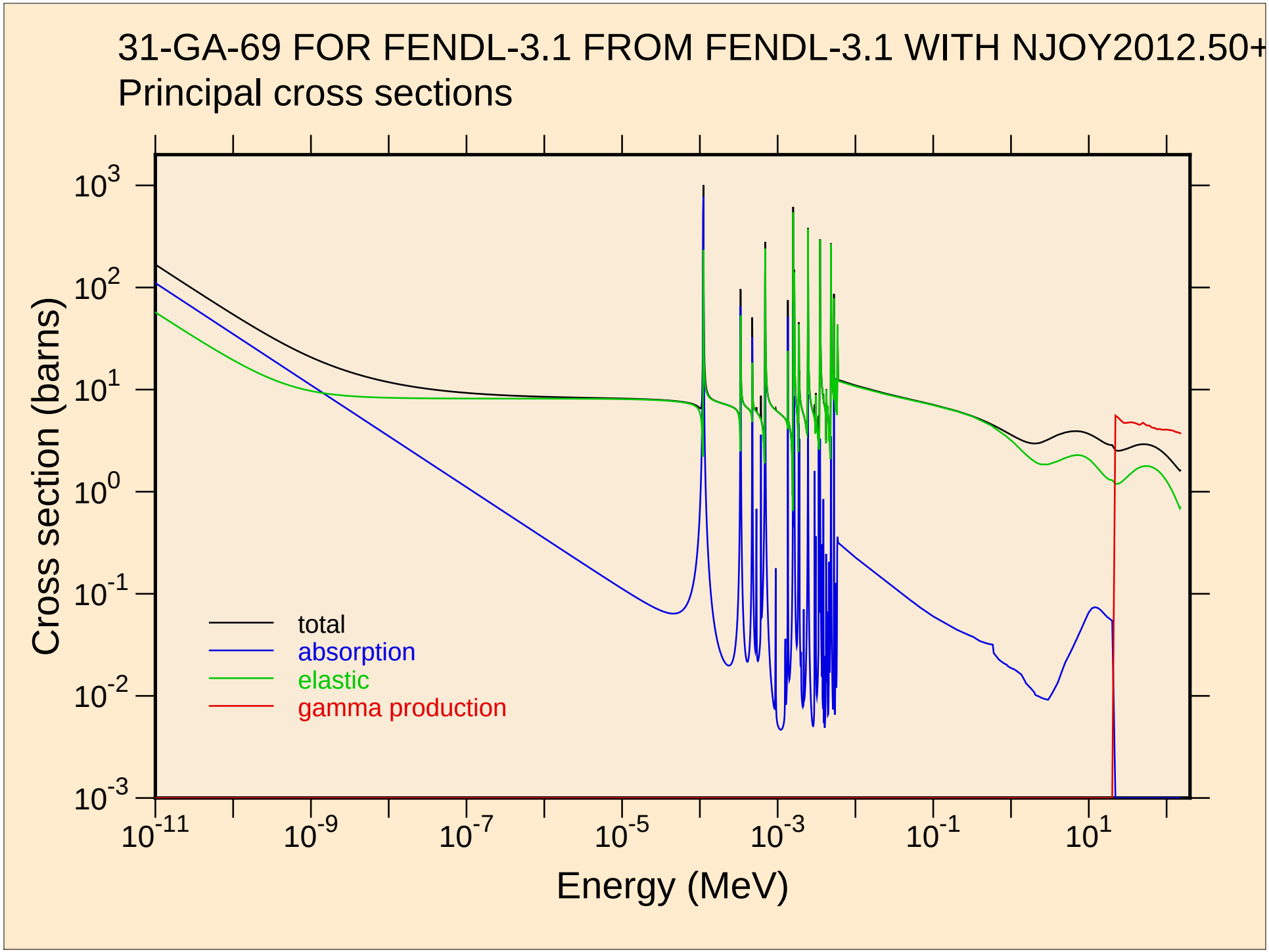
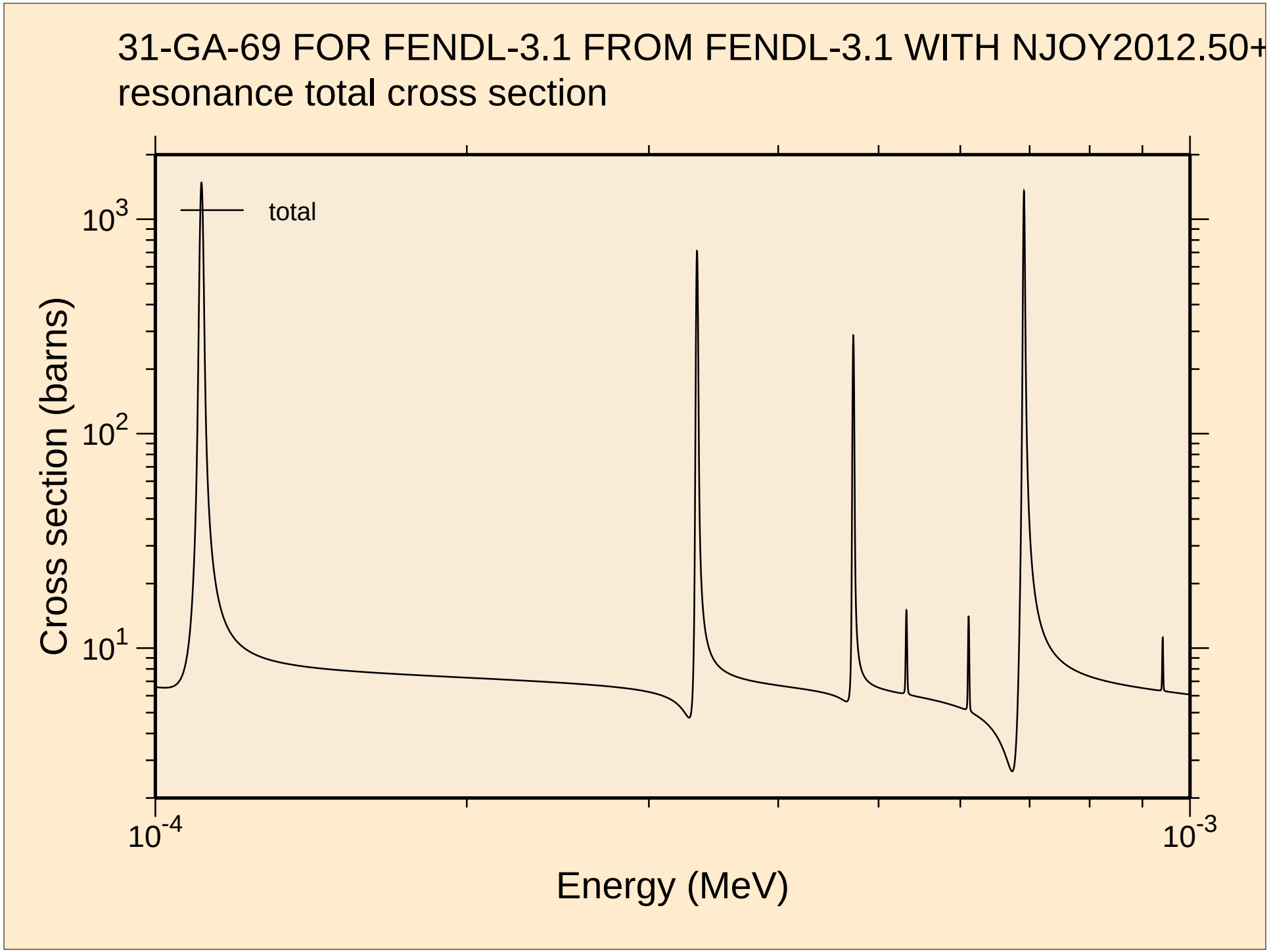
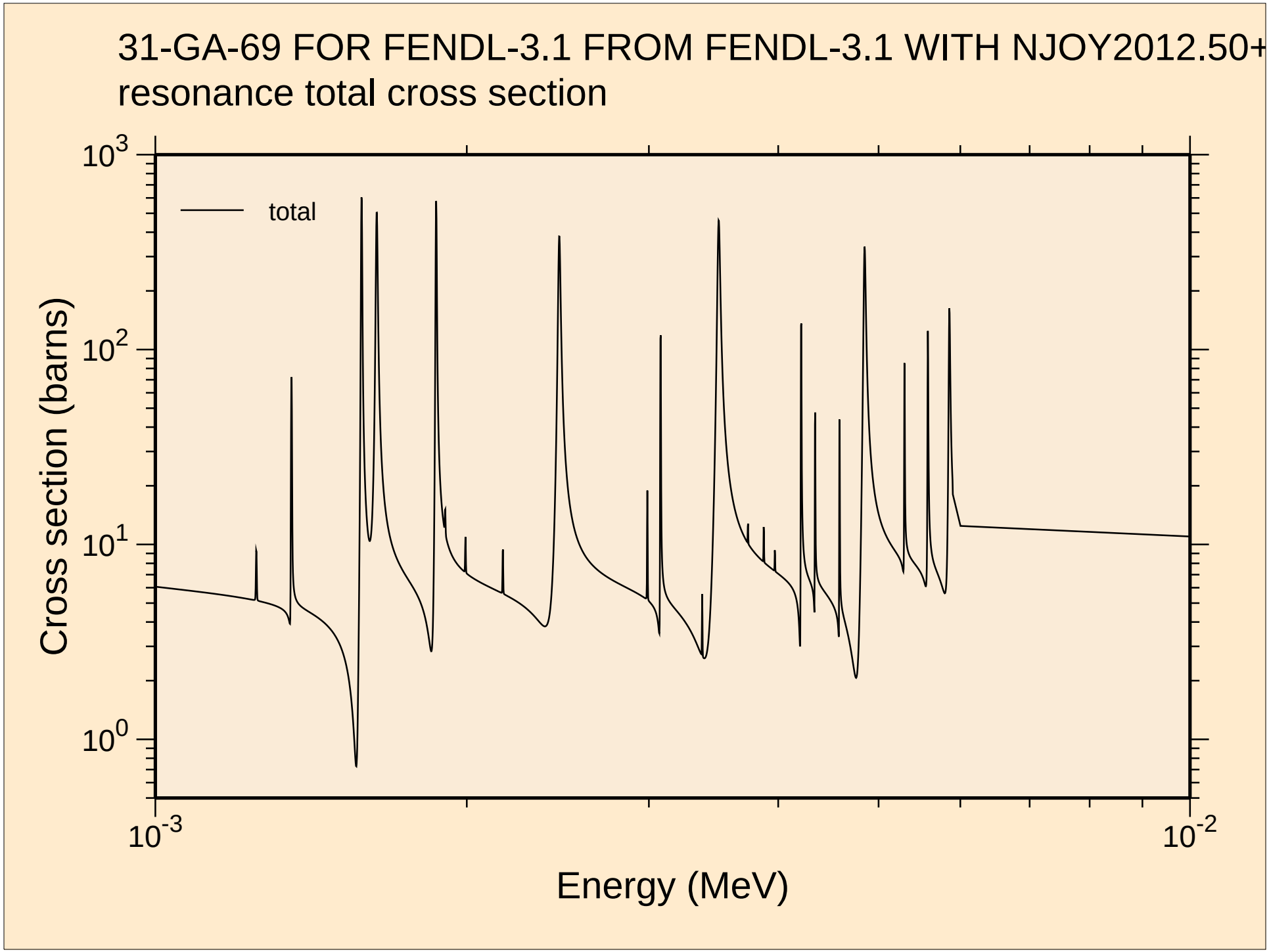
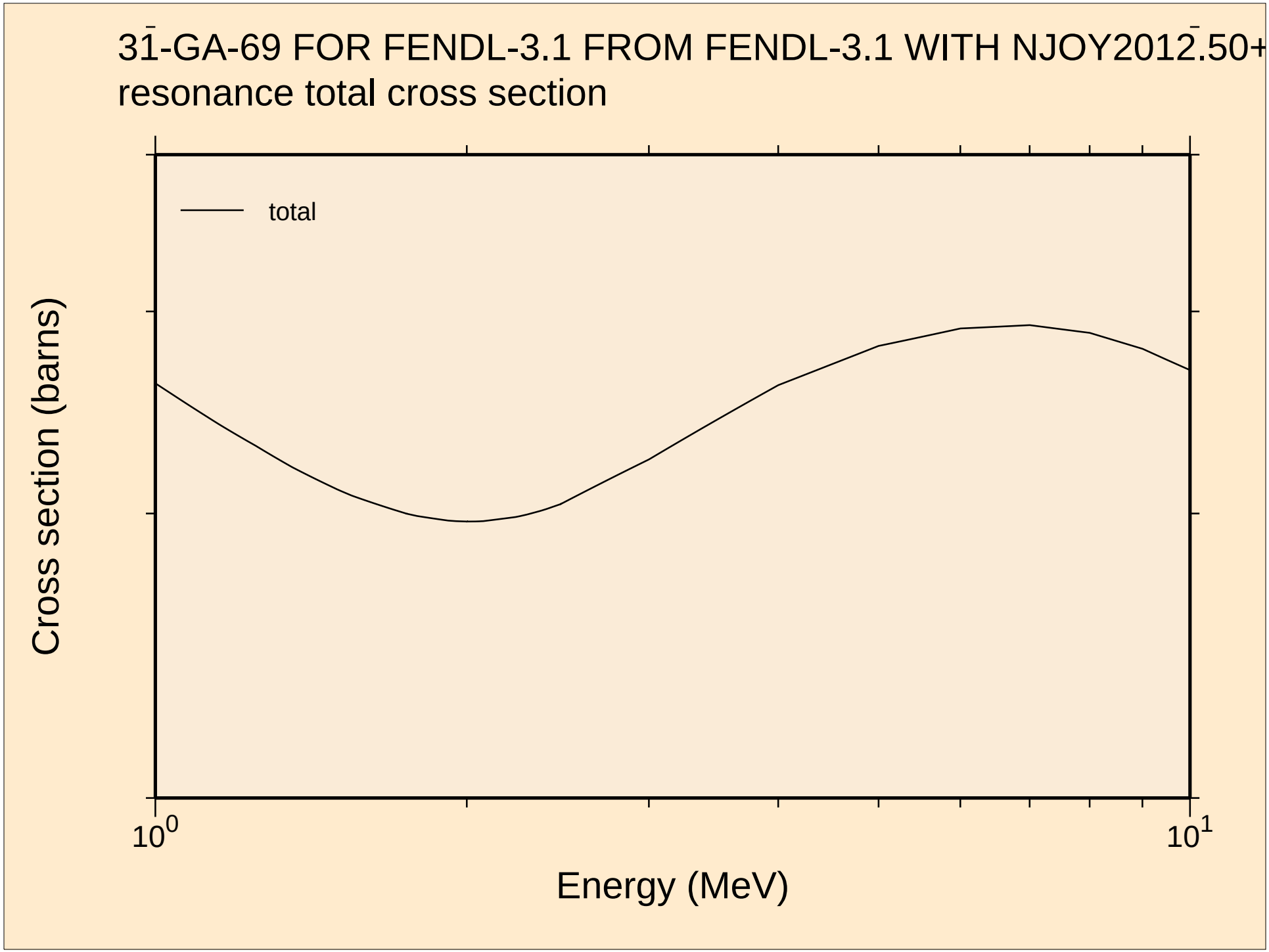
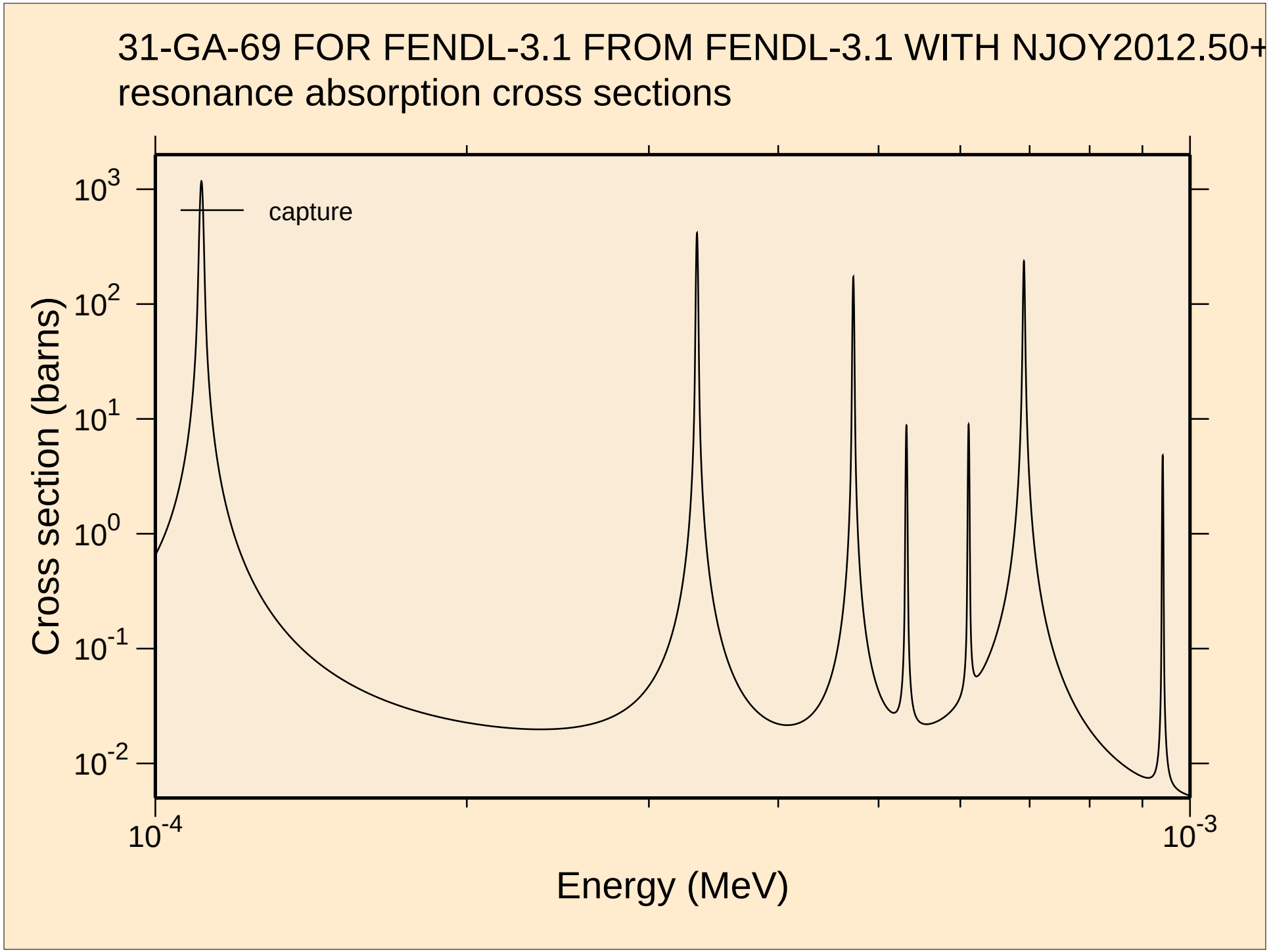
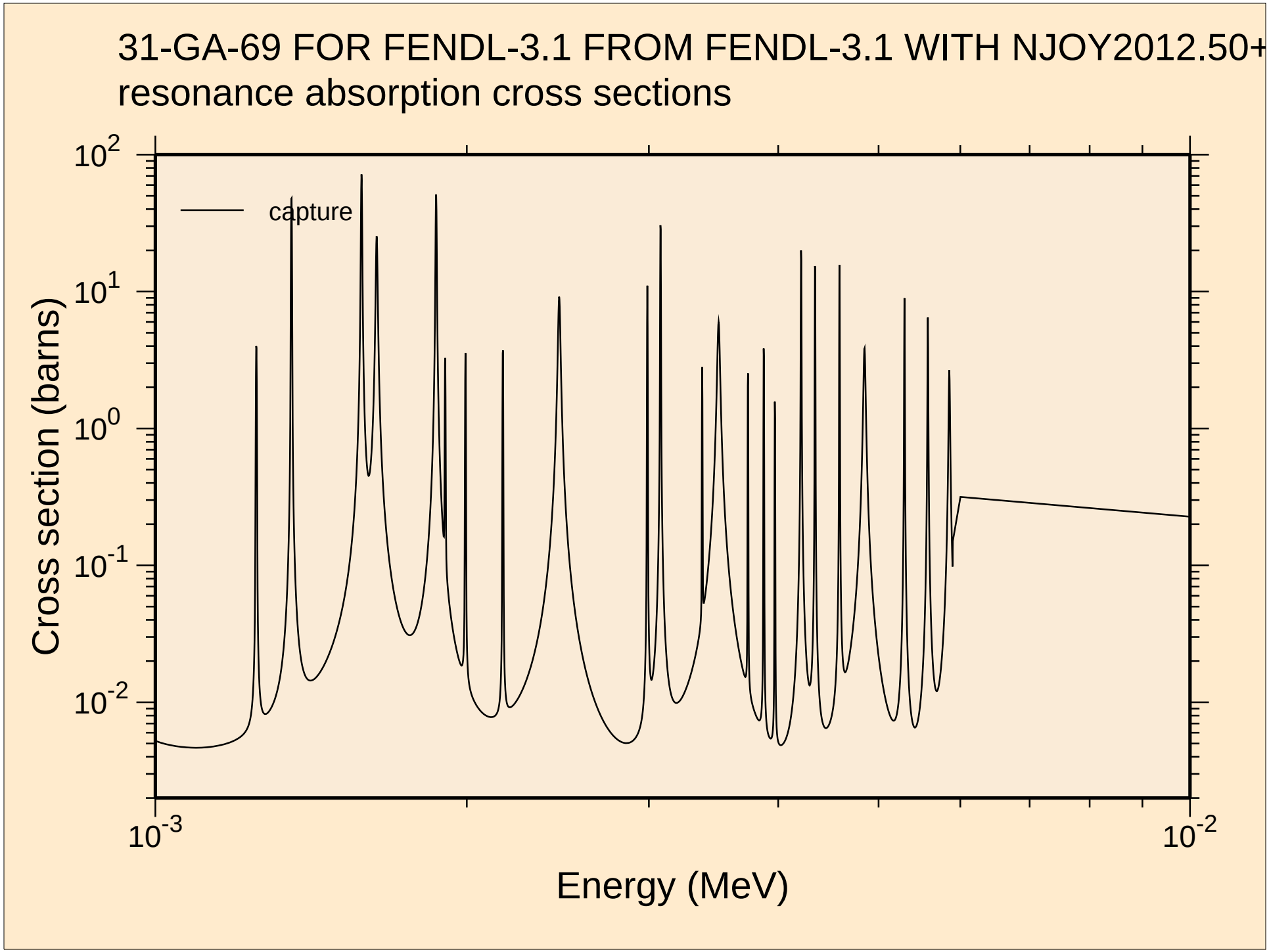

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Principal cross sections
Cross section (barns)
Energy (MeV)
total
absorption
elastic
gamma production

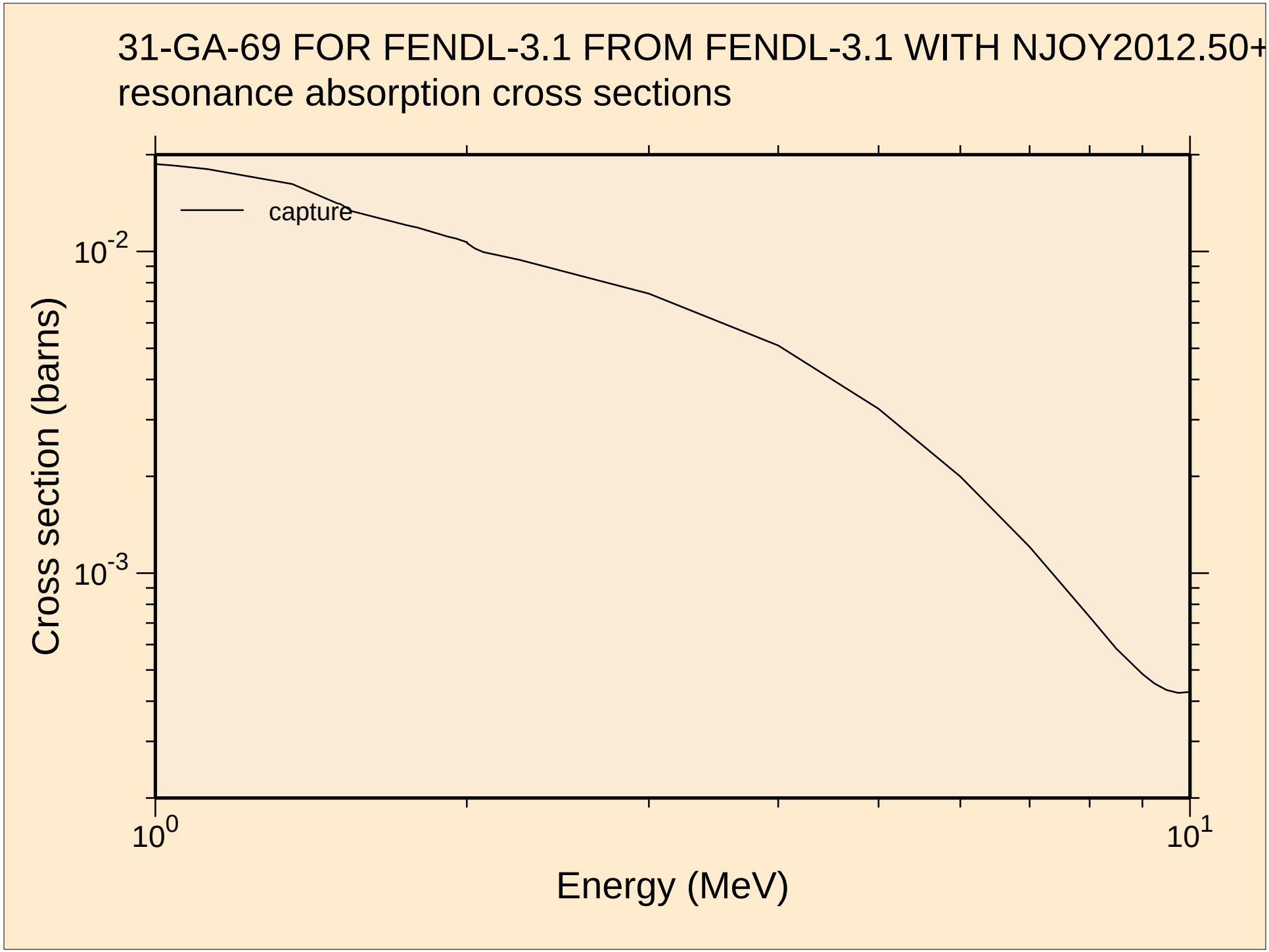

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
resonance total cross section
total
Cross section (barns)
10^3
10^2
10^1
10^-4
10^-3
Energy (MeV)

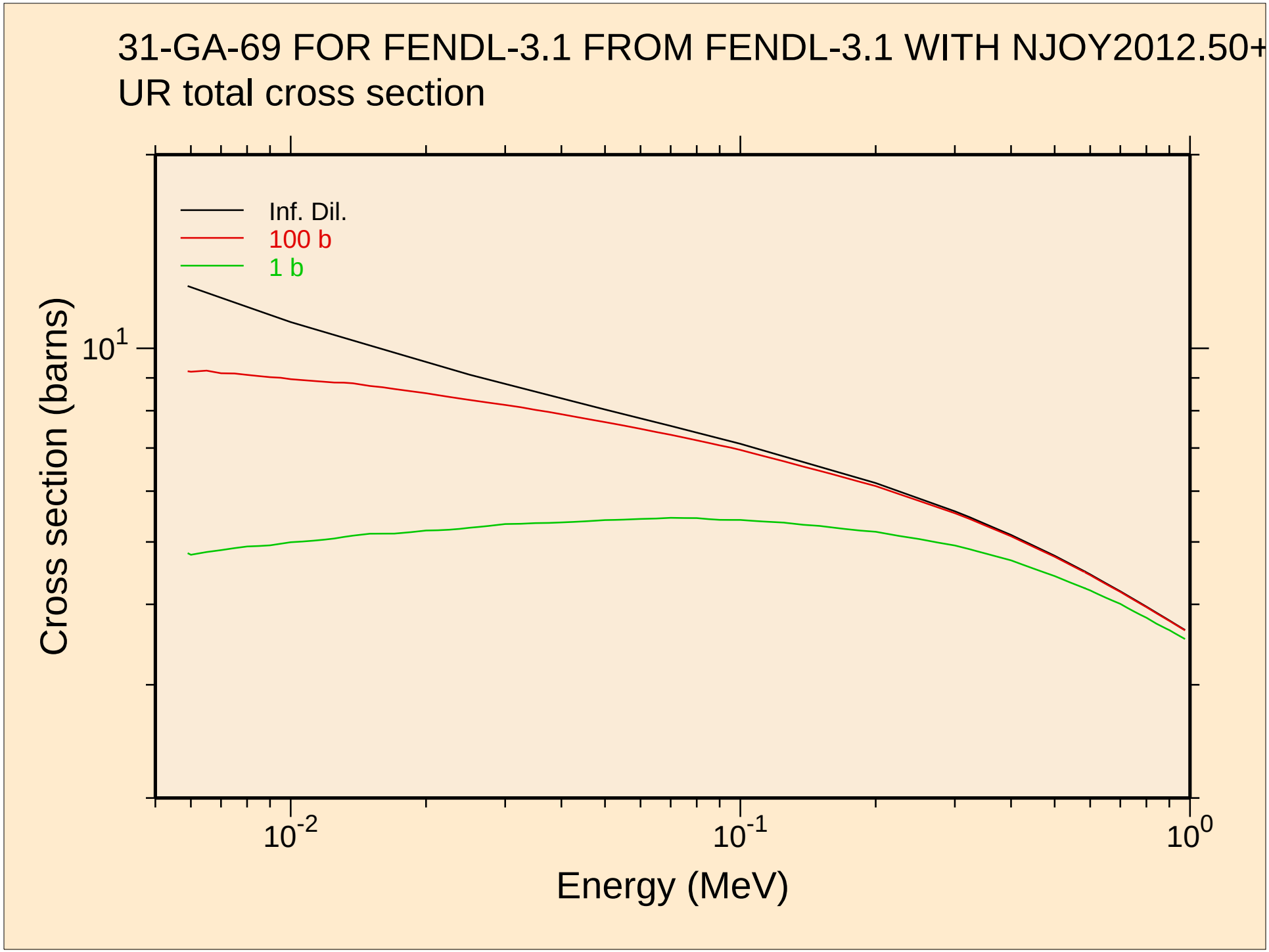

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
resonance total cross section
total
Cross section (barns)
10^3
10^2
10^1
10^0
10^-3
10^-2
Energy (MeV)

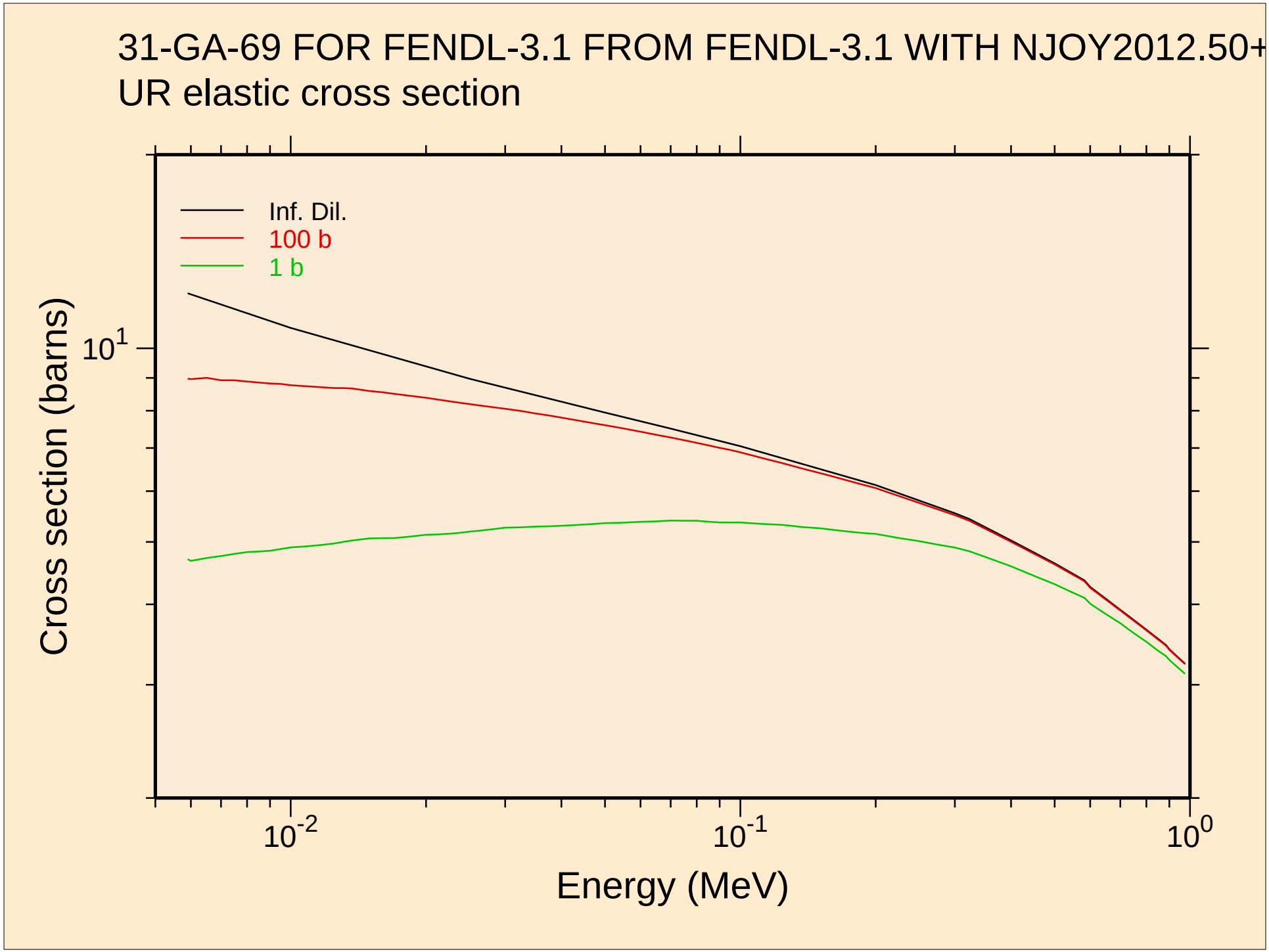

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
resonance total cross section
total
Cross section (barns)
10^0
10^1
Energy (MeV)

