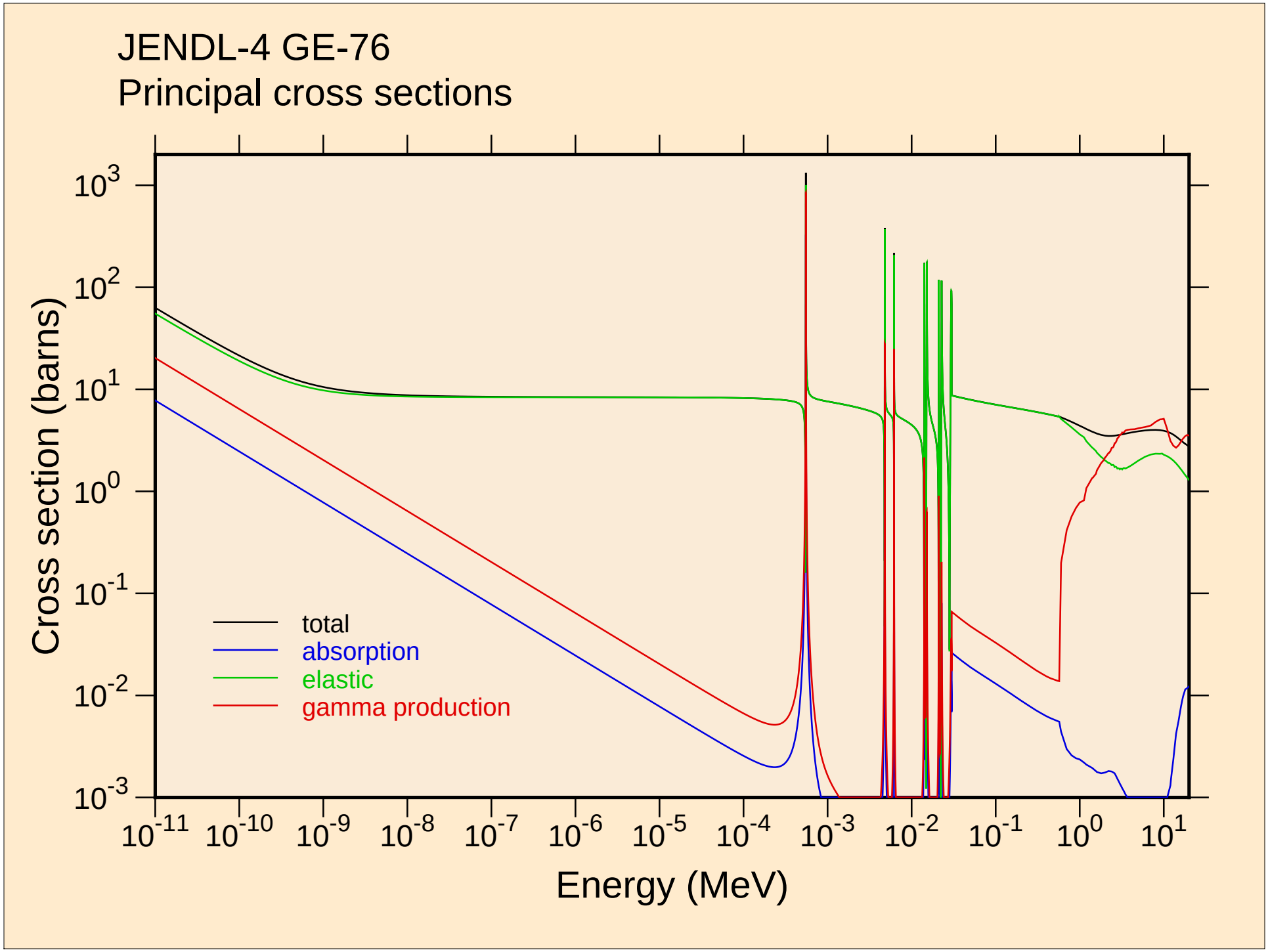
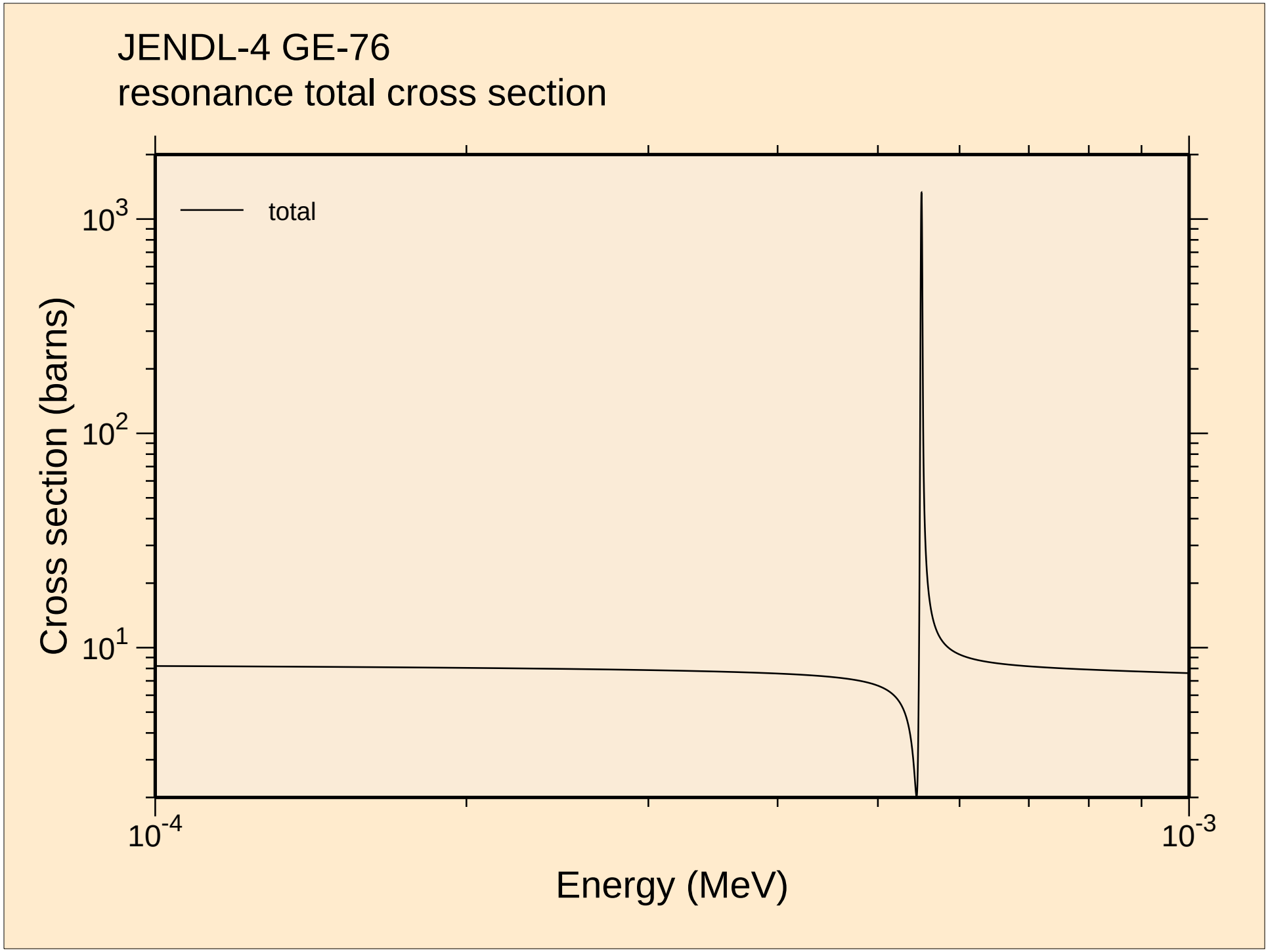
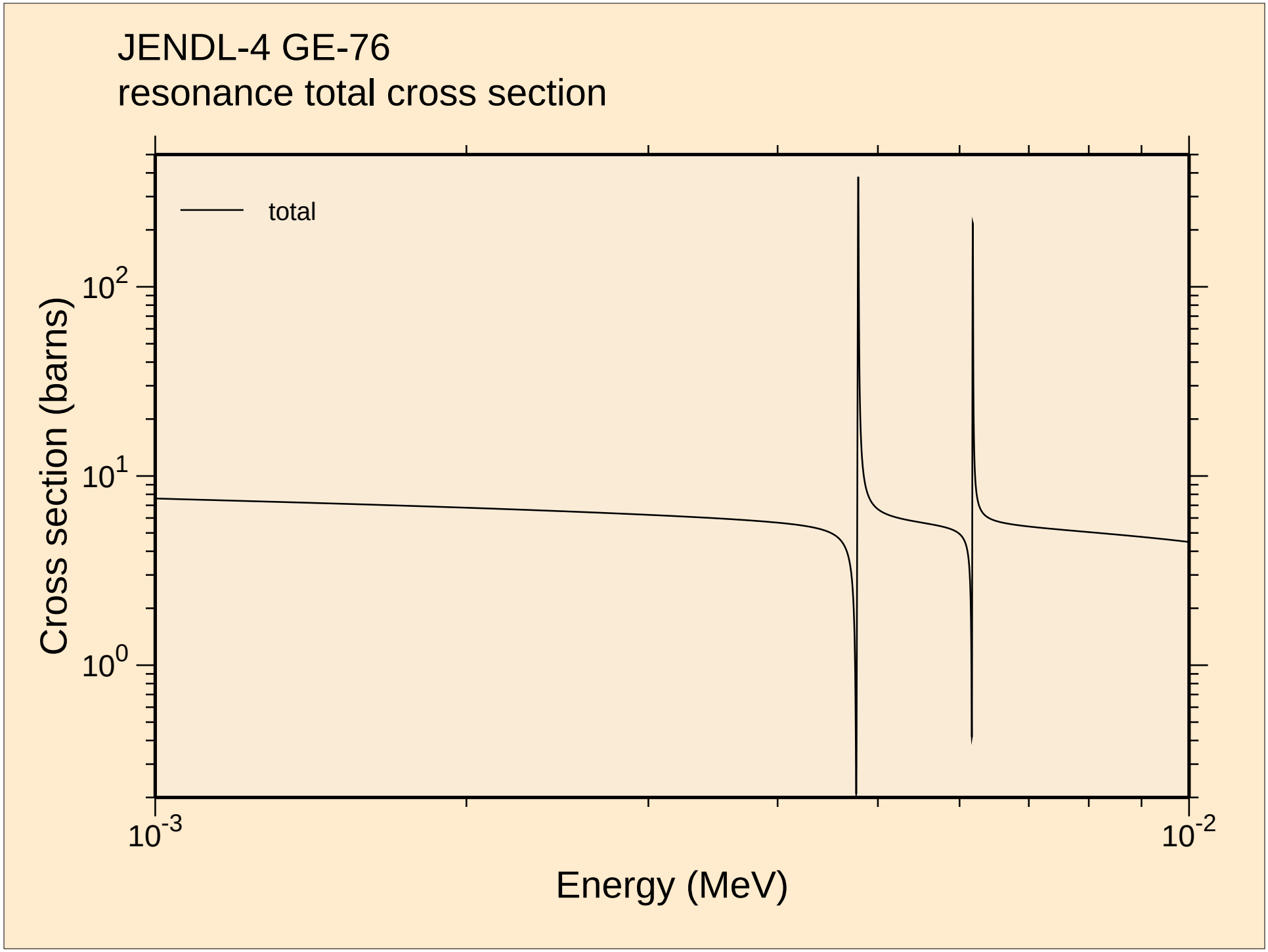
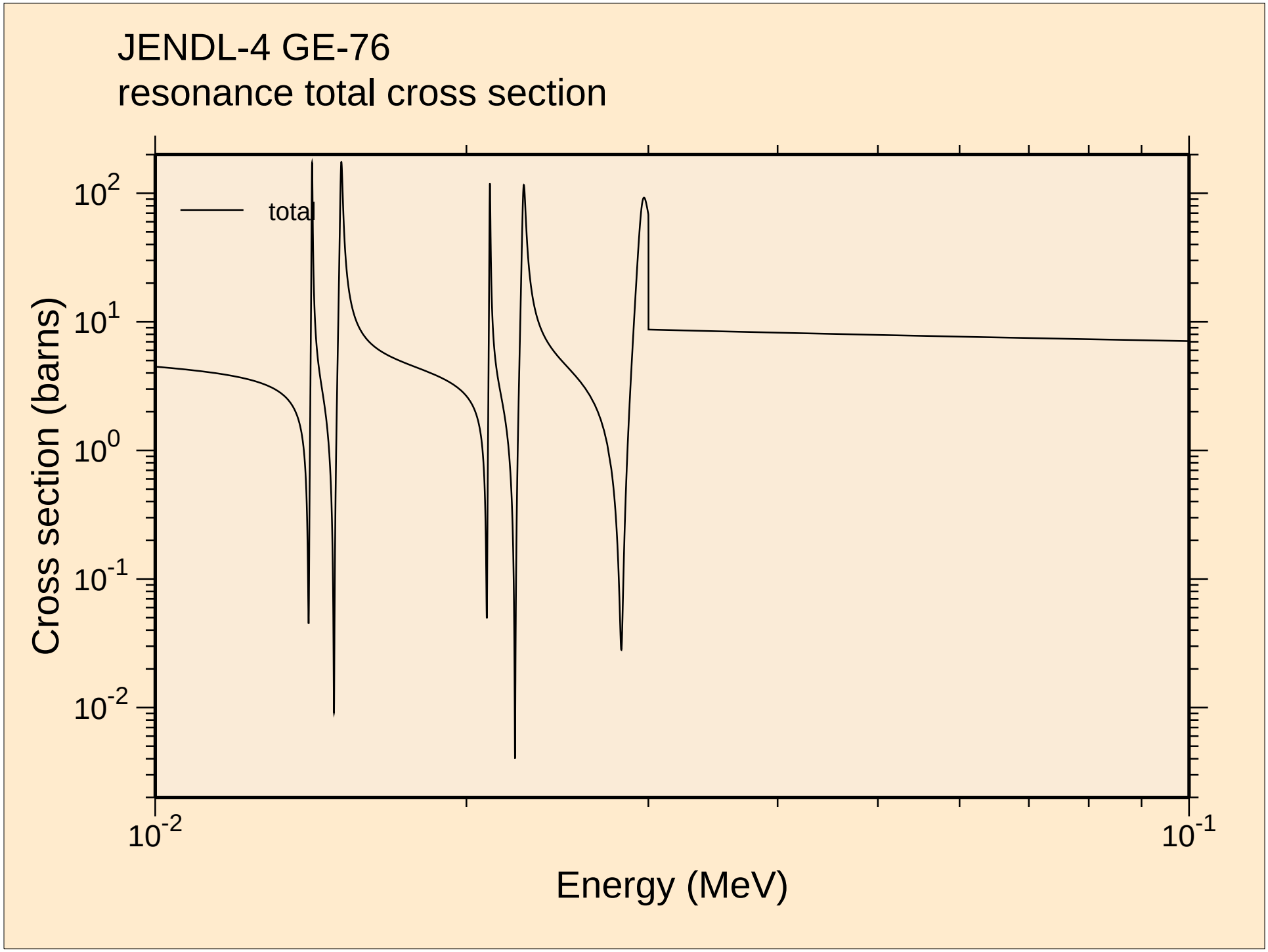
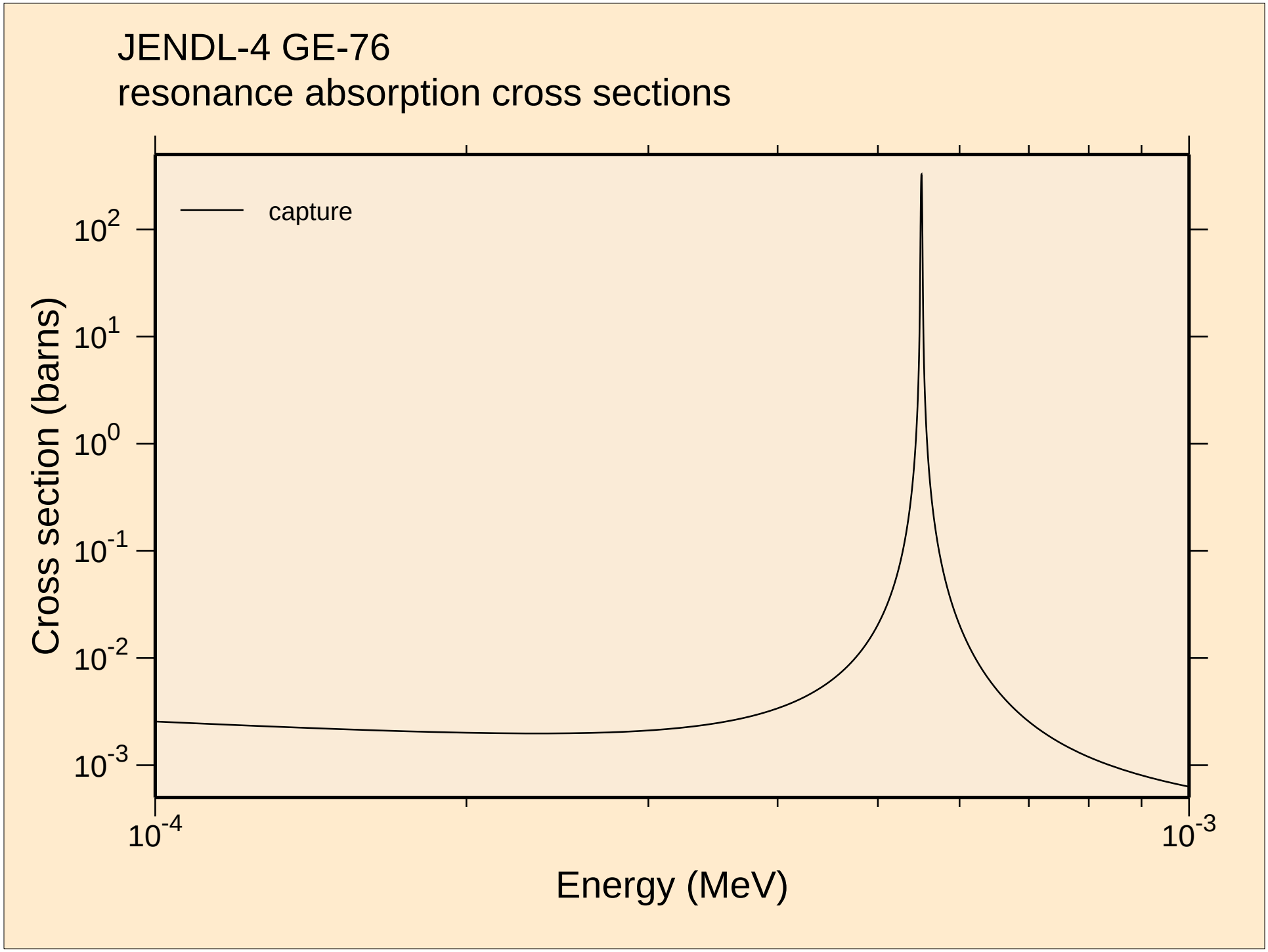
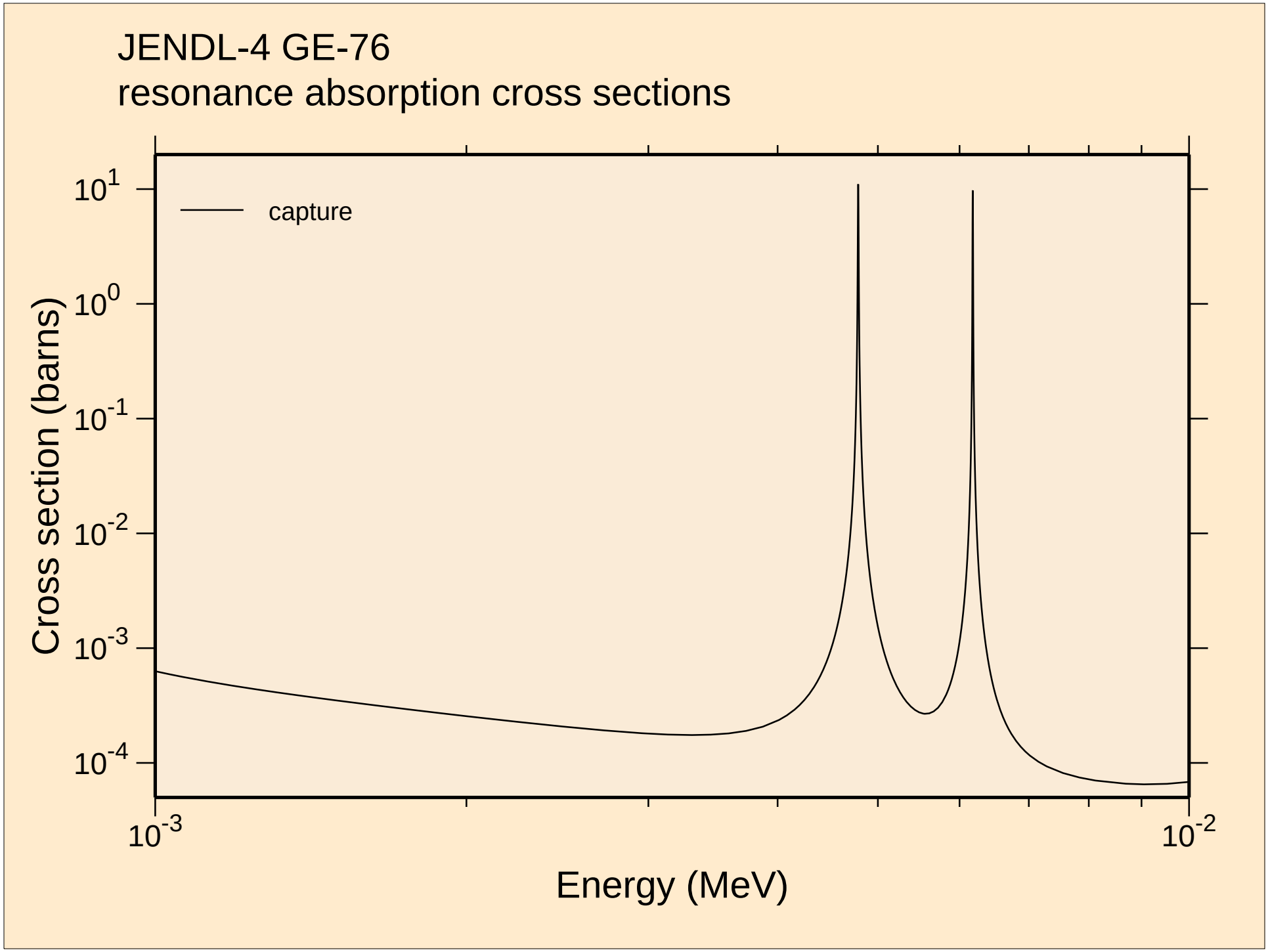

JENDL-4 GE-76
Principal cross sections
Cross section (barns)
Energy (MeV)
total
absorption
elastic
gamma production
10^{3}
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-11} 10^{-10} 10^{-9} 10^{-8} 10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1}

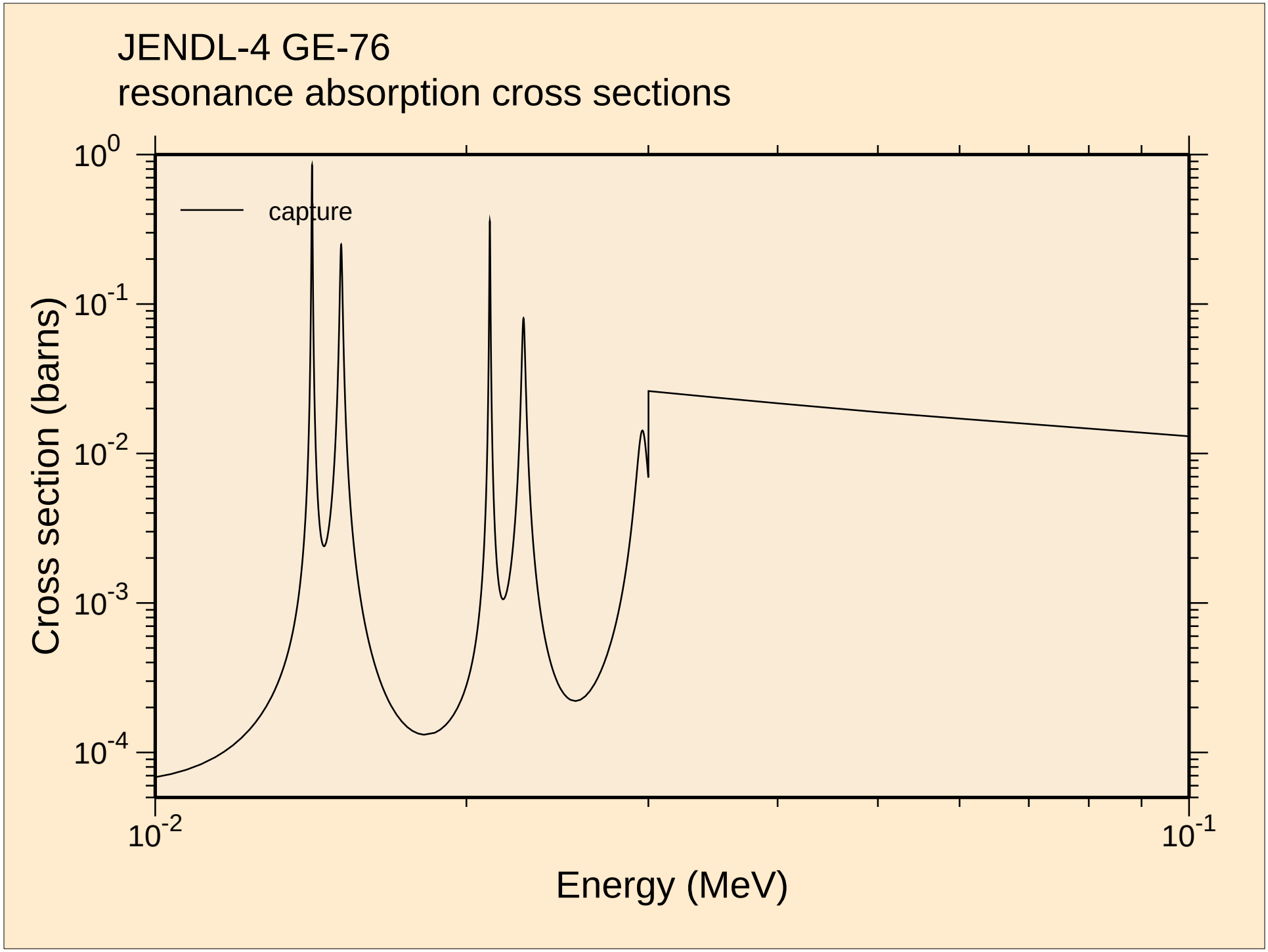

JENDL-4 GE-76
resonance total cross section
total
Cross section (barns)
10^3
10^2
10^1
10^{-4}
10^{-3}
Energy (MeV)

