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EDIT – A FORTRAN IV LEVEL H PROGRAM TO PUNCH, PRINT, AND PLOT SELECTED PORTIONS OF AN ENDF/B DATA TAPE

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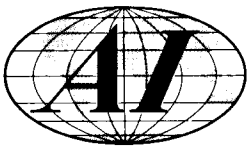

ATOMICS INTERNATIONAL

A DIVISION OF NORTH AMERICAN AVIATION, INC.

Printed in the United States of America
Available from
Clearinghouse for Federal Scientific and Technical Information
National Bureau of Standards, U.S. Department of Commerce
Springfield, Virginia 22151
Price: Printed Copy $3.00; Microfiche $0.65

NAA-SR-12525
ENDF-105
MATHEMATICS AND
COMPUTERS

EDIT – A FORTRAN IV LEVEL H PROGRAM TO PUNCH, PRINT, AND PLOT SELECTED PORTIONS OFAN ENDF B DATA TAPE

By

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ATOMICS INTERNATIONAL

A DIVISION OF NORTH AMERICAN AVIATION, INC.

CONTRACT: AT(04-3)-701
ISSUED: NOVEMBER 1, 1967

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ABSTRACT

The EDIT program was written in FORTRAN IV Level H for the IBM System 360 Model 50 (S/360-50) computer. It will process selected materials and files on an ENDF/B EBCDIC data tape. Punching as well as printing may be requested for all seven files. Plotting with SC-4020 equipment may be requested for File 1 (first two sections) and Files 3 through 6. EDIT input and output are described. Examples of EDIT's use are given.

I. INTRODUCTION

EDIT is a service routine written in FORTRAN IV Level H for the Evaluated Nuclear Data File, Version B (ENDF/B) System.* Using EDIT, selected portions of an ENDF/B magnetic tape can be punched on cards, printed, and/or plotted with SC-4020 equipment.

The ENDF/B system is one phase of a larger plan for the automated processing of nuclear data. An ENDF/B tape contains evaluated point data and is intended to be direct input to multigroup and Monte Carlo preprocessing codes. It contains one complete set of data for each material. The data on the ENDF/B are to serve as a reference cross section set to facilitate inter-laboratory comparisons, and to provide small user groups with recommended data. Nuclear data other than that for neutron induced reactions required for reactor applications are not included at this time.

Currently the energy range on the ENDF/B is from 0.001 ev or below to 1.5×10^7 ev or above. All required data that is non-zero must be specified in some fashion over this range. Included in the requirements are smooth cross sections (total, elastic, fission, etc.), the number of neutrons per fission, secondary angular distributions, and secondary energy distributions. Although some of the data may be represented by parameters used in equations over certain energy intervals, the majority of the data is in tabular form. A large amount of data must be prepared and processed in the generation of an ENDF/B tape.

The plotting option in program EDIT serves two purposes. The first is the need for error checking of the large amount of data stored on the ENDF/B tape. Spurious errors in the preparation of data for keypunching as well as errors in keypunching generally can be easily spotted on a graph depicting the data. Systematic errors in the data preparation can be detected by inspection of a graph much more easily than by reading the printed data, especially when the data may be specified at up to 2000 energy points. The second purpose of the plotting option is to provide a visual record of the extent of the available data and of its gross features. The importance of different or new data can be assessed by the inspection of a graph of the current data.

*Henry C. Honeck, Specification for an Evaluated Nuclear Data File for Reactor Applications, ENDF/B, Published by CSEWG, BNL, May 1966.

II. STRUCTURE OF AN ENDF/B TAPE

An ENDF/B tape contains a single record at the beginning which identifies the tape and a single record at the end signalling the end of the tape. The major subdivision between these records is by material. A material is either an isotope or a collection of isotopes. The data for a material is divided into files, each containing certain classes of data. The designation files does not mean physical file. A file is subdivided into sections, each containing data for a particular reaction type. Associated with each of these subdivisions is a number. MAT is the material number, MF is the file number, and MT is the reaction type number.*

There is no count of physical records in a section, sections in a file, files in a material, or materials on a tape. Sections and files (except for the first section of File 1) which are not used are omitted from the tape. The end of a section, file, or material is indicated by a special physical record.

There are three tape modes in the ENDF/B system:

Mode 1 - Binary tape, standard arrangement (MAT, MF, MT)
Mode 2 - Binary tape, alternate arrangement (MF, MAT, MT)
Mode 3 - Card images on tape, standard arrangement (MAT, MF, MT)

Program EDIT will handle an ENDF/B tape in Mode 3 only.

A Mode 3 ENDF/B tape consists of one card image per physical record. For program EDIT this means that each physical record contains 80 EBCDIC characters. Columns 1 through 66 contain the control information and/or cross section data required for the particular reaction type (MT) involved; columns 67 through 80 of every physical record except the first and the last on the tape contain MAT, MF, MT, and ISEQ. ISEQ is a card sequence number beginning at 1 for the first card of each material and being incremented by 1 for each succeeding card. The format for these columns is I4, I2, I3, I5.

Each section (MT) of a Mode 3 ENDF/B tape is subdivided into logical records composed of one or more cards (physical records). There are 4 possible logical record types.

*Material numbers, MAT, and reaction type numbers, MT, are listed in Appendix A.

A. RECORDS

1. CONT Logical Record

This is the smallest possible logical record and is a control record consisting of six numbers in addition to MAT, MF, MT, and ISEQ. The format for Columns 1 through 66 is 2E11.0, 4I11. The information in this record consists of constants and control parameters needed for the next logical records.

There are six special cases of a CONT record denoted by TPID, HEAD, SEND, FEND, MEND, and TEND. The TPID record is the first record on the tape and contains a tape label in the MAT position on the card. The TEND record is the last record on the tape and contains a -1 in the MAT position on the card. SEND, FEND, and MEND records signal the end of a section, file, or material, respectively. A SEND record has MT = 0, a FEND record has MT = MF = 0, and a MEND record has MT = MF = MAT = 0. All other information space on these cards is zero except for the HEAD record which contains the necessary constants and control parameters for the next logical records.

2. LIST Logical Record

This record type is used to list a string of floating point numbers for which the format for Columns 1 through 66 is 6E11.0. The first card is a HEAD-type record and is followed by as many cards as necessary to form the list. The number of elements in the list is given on the first card in the fifth data position.

3. TAB1 Logical Record

This record type is used for one-dimensional tabulated functions. A one-dimensional function is represented as a series of tabulated values plus rules for interpolating between values.

Define:

X(N) - the N^{th} value of X, the independent variable, in increasing order

Y(N) - the N^{th} value of the function being tabulated

NP - the number of X,Y pairs given

NR - the number of regions (X intervals) having different interpolation schemes

INT(M) - the interpolation scheme used in the M^{th} region

NBT(M) - the value of N separating the M^{th} and the $M + 1^{st}$ interpolation regions

Permissible interpolation schemes are:

INT	
1	constant
2	Y linear in X
3	Y linear in ln (X)
4	ln (Y) linear in X
5	ln (Y) linear in ln (X)

The first card of a TAB1 record is a HEAD-type record and contains the values of NR and NP in the fifth and sixth data positions, respectively. The next cards contain the interpolation scheme,

$$NBT(N),\ INT(N),\ N = 1,\ NR\ ,$$

for which the format is 6I11. The last group of cards contains the tabulated function,

$$X(N),\ Y(N),\ N = 1,\ NP\ ,$$

for which the format is 6E11.0.

4. TAB2 Logical Record

This record type is used for two-dimensional tabulated functions, Y(X, Z). Again the function is represented by a series of tabulated values for a given Z plus rules for interpolating between values (TAB1 record). The value of Z is given on the TAB1 HEAD-type record in the second data position. The series of TAB1 records must be preceded by the TAB2 record containing rules for interpolating between Z values.

The first card of a TAB2 record is a HEAD-type record and contains the value of NR (the number of Z interpolation regions) in the fifth data position. The value NZ (number of Z values) is in the sixth data position. The next cards contain the interpolation scheme,

$$NBT(N),\ INT(N),\ N = 1,\ NR\ ,$$

for which the format is 6I11. The TAB 2 record is then followed by NZ TAB1 or LIST records.

B. FILES

An ENDF/B tape may have as many as seven files for each material. Each file contains certain classes of data.

1. File 1

File 1 contains general information. The first section, which must always be present, contains a literal description of the material on a maximum of 100 cards. This information is given in the first 66 columns of each card. The first 48 characters on the first card are reserved for a title. The second section contains the average number of neutrons per fission. The energy dependence may be represented either by a polynomial or by a tabulation. The third and forth sections contain decay data and fission product yield data, respectively.

2. File 2

Resonance parameters for both resolved and unresolved resonances are given in File 2. The file contains only one section. Cross sections given in File 3 must be added to the cross sections computed from the parameters in this file to obtain the total reaction cross section. Program EDIT does not plot this file.

3. File 3

Smooth cross section data, such as absorption, fission, elastic scatter, etc., are contained in File 3. Derived quantities such as the average logarithmic energy decrement and the average cosine of the lab scattering angle may also be included. All data for a given section are given by a tabulation.

4. File 4

Secondary angular distributions, expressed as normalized probability distributions, are given in File 4. The distributions may be represented either in a tabulated form or as Legendre coefficients listed at various energies. The coefficient for $\ell = 0$ is 1 and is omitted. The angular variable may refer to either the laboratory or the center-of-mass coordinate system. A transformation matrix may be included.

5. File 5

Secondary energy distributions, expressed as normalized probability distributions, are given in File 5. The energy distribution is expressed as

$$P(E' \leftarrow E) = \sum_{K=1}^{NK} P_K(E) F_K(E' \leftarrow E) \ ,$$

so that partial distributions or different distributions in different energy ranges can be accommodated. Each section (reaction type) is composed of NK subsections. Each subsection starts with a tabulation of the $P_K(E)$ and is followed by the $F_K(E' \leftarrow E)$, which may be specified in a variety of ways, including two-dimensional tabulated functions and parameters for well-known spectral distributions.

6. File 6

Secondary energy-angle distributions, expressed as normalized probability distributions, are given in File 6. The angular part of the distribution may be tabulated at a set of values of the angular variable or may be expressed as a Legendre expansion. A section (reaction type) is composed of subsections for each value of the angular variable or for each Legendre polynomial coefficient. In either case the energy distribution of each subsection is treated as a File 5 section.

7. File 7

Thermal neutron scattering law data is given in File 7. This file contains only one section. Program EDIT does not plot this file.

8. Temperature Dependence

Any of the data in Files 3 through 7 may have a temperature dependence specified by repeating the data for each temperature given and indicating how to interpolate between tabulated temperatures. Program EDIT does not plot the temperature dependence. It plots only the data for the first temperature.

C. BASIC UNITS

The basic units used on an ENDF/B tape are as follows:

Energy	ev
Angle	dimensionless cosine of the angle
Cross Section	barns
Solid Angle	Steradian
Temperature	°Kelvin
Mass	neutron mass

III. EDIT PROGRAM DESCRIPTION

A. EDIT FUNCTIONS

The EDIT program will punch, print, and/or plot selected portions of a Mode 3 ENDF/B tape. The processing of a tape is done first by material. Input information for each material on the tape must be provided. If a material is to be skipped the input cards may be left blank. Thus, in order to select the desired materials to be processed, the order of materials on the tape must be known.

For a desired material, the input information states which files are to be processed. Files may be skipped; however, if plotting is requested, File 1 should be processed in order to obtain a title for the plots.

For a desired material and file, all sections are processed if possible.

If punching and/or printing is requested for a desired material and file, all sections will be punched and/or printed including temperature dependent records.

If File 1 plotting is requested, the literal information in the first section is printed by the SC-4020 equipment; 25 cards will be printed per frame. If the average number of neutrons per fission given as a tabulation is present, it will be plotted. The other possible sections in File 1 are not plotted.

If File 3 plotting is requested, all sections will be plotted. There will be one frame for each interpolation region. The type of plotting will depend upon the interpolation code for the region. Straight lines will connect consecutive points. If the abscissa is the logarithm of the energy and if more than 10 decades are required, two frames will be produced; the number of decades in each frame will be approximately the same (about half the original number). When plotting the logarithm of the ordinate, the range is limited to 10 decades.

If File 4 plotting is requested, all sections will be plotted. If a section contains Legendre polynomial coefficients, there will be one frame produced for each coefficient. The first set of frames will contain the first 200 energy points. There will be a new set of frames for each additional 200 energy points. The ordinate will be linear, and the abscissa will be the logarithm of the energy. On each frame the energy axis is limited to 10 decades. Since the coefficients are

generally zero below 1.0×10^4 ev, a safeguard was placed in the program to eliminate the possibility of exceeding 10 decades. This causes the first energy value to be set equal to one tenth of the second energy value if the first value was less than 1.0×10^2 ev. If a section contains the angular distributions in a tabulation, there will be one frame for each energy. The abscissa will be linear and range from -1 to 1; the ordinate will be on a logarithmic scale. The energy will be printed with the ordinate title. In either case, Legendre polynomial or tabulation, the plotted points will be connected by straight lines.

If File 5 plotting is requested, all sections will be plotted. The first plot will be $P_K(E)$. The $F_K(E' \leftarrow E)$ may be specified in a variety of ways; however, plotting is done only if tabulations are used. The $P_K(E)$ frame will contain the LF index indicating the way $F_K(E' \leftarrow E)$ is specified and the constant, CONS, involved in the $F_K(E' \leftarrow E)$ expression. In all plots there will be one frame for each interpolation region. The type of plotting will depend upon the interpolation code for the region. Straight lines will connect consecutive points. If the abscissa is the logarithm of a variable, and if more than 10 decades are required, two frames will be produced; the number of decades in each frame will be approximately the same (about half of the original number). When plotting the logarithm of the ordinate, the range is limited to 10 decades.

If File 6 plotting is requested, all sections will be plotted. The first frame will contain printed information on the method of tabulation (Legendre expansion, or tabulation). Since the subsections for each Legendre polynomial coefficient or for each value of the angular variable (tabulation) are the same as File 5 sections, the plotting is the same as in File 5; however, each subsection is preceded by a printed frame giving the Legendre polynomial index or the angular variable index and value (MU).

Files 2 and 7 are not plotted.

If desired, a table of contents for the tape may be printed. It will contain only those materials selected to be processed and will contain file information only for files selected to be processed; however, a material and file may be selected without punching, printing, or plotting and still be included in the table of contents. Information will be absent only if a material or a file is skipped.

If a file is requested and it is not on the tape, a message will be printed and the program will continue.

B. EDIT RESTRICTIONS

The EDIT program was written in FORTRAN IV level H for the IBM S/360-50 computer. The program, including library subroutines and data storage, occupies about 113940 decimal bytes of core storage. Two tape drives in addition to CRT (SC-4020 tape), input, and output are required; however, one drive may be eliminated if the table of contents is not desired.

Restrictions on the functions of EDIT are:

1) Only Mode 3 of an ENDF/B tape can be processed.

2) File 1, Sections 3 and 4, and Files 2 and 7 are not plotted.

3) Temperature dependent records are not plotted.

4) On the first card of the literal information in File 1, only the first 48 characters are used for plot titles.

5) Legendre coefficients are always plotted vs log energy.

6) Ordinates plotted on a logarithmic scale are limited to 10 decades.

7) File 6 plotting has not been checked out.

8) Cross section data must contain no more than 2000 energy points.

9) A maximum of 30 Legendre coefficients are allowed.

The average running time is 0.041 minutes per CRT frame on the IBM S/360-50. No information on printing or punching running times is available.

C. EDIT SUBROUTINE CONSTRUCTION

Program EDIT is composed of a main program, a BLOCK DATA subprogram, and 20 subroutines in addition to the library subroutines.

The main program reads the input, rewinds tapes, controls the flow to other subroutines, skips files or materials not of interest, and determines when a file of interest is positioned properly for processing.

The BLOCK DATA subprogram sets up abscissa and ordinate title information for the CRT plots.

The 20 subroutines are:

1) Subroutine HEAD – Reads a CONT logical record, saves the required control parameters, and punches and/or prints the record according to the selected input option.

2) Subroutine TAB1 – Reads a TAB2 logical record, punches and/or prints the record, and saves the required control information. The first part of a TAB1 logical record is the same as a TAB2 logical record; hence, a call to subroutine TAB1 followed by a call to XSEC, reads a complete TAB1 logical record.

3) Subroutine XSEC – Reads x, y pairs of numbers as in the last part of a TAB1 logical record and punches and/or prints the information; also reads the coordinate system transformation matrix in File 4 and punches and/or prints the information.

4) Subroutine FILE 1 – Reads the first section of File 1 (literal information) and punches, prints, and/or plots (prints on a CRT frame) the information; also controls the flow to subroutines SC 12, SC 13, and SC 14.

5) Subroutine SC12 – Reads the second section of File 1 (NU(E)) and punches and/or prints the information; if NU(E) is tabulated, it may be plotted by calling subroutine PLOT (IENTER).

6) Subroutine SC13 – Reads the third section of File 1 and punches and/or prints the information; no plotting is done.

7) Subroutine SC14 – Reads the fourth section of File 1 and punches and/or prints the information; no plotting is done.

8) Subroutine FILE 2 – Reads File 2 and punches and/or prints the information; no plotting is done.

9) Subroutine FILE 3 – Reads all sections of File 3 and punches, prints, and/or plots the information; plotting is done by subroutine PLOT (IENTER).

10) Subroutine FILE 4 – Reads all sections of File 4 and punches, prints, and/or plots the information; contains two calls to AICRT3, first for plotting tabulated data and second for plotting Legendre coefficients; uses subroutine SIX (LOOP) to read the Legendre coefficients.

11) Subroutine SIX (LOOP) – Reads the Legendre coefficient data in File 4; called by subroutine FILE 4.

12) Subroutine FILE 5 – Reads all sections of File 5 and punches, prints, and/or plots the information; plotting is done by subroutine PLOT (IENTER); plot titles are set up by subroutine TFIX (MT, LF); also, reads File 6 and punches, prints, and/or plots the information as controlled by subroutine FILE 6.

13) Subroutine FILE 6 – Reads heading record and TAB2 record for each section and calls FILE 5 through FILE 56 entry point for processing the section.

14) Subroutine TFIX (MT, LF) – Sets up plot abscissa and ordinate titles for Files 5 and 6.

15) Subroutine FILE 7 – Reads File 7 and punches and/or prints the information; no plotting is done.

16) Subroutine SKIP (LT) – Reads temperature dependent records in Files 3, 4, 5, and 6 and punches and/or prints the information; no plotting is done.

17) Subroutine PLOT (IENTER) – Sets up plot abscissa and ordinate titles for File 1, Section 2, and File 3 depending upon the parameter IENTER. Sets up arguments for the AICRT3 subroutine; controls the plotting of one frame for each interpolation region; calls subroutine DECADE (NO, LA, N) to split plots requiring more than 10 decades on a logarithmic abscissa axis.

18) Subroutine DECADE (NO, LA, N) – Splits plots requiring more than 10 decades on a logarithmic abscissa axis.

19) Subroutine AICRT3 – Calls library CRT subroutines to effect the plotting of data supplied in its arguments (NAA-SR-TDR-11915, "AICRT3-3, SPRINTV, FLINTV – General Purpose Subroutines for Display of Digital Data," M. A. Boling and W. A. Rhoades).

20) Subroutine QUIT – Prints a table of contents if desired from information stored on a scratch tape; calls library subroutine EXIT.

Flow diagrams for program EDIT are found in Appendix B. Program listings are found in Appendix C.

IV. EDIT INPUT

A list of input quantities, their definitions, and card formats are given below.

A. CARD 1 – FORMAT (5I12)

Item		Definition
IGRAPH	= 1	if plotting is to be done
	= 0	if no plotting
ICONT 1	= 1	if table of contents is desired
	= 0	if no table of contents
IHOL	= 1	if SCOUTV printing of File 1, Section 1, is desired
	= 0	if RITE2V printing is desired
		IHOL = 1 is recommended
IPRNT	= 1	if printing of selected files is desired
	= 0	if no printing (not including table of contents)
IPUN	= 1	if punching of selected files is desired
	= 0	if no punching

B. CARDS 2 AND 3 – FORMAT (I12, 20I3/8I3)

This set of two cards is read for each material on the tape through the last material to be processed. An end-of-file input causes the program to call subroutine QUIT and subsequently to terminate.

C. CARD 2 – FORMAT (I12, 20I3)

Card Column	Item		Description
1-12	MATL	= 1	if the material is to be processed
		= 0	if the material is to be skipped
13-15	IFILE(1)	= 1	if File 1 is to be processed
		= 0	if File 1 is to be skipped
			IFILE(1) = 1 is recommended

16-18	IOPT1(1)	= 1	for punching of File 1
		= 0	for no punching
19-21	IOPT2(1)	= 1	for printing of File 1
		= 0	for no printing
22-24	IOPT3(1)	= 1	for plotting of File 1
		= 0	for no plotting
25-27	IFILE(2)	= 2	if File 2 is to be processed
		= 0	if File 2 is to be skipped
28-30	IOPT1(2)	= 1	for punching of File 2
		= 0	for no punching
31-33	IOPT2(2)	= 1	for printing of File 2
		= 0	for no printing
34-36	IOPT3(2)	= 0	always (no plotting of File 2)
37-39	IFILE(3)	= 3	if File 3 is to be processed
		= 0	if File 3 is to be skipped
40-42	IOPT1(3)	= 1	for punching of File 3
		= 0	for no punching
43-45	IOPT2(3)	= 1	for printing of File 3
		= 0	for no printing
46-48	IOPT3(3)	= 1	for plotting of File 3
		= 0	for no plotting
49-51	IFILE(4)	= 4	if File 4 is to be processed
		= 0	if File 4 is to be skipped
52-54	IOPT1(4)	= 1	for punching of File 4
		= 0	for no punching

steel mesh which filters out large particulates and acts as an impingement crystallizer. The sodium is progressively cooled as it flows through the mesh, by forced circulation of gas through a shroud around the tank. The cooling rate is controlled by manual adjustment of louvers, and internal temperature is controlled automatically by a cooling fan on/off controller. The temperature controller is set to control internal temperature as desired, by using plugging temperature as a guide.

The major impurity removed by cold-trapping is oxygen in the form of sodium oxide. Cold-trapping of oxides is very effective, as evidenced by the rapid lowering of plugging temperature during periods of cold-trapping of primary sodium.

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE 1 of 2 JOB NO. _____

NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1		IGRAPH = 1, plotting is to be done.
13 1		ICONT1 = 1, table of contents is desired.
25 1		IHOL = 1, SCOUTV printing of File 1.
37 1		IPRNT = 1, printing is to be done.
49 1	73 80	IPUN = 1, punching is to be done.
61	1	
1 1		MATL = 1, the first material on the ENDF/B
13 1 0 0 1		tape is to be processed;
25 2 0 1 0		File 3 is to be punched;
37 3 1 0 1		Files 2, 4, and 5 are to be printed;
49 4 0 1 0	73 80	Files 1 and 3 are to be plotted.
61 5 0 1 0	1 1	
1 6 0 0 0		File 6 is not to be processed but will be included in
13		the table of contents; File 7 is to be punched and
25		printed.
37		
49	73 80	
61	1 2	
1 0		MATL = 0, the second material on the ENDF/B tape is to be
13		skipped; there will be no table of contents for this
25		material.
37		The remaining items may be left blank.
49	73 80	
61	2 1	

FORTRAN FIXED 10 DIGIT DECIMAL DATA

DECK NO. _____ PROGRAMMER _____ DATE _____ PAGE 2 of 2 JOB NO. _____

NUMBER	IDENTIFICATION	DESCRIPTION DO NOT KEY PUNCH
1		The second card for the second material may be
13		left blank.
25		
37		
49	73 80	
61	2 2	
1 1		MATL = 1, the third material on the ENDF/B tape is to be
13 1 1 1 1		processed;
25 0 0 0 0		File 1 is to be punched;
37 3 0 1 1		Files 1, 3, and 4 are to be printed;
49 4 0 1 1	73 80	Files 1, 3, and 4 are to be plotted;
61 0 0 0 0	3 1	Files 2 and 5 are to be skipped.
1 0 0 0 0		File 6 is to be skipped;
13 7 0 1 0		File 7 is to be printed.
25		
37		
49	73 80	
61	3 2	
1		
13		
25		
37		
49	73 80	
61		

F. OPERATION OF PROGRAM

The operation of program EDIT on the IBM S/360-50 requires that the ENDF/B Mode 3 tape be written in EBCDIC on a 9-track tape; the data set reference number is 9. The data set reference numbers 5, 6, 8, and 14 refer to card intput, printed output, a scratch tape, and punched output, respectively. An additional tape is needed to write the data required by the SC-4020 plotting equipment.

Program EDIT can process only one ENDF/B tape at a time.

V. EDIT OUTPUT

Punched and printed output from Program EDIT consists of 80 EBCDIC characters per card or line. The information in either case is the same and the format corresponds to that for the cards from which the ENDF/B tape was made.

The character of the plotted output depends upon the contents of each file. Except for File 4 and for log abscissa interpolation regions, there will be one plot per interpolation region; for log abscissa interpolation regions containing more than 10 decades, there will be two plots.

The plotting results that can be expected are described for each file.

A. FILE 1

The literal information, MT = 451, will be printed. There will be one line per record. Only the first 66 columns of the record will be printed. There will be 25 lines (or less) printed per CRT frame. Since the ENDF/B tape is limited to 100 such records, the maximum number of frames that can be expected is 4. The type of printing is controlled by the input parameter IHOL. If IHOL = 1, the printing is controlled by the library subroutine SCOUTV. The characters will be the charactron characters that are built into the Charactron cathode ray tube. If IHOL = 0, the printing is controlled by the library subroutine RITE2V. A vector generator will draw the characters; the result is larger characters. The IHOL = 0 option does not work at present.

An example of File 1 "plotted" output is given in Figure 1.

If a tabulation of the number of neutrons per fission, MT = 452, is given, it will be plotted in the same manner as the cross sections in File 3.

B. FILE 3

The type of grid for the plots of File 3 "smooth" cross sections depends upon the interpolation code specified in the TAB1 record. At the top of the grid will be a title consisting of the first 48 characters of the first literal record in File 1. The abscissa title is

ENERGY (EV)

PLUTONIUM-238, REVISED DECEMBER 25,1966

FAST NEUTRON CROSS SECTIONS BASED ON THEORETICAL
CALCULATIONS USING A DEFORMED POTENTIAL OPTICAL MODEL
AND STATISTICAL THEORY OF THE COMPOUND NUCLEUS

THERMAL AND RESONANCE DATA BASED ON EXPERIMENTAL DATA

DOCUMENTATION - NAA-SR-12271

Figure 1. File 1 Literal Information Plotting Example

The ordinate title depends upon the reaction type (the MT number). For example, it might be

TOTAL

or

(N, 2N) ,

meaning the total or the n, 2n cross section. There are 28 possible ordinate titles. If an MT number is used that does not correspond to one of the possible titles, the title will be left blank and a message will be printed.

Figures 2 through 5 show examples of plotting for File 3.

C. FILE 4

Angular distribution data in File 4 are given as energy-dependent Legendre coefficients or as tabulated functions of the cosine of the scattering angle for various energies. The ordinate and the abscissa will be linear and logarithmic, respectively, for the coefficient data and will be logarithmic and linear, respectively, for the tabulated data. At the top of the grid will be a title consisting of the first 48 characters of the first literal record in File 1.

For Legendre coefficient data, the abscissa title is

ENERGY (EV) .

The ordinate title depends upon the reaction type (MT) and the index of the coefficient. For example, it might be

ELASTIC LEGENDRE COEFFICIENT F 12

which means that the data plotted is the twelfth Legendre coefficient for the angular distribution of elastic scattering. There will be one plot for each coefficient for the first 200 energy points. If more than 200 energies are used, there will be one plot for each coefficient for each additional 200 energy points. Figures 6 and 7 are examples of this type of data.

For the tabulated data, the abscissa title is

COSINE OF THE SCATTERING ANGLE .

The ordinate title depends upon the reaction type (MT) and the energy of the incident neutron. For example, it might be

