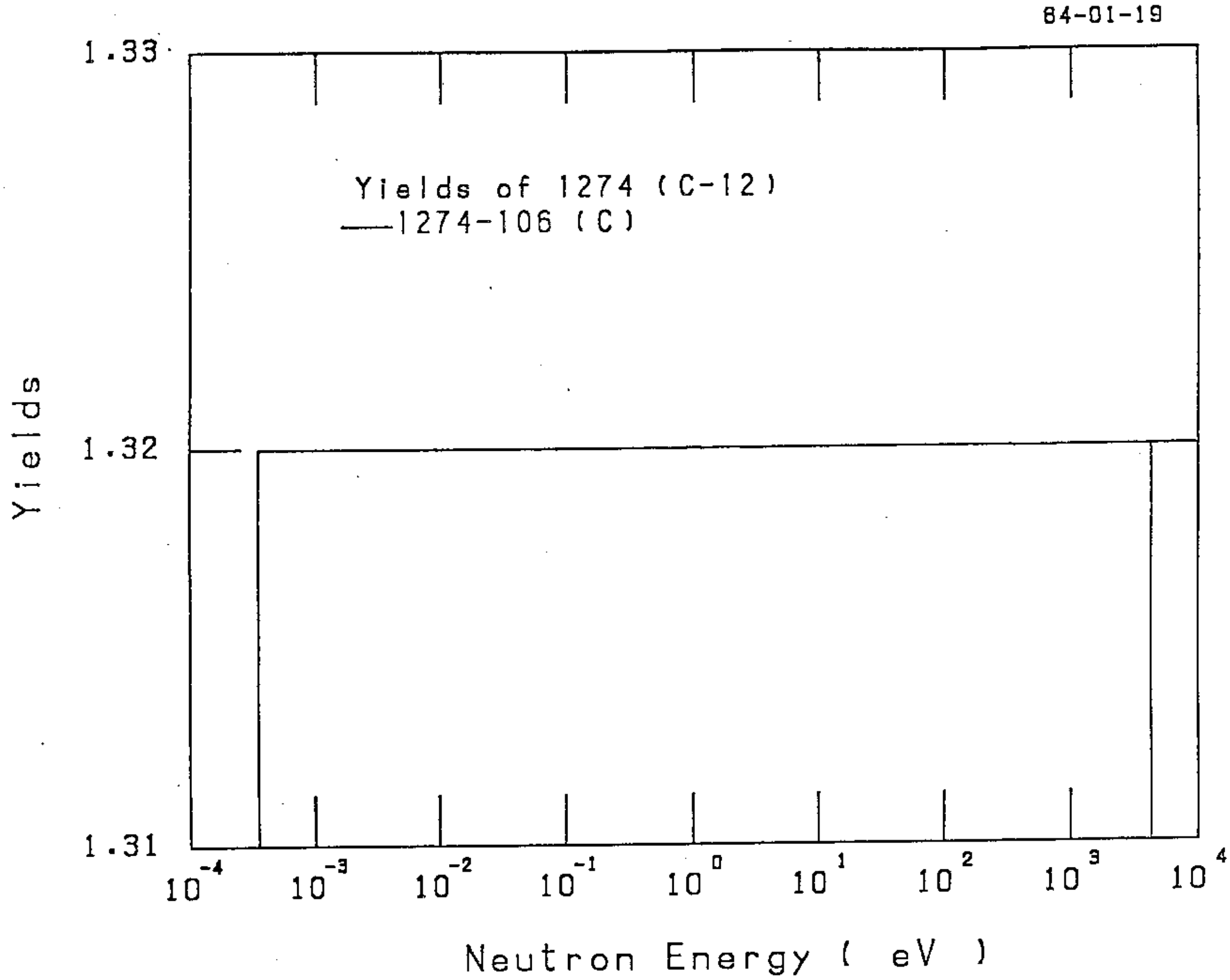


Fig. 5.1.26 Yields for neutron energy structure

```
              <<< COMMON EXECUTING DATA >>>

=============================================================

 >TITLE   =
          : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥N?EUTRON ¥E?NERGY ( E¥V )
          : X-AXIS CAPTION
 >YTITLE = ¥C?ROSS ¥S?ECTION ( CM@-1 ?)
          : Y-AXIS CAPTION
 >ZTITLE =
          : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
          : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
          : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP
 >NODE(2)=EGRP       FX16       KFEE
          : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1    0    0    0    0    0    0    0    0    0
 >CODE( 2)=  6    0    0    0    0    0    0    0    0    0
 >CODE( 3)= -3    0    0    0    0    0    0    0    0    0
 >CODE( 4)=100    0    0    0    0    0    0    0    0    0
          : CODE NUMBER OF THE PLOTTING DATA
 >XW      =200.00
          : X-AXIS LENGTH(MM)
 >YW      =160.00
          : Y-AXIS LENGTH(MM)

=============================================================


              <<< EXECUTING DATA FOR MODE-1 >>>

=======================================================================

 >NPL     =  1       : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS   = A        : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA   =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA   = /        : TRANSFORM FORMAT OF THE DATA
 >COMP    =  1       : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
          : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT    = ¥D.A.R. ?FOR 16 ANGULAR POINTS
          : COMMENT FOR ALL DATA
 >SUBT( 1) = ¥KFK-F?E (¥ENDF/B-IV)
          : COMMENT FOR EACH DATA


---------*** PLOTTING TYPE OPTION ***---------------------

 >TPO     = H : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
           : SYMBOL CODE OF THE CALCULATION DATA
           : SYMBOL CODE OF THE EXPERIMENTAL DATA
           : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE   =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE   =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN      =      87.05: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN      =     181.98: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID    = 0        : OPTION FOR GRID LINE
 >XSCALE = 1        : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE = 1        : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE   = 0        : METHOD OF SCALING TYPE
 >XMIN    =    0.352E-03  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX    =    0.165E+08  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN    =    0.511E-01  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX    =    0.237E+01  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN   =    0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX   =    0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
=======================================================================
```

Fig. 5.1.27 Input data of FXSN data form for Fig. 5.1.28

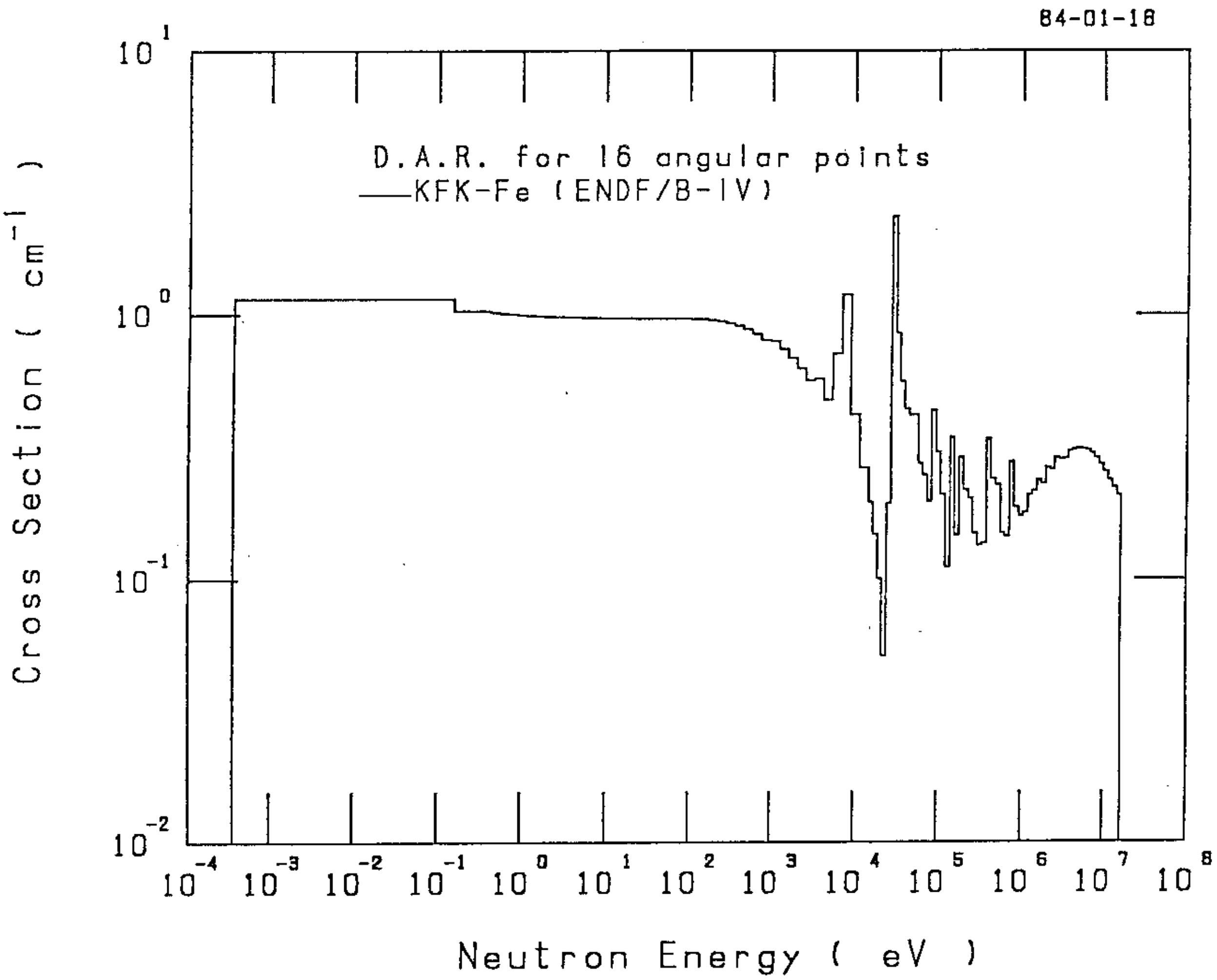


Fig. 5.1.28 Effective macroscopic cross section

```
              <<< COMMON EXECUTING DATA >>>
==========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥N?EUTRON ¥E?NERGY ( E¥V )
         : X-AXIS CAPTION
 >YTITLE = ¥S?ELF-SHIELDING ¥F?ACTOR
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP
 >NODE(2)=EGRP      SELF      200       1192
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1    1    1    1    0    0    0    0    0    0
 >CODE( 2)=  3    4    5    6    0    0    0    0    0    0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =160.00
         : Y-AXIS LENGTH(MM)

==========================================================

              <<< EXECUTING DATA FOR MODE-1 >>>
====================================================================

 >NPL    =  4      : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS  = A       : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA  =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA  = /       : TRANSFORM FORMAT OF THE DATA
 >COMP   =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT   = ¥1192 (F?E) FROM ¥ENDF/B-IV
         : COMMENT FOR ALL DATA
 >SUBT( 1) = TOTAL
 >SUBT( 2) = ELASTIC
 >SUBT( 3) = INELASTIC
 >SUBT( 4) = CAPTURE
         : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------

 >TPO    = H : GRAPHIC FORM
 >PAT    = S : GRAPHIC PATTERN
 >SYMBOL = 10 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
 >CODE ( 1)= 1
 >CODE ( 2)= 2
 >CODE ( 3)= 3
 >CODE ( 4)= 4
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE  =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE  =   3.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN     =     153.38: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN     =      76.99: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID   = 0        : OPTION FOR GRID LINE
 >XSCALE = 1        : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE = 0        : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE  = 1        : METHOD OF SCALING TYPE
 >XMIN   =     0.100E+04  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX   =     0.100E+07  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN   =     0.968E-01  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX   =     0.105E+01  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN  =     0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX  =     0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
====================================================================
```

Fig. 5.1.29 Input data of SELF data form for Fig. 5.1.30

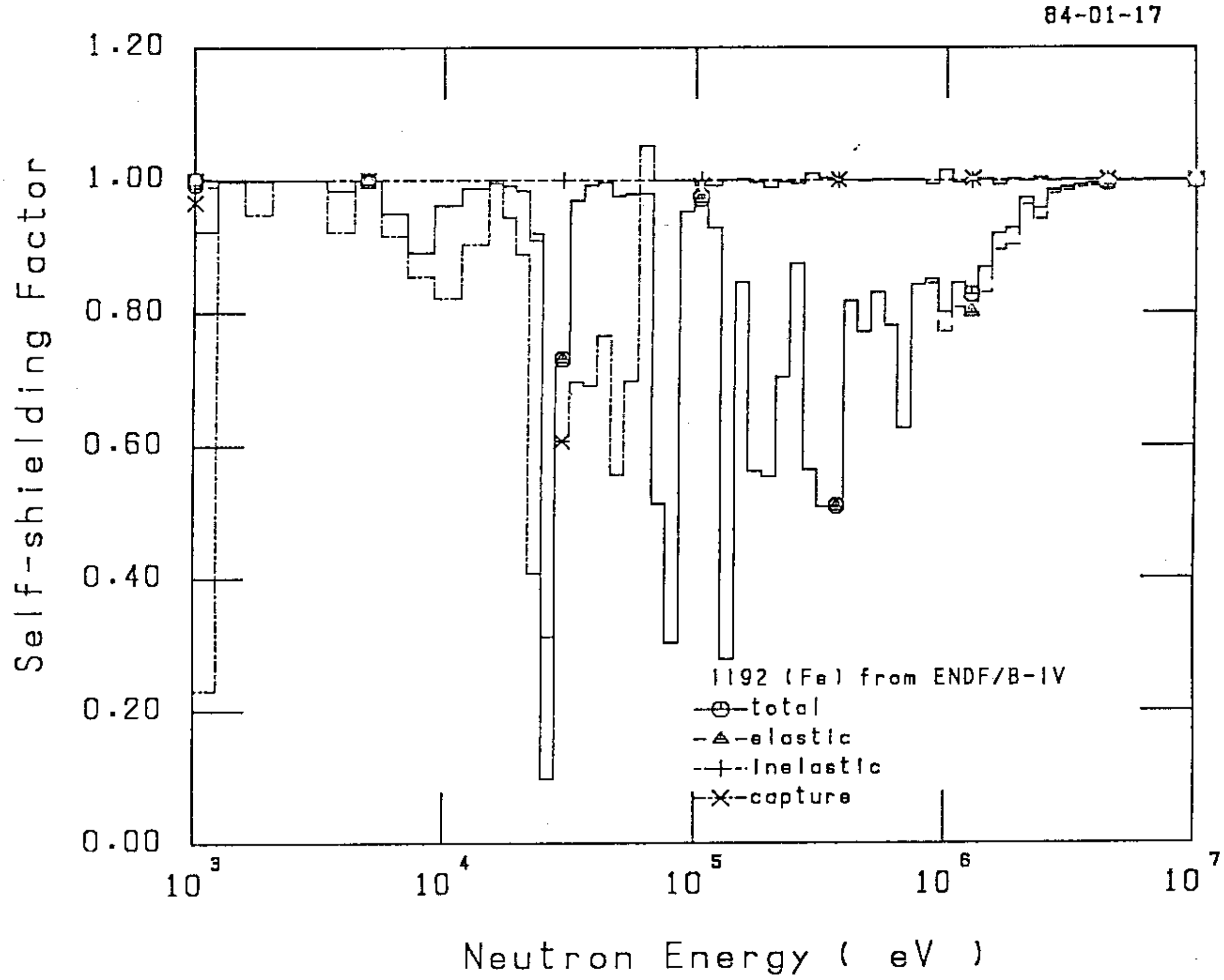


Fig. 5.1.30 Self-shielding factor

```
              <<< COMMON EXECUTING DATA >>>
==========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥N?EUTRON ¥E?NERGY ( E¥V )
         : X-AXIS CAPTION
 >YTITLE = ¥N?EUTRON ¥F?LUX ( N/CM@2?/SOURCE )
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
 >UNIT( 3)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=HA92
 >NODE(2)=HA92       1010
 >NODE(3)=HA92       1010      SFXO
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1    0    0    0    0    0    0    0    0    0
 >CODE( 2)=  1    0    0    0    0    0    0    0    0    0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =160.00
         : Y-AXIS LENGTH(MM)

==========================================================

             <<< EXECUTING DATA FOR MODE-1 >>>
====================================================================

 >NPL    =  1       : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS  = A        : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA  =    1.00  : CONSTANT NUMBER TO TRANSFORM
 >OPERA  = /        : TRANSFORM FORMAT OF THE DATA
 >COMP   =  1       : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
         : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT   = ¥N?O. 101 ¥F?E (0.9¥M.F.P.)?:SPHERE
         : COMMENT FOR ALL DATA
 >SUBT( 1) =  CENTER (IM:1)
         : COMMENT FOR EACH DATA

----------*** PLOTTING TYPE OPTION ***----------------------

 >TPO    = H : GRAPHIC FORM
 >PAT    = S : GRAPHIC PATTERN
 >SYMBOL =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE  =    2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE  =    4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN     =       67.54: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN     =      191.20: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID   = 0        : OPTION FOR GRID LINE
 >XSCALE = 1        : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE = 1        : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE  = 0        : METHOD OF SCALING TYPE
 >XMIN   =     0.100E+07  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX   =     0.165E+08  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN   =     0.441E-06  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX   =     0.164E+00  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN  =     0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX  =     0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
====================================================================
```

Fig. 5.1.31 Input data of SFXO data form for Fig. 5.1.32

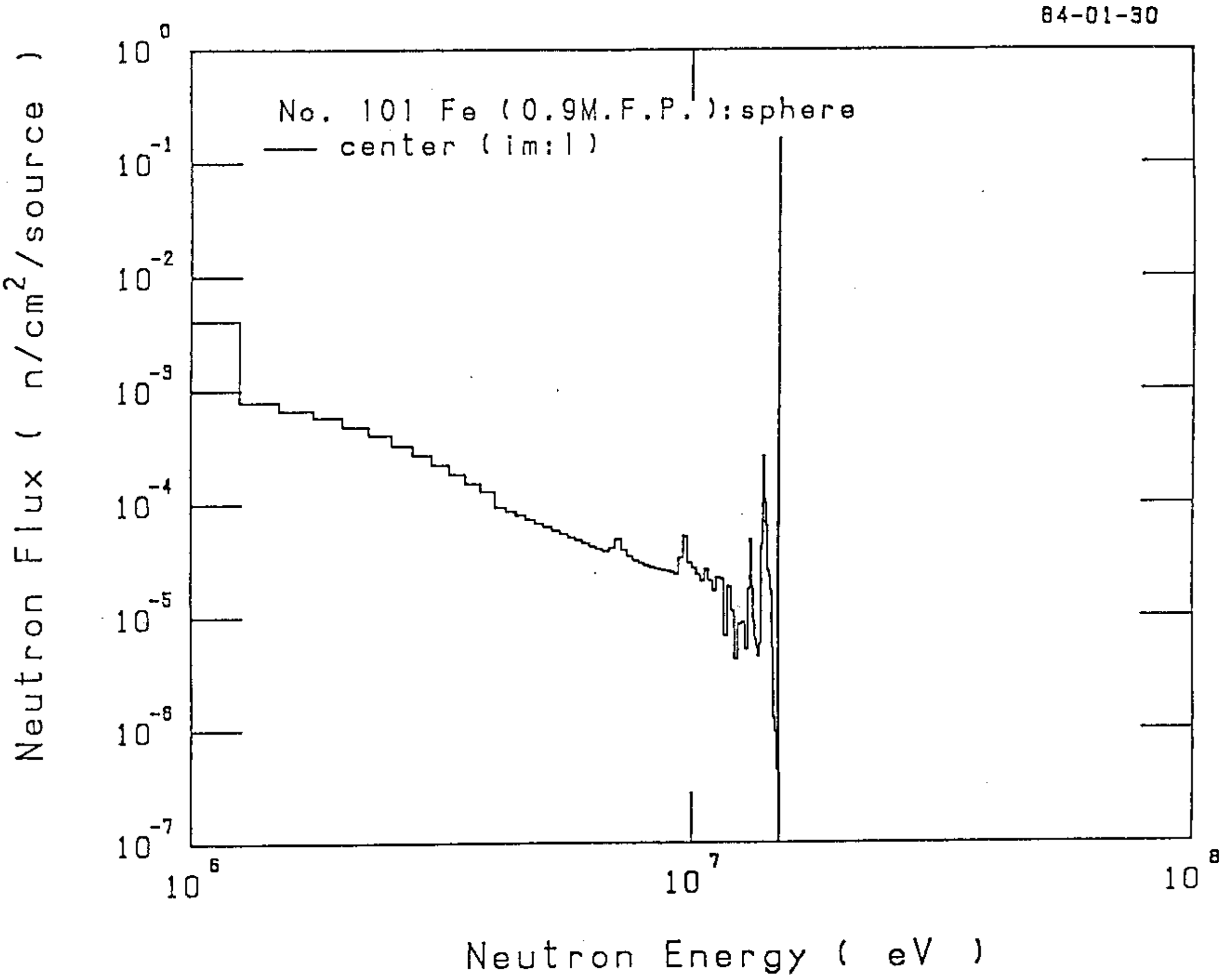


Fig. 5.1.32 Energy spectrum of SFXO data form

```
<<< COMMON EXECUTING DATA >>>

==========================================================

 >TITLE   =
          : MAIN TITLE OF THE GRAPH
 >XTITLE = ¥D?ISTANCE FROM ¥C?ENTER ( CM )
          : X-AXIS CAPTION
 >YTITLE = ¥N?EUTRON ¥F?LUX ( N/CM@2?/SOURCE )
          : Y-AXIS CAPTION
 >ZTITLE =
          : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
          : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
          : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=HA92      1010
 >NODE(2)=HA92      1010      SFXO
          : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  2   0   0   0   0   0   0   0   0   0
 >CODE( 2)= 20   0   0   0   0   0   0   0   0   0
          : CODE NUMBER OF THE PLOTTING DATA
 >XW      =200.00
          : X-AXIS LENGTH(MM)
 >YW      =160.00
          : Y-AXIS LENGTH(MM)

==========================================================

           <<< EXECUTING DATA FOR MODE-1 >>>

===================================================================

 >NPL     =  1       : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS   = A        : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA   =   1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA   = /        : TRANSFORM FORMAT OF THE DATA
 >COMP    =  1       : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
        : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT    = ¥N?O. 101 ¥F?E (0.9¥M.F.P.)?:SPHERE
        : COMMENT FOR ALL DATA
 >SUBT( 1) =  NEUTRON 20 GROUP
        : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------

 >TPO     = L : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL  =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE   =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE   =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN      =      82.44: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN      =      97.21: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID    = 0        : OPTION FOR GRID LINE
 >XSCALE  = 0        : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE  = 1        : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE   = 0        : METHOD OF SCALING TYPE
 >XMIN    =    0.515E+00  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX    =    0.422E+01  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN    =    0.529E-05  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX    =    0.737E-04  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN   =    0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX   =    0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
===================================================================
```

