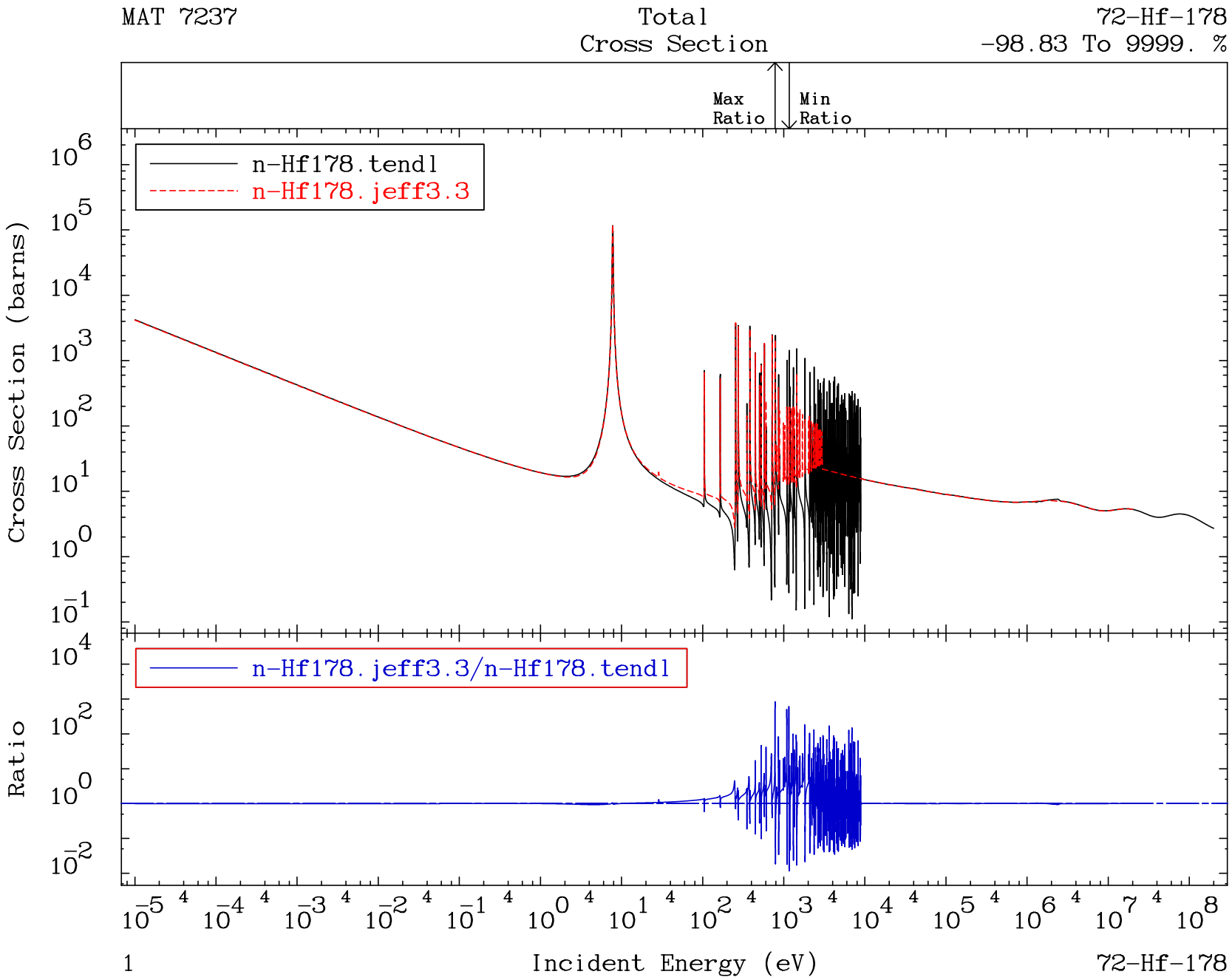
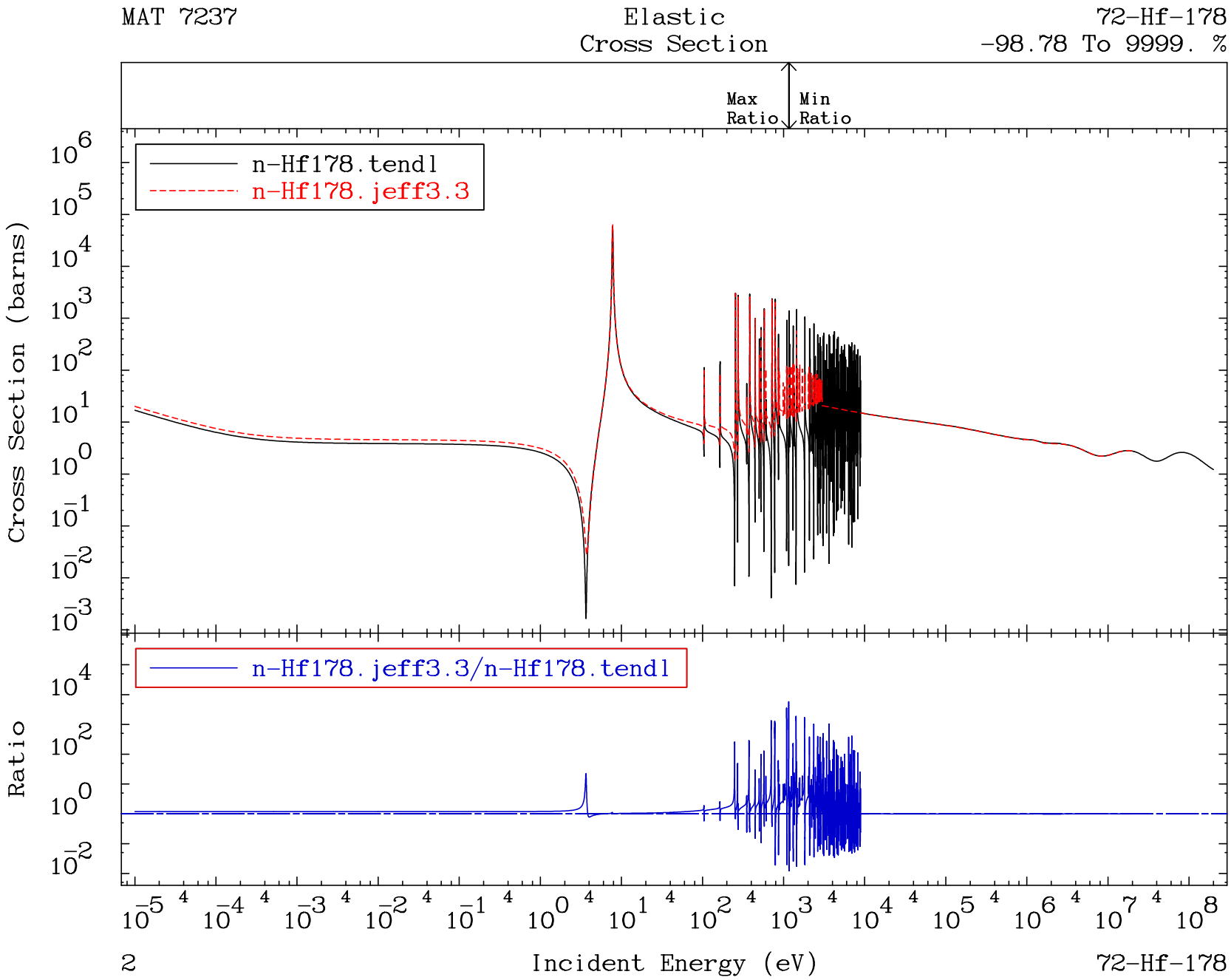
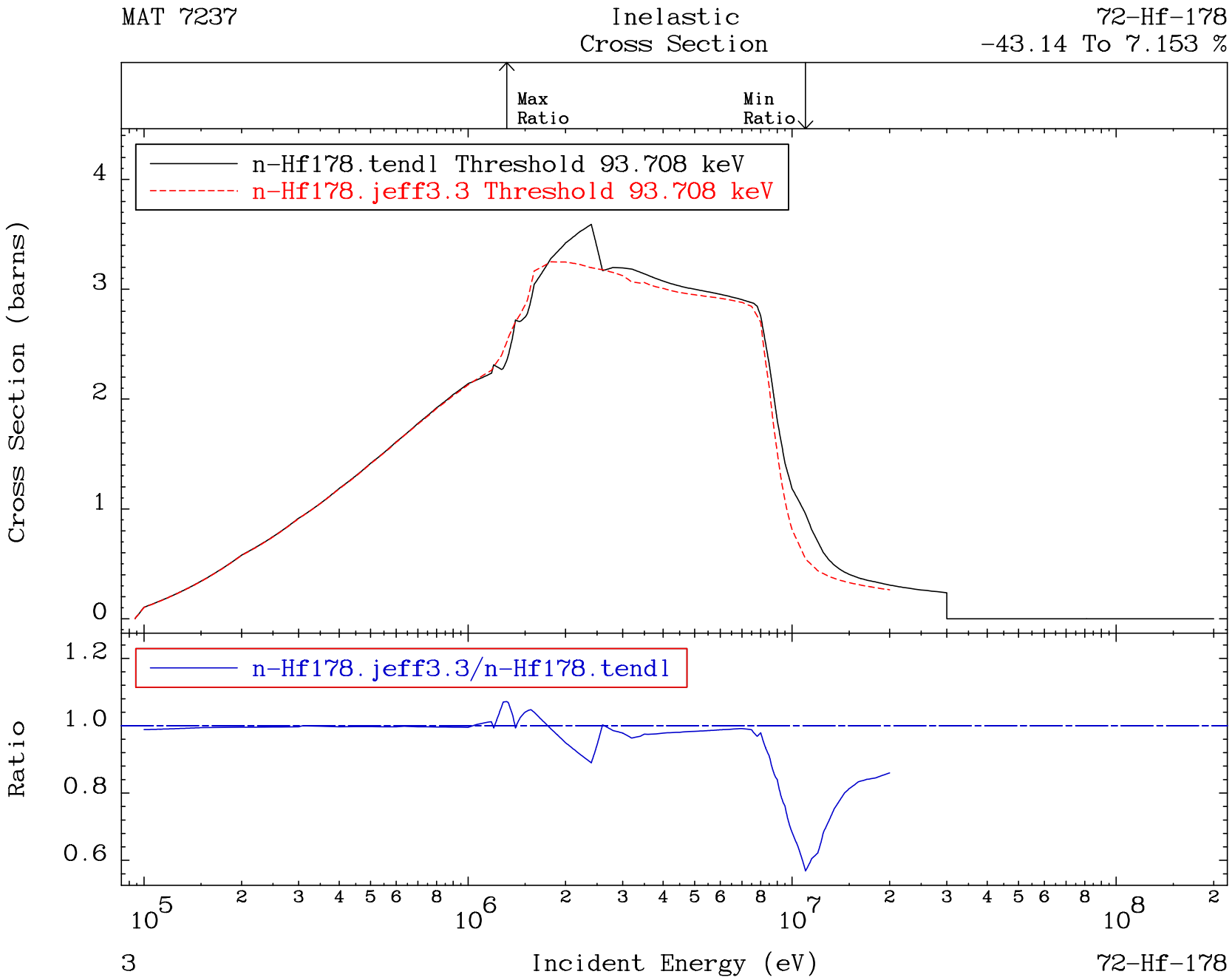
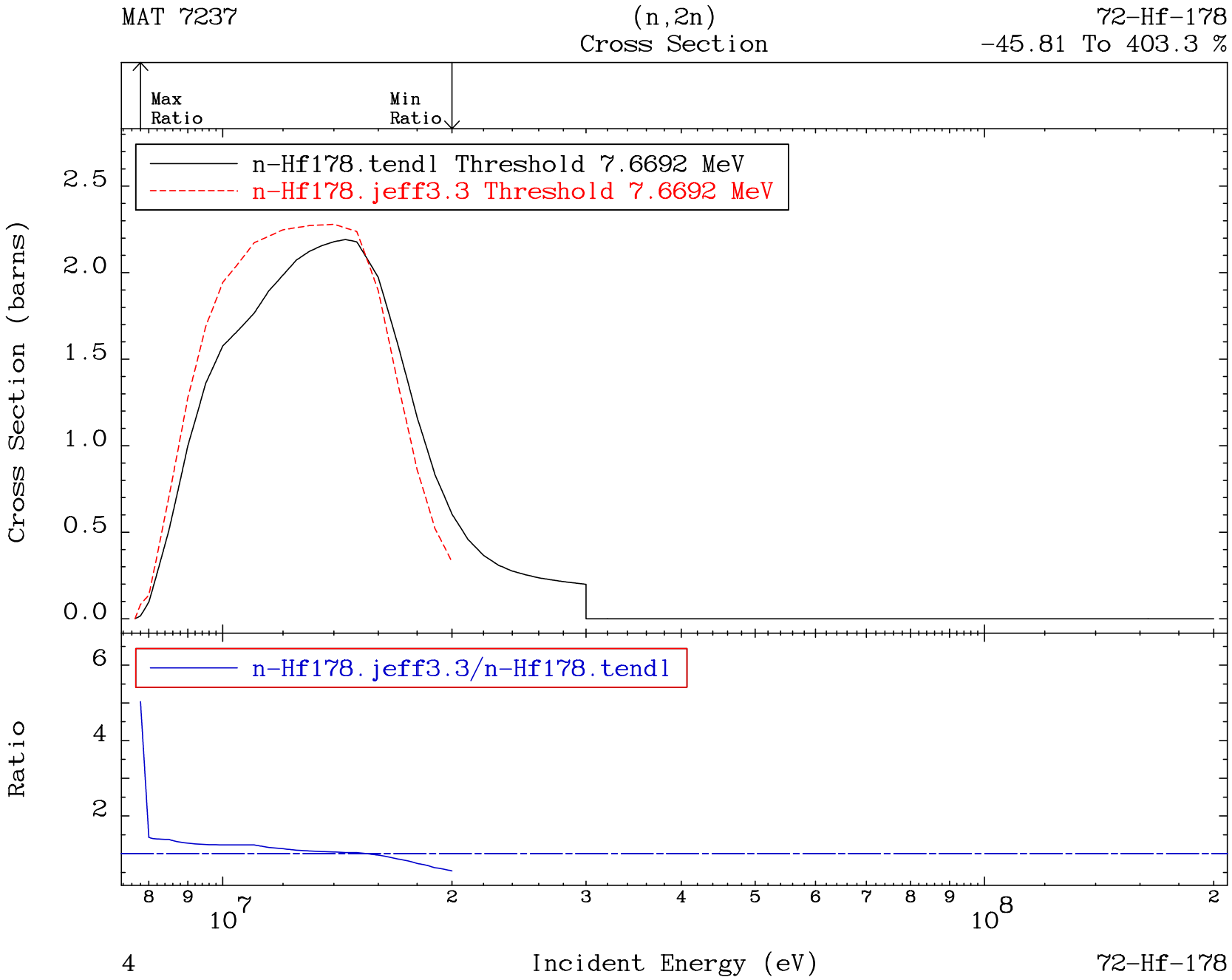
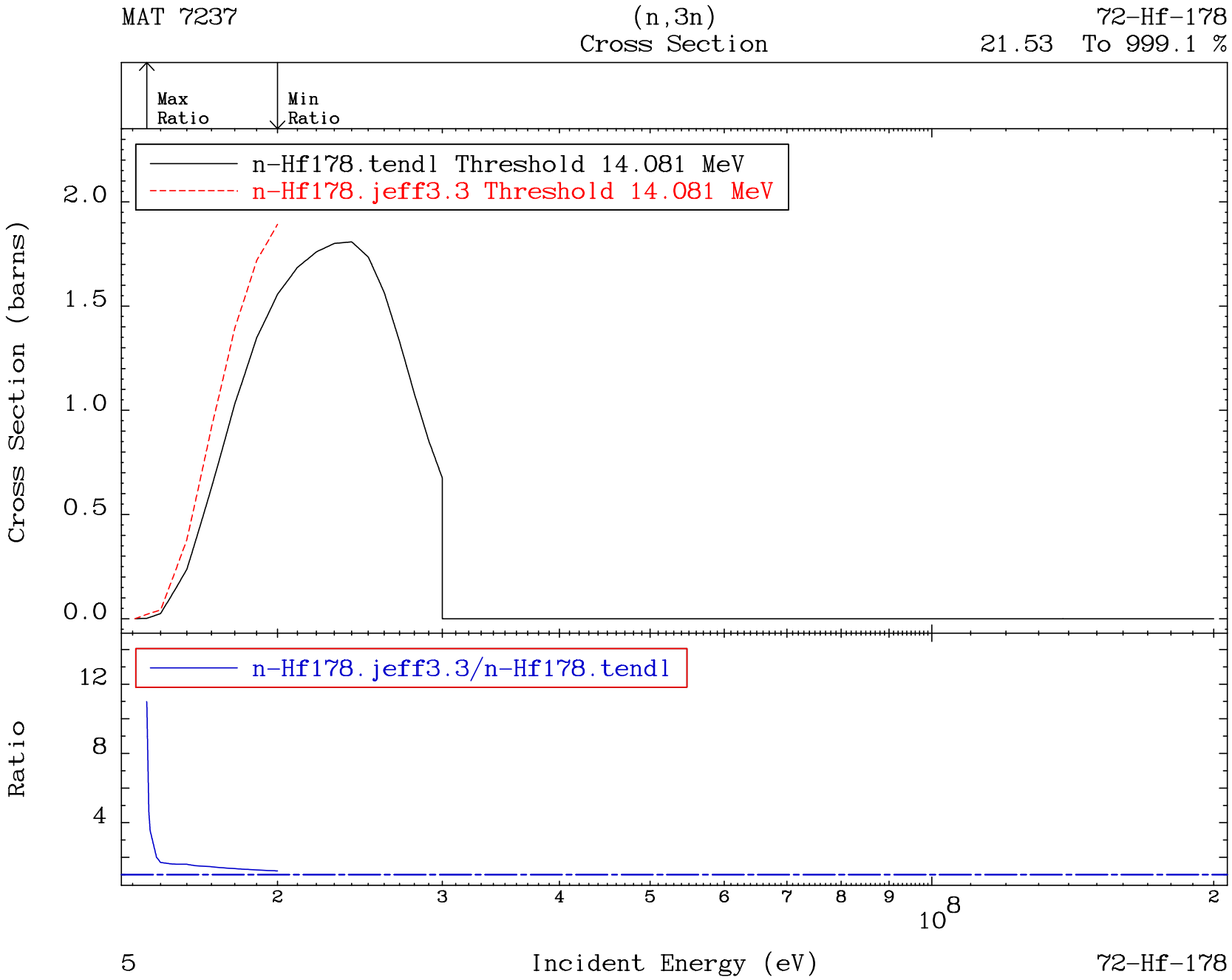
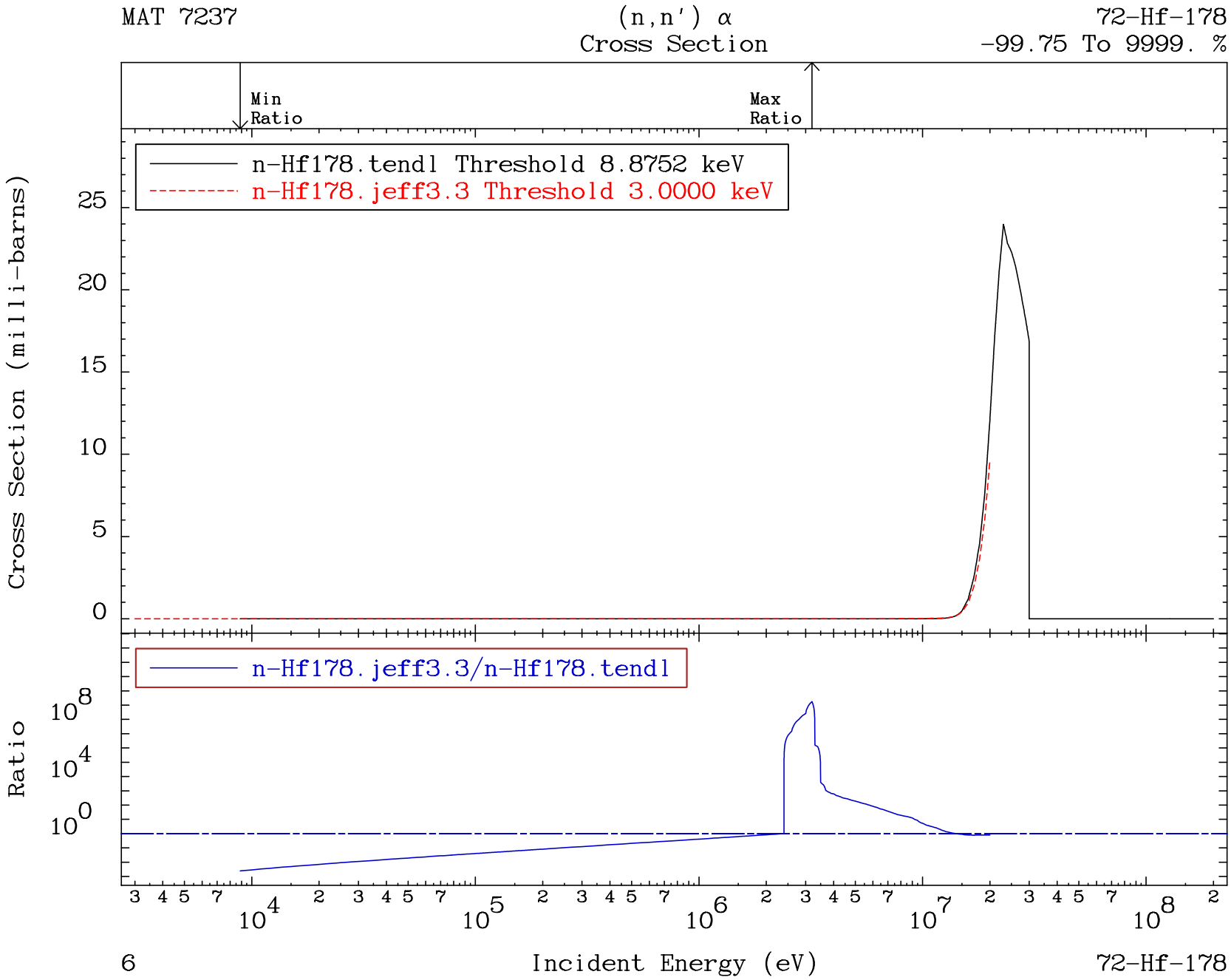

MAT 7237
Total
Cross Section
72-Hf-178
-98.83 To 9999. %
Max
Ratio
Min
Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
1
72-Hf-178

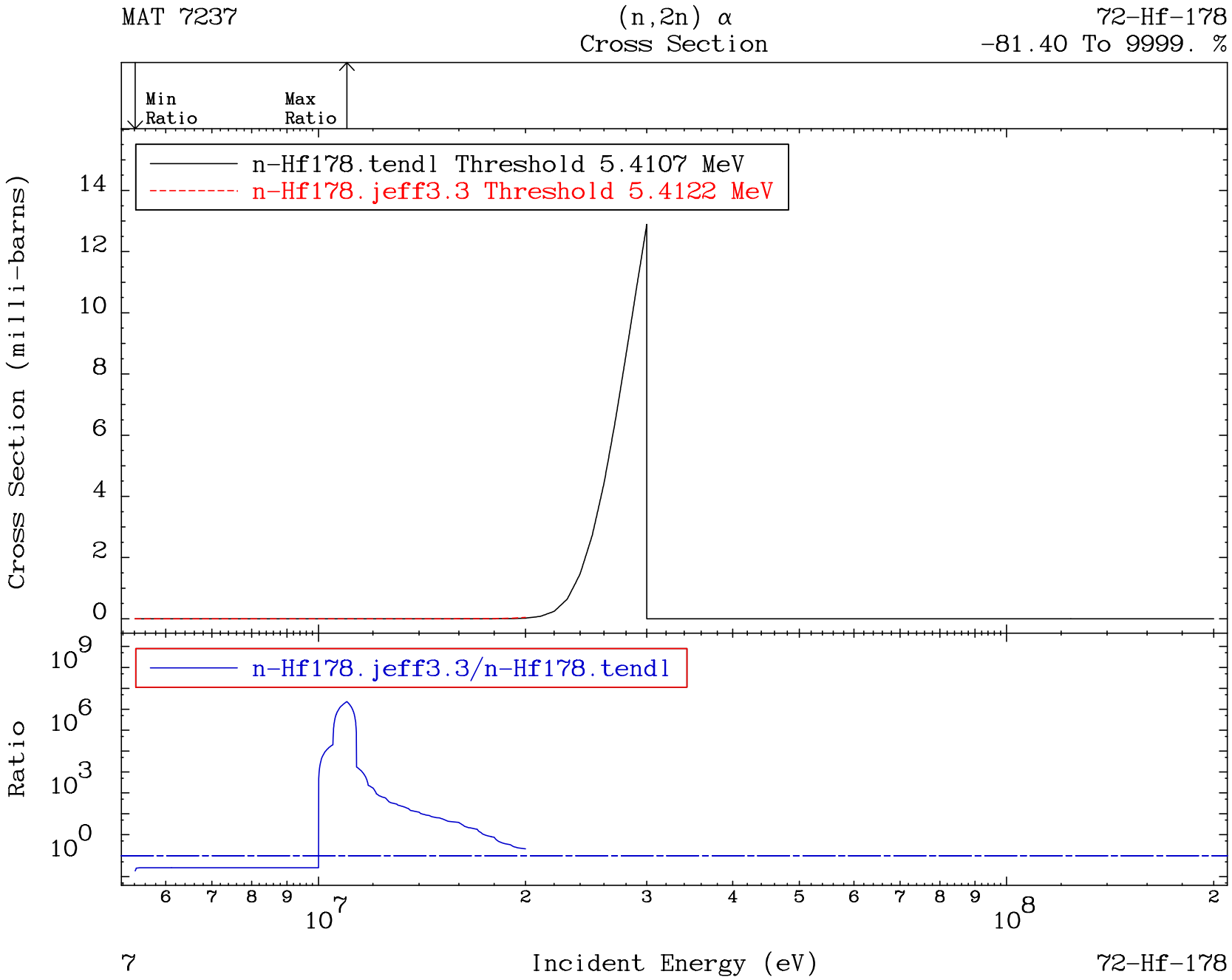

MAT 7237
Elastic
Cross Section
72-Hf-178
-98.78 To 9999. %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
2
72-Hf-178

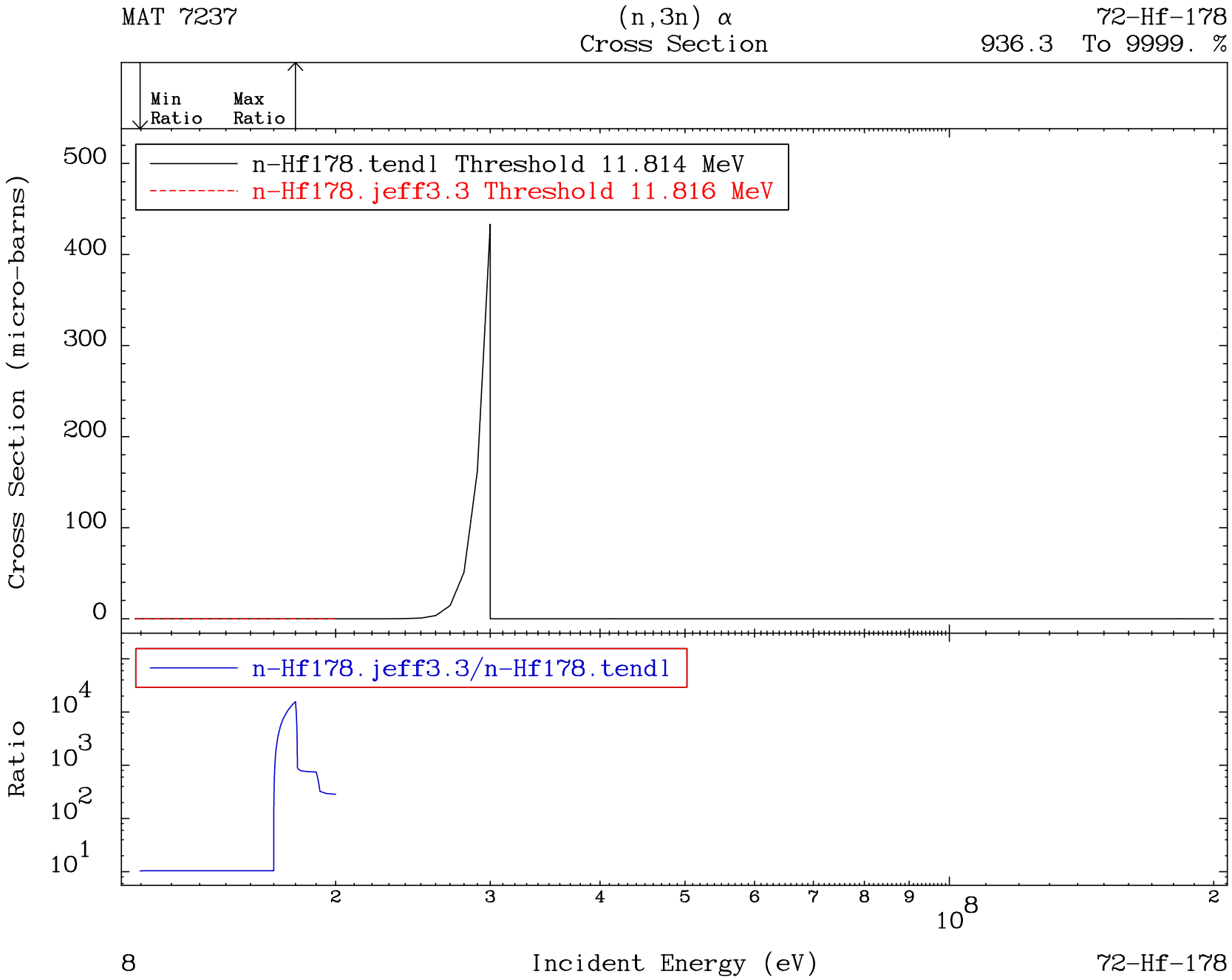

MAT 7237
Inelastic
Cross Section
72-Hf-178
-43.14 To 7.153 %
Max
Ratio
Min
Ratio
n-Hf178.tendl Threshold 93.708 keV
n-Hf178.jeff3.3 Threshold 93.708 keV
Cross Section (barns)
0
1
2
3
4
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
0.6
0.8
1.0
1.2
10^5
10^6
10^7
10^8
Incident Energy (eV)
3
72-Hf-178

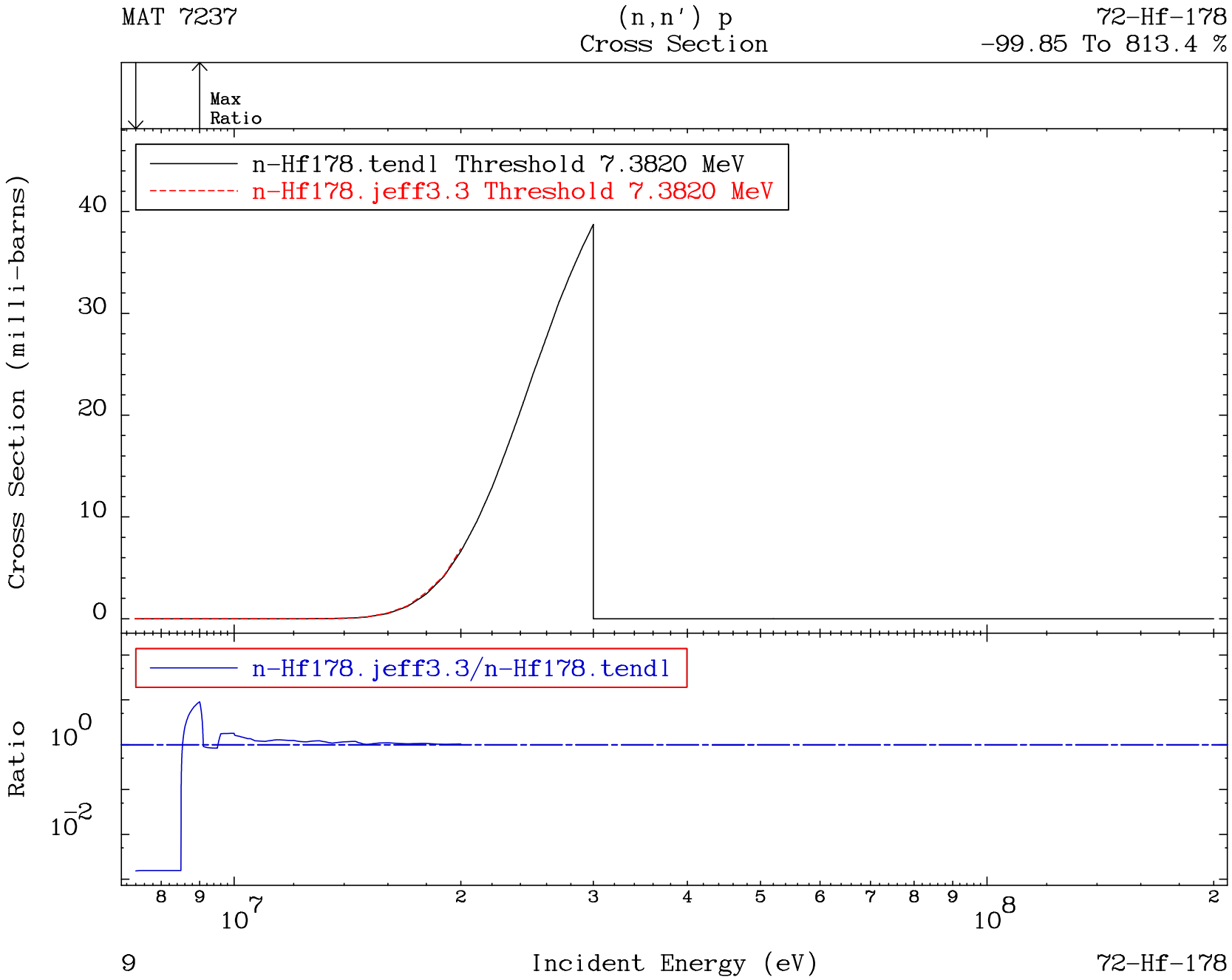

MAT 7237
(n,2n)
Cross Section
72-Hf-178
-45.81 To 403.3 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 7.6692 MeV
n-Hf178.jeff3.3 Threshold 7.6692 MeV
Cross Section (barns)
2.5
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
6
4
2
8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
4
Incident Energy (eV)
72-Hf-178

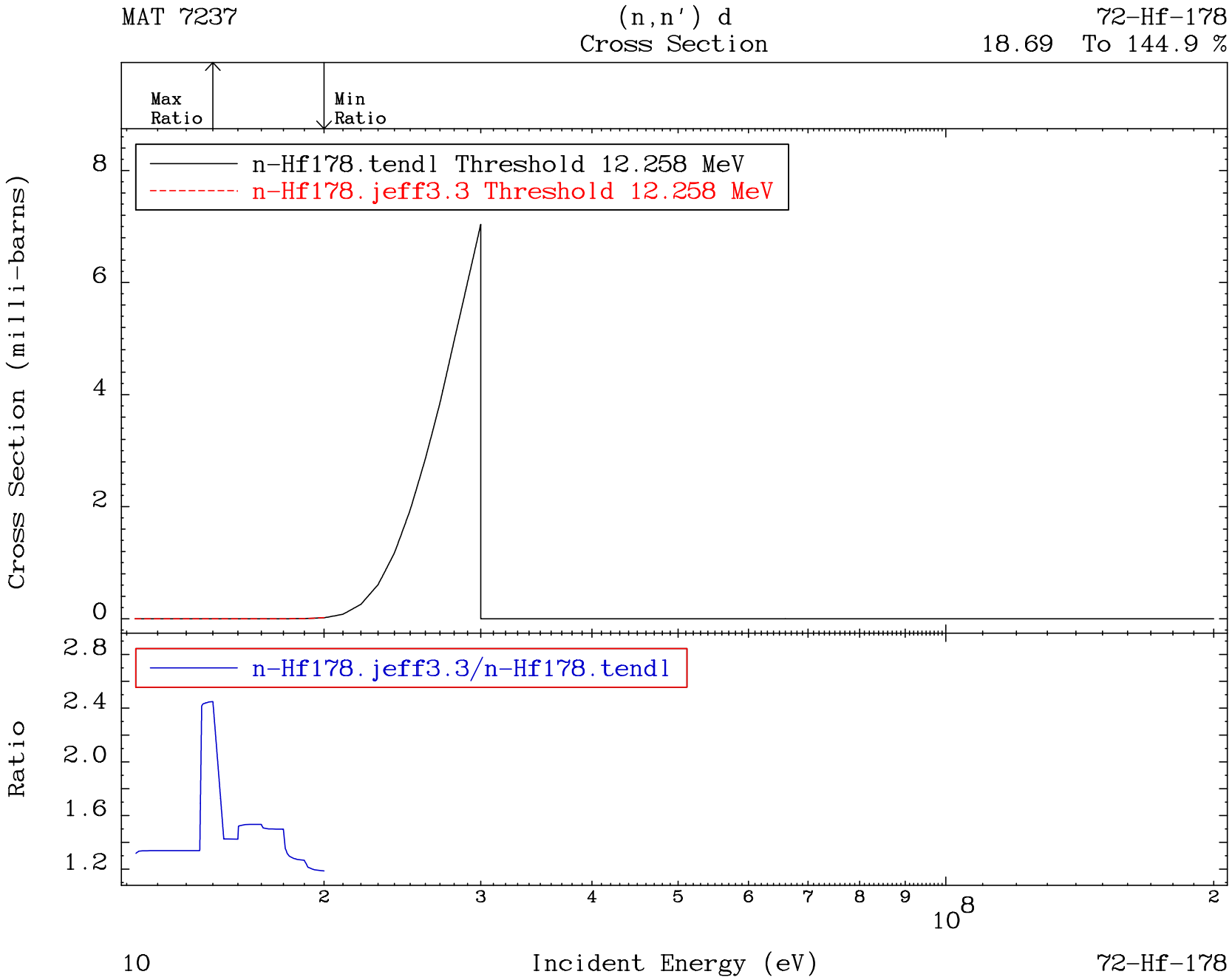

MAT 7237
(n,3n)
Cross Section
72-Hf-178
21.53 To 999.1 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 14.081 MeV
n-Hf178.jeff3.3 Threshold 14.081 MeV
Cross Section (barns)
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
12
8
4
2
3
4
5
6
7
8
9
2
10^8
5
Incident Energy (eV)
72-Hf-178

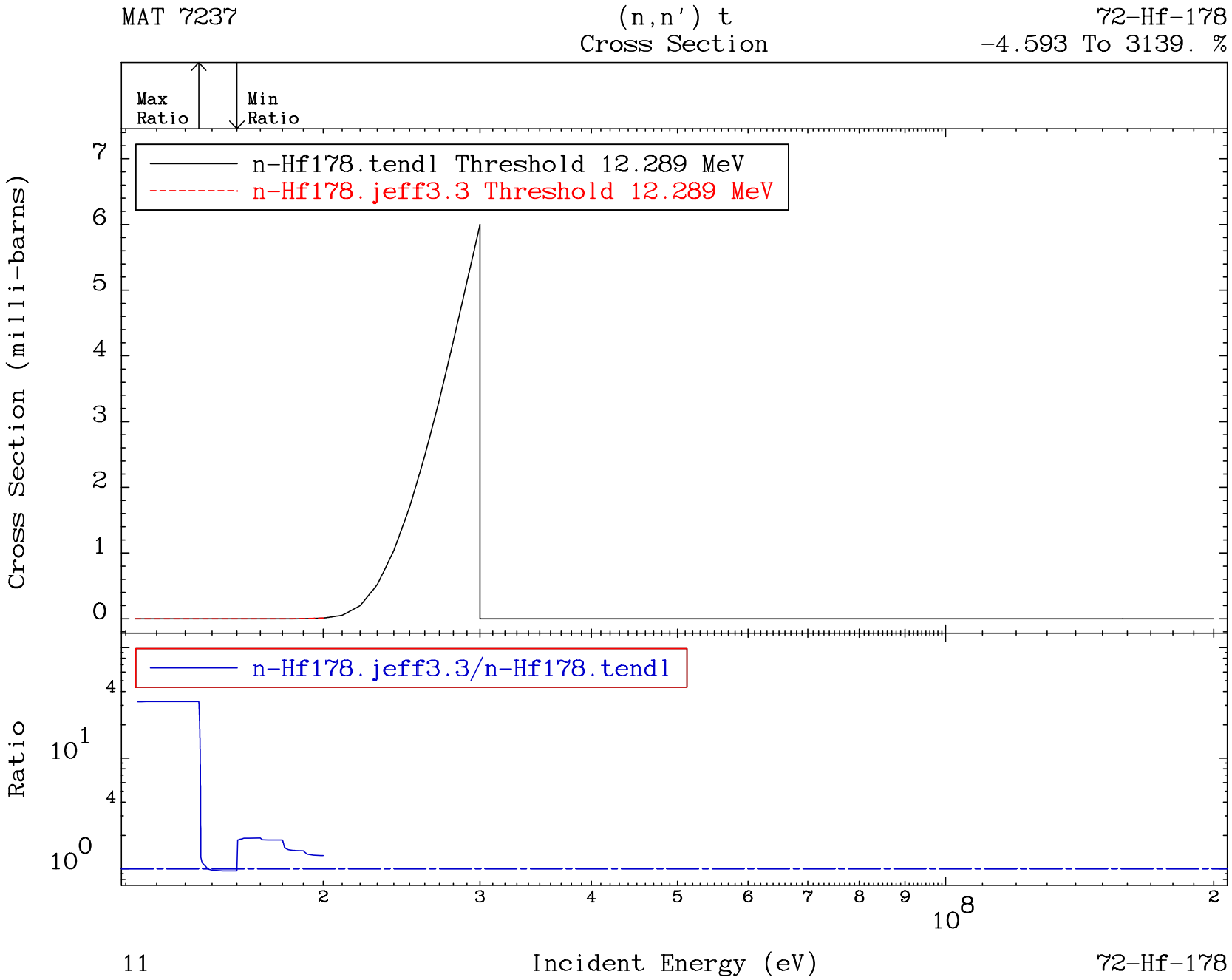

MAT 7237
(n,n') α
Cross Section
72-Hf-178
-99.75 To 9999. %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 8.8752 keV
n-Hf178.jeff3.3 Threshold 3.0000 keV
Cross Section (milli-barns)
25
20
15
10
5
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^8
10^4
10^0
3 4 5 7 10^4 2 3 4 5 7 10^5 2 3 4 5 7 10^6 2 3 4 5 7 10^7 2 3 4 5 7 10^8 2
6
Incident Energy (eV)
72-Hf-178