DIFFERENTIAL ELASTIC E = 0.9030E 06 ,

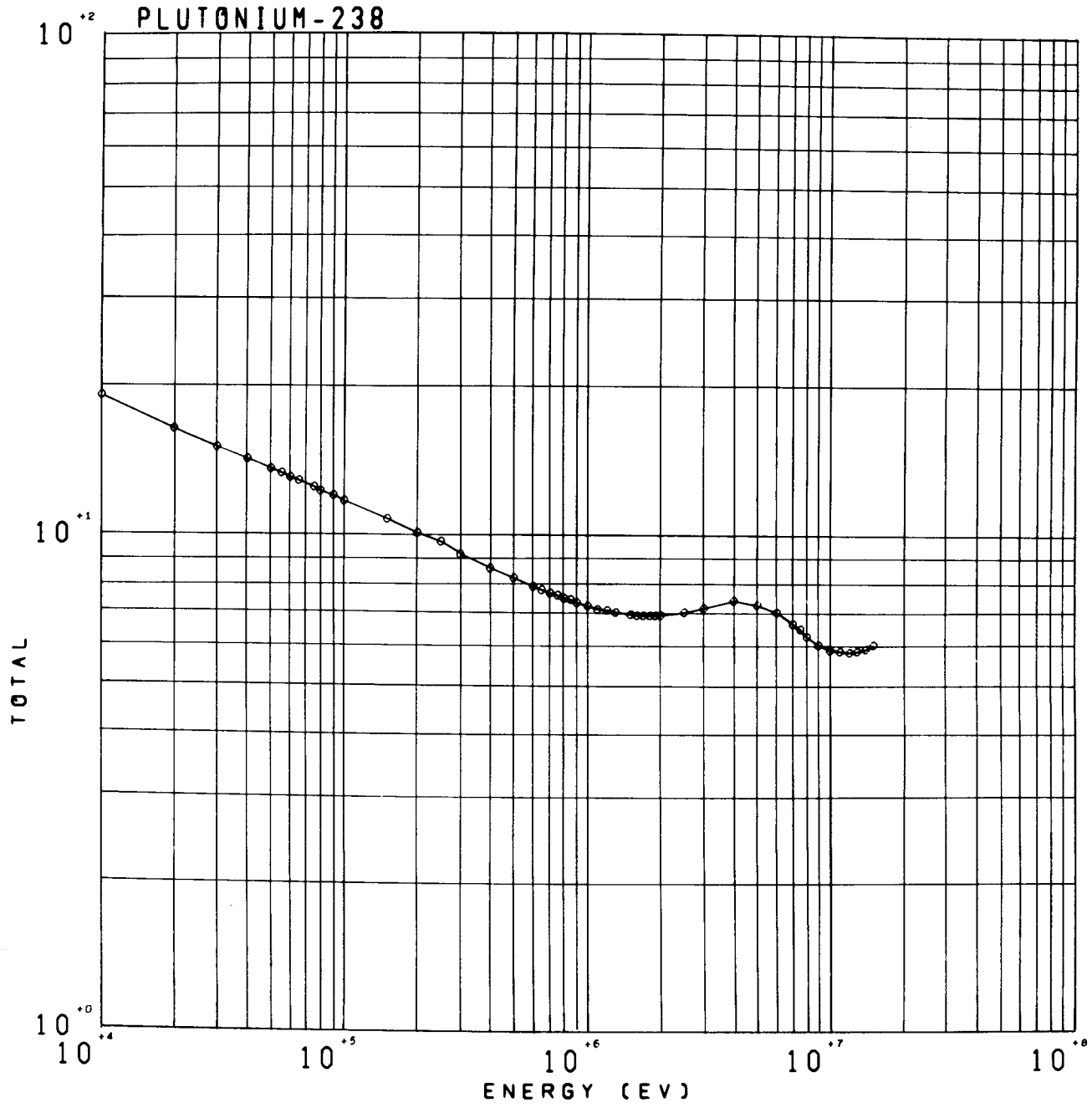

Figure 2. File 3 Smooth Cross Section Plotting Example 1

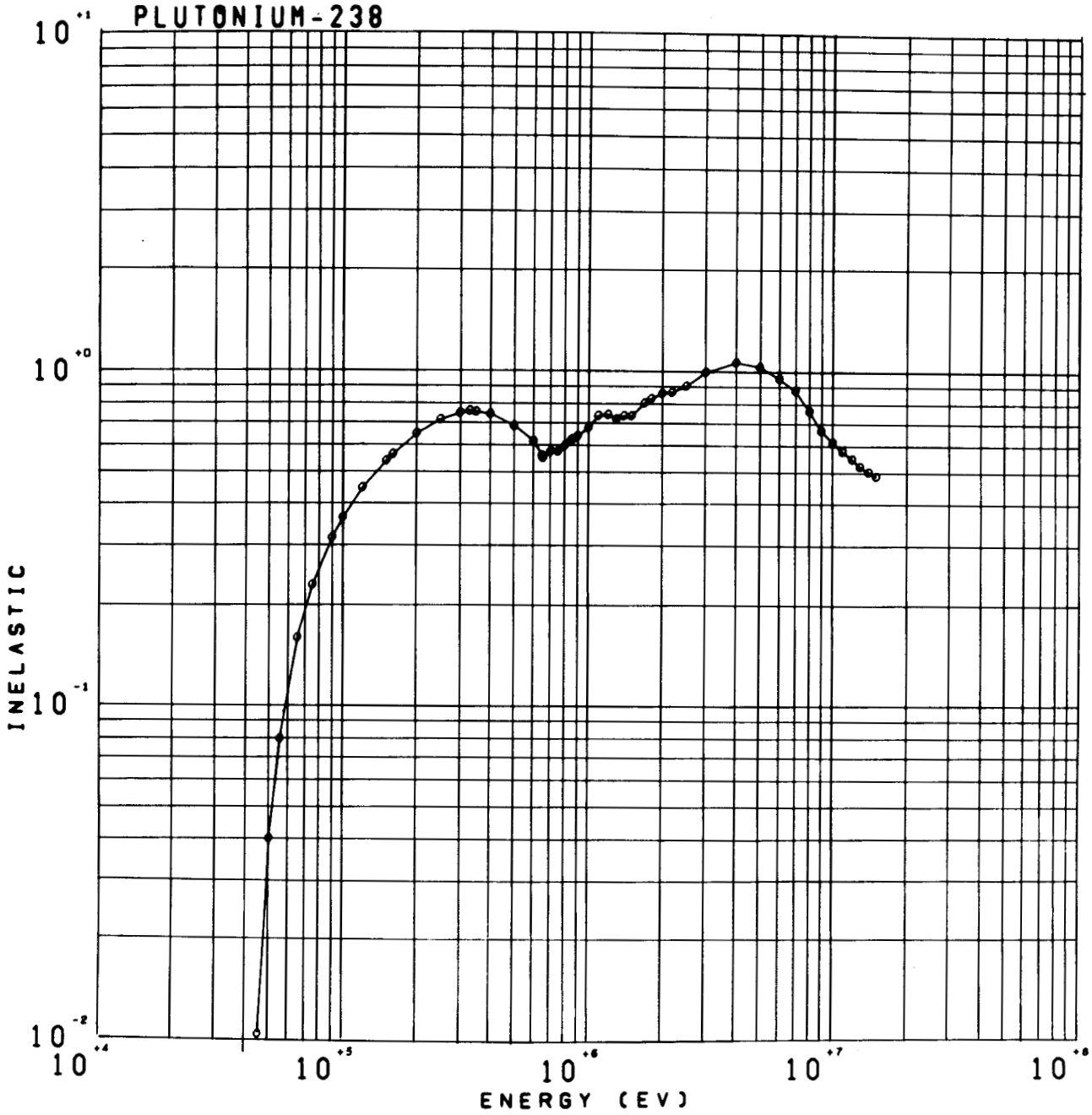

Figure 3. File 3 Smooth Cross Section Plotting Example 2

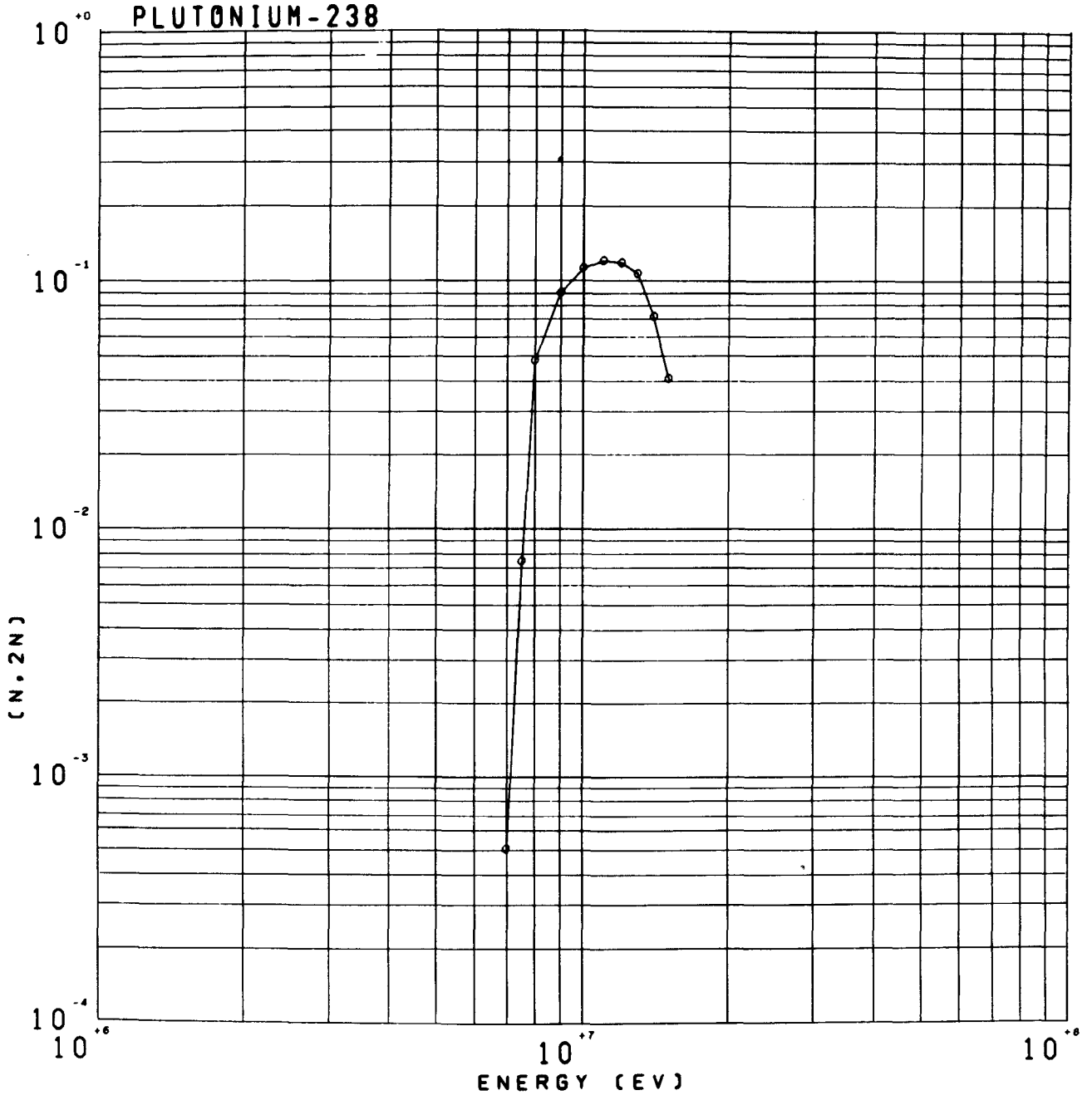

Figure 4. File 3 Smooth Cross Section Plotting Example 3

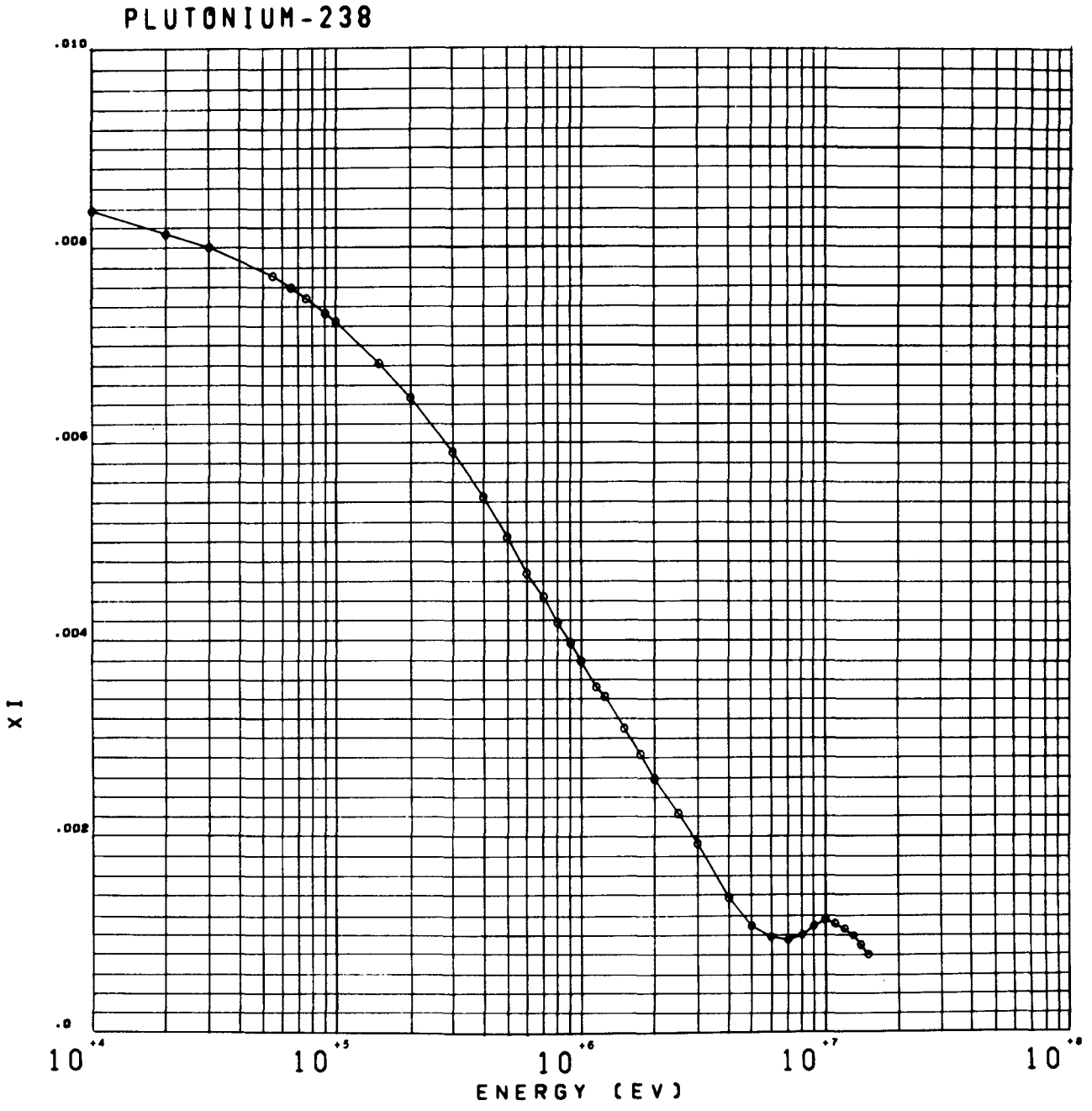

Figure 5. File 3 Smooth Cross Section Plotting Example 4

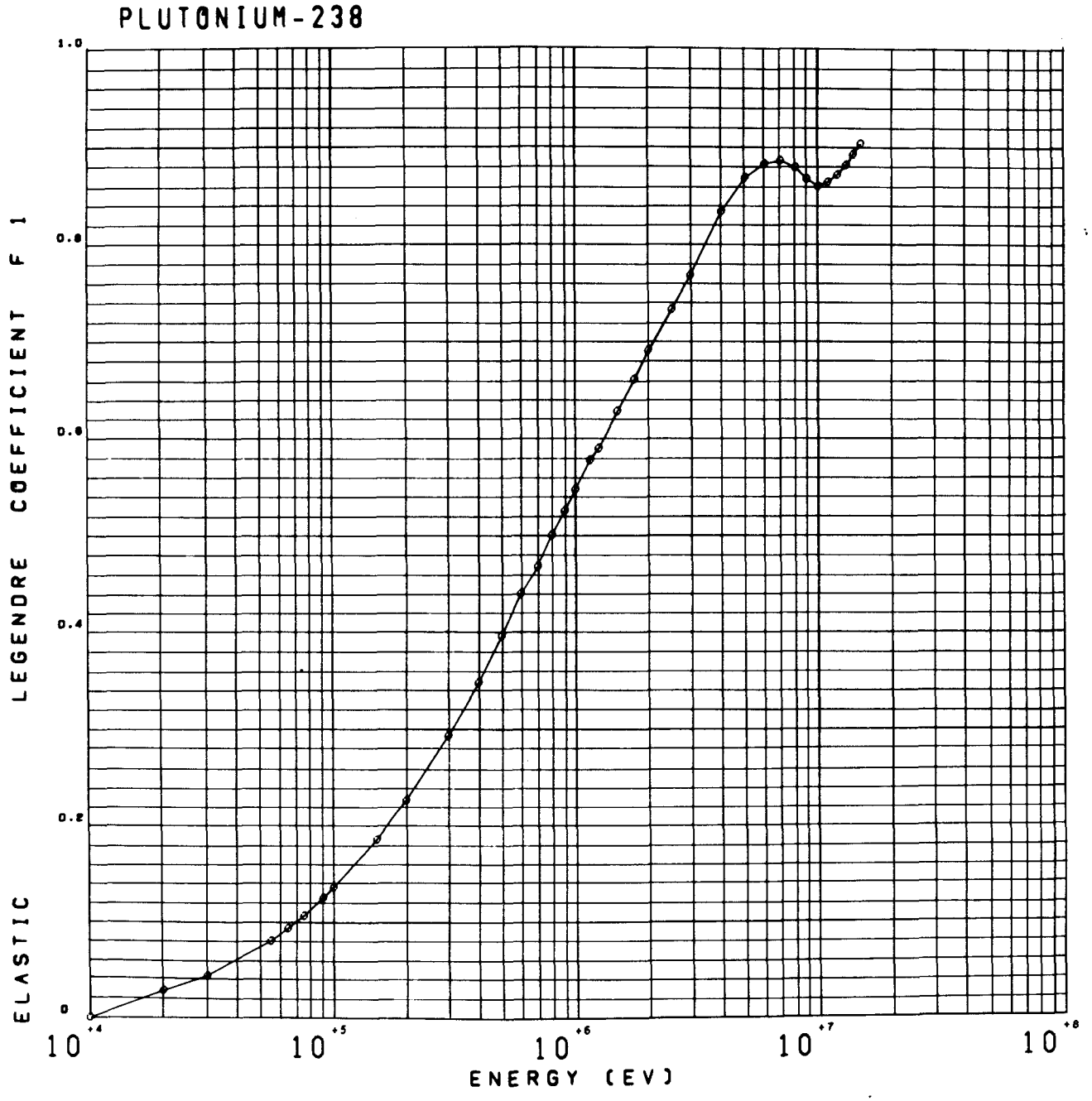

Figure 6. File 4 Legendre Coefficients Plotting Example 1

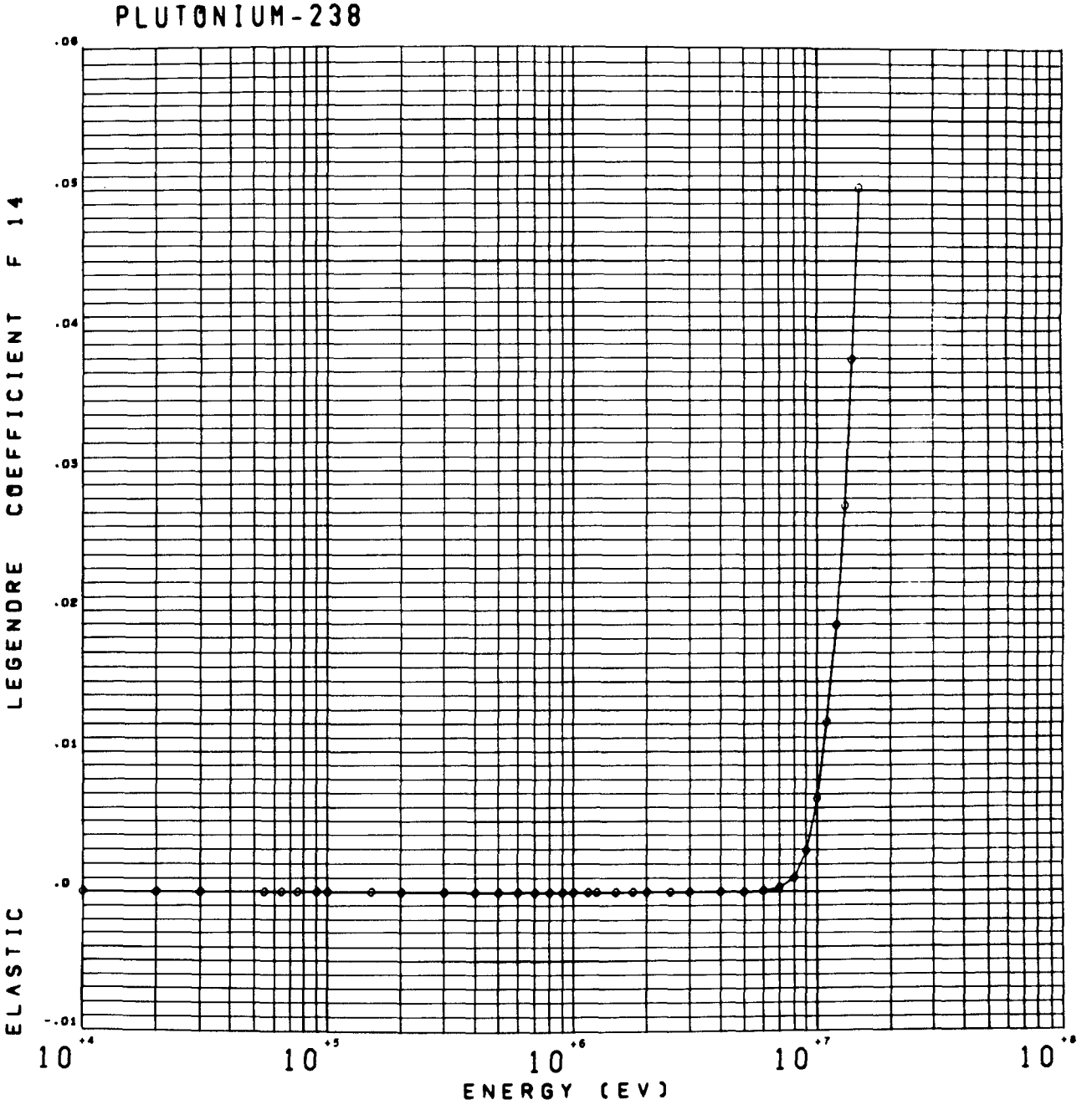

Figure 7. File 4 Legendre Coefficients Plotting Example 2

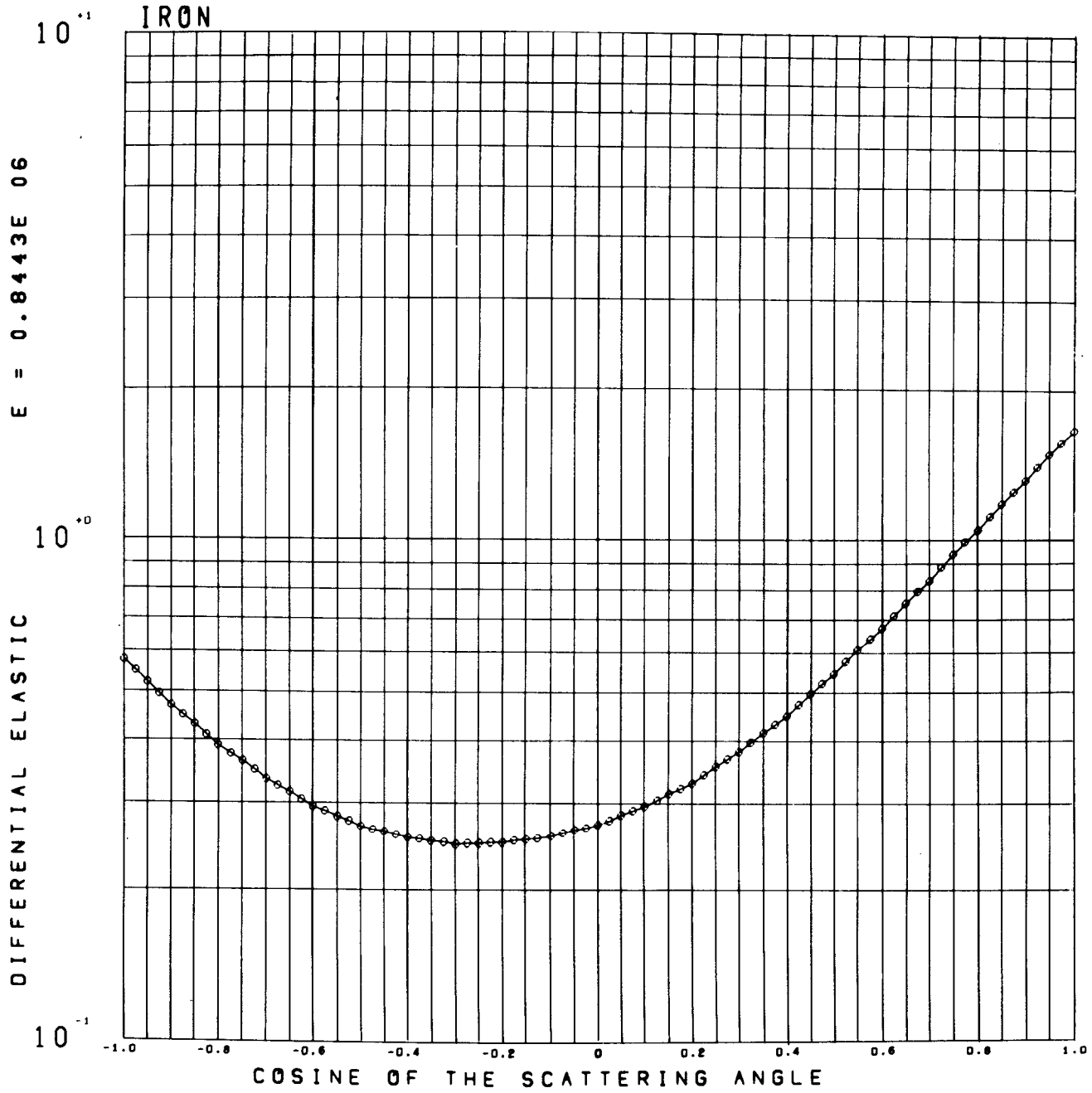

Figure 8. File 4 Differential Scattering Distribution Plotting Example

which means that the data plotted is the normalized differential elastic scattering cross section for a neutron with an energy of 9.030×10^6 ev. There will be one plot for each incident neutron energy. Figure 8 gives an example of this type of data.

D. FILE 5

Plots of the energy distribution data in File 5 depend upon the $F_K(E' \leftarrow E)$ which may be specified in a variety of ways; the parameter LF is used to denote the method used. A reaction type may consist of sets of data for one or more values of LF.

The first plot for any value of LF contains the $P_K(E)$. Comments on File 3 plots apply here except for the ordinate title. It depends upon the reaction type (MT), the value of LF (the subsection), and a constant which may appear in the expression for $F_K(E' \leftarrow E)$. For example, it might be

(N, 2N) P(E) LF = 8 CONS = 1.00E + 06 ,

which means that the $P_K(E)$ data is for the (N, 2N) reaction and the $F_K(E' \leftarrow E)$ uses the eighth method of specification (Maxwellian distribution); the constant θ for the distribution is 1.00×10^6 ev.

The following list defines LF and the meaning of CONS:

LF	Description	CONS
1	Arbitrary tabulated function	Undefined; value will be 0.0
2	Discrete final energy	The discrete final energy, ev
3	Discrete energy loss	The discrete energy loss, ev
4	General evaporation spectrum tabulated as $g(E'/\theta)$	The value of θ, ev
5	Same as LF = 4 but $\theta = \theta(E)$ and is tabulated	Undefined; value will be 0.0
6	Simple fission spectrum $(4E'/\pi\theta^3)^{1/2} \exp(-E'/\theta)$	The value of θ, ev

LF	Description	CONS
7	Same as LF = 6 but $\theta = \theta(E)$ and is tabulated	Undefined; value will be 0.0
8	Maxwellian distribution $(E'/\theta^2)\exp(-E'/\theta)$	The value of θ, ev
9	Same as LF = 8 but $\theta = \theta(E)$ and is tabulated	Undefined; value will be 0.0
10	Watt spectrum	Undefined; value will be 0.0

LF subsections 2, 3, 6, 8, and 10 require no further plotting; however, additional plotting is done for the other LF values. Comments on File 3 plots apply here except as noted in the following paragraphs.

1. LF = 1

The $F_K(E' \leftarrow E)$ is plotted; there will be one or more plots for each value of E. The ordinate title will contain the reaction name and the value of E. For example, it might be

(N, N') ALPHA F(E' FROM E) ARB.TAB. E = 5.25 E + 06 ,

which means that the arbitrary tabulation of $F_K(E' \leftarrow E)$ for the (N, N'α) reaction is plotted for an incident energy of 5.25×10^6 ev.

2. LF = 4

A tabulated general evaporation spectrum $F(E'/\theta)$ is plotted. The abscissa will be E'/θ. The abscissa title will be

ENERGY/THETA .

The ordinate contains the reaction name. For example, it might be

(N, N') ALPHA F(E'/THETA) TABLE .

3. LF = 5

Plots of a tabulated $\theta(E)$ and a tabulated general evaporation spectrum $F(E/\theta(E))$ will be produced. The ordinate of the $\theta(E)$ plot might read

(N, N') ALPHA THETA(E) TABLE .

The abscissa of the $F(E/\theta(E))$ plot will be

ENERGY/THETA .

The ordinate might read

(N, N′) ALPHA F(E′/THETA (E)) TABLE .

4. LF = 7

A plot of a tabulated $\theta(E)$ will be produced. The ordinate might read

(N, N′) ALPHA THETA(E) TAB. FOR SIMPLE FISSION SPEC

5. LF = 9

A plot of a tabulated $\theta(E)$ will be produced. The ordinate might read

(N, 2N) THETA(E) TAB. FOR MAXWELLIAN DISTRIB .

Examples of File 5 plotting are given in Figures 9, 10, and 11 for LF = 1, in Figure 12 for LF = 3, in Figures 13, 14, and 15 for LF = 5, and in Figures 16 and 17 for LF = 9.

E. FILE 6

Since each subsection of a File 6 section (MT) is plotted as if it were a File 5 section, no further explanation is required regarding the plots; however, the plots for a File 6 section are preceded by a frame containing printed information on the method used to present the data. In addition, each subsection is preceded by a frame giving the Legendre polynomial index or the MU index and value for that subsection.

For a File 6 section that is given by a Legendre expansion, the first page might read:

FILE 6
SECONDARY ENERGY-ANGLE DISTRIBUTIONS
LEGENDRE EXPANSION

9, ORDER OF LEGENDRE EXPANSION
DATA IN CENTER OF MASS SYSTEM

The last line might have read

DATA IN LAB. SYSTEM .