Fig. 5.1.33 Input data of SFXO data form for Fig. 5.1.34

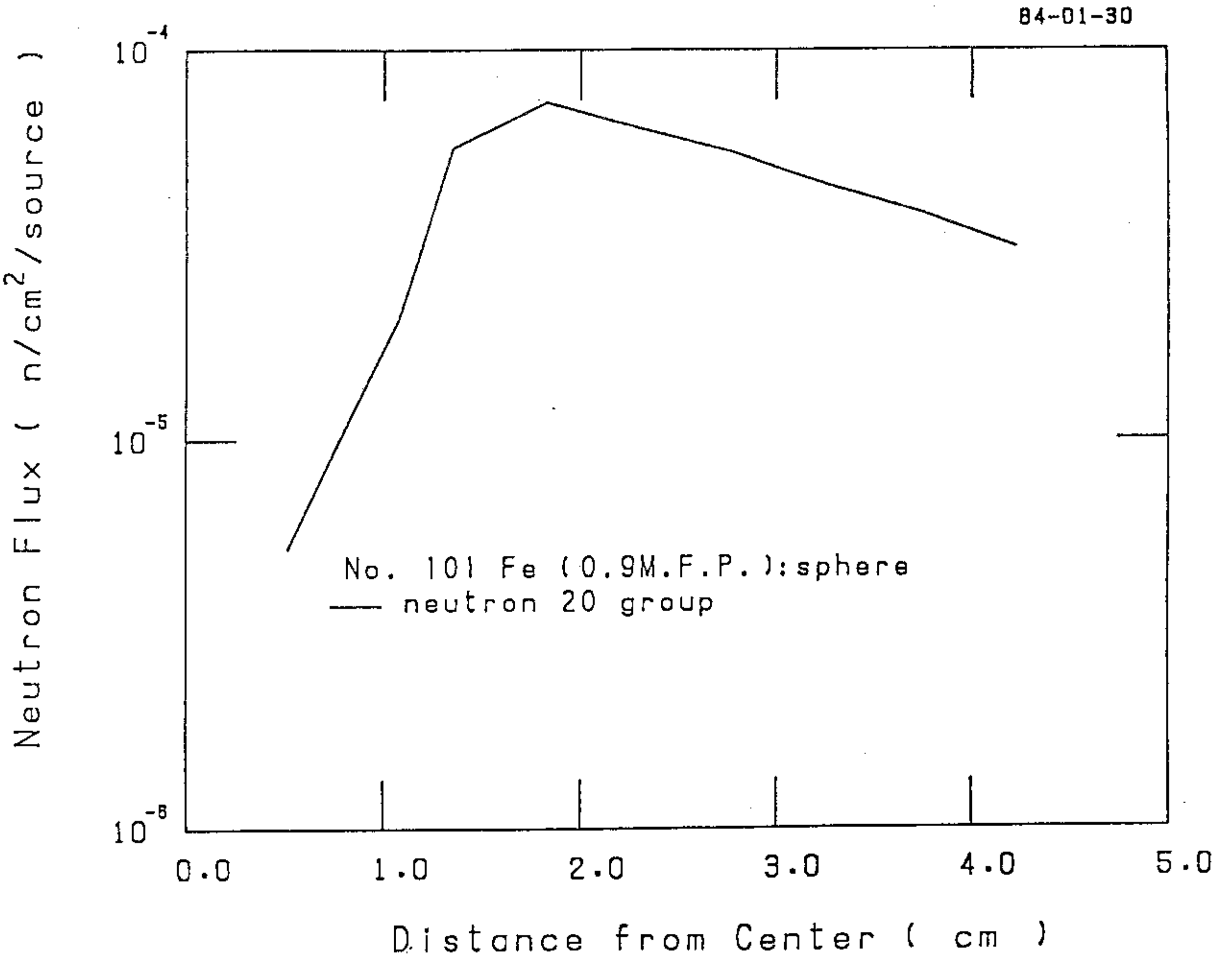


Fig. 5.1.34 Flux plotted for radial distance from center

```
               <<< COMMON EXECUTING DATA >>>

==========================================================

 >TITLE   =
          : MAIN TITLE OF THE GRAPH
 >XTITLE  = $G?AMMA-$R?AY $E?NERGY ( E$V )
          : X-AXIS CAPTION
 >YTITLE  = $G?AMMA-$R?AY $F?LUX ( N/CM@2/SOURCE )
          : Y-AXIS CAPTION
 >ZTITLE  =
          : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
 >UNIT( 3)=91
          : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
          : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=G09
 >NODE(2)=G09       TEST
 >NODE(3)=G09       TEST      SFX2
          : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1    0    0    0    0    0    0    0    0    0
 >CODE( 2)=  1    0    0    0    0    0    0    0    0    0
 >CODE( 3)=  1    0    0    0    0    0    0    0    0    0
          : CODE NUMBER OF THE PLOTTING DATA
 >XW      =200.00
          : X-AXIS LENGTH(MM)
 >YW      =160.00
          : Y-AXIS LENGTH(MM)

==========================================================

               <<< EXECUTING DATA FOR MODE-1 >>>

==================================================================

 >NPL     =  1      : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS   = A       : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA   =    1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA   = /       : TRANSFORM FORMAT OF THE DATA
 >COMP    =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
          : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT    = $G?AMMA-$R?AY $S?KYSHINE $P?ROBLEM
          : COMMENT FOR ALL DATA
 >SUBT( 1) =  CENTER (IM=1,JM=1)
          : COMMENT FOR EACH DATA

----------*** PLOTTING TYPE OPTION ***----------------------

 >TPO     = H : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL  =  1 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
 >CODE ( 1)= 1
           : SYMBOL CODE OF THE CALCULATION DATA
           : SYMBOL CODE OF THE EXPERIMENTAL DATA
           : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE   =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE   =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN      =     132.45: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN      =     184.11: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID    = 0        : OPTION FOR GRID LINE
 >XSCALE  = 1        : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE  = 1        : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE   = 0        : METHOD OF SCALING TYPE
 >XMIN    =    0.200E+05  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX    =    0.140E+08  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN    =    0.222E-10  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX    =    0.374E-07  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN   =    0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX   =    0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
==================================================================
```

Fig. 5.1.35 Input data of SFX2 data form for Fig. 5.1.36

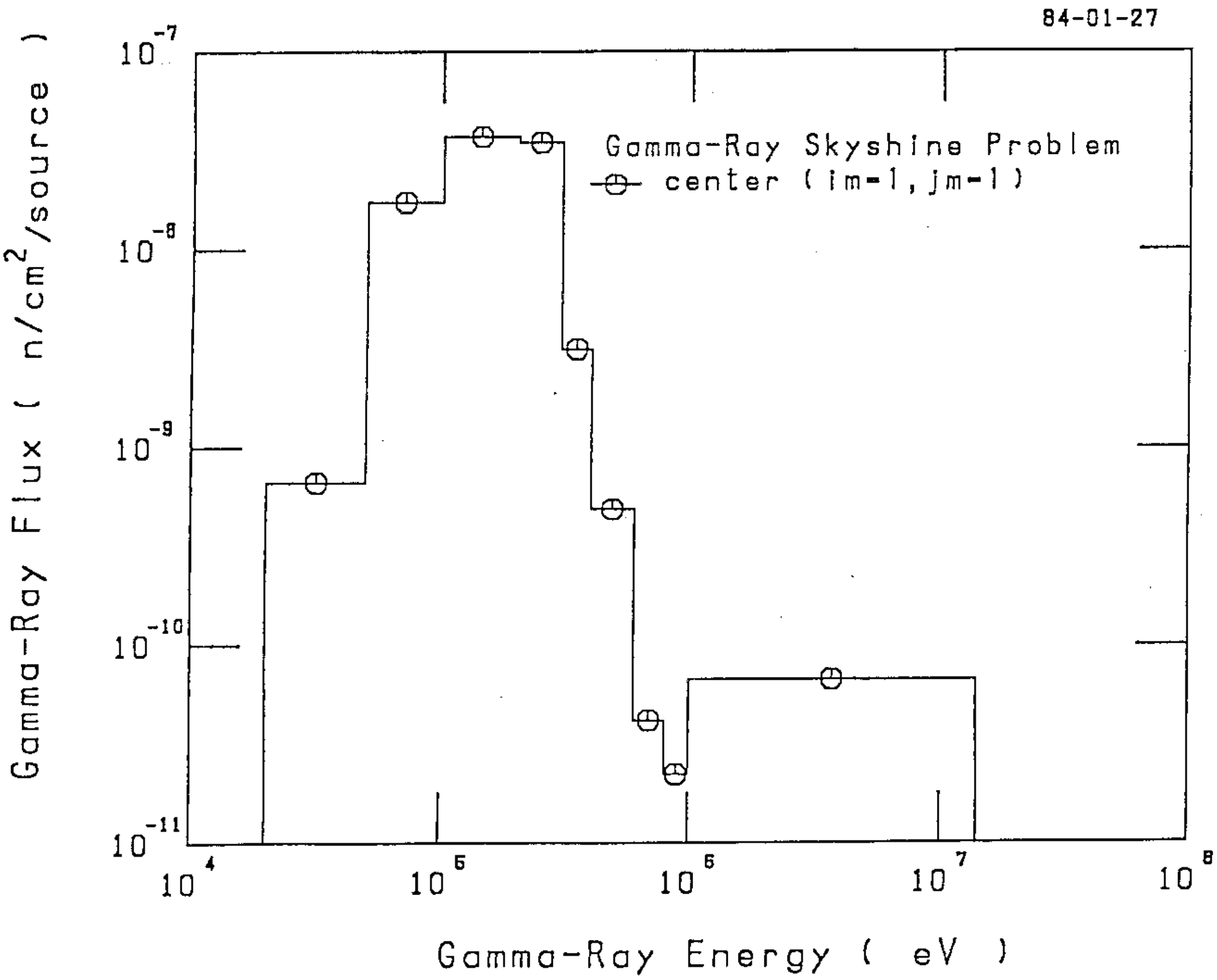


Fig. 5.1.36 Energy spectrum of SFX2 data form

```
                <<< COMMON EXECUTING DATA >>>

==========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = $A?XIAL $M?ESH $I?NTERVAL  ( CM )
         : X-AXIS CAPTION
 >YTITLE = $G?AMMA-$R?AY $F?LUX ( N/CM@2/SOURCE )
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=G09       TEST
 >NODE(2)=G09       TEST      SFX2
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  2   0   0   0   0   0   0   0   0   0
 >CODE( 2)=  1   0   0   0   0   0   0   0   0   0
 >CODE( 3)=  1   0   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =160.00
         : Y-AXIS LENGTH(MM)

==========================================================


           <<< EXECUTING DATA FOR MODE-1 >>>

==================================================================

 >NPL    =  1      : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS  = A       : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA  =   1.00 : CONSTANT NUMBER TO TRANSFORM
 >OPERA  = /       : TRANSFORM FORMAT OF THE DATA
 >COMP   =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
        : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT   = $G?AMMA-$R?AY $S?KYSHINE $P?ROBLEM
        : COMMENT FOR ALL DATA
 >SUBT( 1) =  1 GROUPS (RADIAL MESH:1)
        : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***-----------------------


 >TPO    = L : GRAPHIC FORM
 >PAT    = S : GRAPHIC PATTERN



 >SYMBOL =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE  =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE  =   4.00 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN     =     118.62: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN     =     184.47: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID   = 0       : OPTION FOR GRID LINE
 >XSCALE = 1       : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE = 1       : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE  = 0       : METHOD OF SCALING TYPE
 >XMIN   =    0.150E+03  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX   =    0.575E+05  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN   =    0.412E-13  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX   =    0.644E-05  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN  =    0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX  =    0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
==================================================================
```

Fig. 5.1.37 Input data of SFX2 data form for Fig. 5.1.38

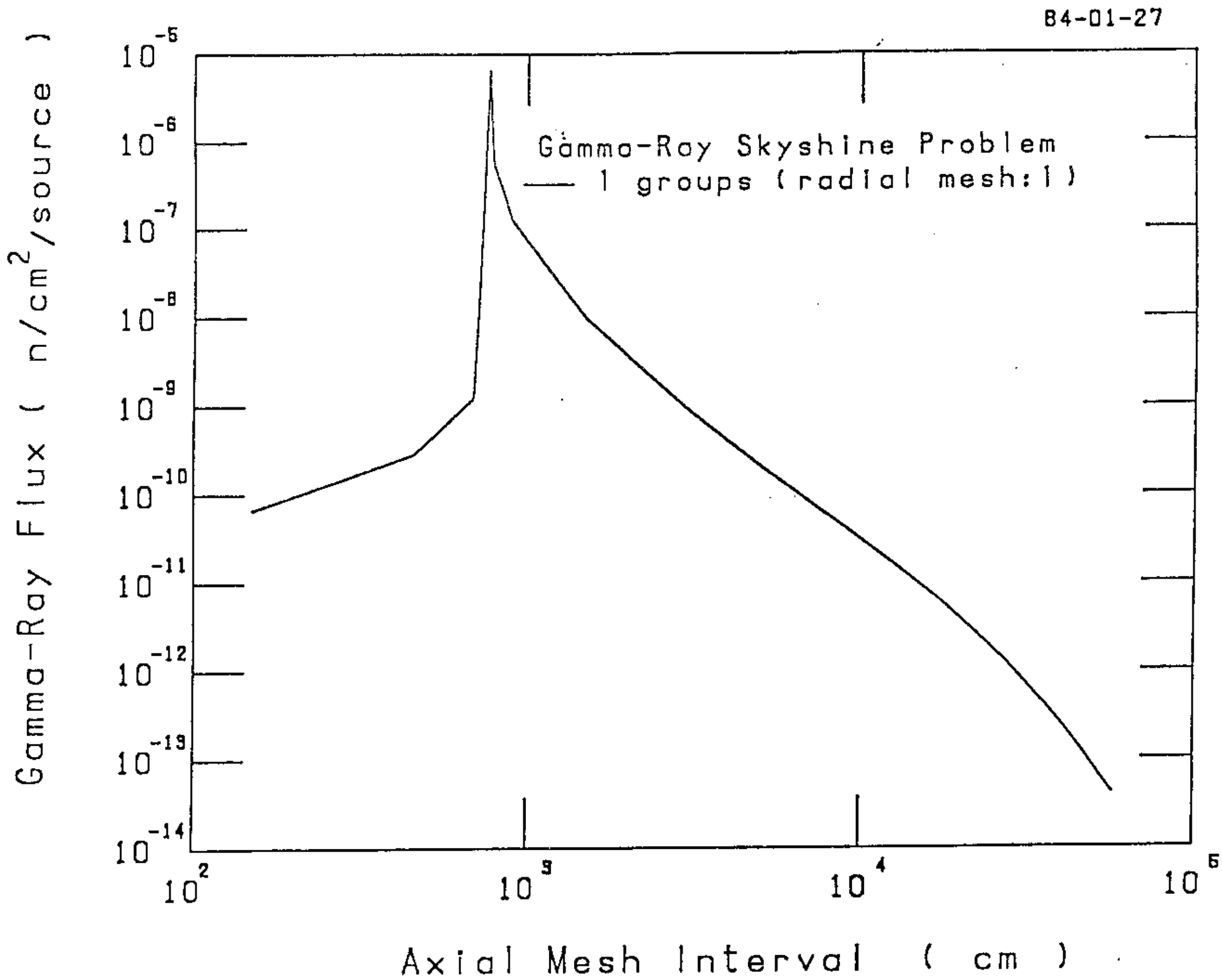


Fig. 5.1.38 Flux plotted for axial distance from center

```
            <<< COMMON EXECUTING DATA >>>

========================================================

 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITLE = $R?ADIAL $M?ESH $I?NTERVAL  ( CM )
         : X-AXIS CAPTION
 >YTITLE = $G?AMMA-$R?AY $F?LUX ( N/CM@2/SOURCE )
         : Y-AXIS CAPTION
 >ZTITLE =
         : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=G09       TEST
 >NODE(2)=G09       TEST      SFX2
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  3   0   0   0   0   0   0   0   0   0
 >CODE( 2)=  1   0   0   0   0   0   0   0   0   0
 >CODE( 3)=  1   0   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =160.00
         : Y-AXIS LENGTH(MM)

========================================================


            <<< EXECUTING DATA FOR MODE-1 >>>

=================================================================

 >NPL     =  1       : NUMBER OF PLOTTING LINE IN A GRAPH
 >TRANS   = A        : TRANSFORM TYPE OF THE PLOTTING DATA
 >ALPHA   =    1.00  : CONSTANT NUMBER TO TRANSFORM
 >OPERA   = /        : TRANSFORM FORMAT OF THE DATA
 >COMP    =  1       : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
          : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
 >COMT    = $G?AMMA-$R?AY $S?KYSHINE $P?ROBLEM
          : COMMENT FOR ALL DATA
 >SUBT( 1) =  1 GROUPS (AXIAL MESH:1)
          : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***-----------------------


 >TPO     = L : GRAPHIC FORM
 >PAT     = S : GRAPHIC PATTERN
 >SYMBOL  =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
          : SYMBOL CODE OF THE CALCULATION DATA
          : SYMBOL CODE OF THE EXPERIMENTAL DATA
          : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
 >ESIZE   =   2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
 >SSIZE   =   3.50 : HEIGHT OF CHARACTER FOR THE COMMENT
 >XN      =       60.45: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
 >YN      =      106.08: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
 >GRID    = 0       : OPTION FOR GRID LINE
 >XSCALE  = 1       : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE  = 1       : SCALING OPTION FOR Y-AXIS COORDINATE
 >SCALE   = 0       : METHOD OF SCALING TYPE
 >XMIN    =    0.100E+01  : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
 >XMAX    =    0.530E+05  : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
 >YMIN    =    0.940E-17  : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YMAX    =    0.124E-09  : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
 >YDMIN   =    0.0        : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
 >YDMAX   =    0.0        : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
*****************************************************************
```

Fig. 5.1.39 Input data of SFX2 data form for Fig. 5.1.40

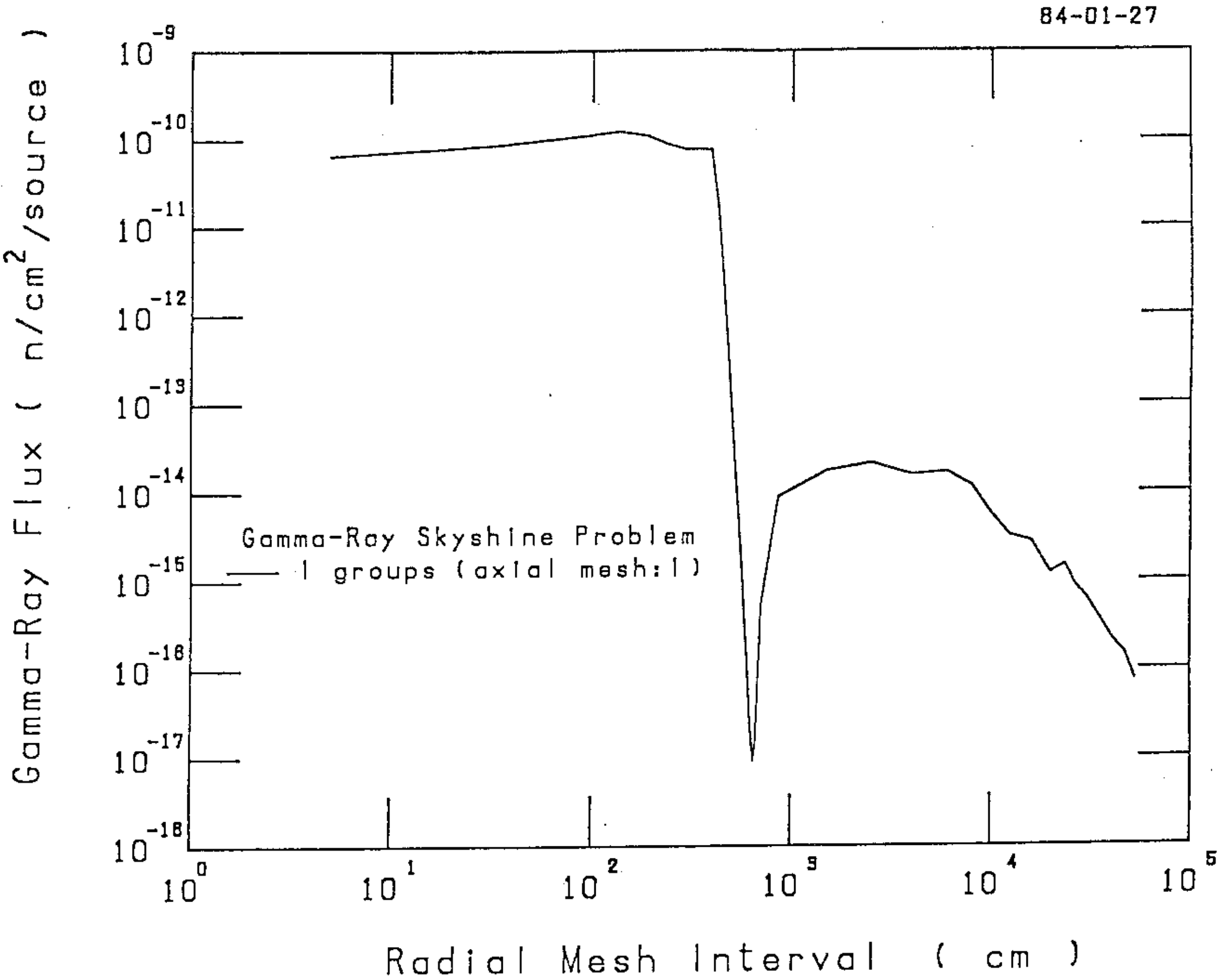


Fig. 5.1.40 Flux plotted for radial distance from center

5.2 MODE-2

(i) EGRP-Id.-SFX2 or SFX3 (calculated by ESPRIT)

This form contains the two dimensional foward scalar flux or adjoint scalar flux calculated by ESPRIT. Sample input to access DATA-POOL is as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=G09     TEST;
(2): UNIT(2)=91;NODE(2)=G09     TEST     SFX2;
(3); CODE(1)=nl;
```

where

(1): The input data is same as the (xi)-(2) data form.

(2): The input data is same as the (xi)-(3) data form.

(3): The code number nl means the energy group number.

The node structure and the record format are shown in Appendix E.2.(1) and E.3.(1) in detail. Sample inputs and outputs are shown in Figs. 5.2.1, 5.2.2, 5.2.3 and 5.2.4.

