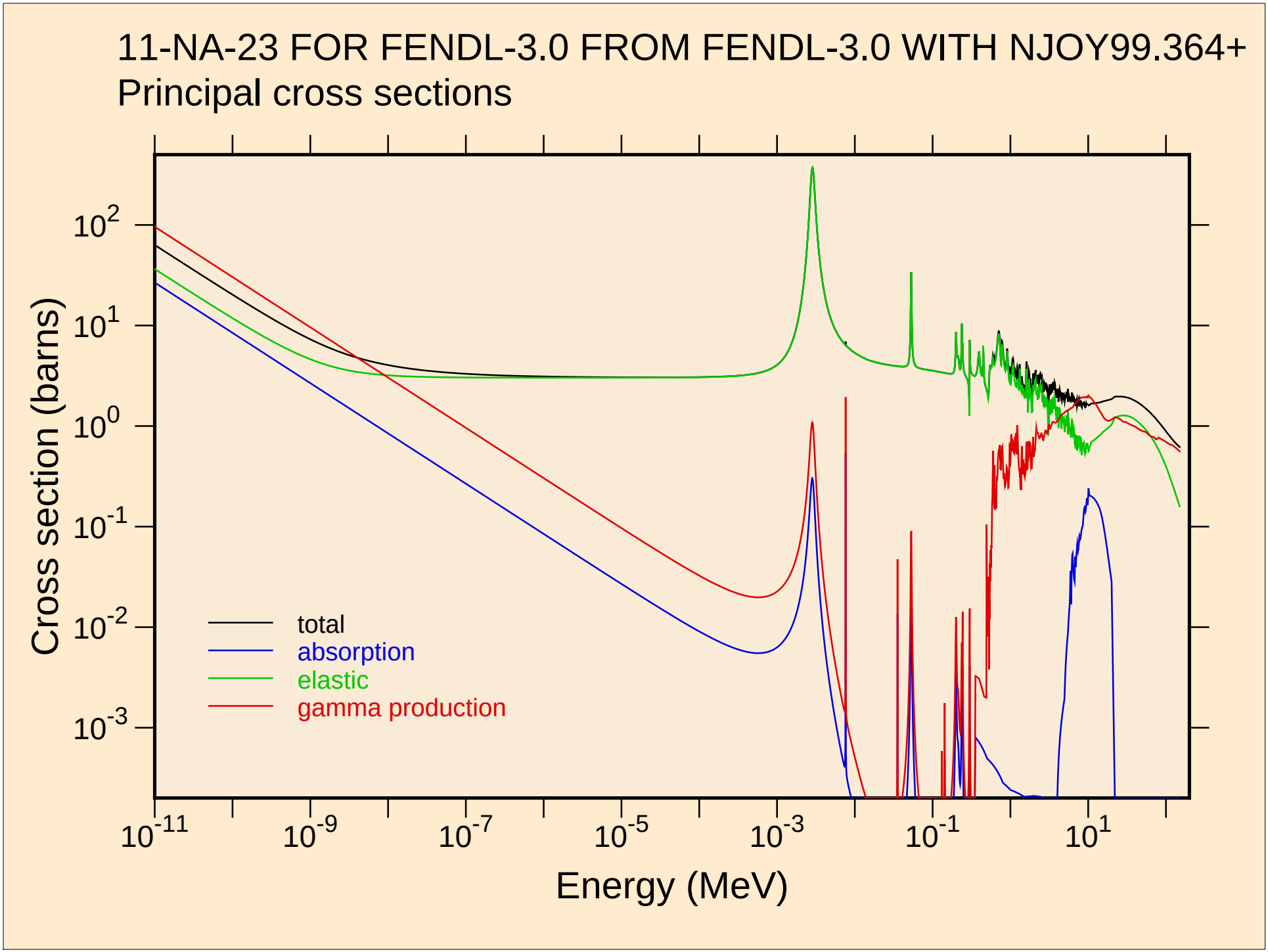
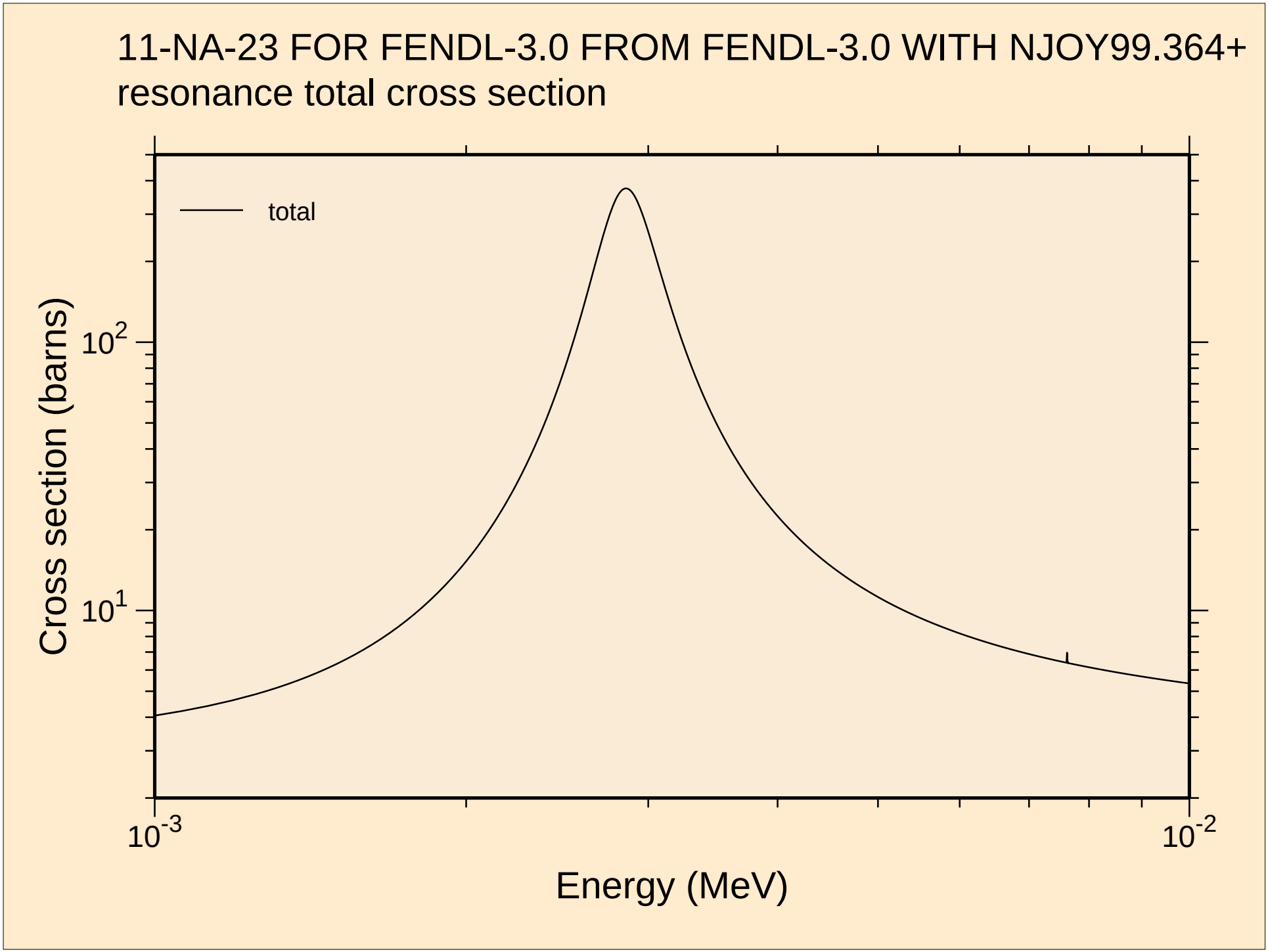
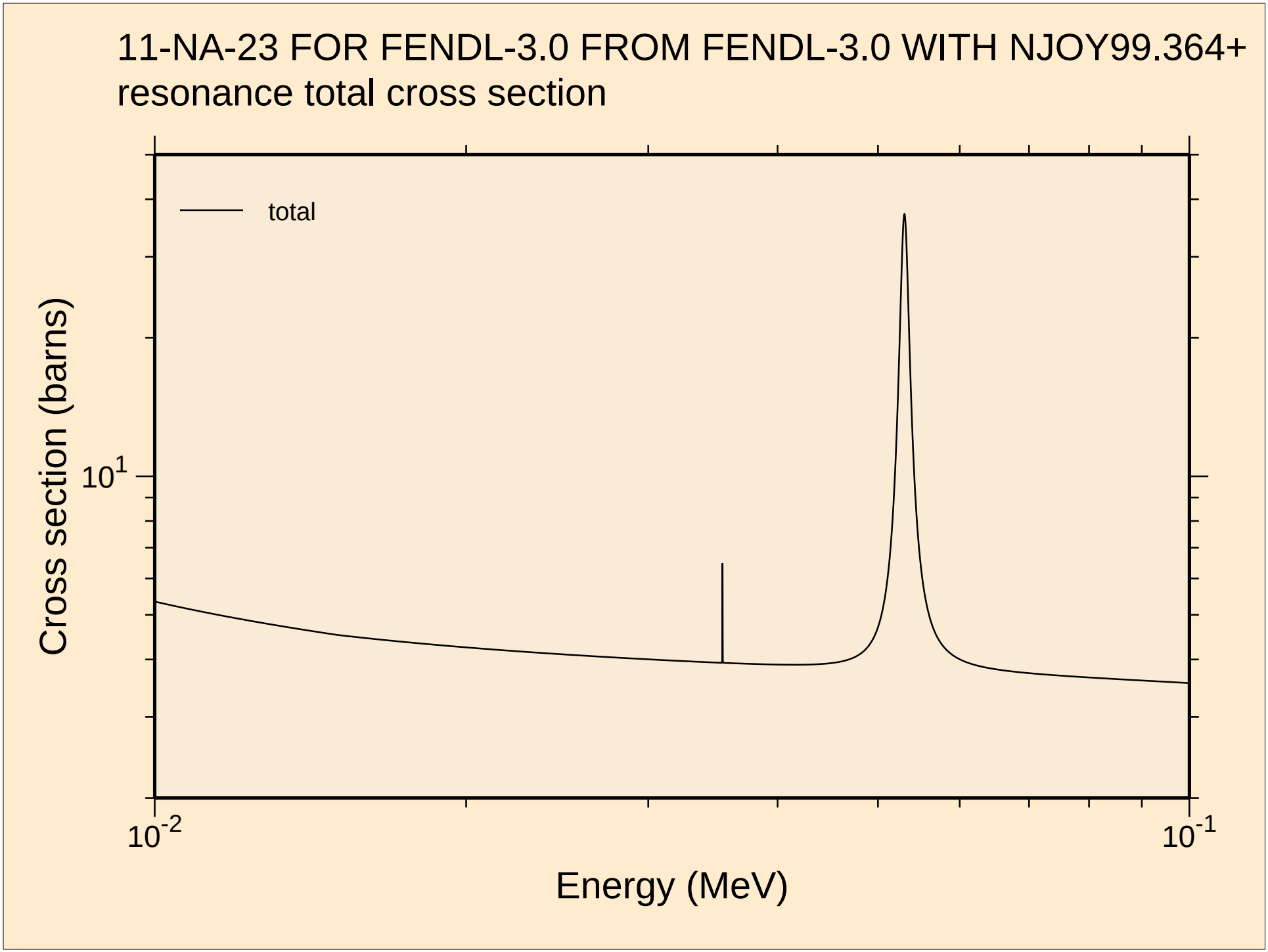
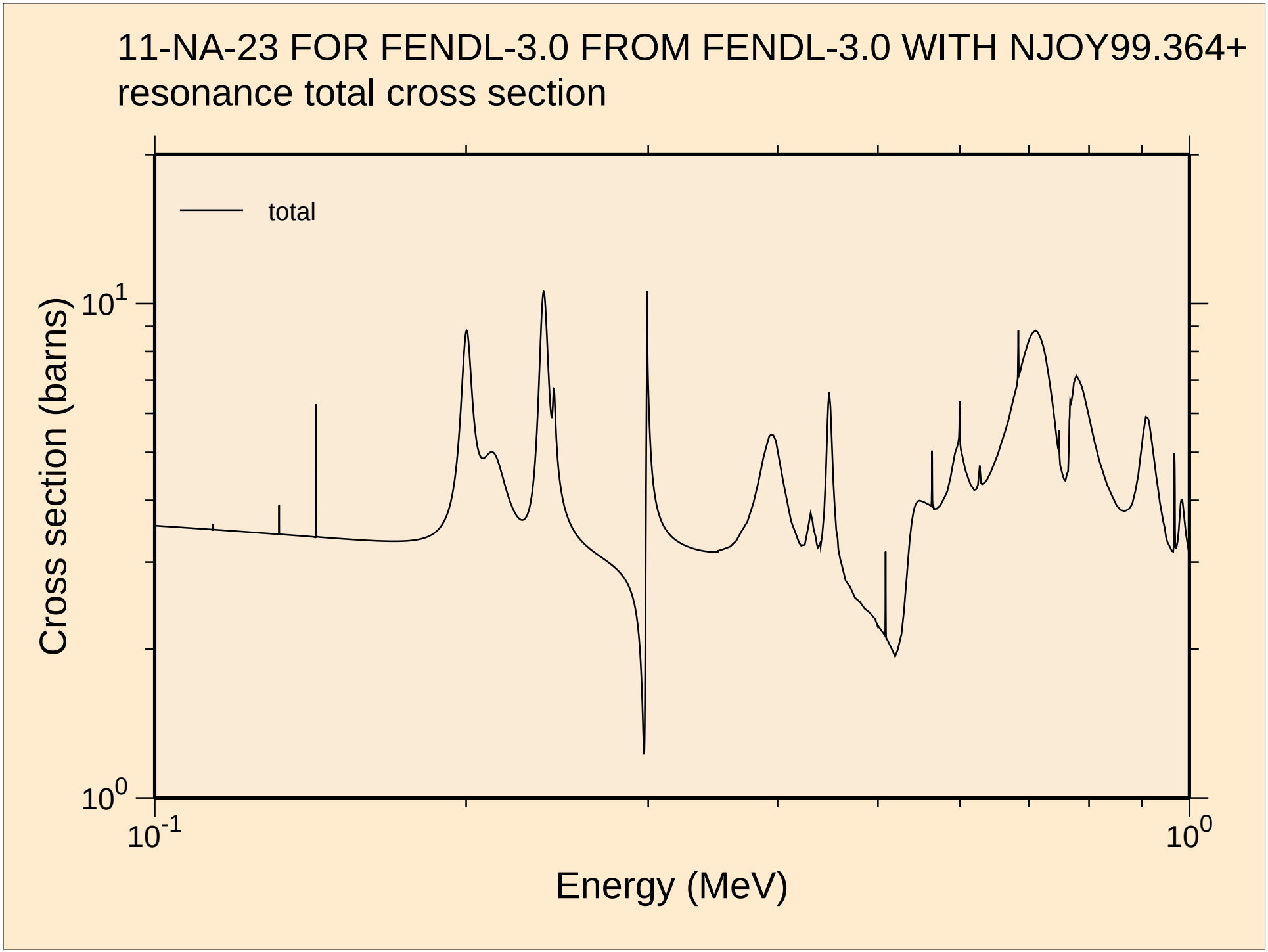
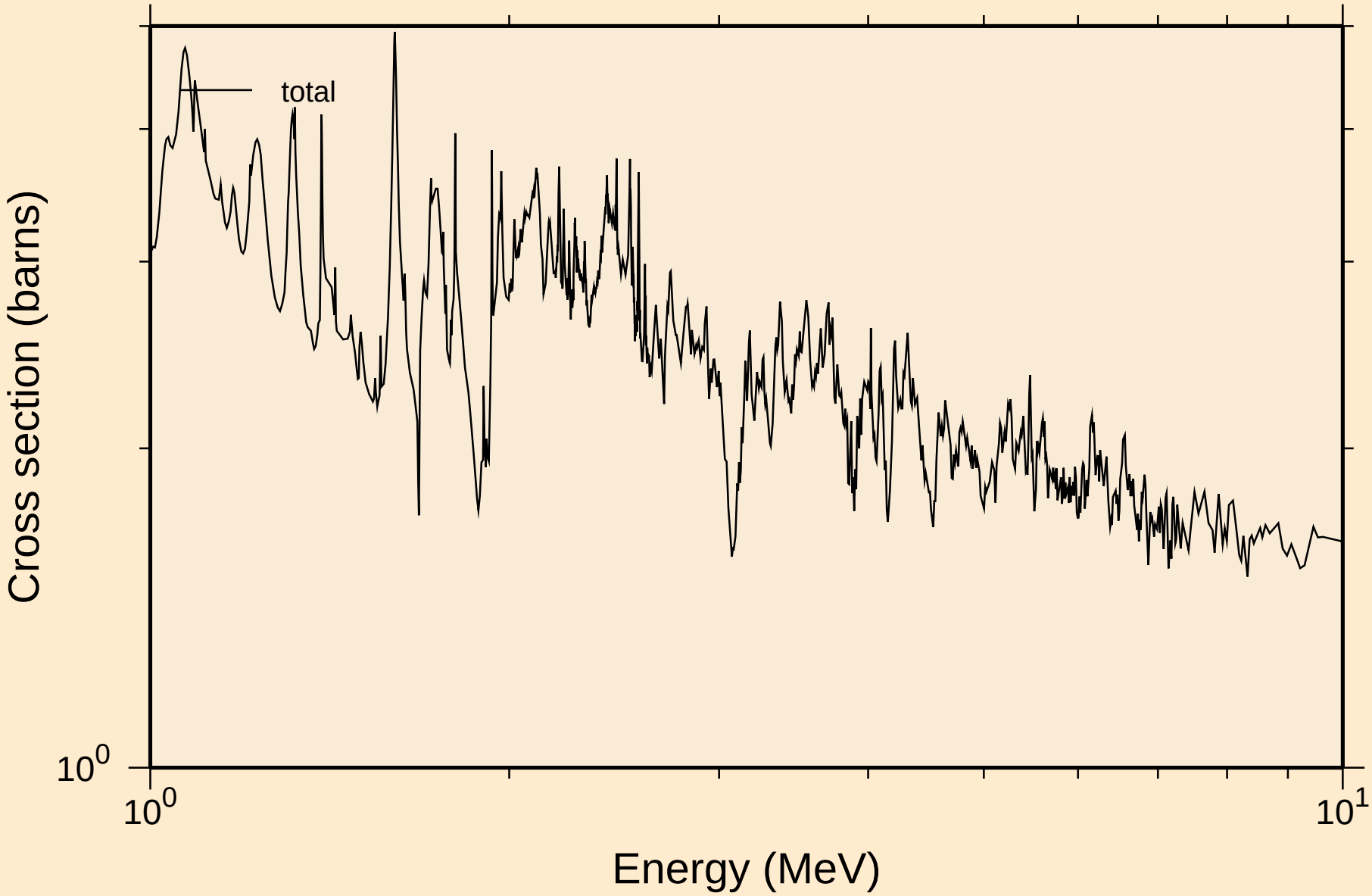

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Principal cross sections
Cross section (barns)
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
total
absorption
elastic
gamma production
10^{-11}
10^{-9}
10^{-7}
10^{-5}
10^{-3}
10^{-1}
10^{1}
Energy (MeV)

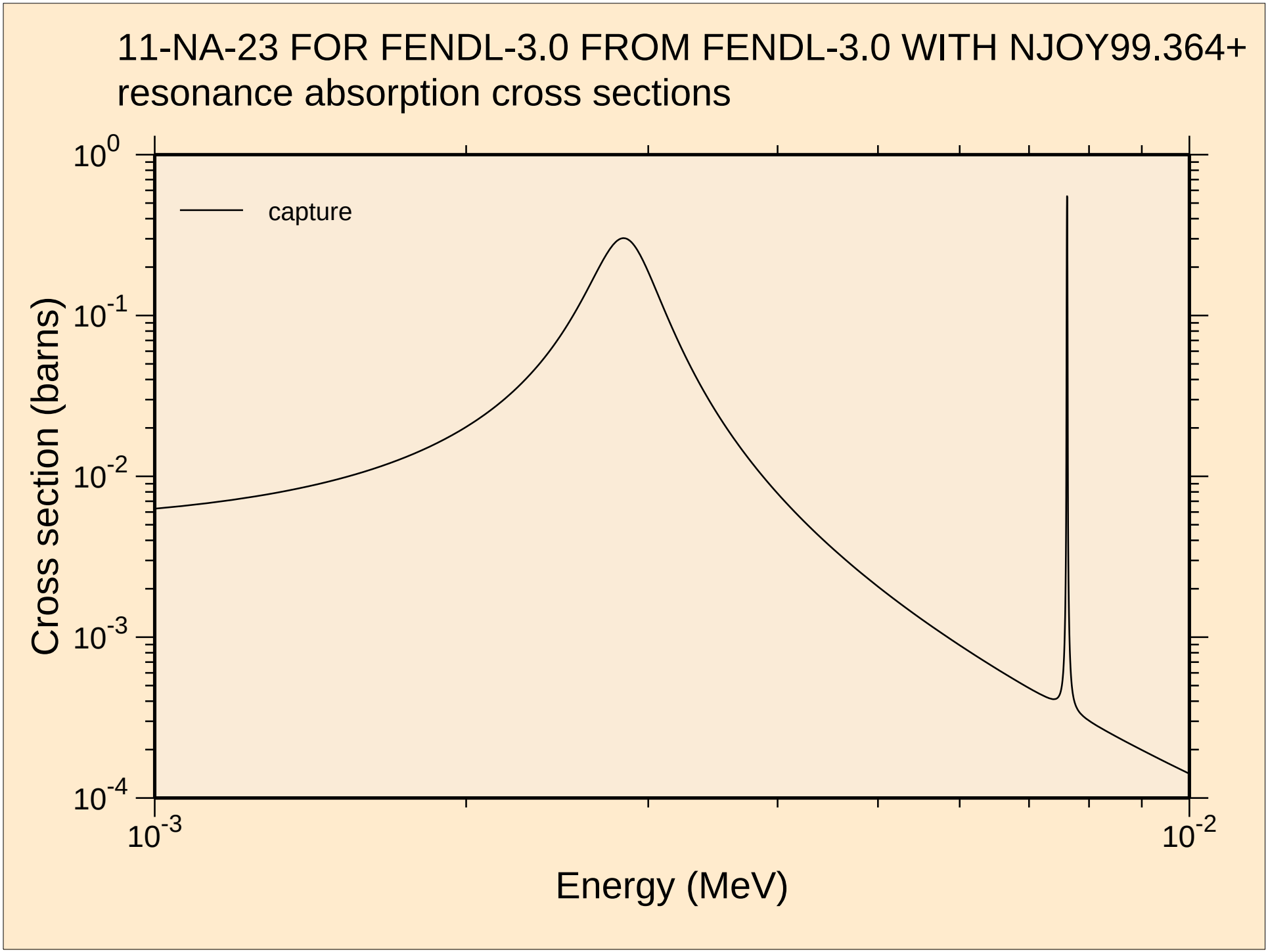

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
resonance total cross section
total
Cross section (barns)
10^2
10^1
10^-3
10^-2
Energy (MeV)

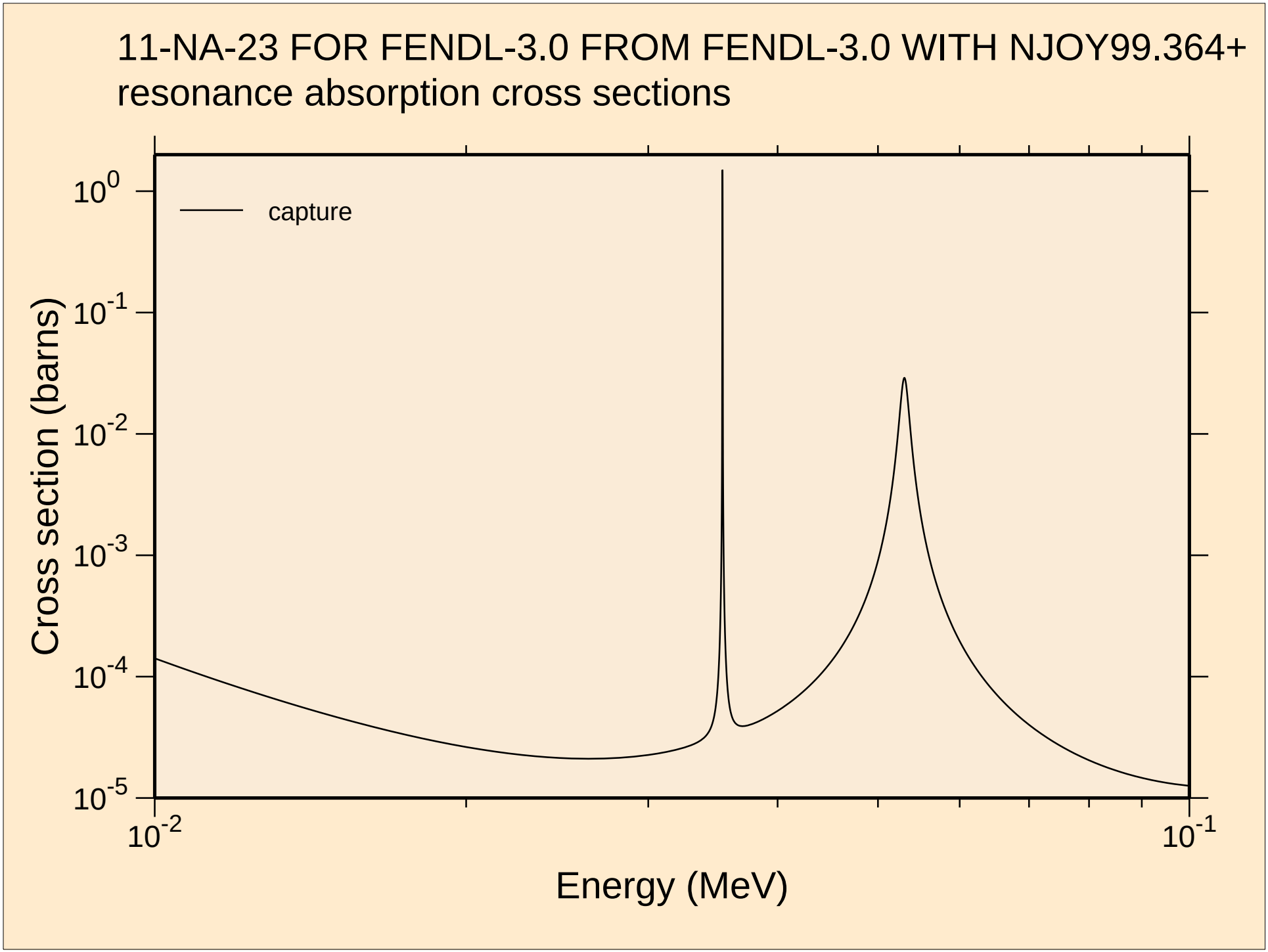

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
resonance total cross section
total
Cross section (barns)
10^1
10^-2
10^-1
Energy (MeV)


11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
resonance total cross section
total
Cross section (barns)
10^1
10^0
10^-1
10^0
Energy (MeV)

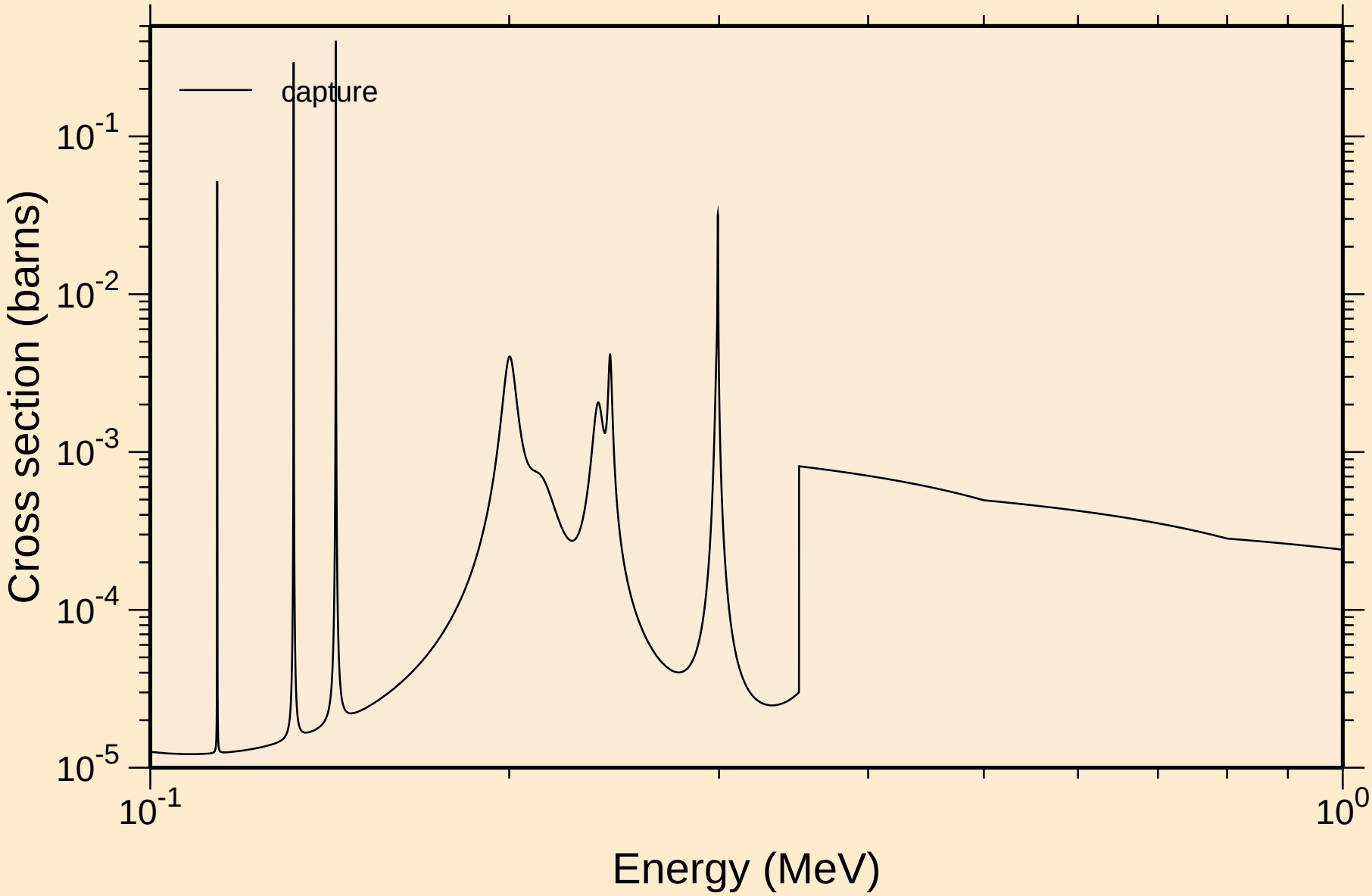
11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
resonance total cross section

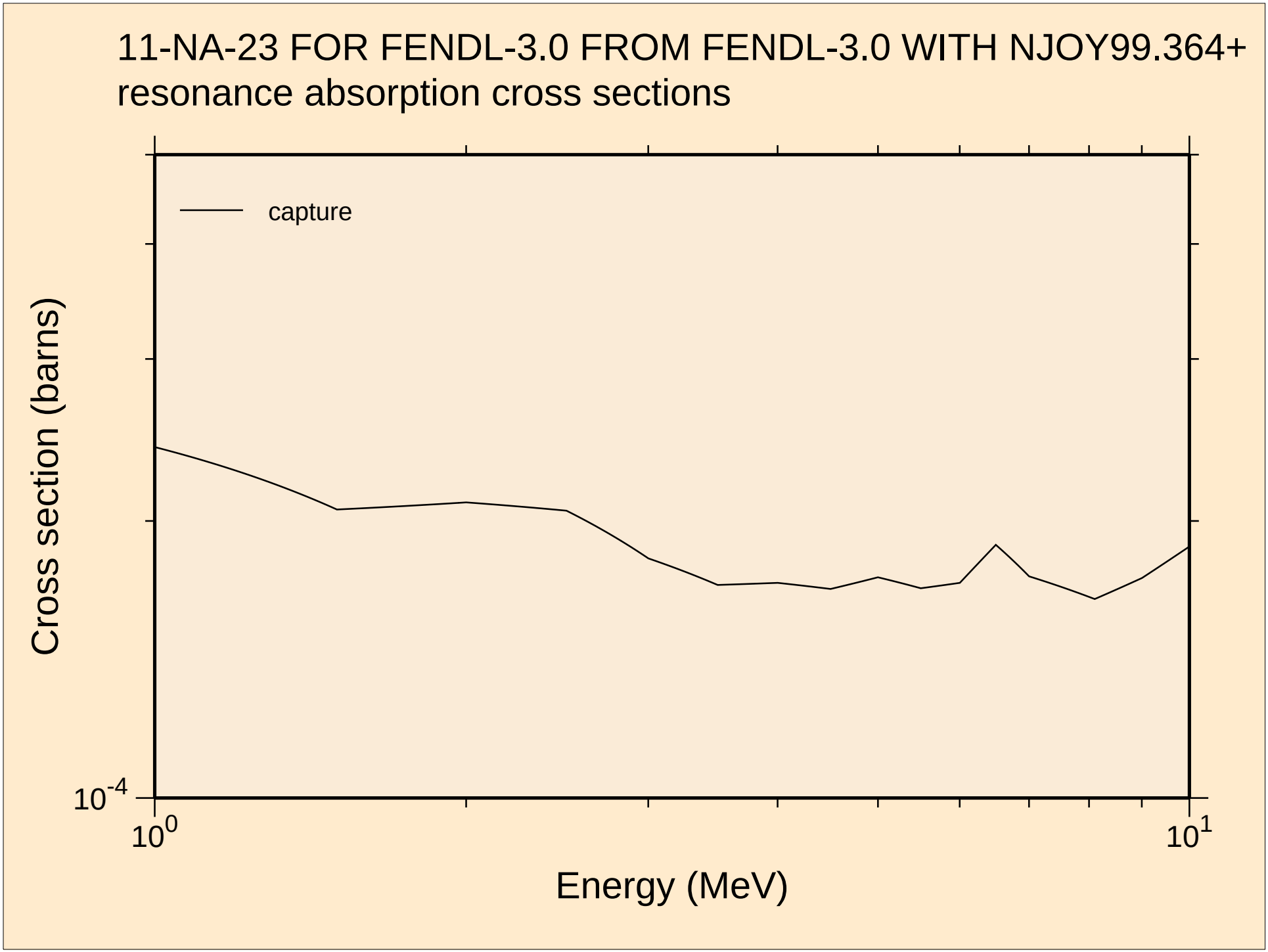


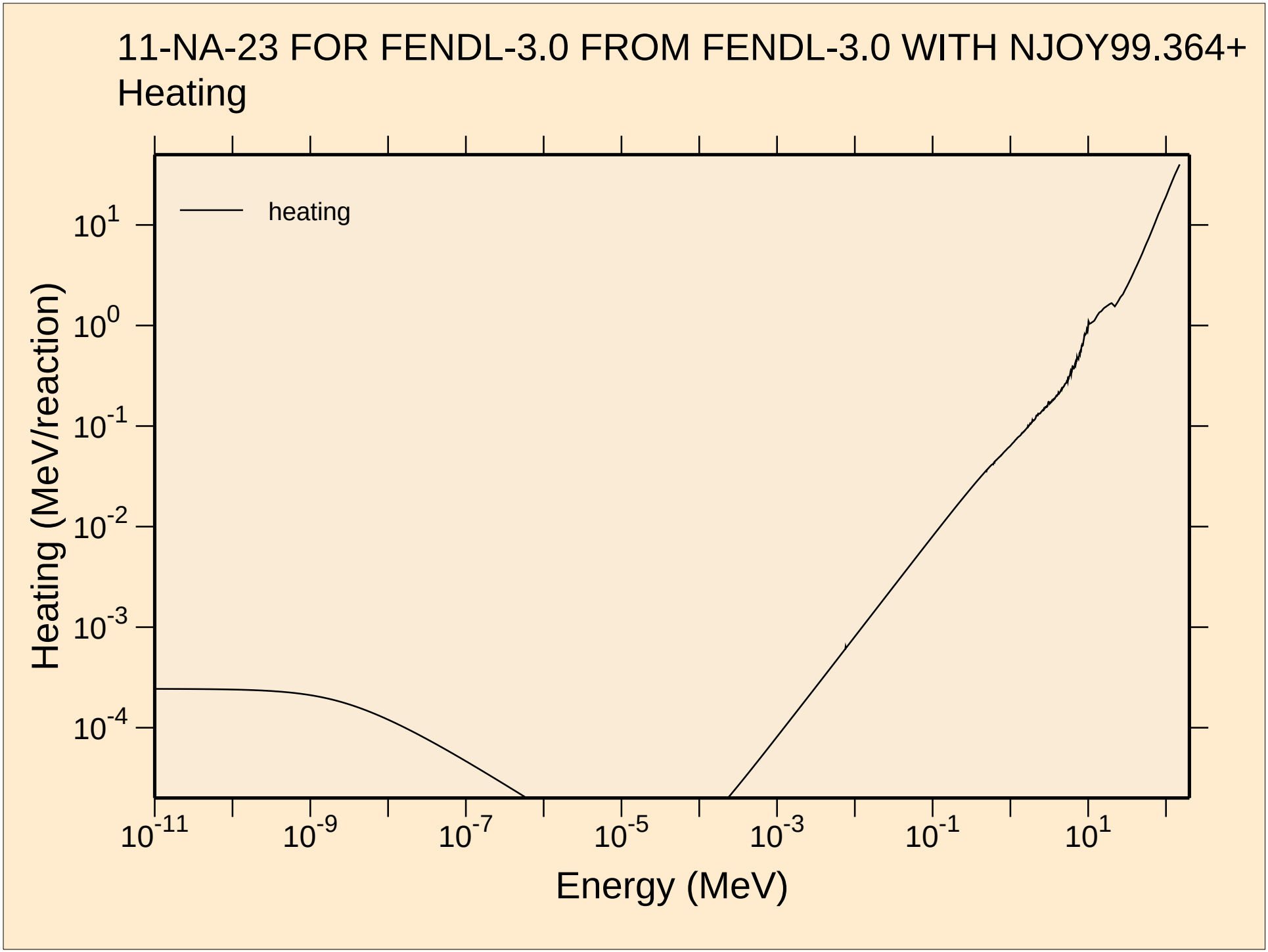

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
resonance absorption cross sections
capture
Cross section (barns)
10^0
10^-1
10^-2
10^-3
10^-4
10^-3
10^-2
Energy (MeV)