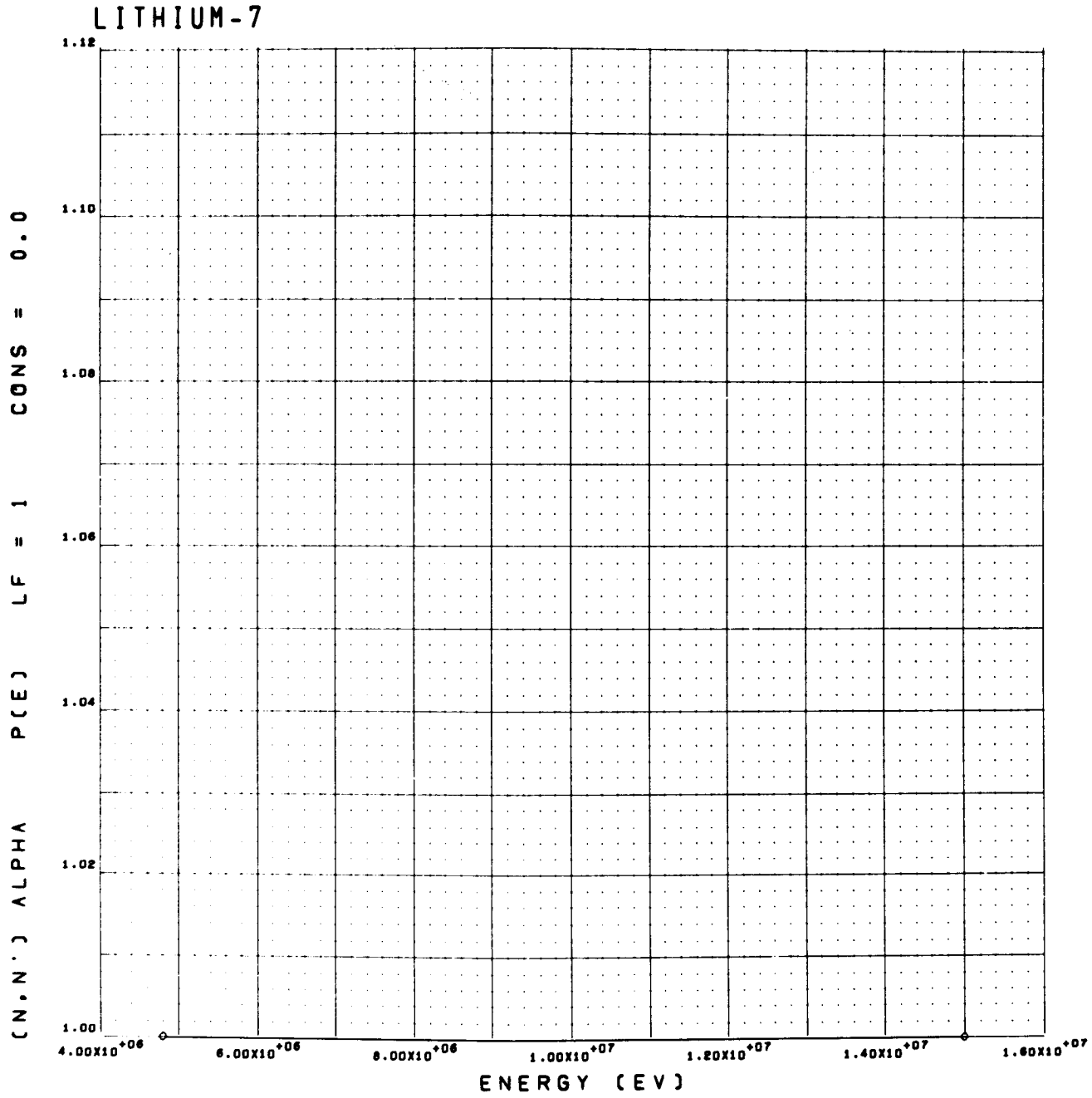

Figure 9. File 5 LF = 1 Energy Distribution Plotting Example 1

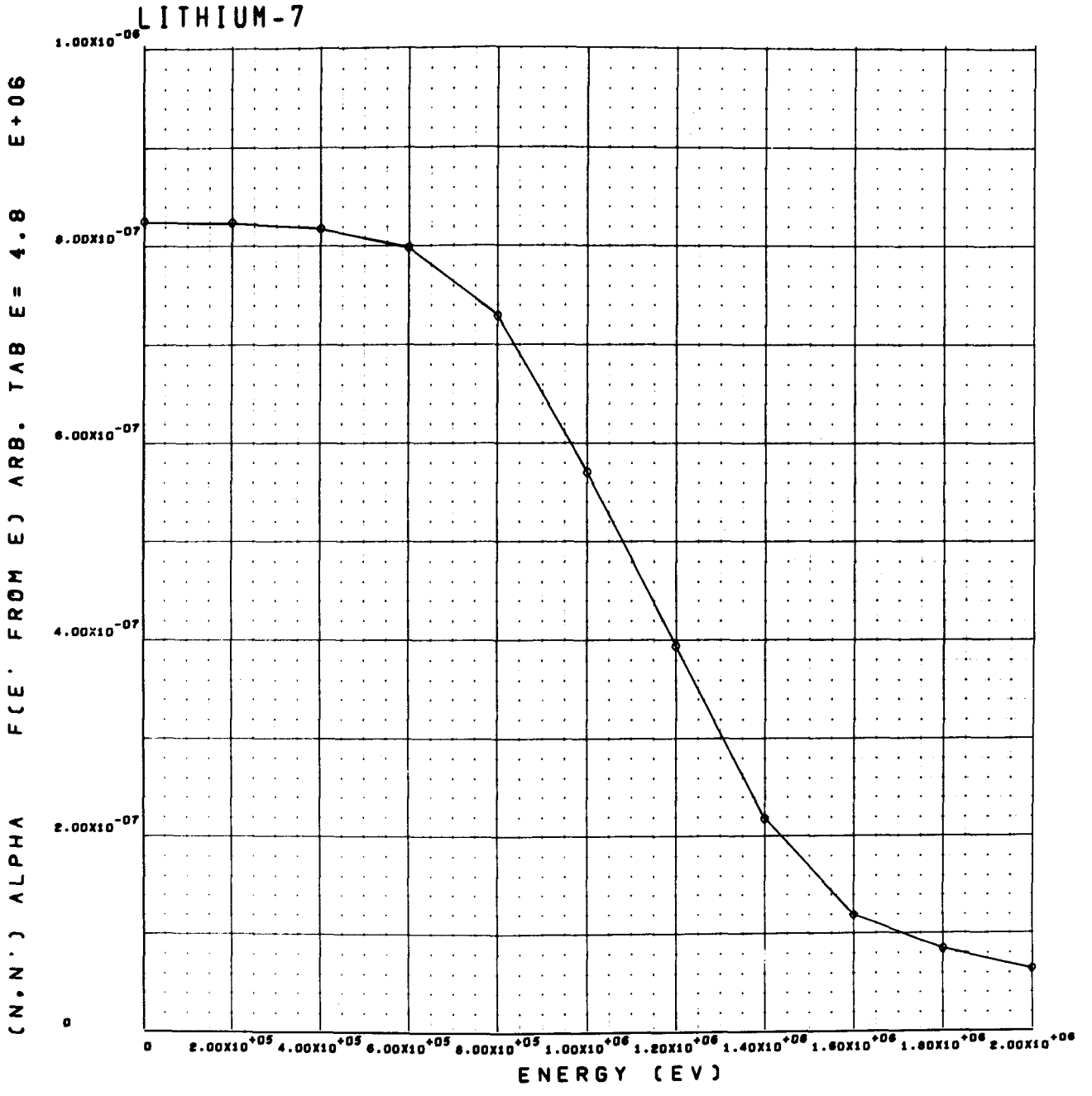

Figure 10. File 5 LF = 1 Energy Distribution Plotting Example 2

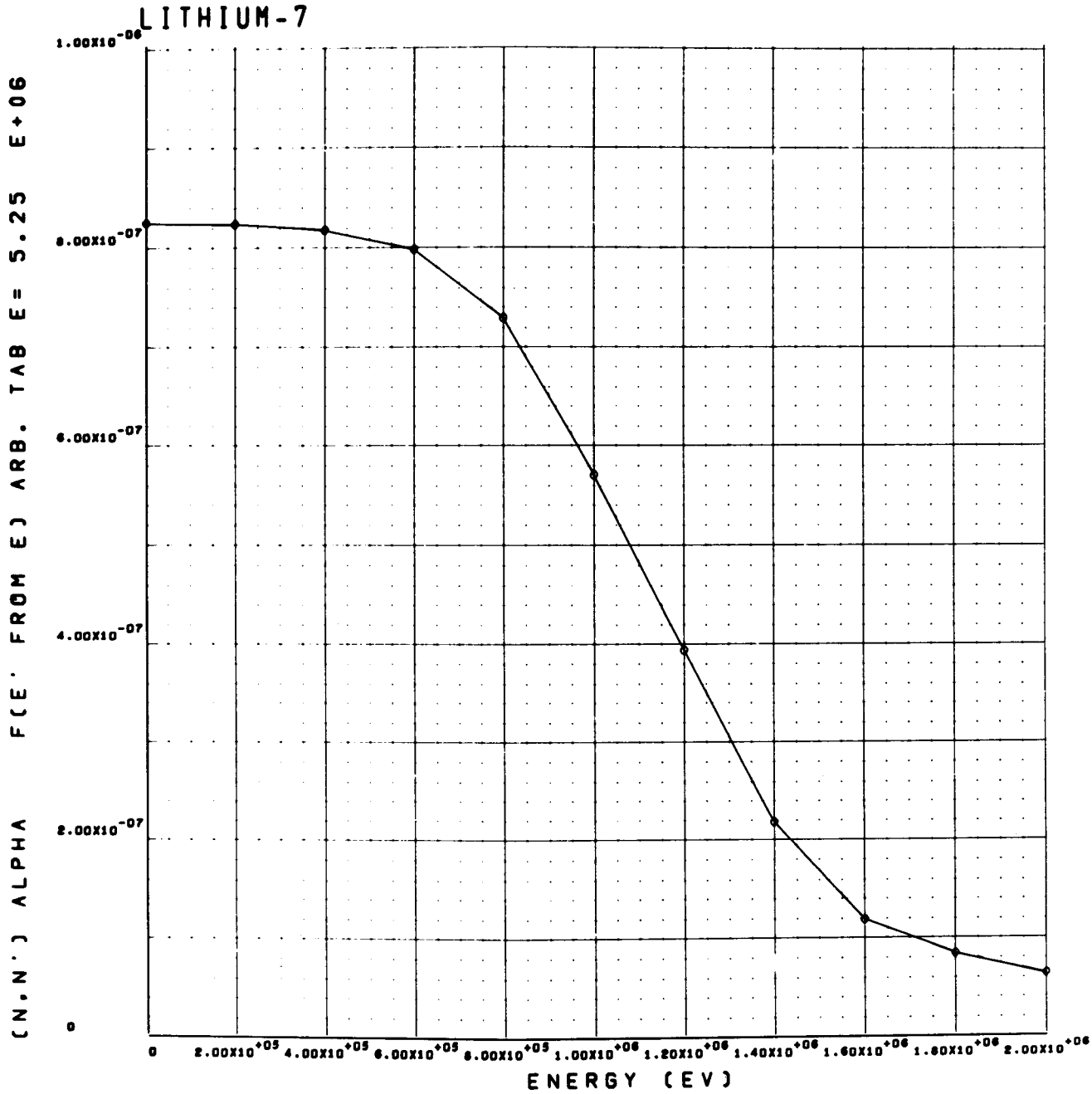

Figure 11. File 5 LF = 1 Energy Distribution Plotting Example 3

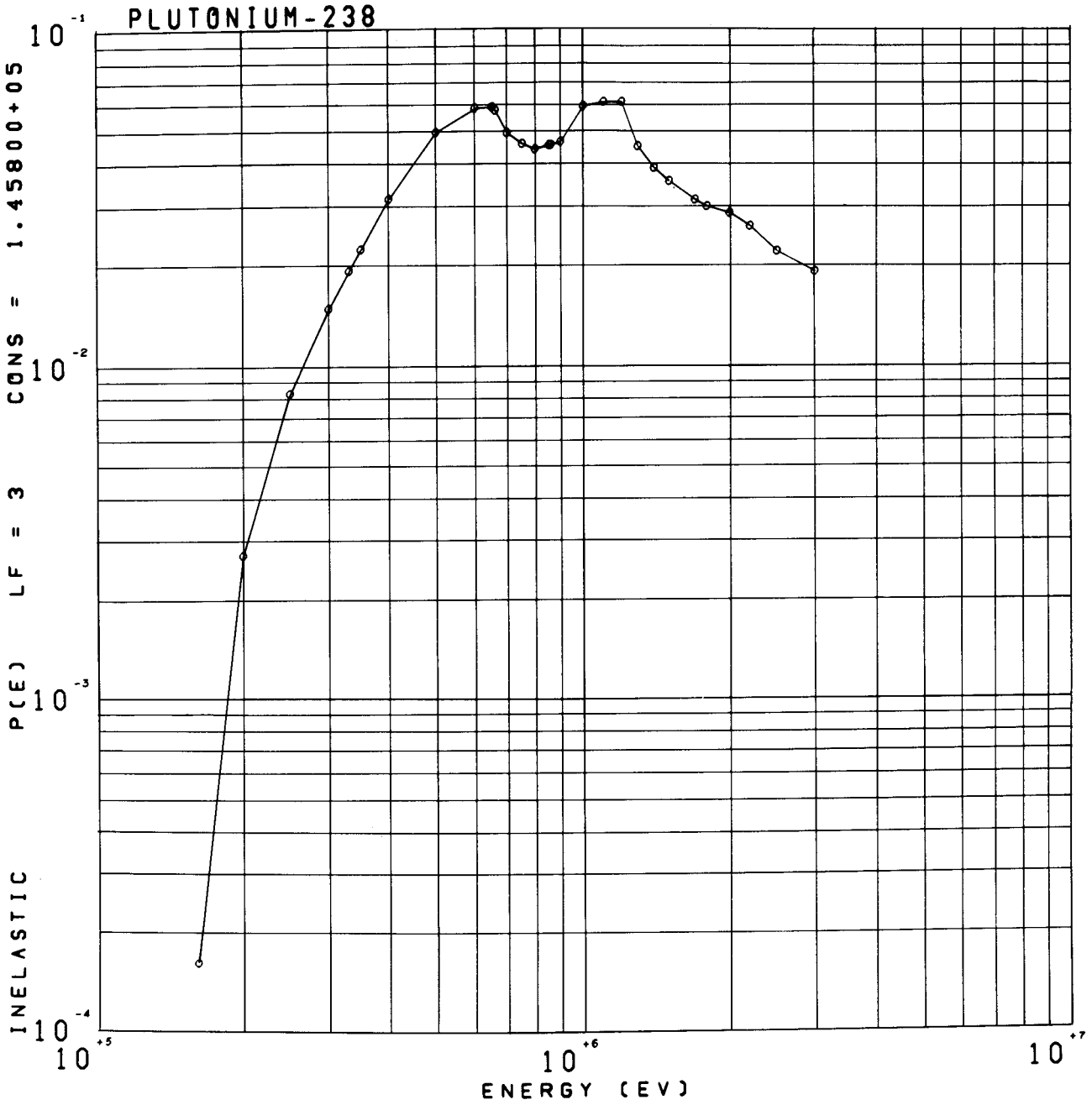

Figure 12. File 5 LF = 3 Energy Distribution Plotting Example

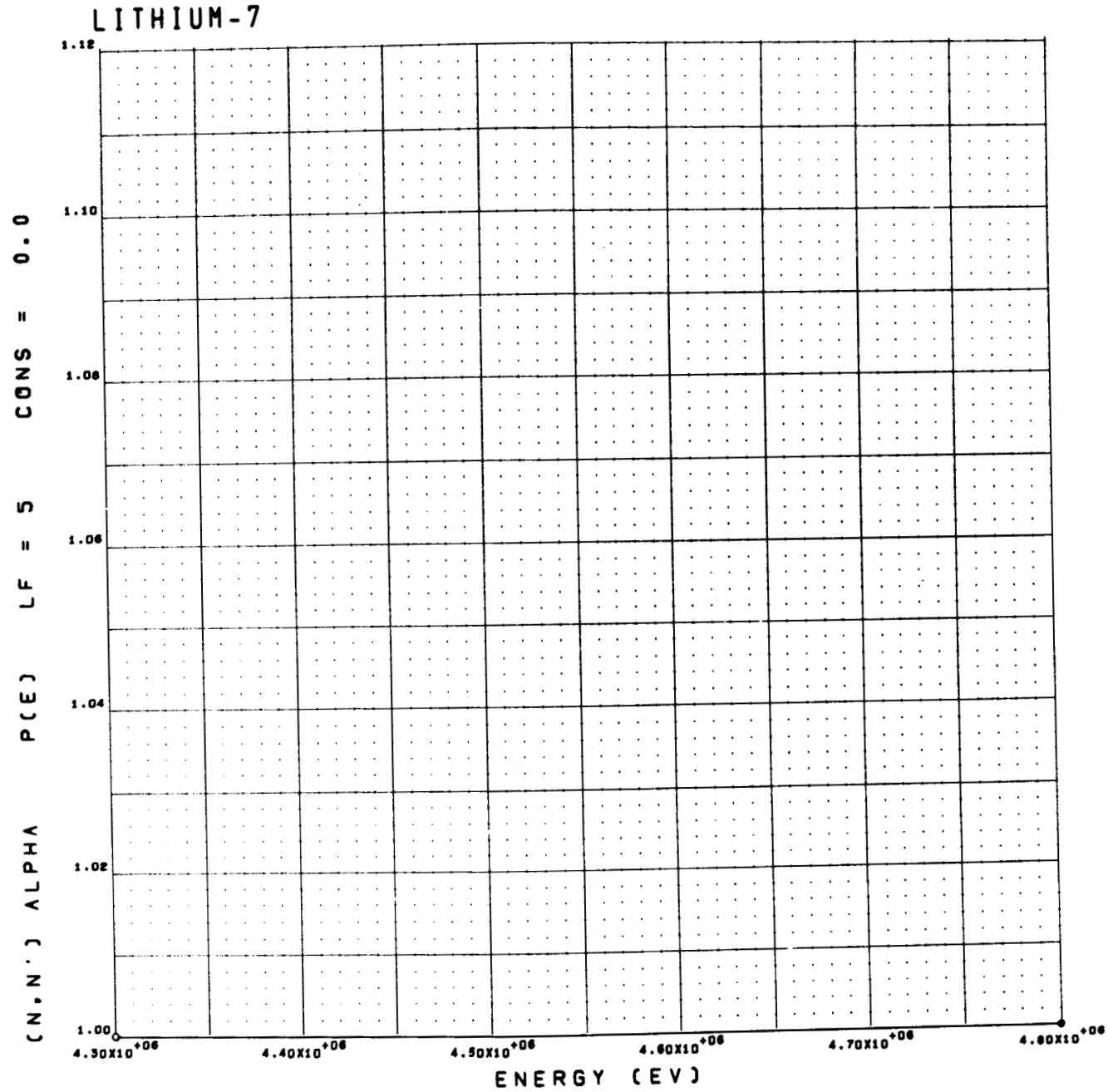

Figure 13. File 5 LF = 5 Energy Distribution Plotting Example 1

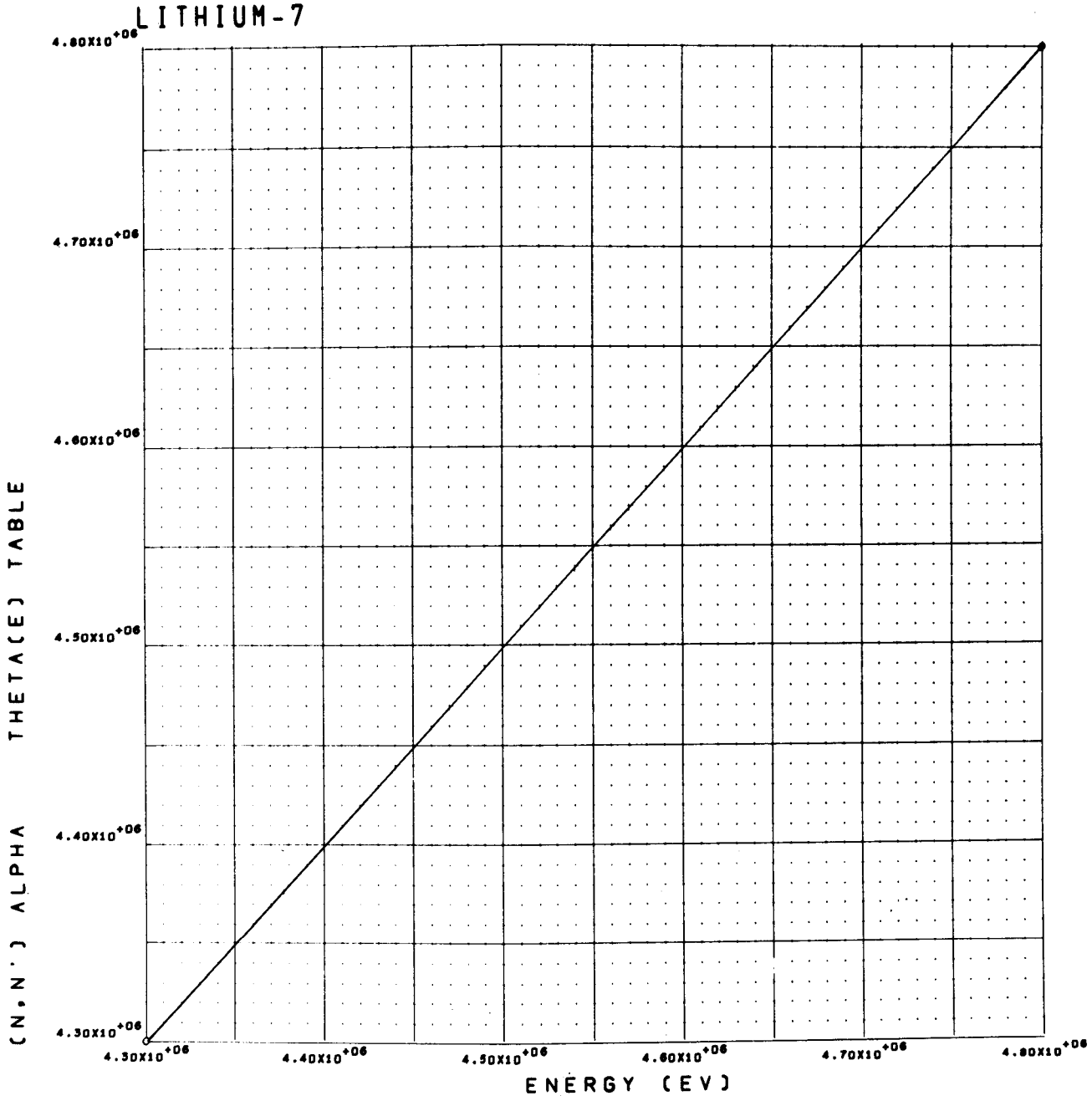

Figure 14. File 5 LF = 5 Energy Distribution Plotting Example 2

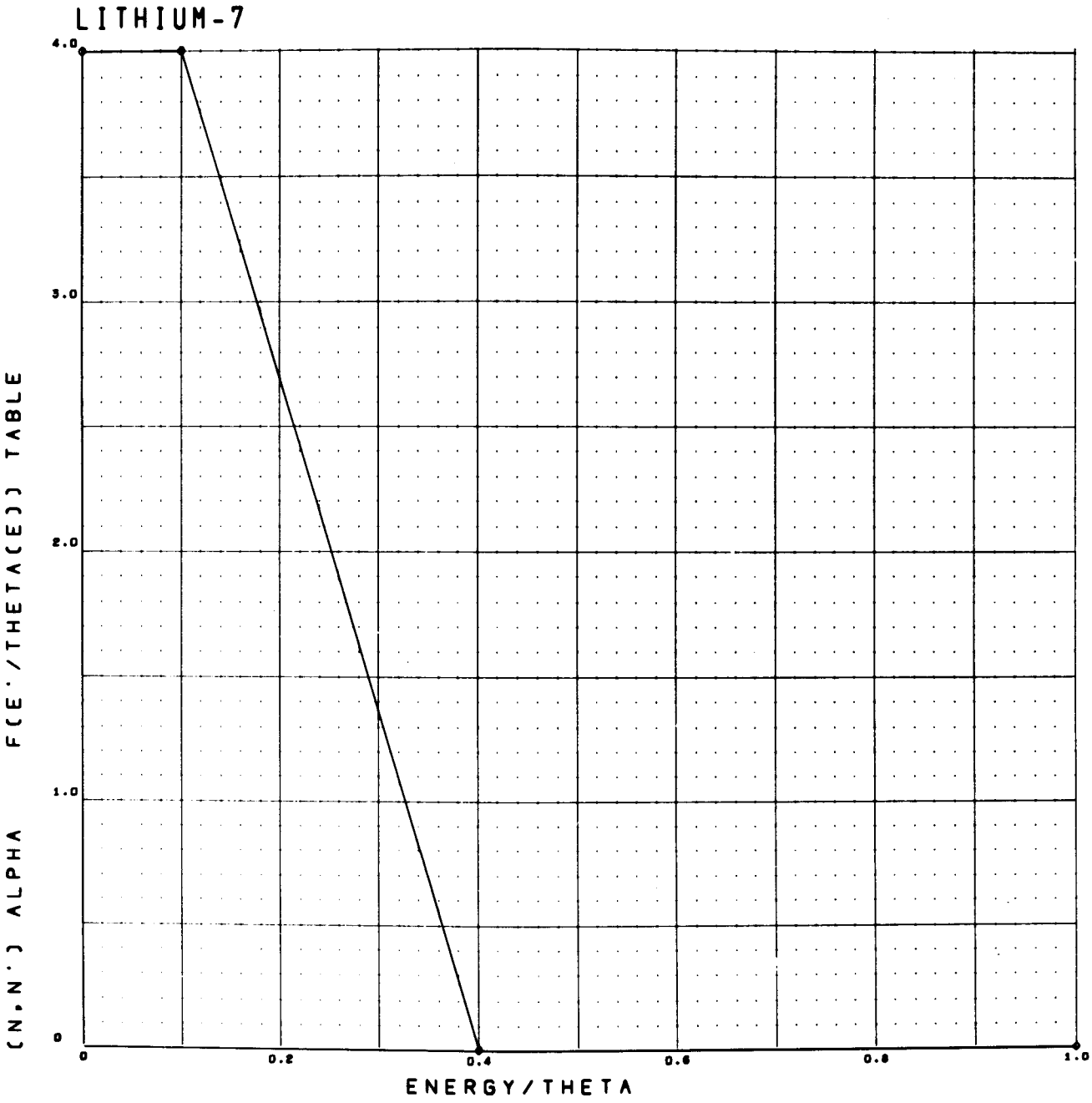

Figure 15. File 5 LF = 5 Energy Distribution Plotting Example 3

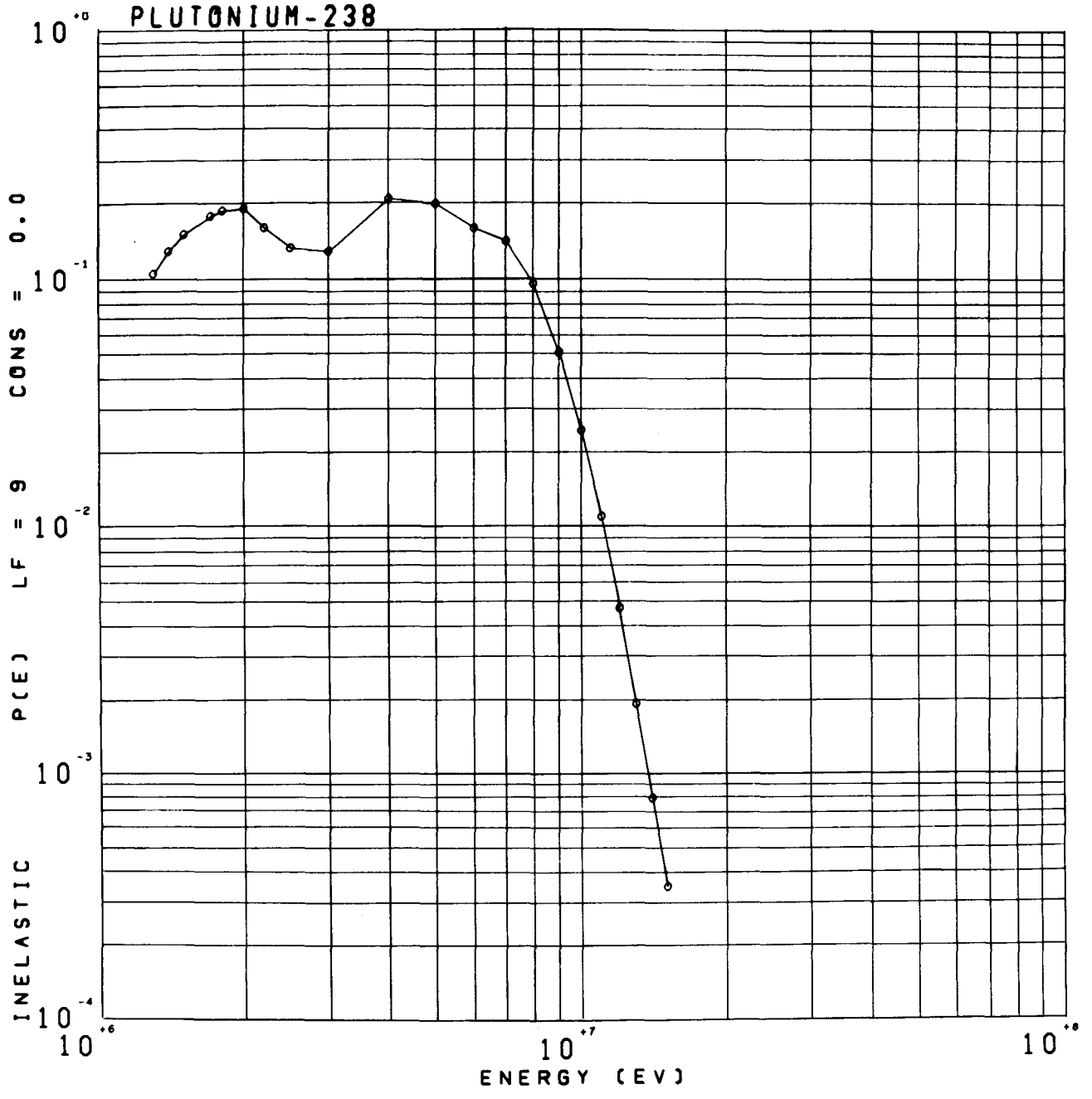

Figure 16. File 5 LF = 9 Energy Distribution Plotting Example 1

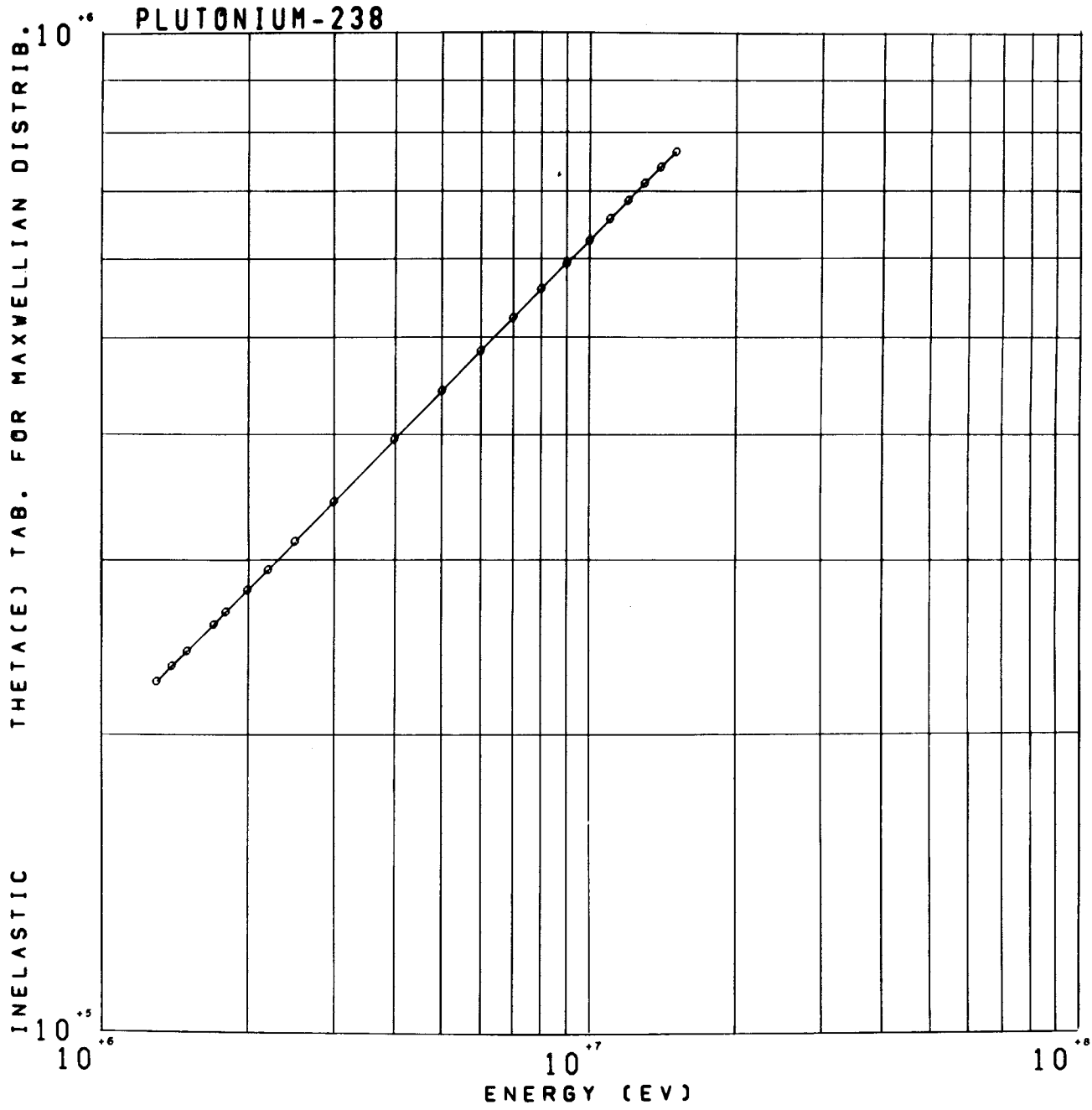

Figure 17. File 5 LF - 9 Energy Distribution Plotting Example 2

For a File 6 section that is given by a tabulation for each value of the cosine of the scattering angle, MU, the third and fourth lines might read

TABULATION

21, NO. OF MU VALUES AT WHICH TABULATIONS ARE GIVEN

The additional frame preceding each subsection might read

LEGENDRE POLYNOMIAL INDEX = 5

or

MU INDEX = 14 MU = 3.0E-01

The use of the plotting option in program EDIT to check for spurious errors in data preparation is best illustrated by several examples. The titles have been deleted from the plots used because the source of the data is of no concern here. Figures 18 and 19 show the results of an error at 1.0×10^4 ev in both the total and the n,γ reactions. In Figure 19 the error required that more than 10 decades be plotted on the ordinate; the 10-decade maximum restriction forced the plotting off scale at higher energies. Figure 20 shows the results of an error in an energy value which caused the plotting of the point off scale in the left margin. Figure 21 shows an error in File 4 data. The point at MU = 0.4 is several decades too small. The 10-decade limit caused the plotting of the point to be off scale.

Figure 18 is an example of plotting when the points are too dense on a small area. Program EDIT plots one frame for each interpolation region and does not expand an interval by making more plots; however, the ENDF/B data does allow several interpolation regions. Good plots of dense points could be achieved if the data specify several interpolation regions in the interval.

If the energy is on a linear scale and if the energy interval for an interpolation region is large (for example 0.001 to 1.5×10^7 ev), the points plotted at the lower energies will appear on the left edge of the grid. Again this may be overcome by specifying several interpolation regions in the ENDF/B data.

The information obtained when the table of contents is printed out is best illustrated by an example for one of the materials on the ENDF/B tape (LABEL = 102). Figure 22 is such an example for material 1050, Pu^{238}. All files were

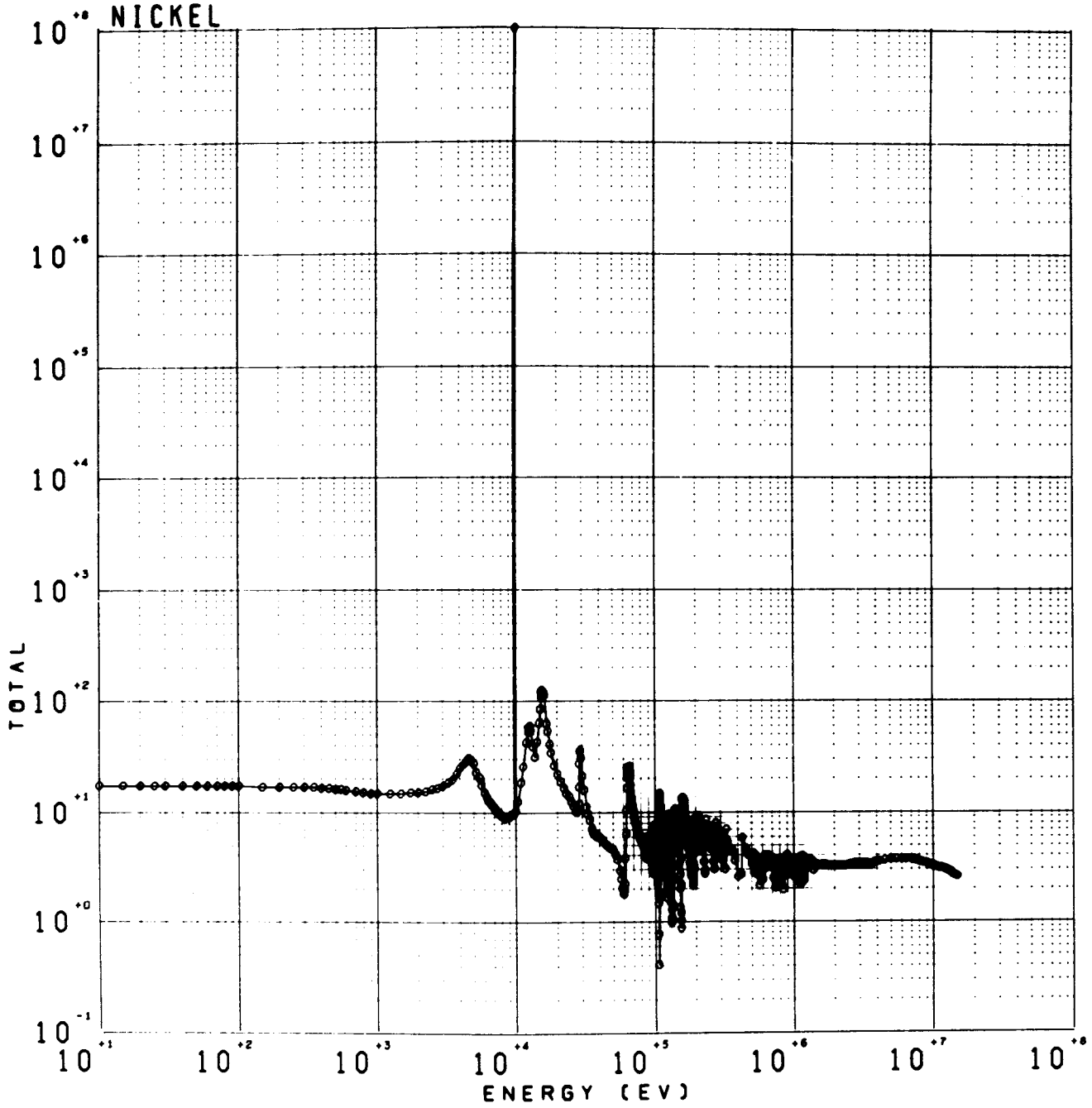

Figure 18. Data Errors Revealed by EDIT Plotting Example 1

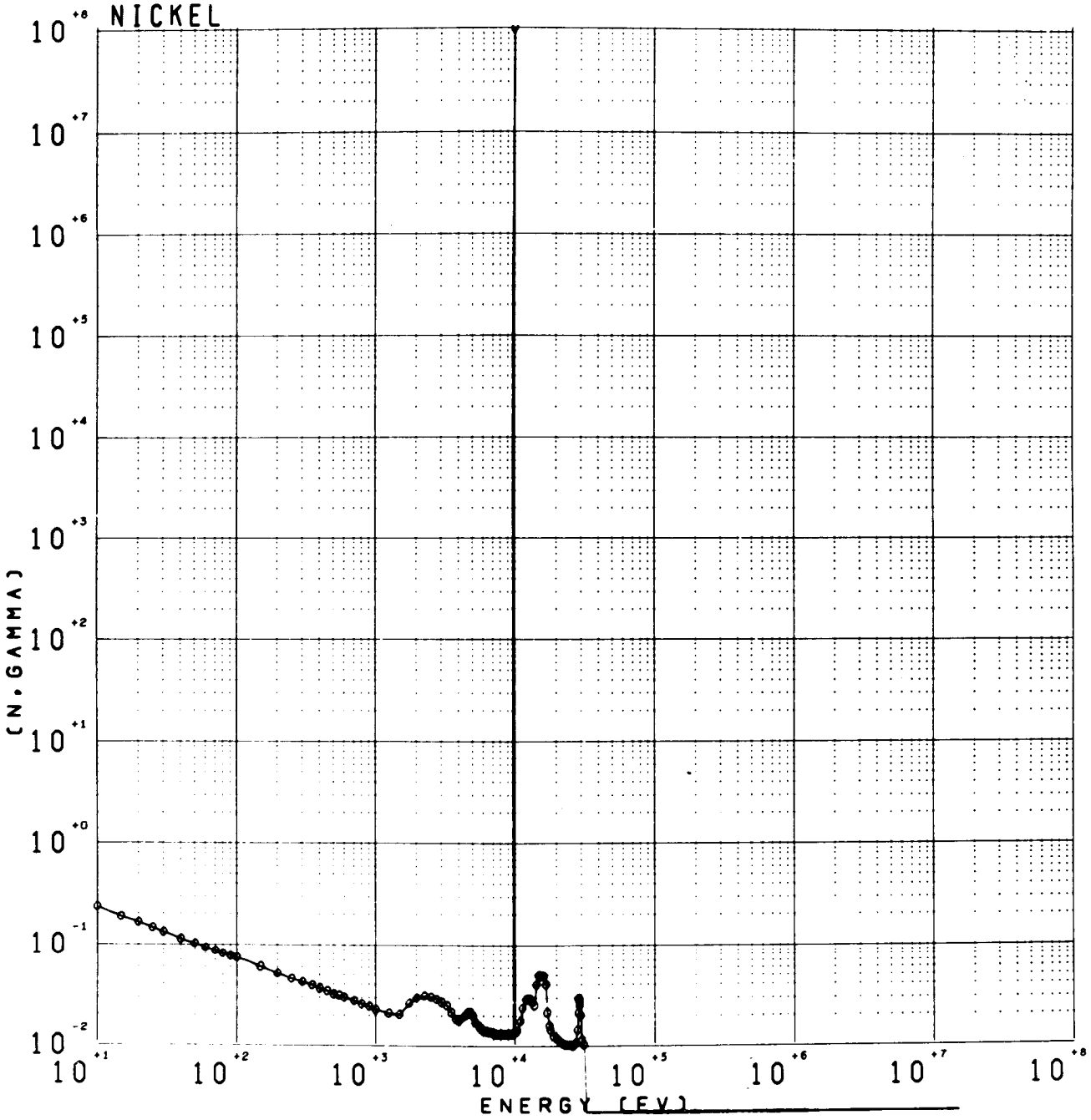

Figure 19. Data Errors Revealed by EDIT Plotting Example 2

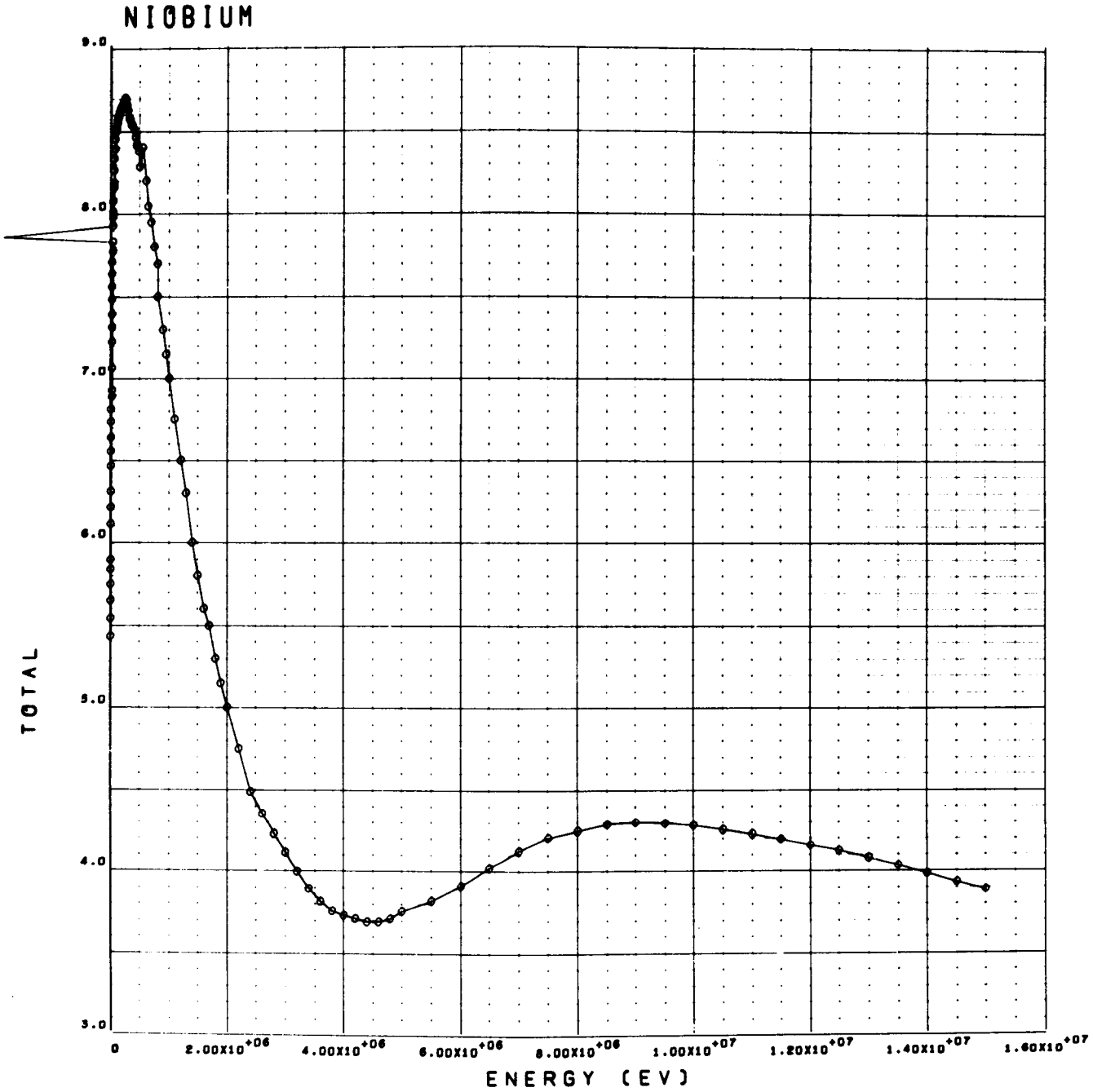

Figure 20. Data Errors Revealed by EDIT Plotting Example 3

APPENDIX 2
FUEL CLADDING SURFACE CARBURIZATION

by

R. W. Woodruff

It is desirable to determine the carbon distribution in stainless steel after exposure to a carburizing environment. The distribution was not measured directly and it cannot be inferred from microhardness traverses or from simple applications of diffusion theory. However, mean carbon was measured in sample tabs of various thicknesses exposed simultaneously. The following analysis determines the carbon distribution from mean carbon measurements.

Distribution of carbon in tabs of any thickness is represented by a single unknown mathematical function. This distribution is integrated to find mean carbon for tabs of any thickness. Since mean carbon was measured experimentally, the integral equation can be differentiated to find the unknown distribution.