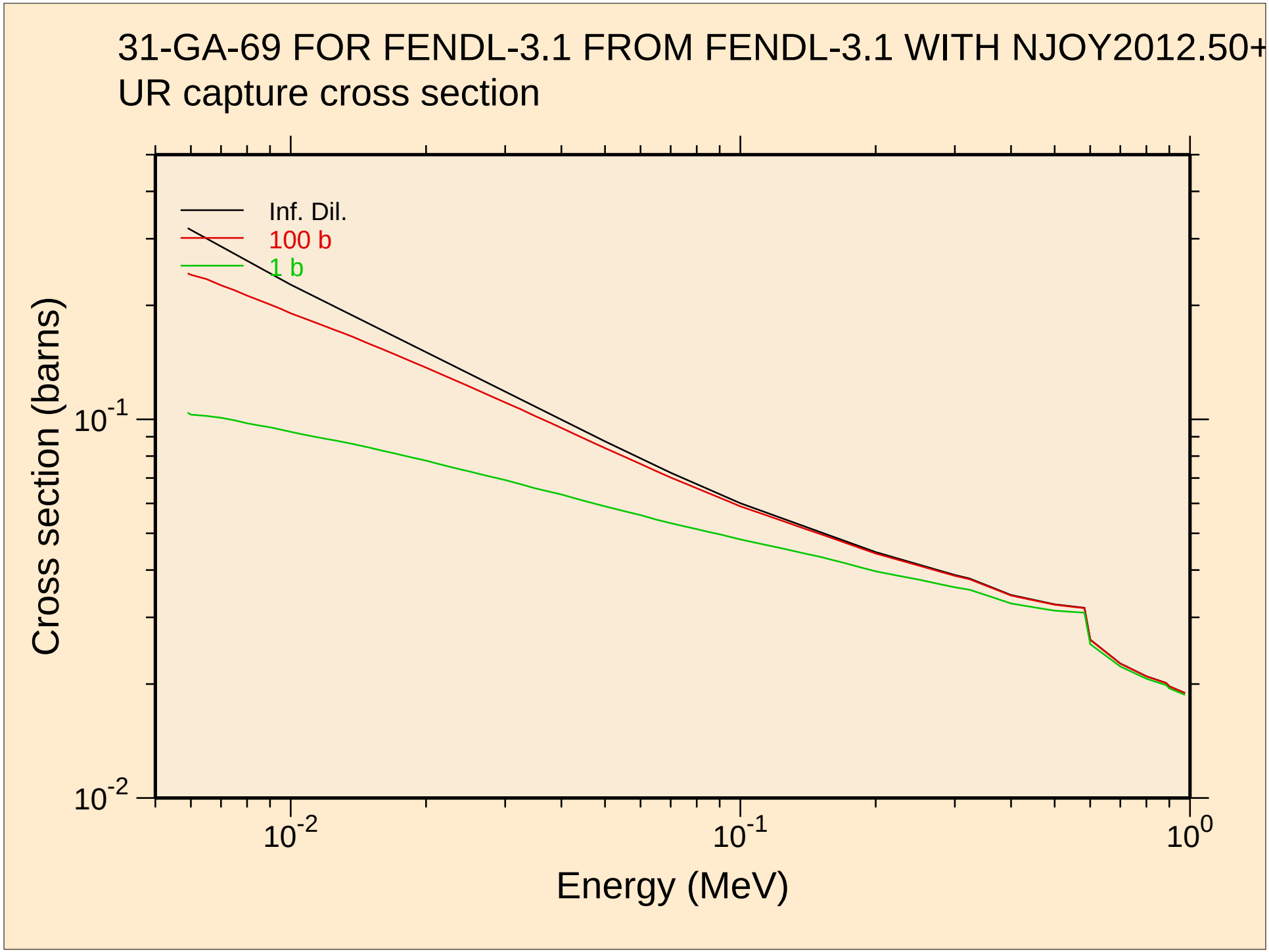

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
resonance absorption cross sections
capture
Cross section (barns)
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-4
10^-3
Energy (MeV)

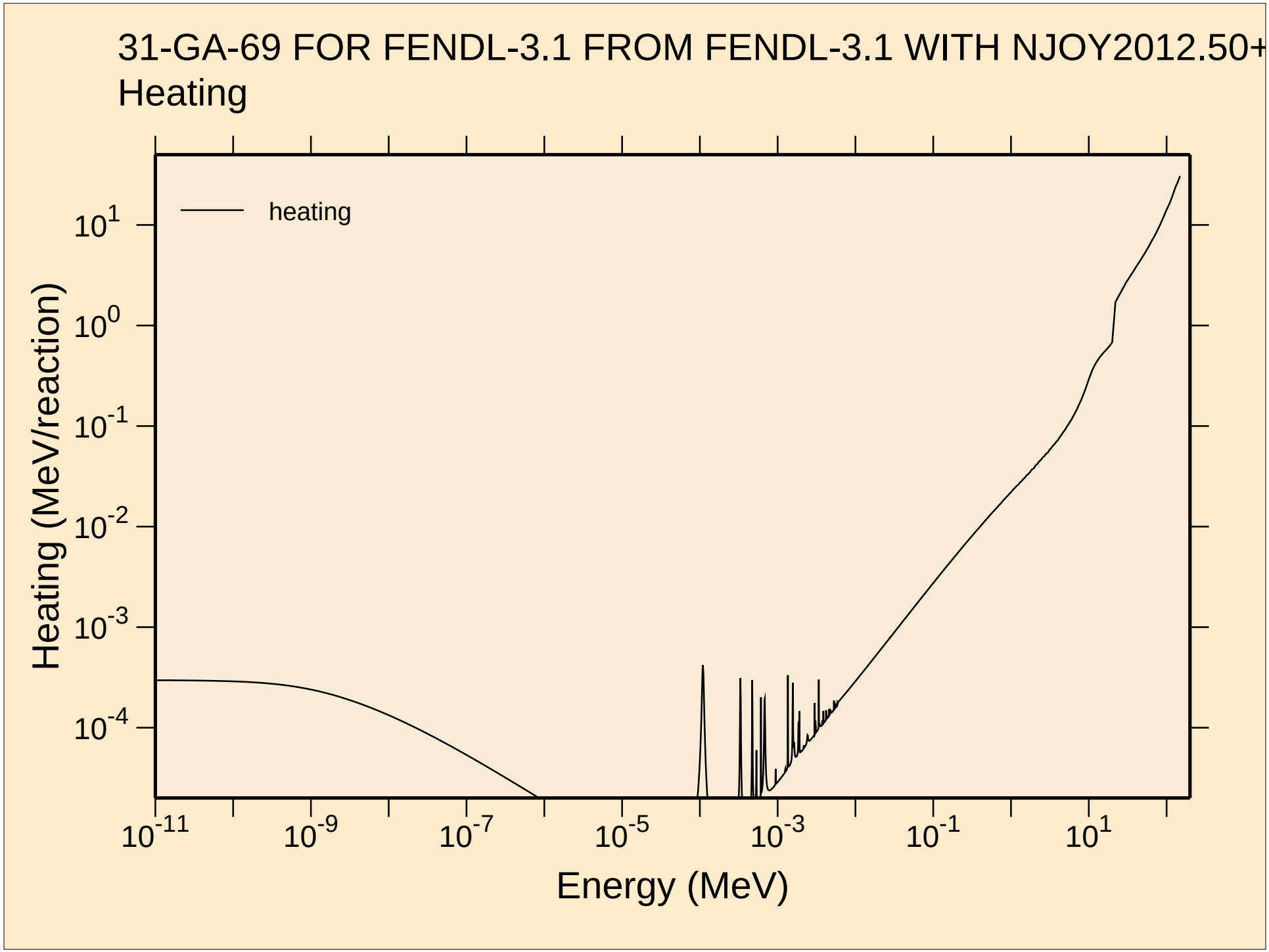

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
resonance absorption cross sections
capture
Cross section (barns)
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-2}
Energy (MeV)

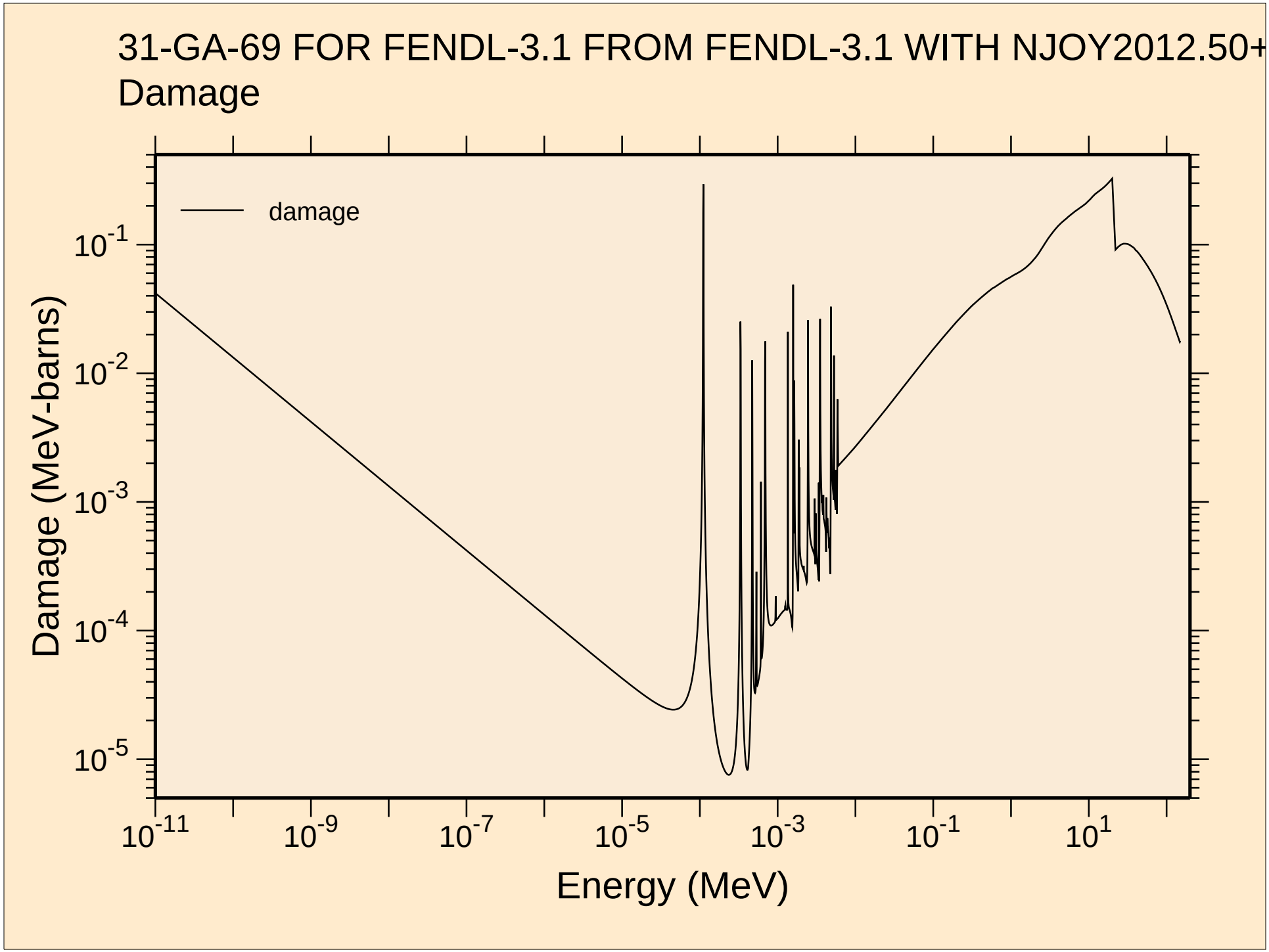

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
resonance absorption cross sections
capture
Cross section (barns)
10-2
10-3
100
101
Energy (MeV)

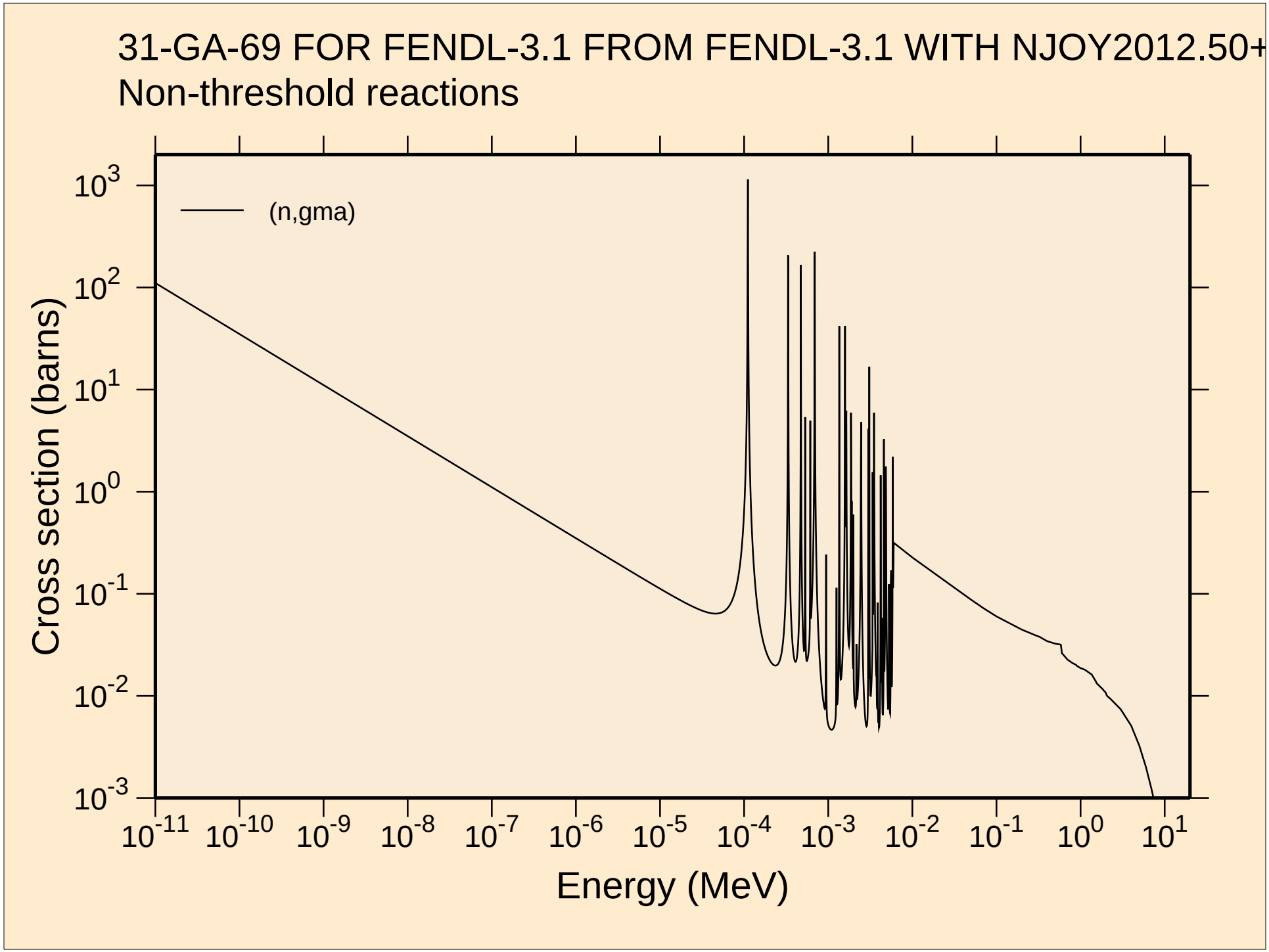

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
UR total cross section
Inf. Dil.
100 b
1 b
Cross section (barns)
10^1
10^-2
10^-1
10^0
Energy (MeV)

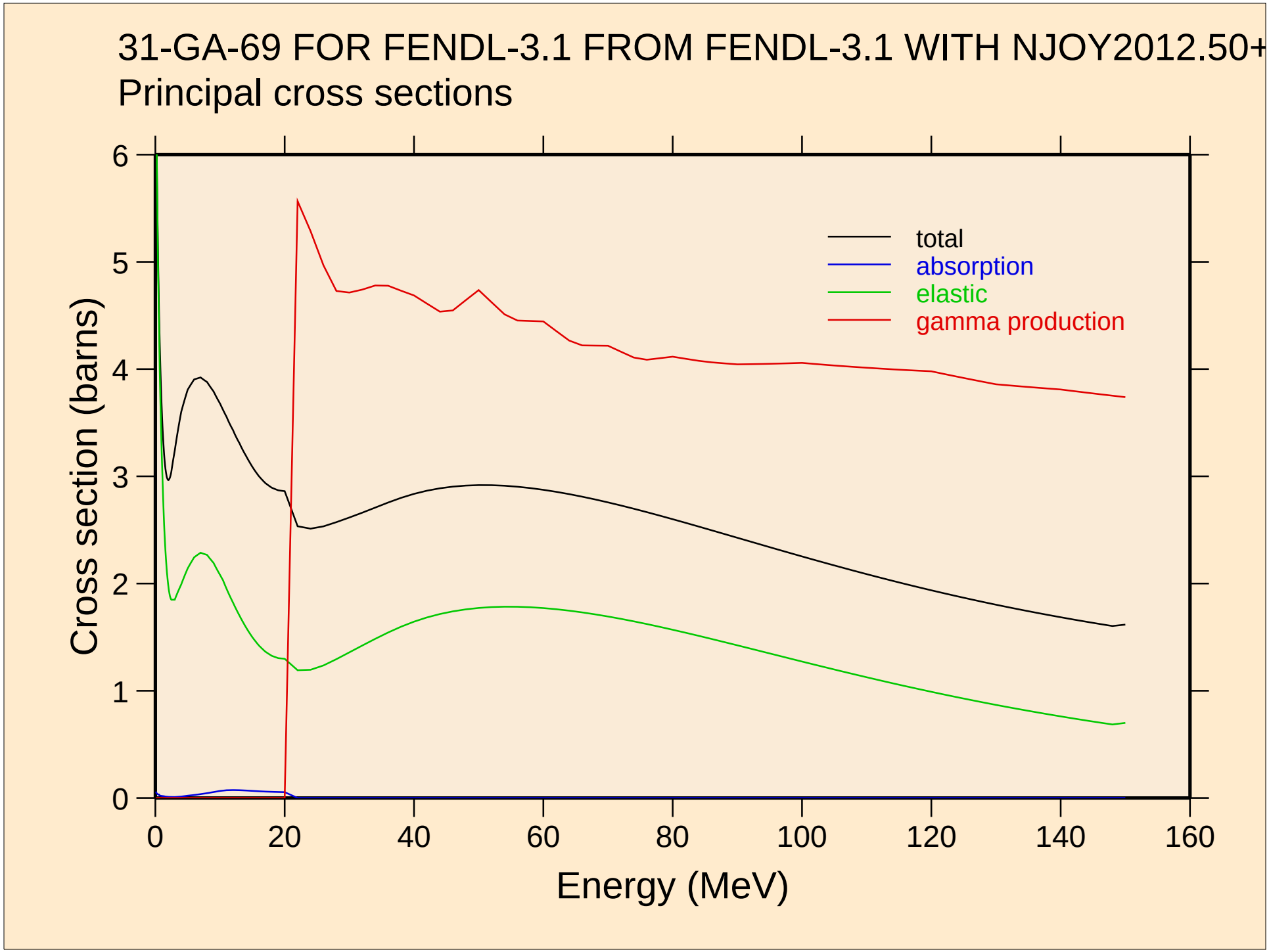

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
UR elastic cross section
Inf. Dil.
100 b
1 b
Cross section (barns)
10^1
10^-2
10^-1
10^0
Energy (MeV)

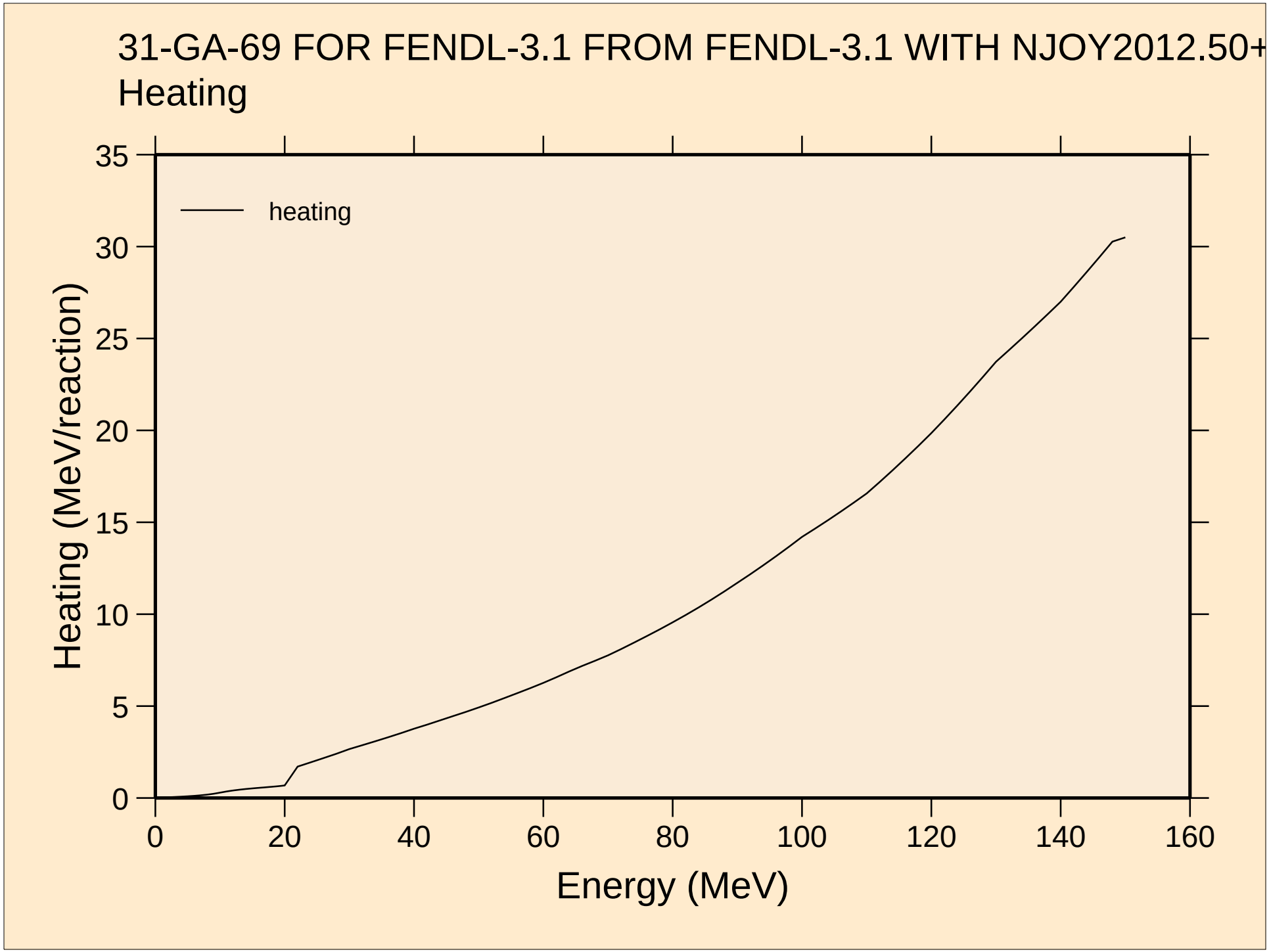

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
UR capture cross section
Inf. Dil.
100 b
1 b
Cross section (barns)
10-1
10-2
10-2
10-1
100
Energy (MeV)

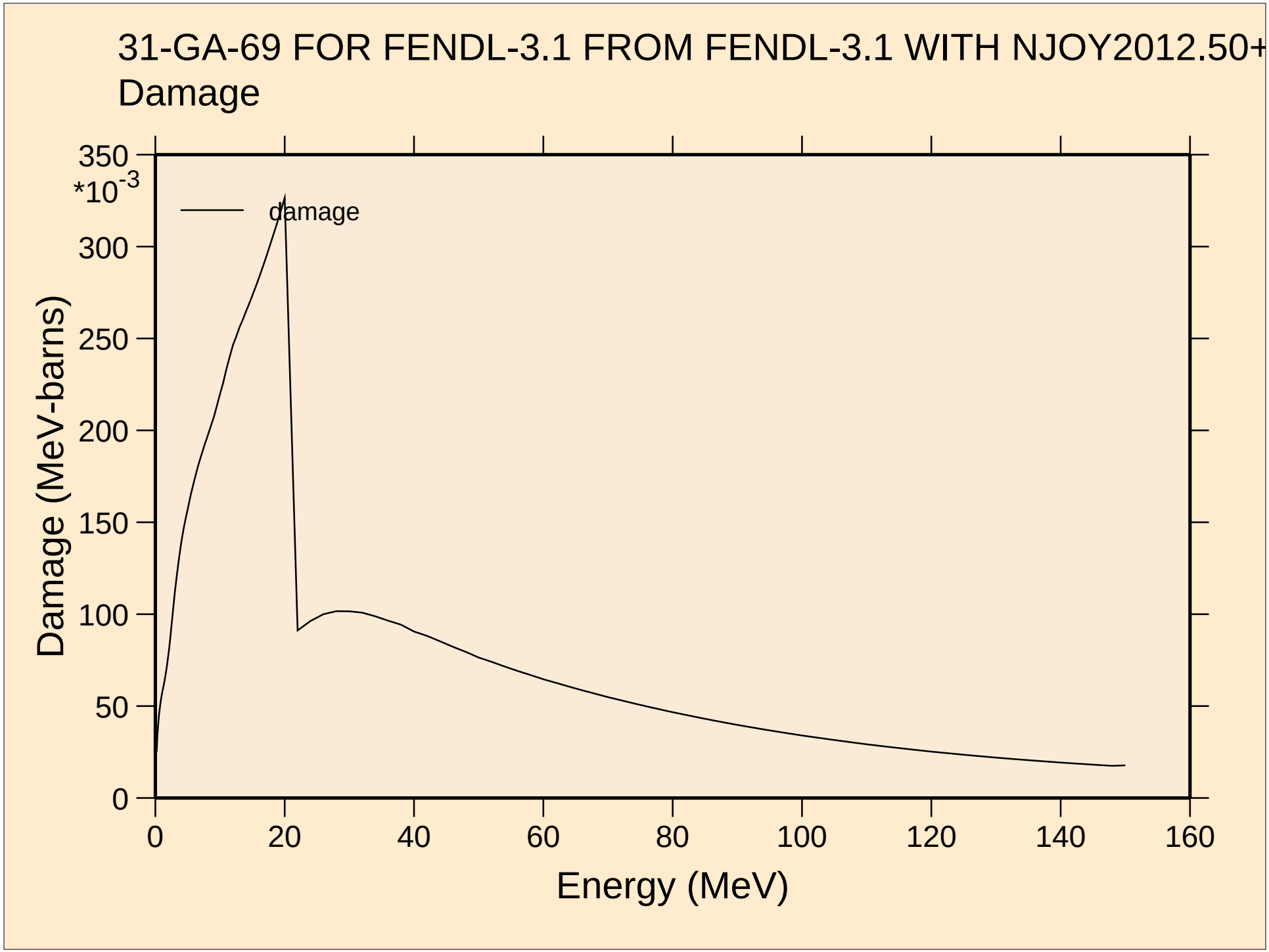

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Heating
heating
Heating (MeV/reaction)
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-11
10^-9
10^-7
10^-5
10^-3
10^-1
10^1
Energy (MeV)

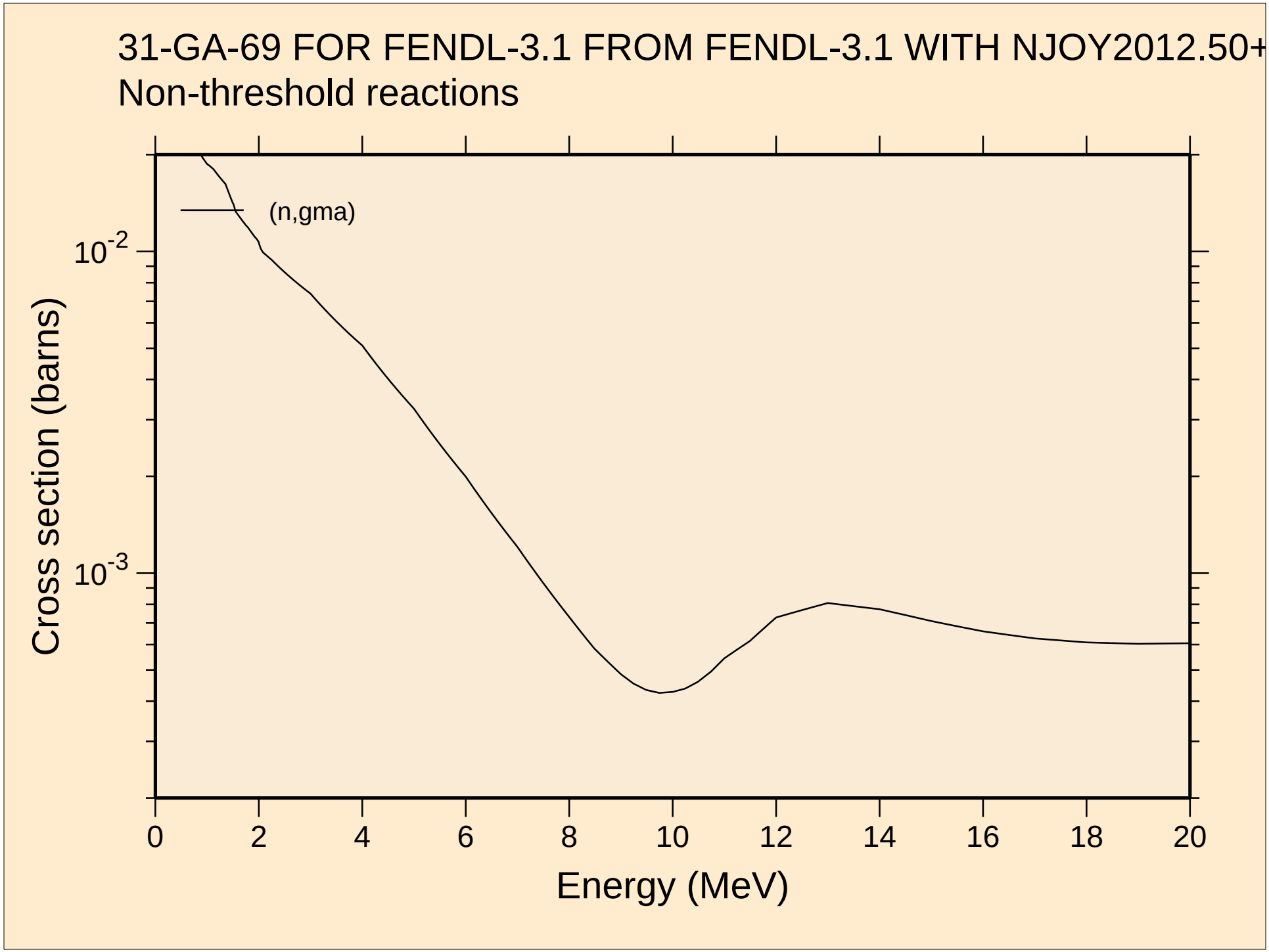

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Damage
damage
Damage (MeV-barns)
10-1
10-2
10-3
10-4
10-5
10-11
10-9
10-7
10-5
10-3
10-1
101
Energy (MeV)

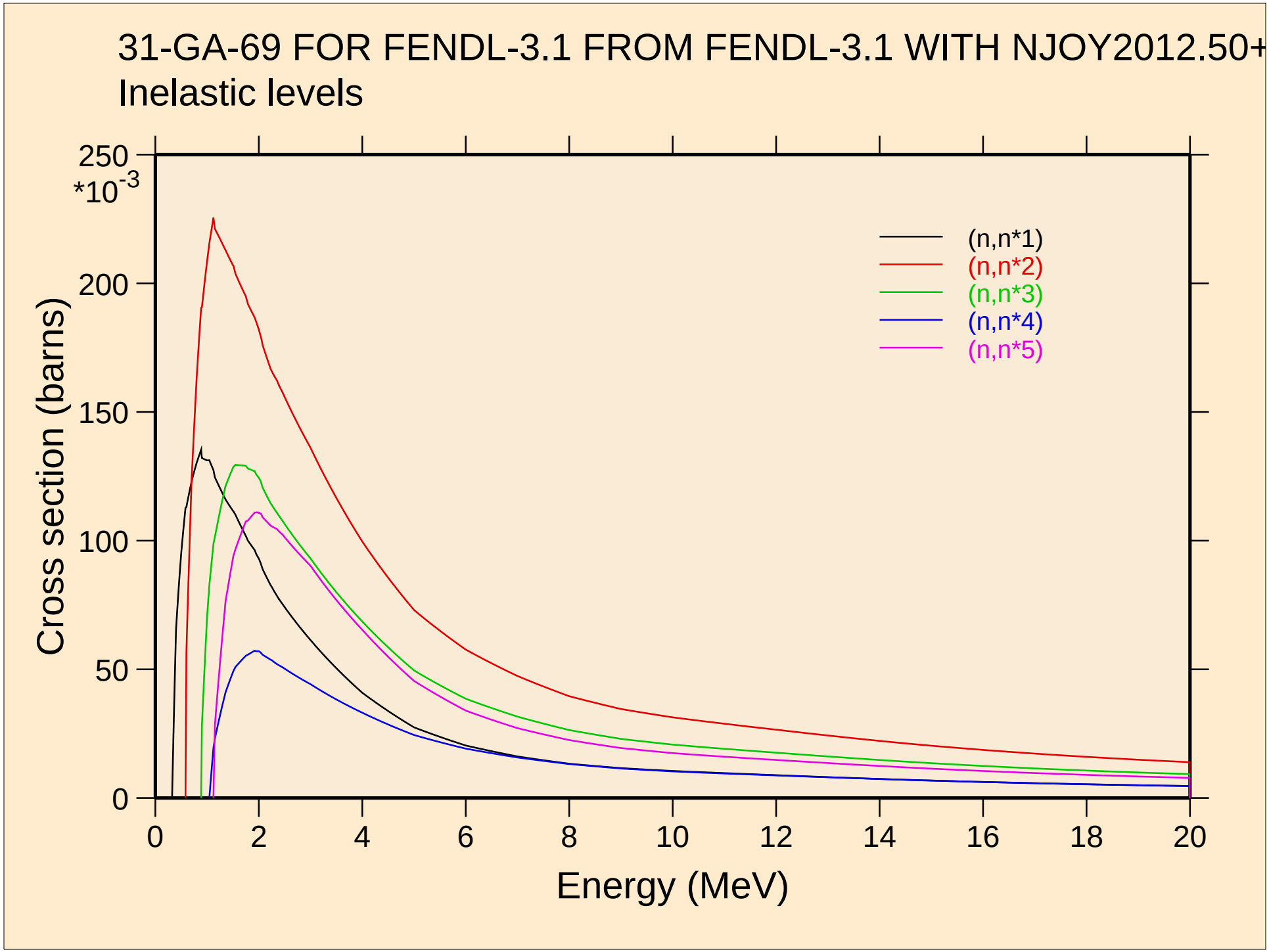

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Non-threshold reactions
(n,gma)
Cross section (barns)
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-11 10^-10 10^-9 10^-8 10^-7 10^-6 10^-5 10^-4 10^-3 10^-2 10^-1 10^0 10^1
Energy (MeV)