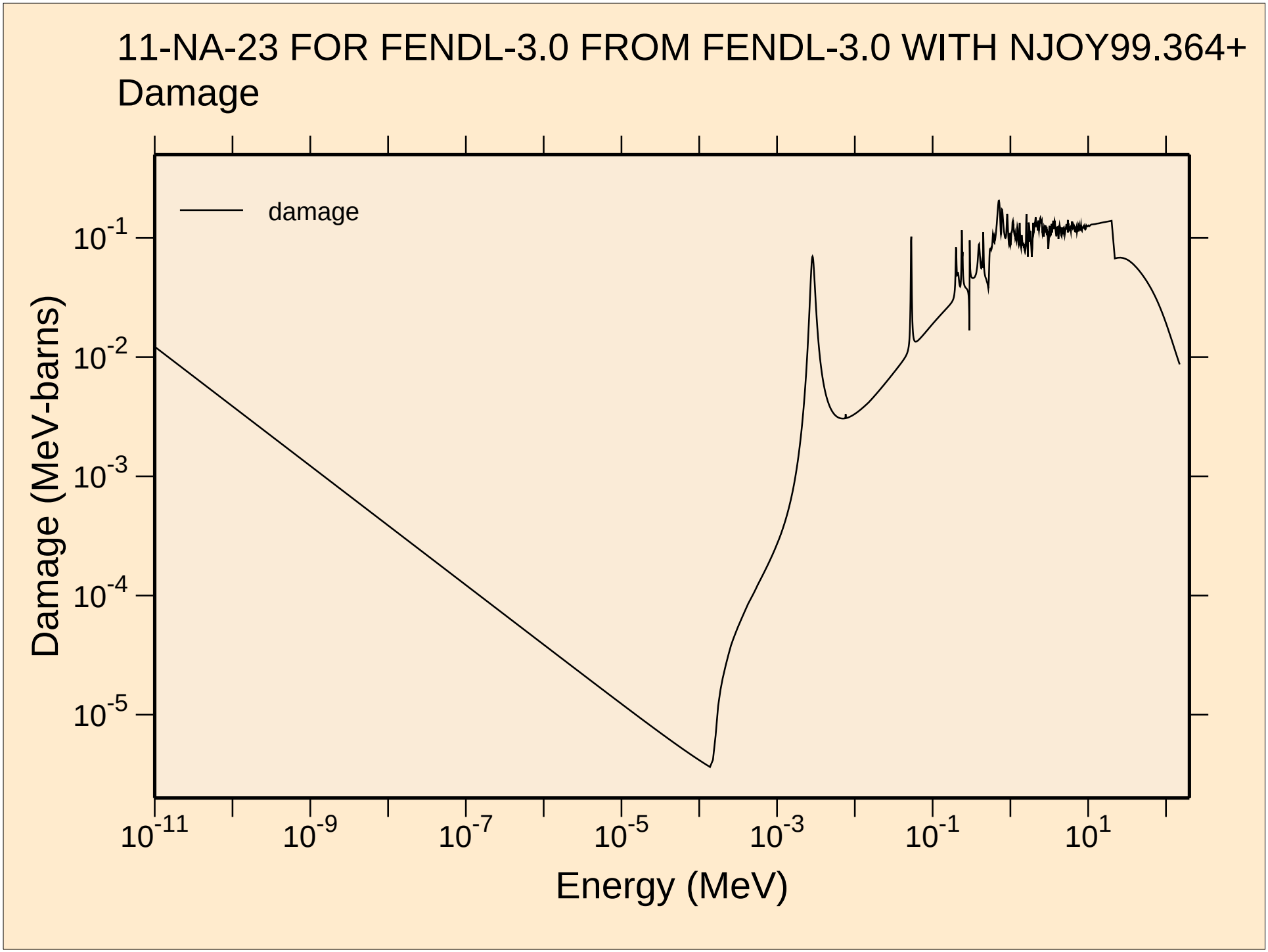

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
resonance absorption cross sections
capture
Cross section (barns)
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-2
10^-1
Energy (MeV)

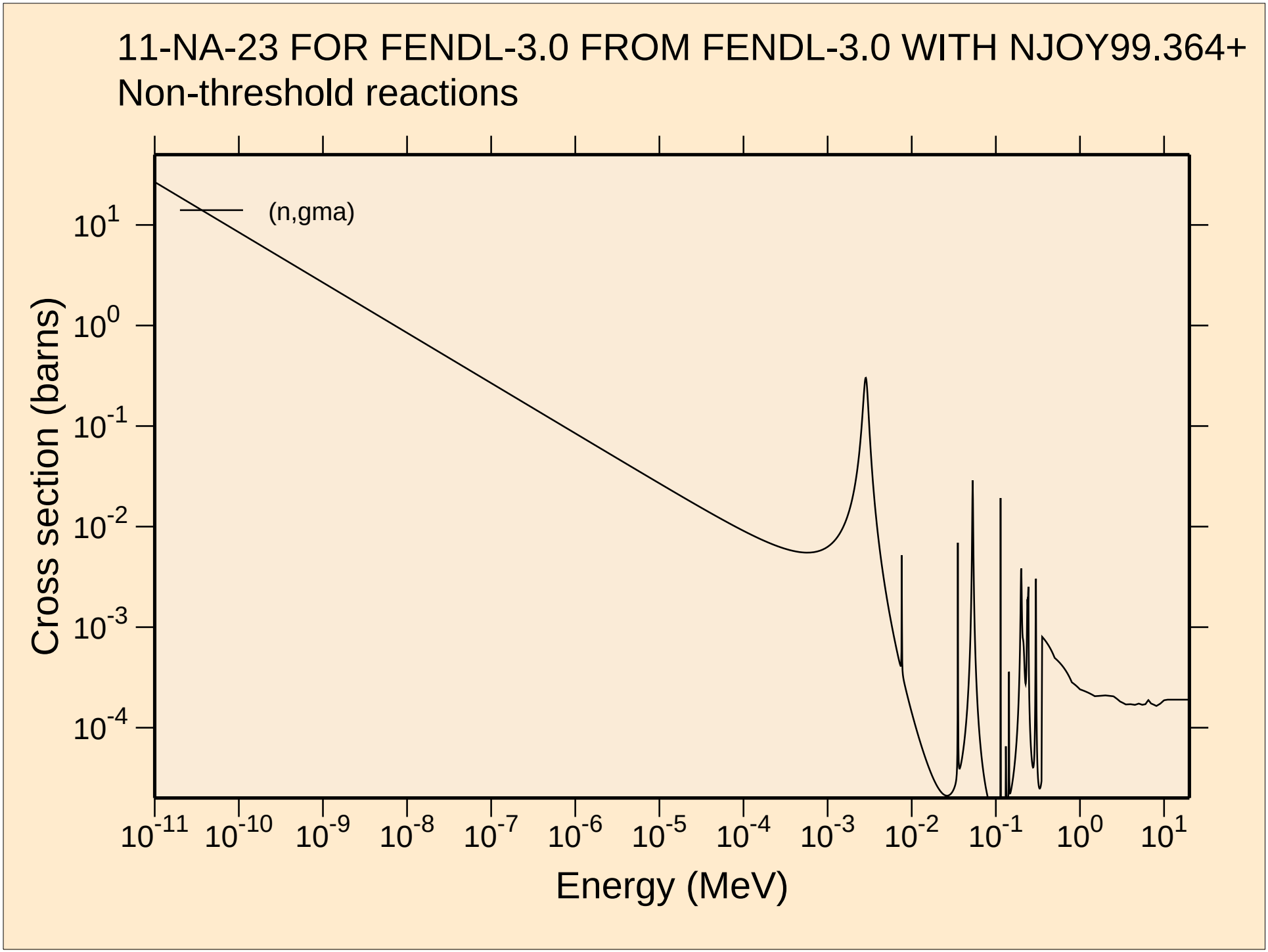
11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
resonance absorption cross sections

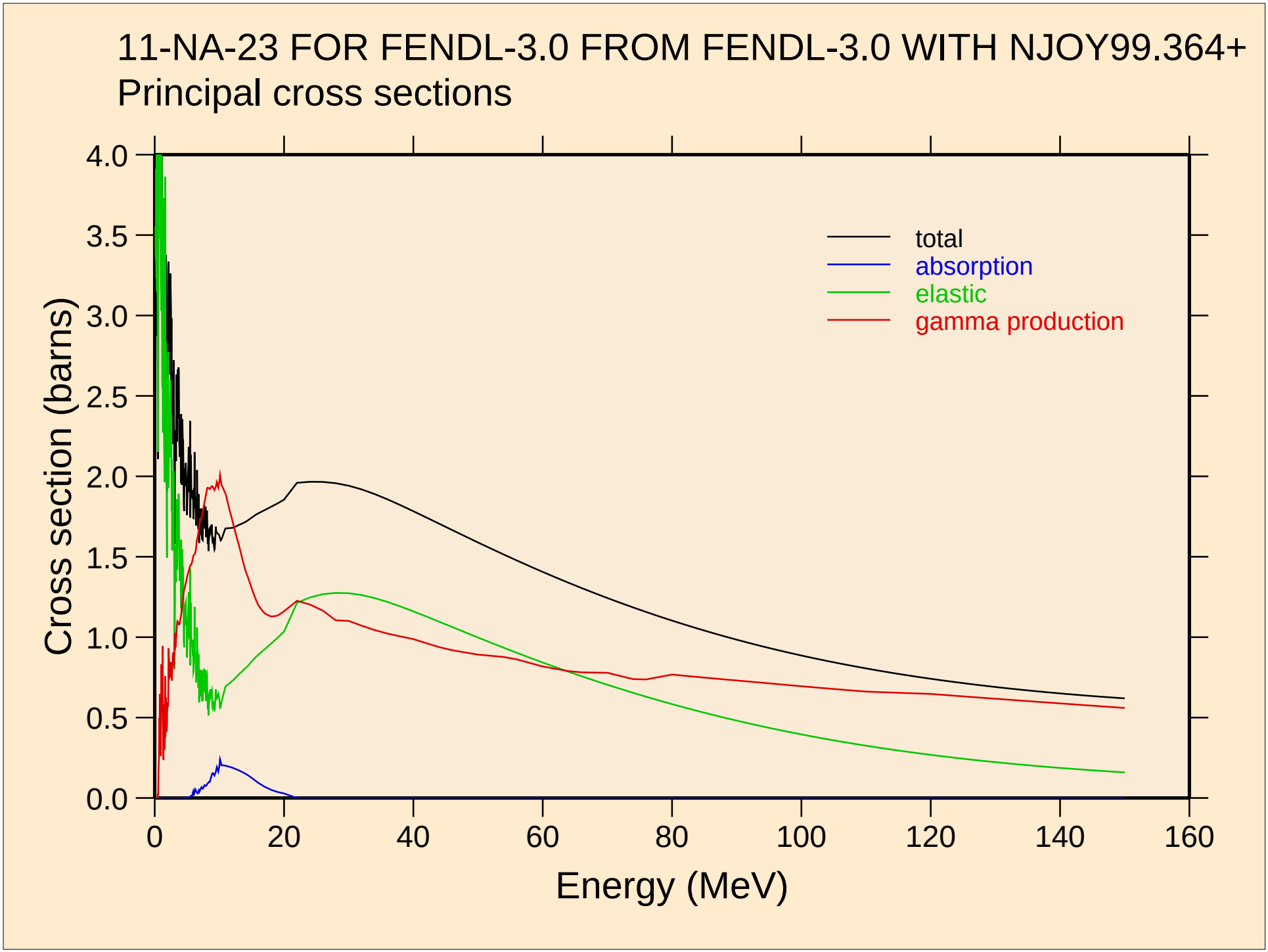


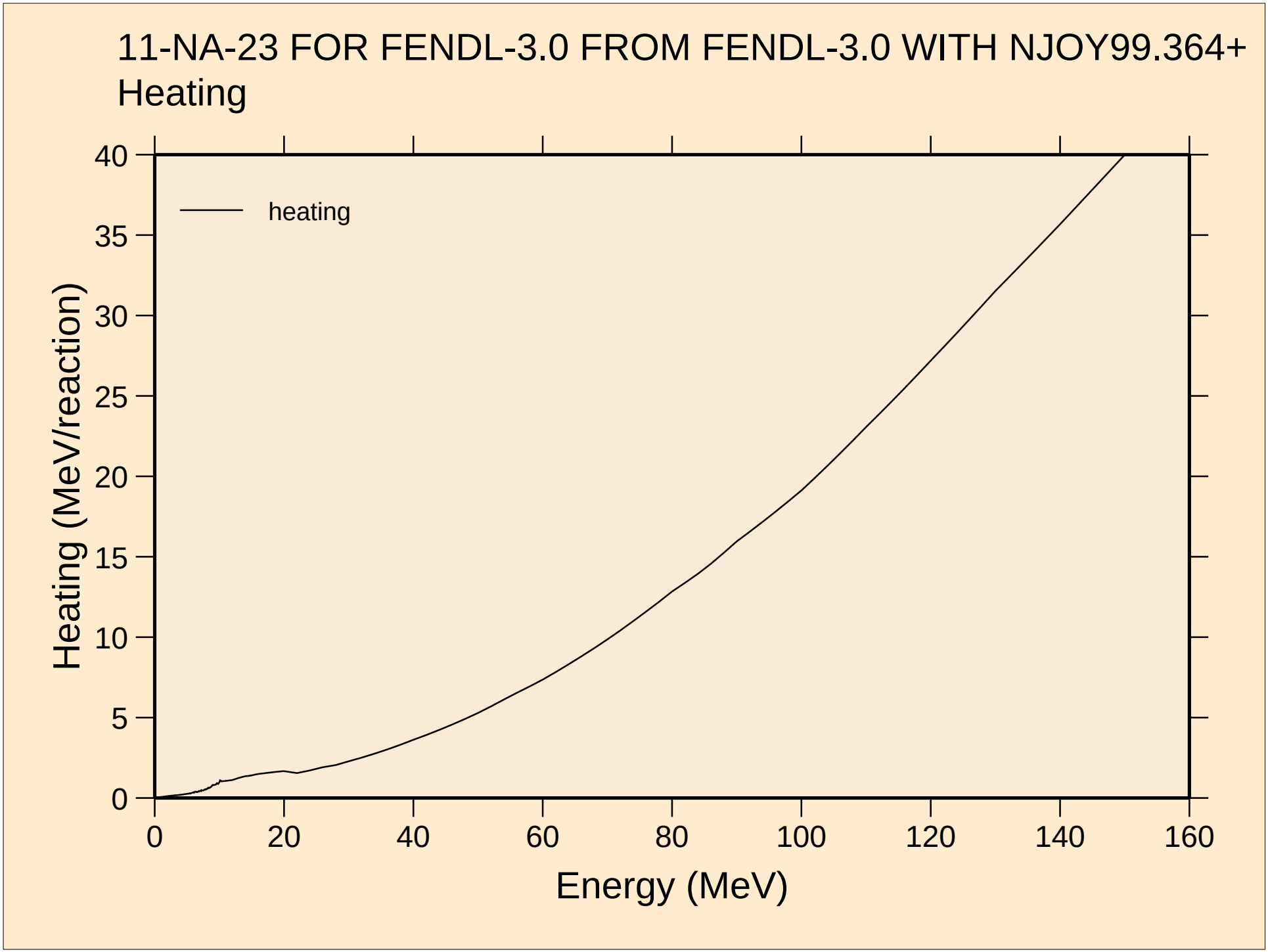

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
resonance absorption cross sections
capture
Cross section (barns)
10-4
100
101
Energy (MeV)

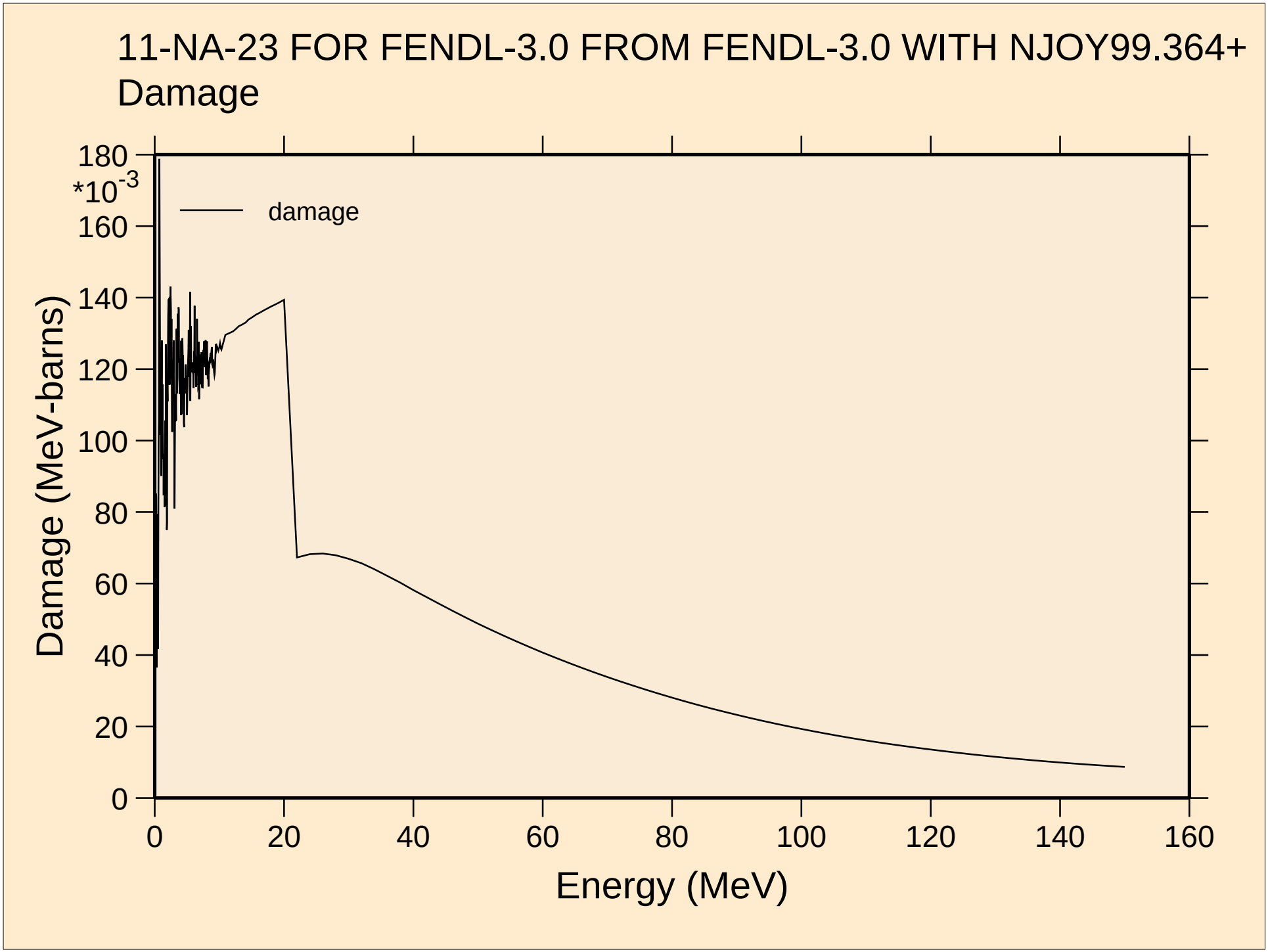

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Heating
heating
Heating (MeV/reaction)
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-11
10^-9
10^-7
10^-5
10^-3
10^-1
10^1
Energy (MeV)

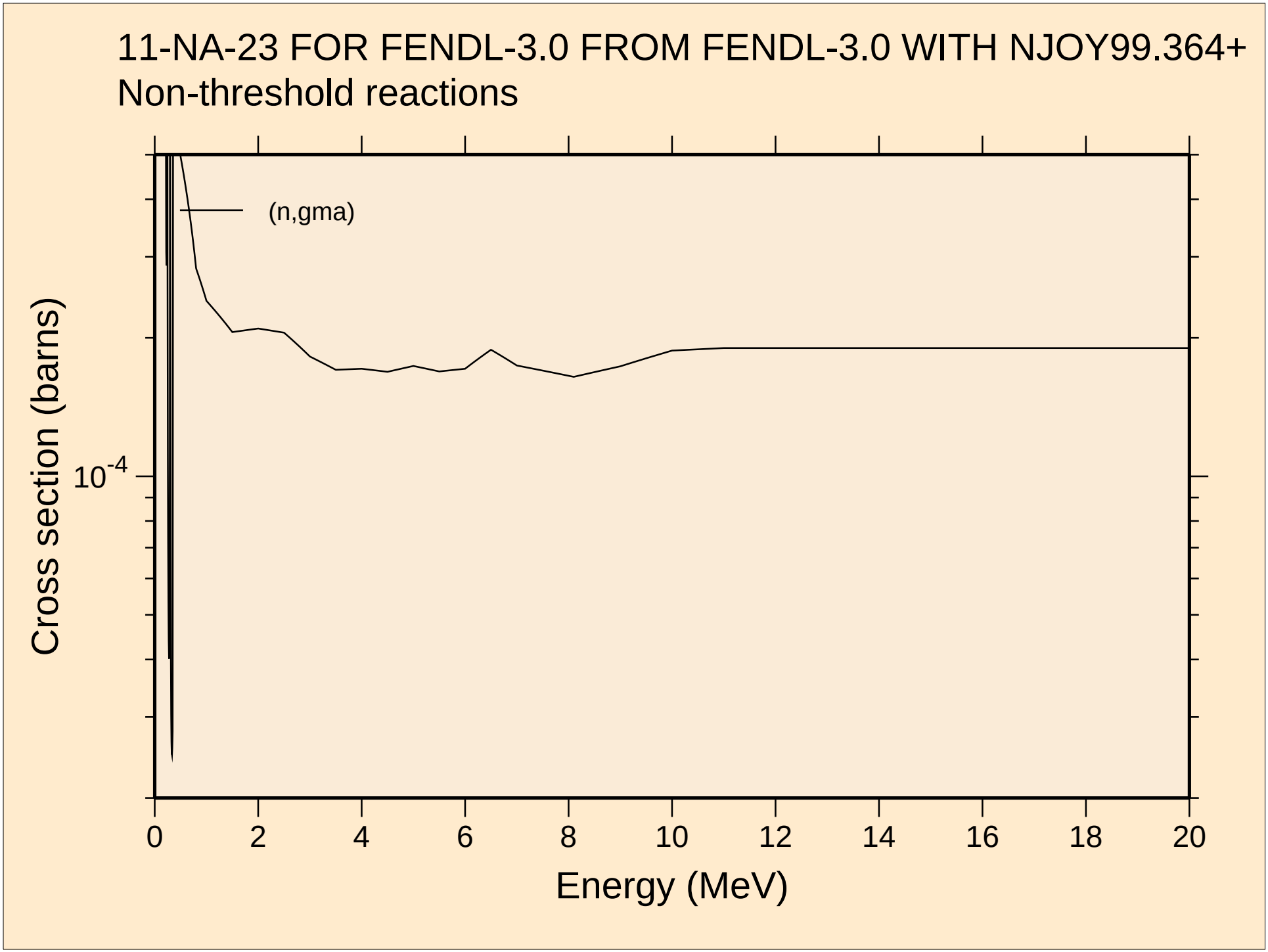

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Damage
damage
Damage (MeV-barns)
10-1
10-2
10-3
10-4
10-5
10-11
10-9
10-7
10-5
10-3
10-1
101
Energy (MeV)

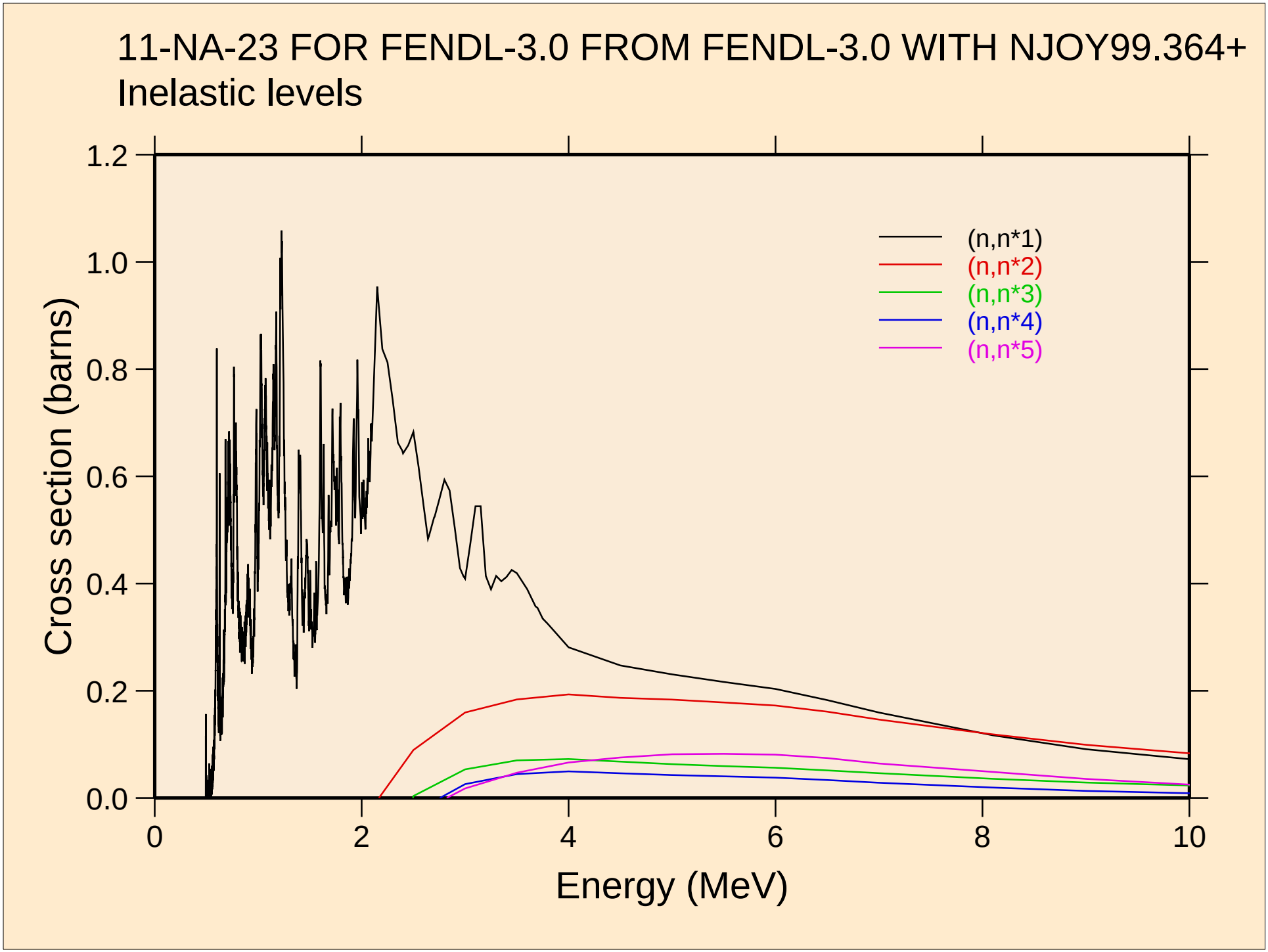

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Non-threshold reactions
(n,gma)
Cross section (barns)
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-11 10^-10 10^-9 10^-8 10^-7 10^-6 10^-5 10^-4 10^-3 10^-2 10^-1 10^0 10^1
Energy (MeV)

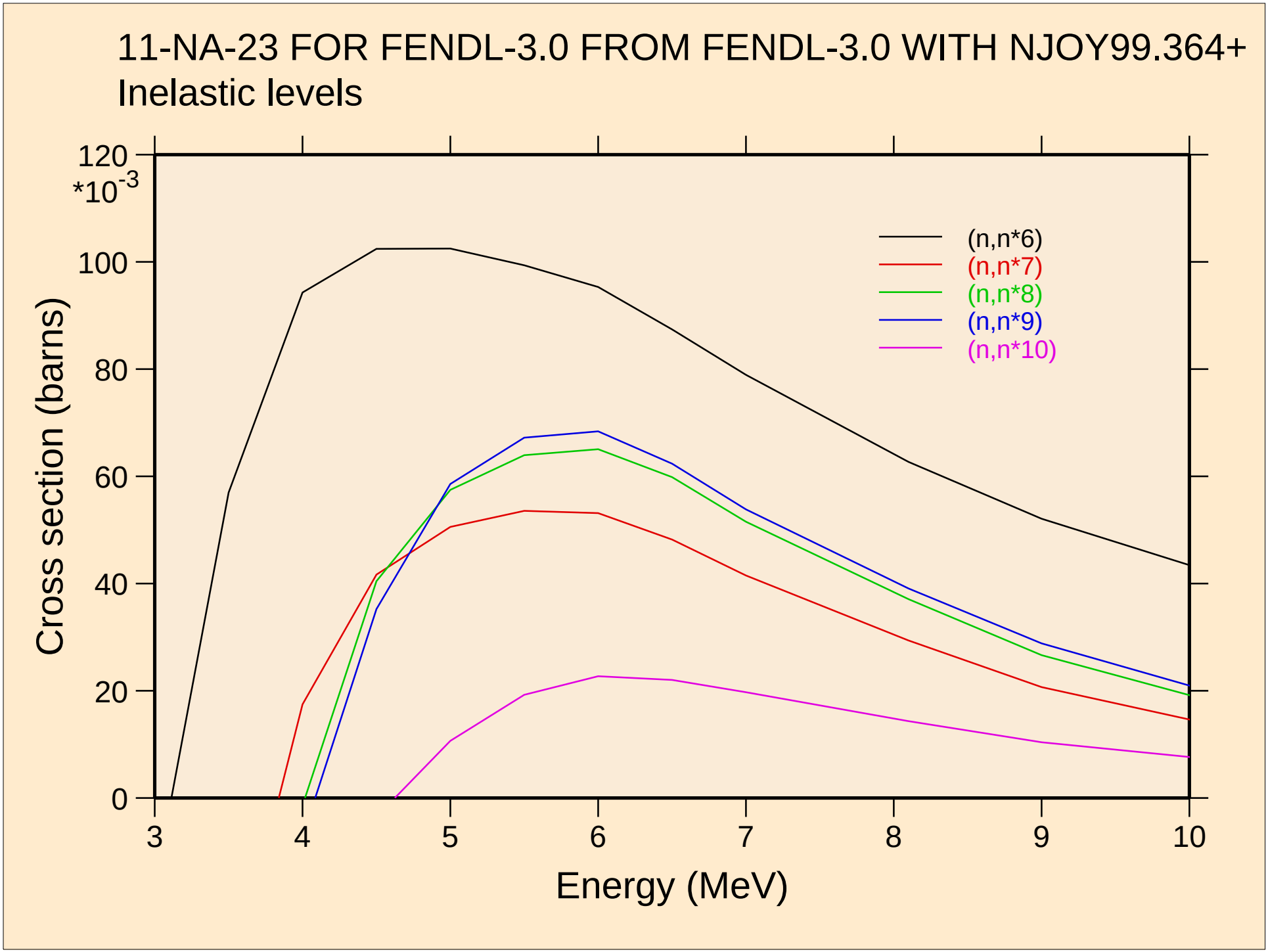

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Principal cross sections
Cross section (barns)
Energy (MeV)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
0
20
40
60
80
100
120
140
160
total
absorption
elastic
gamma production

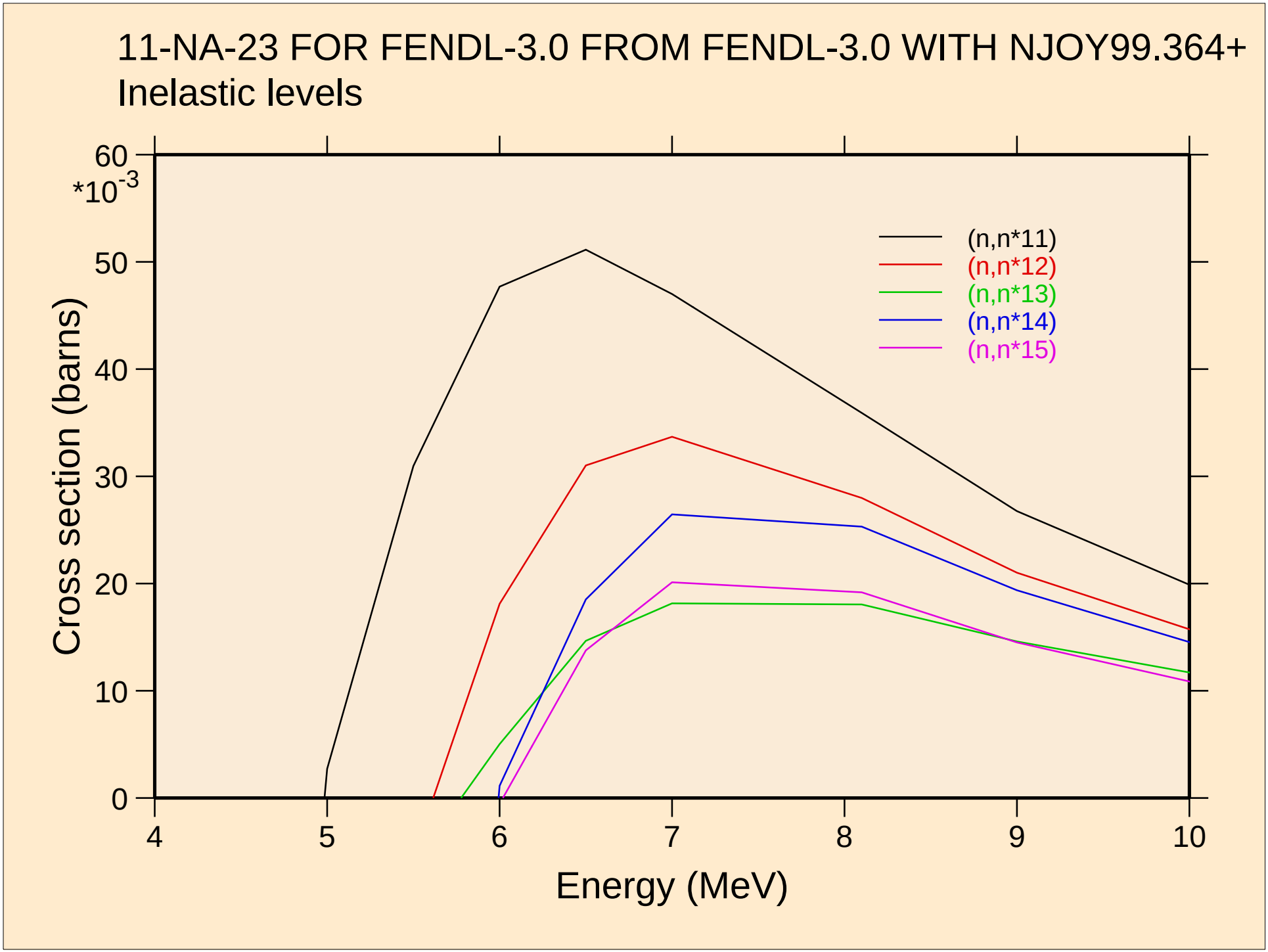

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Heating
heating
Heating (MeV/reaction)
Energy (MeV)
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140
160

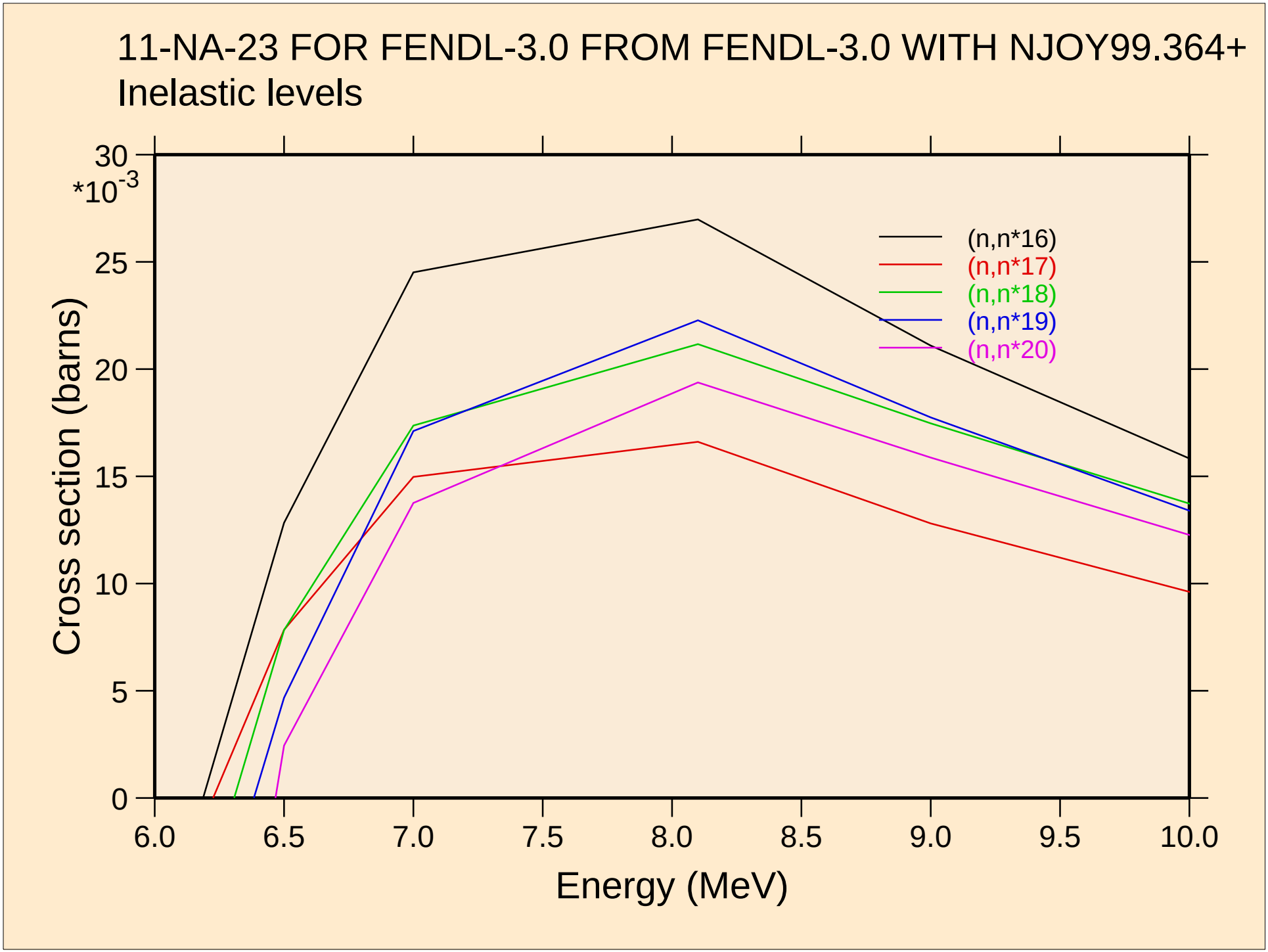

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Damage
*10-3
damage
Damage (MeV-barns)
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
Energy (MeV)