Let C(x) represent the carbon concentration in weight percent at distance x from the left hand surface of a tab with thickness ℓ. Let $C_o\ell$ be the uniform carbon concentration in the virgin tab. When exposure is terminated, let $f_1(x)$ be the increase in carbon resulting from carbon crossing the left hand surface. Likewise, let $f_2(x)$ result from the right hand surface. Then

$$C(x) = C_o + f_1(x) + f_2(x)$$

as shown in Figure 14. Mean carbon content for a tab of any thickness ℓ is given by

$$M(\ell) = \int_{x=o}^{\ell} \frac{C(x)\,dx}{\ell}$$

or

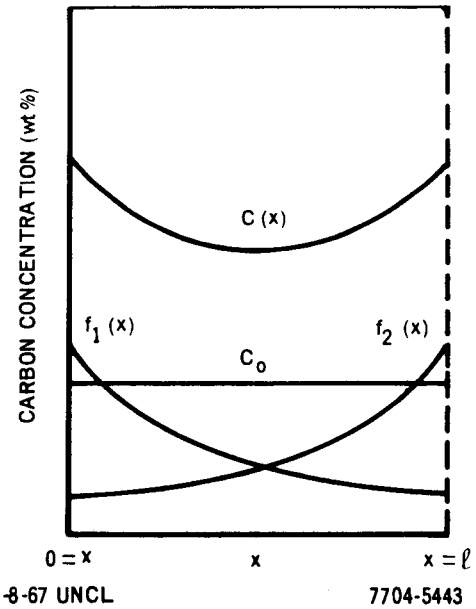

Figure 14. Carbon Distribution Across Thin Carburized Tabs

$$\ell M(\ell) = C_o \ell + \int_{x=o}^{\ell} [f_1(x) + f_2(x)]dx \qquad \ldots(1)$$

Because of symmetry,*

$$f_1(x) = f_2(\ell - x) \quad .$$

Transforming,

$$\int_{x=o}^{\ell} f_2(x)\,dx = \int_{\ell-x=o}^{\ell} f_2(\ell - x)d(\ell - x) = \int_{x=\ell}^{o} f_2(\ell - x)d(-x) = \int_{x=o}^{\ell} f_1(x)\,dx \quad ,$$

Equation 1 becomes

$$\ell M(\ell) = Co\ell + 2\int_{x=o}^{\ell} f_1(x)\,dx \quad .$$

$M(\ell)$ is known from tab measurements. It is necessary to extract $f_1(x)$. Differentiating,

$$\ell \frac{dM(\ell)}{d\ell} + M(\ell) - C_o = 2f_1(\ell) \quad . \qquad \ldots(2)$$

Note the change of variable. Function $f_1(\ell)$ now approximates the carbon concentration increase at any point which is ℓ distant from the surface of a semi-infinite slab of stainless steel. $M(\ell)$ is the mean carbon concentration of any tab of thickness ℓ. For fuel cladding, which can only be carburized from one

*A tab exposed to the same conditions on both sides would be expected to carburize symmetrically. However it should be pointed out here that nonsymmetrical carburization of sample tabs has been observed (see Figure 5).

requested in the input data. File 1 is self-explanatory. File 2 is present on the tape and consists of one isotope. Files 3 through 5 are present and the reaction types are listed. Files 6 and 7 are not on the tape. If File X were to be skipped, the message

FILE X NOT PRESENT FOR THIS MATERIAL

would be printed under the File X heading.

APPENDIX A
MATERIAL AND REACTION TYPE IDENTIFICATION NUMBERS

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MATERIAL AND REACTION TYPE IDENTIFICATION NUMBERS

TABLE I

MATERIAL IDENTIFICATION NO. (MAT)

Material	MAT	Material	MAT
H-1	1001	Gd	1030
H_2O	1002	Dy-164	1031
D-2	1003	Lu-175	1032
D_2O	1004	Lu-176	1033
Li-6	1005	Hf	1034
Li-7	1006	Ta-181	1035
Be-9	1007	W	1036
Be-0	1008	Au-197	1037
B-10	1009	Th-232	1038
C	1010	Th-233	1039
CH_2	1011	Pa-233	1040
N-14	1012	U-233	1041
O-16	1013	U-233 F.P.	1042
Mg	1014	U-234	1043
Al-27	1015	U-235	1044
Ti	1016	U-235 F.P.	1045
V-51	1017	U-236	1046
Cr	1018	U-238	1047
Mn-55	1019	Np-237	1048
Fe	1020	Np-239	1049
Ni	1021	Pu-238	1050
Zr	1022	Pu-239	1051
ZrH	1023	Pu-239 F.P.	1052
Nb	1024	Pu-240	1053
Mo	1025	Pu-241	1054
Xe-135	1026	Pu-242	1055
Sm-149	1027	Am-241	1056
Eu-151	1028	Am-243	1057
Eu-153	1029	Cm-244	1058
		Na	1059

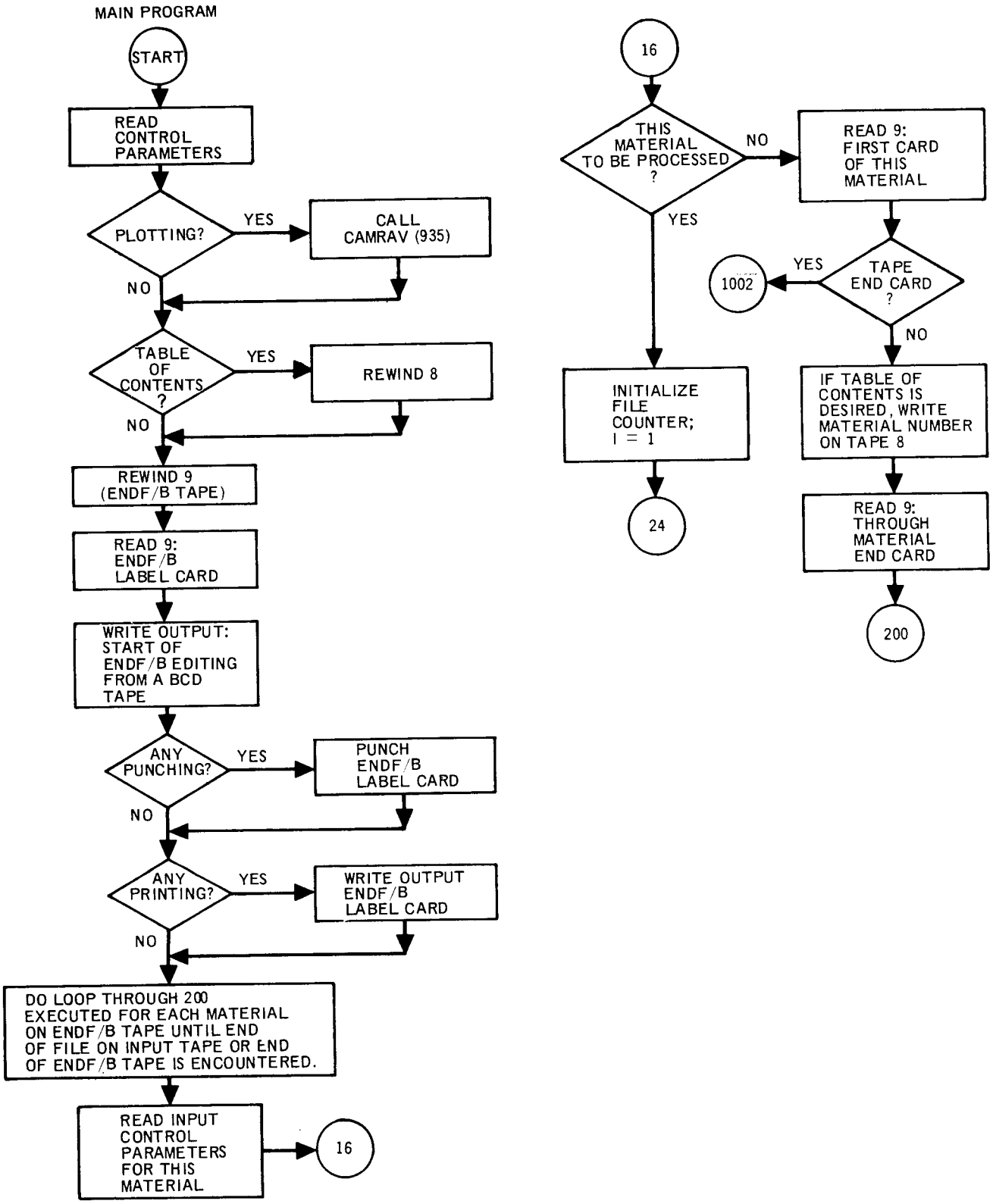
TABLE 2

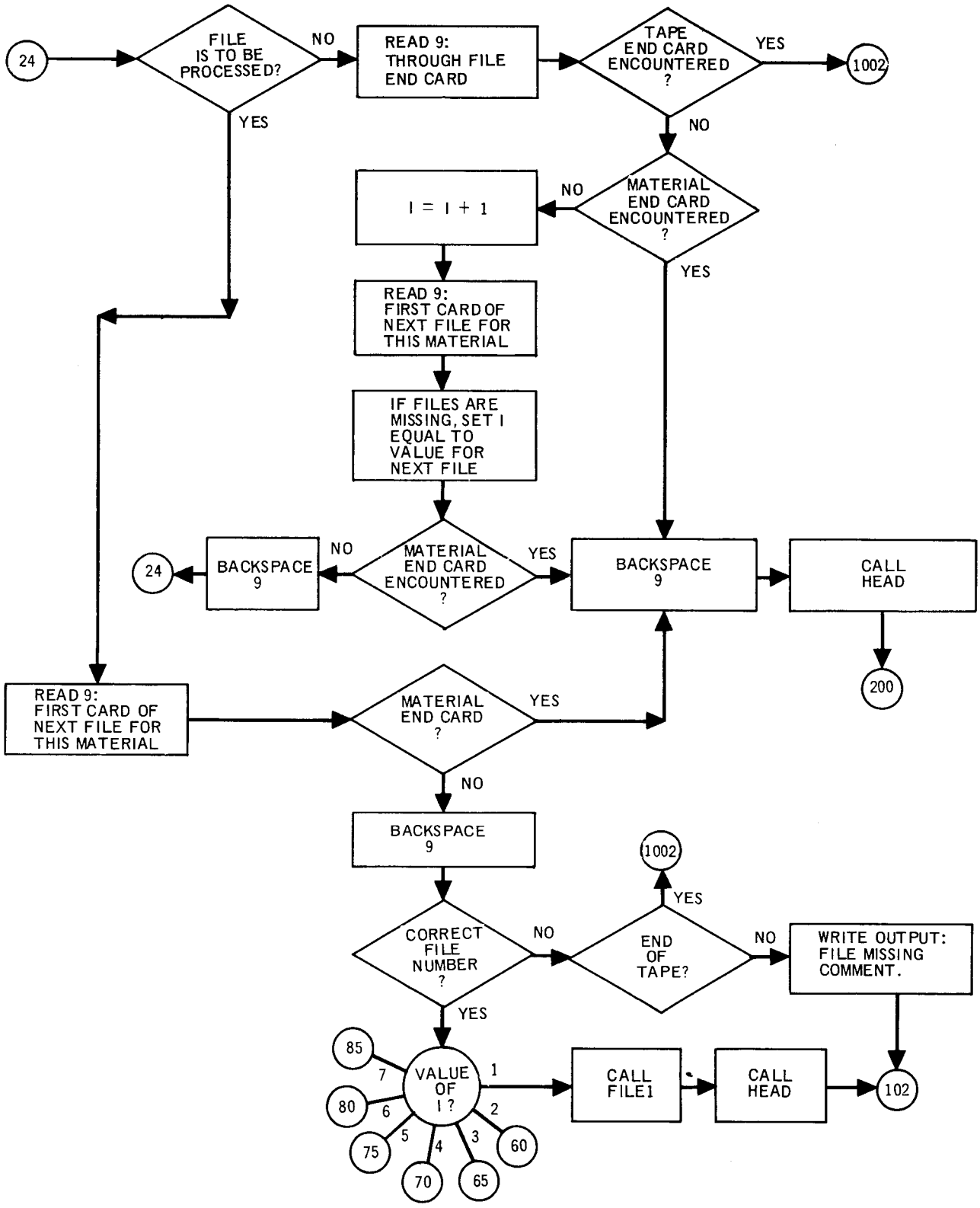
REACTION TYPE IDENTIFICATION NUMBER (MT)

MT	Description	MT	Description	MT	Description
1	Total	101	Parasitic absorption	201-250	To be assigned
2	Elastic	102	(n,γ)	251	$\bar{\mu}_L$, average cosine of the scattering angle in the laboratory system for elastic scattering
3	Non-elastic	103	(n, p)	252	ξ, average logarithmic energy decrement
4	Inelastic	104	(n, d)	253	γ, as used in the expression, $\xi\sigma_s + \gamma\sigma_a$
5-15	Not used	105	(n, t)	254-300	To be assigned
16	(n, 2n)	106	(n, He^3)	301-450	Energy release rate parameters ($\overline{\sigma E}$) for total and partial cross sections. Subtract 300 from this number to obtain the reaction type. For example, 302 = (300 + 2) denotes elastic scattering.
17	(n, 3n)	107	(n,α)		
18	Fission = (n, f) + (n, n′f) + ...	108	$(n, 2\alpha)$		
19	(n, f)	109-150	To be assigned		
20	(n, n′f)	151	General designation for resonance information	451	Heading or title information
21	(n, 2nf)	152-200	To be assigned for specific resonance information	452	ν, number of neutrons per fission
22	$(n, n')\alpha$				
23	$(n, n')3\alpha$			453	Radioactive decay data
24	$(n, 2n)\alpha$			454	Fission product yield
25	$(n, 3n)\alpha$			455-999	To be assigned
26	Not used				
27	Absorption (fission + capture)				
28	(n, n′)p				
29	Scattering (elastic and inelastic)				
30-100	To be assigned				

APPENDIX B
FLOW DIAGRAMS FOR PROGRAM EDIT

APPENDIX B
FLOW DIAGRAMS FOR PROGRAM EDIT




24
FILE IS TO BE PROCESSED?
NO
YES
READ 9: THROUGH FILE END CARD
TAPE END CARD ENCOUNTERED ?
YES
1002
NO
MATERIAL END CARD ENCOUNTERED ?
NO
I = I + 1
YES
READ 9: FIRST CARD OF NEXT FILE FOR THIS MATERIAL
IF FILES ARE MISSING, SET I EQUAL TO VALUE FOR NEXT FILE
MATERIAL END CARD ENCOUNTERED ?
NO
BACKSPACE 9
24
YES
BACKSPACE 9
CALL HEAD
200
READ 9: FIRST CARD OF NEXT FILE FOR THIS MATERIAL
MATERIAL END CARD ?
YES
NO
BACKSPACE 9
1002
YES
CORRECT FILE NUMBER ?
NO
END OF TAPE?
NO
WRITE OUTPUT: FILE MISSING COMMENT.
YES
VALUE OF I ?
1
2
3
4
5
6
7
85
80
75
70
65
60
CALL FILE1
CALL HEAD
102

For 10-mil tabs, the data shown in Figure 17 appear to obey a relation of the form

$$10\,(C_m - C_o) = 10\,(C_s - C_o)\,(1 - e^{-\lambda t}) \quad , \qquad \ldots(4)$$

and, assuming complete saturation occurs at $(C_s - C_o) = 4.0$ wt % carbon, Equation 4 above yields

$$\lambda = 0.00215\ \text{hr}^{-1} \quad .$$

By differentiating Equation 4 with respect to time, the initial rate of carbon increase is seen to be 0.0086 wt % carbon per hour. Analysis of Equation 4 indicates that carbon-pickup-rate changes slowly with time for low exposure times, indicating that the mean carbon increase is proportional to exposure time at low values of carbon increase. At 0.1 wt % carbon increase, the assumption of proportionality results in an error of only +1% (10^{-3} wt % carbon) compared to Equation 4 results. At 0.5 wt %, the error is +6% (0.03 wt % carbon) and at 1.0 wt %, the error is +12% (0.12 wt % carbon).

Both hot-traps used during PEP operations have a history of prior use. Data resulting from hot-trapping operations prior to PEP modifications are shown in Table 8. Hot-trap tab carburization data for operations following PEP modifications are shown in Table 4.

It is assumed that tabs exposed at a lower carburizing potential for longer periods of time would result in a family of curves identical in shape to those shown in Figure 17, but with different values of the parameter time. By making this assumption, equivalent exposure times can be used in Equation 4 to predict cumulative effects, and the amount of carbon in 4-mil stock can be estimated by extrapolation, using the curves shown in Figure 17 as a guide.

From Tables 4 and 8 it can be seen that for Hot-Trap A-5, the sum of mean carbon increases in 10-mil inlet tabs is 1.90 wt % carbon. This amount of carbon would result after a 221-hr exposure at a constant rate of 0.0086 wt % per hour, the initial rate calculated from Equation 4. By using 221 "equivalent" hours in Equation 4 it is indicated that a 10-mil tab present during all runs

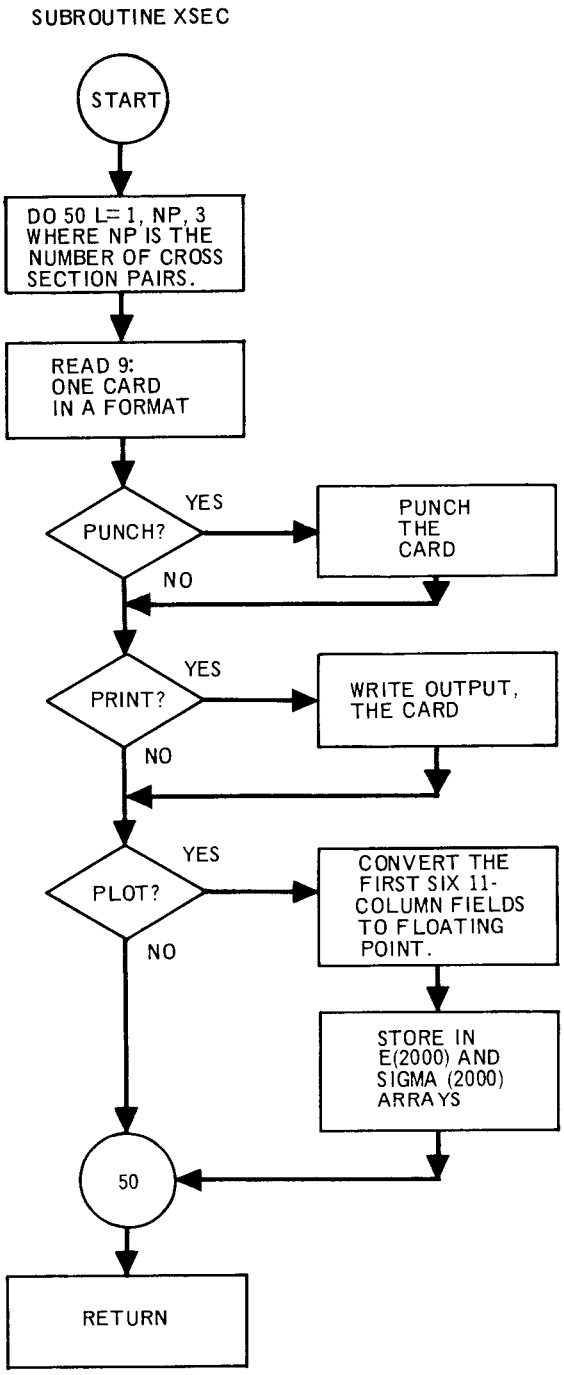
would have increased in mean carbon content by only 1.51 wt %. This point has been converted to total carbon, and is shown on Figure 17. Extrapolation to 4-mils indicates that Hot-Trap A-5 getter foil, at the inlet, has increased in mean carbon content by 2.8 wt %.

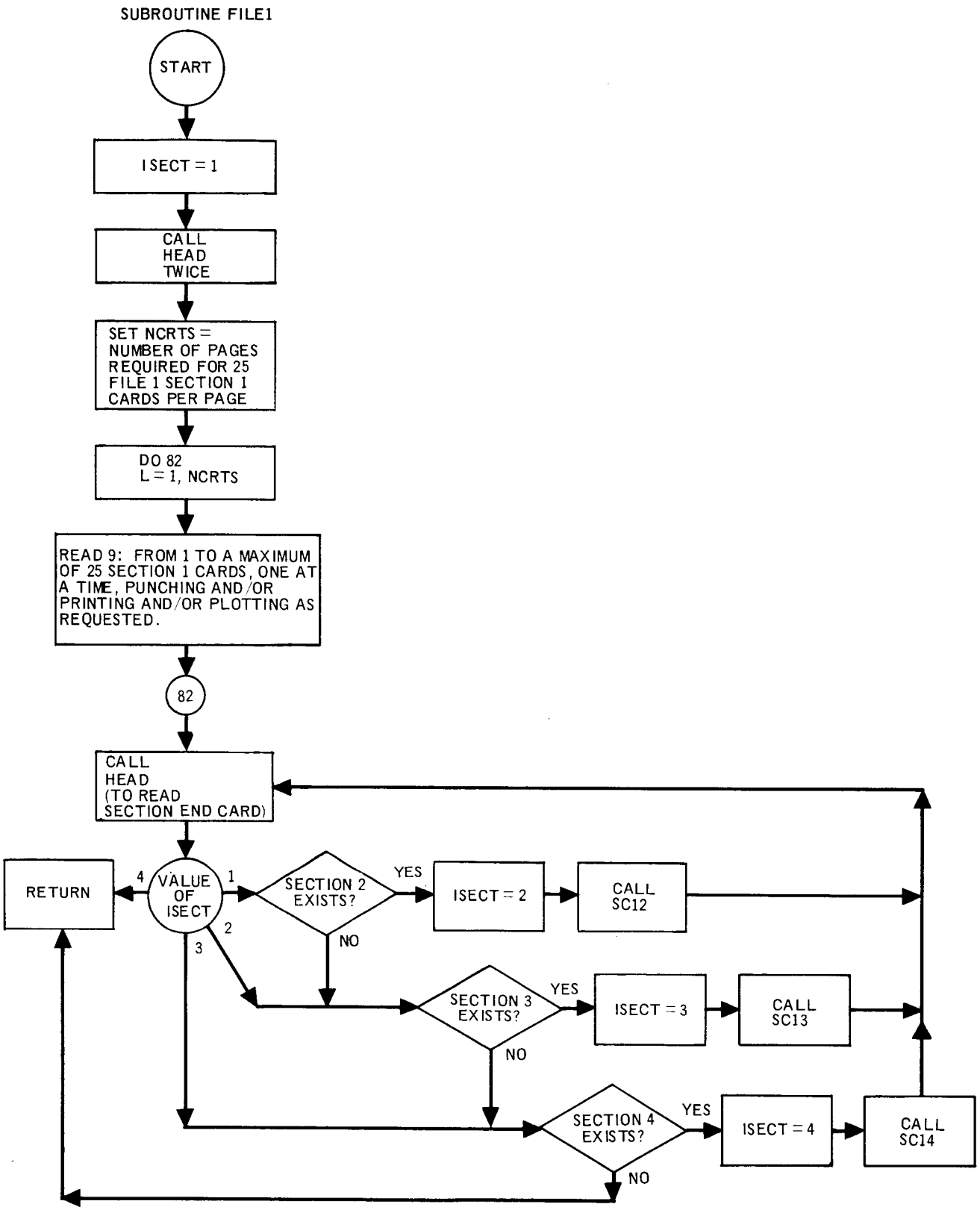
Similarly, the Hot-Trap B-2, 10-mil inlet tab, carbon increases total 1.24 wt %, and this is equivalent to 144-hr exposure at 0.0086 wt %/hr. Equation 4 indicates that a 10-mil tab present during all runs would have increased in mean carbon by only 1.07 wt %. This point is also shown on Figure 17, and extrapolation indicates that the Hot-Trap B-2 foil at the inlet would increase in mean carbon content by 2.3 wt %.

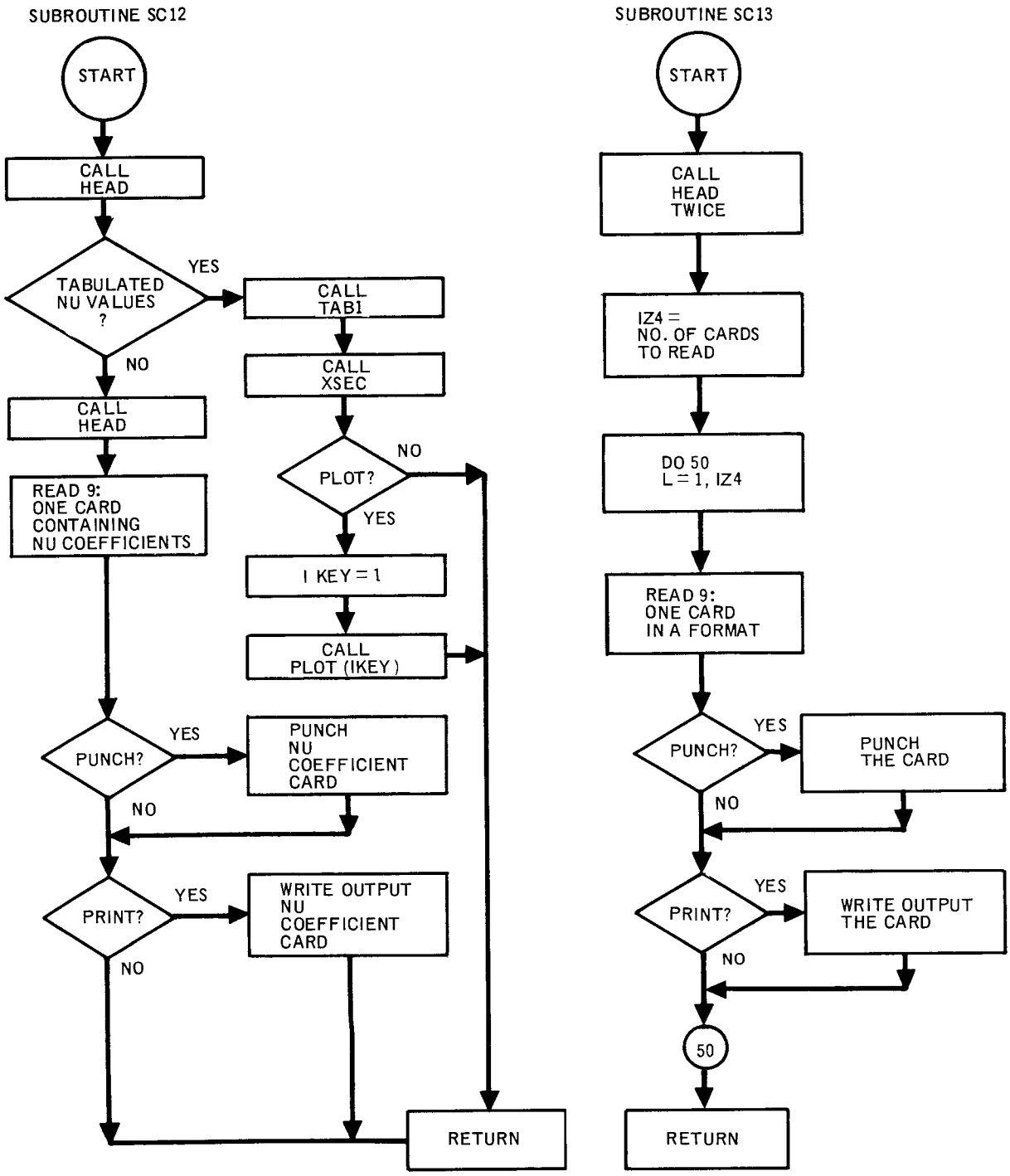
No carbon increase in outlet tabs for pre-PEP (see Table 8 first footnote) runs is interpreted to mean that the hot-traps were gettering all the carbon available for carburizing. Detectable carbon increases during PEP operation (Table 4) indicate that some carbon was escaping the gettering foil; hence some carbon pickup was occurring at the foil discharge. Based on these data, it is assumed that a 10-mil outlet tab present during all Hot-Trap A-5 runs would have shown an increase of only 0.31 mean wt % carbon (the same as observed during PEP operation). Similarly, for Hot-Trap B-2, the tab would have shown an increase of only 0.08 mean wt % carbon. Saturation effects can be neglected below 0.31 wt % carbon increase in 10-mil tabs, and inspection of Figure 17 indicates that saturation effects are negligible for 4-mil foil as well. Therefore, Hot-Trap A-5 foil, at the trap discharge, must have increased in mean carbon content by approximately $0.31 \times \frac{10}{4} = 0.78$ wt %. Similarly, Hot-Trap B-2 must have increased by approximately $0.08 \times \frac{10}{4} = 0.2$ wt %.

End points have now been established for hot-trap foil axial carbon distribution.* The calculation of the total amount of carbon removed by the traps requires a knowledge of axial carbon distribution, which is unknown. By assuming a linear distribution and complete saturation at 4.0 wt % increase, as shown in Figure 18, Hot-Trap A-5 is estimated to be carburized to 45% of saturation, and Hot-Trap B-2 is estimated to be carburized to 31% of saturation. Since a hot-trap contains 1140 lb of 4-mil gettering foil, this corresponds to

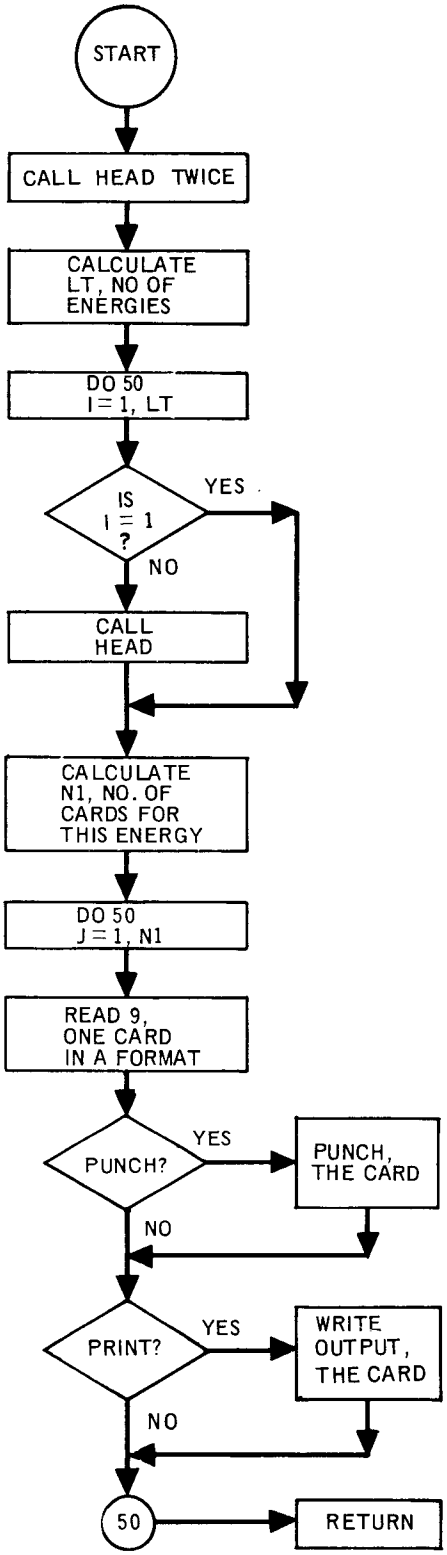
*Carbon is assumed to be evenly distributed radially, since flow and temperature gradients are slight.