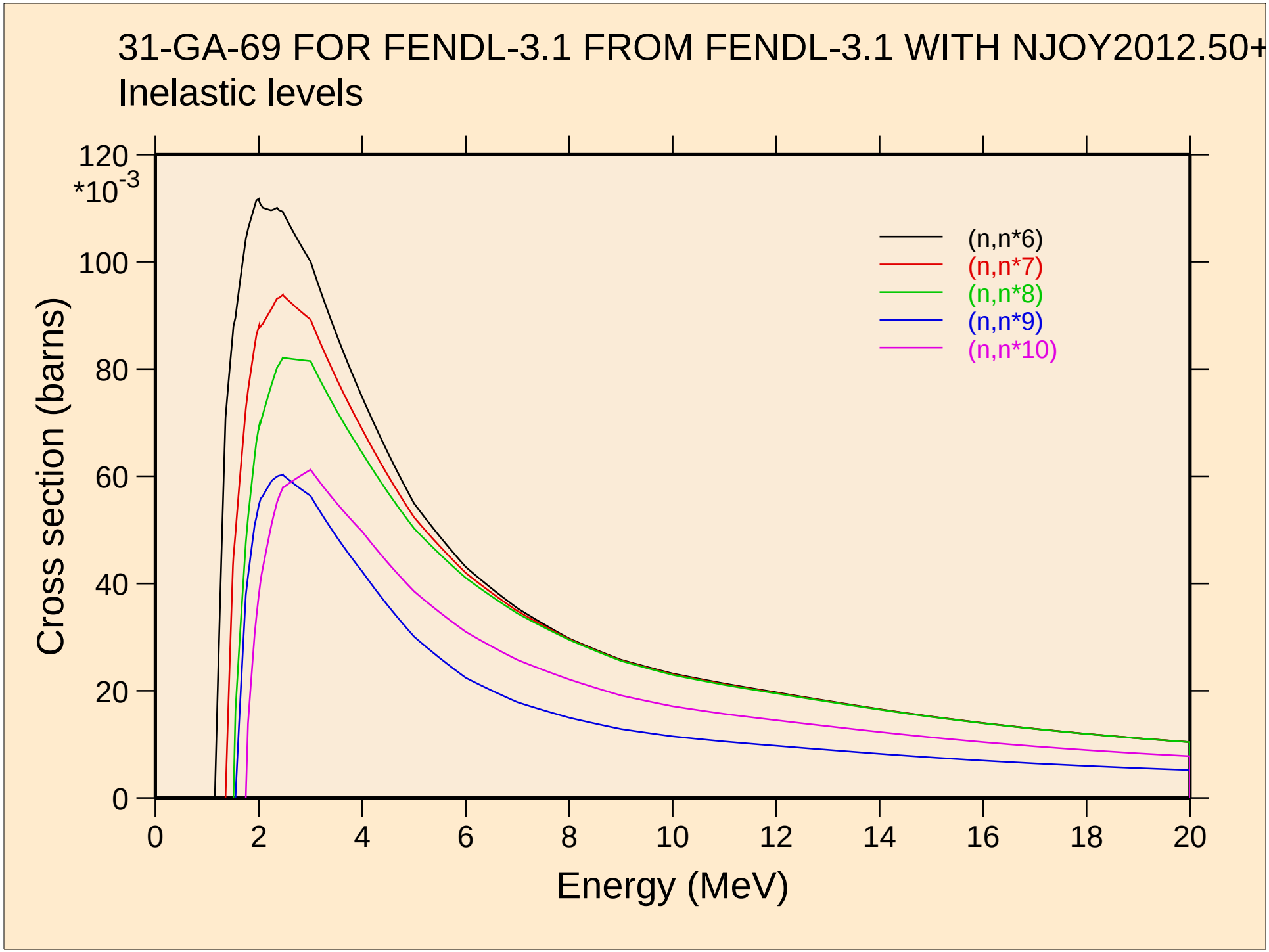

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Principal cross sections
Cross section (barns)
Energy (MeV)
0
1
2
3
4
5
6
0
20
40
60
80
100
120
140
160
total
absorption
elastic
gamma production

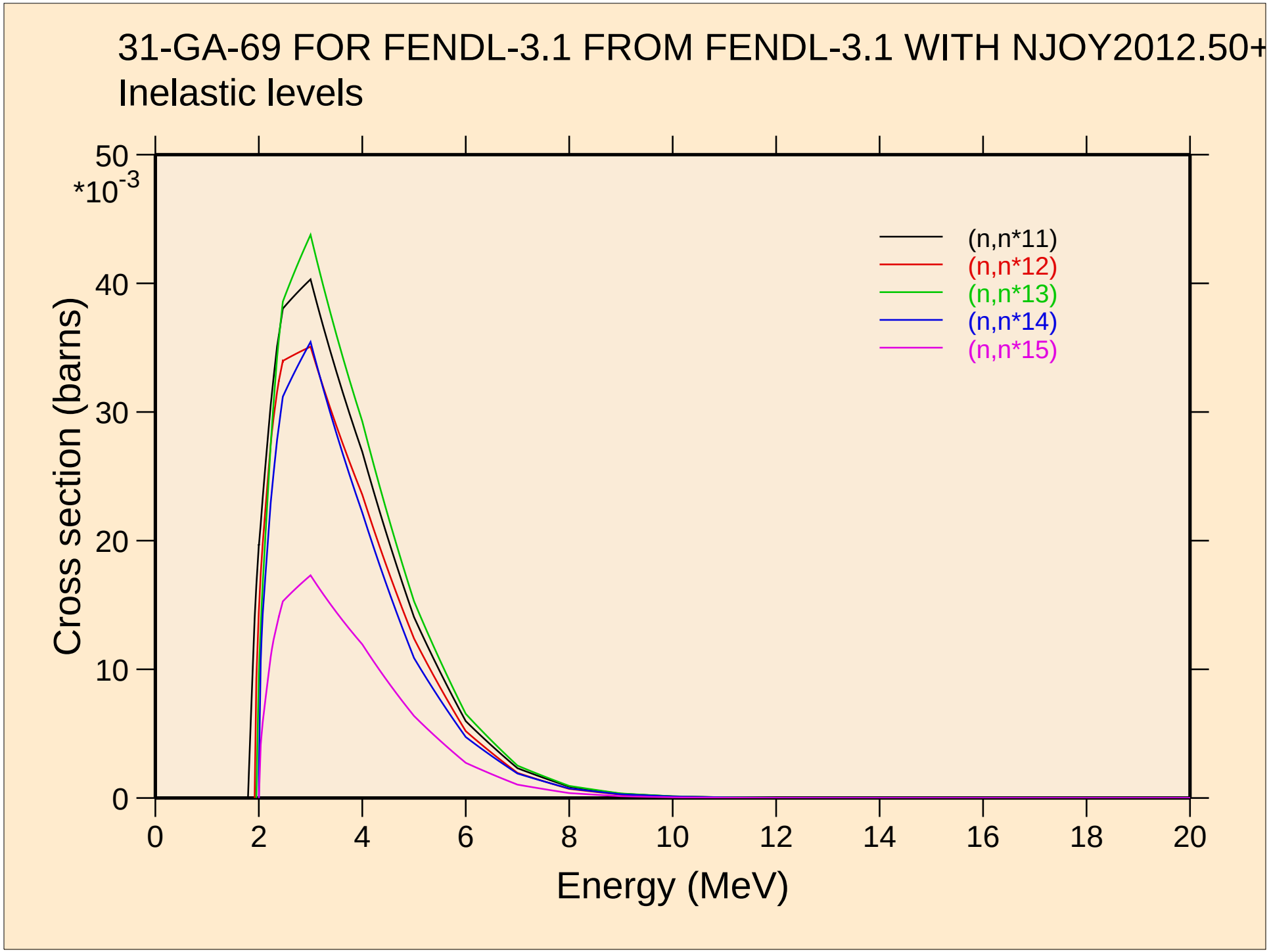

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Heating
heating
Heating (MeV/reaction)
Energy (MeV)
0
5
10
15
20
25
30
35
0
20
40
60
80
100
120
140
160

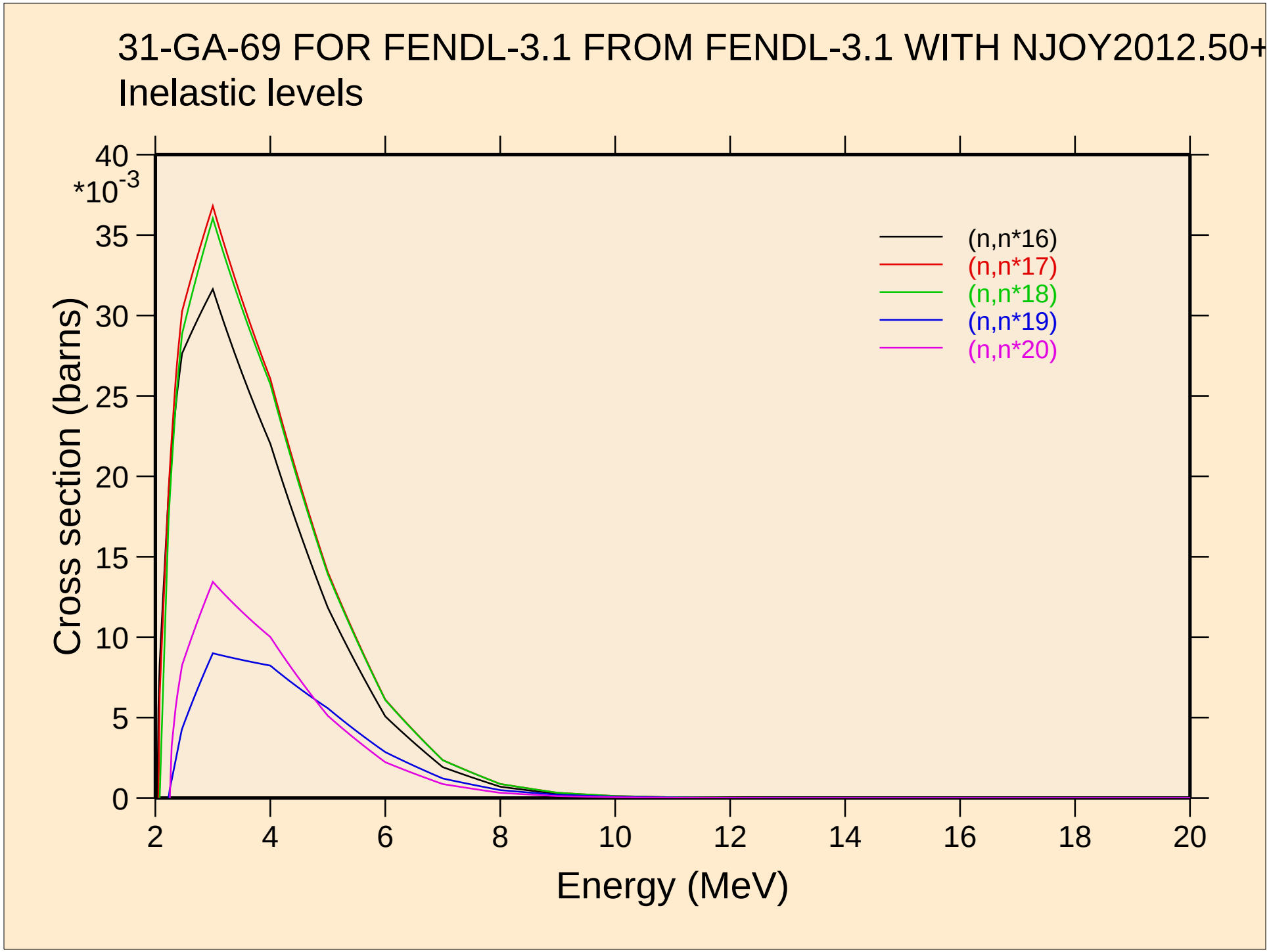

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Damage
damage
*10-3
350
300
250
200
150
100
50
0
Damage (MeV-barns)
0
20
40
60
80
100
120
140
160
Energy (MeV)

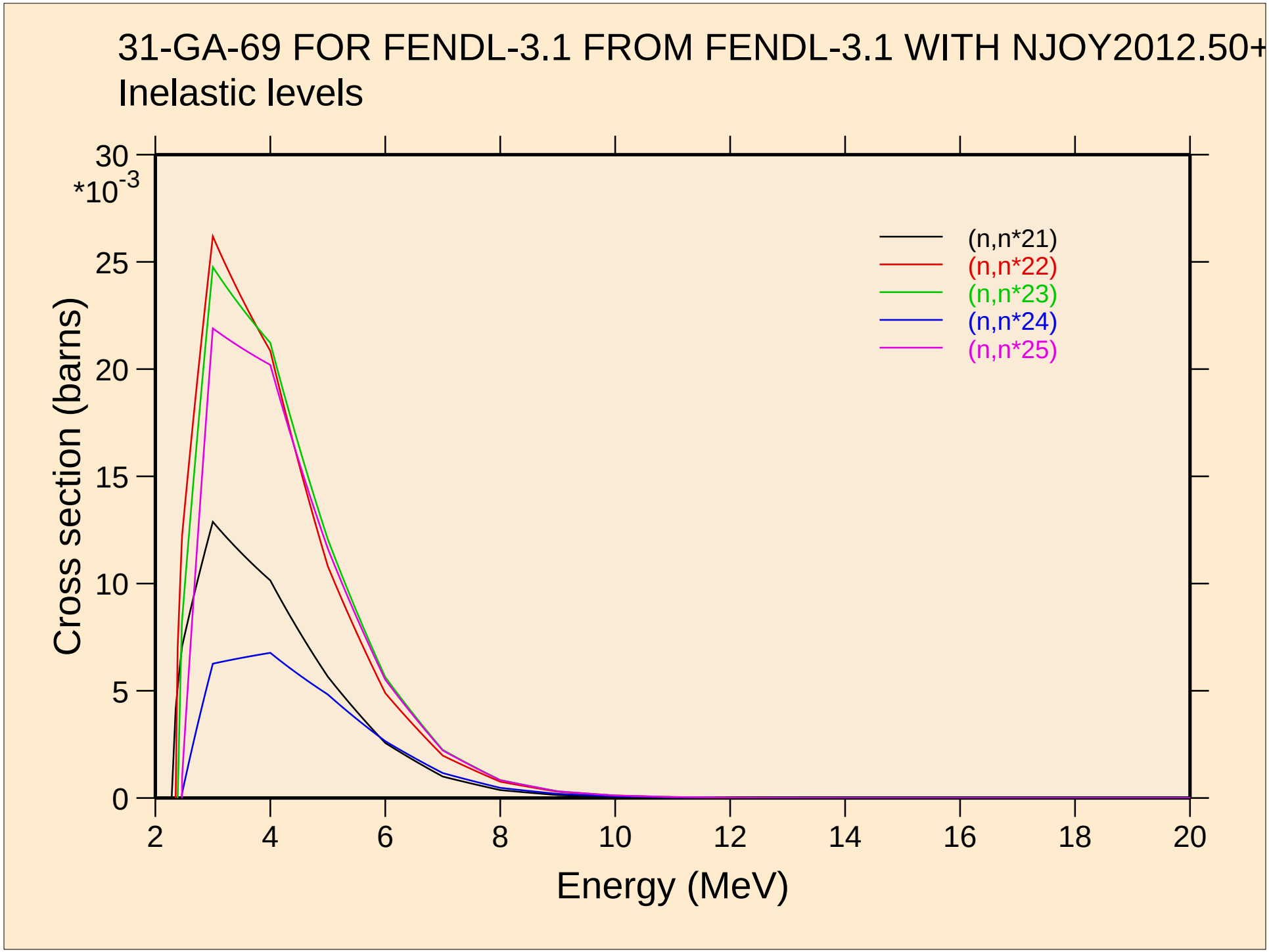

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Non-threshold reactions
(n,gma)
Cross section (barns)
10-2
10-3
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

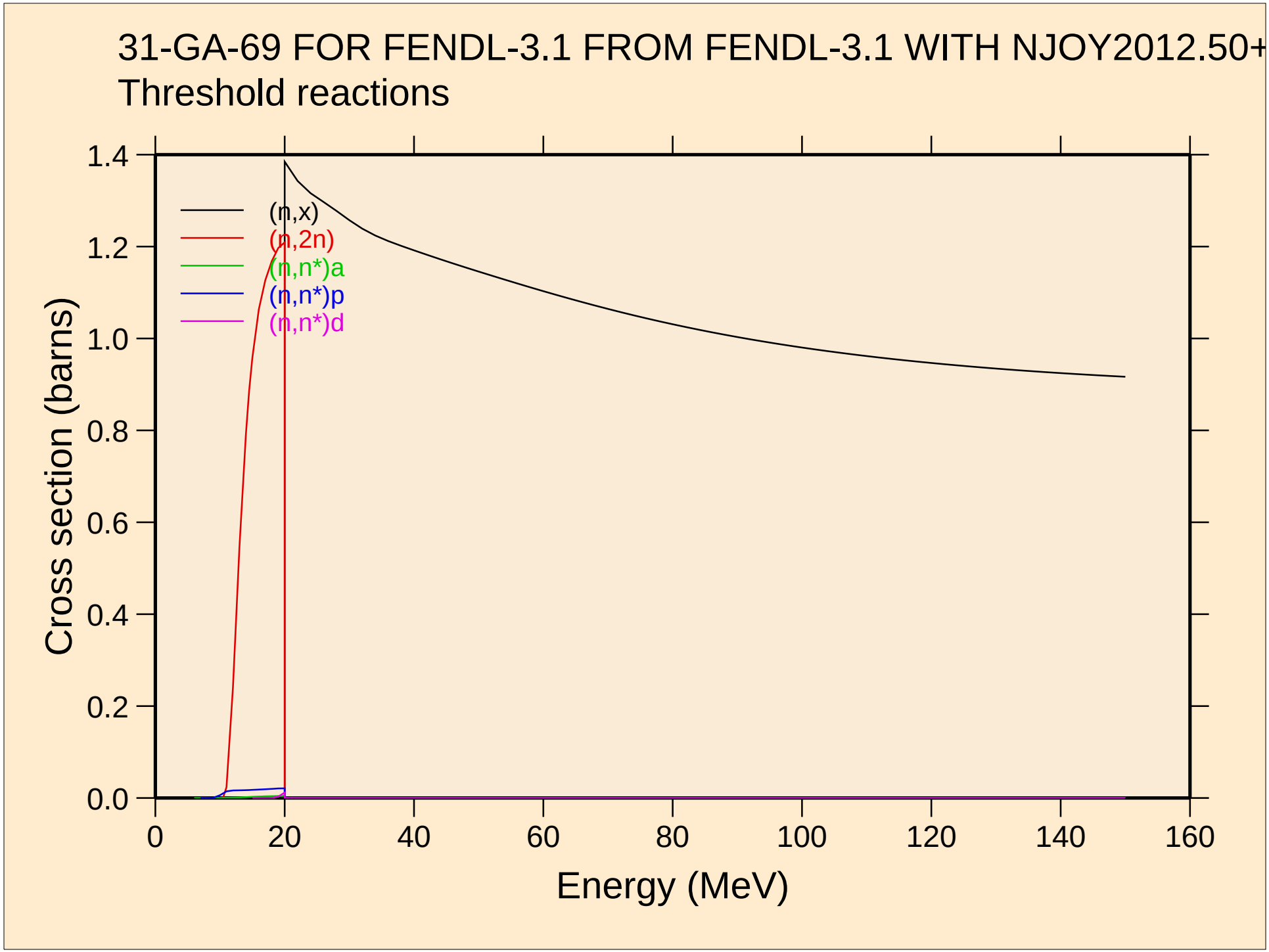

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Inelastic levels
Cross section (barns)
*10-3
250
200
150
100
50
0
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*1)
(n,n*2)
(n,n*3)
(n,n*4)
(n,n*5)

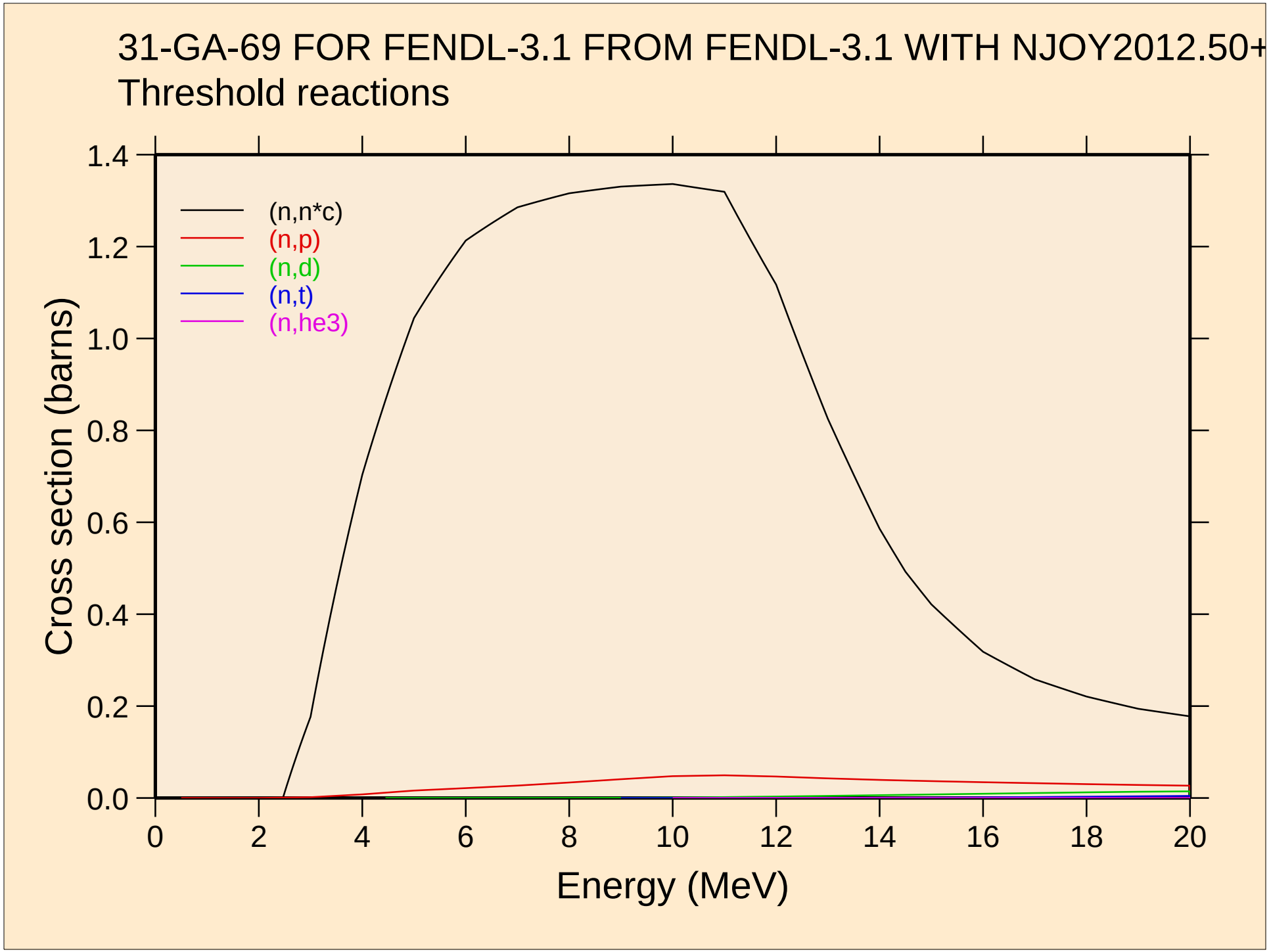

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Inelastic levels
Cross section (barns)
*10-3
120
100
80
60
40
20
0
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*6)
(n,n*7)
(n,n*8)
(n,n*9)
(n,n*10)

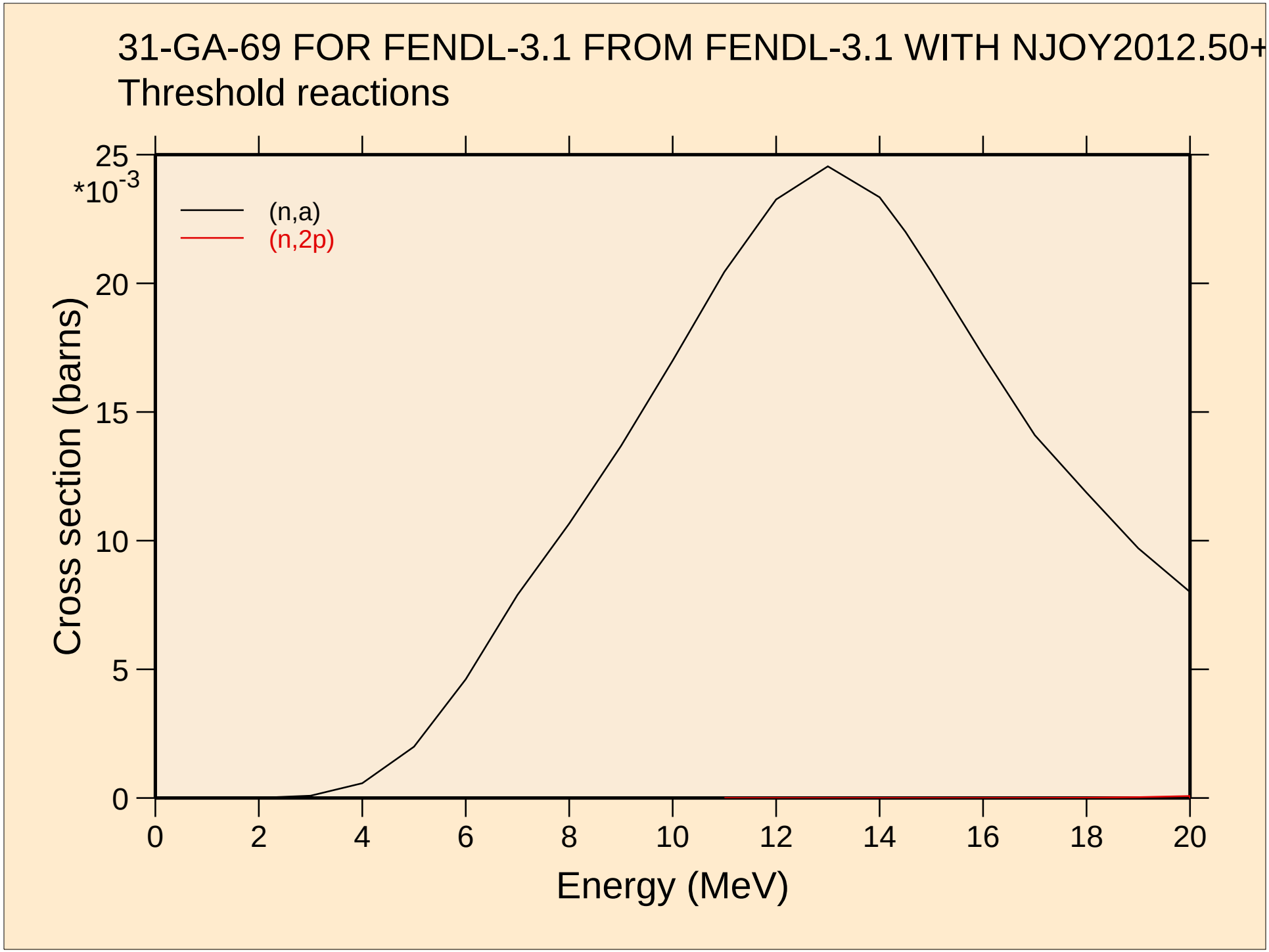

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Inelastic levels
Cross section (barns)
*10-3
50
40
30
20
10
0
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*11)
(n,n*12)
(n,n*13)
(n,n*14)
(n,n*15)

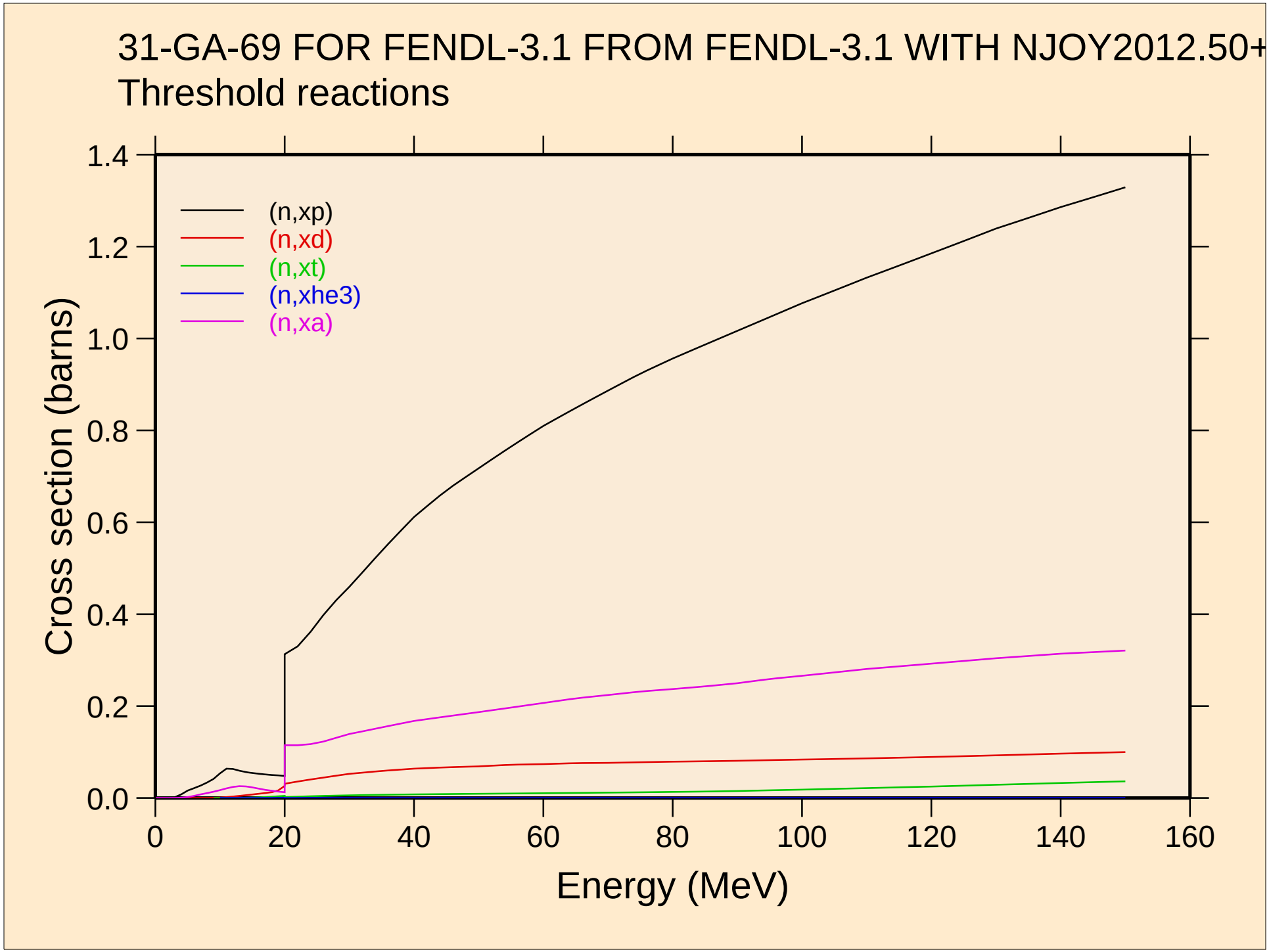

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Inelastic levels
Cross section (barns)
*10-3
40
35
30
25
20
15
10
5
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*16)
(n,n*17)
(n,n*18)
(n,n*19)
(n,n*20)

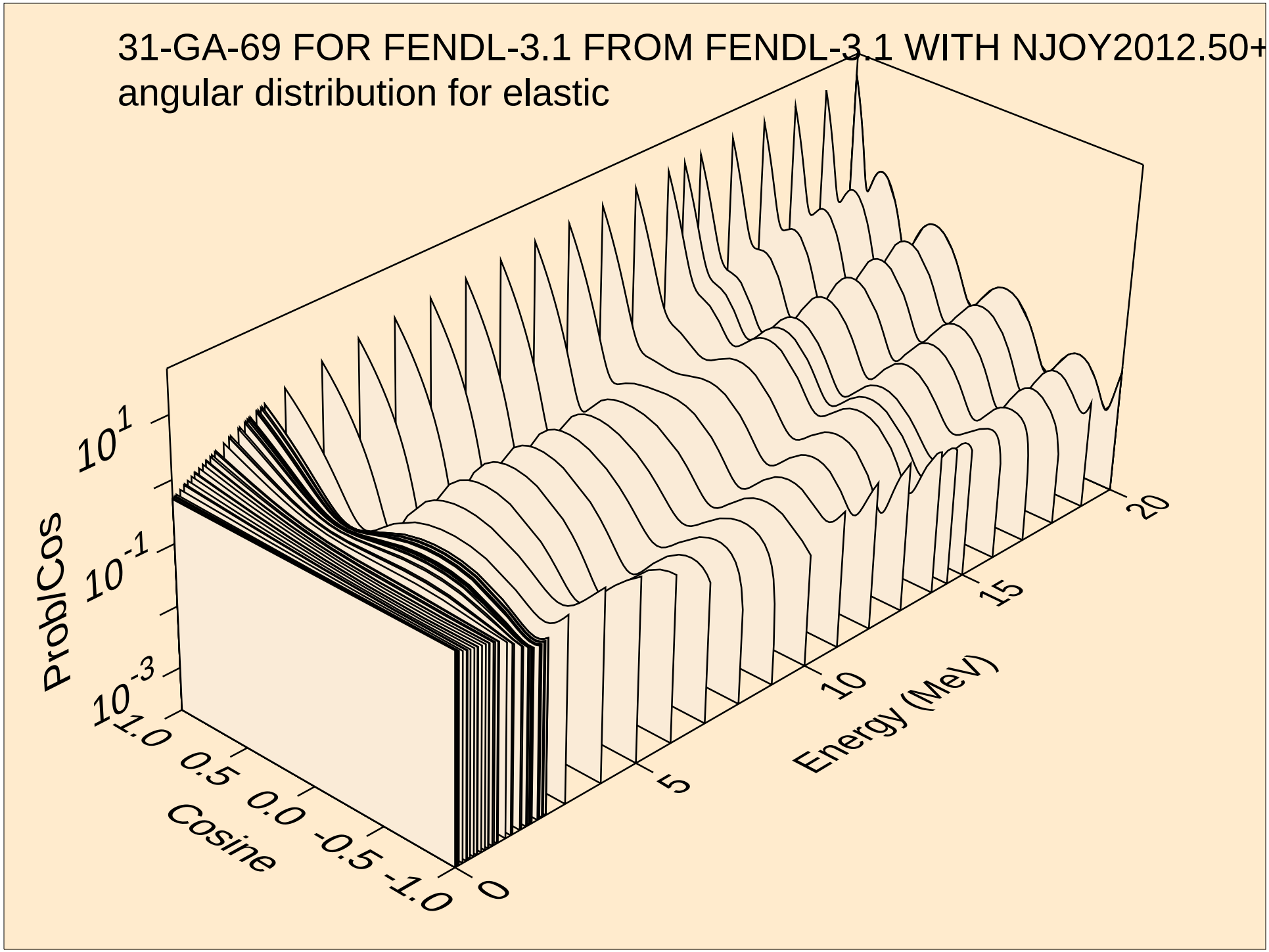

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Inelastic levels
Cross section (barns)
*10-3
30
25
20
15
10
5
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*21)
(n,n*22)
(n,n*23)
(n,n*24)
(n,n*25)

