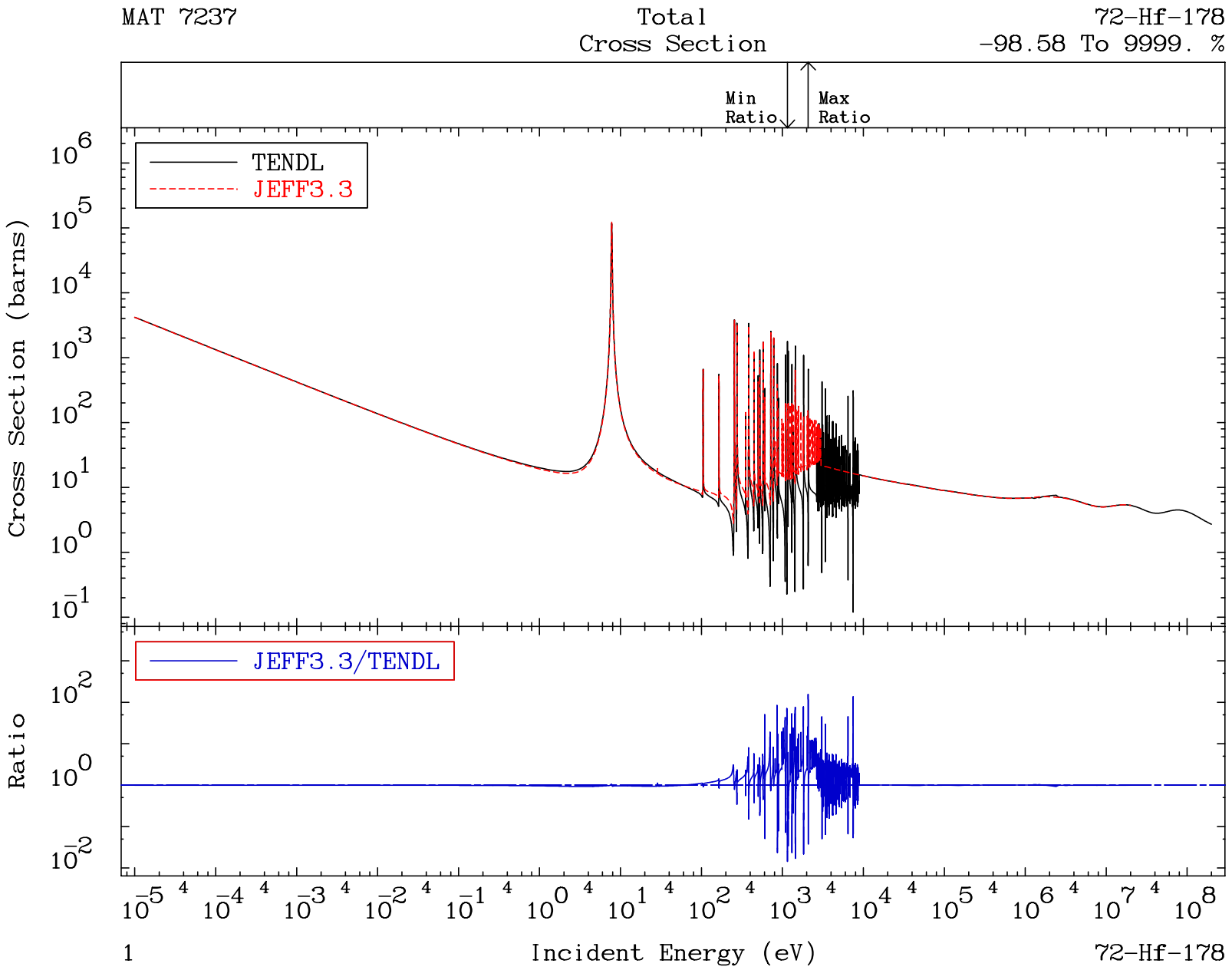
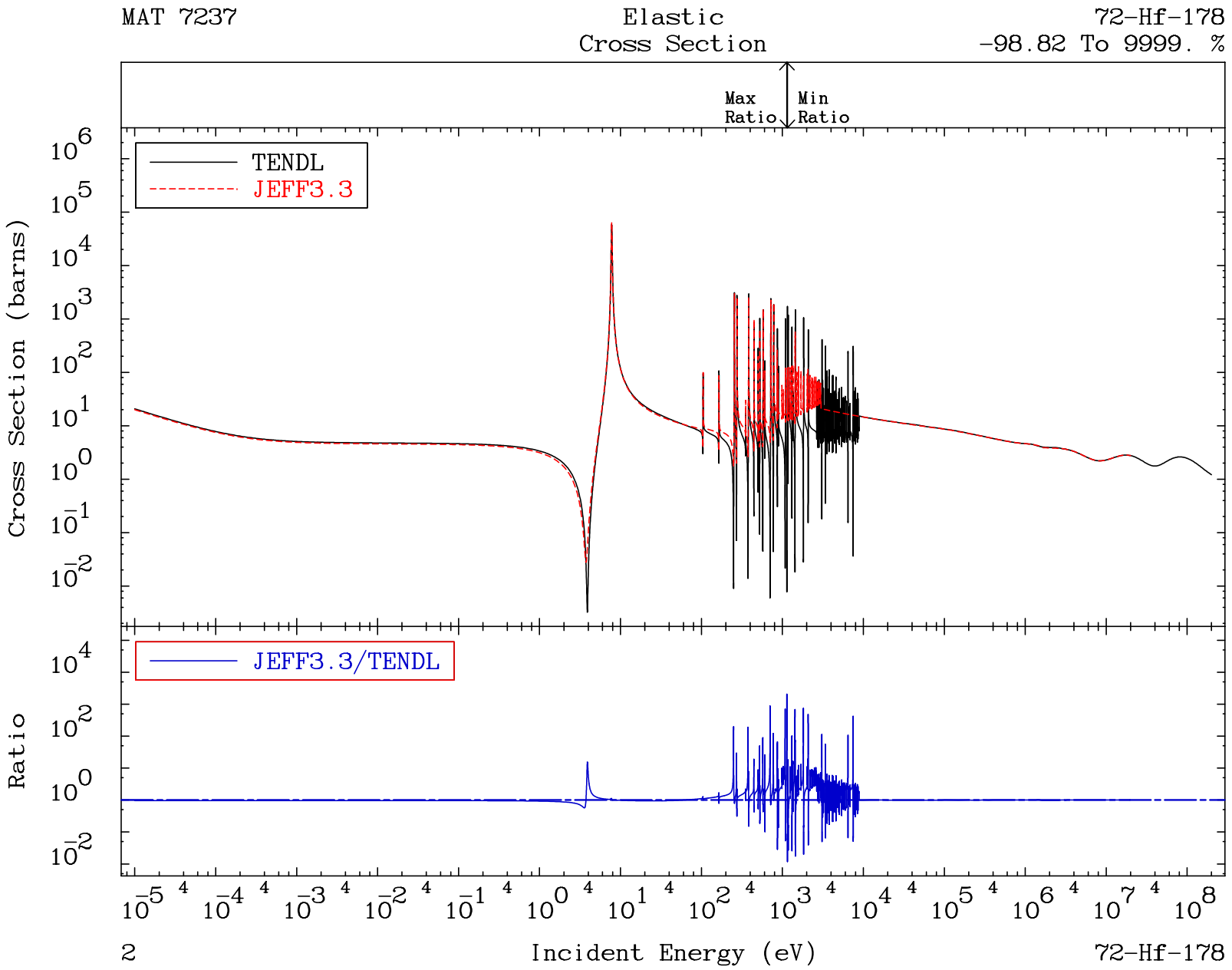
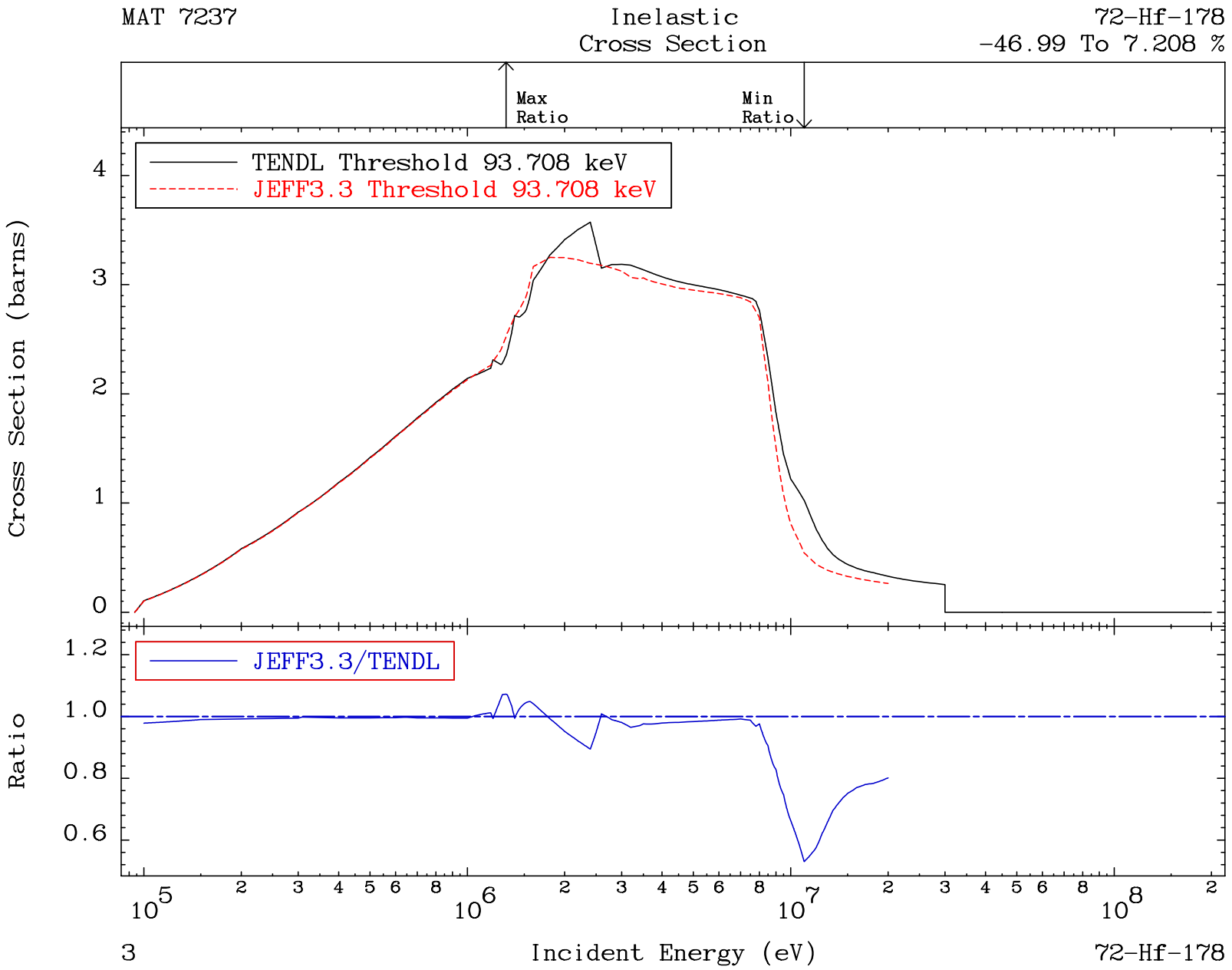
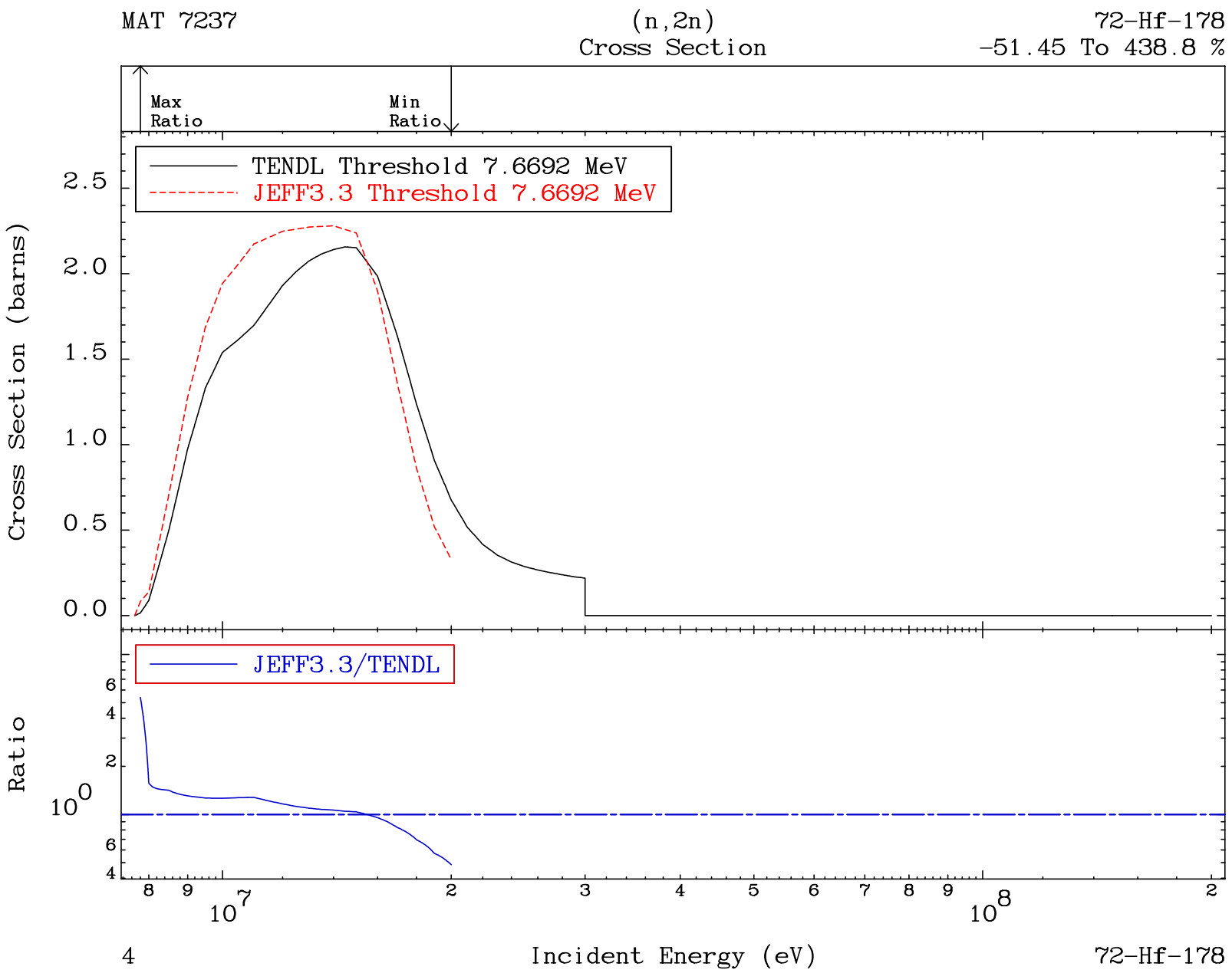
Program Complot
(Version 2018-1)
by
Dermott E. Cullen
(Present Contact Information)
Dermott E. Cullen
1466 Hudson Way
Livermore, CA 94550
U.S.A.
Tele: 925-443-1911
E.Mail:redcullen1@comcast.net
Web:redcullen1.net/HOMEPAGE.NEW

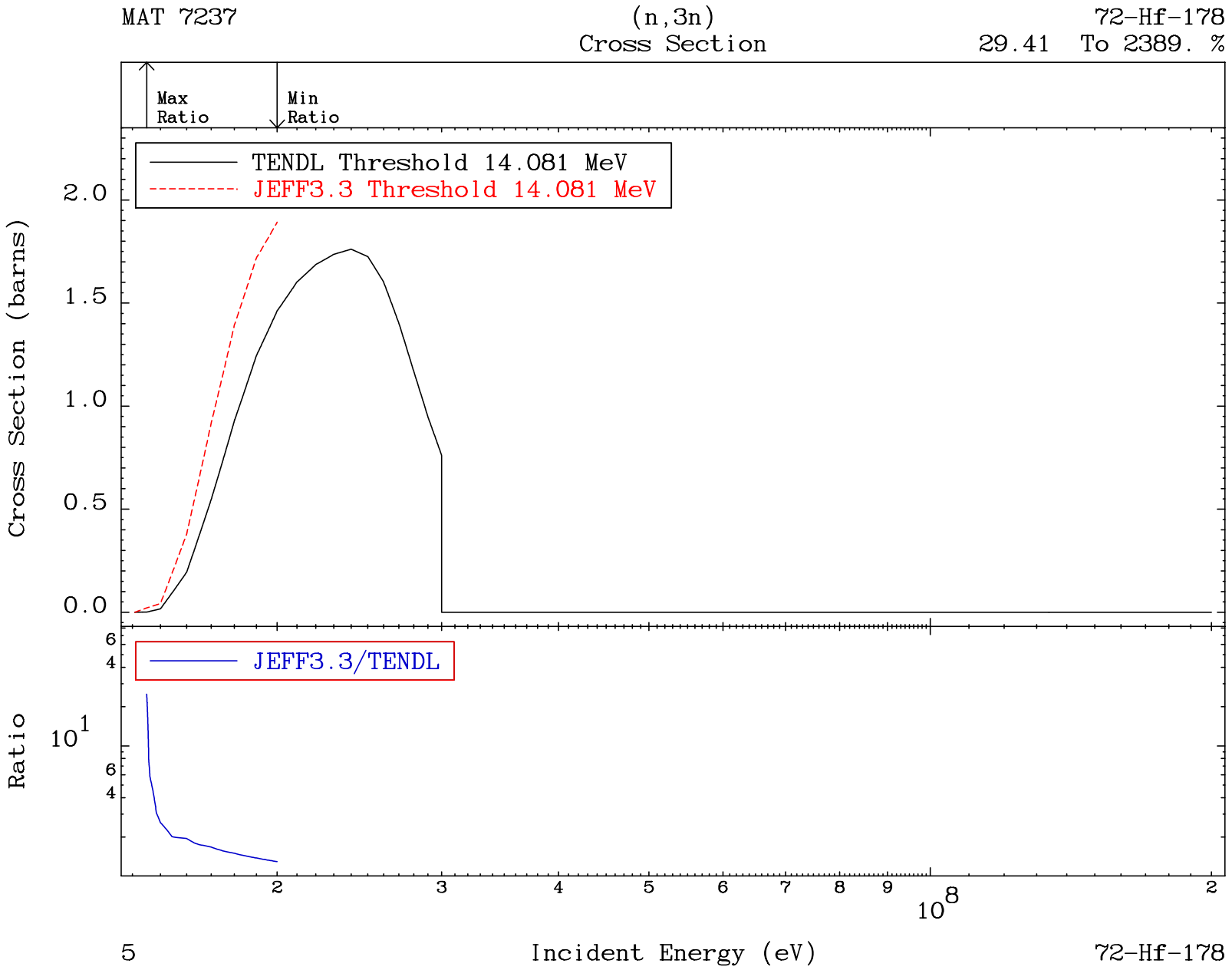
Press Mouse Button to Start

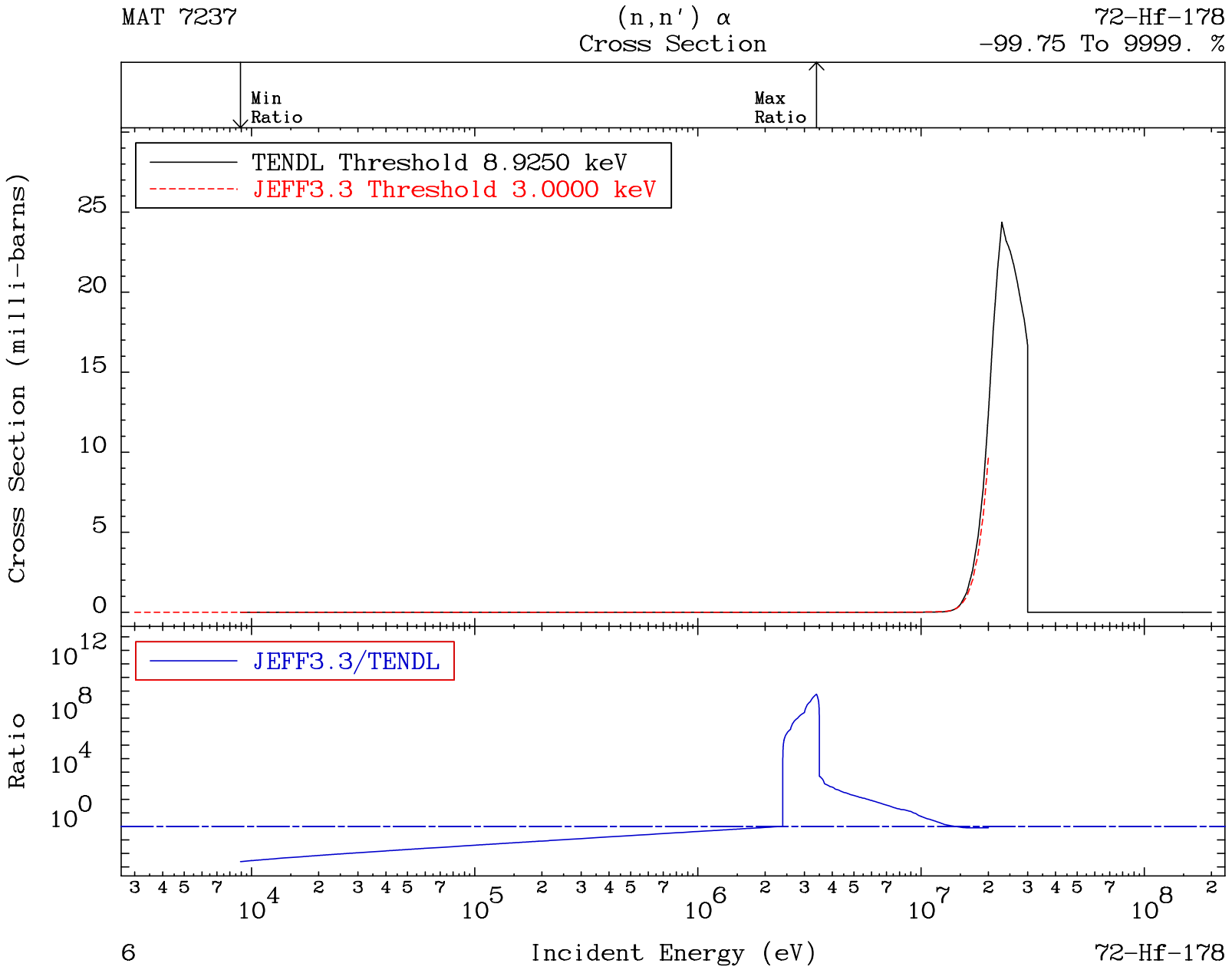

MAT 7237
Total
Cross Section
72-Hf-178
-98.58 To 9999. %
Min
Ratio
Max
Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
1
72-Hf-178

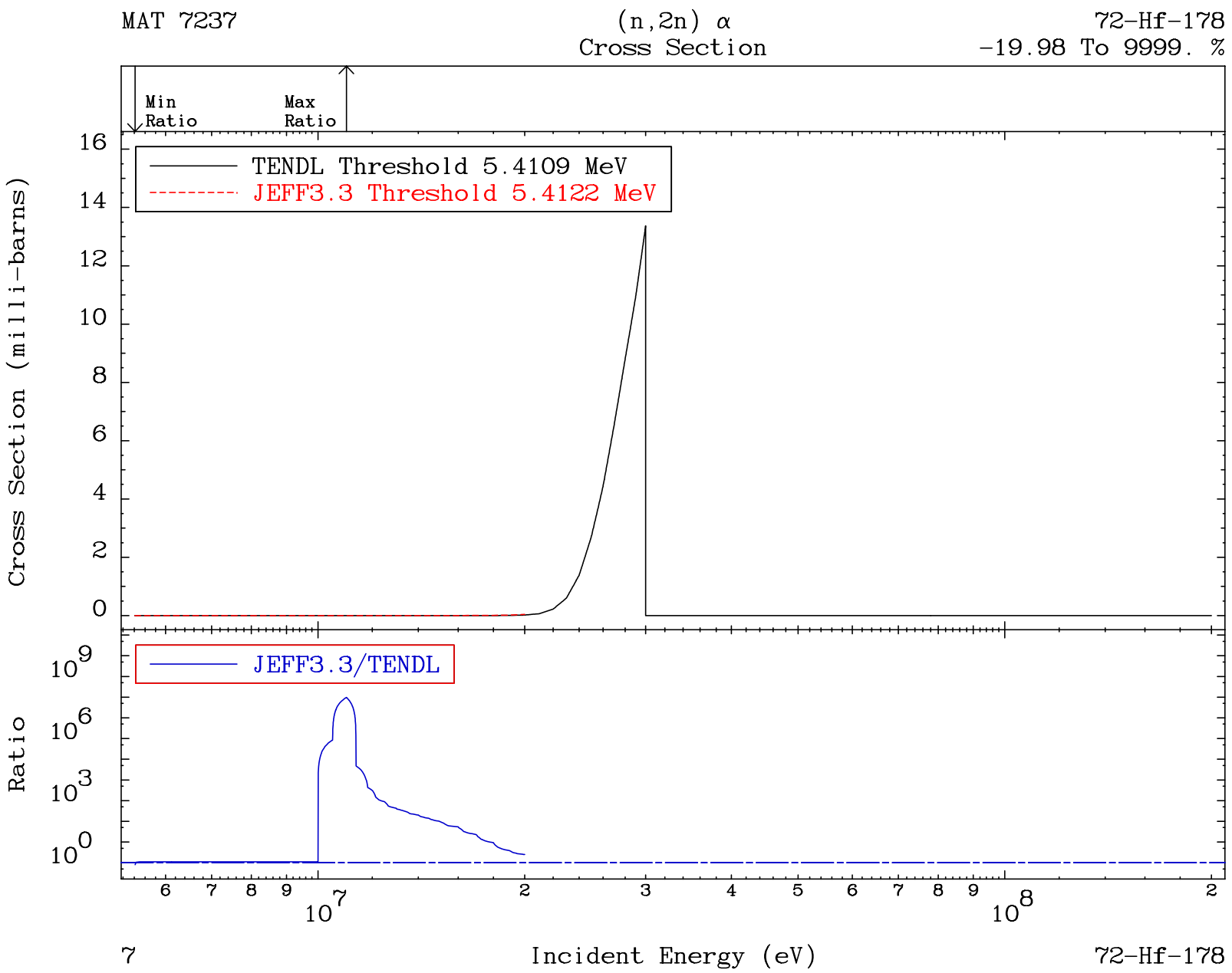

MAT 7237
Elastic
Cross Section
72-Hf-178
-98.82 To 9999. %
Max Ratio
Min Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
2
72-Hf-178

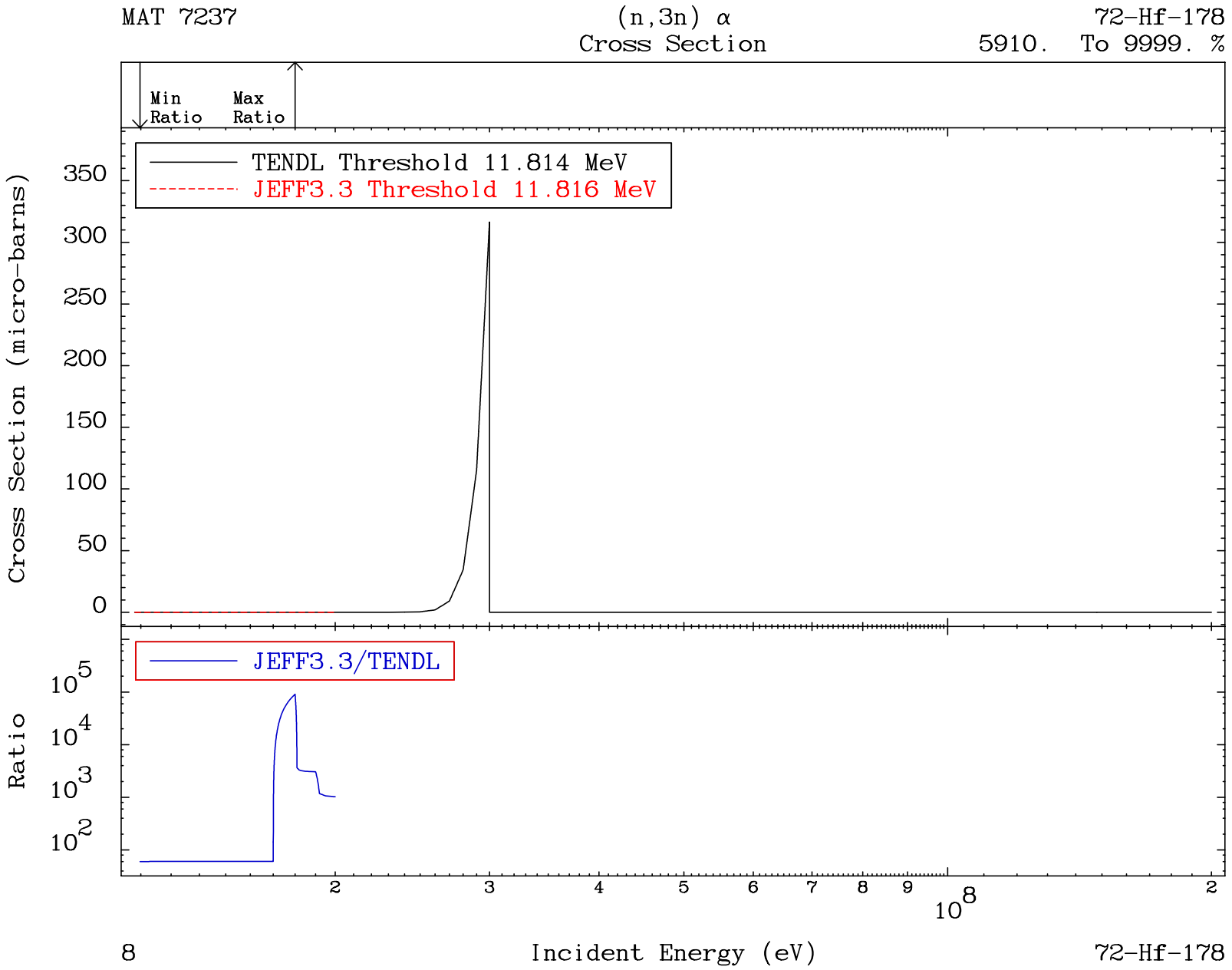

MAT 7237
Inelastic
Cross Section
72-Hf-178
-46.99 To 7.208 %
Max
Ratio
Min
Ratio
TENDL Threshold 93.708 keV
JEFF3.3 Threshold 93.708 keV
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
3
72-Hf-178

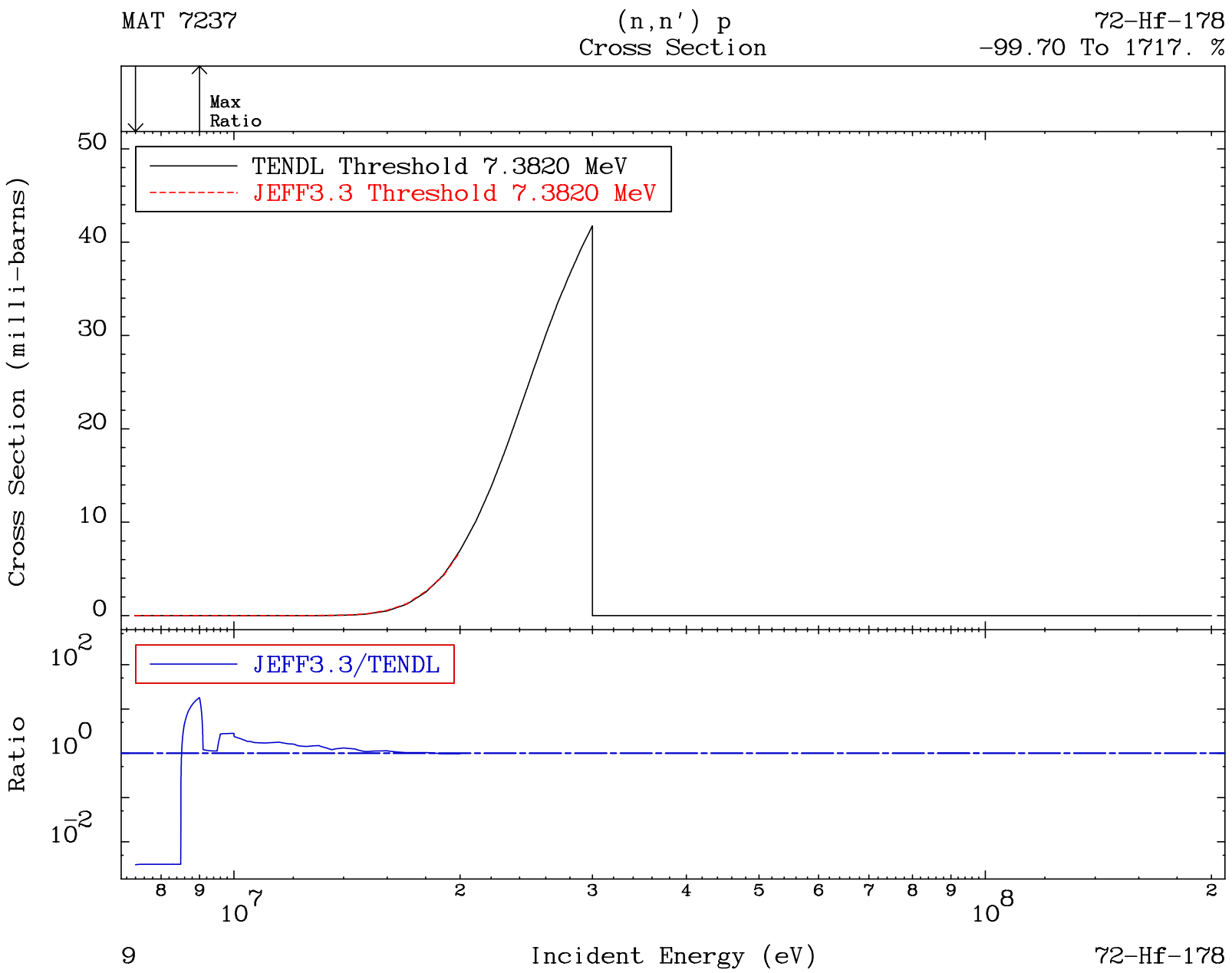

MAT 7237
(n,2n)
Cross Section
72-Hf-178
-51.45 To 438.8 %
Max Ratio
Min Ratio
TENDL Threshold 7.6692 MeV
JEFF3.3 Threshold 7.6692 MeV
Cross Section (barns)
2.5
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
6
4
2
10^0
6
4
8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
4
Incident Energy (eV)
72-Hf-178

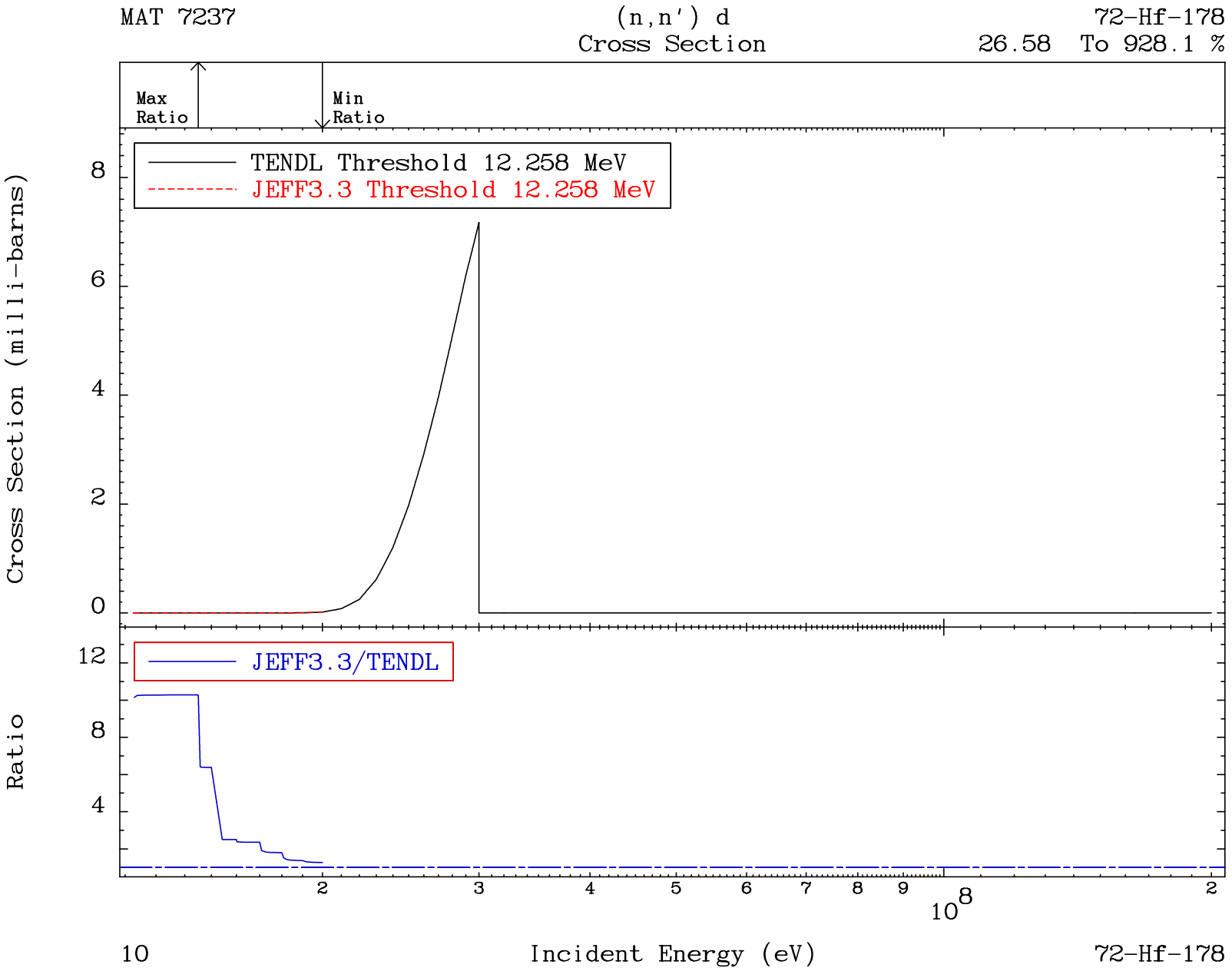

MAT 7237
(n,3n)
Cross Section
72-Hf-178
29.41 To 2389. %
Max Ratio
Min Ratio
TENDL Threshold 14.081 MeV
JEFF3.3 Threshold 14.081 MeV
Cross Section (barns)
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
6
4
10^1
6
4
2
3
4
5
6
7
8
9
10^8
2
5
Incident Energy (eV)
72-Hf-178

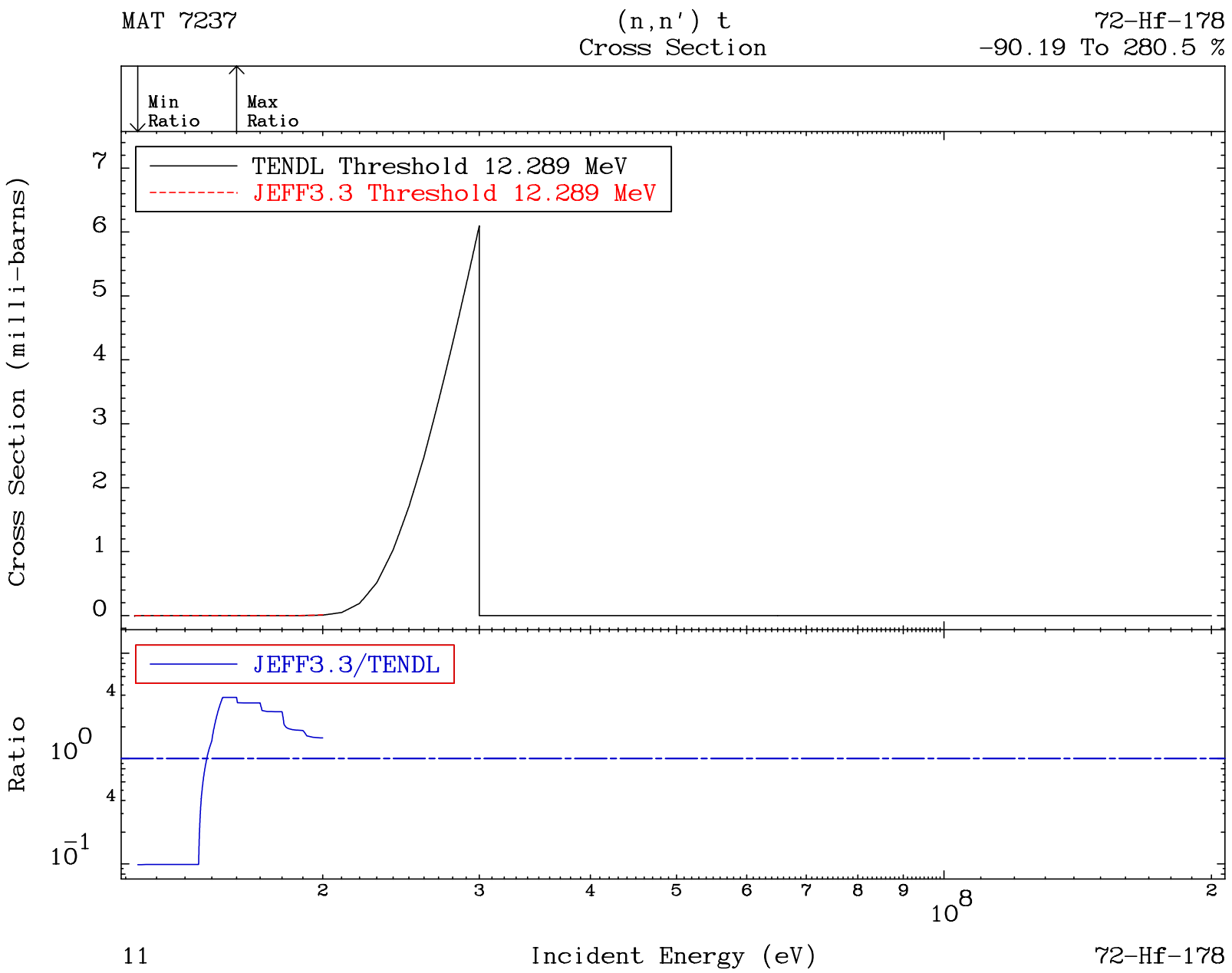

MAT 7237
(n,n') α
Cross Section
72-Hf-178
-99.75 To 9999. %
Min Ratio
Max Ratio
TENDL Threshold 8.9250 keV
JEFF3.3 Threshold 3.0000 keV
Cross Section (milli-barns)
25
20
15
10
5
0
JEFF3.3/TENDL
Ratio
10^12
10^8
10^4
10^0
3 4 5 7 10^4 2 3 4 5 7 10^5 2 3 4 5 7 10^6 2 3 4 5 7 10^7 2 3 4 5 7 10^8 2
6
Incident Energy (eV)
72-Hf-178