SUBROUTINE XSEC
START
DO 50 L= 1, NP, 3 WHERE NP IS THE NUMBER OF CROSS SECTION PAIRS.
READ 9: ONE CARD IN A FORMAT
PUNCH?
YES
PUNCH THE CARD
NO
PRINT?
YES
WRITE OUTPUT, THE CARD
NO
PLOT?
YES
CONVERT THE FIRST SIX 11-COLUMN FIELDS TO FLOATING POINT.
NO
STORE IN E(2000) AND SIGMA (2000) ARRAYS
50
RETURN

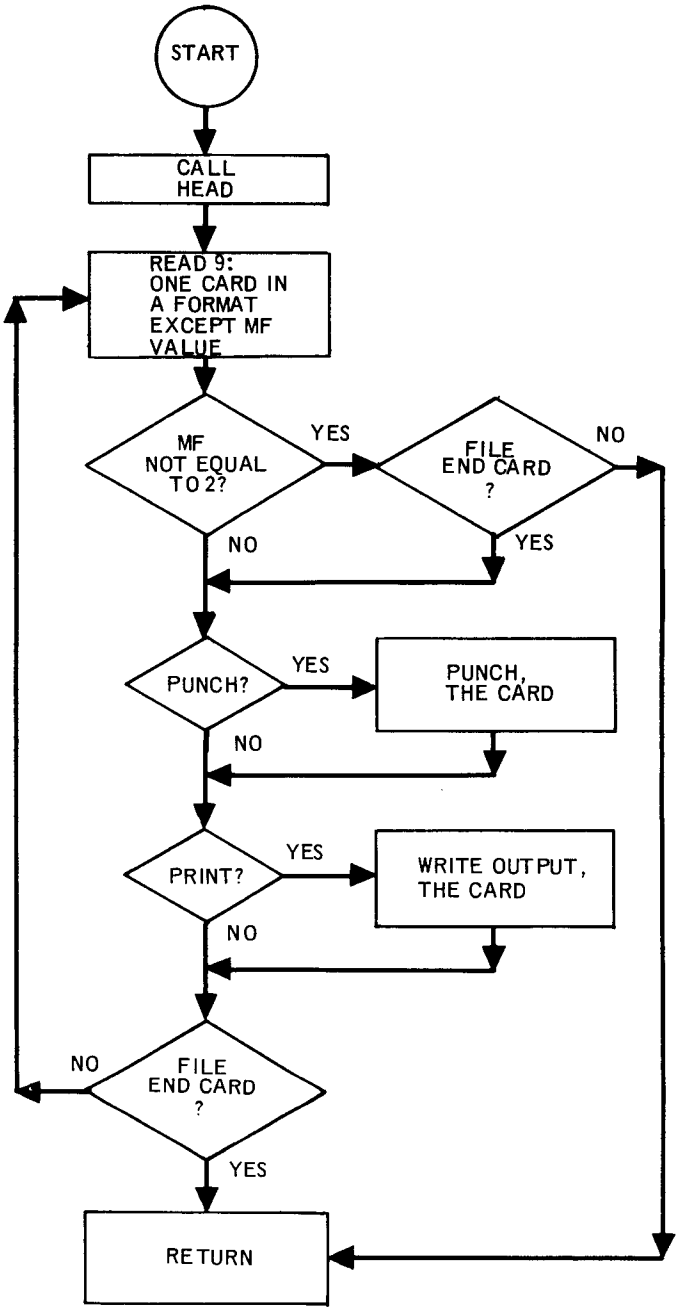

SUBROUTINE FILE1
START
ISECT = 1
CALL HEAD TWICE
SET NCRTS = NUMBER OF PAGES REQUIRED FOR 25 FILE 1 SECTION 1 CARDS PER PAGE
DO 82 L = 1, NCRTS
READ 9: FROM 1 TO A MAXIMUM OF 25 SECTION 1 CARDS, ONE AT A TIME, PUNCHING AND/OR PRINTING AND/OR PLOTTING AS REQUESTED.
82
CALL HEAD (TO READ SECTION END CARD)
VALUE OF ISECT
4
1
2
3
RETURN
SECTION 2 EXISTS?
YES
NO
ISECT = 2
CALL SC12
SECTION 3 EXISTS?
YES
NO
ISECT = 3
CALL SC13
SECTION 4 EXISTS?
YES
NO
ISECT = 4
CALL SC14

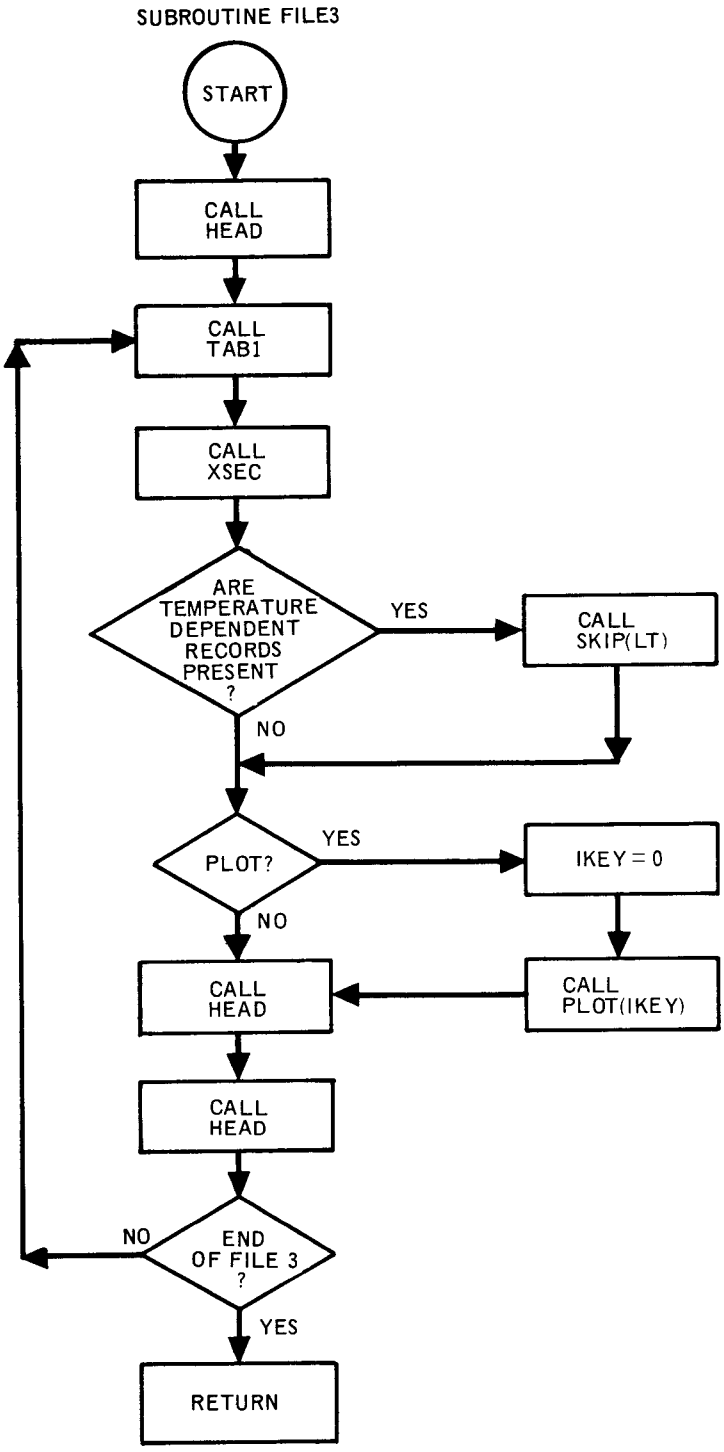

SUBROUTINE SC12
START
CALL HEAD
TABULATED NU VALUES ?
YES
NO
CALL TAB1
CALL XSEC
PLOT?
NO
YES
I KEY = 1
CALL PLOT (IKEY)
CALL HEAD
READ 9: ONE CARD CONTAINING NU COEFFICIENTS
PUNCH?
YES
PUNCH NU COEFFICIENT CARD
NO
PRINT?
YES
WRITE OUTPUT NU COEFFICIENT CARD
NO
RETURN
SUBROUTINE SC13
START
CALL HEAD TWICE
IZ4 = NO. OF CARDS TO READ
DO 50 L = 1, IZ4
READ 9: ONE CARD IN A FORMAT
PUNCH?
YES
PUNCH THE CARD
NO
PRINT?
YES
WRITE OUTPUT THE CARD
NO
50
RETURN

SUBROUTINE SC14

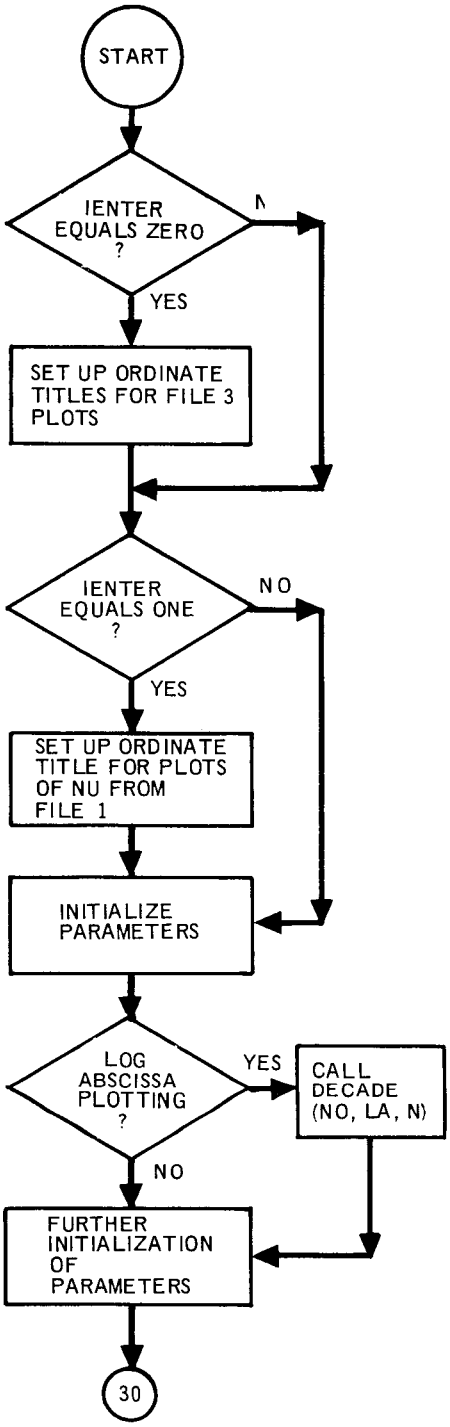


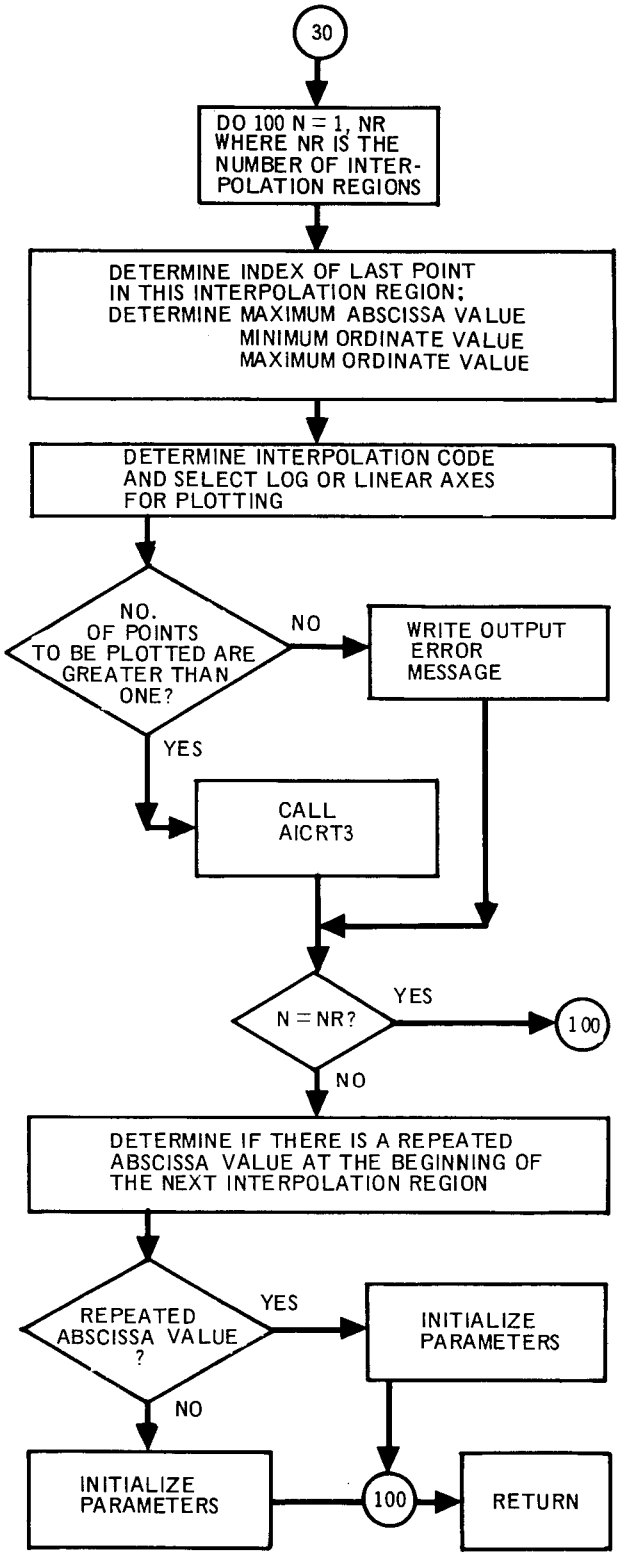
SUBROUTINE FILE2

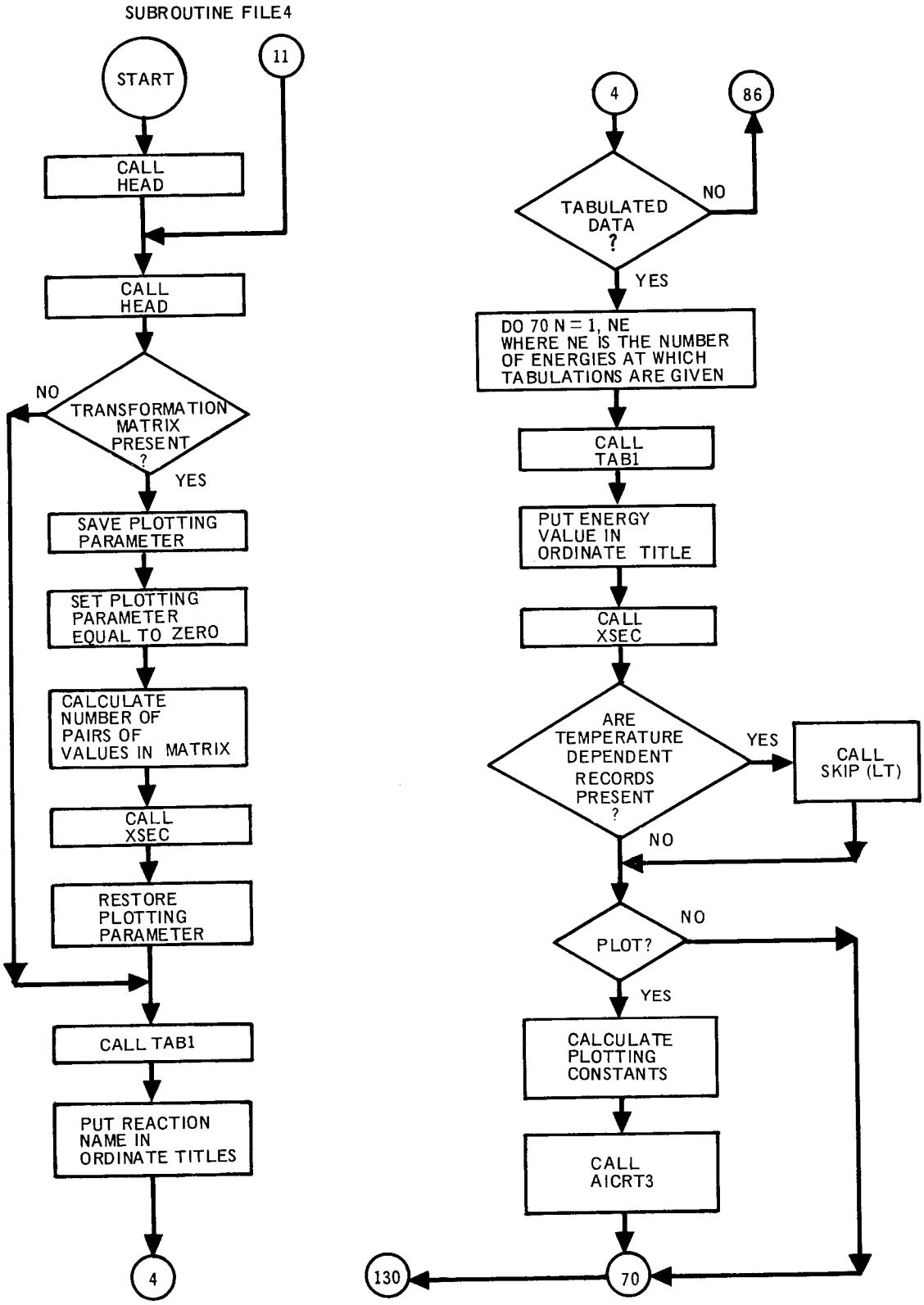


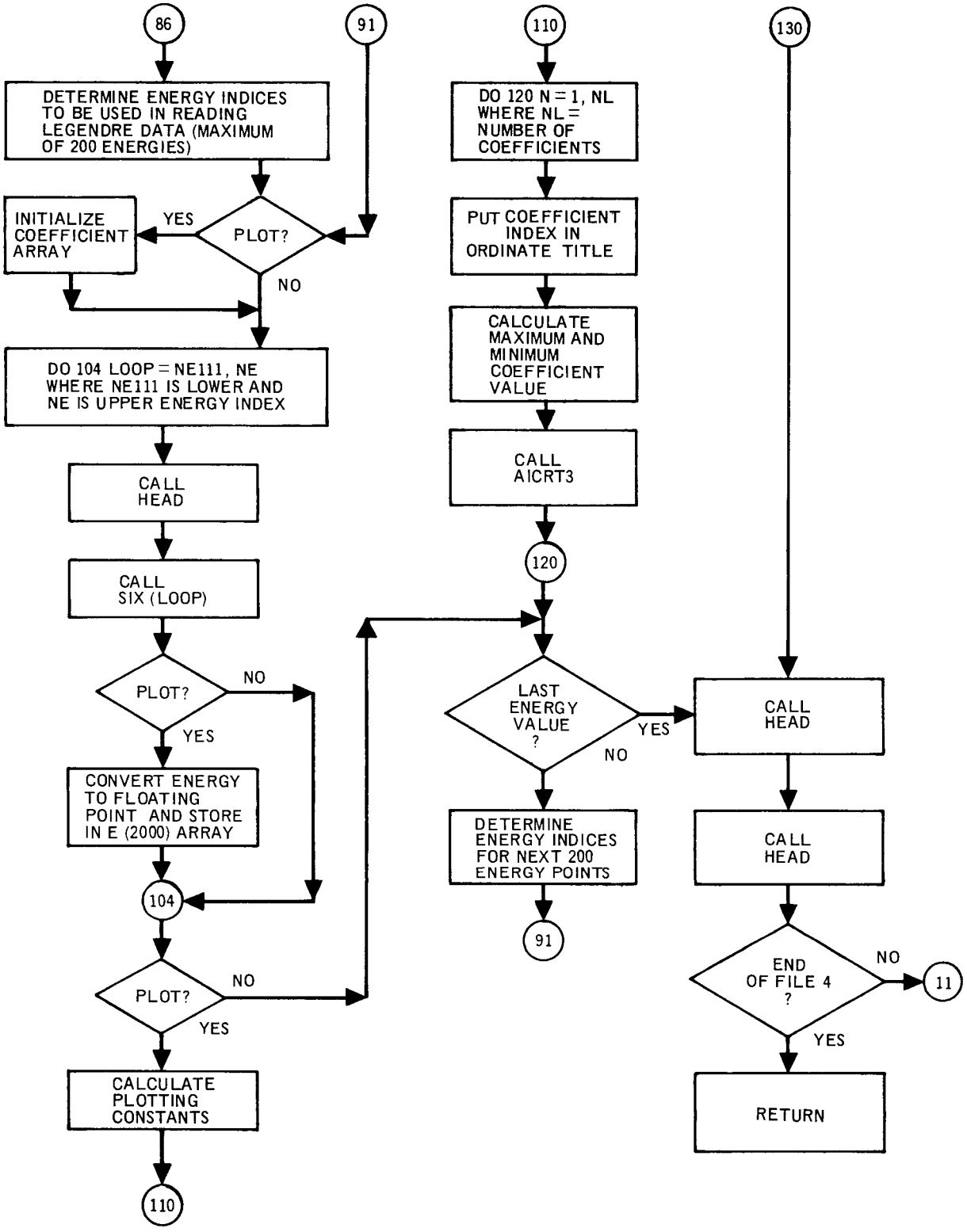

SUBROUTINE FILE3
START
CALL HEAD
CALL TAB1
CALL XSEC
ARE TEMPERATURE DEPENDENT RECORDS PRESENT ?
YES
CALL SKIP(LT)
NO
PLOT?
YES
IKEY = 0
NO
CALL HEAD
CALL PLOT(IKEY)
CALL HEAD
NO
END OF FILE 3 ?
YES
RETURN

SUBROUTINE PLOT (IENTER)

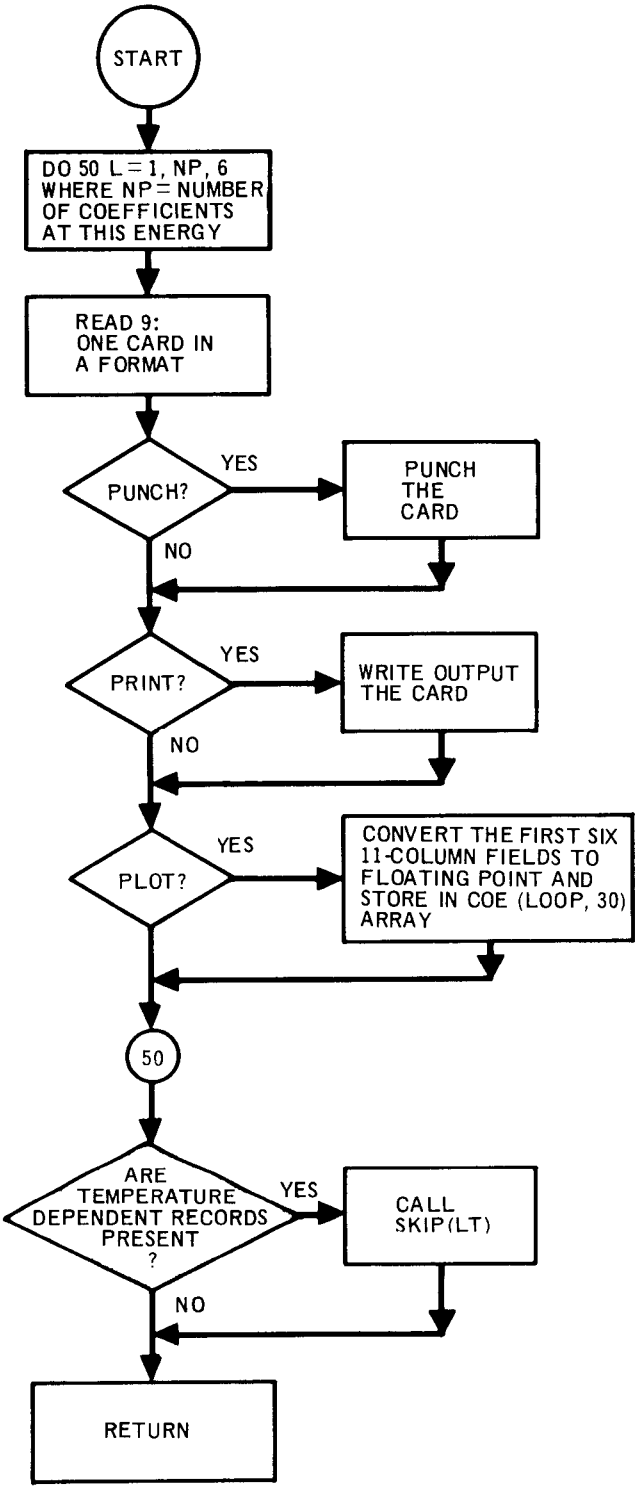




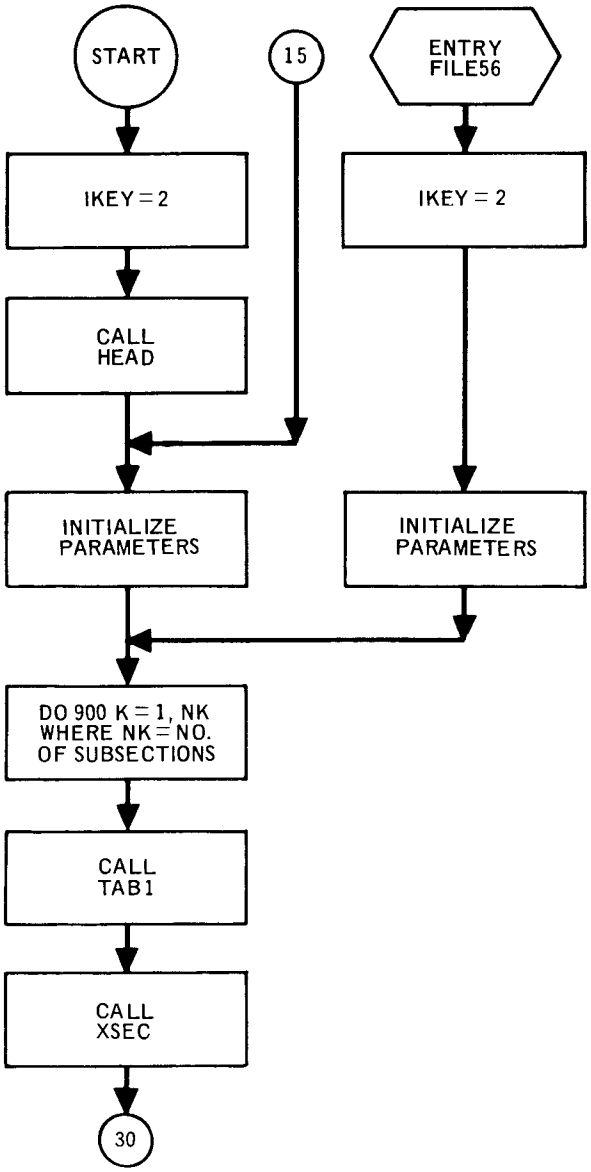

SUBROUTINE FILE4
START
11
CALL HEAD
CALL HEAD
NO
TRANSFORMATION MATRIX PRESENT ?
YES
SAVE PLOTTING PARAMETER
SET PLOTTING PARAMETER EQUAL TO ZERO
CALCULATE NUMBER OF PAIRS OF VALUES IN MATRIX
CALL XSEC
RESTORE PLOTTING PARAMETER
CALL TAB1
PUT REACTION NAME IN ORDINATE TITLES
4
4
86
TABULATED DATA ?
NO
YES
DO 70 N = 1, NE WHERE NE IS THE NUMBER OF ENERGIES AT WHICH TABULATIONS ARE GIVEN
CALL TAB1
PUT ENERGY VALUE IN ORDINATE TITLE
CALL XSEC
ARE TEMPERATURE DEPENDENT RECORDS PRESENT ?
YES
CALL SKIP (LT)
NO
PLOT?
NO
YES
CALCULATE PLOTTING CONSTANTS
CALL AICRT3
130
70

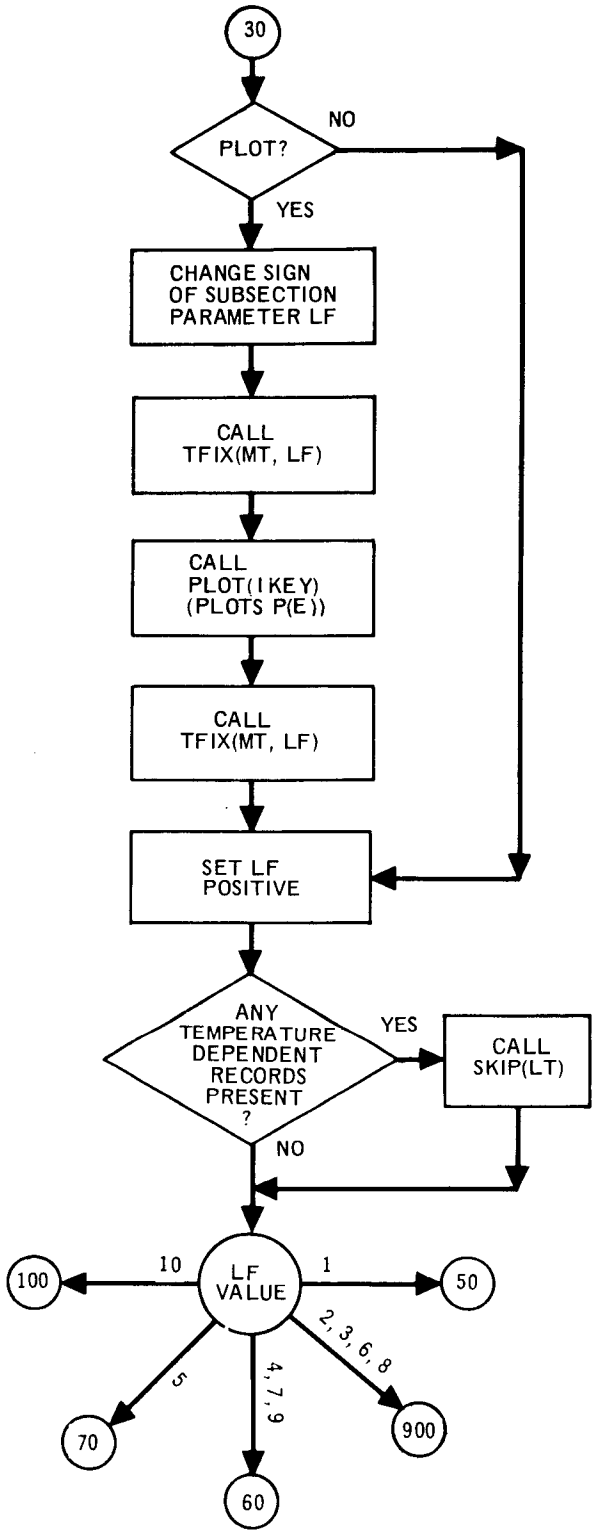

86
91
110
130
DETERMINE ENERGY INDICES TO BE USED IN READING LEGENDRE DATA (MAXIMUM OF 200 ENERGIES)
INITIALIZE COEFFICIENT ARRAY
YES
PLOT?
NO
DO 104 LOOP = NE111, NE WHERE NE111 IS LOWER AND NE IS UPPER ENERGY INDEX
CALL HEAD
CALL SIX (LOOP)
PLOT?
NO
YES
CONVERT ENERGY TO FLOATING POINT AND STORE IN E (2000) ARRAY
104
PLOT?
NO
YES
CALCULATE PLOTTING CONSTANTS
110
DO 120 N = 1, NL WHERE NL = NUMBER OF COEFFICIENTS
PUT COEFFICIENT INDEX IN ORDINATE TITLE
CALCULATE MAXIMUM AND MINIMUM COEFFICIENT VALUE
CALL AICRT3
120
LAST ENERGY VALUE ?
YES
NO
DETERMINE ENERGY INDICES FOR NEXT 200 ENERGY POINTS
91
CALL HEAD
CALL HEAD
END OF FILE 4 ?
NO
11
YES
RETURN

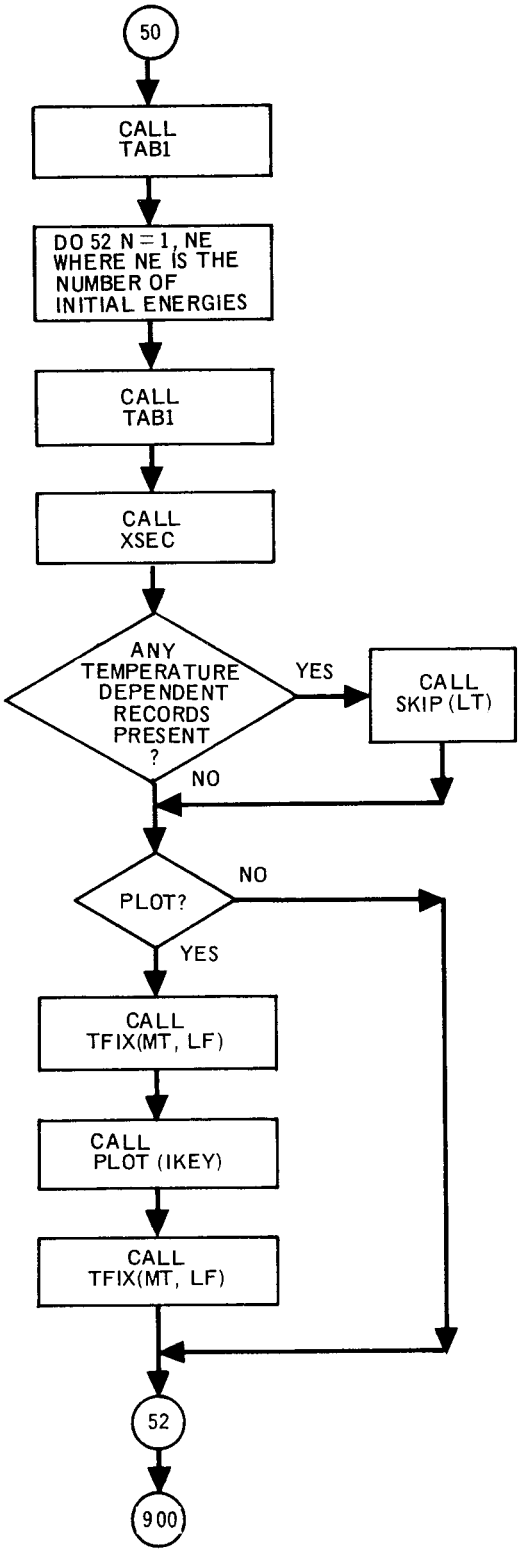
SUBROUTINE SIX (LOOP)