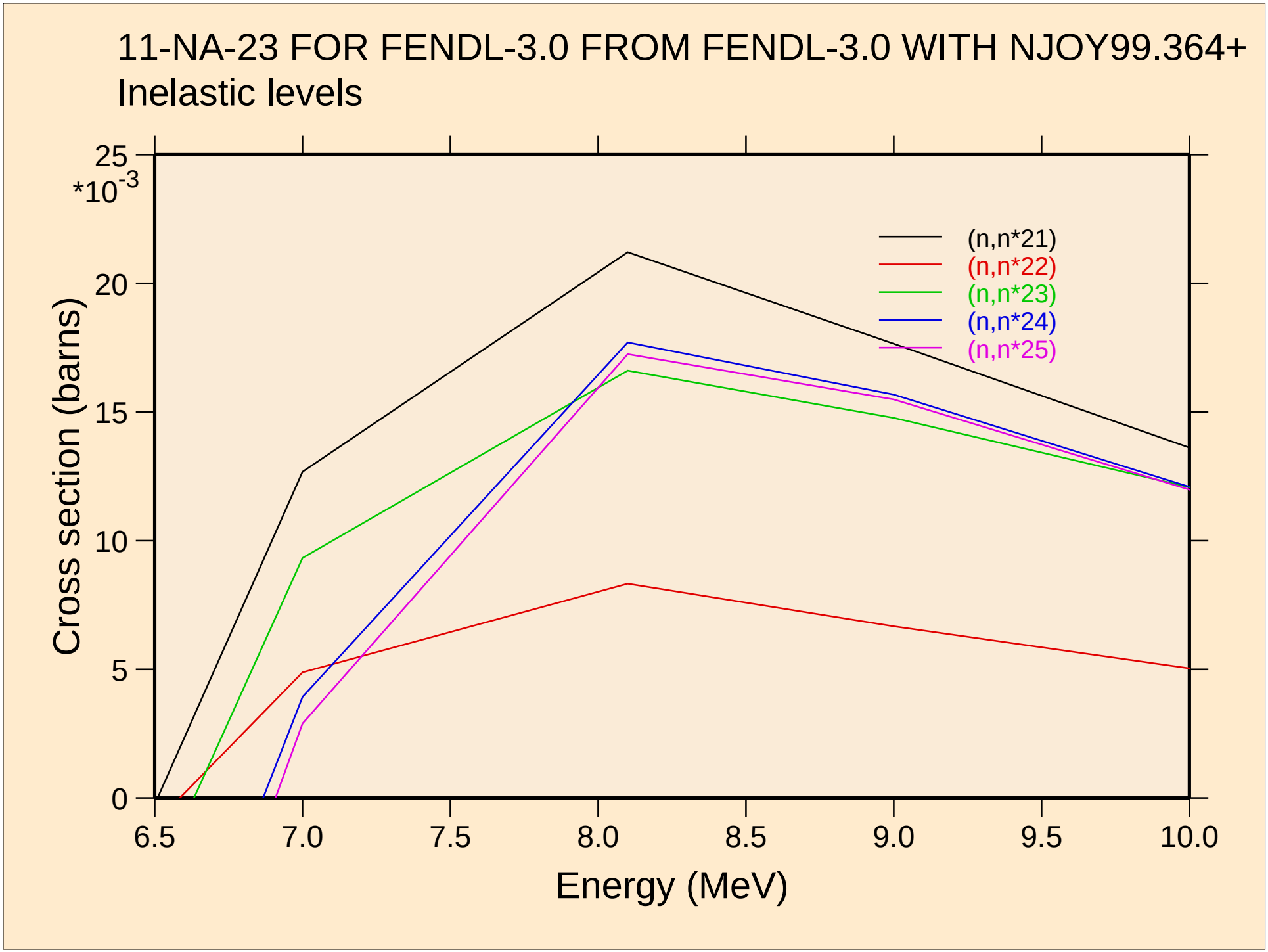

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Non-threshold reactions
(n,gma)
Cross section (barns)
10-4
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

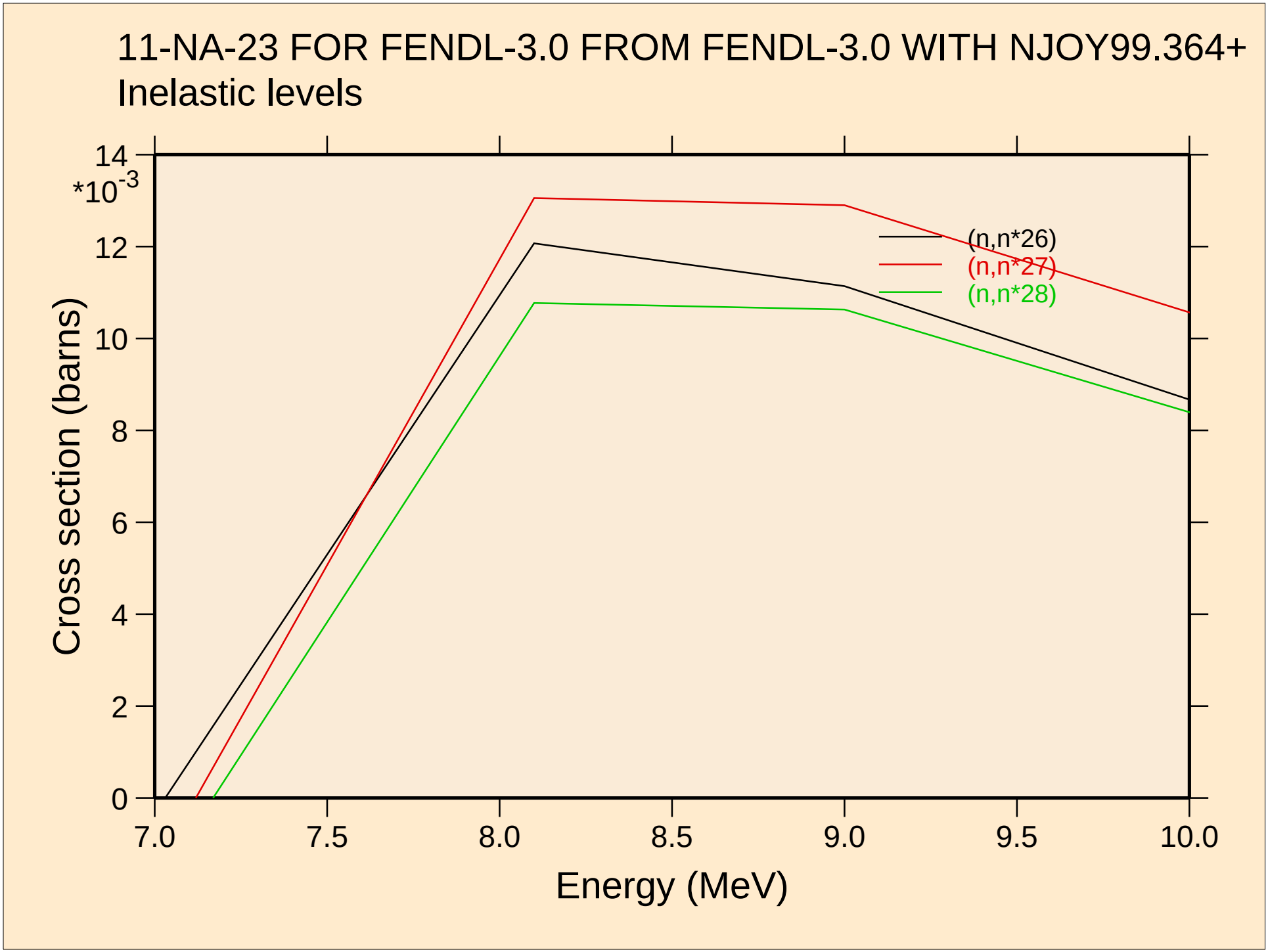

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Inelastic levels
Cross section (barns)
Energy (MeV)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
0
2
4
6
8
10
(n,n*1)
(n,n*2)
(n,n*3)
(n,n*4)
(n,n*5)

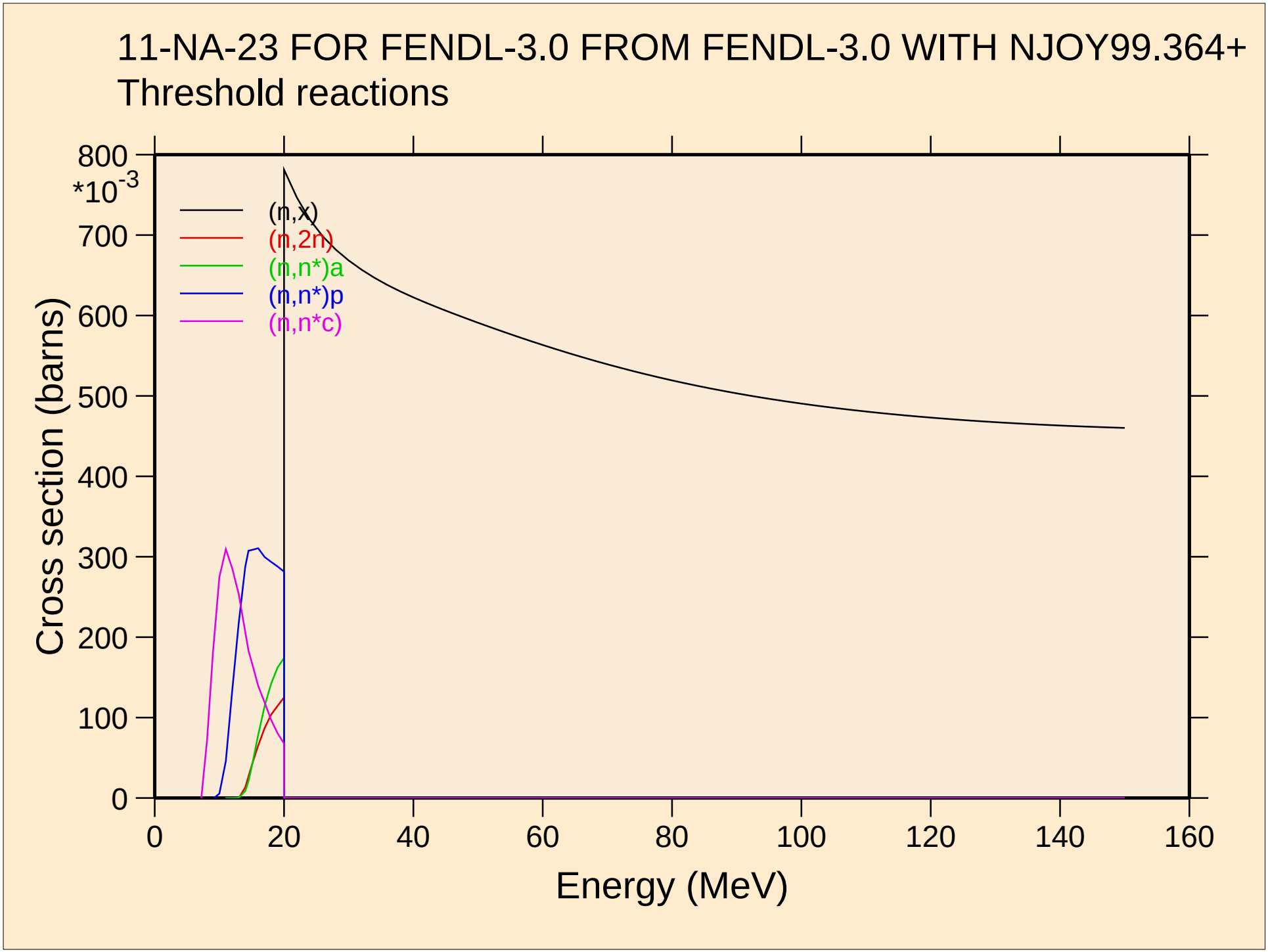

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Inelastic levels
120
*10-3
100
80
60
40
20
0
Cross section (barns)
3
4
5
6
7
8
9
10
Energy (MeV)
(n,n*6)
(n,n*7)
(n,n*8)
(n,n*9)
(n,n*10)

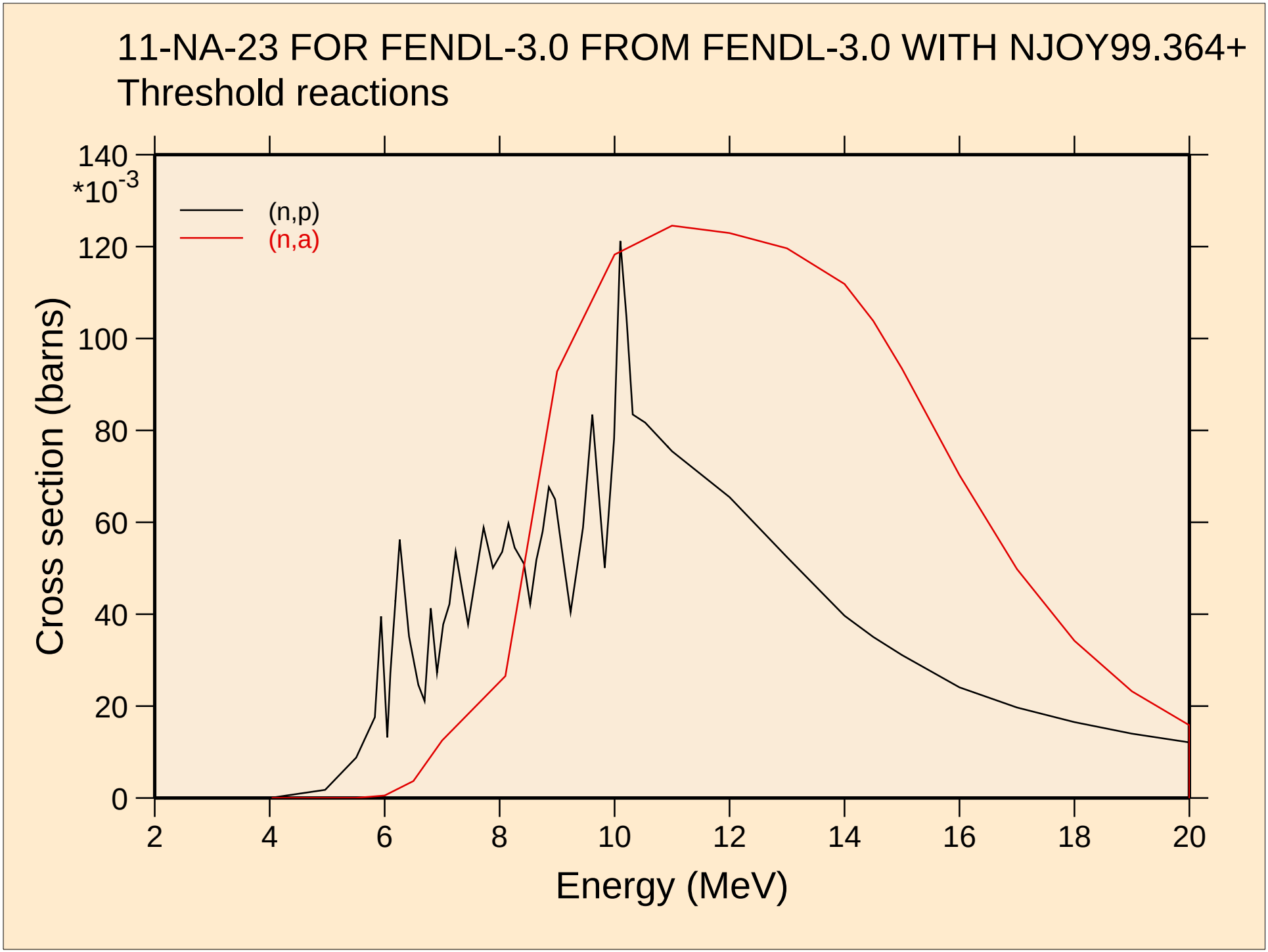

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Inelastic levels
Cross section (barns)
*10-3
60
50
40
30
20
10
0
4
5
6
7
8
9
10
Energy (MeV)
(n,n*11)
(n,n*12)
(n,n*13)
(n,n*14)
(n,n*15)

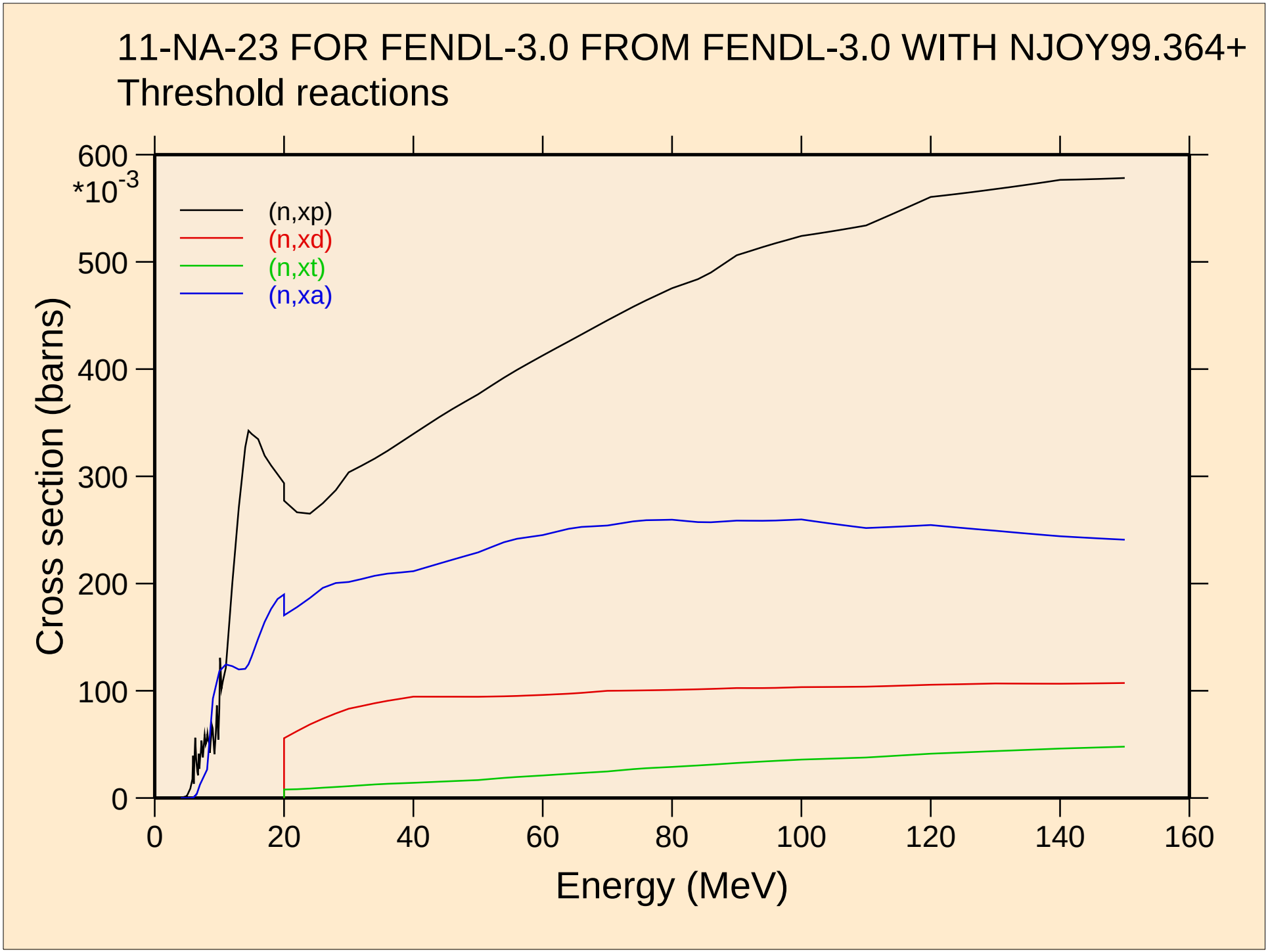

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Inelastic levels
Cross section (barns)
*10-3
30
25
20
15
10
5
0
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
Energy (MeV)
(n,n*16)
(n,n*17)
(n,n*18)
(n,n*19)
(n,n*20)

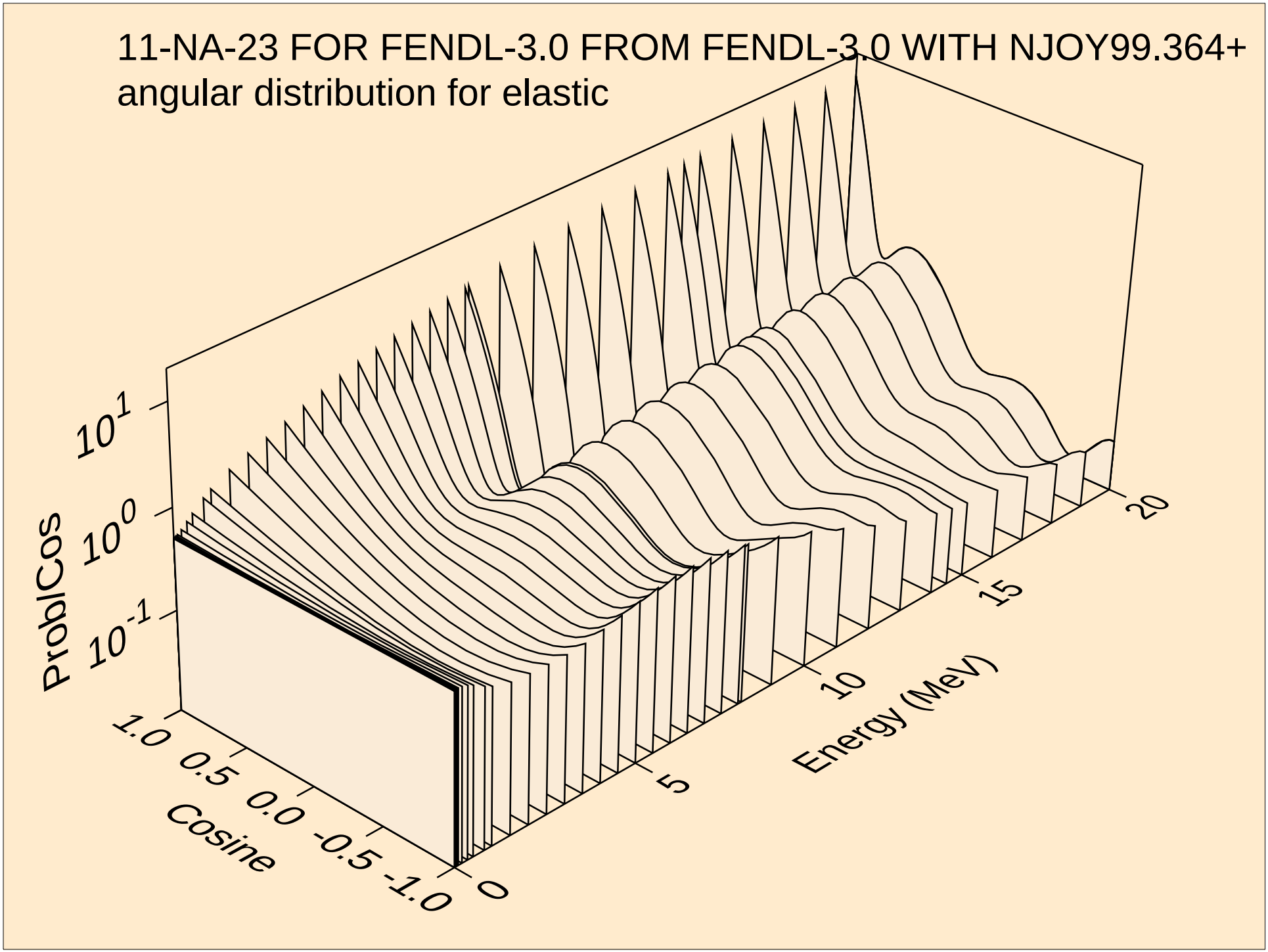

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Inelastic levels
Cross section (barns)
*10-3
25
20
15
10
5
0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
Energy (MeV)
(n,n*21)
(n,n*22)
(n,n*23)
(n,n*24)
(n,n*25)

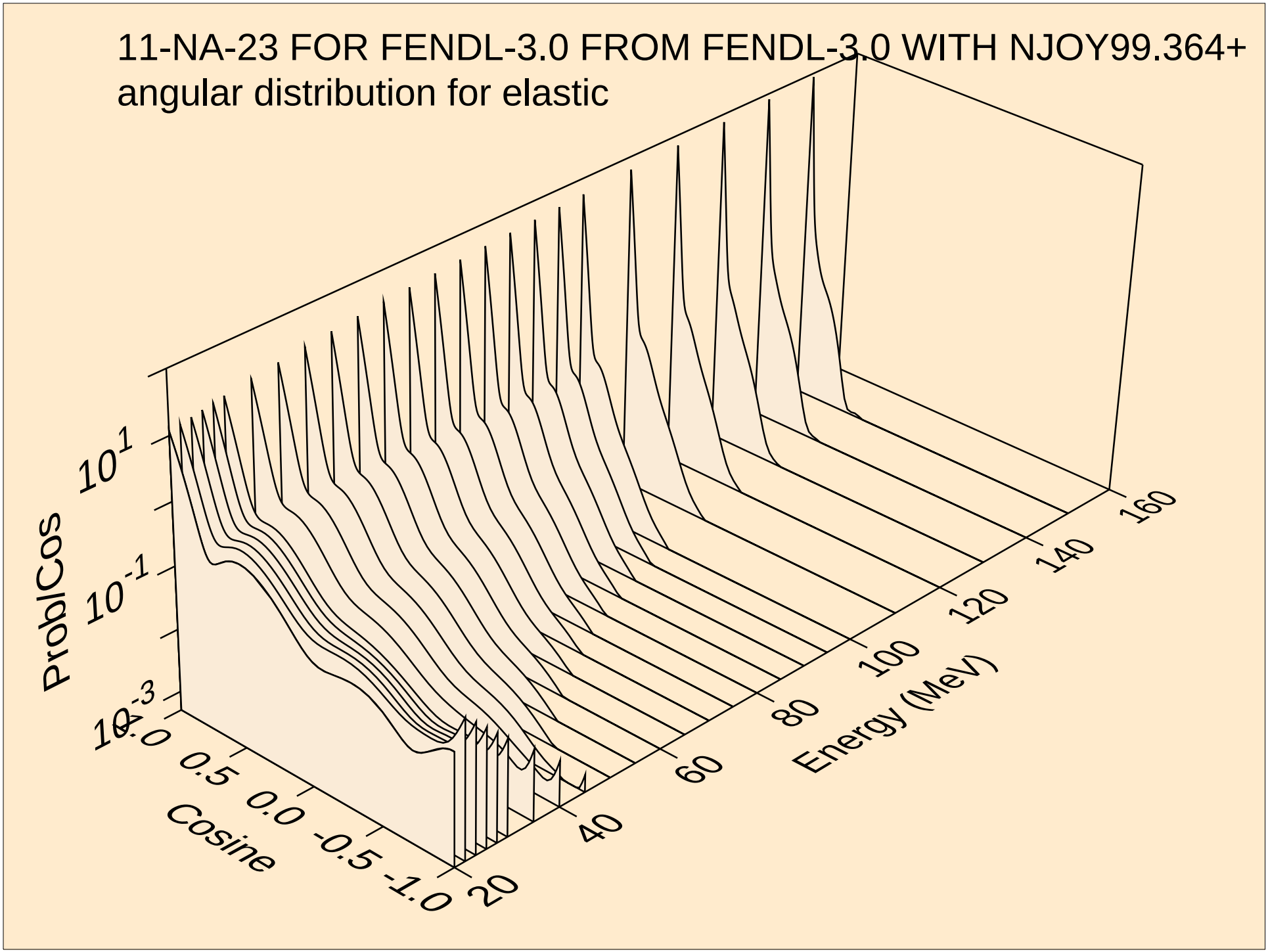

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Inelastic levels
*10-3
14
12
10
8
6
4
2
0
Cross section (barns)
7.0
7.5
8.0
8.5
9.0
9.5
10.0
Energy (MeV)
(n,n*26)
(n,n*27)
(n,n*28)

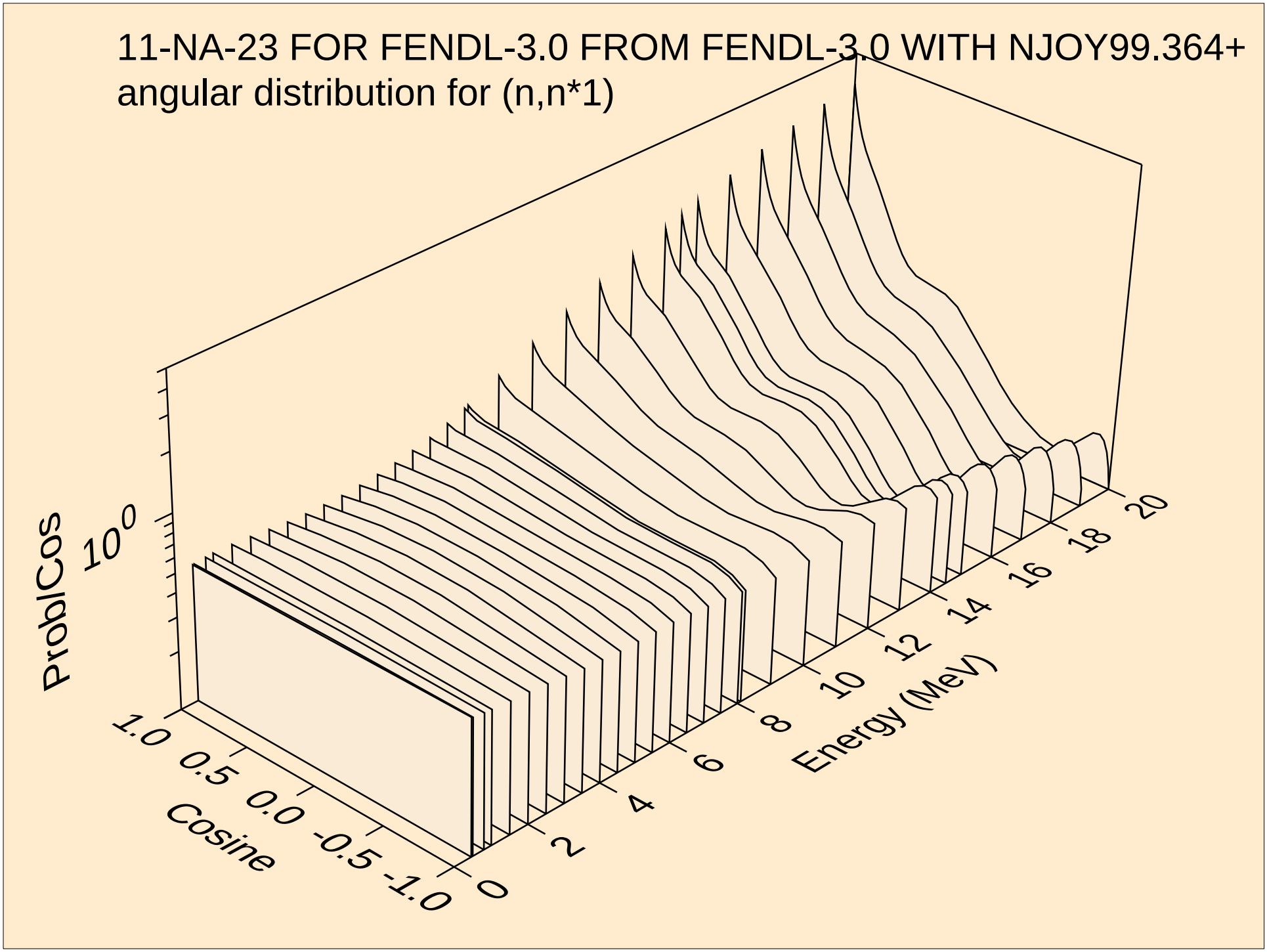

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Threshold reactions
Cross section (barns)
*10-3
800
700
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
Energy (MeV)
(n,x)
(n,2n)
(n,n*)a
(n,n*)p
(n,n*c)

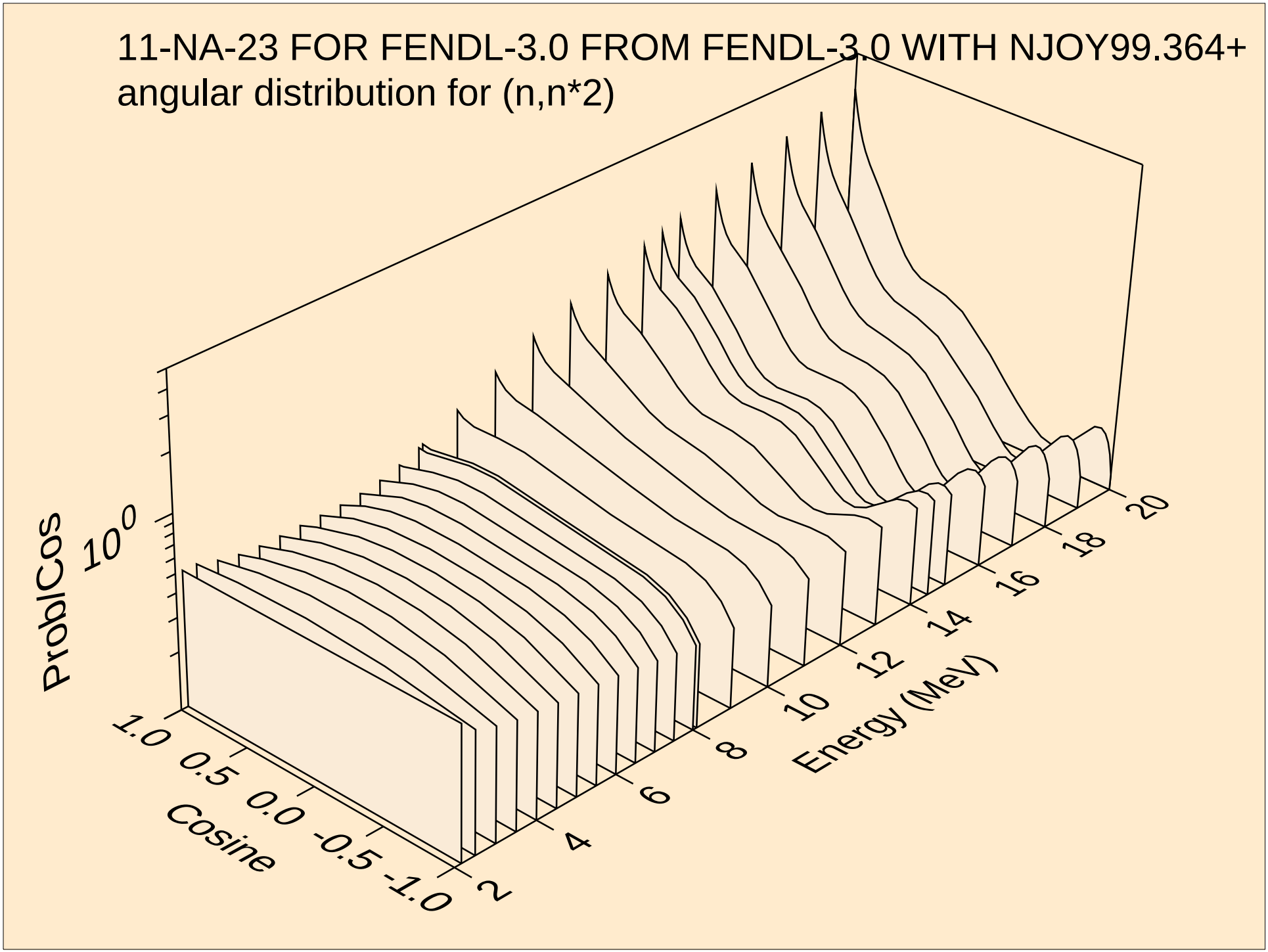

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Threshold reactions
140
*10-3
120
100
80
60
40
20
0
(n,p)
(n,a)
Cross section (barns)
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

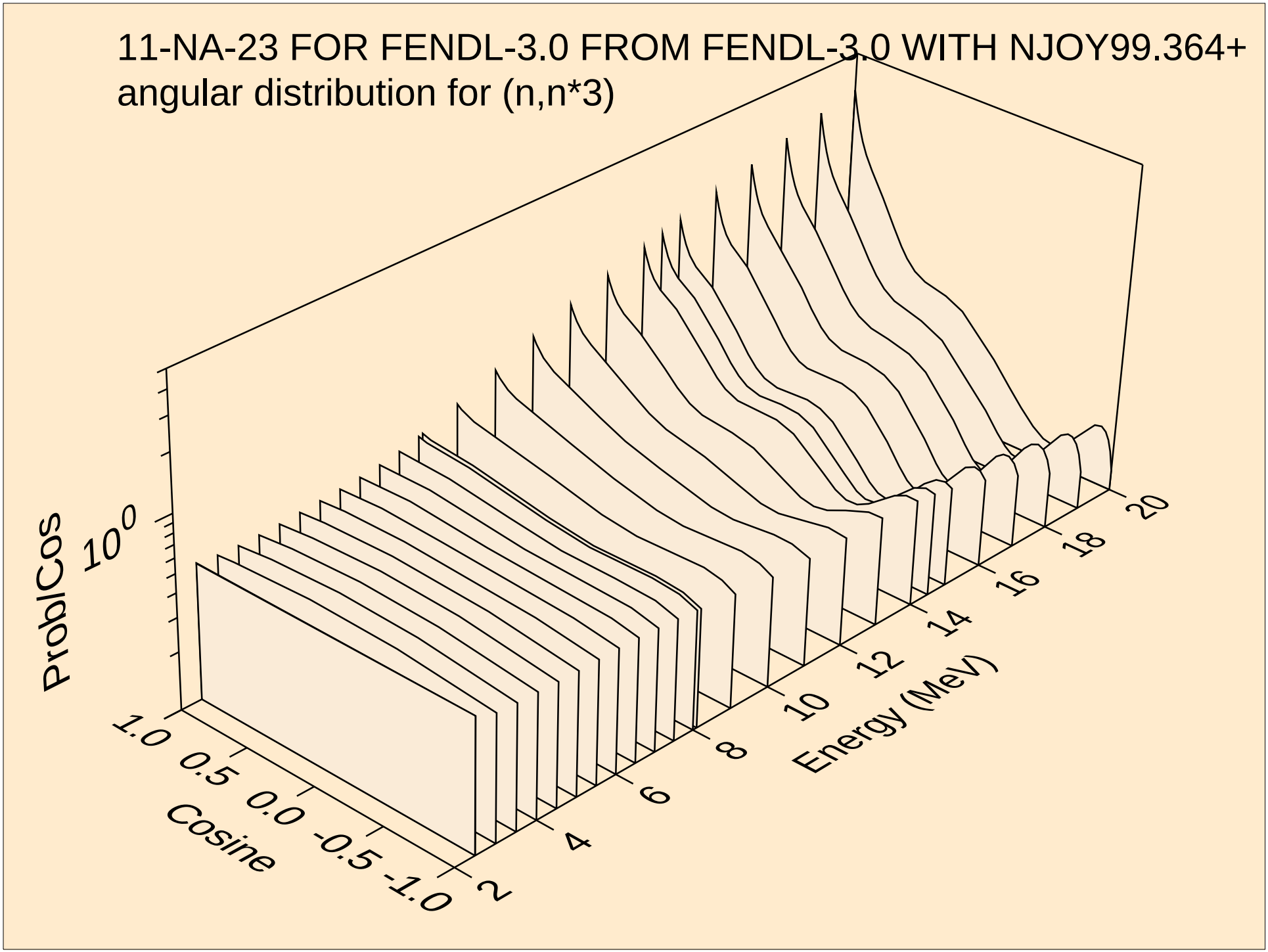

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Threshold reactions
600
*10-3
500
400
300
200
100
0
Cross section (barns)
(n,xp)
(n,xd)
(n,xt)
(n,xa)
0
20
40
60
80
100
120
140
160
Energy (MeV)