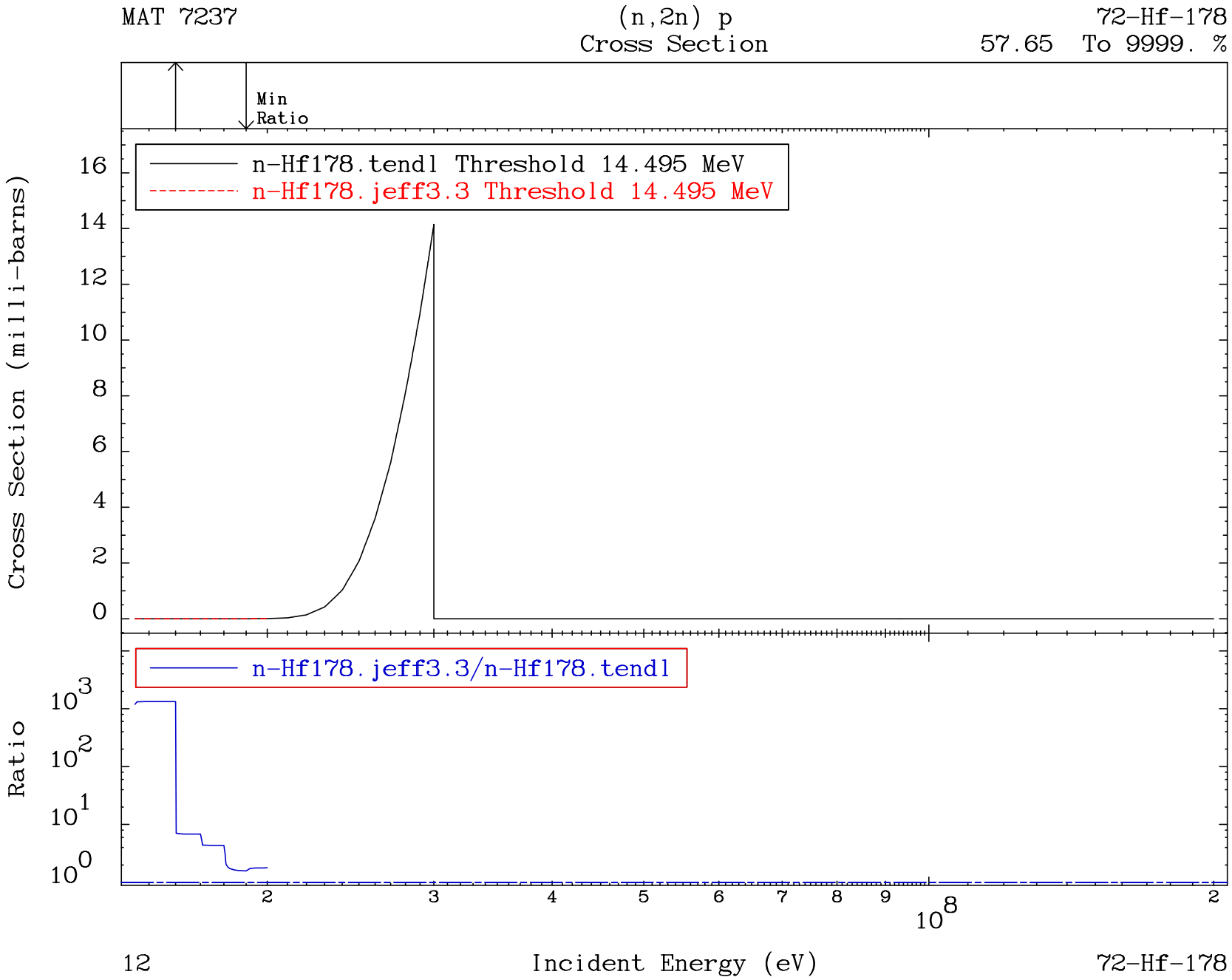

MAT 7237
(n,2n) α
Cross Section
72-Hf-178
-81.40 To 9999. %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 5.4107 MeV
n-Hf178.jeff3.3 Threshold 5.4122 MeV
Cross Section (milli-barns)
0
2
4
6
8
10
12
14
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^0
10^3
10^6
10^9
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
Incident Energy (eV)
7
72-Hf-178

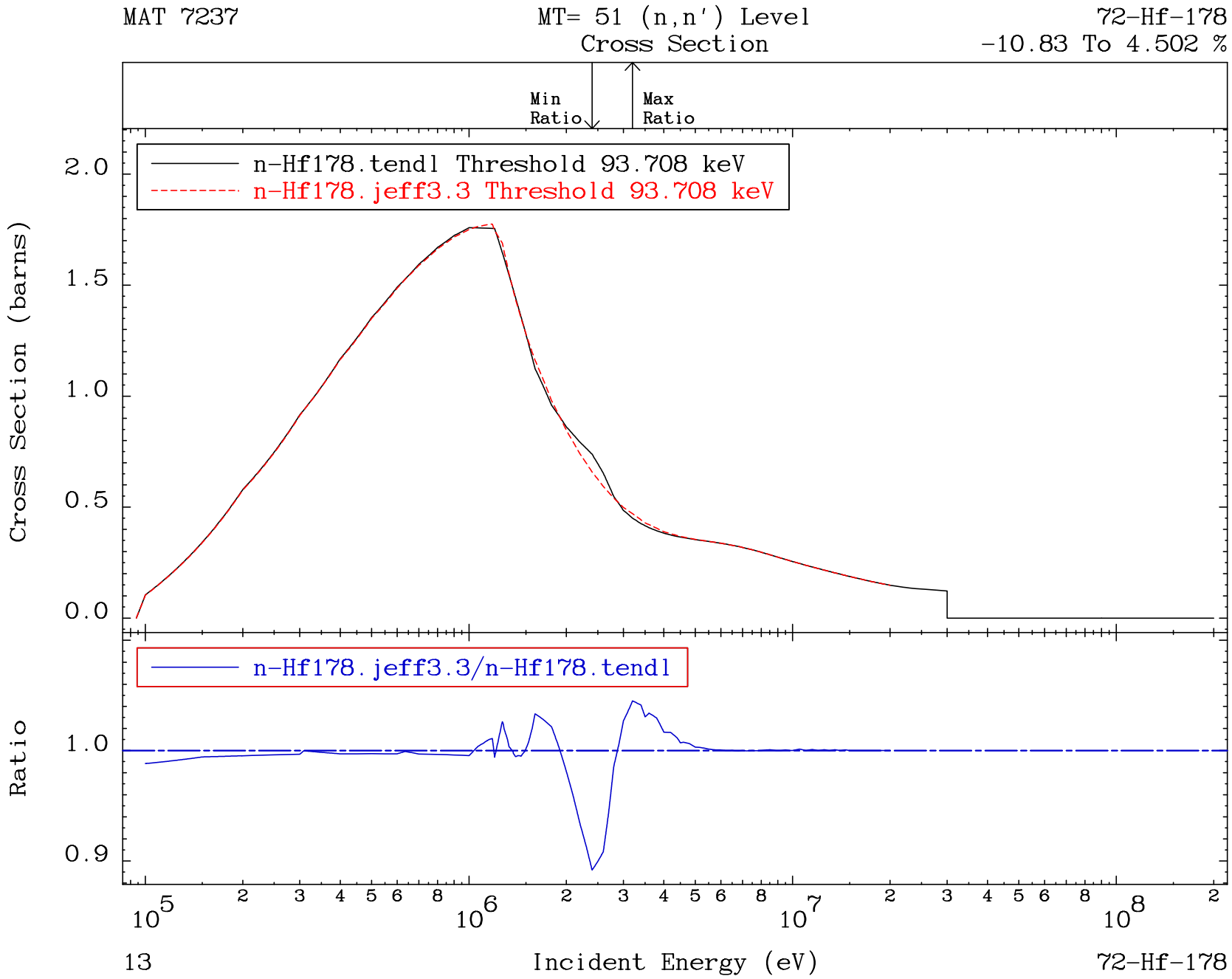

MAT 7237
(n,3n) α
Cross Section
72-Hf-178
936.3 To 9999. %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 11.814 MeV
n-Hf178.jeff3.3 Threshold 11.816 MeV
Cross Section (micro-barns)
500
400
300
200
100
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^4
10^3
10^2
10^1
2
3
4
5
6
7
8
9
10^8
2
8
Incident Energy (eV)
72-Hf-178

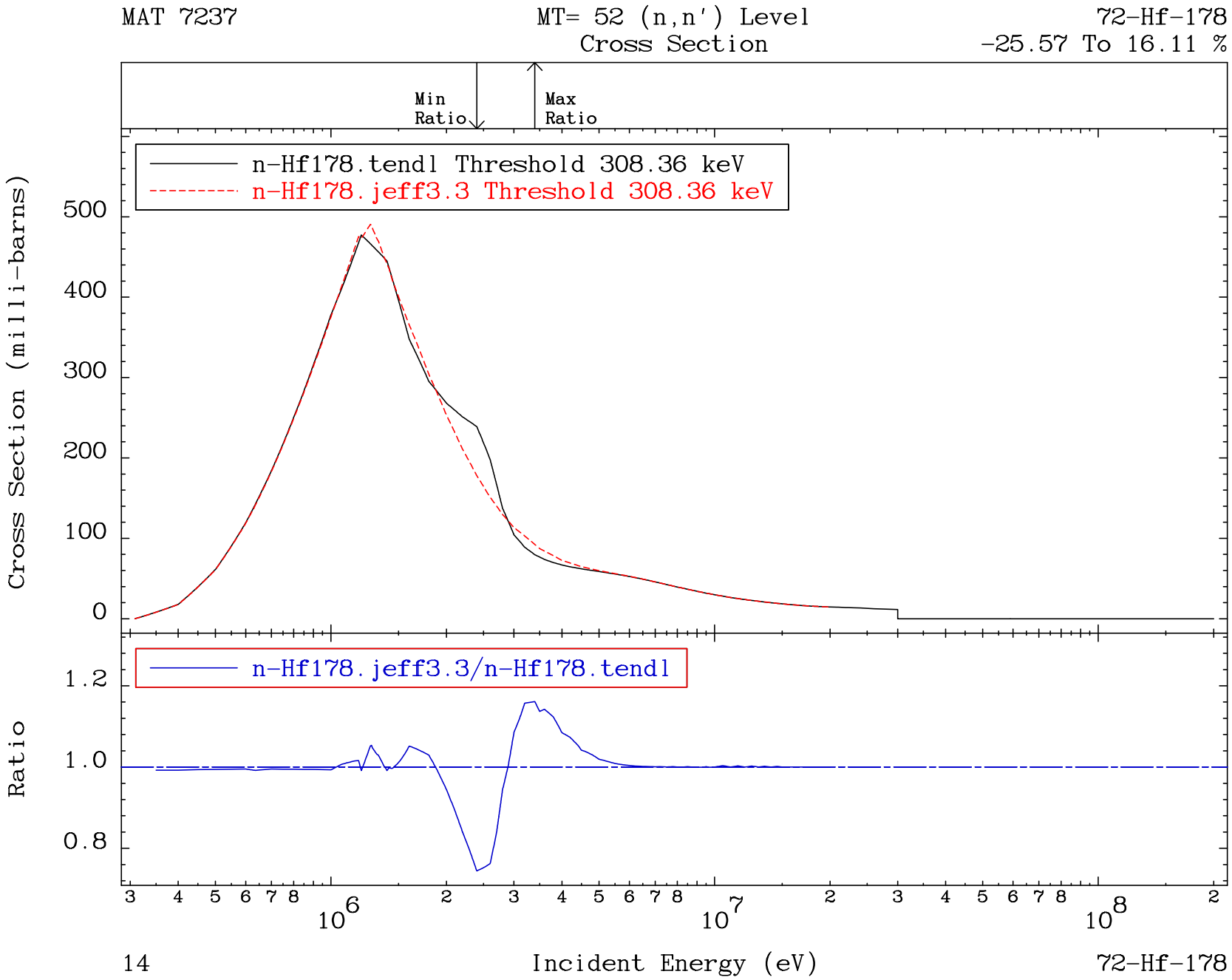

MAT 7237
(n,n') p
Cross Section
72-Hf-178
-99.85 To 813.4 %
Max
Ratio
n-Hf178.tendl Threshold 7.3820 MeV
n-Hf178.jeff3.3 Threshold 7.3820 MeV
Cross Section (milli-barns)
40
30
20
10
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^0
10^-2
8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
9
Incident Energy (eV)
72-Hf-178

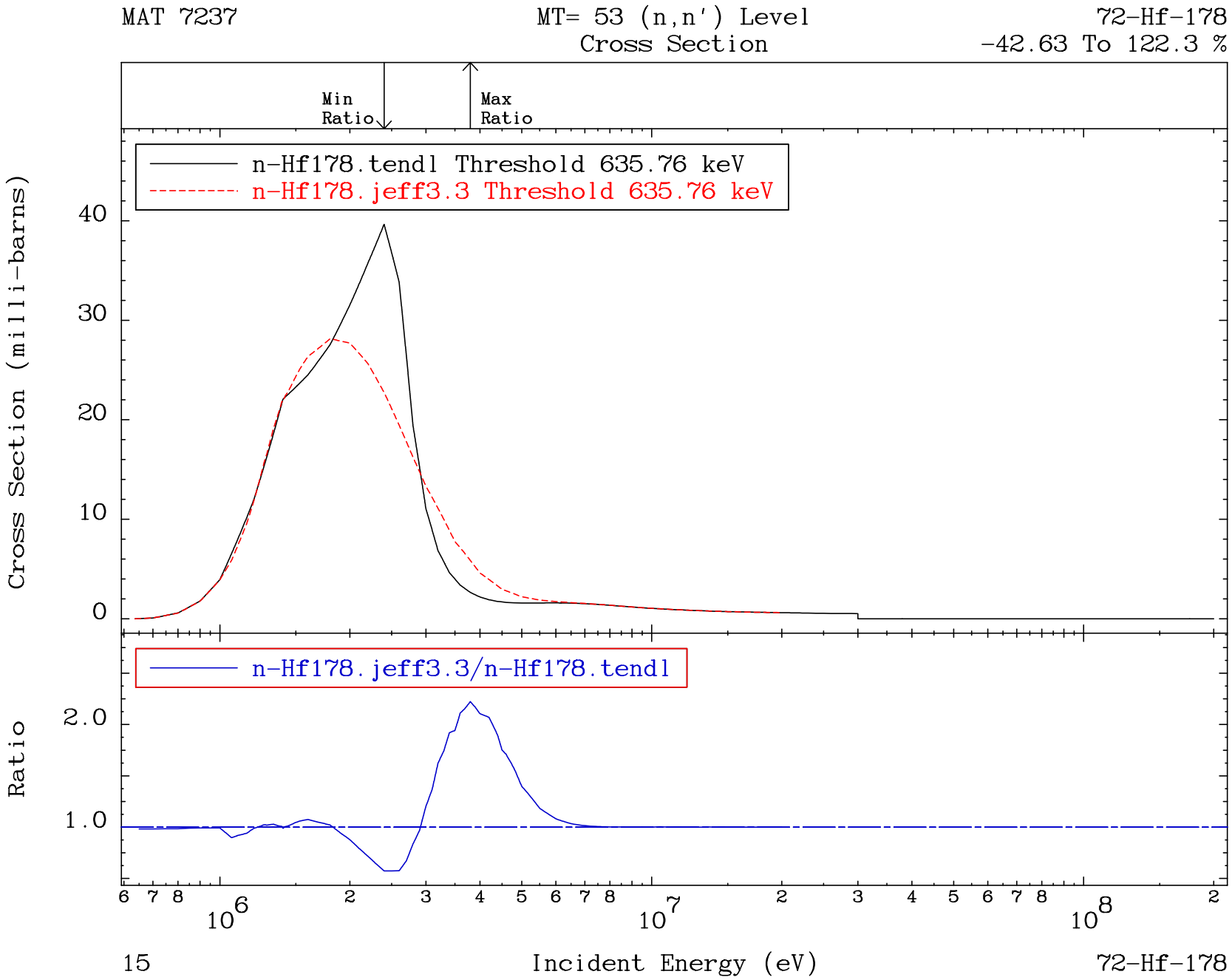

MAT 7237
(n,n') d
Cross Section
72-Hf-178
18.69 To 144.9 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 12.258 MeV
n-Hf178.jeff3.3 Threshold 12.258 MeV
Cross Section (milli-barns)
8
6
4
2
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
2.8
2.4
2.0
1.6
1.2
2
3
4
5
6
7
8
9
10^8
2
10
Incident Energy (eV)
72-Hf-178

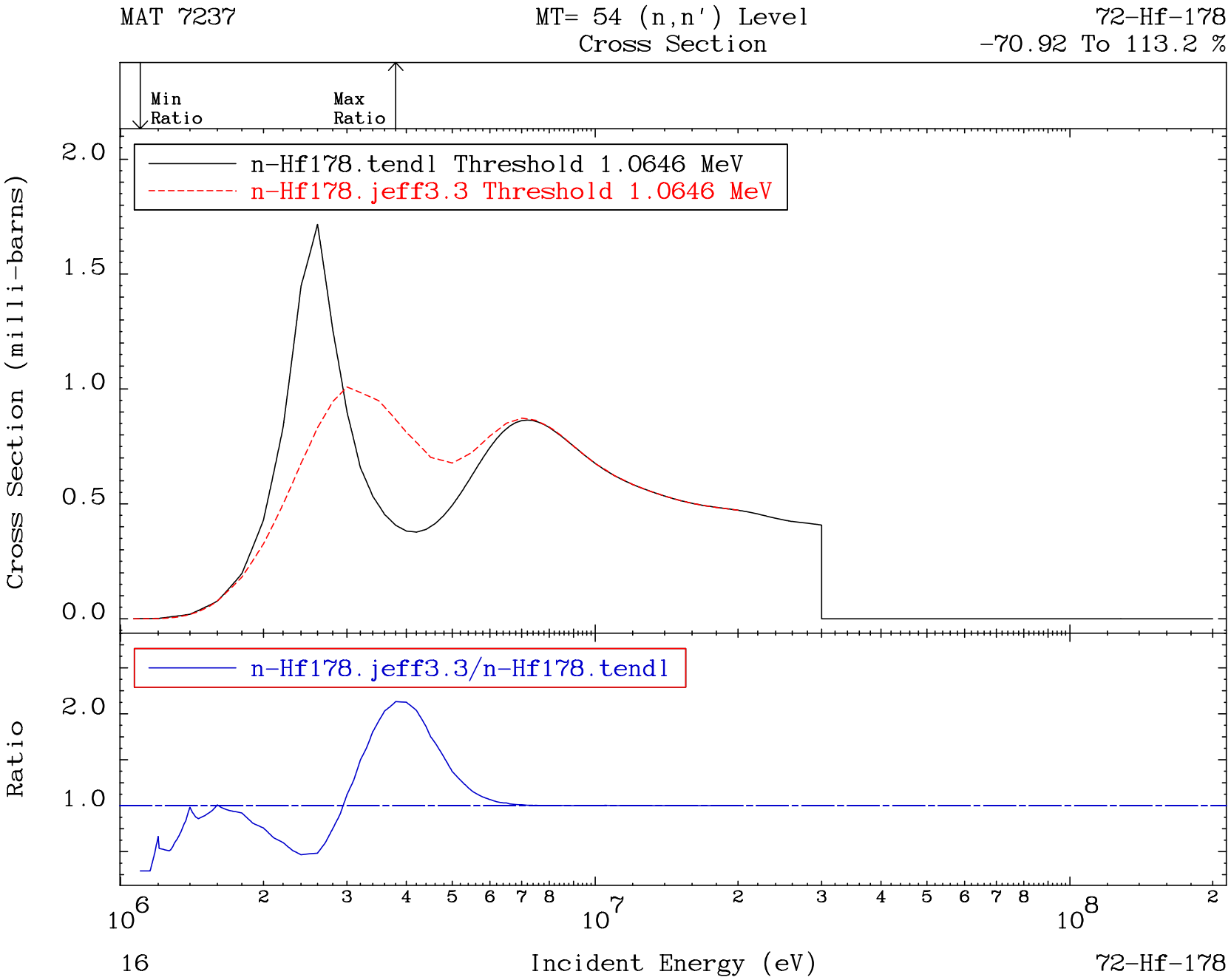

MAT 7237
(n,n') t
Cross Section
72-Hf-178
-4.593 To 3139. %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 12.289 MeV
n-Hf178.jeff3.3 Threshold 12.289 MeV
Cross Section (milli-barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
11
72-Hf-178

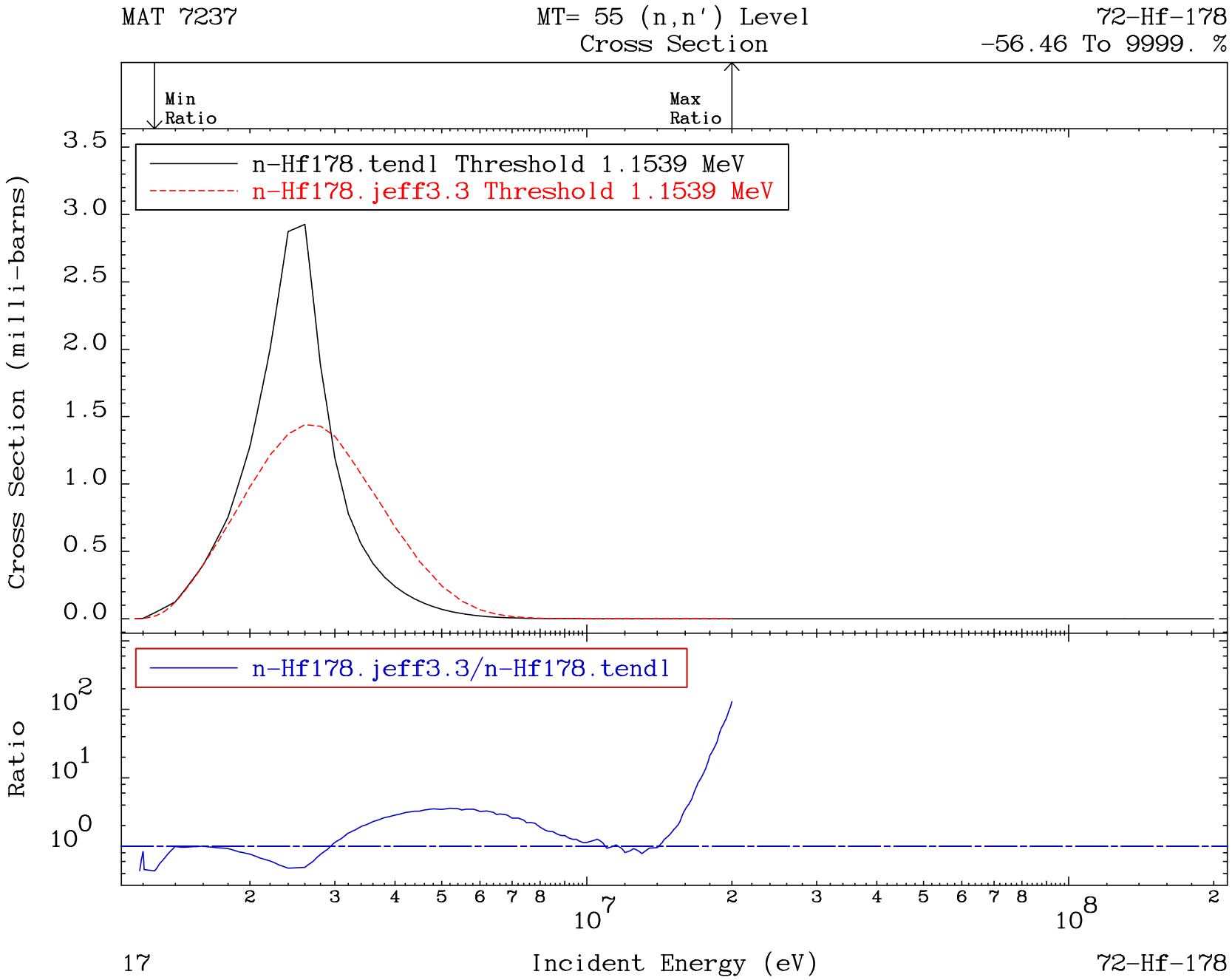

MAT 7237
(n,2n) p
Cross Section
72-Hf-178
57.65 To 9999. %
Min
Ratio
n-Hf178.tendl Threshold 14.495 MeV
n-Hf178.jeff3.3 Threshold 14.495 MeV
Cross Section (milli-barns)
16
14
12
10
8
6
4
2
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^3
10^2
10^1
10^0
2
3
4
5
6
7
8
9
10^8
2
12
Incident Energy (eV)
72-Hf-178

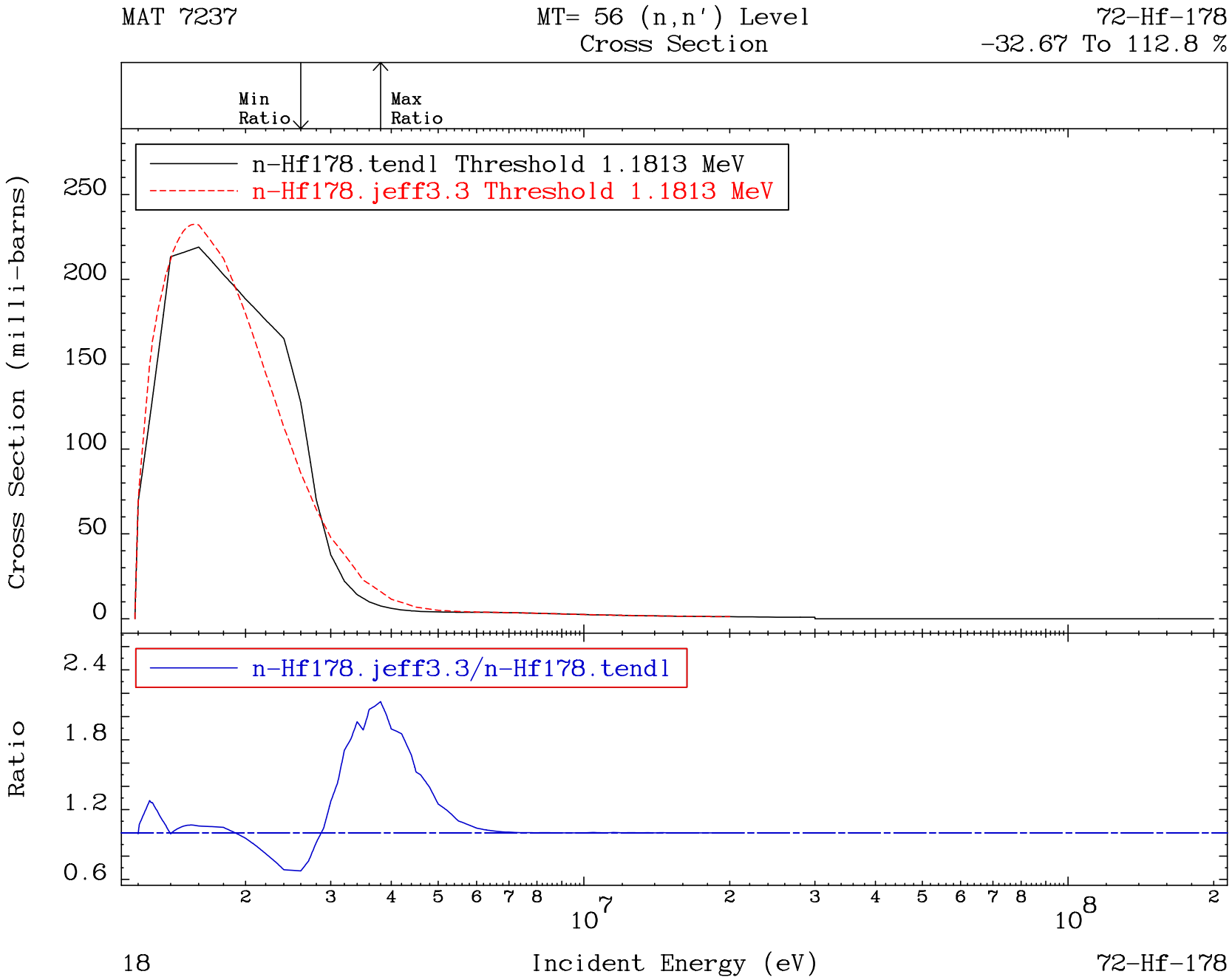

MAT 7237
MT= 51 (n,n') Level
Cross Section
72-Hf-178
-10.83 To 4.502 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 93.708 keV
n-Hf178.jeff3.3 Threshold 93.708 keV
Cross Section (barns)
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.0
0.9
10^5
10^6
10^7
10^8
13
Incident Energy (eV)
72-Hf-178

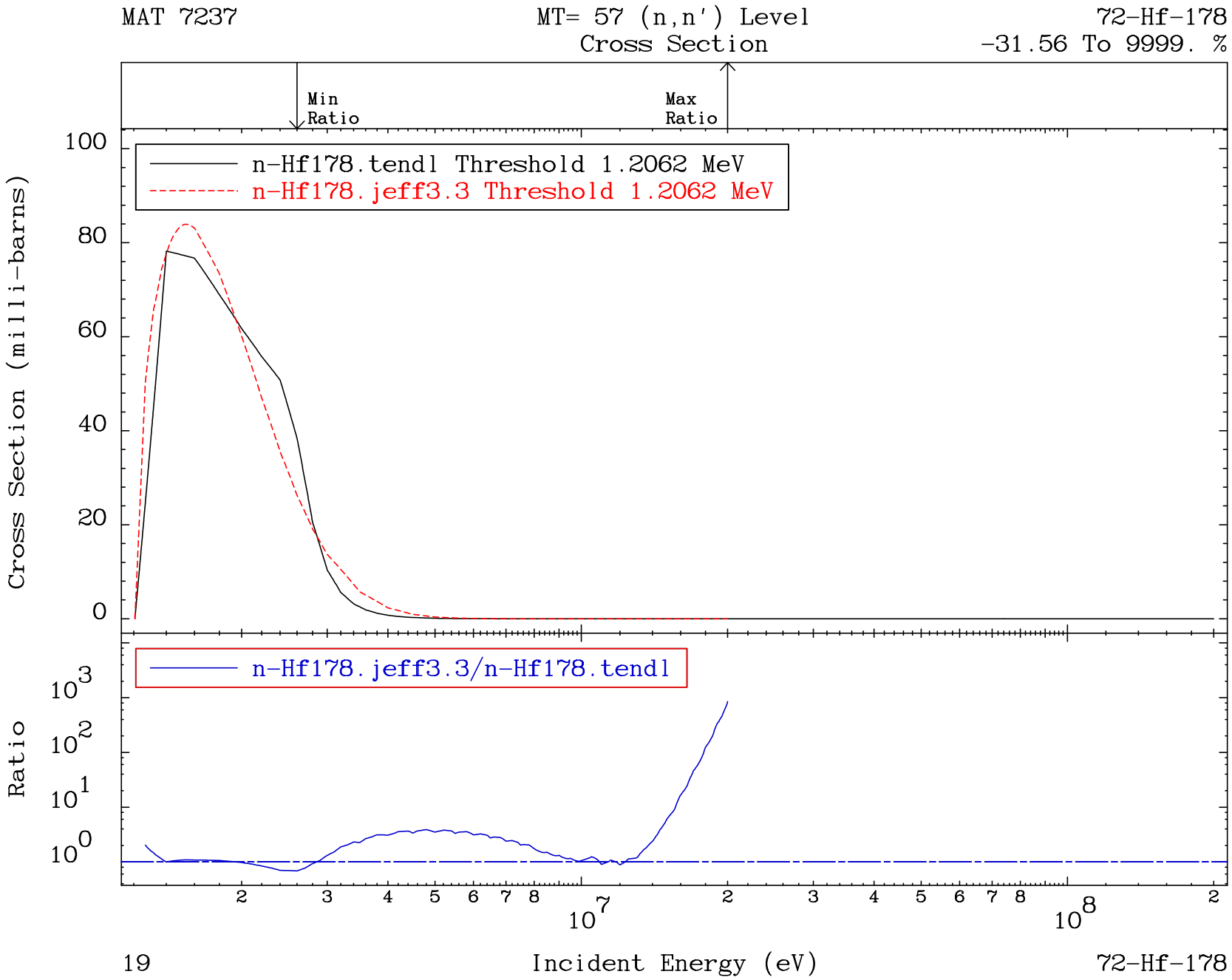

MAT 7237
MT= 52 (n,n') Level
Cross Section
72-Hf-178
-25.57 To 16.11 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 308.36 keV
n-Hf178.jeff3.3 Threshold 308.36 keV
Cross Section (milli-barns)
500
400
300
200
100
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.2
1.0
0.8
3 4 5 6 7 8 10^6 2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
14
Incident Energy (eV)
72-Hf-178

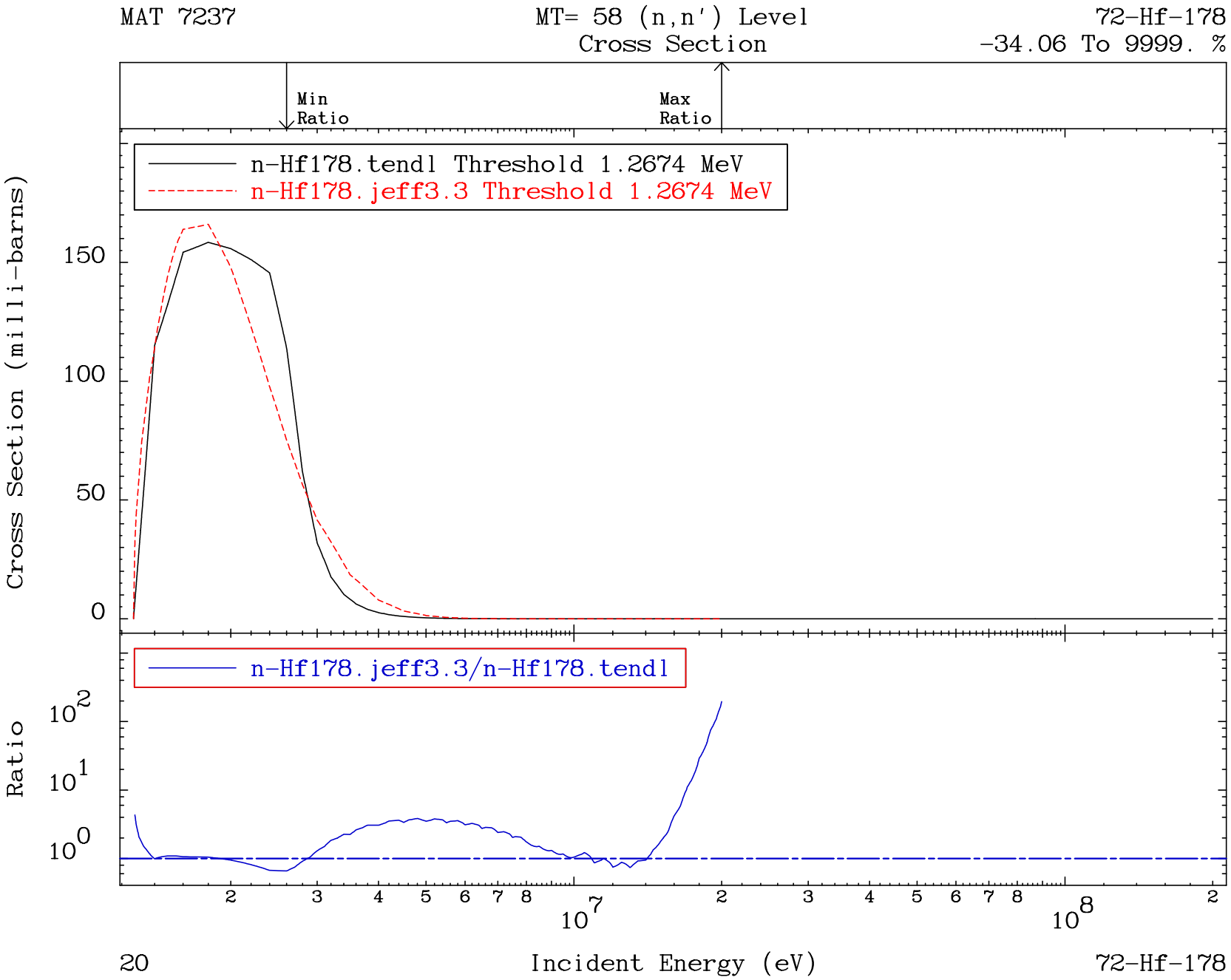

MAT 7237
MT= 53 (n,n') Level
Cross Section
72-Hf-178
-42.63 To 122.3 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 635.76 keV
n-Hf178.jeff3.3 Threshold 635.76 keV
Cross Section (milli-barns)
40
30
20
10
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
2.0
1.0
6 7 8 10^6 2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
15
Incident Energy (eV)
72-Hf-178

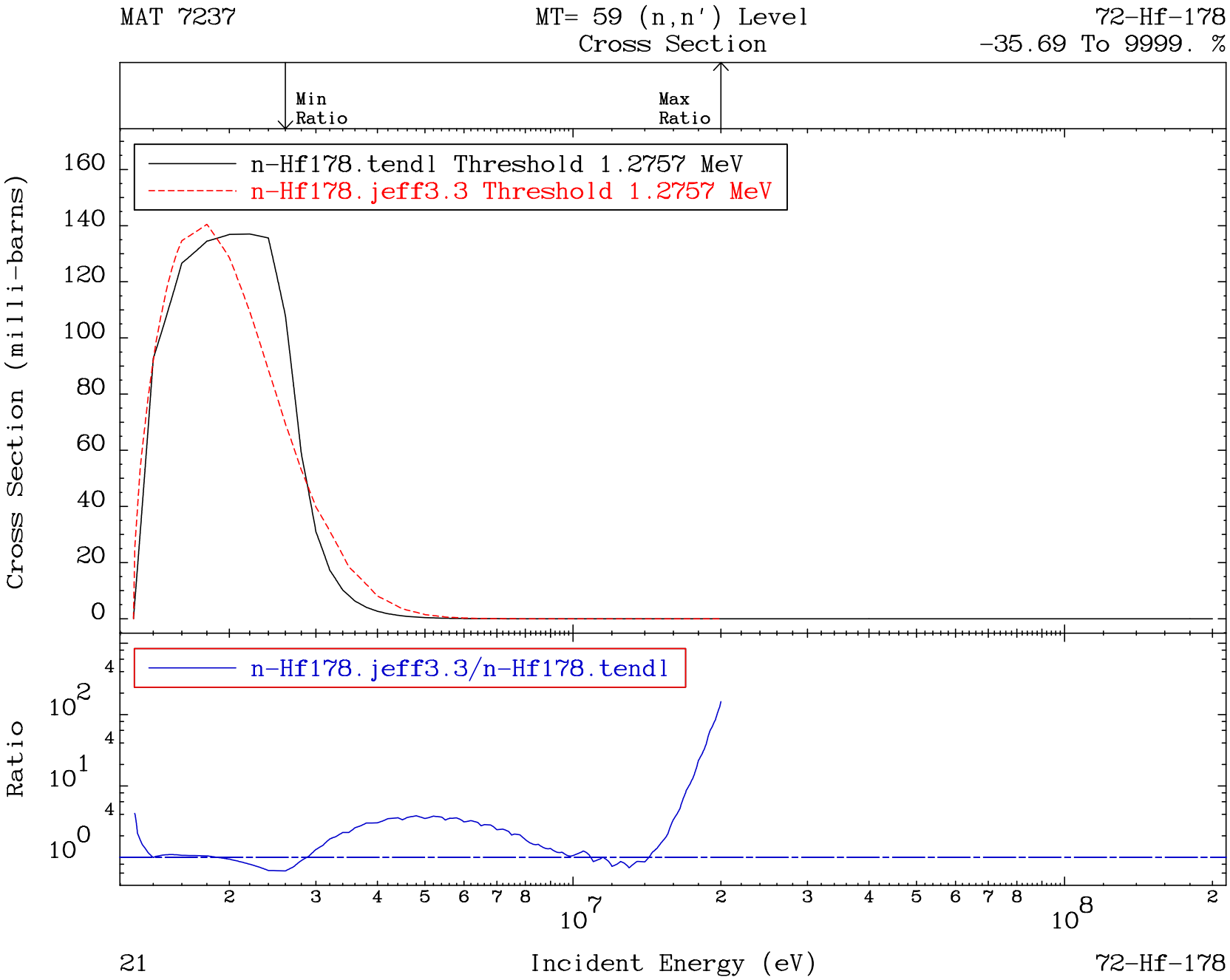

MAT 7237
MT= 54 (n,n') Level
Cross Section
72-Hf-178
-70.92 To 113.2 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.0646 MeV
n-Hf178.jeff3.3 Threshold 1.0646 MeV
Cross Section (milli-barns)
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
2.0
1.0
10^6
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
16
Incident Energy (eV)
72-Hf-178

