ETOT

A Fortran IV Program to Process Data From the ENDF/B File To Thermal Library Format

Westinghouse Nuclear Energy Systems

Proprietary Class III

ETOT

A Fortran IV Program to Process Data From the ENDF/B File To Thermal Library Format

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ABSTRACT

ETOT is a digital computer program which processes basic nuclear data in the ENDF/B format and produces library data in thermal library format. ETOT is written entirely in ASA standard FORTRAN and is designed to be computer independent. Along with printed results, the output includes punched cards in the format appropriate to the desired library.

1.0 INTRODUCTION

ETOT was developed to provide a program which would convert the ENDF/B (Reference 1, 2) data into the various thermal libraries. (The name, ETOT, is the mnemonic for ENDF/B TO Thermal.)

The basic frame of ETOT is based on ETOM-1 (Reference 3), a program to process the data from the ENDF/B file to the MUFT format.

In this report, a limited knowledge of the thermal codes (References 4-9) and the ENDF/B structure is assumed. Some ENDF/B notation will be used without a detailed explanation. Likewise the meanings of the thermal parameters will not be explained in detail but only the means of calculating them will be described.

2.0 PROGRAM DESCRIPTION

2.1 General Information

The program is divided into four general parts - input, resonance data, smooth data and output. These sections will be described separately in the following pages.

2.1.1 Average Values

ETOT may be asked to calculate group averaged cross sections. These are calculated as

$$\bar{\sigma} = \frac{\int \sigma(E)\ W(E)\ dE}{\int W(E)\ dE} \quad .$$

Here the integral is taken over the appropriate energy range (usually) the group) and W(E) is the weighting function. The present version of the program does the integration by using the specified interpolation schemes associated with the cross sections and the weighting function.

2.1.2 Weighting Functions

At present there are four possible weighting functions. These are 1/E, constant at a value of 1.0, input, or a combination of a Maxwellian distribution joined to 1/E.

For the combination of a Maxwellian distribution joined to 1/E, the joining point is taken at the energy 4kT. The Maxwellian distribution is given by:

$$W(E) = \frac{E}{(kT)^2} \exp(-E/kT)$$

where

k - Boltzmann's constant - 8.6167×10^5 ev/°K

T - Temperature °K

E - energy ev.

E_J - energy ev. at joining point

The 1/E part of the function is given by C/E where

$$C = \frac{E_J}{(kT)^2} \exp(-E_J/kT)$$

2.1.3 Point Values

ETOT has to calculate point values of the cross sections. These are found by interpolation of the given function using the interpolation schemes given by the data.

2.2 Resolved Resonance Data

ETOT will calculate KATE type resonance parameters and/or calculate the microscopic cross sections using the single level Breit-Wigner formula.

The resonance parameters are located in file 2 of the ENDF/B tape. Since ETOT does not consider unresolved resonances, only the resolved parameters are read from the ENDF/B tape. This corresponds to the section where LRU=1.

The user inputs through the parameter IRES the number of resonances which will be represented by KATE type resonance parameters.

The KATE resonance parameters are given separately for each type of cross section, capture, fission and scattering. They will only be calculated when the remaining non-resonant cross section can be input to KATE as a single number, i.e. capture or fission being 1/v and scattering being a constant. Otherwise, the cross sections are calculated over the thermal library energy mesh as described in section 2.2.1.

2.2.1 Microscopic Cross Sections

The Breit-Wigner single level formulation is used when the microscopic cross sections are to be computed from the resonance parameters:

$$\sigma_c = \sigma_o \left(\frac{|E_o|}{E}\right)^{1/2} \frac{\Gamma_\gamma}{\Gamma} \frac{1}{1+x^2}$$

$$\sigma_f = \sigma_o \left(\frac{|E_o|}{E}\right)^{1/2} \frac{\Gamma_f}{\Gamma} \frac{1}{1+x^2}$$

$$\sigma_s = \sigma_o \frac{\Gamma_n}{\Gamma} \frac{1}{1+x^2} + \sqrt{\sigma_o \sigma_p g \frac{\Gamma_n}{\Gamma}} \frac{2x}{1+x^2} + \sigma_p$$

$$\sigma_o = \frac{(2.6036 \times 10^6)}{|E_o|} \frac{\Gamma_n}{\Gamma} g \left(\frac{AWR + 1.008665}{AWR}\right)^2$$

$$\sigma_p = 4\pi R^2$$

where R is designated as AP in ENDF/B

$$x = \frac{2(E-E_o)}{\Gamma}$$

$$g = \frac{2J+1}{2(2I+1)}$$

$$\Gamma = \Gamma_n + \Gamma_\gamma + \Gamma_f$$

The cross section is computed for each resonance of all isotopes in the material. The complete cross section is taken as the sum of the cross sections from each resonance times its relative isotopic abundance. If the cross sections are point values, the cross section is calculated at the energy point. If the cross sections are group averaged values, the cross section is calculated over 100 energy points of equal mesh spacing per group and then averaged over the group.

All resonances are used when calculating the cross sections; however, it must be remembered that these cross sections are added to the smooth cross sections from file 3 only for points within the resonance region as defined by the ENDF/B tape.

2.2.2 KATE Resonance Parameters

The KATE resonance parameters are denoted* by E_o, Γ_n^o, Γ_a, K_1, K_2, and K_3. If KATE resonance parameters are desired, ETOT will find the IRES largest resonances that are both within the thermal library range and within the ENDF/B defined resonance region. The resonances are compared as to their total peak cross section given by

$$\sigma_o = \frac{(2.6036 \times 10^6)}{|E_o|} \frac{\Gamma_n}{\Gamma} g \left(\frac{AWR + 1.008665}{AWR}\right)^2$$

The IRES largest resonances are converted into KATE parameters if the background cross sections are 1/v. The background is composed of the remaining resonances (usually epithermal) and the smooth cross sections from ENDF/B file 3.

The single level Breit-Wigner formula, when written using the KATE parameters is given by:

$$E\ \sigma_a = \frac{K_1\gamma}{(\Gamma_a + \Gamma_n^o E^{1/2})^2 + 4(E - E_o)^2}$$

$$E\ \sigma_f = \frac{K_2\gamma}{(\Gamma_a + \Gamma_n^o E^{1/2})^2 + 4(E - E_o)^2}$$

$$\sigma_s = \frac{K_3\gamma}{(\Gamma_a + \Gamma_n^o E^{1/2})^2 + 4(E - E_o)^2}$$

*In the KATE report (ref. 9), Γ_n^o is denoted by n and Γ_a is denoted by γ.

where

$$\Gamma_a = \Gamma_\gamma + \Gamma_f$$

$$\Gamma_n^o = \frac{\Gamma_n}{|E_o|}$$

$$K_1 = \frac{(2.6036 \times 10^6)}{|E_o|} \Gamma_n g \left(\frac{AWR + 1.008665}{AWR}\right)^2$$

$$K_2 = \frac{(2.6036 \times 10^6)}{|E_o|} \Gamma_n g \frac{\Gamma_f}{\Gamma_\gamma + \Gamma_f} \left(\frac{AWR + 1.008665}{AWR}\right)^2$$

$$K_3 = \frac{(2.6036 \times 10^6)}{|E_o|} \Gamma_n g \frac{\Gamma_n}{\Gamma_\gamma + \Gamma_f} \left(\frac{AWR + 1.008665}{AWR}\right)^2$$

Since the resonance region usually will not cover the library energy mesh, the tails of the resonances which are put into KATE parameters must be subtracted from the smooth cross sections outside of the resonance region. Also, the scattering cross section does not include the interference term so it must be added to the smooth cross section for these resonances. This corresponds to the second term of the equation for σ_s in Section 2.2.1.

2.3 Smooth Cross Sections

The information required for the thermal codes includes the capture, fission, and scattering cross sections as well as the fission neutron yield and the average cosine of scattering. These values can be calculated as group averaged values or point values depending on the input option IAV.

2.3.1 Scattering

In the thermal range, the scattering cross section is taken as the elastic cross section which is obtained from ENDF/B file 3, MT=2.

2.3.2 Capture

The basic smooth capture is taken as σ_γ, but if any other "capture-like" cross section is non-zero, it is added to the capture cross section. If a material index is given in File 1, ETOT will see if the (n,γ) cross section is tabulated. If it is not, and σ_a is given, it will calculate σ_c by $\sigma_c = \sigma_a - \sigma_f$. σ_a is obtained from ENDF/B file 3, MT=27 and σ_γ is obtained from ENDF/B file 3, MT=102.

2.3.3 Fission

The fission cross section is taken from ENDF/B file 3, MT=18.

2.3.4 Neutrons per Fission

The number of neutrons per fission is taken as a single point value since it does not vary in the thermal range. ν is obtained from ENDF/B file 1, MT=452.

2.3.5 Average Cosine of Scattering

The average cosine of scattering is taken as a point value since it usually does not vary in the thermal range. μ is obtained from ENDF/B file 3, MT=251. If μ is not given on the ENDF/B tape, then

$$\bar{\mu} = \frac{2}{3\ AWR}$$

where AWR is the atomic mass ratio taken from ENDF/B file 1.

2.3.6 Epithermal Scattering and Epithermal Average Logarithmic Energy Change per Collission

Since ETOT cannot find values outside of the energy structure, the epithermal scattering is taken to be equal to the scattering in the highest group. The average logarithmic energy change is calculated using the approximation

$$\xi = 1 + \frac{(AWR - 1)}{2} \text{Log}_e \left(\frac{AWR - 1}{AWR + 1}\right)$$

where AWR is the atomic mass ratio taken from ENDF/B file 1.

2.3.7 Extension of the Cross Sections

Frequently the cross sections are not tabulated to a low enough energy on the ENDF/B tape. Rather than assume these cross sections are zero, ETOT extrapolates and calculates these values from a second degree polynomial fitted by least squares to the last ten points for which the cross section is known. The polynomial is of the form $a_o + a_1 E + a_2 E^2$ and it is fit to the values $\sqrt{E}\,\sigma_a$, $\sqrt{E}\,\sigma_f$ and σ_{tr} where $\sigma_{tr} = (1 - \bar{\mu})\sigma_s$. These coefficients correspond to the KATE smooth coefficients designated as $R_{i\ell}$.

3.0 EXECUTION INFORMATION AND OUTPUT DESCRIPTION

This section is written so as to be reasonably self-contained in order to provide sufficient information to run problems with the program. The intent is that this section will provide the user with a program running prescription. The other sections of this report should be consulted where further details are required.

3.1 Summary

ETOT is a program to process data from the ENDF/B file and produce thermal library decks for ARK, LASER, TEMPEST, THERMOS and KATE.

3.2 Limitations

Due to the finite storage capacity of the computer, certain limitations are necessary. It is felt that these restrictions are not presently confining. The program is constructed such that these limitations can be easily relaxed to accommodate future needs.

3.2.1 Group Restrictions

1) Maximum number of groups - 310
2) Maximum number of resonances representable in KATE parameters - 4 (NOTE: This is a KATE restriction).

3.2.2 ENDF/B Data Restrictions

3.2.2.1 File 1 - General Information

1) ν Representation by a polynomial: maximum number of coefficients - 10.
2) ν Representation by a tabulation: maximum number of tabulated points - 4000; maximum number of interpolation ranges - 50.

3.2.2.2 File 2 - Resonance Parameters

1) Maximum number of resolved resonances - 500.

3.2.2.3 File 3 - Smooth Cross Sections

1) Maximum number of points for each tabulation - 4000
2) Maximum number of interpolation ranges for each tabulation - 50.

3.2.3 Input Option Restrictions

1) Maximum number of points in input weighting function tabulation - 4000.
2) Maximum number of interpolation ranges for the input weighting function tabulation - 50.

3.3 Input Description

In the following input list, the various items are described and the columns to be used for each item designated. Standard FORTRAN input is used. For added convenience the actual program formats and symbols are also listed. The various options are more fully described in the next section.

Card No. 1 (20A4)

Item	Columns	Name	Description
1	1-80	LABEL	General output label

Card No. 2 (7I5, 13X, E12.5)

Item	Columns	Name	Description
1	1-5	INALL	0=only cards number 1-3 are read in. 1=all input cards are read.

Card No. 2 (7I5, 13X, E12.5) (cont'd.)

Item	Columns	Name	Description
2	6-10	MCODE	Program for which the library is intended =1 KATE =2 THERMOS =3 ARK =4 TEMPEST =5 LASER
3	11-15	NMAT	Number of materials
4	16-20	IREW	0=ENDF/B tape is not rewound by ETOT. 1=ENDF/B tape is rewound by ETOT.
5	21-25	IPUN	0=no punched output 1=punched output
6	26-30	IAPX	0=do not try to fit cross sections to 1/v 1=try to fit cross sections to 1/v
7	31-35	IRES	Number of resonances which are to be output by resonance parameters.
8	49-60	EPSLON	Maximum relative deviation for 1/v fit.
9	61-72	TEMP	Temperature for Maxwellian distribution.

Card No. 3 (4(2I5, 1X, A4)) or (12I5)

Item	Columns	Name	Description
1	1-5	MATNOS	ENDF/B tape material number
2	6-10	MATIDS	Principle thermal material number
3	12-15	MAT2ID	Secondary thermal material identification number. Alphanumeric (A4) for MCODE=1, 3 & 4 and numeric for MCODE= 2 or 5.

The above set is repeated NMAT times with four sets per card.

Card No. 4(5I5) (If INALL=1)

Item	Columns	Name	Description
1	1-5	IAV	If=0, cross sections will be group averaged If=1, cross sections will be point values.
2	6-10	IEU	Group structure option.
3	11-15	IW	Type of weighting function
4	16-20	MAXG	Number of groups
5	21-25	IGRAPH	Graphing option, graphs made if $\neq$ 0.
6	49-60	EPSMIN	Minimum error for combining two TAB1 functions
7	61-72	EPSMAX	Maximum error for combining two TAB1 functions

Card No. 5(4I5) (If INALL=1)

Item	Columns	Name	Description
1	1-5	NDFB	ENDF/B tape unit
2	6-10	IDTAP	ENDF/B tape ID
3	11-15	MODE	Mode of ENDF/B tape =1 binary =2 BCD
4	16-20	LTAPE	Library tape unit If=0, no library written.

Card No. 6

This is actually a card set and is necessary only if IW=3. The set consists of the desired weighting function as tabulated points plus the interpolation tables defining the interpolation scheme to be used with the tabulated points. The weighting function must be given from low to high in energy. The format of the card set is a standard ENDF/B TAB 1 record.

Card 6.1 (44X, 2I11)

Item	Columns	Name	Description
1	45-55	N1	Number of interpolation ranges
2	56-66	N2	Number of weighting function points.

Card 6.2 - ... (6I11)

Item	Columns	Name	Description
1	1-11	NBT(1)	Last point number in 1st interpolation range.
2	12-22	JNT(1)	Interpolation scheme for 1st range
3	23-33	NBT(2)	Last point number in 2nd interpolation range.
4	34-44	JNT(2)	Interpolation scheme for 2nd range.
⋮			
etc.			
2*N1-1		NBT(N1)	Last point number in N1 interpolation range.
2*N1		JNT(N1)	Interpolation scheme for the N1 range.

Card 6.3 - ... (6E11.4)

Item	Columns	Name	Description
1	1-11	BLOK3(1)	First energy point ($\leq$ lowest energy in group structure).
2	12-22	BLOK4(1)	Weight at this energy.
⋮			
etc. using N2/3 cards			
⋮			
2*N2-1		BLOK3(N2)	Last energy point ($\geq$ highest energy in group structure).

Card 6.3 - ... (6E11.4) (cont'd.)

Item	Columns	Name	Description
2*N2		BLOK4 (N2)	Weight at this energy.

Card No. 7

This is actually a card set and is necessary only if INALL=1 and IEU=1,2,3,6,7, or 8. If IEU=1, the set is the energy breakpoints from low to high energy. If IEU=2, the set is the speed breakpoints of the structure given from low to high velocity. If IEU=3, the set is the energy points from low to high energy. If IEU=6, the set is the description of the energy point mesh in terms of the increments and endpoints. If IEU=7, the set is the speed points from low to high in energy. If IEU=8, the set is the description of the speed point mesh in terms of the increments and endpoints. An example best clarifies the increment input. If the input consists of XX(1)=0.0, XX(2)=.005, XX(3)=.1, XX(4)=.05, XX(5)=1.5, the energy array would begin at 0.0, step .005 for each point until .1 and then step .05 until 1.5. See Section 3.4.8 for further explanation.

An energy point or a group breakpoint of zero is allowed.

Card 7.1 (6E11.4)

Item	Columns	Name
1	1-11	XX(1)
2	12-22	XX(2)
⋮		
etc. using (MAXG+1)/6 cards		
⋮		
MAXG		XX(MAXG)
MAXG1		XX(MAXG1)

NOTE: (MAXG+1)/6 cards must be used, even if blanks must be used.

3.4 Available Options

3.4.1 Read Input Option (INALL)

This option is designed to facilitate stacked cases where several materials are to be processed in about the same way. Complete input is necessary only with the first case (INALL=1) and subsequent cases need only the first few cards (INALL=0).

3.4.2 Thermal Code Option (MCODE)

Since actual processing is the same, this merely controls the punched output formats. The available options are:

1	KATE
2	THERMOS
3	ARK
4	TEMPEST
5	LASER

3.4.3 Tape Rewind Option (IREW)

This is to provide running efficiency by a single pass over the ENDF/B tape during a stack of cases. The first case should request a tape rewind (IREW=1) but subsequent cases should not.

3.4.4 Punch Option (IPUN)

This option merely selects whether or not the results should be punched out on cards.

3.4.5 1/v Approximation Option (IAPX)

This is an option to signal that the cross section is to be tested for a 1/v fit within a relative error of EPSLON.

3.4.6 Resonance Parameter Option (IRES)

This corresponds to the maximum number of resonances which will be given as resonance parameters if the remaining cross section is 1/v. If the remaining cross section is not 1/v, no resonances will be specified by parameters.

3.4.7 Average Option (IAV)

This option determines whether the cross sections will be group averaged (IAV=0) or point values (IAV=1).

3.4.8 Energy Structure Option (IEU)

This option permits the standard thermal structures to be internally generated or allows the structure to be input in a variety of ways.

IEU=1	Input energy breakpoints
IEU=2	Input speed breakpoints
IEU=3	Input energy points
IEU=4	Standard LEOPARD 172 points
IEU=5	Standard LEOPARD 309 points
IEU=6	Energy increment input
IEU=7	Speed points input
IEU=8	Speed increment input
IEU=9	LASER standard 35 points
IEU=10	TEMPEST and KATE standard 246 points.
IEU=11	THERMOS standard 30 points

The speeds as input are in fractions of 2200 m/sec and the energies are in electron volts. The increment inputs are a shortened form by which the structures can be given. The first number is the initial value, the second is the increment, the third is the final value for this increment and the initial value for the next increment, etc. For example,

0.0, 0.1, 0.3, 0.2, 0.9

implies the point values:

0.0, 0.1, 0.2, 0.3, 0.5, 0.7, 0.9

The breakpoints are the end points of the groups while the points are the center points of the group.

3.4.9 Weighting Function Option (IW)

This option chooses the weighting function to be used. The following four are currently available and other built-in functions can be easily added in the future.

IW=1	1/E
IW=2	1.0
IW=3	Input
IW=4	Combination of 1/E plus Maxwellian.

3.4.10 Graph Option (IGRAPH)

This option allows for the absorption, fission and transport cross section to be graphed (IGRAPH > 1). If IGRAPH=9 only the 9" hard copy will be made and if IGRAPH=35 only the 35 mm film will be used. For any other value, both will be made.

3.4.11 Tape Mode Option (MODE)

The ENDF/B may be either in the standard binary or BCD mode. For compactness and running efficiency, it is recommended that the binary mode be used where possible.

3.5 Output

ETOT gives a very thorough listing of the cross sections and values associated with them, graphs of the absorption, fission and transport cross section, and punches cards in KATE, TEMPEST, LASER, THERMOS, or ARK format.

3.5.1 Printed Output

ETOT first lists the materials for which cross sections are to be found and then gives a summary of the input options. The group structure will then be listed. The energy is in e.v. and the speed is given as fractions of 2200 m/sec. If applicable, the weighting function will then be given.

The data description from file 1 is listed.

The potential scattering and the cross sections resulting from the resonance parameters are then listed.

The smooth coefficients are found and listed for the transport, fission and absorption cross sections.

ETOT will then give the final listing of the cross sections. The first set is the energy (E), square root of the energy (SQRT(E)), absorption cross section (SIGA), fission cross section (SIGF), capture cross section (SIGC), transport cross section (SIGTR), scattering cross section (SIGS) and the average cosine of the scattering angle (MUBAR) for each group, the thermal value of the number of neutrons per fission (NU), and the epithermal values of scattering (XS(EPI)) and average logarithmic energy change per collision times the scattering (XI*XS(EPI)). In the second set is the energy (E), square root of energy (SQRT(E)), number of neutrons per fission times the fission cross section (NUSIGF), the capture to fission ratio (ALPHA), the number of neutrons per absorption (ETA), square root of energy times the absorption cross section (RTE*SIGA), and the square root of energy times the fission cross section (RTE*SIGF).

The punched output is also listed.