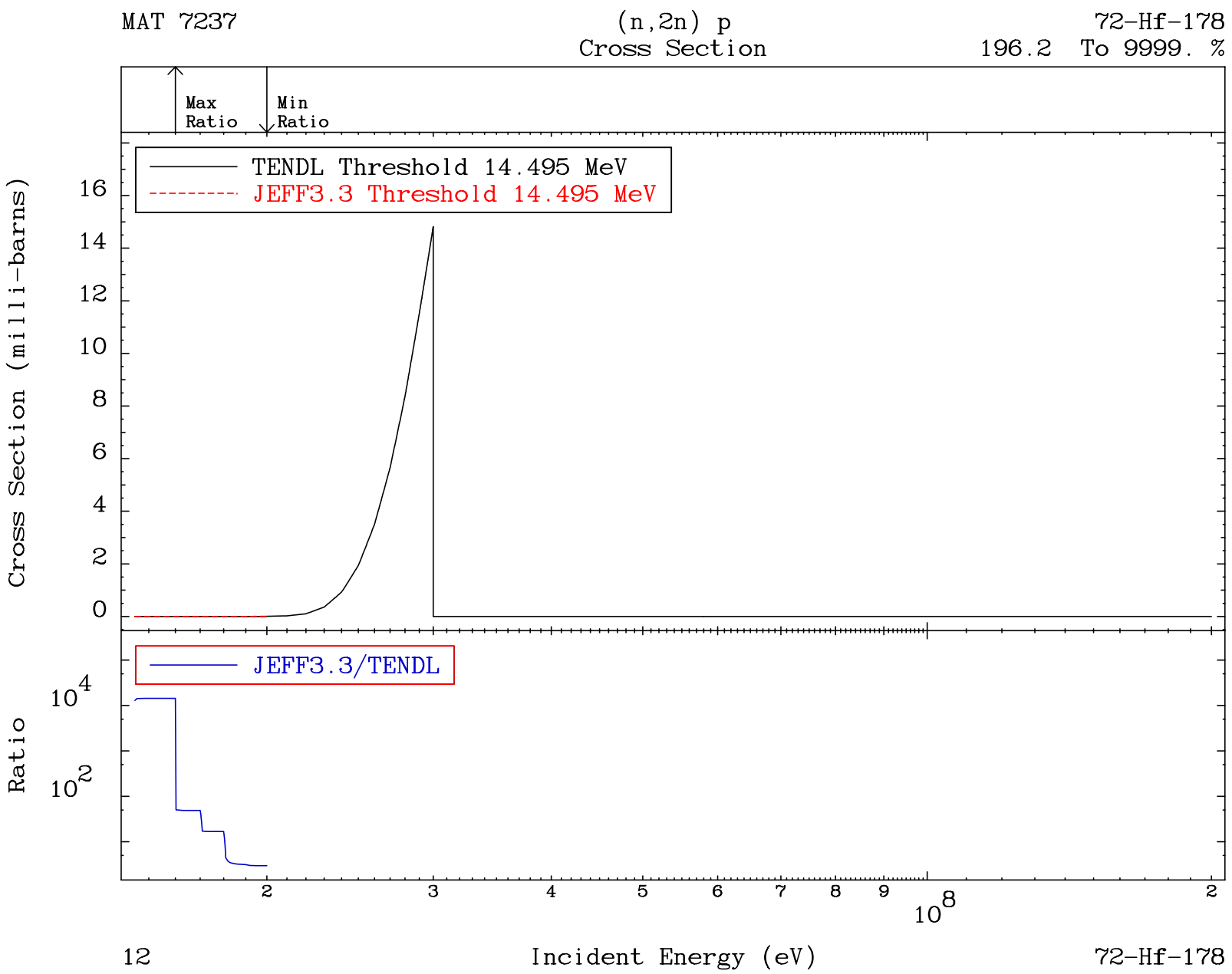

MAT 7237
(n,2n) α
Cross Section
72-Hf-178
-19.98 To 9999. %
Min Ratio
Max Ratio
TENDL Threshold 5.4109 MeV
JEFF3.3 Threshold 5.4122 MeV
Cross Section (milli-barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
7
72-Hf-178

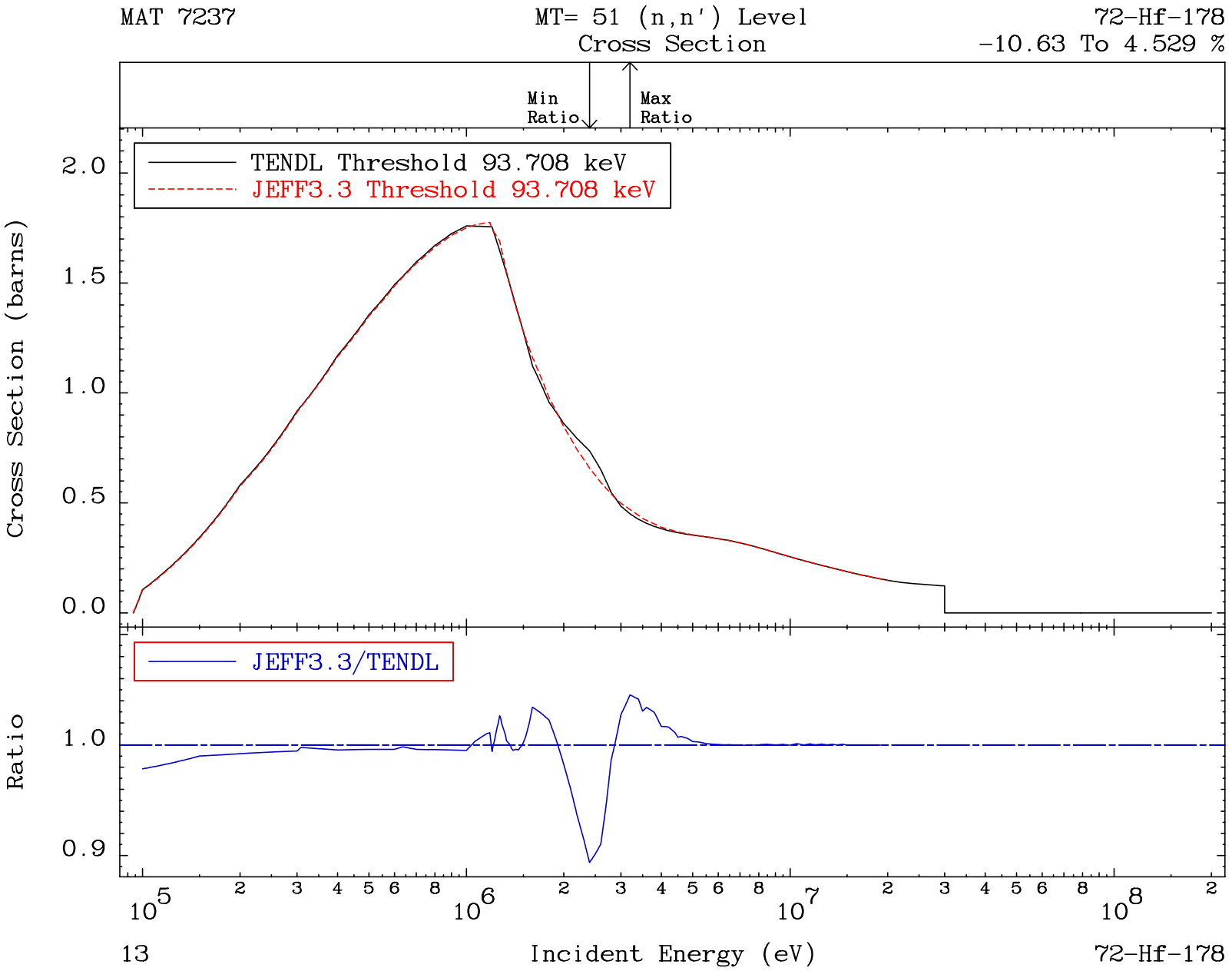

MAT 7237
(n,3n) α
Cross Section
72-Hf-178
5910. To 9999. %
Min Ratio
Max Ratio
TENDL Threshold 11.814 MeV
JEFF3.3 Threshold 11.816 MeV
Cross Section (micro-barns)
350
300
250
200
150
100
50
0
JEFF3.3/TENDL
Ratio
10^5
10^4
10^3
10^2
2
3
4
5
6
7
8
9
10^8
2
8
Incident Energy (eV)
72-Hf-178

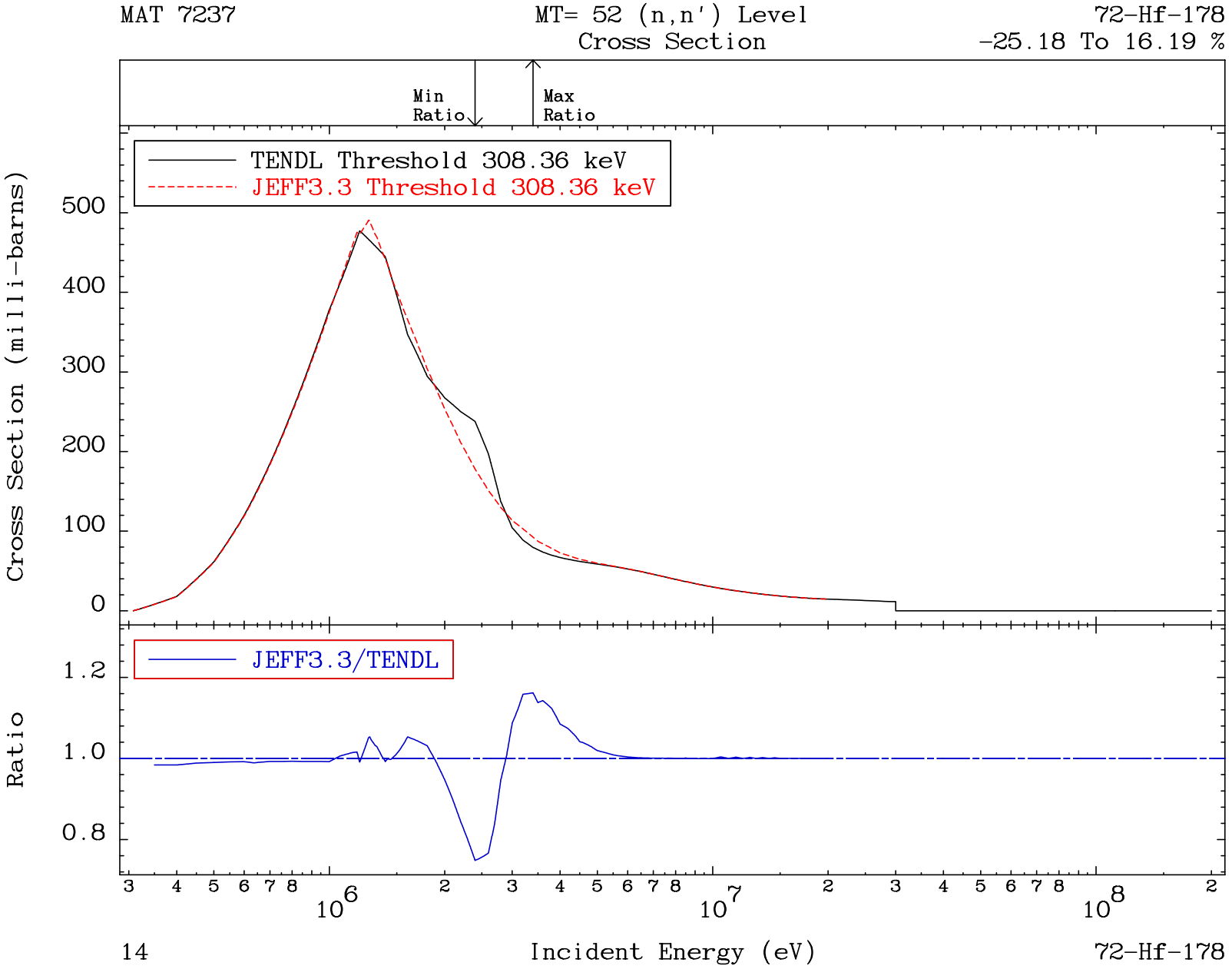

MAT 7237
(n,n') p
Cross Section
72-Hf-178
-99.70 To 1717. %
Max
Ratio
TENDL Threshold 7.3820 MeV
JEFF3.3 Threshold 7.3820 MeV
Cross Section (milli-barns)
50
40
30
20
10
0
JEFF3.3/TENDL
Ratio
10^2
10^0
10^-2
8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
9
Incident Energy (eV)
72-Hf-178

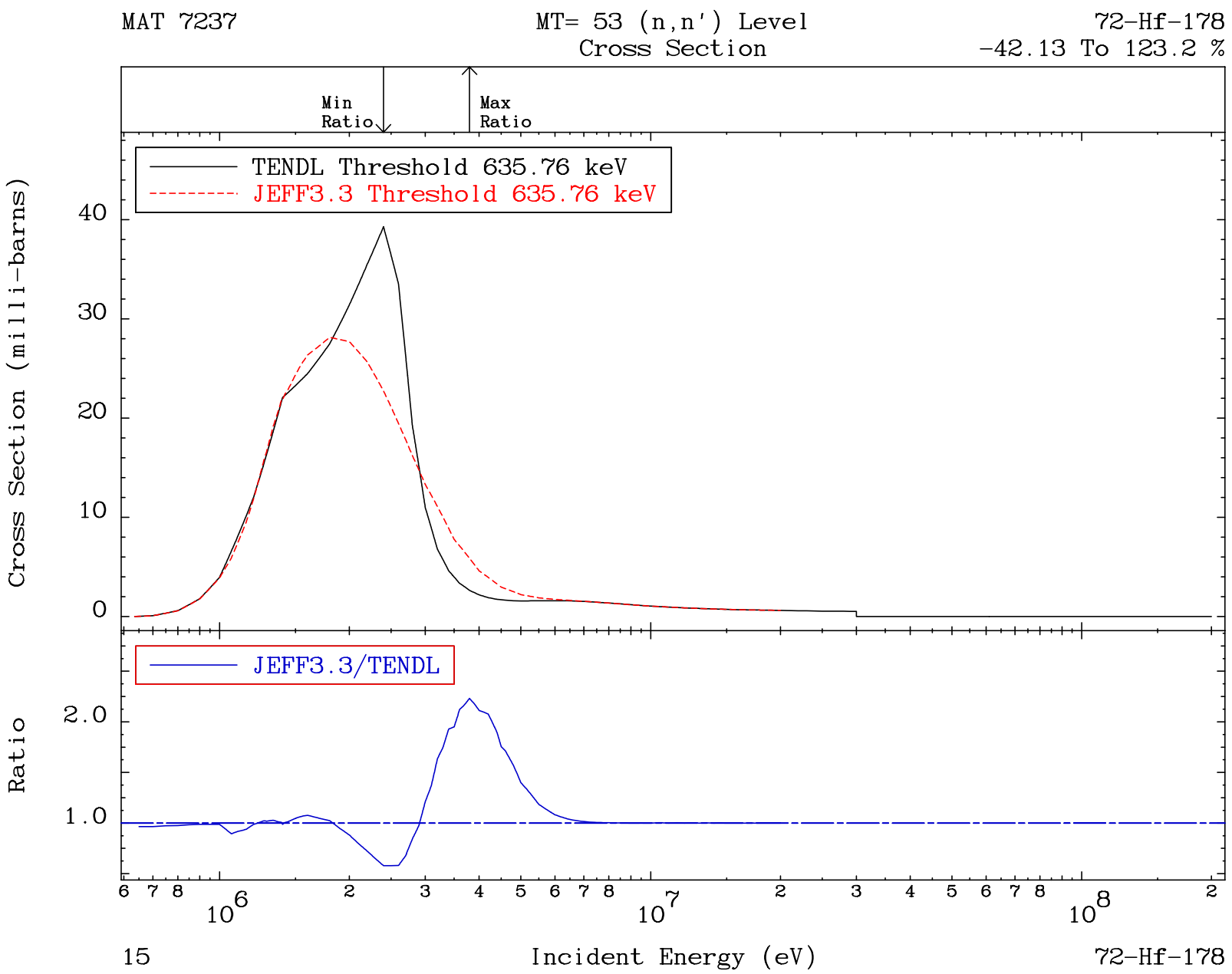

MAT 7237
(n,n') d
Cross Section
72-Hf-178
26.58 To 928.1 %
Max Ratio
Min Ratio
TENDL Threshold 12.258 MeV
JEFF3.3 Threshold 12.258 MeV
Cross Section (milli-barns)
0
2
4
6
8
JEFF3.3/TENDL
Ratio
4
8
12
2
3
4
5
6
7
8
9
10^8
2
10
Incident Energy (eV)
72-Hf-178

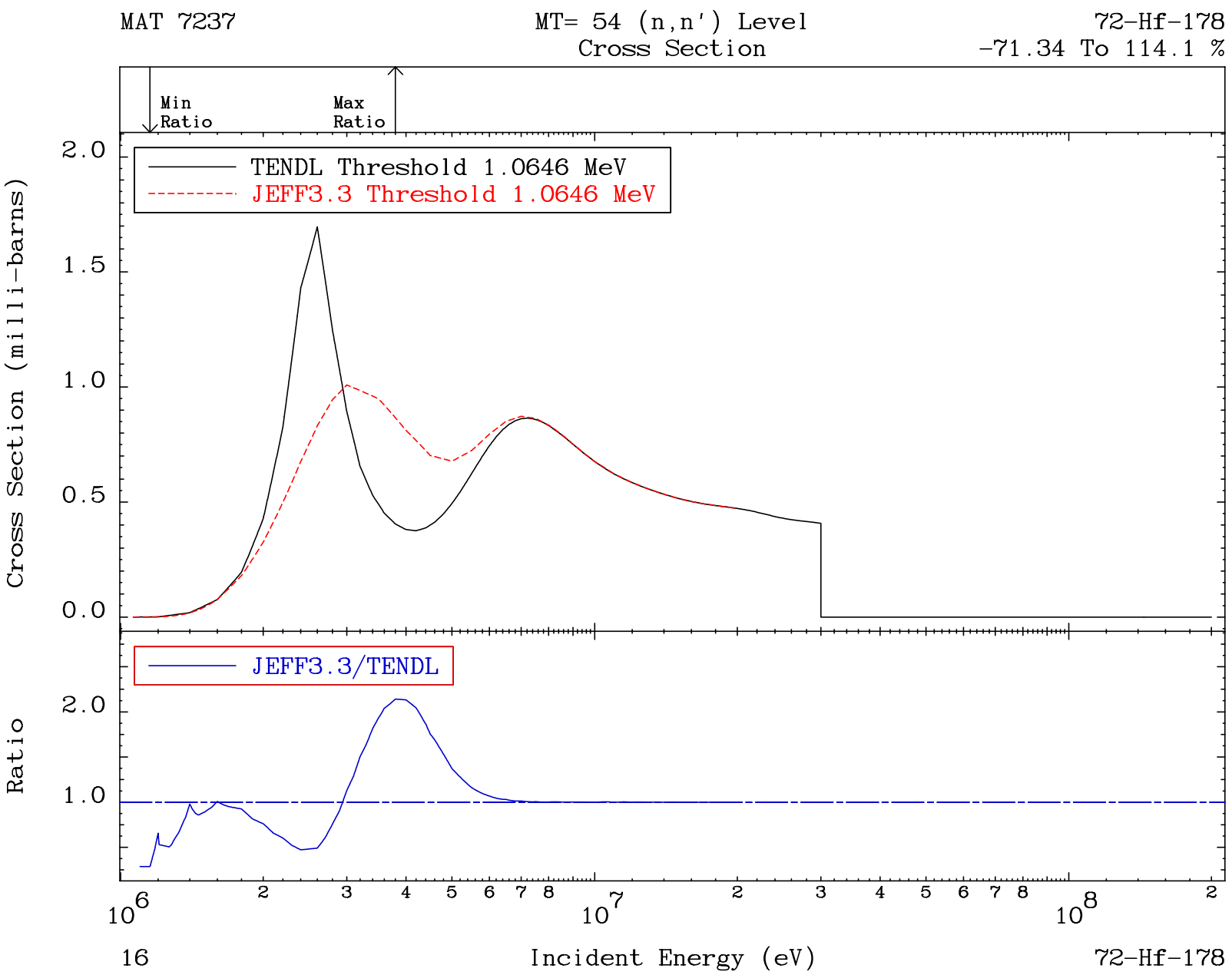

MAT 7237
(n,n') t
Cross Section
72-Hf-178
-90.19 To 280.5 %
Min Ratio
Max Ratio
TENDL Threshold 12.289 MeV
JEFF3.3 Threshold 12.289 MeV
Cross Section (milli-barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
11
72-Hf-178

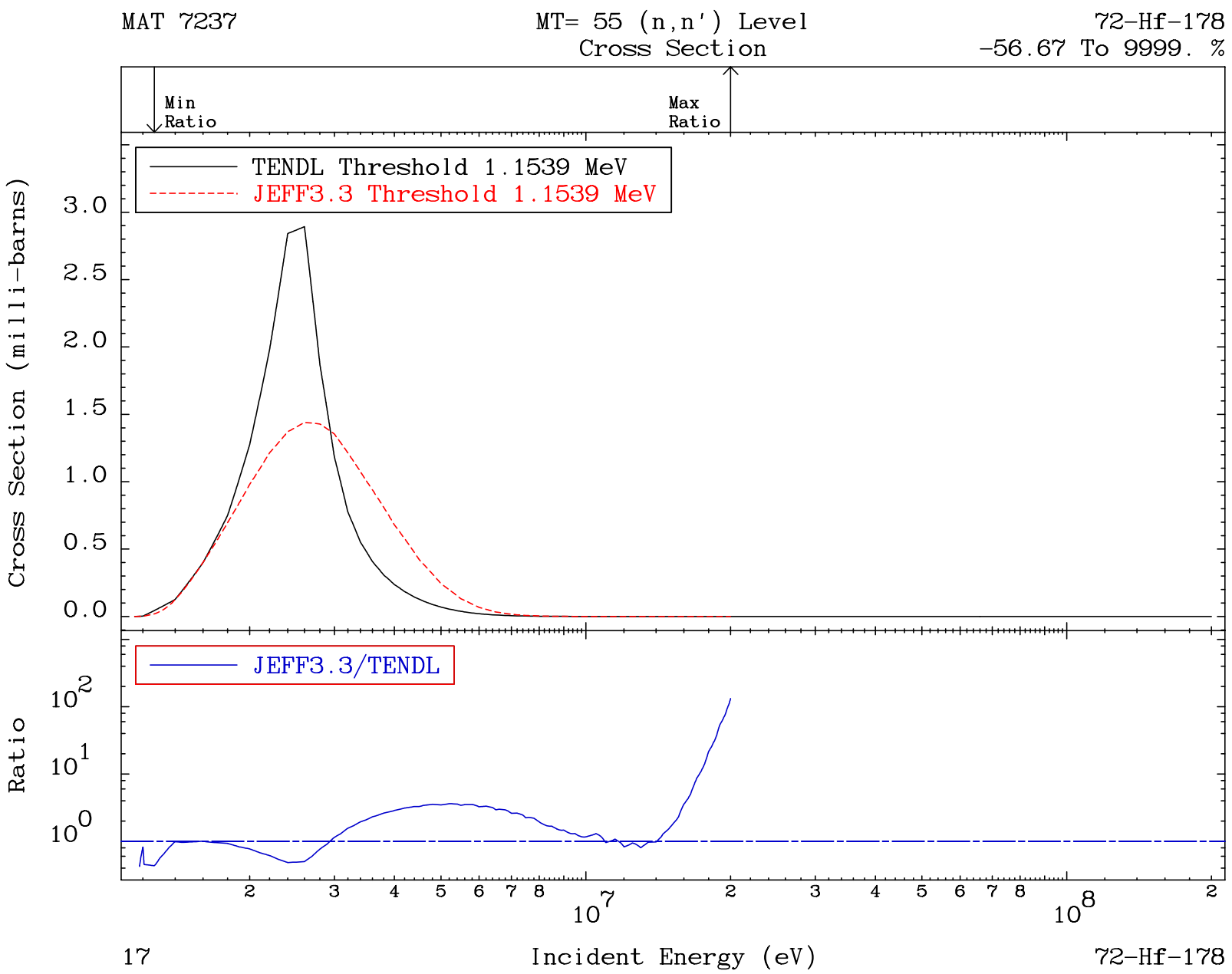

MAT 7237
(n,2n) p
Cross Section
72-Hf-178
196.2 To 9999. %
Max Ratio
Min Ratio
TENDL Threshold 14.495 MeV
JEFF3.3 Threshold 14.495 MeV
Cross Section (milli-barns)
16
14
12
10
8
6
4
2
0
JEFF3.3/TENDL
Ratio
10^4
10^2
2
3
4
5
6
7
8
9
10^8
2
12
Incident Energy (eV)
72-Hf-178

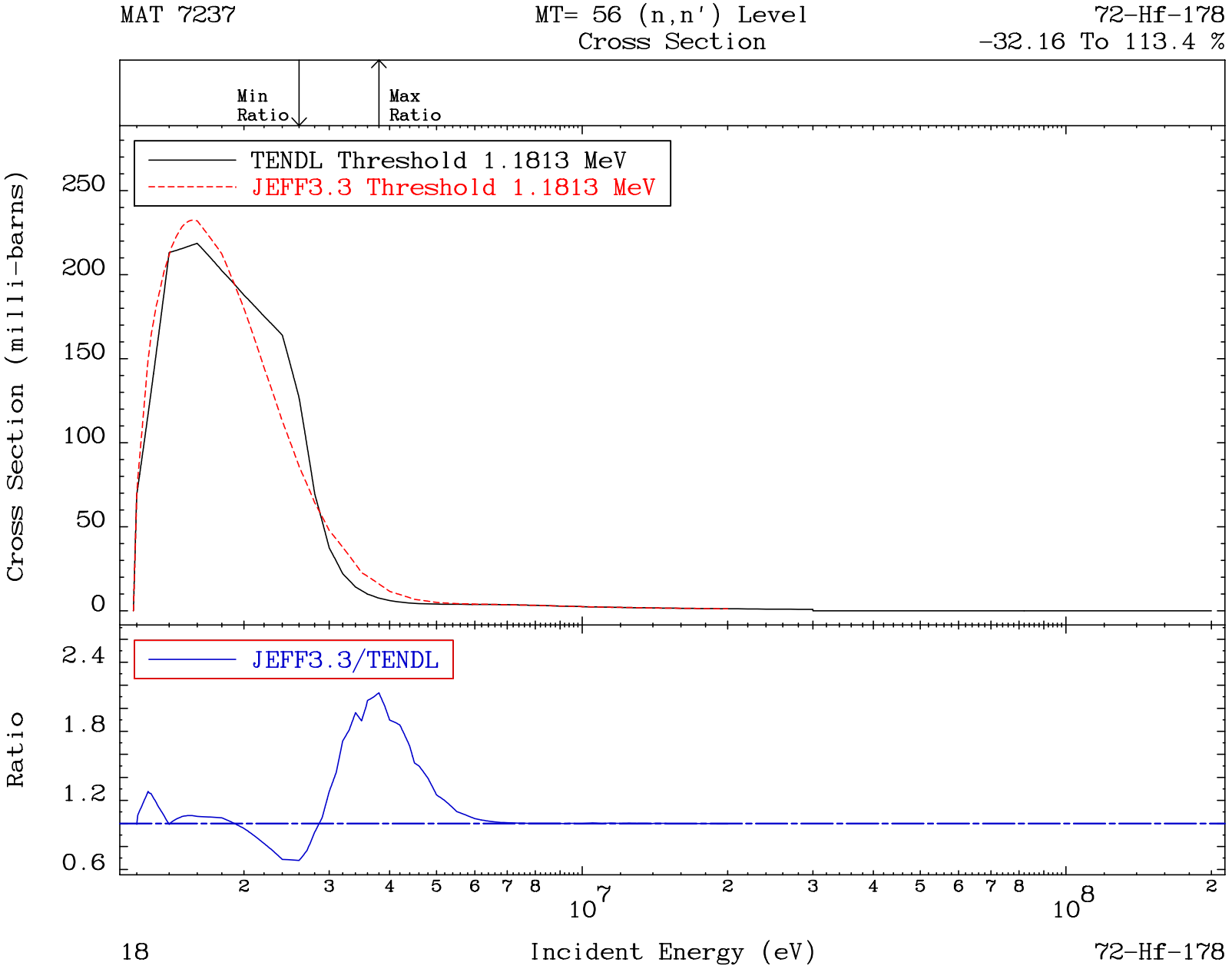

MAT 7237
MT= 51 (n,n') Level
Cross Section
72-Hf-178
-10.63 To 4.529 %
Min Ratio
Max Ratio
TENDL Threshold 93.708 keV
JEFF3.3 Threshold 93.708 keV
Cross Section (barns)
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
1.0
0.9
10^5
10^6
10^7
10^8
13
Incident Energy (eV)
72-Hf-178

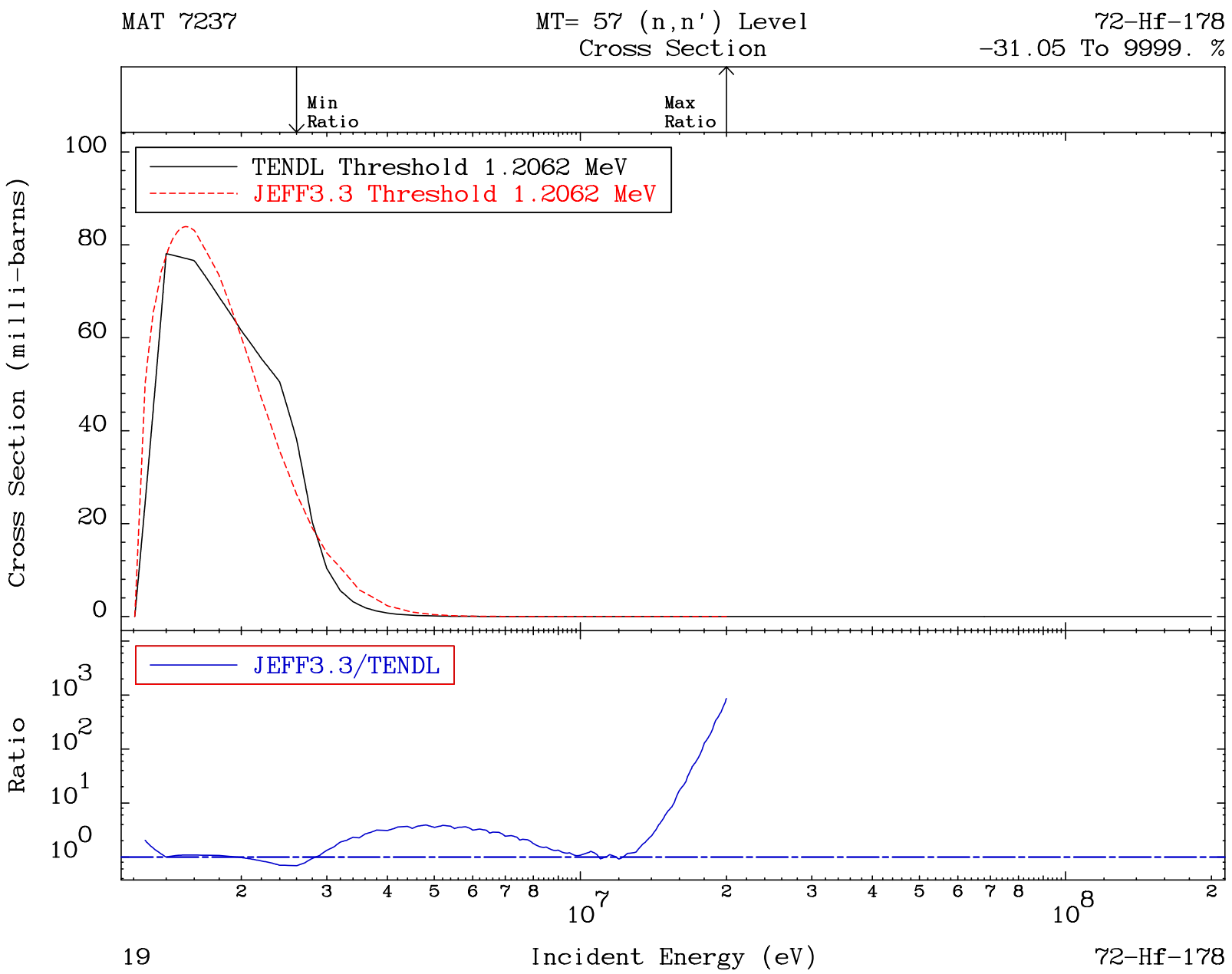

MAT 7237
MT= 52 (n,n') Level
Cross Section
72-Hf-178
-25.18 To 16.19 %
Min Ratio
Max Ratio
TENDL Threshold 308.36 keV
JEFF3.3 Threshold 308.36 keV
Cross Section (milli-barns)
500
400
300
200
100
0
JEFF3.3/TENDL
Ratio
1.2
1.0
0.8
3 4 5 6 7 8 10^6 2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
14
Incident Energy (eV)
72-Hf-178

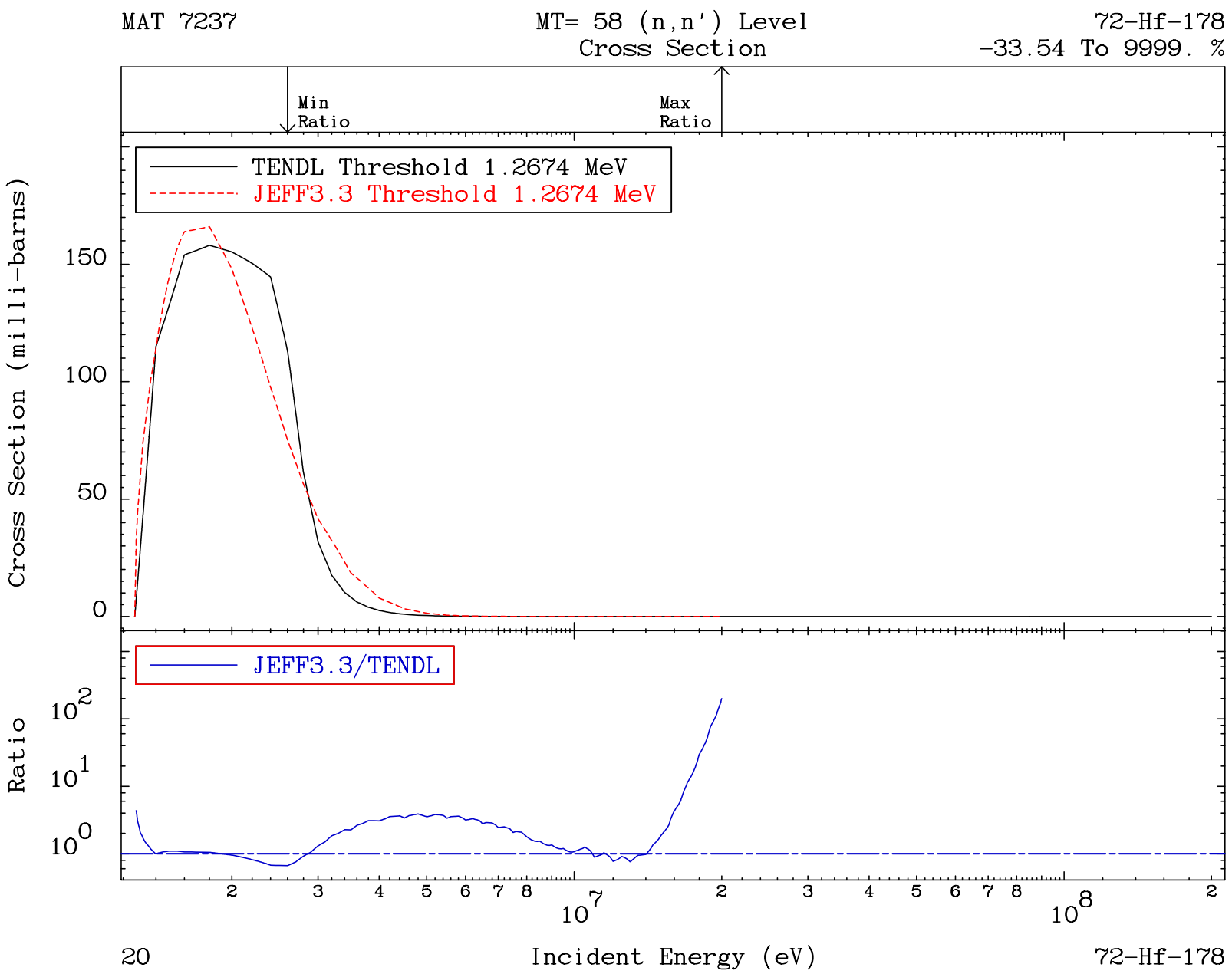

MAT 7237
MT= 53 (n,n') Level
Cross Section
72-Hf-178
-42.13 To 123.2 %
Min Ratio
Max Ratio
TENDL Threshold 635.76 keV
JEFF3.3 Threshold 635.76 keV
Cross Section (milli-barns)
40
30
20
10
0
JEFF3.3/TENDL
Ratio
2.0
1.0
6 7 8 10^6 2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
15
Incident Energy (eV)
72-Hf-178

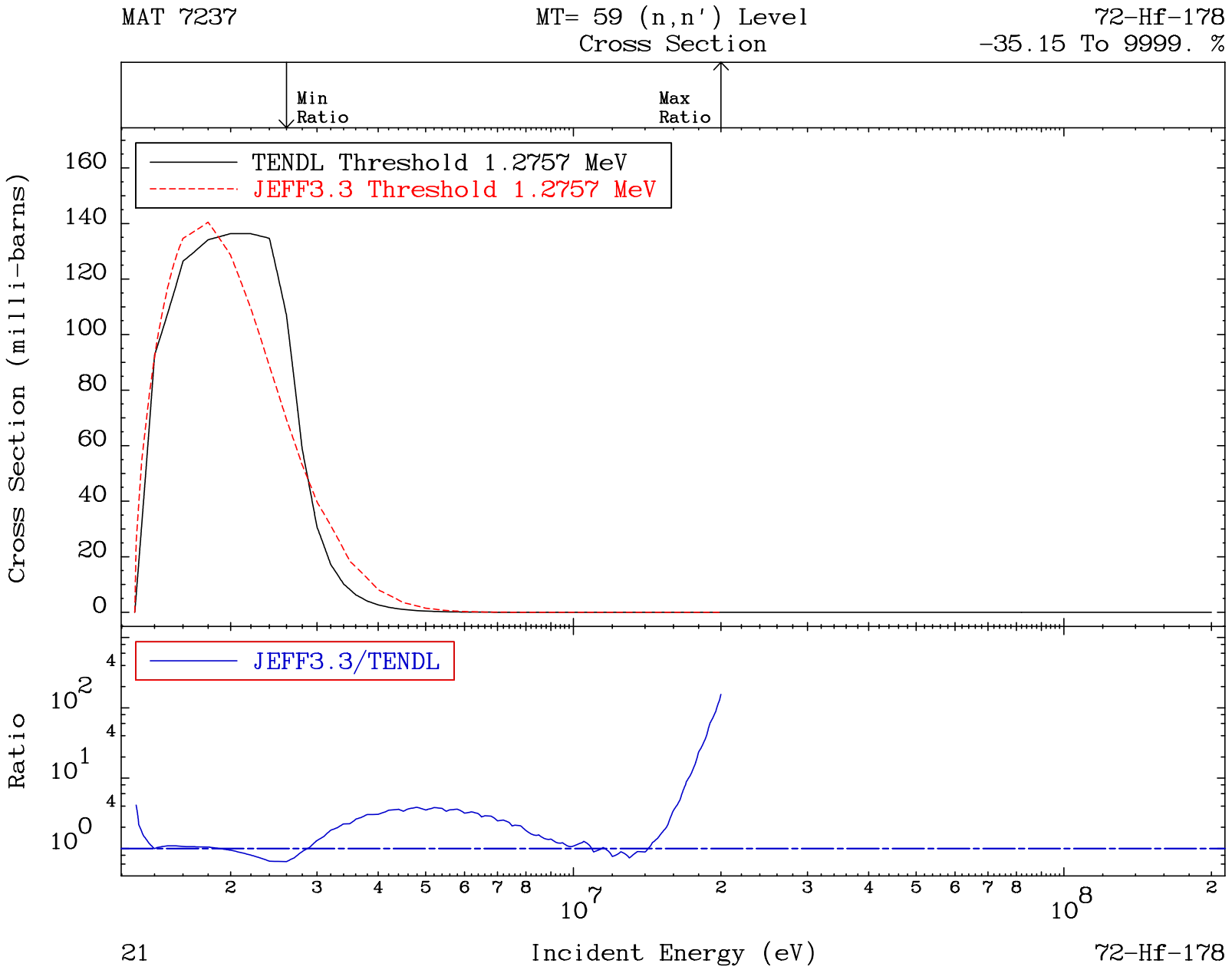

MAT 7237
MT= 54 (n,n') Level
Cross Section
72-Hf-178
-71.34 To 114.1 %
Min Ratio
Max Ratio
TENDL Threshold 1.0646 MeV
JEFF3.3 Threshold 1.0646 MeV
Cross Section (milli-barns)
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
2.0
1.0
10^6
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
16
Incident Energy (eV)
72-Hf-178

