PROGRAM PLOTTAB:
A Code Designed to Plot
Continuous and/or Discrete Physical Data
(Version 2013-1)
Part B: Examples

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Abstract

PLOTTAB is designed as a general purpose plotting utility code to plot continuous and/or discrete physical data for use in almost any application. It is designed to be easily used by your application codes to produce your output results in a form that can be immediately used by PLOTTAB to allow you to see your results.

It produces on screen graphics as well as Postscript formatted output files that can be viewed or printed on any Postscript printer. The code is designed to be easily used on any computer - not only today's computers, but also anything that comes along in the future. So you can be assured that once you start using PLOTTAB your graphics problems are over - not just today, but well into the future.

Part A of this report documents the basic features of PLOTTAB.

Part B is designed to aid users in using the code, by describes a variety of applications, including listings of input parameters and output plots.

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Introduction

The code PLOTTAB is designed as a simple plotting code which can be used on virtually any computer and graphics device to plot continuous and/or discrete physical data. To date this code has been successfully interfaced and used on a wide variety of computers as simple as IBM-PCs and as advanced as CRAY supercomputers.

In order to use this code on any given computer all you have to be able to do is turn your plotting device on or off and draw a line from one (X,Y) position to another. That's all you have to be able to do to interface this code to any plotting device; for details see below.

Although the graphics interface used by this code is very simple, it can still take advantage of many features of individual plotting devices in order to produce either hardcopy or images on screens, either in black and white or in full color.

This code can be used with plotting devices of any physical size, whose size is defined in any set of units. This code allows you to define the physical size of your plotting device in whatever dimensions you are used to using, e.g., inches, millimeters, centimeters - anything; so that you can properly size the plots for use with any plotting device.

The formats of the continuous and discrete physical data read by this code are designed to be extremely simple, so that virtually any computer code can be simply modified to produce output results in the input format required by this code. The continuous data includes a one title line, followed by a series of (X,Y) coordinates, one per line. Each "curve" of continuous data is terminated by a blank line. One curve can be followed by another, starting with the one line title line. The input to this code may include any number of such "curves". The format of the discrete data is very similar to the continuous data; each set of discrete points starts with a one line title and ends with a blank line. Each point is defined by an (X,Y) value plus uncertainties in both X and Y; each point is defined by up to six values X,-DX,+DX,Y,-DY,+DY, one point per input line. The input to this code may include any number of such sets of discrete points. See below for details of the continuous and discrete data formats.

This code has been designed to meet the needs of a wide variety of users. The code has been designed to allow the casual user to simply produce plots without becoming familiar with all of the options available in this code. This design feature allows some users to concentrate on applications and still produce meaningful graphic results without having to become an expert in graphics. At the same time this code includes many options which may be used to produce customized plots to meet most needs, varying from very simple and fast plots which can be quickly produced and used, to complicated, detailed figures of a quality suitable for publications (for examples of the latter see the below list of publications).

For extensive examples of the results produced by this code see,

"Tables and Graphs of Photon-Interaction Cross Sections from 10 eV to 100 GeV Derived from the LLNL Evaluated Photon Data Library (EPDL), Part A: Z = 1 to 50, Part B: Z = 51 to 100", UCRL-50400, Vol. 6, Rev. 4, Oct. 1989, Lawrence Livermore National Laboratory.

"Tables and Graphs of Atomic Subshell and Relaxation Data Derived from the LLNL Evaluated Atomic Data Library (EADL), Z = 1 - 100", UCRL-50400, Vol. 30, Oct. 1991, Lawrence Livermore National Laboratory.

"Tables and Graphs of Electron-Interaction Cross Sections from 10 eV to 100 GeV Derived from the LLNL Evaluated Electron Data Library (EEDL), Z = 1 - 100", UCRL-50400, Vol. 31, Nov. 1991, Lawrence Livermore National Laboratory.

Software Character Sets

In order to make this code as computer independent as possible it uses an input file (PLOT.CHR) to define the strokes necessary to plot each character - this is called a software character set. Using this method the interface for each computer and plotting device need only be able to draw lines from one (X,Y) coordinate to another - and all character sizes and aspect ratios will be plotted identically on all plotters.

This code is distributed with three sets of software characters, which in the order of character detail are called SIMPLEX, DUPLEX and COMPLEX. Each of these sets is distributed as a separate computer file and to use any one of them you need merely copy it to PLOT.CHR before executing this code. The three files of strokes are completely compatible and this code will simply use whichever set you have in PLOT.CHR.

Each of these sets can be used in given situations. The SIMPLEX set is a fairly simple set of characters, each of which may be drawn with a minimum number of strokes; this makes using this set very economical. At the other extreme the COMPLEX set included detailed characters, each of which may require a large number of strokes to draw; this set can be expensive to use, but it can produce finished plots suitable for use in publications.

The following page illustrates all available characters for each of the three software character sets. For each set the upper two lines illustrate the standard characters and the lower two lines illustrate the alternate character set.

Complex

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ΑΒΧΔΕΦΓΗΙ ΚΛΜΝΟΠΘΡΣΤΥ ΩΞΨΖ

αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

Duplex

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ΑΒΧΔΕΦΓΗΙ ΚΛΜΝΟΠΘΡΣΤΥ ΩΞΨΖ

αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

Simplex

ABCDEFGHIJKLMNOPQRSTUVWXYZØ123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ΑΒΧΔΕΦΓΗΙ ΚΛΜΝΟΠΘΡΣΤΥ ΩΞΨΖ

αβχδεφγηι κλμνοπθρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

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Standard vs. Alternate Character Set

To use the standard character set as input to this code one need merely type the desired character; all of the standard characters are available on most computer keyboards.

To use the alternate character set you should consult the following equivalence table and precede each character by]. For example, to plot (n, Greek alpha), you should type (n,]a) -] indicates that the next character is from the alternate character set and the following equivalence table indicates that - a - is equivalence to a lower case Greek alpha.

Alternate Character Equivalences

A = A	M = M	Y = Ψ	k = κ	w = ω	8 = ∞
B = B	N = N	Z = Z	l = λ	x = ξ	9 = ∈
C = X	O = O	a = α	m = μ	y = ψ	+ = ∝
D = Δ	P = Π	b = β	n = ν	z = ζ	− = ∂
E = E	Q = Θ	c = χ	o = ο	0 = →	* = ∇
F = Φ	R = P	d = δ	p = π	1 = ↑	/ = √
G = Γ	S = Σ	e = ε	q = ϑ	2 = ←	$ = ∫
H = H	T = T	f = φ	r = ρ	3 = ↓	(= [
I = I	U = Υ	g = γ	s = σ	4 = ≠	) =]
J =	V =	h = η	t = τ	5 = ≡	
K = K	W = Ω	i = ι	u = υ	6 = ≦	
L = Λ	X = Ξ	j =	v =	7 = ≧	

Character Thicknesses

All lines on a plot, except the grid, may be drawn using a specified line thickness. This option may be used to good advantage to insure that data can be properly and easily distinguished from the background grid.

As input you can specify that all lines should be of thickness between 0 (only draw each line once) up to 5 (with thickness 5 each line is drawn and then slightly offset to either side of the line and drawn 5 times - each line is drawn 11 times). Using line thickness can be very effective as far as improving the end product plots, but it can be very expensive if not properly used. For example, with thickness 5 each line is drawn 11 times and between drawing the beam or pen must be returned to the start of the line. Therefore plots with thickness 5 will contain 20 times as many strokes as a plot with thickness 0, and as such will take 20 times as long to create.

For most plots it is sufficient to have thickness for curves and points, but generally it is not necessary to have thickness for characters; the basic COMPLEX characters already contain an intrinsic thickness. In order to allow this option you can specify as input thickness 0 through 5, which indicates thickness for all lines, except the grid, on each plot, or -1 through -5 which indicates thickness only for curves and set of data points - but not for characters. Using the latter option can significant decrease the time required to produce plots, and this option is recommended.

For reference purposes the following pages illustrate each of the three software character sets in the order COMPLEX, DUPLEX and SIMPLEX, using line thickness 0 through 5. As stated above, the recommended procedure is not to use a line thickness for characters, and this recommendation will be followed in all of the examples included in this report.

0 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()=
abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"
ΑΒΧΔΕΦΓΗΙ ΚΛΜΝΟΠΘΡΣΤΥ ΩΞΨΖ
αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

1 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()=
abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"
ΑΒΧΔΕΦΓΗΙ ΚΛΜΝΟΠΘΡΣΤΥ ΩΞΨΖ
αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

2 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()=
abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"
ΑΒΧΔΕΦΓΗΙ ΚΛΜΝΟΠΘΡΣΤΥ ΩΞΨΖ
αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

3 Thick	ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()= abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|" ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]
4 Thick	ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()= abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|" ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]
5 Thick	ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()= abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|" ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

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0 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ

αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

1 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ

αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

2 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ

αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

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<table>
<tr><td>3 Thick</td><td>ABCDEFGHI JKLMNOPQRSTUVWXYZ0123456789+-*/$( )=
abcdefghi jklmnopqrstuvwxyz, . : ; ! ?<>% ' ~@#&_| "
ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ
αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]</td></tr>
<tr><td>4 Thick</td><td>ABCDEFGHI JKLMNOPQRSTUVWXYZ0123456789+-*/$( )=
abcdefghi jklmnopqrstuvwxyz, . : ; ! ?<>% ' ~@#&_| "
ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ
αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]</td></tr>
<tr><td>5 Thick</td><td>ABCDEFGHI JKLMNOPQRSTUVWXYZ0123456789+-*/$( )=
abcdefghi jklmnopqrstuvwxyz, . : ; ! ?<>% ' ~@#&_| "
ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ
αβχδεφγηι κλμνοπϑρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]</td></tr>
</table>

Ø Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZØ123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ΑΒΧΔΕΦΓΗΙ ΚΛΜΝΟΠΘΡΣΤΥ ΩΞΨΖ

αβχδεφγηι κλμνοπθρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

1 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZØ123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ΑΒΧΔΕΦΓΗΙ ΚΛΜΝΟΠΘΡΣΤΥ ΩΞΨΖ

αβχδεφγηι κλμνοπθρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

2 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZØ123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ΑΒΧΔΕΦΓΗΙ ΚΛΜΝΟΠΘΡΣΤΥ ΩΞΨΖ

αβχδεφγηι κλμνοπθρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

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3 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZØ123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ

αβχδεφγηι κλμνοπθρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

4 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZØ123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ

αβχδεφγηι κλμνοπθρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

40

5 Thick

ABCDEFGHIJKLMNOPQRSTUVWXYZØ123456789+-*/$()=

abcdefghijklmnopqrstuvwxyz,.:;!?<>%'~@#&_|"

ABXΔEΦΓHI KΛMNOΠΘPΣTΥ ΩΞΨZ

αβχδεφγηι κλμνοπθρστυ ωξψζ→↑←↓≠≡≦≧∞∈∝∂∇√∫[ ]

Software Symbols and Line Types

In order to identify sets of points or curves this code uses a file defining the strokes required to draw any one of 30 different symbols (to identify sets of points) or any one of 30 types of lines (to identify curves).

This code is distributed with two files: PLOT.SYM containing the strokes required to draw the standard symbol set, and PLOT.ALT containing the strokes required to draw the alternate symbol set. In both cases the types of lines are identical in the two files. In order to use either of these sets of symbols it is merely necessary to insure that the selected set is copied to the file PLOT.SYM prior to executing this code.

The following pages illustrate the standard and alternate symbol sets and the types of lines. The standard symbol set includes 30 different symbols which can be readily distinguished from one another on a plot. When symbols severely overlap on plots it may not be easy to distinguish symbols. Each member of the alternate symbol set is merely a square containing a number (1 through 9) or letter (A through Y). The alternate set is not as elegant as the standard set, but when symbols severely overlap the alternate symbols can be more easily distinguished than the standard symbols.

The types of lines allow for up to 30 different types of lines, but as distributed there are really only 10 different types of lines; line types 11-20 or 21-30 are merely repeats of line types 1-10. Even with only 10 different types of lines it is often difficult to distinguish between them and the author has not been able to define more than this number of different types of lines.

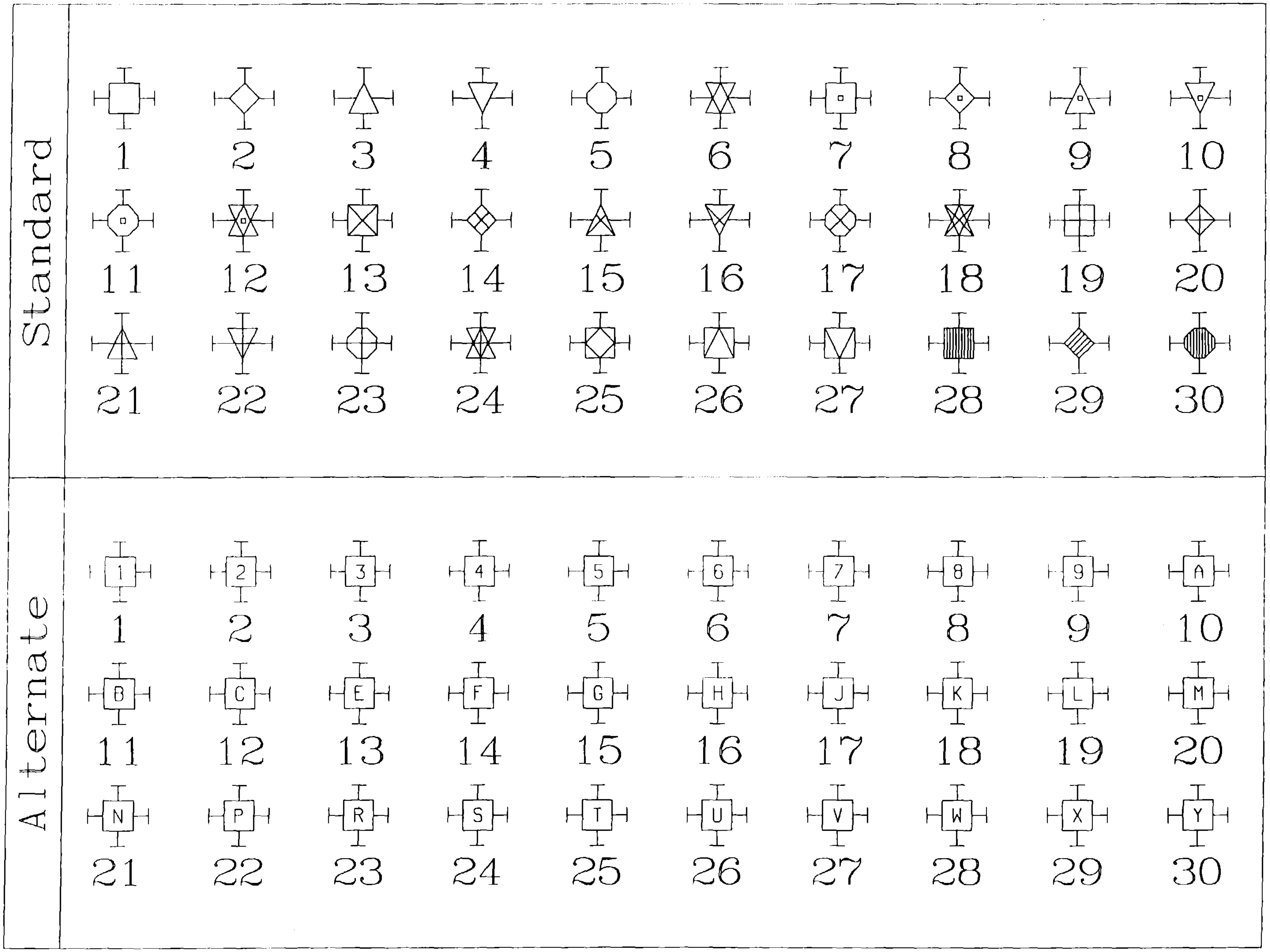
The symbols and line types are used in the order that they are read from the file (PLOT.SYM). The user is free to re-order the symbols and line types in any manner, e.g., if you would like symbols 28-30 to be used for the first 3 sets of points, merely move these symbols to be the beginning of the file. Similarly you are free to modify these symbols and line types to create your own sets. The only restriction to modifying this file is that there MUST BE EXACTLY 30 symbols followed by 30 line types - otherwise the results will be unpredictable.

The files containing the symbols and line types define the strokes required to draw symbols and lines. Each stroke is defined by (X,Y) and either 3 = move (blank) or 2 = draw. For each symbol the first line defines an index (1 to 30 - not used by the code), the number of strokes required to draw the symbol (e.g., for a box, 5 strokes) and the X width of the symbol at the Y midpoint (to allow error bars to be easily and correctly connected to symbols). The first line is then followed by the indicated number of strokes. The first stroke must always include 3 = move, in order to move to the beginning of the symbol without drawing a line from the last location of the beam or pen. Below are the first three symbols from the standard symbol set. See the following page illustrating these symbols.

```
1     5  1.000     BOX
  0.000  0.000     3
  0.000  1.000     2
  1.000  1.000     2
  1.000  0.000     2
  0.000  0.000     2
2     5  1.000     DIAMOND
  0.500  0.000     3
  0.000  0.500     2
  0.500  1.000     2
  1.000  0.500     2
  0.500  0.000     2
3     4  0.500     UP  TRIANGLE
  0.000  0.000     3
  0.500  1.000     2
  1.000  0.000     2
  0.000  0.000     2
```

Similarly, each line type is defined by a series of strokes. The first line defines an index (1 to 30 - not used by this code) and the number of strokes. The following field is not used by this code. The following lines define each stroke as either 3 = drawn or 2 = blank. Once the pattern has been used it is merely repeated. Below are the first three line types. See the following page illustrating these line types.

```
1     1  1.000     SOLID
  1.000  0.000     2
2     2  1.000     LONG DASH-SPACE
  0.180  0.000     2
  0.045  0.000     3
3     2  1.000     SHORT DASH-SPACE
  0.060  0.000     2
  0.045  0.000     3
```


Standard
1 2 3 4 5 6 7 8 9 10
11 12 13 14 15 16 17 18 19 20
21 22 23 24 25 26 27 28 29 30
Alternate
1 2 3 4 5 6 7 8 9 A
1 2 3 4 5 6 7 8 9 10
B C E F G H J K L M
11 12 13 14 15 16 17 18 19 20
N P R S T U V W X Y
21 22 23 24 25 26 27 28 29 30

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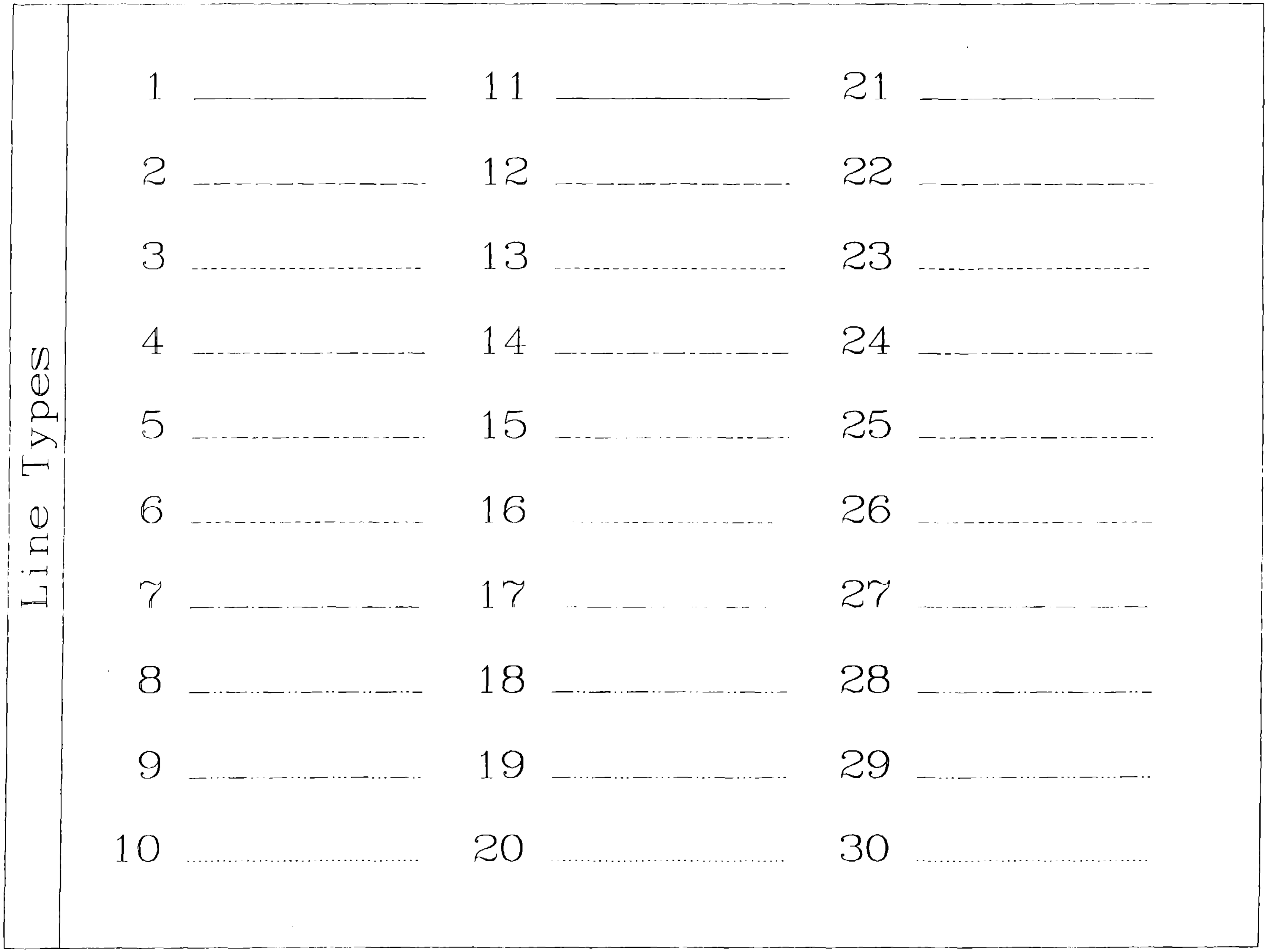

Line Types
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30

A Basic Series of Plots

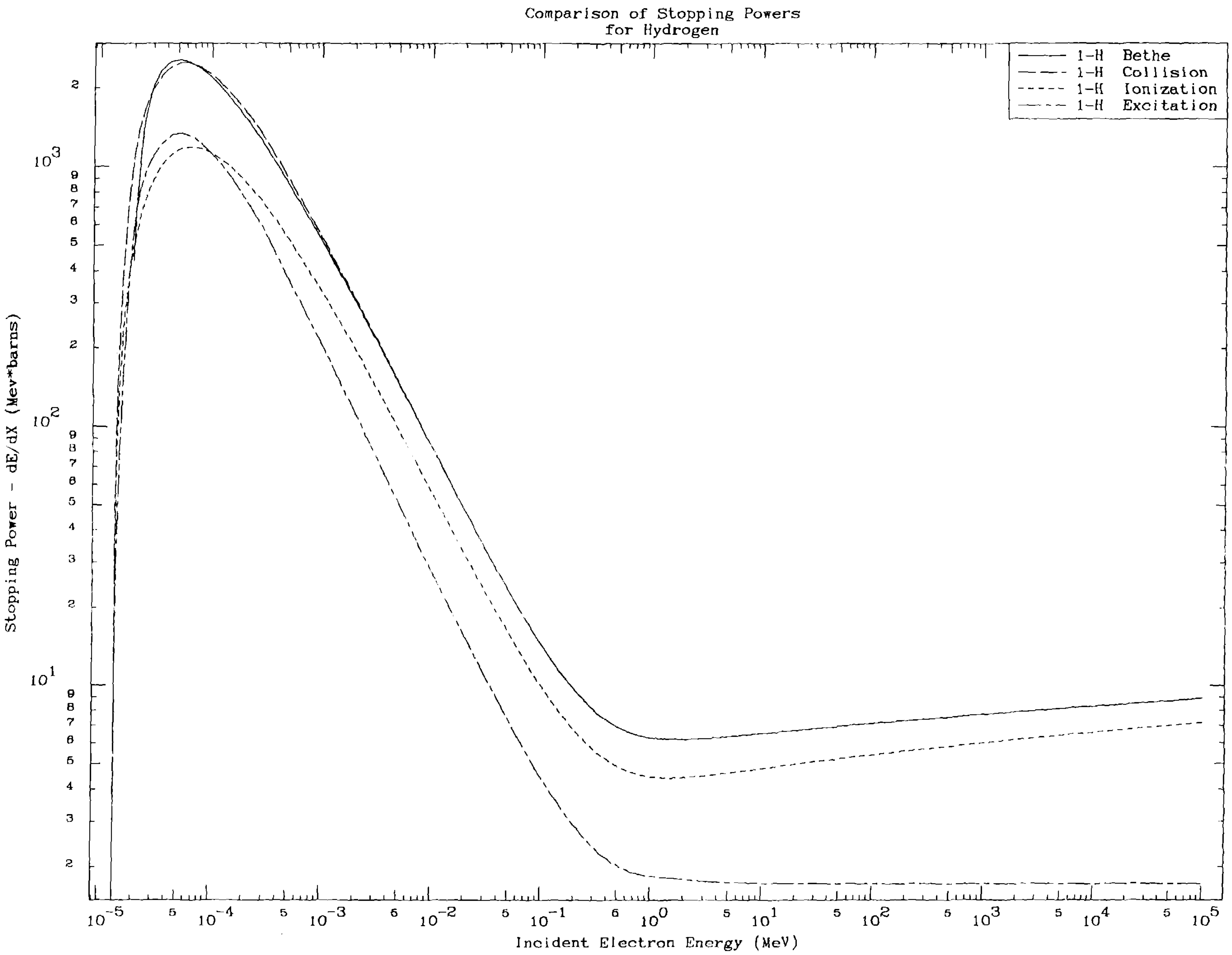
The following four plots illustrate the simplest use of the code to plot four curves on each of a series of plots. The X and Y axis labels will be identical on all four plots. Only the titles at the top of each plot will be different from one plot to the next.

In this case you need only define the physical size of each page (in this case 13.5 by 10.0) and the number of plots per page (in this case 1 by 1), the number of curves to read and plot on each plot (4) and the X and Y axis labels; all of these will be the same for all plots and these first four lines of input need only appear once.

Next there are four input lines for each plot. The first two lines define a two line title to appear at the top of the plot. The next two lines define options for the X and Y dimensions of the plot. Note in this case these lines are completely blank or 0, in which case the code will use all of the standard options; this illustrates that in most cases the user need not be familiar with all of the options available, since generally acceptable results can be obtained using the standard code options.

These four lines for a plot can be immediately followed by another four lines for the next plot. This cycle can be repeated any number of times and each four lines will produce one plot, e.g., in this case the cycle is repeated four times to produce the following four plots.

```
  0.00000   13.50000    0.00000   10.0              1          1 1.0
        4          0          0          0          0          0    0
Incident Electron Energy (MeV)
Stopping Power - dE/dX (Mev*barns)
Comparison of Stopping Powers
for Hydrogen
                              0          0          0          0
                              0          0          0          0
Comparison of Stopping Powers
for Helium
                              0          0          0          0
                              0          0          0          0
Comparison of Stopping Powers
for Lithium
                              0          0          0          0
                              0          0          0          0
Comparison of Stopping Powers
for Beryllium
                              0          0          0          0
                              0          0          0          0
```


Comparison of Stopping Powers
for Hydrogen
1-H Bethe
1-H Collision
1-H Ionization
1-H Excitation
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)
10^-5
10^-4
10^-3
10^-2
10^-1
10^0
10^1
10^2
10^3
10^4
10^5
10^1
10^2
10^3

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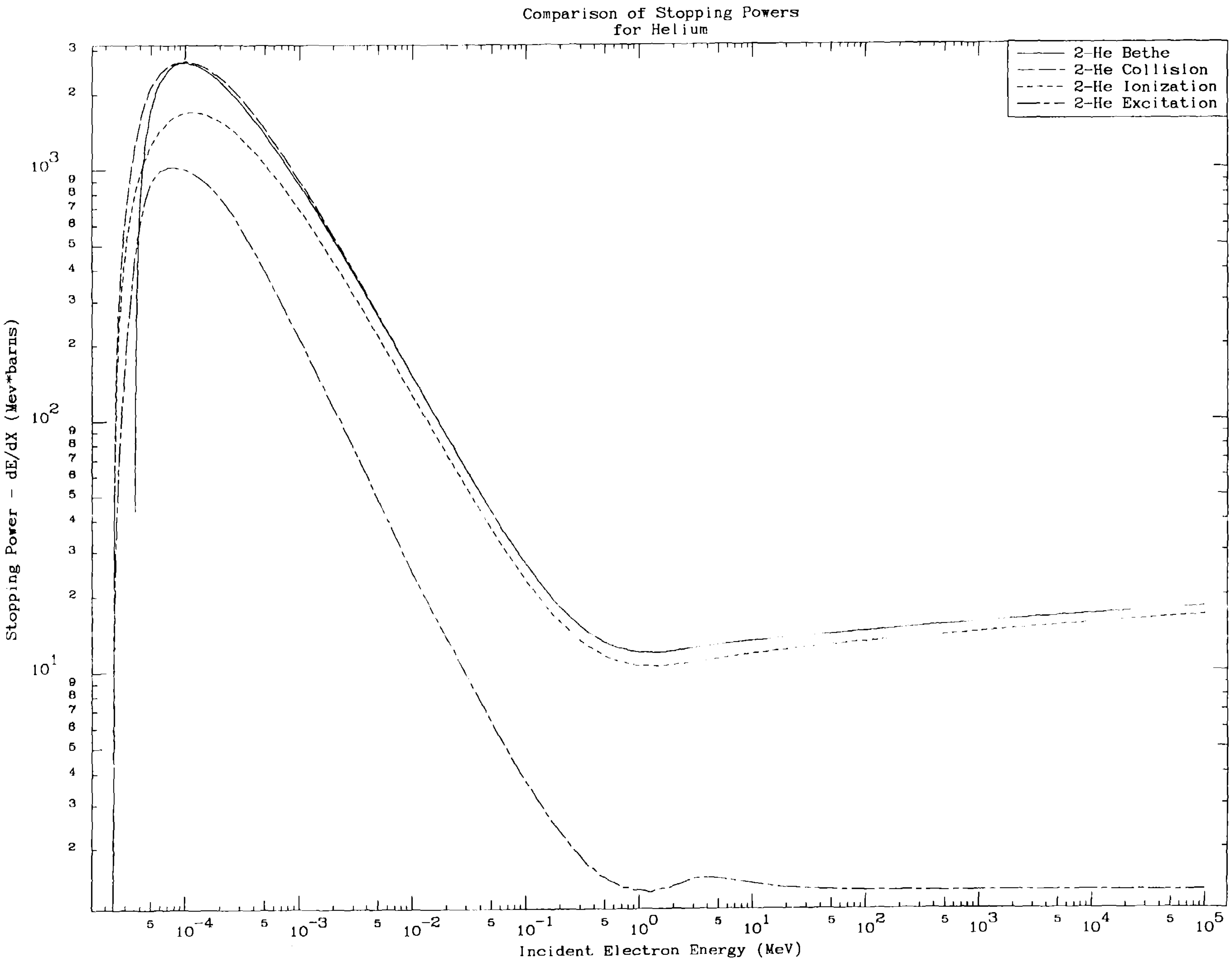
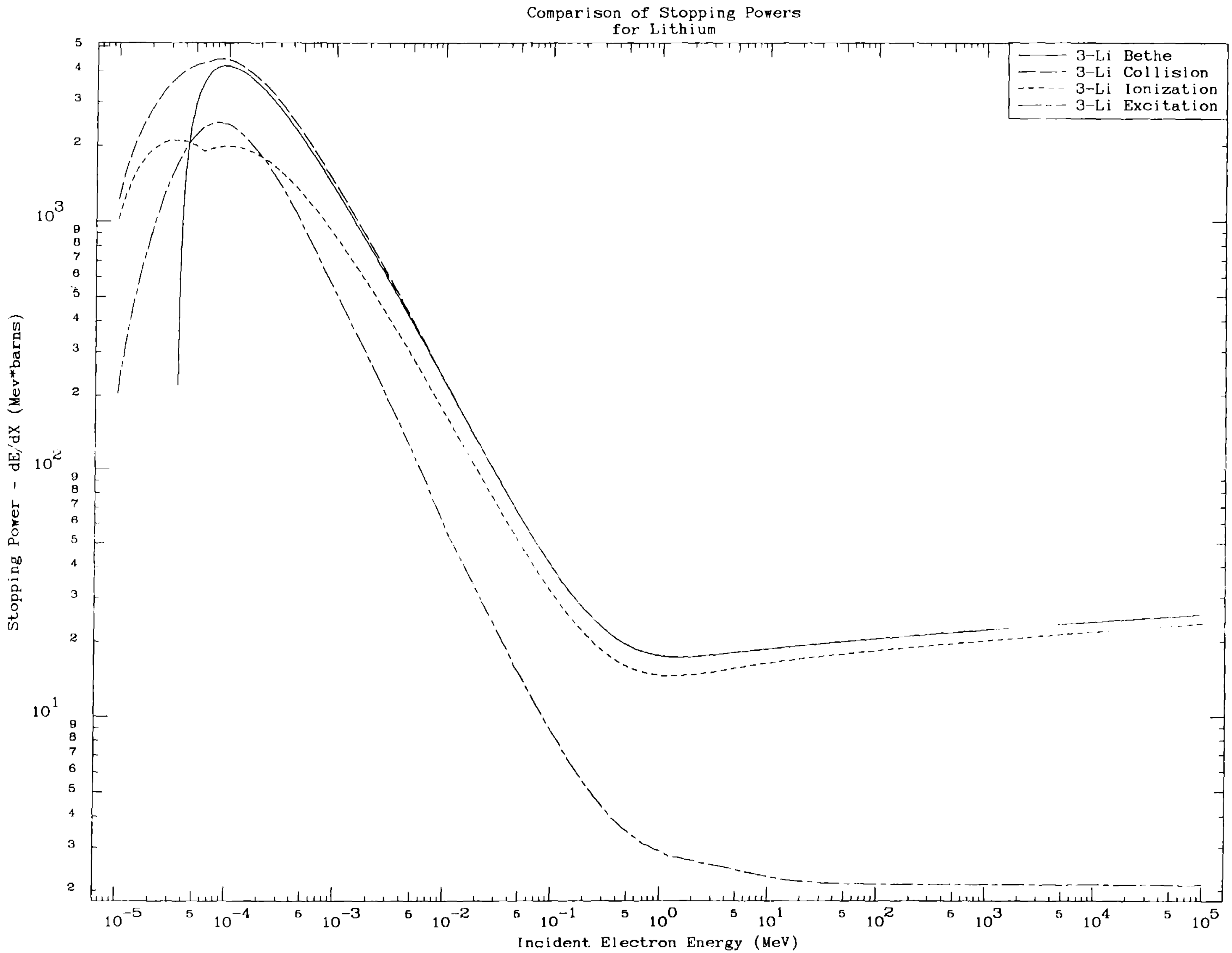
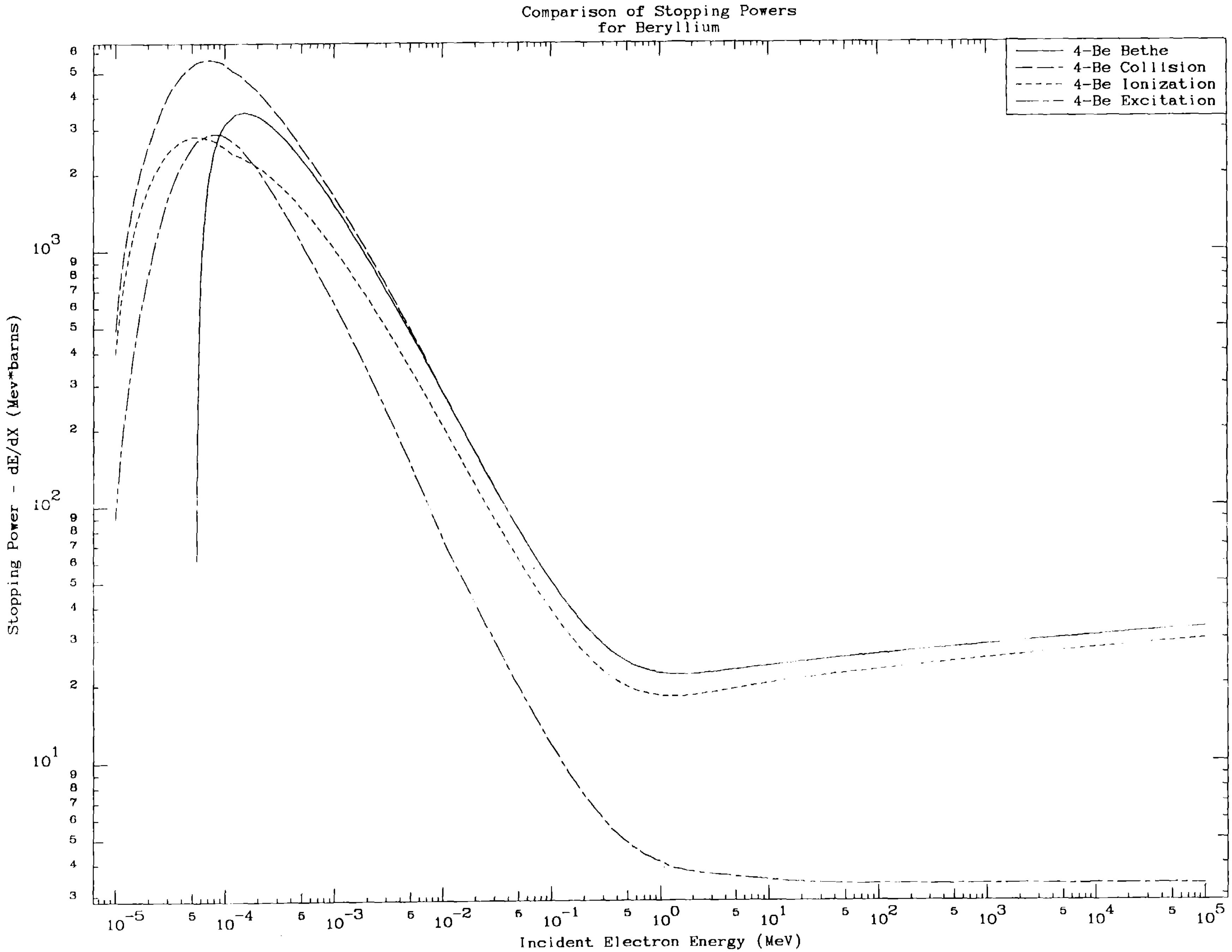

