INTERNATIONAL ATOMIC ENERGY AGENCY

NUCLEAR DATA SERVICES

DOCUMENTATION SERIES OF THE IAEA NUCLEAR DATA SECTION

IAEA-NDS-152
Rev. O, Sept. 1994

WIMSD Nb Bi

WIMSD data for niobium and bismuth
derived from ENDF/B-6.1, JEF-2.2, JENDL-3.2

Jung-Do Kim, Choong-Sup Gil

Abstract: Multigroup neutron cross-section data for niobium and bismuth have been obtained by processing data from the nuclear data libraries ENDF/B-6.1, JEF-2.2, and JENDL-3.2. Tabular and graphical intercomparisons of the data derived from these three data libraries are given. The WIMSD data are available, on a PC diskette from the IAEA Nuclear Data Section costfree upon request.

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The diskette contains the following 6 files

WSNB93.ENG
WSNB93.JEF
WSNB93.JEN
WSBI209.ENG
WSBI209.JEF
WSBI209.JEN

with a total of 478 000 bytes. It was received from the authors on 1 September 1994. The diskette is available from the IAEA Nuclear Data Section, costfree, upon request.

GENERATION AND INTERCOMPARISON OF WIMSD-FORMAT DATA FOR NIOBIUM AND BISMUTH PROCESSED FROM ENDF/B-VI.1, JEF-2.2 AND JENDL-3.2 EVALUATIONS

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WIMSD-format niobium and bismuth cross section libraries were processed from the most recent ENDF/B-VI.1, JEF-2.2 and JENDL-3.2 evaluations.

The NJOY91.91 processing system was used on an HP710 workstation to produce the point data and 69-group averaged data. The reconstuction, linearization and thinning tolerances were chosen to be 0.1% for all cases. Processed temperatures are 300, 600 and 900 ° Kelvin. And Bondarenko's background cross sections are 0.5, 1.0, 10, 50, 100, 1000, $1.0x10^4$, $1.0x10^5$, $1.0x10^6$ and $1.0x10^{10}$ barns. The weight function selected for use in collapsing the point data was typical spectrum of a light water reactor system built in GROUPR routine (iwt=5).

The WIMSKR routine, which is similar to the WIMS-IAEA routine, was used to translate the 69-group data in GENDF-format into the WIMSD-format data. Potential cross sections were calculated from the potential scattering radius value of the ENDF/B-VI.1 evaluations. P_1-row sum and 1/E-weighted P_1-column sum corrections were used respectively to obtain transport cross sections in the thermal and epithermal regions. Transport corrections were used to self-scattered P_0 matrix data.

Comparisons of cross section line shapes at zero Kelvin were made using COMPLOT code. Results of intercomparison among ENDF/B-VI.1, JEF-2.2 and JENDL-3.2 for niobium and bismuth which were performed at the point and 69-group cross sections(300°K) are shown in Fig. 1 - 12 and Table 1 - 6.

Processed WIMSD-format libraries in this report are available from Nuclear Data Section of IAEA.

Note that if a nuclide would be used to a region which is not fuel, the first record of the processed WIMSD-format libraries should be corrected

from ' ID AW Z 1 3 1'
to ' ID AW Z 0 3 0',

because of an inherent limitation of original WIMSD/4 code.

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ID numbers for each nuclide from different data sources are as follows:

ID	ID of RI	Source
41093	41093.1	Nb-93 from ENDF/B-VI.1
41193	41193.1	" JEF-2.2
41293	41293.1	" JENDL-3.2
83209	83209.1	Bi-209 from ENDF/B-VI
83309	83309.1	" JEF-2.2
83409	83409.1	" JENDL-3.2.

Finally, we would like to thank Dr. H.D. Lemmel of Nuclear Data Section of IAEA and Mr. T. Nakagawa of Nuclear Data Center of JAERI for providing us the most recent evaluated data sources. We wish also to thank Drs. S. Ganesan and A. Trkov for their helpful discussions.

Table 1. Comparison of Elastic Scattering Cross Sections for Niobium

GROUP	ENDF/B-6.1	JEF-2.2	% Difference	JENDL-3.2	% Difference
1	2.2007E+00	2.4468E+00	(11.19)	2.3977E+00	(8.95)
2	1.8223E+00	1.8497E+00	(1.50)	1.9685E+00	(8.02)
3	2.2215E+00	2.0771E+00	(-6.50)	2.3270E+00	(4.75)
4	3.4082E+00	3.1790E+00	(-6.73)	3.5261E+00	(3.46)
5	5.6336E+00	5.5900E+00	(-.77)	5.7399E+00	(1.89)
6	7.6257E+00	7.5997E+00	(-.34)	7.6731E+00	(.62)
7	8.7926E+00	8.8968E+00	(1.18)	8.9322E+00	(1.59)
8	9.2994E+00	9.3135E+00	(.15)	9.4622E+00	(1.75)
9	9.3909E+00	9.2624E+00	(-1.37)	9.5747E+00	(1.96)
10	9.1543E+00	6.9918E+00	(-23.62)	9.4011E+00	(2.70)
11	8.6192E+00	6.4290E+00	(-25.41)	8.9834E+00	(4.23)
12	7.8992E+00	6.4856E+00	(-17.90)	8.3527E+00	(5.74)
13	7.1936E+00	6.5378E+00	(-9.12)	7.9996E+00	(11.20)
14	6.5936E+00	6.5998E+00	(.09)	7.8890E+00	(19.65)
15	9.1104E+00	9.3483E+00	(2.61)	9.8962E+00	(8.63)
16	9.0705E+00	9.0738E+00	(.04)	9.9130E+00	(9.29)
17	1.0465E+01	1.0439E+01	(-.25)	9.8102E+00	(-6.26)
18	8.9796E+00	8.9782E+00	(-.02)	9.2823E+00	(3.37)
19	9.2966E+00	9.2872E+00	(-.10)	1.0712E+01	(15.23)
20	6.4653E+00	6.4766E+00	(.18)	6.7880E+00	(4.99)
21	5.9597E+00	5.9639E+00	(.07)	6.2499E+00	(4.87)
22	5.6541E+00	5.6514E+00	(-.05)	5.9246E+00	(4.79)
23	5.7655E+00	5.7564E+00	(-.16)	6.0395E+00	(4.75)
24	5.8587E+00	5.8454E+00	(-.23)	6.1291E+00	(4.62)
25	5.9329E+00	5.9166E+00	(-.27)	6.2003E+00	(4.51)
26	5.9817E+00	5.9642E+00	(-.29)	6.2479E+00	(4.45)
27	6.0228E+00	6.0070E+00	(-.26)	6.2906E+00	(4.45)
28	6.0454E+00	6.0341E+00	(-.19)	6.3176E+00	(4.50)
29	6.0520E+00	6.0440E+00	(-.13)	6.3274E+00	(4.55)
30	6.0584E+00	6.0549E+00	(-.06)	6.3383E+00	(4.62)
31	6.0655E+00	6.0696E+00	(.07)	6.3530E+00	(4.74)
32	6.0715E+00	6.0843E+00	(.21)	6.3677E+00	(4.88)
33	6.0748E+00	6.0936E+00	(.31)	6.3770E+00	(4.98)
34	6.0766E+00	6.0991E+00	(.37)	6.3826E+00	(5.04)
35	6.0772E+00	6.1009E+00	(.39)	6.3844E+00	(5.05)
36	6.0778E+00	6.1030E+00	(.41)	6.3863E+00	(5.08)
37	6.0784E+00	6.1050E+00	(.44)	6.3883E+00	(5.10)
38	6.0790E+00	6.1070E+00	(.46)	6.3903E+00	(5.12)
39	6.0796E+00	6.1090E+00	(.48)	6.3925E+00	(5.15)
40	6.0802E+00	6.1111E+00	(.51)	6.3946E+00	(5.17)
41	6.0808E+00	6.1132E+00	(.53)	6.3966E+00	(5.19)
42	6.0817E+00	6.1162E+00	(.57)	6.3997E+00	(5.23)
43	6.0832E+00	6.1215E+00	(.63)	6.4050E+00	(5.29)
44	6.0852E+00	6.1293E+00	(.73)	6.4127E+00	(5.38)
45	6.0894E+00	6.1467E+00	(.94)	6.4301E+00	(5.59)
46	6.0960E+00	6.1597E+00	(1.05)	6.4578E+00	(5.94)
47	6.1033E+00	6.0407E+00	(-1.03)	6.3497E+00	(4.04)
48	6.1097E+00	6.0359E+00	(-1.21)	6.3194E+00	(3.43)
49	6.1139E+00	6.0365E+00	(-1.27)	6.3199E+00	(3.37)
50	6.1171E+00	6.0368E+00	(-1.31)	6.3203E+00	(3.32)
51	6.1199E+00	6.0372E+00	(-1.35)	6.3206E+00	(3.28)
52	6.1240E+00	6.0376E+00	(-1.41)	6.3211E+00	(3.22)
53	6.1297E+00	6.0382E+00	(-1.49)	6.3218E+00	(3.13)
54	6.1383E+00	6.0391E+00	(-1.62)	6.3227E+00	(3.00)
55	6.1515E+00	6.0405E+00	(-1.80)	6.3241E+00	(2.81)
56	6.1716E+00	6.0426E+00	(-2.09)	6.3263E+00	(2.51)
57	6.1942E+00	6.0451E+00	(-2.41)	6.3289E+00	(2.17)
58	6.2134E+00	6.0473E+00	(-2.67)	6.3312E+00	(1.90)
59	6.2307E+00	6.0494E+00	(-2.91)	6.3334E+00	(1.65)
60	6.2482E+00	6.0516E+00	(-3.15)	6.3357E+00	(1.40)
61	6.2695E+00	6.0544E+00	(-3.43)	6.3386E+00	(1.10)
62	6.2960E+00	6.0580E+00	(-3.78)	6.3424E+00	(.74)
63	6.3240E+00	6.0621E+00	(-4.14)	6.3467E+00	(.36)
64	6.3523E+00	6.0669E+00	(-4.49)	6.3517E+00	(-.01)
65	6.3784E+00	6.0738E+00	(-4.77)	6.3589E+00	(-.30)
66	6.3964E+00	6.0847E+00	(-4.87)	6.3703E+00	(-.41)
67	6.4175E+00	6.1042E+00	(-4.88)	6.3907E+00	(-.42)
68	6.4651E+00	6.1495E+00	(-4.88)	6.4381E+00	(-.42)
69	6.7043E+00	6.3771E+00	(-4.88)	6.6764E+00	(-.42)