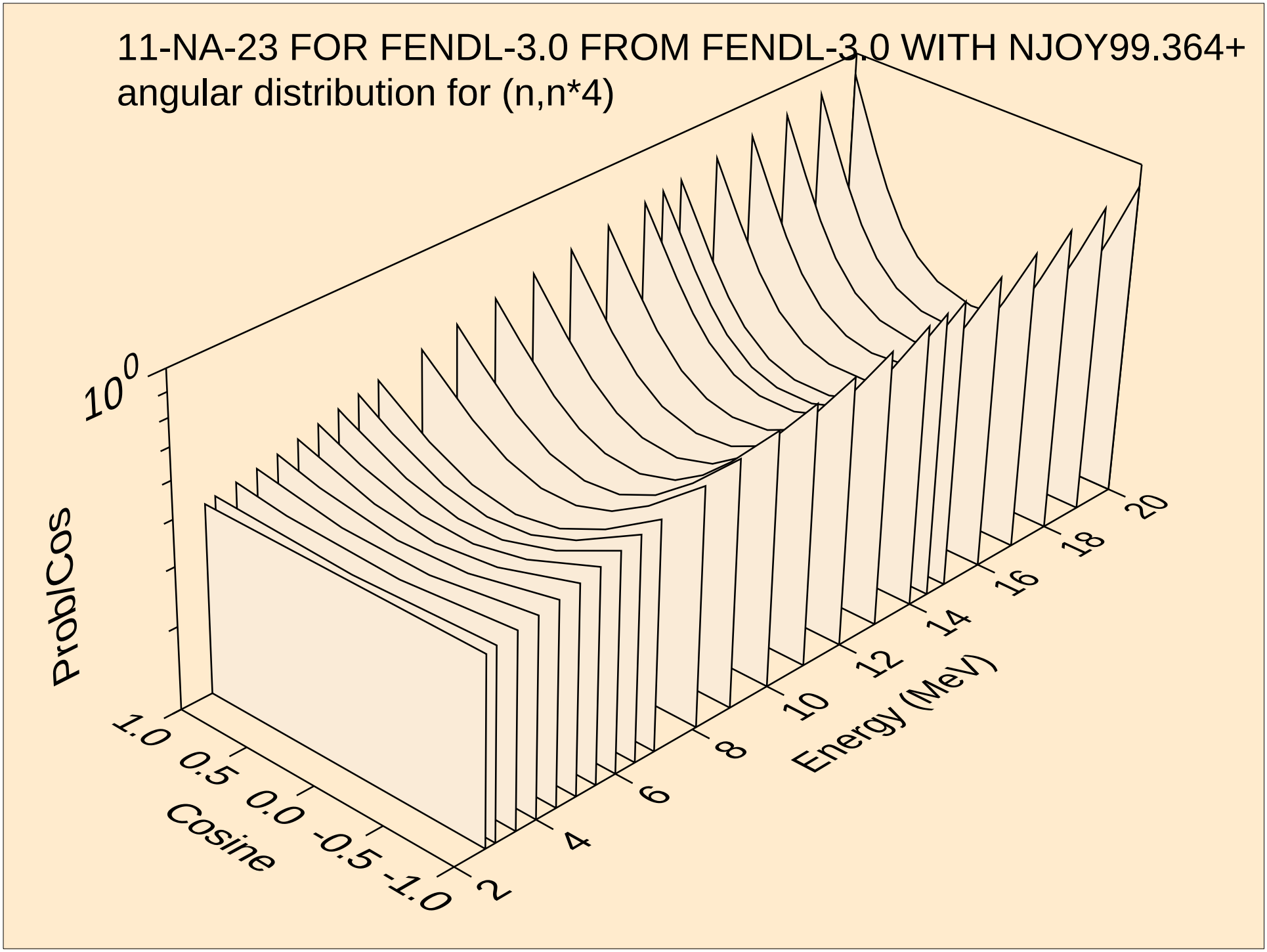

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for elastic
ProbICos
10^{1}
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
5
10
15
20
Energy (MeV)

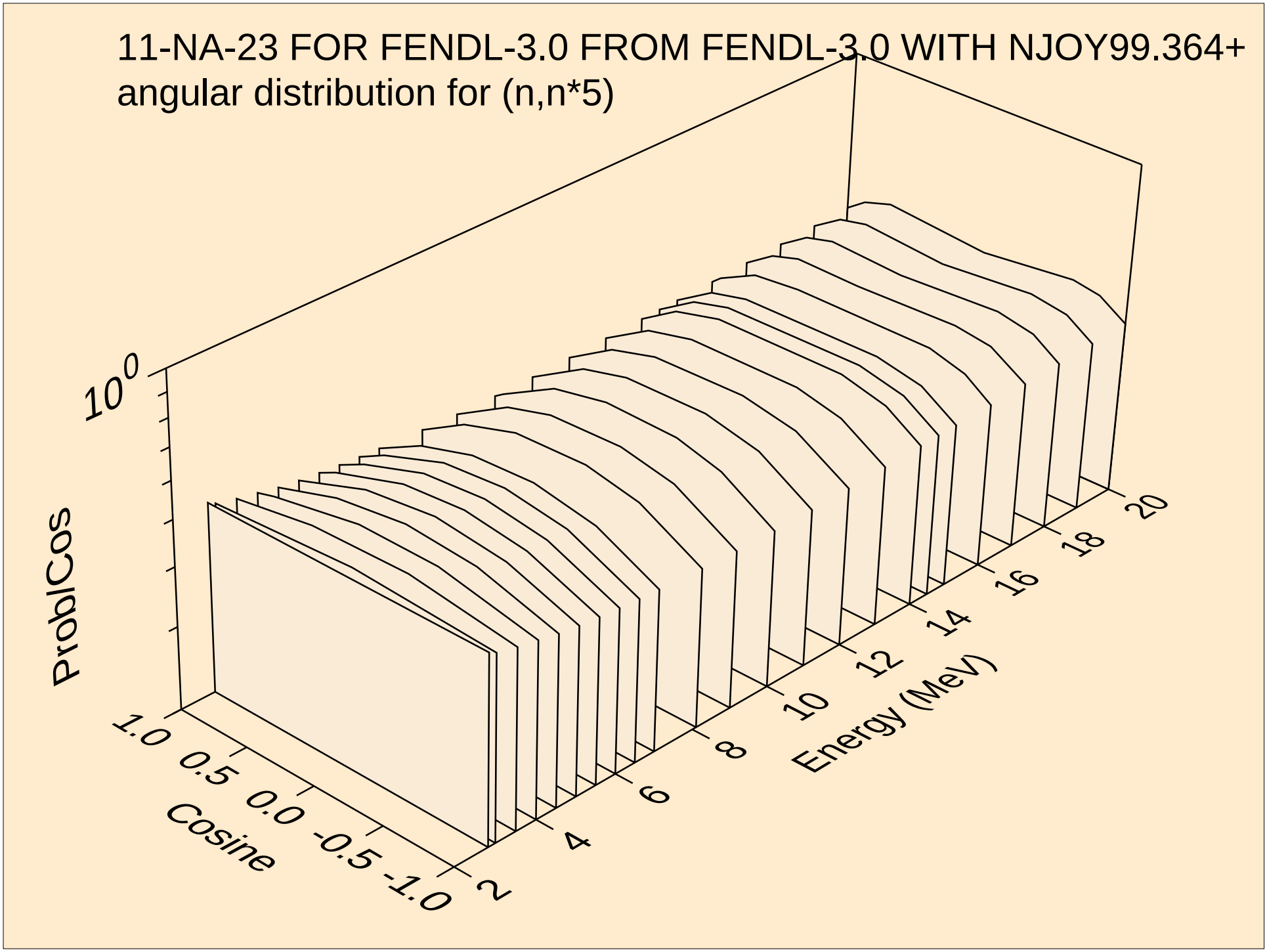

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for elastic
Prob\Cos
10^1
10^-1
10^-3
1.0
0.5
0.0
-0.5
-1.0
Cosine
20
40
60
80
100
120
140
160
Energy (MeV)

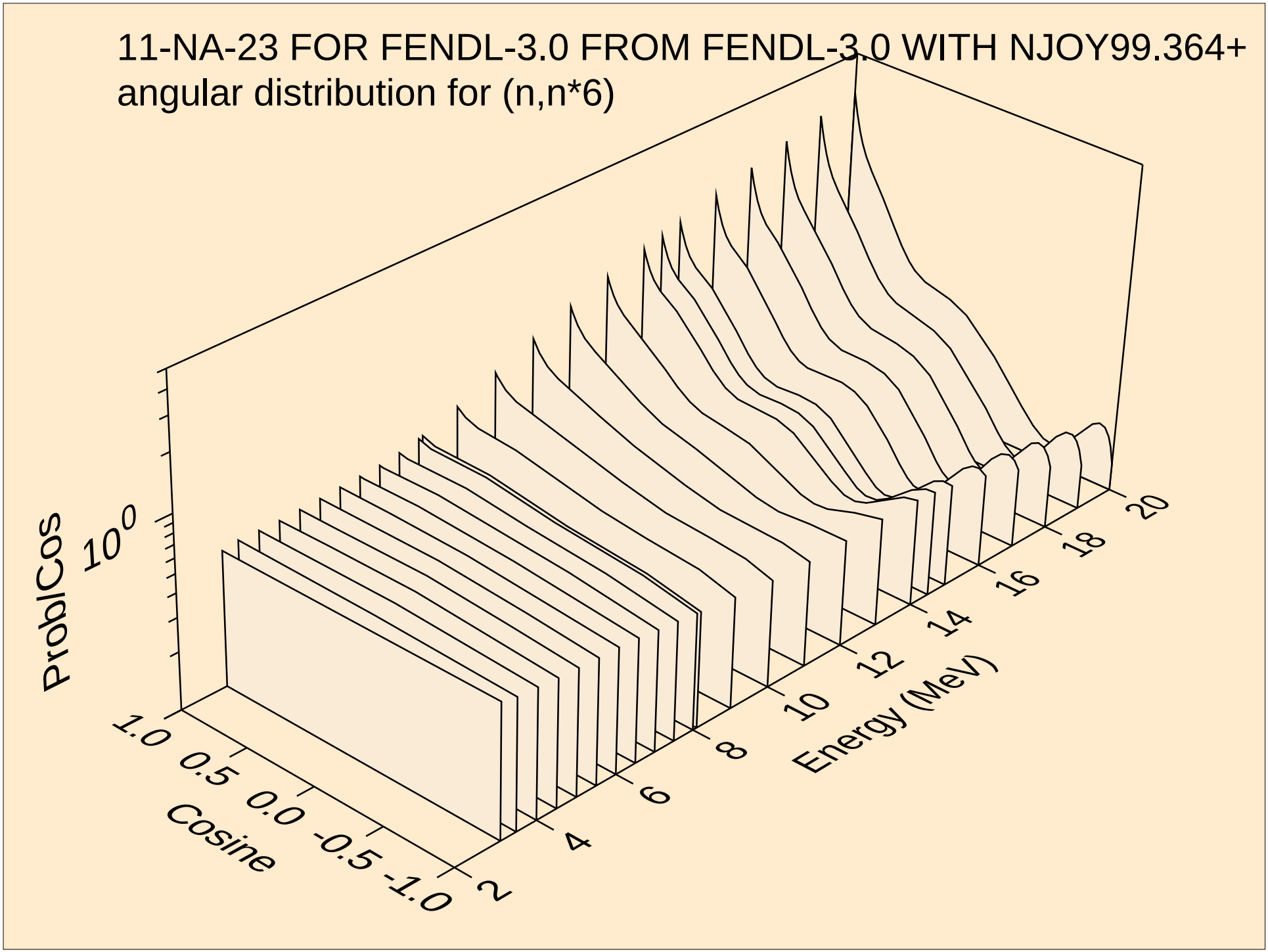

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*1)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

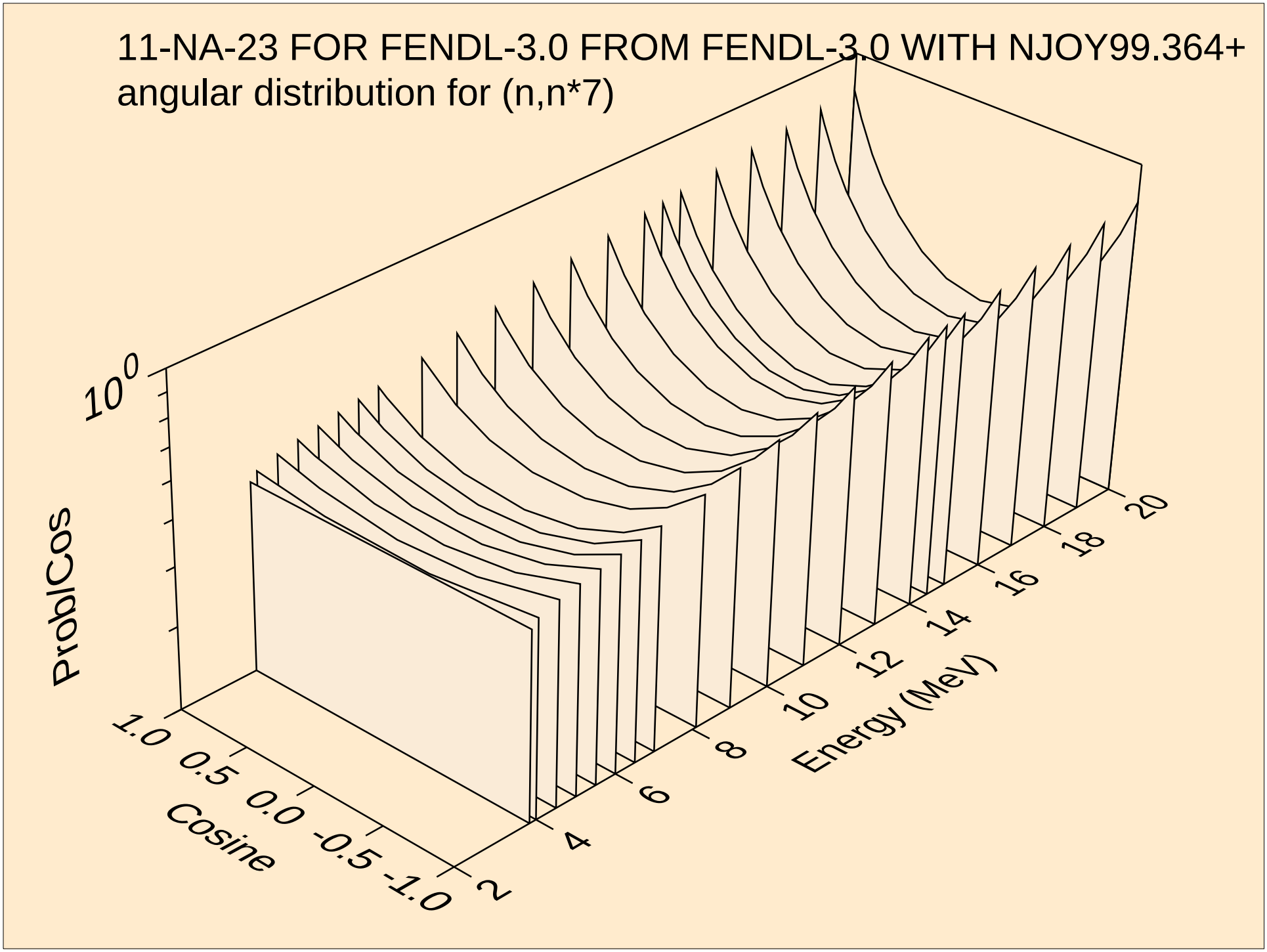

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*2)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

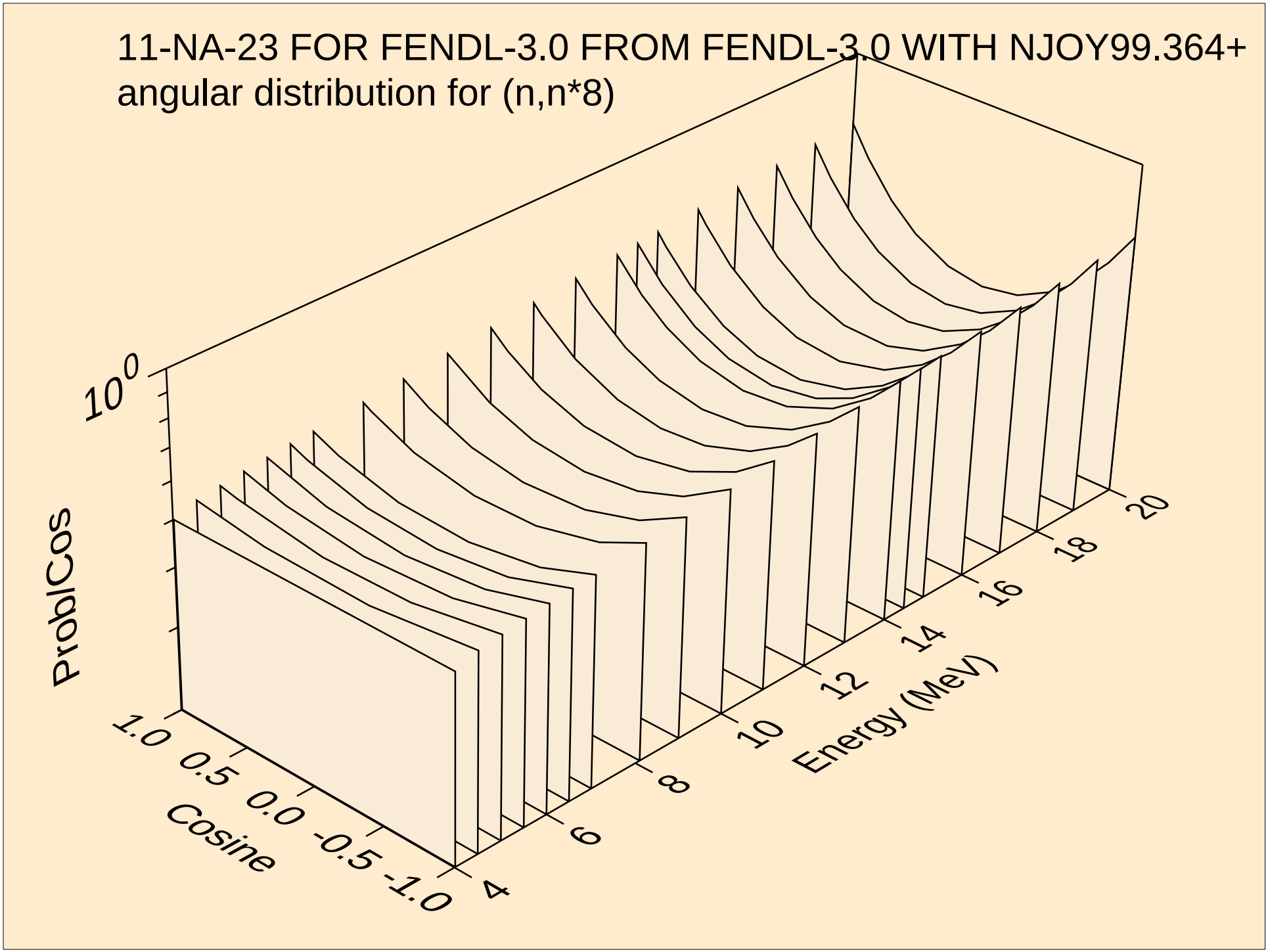

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*3)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

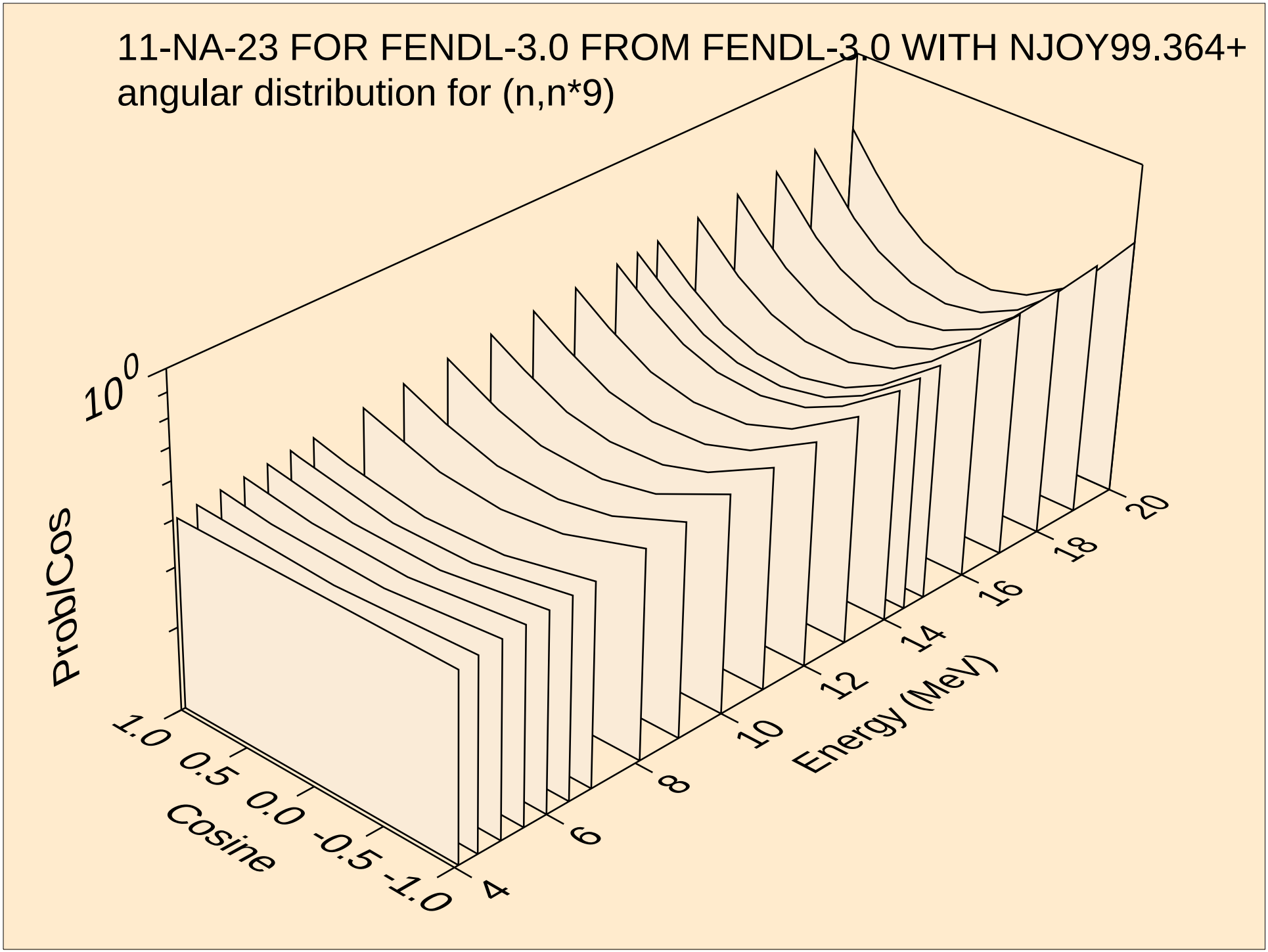

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*4)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

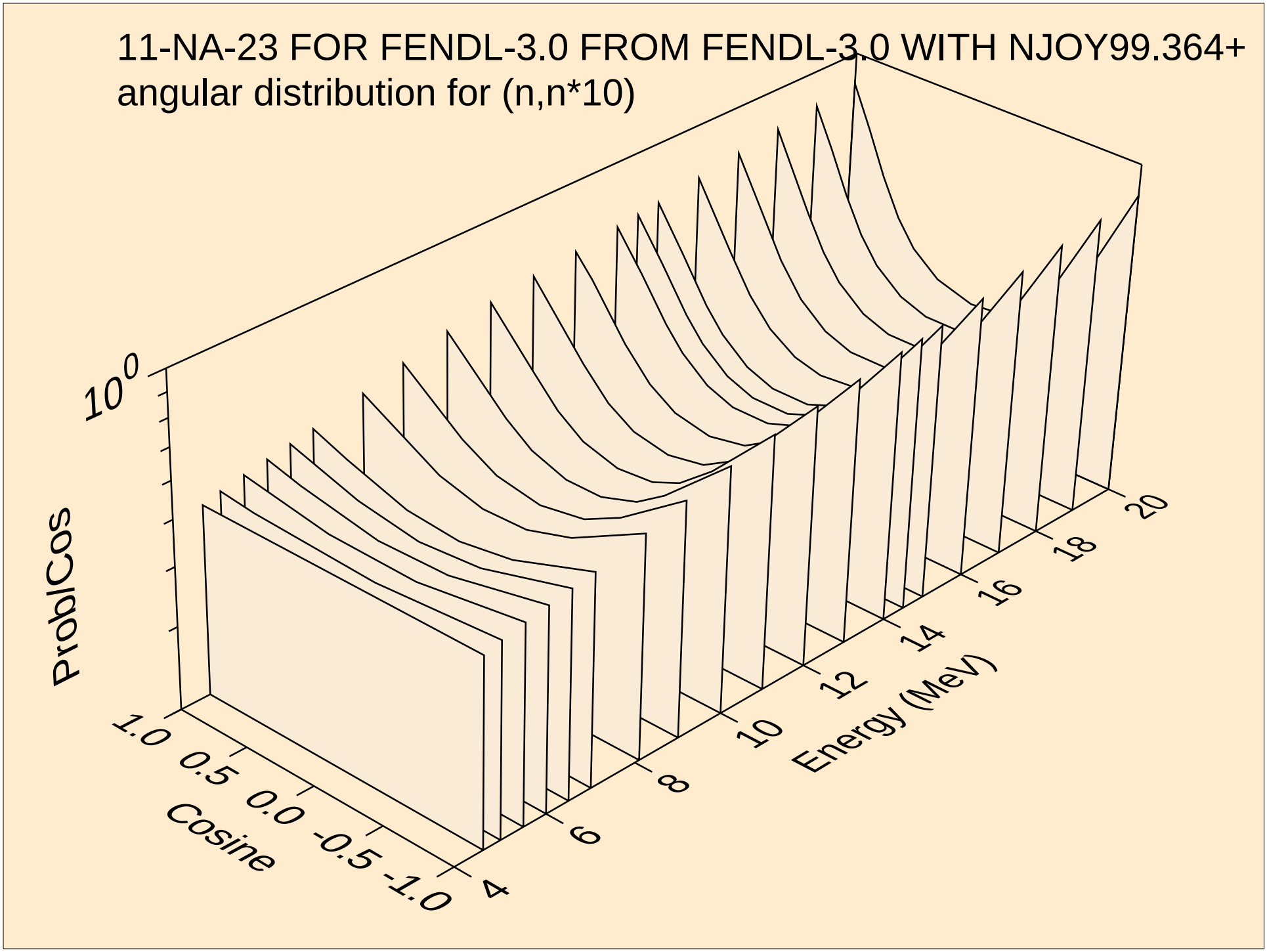

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*5)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

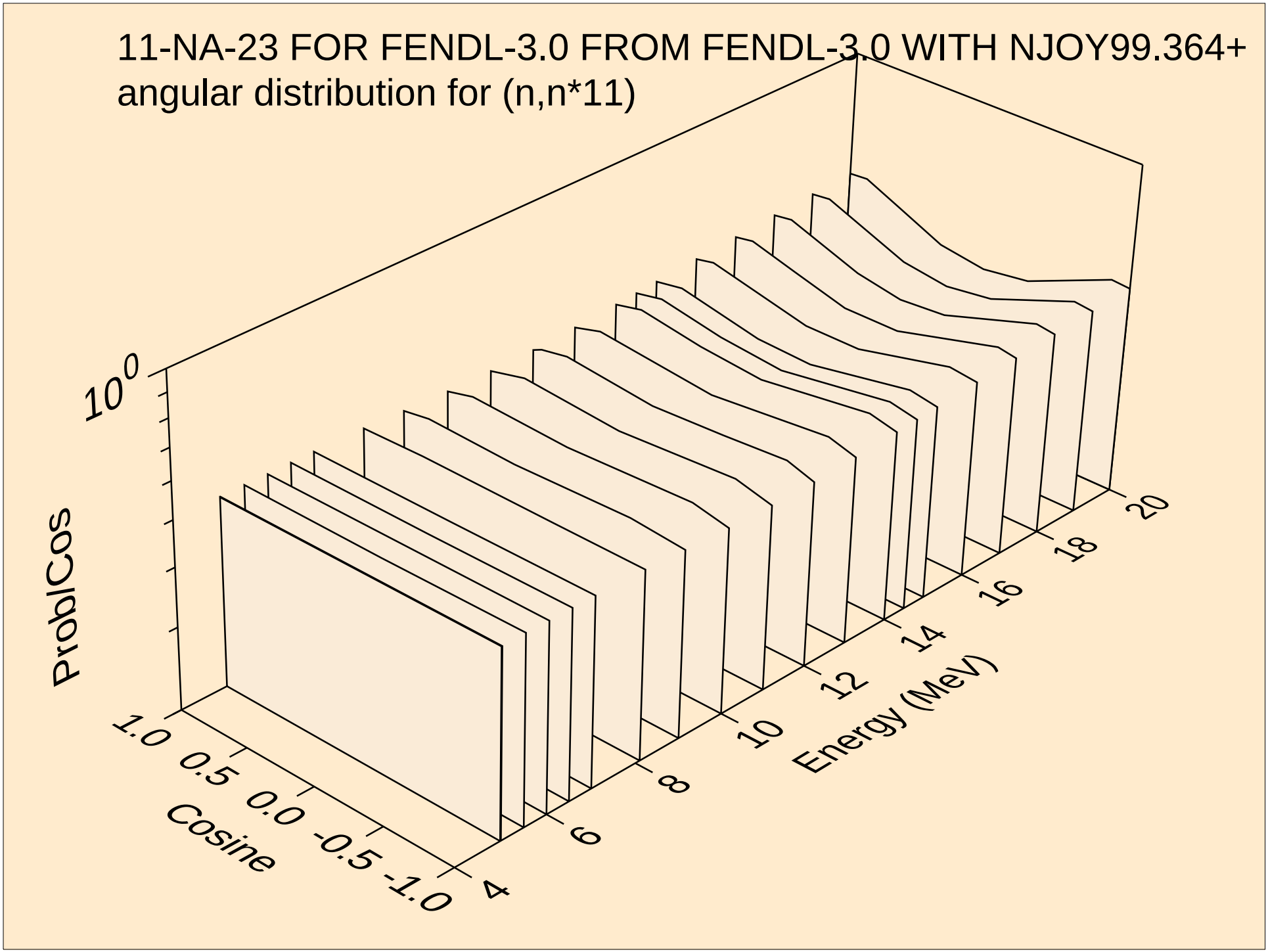

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*6)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

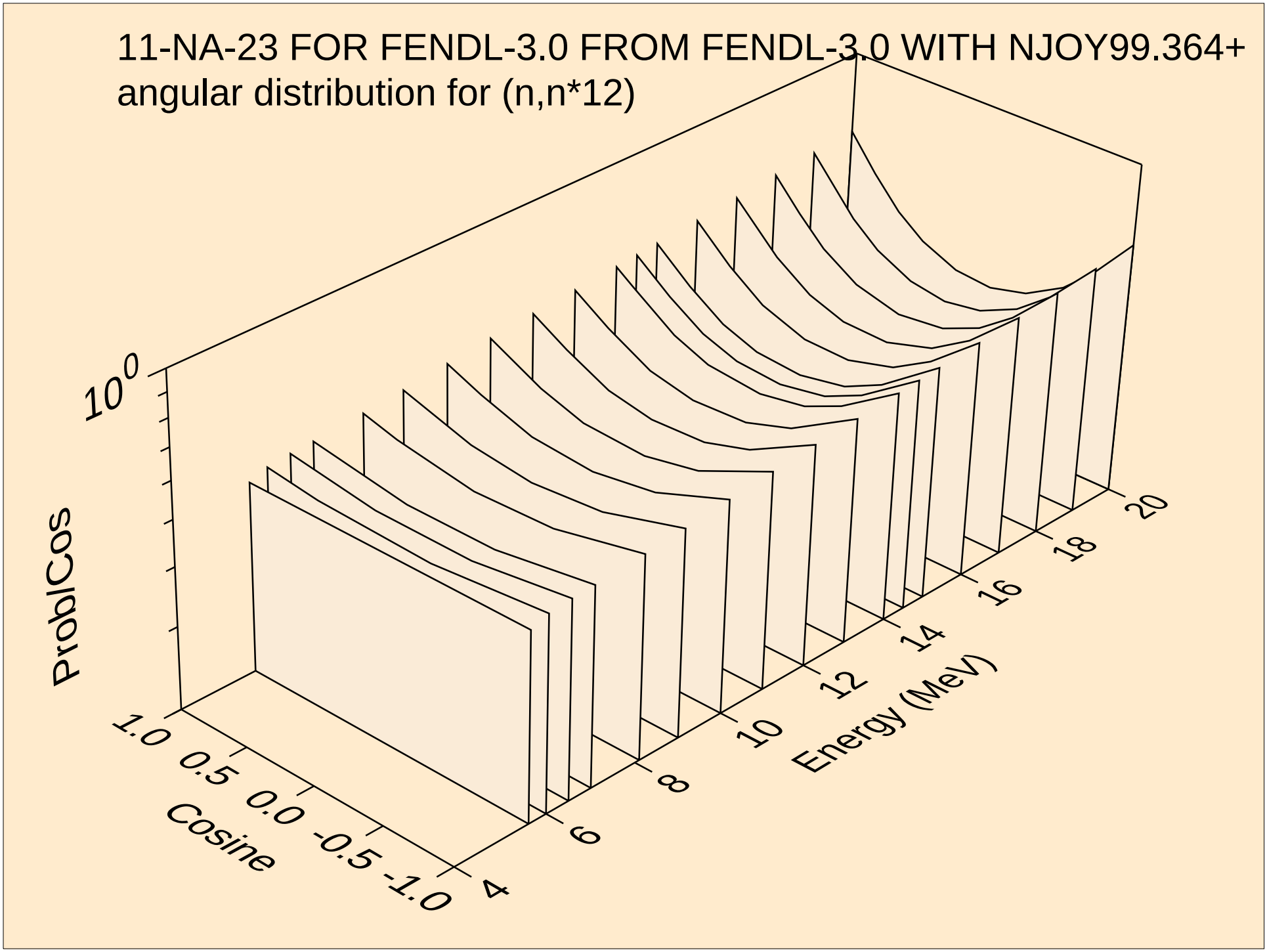

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*7)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

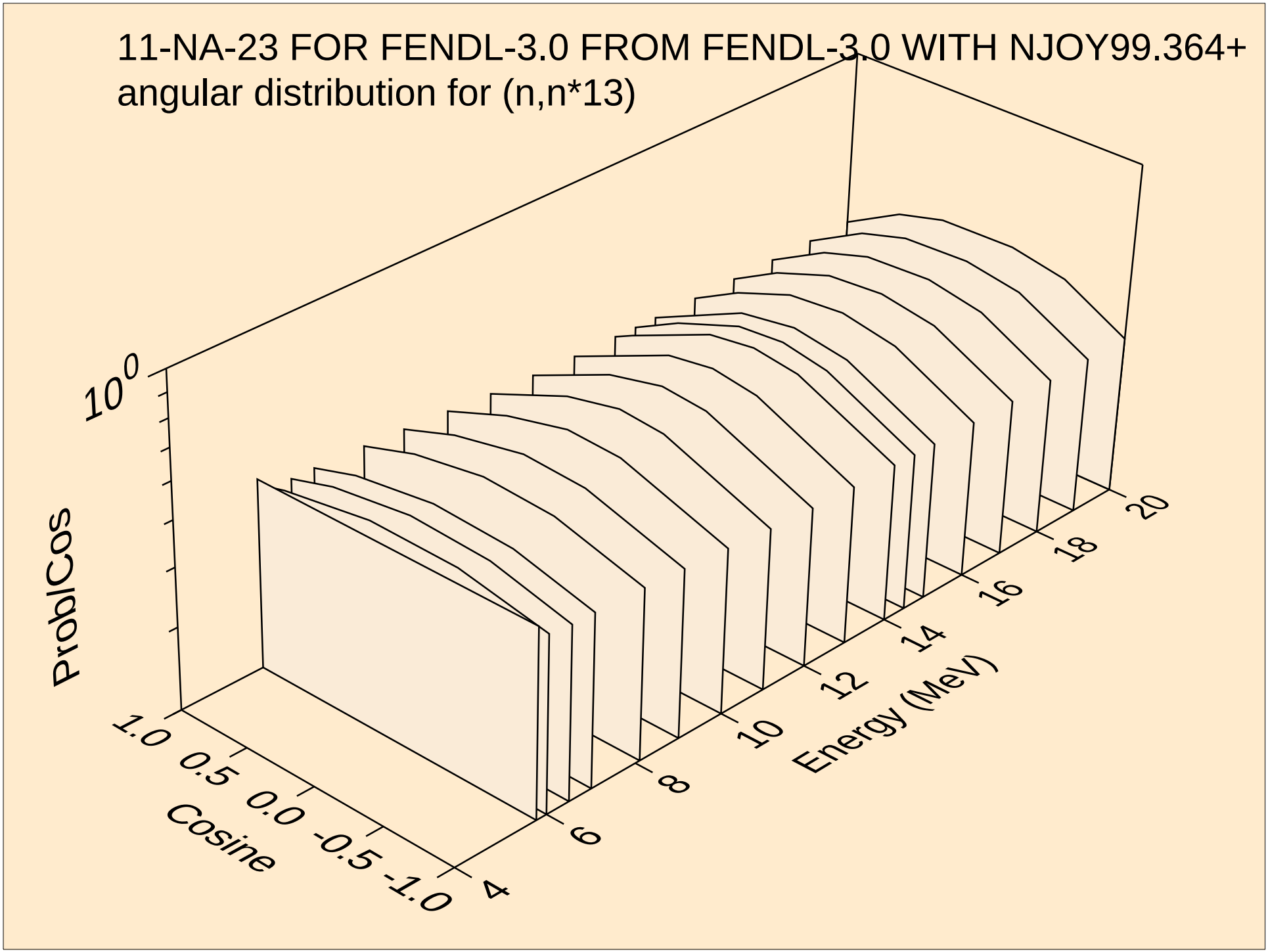

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*8)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
4
6
8
10
12
14
16
18
20
Energy (MeV)

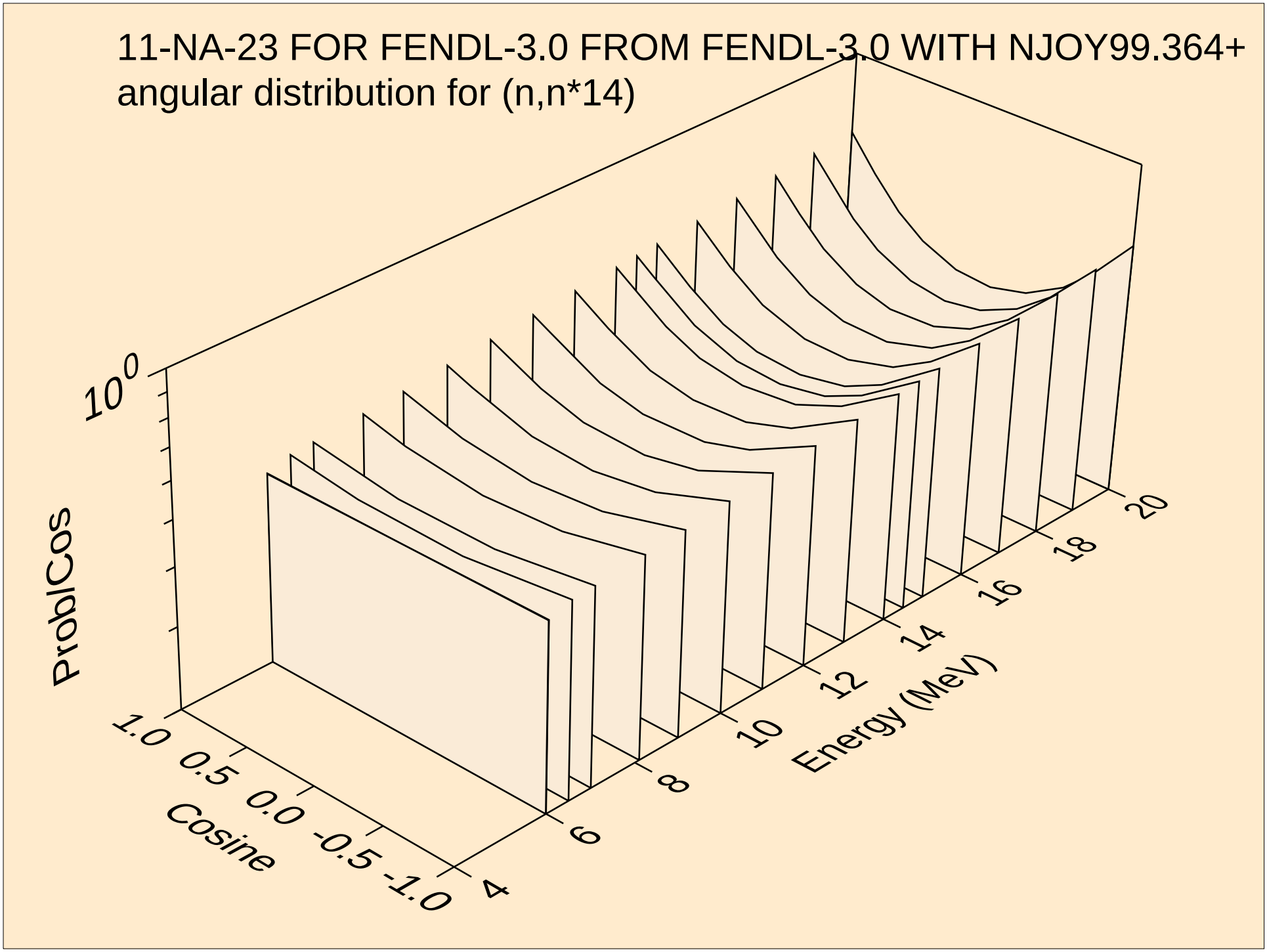

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*9)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
4
6
8
10
12
14
16
18
20
Energy (MeV)