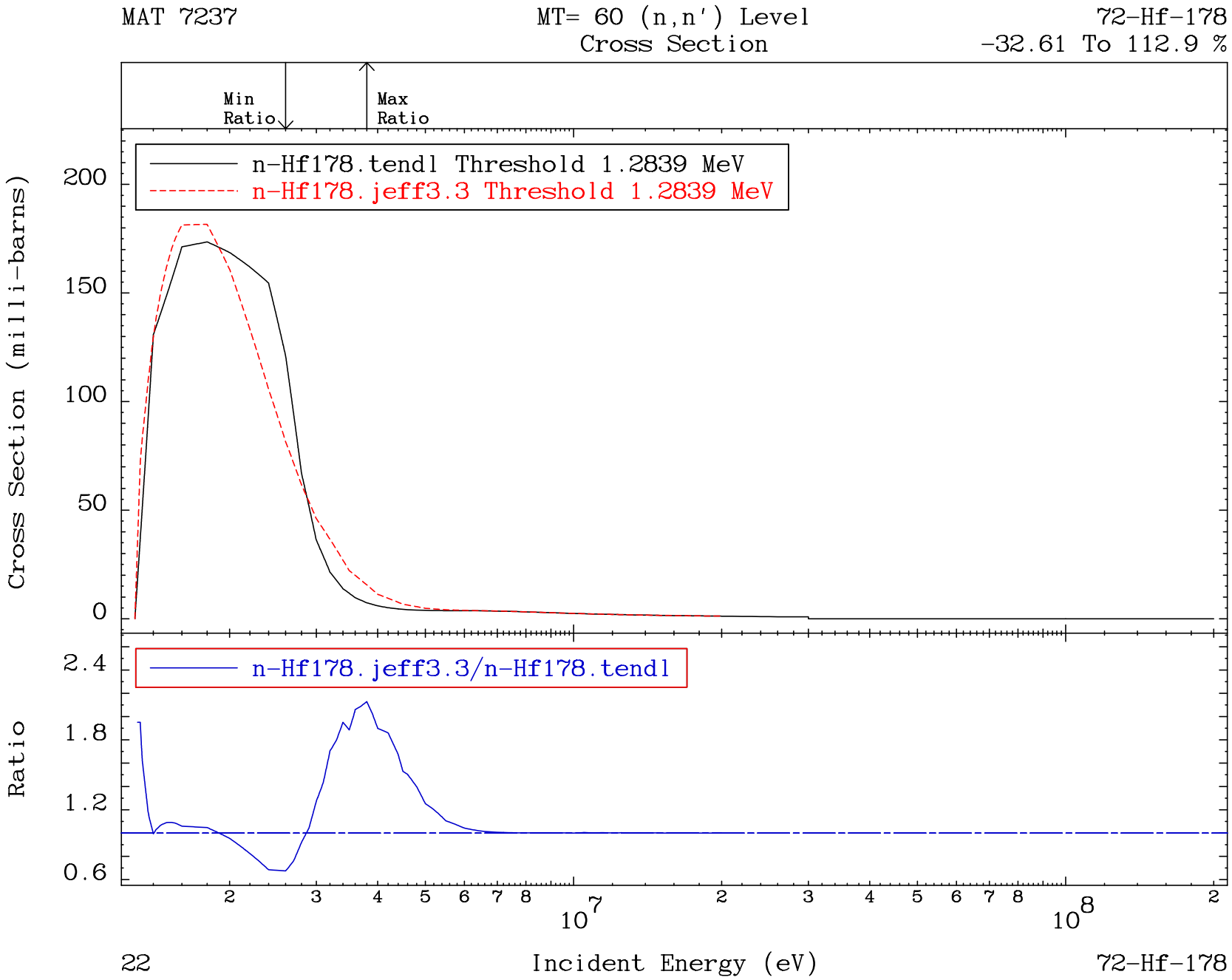

MAT 7237
MT= 55 (n,n') Level
Cross Section
72-Hf-178
-56.46 To 9999. %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.1539 MeV
n-Hf178.jeff3.3 Threshold 1.1539 MeV
Cross Section (milli-barns)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^2
10^1
10^0
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
17
Incident Energy (eV)
72-Hf-178

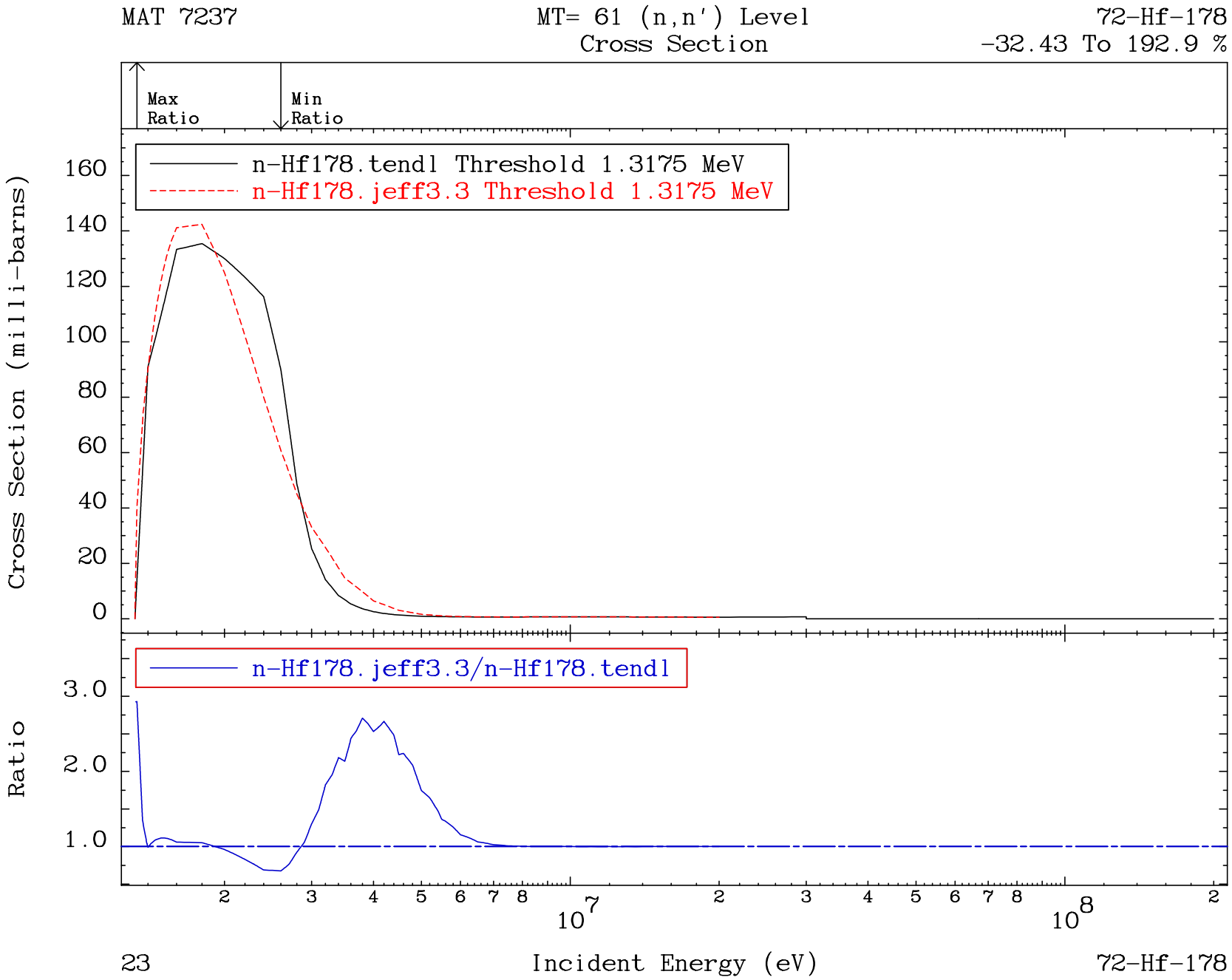

MAT 7237
MT= 56 (n,n') Level
Cross Section
72-Hf-178
-32.67 To 112.8 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.1813 MeV
n-Hf178.jeff3.3 Threshold 1.1813 MeV
Cross Section (milli-barns)
250
200
150
100
50
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
2.4
1.8
1.2
0.6
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
18
Incident Energy (eV)
72-Hf-178

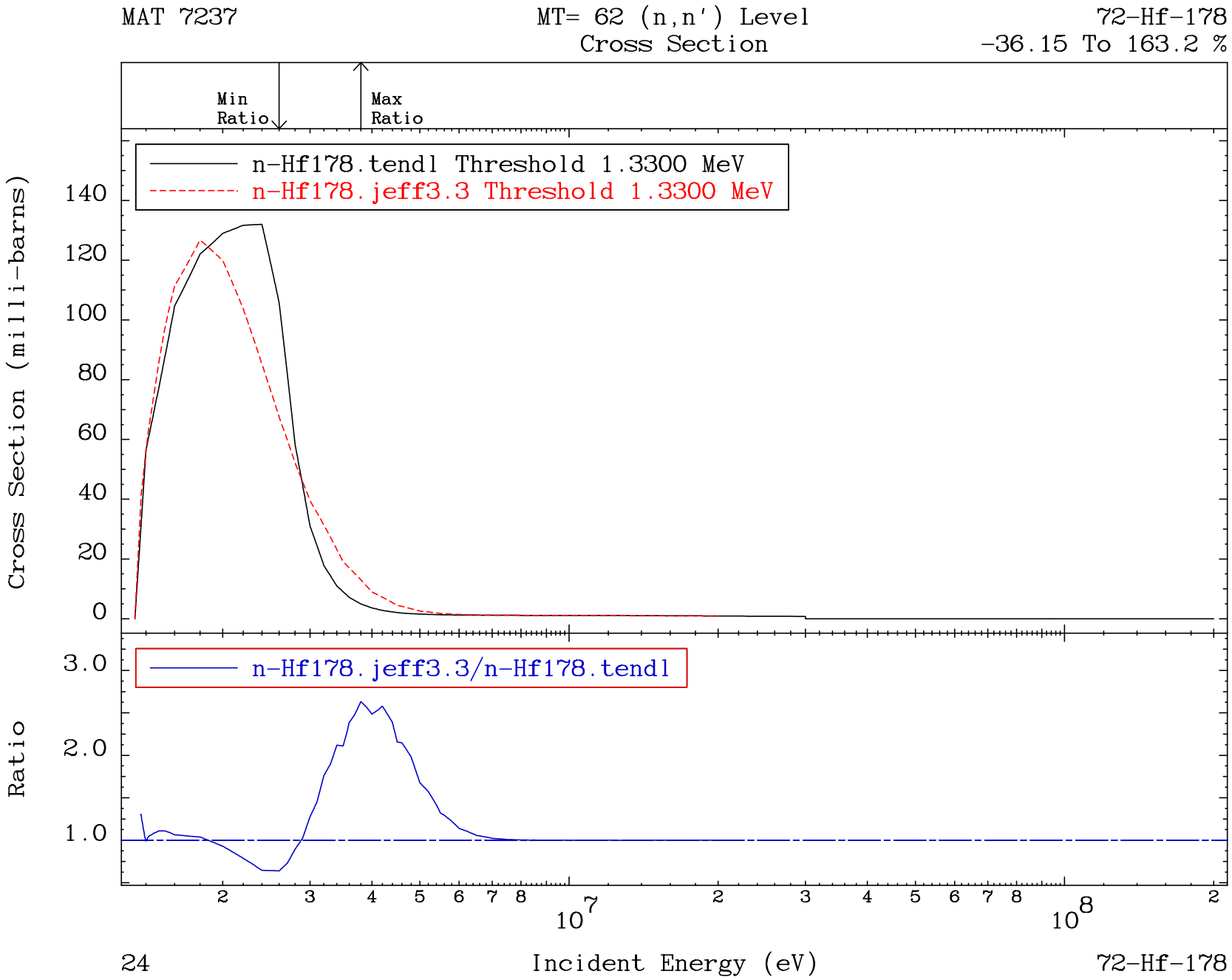

MAT 7237
MT= 57 (n,n') Level
Cross Section
72-Hf-178
-31.56 To 9999. %
Min
Ratio
Max
Ratio
n-Hf178.tendl Threshold 1.2062 MeV
n-Hf178.jeff3.3 Threshold 1.2062 MeV
Cross Section (milli-barns)
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^3
10^2
10^1
10^0
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
19
Incident Energy (eV)
72-Hf-178

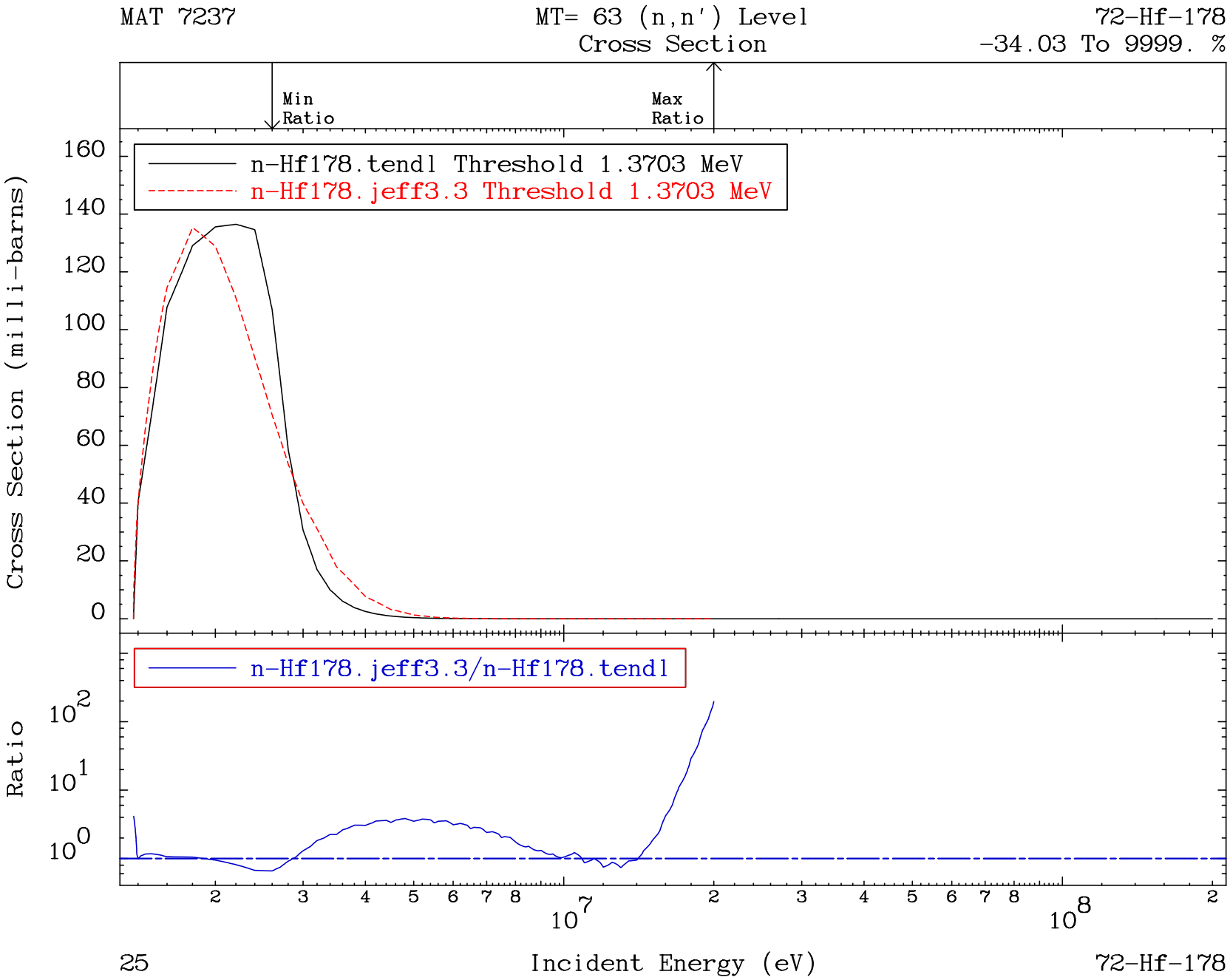

MAT 7237
MT= 58 (n,n') Level
Cross Section
72-Hf-178
-34.06 To 9999. %
Min
Ratio
Max
Ratio
n-Hf178.tendl Threshold 1.2674 MeV
n-Hf178.jeff3.3 Threshold 1.2674 MeV
Cross Section (milli-barns)
150
100
50
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^2
10^1
10^0
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
20
Incident Energy (eV)
72-Hf-178

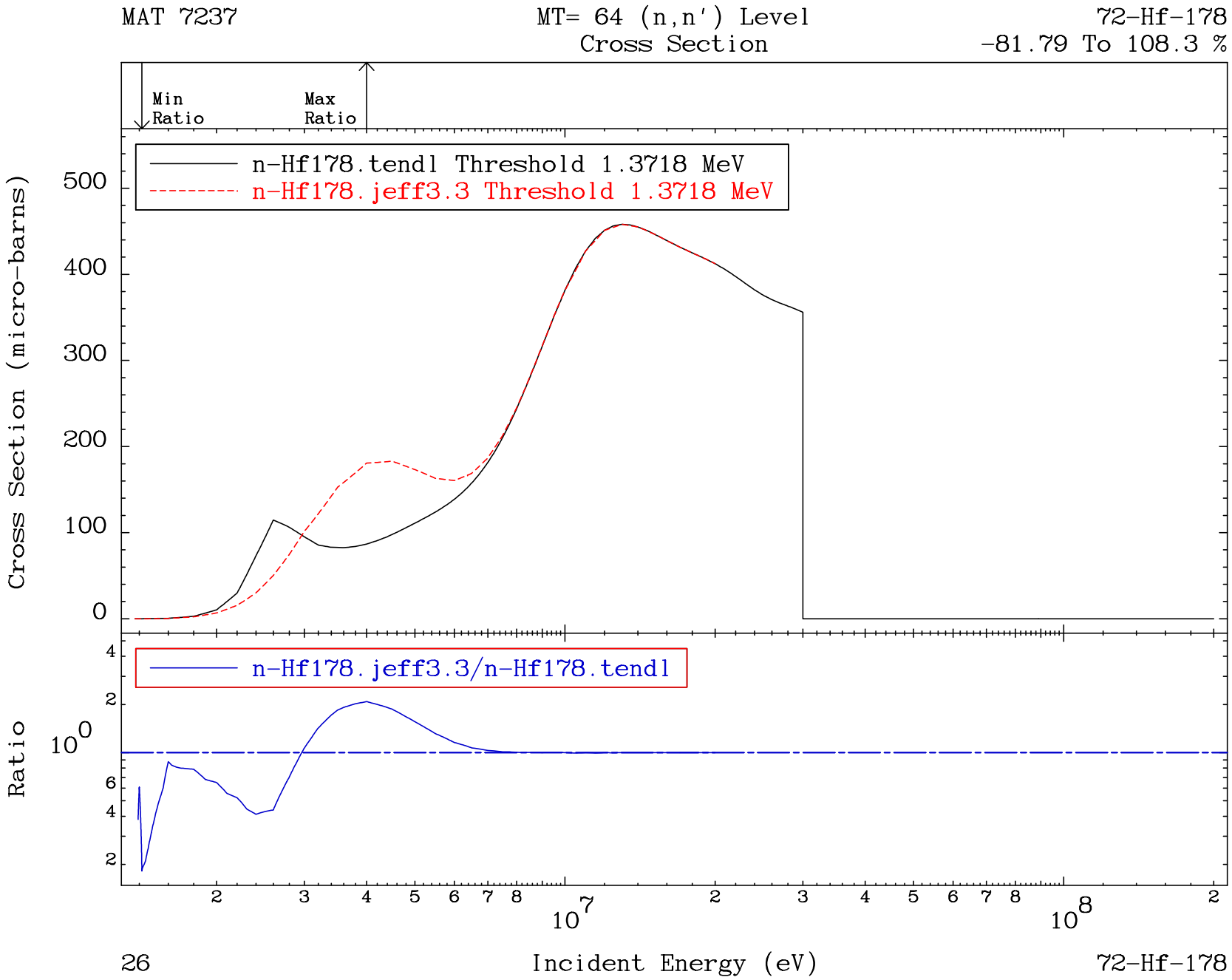

MAT 7237
MT= 59 (n,n') Level
Cross Section
72-Hf-178
-35.69 To 9999. %
Min
Ratio
Max
Ratio
n-Hf178.tendl Threshold 1.2757 MeV
n-Hf178.jeff3.3 Threshold 1.2757 MeV
Cross Section (milli-barns)
160
140
120
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^2
10^1
10^0
2
3
4
5
6
7
8
10^7
10^8
21
Incident Energy (eV)
72-Hf-178

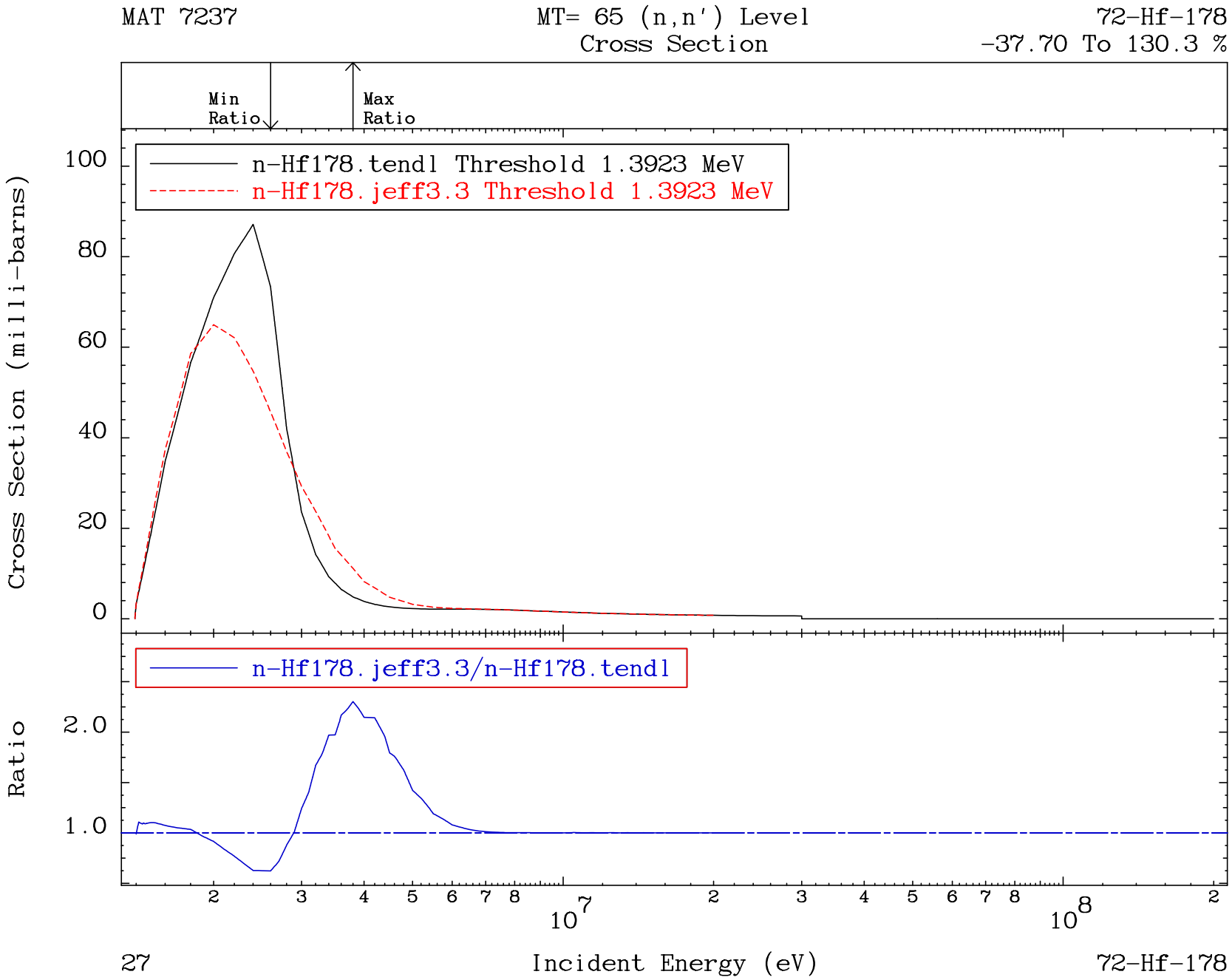

MAT 7237
MT= 60 (n,n') Level
Cross Section
72-Hf-178
-32.61 To 112.9 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.2839 MeV
n-Hf178.jeff3.3 Threshold 1.2839 MeV
Cross Section (milli-barns)
200
150
100
50
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
2.4
1.8
1.2
0.6
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
22
Incident Energy (eV)
72-Hf-178

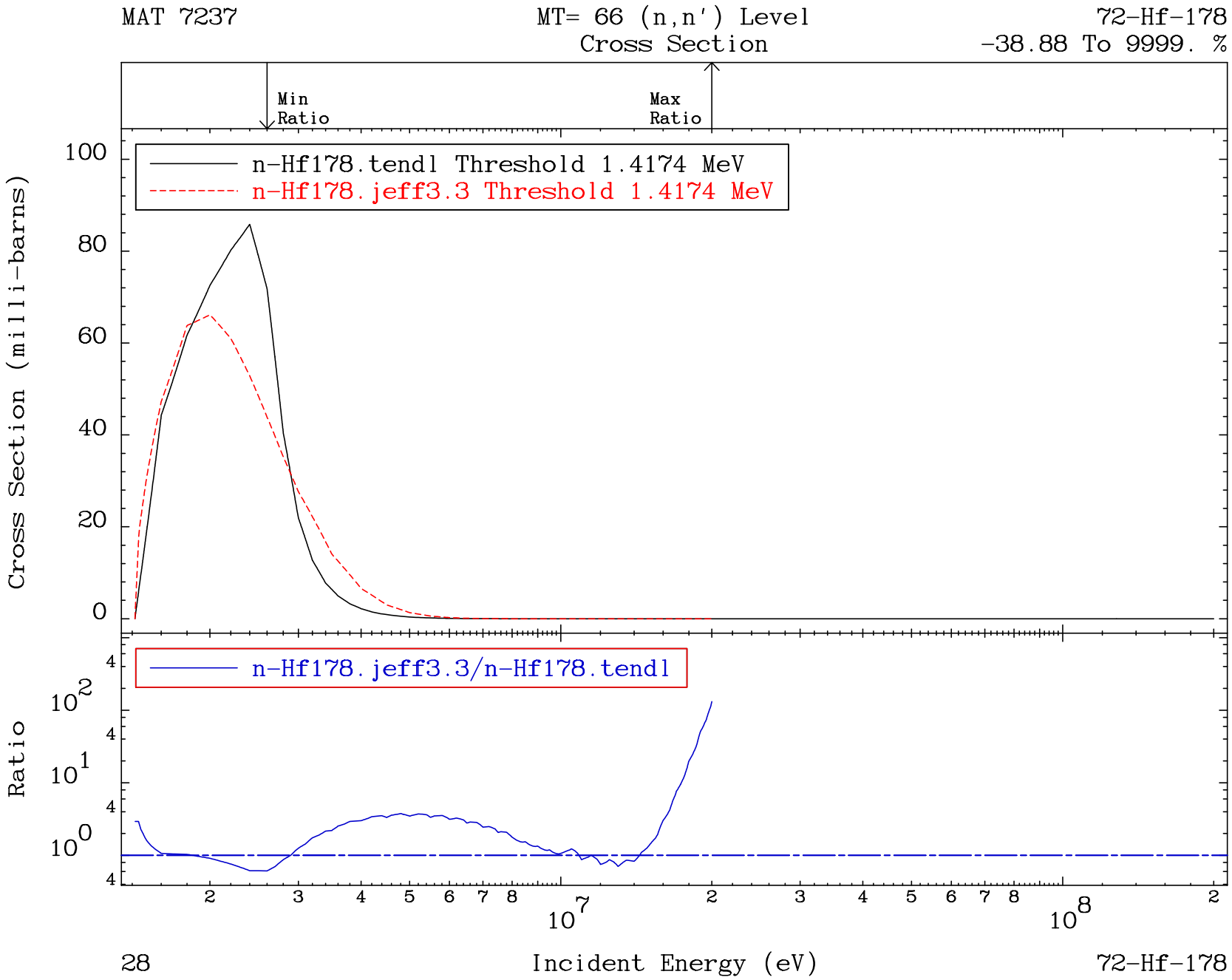

MAT 7237
MT= 61 (n,n') Level
Cross Section
72-Hf-178
-32.43 To 192.9 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 1.3175 MeV
n-Hf178.jeff3.3 Threshold 1.3175 MeV
Cross Section (milli-barns)
160
140
120
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
3.0
2.0
1.0
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
23
Incident Energy (eV)
72-Hf-178

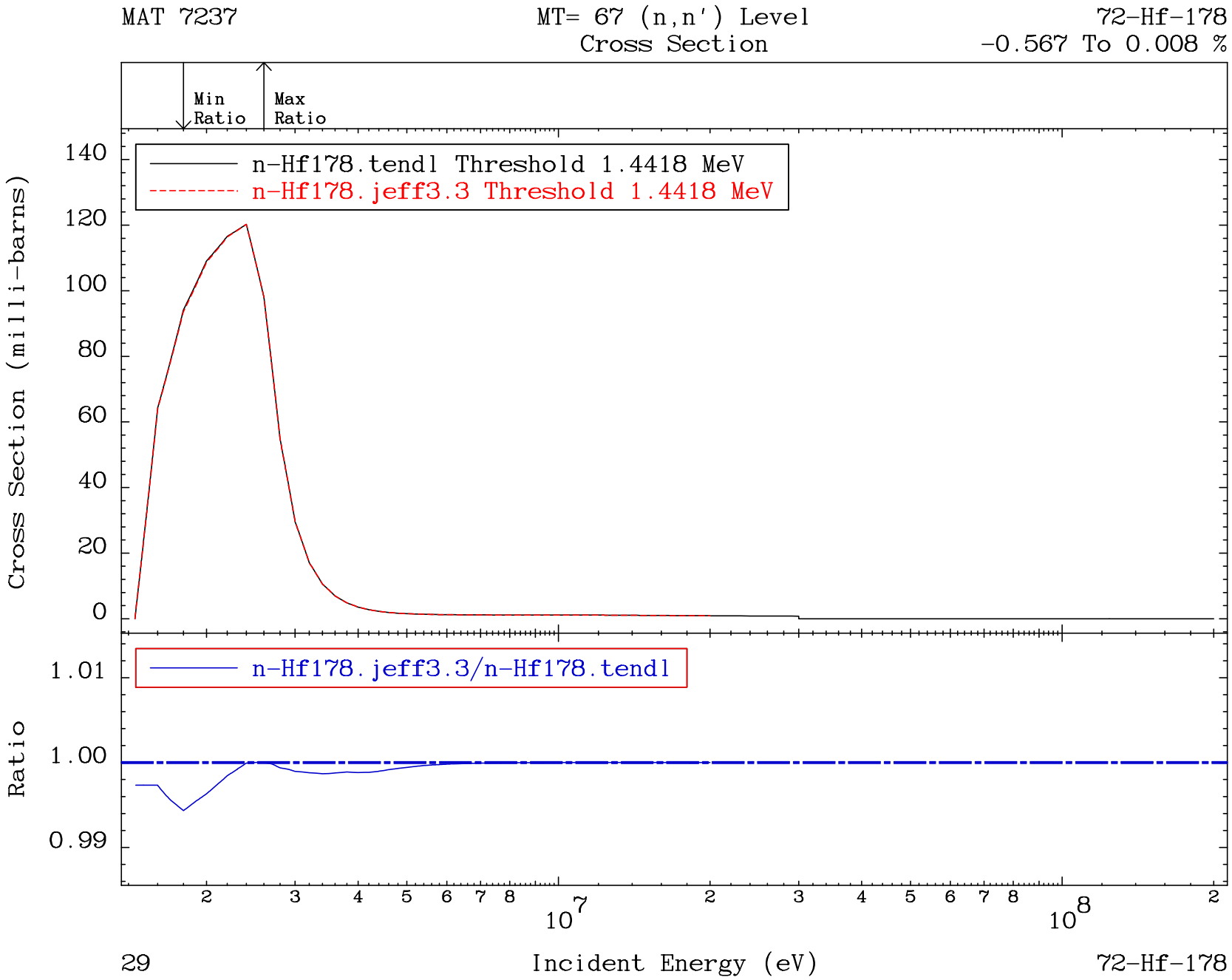

MAT 7237
MT= 62 (n,n') Level
Cross Section
72-Hf-178
-36.15 To 163.2 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.3300 MeV
n-Hf178.jeff3.3 Threshold 1.3300 MeV
Cross Section (milli-barns)
140
120
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
3.0
2.0
1.0
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
24
Incident Energy (eV)
72-Hf-178

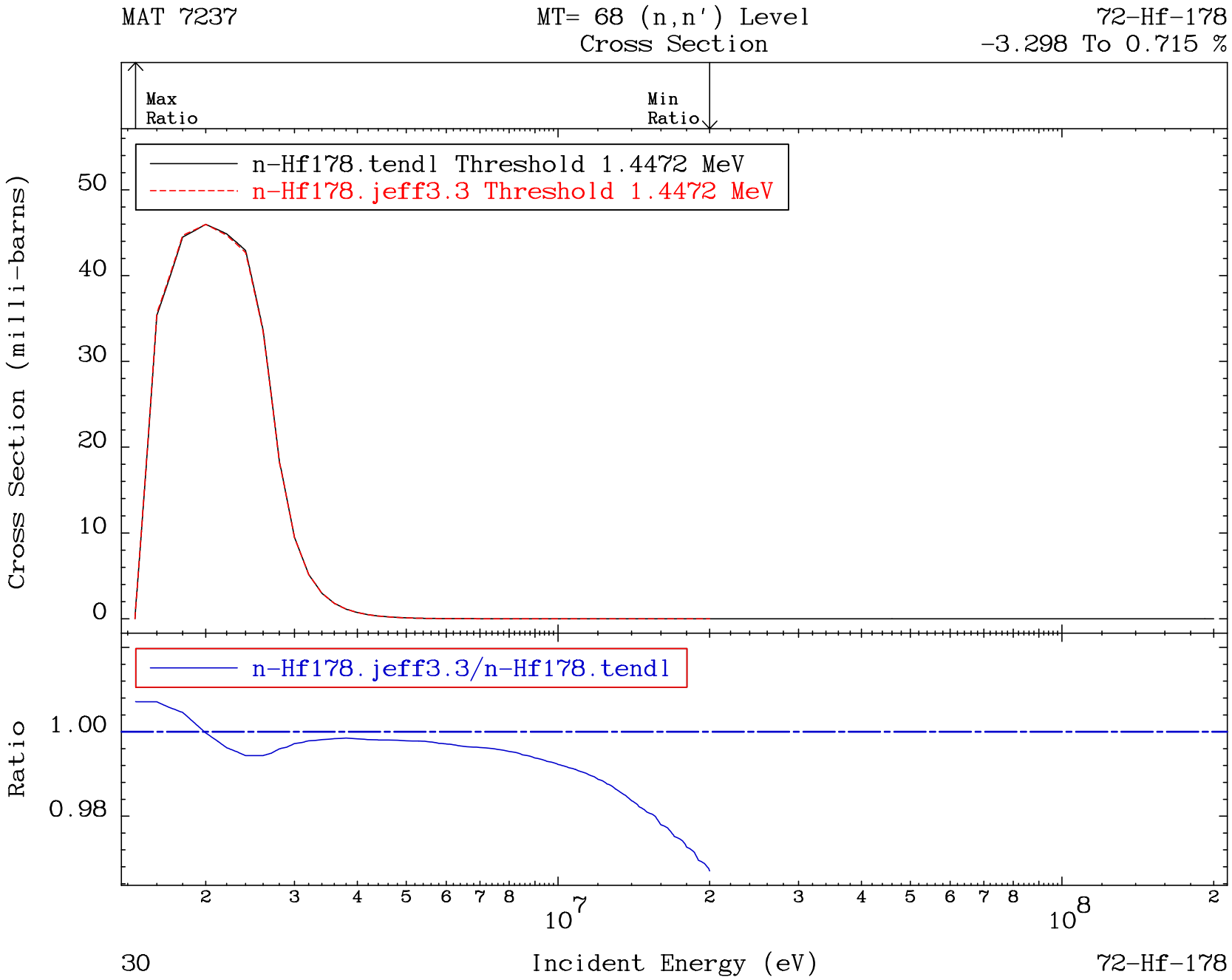

MAT 7237
MT= 63 (n,n') Level
Cross Section
72-Hf-178
-34.03 To 9999. %
Min
Ratio
Max
Ratio
n-Hf178.tendl Threshold 1.3703 MeV
n-Hf178.jeff3.3 Threshold 1.3703 MeV
Cross Section (milli-barns)
160
140
120
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^2
10^1
10^0
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
25
Incident Energy (eV)
72-Hf-178

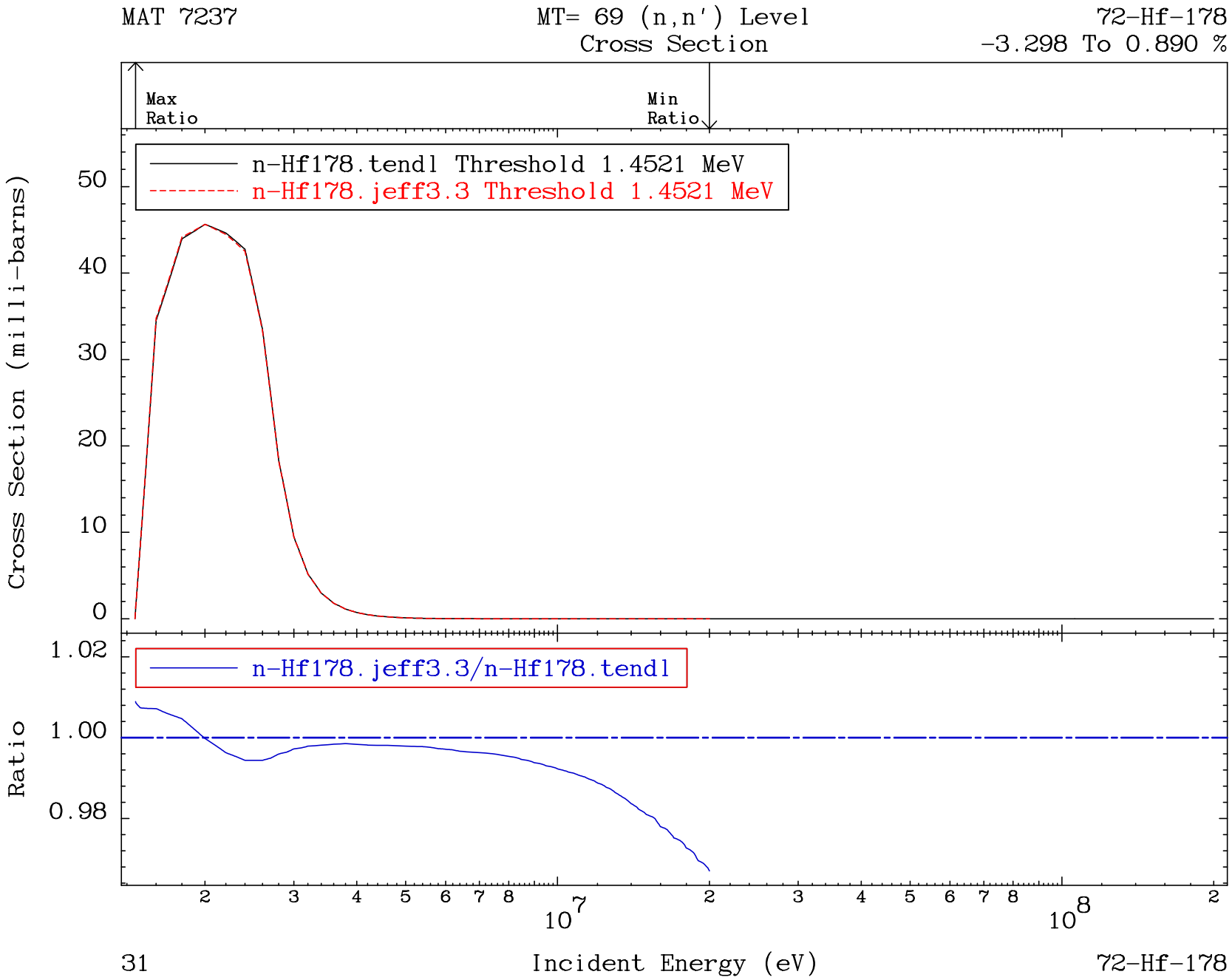

MAT 7237
MT= 64 (n,n') Level
Cross Section
72-Hf-178
-81.79 To 108.3 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.3718 MeV
n-Hf178.jeff3.3 Threshold 1.3718 MeV
Cross Section (micro-barns)
500
400
300
200
100
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^0
4
2
6
4
2
2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
26
Incident Energy (eV)
72-Hf-178

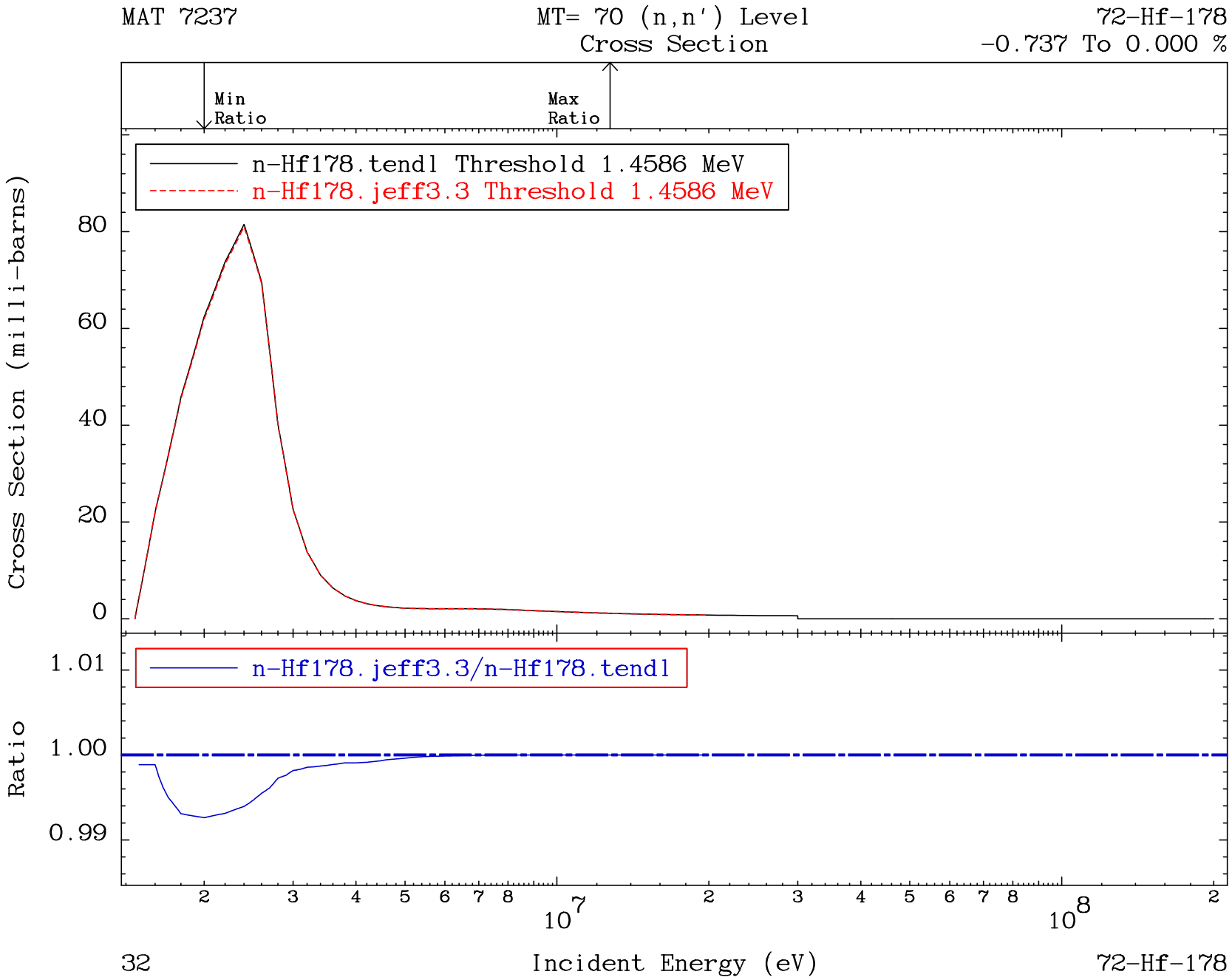

MAT 7237
MT= 65 (n,n') Level
Cross Section
72-Hf-178
-37.70 To 130.3 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.3923 MeV
n-Hf178.jeff3.3 Threshold 1.3923 MeV
Cross Section (milli-barns)
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
2.0
1.0
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
27
Incident Energy (eV)
72-Hf-178

