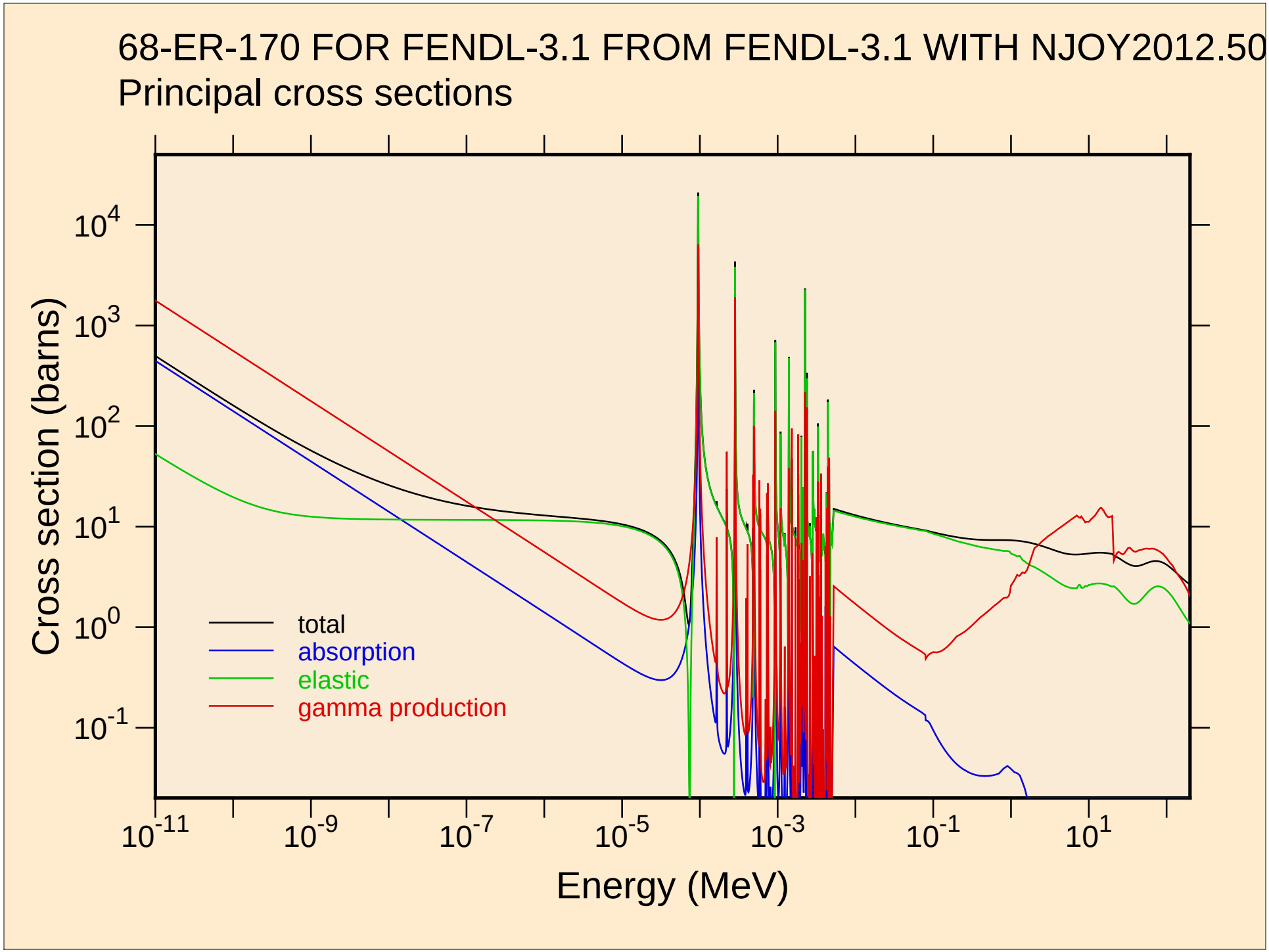
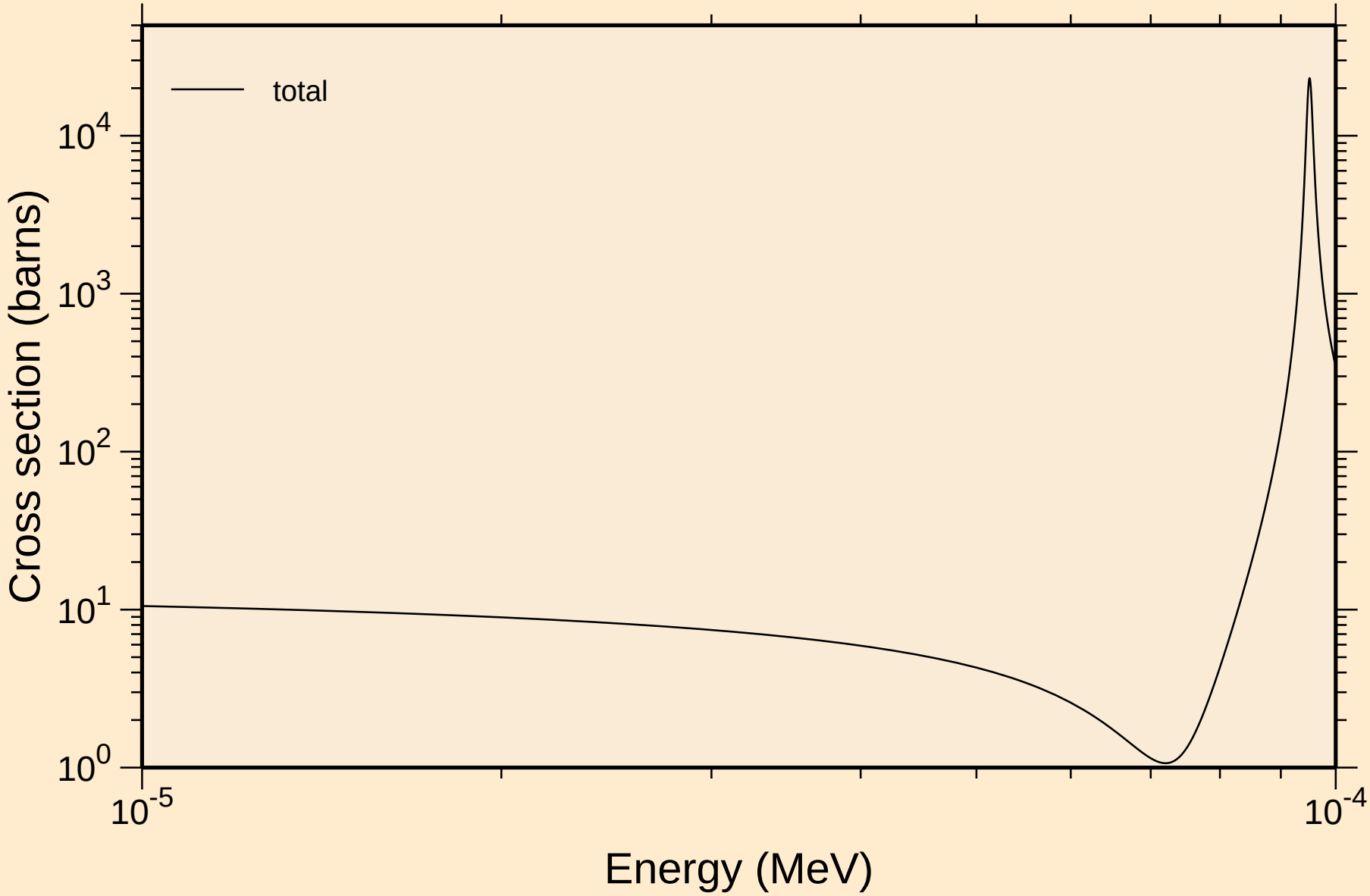
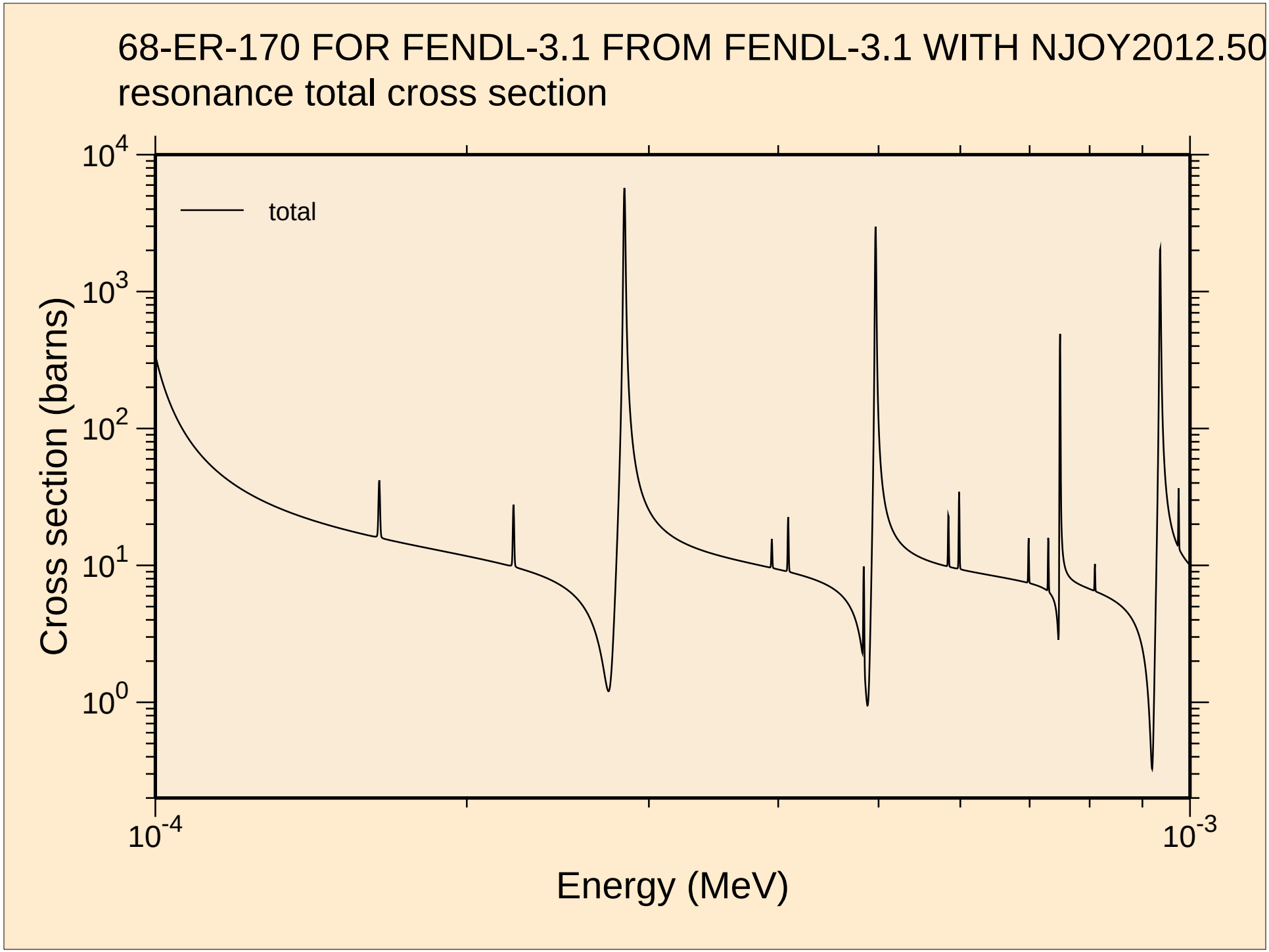
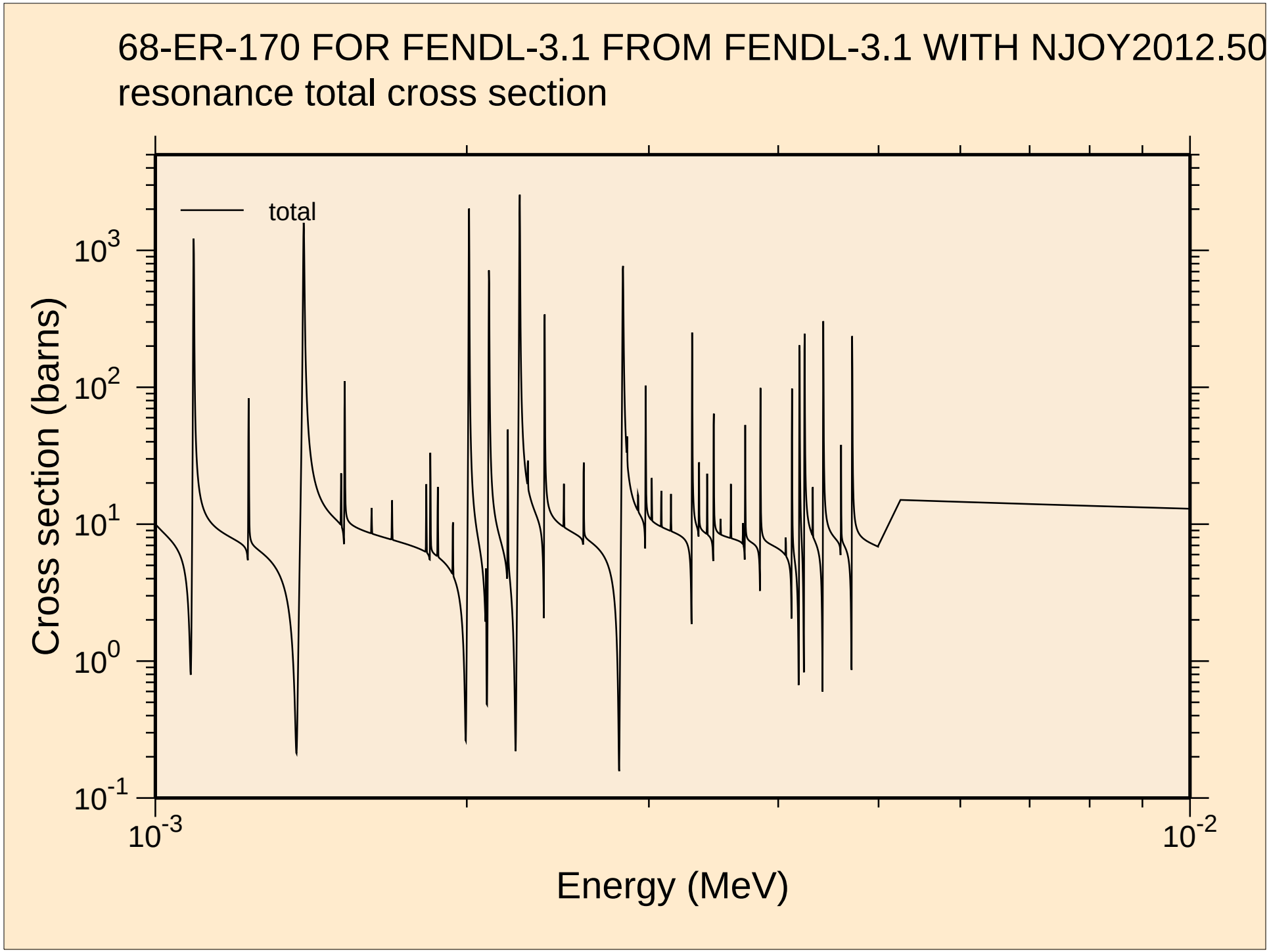
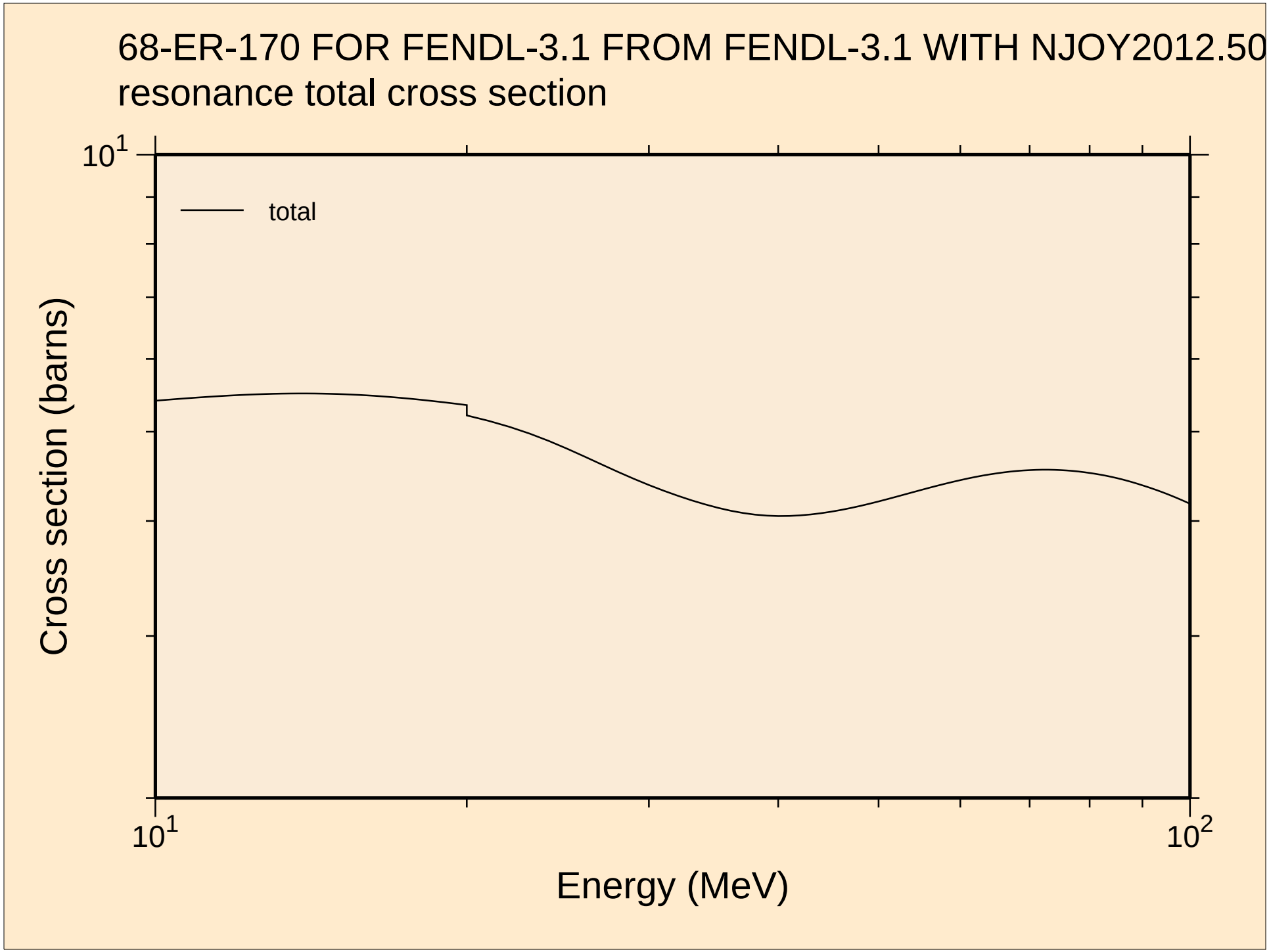

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Principal cross sections
Cross section (barns)
10^4
10^3
10^2
10^1
10^0
10^-1
total
absorption
elastic
gamma production
10^-11
10^-9
10^-7
10^-5
10^-3
10^-1
10^1
Energy (MeV)

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
resonance total cross section

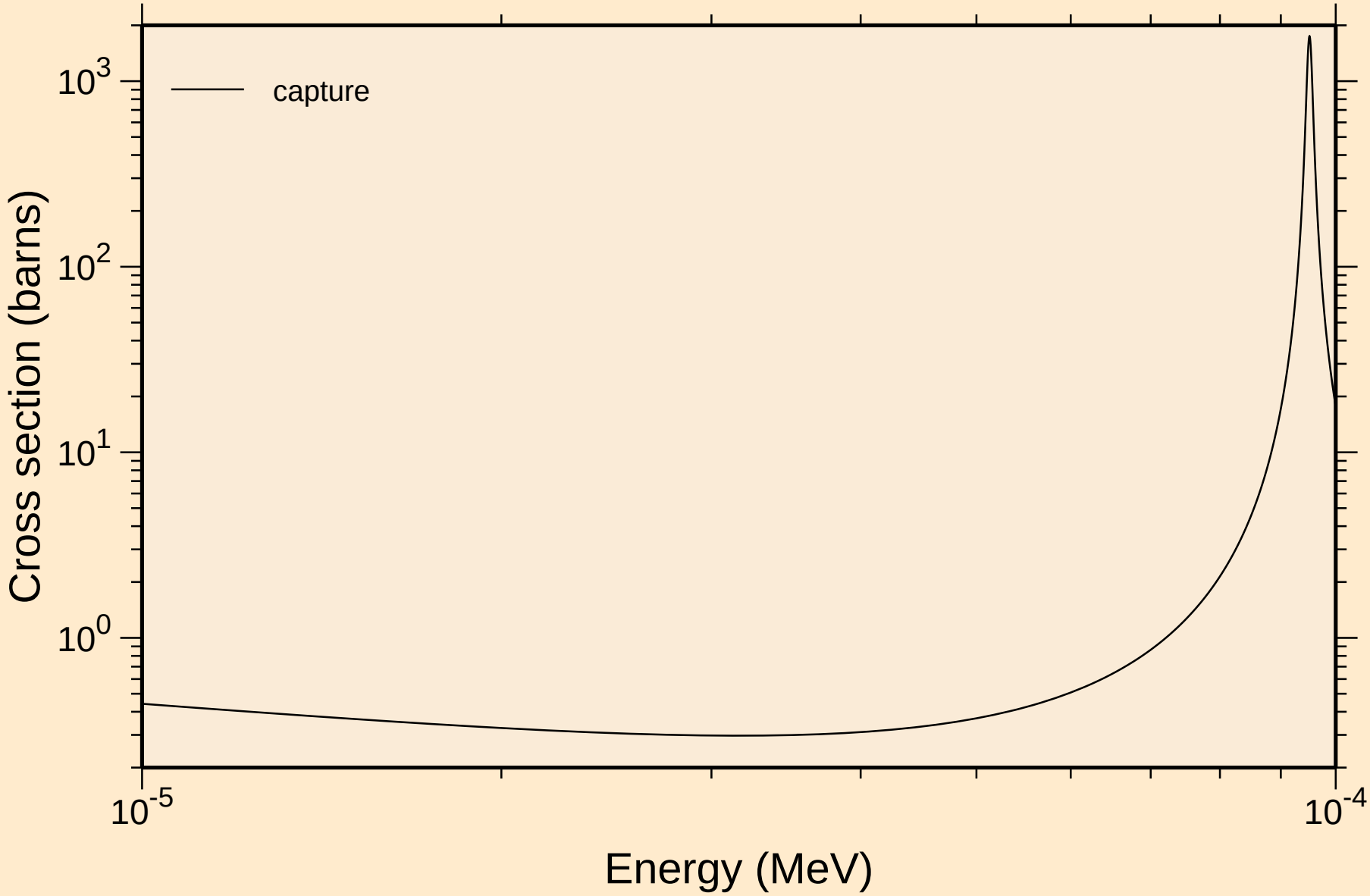


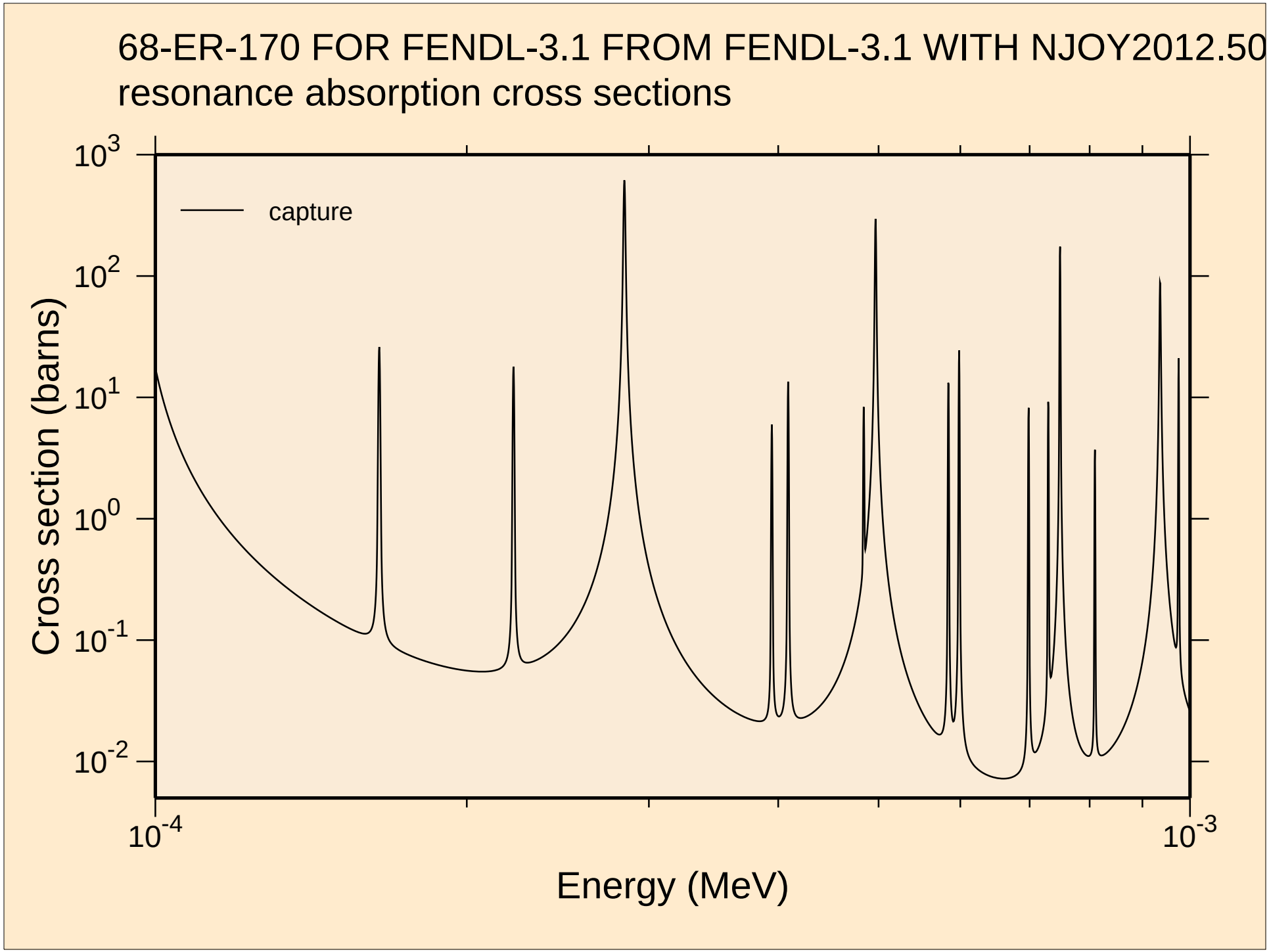

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
resonance total cross section
total
Cross section (barns)
10^4
10^3
10^2
10^1
10^0
10^{-4}
10^{-3}
Energy (MeV)

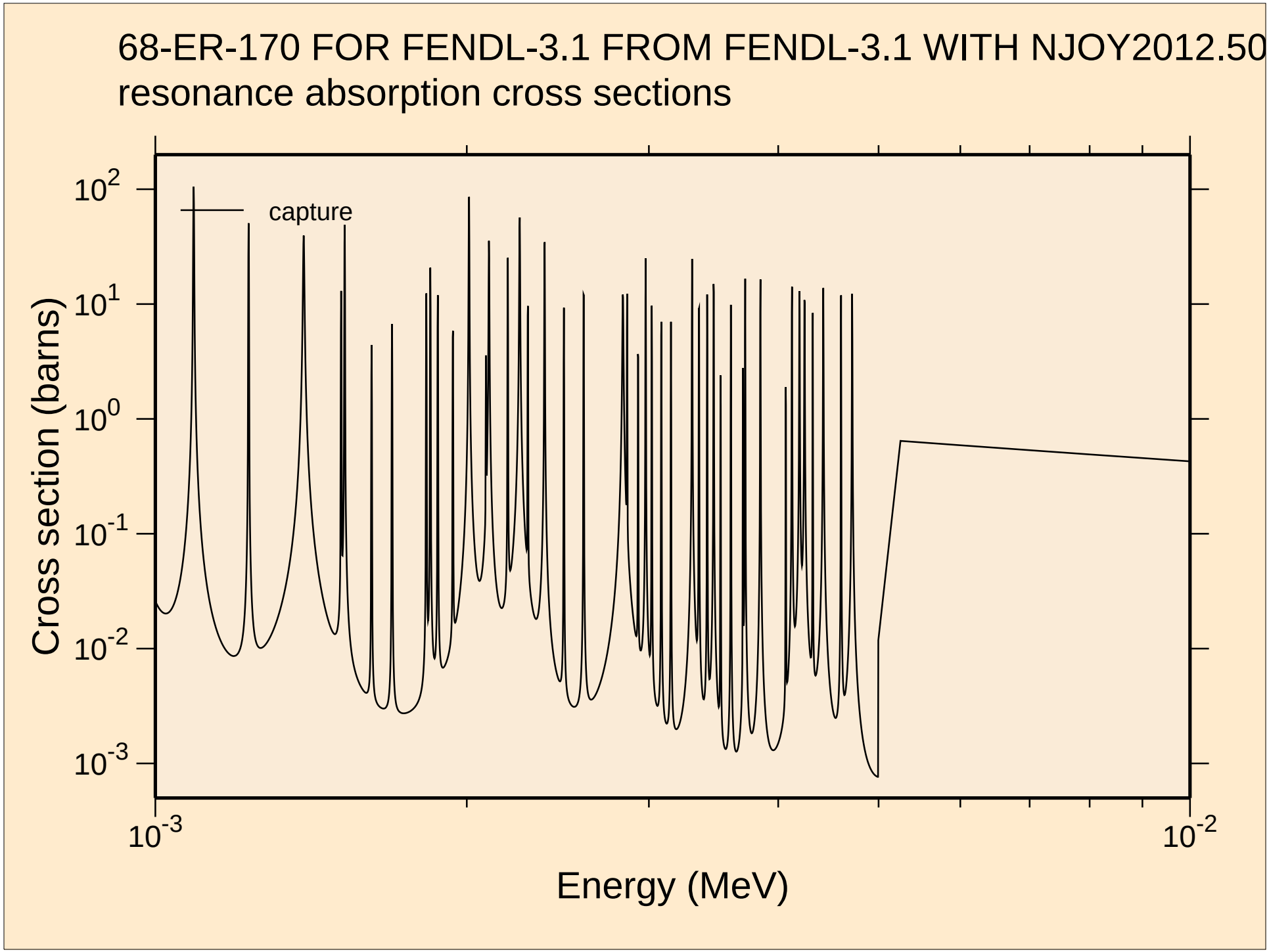

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
resonance total cross section
total
Cross section (barns)
10^3
10^2
10^1
10^0
10^-1
10^-3
10^-2
Energy (MeV)

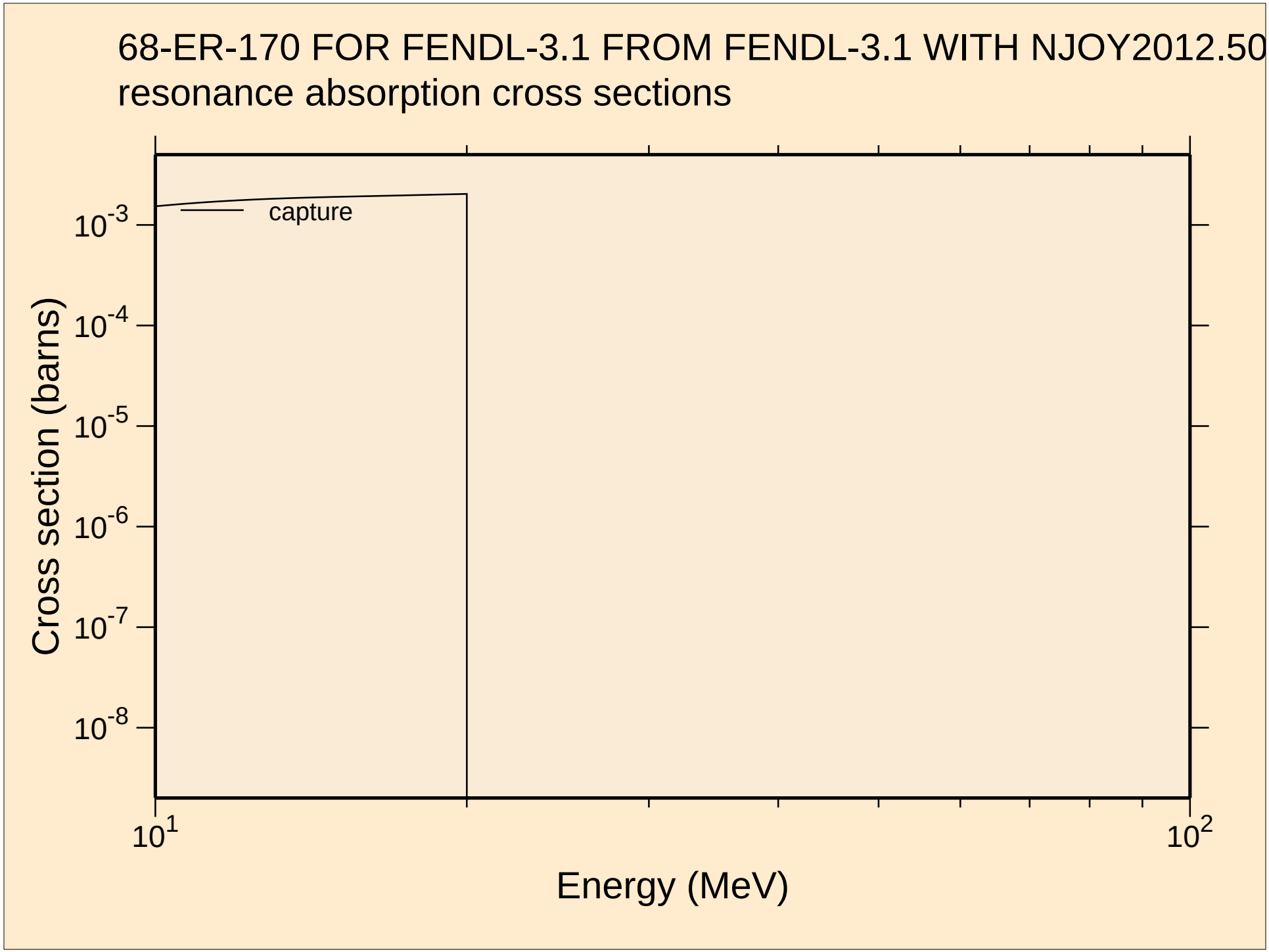

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
resonance total cross section
10^1
total
Cross section (barns)
10^1
10^2
Energy (MeV)

