

Program Complot  
(Version 2018-1)

by

Dermott E. Cullen  
(Present Contact Information)

Dermott E. Cullen  
1466 Hudson Way  
Livermore, CA 94550

U.S.A.

Tele: 925-443-1911

E.Mail: [redcullen1@comcast.net](mailto:redcullen1@comcast.net)  
Web: [redcullen1.net/HOMEPAGE.NEW](http://redcullen1.net/HOMEPAGE.NEW)

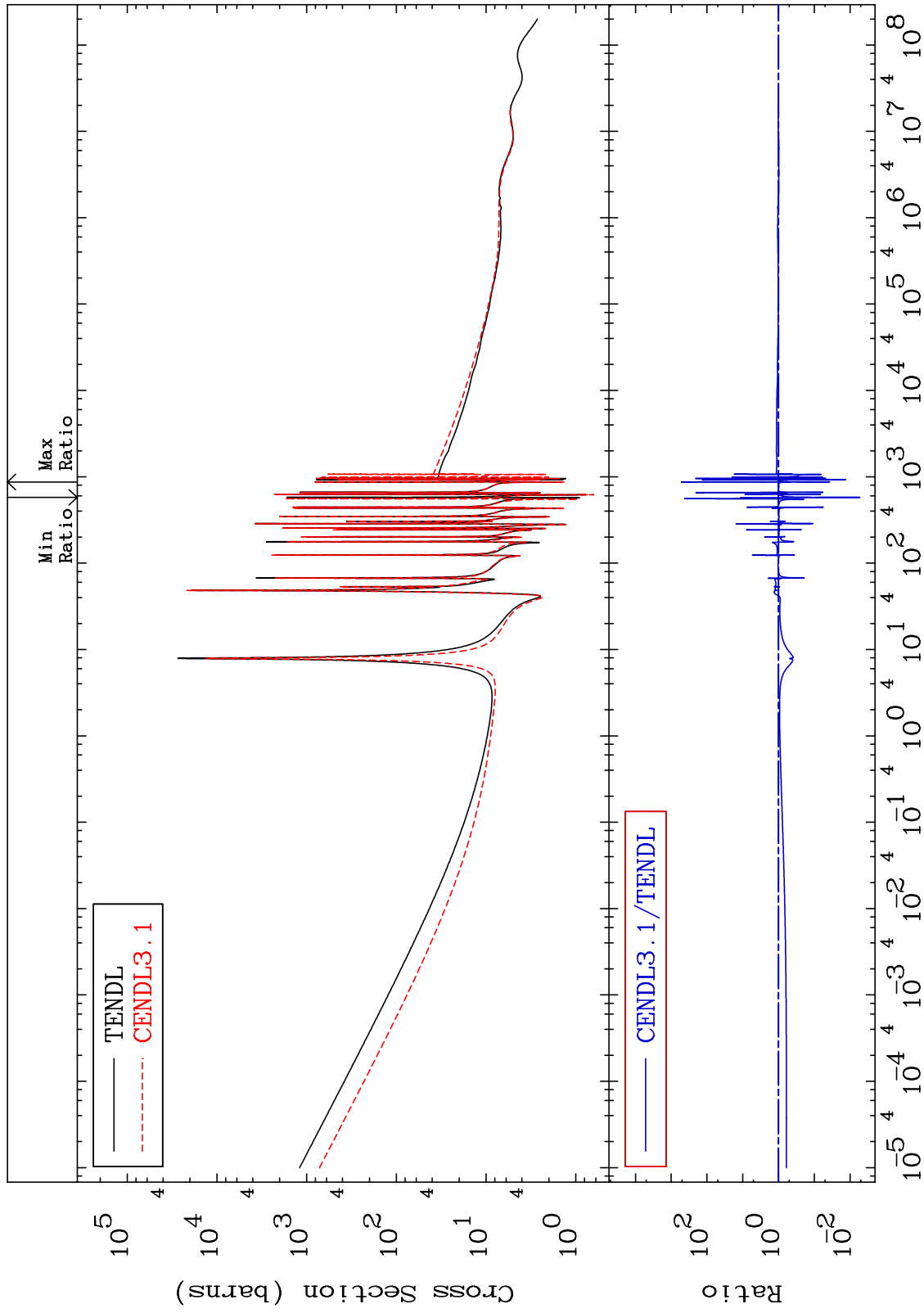
Press Mouse Button to Start

MAT 7231

Total  
Cross Section

72-Hf-176

-99.46 To 9999. %



Incident Energy (eV)

72-Hf-176

1

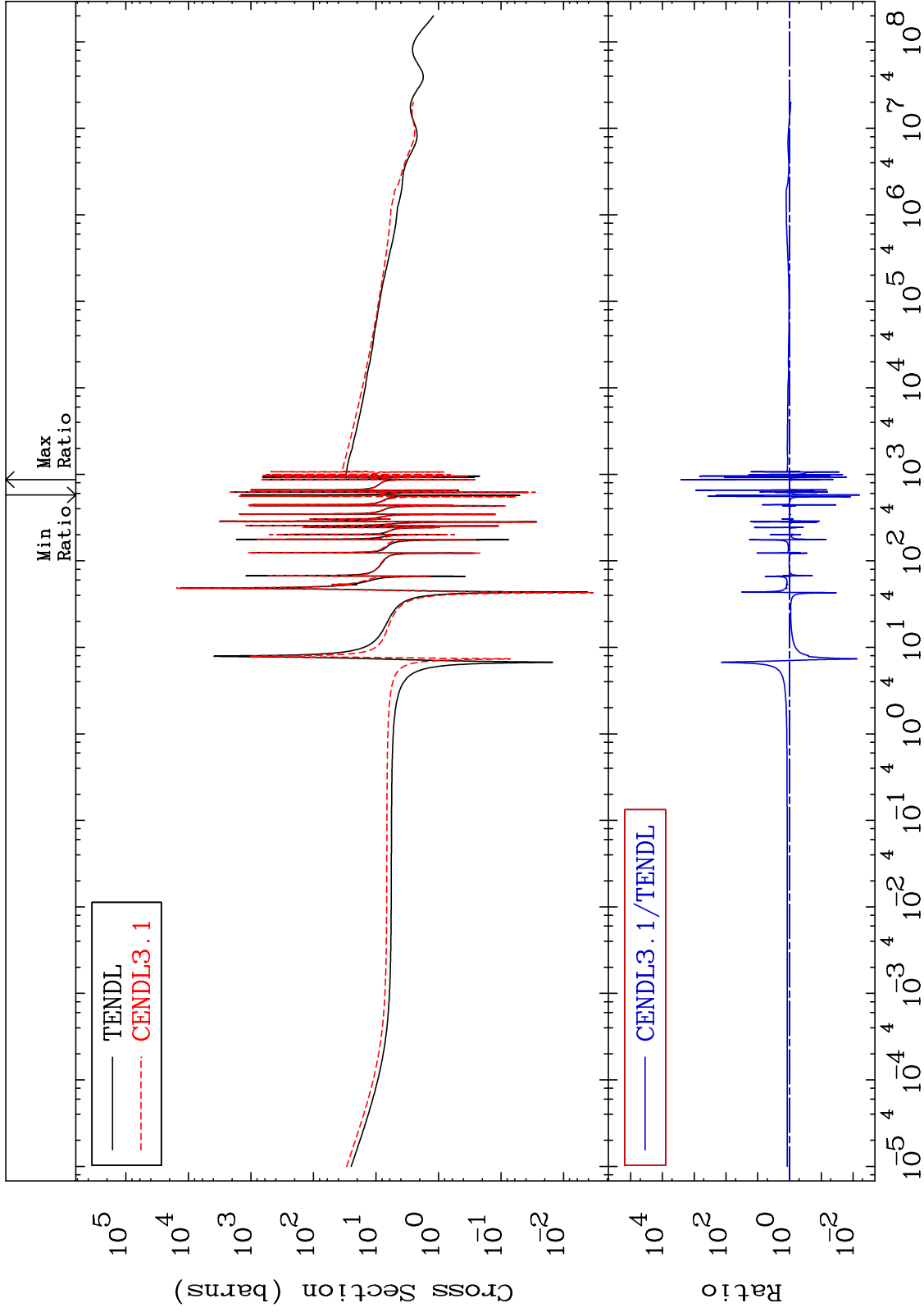
MAT 7231

Elastic

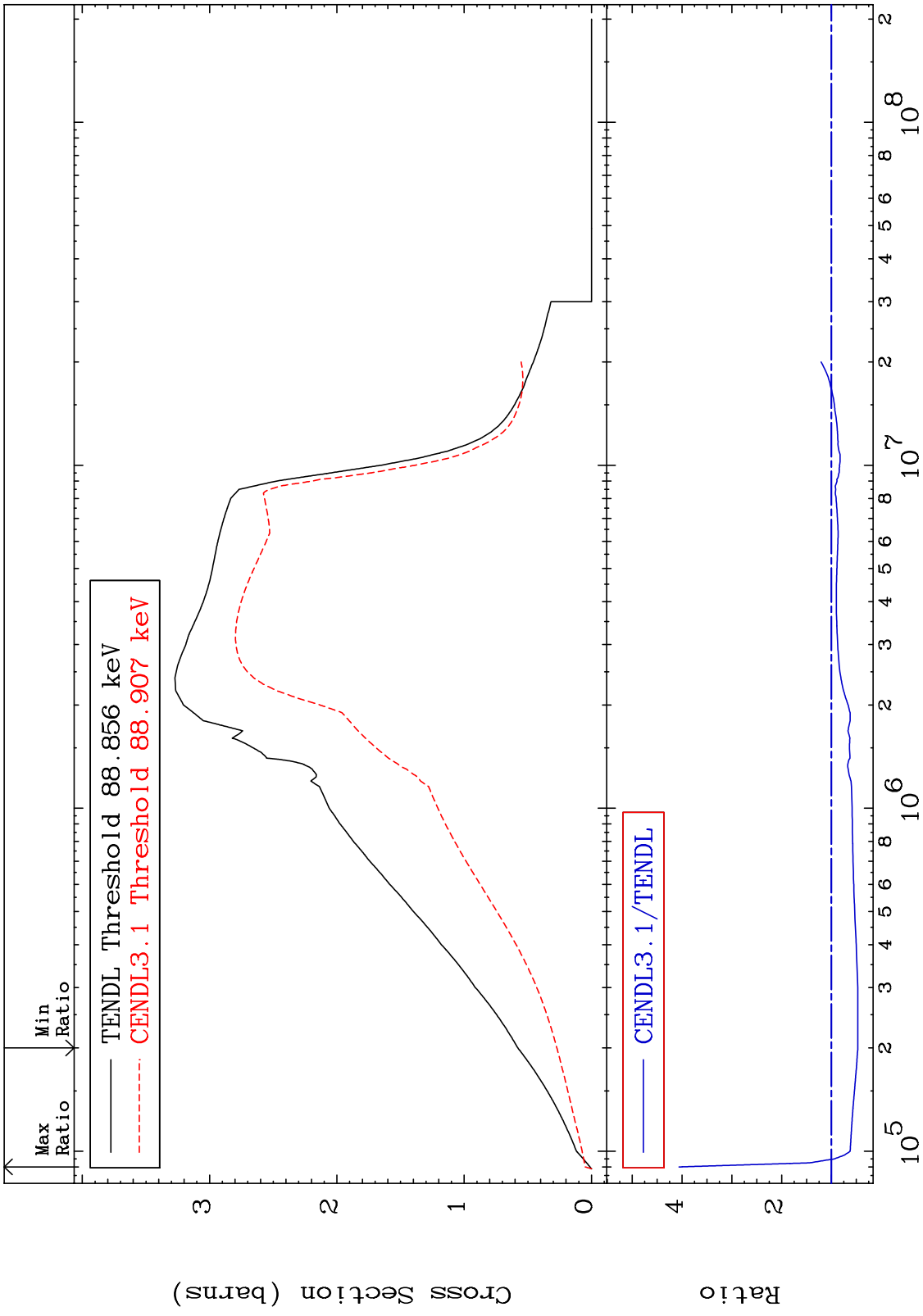
72-Hf-176

Cross Section

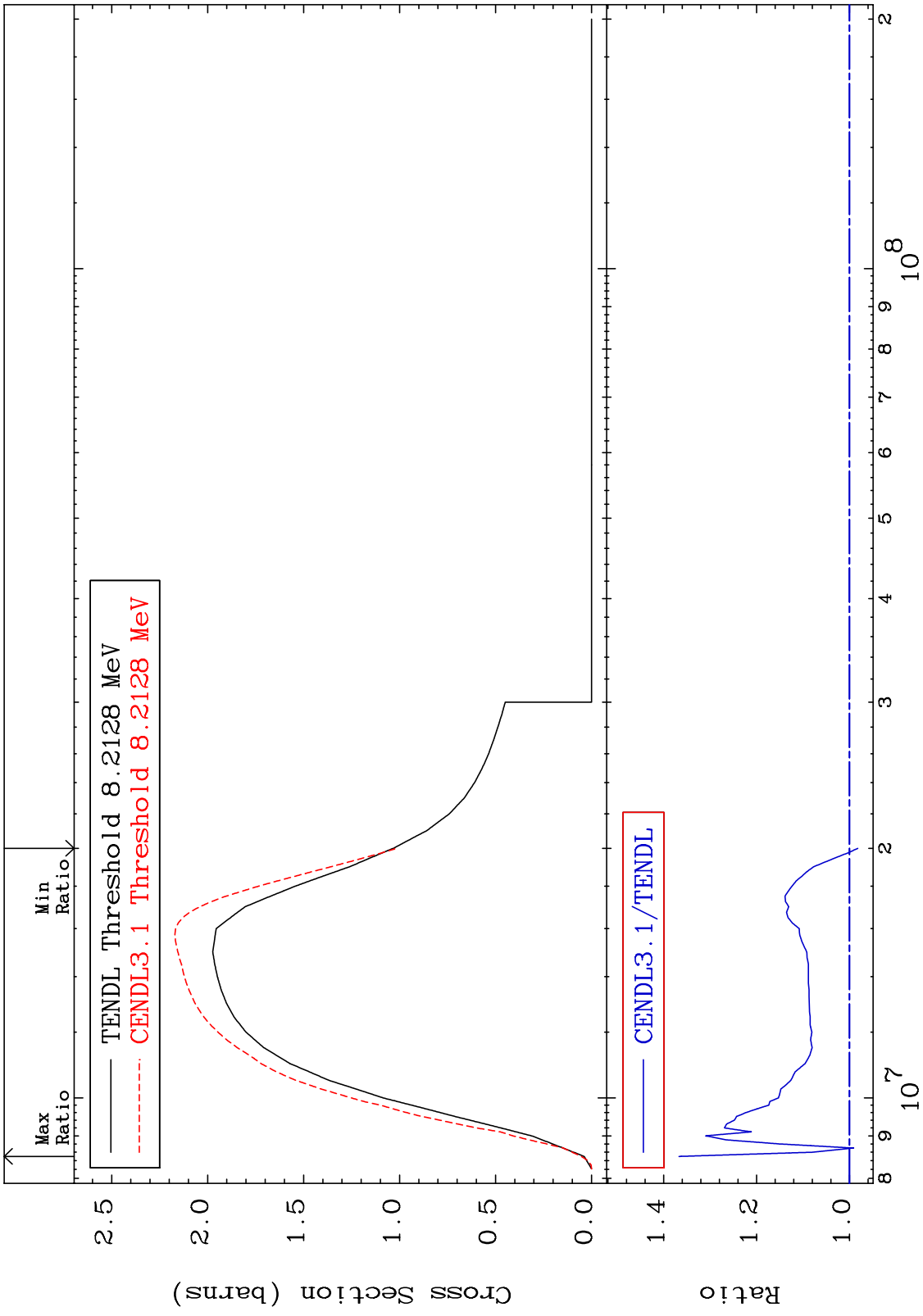
-99.38 To 9999. %



MAT 7231 Inelastic Cross Section 72-Hf-176 -52.97 To 305.9 %



MAT 7231 (n,2n) 72-Hf-176  
 Cross Section -1.803 To 36.68 %



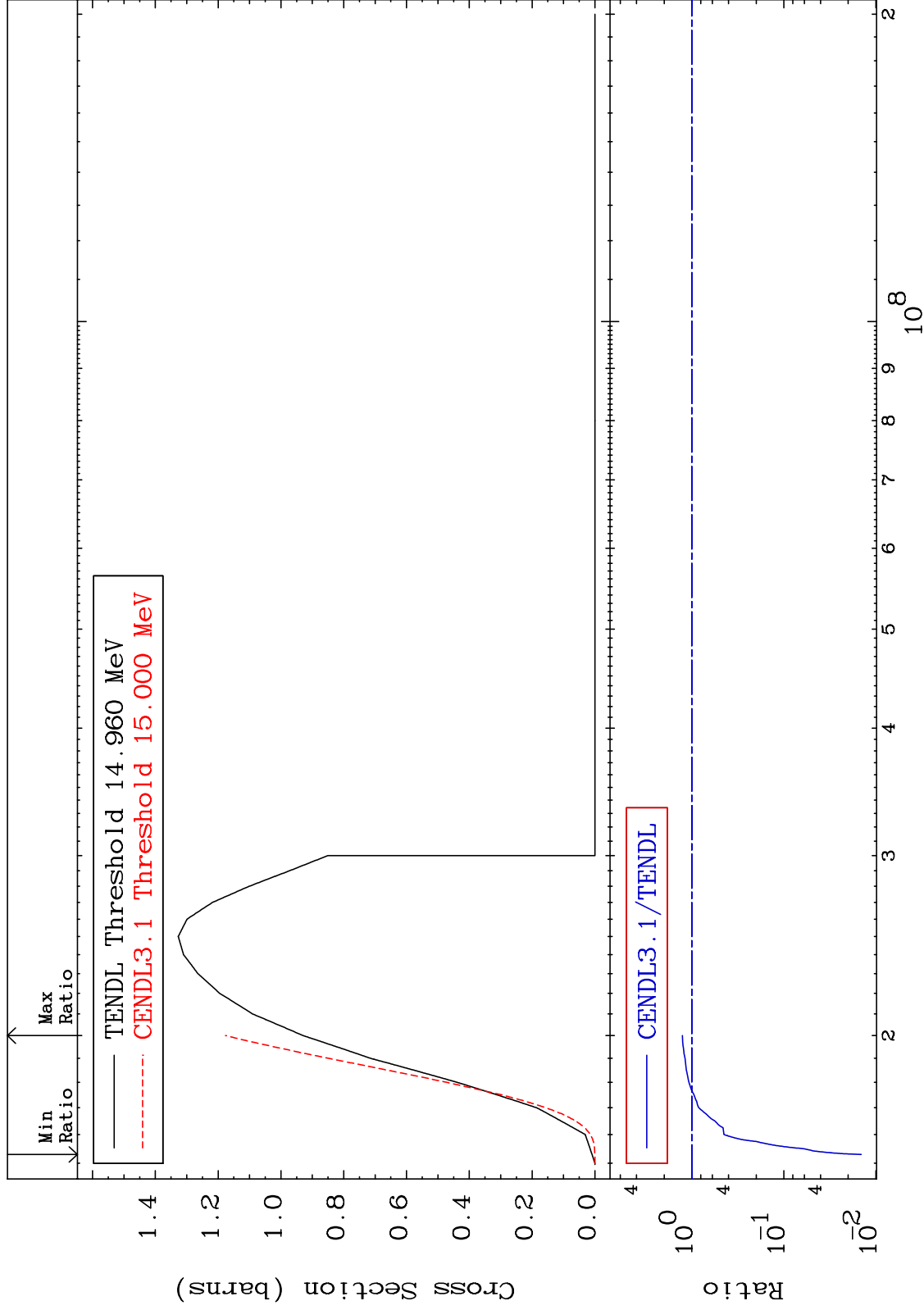
MAT 7231

(n,3n)

72-Hf-176

Cross Section

-98.56 To 26.58 %



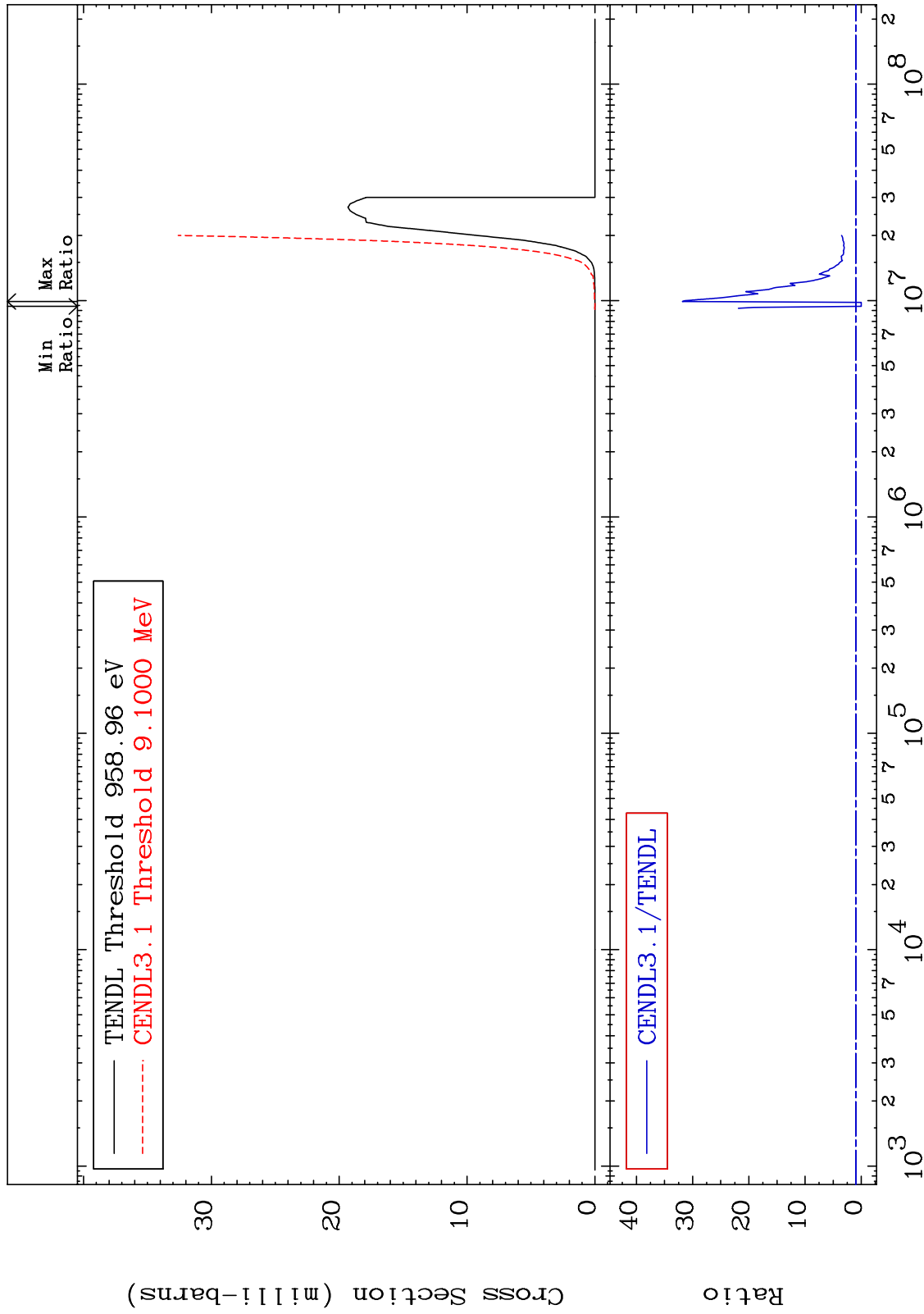
MAT 7231

(n, n')  $\alpha$

72-Hf-176

Cross Section

-100.0 To 3081. %



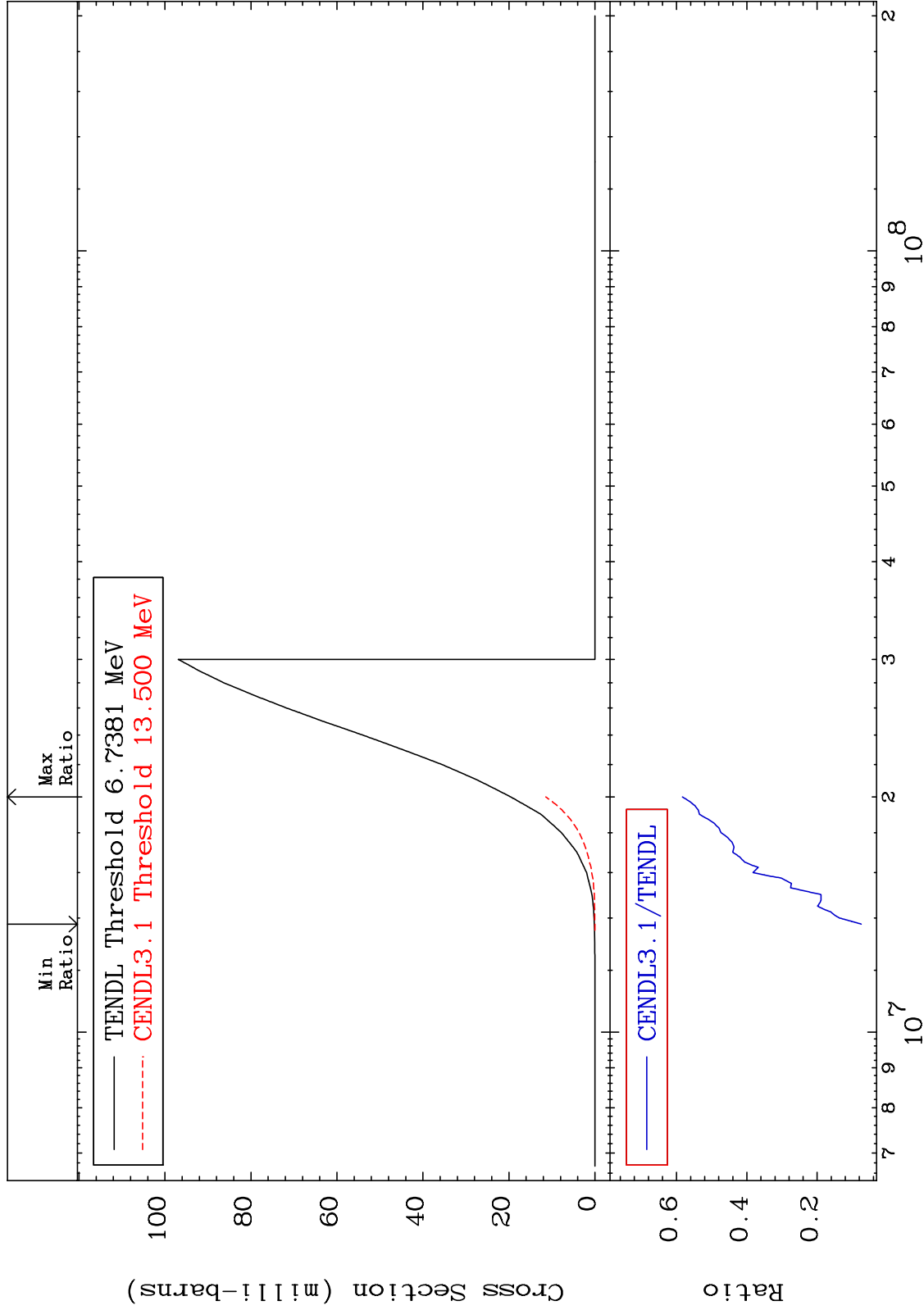
Incident Energy (eV)