3.5.2 Graphical Output

An option is available in ETOT to graph the transport, absorption

and fission cross sections. This is done using the S-C 4020 film plotting equipment.

3.6 Sample Problem Input

The sample problem processes data for ENDF/B material number 1104 and produces a 246 point TEMPEST deck. The 1104 data is that present on ENDF/B tape 201.

3.7 Sample Problem Output

The sample problem was run on a CDC-6600 using the scope 3.1 operating system. The output is on the following pages and is self-explanatory.

Westinghouse Electric Corporation

DATA CODING FORM

ETOT SAMPLE PROBLEM

ANALYST C. L. Beard DATE

PHONE L.S. NO. LABEL (73 — 76) SHEET 1

Cols. 1–10	11–20	21–30	31–40	41–50	51–60	61–70
	ETOT SAMPLE PRO	BLEM	PU-239	ENDF/B 1104		
4	1 1	1 0	0			
4	PU39					
10	0 246	1			1.00E-05	5.0
20 1	2 0					

ETOT SAMPLE PROBLEM PU-239 ENDF/B 1104

TEMPEST

ENDF/B MATERIAL	THERMAL MATERIAL FIRST ID	SECOND ID
1104	4	PU39

ENDF/B TAPE NUMBER = 201

ENDF/B TAPE LABEL = ENDF/B-II TAPE 201 REVISION 3 8-28-70

EPSMIN = 0.10E-04 EPSMAX = 0.50E-04

PUNCH OPTION = 1

NO RESONANCE PARAMETERS WILL BE CALCULATED

THE CROSS SECTIONS ARE POINT VALUES

THE CROSS SECTIONS WILL BE GRAPHED

*** ETOT ***

GROUP STRUCTURE

GROUP	ENERGY POINT	SPEED POINT	ENERGY RANGE	SPEED RANGE
1	0.000000	0.000000	0.000000 - .000500	0.000000 - .140580
2	.001000	.198811	.000500 - .001500	.140580 - .243492
3	.002000	.281161	.001500 - .002500	.243492 - .314347
4	.003000	.344350	.002500 - .003500	.314347 - .371941
5	.004000	.397621	.003500 - .004500	.371941 - .421741
6	.005000	.444554	.004500 - .005500	.421741 - .466252
7	.006000	.486985	.005500 - .006500	.466252 - .506870
8	.007000	.526004	.006500 - .007500	.506870 - .544466
9	.008000	.562322	.007500 - .008500	.544466 - .579628
10	.009000	.596432	.008500 - .009500	.579628 - .612776
11	.010000	.628695	.009500 - .010500	.612776 - .644220
12	.011000	.659380	.010500 - .011500	.644220 - .674200
13	.012000	.688700	.011500 - .012500	.674200 - .702902
14	.013000	.716822	.012500 - .013500	.702902 - .730477
15	.014000	.743881	.013500 - .014500	.730477 - .757049
16	.015000	.769991	.014500 - .015500	.757049 - .782718
17	.016000	.795243	.015500 - .016500	.782718 - .807573
18	.017000	.819717	.016500 - .017500	.807573 - .831685
19	.018000	.843482	.017500 - .018500	.831685 - .855117
20	.019000	.866596	.018500 - .019500	.855117 - .877924
21	.020000	.889108	.019500 - .020500	.877924 - .900154
22	.021000	.911065	.020500 - .021500	.900154 - .921847
23	.022000	.932505	.021500 - .022500	.921847 - .943042
24	.023000	.953463	.022500 - .023500	.943042 - .963771
25	.024000	.973970	.023500 - .024500	.963771 - .984063
26	.025000	.994053	.024500 - .025500	.984063 - 1.003945
27	.026000	1.013740	.025500 - .026500	1.003945 - 1.023441
28	.027000	1.033051	.026500 - .027500	1.023441 - 1.042572
29	.028000	1.052007	.027500 - .028500	1.042572 - 1.061359
30	.029000	1.070628	.028500 - .029500	1.061359 - 1.079818
31	.030000	1.088931	.029500 - .030500	1.079818 - 1.097968
32	.031000	1.106931	.030500 - .031500	1.097968 - 1.115822
33	.032000	1.124643	.031500 - .032500	1.115822 - 1.133395
34	.033000	1.142080	.032500 - .033500	1.133395 - 1.150700
35	.034000	1.159256	.033500 - .034500	1.150700 - 1.167748
36	.035000	1.176180	.034500 - .035500	1.167748 - 1.184551

*** ETOT ***

GROUP STRUCTURE

GROUP	ENERGY POINT	SPEED POINT	ENERGY RANGE	SPEED RANGE
37	.036000	1.192864	.035500 - .036500	1.184551 - 1.201119
38	.037000	1.209318	.036500 - .037500	1.201119 - 1.217462
39	.038000	1.225551	.037500 - .038500	1.217462 - 1.233588
40	.039000	1.241572	.038500 - .039500	1.233588 - 1.249506
41	.040000	1.257389	.039500 - .040500	1.249506 - 1.265224
42	.041000	1.273010	.040500 - .041500	1.265224 - 1.280748
43	.042000	1.288441	.041500 - .042500	1.280748 - 1.296087
44	.043000	1.303689	.042500 - .043500	1.296087 - 1.311247
45	.044000	1.318761	.043500 - .044500	1.311247 - 1.326233
46	.045000	1.333663	.044500 - .045500	1.326233 - 1.341051
47	.046000	1.348400	.045500 - .046500	1.341051 - 1.355708
48	.047000	1.362977	.046500 - .047500	1.355708 - 1.370208
49	.048000	1.377401	.047500 - .048500	1.370208 - 1.384556
50	.049000	1.391675	.048500 - .049500	1.384556 - 1.398757
51	.050000	1.405804	.049500 - .050500	1.398757 - 1.412815
52	.060000	1.539981	.050500 - .065000	1.412815 - 1.602863
53	.070000	1.663370	.065000 - .075000	1.602863 - 1.721751
54	.080000	1.778217	.075000 - .085000	1.721751 - 1.832944
55	.090000	1.886084	.085000 - .095000	1.832944 - 1.937767
56	.100000	1.988107	.095000 - .105000	1.937767 - 2.037203
57	.110000	2.085144	.105000 - .115000	2.037203 - 2.132007
58	.120000	2.177862	.115000 - .125000	2.132007 - 2.222771
59	.130000	2.266791	.125000 - .135000	2.222771 - 2.309972
60	.140000	2.352360	.135000 - .145000	2.309972 - 2.393998
61	.150000	2.434924	.145000 - .155000	2.393998 - 2.475173
62	.160000	2.514778	.155000 - .165000	2.475173 - 2.553770
63	.170000	2.592174	.165000 - .175000	2.553770 - 2.630018
64	.180000	2.667325	.175000 - .185000	2.630018 - 2.704118
65	.190000	2.740416	.185000 - .195000	2.704118 - 2.776240
66	.200000	2.811608	.195000 - .205000	2.776240 - 2.846536
67	.210000	2.881041	.205000 - .215000	2.846536 - 2.915137
68	.220000	2.948839	.215000 - .225000	2.915137 - 2.982160
69	.230000	3.015113	.225000 - .235000	2.982160 - 3.047710
70	.240000	3.079962	.235000 - .245000	3.047710 - 3.111880
71	.250000	3.143473	.245000 - .255000	3.111880 - 3.174752

*** EIOT ***

GROUP STRUCTURE

GROUP	ENERGY POINT	SPEED POINT	ENERGY RANGE	SPEED RANGE
72	.260000	3.205726	.255000 - .265000	3.174752 - 3.236404
73	.270000	3.266793	.265000 - .275000	3.236404 - 3.296902
74	.280000	3.326739	.275000 - .285000	3.296902 - 3.356311
75	.290000	3.385624	.285000 - .295000	3.356311 - 3.414686
76	.300000	3.443502	.295000 - .305000	3.414686 - 3.472079
77	.310000	3.500423	.305000 - .315000	3.472079 - 3.528540
78	.320000	3.556434	.315000 - .325000	3.528540 - 3.584111
79	.330000	3.611576	.325000 - .335000	3.584111 - 3.638833
80	.340000	3.665888	.335000 - .345000	3.638833 - 3.692745
81	.350000	3.719407	.345000 - .355000	3.692745 - 3.745880
82	.360000	3.772168	.355000 - .365000	3.745880 - 3.798273
83	.370000	3.824200	.365000 - .375000	3.798273 - 3.849953
84	.380000	3.875534	.375000 - .385000	3.849953 - 3.900947
85	.390000	3.926197	.385000 - .395000	3.900947 - 3.951284
86	.400000	3.976214	.395000 - .405000	3.951284 - 4.000988
87	.410000	4.025610	.405000 - .415000	4.000988 - 4.050082
88	.420000	4.074407	.415000 - .425000	4.050082 - 4.098587
89	.430000	4.122626	.425000 - .435000	4.098587 - 4.146526
90	.440000	4.170288	.435000 - .445000	4.146526 - 4.193916
91	.450000	4.217412	.445000 - .455000	4.193916 - 4.240777
92	.460000	4.264014	.455000 - .465000	4.240777 - 4.287126
93	.470000	4.310113	.465000 - .475000	4.287126 - 4.332979
94	.480000	4.355724	.475000 - .485000	4.332979 - 4.378351
95	.490000	4.400862	.485000 - .495000	4.378351 - 4.423259
96	.500000	4.445542	.495000 - .505000	4.423259 - 4.467715
97	.510000	4.489778	.505000 - .515000	4.467715 - 4.511733
98	.520000	4.533581	.515000 - .525000	4.511733 - 4.555325
99	.530000	4.576966	.525000 - .535000	4.555325 - 4.598505
100	.540000	4.619943	.535000 - .545000	4.598505 - 4.641282
101	.550000	4.662524	.545000 - .555000	4.641282 - 4.683669
102	.560000	4.704720	.555000 - .565000	4.683669 - 4.725676
103	.570000	4.746540	.565000 - .575000	4.725676 - 4.767313
104	.580000	4.787996	.575000 - .585000	4.767313 - 4.808589
105	.590000	4.829095	.585000 - .595000	4.808589 - 4.849514
106	.600000	4.869848	.595000 - .605000	4.849514 - 4.890096

*** ETOT ***

GROUP STRUCTURE

GROUP	ENERGY POINT	SPEED POINT	ENERGY RANGE	SPEED RANGE
107	.610000	4.910262	.605000 - .615000	4.890096 - 4.930345
108	.620000	4.950346	.615000 - .625000	4.930345 - 4.970267
109	.630000	4.990109	.625000 - .635000	4.970267 - 5.009872
110	.640000	5.029557	.635000 - .645000	5.009872 - 5.049165
111	.650000	5.068698	.645000 - .655000	5.049165 - 5.088156
112	.660000	5.107539	.655000 - .665000	5.088156 - 5.126849
113	.670000	5.146087	.665000 - .675000	5.126849 - 5.165253
114	.680000	5.184349	.675000 - .685000	5.165253 - 5.203374
115	.690000	5.222330	.685000 - .695000	5.203374 - 5.241217
116	.700000	5.260037	.695000 - .705000	5.241217 - 5.278789
117	.710000	5.297475	.705000 - .715000	5.278789 - 5.316095
118	.720000	5.334651	.715000 - .725000	5.316095 - 5.353142
119	.730000	5.371569	.725000 - .735000	5.353142 - 5.389934
120	.740000	5.408236	.735000 - .745000	5.389934 - 5.426476
121	.750000	5.444655	.745000 - .755000	5.426476 - 5.462774
122	.760000	5.480833	.755000 - .765000	5.462774 - 5.498832
123	.770000	5.516773	.765000 - .775000	5.498832 - 5.534655
124	.780000	5.552480	.775000 - .785000	5.534655 - 5.570248
125	.790000	5.587960	.785000 - .795000	5.570248 - 5.605615
126	.800000	5.623216	.795000 - .805000	5.605615 - 5.640761
127	.810000	5.658252	.805000 - .815000	5.640761 - 5.675688
128	.820000	5.693072	.815000 - .825000	5.675688 - 5.710402
129	.830000	5.727681	.825000 - .835000	5.710402 - 5.744907
130	.840000	5.762081	.835000 - .845000	5.744907 - 5.779205
131	.850000	5.796278	.845000 - .855000	5.779205 - 5.813301
132	.860000	5.830274	.855000 - .865000	5.813301 - 5.847198
133	.870000	5.864073	.865000 - .875000	5.847198 - 5.880900
134	.880000	5.897678	.875000 - .885000	5.880900 - 5.914409
135	.890000	5.931093	.885000 - .895000	5.914409 - 5.947730
136	.900000	5.964321	.895000 - .905000	5.947730 - 5.980865
137	.910000	5.997364	.905000 - .915000	5.980865 - 6.013818
138	.920000	6.030227	.915000 - .925000	6.013818 - 6.046591
139	.930000	6.062911	.925000 - .935000	6.046591 - 6.079188
140	.940000	6.095420	.935000 - .945000	6.079188 - 6.111610
141	.950000	6.127757	.945000 - .955000	6.111610 - 6.143862

*** ETOT ***

GROUP STRUCTURE

GROUP	ENERGY POINT	SPEED POINT	ENERGY RANGE	SPEED RANGE
142	.960000	6.159924	.955000 - .965000	6.143862 - 6.175945
143	.970000	6.191924	.965000 - .975000	6.175945 - 6.207862
144	.980000	6.223759	.975000 - .985000	6.207862 - 6.239616
145	.990000	6.255432	.985000 - .995000	6.239616 - 6.271209
146	1.000000	6.286946	.995000 - 1.005000	6.271209 - 6.302644
147	1.010000	6.318303	1.005000 - 1.015000	6.302644 - 6.333923
148	1.020000	6.349504	1.015000 - 1.025000	6.333923 - 6.365048
149	1.030000	6.380553	1.025000 - 1.035000	6.365048 - 6.396021
150	1.040000	6.411452	1.035000 - 1.045000	6.396021 - 6.426846
151	1.050000	6.442203	1.045000 - 1.055000	6.426846 - 6.457523
152	1.060000	6.472807	1.055000 - 1.065000	6.457523 - 6.488055
153	1.070000	6.503268	1.065000 - 1.075000	6.488055 - 6.518444
154	1.080000	6.533586	1.075000 - 1.085000	6.518444 - 6.548693
155	1.090000	6.563764	1.085000 - 1.095000	6.548693 - 6.578802
156	1.100000	6.593805	1.095000 - 1.105000	6.578802 - 6.608774
157	1.110000	6.623709	1.105000 - 1.115000	6.608774 - 6.638610
158	1.120000	6.653478	1.115000 - 1.125000	6.638610 - 6.668313
159	1.130000	6.683115	1.125000 - 1.135000	6.668313 - 6.697885
160	1.140000	6.712622	1.135000 - 1.145000	6.697885 - 6.727326
161	1.150000	6.741999	1.145000 - 1.155000	6.727326 - 6.756639
162	1.160000	6.771248	1.155000 - 1.165000	6.756639 - 6.785826
163	1.170000	6.800372	1.165000 - 1.175000	6.785826 - 6.814887
164	1.180000	6.829372	1.175000 - 1.185000	6.814887 - 6.843825
165	1.190000	6.858249	1.185000 - 1.195000	6.843825 - 6.872642
166	1.200000	6.887004	1.195000 - 1.205000	6.872642 - 6.901337
167	1.210000	6.915641	1.205000 - 1.215000	6.901337 - 6.929915
168	1.220000	6.944159	1.215000 - 1.225000	6.929915 - 6.958374
169	1.230000	6.972561	1.225000 - 1.235000	6.958374 - 6.986718
170	1.240000	7.000847	1.235000 - 1.245000	6.986718 - 7.014947
171	1.250000	7.029019	1.245000 - 1.255000	7.014947 - 7.043063
172	1.260000	7.057080	1.255000 - 1.265000	7.043063 - 7.071068
173	1.270000	7.085028	1.265000 - 1.275000	7.071068 - 7.098962
174	1.280000	7.112868	1.275000 - 1.285000	7.098962 - 7.126746
175	1.290000	7.140598	1.285000 - 1.295000	7.126746 - 7.154423
176	1.300000	7.168221	1.295000 - 1.305000	7.154423 - 7.181993

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GROUP STRUCTURE

GROUP	ENERGY POINT	SPEED POINT	ENERGY RANGE	SPEED RANGE
177	1.310000	7.195739	1.305000 - 1.315000	7.181993 - 7.209458
178	1.320000	7.223151	1.315000 - 1.325000	7.209458 - 7.236818
179	1.330000	7.250460	1.325000 - 1.335000	7.236818 - 7.264076
180	1.340000	7.277666	1.335000 - 1.345000	7.264076 - 7.291231
181	1.350000	7.304771	1.345000 - 1.355000	7.291231 - 7.318286
182	1.360000	7.331776	1.355000 - 1.365000	7.318286 - 7.345241
183	1.370000	7.358682	1.365000 - 1.375000	7.345241 - 7.372098
184	1.380000	7.385489	1.375000 - 1.385000	7.372098 - 7.398857
185	1.390000	7.412200	1.385000 - 1.395000	7.398857 - 7.425520
186	1.400000	7.438815	1.395000 - 1.405000	7.425520 - 7.452087
187	1.410000	7.465335	1.405000 - 1.415000	7.452087 - 7.478560
188	1.420000	7.491761	1.415000 - 1.425000	7.478560 - 7.504939
189	1.430000	7.518094	1.425000 - 1.435000	7.504939 - 7.531226
190	1.440000	7.544335	1.435000 - 1.445000	7.531226 - 7.557422
191	1.450000	7.570486	1.445000 - 1.455000	7.557422 - 7.583527
192	1.460000	7.596546	1.455000 - 1.465000	7.583527 - 7.609543
193	1.470000	7.622517	1.465000 - 1.475000	7.609543 - 7.635470
194	1.480000	7.648400	1.475000 - 1.485000	7.635470 - 7.661309
195	1.490000	7.674196	1.485000 - 1.495000	7.661309 - 7.687061
196	1.500000	7.699905	1.495000 - 1.505000	7.687061 - 7.712728
197	1.510000	7.725529	1.505000 - 1.515000	7.712728 - 7.738309
198	1.520000	7.751068	1.515000 - 1.525000	7.738309 - 7.763806
199	1.530000	7.776523	1.525000 - 1.535000	7.763806 - 7.789219
200	1.540000	7.801895	1.535000 - 1.545000	7.789219 - 7.814550
201	1.550000	7.827185	1.545000 - 1.555000	7.814550 - 7.839799
202	1.560000	7.852393	1.555000 - 1.565000	7.839799 - 7.864967
203	1.570000	7.877521	1.565000 - 1.575000	7.864967 - 7.890055
204	1.580000	7.902569	1.575000 - 1.585000	7.890055 - 7.915063
205	1.590000	7.927537	1.585000 - 1.595000	7.915063 - 7.939992
206	1.600000	7.952428	1.595000 - 1.605000	7.939992 - 7.964844
207	1.610000	7.977240	1.605000 - 1.615000	7.964844 - 7.989618
208	1.620000	8.001976	1.615000 - 1.625000	7.989618 - 8.014315
209	1.630000	8.026636	1.625000 - 1.635000	8.014315 - 8.038937
210	1.640000	8.051219	1.635000 - 1.645000	8.038937 - 8.063483
211	1.650000	8.075729	1.645000 - 1.655000	8.063483 - 8.087955

*** ETOT ***

GROUP STRUCTURE

GROUP	ENERGY POINT	SPEED POINT	ENERGY RANGE	SPEED RANGE
212	1.660000	8.100163	1.655000 - 1.665000	8.087955 - 8.112353
213	1.670000	8.124525	1.665000 - 1.675000	8.112353 - 8.136678
214	1.680000	8.148814	1.675000 - 1.685000	8.136678 - 8.160931
215	1.690000	8.173030	1.685000 - 1.695000	8.160931 - 8.185111
216	1.700000	8.197175	1.695000 - 1.705000	8.185111 - 8.209221
217	1.710000	8.221249	1.705000 - 1.715000	8.209221 - 8.233259
218	1.720000	8.245253	1.715000 - 1.725000	8.233259 - 8.257228
219	1.730000	8.269187	1.725000 - 1.735000	8.257228 - 8.281128
220	1.740000	8.293052	1.735000 - 1.745000	8.281128 - 8.304958
221	1.750000	8.316848	1.745000 - 1.755000	8.304958 - 8.328721
222	1.760000	8.340577	1.755000 - 1.765000	8.328721 - 8.352416
223	1.770000	8.364238	1.765000 - 1.775000	8.352416 - 8.376043
224	1.780000	8.387832	1.775000 - 1.785000	8.376043 - 8.399605
225	1.790000	8.411361	1.785000 - 1.795000	8.399605 - 8.423100
226	1.800000	8.434823	1.795000 - 1.805000	8.423100 - 8.446530
227	1.810000	8.458221	1.805000 - 1.815000	8.446530 - 8.469896
228	1.820000	8.481554	1.815000 - 1.825000	8.469896 - 8.493197
229	1.830000	8.504823	1.825000 - 1.835000	8.493197 - 8.516434
230	1.840000	8.528029	1.835000 - 1.845000	8.516434 - 8.539608
231	1.850000	8.551171	1.845000 - 1.855000	8.539608 - 8.562719
232	1.860000	8.574251	1.855000 - 1.865000	8.562719 - 8.585768
233	1.870000	8.597270	1.865000 - 1.875000	8.585768 - 8.608756
234	1.880000	8.620226	1.875000 - 1.885000	8.608756 - 8.631682
235	1.890000	8.643122	1.885000 - 1.895000	8.631682 - 8.654547
236	1.900000	8.665957	1.895000 - 1.905000	8.654547 - 8.677352
237	1.910000	8.688732	1.905000 - 1.915000	8.677352 - 8.700098
238	1.920000	8.711448	1.915000 - 1.925000	8.700098 - 8.722784
239	1.930000	8.734105	1.925000 - 1.935000	8.722784 - 8.745411
240	1.940000	8.756703	1.935000 - 1.945000	8.745411 - 8.767980
241	1.950000	8.779242	1.945000 - 1.955000	8.767980 - 8.790491
242	1.960000	8.801725	1.955000 - 1.965000	8.790491 - 8.812944
243	1.970000	8.824149	1.965000 - 1.975000	8.812944 - 8.835340
244	1.980000	8.846517	1.975000 - 1.985000	8.835340 - 8.857680
245	1.990000	8.868829	1.985000 - 1.995000	8.857680 - 8.879964
246	2.000000	8.891084	1.995000 - 2.005000	8.879964 - 8.902191

IN PROGRAM ETOT1 CP TIME WAS .8420 SEC. , ELAPSED TIME WAS 35.0000 SEC.