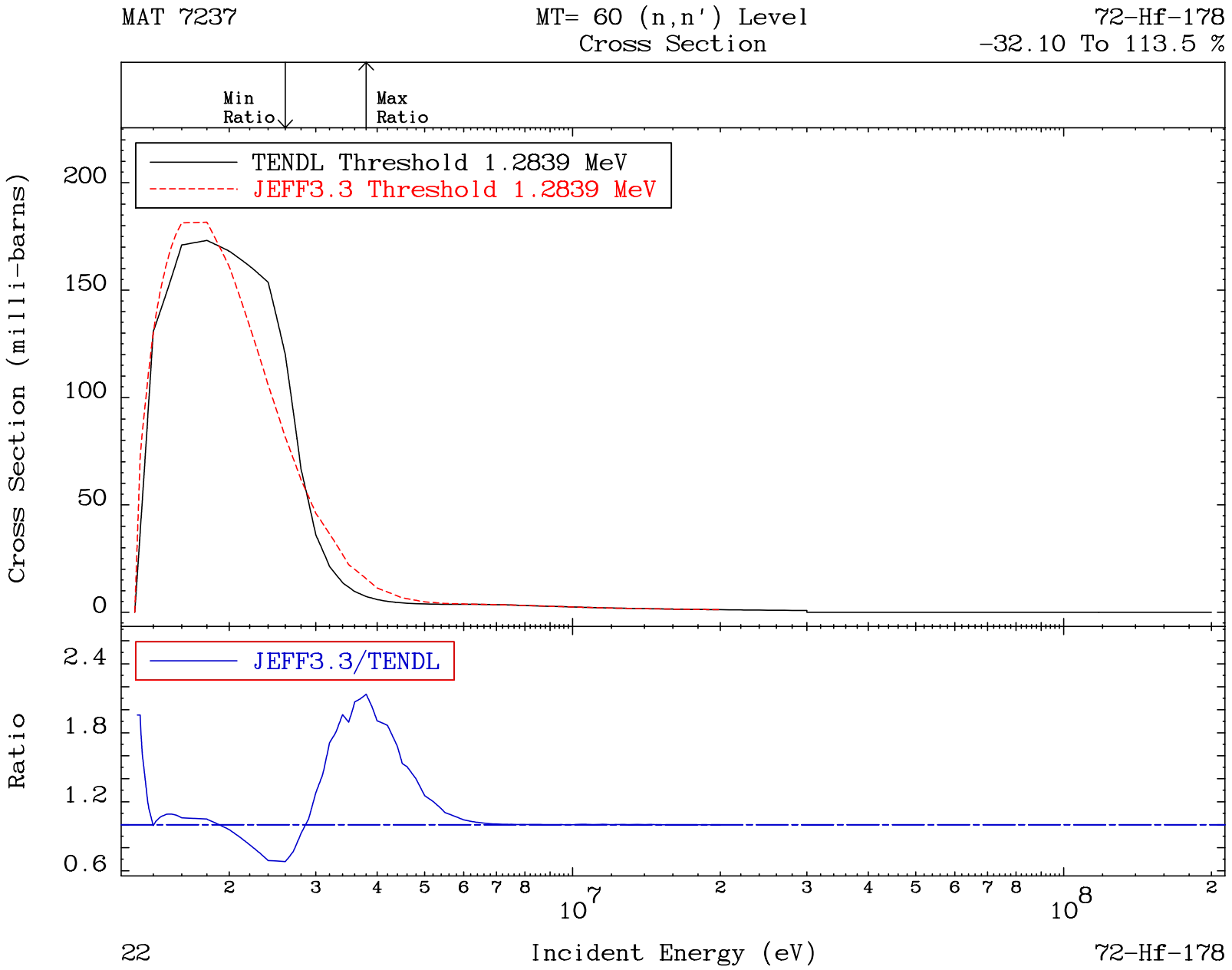

MAT 7237
MT= 55 (n,n') Level
Cross Section
72-Hf-178
-56.67 To 9999. %
Min
Ratio
Max
Ratio
TENDL Threshold 1.1539 MeV
JEFF3.3 Threshold 1.1539 MeV
Cross Section (milli-barns)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
10^2
10^1
10^0
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
17
Incident Energy (eV)
72-Hf-178

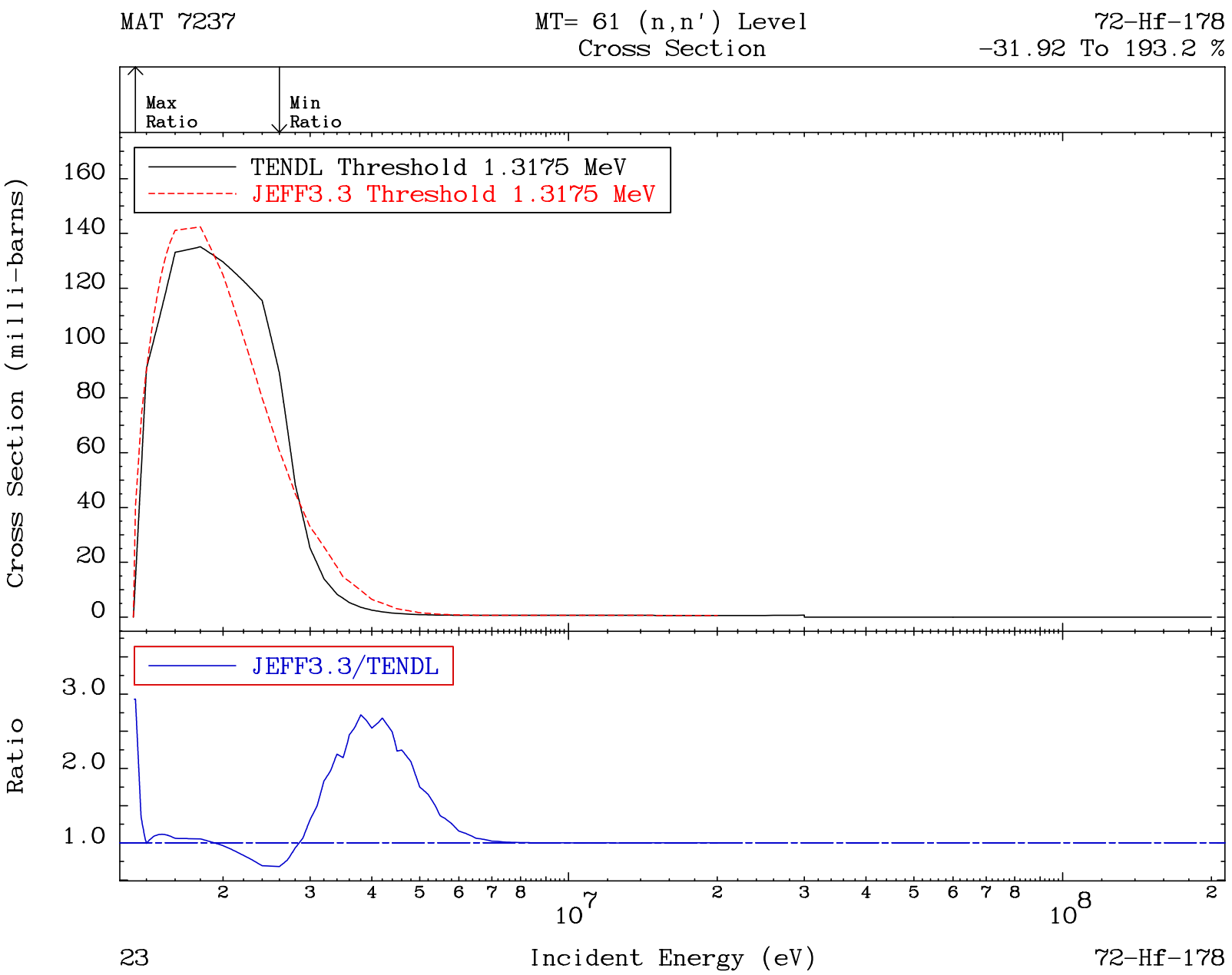

MAT 7237
MT= 56 (n,n') Level
Cross Section
72-Hf-178
-32.16 To 113.4 %
Min Ratio
Max Ratio
TENDL Threshold 1.1813 MeV
JEFF3.3 Threshold 1.1813 MeV
Cross Section (milli-barns)
250
200
150
100
50
0
JEFF3.3/TENDL
Ratio
2.4
1.8
1.2
0.6
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
18
Incident Energy (eV)
72-Hf-178

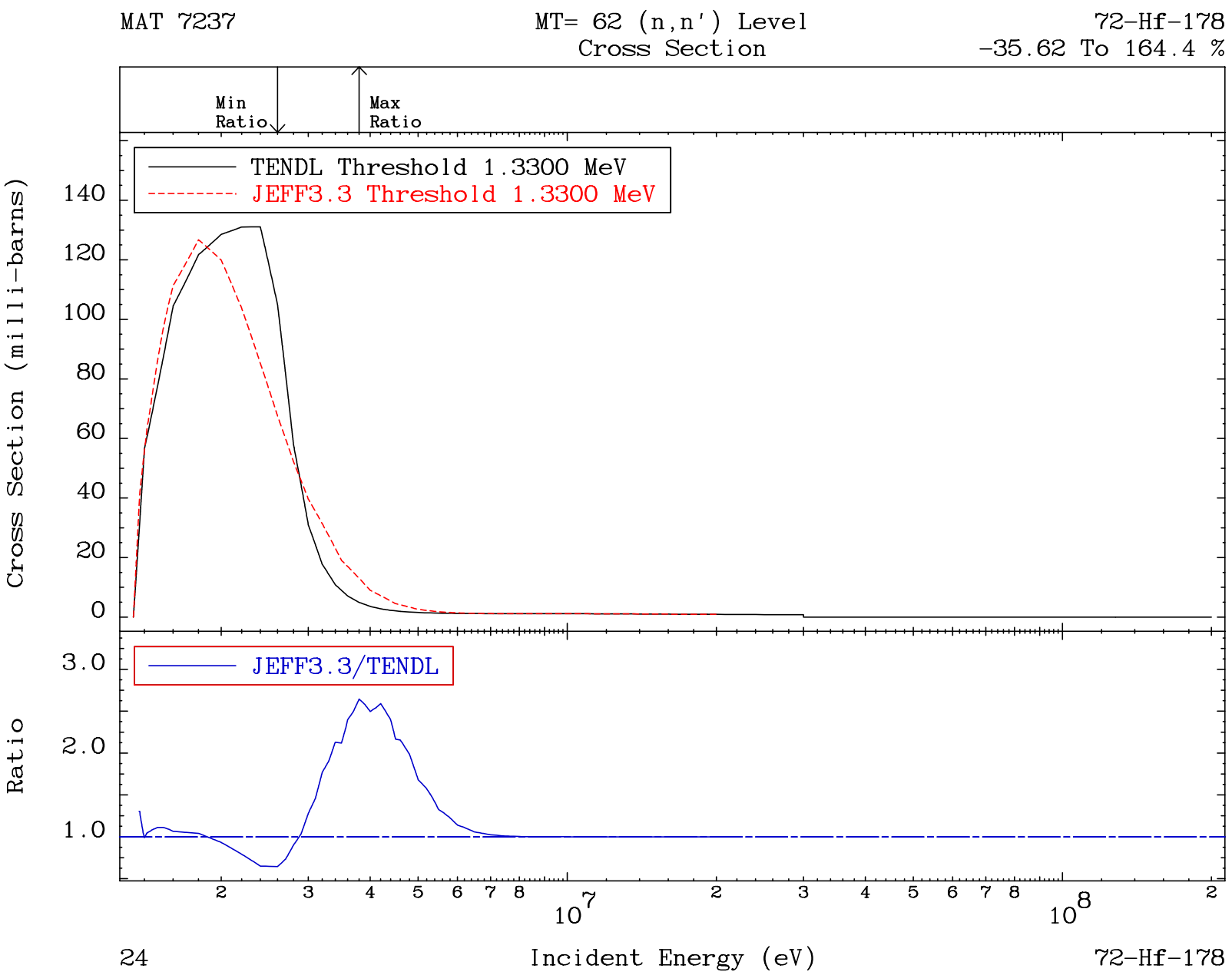

MAT 7237
MT= 57 (n,n') Level
Cross Section
72-Hf-178
-31.05 To 9999. %
Min
Ratio
Max
Ratio
TENDL Threshold 1.2062 MeV
JEFF3.3 Threshold 1.2062 MeV
Cross Section (milli-barns)
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
10^3
10^2
10^1
10^0
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
19
Incident Energy (eV)
72-Hf-178

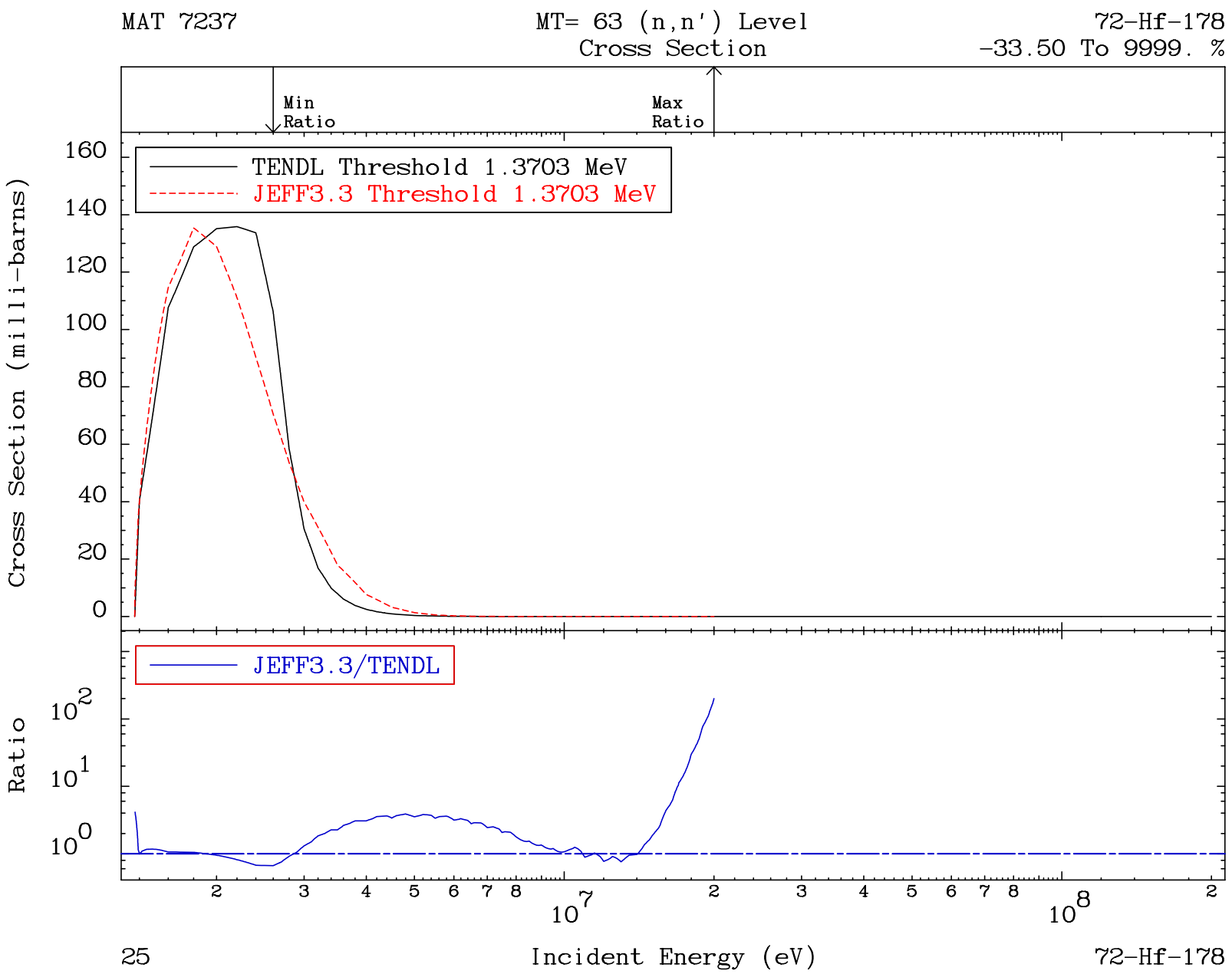

MAT 7237
MT= 58 (n,n') Level
Cross Section
72-Hf-178
-33.54 To 9999. %
Min
Ratio
Max
Ratio
TENDL Threshold 1.2674 MeV
JEFF3.3 Threshold 1.2674 MeV
Cross Section (milli-barns)
150
100
50
0
JEFF3.3/TENDL
Ratio
10^2
10^1
10^0
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
20
Incident Energy (eV)
72-Hf-178

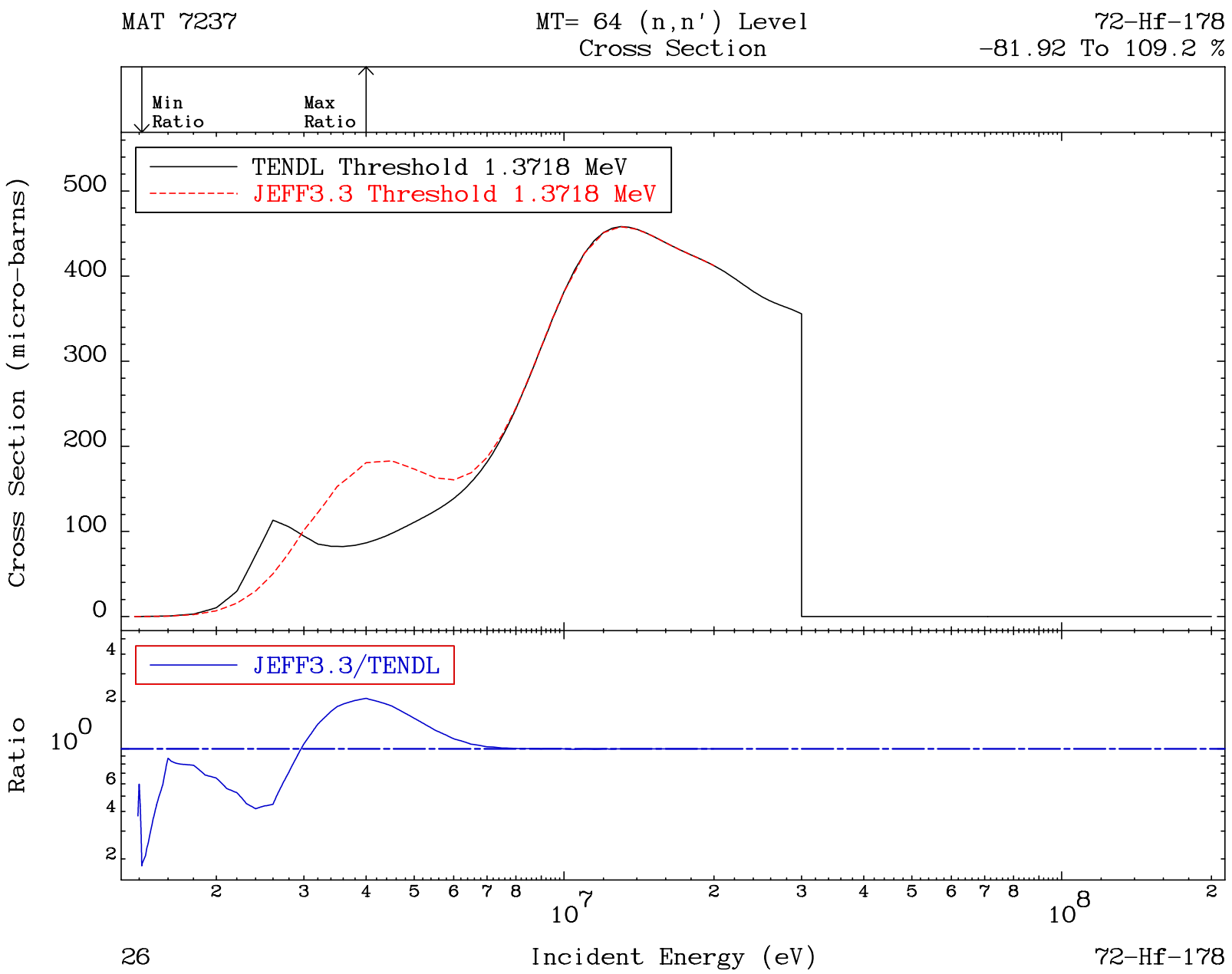

MAT 7237
MT= 59 (n,n') Level
Cross Section
72-Hf-178
-35.15 To 9999. %
Min
Ratio
Max
Ratio
TENDL Threshold 1.2757 MeV
JEFF3.3 Threshold 1.2757 MeV
Cross Section (milli-barns)
160
140
120
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
10^2
10^1
10^0
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
21
Incident Energy (eV)
72-Hf-178

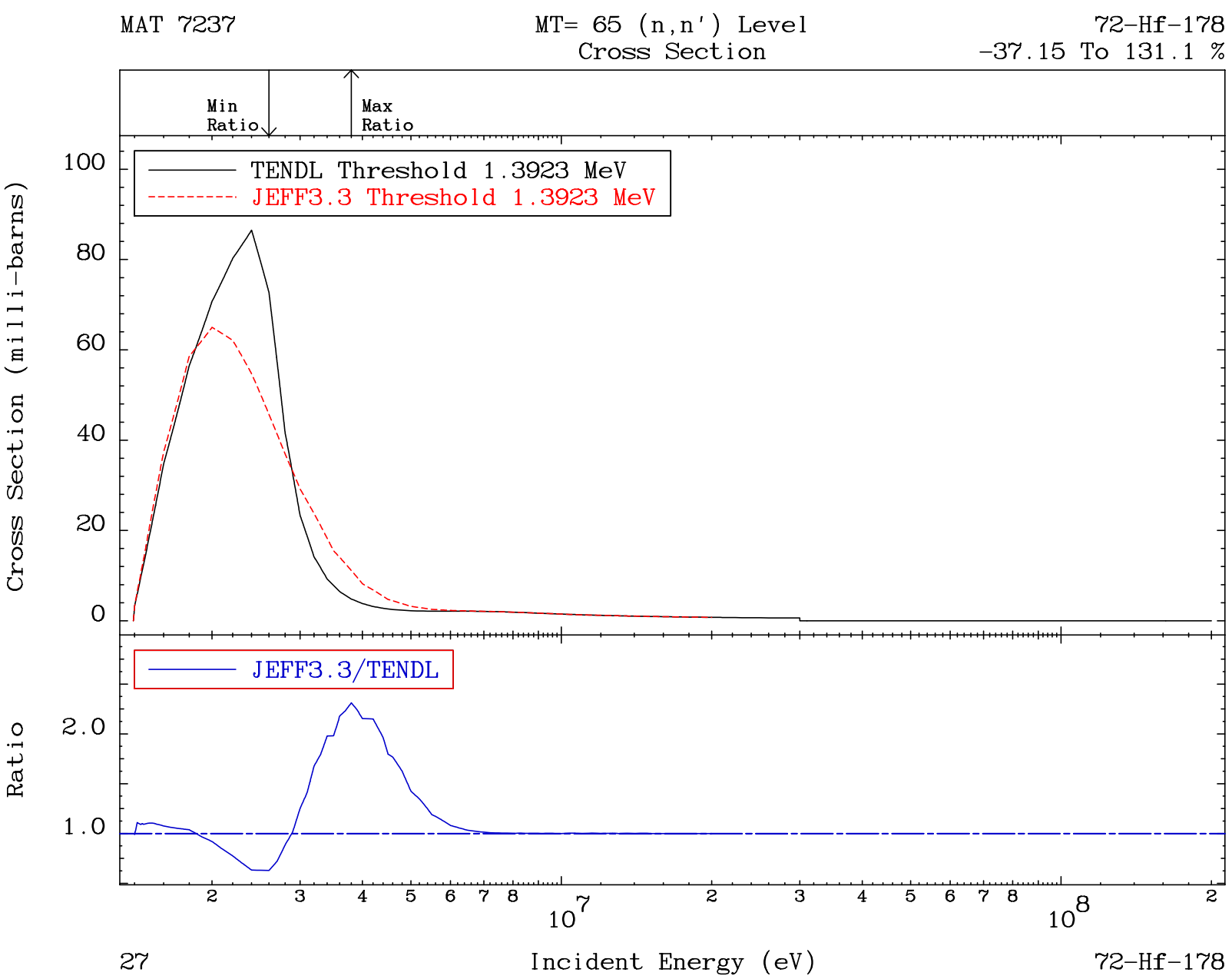

MAT 7237
MT= 60 (n,n') Level
Cross Section
72-Hf-178
-32.10 To 113.5 %
Min Ratio
Max Ratio
TENDL Threshold 1.2839 MeV
JEFF3.3 Threshold 1.2839 MeV
Cross Section (milli-barns)
200
150
100
50
0
JEFF3.3/TENDL
Ratio
2.4
1.8
1.2
0.6
2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
22
Incident Energy (eV)
72-Hf-178

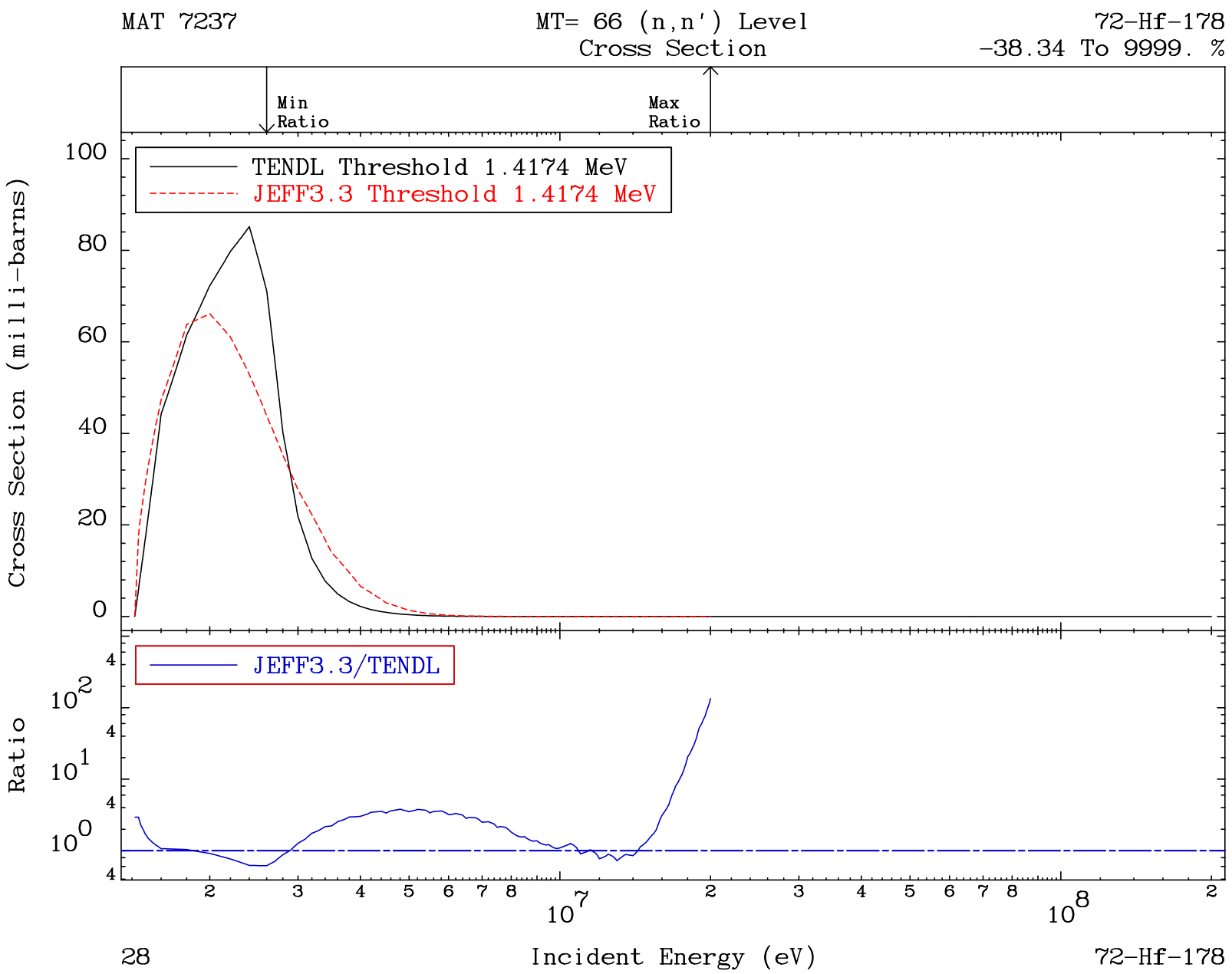

MAT 7237
MT= 61 (n,n') Level
Cross Section
72-Hf-178
-31.92 To 193.2 %
Max
Ratio
Min
Ratio
TENDL Threshold 1.3175 MeV
JEFF3.3 Threshold 1.3175 MeV
Cross Section (milli-barns)
160
140
120
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
3.0
2.0
1.0
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
23
Incident Energy (eV)
72-Hf-178

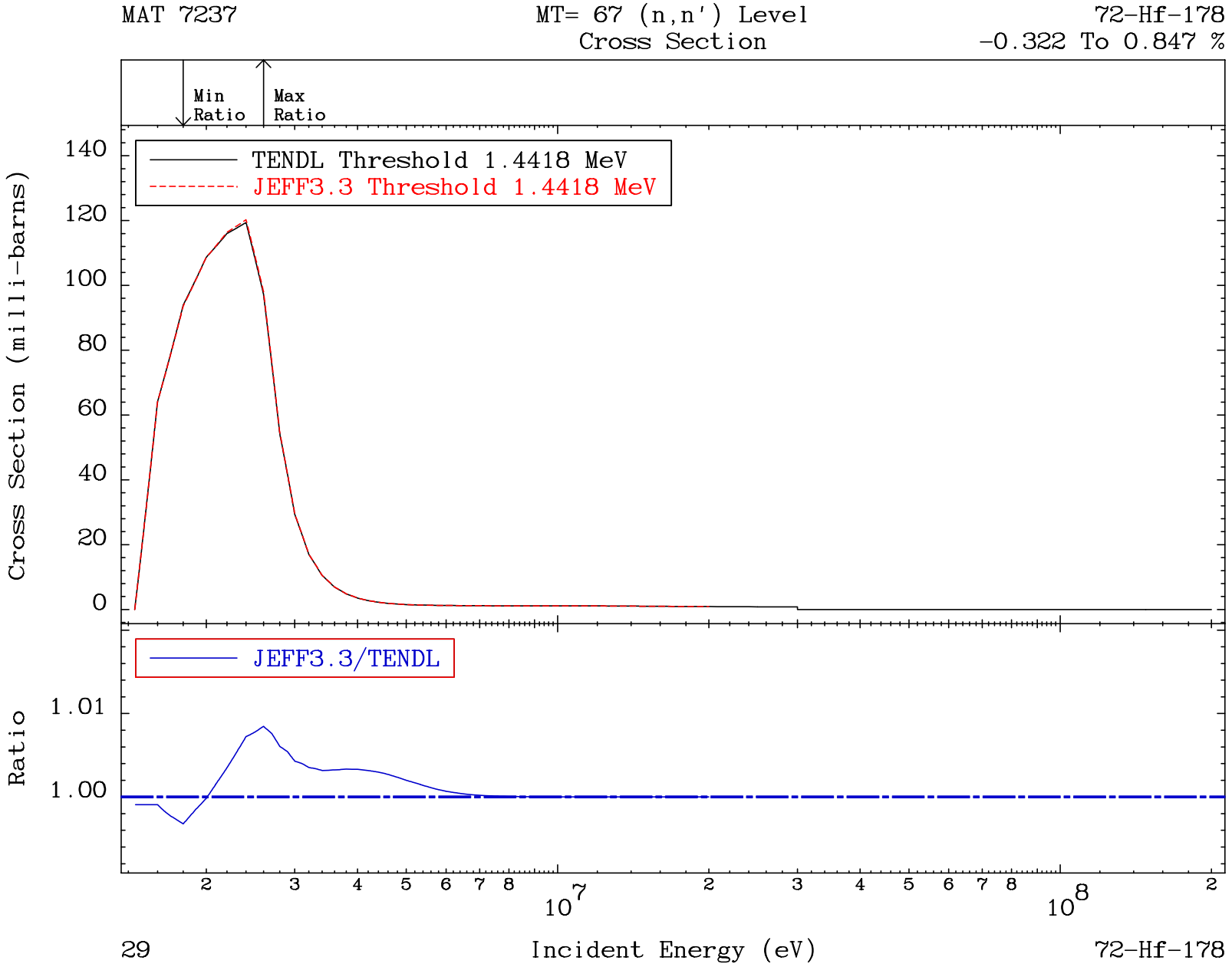

MAT 7237
MT= 62 (n,n') Level
Cross Section
72-Hf-178
-35.62 To 164.4 %
Min Ratio
Max Ratio
TENDL Threshold 1.3300 MeV
JEFF3.3 Threshold 1.3300 MeV
Cross Section (milli-barns)
140
120
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
3.0
2.0
1.0
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
24
Incident Energy (eV)
72-Hf-178

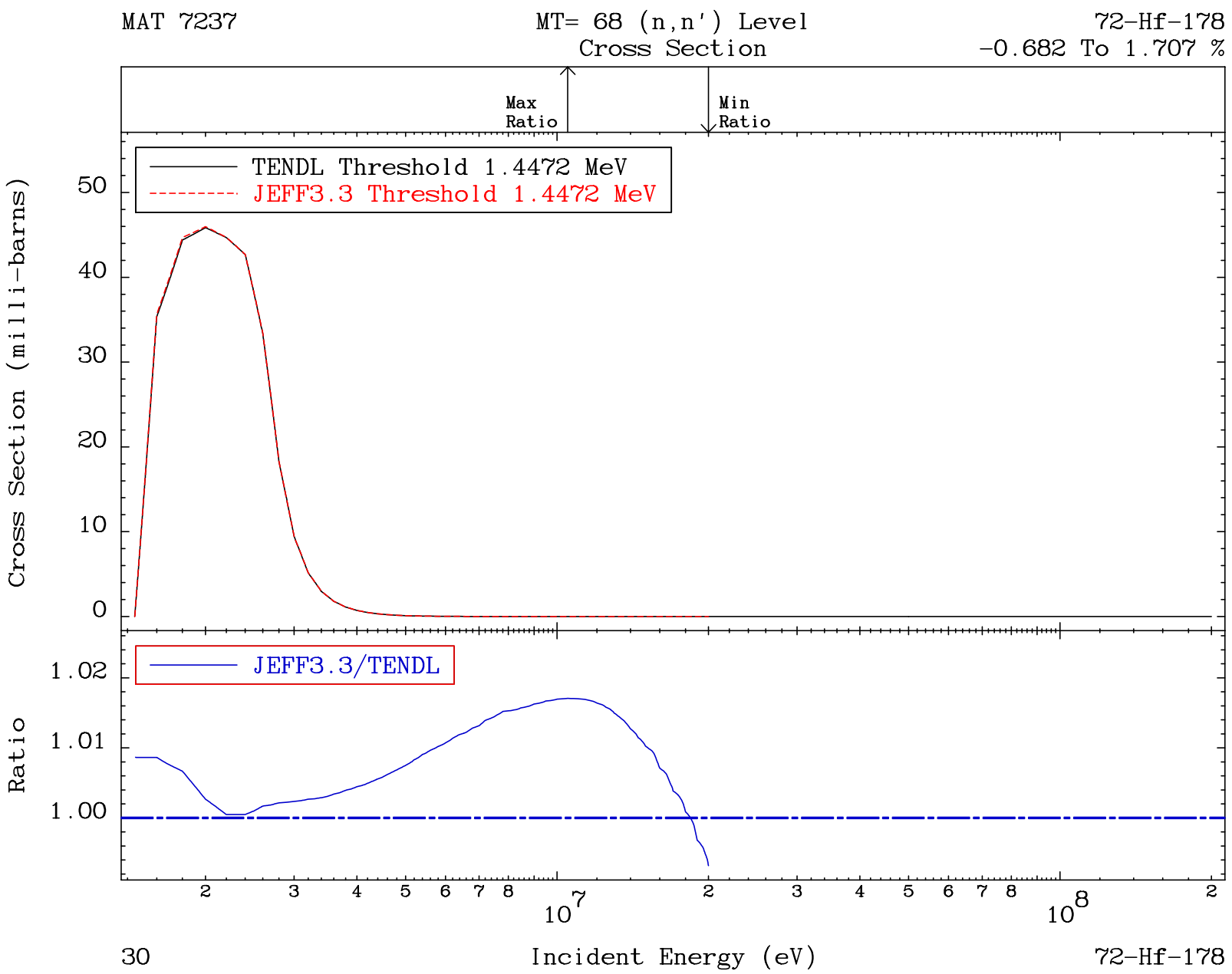

MAT 7237
MT= 63 (n,n') Level
Cross Section
72-Hf-178
-33.50 To 9999. %
Min
Ratio
Max
Ratio
TENDL Threshold 1.3703 MeV
JEFF3.3 Threshold 1.3703 MeV
Cross Section (milli-barns)
160
140
120
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
10^2
10^1
10^0
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
25
Incident Energy (eV)
72-Hf-178

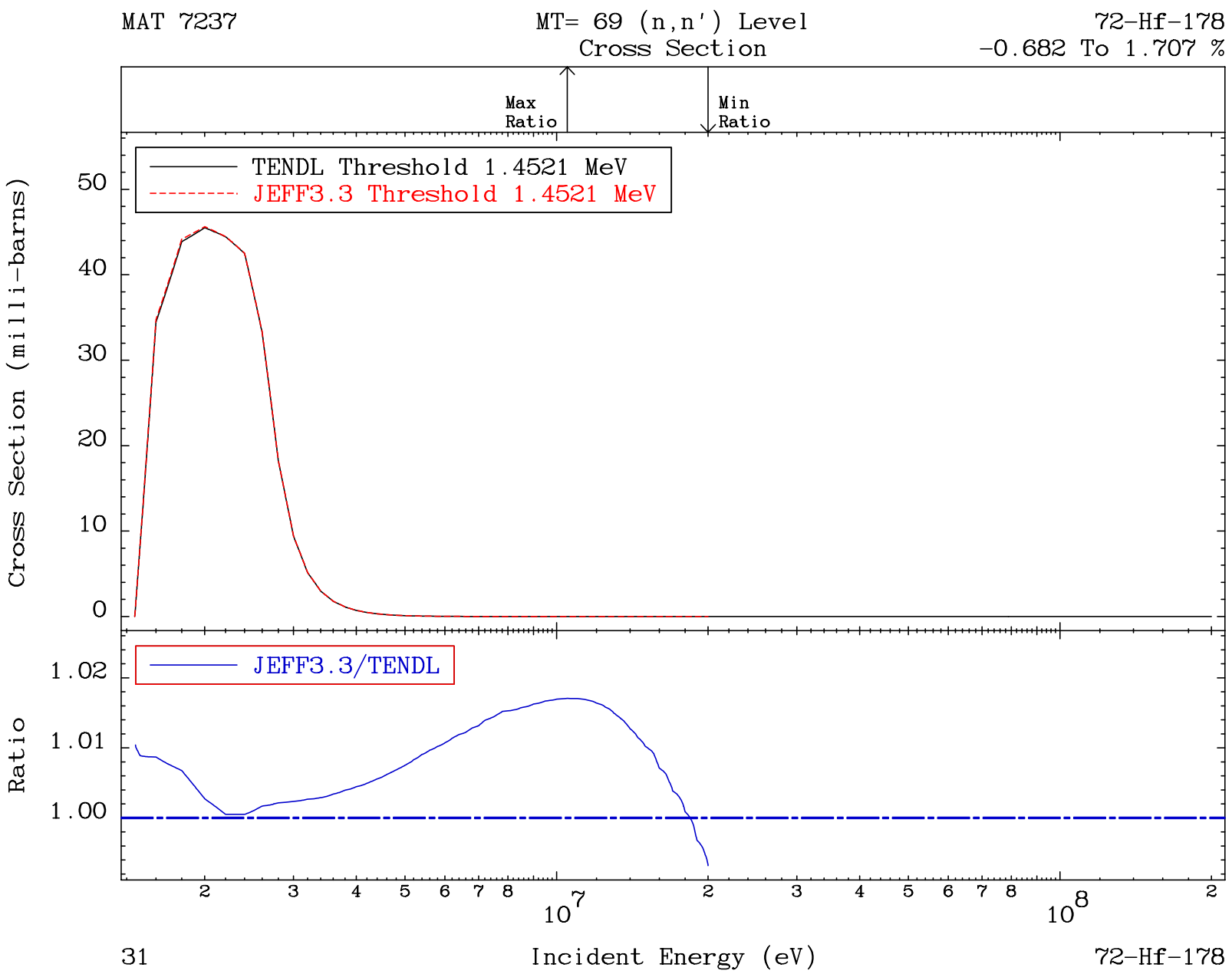

MAT 7237
MT= 64 (n,n') Level
Cross Section
72-Hf-178
-81.92 To 109.2 %
Min
Ratio
Max
Ratio
TENDL Threshold 1.3718 MeV
JEFF3.3 Threshold 1.3718 MeV
Cross Section (micro-barns)
500
400
300
200
100
0
JEFF3.3/TENDL
Ratio
4
2
10^0
6
4
2
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
26
Incident Energy (eV)
72-Hf-178