72-Hf-176

MAT 7231

(n,n') p  
Cross Section

72-Hf-176  
-92.54 To -41.68%



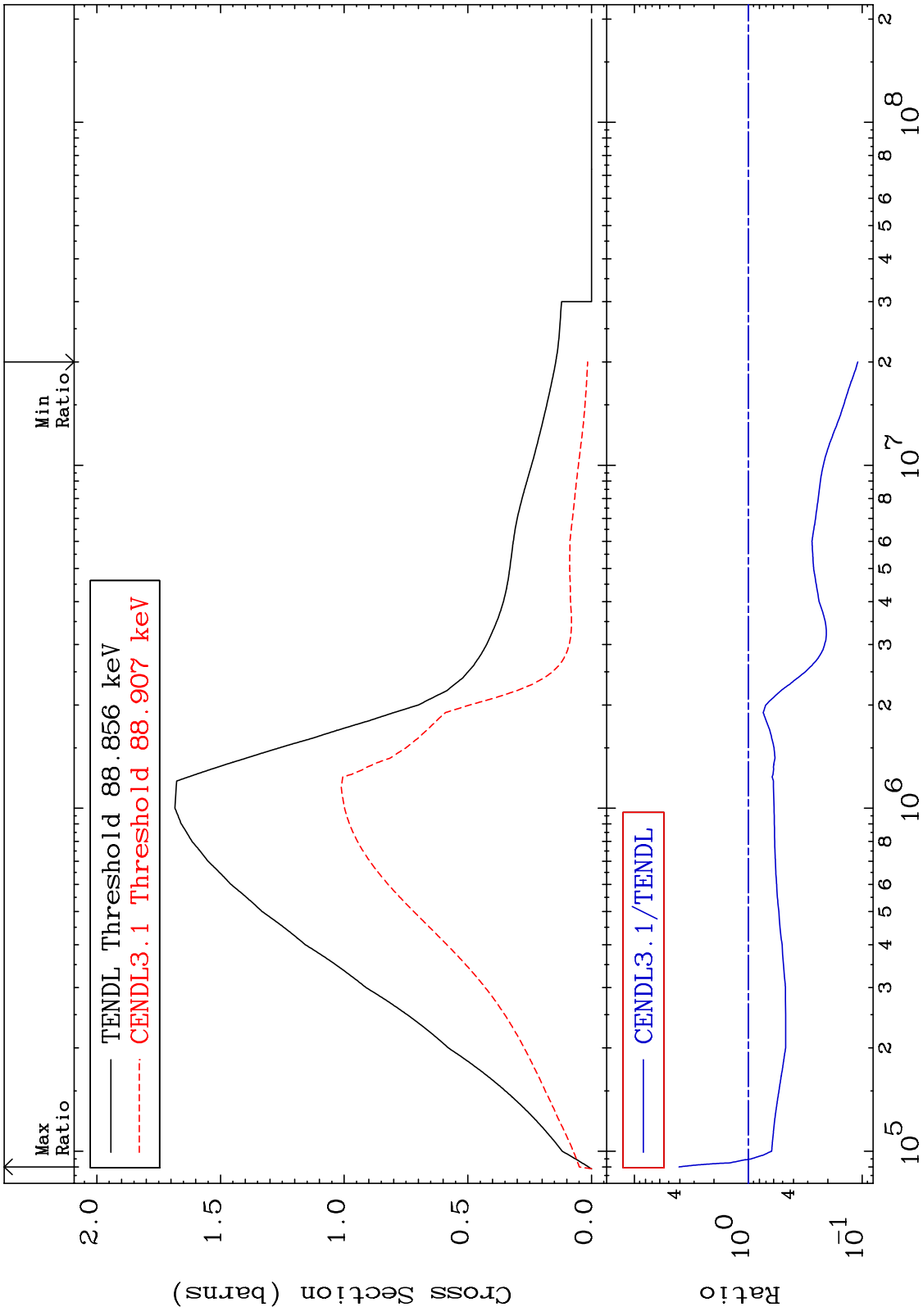
7

Incident Energy (eV)

72-Hf-176



MAT 7231 MT= 51 (n,n') Level Cross Section 72-Hf-176 -89.09 To 305.9 %

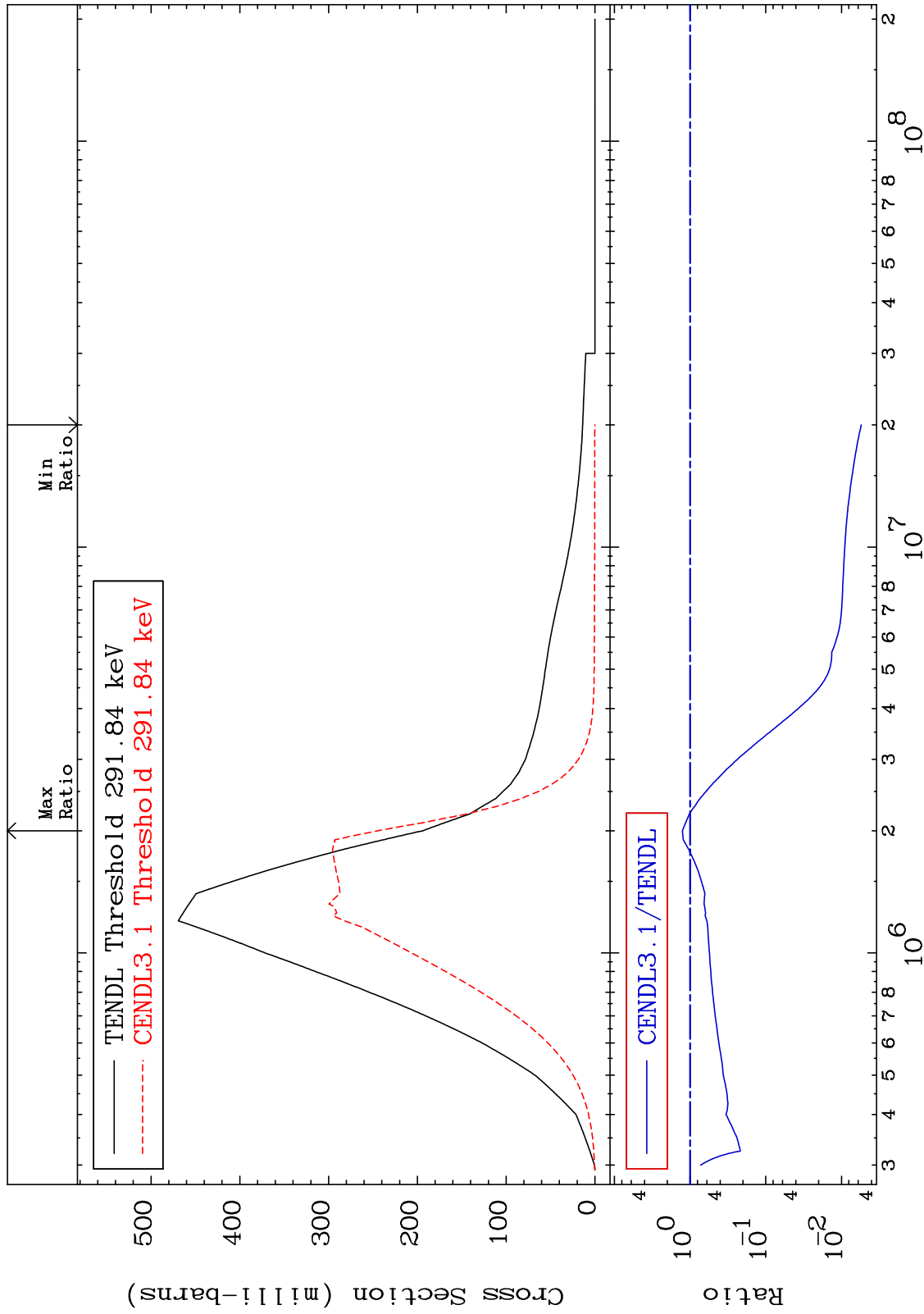


8 Incident Energy (eV) 72-Hf-176

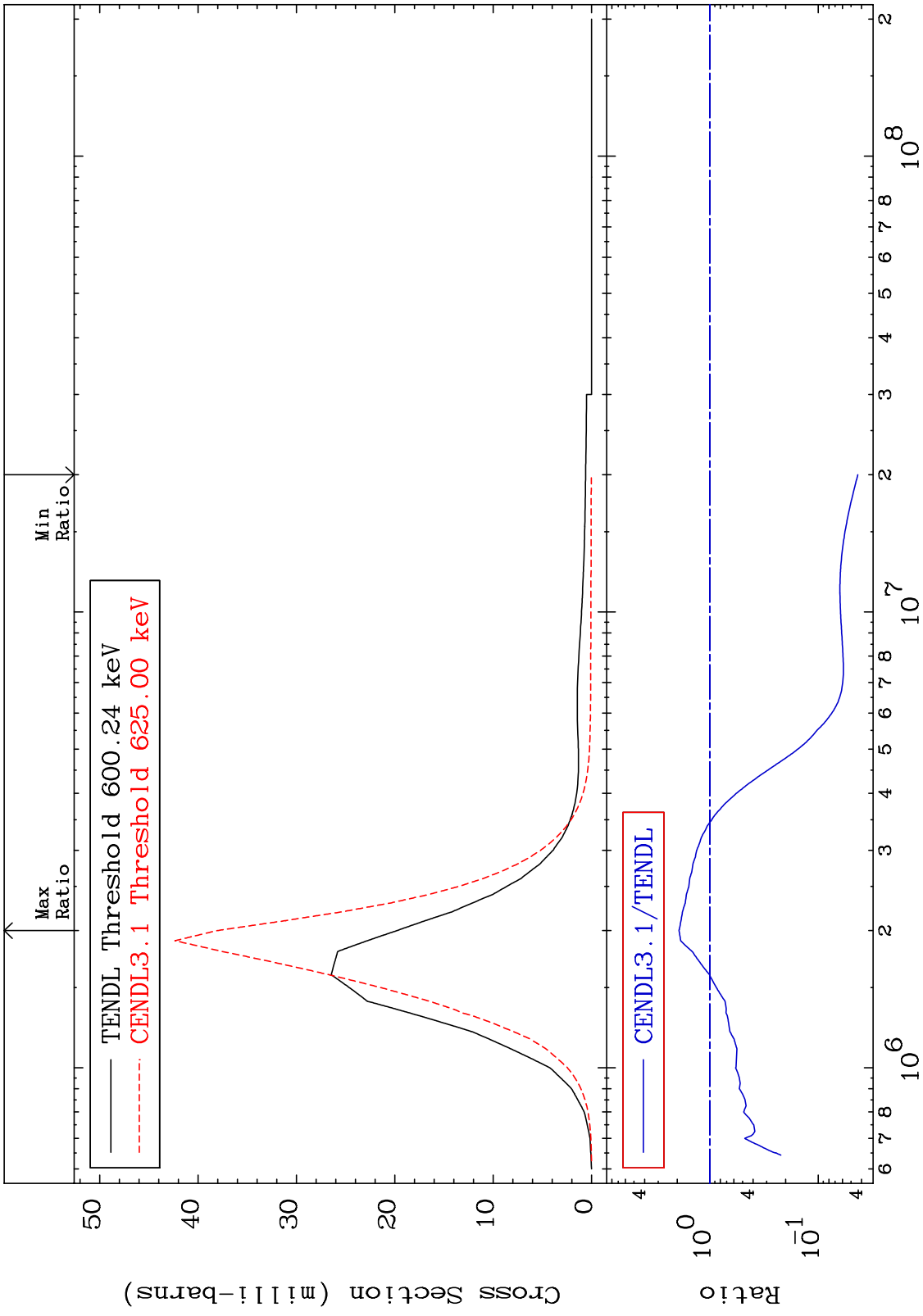
MAT 7231

MT= 52 (n,n') Level  
Cross Section

72-Hf-176  
-99.45 To 26.28 %

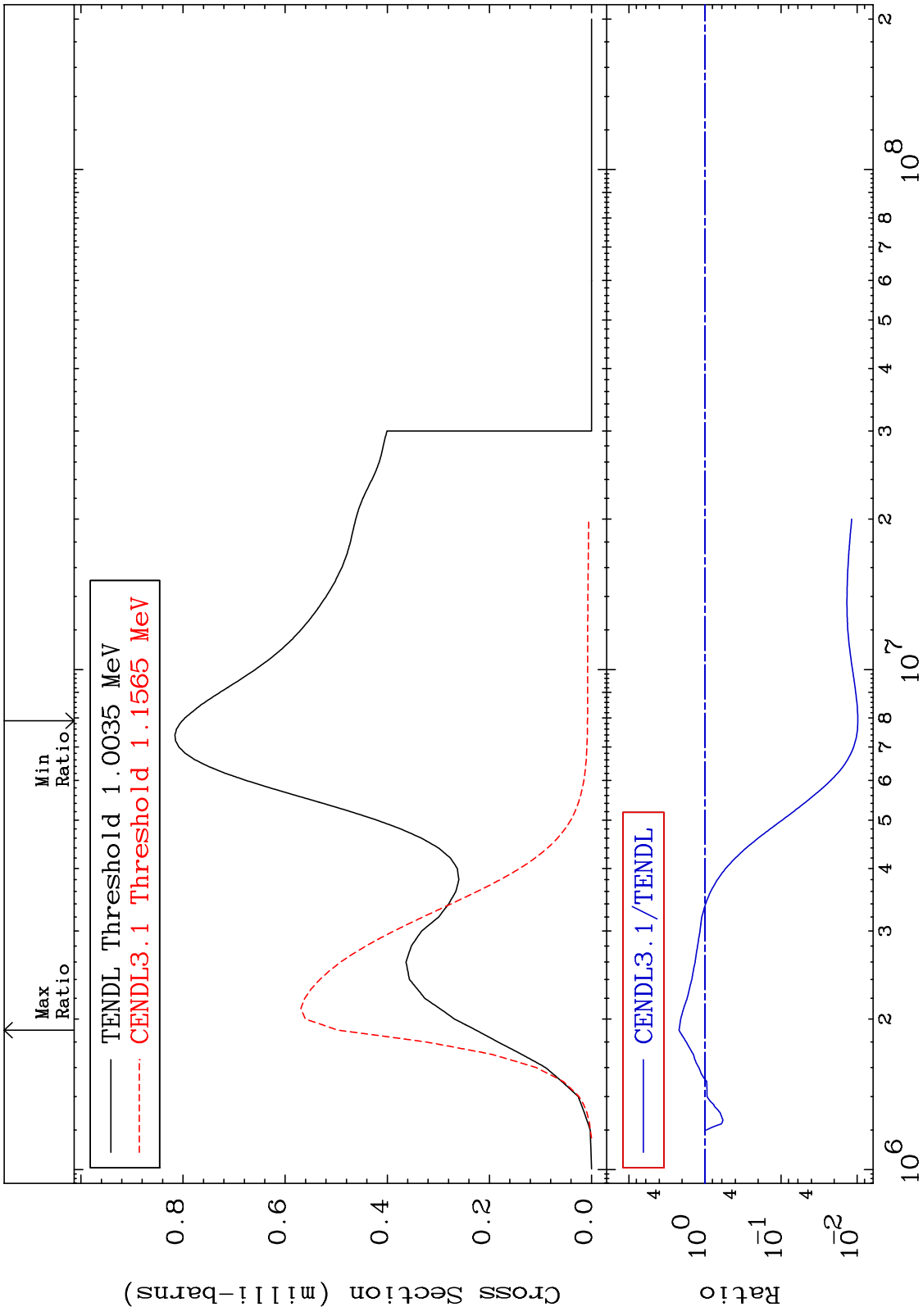


MAT 7231 MT= 53 (n,n') Level Cross Section 72-Hf-176  
 -95.68 To 92.36 %

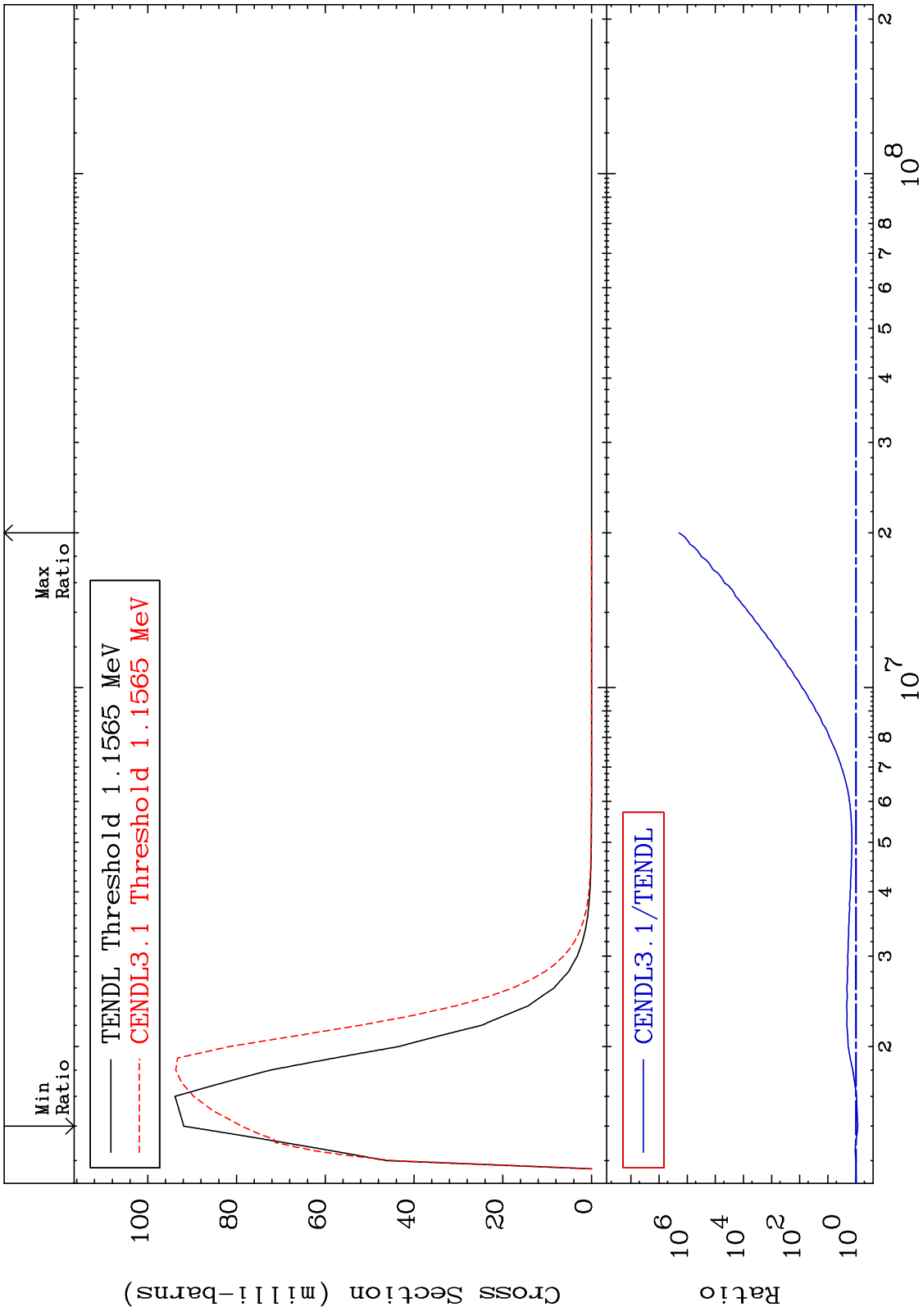


10 Incident Energy (eV) 72-Hf-176

MAT 7231 MT= 54 (n,n') Level Cross Section 72-Hf-176  
 -99.02 To 119.6 %



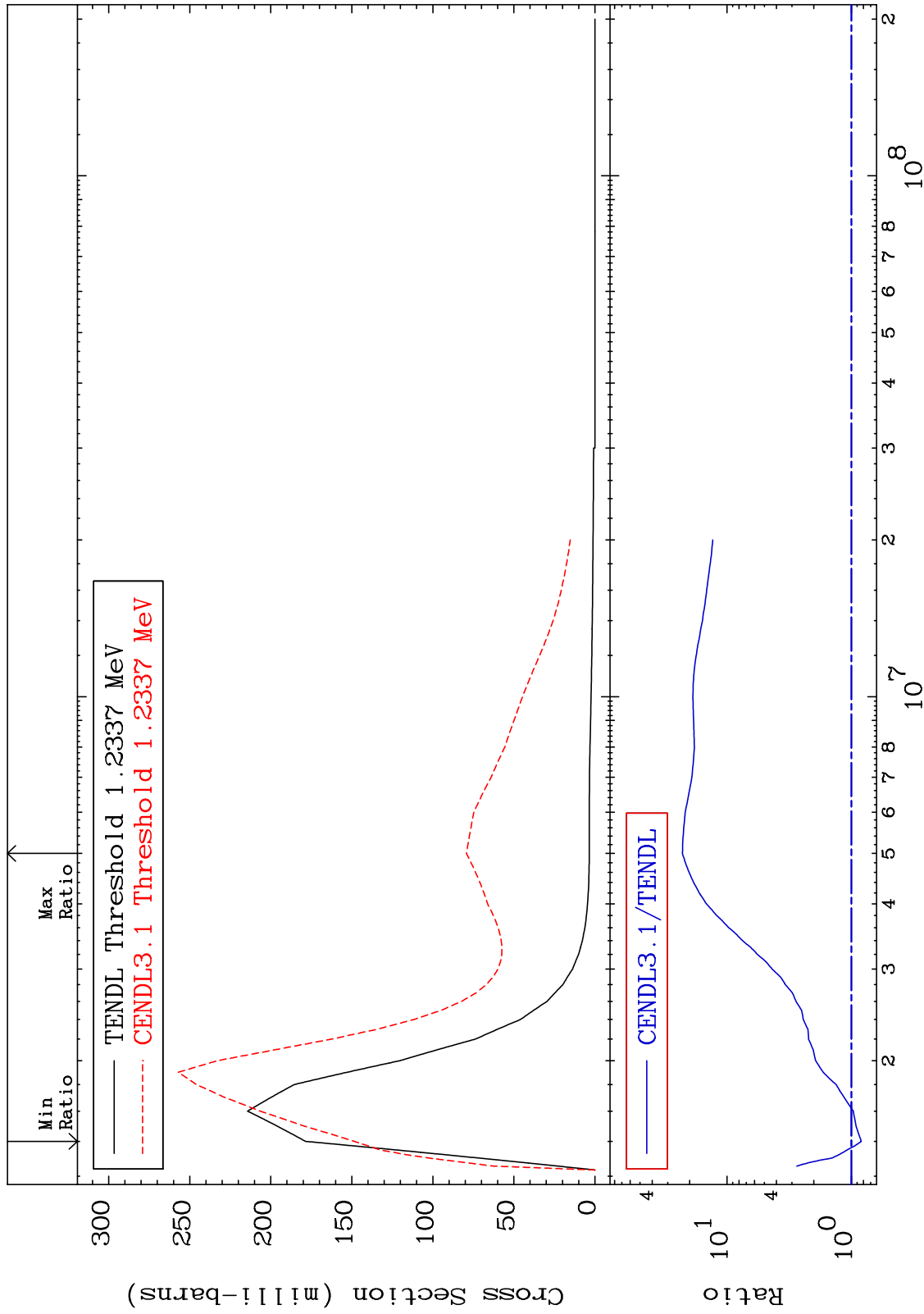
MAT 7231 MT= 55 (n,n') Level Cross Section -14.22 To 9999. % 72-Hf-176



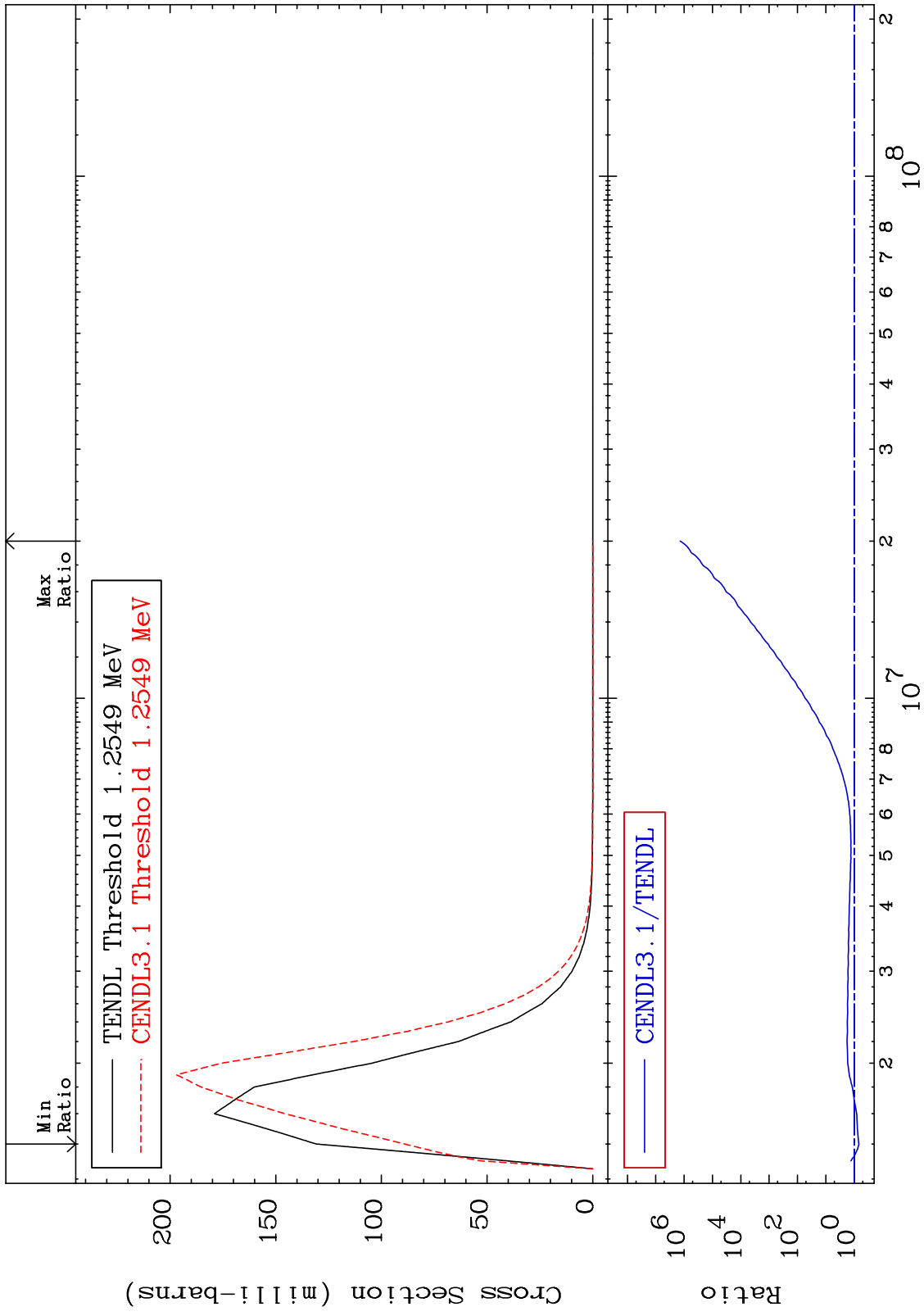
MAT 7231

MT= 56 (n,n') Level  
Cross Section

72-Hf-176  
-16.89 To 2181. %



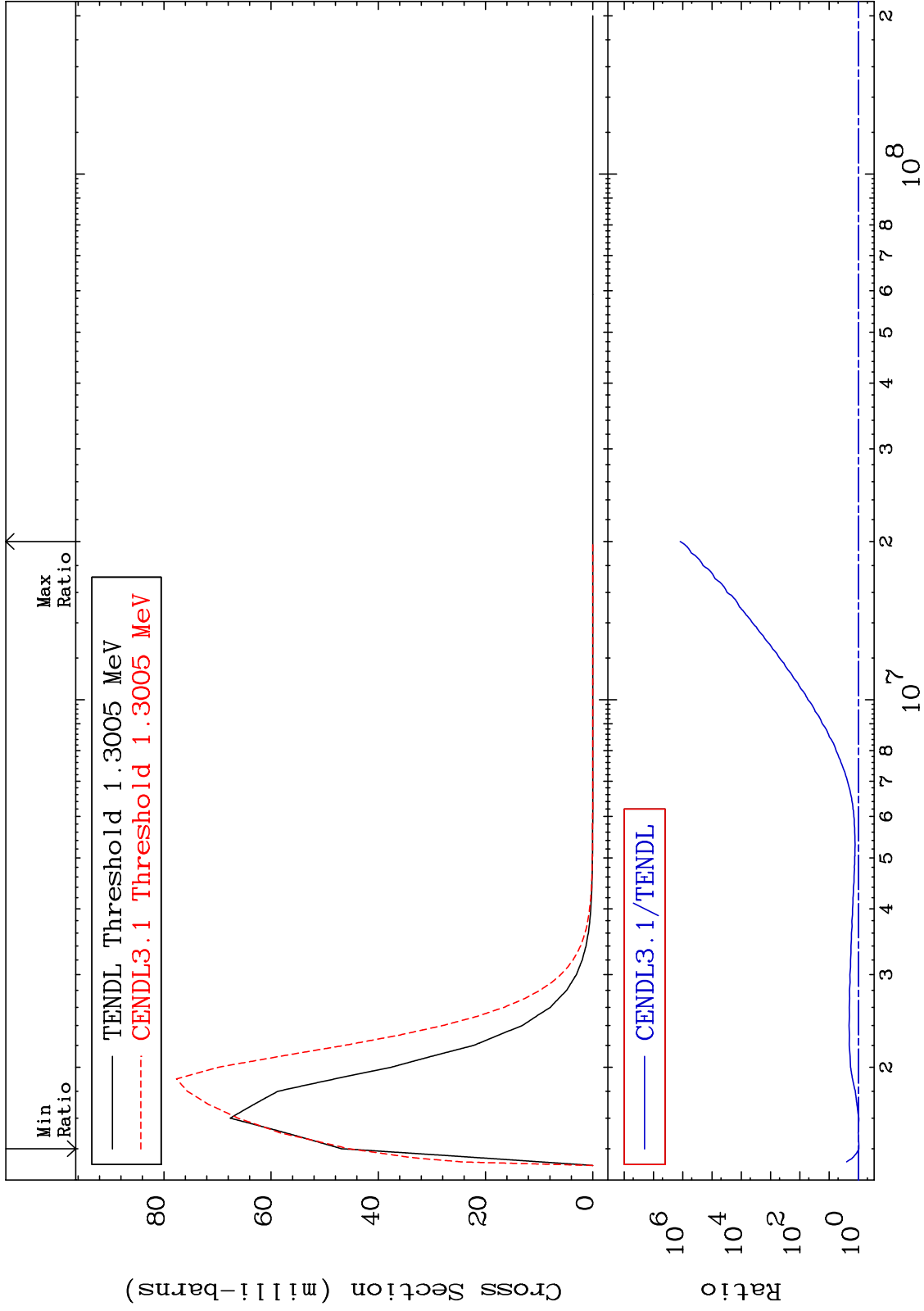
MAT 7231 MT= 57 (n,n') Level Cross Section 72-Hf-176 -31.91 To 9999. %