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THE (TAPE) DESCRIPTION OF MATERIAL  1104 IS -
     PU-239     CSEWG       ELAL-SEP69 HUTCHINS,LEONARD,CRAVEN,PRINCE
                            DIST-JAN70 REV-APR70
     *          *           *          *          *          *
     PLUTONIUM-239
                VARIOUS INDIVIDUALS CONTRIBUTED TO THE EVALUATION
                OF THE CROSS SECTIONS FOR THIS MATERIAL

                B.R.LEONARD(BNW)- CROSS SECTIONS BELOW 1.0 EV
                R HUTCHINS(GE-SUNNYVALE)- CROSS SECTION FROM 1.0EV
                            TO 25 KEV
                N.M.GREENE,J.L.LUCIUS,C.W.CRAVEN,JR.(ORNL)- FISSION
                            AND RADIATIVE CAPTURE CROSS SECTIONS 25 KEV
                            TO 15 MEV
                A.PRINCE(BNL) ALL OTHER CROSS SECTIONS ABOVE 25 KEV
                AND THE FISSILE AND FERTILE TASK FORCE (JUNE-AUG.,1969)
     *          *           *          *          *          *
     MAT=1104 IS A PARTIAL RE-EVALUATION OF THE DATA IN MAT=1051
     *          *           *          *          *          *
     THE TOTAL AND ALL PARTIAL CROSS SECTIONS FOR NEUTRON ENERGIES
     BELOW 1.0 EV WERE PROVIDED BY B.R.LEONARD,JR.(BNL), (UNPUBLISHED
     MEMO CSEWG (AUG. 1969).
     THE PARTIAL X-SEC WERE OBTAINED BY STARTING WITH DATA GIVEN IN
     MAT=1051 AND MODIFYING THE SHAPE AND MAGNITUDE OF THESE DATA TO
     CONFORM TO THE 2200 M/SEC PARAMETERS (INCLUDING G FACTORS) THAT
     WERE OBTAINED DURING THE 1969 IAEA EVALUATION EFFORT (SEE- HANNA
     ET AL, ATOMIC ENERGY REVIEW, VOL VII, NO.4, 1969).
     *          *           *          *          *          *
     THE 2200 M/SEC PARAMETERS ARE
                TOTAL   =   1021.53
                ELASTIC=       8.626
                FISSION=     741.6
                N.GAMMA=     271.3
                NU      =      2.880
                ALPHA   =      0.36583
                ETA     =      2.1086
     *          *           *          *          *          *
     BELOW 1.0 EV, ALL X-SEC GIVEN IN FILE 3 (SMOOTH X-SEC).
     BETWEEN 1.0 EV AND 300 EV DATA GIVEN AS SLBW RESOLVED RESONANCE
     PARAMETERS PLUS BACKGROUND X-SEC IN FILE 3.
     BETWEEN 300 EV AND 25 KEV ALL DATA GIVEN IN FILE 2 (LRF=2,
     ENERG DEPENDENT REDUCED NEUTRON WIDTHS AND FISSION WIDTHS).
     ABOVE 25 KEV ALL DATA GIVEN IN FILE 3.
     *          *           *          *          *          *
```

BELOW 1.0 EV THE TOTAL AND FISSION CROSS SECTION WAS BASED ON
EVAL. BY LEONARD (BNW-09342(196) AND INCC(US)-58(1959)) AND AS
ADJUSTED BY LEONARD (UNPUBLISHED MEMO (1969)) TO CONFORM TO 1969
IAEA 2200 M/SEC VALUES. THE SCATTERING AND RADIATIVE CAPTURE
X-SEC SECTION WAS BASED ON EVAL. BY P.ALINE(GEAP-5272(1966)) AND
AS ADJUSTED BY LEONARD (1969).
* * * * * *
BETWEEN 1.0 EV AND 300 EV DATA BASED ON EVALUATION BY GREEBLER
AND HUTCHINS (GEAP-5272(1966)).
* * * * * *
BETWEEN 300 EV AND 25 KEV (UNRESOLVED) RESONANCE REGION)
S-WAVE STRENGTH FUNCTION OBTAINED BY FITTING TOTAL X-SEC MEASURED
BY UTTLEY (EANDC(UK)-35 L (1964) AND EANDC(UK)- 40 L (1964))
P-WAVE STRENGTH FUNCTION = CONSTANT =(1.5 E-04)
RADIATION WIDTH = CONSTANT = 0.0416 EV
FISSION WIDTH OBTAINED BY FITTING MEASUREMENTS OF SHUNK (LADC-
7620 AND LA 3586). JAMES (AERE-M2065(AMENDED 1968), PATRICK
(NUCLEAR DATA FOR REACTORS 2,117 (1967) , AND GWIN (1969 ORNL-RPI
DATA). ALSO ALPHA DATA MEASURED BY GWIN (1969 ORNL-RPI DATA),
CZIRR (1969 UCRL), AND SOWERBY (1969 HARWELL DATA).
* * * * * *
ABOVE 25 KEV THE N,GAMMA AND FISSION CROSS SECTIONS TAKEN FROM
EVAL. BY GREENE, LUCIUS, AND CRAVEN (ORNL-TM-2797, JAN.1970)
N,GAMMA FROM EVALUATING AVAILABLE MEASURED VALUES OF ALPHA
FISSION FROM EVALUATING RATIO OF FISS. X-SEC OF PU-239 TO THAT
OF U-235
TOTAL AND OTHER PARTIAL X-SEC OBTAIN BY PRINCE (BNL-1969) USING
OPTICAL MODEL CODES JUPITOR AND ABACUS-NEARREX
* * * * * *
VALUES OF NU(E) BASED ON 1969 IAEA RECOMMENDED VALUES AT THERMAL
FAST DATA BASED ON MEASURED VALUES OBTAINED BY SOLEILHAC (JNE 23,
257, 1969), CONDE ET AL (JNE 22, 53, 1968), AND BY HOPKINS AND
DIVEN (NP 48,433, 1963).
* * * * * *
FISSION PRODUCT YIELD DATA FROM RECOMMENDED VALUES OF M.E.MEEK
AND R.F.RIDER (APED-5398-A, REVISED OCT, 1968).
YIELDS NORMALIZED TO HAVE A SUM OF 2.0000
* * * * * *
ENERGY DISTRIBUTION OF SECONDARY NEUTRONS
FISSION, SIMPLE FISSION SPECTRUM, T(THERMAL)=1.41 MEV BASED ON
VALUE BY BARNARD ET AL (NP 71,228(1965)).
INELASTIC, (N,2N), AND (N,3N), MAXWELLIAN, T(E) BASED ON EVAL.
BY HUTCHINS AND GREEBLER (GEAP-5272 (1966))
* * * * * *
ANGULAR DISTR. OF ELASTICALLY SCATTERED NEUTRON BASED ON JUPITOR
CALCULATIONS MADE BY PRINCE (BNL),(1969).
ANG. FOR INELASTIC ASSUMED TO BE ISOTROPIC IN C.M. SYSTEM

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 *          *          *          *          *          *
IN PROGRAM FTOT2 CP TIME WAS    29.3840 SEC. , ELAPSED TIME WAS    54.0000 SEC.
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*** EIOI ***

RESONANCE DATA

MICROSCOPIC CROSS SECTIONS

RESONANCE REGION IS 0.10E+01 TO 0.30E+03 EV.

POTENTIAL SCATTERING = 10.29217

GROUP	FISSION	CAPTURE	SCATTERING	GROUP	FISSION	CAPTURE	SCATTERING
147	0.24903E+02	0.87370E+01	0.99887E+01	181	0.14786E+02	0.45075E+01	0.94769E+01
148	0.24441E+02	0.85266E+01	0.99689E+01	182	0.14601E+02	0.44381E+01	0.94654E+01
149	0.23995E+02	0.83246E+01	0.99495E+01	183	0.14419E+02	0.43704E+01	0.94540E+01
150	0.23562E+02	0.81304E+01	0.99304E+01	184	0.14241E+02	0.43046E+01	0.94428E+01
151	0.23144E+02	0.79436E+01	0.99118E+01	185	0.14067E+02	0.42404E+01	0.94317E+01
152	0.22739E+02	0.77639E+01	0.98935E+01	186	0.13896E+02	0.41778E+01	0.94208E+01
153	0.22346E+02	0.75909E+01	0.98755E+01	187	0.13729E+02	0.41169E+01	0.94100E+01
154	0.21965E+02	0.74242E+01	0.98579E+01	188	0.13565E+02	0.40574E+01	0.93993E+01
155	0.21595E+02	0.72636E+01	0.98406E+01	189	0.13405E+02	0.39994E+01	0.93887E+01
156	0.21236E+02	0.71087E+01	0.98236E+01	190	0.13248E+02	0.39428E+01	0.93783E+01
157	0.20888E+02	0.69593E+01	0.98070E+01	191	0.13094E+02	0.38876E+01	0.93679E+01
158	0.20550E+02	0.68150E+01	0.97906E+01	192	0.12943E+02	0.38337E+01	0.93577E+01
159	0.20221E+02	0.66757E+01	0.97745E+01	193	0.12795E+02	0.37810E+01	0.93476E+01
160	0.19901E+02	0.65412E+01	0.97587E+01	194	0.12650E+02	0.37296E+01	0.93376E+01
161	0.19590E+02	0.64111E+01	0.97431E+01	195	0.12508E+02	0.36795E+01	0.93277E+01
162	0.19288E+02	0.62853E+01	0.97278E+01	196	0.12369E+02	0.36304E+01	0.93180E+01
163	0.18994E+02	0.61637E+01	0.97128E+01	197	0.12232E+02	0.35825E+01	0.93083E+01
164	0.18707E+02	0.60459E+01	0.96979E+01	198	0.12098E+02	0.35357E+01	0.92987E+01
165	0.18428E+02	0.59319E+01	0.96834E+01	199	0.11966E+02	0.34899E+01	0.92892E+01
166	0.18156E+02	0.58215E+01	0.96690E+01	200	0.11837E+02	0.34452E+01	0.92798E+01
167	0.17891E+02	0.57145E+01	0.96549E+01	201	0.11710E+02	0.34015E+01	0.92705E+01
168	0.17633E+02	0.56108E+01	0.96410E+01	202	0.11585E+02	0.33587E+01	0.92613E+01
169	0.17381E+02	0.55103E+01	0.96272E+01	203	0.11463E+02	0.33168E+01	0.92522E+01
170	0.17136E+02	0.54127E+01	0.96137E+01	204	0.11343E+02	0.32759E+01	0.92432E+01
171	0.16896E+02	0.53181E+01	0.96004E+01	205	0.11225E+02	0.32358E+01	0.92343E+01
172	0.16662E+02	0.52262E+01	0.95873E+01	206	0.11109E+02	0.31966E+01	0.92254E+01
173	0.16434E+02	0.51370E+01	0.95743E+01	207	0.10995E+02	0.31582E+01	0.92167E+01
174	0.16211E+02	0.50503E+01	0.95616E+01	208	0.10883E+02	0.31206E+01	0.92080E+01
175	0.15993E+02	0.49661E+01	0.95490E+01	209	0.10774E+02	0.30838E+01	0.91994E+01
176	0.15780E+02	0.48843E+01	0.95366E+01	210	0.10666E+02	0.30478E+01	0.91909E+01
177	0.15572E+02	0.48047E+01	0.95243E+01	211	0.10560E+02	0.30125E+01	0.91824E+01
178	0.15369E+02	0.47273E+01	0.95122E+01	212	0.10455E+02	0.29779E+01	0.91740E+01
179	0.15171E+02	0.46520E+01	0.95003E+01	213	0.10353E+02	0.29440E+01	0.91657E+01
180	0.14976E+02	0.45788E+01	0.94885E+01	214	0.10252E+02	0.29108E+01	0.91575E+01

*** EIOT ***

RESONANCE DATA

MICROSCOPIC CROSS SECTIONS

GROUP	FISSION	CAPTURE	SCATTERING	GROUP	FISSION	CAPTURE	SCATTERING
215	0.10153E+02	0.28782E+01	0.91493E+01	231	0.87679E+01	0.24344E+01	0.90276E+01
216	0.10055E+02	0.28463E+01	0.91413E+01	232	0.86924E+01	0.24108E+01	0.90205E+01
217	0.99596E+01	0.28150E+01	0.91332E+01	233	0.86180E+01	0.23876E+01	0.90134E+01
218	0.98653E+01	0.27843E+01	0.91253E+01	234	0.85446E+01	0.23648E+01	0.90064E+01
219	0.97725E+01	0.27543E+01	0.91174E+01	235	0.84724E+01	0.23424E+01	0.89994E+01
220	0.96813E+01	0.27247E+01	0.91096E+01	236	0.84013E+01	0.23204E+01	0.89925E+01
221	0.95915E+01	0.26958E+01	0.91018E+01	237	0.83312E+01	0.22988E+01	0.89856E+01
222	0.95032E+01	0.26674E+01	0.90942E+01	238	0.82621E+01	0.22775E+01	0.89788E+01
223	0.94163E+01	0.26396E+01	0.90865E+01	239	0.81940E+01	0.22566E+01	0.89721E+01
224	0.93307E+01	0.26122E+01	0.90790E+01	240	0.81269E+01	0.22361E+01	0.89653E+01
225	0.92465E+01	0.25854E+01	0.90715E+01	241	0.80608E+01	0.22159E+01	0.89587E+01
226	0.91636E+01	0.25590E+01	0.90640E+01	242	0.79956E+01	0.21960E+01	0.89520E+01
227	0.90820E+01	0.25332E+01	0.90566E+01	243	0.79314E+01	0.21765E+01	0.89454E+01
228	0.90017E+01	0.25078E+01	0.90493E+01	244	0.78680E+01	0.21573E+01	0.89389E+01
229	0.89226E+01	0.24829E+01	0.90420E+01	245	0.78056E+01	0.21385E+01	0.89324E+01
230	0.88447E+01	0.24584E+01	0.90348E+01	246	0.77440E+01	0.21199E+01	0.89259E+01

IN PROGRAM FTOT3 CP TIME WAS 3.9630 SEC. , ELAPSED TIME WAS 5.0000 SEC.

IN PROGRAM FTOT4 CP TIME WAS 2.8210 SEC. , ELAPSED TIME WAS 6.0000 SEC.

*** EIOT ***

TRANSPORT MICROSCOPIC CROSS SECTION
SMOOTH COEFICIENTS

R 0	R 1	R 2	R 3	R 4
0.87420E+01	0.	-0.49347E+01	0.	-0.48329E+02

FISSION MICROSCOPIC CROSS SECTION
SMOOTH COEFICIENTS

R 0	R 1	R 2	R 3	R 4
0.11570E+03	0.	0.23290E+02	0.	0.28643E+04

ABSORPTION MICROSCOPIC CROSS SECTION
SMOOTH COEFICIENTS

R 0	R 1	R 2	R 3	R 4
0.15171E+03	0.	0.30799E+03	0.	0.25384E+04

*** EIOT ***

MATERIAL NUMBER 4

SELECTED DATA SUMMARY

	2200 M/S	WEIGHTED AVERAGE	EQUIVALENT 2200 M/S
ABSORPTION	0.10130E+04	0.	0.
FISSION	0.74169E+03	0.	0.
CAPTURE	0.27126E+03	0.	0.
ALPHA	0.36574E+00	0.	0.
ETA	0.21088E+01	0.28800E+01	0.28800E+01
SCATTERING	0.86274E+01	0.	0.
TRANSPORT	0.86032E+01	0.	0.

*** EIOT ***

MATERIAL NUMBER 4

NU = 2.88000 XS(EPI) = 0.10626E+02 XI*XS(EPI) = 0.89419E-01

GROUP	E	SQRT(E)	SIGA	SIGF	SIGC	SIGIR	SIGS	MUBAR
1	0.	0.	0.	0.	0.	0.87420E+01	0.87666E+01	0.28130E-02
2	0.10000E-02	0.31623E-01	0.48074E+04	0.36596E+04	0.11479E+04	0.87374E+01	0.87620E+01	0.28130E-02
3	0.20000E-02	0.44721E-01	0.34064E+04	0.25884E+04	0.81801E+03	0.87311E+01	0.87557E+01	0.28130E-02
4	0.30000E-02	0.54772E-01	0.27872E+04	0.21141E+04	0.67306E+03	0.87274E+01	0.87520E+01	0.28130E-02
5	0.40000E-02	0.63246E-01	0.24189E+04	0.18315E+04	0.58740E+03	0.87212E+01	0.87458E+01	0.28130E-02
6	0.50000E-02	0.70711E-01	0.21682E+04	0.16389E+04	0.52930E+03	0.87164E+01	0.87410E+01	0.28130E-02
7	0.60000E-02	0.77460E-01	0.19837E+04	0.14968E+04	0.48686E+03	0.87105E+01	0.87350E+01	0.28130E-02
8	0.70000E-02	0.83666E-01	0.18406E+04	0.13864E+04	0.45417E+03	0.87054E+01	0.87300E+01	0.28130E-02
9	0.80000E-02	0.89443E-01	0.17256E+04	0.12976E+04	0.42797E+03	0.86995E+01	0.87240E+01	0.28130E-02
10	0.90000E-02	0.94868E-01	0.16306E+04	0.12242E+04	0.40640E+03	0.86942E+01	0.87188E+01	0.28130E-02
11	0.10000E-01	0.10000E+00	0.15505E+04	0.11622E+04	0.38831E+03	0.86895E+01	0.87140E+01	0.28130E-02
12	0.11000E-01	0.10488E+00	0.14817E+04	0.11088E+04	0.37295E+03	0.86838E+01	0.87083E+01	0.28130E-02
13	0.12000E-01	0.10954E+00	0.14220E+04	0.10623E+04	0.35965E+03	0.86785E+01	0.87030E+01	0.28130E-02
14	0.13000E-01	0.11402E+00	0.13695E+04	0.10214E+04	0.34806E+03	0.86727E+01	0.86972E+01	0.28130E-02
15	0.14000E-01	0.11832E+00	0.13228E+04	0.98497E+03	0.33786E+03	0.86674E+01	0.86918E+01	0.28130E-02
16	0.15000E-01	0.12247E+00	0.12811E+04	0.95230E+03	0.32877E+03	0.86615E+01	0.86859E+01	0.28130E-02
17	0.16000E-01	0.12649E+00	0.12435E+04	0.92282E+03	0.32064E+03	0.86560E+01	0.86805E+01	0.28130E-02
18	0.17000E-01	0.13038E+00	0.12093E+04	0.89603E+03	0.31328E+03	0.86501E+01	0.86745E+01	0.28130E-02
19	0.18000E-01	0.13416E+00	0.11782E+04	0.87161E+03	0.30661E+03	0.86446E+01	0.86690E+01	0.28130E-02
20	0.19000E-01	0.13784E+00	0.11497E+04	0.84924E+03	0.30044E+03	0.86386E+01	0.86630E+01	0.28130E-02
21	0.20000E-01	0.14142E+00	0.11235E+04	0.82864E+03	0.29482E+03	0.86330E+01	0.86573E+01	0.28130E-02
22	0.21000E-01	0.14491E+00	0.10992E+04	0.80962E+03	0.28958E+03	0.86269E+01	0.86513E+01	0.28130E-02
23	0.22000E-01	0.14832E+00	0.10768E+04	0.79194E+03	0.28482E+03	0.86212E+01	0.86455E+01	0.28130E-02
24	0.23000E-01	0.15166E+00	0.10558E+04	0.77549E+03	0.28034E+03	0.86151E+01	0.86394E+01	0.28130E-02
25	0.24000E-01	0.15492E+00	0.10364E+04	0.76019E+03	0.27616E+03	0.86092E+01	0.86335E+01	0.28130E-02
26	0.25000E-01	0.15811E+00	0.10182E+04	0.74576E+03	0.27239E+03	0.86032E+01	0.86274E+01	0.28130E-02
27	0.26000E-01	0.16125E+00	0.10012E+04	0.73246E+03	0.26870E+03	0.85971E+01	0.86214E+01	0.28130E-02
28	0.27000E-01	0.16432E+00	0.98515E+03	0.72000E+03	0.26515E+03	0.85909E+01	0.86151E+01	0.28130E-02
29	0.28000E-01	0.16733E+00	0.97010E+03	0.70822E+03	0.26188E+03	0.85849E+01	0.86091E+01	0.28130E-02
30	0.29000E-01	0.17029E+00	0.95593E+03	0.69706E+03	0.25887E+03	0.85786E+01	0.86028E+01	0.28130E-02
31	0.30000E-01	0.17321E+00	0.94244E+03	0.68644E+03	0.25600E+03	0.85725E+01	0.85966E+01	0.28130E-02
32	0.31000E-01	0.17607E+00	0.92964E+03	0.67586E+03	0.25398E+03	0.85661E+01	0.85902E+01	0.28130E-02
33	0.32000E-01	0.17889E+00	0.91780E+03	0.66577E+03	0.25203E+03	0.85599E+01	0.85840E+01	0.28130E-02
34	0.33000E-01	0.18166E+00	0.90642E+03	0.65686E+03	0.24956E+03	0.85534E+01	0.85775E+01	0.28130E-02