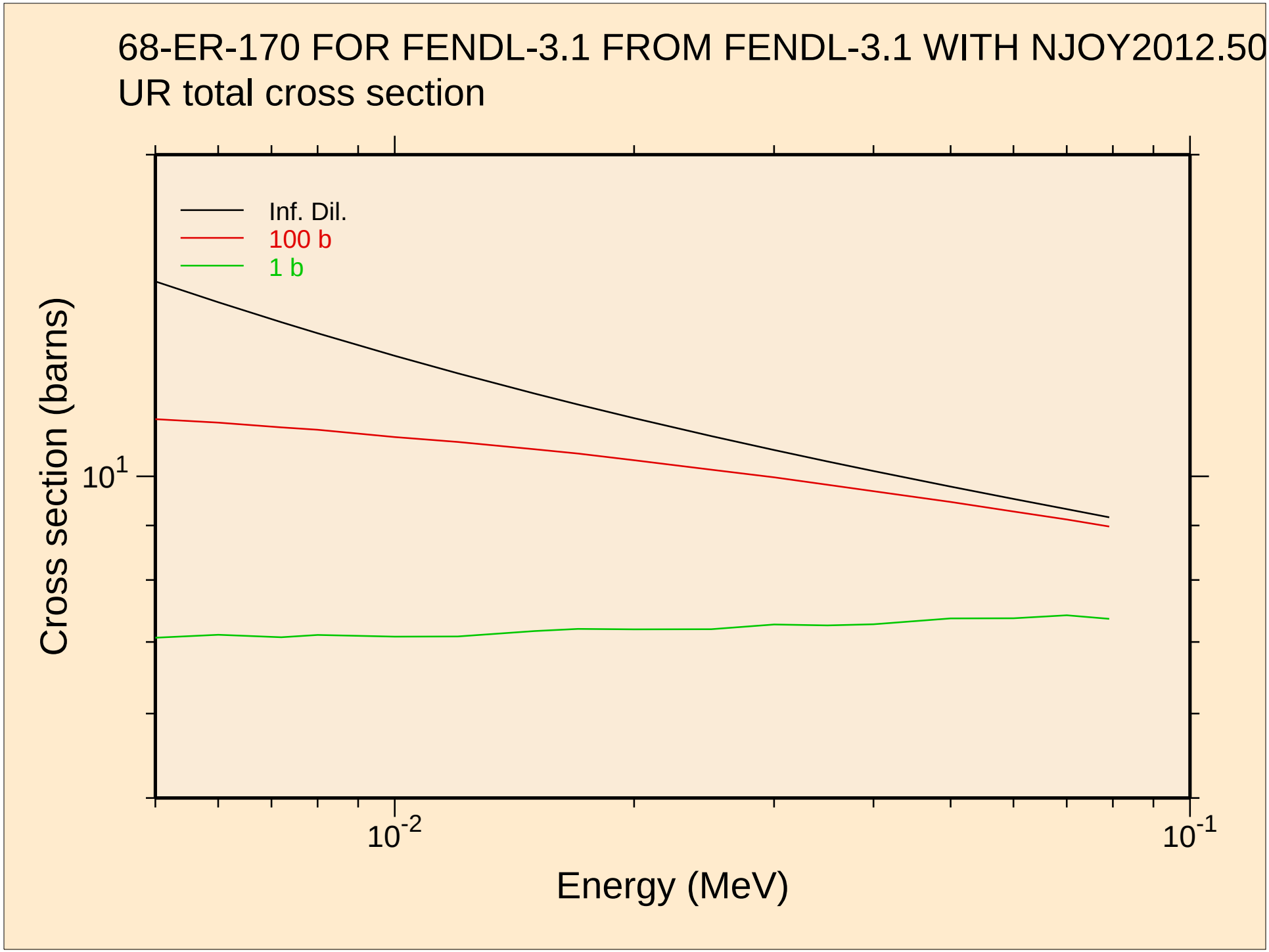
68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
resonance absorption cross sections

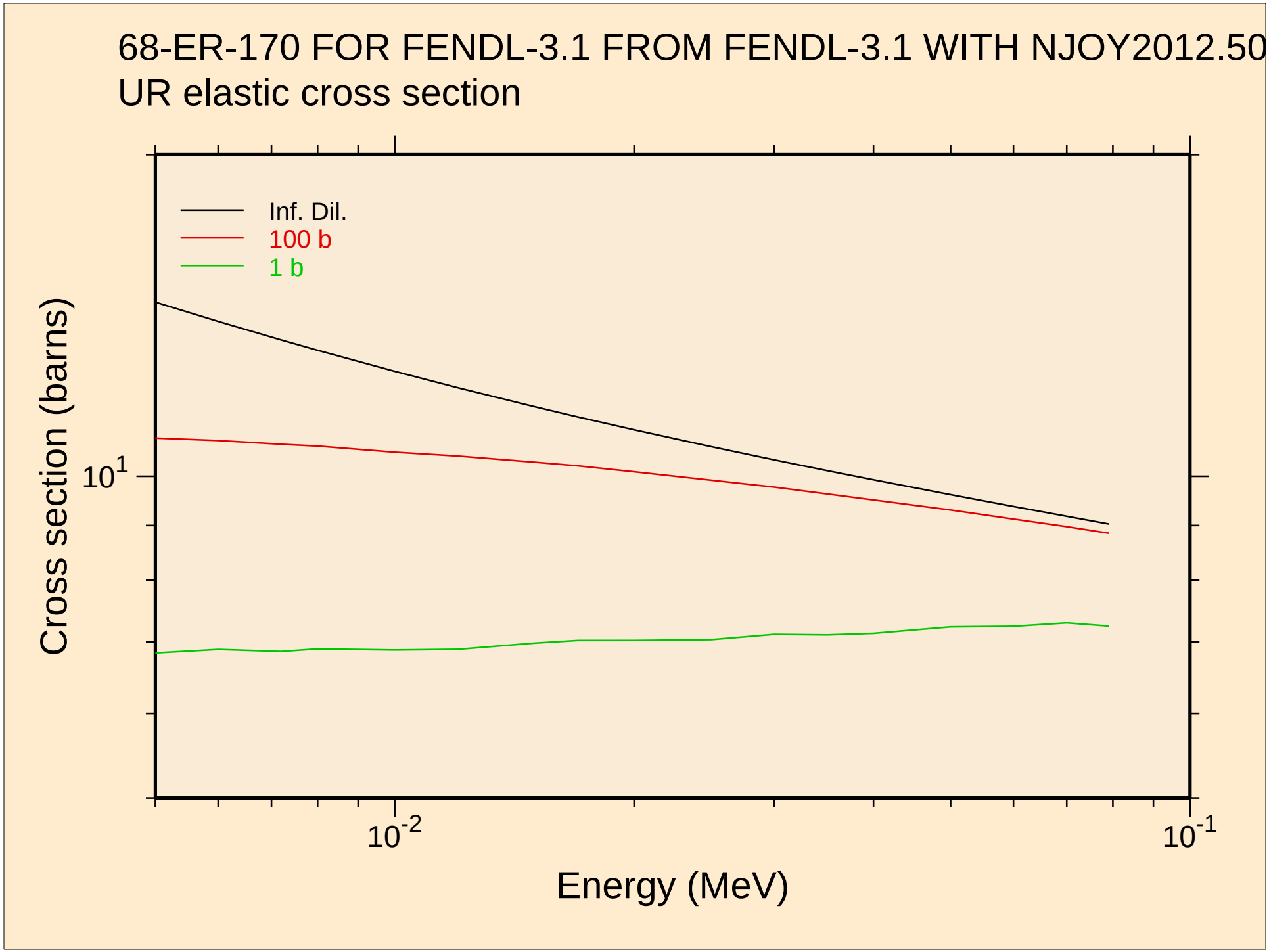


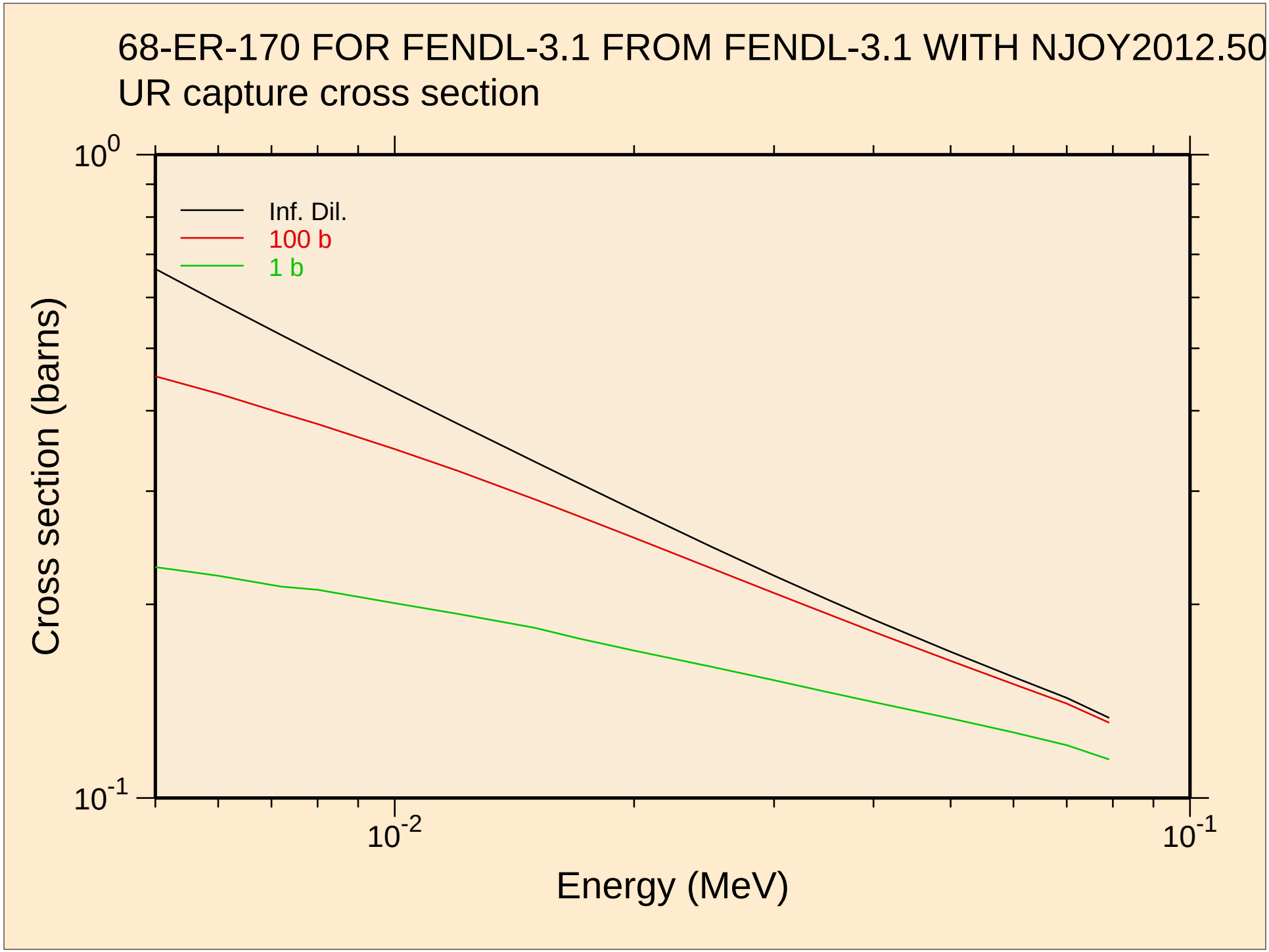

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
resonance absorption cross sections
capture
Cross section (barns)
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-4
10^-3
Energy (MeV)

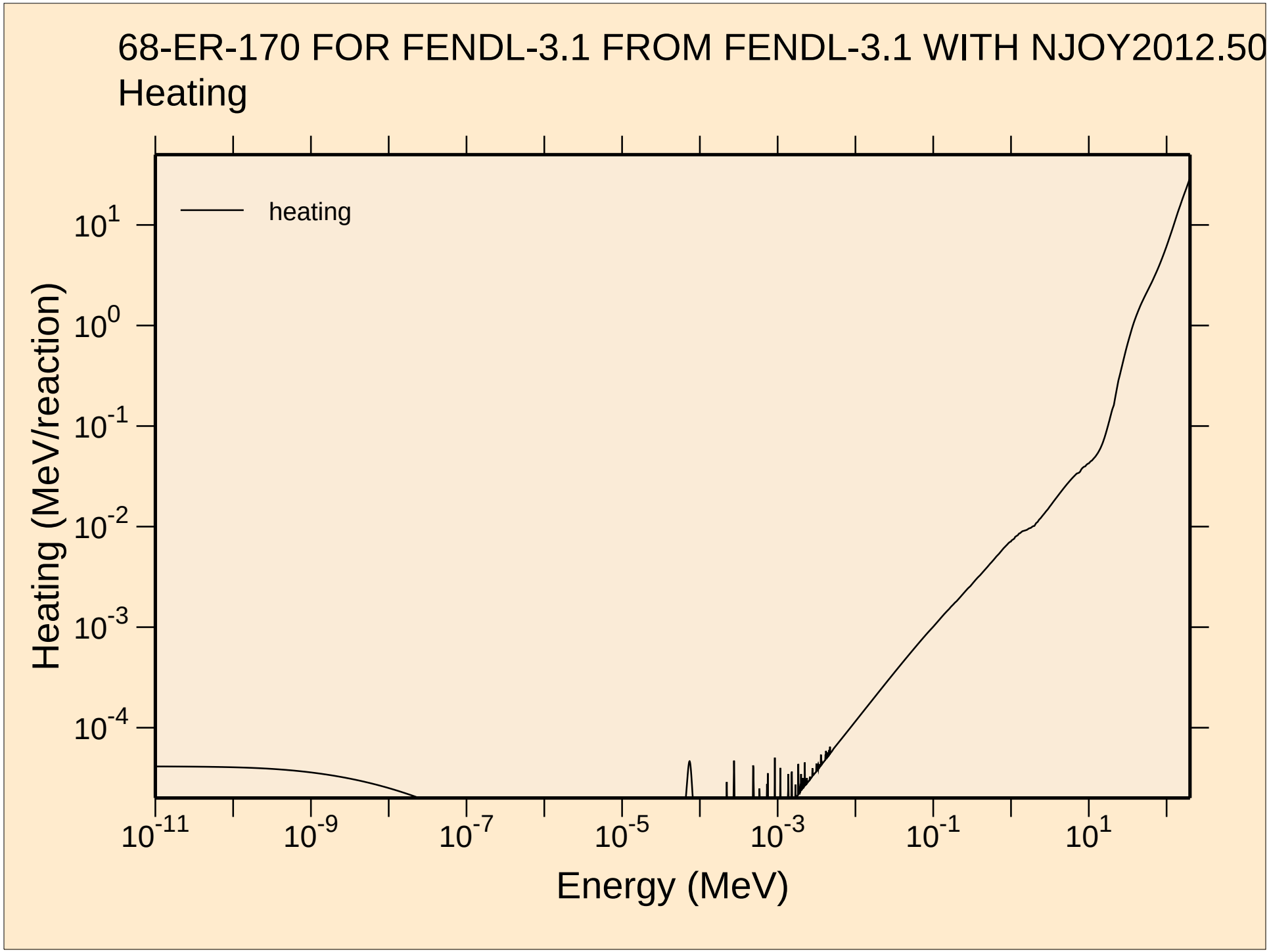

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
resonance absorption cross sections
capture
Cross section (barns)
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-3}
10^{-2}
Energy (MeV)

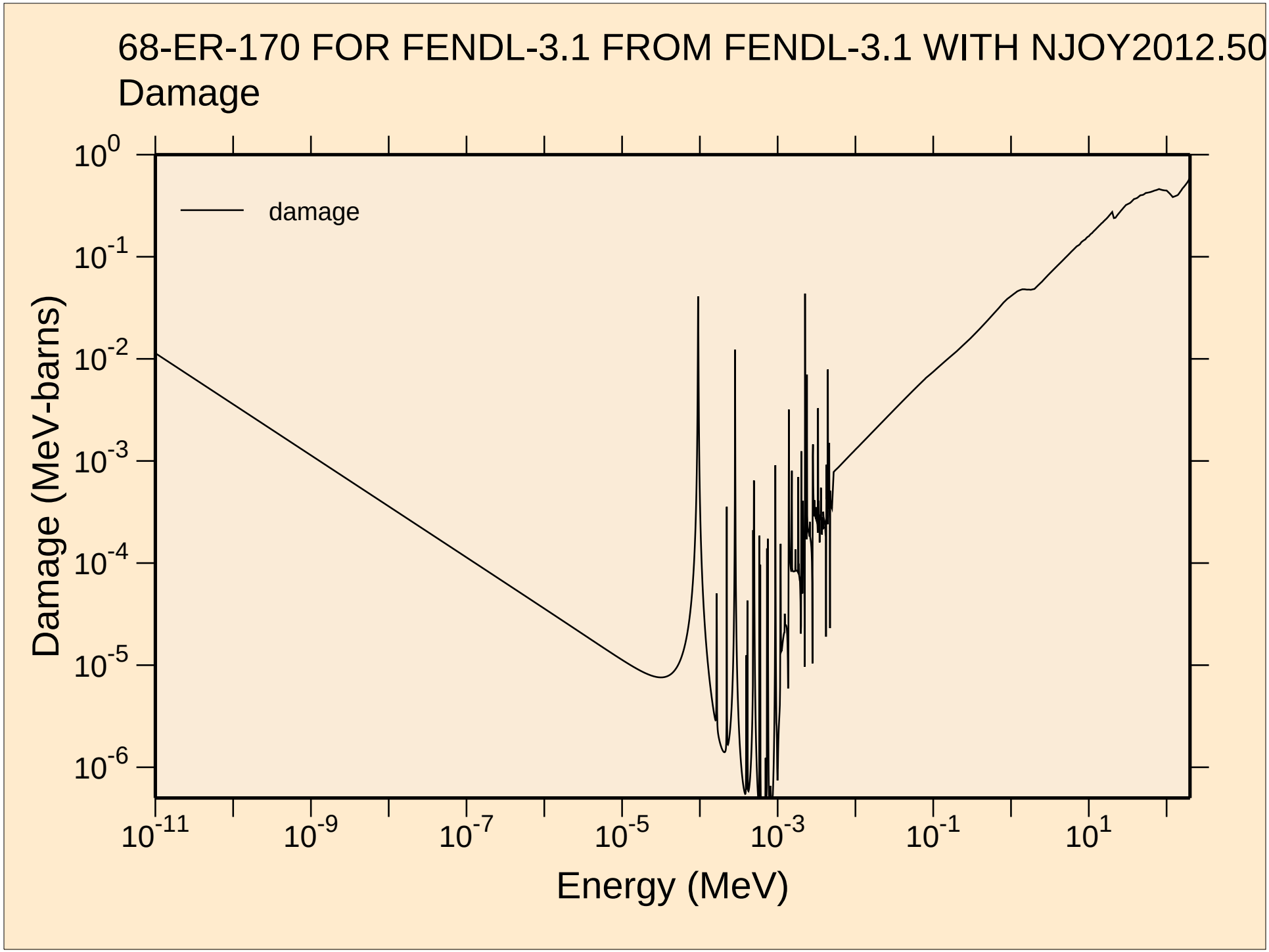

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
resonance absorption cross sections
capture
Cross section (barns)
10-3
10-4
10-5
10-6
10-7
10-8
101
102
Energy (MeV)

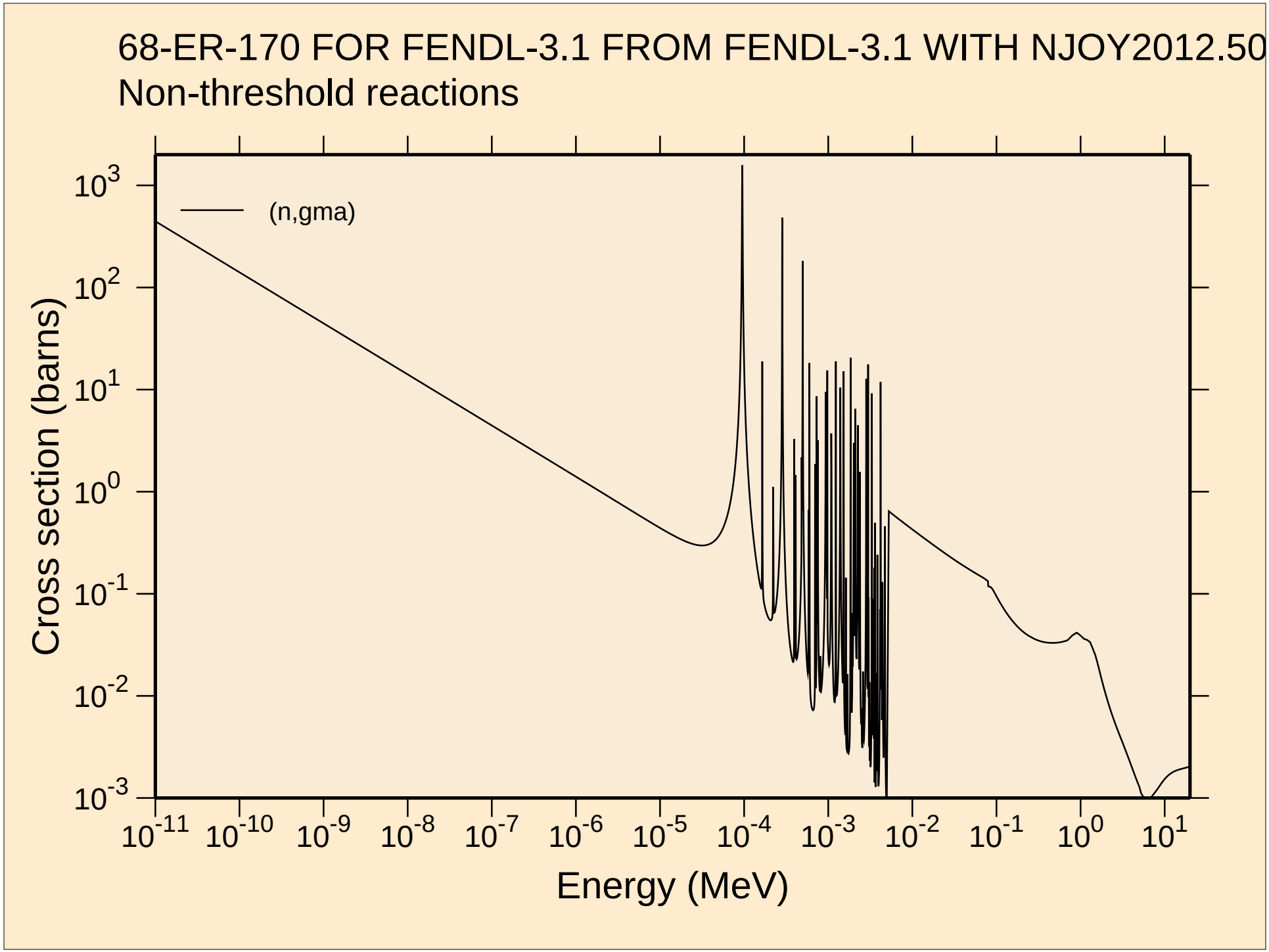

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
UR total cross section
Inf. Dil.
100 b
1 b
Cross section (barns)
10^1
10^-2
10^-1
Energy (MeV)

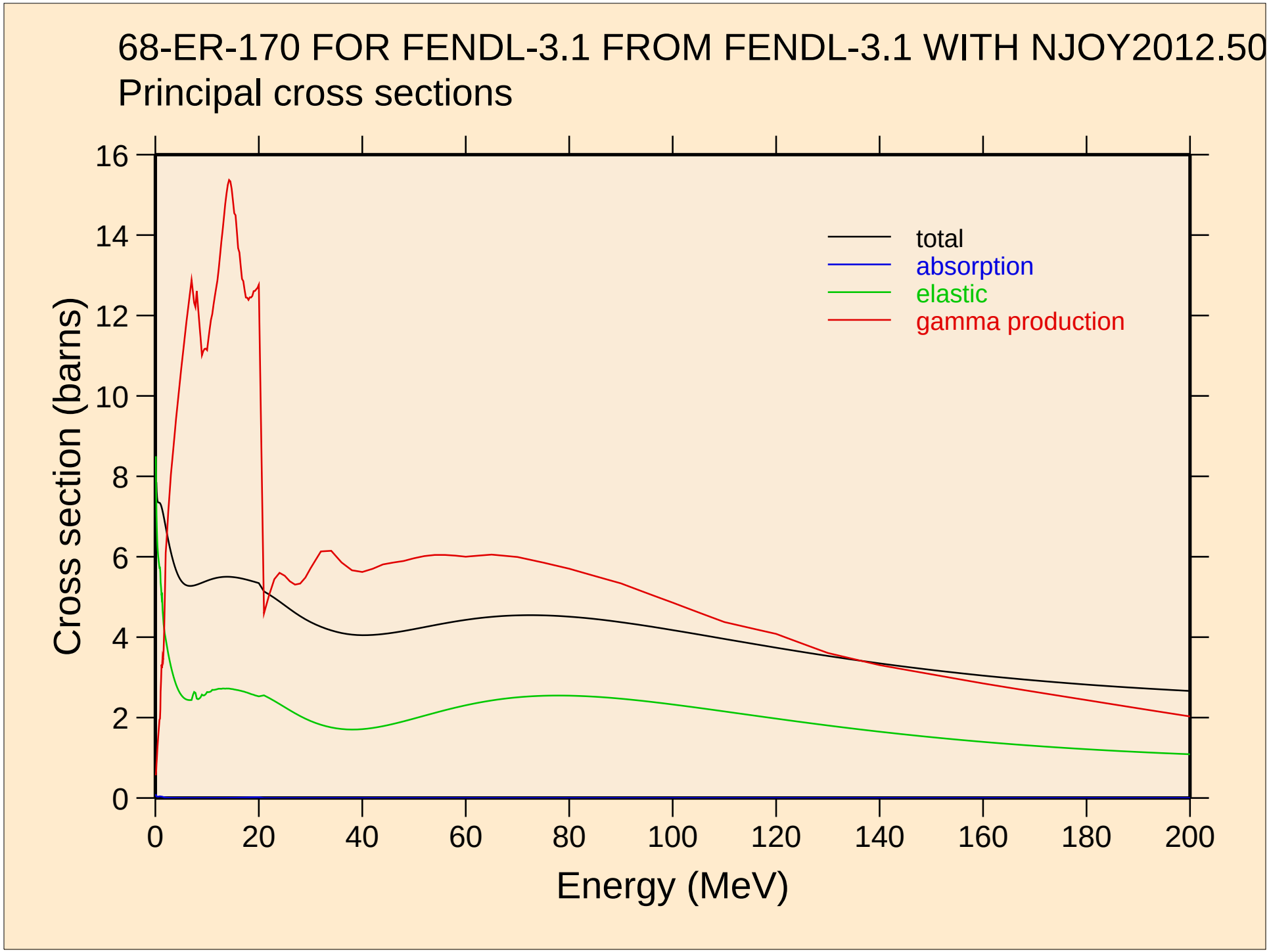

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
UR elastic cross section
Inf. Dil.
100 b
1 b
Cross section (barns)
10^1
10^-2
10^-1
Energy (MeV)

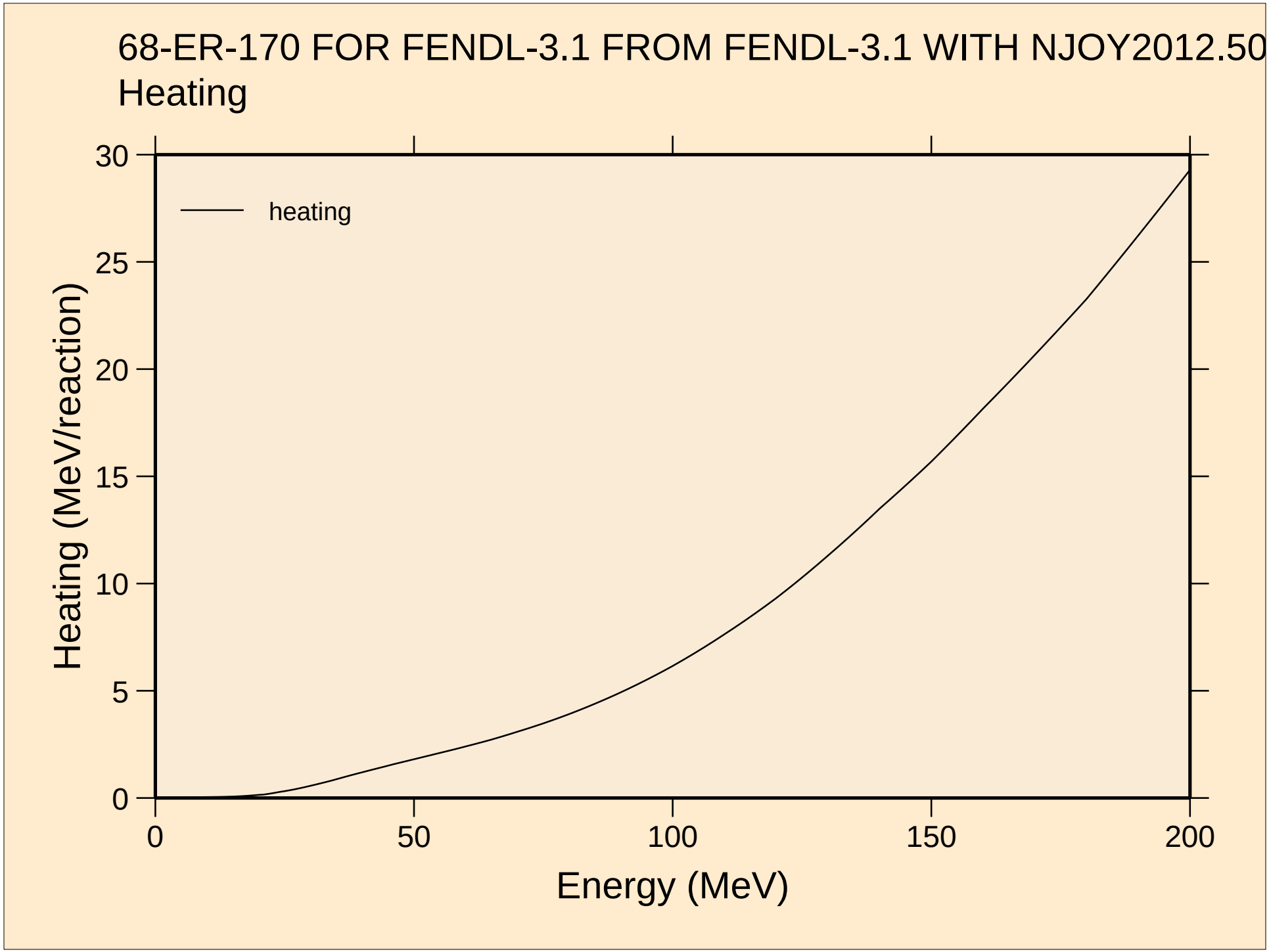

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
UR capture cross section
Inf. Dil.
100 b
1 b
Cross section (barns)
Energy (MeV)
10^0
10^-1
10^-2
10^-1

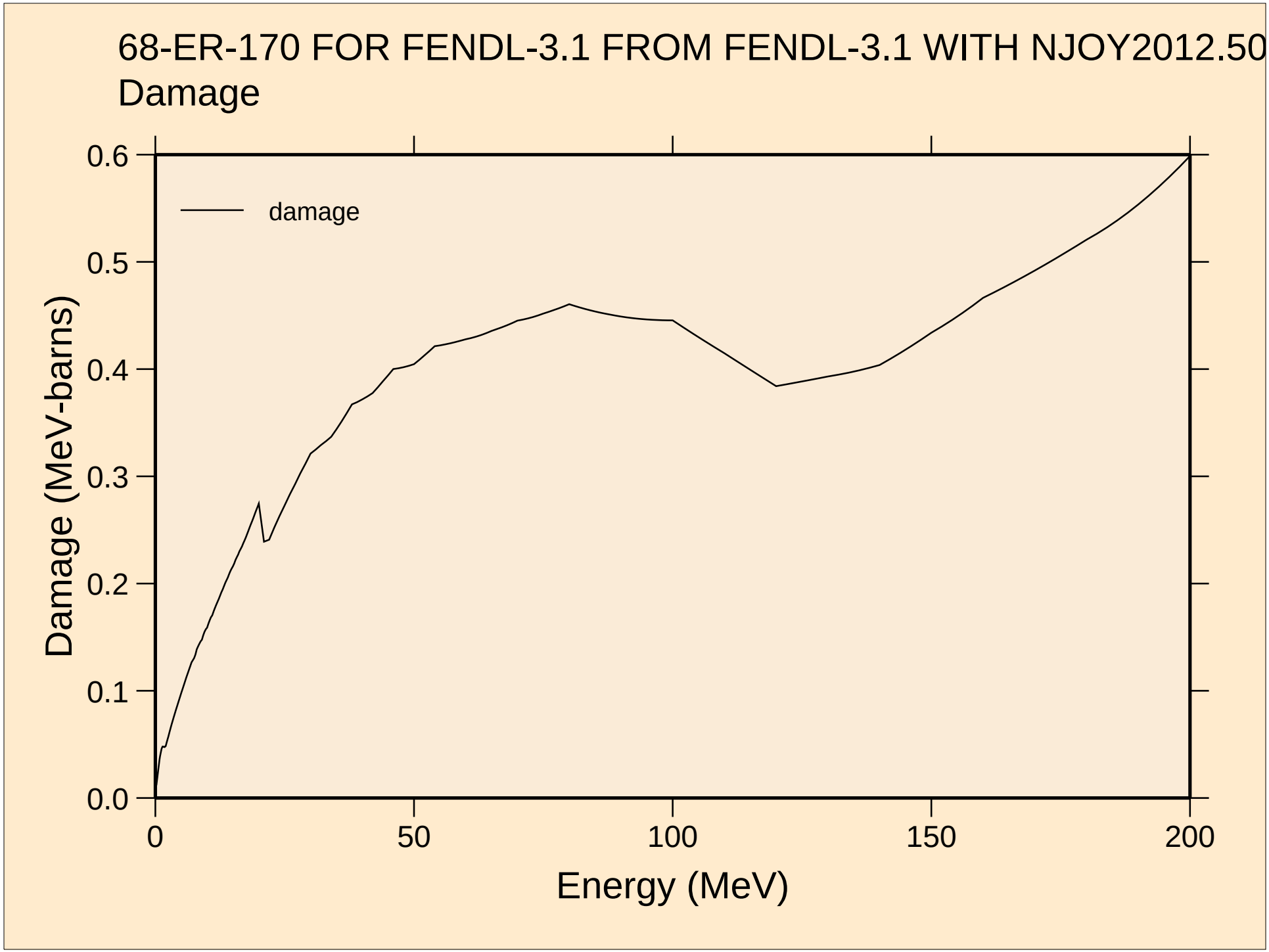

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Heating
heating
Heating (MeV/reaction)
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-11
10^-9
10^-7
10^-5
10^-3
10^-1
10^1
Energy (MeV)