```
          <<< COMMON EXECUTING DATA >>>
===========================================================
>TITLE  =
        : MAIN TITLE OF THE GRAPH
>XTITL  = $R?ADIAL $M?ESH $I?NTERVAL  ( CM )
        : X-AXIS CAPTION
>YTITL  = $A?XIAL $M?ESH $I?NTERVAL  ( CM )
        : Y-AXIS CAPTION
>ZTITL  = $G?AMMA-$R?AY $F?LUX ( N/CM@2/SOURCE )
        : Z-AXIS CAPTION
>UNIT( 1)=91
>UNIT( 2)=91
        : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
        : FILE NAME OF THE CALCULATION DATA
>NODE(1)=G09       TEST
>NODE(2)=G09       TEST      SFX2
        : NODE NAME OF THE CALCULATION DATA
>CODE( 1)=  1   0   0   0   0   0   0   0   0   0
        : CODE NUMBER OF THE CALCULATION DATA
>XW     =220.00
        : X-AXIS LENGTH(MM)
>YW     =190.00
        : Y-AXIS LENGTH(MM)

===========================================================
        <<< EXECUTING DATA FOR MODE-2 >>>
===================================================================
>NPL    =  0      : NUMBER OF PLSTTING DATA IN A GRAPH
>IOP    =  1      : OPTION OF SCREEN SIZE
>XSC    = 297.00 : HORIZONTAL LENGTH OF THE SCREEN
>YSC    = 210.00 : VERTICAL LENGTH OF THE SCREEN
>LFR    =  1      : OPTION OF SCREEN TYPE
>IFRAM  =  1      : OPTION OF FRAME TYPE
>XW     = 200.00 : X-AXIS LENGTH
>YW     = 150.00 : Y-AXIS LENGTH
>XO     =  30.00 : INITIAL CO-ORDINATES OF X-AXIS
>YO     =  10.00 : INITIAL CO-ORDINATES OF Y-AXIS

>ZMIN   =    0.0        : MINIMUM VALUE FOR Z-AXIS
>ZMAX   =    0.0        : MAXIMUM VALUE FOR Z-AXIS
>KA     =  5      : GRADUATION TYPE
>SIZE   =  30.00 : HEIGHT OF GRID NUMBER
>NCNV   =  1      : DATA CONVERSION OPTION
>LFG    =  2      : GRADUATION FRAG
>IGRID  =  0      : GRID TYPE
>MX     =  0      : NUMBER OF GRID FOR X-AXIS
>MY     =  0      : NUMBER OF GRID FOR Y-AXIS
>ICENT  =   0     : CENTER SYMBOL CODE
>SSYMB  =   0.0   : SIZE OF CENTER SYMBOL
>INTER  =  0      : OPTION OF INTERPOLATION TYPE
>NCONTR =   8     : CONTOUR LINE NUMBER

>CONTV  =  1.000E-17   1.000E-16   1.000E-15   1.000E-14   1.000E-13
           1.000E-12   1.000E-11   1.000E-10
        : CONTOUR VALUE

>KIND   =      1           1           1           1           1

               1           1           1
        : TYPE OF CONTOUR LINE

>LCVOP  =  1      : CONTOUR VALUE PLOTTING PARAMETER
>ISTL   =  1      : INITIAL LINE NUMBER TO PLOT CONTOUR VALUE
>ML     =  1      : INTERVAL TO PLOT CONTOUR VALUE
>ICMT   = $G?AMMA-$R?AY $S?KYSHINE $P?ROBLEM : 1 GROUP
        : COMMON COMMENT FOR CONTOUR LINE
>XST    =   0.0  : INITIAL CO-ORDINATE OF X-AXIS TO PLOT THE COMMENT
>YST    =   0.0  : INITIAL CO-ORDINATE OF Y-AXIS TO PLOT THE COMMENT
>THETA  =   0.0  : ANGLE OF COMMENT
>CHIGH  =   4.00 : HEIGHT OF CHARACTOR
>IREAL  =  0      : OPTION TO DISPLAY REAL SIZE
>ID     = CONTOUR1  : IDENTICAL SIGN FOR FIGURE
>COMT   = $N?AME OF $T?HE $Z?ONE
        : COMMENT FOR ALL DATA
>SUBT( 1) = 1:AIR
>SUBT( 2) = 2:CONCRETE
>SUBT( 3) = 3:AIR
        : COMMENT FOR EACH DATA
===================================================================
```

Fig. 5.2.1 Input data of SFX2 data form for Fig. 5.2.2

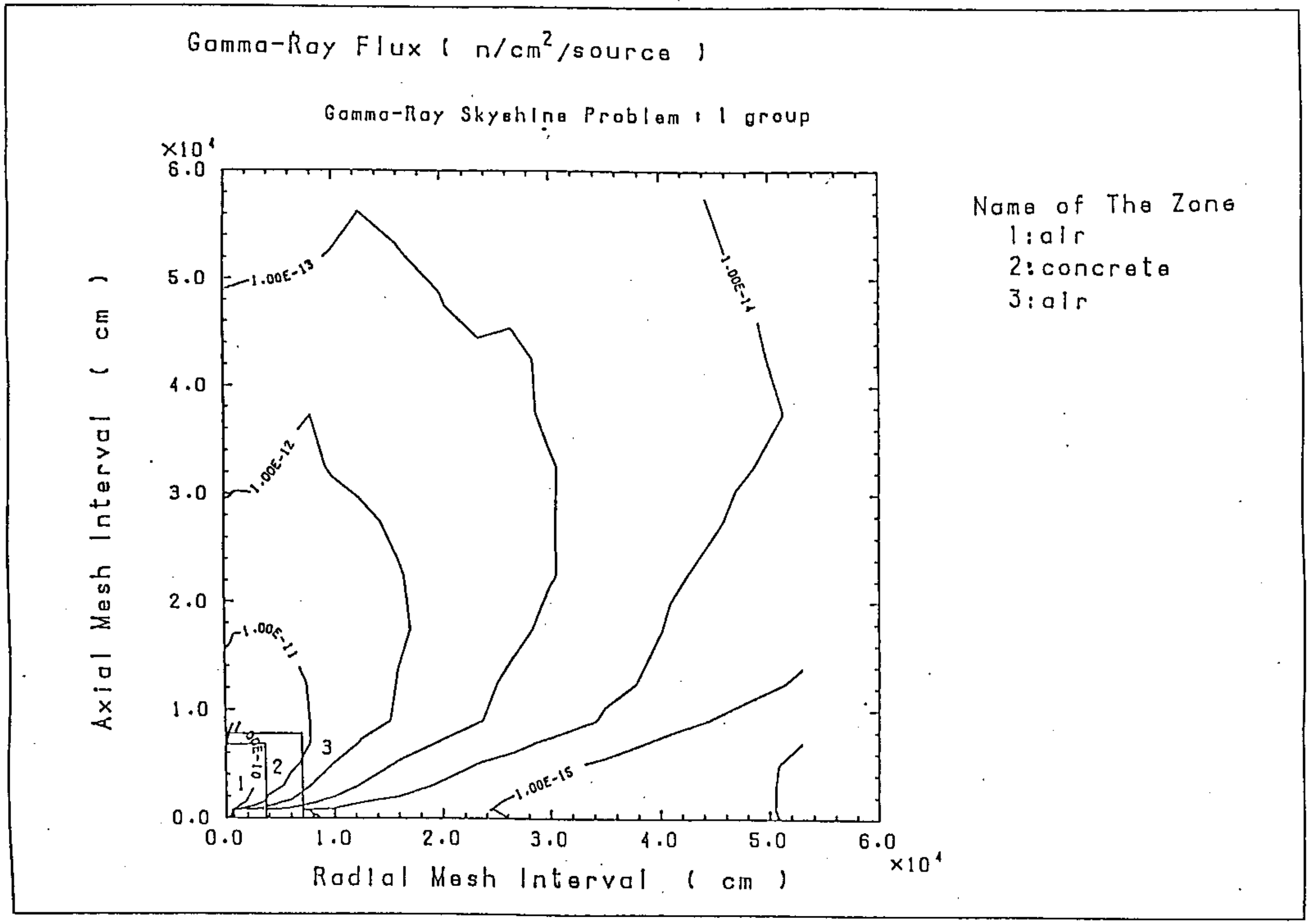


Fig. 5.2.2 Two dimensional flux of the energy group number 1

calculated by ESPRIT

```
          <<< COMMON EXECUTING DATA >>>
=================================================================
 >TITLE  =
         : MAIN TITLE OF THE GRAPH
 >XTITL  = $R?ADIAL $M?ESH $I?NTERVAL  ( CM )
         : X-AXIS CAPTION
 >YTITL  = $A?XIAL $M?ESH $I?NTERVAL  ( CM )
         : Y-AXIS CAPTION
 >ZTITL  = $G?AMMA-$R?AY $F?LUX ( N/CM@2/SOURCE )
         : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE CALCULATION DATA
 >NODE(1)=G09        TEST
 >NODE(2)=G09        TEST      SFX2
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  9   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE CALCULATION DATA
 >XW     =220.00
         : X-AXIS LENGTH(MM)
 >YW     =190.00
         : Y-AXIS LENGTH(MM)
=================================================================

          <<< EXECUTING DATA FOR MODE-2 >>>
=================================================================

 >NPL     =  0      : NUMBER OF PLSTTING DATA IN A GRAPH
 >IOP     =  1      : OPTION OF SCREEN SIZE
 >XSC     = 297.00 : HORIZONTAL LENGTH OF THE SCREEN
 >YSC     = 210.00 : VERTICAL LENGTH OF THE SCREEN
 >LFR     =  1      : OPTION OF SCREEN TYPE
 >IFRAM   =  1      : OPTION OF FRAME TYPE
 >XW      = 200.00 : X-AXIS LENGTH
 >YW      = 150.00 : Y-AXIS LENGTH
 >XO      =  30.00 : INITIAL CO-ORDINATES OF X-AXIS
 >YO      =  10.00 : INITIAL CO-ORDINATES OF Y-AXIS

 >ZMIN    =     0.0        : MINIMUM VALUE FOR Z-AXIS
 >ZMAX    =     0.0        : MAXIMUM VALUE FOR Z-AXIS
 >KA      =  5      : GRADUATION TYPE
 >SIZE    =  30.00 : HEIGHT OF GRID NUMBER
 >NCNV    =  1      : DATA CONVERSION OPTION
 >LFG     =  2      : GRADUATION FRAG
 >IGRID   =  0      : GRID TYPE
 >MX      =  0      : NUMBER OF GRID FOR X-AXIS
 >MY      =  0      : NUMBER OF GRID FOR Y-AXIS
 >ICENT   =   0     : CENTER SYMBOL CODE
 >SSYMB   =   0.0   : SIZE OF CENTER SYMBOL
 >INTER   =  0      : OPTION OF INTERPOLATION TYPE
 >NCONTR  =   8     : CONTOUR LINE NUMBER

 >CONTV   =  1.000E-14   1.000E-13   1.000E-12   1.000E-11   1.000E-10
             1.000E-09   5.000E-08   1.000E-08
         : CONTOUR VALUE

 >KIND    =      1           2           3           4           5
                 6           7           8
         : TYPE OF CONTOUR LINE

 >LCVOP   =  1      : CONTOUR VALUE PLOTTING PARAMETER
 >ISTL    =  1      : INITIAL LINE NUMBER TO PLOT CONTOUR VALUE
 >ML      =  1      : INTERVAL TO PLOT CONTOUR VALUE
 >ICMT    = $G?AMMA-$R?AY $S?KYSHINE $P?ROBLEM :9 GROUP
         : COMMON COMMENT FOR CONTOUR LINE
 >XST     =   0.0  : INITIAL CO-ORDINATE OF X-AXIS TO PLOT THE COMMENT
 >YST     =   0.0  : INITIAL CO-ORDINATE OF Y-AXIS TO PLOT THE COMMENT
 >THETA   =   0.0  : ANGLE OF COMMENT
 >CHIGH   =   4.00 : HEIGHT OF CHARACTOR
 >IREAL   =  0      : OPTION TO DISPLAY REAL SIZE
 >ID      = CONTOUR1  : IDENTICAL SIGN FOR FIGURE
 >COMT    =  $N?AME OF $T?HE $Z?ONE
         : COMMENT FOR ALL DATA
 >SUBT( 1) = 1:AIR
 >SUBT( 2) = 2:CONCRETE
 >SUBT( 3) = 3:AIR
         : COMMENT FOR EACH DATA
=================================================================
```

Fig. 5.2.3 Input data of SFX2 data form for Fig. 5.2.4

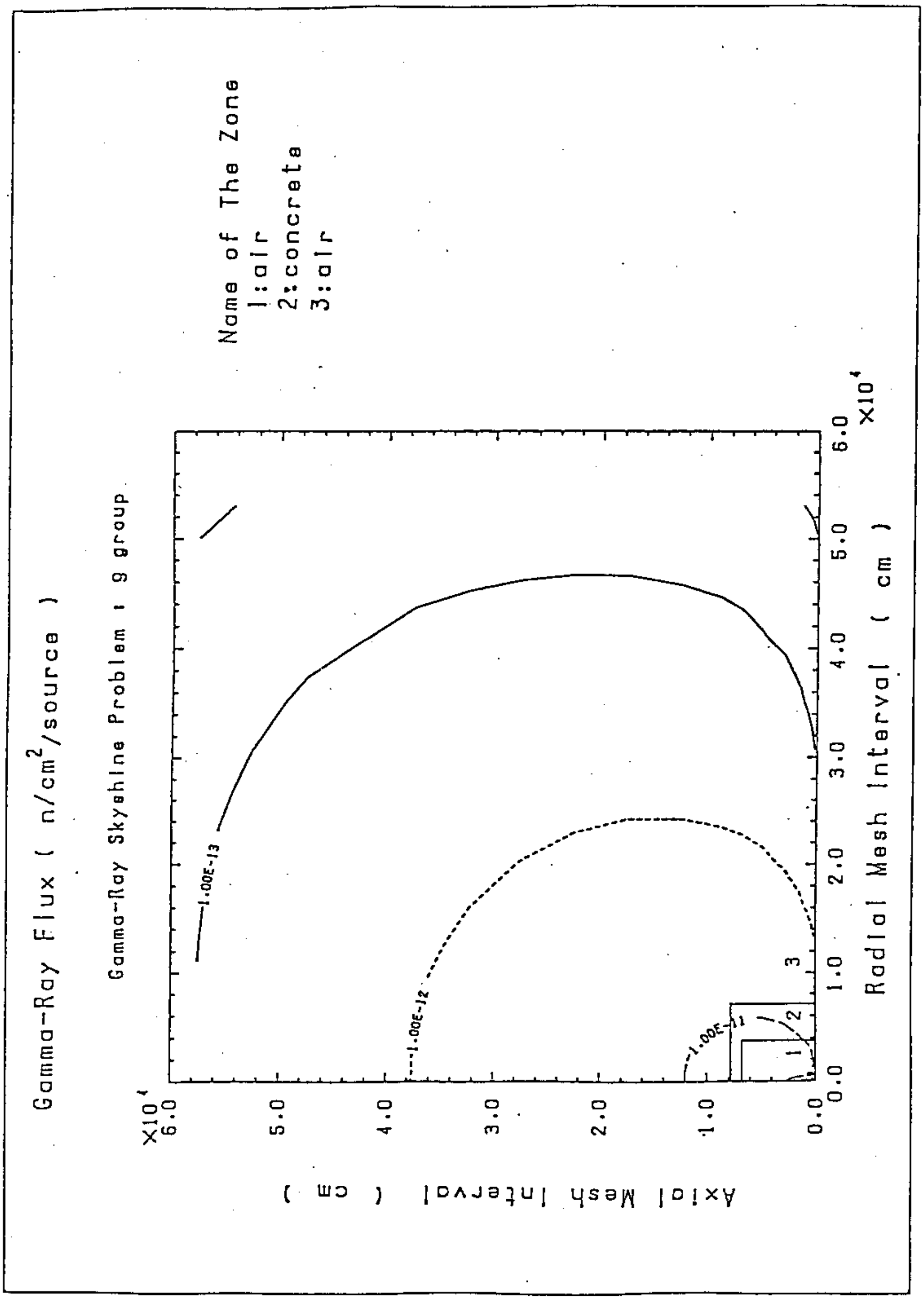


Fig. 5.2.4 Two dimensional flux of the energy group number 9 calculated by ESPRIT

5.3 MODE-3

(i) EGRP-INFX-Mat.no.-ELA(or INS or N2N)

This form contains the scattering matrices of elastic, inelastic or (n,2n) reactions. Sample input to access DATA-POOL is as follows:

```
     ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP     INFX     1192     INS;
(2): CODE(1)=n1;
(3): CODE(2)=n2;
(4): CODE(3)=n3;
(5): CODE(4)=IM;
(6): CODE(5)=JM;
```

where

(1): UNIT(1)=91 means that DATA-POOL allocated by logical unit number 91 is assigned, and the sub-data sets and the informations of the material number 1192 (Fe) in the level 4 are read by using the node structure assigned by NODE(1).

(2): The code number n1 means the fixed energy group number of the group-to-group cross section of the scattering matrix. The number indicates the one of the groups for the source energy or the sink energy determined with CODE(2).

(3): The code number indicates the option to fix the source term or the sink term. If n2 equals 1, the number assigned by CODE(1) means the number of source group and equals 0, it means the number of sink group.

(4): The code number n3 assigned by CODE(3) means the kind of scattering matrix. If the number equals 1, it means elastic reaction, equals 2, it means inelastic reaction, and equals 3, it means (n,2n) scattering matrix.

(5): IM assigned by CODE(4) must be greater than the maximum number of angular points.

(6): If the code number assigned by CODE(2) indicates the source group, JM must be greater than the maximum number of the sink groups and if it indicates the sink group, JM must be greater than the maximum number of source groups.

In the plotting the data form, the scratch file must be allocated to logical unit 10. The node structure and the record format are shown in Appendix E.2.(d), (e), (f) and E.3.(d), (e), (f) in detail. Sample inputs and outputs are shown in Figs. 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.5 and 5.3.6.

(ii) **EGRP-SGRX-Mat.no.-Ncode**

This form contains the secondary gamma-ray production cross sections of each reaction. Sample input to access DATA-POOL is as follows:

```
     ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP;
(2): UNIT(2)=91;NODE(2)=EGRP    SGRX    1274    106;
(3): CODE(1)=n1;
(4): CODE(2)=n2;
(5): CODE(3)=-11;
(6): CODE(4)=IGG;
(7): CODE(5)=ING;
```

where

(1): UNIT(1)=91 means that DATA-POOL file allocated by logical unit number 91 is used in the job, and NODE(1)=EGRP means that the fine-energy group structure and the informations are read in DATA-POOL.

(2): The sentence indicates that DATA-POOL allocated by logical unit number 91 is assigned, and the neutron interaction cross section, the yields, the probabilities and the informations of the material number 1274 (C) are read by using the node structure assigned by NODE(2) in DATA-POOL.

(3): The code number assigned by CODE(1) means the location of sub-data sets for gamma-ray energy. If it is greater than 0, it means the energy, and less than 0, it means the energy group number.

(4): The code number assigned by CODE(2) means the location of sub-data set for neutron energy. If it is greater than 0, it means the energy group structure and less than 0, it means the energy group number.

(5): The absolute value of this code number means the location of sub-data set for probability. The number must be less than 0.

(6): IGG assigned by CODE(4) means the number of energy data points for gamma-ray energy.

(7): ING assigned by CODE(5) means the number of energy data points for neutron energy.

The node structure and the record format are shown in Appendix E.2.(h) and E.3.(h) in detail. Sample input and output are shown in Figs. 5.3.7 and 5.3.8.

(iii) **EGRP-Id.SFX2 or SFX3** (calculated by ESPRIT)

This form contains the two dimensional foward scalar flux or adjoint scalar flux calculated by ESPRIT. Sample input to access DATA-POOL is as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EGRP     TEST;
(2): UNIT(2)=91;NODE(2)=EGRP     TEST     SFX2;
(3): CODE(1)=n1;
```

where

(1): The input data is same as the (xi)-(2) data form.

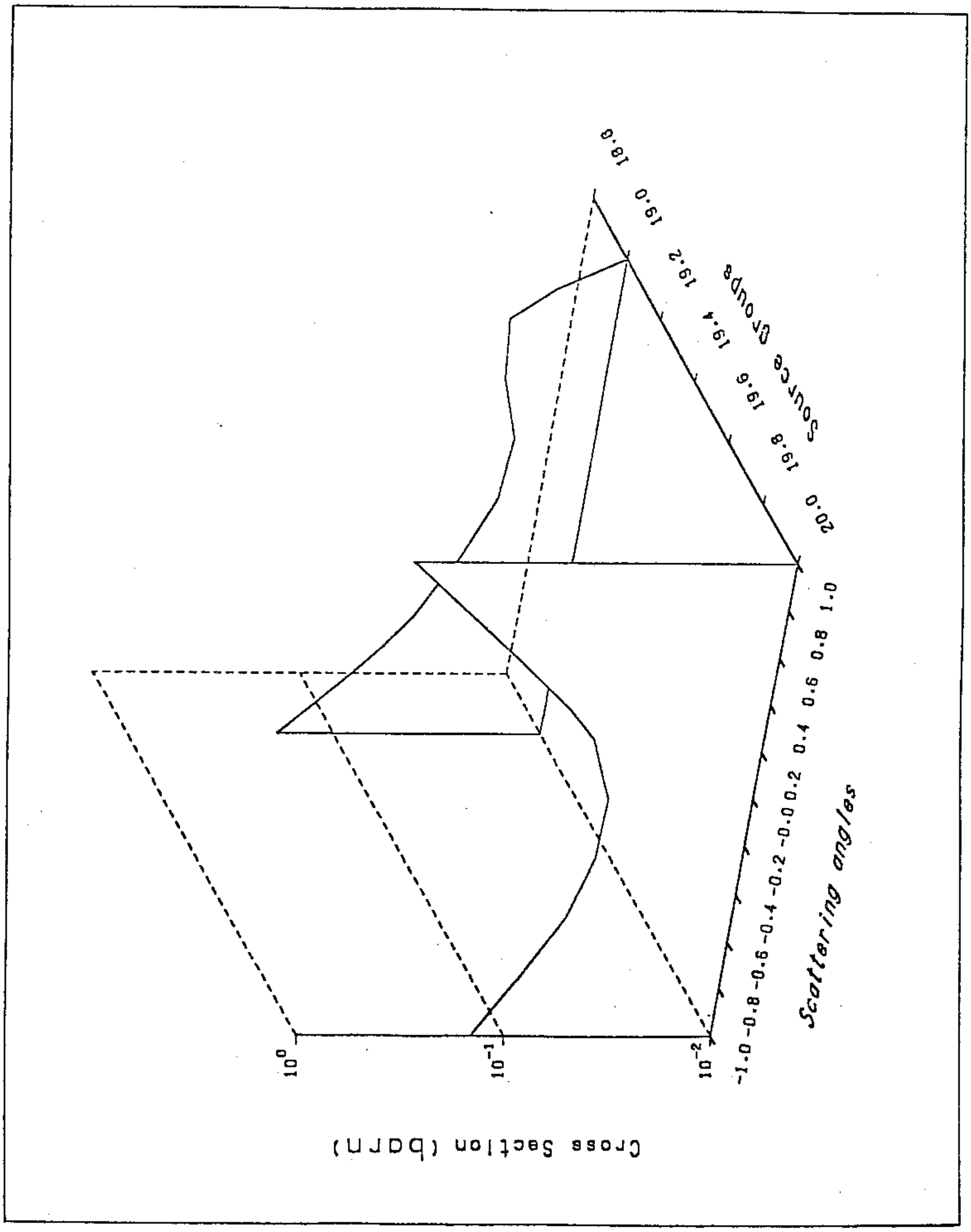
(2): The input data is same as the (xi)-(3) data form.

(3): The code number means the energy group number.

The node structure and the record format are shown in Appendix E.2.(1) and E.3.(1) in detail. Sample input and output are shown in Figs. 5.3.9, 5.3.10, 5.3.11 and 5.3.12.

```
                <<< COMMON EXECUTING DATA >>>

===========================================================

 >TITLE  = ¥E?LASTIC ¥S?CATTERING ¥M?ATRIX (SINK 20 GROUPS)S)/
         : MAIN TITLE OF THE GRAPH
 >XTITLE = SCATTERING ANGLES
         : X-AXIS CAPTION
 >YTITLE = SOURCE GROUPS
         : Y-AXIS CAPTION
 >ZTITLE = ¥C?ROSS ¥S?ECTION  ( BARN )
         : Z-AXIS CAPTION
 >UNIT( 1)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP      INFX      1192       ELA
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)= 20   0   0   0   0   0   0   0   0   0
 >CODE( 3)=  1   0   0   0   0   0   0   0   0   0
 >CODE( 4)= 20   0   0   0   0   0   0   0   0   0
 >CODE( 5)= 20   0   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =170.00
         : Y-AXIS LENGTH(MM)

===========================================================

          <<< EXECUTING DATA FOR MODE-3 >>>

===========================================================

 >XSCALE =  0      : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE =  0      : SCALING OPTION FOR Y-AXIS COORDINATE
 >ZSCALE =  1      : SCALING OPTION FOR Z-AXIS COORDINATE
 >NSTEP  =  0      : READ OR WRITE OPTION OF ORIGINAL DATA
 >THETA  =  30.00  : GRADIENT OF Y-AXIS ( DEG. )
 >DELTA  =  10.00  : GRADIENT OF X-AXIS ( DEG. )
 >BETA   =   1.00  : (Y-AXIS LENGTH)/(X-AXIS LENGTH)

 >MGRAPH =  1      : GRAPHIC TYPE OPTION
 >NXCH   =  0      : OPTION TO CHANGE X-AXIS DATA ARRAY
 >NYCH   =  0      : OPTION TO CHANGE Y-AXIS DATA ARRAY
 >NVALUE =  0      : INPUT OPTION OF THE THRESHOLD VALUE
 >ALPHA  =   0.0   : THRESHOLD VALUE OF Z-AXIS
 >LIMIT  =  0      : INTERPOLATED POINT NUMBER
 >PRINT  =  0      : PRINT OPTION OF INPUT DATA
 >DDXY   =   0.10  : MINIMUM MESH WIDTH ( MM )
===========================================================
```

Fig. 5.3.1 Input data of ELA data form for Fig. 5.3.2



Fe Elastic Scattering Matrix (sink 20 groups)

Fig. 5.3.2 Scattering matrix of elastic reaction for MODE-3

```
<<< COMMON EXECUTING DATA >>>

==========================================================

 >TITLE  = ¥I?NELASTIC ¥S?CATTERING ¥M?ATRIX (SOURCE 1 GROUP)
         : MAIN TITLE OF THE GRAPH
 >XTITLE = SCATTERING ANGLES
         : X-AXIS CAPTION
 >YTITLE = SINK GROUPS S
         : Y-AXIS CAPTION
 >ZTITLE = ¥C?ROSS ¥S?ECTION  ( BARN )
         : Z-AXIS CAPTION
 >UNIT( 1)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP     INFX     1192     INS
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1   0   0   0   0   0   0   0   0   0
 >CODE( 2)=  1   0   0   0   0   0   0   0   0   0
 >CODE( 3)=  2   0   0   0   0   0   0   0   0   0
 >CODE( 4)= 20   0   0   0   0   0   0   0   0   0
 >CODE( 5)=100   0   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =200.00
         : X-AXIS LENGTH(MM)
 >YW     =170.00
         : Y-AXIS LENGTH(MM)

==========================================================

<<< EXECUTING DATA FOR MODE-3 >>>

==========================================================

 >XSCALE =  0     : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE =  0     : SCALING OPTION FOR Y-AXIS COORDINATE
 >ZSCALE =  1     : SCALING OPTION FOR Z-AXIS COORDINATE
 >NSTEP  =  0     : READ OR WRITE OPTION OF ORIGINAL DATA
 >THETA  =  30.00 : GRADIENT OF Y-AXIS ( DEG. )
 >DELTA  =  10.00 : GRADIENT OF X-AXIS ( DEG. )
 >BETA   =   1.00 : (Y-AXIS LENGTH)/(X-AXIS LENGTH)

 >MGRAPH =  1     : GRAPHIC TYPE OPTION
 >NXCH   =  0     : OPTION TO CHANGE X-AXIS DATA ARRAY
 >NYCH   =  1     : OPTION TO CHANGE Y-AXIS DATA ARRAY
 >NVALUE =  0     : INPUT OPTION OF THE THRESHOLD VALUE
 >ALPHA  =   0.0  : THRESHOLD VALUE OF Z-AXIS
 >LIMIT  =  0     : INTERPOLATED POINT NUMBER
 >PRINT  =  0     : PRINT OPTION OF INPUT DATA
 >DDXY   =   0.10 : MINIMUM MESH WIDTH ( MM )
==========================================================
```