35	0.34000E-01	0.18439E+00	0.89562E+03	0.64902E+03	0.24661E+03	0.85471E+01	0.85712E+01	0.28130E-02
36	0.35000E-01	0.18708E+00	0.88526E+03	0.64149E+03	0.24377E+03	0.85405E+01	0.85646E+01	0.28130E-02

*** EJOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	SIGA	SIGF	SIGC	SIGTR	SIGS	MUBAR
37	0.36000E-01	0.18974E+00	0.87554E+03	0.63350E+03	0.24204E+03	0.85342E+01	0.85582E+01	0.28130E-02
38	0.37000E-01	0.19235E+00	0.86619E+03	0.62582E+03	0.24037E+03	0.85275E+01	0.85516E+01	0.28130E-02
39	0.38000E-01	0.19494E+00	0.85729E+03	0.61848E+03	0.23881E+03	0.85211E+01	0.85451E+01	0.28130E-02
40	0.39000E-01	0.19748E+00	0.84882E+03	0.61147E+03	0.23734E+03	0.85143E+01	0.85383E+01	0.28130E-02
41	0.40000E-01	0.20000E+00	0.84064E+03	0.60472E+03	0.23592E+03	0.85078E+01	0.85318E+01	0.28130E-02
42	0.41000E-01	0.20248E+00	0.83294E+03	0.59885E+03	0.23409E+03	0.85009E+01	0.85249E+01	0.28130E-02
43	0.42000E-01	0.20494E+00	0.82550E+03	0.59318E+03	0.23231E+03	0.84943E+01	0.85183E+01	0.28130E-02
44	0.43000E-01	0.20736E+00	0.81839E+03	0.58725E+03	0.23114E+03	0.84874E+01	0.85113E+01	0.28130E-02
45	0.44000E-01	0.20976E+00	0.81162E+03	0.58107E+03	0.23055E+03	0.84806E+01	0.85046E+01	0.28130E-02
46	0.45000E-01	0.21213E+00	0.80507E+03	0.57510E+03	0.22997E+03	0.84737E+01	0.84976E+01	0.28130E-02
47	0.46000E-01	0.21448E+00	0.79892E+03	0.57050E+03	0.22841E+03	0.84668E+01	0.84907E+01	0.28130E-02
48	0.47000E-01	0.21679E+00	0.79294E+03	0.56604E+03	0.22690E+03	0.84597E+01	0.84836E+01	0.28130E-02
49	0.48000E-01	0.21909E+00	0.78725E+03	0.56155E+03	0.22570E+03	0.84528E+01	0.84766E+01	0.28130E-02
50	0.49000E-01	0.22136E+00	0.78182E+03	0.55702E+03	0.22480E+03	0.84456E+01	0.84694E+01	0.28130E-02
51	0.50000E-01	0.22361E+00	0.77654E+03	0.55263E+03	0.22392E+03	0.84386E+01	0.84624E+01	0.28130E-02
52	0.60000E-01	0.24495E+00	0.73552E+03	0.51789E+03	0.21763E+03	0.83646E+01	0.83882E+01	0.28130E-02
53	0.70000E-01	0.26458E+00	0.71053E+03	0.49542E+03	0.21511E+03	0.82854E+01	0.83088E+01	0.28130E-02
54	0.80000E-01	0.28284E+00	0.69778E+03	0.47908E+03	0.21870E+03	0.82007E+01	0.82239E+01	0.28130E-02
55	0.90000E-01	0.30000E+00	0.69493E+03	0.47193E+03	0.22300E+03	0.81100E+01	0.81329E+01	0.28130E-02
56	0.10000E+00	0.31623E+00	0.70092E+03	0.47091E+03	0.23001E+03	0.80129E+01	0.80355E+01	0.28130E-02
57	0.11000E+00	0.33166E+00	0.71469E+03	0.47091E+03	0.24379E+03	0.78996E+01	0.79218E+01	0.28130E-02
58	0.12000E+00	0.34641E+00	0.73595E+03	0.47806E+03	0.25789E+03	0.77975E+01	0.78195E+01	0.28130E-02
59	0.13000E+00	0.36056E+00	0.76644E+03	0.49134E+03	0.27510E+03	0.76687E+01	0.76903E+01	0.28130E-02
60	0.14000E+00	0.37417E+00	0.80459E+03	0.50768E+03	0.29691E+03	0.75513E+01	0.75726E+01	0.28130E-02
61	0.15000E+00	0.38730E+00	0.85721E+03	0.53730E+03	0.31990E+03	0.74151E+01	0.74360E+01	0.28130E-02
62	0.16000E+00	0.40000E+00	0.92328E+03	0.57305E+03	0.35022E+03	0.72734E+01	0.72939E+01	0.28130E-02
63	0.17000E+00	0.41231E+00	0.10109E+04	0.62209E+03	0.38877E+03	0.71159E+01	0.71360E+01	0.28130E-02
64	0.18000E+00	0.42426E+00	0.11217E+04	0.68440E+03	0.43728E+03	0.69706E+01	0.69903E+01	0.28130E-02
65	0.19000E+00	0.43589E+00	0.12666E+04	0.76816E+03	0.49845E+03	0.68159E+01	0.68352E+01	0.28130E-02
66	0.20000E+00	0.44721E+00	0.14476E+04	0.87337E+03	0.57426E+03	0.66724E+01	0.66912E+01	0.28130E-02
67	0.21000E+00	0.45826E+00	0.16502E+04	0.99084E+03	0.65932E+03	0.65506E+01	0.65690E+01	0.28130E-02
68	0.22000E+00	0.46904E+00	0.19199E+04	0.11481E+04	0.77176E+03	0.64717E+01	0.64900E+01	0.28130E-02
69	0.23000E+00	0.47958E+00	0.22438E+04	0.13371E+04	0.90663E+03	0.64929E+01	0.65113E+01	0.28130E-02
70	0.24000E+00	0.48990E+00	0.26833E+04	0.15945E+04	0.10888E+04	0.66331E+01	0.66518E+01	0.28130E-02
71	0.25000E+00	0.50000E+00	0.32098E+04	0.19010E+04	0.13088E+04	0.70834E+01	0.71034E+01	0.28130E-02
72	0.26000E+00	0.50990E+00	0.38462E+04	0.22779E+04	0.15683E+04	0.78148E+01	0.78369E+01	0.28130E-02

*** ETOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	SIGA	SIGF	SIGC	SIGTR	SIGS	MUBAR
73	0.27000E+00	0.51962E+00	0.44275E+04	0.26222E+04	0.18053E+04	0.91506E+01	0.91765E+01	0.28130E-02
74	0.28000E+00	0.52915E+00	0.49536E+04	0.29337E+04	0.20199E+04	0.11044E+02	0.11075E+02	0.28130E-02
75	0.29000E+00	0.53852E+00	0.52312E+04	0.30982E+04	0.21330E+04	0.13406E+02	0.13444E+02	0.28130E-02
76	0.30000E+00	0.54772E+00	0.52398E+04	0.31033E+04	0.21365E+04	0.15765E+02	0.15809E+02	0.28130E-02
77	0.31000E+00	0.55678E+00	0.49639E+04	0.29398E+04	0.20240E+04	0.17546E+02	0.17595E+02	0.28130E-02
78	0.32000E+00	0.56569E+00	0.44137E+04	0.26140E+04	0.17997E+04	0.18589E+02	0.18641E+02	0.28130E-02
79	0.33000E+00	0.57446E+00	0.37255E+04	0.22064E+04	0.15191E+04	0.18808E+02	0.18861E+02	0.28130E-02
80	0.34000E+00	0.58310E+00	0.30580E+04	0.18111E+04	0.12469E+04	0.18696E+02	0.18749E+02	0.28130E-02
81	0.35000E+00	0.59161E+00	0.25230E+04	0.14995E+04	0.10235E+04	0.18204E+02	0.18255E+02	0.28130E-02
82	0.36000E+00	0.60000E+00	0.20635E+04	0.12319E+04	0.83161E+03	0.17738E+02	0.17788E+02	0.28130E-02
83	0.37000E+00	0.60828E+00	0.17254E+04	0.10409E+04	0.68447E+03	0.17196E+02	0.17245E+02	0.28130E-02
84	0.38000E+00	0.61644E+00	0.14336E+04	0.88154E+03	0.55208E+03	0.16681E+02	0.16728E+02	0.28130E-02
85	0.39000E+00	0.62450E+00	0.11917E+04	0.74467E+03	0.44702E+03	0.16217E+02	0.16262E+02	0.28130E-02
86	0.40000E+00	0.63246E+00	0.10025E+04	0.63434E+03	0.36811E+03	0.15782E+02	0.15826E+02	0.28130E-02
87	0.41000E+00	0.64031E+00	0.85671E+03	0.54752E+03	0.30919E+03	0.15409E+02	0.15452E+02	0.28130E-02
88	0.42000E+00	0.64807E+00	0.72764E+03	0.46886E+03	0.25877E+03	0.15061E+02	0.15104E+02	0.28130E-02
89	0.43000E+00	0.65574E+00	0.63420E+03	0.41166E+03	0.22254E+03	0.14760E+02	0.14802E+02	0.28130E-02
90	0.44000E+00	0.66332E+00	0.55359E+03	0.36161E+03	0.19198E+03	0.14488E+02	0.14529E+02	0.28130E-02
91	0.45000E+00	0.67082E+00	0.48836E+03	0.32075E+03	0.16761E+03	0.14253E+02	0.14293E+02	0.28130E-02
92	0.46000E+00	0.67823E+00	0.43670E+03	0.28806E+03	0.14864E+03	0.14028E+02	0.14068E+02	0.28130E-02
93	0.47000E+00	0.68557E+00	0.39609E+03	0.26252E+03	0.13357E+03	0.13838E+02	0.13877E+02	0.28130E-02
94	0.48000E+00	0.69282E+00	0.36394E+03	0.24209E+03	0.12185E+03	0.13654E+02	0.13693E+02	0.28130E-02
95	0.49000E+00	0.70000E+00	0.33359E+03	0.22269E+03	0.11091E+03	0.13496E+02	0.13534E+02	0.28130E-02
96	0.50000E+00	0.70711E+00	0.30589E+03	0.20532E+03	0.10057E+03	0.13346E+02	0.13383E+02	0.28130E-02
97	0.51000E+00	0.71414E+00	0.27350E+03	0.18387E+03	0.89635E+02	0.13215E+02	0.13252E+02	0.28130E-02
98	0.52000E+00	0.72111E+00	0.25579E+03	0.17263E+03	0.83158E+02	0.13087E+02	0.13124E+02	0.28130E-02
99	0.53000E+00	0.72801E+00	0.23689E+03	0.16037E+03	0.76514E+02	0.12977E+02	0.13013E+02	0.28130E-02
100	0.54000E+00	0.73485E+00	0.22227E+03	0.15118E+03	0.71086E+02	0.12869E+02	0.12905E+02	0.28130E-02
101	0.55000E+00	0.74162E+00	0.20496E+03	0.13994E+03	0.65018E+02	0.12772E+02	0.12808E+02	0.28130E-02
102	0.56000E+00	0.74833E+00	0.19374E+03	0.13279E+03	0.60947E+02	0.12681E+02	0.12717E+02	0.28130E-02
103	0.57000E+00	0.75498E+00	0.18275E+03	0.12564E+03	0.57106E+02	0.12599E+02	0.12635E+02	0.28130E-02
104	0.58000E+00	0.76158E+00	0.17343E+03	0.11951E+03	0.53913E+02	0.12519E+02	0.12554E+02	0.28130E-02
105	0.59000E+00	0.76811E+00	0.16392E+03	0.11339E+03	0.50531E+02	0.12447E+02	0.12482E+02	0.28130E-02
106	0.60000E+00	0.77460E+00	0.15310E+03	0.10623E+03	0.46870E+02	0.12377E+02	0.12412E+02	0.28130E-02
107	0.61000E+00	0.78102E+00	0.14516E+03	0.10103E+03	0.44138E+02	0.12313E+02	0.12348E+02	0.28130E-02
108	0.62000E+00	0.78740E+00	0.13828E+03	0.96531E+02	0.41751E+02	0.12252E+02	0.12287E+02	0.28130E-02

*** EIOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	SIGA	SIGF	SIGC	SIGIR	SIGS	MUBAR
109	0.63000E+00	0.79373E+00	0.13101E+03	0.91730E+02	0.39281E+02	0.12197E+02	0.12231E+02	0.28130E-02
110	0.64000E+00	0.80000E+00	0.12572E+03	0.88359E+02	0.37861E+02	0.12142E+02	0.12176E+02	0.28130E-02
111	0.65000E+00	0.80623E+00	0.11931E+03	0.84477E+02	0.36832E+02	0.12092E+02	0.12126E+02	0.28130E-02
112	0.66000E+00	0.81240E+00	0.11495E+03	0.81208E+02	0.35740E+02	0.12043E+02	0.12077E+02	0.28130E-02
113	0.67000E+00	0.81854E+00	0.11109E+03	0.78655E+02	0.34833E+02	0.11998E+02	0.12032E+02	0.28130E-02
114	0.68000E+00	0.82462E+00	0.10641E+03	0.75488E+02	0.33919E+02	0.11954E+02	0.11988E+02	0.28130E-02
115	0.69000E+00	0.83066E+00	0.10285E+03	0.73036E+02	0.33010E+02	0.11914E+02	0.11947E+02	0.28130E-02
116	0.70000E+00	0.83666E+00	0.98726E+02	0.70687E+02	0.32039E+02	0.11874E+02	0.11907E+02	0.28130E-02
117	0.71000E+00	0.84261E+00	0.96015E+02	0.68746E+02	0.31269E+02	0.11837E+02	0.11870E+02	0.28130E-02
118	0.72000E+00	0.84853E+00	0.93015E+02	0.66601E+02	0.30414E+02	0.11801E+02	0.11834E+02	0.28130E-02
119	0.73000E+00	0.85440E+00	0.89914E+02	0.64354E+02	0.29560E+02	0.11768E+02	0.11801E+02	0.28130E-02
120	0.74000E+00	0.86023E+00	0.87464E+02	0.62617E+02	0.28847E+02	0.11735E+02	0.11768E+02	0.28130E-02
121	0.75000E+00	0.86603E+00	0.85174E+02	0.60983E+02	0.28191E+02	0.11704E+02	0.11737E+02	0.28130E-02
122	0.76000E+00	0.87178E+00	0.82893E+02	0.59349E+02	0.27545E+02	0.11674E+02	0.11707E+02	0.28130E-02
123	0.77000E+00	0.87750E+00	0.80613E+02	0.57714E+02	0.26899E+02	0.11646E+02	0.11679E+02	0.28130E-02
124	0.78000E+00	0.88318E+00	0.78473E+02	0.56182E+02	0.26291E+02	0.11618E+02	0.11651E+02	0.28130E-02
125	0.79000E+00	0.88882E+00	0.77182E+02	0.55263E+02	0.25920E+02	0.11592E+02	0.11625E+02	0.28130E-02
126	0.80000E+00	0.89443E+00	0.75762E+02	0.54241E+02	0.25521E+02	0.11566E+02	0.11599E+02	0.28130E-02
127	0.81000E+00	0.90000E+00	0.73762E+02	0.52811E+02	0.24951E+02	0.11543E+02	0.11575E+02	0.28130E-02
128	0.82000E+00	0.90554E+00	0.71621E+02	0.51279E+02	0.24343E+02	0.11519E+02	0.11551E+02	0.28130E-02
129	0.83000E+00	0.91104E+00	0.70341E+02	0.50359E+02	0.23982E+02	0.11497E+02	0.11529E+02	0.28130E-02
130	0.84000E+00	0.91652E+00	0.69201E+02	0.49542E+02	0.23659E+02	0.11475E+02	0.11507E+02	0.28130E-02
131	0.85000E+00	0.92195E+00	0.67201E+02	0.48112E+02	0.23089E+02	0.11454E+02	0.11486E+02	0.28130E-02
132	0.86000E+00	0.92736E+00	0.66060E+02	0.47295E+02	0.22766E+02	0.11434E+02	0.11466E+02	0.28130E-02
133	0.87000E+00	0.93274E+00	0.64920E+02	0.46478E+02	0.22443E+02	0.11414E+02	0.11446E+02	0.28130E-02
134	0.88000E+00	0.93808E+00	0.63490E+02	0.45456E+02	0.22034E+02	0.11395E+02	0.11427E+02	0.28130E-02
135	0.89000E+00	0.94340E+00	0.62060E+02	0.44435E+02	0.21625E+02	0.11377E+02	0.11409E+02	0.28130E-02
136	0.90000E+00	0.94868E+00	0.61870E+02	0.43413E+02	0.21456E+02	0.11359E+02	0.11391E+02	0.28130E-02
137	0.91000E+00	0.95394E+00	0.59920E+02	0.42903E+02	0.21017E+02	0.11342E+02	0.11374E+02	0.28130E-02
138	0.92000E+00	0.95917E+00	0.58349E+02	0.41779E+02	0.20571E+02	0.11326E+02	0.11358E+02	0.28130E-02
139	0.93000E+00	0.96437E+00	0.57639E+02	0.41268E+02	0.20371E+02	0.11310E+02	0.11342E+02	0.28130E-02
140	0.94000E+00	0.96954E+00	0.56359E+02	0.40349E+02	0.20010E+02	0.11294E+02	0.11326E+02	0.28130E-02
141	0.95000E+00	0.97468E+00	0.55639E+02	0.39838E+02	0.19801E+02	0.11279E+02	0.11311E+02	0.28130E-02
142	0.96000E+00	0.97980E+00	0.54359E+02	0.38919E+02	0.19440E+02	0.11265E+02	0.11296E+02	0.28130E-02
143	0.97000E+00	0.98489E+00	0.53929E+02	0.38612E+02	0.19316E+02	0.11250E+02	0.11282E+02	0.28130E-02
144	0.98000E+00	0.98995E+00	0.52938E+02	0.37897E+02	0.19041E+02	0.11237E+02	0.11268E+02	0.28130E-02

*** EIOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	SIGA	SIGF	SIGC	SIGTR	SIGS	MUBAR
145	0.99000E+00	0.99499E+00	0.51928E+02	0.37182E+02	0.14746E+02	0.11222E+02	0.11254E+02	0.28130E-02
146	0.10000E+01	0.10000E+01	0.50928E+02	0.36467E+02	0.14461E+02	0.11208E+02	0.11240E+02	0.28130E-02
147	0.10100E+01	0.10050E+01	0.50797E+02	0.36318E+02	0.14478E+02	0.11656E+02	0.11689E+02	0.28130E-02
148	0.10200E+01	0.10100E+01	0.50046E+02	0.35832E+02	0.14214E+02	0.11636E+02	0.11669E+02	0.28130E-02
149	0.10300E+01	0.10149E+01	0.49319E+02	0.35361E+02	0.13958E+02	0.11617E+02	0.11649E+02	0.28130E-02
150	0.10400E+01	0.10198E+01	0.48615E+02	0.34905E+02	0.13710E+02	0.11598E+02	0.11630E+02	0.28130E-02
151	0.10500E+01	0.10247E+01	0.47931E+02	0.34462E+02	0.13469E+02	0.11579E+02	0.11612E+02	0.28130E-02
152	0.10600E+01	0.10296E+01	0.47268E+02	0.34032E+02	0.13236E+02	0.11561E+02	0.11593E+02	0.28130E-02
153	0.10700E+01	0.10344E+01	0.46624E+02	0.33615E+02	0.13009E+02	0.11543E+02	0.11576E+02	0.28130E-02
154	0.10800E+01	0.10392E+01	0.45998E+02	0.33210E+02	0.12788E+02	0.11525E+02	0.11558E+02	0.28130E-02
155	0.10900E+01	0.10440E+01	0.45389E+02	0.32816E+02	0.12573E+02	0.11508E+02	0.11541E+02	0.28130E-02
156	0.11000E+01	0.10488E+01	0.44797E+02	0.32432E+02	0.12365E+02	0.11491E+02	0.11524E+02	0.28130E-02
157	0.11100E+01	0.10536E+01	0.44221E+02	0.32060E+02	0.12161E+02	0.11475E+02	0.11507E+02	0.28130E-02
158	0.11200E+01	0.10583E+01	0.43660E+02	0.31697E+02	0.11963E+02	0.11458E+02	0.11491E+02	0.28130E-02
159	0.11300E+01	0.10630E+01	0.43113E+02	0.31344E+02	0.11770E+02	0.11442E+02	0.11474E+02	0.28130E-02
160	0.11400E+01	0.10677E+01	0.42581E+02	0.31000E+02	0.11581E+02	0.11426E+02	0.11459E+02	0.28130E-02
161	0.11500E+01	0.10724E+01	0.42062E+02	0.30664E+02	0.11397E+02	0.11411E+02	0.11443E+02	0.28130E-02
162	0.11600E+01	0.10770E+01	0.41555E+02	0.30338E+02	0.11217E+02	0.11396E+02	0.11428E+02	0.28130E-02
163	0.11700E+01	0.10817E+01	0.41061E+02	0.30019E+02	0.11042E+02	0.11381E+02	0.11413E+02	0.28130E-02
164	0.11800E+01	0.10863E+01	0.40578E+02	0.29708E+02	0.10870E+02	0.11366E+02	0.11398E+02	0.28130E-02
165	0.11900E+01	0.10909E+01	0.40107E+02	0.29404E+02	0.10702E+02	0.11351E+02	0.11383E+02	0.28130E-02
166	0.12000E+01	0.10954E+01	0.39646E+02	0.29108E+02	0.10538E+02	0.11337E+02	0.11369E+02	0.28130E-02