Comparison of Stopping Powers
for Helium
2-He Bethe
2-He Collision
2-He Ionization
2-He Excitation
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{1}
10^{2}
10^{3}

47


Comparison of Stopping Powers
for Lithium
3-Li Bethe
3-Li Collision
3-Li Ionization
3-Li Excitation
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)
10^{-5} 5 10^{-4} 5 10^{-3} 5 10^{-2} 5 10^{-1} 5 10^{0} 5 10^{1} 5 10^{2} 5 10^{3} 5 10^{4} 5 10^{5}
10^{1} 10^{2} 10^{3}

48


Comparison of Stopping Powers
for Beryllium
4-Be Bethe
4-Be Collision
4-Be Ionization
4-Be Excitation
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10^{1}
10^{2}
10^{3}

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Multiple Plots per Page

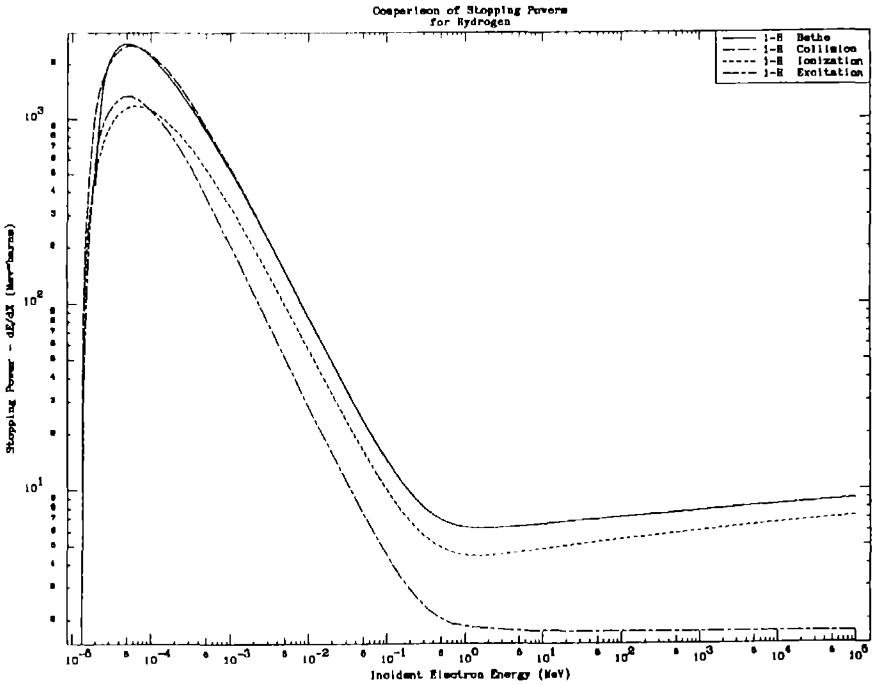
When you have a series of similar plots and each does not contain too much information this code can be used to plot a number of plots on each page.

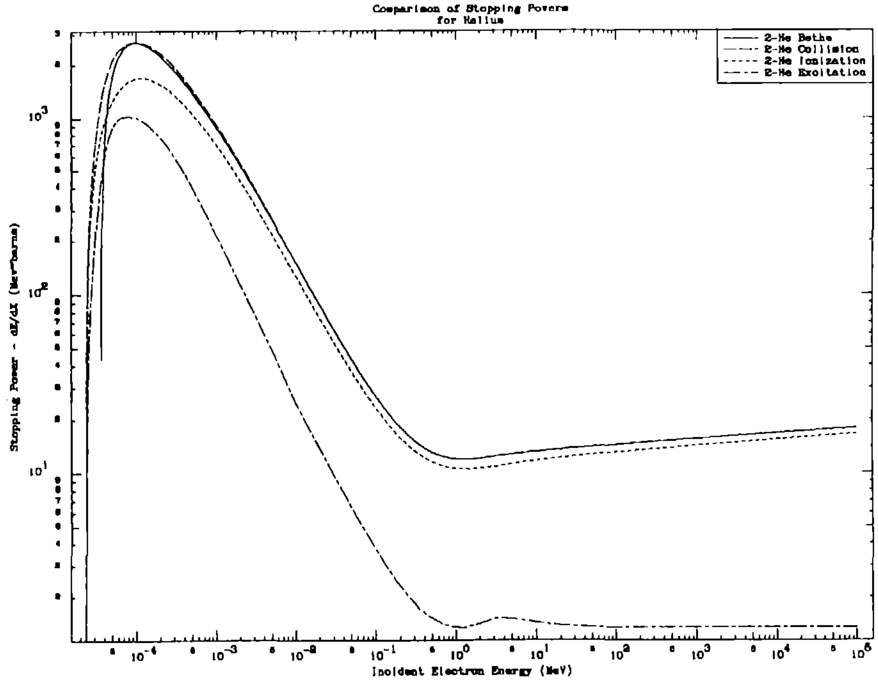
For example, the preceding four pages of plots could have been condensed onto a single page. The only change in the input parameters would be to specify 2 by 2 plots per page (cols. 45-66 on line 1).

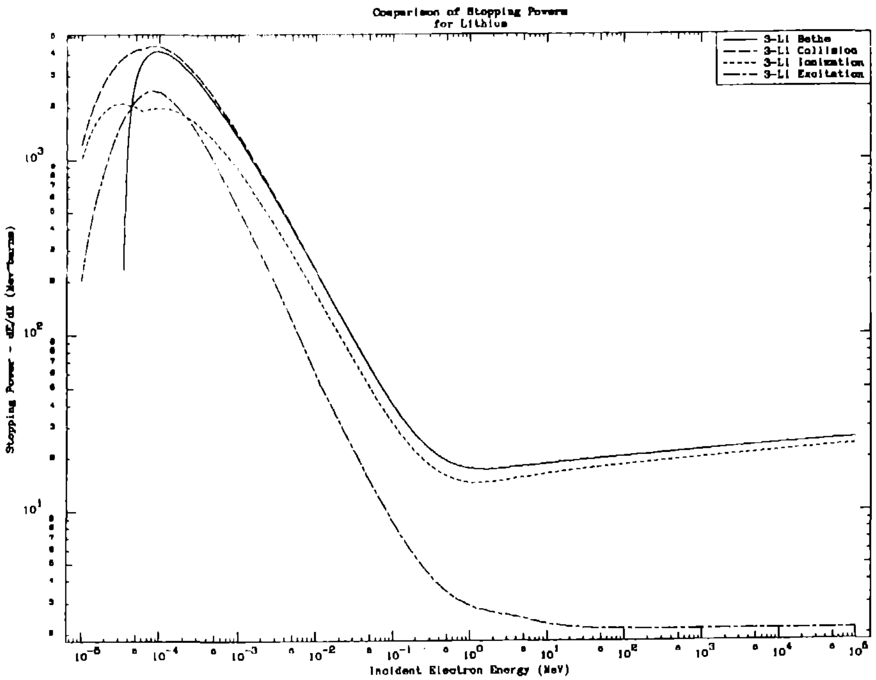
Note, that in this case there is an advantage in presenting the results in this form, since it allows us to see the atomic number (Z) dependence of the stopping power, without having to consult a number of different pages.

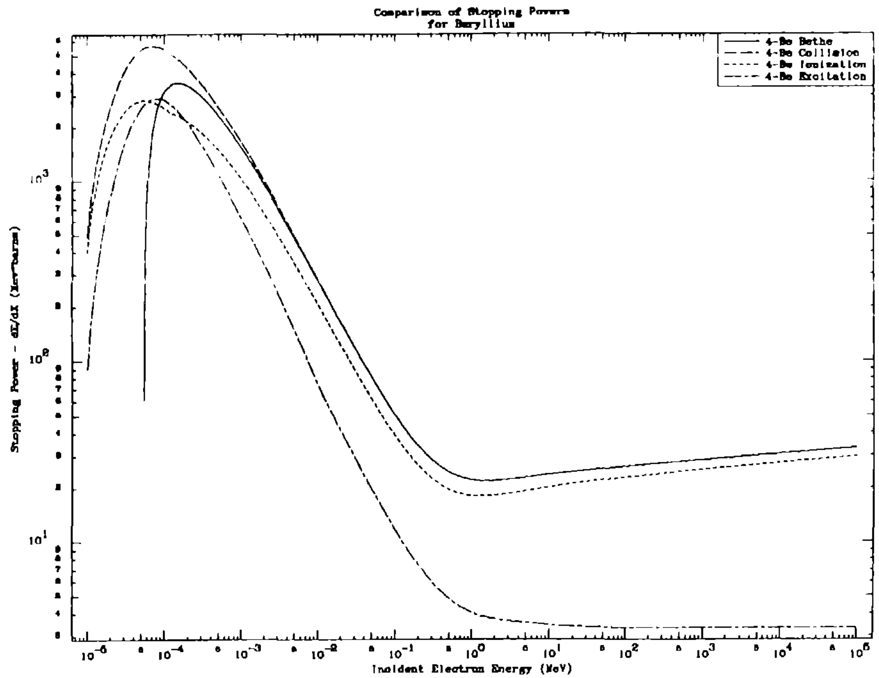
```
    0.00000    13.50000     0.00000    10.0                2          2 1.0
          4           0           0           0            0          0    0
Incident Electron Energy (MeV)
Stopping Power - dE/dX (Mev*barns)
Comparison of Stopping Powers
for Hydrogen
                                0           0           0           0
                                0           0           0           0
Comparison of Stopping Powers
for Helium
                                0           0           0           0
                                0           0           0           0
Comparison of Stopping Powers
for Lithium
                                0           0           0           0
                                0           0           0           0
Comparison of Stopping Powers
for Beryllium
                                0           0           0           0
                                0           0           0           0
```

A second page of four plots are presented here. The second page contains exactly the same data as on the first page. The only difference is that for the second page a character size multiplier of 1.5 (cols. 67-70 on first input line) has been used. The basic limitation on the number of plots per pages is that with more plots per page the characters become progressively smaller and are eventually impossible to read. This effect can be at least partially offset by using larger characters for multiple plots per page.


Comparison of Stopping Powers
for Hydrogen
1-H Bethe
1-H Collision
1-H Ionization
1-H Excitation
Incident Electron Energy (MeV)


Comparison of Stopping Powers
for Helium
2-He Bethe
2-He Collision
2-He Ionization
2-He Excitation
Incident Electron Energy (MeV)


Comparison of Stopping Powers
for Lithium
3-Li Bethe
3-Li Collision
3-Li Ionization
3-Li Excitation
Incident Electron Energy (MeV)


Comparison of Stopping Powers
for Beryllium
4-Be Bethe
4-Be Collision
4-Be Ionization
4-Be Excitation
Incident Electron Energy (MeV)

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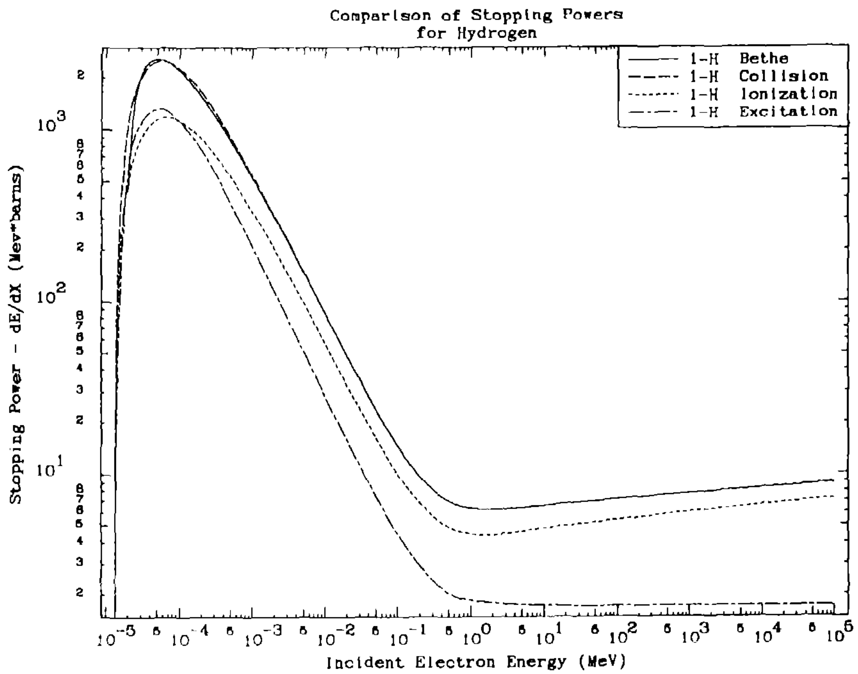
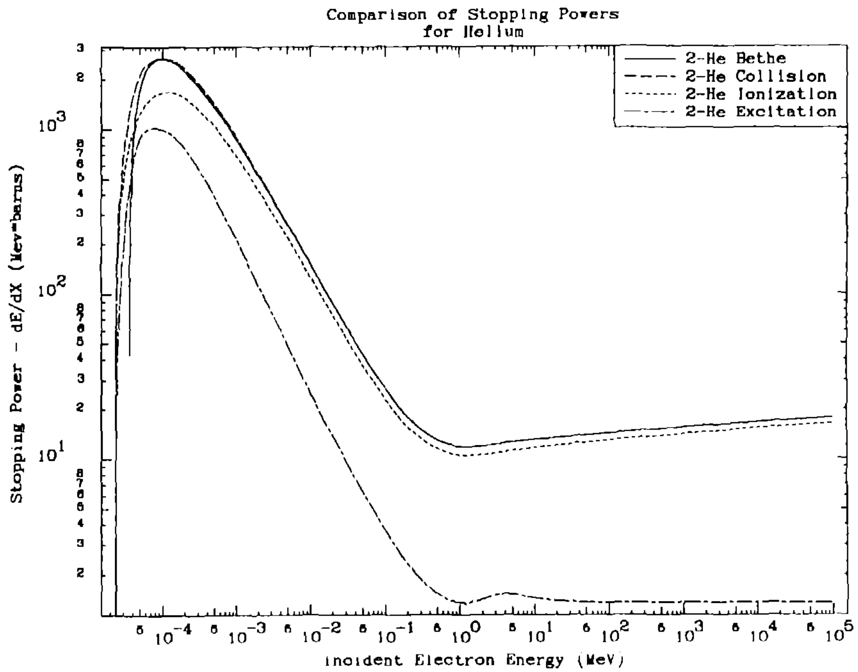
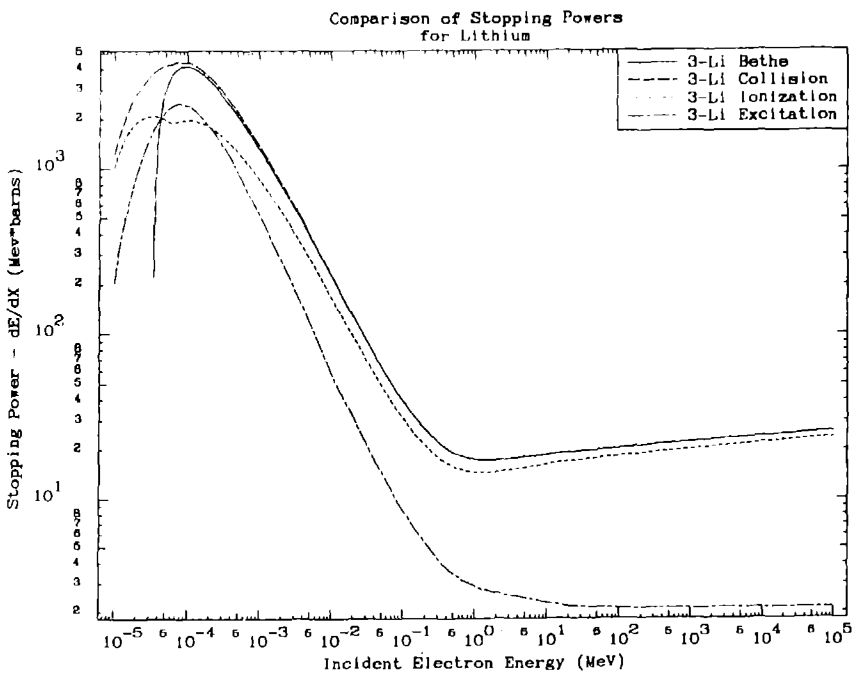
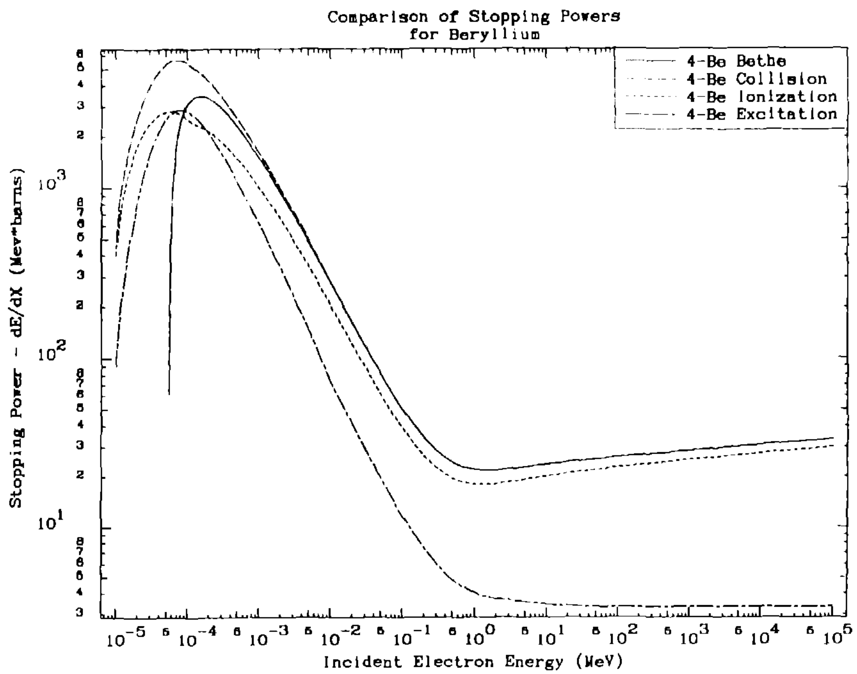

Comparison of Stopping Powers
for Hydrogen
1-H Bethe
1-H Collision
1-H Ionization
1-H Excitation
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)


Comparison of Stopping Powers
for Helium
2-He Bethe
2-He Collision
2-He Ionization
2-He Excitation
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)


Comparison of Stopping Powers
for Lithium
3-Li Bethe
3-Li Collision
3-Li Ionization
3-Li Excitation
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)


Comparison of Stopping Powers
for Beryllium
4-Be Bethe
4-Be Collision
4-Be Ionization
4-Be Excitation
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)

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Zoom and Ratios

Two of the most important capabilities of this code are the ability,

1) to select any X and/or Y ranges which you wish to "see" - this is called ZOOMING. This option allows you to examine data in any detail that you consider to be necessary.

2) to define the ratio of all other curves and all sets of data points to the first (standard) curve, and to quantitatively define the position and magnitude of the maximum difference between the first curve and all the other data. In comparing data, plots can be extremely misleading in making different sets of data appear to be very similar - particularly when log scaling scaling is used in the Y dimension. By presenting the ratio one can not only quantitatively define differences, but one can also more clearly "see" trends in differences.

The following example input will produce the three plots which follow this page. The plots include,

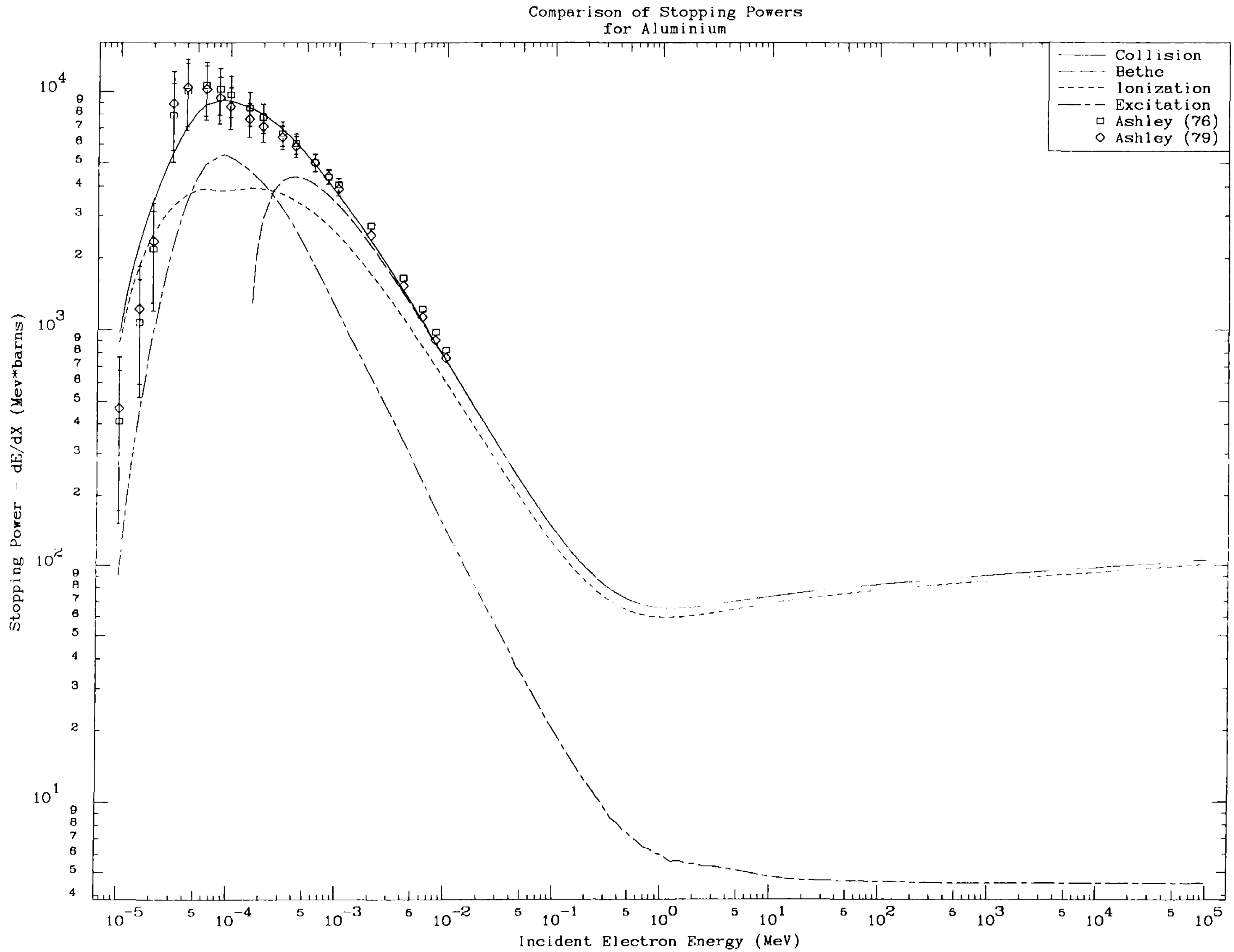
1) 4 curves and 2 sets of points are read and kept in core for all plots. The first plot is of the entire X and Y range of data using a log-log plot and including Y error bars for the sets of points.

2) The second plot is of the X range up to 0.01; otherwise all of the parameters are the same as the first plot. This is an example of specifying the X and/or Y range to create a ZOOMED plot of a portion of the data.

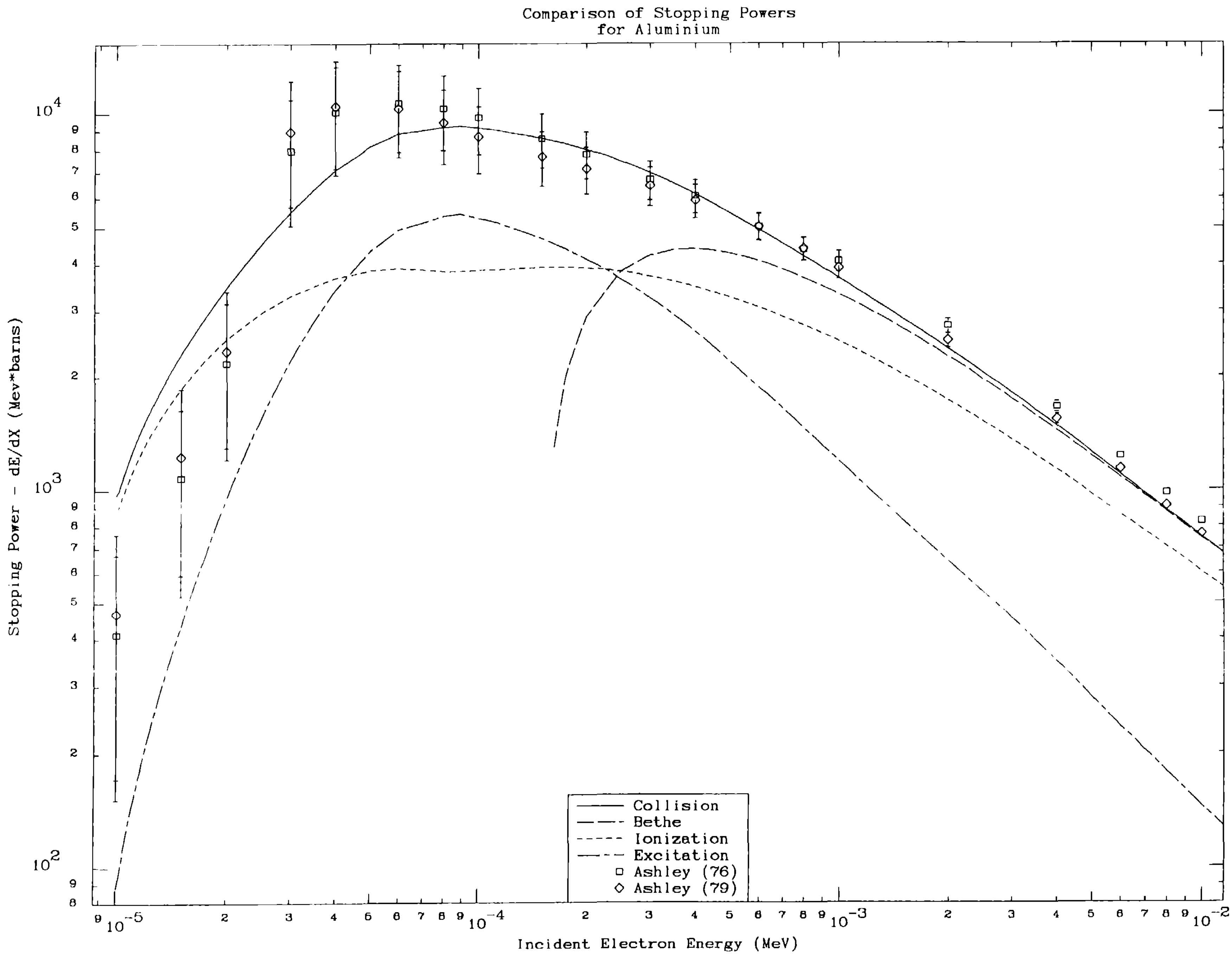
3) The third plot uses all of the same parameters as for the second plot, except that the RATIO option has been turned on to show the ratio of everything to the first curve. In order to do this it was necessary to insert a blank line after the lines for the second plot and to then start all over again defining the plot layout, etc.

```
    0.00000    13.50000     0.00000    10.0                   1           1 1.0
         -4          -2           0          0                0           0   0
Incident Electron Energy (MeV)
Stopping Power - dE/dX (Mev*barns)
Comparison of Stopping Powers
for Aluminium
                                  0          2                0           0
                                  1          2                0           0
Comparison of Stopping Powers
for Aluminium
            1.00000- 2            0          2                0           0
                                  1          2                0           0

    0.00000    13.50000     0.00000    10.0                   1           1 1.0
         -4          -2           0          0                1           0   0
Incident Electron Energy (MeV)
Stopping Power - dE/dX (Mev*barns)
Comparison of Stopping Powers
for Aluminium
            1.00000- 2            0          2                0           0
                                  1          2                0           0
```

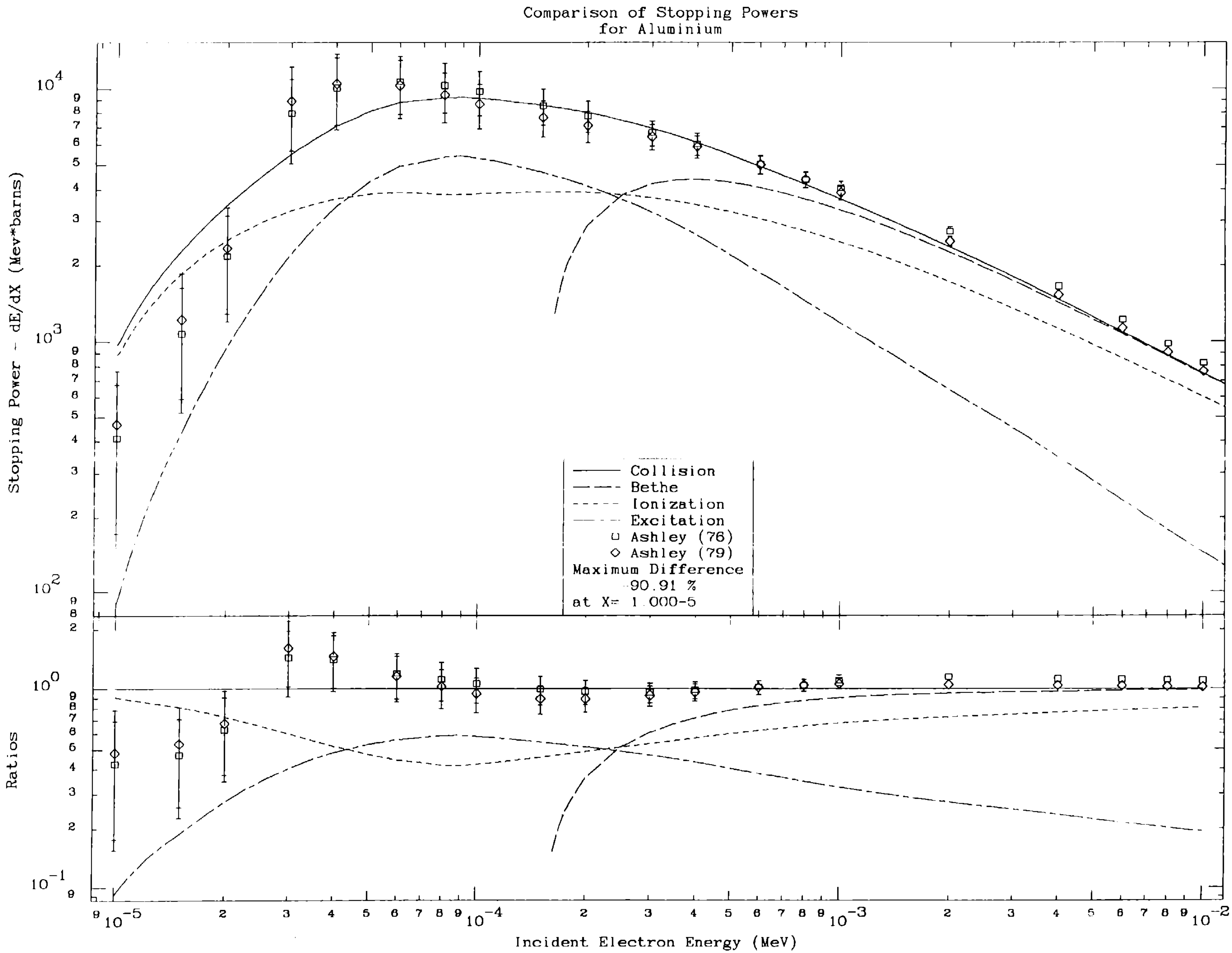

Comparison of Stopping Powers
for Aluminium
Collision
Bethe
Ionization
Excitation
Ashley (76)
Ashley (79)
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)

54



Comparison of Stopping Powers
for Aluminium
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)
Collision
Bethe
Ionization
Excitation
Ashley (76)
Ashley (79)

55


Comparison of Stopping Powers
for Aluminium
Stopping Power - dE/dX (Mev*barns)
Ratios
Incident Electron Energy (MeV)
Collision
Bethe
Ionization
Excitation
Ashley (76)
Ashley (79)
Maximum Difference
-90.91 %
at X= 1.000-5

Rotate Plots and Multiple Plots per Page

The following example uses exactly the same data that appeared on the preceding three plots. The only difference is in the presentation of the data.