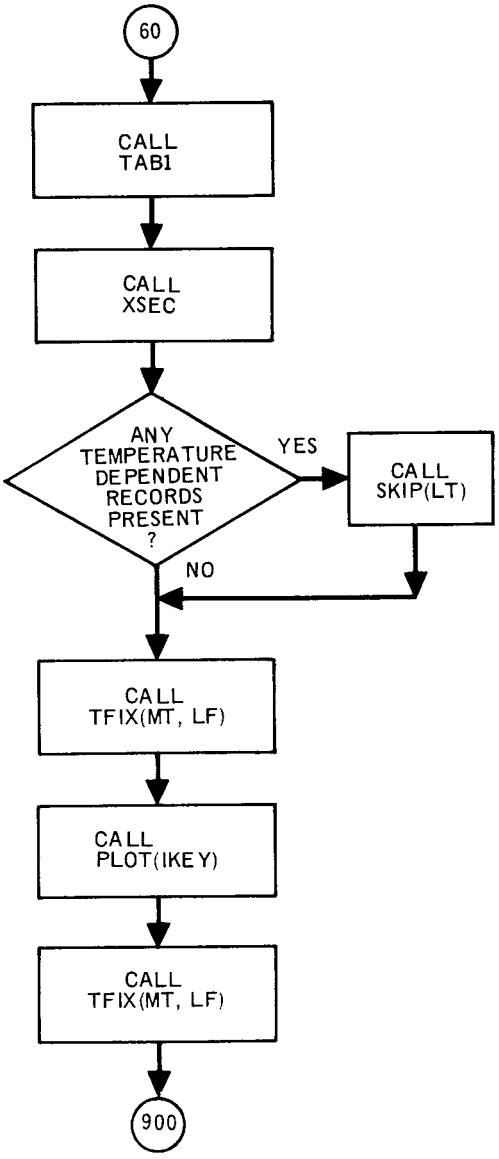


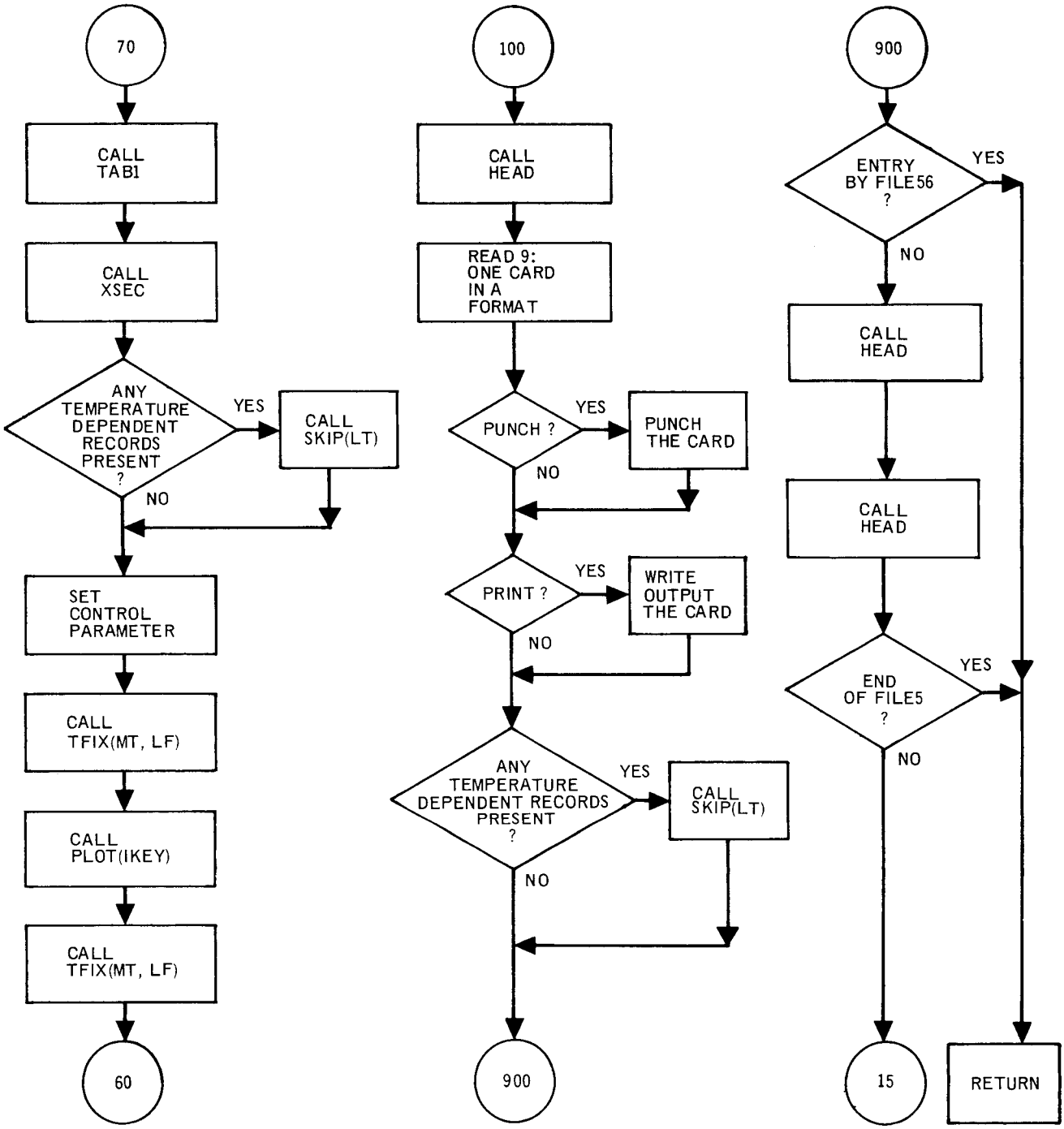
SUBROUTINE FILE5



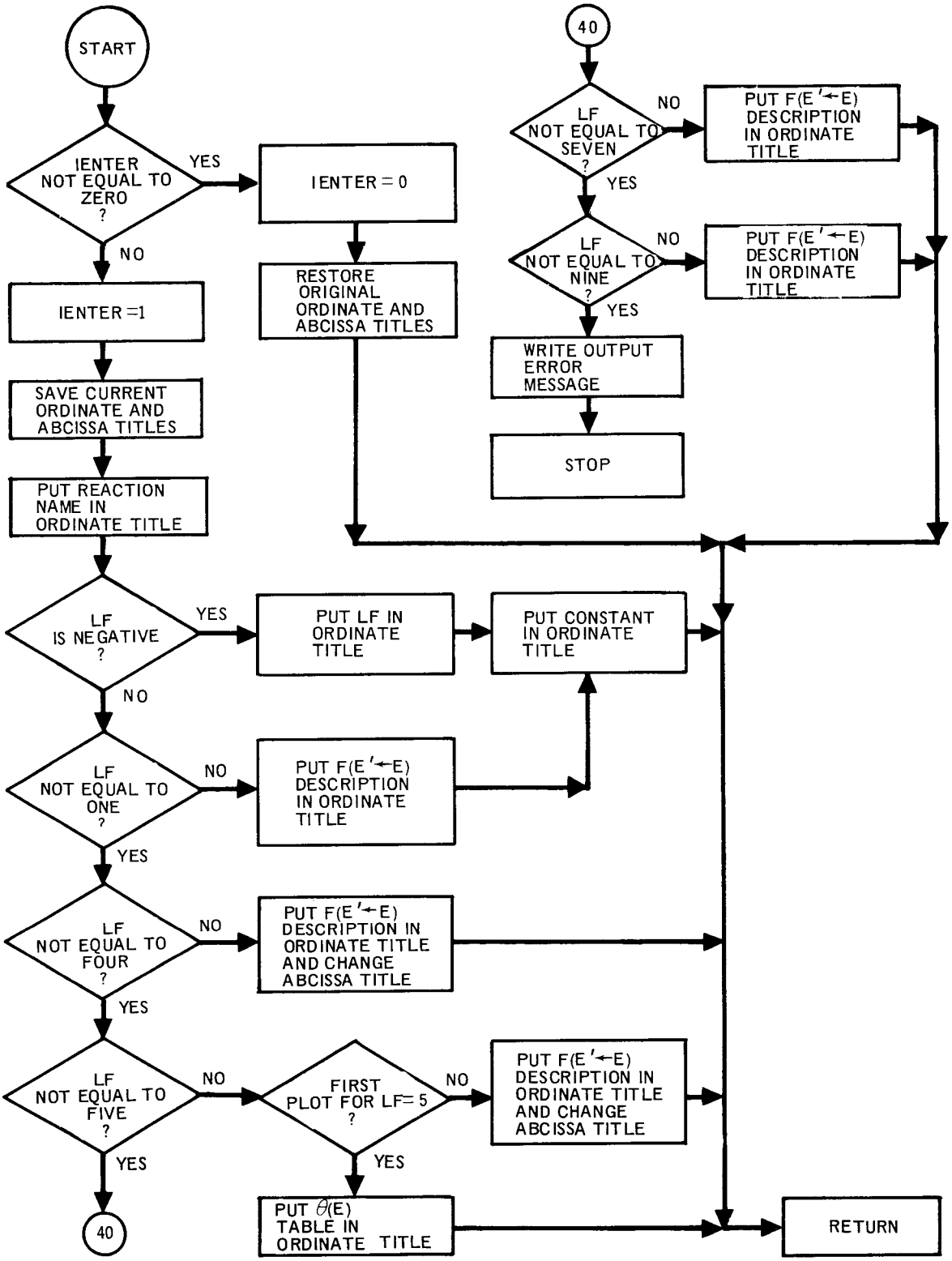


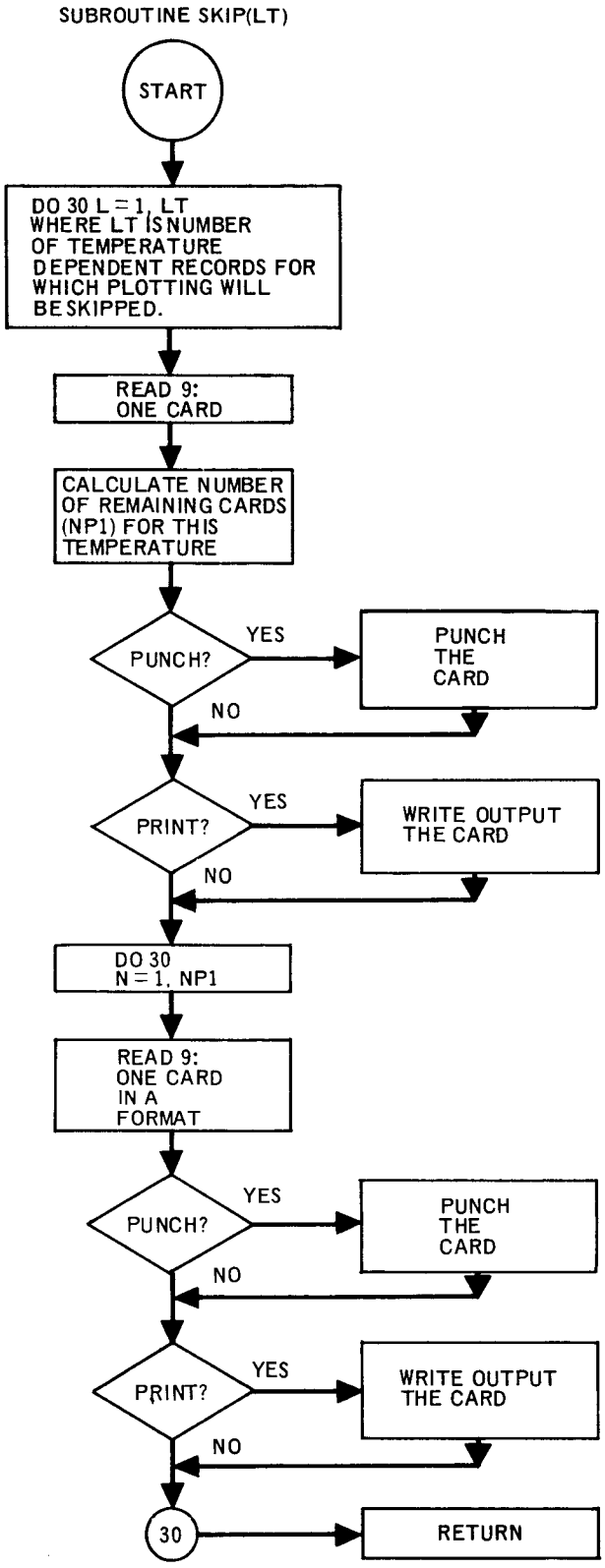

50
CALL TAB1
DO 52 N = 1, NE WHERE NE IS THE NUMBER OF INITIAL ENERGIES
CALL TAB1
CALL XSEC
ANY TEMPERATURE DEPENDENT RECORDS PRESENT ?
YES
CALL SKIP (LT)
NO
PLOT?
NO
YES
CALL TFIX(MT, LF)
CALL PLOT (IKEY)
CALL TFIX(MT, LF)
52
900

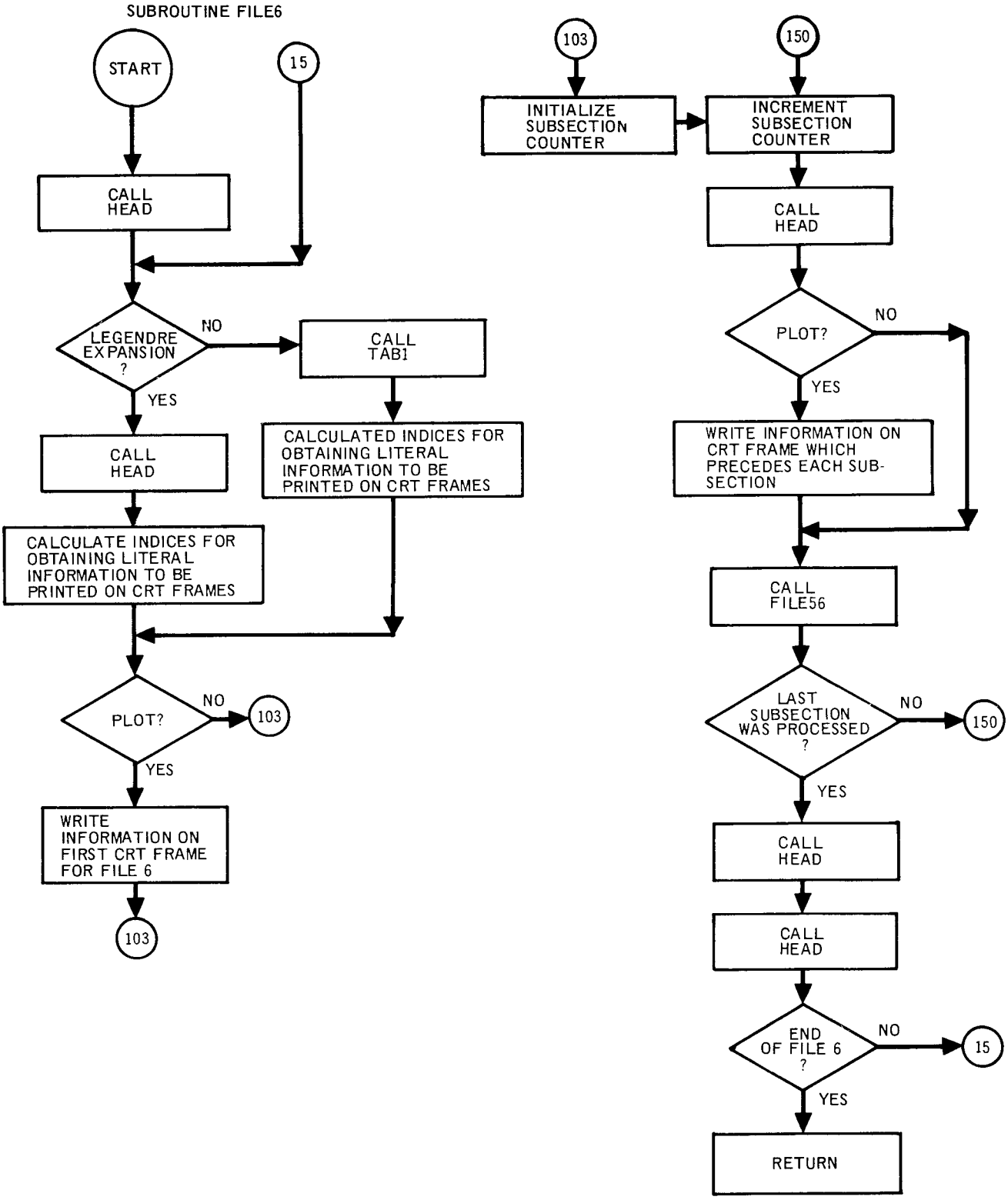

60
CALL TAB1
CALL XSEC
ANY TEMPERATURE DEPENDENT RECORDS PRESENT ?
YES
CALL SKIP(LT)
NO
CALL TFIX(MT, LF)
CALL PLOT(IKEY)
CALL TFIX(MT, LF)
900

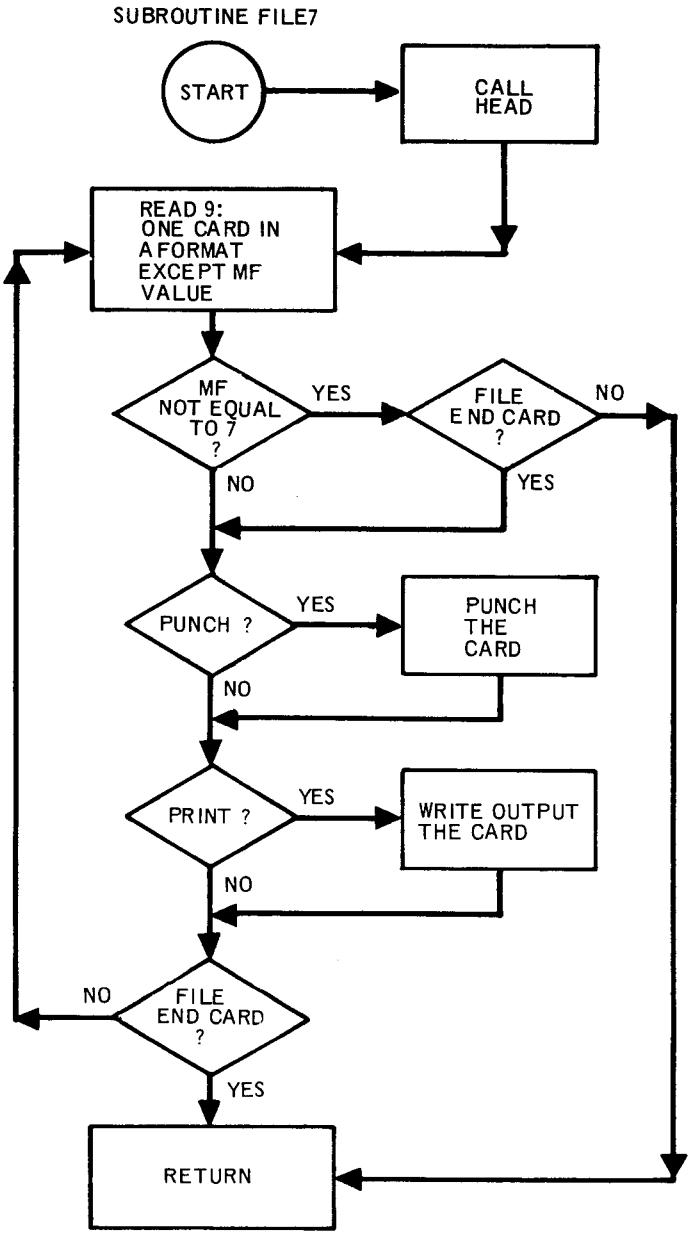

70
CALL TAB1
CALL XSEC
ANY TEMPERATURE DEPENDENT RECORDS PRESENT ?
YES
CALL SKIP(LT)
NO
SET CONTROL PARAMETER
CALL TFIX(MT, LF)
CALL PLOT(IKEY)
CALL TFIX(MT, LF)
60
100
CALL HEAD
READ 9: ONE CARD IN A FORMAT
PUNCH ?
YES
PUNCH THE CARD
NO
PRINT ?
YES
WRITE OUTPUT THE CARD
NO
ANY TEMPERATURE DEPENDENT RECORDS PRESENT ?
YES
CALL SKIP(LT)
NO
900
900
ENTRY BY FILE56 ?
YES
NO
CALL HEAD
CALL HEAD
END OF FILE5 ?
YES
NO
15
RETURN

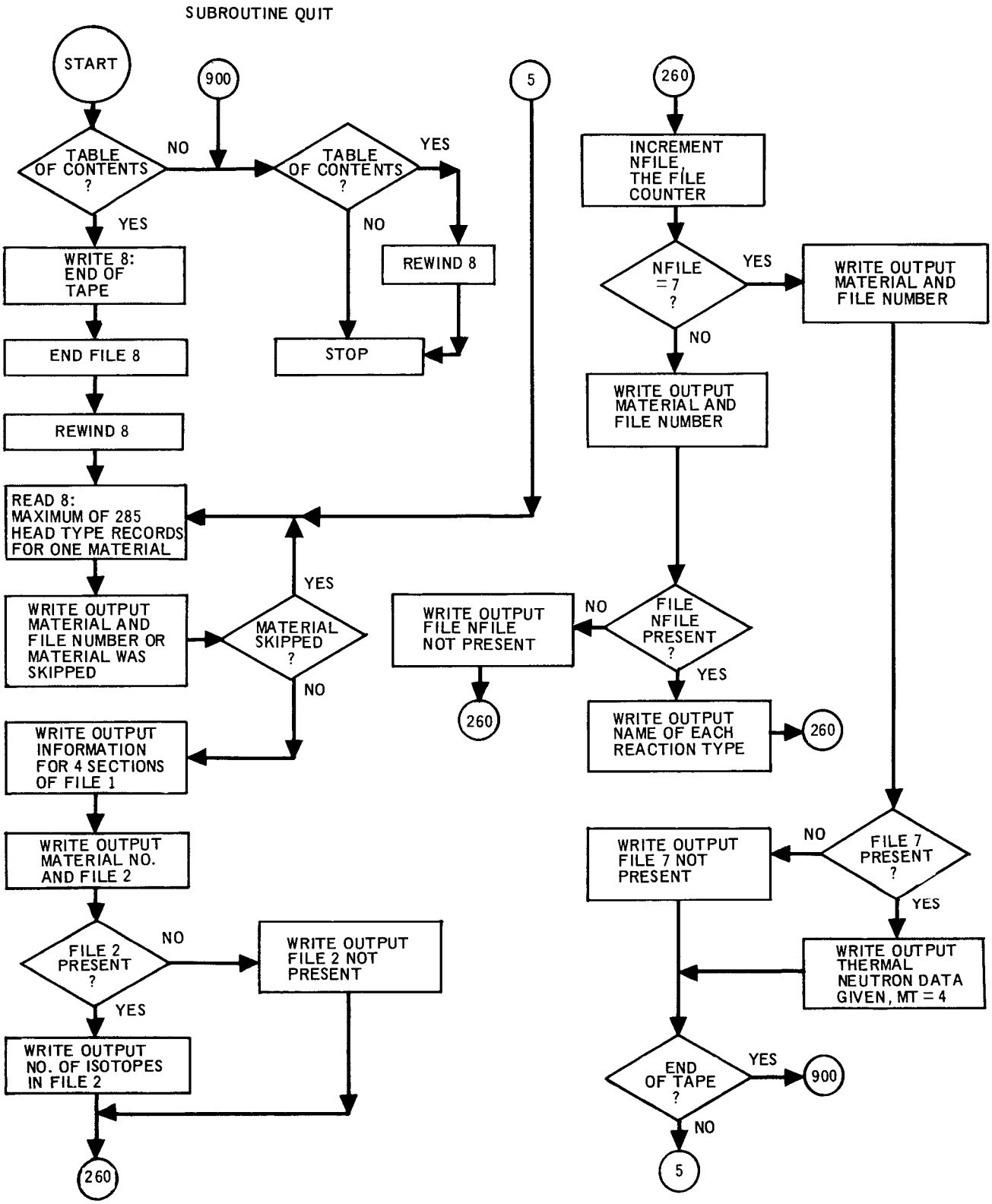
SUBROUTINE TFIX(MT, LF)
ON FIRST ENTRY IENTER = 0



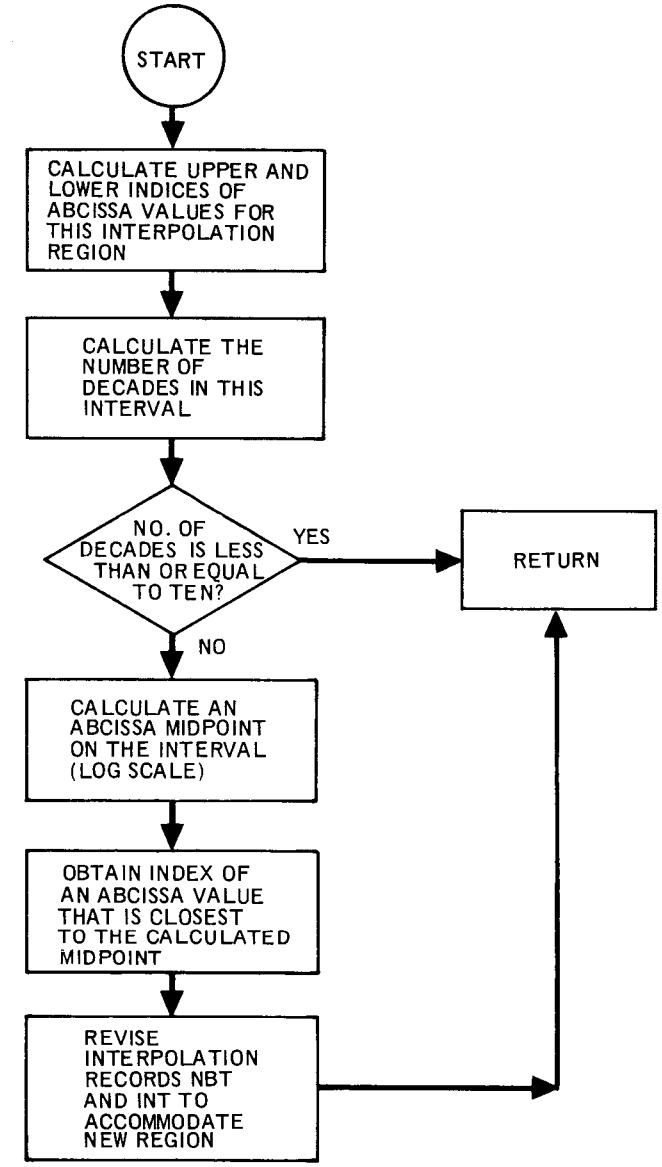

SUBROUTINE SKIP(LT)
START
DO 30 L = 1, LT
WHERE LT IS NUMBER
OF TEMPERATURE
DEPENDENT RECORDS FOR
WHICH PLOTTING WILL
BE SKIPPED.
READ 9:
ONE CARD
CALCULATE NUMBER
OF REMAINING CARDS
(NP1) FOR THIS
TEMPERATURE
PUNCH?
YES
PUNCH
THE
CARD
NO
PRINT?
YES
WRITE OUTPUT
THE CARD
NO
DO 30
N = 1, NP1
READ 9:
ONE CARD
IN A
FORMAT
PUNCH?
YES
PUNCH
THE
CARD
NO
PRINT?
YES
WRITE OUTPUT
THE CARD
NO
30
RETURN


SUBROUTINE FILE6
START
15
CALL HEAD
LEGENDRE EXPANSION ?
NO
YES
CALL TAB1
CALCULATED INDICES FOR OBTAINING LITERAL INFORMATION TO BE PRINTED ON CRT FRAMES
CALL HEAD
CALCULATE INDICES FOR OBTAINING LITERAL INFORMATION TO BE PRINTED ON CRT FRAMES
PLOT?
NO
103
YES
WRITE INFORMATION ON FIRST CRT FRAME FOR FILE 6
103
103
INITIALIZE SUBSECTION COUNTER
150
INCREMENT SUBSECTION COUNTER
CALL HEAD
PLOT?
NO
YES
WRITE INFORMATION ON CRT FRAME WHICH PRECEDES EACH SUB-SECTION
CALL FILE56
LAST SUBSECTION WAS PROCESSED ?
NO
150
YES
CALL HEAD
CALL HEAD
END OF FILE 6 ?
NO
15
YES
RETURN


SUBROUTINE FILE7
START
CALL HEAD
READ 9: ONE CARD IN A FORMAT EXCEPT MF VALUE
MF NOT EQUAL TO 7 ?
YES
FILE END CARD ?
NO
YES
NO
PUNCH ?
YES
PUNCH THE CARD
NO
PRINT ?
YES
WRITE OUTPUT THE CARD
NO
FILE END CARD ?
NO
YES
RETURN


SUBROUTINE QUIT
START
900
TABLE OF CONTENTS ?
NO
YES
TABLE OF CONTENTS ?
YES
NO
WRITE 8: END OF TAPE
REWIND 8
STOP
END FILE 8
REWIND 8
READ 8: MAXIMUM OF 285 HEAD TYPE RECORDS FOR ONE MATERIAL
WRITE OUTPUT MATERIAL AND FILE NUMBER OR MATERIAL WAS SKIPPED
MATERIAL SKIPPED ?
YES
NO
WRITE OUTPUT INFORMATION FOR 4 SECTIONS OF FILE 1
WRITE OUTPUT MATERIAL NO. AND FILE 2
FILE 2 PRESENT ?
NO
YES
WRITE OUTPUT FILE 2 NOT PRESENT
WRITE OUTPUT NO. OF ISOTOPES IN FILE 2
260
5
260
INCREMENT NFILE, THE FILE COUNTER
NFILE = 7 ?
YES
NO
WRITE OUTPUT MATERIAL AND FILE NUMBER
WRITE OUTPUT MATERIAL AND FILE NUMBER
FILE NFILE PRESENT ?
NO
YES
WRITE OUTPUT FILE NFILE NOT PRESENT
260
WRITE OUTPUT NAME OF EACH REACTION TYPE
260
FILE 7 PRESENT ?
NO
YES
WRITE OUTPUT FILE 7 NOT PRESENT
WRITE OUTPUT THERMAL NEUTRON DATA GIVEN, MT = 4
END OF TAPE ?
YES
NO
900
5

SUBROUTINE DECADE (NO, LA, N)