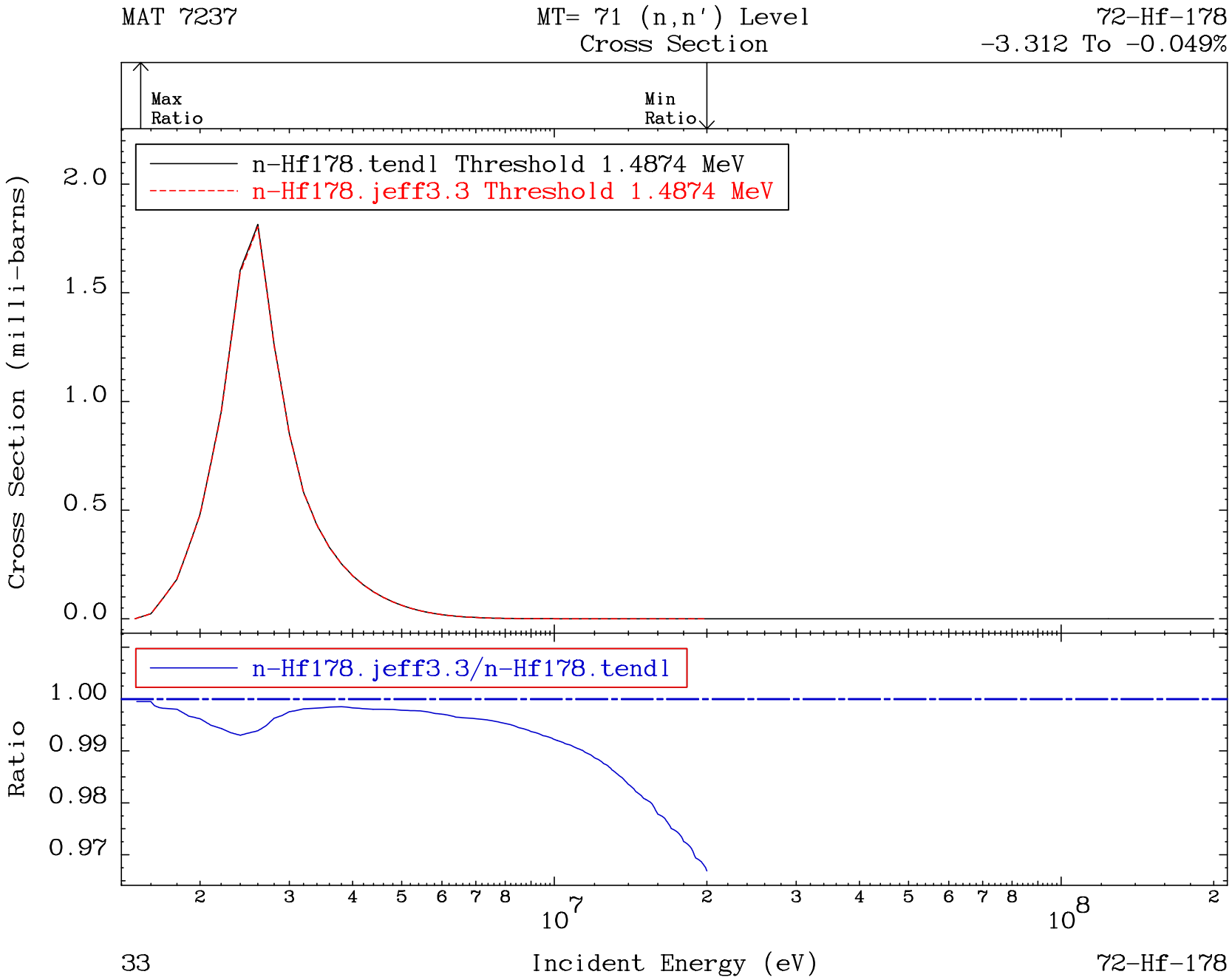

MAT 7237
MT= 66 (n,n') Level
Cross Section
72-Hf-178
-38.88 To 9999. %
Min
Ratio
Max
Ratio
n-Hf178.tendl Threshold 1.4174 MeV
n-Hf178.jeff3.3 Threshold 1.4174 MeV
Cross Section (milli-barns)
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^2
10^1
10^0
2
3
4
5
6
7
8
10^7
10^8
28
Incident Energy (eV)
72-Hf-178

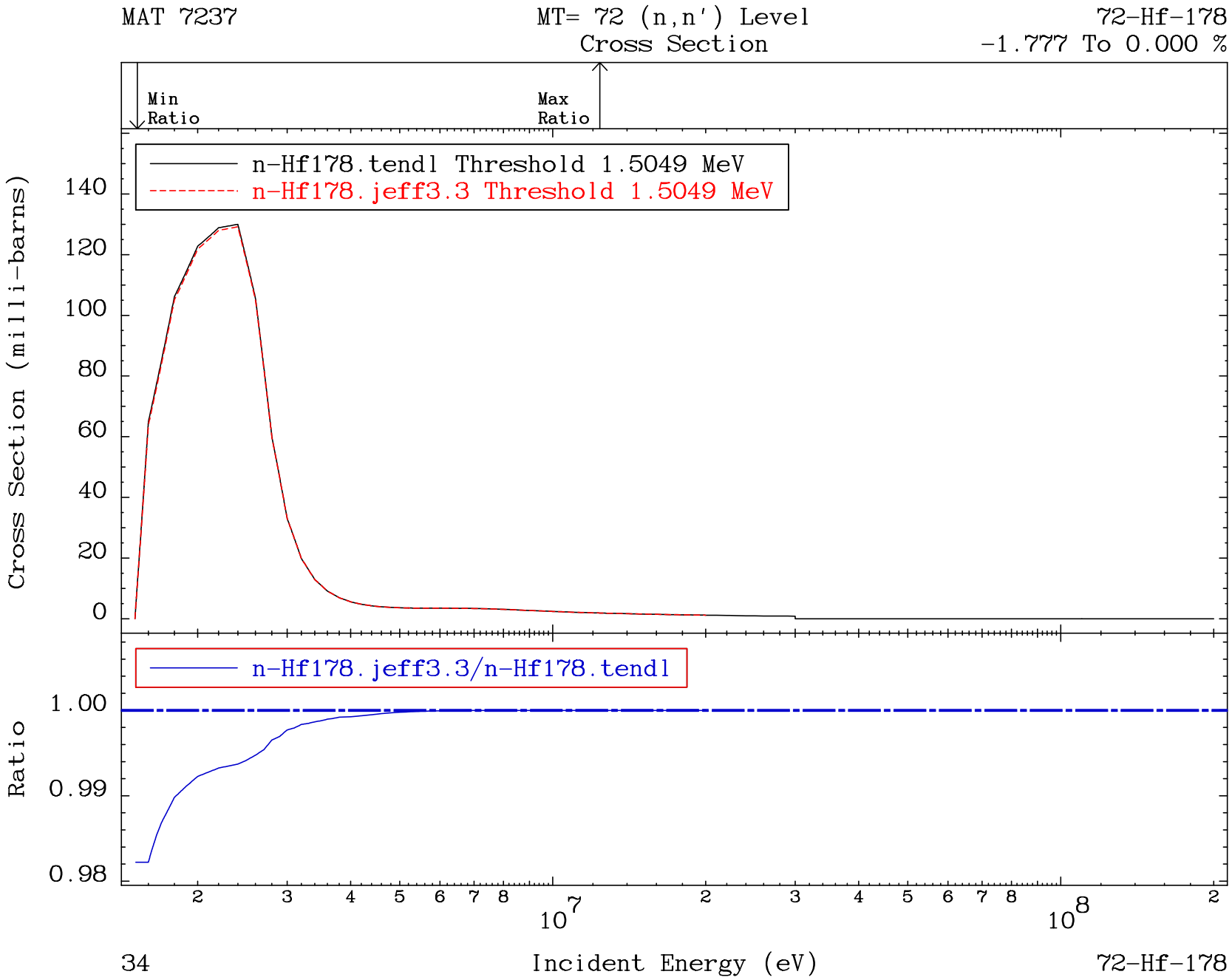

MAT 7237
MT= 67 (n,n') Level
Cross Section
72-Hf-178
-0.567 To 0.008 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.4418 MeV
n-Hf178.jeff3.3 Threshold 1.4418 MeV
Cross Section (milli-barns)
140
120
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.01
1.00
0.99
2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
29
Incident Energy (eV)
72-Hf-178

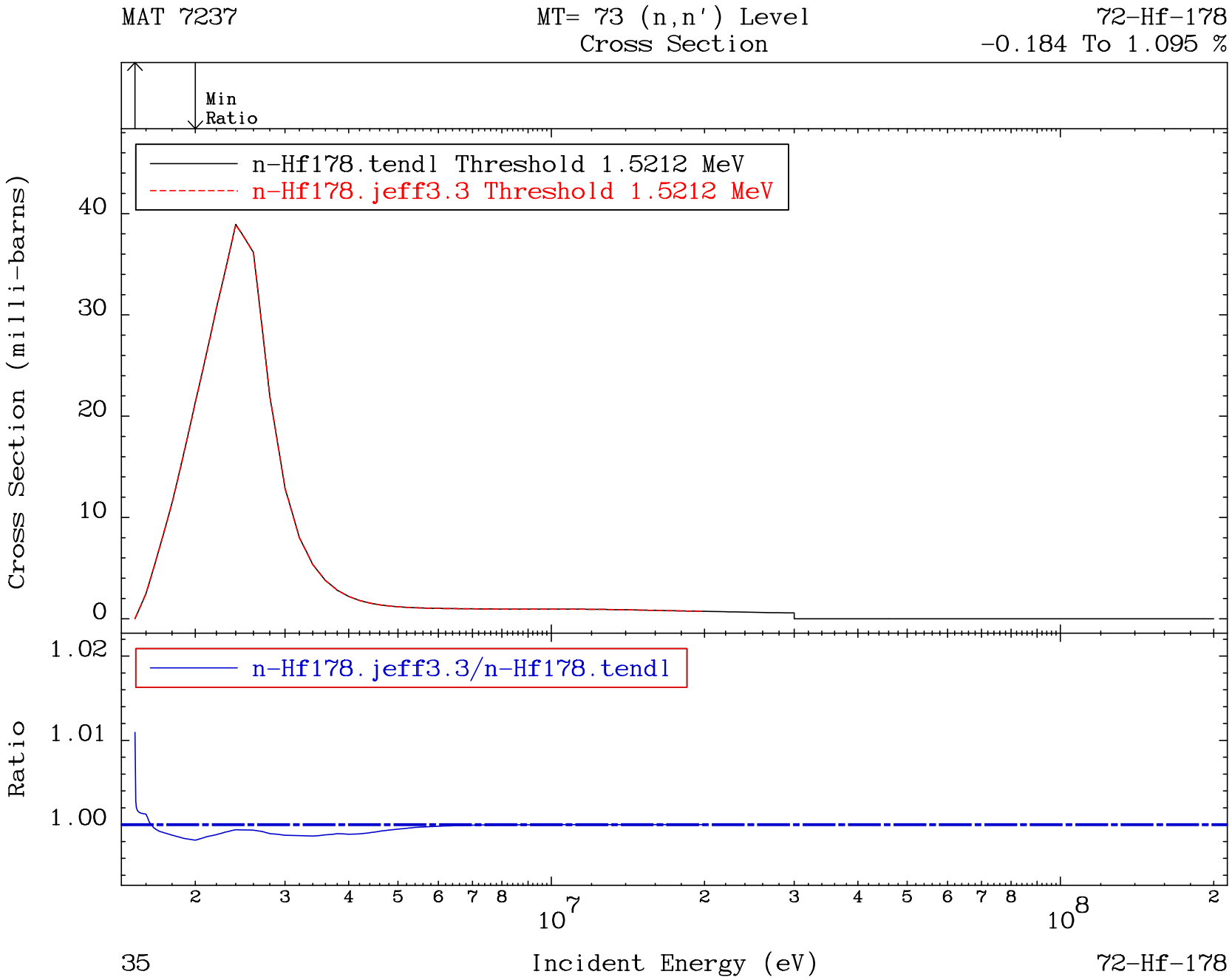

MAT 7237
MT= 68 (n,n') Level
Cross Section
72-Hf-178
-3.298 To 0.715 %
Max
Ratio
Min
Ratio
n-Hf178.tendl Threshold 1.4472 MeV
n-Hf178.jeff3.3 Threshold 1.4472 MeV
Cross Section (milli-barns)
50
40
30
20
10
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.00
0.98
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
30
Incident Energy (eV)
72-Hf-178

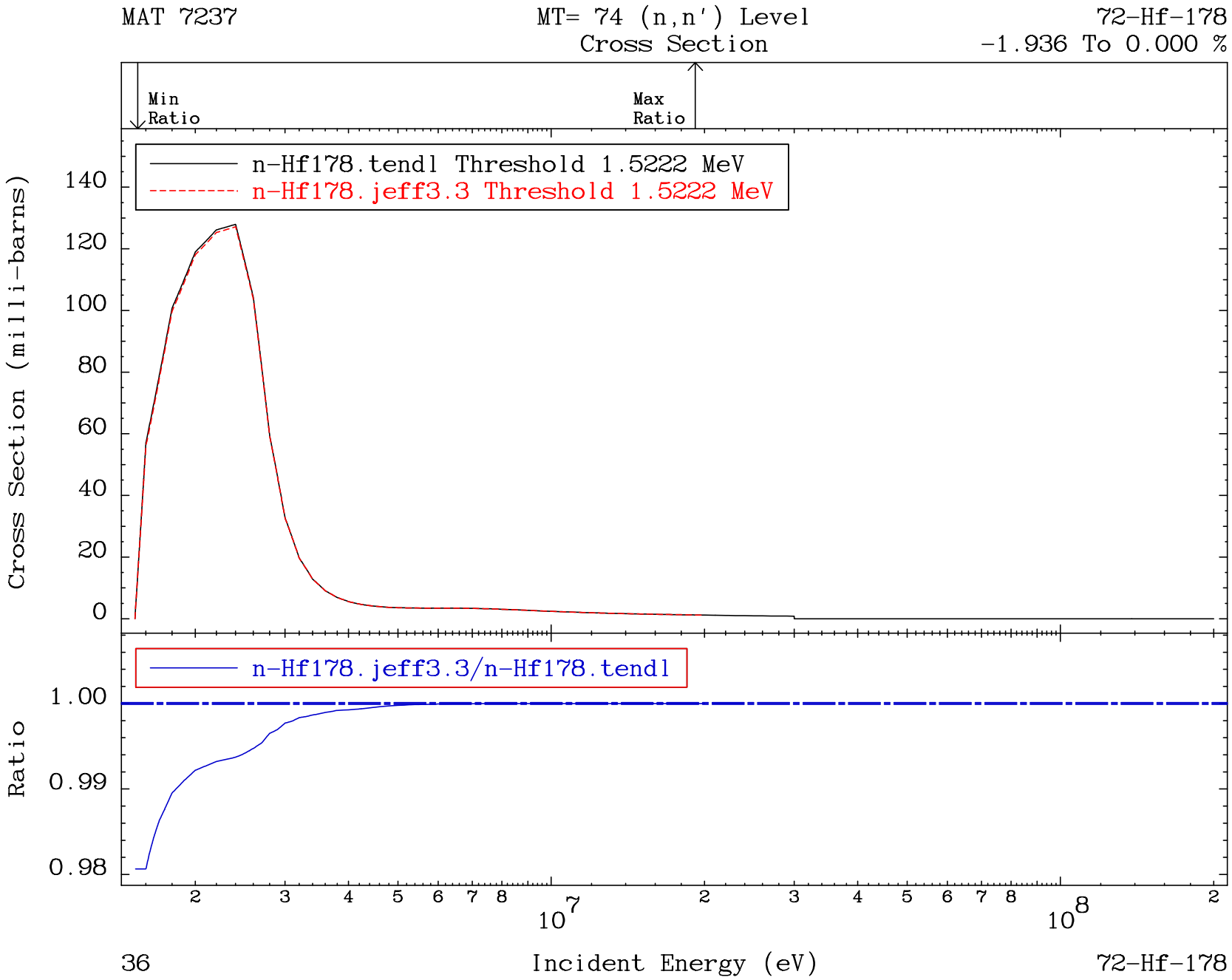

MAT 7237
MT= 69 (n,n') Level
Cross Section
72-Hf-178
-3.298 To 0.890 %
Max
Ratio
Min
Ratio
n-Hf178.tendl Threshold 1.4521 MeV
n-Hf178.jeff3.3 Threshold 1.4521 MeV
Cross Section (milli-barns)
50
40
30
20
10
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.02
1.00
0.98
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
31
Incident Energy (eV)
72-Hf-178

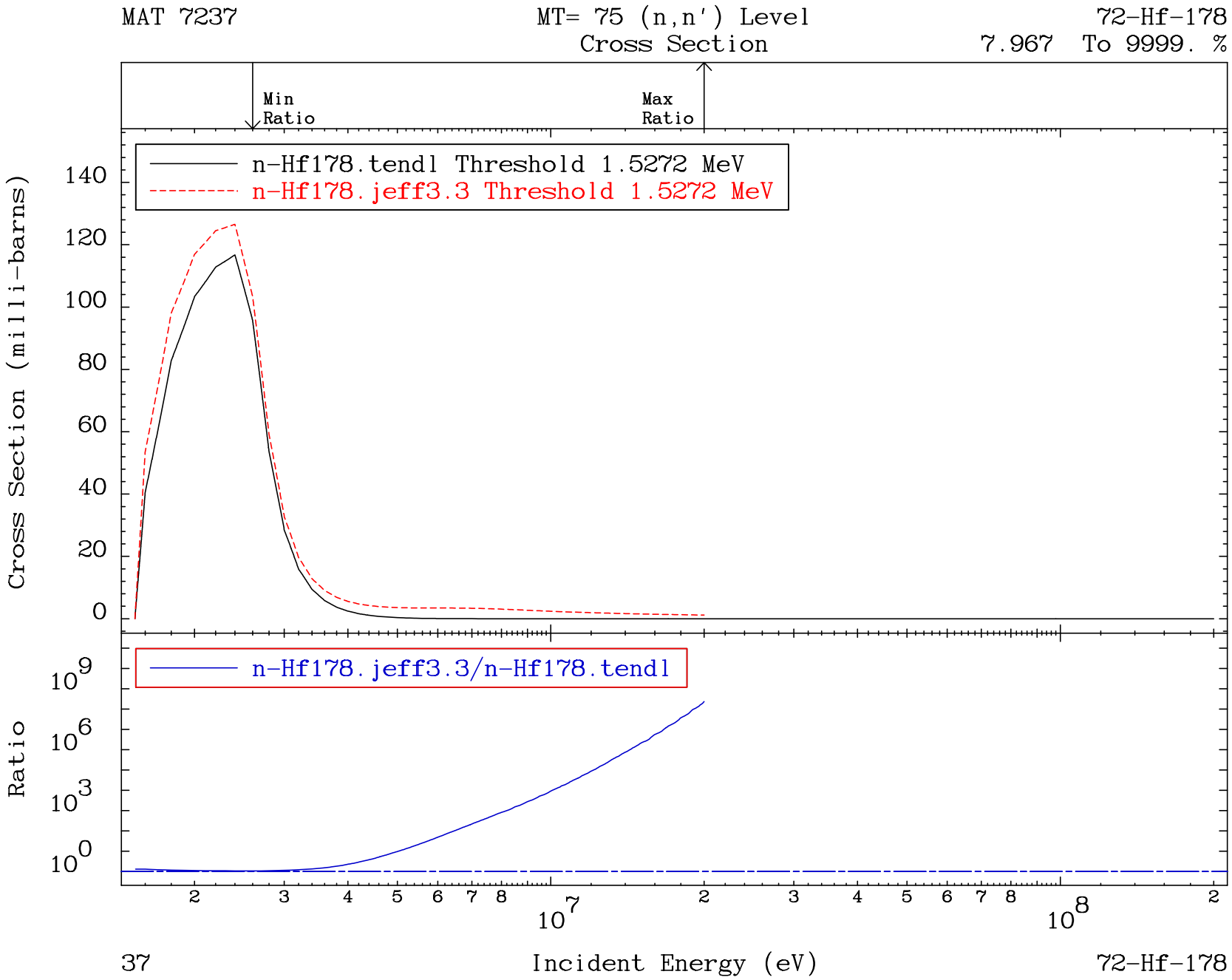

MAT 7237
MT= 70 (n,n') Level
Cross Section
72-Hf-178
-0.737 To 0.000 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.4586 MeV
n-Hf178.jeff3.3 Threshold 1.4586 MeV
Cross Section (milli-barns)
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.01
1.00
0.99
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
32
Incident Energy (eV)
72-Hf-178

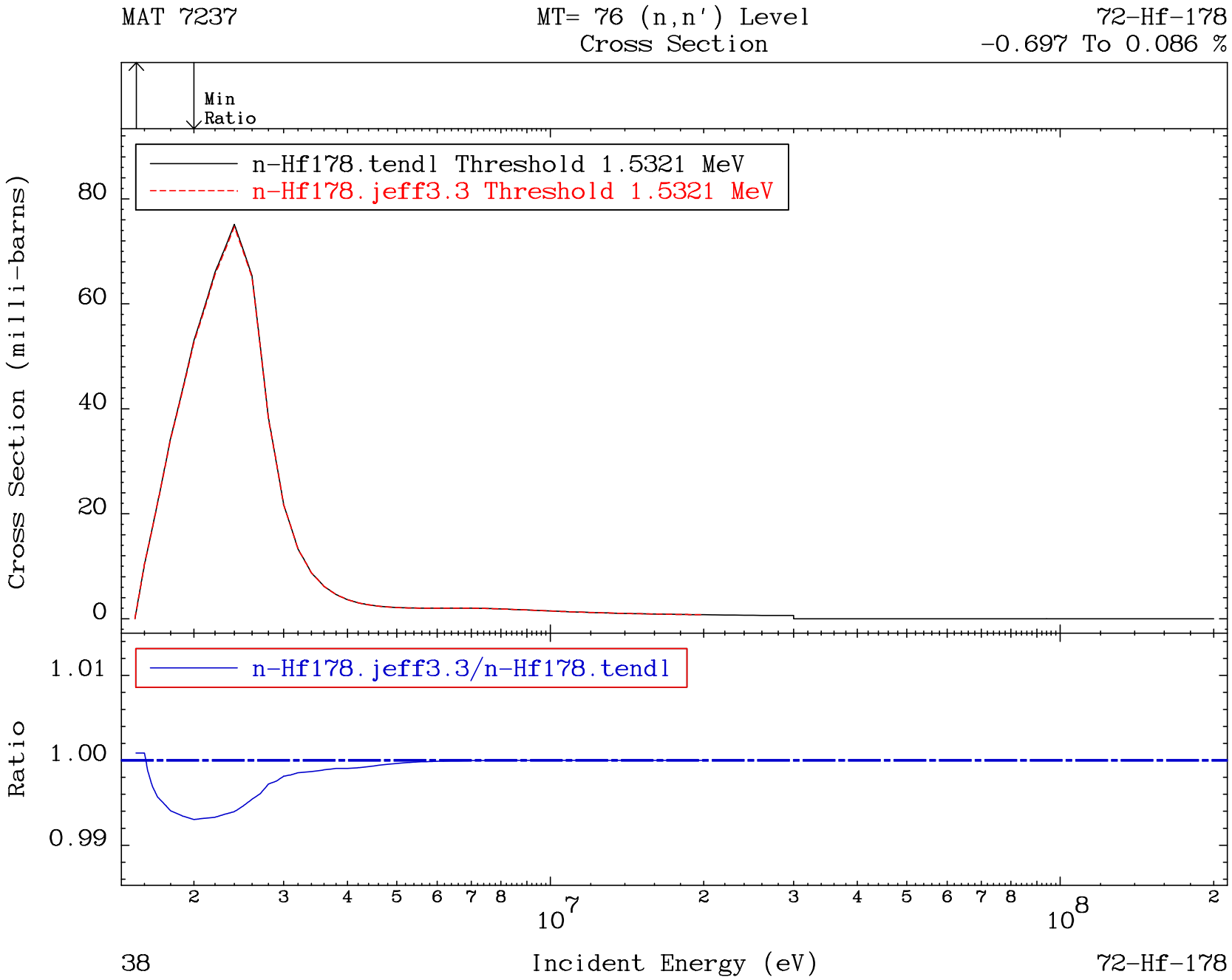

MAT 7237
MT= 71 (n,n') Level
Cross Section
72-Hf-178
-3.312 To -0.049%
Max
Ratio
Min
Ratio
n-Hf178.tendl Threshold 1.4874 MeV
n-Hf178.jeff3.3 Threshold 1.4874 MeV
Cross Section (milli-barns)
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.00
0.99
0.98
0.97
2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
33
Incident Energy (eV)
72-Hf-178

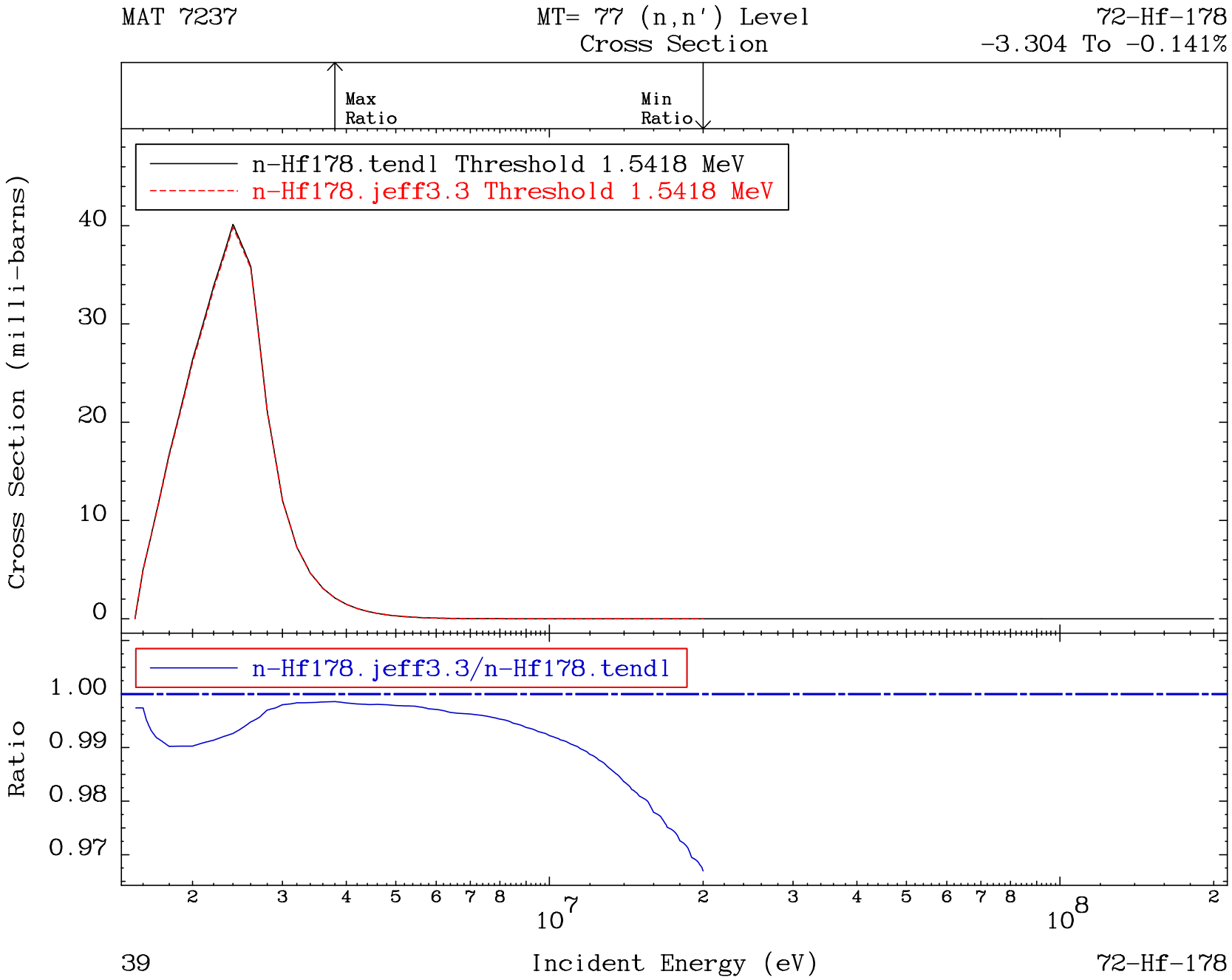

MAT 7237
MT= 72 (n,n') Level
Cross Section
72-Hf-178
-1.777 To 0.000 %
Min
Ratio
Max
Ratio
n-Hf178.tendl Threshold 1.5049 MeV
n-Hf178.jeff3.3 Threshold 1.5049 MeV
Cross Section (milli-barns)
140
120
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.00
0.99
0.98
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
34
Incident Energy (eV)
72-Hf-178

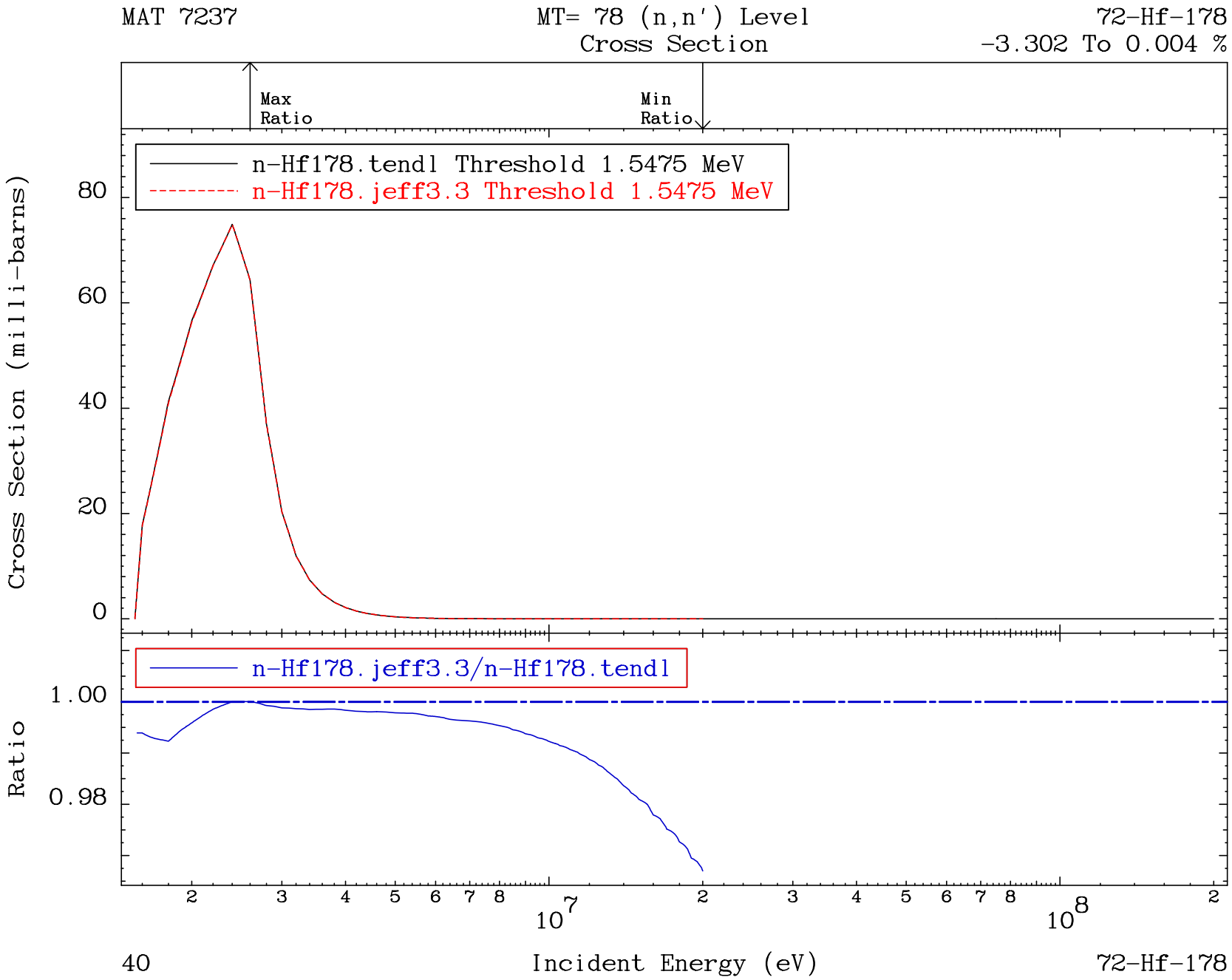

MAT 7237
MT= 73 (n,n') Level
Cross Section
72-Hf-178
-0.184 To 1.095 %
Min
Ratio
n-Hf178.tendl Threshold 1.5212 MeV
n-Hf178.jeff3.3 Threshold 1.5212 MeV
Cross Section (milli-barns)
40
30
20
10
0
1.02
1.01
1.00
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
35
Incident Energy (eV)
72-Hf-178

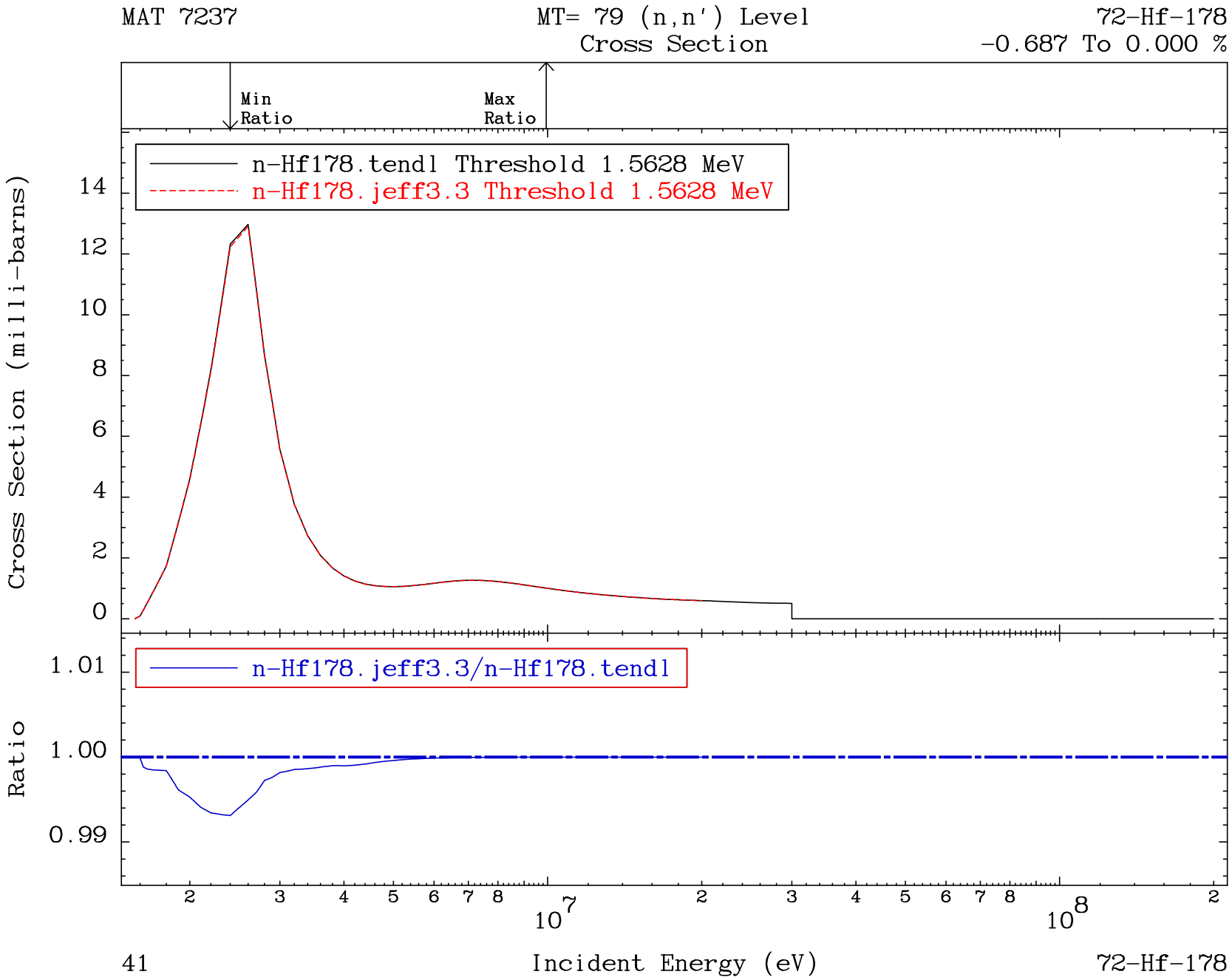

MAT 7237
MT= 74 (n,n') Level
Cross Section
72-Hf-178
-1.936 To 0.000 %
Min
Ratio
Max
Ratio
n-Hf178.tendl Threshold 1.5222 MeV
n-Hf178.jeff3.3 Threshold 1.5222 MeV
Cross Section (milli-barns)
140
120
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.00
0.99
0.98
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
36
Incident Energy (eV)
72-Hf-178

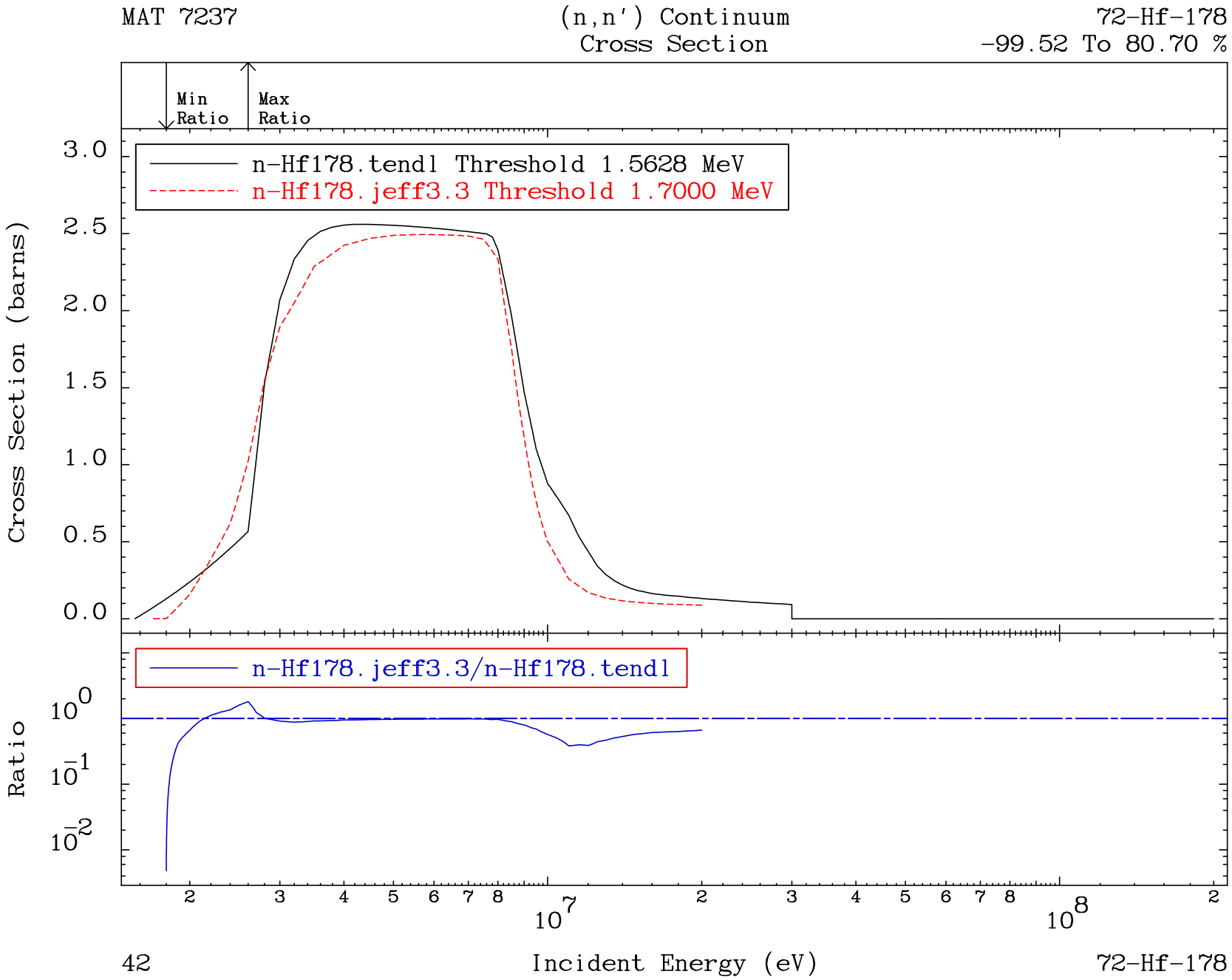

MAT 7237
MT= 75 (n,n') Level
Cross Section
72-Hf-178
7.967 To 9999. %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.5272 MeV
n-Hf178.jeff3.3 Threshold 1.5272 MeV
Cross Section (milli-barns)
140
120
100
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^9
10^6
10^3
10^0
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
37
Incident Energy (eV)
72-Hf-178