1) *All of the plots have been ROTATED by specifying a negative upper X limit for the size of the plots (cols. 12-22 on first line).*

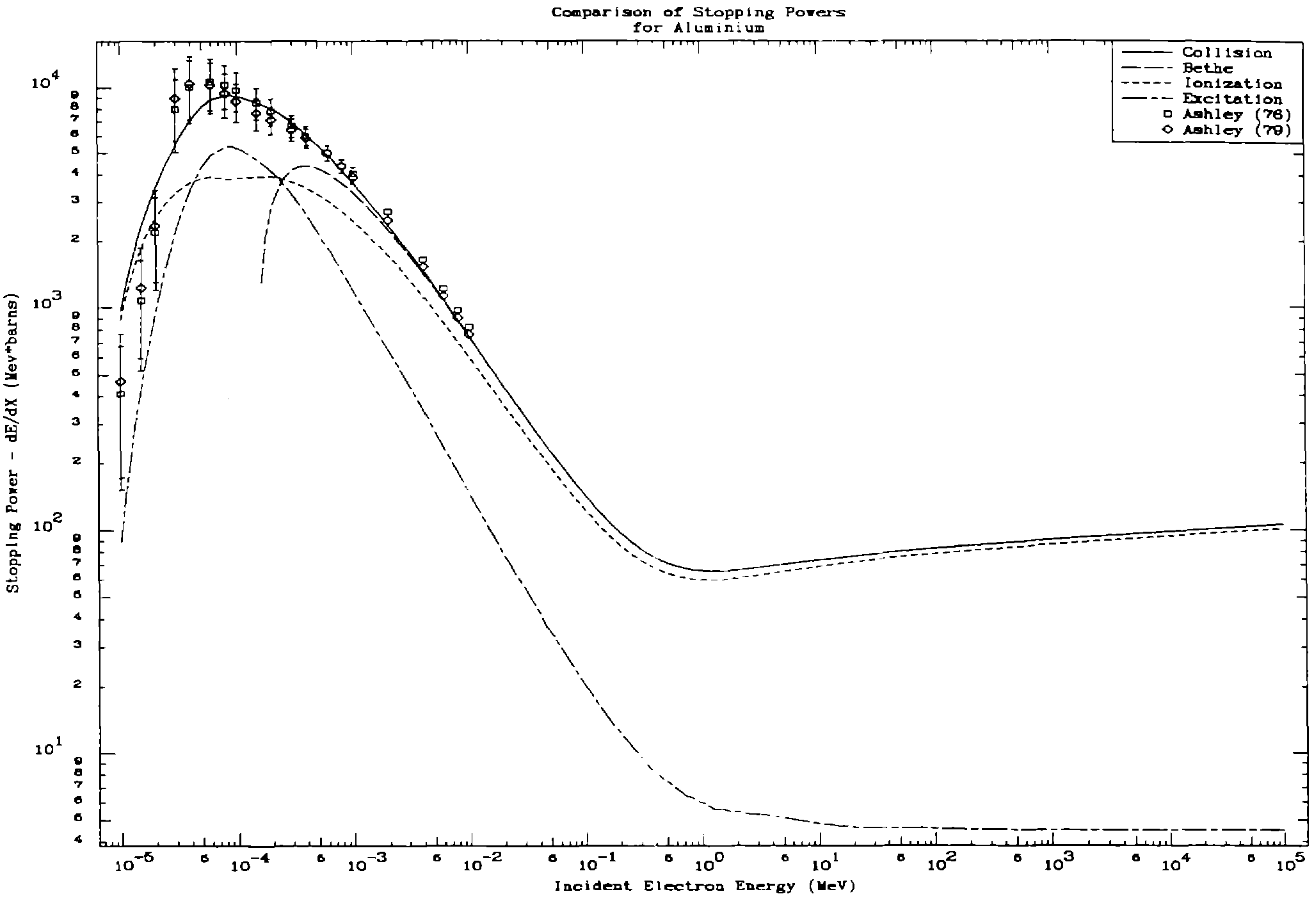
2) *The first two plots are presented on a single page by specifying 1 by 2 plots (cols. 45-66 on first line).*

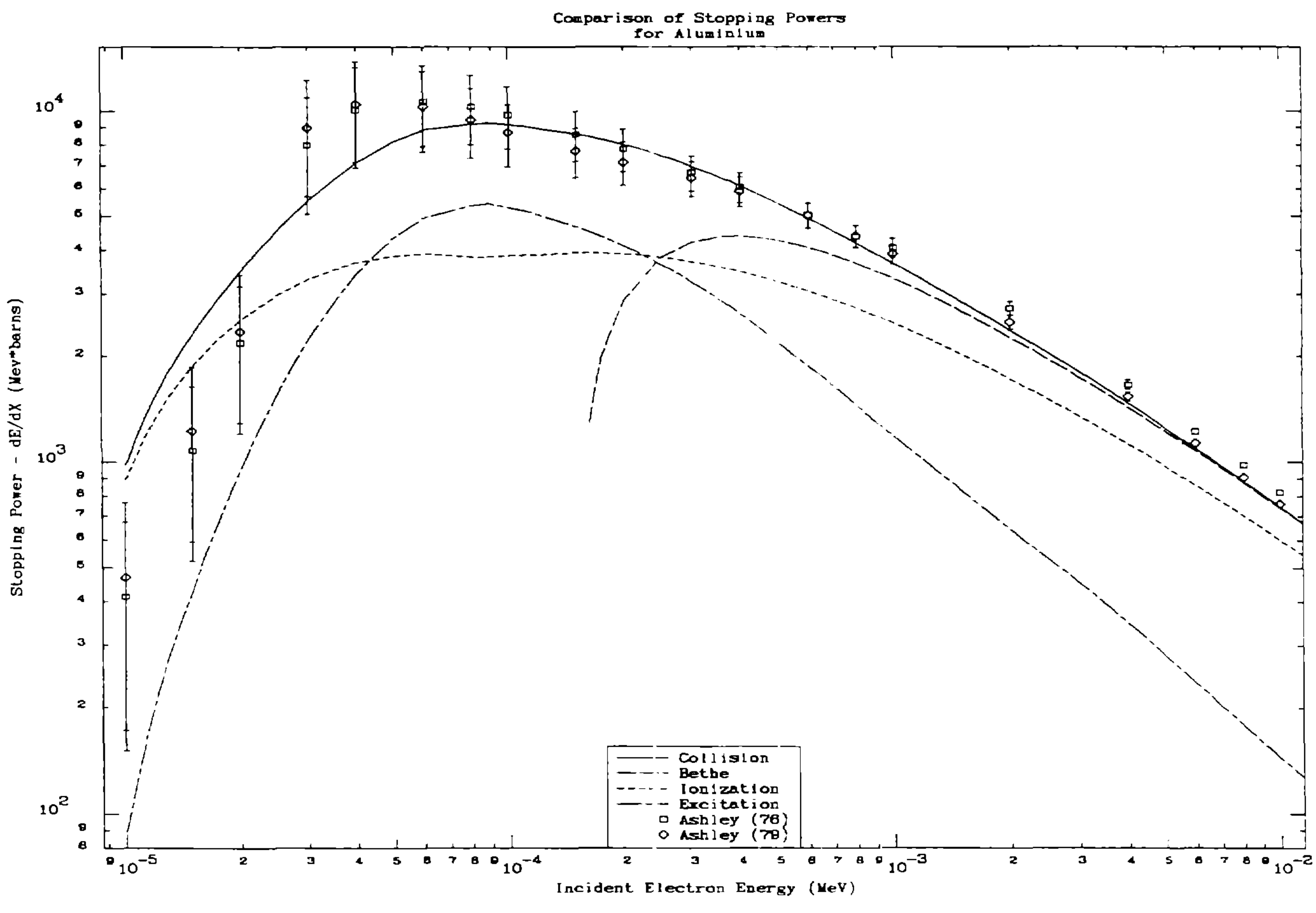
3) *The third plot is presented as one plot per page.*

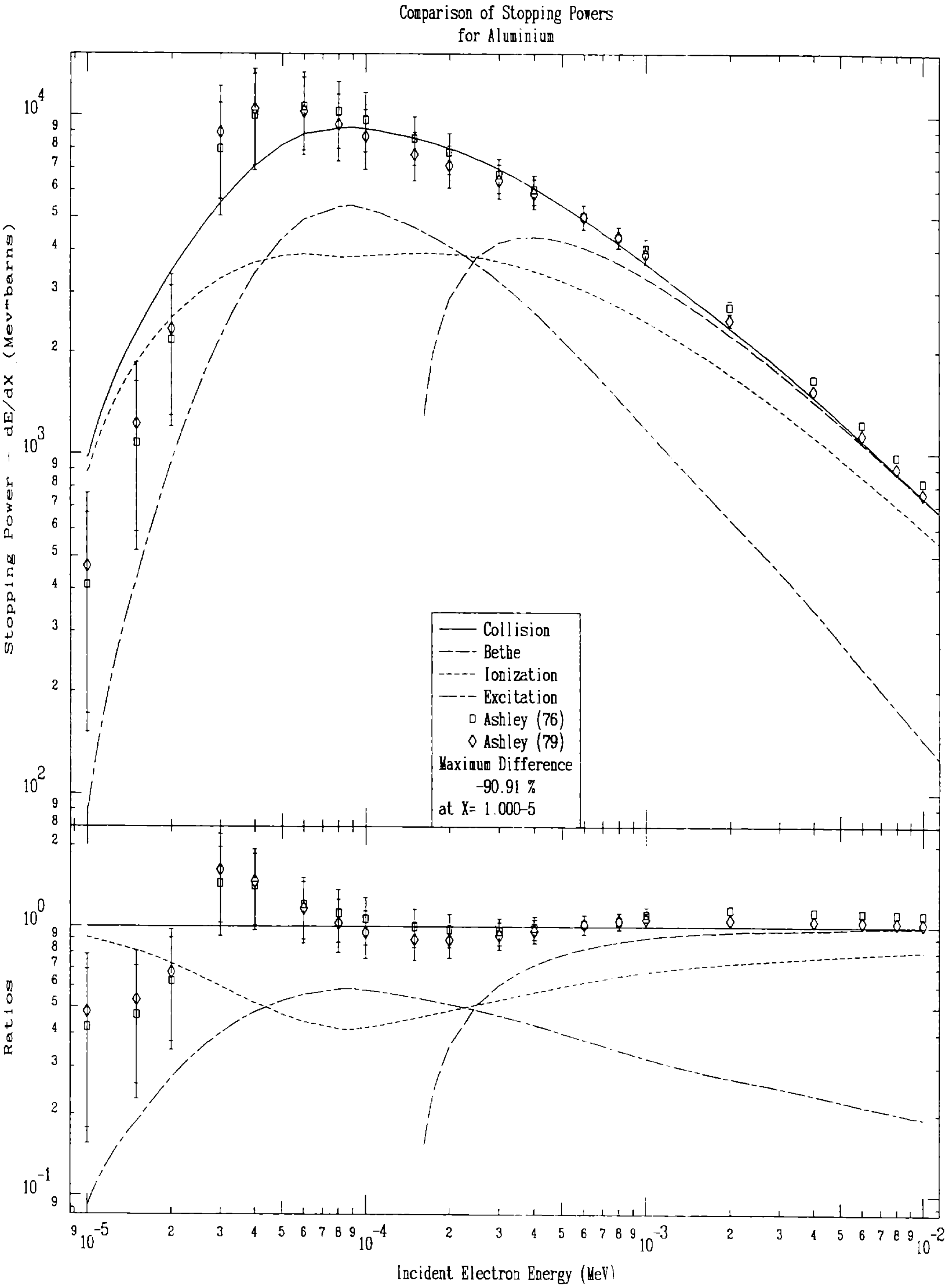
Except for these modifications the presentation of the plots is identical to that of the preceding three plots.

```
    0.00000  -13.50000    0.00000   10.0                    1          2 1.0
         -4         -2          0          0            0          0    0
Incident Electron Energy (MeV)
Stopping Power - dE/dX (Mev*barns)
Comparison of Stopping Powers
for Aluminium
                                0          2            0          0
                                1          2            0          0
Comparison of Stopping Powers
for Aluminium
            1.00000- 2          0          2            0          0
                                1          2            0          0

    0.00000  -13.50000    0.00000   10.0                    1          1 1.0
         -4         -2          0          0            1          0    0
Incident Electron Energy (MeV)
Stopping Power - dE/dX (Mev*barns)
Comparison of Stopping Powers
for Aluminium
            1.00000- 2          0          2            0          0
                                1          2            0          0
```


Comparison of Stopping Powers
for Aluminium
Collision
Bethe
Ionization
Excitation
Ashley (76)
Ashley (79)
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)


Comparison of Stopping Powers
for Aluminium
Collision
Bethe
Ionization
Excitation
Ashley (76)
Ashley (79)
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)


Comparison of Stopping Powers
for Aluminium
Stopping Power - dE/dX (Mev-barns)
Ratios
Incident Electron Energy (MeV)
Collision
Bethe
Ionization
Excitation
Ashley (76)
Ashley (79)
Maximum Difference
-90.91 %
at X= 1.000-5

Linear vs. Log Scaling

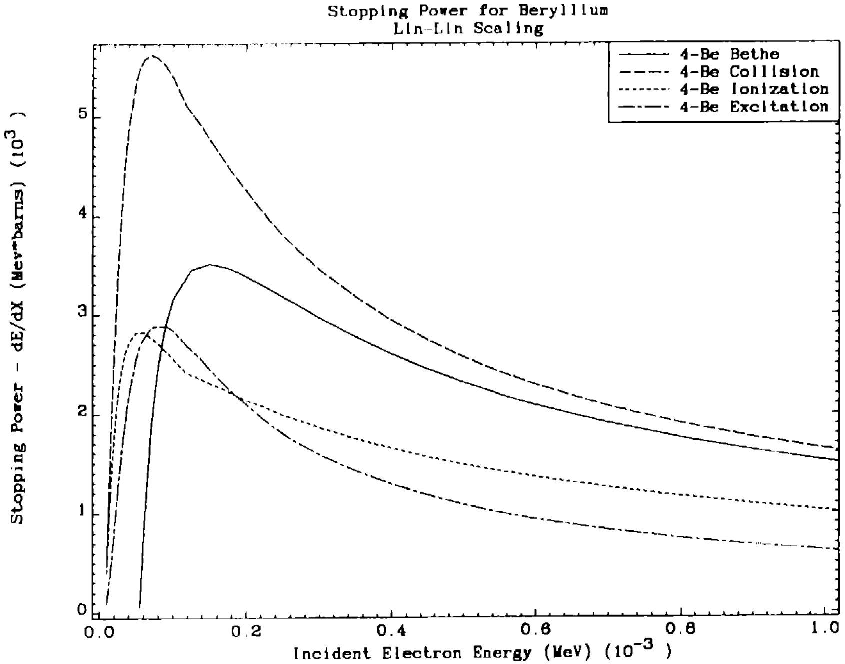
Normally the automatic scaling conventions built into the code are adequate to select either linear or log scaling for the X and Y axis. The automatic scaling convention is extremely simple: if the X or Y range is positive and the maximum of the range is more than ten times the minimum, log scaling is used. Otherwise linear scaling is used. Automatic scaling is indicated by specifying blank or 0 in cols. 34-44 of the third (for X) or fourth (for Y) input line for each plot.

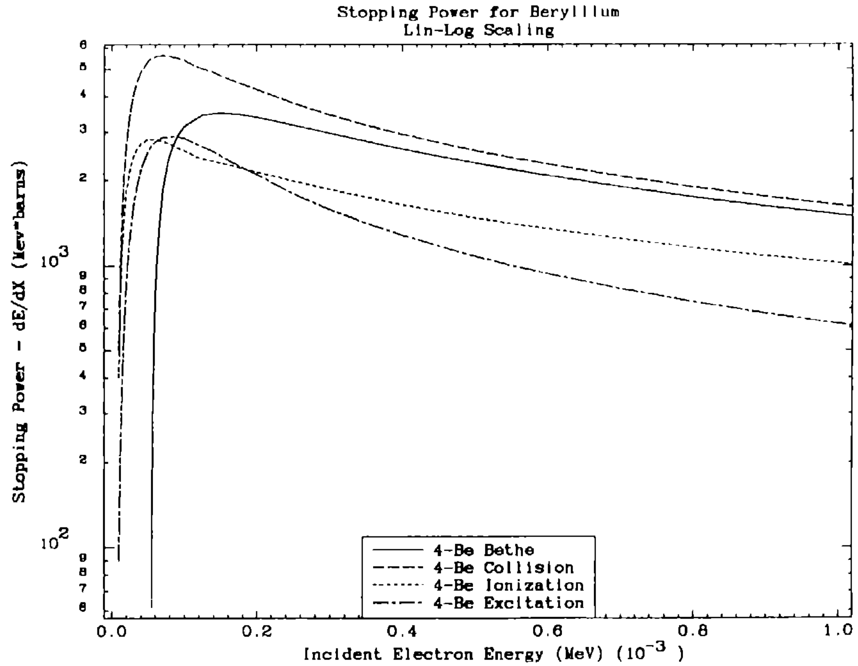
However, occasionally you may wish to force the scaling to be either linear or log. The following page presents four plots to illustrate the results obtained using exactly the same data on each plot and using all combinations of X and Y linear or log scaling.

Note, on the input lines below how the scaling is forced by specifying either 1 (linear) or 2 (log) in cols. 34-44 of the third (for X) or fourth (for Y) input line for each plot. When log scaling is forced by input any non-positive values are ignored and not considered in defining the range of the plot, i.e., log scaling is forced by only considering positive values to plot.

For these plots the character size has been increased by a factor of 1.5 (cols. 67-70 on the first input line) and the upper limit of the X range has been set to 0.001. Note, on the plots for linear scaling the axis annotation will always be in normal form containing numbers in the range 1 to 999. In order to do this the axis labels may have a scale factor added to them, e.g., on the enclosed plot where the Y axis label includes a scale factor of 10**3 and the X axis label a scale factor of 10**(-3).

```
    0.00000   13.50000    0.00000   10.0                2          2 1.5
         -4          0          0          0          0          0    0
Incident Electron Energy (MeV)
Stopping Power - dE/dX (Mev*barns)
Stopping Power for Beryllium
Lin-Lin Scaling
            1.00000- 3          0          1          0          0
                                0          1          0          0
Stopping Power for Beryllium
Lin-Log Scaling
            1.00000- 3          0          1          0          0
                                0          2          0          0
Stopping Power for Beryllium
Log-Lin Scaling
            1.00000- 3          0          2          0          0
                                0          1          0          0
Stopping Power for Beryllium
Log-Log Scaling
            1.00000- 3          0          2          0          0
                                0          2          0          0
```


Stopping Power for Beryllium
Lin-Lin Scaling
4-Be Bethe
4-Be Collision
4-Be Ionization
4-Be Excitation
Stopping Power - dE/dX (Mev*barns) (10^3)
Incident Electron Energy (MeV) (10^-3)


Stopping Power for Beryllium
Lin-Log Scaling
4-Be Bethe
4-Be Collision
4-Be Ionization
4-Be Excitation
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV) (10^-3)

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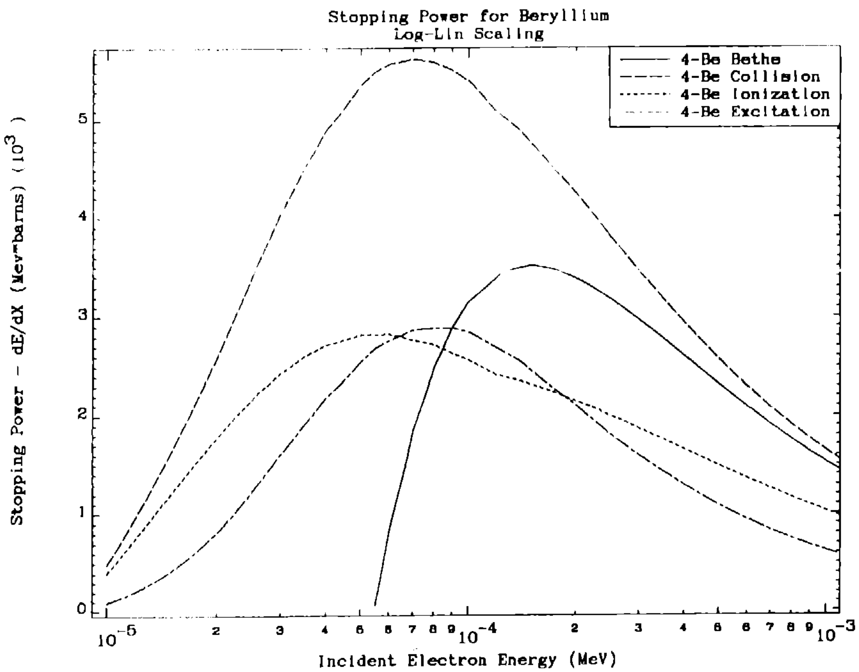
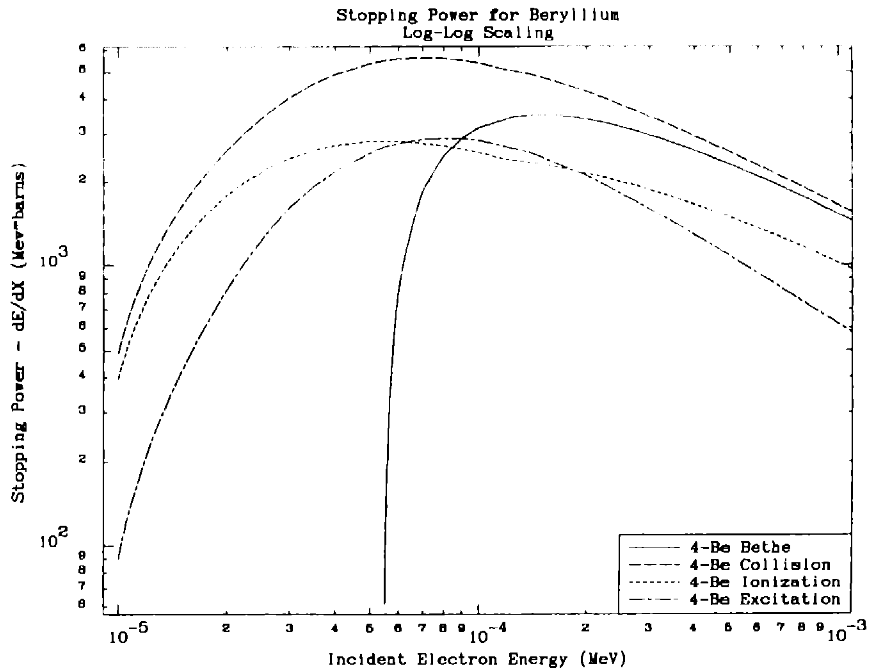

Stopping Power for Beryllium
Log-Lin Scaling
4-Be Bethe
4-Be Collision
4-Be Ionization
4-Be Excitation
Stopping Power - dE/dX (Mev*barns) (10^3)
Incident Electron Energy (MeV)


Stopping Power for Beryllium
Log-Log Scaling
4-Be Bethe
4-Be Collision
4-Be Ionization
4-Be Excitation
Stopping Power - dE/dX (Mev*barns)
Incident Electron Energy (MeV)

Linear vs. Log Interpolation

The preceding example illustrated the effect of presenting exactly the same data using either linear or log scaling in the X and/or Y directions. Here we illustrate the effect of using either linear or log interpolation to define data between the points where it is tabulated.

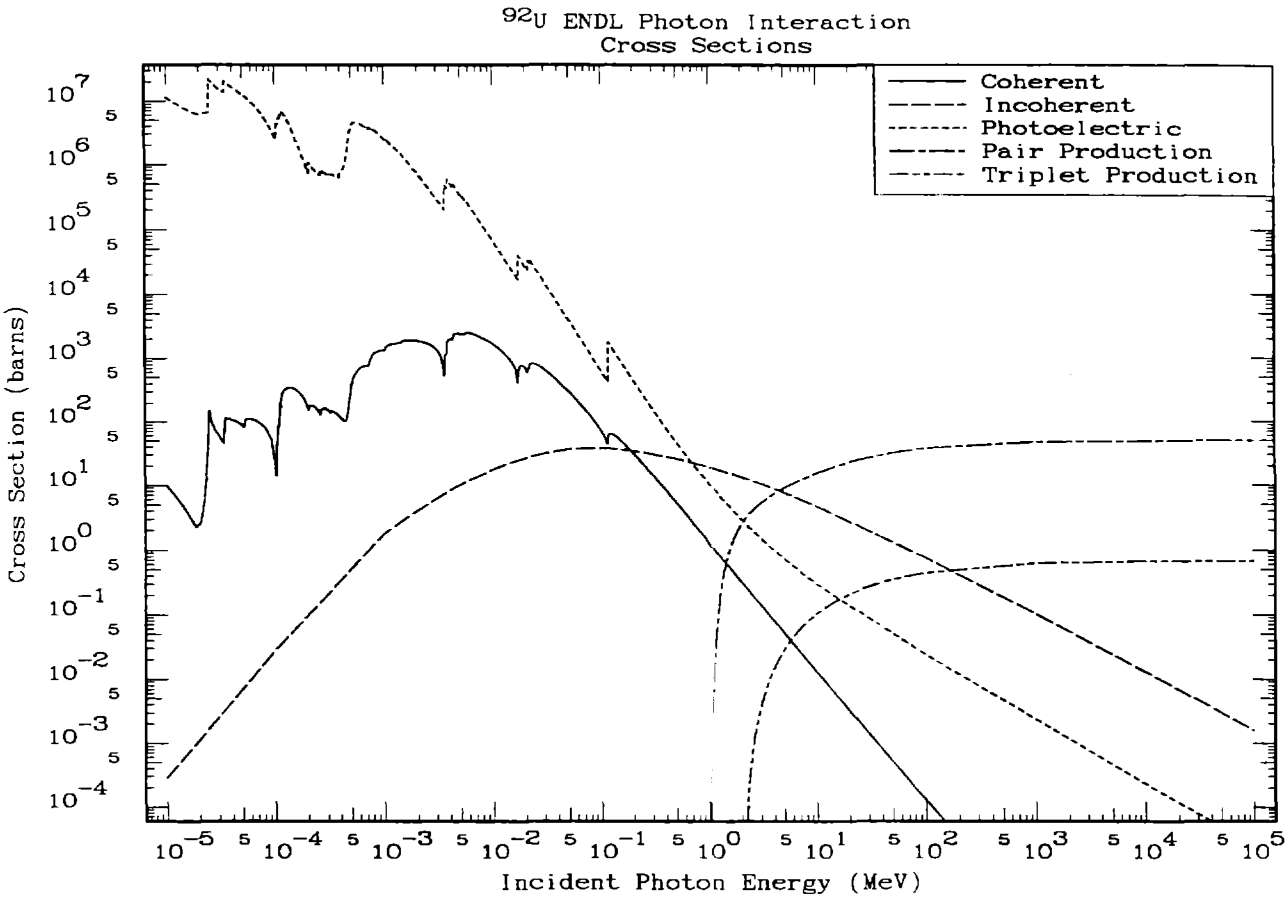
*The ENDL photon interaction cross sections are defined to be log-log interpolable between tabulated values. The plot on the upper half of the following page illustrates the results obtained using log-log interpolation between tabulated values. The input parameters indicate log interpolation for X and Y by using -2 in columns 34-44 of the 7-th (for X) and 8-th (for Y) input lines. At high photon energies the cross sections all follow simple power laws, i.e., vary as E**n. As such, at high energies the cross sections can be represented by just a few widely spaced tabulated energy points with log-log interpolation between tabulated values.*

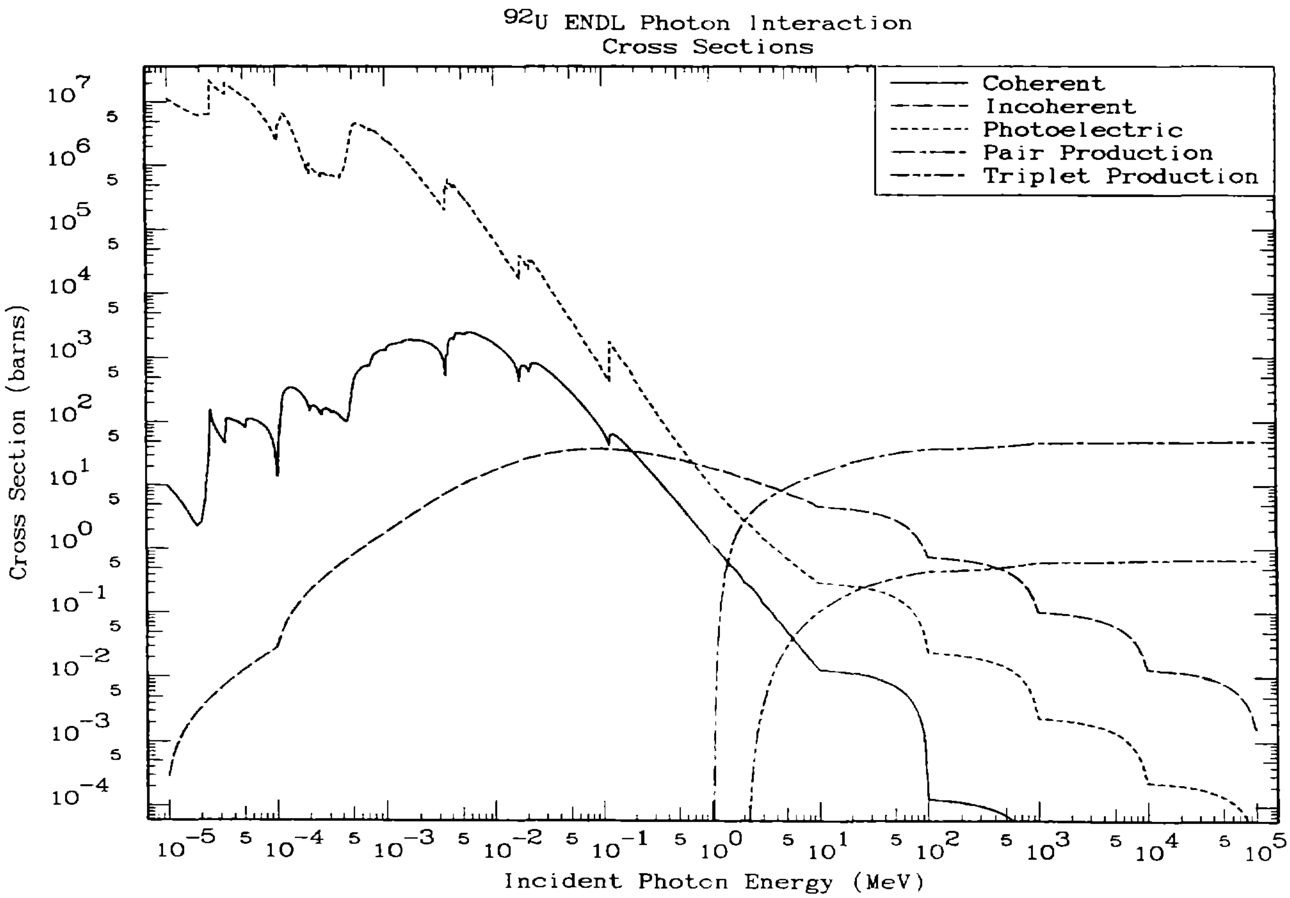
The plot in the lower half of the following page illustrates the results obtained using linear-linear interpolation between tabulated values. Note, the "bumps" or "bubbles" at high energy, due to improperly interpolating between the tabulated values. In this example improperly interpolating can lead to values of the cross section which are an order of magnitude or more too large at some energies; needless to say similar results will occur in integrals.