167	0.12100E+01	0.11000E+01	0.39196E+02	0.28819E+02	0.10377E+02	0.11323E+02	0.11355E+02	0.28130E-02
168	0.12200E+01	0.11045E+01	0.38755E+02	0.28536E+02	0.10219E+02	0.11309E+02	0.11341E+02	0.28130E-02
169	0.12300E+01	0.11091E+01	0.38325E+02	0.28260E+02	0.10065E+02	0.11295E+02	0.11327E+02	0.28130E-02
170	0.12400E+01	0.11136E+01	0.37903E+02	0.27990E+02	0.99132E+01	0.11282E+02	0.11314E+02	0.28130E-02
171	0.12500E+01	0.11180E+01	0.37490E+02	0.27726E+02	0.97646E+01	0.11269E+02	0.11300E+02	0.28130E-02
172	0.12600E+01	0.11225E+01	0.37086E+02	0.27468E+02	0.96188E+01	0.11256E+02	0.11287E+02	0.28130E-02
173	0.12700E+01	0.11269E+01	0.36690E+02	0.27215E+02	0.94756E+01	0.11243E+02	0.11274E+02	0.28130E-02
174	0.12800E+01	0.11314E+01	0.36303E+02	0.26968E+02	0.93350E+01	0.11230E+02	0.11262E+02	0.28130E-02
175	0.12900E+01	0.11358E+01	0.35922E+02	0.26725E+02	0.91968E+01	0.11217E+02	0.11249E+02	0.28130E-02
176	0.13000E+01	0.11402E+01	0.35549E+02	0.26488E+02	0.90611E+01	0.11205E+02	0.11237E+02	0.28130E-02
177	0.13100E+01	0.11446E+01	0.35184E+02	0.26256E+02	0.89275E+01	0.11193E+02	0.11224E+02	0.28130E-02
178	0.13200E+01	0.11489E+01	0.34825E+02	0.26028E+02	0.87962E+01	0.11181E+02	0.11212E+02	0.28130E-02
179	0.13300E+01	0.11533E+01	0.34472E+02	0.25805E+02	0.86670E+01	0.11169E+02	0.11200E+02	0.28130E-02
180	0.13400E+01	0.11576E+01	0.34127E+02	0.25587E+02	0.85398E+01	0.11157E+02	0.11188E+02	0.28130E-02

*** FIOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	SIGA	SIGF	SIGC	SIGIR	SIGS	MUBAR
181	0.13500E+01	0.11619E+01	0.33787E+02	0.25372E+02	0.84145E+01	0.11145E+02	0.11177E+02	0.28130E-02
182	0.13600E+01	0.11662E+01	0.33453E+02	0.25162E+02	0.82911E+01	0.11134E+02	0.11165E+02	0.28130E-02
183	0.13700E+01	0.11705E+01	0.33126E+02	0.24956E+02	0.81695E+01	0.11123E+02	0.11154E+02	0.28130E-02
184	0.13800E+01	0.11747E+01	0.32803E+02	0.24754E+02	0.80497E+01	0.11111E+02	0.11143E+02	0.28130E-02
185	0.13900E+01	0.11790E+01	0.32487E+02	0.24555E+02	0.79316E+01	0.11100E+02	0.11132E+02	0.28130E-02
186	0.14000E+01	0.11832E+01	0.32175E+02	0.24360E+02	0.78151E+01	0.11090E+02	0.11121E+02	0.28130E-02
187	0.14100E+01	0.11874E+01	0.31869E+02	0.24169E+02	0.77001E+01	0.11079E+02	0.11110E+02	0.28130E-02
188	0.14200E+01	0.11916E+01	0.31567E+02	0.23981E+02	0.75867E+01	0.11068E+02	0.11099E+02	0.28130E-02
189	0.14300E+01	0.11958E+01	0.31271E+02	0.23796E+02	0.74747E+01	0.11058E+02	0.11089E+02	0.28130E-02
190	0.14400E+01	0.12000E+01	0.30979E+02	0.23614E+02	0.73642E+01	0.11047E+02	0.11078E+02	0.28130E-02
191	0.14500E+01	0.12042E+01	0.30691E+02	0.23436E+02	0.72550E+01	0.11037E+02	0.11068E+02	0.28130E-02
192	0.14600E+01	0.12083E+01	0.30408E+02	0.23261E+02	0.71472E+01	0.11027E+02	0.11058E+02	0.28130E-02
193	0.14700E+01	0.12124E+01	0.30129E+02	0.23089E+02	0.70406E+01	0.11017E+02	0.11048E+02	0.28130E-02
194	0.14800E+01	0.12166E+01	0.29854E+02	0.22919E+02	0.69352E+01	0.11007E+02	0.11038E+02	0.28130E-02
195	0.14900E+01	0.12207E+01	0.29584E+02	0.22753E+02	0.68311E+01	0.10997E+02	0.11028E+02	0.28130E-02
196	0.15000E+01	0.12247E+01	0.29317E+02	0.22589E+02	0.67281E+01	0.10987E+02	0.11018E+02	0.28130E-02
197	0.15100E+01	0.12288E+01	0.29054E+02	0.22427E+02	0.66263E+01	0.10977E+02	0.11008E+02	0.28130E-02
198	0.15200E+01	0.12329E+01	0.28794E+02	0.22269E+02	0.65255E+01	0.10968E+02	0.10999E+02	0.28130E-02
199	0.15300E+01	0.12369E+01	0.28539E+02	0.22113E+02	0.64258E+01	0.10958E+02	0.10989E+02	0.28130E-02
200	0.15400E+01	0.12410E+01	0.28286E+02	0.21959E+02	0.63271E+01	0.10949E+02	0.10980E+02	0.28130E-02
201	0.15500E+01	0.12450E+01	0.28037E+02	0.21808E+02	0.62294E+01	0.10940E+02	0.10971E+02	0.28130E-02
202	0.15600E+01	0.12490E+01	0.27791E+02	0.21659E+02	0.61327E+01	0.10931E+02	0.10961E+02	0.28130E-02
203	0.15700E+01	0.12530E+01	0.27549E+02	0.21512E+02	0.60368E+01	0.10921E+02	0.10952E+02	0.28130E-02
204	0.15800E+01	0.12570E+01	0.27310E+02	0.21368E+02	0.59419E+01	0.10912E+02	0.10943E+02	0.28130E-02
205	0.15900E+01	0.12610E+01	0.27073E+02	0.21225E+02	0.58479E+01	0.10904E+02	0.10934E+02	0.28130E-02
206	0.16000E+01	0.12649E+01	0.26840E+02	0.21085E+02	0.57547E+01	0.10895E+02	0.10925E+02	0.28130E-02
207	0.16100E+01	0.12689E+01	0.26609E+02	0.20947E+02	0.56624E+01	0.10886E+02	0.10917E+02	0.28130E-02
208	0.16200E+01	0.12728E+01	0.26382E+02	0.20811E+02	0.55709E+01	0.10877E+02	0.10908E+02	0.28130E-02
209	0.16300E+01	0.12767E+01	0.26157E+02	0.20676E+02	0.54801E+01	0.10869E+02	0.10899E+02	0.28130E-02
210	0.16400E+01	0.12806E+01	0.25934E+02	0.20544E+02	0.53901E+01	0.10860E+02	0.10891E+02	0.28130E-02
211	0.16500E+01	0.12845E+01	0.25714E+02	0.20414E+02	0.53008E+01	0.10852E+02	0.10882E+02	0.28130E-02
212	0.16600E+01	0.12884E+01	0.25497E+02	0.20285E+02	0.52123E+01	0.10843E+02	0.10874E+02	0.28130E-02
213	0.16700E+01	0.12923E+01	0.25282E+02	0.20158E+02	0.51245E+01	0.10835E+02	0.10866E+02	0.28130E-02
214	0.16800E+01	0.12961E+01	0.25070E+02	0.20033E+02	0.50373E+01	0.10827E+02	0.10858E+02	0.28130E-02
215	0.16900E+01	0.13000E+01	0.24860E+02	0.19909E+02	0.49508E+01	0.10819E+02	0.10849E+02	0.28130E-02
216	0.17000E+01	0.13038E+01	0.24652E+02	0.19787E+02	0.48649E+01	0.10811E+02	0.10841E+02	0.28130E-02

*** EIOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	SIGA	SIGF	SIGC	SIGIR	SIGS	MUBAR
217	0.17100E+01	0.13077E+01	0.24447E+02	0.19667E+02	0.47797E+01	0.10803E+02	0.10833E+02	0.28130E-02
218	0.17200E+01	0.13115E+01	0.24244E+02	0.19548E+02	0.46950E+01	0.10795E+02	0.10825E+02	0.28130E-02
219	0.17300E+01	0.13153E+01	0.24042E+02	0.19431E+02	0.46110E+01	0.10787E+02	0.10817E+02	0.28130E-02
220	0.17400E+01	0.13191E+01	0.23843E+02	0.19316E+02	0.45276E+01	0.10779E+02	0.10810E+02	0.28130E-02
221	0.17500E+01	0.13229E+01	0.23646E+02	0.19202E+02	0.44447E+01	0.10771E+02	0.10802E+02	0.28130E-02
222	0.17600E+01	0.13266E+01	0.23451E+02	0.19089E+02	0.43623E+01	0.10764E+02	0.10794E+02	0.28130E-02
223	0.17700E+01	0.13304E+01	0.23258E+02	0.18977E+02	0.42805E+01	0.10756E+02	0.10787E+02	0.28130E-02
224	0.17800E+01	0.13342E+01	0.23067E+02	0.18868E+02	0.41992E+01	0.10749E+02	0.10779E+02	0.28130E-02
225	0.17900E+01	0.13379E+01	0.22877E+02	0.18759E+02	0.41184E+01	0.10741E+02	0.10771E+02	0.28130E-02
226	0.18000E+01	0.13416E+01	0.22690E+02	0.18652E+02	0.40381E+01	0.10734E+02	0.10764E+02	0.28130E-02
227	0.18100E+01	0.13454E+01	0.22504E+02	0.18546E+02	0.39583E+01	0.10726E+02	0.10757E+02	0.28130E-02
228	0.18200E+01	0.13491E+01	0.22320E+02	0.18441E+02	0.38790E+01	0.10719E+02	0.10749E+02	0.28130E-02
229	0.18300E+01	0.13528E+01	0.22137E+02	0.18337E+02	0.38001E+01	0.10712E+02	0.10742E+02	0.28130E-02
230	0.18400E+01	0.13565E+01	0.21957E+02	0.18235E+02	0.37217E+01	0.10705E+02	0.10735E+02	0.28130E-02
231	0.18500E+01	0.13601E+01	0.21778E+02	0.18134E+02	0.36437E+01	0.10697E+02	0.10728E+02	0.28130E-02
232	0.18600E+01	0.13638E+01	0.21600E+02	0.18034E+02	0.35661E+01	0.10690E+02	0.10720E+02	0.28130E-02
233	0.18700E+01	0.13675E+01	0.21424E+02	0.17935E+02	0.34890E+01	0.10683E+02	0.10713E+02	0.28130E-02
234	0.18800E+01	0.13711E+01	0.21250E+02	0.17837E+02	0.34122E+01	0.10676E+02	0.10706E+02	0.28130E-02
235	0.18900E+01	0.13748E+01	0.21077E+02	0.17741E+02	0.33359E+01	0.10669E+02	0.10699E+02	0.28130E-02
236	0.19000E+01	0.13784E+01	0.20905E+02	0.17645E+02	0.32599E+01	0.10662E+02	0.10693E+02	0.28130E-02
237	0.19100E+01	0.13820E+01	0.20735E+02	0.17551E+02	0.31843E+01	0.10656E+02	0.10686E+02	0.28130E-02
238	0.19200E+01	0.13856E+01	0.20566E+02	0.17457E+02	0.31091E+01	0.10649E+02	0.10679E+02	0.28130E-02
239	0.19300E+01	0.13892E+01	0.20399E+02	0.17365E+02	0.30343E+01	0.10642E+02	0.10672E+02	0.28130E-02
240	0.19400E+01	0.13928E+01	0.20233E+02	0.17273E+02	0.29598E+01	0.10635E+02	0.10665E+02	0.28130E-02
241	0.19500E+01	0.13964E+01	0.20068E+02	0.17183E+02	0.28857E+01	0.10629E+02	0.10659E+02	0.28130E-02
242	0.19600E+01	0.14000E+01	0.19905E+02	0.17093E+02	0.28119E+01	0.10622E+02	0.10652E+02	0.28130E-02
243	0.19700E+01	0.14036E+01	0.19743E+02	0.17005E+02	0.27384E+01	0.10615E+02	0.10645E+02	0.28130E-02
244	0.19800E+01	0.14071E+01	0.19582E+02	0.16917E+02	0.26652E+01	0.10609E+02	0.10639E+02	0.28130E-02
245	0.19900E+01	0.14107E+01	0.19422E+02	0.16830E+02	0.25924E+01	0.10602E+02	0.10632E+02	0.28130E-02
246	0.20000E+01	0.14142E+01	0.19264E+02	0.16744E+02	0.25199E+01	0.10596E+02	0.10626E+02	0.28130E-02

*** ETOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	NUSIGF	ALPHA	ETA	RTE*SIGA	RTE*SIGF
1	0.	0.	0.	0.	0.28800E+01	0.15171E+03	0.11570E+03
2	0.10000E-02	0.31623E-01	0.10540E+05	0.31366E+00	0.21923E+01	0.15202E+03	0.11573E+03
3	0.20000E-02	0.44721E-01	0.74546E+04	0.31603E+00	0.21884E+01	0.15234E+03	0.11576E+03
4	0.30000E-02	0.54772E-01	0.60887E+04	0.31837E+00	0.21845E+01	0.15266E+03	0.11580E+03
5	0.40000E-02	0.63246E-01	0.52748E+04	0.32072E+00	0.21806E+01	0.15299E+03	0.11584E+03
6	0.50000E-02	0.70711E-01	0.47201E+04	0.32295E+00	0.21769E+01	0.15332E+03	0.11589E+03
7	0.60000E-02	0.77460E-01	0.43108E+04	0.32527E+00	0.21731E+01	0.15365E+03	0.11594E+03
8	0.70000E-02	0.83666E-01	0.39928E+04	0.32759E+00	0.21693E+01	0.15399E+03	0.11599E+03
9	0.80000E-02	0.89443E-01	0.37371E+04	0.32982E+00	0.21657E+01	0.15434E+03	0.11606E+03
10	0.90000E-02	0.94868E-01	0.35256E+04	0.33198E+00	0.21622E+01	0.15469E+03	0.11614E+03
11	0.10000E-01	0.10000E+00	0.33470E+04	0.33413E+00	0.21587E+01	0.15505E+03	0.11622E+03
12	0.11000E-01	0.10488E+00	0.31933E+04	0.33635E+00	0.21551E+01	0.15541E+03	0.11629E+03
13	0.12000E-01	0.10954E+00	0.30596E+04	0.33854E+00	0.21516E+01	0.15577E+03	0.11637E+03
14	0.13000E-01	0.11402E+00	0.29416E+04	0.34077E+00	0.21480E+01	0.15614E+03	0.11646E+03
15	0.14000E-01	0.11832E+00	0.28367E+04	0.34301E+00	0.21444E+01	0.15652E+03	0.11654E+03
16	0.15000E-01	0.12247E+00	0.27426E+04	0.34524E+00	0.21409E+01	0.15690E+03	0.11663E+03
17	0.16000E-01	0.12649E+00	0.26577E+04	0.34745E+00	0.21374E+01	0.15729E+03	0.11673E+03
18	0.17000E-01	0.13038E+00	0.25806E+04	0.34963E+00	0.21339E+01	0.15768E+03	0.11683E+03
19	0.18000E-01	0.13416E+00	0.25102E+04	0.35178E+00	0.21305E+01	0.15808E+03	0.11694E+03
20	0.19000E-01	0.13784E+00	0.24458E+04	0.35377E+00	0.21274E+01	0.15847E+03	0.11706E+03
21	0.20000E-01	0.14142E+00	0.23865E+04	0.35579E+00	0.21242E+01	0.15888E+03	0.11719E+03
22	0.21000E-01	0.14491E+00	0.23317E+04	0.35768E+00	0.21213E+01	0.15929E+03	0.11732E+03
23	0.22000E-01	0.14832E+00	0.22808E+04	0.35964E+00	0.21182E+01	0.15971E+03	0.11746E+03
24	0.23000E-01	0.15166E+00	0.22334E+04	0.36149E+00	0.21153E+01	0.16012E+03	0.11761E+03
25	0.24000E-01	0.15492E+00	0.21893E+04	0.36328E+00	0.21125E+01	0.16055E+03	0.11777E+03
26	0.25000E-01	0.15811E+00	0.21478E+04	0.36525E+00	0.21095E+01	0.16098E+03	0.11792E+03
27	0.26000E-01	0.16125E+00	0.21095E+04	0.36685E+00	0.21070E+01	0.16143E+03	0.11811E+03
28	0.27000E-01	0.16432E+00	0.20736E+04	0.36826E+00	0.21049E+01	0.16188E+03	0.11831E+03
29	0.28000E-01	0.16733E+00	0.20397E+04	0.36977E+00	0.21025E+01	0.16233E+03	0.11851E+03
30	0.29000E-01	0.17029E+00	0.20075E+04	0.37138E+00	0.21001E+01	0.16279E+03	0.11870E+03
31	0.30000E-01	0.17321E+00	0.19769E+04	0.37294E+00	0.20977E+01	0.16324E+03	0.11889E+03
32	0.31000E-01	0.17607E+00	0.19465E+04	0.37578E+00	0.20934E+01	0.16371E+03	0.11900E+03
33	0.32000E-01	0.17889E+00	0.19174E+04	0.37855E+00	0.20891E+01	0.16418E+03	0.11910E+03
34	0.33000E-01	0.18166E+00	0.18917E+04	0.37993E+00	0.20871E+01	0.16466E+03	0.11932E+03
35	0.34000E-01	0.18439E+00	0.18692E+04	0.37997E+00	0.20870E+01	0.16514E+03	0.11967E+03
36	0.35000E-01	0.18708E+00	0.18475E+04	0.38000E+00	0.20870E+01	0.16562E+03	0.12001E+03

*** EIOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	NUSIGF	ALPHA	ETA	RTE*SIGA	RTE*SIGF
37	0.36000E-01	0.18974E+00	0.18245E+04	0.38207E+00	0.20838E+01	0.16612E+03	0.12020E+03
38	0.37000E-01	0.19235E+00	0.18023E+04	0.38410E+00	0.20808E+01	0.16661E+03	0.12038E+03
39	0.38000E-01	0.19494E+00	0.17812E+04	0.38612E+00	0.20777E+01	0.16712E+03	0.12056E+03
40	0.39000E-01	0.19748E+00	0.17610E+04	0.38815E+00	0.20747E+01	0.16763E+03	0.12076E+03
41	0.40000E-01	0.20000E+00	0.17416E+04	0.39013E+00	0.20717E+01	0.16813E+03	0.12094E+03
42	0.41000E-01	0.20248E+00	0.17247E+04	0.39089E+00	0.20706E+01	0.16866E+03	0.12126E+03
43	0.42000E-01	0.20494E+00	0.17084E+04	0.39163E+00	0.20695E+01	0.16918E+03	0.12157E+03
44	0.43000E-01	0.20736E+00	0.16913E+04	0.39360E+00	0.20666E+01	0.16971E+03	0.12178E+03
45	0.44000E-01	0.20976E+00	0.16735E+04	0.39676E+00	0.20619E+01	0.17025E+03	0.12189E+03
46	0.45000E-01	0.21213E+00	0.16563E+04	0.39988E+00	0.20573E+01	0.17078E+03	0.12200E+03
47	0.46000E-01	0.21448E+00	0.16431E+04	0.40037E+00	0.20566E+01	0.17135E+03	0.12236E+03
48	0.47000E-01	0.21679E+00	0.16302E+04	0.40085E+00	0.20559E+01	0.17191E+03	0.12272E+03
49	0.48000E-01	0.21909E+00	0.16173E+04	0.40192E+00	0.20543E+01	0.17248E+03	0.12303E+03
50	0.49000E-01	0.22136E+00	0.16042E+04	0.40357E+00	0.20519E+01	0.17306E+03	0.12330E+03
51	0.50000E-01	0.22361E+00	0.15916E+04	0.40519E+00	0.20495E+01	0.17364E+03	0.12357E+03
52	0.60000E-01	0.24495E+00	0.14915E+04	0.42022E+00	0.20279E+01	0.18017E+03	0.12686E+03
53	0.70000E-01	0.26458E+00	0.14268E+04	0.43420E+00	0.20081E+01	0.18799E+03	0.13108E+03
54	0.80000E-01	0.28284E+00	0.13797E+04	0.45651E+00	0.19773E+01	0.19736E+03	0.13550E+03
55	0.90000E-01	0.30000E+00	0.13592E+04	0.47254E+00	0.19558E+01	0.20848E+03	0.14158E+03
56	0.10000E+00	0.31623E+00	0.13562E+04	0.48845E+00	0.19349E+01	0.22165E+03	0.14891E+03
57	0.11000E+00	0.33166E+00	0.13562E+04	0.51770E+00	0.18976E+01	0.23704E+03	0.15618E+03
58	0.12000E+00	0.34641E+00	0.13768E+04	0.53946E+00	0.18708E+01	0.25494E+03	0.16560E+03
59	0.13000E+00	0.36056E+00	0.14150E+04	0.55991E+00	0.18463E+01	0.27634E+03	0.17715E+03
60	0.14000E+00	0.37417E+00	0.14621E+04	0.58483E+00	0.18172E+01	0.30105E+03	0.18996E+03