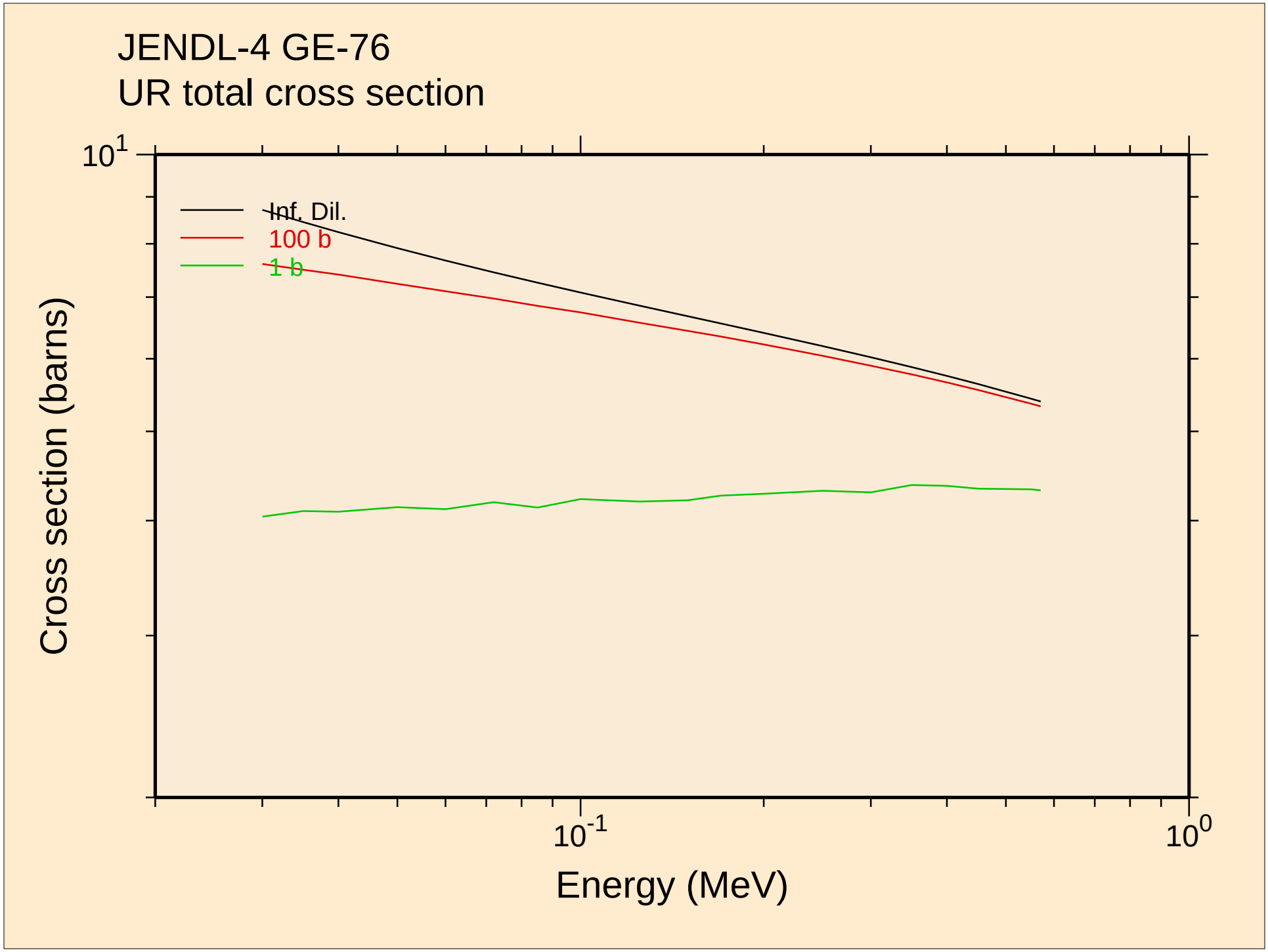

JENDL-4 GE-76
resonance total cross section
total
Cross section (barns)
10^2
10^1
10^0
10^{-3}
10^{-2}
Energy (MeV)

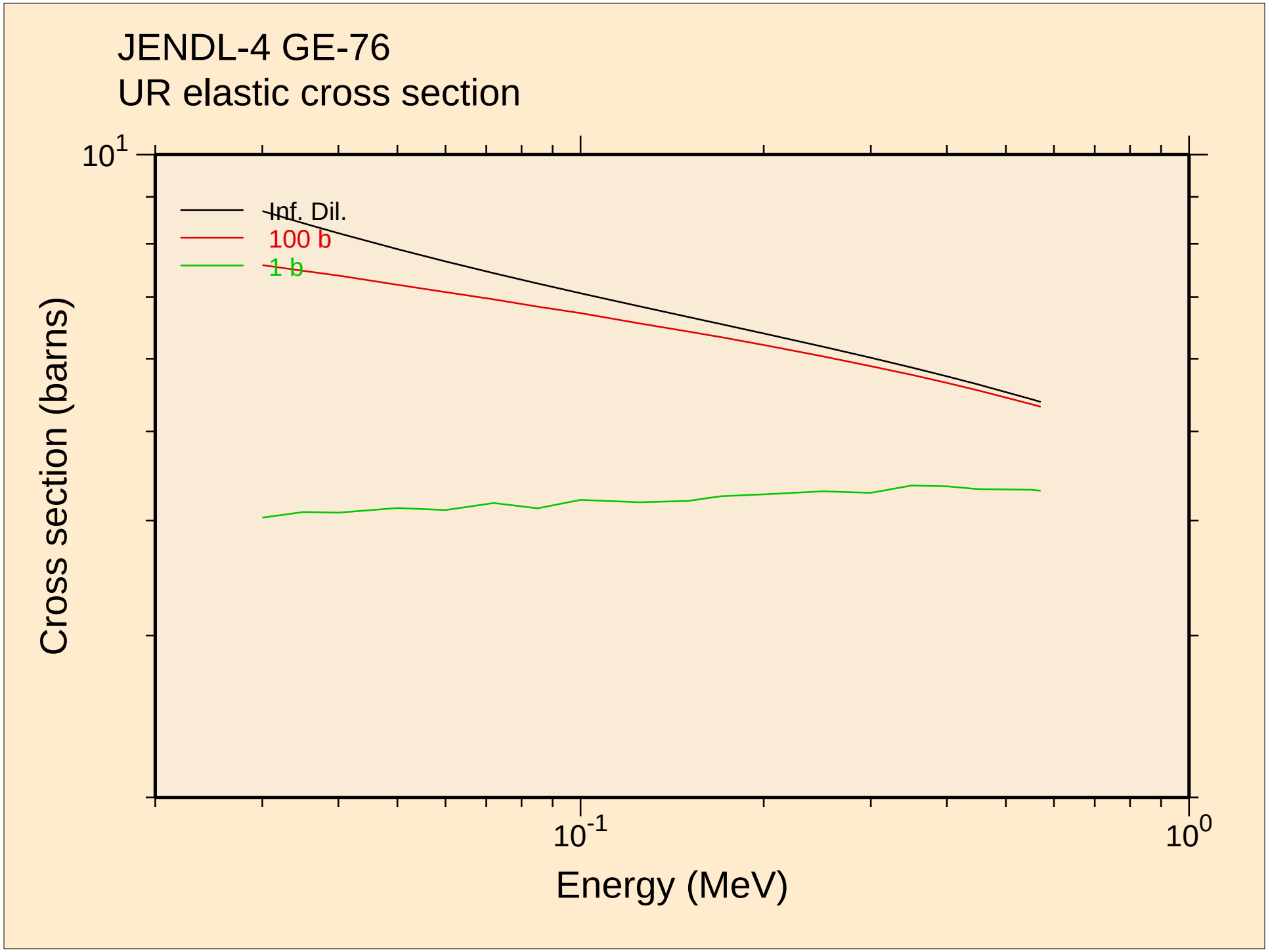

JENDL-4 GE-76
resonance total cross section
total
Cross section (barns)
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-2}
10^{-1}
Energy (MeV)

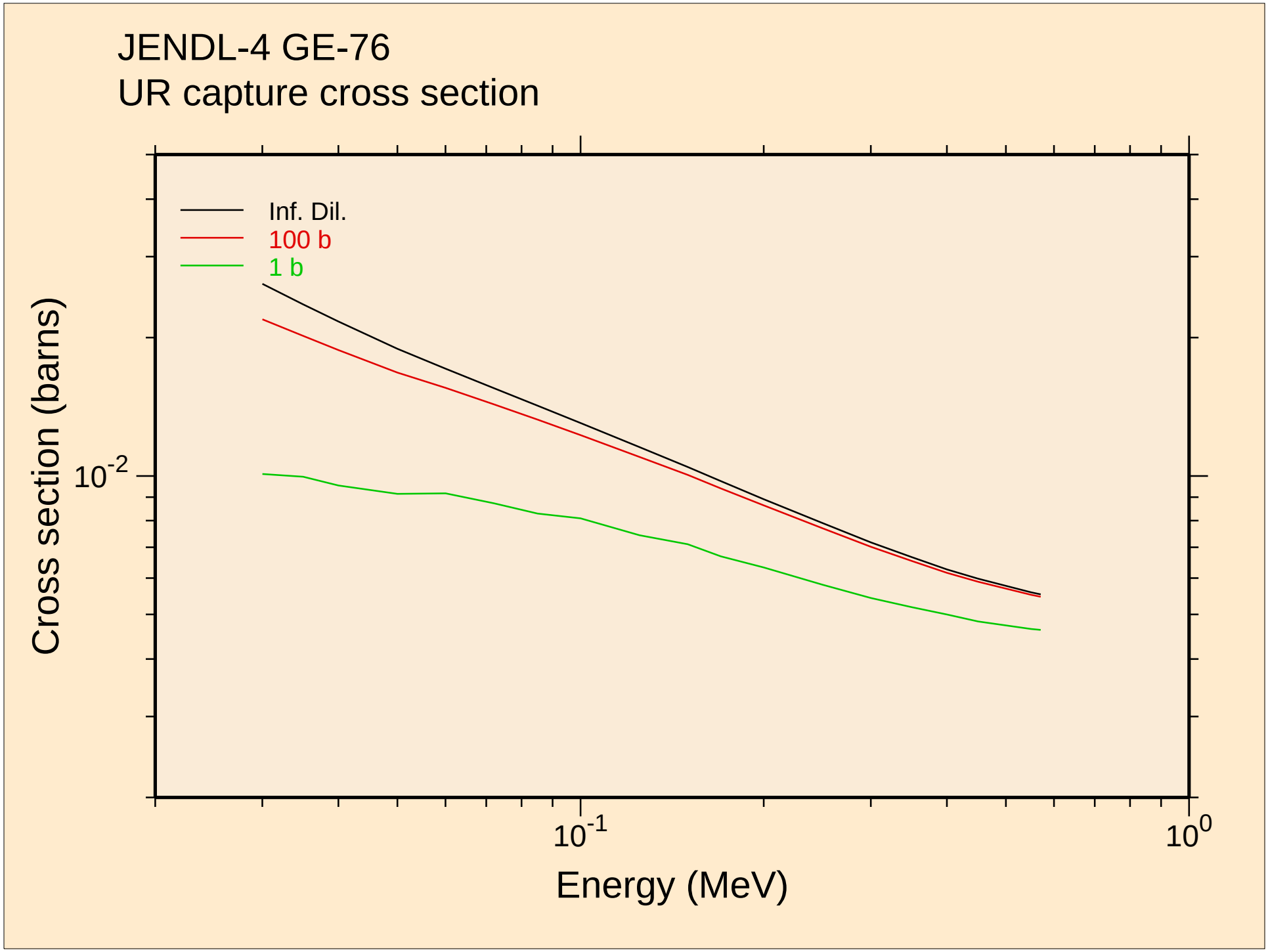

JENDL-4 GE-76
resonance absorption cross sections
capture
Cross section (barns)
10^{2}
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-3}
Energy (MeV)

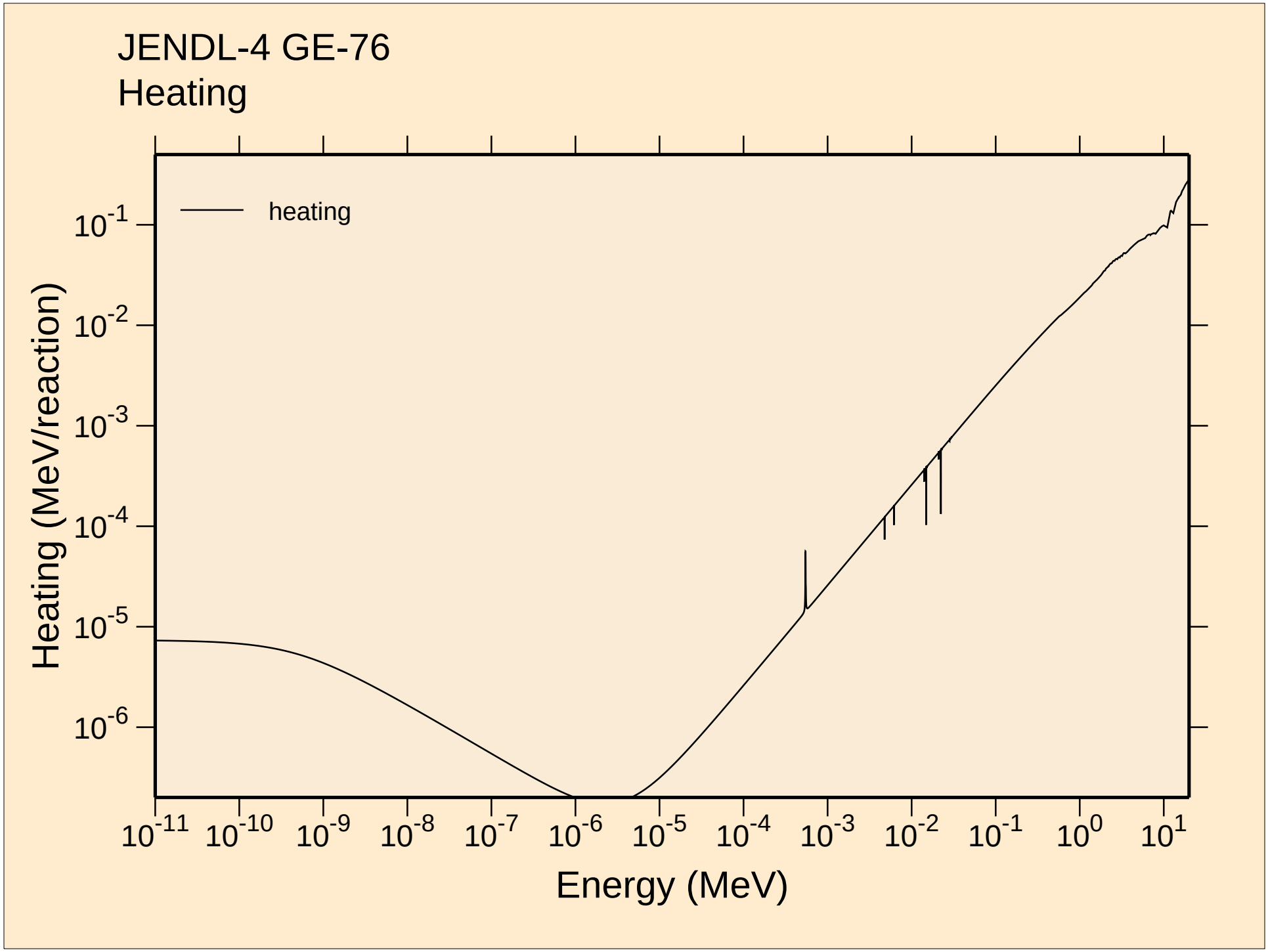

JENDL-4 GE-76
resonance absorption cross sections
capture
Cross section (barns)
10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-3}
10^{-2}
Energy (MeV)

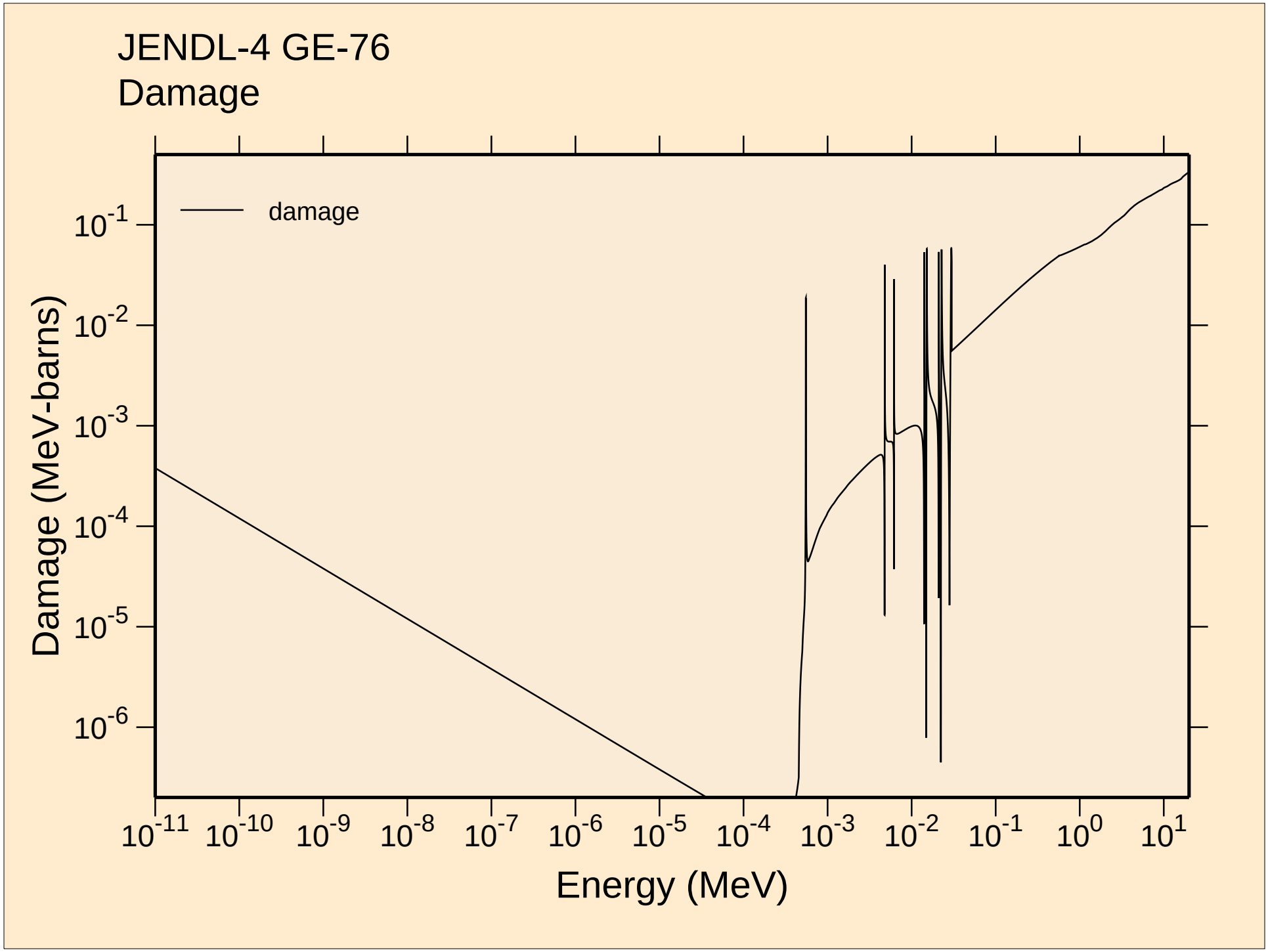

JENDL-4 GE-76
resonance absorption cross sections
capture
Cross section (barns)
Energy (MeV)
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-2}
10^{-1}

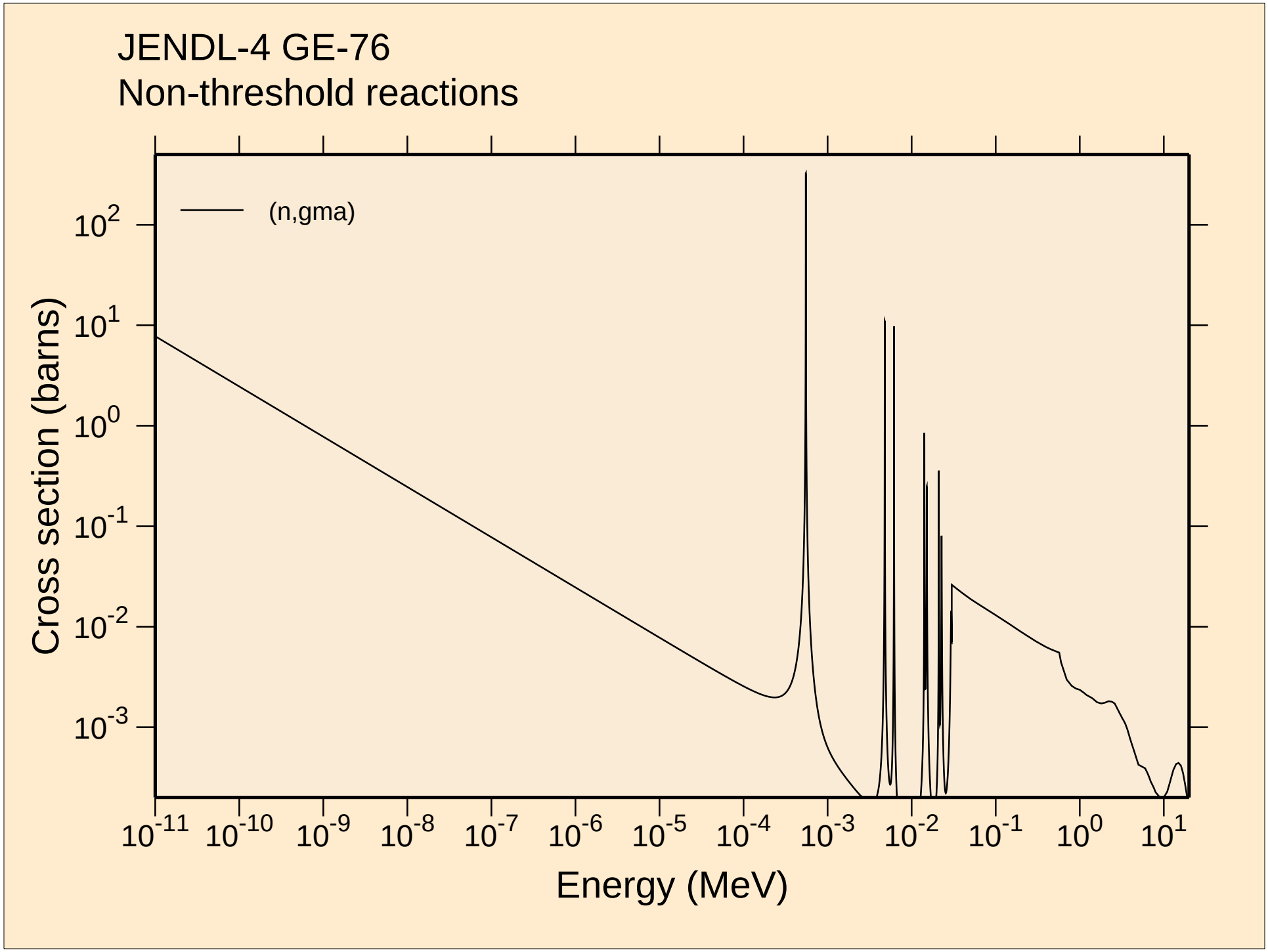

JENDL-4 GE-76
UR total cross section
Inf. Dil.
100 b
1 b
Cross section (barns)
Energy (MeV)
10^1
10^-1
10^0

