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ENDF/B

SPECIFICATIONS FOR AN EVALUATED NUCLEAR DATA FILE FOR REACTOR APPLICATIONS

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1. Introduction

Several steps are required to process measured nuclear data into a form suitable for input to a reactor design code. These steps are illustrated in figure 1.1. In this figure, boxes represent computer codes which perform some operation on the data, the circles represent magnetic tape (or card) files to store data, the solid lines represent the flow of data, and the dashed lines represent "feed back" to the evaluation phases from the testing of the data against the results of integral experiments.

The ENDF (Evaluated Nuclear Data File) is one of these magnetic tape stores of data. The system (referred to here as ENDF/A) has been described in BNL 8381. This report describes a second part of the ENDF system, referred to as ENDF/B, and contains the specifications for a magnetic tape (or punched card) storage for evaluated nuclear data to be used for reactor design calculations. The extension of these formats to other than reactor applications has not been attempted, but may be considered at a later date.

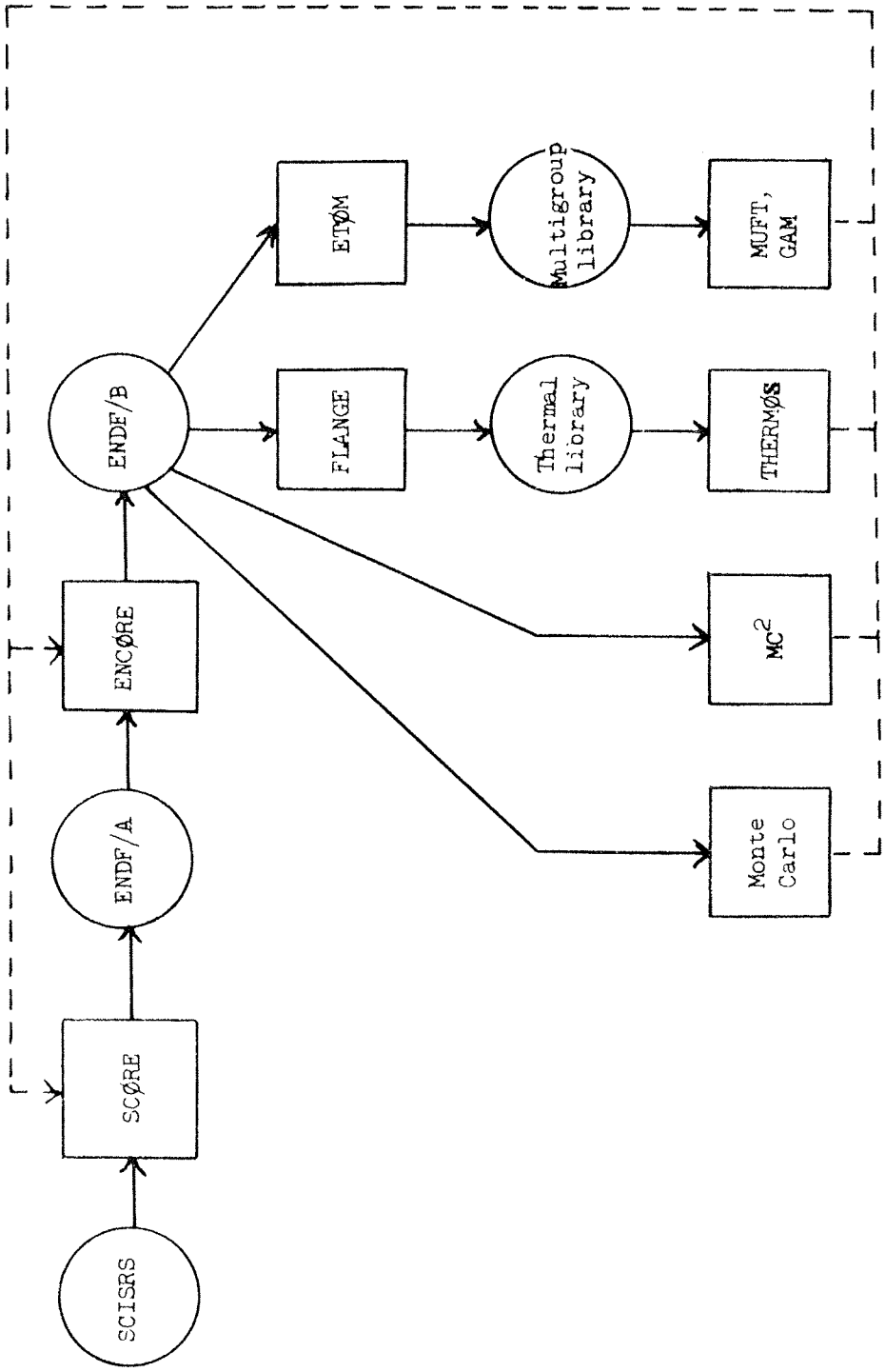

Figure 1.1 Schematic of the flow of nuclear data from compilation to reactor calculation.

2. Steps in the Processing of Nuclear Data for Use in Reactor Design Calculations

In this section we will amplify some of the general remarks made in the previous section, and further describe the codes and magnetic tape stores shown in figure 1.1.

2.1 The SCISRS

The Sigma Center Information Storage and Retrieval System is an automated compilation of experimental nuclear data. The system has been described in BNL 883. The main items stored are the measured values of cross sections, but many secondary items of interest to evaluators (errors, method, references, etc.) are also stored.

2.2 The ENDF

The process of digesting the experimental data, combining it with the predictions of nuclear model calculations, and attempting to extract the true value of a cross section is referred to as evaluation. The ENDF was developed to store the results of this evaluation process in a form suitable for automated retrieval for further processing.

The reactor designer wants evaluated data for all neutron induced reactions covering the full range of incident neutron energies for each material used in a reactor. Evaluators generally do not supply the data in this form. Rather, they supply the "bits and pieces" which, when put together, form a fully evaluated set of data for each material. Thus, there is a need for two storage systems, one to contain the evaluated

bits and pieces as they are completed, and a second to contain complete sets of data for each material. These two systems will be disignated as ENDF/A and ENDF/B, respectively. ENDF/A is described in BNL 8381, "Evaluated Nuclear Data File Description and Specifications," by H. Honeck.

The differences between these two systems can best be described by making the following comparisons:

Basic storage unit

ENDF/A - Data for a particular energy range of a particular cross section of a particular material.

ENDF/B - All data for a material needed for a reactor calculation.

Type of data included

ENDF/A - All reaction types for all incident particle types and all final particle types.

ENDF/B - Data for neutron induced reactions required for reactor calculations.

Ordering of data

ENDF/A - data stored in the order received at the ENDF Center.

ENDF/B - Data stored first by material, second by type of data, and third by reaction type.

Main usage

ENDF/A - Used mainly by evaluators to store their results as building blocks with which to generate data for the ENDF/B.

ENDF/B - Used mainly be reactor designers either as direct input to reactor codes or as input to codes which generate multi-group sets.

Format

ENDF/A - Highly flexible to accept data in almost any arrangement or representation.

ENDF/B - Simple so as to facillitate writing of codes to use the data.

Selection of data and revisions

ENDF/A - No selection of data is made. All data is accepted and added to the master files. Hence, many alternate evaluations will be found.

ENDF/B - One complete set of data for each material will be selected. This set will be updated at regular intervals of about one year. Only a limited number of alternate evaluations will be provided.

2.3 Linkage Between the Storage Systems

Two boxes (labeled SCØRE and ENCØRE) are shown in figure 1.1. These represent the evaluation process and are largely hand operations at the present time. Much of the tedious manipulation of the data in the evaluation process can be automated. The computer codes SCØRE and ENCØRE will be developed for this purpose.

3. General Description of ENDF/B

ENDF/B is primarily intended as a binary magnetic tape format to be used as the main input to a cross section processing program. As such, it is designed with the processing program in mind and the reader must be familiar with the Fortran programming language. The ordering of data on the tape allows the use of segmented as well as ordinary programs.

Punched cards are a nuisance, particularly when vast numbers of them are required, as is the case here. Unfortunately, it is not always possible to exchange data on tapes. Therefore, a punched card format for ENDF/B, equivalent to the tape format, is reluctantly provided.

3.1 Some Definitions and Conventions

We define a material as either an isotope or a collection of isotopes. Each material on the ENDF/B has a material number designated by the symbol MAT. These numbers range from 1 to 9999. A program processing data from an ENDF/B tape generally refers to the materials by their material number, but a (Z,A) designation also appears and may be used.

Assignment of material numbers is arbitrary with one exception. For example, the user might assign the number 28 to a complete set of data for hydrogen and make up an ENDF/B tape; to use this hydrogen data in a later processing program, he would then refer to number 28. An alternate set of data for hydrogen could also be placed on the users ENDF/B tape, but it would be assigned a different material number. The exception to the rule recognizes the fact that the data for some materials may have been generated by the user while data for other materials were sent from the ENDF center. Material numbers 1-999 are to be assigned by the user for data he generates. Numbers 1000-9999 are to be assigned by the ENDF center in the form of acquisition numbers.

As an example, consider the following sequence of events. User X evaluates the data for U-235 and assigns the material number 278 to this collection of data. Within his installation the data is always referred to as material 278. After a period of checking and testing, the user feels that the data is satisfactory and transmits it to the ENDF center. The center adds the data to its files and assigns it an acquisition number, say, 4395. The center then issues a newsletter describing data received and available for distribution. User Y reads the newsletter and requests material 4395 from the center's files. Upon receipt of the data he adds it to his ENDF/B tape as material 4395 and

refers to it in later processing programs by this number. Should user Y subsequently alter the data, he would assign a new material number between 1 and 999. The entire process might then start anew.

Identification numbers are used to designate materials, files, sections, reactions, etc. These numbers are always given in increasing numerical order. The same rule applies to energies, angular cosines, temperature, and any other independent variable.

The following units are always used.

energy	- ev
angle	- dimensionless cosine of the angle,
cross section	- barns
solid angle	- steradian
temperature	- ^{o}Kelvin
mass	- in units of the neutron mass

Many distributions are given as normalized probability distributions. It is the responsibility of the user to check the normalization.

3.2 Structure of an ENDF/B Tape

The structure of an ENDF/B binary tape is shown schematically in Figure 3.2.1. The structure of a card deck is exactly the same. The tape is written or read in the binary mode.

The tape contains a single record at the beginning which identifies the tape, and a single record at the end signalling the end of the tape. The major subdivision between these records is by material. The data for a material is divided into files, each containing certain classes of data. A file is subdivided into sections, each containing data for a particular reaction. Finally, a section is divided into records, each of which correspond to a logical binary record on the tape.

Associated with each of these major subdivisions is a number. MAT is the material number, MF is the file number, and MT is a reaction type number indicating the contents of a section. Every record on the tape contains these three numbers as the first three numbers in the record. These numbers are always in increasing numerical order, and the hierarchy is MAT, MF, and MT.

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

The structure of a card deck is exactly the same except that a record may require several cards.

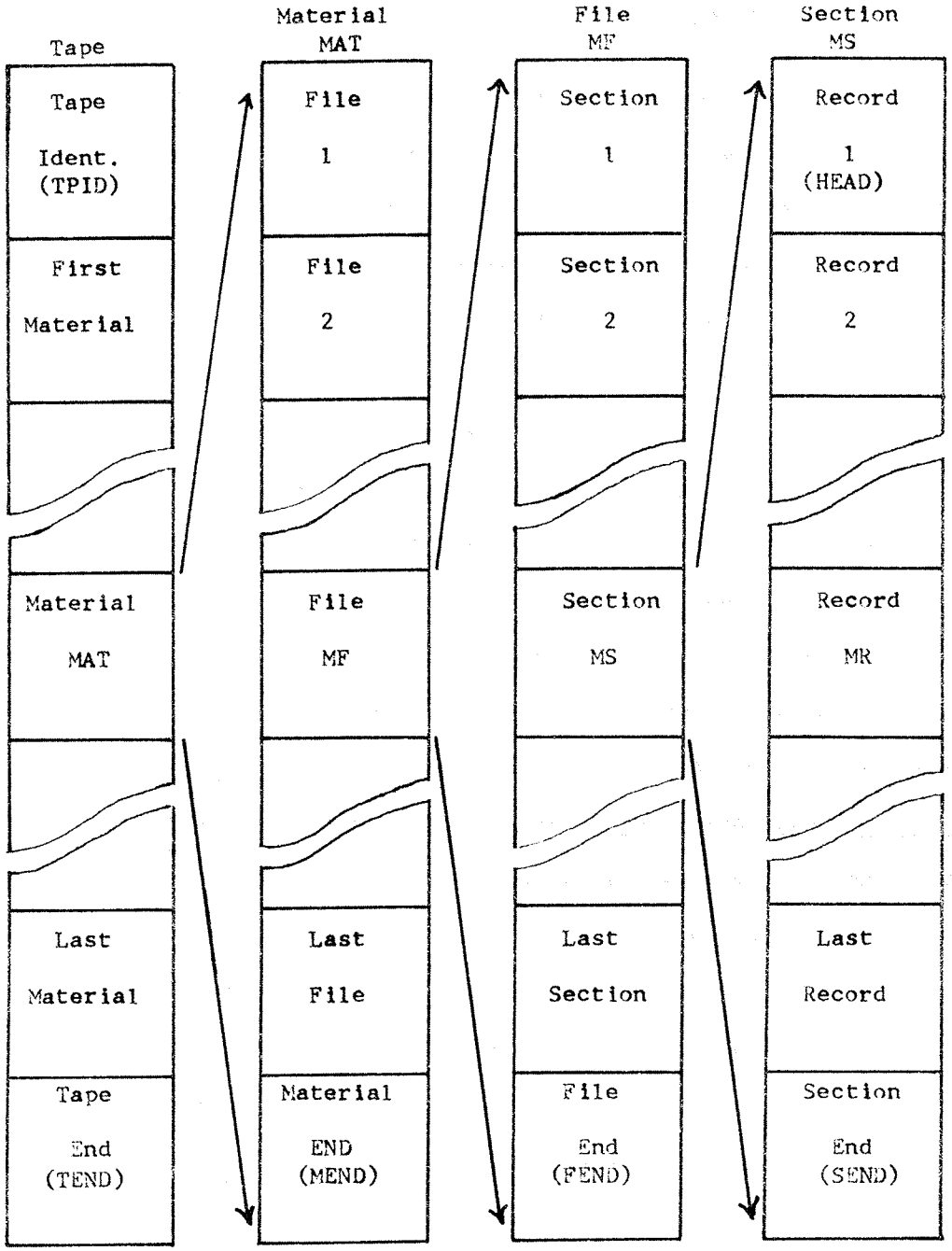

Figure 3.2.1 Arrangement of an ENDF/B Tape

3.3 Alternate Structure of an ENDF/B Tape

The structure given in the preceding section is well suited for card decks and binary tapes for many processing programs. It is desirable to indicate an alternate arrangement for a binary tape more suited to segmented types of processing programs. This alternate arrangement is illustrated in Figure 3.3.1 and is simply an interchange of materials and files. The hierarchy is now MF, MAT, and MT, and the first three numbers in each record should conform to this order.

A simple program can be written to reorder a tape and provide this alternate arrangement.

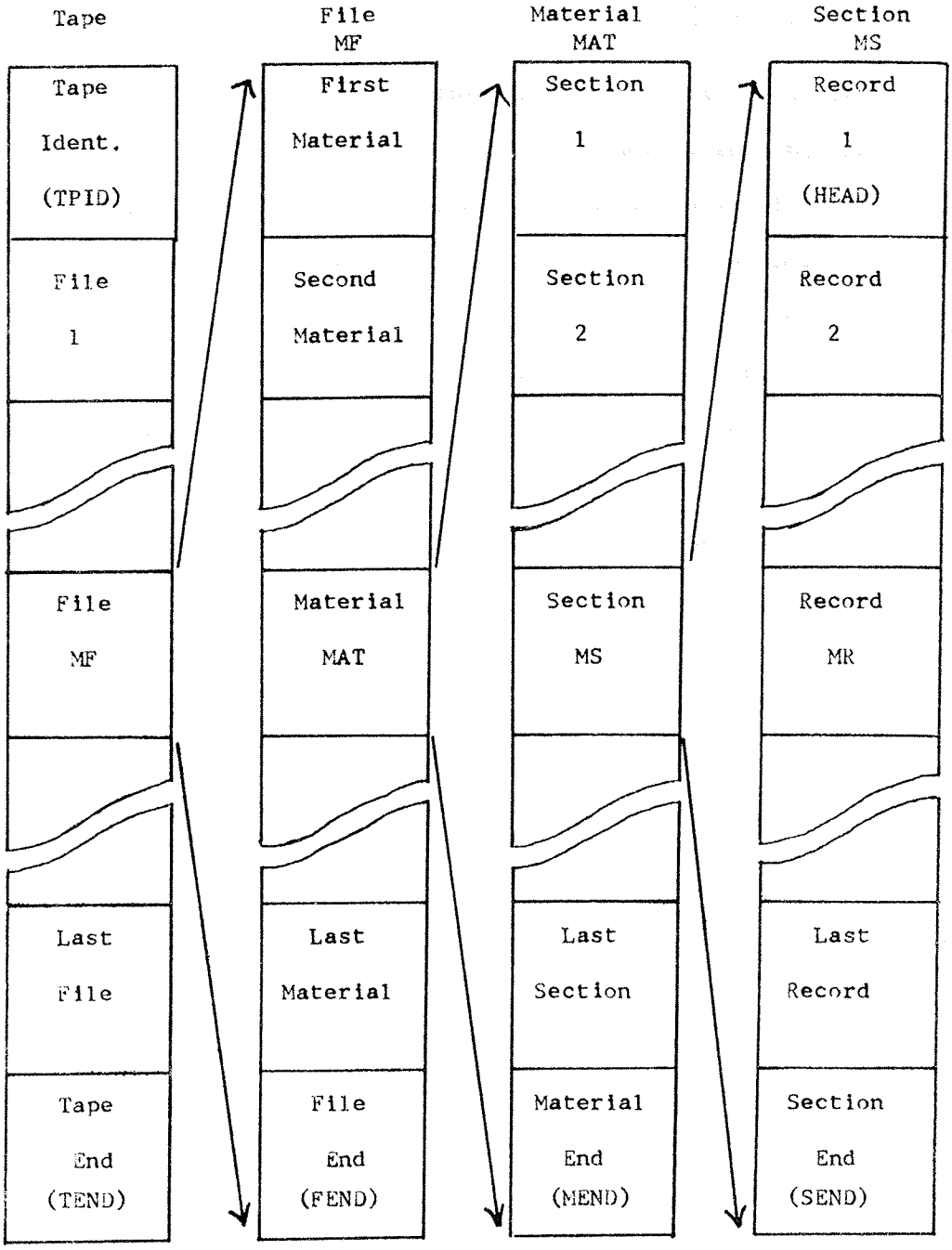

Figure 3.3.1 Alternate Arrangement of an ENDF/B Tape

3.4 Representation of a Function

We consider here how a simple function y(x), which might be a cross section $\sigma(E)$, is represented on the ENDF/B tape. We consider one-dimensional functions first.

A one-dimensional function f(x) is represented as a series of tabulated values plus rules for interpolating between values (see Figure 3.4.1). Define:

X(N) - N^{th} value of x, the values in increasing order.

Y(N) - N^{th} value of y.

NP - The number of values of x (and y) given.

NR - The number of regions having different interpolation schemes.

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

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

Permissible interpolation schemes are given in the following table.

INT	Description
1	constant
2	y linear in x
3	y linear in lnx
4	lny linear in x
5	lny linear in lnx

Interpolation code 1 (constant) implies that the function is constant and equal to the value given at the lower limit of the interval. In

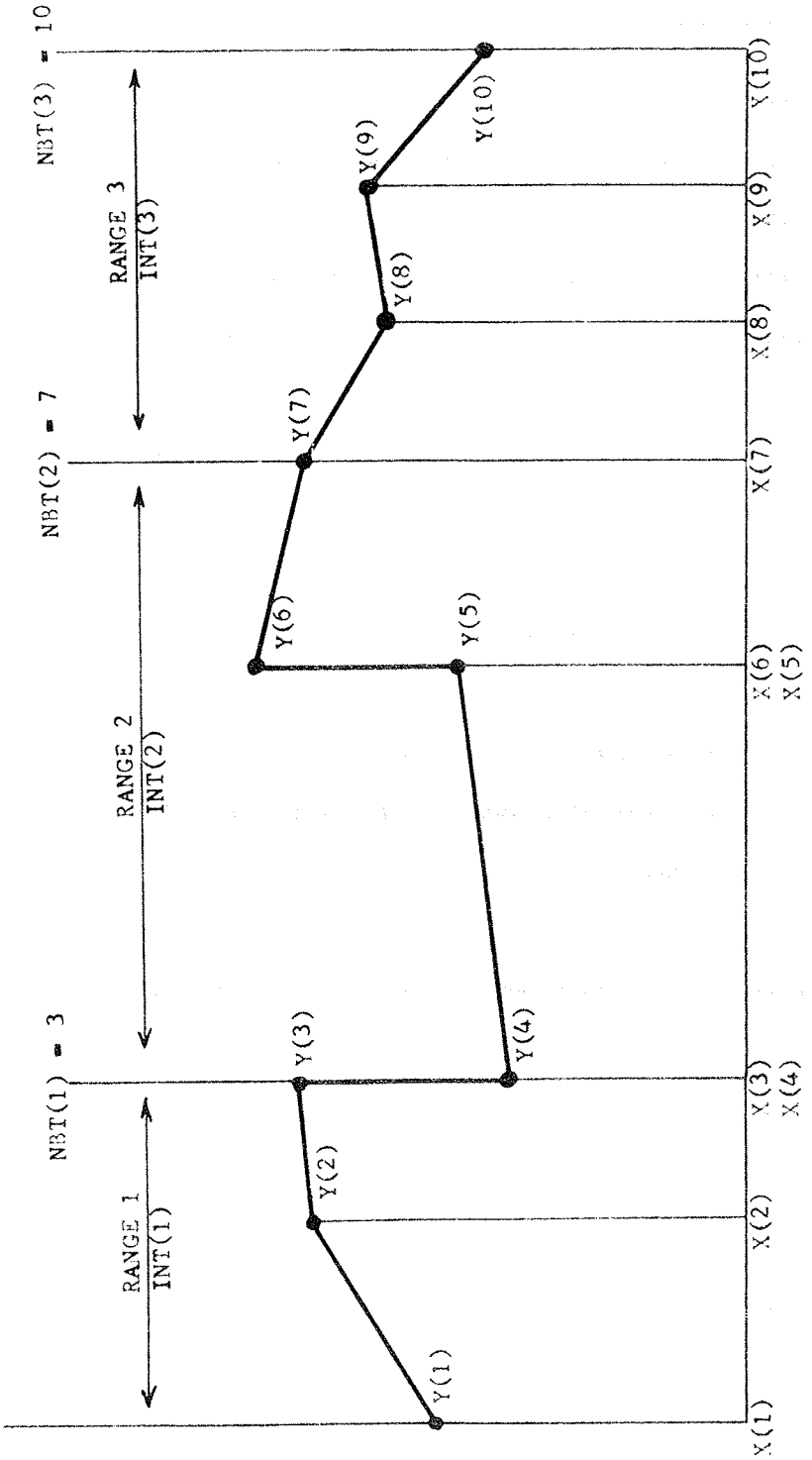

Figure 3.4.1 Tabulated one dimensional function illustrated for the case NP=10, NR=3

the case where a function is discontinuous (for example, when resonance parameters are used to specify the cross section in one range) the value of x is repeated and a pair (x,y) given for each of the two values at the discontinuity (see Figure 3.4.1).

Next consider a two-dimensional function y(x,z). Again the function is represnted by a series of tabulated values plus rules for interpolating between values of the more slowly moving variable in a tabulation of y(x,z). The function is then considered to be a sequence of one-dimensional functions, y(x), each evaluated at a particular value of z. The individual y(x) can be represented as illustrated above. The only additional information that need be given is a break point and interpolation table for interpolation between values of z.

4. General Description of the Formats

4.1 Nomenclature

An attempt has been made to use an internally consistant notation. We list here some of the rules used.

1. Symbols starting with letters I, J, K, L, M, or N are integers. All other symbols refer to floating point numbers.
2. The letter I or a symbol starting with I refers to an interpolation code.
3. Letters J, K, L, M, or N, when used alone, are indices.
4. A symbol starting with M is a control number. Examples: MAT, MT, MF.
5. A symbol starting with L is a test number. Examples: LFI, LCT, LTT.
6. A symbol starting with N is a count of items. Examples: NI, NR, NP, NFP.
7. Brackets, [ ], denote one record on a binary tape.
8. Brackets, $\langle\ \rangle$, denote a group of records.

Several symbols are frequently used and are defined below.

MAT - Material number

MF - File number

MT - Reaction type number

ZA - The (Z,A) designation for a material (see Appendix A)

AWR - The ratio of the weight of an atom (or molecule) to that of the neutron.

NP - The number of points in a tabulation of y(x) which is contained in the same record.

NR - The number of interpolation break points in a tabulation of y(x) which are contained in the same record.

T - Temperature

E - Energy

μ - cosine of an angle

Q - a "nuclear temperature"

4.2 Record Types

All records on an ENDF/B tape are one of four possible types. These are denoted by CØNT, LIST, TAB1, and TAB2. A record always consists of nine numbers followed (perhaps) by one or two arrays of numbers.

The smallest possible record is a control (CØNT) record consisting of nine numbers. A general description of these nine numbers is given below, but the actual interpretation of each number will depend on its usage.

MAT - The material number (integer from 1 to 9999)

MF - The file number (integer < 100)

MT - The reaction type number (integer, see Appendix B)

C1 - A constant (floating point). In most cases, this constant will be the temperature (^{o}K)

C2 - A constant (floating point)

L1 - An integer generally used as a test. In most cases, this will be used to indicate the temperature interpolation scheme and whether or not temperature dependence is considered.

L2 - An integer used as a test.

N1 - A count of items in a list to follow.

N2 - A count of items in a second list to follow.

A Fortran IV statement to read a CØNT record from tape LIB would be:

```
READ(LIB)MAT,MF,MT,C1,C2,L1,L2,N1,N2
```

For convenience we will simply denote a CØNT record by:

[MAT, MF, MT/ C1, C2; L1, L2; N1, N2] CØNT

The semi-colon punctuation is merely to remind the reader of the separation between floating point numbers, test numbers, and counts. The slash punctuation is a reminder of card punching formats and will be explained in more detail in the following section.

There are six special cases of a CØNT record denoted by TPID, HEAD, SEND, FEND, MEND, and TEND. The TPID record is the first record on tape and contains a tape label, LABEL.

[LABEL, 0, 0/ 0.0, 0.0; 0, 0; 0, 0] TPID

Tape labels greater than 100 will be used by the ENDF center and should be avoided by the users. Positive tape labels will denote the standard arrangement of figure 3.2.1; negative labels will denote the alternate arrangement of figure 3.3.1.

The HEAD record is the first record in a section and is of the same form as a CØNT record. The numbers C1 and C2 are interpreted as ZA and AWR on a HEAD record.

The SEND, FEND, MEND, and TEND records only use the first three numbers in the CØNT record, and are used to signal the end of a section, file, material, or tape respectively.

[MAT, MF, 0/ 0.0, 0.0; 0, 0; 0, 0] SEND

[MAT, 0 , 0/ 0.0, 0.0; 0, 0; 0, 0] FEND

[0 , 0 , 0/ 0.0, 0.0; 0, 0; 0, 0] MEND

[-1 , 0 , 0/ 0.0, 0.0; 0, 0; 0, 0] TEND

A SEND record is distinguished by MT=0, MF≠0, and MAT≠0; a FEND record by MF=0, and MAT≠0; a MEND record by MAT=0; and a TEND record by MAT < 0.

A second record type is the LIST record used to list a string of floating point numbers, B_1, B_2, B_3, etc. We assume that these numbers are in the array B(N) and that there are N1 of them. A Fortran IV statement to read a LIST record from tape LIB would be:

```
READ(LIB)MAT,MF,MT,C1,C2,L1,L2,N1,N2,(B(N),N=1,N1)
```

For convenience we will denote this record by:

[MAT, MF, MT/ C1, C2; L1, L2; N1, N2/ B_n] LIST

If, in a particular section, we wished to enumerate the particular items in a list (i.e. A, B, C, D, E), we would write:

[MAT, MF, MT/ C1, C2; L1, L2; 5, N2/ A, B, C, D, E] LIST

where the 5 indicates that there are five items in the list.

The third type of record is the TAB1 record used for one-dimensional tabulated functions. The data needed to specify a one-dimensional tabulated function are the interpolation table NBT(N), INT(N) for each of the NR ranges, and the NP tabulated points X(N) and Y(N). The Fortran IV read statement for a TAB1 record is:

```
READ(LIB)MAT,MF,MT,C1,C2,L1,L2,NR,NP,(NBT(N),INT(N),N=1,NR),X(N),
Y(N),N=1,NP)
```

For convenience we will denote this record by:

[MAT, MF, MT/ C1, C2; L1, L2; NR, NP/ x int/ y(x)] TAB1

The term "x int" means the interpolation table for interpolation between successive values of the variable x.

The last record type is the TAB2 record used to control the tabulation of a two-dimensional function, y(x,z). It is used to specify how many values of z are given and how to interpolate between successive values of z. The values of y(x) at each value of z are given in TAB1 or LIST records following the TAB2 record with the appropriate value of z in the field designated as C2. The Fortran IV read statement for a TAB2 record is:

```
READ(LIB)MAT,MF,MT,C1,C2,L1,L2,NR,NZ,(NBT(N),INT(N),N=1,NR)
```

where NZ is the number of values of z. For convenience we denote this record by:

[MAT, MF, MT/ C1, C2; L1, L2; NR, NZ/ z int] TAB2

4.3 Punched Card Formats

Punched card formats will be given in much greater detail in each appropriate section. Only a brief description will be given here.

A standard 80 column card is divided into the following ten fields:

Field	Columns	Description
1	1-11	Datum
2	12-22	"
3	23-33	"
4	34-44	"
5	45-55	"
6	56-66	"
7	67-70	Material number (MAT)
8	71-72	File number (MF)
9	73-75	Reaction type (MT)
10	76-80	Sequence number starting with 1 for the first card of a material.