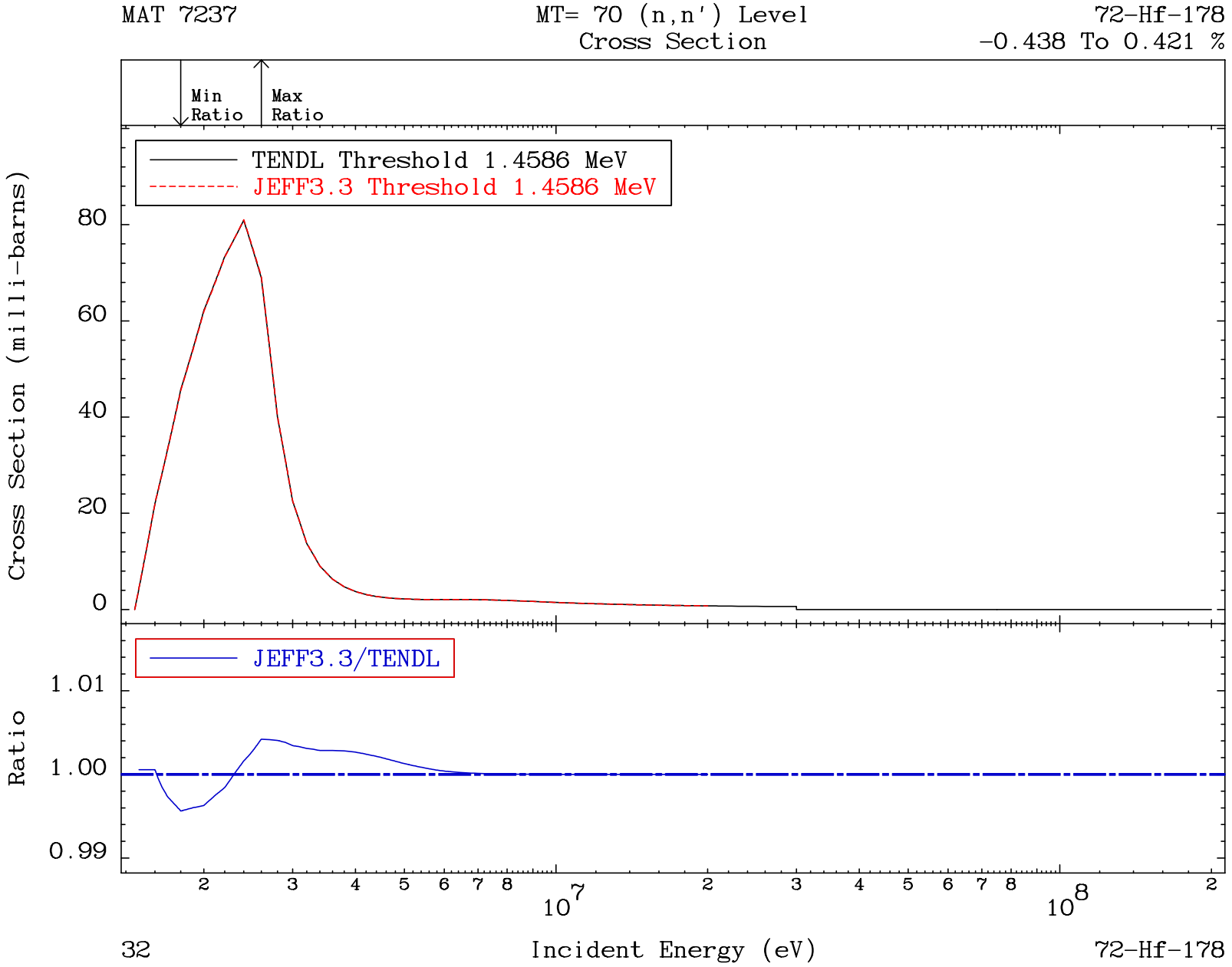

MAT 7237
MT= 65 (n,n') Level
Cross Section
72-Hf-178
-37.15 To 131.1 %
Min Ratio
Max Ratio
TENDL Threshold 1.3923 MeV
JEFF3.3 Threshold 1.3923 MeV
Cross Section (milli-barns)
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
2.0
1.0
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
27
Incident Energy (eV)
72-Hf-178

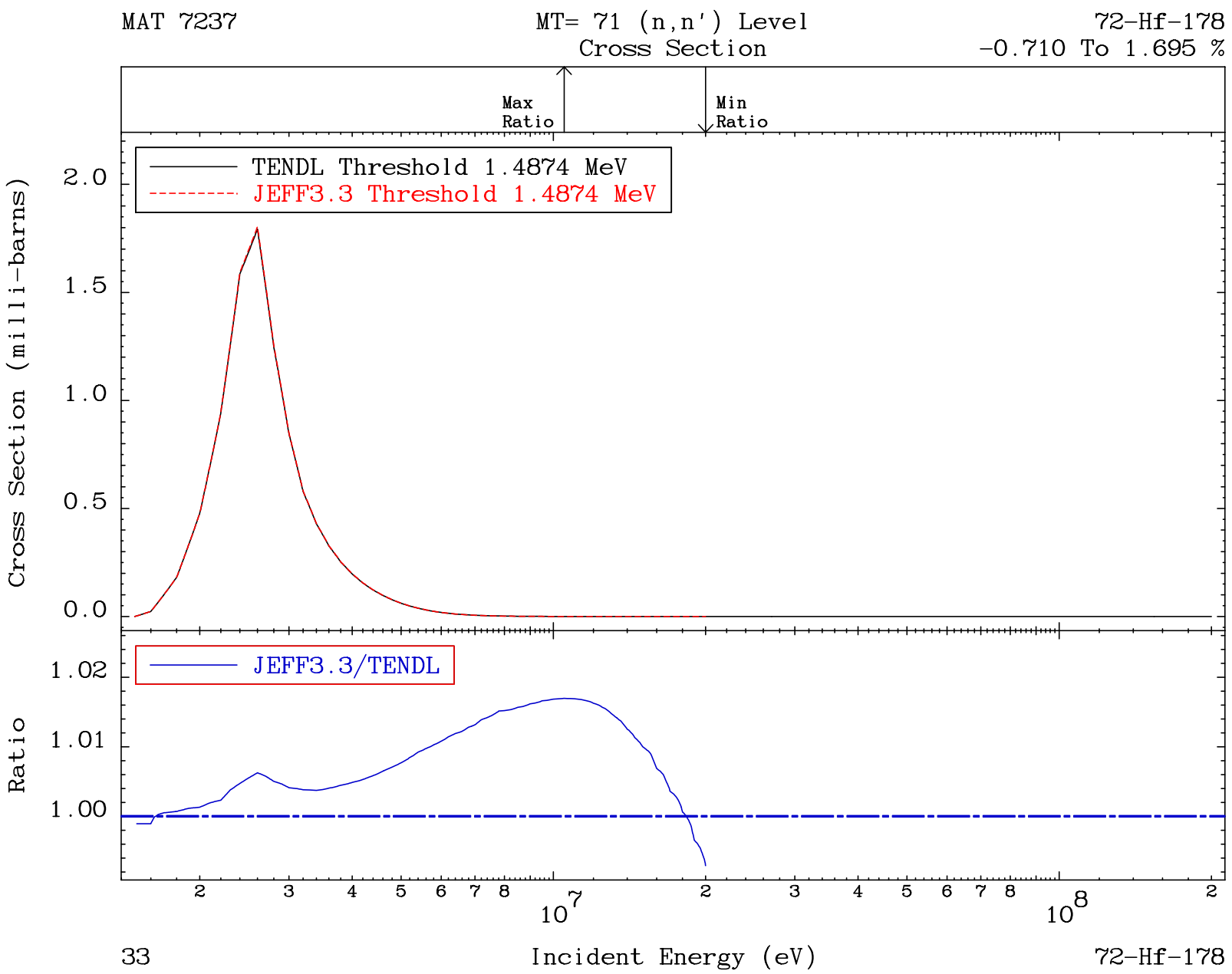

MAT 7237
MT= 66 (n,n') Level
Cross Section
72-Hf-178
-38.34 To 9999. %
Min
Ratio
Max
Ratio
TENDL Threshold 1.4174 MeV
JEFF3.3 Threshold 1.4174 MeV
Cross Section (milli-barns)
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
10^2
10^1
10^0
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
28
Incident Energy (eV)
72-Hf-178

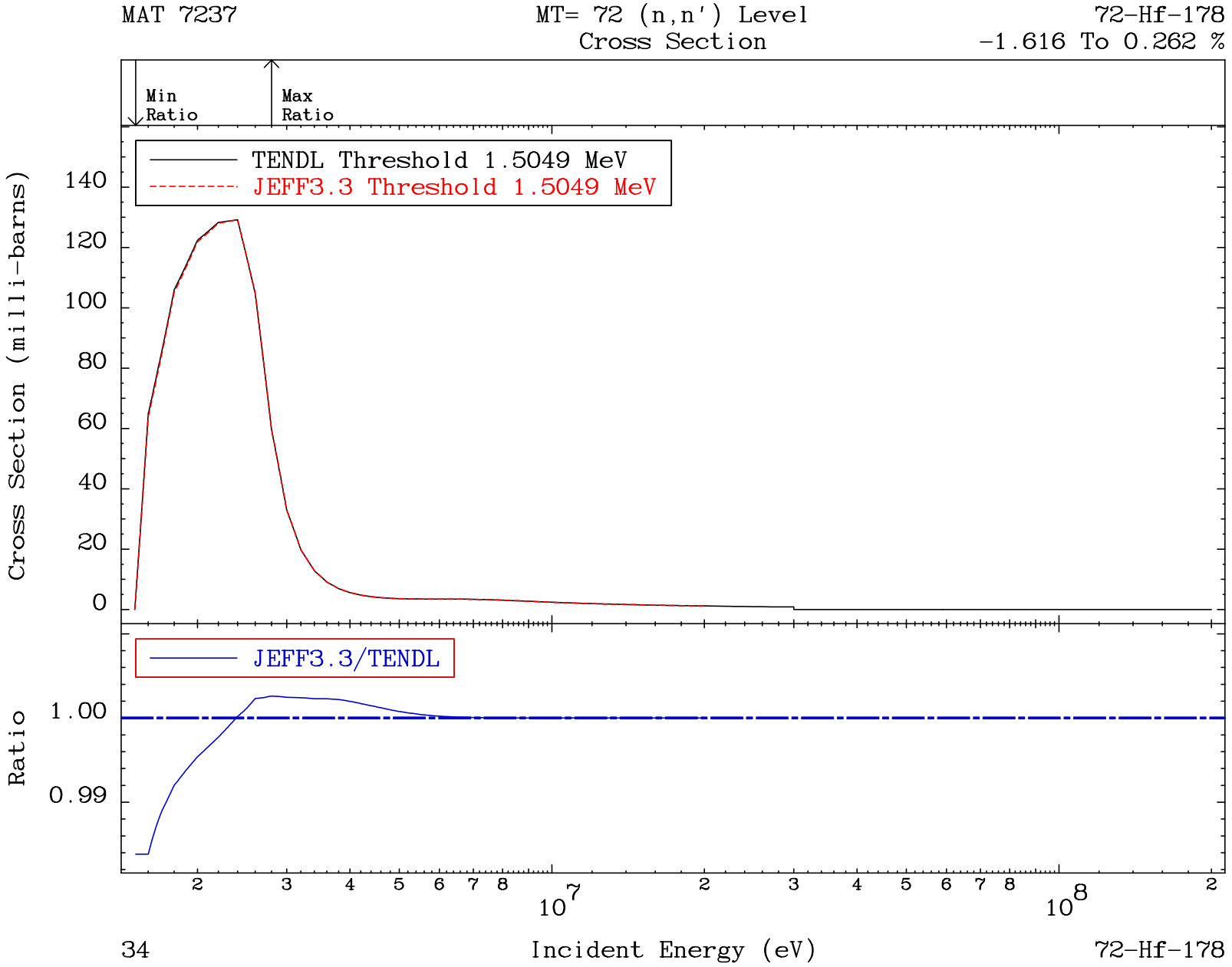

MAT 7237
MT= 67 (n,n') Level
Cross Section
72-Hf-178
-0.322 To 0.847 %
Min Ratio
Max Ratio
TENDL Threshold 1.4418 MeV
JEFF3.3 Threshold 1.4418 MeV
Cross Section (milli-barns)
140
120
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
1.01
1.00
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
29
Incident Energy (eV)
72-Hf-178

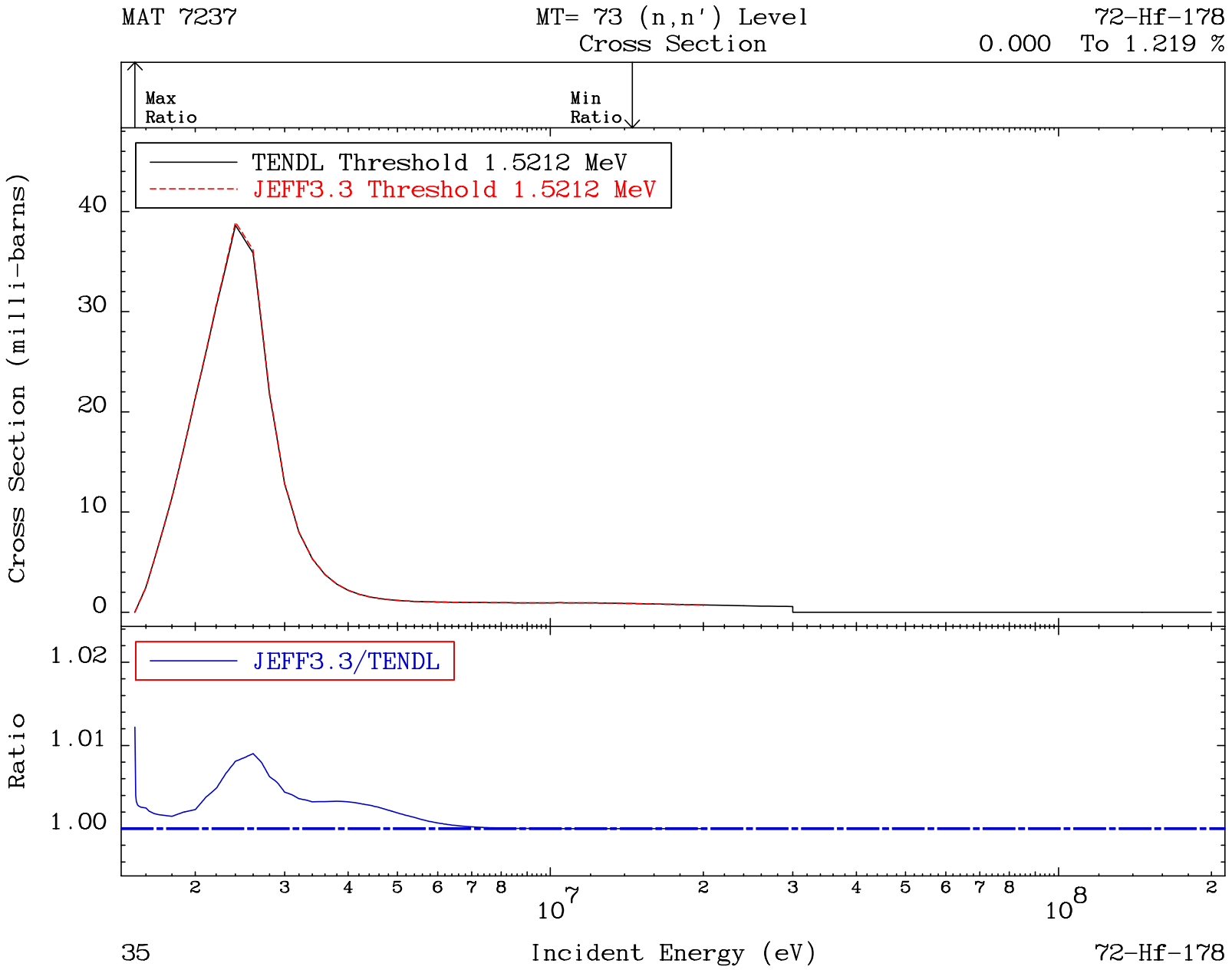

MAT 7237
MT= 68 (n,n') Level
Cross Section
72-Hf-178
-0.682 To 1.707 %
Max
Ratio
Min
Ratio
TENDL Threshold 1.4472 MeV
JEFF3.3 Threshold 1.4472 MeV
Cross Section (milli-barns)
50
40
30
20
10
0
JEFF3.3/TENDL
Ratio
1.02
1.01
1.00
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
30
Incident Energy (eV)
72-Hf-178

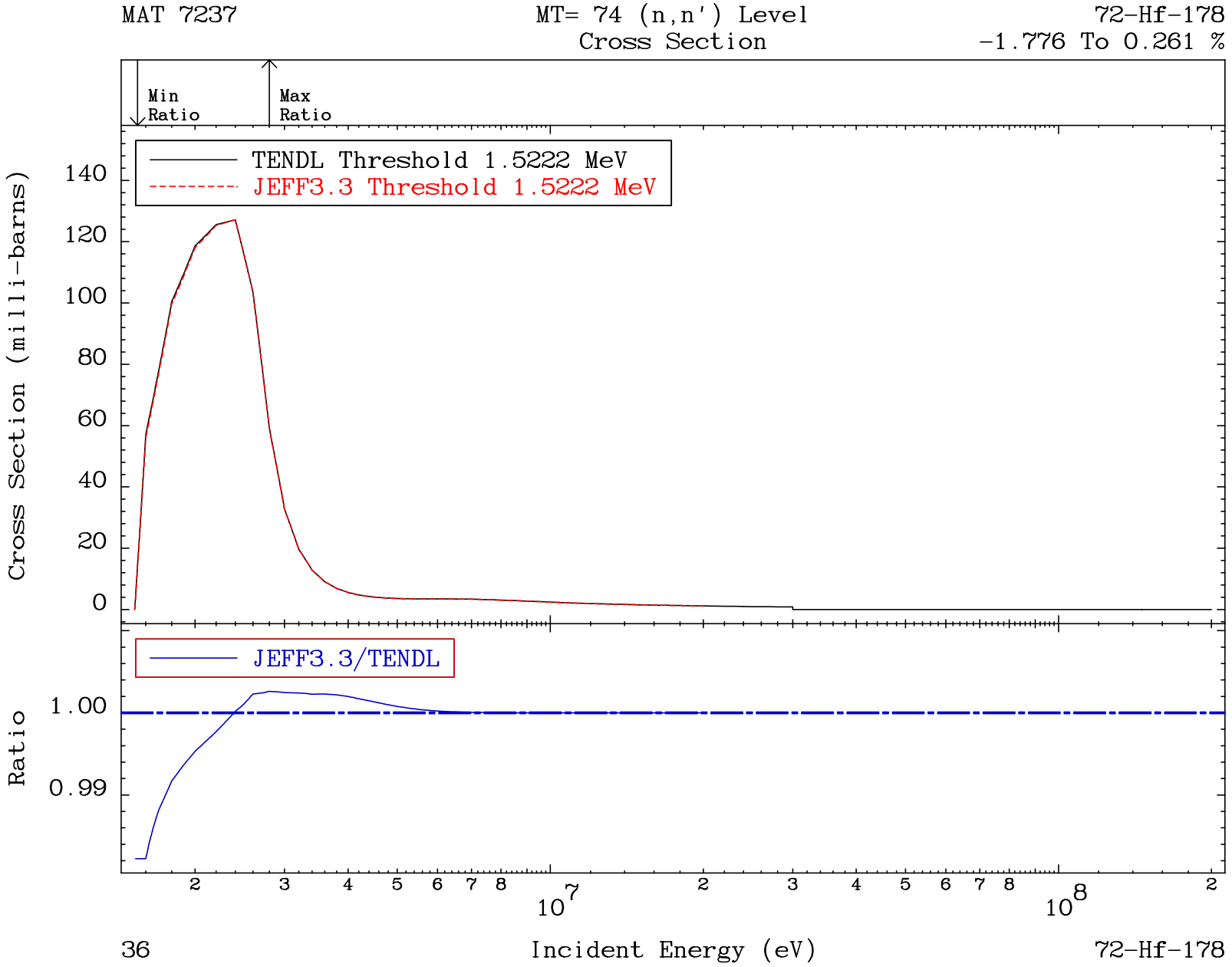

MAT 7237
MT= 69 (n,n') Level
Cross Section
72-Hf-178
-0.682 To 1.707 %
Max Ratio
Min Ratio
TENDL Threshold 1.4521 MeV
JEFF3.3 Threshold 1.4521 MeV
Cross Section (milli-barns)
50
40
30
20
10
0
JEFF3.3/TENDL
Ratio
1.02
1.01
1.00
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
31
Incident Energy (eV)
72-Hf-178

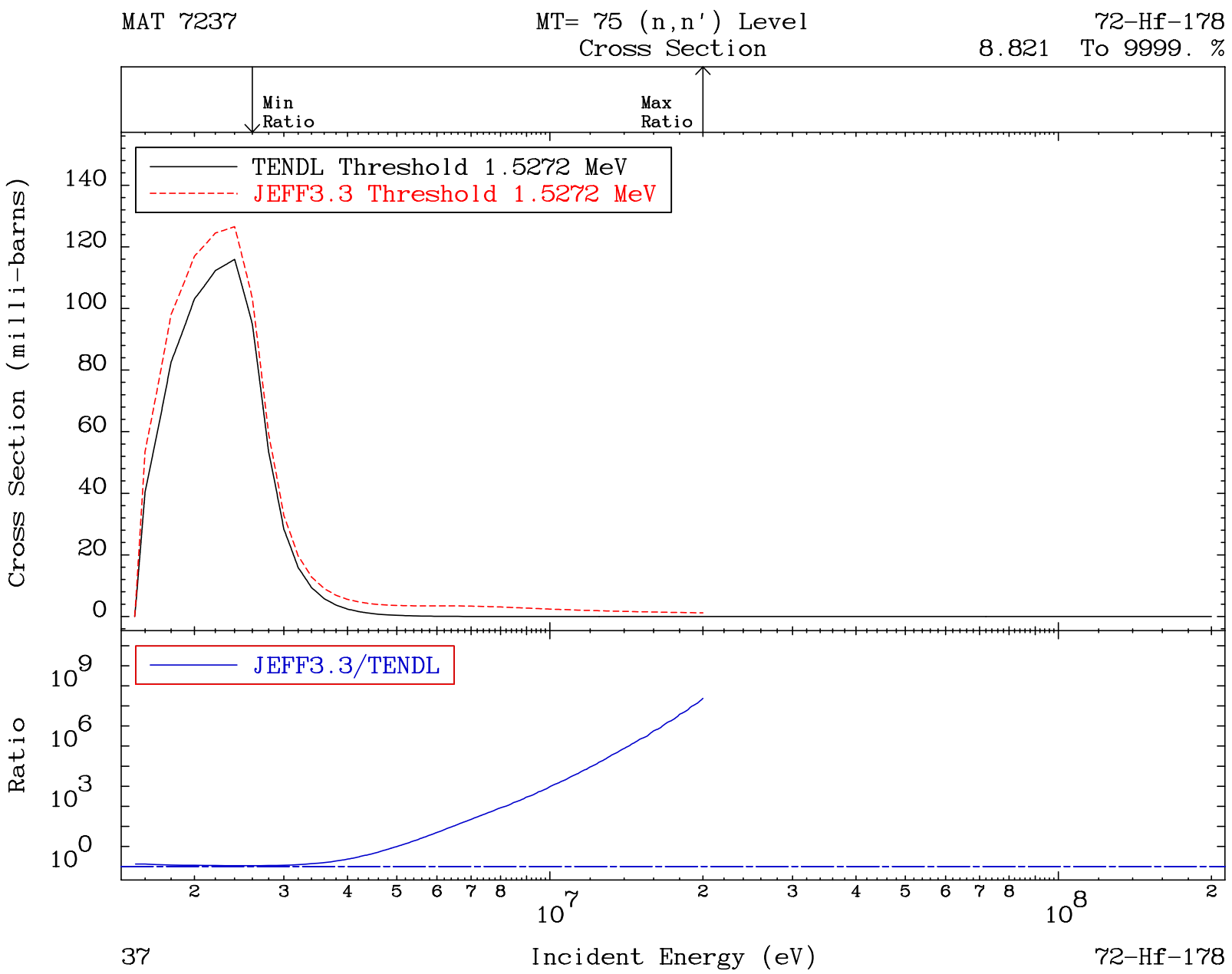

MAT 7237
MT= 70 (n,n') Level
Cross Section
72-Hf-178
-0.438 To 0.421 %
Min Ratio
Max Ratio
TENDL Threshold 1.4586 MeV
JEFF3.3 Threshold 1.4586 MeV
Cross Section (milli-barns)
80
60
40
20
0
JEFF3.3/TENDL
Ratio
1.01
1.00
0.99
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
32
Incident Energy (eV)
72-Hf-178

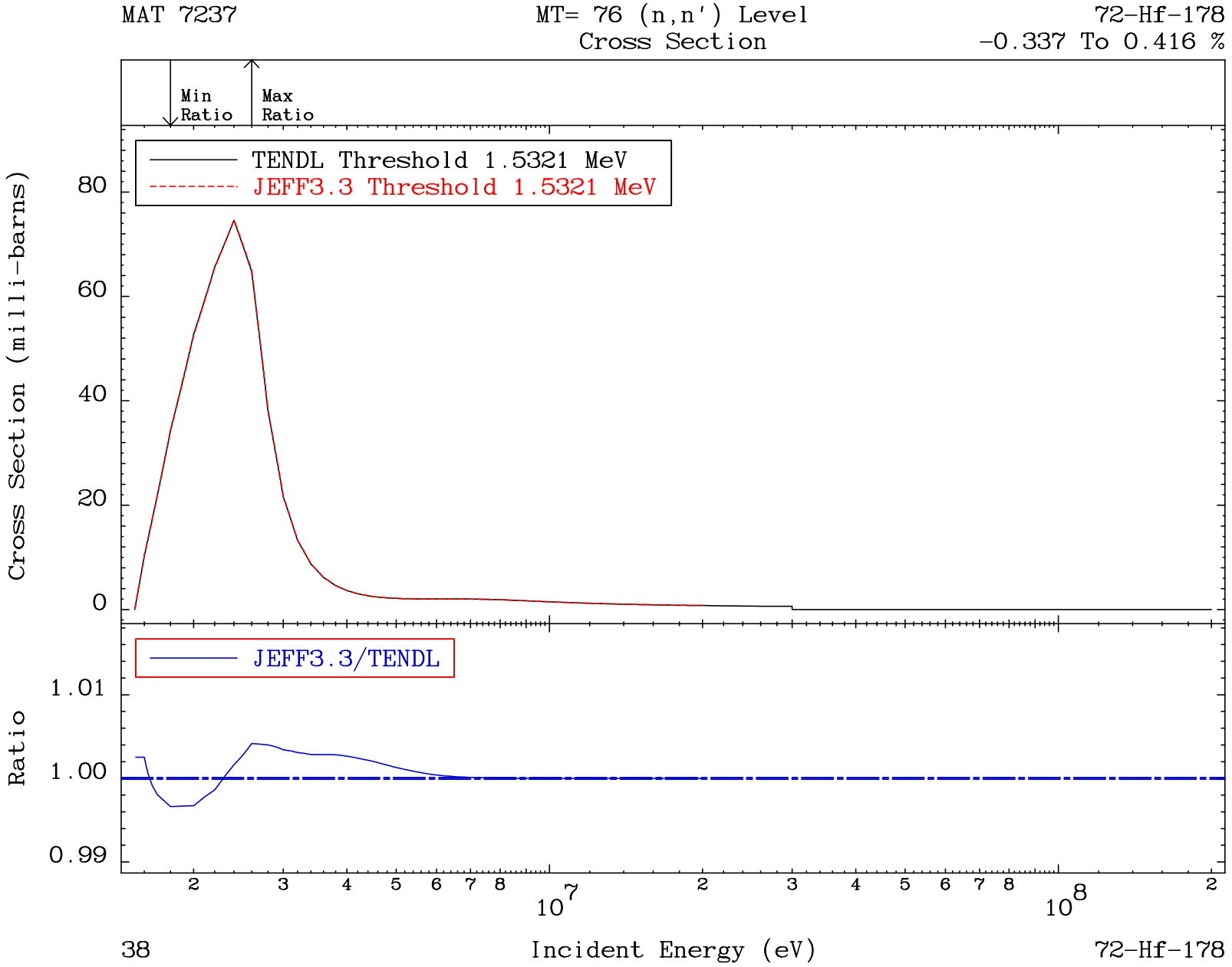

MAT 7237
MT= 71 (n,n') Level
Cross Section
72-Hf-178
-0.710 To 1.695 %
Max Ratio
Min Ratio
TENDL Threshold 1.4874 MeV
JEFF3.3 Threshold 1.4874 MeV
Cross Section (milli-barns)
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
1.02
1.01
1.00
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
33
Incident Energy (eV)
72-Hf-178

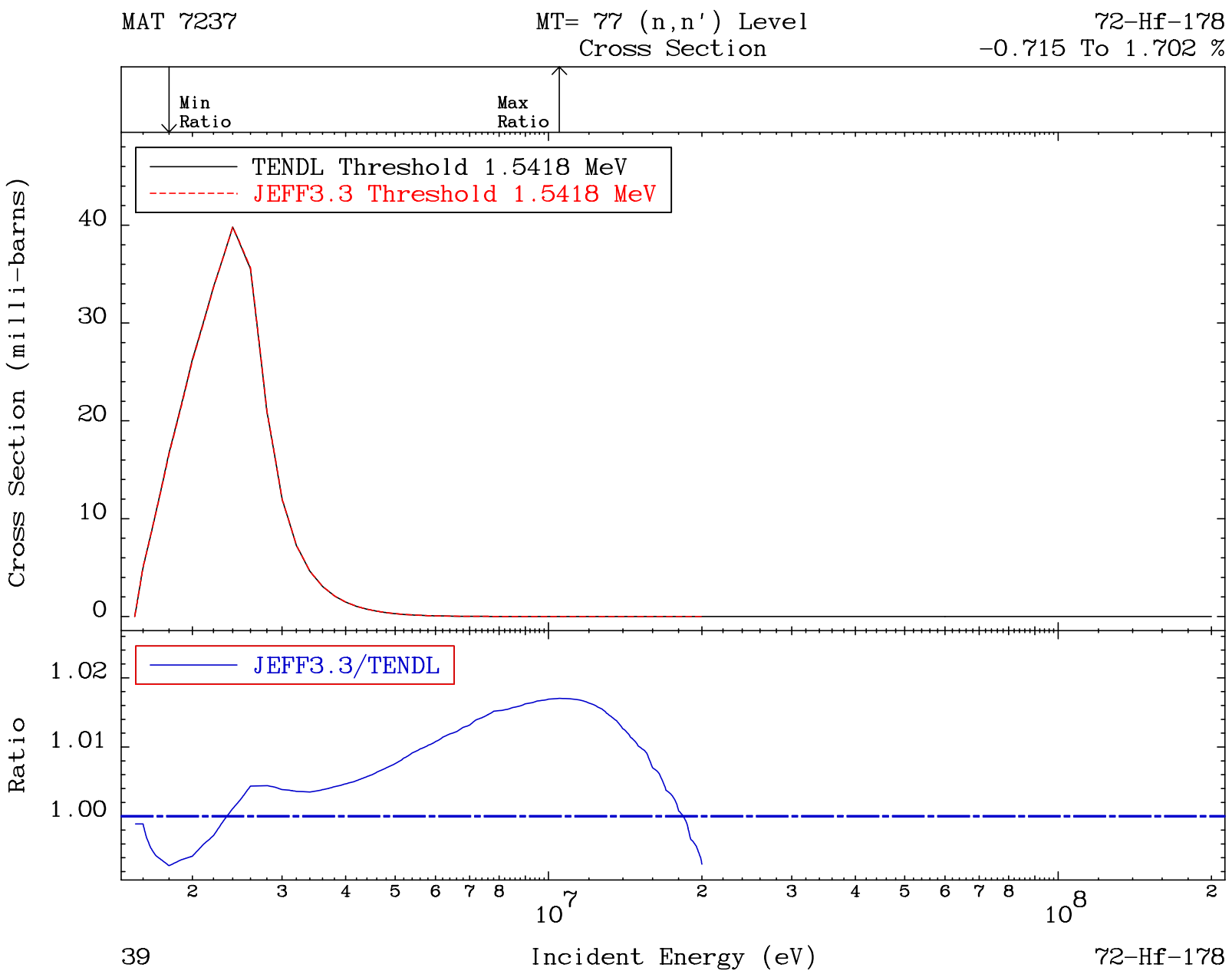

MAT 7237
MT= 72 (n,n') Level
Cross Section
72-Hf-178
-1.616 To 0.262 %
Min Ratio
Max Ratio
TENDL Threshold 1.5049 MeV
JEFF3.3 Threshold 1.5049 MeV
Cross Section (milli-barns)
140
120
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
1.00
0.99
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
34
Incident Energy (eV)
72-Hf-178

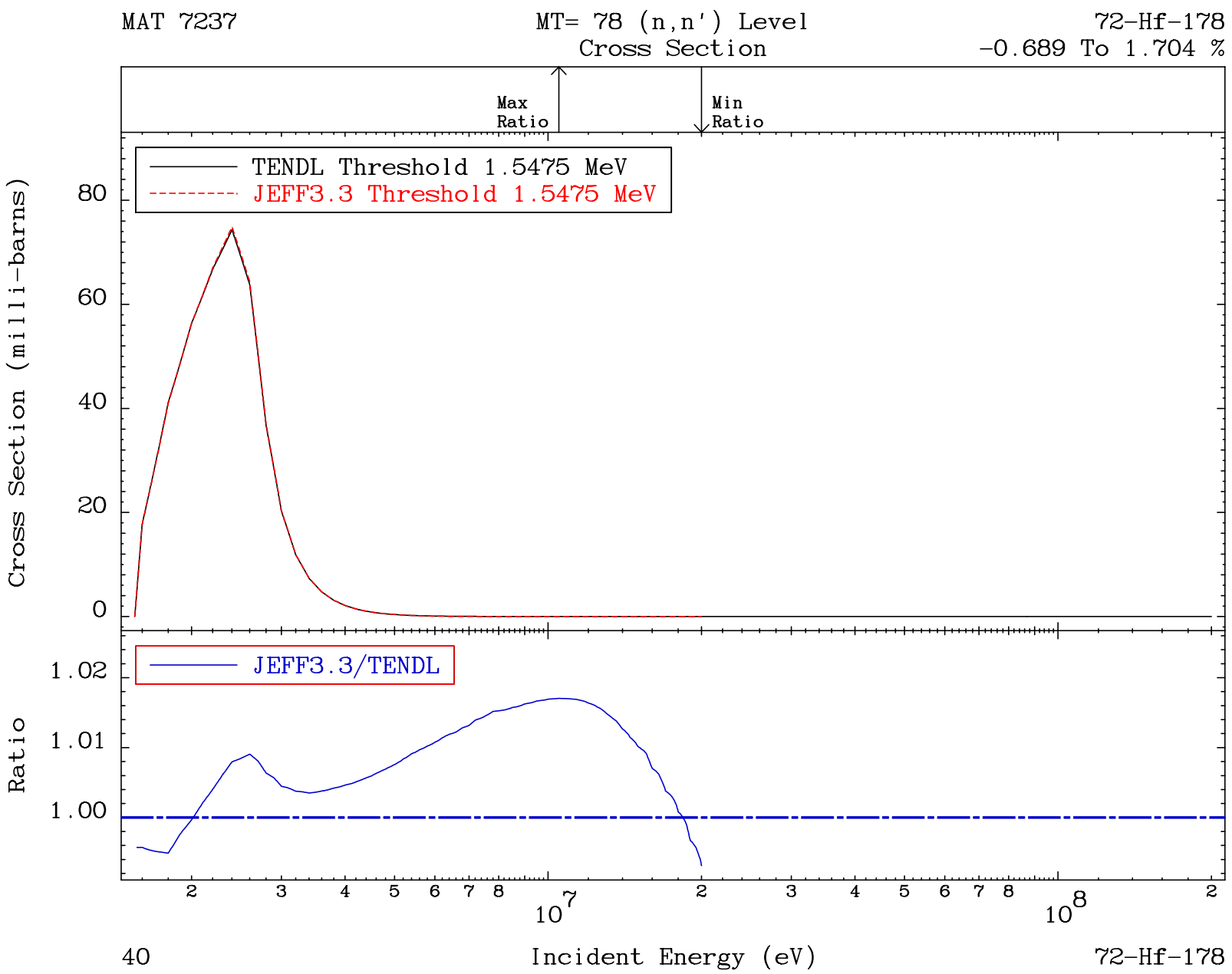

MAT 7237
MT= 73 (n,n') Level
Cross Section
72-Hf-178
0.000 To 1.219 %
Max Ratio
Min Ratio
TENDL Threshold 1.5212 MeV
JEFF3.3 Threshold 1.5212 MeV
Cross Section (milli-barns)
40
30
20
10
0
JEFF3.3/TENDL
Ratio
1.02
1.01
1.00
2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
35
Incident Energy (eV)
72-Hf-178

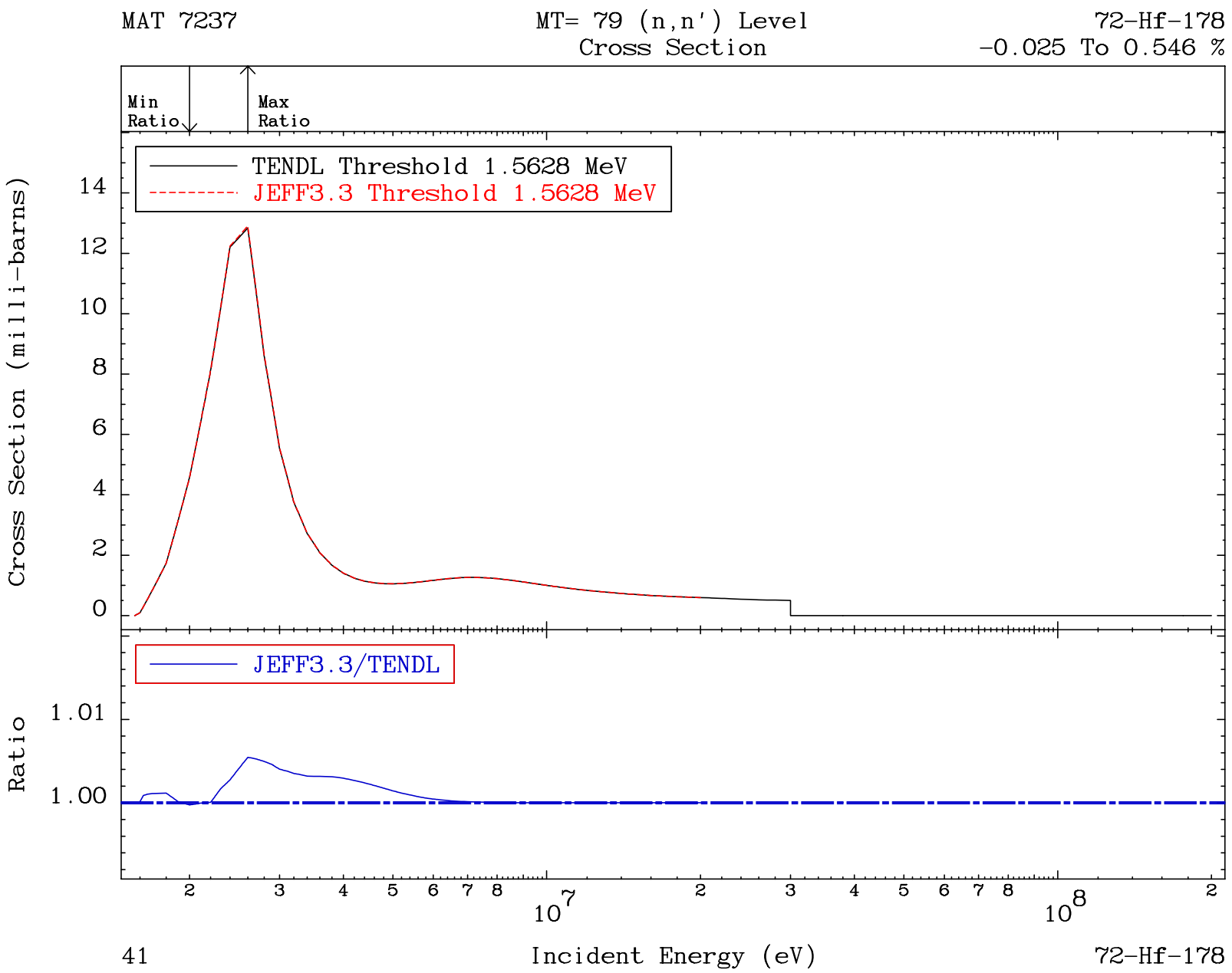

MAT 7237
MT= 74 (n,n') Level
Cross Section
72-Hf-178
-1.776 To 0.261 %
Min
Ratio
Max
Ratio
TENDL Threshold 1.5222 MeV
JEFF3.3 Threshold 1.5222 MeV
Cross Section (milli-barns)
140
120
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
1.00
0.99
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
36
Incident Energy (eV)
72-Hf-178