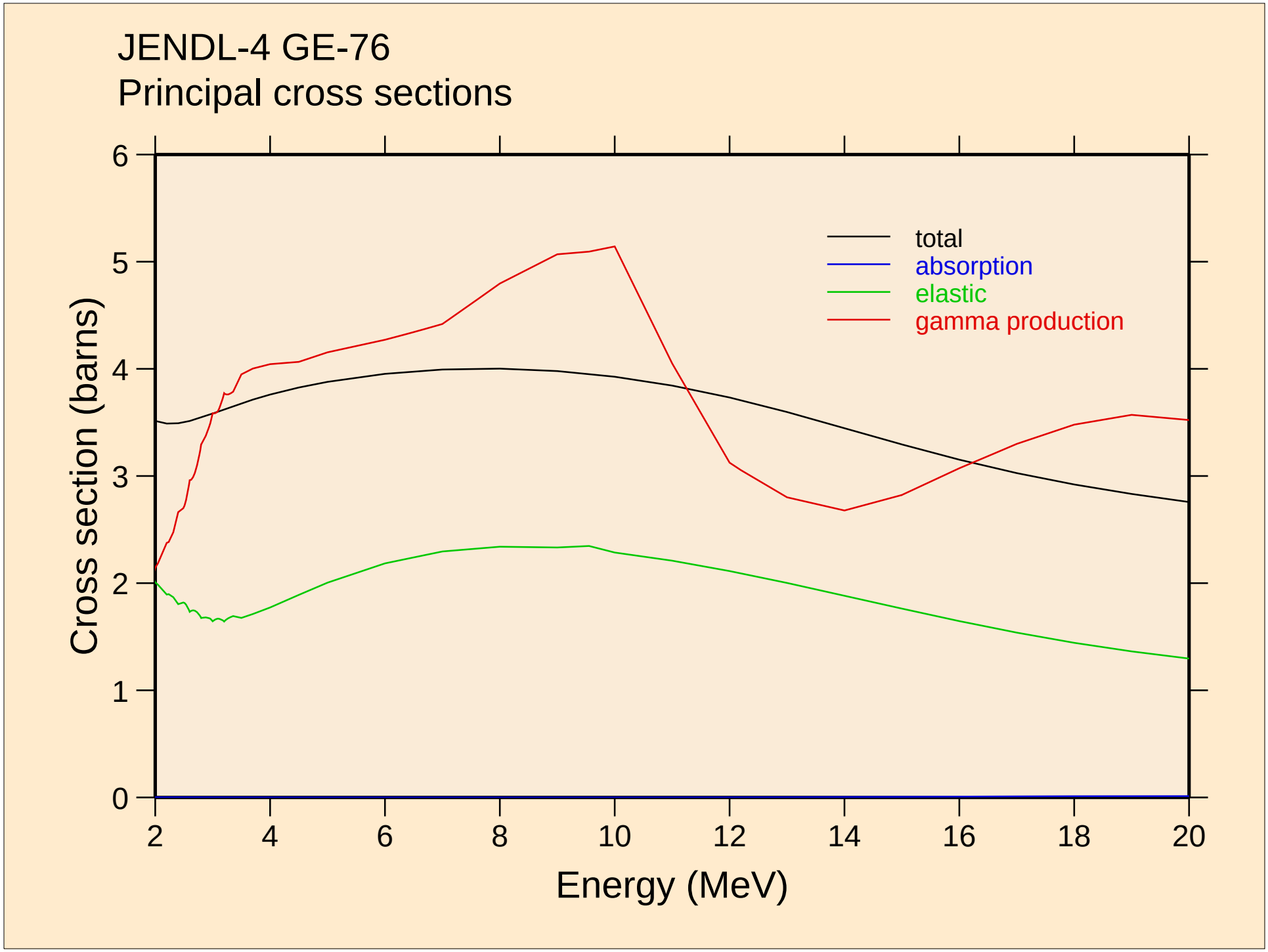

JENDL-4 GE-76
UR elastic cross section
Inf. Dil.
100 b
1 b
Cross section (barns)
Energy (MeV)
10^1
10^-1
10^0

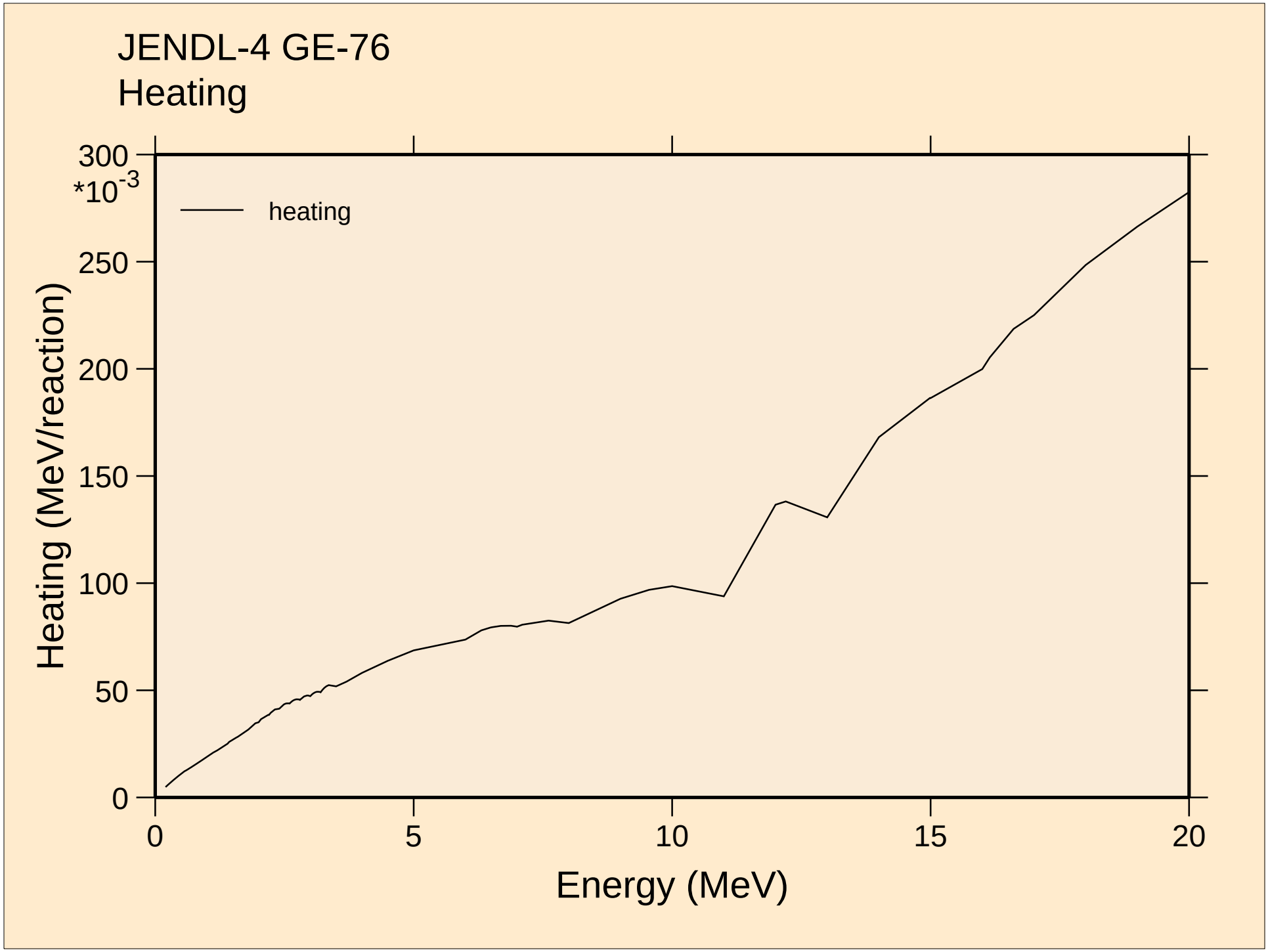

JENDL-4 GE-76
UR capture cross section
Inf. Dil.
100 b
1 b
Cross section (barns)
10^-2
10^-1
10^0
Energy (MeV)

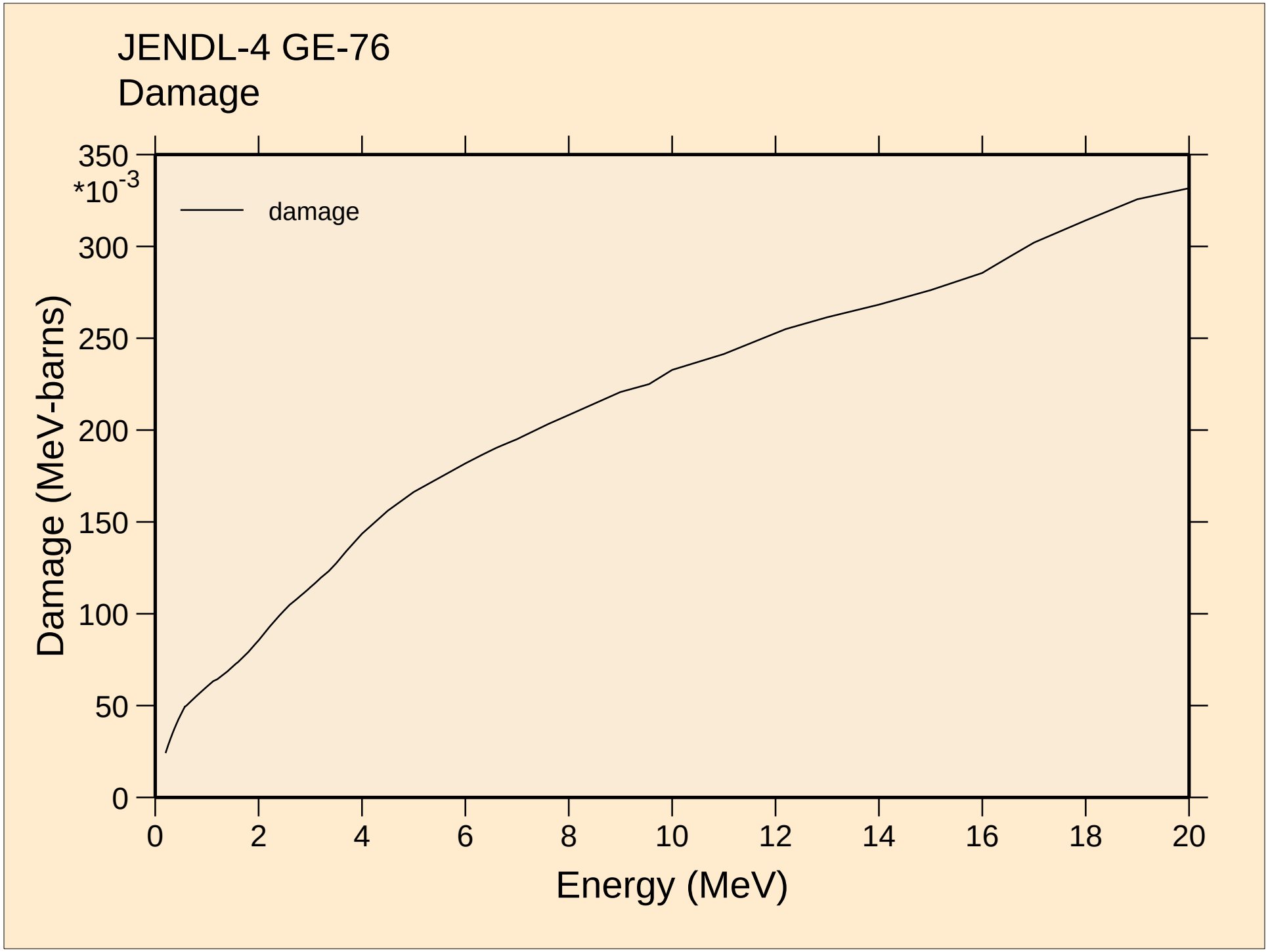

JENDL-4 GE-76
Heating
heating
Heating (MeV/reaction)
Energy (MeV)
10-1
10-2
10-3
10-4
10-5
10-6
10-11
10-10
10-9
10-8
10-7
10-6
10-5
10-4
10-3
10-2
10-1
100
101

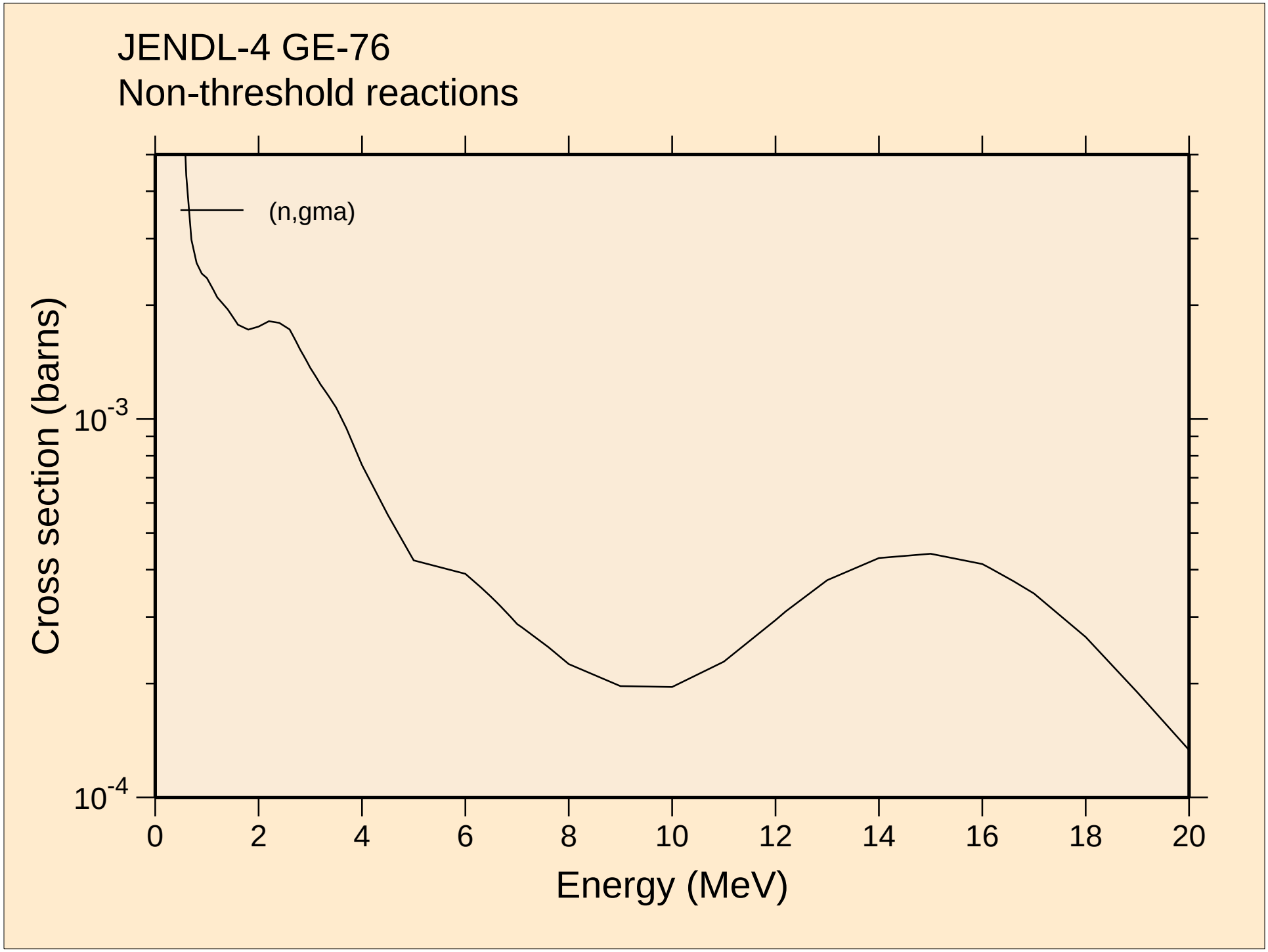

JENDL-4 GE-76
Damage
damage
Damage (MeV-barns)
Energy (MeV)
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-11
10^-10
10^-9
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
10^-2
10^-1
10^0
10^1

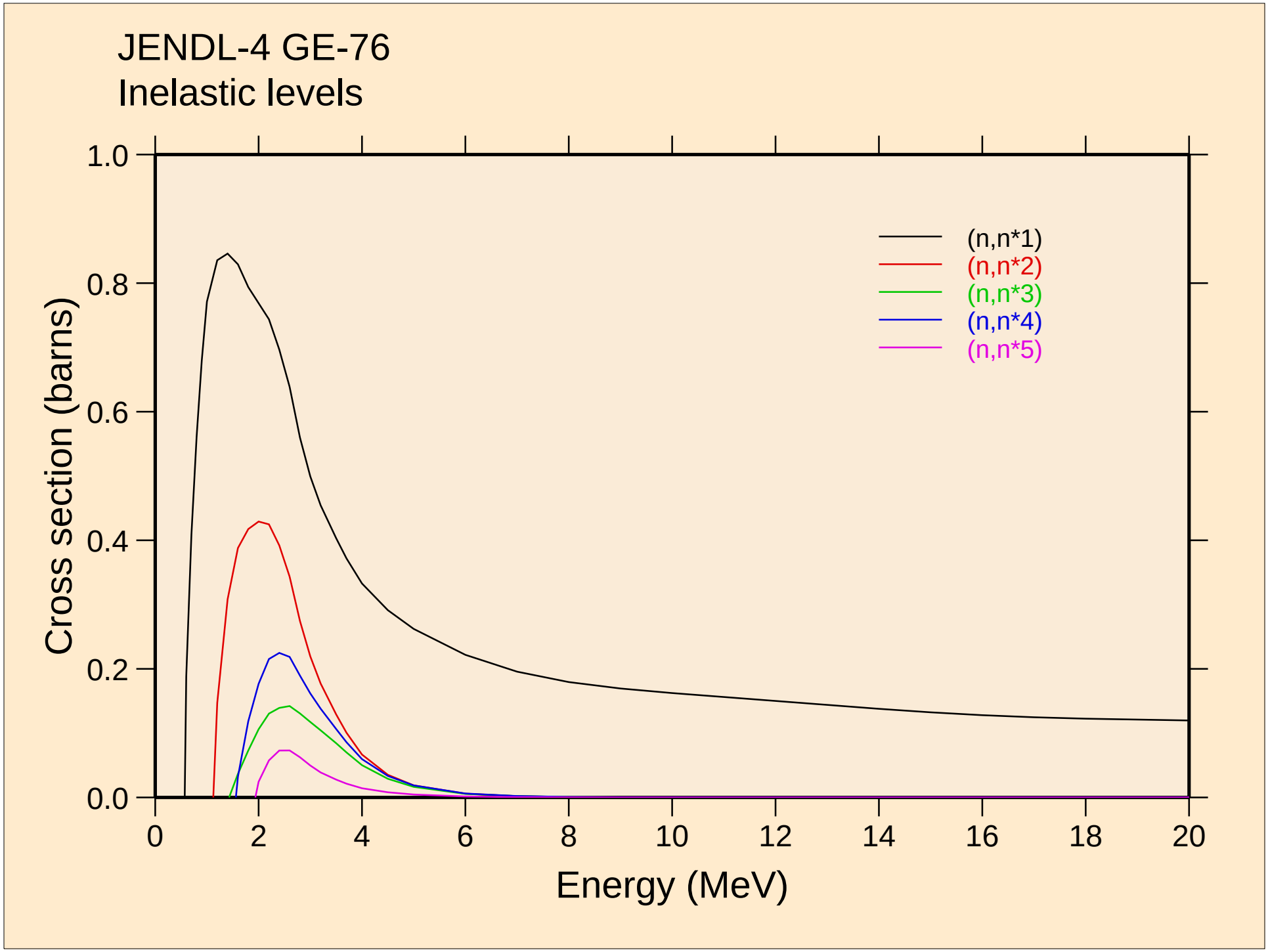

JENDL-4 GE-76
Non-threshold reactions
(n,gma)
Cross section (barns)
Energy (MeV)
10^2
10^1
10^0
10^-1
10^-2
10^-3
10^-11
10^-10
10^-9
10^-8
10^-7
10^-6
10^-5
10^-4
10^-3
10^-2
10^-1
10^0
10^1

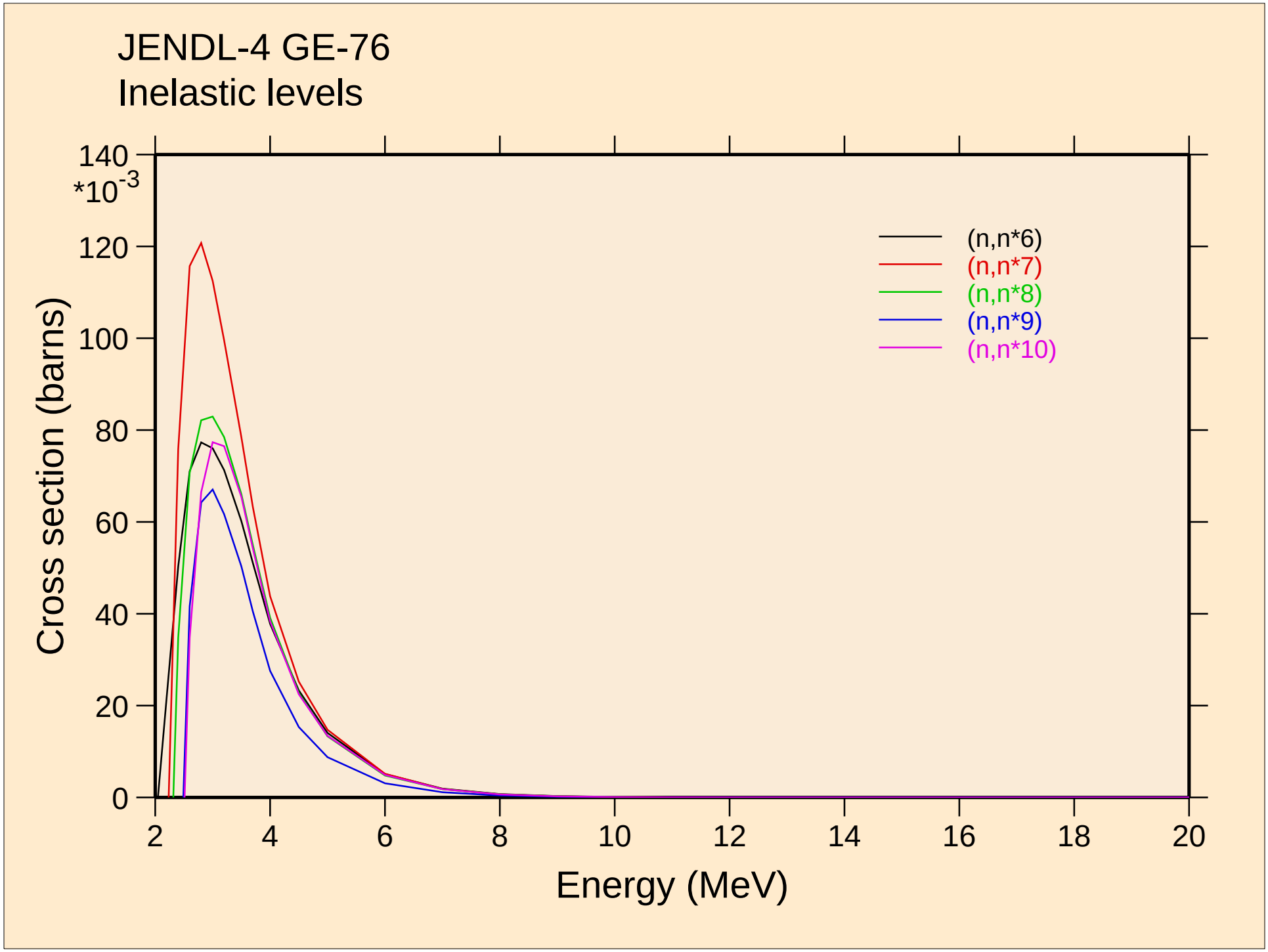

JENDL-4 GE-76
Principal cross sections
total
absorption
elastic
gamma production
Cross section (barns)
Energy (MeV)
0
1
2
3
4
5
6
2
4
6
8
10
12
14
16
18
20