Table 2. Comparison of Capture Cross Sections for Niobium

GROUP	ENDF/B-6.1	JEF-2.2	% Difference	JENDL-3.2	% Difference
1	1.8099E-03	1.7505E-03	(-3.28)	5.8694E-04	(-67.57)
2	3.7837E-03	2.7812E-03	(-26.49)	2.2275E-03	(-41.13)
3	7.4543E-03	5.7207E-03	(-23.26)	7.0330E-03	(-5.65)
4	1.4197E-02	1.2110E-02	(-14.70)	1.6518E-02	(16.35)
5	3.4832E-02	3.3479E-02	(-3.89)	3.8822E-02	(11.45)
6	5.0459E-02	4.9283E-02	(-2.33)	5.5556E-02	(10.10)
7	5.7666E-02	5.9214E-02	(2.68)	5.9091E-02	(2.47)
8	6.8344E-02	7.1207E-02	(4.19)	6.7661E-02	(-1.00)
9	9.2239E-02	8.9505E-02	(-2.96)	8.6204E-02	(-6.54)
10	1.2756E-01	1.2740E-01	(-.12)	1.2057E-01	(-5.48)
11	1.8627E-01	1.5399E-01	(-17.33)	1.7769E-01	(-4.61)
12	2.6602E-01	2.1934E-01	(-17.55)	2.6071E-01	(-2.00)
13	3.6871E-01	3.1168E-01	(-15.47)	3.6653E-01	(-.59)
14	5.1521E-01	4.1242E-01	(-19.95)	5.3260E-01	(3.38)
15	6.6985E-01	6.8174E-01	(1.78)	8.5024E-01	(26.93)
16	8.4803E-01	8.2159E-01	(-3.12)	1.0298E+00	(21.44)
17	1.1003E+00	1.0566E+00	(-3.97)	1.0069E+00	(-8.49)
18	1.9648E+00	1.9238E+00	(-2.09)	1.9188E+00	(-2.34)
19	3.5690E+00	3.5292E+00	(-1.12)	2.4727E+00	(-30.72)
20	1.7712E+00	1.7354E+00	(-2.02)	1.6800E+00	(-5.15)
21	2.3029E+00	2.2708E+00	(-1.39)	2.4524E+00	(6.49)
22	1.1279E+00	1.0991E+00	(-2.55)	1.0716E+00	(-4.99)
23	4.1034E-02	1.4164E-02	(-65.48)	1.3831E-02	(-66.29)
24	5.5448E-01	5.2932E-01	(-4.54)	5.1452E-01	(-7.21)
25	5.4210E-02	3.0711E-02	(-43.35)	3.0413E-02	(-43.90)
26	6.4906E-02	4.2909E-02	(-33.89)	4.2872E-02	(-33.95)
27	8.6555E-02	6.6411E-02	(-23.27)	6.6502E-02	(-23.17)
28	1.0910E-01	9.0334E-02	(-17.20)	9.0538E-02	(-17.01)
29	1.1998E-01	1.0174E-01	(-15.20)	1.0197E-01	(-15.01)
30	1.3269E-01	1.1496E-01	(-13.36)	1.1524E-01	(-13.15)
31	1.5027E-01	1.3317E-01	(-11.38)	1.3350E-01	(-11.16)
32	1.6750E-01	1.5091E-01	(-9.90)	1.5133E-01	(-9.65)
33	1.7803E-01	1.6174E-01	(-9.15)	1.6217E-01	(-8.91)
34	1.8408E-01	1.6790E-01	(-8.79)	1.6846E-01	(-8.49)
35	1.8615E-01	1.6998E-01	(-8.69)	1.7047E-01	(-8.42)
36	1.8822E-01	1.7218E-01	(-8.52)	1.7262E-01	(-8.29)
37	1.9030E-01	1.7441E-01	(-8.35)	1.7478E-01	(-8.15)
38	1.9249E-01	1.7659E-01	(-8.26)	1.7697E-01	(-8.07)
39	1.9468E-01	1.7870E-01	(-8.21)	1.7924E-01	(-7.93)
40	1.9683E-01	1.8097E-01	(-8.06)	1.8148E-01	(-7.80)
41	1.9894E-01	1.8320E-01	(-7.91)	1.8365E-01	(-7.69)
42	2.0202E-01	1.8630E-01	(-7.78)	1.8688E-01	(-7.49)
43	2.0737E-01	1.9174E-01	(-7.54)	1.9229E-01	(-7.27)
44	2.1497E-01	1.9952E-01	(-7.19)	2.0005E-01	(-6.94)
45	2.3108E-01	2.1592E-01	(-6.56)	2.1652E-01	(-6.30)
46	2.5661E-01	2.4185E-01	(-5.75)	2.4257E-01	(-5.47)
47	2.8547E-01	2.7115E-01	(-5.01)	2.7190E-01	(-4.75)
48	3.1057E-01	2.9654E-01	(-4.52)	2.9743E-01	(-4.23)
49	3.2739E-01	3.1369E-01	(-4.18)	3.1468E-01	(-3.88)
50	3.3972E-01	3.2628E-01	(-3.96)	3.2713E-01	(-3.71)
51	3.5086E-01	3.3737E-01	(-3.84)	3.3829E-01	(-3.58)
52	3.6672E-01	3.5343E-01	(-3.62)	3.5456E-01	(-3.32)
53	3.8875E-01	3.7574E-01	(-3.35)	3.7677E-01	(-3.08)
54	4.2129E-01	4.0852E-01	(-3.03)	4.0978E-01	(-2.73)
55	4.7014E-01	4.5793E-01	(-2.60)	4.5905E-01	(-2.36)
56	5.4210E-01	5.3013E-01	(-2.21)	5.3168E-01	(-1.92)
57	6.2029E-01	6.0873E-01	(-1.86)	6.1066E-01	(-1.55)
58	6.8424E-01	6.7320E-01	(-1.61)	6.7502E-01	(-1.35)
59	7.4038E-01	7.2963E-01	(-1.45)	7.3161E-01	(-1.18)
60	7.9553E-01	7.8483E-01	(-1.34)	7.8704E-01	(-1.07)
61	8.6094E-01	8.5065E-01	(-1.20)	8.5292E-01	(-.93)
62	9.3986E-01	9.2984E-01	(-1.07)	9.3273E-01	(-.76)
63	1.0217E+00	1.0115E+00	(-1.00)	1.0146E+00	(-.69)
64	1.1096E+00	1.1001E+00	(-.85)	1.1032E+00	(-.58)
65	1.2253E+00	1.2161E+00	(-.75)	1.2197E+00	(-.46)
66	1.3880E+00	1.3791E+00	(-.64)	1.3832E+00	(-.35)
67	1.6396E+00	1.6312E+00	(-.51)	1.6359E+00	(-.22)
68	2.1063E+00	2.0984E+00	(-.37)	2.1047E+00	(-.07)
69	3.4704E+00	3.4640E+00	(-.18)	3.4741E+00	(.11)

Table 3. Comparison of Transport Cross Sections for Niobium

GROUP	ENDF/B-6.1	JEF-2.2	% Difference	JENDL-3.2	% Difference
1	2.4393E+00	2.4232E+00	(-.66)	2.5292E+00	(3.68)
2	2.6491E+00	2.6925E+00	(1.64)	2.7902E+00	(5.32)
3	2.9979E+00	3.1280E+00	(4.34)	3.1798E+00	(6.07)
4	3.3924E+00	3.4569E+00	(1.90)	3.5706E+00	(5.25)
5	4.0280E+00	3.9799E+00	(-1.19)	4.1569E+00	(3.20)
6	5.1029E+00	5.1899E+00	(1.70)	5.1571E+00	(1.06)
7	6.4879E+00	6.7265E+00	(3.68)	6.8399E+00	(5.43)
8	7.5675E+00	7.7712E+00	(2.69)	8.1784E+00	(8.07)
9	8.2897E+00	8.3434E+00	(.65)	9.0174E+00	(8.78)
10	8.5518E+00	6.6853E+00	(-21.83)	9.3152E+00	(8.93)
11	8.3840E+00	6.3274E+00	(-24.53)	9.1431E+00	(9.05)
12	7.9260E+00	6.5486E+00	(-17.38)	8.6442E+00	(9.06)
13	7.4130E+00	6.7521E+00	(-8.92)	8.3794E+00	(13.04)
14	7.0119E+00	6.9529E+00	(-.84)	8.4246E+00	(20.15)
15	9.5928E+00	9.8905E+00	(3.10)	1.0597E+01	(10.47)
16	9.8788E+00	9.8845E+00	(.06)	1.1002E+01	(11.37)
17	1.1526E+01	1.1476E+01	(-.43)	1.0857E+01	(-5.80)
18	1.0484E+01	1.0453E+01	(-.29)	1.0774E+01	(2.77)
19	1.2868E+01	1.2825E+01	(-.34)	1.3186E+01	(2.47)
20	8.2204E+00	8.1989E+00	(-.26)	8.4448E+00	(2.73)
21	8.3316E+00	8.3053E+00	(-.32)	8.7834E+00	(5.42)
22	6.7383E+00	6.7074E+00	(-.46)	6.9514E+00	(3.16)
23	5.7624E+00	5.7268E+00	(-.62)	6.0077E+00	(4.26)
24	6.3698E+00	6.3316E+00	(-.60)	6.5986E+00	(3.59)
25	5.9433E+00	5.9037E+00	(-.67)	6.1852E+00	(4.07)
26	6.0025E+00	5.9632E+00	(-.65)	6.2448E+00	(4.04)
27	6.0660E+00	6.0302E+00	(-.59)	6.3118E+00	(4.05)
28	6.0778E+00	6.0479E+00	(-.49)	6.3280E+00	(4.12)
29	6.0962E+00	6.0701E+00	(-.43)	6.3502E+00	(4.17)
30	6.1207E+00	6.0995E+00	(-.35)	6.3799E+00	(4.23)
31	6.1405E+00	6.1274E+00	(-.21)	6.4076E+00	(4.35)
32	6.1685E+00	6.1646E+00	(-.06)	6.4451E+00	(4.48)
33	6.1817E+00	6.1841E+00	(.04)	6.4646E+00	(4.58)
34	6.1895E+00	6.1955E+00	(.10)	6.4763E+00	(4.63)
35	6.1932E+00	6.2005E+00	(.12)	6.4811E+00	(4.65)
36	6.1969E+00	6.2057E+00	(.14)	6.4863E+00	(4.67)
37	6.2006E+00	6.2110E+00	(.17)	6.4915E+00	(4.69)
38	6.2044E+00	6.2162E+00	(.19)	6.4967E+00	(4.71)
39	6.2077E+00	6.2208E+00	(.21)	6.5017E+00	(4.74)
40	6.2101E+00	6.2248E+00	(.24)	6.5056E+00	(4.76)
41	6.2124E+00	6.2287E+00	(.26)	6.5094E+00	(4.78)
42	6.2156E+00	6.2340E+00	(.30)	6.5149E+00	(4.82)
43	6.2210E+00	6.2433E+00	(.36)	6.5241E+00	(4.87)
44	6.2288E+00	6.2570E+00	(.45)	6.5376E+00	(4.96)
45	6.2452E+00	6.2866E+00	(.66)	6.5671E+00	(5.15)
46	6.2782E+00	6.3264E+00	(.77)	6.6216E+00	(5.47)
47	6.3183E+00	6.2421E+00	(-1.21)	6.5483E+00	(3.64)
48	6.3505E+00	6.2636E+00	(-1.37)	6.5447E+00	(3.06)
49	6.3755E+00	6.2852E+00	(-1.42)	6.5666E+00	(3.00)
50	6.3938E+00	6.3009E+00	(-1.45)	6.5823E+00	(2.95)
51	6.4084E+00	6.3131E+00	(-1.49)	6.5946E+00	(2.90)
52	6.4245E+00	6.3257E+00	(-1.54)	6.6073E+00	(2.85)
53	6.4463E+00	6.3429E+00	(-1.60)	6.6241E+00	(2.76)
54	6.4817E+00	6.3710E+00	(-1.71)	6.6522E+00	(2.63)
55	6.5408E+00	6.4191E+00	(-1.86)	6.7001E+00	(2.43)
56	6.6370E+00	6.4977E+00	(-2.10)	6.7794E+00	(2.15)
57	6.7402E+00	6.5813E+00	(-2.36)	6.8636E+00	(1.83)
58	6.8190E+00	6.6440E+00	(-2.57)	6.9261E+00	(1.57)
59	6.8863E+00	6.6967E+00	(-2.75)	6.9787E+00	(1.34)
60	6.9587E+00	6.7540E+00	(-2.94)	7.0364E+00	(1.12)
61	7.0529E+00	6.8302E+00	(-3.16)	7.1131E+00	(.85)
62	7.1608E+00	6.9157E+00	(-3.42)	7.1996E+00	(.54)
63	7.2696E+00	7.0007E+00	(-3.70)	7.2849E+00	(.21)
64	7.3845E+00	7.0932E+00	(-3.95)	7.3776E+00	(-.09)
65	7.5263E+00	7.2162E+00	(-4.12)	7.5015E+00	(-.33)
66	7.7079E+00	7.3911E+00	(-4.11)	7.6774E+00	(-.40)
67	7.9685E+00	7.6511E+00	(-3.98)	7.9384E+00	(-.38)
68	8.4956E+00	8.1758E+00	(-3.76)	8.4674E+00	(-.33)
69	1.0097E+01	9.7669E+00	(-3.27)	1.0073E+01	(-.24)