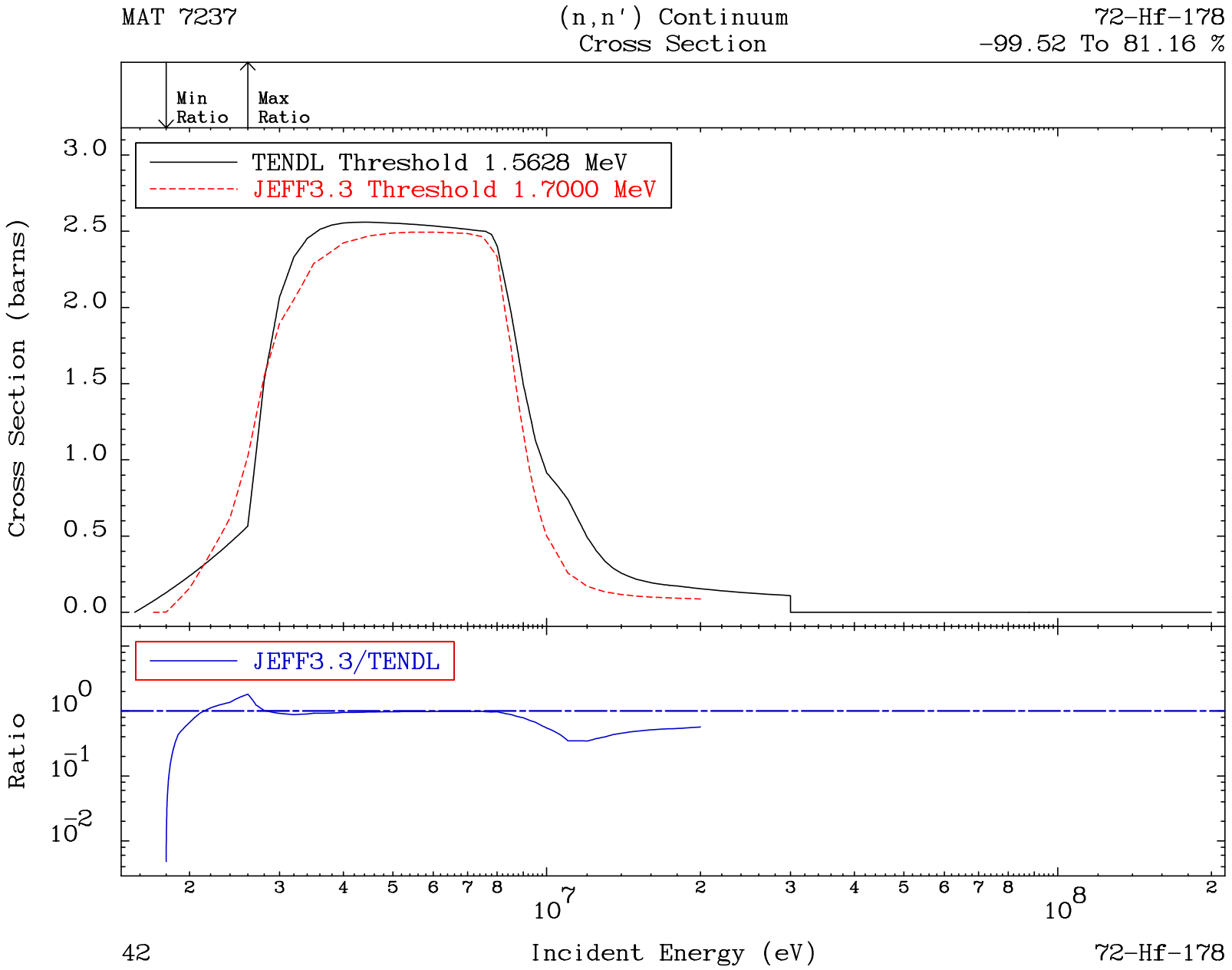

MAT 7237
MT= 75 (n,n') Level
Cross Section
72-Hf-178
8.821 To 9999. %
Min Ratio
Max Ratio
TENDL Threshold 1.5272 MeV
JEFF3.3 Threshold 1.5272 MeV
Cross Section (milli-barns)
140
120
100
80
60
40
20
0
JEFF3.3/TENDL
Ratio
10^9
10^6
10^3
10^0
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
37
Incident Energy (eV)
72-Hf-178

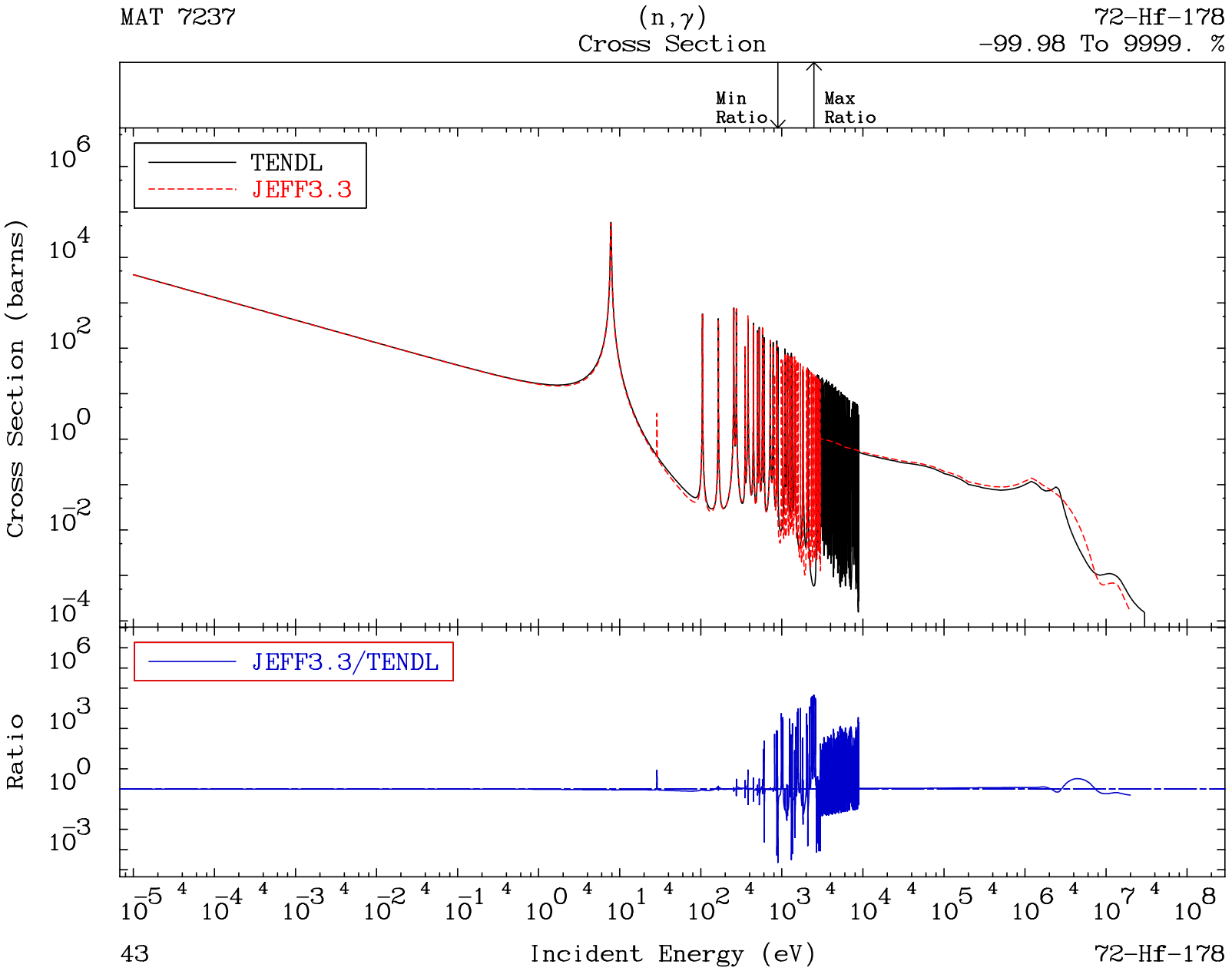

MAT 7237
MT= 76 (n,n') Level
Cross Section
72-Hf-178
-0.337 To 0.416 %
Min Ratio
Max Ratio
TENDL Threshold 1.5321 MeV
JEFF3.3 Threshold 1.5321 MeV
Cross Section (milli-barns)
80
60
40
20
0
JEFF3.3/TENDL
Ratio
1.01
1.00
0.99
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
38
Incident Energy (eV)
72-Hf-178

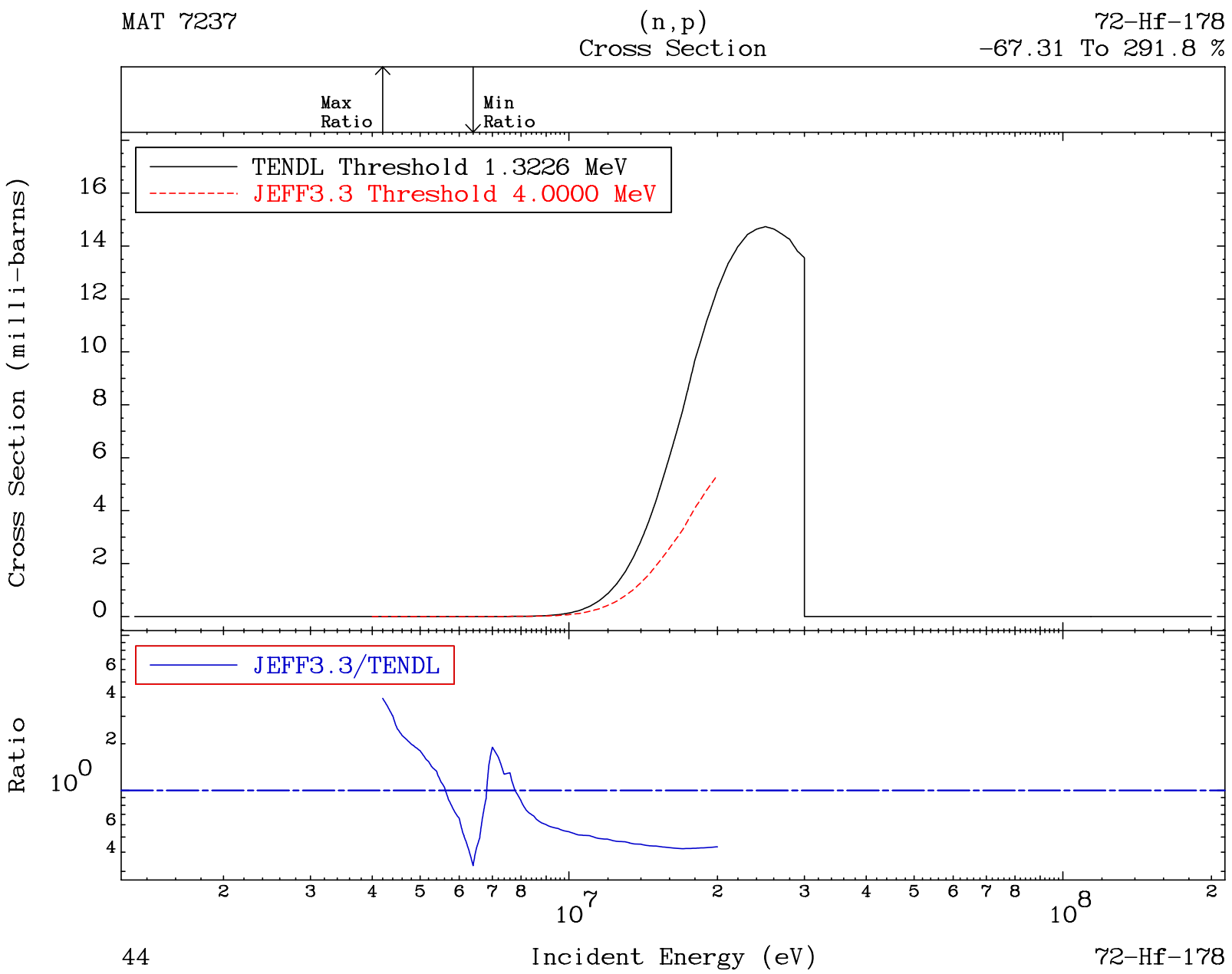

MAT 7237
MT= 77 (n,n') Level
Cross Section
72-Hf-178
-0.715 To 1.702 %
Min Ratio
Max Ratio
TENDL Threshold 1.5418 MeV
JEFF3.3 Threshold 1.5418 MeV
Cross Section (milli-barns)
40
30
20
10
0
JEFF3.3/TENDL
Ratio
1.02
1.01
1.00
2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
39
Incident Energy (eV)
72-Hf-178

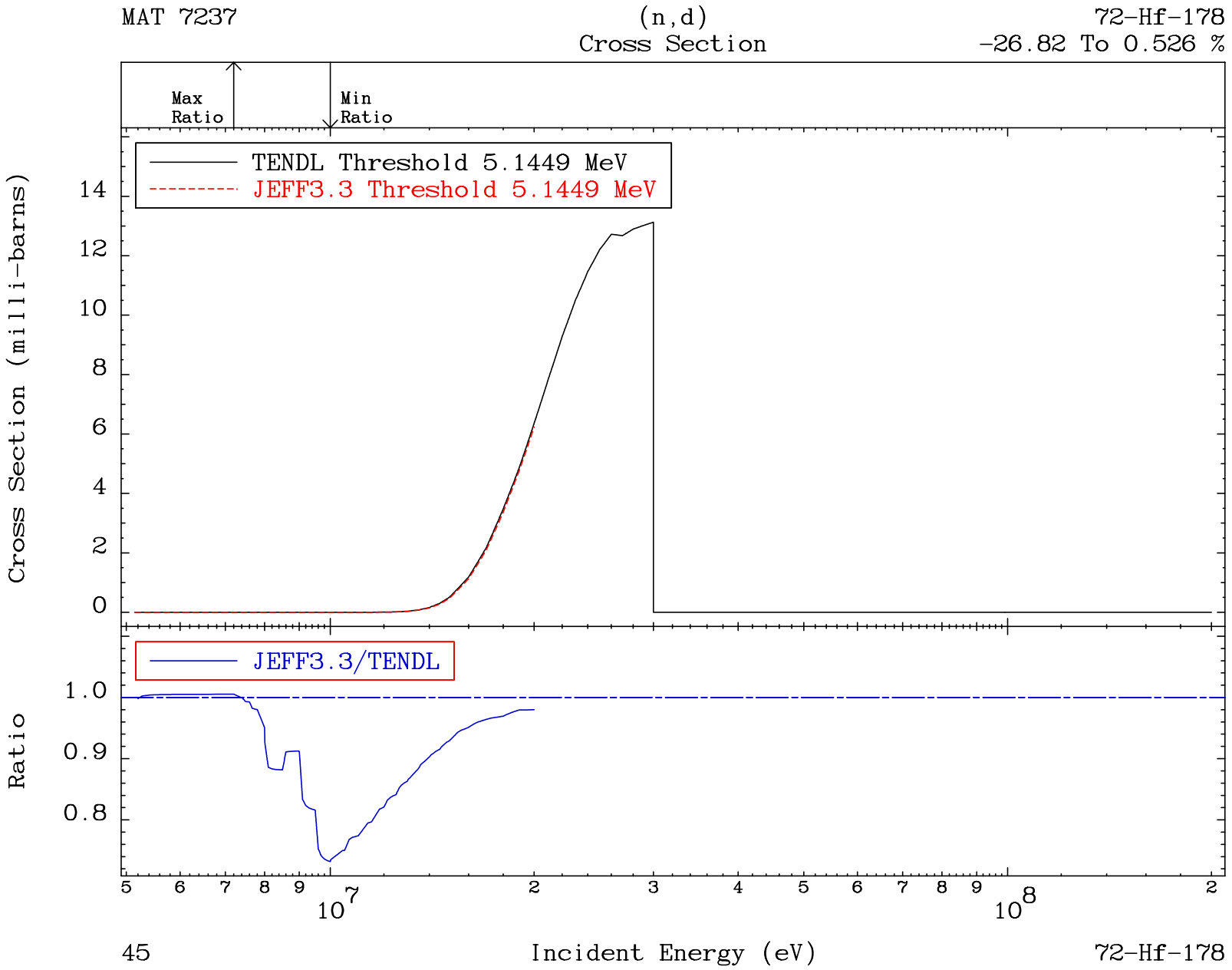

MAT 7237
MT= 78 (n,n') Level
Cross Section
72-Hf-178
-0.689 To 1.704 %
Max
Ratio
Min
Ratio
TENDL Threshold 1.5475 MeV
JEFF3.3 Threshold 1.5475 MeV
Cross Section (milli-barns)
80
60
40
20
0
JEFF3.3/TENDL
Ratio
1.02
1.01
1.00
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
40
Incident Energy (eV)
72-Hf-178

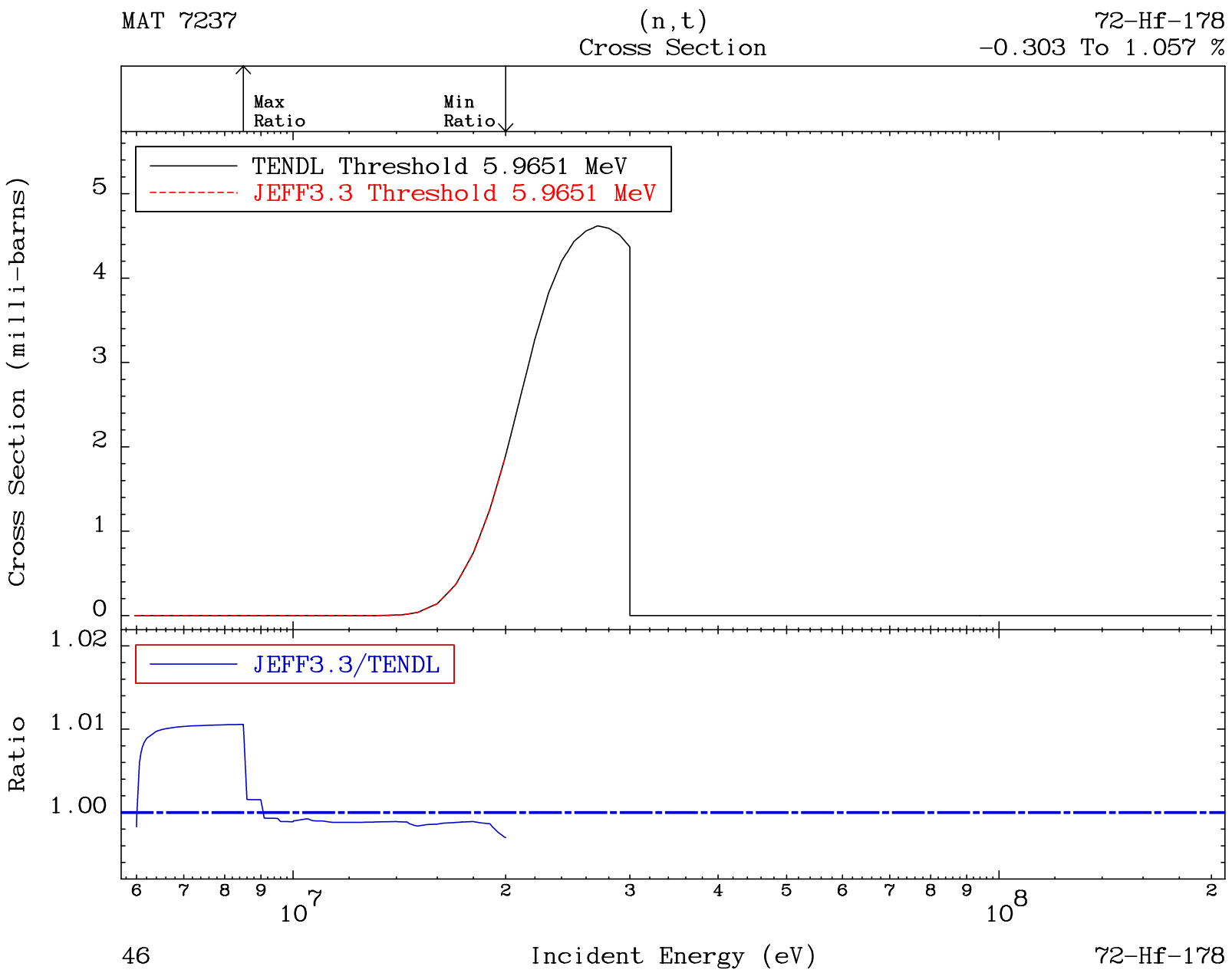

MAT 7237
MT= 79 (n,n') Level
Cross Section
72-Hf-178
-0.025 To 0.546 %
Min Ratio
Max Ratio
TENDL Threshold 1.5628 MeV
JEFF3.3 Threshold 1.5628 MeV
Cross Section (milli-barns)
0
2
4
6
8
10
12
14
JEFF3.3/TENDL
Ratio
1.00
1.01
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
41
Incident Energy (eV)
72-Hf-178

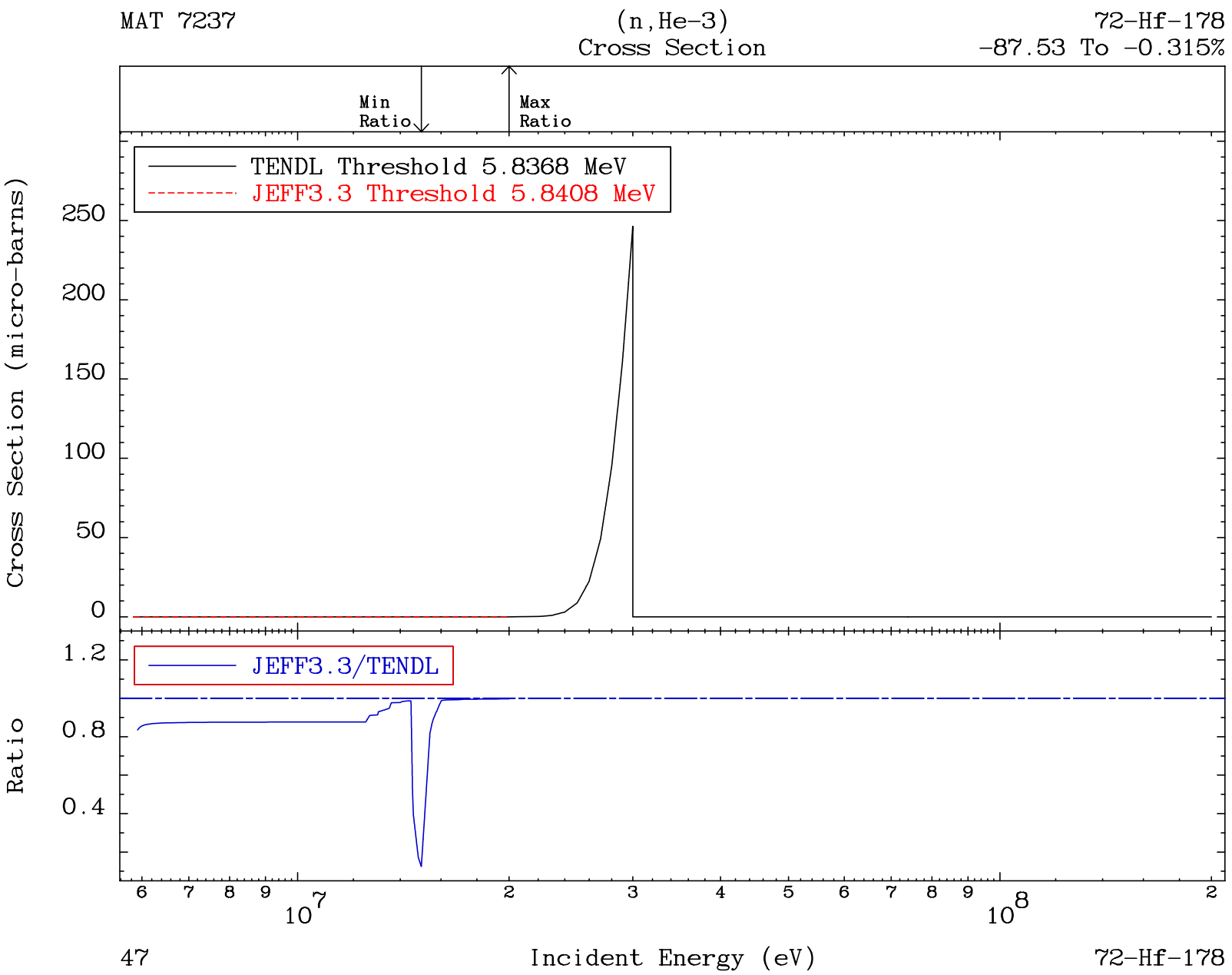

MAT 7237
(n,n') Continuum
Cross Section
72-Hf-178
-99.52 To 81.16 %
Min Ratio
Max Ratio
TENDL Threshold 1.5628 MeV
JEFF3.3 Threshold 1.7000 MeV
Cross Section (barns)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
10^0
10^-1
10^-2
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
42
Incident Energy (eV)
72-Hf-178

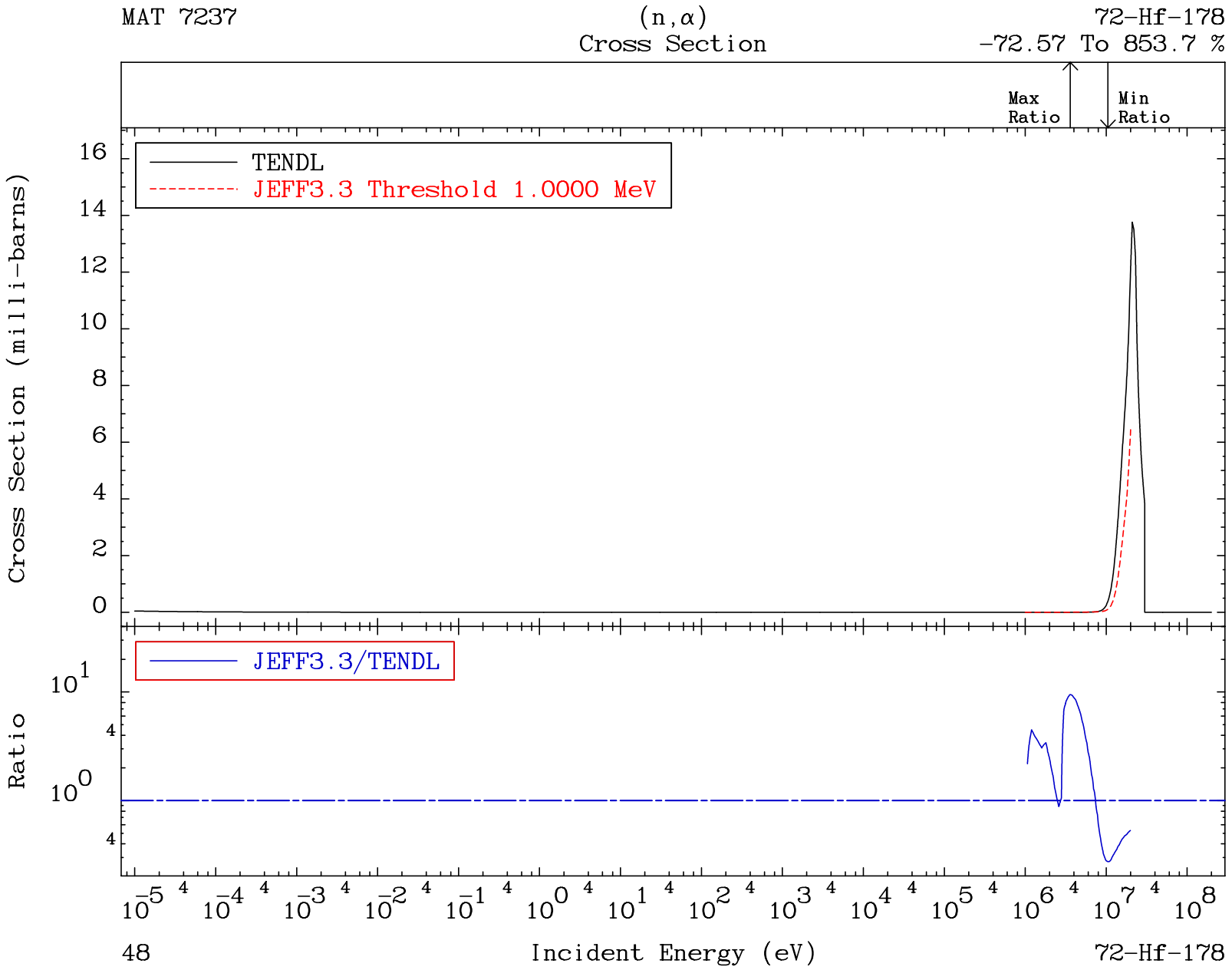

MAT 7237
(n,γ)
Cross Section
72-Hf-178
-99.98 To 9999. %
Min Ratio
Max Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
43
72-Hf-178

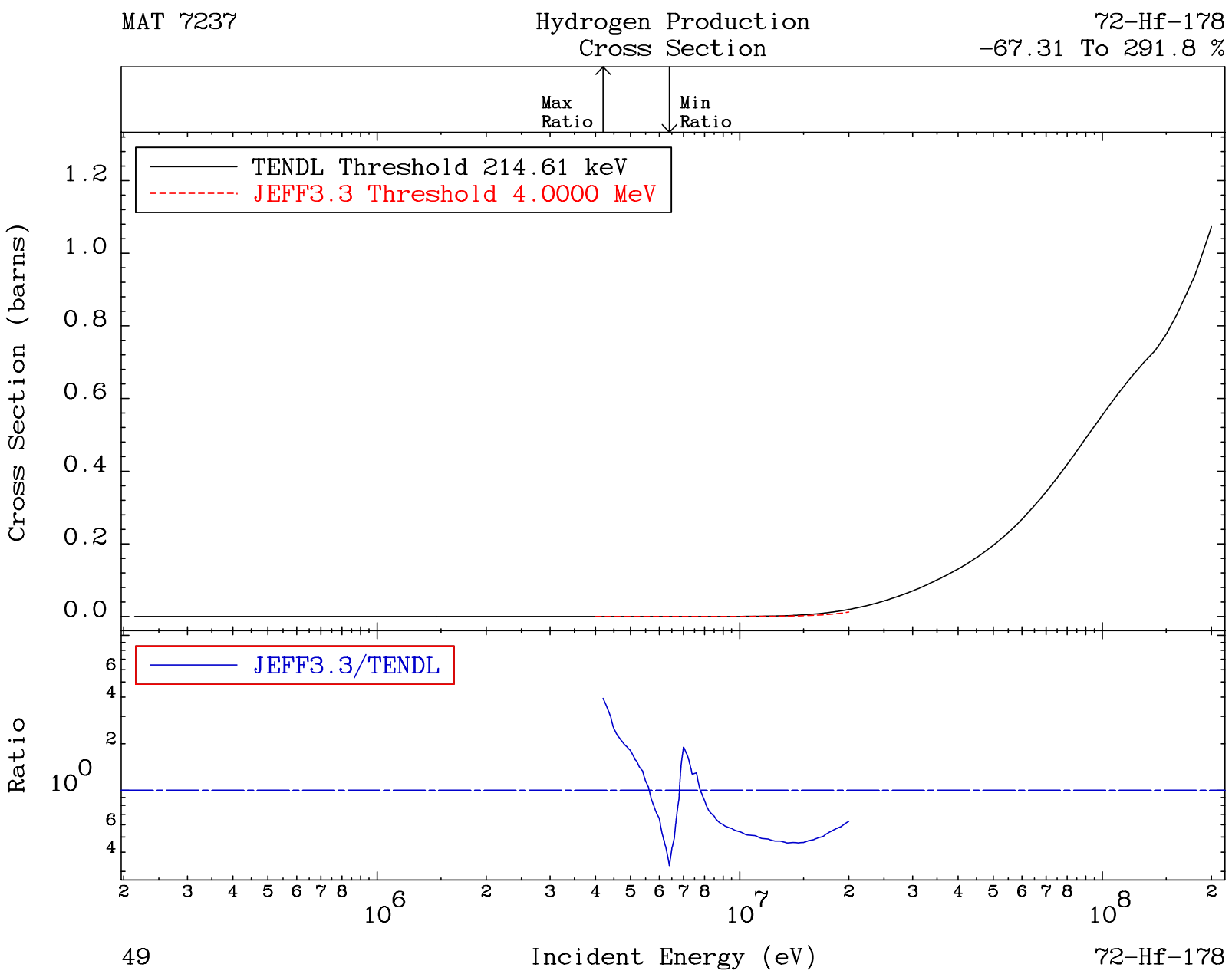

MAT 7237
(n,p)
Cross Section
72-Hf-178
-67.31 To 291.8 %
Max Ratio
Min Ratio
TENDL Threshold 1.3226 MeV
JEFF3.3 Threshold 4.0000 MeV
Cross Section (milli-barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
44
72-Hf-178

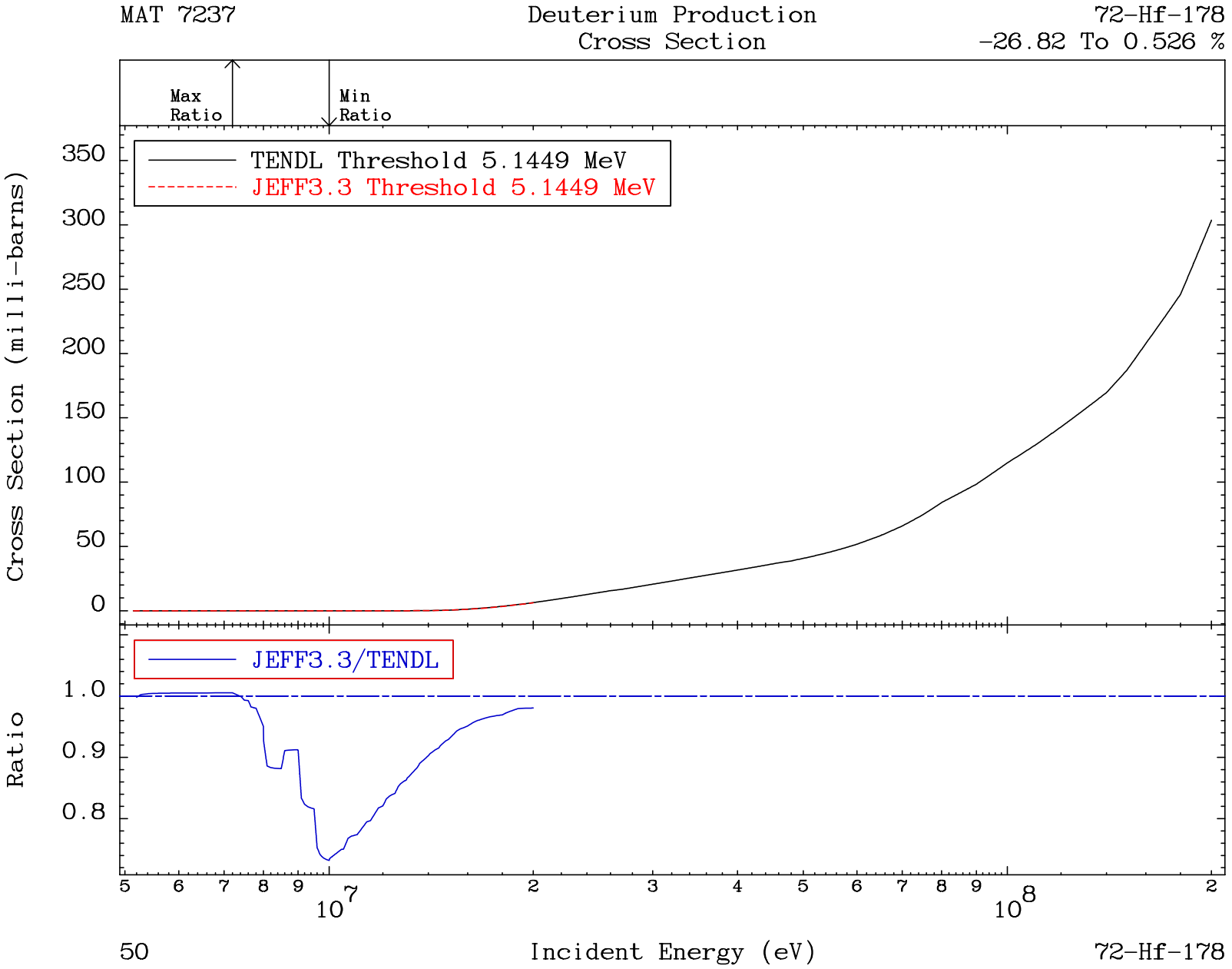

MAT 7237
(n,d)
Cross Section
72-Hf-178
-26.82 To 0.526 %
Max Ratio
Min Ratio
TENDL Threshold 5.1449 MeV
JEFF3.3 Threshold 5.1449 MeV
Cross Section (milli-barns)
14
12
10
8
6
4
2
0
JEFF3.3/TENDL
Ratio
1.0
0.9
0.8
5 6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
45
Incident Energy (eV)
72-Hf-178

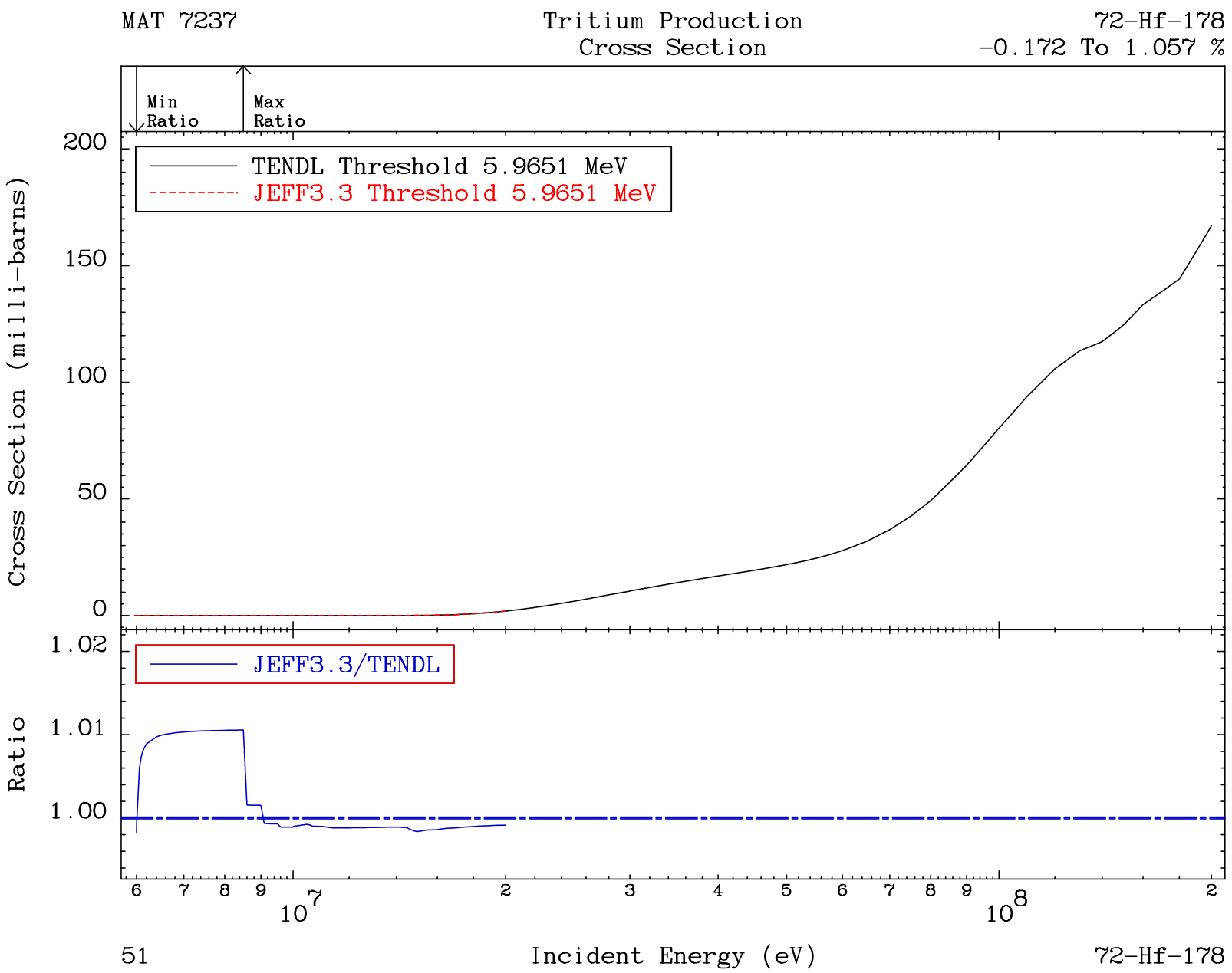

MAT 7237
(n,t)
Cross Section
72-Hf-178
-0.303 To 1.057 %
Max Ratio
Min Ratio
TENDL Threshold 5.9651 MeV
JEFF3.3 Threshold 5.9651 MeV
Cross Section (milli-barns)
0
1
2
3
4
5
JEFF3.3/TENDL
Ratio
1.00
1.01
1.02
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
46
Incident Energy (eV)
72-Hf-178

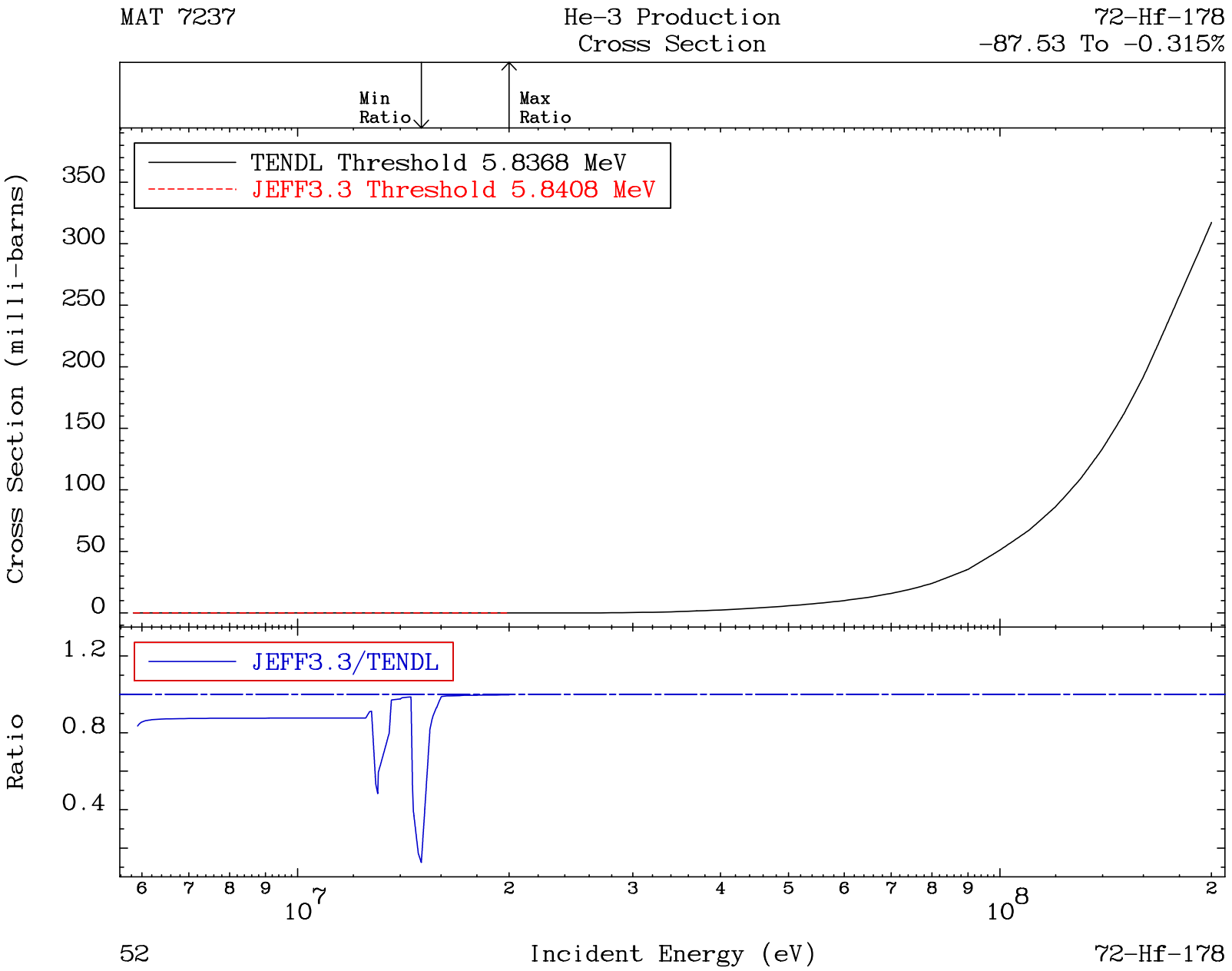

MAT 7237
(n,He-3)
Cross Section
72-Hf-178
-87.53 To -0.315%
Min Ratio
Max Ratio
TENDL Threshold 5.8368 MeV
JEFF3.3 Threshold 5.8408 MeV
Cross Section (micro-barns)
250
200
150
100
50
0
JEFF3.3/TENDL
Ratio
1.2
0.8
0.4
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
47
Incident Energy (eV)
72-Hf-178