Hopefully this example clearly illustrates the importance of properly interpolating data, not only in order to obtain acceptable plots using this code, but even more importantly in using data in applications, e.g., in a Monte Carlo transport code linearly interpolating high energy photon interaction cross sections can overestimate the actual cross sections by an order of magnitude or more.

```
    0.00000  -13.50000    0.00000   10.0                1             2 1.5
        -30          0          0          0          0            -2    0
Incident Photon Energy (MeV)
Cross Section (barns)
{9{2 U ENDL Photon Interaction
Cross Sections
                                0         -2          0          0
 1.00000- 4                     0         -2          0          0
{9{2 U ENDL Photon Interaction
Cross Sections
                                0          2          0          0
 1.00000- 4                     0          2          0          0
```

63


92U ENDL Photon Interaction
Cross Sections
Coherent
Incoherent
Photoelectric
Pair Production
Triplet Production
Cross Section (barns)
Incident Photon Energy (MeV)


92U ENDL Photon Interaction
Cross Sections
Coherent
Incoherent
Photoelectric
Pair Production
Triplet Production
Cross Section (barns)
Incident Photon Energy (MeV)

Line Thicknesses

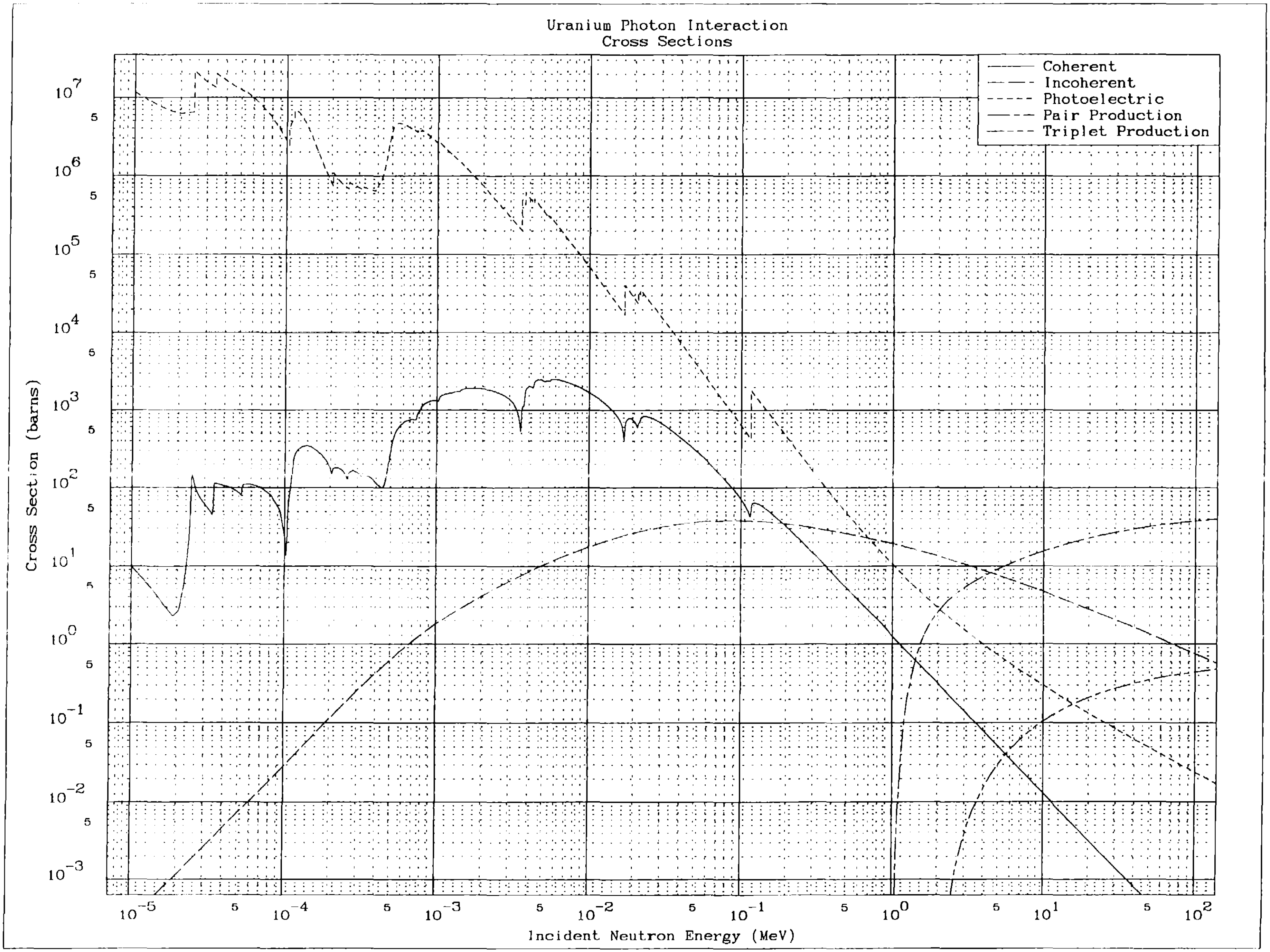
The following example illustrates the effect of using line thicknesses 0 through -5 (thick lines, but not characters). Line thickness is controlled by cols. 56-66 of the second input line. This example also includes a border around each plot (cols. 23-33 of the second input line), a solid-dash grid (cols. 34-44 of the second input line) and log-log interpolation between tabulated data points (cols. 34-44 of the 7-th [for X] and 8-th [for Y] input lines - in this case this option is set to -2 to force log scaling and interpolation).

In this example it can be seen that since we decided that we need a grid on the plot, at thickness 0 it is difficult to see the actual curves; this becomes even more true when any portion of a curve approaches being horizontal or vertical. Thickness can be used to make the curves stand out from the background and generally make the plots more acceptable for use in publications.

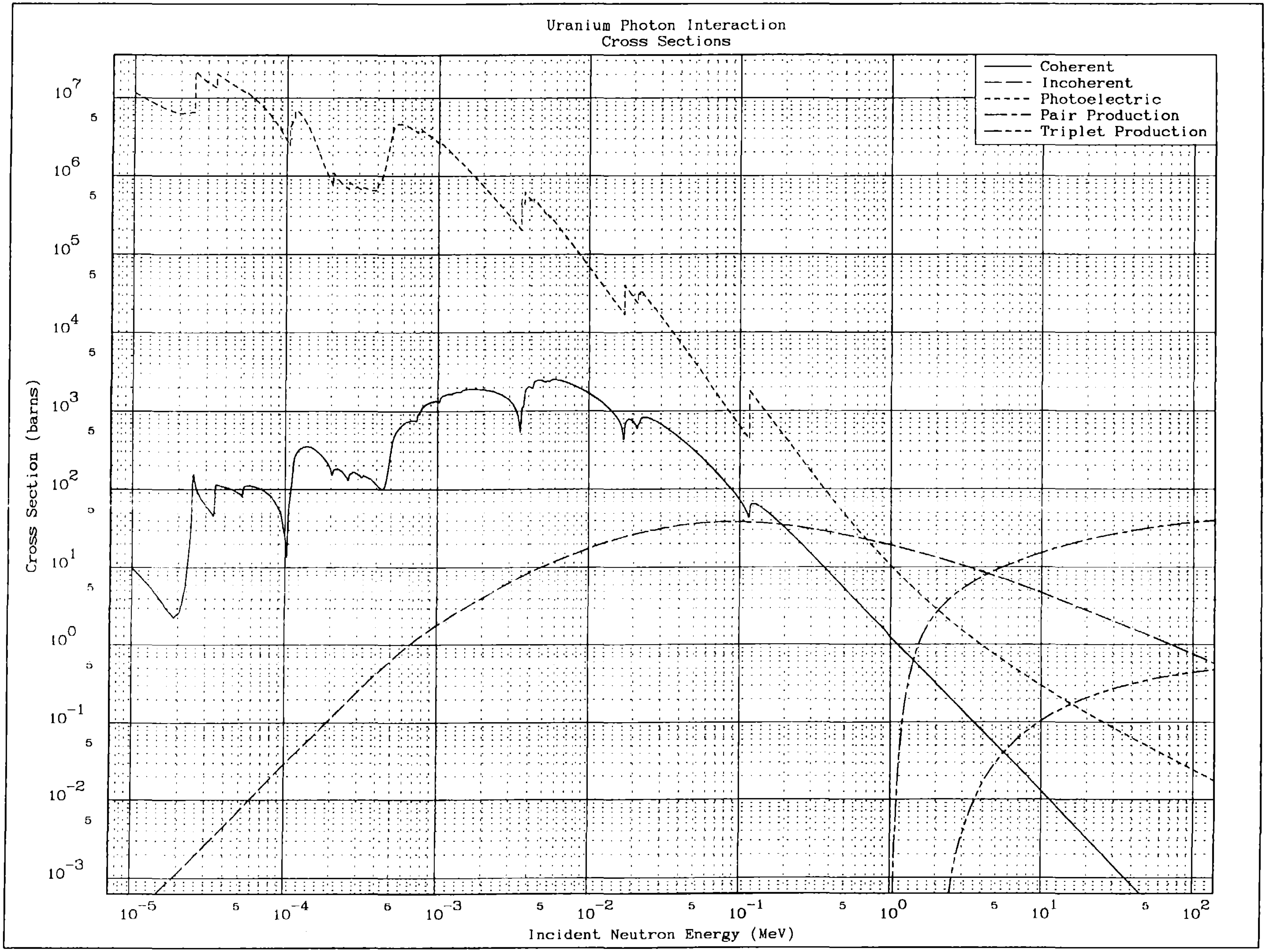
Line thicknesses should be used carefully, since it can be quite expensive and time consuming to produce plots with thick lines. For low resolution plotting devices (e.g., pen and paper plotters) it can also be a waste of time, since the small offset in strokes used by this code to create line thickness may be less than the resolution of your plotter.

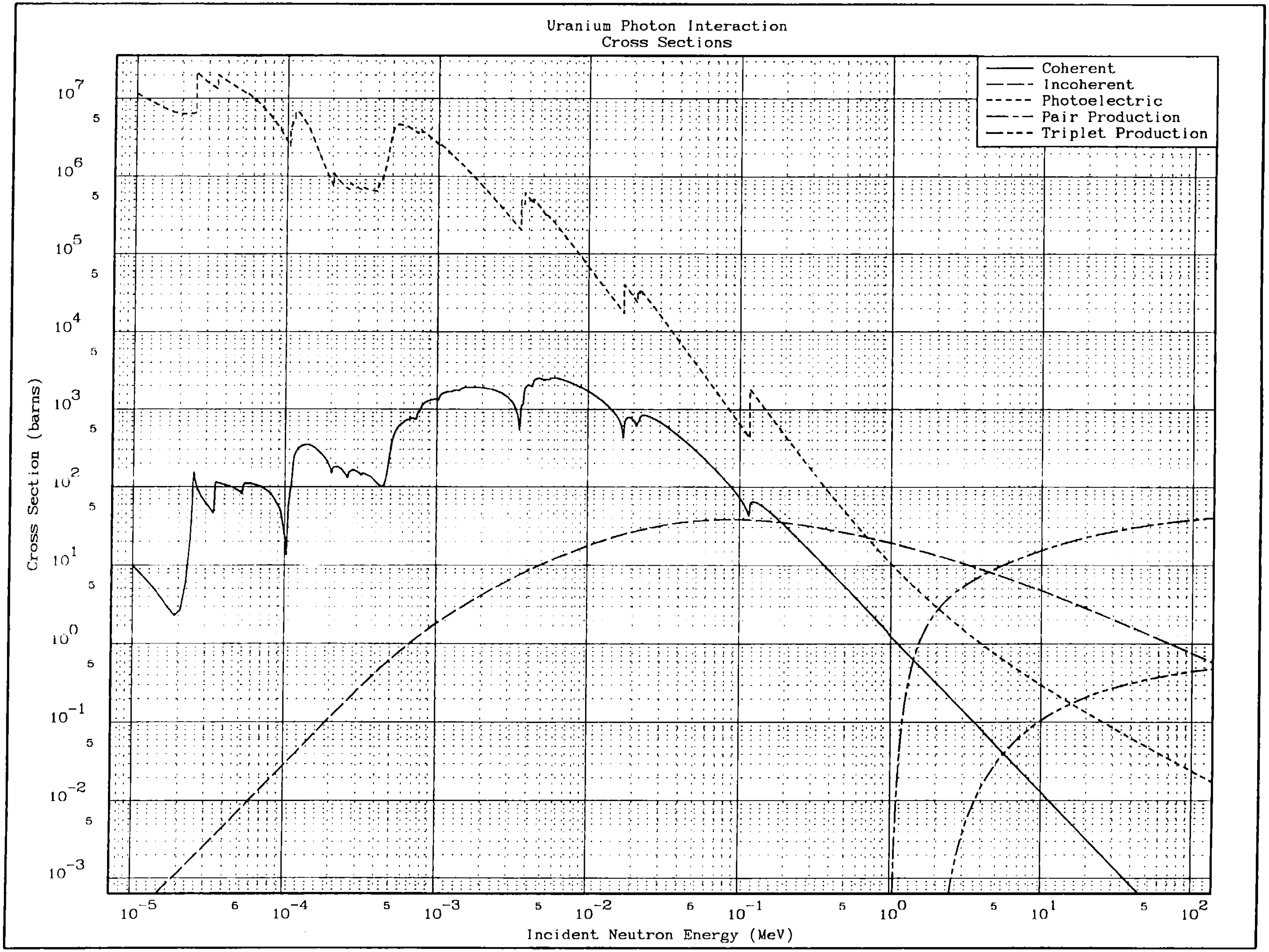
On low resolution plotters line thickness should not be used. On high resolution plotters generally good quality plots can be obtained using line thickness -2. For an illustration of extensive results using a dashed grid and line thickness -2 see UCRL-50400, Vol. 6 and 30, the documentation for the Livermore photon and electron interaction data.

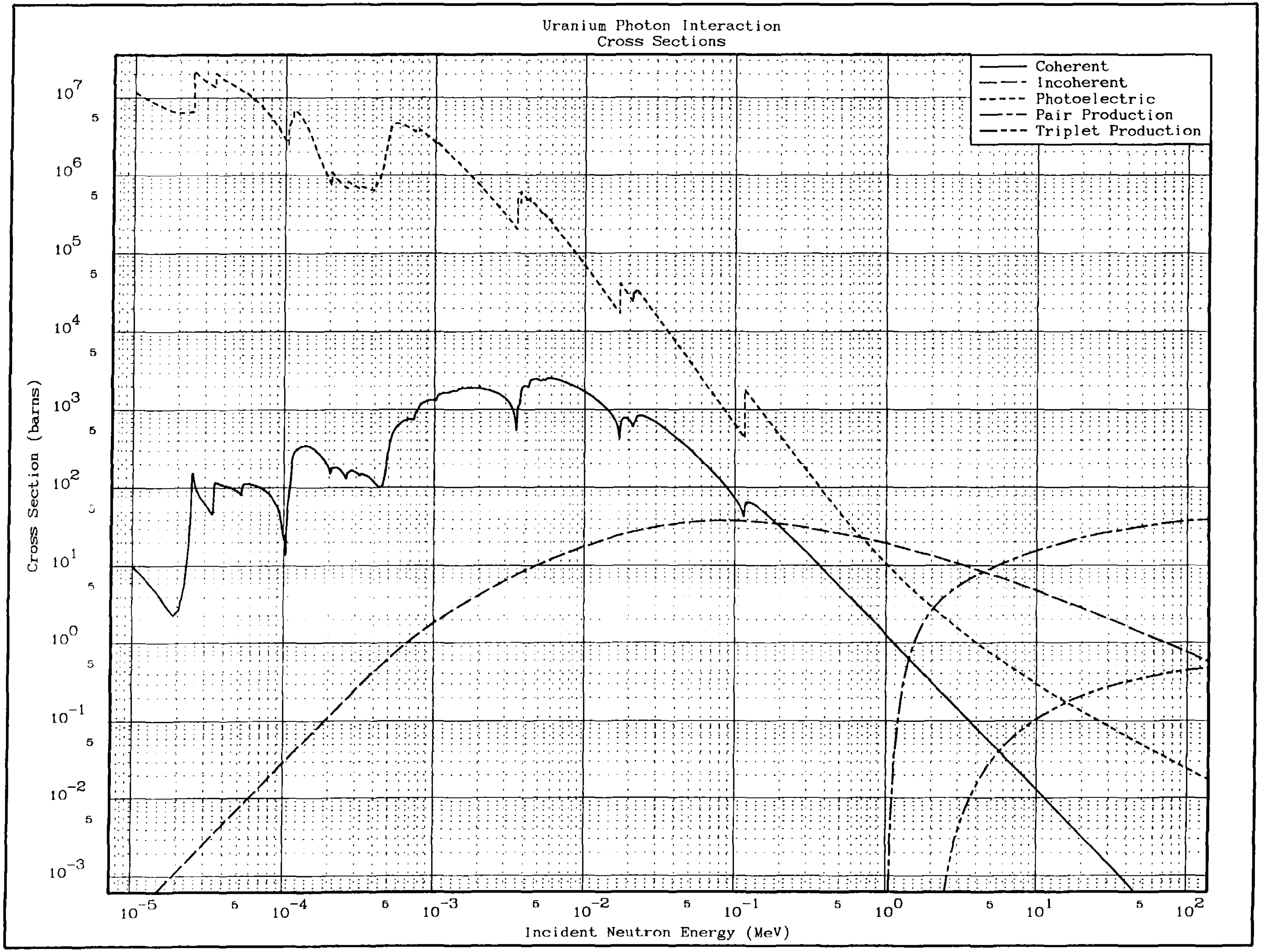
```
                        65

   0.00000   13.50000    0.00000   10.0              1          1 1.0
        -5          0          1          4          0          0   0
Incident Neutron Energy (MeV)
Cross Section (barns)
Uranium Photon Interaction
Cross Sections
           1.00000+ 2          0         -2          0          0
 1.00000- 3                    0         -2          0          0

   0.00000   13.50000    0.00000   10.0              1          1 1.0
        -5          0          1          4          0         -1   0
Incident Neutron Energy (MeV)
Cross Section (barns)
Uranium Photon Interaction
Cross Sections
           1.00000+ 2          0         -2          0          0
 1.00000- 3                    0         -2          0          0

   0.00000   13.50000    0.00000   10.0              1          1 1.0
        -5          0          1          4          0         -2   0
Incident Neutron Energy (MeV)
Cross Section (barns)
Uranium Photon Interaction
Cross Sections
           1.00000+ 2          0         -2          0          0
 1.00000- 3                    0         -2          0          0

   0.00000   13.50000    0.00000   10.0              1          1 1.0
        -5          0          1          4          0         -3   0
Incident Neutron Energy (MeV)
Cross Section (barns)
Uranium Photon Interaction
Cross Sections
           1.00000+ 2          0         -2          0          0
 1.00000- 3                    0         -2          0          0

   0.00000   13.50000    0.00000   10.0              1          1 1.0
        -5          0          1          4          0         -4   0
Incident Neutron Energy (MeV)
Cross Section (barns)
Uranium Photon Interaction
Cross Sections
           1.00000+ 2          0         -2          0          0
 1.00000- 3                    0         -2          0          0

   0.00000   13.50000    0.00000   10.0              1          1 1.0
        -5          0          1          4          0         -5   0
Incident Neutron Energy (MeV)
Cross Section (barns)
Uranium Photon Interaction
Cross Sections
           1.00000+ 2          0         -2          0          0
 1.00000- 3                    0         -2          0          0
```



Uranium Photon Interaction
Cross Sections
Coherent
Incoherent
Photoelectric
Pair Production
Triplet Production
Cross Section (barns)
Incident Neutron Energy (MeV)


Uranium Photon Interaction
Cross Sections
Coherent
Incoherent
Photoelectric
Pair Production
Triplet Production
Cross Section (barns)
Incident Neutron Energy (MeV)
10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1} 10^{2} 10^{3} 10^{4} 10^{5} 10^{6} 10^{7}
10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1} 10^{2}


Uranium Photon Interaction
Cross Sections
Coherent
Incoherent
Photoelectric
Pair Production
Triplet Production
Cross Section (barns)
Incident Neutron Energy (MeV)



Uranium Photon Interaction
Cross Sections
Coherent
Incoherent
Photoelectric
Pair Production
Triplet Production
Cross Section (barns)
10^{7}
10^{6}
10^{5}
10^{4}
10^{3}
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
Incident Neutron Energy (MeV)

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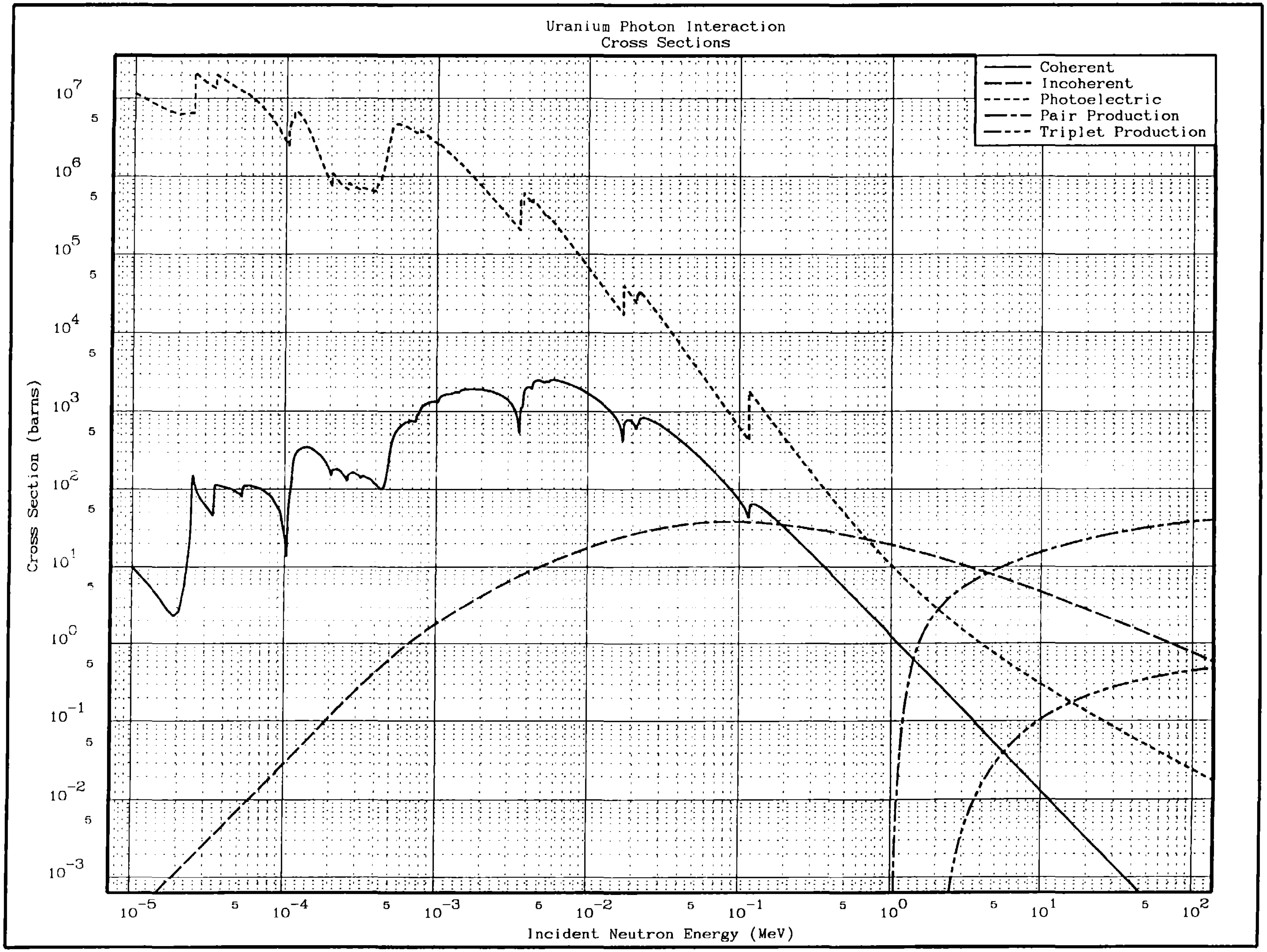
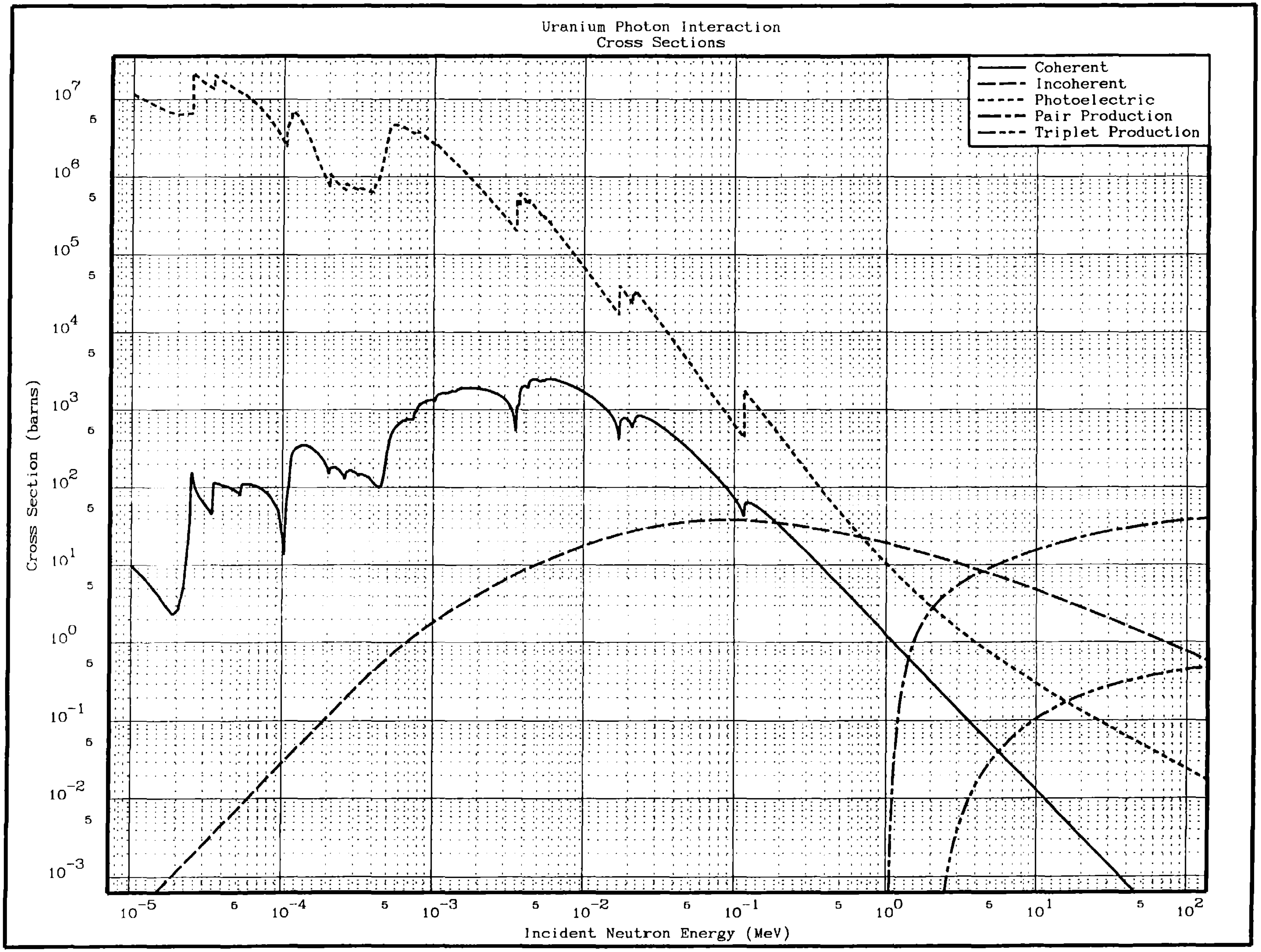

Uranium Photon Interaction
Cross Sections
Coherent
Incoherent
Photoelectric
Pair Production
Triplet Production
Cross Section (barns)
Incident Neutron Energy (MeV)
10^{-5} 5 10^{-4} 5 10^{-3} 5 10^{-2} 5 10^{-1} 5 10^{0} 5 10^{1} 5 10^{2}
10^{7} 10^{6} 10^{5} 10^{4} 10^{3} 10^{2} 10^{1} 10^{0} 10^{-1} 10^{-2} 10^{-3}


Uranium Photon Interaction
Cross Sections
Coherent
Incoherent
Photoelectric
Pair Production
Triplet Production
Cross Section (barns)
Incident Neutron Energy (MeV)
10^{7}
10^{6}
10^{5}
10^{4}
10^{3}
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}

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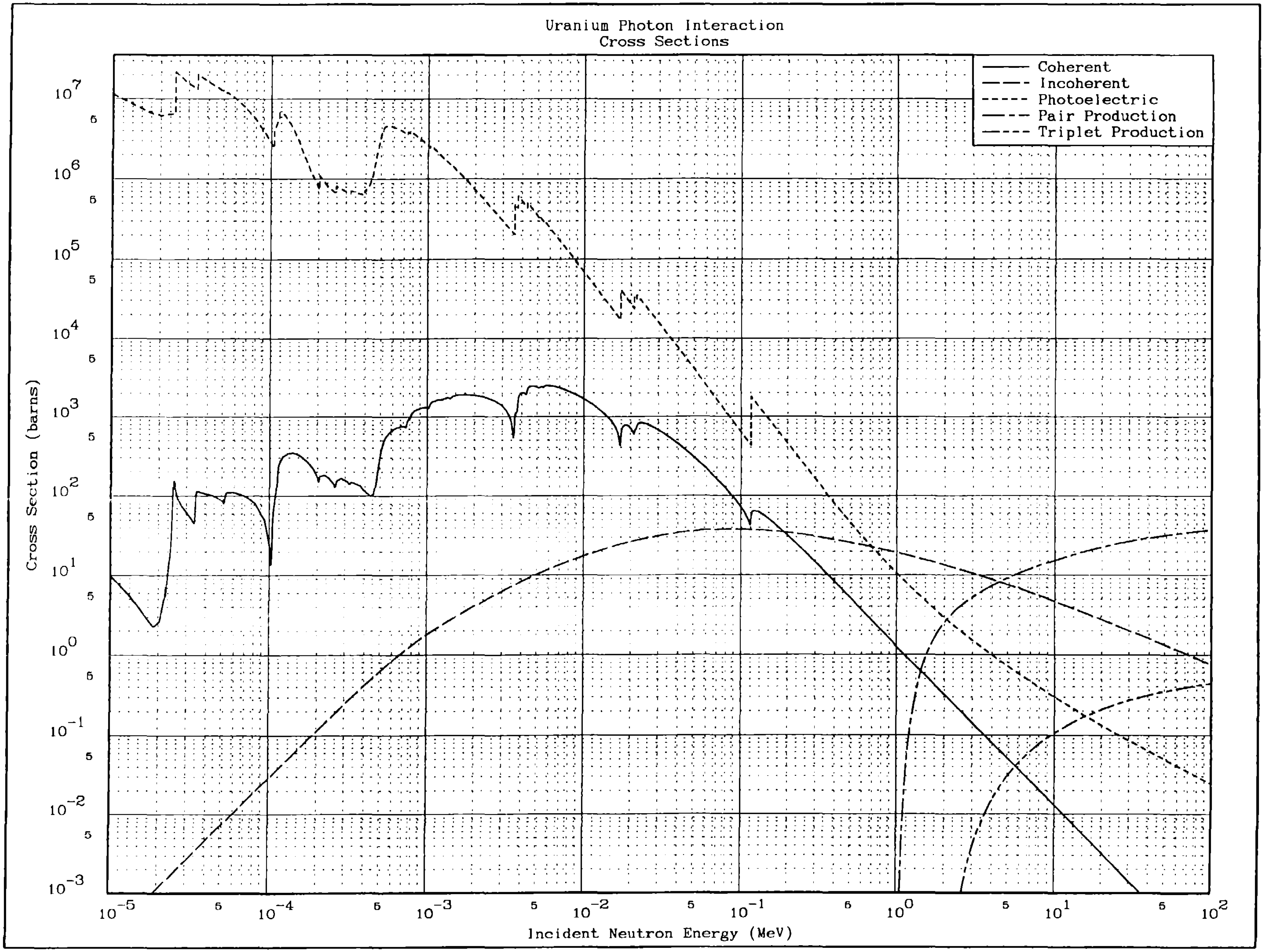
Rounded vs. Non-rounded Limits

The default option for this code is that it will read the data and determine its X and Y limits (i.e., X and Y minimum and maximum). These limits will then be rounded outward from the middle of the plot to insure that all data will be clearly shown away from the border of the plot without any interference from tick marks on the border. For most applications this default option is acceptable.