Table 4. Comparison of Elastic Scattering Cross Sections for Bismuth

GROUP	ENDF/B-6	JEF-2.2	% Difference	JENDL-3.2	% Difference
1	3.4428E+00	3.3140E+00	(-3.74)	3.3863E+00	(-1.64)
2	5.3611E+00	5.1566E+00	(-3.81)	5.3164E+00	(-.83)
3	6.2946E+00	6.2895E+00	(-.08)	6.3554E+00	(.97)
4	5.3097E+00	5.3167E+00	(.13)	5.2847E+00	(-.47)
5	4.9982E+00	4.9341E+00	(-1.28)	4.9170E+00	(-1.63)
6	5.7655E+00	5.7164E+00	(-.85)	5.7215E+00	(-.76)
7	7.1267E+00	7.1375E+00	(.15)	7.1191E+00	(-.11)
8	7.8312E+00	9.4098E+00	(20.16)	7.8070E+00	(-.31)
9	8.8571E+00	1.0131E+01	(14.38)	8.6578E+00	(-2.25)
10	1.0487E+01	1.0769E+01	(2.69)	9.8522E+00	(-6.05)
11	1.0634E+01	1.0857E+01	(2.09)	1.0332E+01	(-2.84)
12	1.1567E+01	1.1782E+01	(1.85)	1.1530E+01	(-.32)
13	1.3467E+01	1.3833E+01	(2.71)	1.3476E+01	(.07)
14	1.5149E+01	1.5386E+01	(1.57)	1.5140E+01	(-.06)
15	9.8578E+00	9.8964E+00	(.39)	9.8480E+00	(-.10)
16	1.1313E+01	1.1490E+01	(1.56)	1.1310E+01	(-.02)
17	2.4809E+01	2.5267E+01	(1.85)	2.4821E+01	(.05)
18	8.8053E+00	8.5617E+00	(-2.77)	8.7819E+00	(-.27)
19	1.1353E+01	1.1456E+01	(.90)	1.1335E+01	(-.16)
20	2.6368E+01	2.6355E+01	(-.05)	2.6368E+01	(.00)
21	8.9856E+00	8.9403E+00	(-.50)	8.9841E+00	(-.02)
22	9.1864E+00	9.1488E+00	(-.41)	9.1841E+00	(-.02)
23	9.2408E+00	9.2182E+00	(-.24)	9.2383E+00	(-.03)
24	9.2664E+00	9.2530E+00	(-.14)	9.2638E+00	(-.03)
25	9.2836E+00	9.2759E+00	(-.08)	9.2810E+00	(-.03)
26	9.2945E+00	9.2886E+00	(-.06)	9.2919E+00	(-.03)
27	9.3070E+00	9.2976E+00	(-.10)	9.3044E+00	(-.03)
28	9.3185E+00	9.3019E+00	(-.18)	9.3159E+00	(-.03)
29	9.3245E+00	9.3030E+00	(-.23)	9.3218E+00	(-.03)
30	9.3319E+00	9.3039E+00	(-.30)	9.3292E+00	(-.03)
31	9.3432E+00	9.3048E+00	(-.41)	9.3406E+00	(-.03)
32	9.3556E+00	9.3055E+00	(-.54)	9.3529E+00	(-.03)
33	9.3637E+00	9.3058E+00	(-.62)	9.3611E+00	(-.03)
34	9.3687E+00	9.3059E+00	(-.67)	9.3661E+00	(-.03)
35	9.3704E+00	9.3060E+00	(-.69)	9.3677E+00	(-.03)
36	9.3721E+00	9.3060E+00	(-.70)	9.3695E+00	(-.03)
37	9.3740E+00	9.3061E+00	(-.72)	9.3714E+00	(-.03)
38	9.3759E+00	9.3061E+00	(-.74)	9.3732E+00	(-.03)
39	9.3777E+00	9.3062E+00	(-.76)	9.3750E+00	(-.03)
40	9.3796E+00	9.3062E+00	(-.78)	9.3769E+00	(-.03)
41	9.3815E+00	9.3063E+00	(-.80)	9.3789E+00	(-.03)
42	9.3844E+00	9.3064E+00	(-.83)	9.3817E+00	(-.03)
43	9.3893E+00	9.3065E+00	(-.88)	9.3866E+00	(-.03)
44	9.3965E+00	9.3066E+00	(-.96)	9.3939E+00	(-.03)
45	9.4130E+00	9.3069E+00	(-1.13)	9.4104E+00	(-.03)
46	9.4415E+00	9.3073E+00	(-1.42)	9.4388E+00	(-.03)
47	9.4773E+00	9.3077E+00	(-1.79)	9.4746E+00	(-.03)
48	9.5115E+00	9.3081E+00	(-2.14)	9.5089E+00	(-.03)
49	9.5367E+00	9.3083E+00	(-2.39)	9.5341E+00	(-.03)
50	9.5553E+00	9.3085E+00	(-2.58)	9.5527E+00	(-.03)
51	9.5705E+00	9.3087E+00	(-2.74)	9.5678E+00	(-.03)
52	9.5240E+00	9.3089E+00	(-2.26)	9.5216E+00	(-.02)
53	9.3165E+00	9.3092E+00	(-.08)	9.3139E+00	(-.03)
54	9.3029E+00	9.3097E+00	(.07)	9.3003E+00	(-.03)
55	9.3037E+00	9.3105E+00	(.07)	9.3011E+00	(-.03)
56	9.3050E+00	9.3119E+00	(.07)	9.3024E+00	(-.03)
57	9.3066E+00	9.3135E+00	(.07)	9.3039E+00	(-.03)
58	9.3080E+00	9.3149E+00	(.07)	9.3054E+00	(-.03)
59	9.3094E+00	9.3163E+00	(.07)	9.3068E+00	(-.03)
60	9.3109E+00	9.3178E+00	(.07)	9.3083E+00	(-.03)
61	9.3128E+00	9.3197E+00	(.07)	9.3101E+00	(-.03)
62	9.3153E+00	9.3222E+00	(.07)	9.3126E+00	(-.03)
63	9.3180E+00	9.3249E+00	(.07)	9.3154E+00	(-.03)
64	9.3213E+00	9.3282E+00	(.07)	9.3187E+00	(-.03)
65	9.3260E+00	9.3330E+00	(.07)	9.3234E+00	(-.03)
66	9.3334E+00	9.3403E+00	(.07)	9.3308E+00	(-.03)
67	9.3468E+00	9.3537E+00	(.07)	9.3441E+00	(-.03)
68	9.3778E+00	9.3847E+00	(.07)	9.3751E+00	(-.03)
69	9.5356E+00	9.5426E+00	(.07)	9.5329E+00	(-.03)

Table 5. Comparison of Capture Cross Sections for Bismuth

GROUP	ENDF/B-6	JEF-2.2	% Difference	JENDL-3.2	% Difference
1	3.0228E-04	8.9527E-04	(196.17)	4.0000E-04	(32.33)
2	8.7361E-04	2.1646E-03	(147.77)	4.2113E-04	(-51.79)
3	2.9194E-03	4.2221E-03	(44.62)	6.9141E-03	(136.83)
4	3.1065E-03	3.9489E-03	(27.12)	7.5782E-03	(143.94)
5	2.8247E-03	2.7375E-03	(-3.09)	4.6414E-03	(64.32)
6	2.7502E-03	2.5753E-03	(-6.36)	3.2246E-03	(17.25)
7	3.0295E-03	2.7962E-03	(-7.70)	2.7284E-03	(-9.94)
8	3.6792E-03	3.4762E-03	(-5.52)	2.8507E-03	(-22.52)
9	4.8303E-03	3.7278E-03	(-22.82)	2.2054E-03	(-54.34)
10	1.9681E-03	5.2272E-03	(165.60)	1.6565E-03	(-15.83)
11	1.3547E-03	1.3175E-02	(872.53)	1.8210E-03	(34.42)
12	2.2541E-03	1.2988E-02	(476.21)	2.4904E-03	(10.48)
13	3.7323E-03	4.4955E-03	(20.45)	3.5641E-03	(-4.51)
14	7.2333E-03	7.6016E-03	(5.09)	7.9473E-03	(9.87)
15	5.9734E-03	3.8978E-03	(-34.75)	6.3815E-03	(6.83)
16	1.7148E-02	1.6059E-02	(-6.35)	1.7148E-02	(.00)
17	4.7218E-02	3.9379E-02	(-16.60)	4.2961E-02	(-9.01)
18	1.6237E-03	1.5349E-03	(-5.47)	1.6239E-03	(.01)
19	1.3632E-03	1.5610E-03	(14.50)	1.3633E-03	(.00)
20	1.5306E-01	1.7783E-01	(16.18)	1.5306E-01	(.00)
21	6.2713E-04	7.0446E-04	(12.33)	6.2745E-04	(.05)
22	6.5162E-04	7.2354E-04	(11.04)	6.5211E-04	(.08)
23	7.8072E-04	8.6319E-04	(10.56)	7.8139E-04	(.09)
24	9.5718E-04	1.0559E-03	(10.31)	9.5805E-04	(.09)
25	1.2235E-03	1.3477E-03	(10.15)	1.2246E-03	(.09)
26	1.5568E-03	1.7144E-03	(10.12)	1.5583E-03	(.10)
27	2.1851E-03	2.4051E-03	(10.07)	2.1872E-03	(.10)
28	2.8421E-03	3.1318E-03	(10.19)	2.8449E-03	(.10)
29	3.1621E-03	3.4769E-03	(9.95)	3.1652E-03	(.10)
30	3.5361E-03	3.8905E-03	(10.02)	3.5396E-03	(.10)
31	4.0552E-03	4.4637E-03	(10.07)	4.0591E-03	(.10)
32	4.5661E-03	5.0185E-03	(9.91)	4.5705E-03	(.10)
33	4.8772E-03	5.3642E-03	(9.98)	4.8820E-03	(.10)
34	5.0591E-03	5.5648E-03	(10.00)	5.0640E-03	(.10)
35	5.1172E-03	5.6355E-03	(10.13)	5.1222E-03	(.10)
36	5.1781E-03	5.7049E-03	(10.17)	5.1832E-03	(.10)
37	5.2432E-03	5.7743E-03	(10.13)	5.2483E-03	(.10)
38	5.3070E-03	5.8423E-03	(10.09)	5.3121E-03	(.10)
39	5.3683E-03	5.9077E-03	(10.05)	5.3736E-03	(.10)
40	5.4326E-03	5.9721E-03	(9.93)	5.4379E-03	(.10)
41	5.4967E-03	6.0477E-03	(10.02)	5.5021E-03	(.10)
42	5.5895E-03	6.1598E-03	(10.20)	5.5949E-03	(.10)
43	5.7468E-03	6.3408E-03	(10.34)	5.7524E-03	(.10)
44	5.9715E-03	6.5758E-03	(10.12)	5.9773E-03	(.10)
45	6.4511E-03	7.0934E-03	(9.96)	6.4574E-03	(.10)
46	7.2085E-03	7.9307E-03	(10.02)	7.2155E-03	(.10)
47	8.0636E-03	8.8816E-03	(10.14)	8.0715E-03	(.10)
48	8.8080E-03	9.6810E-03	(9.91)	8.8166E-03	(.10)
49	9.3147E-03	1.0235E-02	(9.88)	9.3237E-03	(.10)
50	9.6749E-03	1.0639E-02	(9.96)	9.6844E-03	(.10)
51	1.0004E-02	1.0998E-02	(9.93)	1.0014E-02	(.10)
52	1.0473E-02	1.1528E-02	(10.07)	1.0483E-02	(.10)
53	1.1127E-02	1.2251E-02	(10.10)	1.1137E-02	(.10)
54	1.2093E-02	1.3308E-02	(10.05)	1.2105E-02	(.10)
55	1.3542E-02	1.4887E-02	(9.94)	1.3555E-02	(.10)
56	1.5673E-02	1.7259E-02	(10.12)	1.5689E-02	(.10)
57	1.7990E-02	1.9772E-02	(9.91)	1.8007E-02	(.10)
58	1.9882E-02	2.1861E-02	(9.96)	1.9901E-02	(.10)
59	2.1544E-02	2.3714E-02	(10.07)	2.1565E-02	(.10)
60	2.3177E-02	2.5533E-02	(10.17)	2.3199E-02	(.10)
61	2.5112E-02	2.7605E-02	(9.92)	2.5137E-02	(.10)
62	2.7444E-02	3.0177E-02	(9.96)	2.7471E-02	(.10)
63	2.9862E-02	3.2843E-02	(9.98)	2.9891E-02	(.10)
64	3.2461E-02	3.5724E-02	(10.05)	3.2493E-02	(.10)
65	3.5889E-02	3.9515E-02	(10.10)	3.5924E-02	(.10)
66	4.0696E-02	4.4753E-02	(9.97)	4.0736E-02	(.10)
67	4.8129E-02	5.2944E-02	(10.00)	4.8176E-02	(.10)
68	6.1914E-02	6.8097E-02	(9.99)	6.1974E-02	(.10)
69	1.0219E-01	1.1239E-01	(9.98)	1.0229E-01	(.10)