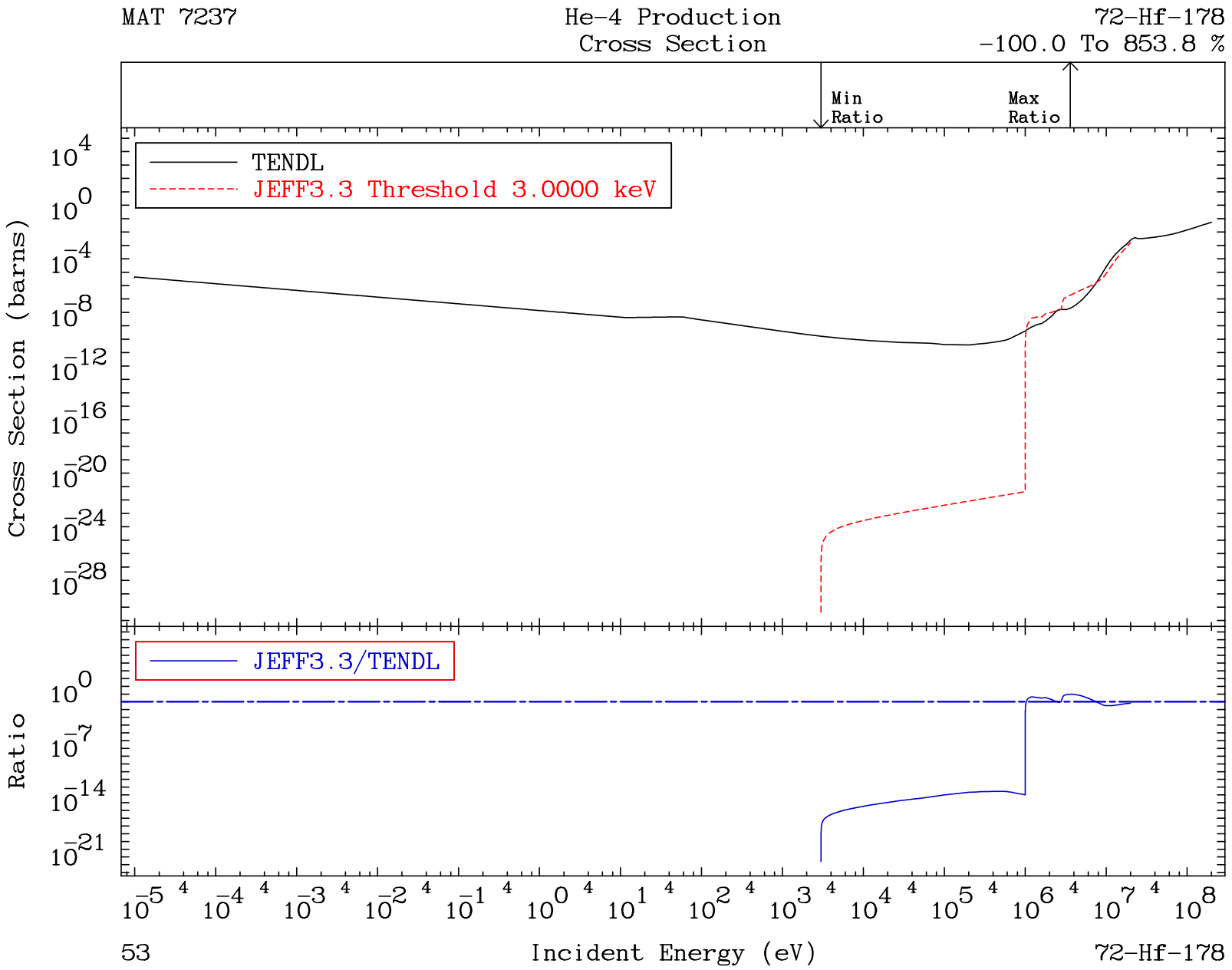

MAT 7237
(n,α)
Cross Section
72-Hf-178
-72.57 To 853.7 %
Max Ratio
Min Ratio
TENDL
JEFF3.3 Threshold 1.0000 MeV
Cross Section (milli-barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
48
72-Hf-178

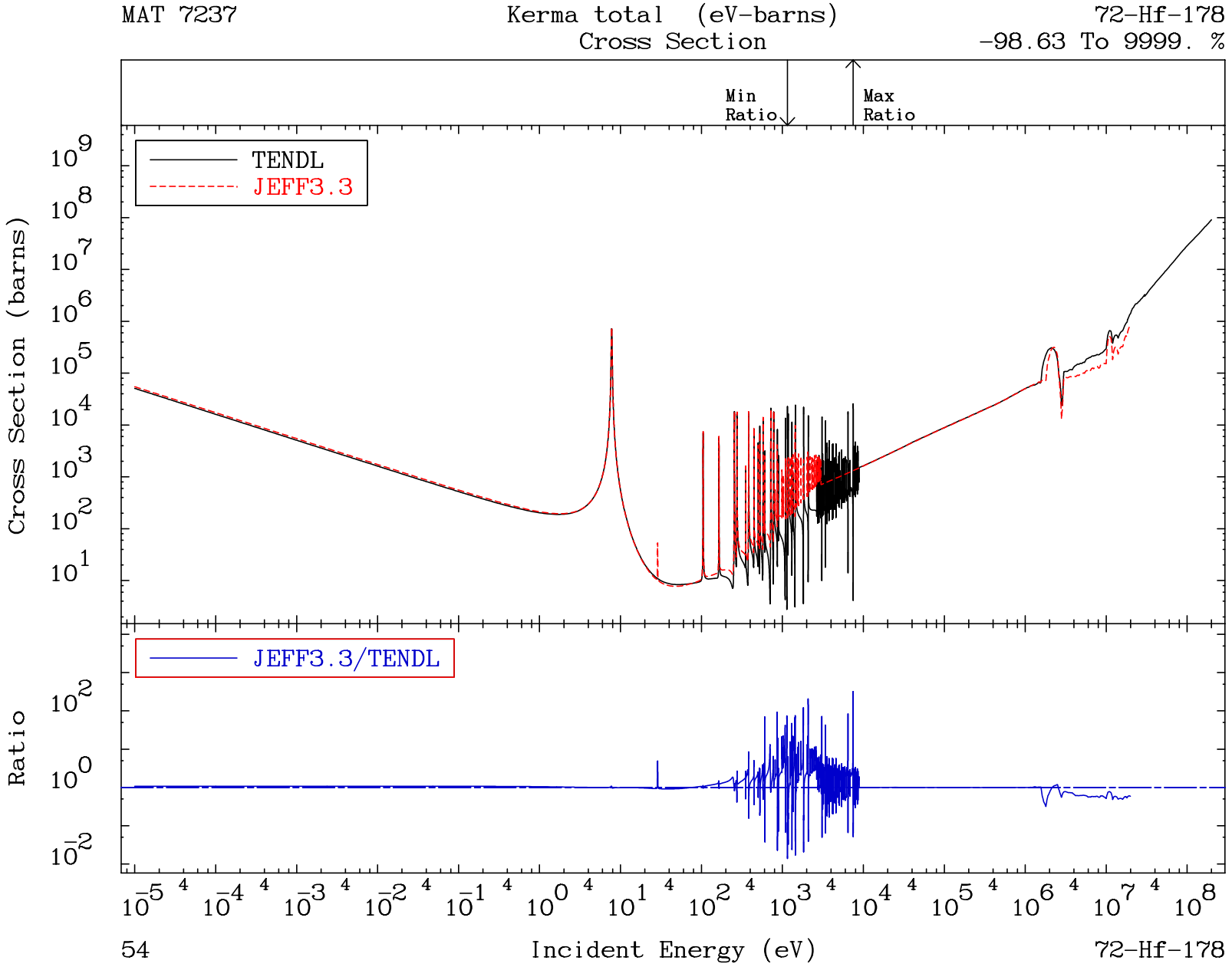

MAT 7237
Hydrogen Production
Cross Section
72-Hf-178
-67.31 To 291.8 %
Max Ratio
Min Ratio
TENDL Threshold 214.61 keV
JEFF3.3 Threshold 4.0000 MeV
Cross Section (barns)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
JEFF3.3/TENDL
Ratio
10^0
6
4
2
6
4
2 3 4 5 6 7 8 10^6 2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
49
Incident Energy (eV)
72-Hf-178

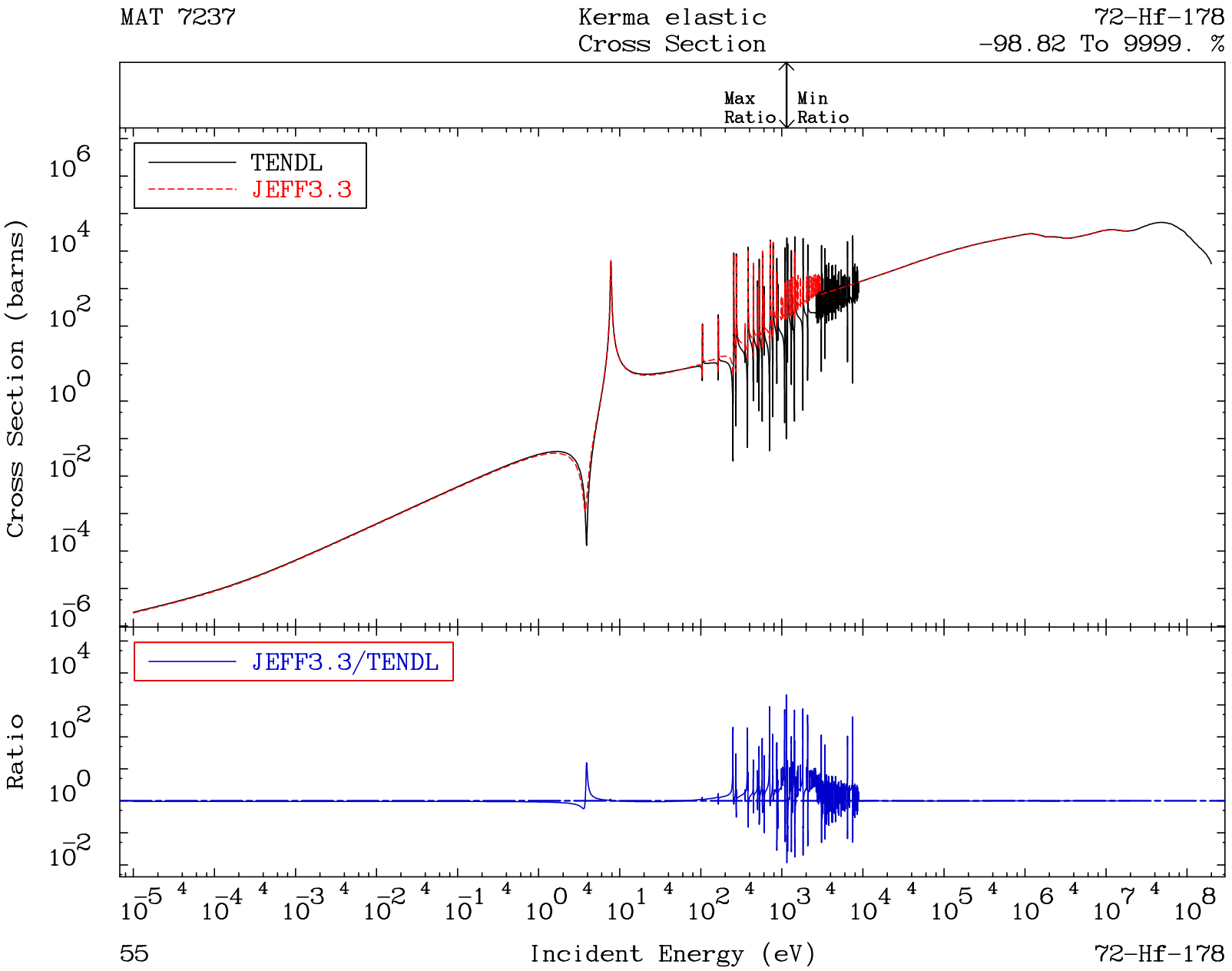

MAT 7237
Deuterium Production
Cross Section
72-Hf-178
-26.82 To 0.526 %
Max Ratio
Min Ratio
TENDL Threshold 5.1449 MeV
JEFF3.3 Threshold 5.1449 MeV
Cross Section (milli-barns)
350
300
250
200
150
100
50
0
JEFF3.3/TENDL
Ratio
1.0
0.9
0.8
5 6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
50
Incident Energy (eV)
72-Hf-178

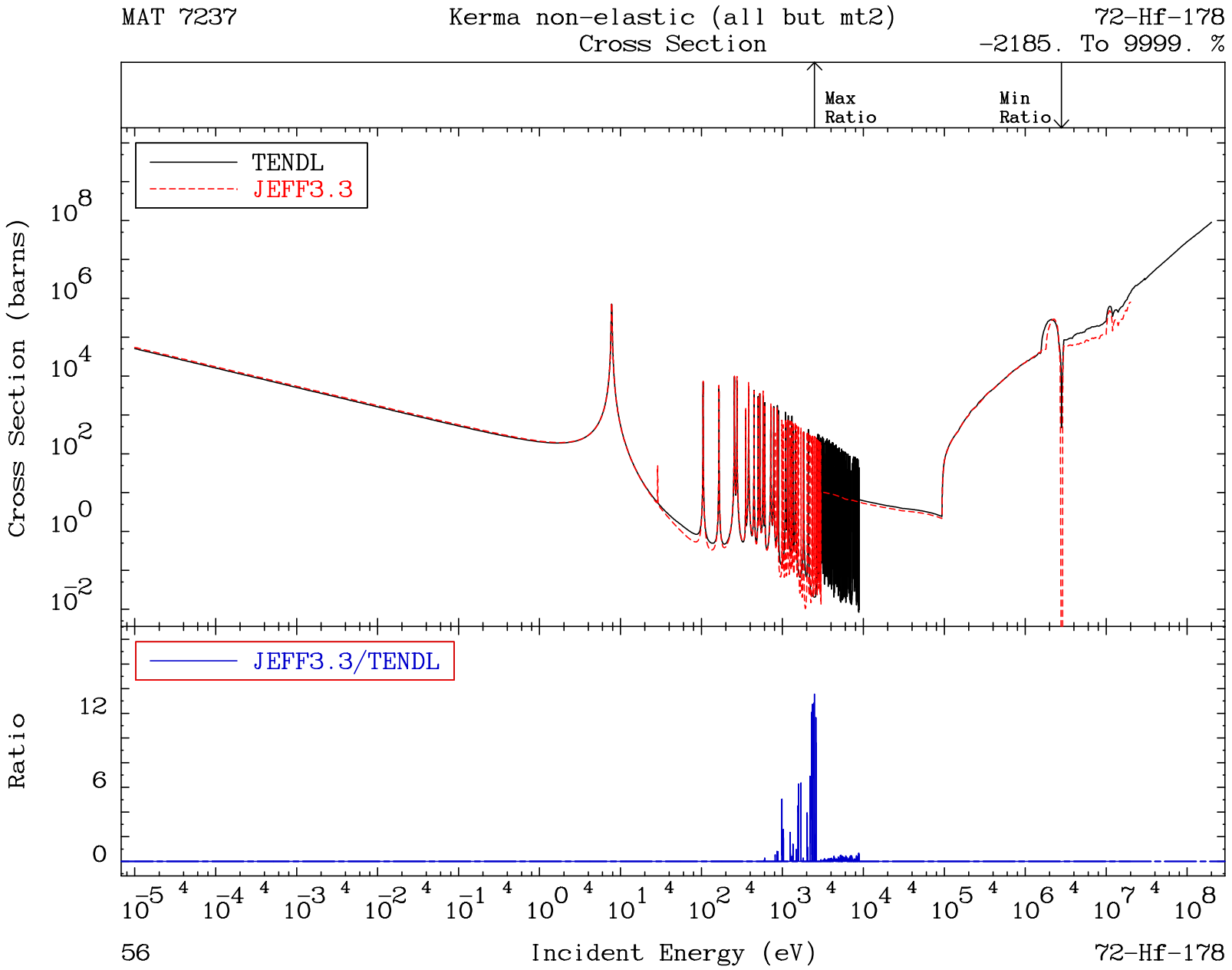

MAT 7237
Tritium Production
Cross Section
72-Hf-178
-0.172 To 1.057 %
Min Ratio
Max Ratio
TENDL Threshold 5.9651 MeV
JEFF3.3 Threshold 5.9651 MeV
Cross Section (milli-barns)
200
150
100
50
0
JEFF3.3/TENDL
Ratio
1.02
1.01
1.00
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
51
Incident Energy (eV)
72-Hf-178

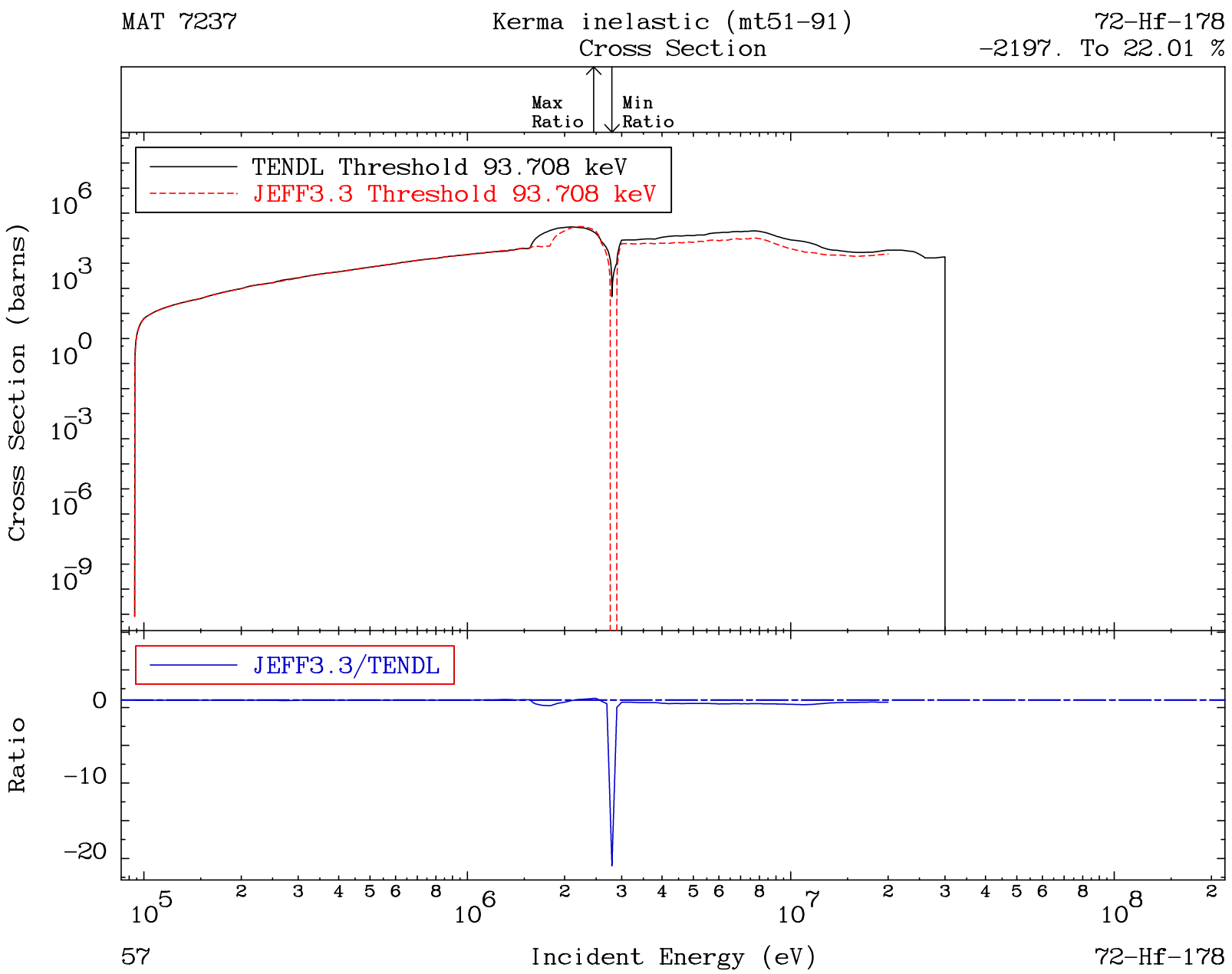

MAT 7237
He-3 Production
Cross Section
72-Hf-178
-87.53 To -0.315%
Min Ratio
Max Ratio
TENDL Threshold 5.8368 MeV
JEFF3.3 Threshold 5.8408 MeV
Cross Section (milli-barns)
350
300
250
200
150
100
50
0
JEFF3.3/TENDL
Ratio
1.2
0.8
0.4
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
52
Incident Energy (eV)
72-Hf-178

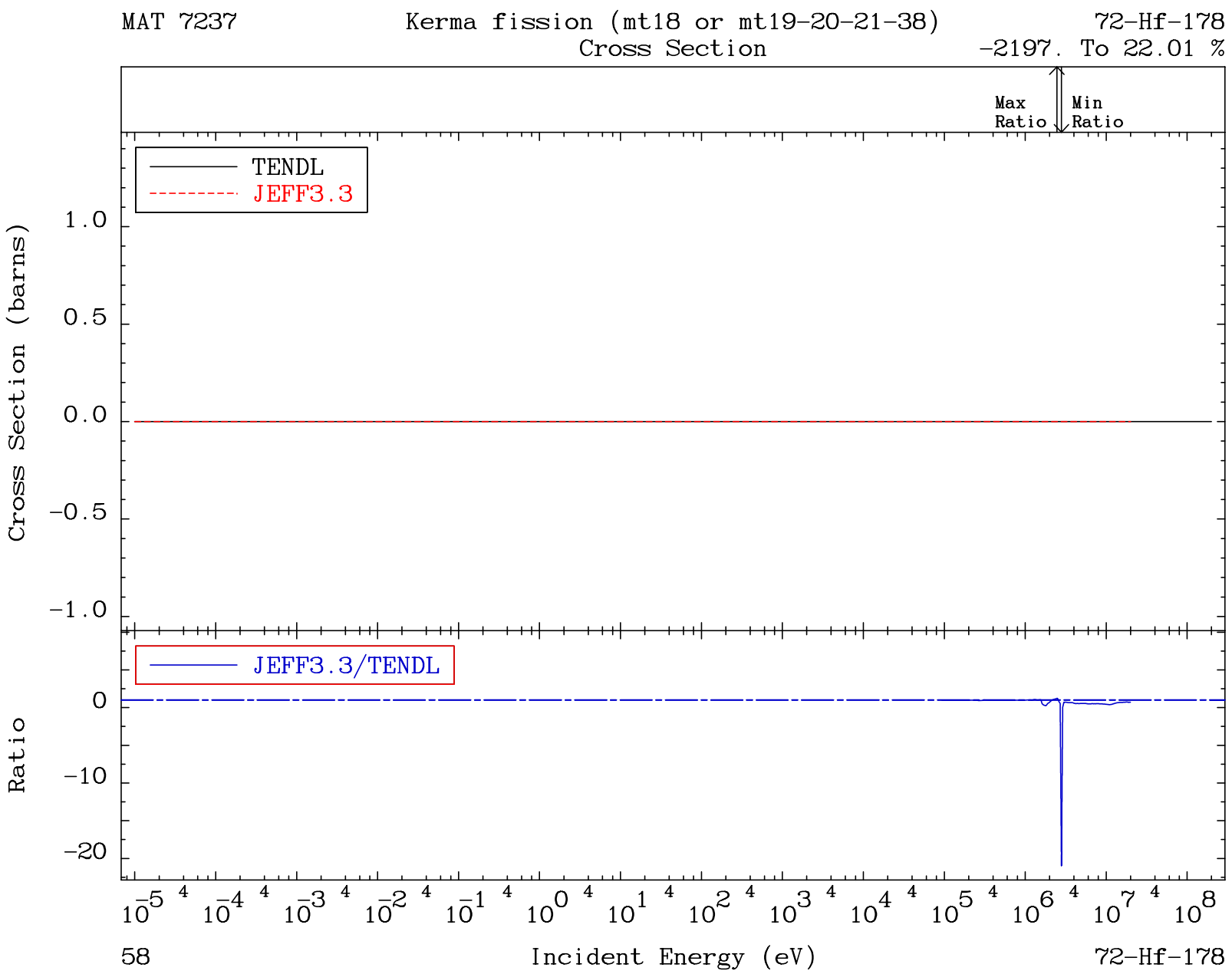

MAT 7237
He-4 Production
Cross Section
72-Hf-178
-100.0 To 853.8 %
Min Ratio
Max Ratio
TENDL
JEFF3.3 Threshold 3.0000 keV
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
53
72-Hf-178

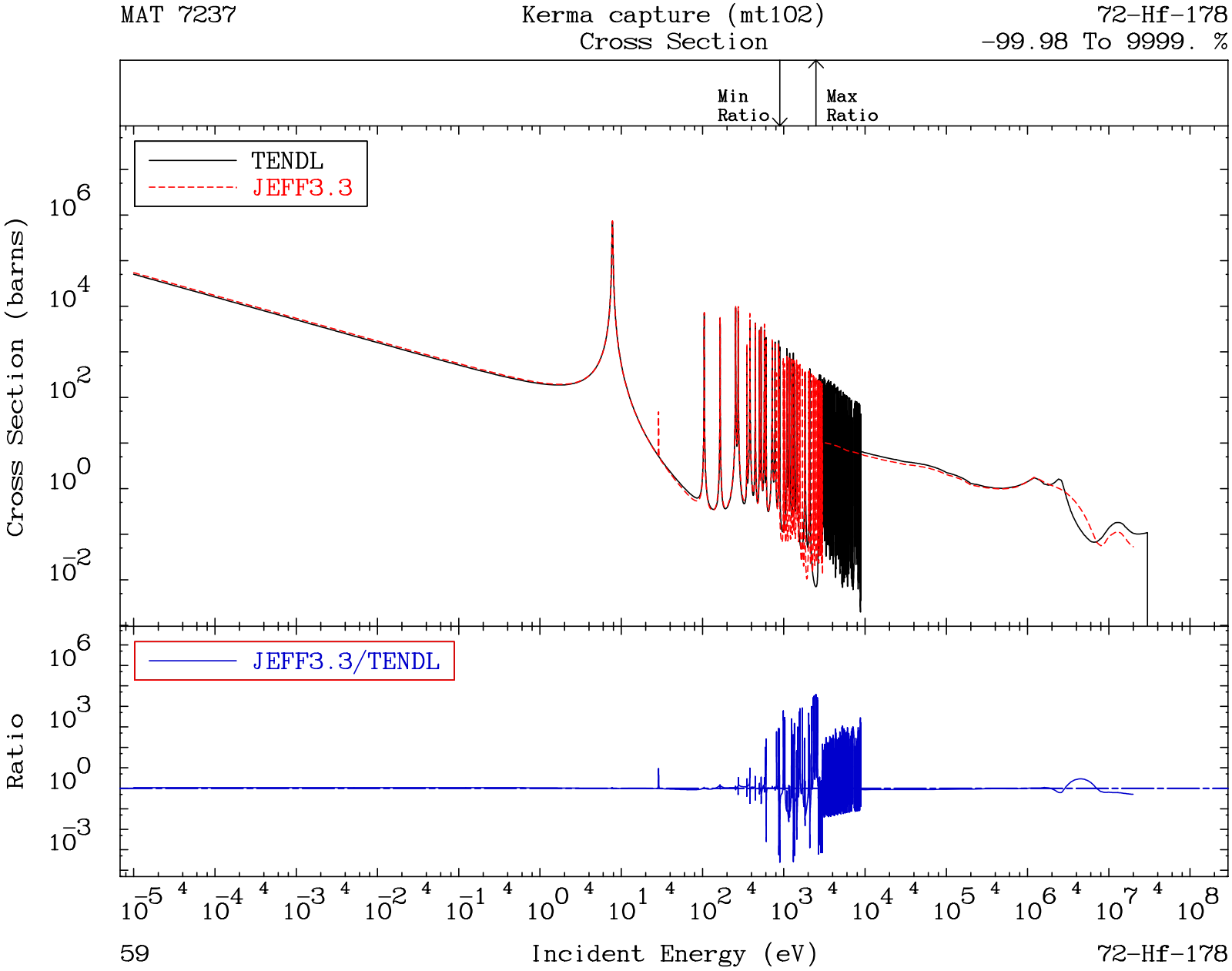

MAT 7237
Kerma total (eV-barns)
Cross Section
72-Hf-178
-98.63 To 9999. %
Min Ratio
Max Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
54
72-Hf-178

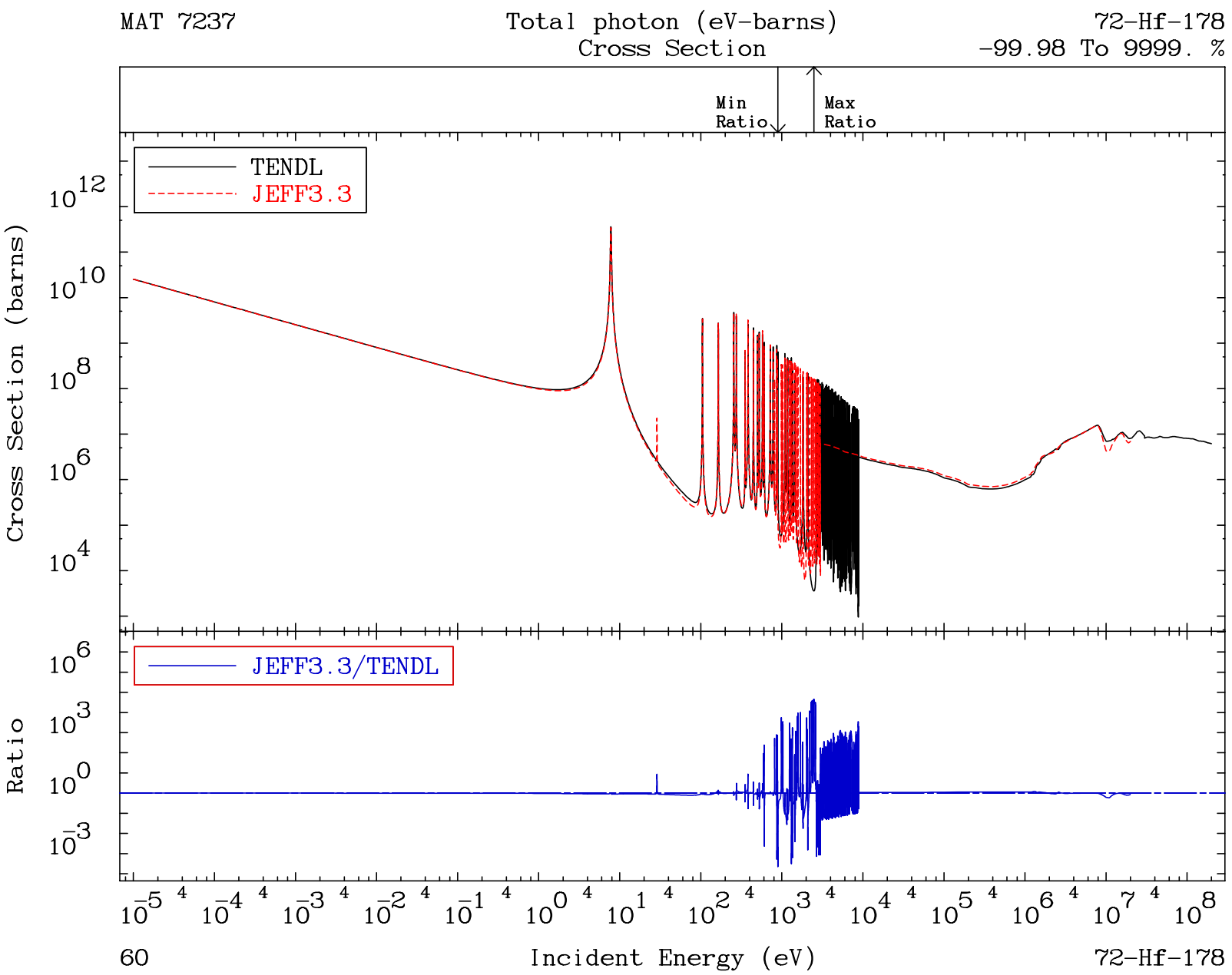

MAT 7237
Kerma elastic
Cross Section
72-Hf-178
-98.82 To 9999. %
Max Ratio
Min Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
55
72-Hf-178

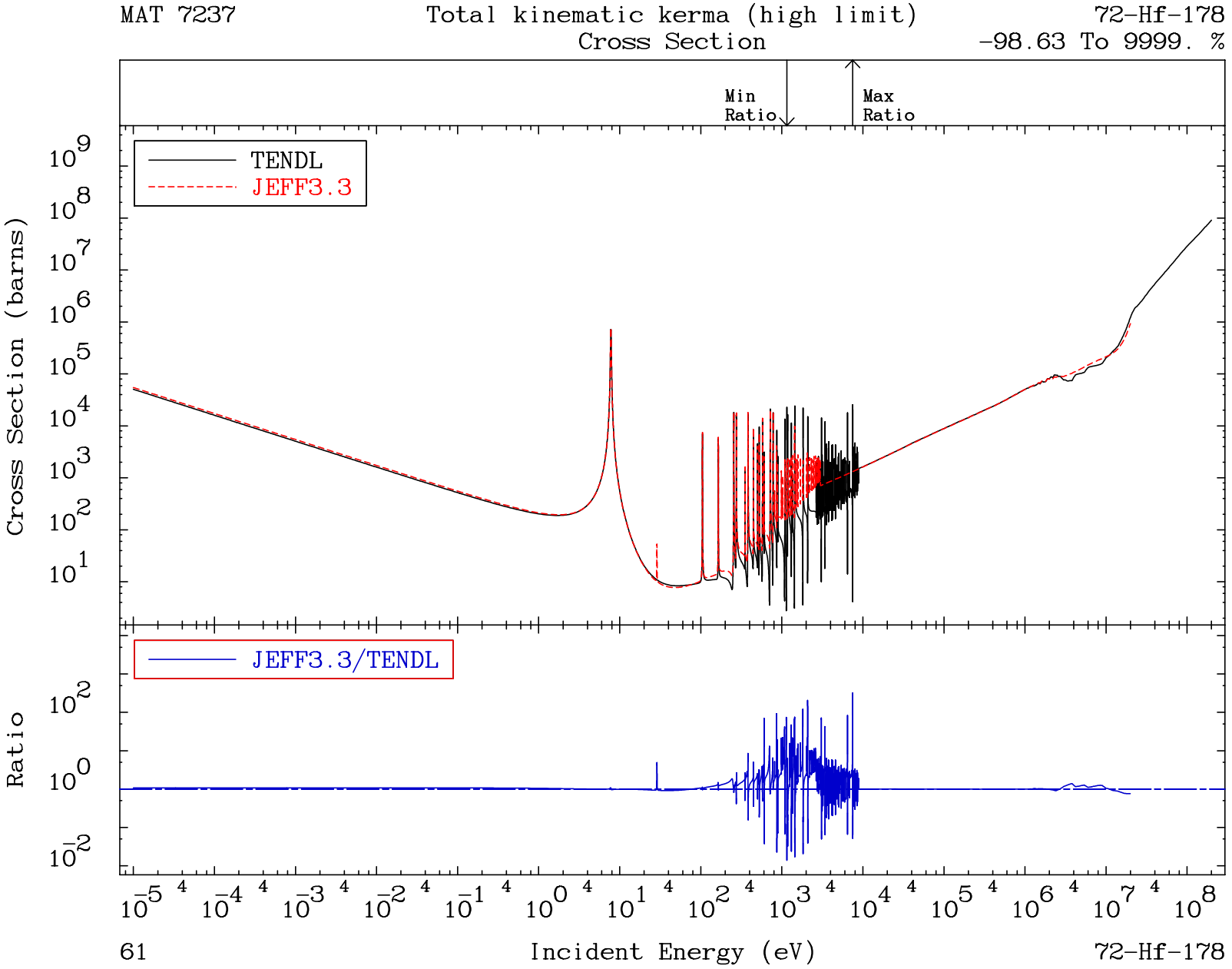

MAT 7237
Kerma non-elastic (all but mt2)
Cross Section
72-Hf-178
-2185. To 9999. %
Max Ratio
Min Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
56
72-Hf-178

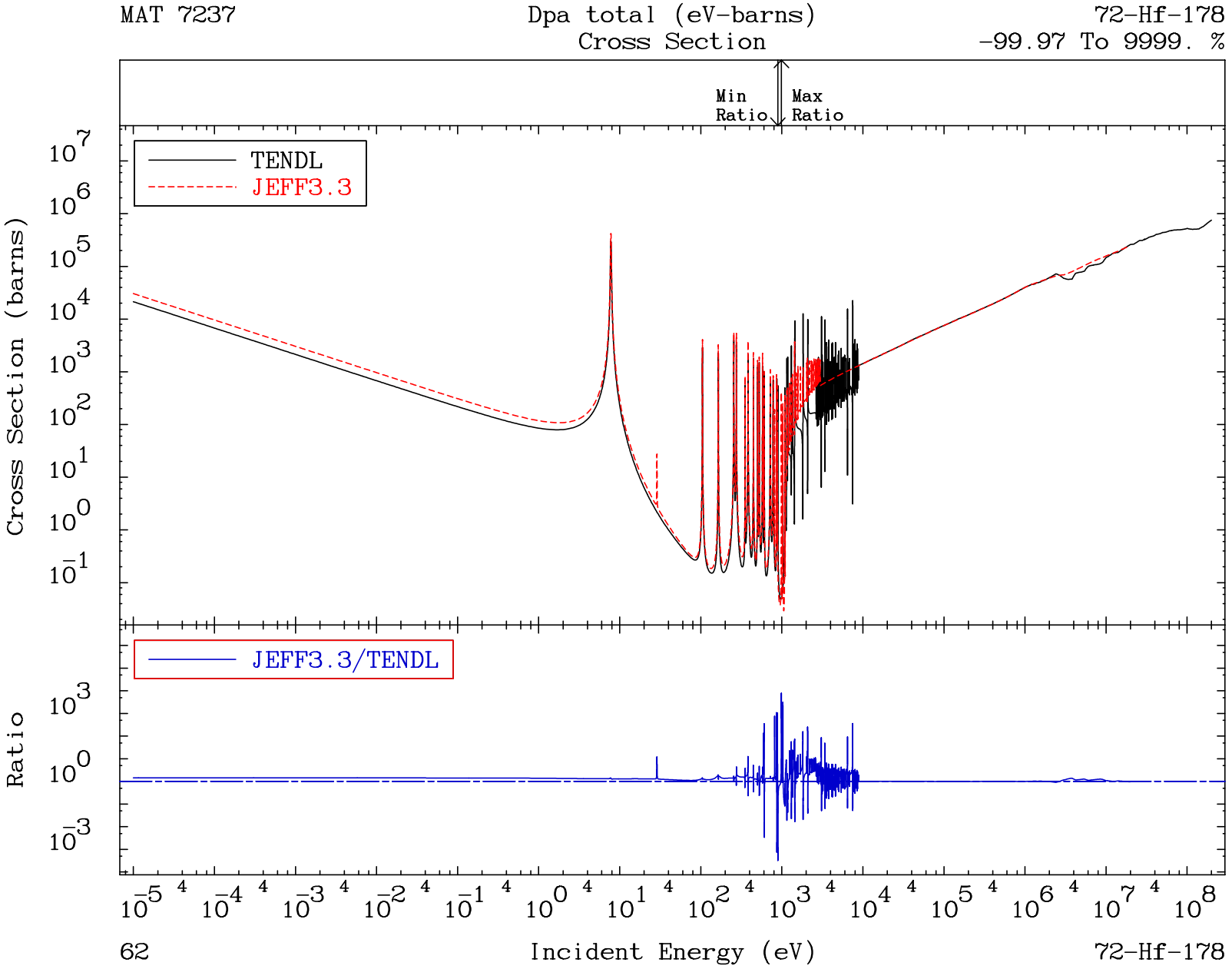

MAT 7237
Kerma inelastic (mt51-91)
Cross Section
72-Hf-178
-2197. To 22.01 %
Max Ratio
Min Ratio
TENDL Threshold 93.708 keV
JEFF3.3 Threshold 93.708 keV
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
57
72-Hf-178