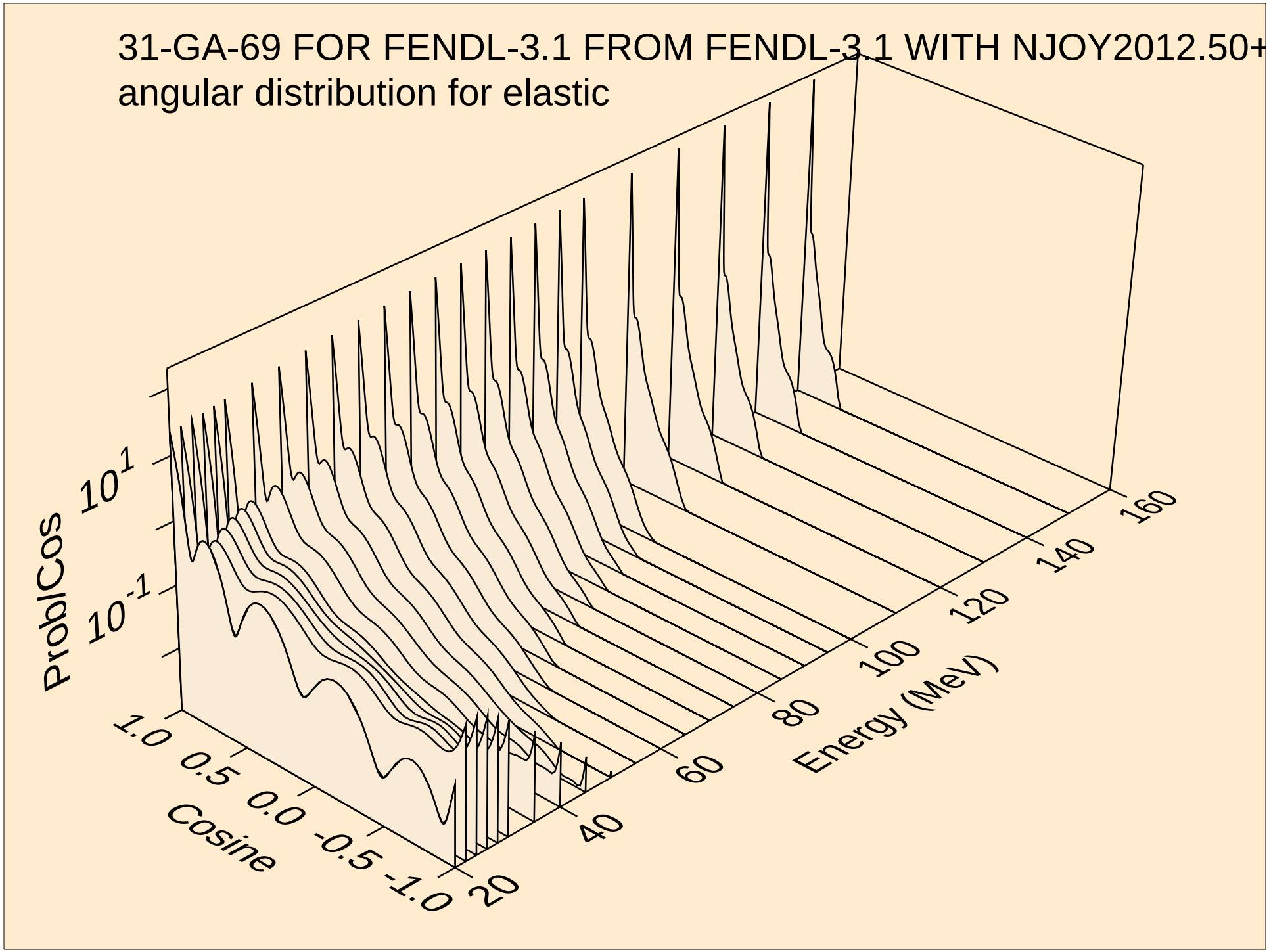

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Threshold reactions
(n,x)
(n,2n)
(n,n*)a
(n,n*)p
(n,n*)d
Cross section (barns)
Energy (MeV)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0
20
40
60
80
100
120
140
160

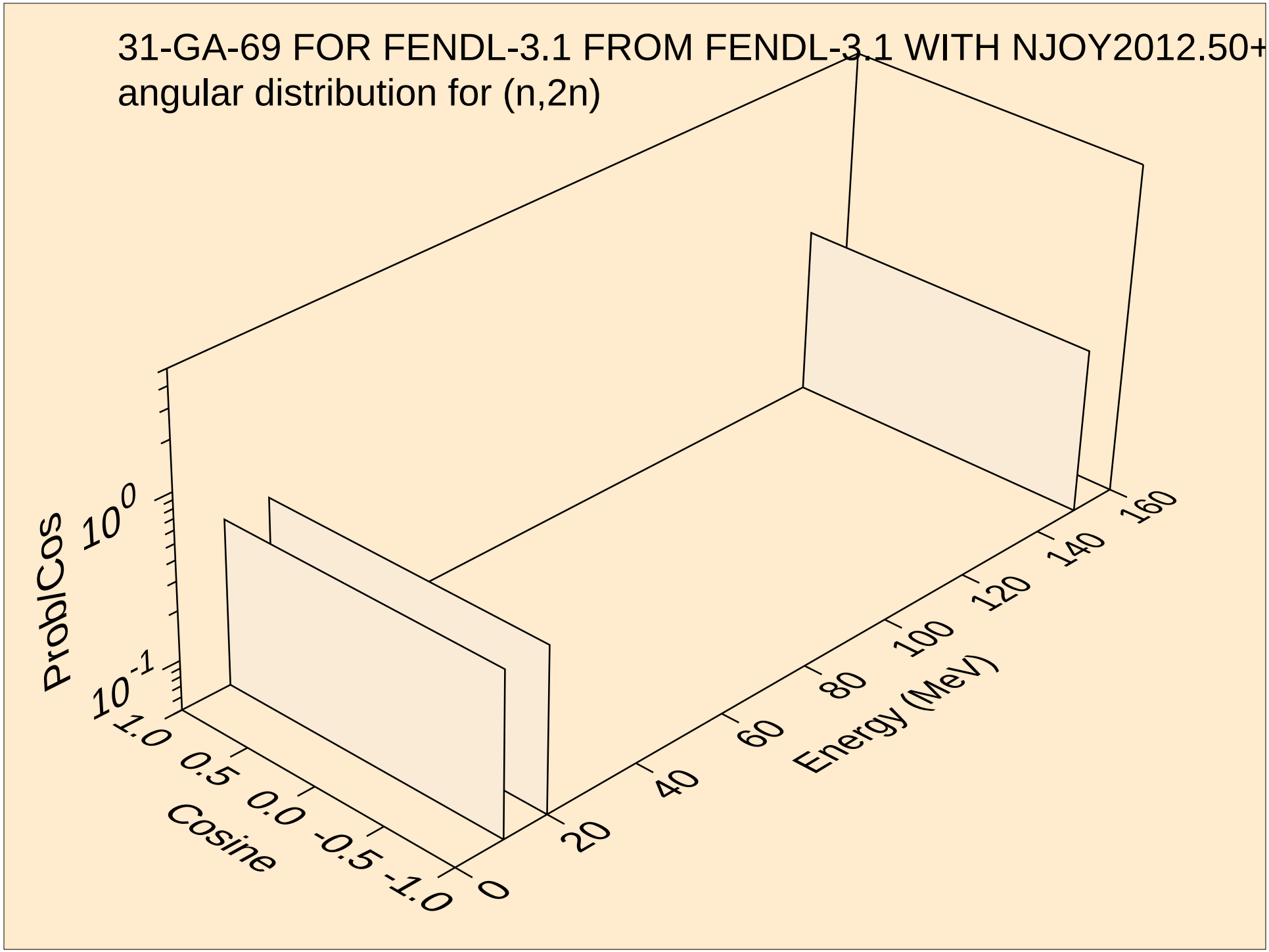

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Threshold reactions
(n,n*c)
(n,p)
(n,d)
(n,t)
(n,he3)
Cross section (barns)
Energy (MeV)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0
2
4
6
8
10
12
14
16
18
20

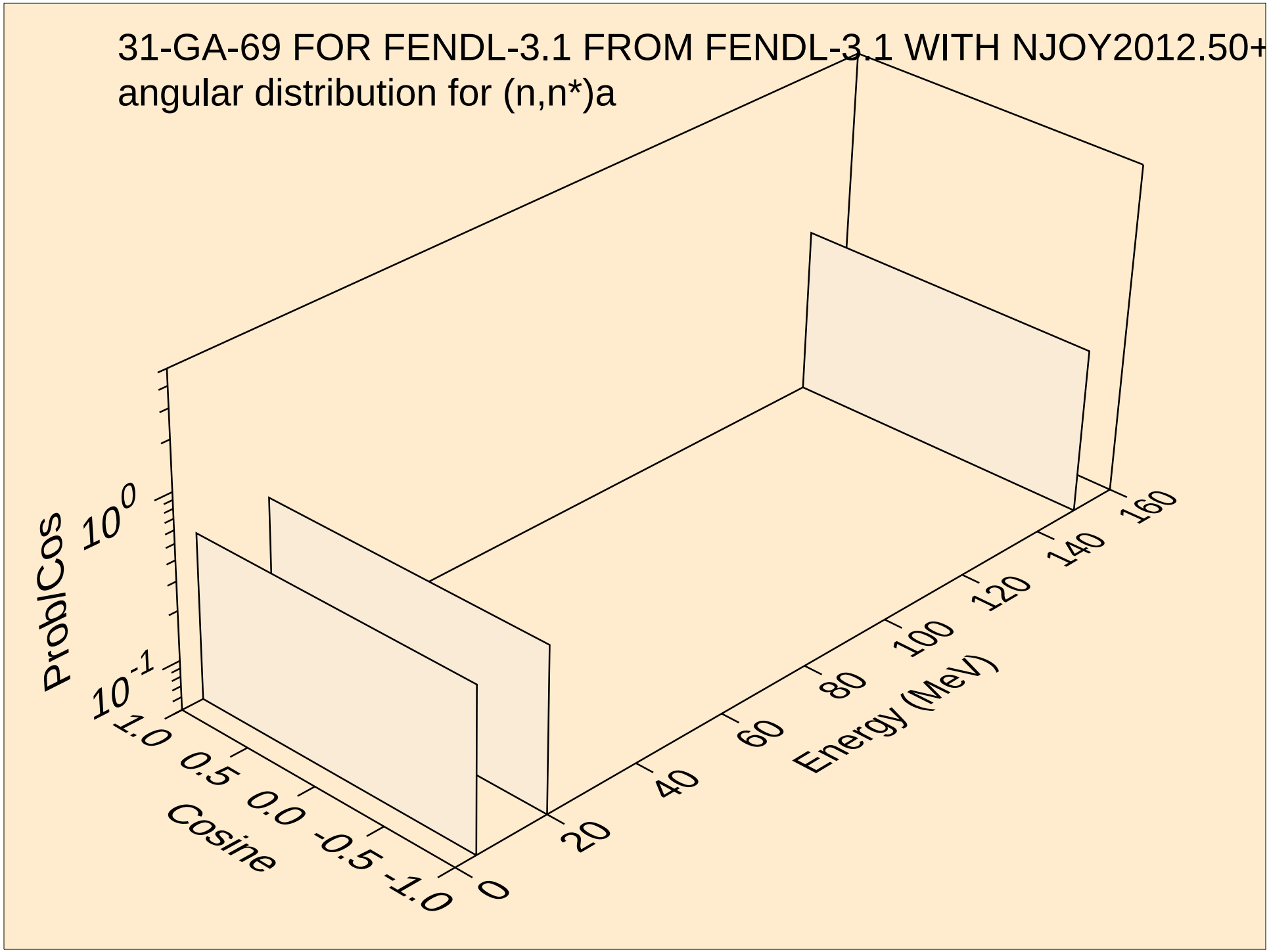

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Threshold reactions
*10-3
(n,a)
(n,2p)
Cross section (barns)
Energy (MeV)
0
5
10
15
20
25
0
2
4
6
8
10
12
14
16
18
20

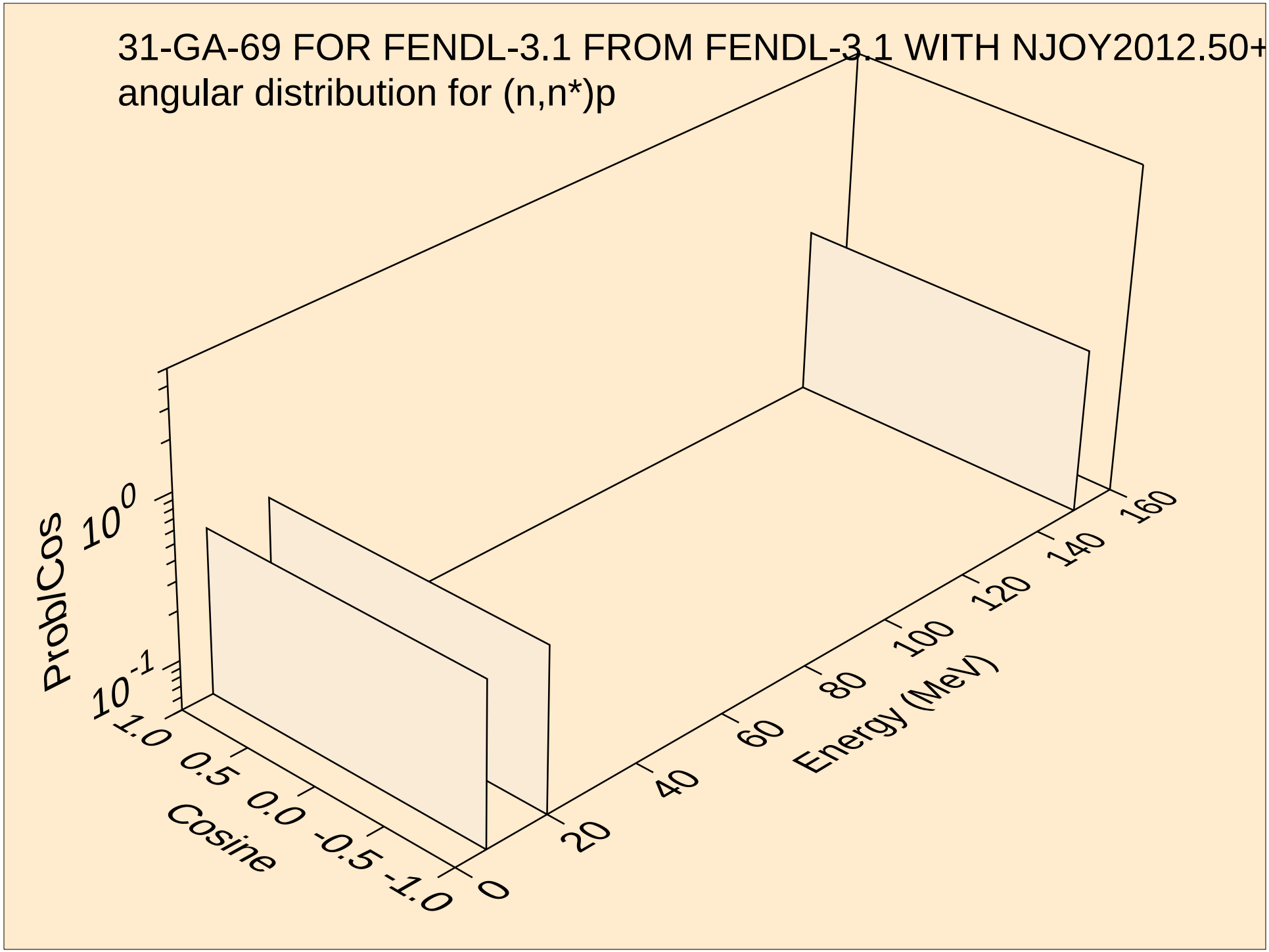

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Threshold reactions
(n,xp)
(n,xd)
(n,xt)
(n,xhe3)
(n,xa)
Cross section (barns)
Energy (MeV)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0
20
40
60
80
100
120
140
160

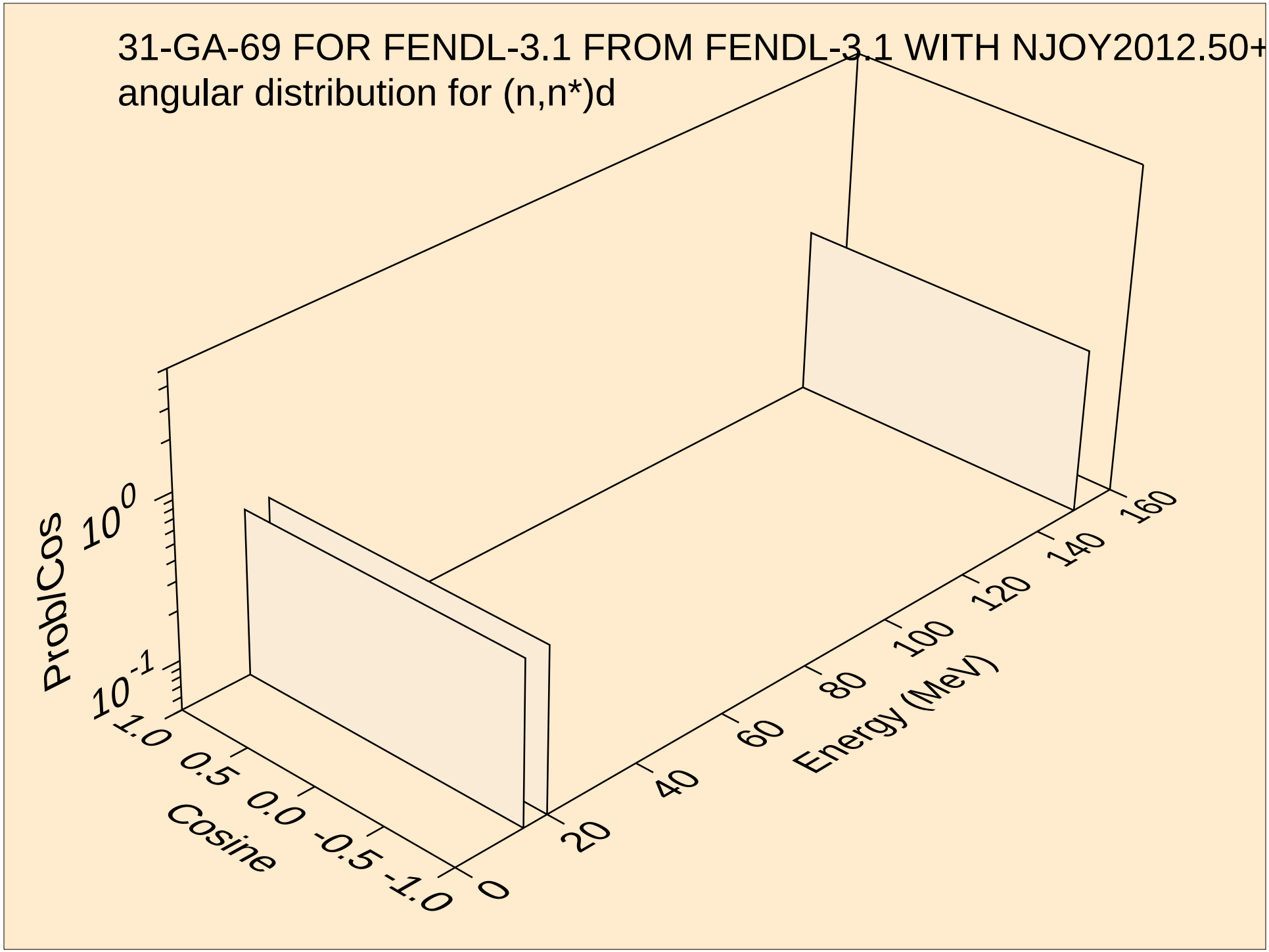

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for elastic
ProbICos
10^{1}
10^{-1}
10^{-3}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
5
10
15
20
Energy (MeV)

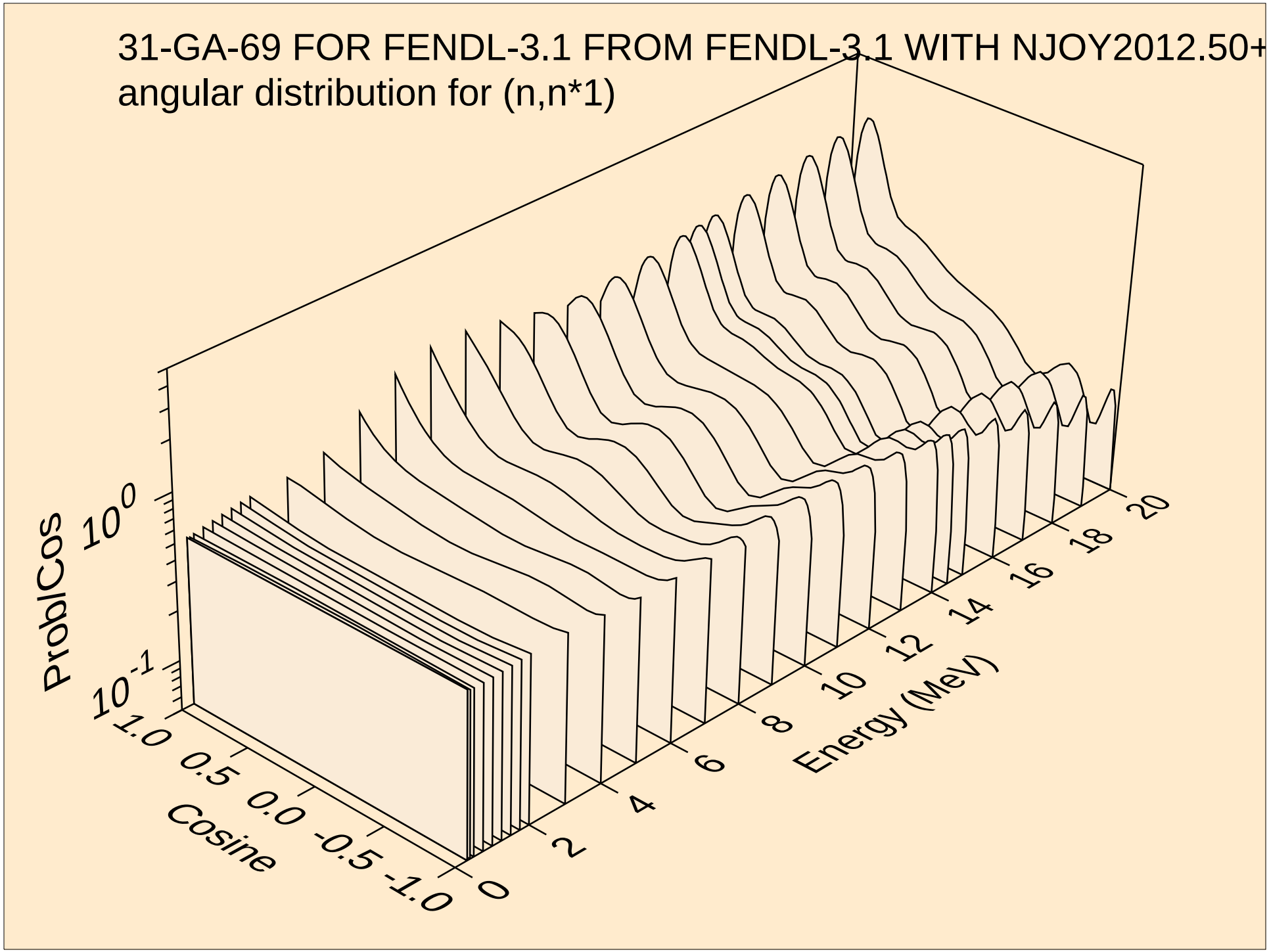

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for elastic
ProbICos
10^1
10^-1
1.0
0.5
0.0
-0.5
-1.0
Cosine
20
40
60
80
100
120
140
160
Energy (MeV)

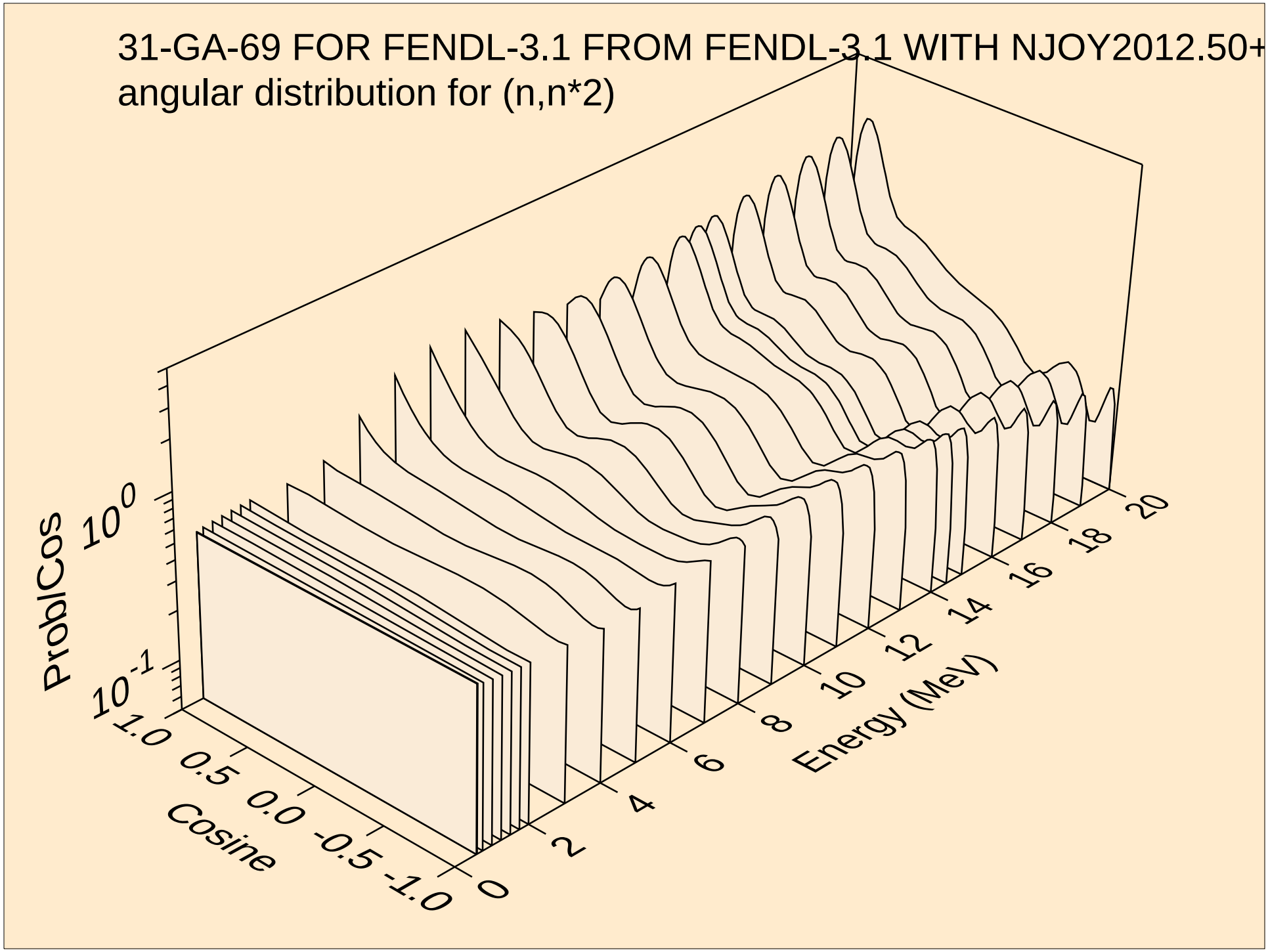

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,2n)
ProblCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
20
40
60
80
100
120
140
160
Energy (MeV)

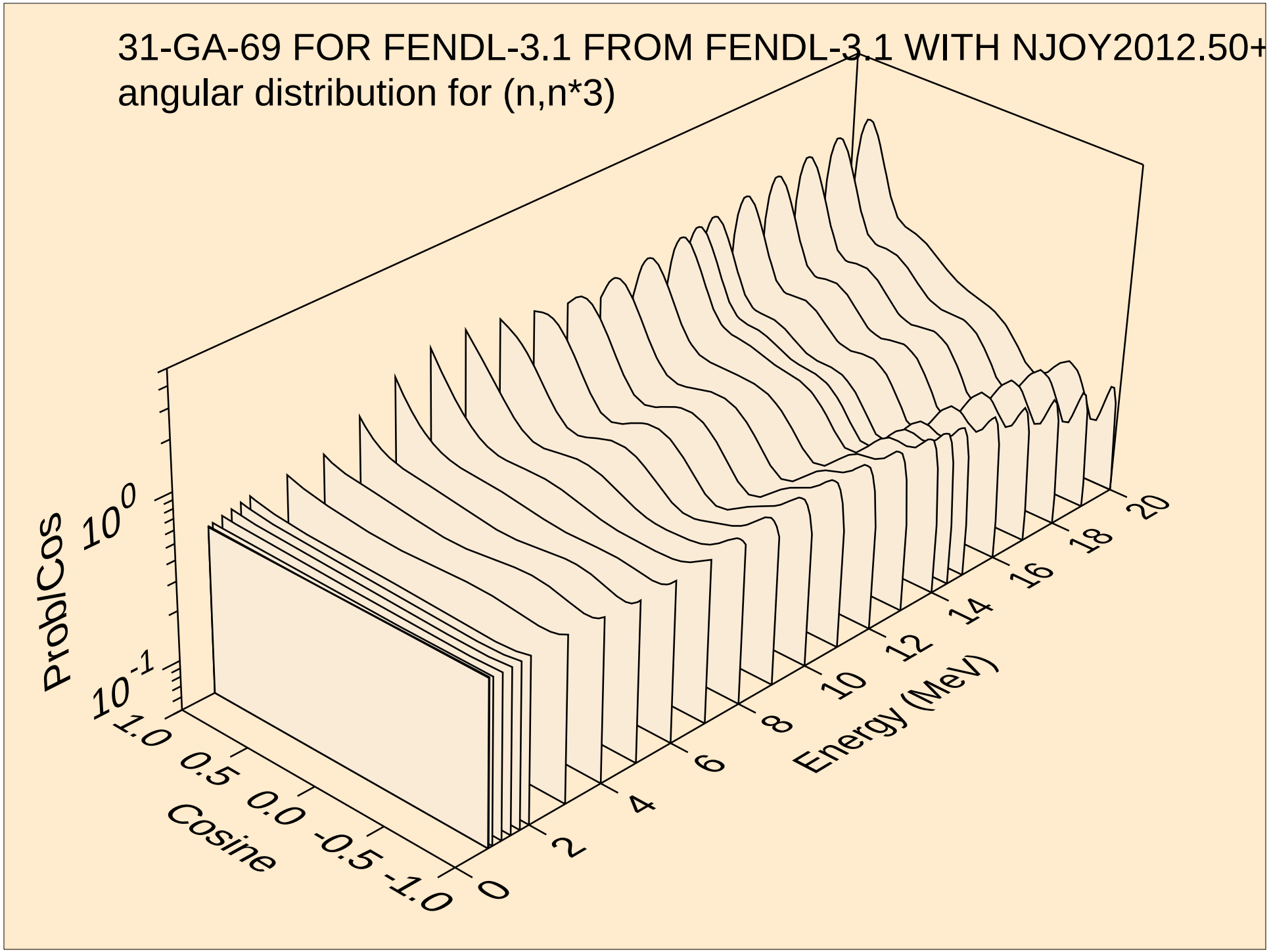

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*)a
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
20
40
60
80
100
120
140
160
Energy (MeV)

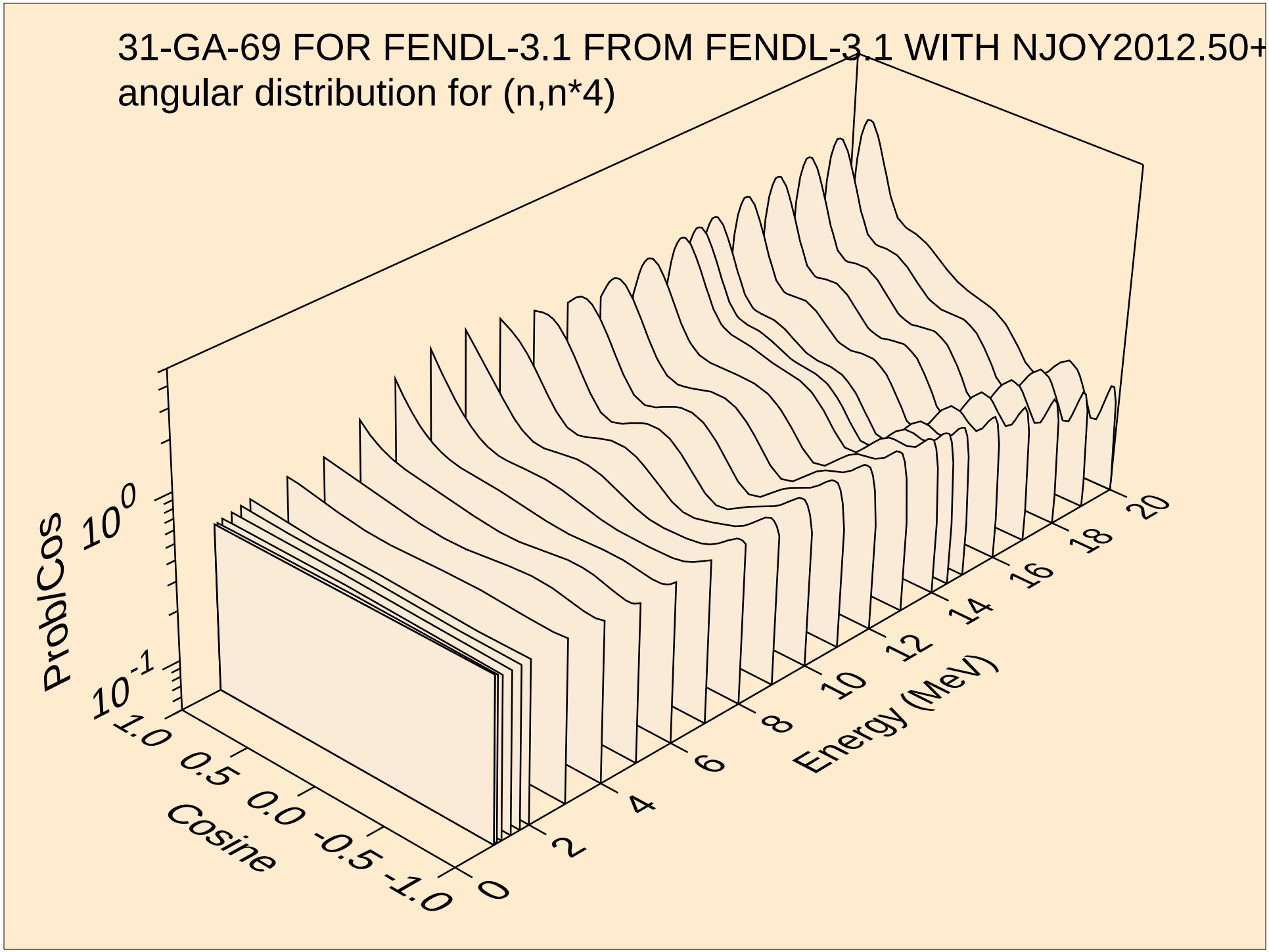

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*)p
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
20
40
60
80
100
120
140
160
Energy (MeV)