61	0.15000E+00	0.38730E+00	0.15474E+04	0.59539E+00	0.18052E+01	0.33199E+03	0.20810E+03
62	0.16000E+00	0.40000E+00	0.16504E+04	0.61115E+00	0.17875E+01	0.36931E+03	0.22922E+03
63	0.17000E+00	0.41231E+00	0.17916E+04	0.62495E+00	0.17724E+01	0.41679E+03	0.25649E+03
64	0.18000E+00	0.42426E+00	0.19711E+04	0.63893E+00	0.17572E+01	0.47589E+03	0.29037E+03
65	0.19000E+00	0.43589E+00	0.22123E+04	0.64888E+00	0.17466E+01	0.55210E+03	0.33483E+03
66	0.20000E+00	0.44721E+00	0.25153E+04	0.65752E+00	0.17375E+01	0.64740E+03	0.39058E+03
67	0.21000E+00	0.45826E+00	0.28536E+04	0.66541E+00	0.17293E+01	0.75620E+03	0.45406E+03
68	0.22000E+00	0.46904E+00	0.33067E+04	0.67217E+00	0.17223E+01	0.90052E+03	0.53853E+03
69	0.23000E+00	0.47958E+00	0.38509E+04	0.67804E+00	0.17163E+01	0.10761E+04	0.64127E+03
70	0.24000E+00	0.48990E+00	0.45923E+04	0.68282E+00	0.17114E+01	0.13146E+04	0.78116E+03
71	0.25000E+00	0.50000E+00	0.54749E+04	0.68849E+00	0.17057E+01	0.16049E+04	0.95049E+03
72	0.26000E+00	0.50990E+00	0.65604E+04	0.68847E+00	0.17057E+01	0.19612E+04	0.11615E+04

*** EIOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	NUSIGF	ALPHA	ETA	RTE*SIGA	RTE*SIGF
73	0.27000E+00	0.51962E+00	0.75518E+04	0.68850E+00	0.17057E+01	0.23006E+04	0.13625E+04
74	0.28000E+00	0.52915E+00	0.84491E+04	0.68850E+00	0.17057E+01	0.26212E+04	0.15524E+04
75	0.29000E+00	0.53852E+00	0.89228E+04	0.68848E+00	0.17057E+01	0.28171E+04	0.16684E+04
76	0.30000E+00	0.54772E+00	0.89374E+04	0.68848E+00	0.17057E+01	0.28700E+04	0.16997E+04
77	0.31000E+00	0.55678E+00	0.84667E+04	0.68849E+00	0.17057E+01	0.27638E+04	0.16368E+04
78	0.32000E+00	0.56569E+00	0.75283E+04	0.68849E+00	0.17057E+01	0.24968E+04	0.14787E+04
79	0.33000E+00	0.57446E+00	0.63545E+04	0.68848E+00	0.17057E+01	0.21401E+04	0.12675E+04
80	0.34000E+00	0.58310E+00	0.52160E+04	0.68847E+00	0.17057E+01	0.17831E+04	0.10560E+04
81	0.35000E+00	0.59161E+00	0.43187E+04	0.68252E+00	0.17117E+01	0.14926E+04	0.88714E+03
82	0.36000E+00	0.60000E+00	0.35479E+04	0.67506E+00	0.17193E+01	0.12381E+04	0.73915E+03
83	0.37000E+00	0.60828E+00	0.29978E+04	0.65757E+00	0.17375E+01	0.10495E+04	0.63315E+03
84	0.38000E+00	0.61644E+00	0.25388E+04	0.62626E+00	0.17709E+01	0.88374E+03	0.54342E+03
85	0.39000E+00	0.62450E+00	0.21446E+04	0.60030E+00	0.17997E+01	0.74421E+03	0.46504E+03
86	0.40000E+00	0.63246E+00	0.18269E+04	0.58031E+00	0.18224E+01	0.63401E+03	0.40119E+03
87	0.41000E+00	0.64031E+00	0.15768E+04	0.56471E+00	0.18406E+01	0.54856E+03	0.35058E+03
88	0.42000E+00	0.64807E+00	0.13503E+04	0.55191E+00	0.18558E+01	0.47156E+03	0.30386E+03
89	0.43000E+00	0.65574E+00	0.11856E+04	0.54059E+00	0.18694E+01	0.41587E+03	0.26994E+03
90	0.44000E+00	0.66332E+00	0.10414E+04	0.53091E+00	0.18812E+01	0.36721E+03	0.23986E+03
91	0.45000E+00	0.67082E+00	0.92375E+03	0.52256E+00	0.18915E+01	0.32760E+03	0.21516E+03
92	0.46000E+00	0.67823E+00	0.82961E+03	0.51601E+00	0.18997E+01	0.29618E+03	0.19537E+03
93	0.47000E+00	0.68557E+00	0.75607E+03	0.50879E+00	0.19088E+01	0.27155E+03	0.17998E+03
94	0.48000E+00	0.69282E+00	0.69723E+03	0.50330E+00	0.19158E+01	0.25214E+03	0.16773E+03
95	0.49000E+00	0.70000E+00	0.64133E+03	0.49805E+00	0.19225E+01	0.23352E+03	0.15588E+03
96	0.50000E+00	0.70711E+00	0.59132E+03	0.49382E+00	0.19331E+01	0.21630E+03	0.14518E+03
97	0.51000E+00	0.71414E+00	0.52954E+03	0.48750E+00	0.19361E+01	0.19532E+03	0.13131E+03
98	0.52000E+00	0.72111E+00	0.49718E+03	0.48171E+00	0.19437E+01	0.18445E+03	0.12449E+03
99	0.53000E+00	0.72801E+00	0.46188E+03	0.47710E+00	0.19498E+01	0.17246E+03	0.11675E+03
100	0.54000E+00	0.73485E+00	0.43540E+03	0.47021E+00	0.19589E+01	0.16333E+03	0.11109E+03
101	0.55000E+00	0.74162E+00	0.40304E+03	0.46460E+00	0.19664E+01	0.15200E+03	0.10379E+03
102	0.56000E+00	0.74833E+00	0.38245E+03	0.45896E+00	0.19740E+01	0.14498E+03	0.99374E+02
103	0.57000E+00	0.75498E+00	0.36185E+03	0.45451E+00	0.19801E+01	0.13797E+03	0.94858E+02
104	0.58000E+00	0.76158E+00	0.34420E+03	0.45110E+00	0.19847E+01	0.13208E+03	0.91019E+02
105	0.59000E+00	0.76811E+00	0.32655E+03	0.44566E+00	0.19922E+01	0.12591E+03	0.87093E+02
106	0.60000E+00	0.77460E+00	0.30595E+03	0.44120E+00	0.19983E+01	0.11859E+03	0.82289E+02
107	0.61000E+00	0.78102E+00	0.29095E+03	0.43690E+00	0.20043E+01	0.11338E+03	0.78903E+02
108	0.62000E+00	0.78740E+00	0.27801E+03	0.43252E+00	0.20104E+01	0.10888E+03	0.76008E+02

*** EIOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	NUSIGF	ALPHA	ETA	RTE*SIGA	RTE*SIGF
109	0.63000E+00	0.79373E+00	0.26418E+03	0.42822E+00	0.20165E+01	0.10399E+03	0.72808E+02
110	0.64000E+00	0.80000E+00	0.25447E+03	0.42284E+00	0.20241E+01	0.10058E+03	0.70687E+02
111	0.65000E+00	0.80623E+00	0.24329E+03	0.41232E+00	0.20392E+01	0.96190E+02	0.68108E+02
112	0.66000E+00	0.81240E+00	0.23388E+03	0.41547E+00	0.20347E+01	0.93384E+02	0.65974E+02
113	0.67000E+00	0.81854E+00	0.22653E+03	0.41235E+00	0.20392E+01	0.90929E+02	0.64382E+02
114	0.68000E+00	0.82462E+00	0.21741E+03	0.40959E+00	0.20431E+01	0.87746E+02	0.62249E+02
115	0.69000E+00	0.83066E+00	0.21034E+03	0.40815E+00	0.20452E+01	0.85430E+02	0.60669E+02
116	0.70000E+00	0.83666E+00	0.20358E+03	0.39666E+00	0.20621E+01	0.82600E+02	0.59141E+02
117	0.71000E+00	0.84261E+00	0.19799E+03	0.39667E+00	0.20621E+01	0.80904E+02	0.57926E+02
118	0.72000E+00	0.84853E+00	0.19181E+03	0.39659E+00	0.20622E+01	0.78926E+02	0.56513E+02
119	0.73000E+00	0.85440E+00	0.18534E+03	0.39719E+00	0.20613E+01	0.76823E+02	0.54984E+02
120	0.74000E+00	0.86023E+00	0.18034E+03	0.39680E+00	0.20619E+01	0.75239E+02	0.53865E+02
121	0.75000E+00	0.86603E+00	0.17563E+03	0.39668E+00	0.20620E+01	0.73762E+02	0.52813E+02
122	0.76000E+00	0.87178E+00	0.17092E+03	0.39672E+00	0.20620E+01	0.72265E+02	0.51739E+02
123	0.77000E+00	0.87750E+00	0.16622E+03	0.39676E+00	0.20619E+01	0.70737E+02	0.50644E+02
124	0.78000E+00	0.88318E+00	0.16180E+03	0.39676E+00	0.20619E+01	0.69305E+02	0.49618E+02
125	0.79000E+00	0.88882E+00	0.15916E+03	0.39665E+00	0.20621E+01	0.68601E+02	0.49118E+02
126	0.80000E+00	0.89443E+00	0.15621E+03	0.39677E+00	0.20619E+01	0.67764E+02	0.48515E+02
127	0.81000E+00	0.90000E+00	0.15210E+03	0.39671E+00	0.20620E+01	0.66386E+02	0.47530E+02
128	0.82000E+00	0.90554E+00	0.14768E+03	0.39671E+00	0.20620E+01	0.64856E+02	0.46435E+02
129	0.83000E+00	0.91104E+00	0.14504E+03	0.39678E+00	0.20619E+01	0.64084E+02	0.45880E+02
130	0.84000E+00	0.91652E+00	0.14268E+03	0.39681E+00	0.20618E+01	0.63424E+02	0.45406E+02
131	0.85000E+00	0.92195E+00	0.13856E+03	0.39675E+00	0.20619E+01	0.61956E+02	0.44357E+02
132	0.86000E+00	0.92736E+00	0.13621E+03	0.39678E+00	0.20619E+01	0.61262E+02	0.43859E+02
133	0.87000E+00	0.93274E+00	0.13386E+03	0.39681E+00	0.20618E+01	0.60554E+02	0.43352E+02
134	0.88000E+00	0.93808E+00	0.13091E+03	0.39673E+00	0.20620E+01	0.59559E+02	0.42642E+02
135	0.89000E+00	0.94340E+00	0.12797E+03	0.39665E+00	0.20621E+01	0.58547E+02	0.41920E+02
136	0.90000E+00	0.94868E+00	0.12503E+03	0.42513E+00	0.20209E+01	0.58695E+02	0.41185E+02
137	0.91000E+00	0.95394E+00	0.12356E+03	0.39664E+00	0.20621E+01	0.57160E+02	0.40926E+02
138	0.92000E+00	0.95917E+00	0.12032E+03	0.39662E+00	0.20621E+01	0.55967E+02	0.40073E+02
139	0.93000E+00	0.96437E+00	0.11885E+03	0.39670E+00	0.20620E+01	0.55585E+02	0.39798E+02
140	0.94000E+00	0.96954E+00	0.11620E+03	0.39679E+00	0.20619E+01	0.54642E+02	0.39120E+02
141	0.95000E+00	0.97468E+00	0.11473E+03	0.39663E+00	0.20621E+01	0.54230E+02	0.38829E+02
142	0.96000E+00	0.97980E+00	0.11209E+03	0.39672E+00	0.20620E+01	0.53260E+02	0.38132E+02
143	0.97000E+00	0.98489E+00	0.11120E+03	0.39667E+00	0.20620E+01	0.53114E+02	0.38029E+02
144	0.98000E+00	0.98995E+00	0.10914E+03	0.39689E+00	0.20617E+01	0.52406E+02	0.37516E+02

*** ETOT ***

MATERIAL NUMBER 4

P	E	SQRT(E)	NUSIGF	ALPHA	ETA	RTE*SIGA	RTE*SIGF
	0.99000E+00	0.99499E+00	0.10708E+03	0.39659E+00	0.20622E+01	0.51668E+02	0.36996E+02
	0.10000E+01	0.10000E+01	0.10503E+03	0.39655E+00	0.20622E+01	0.50928E+02	0.36467E+02
	0.10100E+01	0.10050E+01	0.10460E+03	0.39865E+00	0.20591E+01	0.51050E+02	0.36499E+02
	0.10200E+01	0.10100E+01	0.10320E+03	0.39668E+00	0.20620E+01	0.50544E+02	0.36189E+02
	0.10300E+01	0.10149E+01	0.10184E+03	0.39473E+00	0.20649E+01	0.50054E+02	0.35888E+02
	0.10400E+01	0.10198E+01	0.10053E+03	0.39278E+00	0.20678E+01	0.49578E+02	0.35596E+02
	0.10500E+01	0.10247E+01	0.99251E+02	0.39084E+00	0.20707E+01	0.49115E+02	0.35313E+02
	0.10600E+01	0.10296E+01	0.98013E+02	0.38891E+00	0.20736E+01	0.48665E+02	0.35038E+02
	0.10700E+01	0.10344E+01	0.96811E+02	0.38699E+00	0.20764E+01	0.48228E+02	0.34772E+02
	0.10800E+01	0.10392E+01	0.95644E+02	0.38507E+00	0.20793E+01	0.47802E+02	0.34512E+02
	0.10900E+01	0.10440E+01	0.94509E+02	0.38315E+00	0.20822E+01	0.47388E+02	0.34261E+02
	0.11000E+01	0.10488E+01	0.93406E+02	0.38124E+00	0.20851E+01	0.46984E+02	0.34015E+02
	0.11100E+01	0.10536E+01	0.92332E+02	0.37933E+00	0.20880E+01	0.46590E+02	0.33777E+02
	0.11200E+01	0.10583E+01	0.91287E+02	0.37742E+00	0.20909E+01	0.46205E+02	0.33545E+02
	0.11300E+01	0.10630E+01	0.90270E+02	0.37551E+00	0.20938E+01	0.45830E+02	0.33319E+02
	0.11400E+01	0.10677E+01	0.89279E+02	0.37359E+00	0.20967E+01	0.45464E+02	0.33099E+02
	0.11500E+01	0.10724E+01	0.88314E+02	0.37168E+00	0.20996E+01	0.45106E+02	0.32884E+02
	0.11600E+01	0.10770E+01	0.87372E+02	0.36976E+00	0.21026E+01	0.44756E+02	0.32675E+02
	0.11700E+01	0.10817E+01	0.86454E+02	0.36783E+00	0.21055E+01	0.44414E+02	0.32470E+02
	0.11800E+01	0.10863E+01	0.85559E+02	0.36590E+00	0.21085E+01	0.44079E+02	0.32271E+02
	0.11900E+01	0.10909E+01	0.84685E+02	0.36397E+00	0.21115E+01	0.43751E+02	0.32076E+02
	0.12000E+01	0.10954E+01	0.83831E+02	0.36202E+00	0.21145E+01	0.43430E+02	0.31886E+02
	0.12100E+01	0.11000E+01	0.82998E+02	0.36007E+00	0.21175E+01	0.43115E+02	0.31701E+02
	0.12200E+01	0.11045E+01	0.82184E+02	0.35811E+00	0.21206E+01	0.42807E+02	0.31519E+02
	0.12300E+01	0.11091E+01	0.81389E+02	0.35615E+00	0.21237E+01	0.42504E+02	0.31342E+02
	0.12400E+01	0.11136E+01	0.80611E+02	0.35417E+00	0.21268E+01	0.42207E+02	0.31168E+02
	0.12500E+01	0.11180E+01	0.79851E+02	0.35218E+00	0.21299E+01	0.41916E+02	0.30998E+02
	0.12600E+01	0.11225E+01	0.79107E+02	0.35019E+00	0.21330E+01	0.41629E+02	0.30832E+02
	0.12700E+01	0.11269E+01	0.78379E+02	0.34818E+00	0.21362E+01	0.41348E+02	0.30670E+02
	0.12800E+01	0.11314E+01	0.77667E+02	0.34616E+00	0.21394E+01	0.41072E+02	0.30510E+02
	0.12900E+01	0.11358E+01	0.76969E+02	0.34412E+00	0.21427E+01	0.40800E+02	0.30354E+02
	0.13000E+01	0.11402E+01	0.76286E+02	0.34208E+00	0.21459E+01	0.40533E+02	0.30201E+02
	0.13100E+01	0.11446E+01	0.75617E+02	0.34002E+00	0.21492E+01	0.40269E+02	0.30051E+02
	0.13200E+01	0.11489E+01	0.74962E+02	0.33795E+00	0.21526E+01	0.40011E+02	0.29904E+02
	0.13300E+01	0.11533E+01	0.74320E+02	0.33586E+00	0.21559E+01	0.39756E+02	0.29760E+02
	0.13400E+01	0.11576E+01	0.73690E+02	0.33376E+00	0.21593E+01	0.39504E+02	0.29619E+02

*** FTOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	NUSIGF	ALPHA	FTA	RTE*SIGA	RTE*SIGF
181	0.13500E+01	0.11619E+01	0.73073E+02	0.33164E+00	0.21627E+01	0.39257E+02	0.29480E+02
182	0.13600E+01	0.11662E+01	0.72467E+02	0.32951E+00	0.21662E+01	0.39013E+02	0.29344E+02
183	0.13700E+01	0.11705E+01	0.71873E+02	0.32736E+00	0.21697E+01	0.38772E+02	0.29210E+02
184	0.13800E+01	0.11747E+01	0.71290E+02	0.32519E+00	0.21733E+01	0.38535E+02	0.29079E+02
185	0.13900E+01	0.11790E+01	0.70718E+02	0.32301E+00	0.21768E+01	0.38301E+02	0.28950E+02
186	0.14000E+01	0.11832E+01	0.70157E+02	0.32082E+00	0.21805E+01	0.38070E+02	0.28823E+02
187	0.14100E+01	0.11874E+01	0.69605E+02	0.31860E+00	0.21841E+01	0.37842E+02	0.28699E+02
188	0.14200E+01	0.11916E+01	0.69064E+02	0.31637E+00	0.21878E+01	0.37617E+02	0.28576E+02
189	0.14300E+01	0.11958E+01	0.68532E+02	0.31412E+00	0.21916E+01	0.37394E+02	0.28456E+02
190	0.14400E+01	0.12000E+01	0.68009E+02	0.31185E+00	0.21954E+01	0.37174E+02	0.28337E+02
191	0.14500E+01	0.12042E+01	0.67496E+02	0.30957E+00	0.21992E+01	0.36957E+02	0.28221E+02
192	0.14600E+01	0.12083E+01	0.66991E+02	0.30726E+00	0.22031E+01	0.36742E+02	0.28106E+02
193	0.14700E+01	0.12124E+01	0.66495E+02	0.30494E+00	0.22070E+01	0.36530E+02	0.27993E+02
194	0.14800E+01	0.12166E+01	0.66007E+02	0.30260E+00	0.22110E+01	0.36319E+02	0.27882E+02
195	0.14900E+01	0.12207E+01	0.65527E+02	0.30023E+00	0.22150E+01	0.36111E+02	0.27773E+02
196	0.15000E+01	0.12247E+01	0.65055E+02	0.29785E+00	0.22190E+01	0.35906E+02	0.27665E+02
197	0.15100E+01	0.12288E+01	0.64591E+02	0.29545E+00	0.22232E+01	0.35702E+02	0.27559E+02
198	0.15200E+01	0.12329E+01	0.64134E+02	0.29303E+00	0.22273E+01	0.35500E+02	0.27455E+02
199	0.15300E+01	0.12369E+01	0.63685E+02	0.29059E+00	0.22315E+01	0.35300E+02	0.27352E+02
200	0.15400E+01	0.12410E+01	0.63242E+02	0.28813E+00	0.22358E+01	0.35102E+02	0.27250E+02
201	0.15500E+01	0.12450E+01	0.62806E+02	0.28565E+00	0.22401E+01	0.34906E+02	0.27150E+02
202	0.15600E+01	0.12490E+01	0.62377E+02	0.28315E+00	0.22445E+01	0.34712E+02	0.27052E+02
203	0.15700E+01	0.12530E+01	0.61955E+02	0.28063E+00	0.22489E+01	0.34519E+02	0.26955E+02
204	0.15800E+01	0.12570E+01	0.61539E+02	0.27808E+00	0.22534E+01	0.34328E+02	0.26859E+02
205	0.15900E+01	0.12610E+01	0.61129E+02	0.27552E+00	0.22579E+01	0.34138E+02	0.26764E+02
206	0.16000E+01	0.12649E+01	0.60725E+02	0.27293E+00	0.22625E+01	0.33950E+02	0.26671E+02
207	0.16100E+01	0.12689E+01	0.60327E+02	0.27032E+00	0.22671E+01	0.33763E+02	0.26579E+02
208	0.16200E+01	0.12728E+01	0.59935E+02	0.26769E+00	0.22718E+01	0.33578E+02	0.26488E+02
209	0.16300E+01	0.12767E+01	0.59548E+02	0.26504E+00	0.22766E+01	0.33394E+02	0.26398E+02
210	0.16400E+01	0.12806E+01	0.59167E+02	0.26237E+00	0.22814E+01	0.33212E+02	0.26309E+02
211	0.16500E+01	0.12845E+01	0.58791E+02	0.25967E+00	0.22863E+01	0.33031E+02	0.26222E+02
212	0.16600E+01	0.12884E+01	0.58421E+02	0.25695E+00	0.22913E+01	0.32851E+02	0.26135E+02