Consider a TAB1 record denoted by:

[MAT, MF, MT/ C1, C2; L1, L2; NR, NP/ x int/ y(x)] TAB1

This record would be punched on cards in the following way:

Field								
1	2	3	4	5	6	7	8	9
C1	C2	L1	L2	NR	NP	MAT	MF	MT
NBT(1)	INT(1)	NBT(2)	INT(2)	NBT(3)	INT(3)	MAT	MF	MT
NBT(4)	INT(4)	NBT(5)	INT(5)	------	------	MAT	MF	MT
------	------	------	------	------	------	---	--	--
X(1)	Y(1)	X(2)	Y(2)	X(3)	Y(3)	MAT	MF	MT
X(4)	Y(4)	X(5)	Y(5)	---	---	MAT	MF	MT
---	---	---	---	---	---	---	--	--

The Fortran IV statements to read a TAB1 record from input tape INP would be:

```
   READ(INP,10)C1,C2,L1,L2,NR,NP,MAT,MF,MT,(NBT(N),INT(N),N=1,NR)
10 FØRMAT(2E11.4,4I11,I4,I2,I3/(6I11))
   READ(INP,20)(X(N),Y(N),N=1,NP)
20 FØRMAT(6E11.4)
```

It is obvious that a TAB2 record is the same as the TAB1 record except that the list of x and y values is omitted. The HEAD record consists of one card punched in fields 1-9. The SEND, FEND, MEND, TEND, and TPID records each consist of one card punched in fields 7-9 only. Note that a completely blank card (MEND record) signals the end of a material.

The LIST record denoted by:

[MAT, MF, MT/ C1, C2; L1, L2; N1, N2/ B_n] LIST

is punched in the following way:

Field								
1	2	3	4	5	6	7	8	9
C1	C2	L1	L2	N1	N2	MAT	MF	MT
B(1)	B(2)	B(3)	B(4)	B(5)	B(6)	MAT	MF	MT
B(7)	B(8)	B(9)	----	----	----	MAT	MF	MT
----	----	----	----	----	----	---	--	--

The Fortran IV statements to read a LIST record from input tape INP would be:

```
   READ(INP,30)C1,C2,L1,L2,N1,N2,MAT,MF,MT,(B(N),N=1,N1)
30 FØRMAT(2E11.4,4I11,I4,I2,I3/(6E11.4))
```

An exception occurs when the LIST record contains Hollerith information (see file 1).

[MAT, MF, MT/ C1, C2; L1, L2; NH, N2/ H_n] LIST

In this case the Fortran IV read statements depend on the type of computer being used, but the cards should be machine-independent. Define NCD as the number of cards containing Hollerith information punched in columns 1-66. The read statements for an IBM 7090 type machine (6 characters/word) would be:

```
   READ(INP,40)C1,C2,L1,L2,NCD,N2,MAT,MF,MT
40 FØRMAT(2E11.4,4I11,I4,I2,I3)
   NH=11*NCD
   READ(INP,50)(H(N),N=1,NH)
50 FØRMAT(11A6)
```

The read statements for an IBM 360 type machine (4 characters/word) would be the same as above except that:

```
   NH=17*NCD
50 FØRMAT(16A4,A2)
```

Similarly, for a CDC 6600 type machine (10 characters/word),

```
   NH=7*NCD
50 FØRMAT(6A10,A6)
```

In each of the following sections we will indicate how cards are punched with a table similar to that given on the following page (illustrating how the basic record types are punched). Fields 1-6 refer to the card columns 1-66 with 11 columns per field. Fields 7-10 (MAT, MF, MT, and sequence numbers) must also be punched but are omitted on these description sheets for convenience.

When arrays of numbers are punched, the first element of the array is in field 1 (for example, X(1)). The last element may fall in any field depending on how many values are in the array. Thus the fact that X(NP) is shown in field 6 should not be taken literally.

Illustration of standard record types

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
C1	C2	L1	L2	N1	N2	1	CØNT	
ZA	AWR	L1	L2	N1	N2	2	HEAD	
C1	C2	L1	L2	NR	NP	3	TAB1	
NBT(1)	INT(1)	NBT(2)	INT(2)	NBT(3)	INT(3)	4		
NBT(4)	INT(4)	----	----	NBT(NR)	INT(NR)	5		
X(1)	Y(1)	X(2)	Y(2)	X(3)	Y(3)	6		
X(4)	Y(4)	----	----	X(NP)	Y(NP)	7		
C1	C2	L1	L2	NR	NP	8	TAB2	
NBT(1)	INT(1)	NBT(2)	INT(2)	NBT(3)	INT(3)	9		
NBT(4)	INT(4)	----	----	NBT(NR)	INT(NR)	10		
C1	C2	L1	L2	N1	N2	11	LIST	
B(1)	B(2)	B(3)	B(4)	B(5)	B(6)	12		
B(7)	B(8)	----	----	----	B(N1)	13		
						14		
						15		
						16		
						17		
						18		
						19		

4.4 Temperature Dependence

Any of the data in files 3-7 may have a temperature dependence (where physically realistic) specified by repeating the data for each temperature given and indicating how to interpolate between tabulated temperatures. Since the data will always be given in a LIST or TAB1 record, we consider a TAB1 record for the function y(x). In this case, we must write y(x,T). We constrain this function in the following way. The set of x values and the interpolation between successive x values must be the same at all temperatures. Define:

T_m - Temperature (°K). These must be listed in increasing order.

LT - A test for temperature dependence.

LT=0, no temperature dependence

LT>0, the function is given at LT+1 temperatures.

I_m - Interpolation scheme used between T_{m-1} and T_m.

The function at the first temperature, $y(x,T_1)$, is given in a TAB1 record. The function at the remaining temperatures is given in LIST records.

[MAT, MF, MT/ T_1, C2; LT, L2; NR, NP/ x int/ $y(x,T_1)$] TAB1

[MAT, MF, MT/ T_2, C2; I_2, L2; NP, 0/ $y_n(T_2)$] LIST

[MAT, MF, MT/ T_3, C2; I_3, L2; NP, 0/ $y_n(T_3)$] LIST

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

There will be a total of LT records of the LIST type, each containing only the list of y values.

If the temperature dependence refers to data already in a LIST

record, all records are of the LIST type.

[MAT, MF, MT/ T_1, C2; LT, L2; N1, 0/ $B_n(T_1)$] LIST
[MAT, MF, MT/ T_2, C2; I_2, L2; N1, 0/ $B_n(T_2)$] LIST
[MAT, MF, MT/ T_3, C2; I_3, L2; N1, 0/ $B_n(T_3)$] LIST
--- -- -- -- -- -- -- -- -- ----- ----

The above mechanism is used in file 1 to allow a variation of fission product yields with incident neutron energy. In this special case, the neutron energy replaces the temperature in the above illustrations and the interpolation codes, I_m, refer to neutron energy.

Temperature dependent TAB1 record

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
T_1	C2	LT	L2	NR	NP	1	TAB1	Basic record. All values of y evaluated at $T = T_1$.
NBT(1)	INT(1)	NBT(2)	INT(2)	NBT(3)	INT(3)	2		
NBT(4)	INT(4)	----	----	NBT(NR)	INT(NR)	3		
X(1)	Y(1)	X(2)	Y(2)	X(3)	Y(3)	4		
X(4)	Y(4)	----	----	X(NP)	Y(NP)	5		
T_2	C2	I_2	L2	NP	0	6	LIST	List of y values evaluated at $T = T_2$. Interpolation codes and values of x same as above.
Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	7		
Y(7)	Y(8)	----	----	----	Y(NP)	8		
T_3	C2	I_3	L2	NP	0	9	LIST	Same as lines 6-8 but evaluated at $T = T_3$.
Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	10		
Y(7)	Y(8)	----	----	----	Y(NP)	11		
						12		Repeat pattern of lines 6-8 until all temperatures have been specified. LT (line 1) is the number of LIST records given. I_n is the interpolation code used between T_{n-1} and T_n. C2 and L2 depend on how the TAB1 record is to be used.
						13		
						14		
						15		
						16		
						17		
						18		
						19		

Temperature dependent LIST record

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
T_1	C2	LT	L2	N1	N2	1	LIST	Basic record. All values of B
B(1)	B(2)	B(3)	B(4)	B(5)	B(6)	2		evaluated at $T=T_1$
B(7)	----	----	----	----	B(N1)	3		
T_2	C2	I_2	L2	N1	N2	4	LIST	All B evaluated at $T=T_2$
B(1)	B(2)	B(3)	B(4)	B(5)	B(6)	5		
B(7)	----	----	----	----	B(N1)	6		
T_3	C2	I_3	L2	N1	N2	7	LIST	All B evaluated at $T=T_3$
B(1)	B(2)	B(3)	B(4)	B(5)	B(6)	8		
B(7)	----	----	----	----	B(N1)	9		
						10		Repeat pattern of lines 4-6 until
						11		all temperatures have been speci-
						12		fied. The number of records will
						13		be LT+1. I_n is the interpolation
						14		code used between T_{n-1} and T_n.
						15		C2, L2, and N2 depend on how the
						16		LIST record is to be used. List
						17		T_n in increasing order.
						18		
						19		

5. File 1, General Information

File 1 consists of one or more sections containing a Hollerith description of the material, number of neutrons per fission, decay data, and fission product yield data.

The first section contains a Hollerith description of the material. The information is in an array H(N), N=1, 2, ... NWD. On cards the information is punched in columns 1-66 and as many cards as needed can be used. The array H(N) contains a multiple of 66 characters, and NWD depends on the number of characters/word for a given computer. A more detailed discussion is given in section 4.3.

The first 66 characters (first card) should be a self-contained title for the material. These first 66 characters will be used to provide titles for listings and plots of the data for this material. The remaining characters should give a verbal description of where the data came from, the evaluation procedure, references, limitations, and any other remarks which will assist the user in understanding the data.

The structure of the first section is:

[MAT, 1, 451/ ZA , AWR; LRP, LFI; 0 , 0] HEAD

[MAT, 1, 451/ 0.0, 0.0; LDD, LFP; NWD, 0/ H_n] LIST

[MAT, 1, 0 / 0.0, 0.0; 0 , 0 ; 0 , 0] SEND

where MT = 451 denotes heading information, and

LRP = 0, no resonance information is given

= 1, resonance information is given in file 2

LFI = 0, isotope is non-fissile

= 1, isotope is fissile

LDD = 0, radioactive decay data not given

= 1, radioactive decay data are given

LFP = 0, fission product yields not given

= 1, fission product yields are given

The second section contains data for ν, the average number of neutrons per fission, and must be present if LFI = 1. The energy dependence of ν may be represented either by a polynomial,

$$\nu(E) = \sum_{n=1}^{NC} C_n E^{n-1}$$

or by a tabulation. The test LNU = 1 indicates the polynomial representation, and LNU = 2 indicates the tabulated representation. The structure of section for LNU = 1 is:

[MAT, 1, 452/ ZA , AWR; 0, 1; 0 , 0] HEAD

[MAT, 1, 452/ 0.0, 0.0; 0, 0; NC, 0/ C_1, C_2, ... C_{NC}] LIST

[MAT, 1, 0/ 0.0, 0.0; 0, 0; 0 , 0] SEND

For LNU = 2, the structure is:

[MAT, 1, 452/ ZA , AWR; 0, 2; 0 , 0] HEAD

[MAT, 1, 452/ 0.0, 0.0; 0, 0; NR, NP/ E int/ ν(E)] TAB1

[MAT, 1, 0 / 0.0, 0.0; 0, 0; 0 , 0] SEND

The value of MT = 452 denotes ν.

The third section (present only if LDD = 1) contains data for the radioactive decay of this isotope and its reaction products. The following sequence is considered.

$$(Z,A) \xrightarrow[\text{reaction}]{} (Z_1,A_1) \xrightarrow[\text{decay}]{\lambda_1} (Z_2,A_2) \xrightarrow[\text{decay}]{\lambda_2} (Z_3,A_3)$$

where the reaction might be (n,α), (n,2n), etc. In the case that (Z,A) is itself radioactive, the reaction is ignored and $(Z,A) = (Z_1,A_1)$. Define the following quantities:

ZA1, ZA2, ZA3 -Identification numbers for the isotopes denoted by (Z_1,A_1), (Z_2,A_2), and (Z_3,A_3). As usual, these numbers are formed by taking the Z and A for a nuclide and computing 1000.0Z+A.

RTYP - Reaction type (floating point) from appendix B. RTYP=0.0 implies spontaneous decay of the original isotope and ZA1=ZA.

DC1, DC2 - Decay constants (sec^{-1}) of isotopes (Z_1,A_1) and (Z_2,A_2).

For each possible reaction the numbers RTYP, ZA1, DC1, ZA2, DC2, and ZA3 are given in that order. The sequence is repeated for each reaction type with the RTYP in increasing numerical order. If there are NRT reaction types, there will be N1 = 6*NRT numbers in the list denoted by D(N), N=1, 2, ... N1. The structure of the section is:

[MAT, 1, 453/ ZA , AWR; 0, 0; 0 , 0] HEAD

[MAT, 1, 453/ 0.0, 0.0; 0, 0; N1, NRT/ D_n] LIST

[MAT, 1, 0 / 0.0, 0.0; 0, 0; 0 , 0] SEND

where MT = 453 denotes radioactive decay data.

The fourth section (present only if LFP = 1) contains fission product yield data as a function of the energy of the neutron causing fission. Define:

NFP - Number of fission products

ZAFP - The (Z,A) designation (as in ZA1, ZA2, etc. above) for a fission product

YLD - The yield (fractional) of the fission product.

The list C(N), N=1, 2, ... N1 contains the pairs ZAFP, YLD for each fission product in order of increasing numerical values of ZAFP. The length of the list is N1 = 2*NFP. The structure of the section is:

[MAT, 1, 454/ ZA , AWR; 0 , 0; 0 , 0] HEAD

[MAT, 1, 454/ E_1 , 0.0; LE, 0; N1, NFP/ $C_n(E_1)$] LIST

[MAT, 1, 454/ E_2 , 0.0; I_2, 0; N1, NFP/ $C_n(E_2)$] LIST

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

[MAT, 1, 0 / 0.0, 0.0; 0 , 0; 0 , 0] SEND

where MT = 454 denotes fission product data. The quantities E, LE, and I are the neutron energy, energy dependence test, and interpolation code, respectively, used in the same manner as for temperature dependence.

File 1, First section				MT = 451		Heading Information		
Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
ZA	AWR	LRP	LFI	0	0	1	HEAD	
0.0	0.0	LDD	LFP	NCD	0	2	LIST	Hollerith information in columns
A self-contained title for this material (66 characters).						3		1-66 of each of the NCD cards
Other Hollerith information describing this material, the						4		
evaluation, source of data, references, etc. Use as many						5		
cards as necessary. Punch information in columns 1-66.						6		
NCD is the total number of cards used.						7		
0.0	0.0	0	0	0	0	8	SEND	Section end card with MT = 0.
						9		Answer tests with 0 (no) or 1 (yes)
						10		LRP - Resonance parameters given?
						11		LFI - Is this isotope fissionable?
						12		LDD - Is decay data given?
						13		LFP - Are fission product yields
						14		given?
						15		
						16		
						17		
						18		
						19		

File 1, Second section					MT=452			neutrons/fission
Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
ZA	AWR	0	1	0	0	1	HEAD	Polynomial representation
0.0	0.0	0	0	NC	0	2	LIST	$\nu(E) = \sum_{n=1}^{NC} C_n E^{n-1}$
C(1)	C(2)	C(3)	----	----	C(NC)	3		
0.0	0.0	0	0	0	0	4	SEND	Section end card with MT=0
						5		
						6		or
						7		
ZA	AWR	0	2	0	0	8	HEAD	Tabulated representation
0.0	0.0	0	0	NR	NP	9	TAB1	Tabulation of ν versus E
NBT(1)	INT(1)	NBT(2)	INT(2)	NBT(3)	INT(3)	10		
NBT(4)	INT(4)	----	----	NBT(NR)	INT(NR)	11		
E(1)	ν(1)	E(2)	ν(2)	E(3)	ν(3)	12		
E(4)	ν(4)	----	----	E(NP)	ν(NP)	13		
0.0	0.0	0	0	0	0	14	SEND	Section end card with MT=0
						15		Note: Section must be given if
						16		LFI=1 and omitted if LFI=0
						17		
						18		
						19		

File 1, Third section					MT=453			Decay Data
Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
ZA	AWR	0	0	0	0	1	HEAD	Omit section if LDD=0
0.0	0.0	0	0	6*NRT	NRT	2	LIST	NRT is the number of reaction types (RTYP) given. RTYP values are given in Appendix B. RTYP=0.0 implies ZA spontaneously decays so that ZA1=ZA. List RTYP in increasing order.
RTYP(1)	ZA1(1)	DC1(1)	ZA2(1)	DC2(1)	ZA3(1)	3		
RTYP(2)	ZA1(2)	DC1(2)	ZA2(2)	DC2(2)	ZA3(2)	4		
----	----	----	----	----	----	5		
RTYP(NRT)	ZA1(NRT)	DC1(NRT)	ZA2(NRT)	DC2(NRT)	ZA3(NRT)	6		
0.0	0.0	0	0	0	0	7	SEND	Section end card with MT=0
						8		ZA is the origional nucleus. ZA1 is the product nucleus from the reaction RTYP. ZA1 decays to ZA2 with a decay constant DC1 (sec^{-1}). ZA2 decays to ZA3 with a decay constant DC2 (sec^{-1}). If ZA1 is stable, set DC1=ZA2=DC2=ZA3=0.0. If ZA2 is stable, set DC2=ZA3=0.0. Isotope ZA is computed from 1000.0*Z+A.
						9		
						10		
						11		
						12		
						13		
						14		
						15		
						16		
						17		
						18		
						19		

File 1, Fourth section					MT=454			Fission Product Yield
Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
ZA	AWR	0	0	0	0	1	HEAD	Omit section if LFP=0
E_1	0.0	LE	0	2*NFP	NFP	2	LIST	NFP is the number of fission products. ZAFP is the ZA identification. YLD is the fractional yield evaluated at an incident energy = E_1.
ZAFP(1)	YLD(1)	ZAFP(2)	YLD(2)	ZAFP(3)	YLD(3)	3		
ZAFP(4)	YLD(4)	----	----	ZAFP(NFP)	YLD(NFP)	4		
E_2	0.0	I_2	0	2*NFP	NFP	5	LIST	Same as above but evaluated at E_2
ZAFP(1)	YLD(1)	ZAFP(2)	YLD(2)	ZAFP(3)	YLD(3)	6		Values between E_1 and E_2 are interpolated according to code I_2
ZAFP(4)	YLD(4)	----	----	ZAFP(NFP)	YLD(NFP)	7		
----	----	----	----	----	----	8		Repeat pattern of lines 5-7 until
----	----	----	----	----	----	9		data has been given at all E.
0.0	0.0	0	0	0	0	10	SEND	Section end card with MT=0
						11		Note: The number of LIST records
						12		will be LE+1. If energy depend-
						13		ence is ignored, set E_1=0.0, LE=0,
						14		and use only lines 1, 2, 3, 4, 10.
						15		List ZAFP in increasing order.
						16		List E in increasing order.
						17		
						18		
						19		

6. File 2, Resonance Parameters

Parameters for both resolved and unresolved resonances are given in file 2. The file contains only one section which is given the reaction type number MT = 151 as a general designation for resonance parameters. Cross sections given in file 3 must be added on to the cross sections computed from the parameters in this file to obtain the total reaction cross section.

The data for a material can be given for individual isotopes in the material, and for each isotope, the data can be subdivided into energy ranges with a different representation in each range. Ranges are given in order of increasing energy and normally should not overlap. If two ranges do overlap, it will be assumed that, in the overlap region, s-wave parameters from the lower range are to be used along with p- and higher wave parameters from the higher range.

Define the following quantities:

NIS - Number of isotopes in this material.

ABN - Abundance (weight fraction) of an isotope in this material.

LFW - If LFW = 1, fission widths are given.

If LFW = 0, fission widths not given.

NER - The number of energy ranges used for this isotope.

EL - The lower energy limit of a range.

EH - The upper energy limit of a range.

LRU - A test indicating type of data given.

LRU = 1 implies resolved parameters

= 2 implies unresolved parameters

LRF - A test indicating the particular type of resonance formula to be used.

ZAI - The (Z,A) designation for an isotope in a material.

The structure of a section is as follows:

[MAT, 2, 151/ ZA , AWR; 0 , 0 ; NIS, 0] HEAD

[MAT, 2, 151/ ZAI, ABN; 0 , LFW; NER, 0] CØNT (isotope)

[MAT, 2, 151/ EL , EH ; LRU, LRF; 0 , 0] CØNT (range)

⟨Subsection depending on the values of LRU and LRF⟩

⟨Subsection depending on the values of LRU and LRF for the last range of the last isotope⟩

[MAT, 2, 0 / 0.0, 0.0; 0 , 0 ; 0 , 0] SEND

The data is given for all ranges for a given isotope, and then for all isotopes. The data for each range starts with a CØNT (range) record. The data for each isotope starts with a CØNT (isotope) record.

Specifications for the subsections are given on the following pages.

LRU = 1, LRF = 1, Resolved Parameters, Type 1 (See Appendix C)

Type 1 resolved resonance parameters are for a single level Breit-Wigner formula with interference and depend on both ℓ (angular) and J (spin) states. The energy variation of the widths is taken to be:

a) Γ_γ and Γ_f are constant for each (ℓ,J) state.

b) $\Gamma_n(E) = \Gamma_n^o \sqrt{E}$ for each (ℓ,J) state, where Γ_n^o is the reduced neutron width.

Spin dependent scattering lengths are also allowed.

Define the following quantities:

SPI - Nuclear spin, I.

AP - A_+ } Spin dependent scattering lengths in units of

AM - A_- } 10^{-12} cm. Set AM = 0 for spin independence.

NLS - Number of ℓ states given.

L - The value of ℓ.

C - Constant used in the calculation of the penetration factor, V_ℓ. $V_\ell = 1/[\rho^2 j_\ell^2(\rho) + \rho^2 n_\ell^2(\rho)]$, $\rho = C\sqrt{E}$, where j_ℓ and n_ℓ are spherical Bessel functions.

NRS - Number of resonances for a given ℓ state.

ER - Resonance energy

AJ - The floating point value of J.

GT - Total width, Γ, evaluated at ER

GN - Neutron width, Γ_n, " " "

GG - Radiation width, Γ_γ, " " "

GF - Fission width, Γ_f, " " "

LIS = 0, calculate scattering cross section from resonance parameters plus smooth contribution from File 3.

= 1, use smooth cross section in File 3 only.

The structure of a subsection is:

[MAT, 2, 151/ SPI, AP; LIS, 0; NLS , 0] CØNT

[MAT, 2, 151. C , AM; L , 0; 6*NRS, NRS/ ER_1, AJ_1, GT_1, GN_1, GG_1, GF_1,
ER_2, AJ_2, GT_2, GN_2, GG_2, GF_2,
.....] LIST

The latter record is repeated until each of the NLS ℓ states have been specified. The values of ER for each ℓ state should be arranged in increasing order.

LRU = 2, LFR = 1, Unresolved Parameters, Type 1 (See Appendix C)

The parameters given are for a single level Breit-Wigner formula with interference and depend on both ℓ (angular) and J (spin) states. Widths are distributed according to a Porter-Thomas (chi-squared) distribution with an arbitrary number of degrees of freedom. The number of degrees of freedom may be different for neutron and fission widths and for different (ℓ,J) states. The energy variation of the mean widths is taken to be:

a) $\overline{\Gamma}_{\gamma_{\ell,J}}$ is constant

b) $\overline{\Gamma_n(E)}_{\ell,J} = \overline{\Gamma^o_{n_{\ell,J}}} \sqrt{E}\, V_\ell\, \mu_{\ell,J}$, where $\overline{\Gamma^o_{n_{\ell,J}}}$ is the reduced neutron width, $\mu_{\ell,J}$ is the number of degrees of freedom in the neutron width distribution, and V_ℓ is the penetration factor.

c) $\overline{\Gamma}_f(E)_{\ell,J}$ is an arbitrary tabulated function.

Define the following quantities:

SPI - Nuclear spin, I.

A - Scattering length in units of 10^{-12} cm.

NE - Number of energy points at which fission width is tabulated.

NLS - Number of ℓ states given

ES(N) - The energy of the N^{th} point used to tabulate fission widths.

L - The value of ℓ.

C - Constant used in the calculation of the penetration factor, V_ℓ. $V_\ell = 1/[\rho^2 j_\ell^2(\rho) + \rho^2 n_\ell^2(\rho)]$, $\rho = C\sqrt{E}$, where j_ℓ and n_ℓ are spherical Bessel functions.

NJS - Number of J states for a given ℓ state.

MUF - Number of degrees of freedom used in the fission width distribution.

D - Mean level spacing.

AJ - The floating point value of J

AMU - Number of degrees of freedom used in the neutron width distribution.

GNO - The average reduced neutron width.

GG - The average gamma width.

GF(N) - The average fission width at energy ES(N). Intermediate values are obtained by interpolation on a log-log scale.

LIS = 0, calculate scattering cross section from resonance parameters plus smooth contribution from File 3.

= 1, use smooth cross section in File 3 only.

In the case where LFW = 1 (fission widths given) the structure of a subsection is:

⌊MAT, 2, 151/ SPI, A ; LIS, 0; NE , NLS/ ES(1), ... ES(NE)⌋ LIST

⌊MAT, 2, 151/ C , 0.0; L , 0; NJS , 0 ⌋ CØNT (ℓ)

⌊MAT, 2, 151/ 0.0, 0.0; L ,MUF; NE+6, 0 / D, AJ, AMU, GNO, GG, 0.0,
GF(1), ... GF(NE)⌋ LIST

The last record is repeated until all J states have been specified for a given ℓ state. A new CØNT (ℓ) record is then given and all J states for that ℓ are given. The structure is repeated until all ℓ states have been specified.

In the case where LFW=0 (fission widths omitted), a more compact structure is used.

[MAT, 2, 151/ SPI, A ;LIS,0; NLS , 0] CØNT

[MAT, 2, 151/ C , 0.0; L ,0; 6*NJS, NJS/ D_1, AJ_1, AMU_1, GNO_1, GG_1, 0.0,
D_2, AJ_2, AMU_2, GNO_2, GG_2, 0.0,
.....] LIST

The LIST record is repeated until all of the L states have been specified.

File 2, Resonance parameters, General structure MT = 151

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
ZA	AWR	0	0	NIS	0	1	HEAD	NIS = Number of isotopes
ZAI	ABN	0	LFW	NER	0	2	CØNT	Control, first isotope
EL	EH	LRU	LRF	0	0	3	CØNT	Control, first energy range, first isotope
Subsection depending on values of LRU and LRF						4		See following pages
EL	EH	LRU	LRF	0	0	5	CØNT	Control, second energy range, first isotope
Subsection depending on values of LRU and LRF						6		See following pages
----	----	----	----	----	----	7		Repeat pattern of lines 5-6 until all NER ranges have been specified
----	----	----	----	----	----	8		
ZAI	ABN	0	LFI	NER	0	9	CØNT	Control, second isotope
EL	EH	LRU	LRF	0	0	10	CØNT	Control, first energy range, second isotope
Subsection depending on values of LRU and LRF						11		See following pages
----	----	----	----	----	----	12		Repeat pattern until all ranges for all isotopes have been specified
----	----	----	----	----	----	13		
0.0	0.0	0	0	0	0	14	SEND	Section end card with MT = 0
						15		Note: Omit section if LRP=0 (file 1). ZAI is the ZA designation for the isotope. ABN is the weight fraction. LRU=1 (resolved) or =2 (unresolved). EL and EH are the low and high limits of range. LRF is the type resonance data given.
						16		
						17		
						18		
						19		

Subsection for Resolved Parameters					MT = 151			LRU = 1 LRF = 1
Field 1	**Field 2**	**Field 3**	**Field 4**	**Field 5**	**Field 6**	**Line**	**Type**	**Comments**
SPI	AP	LIS	0	NLS	0	1	CØNT	NLS is the number of L states
C	AM	L	0	6*NRS	NRS	2	LIST	Resolved parameters for L=0. NRS is the number of L=0 resonances ER is the resonance energy; AJ the J value; GT, GN, GG, GF are the total, neutron, gamma, and fission widths.
ER(1)	AJ(1)	GT(1)	GN(1)	GG(1)	GF(1)	3		
ER(2)	AJ(2)	GT(2)	GN(2)	GG(2)	GF(2)	4		
----	----	----	----	----	----	5		
ER(NRS)	AJ(NRS)	GT(NRS)	GN(NRS)	GG(NRS)	GF(NRS)	6		
C	AM	L	0	6*NRS	NRS	7	LIST	Same as lines 2-6 but for L=1. Here, NRS is the number of L=1 resonances.
ER(1)	AJ(1)	GT(1)	GN(1)	GG(1)	GF(1)	8		
----	----	----	----	----	----	9		
ER(NRS)	AJ(NRS)	GT(NRS)	N(NRS)	GG(NRS)	GF(NRS)	10		
----	----	----	----	----	----	11		Repeat pattern of lines 7-10 until all L states habe been specified
						12		
						13		Notes: SPI is the nuclear spin I. AP and AM are the spin dependent scattering lengths (10^{-12} cm.). AM=0.0 for spin independence. C is used in the calculation of the penetration factor.
						14		
						15		
						16		
						17		
						18		
						19		

Subsection for Unresolved Parameters					MT = 151			LFI = 1 LRU = 2 LRF = 1
Field 1	**Field 2**	**Field 3**	**Field 4**	**Field 5**	**Field 6**	**Line**	**Type**	**Comments**
SPI	A	LIS	0	NE	NLS	1	LIST	NE is the number of energies at which fission widths are tabulated. ES are the energies. NLS is the number of L states given.
ES(1)	ES(2)	ES(3)	----	----	----	2		
----	----	----	----	----	ES(NE)	3		
C	0.0	L	0	NJS	0	4	CØNT	Control, first L state
0.0	0.0	L	MUF	NE + 6	0	5	LIST	Data for first J state, first L state.
D	AJ	AMU	GNO	GG	0.0	6		
GF(1)	GF(2)	GF(3)	----	----	GF(NE)	7		
0.0	0.0	L	MUF	NE + 6	0	8	LIST	Data for second J state, first L state.
D	AJ	AMU	GNO	GG	0.0	9		
GF(1)	GF(2)	GF(3)	----	----	G(NE)	10		
----	----	----	----	----	----	11		Repeat pattern of lines 8-10 until all J states for first L state are specified
----	----	----	----	----	----	12		
						13		Repeat pattern of lines 4-12 until all L states are specified. NJS is the number of J states for a given L state. See text for definition of other symbols.
						14		
						15		
						16		
						17		
						18		
						19		

Subsection for Unresolved Parameters					MT = 151			LFI = 0 LRU = 2 LRF = 1
Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
SPI	A	LIS	0	NLS	0	1	CØNT	NLS is the number of L states
C	0.0	L	0	6*NJS	NJS	2	LIST	Parameters for L=0. NJS is the number of J states. D is the mean spacing; AJ is the value of J; AMU the number of degrees of freedom in the neutron distribution; GNO, GG are the reduced neutron and gamma widths.
D(1)	AJ(1)	AMU(1)	GNO(1)	GG(1)	0.0	3		
D(2)	AJ(2)	AMU(2)	GNO(2)	GG(2)	0.0	4		
----	----	----	----	----	----	5		
D(NJS)	AJ(NJS)	AMU(NJS)	GNO(NJS)	GG(NJS)	0.0	6		
----	----	----	----	----	----	7		Repeat lines 2-6 until all L have
----	----	----	----	----	----	8		been specified.
						9		Note: C is used to calculate the
						10		penetration factor. SPI is the
						11		nuclear spin I. A is the scatter-
						12		ing length in units of 10^{-12} cm.
						13		
						14		
						15		
						16		
						17		
						18		
						19		

7. File 3, Smooth Cross Sections

Smooth cross section data, such as $\sigma_a(E)$, $\sigma_f(E)$, $\sigma_s(E)$, etc., is contained in file 3. Derived quantities such as $\xi(E)$, $\bar{\mu}_L(E)$, may also be included. A complete listing of these quantities and the associated reaction type numbers (MT) is given in Appendix B.