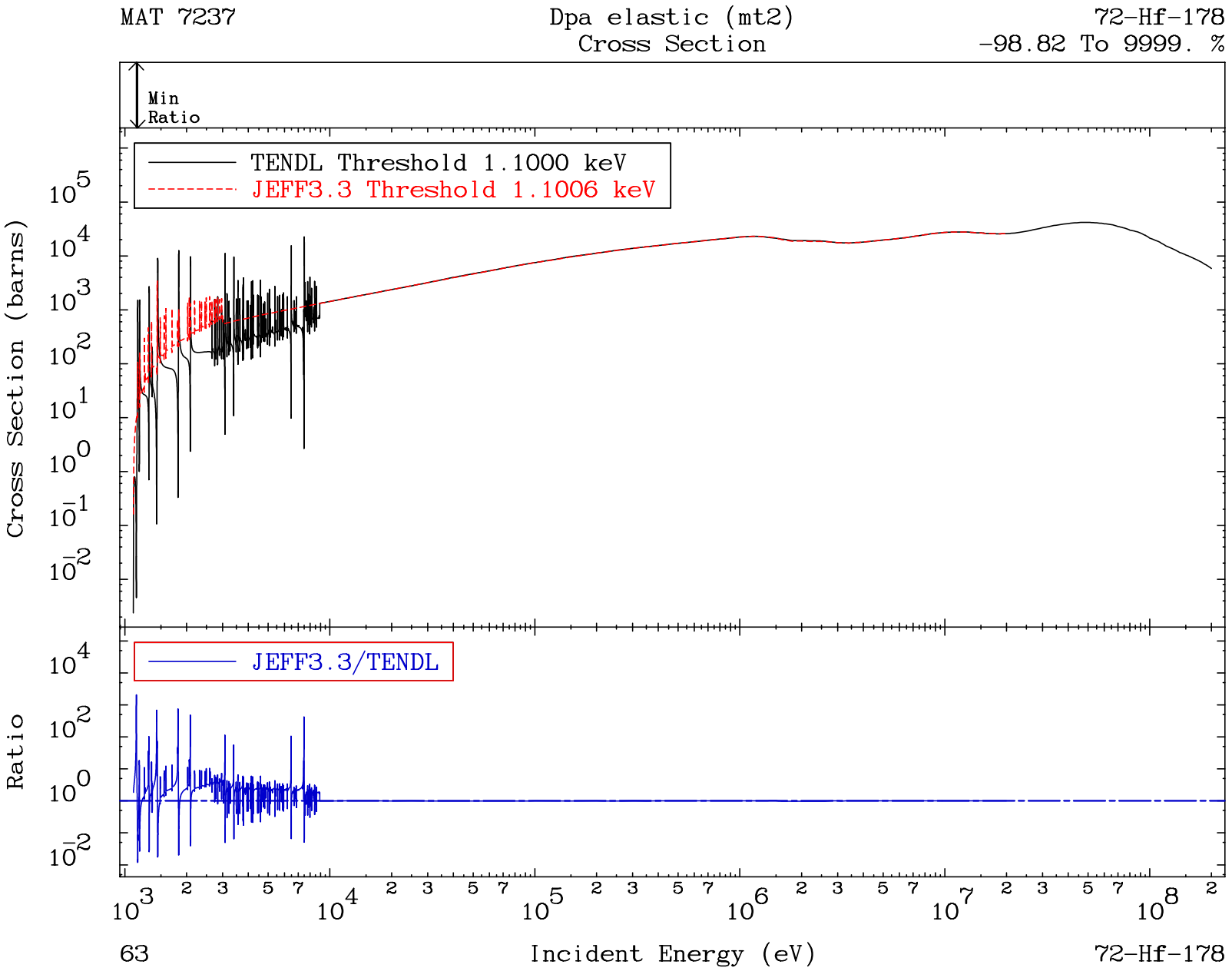

MAT 7237
Kerma fission (mt18 or mt19-20-21-38)
Cross Section
72-Hf-178
-2197. To 22.01 %
Max Ratio
Min Ratio
TENDL
JEFF3.3
Cross Section (barns)
1.0
0.5
0.0
-0.5
-1.0
JEFF3.3/TENDL
Ratio
0
-10
-20
10-5 4 10-4 4 10-3 4 10-2 4 10-1 4 100 4 101 4 102 4 103 4 104 4 105 4 106 4 107 4 108
58
Incident Energy (eV)
72-Hf-178

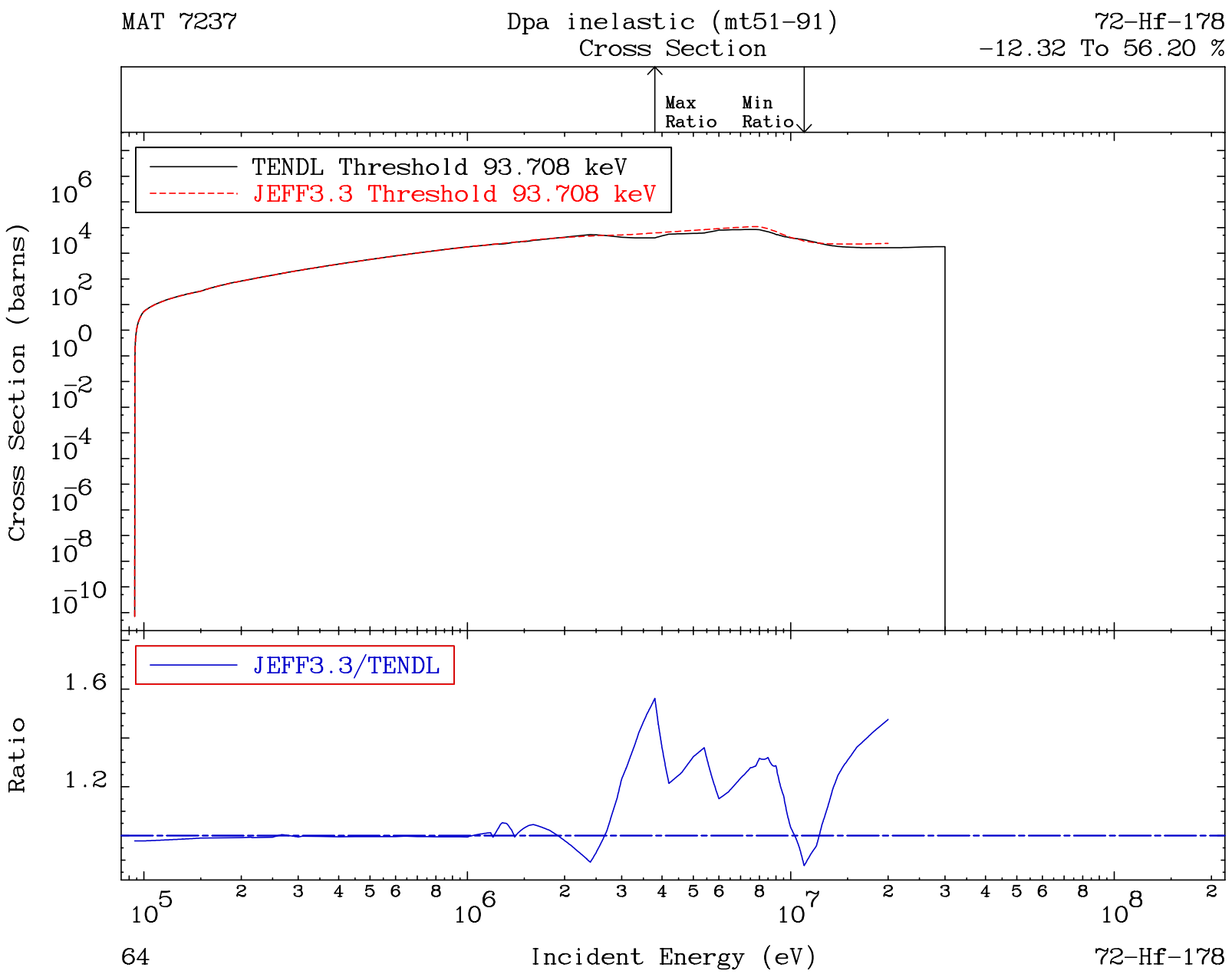

MAT 7237
Kerma capture (mt102)
Cross Section
72-Hf-178
-99.98 To 9999. %
Min Ratio
Max Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
59
Incident Energy (eV)
72-Hf-178

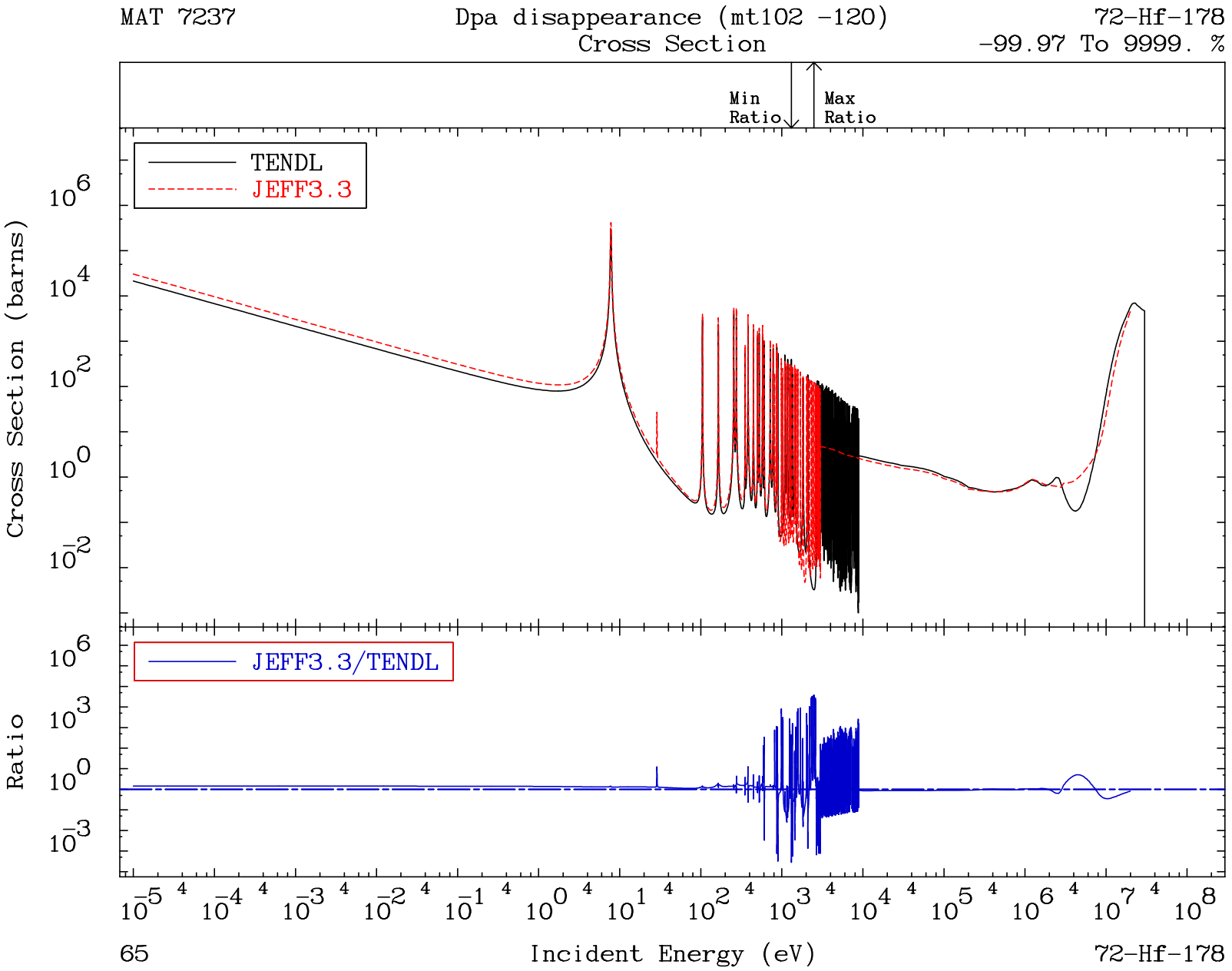

MAT 7237
Total photon (eV-barns)
Cross Section
72-Hf-178
-99.98 To 9999. %
Min Ratio
Max Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
60
72-Hf-178

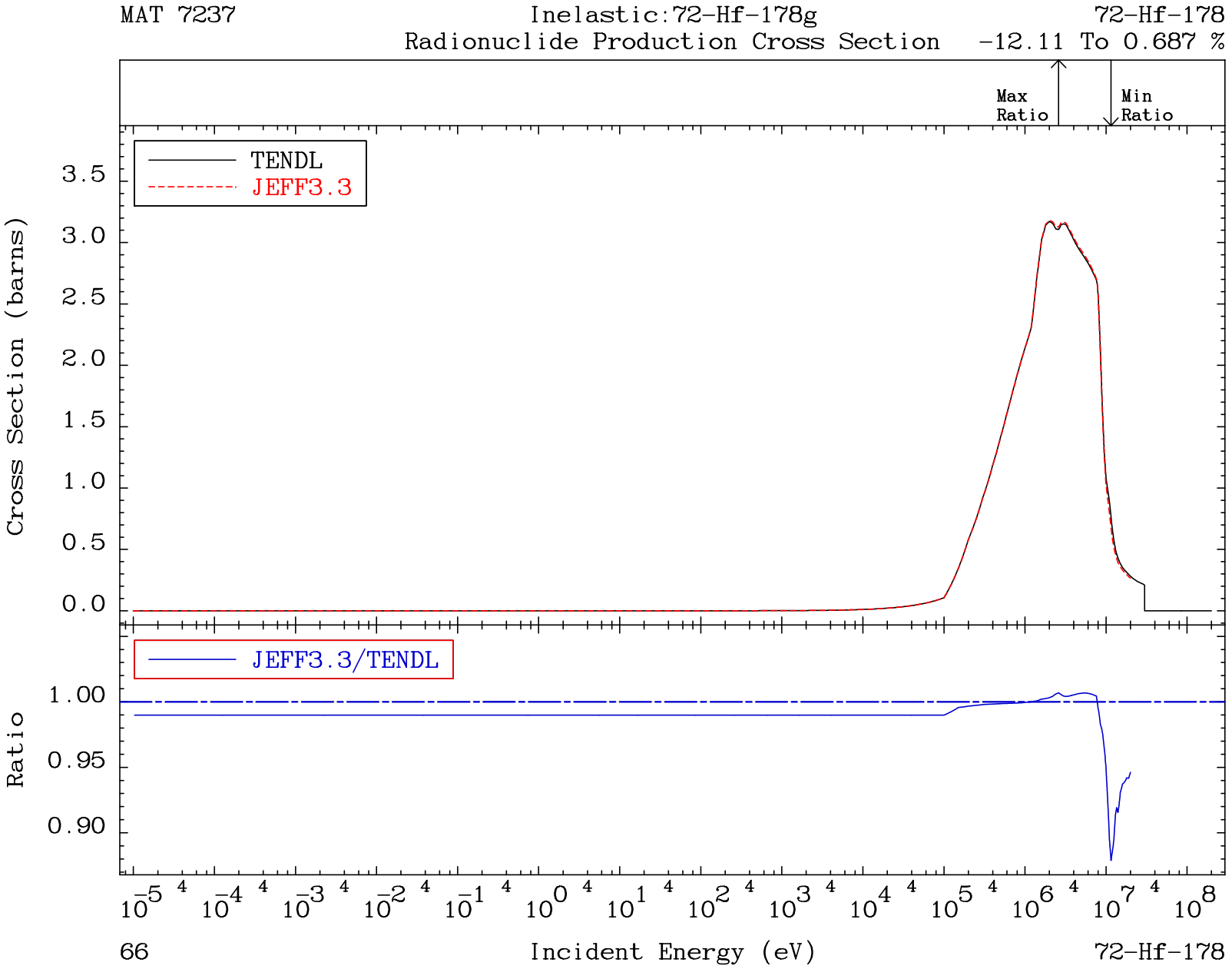

MAT 7237
Total kinematic kerma (high limit)
Cross Section
72-Hf-178
-98.63 To 9999. %
Min Ratio
Max Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
61
72-Hf-178

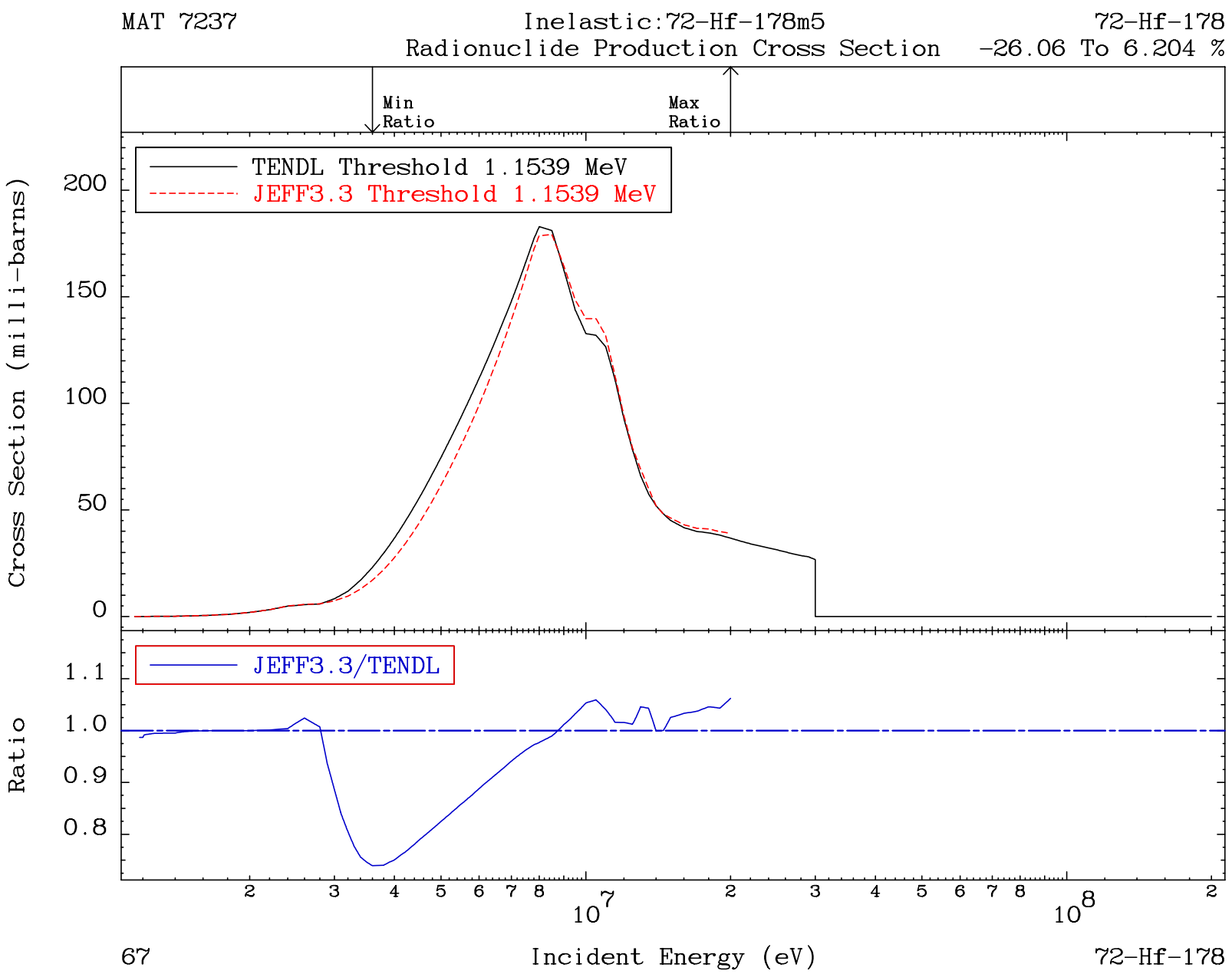

MAT 7237
Dpa total (eV-barns)
Cross Section
72-Hf-178
-99.97 To 9999. %
Min Ratio
Max Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
62
72-Hf-178

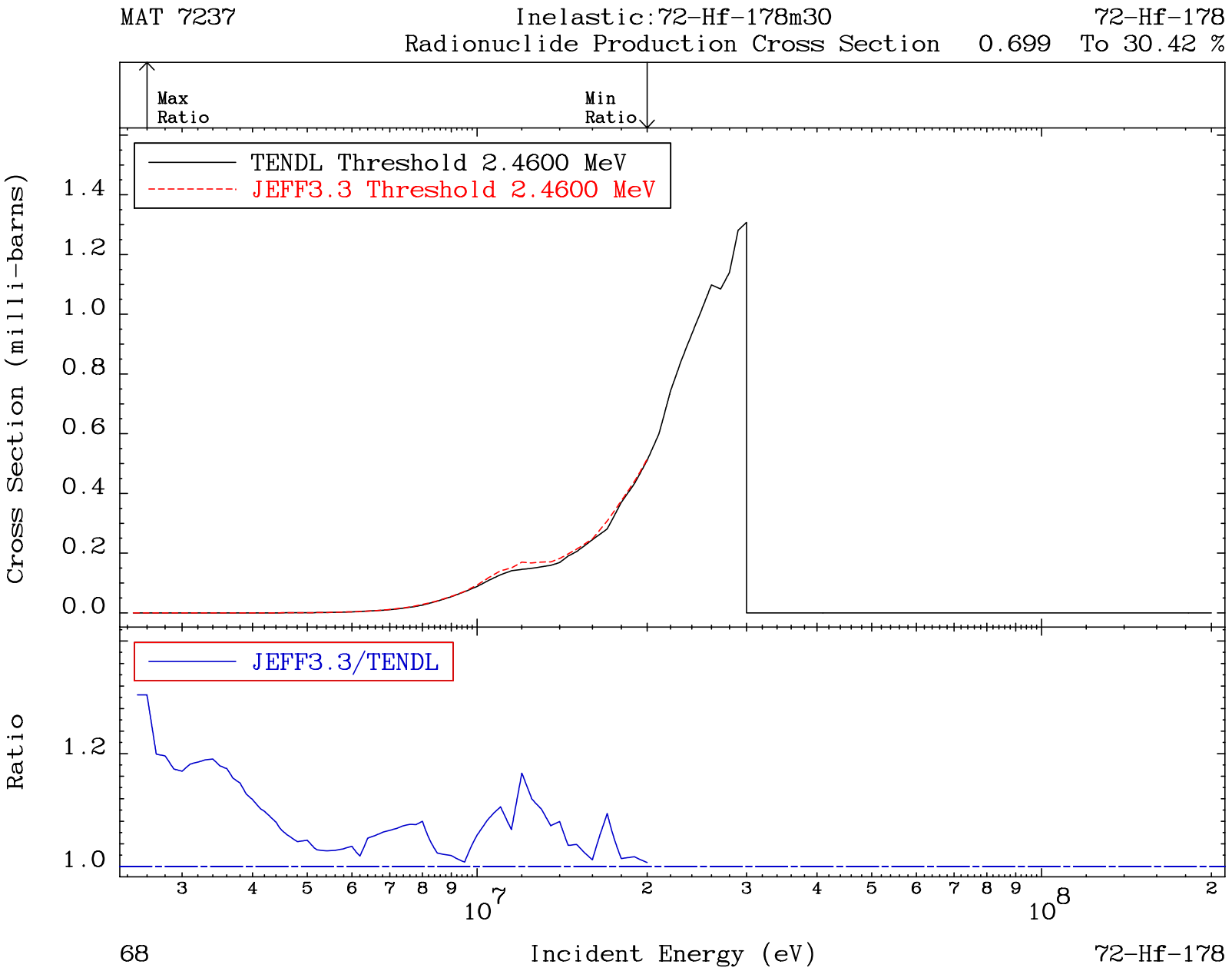

MAT 7237
Dpa elastic (mt2)
Cross Section
72-Hf-178
-98.82 To 9999. %
Min
Ratio
TENDL Threshold 1.1000 keV
JEFF3.3 Threshold 1.1006 keV
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
63
72-Hf-178

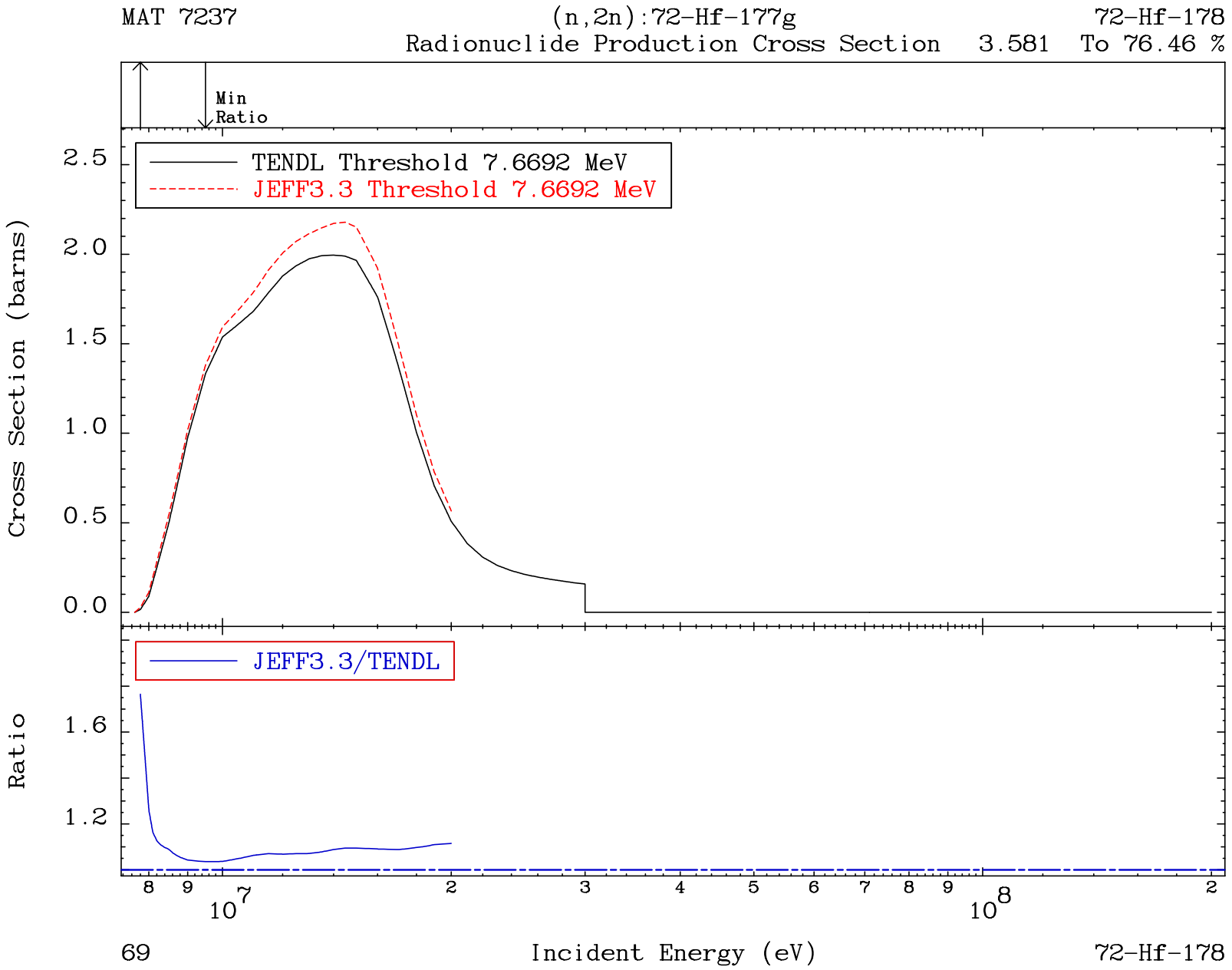

MAT 7237
Dpa inelastic (mt51-91)
Cross Section
72-Hf-178
-12.32 To 56.20 %
Max Ratio
Min Ratio
TENDL Threshold 93.708 keV
JEFF3.3 Threshold 93.708 keV
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
64
72-Hf-178

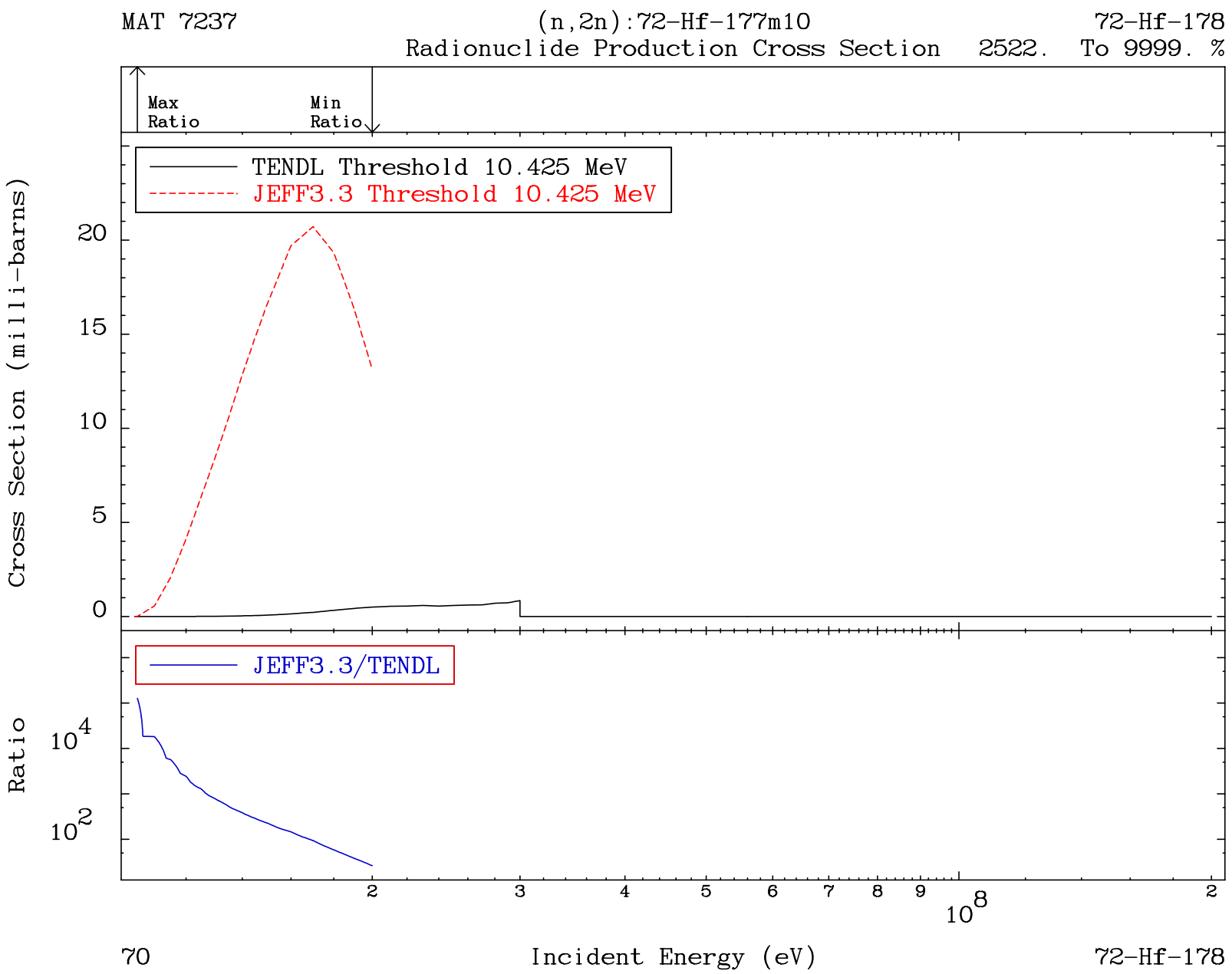

MAT 7237
Dpa disappearance (mt102 -120)
Cross Section
72-Hf-178
-99.97 To 9999. %
Min Ratio
Max Ratio
TENDL
JEFF3.3
Cross Section (barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
65
72-Hf-178

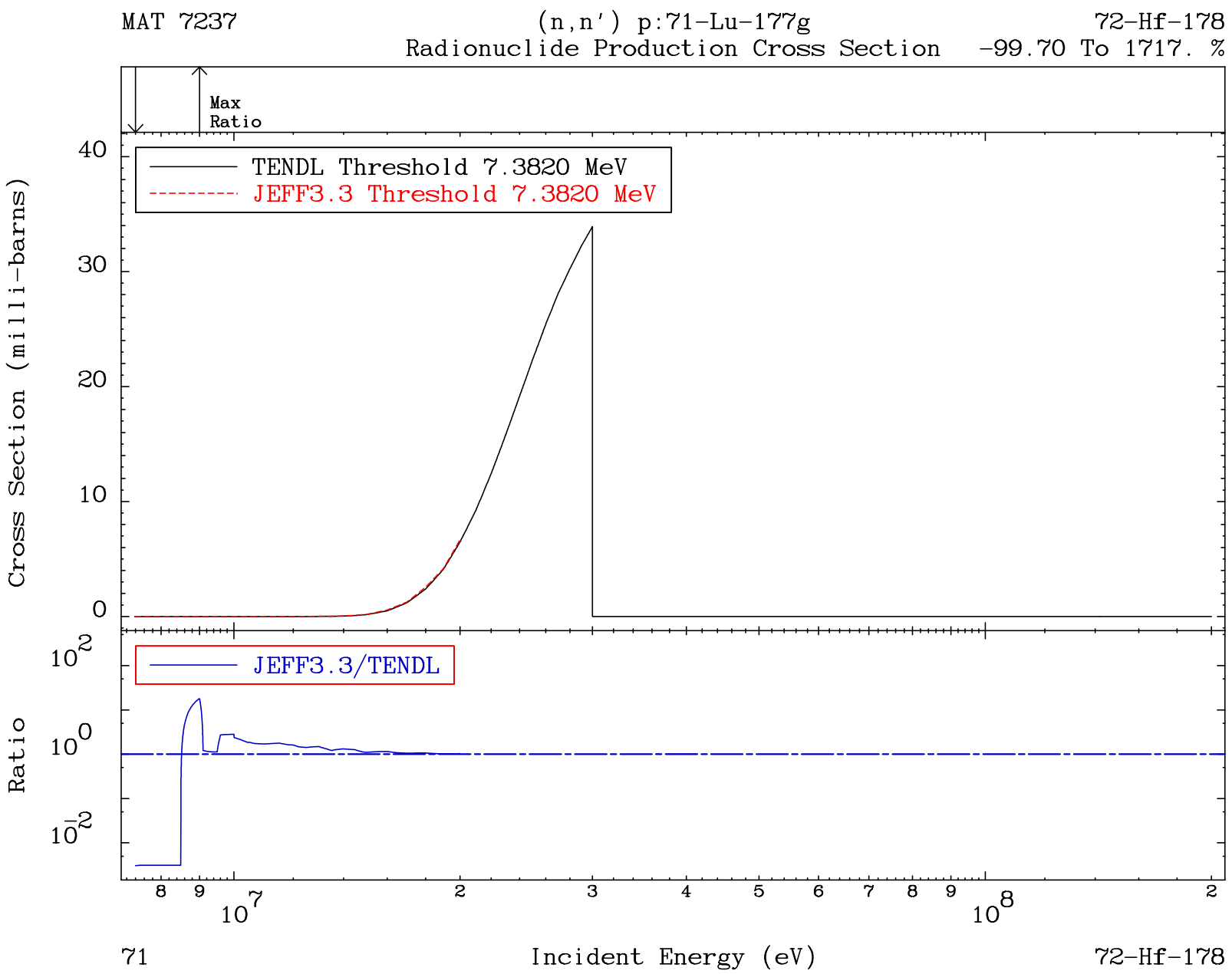

MAT 7237
Inelastic:72-Hf-178g
72-Hf-178
Radionuclide Production Cross Section
-12.11 To 0.687 %
Max Ratio
Min Ratio
TENDL
JEFF3.3
Cross Section (barns)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
1.00
0.95
0.90
10^-5 10^-4 10^-3 10^-2 10^-1 10^0 10^1 10^2 10^3 10^4 10^5 10^6 10^7 10^8
66
Incident Energy (eV)
72-Hf-178

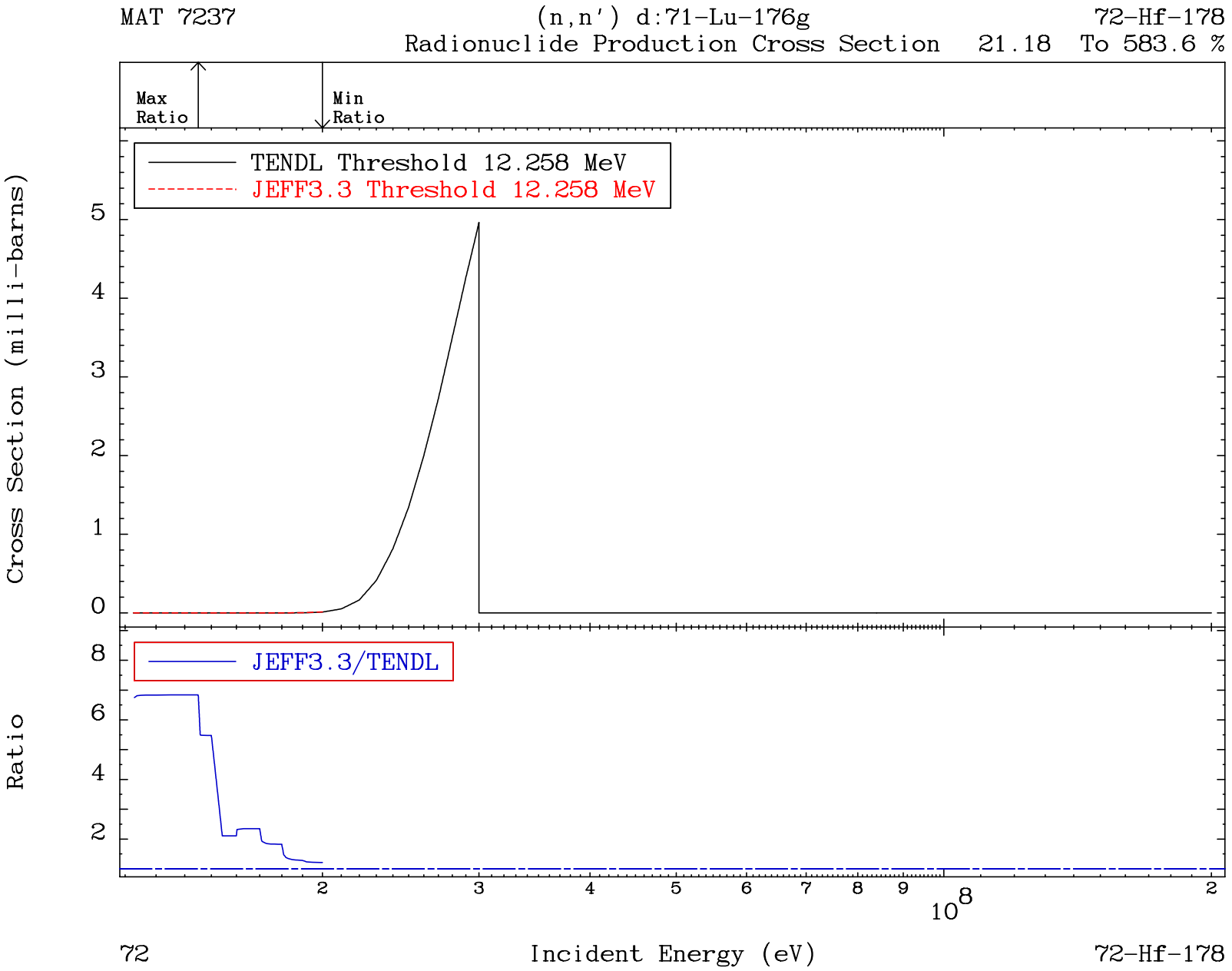

MAT 7237
Inelastic:72-Hf-178m5
72-Hf-178
Radionuclide Production Cross Section
-26.06 To 6.204 %
Min Ratio
Max Ratio
TENDL Threshold 1.1539 MeV
JEFF3.3 Threshold 1.1539 MeV
Cross Section (milli-barns)
200
150
100
50
0
JEFF3.3/TENDL
Ratio
1.1
1.0
0.9
0.8
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
67
Incident Energy (eV)
72-Hf-178