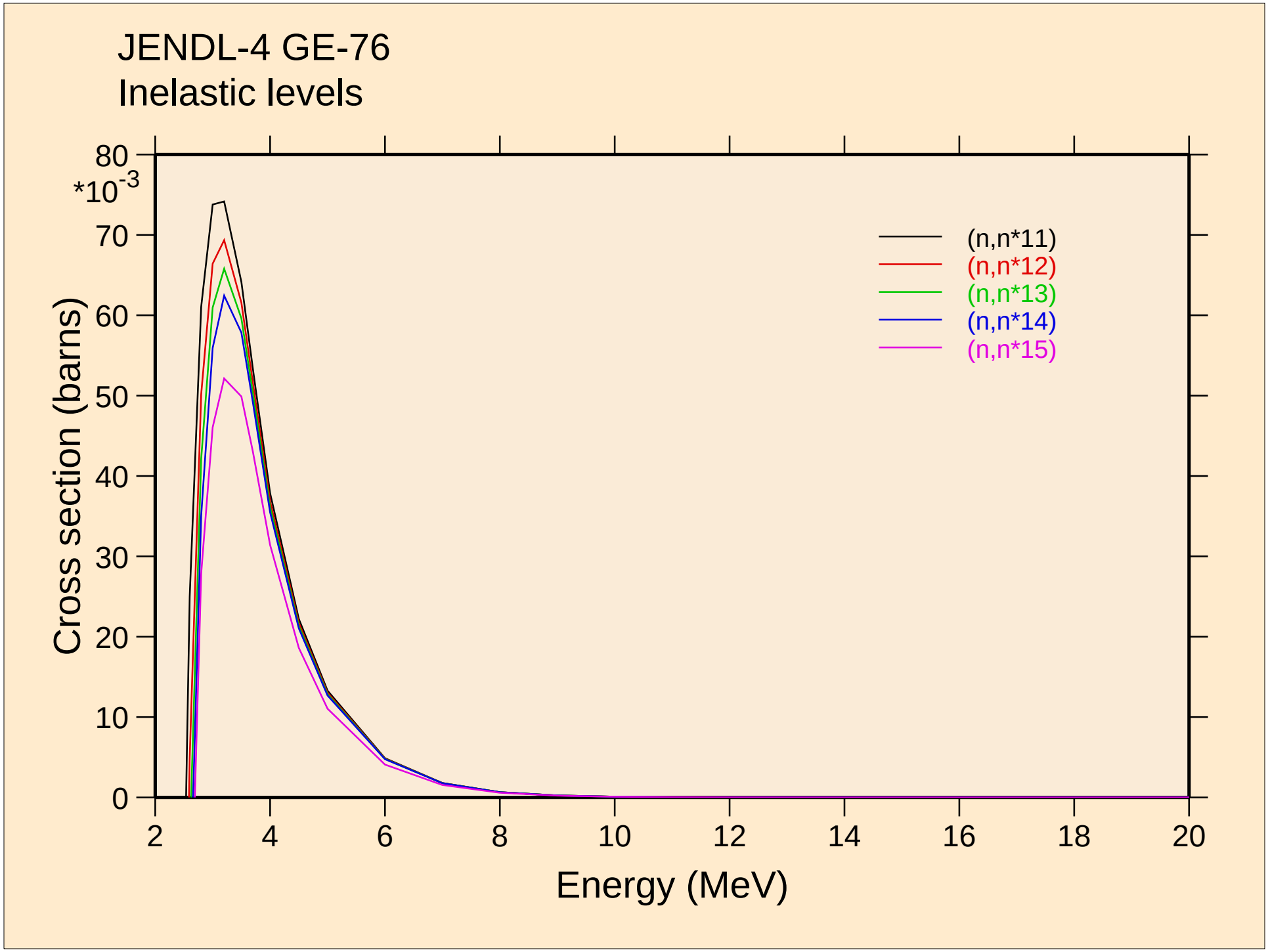

JENDL-4 GE-76
Heating
heating
Heating (MeV/reaction)
*10-3
300
250
200
150
100
50
0
0
5
10
15
20
Energy (MeV)

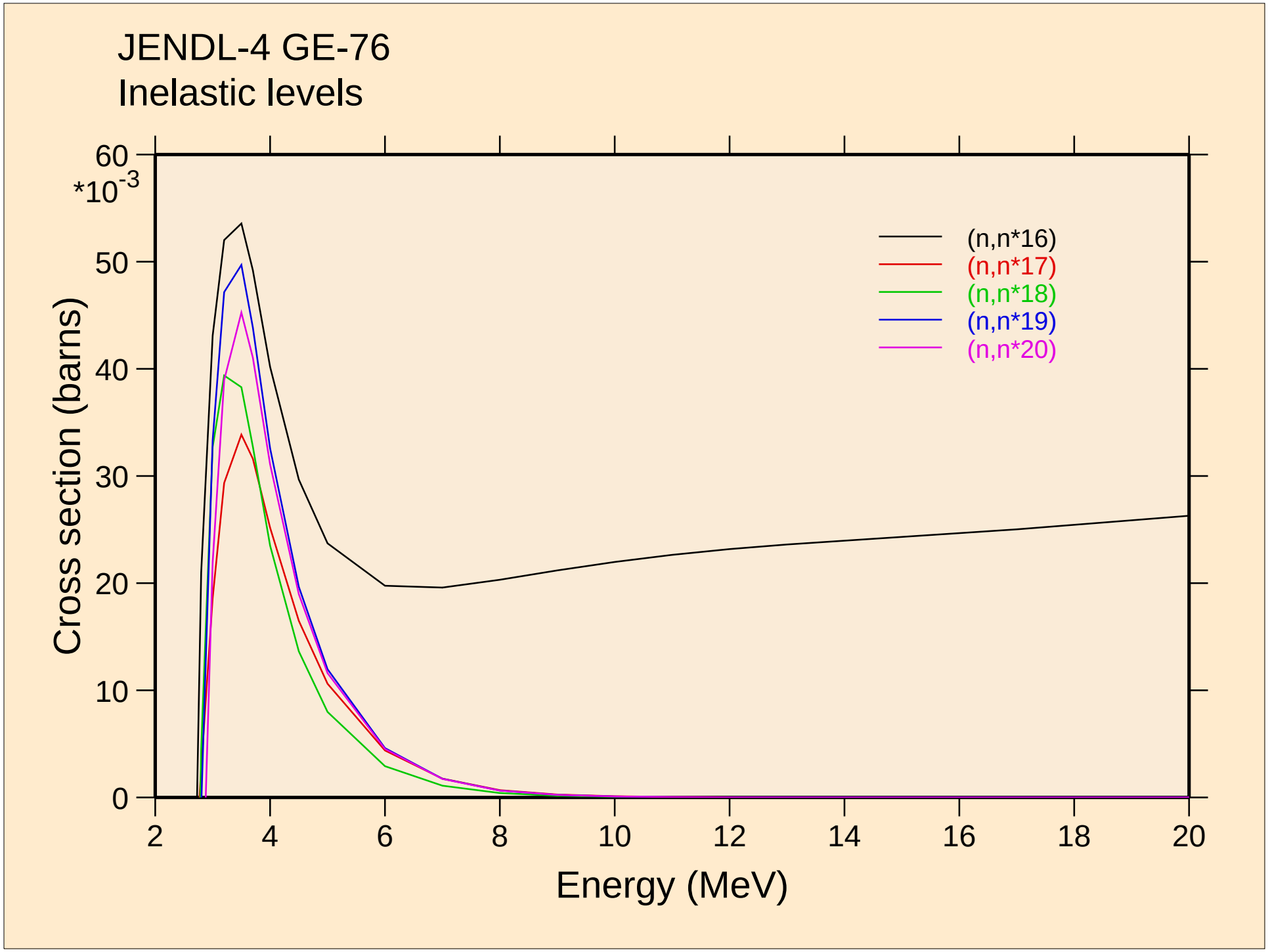

JENDL-4 GE-76
Damage
damage
*10-3
350
300
250
200
150
100
50
0
Damage (MeV-barns)
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

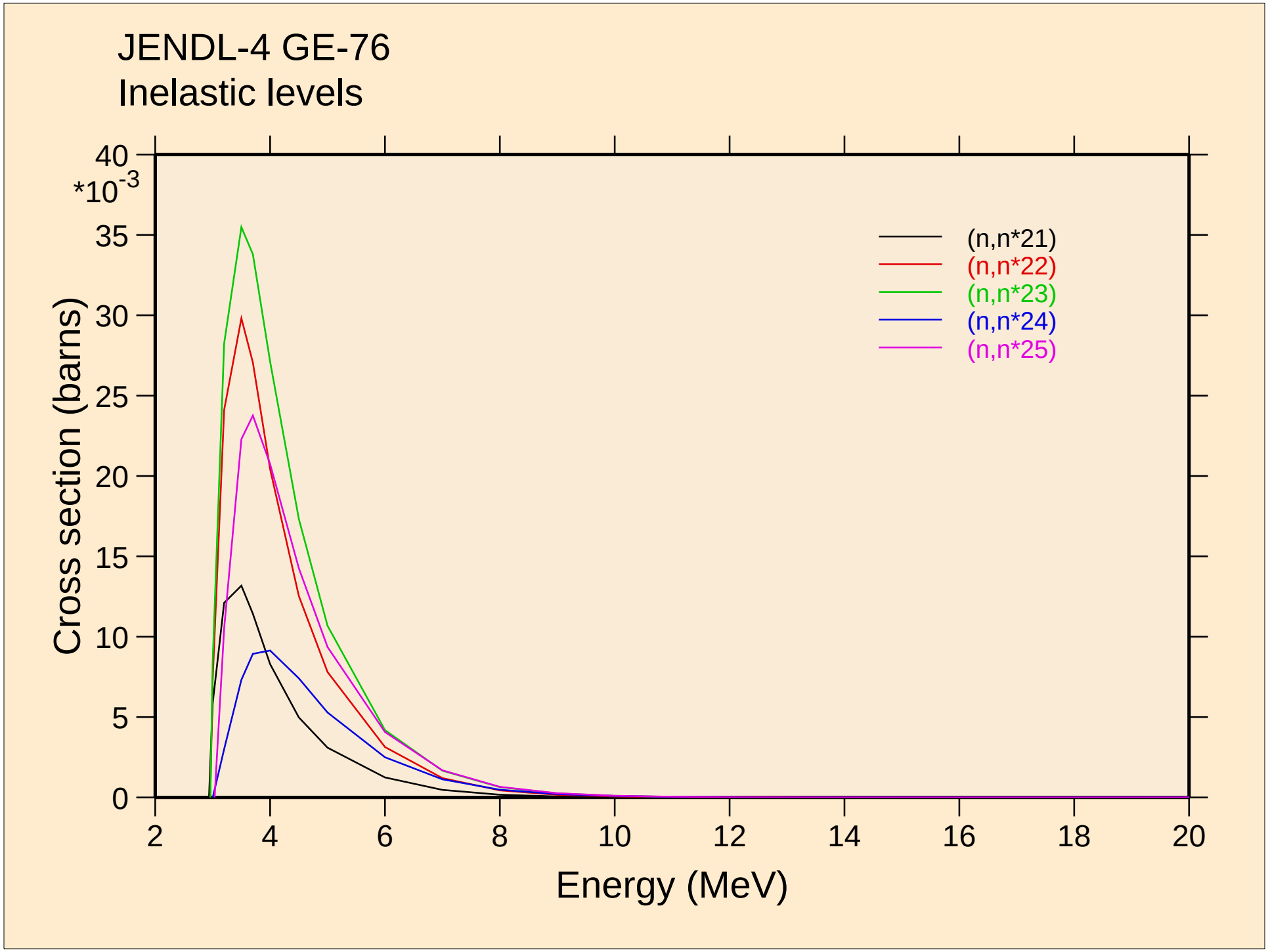

JENDL-4 GE-76
Non-threshold reactions
(n,gma)
Cross section (barns)
10-3
10-4
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

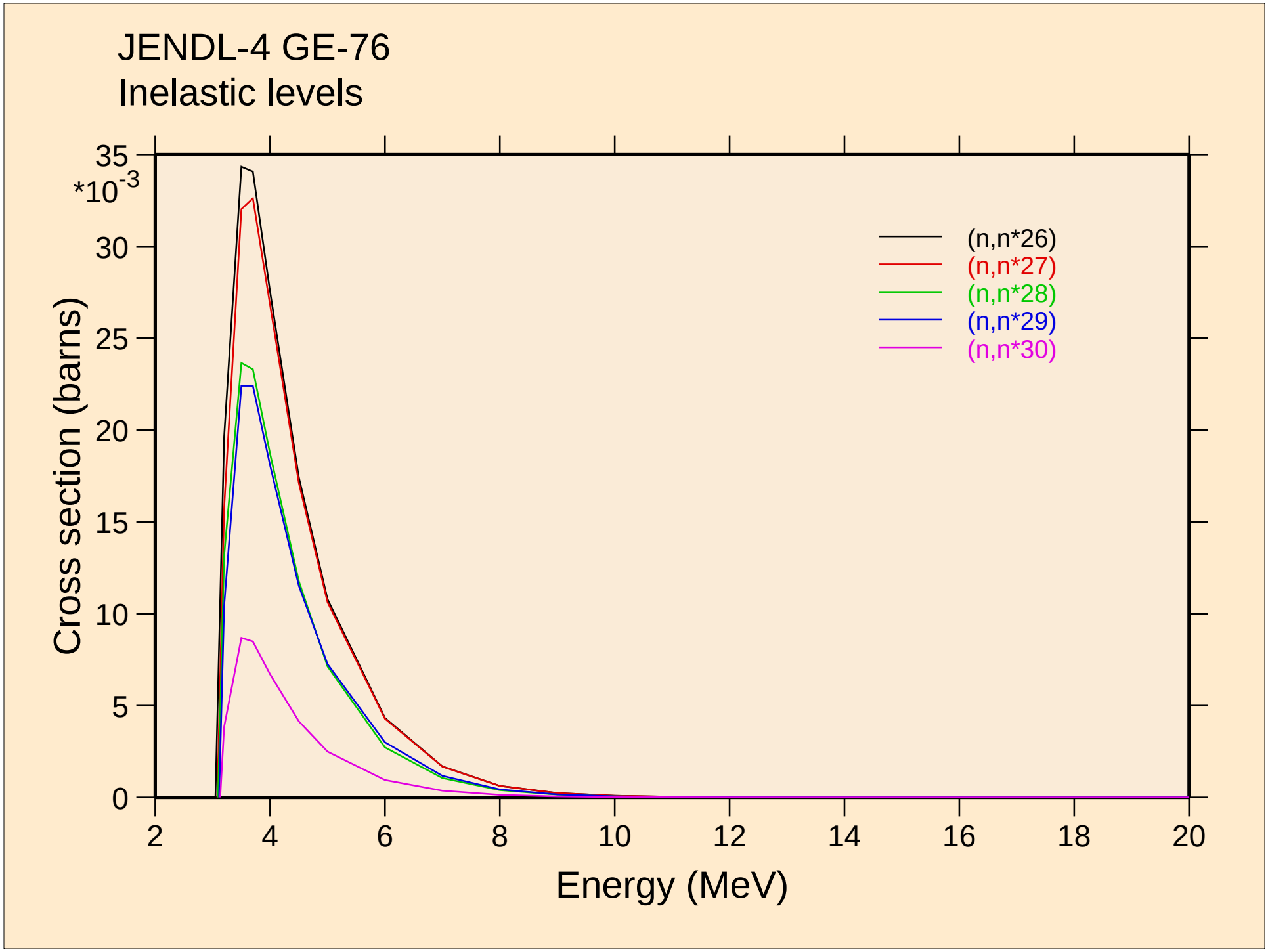

JENDL-4 GE-76
Inelastic levels
(n,n*1)
(n,n*2)
(n,n*3)
(n,n*4)
(n,n*5)
Cross section (barns)
Energy (MeV)
0.0
0.2
0.4
0.6
0.8
1.0
0
2
4
6
8
10
12
14
16
18
20

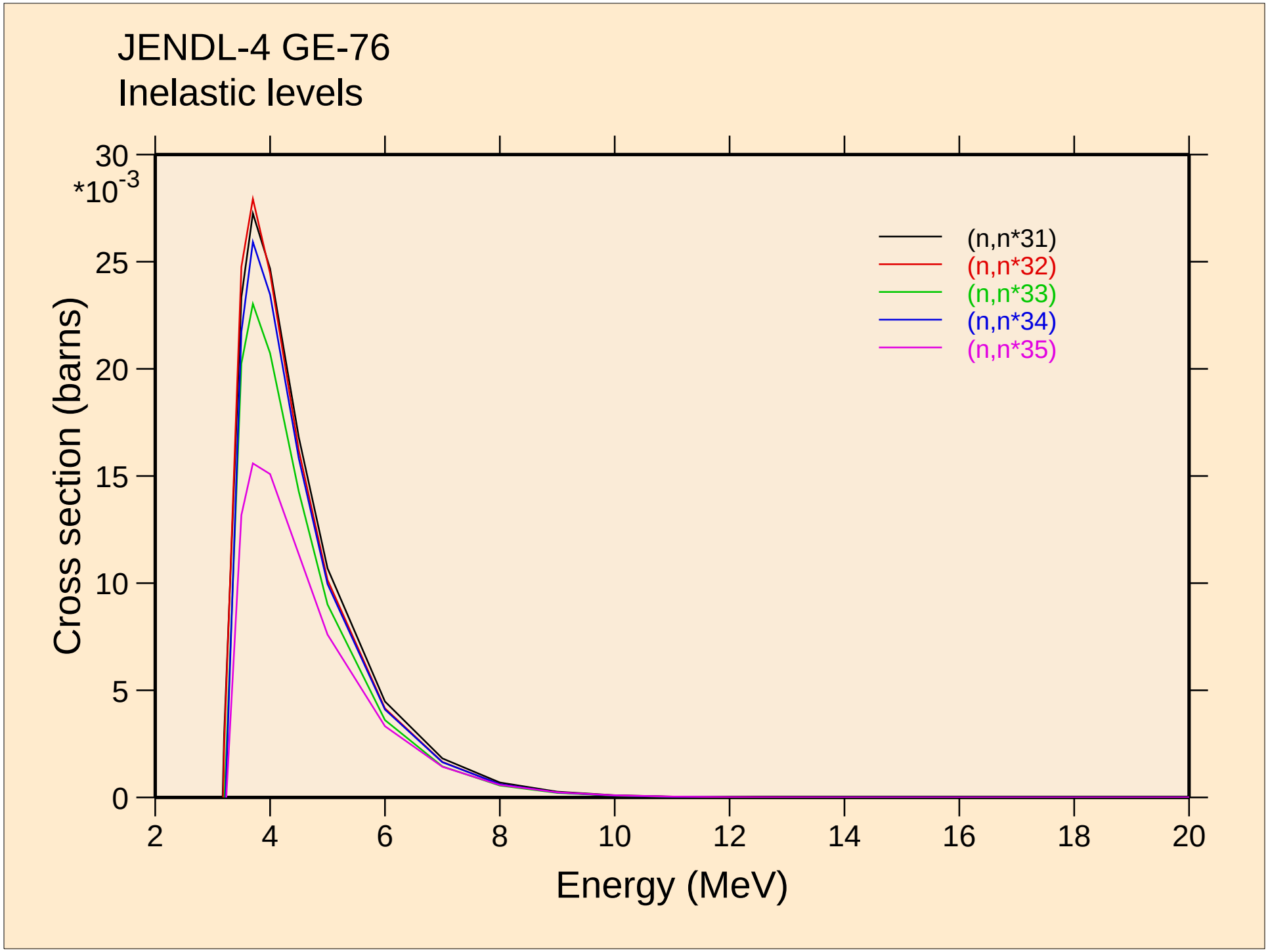

JENDL-4 GE-76
Inelastic levels
Cross section (barns)
*10^-3
140
120
100
80
60
40
20
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*6)
(n,n*7)
(n,n*8)
(n,n*9)
(n,n*10)

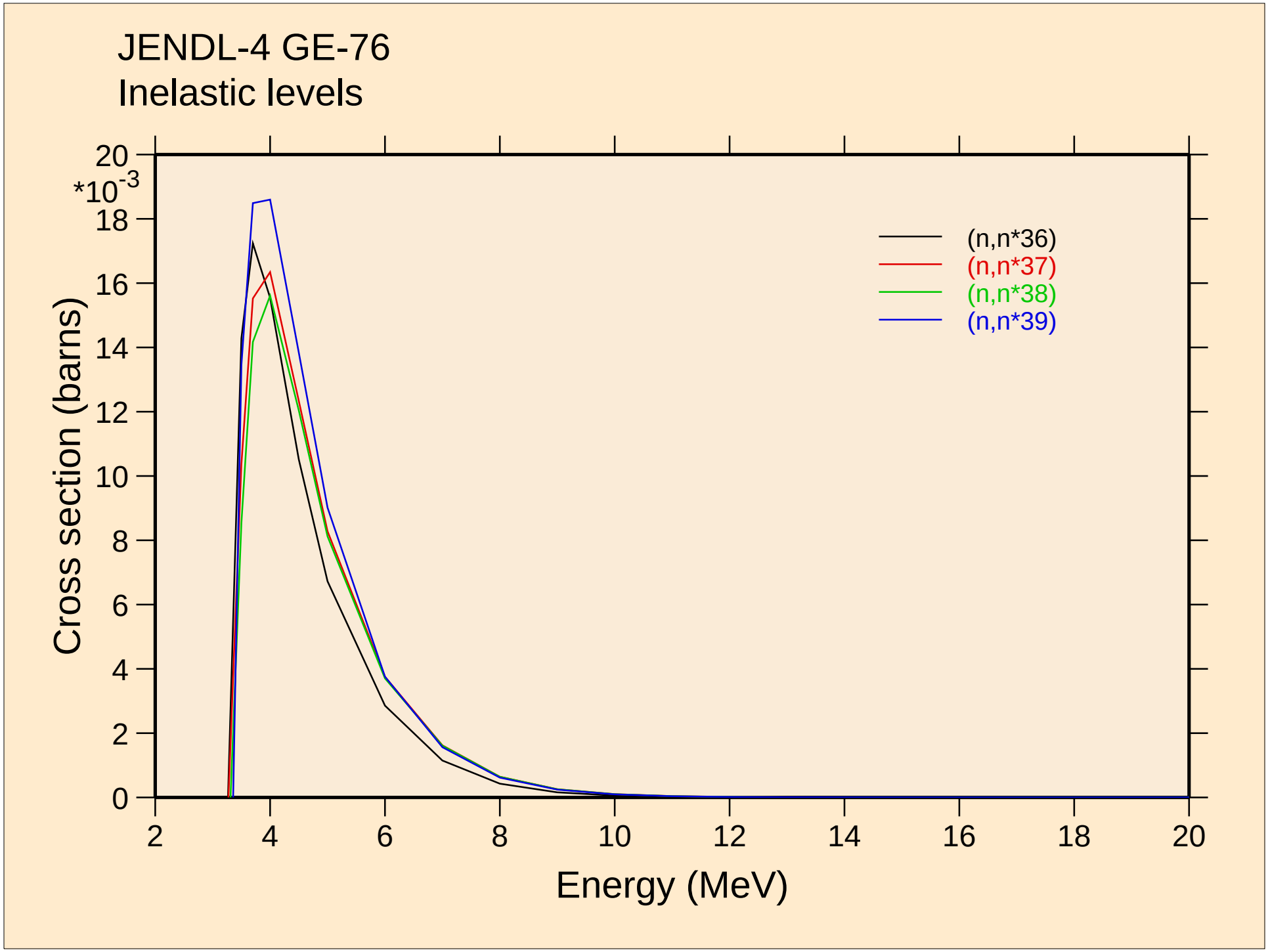

JENDL-4 GE-76
Inelastic levels
*10-3
80
70
60
50
40
30
20
10
0
Cross section (barns)
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*11)
(n,n*12)
(n,n*13)
(n,n*14)
(n,n*15)