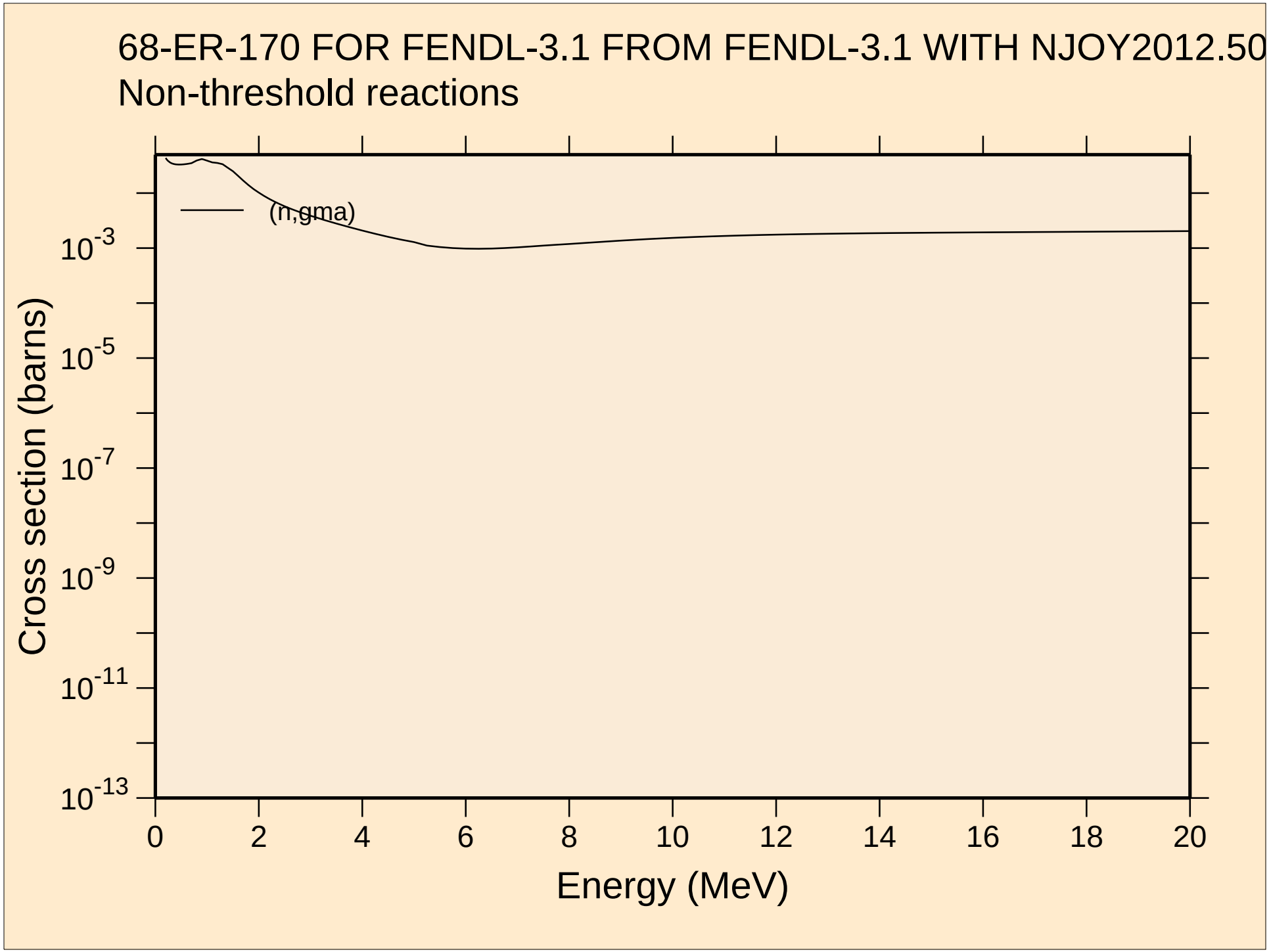

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Damage
damage
Damage (MeV-barns)
Energy (MeV)
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-11
10^-9
10^-7
10^-5
10^-3
10^-1
10^1

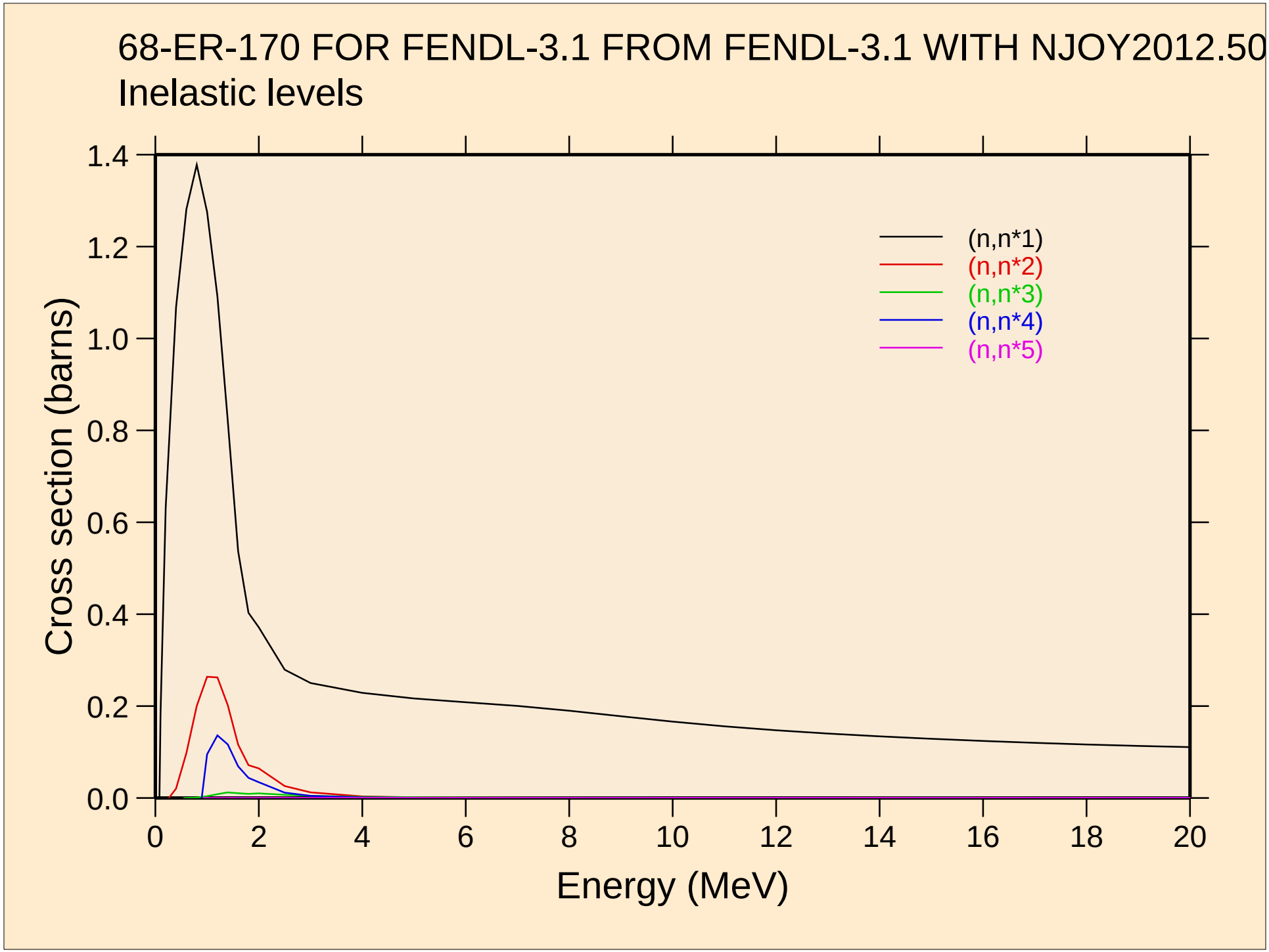

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Non-threshold reactions
(n,gma)
Cross section (barns)
10^3
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-11 10^-10 10^-9 10^-8 10^-7 10^-6 10^-5 10^-4 10^-3 10^-2 10^-1 10^0 10^1
Energy (MeV)

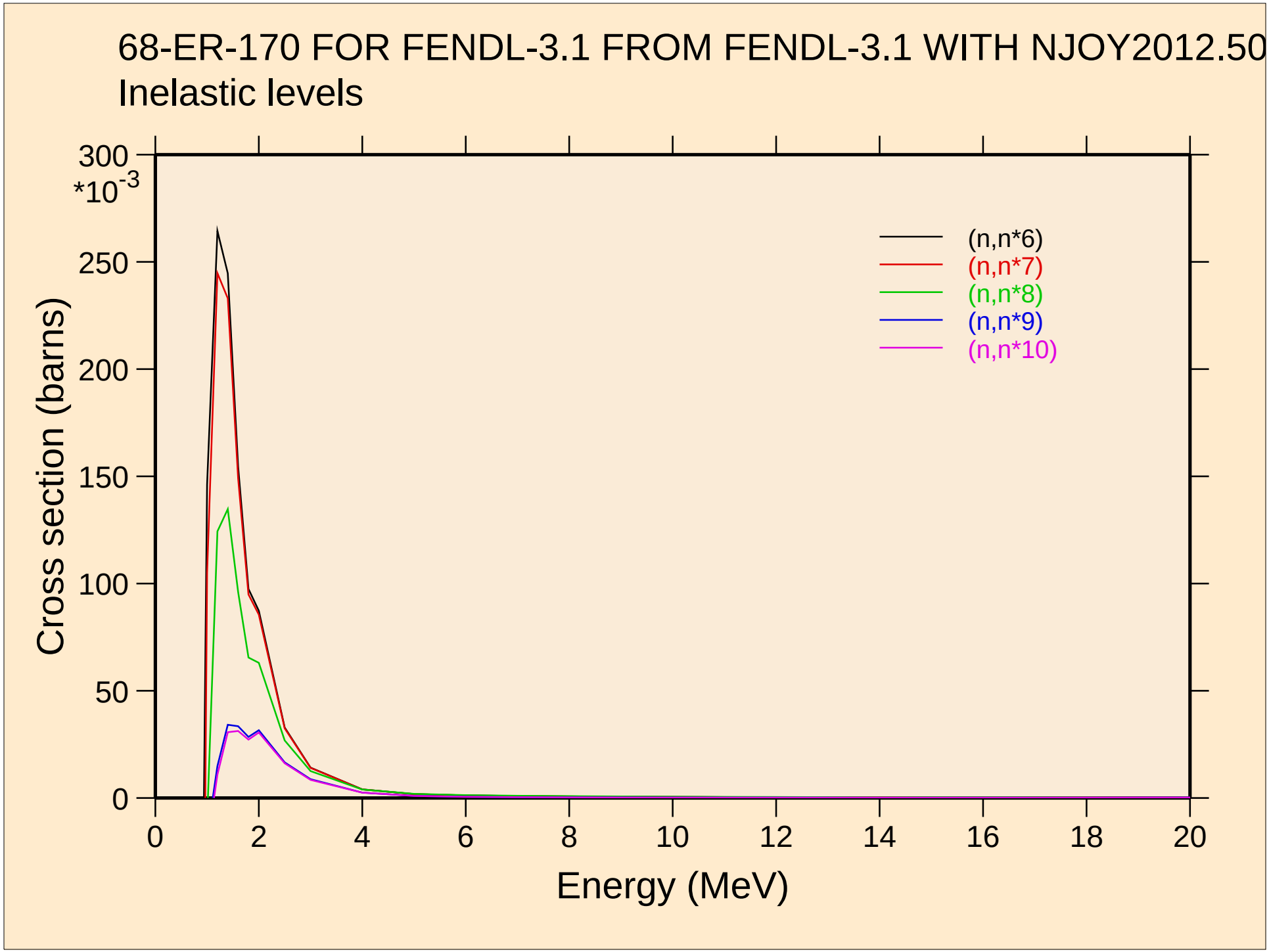

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Principal cross sections
Cross section (barns)
Energy (MeV)
0
2
4
6
8
10
12
14
16
0
20
40
60
80
100
120
140
160
180
200
total
absorption
elastic
gamma production

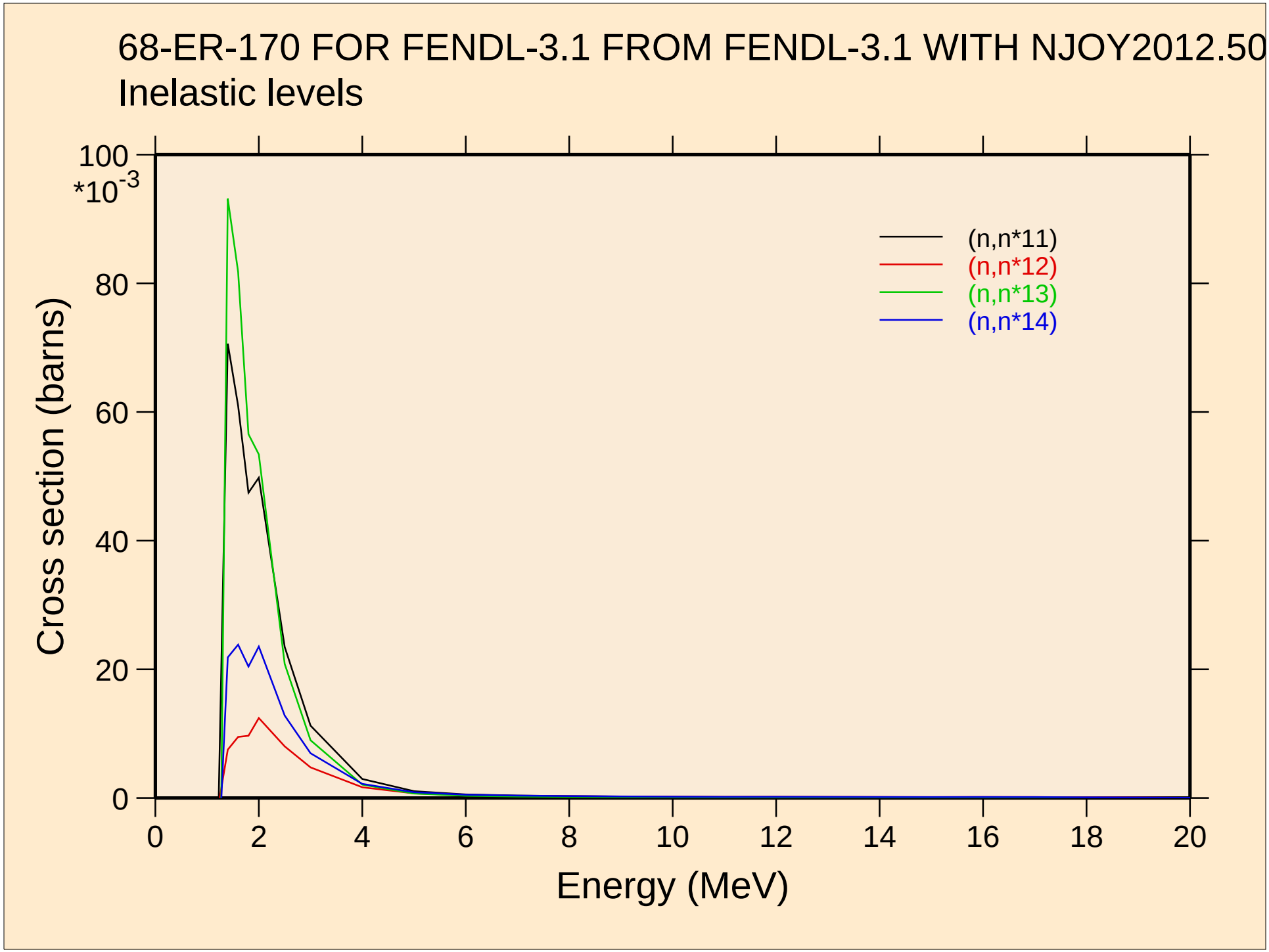

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Heating
heating
Heating (MeV/reaction)
Energy (MeV)
0
5
10
15
20
25
30
0
50
100
150
200

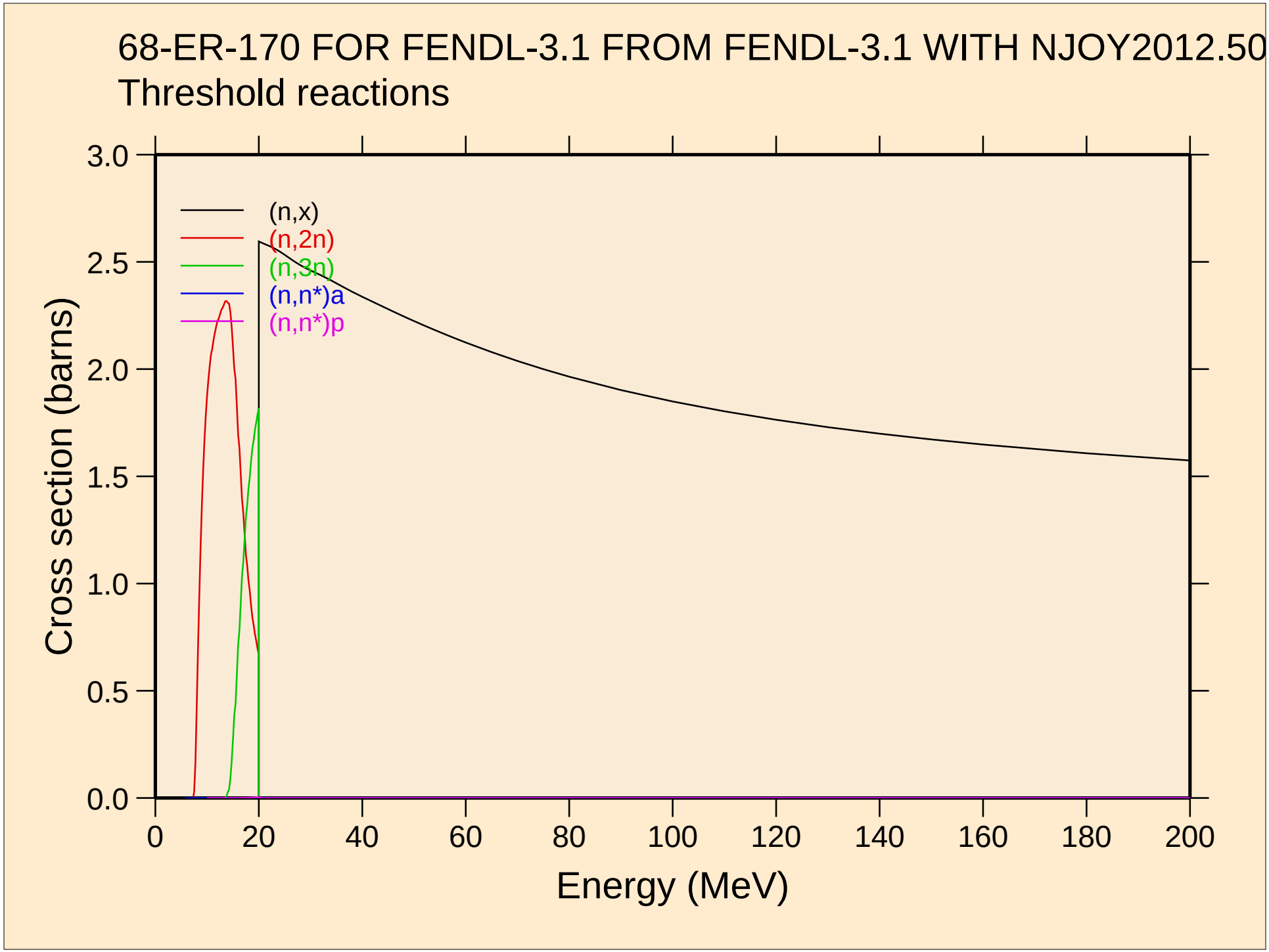

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Damage
damage
Damage (MeV-barns)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0
50
100
150
200
Energy (MeV)

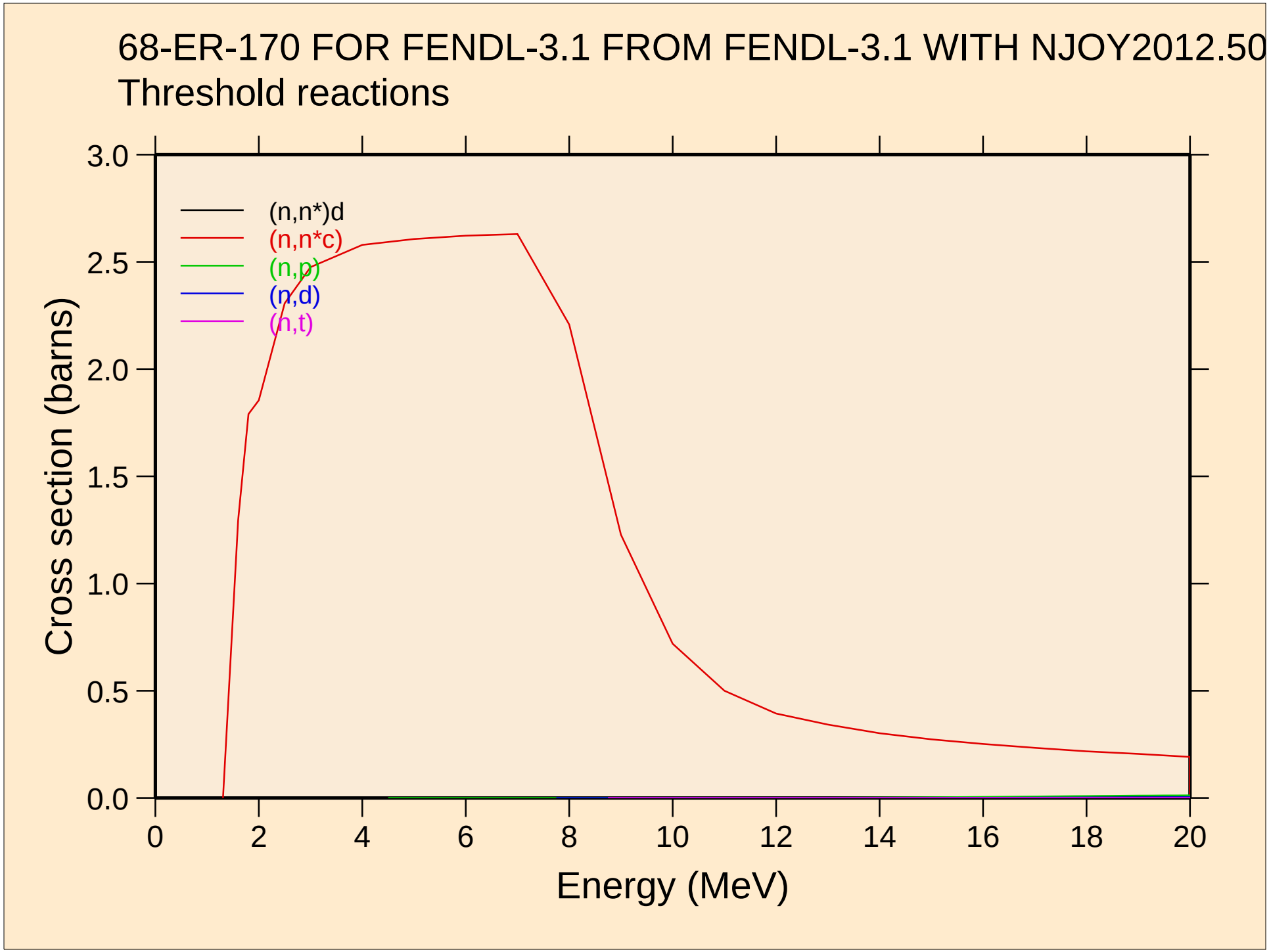

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Non-threshold reactions
(n,gma)
Cross section (barns)
10-3
10-5
10-7
10-9
10-11
10-13
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

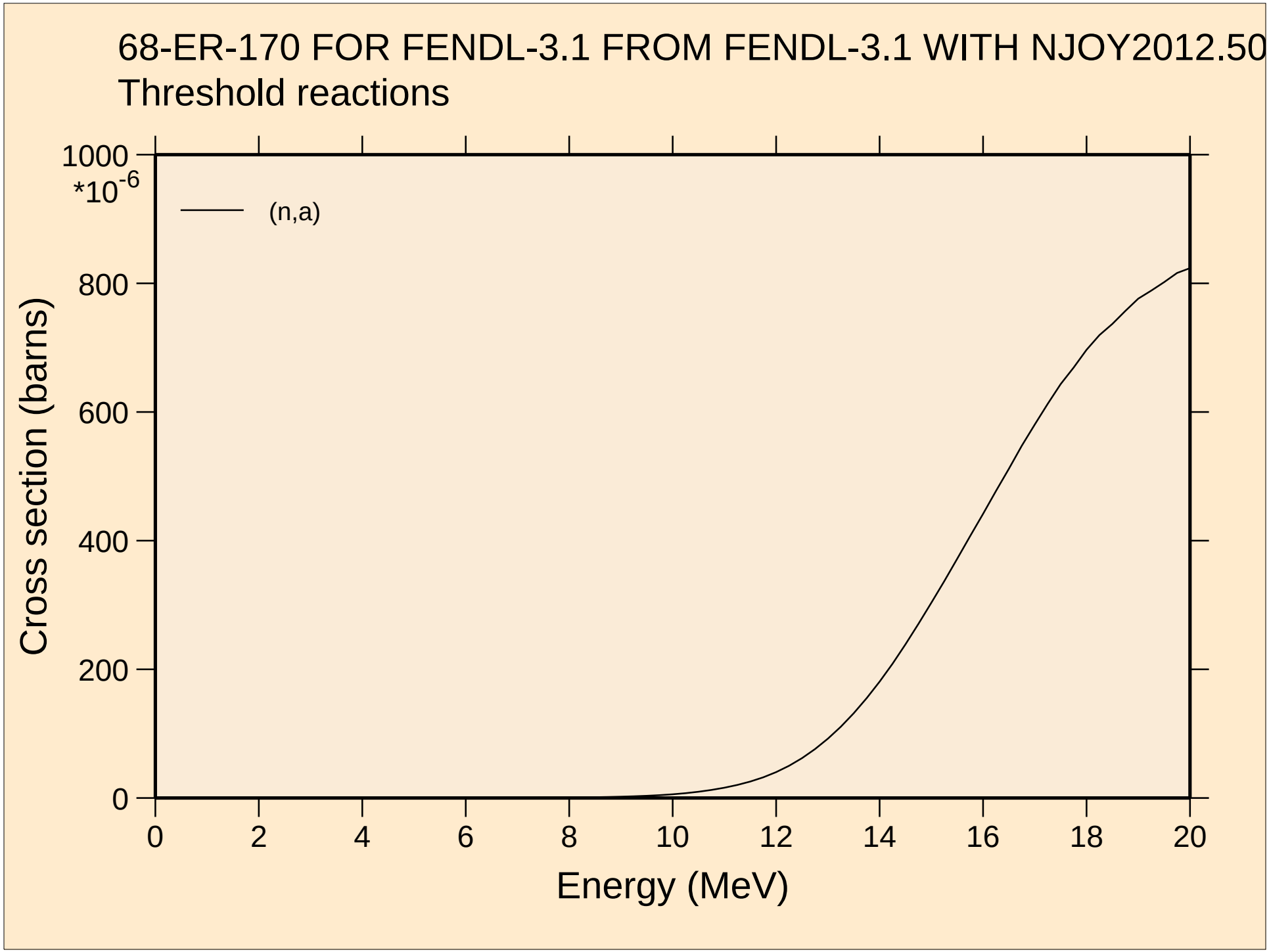

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Inelastic levels
Cross section (barns)
Energy (MeV)
(n,n*1)
(n,n*2)
(n,n*3)
(n,n*4)
(n,n*5)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
0
2
4
6
8
10
12
14
16
18
20

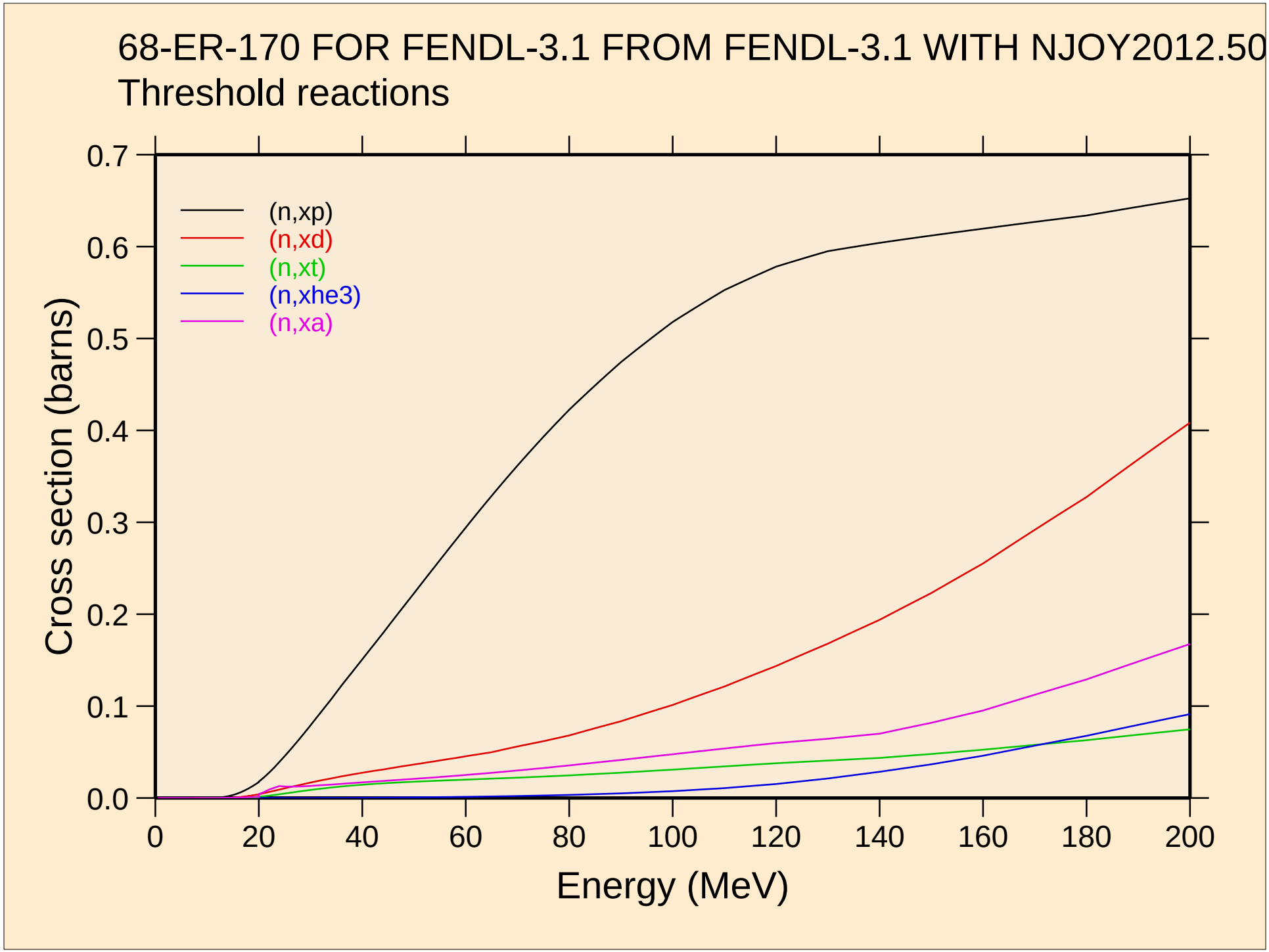

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Inelastic levels
300
*10-3
250
200
150
100
50
0
Cross section (barns)
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*6)
(n,n*7)
(n,n*8)
(n,n*9)
(n,n*10)