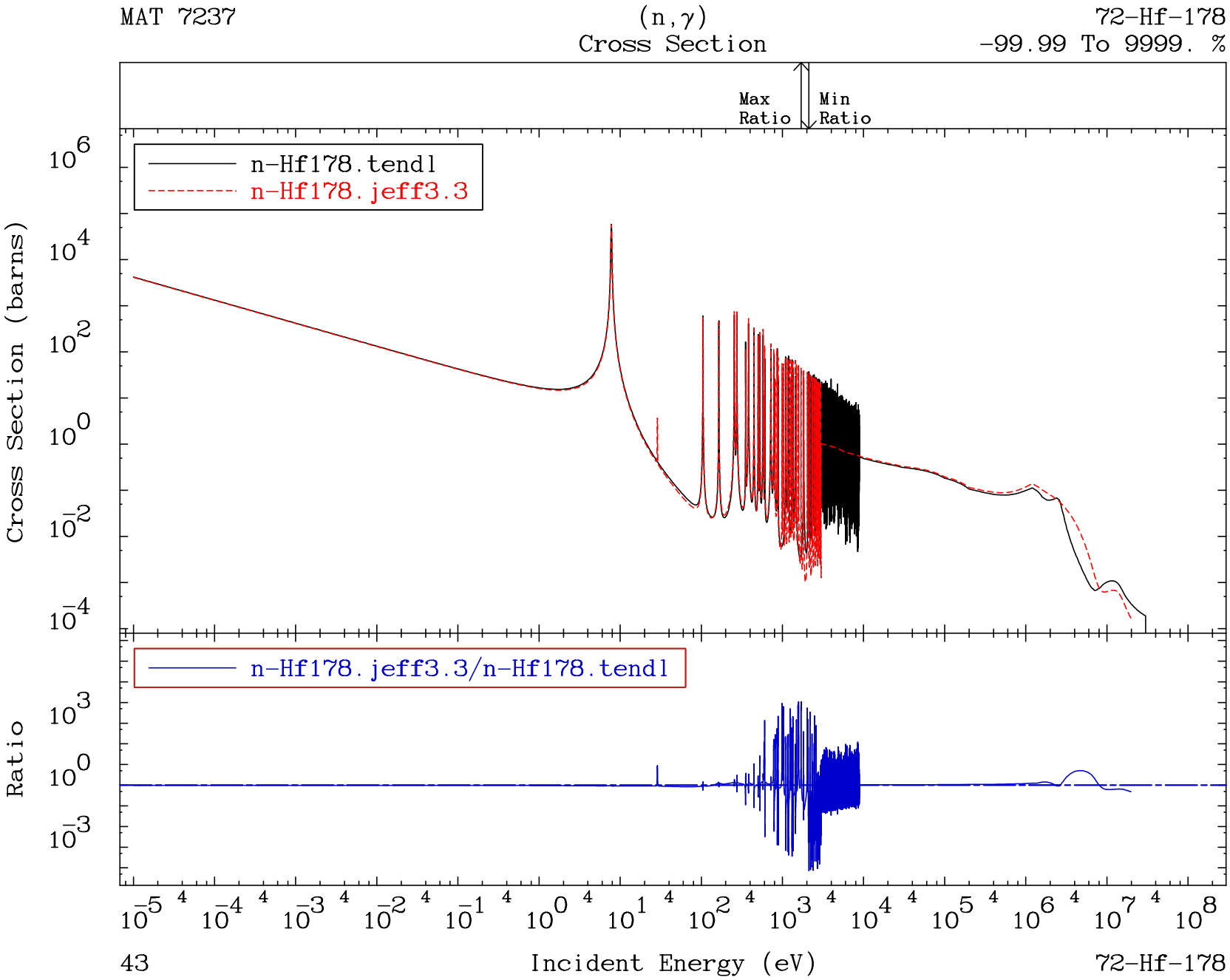

MAT 7237
MT= 76 (n,n') Level
Cross Section
72-Hf-178
-0.697 To 0.086 %
Min
Ratio
n-Hf178.tendl Threshold 1.5321 MeV
n-Hf178.jeff3.3 Threshold 1.5321 MeV
Cross Section (milli-barns)
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.01
1.00
0.99
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
38
Incident Energy (eV)
72-Hf-178

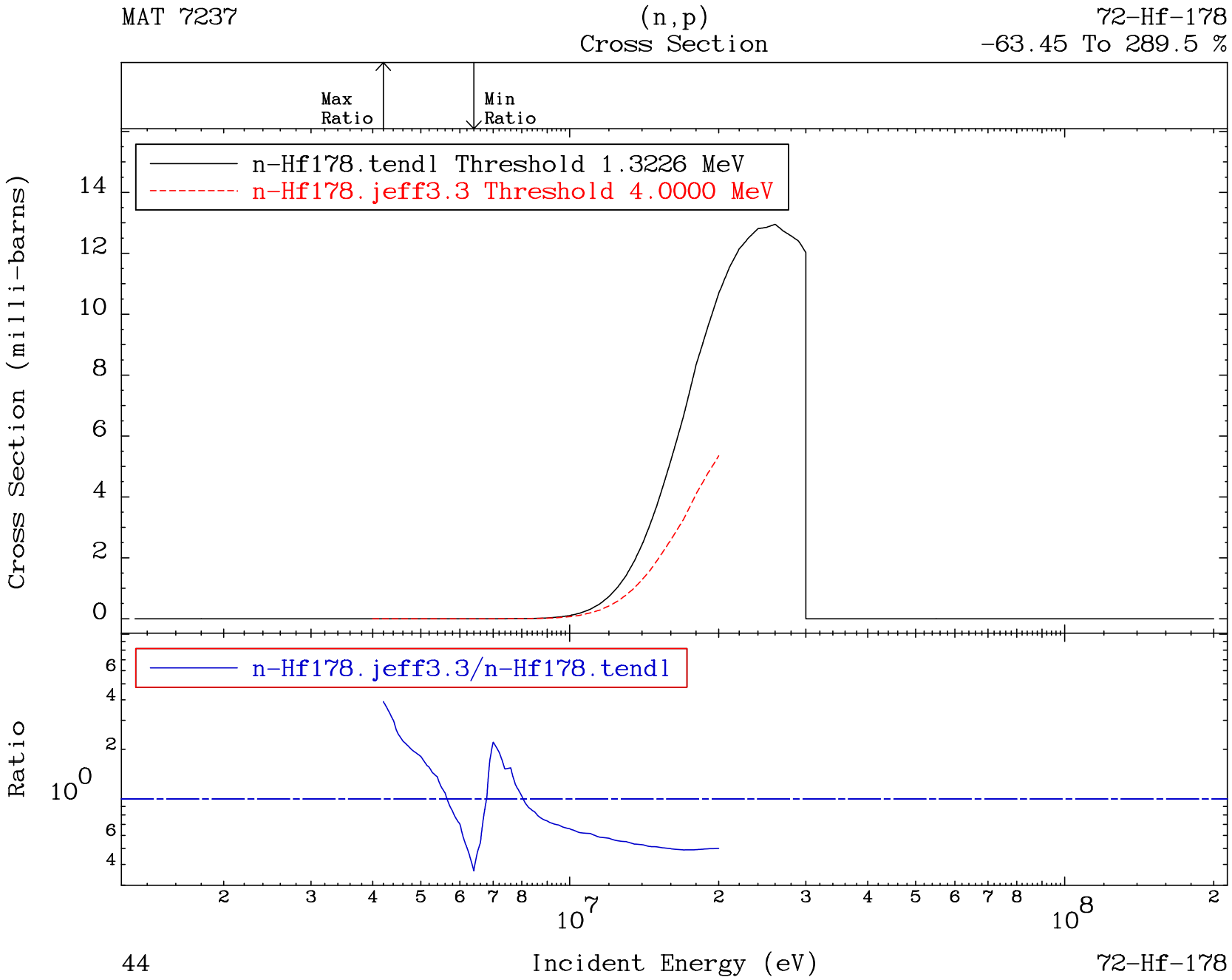

MAT 7237
MT= 77 (n,n') Level
Cross Section
72-Hf-178
-3.304 To -0.141%
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 1.5418 MeV
n-Hf178.jeff3.3 Threshold 1.5418 MeV
Cross Section (milli-barns)
40
30
20
10
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.00
0.99
0.98
0.97
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
39
Incident Energy (eV)
72-Hf-178

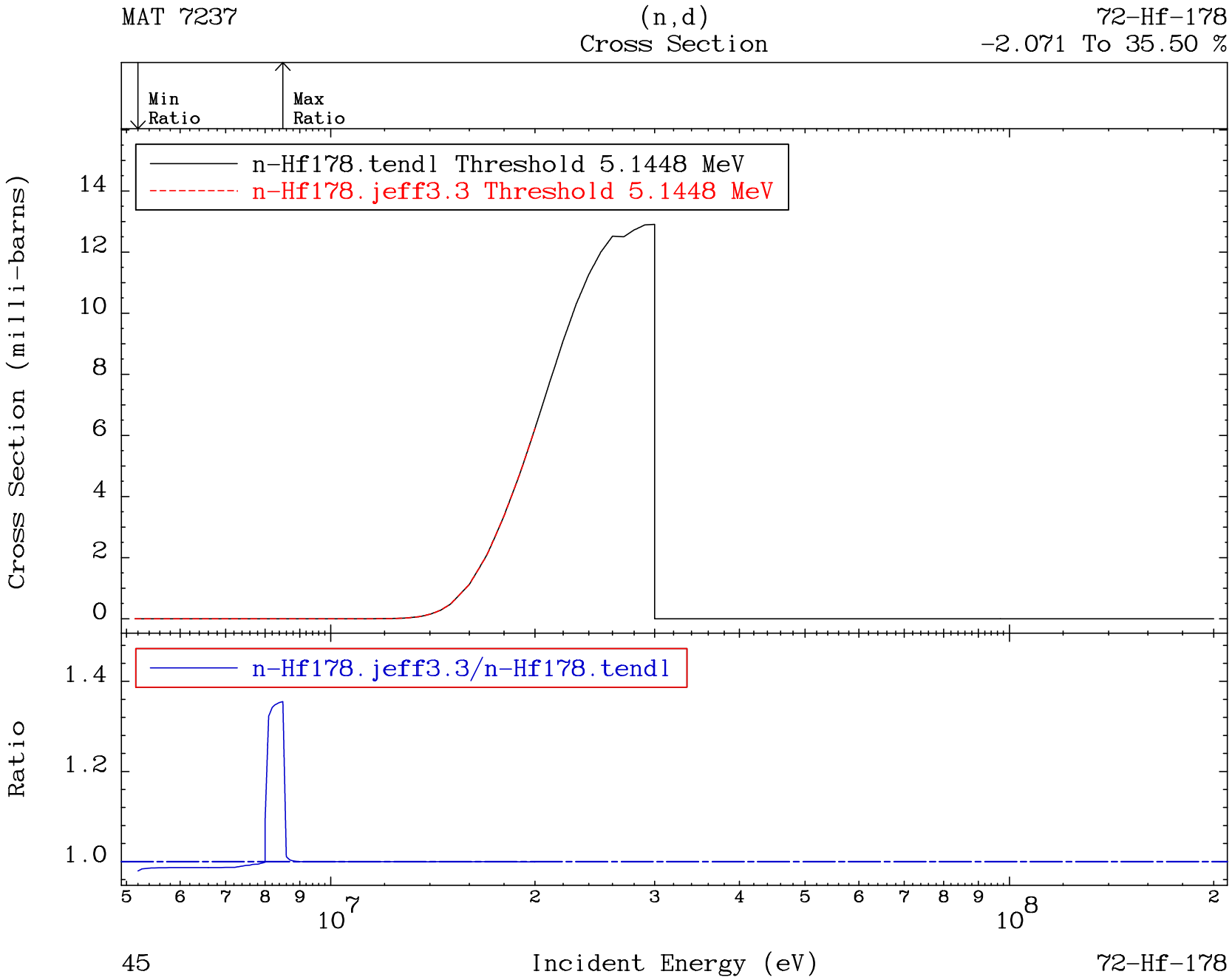

MAT 7237
MT= 78 (n,n') Level
Cross Section
72-Hf-178
-3.302 To 0.004 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 1.5475 MeV
n-Hf178.jeff3.3 Threshold 1.5475 MeV
Cross Section (milli-barns)
80
60
40
20
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.00
0.98
2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
40
Incident Energy (eV)
72-Hf-178

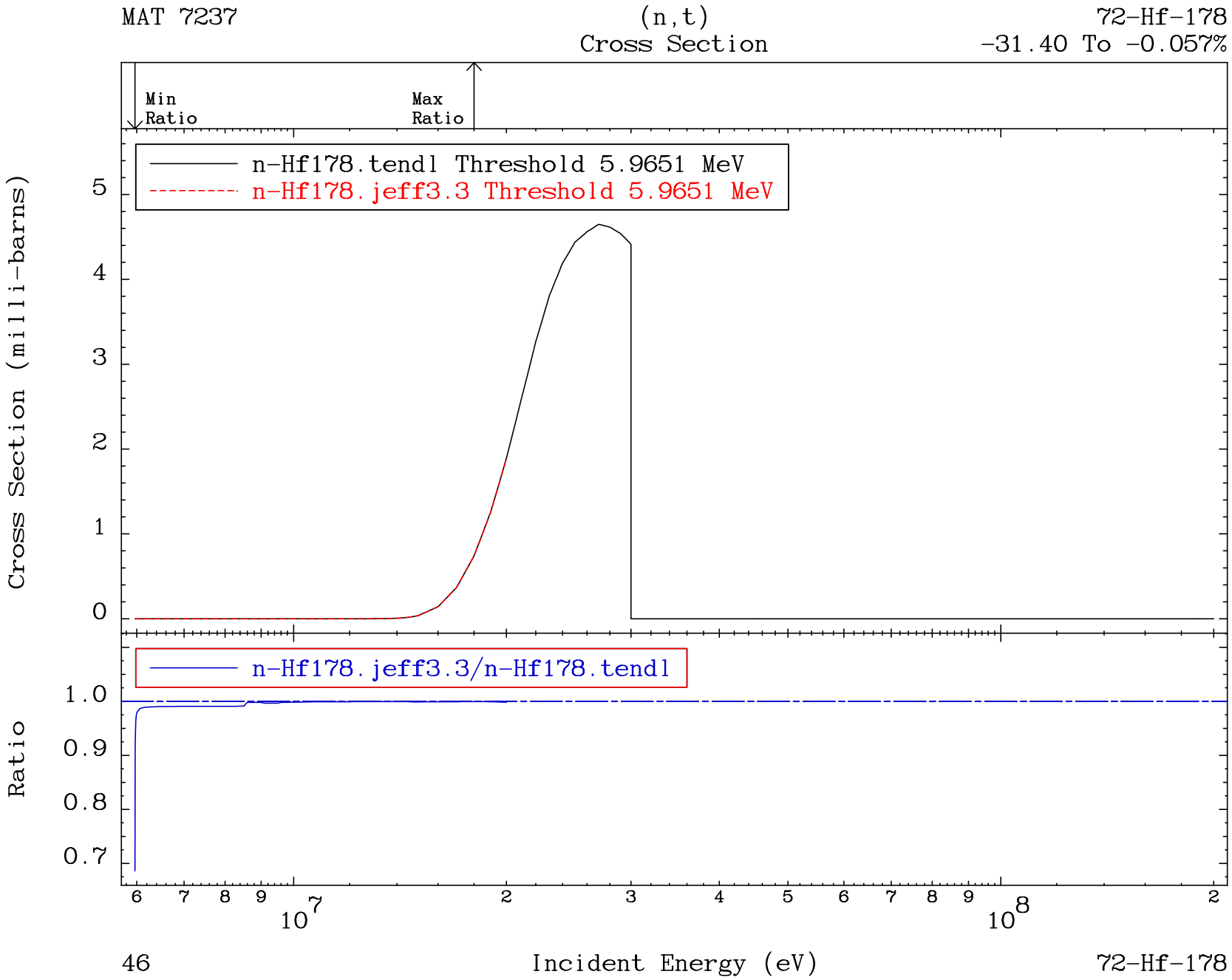

MAT 7237
MT= 79 (n,n') Level
Cross Section
72-Hf-178
-0.687 To 0.000 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.5628 MeV
n-Hf178.jeff3.3 Threshold 1.5628 MeV
Cross Section (milli-barns)
14
12
10
8
6
4
2
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.01
1.00
0.99
2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
41
Incident Energy (eV)
72-Hf-178

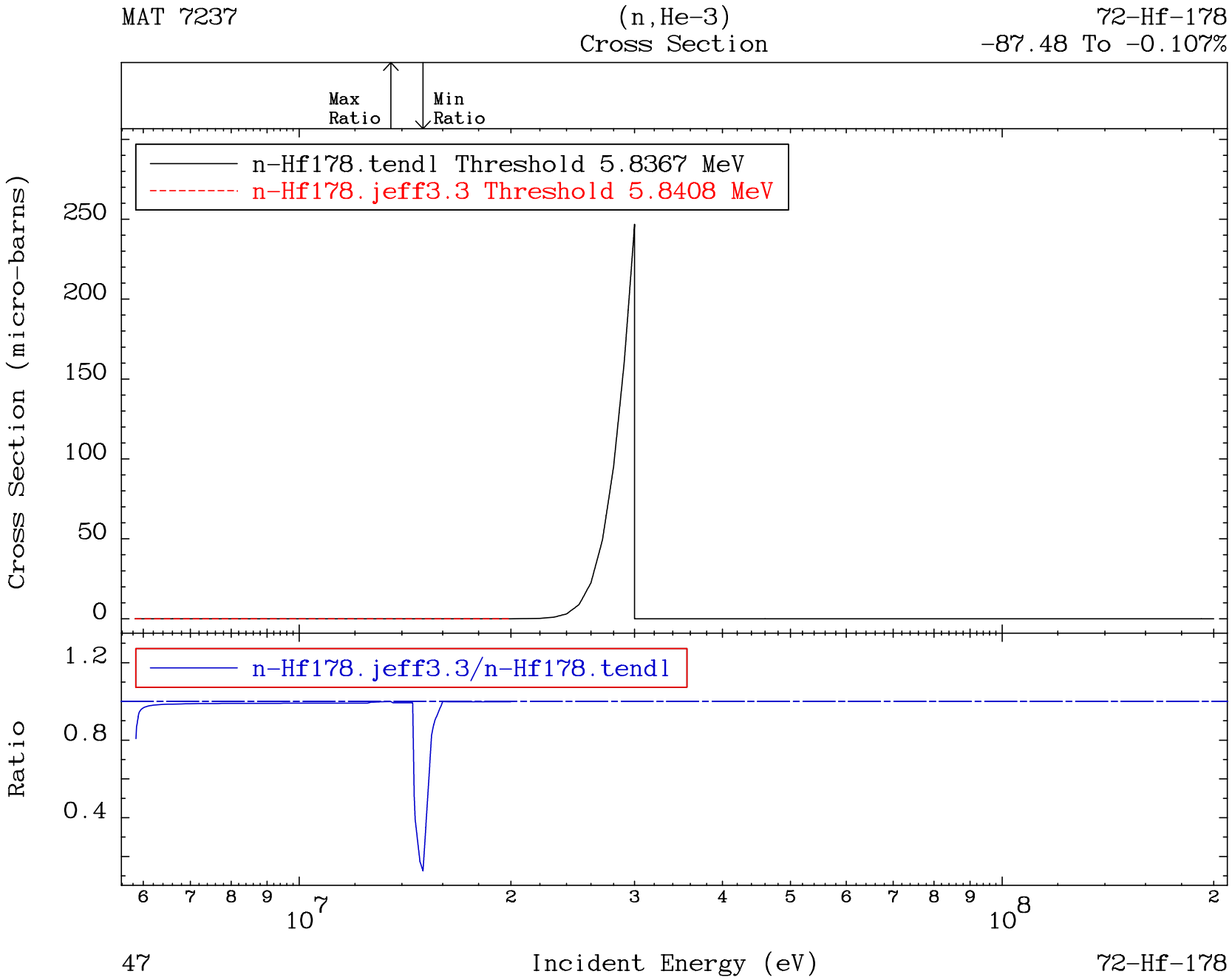

MAT 7237
(n,n') Continuum
Cross Section
72-Hf-178
-99.52 To 80.70 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.5628 MeV
n-Hf178.jeff3.3 Threshold 1.7000 MeV
Cross Section (barns)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^0
10^-1
10^-2
2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
42
Incident Energy (eV)
72-Hf-178

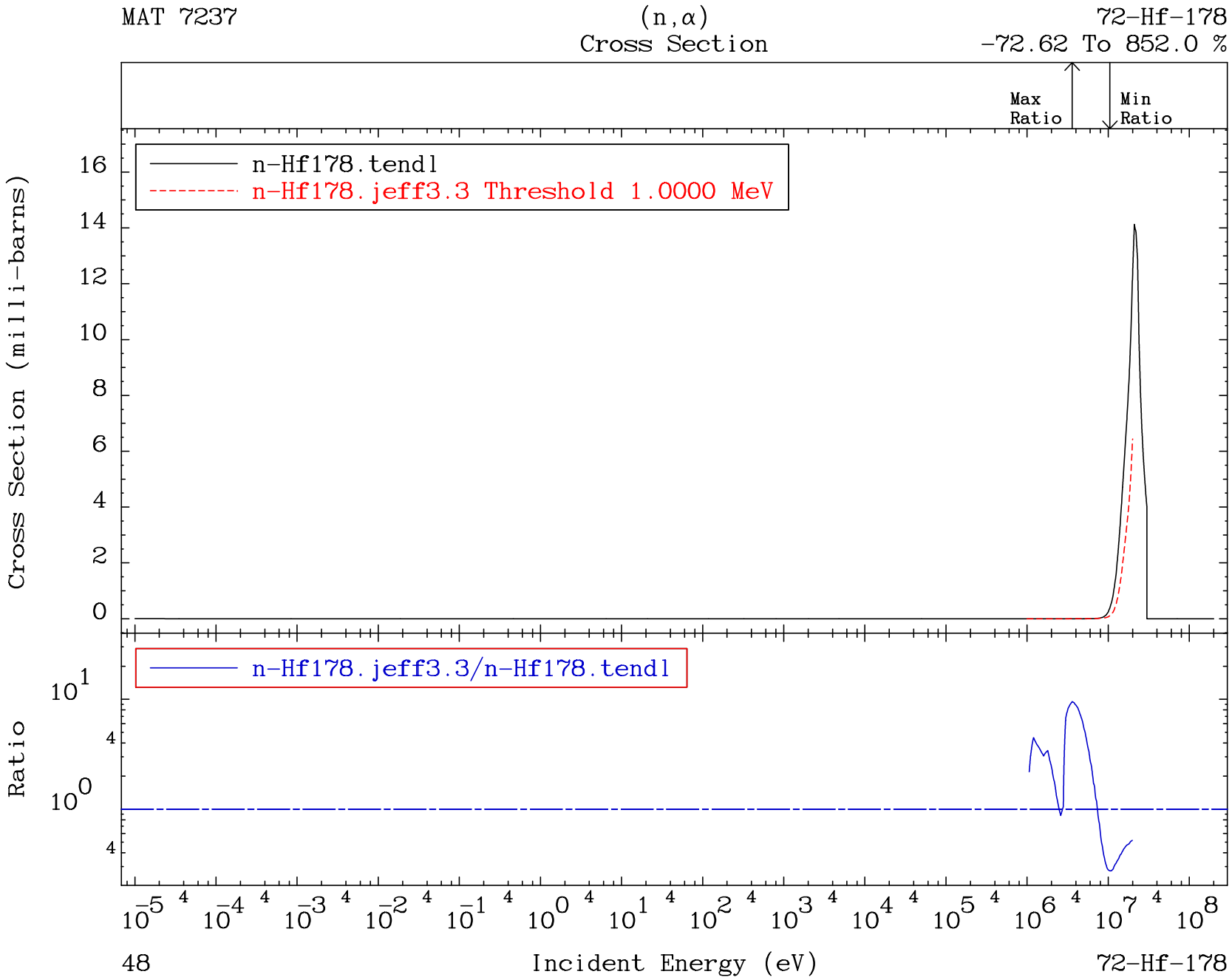

MAT 7237
(n,γ)
Cross Section
72-Hf-178
-99.99 To 9999. %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
43
72-Hf-178

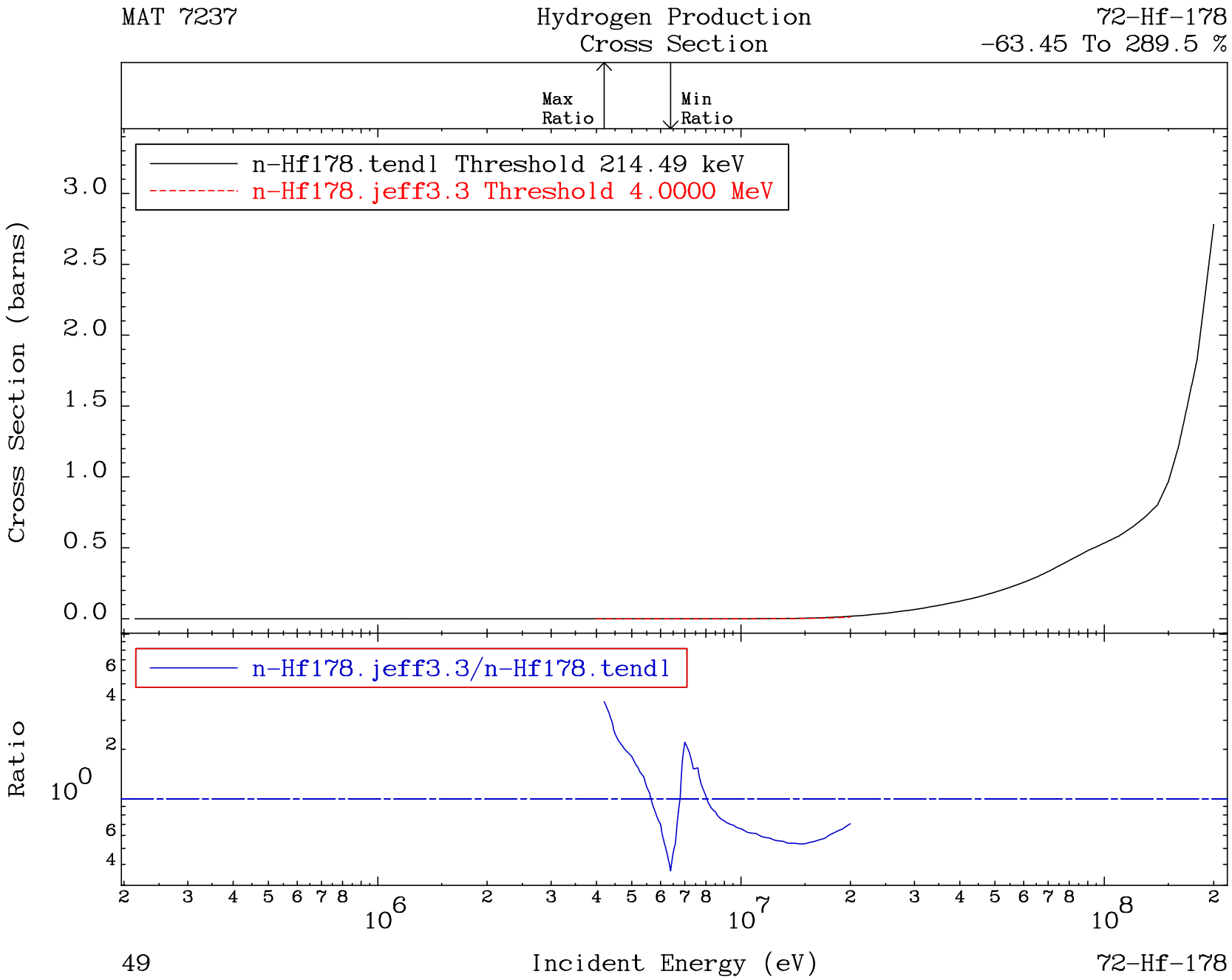

MAT 7237
(n,p)
Cross Section
72-Hf-178
-63.45 To 289.5 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 1.3226 MeV
n-Hf178.jeff3.3 Threshold 4.0000 MeV
Cross Section (milli-barns)
14
12
10
8
6
4
2
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
6
4
2
10^0
6
4
2
3
4
5
6
7
8
10^7
2
3
4
5
6
7
8
10^8
2
44
Incident Energy (eV)
72-Hf-178

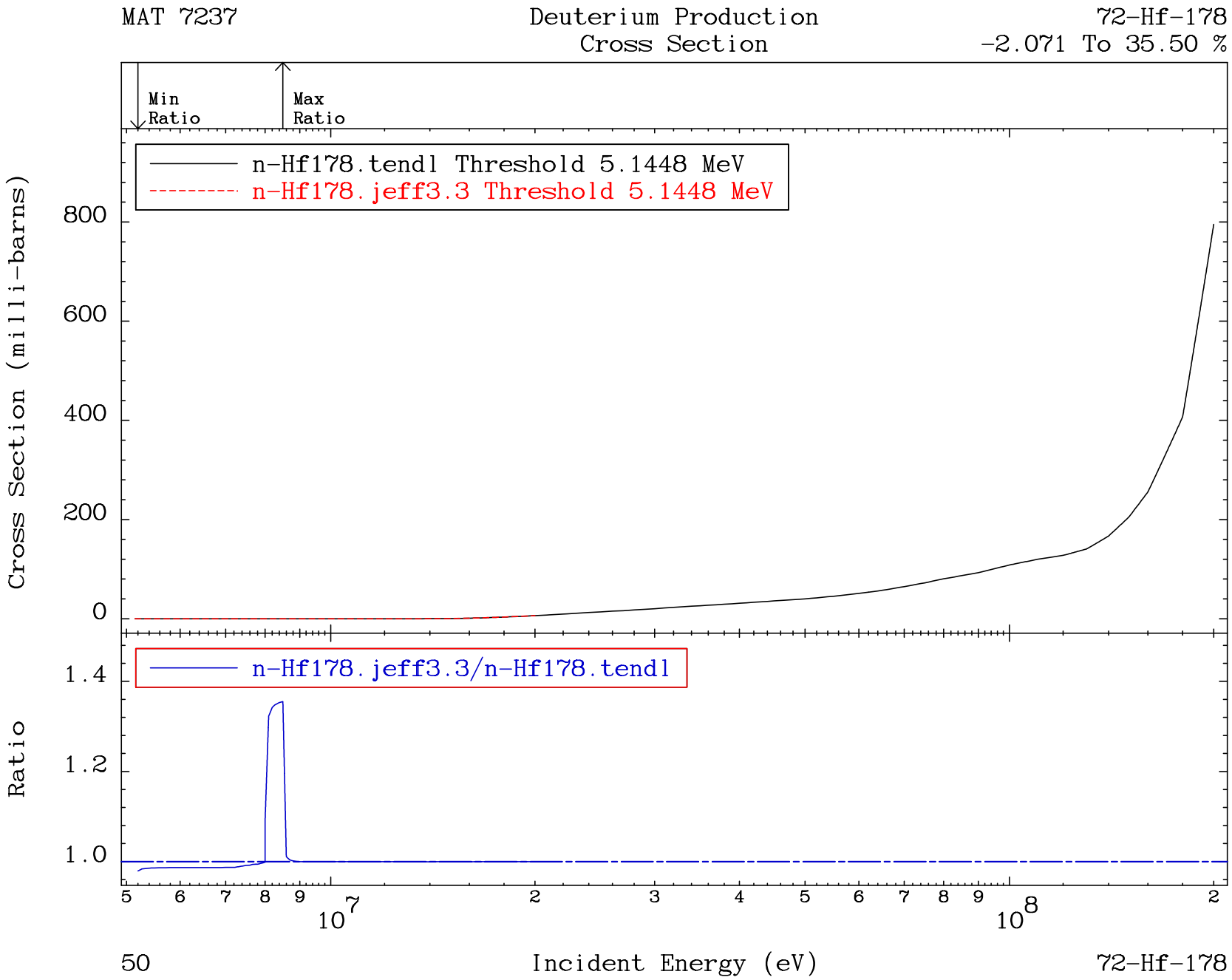

MAT 7237
(n,d)
Cross Section
72-Hf-178
-2.071 To 35.50 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 5.1448 MeV
n-Hf178.jeff3.3 Threshold 5.1448 MeV
Cross Section (milli-barns)
0
2
4
6
8
10
12
14
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.0
1.2
1.4
5 6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
45
Incident Energy (eV)
72-Hf-178

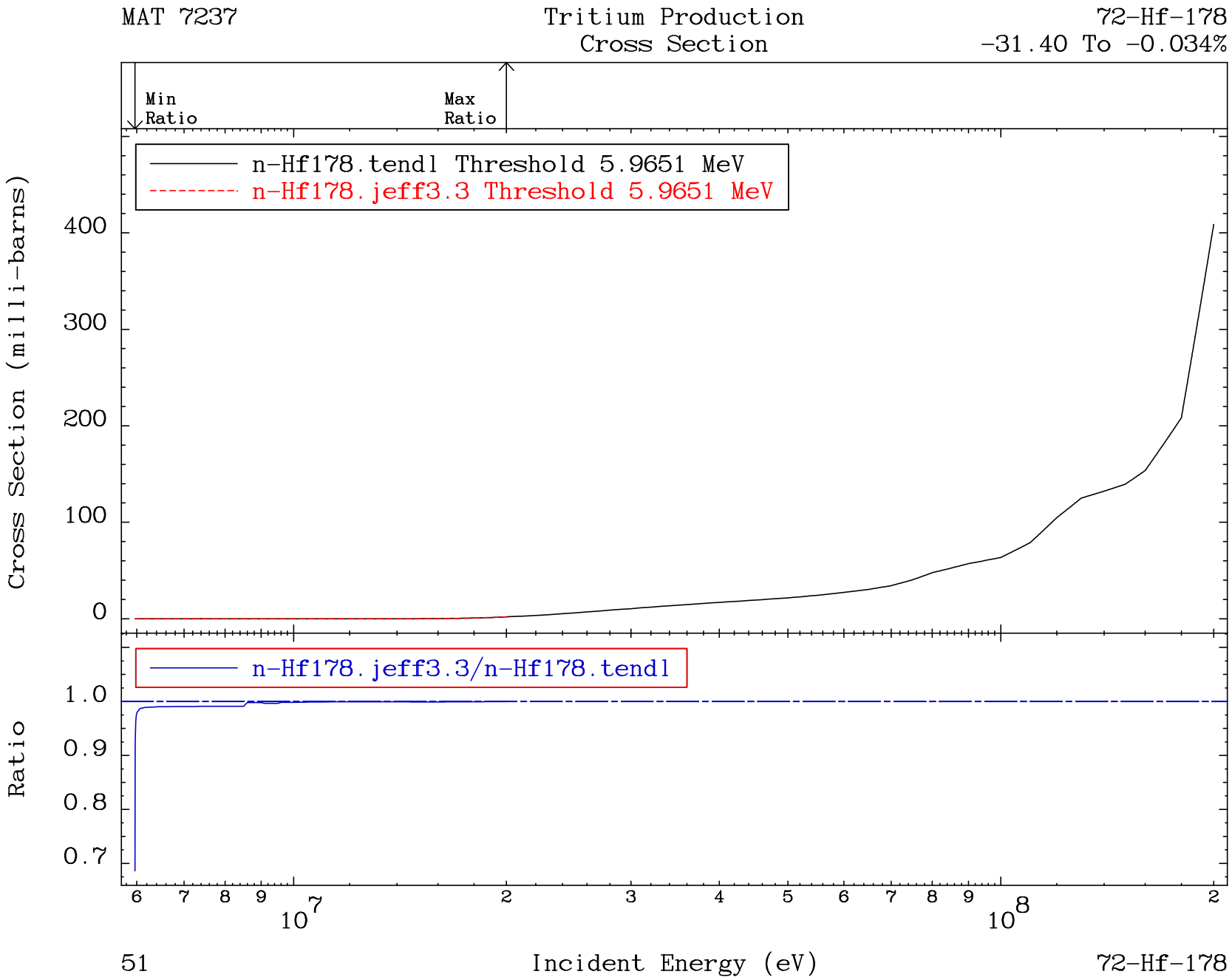

MAT 7237
(n,t)
Cross Section
72-Hf-178
-31.40 To -0.057%
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 5.9651 MeV
n-Hf178.jeff3.3 Threshold 5.9651 MeV
Cross Section (milli-barns)
0
1
2
3
4
5
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
0.7
0.8
0.9
1.0
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
46
Incident Energy (eV)
72-Hf-178

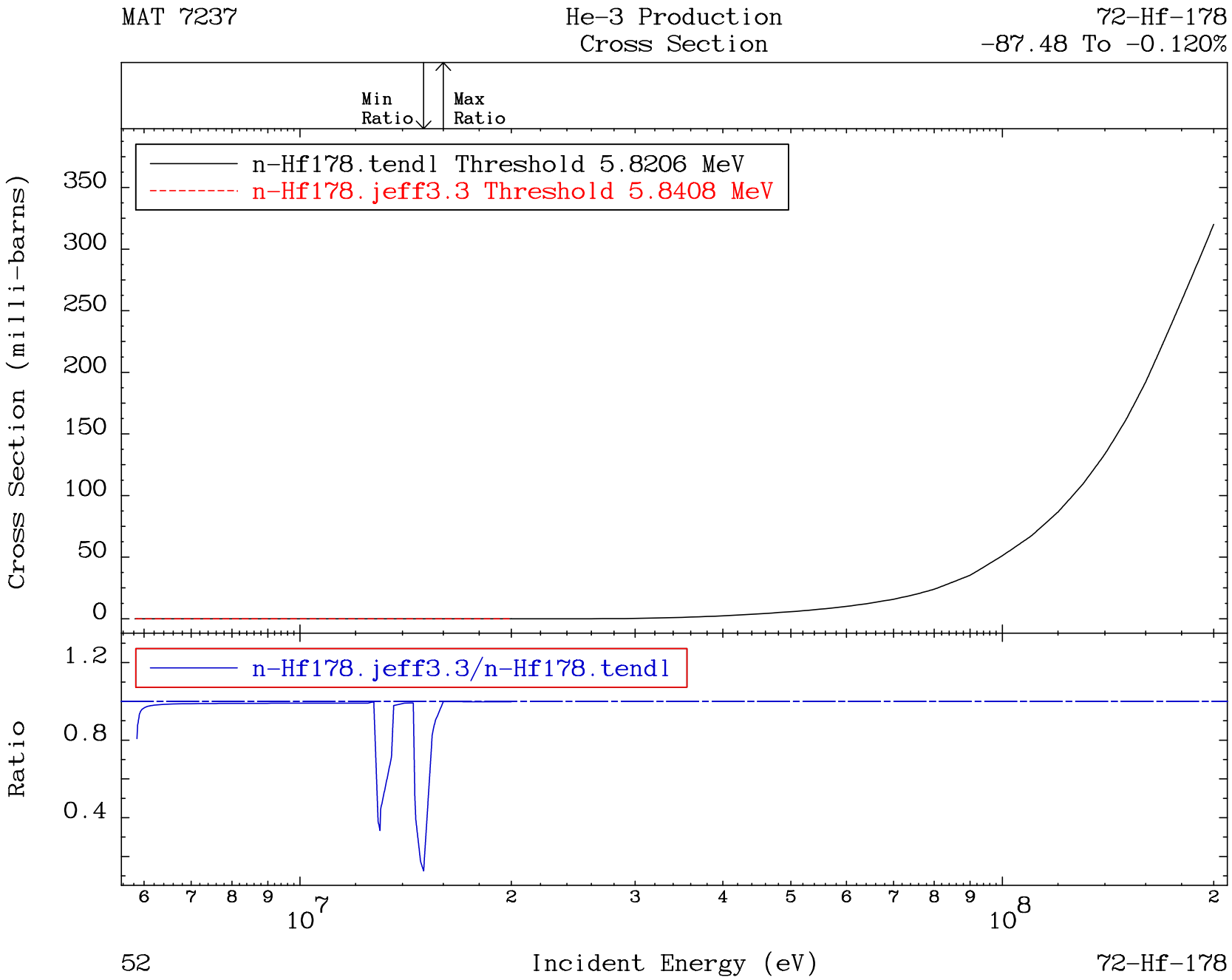

MAT 7237
(n,He-3)
Cross Section
72-Hf-178
-87.48 To -0.107%
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 5.8367 MeV
n-Hf178.jeff3.3 Threshold 5.8408 MeV
Cross Section (micro-barns)
250
200
150
100
50
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.2
0.8
0.4
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
47
Incident Energy (eV)
72-Hf-178

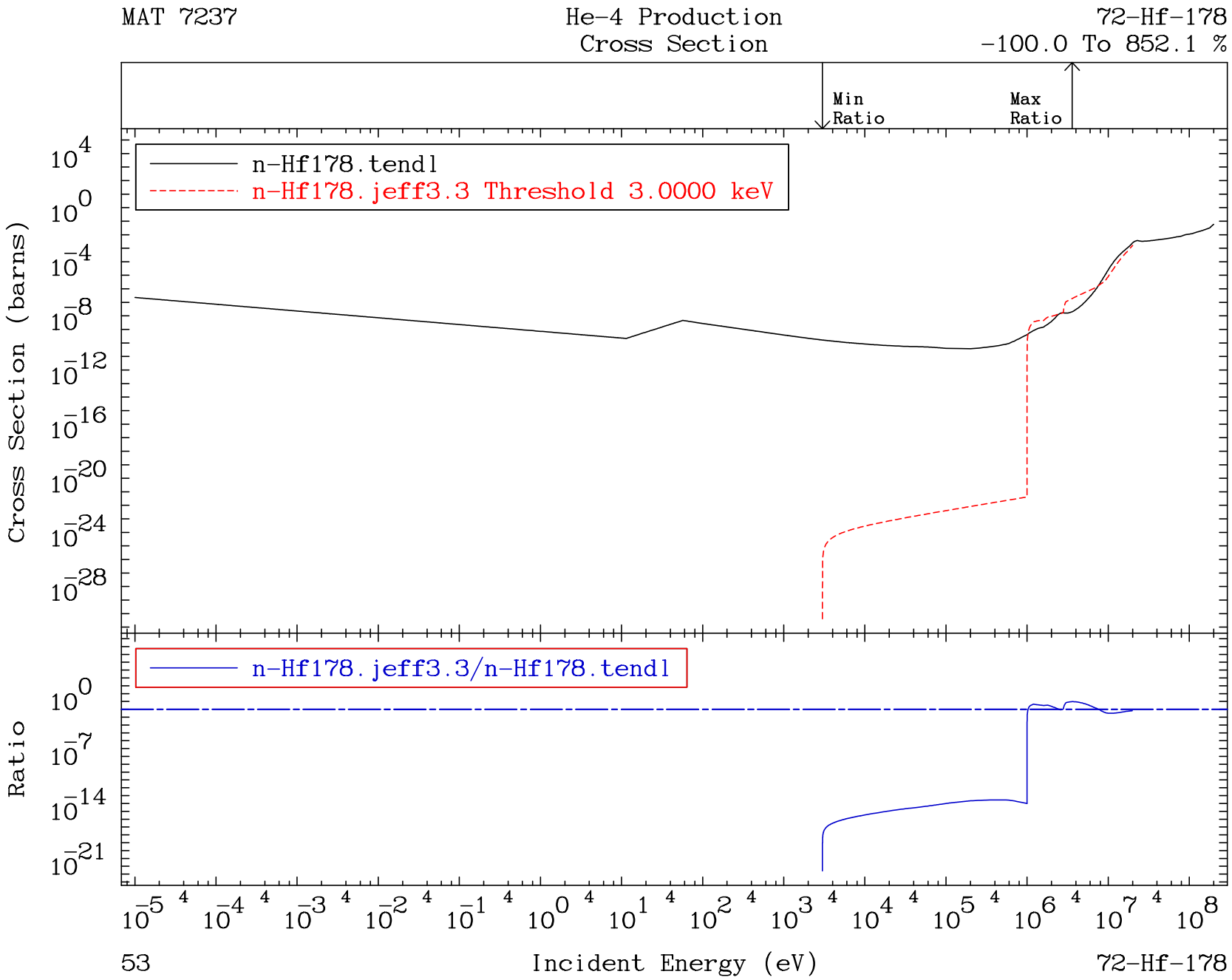

MAT 7237
(n,α)
Cross Section
72-Hf-178
-72.62 To 852.0 %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3 Threshold 1.0000 MeV
Cross Section (milli-barns)
16
14
12
10
8
6
4
2
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^1
10^0
10^-5 10^-4 10^-3 10^-2 10^-1 10^0 10^1 10^2 10^3 10^4 10^5 10^6 10^7 10^8
48
Incident Energy (eV)
72-Hf-178