Fig. 5.3.3 Input data of INS data form for Fig. 5.3.4

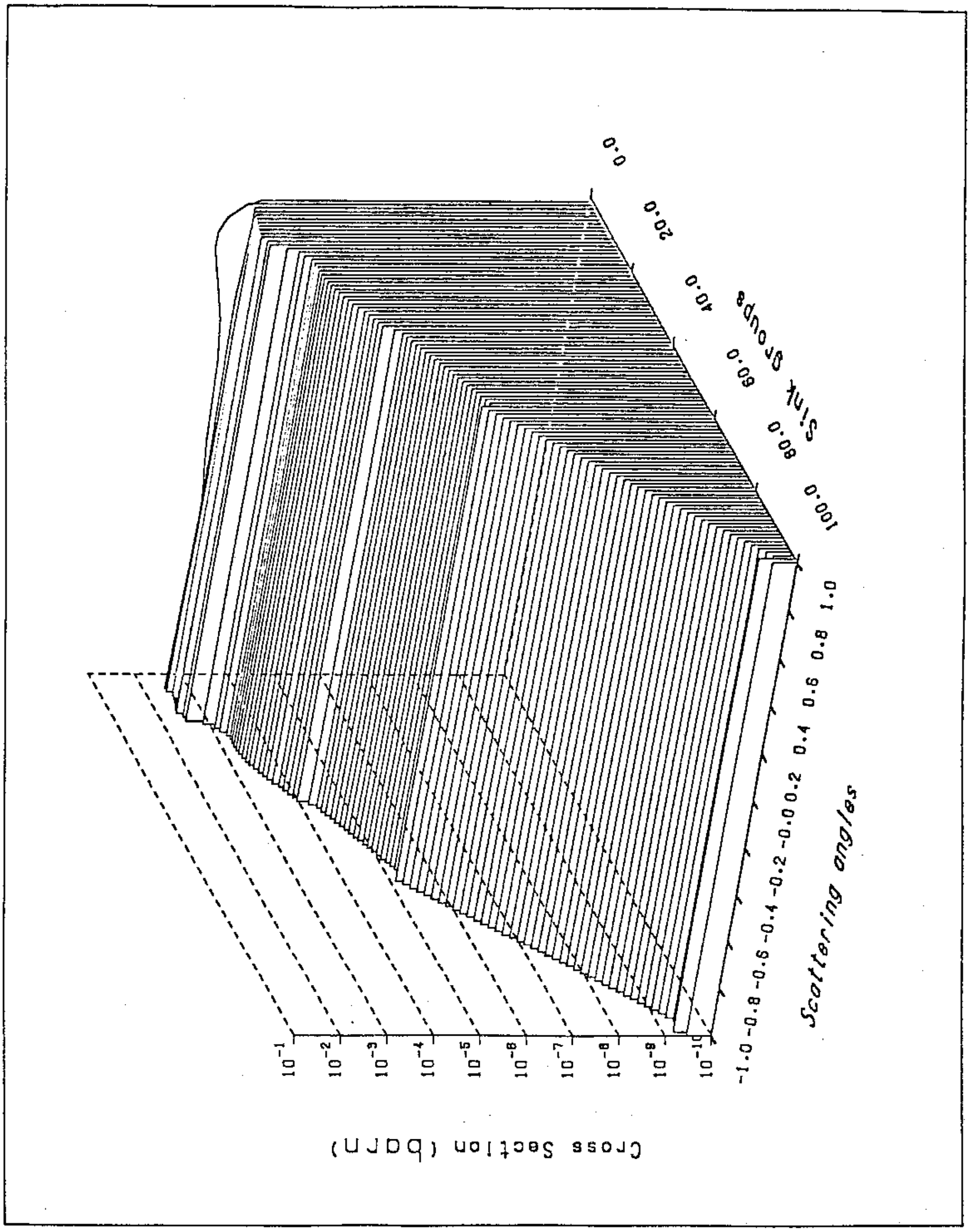


Fig. 5.3.4 Scattering matrix of inelastic reaction for MODE-3

```
          <<< COMMON EXECUTING DATA >>>

============================================================

>TITLE  = ¥(?N,2N) ¥S?CATTERING ¥M?ATRIX (SOURCE 1 GROUP)
        : MAIN TITLE OF THE GRAPH
>XTITLE = SCATTERING ANGLES
        : X-AXIS CAPTION
>YTITLE = SINK GROUPS S
        : Y-AXIS CAPTION
>ZTITLE = ¥C?ROSS ¥S?ECTION ( BARN )
        : Z-AXIS CAPTION
>UNIT( 1)=91
        : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
        : FILE NAME OF THE NUMAL DATA POOL
>NODE(1)=EGRP     INFX     1192     N2N
        : NODE NAME OF THE CALCULATION DATA
>CODE( 1)=  1   0   0   0   0   0   0   0   0   0
>CODE( 2)=  1   0   0   0   0   0   0   0   0   0
>CODE( 3)=  3   0   0   0   0   0   0   0   0   0
>CODE( 4)= 20   0   0   0   0   0   0   0   0   0
>CODE( 5)=100   0   0   0   0   0   0   0   0   0
        : CODE NUMBER OF THE PLOTTING DATA
>XW     =200.00
        : X-AXIS LENGTH(MM)
>YW     =170.00
        : Y-AXIS LENGTH(MM)

============================================================

     <<< EXECUTING DATA FOR MODE-3 >>>

============================================================

>XSCALE =  0      : SCALING OPTION FOR X-AXIS COORDINATE
>YSCALE =  0      : SCALING OPTION FOR Y-AXIS COORDINATE
>ZSCALE =  1      : SCALING OPTION FOR Z-AXIS COORDINATE
>NSTEP  =  0      : READ OR WRITE OPTION OF ORIGINAL DATA
>THETA  =  30.00  : GRADIENT OF Y-AXIS ( DEG. )
>DELTA  =  10.00  : GRADIENT OF X-AXIS ( DEG. )
>BETA   =   1.00  : (Y-AXIS LENGTH)/(X-AXIS LENGTH)

>MGRAPH =  1      : GRAPHIC TYPE OPTION

>NXCH   =  0      : OPTION TO CHANGE X-AXIS DATA ARRAY
>NYCH   =  1      : OPTION TO CHANGE Y-AXIS DATA ARRAY
>NVALUE =  0      : INPUT OPTION OF THE THRESHOLD VALUE
>ALPHA  =   0.0   : THRESHOLD VALUE OF Z-AXIS
>LIMIT  =  0      : INTERPOLATED POINT NUMBER
>PRINT  =  0      : PRINT OPTION OF INPUT DATA
>DDXY   =   0.10  : MINIMUM MESH WIDTH ( MM )
============================================================
```

Fig. 5.3.5 Input data of N2N data form for Fig. 5.3.6

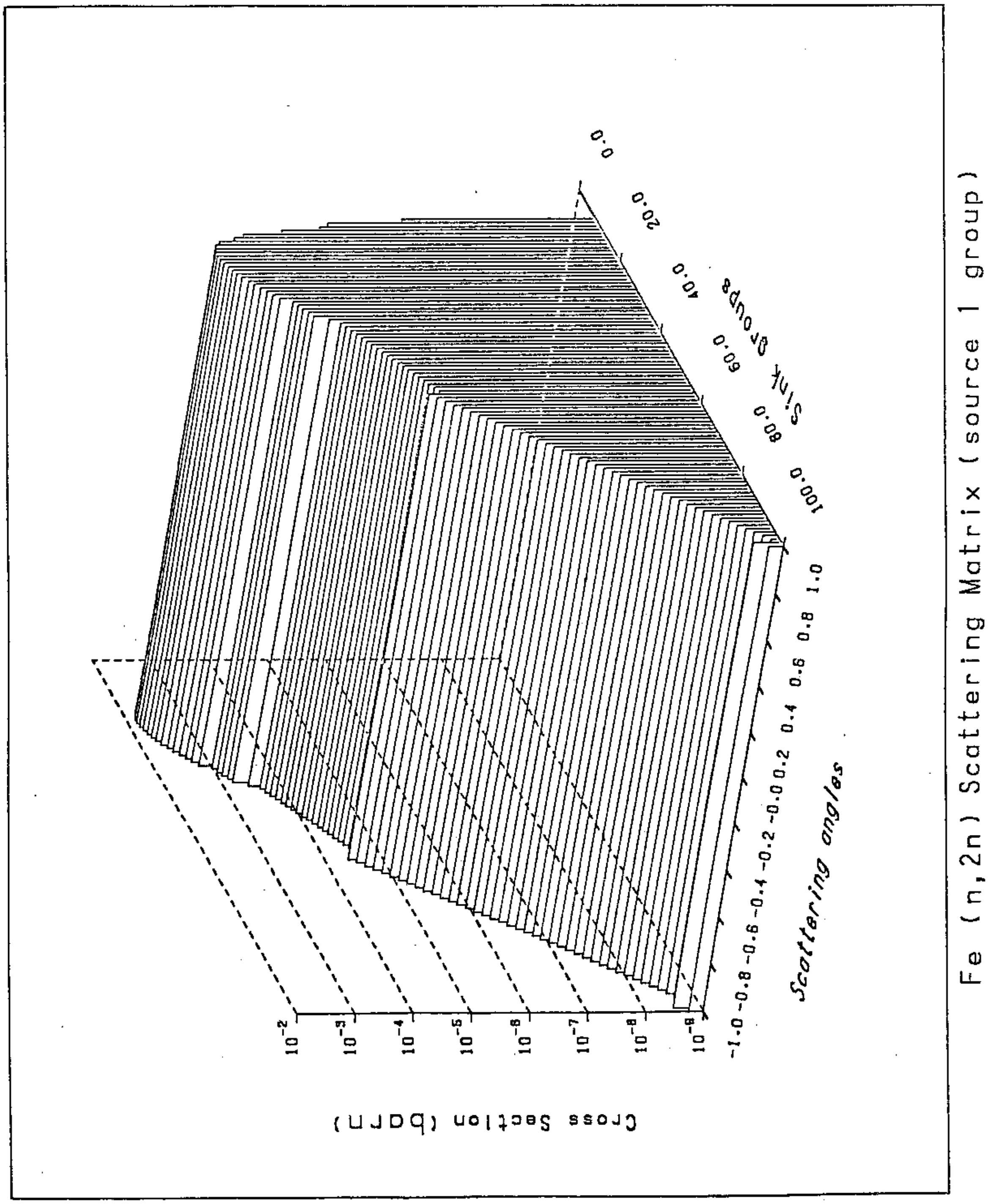
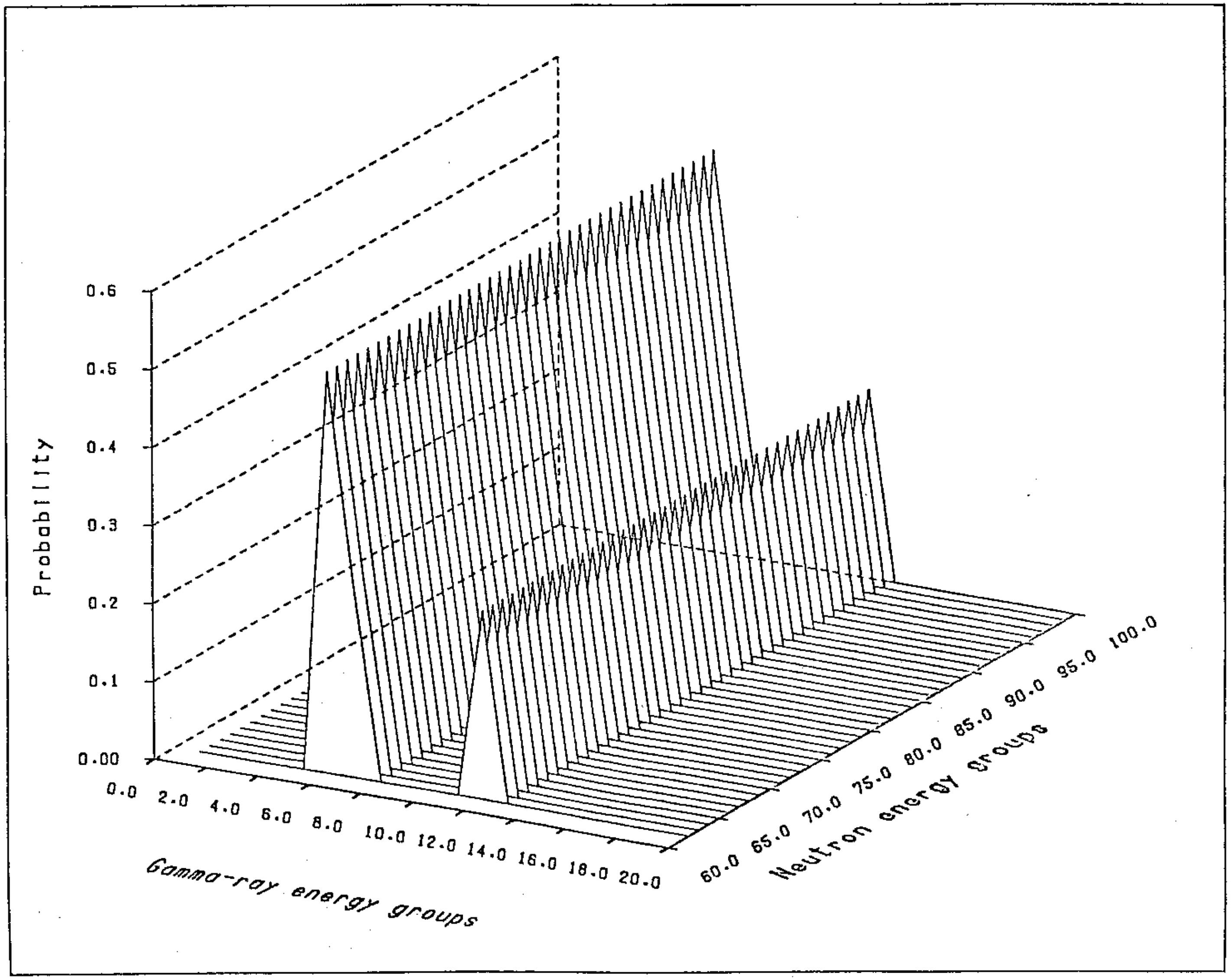


Fig. 5.3.6 Scattering matrix of (n,2n) reaction for MODE-3

```
               <<< COMMON EXECUTING DATA >>>

==========================================================

 >TITLE  = ¥S?ECONDARY ¥G?AMMA-RAY ¥D?ATA ¥(1274-106 C-12)
         : MAIN TITLE OF THE GRAPH
 >XTITLE = GAMMA-RAY ENERGY GROUPS
         : X-AXIS CAPTION
 >YTITLE = NEUTRON ENERGY GROUPS
         : Y-AXIS CAPTION
 >ZTITLE = ¥P?ROBABILITY
         : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
         : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
         : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=EGRP
 >NODE(2)=EGRP     SGRX      1274       106
         : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)= -1   0   0   0   0   0   0   0   0   0
 >CODE( 2)= -1   0   0   0   0   0   0   0   0   0
 >CODE( 3)= -5   0   0   0   0   0   0   0   0   0
 >CODE( 4)= 20   0   0   0   0   0   0   0   0   0
 >CODE( 5)=100   0   0   0   0   0   0   0   0   0
         : CODE NUMBER OF THE PLOTTING DATA
 >XW     =220.00
         : X-AXIS LENGTH(MM)
 >YW     =190.00
         : Y-AXIS LENGTH(MM)

==========================================================

         <<< EXECUTING DATA FOR MODE-3 >>>

==========================================================

 >XSCALE =  0     : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE =  0     : SCALING OPTION FOR Y-AXIS COORDINATE
 >ZSCALE =  0     : SCALING OPTION FOR Z-AXIS COORDINATE
 >NSTEP  =  0     : READ OR WRITE OPTION OF ORIGINAL DATA
 >THETA  =  30.00 : GRADIENT OF Y-AXIS ( DEG. )
 >DELTA  =  10.00 : GRADIENT OF X-AXIS ( DEG. )
 >BETA   =   1.00 : (Y-AXIS LENGTH)/(X-AXIS LENGTH)

 >MGRAPH =  1     : GRAPHIC TYPE OPTION
 >NXCH   =  0     : OPTION TO CHANGE X-AXIS DATA ARRAY
 >NYCH   =  0     : OPTION TO CHANGE Y-AXIS DATA ARRAY
 >NVALUE =  0     : INPUT OPTION OF THE THRESHOLD VALUE
 >ALPHA  =   0.0  : THRESHOLD VALUE OF Z-AXIS
 >LIMIT  =  0     : INTERPOLATED POINT NUMBER
 >PRINT  =  0     : PRINT OPTION OF INPUT DATA
 >DDXY   =   0.10 : MINIMUM MESH WIDTH ( MM )

==========================================================
```

Fig. 5.3.7 Input data of SGRX data form for Fig. 5.3.8

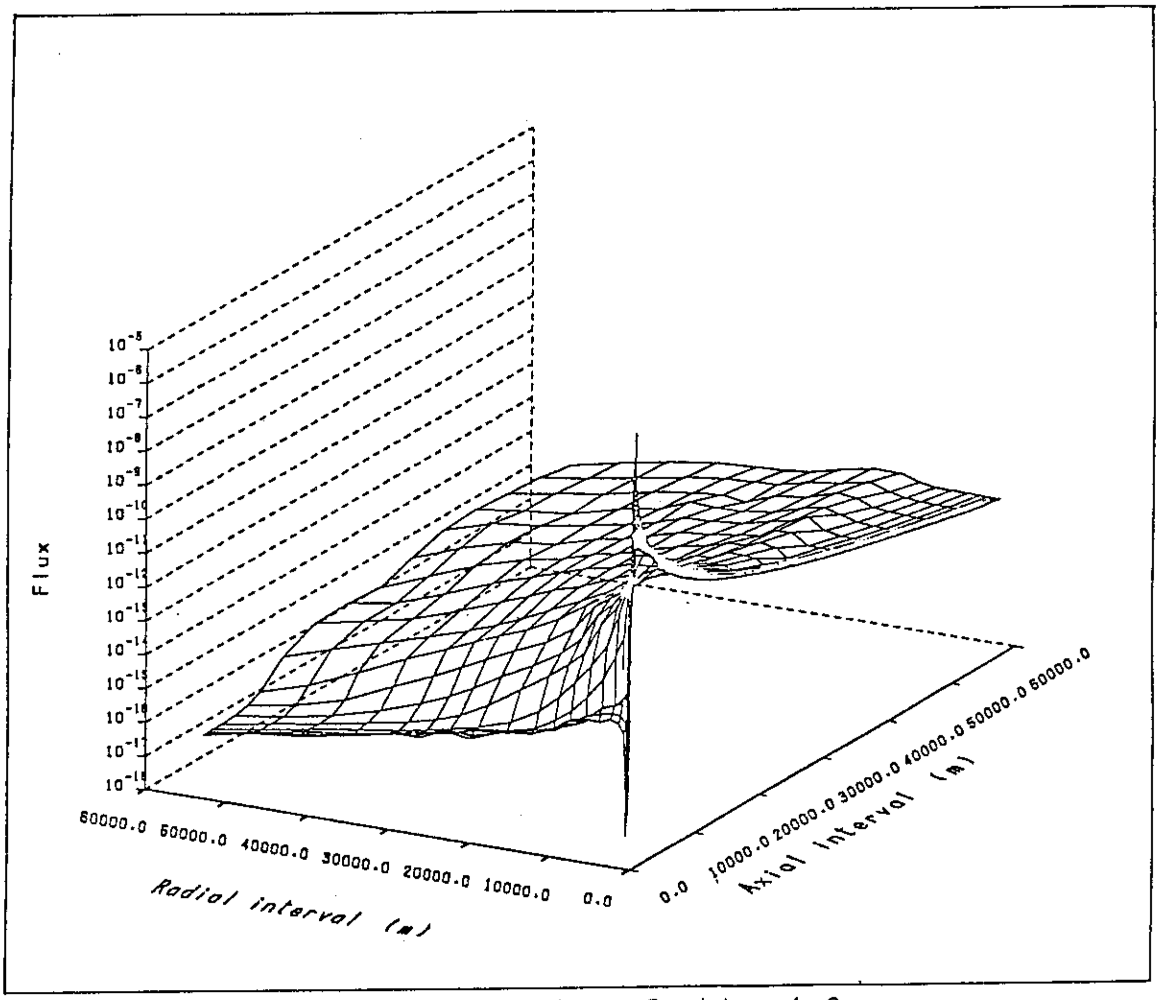


Secondary Gamma-ray Data (1274-106 C-12)

Fig. 5.3.8 Probabilities of secondary gamma-ray production for MODE-3

```
<<< COMMON EXECUTING DATA >>>

==========================================================

>TITLE  = ¥G?AMMA-¥R?AY ¥S?KYSHINE ¥P?ROBLEM 1 ¥G?ROUPS
        : MAIN TITLE OF THE GRAPH
>XTITLE = RADIAL INTERVAL  (M)
        : X-AXIS CAPTION
>YTITLE = AXIAL INTERVAL  (M)
        : Y-AXIS CAPTION
>ZTITLE = ¥F?LUX
        : Z-AXIS CAPTION
>UNIT( 1)=91
>UNIT( 2)=91
        : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
        : FILE NAME OF THE NUMAL DATA POOL
>NODE(1)=G09       TEST
>NODE(2)=G09       TEST.     SFX2
        : NODE NAME OF THE CALCULATION DATA
>CODE( 1)=  1   0   0   0   0   0   0   0   0   0
        : CODE NUMBER OF THE PLOTTING DATA
>XW     =220.00
        : X-AXIS LENGTH(MM)
>YW     =190.00
        : Y-AXIS LENGTH(MM)

==========================================================


<<< EXECUTING DATA FOR MODE-3 >>>

==========================================================

>XSCALE =  0      : SCALING OPTION FOR X-AXIS COORDINATE
>YSCALE =  0      : SCALING OPTION FOR Y-AXIS COORDINATE
>ZSCALE =  1      : SCALING OPTION FOR Z-AXIS COORDINATE
>NSTEP  =  0      : READ OR WRITE OPTION OF ORIGINAL DATA
>THETA  =  30.00 : GRADIENT OF Y-AXIS ( DEG. )
>DELTA  =  10.00 : GRADIENT OF X-AXIS ( DEG. )
>BETA   =   1.00 : (Y-AXIS LENGTH)/(X-AXIS LENGTH)

>MGRAPH =  0      : GRAPHIC TYPE OPTION
>NXCH   =  1      : OPTION TO CHANGE X-AXIS DATA ARRAY
>NYCH   =  0      : OPTION TO CHANGE Y-AXIS DATA ARRAY
>NVALUE =  0      : INPUT OPTION OF THE THRESHOLD VALUE
>ALPHA  =   0.0  : THRESHOLD VALUE OF Z-AXIS
>LIMIT  =  0      : INTERPOLATED POINT NUMBER
>PRINT  =  0      : PRINT OPTION OF INPUT DATA
>DDXY   =   0.10 : MINIMUM MESH WIDTH ( MM )

==========================================================
```