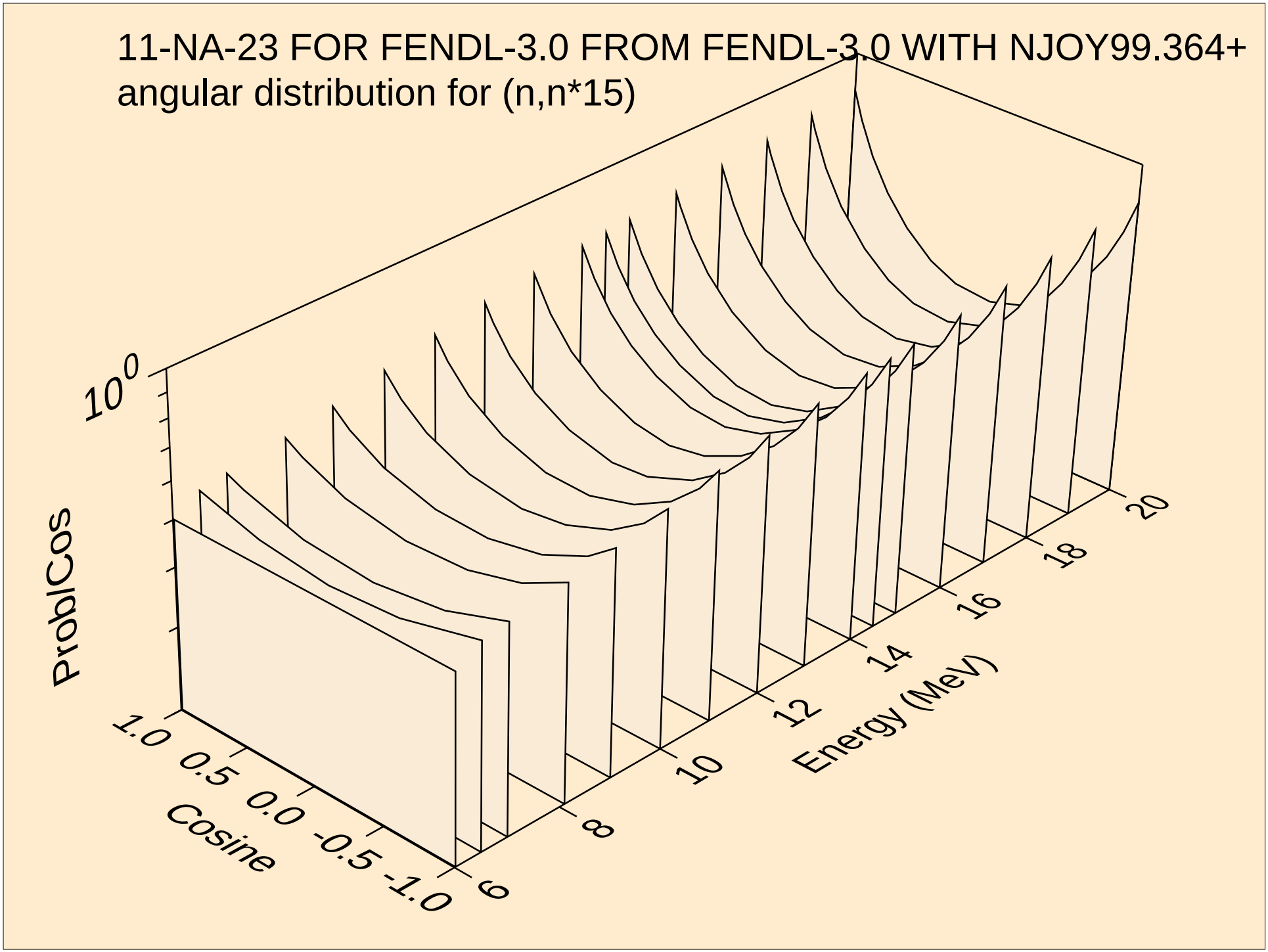

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*10)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
4
6
8
10
12
14
16
18
20
Energy (MeV)

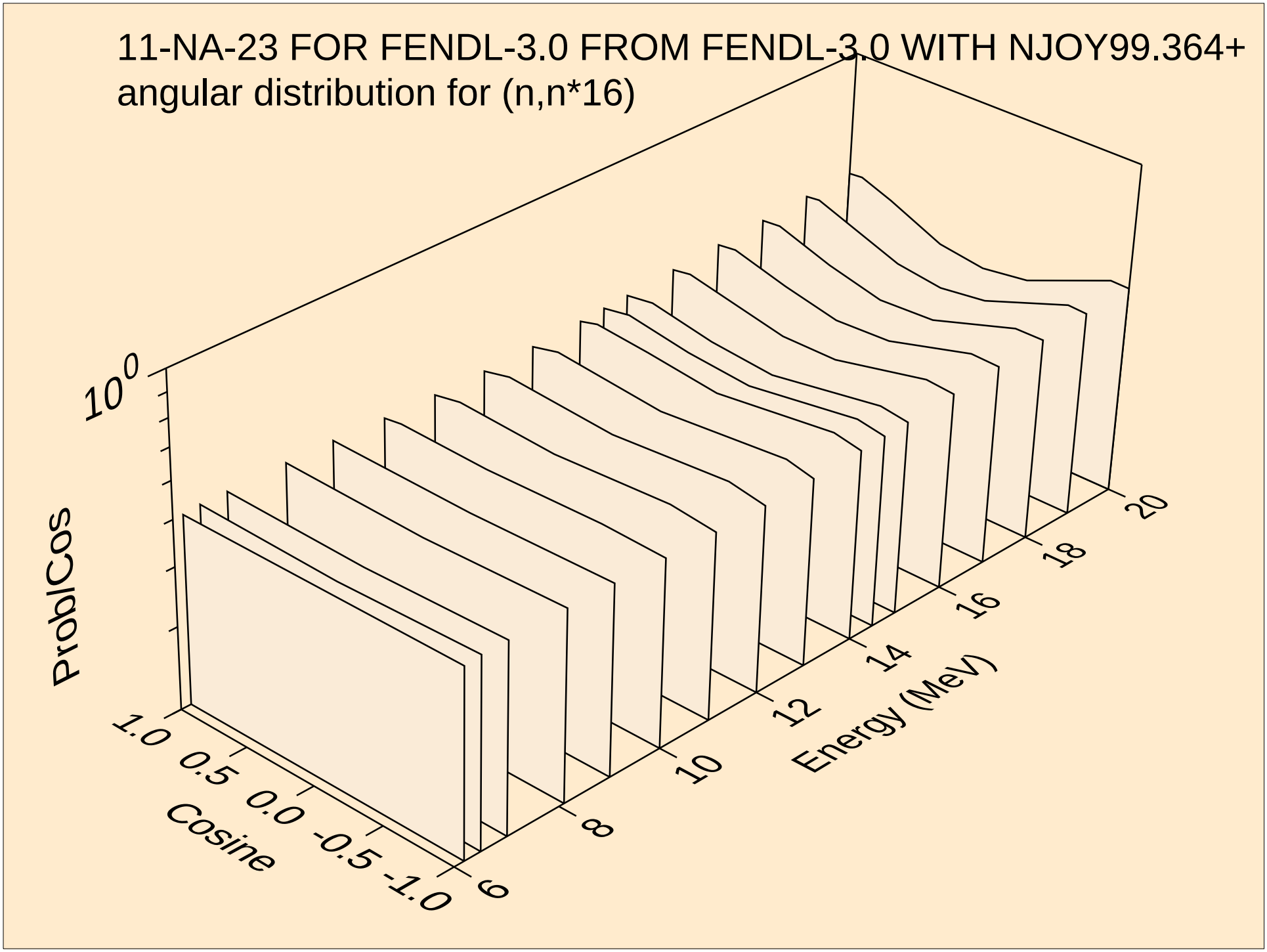

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*11)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
4
6
8
10
12
14
16
18
20
Energy (MeV)

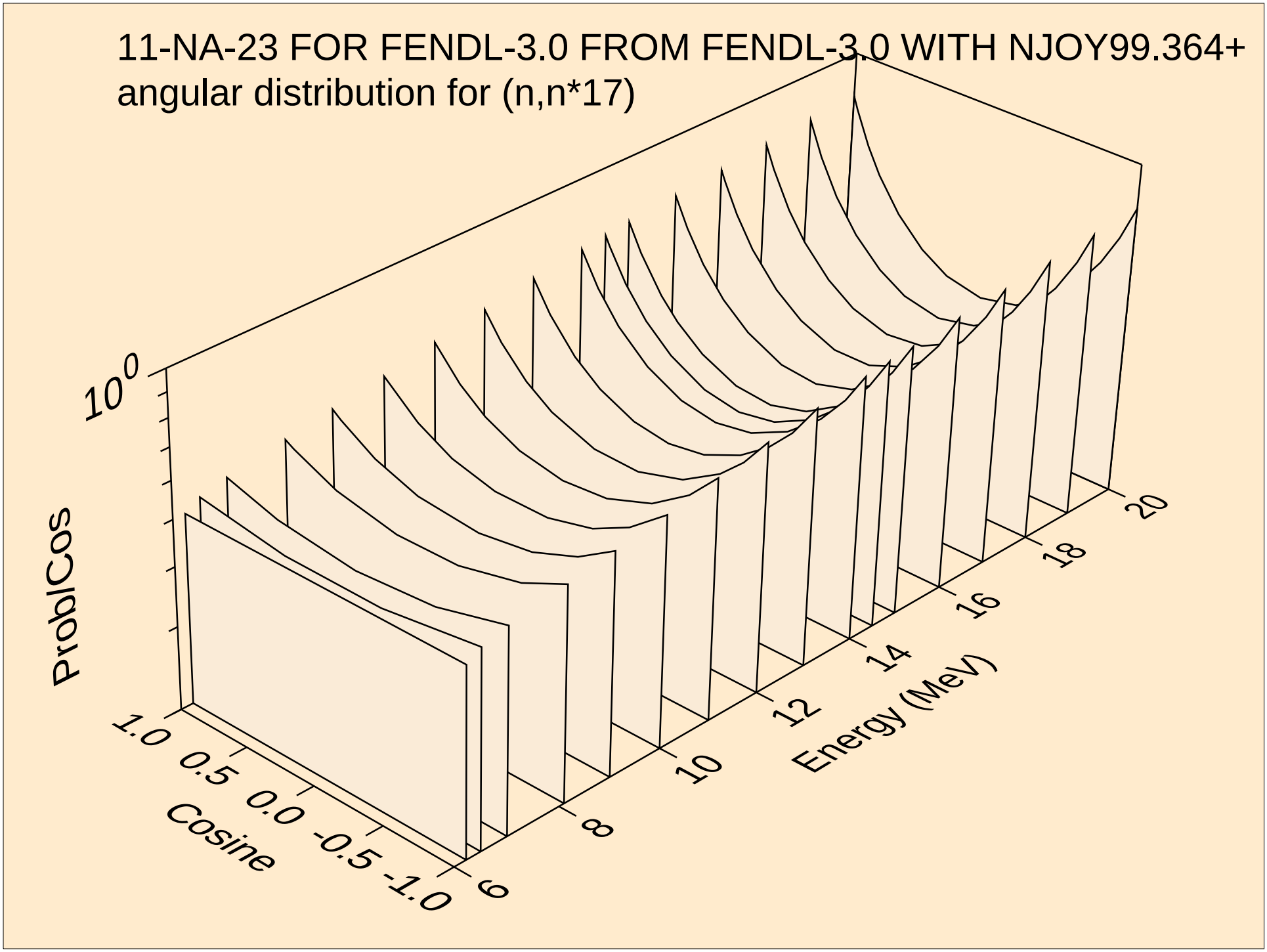

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*12)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
4
6
8
10
12
14
16
18
20
Energy (MeV)

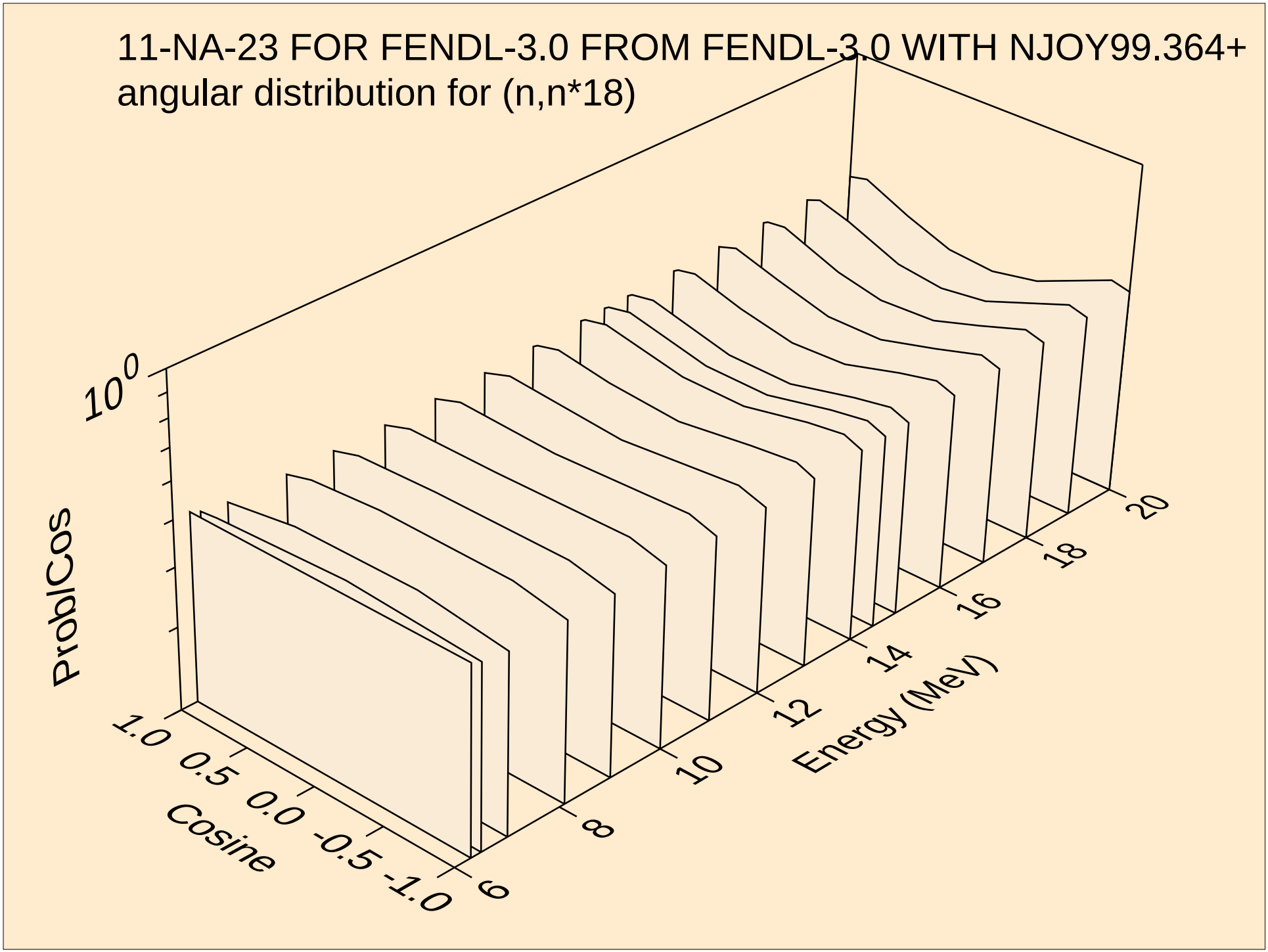

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*13)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
4
6
8
10
12
14
16
18
20
Energy (MeV)

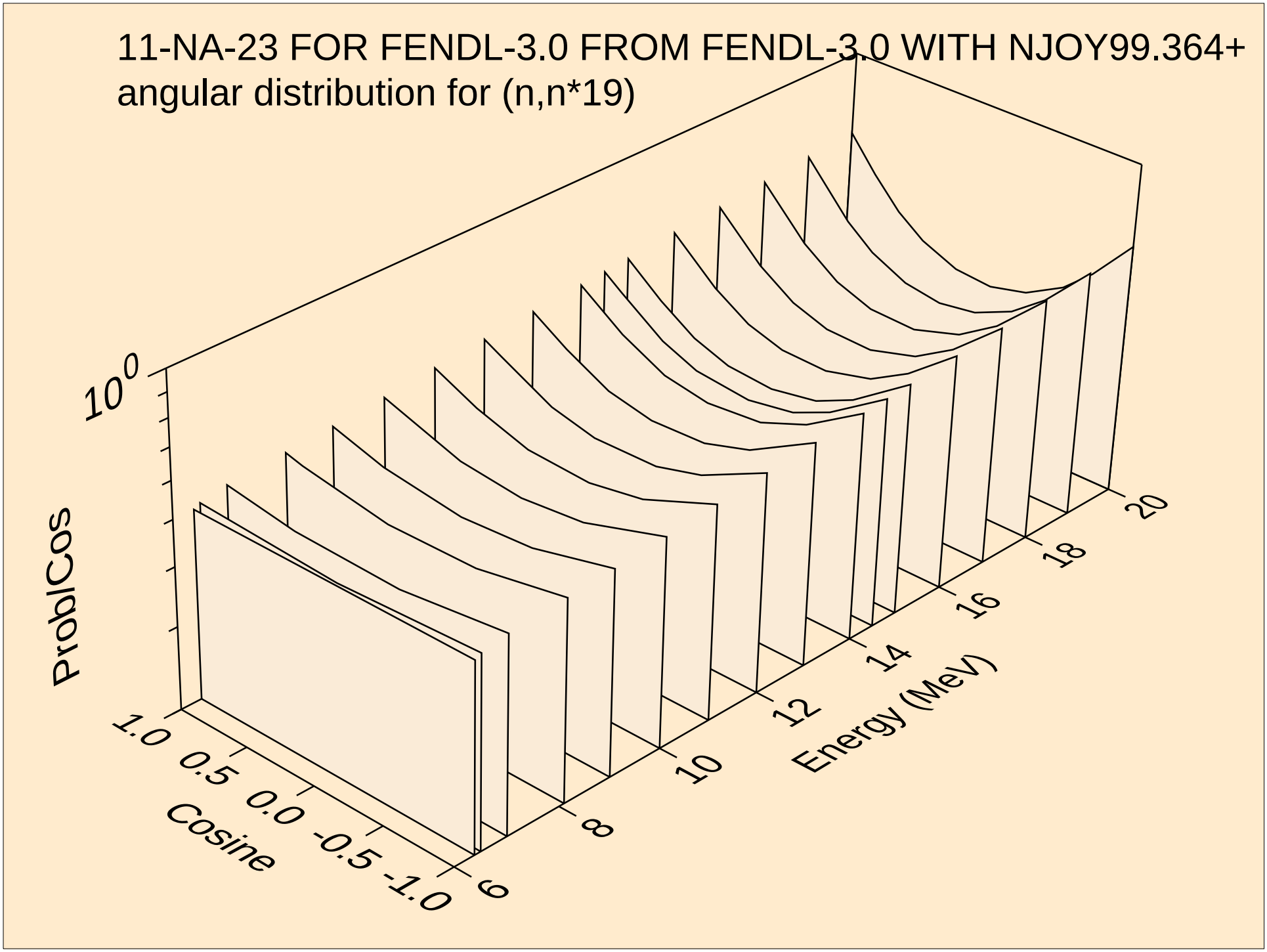

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*14)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
4
6
8
10
12
14
16
18
20
Energy (MeV)

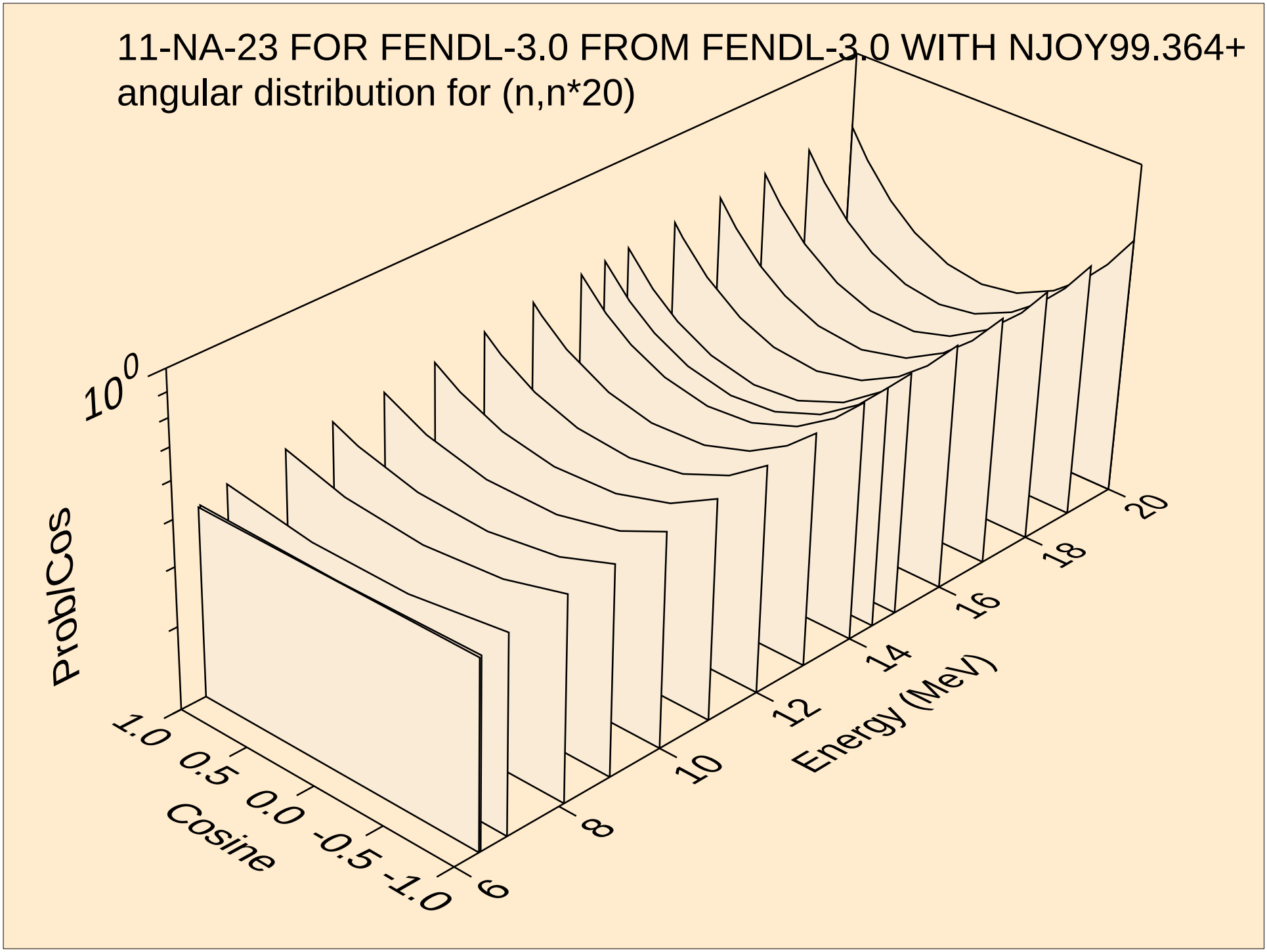

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*15)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

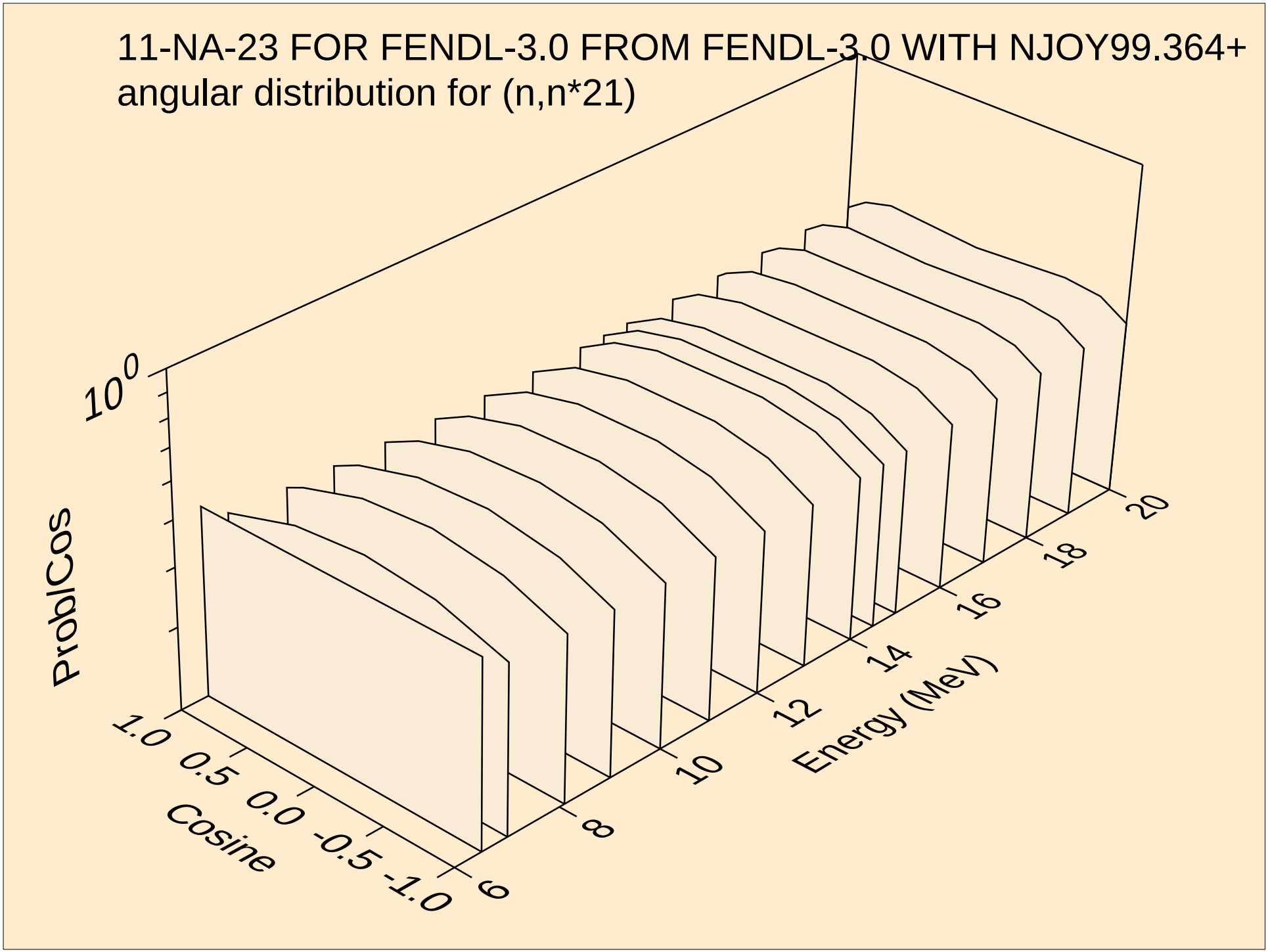

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*16)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

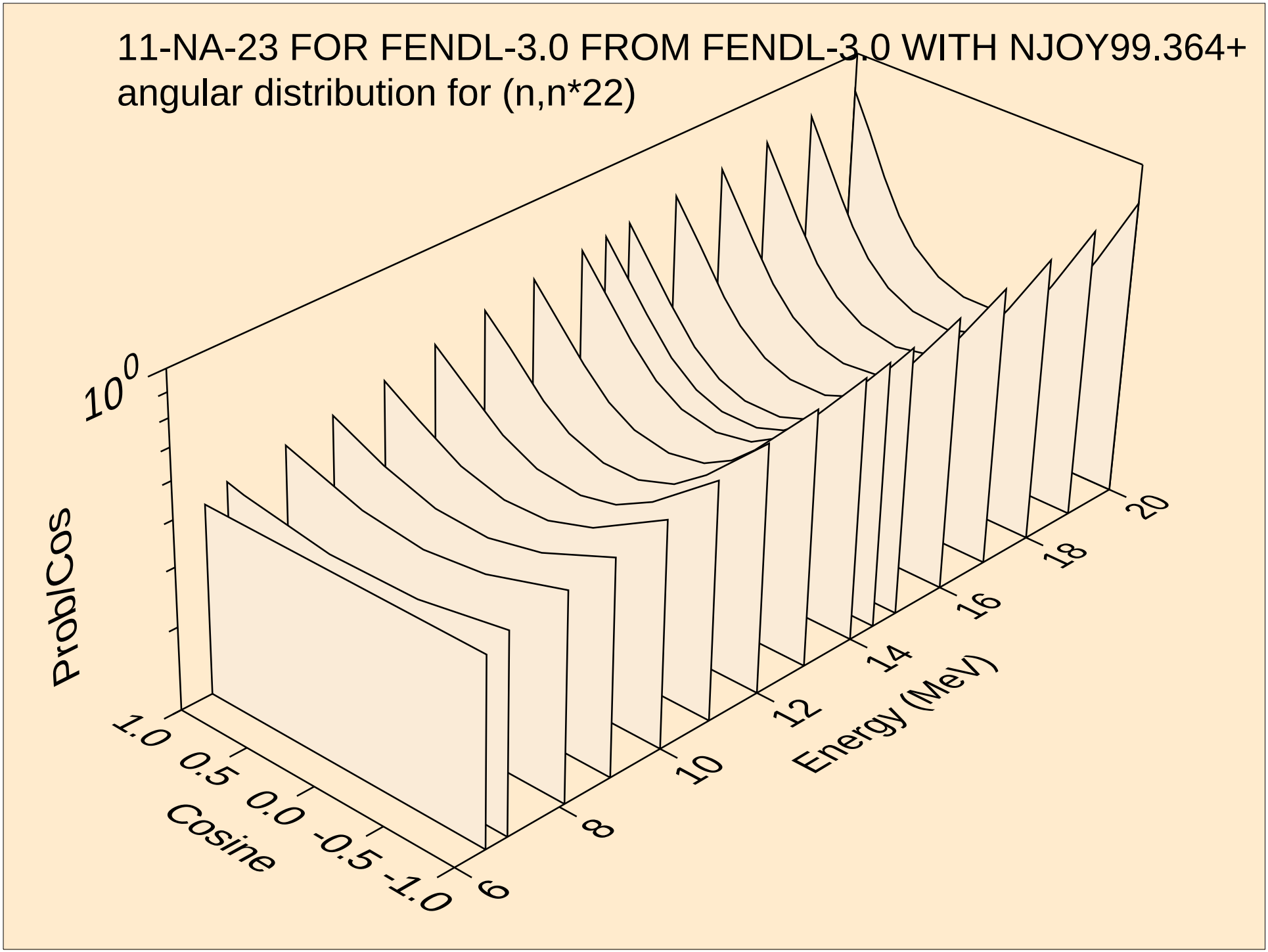

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*17)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

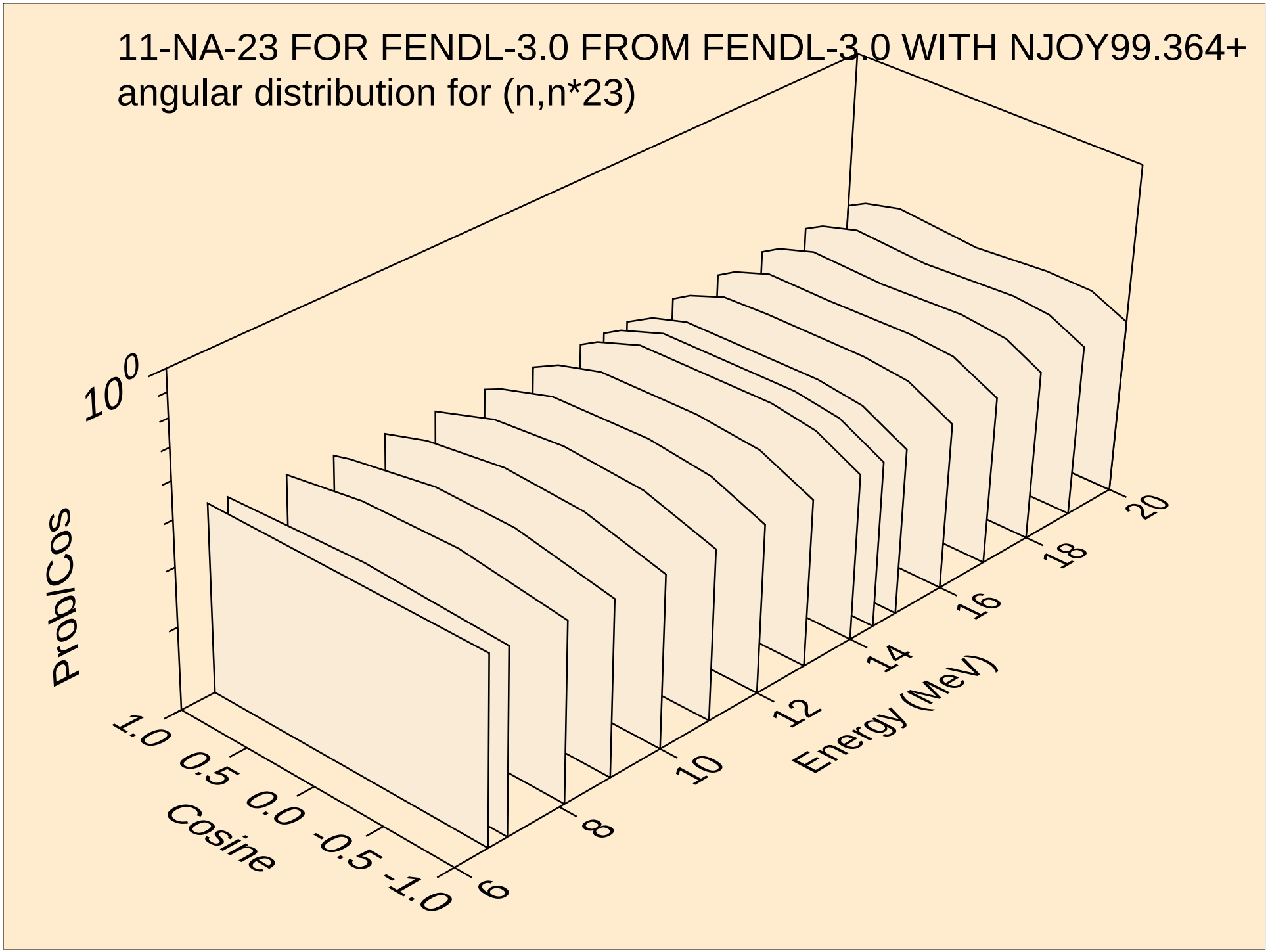

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*18)
10^0
Prob/Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

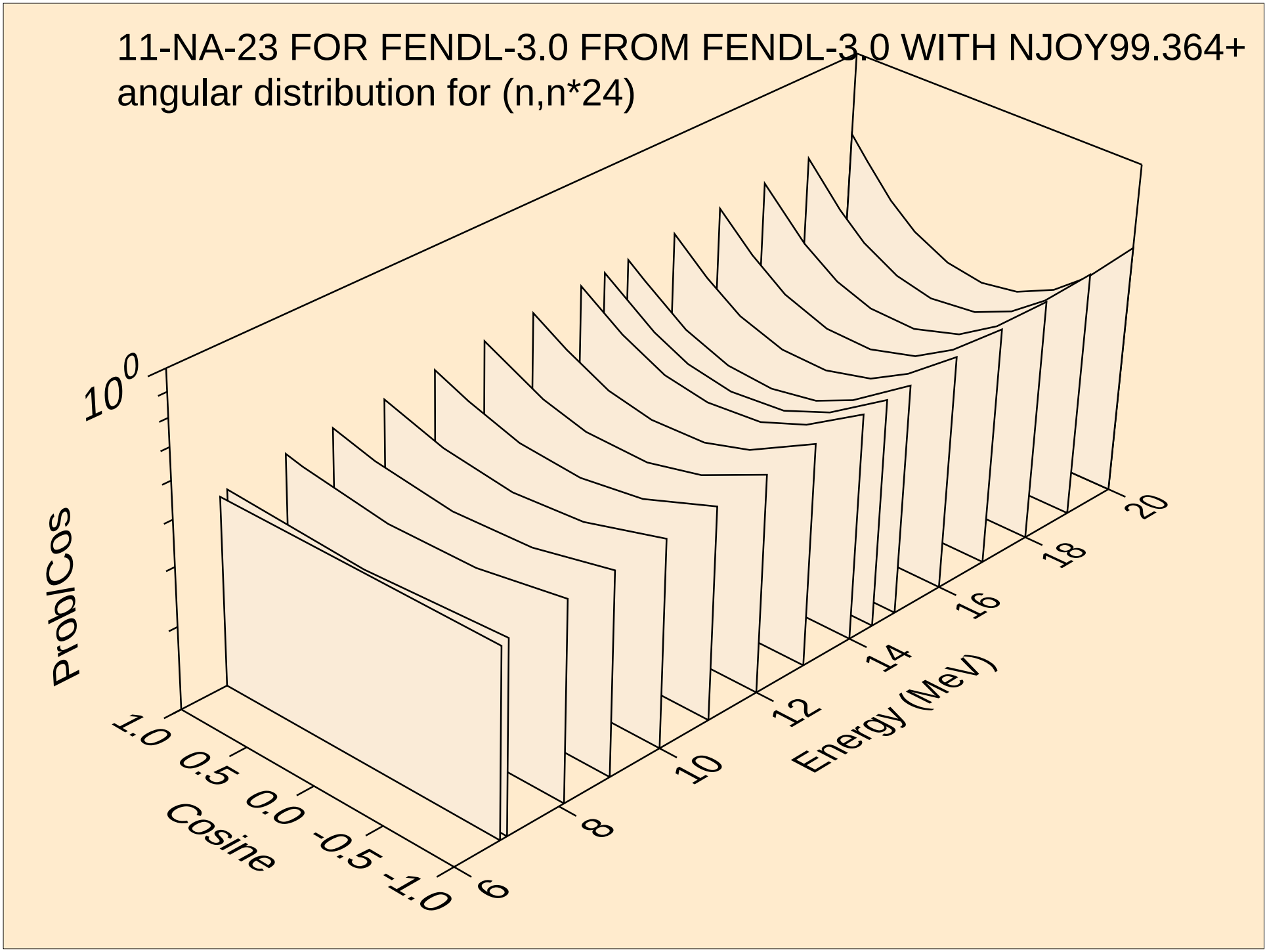

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*19)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