However, if you wish to absolutely control the X and/or Y limits of a plot you may do so using the rounded vs. non-rounded limits option (cols. 45-55 on input line 7 [for X] and 8 [for Y]). In the following example the X limits are not rounded, so that the X limits of the plot are from the lower X limit of the data (10 eV) up to the specified upper X limit (100 MeV). Only the upper Y limit is rounded, so that the lower Y limit will be the specified Y limit (0.001 barns).

The most frequent use of this option is when the user wishes to fix the lower X and/or Y limits of a plot to exactly zero. For example, for data which is inherently non-negative (e.g., cross sections), but starts with Y = 0.0 at some threshold value, you may want to set the lower Y limit to exactly zero.

```
    0.00000   13.50000    0.00000   10.0              1          1 1.0
         -5          0          1          4          0         -2    0
Incident Neutron Energy (MeV)
Cross Section (barns)
Uranium Photon Interaction
Cross Sections
             1.00000+ 2          0         -2          1          0
 1.00000- 3                      0         -2          3          0
```


Uranium Photon Interaction
Cross Sections
Coherent
Incoherent
Photoelectric
Pair Production
Triplet Production
Cross Section (barns)
Incident Neutron Energy (MeV)

Master Curve

When a plot contains many curves you may want one curve to stand out from all the others; use of the master curve option (cols. 67-70 of the second input line) will allow you be do this.

In the following example the (n,2n) double differential spectrum due to 14.2 MeV neutrons incident on beryllium is shown at 21 fixed cosine values between -1.0 and +1.0. In addition the spectrum that results when one averages over cosine is also shown.

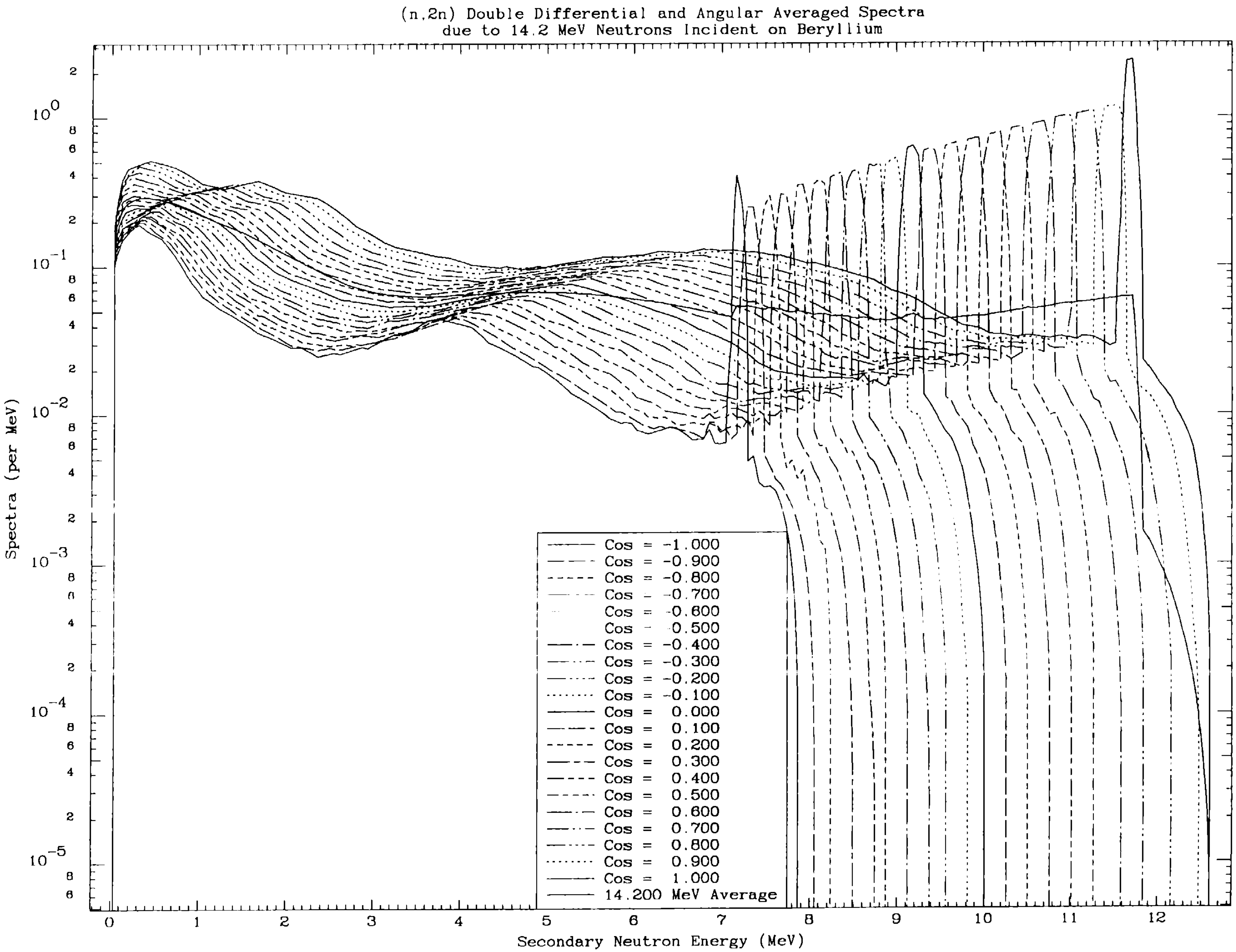
On the first plot the master curve option is not used and it is very difficult to see the average value. On the second plot the master curve option is used to make the average value stand out from all the other curves.

On a third plot the same data and options are used as were used for the second plot, except that log X scaling is used. This plot is included here merely to once again illustrate the effect that linear vs. log scaling can have on graphic results, i.e., compare the second and third plots.

```
    0.00000    13.50000    0.00000    10.0              1           1 1.0
        -22           0          0           0          0           0   0
Secondary Neutron Energy (MeV)
Spectra (per MeV)
(n,2n) Double Differential and Angular Averaged Spectra
due to 14.2 MeV Neutrons Incident on Beryllium
                                 0           1          0           0
                                 0           2          0           0

    0.00000    13.50000    0.00000    10.0              1           1 1.0
        -22           0          0           0          0           0  22
Secondary Neutron Energy (MeV)
Spectra (per MeV)
(n,2n) Double Differential and Angular Averaged Spectra
due to 14.2 MeV Neutrons Incident on Beryllium
                                 0           1          0           0
                                 0           2          0           0

    0.00000    13.50000    0.00000    10.0              1           1 1.0
        -22           0          0           0          0           0  22
Secondary Neutron Energy (MeV)
Spectra (per MeV)
(n,2n) Double Differential and Angular Averaged Spectra
due to 14.2 MeV Neutrons Incident on Beryllium
                                 0           2          0           0
                                 0           2          0           0
```


(n,2n) Double Differential and Angular Averaged Spectra
due to 14.2 MeV Neutrons Incident on Beryllium
Spectra (per MeV)
Secondary Neutron Energy (MeV)
Cos = -1.000
Cos = -0.900
Cos = -0.800
Cos = -0.700
Cos = -0.600
Cos = -0.500
Cos = -0.400
Cos = -0.300
Cos = -0.200
Cos = -0.100
Cos = 0.000
Cos = 0.100
Cos = 0.200
Cos = 0.300
Cos = 0.400
Cos = 0.500
Cos = 0.600
Cos = 0.700
Cos = 0.800
Cos = 0.900
Cos = 1.000
14.200 MeV Average

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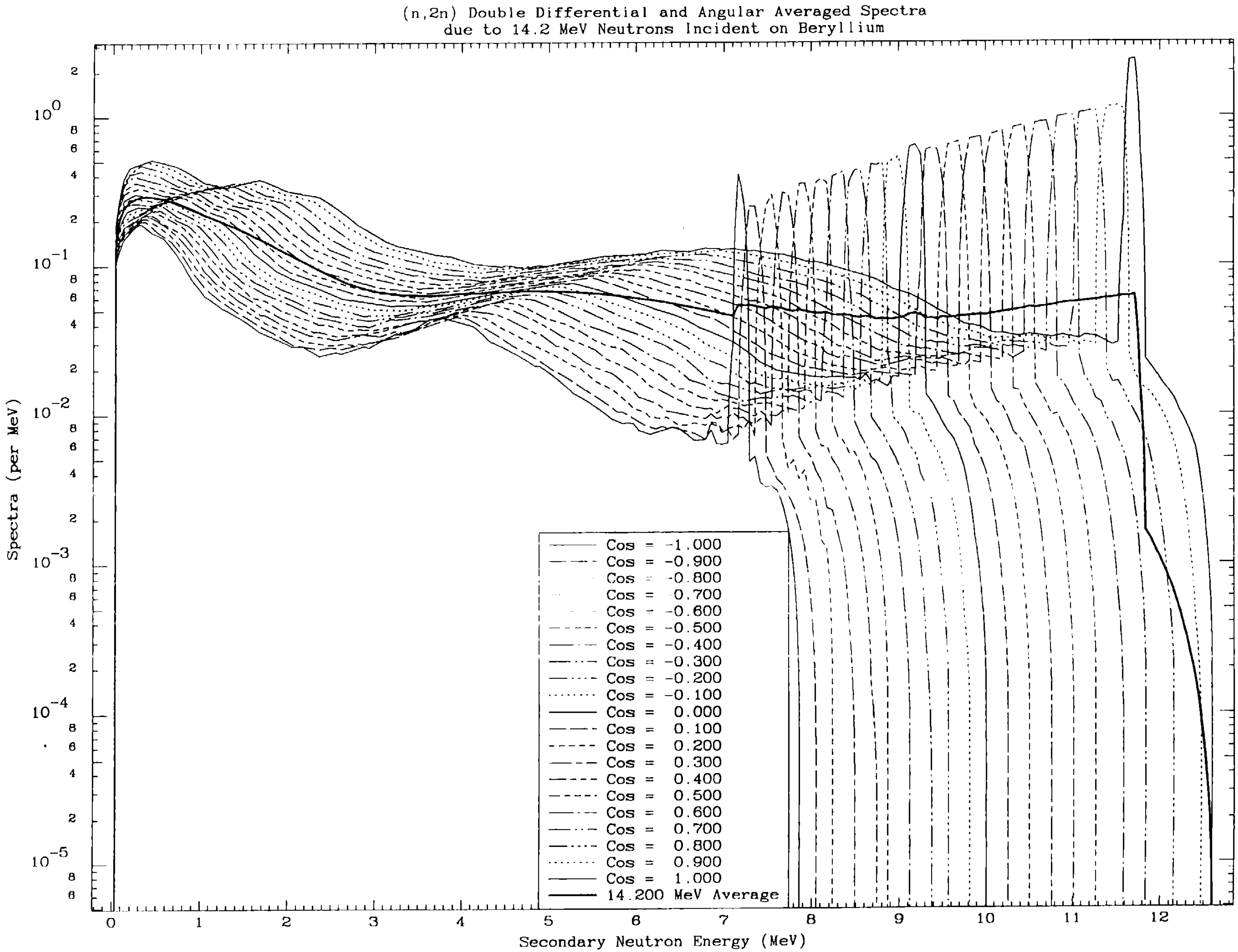
(n,2n) Double Differential and Angular Averaged Spectra
due to 14.2 MeV Neutrons Incident on Beryllium
Spectra (per MeV)
Secondary Neutron Energy (MeV)
Cos = -1.000
Cos = -0.900
Cos = -0.800
Cos = -0.700
Cos = -0.600
Cos = -0.500
Cos = -0.400
Cos = -0.300
Cos = -0.200
Cos = -0.100
Cos = 0.000
Cos = 0.100
Cos = 0.200
Cos = 0.300
Cos = 0.400
Cos = 0.500
Cos = 0.600
Cos = 0.700
Cos = 0.800
Cos = 0.900
Cos = 1.000
14.200 MeV Average

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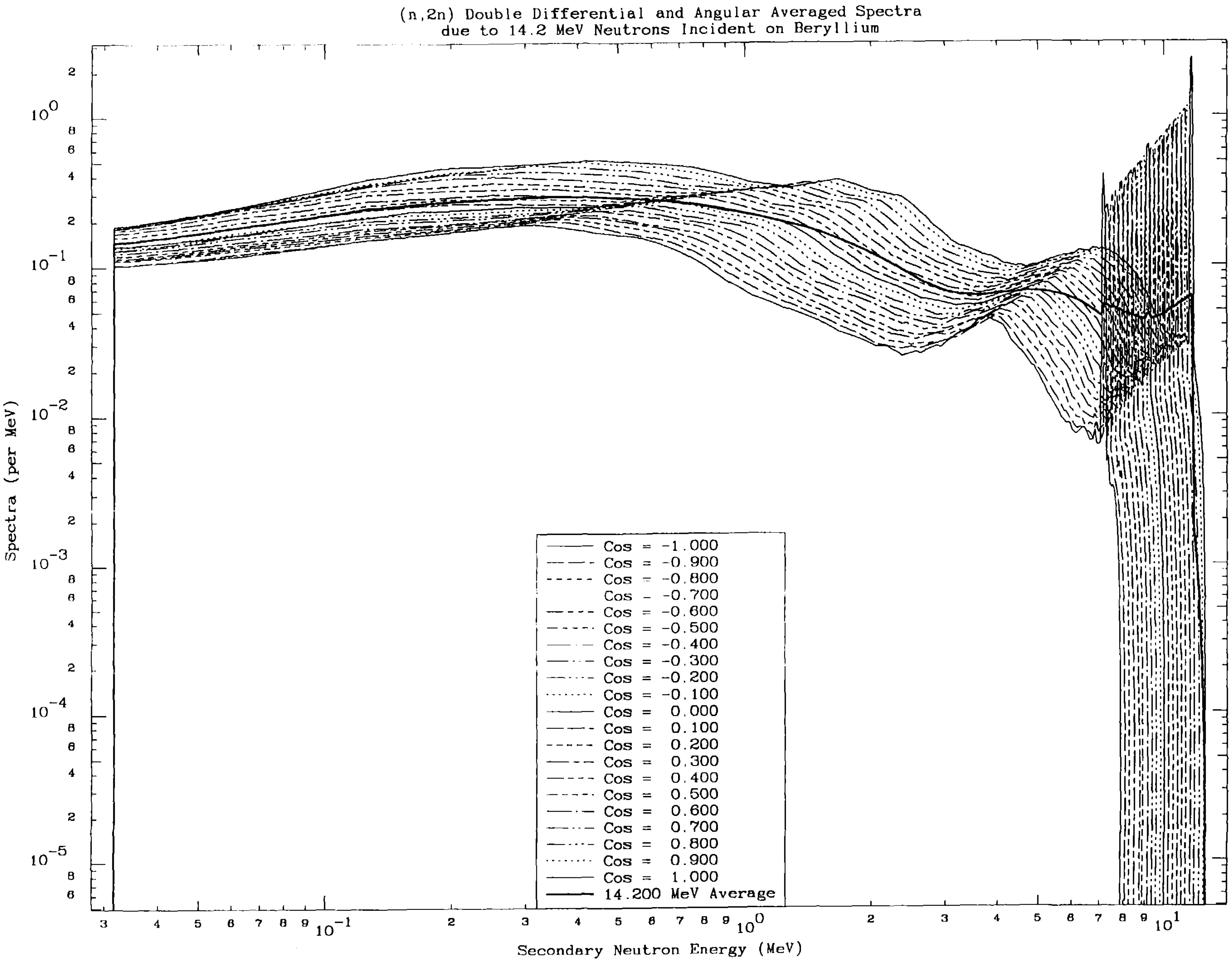
(n,2n) Double Differential and Angular Averaged Spectra
due to 14.2 MeV Neutrons Incident on Beryllium
Spectra (per MeV)
Secondary Neutron Energy (MeV)
Cos = -1.000
Cos = -0.900
Cos = -0.800
Cos = -0.700
Cos = -0.600
Cos = -0.500
Cos = -0.400
Cos = -0.300
Cos = -0.200
Cos = -0.100
Cos = 0.000
Cos = 0.100
Cos = 0.200
Cos = 0.300
Cos = 0.400
Cos = 0.500
Cos = 0.600
Cos = 0.700
Cos = 0.800
Cos = 0.900
Cos = 1.000
14.200 MeV Average

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Alternate Character Set - Super and Subscripts

The following example illustrates how to use the alternate character set, as well as super and subscripts.

To use the alternate character set each character from the alternate character set is preceded by] - using the enclosed table of alternate character set equivalences we can see that]a will be plotted as a Greek alpha. In the following example there is a plot of a number of (n,alpha) cross sections. In order to have this plotted as (n, Greek character alpha) the below input parameters includes on the second title line (n,]a) - which from the following plot can be seen to be plotted in exactly the form we require.

To use superscripts each character is preceded by {. Similarly to use subscripts each character is preceded by }. For the following plot the titles in the curve file (PLOTTAB.CUR) are of the form,

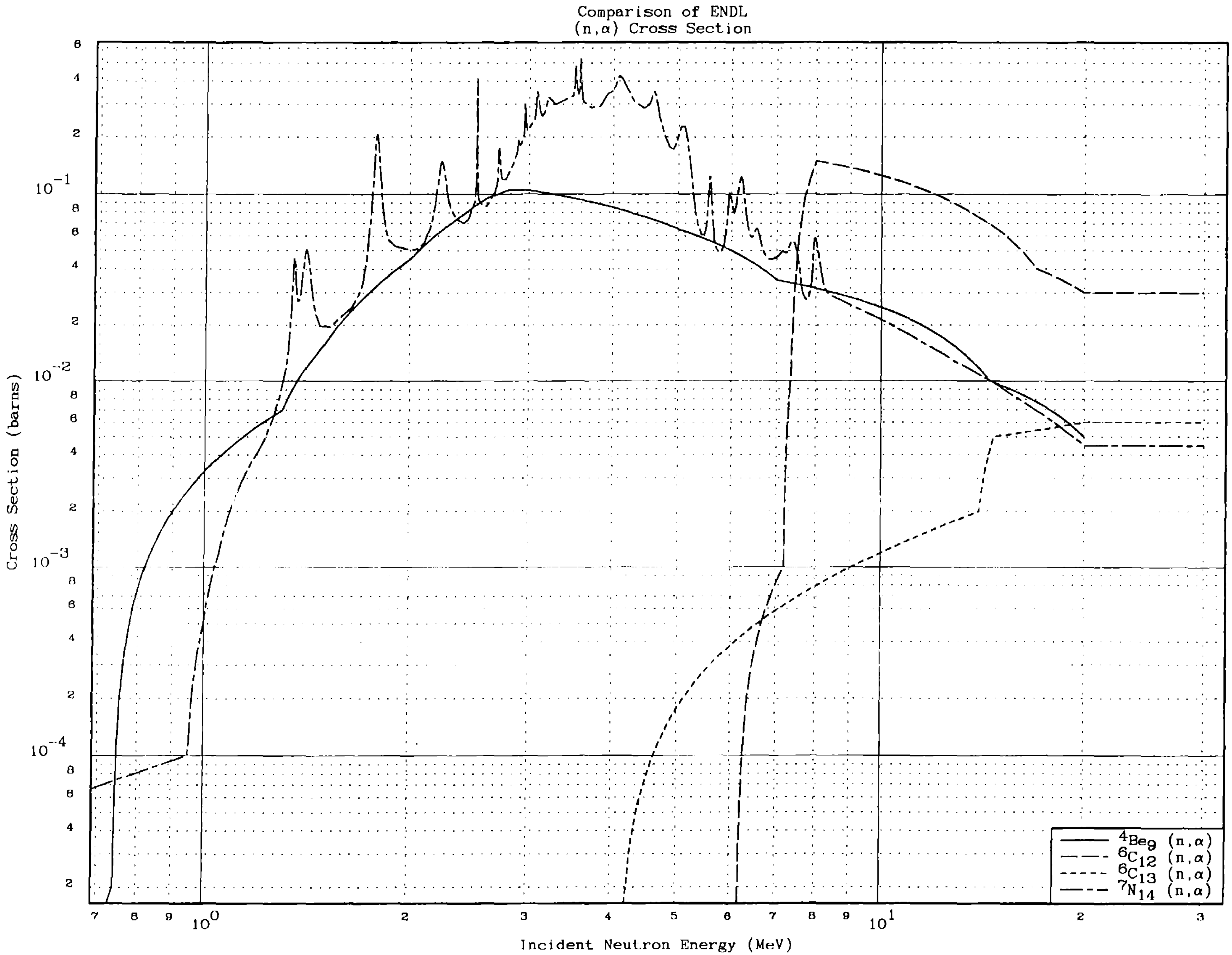
{6C}1}2

which from the following plot we can see is plotted as,

superscript 6, C, subscript 1, subscript 2

The input parameters used to produce the following plot are listed below.

```
    0.00000   13.50000    0.00000   10.0               1           1 1.0
         -4          0          0          4          0          -2    0
Incident Neutron Energy (MeV)
Cross Section (barns)
Comparison of ENDL
(n,]a) Cross Section
                                0          2          0          0
                                0          2          0          0
```


Comparison of ENDL
(n,α) Cross Section
Cross Section (barns)
Incident Neutron Energy (MeV)
4Be9 (n,α)
6C12 (n,α)
6C13 (n,α)
7N14 (n,α)

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Change Character Size

In the following example each of the three plots contains exactly the same data and the only difference between them is that each has a different multiplier for the character size (cols. 67-70 on the first line). The three plots have character size multipliers of 0.7, 1.0 and 1.5, respectively.

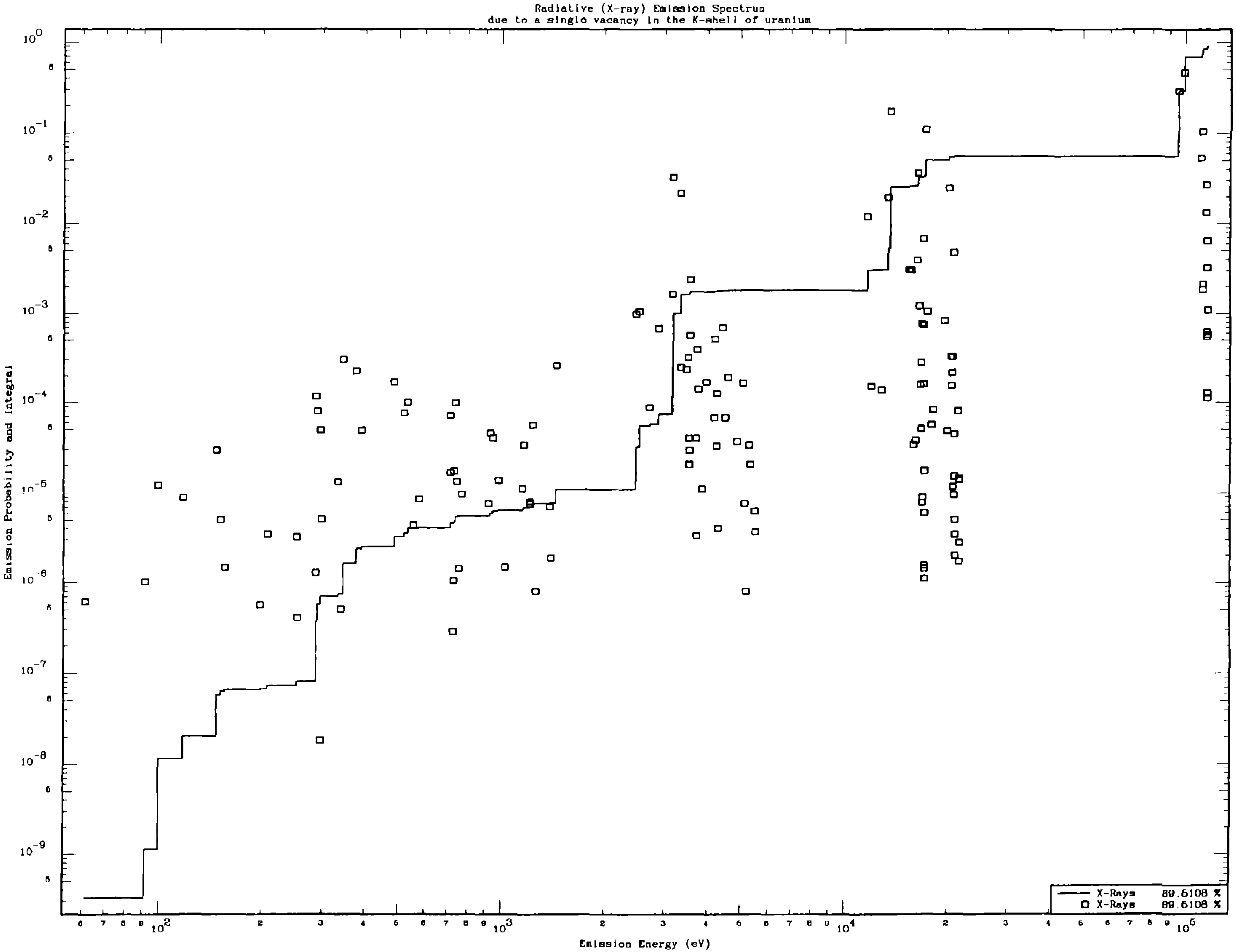
These multipliers correspond to roughly increasing the size of the characters to 150 % in each successful plot; an increase in the area of the characters (which is what your eye registers) of a factor of roughly 2.25.

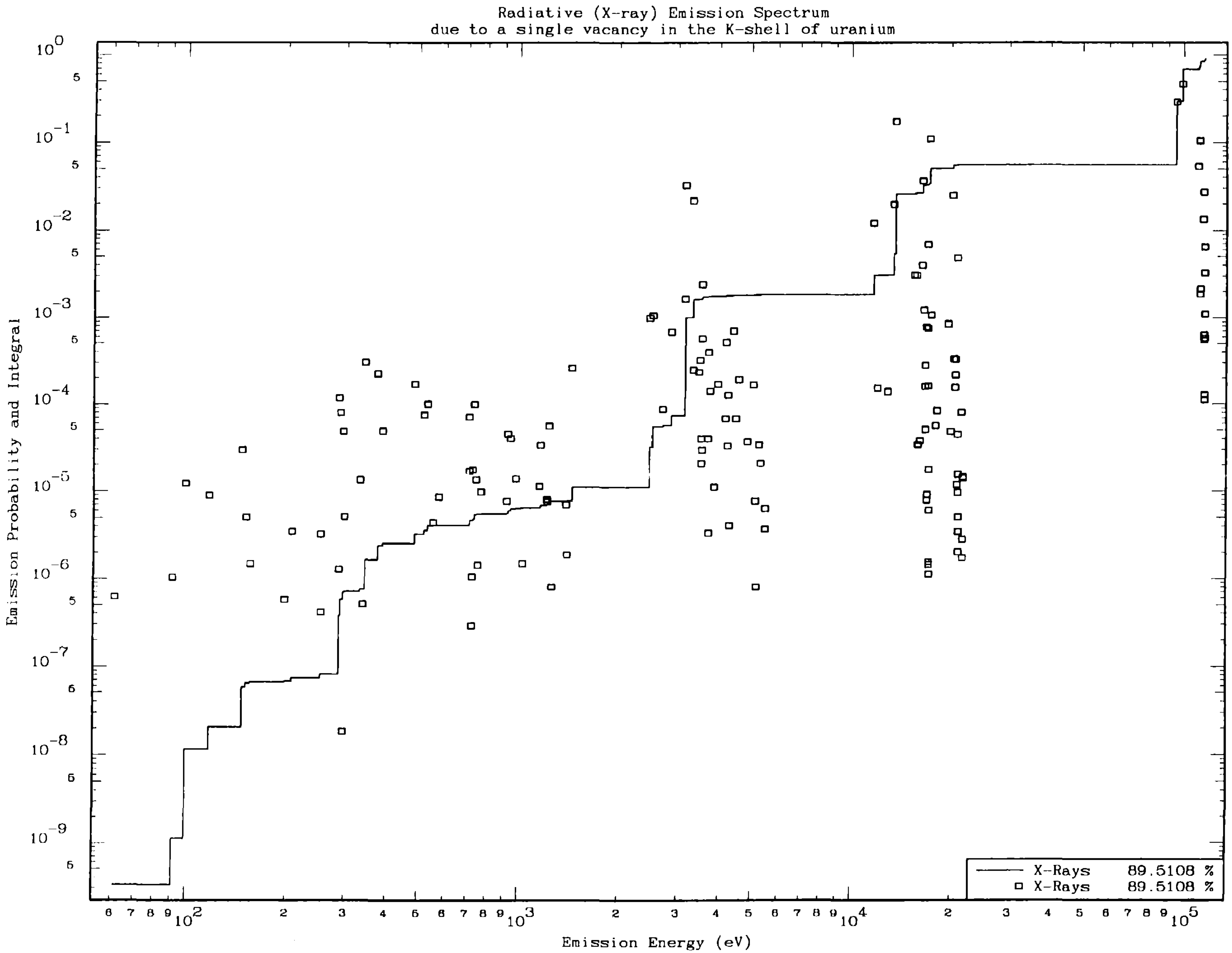
From these three plots it can be seen that for plots of this overall size the range of multipliers considered here more or less span the useful range of the character multiplier, i.e. a smaller multiplier would make the characters difficult to read and a larger multiplier would make the characters disproportionally large.

```
    0.00000   13.50000    0.00000   10.0                 1          1 0.7
         -1         -1          0          0          0         -2    0
Emission Energy (eV)
Emission Probability and Integral
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
                                0          2          0          0
                                0          2          0          0

    0.00000   13.50000    0.00000   10.0                 1          1 1.0
         -1         -1          0          0          0         -2    0
Emission Energy (eV)
Emission Probability and Integral
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
                                0          2          0          0
                                0          2          0          0

    0.00000   13.50000    0.00000   10.0                 1          1 1.5
         -1         -1          0          0          0         -2    0
Emission Energy (eV)
Emission Probability and Integral
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
                                0          2          0          0
                                0          2          0          0
```


Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
Emission Probability and Integral
Emission Energy (eV)
X-Rays 89.5108 %
X-Rays 89.5108 %


Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
Emission Probability and Integral
Emission Energy (eV)
X-Rays 89.5108 %
X-Rays 89.5108 %