The file is divided into sections, each containing the data for a particular reaction type. Sections are ordered by increasing reaction type numbers (MT).

The structure of a section is:

[MAT, 3, MT/ ZA , AWR; 0 , LFS; 0 , 0] HEAD

[MAT, 3, MT/ T , Q ; LT, 0 ; NR, NP/ E int/ σ(E)] TAB1

[MAT, 3, 0/ 0.0, 0.0; 0 , 0 ; 0 , 0] SEND

Q is the reaction Q value (ev.), and T and LT refer to temperature dependence and are normally zero. LFS is the final state number and can be used to specify final states of the nucleus other than the ground state. The conventions used are:

LFS	meaning
0	ground state
1	first excited state
---	-----
98	a range of final states
99	all final states

File 3, Smooth Cross Sections

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
ZA	AWR	0	LFS	0	0	1	HEAD	
T	Q	LT	0	NR	NP	2	TAB1	NR is the number of break points
NBT(1)	INT(1)	NBT(2)	INT(2)	NBT(3)	INT(3)	3		(NBT) and interpolation codes (INT)
NBT(4)	INT(4)	----	----	NBT(NR)	INT(NR)	4		given. NP is the number of energy
E(1)	σ(1)	E(2)	σ(2)	E(3)	σ(3)	5		(E) and cross section (σ) values
E(4)	σ(4)	----	----	E(NP)	σ(NP)	6		given.
0.0	0.0	0	0	0	0	7	SEND	Section end card with MT = 0
						8		Notes: T and LT (normally zero)
						9		refer to possible temperature de-
						10		pendence. Q is the reaction Q
						11		value in ev. LFS is the final
						12		state number.
						13		
						14		
						15		
						16		
						17		
						18		
						19		

8. File 4, Secondary Angular Distributions

Secondary angular distributions, expressed as normalized probability distributions, are given in file 4. For the most part they will be elastic angular distributions, but other distributions (such as inelastic distributions integrated over final energies) are also allowed. Angular distributions may be represented either in a tabulated form normalized such that

$$\int_{-1}^{1} d\mu \, p(\mu, E) = 1$$

or as Legendre coefficients $f_\ell(E)$ defined by

$$\frac{d\sigma(\mu, E)}{d\Omega} = \frac{\sigma_s(E)}{2\pi} \sum_{\ell=0}^{NL} \frac{2\ell+1}{2} f_\ell(E) P_\ell(\mu)$$

Since $f_o(E) = 1$, only values for $\ell = 1, 2, \ldots NL$ are given. The scattering cross section, $\sigma_s(E)$, is given in file 3. The angular variable μ may refer to either the laboratory (L) or center-of-mass (C) coordinate system.

Data expressed as Legendre coefficients for elastic scattering above thermal energies in either the (L) or (C) system can be transformed to the other system with energy-independent transformation matrices $U_{\ell m}$ or $U^{-1}_{\ell m}$.

$$f^L_\ell(E) = \sum_{m=0}^{NM} U_{\ell m} f^c_m(E)$$

$$f^c_\ell(E) = \sum_{m=0}^{NM} U^{-1}_{\ell m} f^L_m(E)$$

The appropriate transformation matrix can be included in file 4 as an array of numbers V_k, k=1, 2, ... NK. V_k denotes either $U_{\ell m}$ or $U^{-1}_{\ell m}$ with $k=1+\ell+m(NL+1)$ and $NK = (NL+1)(NM+1)$.

The file is divided into sections each containing the data for a particular reaction type. The sections are ordered by increasing reaction type numbers (MT).

Define the following quantities:

LTT = 1, data is given as Legendre coefficients.

= 2, data is given as a tabulation.

LCT = 1, data is given in the (L) system.

= 2, data is given in the (C) system.

LVT = 0, transformation matrix not given.

= 1, transformation matrix is given.

NE = number of energy points given.

NL = highest value of ℓ required at each energy.

The structure of a section depends on the values of LTT and LVT but always starts with a HEAD record of the form:

[MAT, 4, MT/ ZA, AWR; LVT, LTT; 0, 0] HEAD

For the case where LTT = 1 (Legendre coefficients) and LVT = 1, the structure of a section is:

[MAT, 4, MT/ ZA , AWR; 1 , 1 ; 0 , 0] HEAD

[MAT, 4, MT/ 0.0, AWR; 0 , LCT; NK , NM / V_k] LIST

[MAT, 4, MT/ 0.0, 0.0; 0 , 0 ; NR , NE / E int] TAB2

[MAT, 4, MT/ T , E_1 ; LT, 0 ; NL , 0/ $f_\ell(E_1)$] LIST

[MAT, 4, MT/ T , E_2 ; LT, 0 ; NL , 0/ $f_\ell(E_2)$] LIST

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

[MAT, 4 MT/ T ; E_{NE}, LT, 0; NL , 0/ $f_\ell(E_{NE})$] LIST

[MAT, 4 0/ 0.0; 0.0, 0 , 0; 0 , 0] SEND

Fields marked T and LT refer to possible temperature dependence and are normally zero. V_k refers to $U^{-1}_{\ell m}$ if LCT = 1, and $U_{\ell m}$ if LCT = 2. If LTT = 1 and LVT = 0, the structure is the same as above except that the second record is replaced by:

[MAT, 4, MT/ 0.0, 0.0, 0, LCT; 0, 0] CØNT

For the case where LTT = 2 (tabulation) and LVT = 1, the structure of a section is:

[MAT, 4, MT/ ZA , AWR; 1 , 2 ; 0 , 0] HEAD

[MAT, 4, MT/ 0.0, AWR; 0 , LCT; NK , NM / V_k] LIST

[MAT, 4, MT/ 0.0, 0.0; 0 , 0 ; NR , NE / E int] TAB2

[MAT, 4, MT/ T , E_1 ; LT, 0 ; NR , NP / μ int/ $p(\mu, E_1)$] TAB1

[MAT, 4, MT/ T , E_2 ; LT, 0 ; NR , NP / μ int/ $p(\mu, E_2)$] TAB1

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

[MAT, 4, MT/ T , E_{NE}; LT, 0; NR , NP / μ int/$p(\mu, E_{NE})$] TAB1

[MAT, 4, MT/ 0.0, 0.0; 0, 0; 0 , 0] SEND

Fields marked T and LT refer to possible temperature dependence and are normally zero. V_k refers to $U^{-1}_{\ell m}$ if LCT = 1, and $U_{\ell m}$ if LCT = 2. If LTT = 2 and LVT = 0, the structure is the same as above except that the second record is replaced by:

[MAT, 4, MT/ 0.0, 0.0, 0, LCT; 0, 0] CØNT

File 4, Secondary angular distributions								Legendre coefficients
Field 1	**Field 2**	**Field 3**	**Field 4**	**Field 5**	**Field 6**	**Line**	**Type**	**Comments**
ZA	AWR	LVT = 1	LTT = 1	0	0	**1**	HEAD	
0.0	AWR	0	LCT = 2	NK	NM	**2**	LIST	Transformation matrix illustrated for LCT =2. If LCT = 1 use U^{-1} instead of U.
U_{00}	U_{10}	U_{20}	U_{30}	U_{40}	U_{50}	**3**		
U_{60}	----	U_{01}	U_{1i}	----	----	**4**		
0.0	0.0	0	0	NR	NE	**5**	TAB2	Codes to interpolate between tabulated energy values. NE is the number of energies given.
NBT(1)	INT(1)	NBT(2)	INT(2)	----	----	**6**		
----	----	----	----	NBT(NR)	INT(NR)	**7**		
T	E_1	LT	0	NL	0	**8**	LIST	The Legendre coefficients at energy E_1.
f_1	f_2	f_3	----	----	----	**9**		
----	----	----	----	----	f_{NL}	**10**		
----	----	----	----	----	----	**11**		Repeat pattern of lines 8-10 until all NE energies have been specified.
----	----	----	----	----	----	**12**		
0.0	0.0	0	0	0	0	**13**	SEND	Section end card with MT = 0
						14		Note: T and LT refer to possible temperature dependence. If LVT=0 (field 3, line 1), replace lines 2-4 with a CØNT record (line 19)
						15		
						16		
						17		
						18		
0.0	0.0	0	LCT	0	0	**19**	CØNT	Alternate to lines 2-4

File 4, Secondary angular distributions — Tabulated

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
ZA	AWR	LVT = 1	LTT = 2	0	0	1	HEAD	
0.0	AWR	0	LCT = 2	NK	NM	2	LIST	Transformation matrix illustrated for LCT = 2. If LCT = 1 use U^{-1} instead of U
U_{00}	U_{10}	U_{20}	U_{30}	----	----	3		
----	U_{01}	U_{11}	----	----	----	4		
0.0	0.0	0	0	NR	NE	5	TAB2	Codes to interpolate between tabulated energy values. NE is the number of energies given.
NBT(1)	INT(1)	NBT(2)	INT(2)	----	----	6		
----	----	----	----	NBT(NR)	INT(NR)	7		
T	E_1	LT	0	NR	NP	8	TAB1	Tabulated $p(\mu, E)$ at $E=E_1$
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	9		
μ_1	$p(\mu_1)$	μ_2	$p(\mu_2)$	μ_3	$p(\mu_3)$	10		
----	----	----	----	μ_{NP}	$p(\mu_{NP})$	11		
----	----	----	----	----	----	12		Repeat pattern of lines 8-11 until all NE energies have been specified.
----	----	----	----	----	----	13		
0.0	0.0	0	0	0	0	14	SEND	Section end card with MT = 0
						15		Note: T and LT refer to possible temperature dependence. If LVT=0 (field 3, line 1), replace lines 2-4 with line 19.
						16		
						17		
						18		
0.0	0.0	0	LCT	0	0	19	CØNT	Alternate to lines 2-4

9. File 5, Secondary Energy Distribution

Secondary energy distributions, expressed as normalized probability distributions, are given in file 5. The file is divided into sections, each giving the data for a particular reaction type. The sections are ordered by increasing reaction type number (MT).

The energy distributions, $p(E' \leftarrow E)$, are normalized such that

$$\int_0^\infty dE' \, p(E' \leftarrow E) = 1$$

The differential cross section is obtained from

$$\frac{d\sigma(E' \leftarrow E)}{dE'} = \sigma(E) p(E' \leftarrow E)$$

where $\sigma(E)$ is the smooth cross section from file 3 with the same reaction type number.

The energy distribution is further expressed as

$$p(E' \leftarrow E) = \sum_{k=1}^{NK} p_k(E) f_k(E' \leftarrow E)$$

so that both partial distributions or different distributions in different energy ranges can be accomodated. The $f_k(E' \leftarrow E)$ are normalized in the same way as the $p(E' \leftarrow E)$.

The $f_k(E' \leftarrow E)$ may be specified in a variety of ways. The number LF is used to denote the specific form.

LF	$f(E' \leftarrow E)$	Description
1	$g(E' \leftarrow E)$	Arbitrary tabulated function.
2	$\delta(E' - \Theta)$	Discrete final energy.
3	$\delta(E' - E + \theta)$	Discrete energy loss.
4	$g(E'/\Theta)$	General evaporation spectrum, $g(x)$ tabulated, Θ constant.
5	same as LF = 4 but $\Theta = \Theta(E)$	and is tabulated.
6	$\sqrt{\frac{4E'}{\pi\Theta^3}}\, e^{-E'/\Theta}$	Simple fission spectrum, θ constant.
7	Same as LF = 6 but $\Theta = \Theta(E)$	and is tabulated.
8	$\left(\frac{E'}{\theta^3}\right) e^{-E'/\theta}$	Maxwellian distribution, θ constant.
9	Same as LF = 8 but $\theta = \theta(E)$	and is tabulated.
10	$\sqrt{\frac{4}{\pi a^3 b}}\, e^{-ab/4}\, e^{-E'/a} \sinh\sqrt{bE'}$	Watt spectrum, a, b constant.

The general structure of a section is:

[MAT, 5, MT/ ZA, AWR; 0, 0; NK, 0] HEAD

⟨Subsection for k = 1⟩

⟨Subsection for k = 2⟩

⟨Subsection for k = NK⟩

[MAT, 5, 0/ 0.0, 0.0; 0, 0; 0, 0] SEND

The structure of a subsection depends on the value of LF, but always starts with a record of the form:

[MAT, 5, MT/ T, θ ; LT, LF; NR, NP/ E int/ p(E)] TAB1

As usual, T and LT refer to possible temperature dependence and are normally zero. For certain values of LF the field marked θ may be omitted. The appropriate subsection for each value of LF is given below.

<u>LF = 1, Arbitrary tabulated function</u>

[MAT, 5, MT/ T , 0.0; LT, 1; NR, NP/ E int/ p(E)] TAB1

[MAT, 5, MT/ 0.0, 0.0; 0 , 0; NR, NE/ E int] TAB2

[MAT, 5, MT/ T , E_1 ; LT, 0; NR, NP/ E' int/ g(E'← E_1)] TAB1

[MAT, 5, MT/ T , E_2 ; LT, 0; NR, NP/ E' int/ g(E'← E_2)] TAB1

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

[MAT, 5, MT/ T , E_{NE}; LT, 0; NR, NP/ E' int/ g(E'← E_{NE})] TAB1

where NE denotes the number of E values in the tabulation of g(E'← E), and E_1, E_2, ... E_{NE} are the initial energies.

LF = 2, Discrete final energy

[MAT, 5, MT/ T, Θ; LT, 2; NR, NP/ E int/ p(E)] TAB1

LF = 3, Discrete energy loss

[MAT, 5, MT/ T, Θ; LT, 3; NR, NP/ E int/ p(E)] TAB1

LF = 4, General evaporation spectrum, Θ constant

[MAT, 5, MT/ T, Θ ; LT, 4; NR, NP/ E int/ p(E)] TAB1

[MAT, 5, MT/ T, 0.0; LT, 0; NR, NP/ x int/ g(x)] TAB1

LF = 5, General evaporation spectrum, Θ = Θ(E)

[MAT, 5, MT/ T, 0.0; LT, 5; NR, NP/ E int/ p(E)] TAB1

[MAT, 5, MT/ T, 0.0; LT, 0; NR, NP/ E int/ Θ(E)] TAB1

[MAT, 5, MT/ T, 0.0; LT, 0; NR, NP/ x int/ g(x)] TAB1

LF = 6, Simple fission spectrum, Θ constant

[MAT, 5, MT/ T, Θ; LT, 6; NR, NP/ E int/ p(E)] TAB1

LF = 7, Simple fission spectrum, Θ = Θ(E)

[MAT, 5, MT/ T, 0.0; LT, 7; NR, NP/ E int/ p(E)] TAB1

[MAT, 5, MT/ T, 0.0; LT, 0; NR, NP/ E int/ Θ(E)] TAB1

LF = 8, Maxwellian distribution, Θ constant

[MAT, 5, MT/ T, Θ; LT, 8; NR, NP/ E int/p(E)] TAB1

LF = 9, Maxwellian distribution, $\theta = \theta(E)$

[MAT, 5, MT/ T, 0.0; LT, 9; NR, NP/ E int/ p(E)] TAB1

[MAT, 5, MT/ T, 0.0; LT, 0; NR, NP/ E int/ θ(E)] TAB1

LF = 10, Watt spectrum

[MAT, 5, MT/ T, 0.0; LT, 10; NR, NP/ E int/ p(E)] TAB1

[MAT, 5, MT/ T, 0.0; LT, 0 ; 2 , 0/ a, b] LIST

File 5, Secondary Energy Distributions

General Structure

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
ZA	AWR	0	0	NK	0	1	HEAD	
Subsection for k=1						2		See following pages
Subsection for k=2						3		" " "
----------	----------					4		
Subsection for k=NK						5		" " "
0.0	0.0	0	0	0	0	6	SEND	Section end card with MT=0
						7		NK is the number of partial dis-
						8		tributions given.
						9		
						10		
						11		
						12		
						13		
						14		
						15		
						16		
						17		
						18		
						19		

Subsection for arbitrary tabulated function

LF = 1

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
T	0.0	LT	LF=1	NR	NP	1	TAB1	Tabulated probability for this partial distribution
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	2		
E_1	$p(E_1)$	E_2	$p(E_2)$	----	----	3		
----	----	----	----	E_{NP}	$p(E_{NP})$	4		
0.0	0.0	0	0	NR	NE	5	TAB2	NE is the number of incident energies. Interpolation refers to incident energy.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	6		
T	E_1	LT	0	NR	NP	7	TAB1	Tabulation of $g(E' \leftarrow E)$ at first incident energy. Interpolation table refers to E'.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	8		
E'_1	$g(E'_1 \leftarrow E)$	E'_2	$g(E'_2 \leftarrow E)$	----	----	9		
----	----	----	----	E'_{NP}	$g(E'_{NP} \leftarrow E)$	10		
-----	----	----	----	----	----	11		Repeat pattern of lines 7-10 until all incident energies have been specified. Note: T and LT refer to possible temperature dependence and are normally zero.
----	----	----	----	----	----	12		
						13		
						14		
						15		
						16		
						17		
						18		
						19		

Subsections for discrete final energy or energy loss

LF = 2, 3

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
T	Q	LT	LF=2	NR	NP	1	TAB1	Tabulated probability for this partial distribution. Q is the discrete final energy.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	2		
E_1	$p(E_1)$	E_2	$p(E_2)$	----	----	3		
----	----	----	----	E_{NP}	$p(E_{NP})$	4		
						5		
						6		
T	Q	LT	LF=3	NR	NP	7	TAB1	Tabulated probability for this partial distribution. Q is the discrete energy loss.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	8		
E_1	$p(E_1)$	E_2	$p(E_2)$	----	----	9		
----	----	----	----	E_{NP}	$p(E_{NP})$	10		
						11		Note: T and LT denote possible temperature dependence and are normally zero.
						12		
						13		
						14		
						15		
						16		
						17		
						18		
						19		

Subsection for evaporation spectrum, Θ constant

LF = 4

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
T	Θ	LT	LF=4	NR	NP	1	TAB1	Tabulated probability for this partial distribution. Θ is the nuclear temperature.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	2		
E_1	$p(E_1)$	E_2	$p(E_2)$	----	----	3		
----	----	----	----	E_{NP}	$p(E_{NP})$	4		
T	0.0	LT	0	NR	NP	5	TAB1	Tabulated evaporation spectrum. $x = E'/\Theta$
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	6		
x_1	$g(x_1)$	x_2	$g(x_2)$	----	----	7		
----	----	----	----	x_{NP}	$g(x_{NP})$	8		
						9		Note: T and LT denote possible temperature dependence and are normally zero.
						10		
						11		
						12		
						13		
						14		
						15		
						16		
						17		
						18		
						19		

Subsection for evaporation spectrum, $\theta = \theta(E)$ LF = 5

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
T	0.0	LT	LF=5	NR	NP	1	TAB1	Tabulated probability for this partial distribution.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	2		
E_1	$p(E_1)$	E_2	$p(E_2)$	----	----	3		
----	----	----	----	E_{NP}	$p(E_{NP})$	4		
T	0.0	LT	0	NR	NP	5	TAB1	Tabulated nuclear temperature.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	6		
E_1	$\theta(E_1)$	E_2	$\theta(E_2)$	----	----	7		
----	----	----	----	E_{NP}	$\theta(E_{NP})$	8		
T	0.0	LT	0	NR	NP	9	TAB1	Tabulated evaporation spectrum $x = E'/\theta(E)$
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	10		
x_1	$g(x_1)$	x_2	$g(x_2)$	----	----	11		
----	----	----	----	x_{NP}	$g(x_{NP})$	12		
						13		Note: T and LT denote possible temperature dependence and are normally zero.
						14		
						15		
						16		
						17		
						18		
						19		

Subsection for simple fission spectrum

LF = 6, 7

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
T	θ	LT	LF=6	NR	NP	1	TAB1	Tabulated probability for this partial distribution. θ is the nuclear temperature.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	2		
E_1	$p(E_1)$	E_2	$p(E_2)$	----	----	3		
----	----	----	----	E_{NP}	$p(E_{NP})$	4		
						5		
						6		
T	0.0	LT	LF=7	NR	NP	7	TAB1	Tabulated probability for this partial distribution
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	8		
E_1	$p(E_1)$	E_2	$p(E_2)$	----	----	9		
----	----	----	----	E_{NP}	$p(E_{NP})$	10		
T	0.0	LT	0	NR	NP	11	TAB1	Tabulated nuclear temperature.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	12		
E_1	$\theta(E_1)$	E_2	$\theta(E_2)$	----	----	13		
----	----	----	----	E_{NP}	$\theta(E_{NP})$	14		
						15		Note: T and LT refer to possible temperature dependence and are normally zero.
						16		
						17		
						18		
						19		

Subsection for Maxwellian distributions

LF = 8, 9

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
T	Θ	LT	LF=8	NR	NP	1	TAB1	Tabulated probability for this partial distribution. Θ is the nuclear temperature.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	2		
E_1	$p(E_1)$	E_2	$p(E_2)$	----	----	3		
----	----	----	----	E_{NP}	$p(E_{NP})$	4		
						5		
						6		
T	0.0	LT	LF=9	NR	NP	7	TAB1	Tabulated probability for this partial distribution
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	8		
E_1	$p(E_1)$	E_2	$p(E_2)$	----	----	9		
----	----	----	----	E_{NP}	$p(E_{NP})$	10		
T	0.0	LT	0	NR	NP	11	TAB1	Tabulated nuclear temperature.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	12		
E_1	$\Theta(E_1)$	E_2	$\Theta(E_2)$	----	----	13		
----	----	----	----	E_{NF}	$\Theta(E_{NP})$	14		
						15		Note: T and LT refer to possible temperature dependence and are normally zero.
						16		
						17		
						18		
						19		

Subsection for Watt spectrum

LF = 10

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
T	0.0	LT	LF=10	NR	NP	1	TAB1	Tabulated probability for this partial distribution
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	2		
E_1	$p(E_1)$	E_2	$p(E_2)$	----	----	3		
----	----	----	----	E_{NP}	$p(E_{NP})$	4		
T	0.0	LT	0	2	0	5	LIST	Constants a and b used in the Watt spectrum.
a	b	0.0	0.0	0.0	0.0	6		
						7		Note: T and LT refer to possible temperature dependence and are normally zero.
						8		
						9		
						10		
						11		
						12		
						13		
						14		
						15		
						16		
						17		
						18		
						19		

10. File 6, Secondary Energy-Angle Distributions

Secondary energy-angle distributions, expressed as normalized probability distributions $p(E' \leftarrow E,\mu)$, are given in file 6. The file is divided into sections, each giving the data for a particular reaction type. Sections are ordered by increasing reaction type numbers (MT).

The distributions are normalized such that

$$\int_0^{\infty} dE' \int_{-1}^{1} d\mu \, p(E' \leftarrow E,\mu) = 1$$

The differential cross section is obtained from

$$\frac{d^2\sigma(E' \leftarrow E,\mu)}{d\Omega \, dE'} = \frac{\sigma(E)}{2\pi} p(E' \leftarrow E,\mu)$$

where $\sigma(E)$ is the smooth cross section from file 3 with the same reaction type number.

The angular part of the distribution may be specified in one of two ways. First, the function may be tabulated at a set of values μ_1, μ_2, $\ldots \mu_{NA}$. Second, the function may be expressed as a Legendre expansion.

$$p(E' \leftarrow E,\mu) = \sum_{\ell=0}^{NL} \frac{2\ell+1}{2} p_\ell(E' \leftarrow E) P_\ell(\mu)$$

Define the following quantities.

LTT = 1, data is given as Legendre coefficients

= 2, data is given as a tabulation

LCT = 1, data is given in the (L) system

= 2, data is given in the (C) system

The structure of a section for LTT = 1 (Legendre expansion) is:

[MAT, 6, MT/ ZA , AWR; 0, 1 ; 0 , 0] HEAD

[MAT, 6, MT/ 0.0, 0.0; 0, LCT; NL, 0] CØNT

⟨Subsection for $p_0(E' \leftarrow E)$⟩

⟨Subsection for $p_1(E' \leftarrow E)$⟩

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

⟨Subsection for $p_{NL}(E' \leftarrow E)$⟩

[MAT, 6, 0/ 0.0, 0.0; 0, 0 ; 0 , 0] SEND

The structure of a subsection is identical to the structure of a section for secondary energy distributions given in file 5 with the following exceptions. First, the SEND record is deleted (since the section in file 5 is used here as a subsection), and second, the HEAD record is changed to read:

[MAT, 6, MT/ 0.0, 0.0; 0, 0; NK, 0] CØNT

The structure of a section for LTT = 2 (tabulation) is:

[MAT, 6, MT/ ZA , AWR; 0, 2 ; 0 , 0] HEAD

[MAT, 6, MT/ 0.0, 0.0; 0, LCT; NR, NA/μ int] TAB2

⟨Subsection for $p(E' \leftarrow E, \mu_1)$⟩

⟨Subsection for $p(E' \leftarrow E, \mu_2)$⟩

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

⟨Subsection for $p(E' \leftarrow E, \mu_{NA})$⟩

[MAT, 6, 0/ 0.0, 0.0; 0, 0 ; 0 , 0] SEND

Again the structure of a subsection is identical to the structure of a section for secondary energy distributions given in file 5 with the following exceptions. First, the SEND record is deleted (since the section in file 5 is used here as a subsection), and second, the HEAD record is changed to read:

[MAT, 6, MT/ 0.0, μ; 0, 0; NK, 0] CØNT

File 6, Secondary energy-angle distributions

Legendre expansion

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
ZA	AWR	0	LTT=1	0	0	1	HEAD	
0.0	0.0	0	LCT	NL	0	2	CØNT	NL is highest order component given
0.0	0.0	0	0	NK	0	3	CØNT	Partial distribution control for $p_0(E' \leftarrow E)$
Subsection for 1st partial distribution for $p_0(E' \leftarrow E)$						4		Subsections are the same as those given in file 5 for LF=1, 2,...10
Subsection for 2nd partial distribution for $p_0(E' \leftarrow E)$						5		
----	----	----	----	----	----	6		
Subsection for NKth partial distribution for $p_0(E' \leftarrow E)$						7		
----	----	----	----	----	----	8		Repeat pattern of lines 3-7 until all components have been specified.
----	----	----	----	----	----	9		
0.0	0.0	0	0	0	0	10	SEND	Section end card with MT=0
						11		Note: NK is the number of partial distributions used to describe $p_\ell(E' \leftarrow E)$ for a given LCT=1 refers to the (L) system, LCT=2 refers to the (C) system.
						12		
						13		
						14		
						15		
						16		
						17		
						18		
						19		

File 6, Secondary energy-angle distributions								Tabulation
Field 1	**Field 2**	**Field 3**	**Field 4**	**Field 5**	**Field 6**	**Line**	**Type**	**Comments**
ZA	AWR	0	LTT=2	0	0	1	HEAD	
0.0	0.0	0	LCT	NR	NA	2	TAB2	NA is the number of angles given.
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	3		Interpolation refers to μ.
0.0		0	0	NK	0	4	CØNT	Partial distribution control
Subsection for 1st		partial distribution		for $p(E' \leftarrow E, \mu_1)$		5		Subsections are the same as those
Subsection for 2nd		partial distribution		for $p(E' \leftarrow E, \mu_1)$		6		given in file 5 for LF=1, 2, ...10
----	----	----	----	----	----	7		
Subsection for NKth		partial distribution		for $p(E' \leftarrow E, \mu_1)$		8		
----	----	----	----	----	----	9		Repeat pattern of lines 4-8 until
----	----	----	----	----	----	10		all angles have been specified.
0.0	0.0	0	0	0	0	11	SEND	Section end card with MT=0
						12		Note: NK is the number of partial
						13		distribution used to describe
						14		$p(E' \leftarrow E, \mu)$ at a specified μ.
						15		LCT=1 refers to the (L) system,
						16		LCT=2 refers to the (C) system.
						17		
						18		
						19		

11 File 7, Thermal Neutron Scattering Law

Thermal neutron scattering law data, $S(\alpha,\beta,T)$, is given in file 7. The file contains only one section.