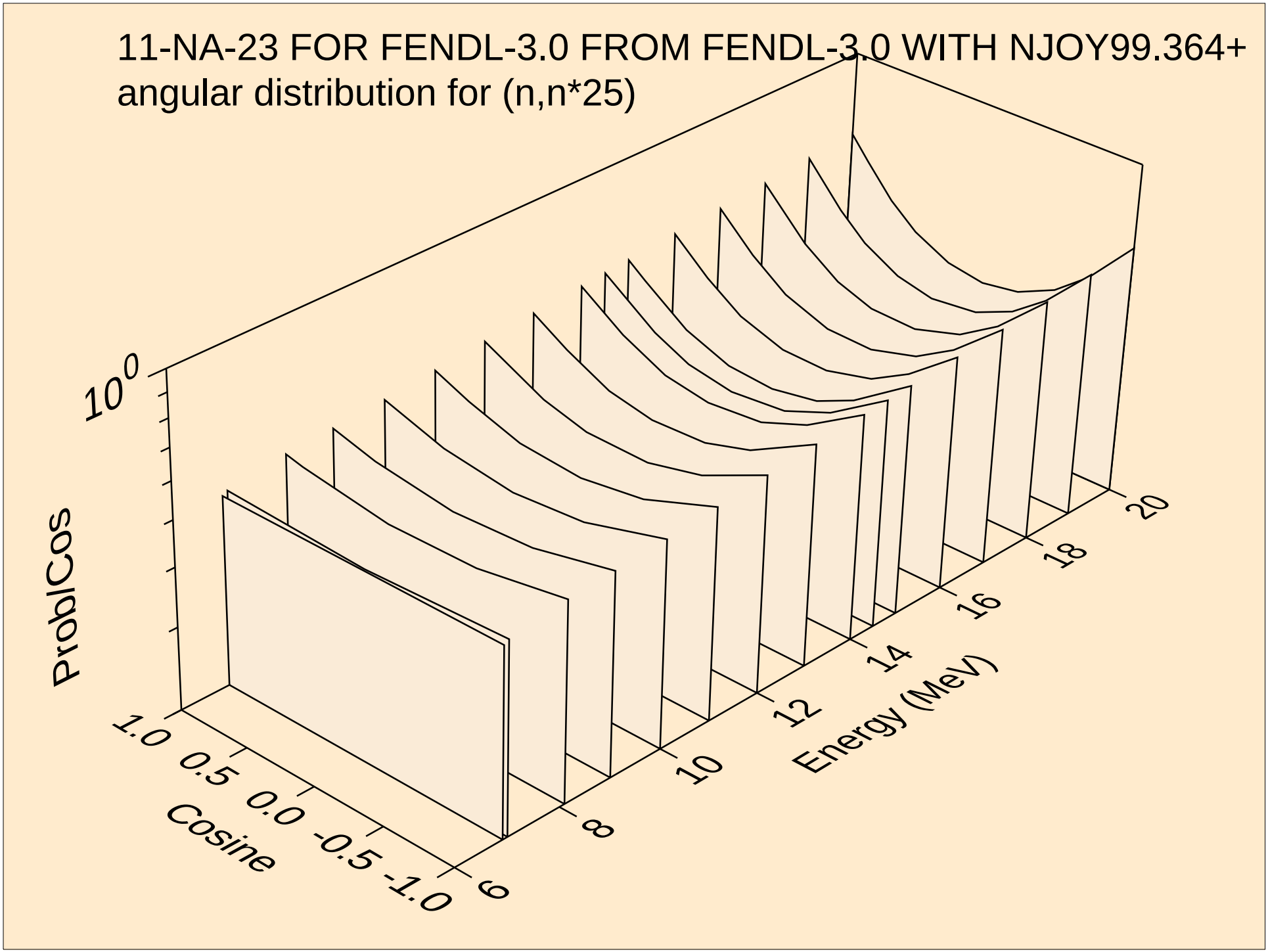

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*20)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

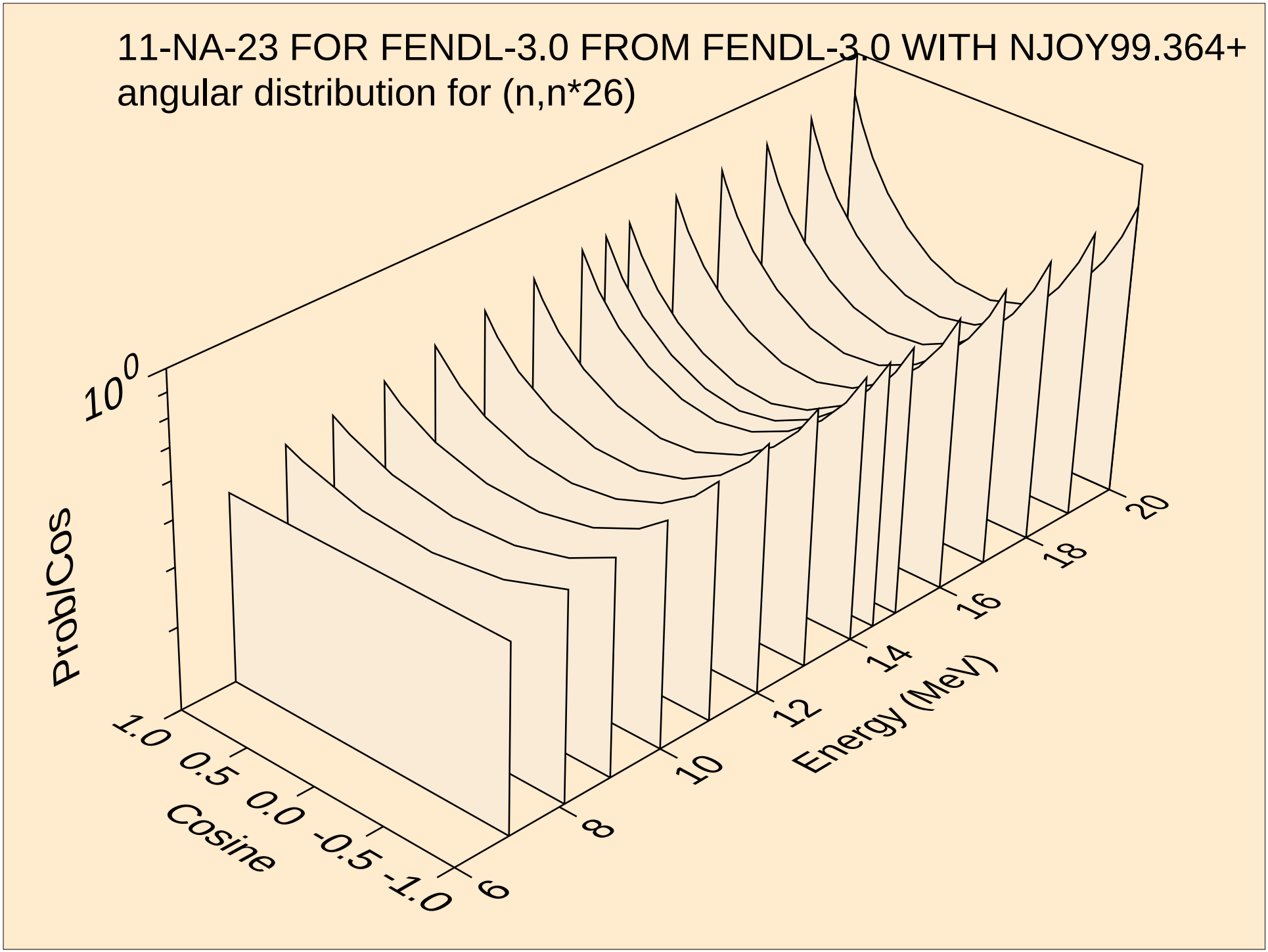

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*21)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

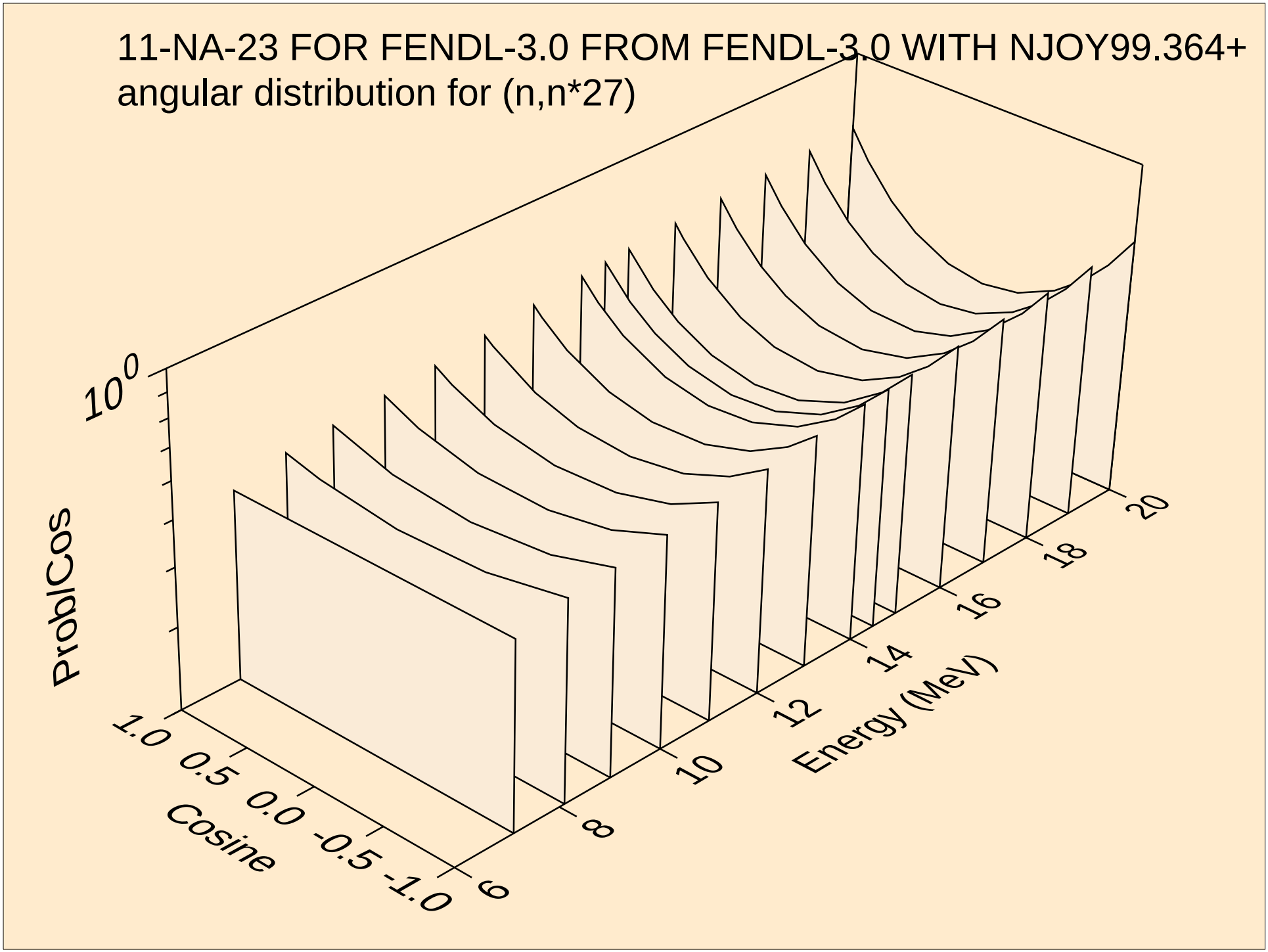

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*22)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

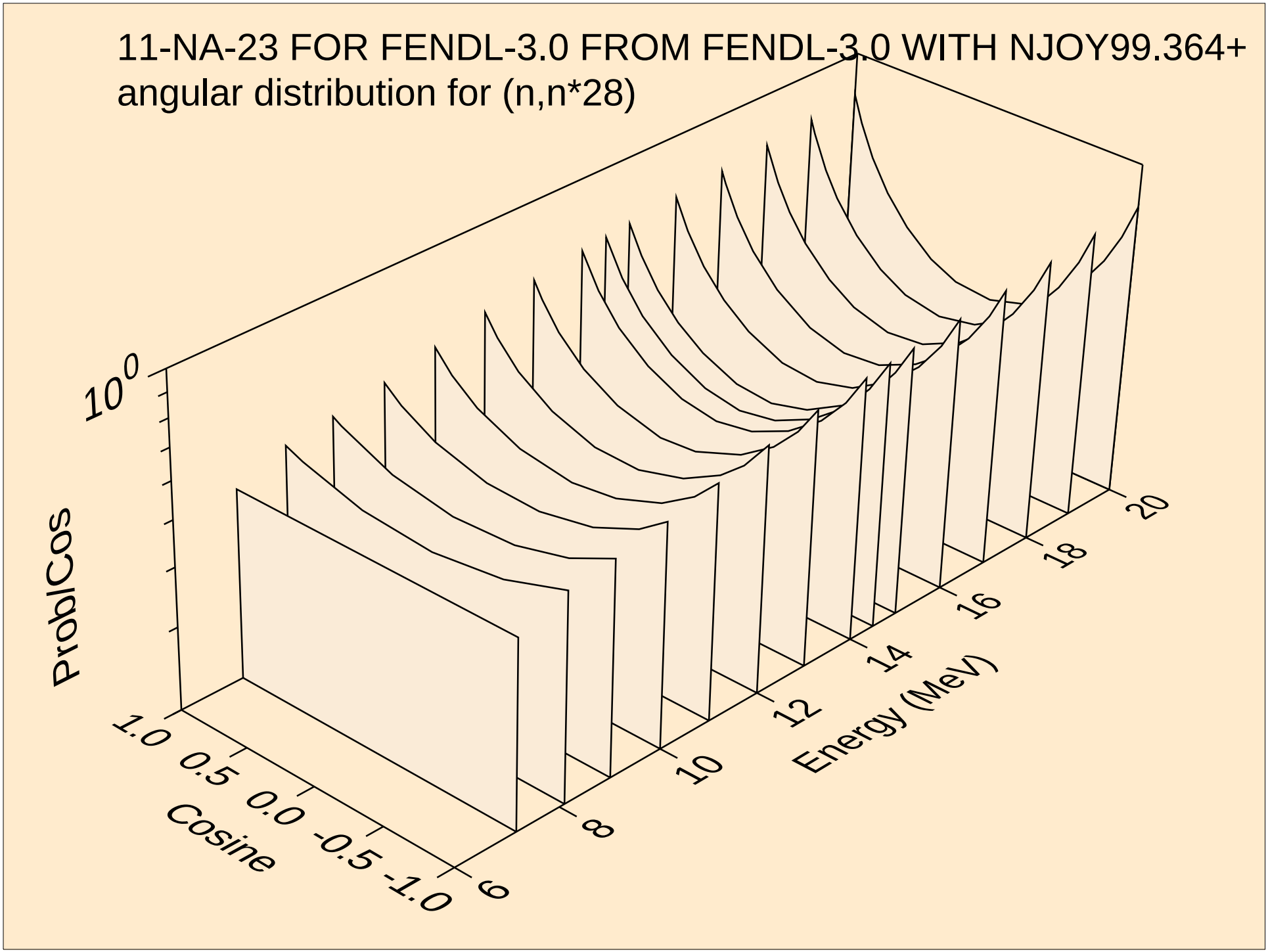

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*23)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

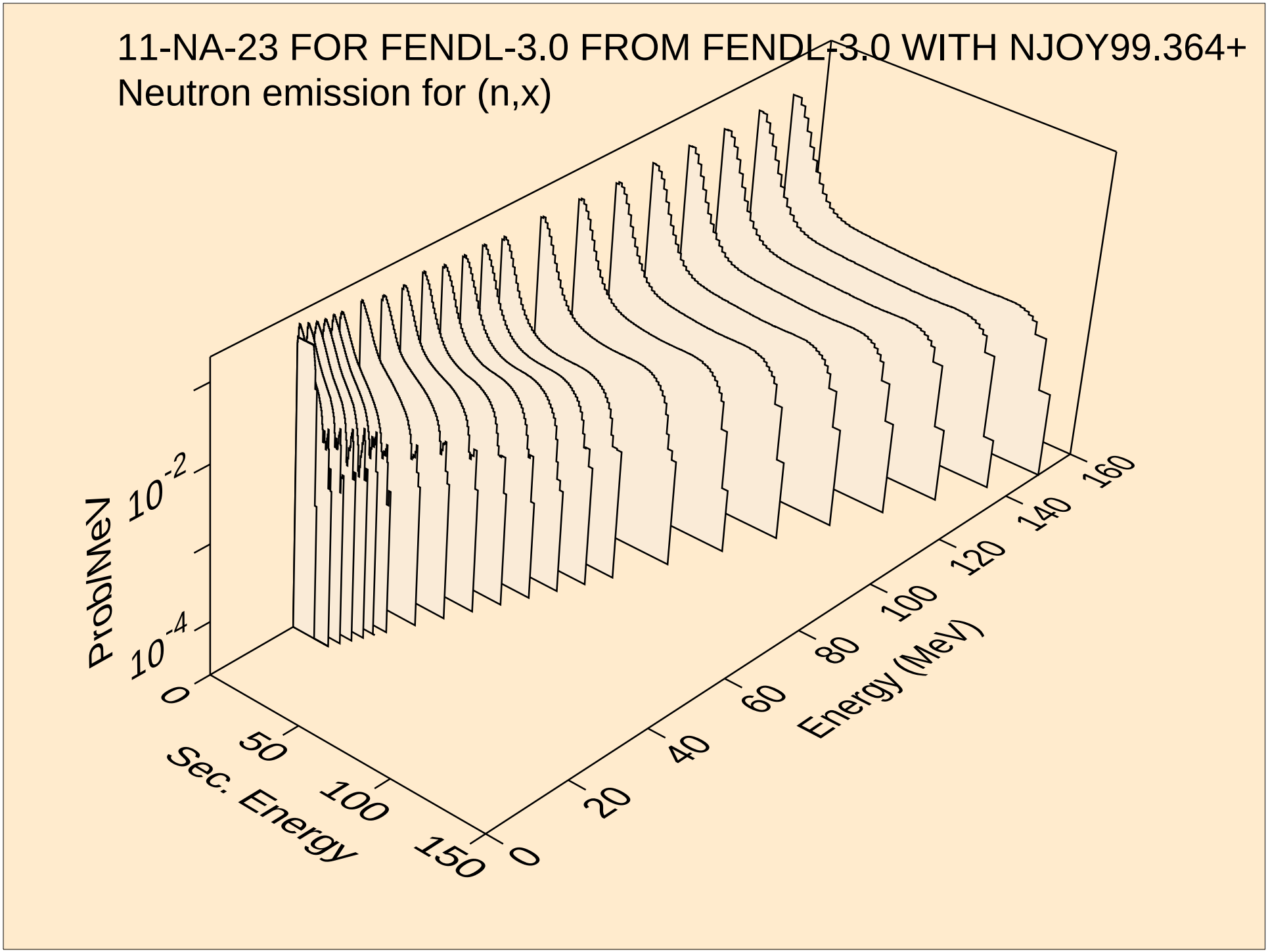

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*24)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

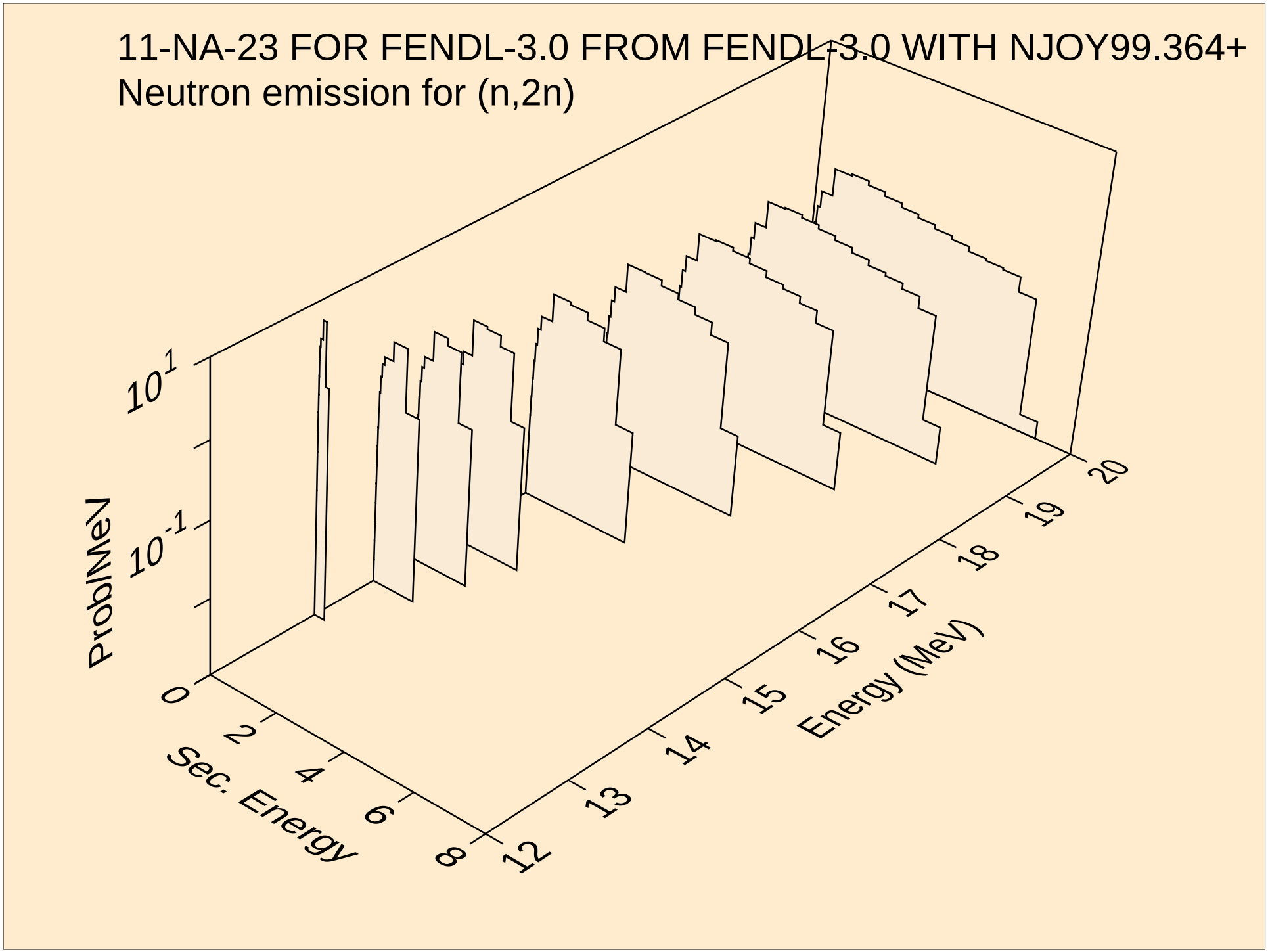

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*25)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

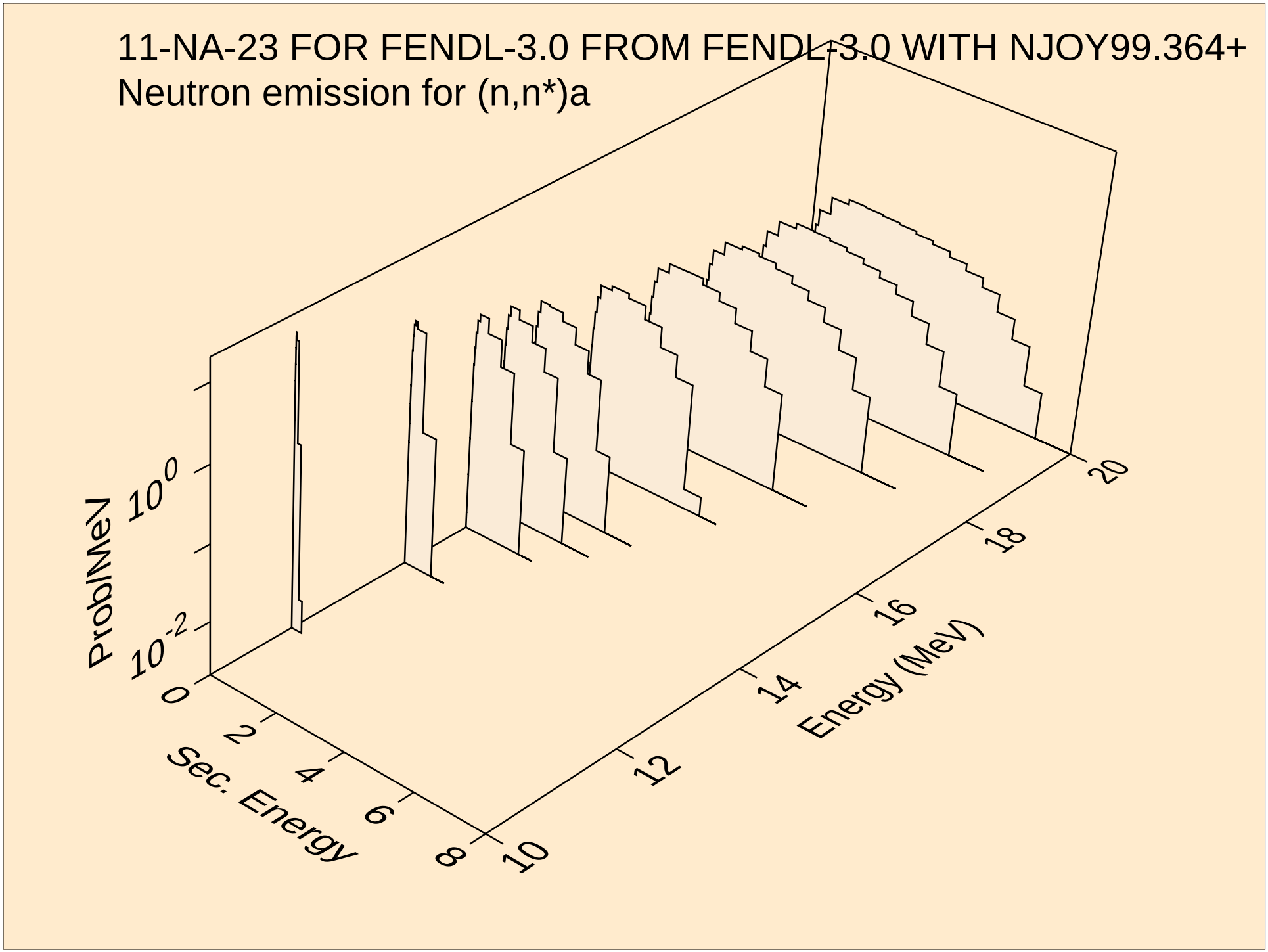

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*26)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

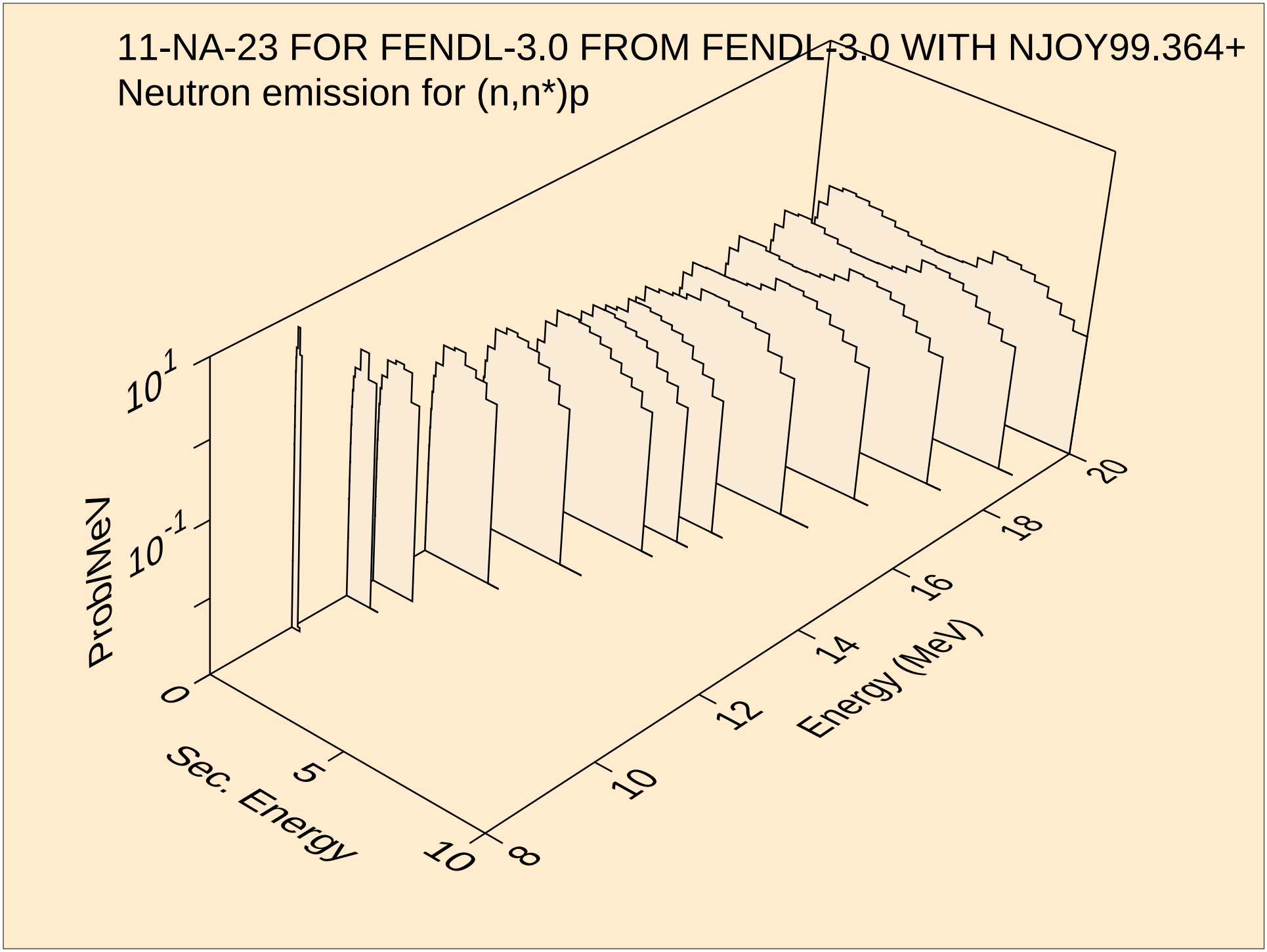

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*27)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

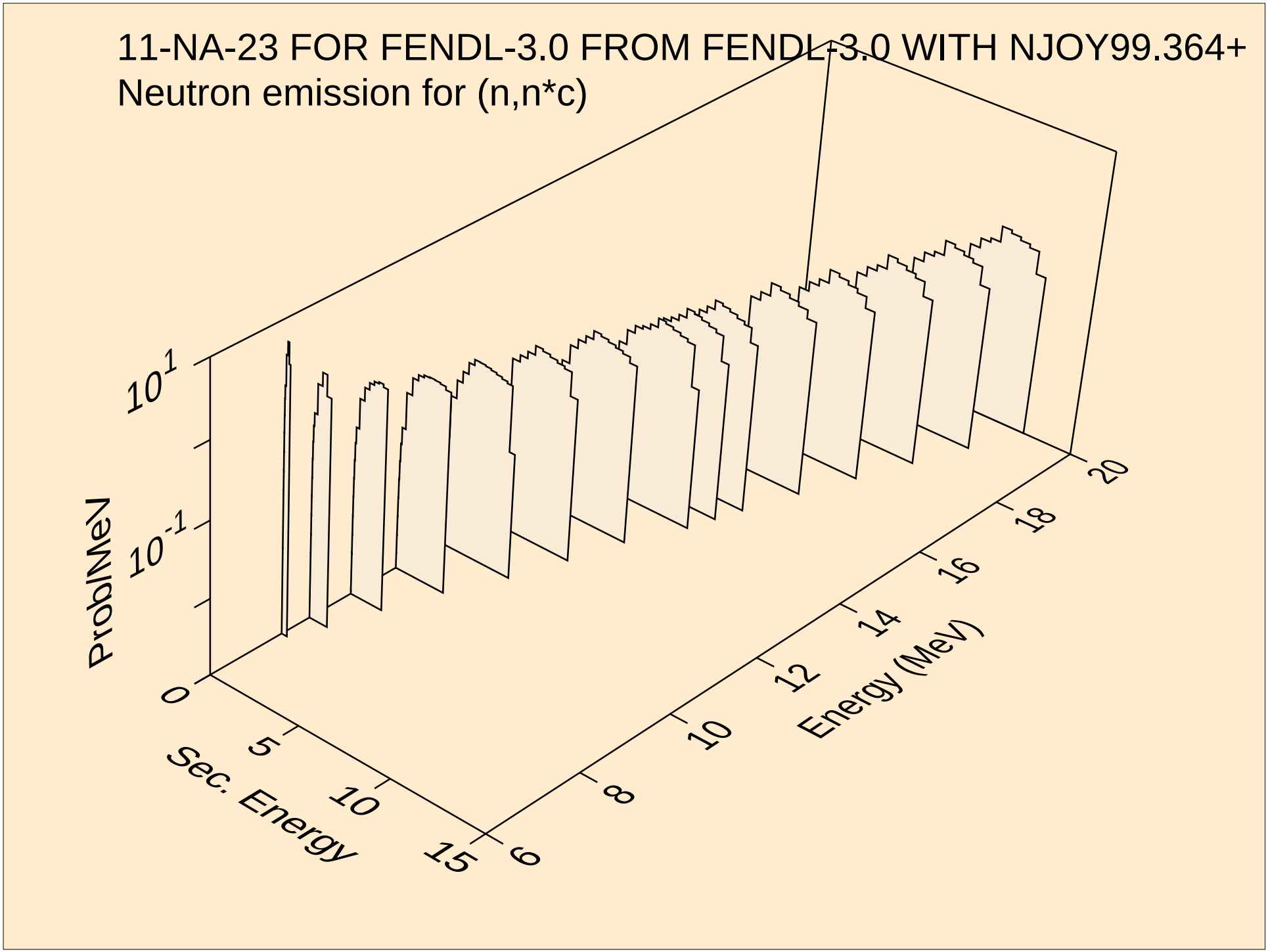

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
angular distribution for (n,n*28)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

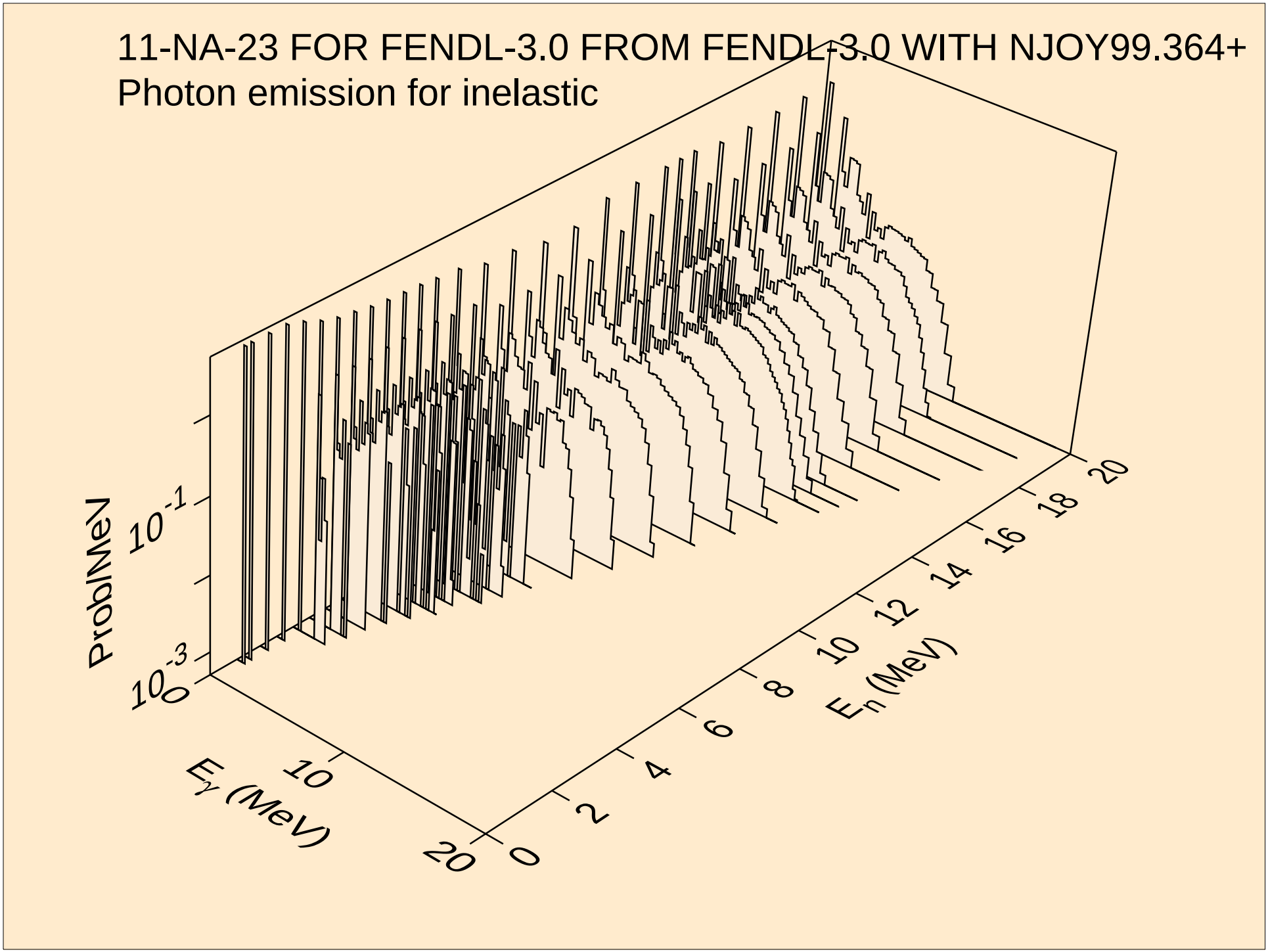

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Neutron emission for (n,x)
Prob/MeV
10-2
10-4
0
50
100
150
Sec. Energy
0
20
40
60
80
100
120
140
160
Energy (MeV)