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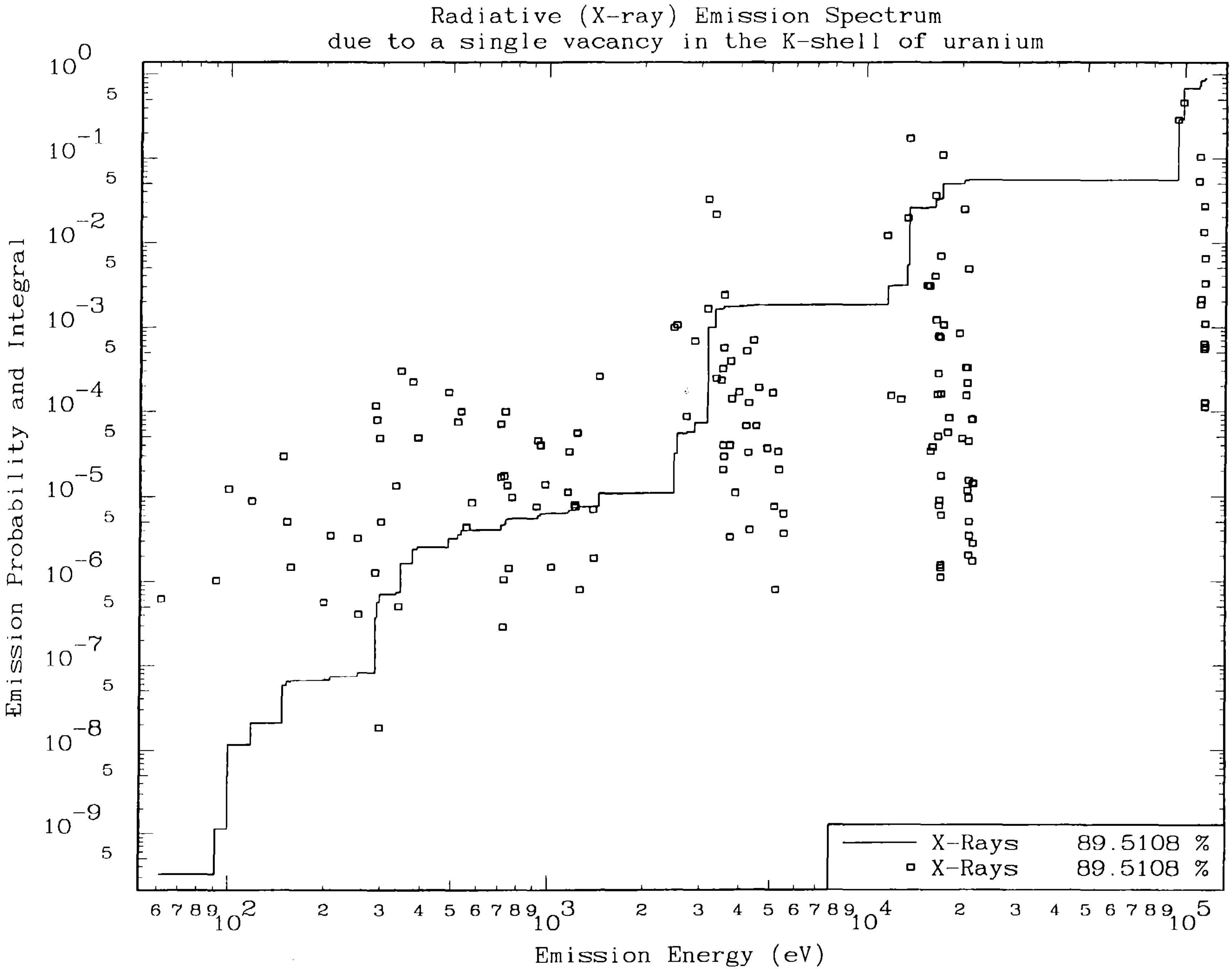
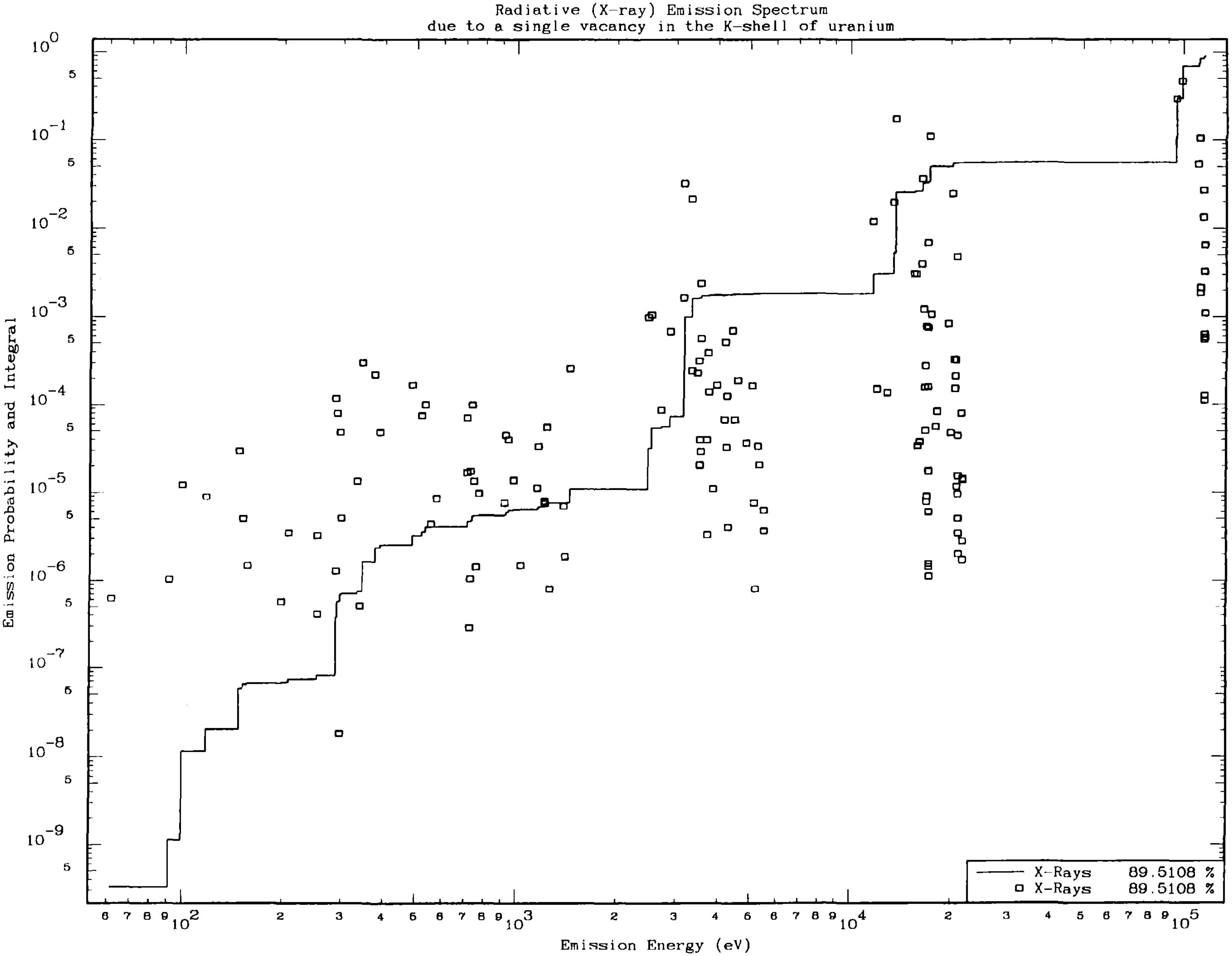
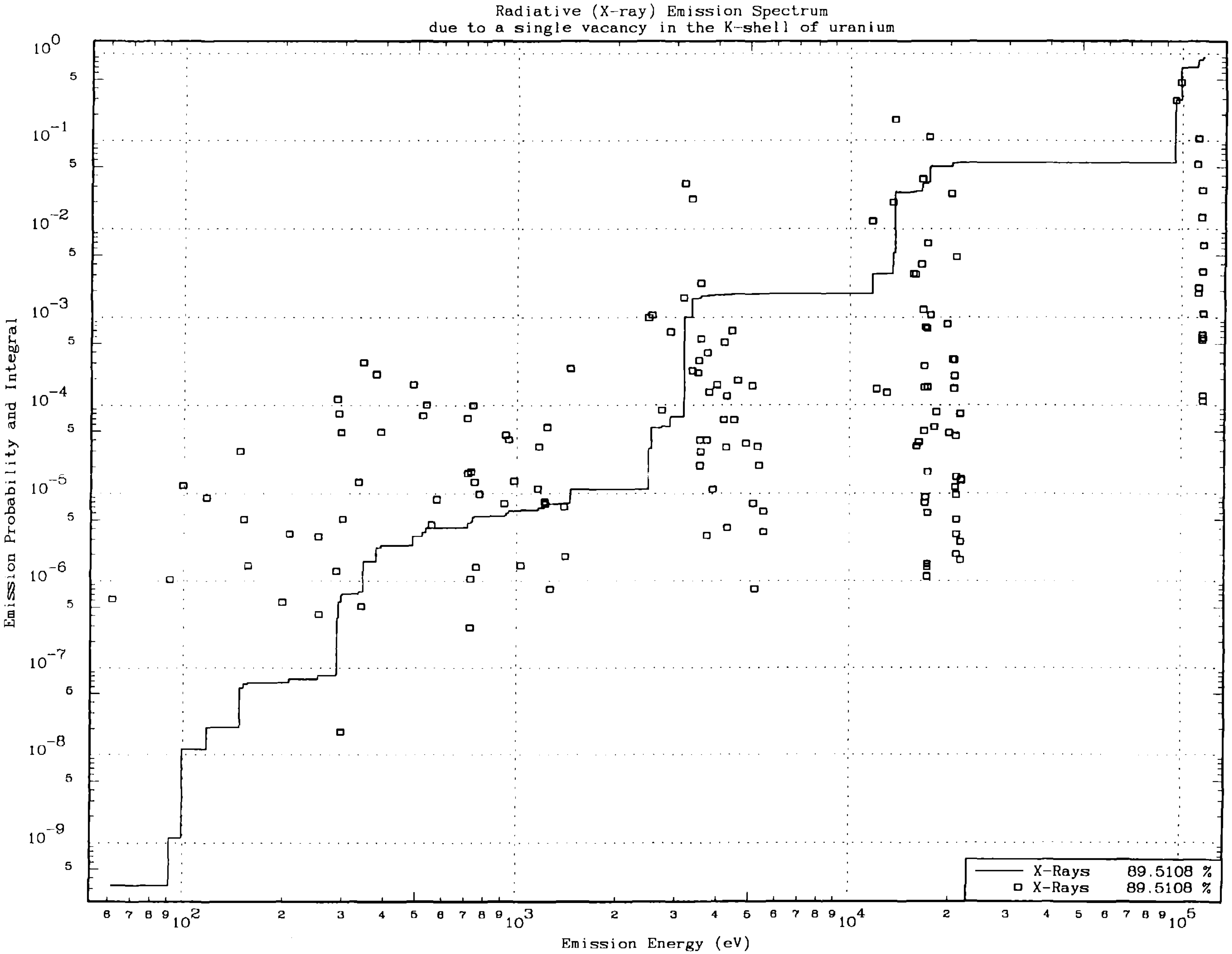

Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
Emission Probability and Integral
Emission Energy (eV)
X-Rays 89.5108 %
X-Rays 89.5108 %

Types of Grids

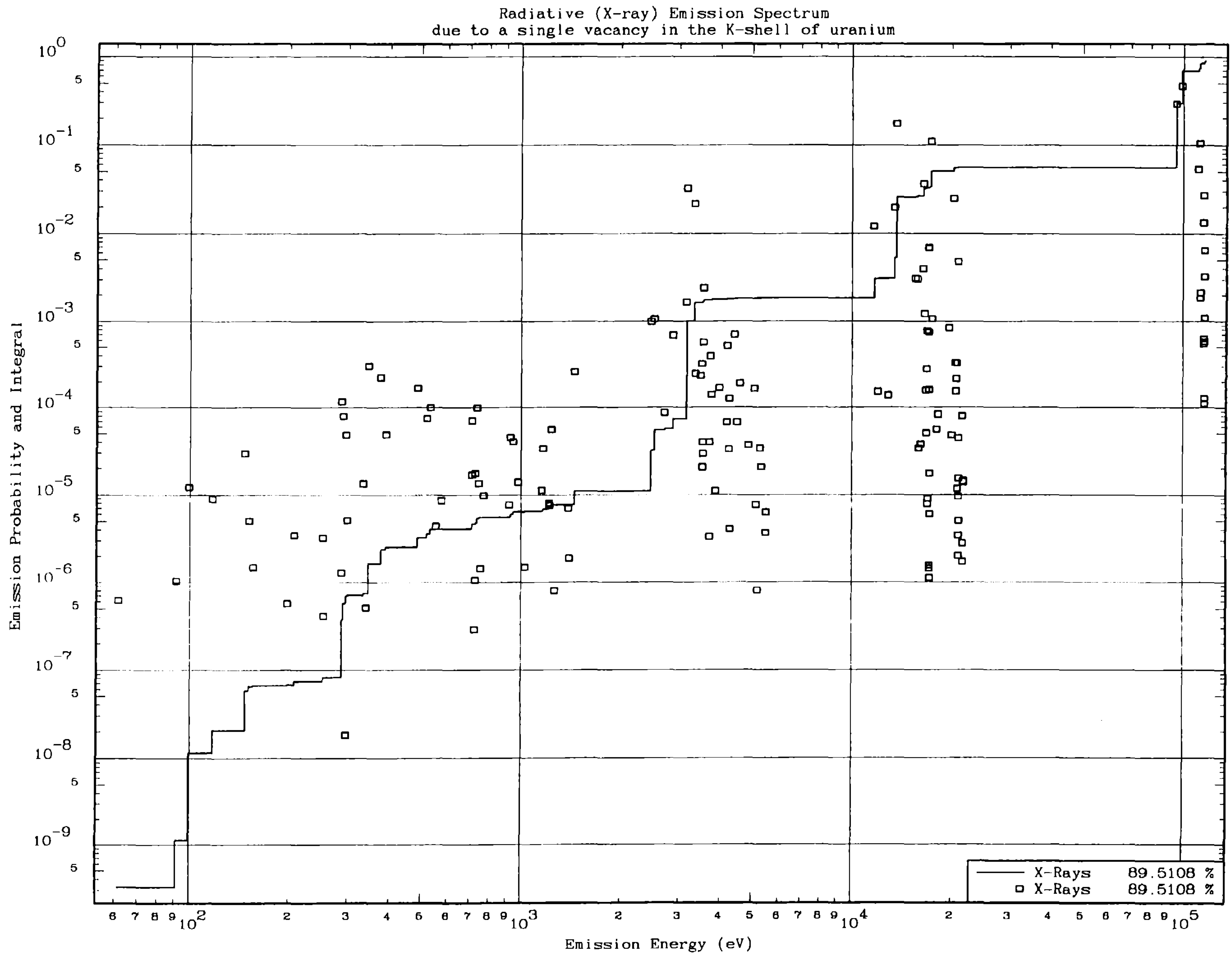
In the following example each of the six plots contains exactly the same data and the only difference between them is that each has a different type of grid, corresponding to grid types 0 through 5 (cols. 34-44 on the second line).

```
    0.00000   13.50000    0.00000   10.0                   1            1 1.0
         -1         -1          0          0               0           -2   0
Emission Energy (eV)
Emission Probability and Integral
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
                                0          2               0            0
                                0          2               0            0

    0.00000   13.50000    0.00000   10.0                   1            1 1.0
         -1         -1          0          1               0           -2   0
Emission Energy (eV)
Emission Probability and Integral
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
                                0          2               0            0
                                0          2               0            0

    0.00000   13.50000    0.00000   10.0                   1            1 1.0
         -1         -1          0          2               0           -2   0
Emission Energy (eV)
Emission Probability and Integral
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
                                0          2               0            0
                                0          2               0            0

    0.00000   13.50000    0.00000   10.0                   1            1 1.0
         -1         -1          0          3               0           -2   0
Emission Energy (eV)
Emission Probability and Integral
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
                                0          2               0            0
                                0          2               0            0

    0.00000   13.50000    0.00000   10.0                   1            1 1.0
         -1         -1          0          4               0           -2   0
Emission Energy (eV)
Emission Probability and Integral
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
                                0          2               0            0
                                0          2               0            0

    0.00000   13.50000    0.00000   10.0                   1            1 1.0
         -1         -1          0          5               0           -2   0
Emission Energy (eV)
Emission Probability and Integral
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
                                0          2               0            0
                                0          2               0            0
```

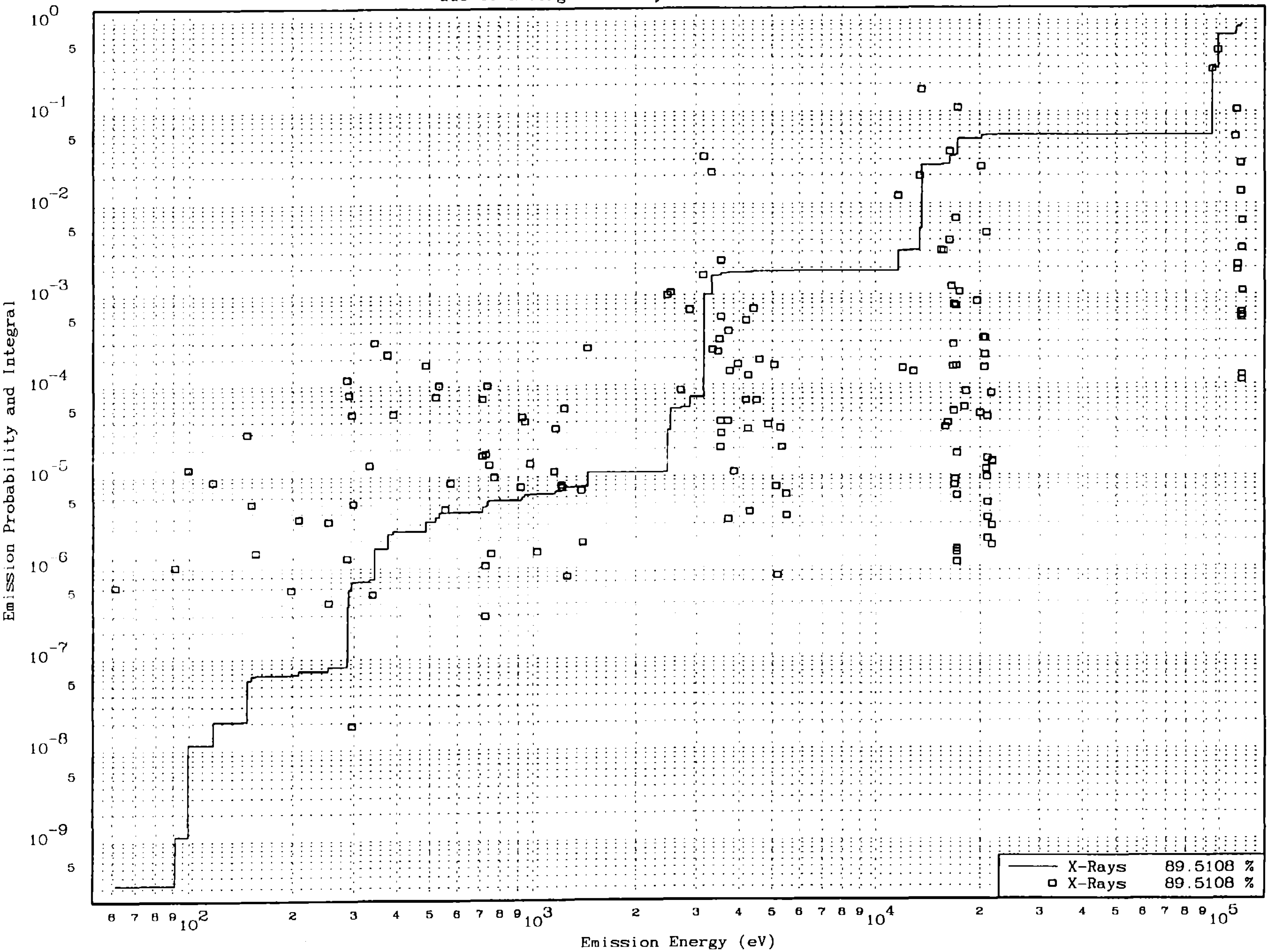

Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
Emission Probability and Integral
Emission Energy (eV)
X-Rays 89.5108 %
X-Rays 89.5108 %



Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
Emission Probability and Integral
Emission Energy (eV)
X-Rays 89.5108 %
X-Rays 89.5108 %


Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
Emission Probability and Integral
Emission Energy (eV)
X-Rays 89.5108 %
X-Rays 89.5108 %

Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium



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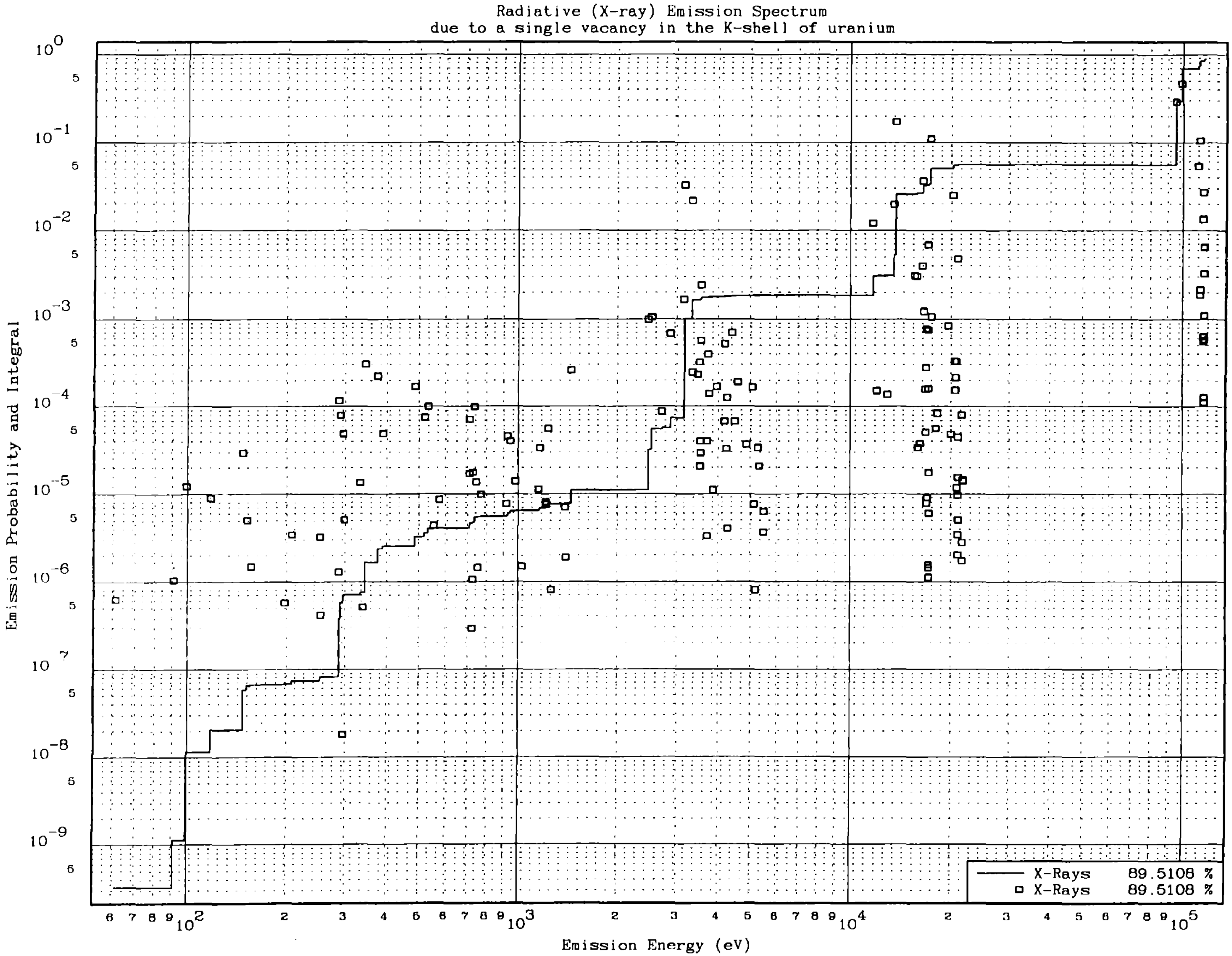
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
Emission Probability and Integral
Emission Energy (eV)
X-Rays 89.5108 %
X-Rays 89.5108 %
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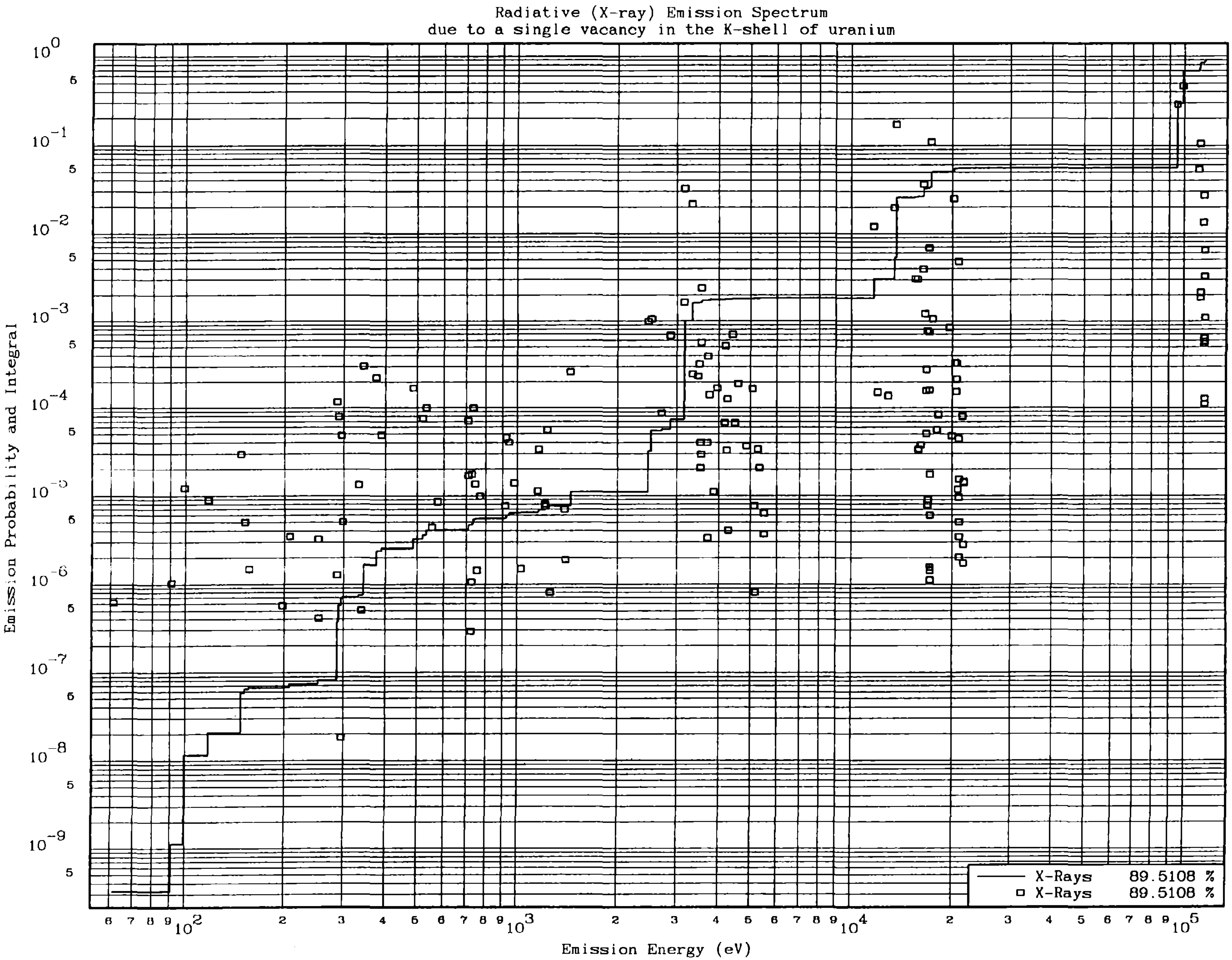
Radiative (X-ray) Emission Spectrum
due to a single vacancy in the K-shell of uranium
Emission Probability and Integral
Emission Energy (eV)
X-Rays 89.5108 %
X-Rays 89.5108 %

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Composition Mode - Non-overlapping Subplots

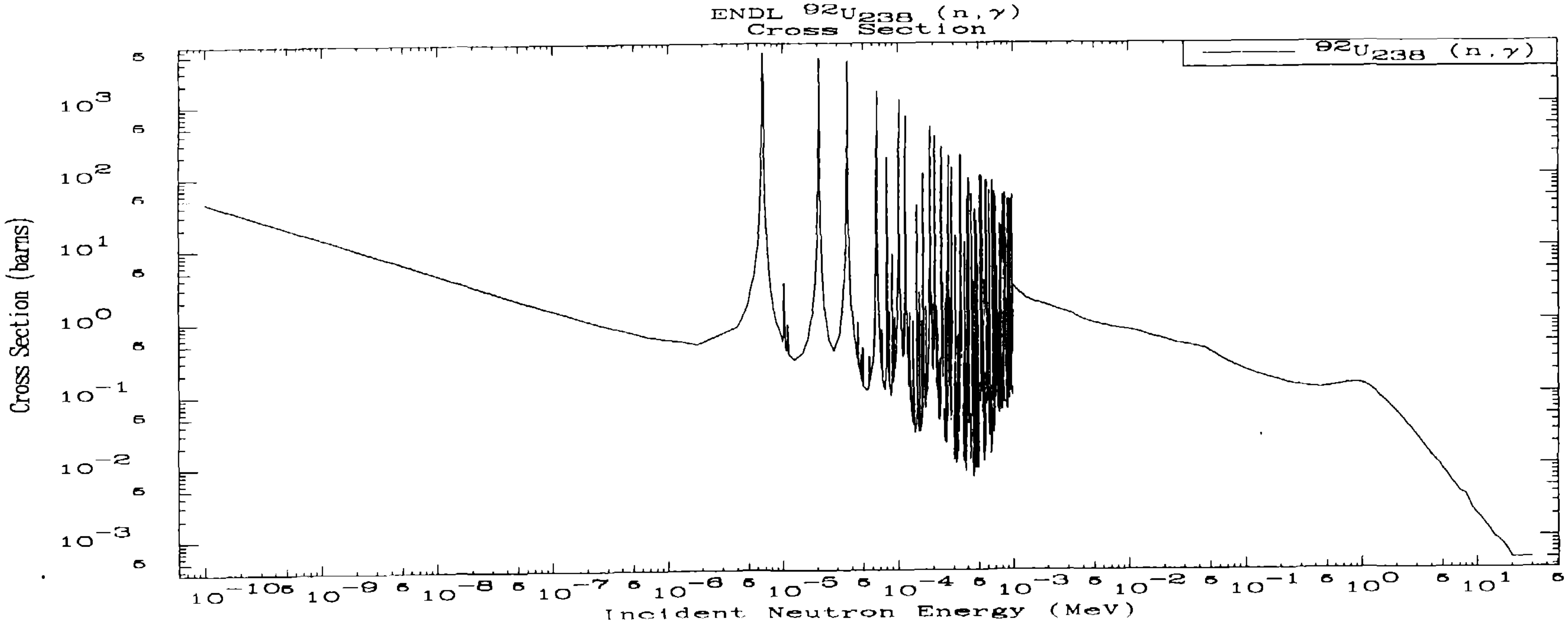
In composition mode you are free to position any number of plots, anyplace on a page. To enter the composition mode the number of plots per page in the X direction should be a negative integer (cols. 45-55 on the first input line); this is a signal to the code not to advance to the next plotting area at the end of the current plot. The code will stay in this mode until you specify a positive number of plots in the X direction; AFTER this plot is completed the code will advance to the next plotting area.

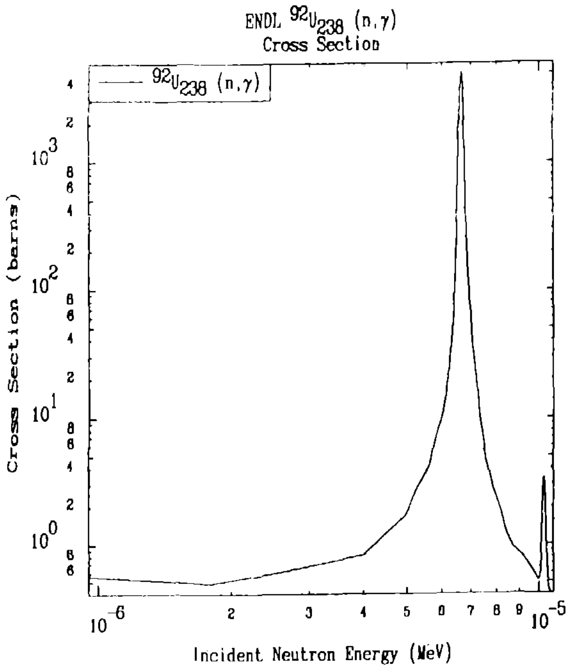
In the below example four subplots are positioned on a page. For the first three of these the number of plots in the X direction is set to -1 (cols. 45-55 on the first input line). For the fourth (last) subplot the number of plots in the X direction is set to 1 - indicating the end of the page AFTER this plot is completed.

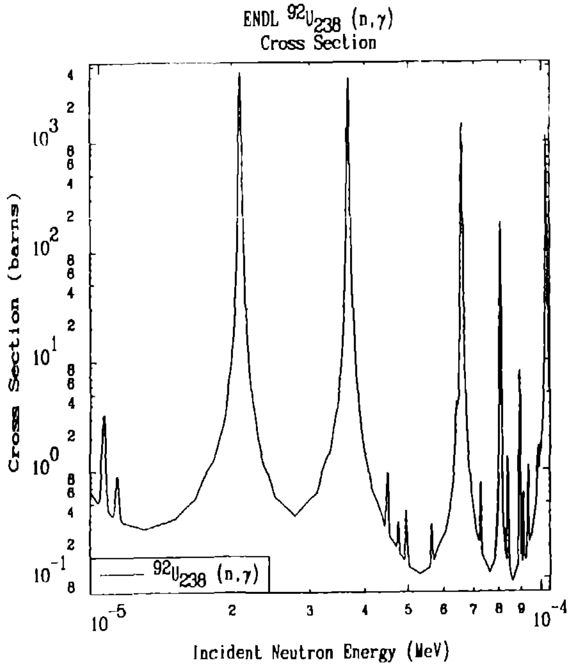
The first subplot occupies the entire upper half of the page (X= 0 to 13.5, Y= 5 to 10 - on the first input line). The following three subplots occupy the lower half of the page (Y = 0 to 5), in three adjacent X ranges (X = 0 to 4.5, 4.5 to 9, 9 to 13.5).