213	0.16700E+01	0.12923E+01	0.58055E+02	0.25421E+00	0.22963E+01	0.32672E+02	0.26050E+02
214	0.16800E+01	0.12961E+01	0.57694E+02	0.25145E+00	0.23013E+01	0.32495E+02	0.25965E+02
215	0.16900E+01	0.13000E+01	0.57339E+02	0.24867E+00	0.23065E+01	0.32318E+02	0.25882E+02
216	0.17000E+01	0.13038E+01	0.56988E+02	0.24586E+00	0.23117E+01	0.32143E+02	0.25800E+02

*** EIOT ***

MATERIAL NUMBER 4

GROUP	E	SQRT(E)	NUSIGF	ALPHA	ETA	RTE*SIGA	RTE*SIGF
217	0.17100E+01	0.13077E+01	0.56641E+02	0.24303E+00	0.23169E+01	0.31968E+02	0.25718E+02
218	0.17200E+01	0.13115E+01	0.56300E+02	0.24017E+00	0.23223E+01	0.31795E+02	0.25638E+02
219	0.17300E+01	0.13153E+01	0.55962E+02	0.23730E+00	0.23277E+01	0.31623E+02	0.25558E+02
220	0.17400E+01	0.13191E+01	0.55629E+02	0.23440E+00	0.23331E+01	0.31451E+02	0.25479E+02
221	0.17500E+01	0.13229E+01	0.55300E+02	0.23147E+00	0.23387E+01	0.31281E+02	0.25401E+02
222	0.17600E+01	0.13266E+01	0.54976E+02	0.22853E+00	0.23443E+01	0.31111E+02	0.25324E+02
223	0.17700E+01	0.13304E+01	0.54655E+02	0.22556E+00	0.23500E+01	0.30943E+02	0.25248E+02
224	0.17800E+01	0.13342E+01	0.54338E+02	0.22256E+00	0.23557E+01	0.30775E+02	0.25172E+02
225	0.17900E+01	0.13379E+01	0.54026E+02	0.21954E+00	0.23615E+01	0.30608E+02	0.25098E+02
226	0.18000E+01	0.13416E+01	0.53717E+02	0.21650E+00	0.23674E+01	0.30441E+02	0.25024E+02
227	0.18100E+01	0.13454E+01	0.53411E+02	0.21344E+00	0.23734E+01	0.30276E+02	0.24951E+02
228	0.18200E+01	0.13491E+01	0.53110E+02	0.21035E+00	0.23795E+01	0.30111E+02	0.24878E+02
229	0.18300E+01	0.13528E+01	0.52812E+02	0.20723E+00	0.23856E+01	0.29947E+02	0.24806E+02
230	0.18400E+01	0.13565E+01	0.52517E+02	0.20409E+00	0.23918E+01	0.29784E+02	0.24735E+02
231	0.18500E+01	0.13601E+01	0.52226E+02	0.20093E+00	0.23981E+01	0.29621E+02	0.24665E+02
232	0.18600E+01	0.13638E+01	0.51938E+02	0.19774E+00	0.24045E+01	0.29459E+02	0.24595E+02
233	0.18700E+01	0.13675E+01	0.51653E+02	0.19453E+00	0.24110E+01	0.29297E+02	0.24526E+02
234	0.18800E+01	0.13711E+01	0.51372E+02	0.19130E+00	0.24175E+01	0.29136E+02	0.24457E+02
235	0.18900E+01	0.13748E+01	0.51094E+02	0.18803E+00	0.24242E+01	0.28976E+02	0.24390E+02
236	0.19000E+01	0.13784E+01	0.50818E+02	0.18475E+00	0.24309E+01	0.28816E+02	0.24322E+02
237	0.19100E+01	0.13820E+01	0.50546E+02	0.18144E+00	0.24377E+01	0.28656E+02	0.24256E+02
238	0.19200E+01	0.13856E+01	0.50277E+02	0.17810E+00	0.24446E+01	0.28498E+02	0.24190E+02
239	0.19300E+01	0.13892E+01	0.50011E+02	0.17474E+00	0.24516E+01	0.28339E+02	0.24124E+02
240	0.19400E+01	0.13928E+01	0.49747E+02	0.17135E+00	0.24587E+01	0.28181E+02	0.24059E+02
241	0.19500E+01	0.13964E+01	0.49486E+02	0.16794E+00	0.24659E+01	0.28024E+02	0.23994E+02
242	0.19600E+01	0.14000E+01	0.49228E+02	0.16450E+00	0.24732E+01	0.27867E+02	0.23930E+02
243	0.19700E+01	0.14036E+01	0.48973E+02	0.16104E+00	0.24805E+01	0.27711E+02	0.23867E+02
244	0.19800E+01	0.14071E+01	0.48720E+02	0.15755E+00	0.24880E+01	0.27554E+02	0.23804E+02
245	0.19900E+01	0.14107E+01	0.48470E+02	0.15404E+00	0.24956E+01	0.27399E+02	0.23742E+02
246	0.20000E+01	0.14142E+01	0.48223E+02	0.15049E+00	0.25033E+01	0.27243E+02	0.23680E+02

*** ETOT ***

PUNCHED OUTPUT FOR TEMPEST

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          ETOT SAMPLE PROBLEM        PU-239  ENDF/B 1104
DECIMAL
PU39 A      4                                                          246    4    1
 1.517E+02 0.          3.080E+02 0.          2.538E+03                        4    2
 0.          0.          0.          0.          0.                         4    3
0.1517E+030.1520E+030.1523E+030.1527E+030.1530E+030.1533E+030.1537E+03      4    4
0.1540E+030.1543E+030.1547E+030.1550E+030.1554E+030.1558E+030.1561E+03      4    5
0.1565E+030.1569E+030.1573E+030.1577E+030.1581E+030.1585E+030.1589E+03      4    6
0.1593E+030.1597E+030.1601E+030.1606E+030.1610E+030.1614E+030.1619E+03      4    7
0.1623E+030.1628E+030.1632E+030.1637E+030.1642E+030.1647E+030.1651E+03      4    8
0.1656E+030.1661E+030.1666E+030.1671E+030.1676E+030.1681E+030.1687E+03      4    9
0.1692E+030.1697E+030.1702E+030.1708E+030.1713E+030.1719E+030.1725E+03      4   10
0.1731E+030.1736E+030.1802E+030.1880E+030.1974E+030.2085E+030.2217E+03      4   11
0.2370E+030.2549E+030.2763E+030.3010E+030.3320E+030.3693E+030.4168E+03      4   12
0.4759E+030.5521E+030.6474E+030.7562E+030.9005E+030.1076E+040.1315E+04      4   13
0.1605E+040.1961E+040.2301E+040.2621E+040.2817E+040.2870E+040.2764E+04      4   14
0.2497E+040.2140E+040.1783E+040.1493E+040.1238E+040.1050E+040.8837E+03      4   15
0.7442E+030.6340E+030.5486E+030.4716E+030.4159E+030.3672E+030.3276E+03      4   16
0.2962E+030.2715E+030.2521E+030.2335E+030.2163E+030.1953E+030.1845E+03      4   17
0.1725E+030.1633E+030.1520E+030.1450E+030.1380E+030.1321E+030.1259E+03      4   18
0.1186E+030.1134E+030.1089E+030.1040E+030.1006E+030.9619E+020.9338E+02      4   19
0.9093E+020.8775E+020.8543E+020.8260E+020.8090E+020.7893E+020.7682E+02      4   20
0.7524E+020.7376E+020.7226E+020.7074E+020.6931E+020.6860E+020.6776E+02      4   21
0.6639E+020.6486E+020.6408E+020.6342E+020.6196E+020.6126E+020.6055E+02      4   22
0.5956E+020.5855E+020.5869E+020.5716E+020.5597E+020.5559E+020.5464E+02      4   23
0.5423E+020.5326E+020.5311E+020.5241E+020.5167E+020.5093E+020.5105E+02      4   24
0.5054E+020.5005E+020.4958E+020.4911E+020.4867E+020.4823E+020.4780E+02      4   25
0.4739E+020.4698E+020.4659E+020.4621E+020.4583E+020.4546E+020.4511E+02      4   26
0.4476E+020.4441E+020.4408E+020.4375E+020.4343E+020.4312E+020.4281E+02      4   27
0.4250E+020.4221E+020.4192E+020.4163E+020.4135E+020.4107E+020.4080E+02      4   28
0.4053E+020.4027E+020.4001E+020.3976E+020.3950E+020.3926E+020.3901E+02      4   29
0.3877E+020.3854E+020.3830E+020.3807E+020.3784E+020.3762E+020.3739E+02      4   30
0.3717E+020.3696E+020.3674E+020.3653E+020.3632E+020.3611E+020.3591E+02      4   31
0.3570E+020.3550E+020.3530E+020.3510E+020.3491E+020.3471E+020.3452E+02      4   32
0.3433E+020.3414E+020.3395E+020.3376E+020.3358E+020.3339E+020.3321E+02      4   33
0.3303E+020.3285E+020.3267E+020.3249E+020.3232E+020.3214E+020.3197E+02      4   34
0.3180E+020.3162E+020.3145E+020.3128E+020.3111E+020.3094E+020.3077E+02      4   35
0.3061E+020.3044E+020.3028E+020.3011E+020.2995E+020.2978E+020.2962E+02      4   36
0.2946E+020.2930E+020.2914E+020.2898E+020.2882E+020.2866E+020.2850E+02      4   37
0.2834E+020.2818E+020.2802E+020.2787E+020.2771E+020.2755E+020.2740E+02      4   38
0.2724E+020          0          0          0          0          0          4   39
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PU39 F   104                                                                246 104   1
 1.157E+02 0.         2.329E+01 0.         2.864E+03                            104   2
 0.          0.         0.          0.         2.880E+00                       104   3
0.1157E+030.1157E+030.1158E+030.1158E+030.1158E+030.1159E+030.1159E+03          104   4
0.1160E+030.1161E+030.1161E+030.1162E+030.1163E+030.1164E+030.1165E+03          104   5
0.1165E+030.1166E+030.1167E+030.1168E+030.1169E+030.1171E+030.1172E+03          104   6
0.1173E+030.1175E+030.1176E+030.1178E+030.1179E+030.1181E+030.1183E+03          104   7
0.1185E+030.1187E+030.1189E+030.1190E+030.1191E+030.1193E+030.1197E+03          104   8
0.1200E+030.1202E+030.1204E+030.1206E+030.1208E+030.1209E+030.1213E+03          104   9
0.1216E+030.1218E+030.1219E+030.1220E+030.1224E+030.1227E+030.1230E+03          104  10
0.1233E+030.1236E+030.1269E+030.1311E+030.1355E+030.1416E+030.1489E+03          104  11
0.1562E+030.1656E+030.1772E+030.1900E+030.2081E+030.2292E+030.2565E+03          104  12
0.2904E+030.3348E+030.3906E+030.4541E+030.5385E+030.6413E+030.7812E+03          104  13
0.9505E+030.1162E+040.1363E+040.1552E+040.1668E+040.1700E+040.1637E+04          104  14
0.1479E+040.1267E+040.1056E+040.8871E+030.7391E+030.6332E+030.5434E+03          104  15
0.4650E+030.4012E+030.3506E+030.3039E+030.2699E+030.2399E+030.2152E+03          104  16
0.1954E+030.1800E+030.1677E+030.1559E+030.1452E+030.1313E+030.1245E+03          104  17
0.1168E+030.1111E+030.1038E+030.9937E+020.9486E+020.9102E+020.8709E+02          104  18
0.8229E+020.7890E+020.7601E+020.7281E+020.7069E+020.6811E+020.6597E+02          104  19
0.6438E+020.6225E+020.6067E+020.5914E+020.5793E+020.5651E+020.5498E+02          104  20
0.5387E+020.5281E+020.5174E+020.5064E+020.4962E+020.4912E+020.4851E+02          104  21
0.4753E+020.4643E+020.4588E+020.4541E+020.4436E+020.4386E+020.4335E+02          104  22
0.4264E+020.4192E+020.4119E+020.4093E+020.4007E+020.3980E+020.3912E+02          104  23
0.3883E+020.3813E+020.3803E+020.3752E+020.3700E+020.3647E+020.3650E+02          104  24
0.3619E+020.3589E+020.3560E+020.3531E+020.3504E+020.3477E+020.3451E+02          104  25
0.3426E+020.3402E+020.3378E+020.3354E+020.3332E+020.3310E+020.3288E+02          104  26
0.3267E+020.3247E+020.3227E+020.3208E+020.3189E+020.3170E+020.3152E+02          104  27
0.3134E+020.3117E+020.3100E+020.3083E+020.3067E+020.3051E+020.3035E+02          104  28
0.3020E+020.3005E+020.2990E+020.2976E+020.2962E+020.2948E+020.2934E+02          104  29
0.2921E+020.2908E+020.2895E+020.2882E+020.2870E+020.2858E+020.2846E+02          104  30
0.2834E+020.2822E+020.2811E+020.2799E+020.2788E+020.2777E+020.2767E+02          104  31
0.2756E+020.2745E+020.2735E+020.2725E+020.2715E+020.2705E+020.2695E+02          104  32
0.2686E+020.2676E+020.2667E+020.2658E+020.2649E+020.2640E+020.2631E+02          104  33
0.2622E+020.2614E+020.2605E+020.2597E+020.2588E+020.2580E+020.2572E+02          104  34
0.2564E+020.2556E+020.2548E+020.2540E+020.2532E+020.2525E+020.2517E+02          104  35
0.2510E+020.2502E+020.2495E+020.2488E+020.2481E+020.2474E+020.2466E+02          104  36
0.2460E+020.2453E+020.2446E+020.2439E+020.2432E+020.2426E+020.2419E+02          104  37
0.2412E+020.2406E+020.2399E+020.2393E+020.2387E+020.2380E+020.2374E+02          104  38
0.2368E+020          0          0          0          0          0              104  39
PU39 X   204                                                                246 204   1
 8.742E+00 0.        -4.935E+00 0.        -4.833E+01                           204   2
 0.          0.         0.          0.         1.000E+00                       204   3
0.8742E+010.8737E+010.8731E+010.8727E+010.8721E+010.8716E+010.8710E+01          204   4
0.8705E+010.8699E+010.8694E+010.8690E+010.8684E+010.8679E+010.8673E+01          204   5
0.8667E+010.8662E+010.8656E+010.8650E+010.8645E+010.8639E+010.8633E+01          204   6
0.8627E+010.8621E+010.8615E+010.8609E+010.8603E+010.8597E+010.8591E+01          204   7
0.8585E+010.8579E+010.8572E+010.8566E+010.8560E+010.8553E+010.8547E+01          204   8
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0.8541E+010.8534E+010.8528E+010.8521E+010.8514E+010.8508E+010.8501E+01    204    9
0.8494E+010.8487E+010.8481E+010.8474E+010.8467E+010.8460E+010.8453E+01    204   10
0.8446E+010.8439E+010.8365E+010.8285E+010.8201E+010.8110E+010.8013E+01    204   11
0.7900E+010.7797E+010.7669E+010.7551E+010.7415E+010.7273E+010.7116E+01    204   12
0.6971E+010.6816E+010.6672E+010.6551E+010.6472E+010.6493E+010.6633E+01    204   13
0.7083E+010.7815E+010.9151E+010.1104E+020.1341E+020.1577E+020.1755E+02    204   14
0.1859E+020.1881E+020.1870E+020.1820E+020.1774E+020.1720E+020.1668E+02    204   15
0.1622E+020.1578E+020.1541E+020.1506E+020.1476E+020.1449E+020.1425E+02    204   16
0.1403E+020.1384E+020.1365E+020.1350E+020.1335E+020.1321E+020.1309E+02    204   17
0.1298E+020.1287E+020.1277E+020.1268E+020.1260E+020.1252E+020.1245E+02    204   18
0.1238E+020.1231E+020.1225E+020.1220E+020.1214E+020.1209E+020.1204E+02    204   19
0.1200E+020.1195E+020.1191E+020.1187E+020.1184E+020.1180E+020.1177E+02    204   20
0.1173E+020.1170E+020.1167E+020.1165E+020.1162E+020.1159E+020.1157E+02    204   21
0.1154E+020.1152E+020.1150E+020.1147E+020.1145E+020.1143E+020.1141E+02    204   22
0.1140E+020.1138E+020.1136E+020.1134E+020.1133E+020.1131E+020.1129E+02    204   23
0.1128E+020.1126E+020.1125E+020.1124E+020.1122E+020.1121E+020.1166E+02    204   24
0.1164E+020.1162E+020.1160E+020.1158E+020.1156E+020.1154E+020.1153E+02    204   25
0.1151E+020.1149E+020.1147E+020.1146E+020.1144E+020.1143E+020.1141E+02    204   26
0.1140E+020.1138E+020.1137E+020.1135E+020.1134E+020.1132E+020.1131E+02    204   27
0.1130E+020.1128E+020.1127E+020.1126E+020.1124E+020.1123E+020.1122E+02    204   28
0.1120E+020.1119E+020.1118E+020.1117E+020.1116E+020.1115E+020.1113E+02    204   29
0.1112E+020.1111E+020.1110E+020.1109E+020.1108E+020.1107E+020.1106E+02    204   30
0.1105E+020.1104E+020.1103E+020.1102E+020.1101E+020.1100E+020.1099E+02    204   31
0.1098E+020.1097E+020.1096E+020.1095E+020.1094E+020.1093E+020.1092E+02    204   32
0.1091E+020.1090E+020.1089E+020.1089E+020.1088E+020.1087E+020.1086E+02    204   33
0.1085E+020.1084E+020.1084E+020.1083E+020.1082E+020.1081E+020.1080E+02    204   34
0.1079E+020.1079E+020.1078E+020.1077E+020.1076E+020.1076E+020.1075E+02    204   35
0.1074E+020.1073E+020.1073E+020.1072E+020.1071E+020.1070E+020.1070E+02    204   36
0.1069E+020.1068E+020.1068E+020.1067E+020.1066E+020.1066E+020.1065E+02    204   37
0.1064E+020.1064E+020.1063E+020.1062E+020.1062E+020.1061E+020.1060E+02    204   38
0.1060E+020          0          0          0          0          0         204   39
X-LAST

IN PROGRAM ETOT5 CP TIME WAS    6.5000 SEC. , ELAPSED TIME WAS   16.0000 SEC.
```
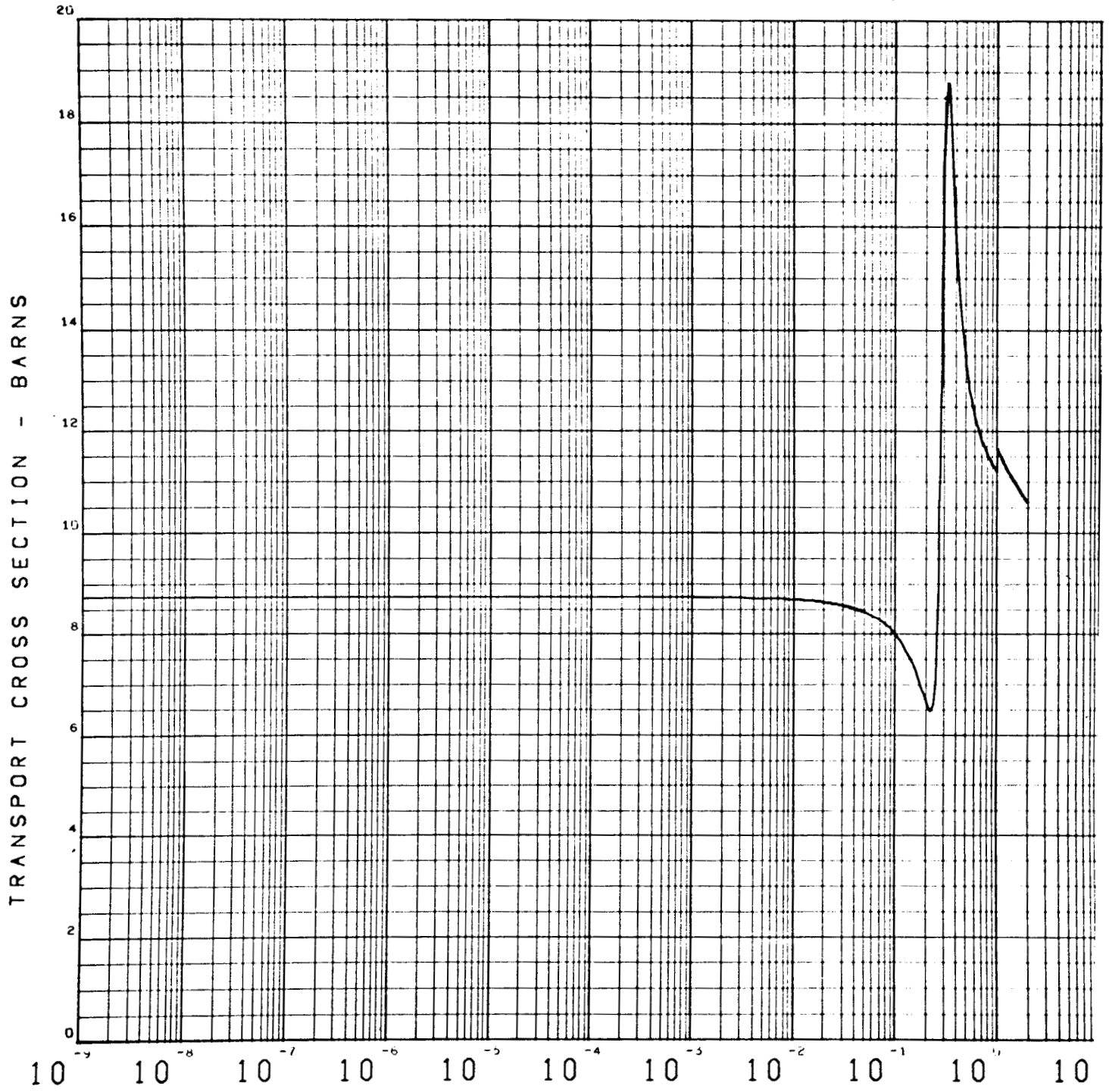
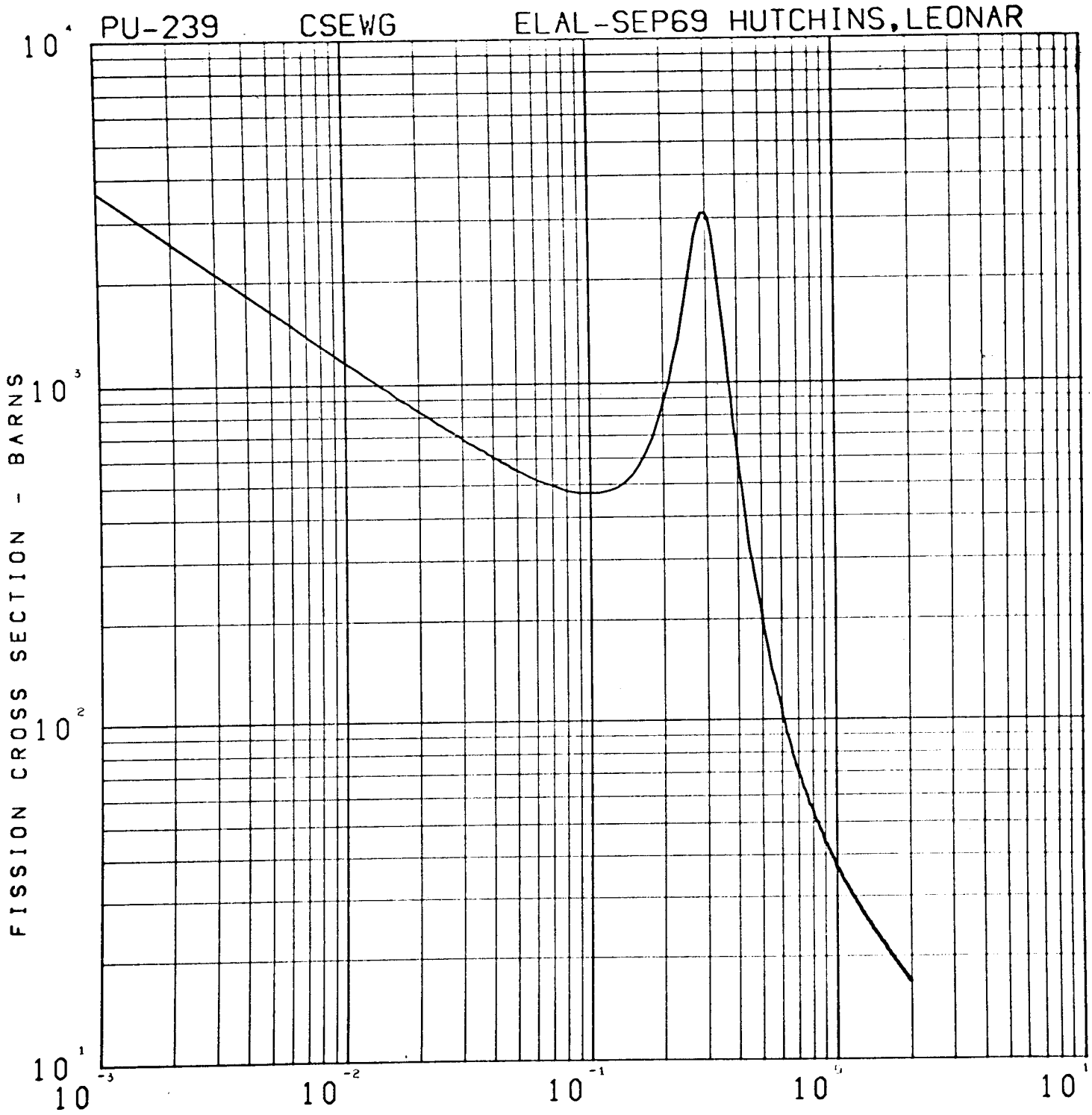
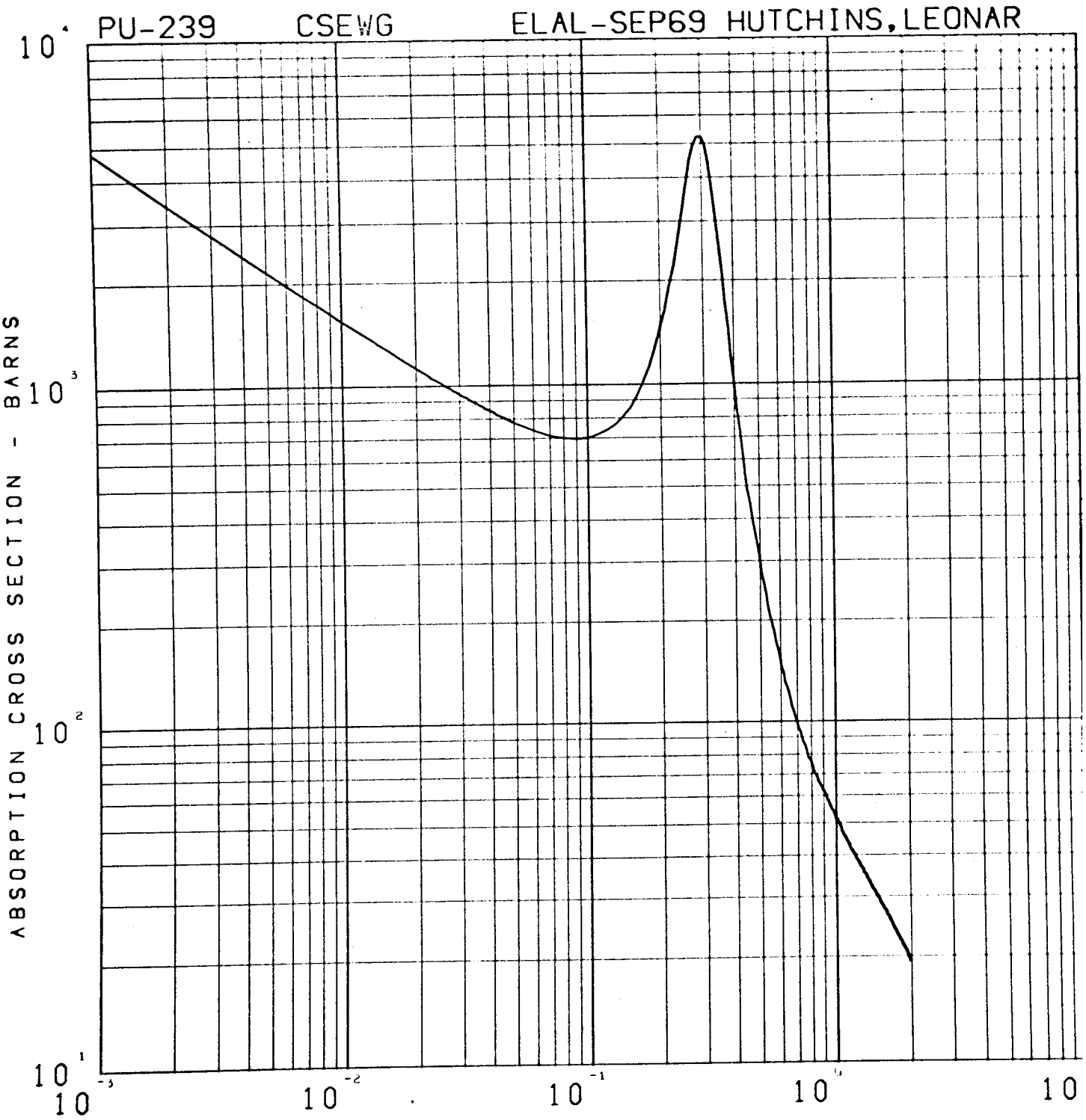