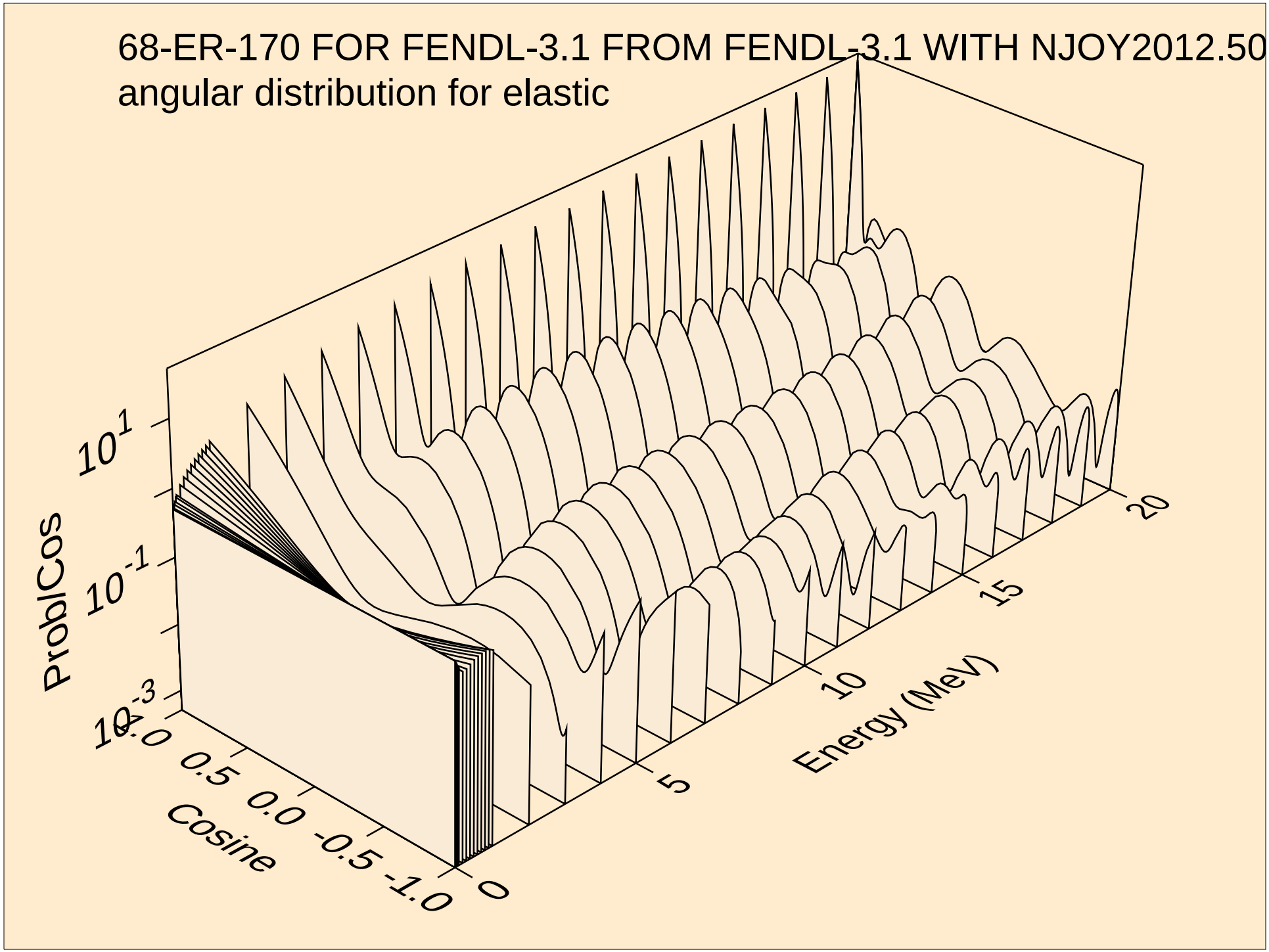

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Inelastic levels
100
*10-3
80
60
40
20
0
Cross section (barns)
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*11)
(n,n*12)
(n,n*13)
(n,n*14)

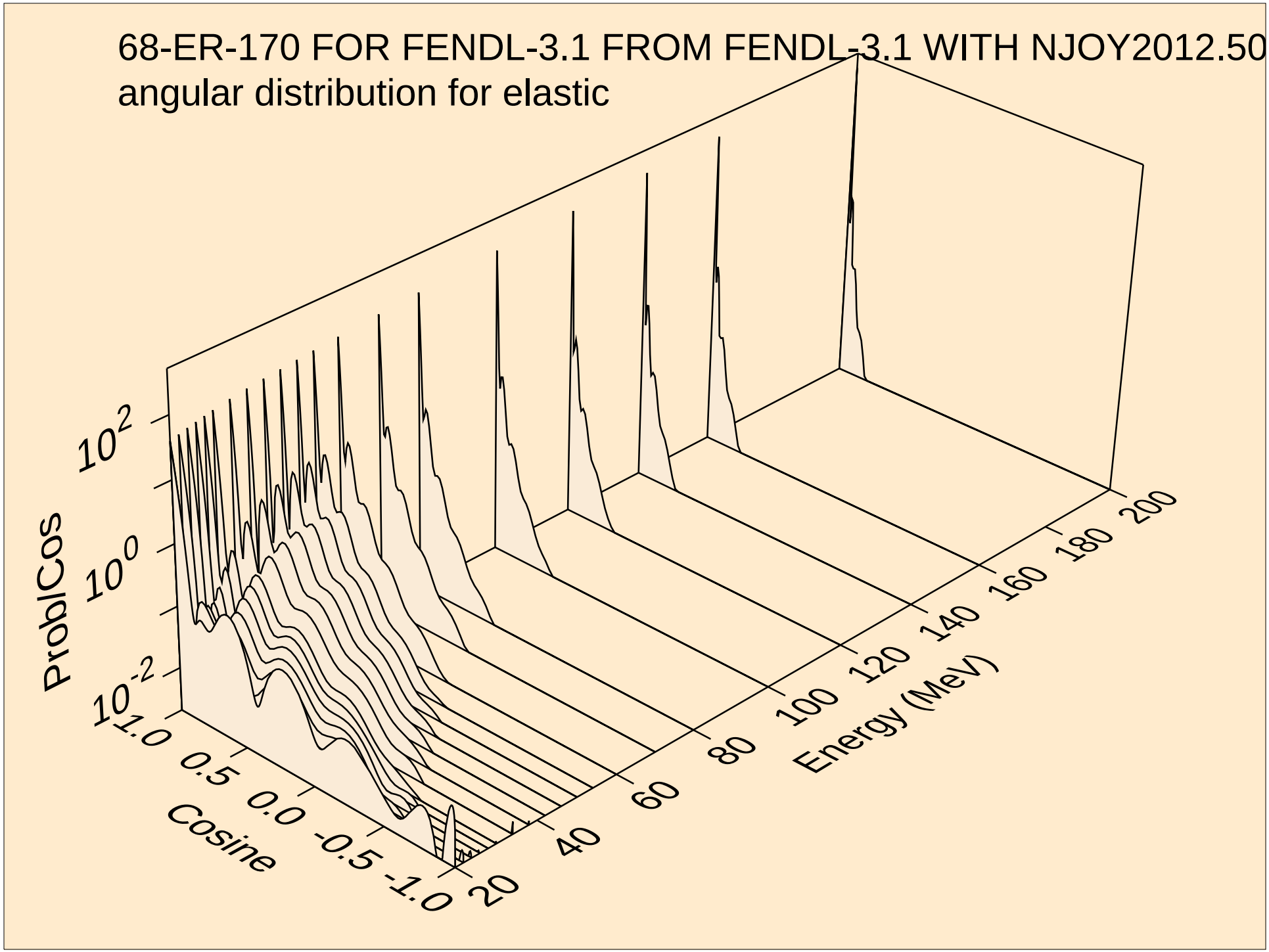

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Threshold reactions
(n,x)
(n,2n)
(n,3n)
(n,n*)a
(n,n*)p
Cross section (barns)
Energy (MeV)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
0
20
40
60
80
100
120
140
160
180
200

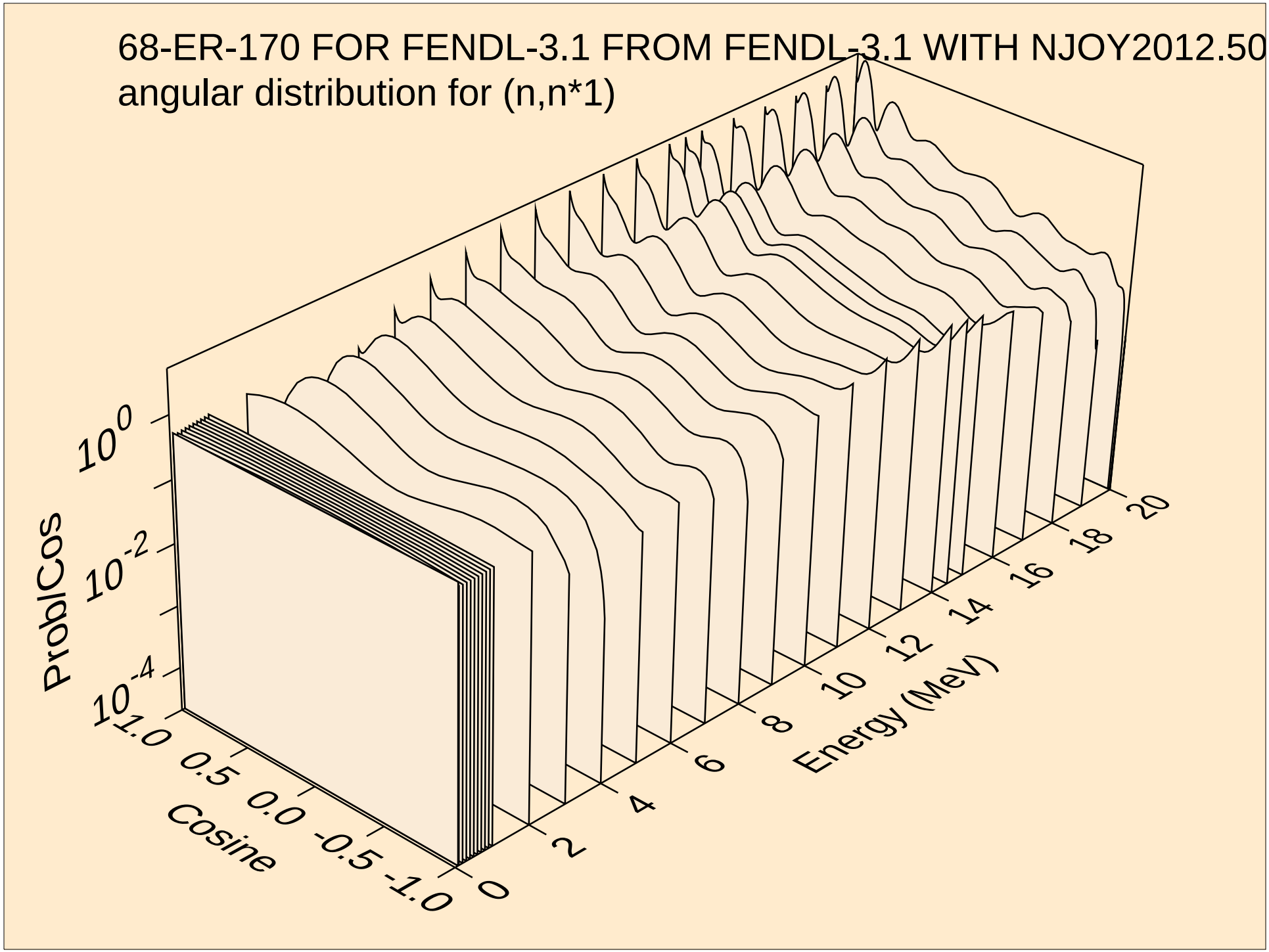

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Threshold reactions
(n,n*)d
(n,n*c)
(n,p)
(n,d)
(n,t)
Cross section (barns)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

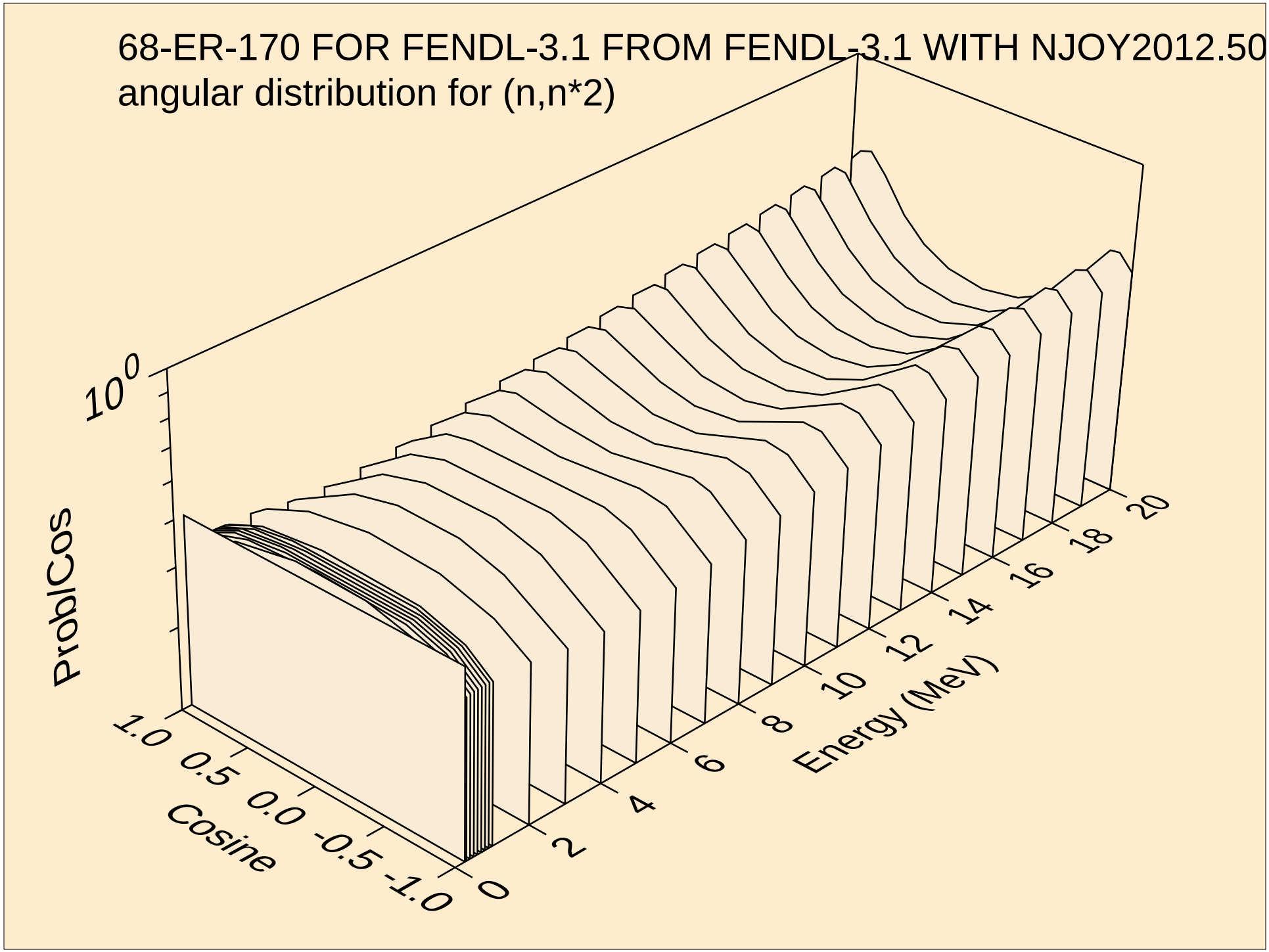

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Threshold reactions
1000
*10-6
800
600
400
200
0
(n,a)
Cross section (barns)
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

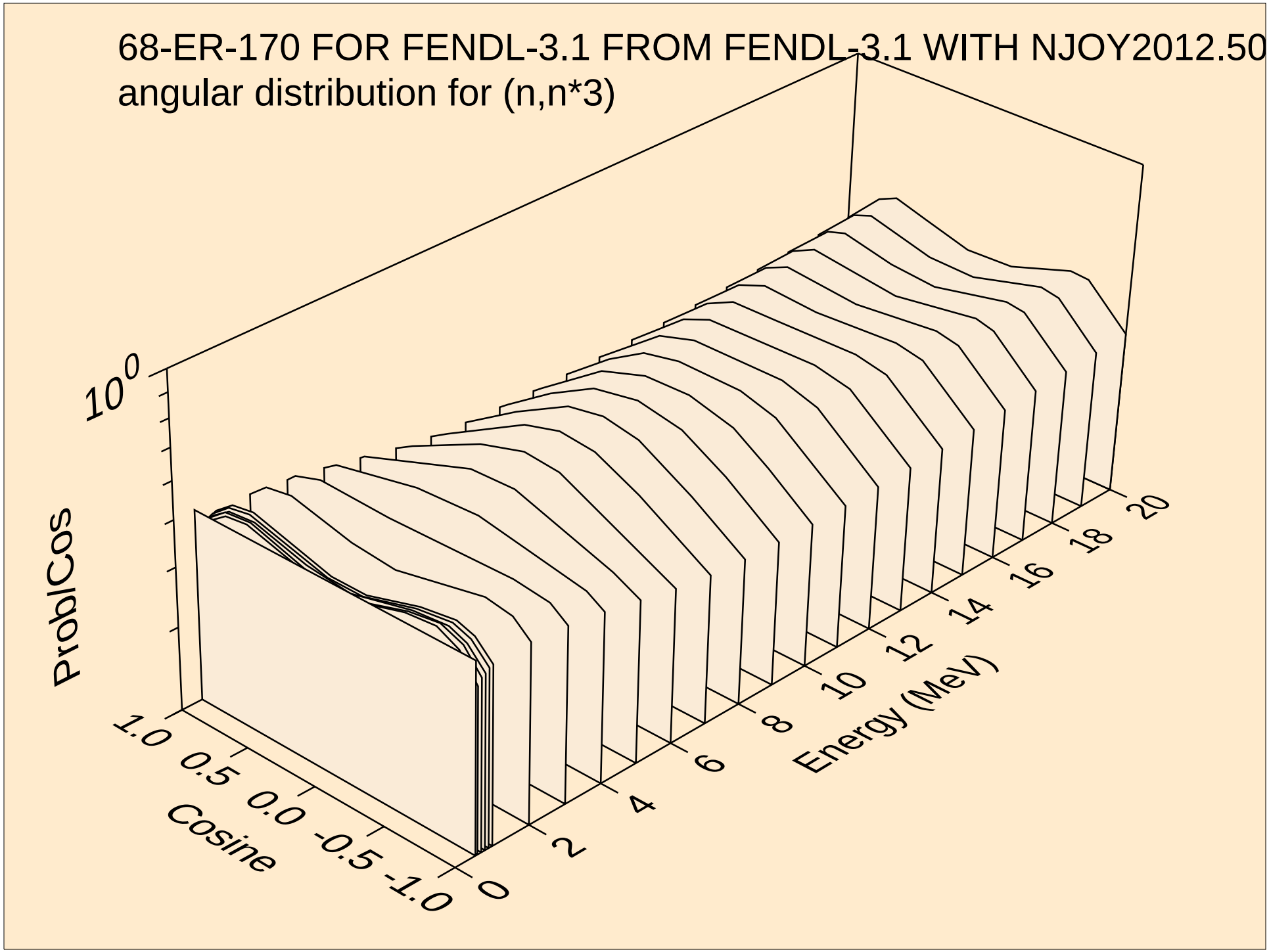

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Threshold reactions
(n,xp)
(n,xd)
(n,xt)
(n,xhe3)
(n,xa)
Cross section (barns)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0
20
40
60
80
100
120
140
160
180
200
Energy (MeV)

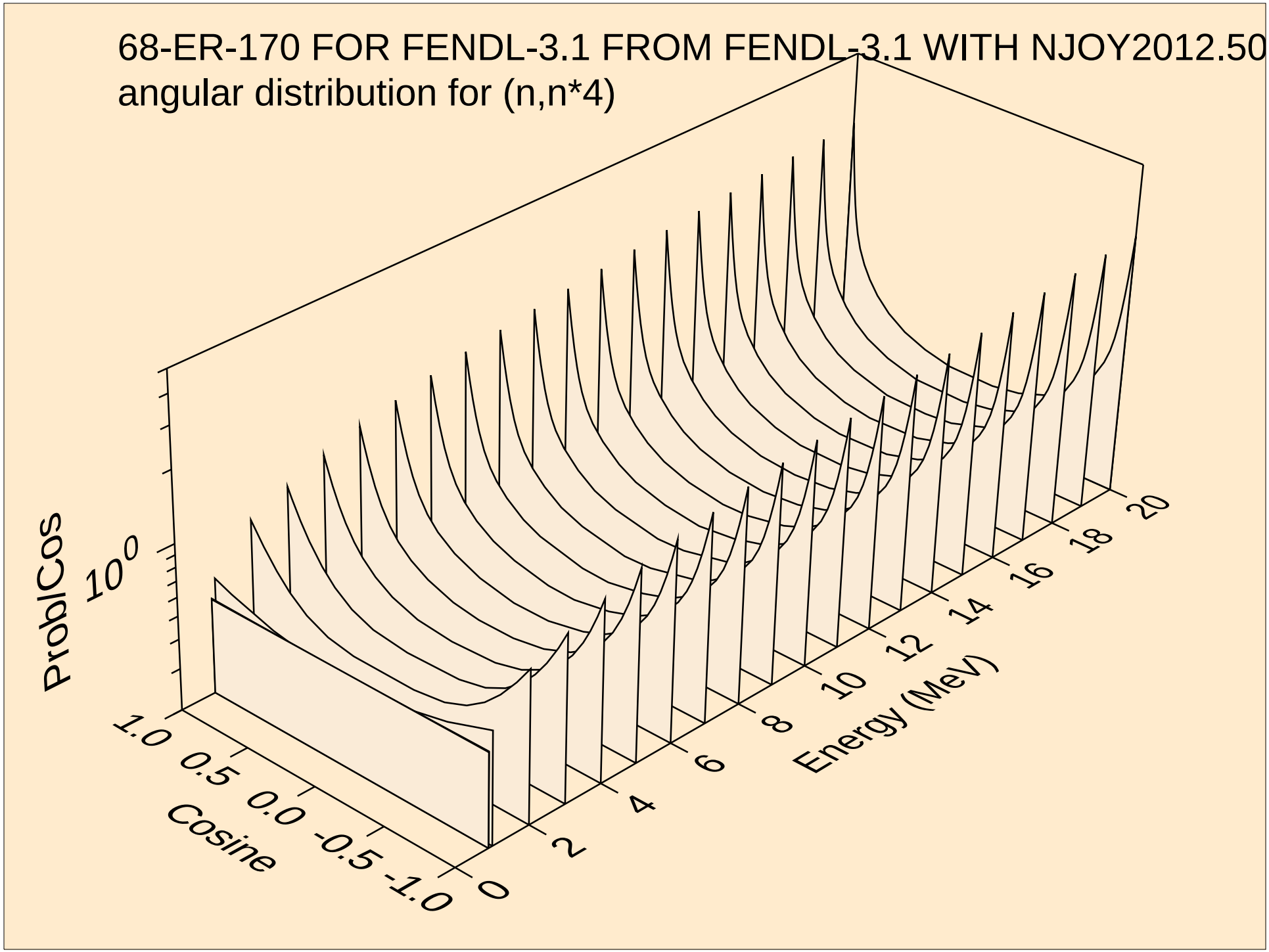

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for elastic
ProbICos
10^1
10^-1
10^-3
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
5
10
15
20
Energy (MeV)

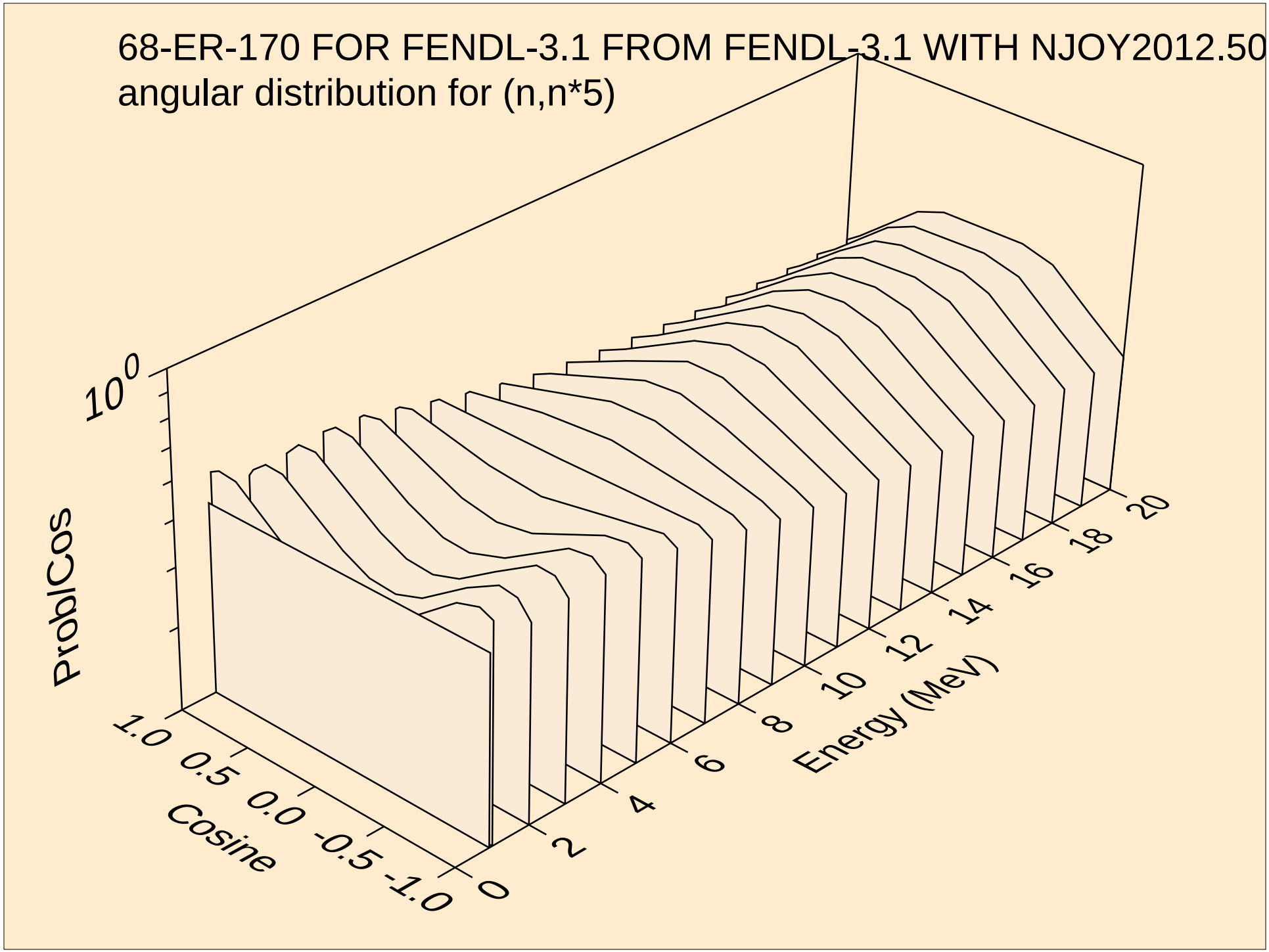

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for elastic
ProblCos
10^{2}
10^{0}
10^{-2}
1.0
0.5
0.0
-0.5
-1.0
Cosine
20
40
60
80
100
120
140
160
180
200
Energy (MeV)

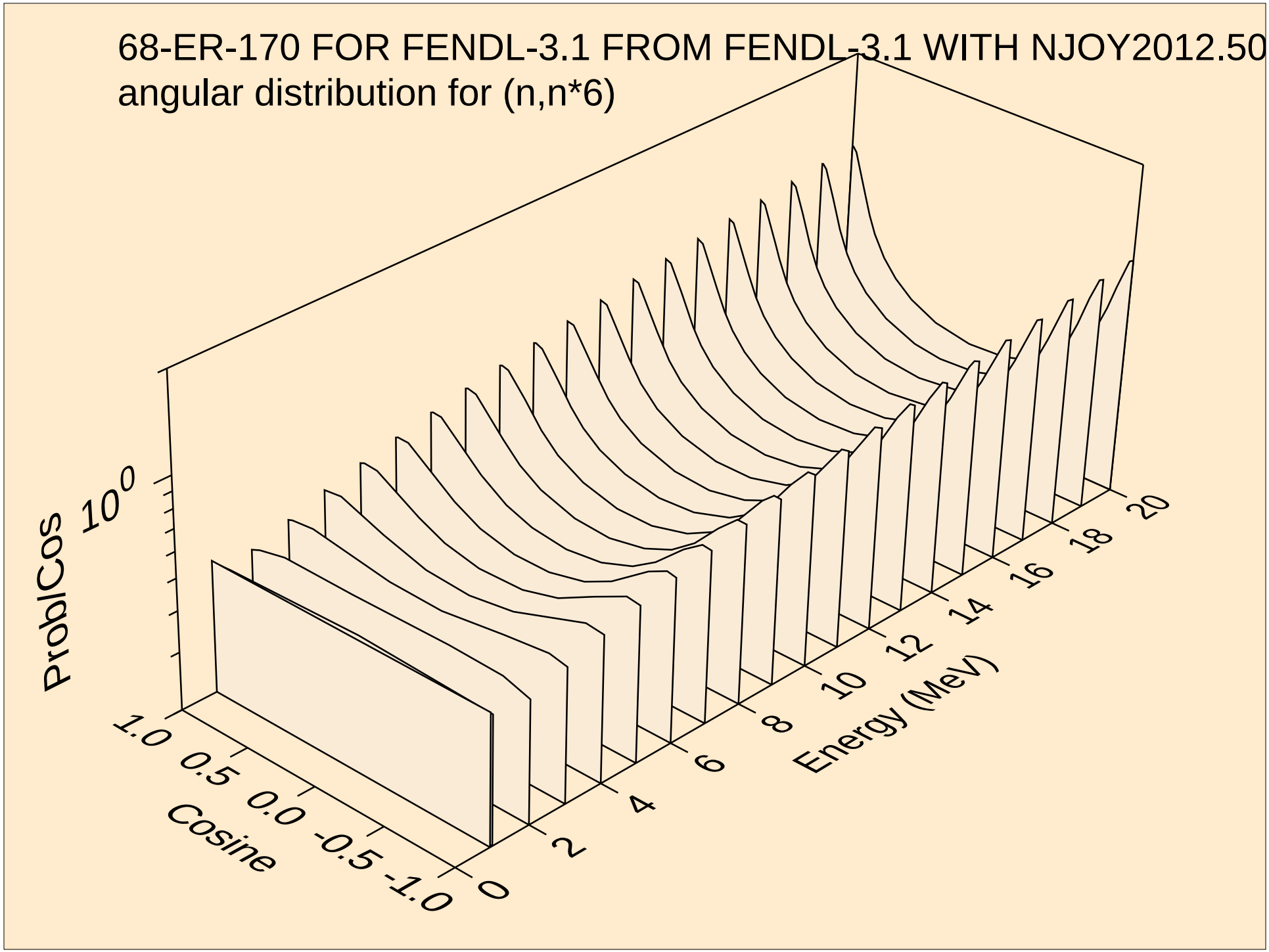

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*1)
ProbCos
10^{0}
10^{-2}
10^{-4}
Cosine
1.0
0.5
0.0
-0.5
-1.0
Energy (MeV)
0
2
4
6
8
10
12
14
16
18
20

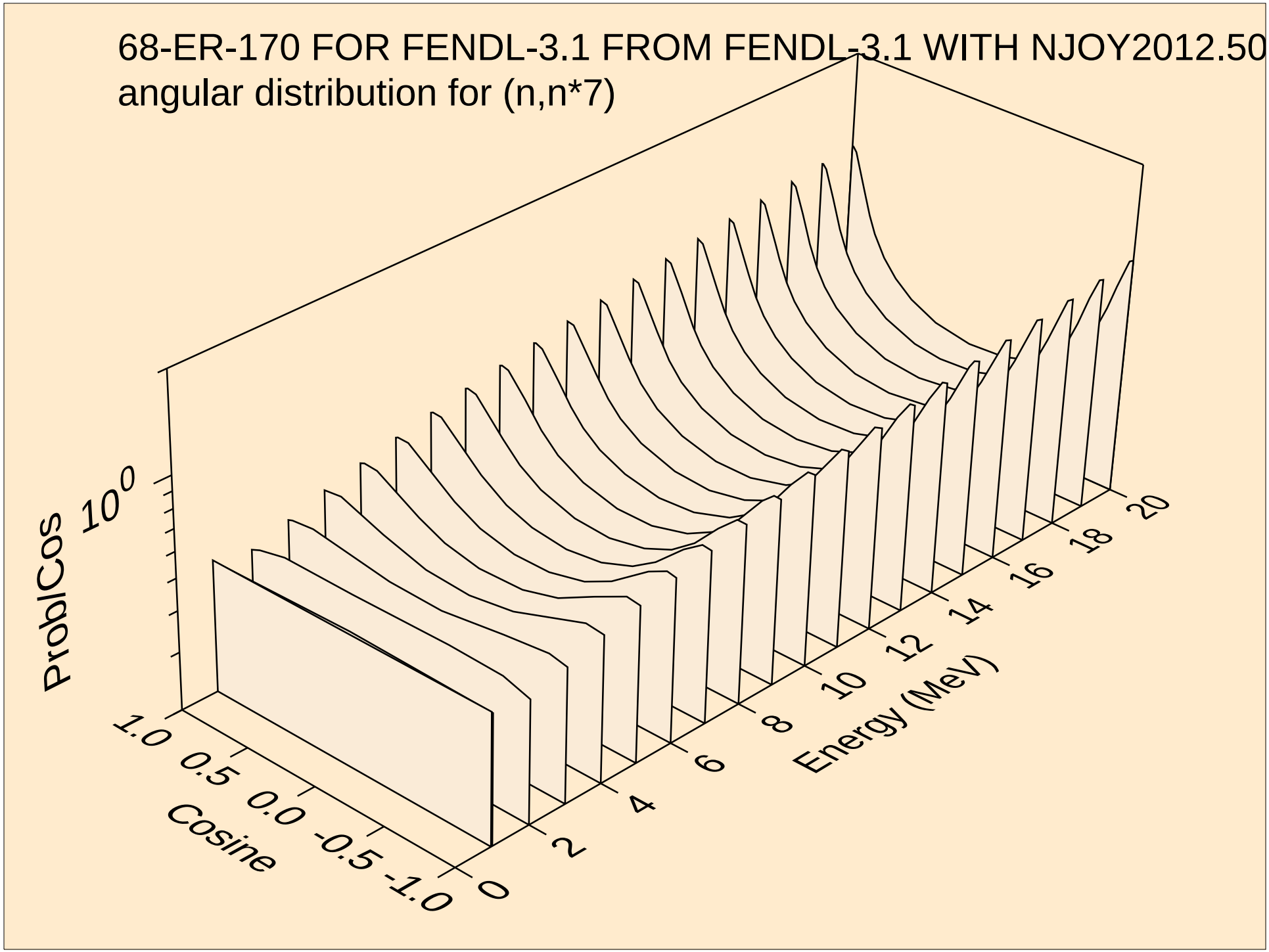

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*2)
ProbICos
10^0
Cosine
1.0
0.5
0.0
-0.5
-1.0
Energy (MeV)
0
2
4
6
8
10
12
14
16
18
20