MAT 7231

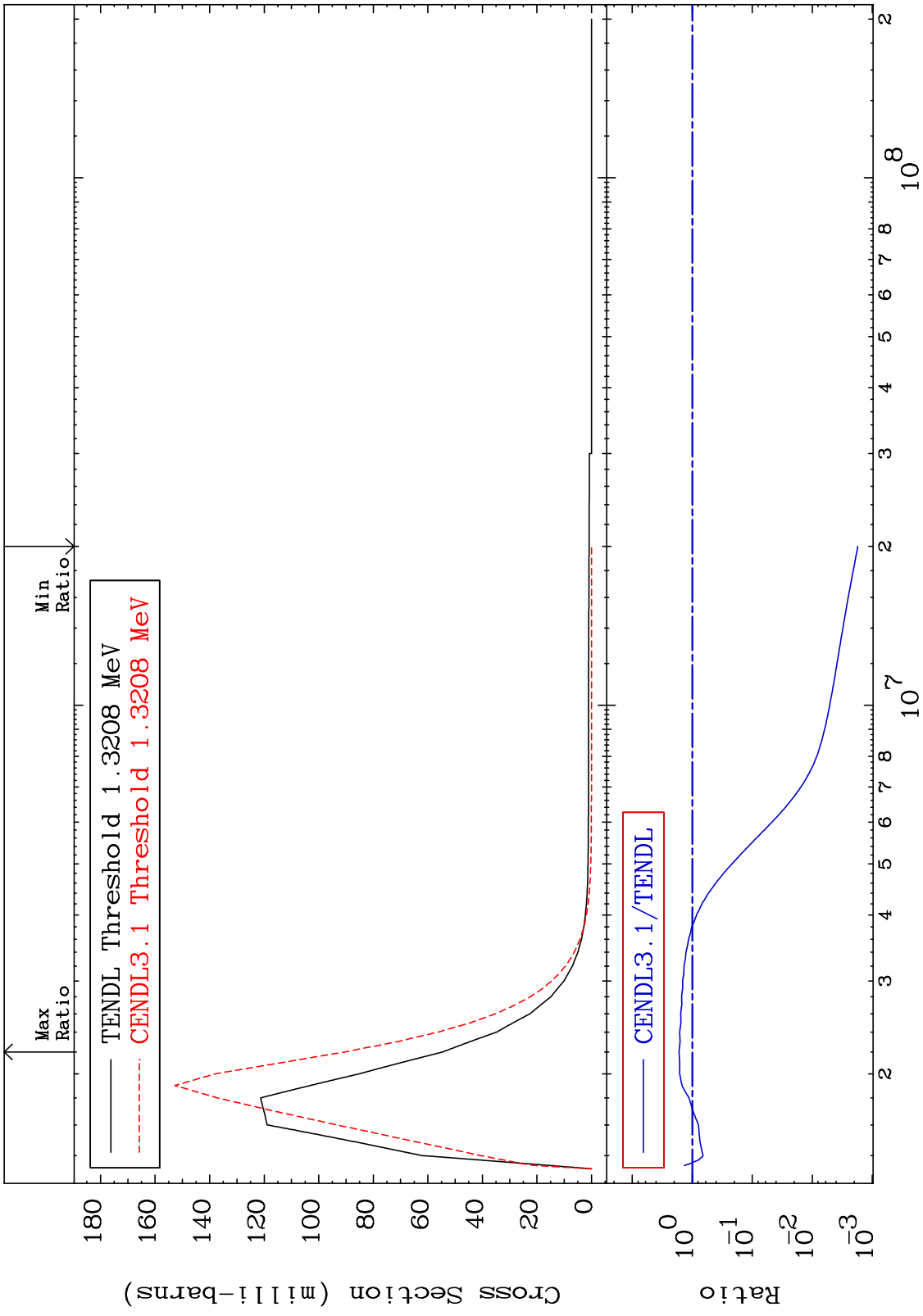
MT= 58 (n,n') Level  
Cross Section

72-Hf-176  
-2.890 To 9999. %

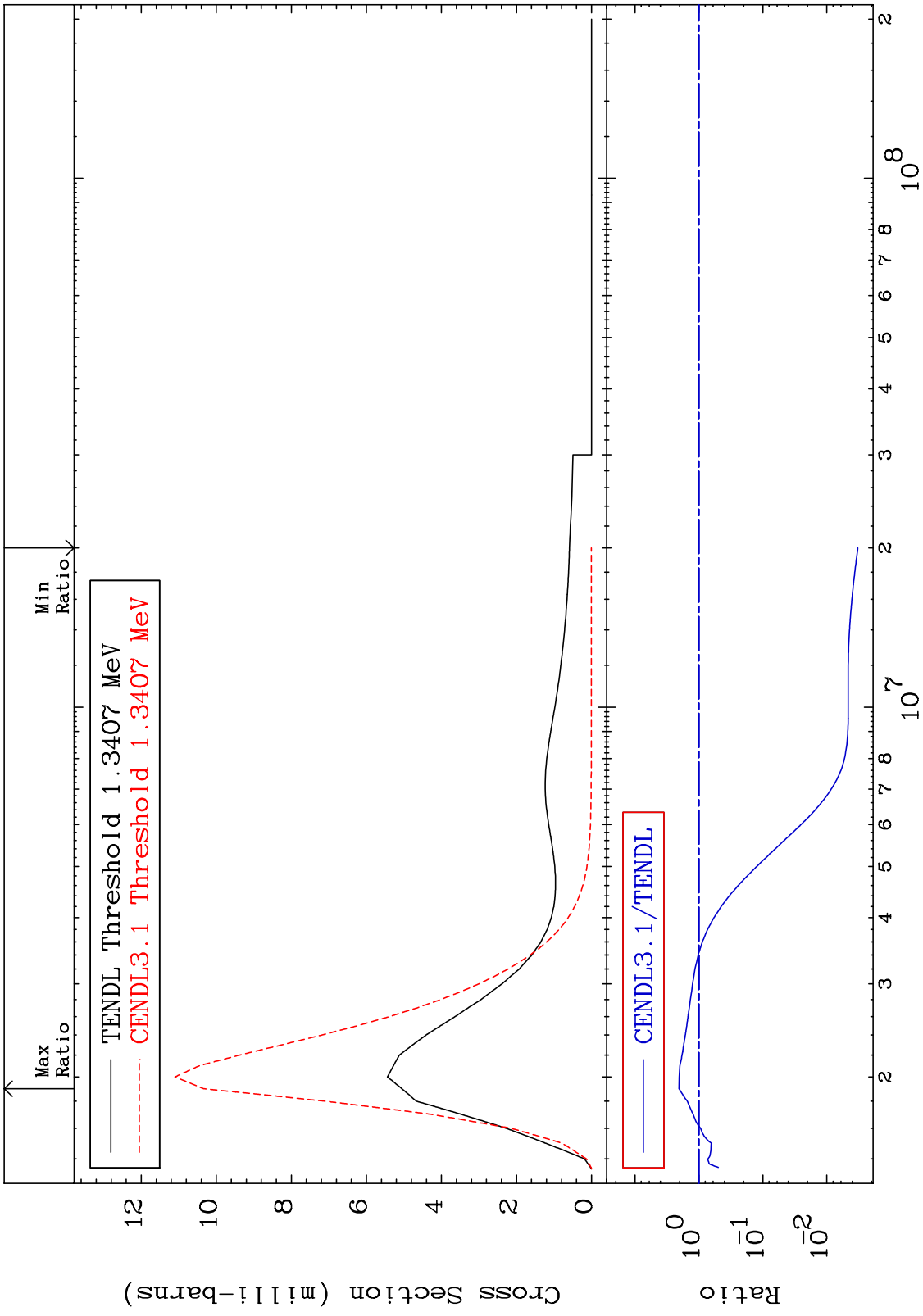




MAT 7231 MT= 59 (n,n') Level Cross Section 72-Hf-176 -99.83 To 65.86 %



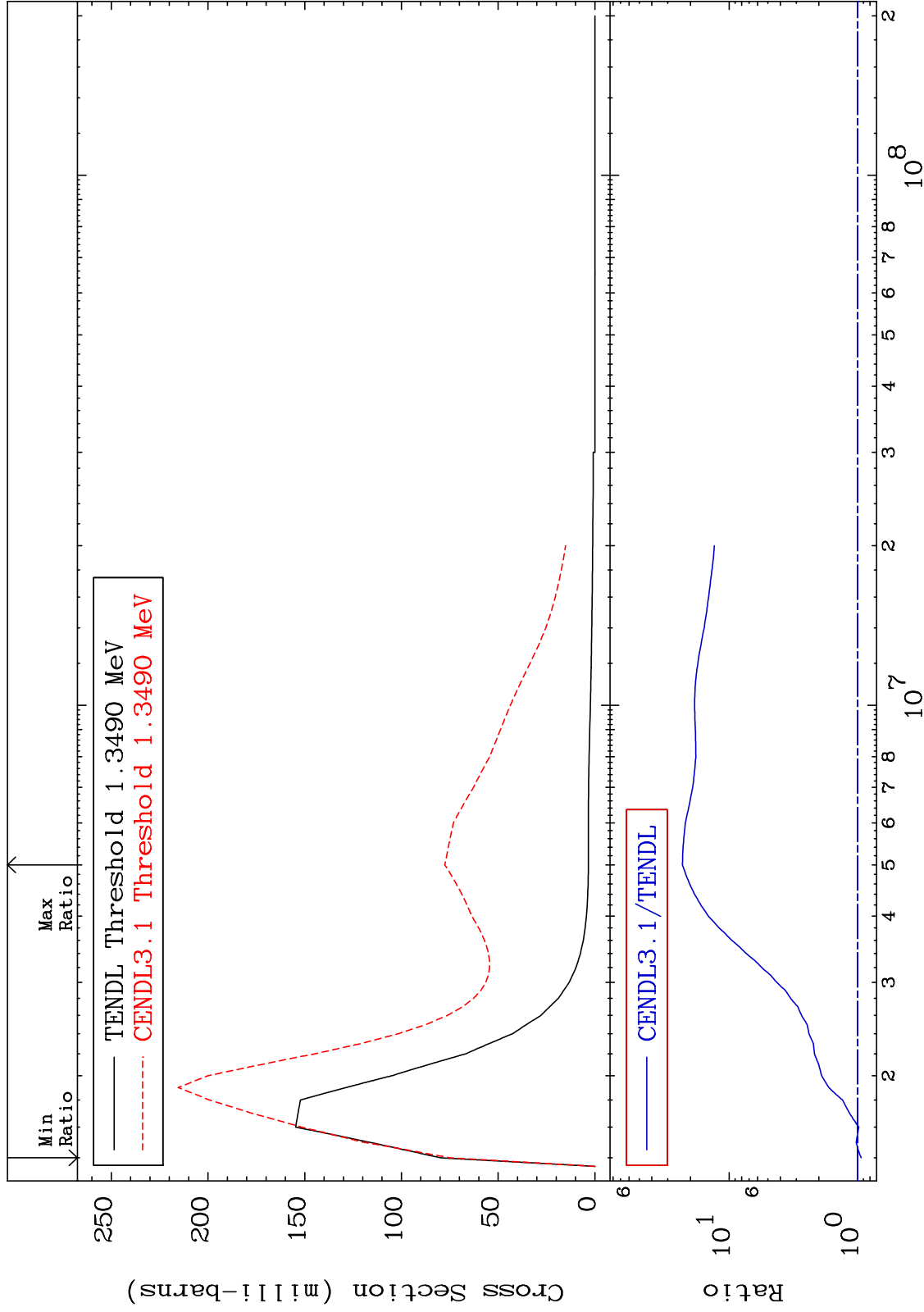
MAT 7231 MT= 60 (n,n') Level Cross Section 72-Hf-176 -99.67 To 104.5 %



MAT 7231

MT= 61 (n,n') Level  
Cross Section

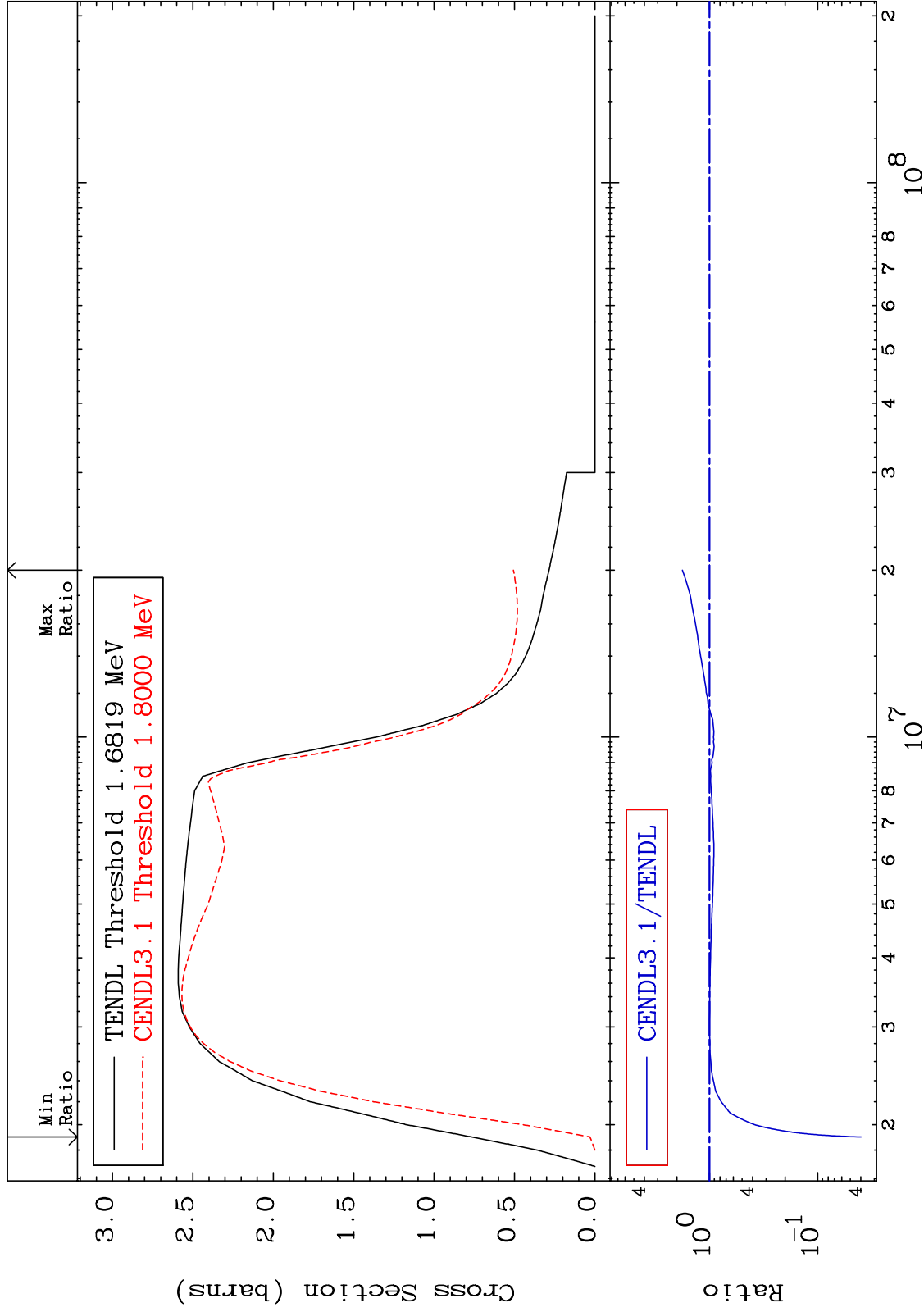
72-Hf-176  
-6.362 To 2206. %



MAT 7231

(n, n') Continuum  
Cross Section

72-Hf-176  
-96.05 To 77.44 %



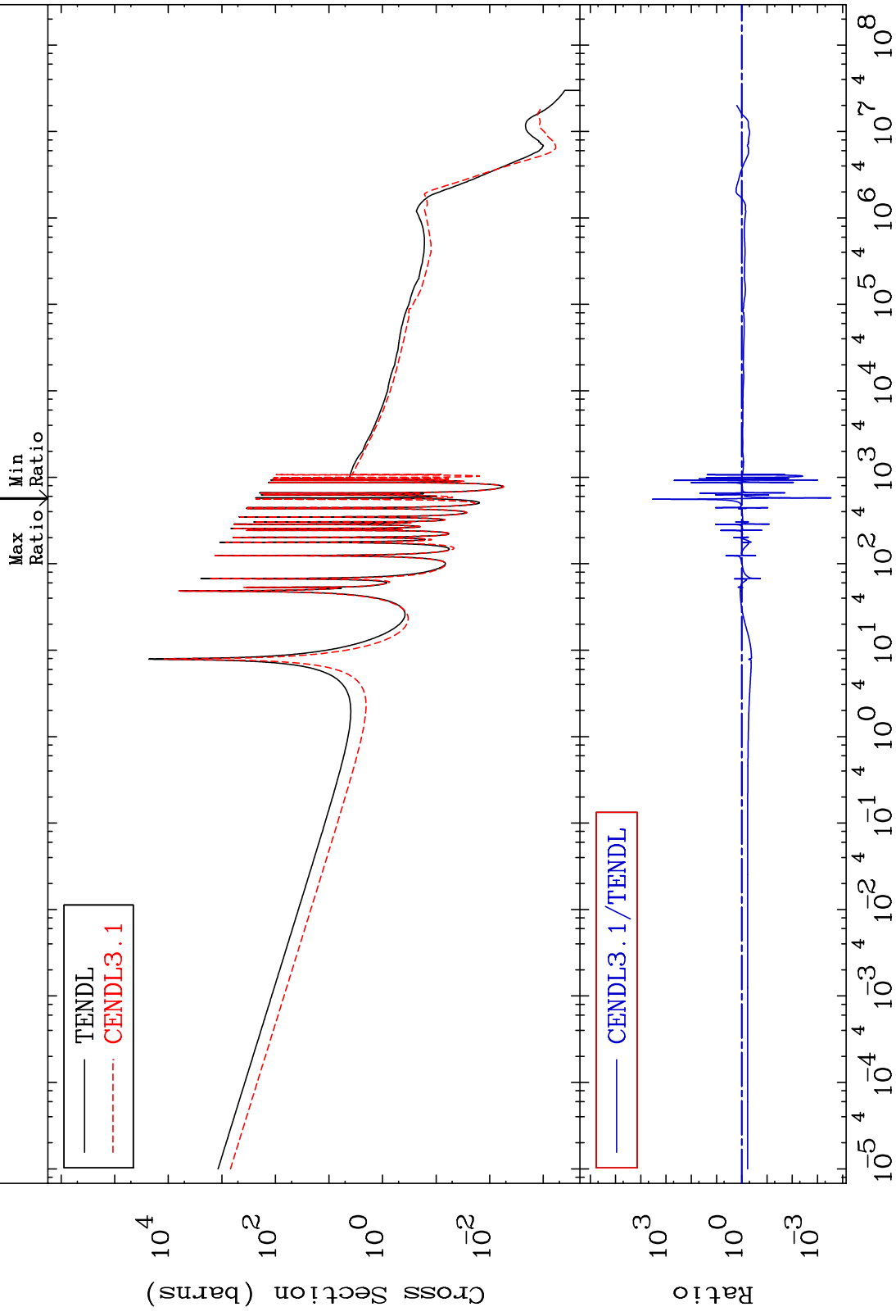
MAT 7231

72-Hf-176

-99.97 To 9999. %

(n,  $\gamma$ )

Cross Section



MAT 7231

(n,p)

72-Hf-176

-93.67 To -47.11%

Cross Section

Min Ratio

Max Ratio

TENDL Threshold 414.09 keV  
CENDL3.1 Threshold 8.8000 MeV

Cross Section (milli-barns)

35

30

25

20

15

10

5

0

0.6

Ratio

0.4

0.2

CENDL3.1/TENDL

4

5

6

7

8

10<sup>6</sup>

10<sup>7</sup>

10<sup>8</sup>

2

3

4

5

6

21

Incident Energy (eV)

72-Hf-176

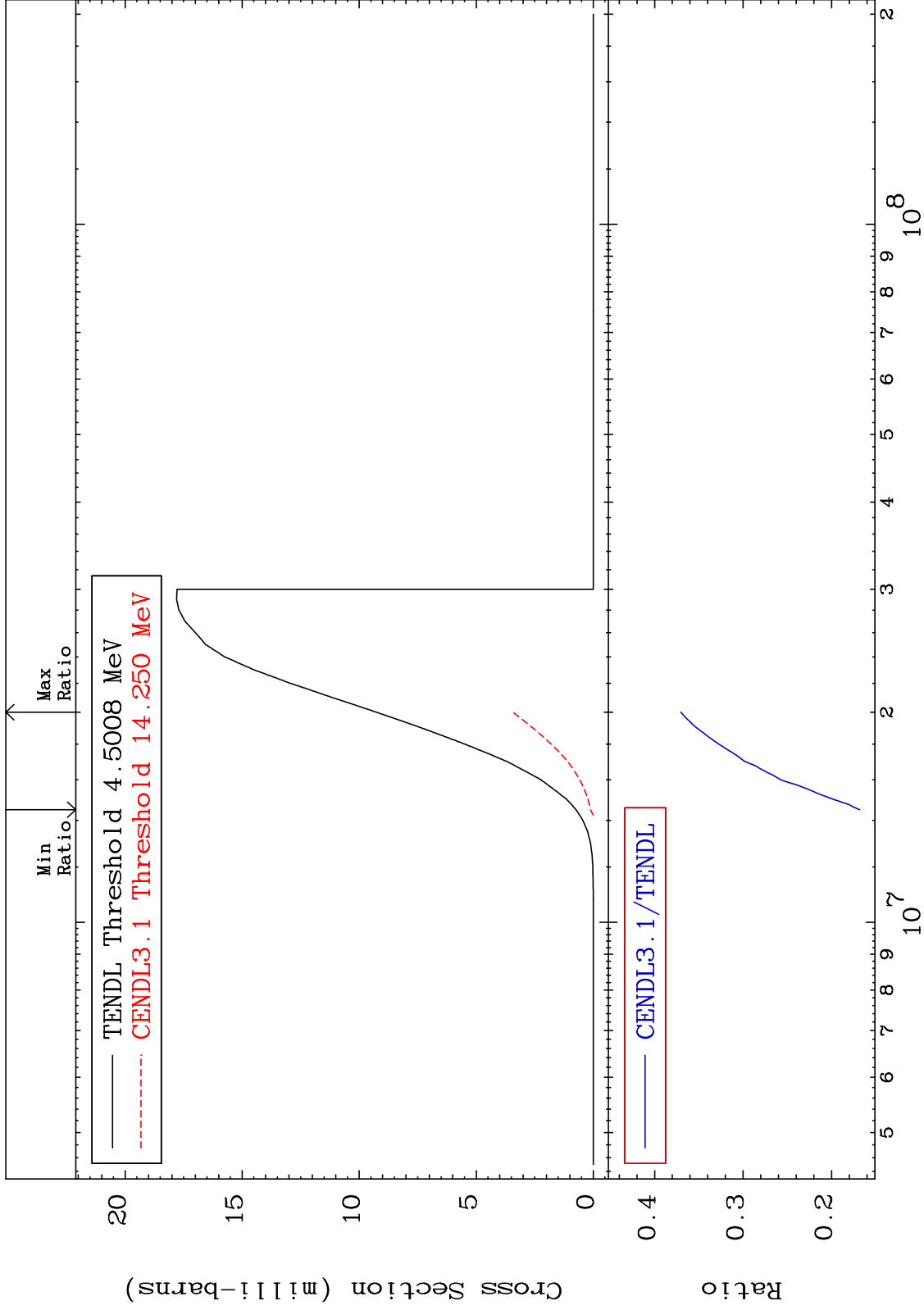
MAT 7231

(n,d)

72-Hf-176

Cross Section

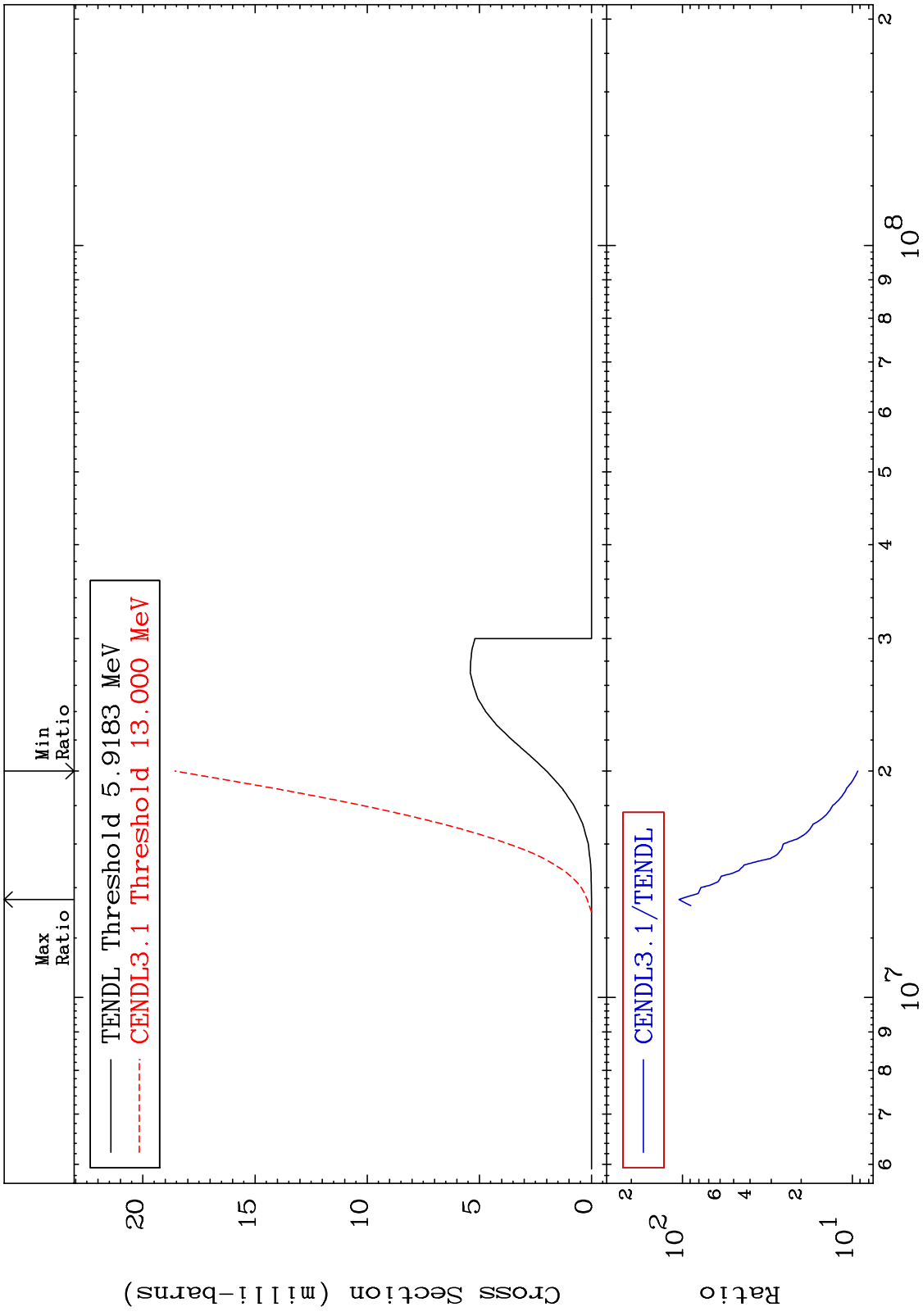
-83.17 To -62.96%



22

Incident Energy (eV)