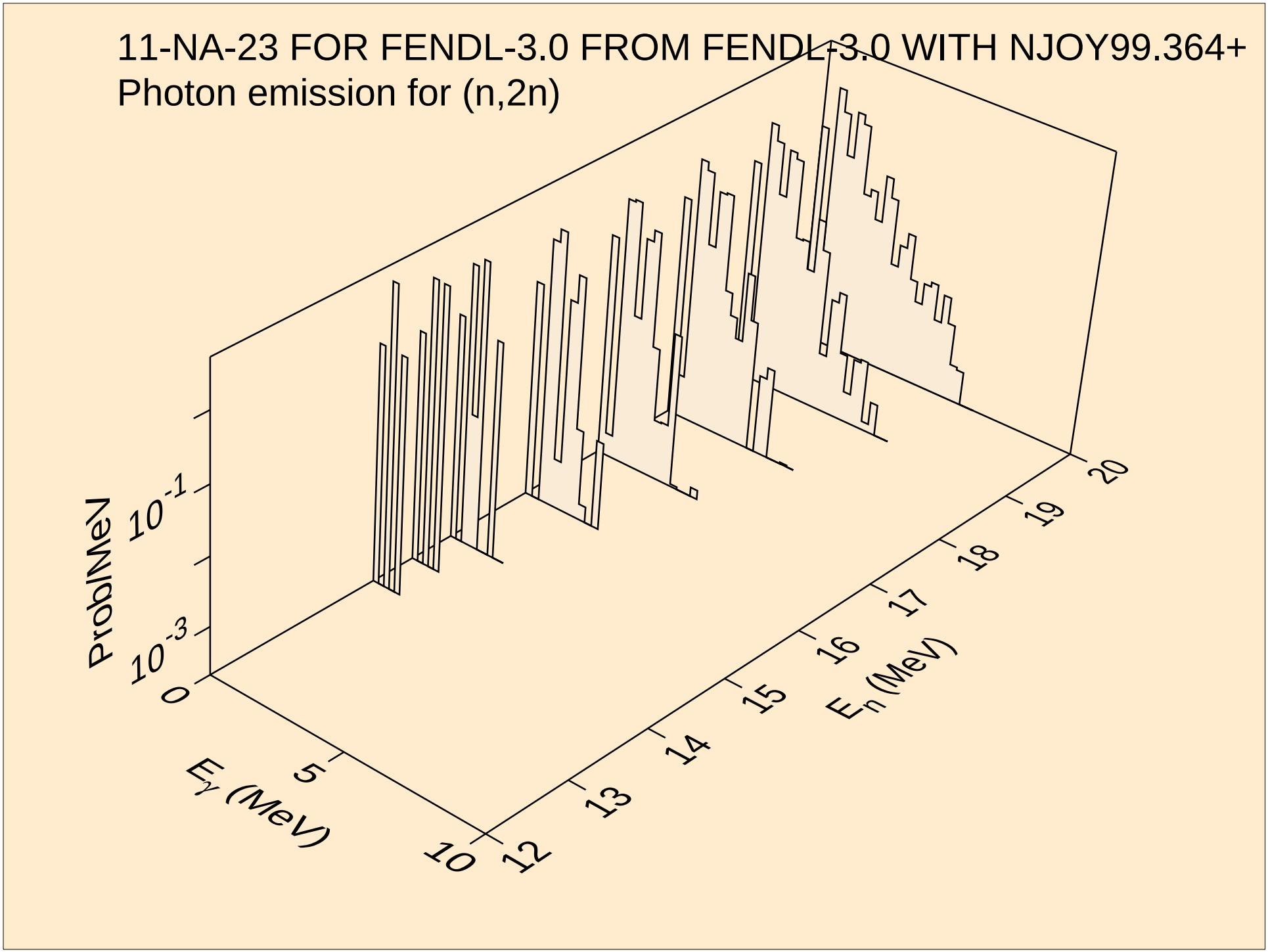

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Neutron emission for (n,2n)
Prob/MeV
10^{1}
10^{-1}
0
2
4
6
8
Sec. Energy
12
13
14
15
16
17
18
19
20
Energy (MeV)

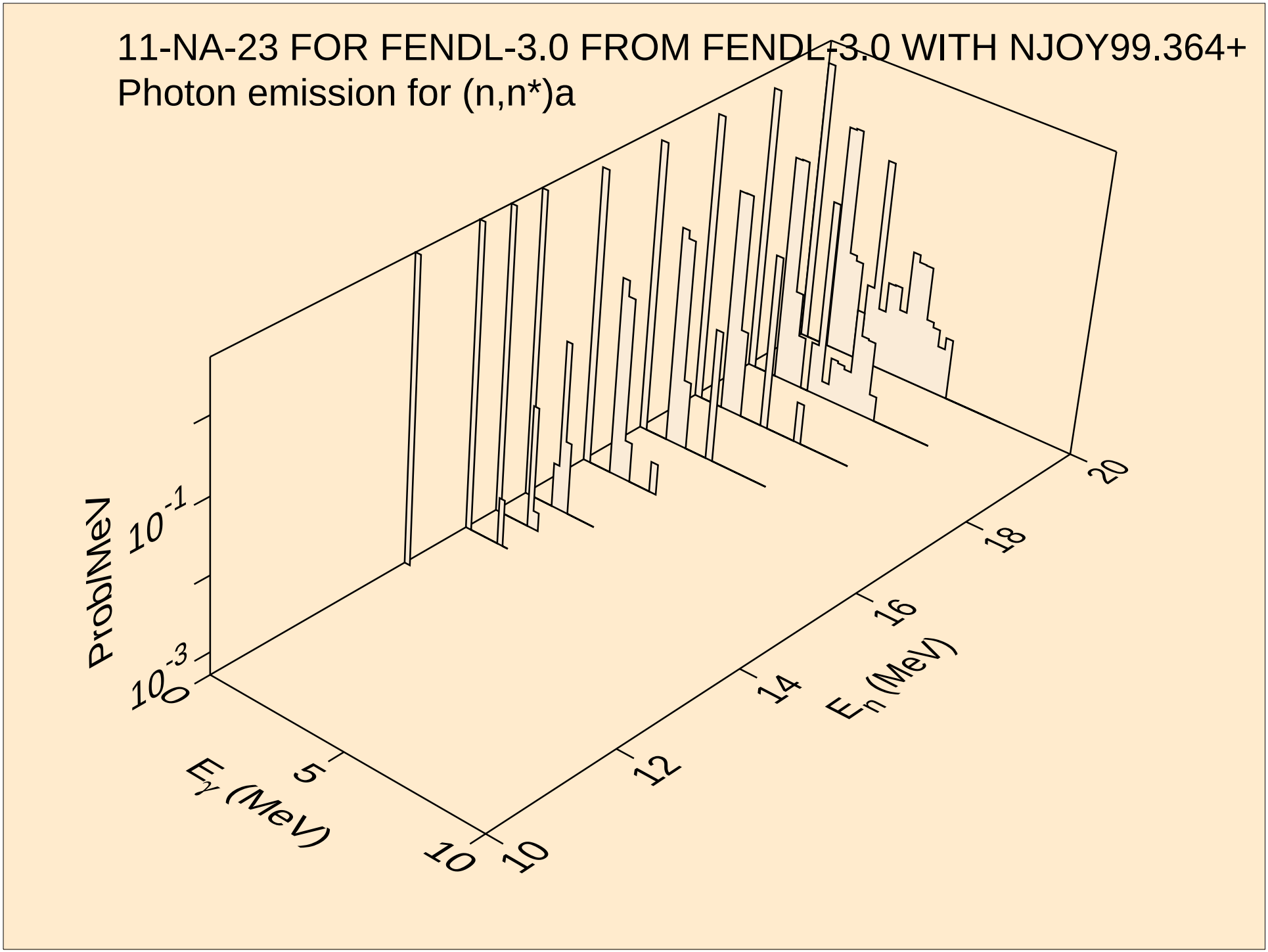

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Neutron emission for (n,n*)a
Prob/MeV
10^0
10^-2
0
2
4
6
8
10
Sec. Energy
12
14
16
18
20
Energy (MeV)

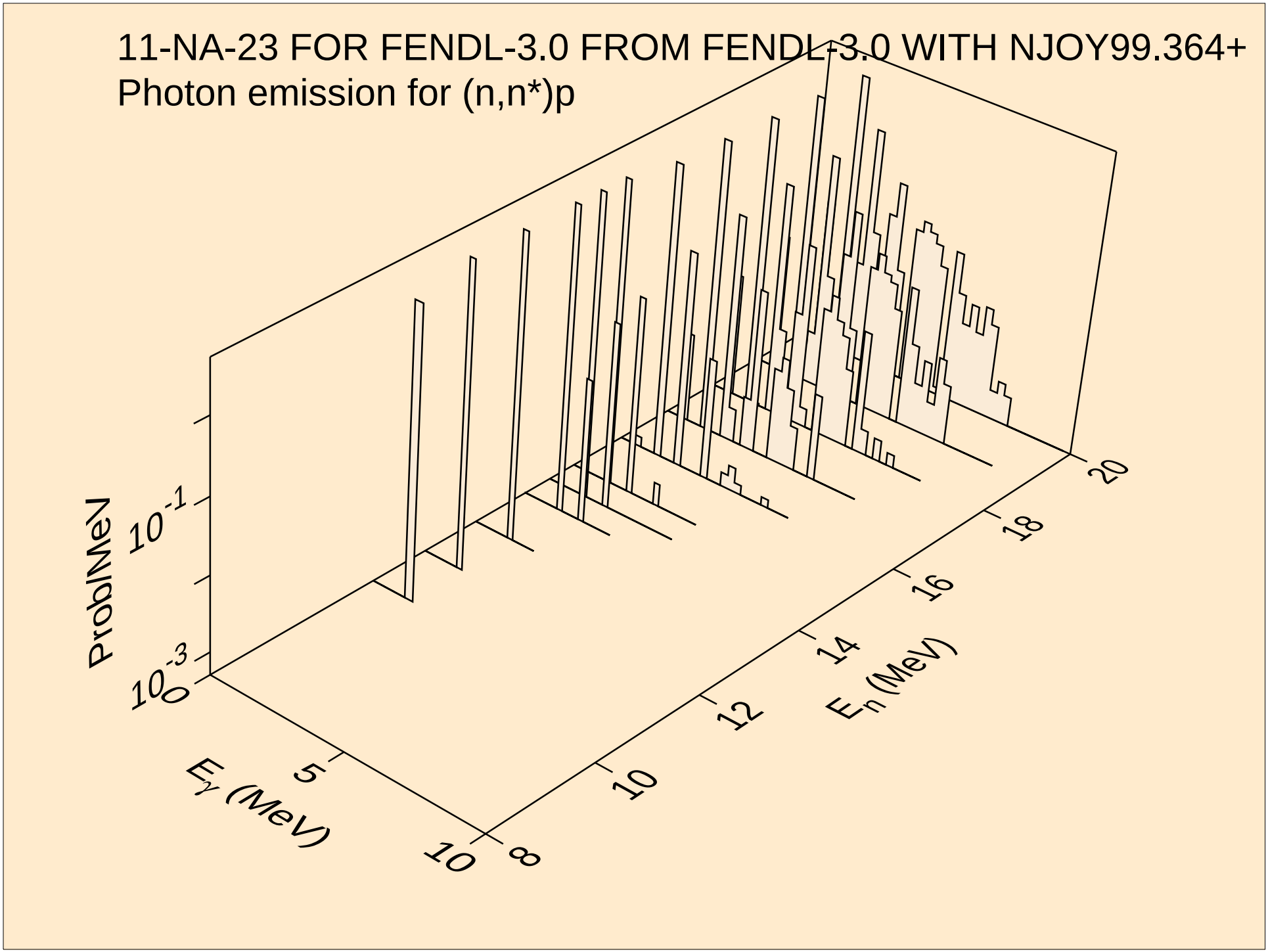

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Neutron emission for (n,n*)p
Prob/MeV
10^1
10^-1
0
Sec. Energy
5
10
8
10
12
14
16
18
20
Energy (MeV)

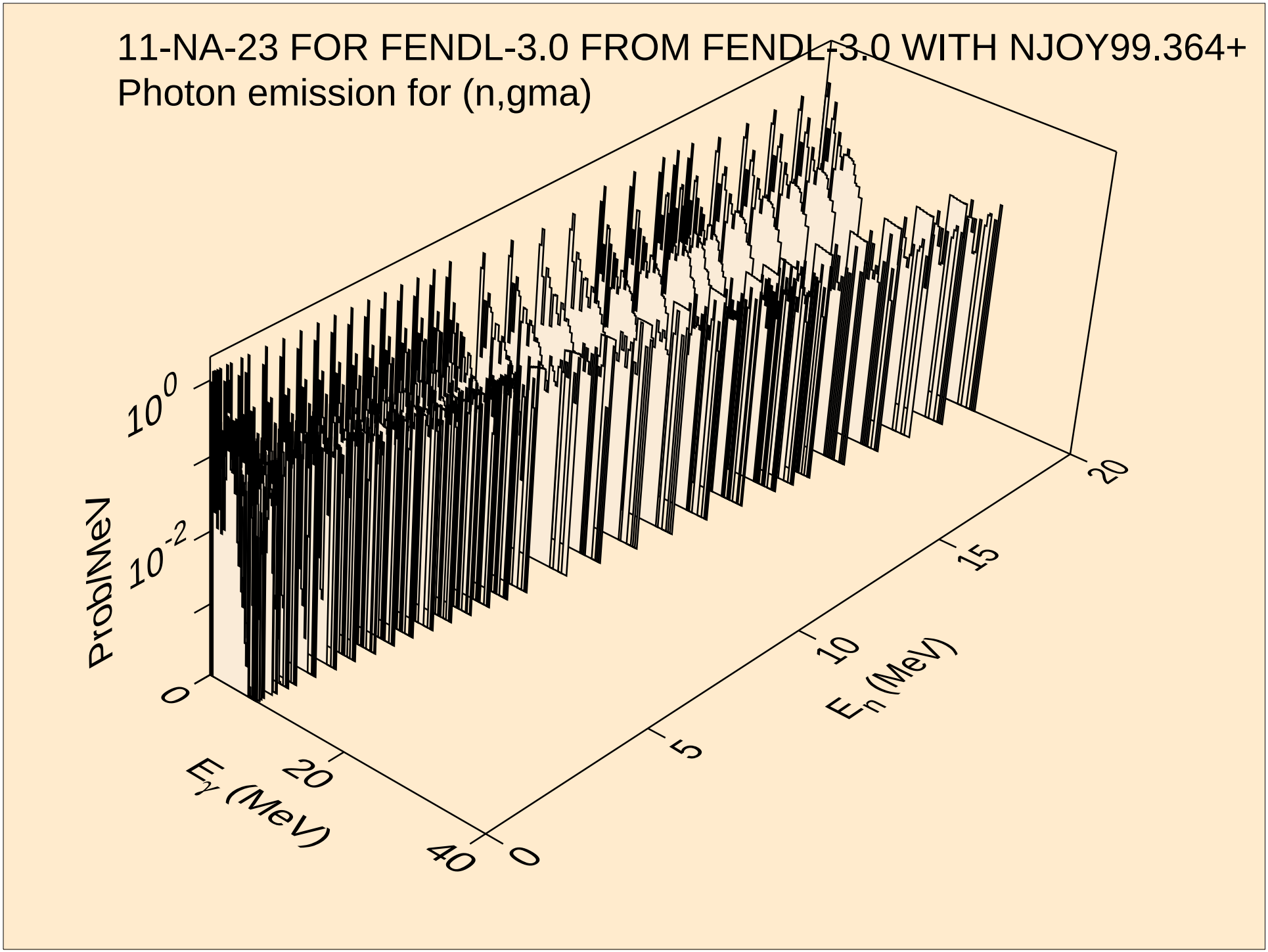

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Neutron emission for (n,n*c)
Prob/MeV
10^1
10^-1
0
Sec. Energy
5
10
15
Energy (MeV)
6
8
10
12
14
16
18
20

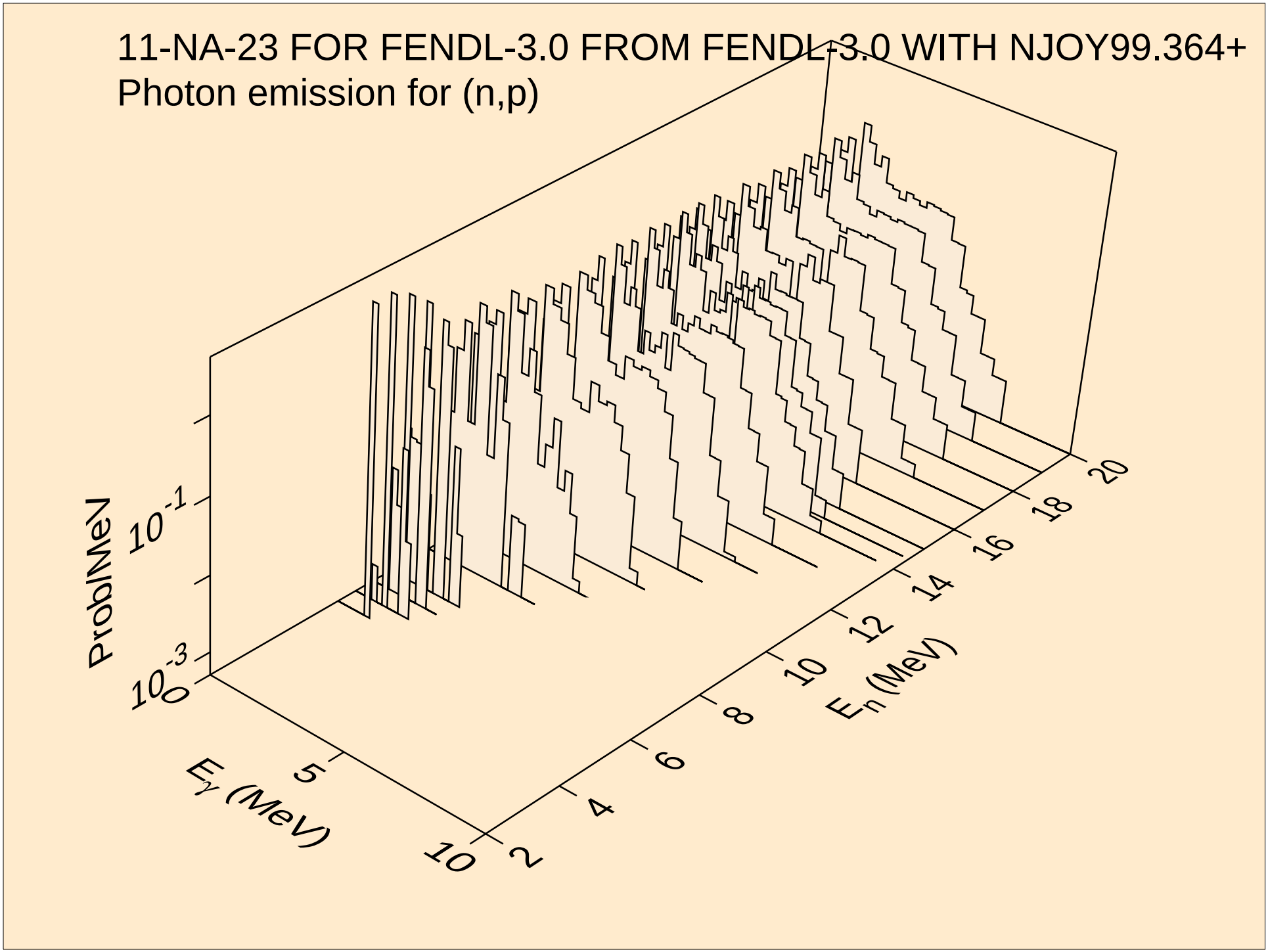

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Photon emission for inelastic
Prob/MeV
10-1
10-3
0
10
20
Eγ (MeV)
0
2
4
6
8
10
12
14
16
18
20
En (MeV)

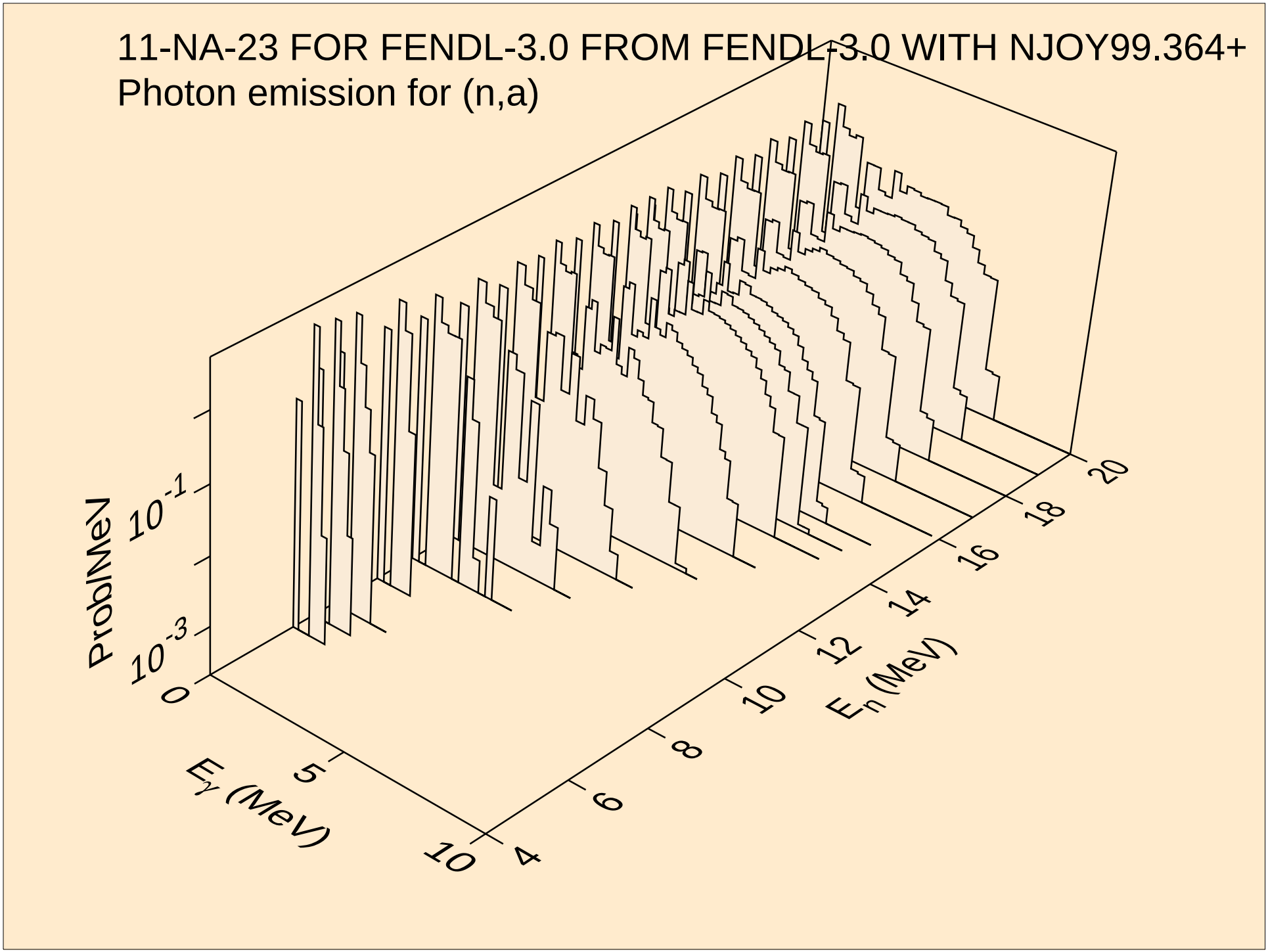

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Photon emission for (n,2n)
Prob/MeV
10-1
10-3
0
5
10
Eγ (MeV)
12
13
14
15
16
17
18
19
20
En (MeV)

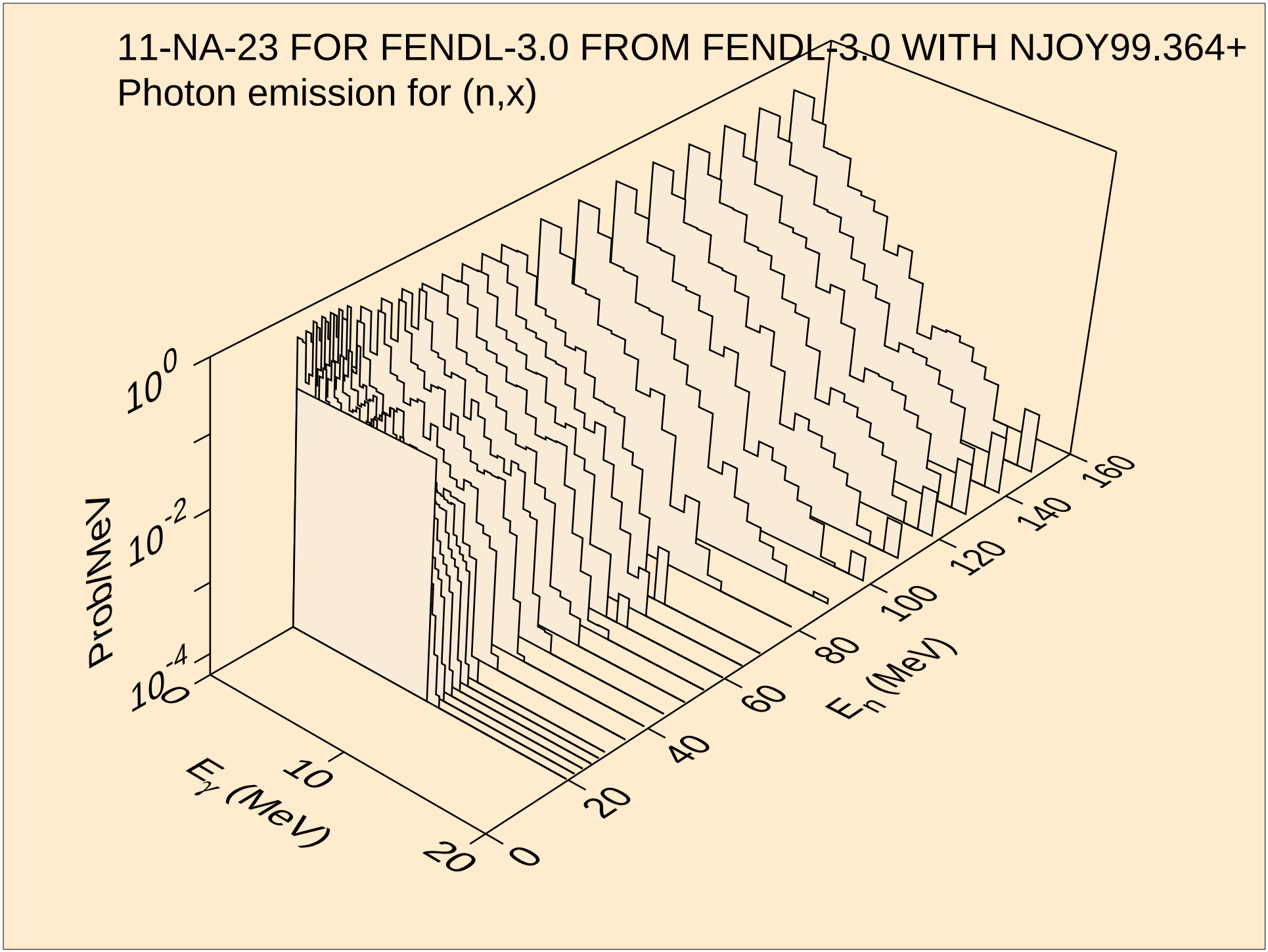

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Photon emission for (n,n*)a
Prob/MeV
10-1
10-3
0
5
10
Eγ (MeV)
10
12
14
16
18
20
En (MeV)

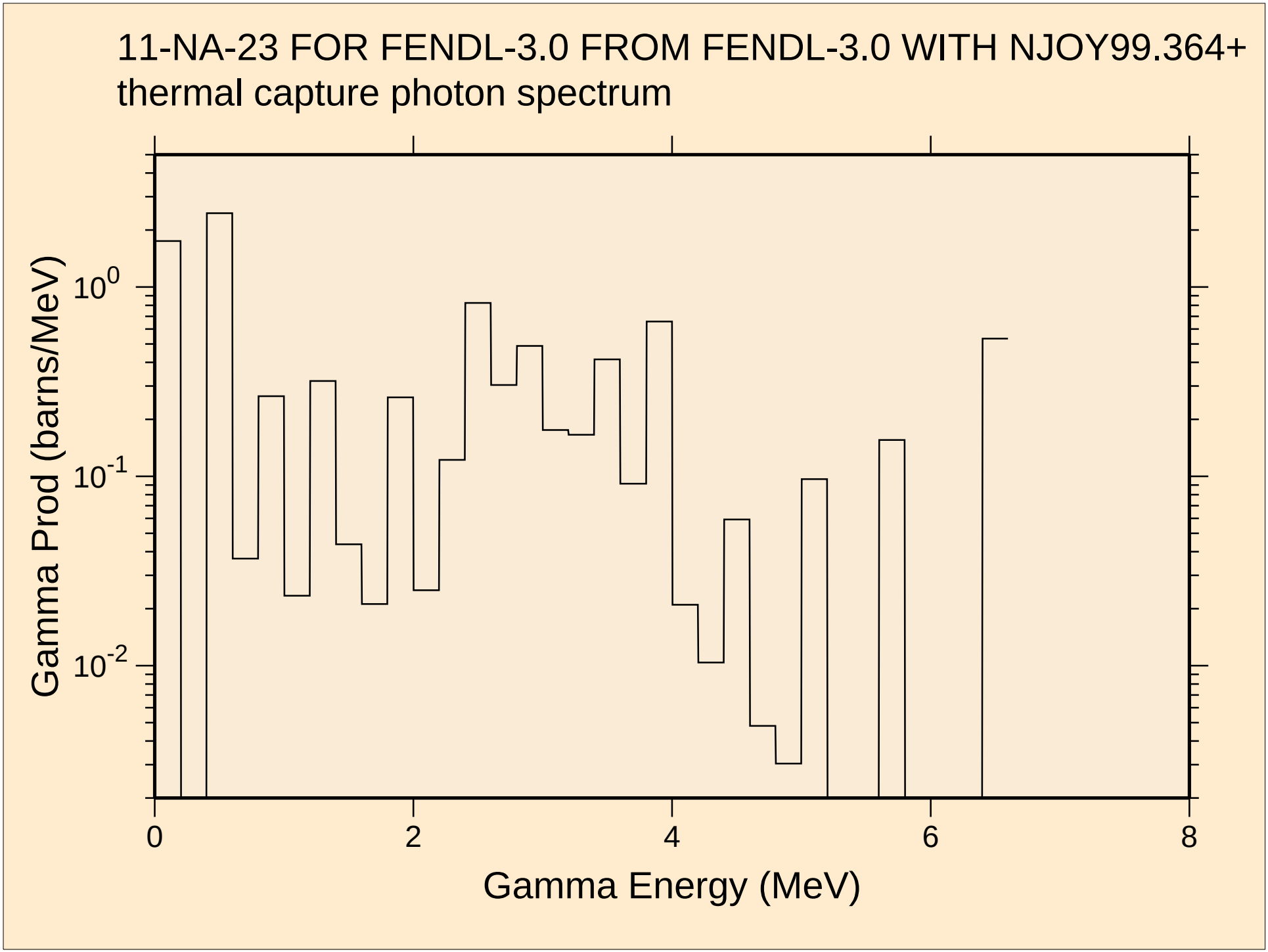

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Photon emission for (n,n*)p
Prob/MeV
10^-1
10^-3
0
5
10
E_γ (MeV)
8
10
12
14
16
18
20
E_n (MeV)

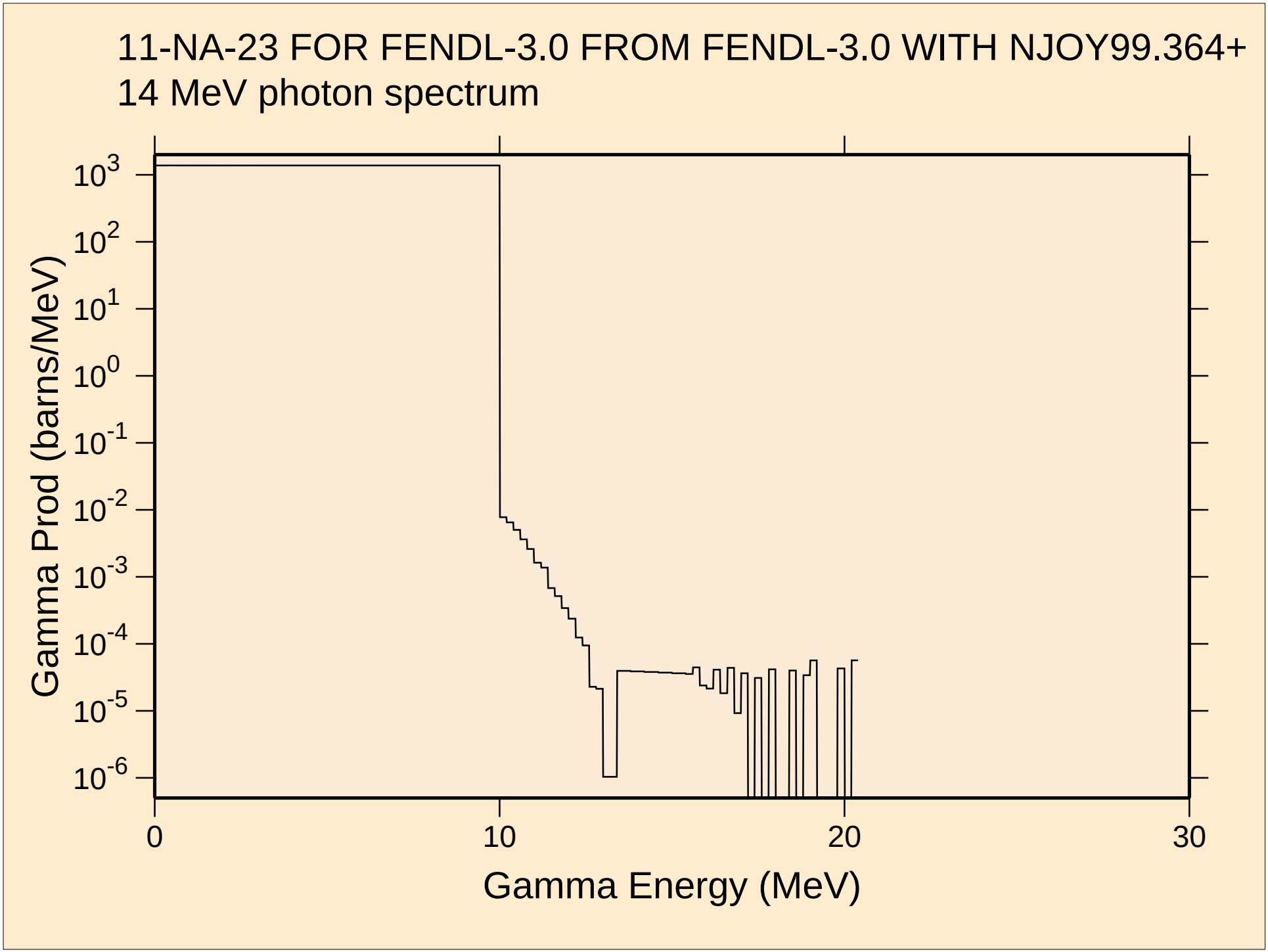

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Photon emission for (n,gma)
Prob/MeV
10^{0}
10^{-2}
0
20
40
E_γ (MeV)
0
5
10
15
20
E_n (MeV)

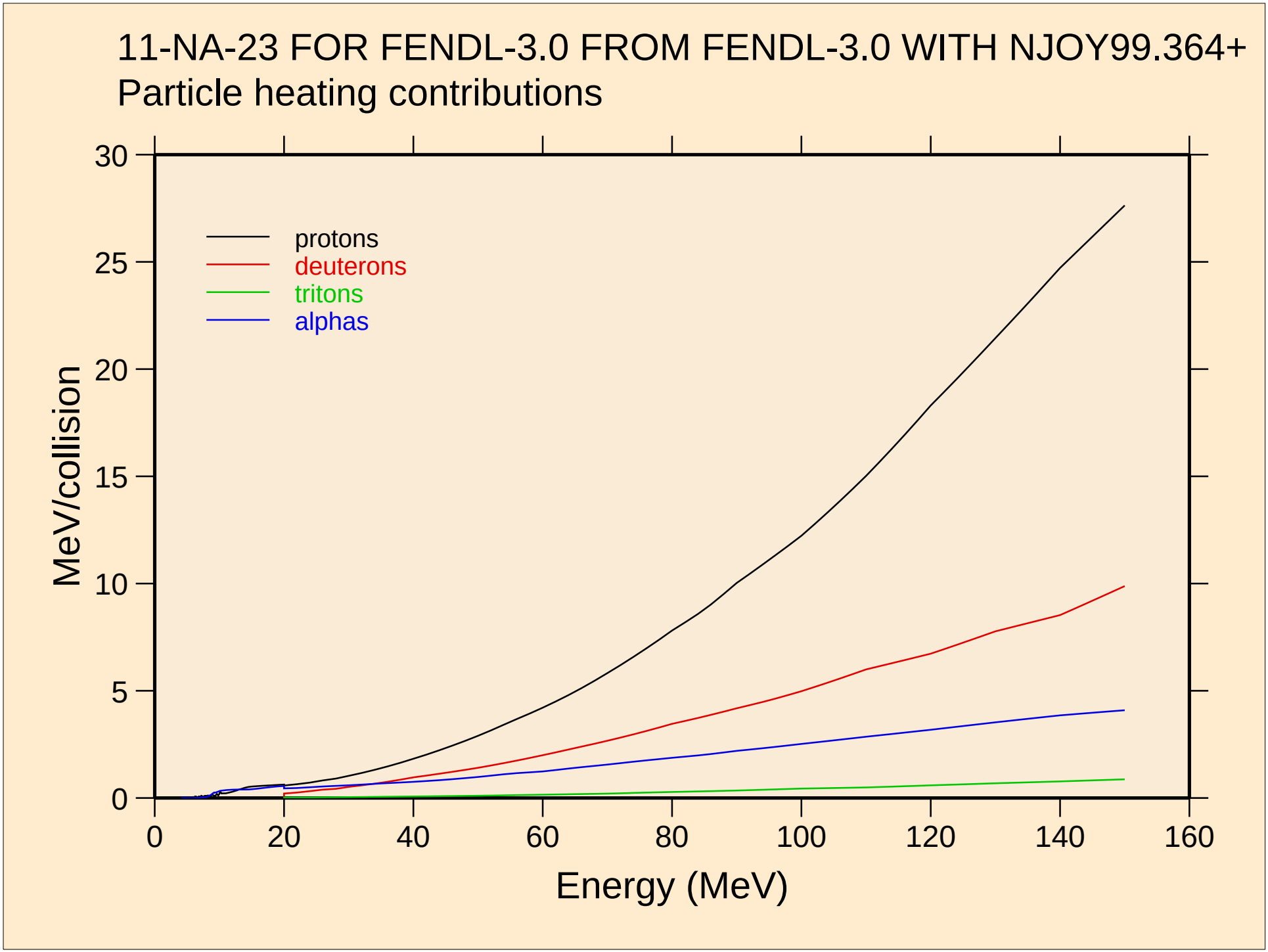

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Photon emission for (n,p)
Prob/MeV
10-1
10-3
0
5
Eγ (MeV)
10
2
4
6
8
10
12
14
16
18
20
En (MeV)