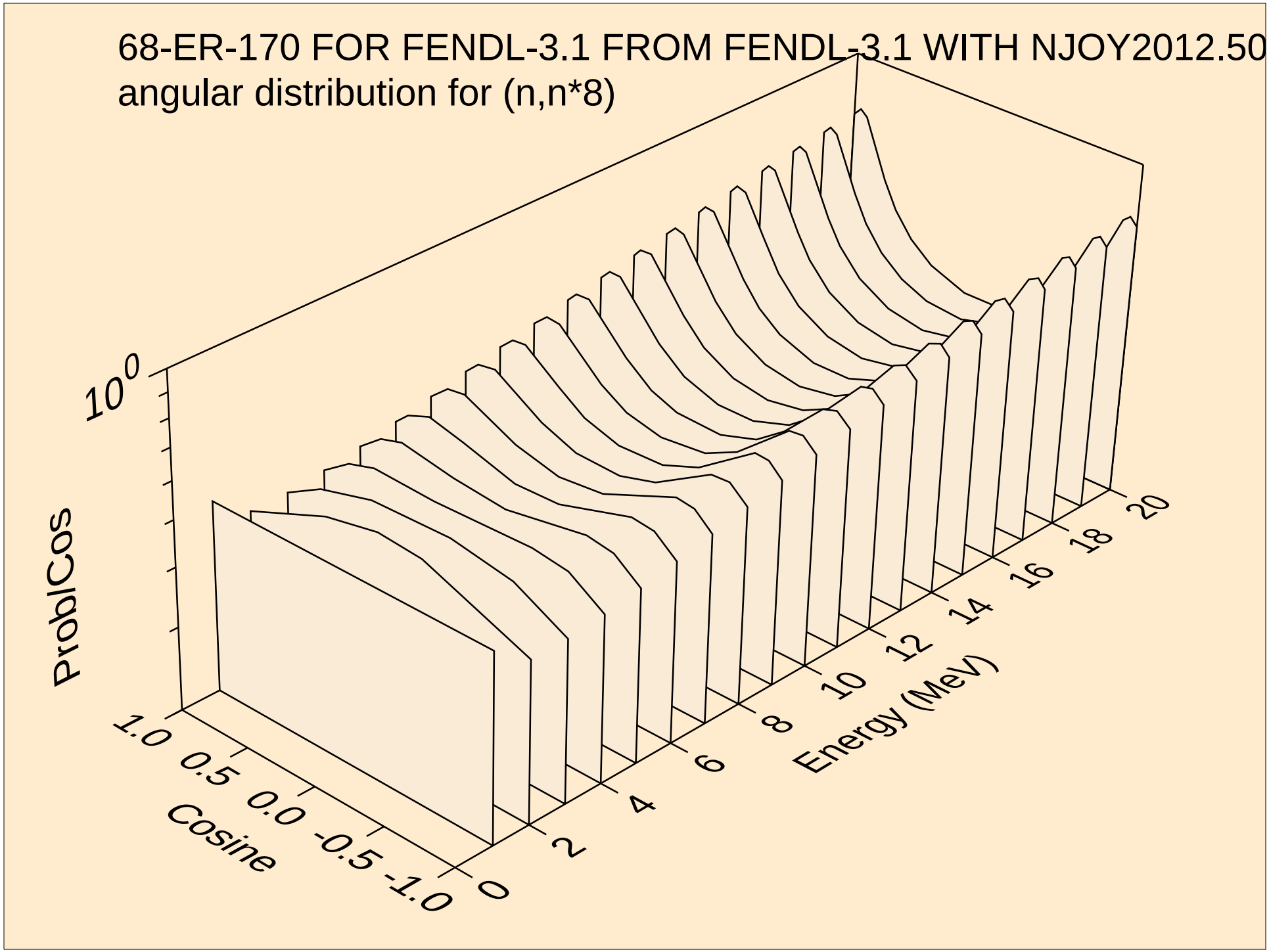

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*3)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

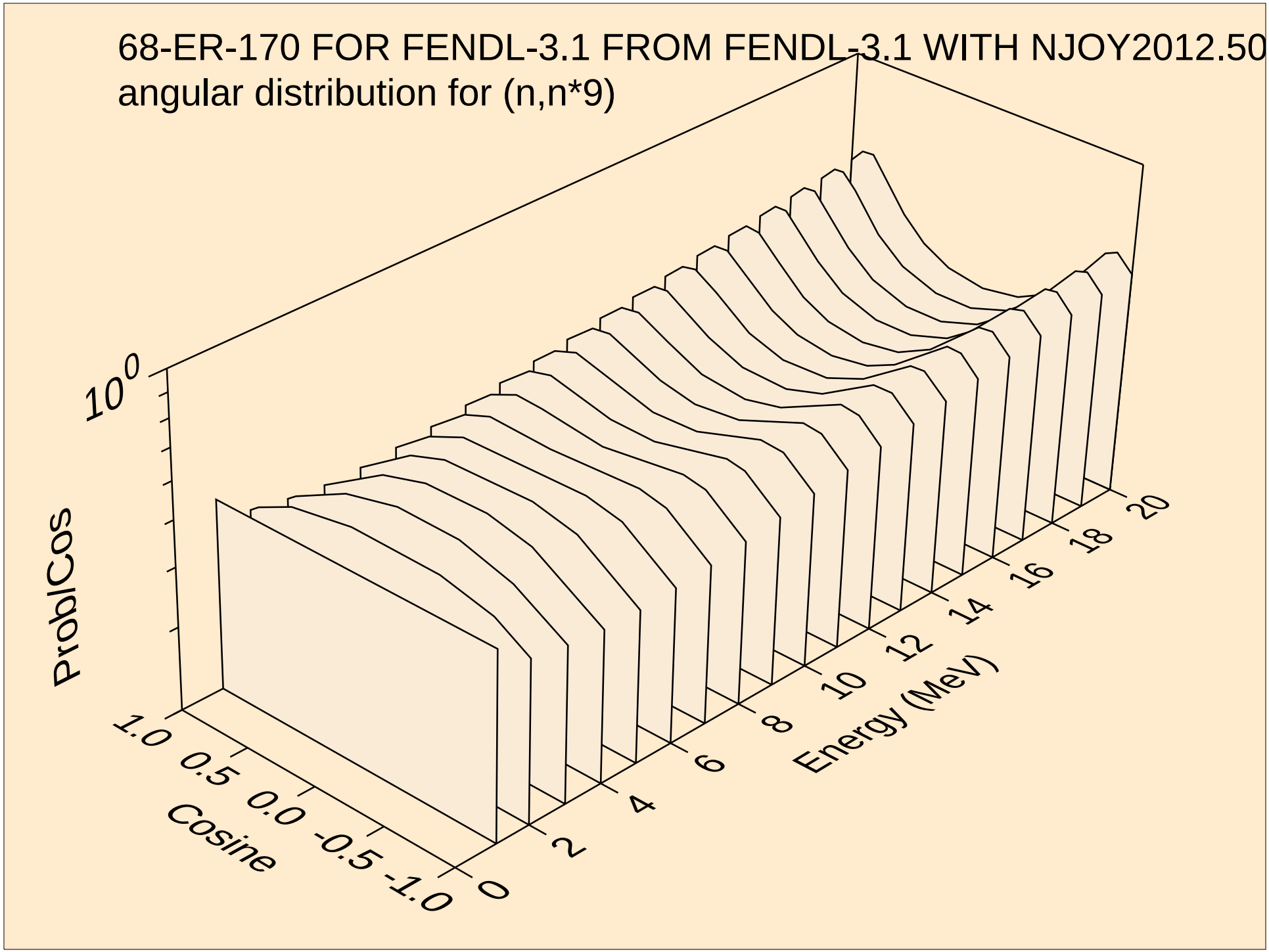

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*4)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

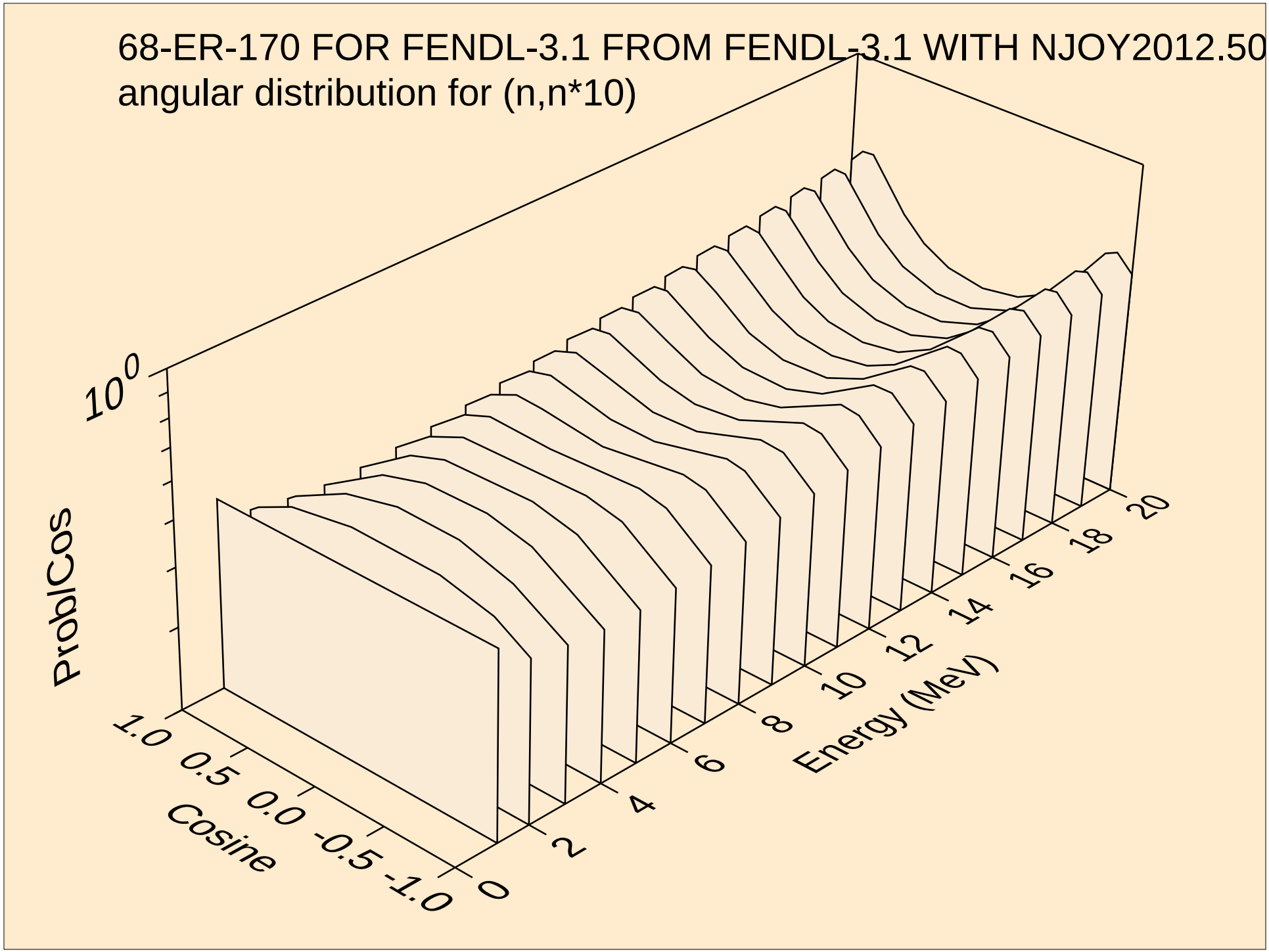

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*5)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

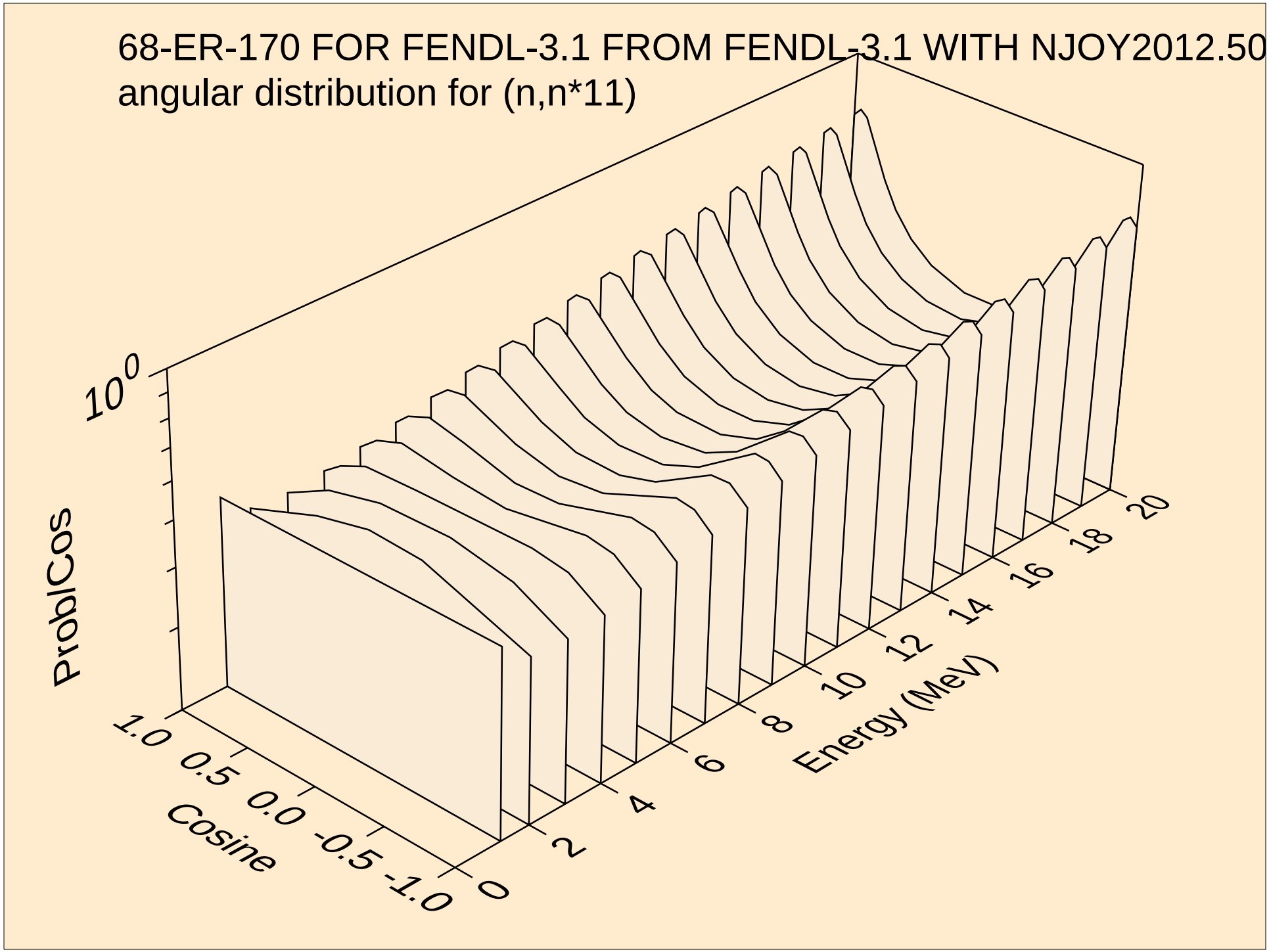

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*6)
ProblCos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

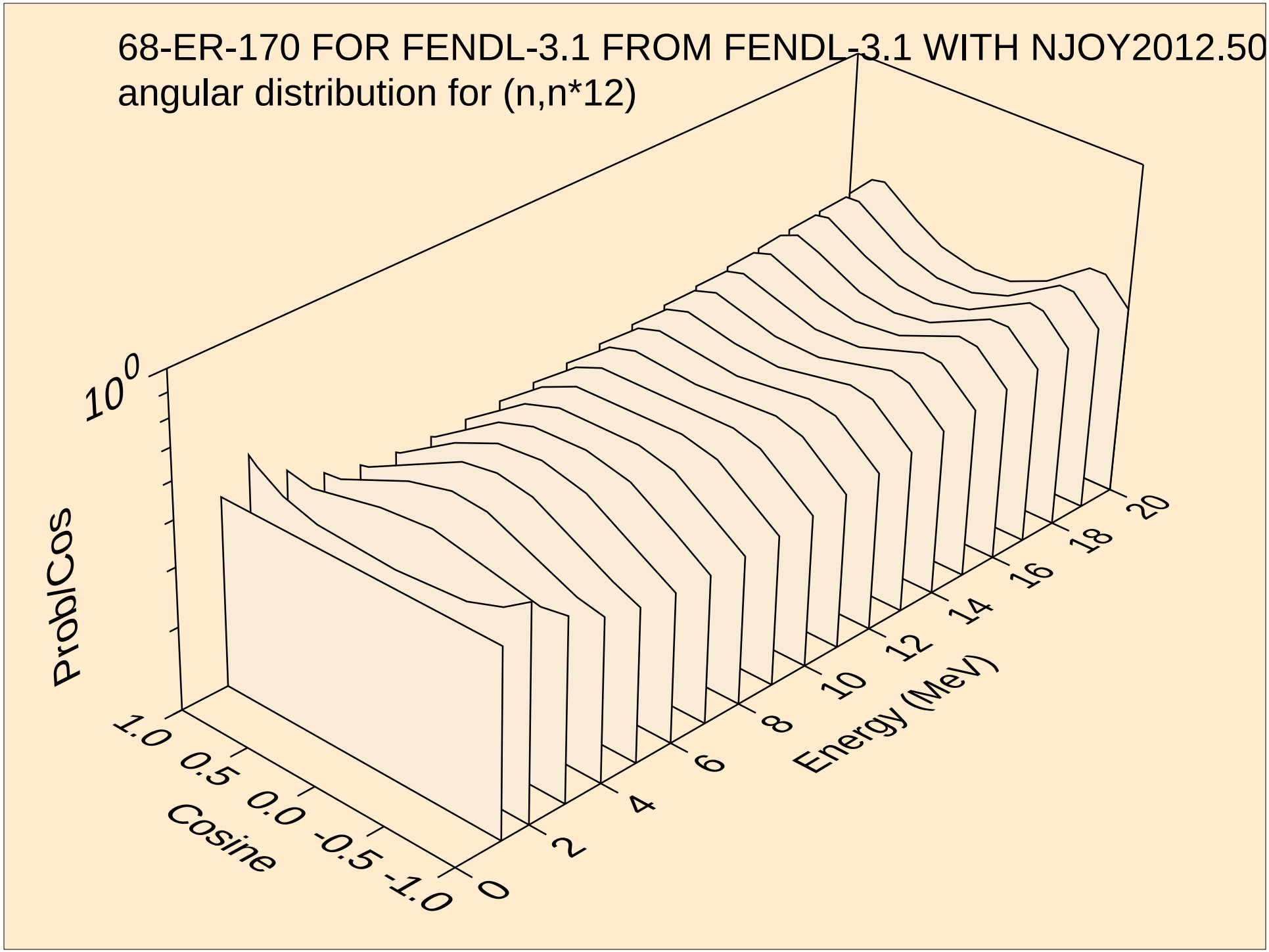

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*7)
ProblCos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

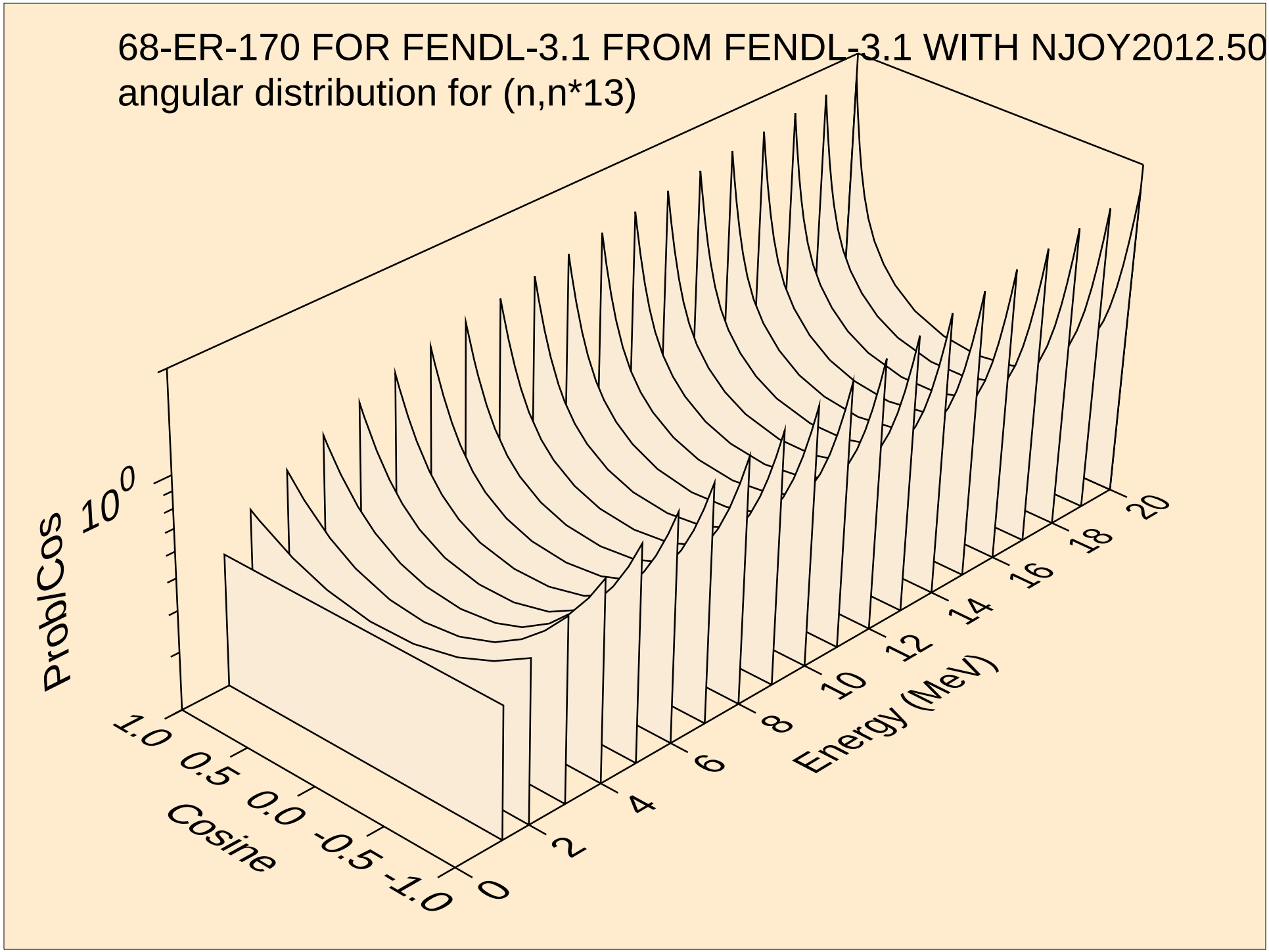

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*8)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

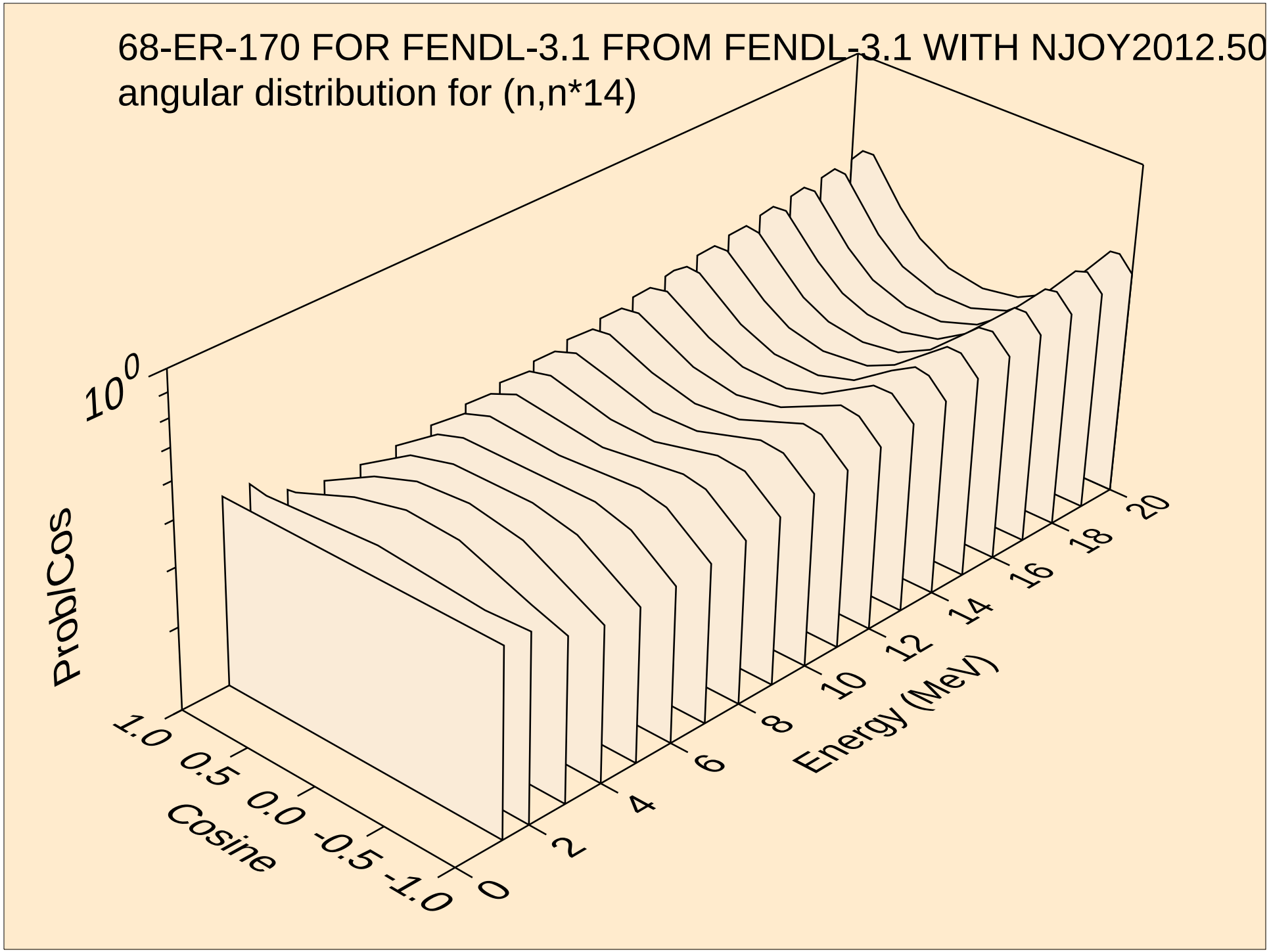

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*9)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

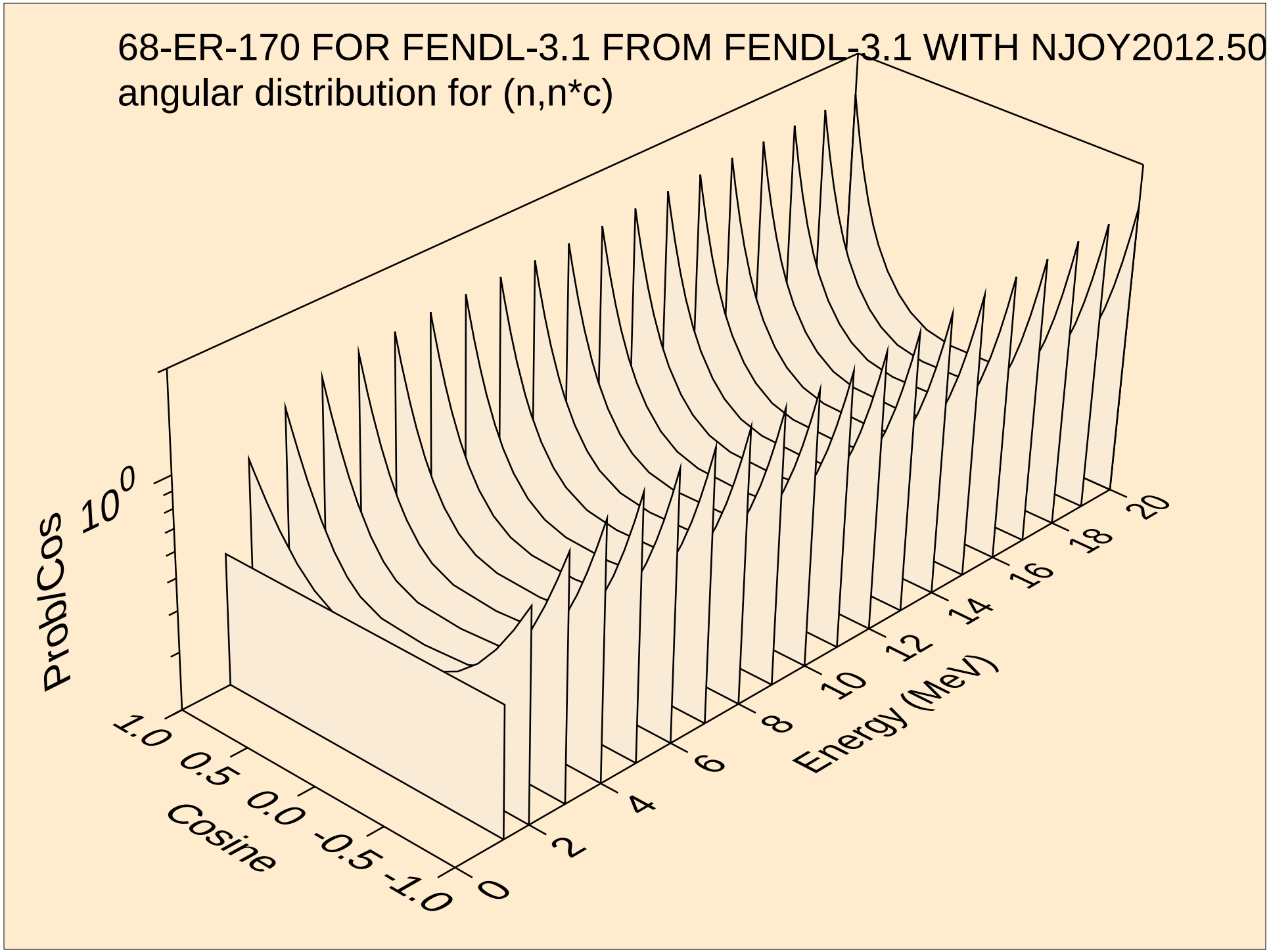

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*10)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

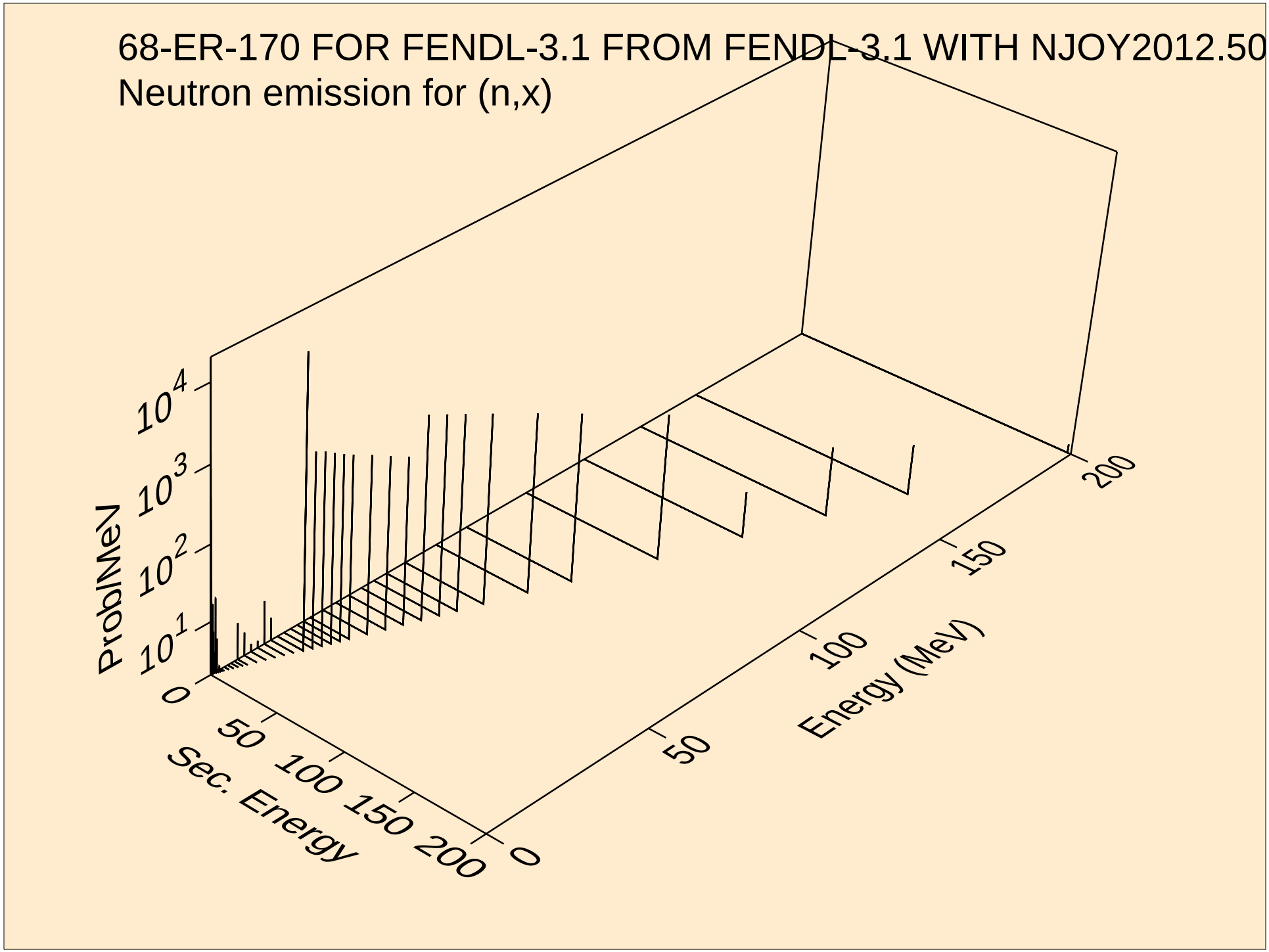

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*11)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