72-Hf-176





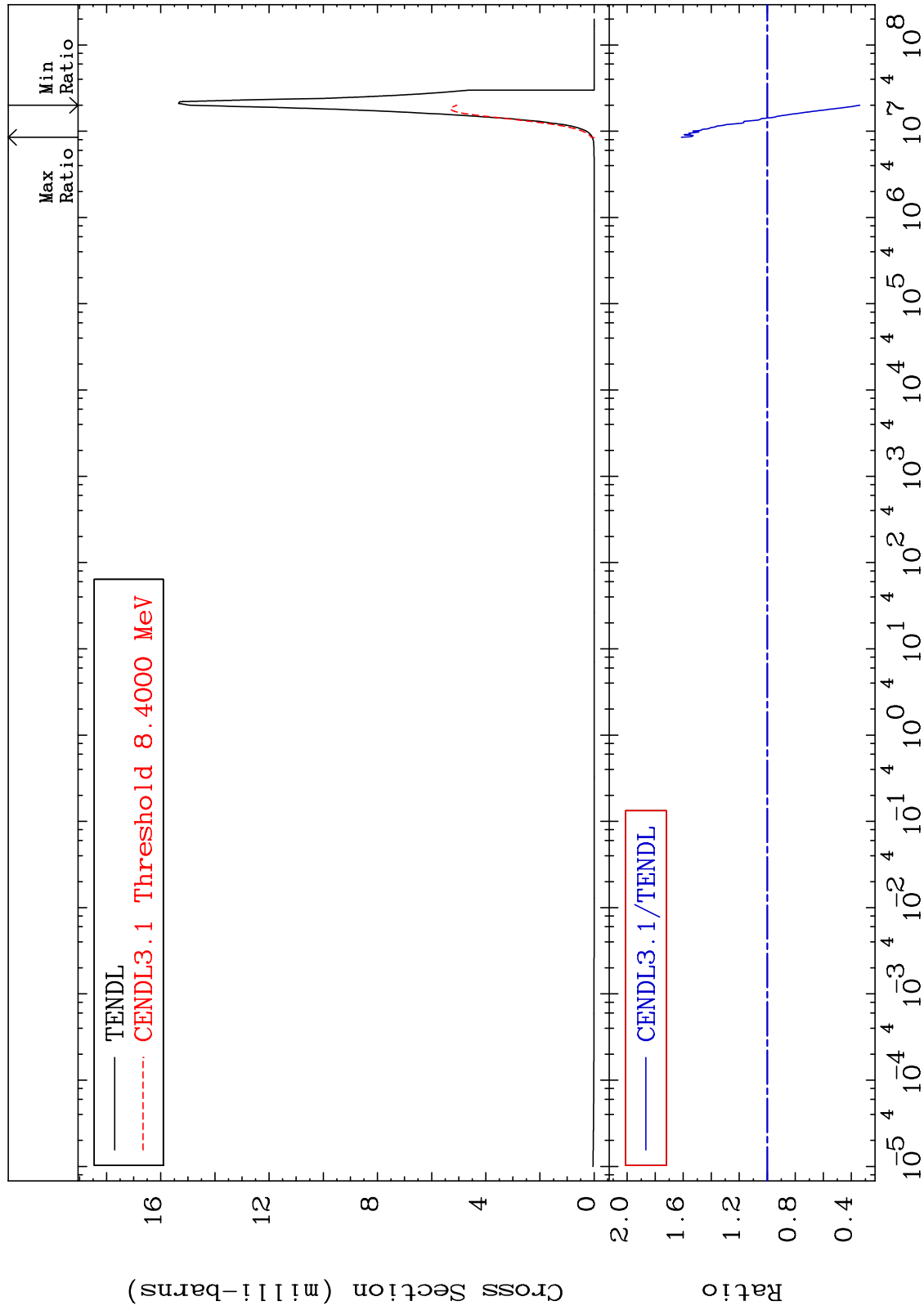
MAT 7231

(n,  $\alpha$ )

72-Hf-176

Cross Section

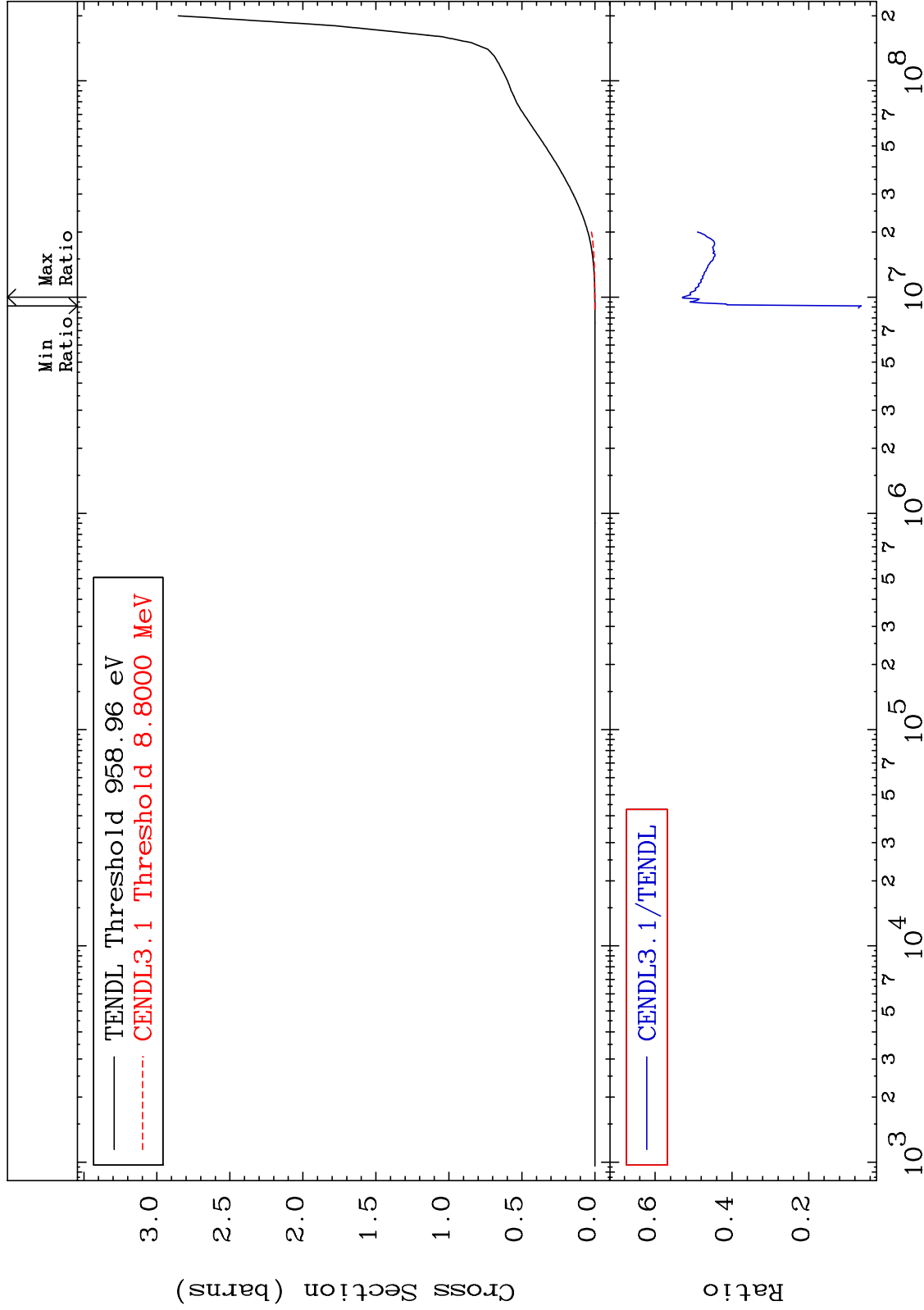
-66.05 To 61.26 %



MAT 7231

### Hydrogen Production Cross Section

72-Hf-176  
-93.67 To -47.11%



25

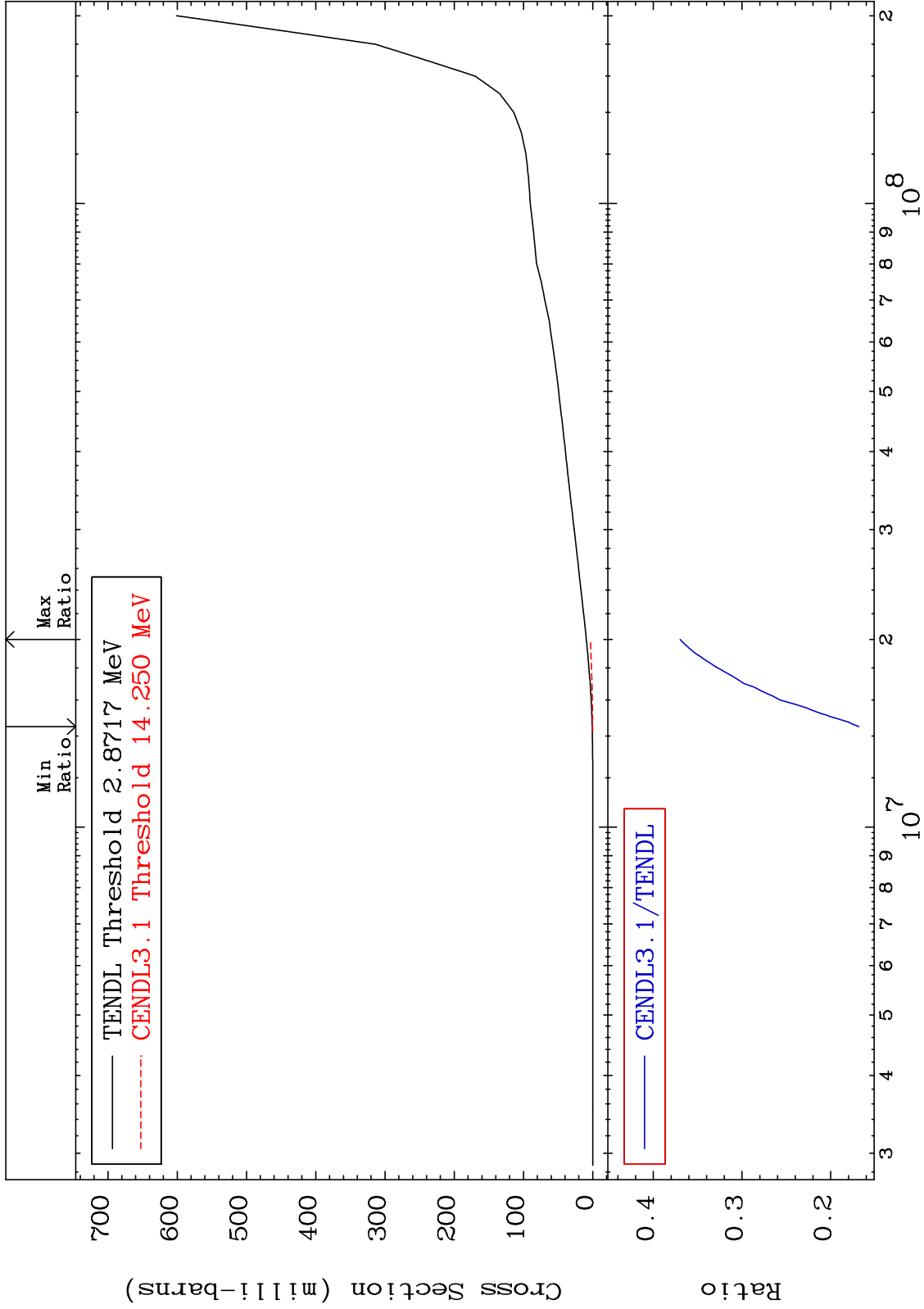
Incident Energy (eV)

72-Hf-176

MAT 7231

Deuterium Production  
Cross Section

72-Hf-176  
-83.17 To -63.03%



26

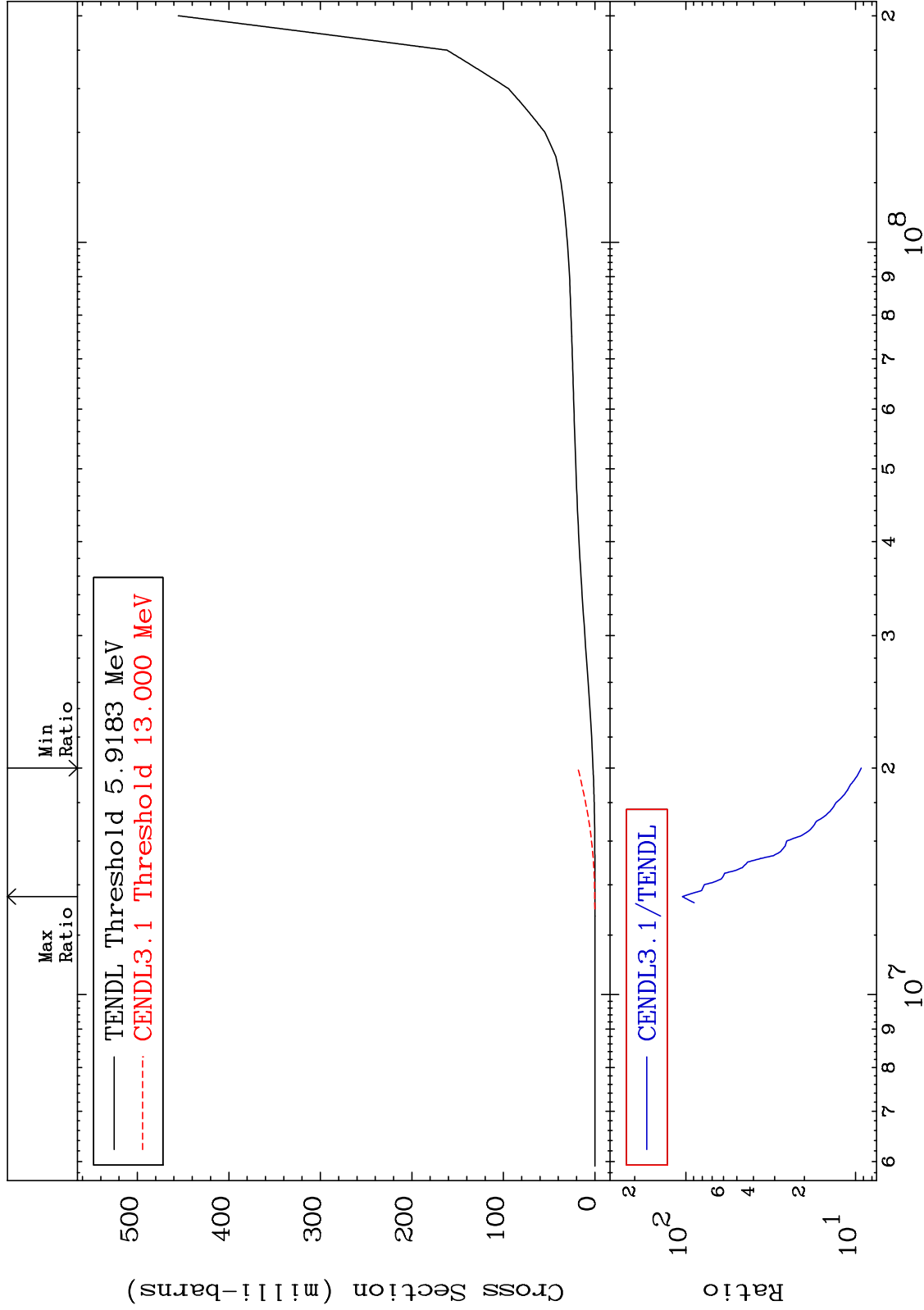
Incident Energy (eV)

72-Hf-176

MAT 7231

Tritium Production  
Cross Section

72-Hf-176  
825.5 To 9999. %



27

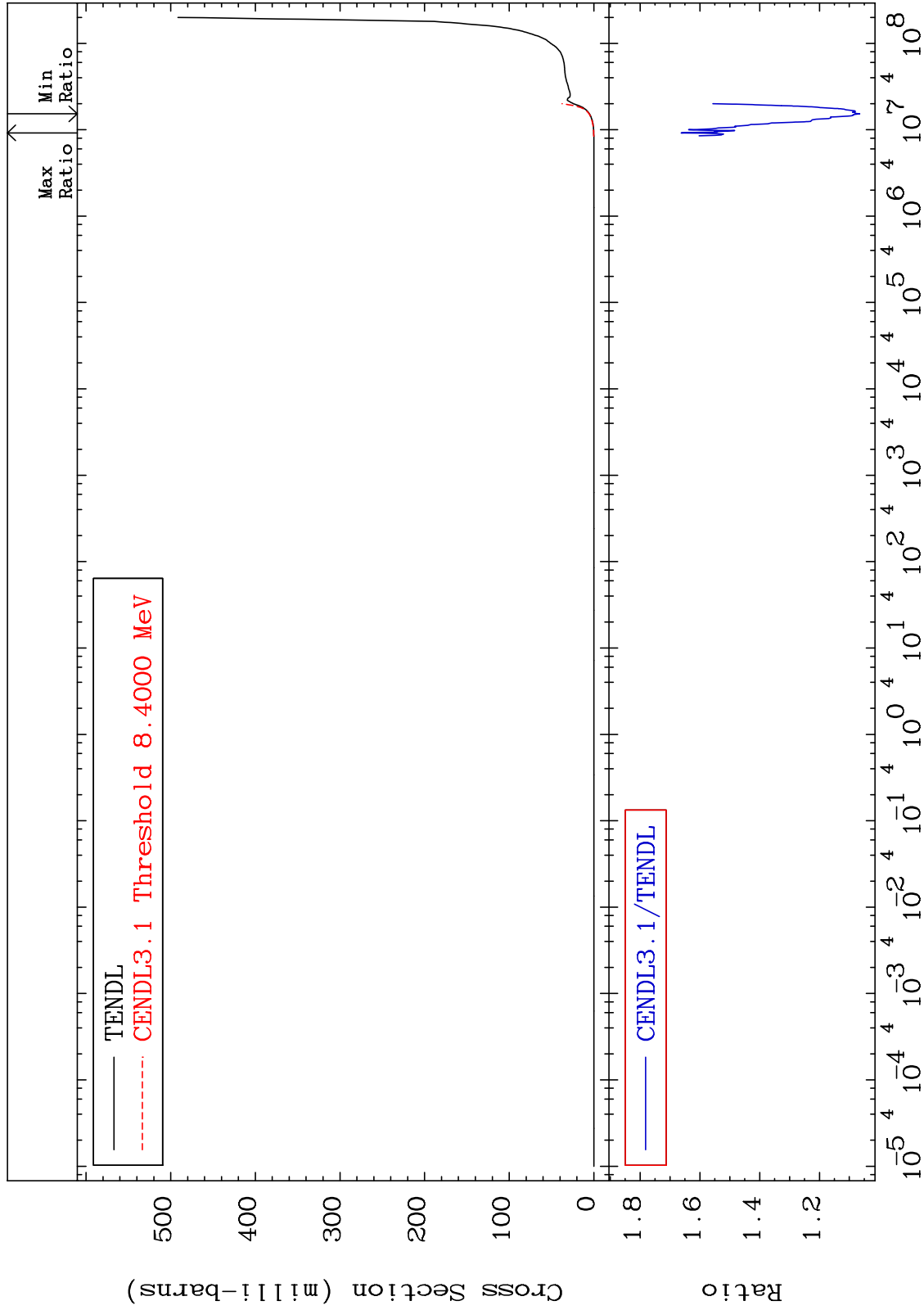
Incident Energy (eV)

72-Hf-176

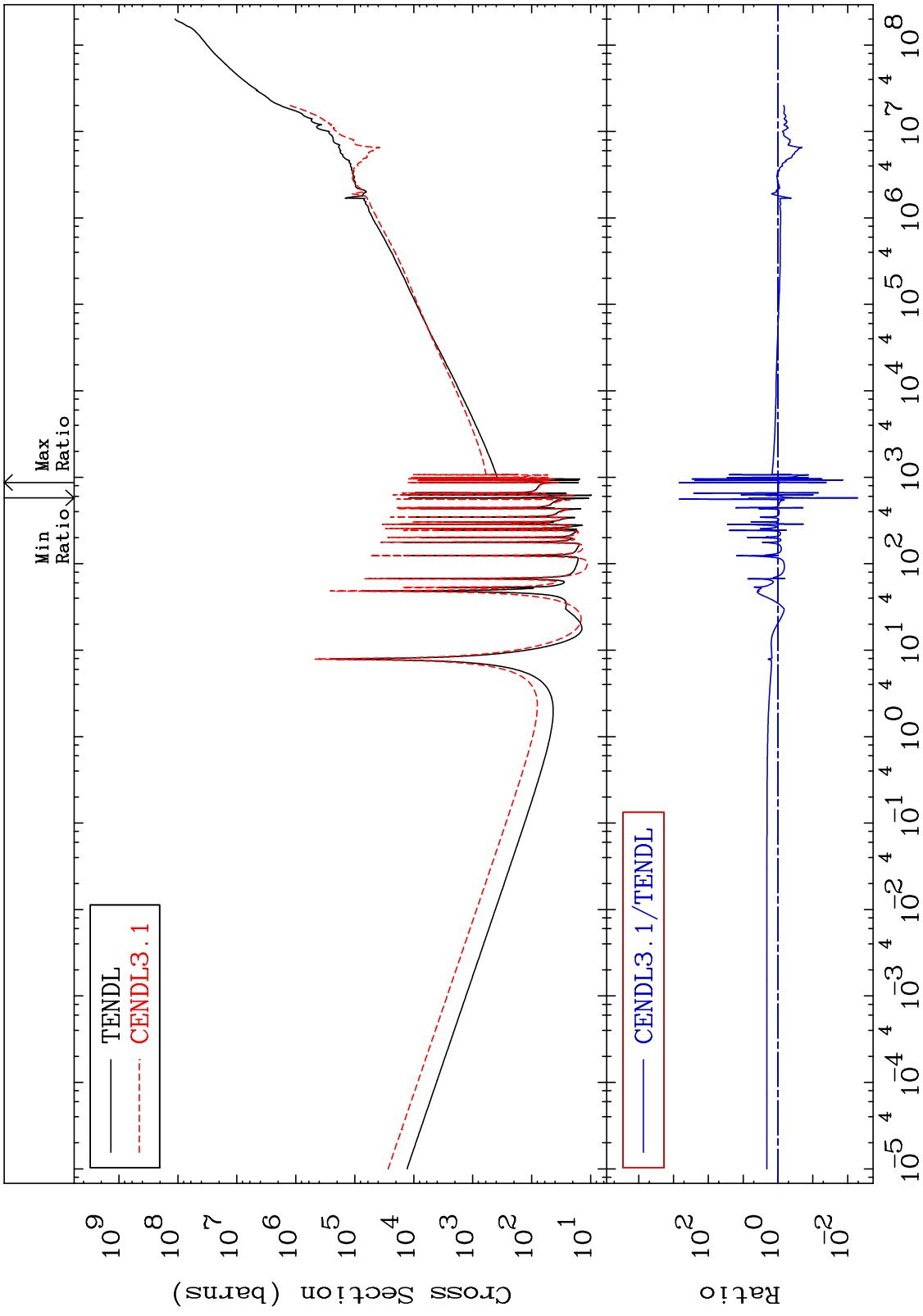
MAT 7231

He-4 Production  
Cross Section

72-Hf-176  
6.515 To 66.24 %



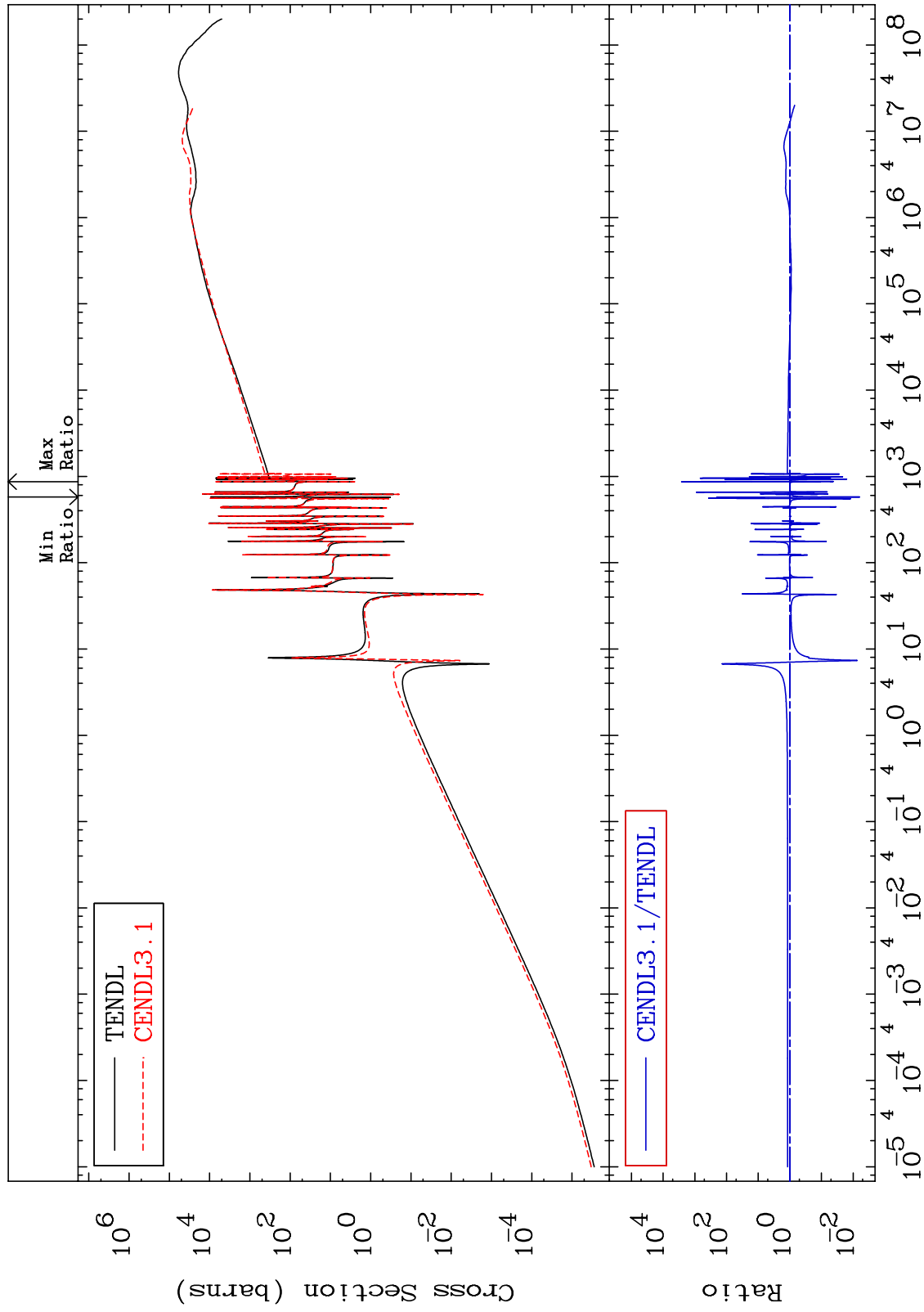
MAT 7231      Kerma total (eV-barns)      72-Hf-176  
 Cross Section      -99.49 To 9999. %