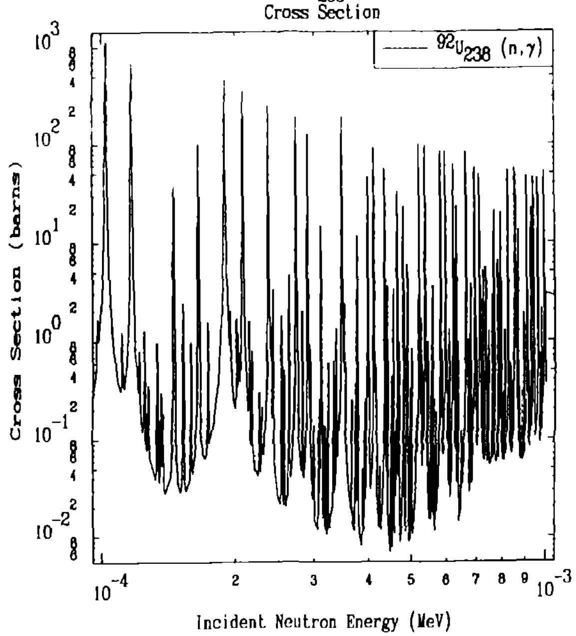
One important restriction on the use of the composition mode - you must only specify one subplot at a time (cols. 45-66 of the first input line) and individually position each subplot.

```
    0.00000    13.50000      5.00000    10.0                  -1            1 1.5
         -1           0            0            0              0            0   0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
                                   0            2              0            0
                                   0            2              0            0

    0.00000     4.50000      0.00000     5.0                  -1            1 2.0
         -1           0            0            0              0            0   0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
 1.00000- 6 1.00000- 5             0            2              0            0
                                   0            2              0            0

    4.50000     9.00000      0.00000     5.0                  -1            1 2.0
         -1           0            0            0              0            0   0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
 1.00000- 5 1.00000- 4             0            2              0            0
                                   0            2              0            0

    9.00000    13.50000      0.00000     5.0                   1            1 2.0
         -1           0            0            0              0            0   0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
 1.00000- 4 1.00000- 3             0            2              0            0
                                   0            2              0            0
```


ENDL $^{92}U_{238}$ (n,γ)
Cross Section
$^{92}U_{238}$ (n,γ)
Cross Section (barns)
Incident Neutron Energy (MeV)


ENDL $^{92}U_{238}$ (n,γ)
Cross Section
$^{92}U_{238}$ (n,γ)
Cross Section (barns)
Incident Neutron Energy (MeV)


ENDL $^{92}U_{238}$ (n,γ)
Cross Section
$^{92}U_{238}$ (n,γ)
Cross Section (barns)
Incident Neutron Energy (MeV)


ENDL $^{92}U_{238}$ (n,γ)
Cross Section
$^{92}U_{238}$ (n,γ)
Cross Section (barns)
Incident Neutron Energy (MeV)

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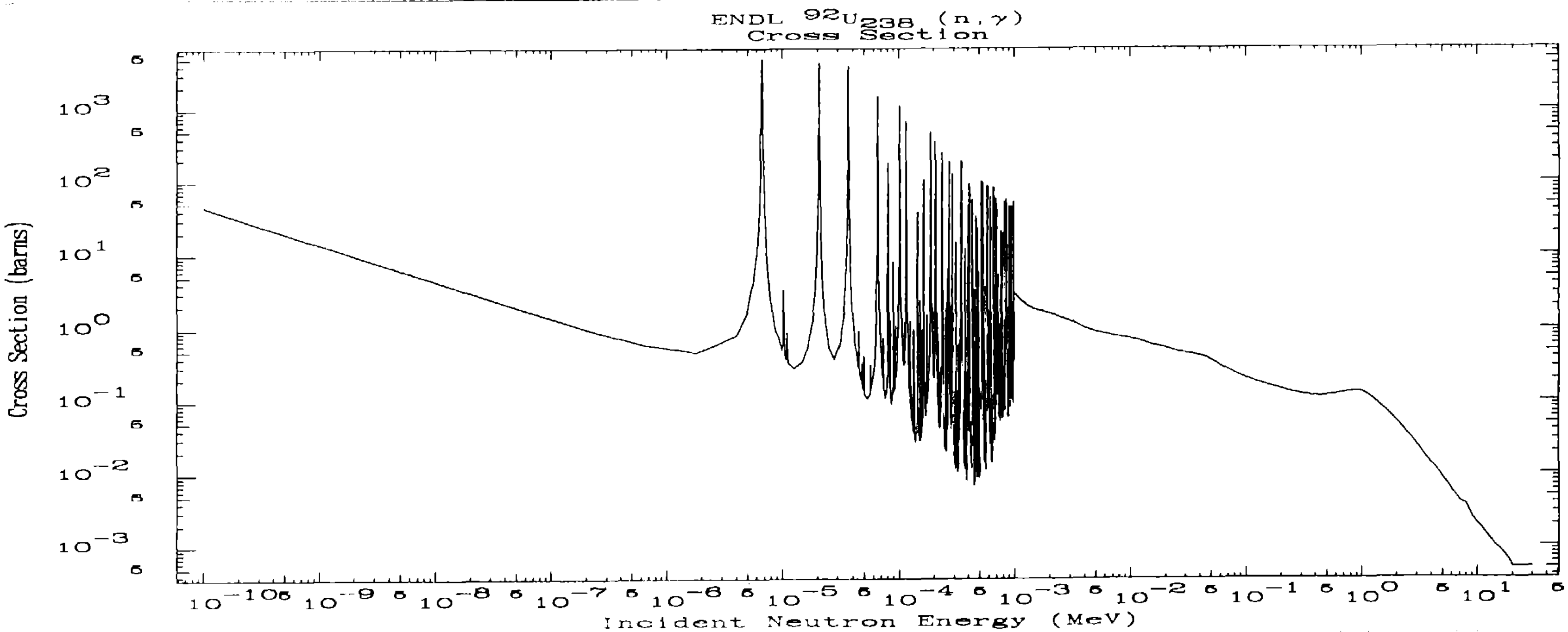
Composition Mode - Non-overlapping Subplots (continued)

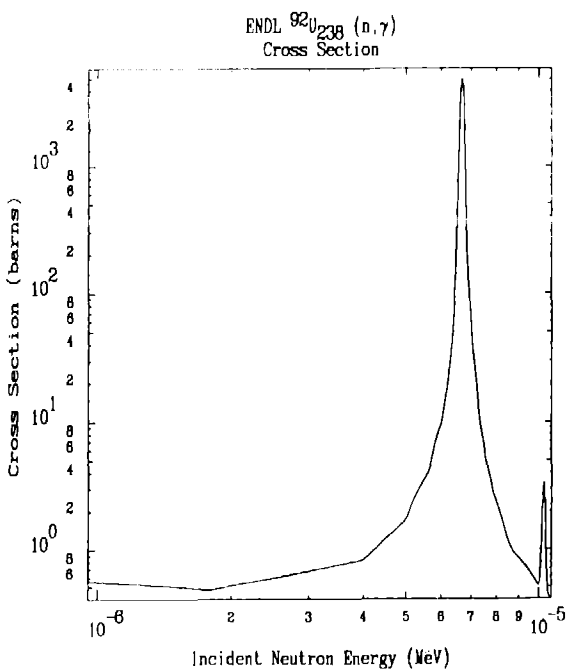
The following plot presents exactly the same data in exactly the same page layout as the preceding plot. The only differences between this plot and the preceding one are,

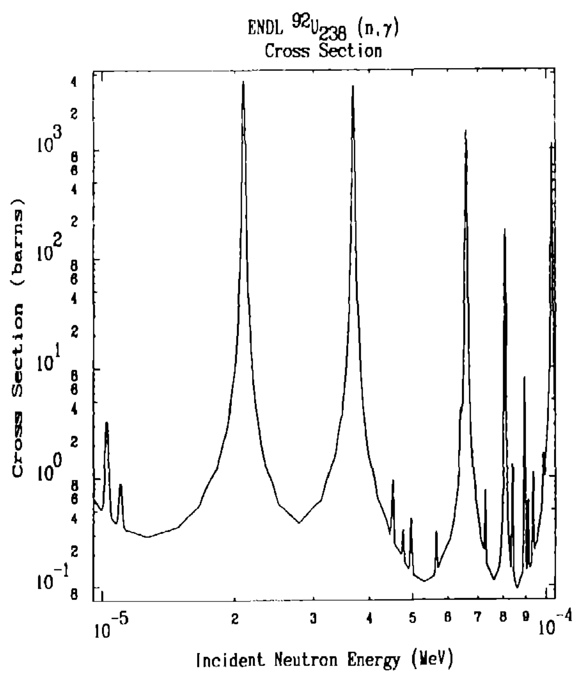
1) Each subplot has a border around it, to more clearly delineate the subplots. This is accomplished by setting cols. 23-33 of the second input line to 1. This option can be handy when preparing plots which will appear in a report as a part of a page mixed in with text.

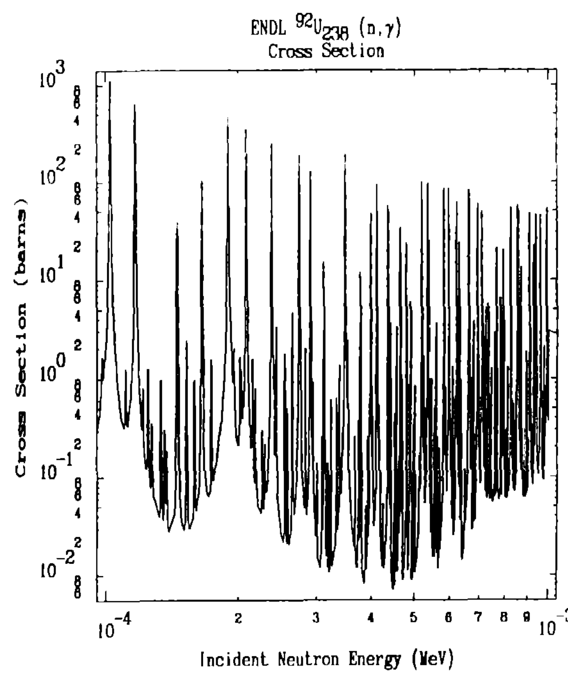
2) The legend box has been removed from all subplots. In this case there is only one curve and the information presented in the legend on the preceding plot is redundant in the sense that it merely repeats what is stated in the title lines at the top of the plot. The legend box will not appear on the plot if cols. 56-66 of the seven line are set to 1.

```
    0.00000    13.50000     5.00000    10.0                 -1          1 1.5
         -1           0           1           0              0          0   0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
                                  0           2              0          1
                                  0           2              0          0

    0.00000     4.50000     0.00000     5.0                 -1          1 2.0
         -1           0           1           0              0          0   0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
 1.00000- 6 1.02000- 5            0           2              0          1
                                  0           2              0          0

    4.50000     9.00000     0.00000     5.0                 -1          1 2.0
         -1           0           1           0              0          0   0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
 1.00000- 5 1.00000- 4            0           2              0          1
                                  0           2              0          0

    9.00000    13.50000     0.00000     5.0                  1          1 2.0
         -1           0           1           0              0          0   0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
 1.00000- 4 1.00000- 3            0           2              0          1
                                  0           2              0          0
```


ENDL 92U238 (n,γ)
Cross Section
Cross Section (barns)
Incident Neutron Energy (MeV)


ENDL 92U238 (n,γ)
Cross Section
Cross Section (barns)
Incident Neutron Energy (MeV)


ENDL 92U238 (n,γ)
Cross Section
Cross Section (barns)
Incident Neutron Energy (MeV)


ENDL 92U238 (n,γ)
Cross Section
Cross Section (barns)
Incident Neutron Energy (MeV)

94

Composition Mode - Overlapping Subplots

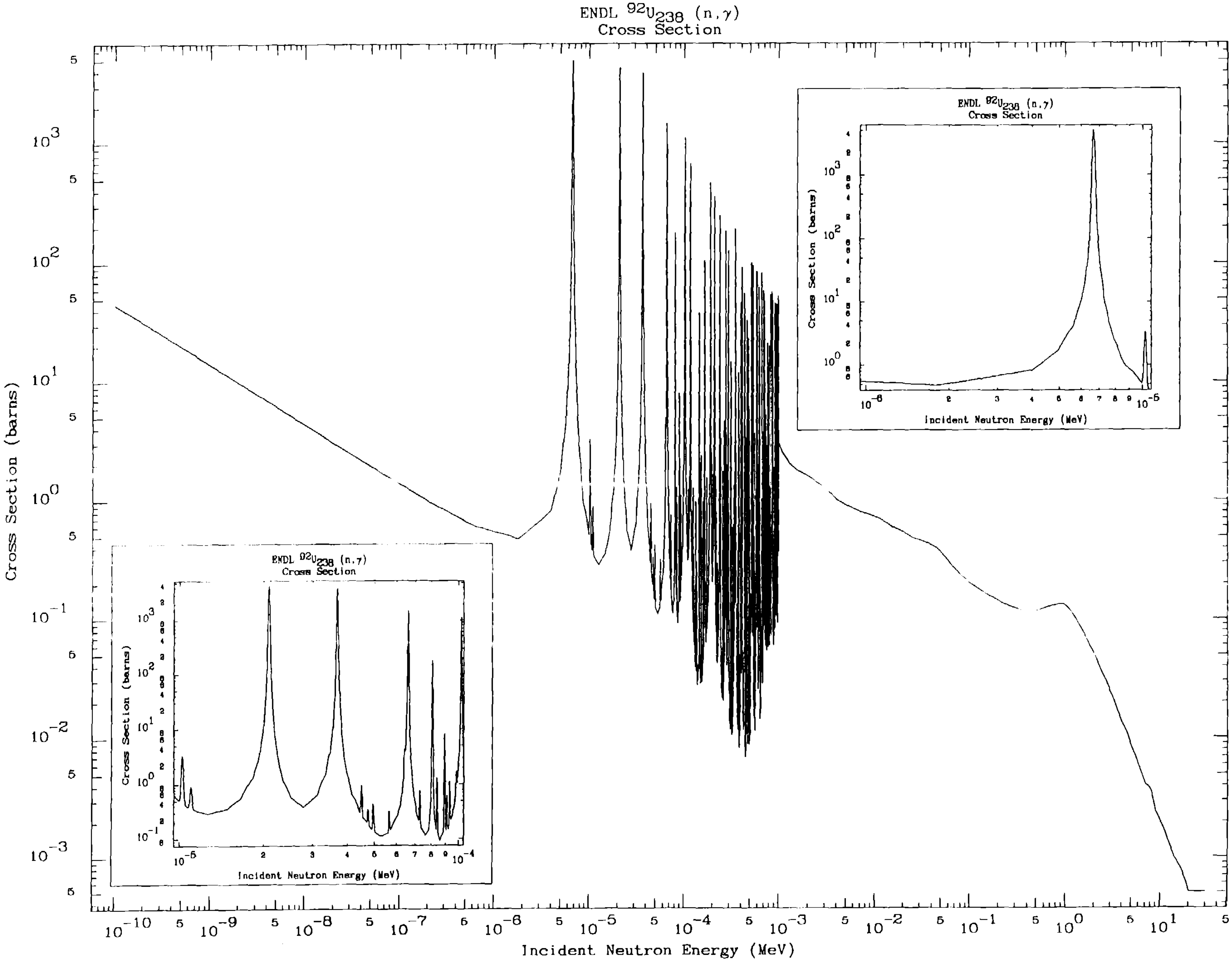
The preceding examples of the composition mode only considered the case of non-overlapping subplots. In the following example the true power of the composition mode is illustrated in positioning subplots anywhere on a page to create special effects.

In this example there are three subplots. The first subplot occupies the entire page (X = 0 to 13.5 and Y = 0 to 10). The following two subplots are positioned within the same plotting area; one is located in X = 8.5 to 12.5, Y = 5.5 to 9.0, and the another in X = 1.3 to 5.3, Y = 0.85 to 4.35 (in each case a 4 by 3.5 subplot). The positions of these subplots were defined in a trial and error manner using a computer terminal screen; once their positions were defined the following hardcopy was produced.

The restrictions in using overlapping subplots includes the general restriction, described earlier, that each subplot must be positions separately, plus the restriction that only the inner most subplots can contain grids other than simple tick marks on the border. Each subplot is positioned and drawn separately without any knowledge of the other subplots. Therefore if subplots other than the inner most subplot include grids, the grid will overwrite the area occupied by the inner subplot and the results will not be very pleasing.

Note, all three examples of using the composition mode also used the alternate character set -]g is plotted as a Greek gamma, as well as super and subscripts to identify 92-U-238.

```
    0.00000    13.50000     0.00000    10.0                    -1           1 1.0
         -1           0           0              0              0           0    0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
                                  0              2              0           1
                                  0              2              0           0

    8.50000    12.50000     5.50000     9.0                    -1           1 2.0
         -1           0           1              0              0           0    0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
 1.00000- 6 1.03000- 5            0              2              0           1
                                  0              2              0           0

    1.30000     5.30000     0.85000    4.35                     1           1 2.0
         -1           0           1              0              0           0    0
Incident Neutron Energy (MeV)
Cross Section (barns)
ENDL {9{2U}2}3}8 (n,]g)
Cross Section
 1.00000- 5 1.00000- 4            0              2              0           1
                                  0              2              0           0
```


ENDL $^{92}U_{238}$ (n,γ)
Cross Section
Cross Section (barns)
Incident Neutron Energy (MeV)
ENDL $^{92}U_{238}$ (n,γ)
Cross Section
Incident Neutron Energy (MeV)
ENDL $^{92}U_{238}$ (n,γ)
Cross Section
Incident Neutron Energy (MeV)

96

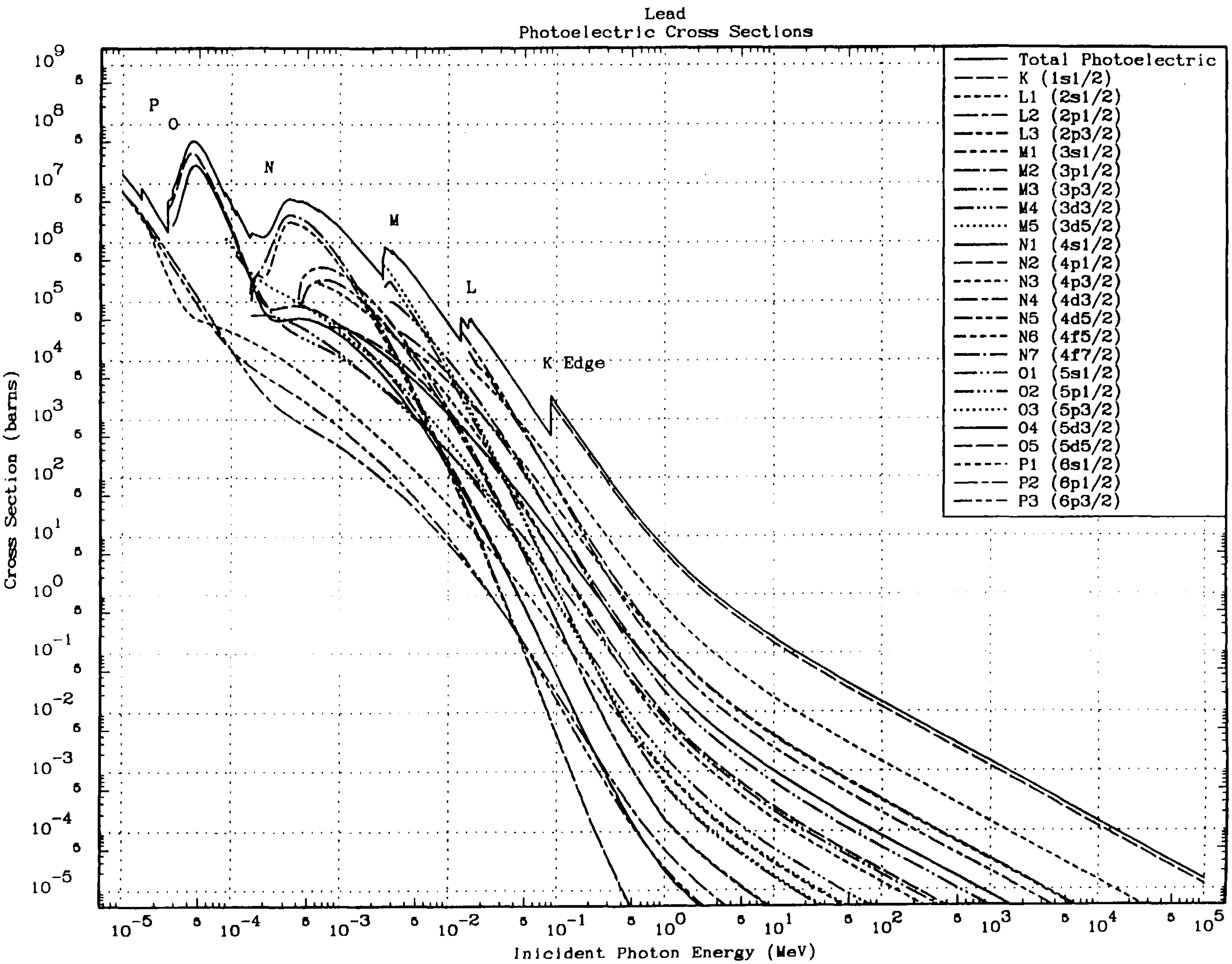
Randomly Positioned Titles

For use in special applications this code has the ability to position titles anywhere on the plotting surface. As distributed this option is internally turned off. However, if you wish to use it, it is fairly easy to reactivate this option; use a text edit to search for the word DEBUG and activate all FORTRAN statements between pairs of DEBUG lines.

Once activated this option will read X and Y coordinates followed by a title from a file named TITLES.DAT. There may be up to 30 sets of X and Y coordinates and titles. Each title may be up to 72 characters in length. X and Y coordinates are absolute in the units of the plotter, e.g., inches, centimeters, etc.

The following plot illustrates the results obtained when this option is used to identify the photoelectric edges of lead. In this case the file TITLES.DAT contained the following 12 lines, used to define 6 sets of X and Y coordinates and titles. The X and Y coordinates for these titles were defined in a trial and error manner using a computer terminal screen; once their positions were defined the following hardcopy was produced.

```
 1.70000+ 0 9.00000+ 0
P
 1.90000+ 0 8.80000+ 0
O
 2.90000+ 0 8.35000+ 0
N
 4.20000+ 0 7.80000+ 0
M
 5.00000+ 0 7.10000+ 0
L
 5.80000+ 0 6.30000+ 0
K Edge
```


Lead
Photoelectric Cross Sections
Cross Section (barns)
Incident Photon Energy (MeV)
P
O
N
M
L
K Edge
Total Photoelectric
K (1s1/2)
L1 (2s1/2)
L2 (2p1/2)
L3 (2p3/2)
M1 (3s1/2)
M2 (3p1/2)
M3 (3p3/2)
M4 (3d3/2)
M5 (3d5/2)
N1 (4s1/2)
N2 (4p1/2)
N3 (4p3/2)
N4 (4d3/2)
N5 (4d5/2)
N6 (4f5/2)
N7 (4f7/2)
O1 (5s1/2)
O2 (5p1/2)
O3 (5p3/2)
O4 (5d3/2)
O5 (5d5/2)
P1 (6s1/2)
P2 (6p1/2)
P3 (6p3/2)

86

Comparison of Evaluated and Experimental Data

The following example uses many of the options described so far to produce a series of plots, first comparing two evaluation to all of the available experimental data, and then comparing only the two evaluations.

The first plot is over the energy range 1 keV to 30 MeV; the entire energy range over which both evaluations are defined. This plot really doesn't show us very much, except that: 1) at low energy the two evaluations are quite different and, 2) there are no experimental data below about 10 keV. Usually if these data haven't been "seen" yet a plot such as this is first generated and based on examining the plot energy ranges or options are selected for additional plots, as is done below.

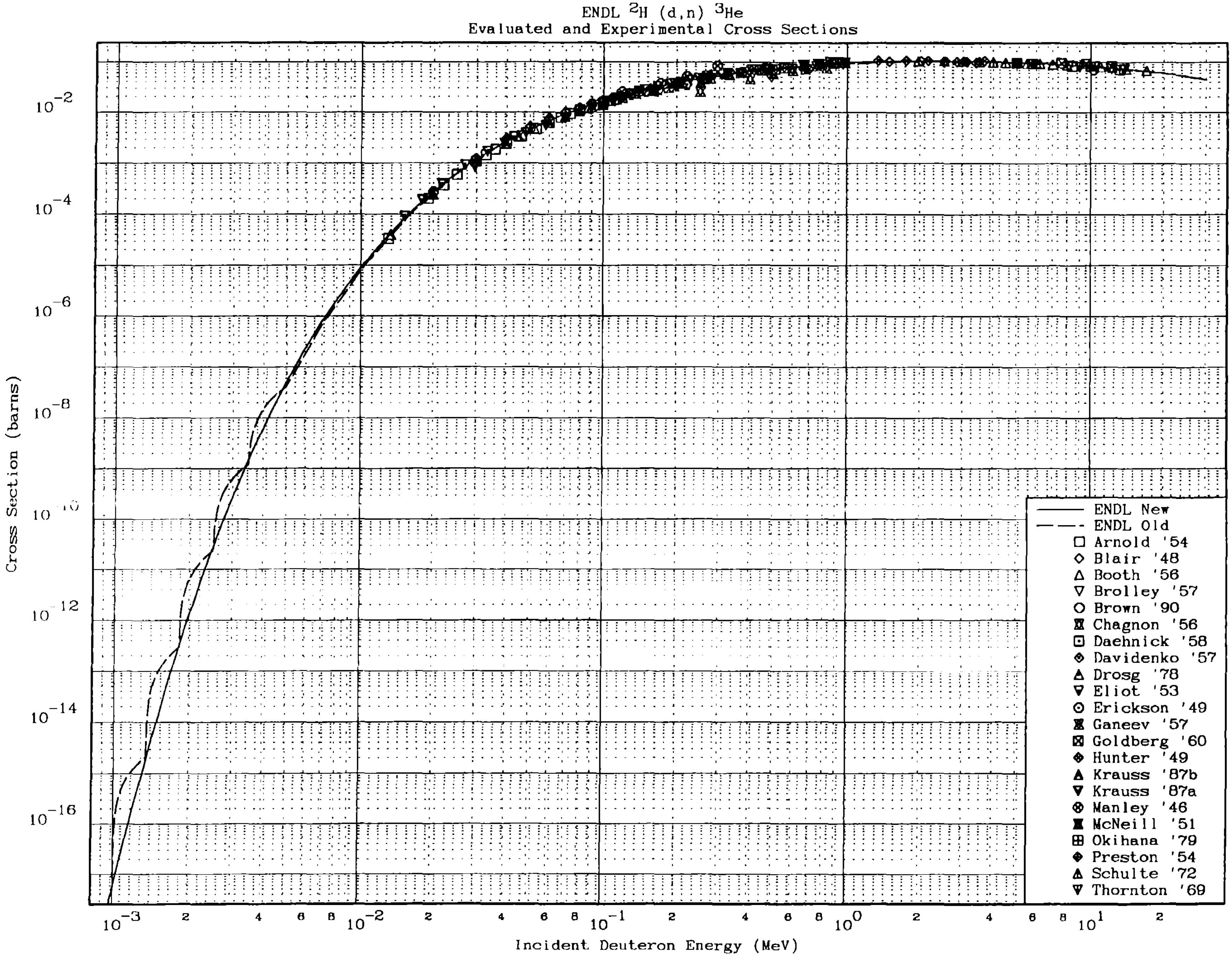
The second plot shows all of the data from 10 keV to 30 MeV. The third through fifth plots show the energy ranges 10-100 keV, 100 keV-1 MeV and 1-30 MeV, including the ratio of everything to the first evaluation. Here by using the ratio we can quantitatively define the actual spread in the evaluated and experimental data. From these plots we can easily see that above 10 keV the two evaluations are very similar, with differences exceeding 10 % only below about 20 keV, and differences of only 6-7 % above 30 keV; these differences are small compared to the spread in the experimental data.

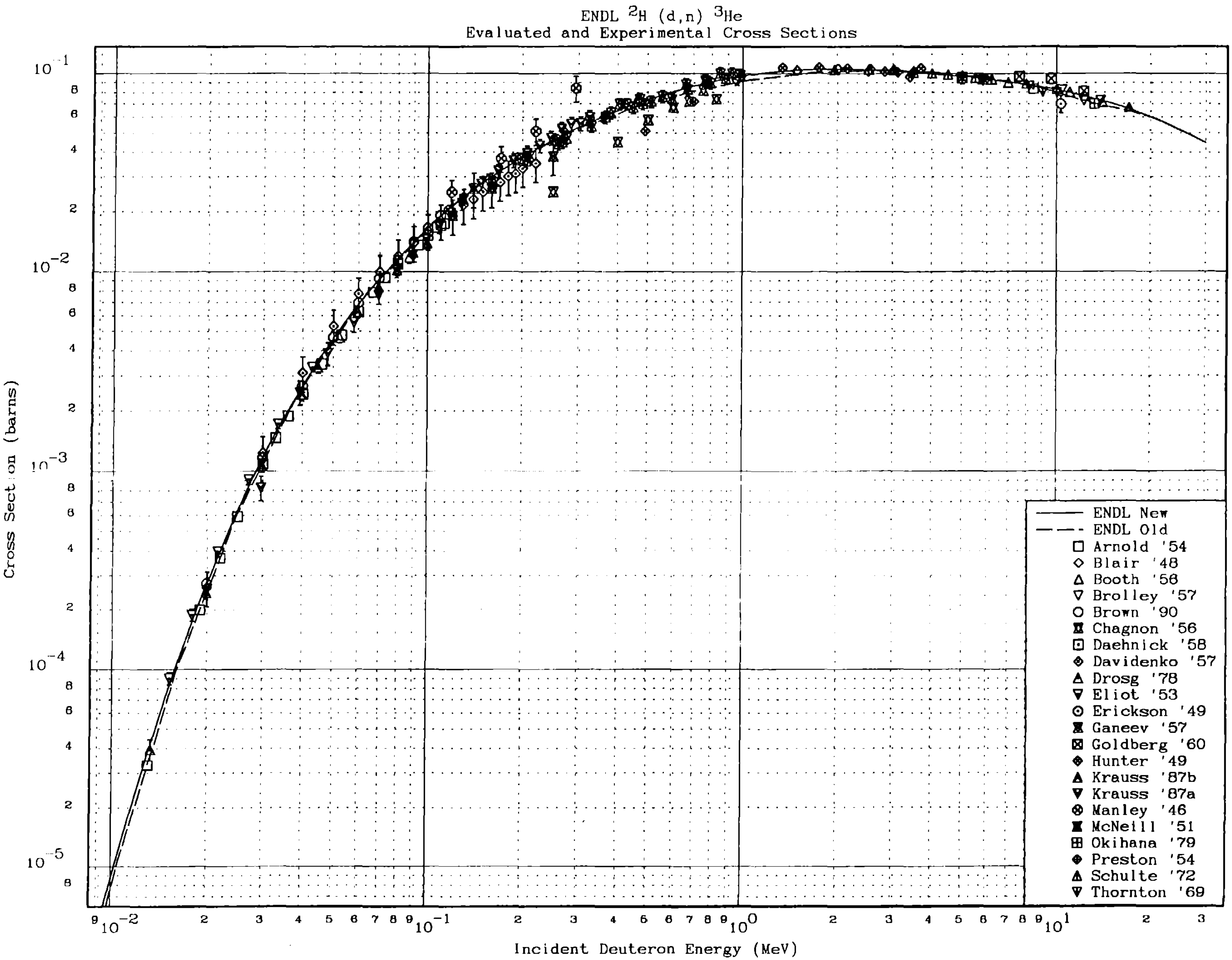
The next two plots compare only the two evaluations over the energy ranges 1 keV-30 MeV and 10 keV-30 MeV. From these plots we can see the importance of interpolation. The tabulated values in the ENDL Old evaluation are quite close to the values in the ENDL New evaluation. However, in the 1-10 keV energy range the ENDL Old evaluation does not contain enough energy points, resulting in the unrealistic "bumps" in the cross section between tabulated points. The result is that between tabulated energies the interpolated values of the cross sections differ by factors of almost 20 (i.e., almost 2000 %). In this energy range there are no experimental values and the cross section is extremely small, i.e., less than 0.1 micro-barns.

The next plot even more dramatically demonstrates the importance of proper interpolation. This plot is exactly the same as the previous plot comparing the two evaluations over the energy range 1 keV-30 MeV, except that the input parameters indicates log-log interpolation between tabulated data points (cols. 34-44 of the 7-th [for X] and 8-th [for Y], input lines). In the previous plot using linear-linear interpolation differences of almost 2000 % were found. Here using exactly the same data but log-log interpolation the differences are less than 60 %, and less than 25 % for all energies above 1.2 keV.