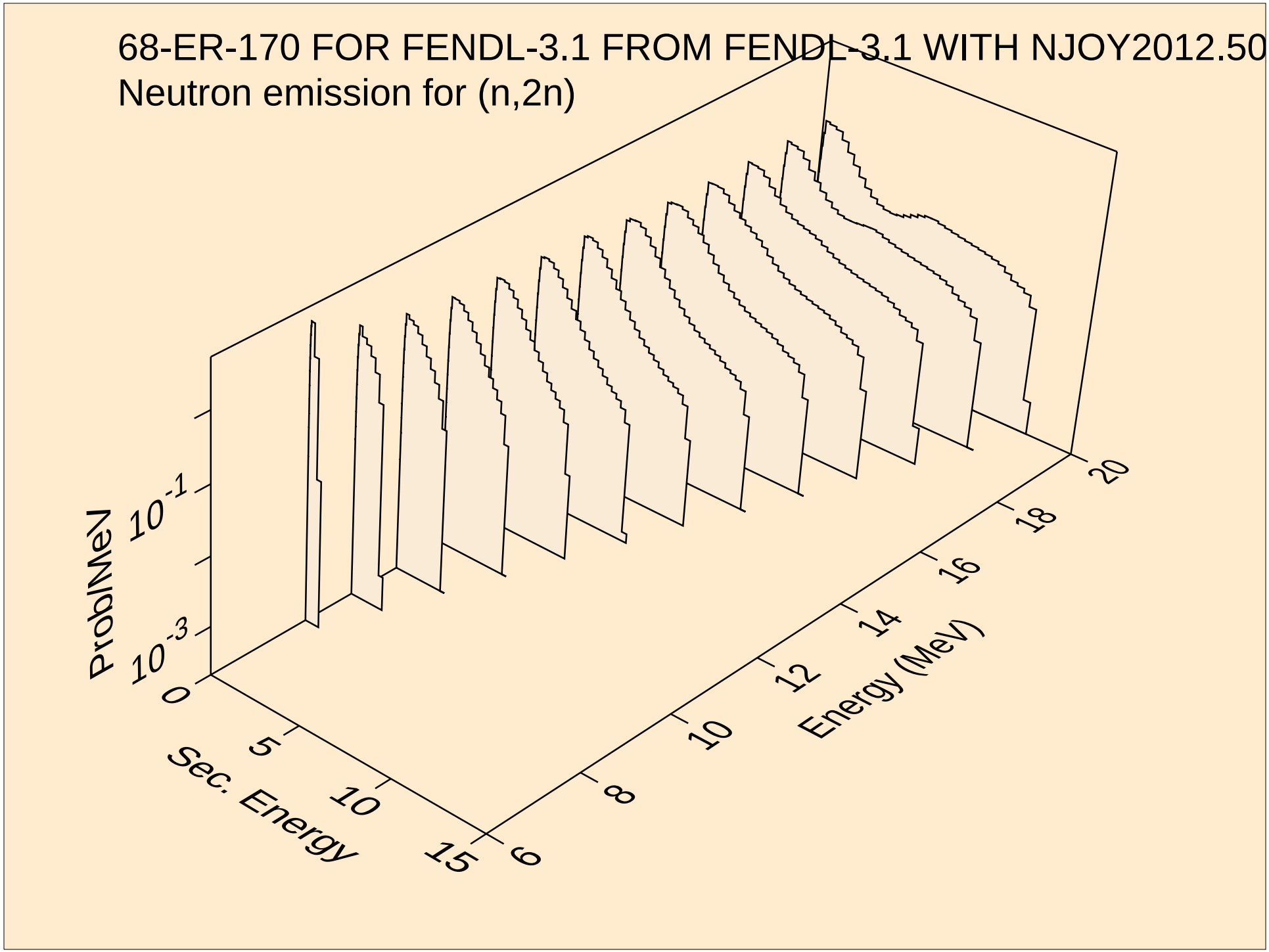

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*12)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

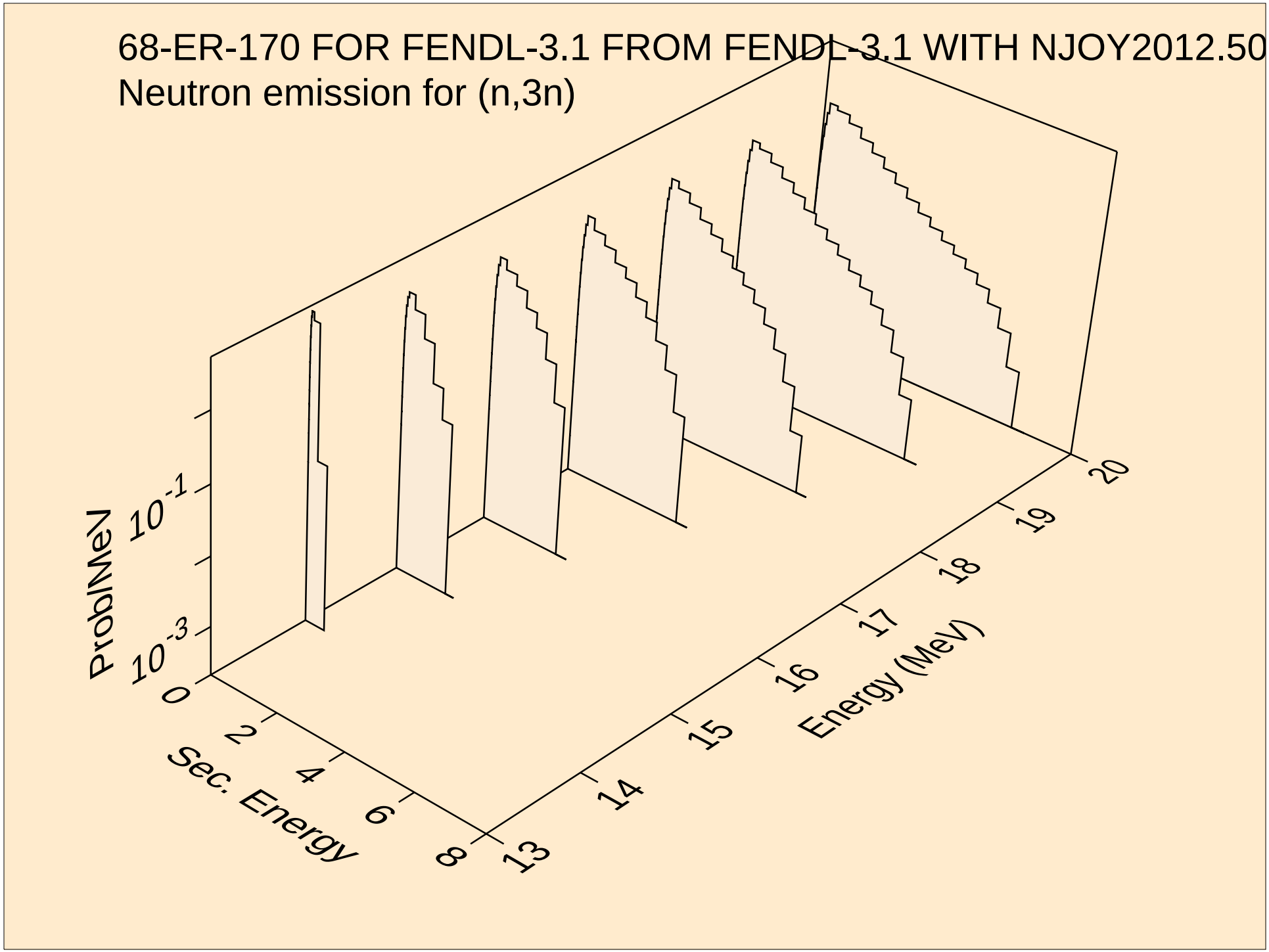

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*13)
ProblCos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

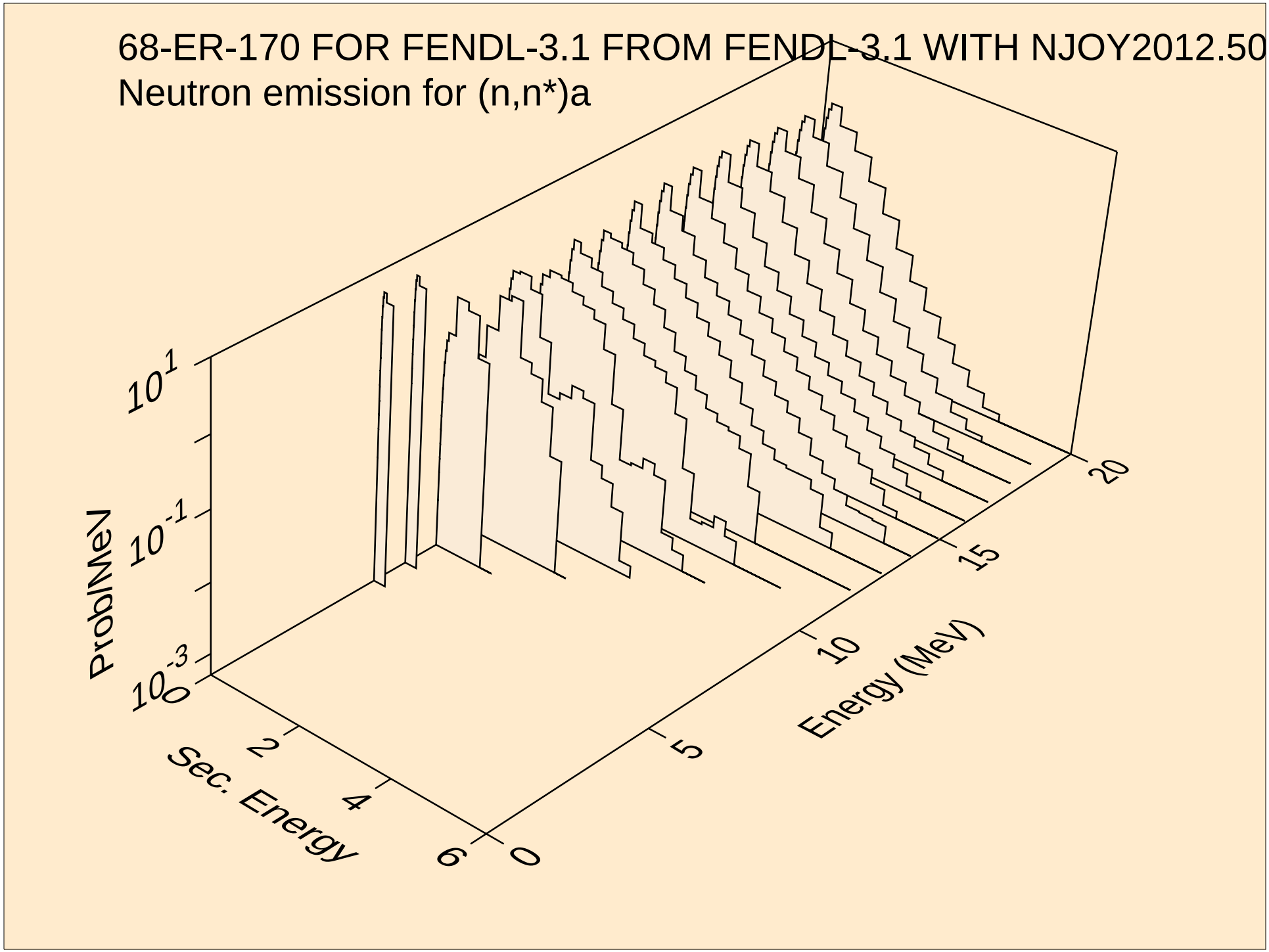

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*14)
10^0
ProbICos
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

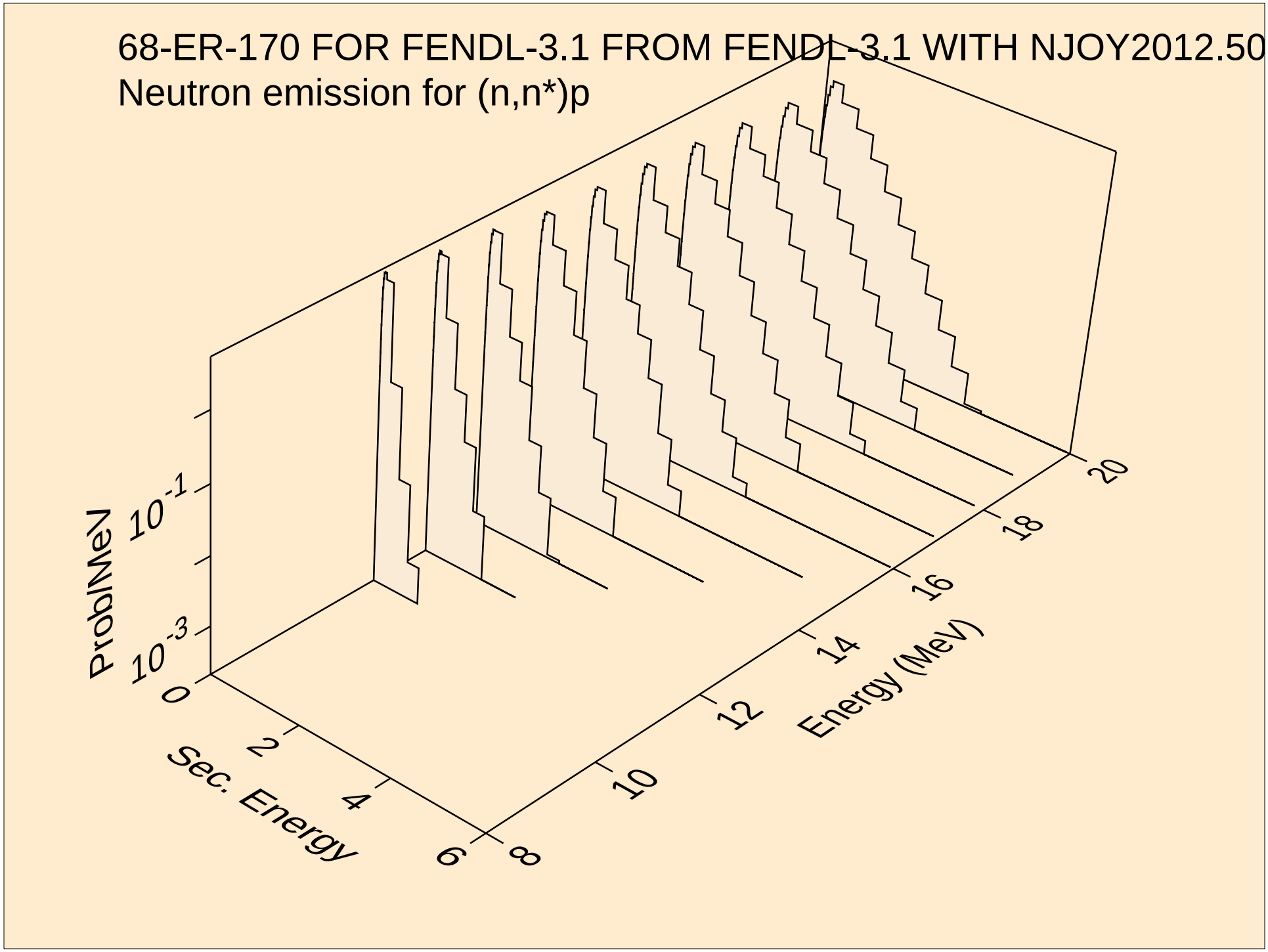

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
angular distribution for (n,n*c)
ProbICos
10^0
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

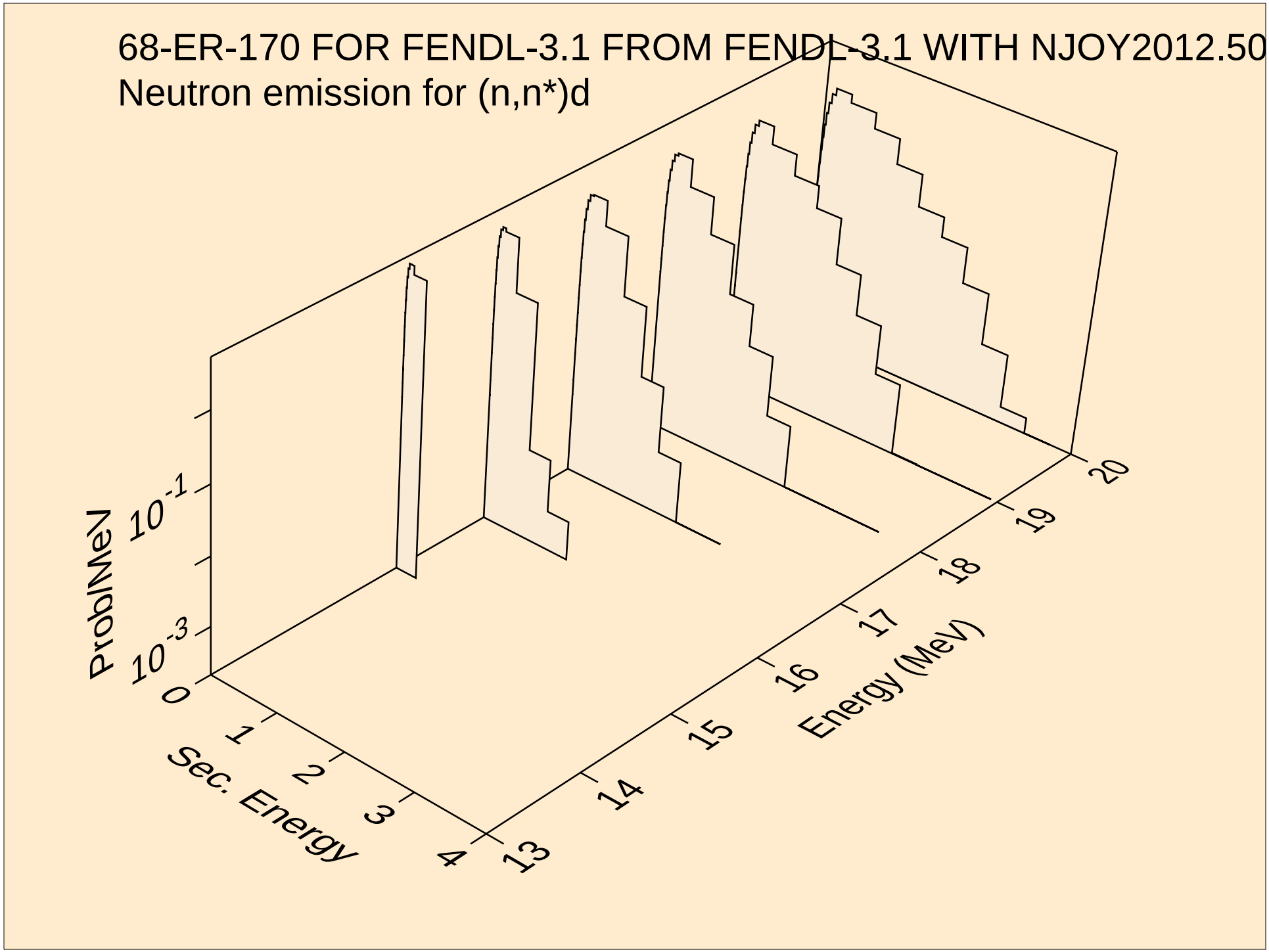

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Neutron emission for (n,x)
Prob/MeV
10^4
10^3
10^2
10^1
0
50
100
150
200
Sec. Energy
0
50
100
150
200
Energy (MeV)

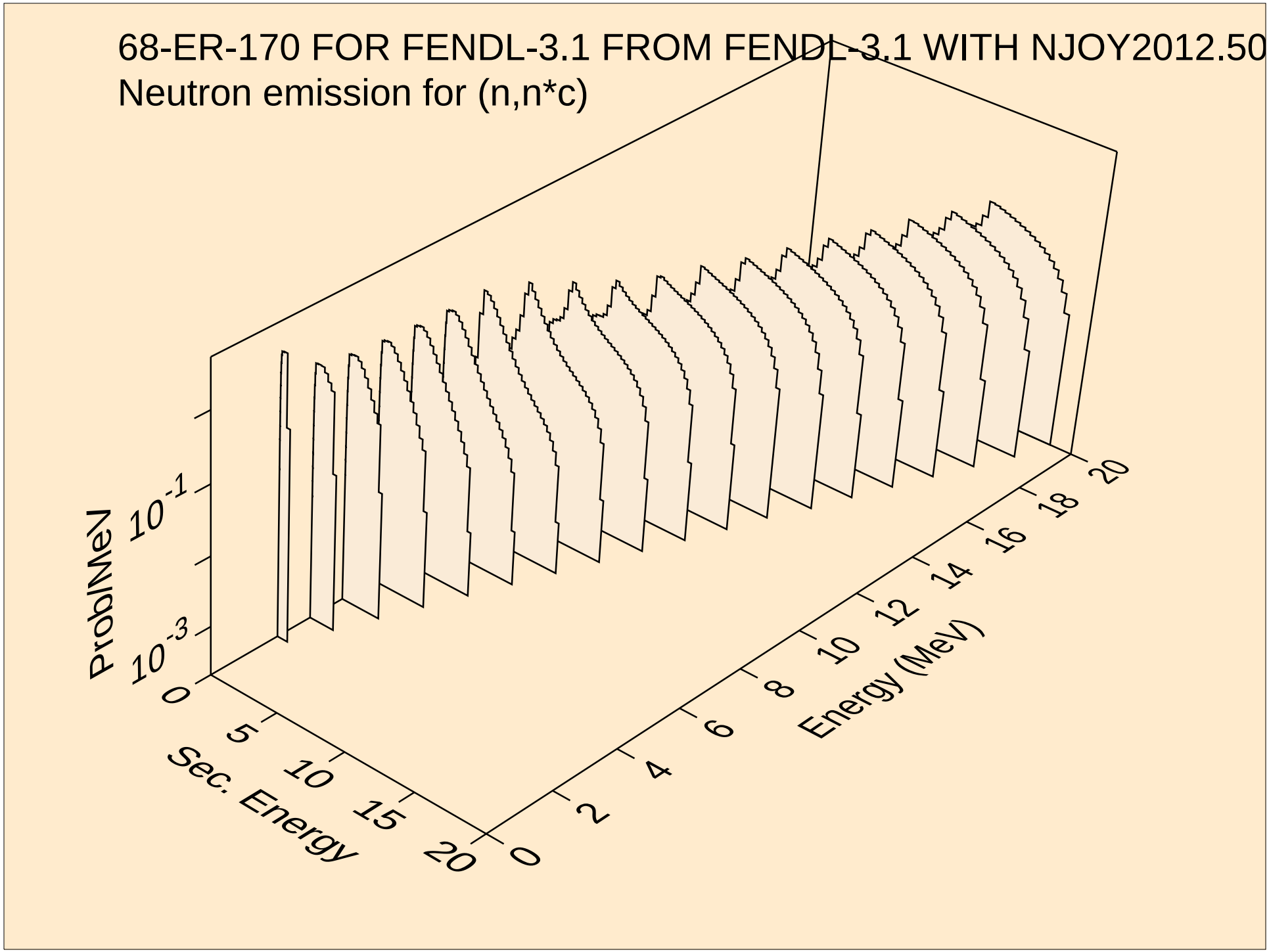

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Neutron emission for (n,2n)
Prob/MeV
10-1
10-3
0
5
10
15
Sec. Energy
6
8
10
12
14
16
18
20
Energy (MeV)

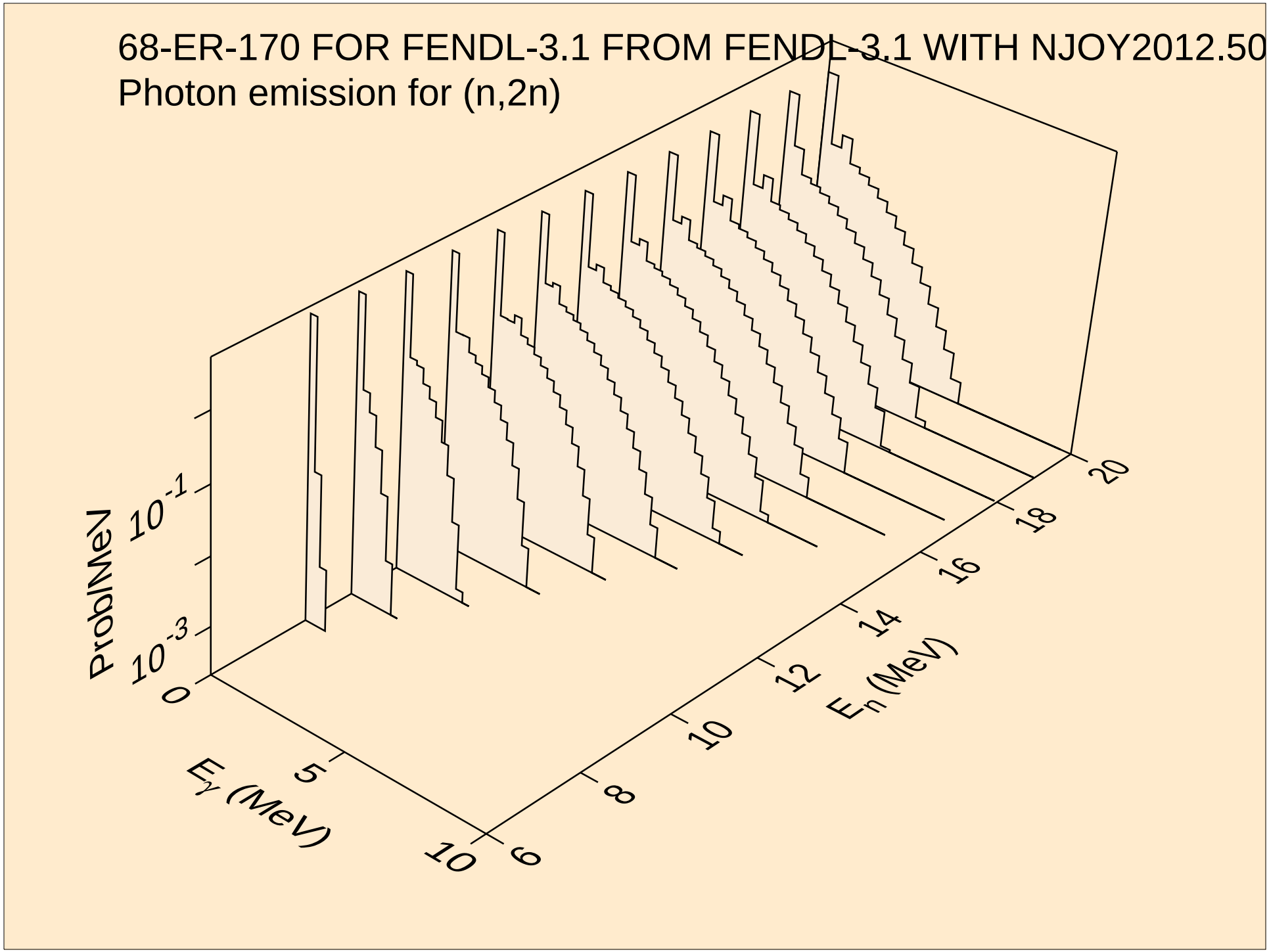

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Neutron emission for (n,3n)
Prob/MeV
10-1
10-3
0
2
4
6
8
Sec. Energy
13
14
15
16
17
18
19
20
Energy (MeV)

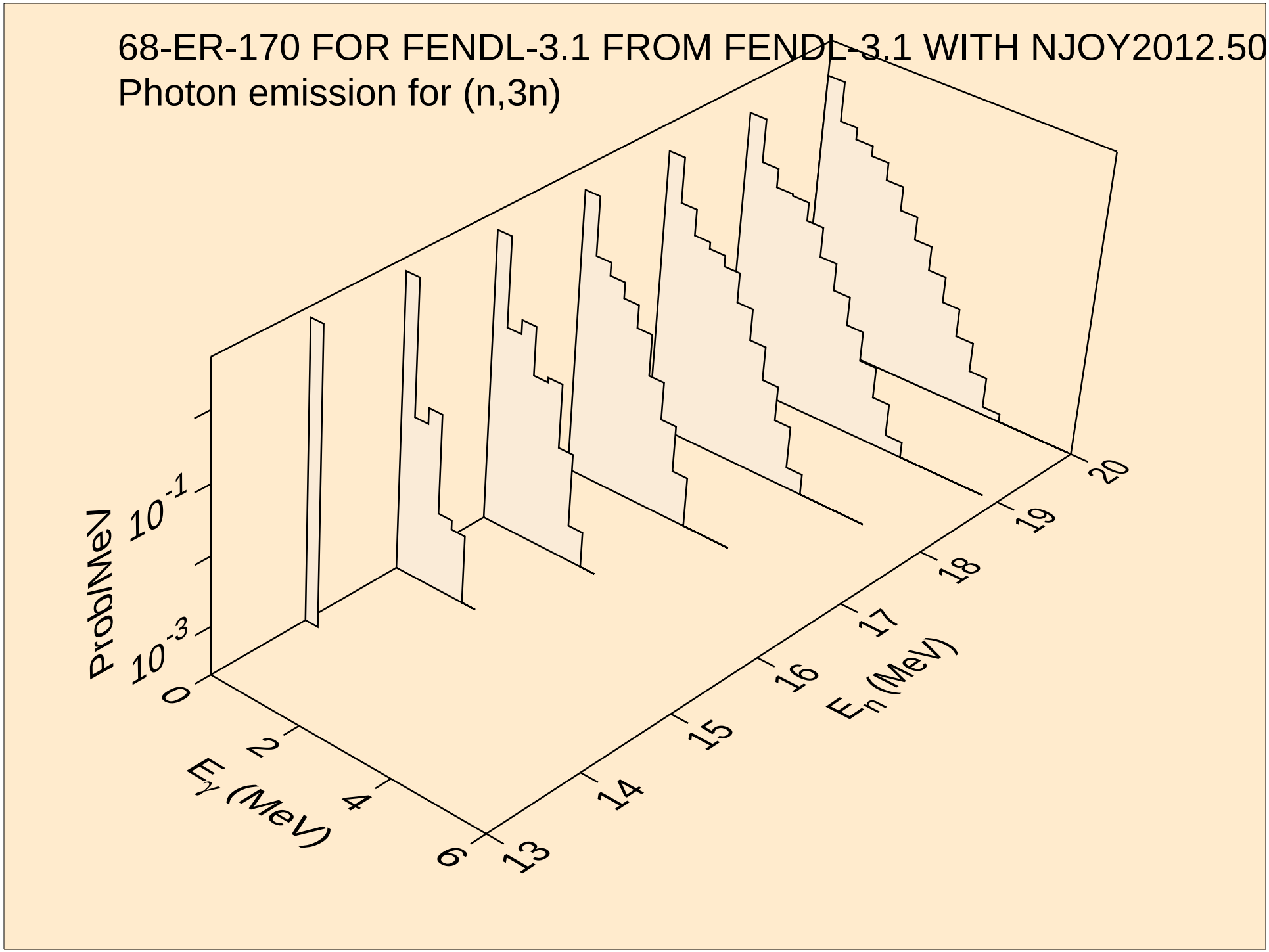

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Neutron emission for (n,n*)a
Prob/MeV
10^1
10^-1
10^-3
0
2
4
6
Sec. Energy
0
5
10
15
20
Energy (MeV)

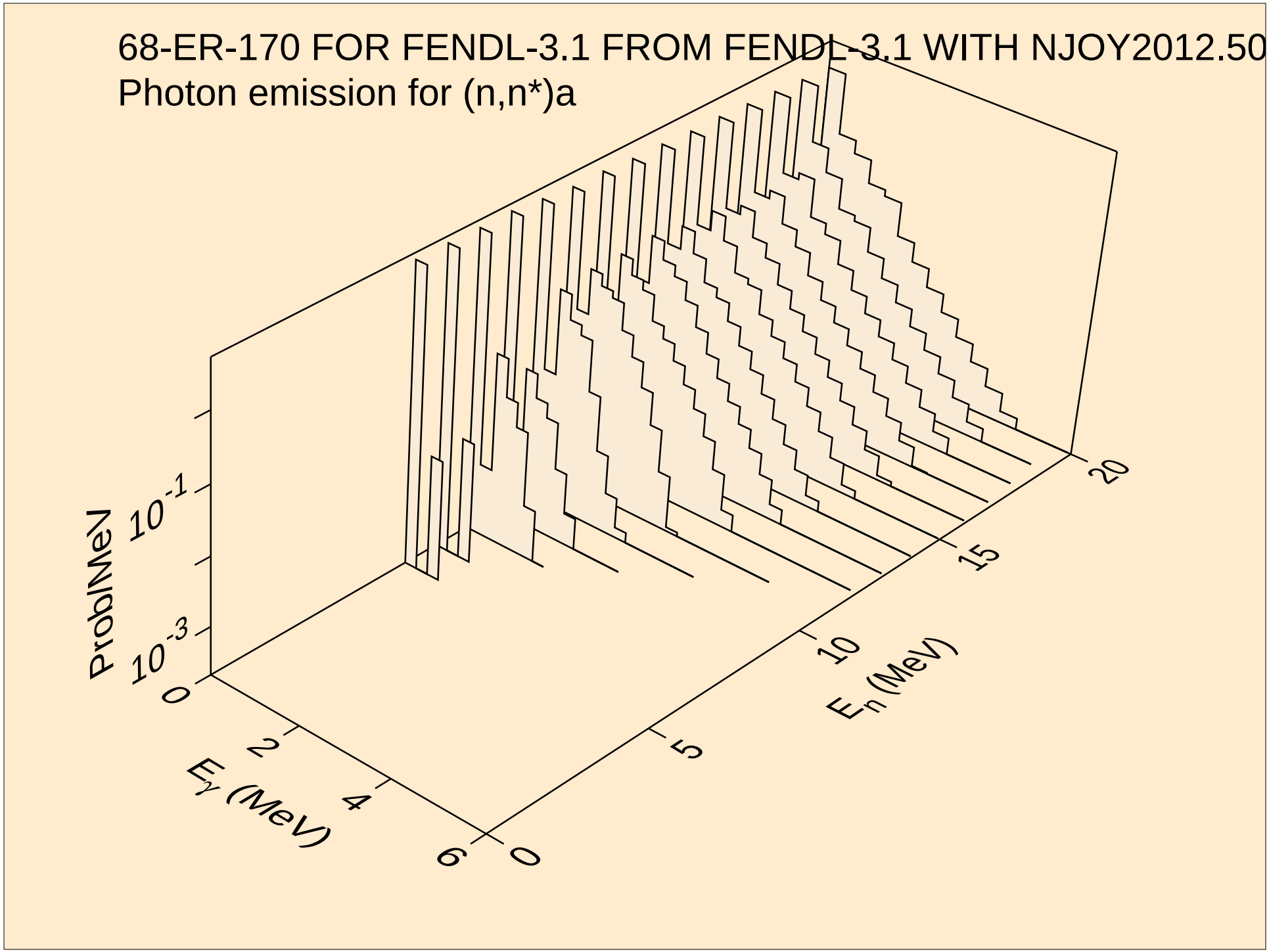

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Neutron emission for (n,n*)p
Prob/MeV
10-1
10-3
0
2
4
6
8
Sec. Energy
10
12
14
16
18
20
Energy (MeV)