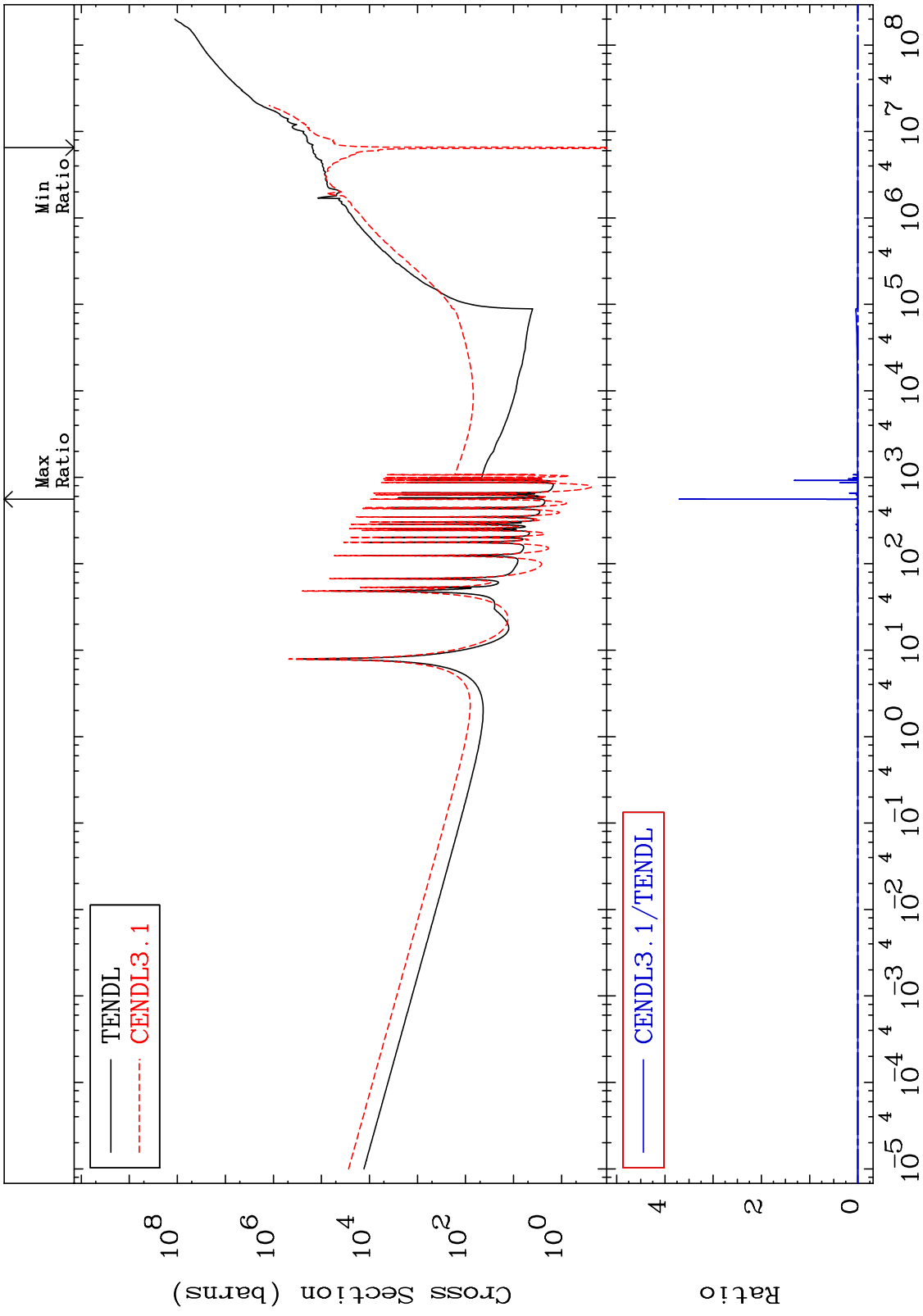
MAT 7231

Kerma elastic  
Cross Section

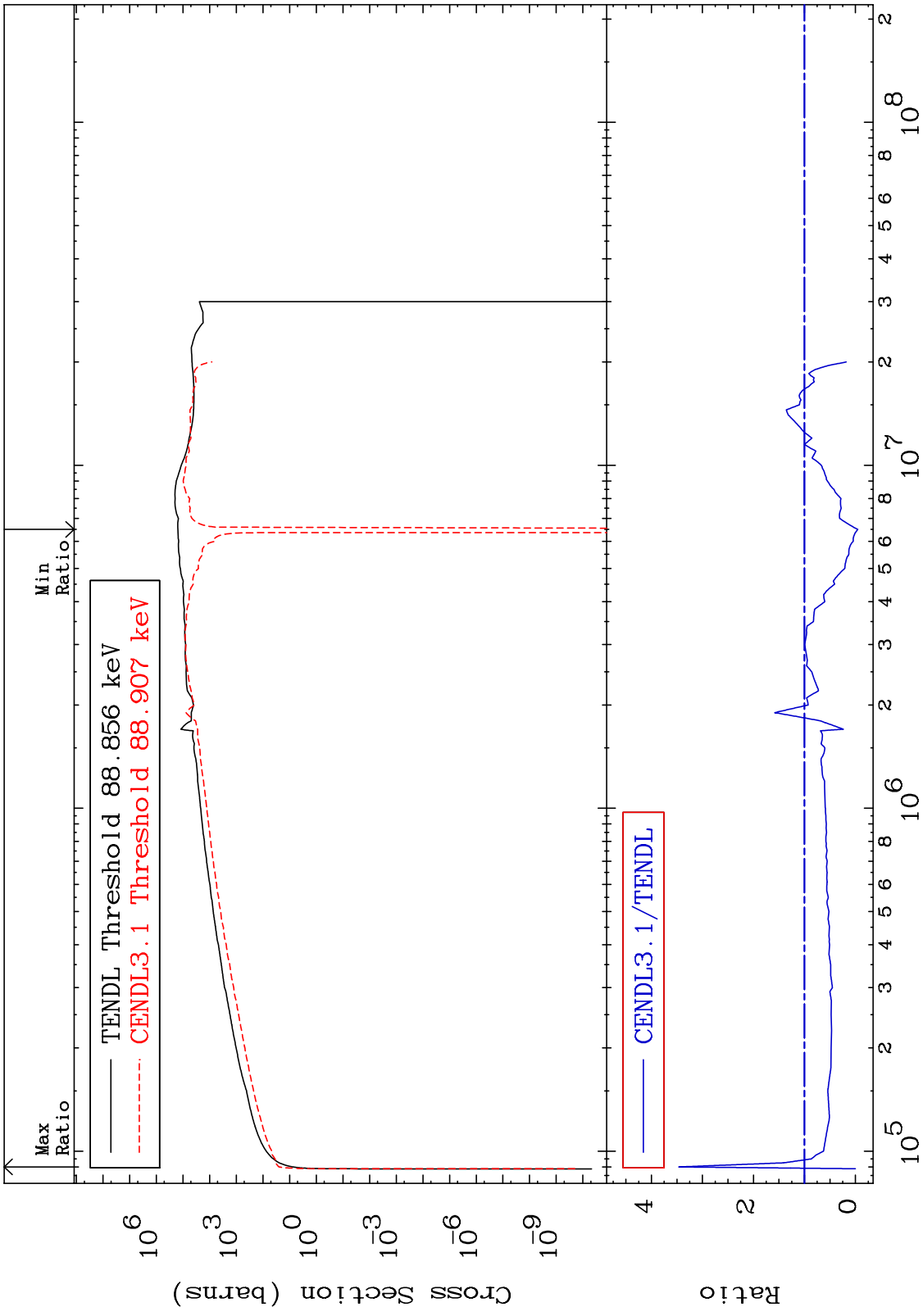
72-Hf-176  
-99.38 To 9999. %



MAT 7231 Kerma non-elastic (all but mt2) 72-Hf-176  
 Cross Section -104.7 To 9999. %



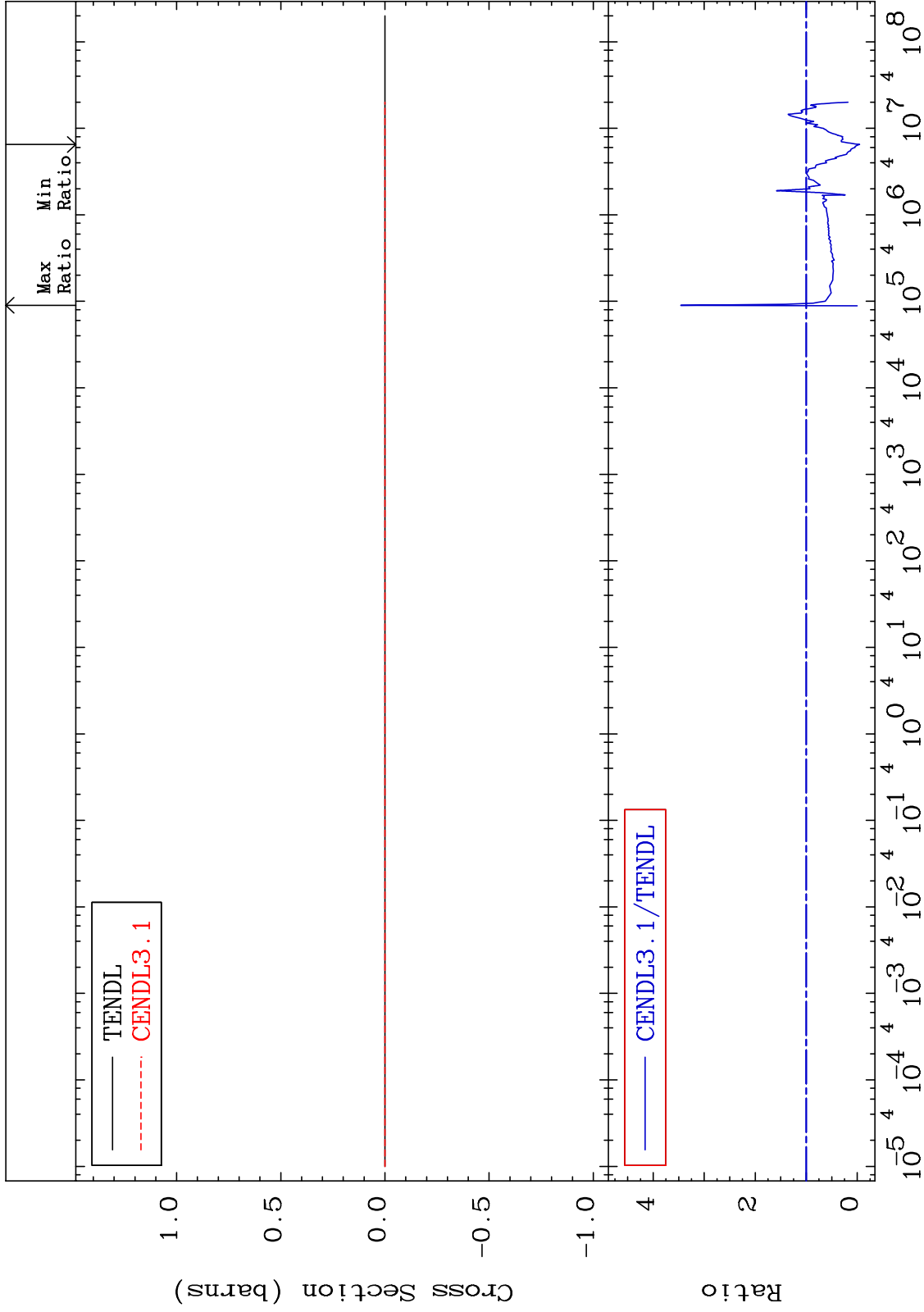




MAT 7231

Kerma fission (mt18 or mt19-20-21-38)  
Cross Section

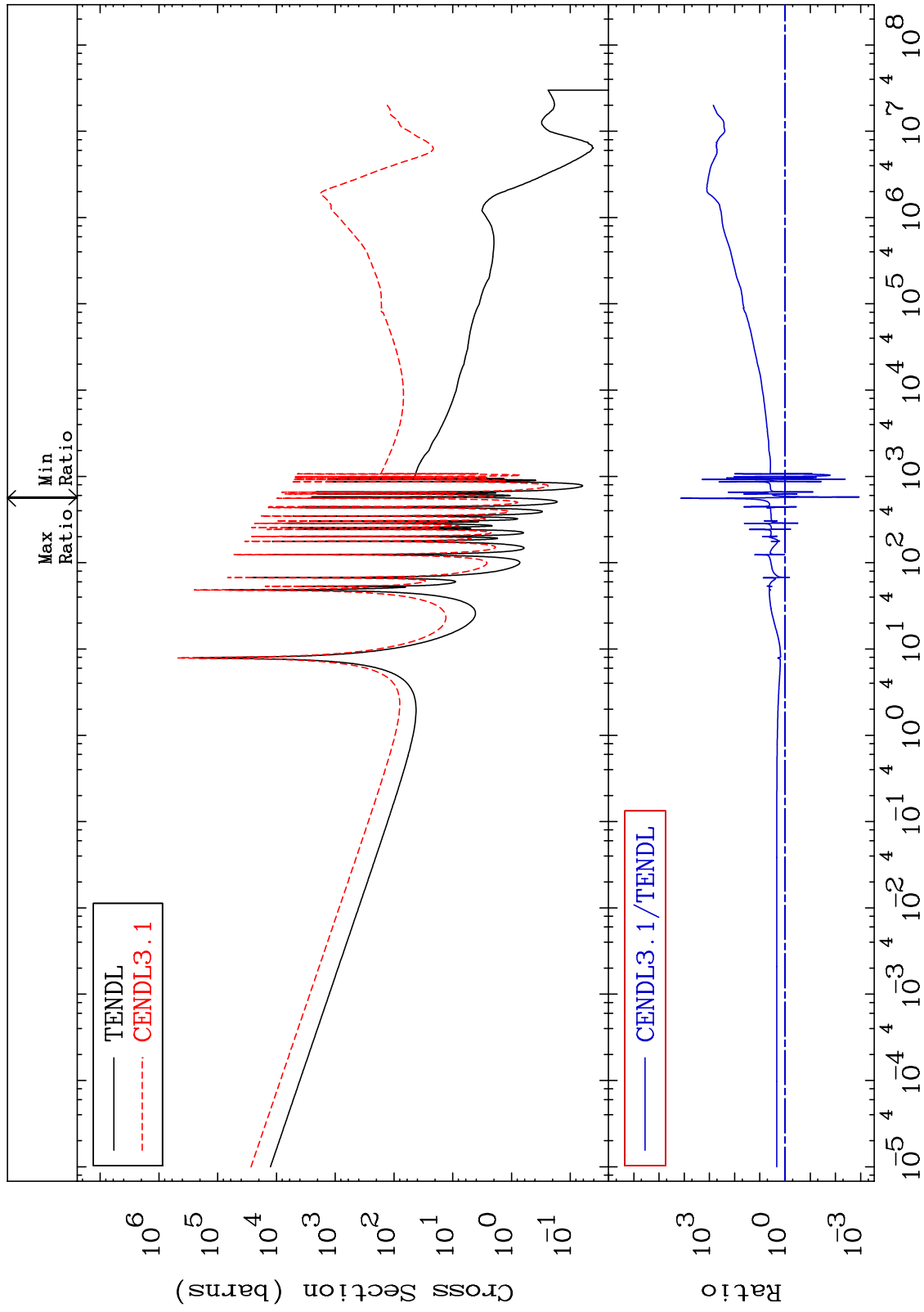
72-Hf-176  
-104.7 To 245.8 %



MAT 7231

Kerma capture (mt102)  
Cross Section

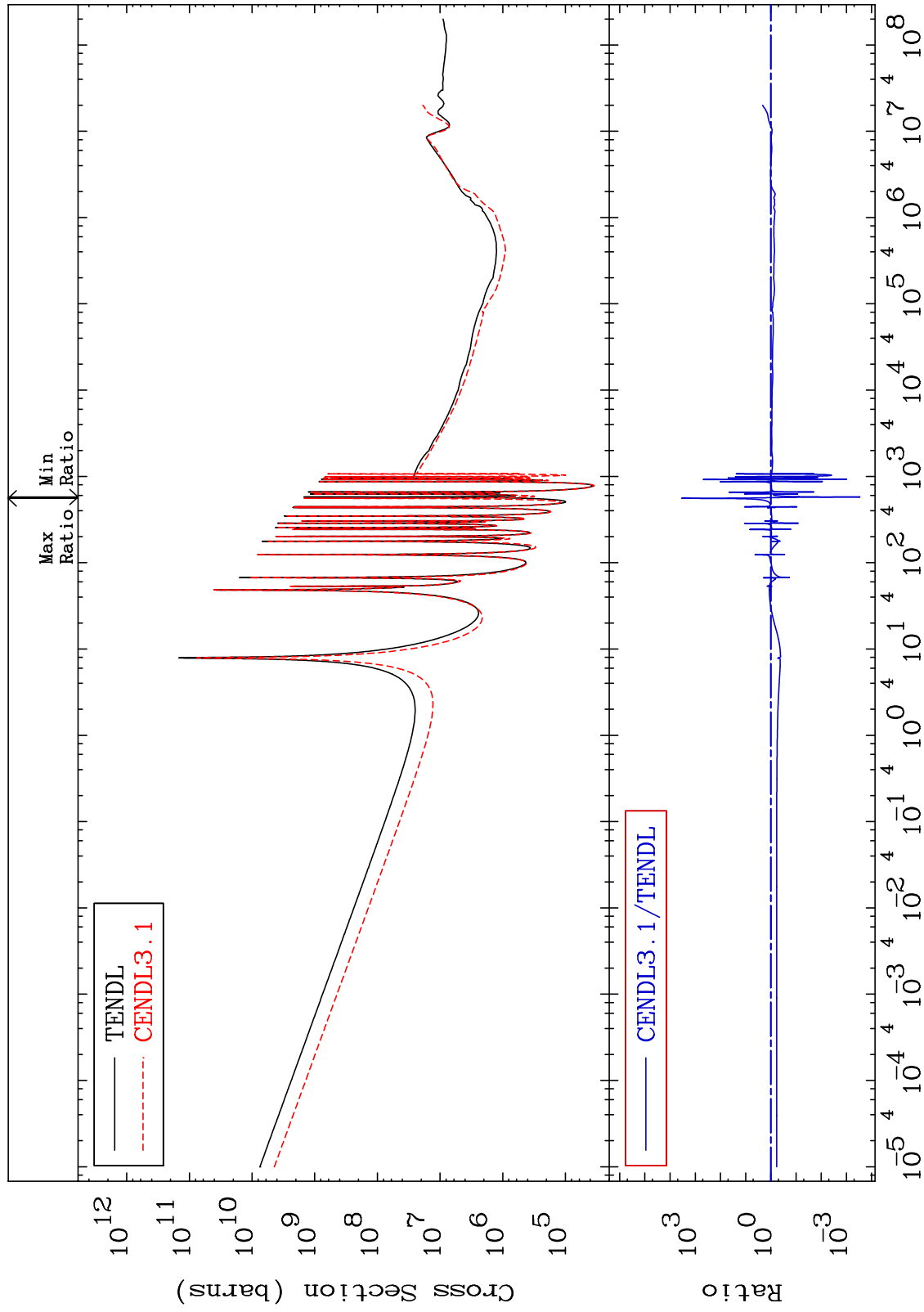
72-Hf-176  
-99.88 To 9999. %



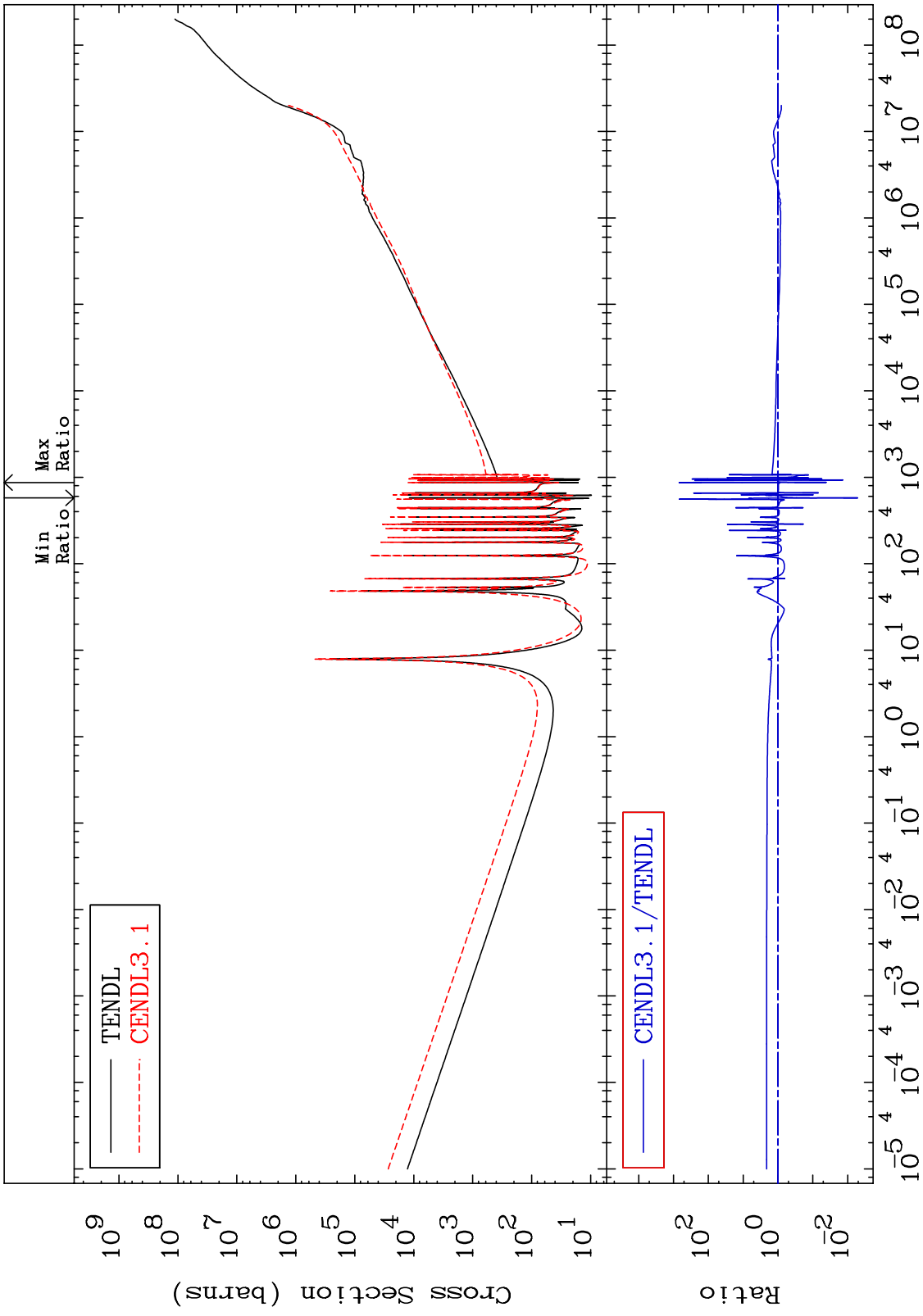
MAT 7231

Total photon (eV-barns)  
Cross Section

72-Hf-176  
-99.97 To 9999. %



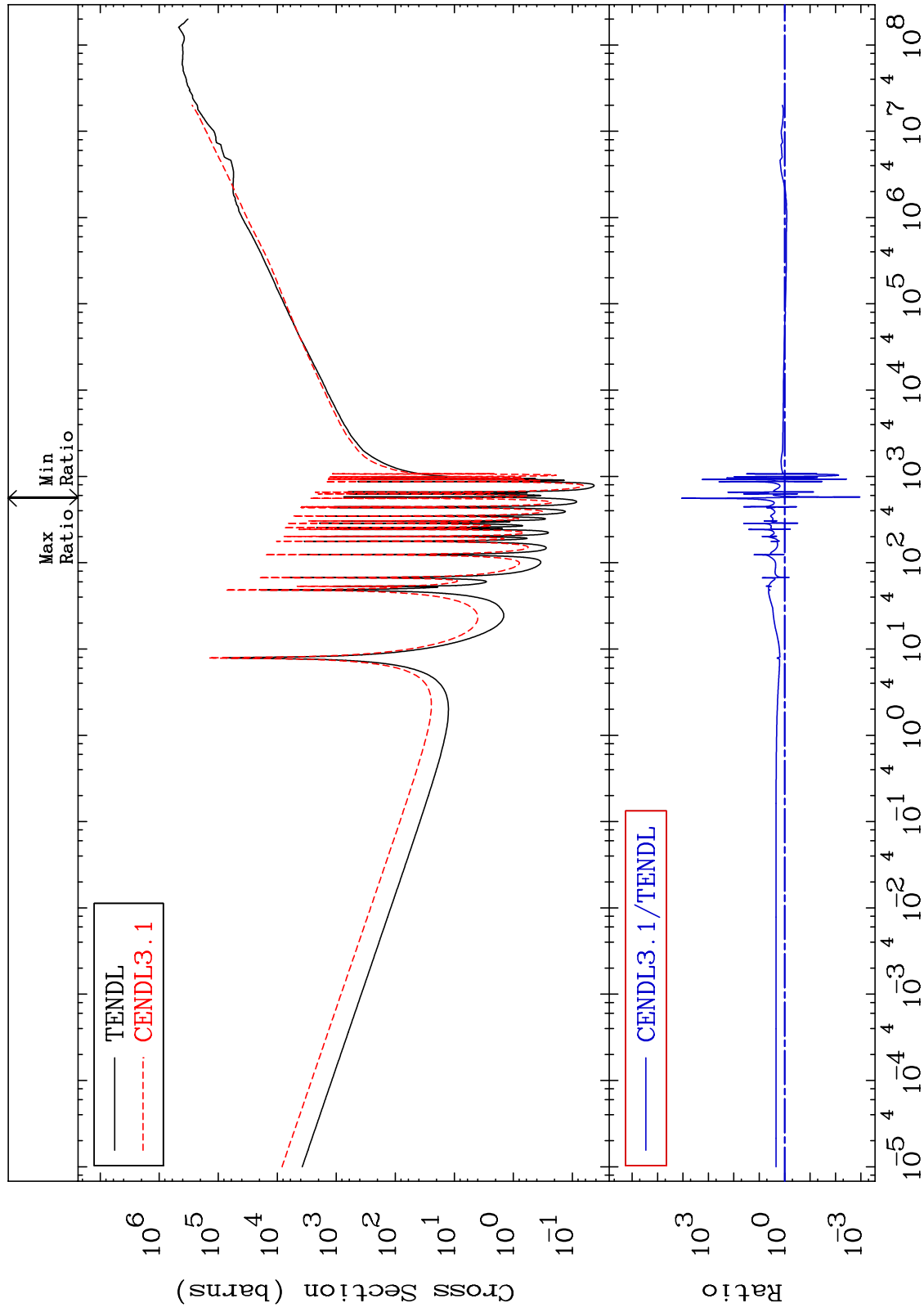
MAT 7231      Total kinematic kerma (high limit)      72-Hf-176  
 Cross Section      -99.49 To 9999. %