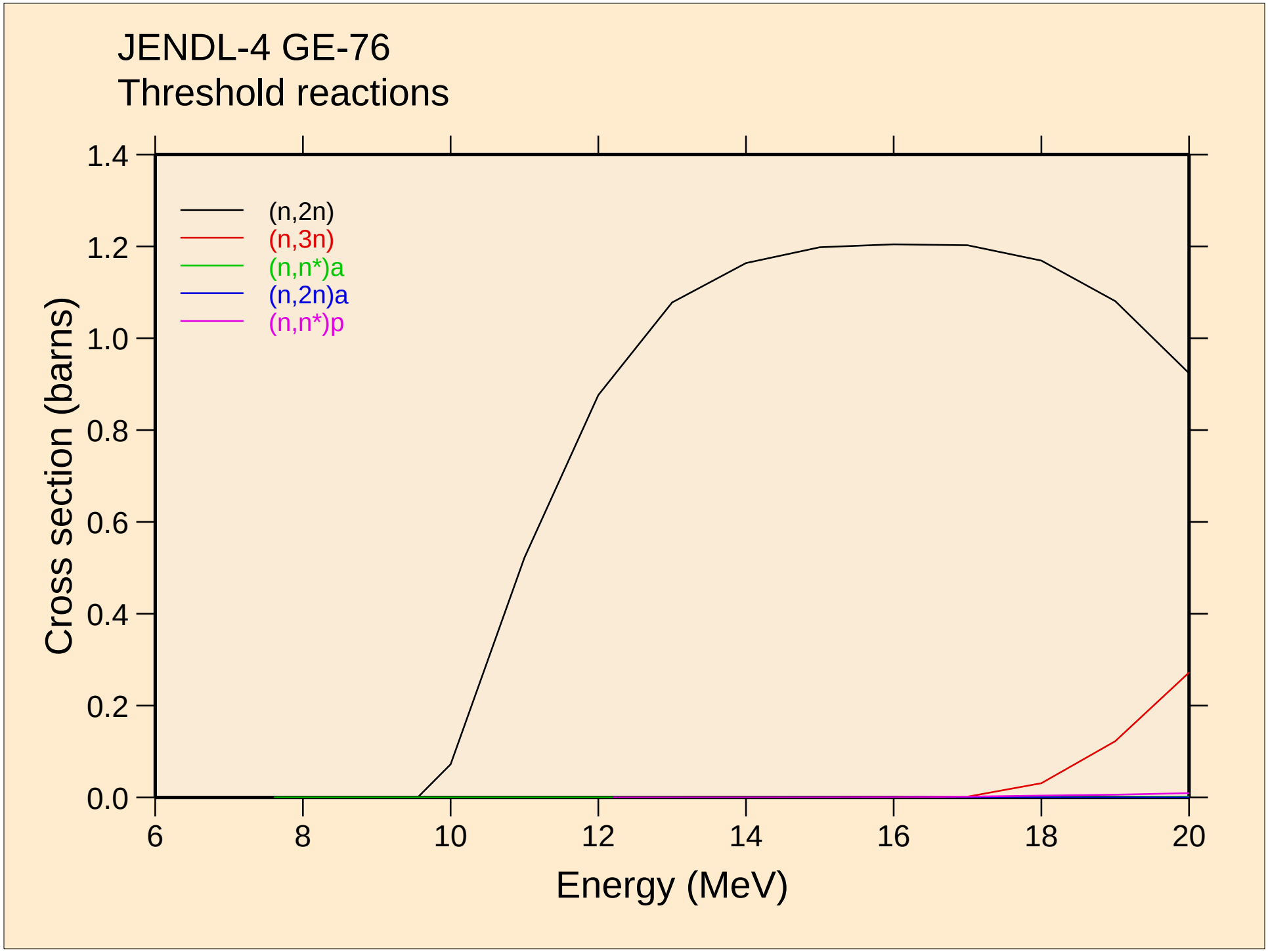

JENDL-4 GE-76
Inelastic levels
*10-3
60
50
40
30
20
10
0
Cross section (barns)
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*16)
(n,n*17)
(n,n*18)
(n,n*19)
(n,n*20)

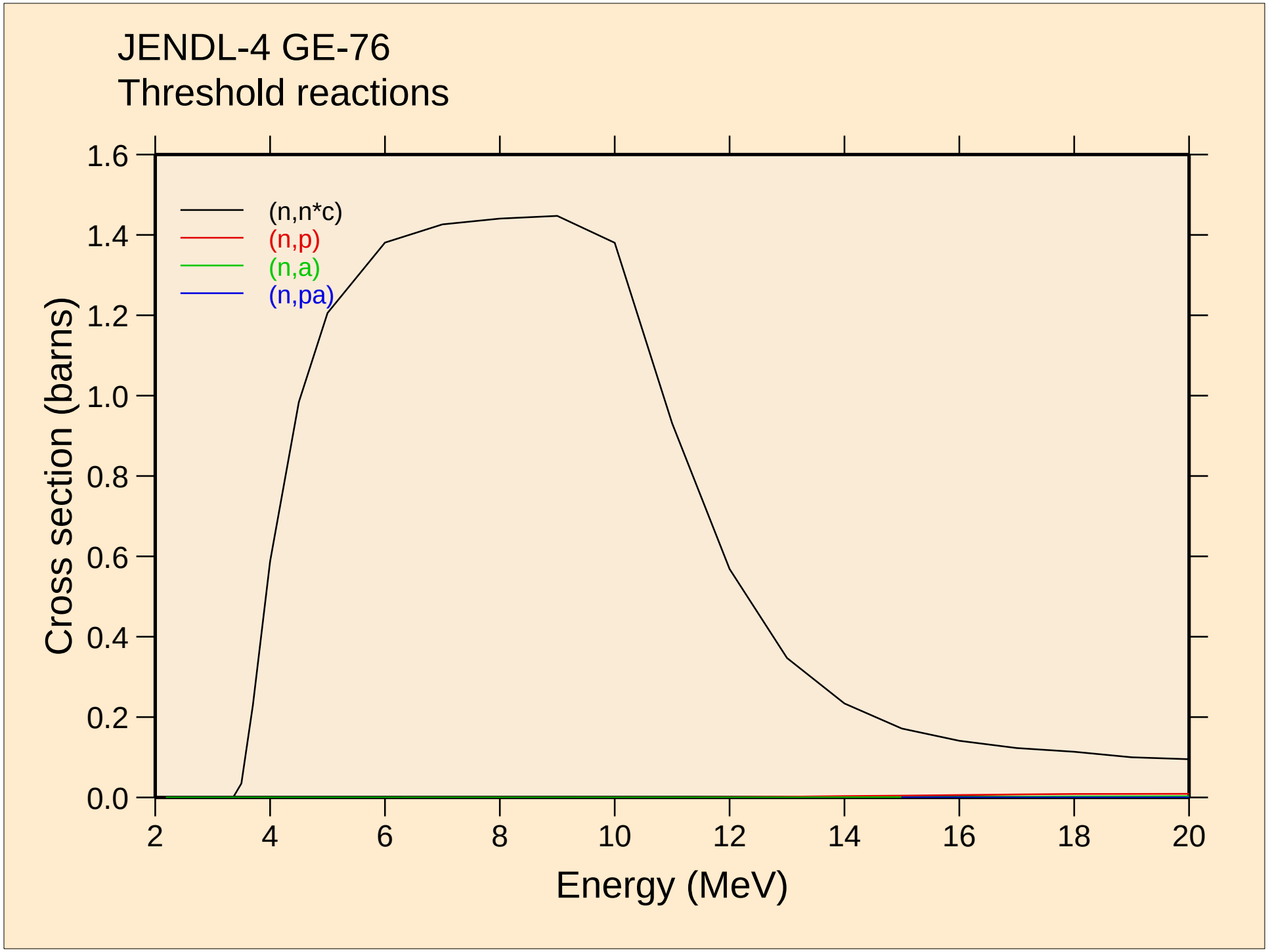

JENDL-4 GE-76
Inelastic levels
*10-3
40
35
30
25
20
15
10
5
0
Cross section (barns)
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*21)
(n,n*22)
(n,n*23)
(n,n*24)
(n,n*25)

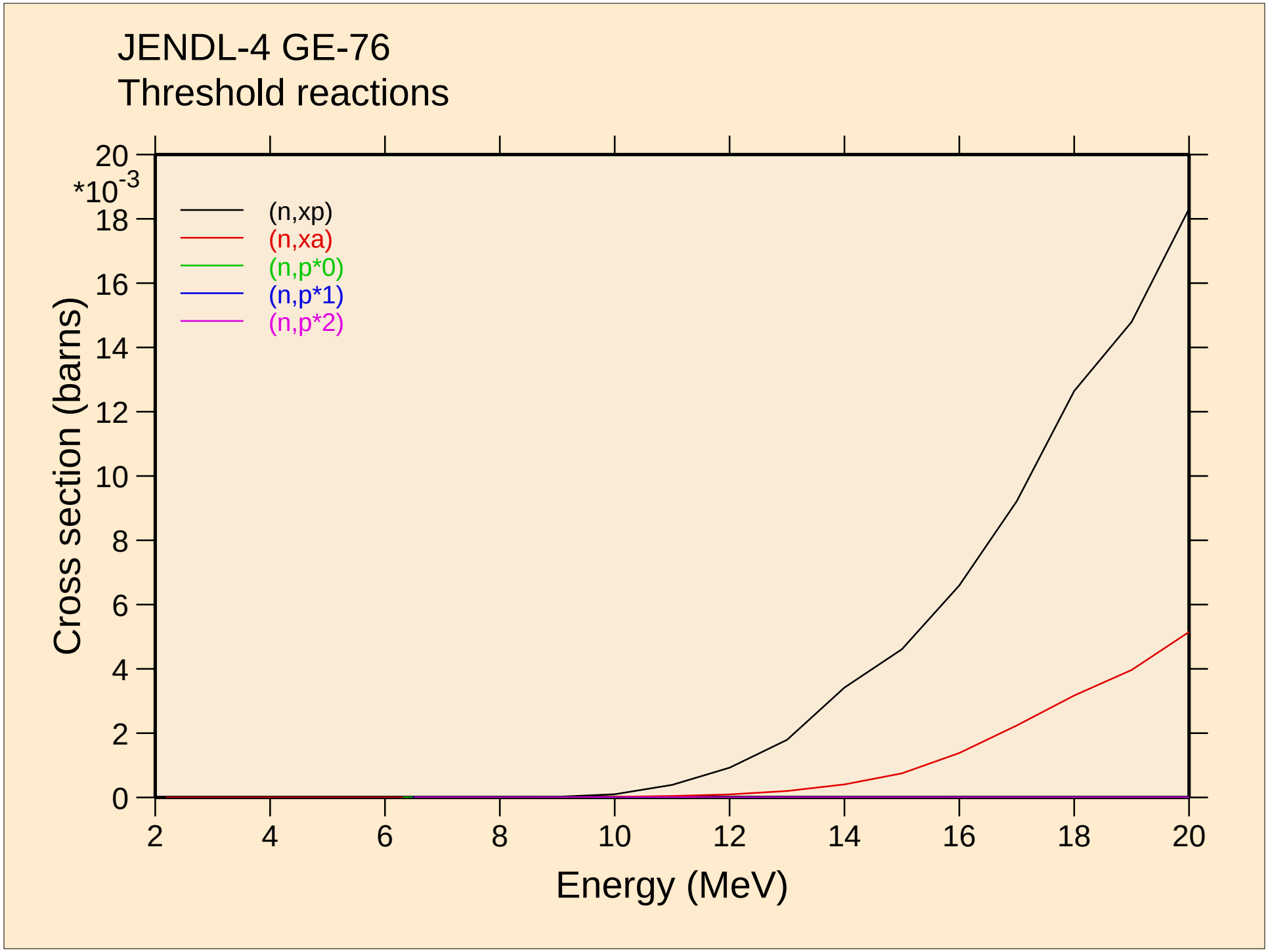

JENDL-4 GE-76
Inelastic levels
*10-3
35
30
25
20
15
10
5
0
Cross section (barns)
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*26)
(n,n*27)
(n,n*28)
(n,n*29)
(n,n*30)

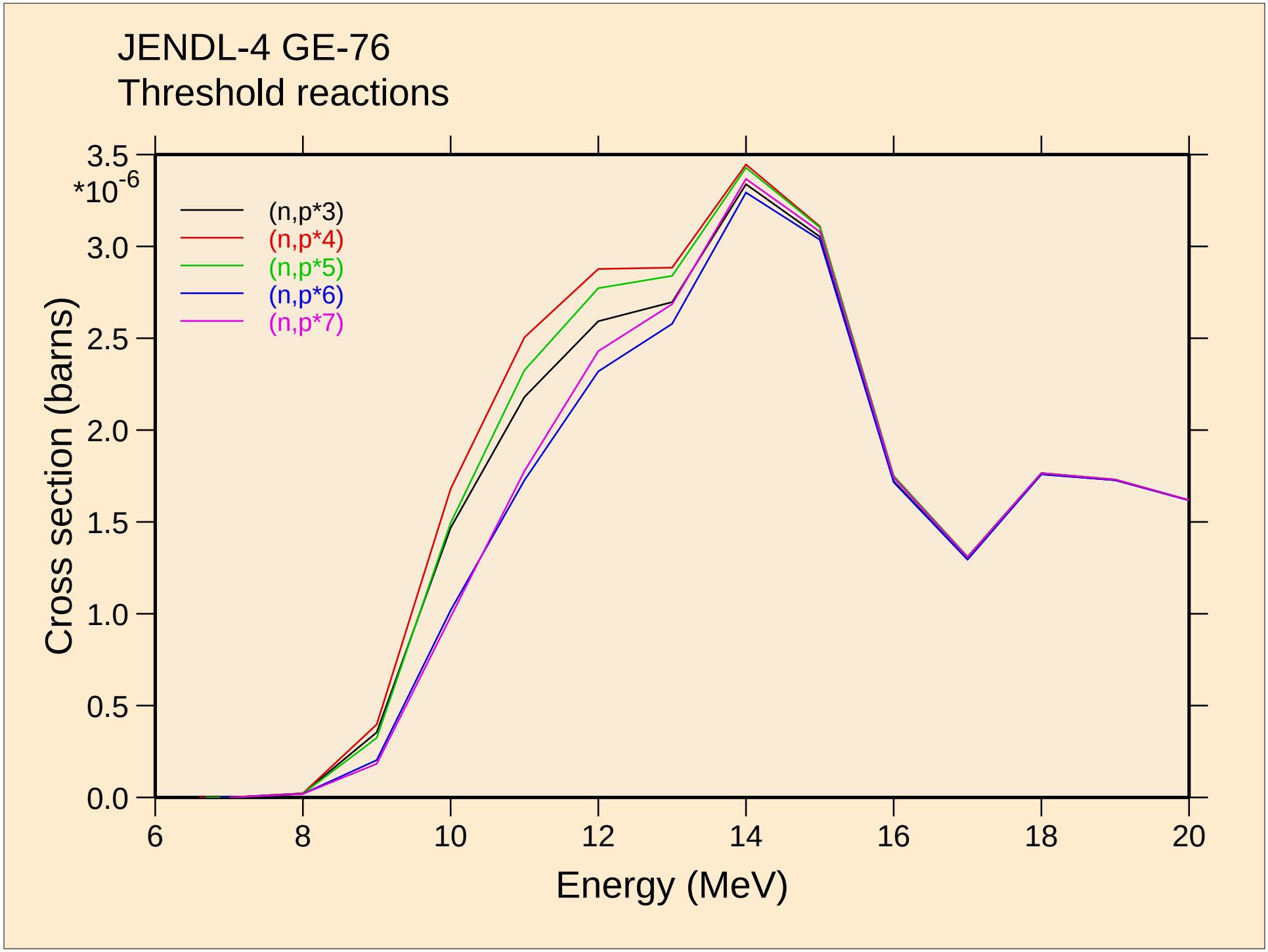

JENDL-4 GE-76
Inelastic levels
*10-3
30
25
20
15
10
5
0
Cross section (barns)
2
4
6
8
10
12
14
16
18
20
Energy (MeV)
(n,n*31)
(n,n*32)
(n,n*33)
(n,n*34)
(n,n*35)

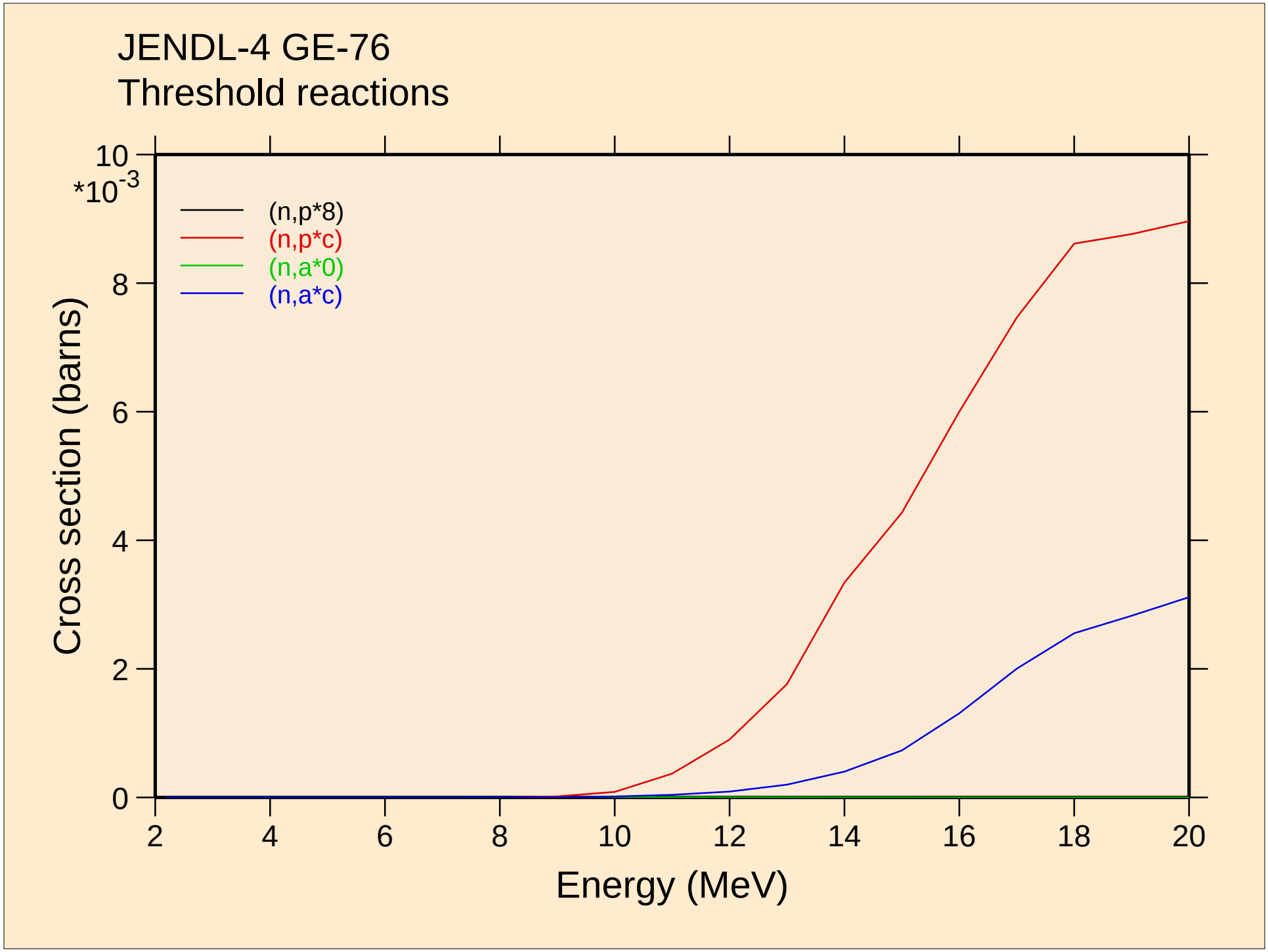

JENDL-4 GE-76
Inelastic levels
*10-3
Cross section (barns)
Energy (MeV)
(n,n*36)
(n,n*37)
(n,n*38)
(n,n*39)
0
2
4
6
8
10
12
14
16
18
20

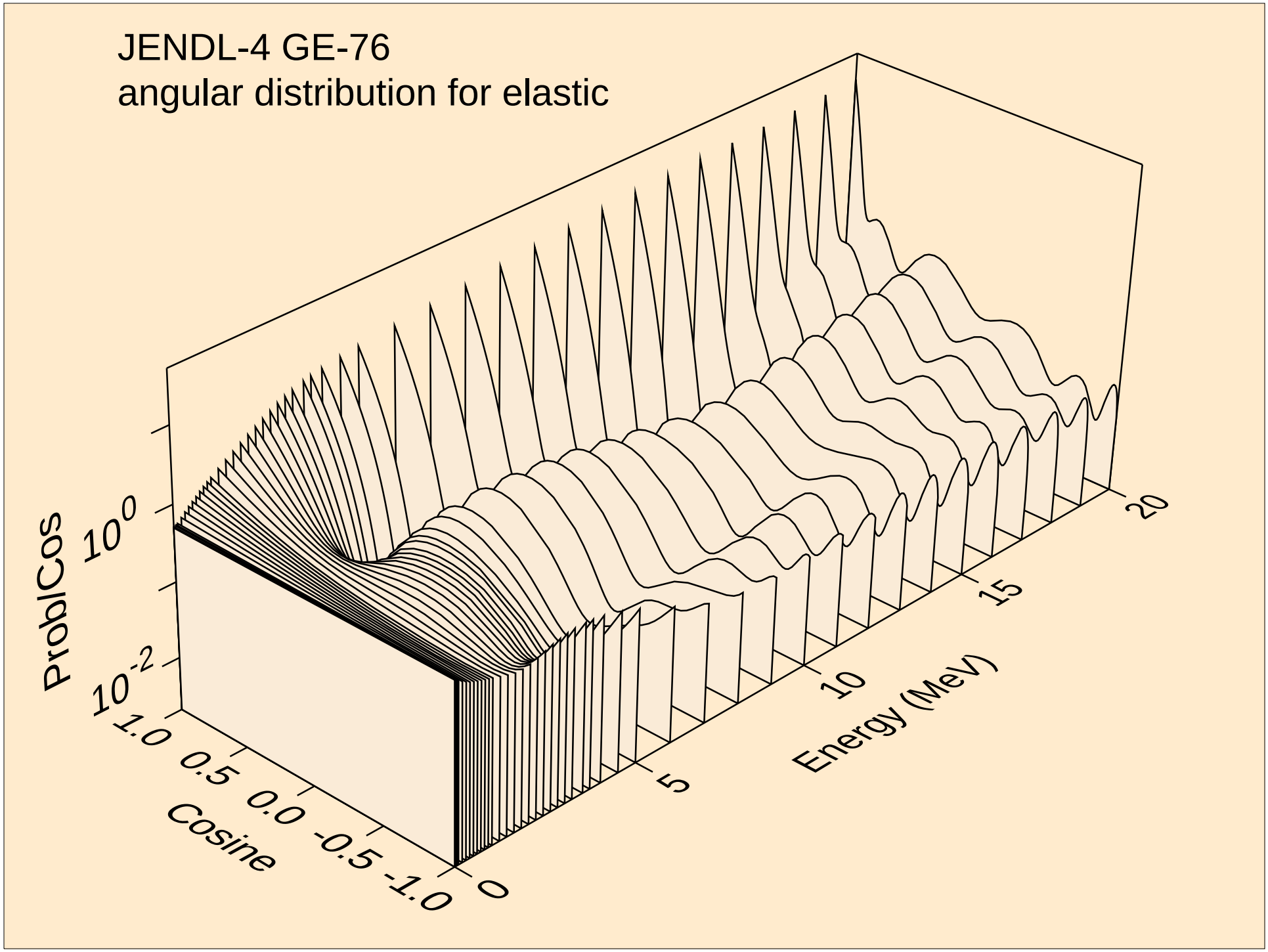

JENDL-4 GE-76
Threshold reactions
(n,2n)
(n,3n)
(n,n*)a
(n,2n)a
(n,n*)p
Cross section (barns)
Energy (MeV)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
6
8
10
12
14
16
18
20

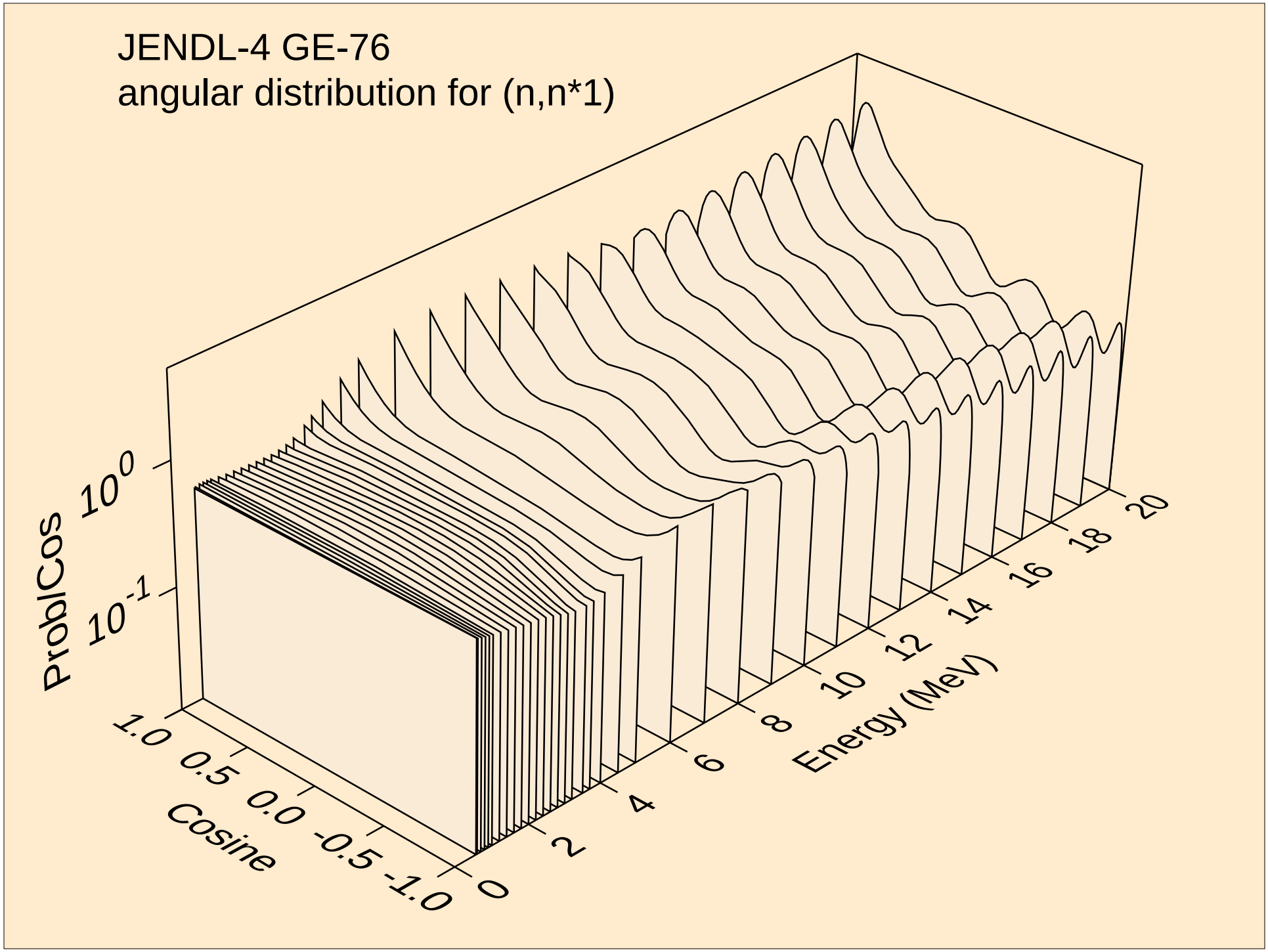

JENDL-4 GE-76
Threshold reactions
(n,n*c)
(n,p)
(n,a)
(n,pa)
Cross section (barns)
Energy (MeV)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
2
4
6
8
10
12
14
16
18
20