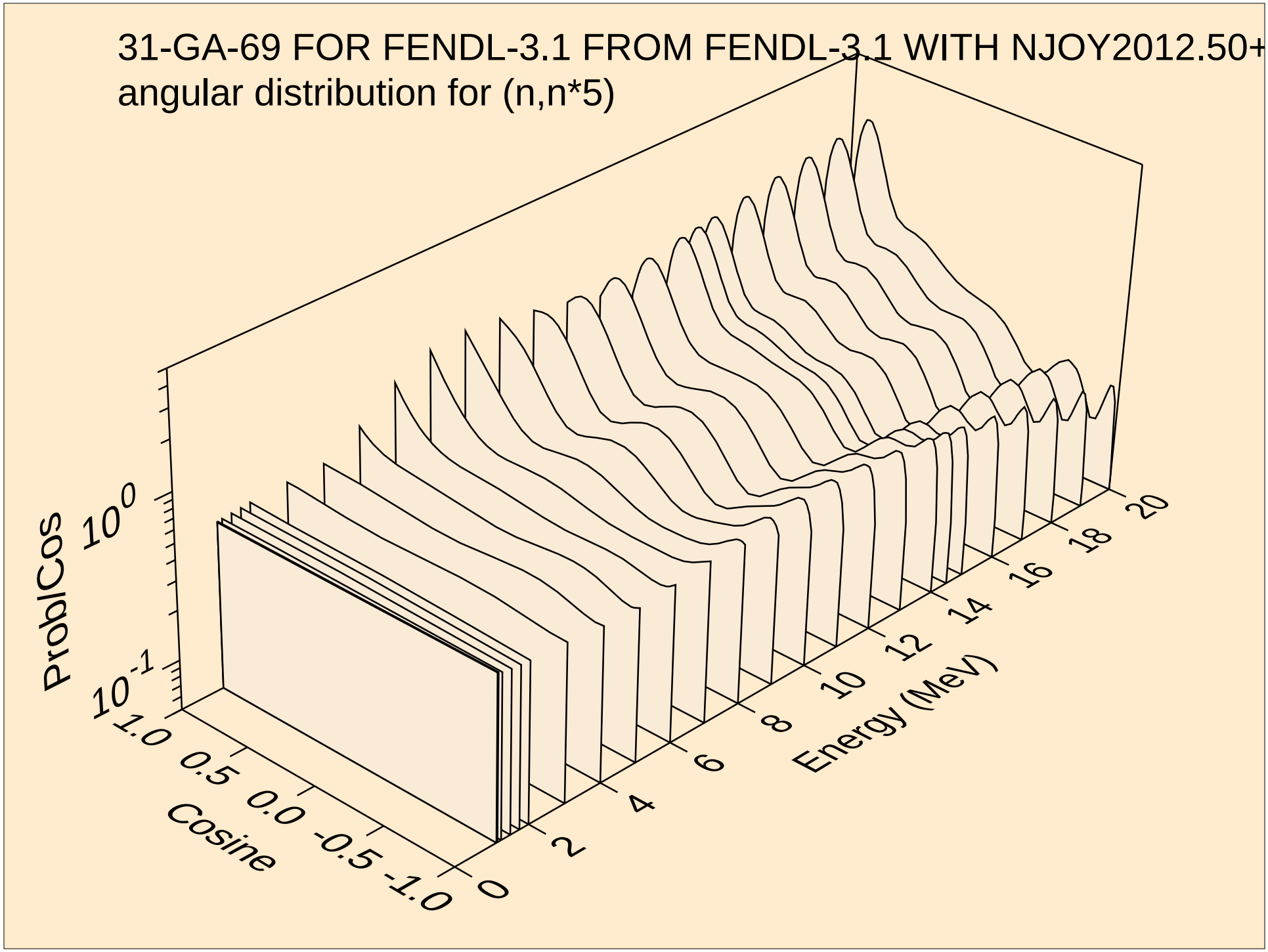

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*)d
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
20
40
60
80
100
120
140
160
Energy (MeV)

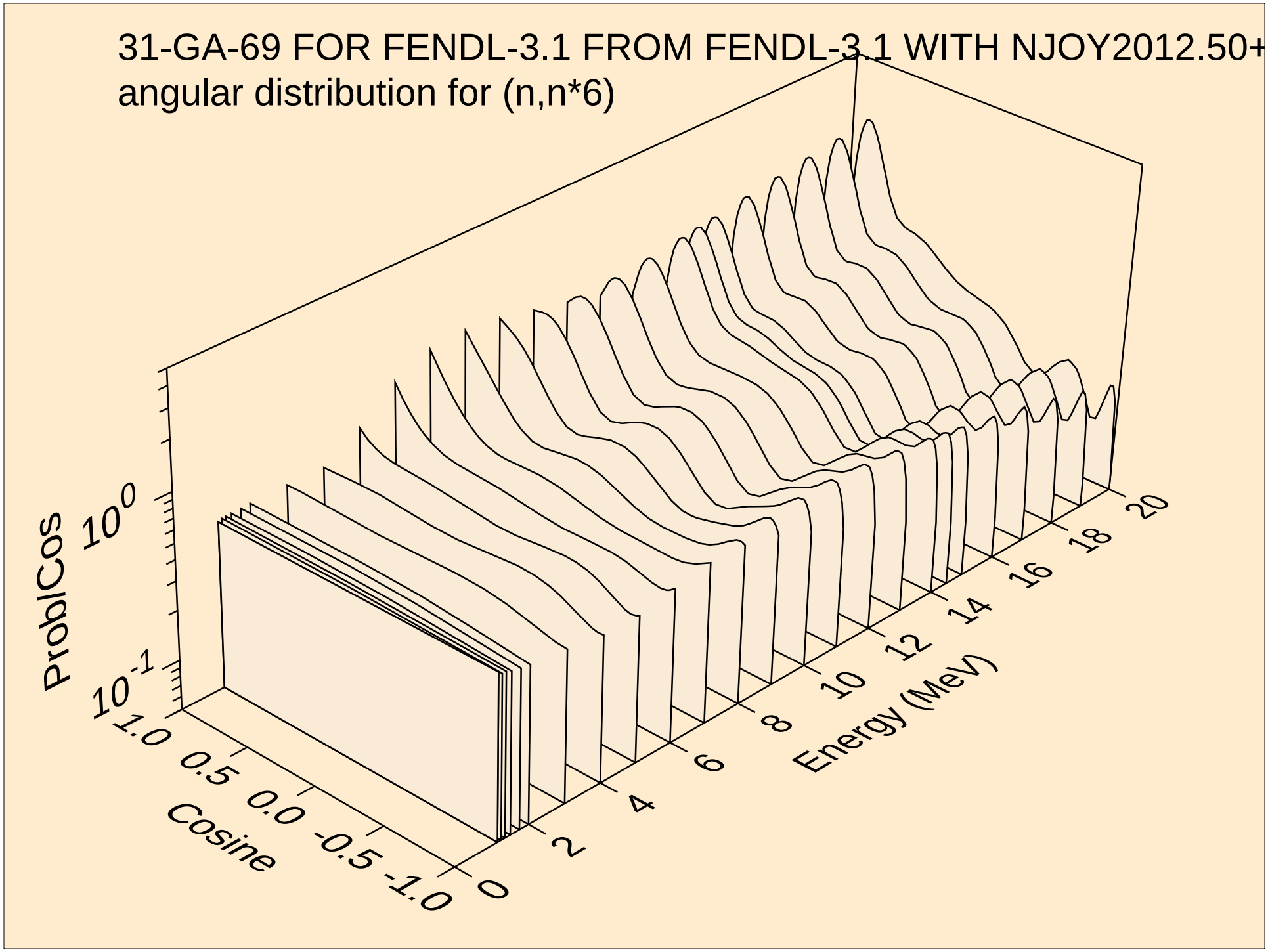

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*1)
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

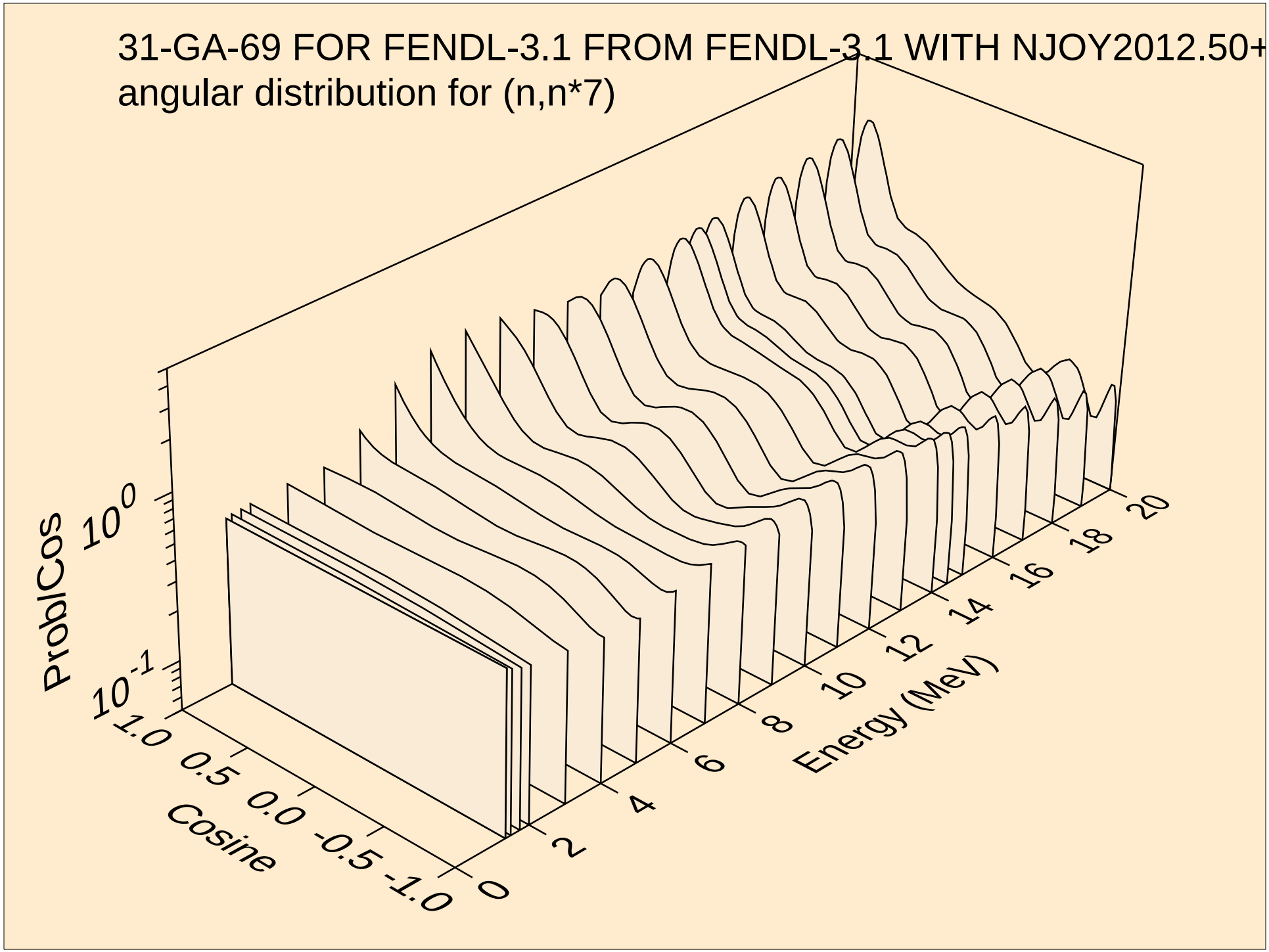

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*2)
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

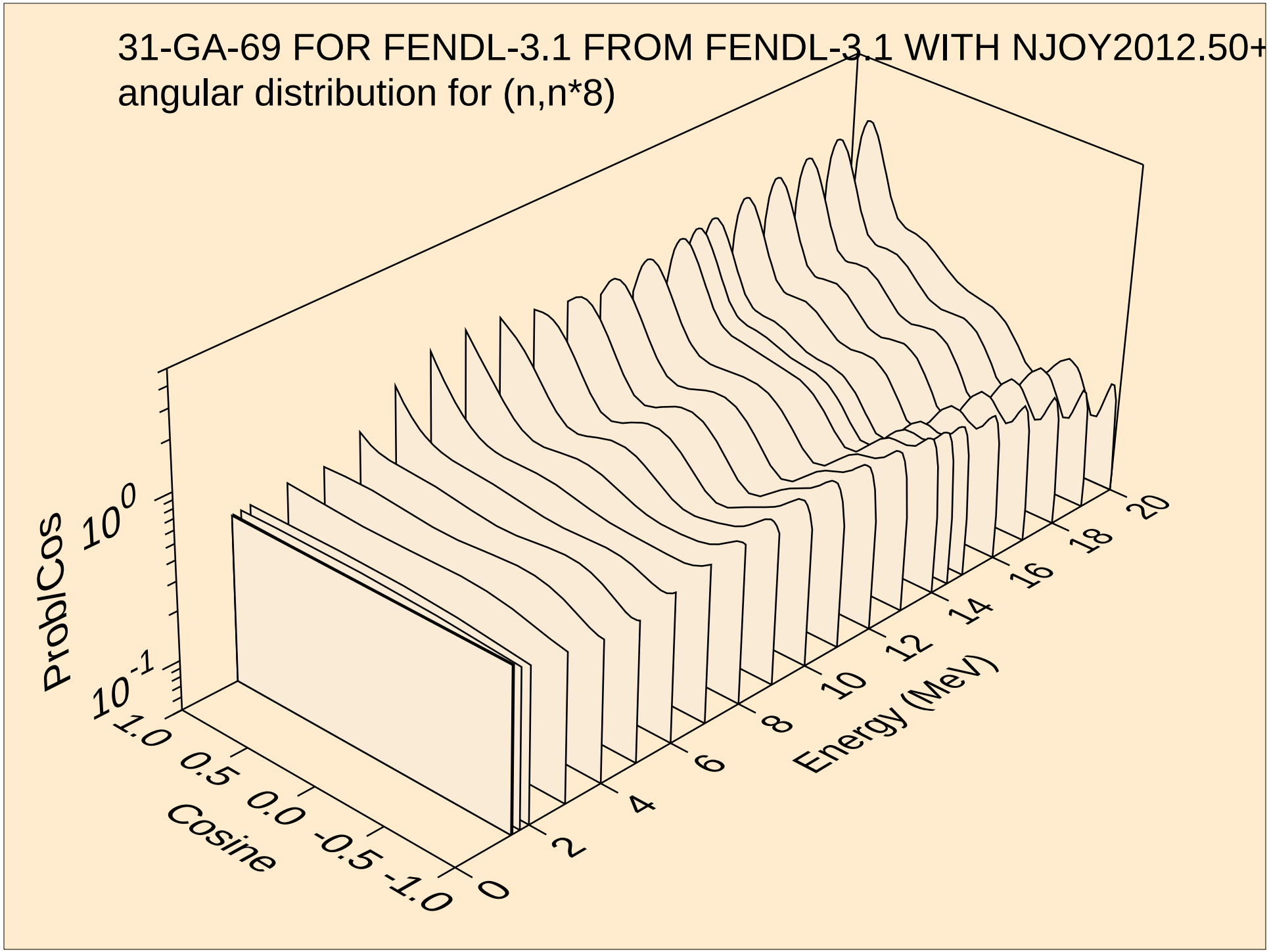

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*3)
ProbCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

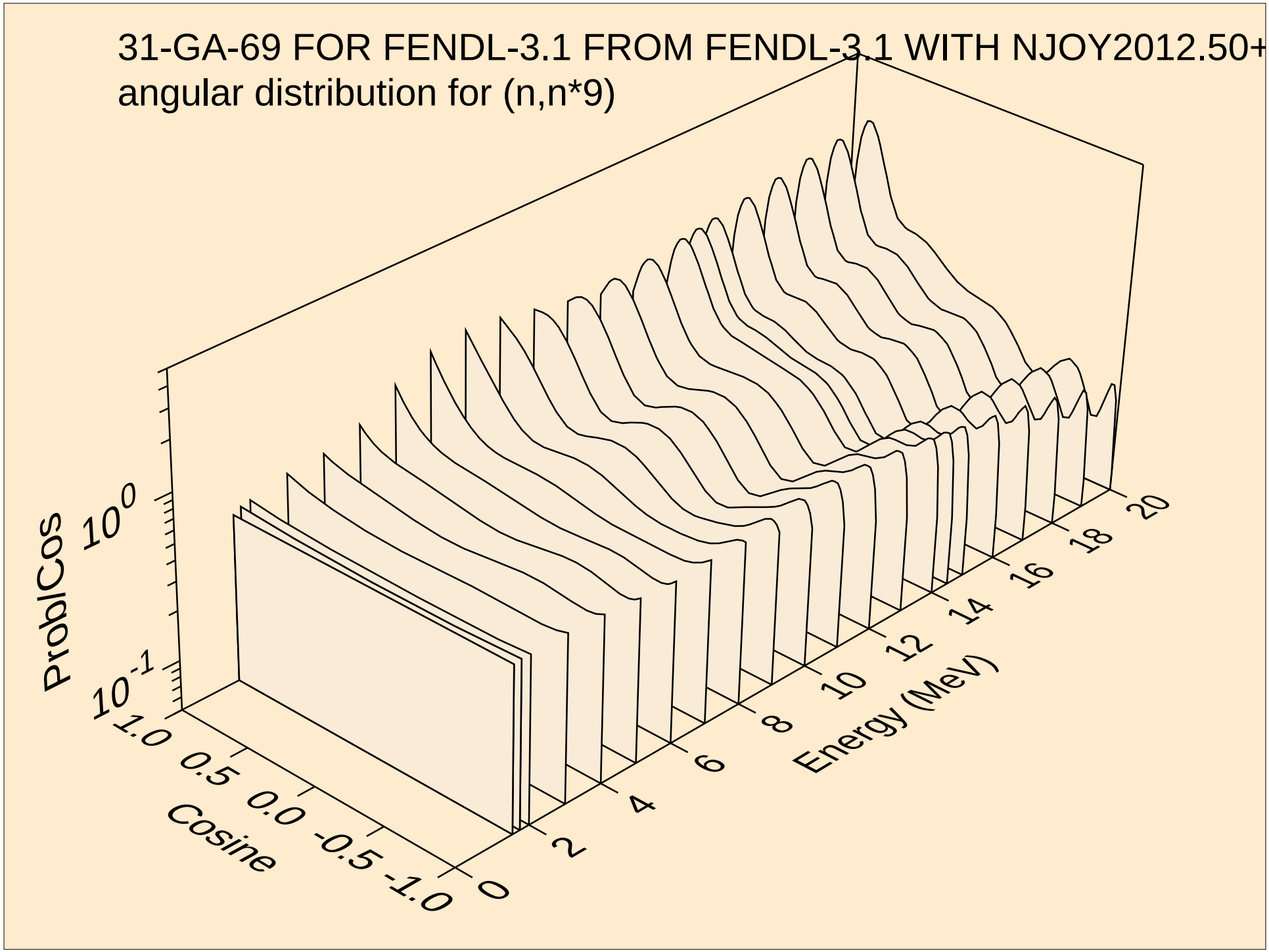

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*4)
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

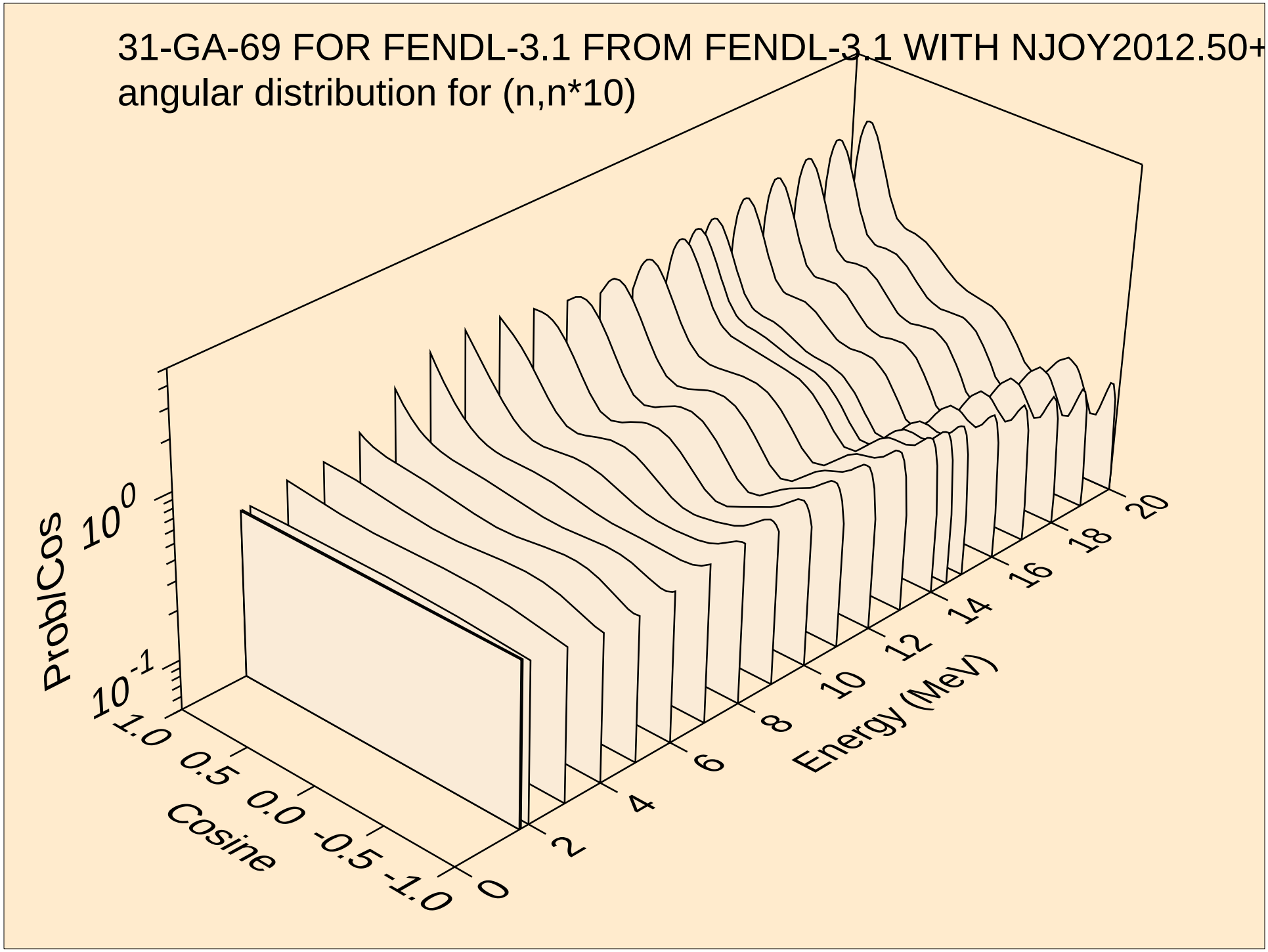

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*5)
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

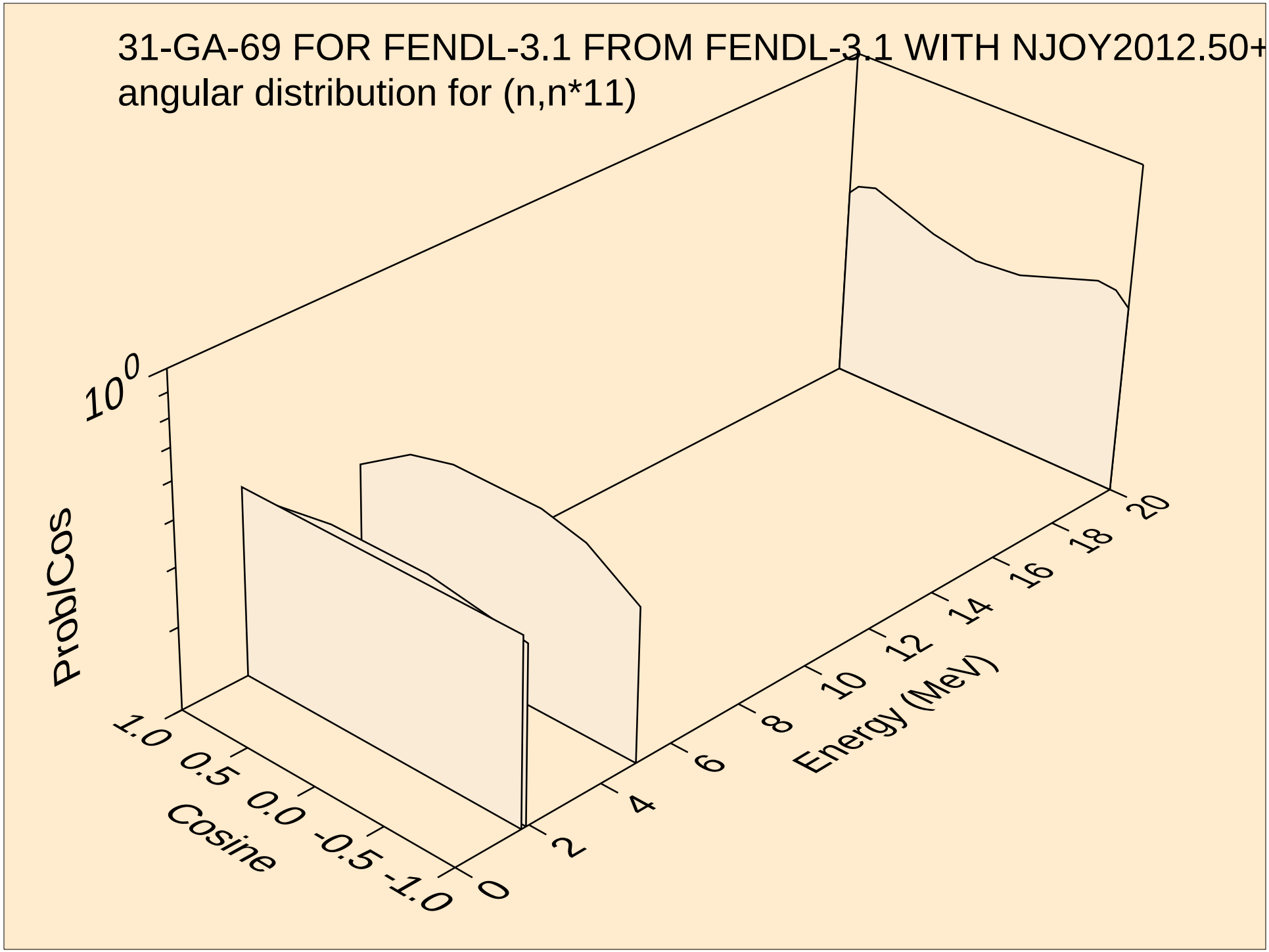

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*6)
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

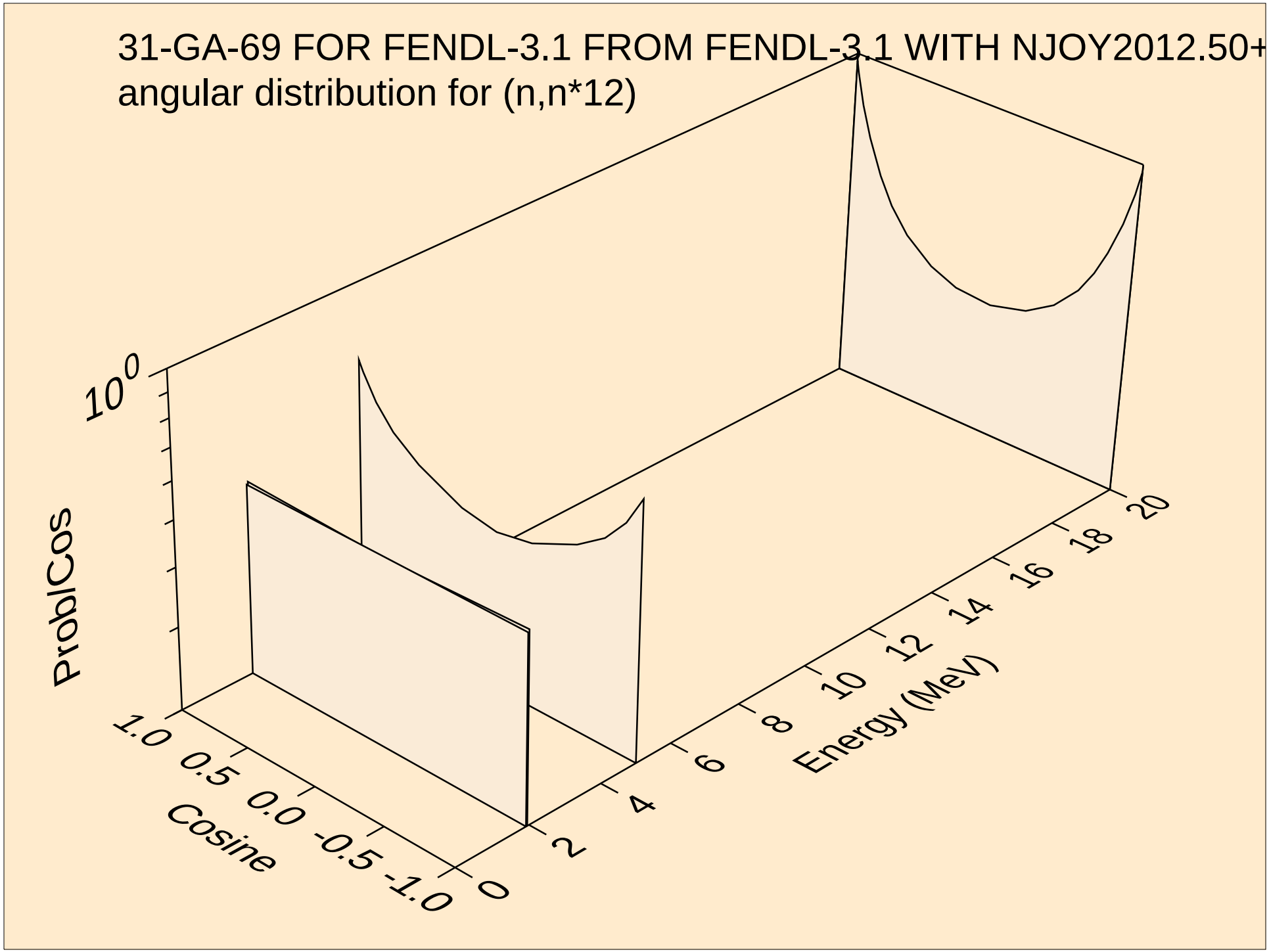

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*7)
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

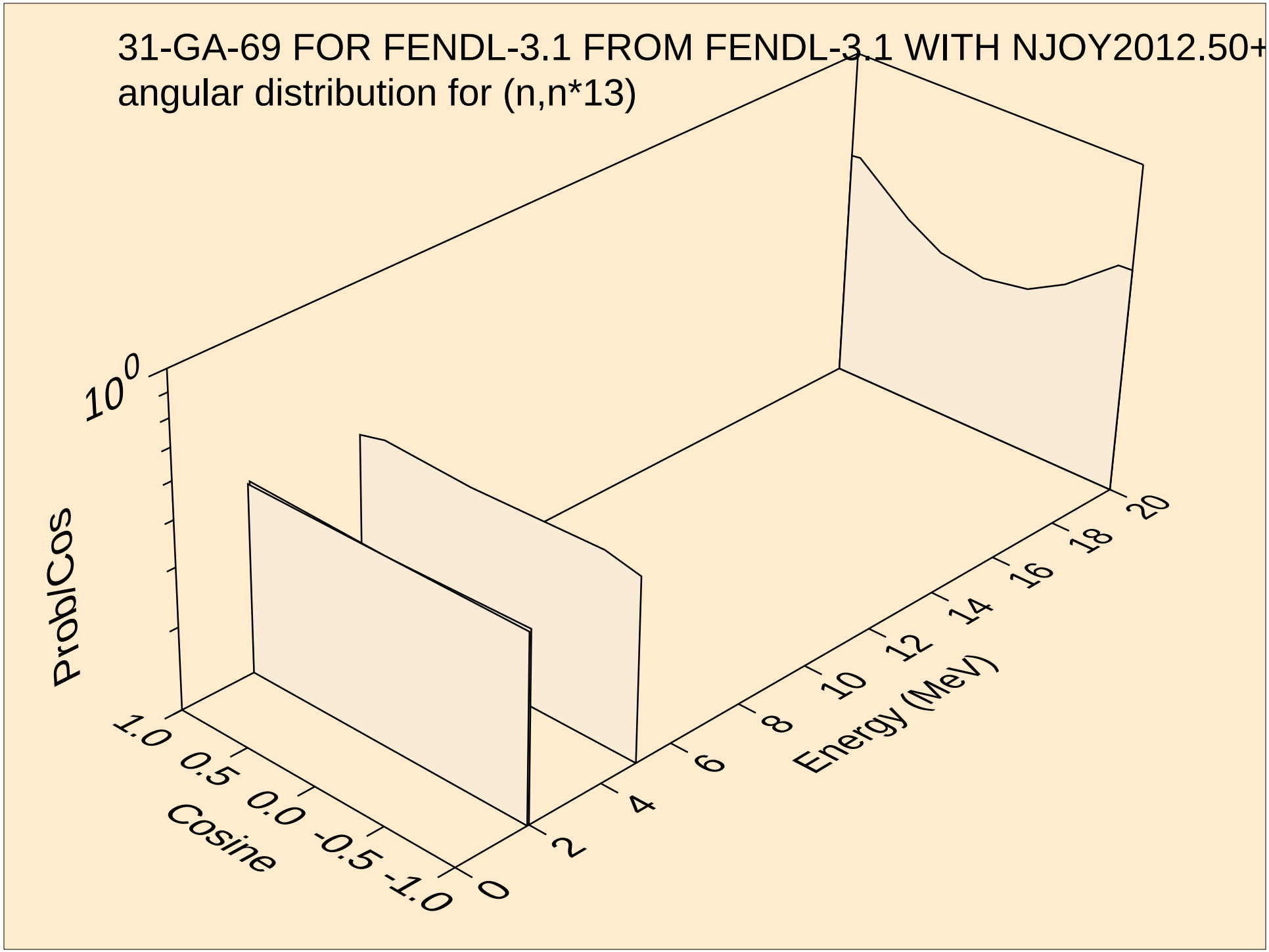

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*8)
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

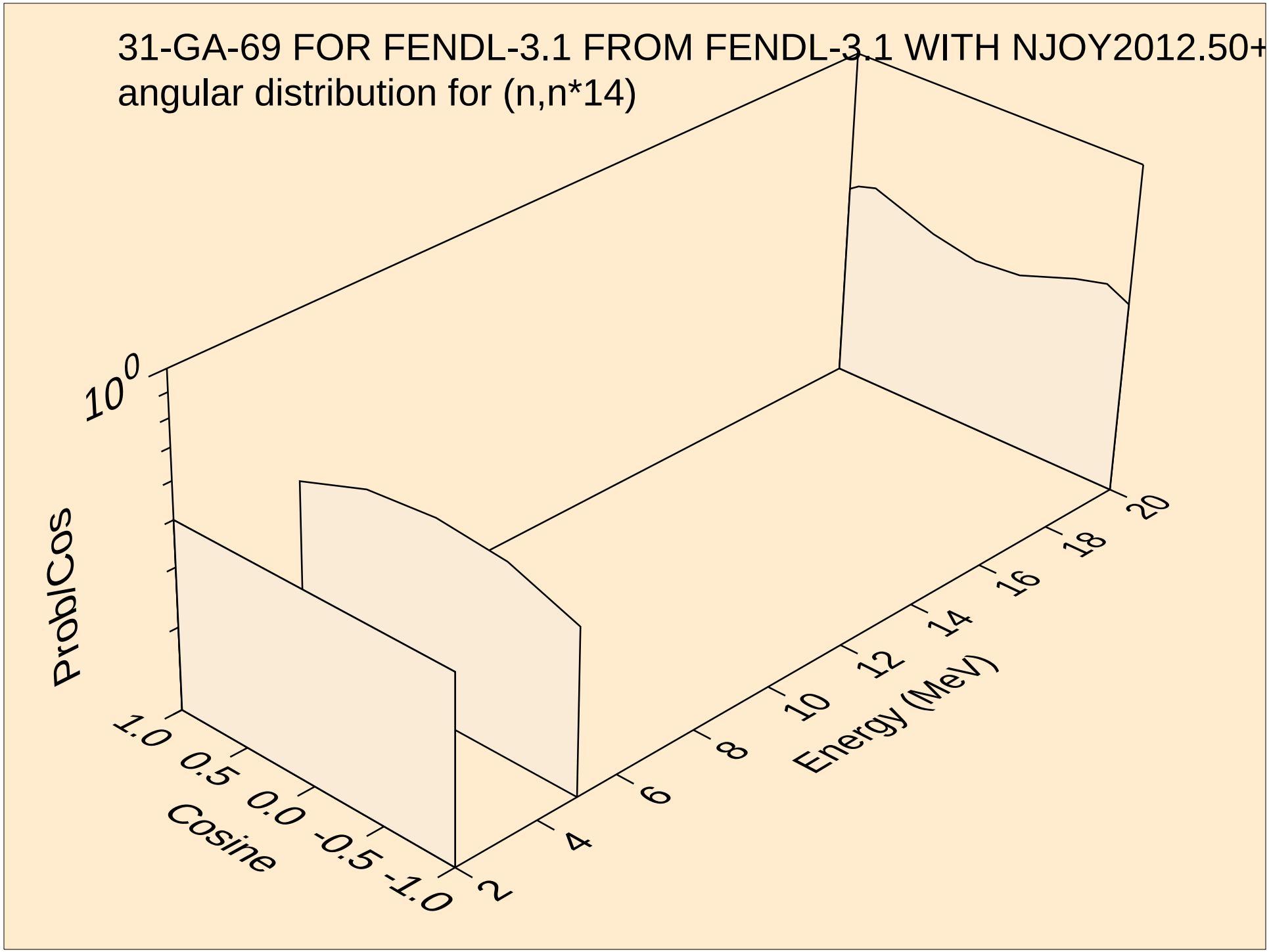

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*9)
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