The scattering law is defined by the equation

$$\frac{d^2\sigma(E' \leftarrow E,\mu,T)}{d\Omega\, dE} = \sum_{n=0}^{NS} \frac{M_n \sigma_{bn}}{4\pi T} \sqrt{\frac{E'}{E}}\, e^{-\beta/2}\, S_n(\alpha,\beta,T)$$

where:

A_n - The mass of the n^{th} type atom in a molecule.

M_n - The number of atoms of the n^{th} type in the molecule.

σ_{fn} - Free atom cross section of the n^{th} type atom.

σ_{bn} - Bound atom cross section of the n^{th} type atom.

$$\sigma_{bn} = \sigma_{fn}(A_n + 1)^2/A_n^2$$

The differential cross section is defined for a molecule rather than for an atom. The above equation includes only inelastic scattering; appropriate elastic scattering from files 3 and 4 must be added to obtain a complete scattering cross section.

The convention is adopted that n=0 denotes the principle scatterer, and A_o is used to compute α.

$$\alpha = (E' + E - 2\sqrt{EE'}\mu)/A_o kT$$

$$\beta = (E' - E)/kT$$

The scattering law for the principle scatterer, $S_o(\alpha,\beta,T)$, is an arbitrary

tabulated function. The remaining laws for n=1, 2, ... NS are known analytic functions specified by six constants.

All constants required are in a list B(N), N=1, 2, ... NL, where NL = 6*(NS + 1). The items in this list are:

B(1) = $M_o \sigma_{fo}$, total free atom cross section, term 0.

B(2) = $\mathcal{E}$, the value of E/kT above which the static model of elastic scattering is adequate.

B(3) = A_o , the value of the mass ratio used to compute α.

B(4) = E_m , the upper limit for constant σ_f.

B(5) = , to be specified

B(6) = , to be specified

B(7) = a , test describing type of analytic function, term 1.

a = 1.0, free gas law

= 2.0, diffusive motion

B(8) = $M_1 \sigma_{f1}$, total free atom cross section, term 1.

B(9) = A_1 , effective mass, term 1.

B(10)= , to be specified

B(11)= , to be specified

B(12)= , to be specified

B(13)=

B(18)= } same as B(7)-B(12), but for term n=2.

etc.

If the scattering law is completely specified by the analytic functions described above, the tabulated term (n=0) is omitted. This case is signalled by setting $M_o \sigma_{fo}=0$ in B(1) above and by omitting the TAB2 and TAB1 records listed in the structure of a section given below.

In certain cases a more accurate temperature interpolation is obtained by replacing the temperature T in the definition of α and β with a constant $T_o = 0.0253$ ev. Define the following test.

LAT = 0, the actual temperature T has been used to compute α and β.

= 1, the constant $T_o = 0.0253$ ev has been used to compute α and β.

The structure of a section is:

[MAT, 7, 4/ ZA , AWR; 0 , LAT; 0 , 0] HEAD

[MAT, 7, 4/ 0.0, 0.0; 0 , 0 ; NL, NS/ B_n] LIST

[MAT, 7, 4/ 0.0, 0.0; 0 , 0 ; NR, NB/β int] TAB2

[MAT, 7, 4/ T , β_1 ; LT, 0 ; NR, NP/α int/ $S(\alpha,\beta_1)$] TAB1

[MAT, 7, 4/ T , β_2 ; LT, 0 ; NR, NP/α int/ $S(\alpha,\beta_2)$] TAB1

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

[MAT, 7, 4/ T , β_{NB}; LT, 0 ; NR, NP/α int/ $S(\alpha,\beta_{NB})$] TAB1

[MAT, 7, 0/ 0.0, 0.0; 0 , 0 ; 0 , 0] SEND

where NB is the number of values of β, and T and LT refer to possible temperature dependence.

File 7, Thermal scattering law

Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Line	Type	Comments
ZA	AWR	0	LAT	0	0	1	HEAD	
0.0	0.0	0	0	NL	NS	2	LIST	NL=6*(NS+1)
$M_o\sigma_{fo}$	$\mathcal{E}$	A_o	E_m	0.0	0.0	3		NS is the number of added free
a_1	$M_1\sigma_{f1}$	A_1	0.0	0.0	0.0	4		gas or diffusive terms. See text
a_2	$M_2\sigma_{f2}$	A_2	0.0	0.0	0.0	5		for meaning of other symbols.
----	----	----	----	----	----	6		
a_{NS}	$M_{NS}\sigma_{fNS}$	A_{NS}	0.0	0.0	0.0	7		
0.0	0.0	0	0	NR	NB	8	TAB2	NB is the number of β values
NBT(1)	INT(1)	----	----	----	----	9		given. Interpolation refers to
----	----	----	----	NBT(NR)	INT(NR)	10		values of β.
T	β_1	LT	0	NR	NP	11	TAB1	Tabulation of $S(\alpha,\beta_1)$. Follow
NBT(1)	INT(1)	----	----	NBT(NR)	INT(NR)	12		with LIST records if temperature
α_1	$S(\alpha_1,\beta_1)$	α_2	$S(\alpha_2,\beta_1)$	----	----	13		dependence is considered.
----	----	----	----	α_{NP}	$S(\alpha_{NP},\beta_1)$	14		
----	----	----	----	-----	----	15		Repeat pattern of lines 11-14 un-
----	----	----	----	----	----	16		til all β have been specified.
0.0	0.0	0	0	0	0	17	SEND	Section end card with MT=0
						18		
						19		

12. Present ENDF/B Format Restrictions and Comments

12.1 Introduction

It is desirable to place certain restrictions on the ENDF/B formats to be used in 1966, since many of the processing codes can, at present, handle data only in certain arrangements. At a later time these restrictions will be removed. New processing codes being written should include all of the features of ENDF/B so that they will not have to be modified later when the restrictions are removed.

Some of the restrictions given here may be too restrictive to adequately present the data. Should this occur, please contact H. Honeck. He will discuss the problem with the people writing the processing codes and see if the restrictions can't be relaxed.

12.2 General Remarks

Files and sections not required are omitted. Data omitted is assumed to be zero. Thus, for threshold reactions, only the non-zero data need be given. If a function is constant, but must be represented by a TABI function, use two data points, one at E = 0, and one at E = 1.5×10^7 or above, specifying linear interpolation (INT = 2) between them. Avoid use of INT = 1 (constant) interpolation code.

12.3 File 1, General Information

Section 1, Hollerith description - 100 card limit

Section 2, ν (E) - Use polynomial representation (LNU = 1) truncated to form (NC = 4) or less terms.

Section 3, radioactive decay data - include section for single isotopes but (obviously) not for mixtures of isotopes.

Section 4, fission product yield data - ignore dependence on incident neutron energy.

12.4 File 2, Resonance Parameters

General structure - Use two energy ranges, one for resolved, and one for unresolved parameters.

Resolved parameters - Use spin independent scattering lengths (AM = 0).

Unresolved parameters - Limit MUF $\leq$ 4, NLS $\leq$ 2, AMU $\leq$ 2.

12.5 File 3, Smooth Cross Sections

Limit number of points in a tabulation to 500 for quantities other than scattering cross sections, and 2000 for scattering cross sections. Ignore temperature dependence except for thermal cross sections. Include (where possible) the following reactions:

MT	Reaction	MT	Reaction
1	total	103	(n,p)
2	elastic	104	(n,d)
4	inelastic	105	(n,t)
16	(n,2n)	106	(n, He^3)
17	(n,3n)	107	(n,α)
18	fission	251	μ_L
27	capture + fission	252	ξ
		253	γ
102	(n, γ)		

Include smooth background cross sections to be added to values computed from resonance parameters. Discontinuities in the tabulation are allowed. For example:

E	σ	E	σ
0.8	5.6	2.5	0.9
1.0	5.4	7.8	0.9
1.2	5.2	8.2	1.0
1.2	1.1	8.2	3.7
1.8	1.0	9.0	3.6

Here, the resonance parameters would be defined from 1.2 to 8.2 eV and would contribute enough to make the total cross section smooth. Processing codes should be written to sense and ignore the repeated value of E at the discontinuities so that it is immaterial what interpolation codes are used.

12.6 File 4, Secondary Angular Distributions

Most of the data will be for elastic scattering. Some data may be given for inelastic or total in the thermal energy region and may be temperature dependent. Legendre coefficients (LTT = 1) in the (C) system (LCT = 2) are recommended. Transformation matrix should be given. Again, data should span the entire energy range.

12.7 File 5, Secondary Energy Distributions

Data should be given for inelastic (MT = 4), (n,2n) (MT = 16), (n,3n) (MT = 17), and fission (MT = 18), if smooth cross section for these reactions are given in File 3.

Inelastic energy distributions should be given as discrete levels (LF = 3) plus a Maxwellian distribution with an arbitrary temperature (LF = 9) or a constant temperature (LF = 8). Let k = 1, 2, ... K denote the discrete levels with energy θ_k. Then

$$\frac{d\sigma_{in}(E' \leftarrow E)}{dE'} = \sigma_{in}(E)\ p(E' \leftarrow E) \ .$$

Appendix A: ZA Designation of Materials

A floating point number, ZA, is used to designate materials. If Z is the atomic number and A the atomic weight, then ZA is computed from

$$ZA = 1000.0*Z + A$$

For example, $_{92}U^{238}$ is given by 92238.0, and hydrogen by 1001.0.

For materials other than isotopes, the following rules apply. If the material is a naturally occurring mixture of isotopes of the same Z but different A, then A is set to 0. For example, natural uranium is given by 92000.0.

For all other types of materials, Z is set to zero, and the appropriate ZA is given in the following tables. For example, H_2O is given by 100.0. The following general rules apply.

1-99 Hypothetical materials

100-199 Liquid moderators and coolants

200-299 Solid moderators

300-399 Metal alloys, cladding, and structural materials

400-499 Lumped poisons

A	Description
1	Pure 1/v absorber, σ_a(2200 m/s) = 1.0
2	Pure scatterer, σ_s = 1.0
3-99	To be assigned
100	Water, H_2O
101	Heavy water, D_2O
102	Biphenyl, $C_{12}H_{10}$
103	Sodium Hydroxide, NaOH
104	Santowax R, $C_{18}H_{14}$
105	Dowtherm A
106	Benzene
107-199	To be assigned
200	Beryllea, BeO
201	Beryllium Carbide, Be_2C
202	Beryllium Fluoride, BeF_2
203	Zirconium Hydride, ZrH_x
204	Polystyrene, $(CH)_n$
205	To be assigned

A	Description
300	To be assigned
301	Zircalloy 1
302	Zircalloy 2
303	To be assigned
304	304 type stainless steel
305-399	To be assigned
400	U^{233} fission products
401	U^{235} fission products
402	PU^{239} fission products
403	PU^{241} fission products
404-499	To be assigned

Appendix B List of Reaction Types

Reaction types are designated by an integer, MT. A list of these reaction types is given below.

The reaction type number (MT) is used for a dual purpose. Generally, it designates reaction types, but occaisonaly, it designates the type of information given. The general rules for assignment of MT are:

1-100 Reactions in which secondaries of the same type as the incident particle appear.

101-150 Reactions in which no secondaries of the same type as the incident particle appear.

151-200 Resonance information.

201-450 Quantities derived from the basic data.

451-999 Miscellaneous quantities.

The assignments are, for the most part, consistant with those used in the UKAEA Nuclear Data Library.

MT	Description
1	total
2	elastic
3	non-elastic
4	inelastic
5-15	not used
16	(n,2n)
17	(n,3n)
18	fission = (n,f) + (n,n'f) + ...
19	(n,f)
20	(n,n'f)
21	(n,2nf)
22	(n,n')α
23	(n,n')3α
24	(n,2n)α
25	(n,3n)α
26	not used
27	absorption (fission + capture)
28	(n,n')p
29	scattering (elastic and inelastic)
30-100	to be assigned

MT	Description
101	parasitic absorption
102	(n,γ)
103	(n,p)
104	(n,d)
105	(n,t)
106	(n,He^3)
107	(n,α)
108	$(n,2\alpha)$
109-150	to be assigned
151	general designation for resonance information
152-200	to be assigned for specific resonance information

MT	Description
201-250	to be assigned
251	$\bar{\mu}_L$, average cosine of the scattering angle in the laboratory system for elastic scattering.
252	ξ, average logarithmic energy decrement.
253	γ, as used in the expression $\xi\sigma_s + \gamma\sigma_a$.
254-300	to be assigned
301-450	energy release rate parameters ($\overline{\sigma E}$) for total and partial cross sections. Subtract 300 from this number to obtain the reaction type. For example, 302 (= 300 + 2) denotes elastic scattering
451	heading or title information
452	ν, number of neutrons per fission
453	radioactive decay data
454	fission product yield
455-999	to be assigned

Appendix C: Resonance Region Formulae

C.1 The Resolved Resonance Region

LRU=1, LRF=1. A single-level Breit-Wigner Formula (SLBWB).

The formulae appearing in Gregson, et al.,[1] omitting the resonance-resonance interference scattering term are adopted. Fission can be included in a way analogous to capture. These formulae, written in the laboratory system for all ℓ and without Doppler broadening, are:

1. Elastic Scattering

$$\sigma_{nn}^{\ell}(m) + (2\ell+1)\frac{4\pi}{k_m^2}\sin^2\varphi_\ell$$

$$+\frac{\pi}{k_m^2}\sum_J g_J \sum_{r=1}^{N_{res}(\ell,J)} \frac{\Gamma_{nr}^2\cos 2\varphi_\ell - 2\Gamma_{nr}\Gamma_{\gamma r}\sin^2\varphi_\ell + 2(E-E_r')\Gamma_{nr}\sin 2\varphi_\ell}{(E-E_r')^2 + \frac{1}{4}\Gamma_r^2}$$

2. Capture

$$\sigma_{n\gamma}^{\ell}(m) = \frac{\pi}{k_m^2}\sum_J g_J \sum_{r=1}^{N_{res}(\ell,J)} \frac{\Gamma_{nr}\Gamma_{\gamma r}}{(E-E_r')^2 + \frac{1}{4}\Gamma_r^2}$$

3. Fission

$$\sigma_{nf}^{\ell}(m) = \frac{\pi}{k_m^2}\sum_J g_J \sum_{r=1}^{N_{res}(\ell,J)} \frac{\Gamma_{nr}\Gamma_{fr}}{(E-E_r')^2 + \frac{1}{4}\Gamma_r^2}$$

where $m = m^{\underline{th}}$ isotope of the material

$N_J(\ell)$ = the number of possible values of J

$N_{res}(\ell,J)$ = the number of resonances for a given pair of values for ℓ and J

$$\Gamma_{nr} = \frac{P_\ell(E)\ \Gamma_{nr}(|E_r|)}{P_\ell(|E_r|)}$$

$$\Gamma_r = \Gamma_{nr}(E) + \Gamma_{\gamma r} + \Gamma_{fr}$$

$$E_r' = E_r + \left[\frac{S_\ell(|E_r|) - S_\ell(E)}{2P_\ell(|E_r|)}\right] \Gamma_{nr}(|E_r|)$$

$$k_m = 2.19685 \left(\frac{M}{M + 1.008665}\right) \sqrt{E}\ (\text{barns})^{-1/2}$$

M = atomic weight of isotope m in the (C^{12} = 12) scale

E = neutron energy in MeV in the laboratory frame

S_ℓ = shift factor $\left(S_0 = 0;\ -S_1 = \frac{1}{1+\rho^2}\right)$

P_ℓ = penetration factor $\left(P_0 = \rho;\ P_1 = \frac{\rho^3}{1+\rho^2}\right)$

$\rho = k\,a$

a = channel radius

φ_ℓ = phase shift ($\varphi_0 = \rho$; $\varphi_1 = \rho - \tan^{-1}\rho$) .

Doppler broadening can be accomplished by reprocessing through a Doppler broadening program such as TEMPØ.[2] A FORTRAN II version of SLBWB is available from BNL.

LRU=1, LRF=2. A multi-level scattering, single level capture and fission formula (MLBWB).

This option differs from the first in that the resonance-resonance interference scattering term in included:

$$\frac{\pi}{k_m^2} \sum_J g_J \sum_{r=2}^{N_{res}(\ell,J)} \sum_{s=1}^{r-1} \frac{2\Gamma_{nr}\Gamma_{ns}\left[(E-E_r')(E-E_s') + \frac{1}{4}\Gamma_r\Gamma_s\right]}{\left[(E-E_r')^2 + \frac{1}{4}\Gamma_r^2\right]\left[(E-E_s')^2 + \frac{1}{4}\Gamma_s^2\right]}$$

A FORTRAN II version of MLBWB is available from BNL.

C.2 The Unresolved Resonance Region

LRU=2, LRF=1. Unresolved Resonance Formula.

Specifications of LRU=2, LRF=1 unresolved resonance parameters are consistent with method described in Ref. 3.

REFERENCES

[1] K. Gregson, M. F. James, and D. S. Norton, "MLBW - A Multi-Level Breit-Wigner Computer Programme," AEEW-M517 (1965).

[2] K. Gregson and M. F. James, "TEMPØ, A General Doppler Broadening Programme for Neutron Cross-Sections," AEEW-M518 (1965).

[3] D. M. O'Shea, B. J. Toppel, and A. L. Rago, "MC^2 - A Code to Calculate Multigroup Cross Sections," ANL-7318 (1967).

Appendix D: Status of ENDF/B Processing Codes

The following codes have been completed:

GAND	- A program coupling ENDF/B to the General Atomic GAF-GAR Multigroup Constant Program.
ETOE	- A program coupling ENDF/B to the ANL MC^2 Multigroup Constant Program.
ETOM	- A program coupling ENDF/B to the Westinghouse MUFT Multigroup Constant Program.
ENCORE	- ENDF/A to ENDF/B Conversion Routine.
FLANGE II	- Program to Process Thermal Scattering Law Data from an ENDF/B tape.
EDIT	- Program to Read and Write Contents of a Binary or BCD ENDF/B Tape.
DAMMET	- Program to Delete, Alter Mode, and Merge ENDF/B Tapes.
CRECT	- Program to Correct ENDF/B Tapes.
CHECKER	- Program to Detect Mechanical Errors in ENDF/B Data.

The following code is under development:

ETOG	- A Program coupling ENDF/B to the GAM Multigroup Constant Program.

Appendix E: Listing of ENDF/B Data for Manganese

```
25055.0        54.466              1          0          0          01019 1451
   0.0           0.0               1          0         48          01019 1451
                          MANGANESE-55                                 1019 1451
EVALUATORS T.E. STEPHENSON, A. PRINCE, S. PEARLSTEIN                   1019 1451
                      GENERAL INFORMATION                              1019 1451
1)DECAY DATA FROM CHART OF THE NUCLIDES, D.GOLDMAN (1965)              1019 1451
2)RATIO M SUB MN TO M SUB N BASED ON DATA IN HNBK CHEM-PHYS (1966)1019 1451
3)2200M/S VALUES    ABS=13.40B,TOT SCAT=1.73B,POT SCAT=2.59B           1019 1451
                  RESOLVED RESONANCE PARAMETERS                        1019 1451
1)27 LEVELS,INCLUDING 2 BOUND LEVELS                                   1019 1451
 COTE,BOLLINGER,THOMAS,PHYS.REV.134,B1048(1964)                        1019 1451
 MORGENSTERN ET AL,INTERNAT.CONF,NUCLEAR STRUCTURE,ANTWERP,JULY65 1019 1451
 STEPHENSON,PEARLSTEIN,BULL.APS 11,742 (JULY 1966)                     1019 1451
2)RESONANCE PARAMETERS IN SINGLE LEVEL B-W,AND WITH SMOOTH ELASTIC1019 1451
 SIGMA,FIT TOTAL SIGMA MEASUREMENTS OF COTE ET AL AND RAINWATER ET1019 1451
 AL,BNL325,2ND ED,SUPP.2 VOL 2A(1966)FROM.001 EV TO 8.94KEV,ABOVE 1019 1451
 WHICH A SMOOTH CAPTURE SIGMA IS SUPPLIED TO CONTINUE FIT TO 80KEV1019 1451
3)SCATTERING RADIUS,4.54FERMI,DETERMINED BY FITTING TOTAL SIGMA        1019 1451
4)RADIATION WIDTH=0.52EV,GIVES I SUB A=15BARNS IN AGREEMENT WITH       1019 1451
 MEAS.OF LOUWRIER,ATEN,J.NUCL.ENERGY,PARTSA/B19,267(1965)              1019 1451
5)THERMAL ABSORPTION CROSS SECTION=13.4B IN AGREEMENT WITH VALUE       1019 1451
 RECOMMENDED IN BNL325,2ND ED,SUPP.2 VOL2A(1966)                       1019 1451
6)REFERENCE FOR N,GAMMA SIGMA IS BNL325,2ND ED,SUPP.2 VOL2A(1966)      1019 1451
                    SMOOTH CROSS SECTIONS                              1019 1451
1)SMOOTH ELASTIC SIGMA .001EV TO 80KEV IS LEVEL-LEVEL INTERFERENCE1019 1451
 SIGMA.FROM100KEV TO 20MEV CALCULATED BY ABACUS II(AVAILABLE BNL),1019 1451
 USING EXPERIMENTAL DATA FROM BNL-325,2ND ED,SUPP.2VOL2A(1966)AND 1019 1451
 A.B.SMITH,S.A.COX(ANL)FOR SUBSTANTIATION                              1019 1451
2) TOTAL XSECT DOES NOT INCLUDE S. L. RESONANCE CONTRIBUTION           1019 1451
3)SMOOTH INELASTIC AND DIFFERENTIAL SCATTERING CALCULATED FROM 1001019 1451
 KEV TO 20MEV BY ABACUS II USING EXPERIMENTAL DATA OF BNL-325,2ND 1019 1451
 ED,SUPP.2A(1966)AND A.B.SMITH,S.A.COX(ANL)FOR SUBSTANTIATION          1019 1451
4)RADIATIVE CAPTURE CALCULATED BY SAUDEX (AVAIL.ANL CODE CENTER)       1019 1451
 FROM 9.5 TO 100KEV SUBSTANTIATED BY EXPERIMENTAL DATA IN BNL-325,1019 1451
 2ND EDITION,SUPP.2A(1966).SMOOTH RADIATIVE CAPTURE IS .782*CALC. 1019 1451
 VALUE BETWEEN 9.5 AND 80KEV AND IS 1*CALCULATED VALUE BETWEEN 80 1019 1451
 AND 100KEV. ABOVE 100 KEV SMOOTH RADIATIVE CAPTURE IS BASED ON EX1019 1451
 PERIMENTAL DATA OF BNL-325,2ND ED,SUPP.2A(1966) AND WASH.1068.        1019 1451
5)SMOOTH N,P SIGMA OBTAINED BY SHAPE NORMALIZATION OF IRON EXPERI-1019 1451
 MENTAL DATA CONTAINED IN BNL-325,2ND ED, SUPP.2A(1966)                1019 1451
6)SMOOTH N,ALPHA SIGMA TAKEN FROM BNL-325,2ND ED,SUPP.2A(1966)         1019 1451
7)SMOOTH N,2N SIGMA ,REF S.PEARLSTEIN,NSE23,238(1965.                  1019 1451
8)MU-BAR(LAB),XI,AND GAMMA,CALCULATED BY MODIFICATION OF CHAD          1019 1451
                    ANGULAR DISTRIBUTIONS                              1019 1451
8)LEGENDRE EXPANSION COEFFICIENTS, AND TRANSFORMATION MATRIX           1019 1451
 CALCULATIONS BY CHAD(AVAILABLE ANL CODE CENTER)                       1019 1451
                   SECONDARY ENERGY DISTRIBUTION                       1019 1451
 1)N,2N REF BAPS,SER 2,12,127,(1967)                                   1019 1451
                   THERMAL NEUTRON SCATTERING LAW                      1019 1451
1)FREE ATOM SIGMA=1.87B,STEPHENSON,PEARLSTEIN,BULL.APS11,742JULY661019 1451
       0.0          0.0           0          0          0          01019 1  0
   25055.       54.466            0          0          0          01019 1453
   0.0          0.0               0          0         30          51019 1453
   16.          25054.       2.715E06   24054.     0.0        0.0     1019 1453
   102.         25056.       9.290E03   26056.     0.0        0.0     1019 1453
   103.         24055.       2.100E02   24055.     0.0        0.0     1019 1453
   104.         24054.       0.0        25055.     0.0        0.0     1019 1453
   107.         23052.       2.260E02   24052.     0.0        0.0     1019 1453
       0.0          0.0           0          0          0          01019 1  0
       0.0          0.0           0          0          0          01019 0  0
```

```
 25055.0      54.466              0          0          1          01019 2151   61
 25055.0       1.00               0          0          1          01019 2151   62
  .001     80000.0                1          1          0          01019 2151   63
    2.5       0.454              0          0          1          01019 2151   64
 .0009974     0.0                0          0        162         271019 2151   65
   -4700.     3.              473.52     473.0      0.52        0.01019 2151   66
   -3300.     2.              272.22     271.7      0.52        0.01019 2151   67
    335.5     2.               22.92      22.4      0.52        0.01019 2151   68
    1098.     3.               15.12      14.6      0.52        0.01019 2151   69
    2355.     3.              404.52     404.0      0.52        0.01019 2151   70
    7110.     2.              425.52     425.0      0.52        0.01019 2151   71
    8740.     3.              370.52     370.0      0.52        0.01019 2151   72
   17774.     3.               11.52      11.0      0.52        0.01019 2151   73
   17945.     2.               65.52      65.0      0.52        0.01019 2151   74
   20910.     3.              860.52     860.0      0.52        0.01019 2151   75
   23640.     2.              380.52     380.0      0.52        0.01019 2151   76
   26370.     2.              120.52     120.0      0.52        0.01019 2151   77
   26910.     3.              340.52     340.0      0.52        0.01019 2151   78
   30400.     2.               23.52      23.0      0.52        0.01019 2151   79
   34650.     2.             1200.52    1200.0      0.52        0.01019 2151   80
   35300.     3.             1400.52    1400.0      0.52        0.01019 2151   81
   36450.     2.               26.52      26.0      0.52        0.01019 2151   82
   40980.     3.              280.52     280.0      0.52        0.01019 2151   83
   53280.     2.               80.52      80.0      0.52        0.01019 2151   84
   57380.     3.              420.52     420.0      0.52        0.01019 2151   85
   58060.     2.              950.52     950.0      0.52        0.01019 2151   86
   59480.     2.              750.52     750.0      0.52        0.01019 2151   87
   64130.     3.              800.52     800.0      0.52        0.01019 2151   88
   66460.     3.              120.52     120.0      0.52        0.01019 2151   89
   69470.     2.              170.52     170.0      0.52        0.01019 2151   90
   70000.     3.              270.52     270.0      0.52        0.01019 2151   91
   73880.     2.             1000.52    1000.0      0.52        0.01019 2151   92
     0.0          0.0              0          0          0          01019 2  0   93
     0.0          0.0              0          0          0          01019 0  0   94
 25055.0      54.466              0          0          0          01019 3  1   95
    0.0       0.0                 0          0          1        3391019 3  1   96
      339           3                                            1019 3  1   97
1.0000E-03-1.8444E+00 5.5000E-03-1.8444E+00 1.0000E+01-1.8166E+001019 3  1   98
2.2400E+02-1.1455E+00 2.3200E+02-1.1178E+00 2.5200E+02-1.0480E+001019 3  1   99
2.6000E+02-1.0198E+00 2.6800E+02-9.9110E-01 2.7600E+02-9.6158E-011019 3  1  100
2.8400E+02-9.3019E-01 2.9200E+02-8.9457E-01 3.0000E+02-8.4880E-011019 3  1  101
3.0800E+02-7.7666E-01 3.1600E+02-6.2875E-01 3.2400E+02-2.4582E-011019 3  1  102
3.3200E+02 6.4294E-01 3.4000E+02 1.0594E+00 3.4800E+02 5.7127E-011019 3  1  103
3.5600E+02 2.1420E-01 3.6400E+02 3.7639E-02 3.7200E+02-4.6261E-021019 3  1  104
3.8000E+02-8.2656E-02 3.8800E+02-9.2557E-02 3.9600E+02-8.6378E-021019 3  1  105
4.0400E+02-6.9689E-02 4.1200E+02-4.5678E-02 4.2000E+02-1.6273E-021019 3  1  106
4.2800E+02 1.7307E-02 4.3600E+02 5.4263E-02 4.4400E+02 9.4056E-021019 3  1  107
4.7600E+02 2.7571E-01 4.8400E+02 3.2595E-01 5.1600E+02 5.4448E-011019 3  1  108
5.4800E+02 7.9136E-01 5.5600E+02 8.5777E-01 5.8800E+02 1.1440E+001019 3  1  109
6.2000E+02 1.4673E+00 6.2800E+02 1.5548E+00 6.6000E+02 1.9349E+001019 3  1  110
7.2800E+02 2.9502E+00 7.3600E+02 3.0936E+00 7.9200E+02 4.2994E+001019 3  1  111
8.4800E+02 6.0273E+00 8.5600E+02 6.3378E+00 9.2400E+02 1.0108E+011019 3  1  112
9.8000E+02 1.6423E+01 9.8400E+02 1.7109E+01 1.0120E+03 2.3672E+011019 3  1  113
1.0640E+03 6.2838E+01 1.0680E+03 7.0864E+01 1.0720E+03 8.0914E+011019 3  1  114
1.0760E+03 9.3715E+01 1.0800E+03 1.1020E+02 1.0840E+03 1.3107E+021019 3  1  115
1.0880E+03 1.5432E+02 1.0920E+03 1.6362E+02 1.0960E+03 1.0247E+021019 3  1  116
1.1000E+03-4.2464E+01 1.1040E+03-1.2490E+02 1.1080E+03-1.3312E+021019 3  1  117
1.1120E+03-1.1990E+02 1.1160E+03-1.0466E+02 1.1200E+03-9.1511E+011019 3  1  118
1.1240E+03-8.0802E+01 1.1280E+03-7.2138E+01 1.1320E+03-6.5073E+011019 3  1  119
1.1360E+03-5.9239E+01 1.1400E+03-5.4361E+01 1.1560E+03-4.0971E+011019 3  1  120
1.1720E+03-3.3026E+01 1.1760E+03-3.1524E+01 1.1980E+03-2.5338E+011019 3  1  121
```