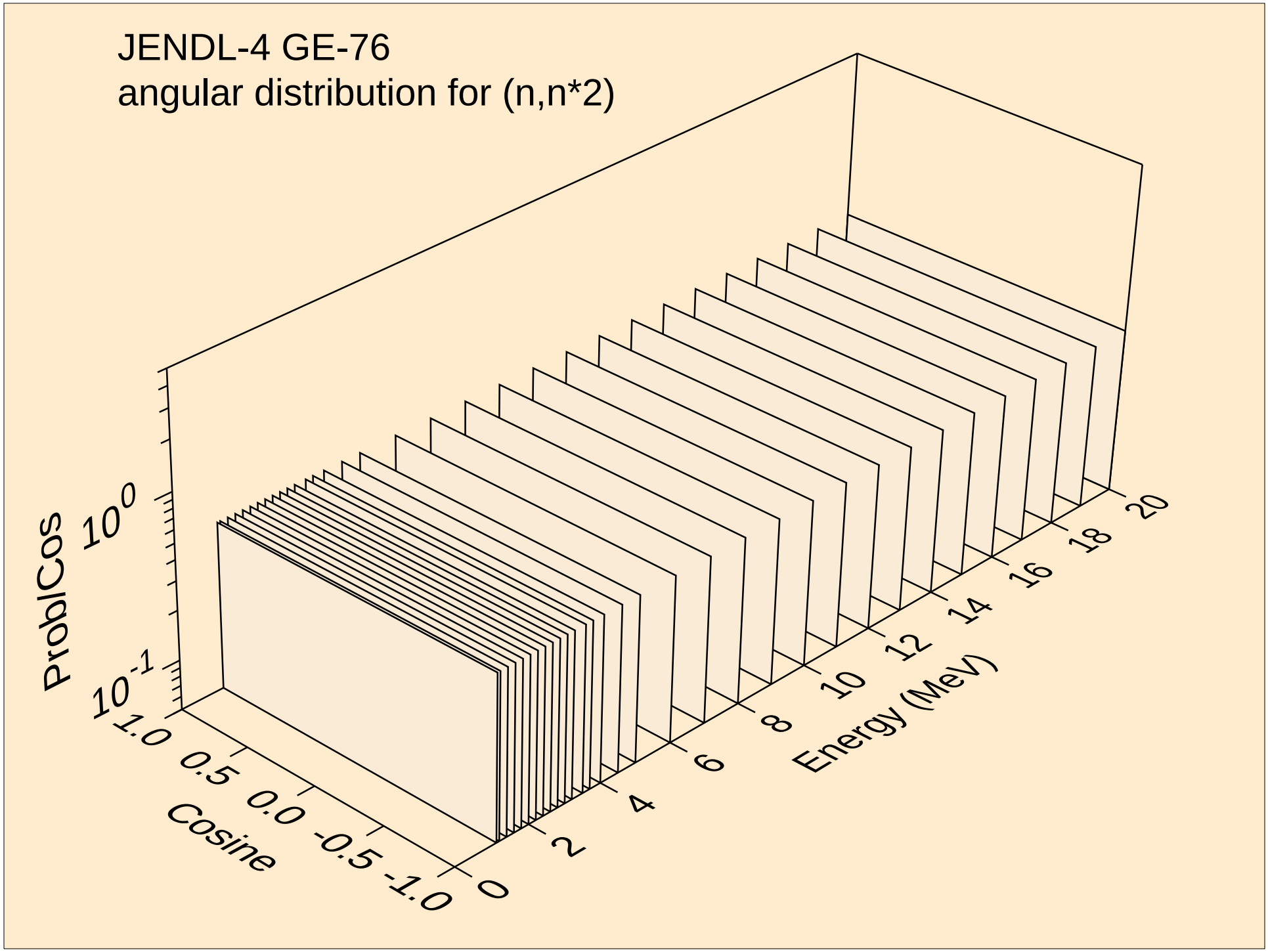

JENDL-4 GE-76
Threshold reactions
*10-3
(n,xp)
(n,xa)
(n,p*0)
(n,p*1)
(n,p*2)
Cross section (barns)
Energy (MeV)
0
2
4
6
8
10
12
14
16
18
20

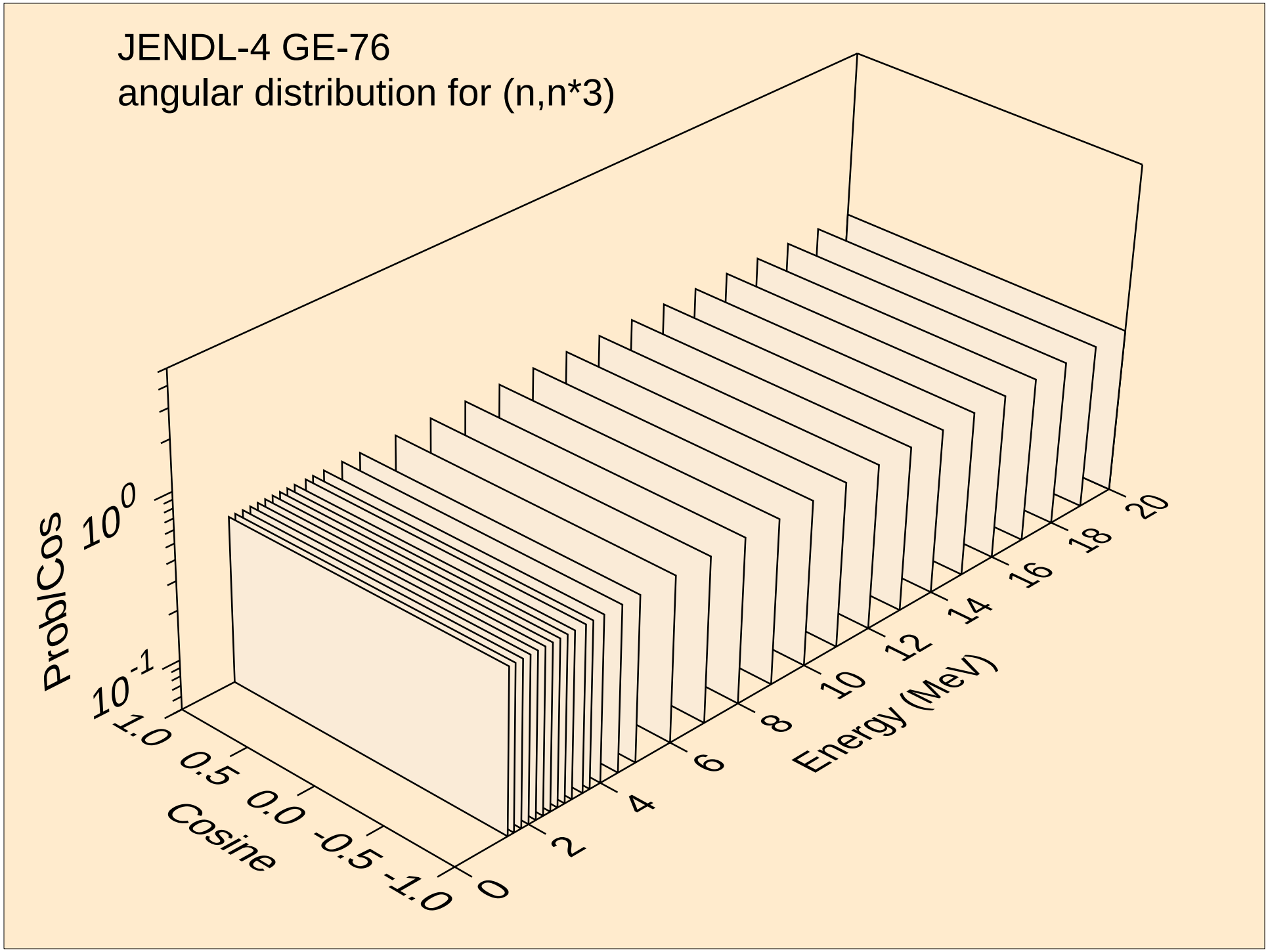

JENDL-4 GE-76
Threshold reactions
(n,p*3)
(n,p*4)
(n,p*5)
(n,p*6)
(n,p*7)
*10-6
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Cross section (barns)
6
8
10
12
14
16
18
20
Energy (MeV)

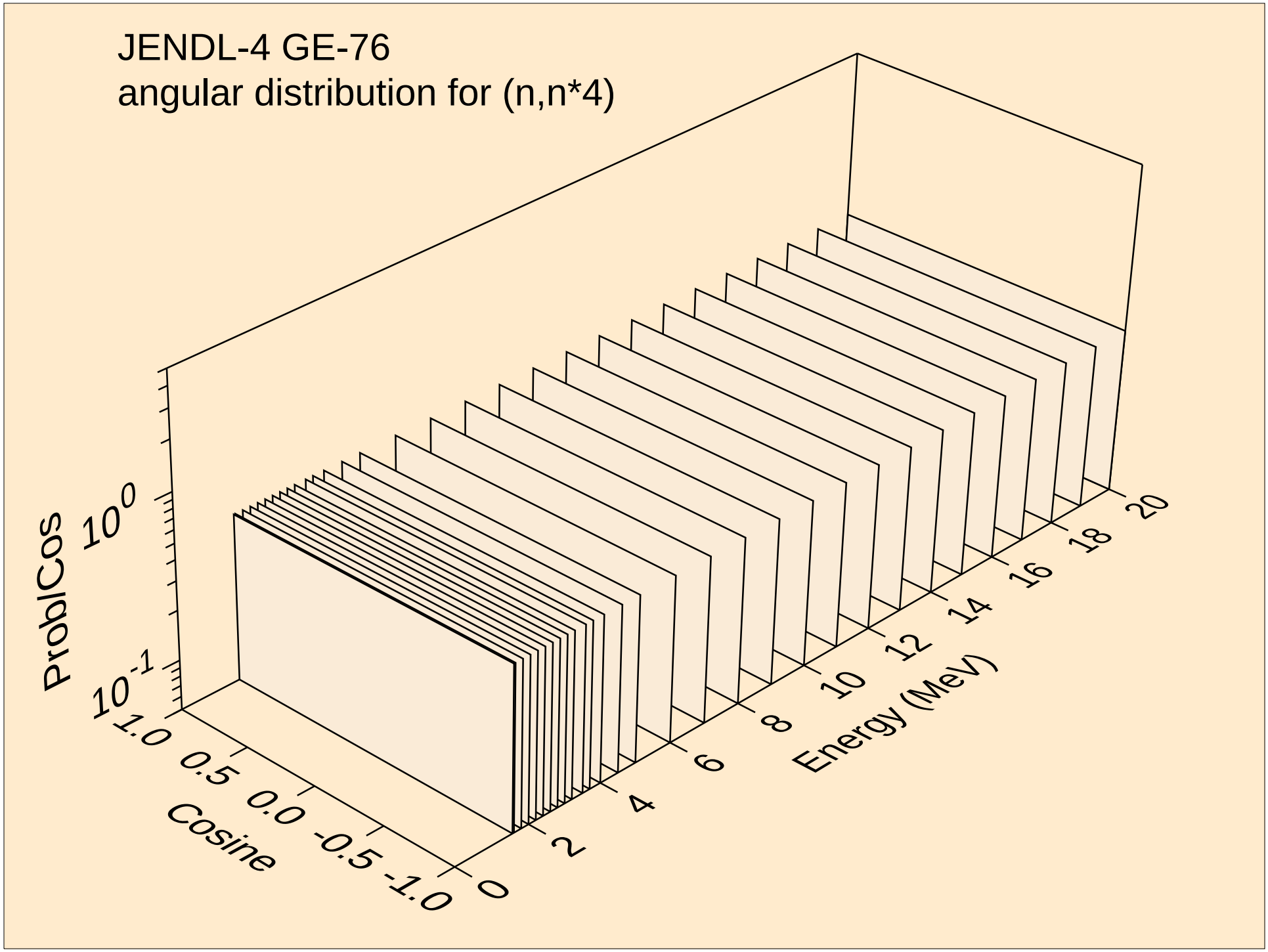

JENDL-4 GE-76
Threshold reactions
(n,p*8)
(n,p*c)
(n,a*0)
(n,a*c)
Cross section (barns)
*10-3
10
8
6
4
2
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

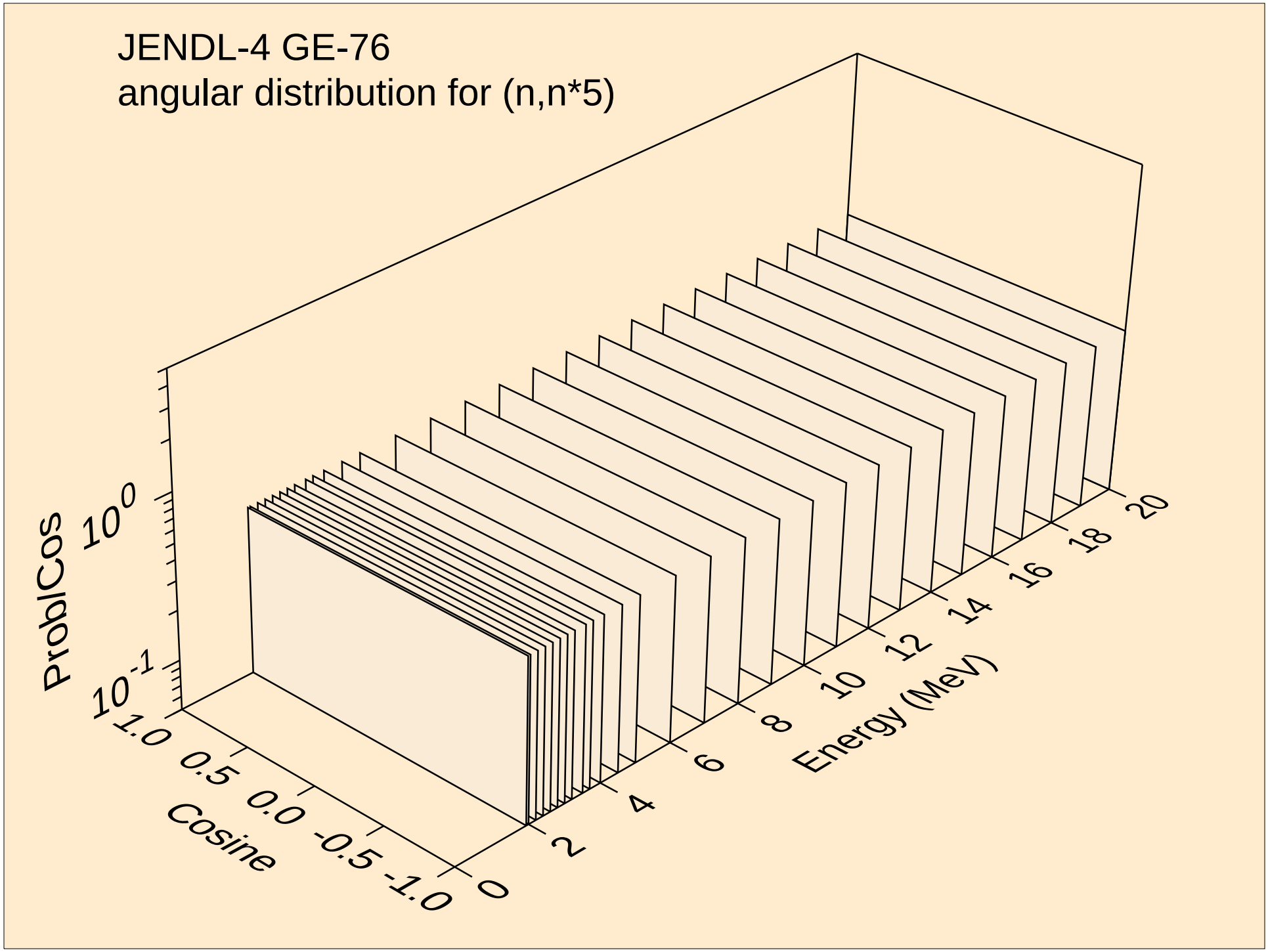

JENDL-4 GE-76
angular distribution for elastic
ProblCos
10^0
10^{-2}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
5
10
15
20
Energy (MeV)

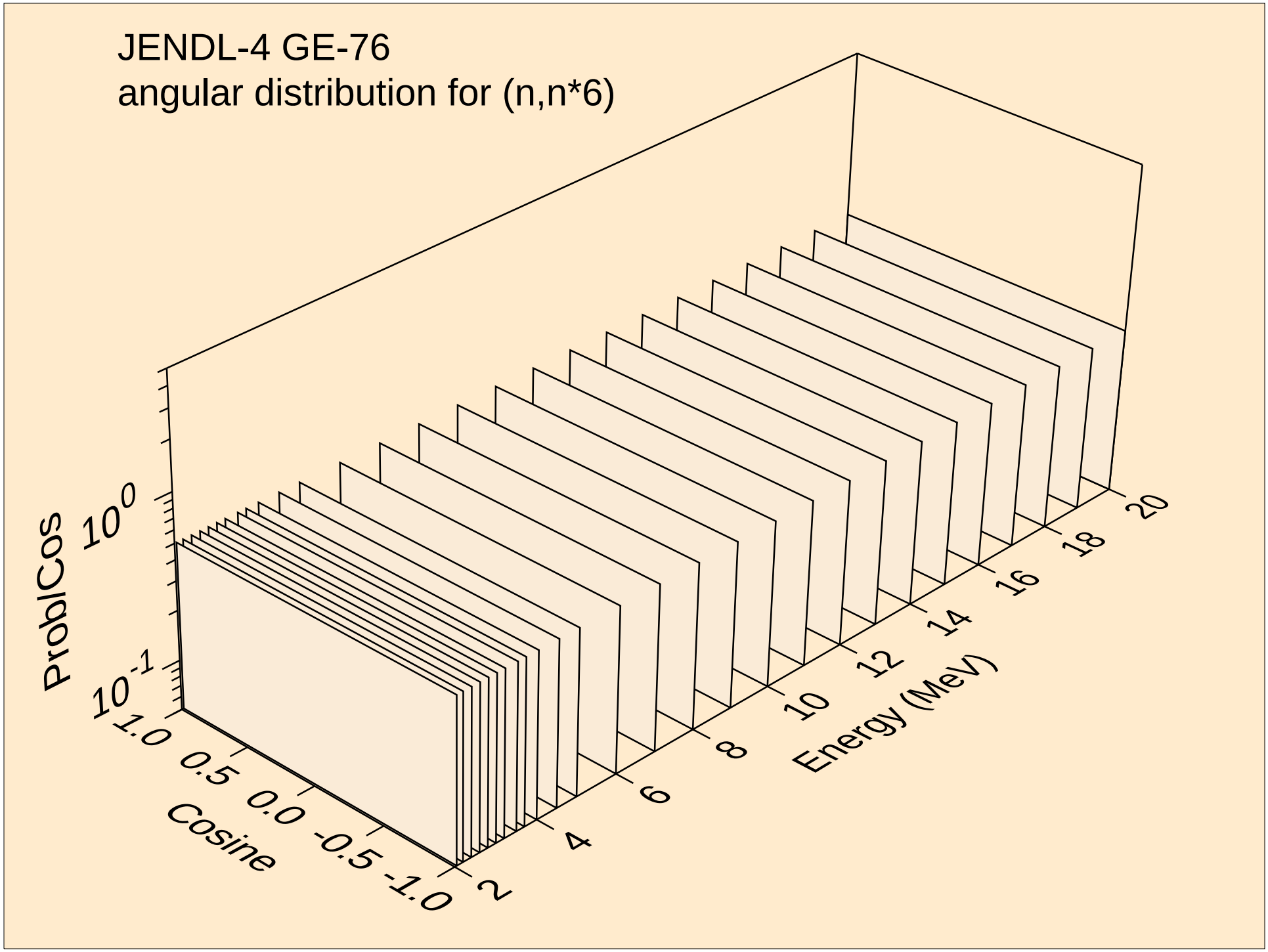

JENDL-4 GE-76
angular distribution for (n,n*1)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

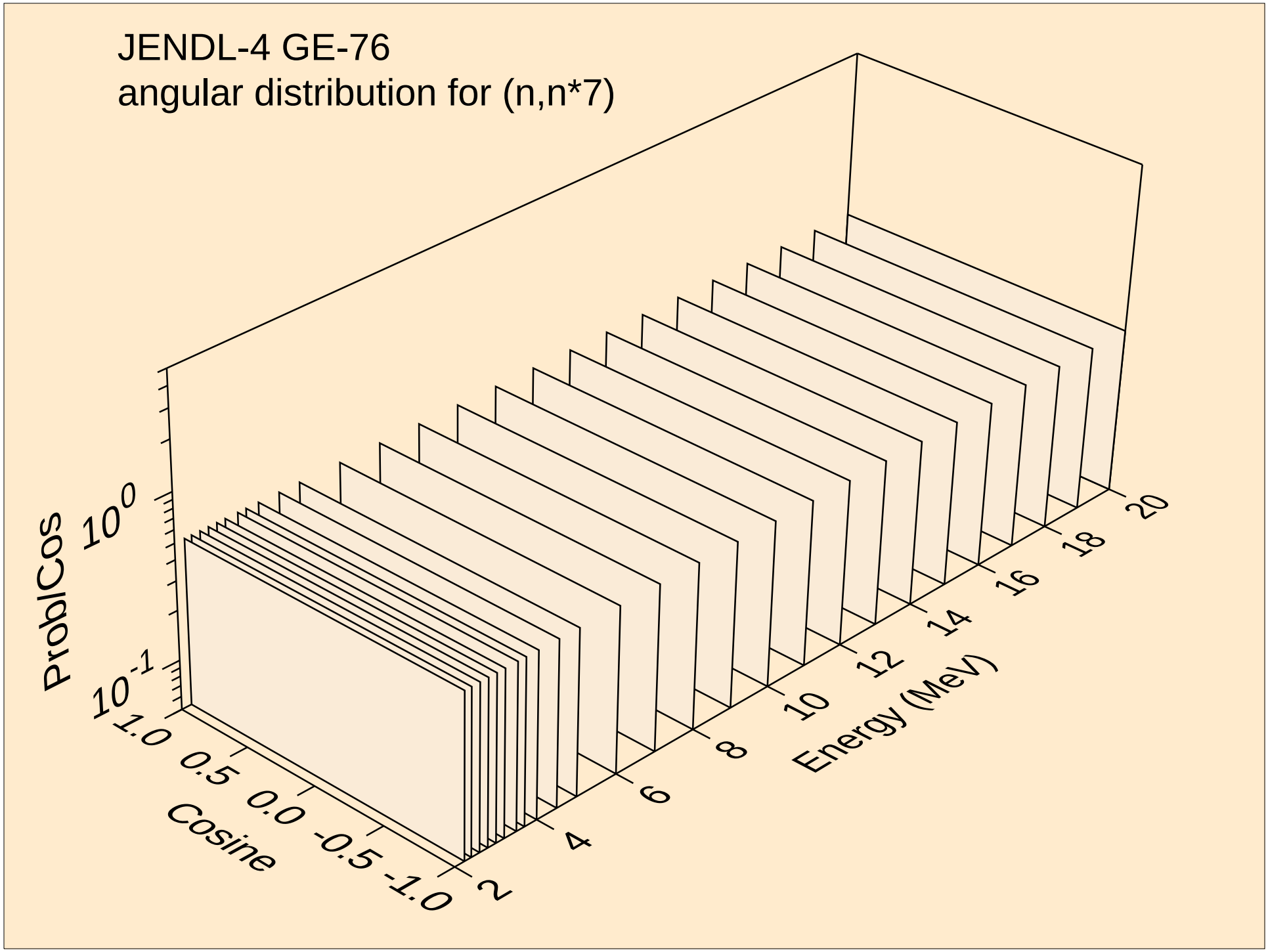

JENDL-4 GE-76
angular distribution for (n,n*2)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