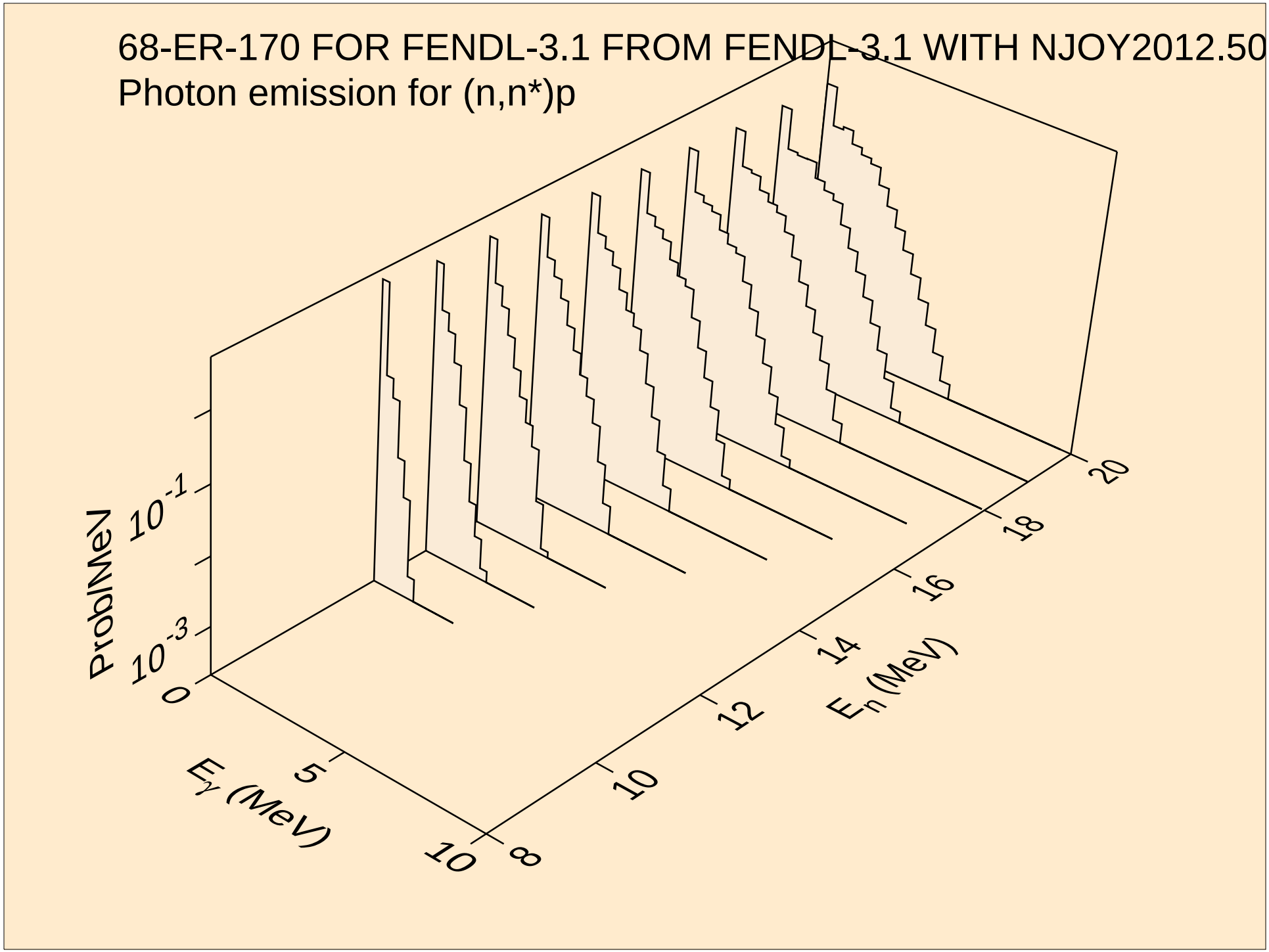

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Neutron emission for (n,n*)d
Prob/MeV
10-1
10-3
0
1
2
3
4
Sec. Energy
13
14
15
16
17
18
19
20
Energy (MeV)

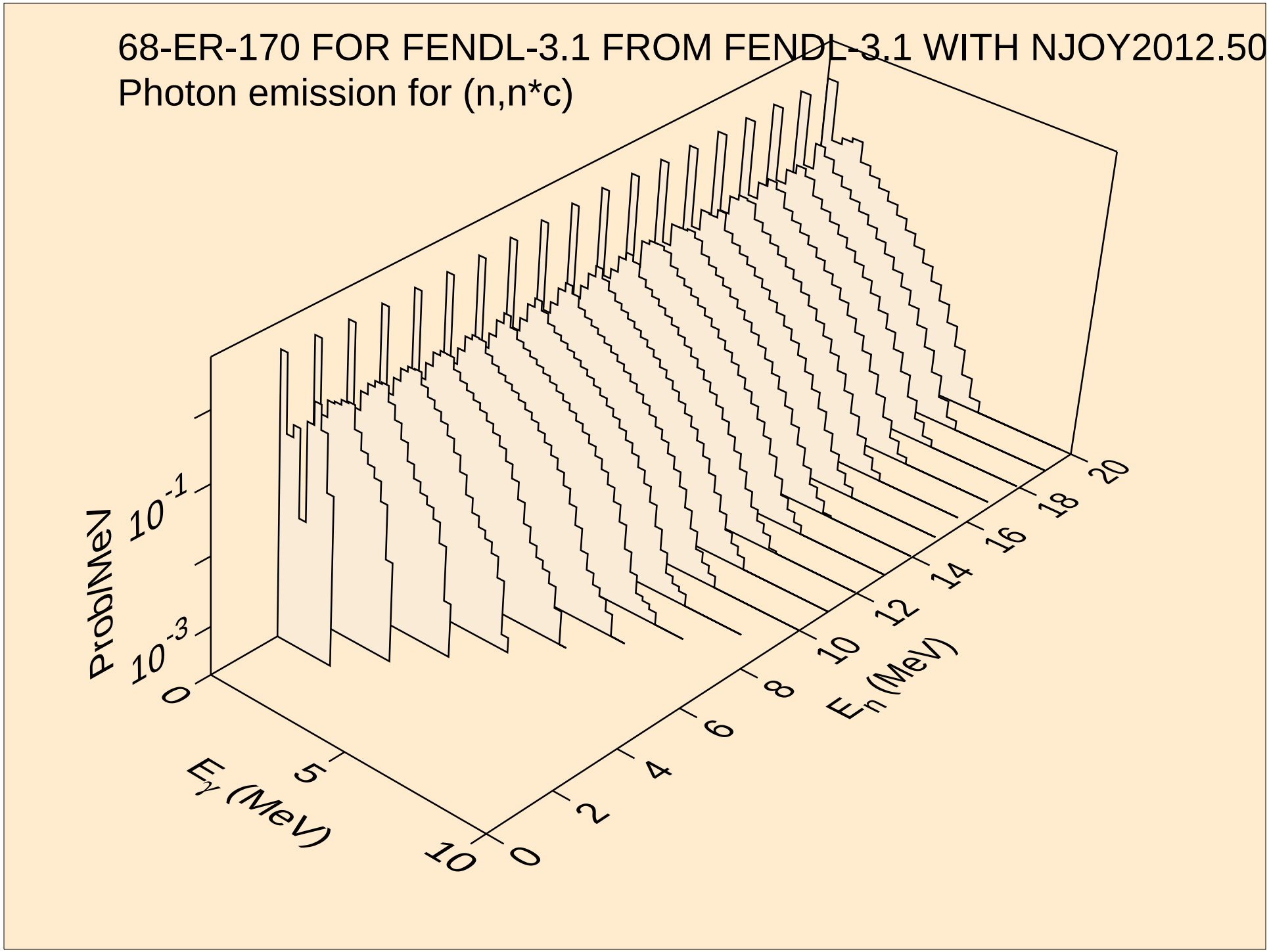

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Neutron emission for (n,n*c)
Prob/MeV
10-1
10-3
0
5
10
15
20
Sec. Energy
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

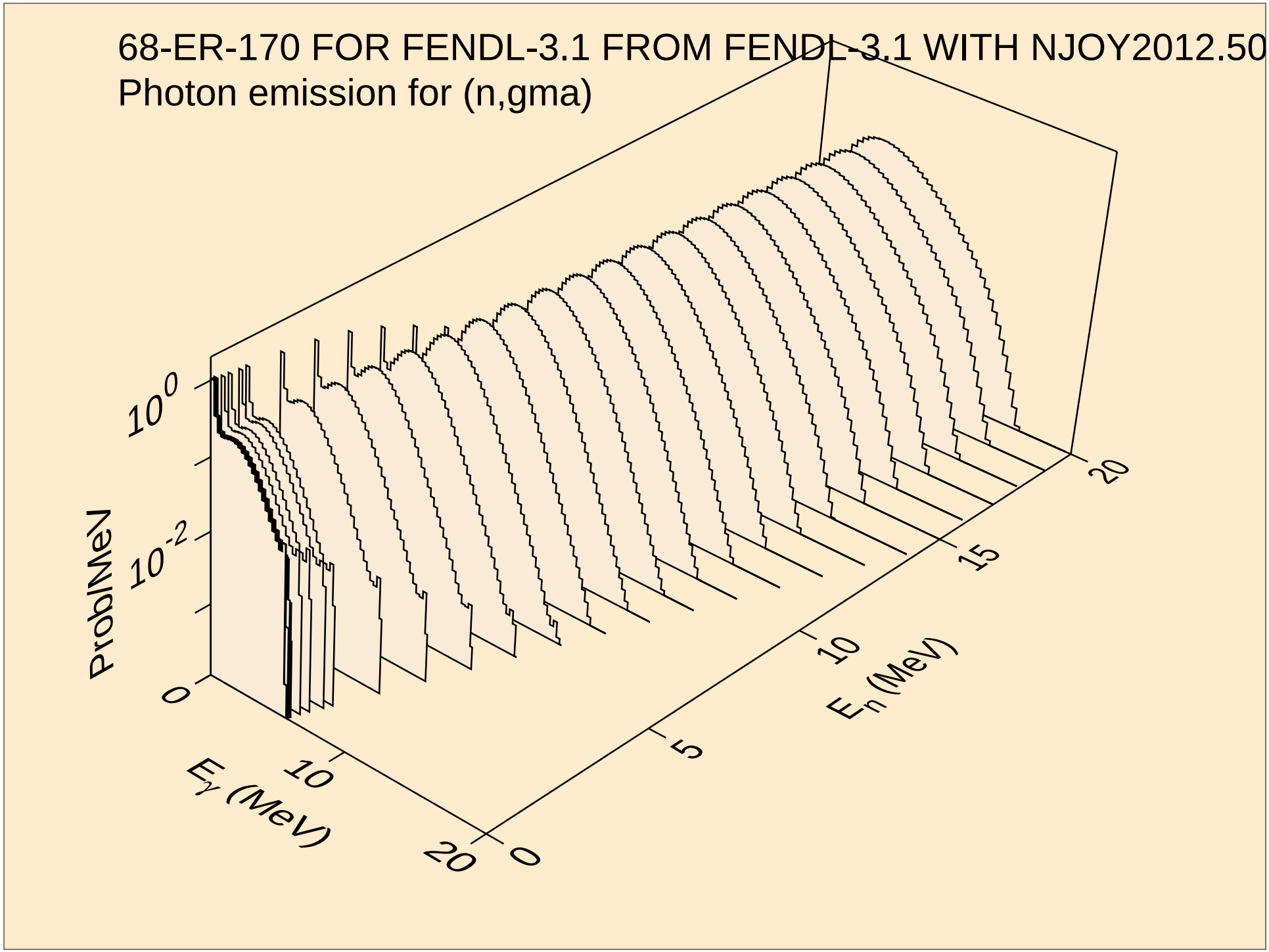

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Photon emission for (n,2n)
Prob/MeV
10-1
10-3
0
5
10
Eγ (MeV)
6
8
10
12
14
16
18
20
En (MeV)

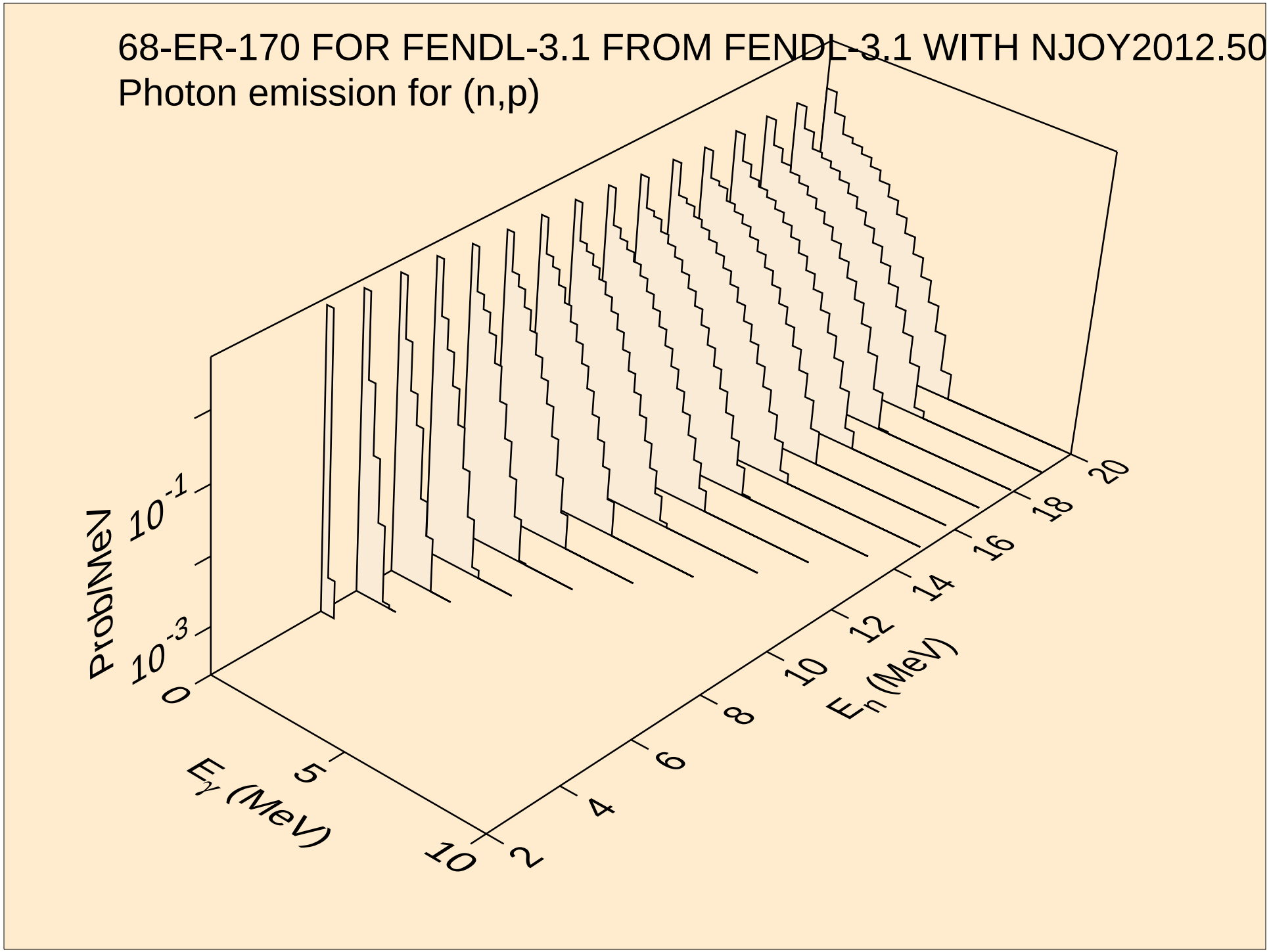

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Photon emission for (n,3n)
Prob/MeV
10-1
10-3
0
2
4
6
Eγ (MeV)
13
14
15
16
17
18
19
20
En (MeV)

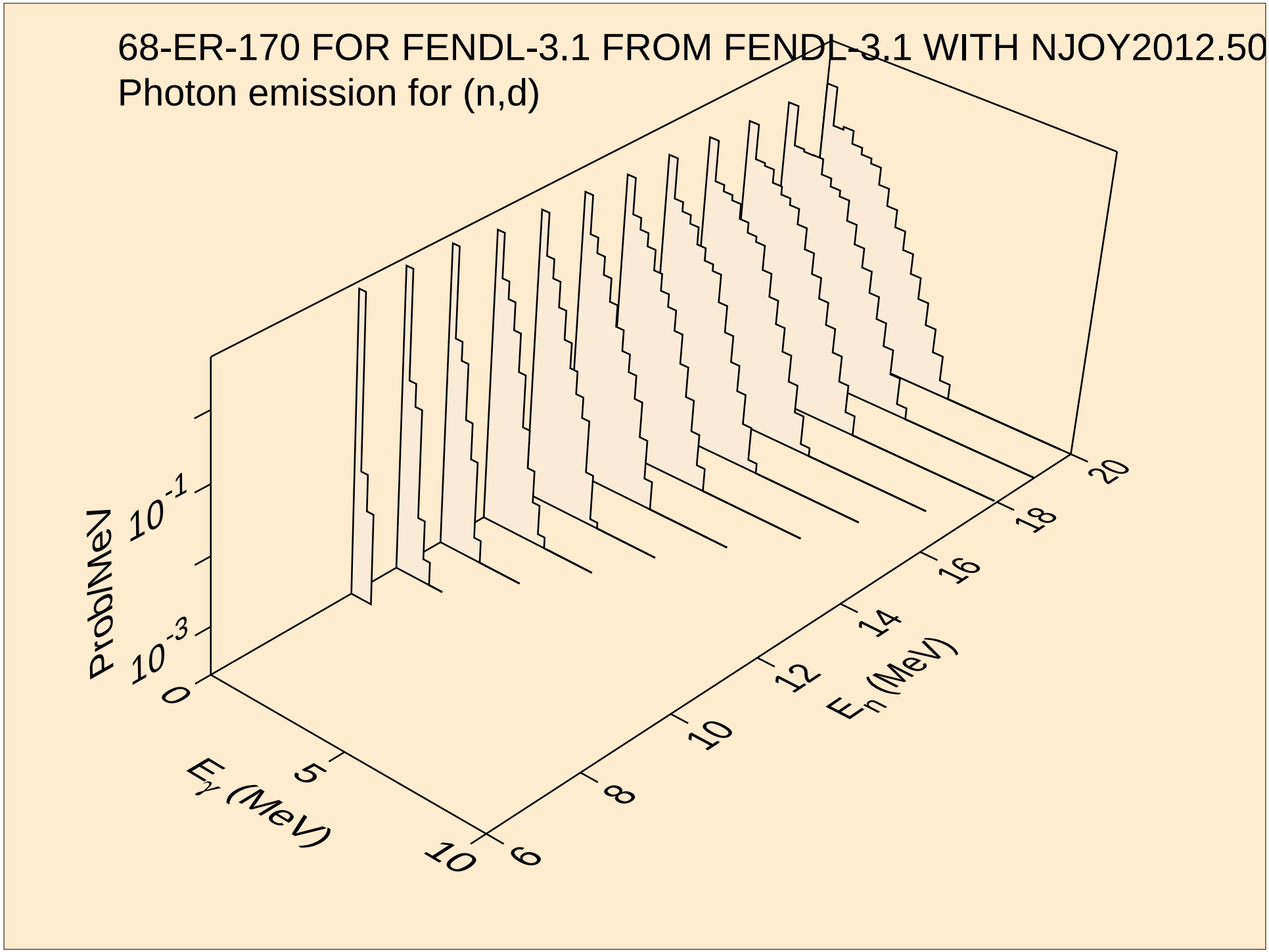

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Photon emission for (n,n*)a
Prob/MeV
10-1
10-3
0
2
4
6
Eγ (MeV)
0
5
10
15
20
En (MeV)

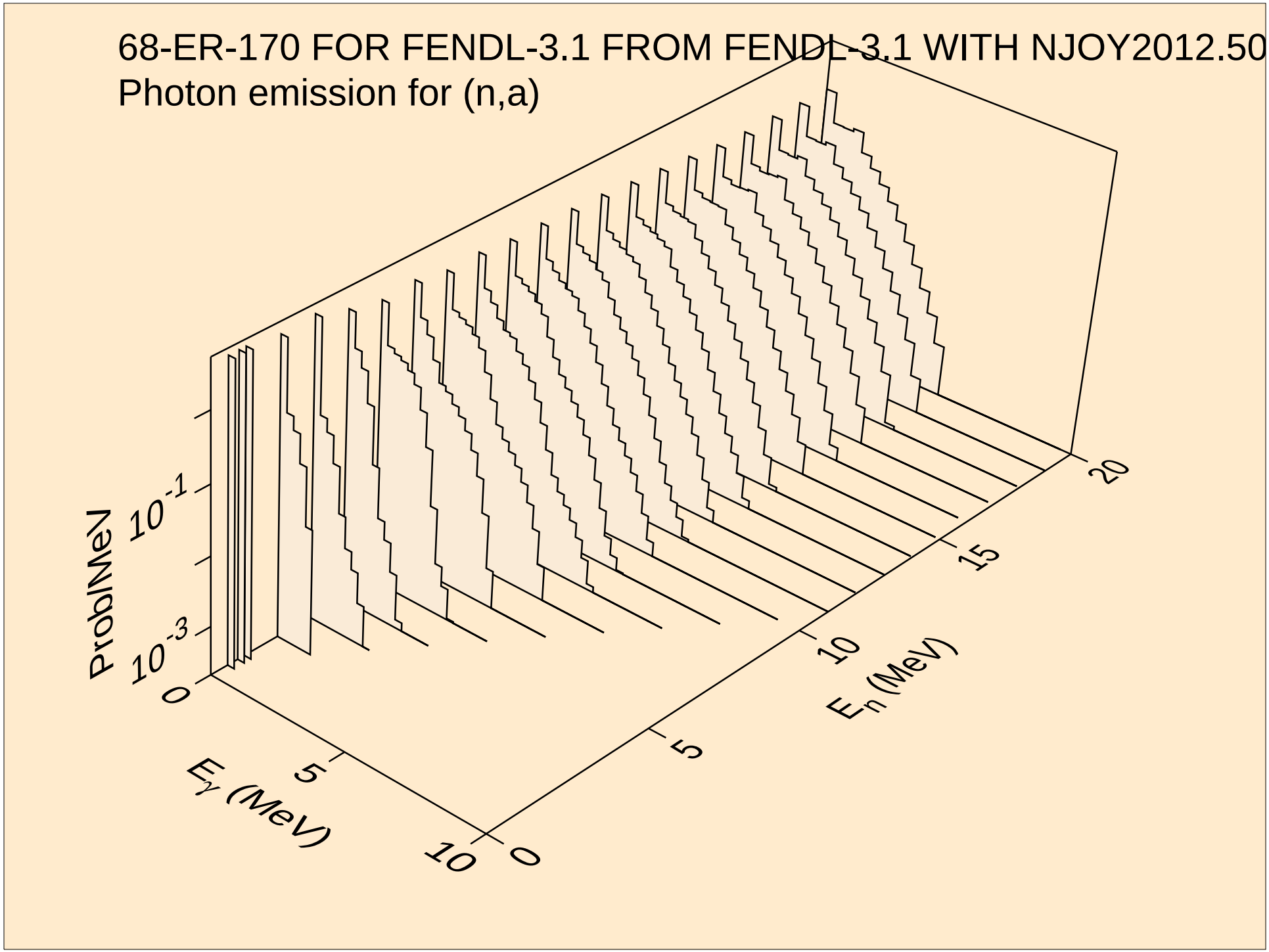

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Photon emission for (n,n*)p
Prob/MeV
10-1
10-3
0
5
10
Eγ (MeV)
8
10
12
14
16
18
20
En (MeV)

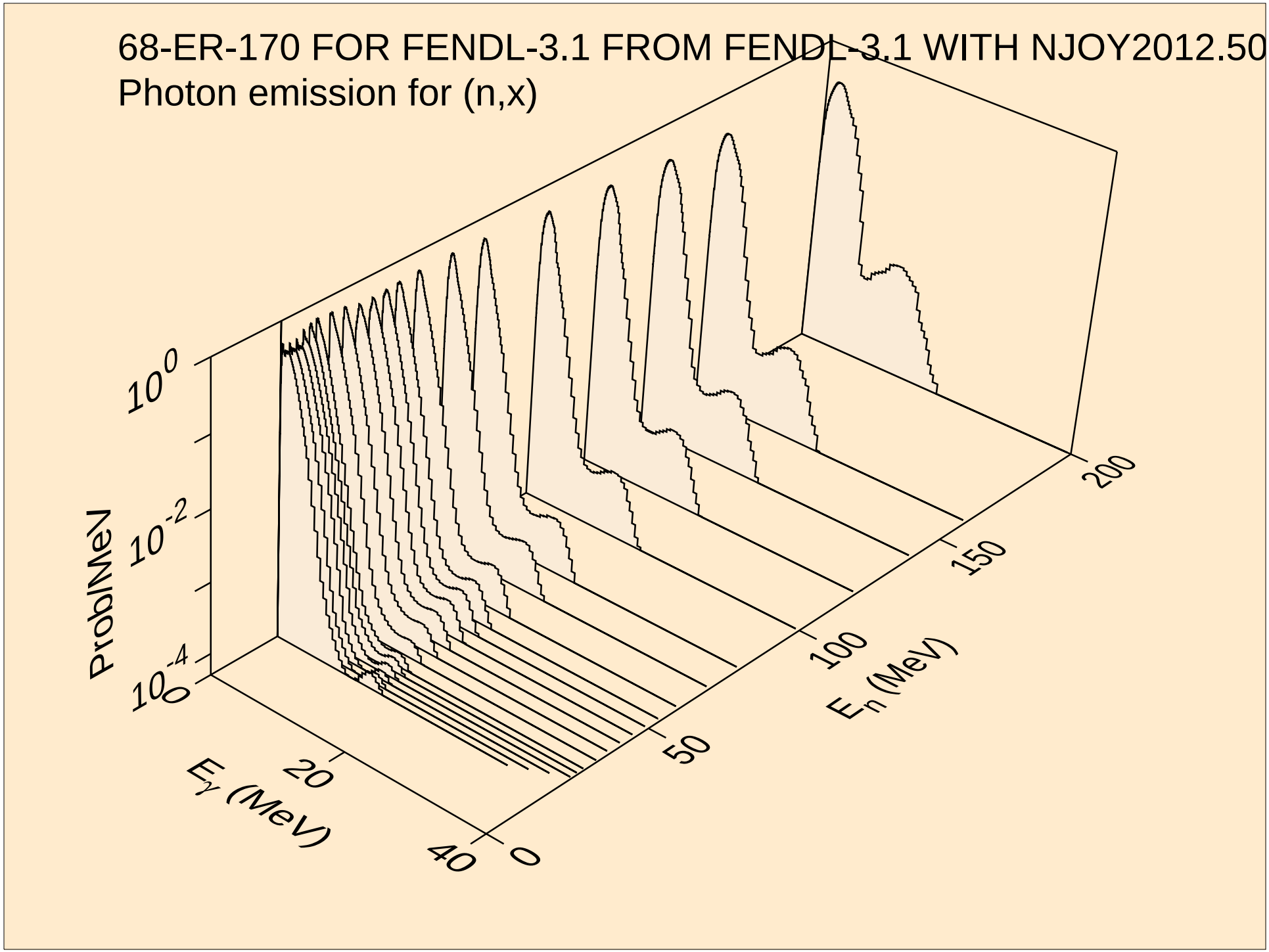

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Photon emission for (n,n*c)
Prob/MeV
10-1
10-3
0
Eγ (MeV)
0
5
10
En (MeV)
0
2
4
6
8
10
12
14
16
18
20

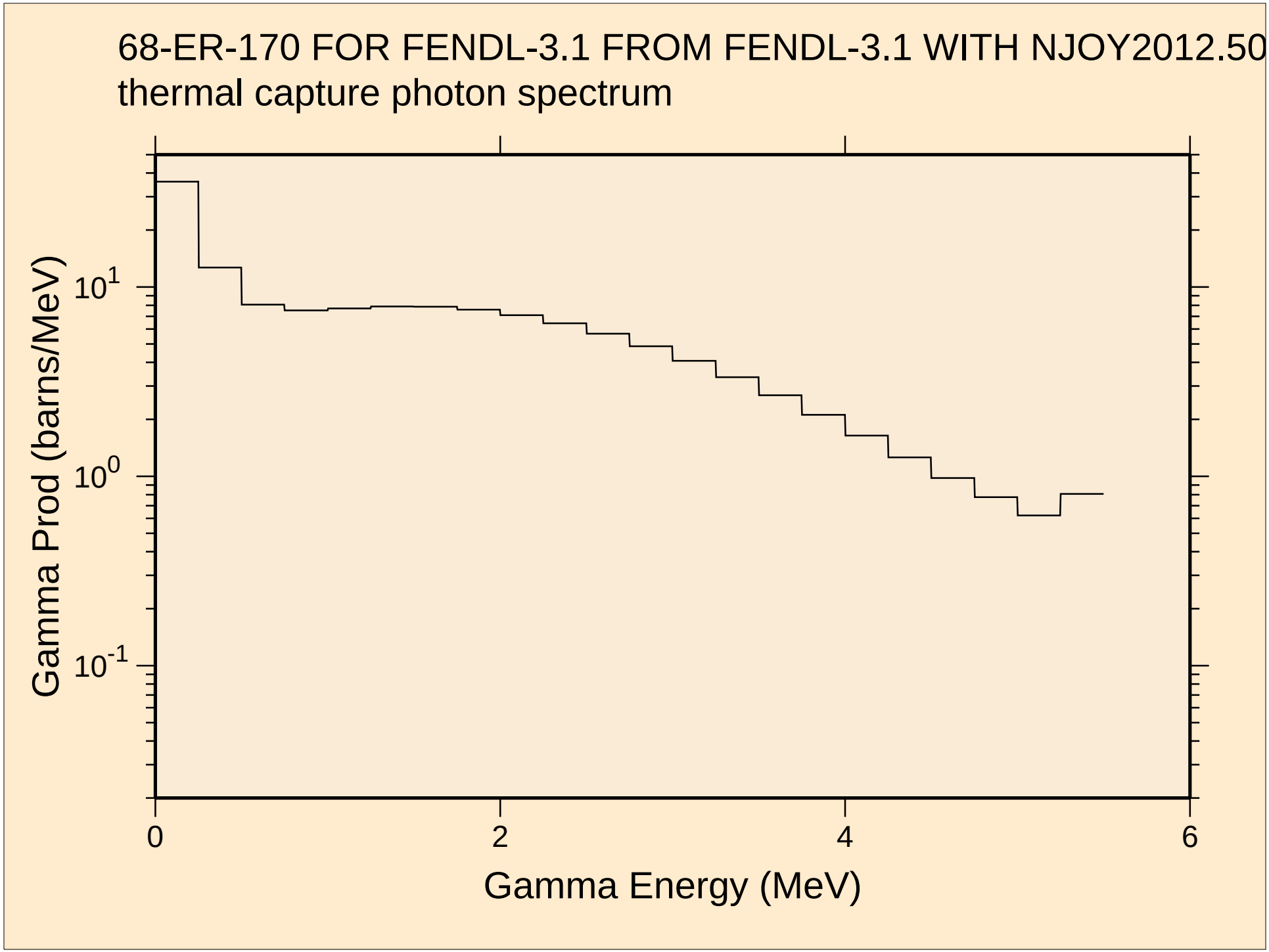

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Photon emission for (n,gma)
Prob/MeV
10^0
10^-2
0
E_γ (MeV)
10
20
0
5
10
15
20
E_n (MeV)

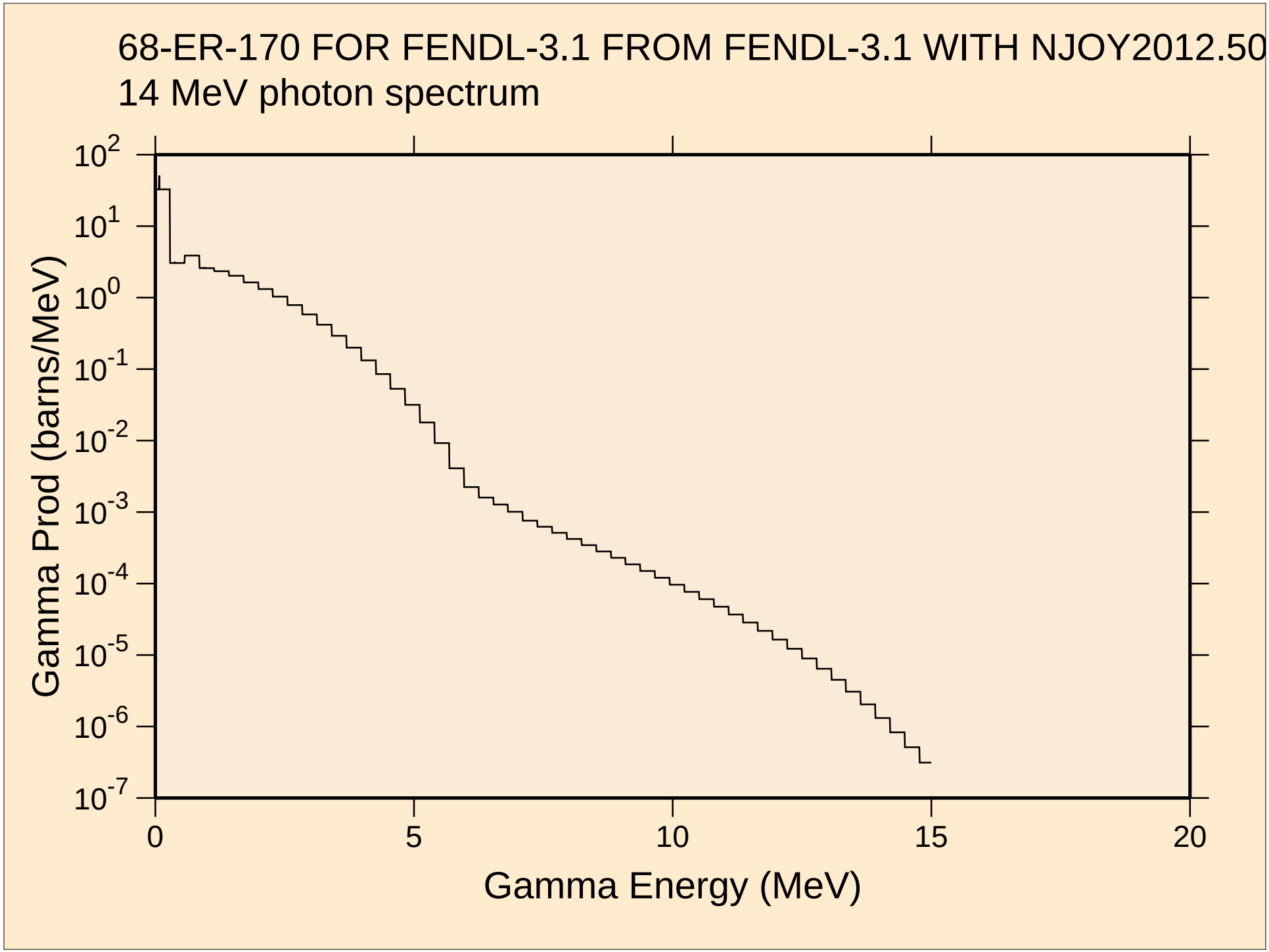

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Photon emission for (n,p)
Prob/MeV
10-1
10-3
0
Eγ (MeV)
5
10
2
4
6
8
10
12
14
16
18
20
En (MeV)