Table 6. Comparison of Transport Cross Sections for Bismuth

GROUP	ENDF/B-6	JEF-2.2	% Difference	JENDL-3.2	% Difference
1	3.3146E+00	3.4472E+00	(4.00)	3.3701E+00	(1.67)
2	3.7174E+00	3.8973E+00	(4.84)	3.5248E+00	(-5.18)
3	4.3195E+00	4.4805E+00	(3.73)	4.2767E+00	(-.99)
4	4.2703E+00	4.2357E+00	(-.81)	4.3642E+00	(2.20)
5	4.2560E+00	4.0180E+00	(-5.59)	3.9917E+00	(-6.21)
6	5.0873E+00	4.8212E+00	(-5.23)	4.6765E+00	(-8.07)
7	6.4326E+00	6.2384E+00	(-3.02)	6.0858E+00	(-5.39)
8	7.2232E+00	8.5081E+00	(17.79)	7.0180E+00	(-2.84)
9	8.3351E+00	9.4302E+00	(13.14)	8.0883E+00	(-2.96)
10	1.0046E+01	1.0283E+01	(2.36)	9.4685E+00	(-5.74)
11	1.0300E+01	1.0520E+01	(2.14)	1.0065E+01	(-2.28)
12	1.1321E+01	1.1555E+01	(2.06)	1.1356E+01	(.30)
13	1.3290E+01	1.3675E+01	(2.89)	1.3377E+01	(.65)
14	1.4958E+01	1.5245E+01	(1.91)	1.5030E+01	(.48)
15	9.7570E+00	9.8249E+00	(.70)	9.7942E+00	(.38)
16	1.1229E+01	1.1444E+01	(1.91)	1.1276E+01	(.41)
17	2.4650E+01	2.5211E+01	(2.28)	2.4758E+01	(.44)
18	8.7536E+00	8.5231E+00	(-2.63)	8.7641E+00	(.12)
19	1.1241E+01	1.1383E+01	(1.26)	1.1265E+01	(.22)
20	2.6353E+01	2.6463E+01	(.42)	2.6451E+01	(.37)
21	8.9223E+00	8.9100E+00	(-.14)	8.9538E+00	(.35)
22	9.1230E+00	9.1189E+00	(-.04)	9.1543E+00	(.34)
23	9.1774E+00	9.1884E+00	(.12)	9.2086E+00	(.34)
24	9.2037E+00	9.2241E+00	(.22)	9.2349E+00	(.34)
25	9.2210E+00	9.2473E+00	(.28)	9.2522E+00	(.34)
26	9.2321E+00	9.2602E+00	(.30)	9.2633E+00	(.34)
27	9.2457E+00	9.2705E+00	(.27)	9.2769E+00	(.34)
28	9.2430E+00	9.2269E+00	(-.17)	9.2404E+00	(-.03)
29	9.2572E+00	9.2362E+00	(-.23)	9.2546E+00	(-.03)
30	9.2684E+00	9.2410E+00	(-.30)	9.2658E+00	(-.03)
31	9.2748E+00	9.2371E+00	(-.41)	9.2722E+00	(-.03)
32	9.2764E+00	9.2272E+00	(-.53)	9.2738E+00	(-.03)
33	9.2909E+00	9.2340E+00	(-.61)	9.2883E+00	(-.03)
34	9.3011E+00	9.2393E+00	(-.66)	9.2985E+00	(-.03)
35	9.3034E+00	9.2400E+00	(-.68)	9.3008E+00	(-.03)
36	9.3057E+00	9.2407E+00	(-.70)	9.3031E+00	(-.03)
37	9.3082E+00	9.2414E+00	(-.72)	9.3056E+00	(-.03)
38	9.3107E+00	9.2421E+00	(-.74)	9.3081E+00	(-.03)
39	9.3124E+00	9.2420E+00	(-.76)	9.3098E+00	(-.03)
40	9.3124E+00	9.2402E+00	(-.78)	9.3098E+00	(-.03)
41	9.3124E+00	9.2384E+00	(-.80)	9.3098E+00	(-.03)
42	9.3168E+00	9.2399E+00	(-.82)	9.3141E+00	(-.03)
43	9.3273E+00	9.2457E+00	(-.88)	9.3247E+00	(-.03)
44	9.3419E+00	9.2531E+00	(-.95)	9.3392E+00	(-.03)
45	9.3596E+00	9.2548E+00	(-1.12)	9.3570E+00	(-.03)
46	9.3877E+00	9.2552E+00	(-1.41)	9.3851E+00	(-.03)
47	9.4156E+00	9.2482E+00	(-1.78)	9.4130E+00	(-.03)
48	9.4457E+00	9.2447E+00	(-2.13)	9.4431E+00	(-.03)
49	9.4622E+00	9.2368E+00	(-2.38)	9.4596E+00	(-.03)
50	9.4765E+00	9.2330E+00	(-2.57)	9.4739E+00	(-.03)
51	9.4942E+00	9.2358E+00	(-2.72)	9.4916E+00	(-.03)
52	9.4494E+00	9.2373E+00	(-2.24)	9.4471E+00	(-.02)
53	9.2458E+00	9.2397E+00	(-.07)	9.2433E+00	(-.03)
54	9.2360E+00	9.2439E+00	(.09)	9.2334E+00	(-.03)
55	9.2434E+00	9.2516E+00	(.09)	9.2408E+00	(-.03)
56	9.2580E+00	9.2665E+00	(.09)	9.2554E+00	(-.03)
57	9.2519E+00	9.2605E+00	(.09)	9.2493E+00	(-.03)
58	9.2494E+00	9.2582E+00	(.10)	9.2468E+00	(-.03)
59	9.2521E+00	9.2611E+00	(.10)	9.2495E+00	(-.03)
60	9.2550E+00	9.2642E+00	(.10)	9.2524E+00	(-.03)
61	9.2587E+00	9.2681E+00	(.10)	9.2561E+00	(-.03)
62	9.2660E+00	9.2756E+00	(.10)	9.2634E+00	(-.03)
63	9.2747E+00	9.2845E+00	(.11)	9.2721E+00	(-.03)
64	9.2638E+00	9.2739E+00	(.11)	9.2612E+00	(-.03)
65	9.2722E+00	9.2827E+00	(.11)	9.2696E+00	(-.03)
66	9.2980E+00	9.3089E+00	(.12)	9.2954E+00	(-.03)
67	9.3159E+00	9.3276E+00	(.13)	9.3133E+00	(-.03)
68	9.3628E+00	9.3759E+00	(.14)	9.3602E+00	(-.03)
69	9.5595E+00	9.5767E+00	(.18)	9.5569E+00	(-.03)

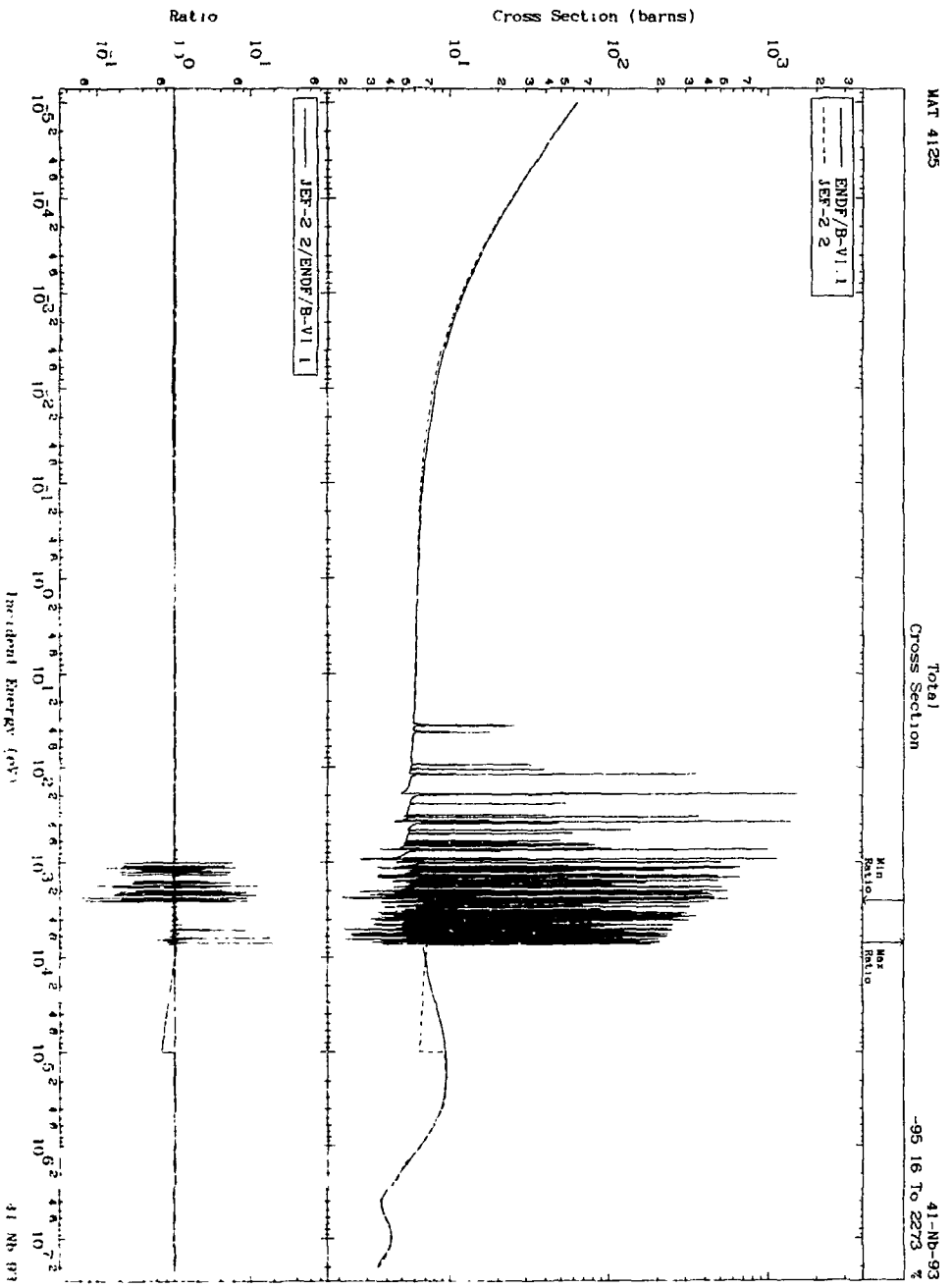

MAT 4125
Total
Cross Section
-95 16 To 2273
41-Nb-93
Cross Section (barns)
ENDF/B-VI.1
JEF-2.2
Min Ratio
Max Ratio
Ratio
JEF-2.2/ENDF/B-VI.1
Incident Energy (eV)
41 Nb 93

Fig. 1.