APPENDIX C
EDIT PROGRAM LISTINGS

APPENDIX C
EDIT PROGRAM LISTINGS

```
      BLOCK DATA                                                        00000510
C                                                                       00000520
C     SET UP TITLES FOR PLOTS DONE IN S.R. PLOT.                        00000522
C                                                                       00000524
      COMMON /LABELS/ TITLE(14), ABSC(14), ORD(14), ORDS(6,30)          00000530
     1       /REACTS/ MTS (30)                                          00000532
      DIMENSION RS1(6),RS2(6),RS3(6),RS4(6),RS5(6),RS6(6),RS7(6),RS8(6),00000533
     1          RS9(6),R10(6),R11(6),R12(6),R13(6),R14(6),R15(6),R16(6),00000534
     2          R17(6),R18(6),R19(6),R20(6),R21(6),R22(6),R23(6),R24(6),00000535
     3          R25(6),R26(6),R27(6),R28(6),R29(6),R30(6)               00000536
      EQUIVALENCE (ORDS(1, 1),RS1(1)),(ORDS(1, 2),RS2(1)),              00000537
     1(ORDS(1, 3),RS3(1)),(ORDS(1, 4),RS4(1)),(ORDS(1, 5),RS5(1)),      00000538
     2(ORDS(1, 6),RS6(1)),(ORDS(1, 7),RS7(1)),(ORDS(1, 8),RS8(1)),      00000539
     3(ORDS(1, 9),RS9(1)),(ORDS(1,10),R10(1)),(ORDS(1,11),R11(1)),      00000540
     4(ORDS(1,12),R12(1)),(ORDS(1,13),R13(1)),(ORDS(1,14),R14(1)),      00000541
     5(ORDS(1,15),R15(1)),(ORDS(1,16),R16(1)),(ORDS(1,17),R17(1)),      00000542
     6(ORDS(1,18),R18(1)),(ORDS(1,19),R19(1)),(ORDS(1,20),R20(1)),      00000543
     7(ORDS(1,21),R21(1)),(ORDS(1,22),R22(1)),(ORDS(1,23),R23(1)),      00000544
     8(ORDS(1,24),R24(1)),(ORDS(1,25),R25(1)),(ORDS(1,26),R26(1)),      00000545
     9(ORDS(1,27),R27(1)),(ORDS(1,28),R28(1)),(ORDS(1,29),R29(1))       00000546
      EQUIVALENCE (ORDS(1,30),R30(1))                                   00000547
C                                                                       00000580
      DATA   MTS(1) / 1/, MTS( 8) /19/, MTS(15) / 27/, MTS(22) /106/,   00000590
     1       MTS(2) / 2/, MTS( 9) /20/, MTS(16) / 28/, MTS(23) /107/,   00000591
     2       MTS(3) / 3/, MTS(10) /21/, MTS(17) /101/, MTS(24) /108/,   00000592
     3       MTS(4) / 4/, MTS(11) /22/, MTS(18) /102/, MTS(25) /251/,   00000593
     4       MTS(5) /16/, MTS(12) /23/, MTS(19) /103/, MTS(26) /252/,   00000594
     5       MTS(6) /17/, MTS(13) /24/, MTS(20) /104/, MTS(27) /253/,   00000595
     6       MTS(7) /18/, MTS(14) /25/, MTS(21) /105/                   00000596
     7      ,MTS(28) /29/                                               00000597
C                                                                       00000600
      DATA   ABSC(1)/54H                    ENERGY (EV)                 00000610
     1      /                                                          00000611
      DATA    ORD(1)/54H                                                00000612
     1      /                                                          00000613
C                                                                       00000620
      DATA   RS1(  1)   / 24HTOTAL                        /,            00000650
     1       RS2(  1)   / 24HELASTIC                     /,            00000651
     2       RS3(  1)   / 24HNON-ELASTIC                 /,            00000652
     3       RS4(  1)   / 24HINELASTIC                   /,            00000653
     4       RS5(  1)   / 24H(N,2N)                      /,            00000654
     5       RS6(  1)   / 24H(N,3N)                      /,            00000655
     6       RS7(  1)   / 24HFISSION                     /,            00000656
     7       RS8(  1)   / 24H(N,F)                       /,            00000657
     8       RS9(  1)   / 24H(N,N'F)                     /,            00000658
     9       R10(  1)   / 24H(N,2NF)                     /             00000659
      DATA   R11(  1)   / 24H(N,N') ALPHA                /,            00000660
     1       R12(  1)   / 24H(N,N') 3 ALPHA              /,            00000661
     2       R13(  1)   / 24H(N,2N) ALPHA                /,            00000662
     3       R14(  1)   / 24H(N,3N) ALPHA                /,            00000663
     4       R15(  1)   / 24HABSORPTION                  /,            00000664
     5       R16(  1)   / 24H(N,N') P                    /,            00000665
     6       R17(  1)   / 24HPARASITIC ABSORPTION        /,            00000666
     7       R18(  1)   / 24H(N,GAMMA)                   /,            00000667
     8       R19(  1)   / 24H(N,P)                       /,            00000668
     9       R20(  1)   / 24H(N,D)                       /             00000669
      DATA   R21(  1)   / 24H(N,T)                       /,            00000670
     1       R22(  1)   / 24H(N, HELIUM 3)              /,            00000671
     2       R23(  1)   / 24H(N,ALPHA)                  /,            00000672
     3       R24(  1)   / 24H(N,2 ALPHA)                /,            00000673
     4       R25(  1)   / 24HMU                         /,            00000674
     5       R26(  1)   / 24HXI                         /,            00000675
     6       R27(  1)   / 24HGAMMA                      /             00000676
     7      ,R28(  1)   / 24HSCATTERING                 /             00000677
C                                                                       00000680
      END                                                               00000700
```

```
C      EDIT CONTROL PROGRAM FOR ENDF/B DATA ON AN EBCDIC TAPE.                00001010
C       THE TAPE HAS 1 PHYSICAL FILE. THE 7 FILES REFERRED TO IN PROGRAM      00001040
C       COMMENTS ARE FOUND FROM POSITION 72 IN EACH RECORD.                   00001050
C      OPTIONS TO PRINT, PUNCH AND PLOT FOR EACH MATERIAL OF INTEREST         00001060
C        ARE READ IN THE INPUT SUB-ROUTINE.                                   00001070
C                                                                             00001090
       COMMON     /HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,MAT,     00001094
      1MF,MT,ISEQ                                                             00001095
C                                                                             00001096
       COMMON     /OPTS/ IPUNCH, IPRINT, IPLOT                               00001100
       COMMON/ICO/ICONT,ICONT1,IHOL                                          00001101
C                                                                             00001102
       DIMENSION  CARD(20), IOPT1(7), IOPT2(7), IOPT3(7), IFILE(7)           00001104
C                                                                             00001106
C      CAMERA MUST BE SELECTED IF ANY PLOTTING IS TO BE DONE. FRAME WILL      00001172
C       BE ADVANCED IN LOOP ON MATERIALS.                                     00001174
C                                                                             00001176
       READ (5,2) IGRAPH,ICONT1,IHOL,IPRNT,IPUN                              00001180
C                                                                             00001181
C      ICONT1=1 IF TABLE OF CONTENTENTS IS DESIRED, =0 IF NO TABLE.           00001182
C      IHOL=1 IF SCOUTV PRINTING OF FILE 1 SECTION 1 IS DESIRED               00001183
C      IHOL=0 IF RITE2V PRINTING DESIRED                                      00001184
C      IPRNT=1 IF PRINTING DESIRED                                            00001185
C      IPUN= 1 IF PUNCHING DESIRED                                            00001186
    2  FORMAT (5I12)                                                          00001187
       IF (IGRAPH .EQ. 1) CALL CAMRAV(935)                                    00001190
       IF (ICONT1 .EQ. 1) REWIND 8                                            00001195
       ICONT=400                                                              00001196
C                                                                             00001210
    4  REWIND 9                                                               00001220
       READ (9,10)  CARD                                                      00001230
   10  FORMAT (20A4)                                                          00001232
       WRITE (6,12)                                                           00001236
   12  FORMAT (42H1 START OF ENDF/B EDITING FROM A BCD TAPE.)                 00001238
       IF (IPUN .EQ. 1) PUNCH 10, CARD                                        00001240
       IF (IPRNT .EQ. 1) WRITE (6,14) CARD                                    00001244
   14  FORMAT (1H0,2X,20A4)                                                   00001246
C                                                                             00001250
C      LOOP FOR EACH MATERIAL. ASSUME NO MORE THAN 50 ON ONE TAPE.            00001251
C                                                                             00001252
       IPAGE=1                                                                00001259
       DO 200 LOOP=1,50                                                       00001260
       IF (IPAGE .NE. 0) WRITE (6,1000)                                       00001261
 1000  FORMAT (1H1)                                                           00001262
       IPAGE=0                                                                00001263
       READ(5,15,END=1002) MATL,(IFILE(M),IOPT1(M),IOPT2(M),IOPT3(M),M=1,     00001264
      17)                                                                     00001265
   15  FORMAT (I12, 2013/ 8I3)                                                00001270
   16  IF (MATL .EQ.  0)          GO TO  170                                  00001280
C                                                                             00001288
C      7 FILES ARE POSSIBLE. FILE 1 IS REQUIRED.                              00001290
C                                                                             00001292
   20  I = 1                                                                  00001300
   24  IPUNCH=IOPT1(I)                                                        00001304
       IPRINT=IOPT2(I)                                                        00001306
       IPAGE=IPAGE+IPRINT                                                     00001307
       IPLOT=IOPT3(I)                                                         00001308
       IF (IFILE(I) .EQ. I)            GO TO 50                               00001310
C                                                                             00001318
C      READ LOOP TO SKIP A FILE NOT OF INTEREST.                              00001320
C                                                                             00001322
   30  READ (9,36) MAT,MF,MT                                                  00001330
       IF (MAT .EQ. -1) GO TO 1002                                            00001331
   32  FORMAT (71X,I1)                                                        00001340
       IF (MAT .EQ. 0) GO TO 39                                               00001341
       IF (I .EQ. MF)         GO TO 30                                        00001350
C                                                                             00001360
C      FILE END CARD HAS 0 FOR MF. READ THE NEXT RECORD TO FIND INCREMENT     00001370
C      FOR I AS FILES MAY BE MISSING ON THE TAPE.                             00001380
C                                                                             00001390
       BACKSPACE 9                                                            00001395
       I=I+1                                                                  00001400
       READ(9,36)  MAT, MF, MT                                                00001410
   36  FORMAT (66X,I4,I2,I3)                                                  00001415
       IF (MF .EQ. 0) READ (9,36) MAT,MF,MT                                   00001416
       IF (I .EQ. MF)         GO TO 40                                        00001420
   39  IF (MAT .EQ. 0 .AND. MF .EQ. 0 .AND. MT .EQ. 0) GO TO 41               00001425
       I=MF                                                                   00001430
C                  NEXT FILE IS ON TAPE. LAST RECORD MUST BE RETRIEVED.       00001450
   40  BACKSPACE 9                                                            00001451
       GO TO 24                                                               00001452
   41  BACKSPACE 9                                                            00001453
       CALL HEAD                                                              00001454
       GO TO 200                                                              00001455
C                                                                             00001456
C      TRANSFER TO CALL DESIRED FILE ROUTINE.                                 00001457
C                                                                             00001458
```

```
   50 READ (9,36) MATN,MFN,MTN                                          00001459
      IF (MATN .EQ. 0) GO TO 41                                         00001459
      BACKSPACE 9                                                       00001460
      IF (MFN .EQ. 1) GO TO 51                                          00001461
      IF (MATN .EQ. -1) GO TO 1002                                      00001462
      WRITE (6,1001) I,MATN                                             00001463
 1001 FORMAT (1HO,' FILE',I3,' CALLED FOR IN INPUT DATA BUT THIS FILE', 00001464
     1' NOT ON TAPE.  MATERIAL IS',I5)                                  00001465
      GO TO 102                                                         00001466
   51 GO TO (55,60,65,70,75,80,85),I                                    00001467
C                                                                       00001468
   55 CALL FILE1                                                        00001474
      GO TO 100                                                         00001476
C                 RESONANCE PARAMETERS                                  00001477
   60 CALL FILE2                                                        00001478
      GO TO 102                                                         00001480
C                 SMOOTH CROSS SECTIONS                                 00001481
   65 CALL FILE3                                                        00001482
      GO TO 102                                                         00001483
C                 SECONDARY ANGULAR DISTRIBUTIONS                       00001490
   70 CALL FILE4                                                        00001500
      GO TO 102                                                         00001510
C                 SECONDARY ENERGY DISTRIBUTIONS                        00001520
   75 CALL FILE5                                                        00001530
      GO TO 102                                                         00001540
C                 SECONDARY ENERGY-ANGLE DISTRIBUTIONS                  00001550
   80 CALL FILE6                                                        00001560
      GO TO 102                                                         00001570
C                 THERMAL SCATTERING LAW                                00001580
   85 CALL FILE7                                                        00001710
      GO TO 102                                                         00001715
C                 READ FILE END CARD. INCREASE I FOR THE NEXT FILE.     00001720
  100 CALL HEAD                                                         00001725
  102 I=I+1                                                             00001730
      IF (I .LE. 7)          GO TO 24                                   00001740
      GO TO 200                                                         00001745
C                                                                       00001750
C     MATERIAL IS TO BE SKIPPED. READ TIL MATERIAL END CARD IS FOUND    00001760
C      WHEN MAT=0                                                       00001770
C                                                                       00001780
  170 READ (9,36)  MAT                                                  00001790
      IF (MAT .EQ. -1) GO TO 1002                                       00001792
      IF (ICONT1 .EQ. 1) WRITE (8,37) MAT,MATL,MATL,MATL                00001793
   37 FORMAT (66X,I4,I2,I3,I5)                                          00001794
  180 READ (9,36)  MATE                                                 00001800
      IF (MAT .EQ. MATE)                GO TO 180                     00001810
  200 CONTINUE                                                          00001820
C                                                                       00001830
 1002 REWIND 9                                                          00001840
  210 CALL QUIT                                                         00001850
      STOP                                                              00001860
      END                                                               00001870
```

```
      SUBROUTINE HEAD                                                   00003010
C                                                                       00003020
      COMMON     /HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,     00003050
     1                  MAT, MF, MT, ISEQ                             00003051
      COMMON     /OPTS/ IPUNCH, IPRINT, IPLOT                          00003070
      COMMON/ICO/ICONT,ICONT1,IHOL                                      00003080
C                                                                       00003100
   10 FORMAT (2(A4,A4,A3),4I11,I4,I2,I3,I5)                             00003520
   20 FORMAT (1X,2(A4,A4,A3),4I11,I4,I2,I3,I5)                          00003530
   24 READ (9,10)   ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,MAT,MF, 00003540
     1MT,ISEQ                                                           00003541
      IF (ICONT1-ICONT .EQ. 0) WRITE (8,10) ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,I00003542
     1Z1,IZ2,IZ3,IZ4,MAT,MF,MT,ISEQ                                     00003543
      ICONT=40C                                                         00003544
      IF (IPUNCH .EQ. 0)    GO TO 30                                    00003550
      PUNCH 10,     ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,MAT,MF, 00003560
     1MT,ISEQ                                                           00003561
   30 IF (IPRINT .EQ. 0)    GO TO 40                                    00003570
      WRITE (6,20)  ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,MAT,MF, 00003580
     1MT,ISEQ                                                           00003581
   40 RETURN                                                            00003590
      END                                                               00003600
```

```
      SUBROUTINE TAB1                                                   00004010
C                                                                       00004020
      COMMON    /HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,      00004050
     1                 MAT, MF, MT, ISEQ                              00004051
      COMMON    /TCARD/T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,NBT(20),INT(20)   00004060
      COMMON    /OPTS/ IPUNCH, IPRINT, IPLOT                            00004070
C                                                                       00004100
   10 FORMAT (2(A4,A4,A3),4I11,I4,I2,I3,I5)                             00004500
   12 FORMAT (1X,2(A4,A4,A3),4I11,I4,I2,I3,I5)                          00004510
   14 FORMAT (6I11,I4,I2,I3,I5)                                         00004520
   16 FORMAT (1X,6I11,I4,I2,I3,I5)                                      00004530
   18 FORMAT (4I11,22X,I4,I2,I3,I5)                                     00004540
   20 FORMAT (1X,4I11,22X,I4,I2,I3,I5)                                  00004550
   22 FORMAT (2I11,44X,I4,I2,I3,I5)                                     00004560
   24 FORMAT (1X,2I11,44X,I4,I2,I3,I5)                                  00004570
   26 READ (9,10)    T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,MAT,MF,MT,ISEQ      00004580
      IF (IPUNCH .EQ. 0)    GO TO 30                                    00004590
      PUNCH 10,      T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,MAT,MF,MT,ISEQ     00004600
   30 IF (IPRINT .EQ. 0)    GO TO 50                                    00004610
      WRITE (6,12)  T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,MAT,MF,MT,ISEQ      00004620
C                                                                       00004630
C     READ NBT(J) AND INT(J) FOR J=1,NR. THREE PAIRS/CARD BUT LAST CARD 00004640
C      MAY HAVE 1, 2 OR 3 PAIRS. IF LAST CARD DOES NOT HAVE 3 PAIRS,    00004650
C      TREAT IT SEPARATELY. NREST=REMAINDER OF NR/3                     00004660
C                                                                       00004670
   50 NREST=MOD(NR,3)                                                   00004680
      IF (NR-2) 76, 64, 52                                              00004685
   52 LIMIT=NR                                                          00004690
      IF (NREST .NE. 0)     LIMIT=NR-NREST                              00004700
C                                                                       00004710
   56 DO 70 L=1,LIMIT,3                                                 00004720
      JEND=L+2                                                          00004730
      READ (9,14)   (NBT(J),INT(J),J=L,JEND), MAT,MF,MT,ISEQ           00004740
   60 IF (IPUNCH .EQ. 0)    GO TO 64                                    00004750
      PUNCH 14,     (NBT(J),INT(J),J=L,JEND), MAT,MF,MT,ISEQ          00004760
   64 IF (IPRINT .EQ. 0)    GO TO 70                                    00004770
      WRITE (6,16)  (NBT(J),INT(J),J=L,JEND), MAT,MF,MT,ISEQ           00004780
   70 CONTINUE                                                          00004790
C                                       LAST CARD FULL TEST             00004800
      IF (NREST-1) 100, 76, 84                                          00004810
C                                                                       00004820
C     1 PAIR ON LAST CARD.                                              00004830
C                                                                       00004840
   76 READ (9,22)   NBT(NR), INT(NR), MAT, MF, MT, ISEQ                 00004850
      IF (NBT(NR) .NE. NP) NBT(NR)=NP                                   00004855
      IF (IPUNCH .EQ. 0)    GO TO 80                                    00004860
      PUNCH 22,     NBT(NR), INT(NR), MAT, MF, MT, ISEQ                 00004870
   80 IF (IPRINT .EQ. 0)    GO TO 100                                   00004880
      WRITE (6,24)  NBT(NR), INT(NR), MAT, MF, MT, ISEQ                 00004890
      GO TO 100                                                         00004900
C                                                                       00004910
C     2 PAIRS ON LAST CARD.                                             00004920
C                                                                       00004930
   84 READ (9,18)   NBT(NR-1),INT(NR-1),NBT(NR),INT(NR), MAT,MF,MT,ISEQ 00004940
      IF (IPUNCH .EQ.0)     GO TO 90                                    00004950
      PUNCH 18,     NBT(NR-1),INT(NR-1),NBT(NR),INT(NR), MAT,MF,MT,ISEQ 00004960
   90 IF (IPRINT .EQ. 0)    GO TO 100                                   00004965
      WRITE (6,20)  NBT(NR-1),INT(NR-1),NBT(NR),INT(NR), MAT,MF,MT,ISEQ 00004970
  100 RETURN                                                            00004975
      END                                                               00004980
```

```
      SUBROUTINE XSEC                                                   00005010
C                                                                       00005020
      COMMON     /HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,     00005050
     1                  MAT, MF, MT, ISEQ                             00005051
      COMMON     /TCARD/T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,NBT(20),INT(20)  00005060
      COMMON     /OPTS/ IPUNCH, IPRINT, IPLOT                          00005070
C                                                                       00005075
      COMMON WORD(18),HOL(425),E(2000),COE(200,30)                      00005080
      DIMENSION SIGMA(2000)                                             00005081
      EQUIVALENCE (COE(1,1),SIGMA(1))                                   00005082
      COMMON/ARSH/A(8C)                                                 00005090
C                                                                       00005100
   10 FORMAT (6(A4,A4,A3),I4,I2,I3,I5)                                  00005500
   12 FORMAT (1X,6(A4,A4,A3),I4,I2,I3,I5)                               00005510
   22 FORMAT (6E11.C)                                                   00005560
C                                                                       00005570
C     3 PAIR X,Y VALLES / CARD. LAST CARD MAY HAVE 1,2,OR 3 PAIRS.      00005580
C                    USE TAPE 99 TO CONVERT A4,A4,A3 TO E11.0 FOR PLOT. 00005630
   26 DO 50 L=1,NP,3                                                    00005640
      KEND=L+2                                                          00005650
      IF (KEND .GT. 200C) KEND=20C0                                     00005655
      READ (9,10)   WORD,MAT,MF,MT,ISEQ                                 00005660
   30 IF (IPUNCH .EQ. 0)    GO TO 36                                    00005670
      PUNCH 10,     WORD,MAT,MF,MT,ISEQ                                 00005680
   36 IF (IPRINT .EQ. 0)    GO TO 4C                                    00005690
      WRITE (6,12)  WORD,MAT,MF,MT,ISEQ                                 00005700
   40 IF (IPLOT .EQ. C)     GO TO 5C                                    00005710
      CALL INFILQ(A,8C)                                                 00005720
   44 WRITE (99,10) WORD                                                00005730
      CALL INFILQ(A,8C)                                                 00005740
      READ  (99,22) (E(K),SIGMA(K),K=L,KEND)                            00005750
   50 CONTINUE                                                          00005760
C                                                                       00005770
      RETURN                                                            00005780
      END                                                               00005790
```

```
      SUBROUTINE FILE1                                                  00010010
C                                                                       00010012
C     THIS ROUTINE HANDLES SECTION 1 AND TESTS FOR OTHER SECTIONS WHICH 00010014
C     ARE SEPARATE ROUTINES.                                            00010016
C     PUNCH AND PRINT OPTIONS ARE CHECKED IN FILE 1. TAPE 9 = BCD TAPE  00010018
C                                                                       00010020
      COMMON     /HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,     00010050
     1                  MAT, MF, MT, ISEQ                             00010051
      COMMON     /OPTS/ IPUNCH, IPRINT, IPLOT                          00010070
      COMMON/ICO/ICONT,ICONT1,IHOL                                      00010071
C                                                                       00010075
      COMMON WORD(18),HOL(425),E(2000),COE(200,30)                      00010080
      DIMENSION SIGMA(2000)                                             00010081
      EQUIVALENCE (COE(1,1),SIGMA(1))                                   00010082
C                                                                       00010090
      EXTERNAL   TABLIV                                                 00010100
      REAL       HEDING(17)                                             00010290
C                                                                       00010300
C     READ SEC.1 HEADING CARD.  ISECT IS USED IN EXIT FROM SECTION END. 00010310
C                                                                       00010320
   20 ISECT = 1                                                         00010330
      ICONT=1                                                           00010331
   24 CALL HEAD                                                         00010340
      LRP=IZ1                                                           00010350
      LFI=IZ2                                                           00010360
C                 READ SECOND CARD OF SECTION 1                       00010400
      ICONT=1                                                           00010401
   30 CALL HEAD                                                         00010410
      LDD=IZ1                                                           00010420
      LFP=IZ2                                                           00010430
      NHOL=IZ3                                                          00010440
C                                                                       00010442
C     100 CARDS OF HOLLERITH DATA ARE PERMITTED IN ENDF/B. SPACE HAS    00010444
C     BEEN SAVED FOR ONLY 25 CARDS AT A TIME, SO EACH SET OVERLAYS THE  00010446
C     PREVIOUS SET. THE FIRST CARD IS RETRIEVED FOR PLOT TITLE BY STOR- 00010448
C     ING IT TEMPORARILY INTIL ALL CARDS ARE READ.                      00010450
C     NCRTS=NO.OF SETS OF 25 CARDS TO BE READ.                          00010452
C                                                                       00010454
   40 NCRTS=(NHOL-1)/25+1                                               00010460
      NHOL1=NHOL                                                        00010480
C                                                                       00010485
   50 DO 82 L=1,NCRTS                                                   00010490
      K1=1                                                              00010495
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      K2=17                                                          00010500
      NEND=25                                                        00010505
      IF (NEND .GT. NHOL1)      NEND=NHOL1                           00010510
   56 IF (IPLOT .EQ. 0)   GO TO 62                                   00010515
      IF (IHOL .NE. 1) GO TO 57                                      00010516
      CALL SCOUTV                                                    00010517
      WRITE (16,69)                                                  00010518
   69 FORMAT (1H1/1H4/1H4)                                           00010519
      GO TO 62                                                       00010520
   57 IY=900                                                         00010521
      CALL FRAMEV(0)                                                 00010525
      CALL CHSIZV (2,3)                                              00010530
      CALL RITSTV (9,26,TABL1V)                                      00010535
C                                                                    00010540
   62 DO 80 N=1,NEND                                                 00010690
   66 READ (9,68)   (HOL(K), K=K1,K2), MAT, MF, MT, ISEQ             00010710
   68 FORMAT (16A4,A2,I4,I2,I3,I5)                                   00010715
   65 FORMAT (27X,16A4,A2)                                           00010716
      IF (IPUNCH .EQ. 0)       GO TO 70                             00010720
      PUNCH 68,     (HOL(K), K=K1,K2), MAT, MF, MT, ISEQ           00010730
   70 IF (IPRINT .EQ. 0)    GO TO 74                                 00010740
      WRITE (6,72)  (HOL(K), K=K1,K2), MAT, MF, MT, ISEQ            00010750
   72 FORMAT (1X,16A4,A2,I4,I2,I3,I5)                                00010760
   74 IF (IPLOT  .EQ. 0)    GO TO 75                                 00010762
      IF (IHOL .NE. 1) GO TO 77                                      00010763
      WRITE (16,65) (HOL(K),K=K1,K2)                                 00010764
      GO TO 75                                                       00010765
   77 CALL RITE2V ( 24,IY,1024,90,2,66,1,HOL(K1),IERR)               00010766
      IY=IY-30                                                       00010770
   75 IF (L .NE. 1)          GO TO 78                                00010775
C                       SAVE TITLE CARD FOR PLOTS.                   00010780
      DO 76 M=1,17                                                   00010785
   76 HEDING(M)=HOL(M)                                               00010790
C                       INCREMENT BY 17 FOR NEXT CARD                00010795
   78 K1=K1+17                                                       00010800
   80 K2=K2+17                                                       00010805
C               END OF LOOP ON 25 CARDS                              00010810
   82 NHOL1=NHOL1-25                                                 00010815
C               END OF CARDS. RESTORE TITLE CARD.                    00010820
      DO 83 M=1,17                                                   00010830
   83 HOL(M)=HEDING(M)                                               00010840
C                        READ SECTION END CARD.                      00010850
   84 CALL HEAD                                                      00010860
  100 GO TO (102, 110, 120, 130), ISECT                              00010940
C                                                                    00010950
C     SECTION 2 EXISTS IF LFI=1.                                     00010960
C                                                                    00010970
  102 IF (LFI .EQ. 0)          GO TO 110                             00010980
      ISECT=2                                                        00010990
      CALL SC12                                                      00011000
      GO TO 84                                                       00011010
C                                      SECTION 3 EXISTS IF LDD=1     00011020
  110 IF (LDD .EQ. 0)          GO TO 120                             00011030
      ISECT=3                                                        00011040
      CALL SC13                                                      00011050
      GO TO 84                                                       00011060
C                                      SECTION 4 EXISTS IF LFP=1     00011070
  120 IF (LFP .EQ. 0)          GO TO 130                             00011080
      ISECT=4                                                        00011090
      CALL SC14                                                      00011100
      GO TO 84                                                       00011110
  130 RETURN                                                         00011120
      END                                                            00011130
```

```
      SUBROUTINE SC12                                                   00012010
C                                                                       00012020
C     FILE 1,SECTION 2 HANDLES NU(E) AS POLY COEFF. OR TABULATED VALUES.00012022
C                                                                       00012024
      COMMON    /HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,      00012050
     1                 MAT, MF, MT, ISEQ                              00012051
      COMMON    /OPTS/ IPUNCH, IPRINT, IPLOT                          00012070
      COMMON/ICO/ICONT,ICONT1,IHOL                                    00012071
C                                                                       00012075
      COMMON WORD(18),HOL(425),E(2000),COE(200,30)                    00012080
      DIMENSION SIGMA(2000)                                           00012081
      EQUIVALENCE (COE(1,1),SIGMA(1))                                 00012082
C                                                                       00012300
C     READ HEADING CARD.                                              00012302
C                                                                       00012304
      ICONT=1                                                         00012305
  100 CALL HEAD                                                       00012310
      LNU=IZ2                                                         00012320
C                                                                       00012390
C     HEADING CARD IS DONE. TEST FOR COEFF. OR TABULATED VALUES.      00012400
C                                                                       00012410
  120 IF (LNU .EQ. 2)         GO TO 160                               00012420
C               NC=NO.OF COEFFICIENTS                                   00012440
  124 CALL HEAD                                                       00012450
      NC=IZ3                                                          00012460
C                                                                       00012510
C     READ,PUNCH,AND PRINT NU COEFFICIENTS. NO MORE THAN 1 CARD.      00012520
C                                                                       00012530
  132 READ (9,134)  WORD,MAT,MF,MT,ISEQ                               00012550
  134 FORMAT (6(A4,A4,A3),I4,I2,I3,I5)                                00012560
      IF (IPUNCH .EQ. 0)    GO TO 136                                 00012570
      PUNCH 134,    WORD,MAT,MF,MT,ISEQ                               00012580
  136 IF (IPRINT .EQ. 0)    GO TO 250                                 00012590
      WRITE (6,138) WORD,MAT,MF,MT,ISEQ                               00012600
  138 FORMAT (1X,6(A4,A4,A3),I4,I2,I3,I5)                             00012605
      GO TO 250                                                       00012610
C                 READ TABULATED VALUES FOR NU(E).                    00012650
C                                                                       00012670
  160 CALL TAB1                                                       00012680
      CALL XSEC                                                       00012690
      IF (IPLOT .EQ. 0)     GO TO 250                                 00012700
      IKEY=1                                                          00012710
  170 CALL PLOT (IKEY)                                                00012720
C                                                                       00012780
  250 RETURN                                                          00012790
      END                                                             00012800
```

```
      SUBROUTINE FILE3                                                  00030010
C                                                                       00030020
C     READ SMOOTH CROSS SECTIONS ONE REACTION AT A TIME.                00030030
C                  PRINT AND PUNCH IN THIS ROUTINE. PLOT IN S.R.PLOT.   00030040
C                                                                       00030050
      COMMON    /HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,      00030150
     1                 MAT, MF, MT, ISEQ                              00030151
      COMMON/TCARD/T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,NBT(20),INT(20)       00030152
      COMMON    /OPTS/ IPUNCH, IPRINT, IPLOT                          00030170
      COMMON/ICO/ICONT,ICONT1,IHOL                                    00030171
C                                                                       00030175
C                 READ HEADING CARD.                                  00030600
      ICONT=1                                                         00030605
   10 CALL HEAD                                                       00030610
      LFS=IZ2                                                         00030620
C                 READ NBT( ) AND INT( )                              00030630
   20 CALL TAB1                                                       00030640
      CALL XSEC                                                       00030645
      IF (LT .NE. 0) CALL SKIP(LT)                                    00030647
C                                        IKEY IS USED FOR PLOT LABEL CLUE.00030650
   30 IF (IPLOT .EQ. 0)     GO TO 40                                  00030660
      IKEY=0                                                          00030670
      CALL PLOT (IKEY)                                                00030680
C                       READ SECTION END CARD.                        00030690
   40 CALL HEAD                                                       00030700
C                 FIRST OF NEXT REACTION SET OR LAST CARD OF FILE 3.  00030710
      ICONT=1                                                         00030715
   50 CALL HEAD                                                       00030720
      IF (MF .NE. 0)        GO TO 20                                  00030730
   60 RETURN                                                          00030740
      END                                                             00030750
```

```
      SUBROUTINE PLOT (IENTER)                                          00033010
C                                                                       00033012
      DIMENSION TABNU(6)                                                00033015
      DATA       TABNU(1) /24HNU                                        00033020
C                                                                       00033025
      COMMON    /HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,      00033050
     1                 MAT, MF, MT, ISEQ                              00033051
      COMMON    /TCARD/T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,NBT(20),INT(20)   00033060
C                                                                       00033075
      COMMON WORD(18),HOL(425),E(2000),COE(200,30)                      00033080
      DIMENSION SIGMA(2000)                                             00033081
      EQUIVALENCE (COE(1,1),SIGMA(1))                                   00033082
C                                                                       00033100
      COMMON    /LABELS/ TITLE(14), ABSC(14), ORD(14), ORDS(6,30)       00033200
     1          /REACTS/ MTS(30)                                        00033202
      IF (IENTER .NE. 0)                GO TO 18                        00033498
C                                                                       00033500
C     SET UP Y-AXIS TITLE BY MATCHING  MT  WITH LIST OF REACTIONS  AND  00033502
C      THEN MOVING CORRESPONDING WORDS TO FILL OUT TITLE.               00033504
C     ALL PLOT TITLES ARE SET UP FOR A MAXIMUM OF 13.5 WORDS (54 CHAR)  00033506
C                                                                       00033510
    4 DO 10 LOOP=1,30                                                   00033520
      IF (MT .NE. MTS(LOOP))            GO TO 10                        00033530
C                                                       MATCH FOUND     00033540
      DO 6 MOVE=1,6                                                     00033550
    6 ORD(MOVE+4)=ORDS(MOVE,LOOP)                                       00033560
      GO TO 26                                                          00033570
C                 CONTINUE SEARCH FOR REACTION MATCH                    00033580
   10 CONTINUE                                                          00033590
C                       NO MATCH. LEAVE TITLE BLANK. WRITE MESSAGE.     00033600
      DO 12 MOVE=1,6                                                    00033610
   12 ORD(MOVE+4)=ORD(11)                                               00033620
C                                                                       00033630
      WRITE (6,16) MT                                                   00033640
   16 FORMAT (41HC NO Y-LABEL AVAILABLE FOR REACTION NO. =,I3)          00033650
      GO TO 26                                                          00033652
C                          TEST FOR TABULATED VALUES OF NU.             00033656
   18 IF (IENTER .NE. 1)                GO TO 26                        00033658
C                                                       MOVE Y-AXIS TITLE=NU  00033660
      DO 20 MOVE=1,6                                                    00033662
   20 ORD(MOVE+4)=TABNU(MOVE)                                           00033664
C                                                                       00033666
C     INITIALIZE FOR FIRST PLOT OF THIS SET.                            00033670
C                                                                       00033680
   26 IBEG=1                                                            00033690
      LSTART=2                                                          00033700
      XMIN=E(1)                                                         00033720
      YMIN=SIGMA(1)                                                     00033730
      YMAX=SIGMA(1)                                                     00033740
      NO=0                                                              00033741
      LA=1                                                              00033742
  700 DO 750 N=1,NR                                                     00033743
      IF (INT(N+NO) .EQ. 3) GO TO 701                                   00033744
      IF (INT(N+NO) .NE. 5) GO TO 750                                   00033745
  701 CALL DECADE(NO,LA,N)                                              00033746
  750 CONTINUE                                                          00033747
      NR=NR+NO                                                          00033748
      NPTS=NBT(1)                                                       00033749
C                       NR=NO.OF INTERPOLATION REGIONS GIVEN.           00033750
   30 DO 100 N=1,NR                                                     00033760
      LAST=NBT(N)                                                       00033770
      XMAX=E(LAST)                                                      00033780
C                              FIND Y-AXIS LIMITS                       00033790
      DO 40 L=LSTART,LAST                                               00033800
      YMIN=AMIN1(YMIN,SIGMA(L))                                         00033810
   40 YMAX=AMAX1(YMAX,SIGMA(L))                                         00033820
C                                       SET UP LINEARITY INDICATORS     00033830
      LINE=INT(N)                                                       00033840
      GO TO (50,50,55,60,65),LINE                                       00033850
C                                       LINEAR X AND Y                  00033860
   50 KX=0                                                              00033870
      KY=0                                                              00033880
      GO TO 70                                                          00033890
C                                       LOG X  LINEAR Y                 00033900
   55 KX=1                                                              00033910
      KY=0                                                              00033920
      GO TO 70                                                          00033930
C                                       LINEAR X  LOG Y                 00033940
   60 KX=0                                                              00033950
      KY=1                                                              00033960
      GO TO 70                                                          00033970
C                                       LOG X AND Y                     00033980
   65 KX=1                                                              00033990
      KY=1                                                              00034000
C                                       CHECK FOR A MIN.OF 2 POINTS     00034010
   70 IF (NPTS .GT. 1)      GO TO 76                                     00034020
      WRITE (6,72) N, MT, NPTS,MAT                                      00034030
```

```
   72 FORMAT (10H0 PLOT NO.,I3,18H  FOR REACTION NO.,I5,63H  IS BEING SK00034040
     1IPPED BECAUSE NO.OF POINTS IS LESS THAN 2.  NPTS =,I3/' MAT=',I5) 00034050
      GO TO 90                                                          00034060
C                                                                       00034070
   76 CONTINUE                                                          00034071
      CALL AICRT3 (KX,KY, E(IBEG),SIGMA(IBEG), NPTS, 1,2,1,38, HOL(1),  00034080
     1            ABSC(1), ORD(1), 1,1, 16.0,16.0, 2,XMIN,XMAX,        00034090
     2            2,YMIN,YMAX)                                         00034100
C                                                                       00034102
C     TEST FOR REPEATED ENERGY VALUE BEFORE SETTING UP NEXT PLOT.       00034103
C                                                                       00034104
   90 IF (N  .EQ. NR)                  GO TO 100                        00034105
      TEST=(ABS(E(LAST)-E(LAST+1)))/ E(LAST+1)                          00034106
      IF (TEST .LE. 1.0E-4)            GO TO 96                         00034110
C                                                 USE LAST ENERGY FOR XMIN00034115
      LSTART=LAST+1                                                     00034120
      YMIN=SIGMA(LAST)                                                  00034130
      YMAX=SIGMA(LAST)                                                  00034140
      XMIN=XMAX                                                         00034150
      NPTS=NBT(N+1)-LAST+1                                              00034160
      IBEG=LAST                                                         00034170
      GO TO 100                                                         00034172
C                          REPEATED ENERGY VALUES                       00034174
   96 LSTART=LAST+2                                                     00034176
      YMIN=SIGMA(LAST+1)                                                00034178
      YMAX=YMIN                                                         00034180
      XMIN=XMAX                                                         00034181
      NPTS=NBT(N+1)-LAST                                                00034182
      IBEG=LAST+1                                                       00034184
  100 CONTINUE                                                          00034186
C                                                                       00034190
      RETURN                                                            00034200
      END                                                               00034210
```

```
      SUBROUTINE FILE4                                                  00040010
      DIMENSION  COEFF(14),FS(30),XAXIS(14),YAXIS(14)                   00040020
      DATA                  COEFF/54H                  LEGENDRE  COEFFICIE00040030
     1NT                 /,                                             00040032
     2                       FS/ 4HF 1 , 4HF 2 , 4HF 3 , 4HF 4 , 4HF 5 ,00040034
     3                           4HF 6 , 4HF 7 , 4HF 8 , 4HF 9 , 4HF 10,00040036
     4                           4HF 11, 4HF 12, 4HF 13, 4HF 14, 4HF 15,00040038
     5                           4HF 16, 4HF 17, 4HF 18, 4HF 19, 4HF 20,00040040
     6                           4HF 21, 4HF 22, 4HF 23, 4HF 24, 4HF 25,00040041
     7                           4HF 26, 4HF 27, 4HF 28, 4HF 29, 4HF 30/00040042
      DATA                  YAXIS/54H   DIFFERENTIAL                  E =00040043
     1                   /,                                             00040044
     2                      XAXIS/54H       COSINE OF THE SCATTERING ANGL00040046
     3E                  /,  XMIN, XMAX /-1.0, 1.0/                     00040048
C                                                                       00040050
      COMMON     /HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,      00040150
     1                  MAT, MF, MT, ISEQ                              00040151
      COMMON     /TCARD/T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,NBT(20),INT(20)  00040160
      COMMON     /OPTS/ IPUNCH, IPRINT, IPLOT                           00040170
      COMMON/ICO/ICONT,ICONT1,IHOL                                      00040171
      COMMON     /LABELS/ TITLE(14), ABSC(14), ORD(14), CRDS(6,30)       00040172
     1     /REACTS/MTS(30)                                              00040173
C                                                                       00040175
      COMMON WORD(18),HOL(425),E(2000),COE(200,30)                      00040180
      DIMENSION SIGMA(2000),CLEM(30)                                    00040181
      EQUIVALENCE (COE(1,1),SIGMA(1))                                   00040182
      COMMON/ARSH/A(8C)                                                 00040190
C                                                                       00040500
C     READ HEADING CARD.                                                00040502
C     LVT=0  TRANFORMATION MATRIX NOT GIVEN       LVT=1  T.M.IS GIVEN   00040504
C     LTT=1  LEGENDRE COEFFICIENT DATA            LTT=2  TABULATION     00040506
C     LCT=1  (L) SYSTEM DATA                      LCT=2  (C) SYSTEM DATA00040508
C     NE=NO. OF ENERGY POINTS GIVEN    NL=HIGHEST L VALUE REQ./ENERGY   00040510
C                                                                       00040520
      ICONT=1                                                           00040525
   10 CALL HEAD                                                         00040530
   11 CONTINUE                                                          00040531
      LVT=IZ1                                                           00040540
      LTT=IZ2                                                           00040550
C                 READ FIRST CARD OF LIST RECORD                        00040560
   16 CALL HEAD                                                         00040570
      LCT=IZ2                                                           00040580
      NK=IZ3                                                            00040590
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   20 NM=IZ4                                                              00040600
C                 TEST FOR TRANSFORMATION MATRIX                         00040610
C                                                                        00040620
      IF (LVT .EQ. C)       GO TO 40                                     00040630
C                                        READ MATRIX FOR 1 TO NK VALUES. 00040640
C     TEST ON LCT FOR MATRIX OR TRANSPOSE IS NOT NEEDED. USE S.R. XSEC   00040650
C     BUT CHANGE IPLOT SO NOS.ARE NOT CONVERTED,AND SET NP.              00040660
C                                                                        00040670
      IPLOT1=IPLOT                                                       00040680
   26 IPLOT=0                                                            00040690
      NP=(NK-1)/2+1                                                      00040710
   30 CALL XSEC                                                          00040720
      IPLOT=IPLOT1                                                       00040730
C                 READ NBT(J) AND INT(J) VALUES FOR J=1,NR               00040750
   40 CALL TAB1                                                          00040760
      NE=NP                                                              00040761
      DO 2 LOOP=1,30                                                     00040762
      IF (MT .NE. MTS(LOOP)) GO TO 2                                     00040763
      DO 3 MOVE=1,4                                                      00040764
      COEFF(MOVE)=ORDS(MOVE,LOOP)                                        00040765
    3 YAXIS(MOVE+4)=ORDS(MOVE,LOOP)                                      00040766
      GO TO 4                                                            00040767
    2 CONTINUE                                                           00040768
      DO 5000 MOVE=1,4                                                   00040769
 5000 YAXIS(MOVE+4)=ORD(11)                                              00040770
      WRITE (6,5001) MT                                                  00040771
 5001 FORMAT (1H1,'NO Y-LABEL AVAILABLE FOR REACTION NO. =',I4)          00040772
    4 CONTINUE                                                           00040773
      IF (LTT .EQ. 1) GO TO 86                                           00040774
C                                        TABULATED DATA                  00040780
C     LOOP OVER NE=NO. OF ENERGIES. LEAVE ENERGY IN (A4,A4,A3) FORM FOR  00040790
C     PRINTING ON Y-AXIS LABEL                                           00040800
C                                                                        00040802
   44 DO 7C N=1,NE                                                       00040810
      CALL TAB1                                                          00040820
      YAXIS(10)=  Q1                                                     00040830
      YAXIS(11)=  Q2                                                     00040840
      YAXIS(12)=  Q3                                                     00040841
   46 CALL XSEC                                                          00040850
C     SKIP PLOTTING TEMPERATURE DEPENDENT RECORDS                        00040854
      IF (LT .NE. 0) CALL SKIP(LT)                                       00040855
      IF (IPLOT .EQ. 0)     GO TO 7C                                     00040860
      DO 45 I=1,NP                                                       00040861
      IF (SIGMA(I) .LE. 0.0) SIGMA(I)=1.0E-06                            00040862
   45 CONTINUE                                                           00040863
      YMIN=SIGMA(1)                                                      00040870
      YMAX=YMIN                                                          00040880
C                                                  FIND Y-AXIS LIMITS    00040890
      DO 50 I=2,NP                                                       00040900
      YMIN=AMIN1(YMIN,SIGMA(I))                                          00040910
   50 YMAX=AMAX1(YMAX,SIGMA(I))                                          00040920
C                                                                        00040930
      KX=0                                                               00040940
      KY=1                                                               00040950
   60 CALL AICRT3 (KX,KY, E(1),SIGMA(1),NP, 1,2,1,38, HOL(1),XAXIS(1),   00040960
     1             YAXIS(1), 1,1, 16.0,16.0, 2, XMIN,XMAX, 2,YMIN,YMAX) 00040970
   70 CONTINUE                                                           00040980
C                                                                        00040990
      GO TO 13C                                                          00041000
C                                                                        00041500
C     LEGENDRE COEFFICIENTS.                                             00041510
C     READ COEFFICIENTS FOR SETS OF 200 ENERGY POINTS(MAXIMUM)           00041520
C     NE2=TOTAL NUMBER OF ENERGY POINTS                                  00041530
C                                                                        00041540
   86 NE2=NE                                                             00041550
      NE111=1                                                            00041555
      IF (NE .GT. 200) NE=200                                            00041560
      NE1=NE                                                             00041565
      DO 88 J=1,30                                                       00041570
   88 CLEM(J)=C.0                                                        00041580
   91 IF (IPLOT .EQ. 0) GO TO 89                                         00041590
      DO 87 J=1,30                                                       00041600
      COE(1,J)=CLEM(J)                                                   00041610
      DO 87 I=2,200                                                      00041620
   87 COE(I,J)=0.0                                                       00041630
   89 DO 104 LOOP=NE111,NE                                               00041640
      CALL HEAD                                                          00042020
      NL=IZ3                                                             00042030
      LT=IZ1                                                             00042035
      NP=NL                                                              00042040
   90 CALL SIX (LOOP)                                                    00042050
      IF (IPLOT .EQ. 0)     GO TO 104                                    00042060
C                                        CONVERT E(LOOP) TO FLOATING POINT00042070
C     S.R.SIX HAS CONVERTED AND STORED COEFF. IN COE(LOOP,K) FOR K=1,NP  00042080
C                AWR1, AWR2, AND AWR3 WERE READ IN S.R.HEAD              00042090
      CALL INFILQ(A,8C)                                                  00042100
   96 WRITE (99,98) AWR1,AWR2,AWR3                                       00042110
   98 FORMAT (2(A4,A4,A3))                                               00042120
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      CALL INFILQ(A,8C)                                                 00042130
      READ (99,100) E(LOOP)                                             00042140
  100 FORMAT (E11.0)                                                    00042150
  104 CONTINUE                                                          00042160
C                                                                       00042170
C     ALL COEFF.READ FOR EACH ENERGY. CHECK PLOT OPTION.                00042180
C                                                                       00042190
      IF (IPLOT .EQ. 0)     GO TO 121                                   00042200
      IF (E(1) .LT. 1.0E+02) E(1)=E(2)/10.0                             00042201
      KX=1                                                              00042210
      KY=0                                                              00042220
C                  DO NL PLOTS OF NE POINTS. SET ORD.TITLE. DO MIN,MAX 00042230
  110 DO 120 N=1,NL                                                     00042240
      COEFF(11)=FS(N)                                                   00042250
      YMIN=COE(1,N)                                                     00042260
  112 YMAX=YMIN                                                         00042270
C                                                                       00042280
      DO 114 I=2,NE                                                     00042290
      YMIN=AMIN1(YMIN,COE(I,N))                                         00042300
  114 YMAX=AMAX1(YMAX,COE(I,N))                                         00042310
C                                                                       00042320
      CALL AICRT3 (KX,KY, E(1),COE(1,N),NE, 1,2,1,38, HOL(1),ABSC(1),   00042330
     1             COEFF(1), 1,1, 16.0,16.0, 2, E(1),E(NE),2,YMIN,YMAX) 00042340
  120 CONTINUE                                                          00042350
  121 IF (NE1 .GE. NE2) GO TO 130                                       00042351
      DO 200 J=1,30                                                     00042352
  200 CLEM(J)=COE(NE,J)                                                 00042353
      E(1)=E(NE)                                                        00042354
      NE11=NE1                                                          00042355
      NE1=NE1+199                                                       00042356
      IF (NE1 .GT. NE2) NE1=NE2                                         00042357
      NE=NE1-NE11+1                                                     00042358
      NE111=2                                                           00042359
      GO TO 91                                                          00042360
C     READ SECTION END CARD                                             00042361
  130 CALL HEAD                                                         00042370
C     IS THE NEXT CARD A FILE END CARD                                  00042371
      ICONT=1                                                           00042372
      CALL HEAD                                                         00042373
      IF (MF .NE. 0) GO TO 11                                           00042374
      RETURN                                                            00042380
      END                                                               00042390
```