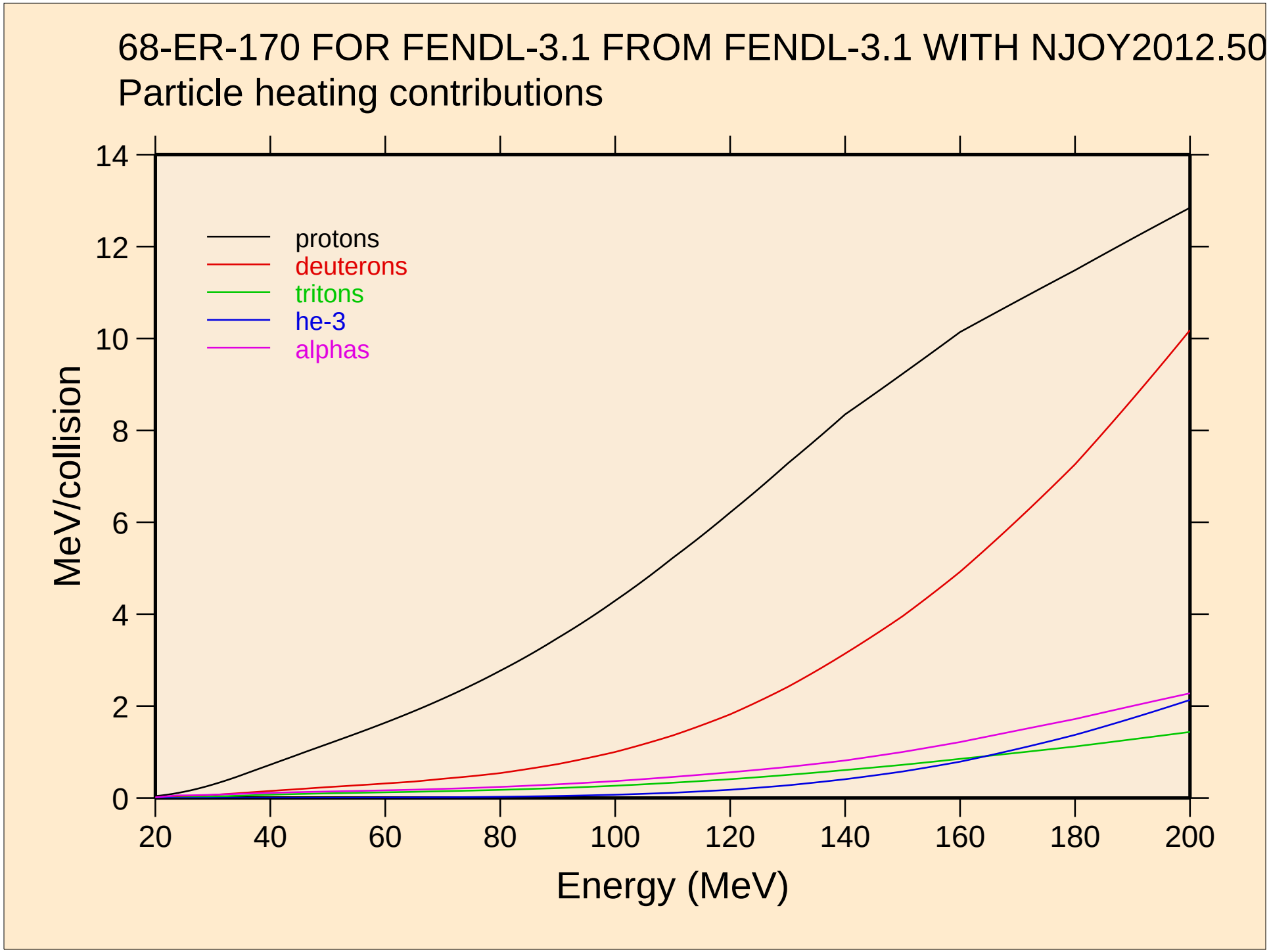

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Photon emission for (n,d)
Prob/MeV
10-1
10-3
0
Eγ (MeV)
5
10
6
8
10
12
14
16
18
20
En (MeV)

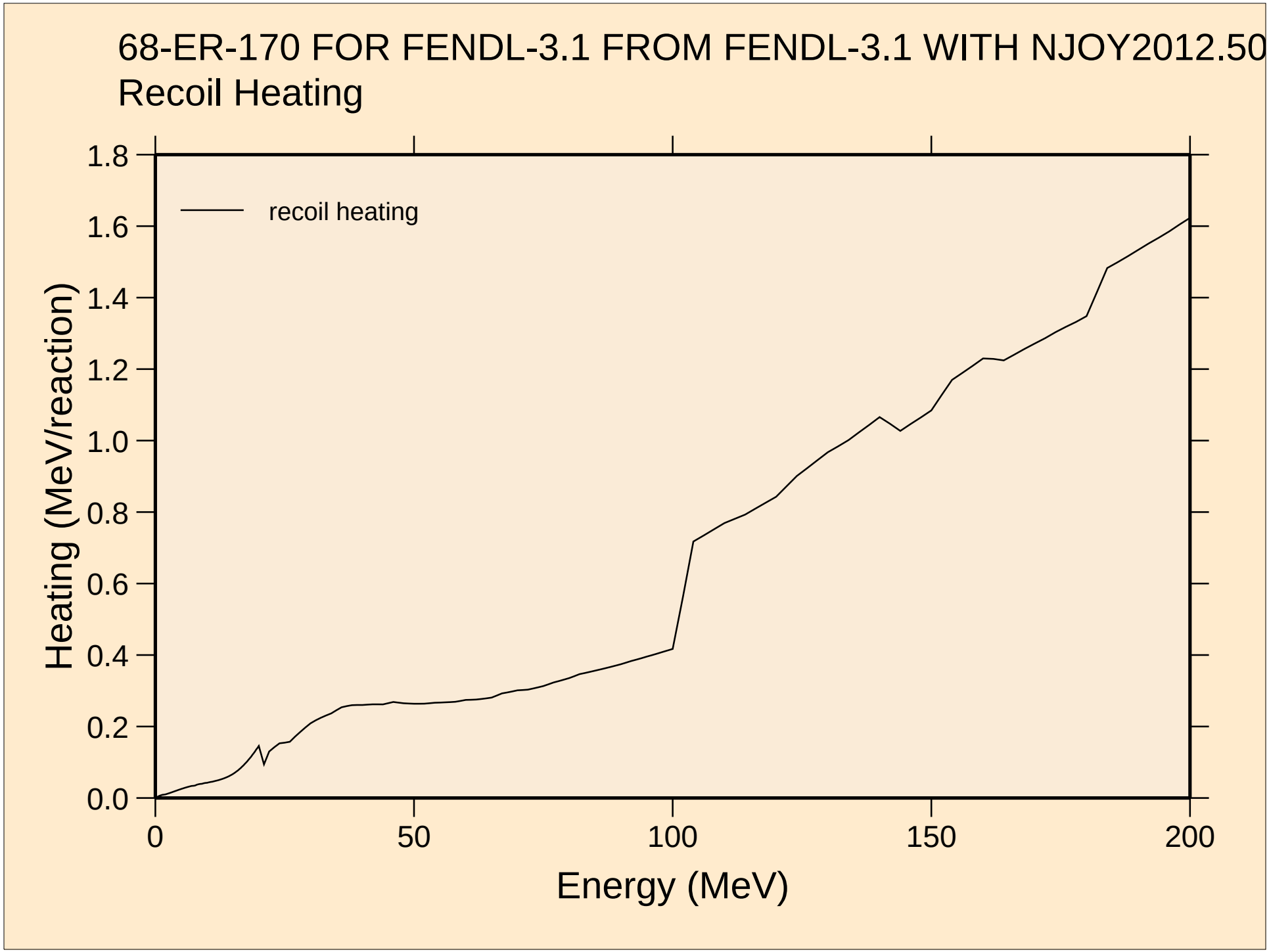

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Photon emission for (n,a)
Prob/MeV
10-1
10-3
0
Eγ (MeV)
5
10
0
5
10
15
20
En (MeV)

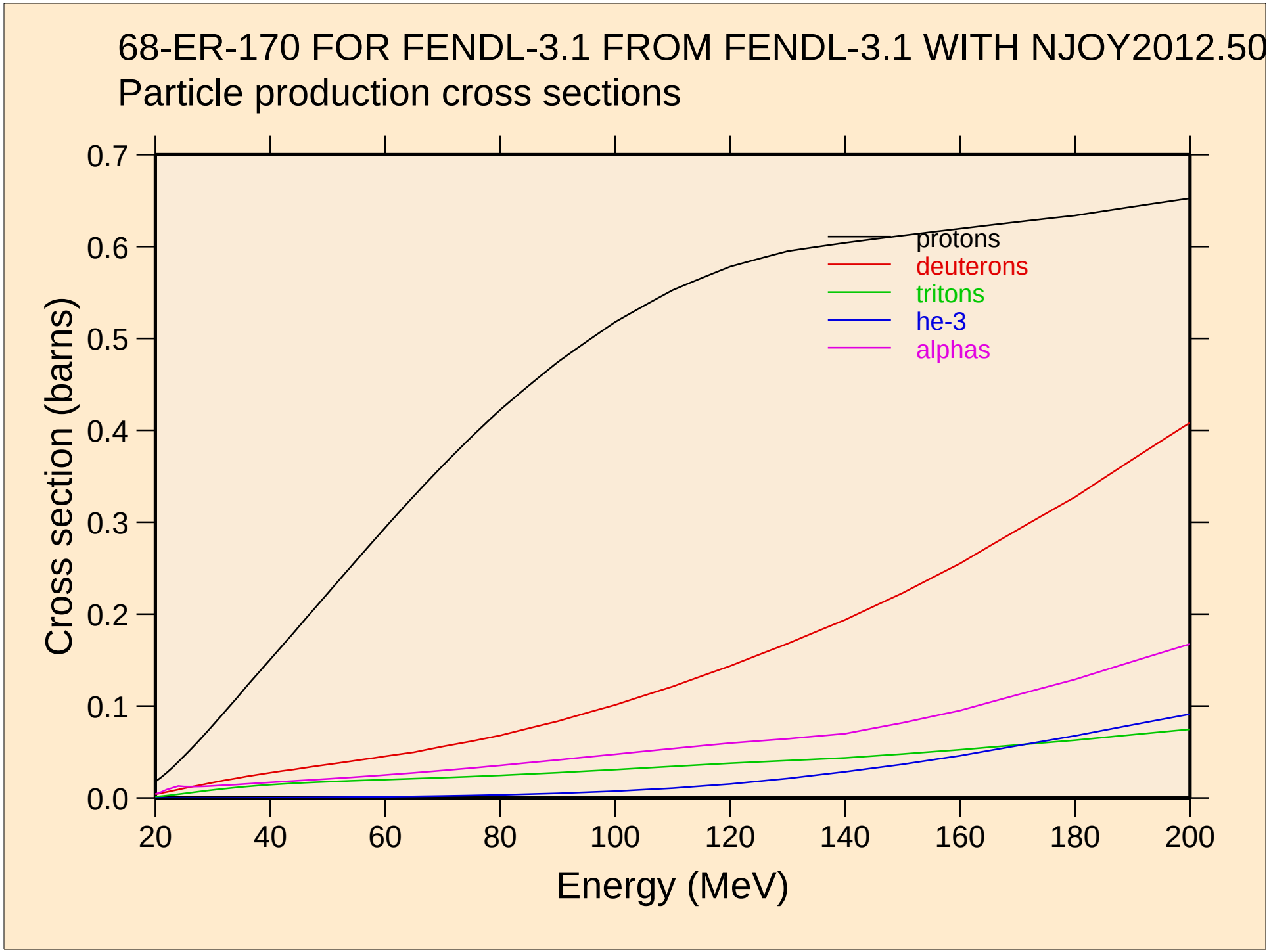

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Photon emission for (n,x)
Prob/MeV
10^{0}
10^{-2}
10^{-4}
0
20
40
E_γ (MeV)
50
100
150
200
E_n (MeV)

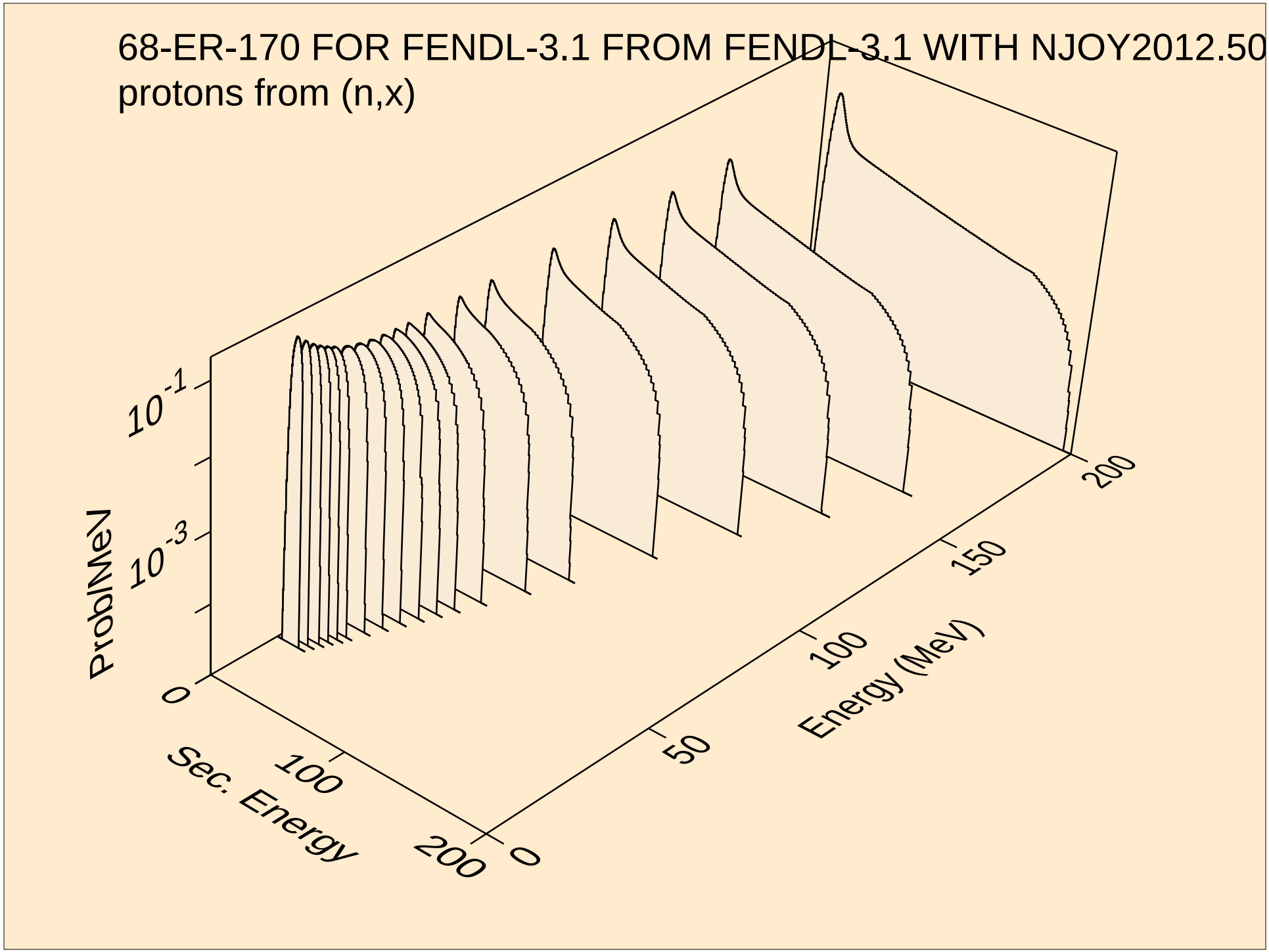

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
thermal capture photon spectrum
Gamma Prod (barns/MeV)
10^1
10^0
10^-1
0
2
4
6
Gamma Energy (MeV)

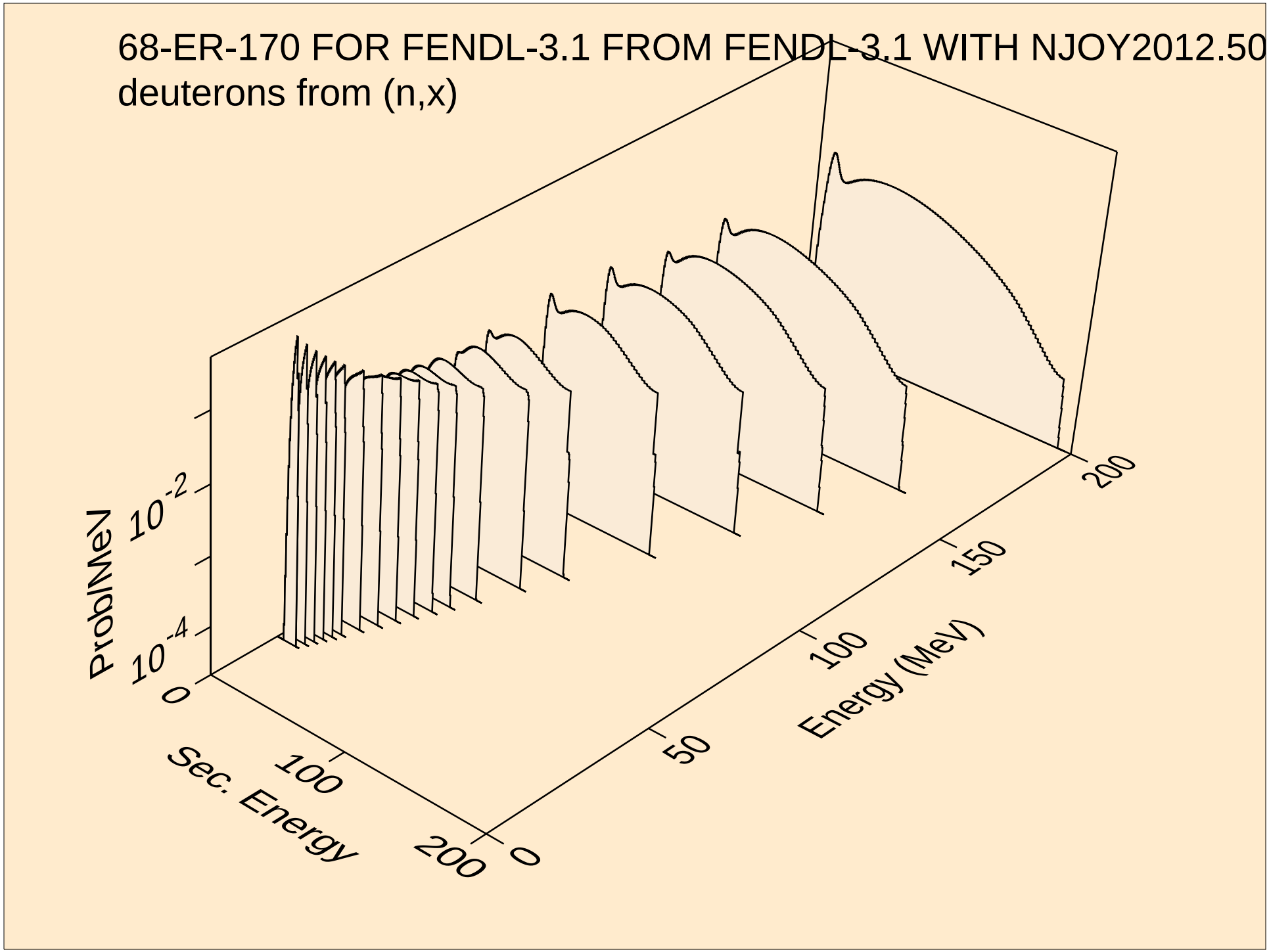

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
14 MeV photon spectrum
Gamma Prod (barns/MeV)
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
0
5
10
15
20
Gamma Energy (MeV)

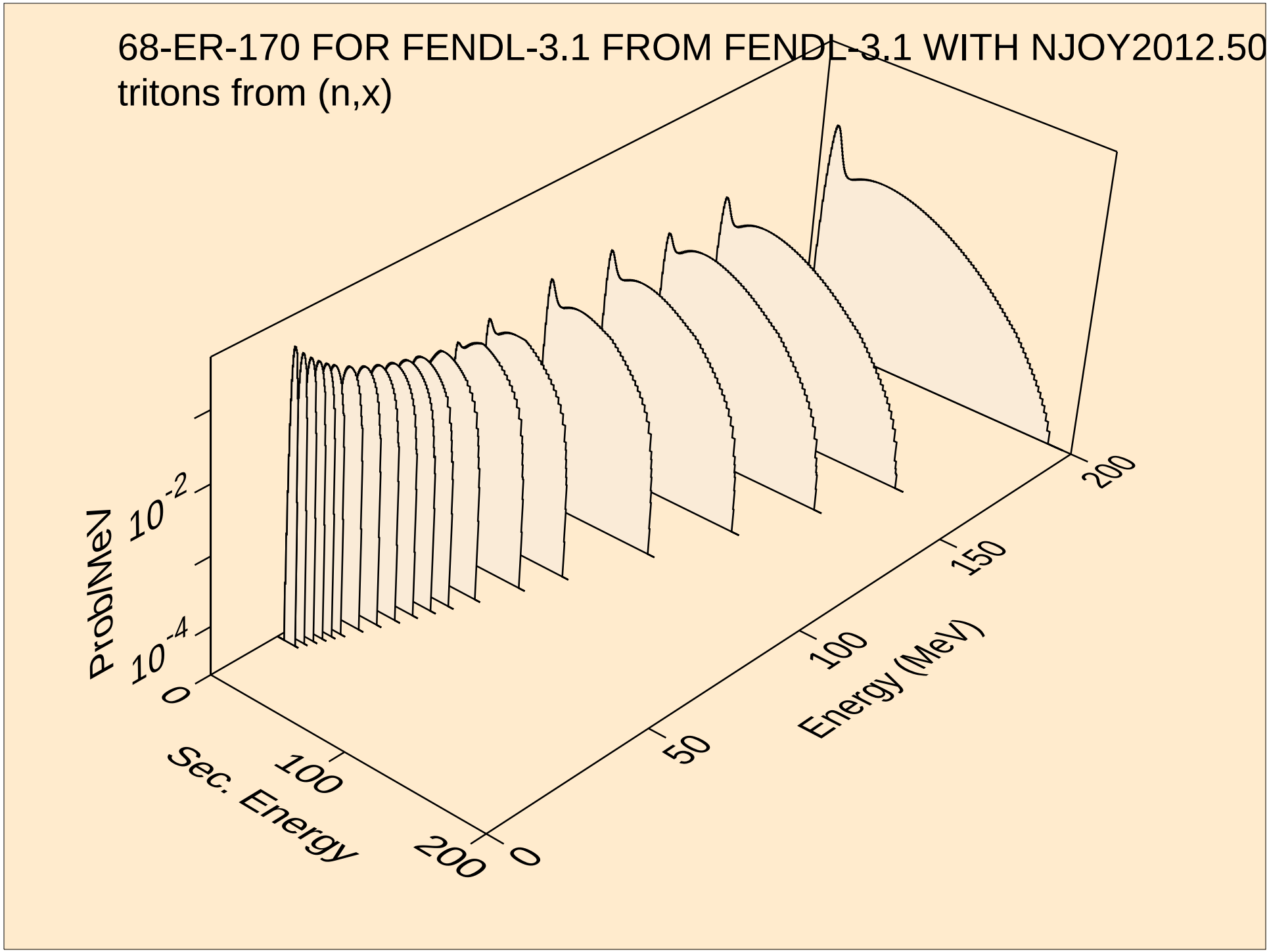

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Particle heating contributions
protons
deuterons
tritons
he-3
alphas
MeV/collision
Energy (MeV)
0
2
4
6
8
10
12
14
20
40
60
80
100
120
140
160
180
200

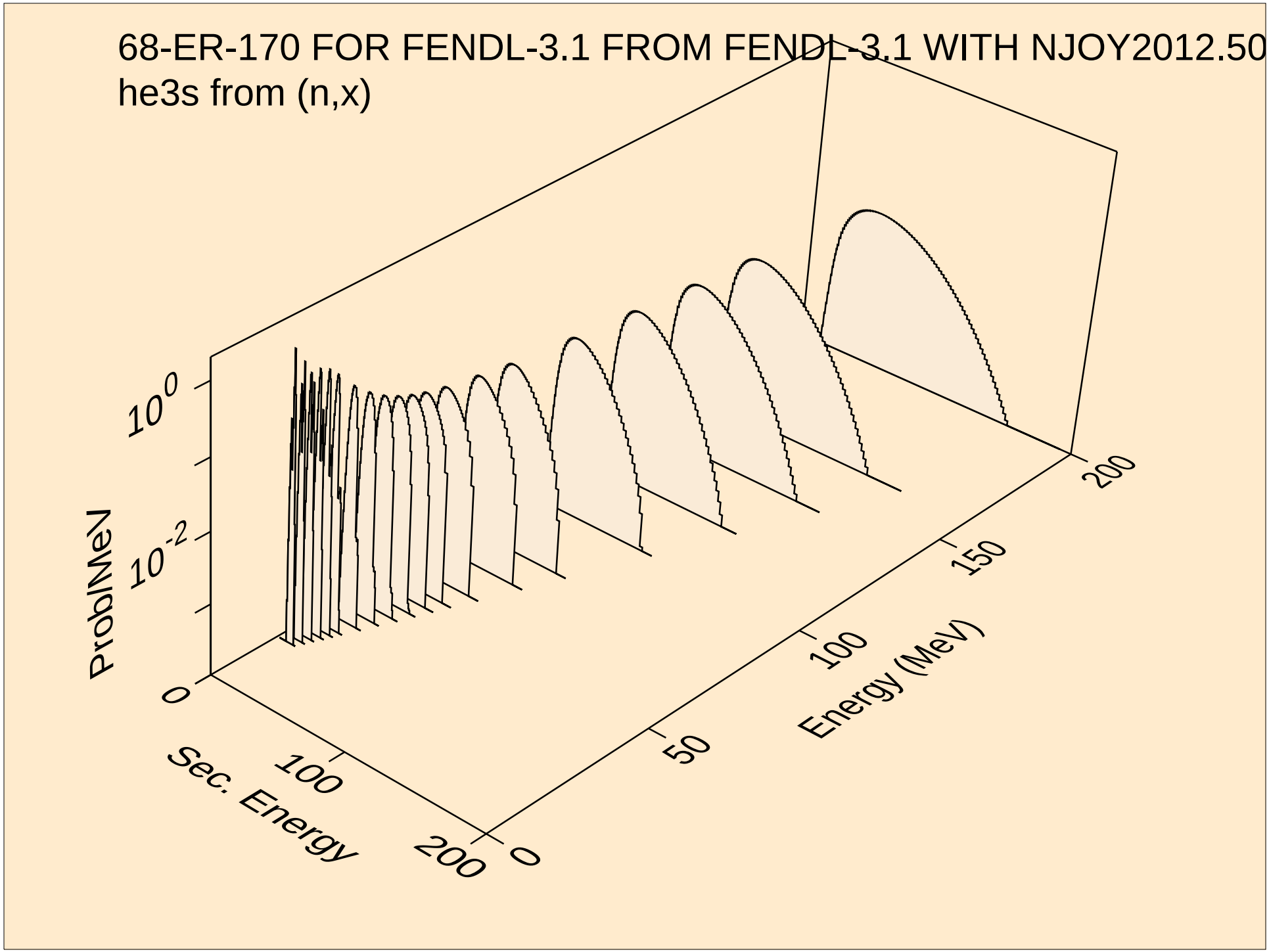

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Recoil Heating
recoil heating
Heating (MeV/reaction)
Energy (MeV)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
0
50
100
150
200

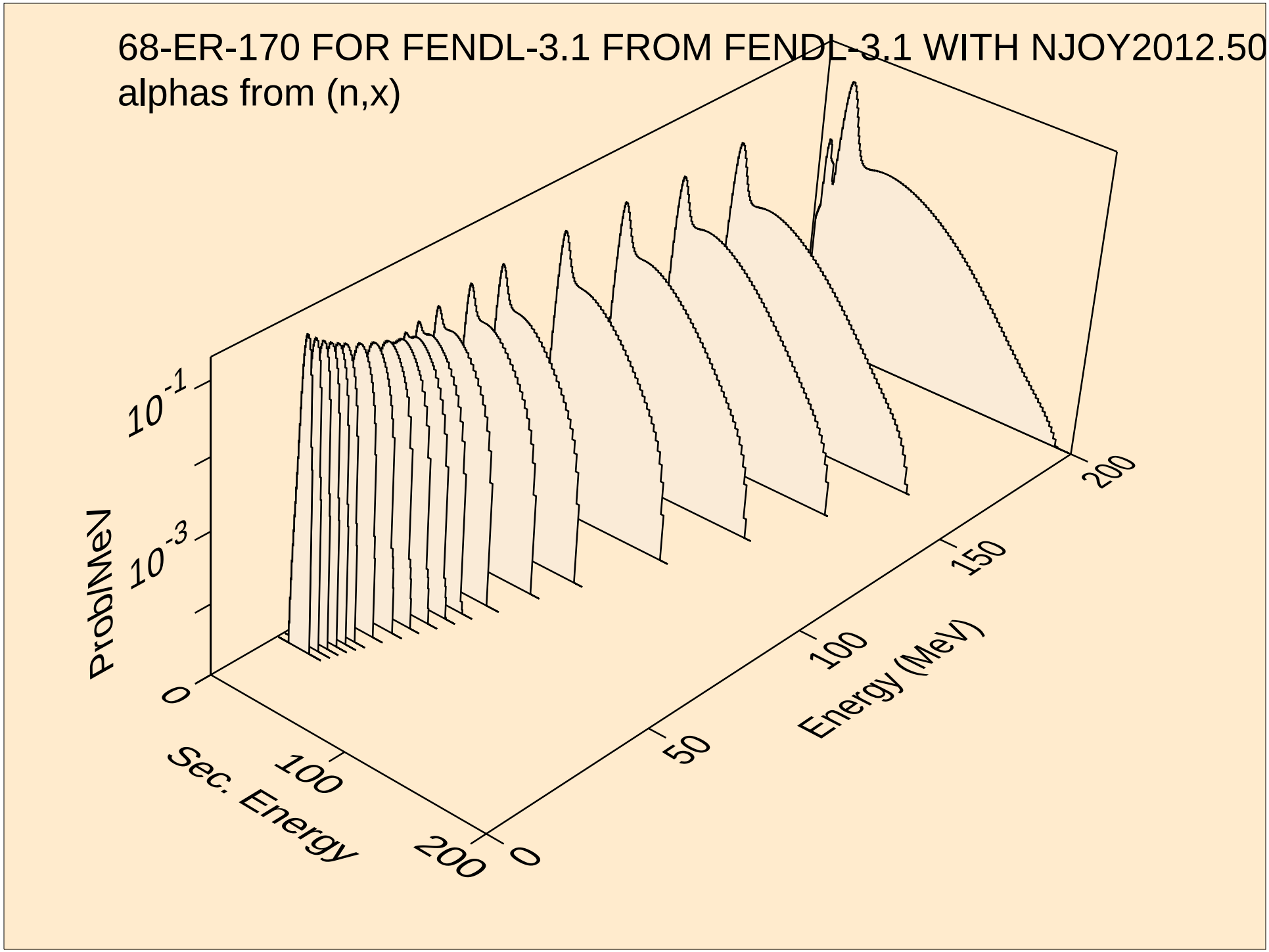

68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
Particle production cross sections
Cross section (barns)
Energy (MeV)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
20
40
60
80
100
120
140
160
180
200
protons
deuterons
tritons
he-3
alphas


68-ER-170 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
50
100
150
200
Energy (MeV)


68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
deuterons from (n,x)
Prob/MeV
10-2
10-4
0
Sec. Energy
100
200
0
50
100
150
200
Energy (MeV)


68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
tritons from (n,x)
Prob/MeV
10-2
10-4
0
Sec. Energy
100
200
0
50
100
150
200
Energy (MeV)


68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
he3s from (n,x)
Prob/MeV
10^0
10^-2
0
Sec. Energy
100
200
0
50
100
150
200
Energy (MeV)


68-ER-170 FOR FENDL-3.1 FROM FENDL-3.1 WITH NJOY2012.50
alphas from (n,x)
Prob/MeV
10-1
10-3
0
Sec. Energy
100
200
0
50
100
150
200
Energy (MeV)