Fig. 2.

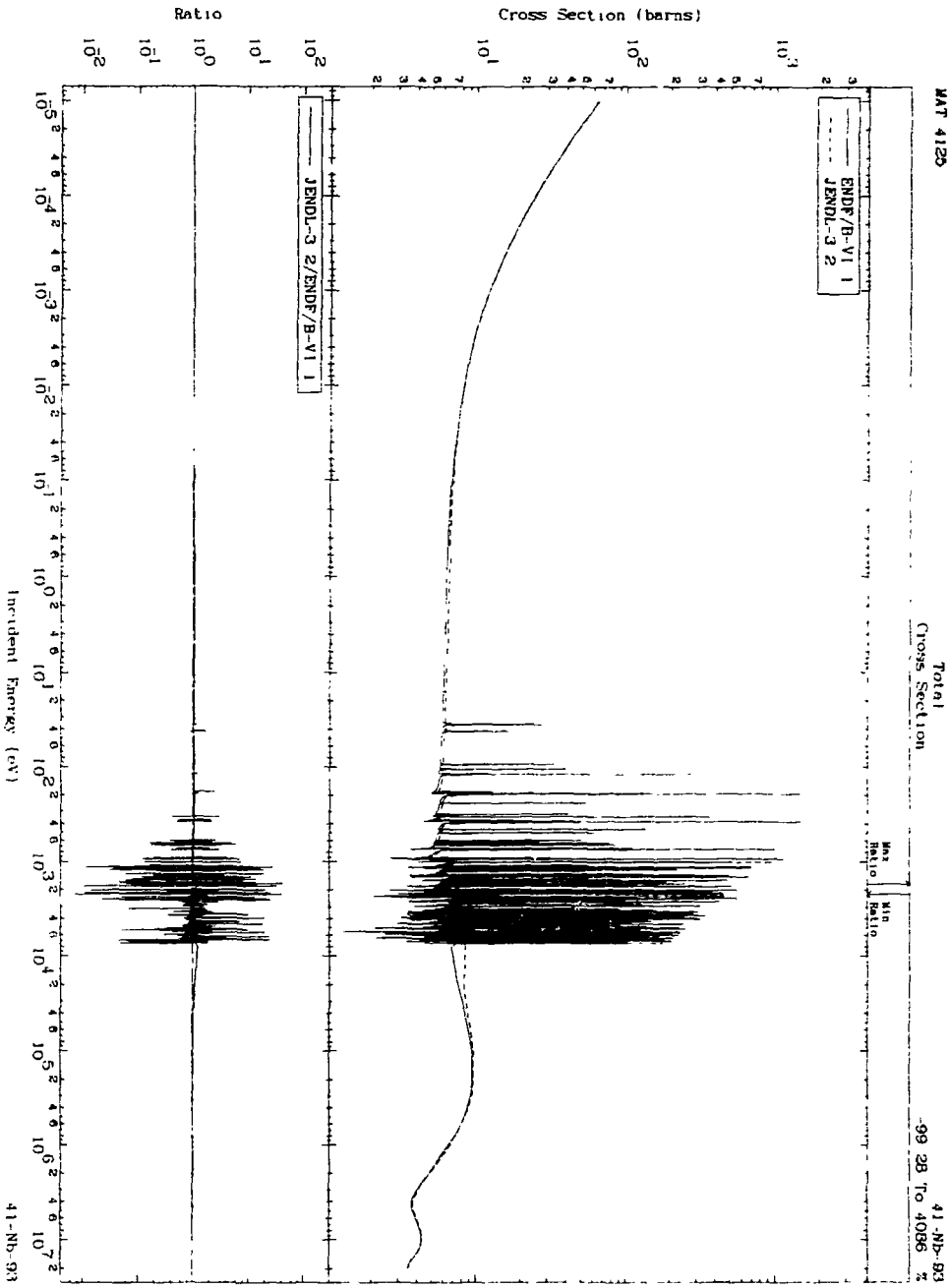

MAT 4125
Total
Cross Section
41-Nb-93
-99 2B To 4096
Cross Section (barns)
ENDF/B-VI 1
JENDL-3 2
Max Ratio
Min Ratio
Ratio
JENDL-3 2/ENDF/B-VI 1
Incident Energy (eV)
41-Nb-93

Fig. 3.

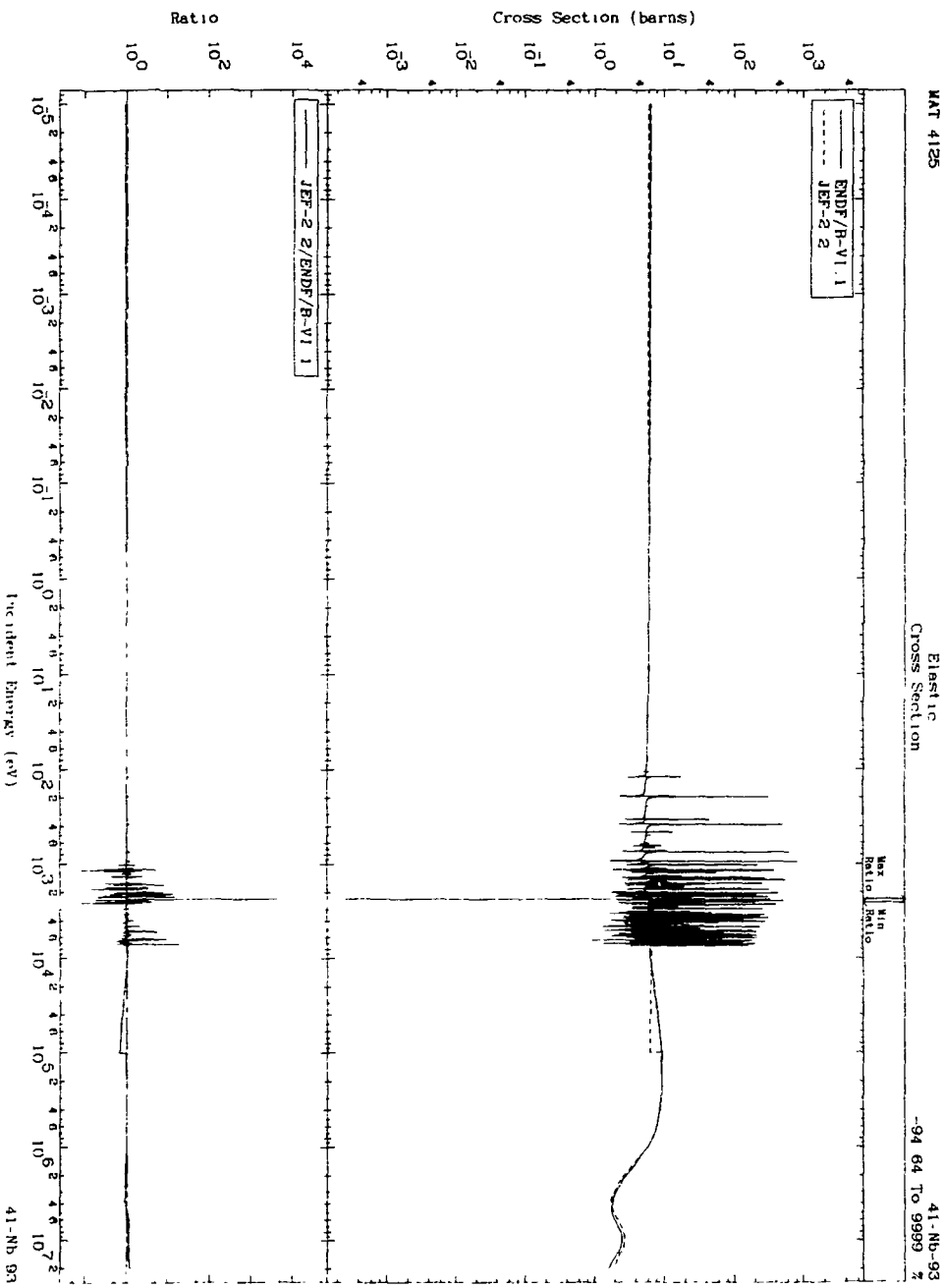
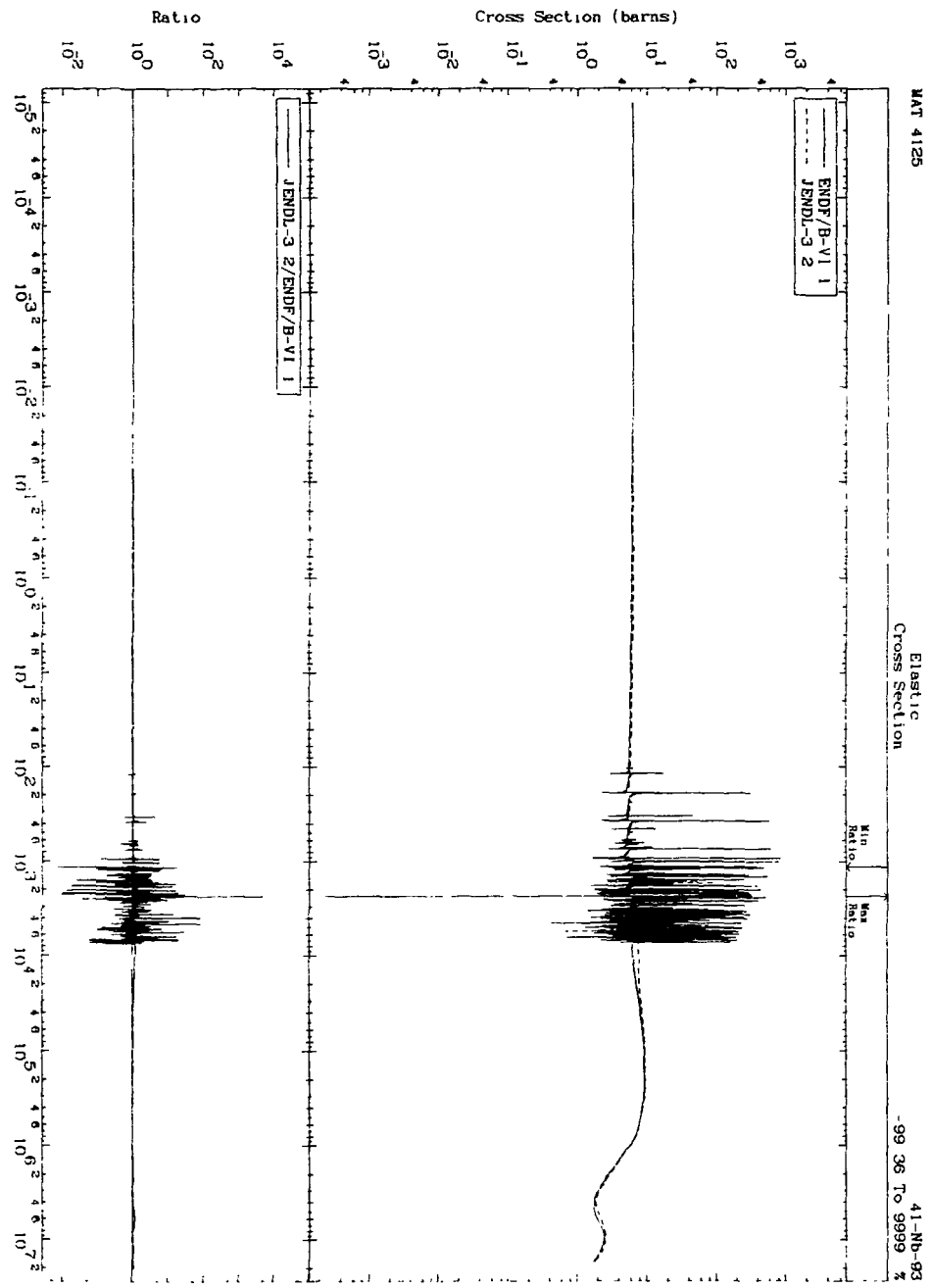

MAT 4125
Elastic
Cross Section
41-Nb-93
-94 64 To 9999
Cross Section (barns)
Ratio
ENDF/B-VI.1
JEF-2.2
JEF-2.2/ENDF/B-VI.1
Max Ratio
Min Ratio
Incident Energy (eV)
41-Nb 93

Fig. 4.