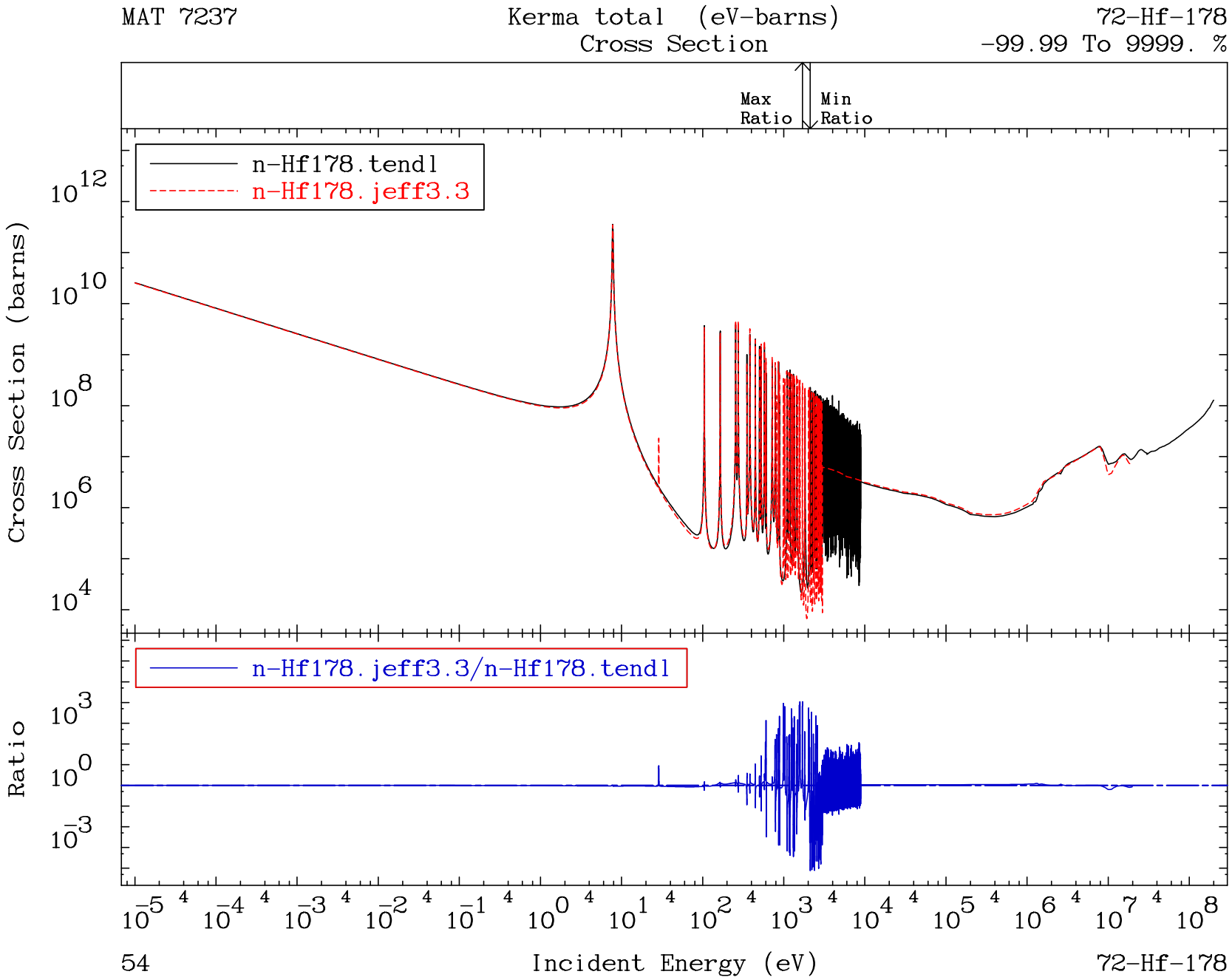

MAT 7237
Hydrogen Production
Cross Section
72-Hf-178
-63.45 To 289.5 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 214.49 keV
n-Hf178.jeff3.3 Threshold 4.0000 MeV
Cross Section (barns)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^0
6
4
2
6
4
2 3 4 5 6 7 8 10^6 2 3 4 5 6 7 8 10^7 2 3 4 5 6 7 8 10^8 2
49
Incident Energy (eV)
72-Hf-178

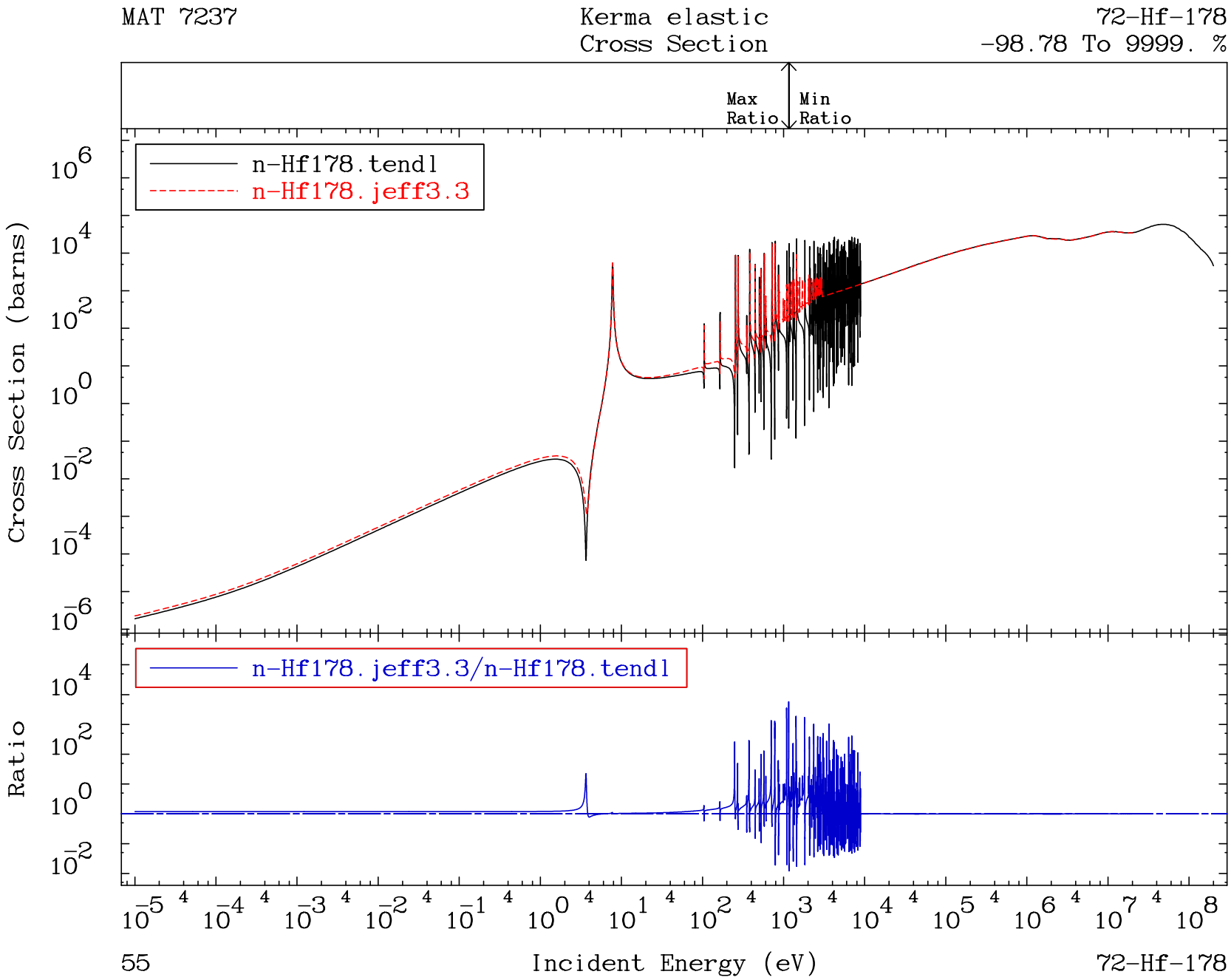

MAT 7237
Deuterium Production
Cross Section
72-Hf-178
-2.071 To 35.50 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 5.1448 MeV
n-Hf178.jeff3.3 Threshold 5.1448 MeV
Cross Section (milli-barns)
800
600
400
200
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.4
1.2
1.0
5 6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
50
Incident Energy (eV)
72-Hf-178

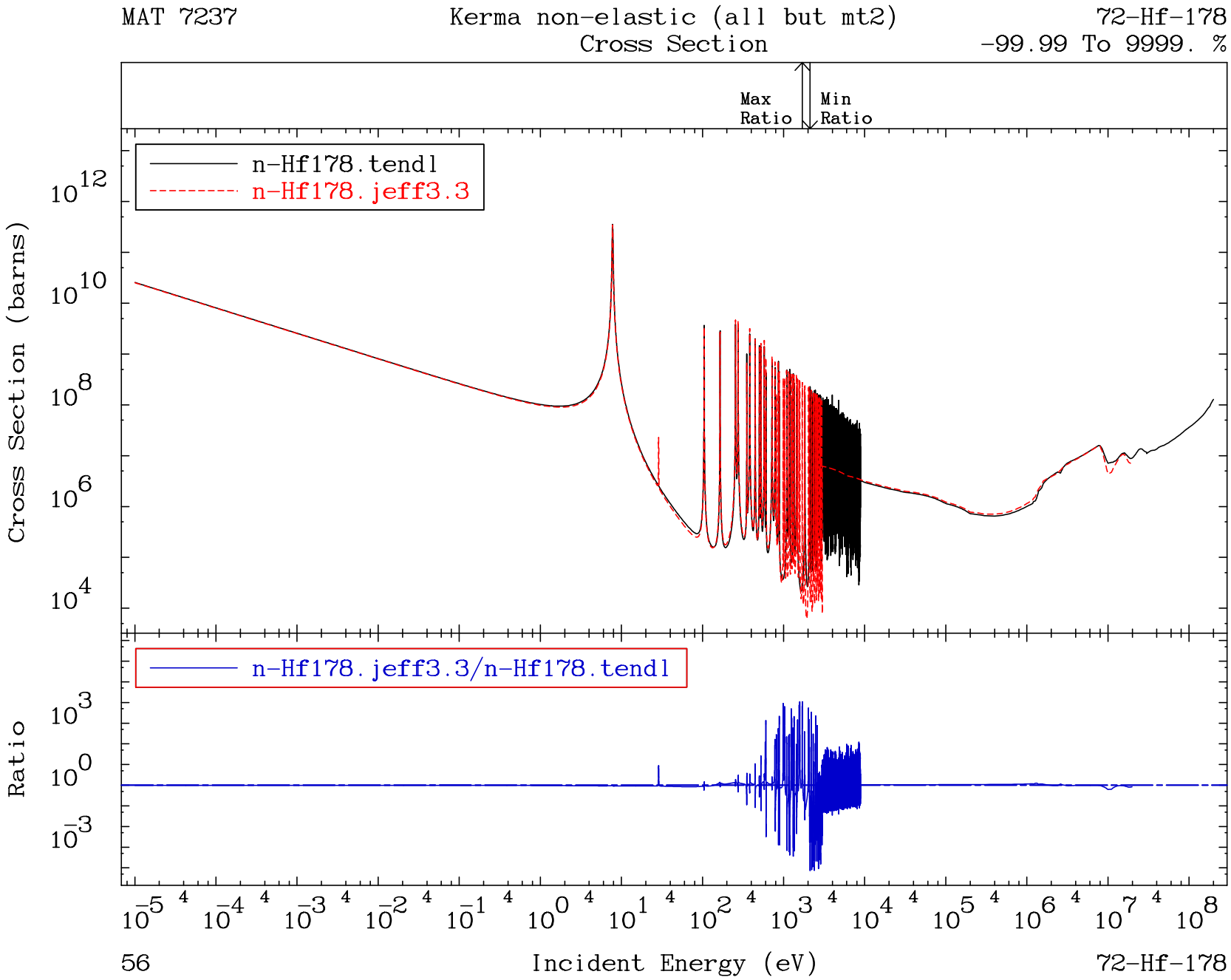

MAT 7237
Tritium Production
Cross Section
72-Hf-178
-31.40 To -0.034%
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 5.9651 MeV
n-Hf178.jeff3.3 Threshold 5.9651 MeV
Cross Section (milli-barns)
400
300
200
100
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.0
0.9
0.8
0.7
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
51
Incident Energy (eV)
72-Hf-178

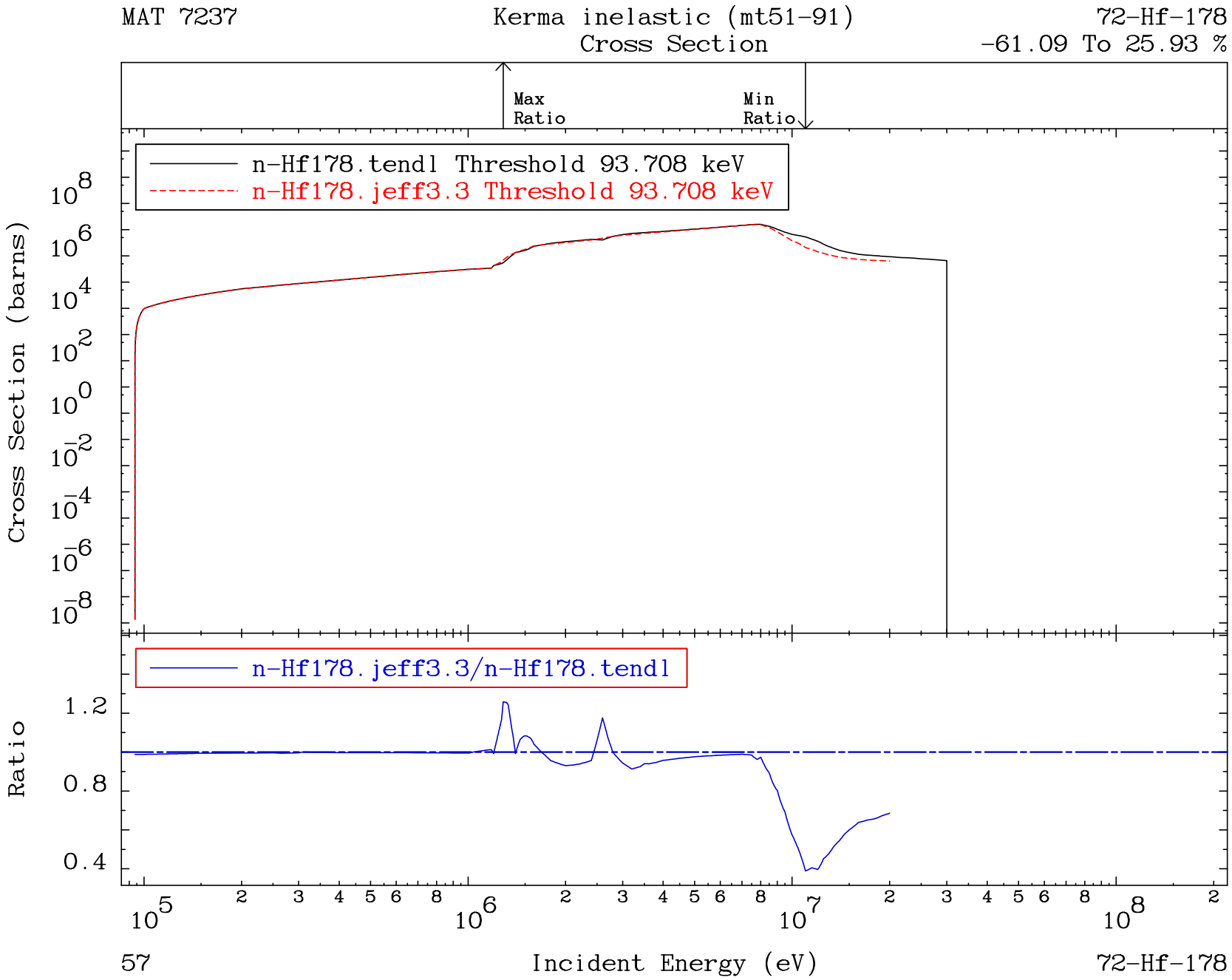

MAT 7237
He-3 Production
Cross Section
72-Hf-178
-87.48 To -0.120%
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 5.8206 MeV
n-Hf178.jeff3.3 Threshold 5.8408 MeV
Cross Section (milli-barns)
350
300
250
200
150
100
50
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.2
0.8
0.4
6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
52
Incident Energy (eV)
72-Hf-178

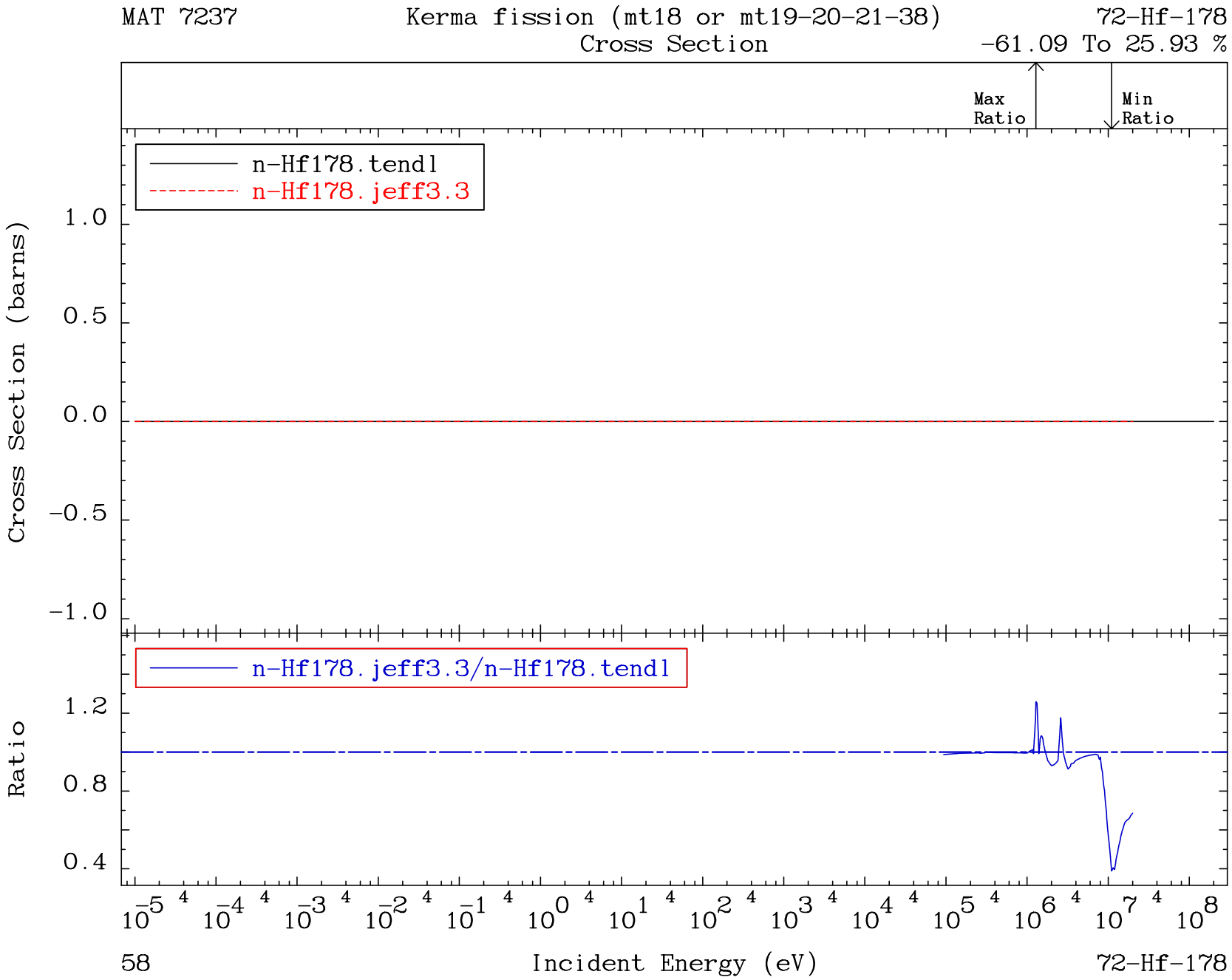

MAT 7237
He-4 Production
Cross Section
72-Hf-178
-100.0 To 852.1 %
Min Ratio
Max Ratio
n-Hf178.tendl
n-Hf178.jeff3.3 Threshold 3.0000 keV
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
53
72-Hf-178

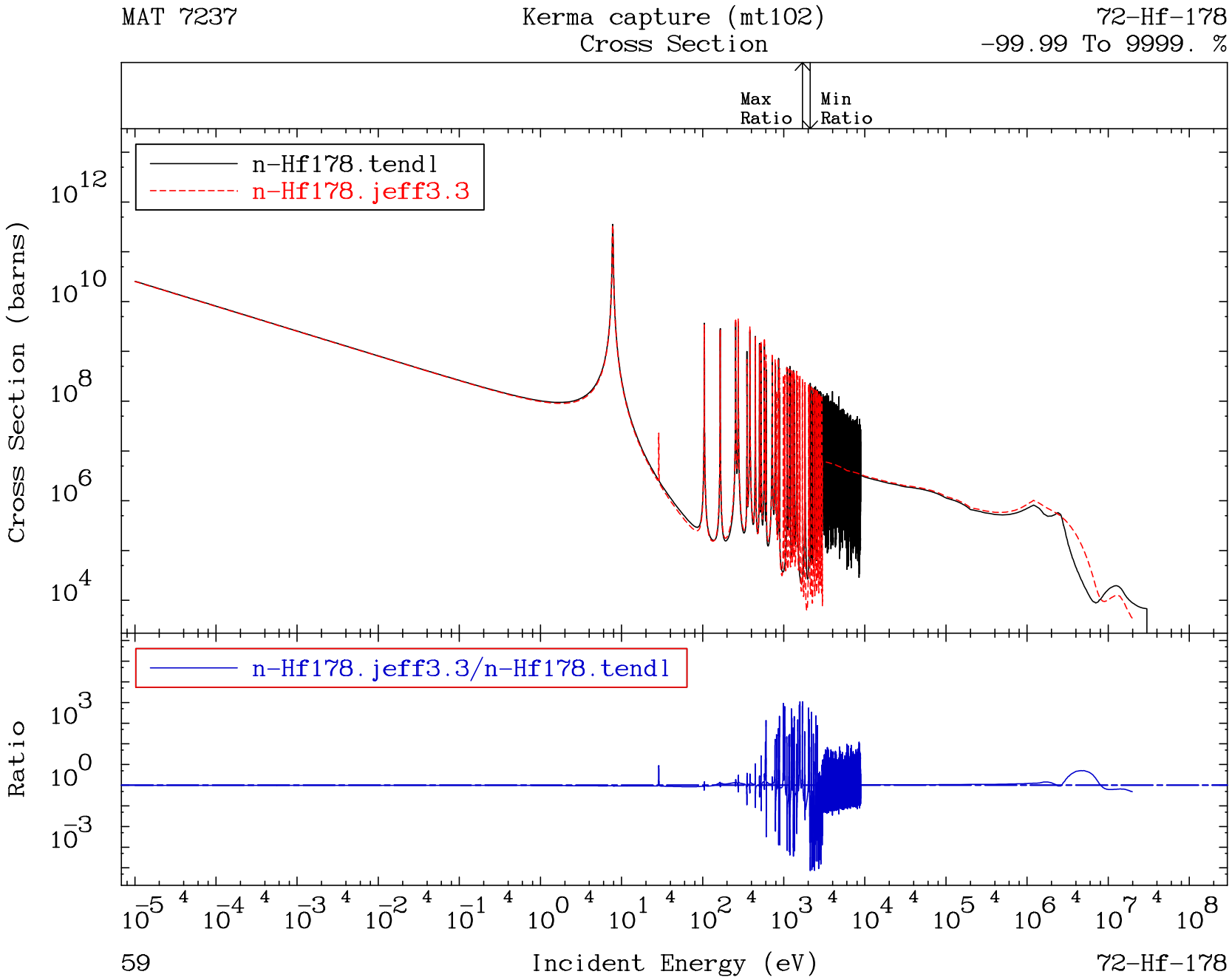

MAT 7237
Kerma total (eV-barns)
Cross Section
72-Hf-178
-99.99 To 9999. %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
54
72-Hf-178

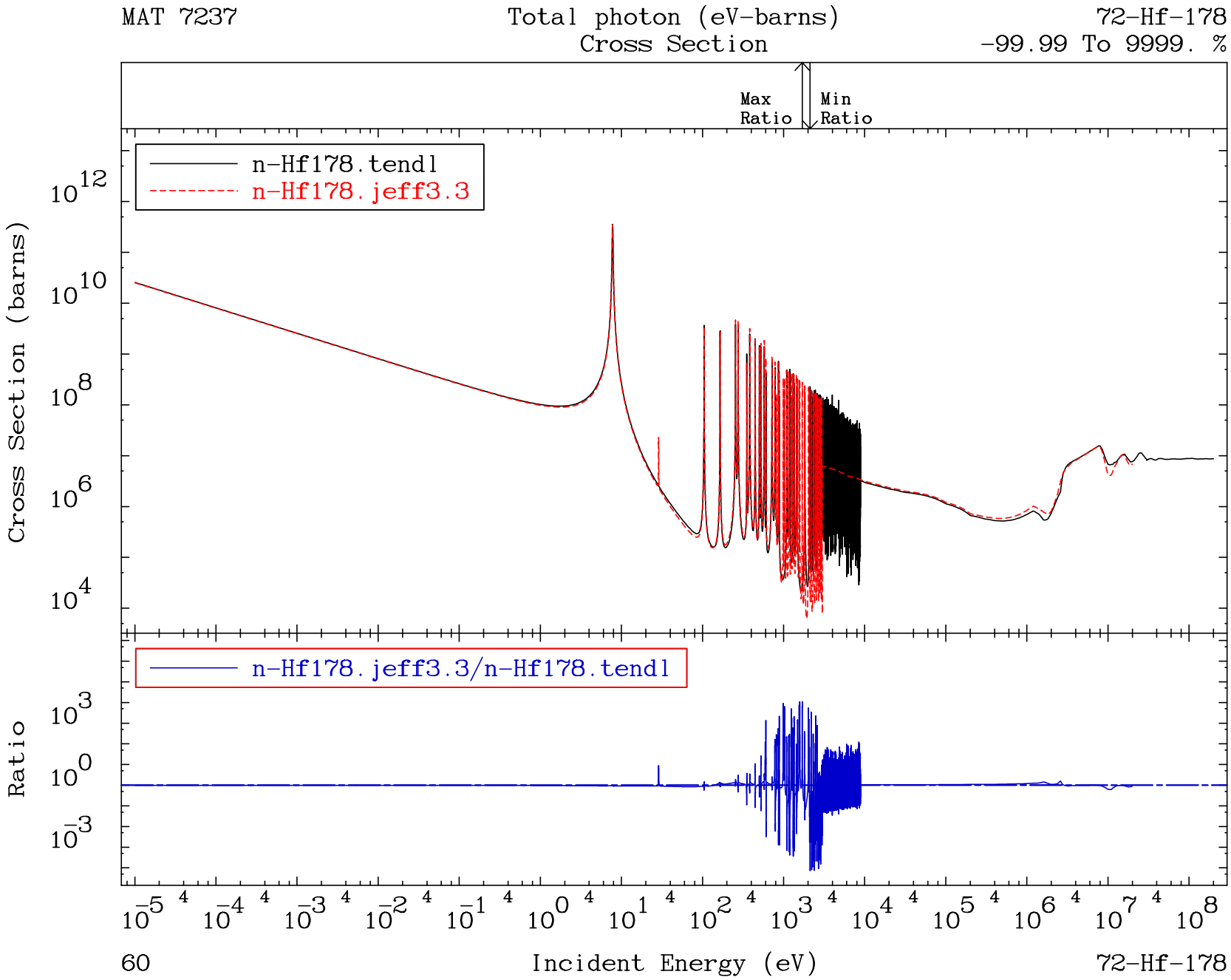

MAT 7237
Kerma elastic
Cross Section
72-Hf-178
-98.78 To 9999. %
Max
Ratio
Min
Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
55
72-Hf-178

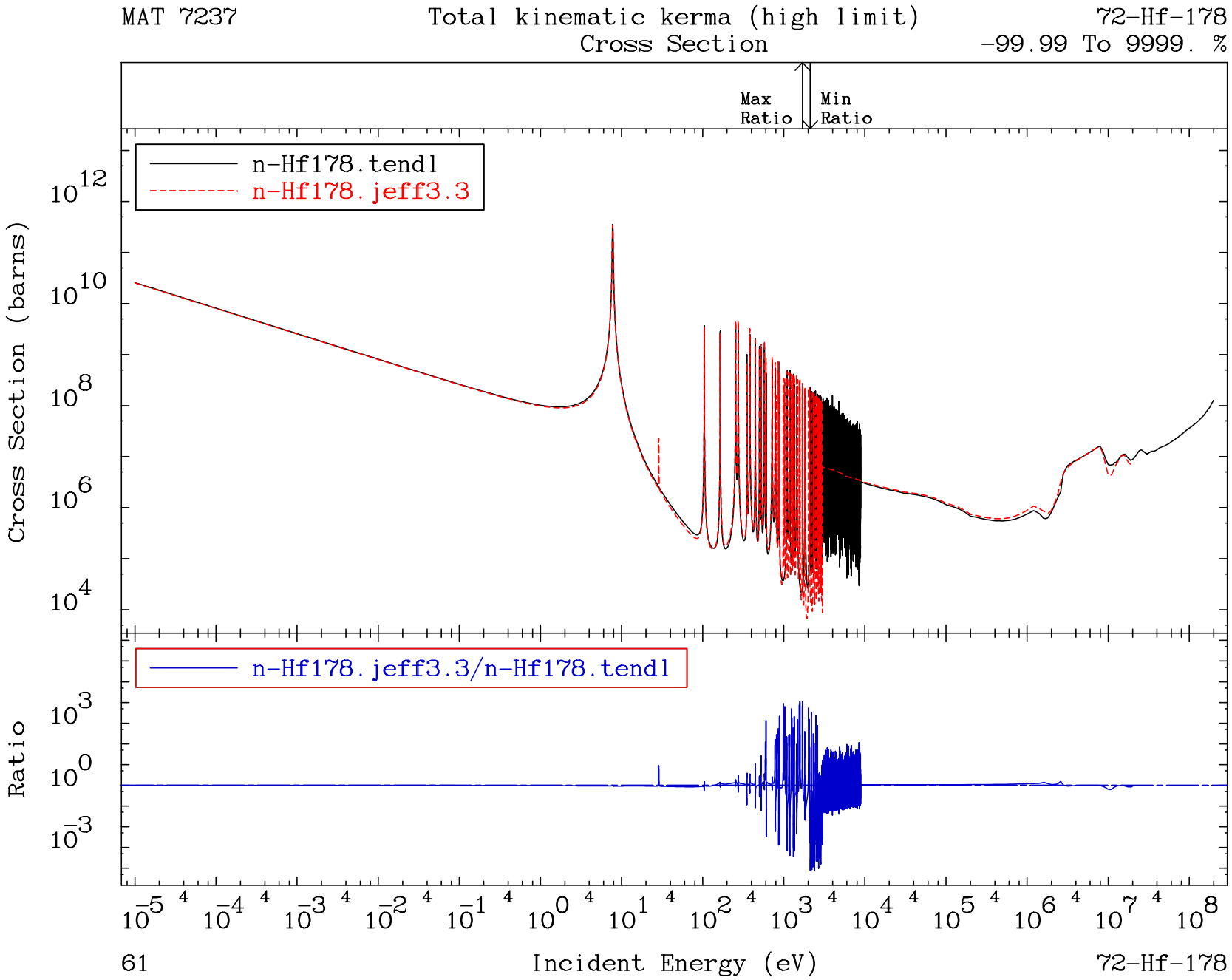

MAT 7237
Kerma non-elastic (all but mt2)
Cross Section
72-Hf-178
-99.99 To 9999. %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
56
72-Hf-178

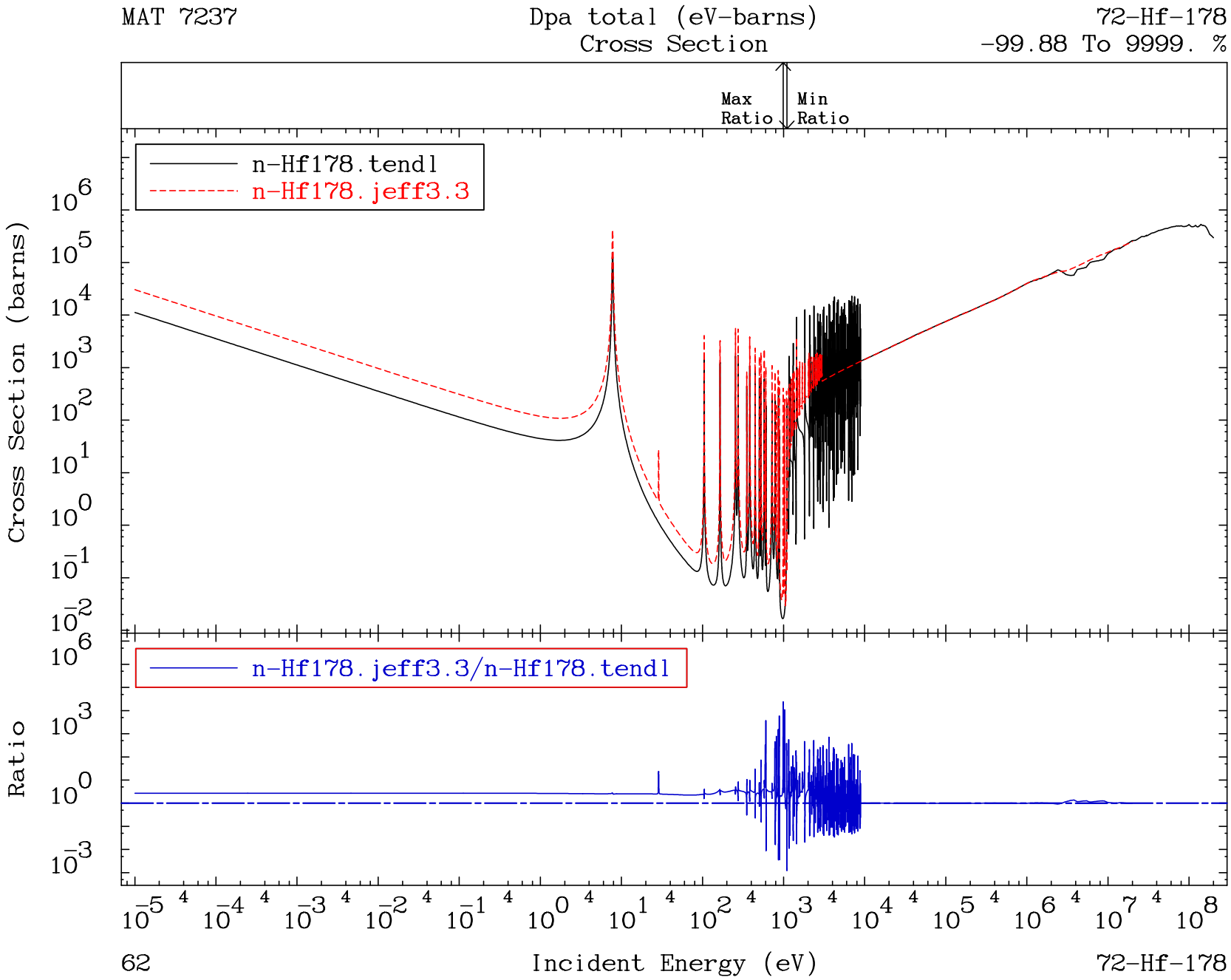

MAT 7237
Kerma inelastic (mt51-91)
Cross Section
72-Hf-178
-61.09 To 25.93 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 93.708 keV
n-Hf178.jeff3.3 Threshold 93.708 keV
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
57
72-Hf-178

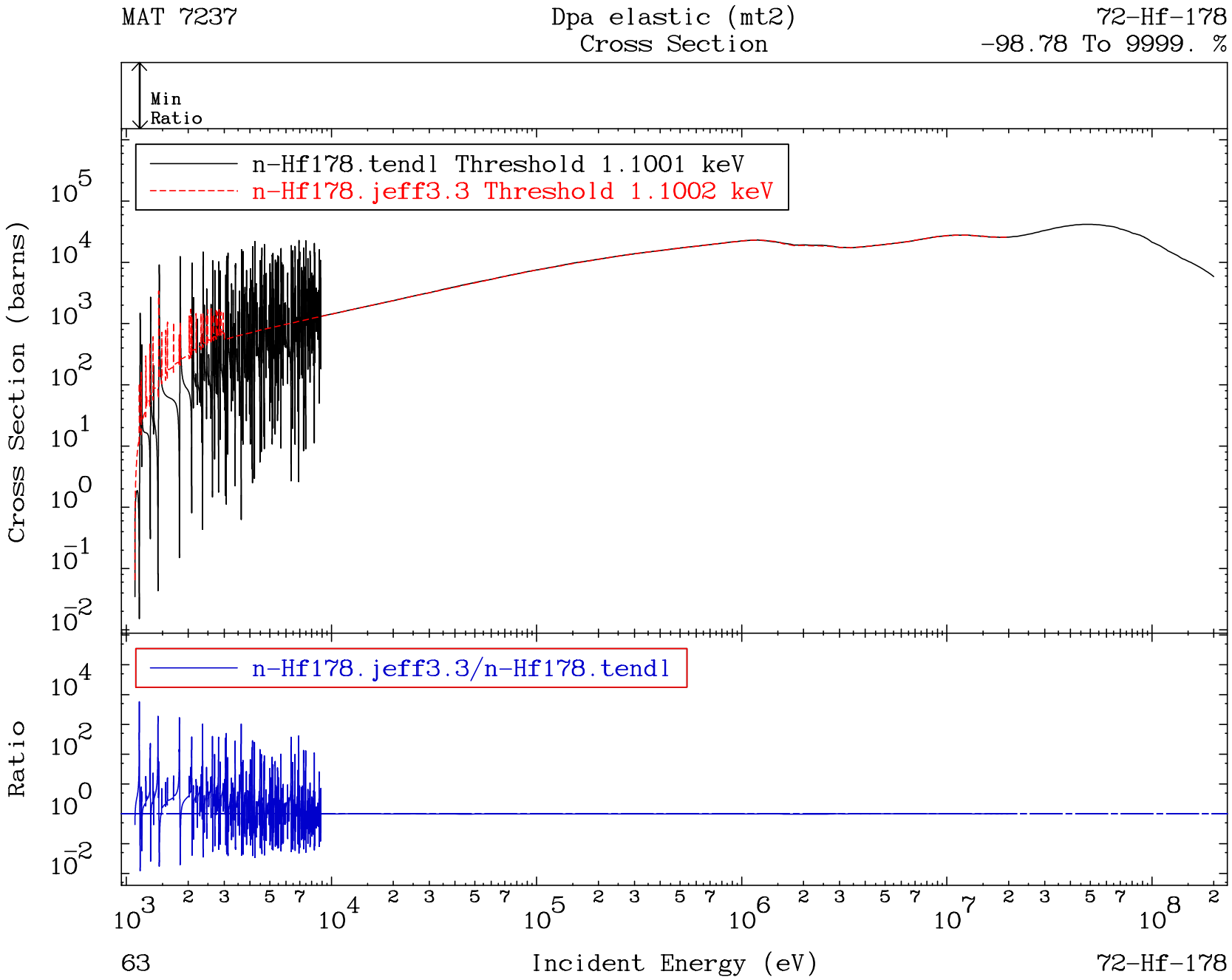

MAT 7237
Kerma fission (mt18 or mt19-20-21-38)
Cross Section
72-Hf-178
-61.09 To 25.93 %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
1.0
0.5
0.0
-0.5
-1.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.2
0.8
0.4
10^-5 10^-4 10^-3 10^-2 10^-1 10^0 10^1 10^2 10^3 10^4 10^5 10^6 10^7 10^8
58
Incident Energy (eV)
72-Hf-178

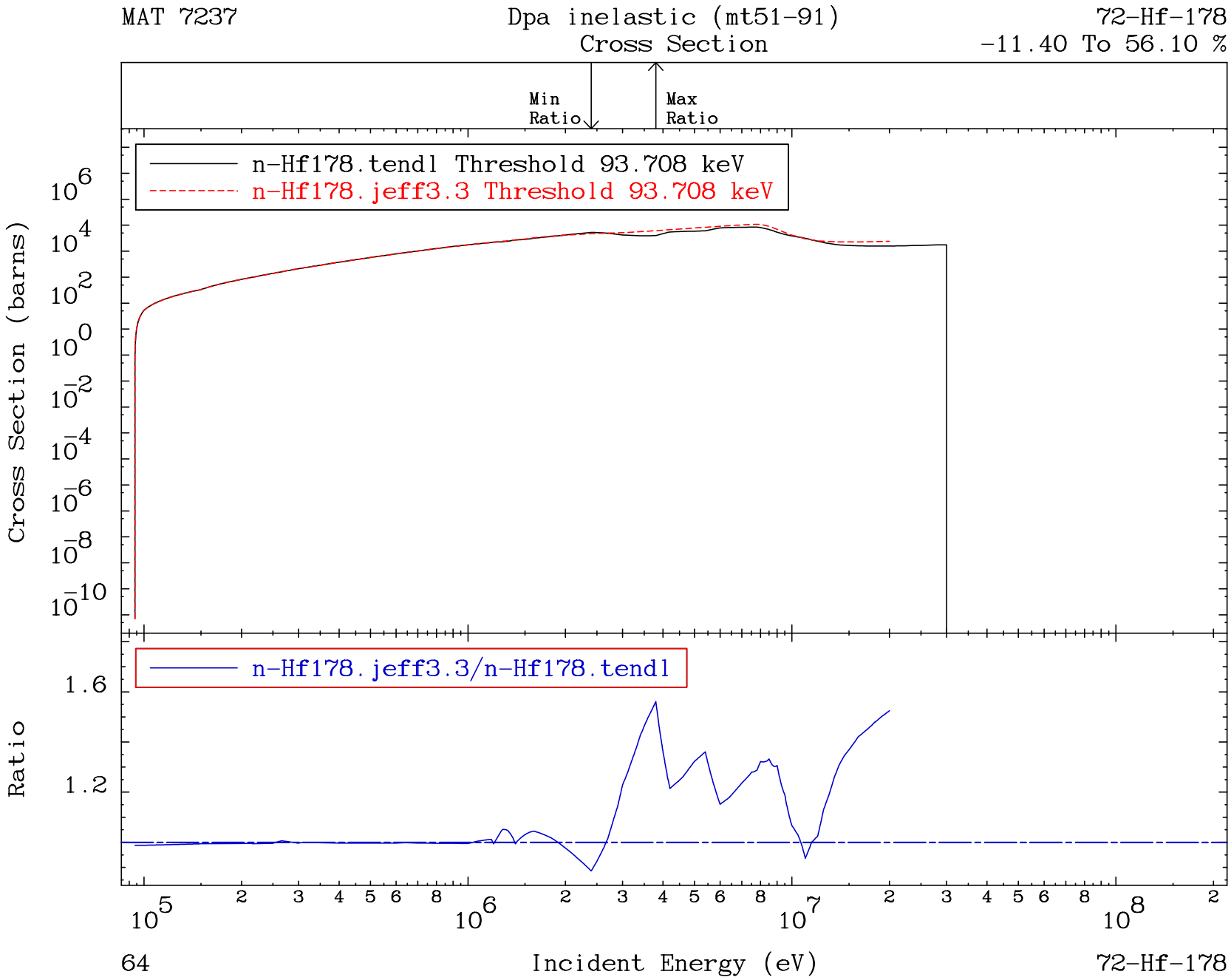

MAT 7237
Kerma capture (mt102)
Cross Section
72-Hf-178
-99.99 To 9999. %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
59
Incident Energy (eV)
72-Hf-178