Fig. 5.3.9 Input data of SFX2 data form for Fig. 5.3.10



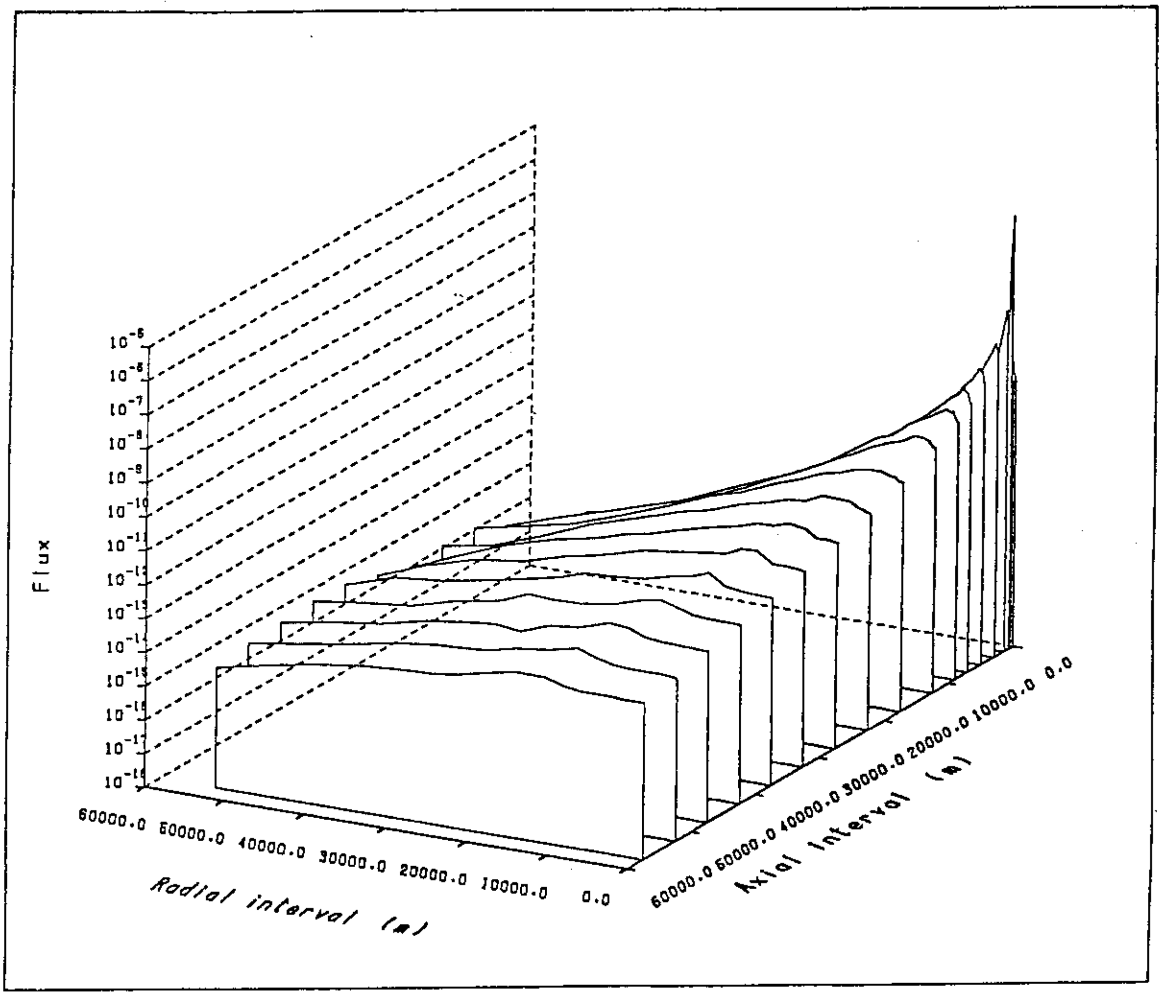
Gamma-Ray Skyshine Problem 1 Groups

Fig. 5.3.10 Two dimensional flux calculated by ESPRIT

(MGRAPH = 0, NXCH = 1)

```
<<< COMMON EXECUTING DATA >>>

=========================================================

 >TITLE   = ¥G?AMMA-¥R?AY ¥S?KYSHINE ¥P?ROBLEM 1 ¥G?ROUPS
          : MAIN TITLE OF THE GRAPH
 >XTITLE = RADIAL INTERVAL  (M)
          : X-AXIS CAPTION
 >YTITLE = AXIAL INTERVAL  (M)
          : Y-AXIS CAPTION
 >ZTITLE = ¥F?LUX
          : Z-AXIS CAPTION
 >UNIT( 1)=91
 >UNIT( 2)=91
          : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
          : FILE NAME OF THE NUMAL DATA POOL
 >NODE(1)=G09       TEST
 >NODE(2)=G09       TEST.     SFX2
          : NODE NAME OF THE CALCULATION DATA
 >CODE( 1)=  1   0   0   0   0   0   0   0   0   0
          : CODE NUMBER OF THE PLOTTING DATA
 >XW      =220.00
          : X-AXIS LENGTH(MM)
 >YW      =190.00
          : Y-AXIS LENGTH(MM)

=========================================================


<<< EXECUTING DATA FOR MODE-3 >>>

=========================================================

 >XSCALE =  0      : SCALING OPTION FOR X-AXIS COORDINATE
 >YSCALE =  0      : SCALING OPTION FOR Y-AXIS COORDINATE
 >ZSCALE =  1      : SCALING OPTION FOR Z-AXIS COORDINATE
 >NSTEP  =  0      : READ OR WRITE OPTION OF ORIGINAL DATA
 >THETA  =  30.00 : GRADIENT OF Y-AXIS ( DEG. )
 >DELTA  =  10.00 : GRADIENT OF X-AXIS ( DEG. )
 >BETA   =   1.00 : (Y-AXIS LENGTH)/(X-AXIS LENGTH)

 >MGRAPH =  1      : GRAPHIC TYPE OPTION
 >NXCH   =  1      : OPTION TO CHANGE X-AXIS DATA ARRAY
 >NYCH   =  1      : OPTION TO CHANGE Y-AXIS DATA ARRAY
 >NVALUE =  0      : INPUT OPTION OF THE THRESHOLD VALUE
 >ALPHA  =    0.0  : THRESHOLD VALUE OF Z-AXIS
 >LIMIT  =  0      : INTERPOLATED POINT NUMBER
 >PRINT  =  0      : PRINT OPTION OF INPUT DATA
 >DDXY   =    0.10 : MINIMUM MESH WIDTH ( MM )

=========================================================
```

Fig. 5.3.11 Input data of SFX2 data form for Fig. 5.3.12



Gamma-Ray Skyshine Problem 1 Groups

Fig. 5.3.12 Two dimensional flux calculated by ESPRIT

(MGRAPH = 1, NXCH = 1, NYCH = 1)

6. Conclusion

A modular code system RADHEAT-V4 consists of the many functional modules for producing coupled multi-group neutron and photon cross section sets, analyzing the neutron and photon transport, and calculating the atomic displacement and the energy deposition due to these radiations in a nuclear reactor or shield. Many types of data produced by the system are stored in a direct-access data base and can be easily handled by pointing out a node name of 4-characters. The software package VISUAL can easily treat the data and plot the arbitrary graphs. The VISUAL is constructed by considering the following features.

(1). It is possible to plot two-dimensional, three-dimensional graphs and contour map.

(2). It is possible to plot promptly and concisely a graph with conversational management that will be able to update the executing data easily on TSS terminal of TEKTRONIX T-4014.

(3). The software package will use the computing time as short as possible and the computer memories as few as possible.

(4). A output of the software package is able to use as a clear graph in a report.

(5). The software package consists of three independent modules of DATA-POOL access module, conversational management module and data plotting module that will not refer to each other.

To satisfy above requirements, many functional subroutines described in this report are developed.

According to use the VISUAL software package, (1) user is able to use VISUAL as a tool to analyze and evaluate a great amount of calculated and experimental data by using the functions of this package effectively and (2) all of the data produced and stored in a DATA-POOL by the RADHEAT-V4 code system can be plotted with prompt and concise procedures so that the user can evaluate them in a short time.

Acknowledgment

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References

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5) N. Yamano : "Multi-Group Cross Section Sets for Shielding Materials", JAERI-M 84-038 (1984).

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The authors wish to thank Mr. Y. Naito for helpful suggestions and a critical reading of the manuscript.

References

1) N. Yamano, K. Koyama and K. Minami; "DEVELOPMENT OF INTEGRATED SHIELDING ANALYSIS CODE SYSTEM RADHEAT-V4", Proc. 6th Int. Conf. on Radiation Shielding, Vol. 1, p.331 (1983).
2) N. Yamano and K. Minami : to be published.
3) YOSHIZAWA BUSINESS MACHINE INC. : "CALCOMP Programing Manual I, II" (1969) (in Japanese).
4) Y. Onuma et al. : private communication (1978).
5) N. Yamano : "Multi-Group Cross Section Sets for Shielding Materials", JAERI-M 84-038 (1984).

Appendix A: Application for DDX Data Plotting

VISUAL can be applied for plotting another data contained DATA-POOL. In this Appendix, an example to plot DDX data in DATA-POOL is described to users who wish to utilize VISUAL for another data plotting. The DDX means Double Differential X-section $\delta(E_{i\rightarrow j},\mu)$ that is measured by integral experiments and used for integral test of nuclear data. The experimental data are stored in a magnetic tape with EXFOR format. The DDX are calculated by FAIR-DDX that is a modified version of the FAIR-CROSS module in the RADHEAT-V4 code system. The experimental and calculated data are stored in a DATA-POOL. However, the format of the data is different from one of RADHEAT-V4. In such a case, a paticular treatment is required to use the VISUAL software package. The detailed description is shown below:

A.1 Node Structure of DATA-POOL

(i) Calculated Data Form

EGRP-DDX-Mat.no.-Angle

This form contains the double differentai cross section. The identifications for the node names are as follows:

level 1 : **EGRP** shows the fine-group data. The energy group structure is stored in the node.

level 2 : **DDX** shows the double differential cross section. The comment is only stored in the node.

level 3 : **Mat no** shows the nuclide number.

level 4 : **Angle** shows the scattering angle in the laboratory system. (degree)

(ii) Experimental Data Form

EXP-Entry no.-Sub-entry no.

This form contains the experimental double differential cross section. The identifications for the node names are as follows:

level 1 : **EXP** shows the experimental data. The comment is only stored in the node.

level 2 : **Entry no.** shows the entry number of EXFOR format.

level 3 : Sub-entry no. shows the sub-entry number of EXFOR formet.

A.2 Record Format of DDX Data

(i) Calculated Data Form

level 1 node : EGRP
information ING, 0, 0, 0, 0
data PREAD1 (N, NCOM, ING+1, E)

level 2 node : DDX
information 0, 0, 0, 0, 0
data PREAD (N, NCOM)

level 3 node : Mat no.
information MATNO, NREACT, 0, 0, 0
data PREAD1 (N, NCOM, NREACT, MT)

level 4 data : Angle
information ANGL, RESOL, UFPA, SPNE, 0
data PREAD1 (N, NCOM, NT, DDCS)

where ING : fine neutron energy group,
N : logical unit number,
NCOM : comment of the node (20 words),
MATNO : material number,
NREACT : number of reactions,
MT : reaction type number,
= 1 : total,
= 2 : inelastic discrete level,
= 3 : inelastic continum level,
= 4 : (n,2n) reaction,
ANGL : angle (degree),
RESOL : time resolution (%),
UFPA : uncertainty of flight pass (%),
SNE : standard point of neutron energy (eV),

NT : ING×4,
DDCS : double differential cross section.

(ii) Experimental Data Form

level 1 node : EXP
information 0, 0, 0, 0, 0
data PREAD (N, NCOM)

level 2 node : Entry no.
information NENT, 0, 0, 0, 0
data PREAD (N, NCOM)

level 3 node : Sub-entry no.
information NENT, NSENT, NUM, ANGL, 0
data PREAD2 (N, NCOM, NUM, E, NUM, D)
PREAD4 (N, NCOM, NUM, EL, NUM, EH, NUM, DL, NUM, DH)

where N : logical unit number,
NCOM : comment of the node (20 words),
NENT : entry number,
NSENT : sub-entry number,
NUM : number of the data points,
ANGL : angle (degree),
E : energy group structure (eV),
D : experimental data,
EL : lower error of energy data,
EH : upper error of energy data,
DL : lower error of experimental data,
DH : upper error of experimental data.

A.3 Sample Input and Output of DDX Data Form

Sample input to access DATA-POOL is as follows:

```
    ++++*++++1++++*++++2++++*++++3++++*++++4++++*++++5++++*++++6++++*
(1): UNIT(1)=91;NODE(1)=EXP     Ent. No.    Sub No.;
```

(2): UNIT(2)=91;NODE(2)=EGRP;

(3): UNIT(3)=91;NODE(3)=EGRP DDX Mat. No. Angle;

(4): CODE(1)=0 7 7 7 7;

(5): CODE(2)=0 1 2 3 4;

where

(1): UNIT(1)=91 means that DATA-POOL allocated by logical unit number 91 is used in the job and NODE(1) means that experimental data and the informations are read in DATA-POOL.

(2): The input data indicate that DATA-POOL allocated by logican unit number 91 is assigned and the fine energy structure and the informations are read in DATA-POOL.

(3): The input data indicate that DATA-POOL allocated by logical unit number 91 is assigned and calculated DDX data and the informations are read by using the node structure assigned by NODE(3) in DATA-POOL.

(4): The code number is same as the ULTX data form described in Chapt. 5.1.(i). The number of sub-data sets stored in the level 3 assigned by NODE(1) are 6 as shown in A.2. Therefore, the location number of sub-data for the fine energy group structure is 7. The code nmber of experimental data assigned by CODE(1) must be set 0 at the first column.

(5): The code numbers mean the reaction types as shown in Sect. A.2. The code number of experimental data must be set 0 at the first column.

Sample input and output are shown in Figs. A.3.1 and A.3.2.

```
              <<< COMMON EXECUTING DATA >>>

*************************************************************

>TITLE  = ¥DDX ?OF ¥N?AT. ¥L?I ¥(JENDL-2,145 ?DEG.¥)
        : MAIN TITLE OF THE GRAPH
>XTITLE = ¥S?ECONDARY ¥N?EUTRON ¥E?NERGY (E¥V)
        : X-AXIS CAPTION
>YTITLE = ¥C?ROSS ¥S?ECTION ¥(?BARN/SR/¥M?E¥V)
        : Y-AXIS CAPTION
>ZTITLE =
        : Z-AXIS CAPTION



>UNIT( 1)=91
>UNIT( 2)=91
>UNIT( 3)=91
>UNIT( 4)=91
>UNIT( 5)=91
>UNIT( 6)=91
        : LOGICAL UNIT NUMBER OF THE CALCULATION DATA
        : FILE NAME OF THE NUMAL DATA POOL
>NODE(1)=EXP        0000        95
>NODE(2)=102G
>NODE(3)=102G       DDX         2033        145
>NODE(4)=102G       DDX         2033        145
>NODE(5)=102G       DDX         2033        145
>NODE(6)=102G       DDX         2033        145
        : NODE NAME OF THE CALCULATION DATA
>CODE( 1)=  0   7   7   7   7   0   0   0   0   0
>CODE( 2)=  0   1   2   3   4   0   0   0   0   0
        : CODE NUMBER OF THE PLOTTING DATA
>XW     =230.00
        : X-AXIS LENGTH(MM)
>YW     =210.00
        : Y-AXIS LENGTH(MM)

*************************************************************
              <<< EXECUTING DATA FOR MODE-1 >>>

*************************************************************************

>NPL    =  5      : NUMBER OF PLOTTING LINE IN A GRAPH
>TRANS  = A       : TRANSFORM TYPE OF THE PLOTTING DATA
>ALPHA  =   1.00  : CONSTANT NUMBER TO TRANSFORM
>OPERA  = /       : TRANSFORM FORMAT OF THE DATA
>COMP   =  1      : DATA NUMBER OF THE DENOMINATOR TO TRANSFORM
        : LOGICAL UNIT NUMBER OF THE EXPERIMENTAL DATA
>COMT   = ¥ INEL=0
        : COMMENT FOR ALL DATA
>SUBT( 1) = ¥ T?OTAL
>SUBT( 2) = ¥ I?NELA. ¥D?ISCR.
>SUBT( 3) = ¥ I?NELA. ¥C?ONT.
>SUBT( 4) = ¥ (?N,2N)
>SUBT( 5) = ¥ E?XP. ¥N?0.95
        : COMMENT FOR EACH DATA


----------*** PLOTTING TYPE OPTION ***----------------------


>TPO    = H : GRAPHIC FORM
>PAT    = S : GRAPHIC PATTERN



>SYMBOL =  0 : OPTION TO PLOT SYMBOL FOR CALCULATION DATA
         : SYMBOL CODE OF THE CALCULATION DATA
>ECODE(1)=906
         : SYMBOL CODE OF THE EXPERIMENTAL DATA
         : PLOTTING I.D. NUMBER OF THE EXPERIMENTAL DATA IN THE SEQUENTIAL DATA SET
>ESIZE  =    2.00 : HEIGHT OF SYMBOL FOR EXPERIMENTAL DATA
>SSIZE  =    3.00 : HEIGHT OF CHARACTER FOR THE COMMENT
>XN     =      64.00: INITIAL X-AXIS COORDINATE TO PLOT THE COMMENT
>YN     =     212.00: INITIAL Y-AXIS COORDINATE TO PLOT THE COMMENT
>GRID   = 0       : OPTION FOR GRID LINE
>XSCALE = 0       : SCALING OPTION FOR X-AXIS COORDINATE
>YSCALE = 1       : SCALING OPTION FOR Y-AXIS COORDINATE
>SCALE  = 1       : METHOD OF SCALING TYPE
>XMIN   =    0.0          : MINIMUM VALUE FOR X-AXIS,IF SCALE=1
>XMAX   =    0.160E+08    : MAXIMUM VALUE FOR X-AXIS,IF SCALE=1
>YMIN   =    0.100E-03    : MINIMUM VALUE FOR Y-AXIS,IF SCALE=1
>YMAX   =    0.100E+00    : MAXIMUM VALUE FOR Y-AXIS,IF SCALE=1
>YDMIN  =    0.0          : MINIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
>YDMAX  =    0.0          : MAXIMUM VALUE FOR Y-AXIS,IF PAT=D,SCALE=1
*************************************************************************
```

Fig. A.3.1 Input data for DDX plot

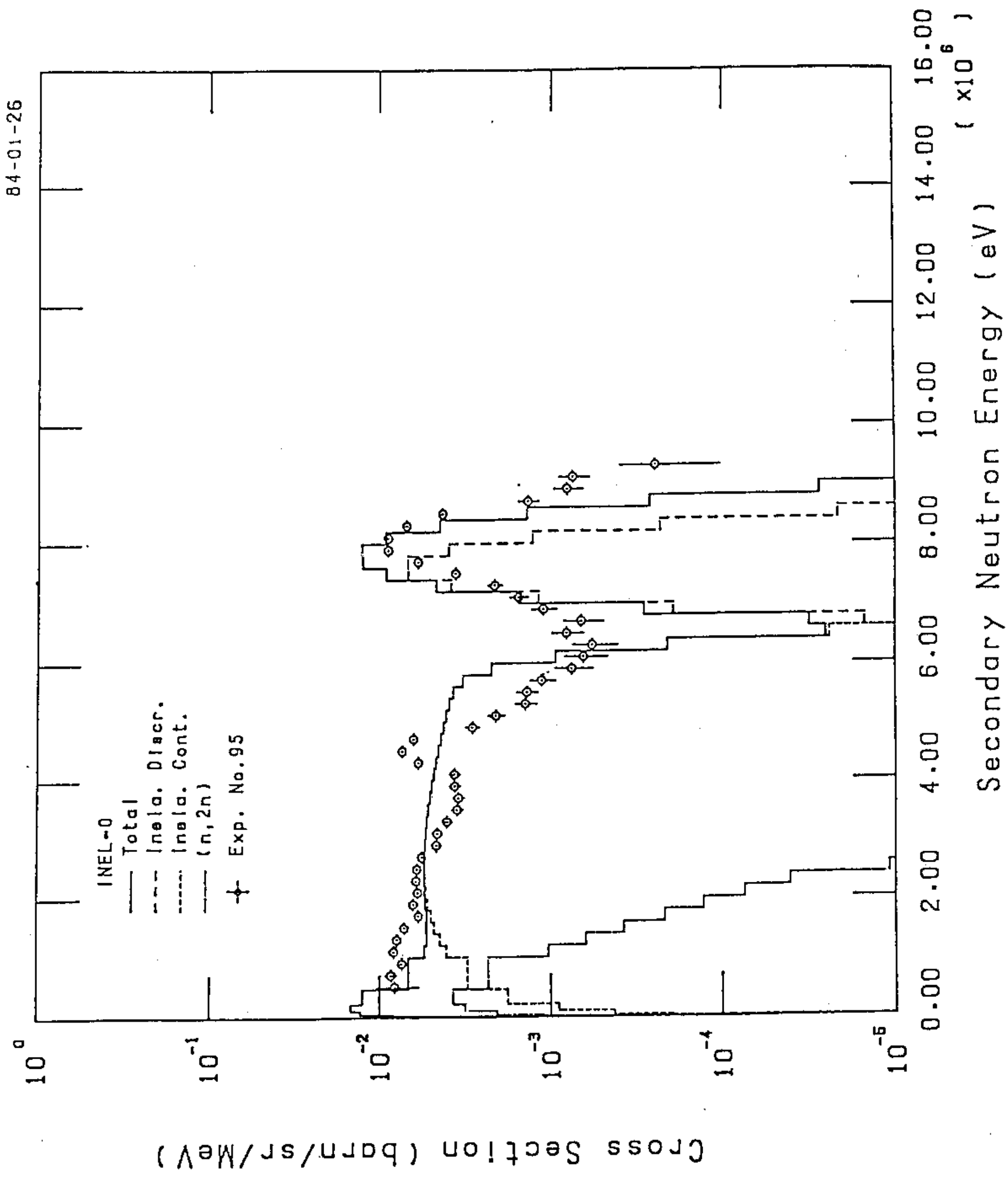


Fig. A.3.2 Sample plot of DDX data form

Appendix B: Constitution of VISUAL

The VISUAL code consists of six overlay segments as shown in Fig. B.1. The main program calls two segments and subroutine DACNTL in the segment 3 calls the segment 4, 5 and 6. The segment 2 is the conversational management module that updates the executing data and sets the default data. The segment 3 is the access module for DATA-POOL and experimental data file and retrieves the plotting data from these files. The segment 4 is used for plotting a two-dimensional coordinate graph and segment 5 is used for plotting a contour map. The segment 6 is used for plotting a three-dimensional coordinate graph. VISUAL software package is programmed with FORTRAN-4 language for using on FACOM M-380 computer.

Since important variables are stored in the block with an adjustable size, the required core memories depend on a problem type to be solved. The size of variable array is set in the blank common in the main routine.