MAT 7231

Dpa total (eV-barns)  
Cross Section

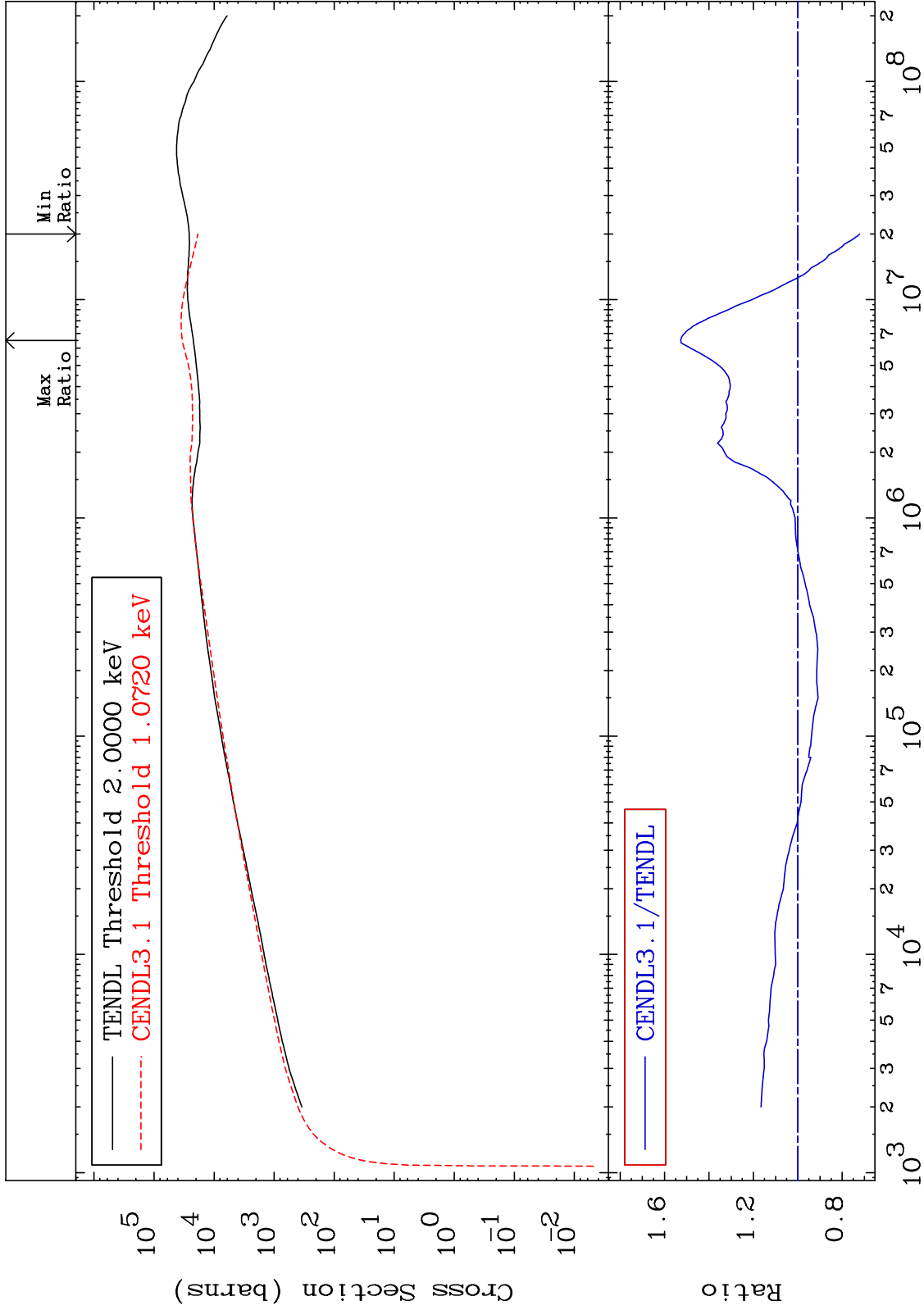
72-Hf-176  
-99.89 To 9999. %



MAT 7231

Dpa elastic (mt2)  
Cross Section

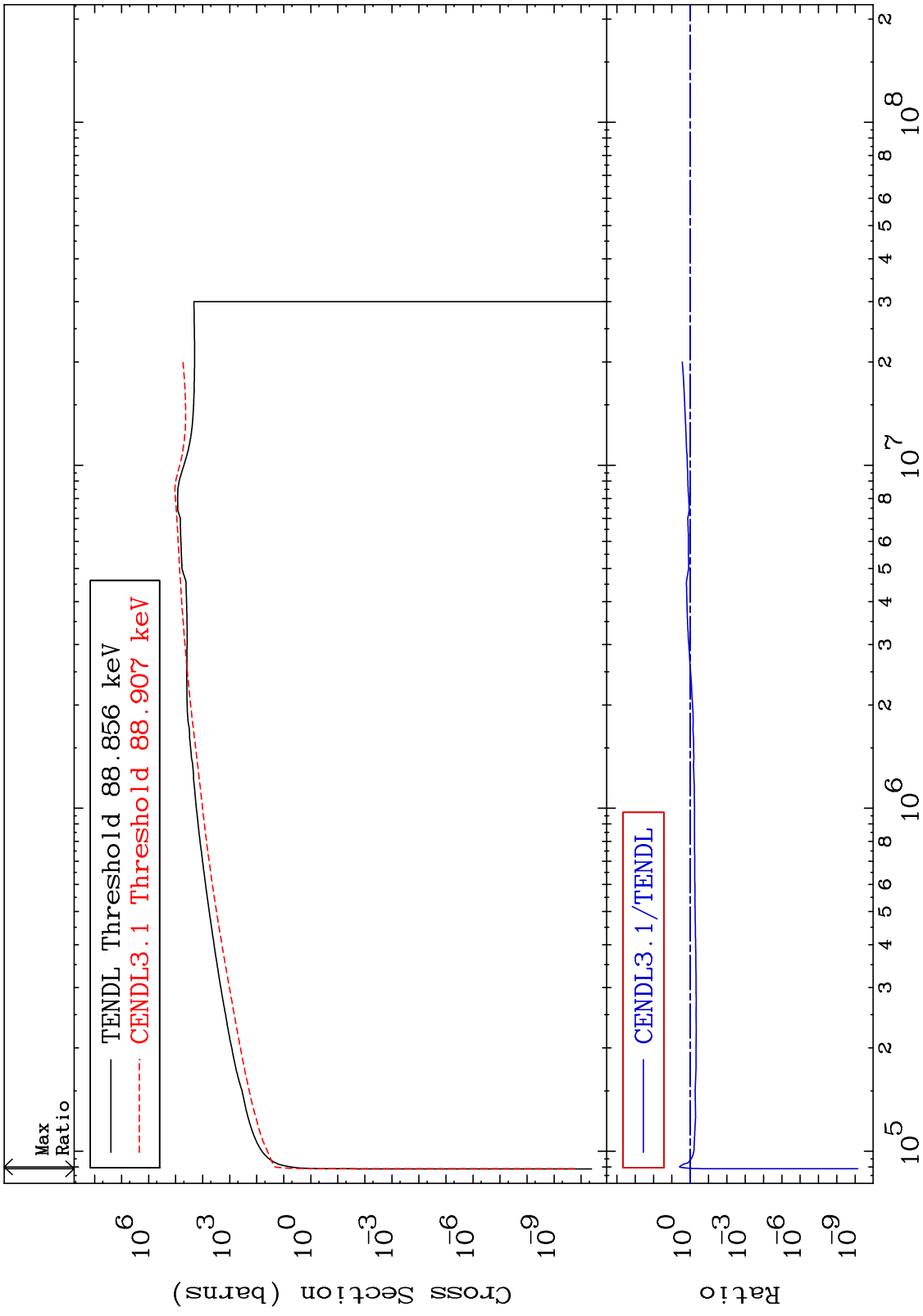
72-Hf-176  
-27.87 To 52.67 %



38

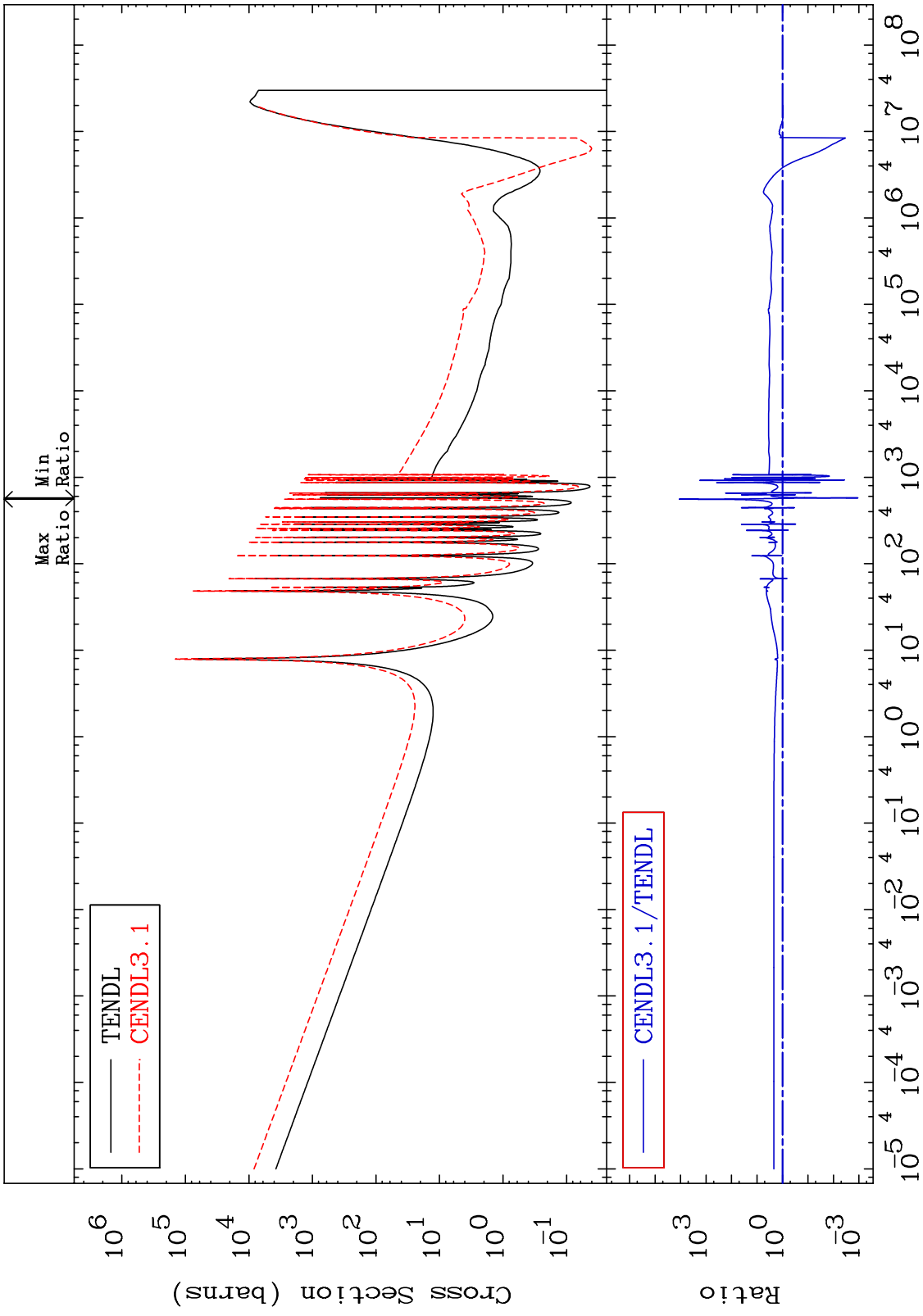
Incident Energy (eV)

72-Hf-176





MAT 7231      Dpa disappearance (mt102 -120)      72-Hf-176  
 Cross Section      -99.89 To 9999. %



40      Incident Energy (eV)      72-Hf-176

MAT 7231

(n,p)

72-Hf-176

-98.80 To 322.9 %

Cross Section

Min Ratio

Max Ratio

TENDL Threshold 414.09 keV  
JENDL4.0 Threshold 4.0000 MeV

Cross Section (milli-barns)

35  
30  
25  
20  
15  
10  
5  
0

Ratio

$10^1$   
 $10^0$   
 $10^{-1}$   
 $10^{-2}$

JENDL4.0/TENDL

4 5 6 7 8 10<sup>6</sup> 2 3 4 5 6 7 8 10<sup>7</sup> 2 3 4 5 6 7 8 10<sup>8</sup>

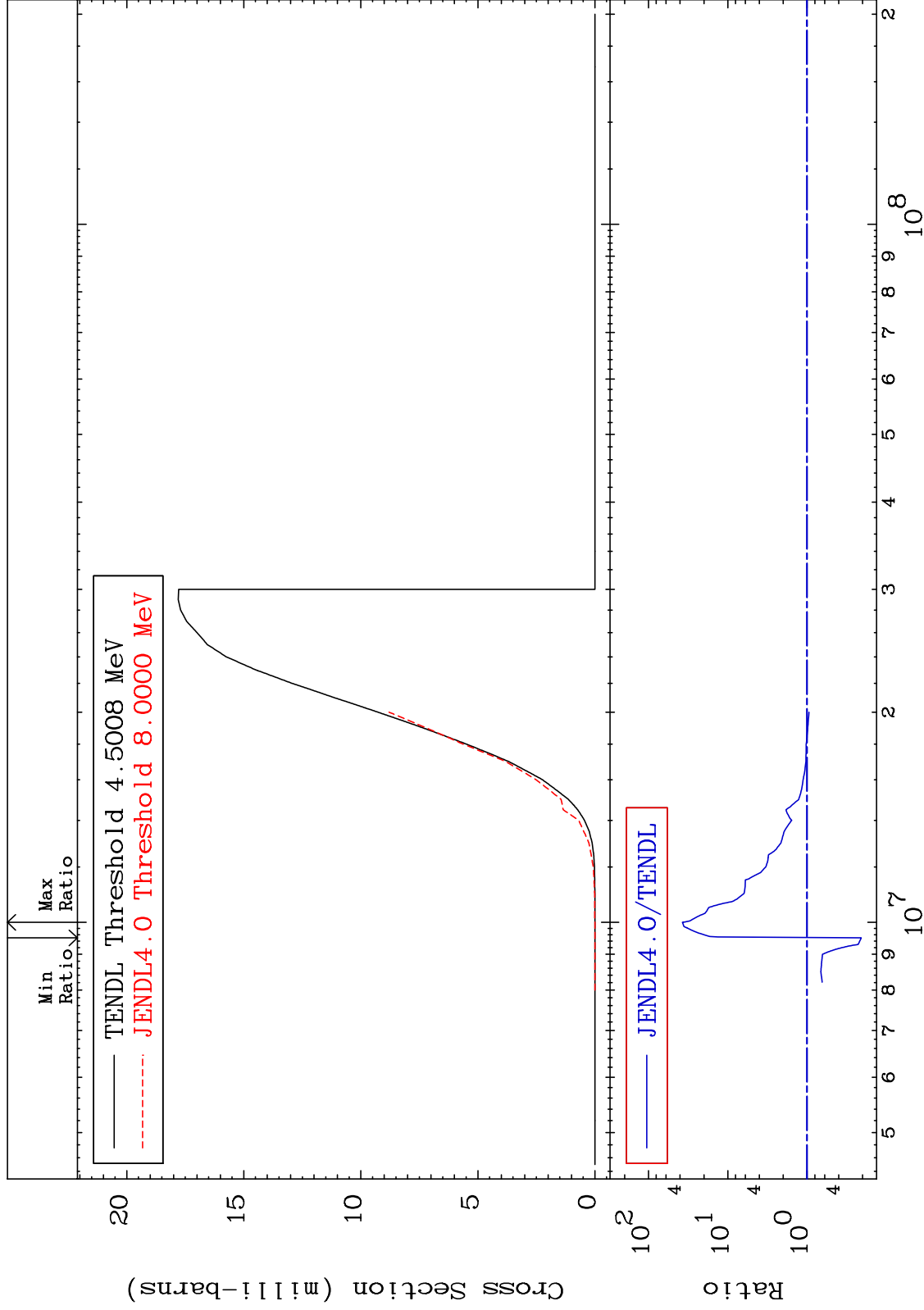
MAT 7231

(n,d)

72-Hf-176

Cross Section

-79.25 To 3631. %



42

Incident Energy (eV)

72-Hf-176

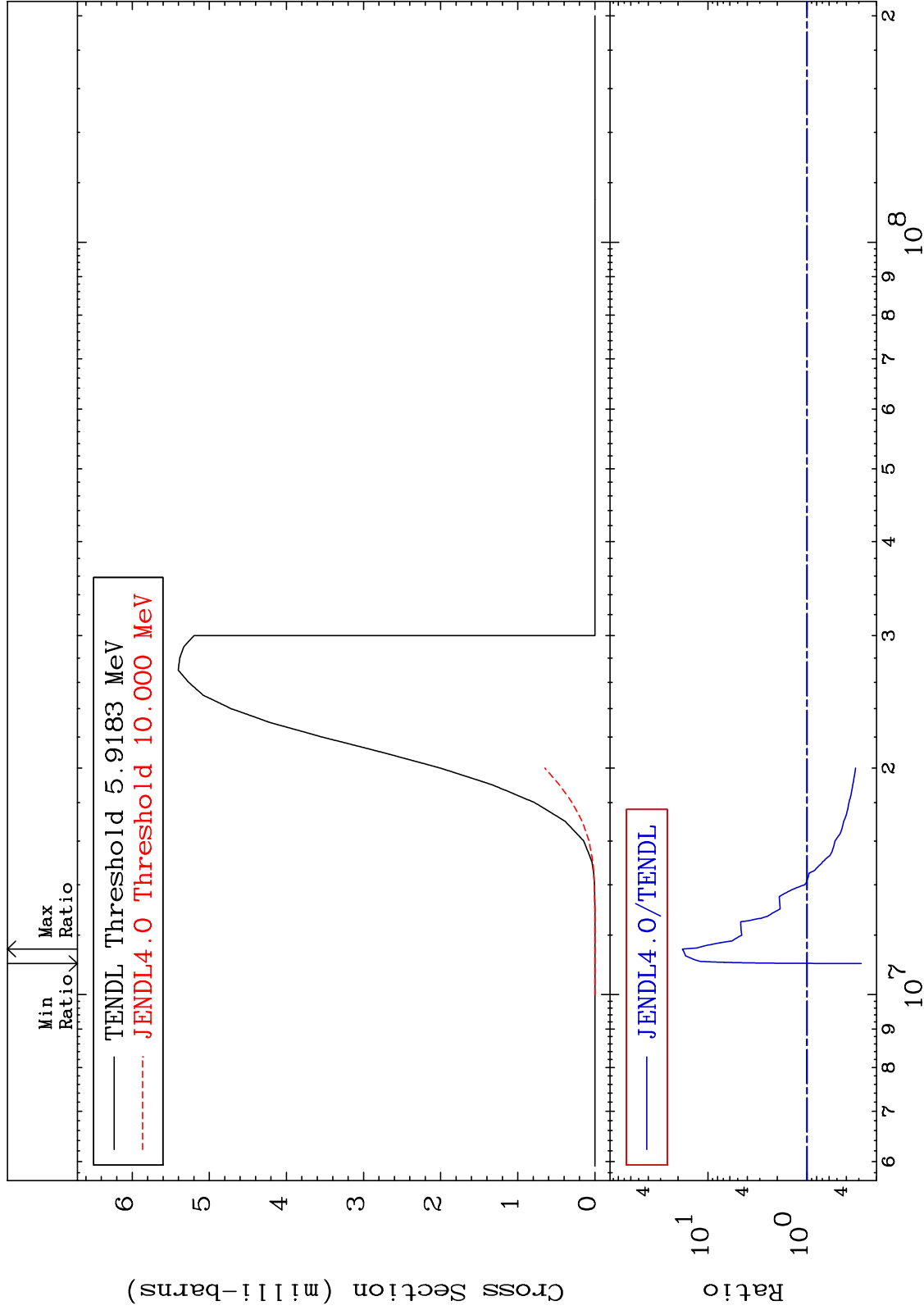
MAT 7231

(n,t)

72-Hf-176

Cross Section

-71.65 To 1707. %



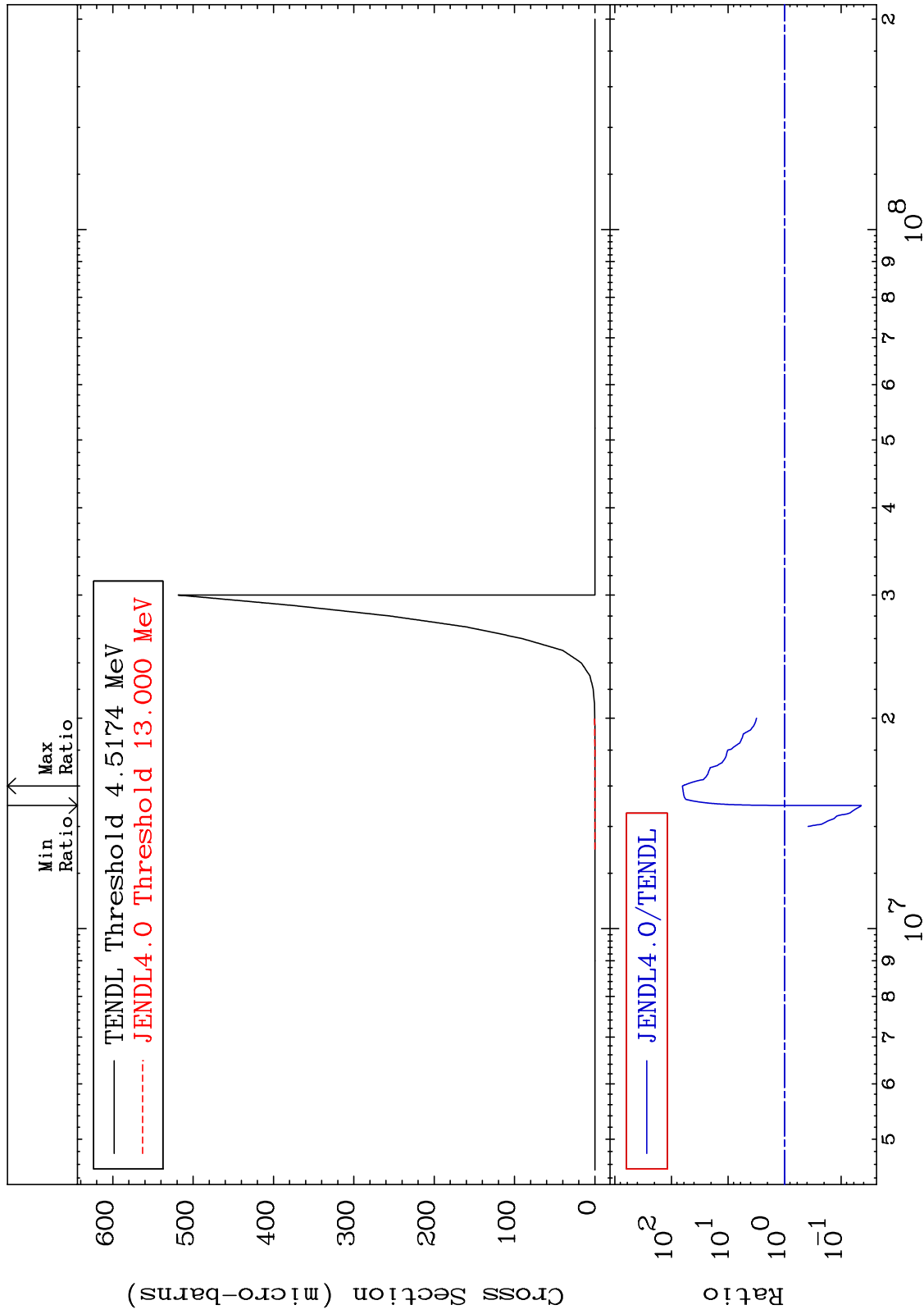
MAT 7231

(n, He-3)

72-Hf-176

Cross Section

-95.59 To 6277. %



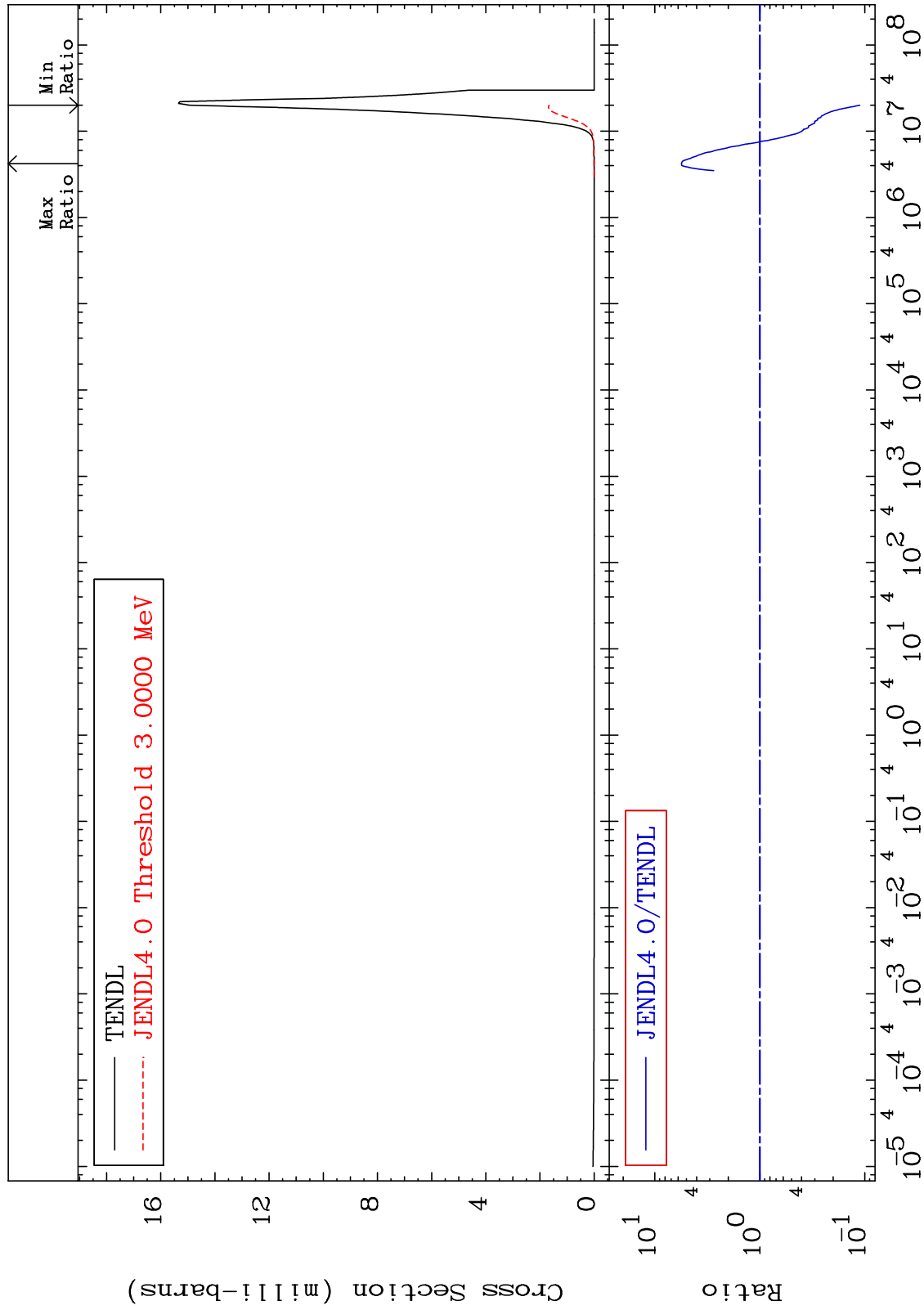
MAT 7231

(n,  $\alpha$ )

72-Hf-176

Cross Section

-88.83 To 458.1 %



45

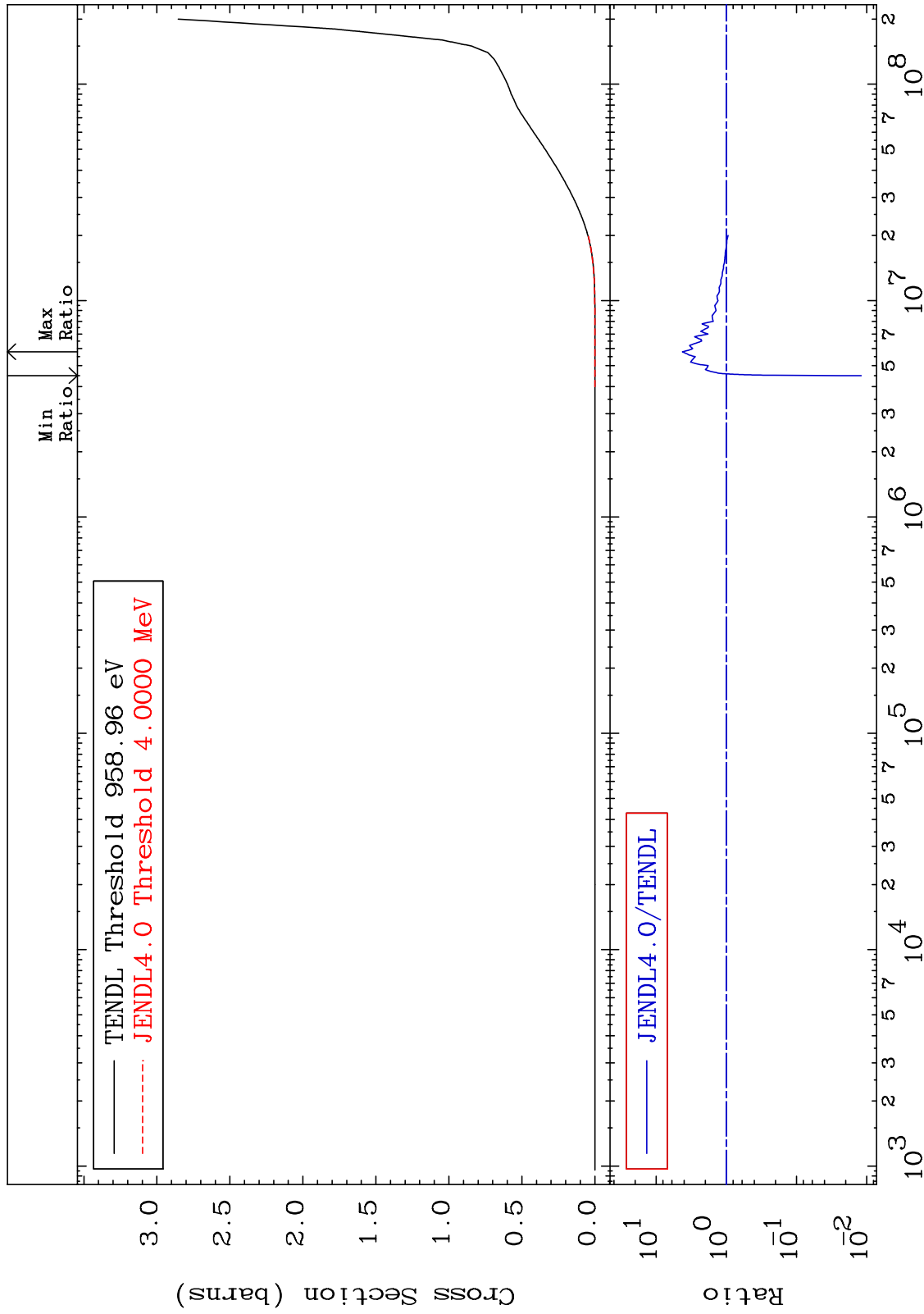
Incident Energy (eV)