MAT 4125
Elastic
Cross Section
-99 36 To 9999 %
41-Nb-93
Cross Section (barns)
Ratio
ENDF/B-VI 1
JENDL-3 2
JENDL-3 2/ENDF/B-VI 1
Min Ratio
Max Ratio
Incident Energy (eV)
41 Nb 93

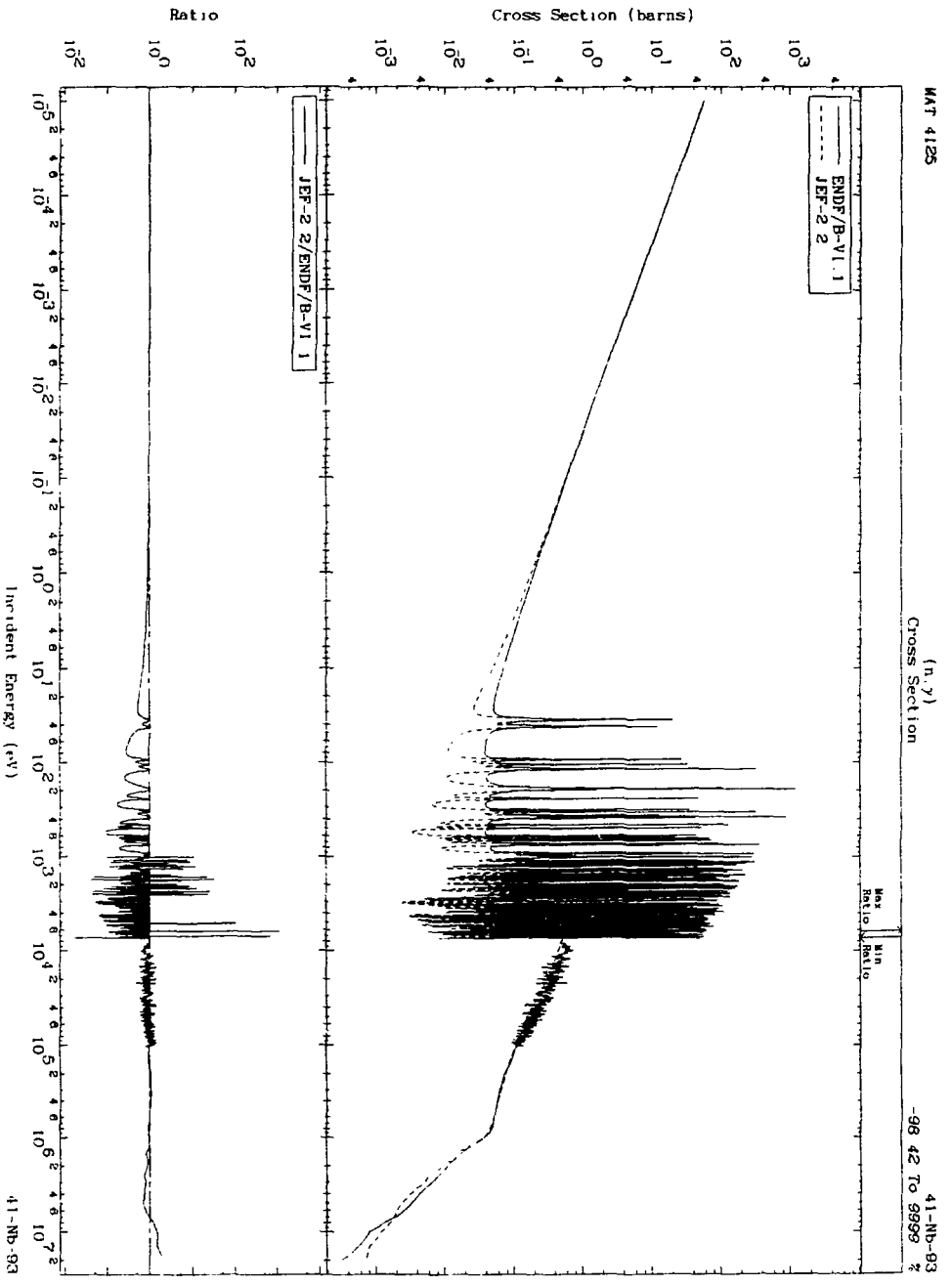

MAT 4125
41-Nb-93
(n,γ)
Cross Section
-98 42 To 9999
41-Nb-93
Cross Section (barns)
Ratio
ENDF/B-VI.1
JEF-2.2
JEF-2.2/ENDF/B-VI.1
Max Ratio
Min Ratio
Incident Energy (eV)

Fig. 5.

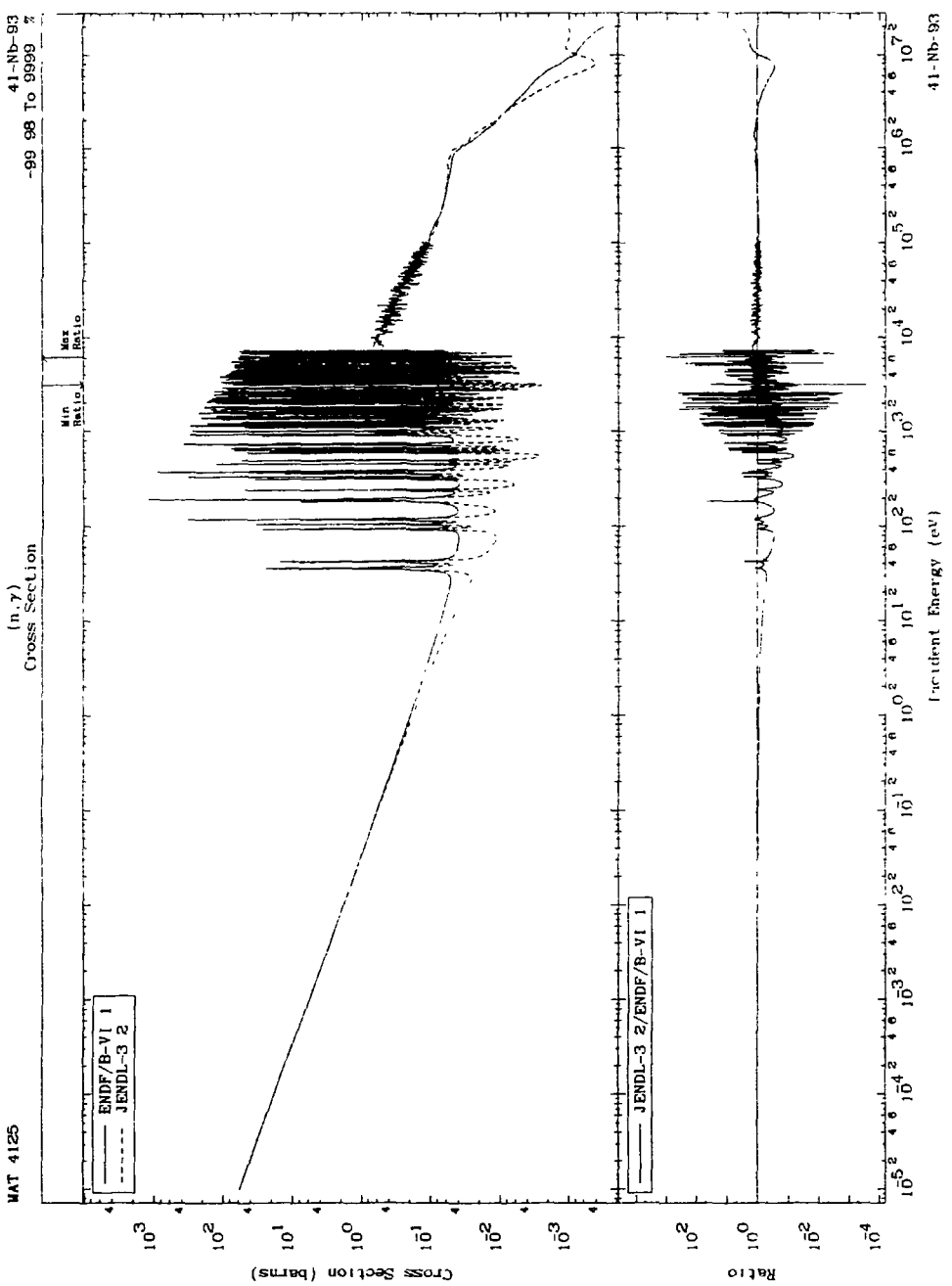
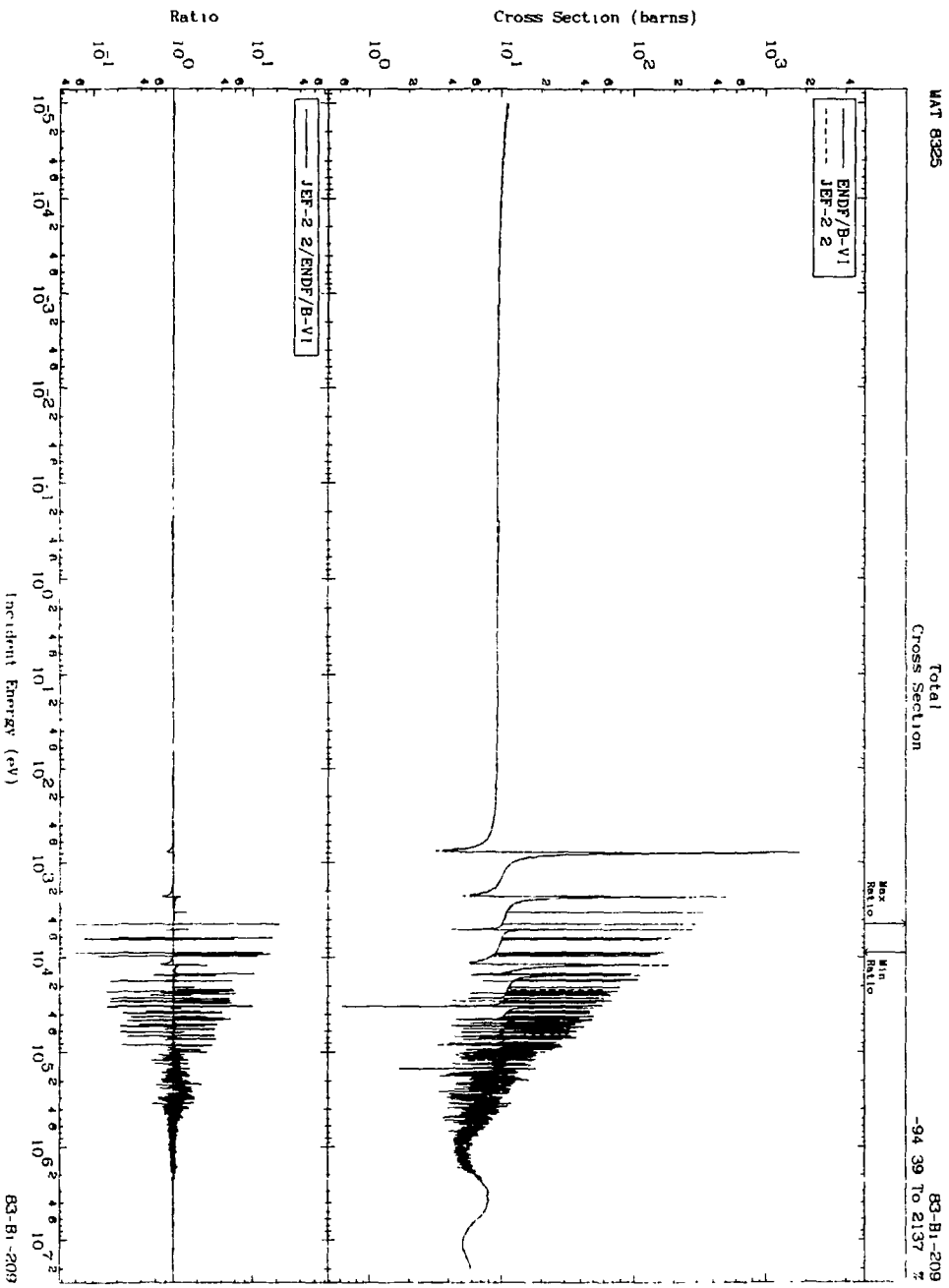