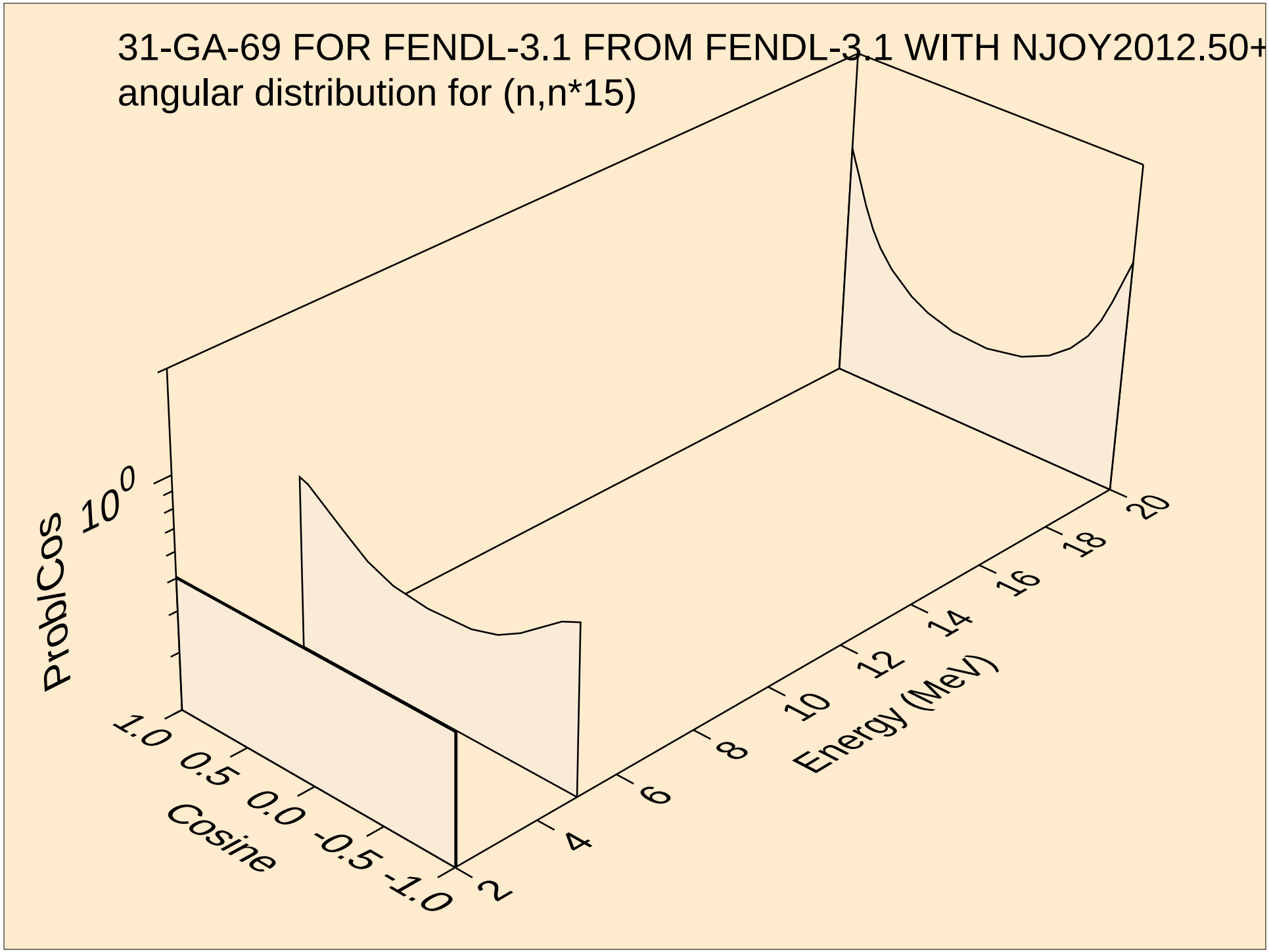

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*10)
ProbICos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

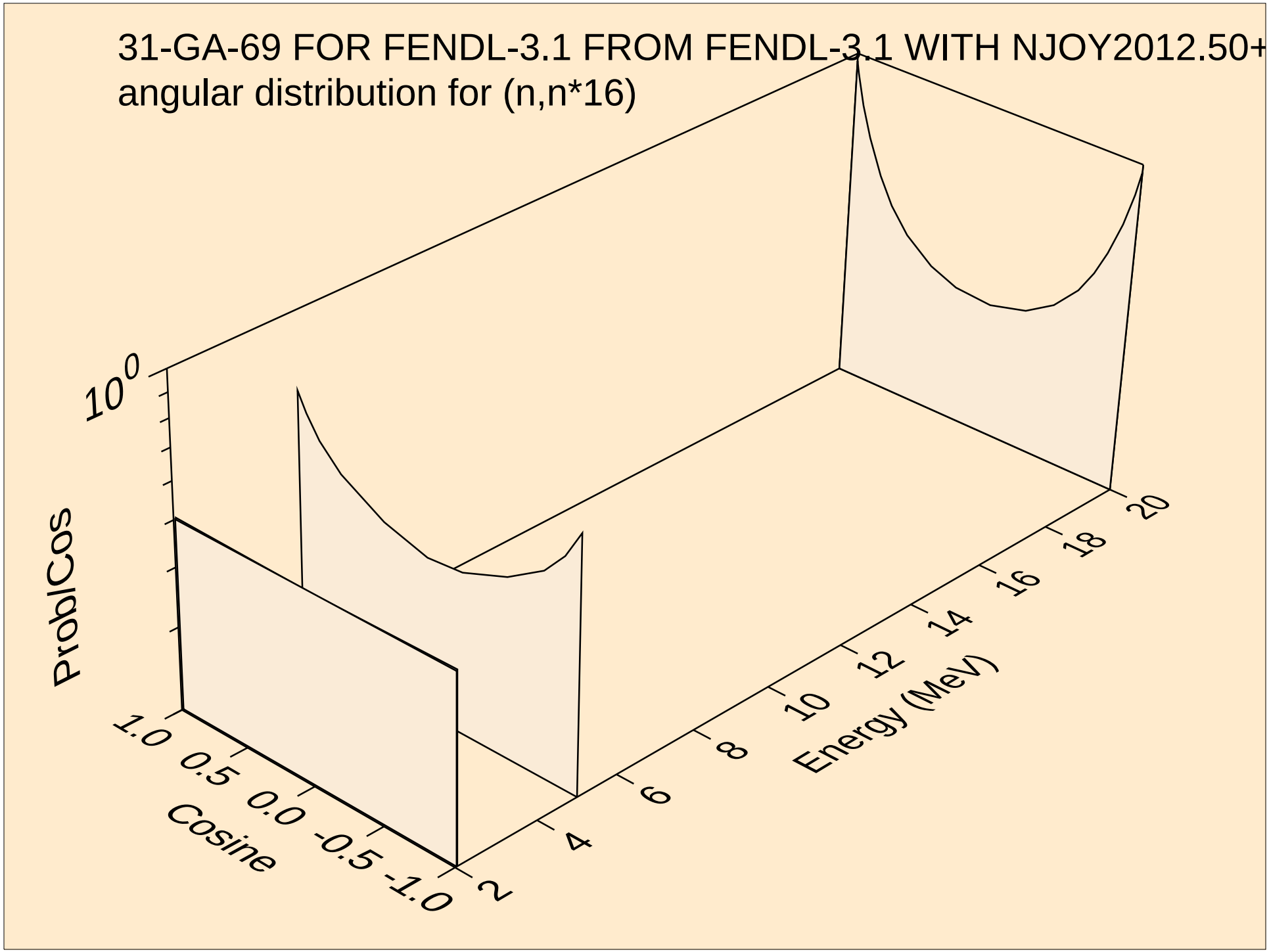

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*11)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

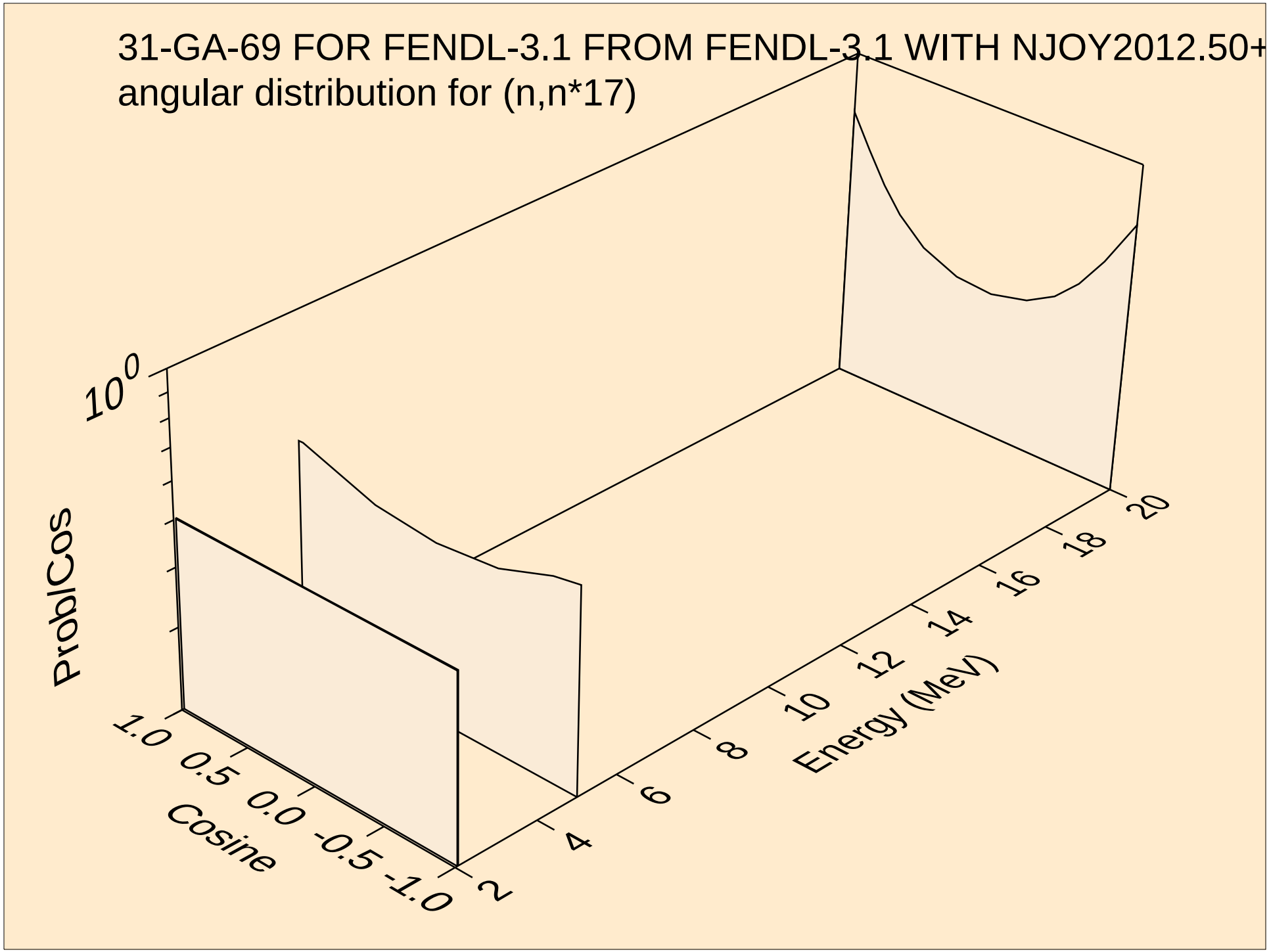

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*12)
10^0
Prob\Cos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

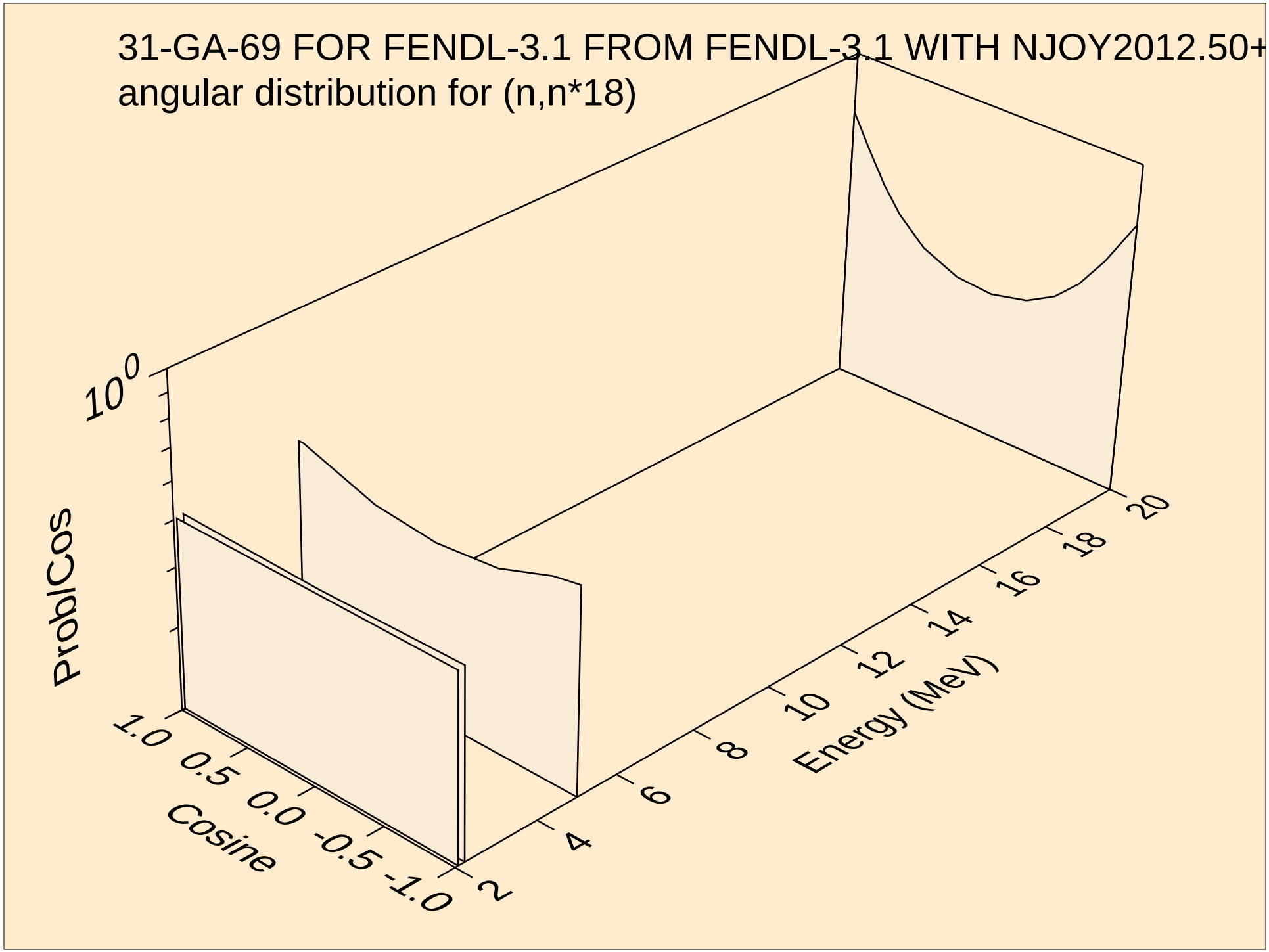

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*13)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

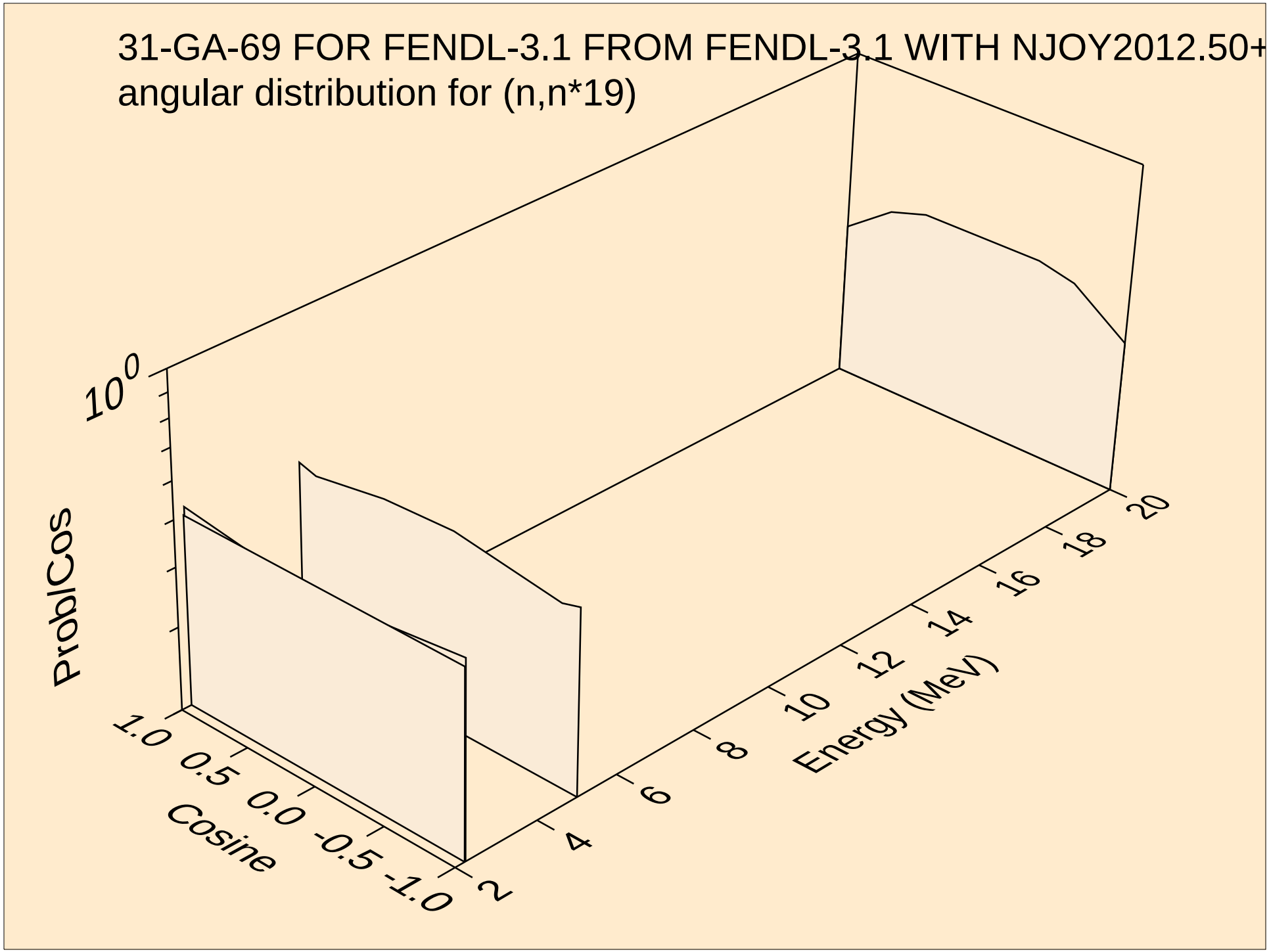

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*14)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

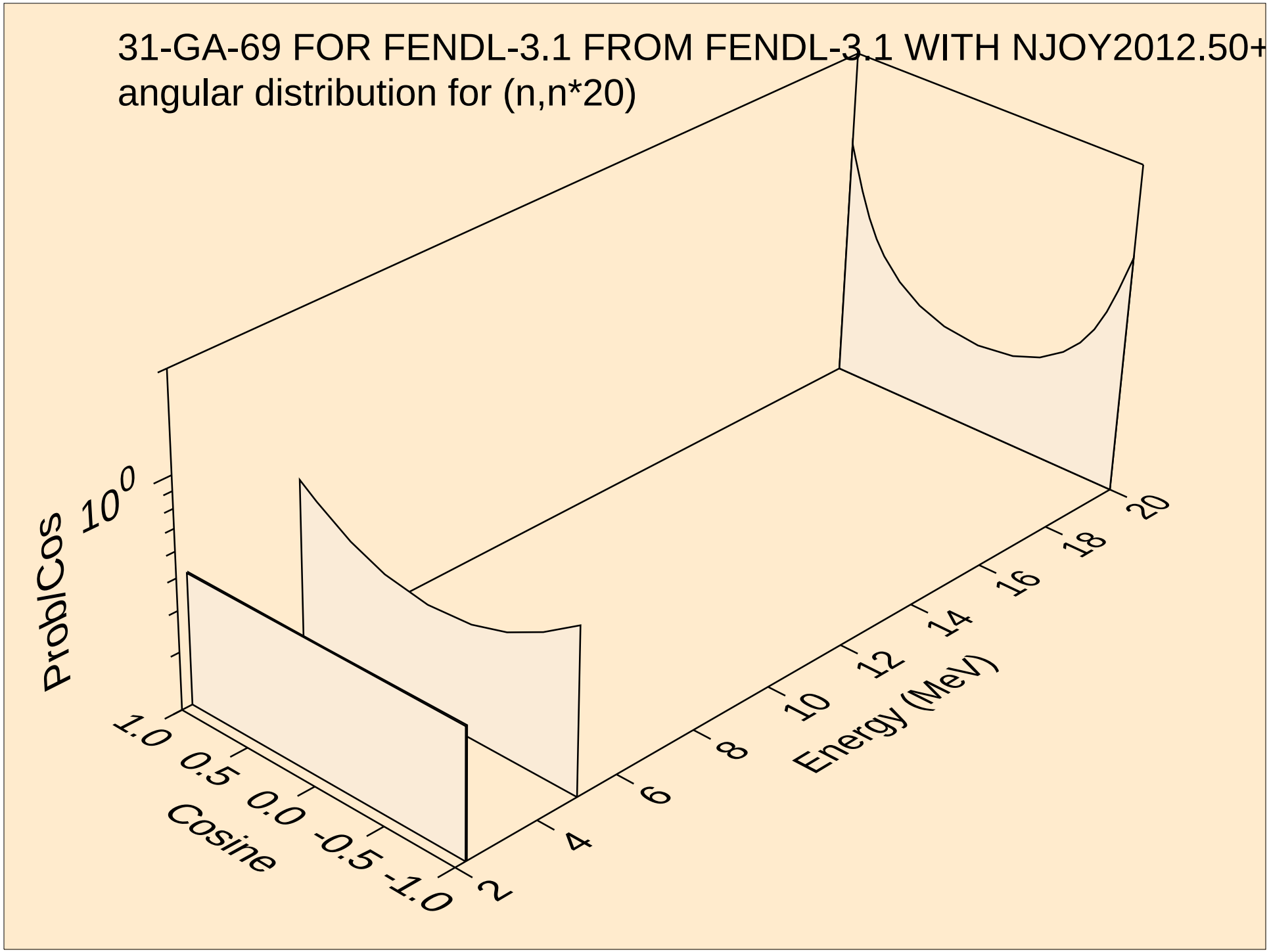

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*15)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

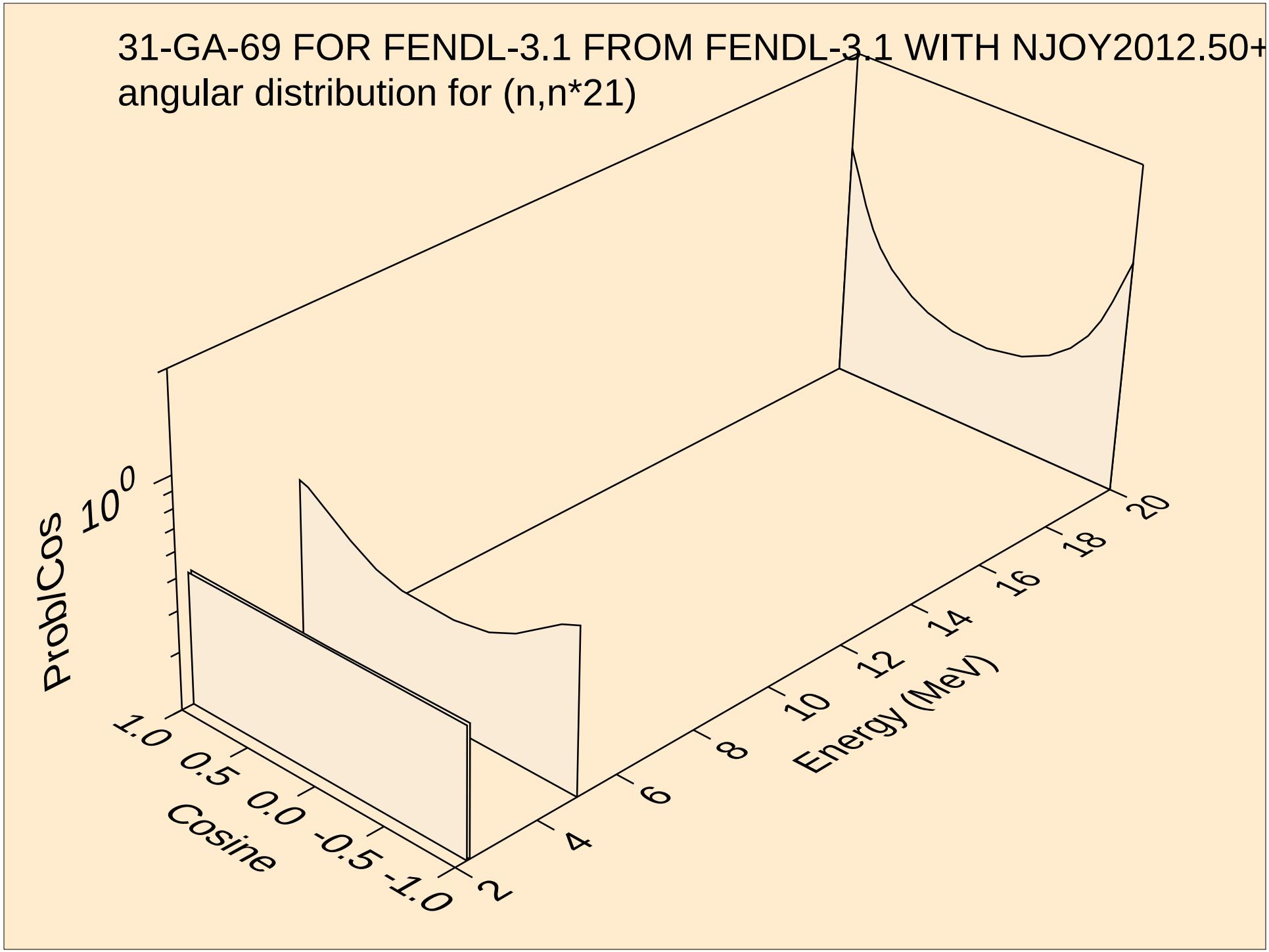

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*16)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

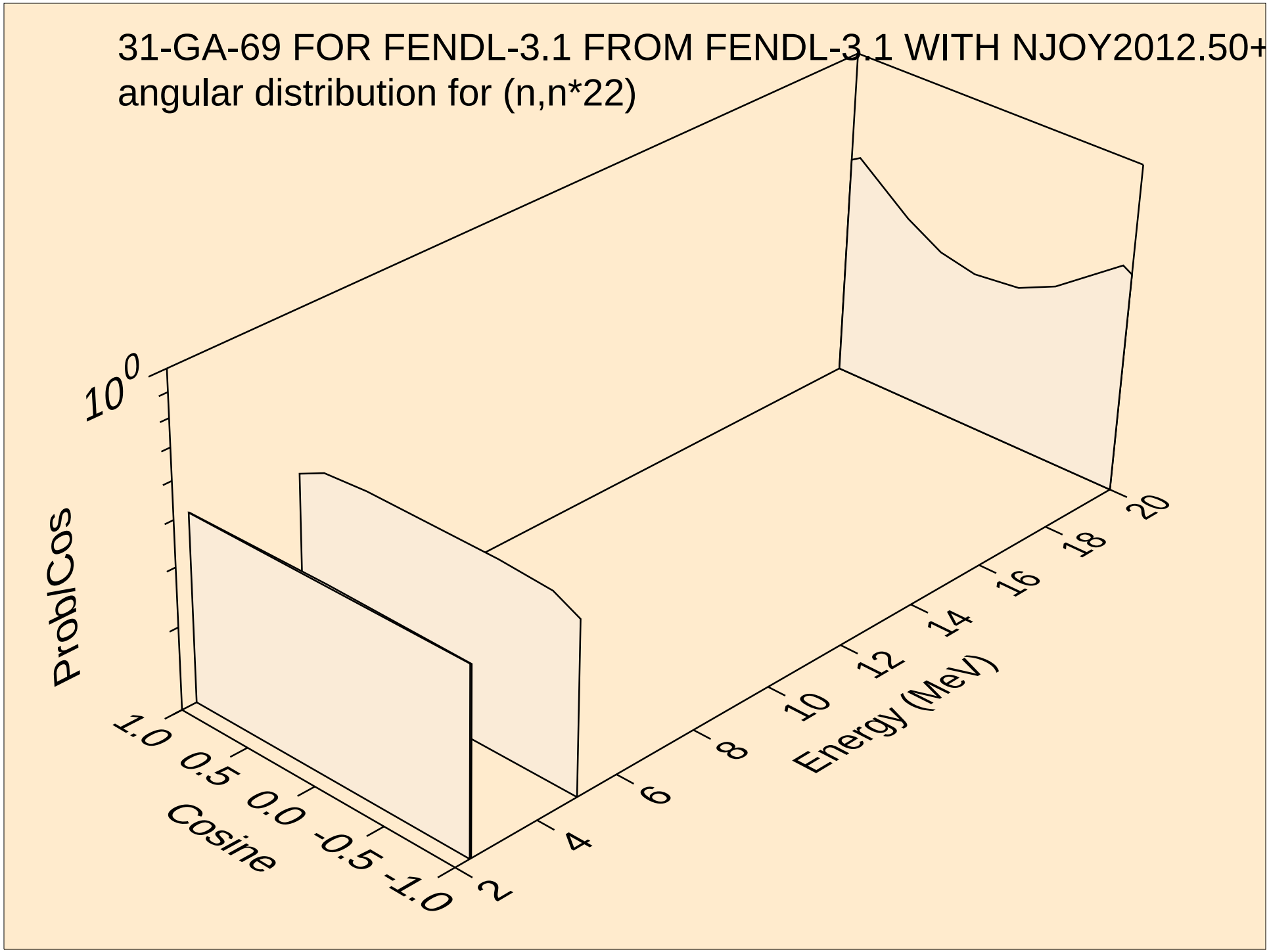

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*17)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

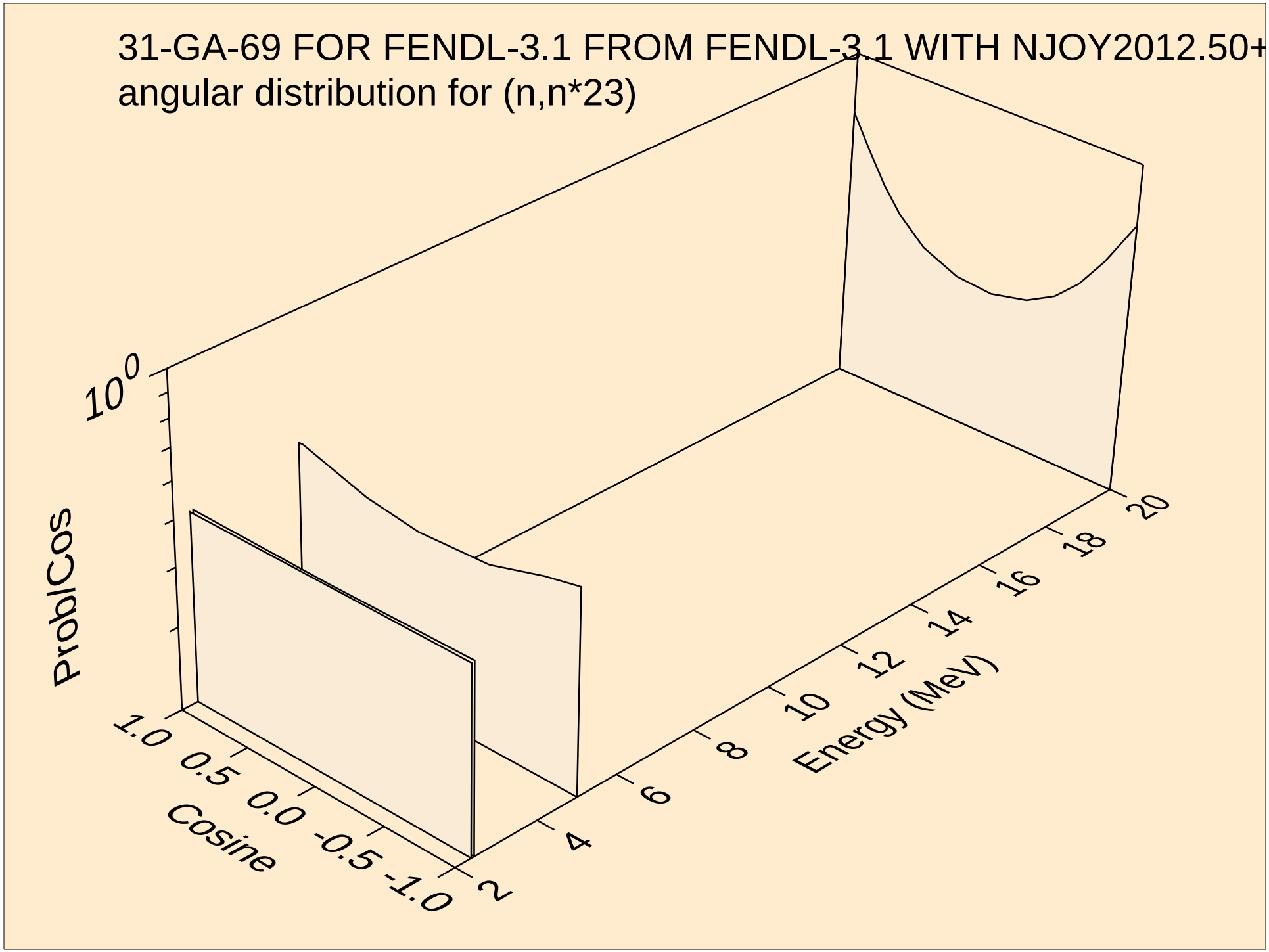

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*18)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