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1.2200E+03-2.1322E+01 1.2240E+03-2.0739E+01 1.2460E+03-1.8081E+011019 3  1  122
1.2740E+03-1.5637E+01 1.2780E+03-1.5348E+01 1.3060E+03-1.3631E+011019 3  1  123
1.3400E+03-1.2064E+01 1.3440E+03-1.1907E+01 1.3720E+03-1.0931E+011019 3  1  124
1.5200E+03-7.8095E+00 1.5600E+03-7.2738E+00 1.7800E+03-5.1599E+001019 3  1  125
2.0000E+03-3.2728E+00 2.0400E+03-2.8472E+00 2.2600E+03 1.1861E-011019 3  1  126
2.3000E+03 3.4886E-01 2.3400E+03 1.9028E-01 2.3800E+03-3.6029E-011019 3  1  127
2.4200E+03-1.1450E+00 2.4600E+03-1.9560E+00 2.5000E+03-2.6551E+001019 3  1  128
2.5400E+03-3.1966E+00 2.5800E+03-3.5905E+00 2.7000E+03-4.1782E+001019 3  1  129
2.9000E+03-4.3339E+00 3.1000E+03-4.2335E+00 3.3000E+03-4.0917E+001019 3  1  130
3.5000E+03-3.9535E+00 3.7000E+03-3.8287E+00 5.1000E+03-3.3022E+001019 3  1  131
6.5000E+03-3.1344E+00 6.7000E+03-3.0771E+00 7.5000E+03-4.2014E+001019 3  1  132
7.7000E+03-4.4860E+00 7.9000E+03-4.8960E+00 8.0200E+03-5.2408E+001019 3  1  133
8.1200E+03-5.6077E+00 8.1600E+03-5.7789E+00 8.2000E+03-5.9658E+001019 3  1  134
8.3000E+03-6.5033E+00 8.3400E+03-6.7424E+00 8.3800E+03-6.9870E+001019 3  1  135
8.4800E+03-7.4930E+00 8.5200E+03-7.5319E+00 8.5600E+03-7.3317E+001019 3  1  136
8.6000E+03-6.7161E+00 8.6400E+03-5.4623E+00 8.6800E+03-3.4114E+001019 3  1  137
8.7200E+03-6.9715E-01 8.7600E+03 2.1170E+00 8.8000E+03 4.3348E+001019 3  1  138
8.8400E+03 5.6213E+00 8.8800E+03 6.0863E+00 8.9200E+03 6.0189E+001019 3  1  139
      8940. 5.8685          9500. 1.4286         10000. -0.4090   1019 3  1  140
     15000. -0.9546         20000. -0.8219        25000.  -2.5505  1019 3  1  141
     30000.  -1.4294        40000.-1.4145         50000. -0.0355   1019 3  1  142
     60000.  5.2731         70000. 0.9075         80000.  0.7525   1019 3  1  143
 .1000E+06      9.019  .1283E+06      7.765  .1290E+06      7.8151019 3  1  144
 .1300E+06      7.805  .1350E+06      7.667  .1400E+06      7.4811019 3  1  145
 .1450E+06      7.302  .1500E+06      7.132  .1550E+06      6.9521019 3  1  146
 .1600E+06      6.780  .1650E+06      6.598  .1700E+06      6.4351019 3  1  147
 .1750E+06      6.277  .1800E+06      6.110  .1850E+06      5.9831019 3  1  148
 .1900E+06      5.855  .1950E+06      5.745  .2000E+06      5.6421019 3  1  149
 .2500E+06      5.109  .3000E+06      4.468  .3500E+06      4.1071019 3  1  150
 .4000E+06      3.806  .4500E+06      3.620  .5000E+06      3.4841019 3  1  151
 .5500E+06      3.382  .6000E+06      3.307  .6500E+06      3.2351019 3  1  152
 .7000E+06      3.204  .7500E+06      3.185  .8000E+06      3.1621019 3  1  153
 .8500E+06      3.150  .9000E+06      3.140  .9500E+06      3.1081019 3  1  154
1.0000E+06      3.059 1.0009E+06      3.105 1.0010E+06      3.1181019 3  1  155
1.0015E+06      3.137 1.0020E+06      3.149 1.0030E+06      3.1651019 3  1  156
1.0040E+06      3.173 1.0050E+06      3.175 1.0060E+06      3.1821019 3  1  157
1.0070E+06      3.186 1.0080E+06      3.189 1.0090E+06      3.1911019 3  1  158
1.0100E+06      3.194 1.0200E+06      3.207 1.0300E+06      3.2151019 3  1  159
1.0400E+06      3.220 1.0500E+06      3.226 1.0600E+06      3.2311019 3  1  160
1.0750E+06      3.234 1.0800E+06      3.237 1.0900E+06      3.2411019 3  1  161
1.1000E+06      3.246 1.1100E+06      3.248 1.1250E+06      3.2531019 3  1  162
1.1300E+06      3.255 1.1400E+06      3.258 1.1500E+06      3.2611019 3  1  163
1.1600E+06      3.265 1.1750E+06      3.271 1.1800E+06      3.2731019 3  1  164
1.1900E+06      3.276 1.2000E+06      3.278 1.2100E+06      3.2811019 3  1  165
1.2250E+06      3.287 1.2300E+06      3.290 1.2400E+06      3.2941019 3  1  166
1.2500E+06      3.297 1.2600E+06      3.301 1.2750E+06      3.3071019 3  1  167
1.2800E+06      3.308 1.2900E+06      3.313 1.3000E+06      3.3151019 3  1  168
1.3100E+06      3.314 1.3125E+06      3.315 1.3130E+06      3.3221019 3  1  169
1.3140E+06      3.328 1.3150E+06      3.330 1.3160E+06      3.3311019 3  1  170
1.3175E+06      3.332 1.3180E+06      3.331 1.3190E+06      3.3321019 3  1  171
1.3200E+06      3.331 1.3300E+06      3.339 1.3400E+06      3.3451019 3  1  172
1.3500E+06      3.348 1.3600E+06      3.352 1.3700E+06      3.3561019 3  1  173
1.3800E+06      3.359 1.3900E+06      3.362 1.4000E+06      3.3651019 3  1  174
1.4100E+06      3.368 1.4250E+06      3.370 1.4300E+06      3.3721019 3  1  175
1.4400E+06      3.375 1.4500E+06      3.377 1.4600E+06      3.3831019 3  1  176
1.4700E+06      3.387 1.4800E+06      3.390 1.4900E+06      3.3921019 3  1  177
1.5000E+06      3.395 1.5100E+06      3.400 1.5250E+06      3.4041019 3  1  178
1.5300E+06      3.405 1.5400E+06      3.409 1.5500E+06      3.4101019 3  1  179
1.5548E+06      3.413 1.5550E+06      3.421 1.5560E+06      3.4221019 3  1  180
1.5570E+06      3.426 1.5580E+06      3.427 1.5590E+06      3.4281019 3  1  181
1.5600E+06      3.425 1.5700E+06      3.441 1.5800E+06      3.4491019 3  1  182
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 1.5900E+06      3.448 1.6100E+06      3.447 1.6250E+06      3.4461019 3  1  183
 1.6300E+06      3.452 1.6400E+06      3.454 1.6450E+06      3.4551019 3  1  184
 1.6500E+06      3.457 1.6600E+06      3.458 1.6700E+06      3.4611019 3  1  185
 1.6800E+06      3.463 1.6900E+06      3.466 1.7000E+06      3.4661019 3  1  186
 1.7100E+06      3.470 1.7250E+06      3.472 1.7300E+06      3.4741019 3  1  187
 1.7400E+06      3.474 1.7500E+06      3.476 1.7600E+06      3.4781019 3  1  188
 1.7700E+06      3.481 1.7800E+06      3.483 1.7900E+06      3.4841019 3  1  189
 1.8000E+06      3.484 1.8100E+06      3.485 1.8200E+06      3.4871019 3  1  190
 1.8300E+06      3.488 1.8400E+06      3.490 1.8500E+06      3.4921019 3  1  191
 1.8600E+06      3.492 1.8700E+06      3.493 1.8800E+06      3.4951019 3  1  192
 1.8900E+06      3.506 1.9000E+06      3.494 1.9100E+06      3.4931019 3  1  193
 1.9183E+06      3.498 1.9190E+06      3.505 1.9200E+06      3.5081019 3  1  194
 1.9210E+06      3.510 1.9220E+06      3.512 1.9230E+06      3.5131019 3  1  195
 1.9240E+06      3.514 1.9250E+06      3.513 1.9300E+06      3.5181019 3  1  196
 1.9400E+06      3.522 1.9500E+06      3.524 1.9600E+06      3.5251019 3  1  197
 1.9700E+06      3.526 1.9800E+06      3.525 1.9900E+06      3.5281019 3  1  198
 2.0000E+06      3.533 3.0000E+06      3.645 3.7500E+06      3.6701019 3  1  199
 4.0000E+06      3.665 4.5000E+06      3.750 5.0000E+06      3.7901019 3  1  200
 5.5000E+06      3.745 6.0000E+06      3.670 6.5000E+06      3.5901019 3  1  201
 7.0000E+06      3.505 7.5000E+06      3.420 8.0000E+06      3.3401019 3  1  202
 8.5000E+06      3.255 9.0000E+06      3.178 9.5000E+06      3.1001019 3  1  203
10.0000E+06      3.03010.5000E+06      2.95511.0000E+06      2.8851019 3  1  204
11.5000E+06      2.82012.0000E+06      2.76212.5000E+06      2.7051019 3  1  205
13.0000E+06      2.65013.5000E+06      2.60014.0000E+06      2.5501019 3  1  206
14.5000E+06      2.50315.0000E+06      2.46015.5000E+06      2.4301019 3  1  207
16.0000E+06      2.40016.5000E+06      2.38517.0000E+06      2.3701019 3  1  208
17.5000E+06      2.35818.0000E+06      2.34118.5000E+06      2.3301019 3  1  209
19.0000E+06      2.32019.5000E+06      2.31020.0000E+06      2.3001019 3  1  210
        0.0        0.0           0           0           0         01019 3  0  211
25055.0    54.466                 0           0           0         01019 3  2  212
        0.0        0.0           0           0           2      19981019 3  2  213
       1800          3        1998           5                     1019 3  2  214
 1.0000E-03-1.8444E+00 3.2500E-03-1.8444E+00 5.5000E-03-1.8444E+001019 3  2  215
 7.7500E-03-1.8444E+00 1.0000E-02-1.8444E+00 5.5000E-02-1.8443E+001019 3  2  216
 1.0000E-01-1.8441E+00 5.5000E-01-1.8429E+00 1.0000E+00-1.8416E+001019 3  2  217
 5.5000E+00-1.8291E+00 1.0000E+01-1.8166E+00 5.5000E+01-1.6876E+001019 3  2  218
 1.0000E+02-1.5524E+00 1.6000E+02-1.3616E+00 2.2000E+02-1.1594E+001019 3  2  219
 2.2400E+02-1.1455E+00 2.2800E+02-1.1317E+00 2.3200E+02-1.1178E+001019 3  2  220
 2.3600E+02-1.1039E+00 2.4000E+02-1.0900E+00 2.4400E+02-1.0761E+001019 3  2  221
 2.4800E+02-1.0621E+00 2.5200E+02-1.0480E+00 2.5600E+02-1.0339E+001019 3  2  222
 2.6000E+02-1.0198E+00 2.6400E+02-1.0055E+00 2.6800E+02-9.9110E-011019 3  2  223
 2.7200E+02-9.7649E-01 2.7600E+02-9.6158E-01 2.8000E+02-9.4622E-011019 3  2  224
 2.8400E+02-9.3019E-01 2.8800E+02-9.1316E-01 2.9200E+02-8.9457E-011019 3  2  225
 2.9600E+02-8.7359E-01 3.0000E+02-8.4880E-01 3.0400E+02-8.1784E-011019 3  2  226
 3.0800E+02-7.7666E-01 3.1200E+02-7.1802E-01 3.1600E+02-6.2875E-011019 3  2  227
 3.2000E+02-4.8488E-01 3.2400E+02-2.4582E-01 3.2800E+02 1.3734E-011019 3  2  228
 3.3200E+02 6.4294E-01 3.3600E+02 1.0345E+00 3.4000E+02 1.0594E+001019 3  2  229
 3.4400E+02 8.3184E-01 3.4800E+02 5.7127E-01 3.5200E+02 3.6351E-011019 3  2  230
 3.5600E+02 2.1420E-01 3.6000E+02 1.0995E-01 3.6400E+02 3.7639E-021019 3  2  231
 3.6800E+02-1.2265E-02 3.7200E+02-4.6261E-02 3.7600E+02-6.8730E-021019 3  2  232
 3.8000E+02-8.2656E-02 3.8400E+02-9.0110E-02 3.8800E+02-9.2557E-021019 3  2  233
 3.9200E+02-9.1054E-02 3.9600E+02-8.6378E-02 4.0000E+02-7.9110E-021019 3  2  234
 4.0400E+02-6.9689E-02 4.0800E+02-5.8457E-02 4.1200E+02-4.5678E-021019 3  2  235
 4.1600E+02-3.1561E-02 4.2000E+02-1.6273E-02 4.2400E+02 5.2826E-051019 3  2  236
 4.2800E+02 1.7307E-02 4.3200E+02 3.5402E-02 4.3600E+02 5.4263E-021019 3  2  237
 4.4000E+02 7.3831E-02 4.4400E+02 9.4056E-02 4.4800E+02 1.1490E-011019 3  2  238
 4.5200E+02 1.3632E-01 4.5600E+02 1.5829E-01 4.6000E+02 1.8079E-011019 3  2  239
 4.6400E+02 2.0380E-01 4.6800E+02 2.2730E-01 4.7200E+02 2.5127E-011019 3  2  240
 4.7600E+02 2.7571E-01 4.8000E+02 3.0061E-01 4.8400E+02 3.2595E-011019 3  2  241
 4.8800E+02 3.5174E-01 4.9200E+02 3.7797E-01 4.9600E+02 4.0463E-011019 3  2  242
 5.0000E+02 4.3173E-01 5.0400E+02 4.5927E-01 5.0800E+02 4.8723E-011019 3  2  243
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5.1200E+02 5.1564E-01 5.1600E+02 5.4448E-01 5.2000E+02 5.7376E-011019 3  2  244
5.2400E+02 6.0348E-01 5.2800E+02 6.3364E-01 5.3200E+02 6.6426E-011019 3  2  245
5.3600E+02 6.9534E-01 5.4000E+02 7.2688E-01 5.4400E+02 7.5888E-011019 3  2  246
5.4800E+02 7.9136E-01 5.5200E+02 8.2432E-01 5.5600E+02 8.5777E-011019 3  2  247
5.6000E+02 8.9171E-01 5.6400E+02 9.2616E-01 5.6800E+02 9.6113E-011019 3  2  248
5.7200E+02 9.9662E-01 5.7600E+02 1.0326E+00 5.8000E+02 1.0692E+001019 3  2  249
5.8400E+02 1.1063E+00 5.8800E+02 1.1440E+00 5.9200E+02 1.1823E+001019 3  2  250
5.9600E+02 1.2211E+00 6.0000E+02 1.2606E+00 6.0400E+02 1.3006E+001019 3  2  251
6.0800E+02 1.3413E+00 6.1200E+02 1.3827E+00 6.1600E+02 1.4247E+001019 3  2  252
6.2000E+02 1.4673E+00 6.2400E+02 1.5107E+00 6.2800E+02 1.5548E+001019 3  2  253
6.3200E+02 1.5996E+00 6.3600E+02 1.6451E+00 6.4000E+02 1.6914E+001019 3  2  254
6.4400E+02 1.7385E+00 6.4800E+02 1.7863E+00 6.5200E+02 1.8350E+001019 3  2  255
6.5600E+02 1.8845E+00 6.6000E+02 1.9349E+00 6.6400E+02 1.9862E+001019 3  2  256
6.6800E+02 2.0384E+00 6.7200E+02 2.0915E+00 6.7600E+02 2.1456E+001019 3  2  257
6.8000E+02 2.2007E+00 6.8400E+02 2.2568E+00 6.8800E+02 2.3139E+001019 3  2  258
6.9200E+02 2.3721E+00 6.9600E+02 2.4314E+00 7.0000E+02 2.4919E+001019 3  2  259
7.0400E+02 2.5535E+00 7.0800E+02 2.6164E+00 7.1200E+02 2.6805E+001019 3  2  260
7.1600E+02 2.7459E+00 7.2000E+02 2.8126E+00 7.2400E+02 2.8807E+001019 3  2  261
7.2800E+02 2.9502E+00 7.3200E+02 3.0211E+00 7.3600E+02 3.0936E+001019 3  2  262
7.4000E+02 3.1676E+00 7.4400E+02 3.2432E+00 7.4800E+02 3.3205E+001019 3  2  263
7.5200E+02 3.3995E+00 7.5600E+02 3.4804E+00 7.6000E+02 3.5630E+001019 3  2  264
7.6400E+02 3.6476E+00 7.6800E+02 3.7341E+00 7.7200E+02 3.8227E+001019 3  2  265
7.7600E+02 3.9135E+00 7.8000E+02 4.0064E+00 7.8400E+02 4.1016E+001019 3  2  266
7.8800E+02 4.1993E+00 7.9200E+02 4.2994E+00 7.9600E+02 4.4020E+001019 3  2  267
8.0000E+02 4.5074E+00 8.0400E+02 4.6155E+00 8.0800E+02 4.7266E+001019 3  2  268
8.1200E+02 4.8406E+00 8.1600E+02 4.9579E+00 8.2000E+02 5.0784E+001019 3  2  269
8.2400E+02 5.2023E+00 8.2800E+02 5.3298E+00 8.3200E+02 5.4611E+001019 3  2  270
8.3600E+02 5.5963E+00 8.4000E+02 5.7356E+00 8.4400E+02 5.8792E+001019 3  2  271
8.4800E+02 6.0273E+00 8.5200E+02 6.1801E+00 8.5600E+02 6.3378E+001019 3  2  272
8.6000E+02 6.5008E+00 8.6400E+02 6.6692E+00 8.6800E+02 6.8434E+001019 3  2  273
8.7200E+02 7.0237E+00 8.7600E+02 7.2103E+00 8.8000E+02 7.4036E+001019 3  2  274
8.8400E+02 7.6041E+00 8.8800E+02 7.8121E+00 8.9200E+02 8.0280E+001019 3  2  275
8.9600E+02 8.2524E+00 9.0000E+02 8.4857E+00 9.0400E+02 8.7285E+001019 3  2  276
9.0800E+02 8.9814E+00 9.1200E+02 9.2451E+00 9.1600E+02 9.5201E+001019 3  2  277
9.2000E+02 9.8074E+00 9.2400E+02 1.0108E+01 9.2800E+02 1.0422E+011019 3  2  278
9.3200E+02 1.0751E+01 9.3600E+02 1.1097E+01 9.4000E+02 1.1459E+011019 3  2  279
9.4400E+02 1.1841E+01 9.4800E+02 1.2242E+01 9.5200E+02 1.2665E+011019 3  2  280
9.5600E+02 1.3112E+01 9.6000E+02 1.3585E+01 9.6400E+02 1.4085E+011019 3  2  281
9.6800E+02 1.4616E+01 9.7200E+02 1.5181E+01 9.7600E+02 1.5782E+011019 3  2  282
9.8000E+02 1.6423E+01 9.8200E+02 1.6760E+01 9.8400E+02 1.7109E+011019 3  2  283
9.8600E+02 1.7470E+01 9.8800E+02 1.7844E+01 9.9000E+02 1.8232E+011019 3  2  284
9.9200E+02 1.8634E+01 9.9400E+02 1.9052E+01 9.9600E+02 1.9485E+011019 3  2  285
9.9800E+02 1.9936E+01 1.0000E+03 2.0405E+01 1.0020E+03 2.0894E+011019 3  2  286
1.0040E+03 2.1403E+01 1.0060E+03 2.1934E+01 1.0080E+03 2.2488E+011019 3  2  287
1.0100E+03 2.3066E+01 1.0120E+03 2.3672E+01 1.0140E+03 2.4305E+011019 3  2  288
1.0160E+03 2.4970E+01 1.0180E+03 2.5666E+01 1.0200E+03 2.6398E+011019 3  2  289
1.0220E+03 2.7168E+01 1.0240E+03 2.7978E+01 1.0260E+03 2.8832E+011019 3  2  290
1.0280E+03 2.9734E+01 1.0300E+03 3.0688E+01 1.0320E+03 3.1698E+011019 3  2  291
1.0340E+03 3.2769E+01 1.0360E+03 3.3908E+01 1.0380E+03 3.5119E+011019 3  2  292
1.0400E+03 3.6412E+01 1.0420E+03 3.7793E+01 1.0440E+03 3.9272E+011019 3  2  293
1.0460E+03 4.0860E+01 1.0480E+03 4.2569E+01 1.0500E+03 4.4412E+011019 3  2  294
1.0520E+03 4.6406E+01 1.0540E+03 4.8570E+01 1.0560E+03 5.0925E+011019 3  2  295
1.0580E+03 5.3497E+01 1.0600E+03 5.6315E+01 1.0620E+03 5.9415E+011019 3  2  296
1.0640E+03 6.2838E+01 1.0660E+03 6.6635E+01 1.0680E+03 7.0864E+011019 3  2  297
1.0700E+03 7.5596E+01 1.0720E+03 8.0914E+01 1.0740E+03 8.6916E+011019 3  2  298
1.0760E+03 9.3715E+01 1.0780E+03 1.0143E+02 1.0800E+03 1.1020E+021019 3  2  299
1.0820E+03 1.2008E+02 1.0840E+03 1.3107E+02 1.0860E+03 1.4282E+021019 3  2  300
1.0880E+03 1.5432E+02 1.0900E+03 1.6304E+02 1.0920E+03 1.6362E+021019 3  2  301
1.0940E+03 1.4678E+02 1.0960E+03 1.0247E+02 1.0980E+03 3.2092E+011019 3  2  302
1.1000E+03-4.2464E+01 1.1020E+03-9.6777E+01 1.1040E+03-1.2490E+021019 3  2  303
1.1060E+03-1.3416E+02 1.1080E+03-1.3312E+02 1.1100E+03-1.2738E+021019 3  2  304
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1.1120E+03-1.1990E+02 1.1140E+03-1.1212E+02 1.1160E+03-1.0466E+021019 3  2  305
1.1180E+03-9.7769E+01 1.1200E+03-9.1511E+01 1.1220E+03-8.5872E+011019 3  2  306
1.1240E+03-8.0802E+01 1.1260E+03-7.6244E+01 1.1280E+03-7.2138E+011019 3  2  307
1.1300E+03-6.8431E+01 1.1320E+03-6.5073E+01 1.1340E+03-6.2021E+011019 3  2  308
1.1360E+03-5.9239E+01 1.1380E+03-5.6695E+01 1.1400E+03-5.4361E+011019 3  2  309
1.1420E+03-5.2213E+01 1.1440E+03-5.0231E+01 1.1460E+03-4.8397E+011019 3  2  310
1.1480E+03-4.6696E+01 1.1500E+03-4.5114E+01 1.1520E+03-4.3639E+011019 3  2  311
1.1540E+03-4.2261E+01 1.1560E+03-4.0971E+01 1.1580E+03-3.9761E+011019 3  2  312
1.1600E+03-3.8625E+01 1.1620E+03-3.7554E+01 1.1640E+03-3.6545E+011019 3  2  313
1.1660E+03-3.5592E+01 1.1680E+03-3.4690E+01 1.1700E+03-3.3836E+011019 3  2  314
1.1720E+03-3.3026E+01 1.1740E+03-3.2256E+01 1.1760E+03-3.1524E+011019 3  2  315
1.1780E+03-3.0827E+01 1.1800E+03-3.0162E+01 1.1820E+03-2.9528E+011019 3  2  316
1.1840E+03-2.8922E+01 1.1860E+03-2.8343E+01 1.1880E+03-2.7789E+011019 3  2  317
1.1900E+03-2.7257E+01 1.1920E+03-2.6748E+01 1.1940E+03-2.6259E+011019 3  2  318
1.1960E+03-2.5789E+01 1.1980E+03-2.5338E+01 1.2000E+03-2.4903E+011019 3  2  319
1.2020E+03-2.4485E+01 1.2040E+03-2.4082E+01 1.2060E+03-2.3694E+011019 3  2  320
1.2080E+03-2.3319E+01 1.2100E+03-2.2958E+01 1.2120E+03-2.2608E+011019 3  2  321
1.2140E+03-2.2271E+01 1.2160E+03-2.1944E+01 1.2180E+03-2.1628E+011019 3  2  322
1.2200E+03-2.1322E+01 1.2220E+03-2.1026E+01 1.2240E+03-2.0739E+011019 3  2  323
1.2260E+03-2.0460E+01 1.2280E+03-2.0190E+01 1.2300E+03-1.9928E+011019 3  2  324
1.2320E+03-1.9674E+01 1.2340E+03-1.9427E+01 1.2360E+03-1.9187E+011019 3  2  325
1.2380E+03-1.8953E+01 1.2400E+03-1.8726E+01 1.2420E+03-1.8505E+011019 3  2  326
1.2440E+03-1.8290E+01 1.2460E+03-1.8081E+01 1.2480E+03-1.7877E+011019 3  2  327
1.2500E+03-1.7678E+01 1.2520E+03-1.7484E+01 1.2540E+03-1.7295E+011019 3  2  328
1.2560E+03-1.7111E+01 1.2580E+03-1.6931E+01 1.2600E+03-1.6756E+011019 3  2  329
1.2620E+03-1.6585E+01 1.2640E+03-1.6418E+01 1.2660E+03-1.6254E+011019 3  2  330
1.2680E+03-1.6095E+01 1.2700E+03-1.5939E+01 1.2720E+03-1.5786E+011019 3  2  331
1.2740E+03-1.5637E+01 1.2760E+03-1.5491E+01 1.2780E+03-1.5348E+011019 3  2  332
1.2800E+03-1.5209E+01 1.2820E+03-1.5072E+01 1.2840E+03-1.4938E+011019 3  2  333
1.2860E+03-1.4807E+01 1.2880E+03-1.4679E+01 1.2900E+03-1.4553E+011019 3  2  334