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      SUBROUTINE SIX (LOOP)                                             00046010
C                                                                       00046020
      COMMON     /HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,     00046050
     1                  MAT, MF, MT, ISEQ                              00046051
      COMMON     /TCARD/T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,NBT(20),INT(20)  00046060
      COMMON     /OPTS/ IPUNCH, IPRINT, IPLOT                           00046070
C                                                                       00046075
      COMMON WORD(18),HOL(425),E(2000),COE(200,30)                      00046080
      DIMENSION SIGMA(2000)                                             00046081
      EQUIVALENCE (COE(1,1),SIGMA(1))                                   00046082
      COMMON/ARSH/A(80)                                                 00046090
C                                                                       00046500
C     ROUTINE READS 6 DATA VALUES/CARD EVEN IF LAST CARD IS NOT FULL.   00046502
C     INTERNAL FILE 99 IS USED TO CONVERT DATA FROM HOLLERITH TO FLOAT- 00046504
C     ING POINT FORM, IF PLOT OPTION WAS SELECTED. THESE VALUES ARE THEN00046506
C     STORED IN COE(LOOP,K), LEGENDRE COEFFICIENTS FOR E(LOOP).         00046508
C                                                                       00046510
   10 FORMAT (6(A4,A4,A3),I4,I2,I3,I5)                                  00046520
   12 FORMAT (1X,6(A4,A4,A3),I4,I2,I3,I5)                               00046530
   22 FORMAT (6E11.0)                                                   00046540
C                        NP=NO.OF VALUES TO BE READ.                    00046550
   26 DO 50 L=1,NP,6                                                    00046560
      KEND=L+5                                                          00046570
      IF (KEND .GT. NP)     KEND=NP                                     00046580
      READ (9,10)   WORD,MAT,MF,MT,ISEQ                                 00046590
   30 IF (IPUNCH .EQ. 0)    GO TO 36                                    00046600
      PUNCH 10,     WORD,MAT,MF,MT,ISEQ                                 00046610
   36 IF (IPRINT .EQ. 0)    GO TO 40                                    00046620
      WRITE (6,12)  WORD,MAT,MF,MT,ISEQ                                 00046630
   40 IF (IPLOT .EQ. 0)     GO TO 50                                    00046640
      CALL INFILQ(A,8C)                                                 00046650
   44 WRITE (99,10) WORD                                                00046660
      CALL INFILQ(A,8C)                                                 00046670
      READ (99,22)  (COE(LOOP,K), K=L,KEND)                             00046680
   50 CONTINUE                                                          00046690
C                                                                       00046700
      IF (LT .NE. 0) CALL SKIP(LT)                                      00046705
      RETURN                                                            00046710
      END                                                               00046720
```

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      SUBROUTINE SC13                                                   00050002
      COMMON/HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,          00050010
     1MAT,MF,MT,ISEQ                                                   00050020
      COMMON/OPTS/IPUNCH,IPRINT,IPLOT                                   00050021
      COMMON/ICO/ICONT,ICONT1,IHOL                                      00050022
      COMMON/RSH11/DN(20)                                               00050030
      ICONT=1                                                           00050035
      CALL HEAD                                                         00050040
      CALL HEAD                                                         00050050
      DO 50 L=1,IZ4                                                     00050060
      READ (9,10) DN                                                    00050070
   10 FORMAT (20A4)                                                     00050080
      IF (IPUNCH .EQ. 0) GO TO 36                                       00050090
      PUNCH 10,DN                                                       00050100
   36 IF (IPRINT .EQ. 0) GO TO 50                                       00050110
      WRITE (6,12) DN                                                   00050120
   12 FORMAT (1X,20A4)                                                  00050130
   50 CONTINUE                                                          00050140
      RETURN                                                            00050150
      END                                                               00050160


      SUBROUTINE SC14                                                   00051002
      COMMON/HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,          00051010
     1MAT,MF,MT,ISEQ                                                   00051020
      COMMON/OPTS/IPUNCH,IPRINT,IPLOT                                   00051030
      COMMON/ICO/ICONT,ICONT1,IHOL                                      00051031
      COMMON/RSH11/DN(20)                                               00051040
      ICONT=1                                                           00051045
      CALL HEAD                                                         00051050
      CALL HEAD                                                         00051060
      LT=IZ1+1                                                          00051070
      DO 50 I=1,LT                                                      00051080
      IF (I .EQ. 1) GO TO 1                                             00051090
      CALL HEAD                                                         00051100
    1 N11=1                                                             00051110
      IF (MOD(IZ3,6) .EQ. 0) N11=0                                      00051120
      N1=IZ3/6+N11                                                      00051130
      DO 50 J=1,N1                                                      00051140
      READ (9,10) DN                                                    00051150
   10 FORMAT (20A4)                                                     00051160
      IF (IPUNCH .EQ. 0) GO TO 36                                       00051170
      PUNCH 10, DN                                                      00051180
   36 IF (IPRINT .EQ. 0) GO TO 50                                       00051190
      WRITE (6,12) DN                                                   00051200
   12 FORMAT (1X,20A4)                                                  00051210
   50 CONTINUE                                                          00051220
      RETURN                                                            00051230
      END                                                               00051240


      SUBROUTINE FILE2                                                  00055000
      COMMON/OPTS/IPUNCH,IPRINT,IPLOT                                   00055010
      COMMON/ICO/ICONT,ICONT1,IHOL                                      00055015
      COMMON/RSH11/DN(20)                                               00055020
      ICONT=1                                                           00055025
      CALL HEAD                                                         00055026
   24 READ (9,10) DN,MF,DN1,DN2                                         00055030
   10 FORMAT (10A4,1CA3,I2,2A4)                                         00055040
      IF (MF .NE. 2) GO TO 100                                          00055050
   25 IF (IPUNCH .EQ. 0) GO TO 30                                       00055060
      PUNCH 10,DN,MF,DN1,DN2                                            00055070
   30 IF (IPRINT .EQ. 0) GO TO 40                                       00055080
      WRITE (6,20) DN,MF,DN1,DN2                                        00055090
   20 FORMAT (1X,10A4,1CA3,I2,2A4)                                      00055100
   40 IF (MF .NE. 0) GO TO 24                                           00055110
  101 RETURN                                                            00055120
  100 IF (MF .EQ. 0) GO TO 25                                           00055130
      GO TO 101                                                         00055140
      END                                                               00055150
```

```
      SUBROUTINE FILE7                                                  00056000
      COMMON/OPTS/IPUNCH,IPRINT,IPLOT                                   00056010
      COMMON/ICO/ICONT,ICONT1,IHOL                                      00056011
      COMMON/RSH11/DN(20)                                               00056020
      ICONT=1                                                           00056025
      CALL HEAD                                                         00056026
   24 READ (9,10) DN,MF,DN1,DN2                                         00056030
   10 FORMAT (10A4,1CA3,I2,2A4)                                         00056040
      IF (MF .NE. 7) GO TO 100                                          00056050
   25 IF (IPUNCH .EQ. 0) GO TO 30                                       00056060
      PUNCH 10,DN,MF,DN1,DN2                                            00056070
   30 IF (IPRINT .EQ. 0) GO TO 40                                       00056080
      WRITE (6,20) DN,MF,DN1,DN2                                        00056090
   20 FORMAT (1X,10A4,10A3,I2,2A4)                                      00056100
   40 IF (MF .NE. 0) GO TO 24                                           00056110
      CALL HEAD                                                         00056120
  101 RETURN                                                            00056130
  100 IF (MF .EQ. 0) GO TO 25                                           00056140
      GO TO 101                                                         00056150
      END                                                               00056160


      SUBROUTINE FILE5                                                  00060000
      COMMON/OPTS/IPUNCH,IPRINT,IPLOT                                   00060010
      COMMON/ICO/ICONT,ICONT1,IHOL                                      00060011
      COMMON/HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,          00060020
     1MAT,MF,MT,ISEQ                                                    00060030
      COMMON/TCARD/T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,NBT(20),INT(20)       00060040
      COMMON WORD(18),HOL(425),E(2000),COE(200,30)                      00060050
      DIMENSION SIGMA(2000)                                             00060051
      EQUIVALENCE (COE(1,1),SIGMA(1))                                   00060052
      COMMON/RSH11/DN(20)                                               00060060
      COMMON/NK1/NK                                                     00060065
      IKEY=2                                                            00060070
C                                                                       00060080
C     READ HEADING CARD                                                 00060090
C                                                                       00060100
      ICONT=1                                                           00060105
   10 CALL HEAD                                                         00060110
   15 NK=IZ3                                                            00060119
      JAZ=0                                                             00060120
      IF (0 .EQ. 0) GO TO 16                                            00060121
      ENTRY FILE56                                                      00060122
      IKEY=2                                                            00060123
      JAZ=1                                                             00060124
   16 CONTINUE                                                          00060125
C                                                                       00060130
C     LOOP OVER NK SUBSECTIONS                                          00060140
C                                                                       00060150
      DO 900 K=1,NK                                                     00060160
C                                                                       00060170
C     OBTAIN P(E) VS. E                                                 00060180
C                                                                       00060190
   20 CALL TAB1                                                         00060200
      CALL XSEC                                                         00060210
   30 IF (IPLOT .EQ. 0) GO TO 40                                        00060220
      LF=-IZZ                                                           00060230
      CALL TFIX(MT,LF)                                                  00060240
      CALL PLOT (IKEY)                                                  00060250
      CALL TFIX(MT,LF)                                                  00060251
   40 LF=IZZ                                                            00060260
C                                                                       00060270
C     LF IS INDEX FOR SUBSECTION STRUCTURE                              00060280
C                                                                       00060290
C     SKIP PLOTTING TEMPERATURE DEPENDENCE OF P(E)                      00060300
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C                                                                       00060310
      IF (LT .NE. 0) CALL SKIP(LT)                                      00060320
C                                                                       00060330
C     GO TO APPROPRIATE SUBSECTION                                      00060340
C                                                                       00060350
      GO TO (50,900,900,60,70,900,60,900,60,100),LF                     00060360
C                                                                       00060370
C     ARBITRARY TABLLATED FUNCTION                                      00060380
C                                                                       00060390
   50 CALL TAB1                                                         00060400
C                                                                       00060410
C     LOOP OVER NE INITIAL ENERGIES                                     00060420
C                                                                       00060430
      NE=NP                                                             00060440
      DO 52 N=1,NE                                                      00060450
      CALL TAB1                                                         00060460
      CALL XSEC                                                         00060470
C                                                                       00060480
C     SKIP PLOTTING TEMPERATURE DEPENDENCE                              00060490
C                                                                       00060500
      IF (LT .NE. 0) CALL SKIP(LT)                                      00060510
      IF (IPLOT .EQ. 0) GO TO 52                                        00060520
      CALL TFIX(MT,LF)                                                  00060530
      CALL PLOT(IKEY)                                                   00060540
      CALL TFIX(MT,LF)                                                  00060541
   52 CONTINUE                                                          00060550
      GO TO 900                                                         00060560
C                                                                       00060570
C     GENERAL EVAPORATION SPECTRUM, THETA CONSTANT                      00060580
C     SIMPLE FISSION SPECTRUM                                           00060590
C     MAXWELLIAN DISTRIBUTION, THETA IS FUNCTION OF E                   00060600
C                                                                       00060610
   60 CALL TAB1                                                         00060620
      CALL XSEC                                                         00060630
C                                                                       00060640
C     SKIP PLOTTING TEMPERATURE DEPENDENCE                              00060650
C                                                                       00060660
   61 IF (LT .NE. 0) CALL SKIP(LT)                                      00060670
      IF (IPLOT .EQ. 0) GO TO 900                                       00060680
      CALL TFIX(MT,LF)                                                  00060690
      CALL PLOT(IKEY)                                                   00060700
      CALL TFIX(MT,LF)                                                  00060701
      GO TO 900                                                         00060710
C                                                                       00060720
C     GENERAL EVAPORATION SPECTRUM THETA IS FUNCTION OF E.  SAVE IZZ.   00060730
C     USE IZZ TO TELL SUBROUTINE TFIX(MT,LF) THAT THETA(E) IS TO BE     00060740
C     PLOTTED ON FIRST ENTRY.                                           00060750
   70 CALL TAB1                                                         00060760
      CALL XSEC                                                         00060770
      IF (LT .NE. 0) CALL SKIP(LT)                                      00060780
      IF (IPLOT .EQ. 0) GO TO 60                                        00060790
      IZZ1=IZZ                                                          00060800
      IZZ=-400                                                          00060810
      CALL TFIX(MT,LF)                                                  00060820
      IZZ=IZZ1                                                          00060830
      CALL PLOT(IKEY)                                                   00060840
      CALL TFIX(MT,LF)                                                  00060841
      GO TO 60                                                          00060850
C                                                                       00060860
C     WATT SPECTRUM                                                     00060870
C                                                                       00060880
  100 CALL HEAD                                                         00060890
      LT=IZ1                                                            00060900
      READ (9,101) DN                                                   00060910
  101 FORMAT (20A4)                                                     00060920
      IF (IPUNCH .EQ. 0) GO TO 130                                      00060930
      PUNCH 101, DN                                                     00060940
  130 IF (IPRINT .EQ. 0) GO TO 103                                      00060950
      WRITE (6,102) DN                                                  00060960
  102 FORMAT (1X,20A4)                                                  00060970
  103 IF (LT .NE. 0) CALL SKIP(LT)                                      00060980
  900 CONTINUE                                                          00060990
      IF (JAZ .EQ. 1) RETURN                                            00060991
C                                                                       00061000
C     READ SECTION END CARD                                             00061010
C                                                                       00061020
      CALL HEAD                                                         00061030
C                                                                       00061040
C     IS THE NEXT CARD THE LAST CARD IN FILE 5                          00061050
C                                                                       00061060
      ICONT=1                                                           00061065
      CALL HEAD                                                         00061070
      IF (MF .NE. 0) GO TO 15                                           00061080
      RETURN                                                            00061090
      END                                                               00061100
```

```
      SUBROUTINE TFIX(MT,LF)                                                00062000
      COMMON/TCARD/T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,NBT(20),INT(20)           00062010
      COMMON/LABELS/TITLE(14),ABSC(14),ORD(14),ORDS(6,30)                   00062020
     1     /REACTS/MTS(30)                                                  00062030
      DIMENSION SEC(10,8),CE1(10),CE2(10),CE3(10),CE4(10),CE5(10),CE6(10)00062040
     1),CE7(10),CE8(10),ORDSAV(14),ABSSAV(14)                              00062041
      DIMENSION OLLF(10)                                                    00062042
      EQUIVALENCE (SEC(1,1),CE1(1)),(SEC(1,2),CE2(1)),(SEC(1,3),CE3(1)),00062050
     1           (SEC(1,4),CE4(1)),(SEC(1,5),CE5(1)),(SEC(1,6),CE6(1)),00062051
     2           (SEC(1,7),CE7(1)),(SEC(1,8),CE8(1))                      00062052
      DATA OLLF(1)/'1   2   3   4   5   6   7   8   9   10  '/            00062055
      DATA CE1( 1)/'P(E)   LF =      CONS =                '/,            00062060
     1     CE2( 1)/'F(E'' FROM E) ARB. TAB E=              '/,            00062070
     2     CE3( 1)/'F(E''/THETA) TABLE                     '/,            00062080
     3     CE4( 1)/'THETA(E) TABLE                         '/,            00062090
     4     CE5( 1)/'F(E''/THETA(E)) TABLE                  '/,            00062100
     5     CE6( 1)/'THETA(E) TAB. FOR SIMPLE FISSION SPEC.'/,             00062110
     6     CE7( 1)/'THETA(E) TAB. FOR MAXWELLIAN DISTRIB. '/,             00062120
     7     CE8( 1)/' ENERGY/THETA                          '/,            00062121
     8     IENTER/0/                                                      00062130
      IF (IENTER .NE. 0) GO TO 500                                          00062140
      IENTER=1                                                              00062150
      DO 1 I=1,14                                                           00062160
      ORDSAV(I)=ORD(I)                                                      00062170
    1 ABSSAV(I)=ABSC(I)                                                     00062180
      DO 2 LOOP=1,30                                                        00062190
      IF (MT .NE. MTS(LOOP)) GO TO 2                                        00062200
      DO 3 MOVE=1,4                                                         00062210
    3 ORD(MOVE)=ORDS(MOVE,LOOP)                                             00062220
      GO TO 4                                                               00062230
    2 CONTINUE                                                              00062240
      DO 5000 MOVE=1,4                                                      00062241
5000  ORD(MOVE)=ORD(11)                                                     00062242
      WRITE (6,5001) MT                                                     00062243
5001  FORMAT (1H1,'NO Y-LABEL AVAILABLE FOR REACTION NO. =',I4)             00062244
    4 IF (LF .GT. 0) GO TO 10                                               00062250
      DO 5 I=1,10                                                           00062260
    5 ORD(I+4)=SEC(I,1)                                                     00062270
      LLF=-LF                                                               00062271
      ORD(8)=OLLF(LLF)                                                      00062272
      GO TO 15                                                              00062273
   10 IF (LF .NE. 1) GO TO 20                                               00062290
      DO 15 I=1,10                                                          00062300
   15 ORD(I+4)=SEC(I,2)                                                     00062310
   16 ORD(11)=Q1                                                            00062320
      ORD(12)=Q2                                                            00062330
      ORD(13)=Q3                                                            00062340
      GO TO 1000                                                            00062350
   20 IF (LF .NE. 4) GO TO 30                                               00062360
      DO 21 I=1,10                                                          00062370
      ORD(I+4)=SEC(I,3)                                                     00062380
   21 ABSC(I+4)=SEC(I,8)                                                    00062390
      GO TO 1000                                                            00062400
   30 IF (LF .NE. 5) GO TO 40                                               00062410
      IF (IZZ .NE. -400) GO TO 35                                           00062420
      DO 31 I=1,10                                                          00062430
   31 ORD(I+4)=SEC(I,4)                                                     00062440
      GO TO 1000                                                            00062450
   35 DO 36 I=1,10                                                          00062460
      ORD(I+4)=SEC(I,5)                                                     00062470
   36 ABSC(I+4)=SEC(I,8)                                                    00062480
      GO TO 1000                                                            00062490
   40 IF (LF .NE. 7) GO TO 50                                               00062500
      DO 41 I=1,10                                                          00062510
   41 ORD(I+4)=SEC(I,6)                                                     00062520
      GO TO 1000                                                            00062530
   50 IF (LF .NE. 9) GO TO 2000                                             00062540
      DO 51 I=1,10                                                          00062550
   51 ORD(I+4)=SEC(I,7)                                                     00062560
 1000 RETURN                                                                00062570
  500 IENTER=0                                                              00062580
      DO 501 I=1,14                                                         00062590
      ORD(I)=ORDSAV(I)                                                      00062600
  501 ABSC(I)=ABSSAV(I)                                                     00062610
      GO TO 1000                                                            00062620
 2000 WRITE (6,2001) LF                                                     00062630
 2001 FORMAT (1H1,' ERROR IN SUBROUTINE TFIX(MT,LF)FOR LF=',I3)             00062640
      CALL EXIT                                                             00062650
      GO TO 1000                                                            00062660
      END                                                                   00062670
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      SUBROUTINE SKIP(LT)                                               00065000
      DIMENSION A1(11),A2(7),A3(20)                                     00065010
      DO 30 L=1,LT                                                      00065020
      READ (5,1000) A1,NP,A2                                            00065030
 1000 FORMAT (11A4,I11,6A4,A1)                                          00065040
      NP2=1                                                             00065050
      IF (MOD(NP,6) .EQ. 0) NP2=0                                       00065060
      NP1=NP/6+NP2                                                      00065070
      IF (IPUNCH .EQ. 0) GO TO 10                                       00065080
      PUNCH 1000,A1,NP,A2                                               00065090
   10 IF (IPRINT .EQ. 0) GO TO 20                                       00065100
      WRITE (6,1001) A1,NP,A2                                           00065110
 1001 FORMAT (1X,11A4,I11,6A4,A1)                                       00065120
   20 DO 30 N=1,NP1                                                     00065130
      READ (5,1002) A3                                                  00065140
 1002 FORMAT (20A4)                                                     00065150
      IF (IPUNCH .EQ. 0) GO TO 22                                       00065160
      PUNCH 1002,A3                                                     00065170
   22 IF (IPRINT .EQ. 0) GO TO 30                                       00065180
      WRITE (6,1003) A3                                                 00065190
 1003 FORMAT (1X,20A4)                                                  00065200
   30 CONTINUE                                                          00065210
      RETURN                                                            00065220
      END                                                               00065230
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      SUBROUTINE FILE6                                                  00070000
      COMMON/HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,          00070010
     1MAT,MF,MT,ISEQ                                                    00070020
      COMMON/TCARD/T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NK,NP,NBT(20),INT(20)       00070030
      COMMON WORD(18),HOL(425),E(2000),CDE(20,3)                        00070040
      DIMENSION SIGMA(2000)                                             00070041
      EQUIVALENCE (CDE(1,1),SIGMA(1))                                   00070042
      COMMON/OPTS/IPUNCH,IPRINT,IPLOT                                   00070050
      COMMON/ICO/ICONT,ICONT1,IHOL                                      00070051
      DIMENSION HOB1(11),HOB2(29),HOB3(13),HOB4(11)                     00070060
      COMMON/NK1/NK                                                     00070065
      EQUIVALENCE (NA,NL)                                               00070070
      DATA HOB1(1)/'FILE 6  SECONDARY ENERGY-ANGLE DISTRIBUTIONS'/,HOB2(00070500
     11)/'LEGENDRE EXPANSION  , ORDER OF LEGENDRE EXPANSION  TABULATION00070510
     2  , NO. OF MU VALUES AT WHICH TABULATIONS ARE GIVEN  '/,HOB3(1)/'C00070520
     3DATA IN LAB. SYSTEM DATA IN CENTER OF MASS SYSTEM  '/,HOB4(1)/'LE00070530
     4GENDRE POLYNOMIAL INDEX = MU INDEX =  MU ='/                      00070540
C                                                                       00070550
C                                                                       00070560
      CALL SCOLTV                                                       00070580
C                                                                       00070581
C                                                                       00071010
C     READ HEAD CARD                                                    00071020
C                                                                       00071030
      ICONT=1                                                           00071035
   10 CALL HEAD                                                         00071040
   15 LTT=IZZ                                                           00071050
C                                                                       00071060
C     TEST SECTION STRUCTURE                                            00071070
C                                                                       00071080
      IF (LTT .EQ. 2) GO TO 50                                          00071090
C                                                                       00071100
C     LEGENDRE EXPANSION                                                00071110
C                                                                       00071120
      CALL HEAD                                                         00071130
      LCT=IZZ                                                           00071140
      NL=IZ3                                                            00071150
      IX1=1                                                             00071160
      IX2=5                                                             00071170
      IX3=6                                                             00071180
      IX4=13                                                            00071190
      IF (LCT .EQ. 2) GO TO 22                                          00071200
      IX5=1                                                             00071210
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      IX6=5                                                                  00071220
      GO TO 23                                                               00071230
   22 IX5=6                                                                  00071240
      IX6=13                                                                 00071250
   23 CONTINUE                                                               00071260
      IX7=1                                                                  00071270
      IX8=7                                                                  00071280
      GO TO 100                                                              00071290
C                                                                            00071300
C     TABULATION                                                             00071310
C                                                                            00071320
   50 CALL TAB1                                                              00071330
      LCT=IZZ                                                                00071340
      NA=NP                                                                  00071350
      IX1=14                                                                 00071360
      IX2=16                                                                 00071370
      IX3=17                                                                 00071380
      IX4=29                                                                 00071390
      IF (LCT .EQ. 2) GO TO 62                                               00071400
      IX5=1                                                                  00071410
      IX6=5                                                                  00071420
      GO TO 63                                                               00071430
   62 IX5=6                                                                  00071440
      IX6=13                                                                 00071450
   63 CONTINUE                                                               00071460
      IX7=8                                                                  00071470
      IX8=12                                                                 00071480
  100 IF (IPLOT .EQ. 0) GO TO 103                                            00071490
      WRITE (16,101) HUB1,(HUB2(I),I=IX1,IX2)                                00071500
      WRITE (16,201) NA,(HUB2(I),I=IX3,IX4)                                  00071502
      WRITE (16,102) (HUB3(I),I=IX5,IX6)                                     00071510
  101 FORMAT (1H1/1H4/49X,2A4/34X,9A4/34X,5A4)                               00071520
  201 FORMAT (1HC,32X,I3,13A4)                                               00071522
  102 FORMAT (1HC,33X,8A4)                                                   00071530
  103 IX11=0                                                                 00071540
  150 IX11=IX11+1                                                            00071550
      CALL READ                                                              00071560
      IF (IPLOT .EQ. 0) GO TO 160                                            00071570
      IF (LTT .NE. 2) GO TO 155                                              00071580
      WRITE (16,151) (HUB4(I),I=IX7,IX8),IX11, HUB4(11),AWR1,AWR2,AWR3       00071590
  151 FORMAT (1H1/1H4/34X,3A4,I4,4X,4A4)                                     00071600
      GO TO 160                                                              00071610
  155 WRITE (16,156) (HUB4(I),I=IX7,IX8),IX11                                00071620
  156 FORMAT (1H1/1H4/34X,7A4,I4)                                            00071630
  160 NK=IZ3                                                                 00071640
      CALL FILE56                                                            00071650
      IF (IX11 .LT. NA) GO TO 150                                            00071660
C                                                                            00071670
C     READ SECTION END CARD                                                  00071680
C                                                                            00071690
      CALL READ                                                              00071700
C                                                                            00071710
C     IS THE NEXT CARD THE LAST CARD IN FILE 6                               00071720
C                                                                            00071730
      ICONT=1                                                                00071735
      CALL READ                                                              00071740
      IF (MF .NE. 0) GO TO 15                                                00071750
      RETURN                                                                 00071760
      END                                                                    00071770
```

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      SUBROUTINE QUIT                                                   00075000
      COMMON/HCARD/ZA1,ZA2,ZA3,AWR1,AWR2,AWR3,IZ1,IZ2,IZ3,IZ4,          00075010
     1MAT,MF,MT,ISEQ                                                    00075020
      COMMON/ICO/ICONT,ICONT1,IHOL                                      00075030
      COMMON WORD(18),HOL(425),E(2000),COE(200,30)                      00075040
      DIMENSION SIGMA(2000)                                             00075041
      EQUIVALENCE (COE(1,1),SIGMA(1))                                   00075042
      COMMON/LABELS/TITLE(14),ABSC(14),ORD(14),ORDS(6,30)/REACTS/MTS(30)00075050
      INTEGER C(4000)                                                   00075060
      EQUIVALENCE (E(1),C(1))                                           00075070
      DIMENSION A(8)                                                    00075080
      DATA A(1)/'POLYNOMIAL  TABULATION    IS NOT'/,        NCOUNT/0/   00075090
    1 IF (ICONT1 .EQ. 0) GO TO 900                                      00075200
      ISEQ=-1                                                           00075210
      WRITE (8,2) ISEQ                                                  00075220
    2 FORMAT (75X,I5)                                                   00075230
      END FILE 8                                                        00075235
      REWIND 8                                                          00075240
    5 K1=-13                                                            00075250
    3 K1=K1+14                                                          00075260
      K2=K1+13                                                          00075270
      READ (8,4) (C(K),K=K1,K2)                                         00075280
      IF (K1 .NE. 1) GO TO 9                                            00075281
      IF (C(K2) .NE. 0) GO TO 9                                         00075282
      WRITE (6,999)                                                     00075283
      WRITE (6,1009) C(11)                                              00075284
 1009 FORMAT (1HO,26X,'MATERIAL',I5,' WAS SKIPPED')                     00075285
      GO TO 5                                                           00075286
    9 CONTINUE                                                          00075287
    4 FORMAT (2(A4,A4,A3),4I11,I4,I2,I3,I5)                             00075290
      IF (K2 .NE. 3990) GO TO 10                                        00075300
      WRITE (6,7) K2                                                    00075310
    7 FORMAT (1HO,'ERROR IN SUBROUTINE QUIT, K2=',I5)                   00075320
      CALL EXIT                                                         00075330
   10 IF (C(K2) .EQ. -1) GO TO 19                                       00075340
      IF (C(11) .EQ. C(K2-3)) GO TO 3                                   00075350
   19 BACKSPACE 8                                                       00075360
      NCARD=K2/14                                                       00075370
      MATO=C(11)                                                        00075380
      NFILE=C(12)                                                       00075390
  100 WRITE (6, 999)                                                    00075400
      WRITE (6,1000) MATO,NFILE                                         00075410
  999 FORMAT (1H1)                                                      00075430
 1000 FORMAT (1HC,47X,'MATERIAL ',I4,'  FILE ',I2)                      00075440
  110 IH=(C(36)-1)*3+1                                                  00075460
      IH1=IH+2                                                          00075470
  120 NCOUNT=7                                                          00075480
      WRITE (6,1002) C(23)                                              00075490
 1002 FORMAT (1HO,26X,I3,' HOLLERITH CARDS IN SECTION 1, MT=451')       00075500
  130 IH2=8-C(8)                                                        00075510
      IH3=8-C(21)                                                       00075520
      IH4=8-C(22)                                                       00075530
  140 WRITE (6,1003) A(IH2),A(IH2),(A(I),I=IH,IH1),A(IH3),A(IH3),A(IH4),00075540
     1A(IH4)                                                            00075550
      I1=  (C(8)+C(21)+C(22))*14+29                                     00075560
 1003 FORMAT (1H ,26X,'DATA FOR NU',A4,' GIVEN.  SECTION 2',A4,' PRESENT00075570
     1, MT=452   ',3A4/27X,'DECAY DATA',A4,' GIVEN.  SECTION 3',A4,' PRE00075580
     2SENT, MT=453  '/27X,'FISSION PRODUCT YIELD DATA',A4,' GIVEN.  SECT00075590
     3ION 4',A4,' PRESENT, MT=454')                                     00075600
  200 NFILE=C(I1+11)                                                    00075610
      NFILE2=2                                                          00075615
      NIS=0                                                             00075620
      NIP=0                                                             00075625
      IF (NFILE .NE. 2) GO TO 210                                       00075630
      IH1=7                                                             00075640
      NIS=C(I1+8)                                                       00075650
      NIP=1                                                             00075655
      I1=I1+14                                                          00075660
  210 NCOUNT=NCOUNT+4                                                   00075670
      WRITE (6,1000) MATO,NFILE2                                        00075680
      IF (NIS .EQ. 0) GO TO 250                                         00075690
      WRITE (6,1005) NIS                                                00075700
 1005 FORMAT (1HO,26X,I2,' ISOTOPES IN THIS MATERIAL')                  00075710
      GO TO 260                                                         00075720
  250 WRITE (6,1006)                                                    00075730
 1006 FORMAT (1HC,26X,'FILE 2 NOT PRESENT FOR THIS MATERIAL')           00075740
  260 NFILE=NFILE+NIP                                                   00075750
  270 IF (C(I1+13) .EQ. -1) GO TO 900                                   00075760
      IF (NFILE .EQ. 7) GO TO 800                                       00075770
      IF (NCOUNT .LE. 38) GO TO 280                                     00075780
      NCOUNT=0                                                          00075790
      WRITE (6,999)                                                     00075800
  280 NCOUNT=NCOUNT+2                                                   00075810
      WRITE (6,1000) MATO,NFILE                                         00075820
      IF (NFILE .EQ. C(I1+11)) GO TO 300                                00075830
      NCOUNT=NCOUNT+2                                                   00075840
      WRITE (6,1007) NFILE                                              00075850
```

```
1007 FORMAT (1HO,26X,'FILE',I2,' NOT PRESENT FOR THIS MATERIAL')        00075860
     NIP=1                                                              00075865
     GO TO 26C                                                          00075870
 300 DO 4CC I=1,NCARD                                                   00075880
     IF (C(I1+11) .EQ. 0) GO TO 42C                                     00075890
     IF (NCOUNT .LE. 41 ) GO TO 301                                     00075900
     NCOUNT=0                                                           00075910
     WRITE (6,999)                                                      00075920
 301 NCOUNT=NCOUNT+1                                                    00075930
     DO 310 LOOP=1,27                                                   00075940
     IF (C(I1+12) .EQ. MTS(LOOP)) GO TO 311                             00075950
 310 CONTINUE                                                           00075960
 311 WRITE (6,1008) (ORDS(MOVE,LCOP),MOVE=1,6)                          00075970
1008 FORMAT (27X,6A4)                                                   00075980
 400 I1=I1+14                                                           00075990
     WRITE (6,101C)                                                     00076000
1010 FORMAT (1HO,'ERROR IN SUBROUTINE QUIT, EXIT FROM STATEMENT 400')   00076010
     CALL EXIT                                                          00076020
 420 I1=I1+14                                                           00076030
     NIP=1                                                              00076035
     GO TO 26C                                                          00076040
 800 IF (NCOUNT .LE. 38) GO TO 810                                      00076050
     NCOUNT=0                                                           00076060
     WRITE (6,999)                                                      00076070
 810 WRITE (6,1000) MATO,NFILE                                          00076080
     IF (MATO .EQ. C(I1+10)) GO TO 850                                  00076090
     WRITE (6,1007) NFILE                                               00076100
 820 IF (C(I1+13) .EQ. -1) GO TO 9C0                                    00076110
     GO TO 5                                                            00076120
 850 WRITE (6,1011)                                                     00076130
1011 FORMAT (1HC,26X,'THERMAL NEUTRON DATA IS GIVEN, MT=4')             00076140
     I1=I1+14                                                           00076150
     GO TO 82C                                                          00076160
 900 IF (ICONT1 .NE. C) REWIND 8                                        00076170
     CALL EXIT                                                          00076180
     STOP                                                               00076190
     END                                                                00076200
```

```
     SUBROUTINE DECADE (NO,LA,N)                                        00080000
     COMMON/TCARD/T1,T2,T3,Q1,Q2,Q3,LT,IZZ,NR,NP,NBT(20),INT(20)        00080010
     COMMON WORD(18),HOL(425),E(2000),COE(200,30)                       00080020
     DIMENSION SIGMA(2000)                                              00080021
     EQUIVALENCE (COE(1,1),SIGMA(1))                                    00080022
     LB=NBT(N+NO)                                                       00080030
     IF (N .NE. 1) LA=NBT(N+NO-1)                                       00080040
     NDEC=ALOG10(E(LB)/E(LA))                                           00080050
     IF (NDEC+1 .LE. 1C) GO TO 750                                      00080060
     E1=E(LA)*10**(NDEC/2)                                              00080070
     DO 705 NN=LA,LB                                                    00080080
     IF (E1 .LE. E(NN)) GO TO 710                                       00080090
     NN=NN                                                              00080100
 705 CONTINUE                                                           00080110
 710 I2=INT(N+NO)                                                       00080120
     NX1=NO+N                                                           00080130
     NX2=NR+NO+1                                                        00080140
     DO 72C NNN=NX1,NX2                                                 00080150
     N1=NBT(NNN)                                                        00080160
     I1=INT(NNN)                                                        00080170
     NBT(NNN)=NN                                                        00080180
     INT(NNN)=I2                                                        00080190
     NN=N1                                                              00080200
 720 I2=I1                                                              00080210
     NO=NO+1                                                            00080220
 750 RETURN                                                             00080230
     END                                                                00080240
```


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