PU-239 CSEWG ELAL-SEP69 HUTCHINS, LEONAR
TRANSPORT CROSS SECTION - BARNS
20
18
16
14
12
10
8
6
4
2
0
10 10 10 10 10 10 10 10 10 10 10


PU-239 CSEWG ELAL-SEP69 HUTCHINS,LEONAR
FISSION CROSS SECTION - BARNS
10^4
10^3
10^2
10^1
10^-3
10^-2
10^-1
10^0
10^1


PU-239 CSEWG ELAL-SEP69 HUTCHINS,LEONAR
ABSORPTION CROSS SECTION - BARNS
10^4
10^3
10^2
10^1
10^-3
10^-2
10^-1
10^0
10

4.0 PROGRAMMER'S INFORMATION

This section contains many of the internal details of the program. The intent is that this section will provide the programmer with information that will prove helpful for making additions or modifications and also assist in making the program operational at other installations.

4.1 General Program Design Philosophy

This program was written with the assumption that it would likely be used at many installations with a variety of computing machinery. Also it is not primarily a production program but one that will simply be used from time to time to generate new libraries or update old ones. Hence, a basic aim was to produce straightforward, clear programming that would be readily understood. The program is entirely in ASA standard FORTRAN (FORTRAN IV) and uses no programming tricks and takes no advantage of any particular hardware or software. Also in the spirit of simplicity, variable dimensioning was not used.

The program was written with the expectation that there will be future additions and modifications. Some of these are anticipated with statement allocations and comments. Others are already wholly or partially included. In any case, adequate storage remains to handle any foreseeable contingency.

The main program is simply a series of tests and calls. It is quite straightforward and serves as a gross flow diagram. The flow is in a straight line with few deviations hence segmenting is readily accomplished. The program as distributed is segmented according to the overlay structure given in Section 4.3.

Many of the subroutines used by the program may be useful in other (present and future) codes connected with the ENDF/B system. Hence an attempt has been made to write these routines with general use in mind and they are self-contained (or nearly so). Some ETOT subroutines may be replaced by similar routines from other ENDF/B codes when they become available.

Most of the data handling is done with large common storage blocks. All tape data are first read into these blocks before processing. When data are manipulated, they are done in blocks. The blocks also serve as temporary space for some processed results before they are output. These blocks are the device which permits the general purpose subroutines to be self-contained. At present there are 4 floating point blocks, two of length 4000 and 2 of length 1000. Associated with each of the four is a fixed point block of length 50.

The logical flow of the program is designed so that the ENDF/B library tape will be scanned only once; hence, the library tape is never backspaced and is only read forward. Thus, the data are processed in the order they appear on the ENDF/B tape.

4.2 Labeled COMMON Variables

/TAPES/

MODE	mode of the ENDF/B library tape
I05	input tape
I06	output print tape
I07	output punch tape
NDFB	ENDF/B library tape
LTAPE	thermal library tape

/DENS/*

JMT	record identifier
JAT	record starting location
JTT	record type
JLT	record length
A	bulk storage array
JNS,MNS	pointers for next record
JX	maximum length of A array
MX	maximum length of JMT, JAT, JTT, and JLT arrays

/RECS/*

MAT	material number
MF	file number
MT	reaction type number
C1,C2	floating point constants
L1,L2	integer constants

---

*This common block is part of the package of Retrieval Subroutines for the ENDF/B system written by H. C. Honeck (Reference 10).

/RECS/* (cont'd.)

N1	count of items in a list to follow
N2	count of items in a second list to follow
NBT,JNT	general integer storage space
X,Y,B	general floating point storage space
NIX	maximum length of the NBT and JNT arrays
NZX	maximum length of the X and Y arrays
NS	card sequence number

/GROUPS/

EGRP	energy breakpoints
VGRP	speed breakpoints
EPTS	energy points
V	speed points

/FILE3/

XS	scattering cross section
XC	capture cross section
XF	fission cross section
XSMU	average cosine of the scattering angle
ZETA	weighting function

/FILE6/

TRUM	extra cross section storage

/RESP/

NREF	number of resonances
EZERO	energy at resonance peak (E_o)
GAMN	neutron width evaluated at E_o
GAMG	radiation width evaluated at E_o
GAMF	fission width evaluated at E_o
G	spin factor
ELOW	lower bound of resonance region
EHIGH	upper bound of resonance region
SIGP	potential scattering

/OPTION/

IDTAP	ENDF/B tape ID
MCODE	output format
MAXG	number of groups
MAXG1	MAXG+1
MAXG2	MAXG+2
IW	type of weight
IEU	energy structure
IGRPE	if lower group is at 0 e.v.
IRES	maximum number of resonance parameters
IPUN	punch option flag
IAV	group averaged or point values
IAPX	test 1/v approximation fit
TEMP	temperature (°K) for Maxwellian distribution
IGRAPH	graph option flag

/IN/	(See input description)
/MATS/	
NMAT	number of materials
IMAT	number of current material being processed
MATNOS	ENDF/B material numbers
MATIDS	thermal material numbers
MAT2ID	second thermal ID
/LABL/	
LABEL	Punched output label
/FLAGS/	
KEY	data presence indicator
NOXF	fission cross section indicator
IVA	1/v fit to absorption cross section
IVF	1/v fit to fission cross section
IVS	constant fit to scattering cross section
/ENDS/	(lowest group where data is tabulated)
/CONTF1/	
ZA	material (Z,A) designation
AWR	atomic weight ratio
LRP	resonance indicator

NOTE: In ETOT5, the /RECS/ labeled common is used as storage for various cross sections and other nuclear data which are edited by ETOT.

4.3 Overlay Structure and Routine List

Following is a list of the programs, subroutines, and functions used by ETOT. A brief summary of the purpose of each is included. The order of the list is the same as that of the physical deck. It is arranged by program segment. Hence this list also serves as the overlay structure description. The subroutines with an asterisk are part of the package of Retrieval Subroutines for the ENDF/B System written by H. C. Honeck (Reference 10).

Overlay (0,0)

FLOW	control flow of ETOT
ERR	print error message
ERROR	print error message *

TIMEIT	compute and print elapsed time
STORE	store record in dense storage*
FETCH	fetch record from dense storage*
DELETE	delete record from dense storage*
LRIDS	locate record in dense storage*
FPDS	fetch point from dense storage*
IPDS	interpolate point in dense storage *
TPOS	position ENDF/B tape to file (MF) and reaction (MT)
CONT	read control (CONT) record
HOLL	read hollerith material description
LIST	read LIST record
TAB1	read TAB1 record
TAB2	read TAB2 record
COMBP	combine one panel of two TAB1 functions*
COMB	combine two TAB1 functions *
ADD	combining function for addition*
SUB	combining function for subtraction *
MULT	combining function for multiplication *
DIV	combining function for division*
TERP	interpolate between two points*
TERP1	interpolate one point*
TERP2	form new table by interpolation*
TERP0	interpolate data array
XTND	extend data array
ECSI	compute integral of y(K)*
GRATE	integrate TAB1 function*
AVRG	average over a selected range
GPAV	average over selected groups
POINT	calculate cross sections at energy points
RES	calculate resolved resonance cross sections
OVERLAY(1,0)	
ETOT1	read input
EU	construct group structure
WEIGHT	construct weight and weight averages
GENT1	generate TAB1 function*
WELL	generating function for Maxwellian distribution
TRID	read ENDF/B tape I.D.
OUT1	print input data

Overlay (2,0)

ETOT2	control flow of program in overlay (2,0)
ZERO	initialize
TMAT	position ENDF/B tape to material
TMF1	read ENDF/B file 1

Overlay (3,0)

ETOT3	control flow of program in overlay (3,0)
TMF2	read ENDF/B file 2
RESCAL	calculate resonance data
OUT3	print resonance data

Overlay (4,0)

ETOT4	control flow of program in Overlay (4,0)
TMF3	read ENDF/B file 3
CROSS	calculate smooth cross sections

Overlay (5,0)

ETOT5	control flow of program in overlay (5,0)
PRELIM	calculate coefficients and resonance parameters (KATE type)
FIT2V	tests for fit to 1/v
FINDC	calculate second order least squares polynomial
SIMQ	simultaneous equation solver
SETUP	extends and prints cross sections and related data
GRAPH	graph the cross sections
PLOT	graph data array
LOUT	punch in ARK format
KOUT	punch in KATE format
CVRT	convert real into decimal and exponent
ALPHA	convert integer into alphanumeric
CARD	punch one KATE card
LAUT	punch in LASER or THERMOS format.

4.4 Error Stops

If certain errors are detected, an error message will be printed. Some messages are printed directly from the routine where they are detected. Others are printed by one of the error printing subroutines. Subroutine ERR will print an error number, the subroutine and the statement number where the error occurred and the control words, MAT, MF, MT, C1, C2, L1,

L2, N1 and N2. Subroutine ERROR prints only the error number and the control words, MAT, MF, and MT. Following is a list of the error numbers, the subroutine which detects the error and an explanation of the error.

Error Number	Detecting Subroutine	Explanation
110	ECSI	Interpolation code out of range
130	TERP2	X(N) not in increasing order
131	TERP2	XP(N) not in increasing order
132	TERP2	Interpolation table incorrect
133	TERP1	Interpolation code not in range 1-5
134	TERP1	X $\leq$ 0 cannot be interpolated by logs
135	TERP1	X1=X2, discontinuity
300	STORE	JT not in range 1-6
301	STORE	MA=0 not allowed
302	STORE	Overflow, record will not fit
303	FETCH	MA=0, record not in /DENS/
308	COMB	Overflow, answer will not fit in /RECS/
309	COMB	MA or MB not in /DENS/
310	COMB	XL $\geq$ XH
311	COMB	MA or MB is zero
314	IPDS	Improper interpolation table
315	GRATE	Interpolation table incorrect.

5.0 ENVIRONMENT INFORMATION

ETOT requires approximately $50{,}000_{10}$ locations and uses the ENDF/B data tape and produces a library tape. It also requires standard system input, output, and punch units. Since the program is entirely in FORTRAN IV, it should compile and execute on any configuration meeting these requirements. The only possible difficulty is that ETOT calls the SC-4020 plotting routine AICRT3.

6.0 ACKNOWLEDGMENTS

The authors would like to thank D. E. Kusner for discussions concerning the ETOM-1 program on which ETOT is based.

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