1.2920E+03-1.4429E+01 1.2940E+03-1.4309E+01 1.2960E+03-1.4190E+011019 3  2  335
1.2980E+03-1.4074E+01 1.3000E+03-1.3960E+01 1.3020E+03-1.3848E+011019 3  2  336
1.3040E+03-1.3738E+01 1.3060E+03-1.3631E+01 1.3080E+03-1.3525E+011019 3  2  337
1.3100E+03-1.3421E+01 1.3120E+03-1.3319E+01 1.3140E+03-1.3219E+011019 3  2  338
1.3160E+03-1.3121E+01 1.3180E+03-1.3024E+01 1.3200E+03-1.2929E+011019 3  2  339
1.3220E+03-1.2836E+01 1.3240E+03-1.2744E+01 1.3260E+03-1.2654E+011019 3  2  340
1.3280E+03-1.2566E+01 1.3300E+03-1.2479E+01 1.3320E+03-1.2393E+011019 3  2  341
1.3340E+03-1.2308E+01 1.3360E+03-1.2226E+01 1.3380E+03-1.2144E+011019 3  2  342
1.3400E+03-1.2064E+01 1.3420E+03-1.1984E+01 1.3440E+03-1.1907E+011019 3  2  343
1.3460E+03-1.1830E+01 1.3480E+03-1.1754E+01 1.3500E+03-1.1680E+011019 3  2  344
1.3520E+03-1.1607E+01 1.3540E+03-1.1535E+01 1.3560E+03-1.1464E+011019 3  2  345
1.3580E+03-1.1394E+01 1.3600E+03-1.1325E+01 1.3620E+03-1.1257E+011019 3  2  346
1.3640E+03-1.1190E+01 1.3660E+03-1.1123E+01 1.3680E+03-1.1058E+011019 3  2  347
1.3700E+03-1.0994E+01 1.3720E+03-1.0931E+01 1.3740E+03-1.0868E+011019 3  2  348
1.3760E+03-1.0806E+01 1.3780E+03-1.0746E+01 1.3800E+03-1.0686E+011019 3  2  349
1.4000E+03-1.0127E+01 1.4200E+03-9.6328E+00 1.4400E+03-9.1923E+001019 3  2  350
1.4600E+03-8.7962E+00 1.4800E+03-8.4374E+00 1.5000E+03-8.1101E+001019 3  2  351
1.5200E+03-7.8095E+00 1.5400E+03-7.5318E+00 1.5600E+03-7.2738E+001019 3  2  352
1.5800E+03-7.0328E+00 1.6000E+03-6.8063E+00 1.6200E+03-6.5924E+001019 3  2  353
1.6400E+03-6.3894E+00 1.6600E+03-6.1957E+00 1.6800E+03-6.0099E+001019 3  2  354
1.7000E+03-5.8308E+00 1.7200E+03-5.6573E+00 1.7400E+03-5.4883E+001019 3  2  355
1.7600E+03-5.3228E+00 1.7800E+03-5.1599E+00 1.8000E+03-4.9987E+001019 3  2  356
1.8200E+03-4.8383E+00 1.8400E+03-4.6778E+00 1.8600E+03-4.5163E+001019 3  2  357
1.8800E+03-4.3527E+00 1.9000E+03-4.1863E+00 1.9200E+03-4.0159E+001019 3  2  358
1.9400E+03-3.8405E+00 1.9600E+03-3.6590E+00 1.9800E+03-3.4702E+001019 3  2  359
2.0000E+03-3.2728E+00 2.0200E+03-3.0655E+00 2.0400E+03-2.8472E+001019 3  2  360
2.0600E+03-2.6167E+00 2.0800E+03-2.3728E+00 2.1000E+03-2.1150E+001019 3  2  361
2.1200E+03-1.8432E+00 2.1400E+03-1.5582E+00 2.1600E+03-1.2623E+001019 3  2  362
2.1800E+03-9.5999E-01 2.2000E+03-6.5824E-01 2.2200E+03-3.6765E-011019 3  2  363
2.2400E+03-1.0266E-01 2.2600E+03 1.1861E-01 2.2800E+03 2.7575E-011019 3  2  364
2.3000E+03 3.4886E-01 2.3200E+03 3.2256E-01 2.3400E+03 1.9028E-011019 3  2  365
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2.3600E+03-4.2882E-02 2.3800E+03-3.6029E-01 2.4000E+03-7.3702E-011019 3  2  366
2.4200E+03-1.1450E+00 2.4400E+03-1.5583E+00 2.4600E+03-1.9560E+001019 3  2  367
2.4800E+03-2.3243E+00 2.5000E+03-2.6551E+00 2.5200E+03-2.9457E+001019 3  2  368
2.5400E+03-3.1966E+00 2.5600E+03-3.4103E+00 2.5800E+03-3.5905E+001019 3  2  369
2.6000E+03-3.7412E+00 2.7000E+03-4.1782E+00 2.8000E+03-4.3190E+001019 3  2  370
2.9000E+03-4.3339E+00 3.0000E+03-4.2950E+00 3.1000E+03-4.2335E+001019 3  2  371
3.2000E+03-4.1635E+00 3.3000E+03-4.0917E+00 3.4000E+03-4.0212E+001019 3  2  372
3.5000E+03-3.9535E+00 3.6000E+03-3.8893E+00 3.7000E+03-3.8287E+001019 3  2  373
3.8000E+03-3.7719E+00 3.9000E+03-3.7187E+00 4.0000E+03-3.6689E+001019 3  2  374
4.1000E+03-3.6224E+00 4.2000E+03-3.5789E+00 4.3000E+03-3.5383E+001019 3  2  375
4.4000E+03-3.5005E+00 4.5000E+03-3.4653E+00 4.6000E+03-3.4326E+001019 3  2  376
4.7000E+03-3.4022E+00 4.8000E+03-3.3741E+00 4.9000E+03-3.3481E+001019 3  2  377
5.0000E+03-3.3242E+00 5.1000E+03-3.3022E+00 5.2000E+03-3.2822E+001019 3  2  378
5.3000E+03-3.2641E+00 5.4000E+03-3.2477E+00 5.5000E+03-3.2331E+001019 3  2  379
5.6000E+03-3.2201E+00 5.7000E+03-3.2086E+00 5.8000E+03-3.1986E+001019 3  2  380
5.9000E+03-3.1897E+00 6.0000E+03-3.1819E+00 6.1000E+03-3.1746E+001019 3  2  381
6.2000E+03-3.1674E+00 6.3000E+03-3.1593E+00 6.4000E+03-3.1490E+001019 3  2  382
6.5000E+03-3.1344E+00 6.6000E+03-3.1121E+00 6.7000E+03-3.0771E+001019 3  2  383
6.8000E+03-3.0238E+00 6.9000E+03-2.9570E+00 7.0000E+03-2.9413E+001019 3  2  384
7.1000E+03-3.1596E+00 7.2000E+03-3.5799E+00 7.3000E+03-3.8897E+001019 3  2  385
7.4000E+03-4.0685E+00 7.5000E+03-4.2014E+00 7.6000E+03-4.3338E+001019 3  2  386
7.7000E+03-4.4860E+00 7.8000E+03-4.6699E+00 7.9000E+03-4.8960E+001019 3  2  387
8.0000E+03-5.1768E+00 8.0200E+03-5.2408E+00 8.0400E+03-5.3078E+001019 3  2  388
8.0600E+03-5.3778E+00 8.0800E+03-5.4510E+00 8.1000E+03-5.5276E+001019 3  2  389
8.1200E+03-5.6077E+00 8.1400E+03-5.6914E+00 8.1600E+03-5.7789E+001019 3  2  390
8.1800E+03-5.8704E+00 8.2000E+03-5.9658E+00 8.2200E+03-6.0653E+001019 3  2  391
8.2400E+03-6.1689E+00 8.2600E+03-6.2766E+00 8.2800E+03-6.3881E+001019 3  2  392
8.3000E+03-6.5033E+00 8.3200E+03-6.6216E+00 8.3400E+03-6.7424E+001019 3  2  393
8.3600E+03-6.8647E+00 8.3800E+03-6.9870E+00 8.4000E+03-7.1072E+001019 3  2  394
8.4200E+03-7.2225E+00 8.4400E+03-7.3291E+00 8.4600E+03-7.4216E+001019 3  2  395
8.4800E+03-7.4930E+00 8.5000E+03-7.5339E+00 8.5200E+03-7.5319E+001019 3  2  396
8.5400E+03-7.4712E+00 8.5600E+03-7.3317E+00 8.5800E+03-7.0893E+001019 3  2  397
8.6000E+03-6.7161E+00 8.6200E+03-6.1826E+00 8.6400E+03-5.4623E+001019 3  2  398
8.6600E+03-4.5381E+00 8.6800E+03-3.4114E+00 8.7000E+03-2.1111E+001019 3  2  399
8.7200E+03-6.9715E-01 8.7400E+03 7.4445E-01 8.7600E+03 2.1170E+001019 3  2  400
8.7800E+03 3.3336E+00 8.8000E+03 4.3348E+00 8.8200E+03 5.0954E+001019 3  2  401
8.8400E+03 5.6213E+00 8.8600E+03 5.9392E+00 8.8800E+03 6.0863E+001019 3  2  402
8.9000E+03 6.1012E+00 8.9200E+03 6.0189E+00 8.9400E+03 5.8685E+001019 3  2  403
8.9600E+03 5.6731E+00 8.9800E+03 5.4500E+00 9.0000E+03 5.2119E+001019 3  2  404
9.0200E+03 4.9678E+00 9.0400E+03 4.7240E+00 9.0600E+03 4.4846E+001019 3  2  405
9.0800E+03 4.2524E+00 9.1000E+03 4.0290E+00 9.1200E+03 3.8155E+001019 3  2  406
9.1400E+03 3.6121E+00 9.1600E+03 3.4190E+00 9.1800E+03 3.2360E+001019 3  2  407
9.2000E+03 3.0628E+00 9.2200E+03 2.8990E+00 9.2400E+03 2.7441E+001019 3  2  408
9.2600E+03 2.5976E+00 9.2800E+03 2.4591E+00 9.3000E+03 2.3280E+001019 3  2  409
9.3200E+03 2.2039E+00 9.3400E+03 2.0864E+00 9.3600E+03 1.9750E+001019 3  2  410
9.3800E+03 1.8694E+00 9.4000E+03 1.7691E+00 9.4200E+03 1.6738E+001019 3  2  411
9.4400E+03 1.5832E+00 9.4600E+03 1.4971E+00 9.4800E+03 1.4150E+001019 3  2  412
9.5000E+03 1.3368E+00 9.5200E+03 1.2622E+00 9.5400E+03 1.1909E+001019 3  2  413
9.5600E+03 1.1229E+00 9.5800E+03 1.0579E+00 9.6000E+03 9.9568E-011019 3  2  414
1.0600E+04-4.1547E-01 1.1600E+04-7.9475E-01 1.2600E+04-9.4375E-011019 3  2  415
1.3600E+04-1.0077E+00 1.4600E+04-1.0289E+00 1.5600E+04-1.0173E+001019 3  2  416
1.6600E+04-9.4738E-01 1.7600E+04-2.2743E-01 1.7602E+04-2.1916E-011019 3  2  417
1.7604E+04-2.1071E-01 1.7606E+04-2.0209E-01 1.7608E+04-1.9328E-011019 3  2  418
1.7610E+04-1.8428E-01 1.7612E+04-1.7509E-01 1.7614E+04-1.6570E-011019 3  2  419
1.7616E+04-1.5610E-01 1.7618E+04-1.4628E-01 1.7620E+04-1.3624E-011019 3  2  420
1.7622E+04-1.2596E-01 1.7624E+04-1.1544E-01 1.7626E+04-1.0467E-011019 3  2  421
1.7628E+04-9.3639E-02 1.7630E+04-8.2337E-02 1.7632E+04-7.0754E-021019 3  2  422
1.7634E+04-5.8876E-02 1.7636E+04-4.6694E-02 1.7638E+04-3.4194E-021019 3  2  423
1.7640E+04-2.1362E-02 1.7642E+04-8.1844E-03 1.7644E+04 5.3540E-031019 3  2  424
1.7646E+04 1.9269E-02 1.7648E+04 3.3578E-02 1.7650E+04 4.8300E-021019 3  2  425
1.7652E+04 6.3452E-02 1.7654E+04 7.9056E-02 1.7656E+04 9.5134E-021019 3  2  426
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1.7658E+04 1.1171E-01 1.7660E+04 1.2880E-01 1.7662E+04 1.4645E-011019 3  2  427
1.7664E+04 1.6467E-01 1.7666E+04 1.8350E-01 1.7668E+04 2.0297E-011019 3  2  428
1.7670E+04 2.2312E-01 1.7672E+04 2.4398E-01 1.7674E+04 2.6560E-011019 3  2  429
1.7676E+04 2.8801E-01 1.7678E+04 3.1128E-01 1.7680E+04 3.3544E-011019 3  2  430
1.7682E+04 3.6056E-01 1.7684E+04 3.8670E-01 1.7686E+04 4.1392E-011019 3  2  431
1.7688E+04 4.4230E-01 1.7690E+04 4.7192E-01 1.7692E+04 5.0286E-011019 3  2  432
1.7694E+04 5.3522E-01 1.7696E+04 5.6911E-01 1.7698E+04 6.0464E-011019 3  2  433
1.7700E+04 6.4194E-01 1.7702E+04 6.8115E-01 1.7704E+04 7.2244E-011019 3  2  434
1.7706E+04 7.6598E-01 1.7708E+04 8.1196E-01 1.7710E+04 8.6062E-011019 3  2  435
1.7712E+04 9.1219E-01 1.7714E+04 9.6696E-01 1.7716E+04 1.0253E+001019 3  2  436
1.7718E+04 1.0874E+00 1.7720E+04 1.1539E+00 1.7722E+04 1.2251E+001019 3  2  437
1.7724E+04 1.3017E+00 1.7726E+04 1.3843E+00 1.7728E+04 1.4735E+001019 3  2  438
1.7730E+04 1.5703E+00 1.7732E+04 1.6757E+00 1.7734E+04 1.7909E+001019 3  2  439
1.7736E+04 1.9173E+00 1.7738E+04 2.0568E+00 1.7740E+04 2.2113E+001019 3  2  440
1.7742E+04 2.3836E+00 1.7744E+04 2.5766E+00 1.7746E+04 2.7944E+001019 3  2  441
1.7748E+04 3.0419E+00 1.7750E+04 3.3252E+00 1.7752E+04 3.6522E+001019 3  2  442
1.7754E+04 4.0329E+00 1.7756E+04 4.4796E+00 1.7758E+04 5.0078E+001019 3  2  443
1.7760E+04 5.6353E+00 1.7762E+04 6.3782E+00 1.7764E+04 7.2393E+001019 3  2  444
1.7766E+04 8.1689E+00 1.7768E+04 8.9599E+00 1.7770E+04 9.0176E+001019 3  2  445
1.7772E+04 7.1862E+00 1.7774E+04 2.7802E+00 1.7776E+04-2.2915E+001019 3  2  446
1.7778E+04-5.4876E+00 1.7780E+04-6.6720E+00 1.7782E+04-6.7724E+001019 3  2  447
1.7784E+04-6.4430E+00 1.7786E+04-5.9861E+00 1.7788E+04-5.5210E+001019 3  2  448
1.7790E+04-5.0896E+00 1.7792E+04-4.7033E+00 1.7794E+04-4.3616E+001019 3  2  449
1.7796E+04-4.0601E+00 1.7798E+04-3.7938E+00 1.7800E+04-3.5574E+001019 3  2  450
1.7802E+04-3.3466E+00 1.7804E+04-3.1576E+00 1.7806E+04-2.9871E+001019 3  2  451
1.7808E+04-2.8325E+00 1.7810E+04-2.6916E+00 1.7812E+04-2.5625E+001019 3  2  452
1.7814E+04-2.4436E+00 1.7816E+04-2.3336E+00 1.7818E+04-2.2315E+001019 3  2  453
1.7820E+04-2.1361E+00 1.7822E+04-2.0468E+00 1.7824E+04-1.9628E+001019 3  2  454
1.7826E+04-1.8834E+00 1.7828E+04-1.8083E+00 1.7830E+04-1.7368E+001019 3  2  455
1.7832E+04-1.6686E+00 1.7834E+04-1.6033E+00 1.7836E+04-1.5407E+001019 3  2  456
1.7838E+04-1.4804E+00 1.7840E+04-1.4221E+00 1.7842E+04-1.3657E+001019 3  2  457
1.7844E+04-1.3109E+00 1.7846E+04-1.2575E+00 1.7848E+04-1.2054E+001019 3  2  458
1.7850E+04-1.1544E+00 1.7852E+04-1.1044E+00 1.7854E+04-1.0552E+001019 3  2  459
1.7856E+04-1.0068E+00 1.7858E+04-9.5892E-01 1.7860E+04-9.1157E-011019 3  2  460
1.7862E+04-8.6463E-01 1.7864E+04-8.1801E-01 1.7866E+04-7.7163E-011019 3  2  461
1.7868E+04-7.2542E-01 1.7870E+04-6.7932E-01 1.7872E+04-6.3327E-011019 3  2  462
1.7874E+04-5.8722E-01 1.7876E+04-5.4113E-01 1.7878E+04-4.9498E-011019 3  2  463
1.7880E+04-4.4875E-01 1.7882E+04-4.0243E-01 1.7884E+04-3.5603E-011019 3  2  464
1.7886E+04-3.0960E-01 1.7888E+04-2.6318E-01 1.7890E+04-2.1685E-011019 3  2  465
1.7892E+04-1.7073E-01 1.7894E+04-1.2496E-01 1.7896E+04-7.9732E-021019 3  2  466
1.7898E+04-3.5296E-02 1.7900E+04 8.0442E-03 1.7902E+04 4.9907E-021019 3  2  467
1.7904E+04 8.9829E-02 1.7906E+04 1.2725E-01 1.7908E+04 1.6148E-011019 3  2  468
1.7910E+04 1.9172E-01 1.7912E+04 2.1703E-01 1.7914E+04 2.3629E-011019 3  2  469
1.7916E+04 2.4824E-01 1.7918E+04 2.5145E-01 1.7920E+04 2.4432E-011019 3  2  470
1.7922E+04 2.2514E-01 1.7924E+04 1.9212E-01 1.7926E+04 1.4344E-011019 3  2  471
1.7928E+04 7.7405E-02 1.7930E+04-7.4685E-03 1.7932E+04-1.1226E-011019 3  2  472
1.7934E+04-2.3747E-01 1.7936E+04-3.8286E-01 1.7938E+04-5.4729E-011019 3  2  473
1.7940E+04-7.2866E-01 1.7942E+04-9.2390E-01 1.7944E+04-1.1291E+001019 3  2  474
1.7946E+04-1.3398E+00 1.7948E+04-1.5511E+00 1.7950E+04-1.7582E+001019 3  2  475
1.7952E+04-1.9569E+00 1.7954E+04-2.1434E+00 1.7956E+04-2.3148E+001019 3  2  476
1.7958E+04-2.4692E+00 1.7960E+04-2.6055E+00 1.7962E+04-2.7234E+001019 3  2  477
1.7964E+04-2.8235E+00 1.7966E+04-2.9065E+00 1.7968E+04-2.9738E+001019 3  2  478
1.7970E+04-3.0267E+00 1.7972E+04-3.0668E+00 1.7974E+04-3.0957E+001019 3  2  479
1.7976E+04-3.1148E+00 1.7978E+04-3.1255E+00 1.7980E+04-3.1290E+001019 3  2  480
1.7982E+04-3.1266E+00 1.7984E+04-3.1191E+00 1.7986E+04-3.1074E+001019 3  2  481
1.7988E+04-3.0924E+00 1.7990E+04-3.0746E+00 1.7992E+04-3.0546E+001019 3  2  482
1.7994E+04-3.0328E+00 1.7996E+04-3.0098E+00 1.7998E+04-2.9857E+001019 3  2  483
1.8000E+04-2.9609E+00 1.8002E+04-2.9357E+00 1.8004E+04-2.9101E+001019 3  2  484
1.8006E+04-2.8844E+00 1.8008E+04-2.8587E+00 1.8010E+04-2.8331E+001019 3  2  485
1.8012E+04-2.8077E+00 1.8014E+04-2.7826E+00 1.8016E+04-2.7578E+001019 3  2  486
1.8018E+04-2.7333E+00 1.8020E+04-2.7093E+00 1.8022E+04-2.6856E+001019 3  2  487
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1.8024E+04-2.6625E+00 1.8026E+04-2.6397E+00 1.8028E+04-2.6175E+001019 3  2  488
1.8030E+04-2.5957E+00 1.8032E+04-2.5744E+00 1.8034E+04-2.5535E+001019 3  2  489
1.8036E+04-2.5332E+00 1.8038E+04-2.5133E+00 1.8040E+04-2.4938E+001019 3  2  490
1.8042E+04-2.4748E+00 1.8044E+04-2.4562E+00 1.8046E+04-2.4381E+001019 3  2  491
1.8048E+04-2.4204E+00 1.8050E+04-2.4031E+00 1.8052E+04-2.3862E+001019 3  2  492
1.8054E+04-2.3698E+00 1.8056E+04-2.3536E+00 1.8058E+04-2.3379E+001019 3  2  493
1.8060E+04-2.3225E+00 1.8062E+04-2.3075E+00 1.8064E+04-2.2928E+001019 3  2  494
1.8066E+04-2.2785E+00 1.8068E+04-2.2645E+00 1.8070E+04-2.2507E+001019 3  2  495
1.8072E+04-2.2373E+00 1.8074E+04-2.2242E+00 1.8076E+04-2.2114E+001019 3  2  496
1.8078E+04-2.1989E+00 1.8080E+04-2.1866E+00 1.8082E+04-2.1746E+001019 3  2  497
1.8084E+04-2.1628E+00 1.8086E+04-2.1513E+00 1.8088E+04-2.1400E+001019 3  2  498
1.8090E+04-2.1290E+00 1.8092E+04-2.1182E+00 1.8094E+04-2.1076E+001019 3  2  499
1.8096E+04-2.0972E+00 1.8098E+04-2.0870E+00 1.8100E+04-2.0771E+001019 3  2  500
1.8102E+04-2.0673E+00 1.8104E+04-2.0577E+00 1.8106E+04-2.0483E+001019 3  2  501
1.8108E+04-2.0391E+00 1.8110E+04-2.0300E+00 1.8112E+04-2.0212E+001019 3  2  502
1.8114E+04-2.0124E+00 1.8116E+04-2.0039E+00 1.8118E+04-1.9955E+001019 3  2  503
1.8120E+04-1.9873E+00 1.8122E+04-1.9792E+00 1.8124E+04-1.9712E+001019 3  2  504
1.8126E+04-1.9634E+00 1.8128E+04-1.9557E+00 1.8130E+04-1.9482E+001019 3  2  505
1.8132E+04-1.9408E+00 1.8134E+04-1.9335E+00 1.8136E+04-1.9263E+001019 3  2  506
1.8138E+04-1.9193E+00 1.8140E+04-1.9124E+00 1.8142E+04-1.9056E+001019 3  2  507
1.8144E+04-1.8989E+00 1.8146E+04-1.8923E+00 1.8148E+04-1.8858E+001019 3  2  508
1.8150E+04-1.8794E+00 1.8152E+04-1.8731E+00 1.8154E+04-1.8670E+001019 3  2  509
1.8156E+04-1.8609E+00 1.8158E+04-1.8549E+00 1.8160E+04-1.8490E+001019 3  2  510
1.8162E+04-1.8432E+00 1.8164E+04-1.8375E+00 1.8166E+04-1.8318E+001019 3  2  511
1.8168E+04-1.8263E+00 1.8170E+04-1.8208E+00 1.8172E+04-1.8154E+001019 3  2  512
1.8174E+04-1.8101E+00 1.8176E+04-1.8049E+00 1.8178E+04-1.7997E+001019 3  2  513
1.8180E+04-1.7946E+00 1.8182E+04-1.7896E+00 1.8184E+04-1.7847E+001019 3  2  514
1.8186E+04-1.7798E+00 1.8188E+04-1.7750E+00 1.8190E+04-1.7702E+001019 3  2  515
1.8192E+04-1.7655E+00 1.8194E+04-1.7609E+00 1.8196E+04-1.7564E+001019 3  2  516
1.8198E+04-1.7519E+00 1.8200E+04-1.7474E+00 1.8300E+04-1.5811E+001019 3  2  517
1.8400E+04-1.4789E+00 1.8500E+04-1.4084E+00 1.8600E+04-1.3557E+001019 3  2  518
1.8700E+04-1.3138E+00 1.8800E+04-1.2788E+00 1.8900E+04-1.2482E+001019 3  2  519
1.9000E+04-1.2203E+00 1.9100E+04-1.1940E+00 1.9200E+04-1.1684E+001019 3  2  520
1.9300E+04-1.1425E+00 1.9400E+04-1.1156E+00 1.9500E+04-1.0869E+001019 3  2  521
1.9600E+04-1.0555E+00 1.9700E+04-1.0201E+00 1.9800E+04-9.7950E-011019 3  2  522
1.9900E+04-9.3178E-01 2.0000E+04-8.7462E-01 2.0100E+04-8.0488E-011019 3  2  523
2.0200E+04-7.1845E-01 2.0300E+04-6.1018E-01 2.0400E+04-4.7439E-011019 3  2  524
2.0500E+04-3.0703E-01 2.0600E+04-1.1182E-01 2.0700E+04 8.7669E-021019 3  2  525
2.0800E+04 2.3604E-01 2.0900E+04 2.6186E-01 2.1000E+04 1.3807E-011019 3  2  526
2.1100E+04-8.2522E-02 2.1200E+04-3.1869E-01 2.1300E+04-5.2028E-011019 3  2  527
2.1400E+04-6.7391E-01 2.1500E+04-7.8437E-01 2.1600E+04-8.6106E-011019 3  2  528
2.1700E+04-9.1253E-01 2.1800E+04-9.4522E-01 2.1900E+04-9.6360E-011019 3  2  529
2.2000E+04-9.7062E-01 2.2100E+04-9.6811E-01 2.2200E+04-9.5706E-011019 3  2  530
2.2300E+04-9.3779E-01 2.2400E+04-9.1001E-01 2.2500E+04-8.7286E-011019 3  2  531
2.2600E+04-8.2481E-01 2.2700E+04-7.6346E-01 2.2800E+04-6.8526E-011019 3  2  532
2.2900E+04-5.8503E-01 2.3000E+04-4.5523E-01 2.3100E+04-2.8510E-011019 3  2  533
2.3200E+04-6.0645E-02 2.3225E+04 5.5890E-03 2.3250E+04 7.6098E-021019 3  2  534
2.3275E+04 1.5077E-01 2.3300E+04 2.2923E-01 2.3325E+04 3.1068E-011019 3  2  535
2.3350E+04 3.9371E-01 2.3375E+04 4.7594E-01 2.3400E+04 5.5359E-011019 3  2  536
2.3425E+04 6.2085E-01 2.3450E+04 6.6919E-01 2.3475E+04 6.8649E-011019 3  2  537
2.3500E+04 6.5662E-01 2.3525E+04 5.5987E-01 2.3550E+04 3.7546E-011019 3  2  538
2.3575E+04 8.7121E-02 2.3600E+04-3.0855E-01 2.3625E+04-7.9415E-011019 3  2  539
2.3650E+04-1.3301E+00 2.3675E+04-1.8638E+00 2.3700E+04-2.3459E+001019 3  2  540
2.3725E+04-2.7440E+00 2.3750E+04-3.0468E+00 2.3775E+04-3.2593E+001019 3  2  541
2.3800E+04-3.3960E+00 2.3825E+04-3.4735E+00 2.3850E+04-3.5076E+001019 3  2  542
2.3875E+04-3.5110E+00 2.3900E+04-3.4937E+00 2.3925E+04-3.4629E+001019 3  2  543
2.3950E+04-3.4238E+00 2.3975E+04-3.3800E+00 2.4000E+04-3.3339E+001019 3  2  544
2.4100E+04-3.1533E+00 2.4200E+04-3.0015E+00 2.4300E+04-2.8825E+001019 3  2  545
2.4400E+04-2.7915E+00 2.4500E+04-2.7228E+00 2.4600E+04-2.6720E+001019 3  2  546
2.4700E+04-2.6358E+00 2.4800E+04-2.6118E+00 2.4900E+04-2.5984E+001019 3  2  547
2.5000E+04-2.5944E+00 2.5100E+04-2.5993E+00 2.5200E+04-2.6127E+001019 3  2  548
```