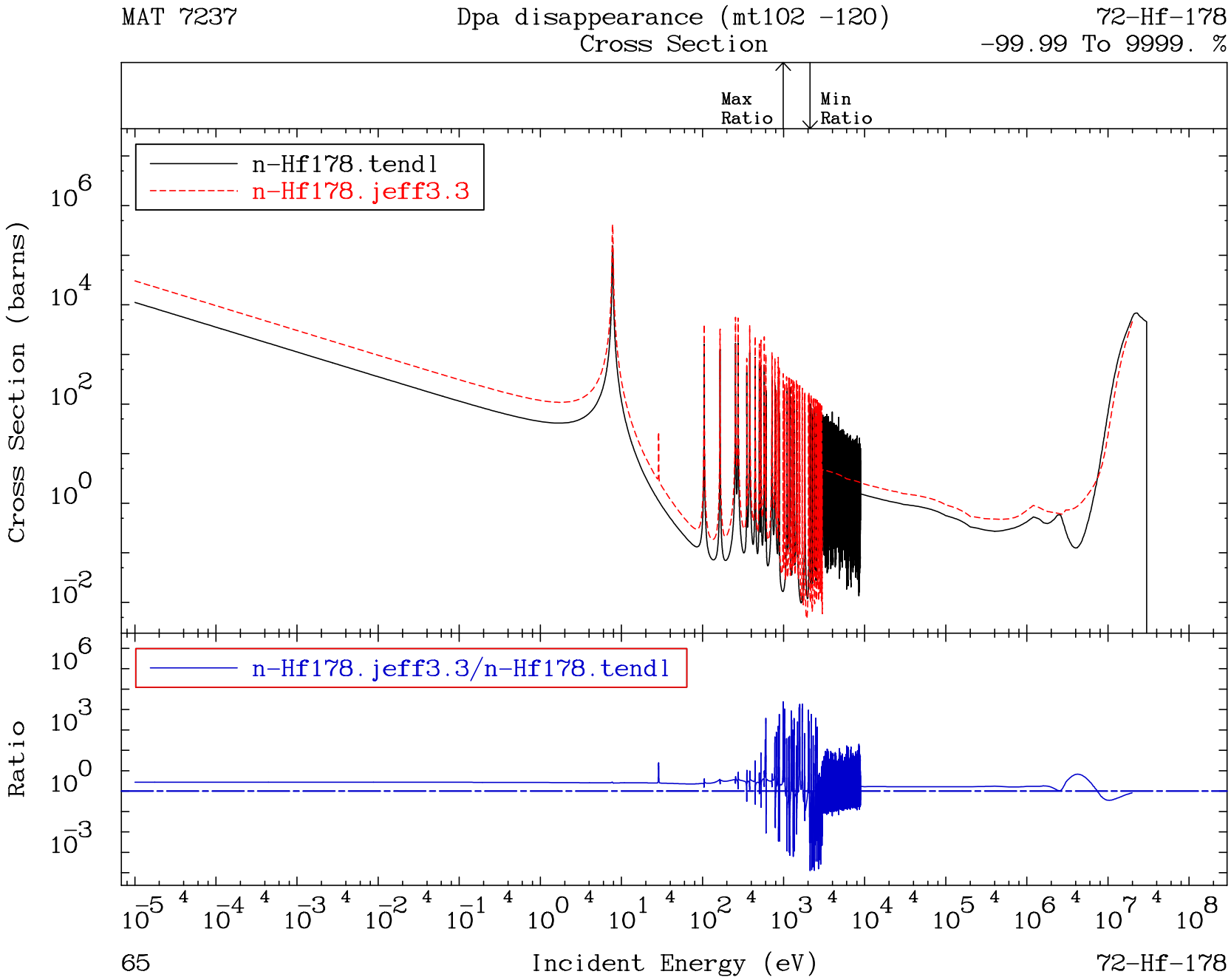

MAT 7237
Total photon (eV-barns)
Cross Section
72-Hf-178
-99.99 To 9999. %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
60
72-Hf-178

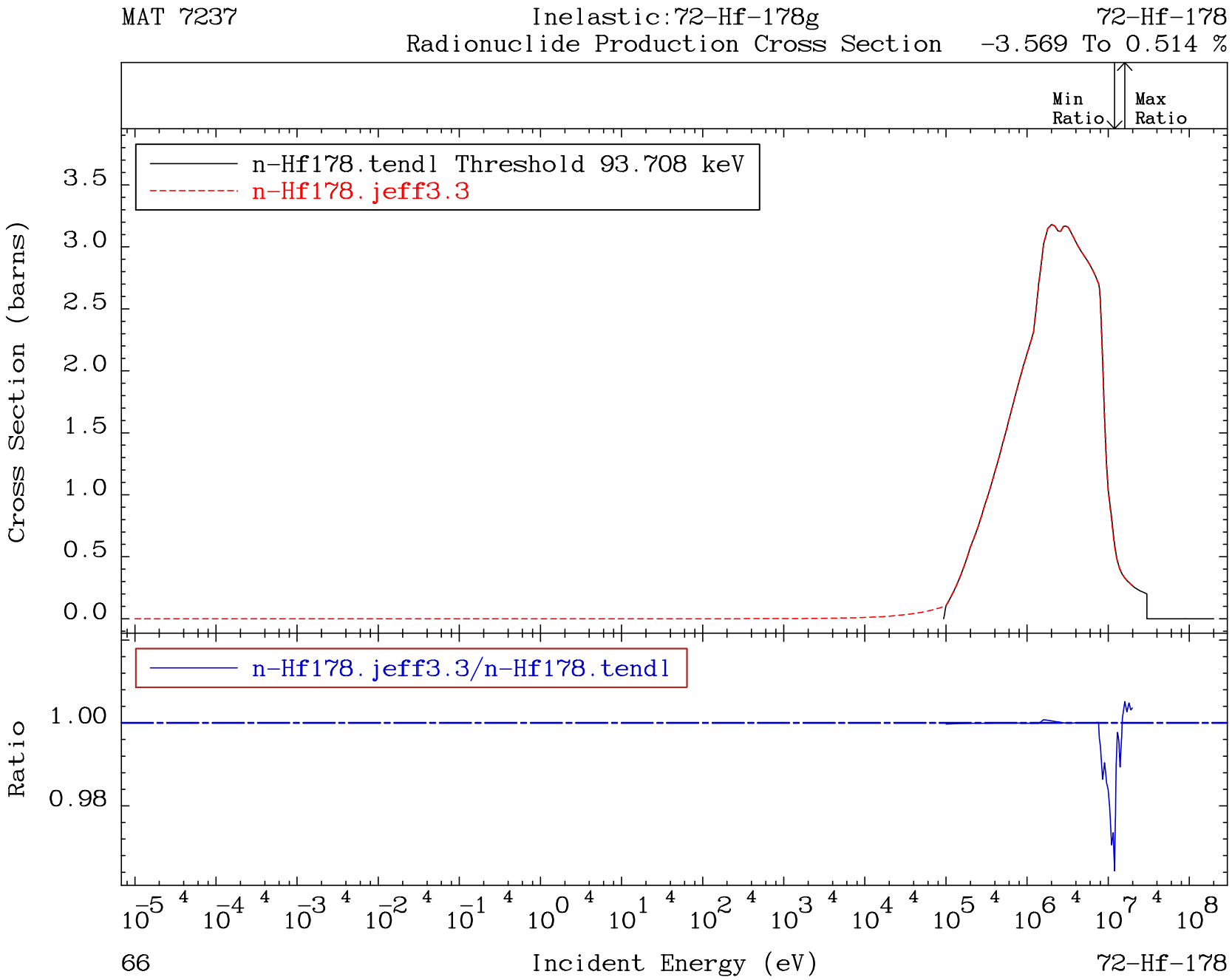

MAT 7237
Total kinematic kerma (high limit)
Cross Section
72-Hf-178
-99.99 To 9999. %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
61
72-Hf-178

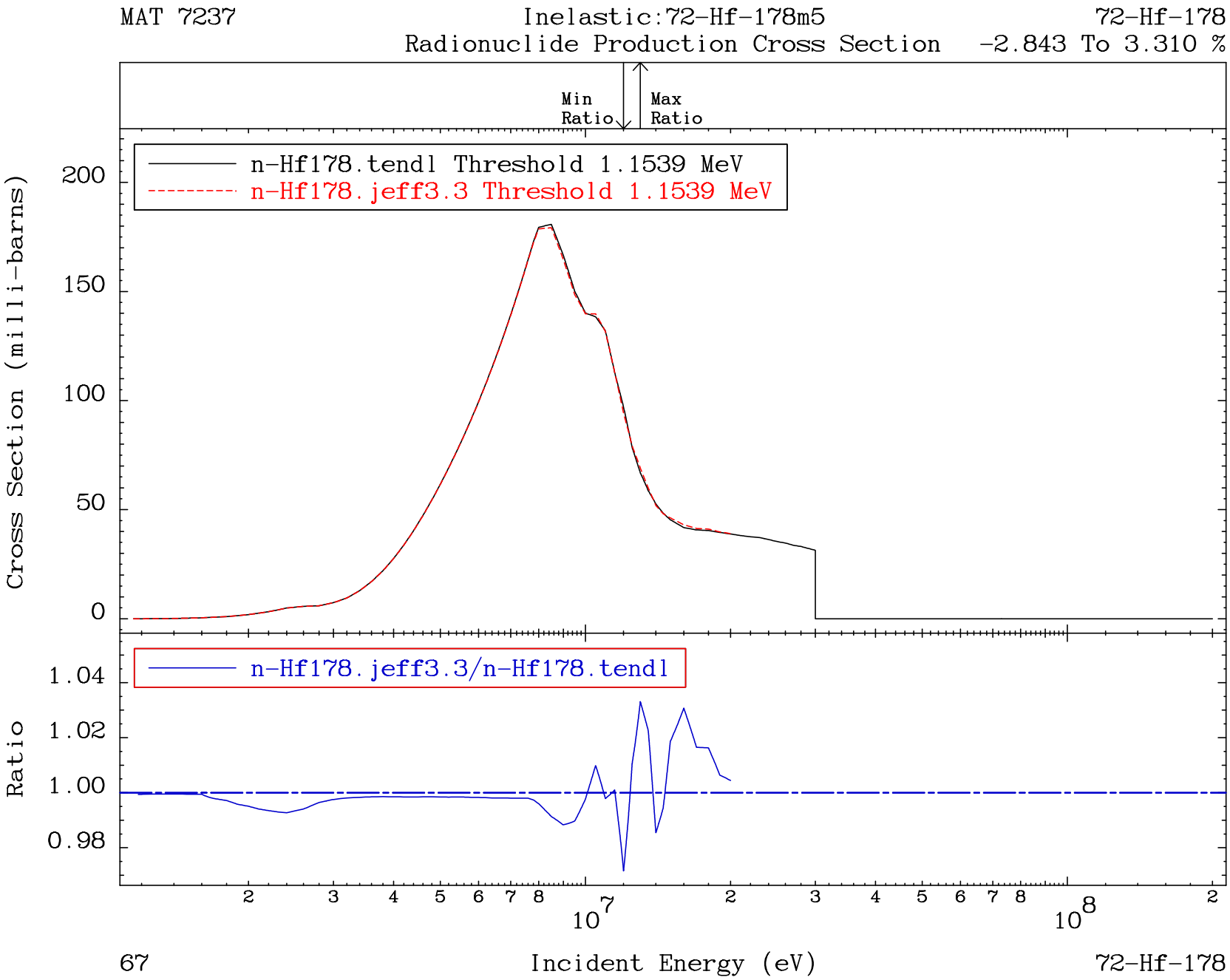

MAT 7237
Dpa total (eV-barns)
Cross Section
72-Hf-178
-99.88 To 9999. %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
62
Incident Energy (eV)
72-Hf-178

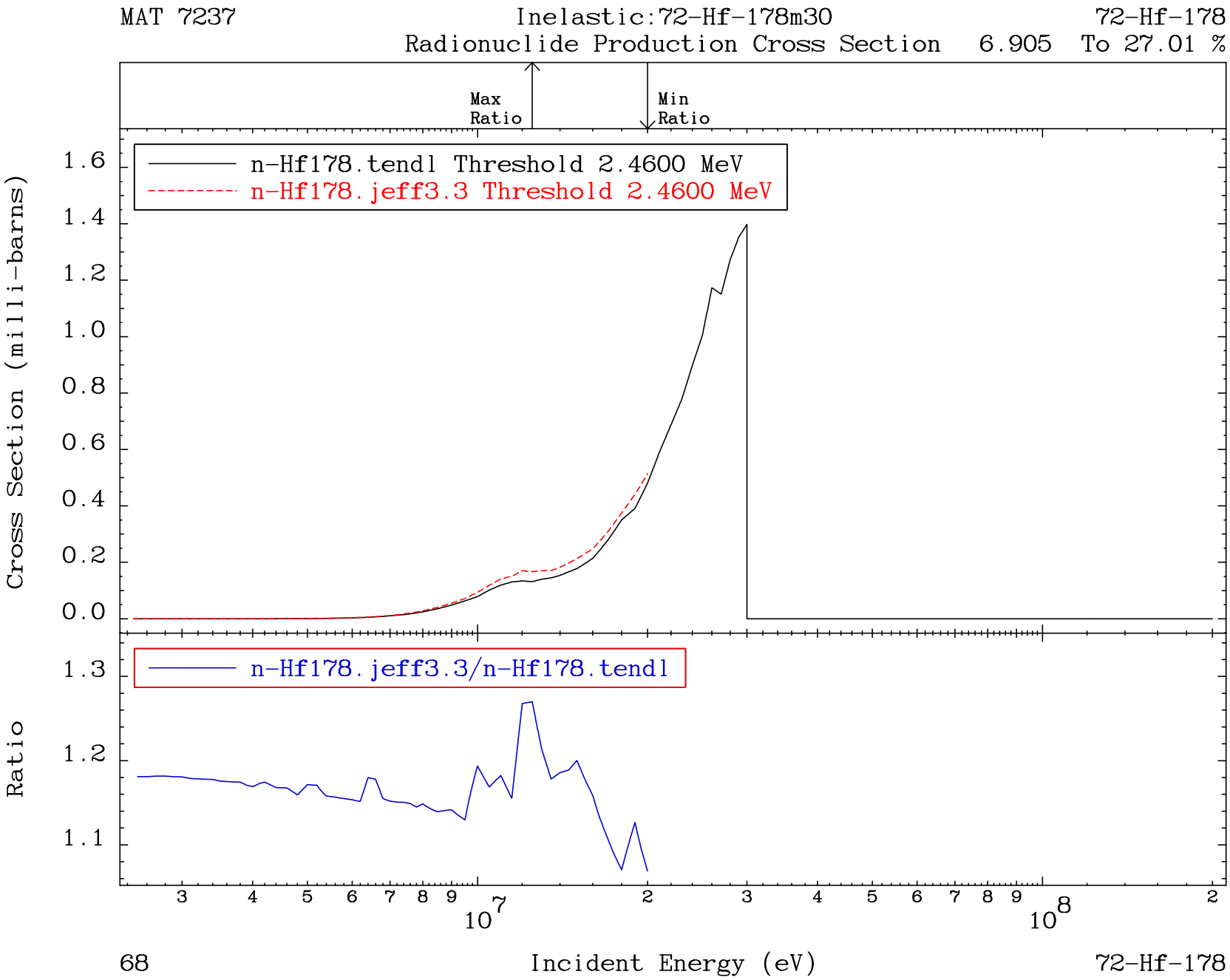

MAT 7237
Dpa elastic (mt2)
Cross Section
72-Hf-178
-98.78 To 9999. %
Min
Ratio
n-Hf178.tendl Threshold 1.1001 keV
n-Hf178.jeff3.3 Threshold 1.1002 keV
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
63
72-Hf-178

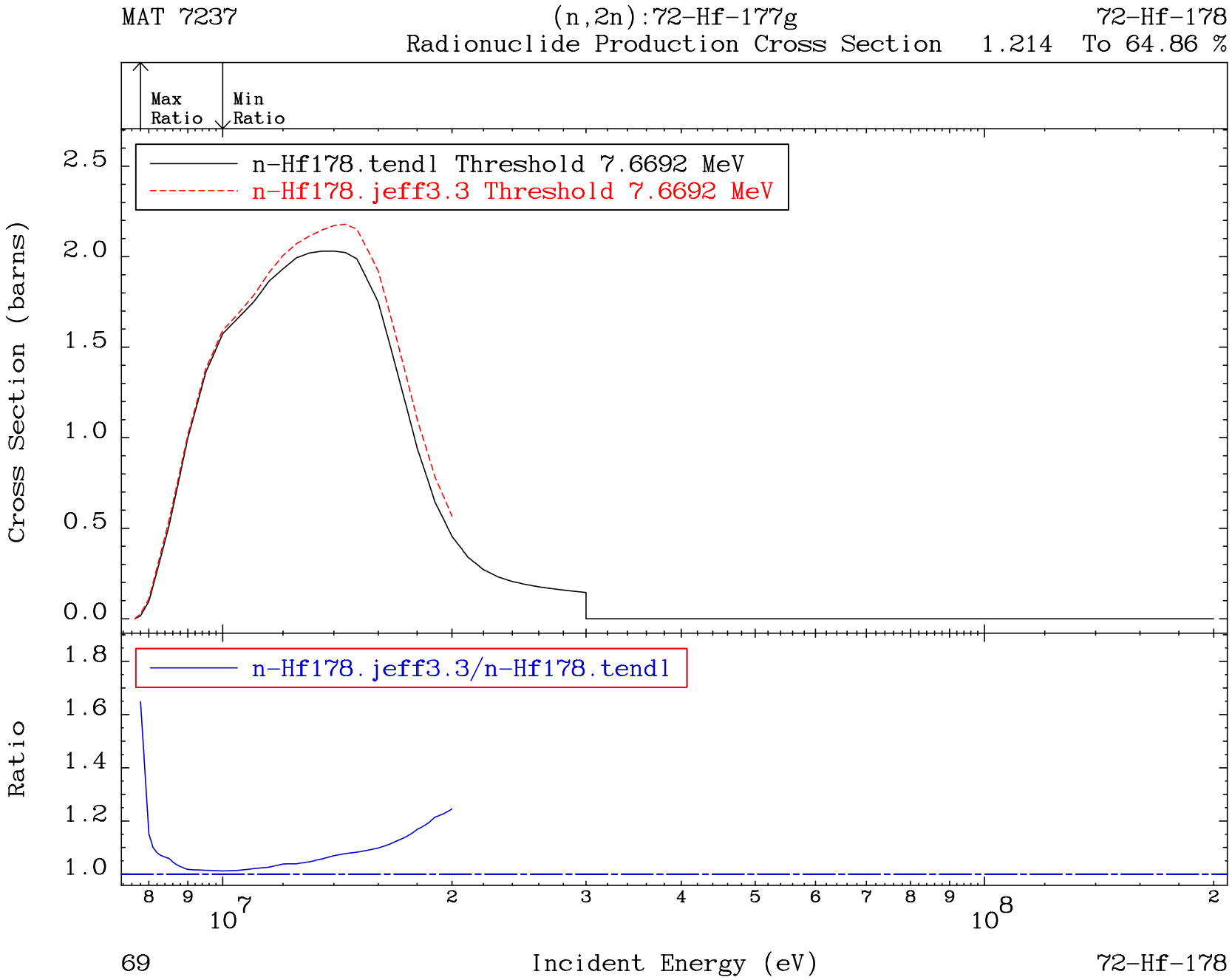

MAT 7237
Dpa inelastic (mt51-91)
Cross Section
72-Hf-178
-11.40 To 56.10 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 93.708 keV
n-Hf178.jeff3.3 Threshold 93.708 keV
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
64
72-Hf-178

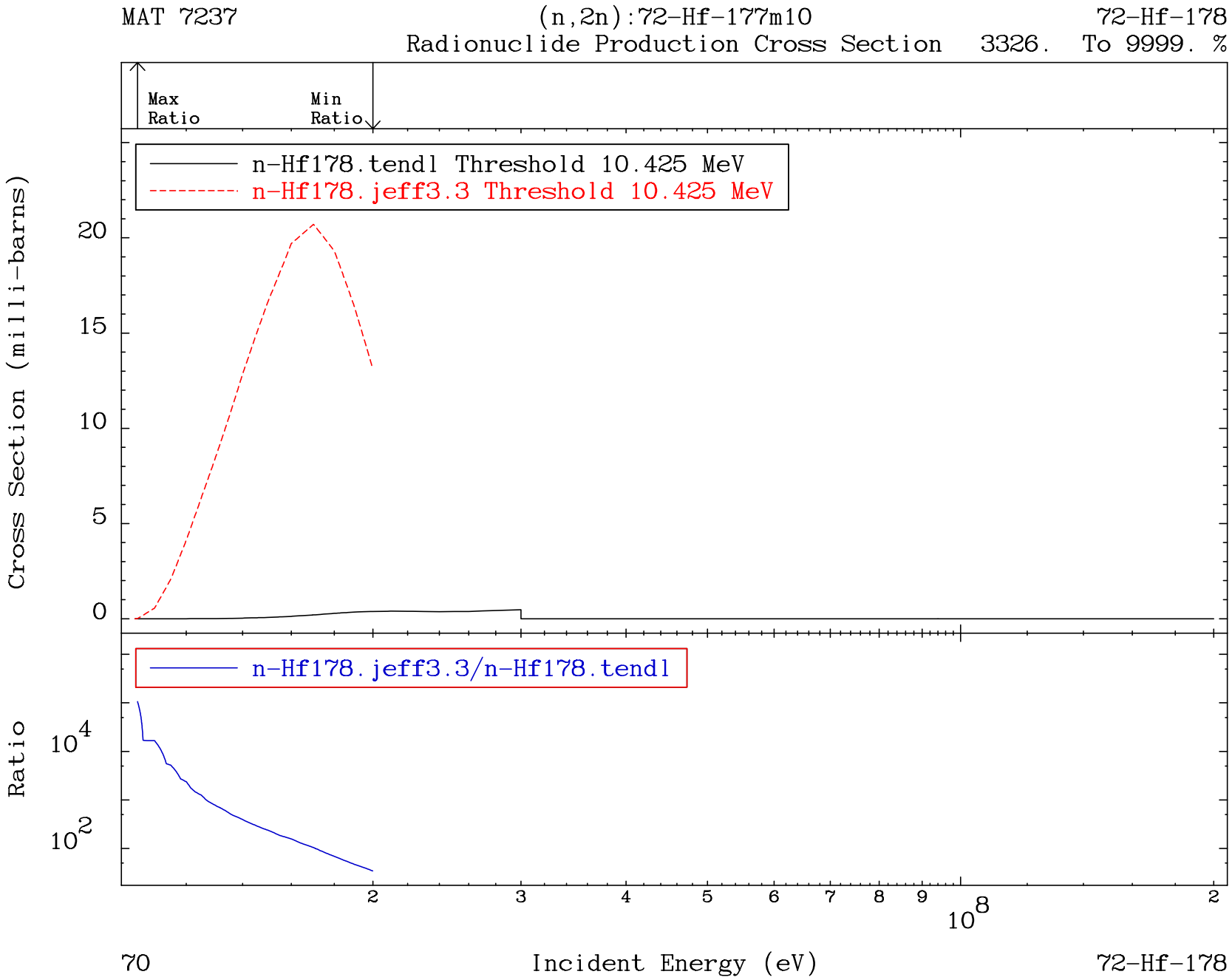

MAT 7237
Dpa disappearance (mt102 -120)
Cross Section
72-Hf-178
-99.99 To 9999. %
Max Ratio
Min Ratio
n-Hf178.tendl
n-Hf178.jeff3.3
Cross Section (barns)
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
Incident Energy (eV)
65
72-Hf-178

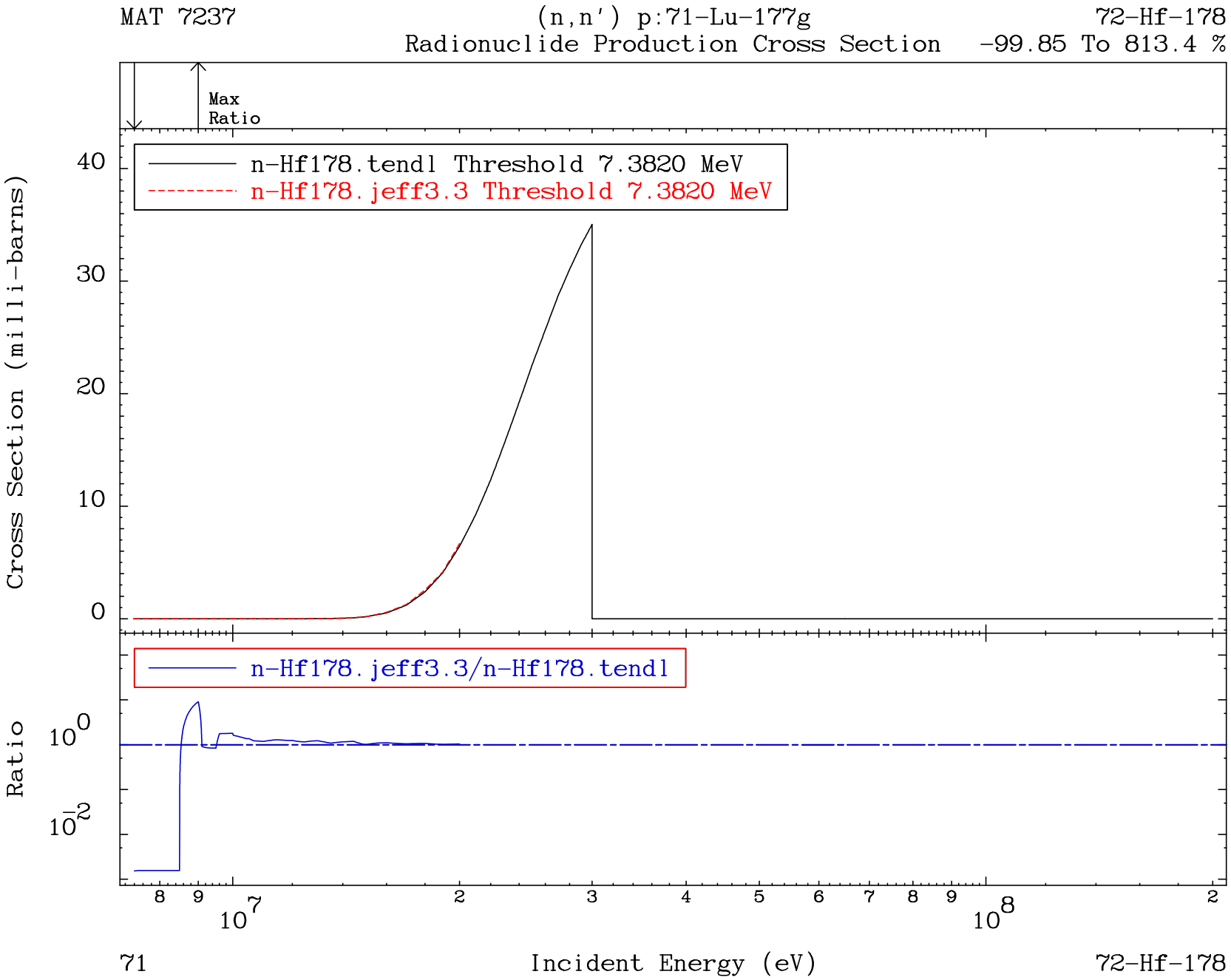

MAT 7237
Inelastic:72-Hf-178g
72-Hf-178
Radionuclide Production Cross Section
-3.569 To 0.514 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 93.708 keV
n-Hf178.jeff3.3
Cross Section (barns)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.00
0.98
10^-5 10^-4 10^-3 10^-2 10^-1 10^0 10^1 10^2 10^3 10^4 10^5 10^6 10^7 10^8
66
Incident Energy (eV)
72-Hf-178

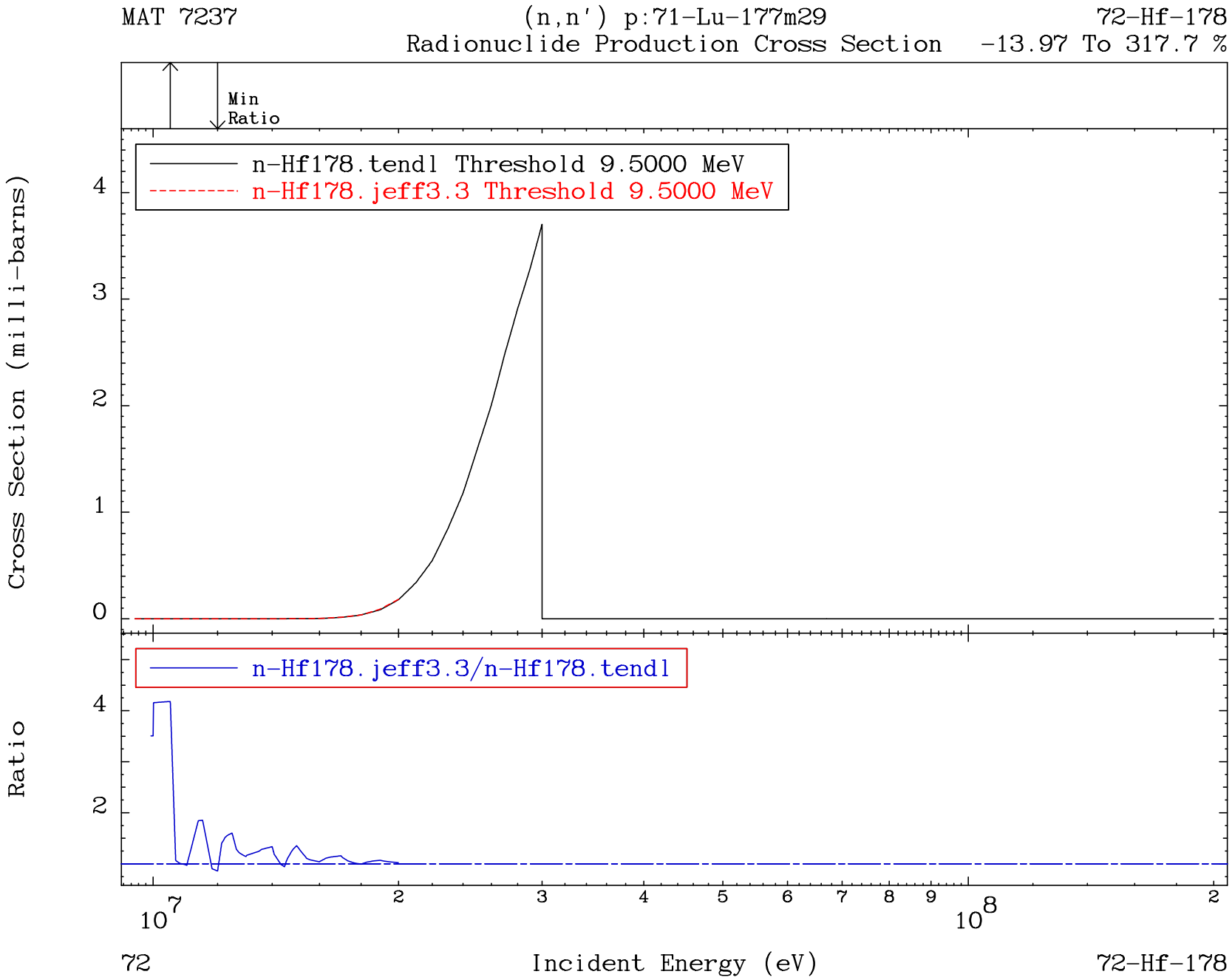

MAT 7237
Inelastic:72-Hf-178m5
72-Hf-178
Radionuclide Production Cross Section
-2.843 To 3.310 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.1539 MeV
n-Hf178.jeff3.3 Threshold 1.1539 MeV
Cross Section (milli-barns)
200
150
100
50
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.04
1.02
1.00
0.98
2 3 4 5 6 7 8
10^7
2 3 4 5 6 7 8
10^8
2
67
Incident Energy (eV)
72-Hf-178

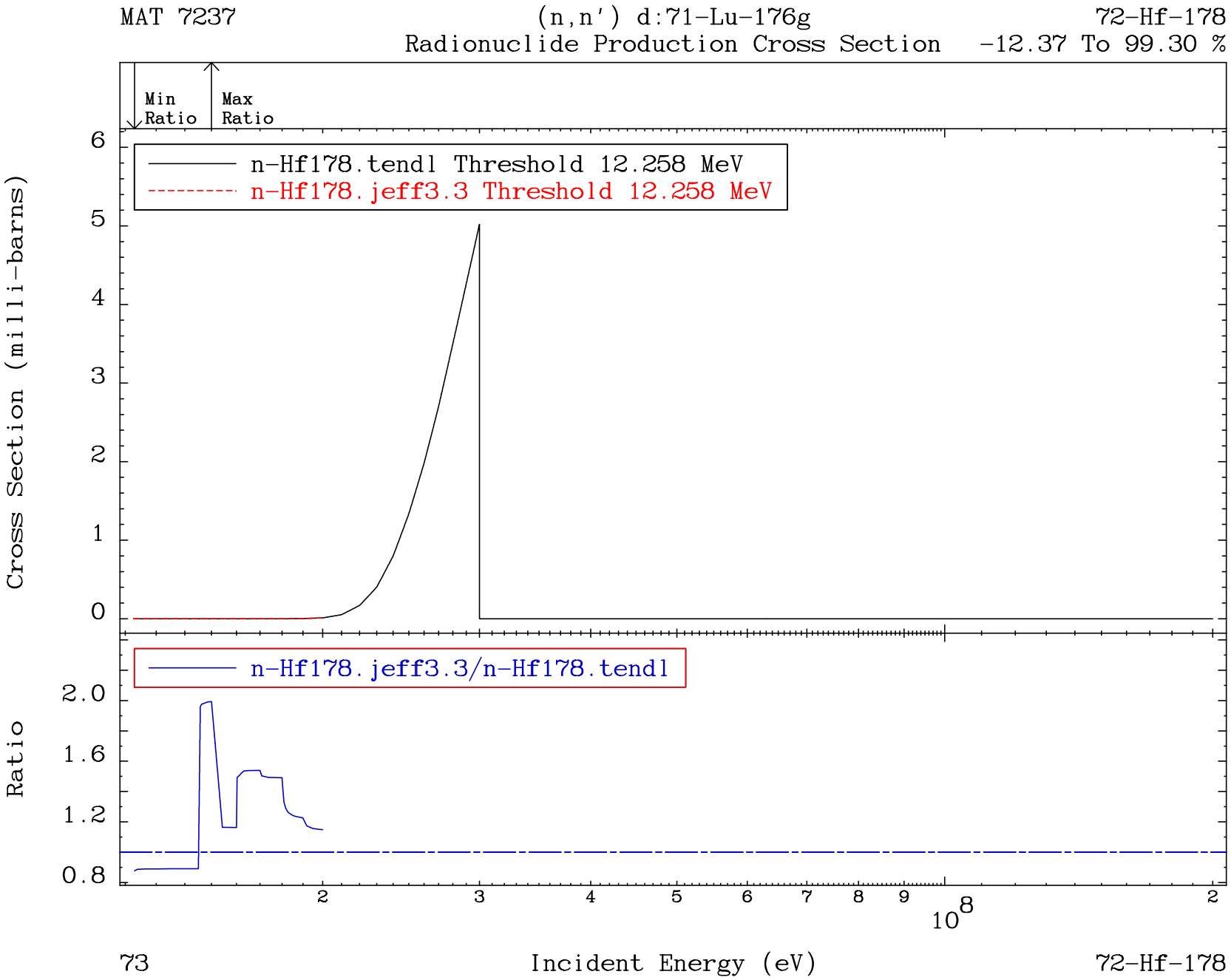

MAT 7237
Inelastic:72-Hf-178m30
72-Hf-178
Radionuclide Production Cross Section 6.905 To 27.01 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 2.4600 MeV
n-Hf178.jeff3.3 Threshold 2.4600 MeV
Cross Section (milli-barns)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.3
1.2
1.1
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

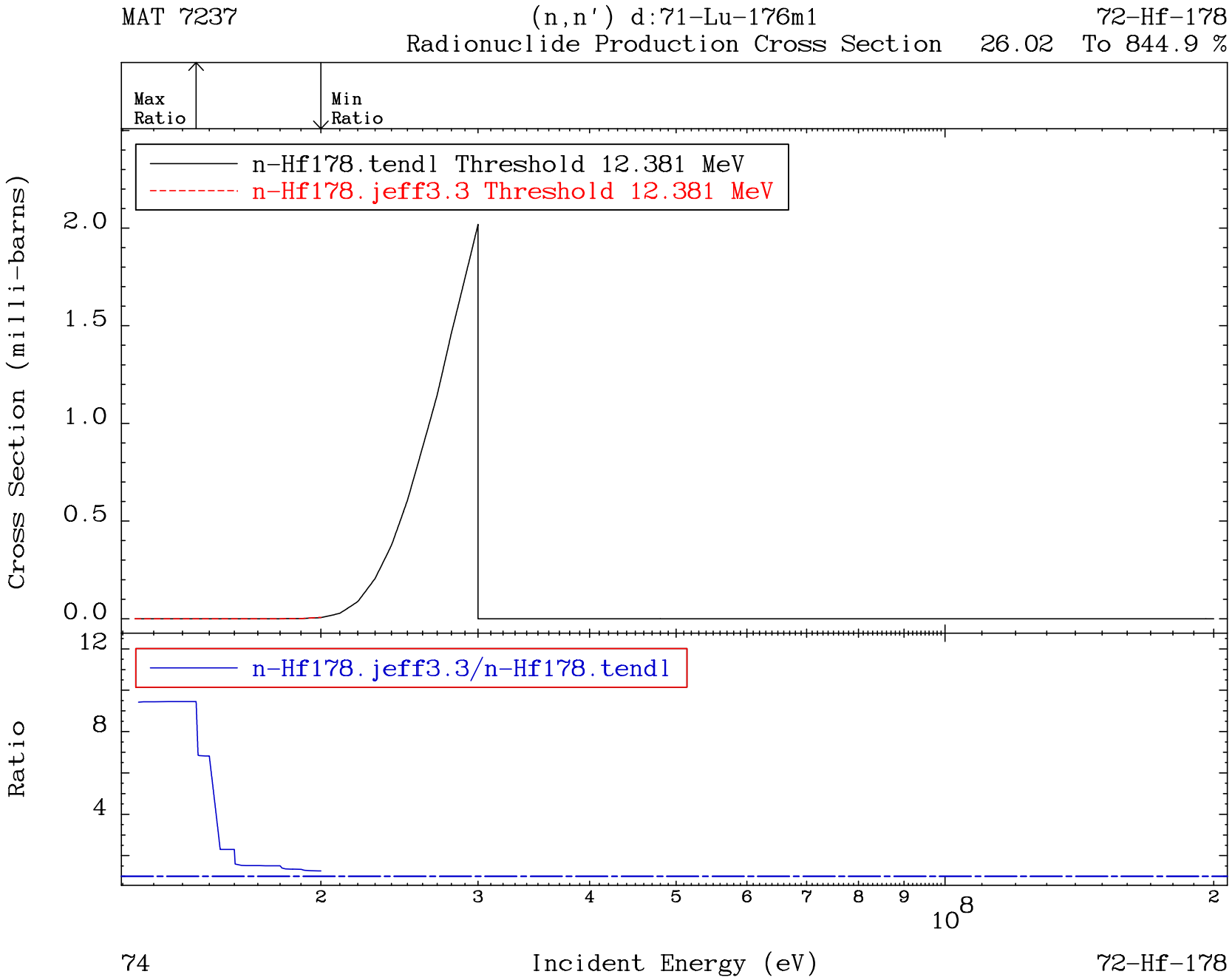

MAT 7237
(n,2n):72-Hf-177g
72-Hf-178
Radionuclide Production Cross Section 1.214 To 64.86 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 7.6692 MeV
n-Hf178.jeff3.3 Threshold 7.6692 MeV
Cross Section (barns)
2.5
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.8
1.6
1.4
1.2
1.0
8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
69
Incident Energy (eV)
72-Hf-178