MAT 4125
(n,γ)
Cross Section
41-Nb-93
-99 98 To 9999 %
Min Ratio
Max Ratio
ENDF/B-VI 1
JENDL-3 2
Cross Section (barns)
JENDL-3 2/ENDF/B-VI 1
Ratio
Incident Energy (eV)
41-Nb-93

Fig. 6.

Fig. 7.


MAT 8325
Total
Cross Section
83-Bi-209
-94 39 To 2137
ENDF/B-VI
JEF-2 2
JEF-2 2/ENDF/B-VI
Max Ratio
Min Ratio
Cross Section (barns)
Ratio
Incident Energy (eV)
83-Bi-209

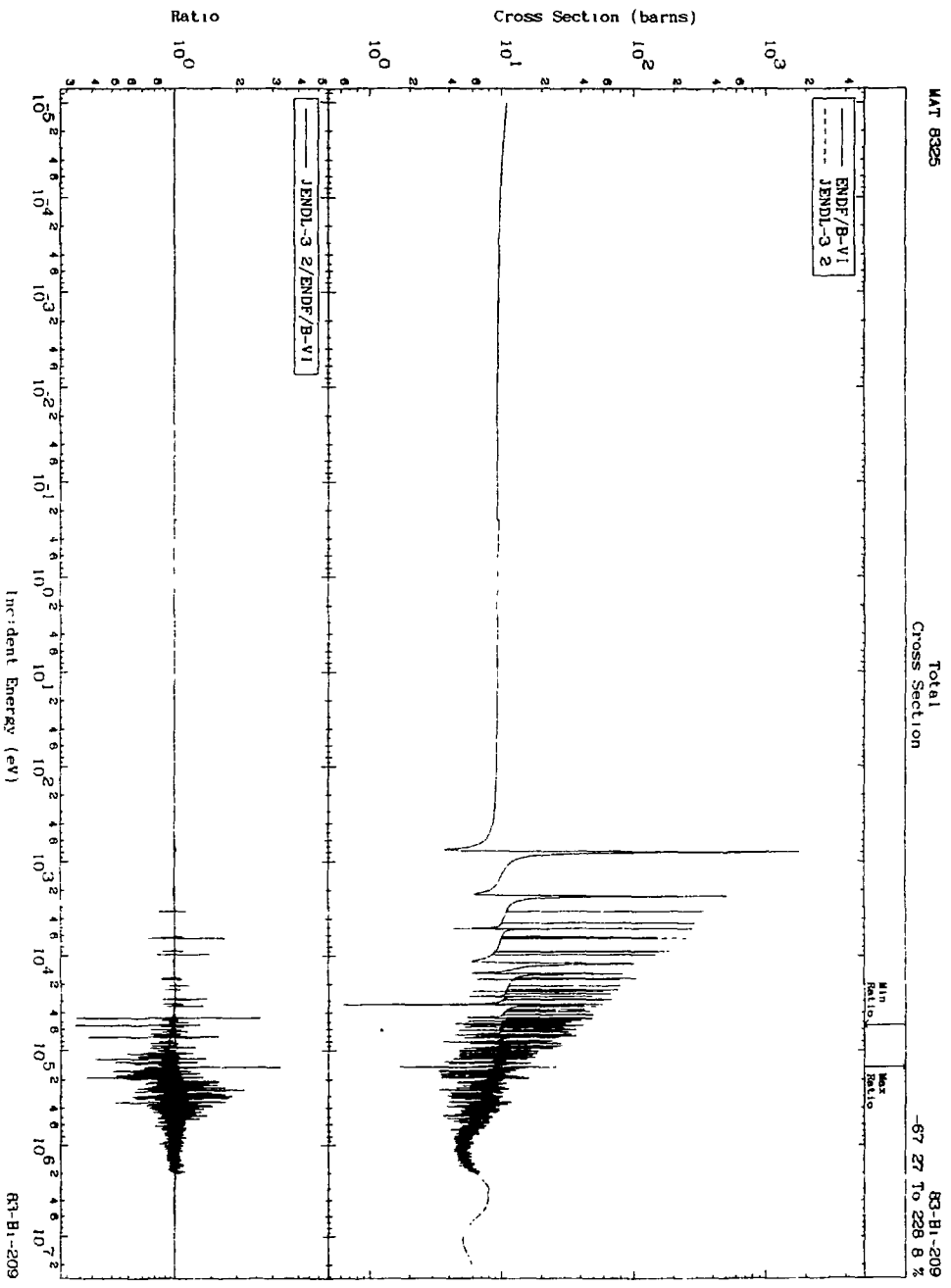
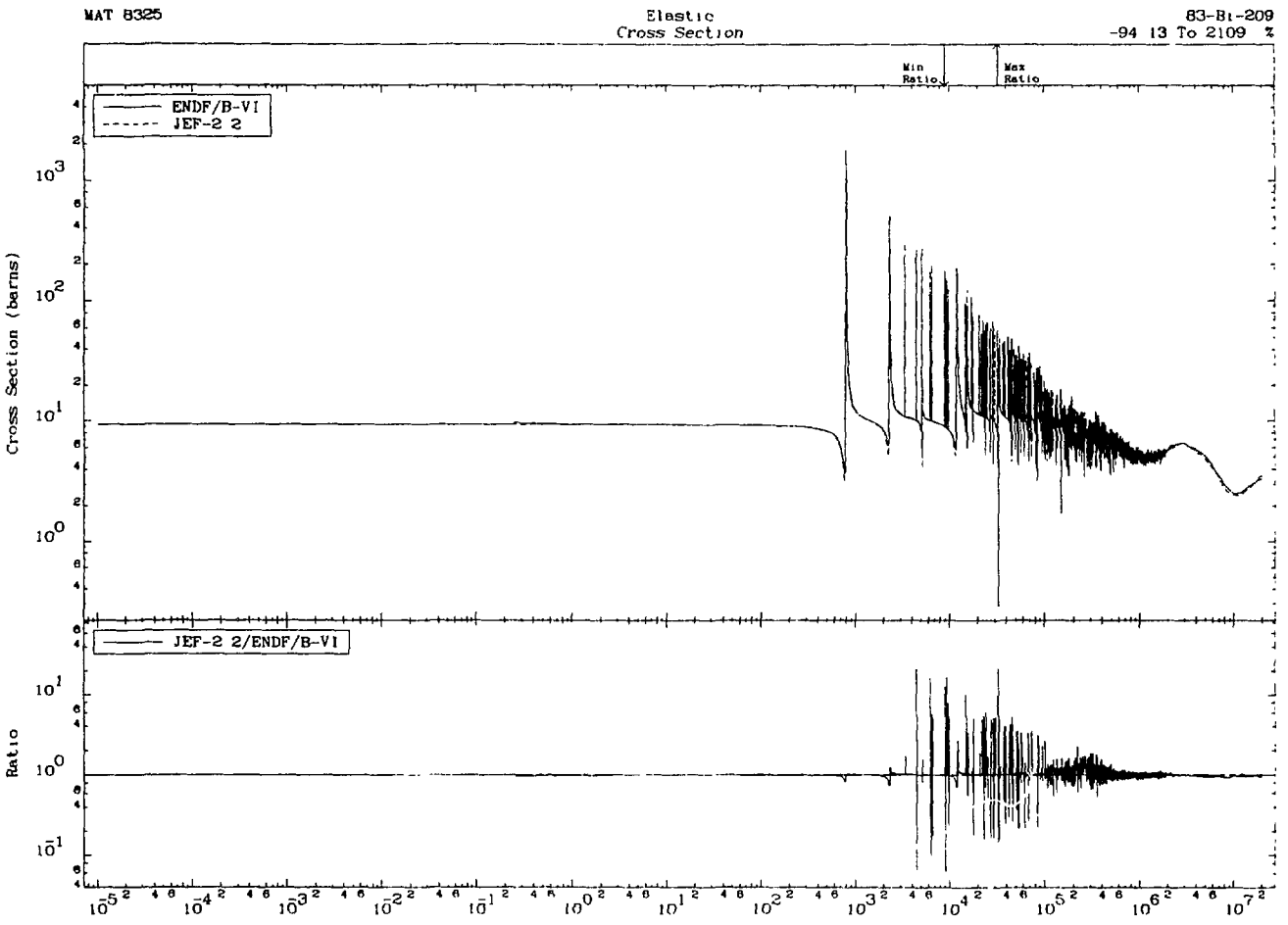

MAT 8325
Total
Cross Section
-67 27 83-Bi-209
To 228 8 %
Min Ratio
Max Ratio
ENDF/B-VI
JENDL-3 2
JENDL-3 2/ENDF/B-VI
Cross Section (barns)
Ratio
Incident Energy (eV)
83-Bi-209

Fig. 8.

Fig. 9.