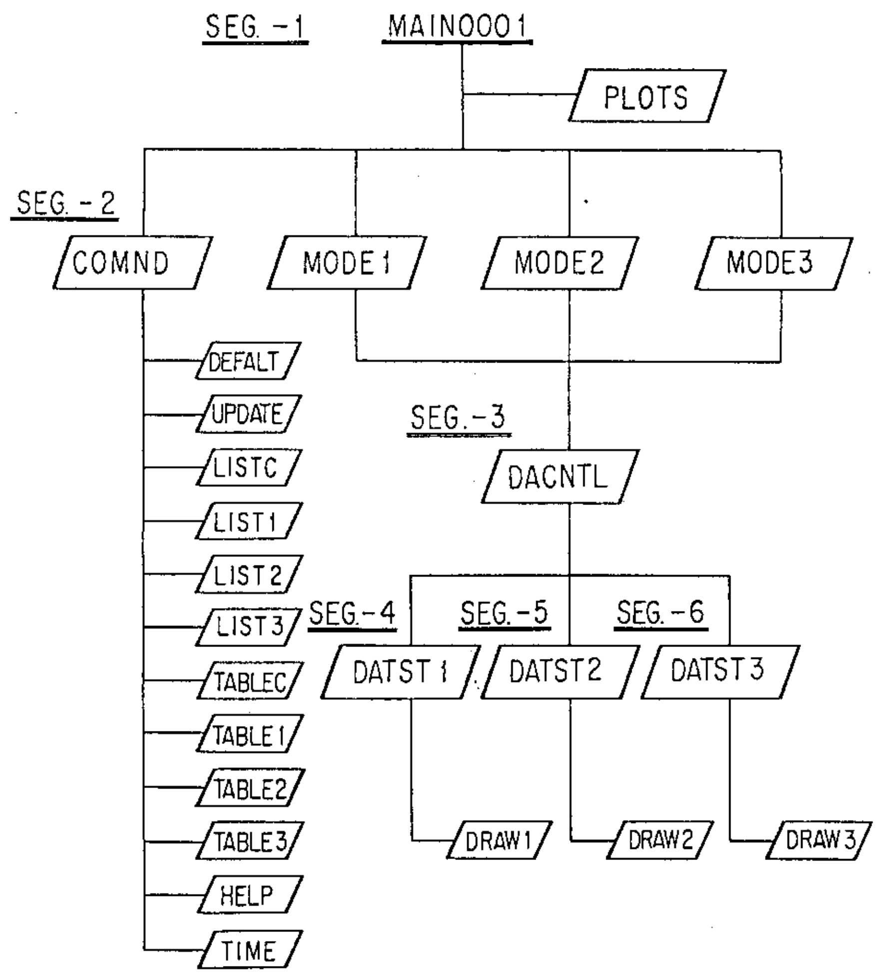


Fig. B.1 Hierarchy of primary subroutine and module

Appendix C: Calculation of Maximum Use of Available Memory

Variable A is used to storage the areas of the variable dimensions and variable MEMORY indicates the maximum use of the available memory in a labeled common block /MEMO/. These variables are used in the subroutine MAIN0001, DACNTL, DATST1, DATST2 and DATST3. On the Conversational Management Mode, the maximum use of the available core memory is 1024 K bytes so that variable MEMORY must be less than 150000 words. The calculation of the maximum use of the available memory is roughly shown as follows:

For MODE-1,

(MEMORY)=(total number of data points for all access sub-data sets)+(number of transformed plotting data for X-axis)×NPL1+(number of transformed plotting data for Y-axis)×NPL2+(number of experimental data)×NPL3

where NPL1 : number of lines for calculated data, if the X-axis data of all lines are the same, NPL1 equals 1,
NPL2 : number of lines for calculated data,
NPL3 : number of lines for experimental data.

For MODE-2,

(MEMORY)=(total number of data points for all access sub-data sets)+(number of transformed plotting data for horizontal direction)×NPL1+(number of transformed plotting data for vertical direction)×NPL2+(number of transformed plotting data for contour values)×NPL1×NPL2,

where NPL1 : number of horizontal lines for lattice data, or number of angle meshes for cylindrical data,
NPL2 : number of vertical lines for lattice data, or number of angle meshes for cylindrical data.

For MODE-3,

(MEMORY)=(total number of data points for all access sub-data sets)+(number of mesh points for vertical direction)×2+(number of transformed plotting data for horizontal direction)×(number of mesh points for vertical direction)×2.

Furthermore, a few local fixed dimensions and the program sizes are added to the variable memories.

Appendix D: Subroutine Information of VISUAL

D.1 Subroutine DACNTL

Subroutine DACNTL is a very important part as an interface routine between DATA-POOL and plotting module. In the subroutine, all of the data assigned by node name produced by RADHEAT-V4 are read, and the head address of the sub-data sets and their data are stored in the variable arrays LARY and A. Summary of structure of DATA-POOL is described in Appendix E.

Plotting data are retrieved from variable array A and transfered to entry subroutines DATST1 for MODE-1 plotting module, DATST2 for MODE-2 plotting module and DATST3 for MODE-3 plotting module. The flow diagram of the subroutine DACNTL is shown in Fig. D.3.5.

D.2 Functions of Major Subroutines

The functions of major subroutines are described below.

MAIN0001; Set the variables to be constant values and controls the flow of CMM and Plotting Mode.

(I) Conversational Management Mode (CMM)

COMND ; Control the command for CMM.

DEFALC ; Set the common variables to be default values.

DEFAULT ; Set the variables to be default values for MODE-1, MODE-2 or MODE-3.

UPDATE ; Read the strings to be updated for common data, MODE-1, MODE-2 and MODE-3 data.

TIME ; Display the used CPU time.

LISTC ; Print the executing data for common variables.

LIST1 ; Print the executing data for MODE-1.

LIST2 ; Print the executing data for MODE-2.

LIST3 ; Print the executing data for mode-3.

TABLEC ; Describe the usage of the common variables.

TABLE1 ; Describe the usage of the data for MODE-1.

TABLE2 ; Describe the usage of the data for MODE-2.

TABLE3 ; Describe the usage of the data for MODE-3.

HELP ; Display the functions of all commands.

MODE1 ; Enter the module for MODE-1.

MODE2 ; Enter the module for MODE-2.

MODE3 ; Enter the module for MODE-3.

(II) DATA-POOL Access

DACNTL ; Allocate direct access data base DATA-POOL and set the variables to be plotting data.

POPEN ; Open direct access data base DATA-POOL.

PFIND ; Read directory section of DATA-POOL.

PREAD ; Read the number of data sets and the data length.

PREAD1 ; Read plotting data from one sub-data set according to the node name structure.

PREAD2 ; Read plotting data from two sub-data sets according to the node name structure.

PREAD3 ; Read plotting data from three sub-data sets according to the node name structure.

PREAD4 ; Read plotting data from four sub-data sets according to the node name structure.

(III) MODE-1

DATST1 ; Select plotting form and experimental data and sets the plotting data to variable array.

DRAW1 ; Control the flow of plotting modules.

SCALE1 ; Calculate scaling factor and determine the number of grids for plotting.

NORMC ; Normalize the calculated data using the scaling factor calculated in the subroutine SCALE1.

NORME ; Normalize the experimental data using the scaling factor calculated in the subroutine SCALE1.

DMAMI ; Search maximum and minimum values for a double graph.

DNORMC ; Normalize the calculated data for a double graph using scaling factor calculated in the subroutine SCALE1.

DNORME ; Normalize the experimental data for a double graph using the scaling factor calculated in the subroutine SCALE1.

PBOX ; Plot a frame of the graph.

PTIT1 ; Draw main title, X-axis title and Y-axis title of the graph.

GRID1 ; Plot grid lines and their graduations.

PLTC ; Plot calculated data and their symbols.

PLTE ; Plot experimental data and their symbols.

SUBT ; Draw sub-titles of calculated, experimental data and the symbols.

(IV) MODE-2

DATST2 ; Select plotting form and set the plotting data to variable array.

STOR2N ; Store the lattice data for X-axis, Y-axis and Z-axis coordinates.

DRAW2 ; Control the flow of plotting modules for MODE-2.

XAXIS ; Determine the plotting characteristic for X-axis.

YAXIS ; Determine the plotting characteristic for Y-axis.

ZAUTO ; Absolve the manual scaling function for Z-axis.

SCSIZE ; Determine the size and the kind of a plotting screen.

GRSIZE ; Determine the size of a graph.

ORIGIN ; Determine the original point of the coordinates for X-axis and Y-axis.

GRID ; Determine the kind of grid.

DATAP2 ; Determine the kind of symbol for plotting data.

APPROX ; Determine the kind of interpolation.

HVALUE ; Determine the values for contour lines.

HKIND ; Determine the kind of contour line and the blanking areas.

CVKIND ; Determine the form of plotting for contour values.

COMENT ; Select the type for plotting the comment.

REALGH ; Select whether to plot a graph with real size.

CONTOR ; Control the flow of plotting modules for MODE-2.

(V) MODE-3

DATST3 ; Select plotting form and set the plotting data to variable array.

DRAW3 ; Control the flow of plotting modules for MODE-3.

AREA ; Calculate using areas and sets 0.0 to them.

SCXY ; Search maximum and minimum values for plotting data.

SACLE1 ; Calculate scaling factor and determines the number of grids for plotting.

DNOR ; Normalize the plotting data using the scaling factor calculated in the subroutine SCALE1.

PBOX ; Plot a frame of the graph.

PTIT ; Draw main title, X-axis, Y-axis and Z-axis captions.

GRID ; Plot grid lines and their graduations.

GPL1 ; Enable to cause hidden lines to be drawn or suppressed for type 0, 1 or 2.

GPL3 ; Enable to cause hidden lines to be drawn or suppressed for type 3.

D.3 Argument and Flow Diagram of Major Subroutines

(MAIN0001)

Argument : No
Used common : /MEMO/, /NUNIT/
Flow diagram : Fig. D.3.1

(COMND)

Argument : NCMND variable of command
Used common : /NUNIT/
Flow diagram : Fig. 2.1.1

(DEFALC)

Argument : No
Used common : /CDATA/, /DDATA/, /NUNIT/
Flow diagram : Fig. D.3.2

(DEFALT)

Argument : NC variable of command
Used common : /DNTRL/, /CNTRL/, /NUNIT/
Flow diagram : Fig. D.3.3

(UPDATE)

Argument : IEER flag of updating error
NC variable of command
Used common : /WFIA/, /NUNIT/
Flow diagram : Fig. D.3.4

(DACNTL)

Argument : UNIT logical unit number of DATA-POOL
FNAME file name of DATA-POOL for NUMAL

	:	NODE	node structure of DATA-POOL
		CODE	code number of plotting data for DATA-POOL
		NPL	line number of plotting data in a graph
		MODE	mode option
Used common	:	/DPCONT/, /DPWORK/, /MEMO/	
Flow diagram	:	Fig. D.3.5	

(DATST1)

Argument	:	ICX	number of plotting data points for X-axis
		XX	array of plotting data for X-axis
		ICY	number of plotting data points for Y-axis
		YY	array of plotting data for Y-axis
		LAEXS	head address of experimental data for variable dimension in the sequential file
		NEXDS	head address of experimental data for variable dimension in the DATA-POOL (DDX)
		NUEXD	number of experimental data in the DATA-POOL
		LINE	number of line for experimental data in the DATA-POOL
Used common	:	/MEMO/, /CNTRL/	
Flow diagram	:	Fig. D.3.6	

(DATST2)

Argument	:	ICX	number of plotting data points for X-axis
		XX	array of plotting data for X-axis
		ICY	number of plotting data points for Y-axis
		YY	array of plotting data for Y-axis
		ICZ	number of plotting data points for Z-axis
		ZZ	array of plotting data for Z-axis
		LNCZ	head address of vacant areas for variable dimension
Used common	:	/CNTRL/, /MEMO/, /PLT1/, /PLT2/, /PLT4/	
Flow diagram	:	Fig. D.3.7	

(DATST3)

Argument	:	ICX	number of plotting data points for X-axis
		XX	array of plotting data for X-axis
		ICY	number of plotting data points for Y-axis

	YY	array of plotting data points for Y-axis
	ICZ	number of plotting data for Z-axis
	ZZ	array of plotting data for Z-axis
	LAEXS	head address of vacant areas for variable dimension

Used common : /CNTRL/, /CDATA/, /MEMO/, /PLT2/

Flow diagram : Fig. D.3.8

(DRAW1)

Argument :

LINC	number of line for calculated data
IMES	number of plotting data points for X-axis
XD	array of plotting data for X-axis
JMES	number of plotting data points for X-axis
YD	array of plotting data for Y-axis
LINE	number of line for experimental data
NDAE	number of plotting data points of experimental data
ED	array of experimental data for plotting
IOPTE	optional parameter to plot experimental data
ITPO	optional parameter for line form
ESIZE	height of symbol for the experimental data
IECODE	symbol code of the experimental data
IPAT	optional parameter for graphic pattern
IXSC	scaling option for X-axis coordinate
IYSC	scaling option for Y-axis coordinate
ISC	method of scaling type
XMIN	minimum value for X-axis coordinate
XMAX	maximum value for X-axis coordinate
YMIN	minimum value for Y-axis coordinate
YMAX	maximum value for Y-axis coordinate
YDMIN	minimum value for Y-axis coordinate for a double graph
YDMAX	maximum value for Y-axis coordinate for a double graph
XN	starting coordinate of X-axis to plot the comment
YN	starting coordinate of Y-axis to plot the comment
ICOMT	common comment for all data

		ISUBT comment for each data
		SSIZE height of character for the comment
		IYSIZE plotting option of symbol for calculated data
		ISCODE symbol code of the calculation data
		IGRID optional parameter for grid pattern
Used common	:	/CDATA/, /PLT2/
Flow diagram	:	Fig. D.3.9

(DRAW2)

Argument	:	LAEXS	head address of memory for variable dimension
		NX	number of mesh interval for X-axis
		NY	number of mesh interval for Y-axis
Used common	:	/CNTRL/, /MEMO/, /PLT1/, /PLT2/, /PLT3/	
Flow diagram	:	Fig. D.3.10	

(DRAW3)

Argument	:	IM	number of mesh points for X-axis coordinate
		JM	number of mesh points for Y-axis coordinate
		X	array of plotting data for X-axis coordinate
		Y	array of plotting data for Y-axis coordinate
		Z	array of plotting data for Z-axis coordinate
		NNMX	number of plotting data of X-axis coordinate for Y-axis coordinate
		MTI	main title of the graph
		XTI	X-axis caption of the graph
		YTI	Y-axis caption of the graph
		ZTI	Z-axis caption of the graph
		IXSO	scaling option for X-axis coordinate
		IYSO	scaling option for Y-axis coordinate
		IZSO	scaling option for Z-axis coordinate
		MGRAP	graphic type option
		NXCH	option to change the order of going up and down for X-axis data array
		NYCH	option to change the order of going up and down for Y-axis data array
		NVALUE	input option for the threshold value
		LIM	interpolated point number
		IPRINT	print option of input data

NSTEP	reading or writing option for original data
SX1	horizontal length
SY1	vertical length
HETA	angle of X-axis coordinate for holizontal direction
DELTA	angle of Y-axis coordinate for holizontal direction
BETA	ratio of Y-axis length for X-axis length
ALPHA	threshold value for Z-axis coordinate
DDXY	minimum mesh width for interpolation
A	data array for variable dimension
LNLA	head address of vacant areas for variable dimension
MEMORY	maximum core memory
ID	logical unit number for scratch file