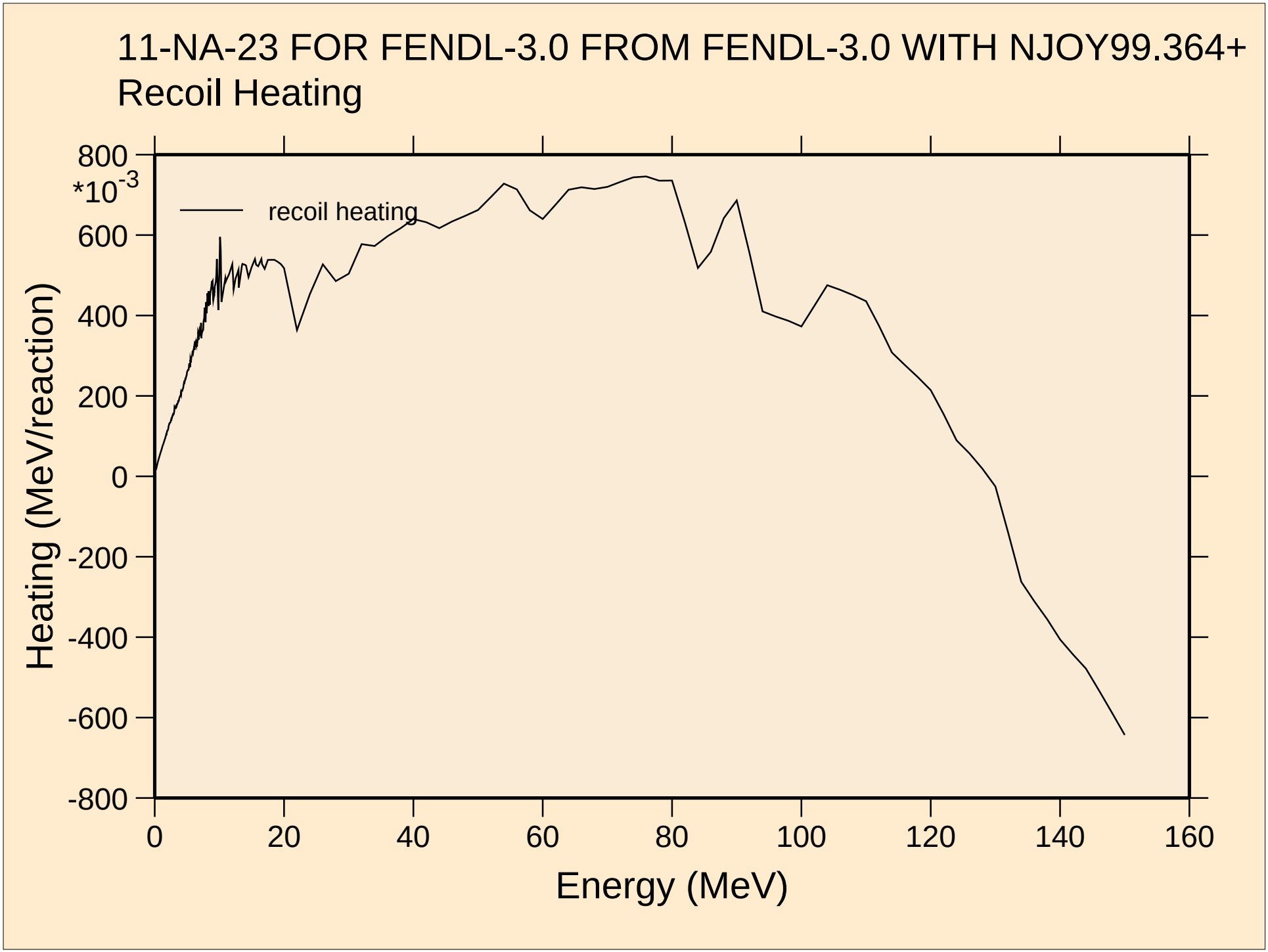

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Photon emission for (n,a)
Prob/MeV
10-1
10-3
0
Eγ (MeV)
5
10
En (MeV)
4
6
8
10
12
14
16
18
20

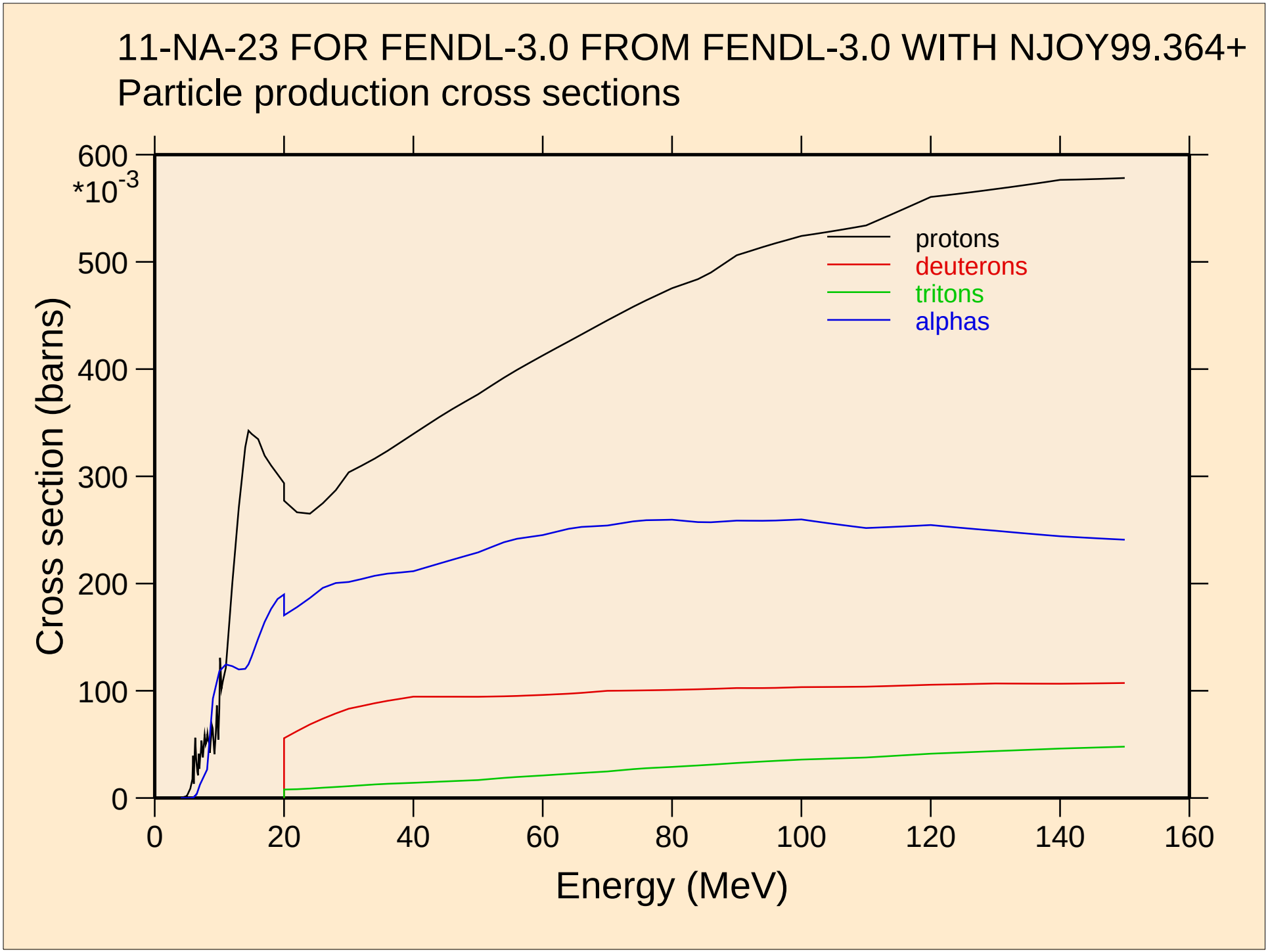

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Photon emission for (n,x)
Prob/MeV
10^{0}
10^{-2}
10^{-4}
E_γ (MeV)
0
10
20
E_n (MeV)
0
20
40
60
80
100
120
140
160

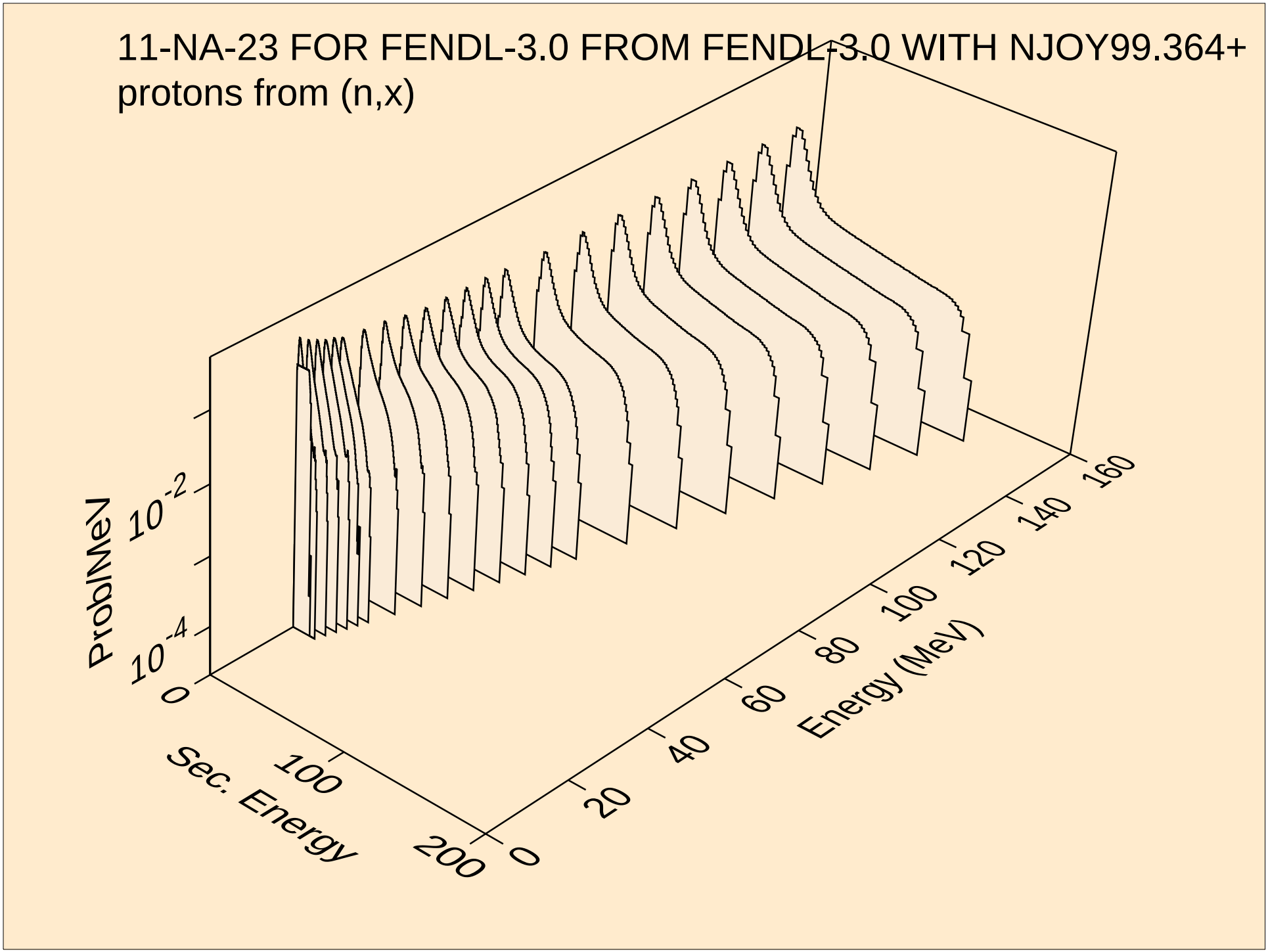

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
thermal capture photon spectrum
Gamma Prod (barns/MeV)
10^0
10^-1
10^-2
0
2
4
6
8
Gamma Energy (MeV)

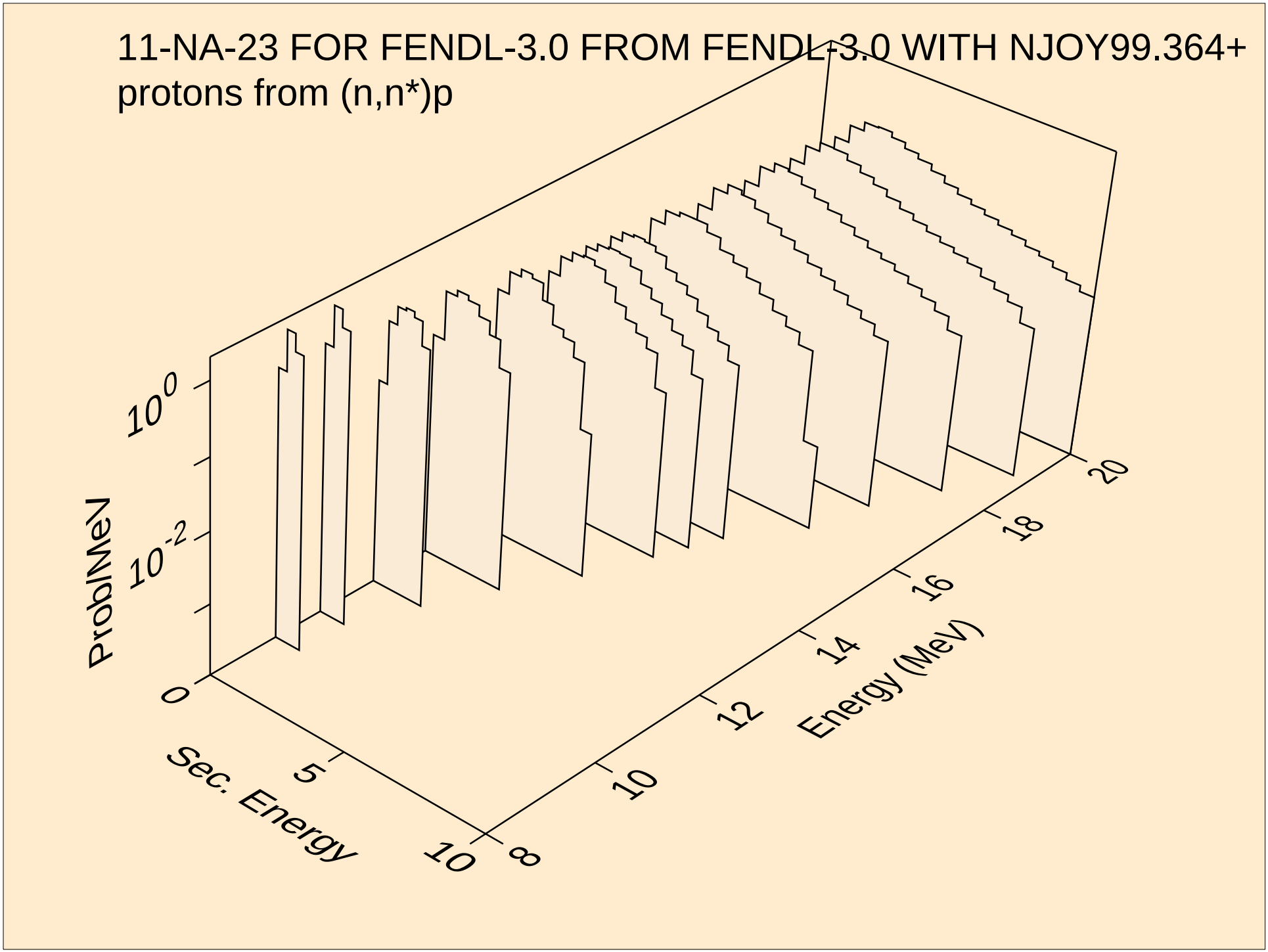

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
14 MeV photon spectrum
Gamma Prod (barns/MeV)
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
0
10
20
30
Gamma Energy (MeV)

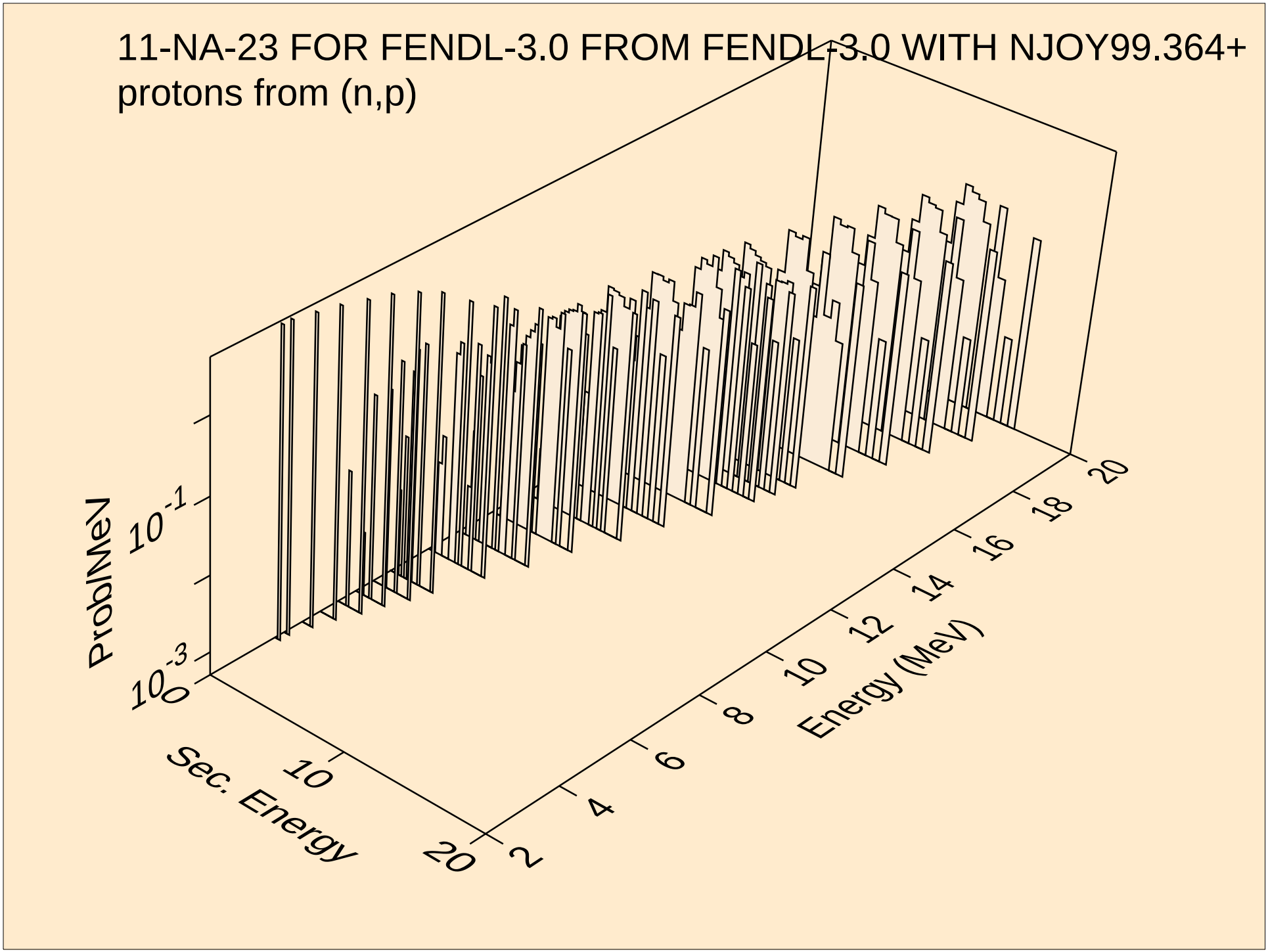

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Particle heating contributions
protons
deuterons
tritons
alphas
MeV/collision
Energy (MeV)
0
5
10
15
20
25
30
0
20
40
60
80
100
120
140
160

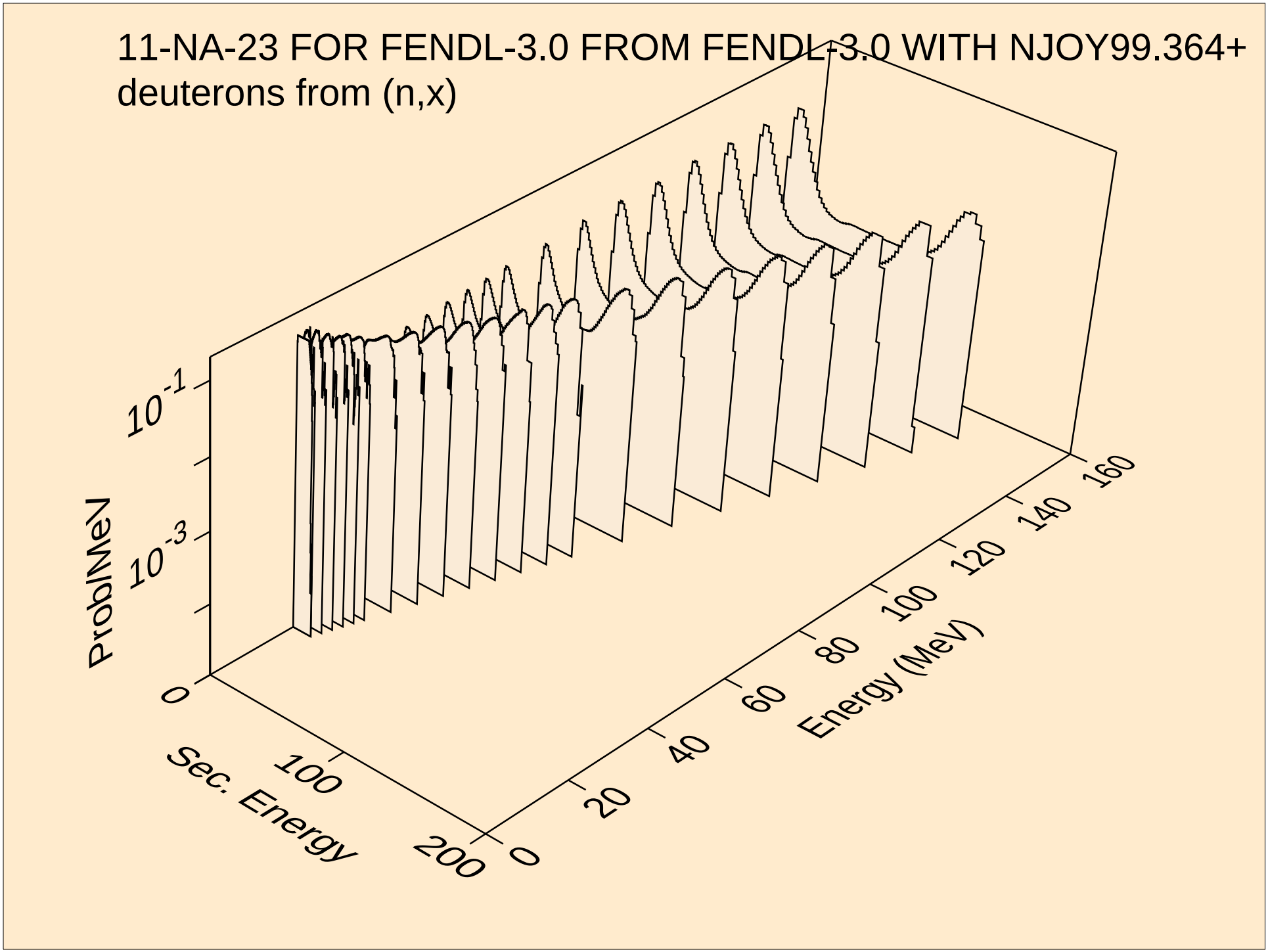

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Recoil Heating
recoil heating
*10-3
800
600
400
200
0
-200
-400
-600
-800
Heating (MeV/reaction)
0
20
40
60
80
100
120
140
160
Energy (MeV)

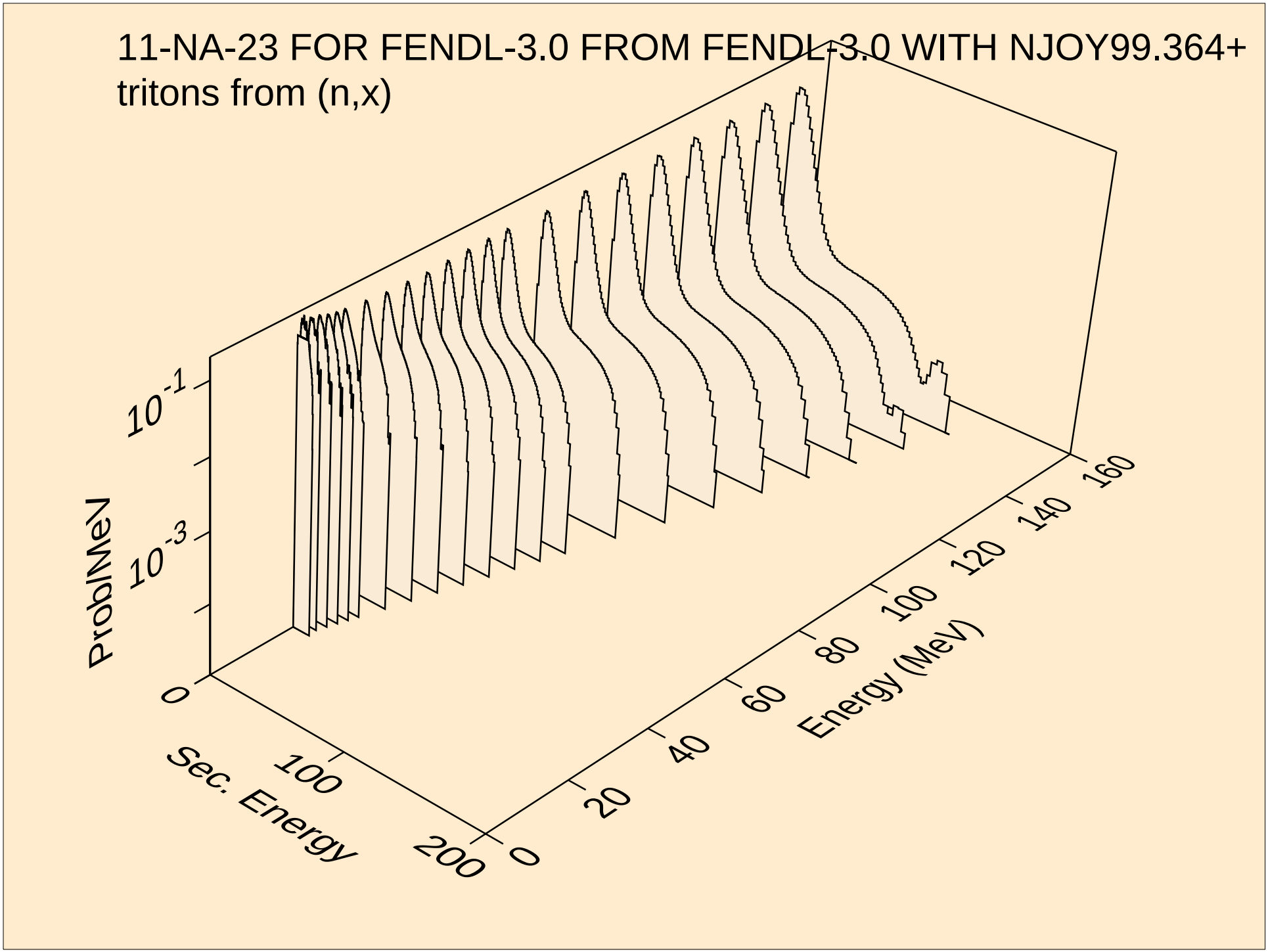

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
Particle production cross sections
Cross section (barns)
*10-3
600
500
400
300
200
100
0
0
20
40
60
80
100
120
140
160
Energy (MeV)
protons
deuterons
tritons
alphas

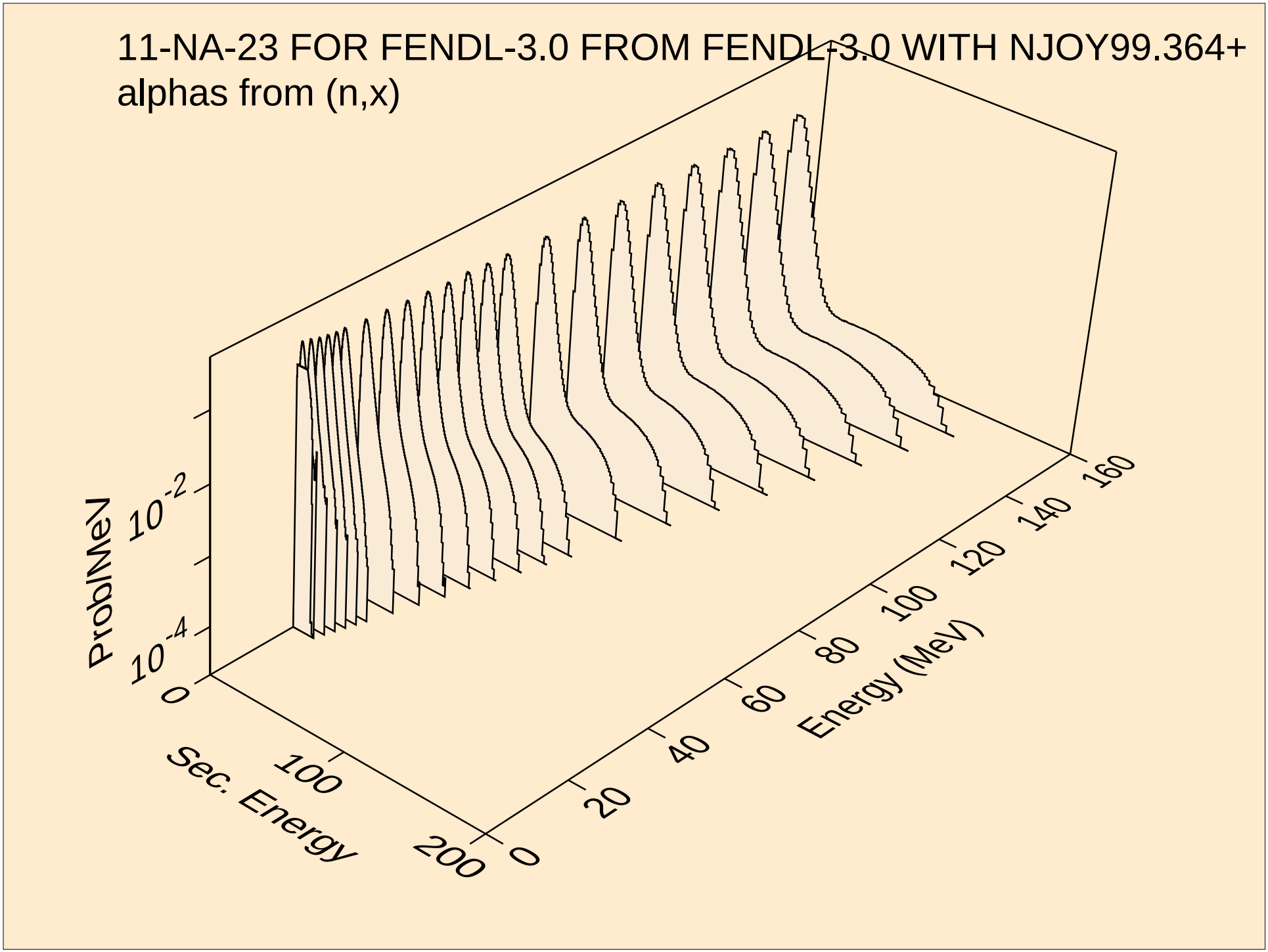

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
protons from (n,x)
Prob/MeV
10-2
10-4
0
Sec. Energy
100
200
0
20
40
60
80
100
120
140
160
Energy (MeV)

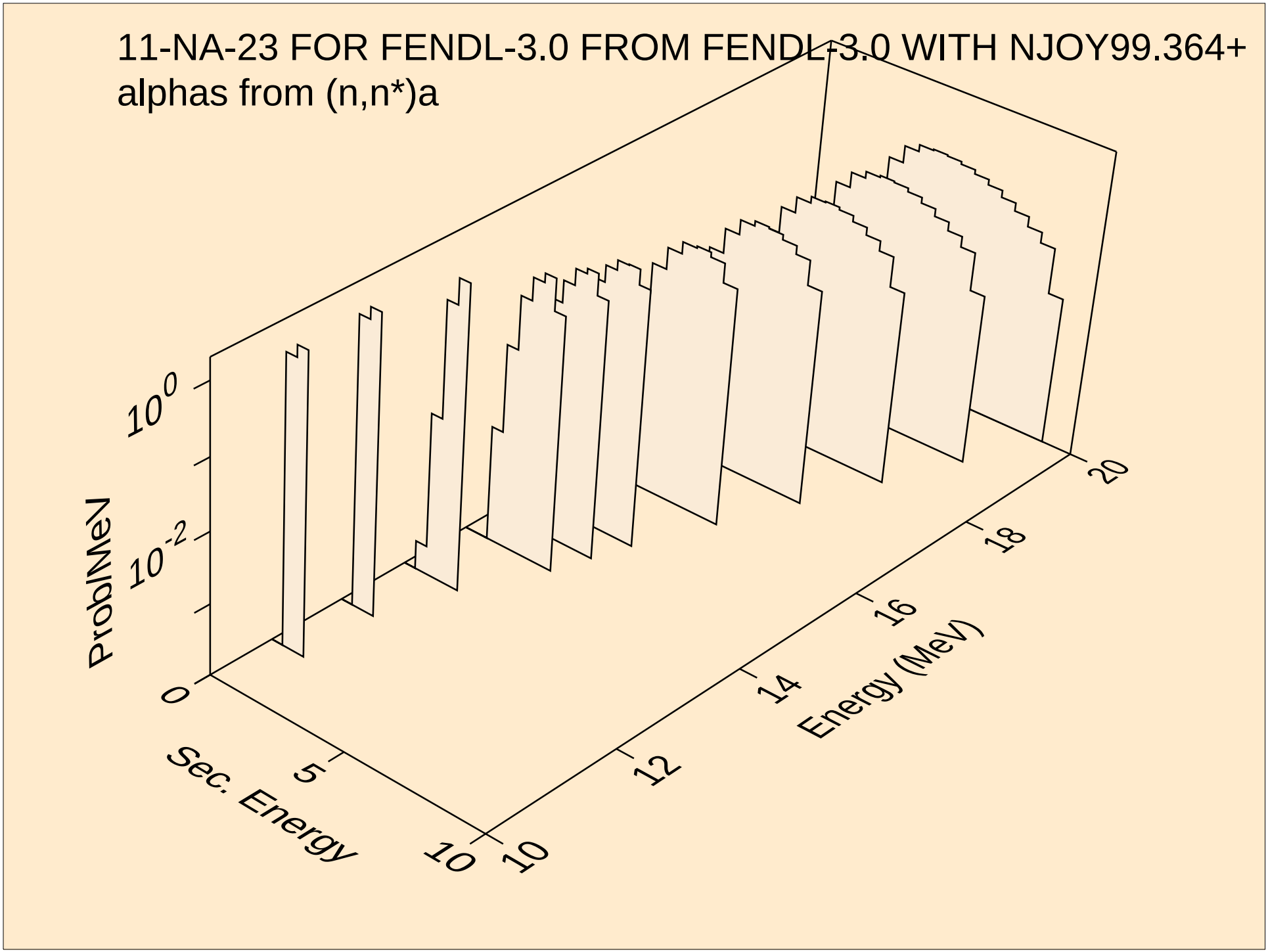

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
protons from (n,n*)p
Prob/MeV
10^0
10^-2
0
Sec. Energy
5
10
8
10
12
14
16
18
20
Energy (MeV)

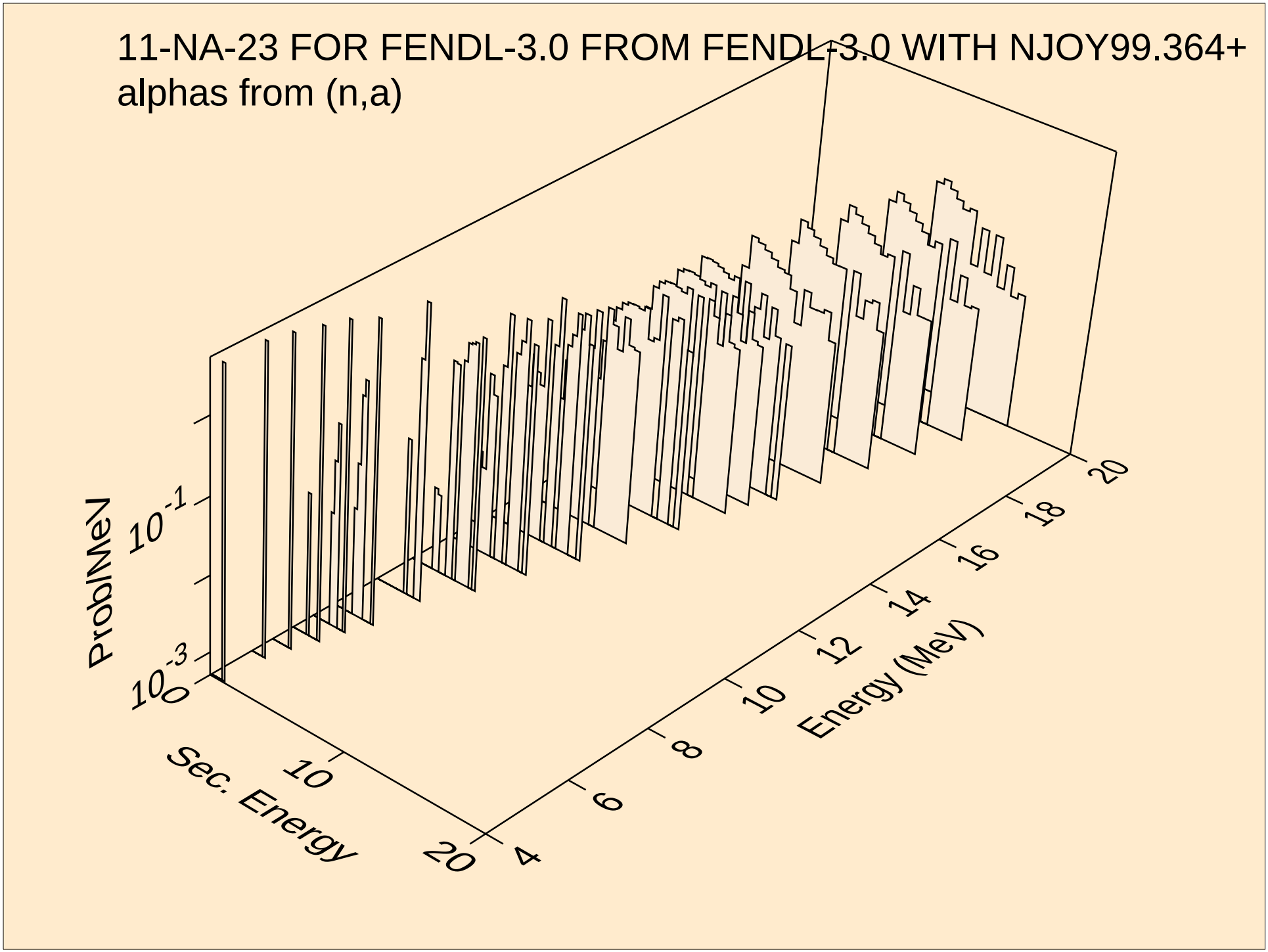

11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
protons from (n,p)
Prob/MeV
10-1
10-3
0
Sec. Energy
10
20
2
4
6
8
10
12
14
16
18
20
Energy (MeV)


11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
deuterons from (n,x)
Prob/MeV
10-1
10-3
0
Sec. Energy
100
200
0
20
40
60
80
100
120
140
160
Energy (MeV)


11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
tritons from (n,x)
Prob/MeV
10-1
10-3
0
Sec. Energy
100
200
0
20
40
60
80
100
120
140
160
Energy (MeV)


11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
alphas from (n,x)
Prob/MeV
10-2
10-4
0
Sec. Energy
100
200
0
20
40
60
80
100
120
140
160
Energy (MeV)


11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
alphas from (n,n*)a
Prob/MeV
10^{0}
10^{-2}
0
Sec. Energy
5
10
10
12
14
Energy (MeV)
16
18
20


11-NA-23 FOR FENDL-3.0 FROM FENDL-3.0 WITH NJOY99.364+
alphas from (n,a)
Prob/MeV
10-1
10-3
0
Sec. Energy
10
20
4
6
8
10
12
14
16
18
20
Energy (MeV)