MAT 8325
Elastic
Cross Section
83-Bi-209
-94 13 To 2109 %
Min Ratio
Max Ratio
ENDF/B-VI
JEF-2 2
Cross Section (barns)
JEF-2 2/ENDF/B-VI
Ratio
Incident Energy (eV)
83-Bi-209

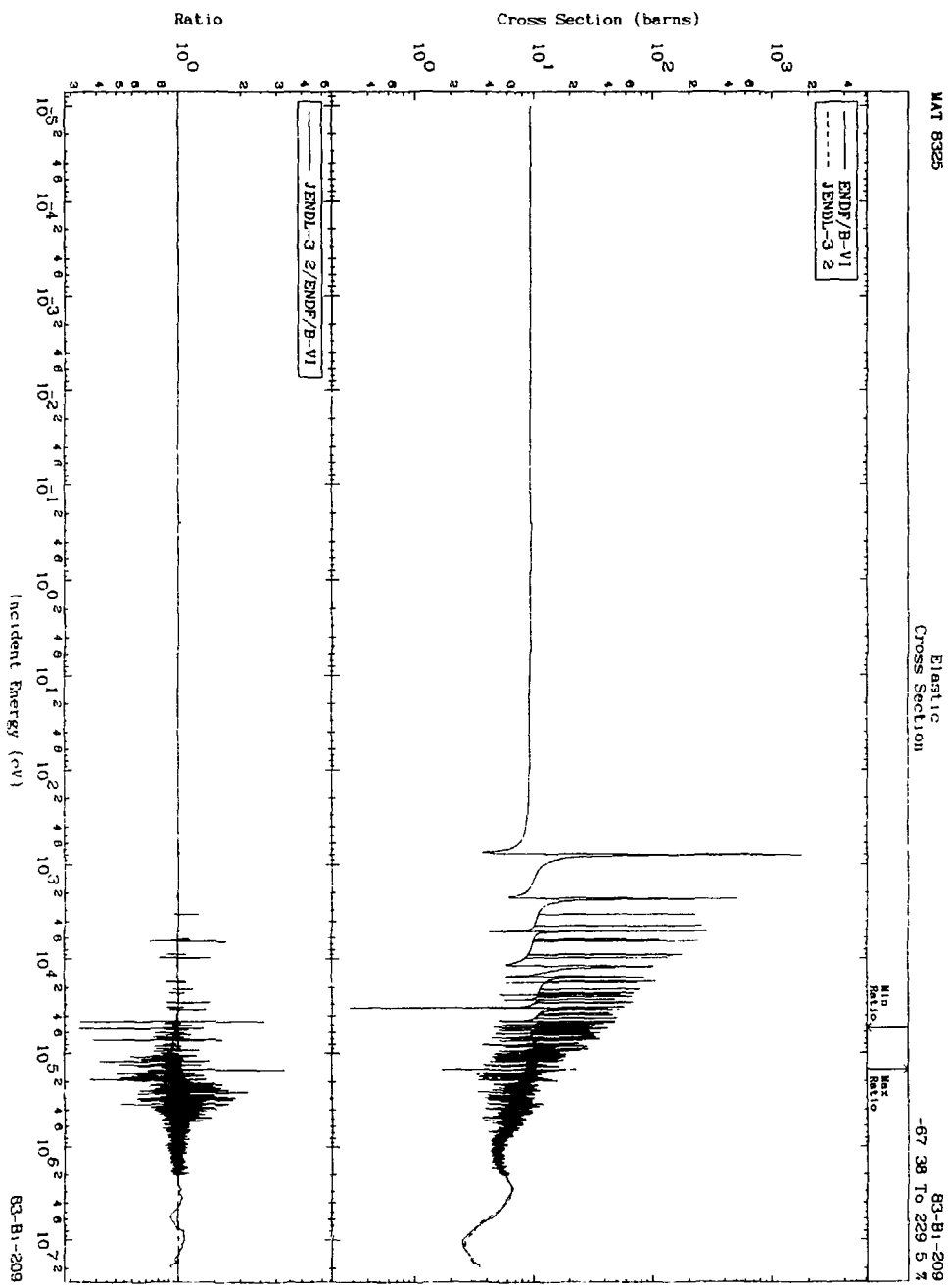

MAT 8325
Elastic
Cross Section
83-Bi-209
-67.38 To 229.5 %
Cross Section (barns)
ENDF/B-VI
JENDL-3.2
Min Ratio
Max Ratio
Ratio
JENDL-3.2/ENDF/B-VI
Incident Energy (eV)
83-Bi-209

Fig. 10.

Fig. 11.

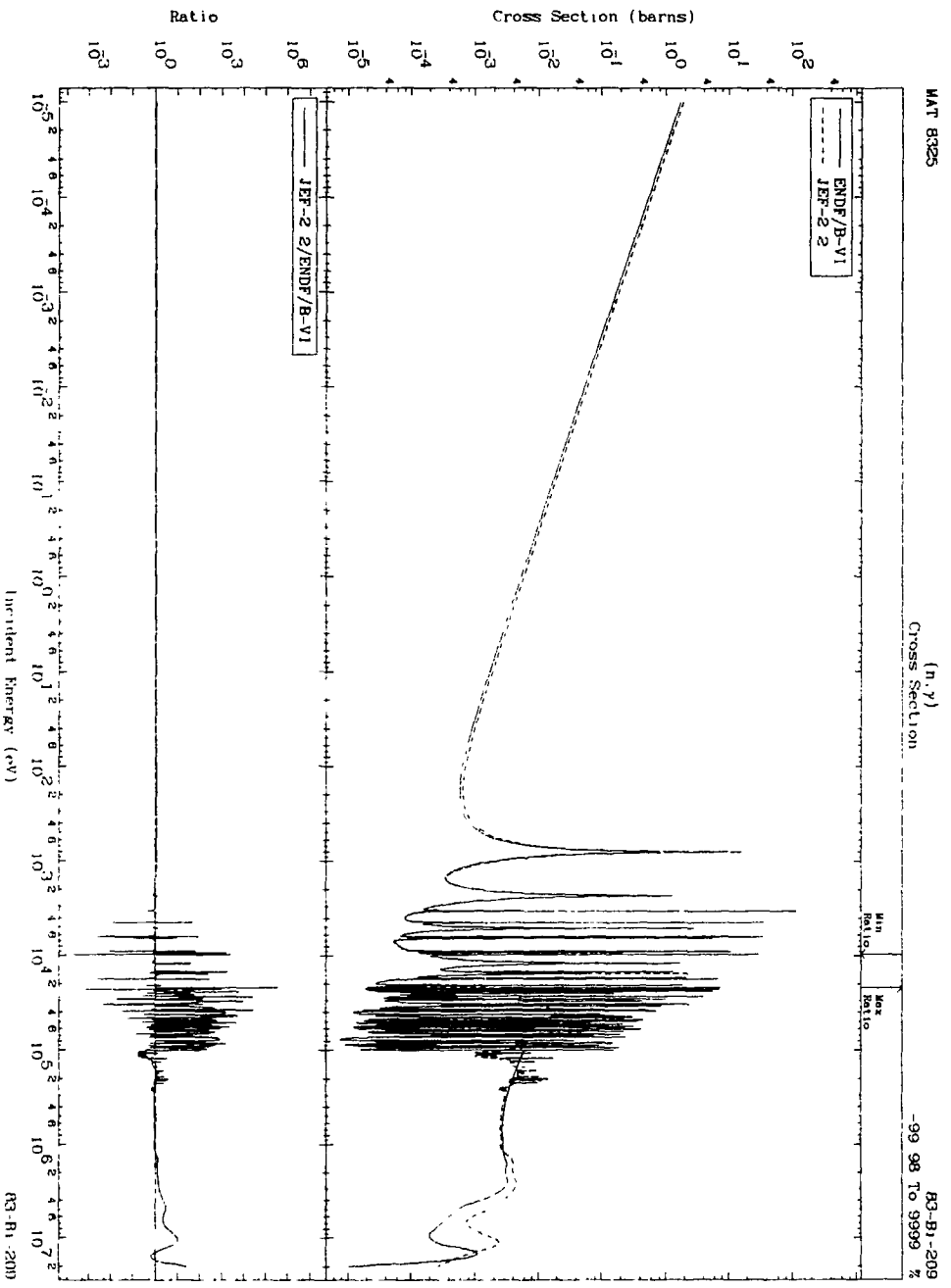
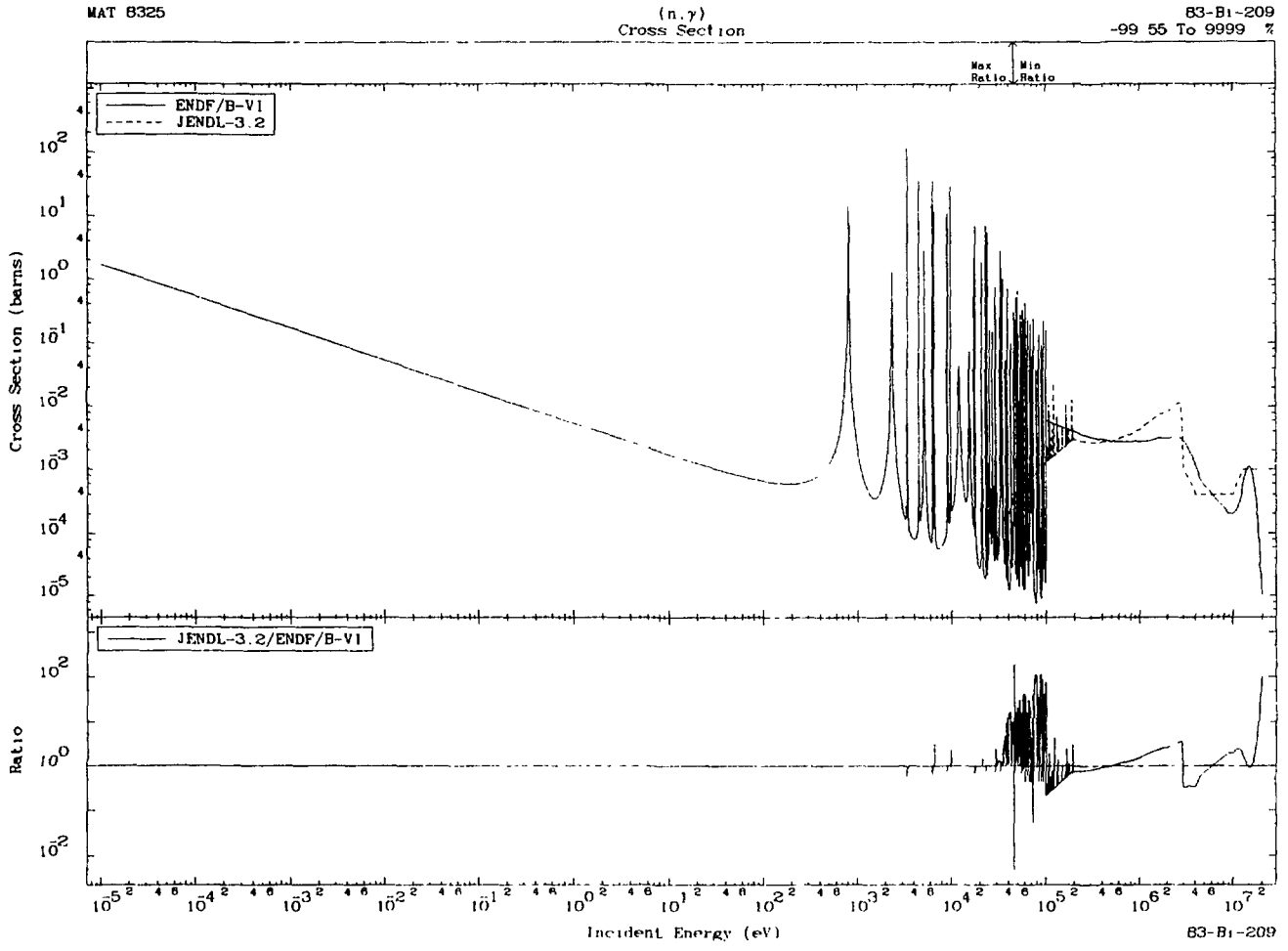

MAT 8325
(n,γ)
Cross Section
83-Bi-209
-99 98 To 9999 %
ENDF/B-VI
JEF-2.2
JEF-2.2/ENDF/B-VI
Min Ratio
Max Ratio
Cross Section (barns)
Ratio
Incident Energy (eV)
83-Bi-209

Fig. 12.


MAT 8325
(n,γ)
Cross Section
83-Bi-209
-99 55 To 9999 %
Max Ratio
Min Ratio
ENDF/B-VI
JENDL-3.2
Cross Section (barns)
JENDL-3.2/ENDF/B-VI
Ratio
Incident Energy (eV)
83-Bi-209