72-Hf-176

MAT 7231

Hydrogen Production  
Cross Section

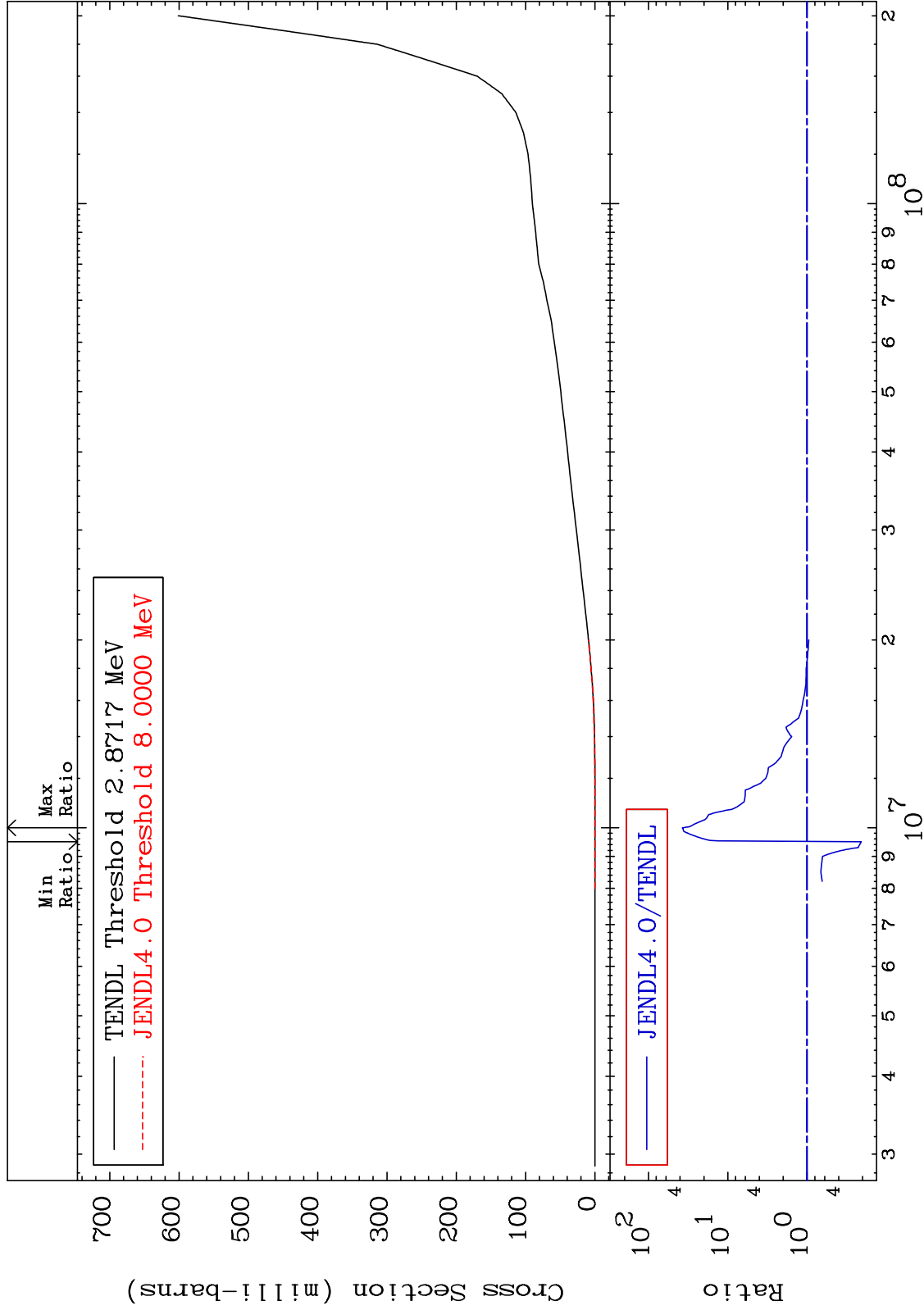
72-Hf-176  
-98.80 To 322.9 %



MAT 7231

Deuterium Production  
Cross Section

72-Hf-176  
-79.25 To 3631. %

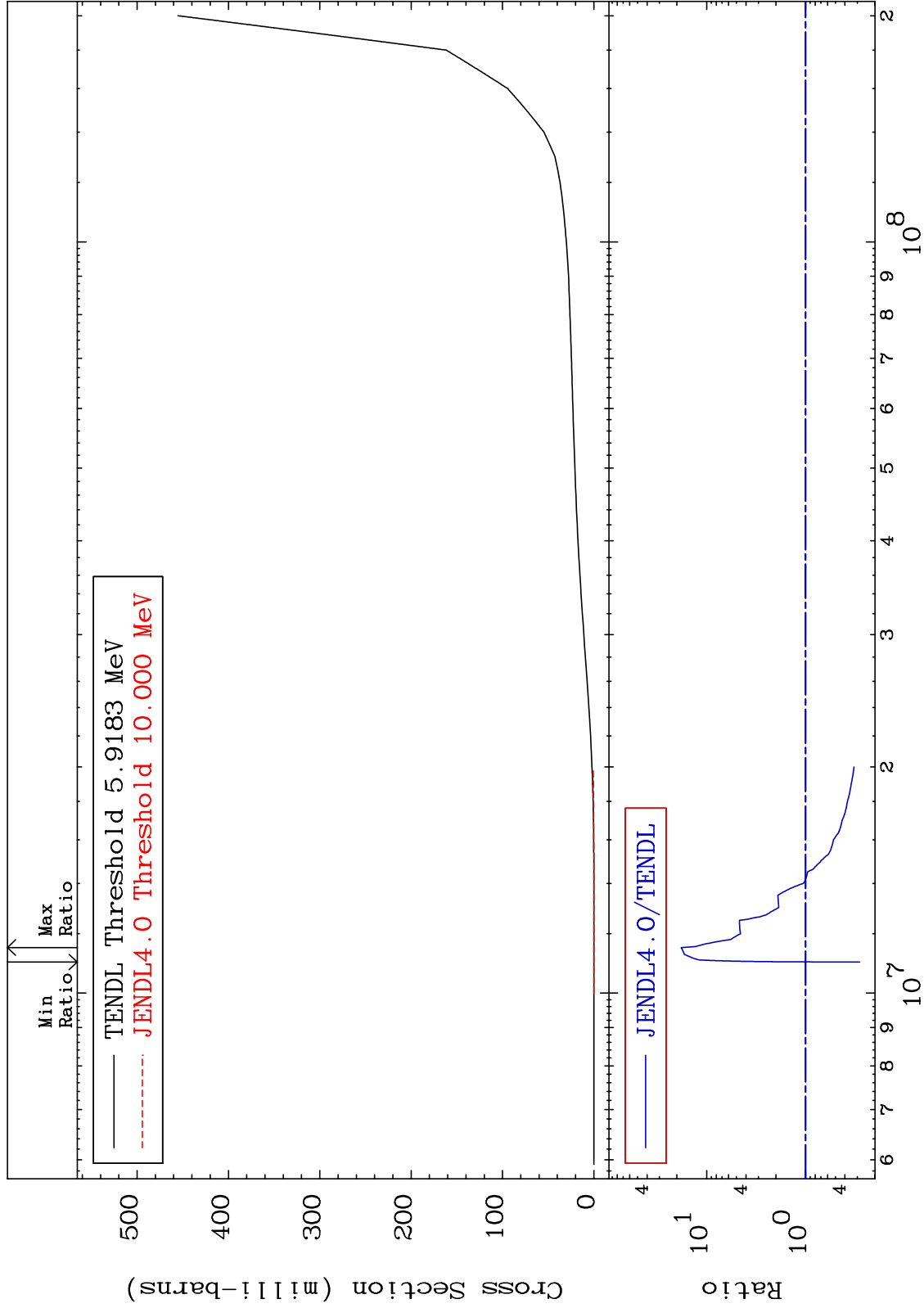




MAT 7231

Tritium Production  
Cross Section

72-Hf-176  
-71.65 To 1707. %



48

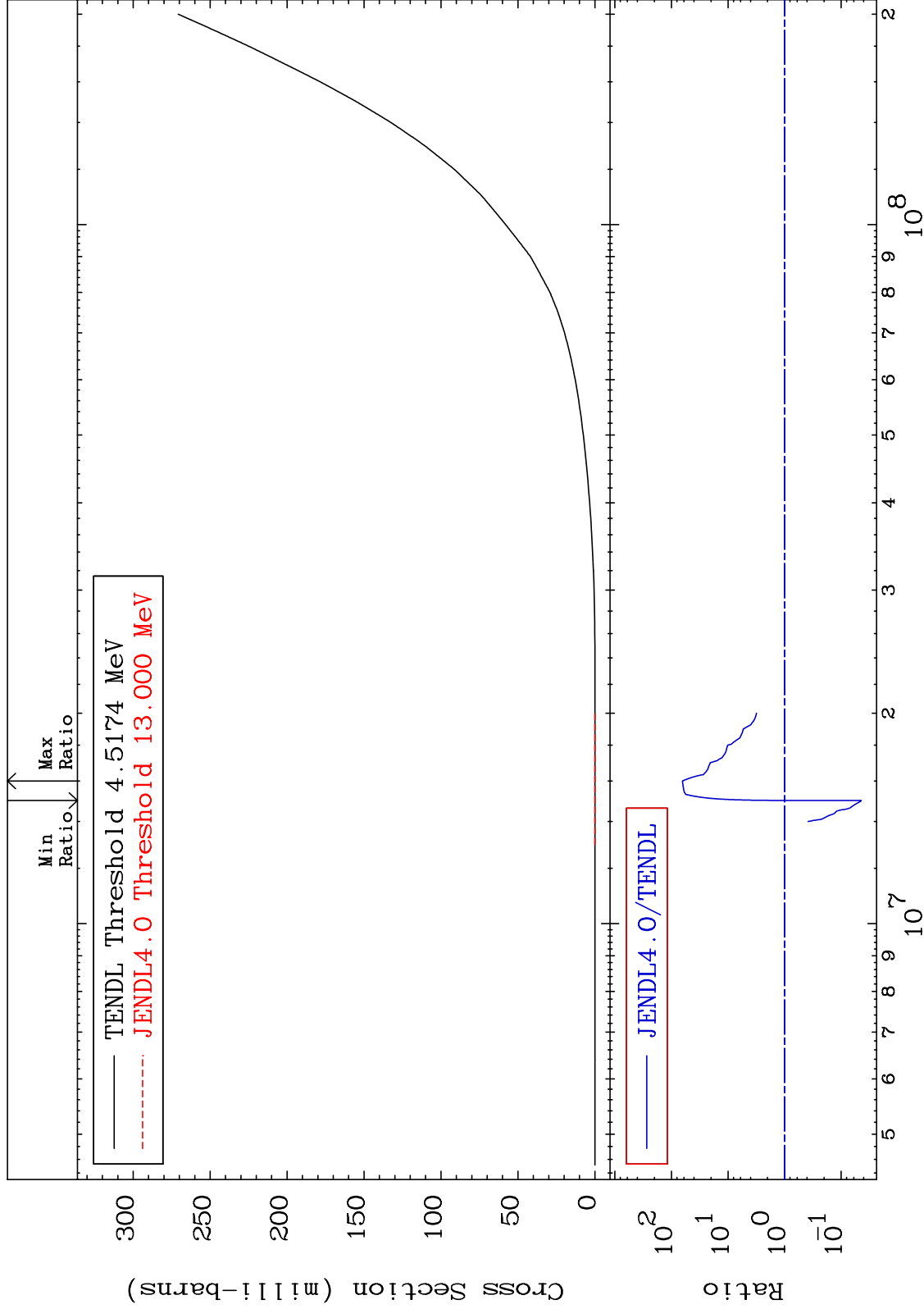
Incident Energy (eV)

72-Hf-176

MAT 7231

He-3 Production  
Cross Section

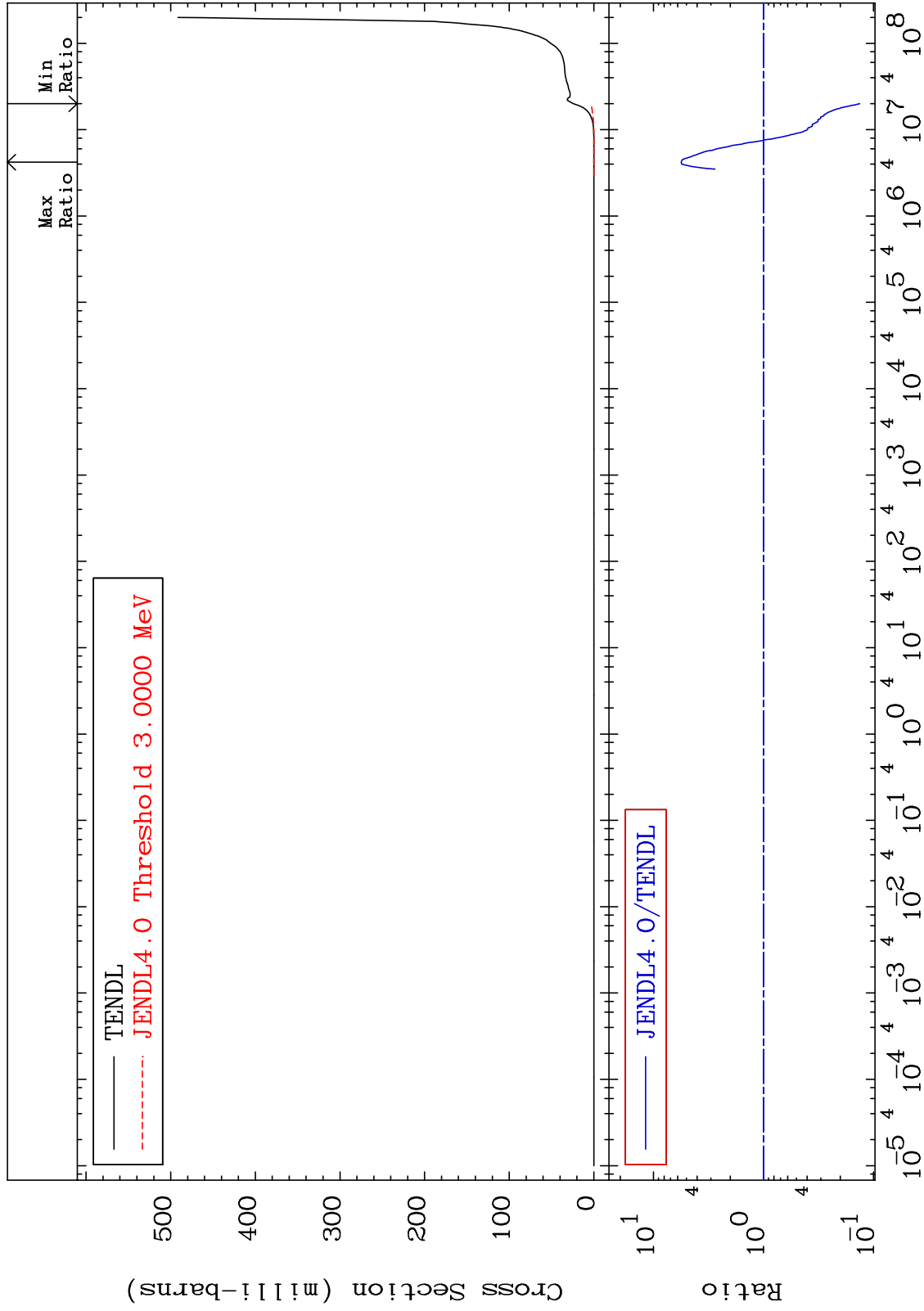
72-Hf-176  
-95.59 To 6277. %



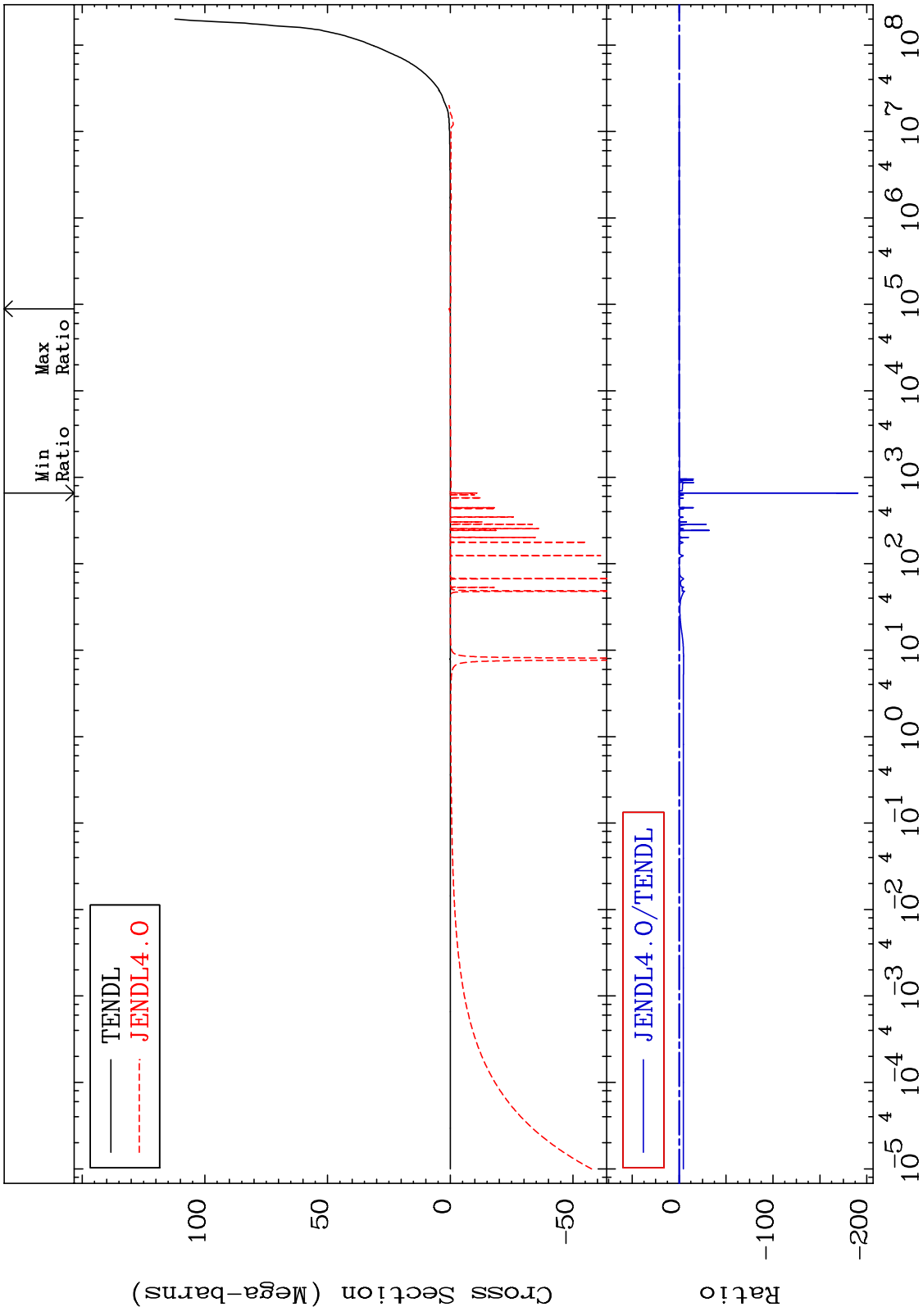
MAT 7231

He-4 Production  
Cross Section

72-Hf-176  
-86.71 To 458.1 %



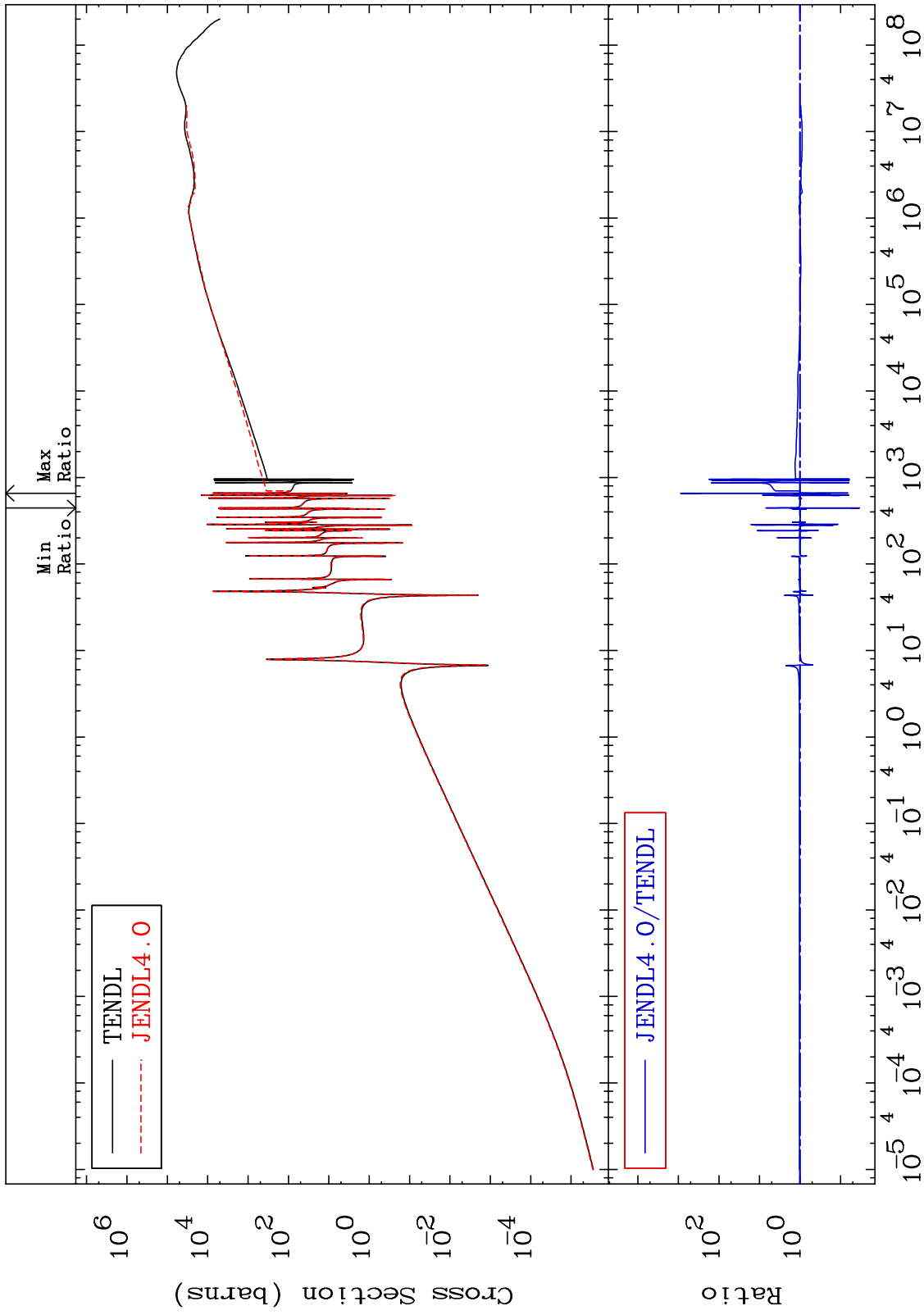
MAT 7231 Kerma total (eV-barns) 72-Hf-176  
 Cross Section -9999. To 5637. %



MAT 7231

Kerma elastic  
Cross Section

72-Hf-176  
-96.62 To 9999. %

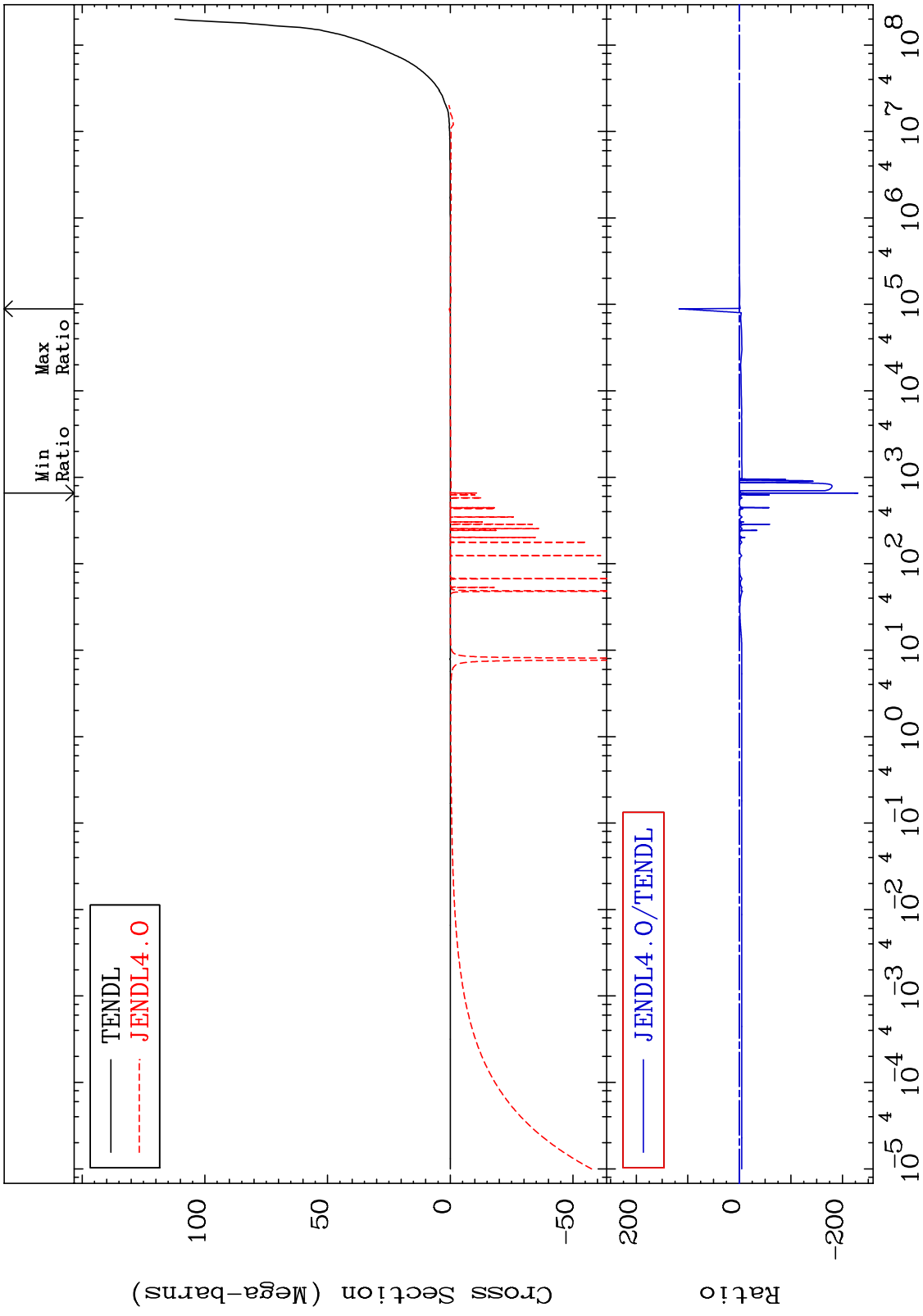


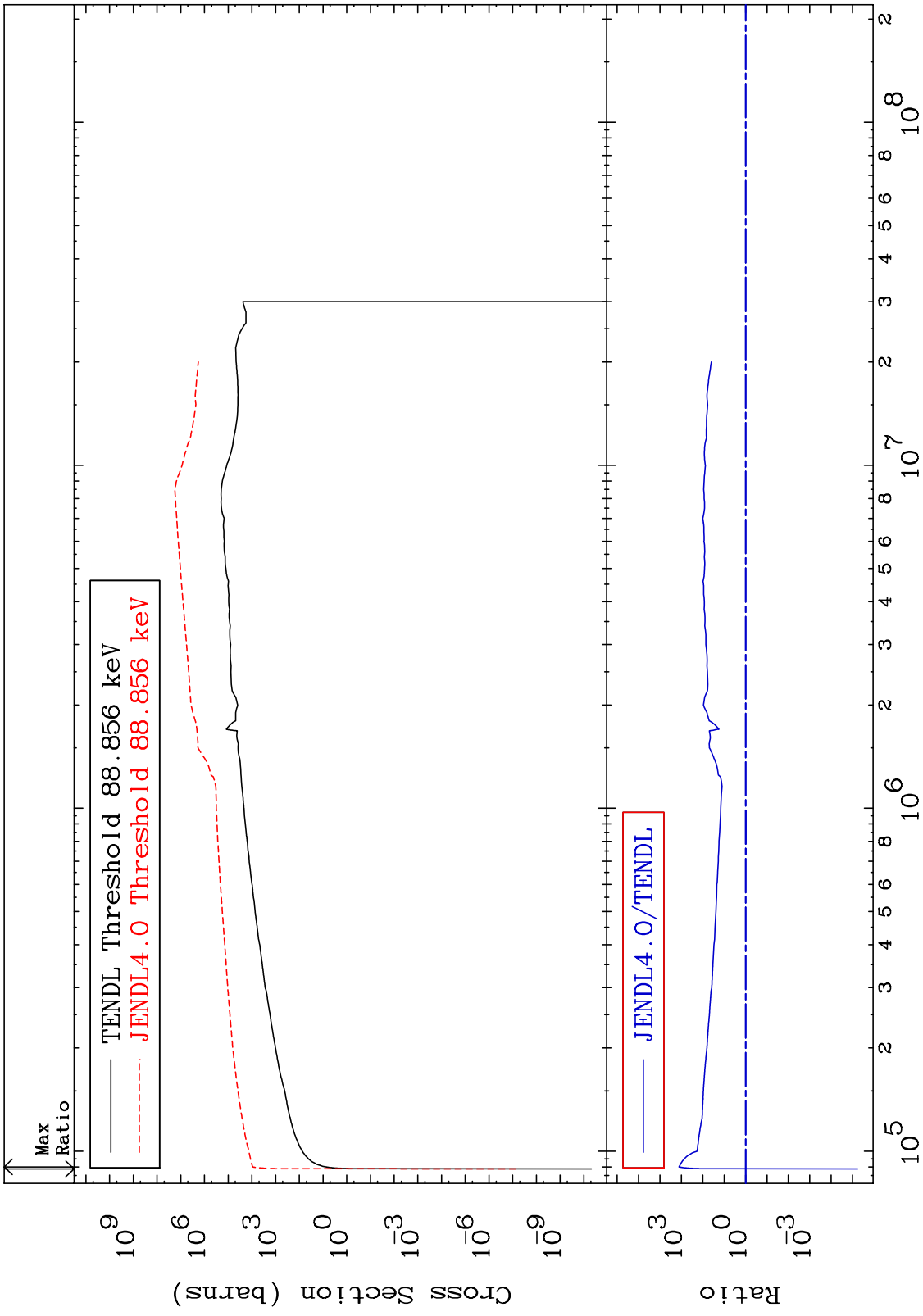
52

Incident Energy (eV)