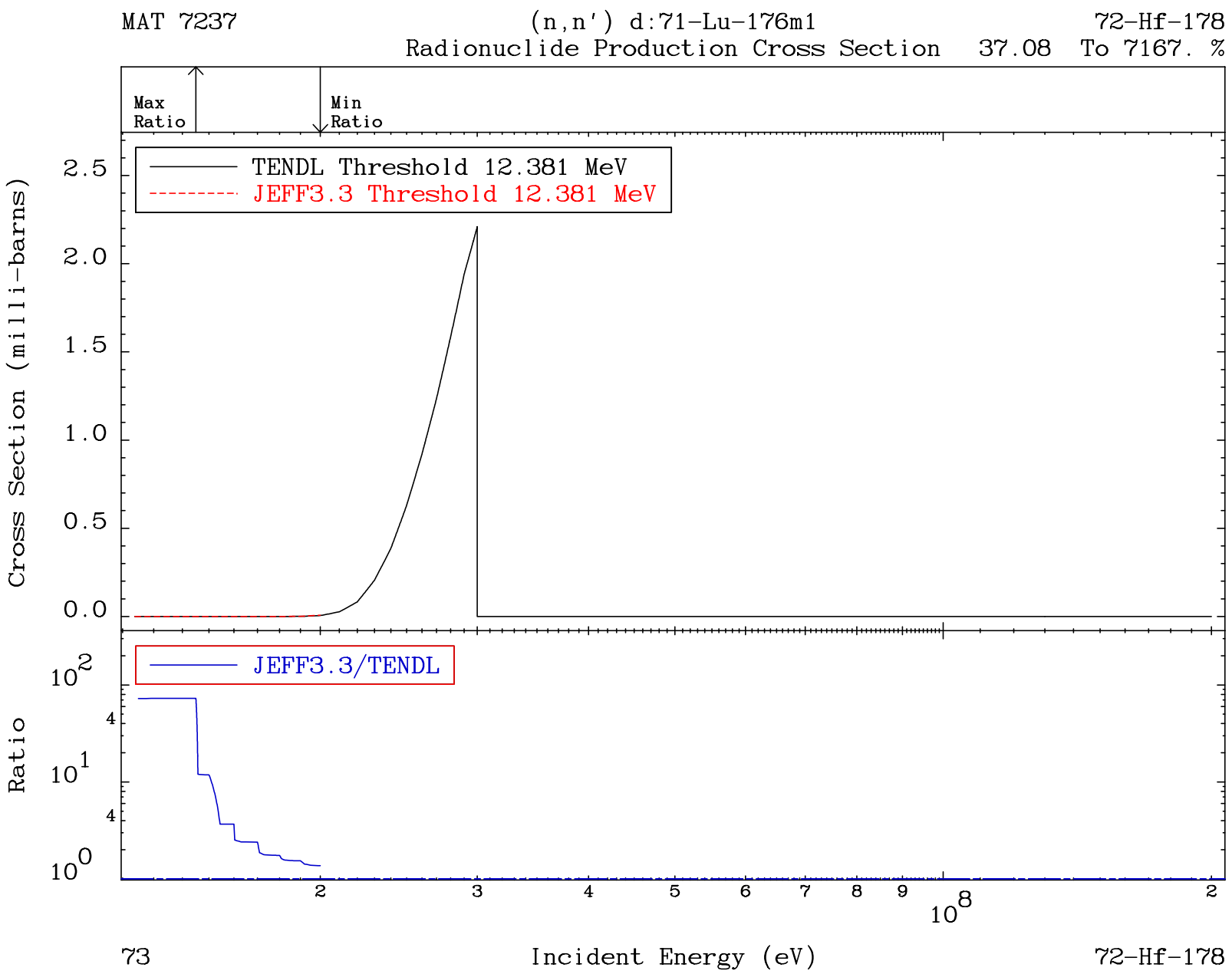

MAT 7237
Inelastic:72-Hf-178m30
72-Hf-178
Radionuclide Production Cross Section 0.699 To 30.42 %
Max Ratio
Min Ratio
TENDL Threshold 2.4600 MeV
JEFF3.3 Threshold 2.4600 MeV
Cross Section (milli-barns)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
JEFF3.3/TENDL
Ratio
1.2
1.0
3 4 5 6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
68
Incident Energy (eV)
72-Hf-178

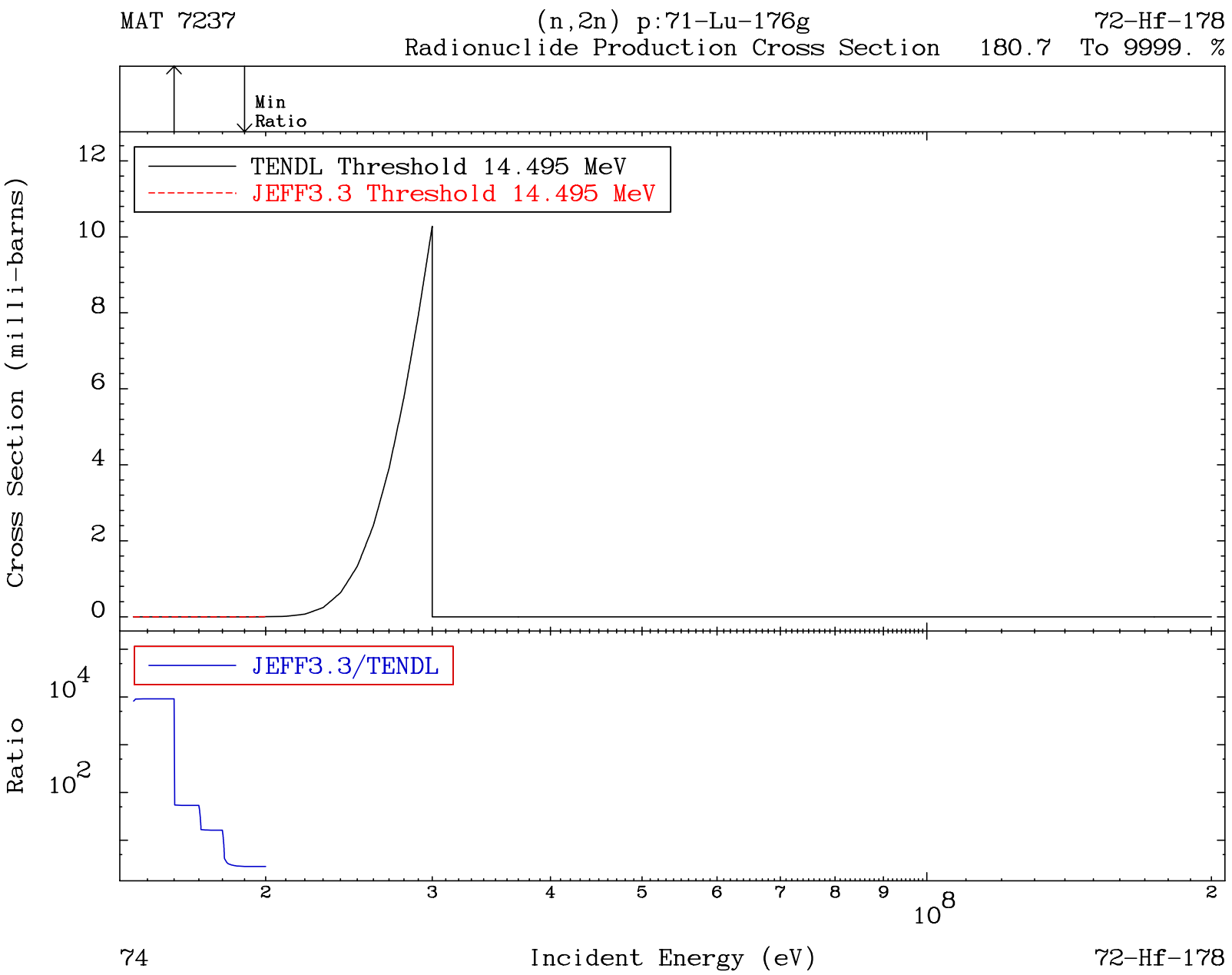

MAT 7237
(n,2n):72-Hf-177g
72-Hf-178
Radionuclide Production Cross Section 3.581 To 76.46 %
Min Ratio
TENDL Threshold 7.6692 MeV
JEFF3.3 Threshold 7.6692 MeV
Cross Section (barns)
2.5
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
1.6
1.2
8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
69
Incident Energy (eV)
72-Hf-178

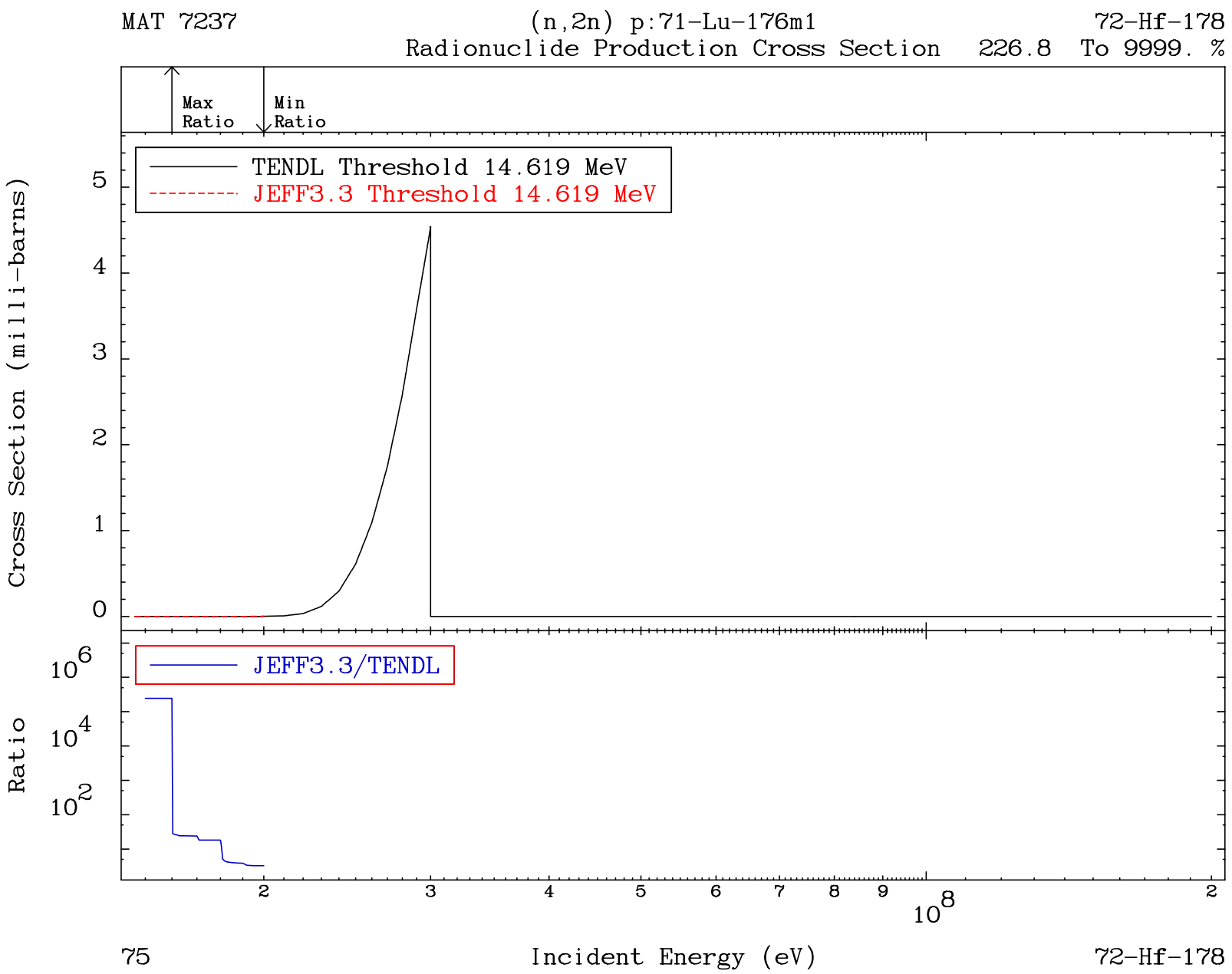

MAT 7237
(n,2n):72-Hf-177m10
72-Hf-178
Radionuclide Production Cross Section 2522. To 9999. %
Max Ratio
Min Ratio
TENDL Threshold 10.425 MeV
JEFF3.3 Threshold 10.425 MeV
Cross Section (milli-barns)
20
15
10
5
0
JEFF3.3/TENDL
Ratio
10^4
10^2
2
3
4
5
6
7
8
9
10^8
2
70
Incident Energy (eV)
72-Hf-178

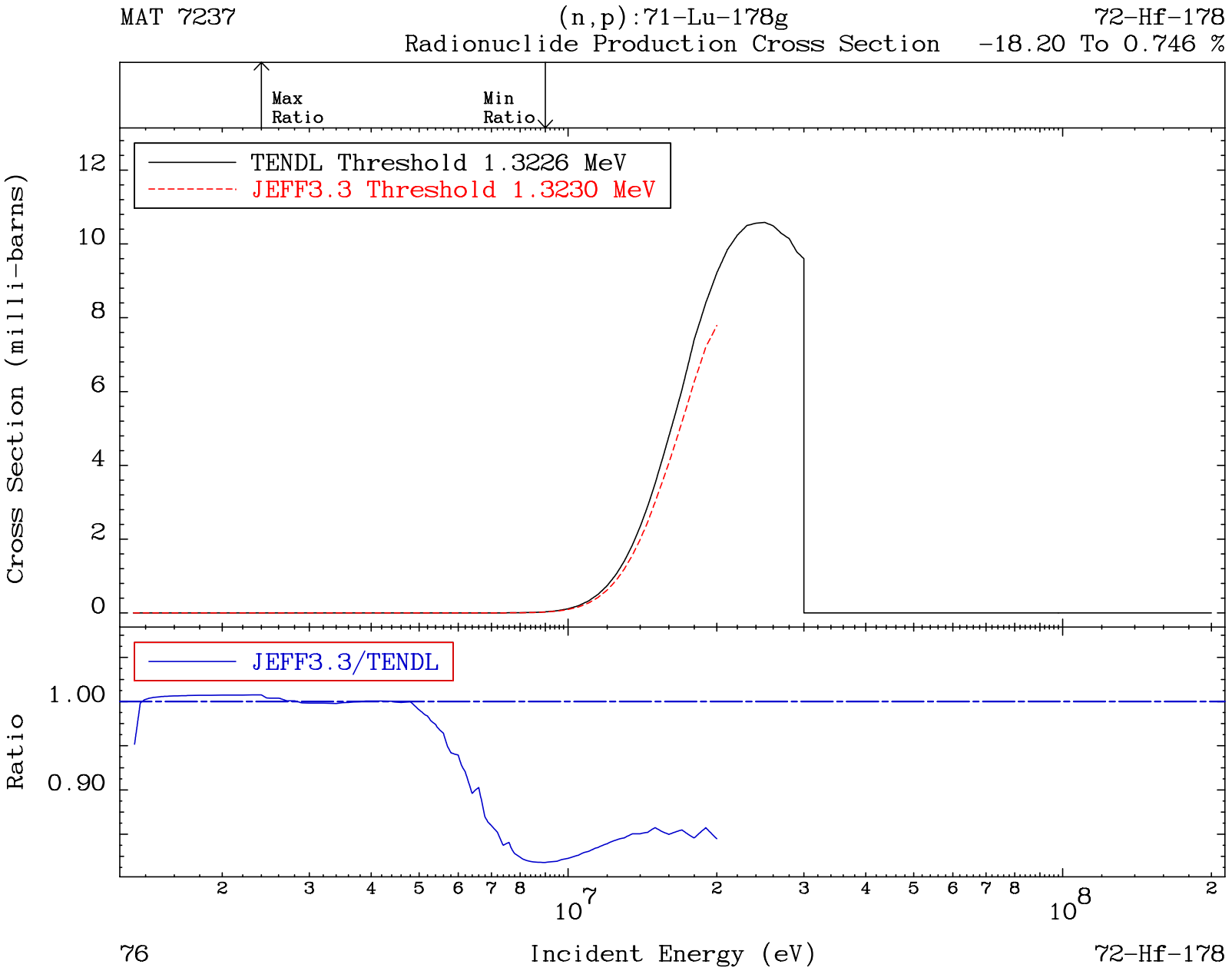

MAT 7237
(n,n') p:71-Lu-177g
72-Hf-178
Radionuclide Production Cross Section -99.70 To 1717. %
Max
Ratio
TENDL Threshold 7.3820 MeV
JEFF3.3 Threshold 7.3820 MeV
Cross Section (milli-barns)
40
30
20
10
0
JEFF3.3/TENDL
Ratio
10^2
10^0
10^-2
8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
71
Incident Energy (eV)
72-Hf-178

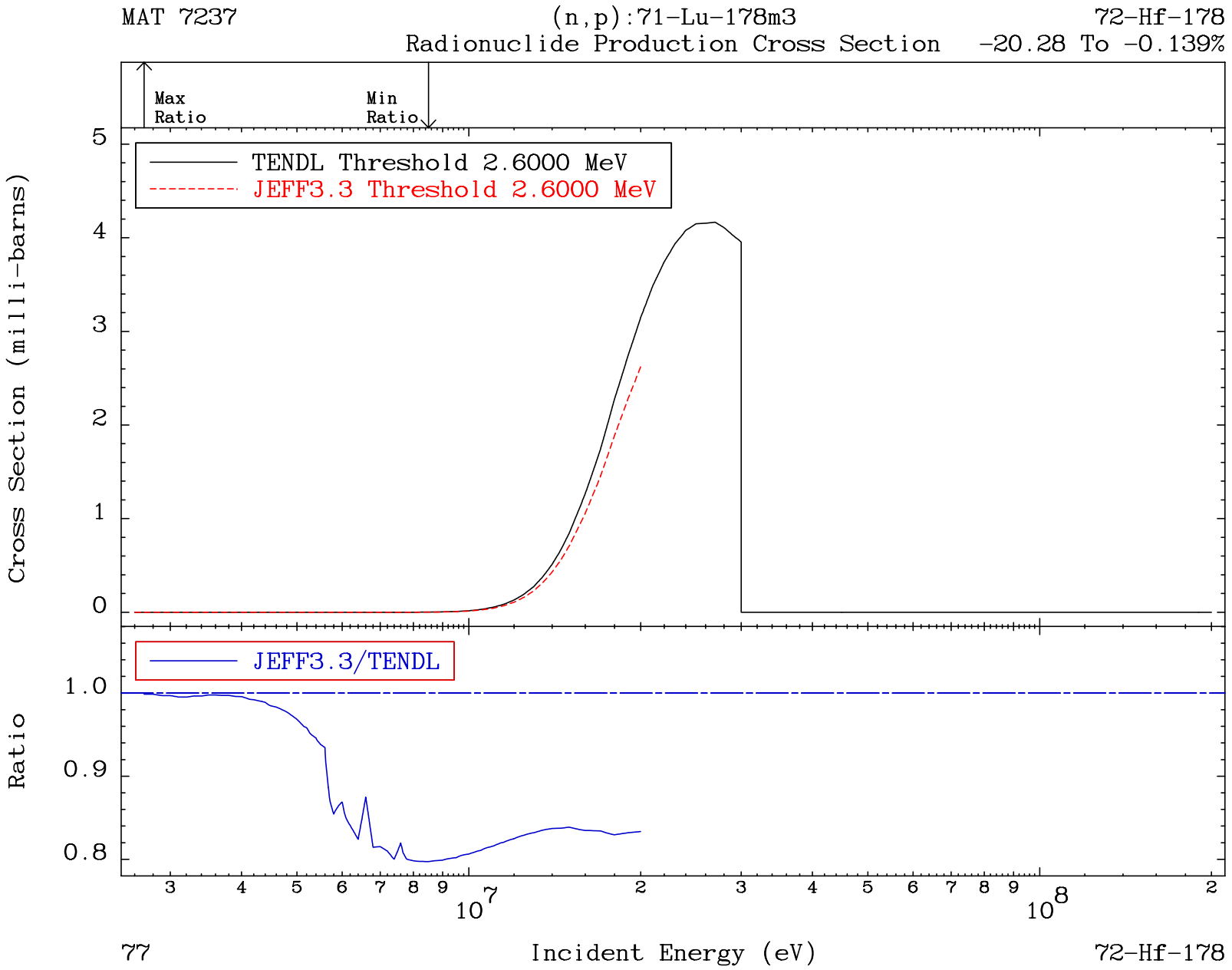

MAT 7237
(n,n') d:71-Lu-176g
72-Hf-178
Radionuclide Production Cross Section 21.18 To 583.6 %
Max Ratio
Min Ratio
TENDL Threshold 12.258 MeV
JEFF3.3 Threshold 12.258 MeV
Cross Section (milli-barns)
0
1
2
3
4
5
JEFF3.3/TENDL
Ratio
2
4
6
8
2
3
4
5
6
7
8
9
10^8
2
72
Incident Energy (eV)
72-Hf-178

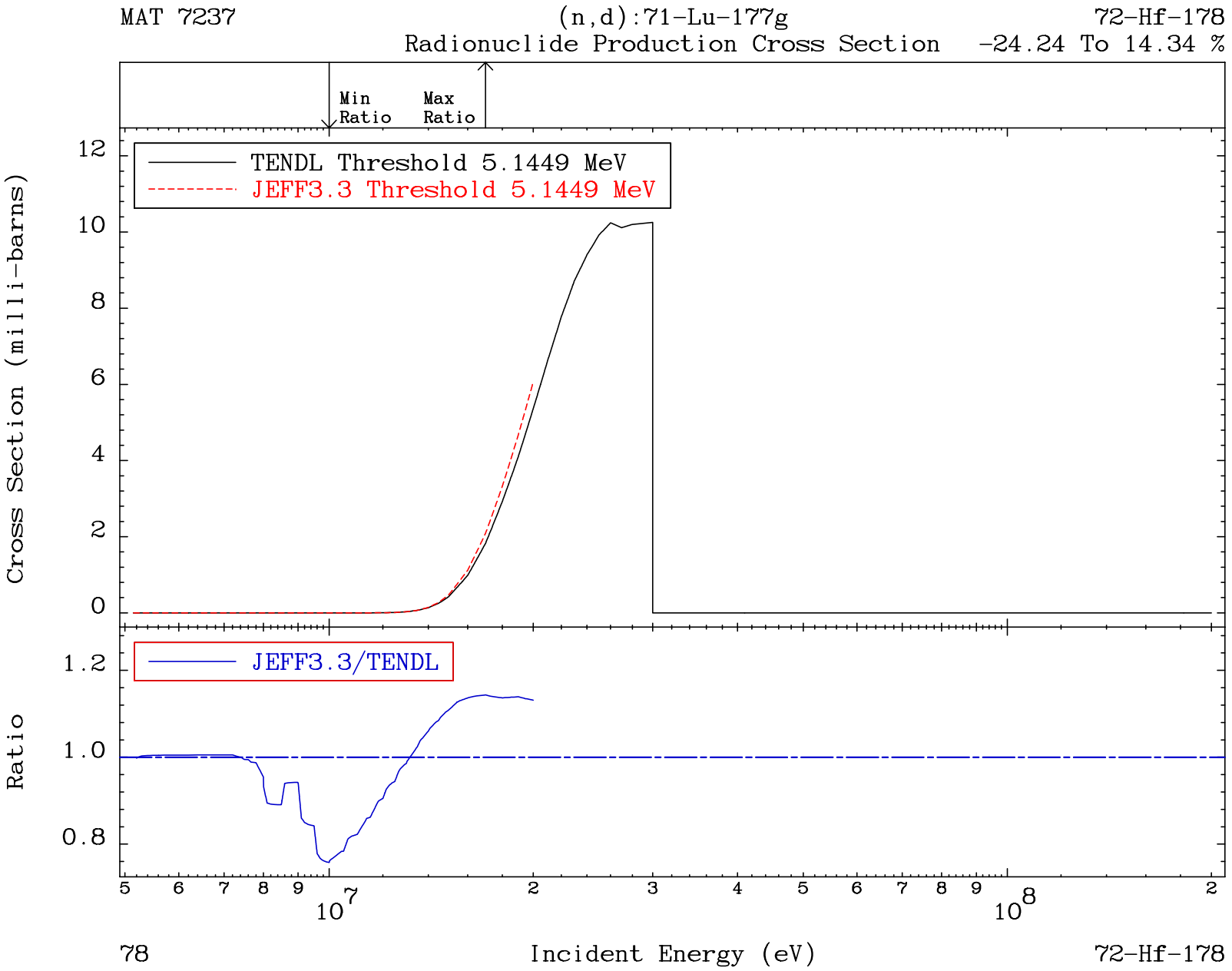

MAT 7237
(n,n') d:71-Lu-176m1
72-Hf-178
Radionuclide Production Cross Section 37.08 To 7167. %
Max Ratio
Min Ratio
TENDL Threshold 12.381 MeV
JEFF3.3 Threshold 12.381 MeV
Cross Section (milli-barns)
2.5
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
10^2
4
10^1
4
10^0
2
3
4
5
6
7
8
9
10^8
2
73
Incident Energy (eV)
72-Hf-178

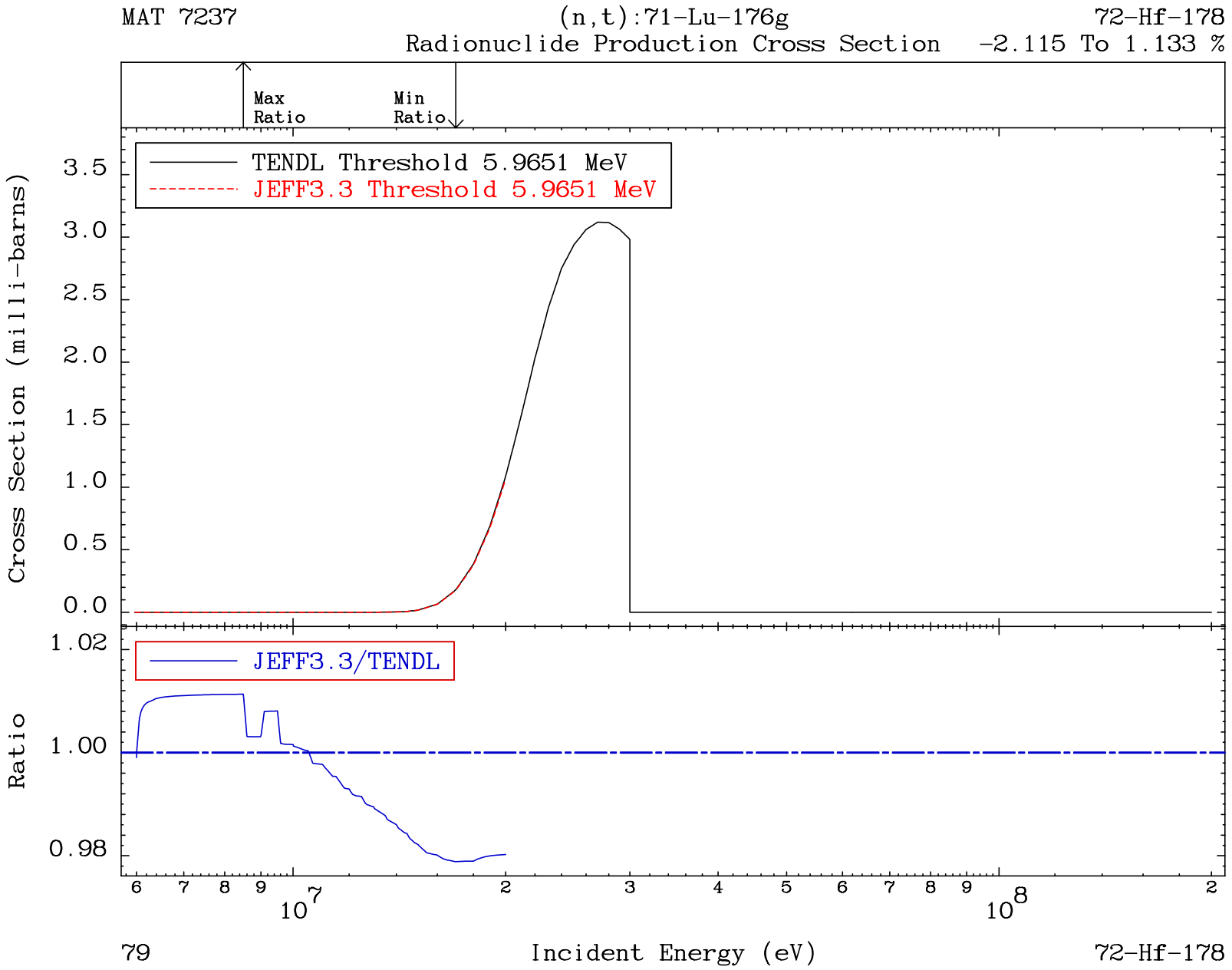

MAT 7237
(n,2n) p:71-Lu-176g
72-Hf-178
Radionuclide Production Cross Section 180.7 To 9999. %
Min
Ratio
TENDL Threshold 14.495 MeV
JEFF3.3 Threshold 14.495 MeV
Cross Section (milli-barns)
12
10
8
6
4
2
0
JEFF3.3/TENDL
Ratio
10^4
10^2
2
3
4
5
6
7
8
9
10^8
2
74
Incident Energy (eV)
72-Hf-178

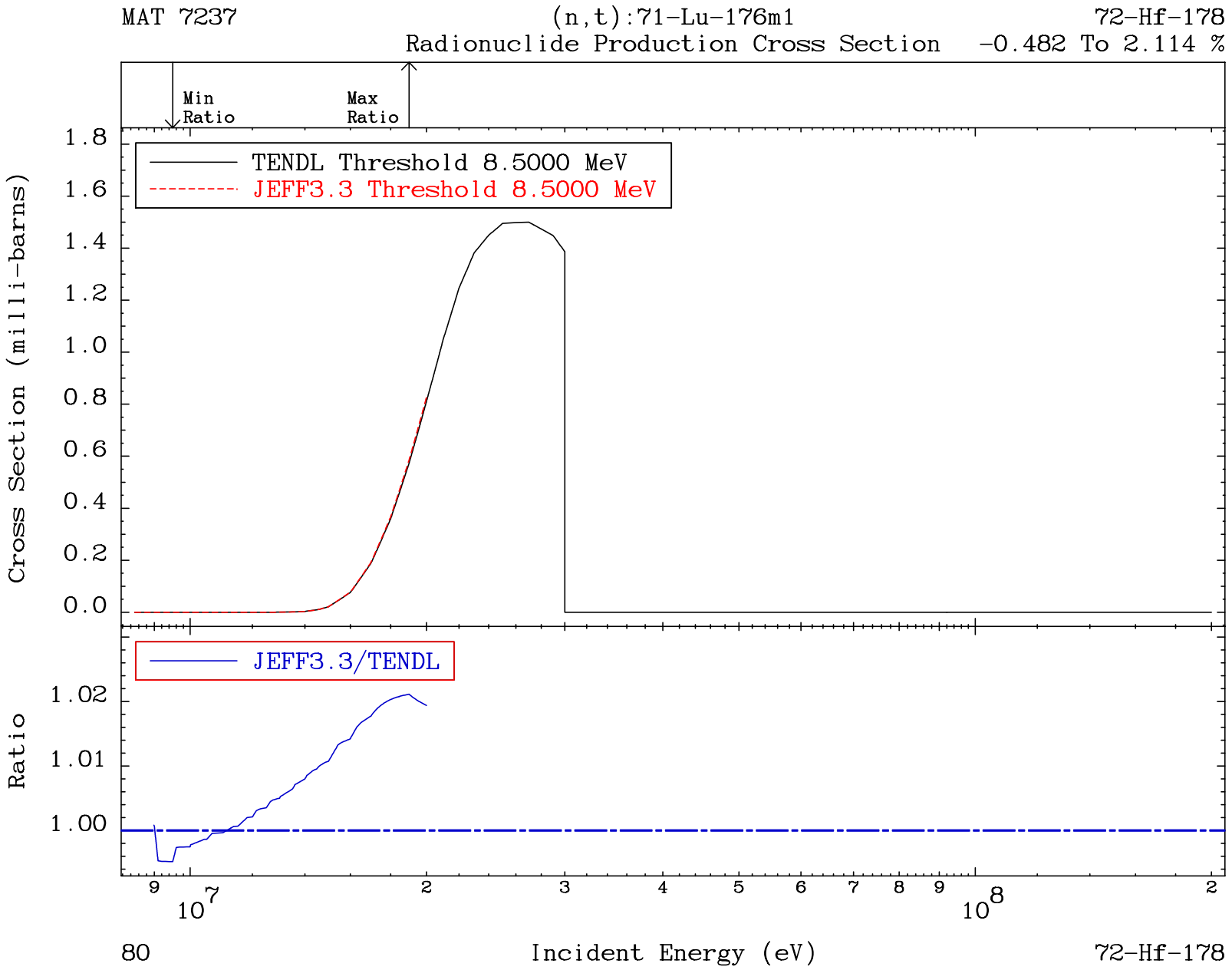

MAT 7237
(n,2n) p:71-Lu-176m1
72-Hf-178
Radionuclide Production Cross Section 226.8 To 9999. %
Max Ratio
Min Ratio
TENDL Threshold 14.619 MeV
JEFF3.3 Threshold 14.619 MeV
Cross Section (milli-barns)
0
1
2
3
4
5
JEFF3.3/TENDL
Ratio
10^6
10^4
10^2
2
3
4
5
6
7
8
9
10^8
2
75
Incident Energy (eV)
72-Hf-178

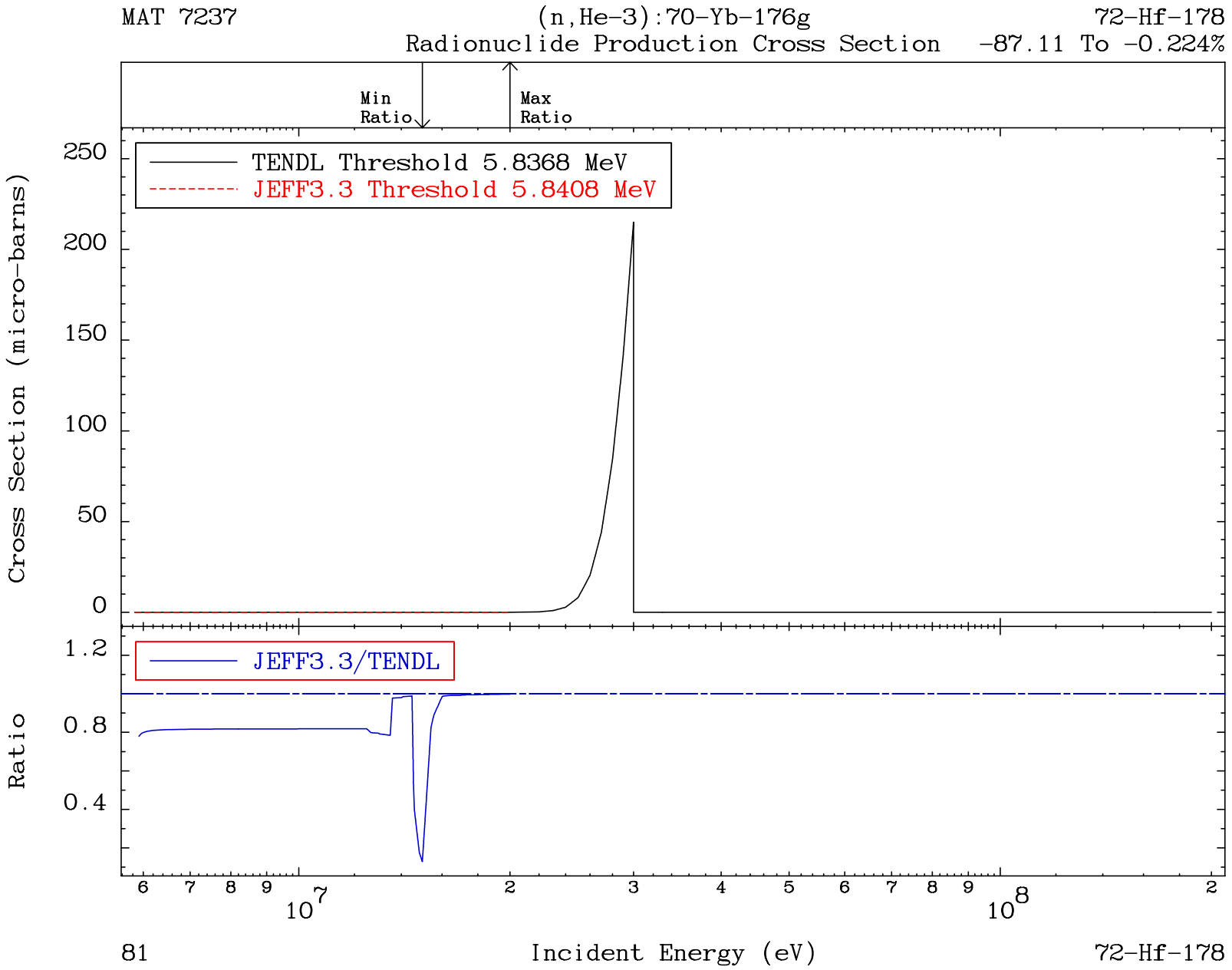

MAT 7237
(n,p):71-Lu-178g
72-Hf-178
Radionuclide Production Cross Section -18.20 To 0.746 %
Max Ratio
Min Ratio
TENDL Threshold 1.3226 MeV
JEFF3.3 Threshold 1.3230 MeV
Cross Section (milli-barns)
12
10
8
6
4
2
0
JEFF3.3/TENDL
Ratio
1.00
0.90
2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
76
Incident Energy (eV)
72-Hf-178

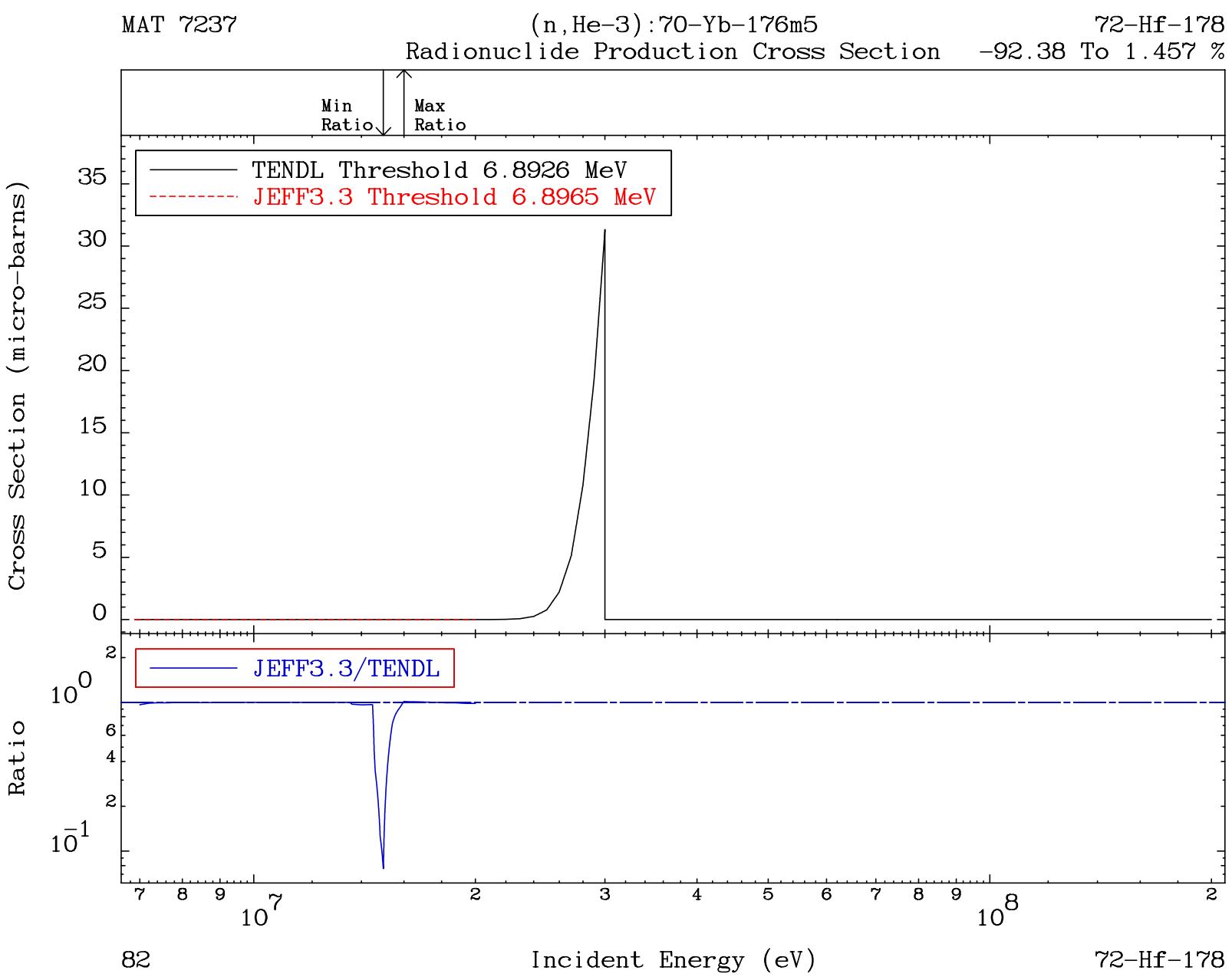

MAT 7237
(n,p):71-Lu-178m3
72-Hf-178
Radionuclide Production Cross Section -20.28 To -0.139%
Max Ratio
Min Ratio
TENDL Threshold 2.6000 MeV
JEFF3.3 Threshold 2.6000 MeV
Cross Section (milli-barns)
JEFF3.3/TENDL
Ratio
Incident Energy (eV)
77
72-Hf-178


MAT 7237
(n,d):71-Lu-177g
72-Hf-178
Radionuclide Production Cross Section
-24.24 To 14.34 %
Min Ratio
Max Ratio
TENDL Threshold 5.1449 MeV
JEFF3.3 Threshold 5.1449 MeV
Cross Section (milli-barns)
12
10
8
6
4
2
0
JEFF3.3/TENDL
Ratio
1.2
1.0
0.8
5 6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
78
Incident Energy (eV)
72-Hf-178


MAT 7237
(n,t):71-Lu-176g
72-Hf-178
Radionuclide Production Cross Section -2.115 To 1.133 %
Max Ratio
Min Ratio
TENDL Threshold 5.9651 MeV
JEFF3.3 Threshold 5.9651 MeV
Cross Section (milli-barns)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
JEFF3.3/TENDL
Ratio
1.02
1.00
0.98
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
79
Incident Energy (eV)
72-Hf-178


MAT 7237
(n,t):71-Lu-176m1
72-Hf-178
Radionuclide Production Cross Section -0.482 To 2.114 %
Min Ratio
Max Ratio
TENDL Threshold 8.5000 MeV
JEFF3.3 Threshold 8.5000 MeV
Cross Section (milli-barns)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
JEFF3.3/TENDL
Ratio
1.02
1.01
1.00
9
10^7
2
3
4
5
6
7
8
9
10^8
2
80
Incident Energy (eV)
72-Hf-178


MAT 7237
(n,He-3):70-Yb-176g
72-Hf-178
Radionuclide Production Cross Section -87.11 To -0.224%
Min Ratio
Max Ratio
TENDL Threshold 5.8368 MeV
JEFF3.3 Threshold 5.8408 MeV
Cross Section (micro-barns)
250
200
150
100
50
0
JEFF3.3/TENDL
Ratio
1.2
0.8
0.4
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
81
Incident Energy (eV)
72-Hf-178


MAT 7237
(n,He-3):70-Yb-176m5
72-Hf-178
Radionuclide Production Cross Section -92.38 To 1.457 %
Min Ratio
Max Ratio
TENDL Threshold 6.8926 MeV
JEFF3.3 Threshold 6.8965 MeV
Cross Section (micro-barns)
35
30
25
20
15
10
5
0
JEFF3.3/TENDL
Ratio
2
10^0
6
4
2
10^-1
7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
82
Incident Energy (eV)
72-Hf-178