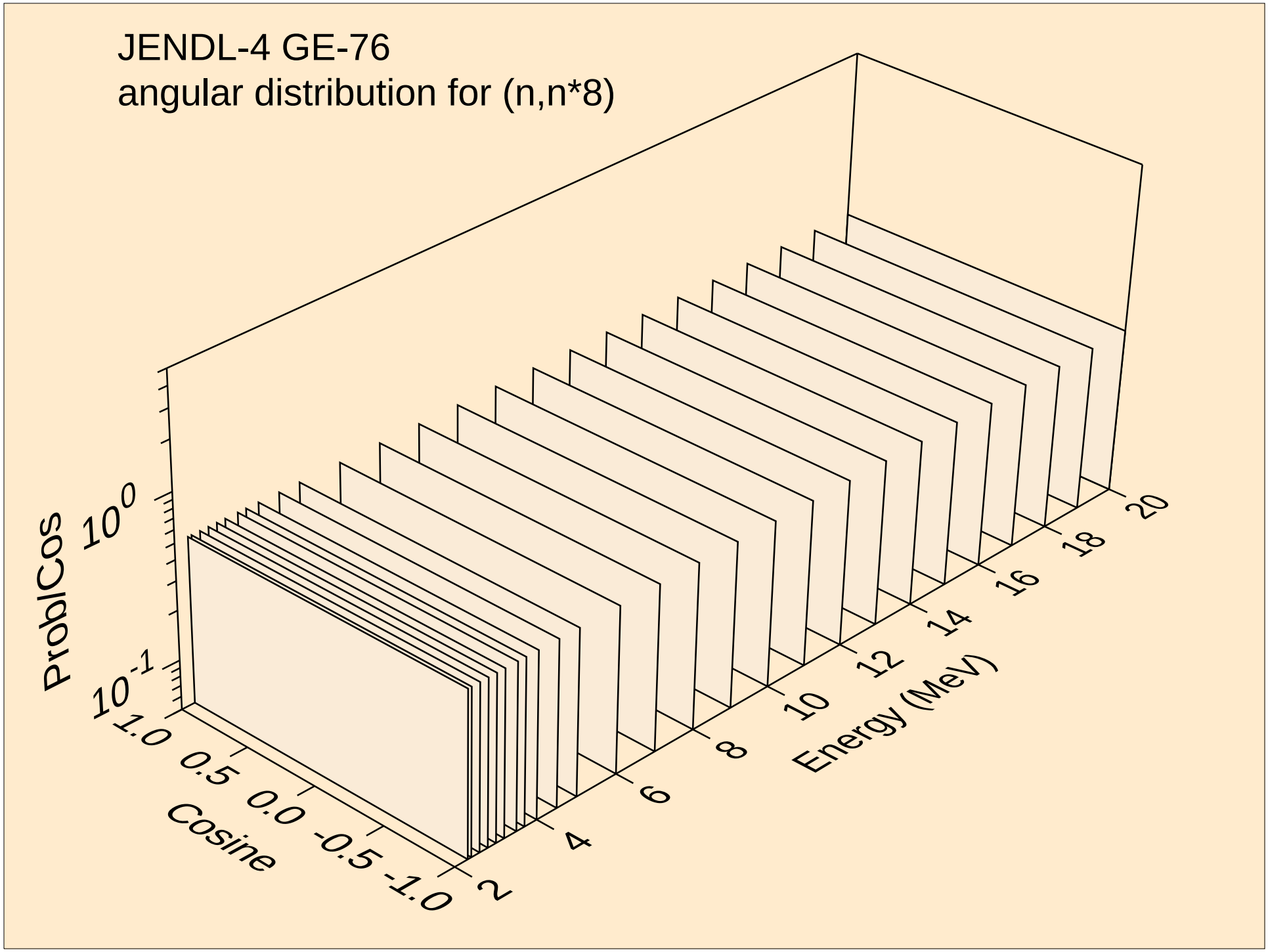

JENDL-4 GE-76
angular distribution for (n,n*3)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

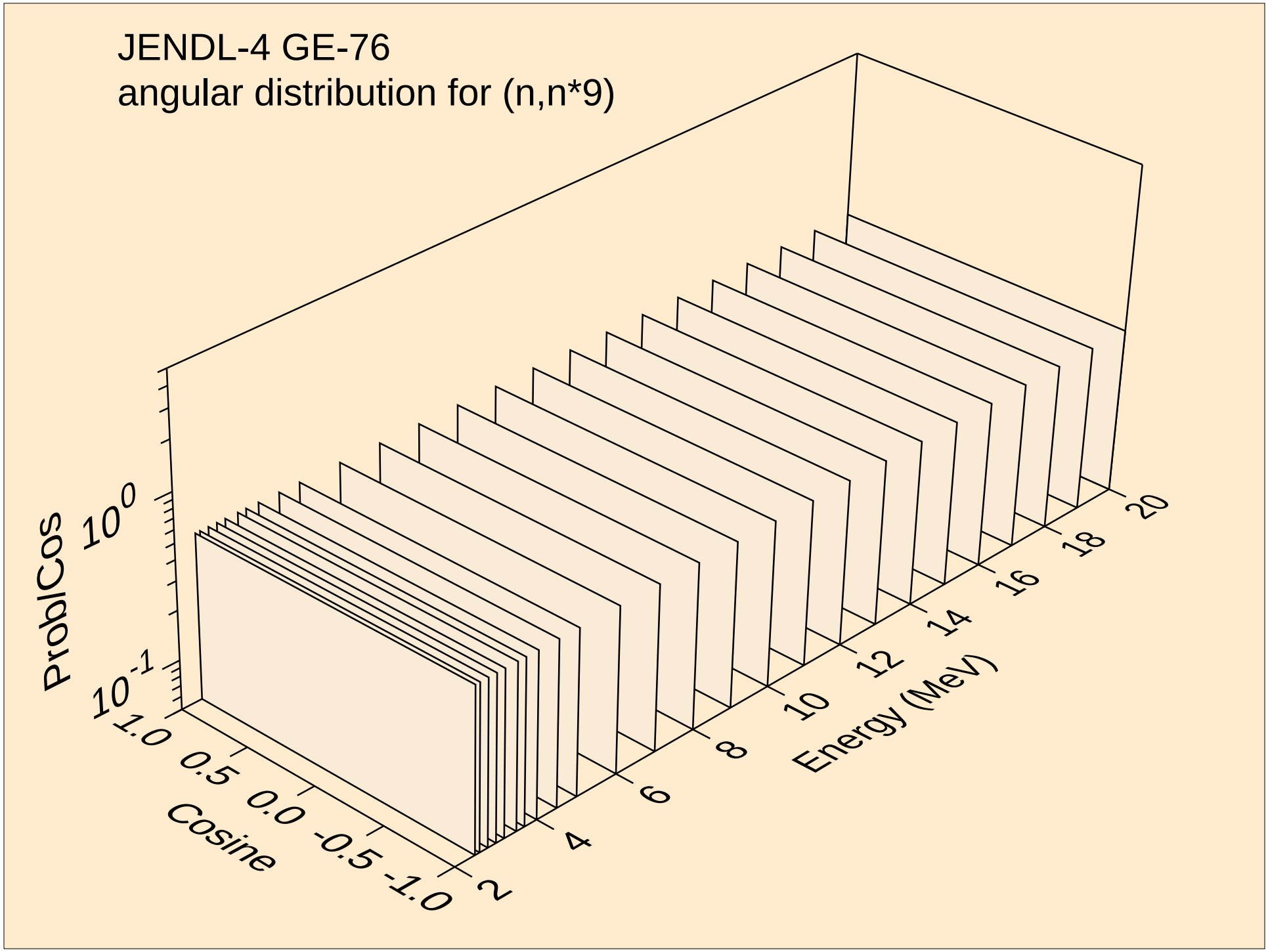

JENDL-4 GE-76
angular distribution for (n,n*4)
ProblCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

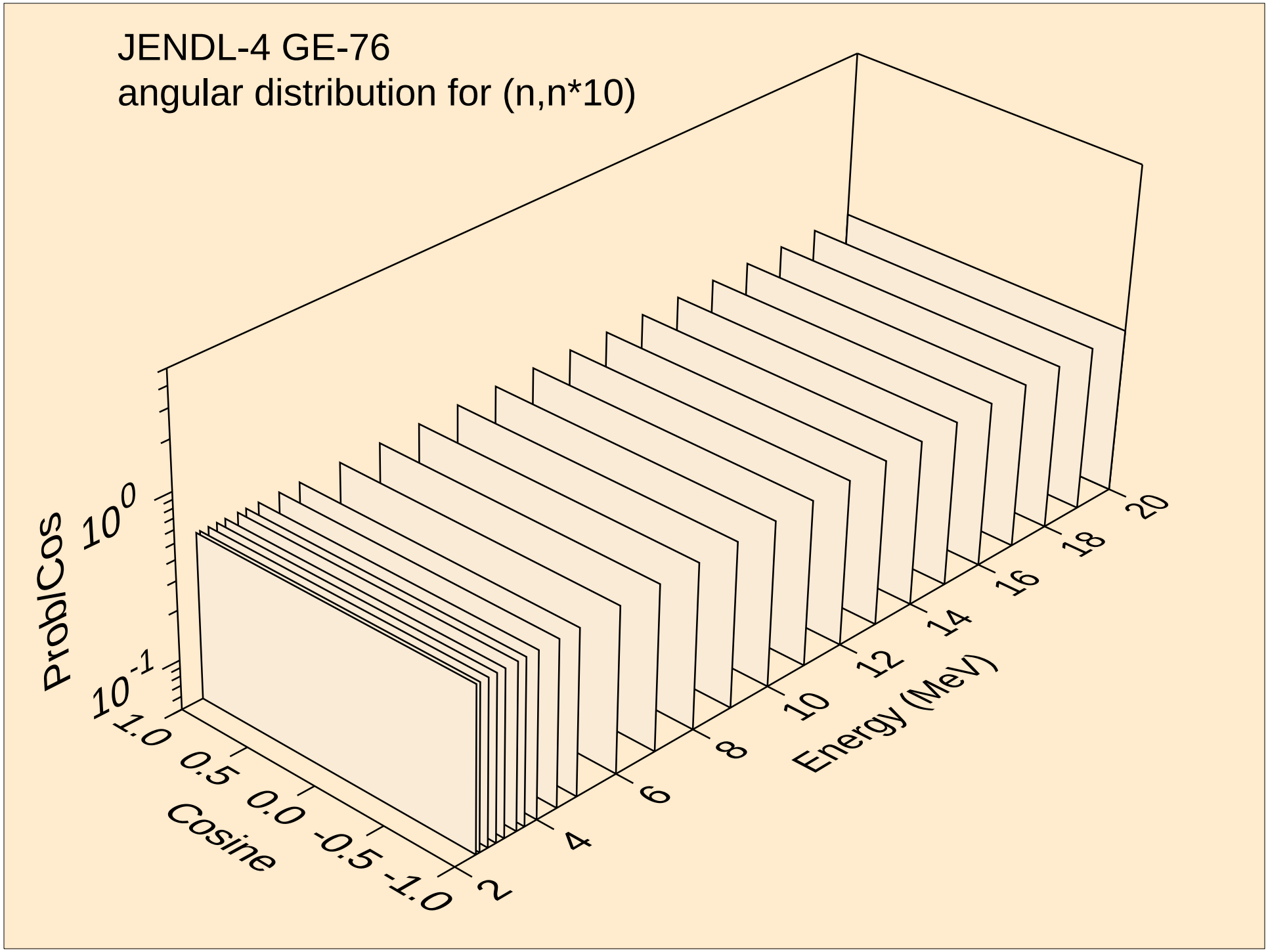

JENDL-4 GE-76
angular distribution for (n,n*5)
ProblCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

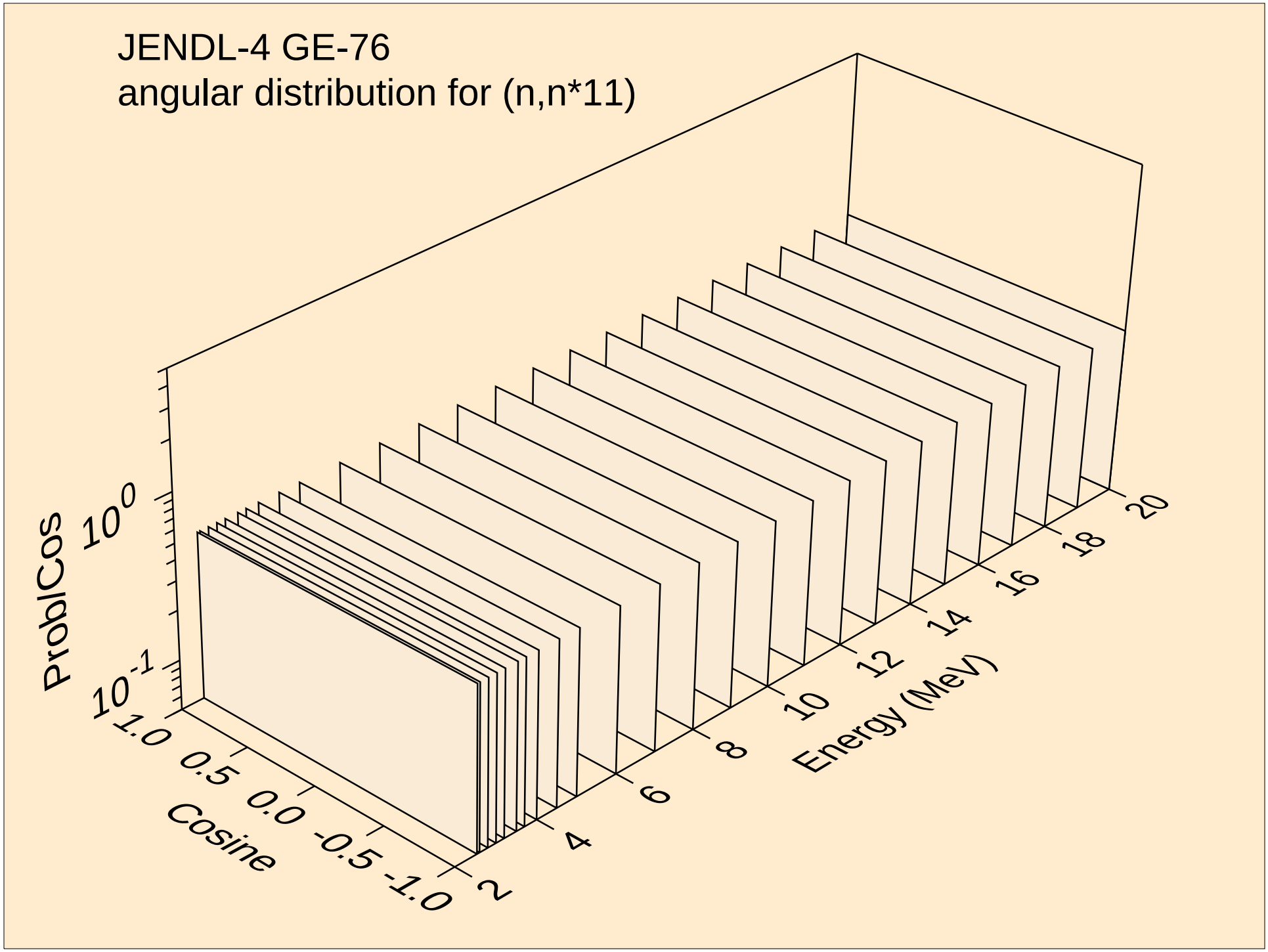

JENDL-4 GE-76
angular distribution for (n,n*6)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

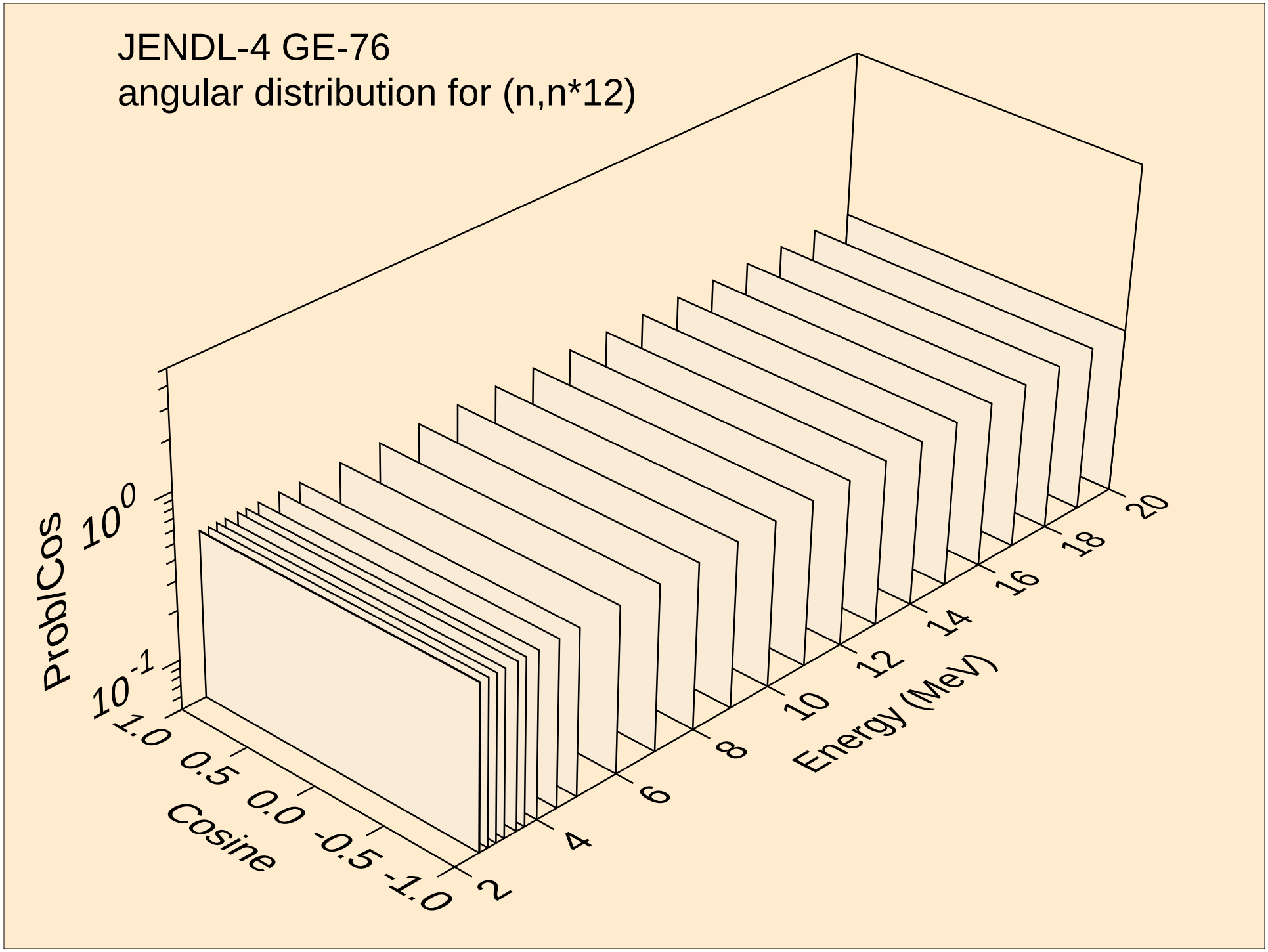

JENDL-4 GE-76
angular distribution for (n,n*7)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

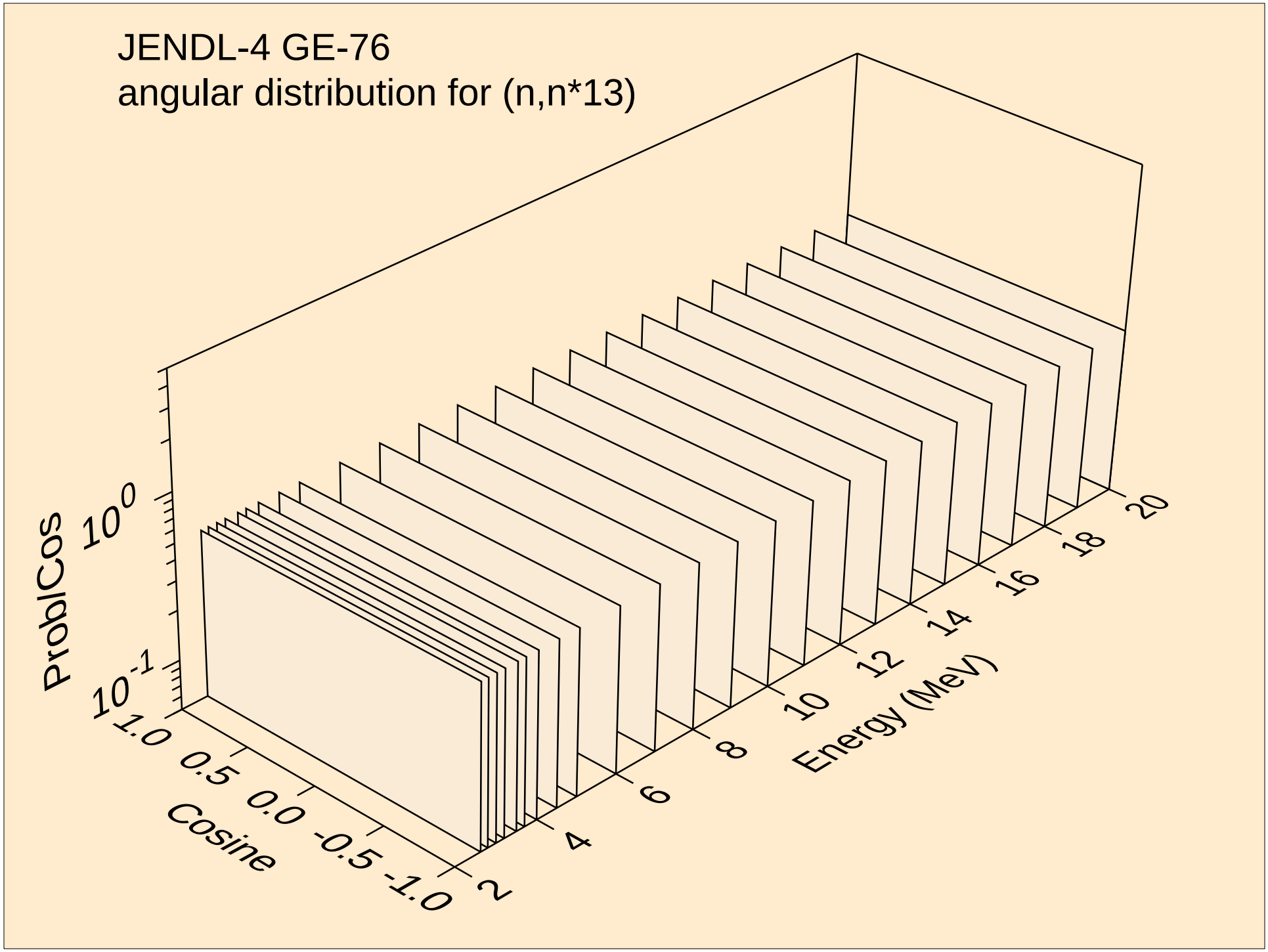

JENDL-4 GE-76
angular distribution for (n,n*8)
ProbCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

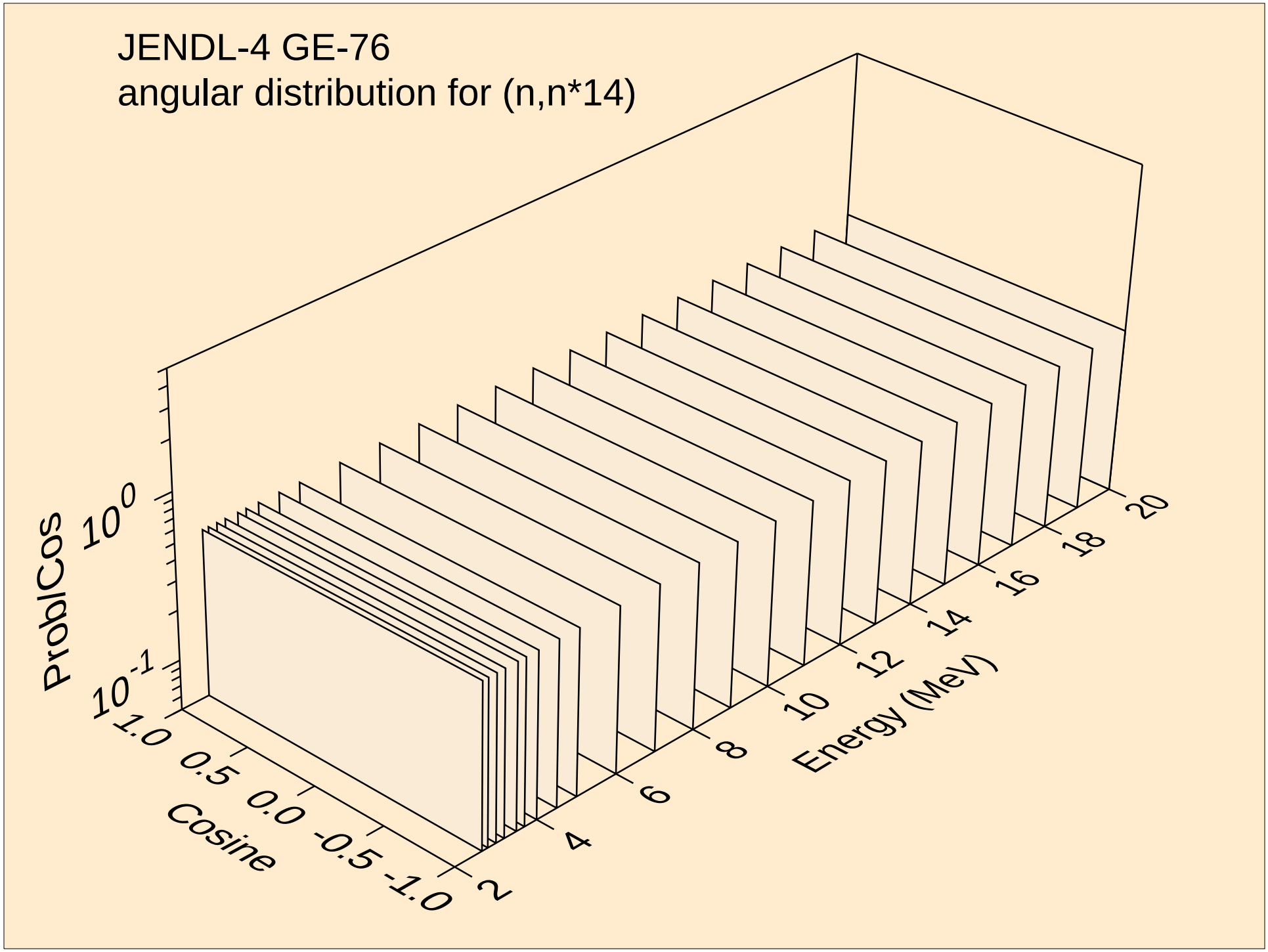

JENDL-4 GE-76
angular distribution for (n,n*9)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