Used common : No

Flow diagram : Fig. D.3.11

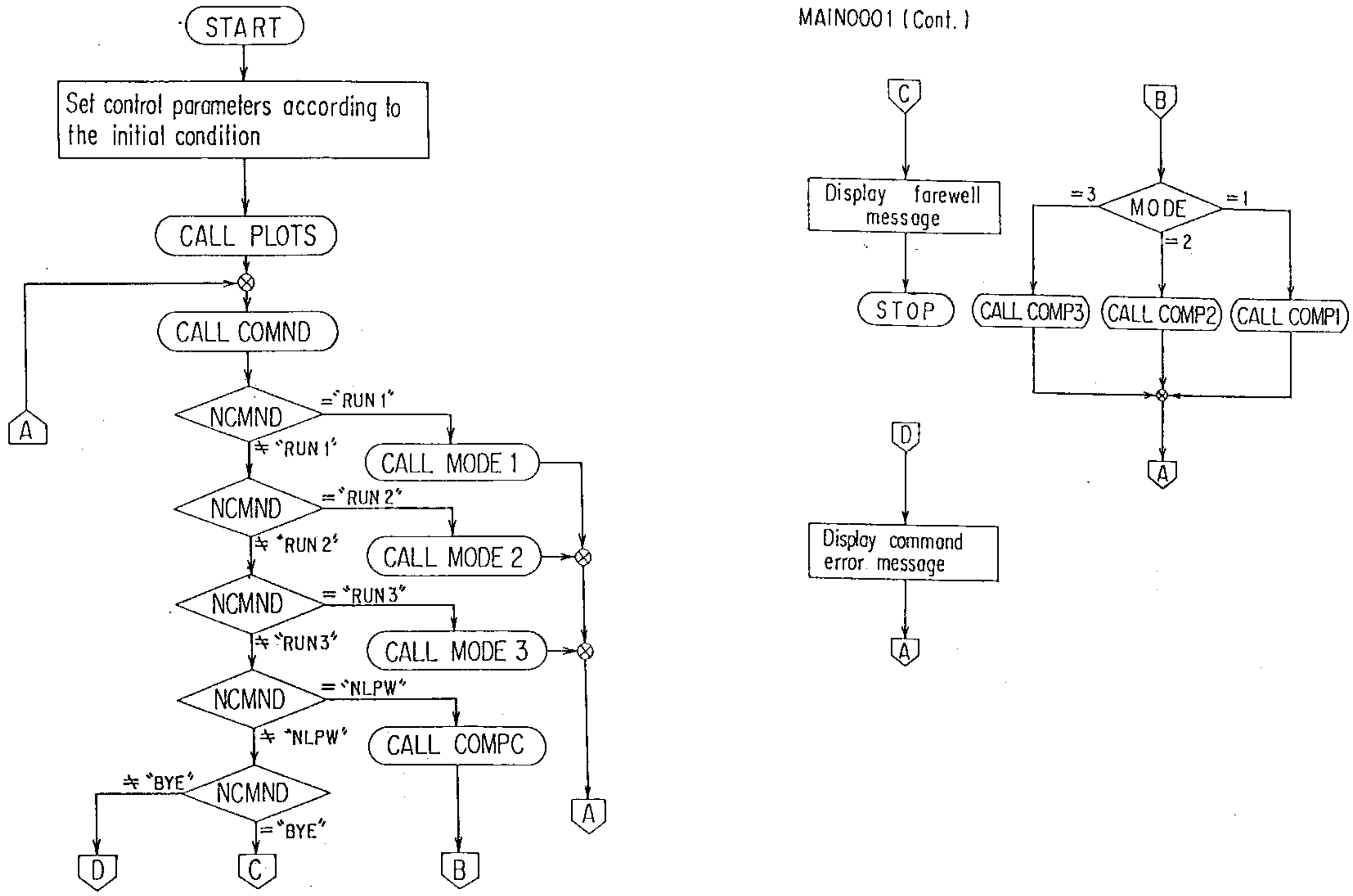


Fig. D.3.1 Flow diagram of subroutine MAIN0001

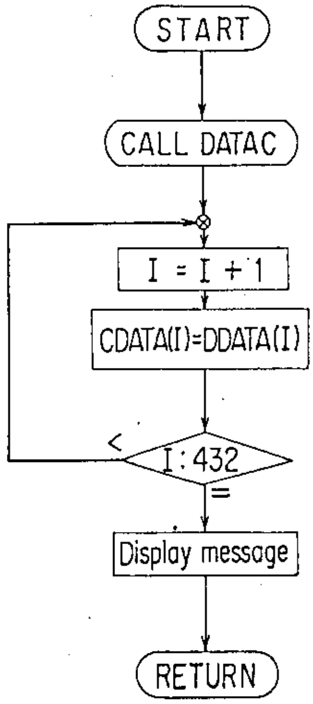


Fig. D.3.2 Flow diagram of subroutine DEFALC

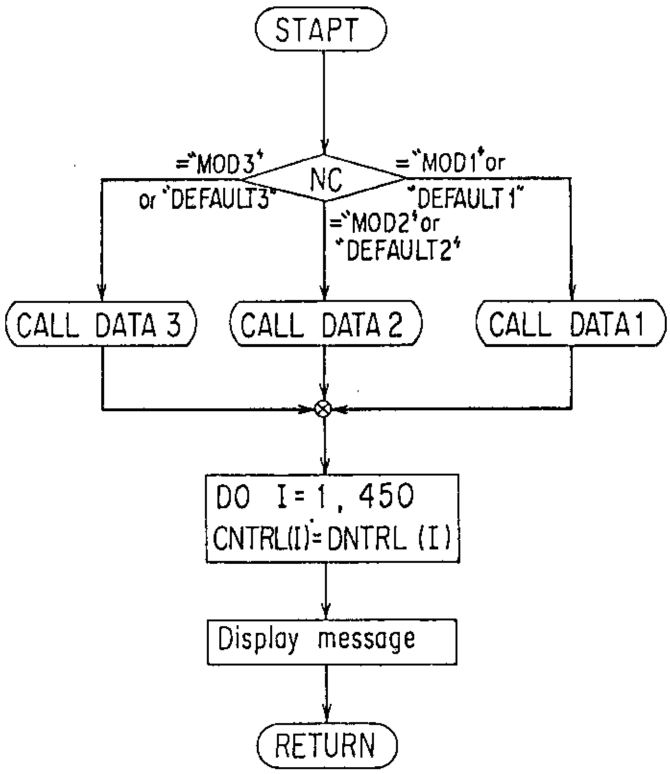


Fig. D.3.3 Flow diagram of subroutine DEFALT

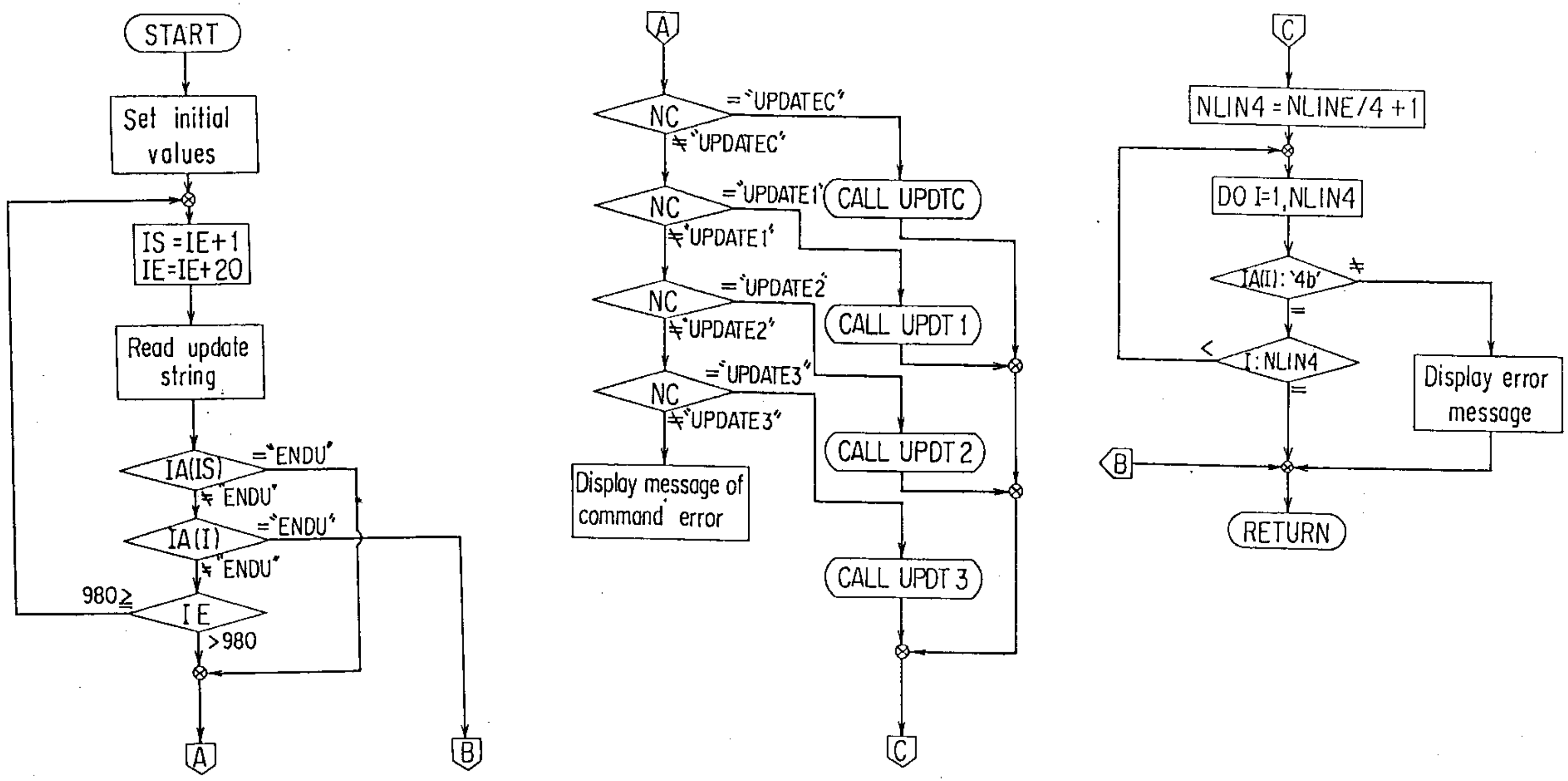


Fig. D.3.4 Flow diagram of subroutine UPDATE

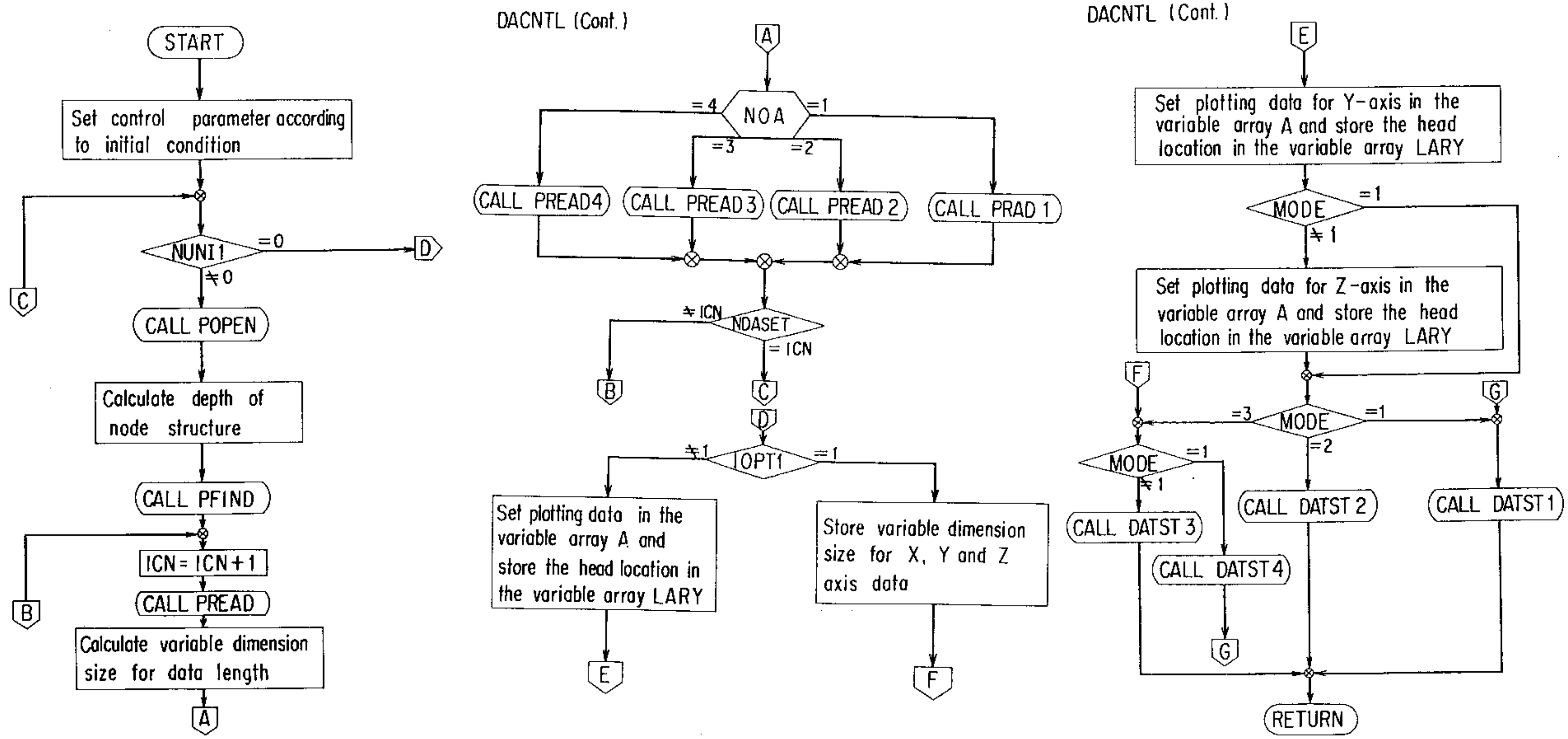


Fig. D.3.5 Flow diagram of subroutine DACNTL

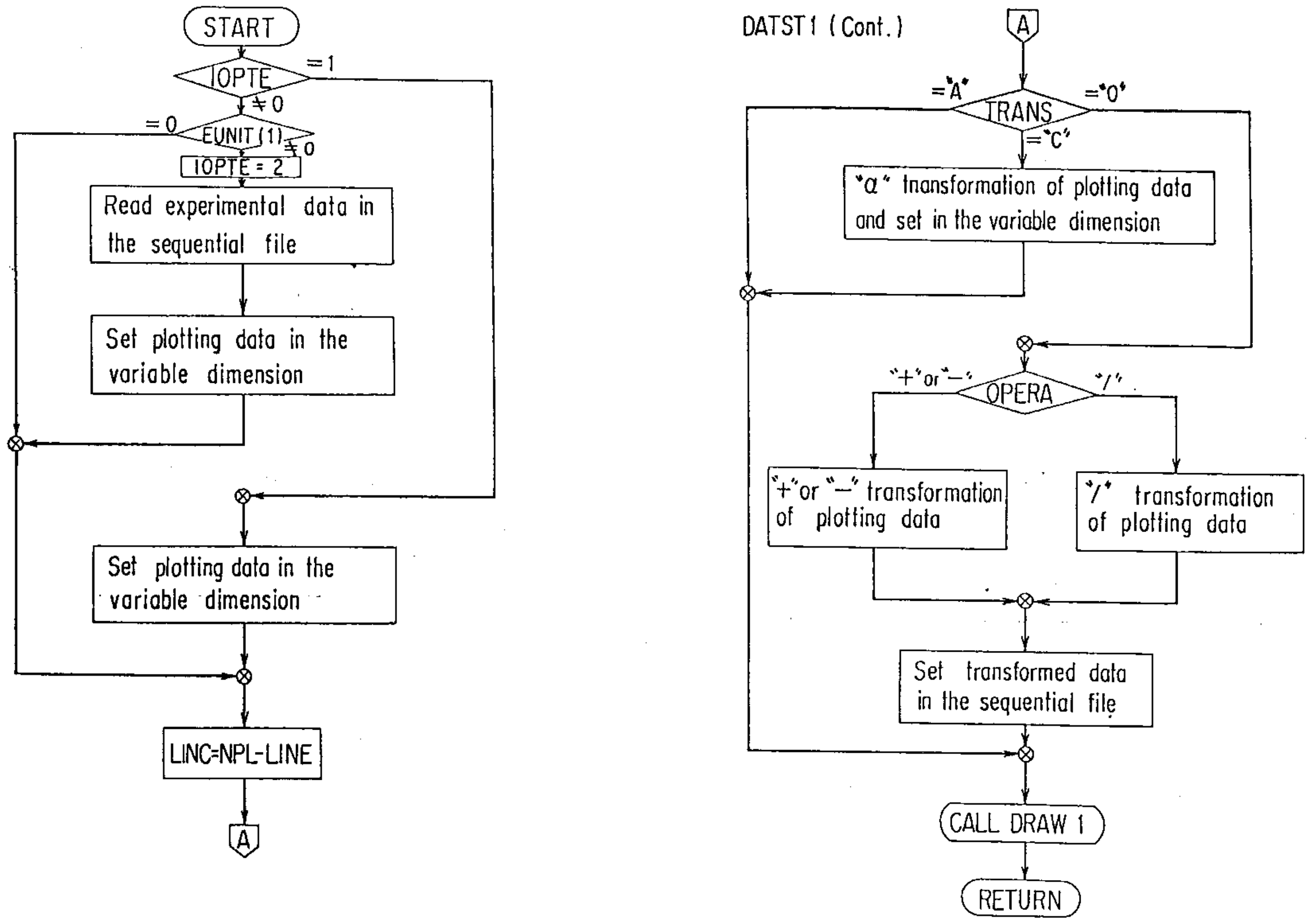


Fig. D.3.6 Flow diagram of subroutine DATST1

Fig. D.3.7 Flow diagram of subroutine DATST2

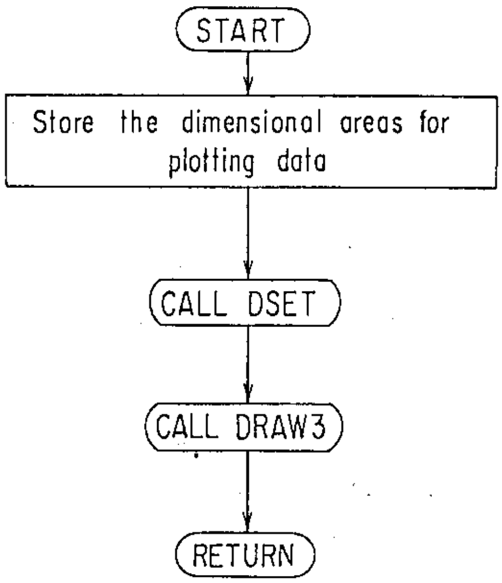


Fig. D.3.8 Flow diagram of subroutine DATST3

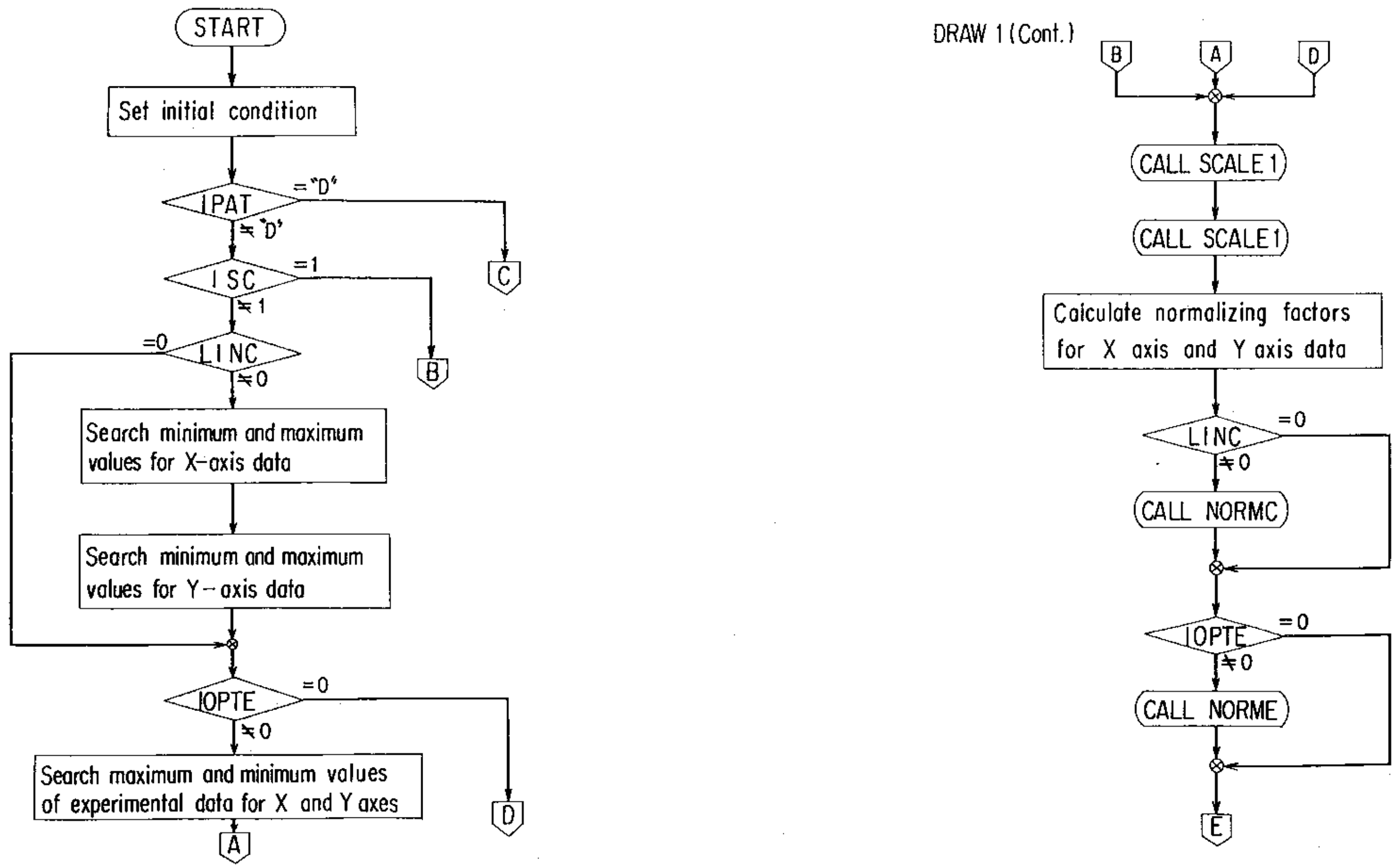
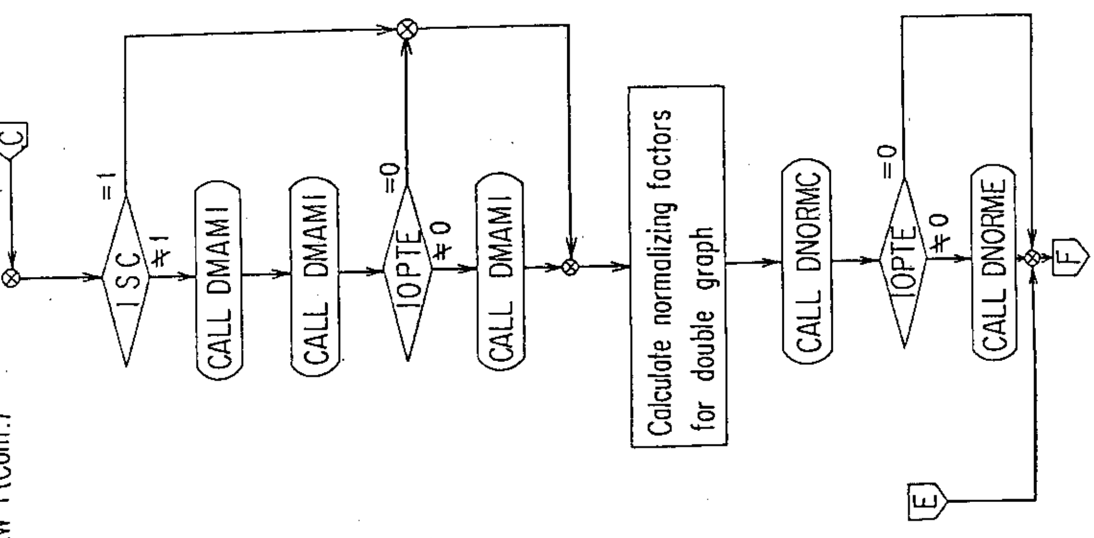
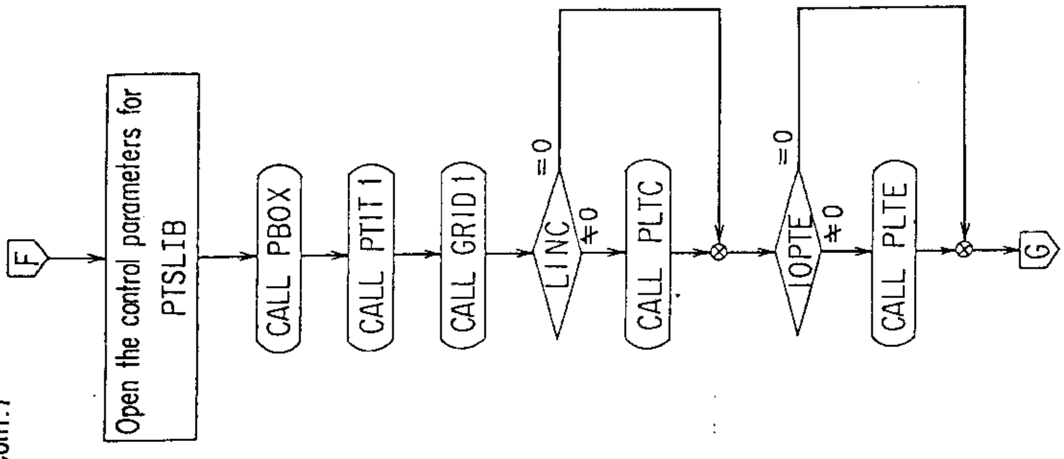


Fig. D.3.9 Flow diagram of subroutine DRAW1

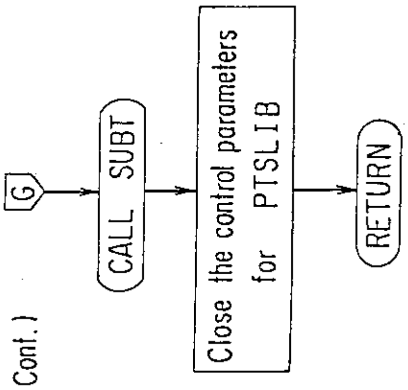
DRAW 1 (Cont.)



DRAW 1 (Cont.)



DRAW 1 (Cont.)



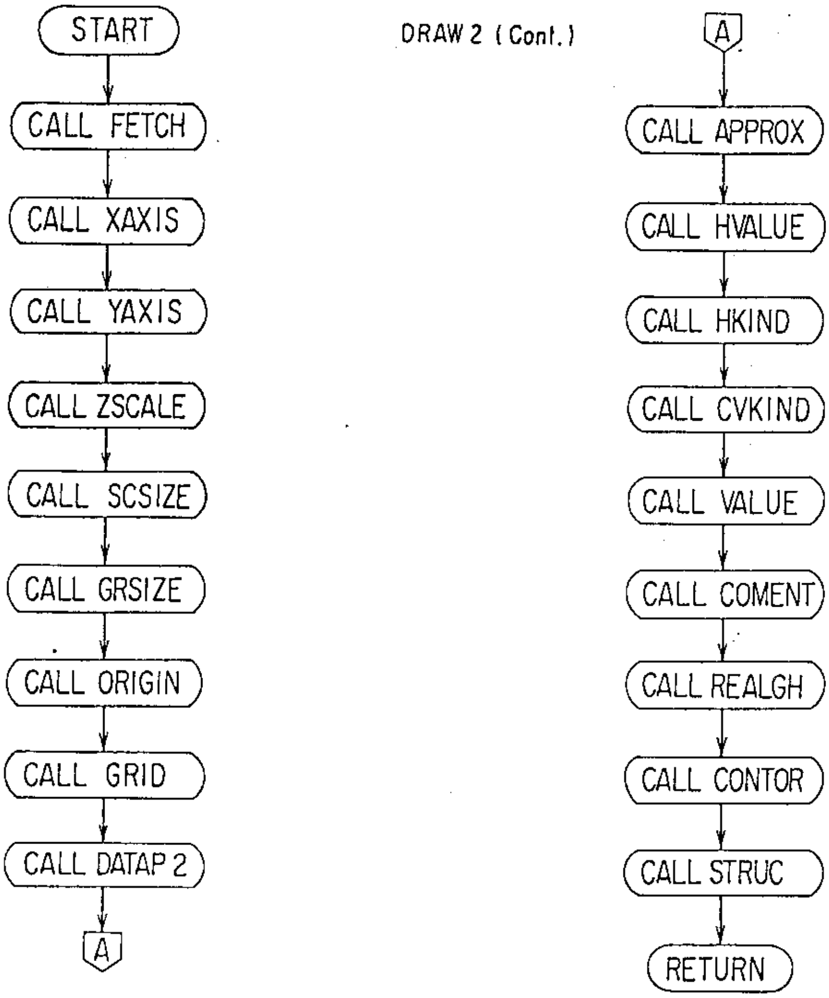


Fig. D.3.10 Flow diagram of subroutine DRAW2

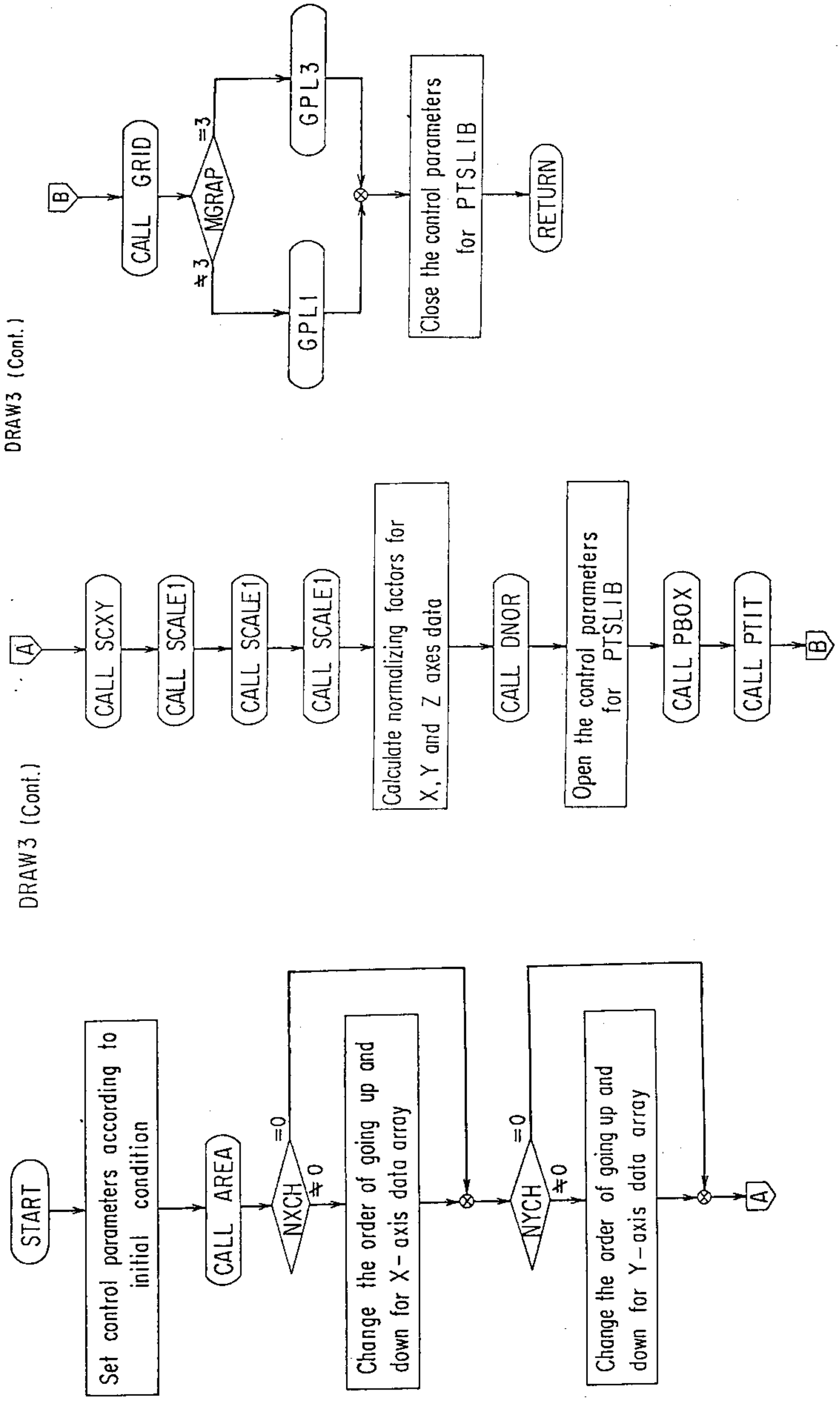


Fig. D.3.11 Flow diagram of subroutine DRAW3

Appendix E: Structure of DATA-POOL

E.1 DATA-POOL Structure

DATA-POOL is a direct-access data set defined by the direct-access read/write statements of the FORTRAN language. The data set has a fixed and unblocked record length of 3600 bytes (900 words). The data in the record are written under the control of unformatted statement.

DATA-POOL consists of three sections named a "Control Section", a " Directory Section " and a " Data Section ", respectively. The Control Section is located at the first record of DATA-POOL and has a size of 40 words. The variables in the section are used for the control of DATA-POOL.

The Directory Section takes an important role which determines the relation between the node name and the record address of the data, and has the informations of the lower nodes in the tree structure. The Directory Section consists of the several sub-directories. The sub-directory has the informations of a node name, a head address of the data section associated with the node name, the data of creation and control variables defined by the user. A sub-directory takes 12 words in the Directory Section, so that the number of nodes associated with the same level is limited to 74. A feature of DATA-POOL is that the informations for the nodes of the lower level can be obtained at once by referring a directory.

The Data Section consists of several sub-data sets. A sub-data set is created by executing a writing. The writing is carried out by calling a subroutine from PRITE to PRITE4. The subroutine PRITE only creates the comments of the node. The data of one-dimensional array are written in the regions from DATA1 to DATA4 by calling a subroutine from PRITE1 to PRITE4 respectively. The subroutine PRITE1 creates the comments of the node and the DATA1. The subroutine PRITE4 generates the comments of the node, DATA1, DATA2, DATA3 and DATA4. These data can be read by using the subroutines from PREAD to PREAD4 which correspond to those from PRITE to PRITE4 subroutines.