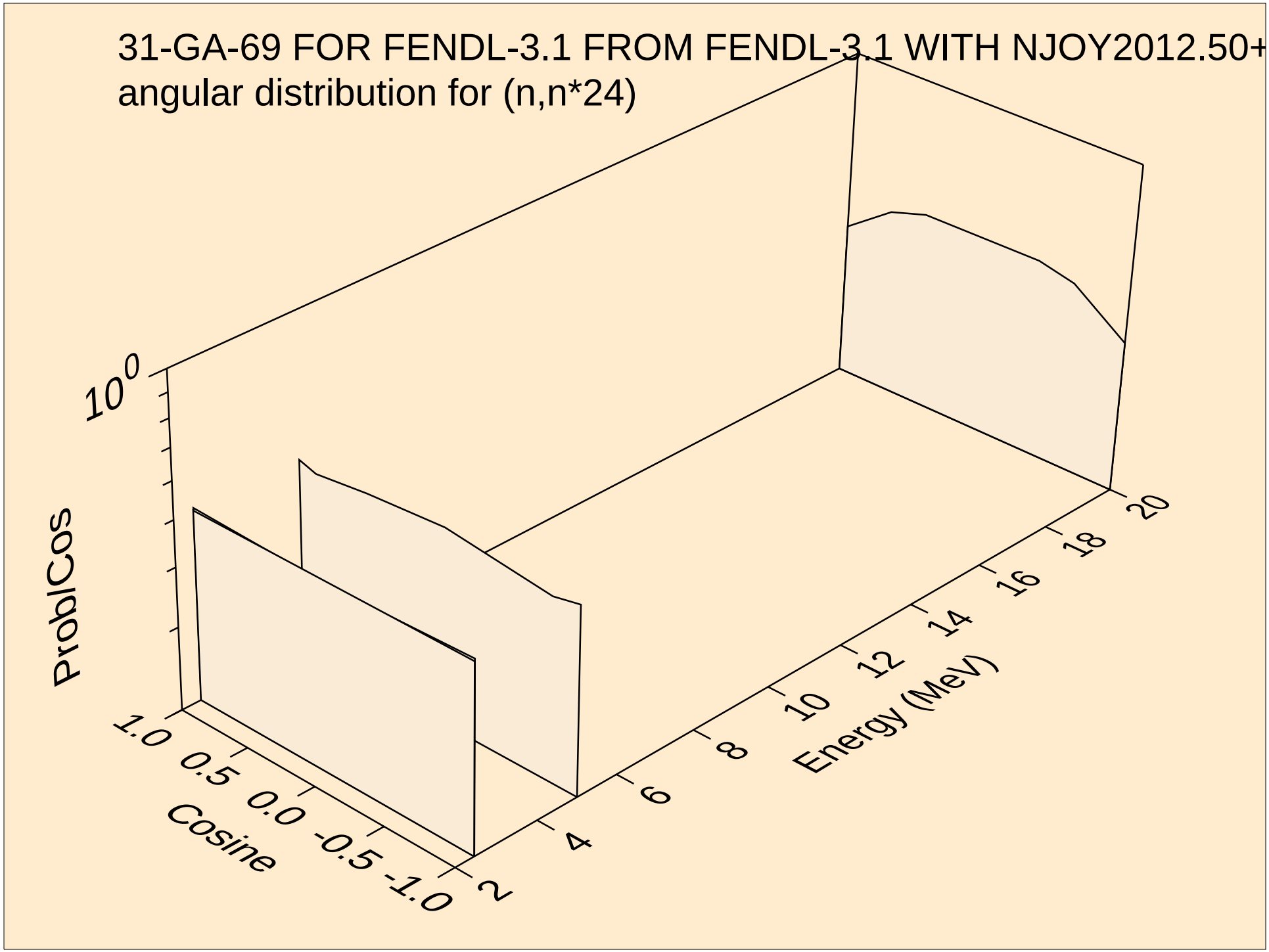

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*19)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

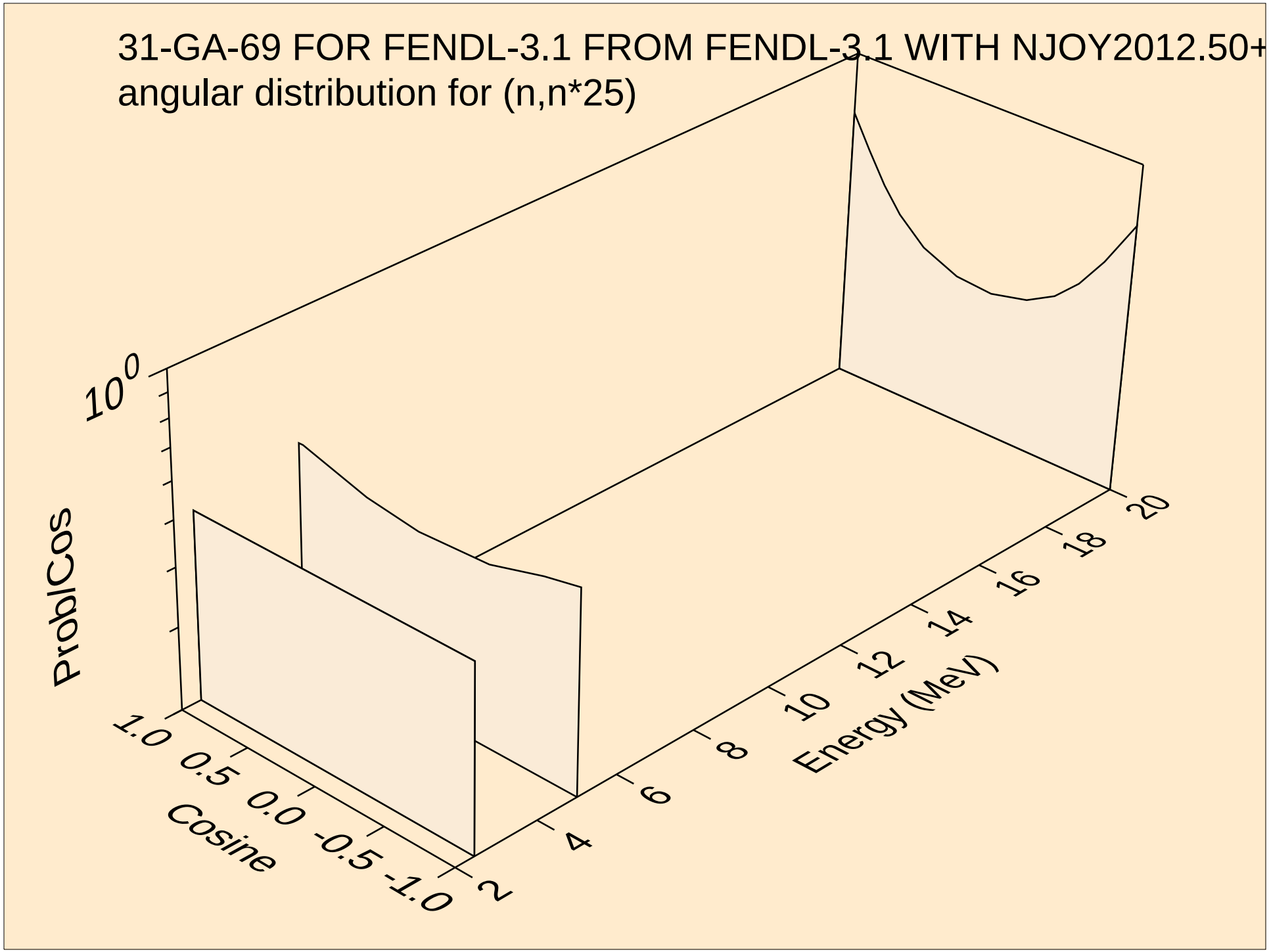

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*20)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

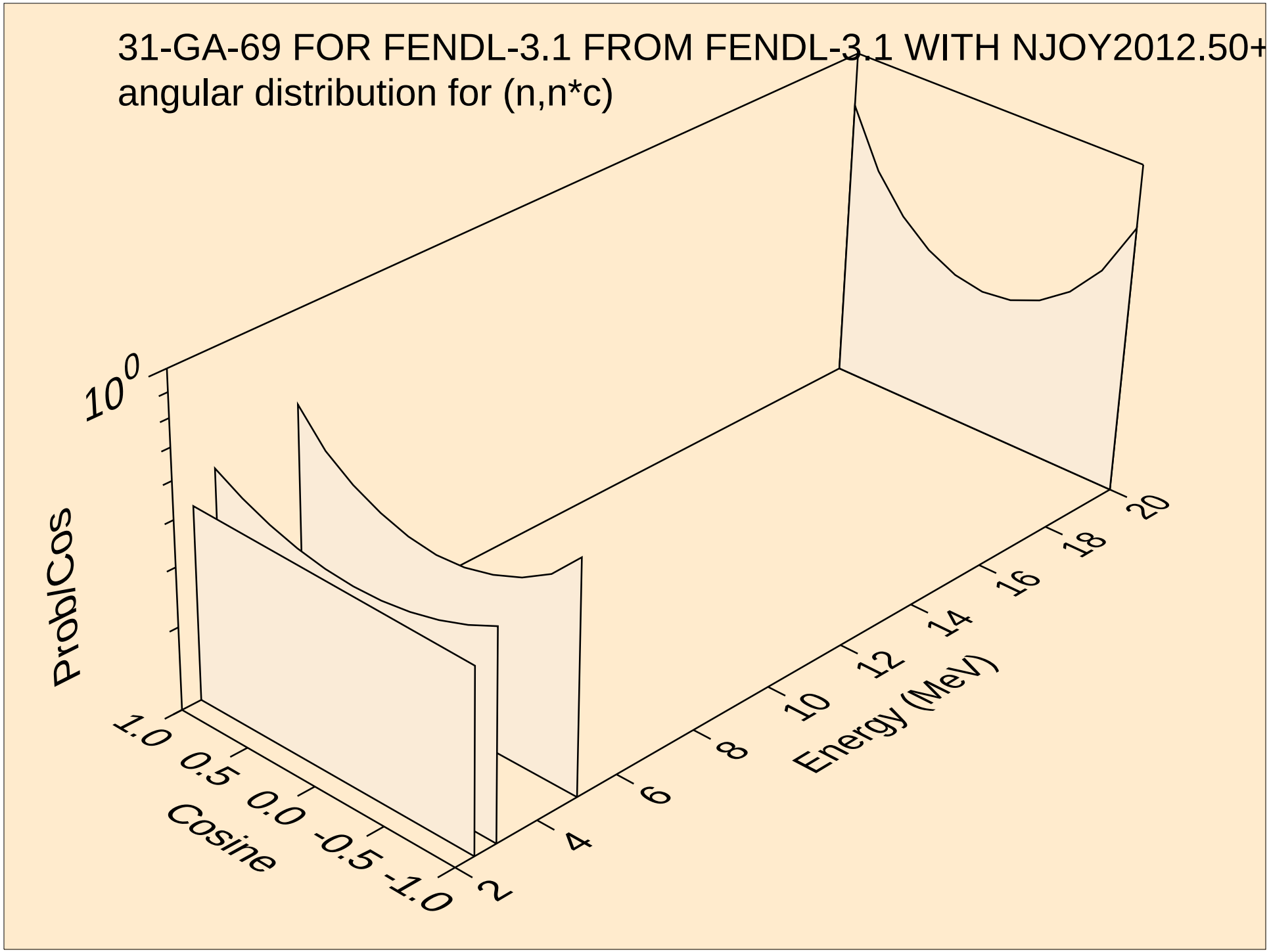

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*21)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

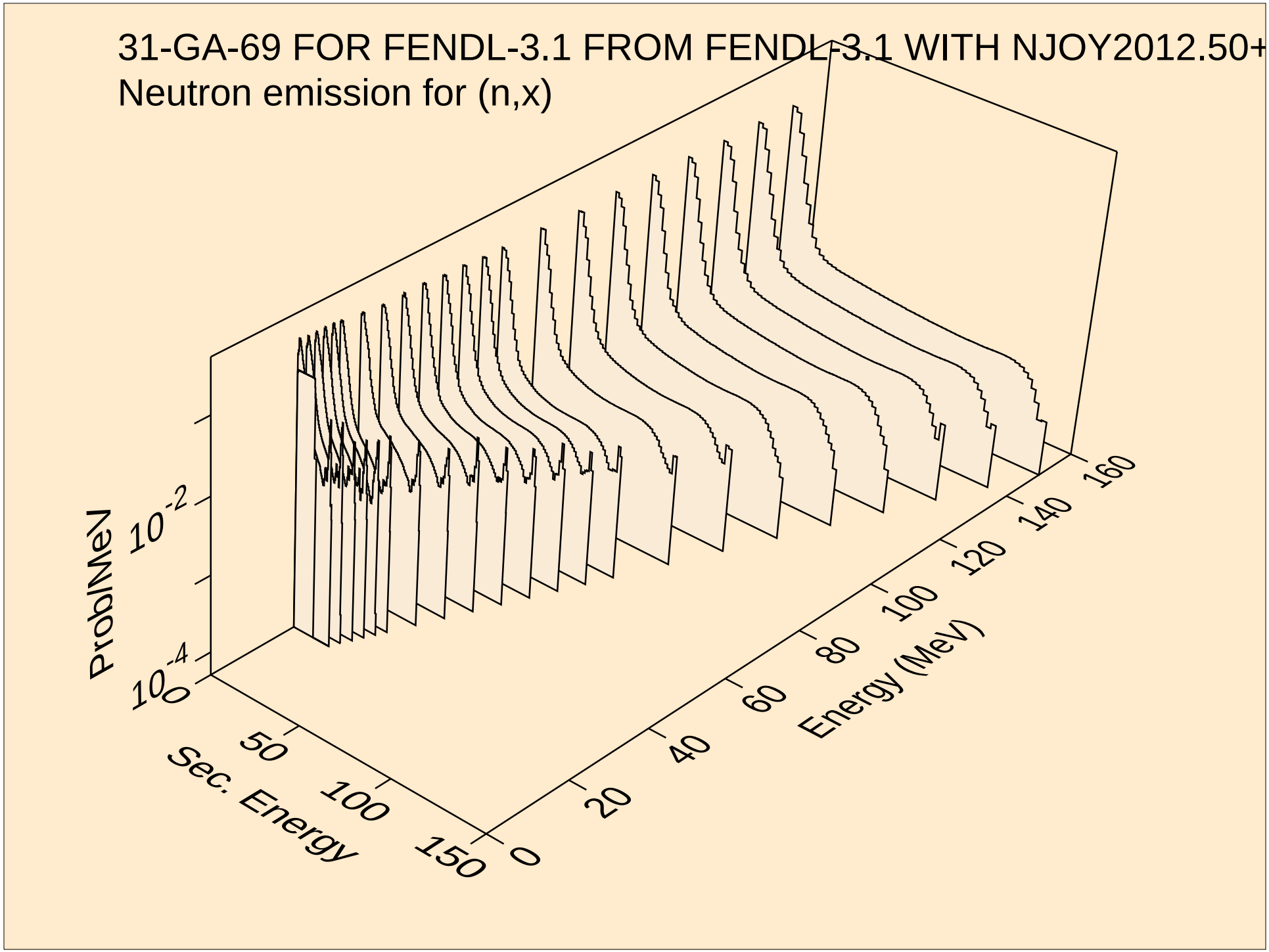

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*22)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

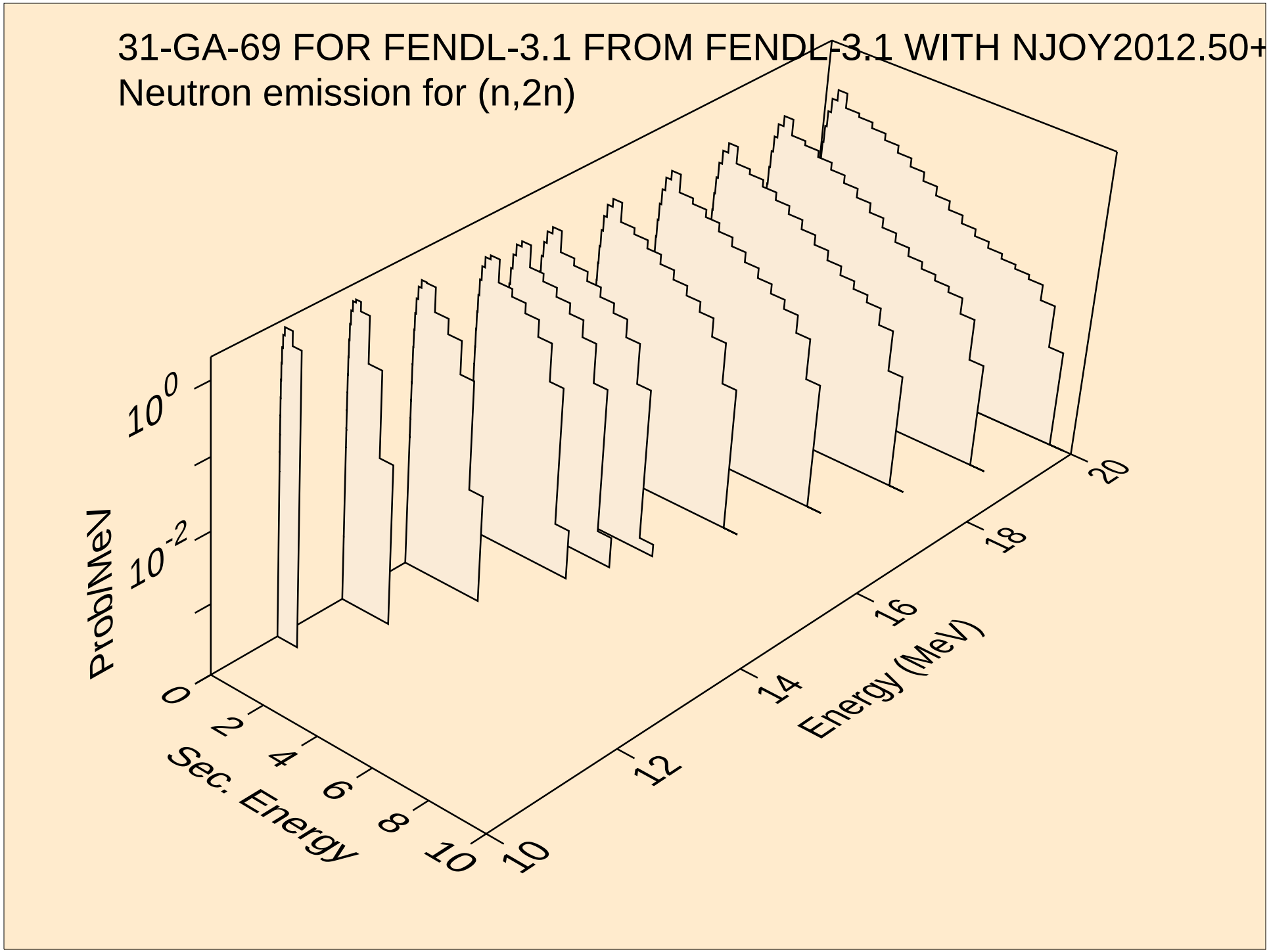

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*23)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

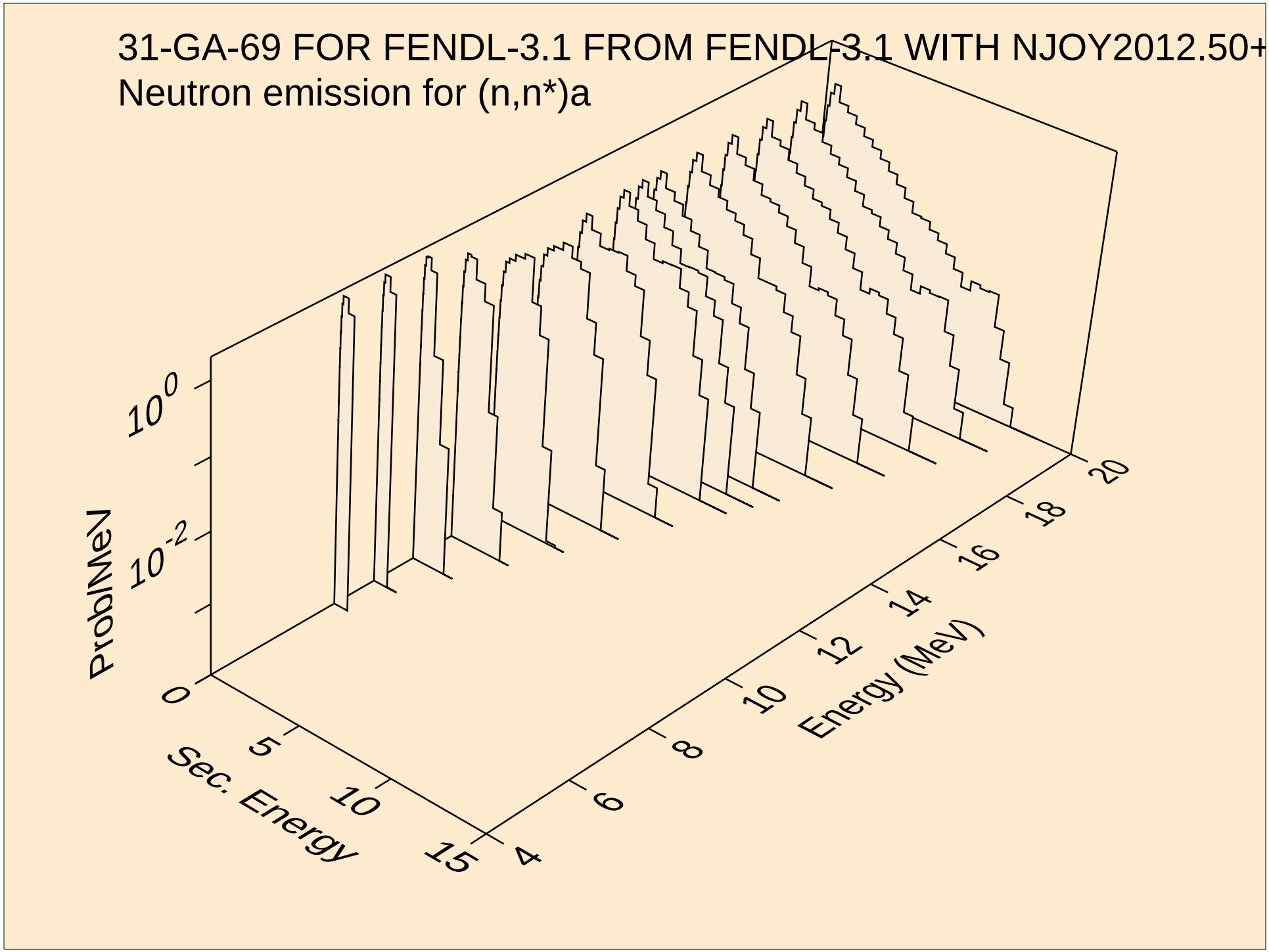

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*24)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

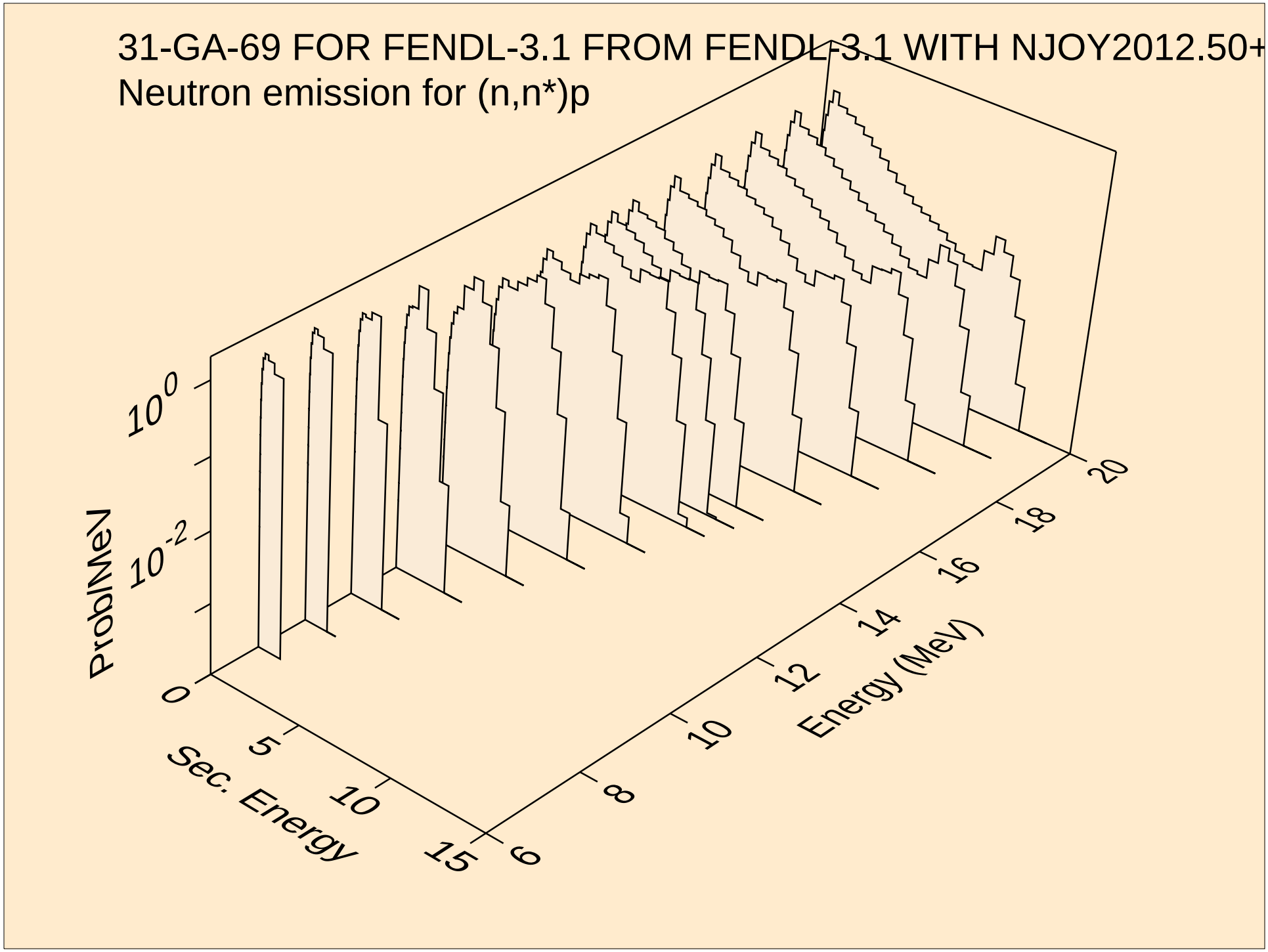

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*25)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

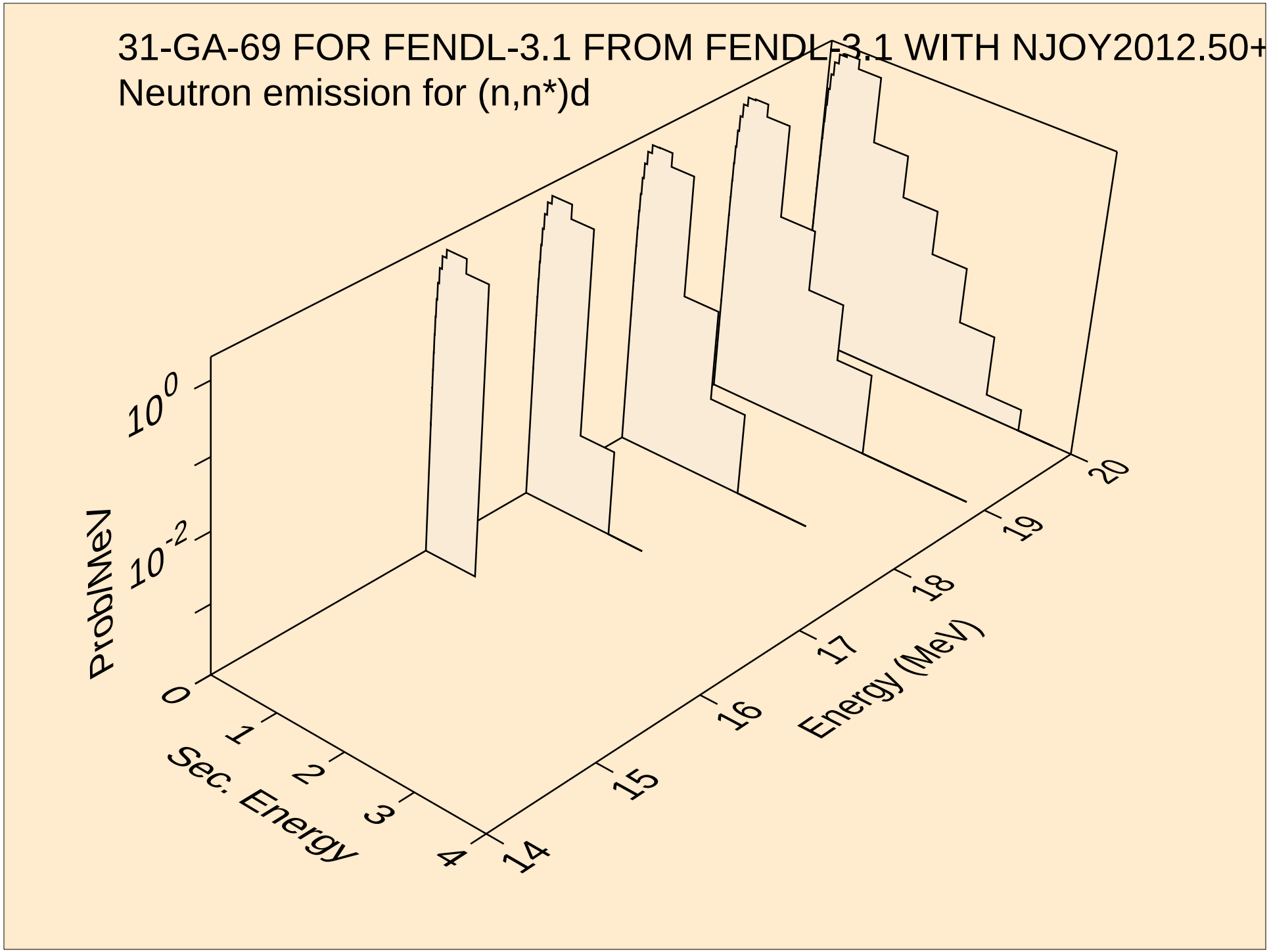

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
angular distribution for (n,n*c)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

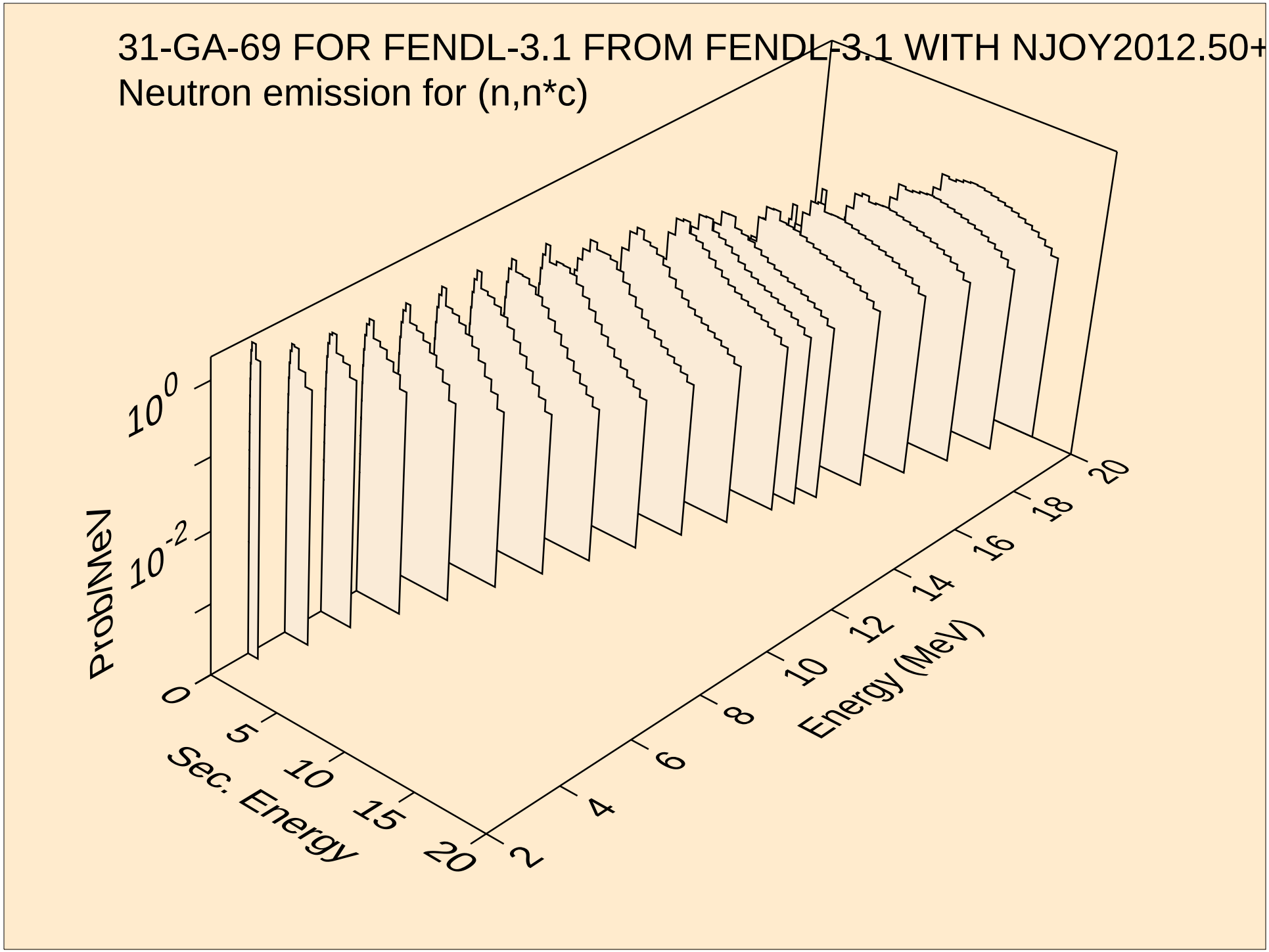

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Neutron emission for (n,x)
Prob/MeV
10-2
10-4
0
50
100
150
Sec. Energy
0
20
40
60
80
100
120
140
160
Energy (MeV)