```
2.5300E+04-2.6347E+00 2.5400E+04-2.6660E+00 2.5500E+04-2.7073E+001019 3  2  549
2.5600E+04-2.7601E+00 2.5700E+04-2.8267E+00 2.5800E+04-2.9104E+001019 3  2  550
2.5900E+04-3.0167E+00 2.6000E+04-3.1543E+00 2.6100E+04-3.3387E+001019 3  2  551
2.6200E+04-3.5928E+00 2.6225E+04-3.6659E+00 2.6250E+04-3.7346E+001019 3  2  552
2.6275E+04-3.7801E+00 2.6300E+04-3.7530E+00 2.6325E+04-3.5367E+001019 3  2  553
2.6350E+04-2.9671E+00 2.6375E+04-2.1989E+00 2.6400E+04-1.8469E+001019 3  2  554
2.6425E+04-1.9712E+00 2.6450E+04-2.2441E+00 2.6475E+04-2.5071E+001019 3  2  555
2.6500E+04-2.7281E+00 2.6525E+04-2.9097E+00 2.6550E+04-3.0591E+001019 3  2  556
2.6575E+04-3.1817E+00 2.6600E+04-3.2800E+00 2.6625E+04-3.3532E+001019 3  2  557
2.6650E+04-3.3980E+00 2.6675E+04-3.4076E+00 2.6700E+04-3.3718E+001019 3  2  558
2.6725E+04-3.2765E+00 2.6750E+04-3.1034E+00 2.6775E+04-2.8319E+001019 3  2  559
2.6800E+04-2.4413E+00 2.6825E+04-1.9182E+00 2.6850E+04-1.2660E+001019 3  2  560
2.6875E+04-5.1439E-01 2.6900E+04 2.7724E-01 2.6925E+04 1.0305E+001019 3  2  561
2.6950E+04 1.6707E+00 2.6975E+04 2.1497E+00 2.7000E+04 2.4552E+001019 3  2  562
2.7025E+04 2.6043E+00 2.7050E+04 2.6294E+00 2.7075E+04 2.5659E+001019 3  2  563
2.7100E+04 2.4447E+00 2.7125E+04 2.2896E+00 2.7150E+04 2.1176E+001019 3  2  564
2.7175E+04 1.9399E+00 2.7200E+04 1.7638E+00 2.7225E+04 1.5935E+001019 3  2  565
2.7250E+04 1.4315E+00 2.7275E+04 1.2788E+00 2.7300E+04 1.1358E+001019 3  2  566
2.7325E+04 1.0024E+00 2.7350E+04 8.7826E-01 2.7375E+04 7.6279E-011019 3  2  567
2.7400E+04 6.5542E-01 2.7425E+04 5.5552E-01 2.7450E+04 4.6249E-011019 3  2  568
2.7475E+04 3.7578E-01 2.7500E+04 2.9483E-01 2.7525E+04 2.1917E-011019 3  2  569
2.7550E+04 1.4833E-01 2.7575E+04 8.1915E-02 2.7600E+04 1.9541E-021019 3  2  570
2.7700E+04-1.9580E-01 2.7800E+04-3.6833E-01 2.7900E+04-5.0963E-011019 3  2  571
2.8000E+04-6.2761E-01 2.8100E+04-7.2781E-01 2.8200E+04-8.1422E-011019 3  2  572
2.8300E+04-8.8974E-01 2.8400E+04-9.5654E-01 2.8500E+04-1.0162E+001019 3  2  573
2.8600E+04-1.0701E+00 2.8700E+04-1.1192E+00 2.8800E+04-1.1641E+001019 3  2  574
2.8900E+04-1.2056E+00 2.9000E+04-1.2440E+00 2.9100E+04-1.2798E+001019 3  2  575
2.9200E+04-1.3132E+00 2.9300E+04-1.3443E+00 2.9400E+04-1.3731E+001019 3  2  576
2.9500E+04-1.3996E+00 2.9600E+04-1.4234E+00 2.9700E+04-1.4440E+001019 3  2  577
2.9800E+04-1.4601E+00 2.9900E+04-1.4696E+00 3.0000E+04-1.4677E+001019 3  2  578
3.0100E+04-1.4433E+00 3.0200E+04-1.3629E+00 3.0202E+04-1.3601E+001019 3  2  579
3.0204E+04-1.3573E+00 3.0206E+04-1.3544E+00 3.0208E+04-1.3514E+001019 3  2  580
3.0210E+04-1.3484E+00 3.0212E+04-1.3452E+00 3.0214E+04-1.3420E+001019 3  2  581
3.0216E+04-1.3387E+00 3.0218E+04-1.3353E+00 3.0220E+04-1.3318E+001019 3  2  582
3.0222E+04-1.3283E+00 3.0224E+04-1.3246E+00 3.0226E+04-1.3209E+001019 3  2  583
3.0228E+04-1.3170E+00 3.0230E+04-1.3130E+00 3.0232E+04-1.3089E+001019 3  2  584
3.0234E+04-1.3047E+00 3.0236E+04-1.3004E+00 3.0238E+04-1.2960E+001019 3  2  585
3.0240E+04-1.2914E+00 3.0242E+04-1.2867E+00 3.0244E+04-1.2819E+001019 3  2  586
3.0246E+04-1.2769E+00 3.0248E+04-1.2718E+00 3.0250E+04-1.2665E+001019 3  2  587
3.0252E+04-1.2611E+00 3.0254E+04-1.2555E+00 3.0256E+04-1.2497E+001019 3  2  588
3.0258E+04-1.2438E+00 3.0260E+04-1.2376E+00 3.0262E+04-1.2313E+001019 3  2  589
3.0264E+04-1.2248E+00 3.0266E+04-1.2180E+00 3.0268E+04-1.2110E+001019 3  2  590
3.0270E+04-1.2038E+00 3.0272E+04-1.1964E+00 3.0274E+04-1.1887E+001019 3  2  591
3.0276E+04-1.1807E+00 3.0278E+04-1.1724E+00 3.0280E+04-1.1639E+001019 3  2  592
3.0282E+04-1.1550E+00 3.0284E+04-1.1458E+00 3.0286E+04-1.1363E+001019 3  2  593
3.0288E+04-1.1264E+00 3.0290E+04-1.1162E+00 3.0292E+04-1.1055E+001019 3  2  594
3.0294E+04-1.0944E+00 3.0296E+04-1.0829E+00 3.0298E+04-1.0709E+001019 3  2  595
3.0300E+04-1.0584E+00 3.0302E+04-1.0454E+00 3.0304E+04-1.0318E+001019 3  2  596
3.0306E+04-1.0176E+00 3.0308E+04-1.0028E+00 3.0310E+04-9.8730E-011019 3  2  597
3.0312E+04-9.7109E-01 3.0314E+04-9.5413E-01 3.0316E+04-9.3635E-011019 3  2  598
3.0318E+04-9.1769E-01 3.0320E+04-8.9811E-01 3.0322E+04-8.7752E-011019 3  2  599
3.0324E+04-8.5585E-01 3.0326E+04-8.3302E-01 3.0328E+04-8.0894E-011019 3  2  600
3.0330E+04-7.8352E-01 3.0332E+04-7.5664E-01 3.0334E+04-7.2818E-011019 3  2  601
3.0336E+04-6.9800E-01 3.0338E+04-6.6596E-01 3.0340E+04-6.3189E-011019 3  2  602
3.0342E+04-5.9561E-01 3.0344E+04-5.5690E-01 3.0346E+04-5.1553E-011019 3  2  603
3.0348E+04-4.7125E-01 3.0350E+04-4.2375E-01 3.0352E+04-3.7271E-011019 3  2  604
3.0354E+04-3.1776E-01 3.0356E+04-2.5847E-01 3.0358E+04-1.9438E-011019 3  2  605
3.0360E+04-1.2496E-01 3.0362E+04-4.9608E-02 3.0364E+04 3.2327E-021019 3  2  606
3.0366E+04 1.2157E-01 3.0368E+04 2.1889E-01 3.0370E+04 3.2511E-011019 3  2  607
3.0372E+04 4.4103E-01 3.0374E+04 5.6734E-01 3.0376E+04 7.0450E-011019 3  2  608
3.0378E+04 8.5243E-01 3.0380E+04 1.0101E+00 3.0382E+04 1.1746E+001019 3  2  609
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3.0384E+04 1.3400E+00 3.0386E+04 1.4956E+00 3.0388E+04 1.6224E+001019 3  2  610
3.0390E+04 1.6904E+00 3.0392E+04 1.6557E+00 3.0394E+04 1.4630E+001019 3  2  611
3.0396E+04 1.0597E+00 3.0398E+04 4.2594E-01 3.0400E+04-3.9333E-011019 3  2  612
3.0402E+04-1.2859E+00 3.0404E+04-2.1178E+00 3.0406E+04-2.7930E+001019 3  2  613
3.0408E+04-3.2790E+00 3.0410E+04-3.5923E+00 3.0412E+04-3.7706E+001019 3  2  614
3.0414E+04-3.8529E+00 3.0416E+04-3.8712E+00 3.0418E+04-3.8491E+001019 3  2  615
3.0420E+04-3.8025E+00 3.0422E+04-3.7420E+00 3.0424E+04-3.6745E+001019 3  2  616
3.0426E+04-3.6044E+00 3.0428E+04-3.5342E+00 3.0430E+04-3.4657E+001019 3  2  617
3.0432E+04-3.3998E+00 3.0434E+04-3.3369E+00 3.0436E+04-3.2772E+001019 3  2  618
3.0438E+04-3.2209E+00 3.0440E+04-3.1679E+00 3.0442E+04-3.1180E+001019 3  2  619
3.0444E+04-3.0711E+00 3.0446E+04-3.0270E+00 3.0448E+04-2.9855E+001019 3  2  620
3.0450E+04-2.9465E+00 3.0452E+04-2.9098E+00 3.0454E+04-2.8751E+001019 3  2  621
3.0456E+04-2.8425E+00 3.0458E+04-2.8116E+00 3.0460E+04-2.7825E+001019 3  2  622
3.0462E+04-2.7549E+00 3.0464E+04-2.7288E+00 3.0466E+04-2.7040E+001019 3  2  623
3.0468E+04-2.6805E+00 3.0470E+04-2.6582E+00 3.0472E+04-2.6369E+001019 3  2  624
3.0474E+04-2.6167E+00 3.0476E+04-2.5975E+00 3.0478E+04-2.5792E+001019 3  2  625
3.0480E+04-2.5617E+00 3.0482E+04-2.5449E+00 3.0484E+04-2.5290E+001019 3  2  626
3.0486E+04-2.5137E+00 3.0488E+04-2.4990E+00 3.0490E+04-2.4850E+001019 3  2  627
3.0492E+04-2.4716E+00 3.0494E+04-2.4587E+00 3.0496E+04-2.4463E+001019 3  2  628
3.0498E+04-2.4344E+00 3.0500E+04-2.4230E+00 3.0550E+04-2.2369E+001019 3  2  629
3.0600E+04-2.1487E+00 3.0650E+04-2.1016E+00 3.0700E+04-2.0755E+001019 3  2  630
3.0750E+04-2.0616E+00 3.0800E+04-2.0555E+00 3.0850E+04-2.0546E+001019 3  2  631
3.0900E+04-2.0575E+00 3.0950E+04-2.0632E+00 3.1000E+04-2.0711E+001019 3  2  632
3.1050E+04-2.0808E+00 3.1100E+04-2.0919E+00 3.1150E+04-2.1041E+001019 3  2  633
3.1200E+04-2.1175E+00 3.1250E+04-2.1317E+00 3.1300E+04-2.1468E+001019 3  2  634
3.1350E+04-2.1626E+00 3.1400E+04-2.1791E+00 3.1450E+04-2.1963E+001019 3  2  635
3.1500E+04-2.2141E+00 3.1550E+04-2.2326E+00 3.1600E+04-2.2516E+001019 3  2  636
3.1650E+04-2.2713E+00 3.1700E+04-2.2915E+00 3.1750E+04-2.3123E+001019 3  2  637
3.1800E+04-2.3337E+00 3.1850E+04-2.3557E+00 3.1900E+04-2.3782E+001019 3  2  638
3.1950E+04-2.4014E+00 3.2000E+04-2.4252E+00 3.2050E+04-2.4496E+001019 3  2  639
3.2100E+04-2.4747E+00 3.2150E+04-2.5004E+00 3.2200E+04-2.5268E+001019 3  2  640
3.2250E+04-2.5539E+00 3.2300E+04-2.5818E+00 3.2350E+04-2.6103E+001019 3  2  641
3.2400E+04-2.6397E+00 3.2450E+04-2.6698E+00 3.2500E+04-2.7007E+001019 3  2  642
3.2550E+04-2.7324E+00 3.2600E+04-2.7650E+00 3.2650E+04-2.7985E+001019 3  2  643
3.2700E+04-2.8329E+00 3.2750E+04-2.8683E+00 3.2800E+04-2.9046E+001019 3  2  644
3.2850E+04-2.9418E+00 3.2900E+04-2.9801E+00 3.2950E+04-3.0195E+001019 3  2  645
3.3000E+04-3.0599E+00 3.3050E+04-3.1013E+00 3.3100E+04-3.1439E+001019 3  2  646
3.3150E+04-3.1875E+00 3.3200E+04-3.2323E+00 3.3250E+04-3.2781E+001019 3  2  647
3.3300E+04-3.3249E+00 3.3350E+04-3.3728E+00 3.3400E+04-3.4217E+001019 3  2  648
3.3450E+04-3.4715E+00 3.3500E+04-3.5220E+00 3.3550E+04-3.5732E+001019 3  2  649
3.3600E+04-3.6249E+00 3.3650E+04-3.6767E+00 3.3700E+04-3.7285E+001019 3  2  650
3.3750E+04-3.7798E+00 3.3800E+04-3.8300E+00 3.3850E+04-3.8787E+001019 3  2  651
3.3900E+04-3.9250E+00 3.3950E+04-3.9680E+00 3.4000E+04-4.0066E+001019 3  2  652
3.4050E+04-4.0395E+00 3.4100E+04-4.0650E+00 3.4150E+04-4.0813E+001019 3  2  653
3.4200E+04-4.0865E+00 3.4250E+04-4.0784E+00 3.4300E+04-4.0547E+001019 3  2  654
3.4350E+04-4.0136E+00 3.4400E+04-3.9533E+00 3.4450E+04-3.8726E+001019 3  2  655
3.4500E+04-3.7712E+00 3.4550E+04-3.6495E+00 3.4600E+04-3.5086E+001019 3  2  656
3.4650E+04-3.3495E+00 3.4700E+04-3.1733E+00 3.4750E+04-2.9798E+001019 3  2  657
3.4800E+04-2.7677E+00 3.4850E+04-2.5342E+00 3.4900E+04-2.2755E+001019 3  2  658
3.4950E+04-1.9877E+00 3.5000E+04-1.6675E+00 3.5050E+04-1.3131E+001019 3  2  659
3.5100E+04-9.2563E-01 3.5150E+04-5.0903E-01 3.5200E+04-7.0865E-021019 3  2  660
3.5250E+04 3.7830E-01 3.5300E+04 8.2572E-01 3.5350E+04 1.2578E+001019 3  2  661
3.5400E+04 1.6614E+00 3.5450E+04 2.0255E+00 3.5500E+04 2.3419E+001019 3  2  662
3.5550E+04 2.6054E+00 3.5600E+04 2.8144E+00 3.5650E+04 2.9698E+001019 3  2  663
3.5700E+04 3.0746E+00 3.5750E+04 3.1331E+00 3.5800E+04 3.1501E+001019 3  2  664
3.5850E+04 3.1302E+00 3.5900E+04 3.0778E+00 3.5950E+04 2.9961E+001019 3  2  665
3.6000E+04 2.8871E+00 3.6050E+04 2.7509E+00 3.6100E+04 2.5851E+001019 3  2  666
3.6150E+04 2.3826E+00 3.6200E+04 2.1289E+00 3.6202E+04 2.1173E+001019 3  2  667
3.6204E+04 2.1056E+00 3.6206E+04 2.0938E+00 3.6208E+04 2.0818E+001019 3  2  668
3.6210E+04 2.0697E+00 3.6212E+04 2.0574E+00 3.6214E+04 2.0450E+001019 3  2  669
3.6216E+04 2.0325E+00 3.6218E+04 2.0198E+00 3.6220E+04 2.0069E+001019 3  2  670
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3.6222E+04 1.9939E+00 3.6224E+04 1.9807E+00 3.6226E+04 1.9674E+001019 3  2  671
3.6228E+04 1.9538E+00 3.6230E+04 1.9402E+00 3.6232E+04 1.9263E+001019 3  2  672
3.6234E+04 1.9122E+00 3.6236E+04 1.8980E+00 3.6238E+04 1.8835E+001019 3  2  673
3.6240E+04 1.8689E+00 3.6242E+04 1.8540E+00 3.6244E+04 1.8389E+001019 3  2  674
3.6246E+04 1.8237E+00 3.6248E+04 1.8082E+00 3.6250E+04 1.7924E+001019 3  2  675
3.6252E+04 1.7765E+00 3.6254E+04 1.7603E+00 3.6256E+04 1.7438E+001019 3  2  676
3.6258E+04 1.7271E+00 3.6260E+04 1.7101E+00 3.6262E+04 1.6929E+001019 3  2  677
3.6264E+04 1.6753E+00 3.6266E+04 1.6575E+00 3.6268E+04 1.6394E+001019 3  2  678
3.6270E+04 1.6210E+00 3.6272E+04 1.6022E+00 3.6274E+04 1.5832E+001019 3  2  679
3.6276E+04 1.5638E+00 3.6278E+04 1.5440E+00 3.6280E+04 1.5239E+001019 3  2  680
3.6282E+04 1.5035E+00 3.6284E+04 1.4826E+00 3.6286E+04 1.4614E+001019 3  2  681
3.6288E+04 1.4397E+00 3.6290E+04 1.4176E+00 3.6292E+04 1.3951E+001019 3  2  682
3.6294E+04 1.3721E+00 3.6296E+04 1.3487E+00 3.6298E+04 1.3247E+001019 3  2  683
3.6300E+04 1.3003E+00 3.6302E+04 1.2754E+00 3.6304E+04 1.2499E+001019 3  2  684
3.6306E+04 1.2238E+00 3.6308E+04 1.1971E+00 3.6310E+04 1.1699E+001019 3  2  685
3.6312E+04 1.1420E+00 3.6314E+04 1.1134E+00 3.6316E+04 1.0842E+001019 3  2  686
3.6318E+04 1.0543E+00 3.6320E+04 1.0236E+00 3.6322E+04 9.9211E-011019 3  2  687
3.6324E+04 9.5984E-01 3.6326E+04 9.2673E-01 3.6328E+04 8.9274E-011019 3  2  688
3.6330E+04 8.5784E-01 3.6332E+04 8.2198E-01 3.6334E+04 7.8511E-011019 3  2  689
3.6336E+04 7.4720E-01 3.6338E+04 7.0819E-01 3.6340E+04 6.6803E-011019 3  2  690
3.6342E+04 6.2666E-01 3.6344E+04 5.8403E-01 3.6346E+04 5.4008E-011019 3  2  691
3.6348E+04 4.9473E-01 3.6350E+04 4.4792E-01 3.6352E+04 3.9956E-011019 3  2  692
3.6354E+04 3.4959E-01 3.6356E+04 2.9792E-01 3.6358E+04 2.4445E-011019 3  2  693
3.6360E+04 1.8908E-01 3.6362E+04 1.3171E-01 3.6364E+04 7.2238E-021019 3  2  694
3.6366E+04 1.0534E-02 3.6368E+04-5.3527E-02 3.6370E+04-1.2008E-011019 3  2  695
3.6372E+04-1.8927E-01 3.6374E+04-2.6125E-01 3.6376E+04-3.3619E-011019 3  2  696
3.6378E+04-4.1427E-01 3.6380E+04-4.9567E-01 3.6382E+04-5.8059E-011019 3  2  697
3.6384E+04-6.6925E-01 3.6386E+04-7.6187E-01 3.6388E+04-8.5868E-011019 3  2  698
3.6390E+04-9.5993E-01 3.6392E+04-1.0659E+00 3.6394E+04-1.1768E+001019 3  2  699
3.6396E+04-1.2929E+00 3.6398E+04-1.4145E+00 3.6400E+04-1.5418E+001019 3  2  700
3.6402E+04-1.6750E+00 3.6404E+04-1.8143E+00 3.6406E+04-1.9597E+001019 3  2  701
3.6408E+04-2.1113E+00 3.6410E+04-2.2689E+00 3.6412E+04-2.4318E+001019 3  2  702
3.6414E+04-2.5995E+00 3.6416E+04-2.7704E+00 3.6418E+04-2.9426E+001019 3  2  703
3.6420E+04-3.1128E+00 3.6422E+04-3.2765E+00 3.6424E+04-3.4269E+001019 3  2  704
3.6426E+04-3.5542E+00 3.6428E+04-3.6446E+00 3.6430E+04-3.6787E+001019 3  2  705
3.6432E+04-3.6295E+00 3.6434E+04-3.4603E+00 3.6436E+04-3.1231E+001019 3  2  706
3.6438E+04-2.5586E+00 3.6440E+04-1.6996E+00 3.6442E+04-4.8339E-011019 3  2  707
3.6444E+04 1.1267E+00 3.6446E+04 3.1090E+00 3.6448E+04 5.3552E+001019 3  2  708
3.6450E+04 7.6699E+00 3.6452E+04 9.8151E+00 3.6454E+04 1.1586E+011019 3  2  709
3.6456E+04 1.2870E+01 3.6458E+04 1.3661E+01 3.6460E+04 1.4028E+011019 3  2  710
3.6462E+04 1.4069E+01 3.6464E+04 1.3884E+01 3.6466E+04 1.3554E+011019 3  2  711
3.6468E+04 1.3142E+01 3.6470E+04 1.2689E+01 3.6472E+04 1.2224E+011019 3  2  712
3.6474E+04 1.1765E+01 3.6476E+04 1.1321E+01 3.6478E+04 1.0899E+011019 3  2  713
3.6480E+04 1.0501E+01 3.6482E+04 1.0128E+01 3.6484E+04 9.7799E+001019 3  2  714
3.6486E+04 9.4556E+00 3.6488E+04 9.1537E+00 3.6490E+04 8.8728E+001019 3  2  715
3.6492E+04 8.6111E+00 3.6494E+04 8.3672E+00 3.6496E+04 8.1397E+001019 3  2  716
3.6498E+04 7.9271E+00 3.6500E+04 7.7282E+00 3.6502E+04 7.5419E+001019 3  2  717
3.6504E+04 7.3671E+00 3.6506E+04 7.2029E+00 3.6508E+04 7.0483E+001019 3  2  718
3.6510E+04 6.9027E+00 3.6512E+04 6.7652E+00 3.6514E+04 6.6353E+001019 3  2  719
3.6516E+04 6.5124E+00 3.6518E+04 6.3959E+00 3.6520E+04 6.2854E+001019 3  2  720
3.6522E+04 6.1804E+00 3.6524E+04 6.0805E+00 3.6526E+04 5.9853E+001019 3  2  721
3.6528E+04 5.8946E+00 3.6530E+04 5.8081E+00 3.6532E+04 5.7253E+001019 3  2  722
3.6534E+04 5.6462E+00 3.6536E+04 5.5704E+00 3.6538E+04 5.4978E+001019 3  2  723
3.6540E+04 5.4282E+00 3.6542E+04 5.3613E+00 3.6544E+04 5.2970E+001019 3  2  724
3.6546E+04 5.2352E+00 3.6548E+04 5.1757E+00 3.6550E+04 5.1184E+001019 3  2  725
3.6552E+04 5.0632E+00 3.6554E+04 5.0098E+00 3.6556E+04 4.9584E+001019 3  2  726
3.6558E+04 4.9086E+00 3.6560E+04 4.8606E+00 3.6562E+04 4.8141E+001019 3  2  727
3.6564E+04 4.7690E+00 3.6566E+04 4.7254E+00 3.6568E+04 4.6832E+001019 3  2  728
3.6570E+04 4.6422E+00 3.6572E+04 4.6024E+00 3.6574E+04 4.5638E+001019 3  2  729
3.6576E+04 4.5263E+00 3.6578E+04 4.4898E+00 3.6580E+04 4.4543E+001019 3  2  730
3.6582E+04 4.4199E+00 3.6584E+04 4.3863E+00 3.6586E+04 4.3536E+001019 3  2  731
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```
3.6588E+04 4.3218E+00 3.6590E+04 4.2907E+00 3.6592E+04 4.2605E+001019 3  2  732
3.6594E+04 4.2310E+00 3.6596E+04 4.2022E+00 3.6598E+04 4.1740E+001019 3  2  733
3.6600E+04 4.1466E+00 3.6800E+04 2.8012E+00 3.7000E+04 2.2280E+001019 3  2  734
3.7200E+04 1.8344E+00 3.7400E+04 1.5229E+00 3.7600E+04 1.2602E+001019 3  2  735
3.7800E+04 1.0301E+00 3.8000E+04 8.2267E-01 3.8200E+04 6.3072E-011019 3  2  736
3.8400E+04 4.4862E-01 3.8600E+04 2.7136E-01 3.8800E+04 9.3970E-021019 3  2  737
3.9000E+04-8.9014E-02 3.9200E+04-2.8421E-01 3.9400E+04-5.0041E-011019 3  2  738
3.9600E+04-7.5037E-01 3.9800E+04-1.0540E+00 4.0000E+04-1.4452E+001019 3  2  739
4.0200E+04-1.9866E+00 4.0240E+04-2.1224E+00 4.0280E+04-2.2703E+001019 3  2  740
4.0320E+04-2.4321E+00 4.0360E+04-2.6100E+00 4.0400E+04-2.8063E+001019 3  2  741
4.0440E+04-3.0239E+00 4.0480E+04-3.2659E+00 4.0520E+04-3.5361E+001019 3  2  742
4.0560E+04-3.8382E+00 4.0600E+04-4.1756E+00 4.0640E+04-4.5500E+001019 3  2  743
4.0680E+04-4.9589E+00 4.0720E+04-5.3885E+00 4.0760E+04-5.8004E+001019 3  2  744
4.0800E+04-6.1019E+00 4.0840E+04-6.0900E+00 4.0880E+04-5.3745E+001019 3  2  745
4.0920E+04-3.3992E+00 4.0960E+04 8.3726E-02 4.1000E+04 4.1558E+001019 3  2  746
4.1040E+04 7.1812E+00 4.1080E+04 8.5325E+00 4.1120E+04 8.6885E+001019 3  2  747
4.1160E+04 8.2724E+00 4.1200E+04 7.6608E+00 4.1240E+04 7.0264E+001019 3  2  748
4.1280E+04 6.4357E+00 4.1320E+04 5.9084E+00 4.1360E+04 5.4453E+001019 3  2  749
4.1400E+04 5.0405E+00 4.1440E+04 4.6864E+00 4.1480E+04 4.3755E+001019 3  2  750
4.1520E+04 4.1014E+00 4.1560E+04 3.8583E+00 4.1600E+04 3.6416E+001019 3  2  751
4.1640E+04 3.4475E+00 4.1680E+04 3.2726E+00 4.1720E+04 3.1144E+001019 3  2  752
4.1760E+04 2.9706E+00 4.1800E+04 2.8393E+00 4.1840E+04 2.7190E+001019 3  2  753
4.1880E+04 2.6083E+00 4.1920E+04 2.5062E+00 4.1960E+04 2.4116E+001019 3  2  754
4.2000E+04 2.3238E+00 4.2040E+04 2.2420E+00 4.2080E+04 2.1656E+001019 3  2  755
4.2120E+04 2.0940E+00 4.2160E+04 2.0269E+00 4.2200E+04 1.9638E+001019 3  2  756
4.2600E+04 1.4899E+00 4.3000E+04 1.1870E+00 4.3400E+04 9.7303E-011019 3  2  757
4.3800E+04 8.1143E-01 4.4200E+04 6.8357E-01 4.4600E+04 5.7886E-011019 3  2  758
4.5000E+04 4.9080E-01 4.5400E+04 4.1520E-01 4.5800E+04 3.4919E-011019 3  2  759
4.6200E+04 2.9075E-01 4.6600E+04 2.3841E-01 4.7000E+04 1.9108E-011019 3  2  760
4.7400E+04 1.4793E-01 4.7800E+04 1.0834E-01 4.8200E+04 7.1818E-021019 3  2  761
4.8600E+04 3.8013E-02 4.9000E+04 6.6779E-03 4.9400E+04-2.2324E-021019 3  2  762
4.9800E+04-4.9008E-02 5.0000E+04-6.1441E-02 5.0500E+04-8.9534E-021019 3  2  763
5.1000E+04-1.1221E-01 5.1500E+04-1.2634E-01 5.2000E+04-1.2353E-011019 3  2  764
5.2500E+04-7.3535E-02 5.3000E+04 2.6613E-01 5.3100E+04 5.6674E-011019 3  2  765
5.3200E+04 1.4107E+00 5.3300E+04-1.3541E+00 5.3400E+04-1.4680E+001019 3  2  766
5.3500E+04-1.0242E+00 5.3600E+04-8.2811E-01 5.3700E+04-7.2196E-011019 3  2  767
5.3800E+04-6.5671E-01 5.3900E+04-6.1321E-01 5.4000E+04-5.8254E-011019 3  2  768
5.5500E+04-4.4568E-01 5.7000E+04-7.3557E-02 5.7100E+04 3.8229E-021019 3  2  769
5.7200E+04 3.4504E-01 5.7300E+04 1.2099E+00 5.7400E+04 2.7521E+001019 3  2  770
5.7500E+04 3.8951E+00 5.7600E+04 4.2757E+00 5.7700E+04 4.3300E+001019 3  2  771
5.7800E+04 4.1826E+00 5.7900E+04 3.7413E+00 5.8000E+04 2.9125E+001019 3  2  772
5.8100E+04 1.7410E+00 5.8200E+04 4.2510E-01 5.8300E+04-8.0913E-011019 3  2  773
5.8400E+04-1.8285E+00 5.8500E+04-2.6064E+00 5.8600E+04-3.1720E+001019 3  2  774
5.8700E+04-3.5639E+00 5.8800E+04-3.8041E+00 5.8900E+04-3.8854E+001019 3  2  775
5.9000E+04-3.7600E+00 5.9100E+04-3.3254E+00 5.9200E+04-2.4179E+001019 3  2  776
5.9300E+04-8.6092E-01 5.9400E+04 1.3467E+00 5.9500E+04 3.7578E+001019 3  2  777
5.9600E+04 5.5965E+00 5.9700E+04 6.4196E+00 5.9800E+04 6.3903E+001019 3  2  778
5.9900E+04 5.9009E+00 6.0000E+04 5.2506E+00 6.0100E+04 4.5944E+001019 3  2  779
6.0200E+04 3.9945E+00 6.0300E+04 3.4676E+00 6.0400E+04 3.0121E+001019 3  2  780
6.0500E+04 2.6195E+00 6.0600E+04 2.2803E+00 6.0700E+04 1.9855E+001019 3  2  781
6.0800E+04 1.7274E+00 6.0900E+04 1.4997E+00 6.1000E+04 1.2970E+001019 3  2  782
6.2000E+04-1.7426E-02 6.3000E+04-1.0702E+00 6.3100E+04-1.1997E+001019 3  2  783
6.3200E+04-1.3364E+00 6.3300E+04-1.4794E+00 6.3400E+04-1.6250E+001019 3  2  784
6.3500E+04-1.7646E+00 6.3600E+04-1.8789E+00 6.3700E+04-1.9293E+001019 3  2  785
6.3800E+04-1.8443E+00 6.3900E+04-1.5132E+00 6.4000E+04-8.2757E-011019 3  2  786
6.4100E+04 1.8070E-01 6.4200E+04 1.2257E+00 6.4300E+04 1.9635E+001019 3  2  787
6.4400E+04 2.2906E+00 6.4500E+04 2.3158E+00 6.4600E+04 2.1804E+001019 3  2  788
6.4700E+04 1.9784E+00 6.4800E+04 1.7582E+00 6.4900E+04 1.5411E+001019 3  2  789
6.5000E+04 1.3348E+00 6.5100E+04 1.1404E+00 6.5200E+04 9.5630E-011019 3  2  790
6.5300E+04 7.7961E-01 6.5400E+04 6.0655E-01 6.5500E+04 4.3263E-011019 3  2  791
6.5600E+04 2.5232E-01 6.5700E+04 5.8252E-02 6.5800E+04-1.6018E-011019 3  2  792
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6.5900E+04-4.1974E-01 6.6000E+04-7.4949E-01 6.6100E+04-1.2055E+001019 3  2  793
6.6200E+04-1.9097E+00 6.6300E+04-3.1434E+00 6.6400E+04-4.4562E+001019 3  2  794
6.6500E+04 7.0584E+00 6.6600E+04 5.0732E+00 6.6700E+04 3.3404E+001019 3  2  795
6.6800E+04 2.4663E+00 6.6900E+04 1.9459E+00 6.7000E+04 1.5957E+001019 3  2  796
6.8000E+04 2.2742E-01 6.9000E+04-8.7937E-01 6.9050E+04-9.7382E-011019 3  2  797
6.9100E+04-1.0779E+00 6.9150E+04-1.1936E+00 6.9200E+04-1.3229E+001019 3  2  798
6.9250E+04-1.4670E+00 6.9300E+04-1.6228E+00 6.9350E+04-1.7666E+001019 3  2  799
6.9400E+04-1.7905E+00 6.9450E+04-1.4101E+00 6.9500E+04-9.2845E-011019 3  2  800
6.9550E+04-1.1372E+00 6.9600E+04-1.5976E+00 6.9650E+04-2.0633E+001019 3  2  801
6.9700E+04-2.5241E+00 6.9750E+04-2.9896E+00 6.9800E+04-3.4336E+001019 3  2  802
6.9850E+04-3.7292E+00 6.9900E+04-3.5090E+00 6.9950E+04-2.0616E+001019 3  2  803
7.0000E+04 8.8745E-01 7.0050E+04 3.7304E+00 7.0100E+04 4.9782E+001019 3  2  804
7.0150E+04 5.0419E+00 7.0200E+04 4.6596E+00 7.0250E+04 4.1878E+001019 3  2  805
7.0300E+04 3.7447E+00 7.0350E+04 3.3587E+00 7.0400E+04 3.0296E+001019 3  2  806
7.0450E+04 2.7496E+00 7.0500E+04 2.5101E+00 7.0550E+04 2.3034E+001019 3  2  807
7.0600E+04 2.1234E+00 7.0650E+04 1.9652E+00 7.0700E+04 1.8249E+001019 3  2  808
7.0750E+04 1.6994E+00 7.0800E+04 1.5863E+00 7.0850E+04 1.4835E+001019 3  2  809
7.0900E+04 1.3894E+00 7.0950E+04 1.3029E+00 7.1000E+04 1.2227E+001019 3  2  810
7.2000E+04 1.8355E-01 7.3000E+04-8.1748E-01 7.4000E+04 1.9542E+001019 3  2  811
7.7000E+04 1.1892E+00 8.0000E+04 7.4445E-01 8.0000E+04 8.8000E+001019 3  2  812
 .0900E+06      4.000  .0950E+06      3.700  .0975E+06      6.5001019 3  2  813
 .1000E+06      9.000  .1283E+06      7.750  .1290E+06      7.7001019 3  2  814
 .1300E+06      7.650  .1350E+06      7.430  .1400E+06      7.2001019 3  2  815
 .1450E+06      7.000  .1500E+06      6.810  .1550E+06      6.6201019 3  2  816
 .1600E+06      6.440  .1650E+06      6.250  .1700E+06      6.0801019 3  2  817
 .1750E+06      5.920  .1800E+06      5.750  .1850E+06      5.6201019 3  2  818
 .1900E+06      5.490  .1950E+06      5.380  .2000E+06      5.2751019 3  2  819
 .2500E+06      4.730  .3000E+06      4.080  .3500E+06      3.7101019 3  2  820
 .4 00E+06      3.400  .4500E+06      3.200  .5000E+06      3.0501019 3  2  821
 .5500E+06      2.930  .6000E+06      2.840  .6500E+06      2.7501019 3  2  822
 .7000E+06      2.700  .7500E+06      2.660  .8000E+06      2.6201019 3  2  823
 .8500E+06      2.590  .9000E+06      2.560  .9500E+06      2.5101019 3  2  824
1.0000E+06      2.460 1.0009E+06      2.505 1.0010E+06      2.5051019 3  2  825
1.0015E+06      2.482 1.0020E+06      2.476 1.0030E+06      2.4691019 3  2  826
1.0040E+06      2.462 1.0050E+06      2.455 1.0060E+06      2.4531019 3  2  827
1.0070E+06      2.450 1.0080E+06      2.447 1.0090E+06      2.4441019 3  2  828
1.0100E+06      2.442 1.0200E+06      2.429 1.0300E+06      2.4231019 3  2  829
1.0400E+06      2.419 1.0500E+06      2.417 1.0600E+06      2.4151019 3  2  830
1.0750E+06      2.412 1.0800E+06      2.412 1.0900E+06      2.4121019 3  2  831
1.1000E+06      2.411 1.1100E+06      2.411 1.1250E+06      2.4101019 3  2  832
1.1300E+06      2.410 1.1400E+06      2.410 1.1500E+06      2.4101019 3  2  833
1.1600E+06      2.411 1.1750E+06      2.412 1.1800E+06      2.4121019 3  2  834
1.1900E+06      2.413 1.2000E+06      2.413 1.2100E+06      2.4141019 3  2  835
1.2250E+06      2.416 1.2300E+06      2.417 1.2400E+06      2.4191019 3  2  836
1.2500E+06      2.420 1.2600E+06      2.422 1.2750E+06      2.4231019 3  2  837
1.2800E+06      2.423 1.2900E+06      2.425 1.3000E+06      2.4261019 3  2  838
1.3100E+06      2.428 1.3125E+06      2.428 1.3130E+06      2.4251019 3  2  839
1.3140E+06      2.423 1.3150E+06      2.422 1.3160E+06      2.4211019 3  2  840
1.3175E+06      2.420 1.3180E+06      2.419 1.3190E+06      2.4181019 3  2  841
1.3200E+06      2.417 1.3300E+06      2.417 1.3400E+06      2.4181019 3  2  842
1.3500E+06      2.418 1.3600E+06      2.419 1.3700E+06      2.4211019 3  2  843
1.3800E+06      2.422 1.3900E+06      2.424 1.4000E+06      2.4251019 3  2  844
1.4100E+06      2.427 1.4250E+06      2.429 1.4300E+06      2.4311019 3  2  845
1.4400E+06      2.433 1.4500E+06      2.434 1.4600E+06      2.4361019 3  2  846
1.4700E+06      2.438 1.4800E+06      2.439 1.4900E+06      2.4411019 3  2  847
1.5000E+06      2.443 1.5100E+06      2.445 1.5250E+06      2.4481019 3  2  848
1.5300E+06      2.449 1.5400E+06      2.451 1.5500E+06      2.4531019 3  2  849