72-Hf-176

MAT 7231 Kerma non-elastic (all but mt2) 72-Hf-176  
 Cross Section -9999. To 9999. %

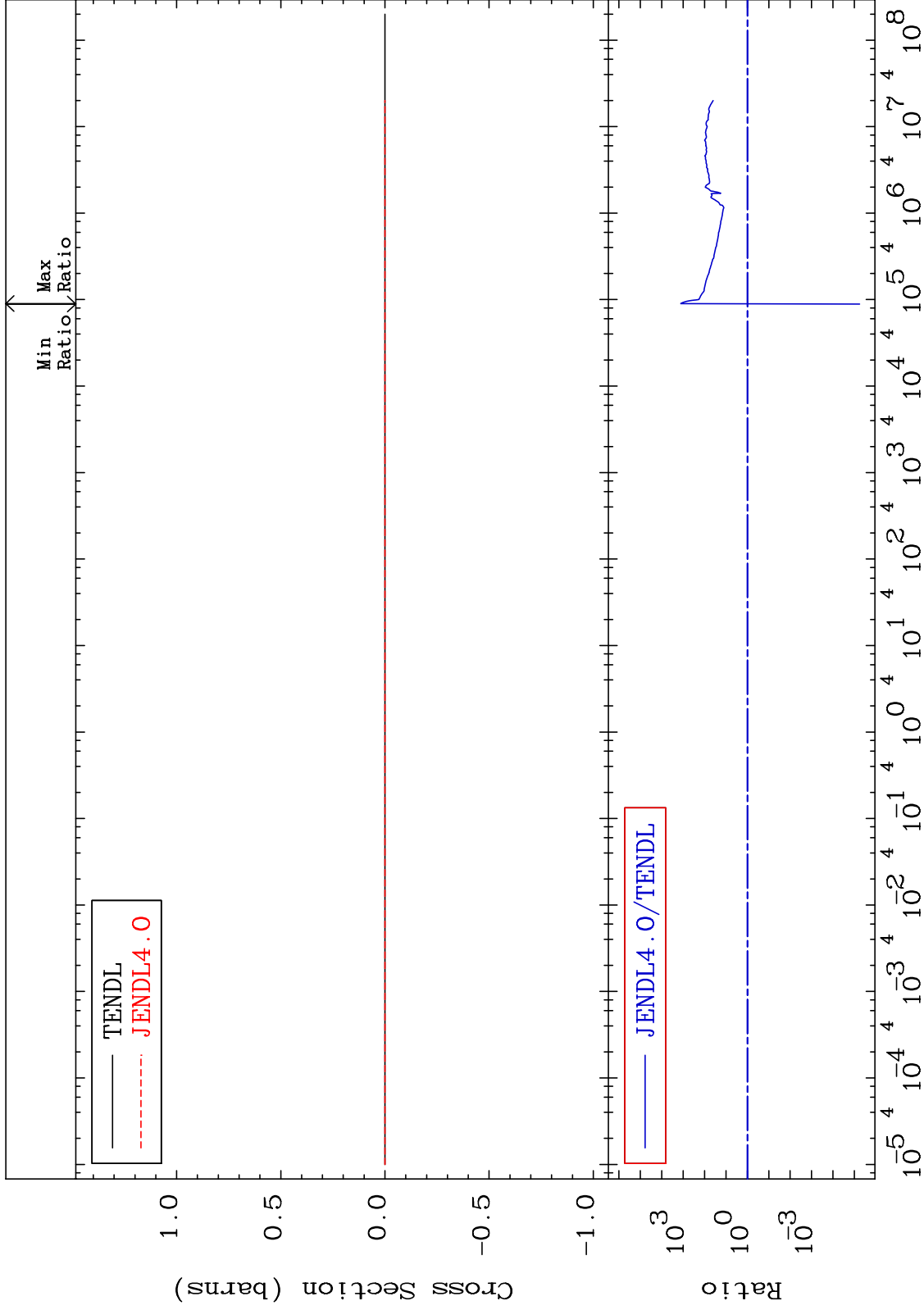




MAT 7231

Kerma fission (mt18 or mt19-20-21-38)  
Cross Section

72-Hf-176  
-100.0 To 9999. %

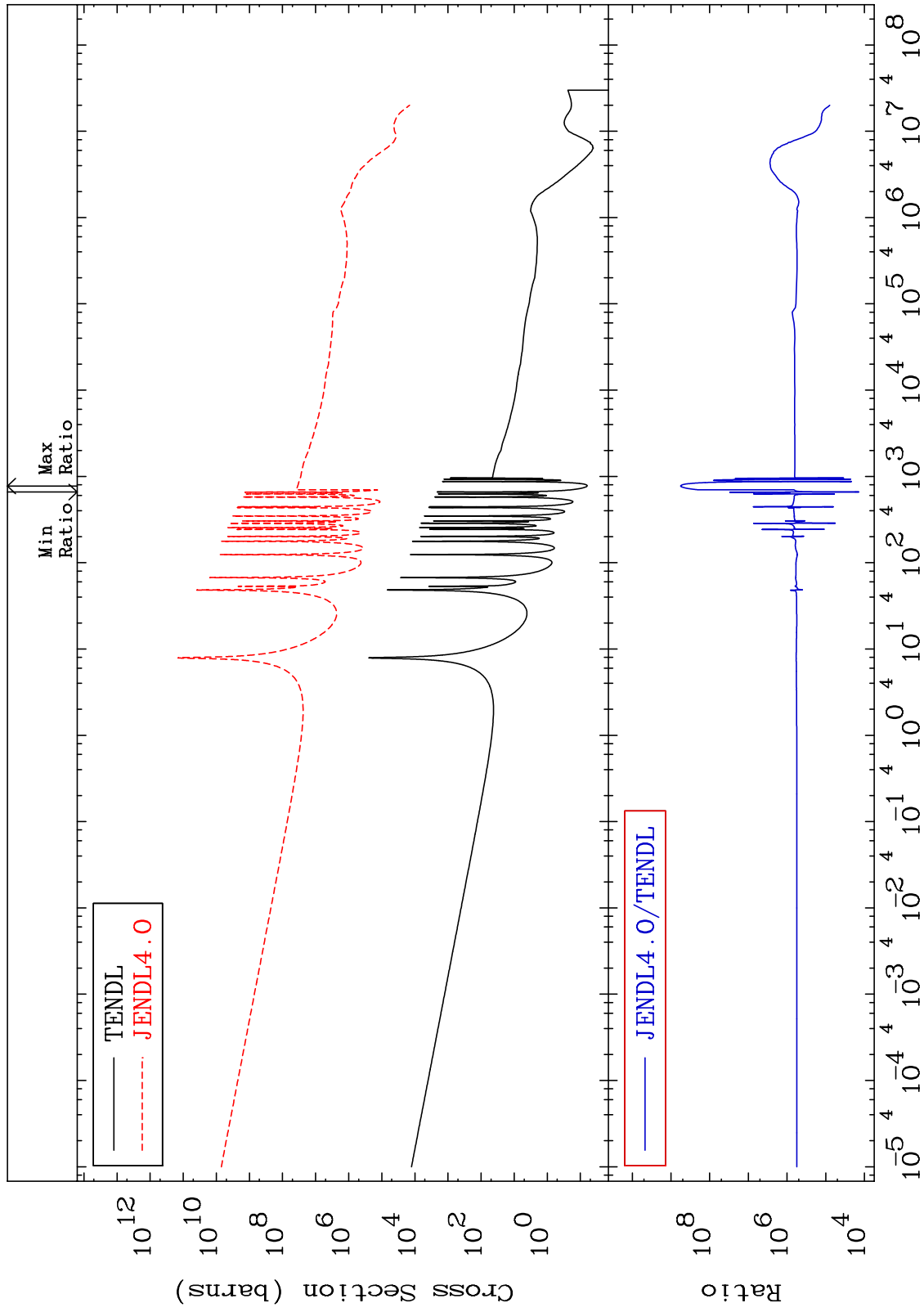




MAT 7231

Kerma capture (mt102)  
Cross Section

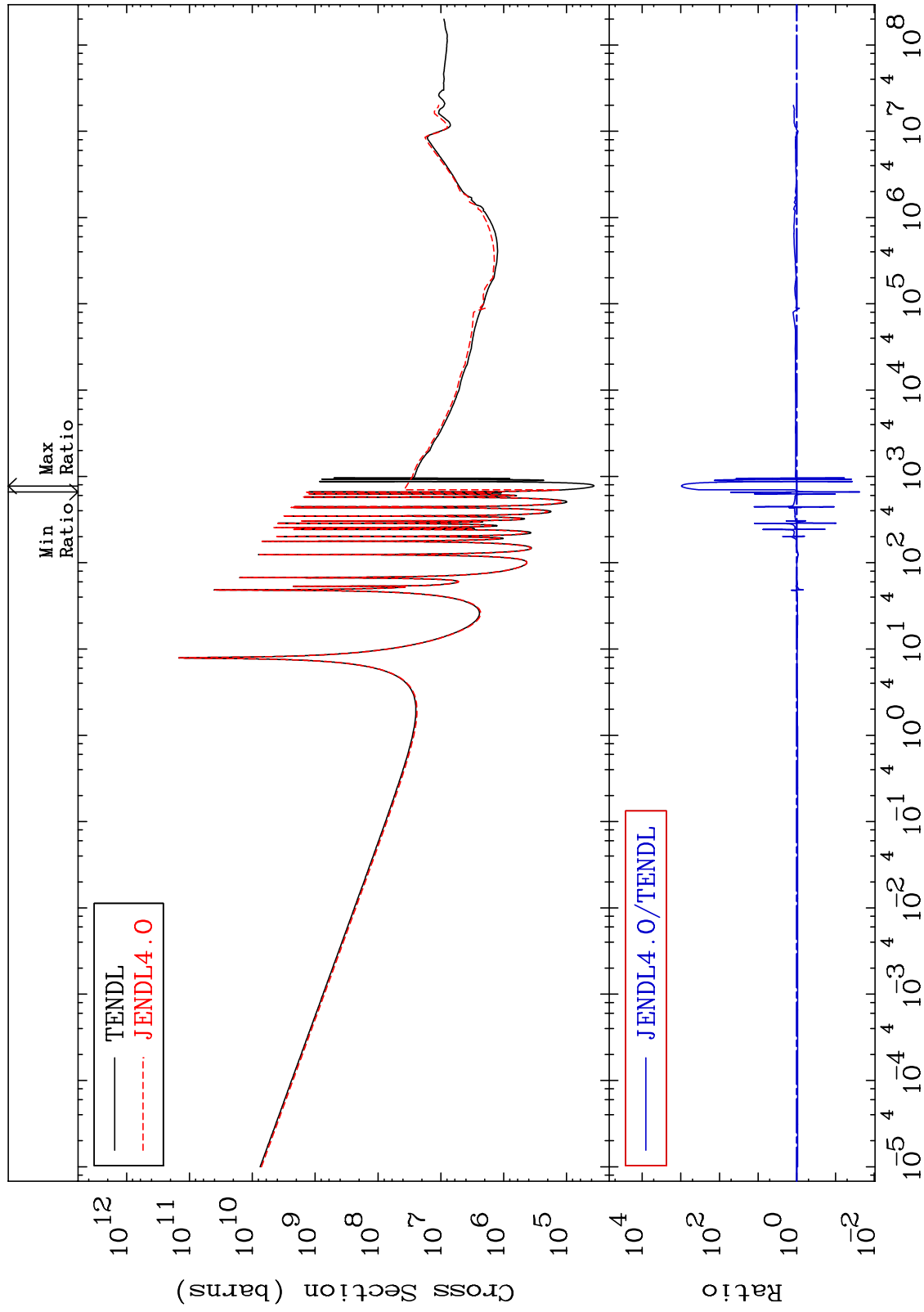
72-Hf-176  
9999. To 9999. %



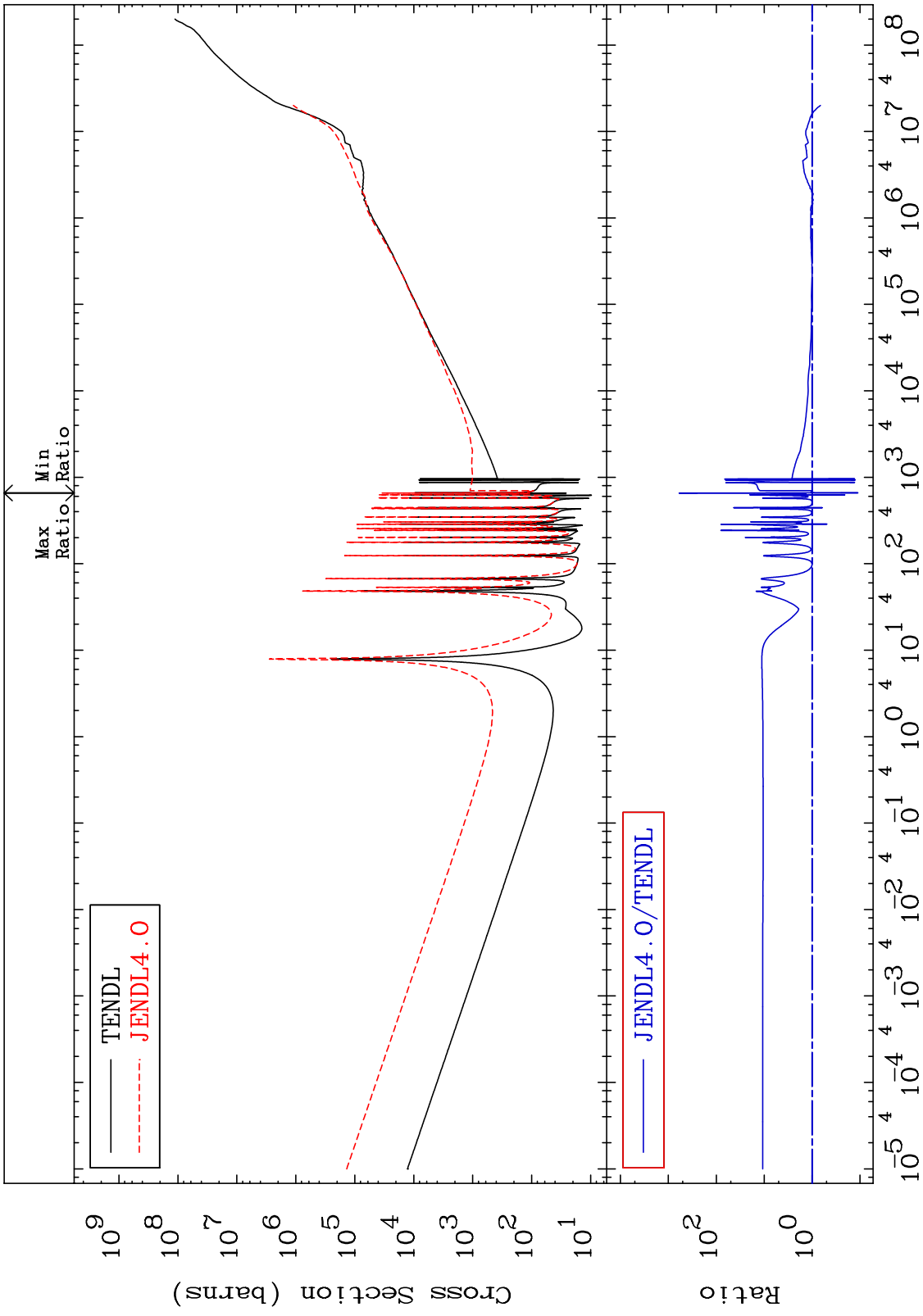
MAT 7231

Total photon (eV-barns)  
Cross Section

72-Hf-176  
-97.65 To 9999. %



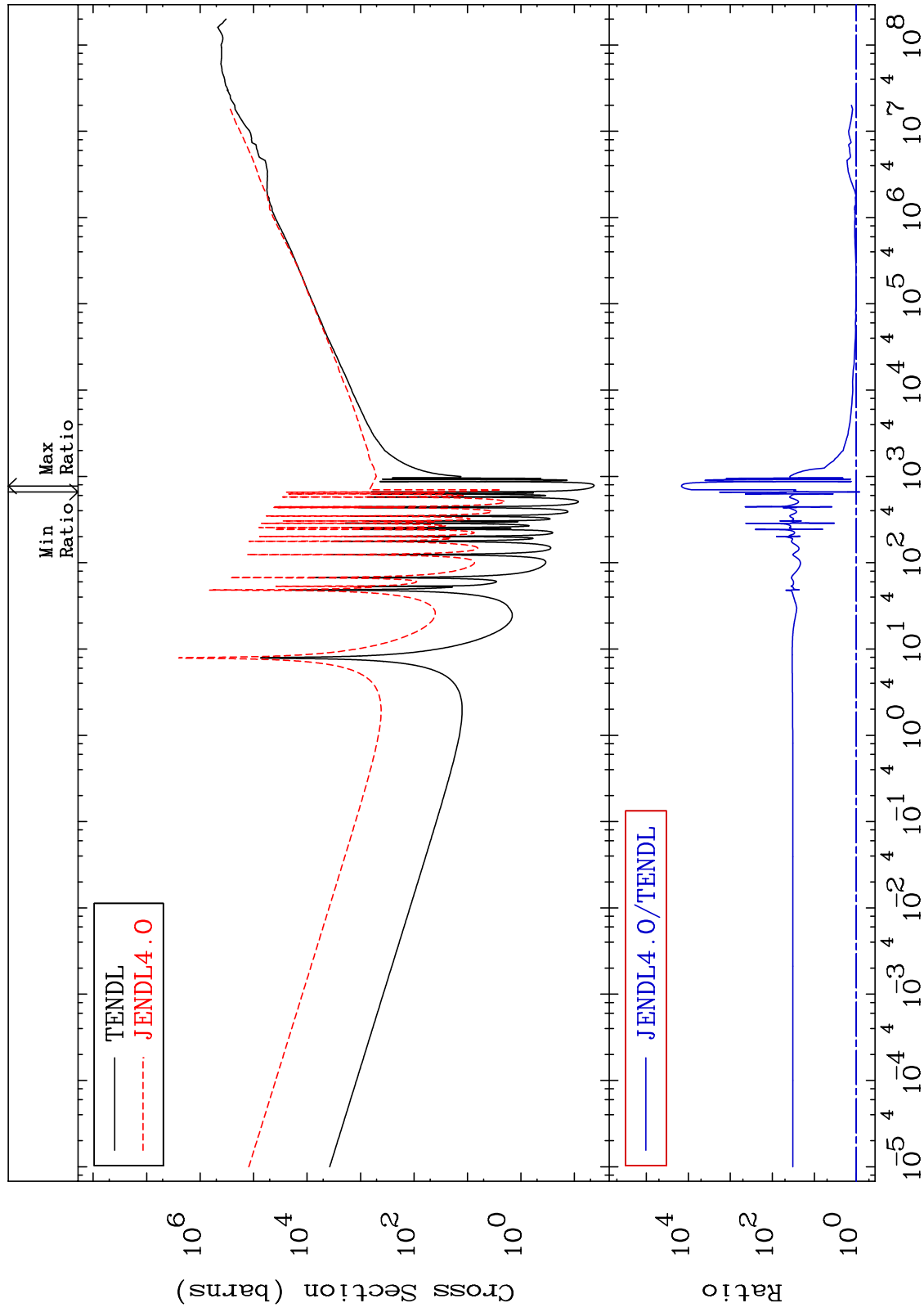
MAT 7231 Total kinematic kerma (high limit) 72-Hf-176  
 Cross Section -88.90 To 9999. %



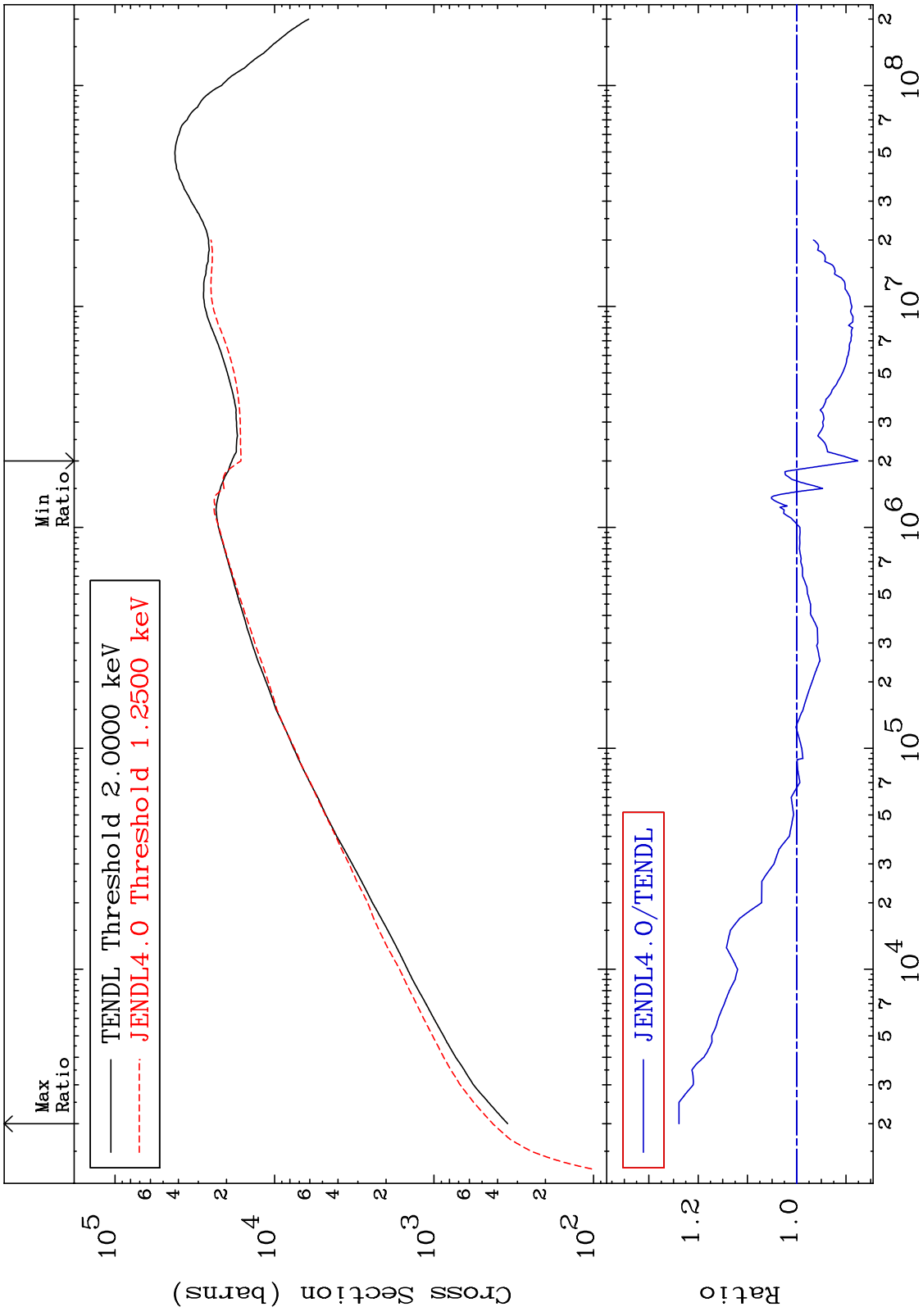
MAT 7231

Dpa total (eV-barns)  
Cross Section

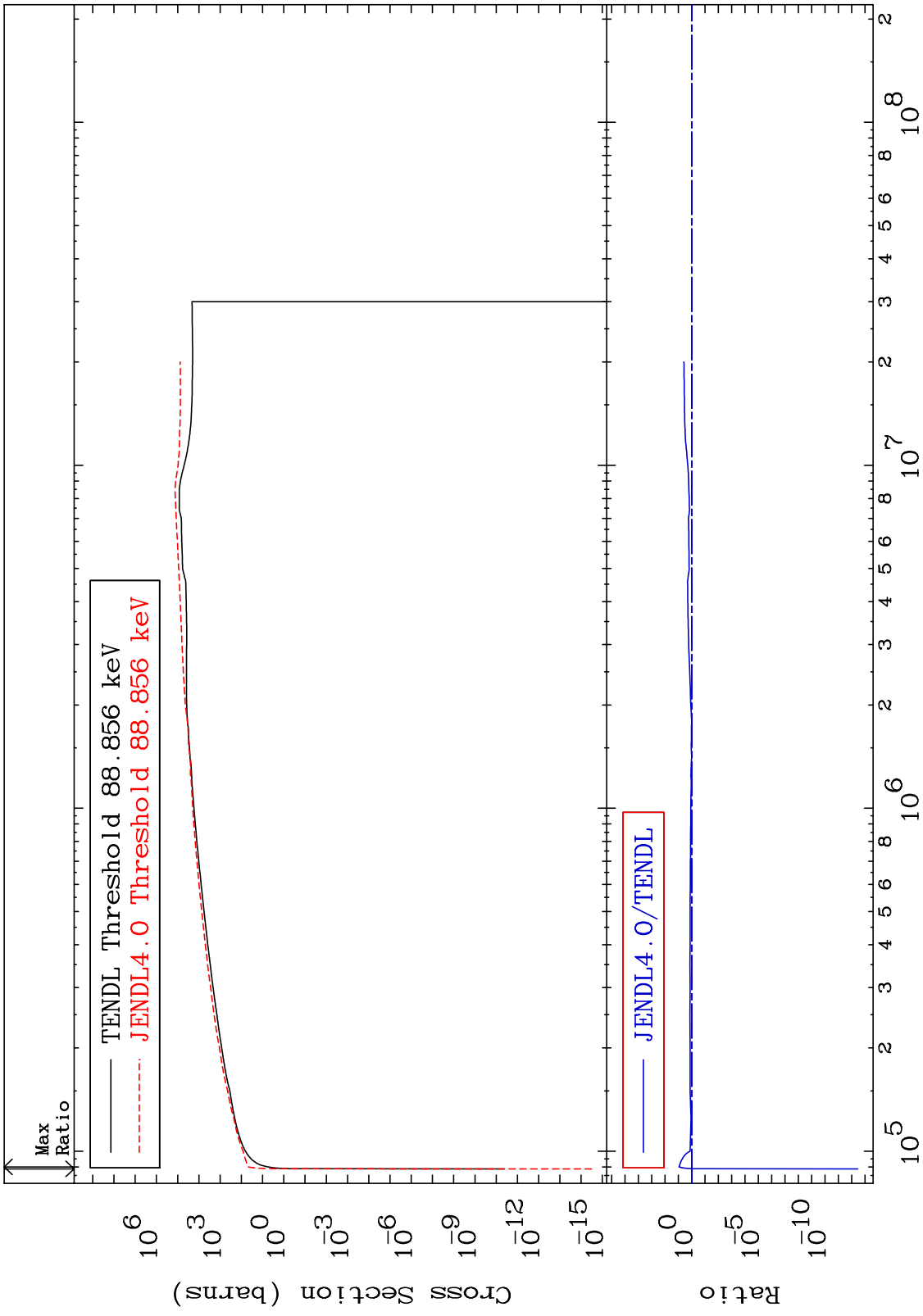
72-Hf-176  
-17.42 To 9999. %



MAT 7231      Dpa elastic (mt2)      72-Hf-176  
Cross Section      -12.40 To 23.88 %



MAT 7231      Dpa inelastic (mt51-91)      72-Hf-176  
Cross Section      -100.0 To 775.7 %



61      Incident Energy (eV)      72-Hf-176

MAT 7231

Dpa disappearance (mt102 -120)  
Cross Section

72-Hf-176  
-33.52 To 9999. %