E.2 Node Structure of DATA-POOL

The node names and the tree structures are summarized in this section. The node names are created automatically by using the functional modules in the RADHEAT-V4 code system. The tree structure of node is generated by connecting the node names with each other. The most of the data are stored in the node of the last level, so that the data are classified and stored in the 12 forms described below. In the following description, the node name with a capital letter in the classification shows the fixed name, and a small letter means that the name changes for each of data.

a) ULTX Data Form

ULTX-matno-TMPi-SIGj

This form contains the ultra-fine group cross section. The identifications for the node names are as follows:

level 1 : **ULTX** shows the ultra-fine group data. The energy group structure is stored in the node.

level 2 : **matno** shows the nuclide number. The numbers in JSD1000 correspond to those of ENDF/B-IV.

level 3 : **TMPi** shows the temperature. i indidates the temperature of i. In JSD1000, i = 1, 2, 3, 4, 5 means 300°, 560°, 900°, 1200° and 2100° K, respectively.

level 4 : **SIGj** shows the background cross section. j indicates the σ_0 value. j = 1 means 10^8 in JSD1000.

b) SMT Data Form

EGRP-INFX-matno-SMT

This form contains the smooth cross sections with the fine-group structure. The identifications for the node names are as follows:

level 1 : **EGRP** shows the fine-group data. The energy group structure is stored in the node.

level 2 : **INFX** shows the infinitely diluted cross section.

level 3 : **matno** shows the nuclide number. The numbers in JSD1000 correspond to those of ENDF/B-IV.

level 4 : **SMT** shows the smooth cross section.

c) FTB Data Form

EGRP-INFX-matno-FTB

This form contains the self-shielding factors of each σ_0 value. The identifications for the node names from level 1 to 3 are the same as the SMT data form. The node name FTB indicates that the self-shielding factors are stored in the node.

d) ELA Data Form

EGRP-INFX-matno-ELA

This form contains the scattering matrix of elastic reaction. The identifications for the node names from level 1 to 3 are the same as the SMT data form. The node name ELA indicates that the scattering matrix of elastic reaction is stored in the node.

e) INS Data Form

EGRP-INFX-matno-INS

This form contains the scattering matrix of inelastic reaction. The identifications for the node names from level 1 to 3 are the same as the SMT data form. The node name INS indicates that the scattering matrix of inelastic reaction is stored in the node.

f) N2N Data Form

EGRP-INFX-matno-N2N

This form contains the scattering matrix of (n,2n) reaction. The identifications for the node names from level 1 to 3 are the same as the SMT data form. The node name N2N indicates that the scattering matrix of (n,2n) reaction is stored in the node.

g) H+D Data Form

EGRP-INFX-matno-H+D

This form contains the energy deposition factor and atomic displacement cross section. The identifications for the node names from level 1 to 3 are the same as the SMT data form. The node name H + D indicates that the energy deposition factor and the atomic displacement cross section are stored in the node.

h) SGRX Data Form

EGRP-SGRX-matno-ncode

This form contains the secondary gamma-ray production cross sections of each reaction. The identifications for the node names are as follows:

level 1 : **EGRP** shows the fine-group data same as the SMT data form.

level 2 : **SGRX** shows the secondary gamma-ray production cross section.

level 3 : **matno** shows the nuclide number. The numbers in JSD1000 correspond to those of ENDF/B-IV.

level 4 : **ncode** shows the reaction channel defined as the previous Chapter.

i) FXsn Data Form

EGRP-FXsn-matid

This form contains the effective macroscopic cross section. The identifications for the node names are as follows:

level 1 : **EGRP** shows the fine-group data same as the SMT data form.

level 2 : **SFsn** shows the effective macroscopic cross section and the number of angular points. The fixed value sn = 32 is defined in JSD1000.

level 3 : **matid** shows the material name. This name are defined in Chapt. 3.

j) SELF Data Form

EGRP-SELF-matid-matno

This form contains the self-shielding factors of each nuclide in the material defined by the matid in the FXsn data form. The data are utilized for generating the effective macro-scopic cross section. The identifications for the node names are as follows:

level 1 : **EGRP** shows the fine-group data same as the SMT data form.

level 2 : **SELF** shows that the self-shielding factors of each nuclide are defined in the FXsn data form.

level 3 : **matid** shows the material name defined in the FXsn data form.

level 4 : **matno** shows the nuclide number contained in the material.

k) FLUX Data Form (created by DIAC)

EGRP-ID-SFX0, SFX1, AFX0 or AFX1

This form contains the forward scalar flux, adjoint scalar flux, forward angular flux or adjoint angular flux created by DIAC. The idendifications for the node names are as follows:

level 1 : **EGRP** shows the fine-group data same as the SMT data form.

level 2 : **ID** consists of characters that is the first word in the 15$ array.

level 3 : **SFX0** shows the forward scalar flux,

SFX1 shows the adjoint scalar flux,

AFX0 shows the forward angular flux and AFX1 shows the adjoint angular flux.

1) FLUX Data Form (created by ESPRIT)

EGRP-ID-SFX2, SFX3, AFX2 or AFX3

This form cotains the forward scalar flux, adjoint scalar flux, forward angular flux or adjoint angular flux created by ESPRIT. The identification for the node names are as follows:

level 1 : **EGRP** shows the fine-group data same as the SMT data form.
level 2 : **ID** consists of characters that is the first word in the title card.
level 3 : **SFX2** shows the forward scalar flux.
SFX3 shows the adjoint scalar flux.
AFX2 shows the forward angular flux.
AFX3 shows the adjoint angular flux.

E.3 Record Format of JSD1000[5)]

The record formats of JSD1000 are classified according to the data forms noted Appendix E.2. DATA-POOL has the user informations in the Directory Section and the data in the Data Section. Each data are utilized for the functional modules in the RADHEAT-V4 code system. The user informations of 5 words are stored by using PSET subroutine and read by using PFIND subroutine in the DATA-POOL access package, respectively. The data in the Data Section are stored by using PRITE - PRITE4 subroutines and read by using PREAD - PREAD4 subroutines noted in Appendix E.1. In the following description, an "information" means the user information in the Directory Section and a "data" indicates the data in the Data Section. The node name with a capital letter shows the fixed name, and a small letter means that the name changes for each data.

a) ULTX Data Form

level 1 node : ULTX
information NGRP, 0, 0, 0, 0
data PREAD1 (N, NCOM, NGRP+1, FEGRP)

level 2 node : MATNO
information MATNO, MTMAX, NTMP, NSIG, LFI
data PREAD3 (N, NCOM, MTMAX, MTYPE, NTMP, TMP, NSIG, SIGO)

level 3 node : <u>TMPi</u>

information TMP, 0, 0, 0, 0

data PREAD(N, NCOM)

level 4 node : <u>SIGj</u>

information SIG, MTMAX2, 0, 0, 0

data PREAD2 (N, NCOM, MTMAX2, MTYPE2, NGRP, W)

```
     DO 1 I=1, MTMAX2
   1 PREAD2( N, NCOM, 5, NDATA, M, GCS )
```

where NGRP : number of the ultra-fine energy groups (3824),

N : logical unit number of DATA-POOL,

NCOM : comment of the node (20 words),

MATNO : material identification number,

MTMAX : number of reactions,

NTMP : number of temperatures,

NSIG : length of σ_0 table,

LFL : fission flag (0: non fission, 1: fission),

MTMAX2 : number of reactions for each σ_0 value,

FEGRP : energy group boundaries (eV),

MTYPE : reaction identification numbers,

TMF : temperatures,

SIGO : σ_0 values,

MTYPE2 : reaction identification numbers,

W : weighting spectrum,

NDATA : MTYPE(i), C1, C2, NLOW, NUP,

M : NUF-NLOW+1,

GCB : ultra-fine group cross section.

b) SMT Data Form

level 1 node : <u>EGRP</u>

information ING, IGG, 0, 0, 0

data PREAD1(N, NCOM, ING+1, GNG) (IGG=0)

PREAD2(N, NCOM, ING+1, GNG, IGG+1, GGG) (IGG≠0)

level 2 node : <u>INFX</u>

information 0, 0, 0, 0, 0

data PREAD(N, NCOM)

level 3 node : matno

information MATNO, 0, 0, 0, 0

data PREAD(N, NCOM)

level 4 node : SMT

information 0, 0, 0, 0, 0

data PREAD3 (N, NCOM, M, MT, 1, TMP, 1, SIGO)

PREAD1 (N, NCOM, MM, SMT)

where ING : number of neutron energy groups (100),

IGG : number of gamma-ray energy groups (20 or 0),

N : logical unit number of DATA-POOL,

NCOM : comment of the node (20 words),

MT : reaction identification numbers,

TMF : temperature,

SIGO : σ_0 value,

M : number of reactions (10),

MM : ING×M,

SMT : smooth cross section.

c) FTB Data Form

level 1 node : EGRP

information same as the SMT data form

data ibid.

level 2 node : INFX

information same as the SMT data form

data ibid.

level 3 node : matno

information same as the SMT data form

data ibid.

level 4 node : FTB

information 0, 0, 0, 0, 0

data PREAD3(N, NCOM, M, MT, NTMP, TMP, NSIG, SIGO)

DO 1 I=1, NTMF

```
         1  PREAD4( N, NCOM, LEN, SFT, LEN, SFE, LEN, SFF,
                                            LEN, SFC )
```

where M : number of reactions (4),

MT : reaction identification numbers,

NTMF : number of temperatures,

NSIG : number of σ_0 values,

N : logical unit number of DATA-POOL,

NCOM : comment of the node (20 words),

LEN : NSIG×ING,

TMF : temperatures,

SIGO : σ_0 values,

SFT : self-shielding factor for total reaction,

SFE : self-shielding factor for elastic reaction,

SFF : self-shielding factor for fission reaction,

SFC : self-shielding factor for capture reaction.

d) ELA Data Form

level 1 node : <u>EGRP</u>

information sample as the SMT data form

data ibid.

level 2 node : <u>INFX</u>

information same as the SMT data form

data ibid.

level 3 node : <u>matno</u>

information same as the SMT data form

data ibid.

level 4 node : <u>ELA</u>

information 0, 0, 0, 0, 0

data

```
            PREAD3( N, NCOM, 1, MT, 1, TMP, 1, SIGO )
            DO 1 I=1, ING, 10
         1  PREAD3( N, NCOM, ING, NOA, NTP, ANG, NTP, SIG)
```

where N : logical unit number of DATA-POOL,

NCOM : comment of the node (20 words),

MT : reaction identification number (MT=2),

TMP : temperature,
SIGO : σ_0 value,
NOA : number of angular points for each energy group,
NTP : summation of NOA(M) values from M=1 to M=ING,
ANG : cosine of scattering angles,
SIG : elastic scattering cross section in the DAR form.

e) INS Data Form

level 1 node : EGRP

information same as the SMT data form
data ibid.

level 2 node : INFX

information same as the SMT data form
data ibid.

level 3 node : matno

information same as the SMT data form
data ibid.

level 4 node : INS

information 0, 0, 0, 0, 0
data

```
      PREAD3( N, NCOM, 1, MT, 1, TMP, 1, SIGO )
      DO 1 I=1, ING, 10
    1 PREAD3( N, NCOM, ING, NOA, NTP, ANG, NTP, SIG )
```

where MT : reaction identification number (MT=4),
SIG : inelastic scattering cross section in the DAR form,
the other notations are the same as the ELA data form.

f) N2N Data Form

level 1 node : EGRP

information same as the SMT data form
data ibid.

level 2 node : INFX

information same as the SMT data form
data ibid.

level 3 node : matno

information same as the SMT data form

data ibid.

level 4 node : N2N

information 0, 0, 0, 0, 0

data

```
      PREAD3( N, NCOM, 1, MT, 1, TMP, 1, SIGO )
      DO 1 I=1, ING, 10
    1 PREAD3( N, NCOM, ING, NOA, NTP, ANG, NTF, SIG )
```

where MT : reaction identification number (MT=16),

SIG : (n,2n) scattering cross section in the DAR form,

the other notations are the same as the ELA data form.

s) H+D Data Form

level 1 node : EGRP

information same as the SMT data form

data ibid.

level 2 node : INFX

information same as the SMT data form

data ibid.

level 3 node : matno

information same as the SMT data form

data ibid.

level 4 node : H+D

information 0, 0, 0, 0, 0

data

```
      PREAD3( N, NCOM, M, MT, 1, TMP, 1, SIGO )
      PREAD1( N, NCOM, MM, HD )
```

where N : logical unit number of DATA-POOL,

NCOM : comment of the node (20 words),

M : number of reaction channels (M=13),

MT : reaction identification numbers,

TMP : temperature,

SIGO : σ_0 VALUE,

MM : ING×M,

HD ; energy deposition factors and atomic displacement cross sections.

h) SGRX Data Form

level 1 node : EGRP

information same as the SMT data form

data lbid.

level 2 node : SGRX

information 0, 0, 0, 0, 0

data PREAD(N, NCOM)

level 3 node : matno

information NATNO, 0, 0, 0, 0

DATA PREAD(N, NCOM)

level 4 node : ncode

information ITWO, ICON, KEY, NHI, NLOW

data PREAD3(N, NCOM, LEN, X, LEN, Y, LEN1, P)

where MATNO : material identification number,
N : logical unit number of DATA-POOL,
NCOM : comment of the node (20 words),
ITWO : flag of the nuclear data (1: ENDF/B-IV, 2: POPOP4),
ICON : flag of the weighting procedure (0: constant weighting, 1: energy weighting),
KEY : flag of the reaction (0: no effect, 1: inelastic excitation),
NHI : the highest energy group for non-zero values,
NLOW : the lowest energy group for non-zero values,
LEN : NHI-NLOW+1,
LEN1 : IGG×LEN,
X : neutron interaction cross sections,
Y : yields,
P : probabilities ((P(i,j), i=1, IGG), j=1, LEN).

i) FXsn Data Form

level 1 node : EGRP

information same as the SMT data form

data ibid.

level 2 node : FXsn

information IPO, 0, 0, 0, 0

data PREAD1(N, NCOM, IPO+1, ANG)

level 3 node : matid

information MATID, IHS, IHT, IHM, 0

data
```
      PREAD4( N, NCOM, NMAT, MAT1, NMAT, MAT2, NMAT, ATOM,
              NMAT, TMP)
      DO 1 I=1, ING+IGG
    1 PREAD2( N, NCOM, IGT1, CRX, IGT2, CRY )
```

where IPO : number of fixed angular points (IPO=sn),
N : logical unit number of DATA-POOL,
NCOM : comment of the node (20 words),
MATID : material identification name,
IHS : position of self-scattering cross section,
IHT : position of total cross section,
IHM : cross section table length,
NMAT : number of nuclides in the material,
MAT1 : nuclide identification numbers for the SMT data,
MAT2 : nuclide identification numbers for the FTB data,
ATOM : atomic number densities (n/barn.cm),
TMP : temperatures,
LGT1 : IHM,
LGT2 : IPO×i,
CRX : effective macroscopic cross section Σ_g,
CRY : effective macroscopic cross section $\Sigma_{g\to g',m}$.

In the data, CRX and CRY are defined by the following sequences.

position	1 - - - - - - NOACT+1 - -IHT IHS - - - - - - - - - IHM
CRX	$\Sigma_{activation}$ ··· Σ_a $\bar{\nu}\Sigma_f$ Σ_t Σ_{gg} ..... $\Sigma_{1\to g}$ ... 0.0

where NOACT is the number of the activation cross sections cosist of the heat deposition factor and the atomic displacement cross section. The above sequence repeats ING+IGG times.

	1	2	3	....	IPO
1	$\Sigma_{g\to g}(\mu_1)$	$\Sigma_{g\to g}(\mu_2)$	$\Sigma_{g\to g}(\mu_3)$	....	$\Sigma_{g\to g}(\mu_{ipo})$
2	$\Sigma_{g-1\to g}(\mu_1)$	$\Sigma_{g-1\to g}(\mu_2)$	$\Sigma_{g-1\to g}(\mu_3)$	....	$\Sigma_{g-1\to g}(\mu_{ipo})$
3	⋮	⋮	⋮		
4	⋮	⋮	⋮		
⋮					
g	$\Sigma_{1\to g}(\mu_1)$	$\Sigma_{1\to g}(\mu_2)$	$\Sigma_{1\to g}(\mu_3)$	....	$\Sigma_{1\to g}(\mu_{ipo})$

where CRY data are stored by starting at top left corner, sweeping from left to right, then from top to bottom. The sequence repeats ING+IGG times.

j) SELF Data Form

level 1 node : EGRP

information same as the SMT data form

data ibid.

level 2 node : SELF

information 0, 0, 0, 0, 0

data PREAD(N, NCOM)

level 3 node : matid

information MATID, NMAT, MTMAX, 0, 0

data PREAD4(N, NCOM, NMAT, MAT1, NMAT, MAT2, NMAT, ATOM, NMAT, TMP)

level 4 node : matno

information MATNO, 0, 0, 0, 0

data PREAD4(N, NCOM, ING, FTM, ING, FEM, ING, FFM, ING, FCM)

where N : logical unit number of DATA-POOL,

NCOM : comment of the node (20 words),

MATID : material identification number,

NMAT : number of nuclides in the material,
MTMAX : number of reactions (4),
MAT1 : nuclide identification number of the SMT data,
MAT2 : nuclide identification number of the FTB data,
ATOM : atomic number densities (n/barn.cm),
TMP : temperatures,
FTM : self-shielding factor for total cross section,
FEM : self-shielding factor for elastic cross section,
FFM : self-shielding factor for fission cross section,
FCM : self-shielding factor for capture cross section.

k) FLUX Data Form (created by DIAC)

level 1 node : EGRP

information   same as the SMT data form
data   ibid.

level 2 node : ID

information   IGE, IM, JM, IZM, MM
data   PREAD3 (N, NCOM, IM+1, R, IM, MA, IZM, MZ)

level 3 node : SFX0, SFX1, AFX0 or AFX1

if node is SFX0 or SFX1
information   ITH, 0, 0, 0, 0
data   PREAD1 (N, NCOM, IM*IGM, FLX)

if node is AFX0 or AFX1
information   ITH, MM, IPMESH, 0, 0

```
DATA           PREAD3 (N, NCOM, MM, W, MM, DSN, IPMESH, NOANLL)
               DO 1 I=1, IGM
             1 PREAD1 (N, NCOM, MM×IPMESH, AFX)
```

where IGE : geometry of configuration,
IM : number of radial intervals,
JM : number of axial intervals,
IZM : number of material zones,
MM : number of angular meshes,
ISN+1 for plane or shere, (ISN×(ISN+4))/4 for cylinder,
N : logical unit number of DATA-POOL,
NCOM : comment of the node (20 words),
R : distance of radial intervals (cm),

MA : zone number mesh intervals,
MZ : material number of the zones,
ITH : solution option, (0: foward, 1: adjoint)
IGM : number of energy groups,
FLX : scalar flux,
IPMESH : number of mesh intervals,
W : angular quadrature weights,
DSN : angular quadrature cosines,
NOANLL : region number of angle mesh,
AFX : angular flux,

1) FLUX Data Form (created by ESPRIT)

level 1 node : EGRP
information same as the SMT data form,
data ibid.

level 2 node : ID
information same as FLUX data form created by DIAC
data PREAD4 (N, NCOM, IM+1, R, JM+1, Z, IM×JM, MA, IZM, MZ)

level 3 node : SFX1, SFX2, AFX1 or AFX2
if node is SFX1 or SFX2,
information same as the FLUX data form created by DIAC
data

```
      DO 1 I=1, IGM
    1 PREAD1 (N, NCOM, IM×JM, FLX)
```

if node is AFX1 or AFX2,
information same as the FLUX data form created by DIAC
data

```
      PREAD4 (N, NCOM, MM, W, MM, MU, MM, ETA, IPMESH, NOANLL)
      DO 1 I=1, IGM
      DO 1 J=1, IPMESH
    1 PREAD1 (N, NCOM, MM×IM, AFX)
```

where N : logical unit number of DATA-POOL,
NCOM : comment of the node (20 words),
IM : number of radial intervals,
JM : number of axial intervals,
R : distance of radial intervals,
Z : distance of axial intervals,

MA : zone number of mesh intervals,
IZN : number of material zones,
MZ : material number of the zones,
IGM : number of energy groups,
FLX : scalar flux,
MM : number of angular meshes,
W : angular quadrature weights,
MU : direction cosine of holizontal angle,
ETA : direction cosine of azimuthal angle,
IPMESH : number of mesh intervals,
NOANLL : region number of angle mesh,
AFX : angular flux.

Appendix F: Format of Experimental Data

Experimental data are stored in a sequential data set defined by the sequential read/write statments of the FORTRAN language. The data in the record are written under the control of formatted statements. The data are read in the subroutine EXREAD. The record formats of experimental data file are as follows:

ID	NDAT	EXX (1)	EXY (1)	EXXL (1)	EXXH (1)	EXYL (1)	EXYH (1)	EXX (2)	----

(EXX(1) through EXYH(1): ← repeat NDAT times →)

where ID : data identification number (I3),
NDAT : number of data (I3),
EXX : plotting data for X-axis (E12.5),
EXY : plotting data for Y-axis (E12.5),
EXXL : lower error data of EXX (E12.5),
EXXH : upper error data of EXX (E12.5),
EXYL : lower error data of EXY (E12.5),
EXYH : upper error data of EXY (E12.5).

For example, the experimental data can be read by using the following FORTRAN statements.

```
      REWIND M
    1 READ (M,10) ID, NDAT
      DO 100 K=1, NDAT
  100 READ (M,11) EXX(K), EXY(K), EXXL(K), EXXH(K), EXYL(K), EXYH(K)
      IF(ID.NE.NN) GO TO 1
      RETURN
   10 FORMAT(2I3)
   11 FORMAT(6E12.5)
        .
        .
        .
```

where M : logical unit number (from 41 to 45),
NN : identification number for plotting.

Appendix G: Computer Code Abstract

(1) Name of program : VISUAL

(2) Computer for which program is designed : FACOM M-380

(3) Nature of physical problem solved:

(4) Method of solution:

(5) Restrictions on the complexity of the problem:

(6) Typical machine time: Running times for each mode step mainly depend on the following things, (a) MODE-1 : number of plotting lines, number of calculated data and experimental data (b) MODE-2: number of contour lines and number of calculated data, (c) MODE-3: number of mesh points for X-axis and Y-axis data. For MODE-1, an iron run with 3824 ultra-fine energy groups takes about 1 seconds for plotting their cross sections and an iron run with 100 neutron energy groups takes about 0.6 seconds for plotting their smooth cross sections. For MODE-2, the gamma-ray flux run with 9 gamma-ray groups and 41 radial flux points and 29 axial flux points takes about 0.7 seconds for plotting contour map of 1 energy group. For MODE-3, an iron run with 100 neutron energy groups takes 2.0 seconds for plotting inelastic scattering matrix from source 1 energy group to all of the sink groups (1 to 100) on the FACOM M-380.

(7) Unusual features of the problem:

(8) Related and auxiliary programs: VISUAL plots cross section data and self-shielding factors produced by FAIR-CROSS step-1 secondary gamma-ray production data produced by TWOWAY, coupled group cross sections produced by FAIR-CROSS step-2, few group cross sections produced by FDEM and flux and reaction rate calculated by DIAC and ESPRIT.

(9) Status:

(10) Machine requirement: Requires -150 K words of storage in addition to the usual complement of direct access device, TSS and NLP or COM.

(11) Programming language: FACOM M-380 in JAERI, FORTRAN IV-H. Links PTSLIB-Plotter compatible TEKTRONIX Graphic Subroutine Library developed by Computing Center of JAERI.

(12) Operating system: FACOM M-380

(13) Other programming information: The program is approximately 25000 source cards.
Overlay structures are employed.

(14) User information:

(15) Reference:

1) N. Yamano, K. Koyama and K. Minami: "DEVELOPMENT OF INTEGRATED SHIELDING ANALYSIS CODE SYSTEM RADHEAT-V4", Proc. 6th Int. Conf. on Radiation Shielding, Vol. 1, p.331 (1983).