1.5548E+06      2.454 1.5550E+06      2.454 1.5560E+06      2.4331019 3  2  850
1.5570E+06      2.427 1.5580E+06      2.422 1.5590E+06      2.4191019 3  2  851
1.5600E+06      2.411 1.5700E+06      2.403 1.5800E+06      2.3981019 3  2  852
1.5900E+06      2.396 1.6100E+06      2.396 1.6250E+06      2.3951019 3  2  853
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 1.6300E+06      2.395 1.6400E+06      2.396 1.6450E+06      2.3971019 3  2  854
 1.6500E+06      2.397 1.6600E+06      2.397 1.6700E+06      2.3981019 3  2  855
 1.6800E+06      2.399 1.6900E+06      2.401 1.7000E+06      2.4011019 3  2  856
 1.7100E+06      2.403 1.7250E+06      2.405 1.7300E+06      2.4061019 3  2  857
 1.7400E+06      2.407 1.7500E+06      2.408 1.7600E+06      2.4101019 3  2  858
 1.7700E+06      2.412 1.7800E+06      2.414 1.7900E+06      2.4151019 3  2  859
 1.8000E+06      2.416 1.8100E+06      2.417 1.8200E+06      2.4181019 3  2  860
 1.8300E+06      2.420 1.8400E+06      2.421 1.8500E+06      2.4231019 3  2  861
 1.8600E+06      2.424 1.8700E+06      2.426 1.8800E+06      2.4281019 3  2  862
 1.8900E+06      2.430 1.9000E+06      2.431 1.9100E+06      2.4321019 3  2  863
 1.9183E+06      2.434 1.9190E+06      2.425 1.9200E+06      2.4201019 3  2  864
 1.9210E+06      2.416 1.9220E+06      2.413 1.9230E+06      2.4121019 3  2  865
 1.9240E+06      2.410 1.9250E+06      2.408 1.9300E+06      2.4041019 3  2  866
 1.9400E+06      2.399 1.9500E+06      2.397 1.9600E+06      2.3961019 3  2  867
 1.9700E+06      2.396 1.9800E+06      2.396 1.9900E+06      2.3961019 3  2  868
 2.0000E+06      2.397 3.0000E+06      2.373 3.7500E+06      2.3481019 3  2  869
 4.0000E+06      2.323 4.5000E+06      2.389 5.0000E+06      2.4191019 3  2  870
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 7.0000E+06      2.075 7.5000E+06      1.988 8.0000E+06      1.9071019 3  2  872
 8.5000E+06      1.826 9.0000E+06      1.753 9.5000E+06      1.6801019 3  2  873
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11.5000E+06      1.42412.0000E+06      1.37212.5000E+06      1.3251019 3  2  875
13.0000E+06      1.28013.5000E+06      1.24014.0000E+06      1.2001019 3  2  876
14.5000E+06      1.16315.0000E+06      1.13015.5000E+06      1.1101019 3  2  877
16.0000E+06      1.09016.5000E+06      1.08517.0000E+06      1.0811019 3  2  878
17.5000E+06      1.08318.0000E+06      1.08118.5000E+06      1.0821019 3  2  879
19.0000E+06      1.08319.5000E+06      1.09020.0000E+06      1.0851019 3  2  880
        0.0            0.0                 0           0           0     01019 3  0  881
25055.0     54.466                         0          99           0     01019 3  4  882
        0.0            0.0                 0           0           2   2011019 3  4  883
         34              2               201           5               1019 3  4  884
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  .1750E+06        .3450  .1800E+06  .3480  .1850E+06  .35101019 3  4  889
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16.0000E+06      .434816.5000E+06      .404817.0000E+06      .38271019 3  4  949
17.5000E+06      .355718.0000E+06      .330518.5000E+06      .31311019 3  4  950
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13.0000E+06    0.0340013.5000E+06    0.0345014.0000E+06    0.034601019 3107 1073
14.5000E+06    0.0341015.0000E+06    0.0339015.5000E+06    0.033001019 3107 1074
16.0000E+06    0.0320016.5000E+06    0.0290017.0000E+06    0.026201019 3107 1075
17.5000E+06    0.0233018.0000E+06    0.0200018.5000E+06    0.016501019 3107 1076
19.0000E+06    0.0130019.5000E+06    0.0090020.0000E+06    0.004001019 3107 1077
        0.0        0.0          0          0          0          01019 3  0 1078
     25055.     54.466          0          0          0          01019 3251 1079
        0.0        0.0          0          0          1         511019 3251 1080
         51          3                                             1019 3251 1081
 1.0000E-03     .01214 1.0000E+03     .01214 1.0000E+04     .020001019 3251 1082
  .1000E+06     .03480  .1300E+06     .03690  .1500E+06     .039101019 3251 1083
  .2000E+06     .04810  .2500E+06     .05020  .3000E+06     .058601019 3251 1084
  .3500E+06     .06130  .4000E+06     .06370  .4500E+06     .064601019 3251 1085
  .5000E+06     .06470  .5500E+06     .06380  .6000E+06     .061901019 3251 1086
  .6500E+06     .06000  .7000E+06     .05680  .7500E+06     .055901019 3251 1087
  .8000E+06     .05050  .8500E+06     .05000  .9000E+06     .048201019 3251 1088
  .9500E+06     .04270 1.0000E+06     .04140 1.5000E+06     .281001019 3251 1089
 2.0000E+06     .40410 2.5000E+06     .48500 3.0000E+06     .548401019 3251 1090
 3.5000E+06     .58230 4.0000E+06     .61540 4.5000E+06     .640001019 3251 1091
 5.0000E+06     .66020 5.5000E+06     .67780 6.0000E+06     .691301019 3251 1092
 6.5000E+06     .70090 7.0000E+06     .71250 7.5000E+06     .718601019 3251 1093
 8.0000E+06     .72280 8.5000E+06     .72960 9.0000E+06     .732301019 3251 1094
 9.5000E+06     .7359010.0000E+06     .7329011.0000E+06     .730801019 3251 1095
12.0000E+06     .7363013.0000E+06     .7180014.0000E+06     .711301019 3251 1096
15.0000E+06     .7084016.0000E+06     .7072017.0000E+06     .709501019 3251 1097
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   25055.       54.466             0           0           0        01019 3252 1100
       0.0          0.0           0           0           1       511019 3252 1101
        51            3                                             1019 3252 1102
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  .1000E+06     .03520  .1300E+06     .03500  .1500E+06     .034901019 3252 1104
  .2000E+06     .03470  .2500E+06     .03440  .3000E+06     .034301019 3252 1105
  .3500E+06     .03420  .4000E+06     .03410  .4500E+06     .033991019 3252 1106
  .5000E+06     .03400  .5500E+06     .03410  .6000E+06     .034201019 3252 1107
  .6500E+06     .03423  .7000E+06     .03430  .7500E+06     .034501019 3252 1108
  .8000E+06     .03460  .8500E+06     .03465  .9000E+06     .034701019 3252 1109
  .9500E+06     .03480 1.0000E+06     .03490 1.5000E+06     .026201019 3252 1110
 2.0000E+06     .02170 2.5000E+06     .01975 3.0000E+06     .016401019 3252 1111
 3.5000E+06     .01518 4.0000E+06     .01397 4.5000E+06     .013201019 3252 1112
 5.0000E+06     .01270 5.5000E+06     .01200 6.0000E+06     .011601019 3252 1113
 6.5000E+06     .01080 7.0000E+06     .01040 7.5000E+06     .009981019 3252 1114
 8.0000E+06     .00985 8.5000E+06     .00979 9.0000E+06     .009761019 3252 1115
 9.5000E+06     .0098110.0000E+06     .0098111.0000E+06     .009951019 3252 1116
12.0000E+06     .0099913.0000E+06     .0103814.0000E+06     .010501019 3252 1117
15.0000E+06     .0105016.0000E+06     .0106017.0000E+06     .010301019 3252 1118
18.0000E+06     .0102019.0000E+06     .0100020.0000E+06     .009651019 3252 1119
       0.0          0.0           0           0           0        01019 3  0 1120
 2.5055E+04 5.4466E+01             1           1           0        01019 3253 1121
 0.           0.                   0           0           1       211019 3253 1122
        21            2                                             1019 3253 1123
 1.0000E-02 2.4332E-02 1.3000E+05 2.4056E-02 2.0000E+05 2.3959E-021019 3253 1124
 3.0000E+05 2.3919E-02 4.0000E+05 2.3993E-02 5.0000E+05 2.4168E-021019 3253 1125
 6.0000E+05 2.4444E-02 7.0000E+05 2.4795E-02 8.0000E+05 2.5200E-021019 3253 1126
 1.0000E+06 2.5981E-02 1.2000E+06 2.5165E-02 1.5000E+06 2.4667E-021019 3253 1127
 2.0000E+06 2.3378E-02 3.0000E+06 2.0665E-02 5.0000E+06 1.8704E-021019 3253 1128
 7.0000E+06 1.8907E-02 1.0000E+07 2.0122E-02 1.2000E+07 2.0410E-021019 3253 1129
 1.4000E+07 2.0373E-02 1.6000E+07 2.0085E-02 2.0000E+07 1.9000E-021019 3253 1130
 0.           0.                   0           0           0        01019 3  0 1131
       0.0          0.0           0           0           0        01019 0  0 1132
   25055.       54.466             1           1           0        01019 4  2 1133
   0.0          54.466             0           2         441         201019 4  2 1134
  1.000E+00    .1213E-01   .6625E-04 -.4155E-09         0.0         0.01019 4  2 1135
       0.0          0.0         0.0         0.0         0.0         0.01019 4  2 1136
       0.0          0.0         0.0         0.0         0.0         0.01019 4  2 1137
       0.0          0.0         0.0         0.0   .9998E+00   .2184E-011019 4  2 1138
  .2271E-03    .1147E-05  -.8192E-07 -.1359E-08         0.0         0.01019 4  2 1139
       0.0          0.0         0.0         0.0         0.0         0.01019 4  2 1140
       0.0          0.0         0.0         0.0         0.0         0.01019 4  2 1141
       0.0  -.1213E-01   .9995E+00   .3120E-01   .4730E-03   .4172E-051019 4  2 1142
-.2037E-06  -.6115E-08         0.0         0.0         0.0         0.01019 4  2 1143
       0.0          0.0         0.0         0.0         0.0         0.01019 4  2 1144
       0.0          0.0         0.0         0.0   .1987E-03  -.2183E-011019 4  2 1145
  .9990E+00    .4043E-01   .8026E-03   .9827E-05  -.2930E-06  -.9793E-081019 4  2 1146
       0.0          0.0         0.0         0.0         0.0         0.01019 4  2 1147
       0.0          0.0         0.0         0.0         0.0         0.01019 4  2 1148
       0.0  -.3445E-05   .4541E-03  -.3118E-01   .9983E+00   .4960E-011019 4  2 1149
  .1215E-02    .1887E-04  -.3295E-06  -.1640E-07         0.0         0.01019 4  2 1150
       0.0          0.0         0.0         0.0         0.0         0.01019 4  2 1151
       0.0          0.0         0.0         0.0   .6096E-07  -.9184E-051019 4  2 1152
  .7882E-03   -.4040E-01   .9975E+00   .5873E-01   .1711E-02   .3205E-041019 4  2 1153
-.3035E-06    -.2184E-07         0.0         0.0         0.0         0.01019 4  2 1154
       0.0          0.0         0.0         0.0         0.0         0.01019 4  2 1155
       0.0  -.1089E-08   .1824E-06  -.1826E-04   .1203E-02  -.4955E-011019 4  2 1156
  .9965E+00    .6783E-01   .2288E-02   .5012E-04  -.1785E-06  -.3121E-071019 4  2 1157
       0.0          0.0         0.0         0.0         0.0         0.01019 4  2 1158
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          0.0           0.0           0.0           0.0           0.0 -.3575E-081019 4  2 1159
-.4027E-06 -.3145E-04  .1700E-02 -.5867E-01  .9954E+00  .7691E-011019 4  2 1160
 .2948E-02  .7382E-04  .1698E-06 -.4149E-07           0.0          0.01019 4  2 1161
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1162
          0.0           0.0 -.8600E-08  .7634E-06 -.4952E-04  .2279E-021019 4  2 1163
-.6775E-01  .9940E+00  .8596E-01  .3691E-02  .1039E-03  .7961E-061019 4  2 1164
 .34088-07           0.0           0.0           0.0           0.0          0.01019 4  2 1165
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1166
 .1796E-09 -.1766E-07  .1312E-05 -.7322E-04  .2939E-02 -.7680E-011019 4  2 1167
 .9925E+00  .9499E-01  .4515E-02  .1411E-03  .1658E-05 -.3048E-071019 4  2 1168
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1169
          0.0           0.0           0.0           0.0           0.0  .3269E-071019 4  2 1170
 .2105E-05 -.1033E-03  .3682E-02 -.8583E-01  .9909E+00  .1040E+001019 4  2 1171
 .5420E-02  .1862E-03  .2888E-05 -.3428E-07           0.0          0.01019 4  2 1172
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1173
          0.0           0.0  .7792E-09 -.5619E-07  .3201E-05 -.1405E-031019 4  2 1174
 .4505E-02 -.9482E-01  .9891E+00  .1130E+00  .6407E-02  .2398E-031019 4  2 1175
 .4707E-05  .6714E-08           0.0           0.0           0.0          0.01019 4  2 1176
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1177
 .1423E-08 -.9120E-07  .4669E-05 -.1855E-03  .5409E-02 -.1038E+001019 4  2 1178
 .9871E+00  .1219E+00  .7474E-02  .3028E-03  .6961E-05  .4661E-071019 4  2 1179
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1180
          0.0           0.0           0.0           0.0  .2446E-08 -.1415E-061019 4  2 1181
 .6585E-05 -.2391E-03  .6395E-02 -.1127E+00  .9850E+00  .1308E+001019 4  2 1182
 .8622E-02  .3759E-03  .9862E-05  .1300E-06           0.0          0.01019 4  2 1183
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1184
          0.0           0.0  .4005E-08 -.2114E-06  .9029E-05 -.3020E-031019 4  2 1185
-.7461E-02 -.1216E+00  .9827E+00  .1397E+00  .9851E-02  .4597E-031019 4  2 1186
 .1339E-04  .2176E-06 -.1254E-06           0.0           0.0          0.01019 4  2 1187
          0.0           0.0           0.0           0.0           0.0 -.1078E-091019 4  2 1188
 .6302E-08  .3061E-06  .1209E-04 -.3749E-03  .8607E-02 -.1305E+001019 4  2 1189
 .9802E+00  .1485E+00  .1116E-01  .5551E-03  .1783E-04  .3650E-061019 4  2 1190
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1191
          0.0           0.0           0.0 -.1776E-09  .9587E-08 -.4317E-061019 4  2 1192
 .1586E-04 -.4587E-03  .9832E-02 -.1393E+00  .9776E+00  .1574E+001019 4  2 1193
 .1255E-01  .6627E-03  .2311E-04           0.0           0.0          0.01019 4  2 1194
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1195
          0.0 -.2826E-09  .1417E-07 -.5950E-06  .2044E-04 -.5538E-031019 4  2 1196
 .1114E-01 -.1481E+00  .9748E+00  .1661E+06  .1401E-01  .7832E-031019 4  2 1197
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1198
          0.0           0.0           0.0           0.0           0.0 -.4359E-091019 4  2 1199
 .2043E-07 -.8040E-06  .2594E-04 -.6612E-03  .1252E-01 -.1569E+001019 4  2 1200
 .9719E+00  .1749E+00  .1556E-01           0.0           0.0          0.01019 4  2 1201
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1202
          0.0           0.0           0.0 -.6548E-09  .2882E-07 -.1067E-051019 4  2 1203
 .3248E-04 -.7815E-03  .1398E+00 -.1656E+00  .9688E+00  .1835E+001019 4  2 1204
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1205
          0.0           0.0           0.0           0.0           0.0          0.01019 4  2 1206
          0.0 -.9608E-09  .3987E-07 -.1395E-05  .4016E-04 -.9154E-031019 4  2 1207
-.4978E-08 -.1743E+00  .9655E+00                                    1019 4  2 1208
          0.0           0.0           0             0             1          201019 4  2 1209
           20             3                                              1019 4  2 1210
          0.0  .1300E+06           0             0             4           01019 4  2 1211
 .2483E-01  .2853E-02  .8524E-04  .1707E-04                               1019 4  2 1212
          0.0  .2000E+06           0             0             4           01019 4  2 1213
 .3607E-01  .6599E-02  .1726E-03  .4720E-04                               1019 4  2 1214
          0.0  .3000E+06           0             0             4           01019 4  2 1215
 .4665E-01  .1427E-01  .6868E-03 -.3720E-04                               1019 4  2 1216
          0.0  .4000E+06           0             0             4           01019 4  2 1217
 .5193E-01  .2523E-01  .1605E-02 -.6794E-04                               1019 4  2 1218
          0.0  .5000E+06           0             0             4           01019 4  2 1219
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 .5309E-01  .3964E-01  .3084E-02 -.2668E-03                    1019 4  2 1220
       0.0  .6000E+06          0          0          4        01019 4  2 1221
 .5043E-01  .5793E-01  .5227E-02 -.7649E-03                    1019 4  2 1222
       0.0  .7000E+06          0          0          4        01019 4  2 1223
 .4563E-01  .8007E-01  .8320E-02 -.1213E-02                    1019 4  2 1224
       0.0  .8000E+06          0          0          4        01019 4  2 1225
 .3962E-01  .1056E+00  .1266E-01 -.1926E-02                    1019 4  2 1226
       0.0 1.0000E+06          0          0          4        01019 4  2 1227
 .3115E-01  .1587E+00  .2502E-01 -.1236E-02                    1019 4  2 1228
       0.0 1.2000E+06          0          0          9        01019 4  2 1229
 .2026E+00  .2528E+00  .6956E-01  .1835E-01  .4904E-03  .1522E-051019 4  2 1230
 .1544E-04 -.3978E-04 -.8907E-04                               1019 4  2 1231
       0.0 1.5000E+06          0          0          9        01019 4  2 1232
 .2724E+00  .2884E+00  .1067E+00  .2877E-01  .1300E-02 -.3509E-041019 4  2 1233
 .2359E-04 -.1281E-03 -.9675E-04                               1019 4  2 1234
       0.0 2.0000E+06          0          0          9        01019 4  2 1235
 .3963E+00  .3457E+00  .1689E+00  .5029E-01  .3710E-02  .4315E-031019 4  2 1236
 .2674E-04 -.1537E-03 -.1051E-03                               1019 4  2 1237
       0.0 3.0000E+06          0          0          9        01019 4  2 1238
 .5414E+00  .4016E+00  .2440E+00  .8804E-01  .1187E-01  .1398E-021019 4  2 1239
-.8133E-04 -.3176E-03 -.2874E-03                               1019 4  2 1240
       0.0 5.0000E+06          0          0          9        01019 4  2 1241
 .6454E+00  .4802E+00  .3118E+00  .1593E+00  .5160E-01  .1466E-011019 4  2 1242
 .3785E-02  .4426E-04 -.5553E-03                               1019 4  2 1243
       0.0 7.0000E+06          0          0          9        01019 4  2 1244
 .7078E+00  .5760E+00  .4055E+00  .2562E+00  .1270E+00  .5629E-011019 4  2 1245
 .2203E-01  .4197E-02 -.3204E-03                               1019 4  2 1246
       0.010.0000E+06          0          0          9        01019 4  2 1247
 .7291E+00  .6341E+00  .4877E+00  .3514E+00  .2151E+00  .1236E+001019 4  2 1248
 .6433E-01  .2277E-01  .5469E-02                               1019 4  2 1249
       0.012.0000E+06          0          0         19        01019 4  2 1250
 .7207E+00  .6301E+00  .5060E+00  .3852E+00  .2591E+00  .1625E+001019 4  2 1251
 .9815E-01  .4592E-01  .1456E-01 -.4262E-02 -.9811E-02 -.1062E-011019 4  2 1252
-.1106E-01 -.9577E-02 -.8434E-02 -.6174E-02 -.4120E-02 -.1736E-021019 4  2 1253
 .5223E-03                                                     1019 4  2 1254
       0.014.0000E+06          0          0         19        01019 4  2 1255
 .7080E+00  .6132E+00  .5068E+00  .4050E+00  .2952E+00  .2007E+001019 4  2 1256
 .1341E+00  .7565E-01  .2866E-01 -.1546E-02 -.1224E-01 -.1548E-011019 4  2 1257
-.1626E-01 -.1430E-01 -.1214E-01 -.8819E-02 -.5564E-02 -.2063E-021019 4  2 1258
 .1168E-02                                                     1019 4  2 1259
       0.016.0000E+06          0          0         19        01019 4  2 1260
 .7031E+00  .6004E+00  .5015E+00  .4157E+00  .3213E+00  .2345E+001019 4  2 1261
 .1657E+00  .1052E+00  .4726E-01  .5770E-02 -.1341E-01 -.2101E-011019 4  2 1262
-.2242E-01 -.2008E-01 -.1652E-01 -.1190E-01 -.7060E-02 -.2270E-021019 4  2 1263
 .2047E-02                                                     1019 4  2 1264
       0.0 20.000E+06          0          0         19        01019 4  2 1265
 .7299E+00  .6134E+00  .5039E+00  .4261E+00  .3471E+00  .2737E+001019 4  2 1266
 .2042E+00  .1435E+00  .8203E-01  .2680E-01 -.1151E-01 -.2964E-011019 4  2 1267
-.3351E-01 -.3083E-01 -.2475E-01 -.1742E-01 -.9567E-02 -.2242E-021019 4  2 1268
 .3984E-02                                                     1019 4  2 1269
       0.0        0.0          0          0          0        01019 4  0 1270
       0.0        0.0          0          0          0        01019 0  0 1271
     25055.     54.466          0          0          6        01019 5  4 1272
       0.0  0.126E+06          0          3          1       141019 5  4 1273
        14          3                                        1019 5  4 1274
0.1283E+06  1.0       1.0009E+06  1.0       1.0010E+06  0.977    1019 5  4 1275
1.0015E+06  0.915     1.0030E+06  0.861     1.0080E+06  0.805    1019 5  4 1276
1.0400E+06  0.739     1.3130E+06  0.697     1.4300E+06  0.651    1019 5  4 1277
1.5570E+06  0.602     1.6800E+06  0.530     1.8600E+06  0.480    1019 5  4 1278
1.9190E+06  0.455     2.0000E+06  0.401     0.0000E+06  0.000    1019 5  4 1279
       0.0  0.983E+06          0          3          1       181019 5  4 1280
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       18             3                                                    1019 5   4 1281
1.0009E+06  0.0         1.0010E+06  0.023       1.0015E+06  0.085          1019 5   4 1282
1.0030E+06  0.139       1.0060E+06  0.180       1.0300E+06  0.251          1019 5   4 1283
1.2000E+06  0.291       1.3000E+06  0.298       1.3160E+06  0.278          1019 5   4 1284
1.3500E+06  0.262       1.4000E+06  0.263       1.4500E+06  0.269          1019 5   4 1285
1.5000E+06  0.275       1.6000E+06  0.260       1.7000E+06  0.266          1019 5   4 1286
1.8000E+06  0.275       1.9000E+06  0.284       2.0000E+06  0.259          1019 5   4 1287
       0.0  1.289E+06            0           3           1               171019 5   4 1288
       17             3                                                    1019 5   4 1289
1.3125E+06  0.0         1.3130E+06  0.015       1.3140E+06  0.027          1019 5   4 1290
1.3300E+06  0.061       1.4000E+06  0.079       1.5000E+06  0.085          1019 5   4 1291
1.5500E+06  0.087       1.6000E+06  0.083       1.6500E+06  0.085          1019 5   4 1292
1.7000E+06  0.089       1.7500E+06  0.092       1.8000E+06  0.098          1019 5   4 1293
1.8500E+06  0.101       1.9180E+06  0.109       1.9200E+06  0.105          1019 5   4 1294
1.9500E+06  0.104       2.0000E+06  0.106       0.0000E+06  0.000          1019 5   4 1295
       0.0  1.527E+06            0           3           1               121019 5   4 1296
       12             3                                                    1019 5   4 1297
1.5548E+06  0.0         1.5550E+06  0.009       1.5560E+06  0.033          1019 5   4 1298
1.5600E+06  0.06        1.6000E+06  0.100       1.7000E+06  0.121          1019 5   4 1299
1.8000E+06  0.132       1.9000E+06  0.142       1.9100E+06  0.144          1019 5   4 1300
1.9220E+06  0.136       1.9600E+06  0.130       2.0000E+06  0.133          1019 5   4 1301
       0.0  1.884E+06            0           3           1               161019 5   4 1302
       16             3                                                    1019 5   4 1303
1.9183E+06  0.0         1.9190E+06  0.019       1.9200E+06  0.032          1019 5   4 1304
1.9210E+06  0.039       1.9220E+06  0.044       1.9230E+06  0.048          1019 5   4 1305
1.9240E+06  0.052       1.9250E+06  0.055       1.9300E+06  0.066          1019 5   4 1306
1.9400E+06  0.078       1.9500E+06  0.085       1.9600E+06  0.091          1019 5   4 1307
1.9700E+06  0.094       1.9800E+06  0.097       1.9900E+06  0.099          1019 5   4 1308
2.0000E+06  0.101       0.0000E+06  0.000       0.0000E+06  0.000          1019 5   4 1309
       0.0  1.000E+06            0           8           1                21019 5   4 1310
        2             3                                                    1019 5   4 1311
2.0000E+06  1.0         20.000E+06  1.0                      0            01019 5   4 1312
       0.0         0.0           0           0           0                01019 5   0 1313
  25055.      54.466             0           0           1                01019 5  16 1314
  0.0         0.50E+06           0           8           1                21019 5  16 1315
        2             3                                                    1019 5  16 1316
  10.42E06    1.0          20.00E06    1.0         0.0          0.0        1019 5  16 1317
  0.0         0.0                0           0           0                01019 5   0 1318
       0.0         0.0           0           0           0                01019 0   0 1319
  25055.      54.466             0           0           0                01019 7   4 1320
  0.0         0.0                0           0          12                11019 7   4 1321
  0.0         59.3         54.466      1.5         0.0          0.0        1019 7   4 1322
  1.0         1.87         54.466      0.0         0.0          0.0        1019 7   4 1323
       0.0         0.0           0           0           0                01019 7   0 1324
       0.0         0.0           0           0           0                01019 0   0 1325
       0.0         0.0           0           0           0               0    0 0   0 1326
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