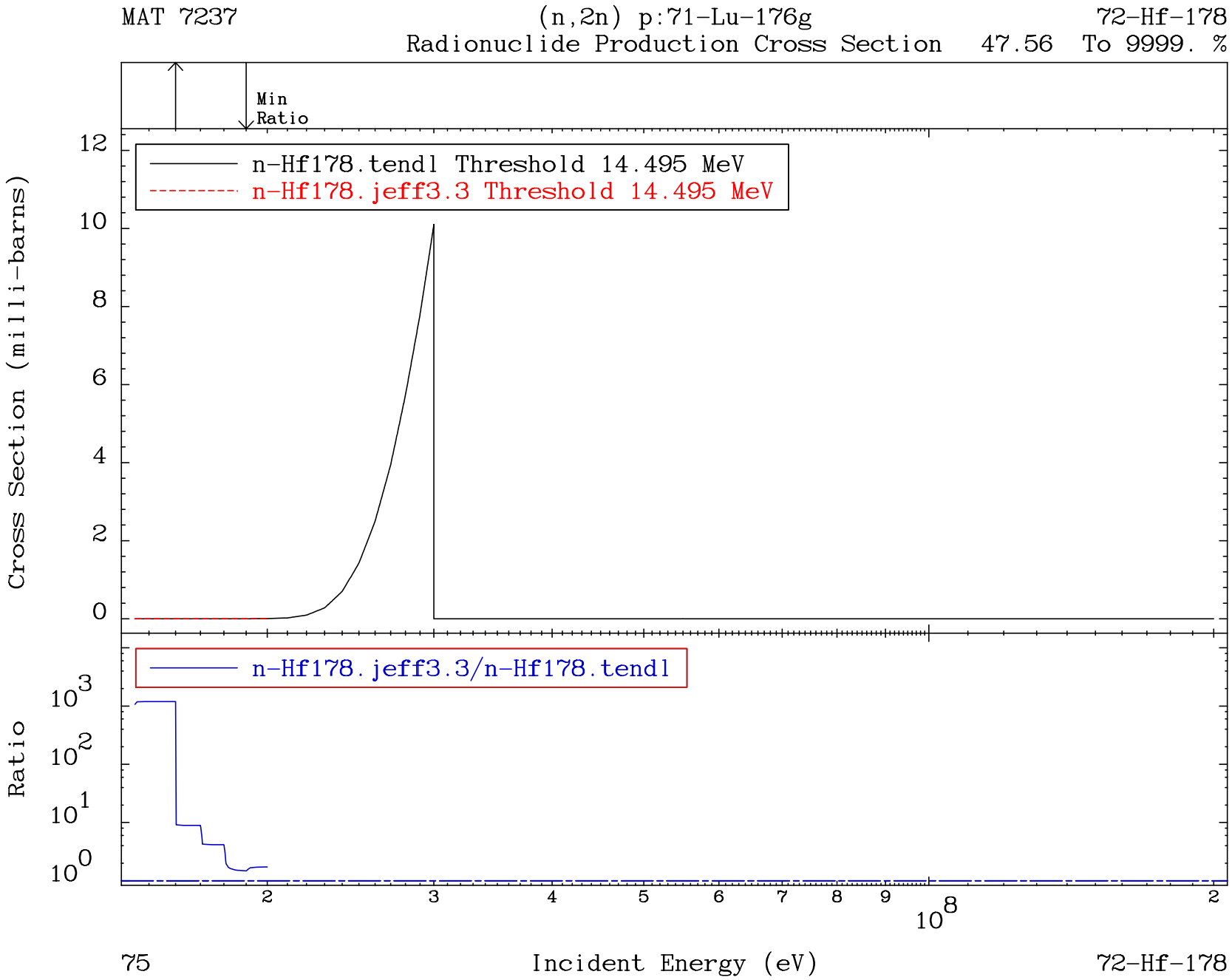

MAT 7237
(n,2n):72-Hf-177m10
72-Hf-178
Radionuclide Production Cross Section 3326. To 9999. %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 10.425 MeV
n-Hf178.jeff3.3 Threshold 10.425 MeV
Cross Section (milli-barns)
20
15
10
5
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^4
10^2
2
3
4
5
6
7
8
9
10^8
2
70
Incident Energy (eV)
72-Hf-178

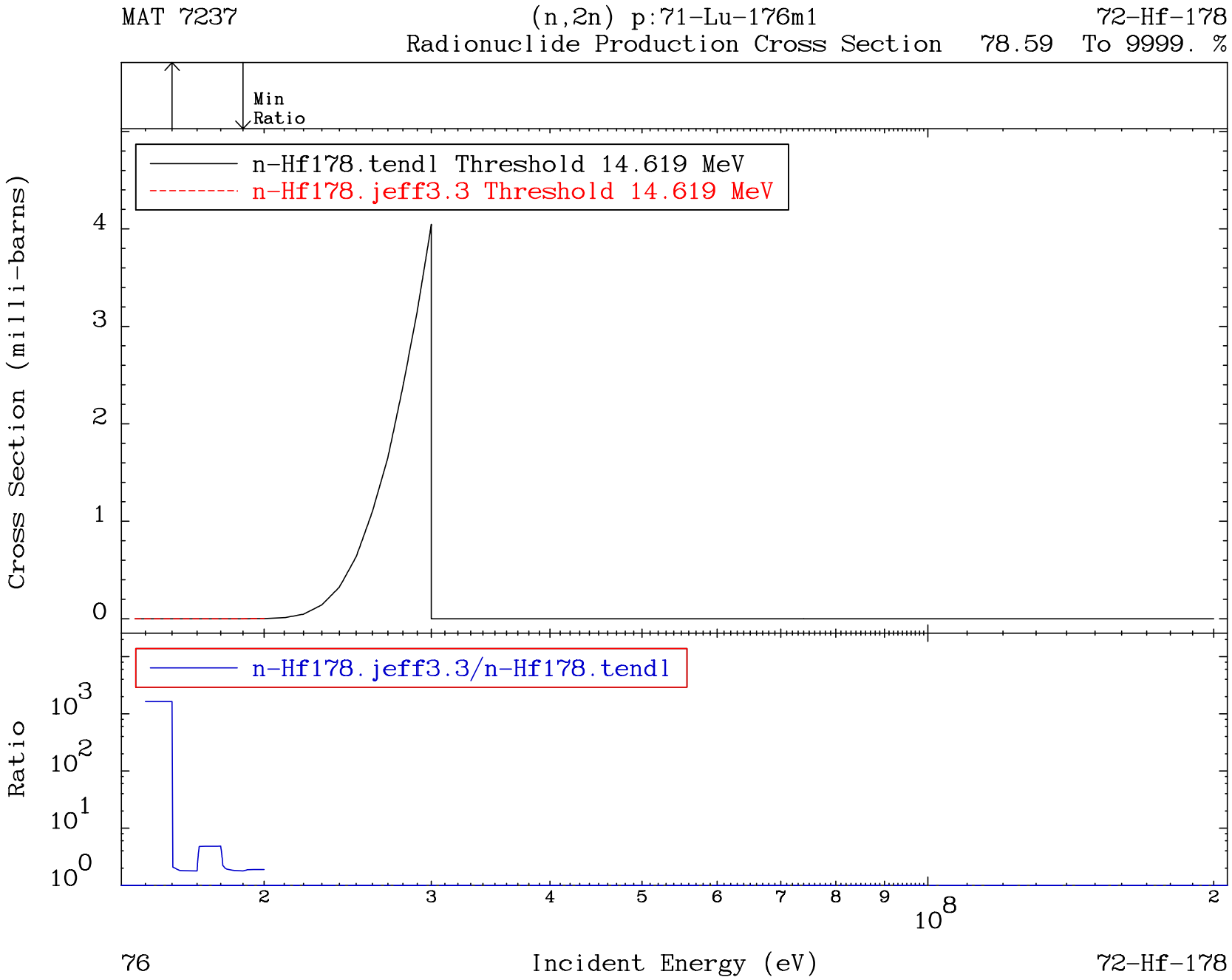

MAT 7237
(n,n') p:71-Lu-177g
72-Hf-178
Radionuclide Production Cross Section -99.85 To 813.4 %
Max
Ratio
n-Hf178.tendl Threshold 7.3820 MeV
n-Hf178.jeff3.3 Threshold 7.3820 MeV
Cross Section (milli-barns)
40
30
20
10
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^0
10^-2
8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
71
Incident Energy (eV)
72-Hf-178

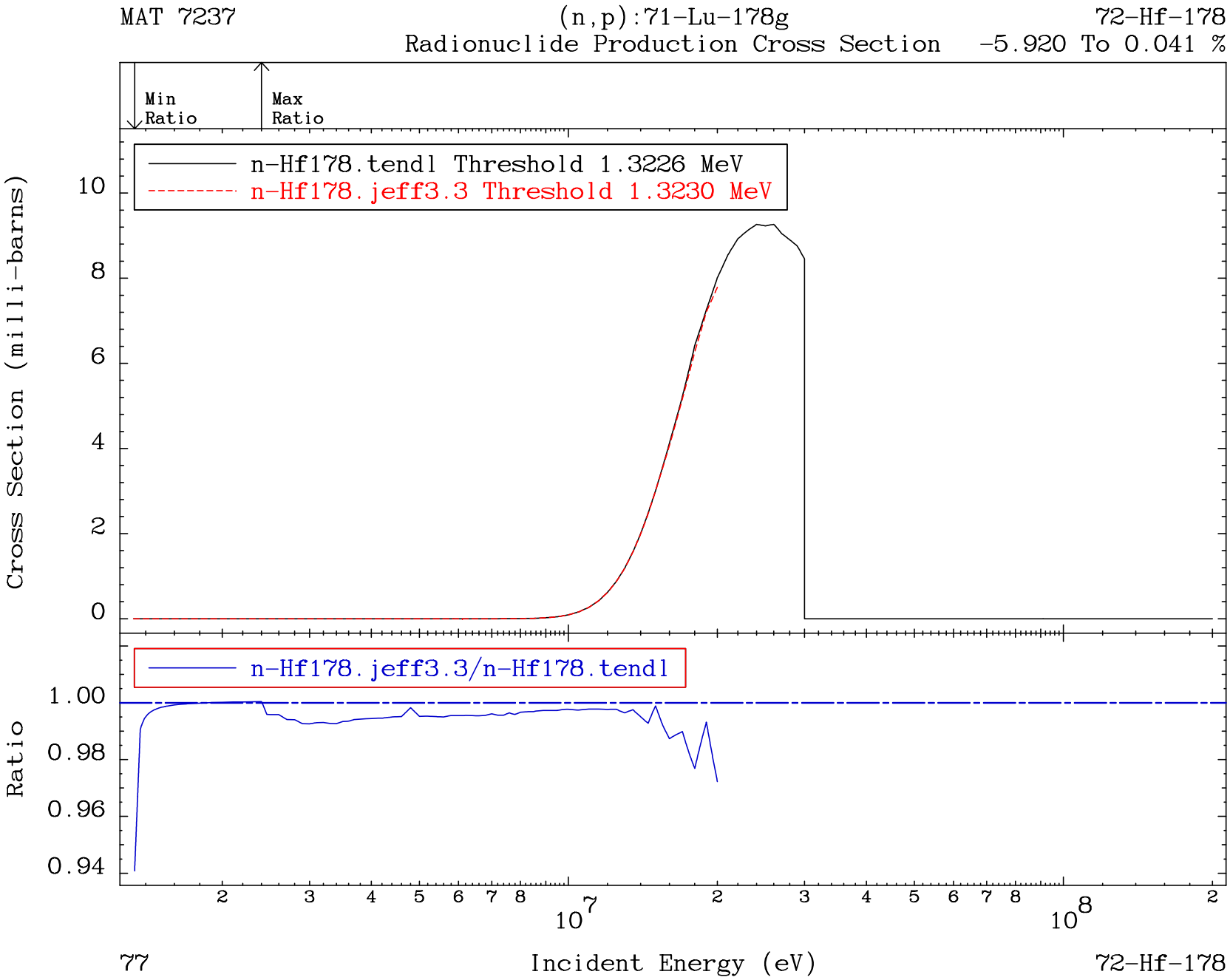

MAT 7237
(n,n') p:71-Lu-177m29
72-Hf-178
Radionuclide Production Cross Section -13.97 To 317.7 %
Min
Ratio
n-Hf178.tendl Threshold 9.5000 MeV
n-Hf178.jeff3.3 Threshold 9.5000 MeV
Cross Section (milli-barns)
0
1
2
3
4
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
2
4
10^7
2
3
4
5
6
7
8
9
10^8
2
72
Incident Energy (eV)
72-Hf-178

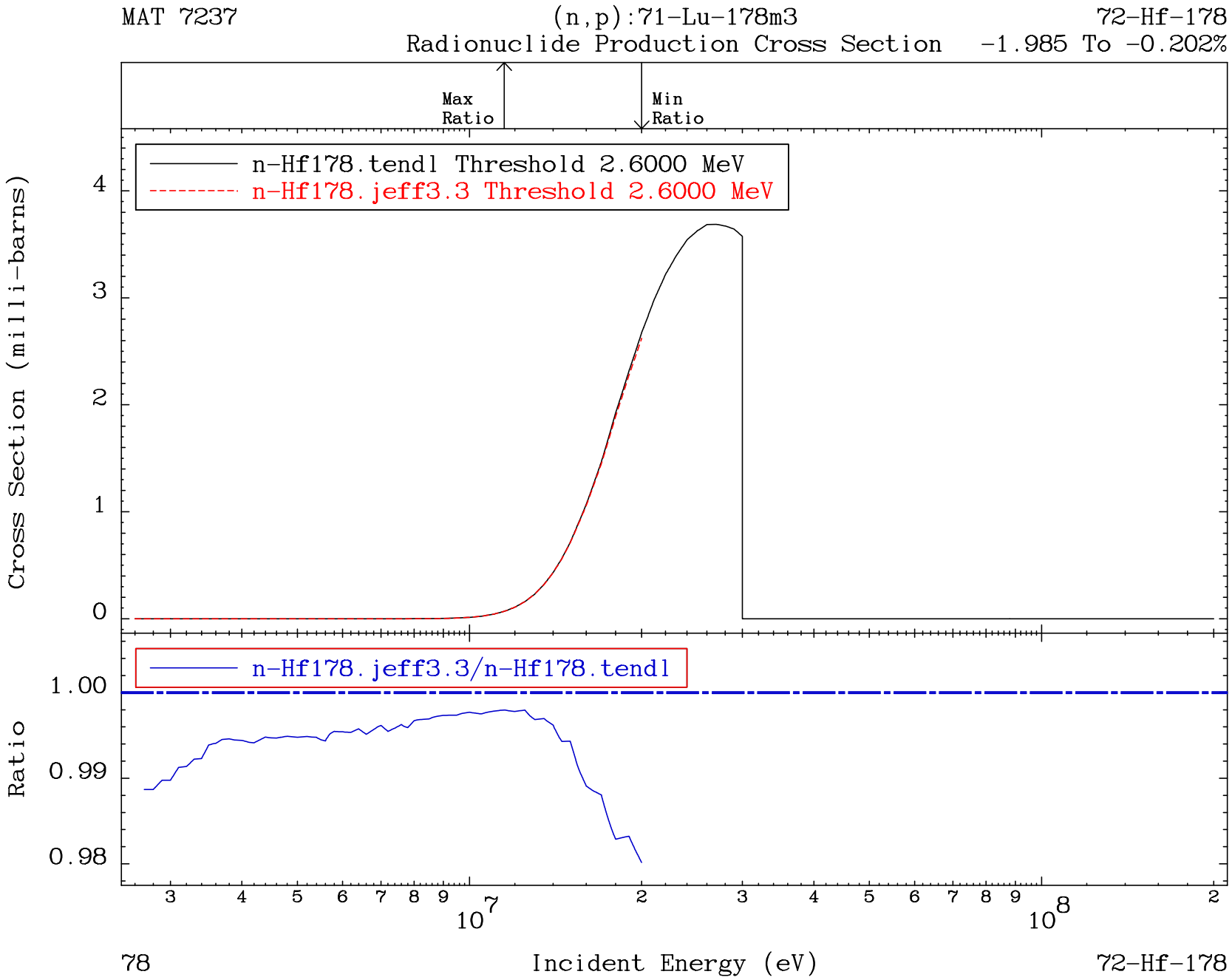

MAT 7237
(n,n') d:71-Lu-176g
72-Hf-178
Radionuclide Production Cross Section -12.37 To 99.30 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 12.258 MeV
n-Hf178.jeff3.3 Threshold 12.258 MeV
Cross Section (milli-barns)
0
1
2
3
4
5
6
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
0.8
1.2
1.6
2.0
2
3
4
5
6
7
8
9
10^8
2
73
Incident Energy (eV)
72-Hf-178

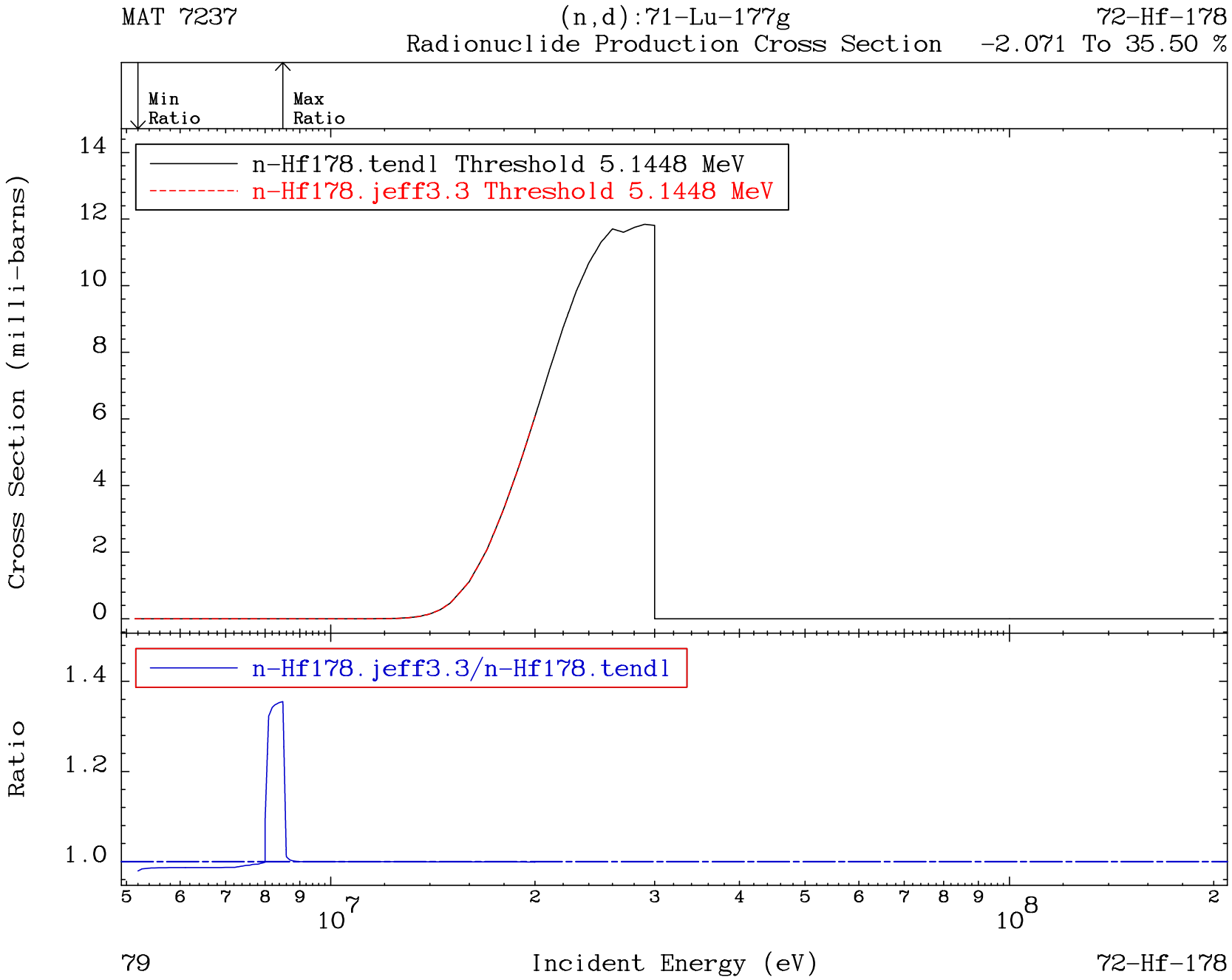

MAT 7237
(n,n') d:71-Lu-176m1
72-Hf-178
Radionuclide Production Cross Section 26.02 To 844.9 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 12.381 MeV
n-Hf178.jeff3.3 Threshold 12.381 MeV
Cross Section (milli-barns)
2.0
1.5
1.0
0.5
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
12
8
4
2
3
4
5
6
7
8
9
10^8
2
74
Incident Energy (eV)
72-Hf-178

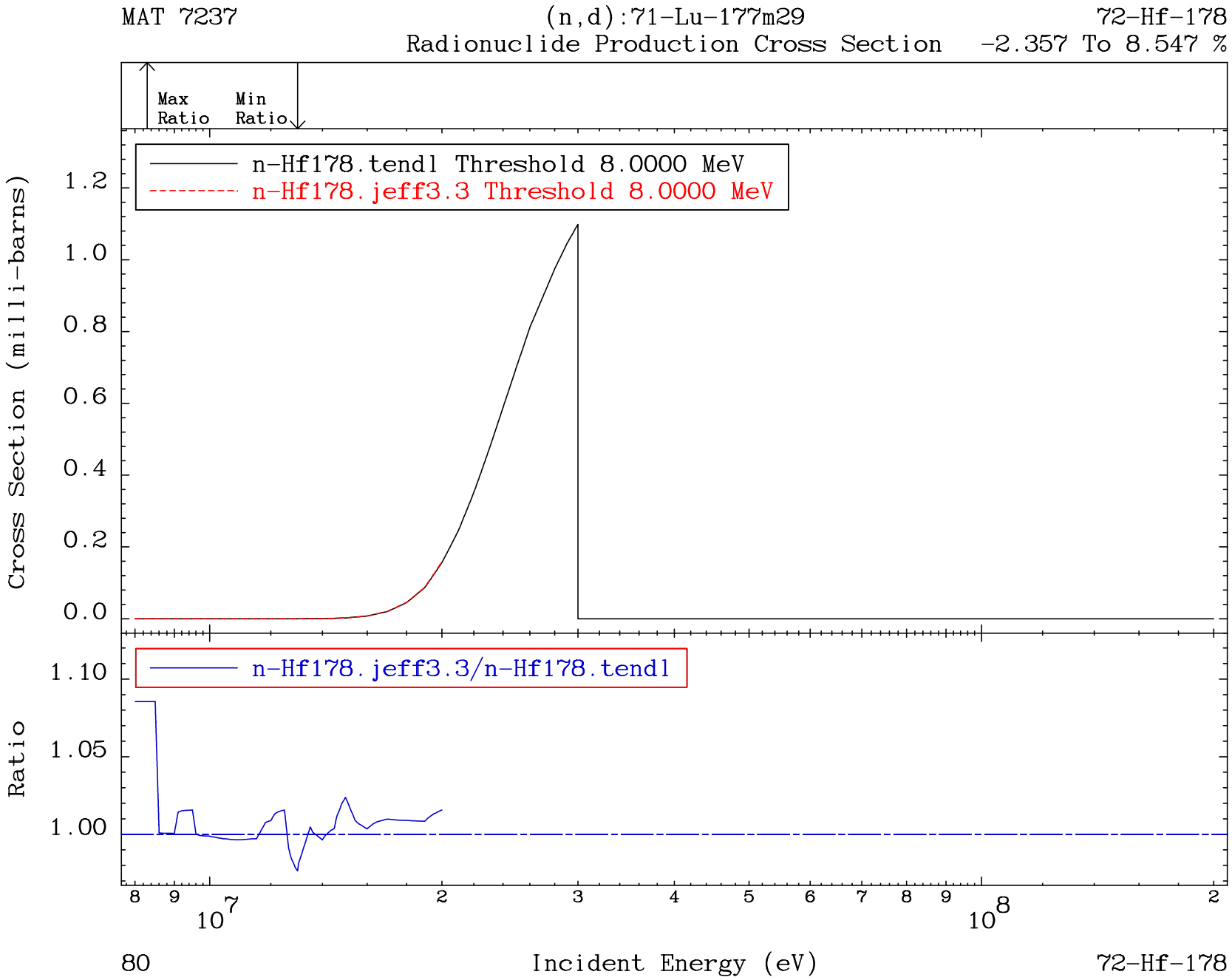

MAT 7237
(n,2n) p:71-Lu-176g
72-Hf-178
Radionuclide Production Cross Section 47.56 To 9999. %
Min
Ratio
n-Hf178.tendl Threshold 14.495 MeV
n-Hf178.jeff3.3 Threshold 14.495 MeV
Cross Section (milli-barns)
12
10
8
6
4
2
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^3
10^2
10^1
10^0
2
3
4
5
6
7
8
9
10^8
2
75
Incident Energy (eV)
72-Hf-178

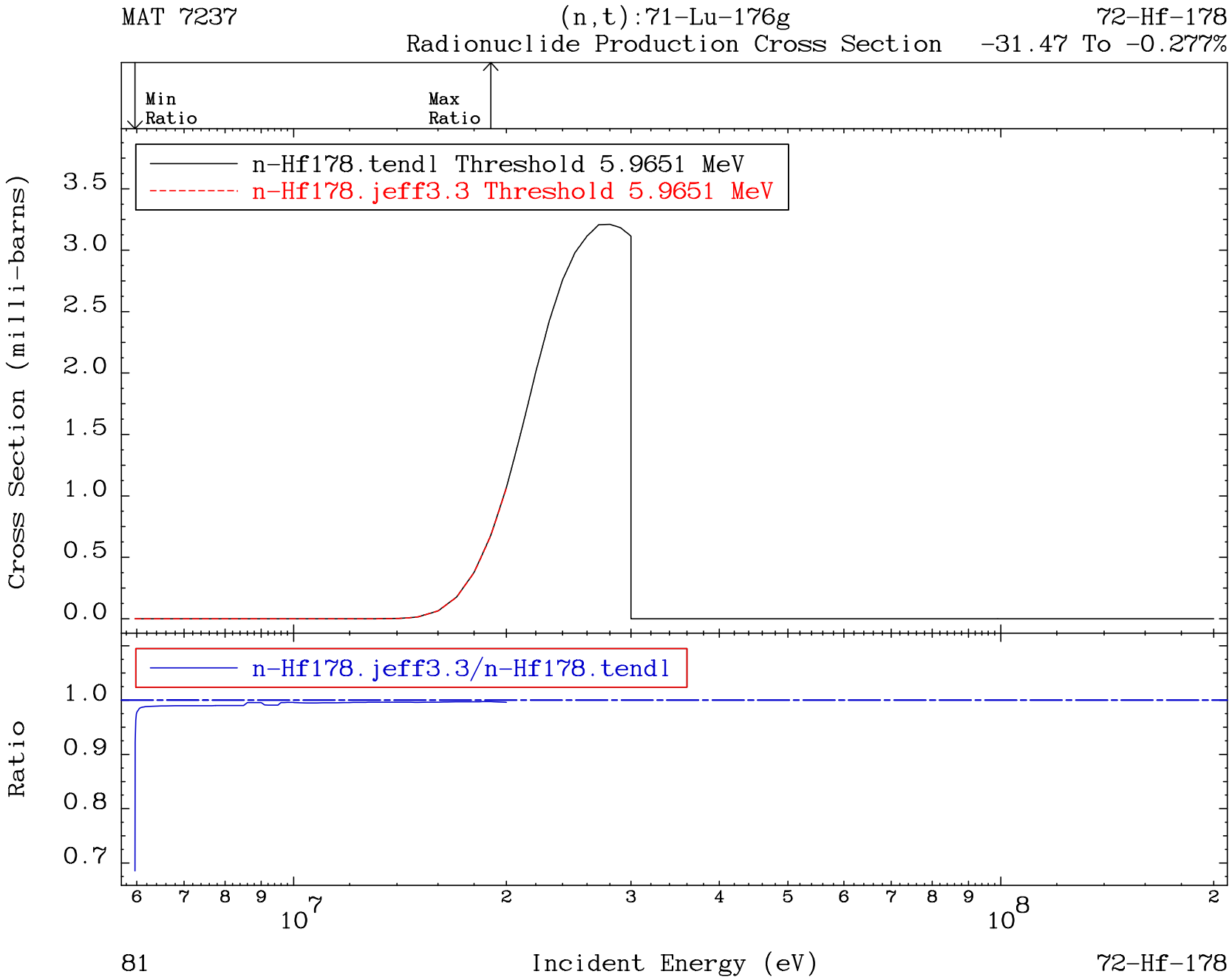

MAT 7237
(n,2n) p:71-Lu-176m1
72-Hf-178
Radionuclide Production Cross Section 78.59 To 9999. %
Min
Ratio
n-Hf178.tendl Threshold 14.619 MeV
n-Hf178.jeff3.3 Threshold 14.619 MeV
Cross Section (milli-barns)
0
1
2
3
4
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
10^0
10^1
10^2
10^3
2
3
4
5
6
7
8
9
10^8
2
76
Incident Energy (eV)
72-Hf-178

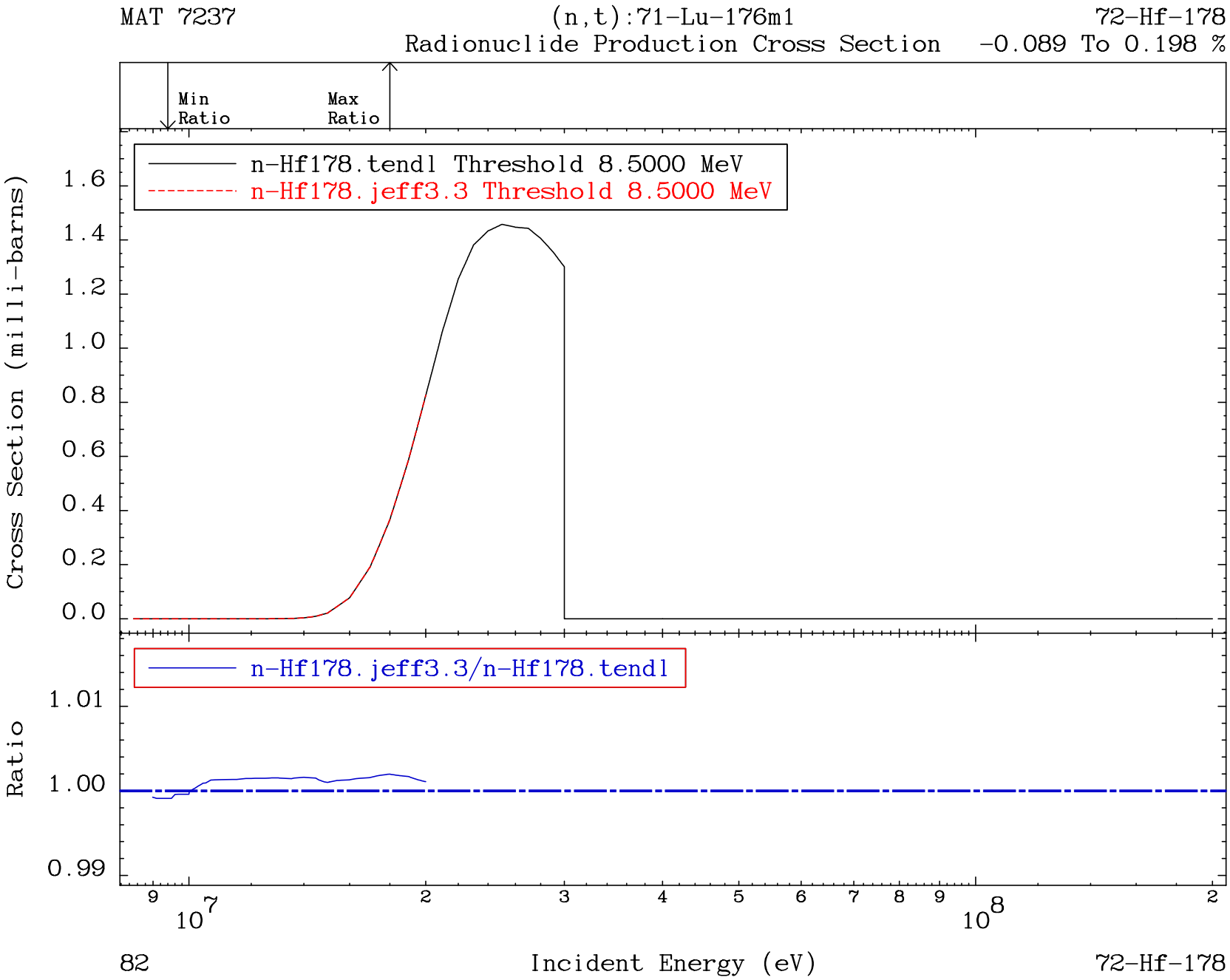

MAT 7237
(n,p):71-Lu-178g
72-Hf-178
Radionuclide Production Cross Section -5.920 To 0.041 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 1.3226 MeV
n-Hf178.jeff3.3 Threshold 1.3230 MeV
Cross Section (milli-barns)
0
2
4
6
8
10
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
0.94
0.96
0.98
1.00
2
3
4
5
6
7
8
10^7
10^8
77
Incident Energy (eV)
72-Hf-178

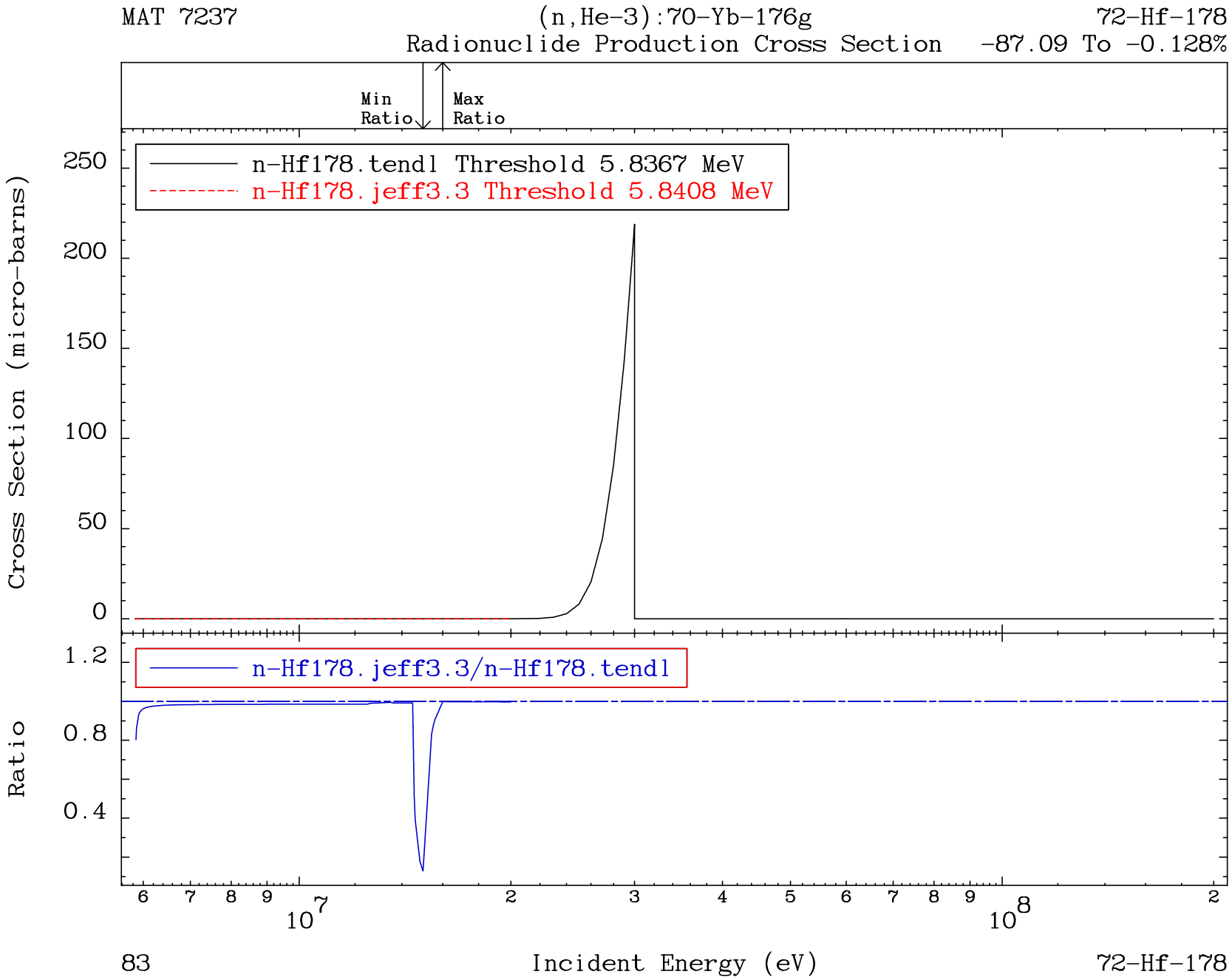

MAT 7237
(n,p):71-Lu-178m3
72-Hf-178
Radionuclide Production Cross Section -1.985 To -0.202%
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 2.6000 MeV
n-Hf178.jeff3.3 Threshold 2.6000 MeV
Cross Section (milli-barns)
0
1
2
3
4
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.00
0.99
0.98
3 4 5 6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
78
Incident Energy (eV)
72-Hf-178

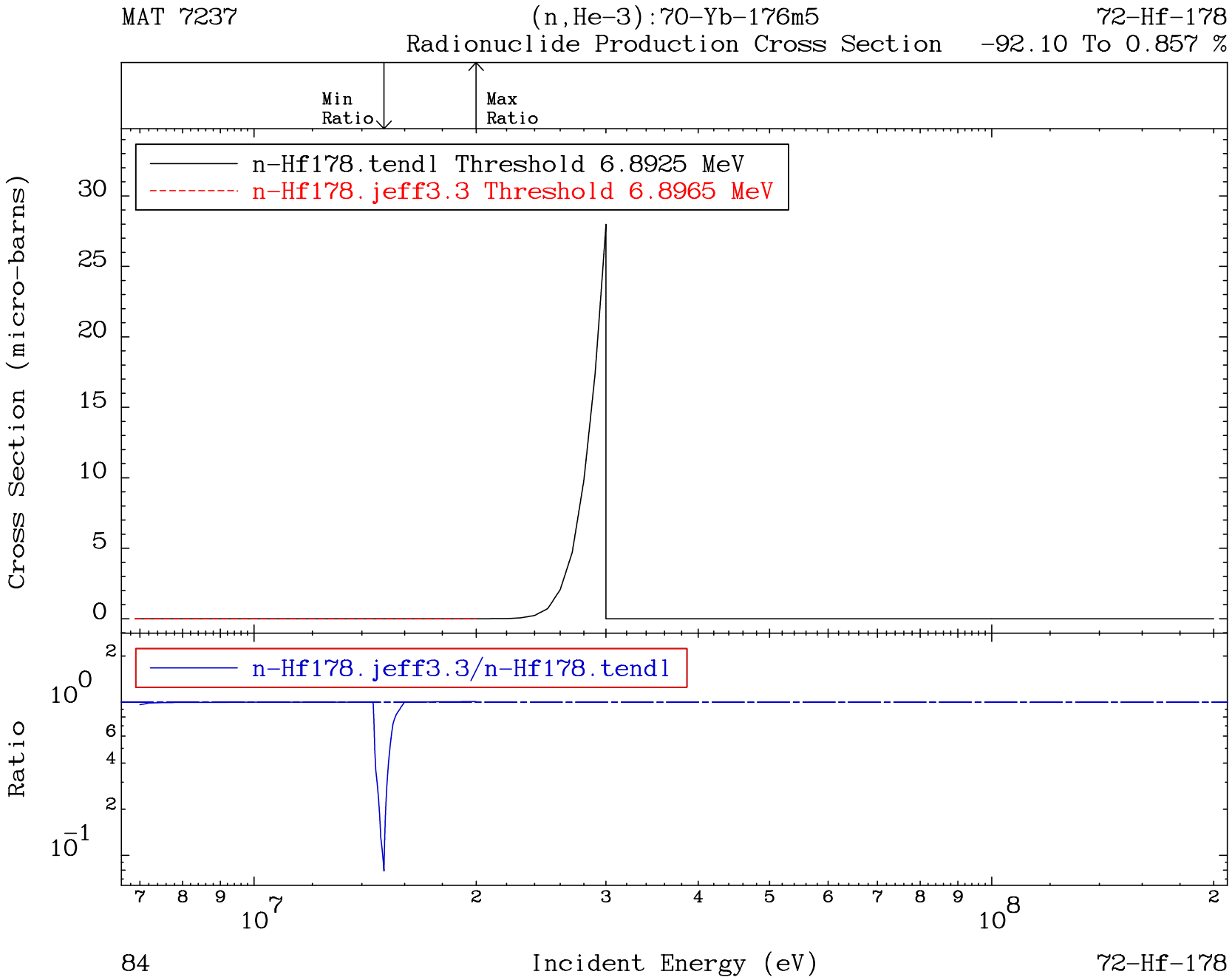

MAT 7237
(n,d):71-Lu-177g
72-Hf-178
Radionuclide Production Cross Section -2.071 To 35.50 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 5.1448 MeV
n-Hf178.jeff3.3 Threshold 5.1448 MeV
Cross Section (milli-barns)
14
12
10
8
6
4
2
0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.4
1.2
1.0
5 6 7 8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
79
Incident Energy (eV)
72-Hf-178


MAT 7237
(n,d):71-Lu-177m29
72-Hf-178
Radionuclide Production Cross Section -2.357 To 8.547 %
Max Ratio
Min Ratio
n-Hf178.tendl Threshold 8.0000 MeV
n-Hf178.jeff3.3 Threshold 8.0000 MeV
Cross Section (milli-barns)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.10
1.05
1.00
8 9 10^7 2 3 4 5 6 7 8 9 10^8 2
80
Incident Energy (eV)
72-Hf-178


MAT 7237
(n,t):71-Lu-176g
72-Hf-178
Radionuclide Production Cross Section -31.47 To -0.277%
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 5.9651 MeV
n-Hf178.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
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.0
0.9
0.8
0.7
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,t):71-Lu-176m1
72-Hf-178
Radionuclide Production Cross Section
-0.089 To 0.198 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 8.5000 MeV
n-Hf178.jeff3.3 Threshold 8.5000 MeV
Cross Section (milli-barns)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
n-Hf178.jeff3.3/n-Hf178.tendl
Ratio
1.01
1.00
0.99
9
10^7
2
3
4
5
6
7
8
9
10^8
2
82
Incident Energy (eV)
72-Hf-178


MAT 7237
(n,He-3):70-Yb-176g
72-Hf-178
Radionuclide Production Cross Section
-87.09 To -0.128%
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 5.8367 MeV
n-Hf178.jeff3.3 Threshold 5.8408 MeV
Cross Section (micro-barns)
250
200
150
100
50
0
n-Hf178.jeff3.3/n-Hf178.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
83
Incident Energy (eV)
72-Hf-178


MAT 7237
(n,He-3):70-Yb-176m5
72-Hf-178
Radionuclide Production Cross Section -92.10 To 0.857 %
Min Ratio
Max Ratio
n-Hf178.tendl Threshold 6.8925 MeV
n-Hf178.jeff3.3 Threshold 6.8965 MeV
Cross Section (micro-barns)
30
25
20
15
10
5
0
n-Hf178.jeff3.3/n-Hf178.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
84
Incident Energy (eV)
72-Hf-178