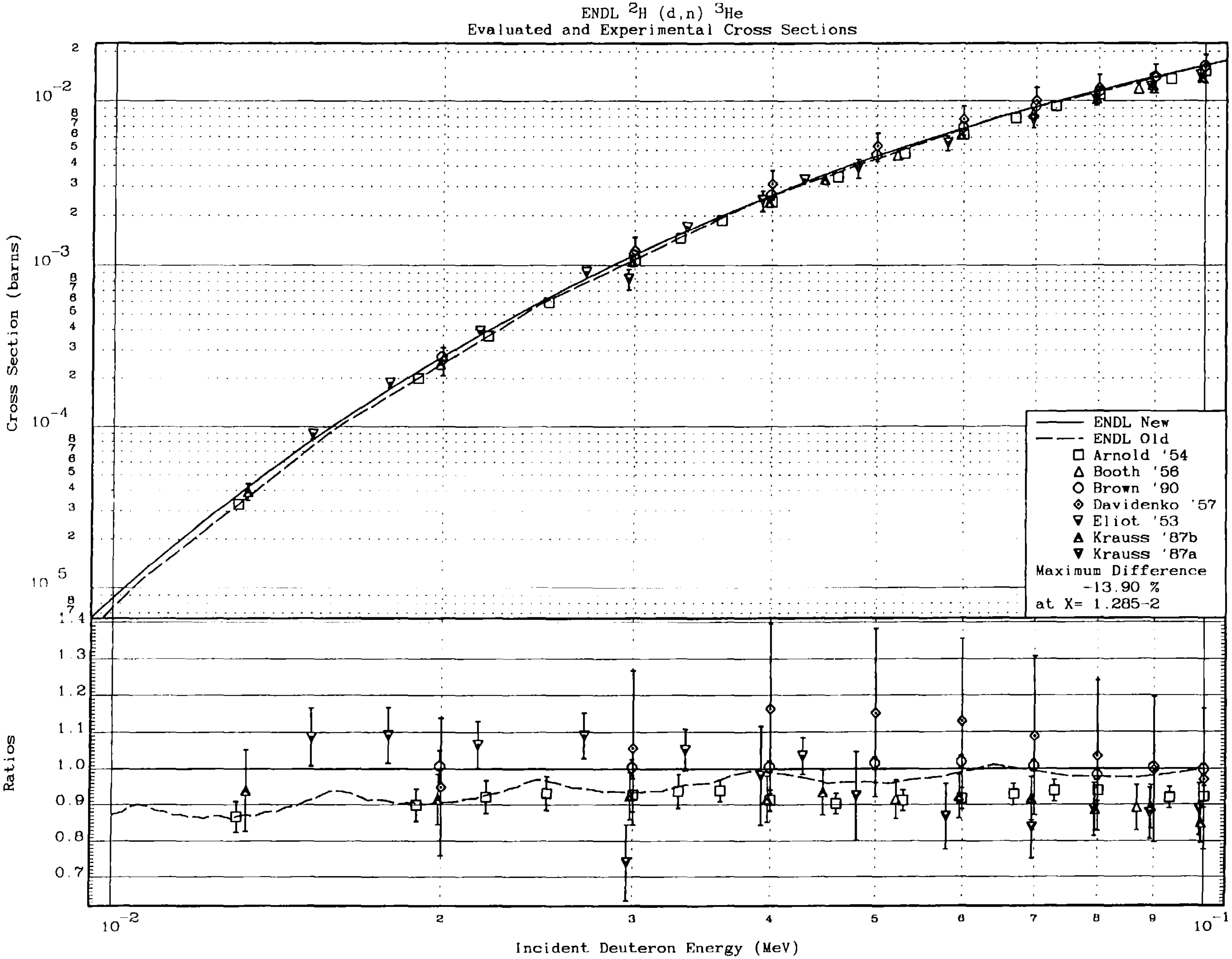
The last two plots illustrate that using the character size multiplier also effects the size of symbols used to define sets of data points. In this case the two plots correspond to previous plots of this series for the energy range 1-30 MeV, but in this case character size multipliers of 1.2 and 1.5, respectively, are used. For plots containing various sets of data points this effect can often be used to more clearly see the individual symbols representing each set of points.

```
                                              100


   0.00000   13.50000    0.00000   10.0                 1          1 1.0
        -2        -30          0          4             0         -2   0
Incident Deuteron Energy (MeV)
Cross Section (barns)
ENDL {2H (d,n) {3He
Evaluated and Experimental Cross Sections
 1.00000- 3                    0          2             0          0
                               1          2             0          0
ENDL {2H (d,n) {3He
Evaluated and Experimental Cross Sections
 1.00000- 2                    0          2             0          0
                               1          2             0          0

   0.00000   13.50000    0.00000   10.0                 1          1 1.0
        -2        -30          0          4             4         -2   0
Incident Deuteron Energy (MeV)
Cross Section (barns)
ENDL {2H (d,n) {3He
Evaluated and Experimental Cross Sections
 1.00000- 2 1.00000- 1         0          2             0          0
                               1          2             0          0
ENDL {2H (d,n) {3He
Evaluated and Experimental Cross Sections
 1.00000- 1 1.00000+ 0         0          2             0          0
                               1          2             0          0
ENDL {2H (d,n) {3He
Evaluated and Experimental Cross Sections
 1.00000+ 0 3.00000+ 1         0          2             0          0
                               1          2             0          0

   0.00000   13.50000    0.00000   10.0                 1          1 1.0
        -2          0          0          4             4         -2   0
Incident Deuteron Energy (MeV)
Cross Section (barns)
ENDL {2H (d,n) {3He
Evaluated Cross Sections
 1.00000- 3                    0          2             0          0
                               1          2             0          0
ENDL {2H (d,n) {3He
Evaluated Cross Sections
 1.00000- 2                    0          2             0          0
                               1          2             0          0
ENDL {2H (d,n) {3He
Evaluated Cross Sections
 1.00000- 3                    0         -2             0          0
                               1         -2             0          0
```

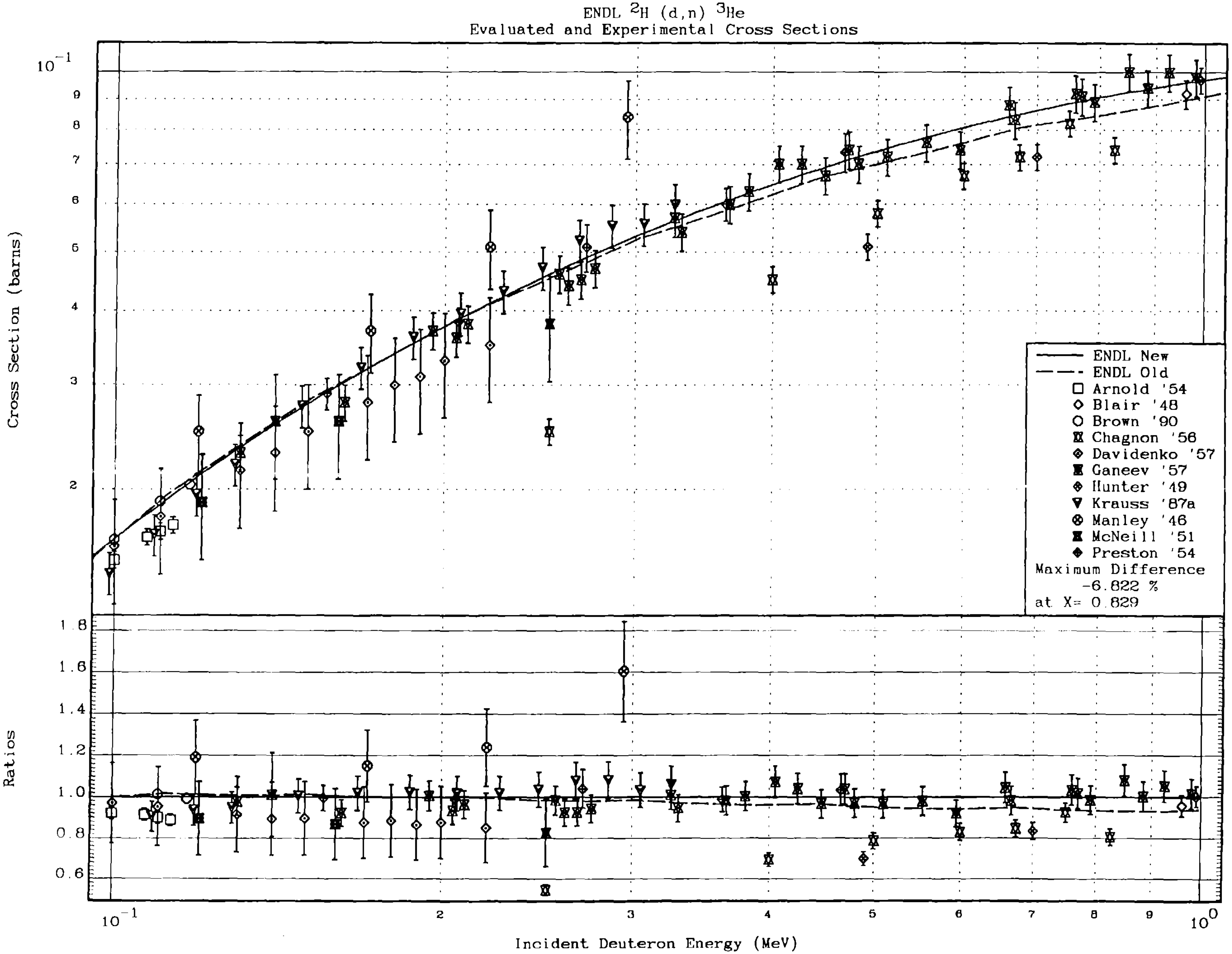

ENDL ^{2}H (d,n) ^{3}He
Evaluated and Experimental Cross Sections
Cross Section (barns)
Incident Deuteron Energy (MeV)
ENDL New
ENDL Old
Arnold '54
Blair '48
Booth '56
Brolley '57
Brown '90
Chagnon '56
Daehnick '58
Davidenko '57
Drosg '78
Eliot '53
Erickson '49
Ganeev '57
Goldberg '60
Hunter '49
Krauss '87b
Krauss '87a
Manley '46
McNeill '51
Okihana '79
Preston '54
Schulte '72
Thornton '69


ENDL ^{2}H (d,n) ^{3}He
Evaluated and Experimental Cross Sections
Cross Section (barns)
Incident Deuteron Energy (MeV)
ENDL New
ENDL Old
Arnold '54
Blair '48
Booth '56
Brolley '57
Brown '90
Chagnon '56
Daehnick '58
Davidenko '57
Drosg '78
Eliot '53
Erickson '49
Ganeev '57
Goldberg '60
Hunter '49
Krauss '87b
Krauss '87a
Manley '46
McNeill '51
Okihana '79
Preston '54
Schulte '72
Thornton '69

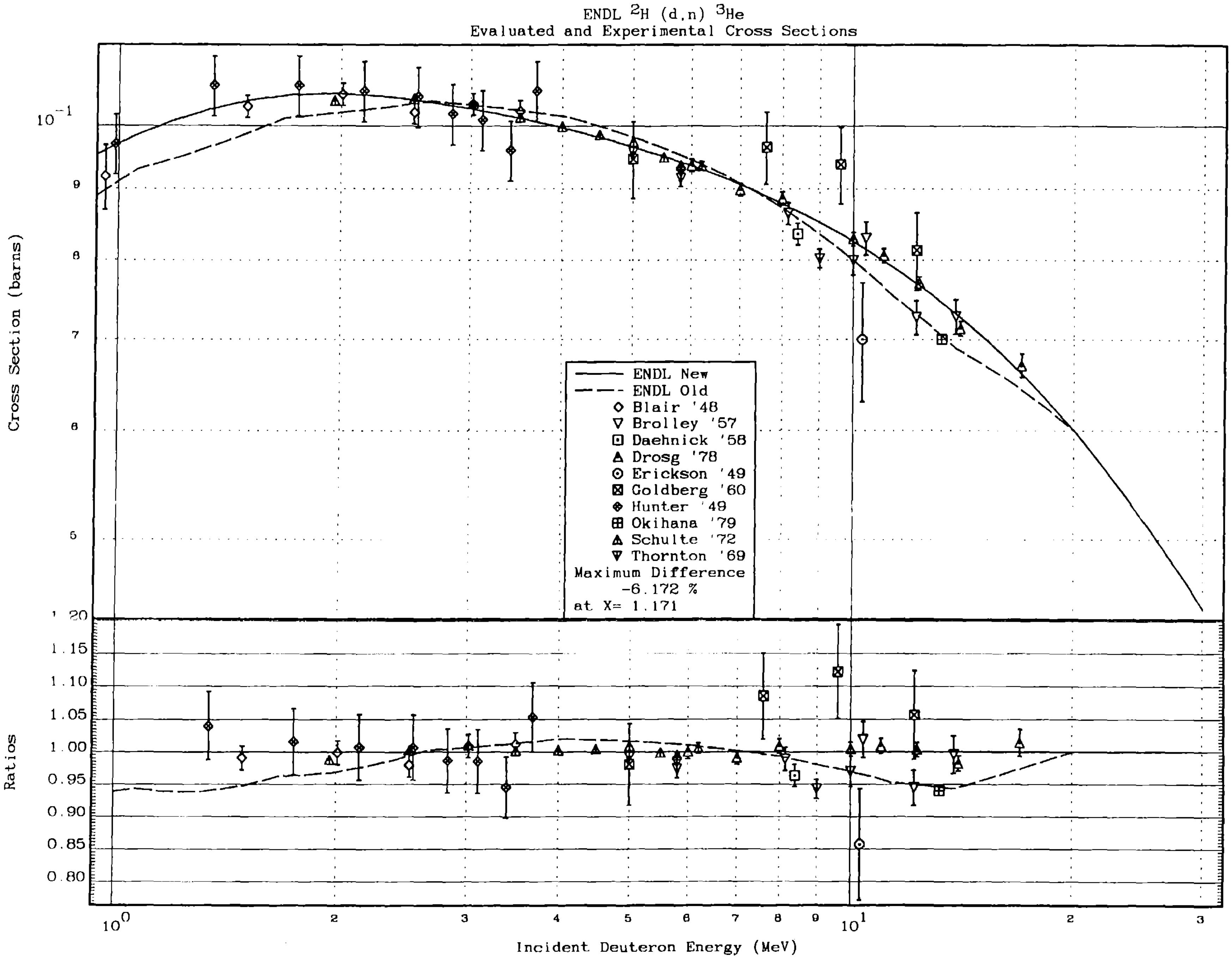
102


ENDL ^{2}H (d,n) ^{3}He
Evaluated and Experimental Cross Sections
Cross Section (barns)
Ratios
Incident Deuteron Energy (MeV)
ENDL New
ENDL Old
Arnold '54
Booth '56
Brown '90
Davidenko '57
Eliot '53
Krauss '87b
Krauss '87a
Maximum Difference
-13.90 %
at X= 1.285-2

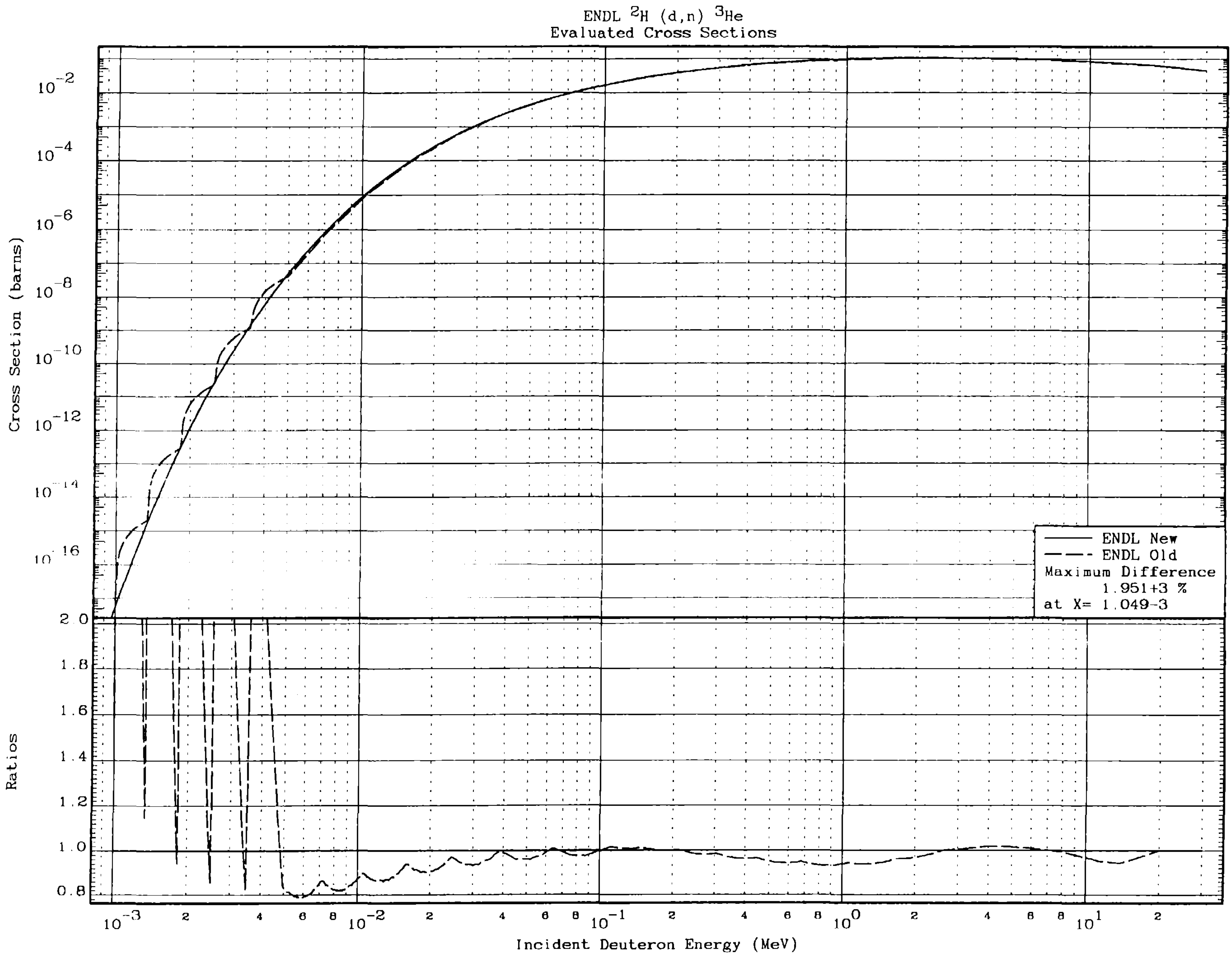
103


ENDL ^{2}H (d,n) ^{3}He
Evaluated and Experimental Cross Sections
Cross Section (barns)
Ratios
Incident Deuteron Energy (MeV)
ENDL New
ENDL Old
Arnold '54
Blair '48
Brown '90
Chagnon '56
Davidenko '57
Ganeev '57
Hunter '49
Krauss '87a
Manley '46
McNeill '51
Preston '54
Maximum Difference
-6.822 %
at X= 0.829

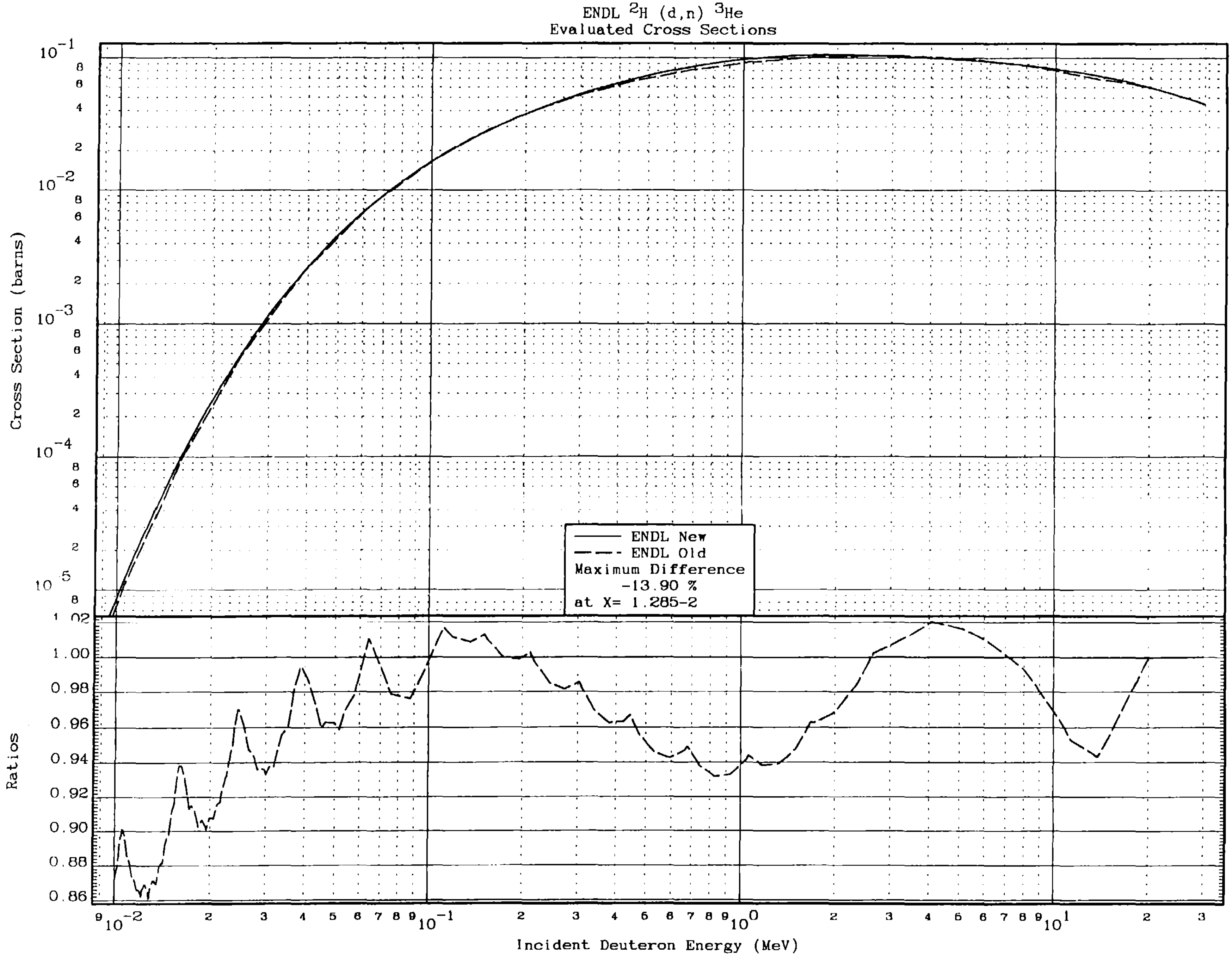
104


ENDL ^{2}H (d,n) ^{3}He
Evaluated and Experimental Cross Sections
Cross Section (barns)
Ratios
Incident Deuteron Energy (MeV)
ENDL New
ENDL Old
Blair '48
Brolley '57
Daehnick '58
Drosg '78
Erickson '49
Goldberg '60
Hunter '49
Okihana '79
Schulte '72
Thornton '69
Maximum Difference
-6.172 %
at X= 1.171

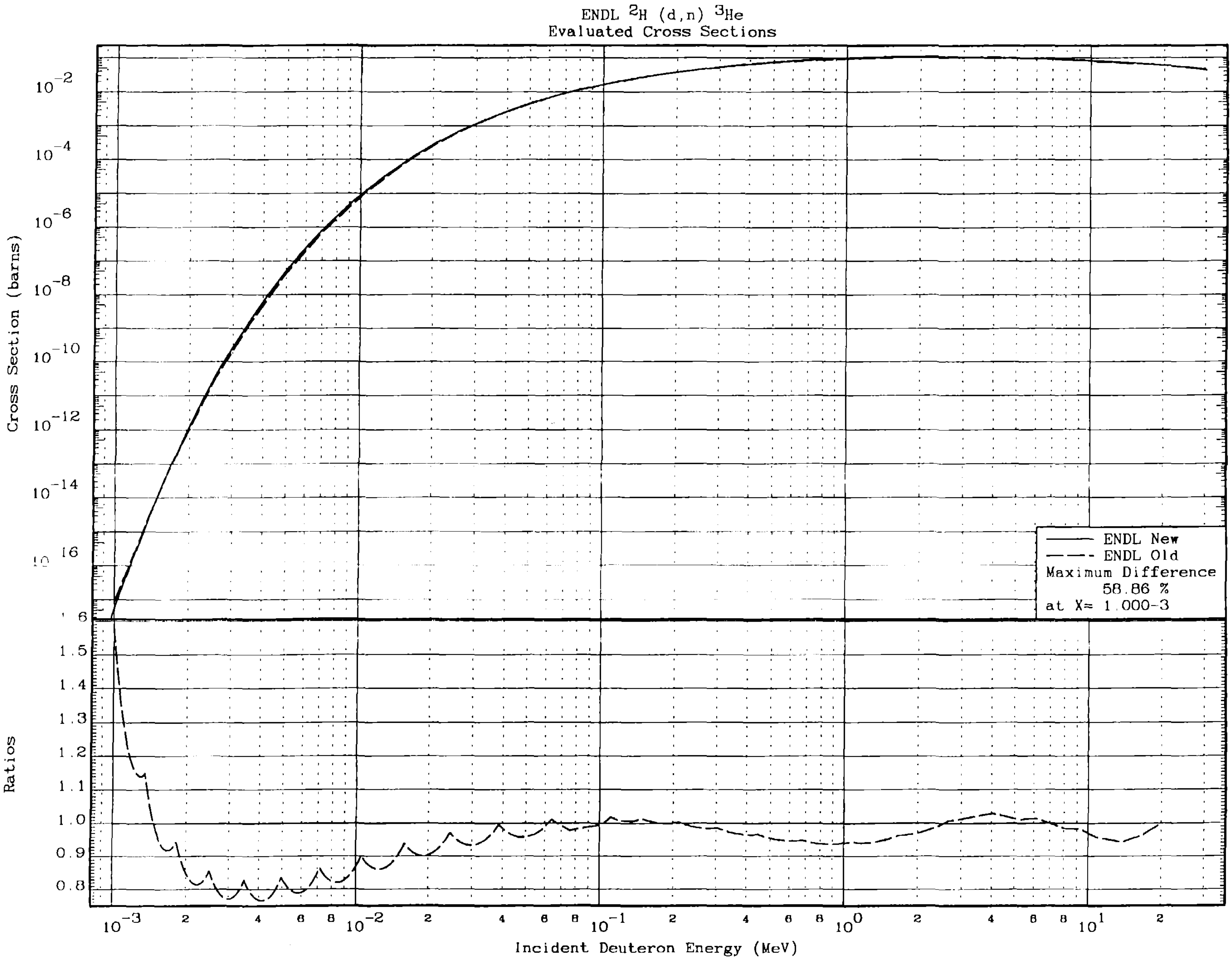
105


ENDL ^{2}H (d,n) ^{3}He
Evaluated Cross Sections
Cross Section (barns)
Ratios
Incident Deuteron Energy (MeV)
ENDL New
ENDL Old
Maximum Difference
1.951+3 %
at X= 1.049-3

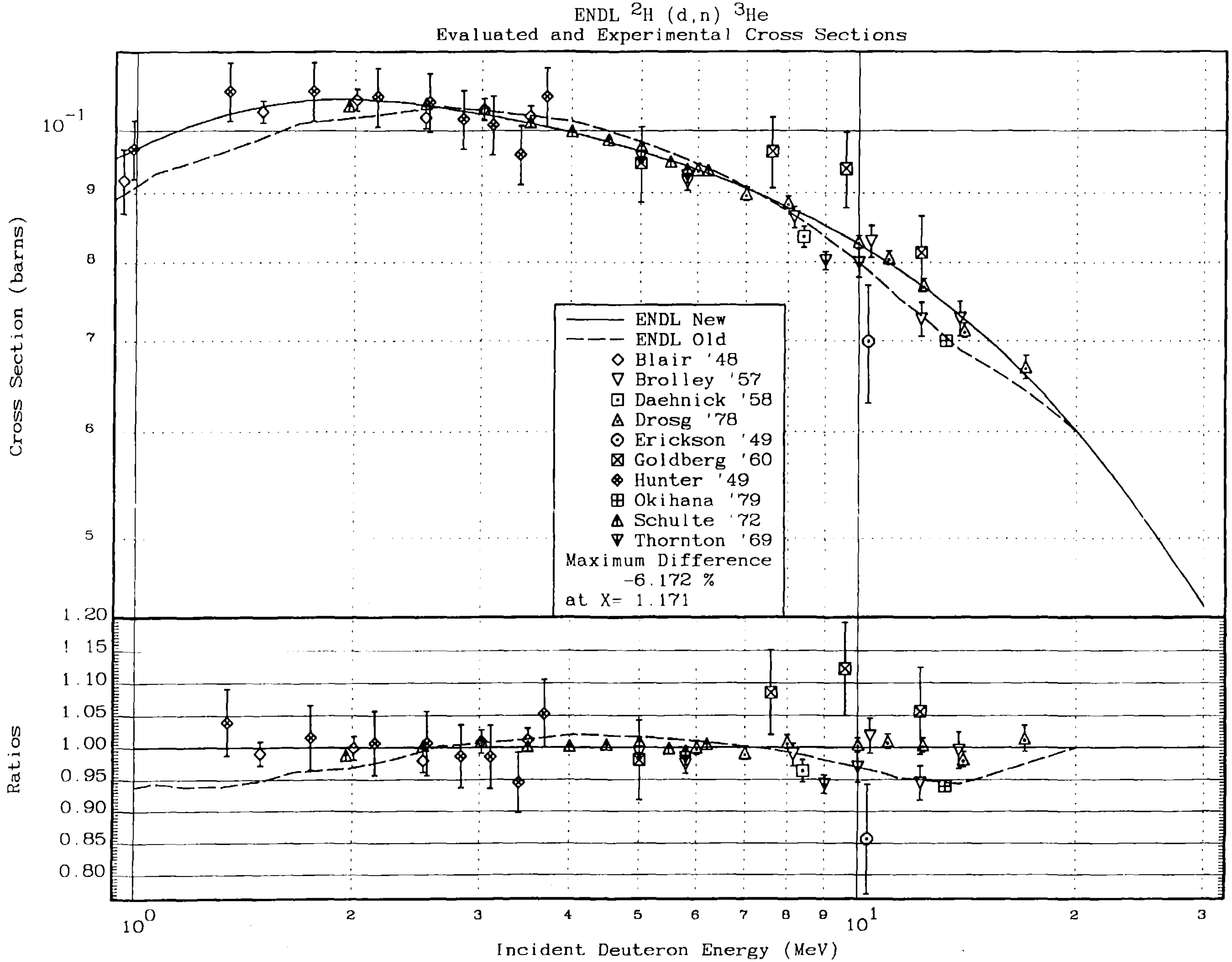
106


ENDL ^{2}H (d,n) ^{3}He
Evaluated Cross Sections
Cross Section (barns)
ENDL New
ENDL Old
Maximum Difference
-13.90 %
at X= 1.285-2
Ratios
Incident Deuteron Energy (MeV)

107

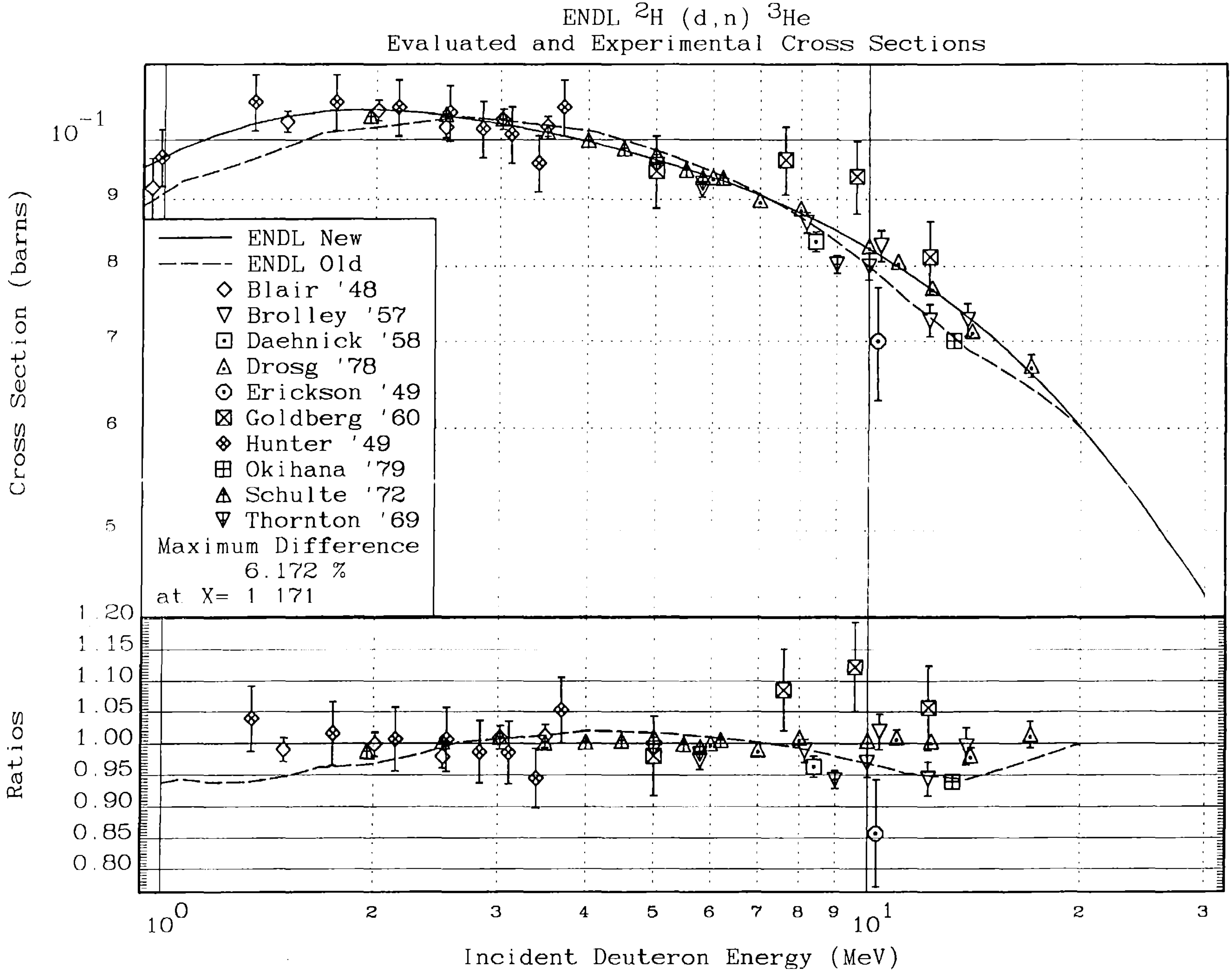

ENDL ^{2}H (d,n) ^{3}He
Evaluated Cross Sections
Cross Section (barns)
Ratios
ENDL New
ENDL Old
Maximum Difference
58.86 %
at X= 1.000-3
Incident Deuteron Energy (MeV)

108


ENDL ^{2}H (d,n) ^{3}He
Evaluated and Experimental Cross Sections
Cross Section (barns)
Ratios
ENDL New
ENDL Old
Blair '48
Brolley '57
Daehnick '58
Drosg '78
Erickson '49
Goldberg '60
Hunter '49
Okihana '79
Schulte '72
Thornton '69
Maximum Difference
-6.172 %
at X= 1.171
Incident Deuteron Energy (MeV)

109

PLOTTAB


ENDL ^{2}H (d,n) ^{3}He
Evaluated and Experimental Cross Sections
Cross Section (barns)
Ratios
ENDL New
ENDL Old
Blair '48
Brolley '57
Daehnick '58
Drosg '78
Erickson '49
Goldberg '60
Hunter '49
Okihana '79
Schulte '72
Thornton '69
Maximum Difference
6.172 %
at X= 1 171
Incident Deuteron Energy (MeV)

110