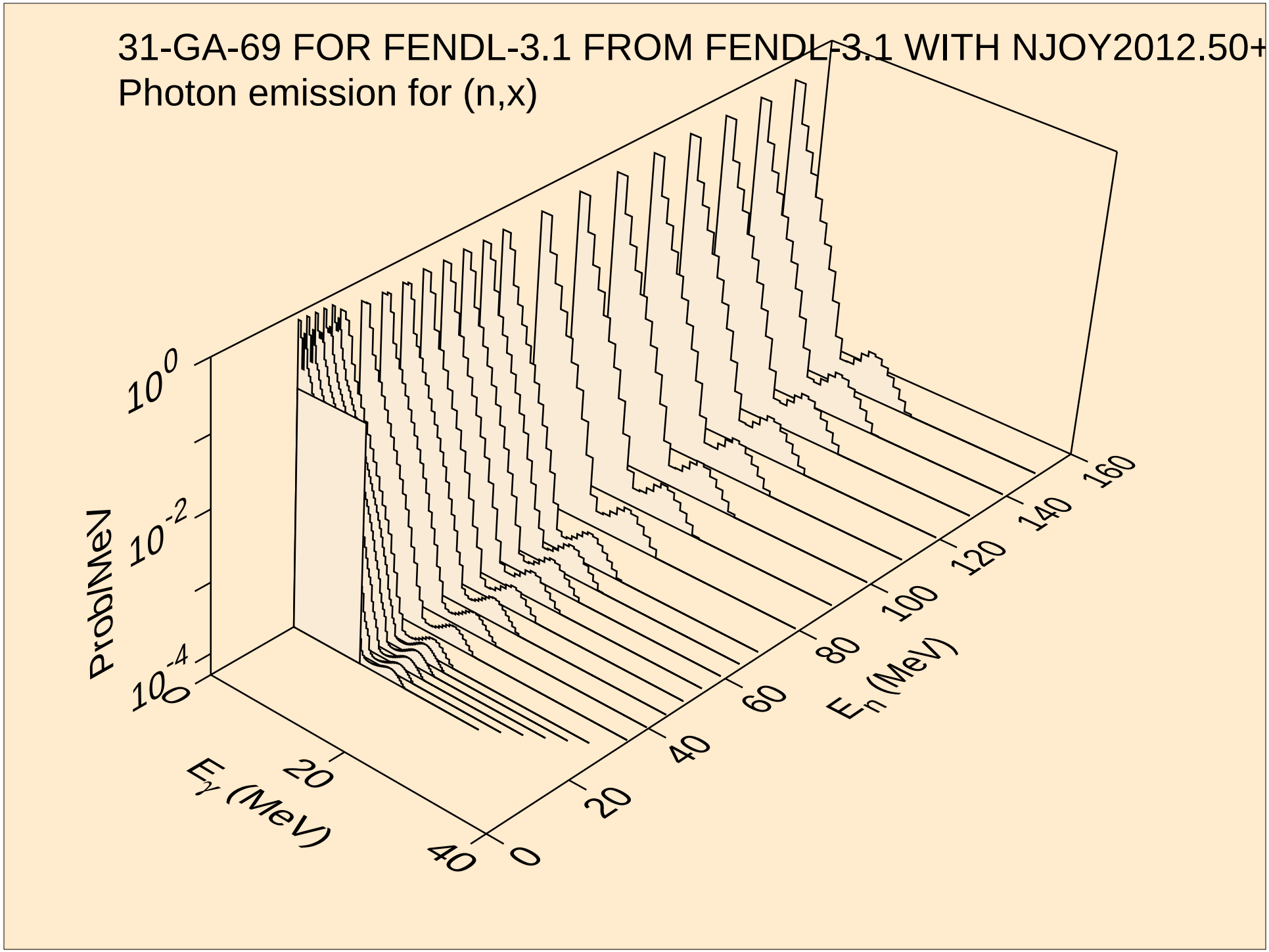

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Neutron emission for (n,2n)
Prob/MeV
10^0
10^-2
0
2
4
6
8
10
Sec. Energy
10
12
14
16
18
20
Energy (MeV)

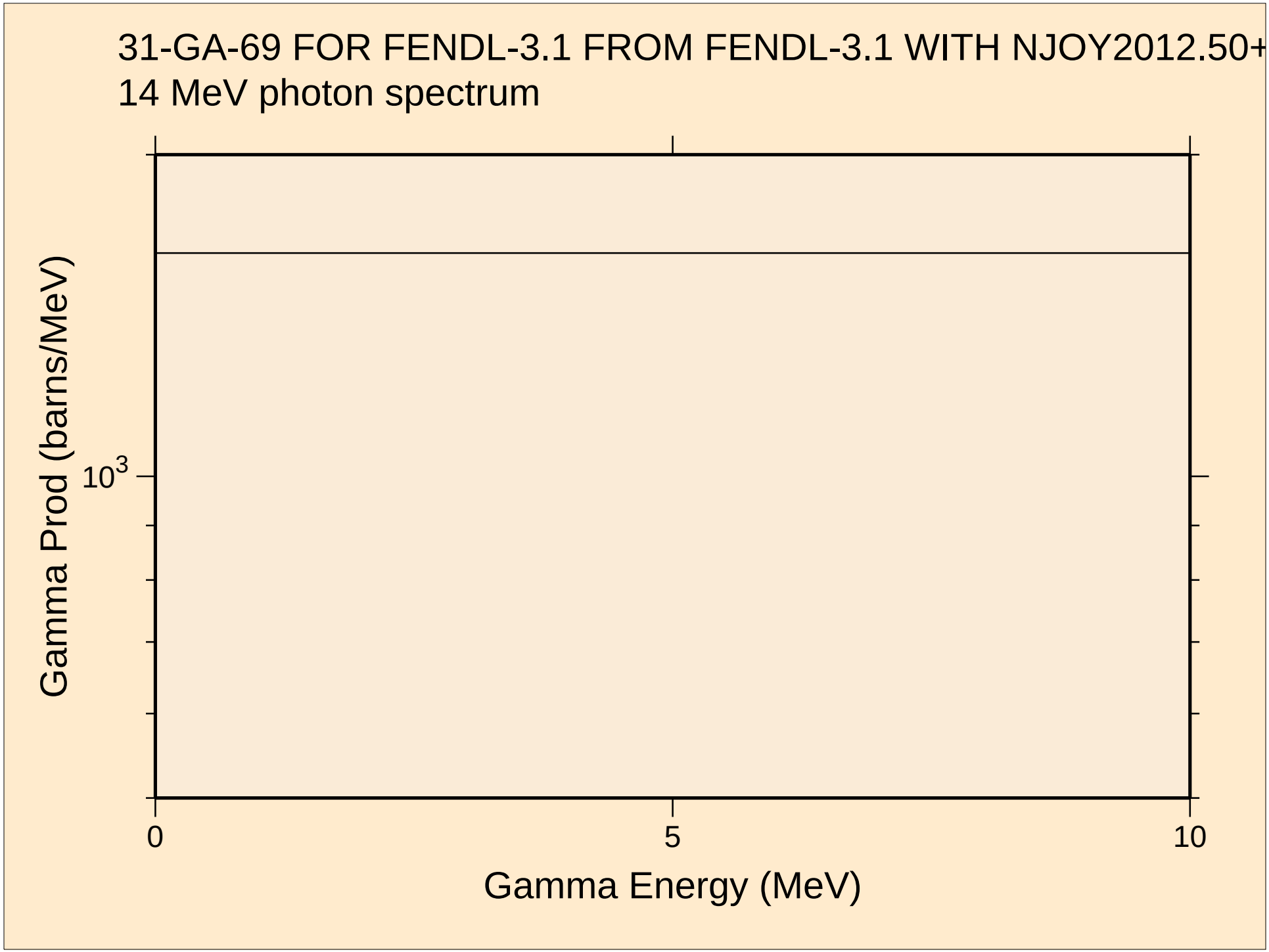

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Neutron emission for (n,n*)a
Prob/MeV
10^0
10^-2
0
5
10
15
Sec. Energy
4
6
8
10
12
14
16
18
20
Energy (MeV)

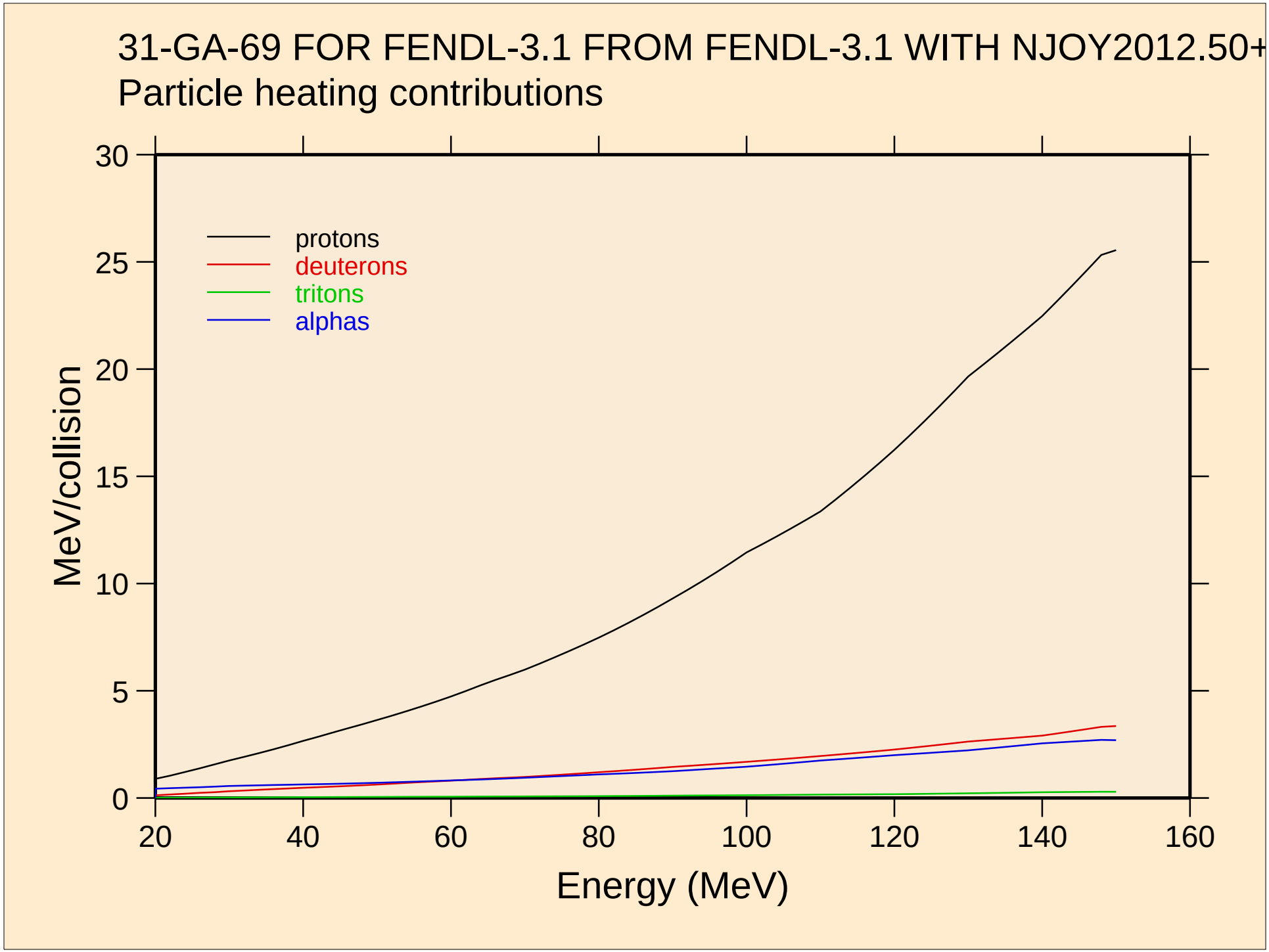

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Neutron emission for (n,n*)p
Prob/MeV
10^0
10^-2
0
Sec. Energy
5
10
15
6
8
10
12
14
16
18
20
Energy (MeV)

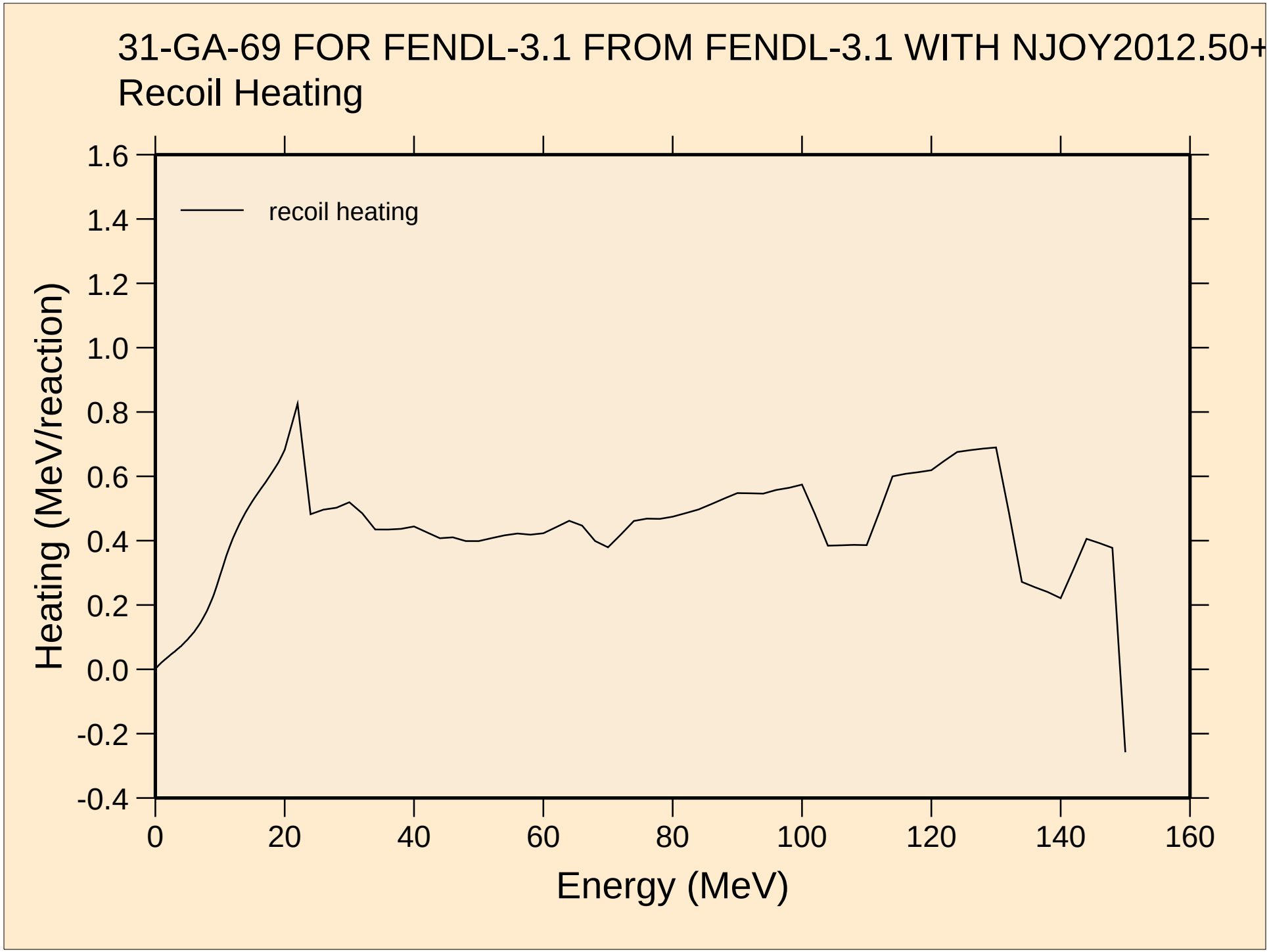

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Neutron emission for (n,n*)d
Prob/MeV
10^0
10^-2
0
Sec. Energy
1
2
3
4
14
15
16
17
18
19
20
Energy (MeV)

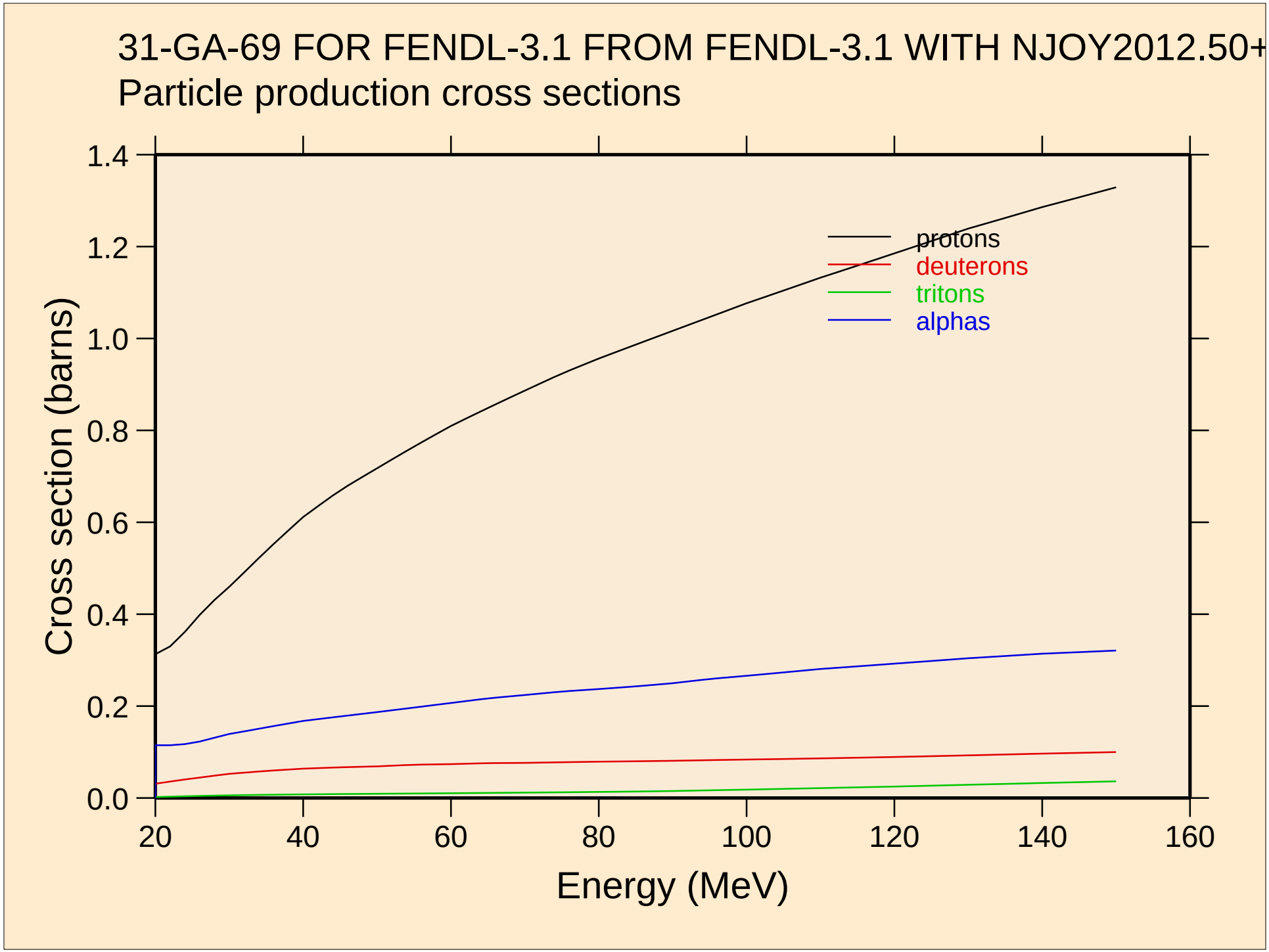

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Neutron emission for (n,n*c)
Prob/MeV
10^0
10^-2
0
5
10
15
20
Sec. Energy
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

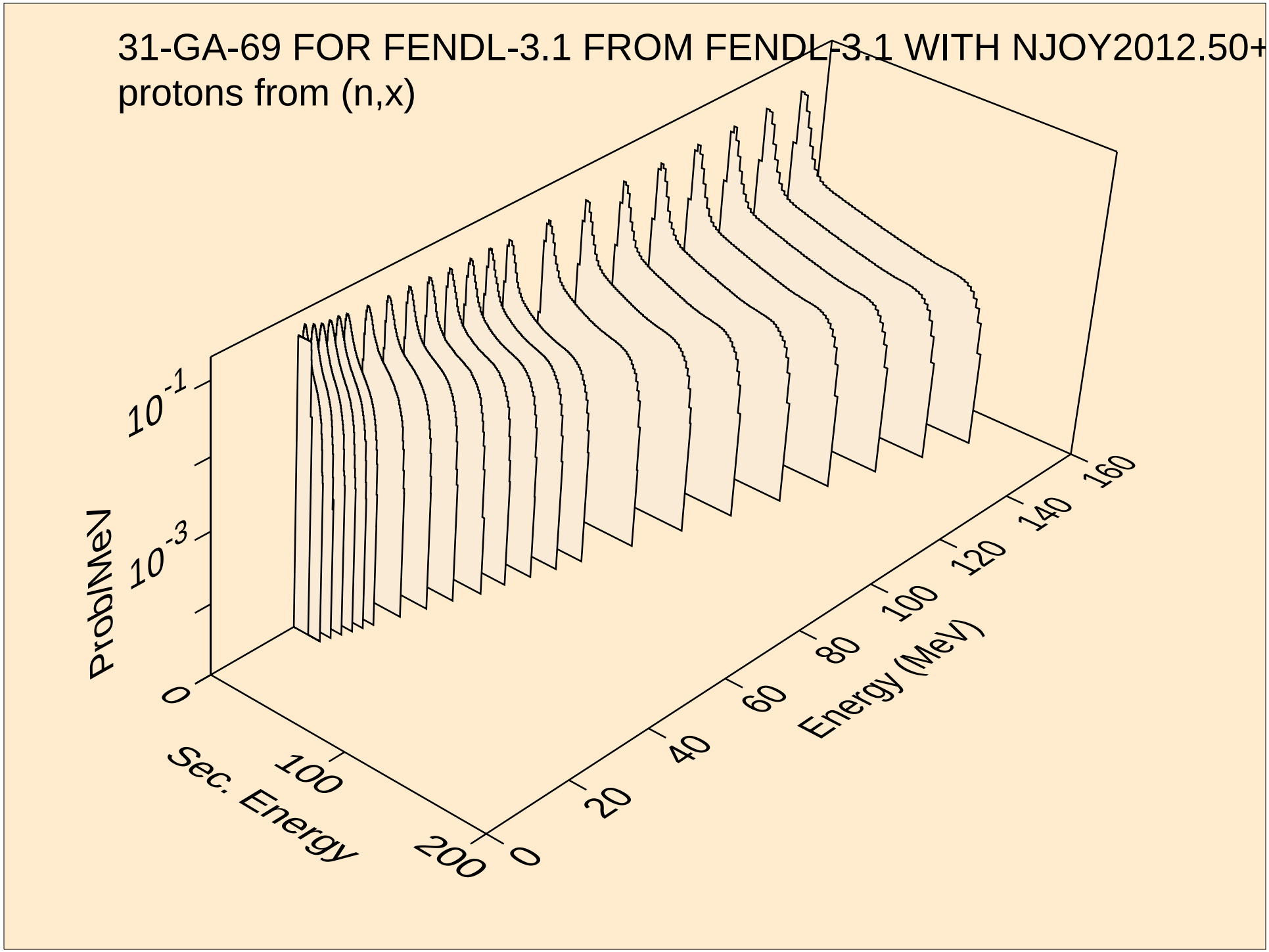

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Photon emission for (n,x)
Prob/MeV
10^{0}
10^{-2}
10^{-4}
E_γ (MeV)
0
20
40
E_n (MeV)
0
20
40
60
80
100
120
140
160

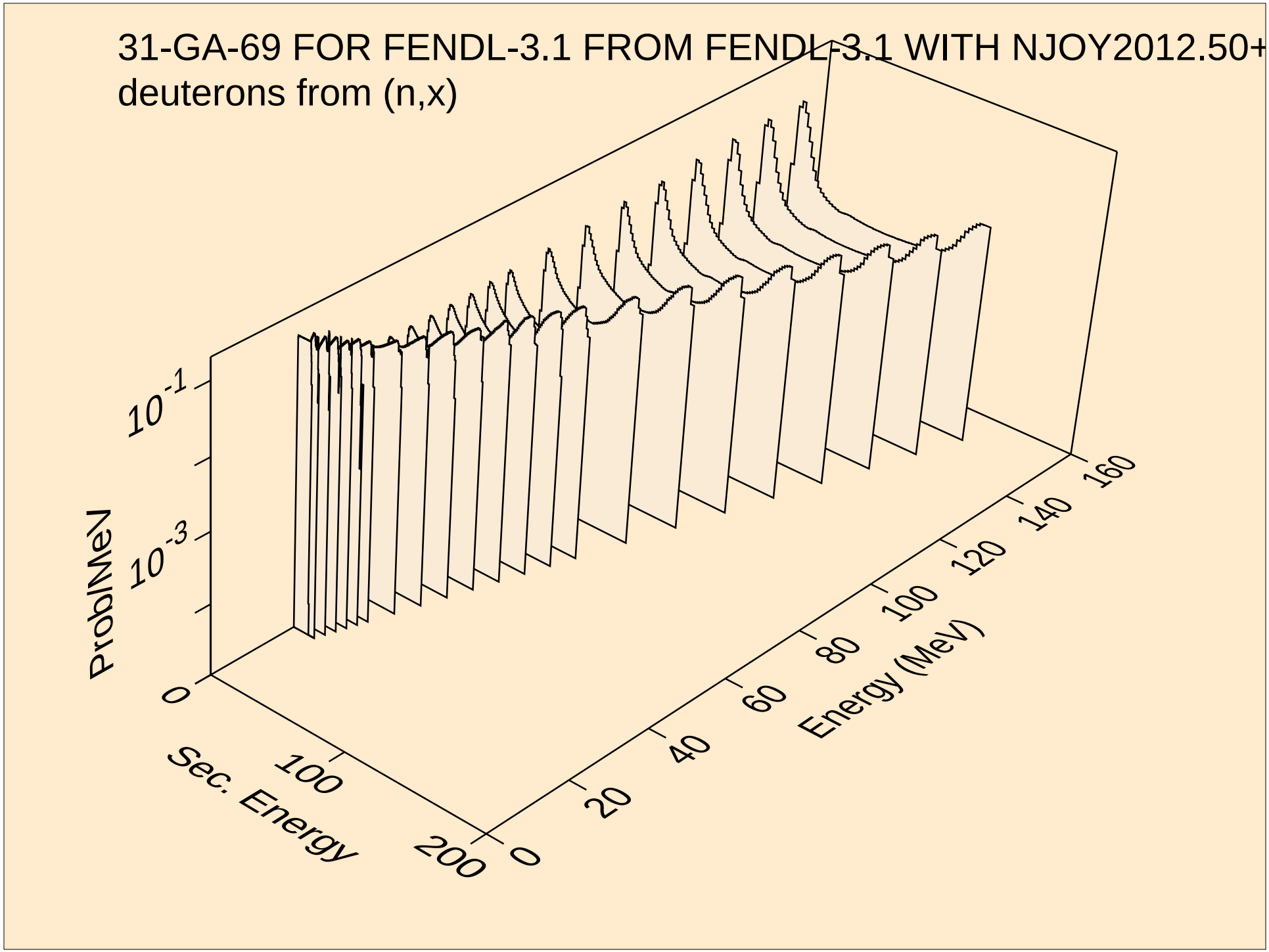

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
14 MeV photon spectrum
Gamma Prod (barns/MeV)
10^3
0
5
10
Gamma Energy (MeV)

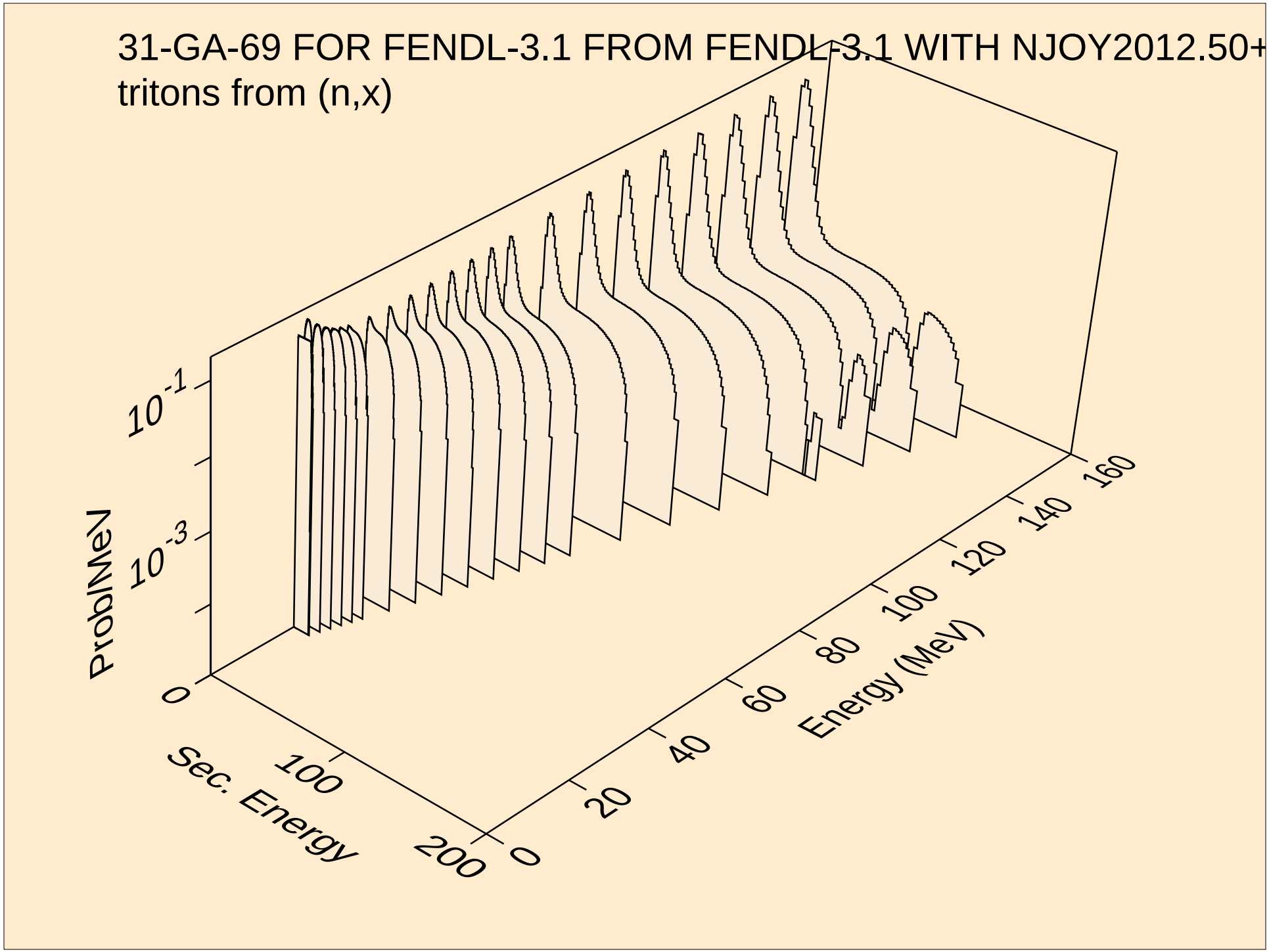

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Particle heating contributions
protons
deuterons
tritons
alphas
MeV/collision
Energy (MeV)
0
5
10
15
20
25
30
20
40
60
80
100
120
140
160

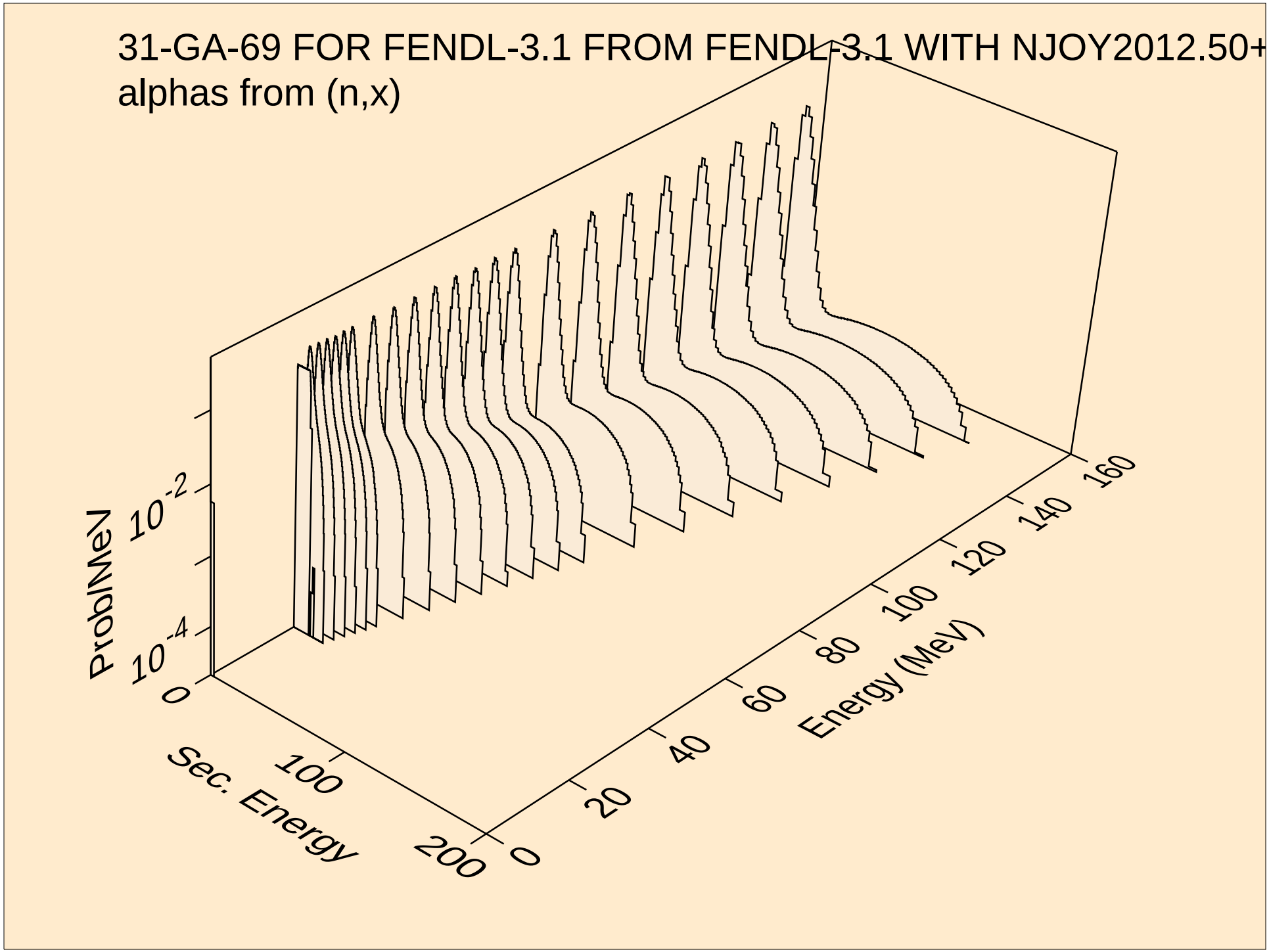

31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Recoil Heating
recoil heating
Heating (MeV/reaction)
Energy (MeV)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
0
20
40
60
80
100
120
140
160


31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
Particle production cross sections
Cross section (barns)
Energy (MeV)
protons
deuterons
tritons
alphas
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
20
40
60
80
100
120
140
160


31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
protons 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)


31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
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)


31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
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)


31-GA-69 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50+
alphas from (n,x)
Prob/MeV
10-2
10-4
0
100
200
Sec. Energy
0
20
40
60
80
100
120
140
160
Energy (MeV)