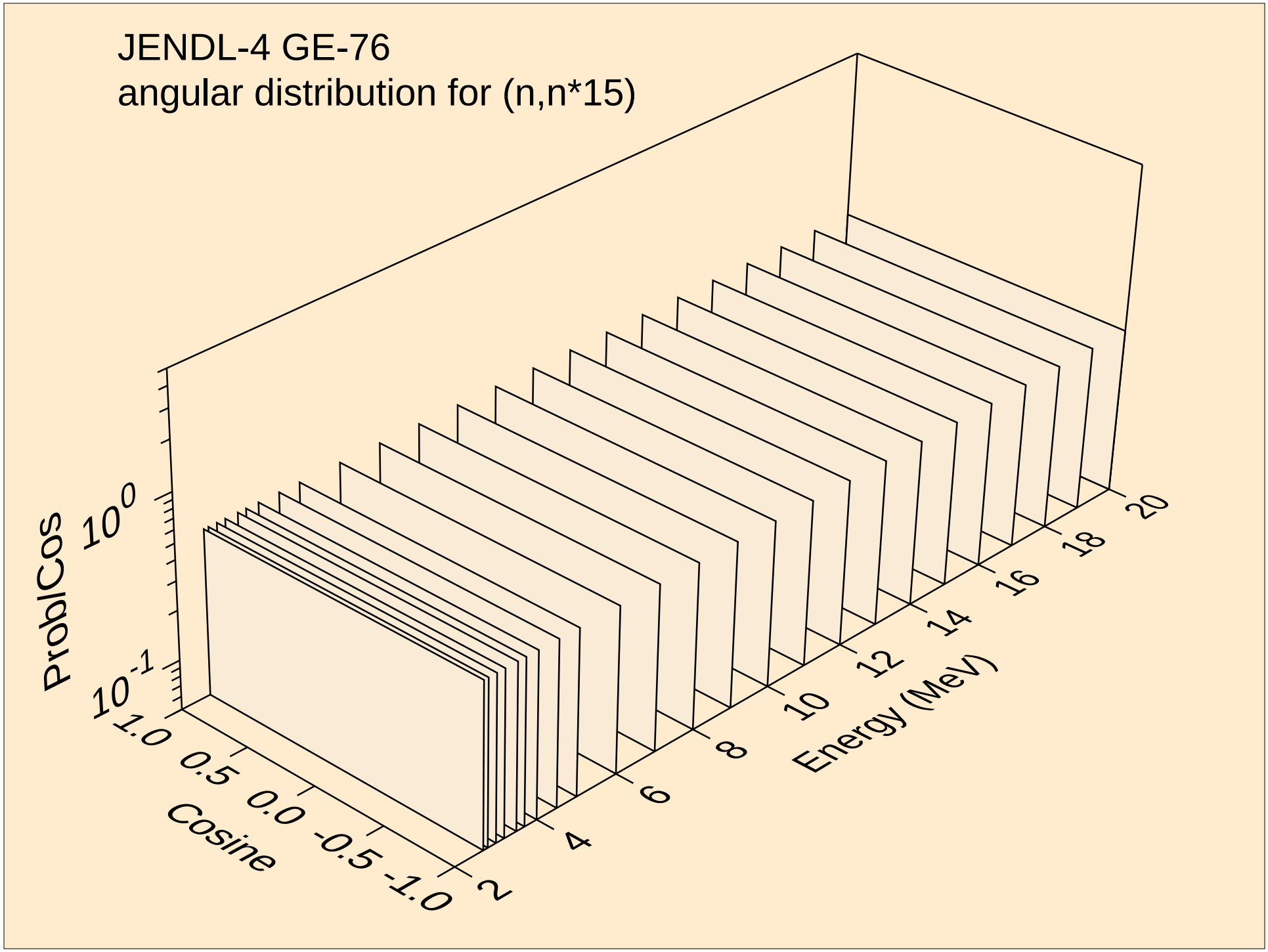

JENDL-4 GE-76
angular distribution for (n,n*10)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

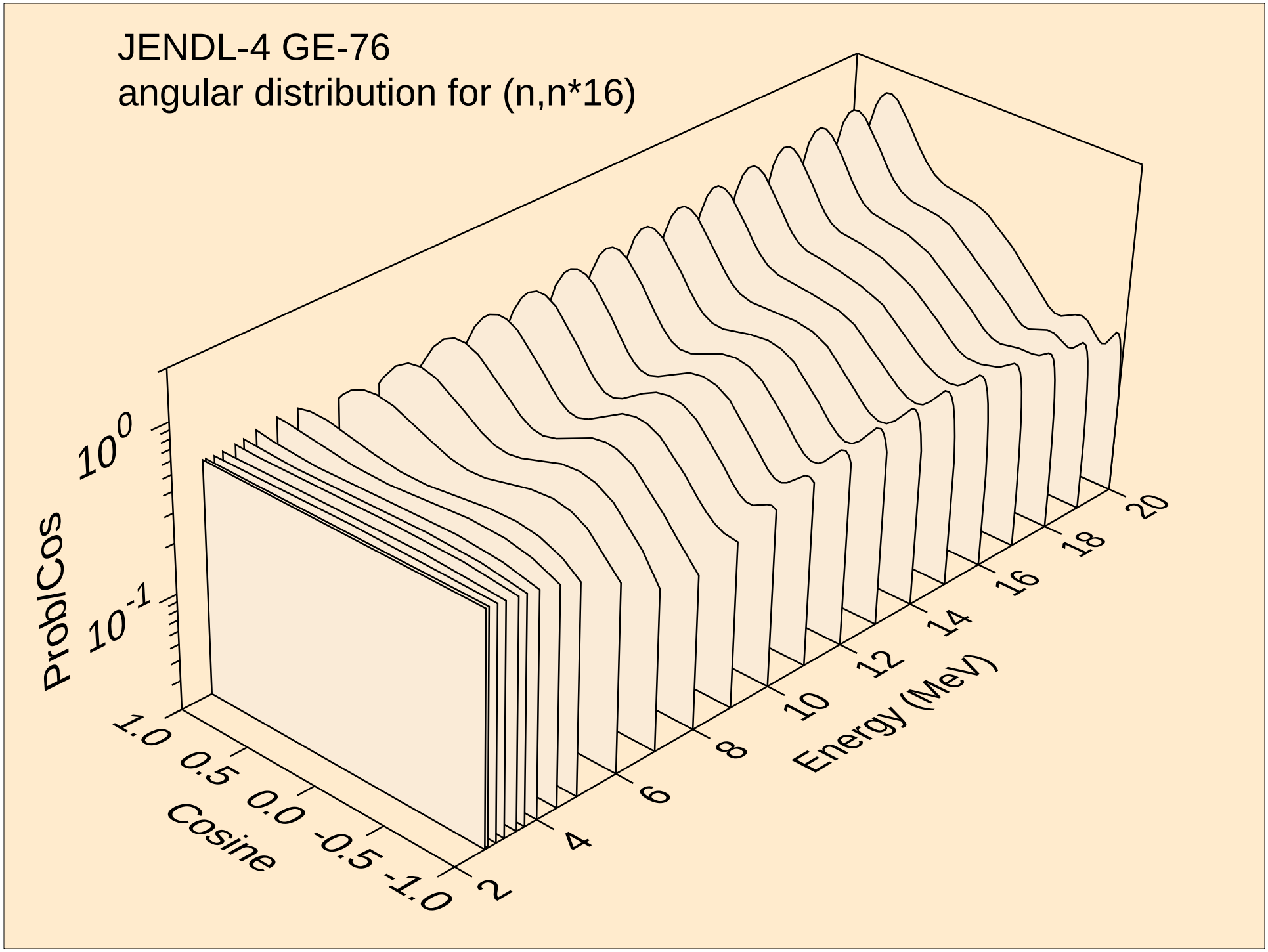

JENDL-4 GE-76
angular distribution for (n,n*11)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

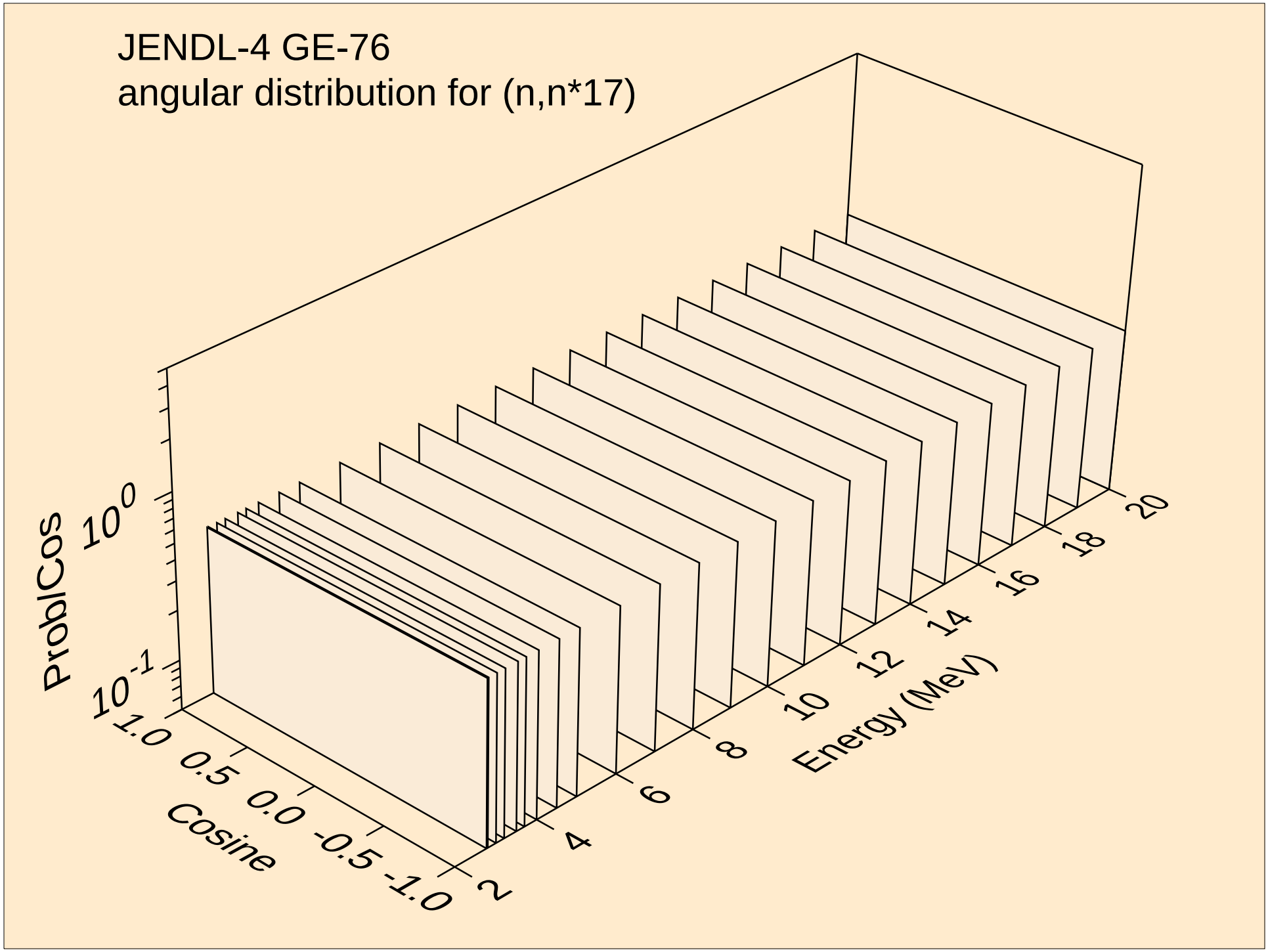

JENDL-4 GE-76
angular distribution for (n,n*12)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

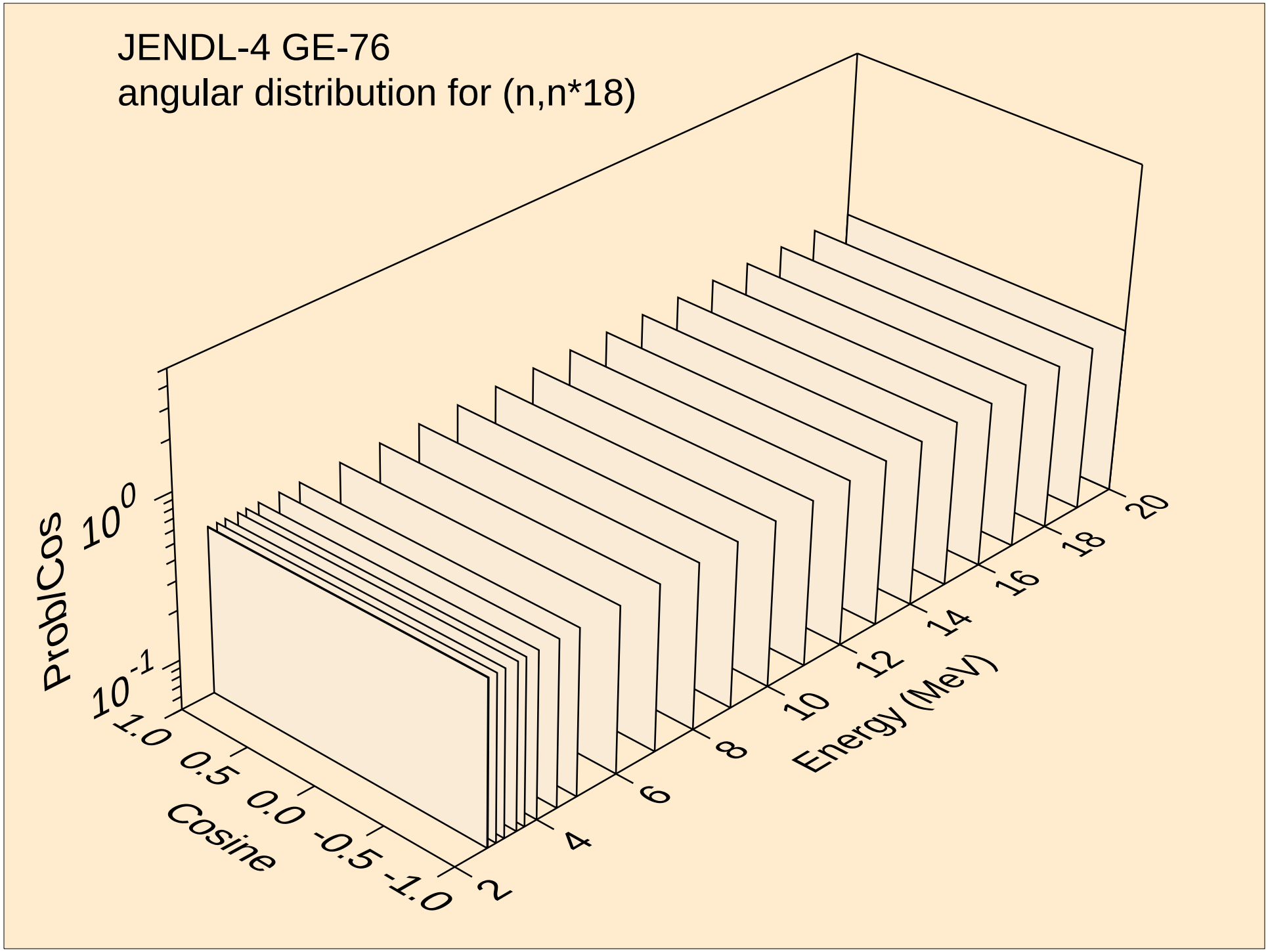

JENDL-4 GE-76
angular distribution for (n,n*13)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

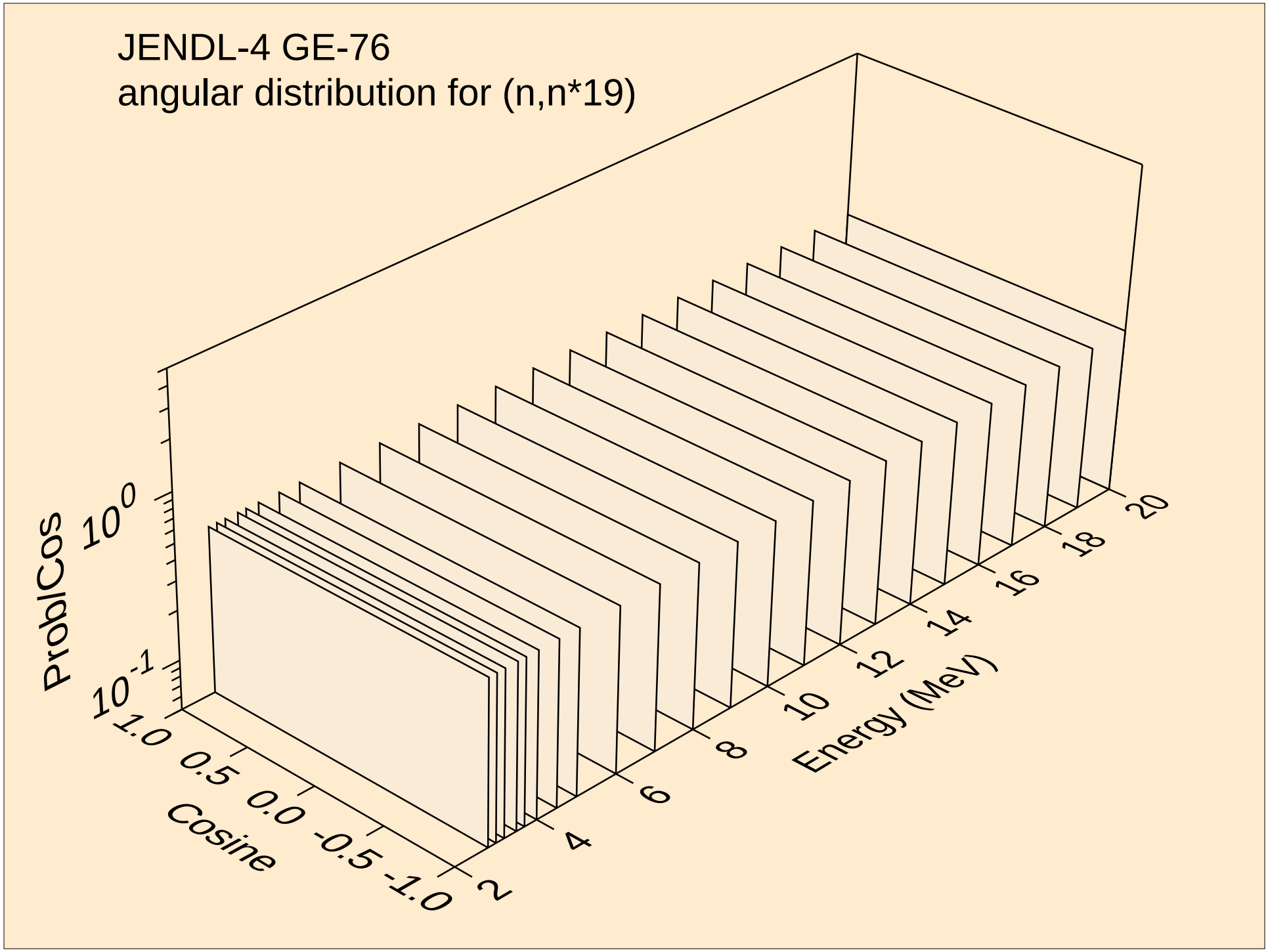

JENDL-4 GE-76
angular distribution for (n,n*14)
ProbCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

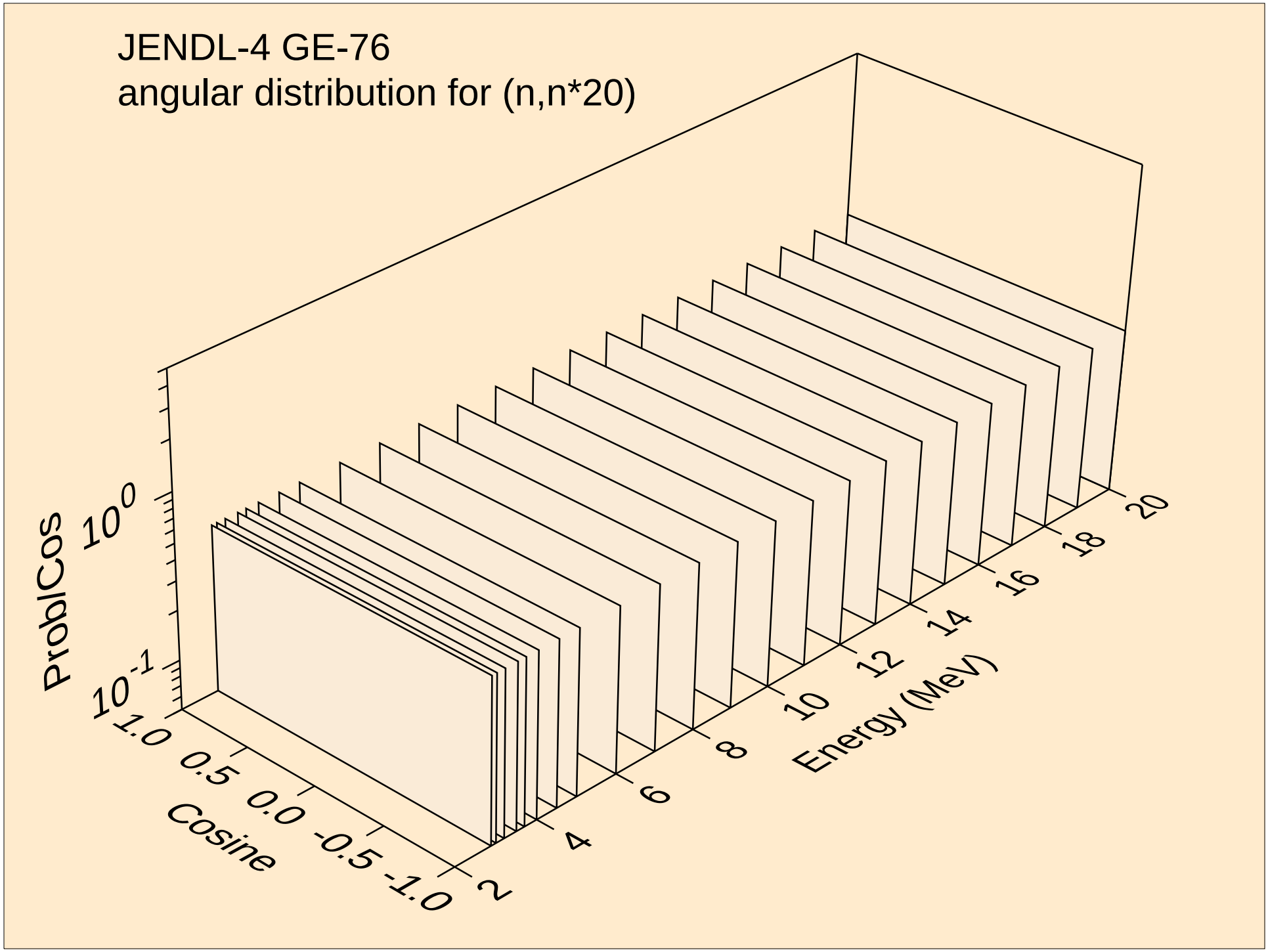

JENDL-4 GE-76
angular distribution for (n,n*15)
ProbCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

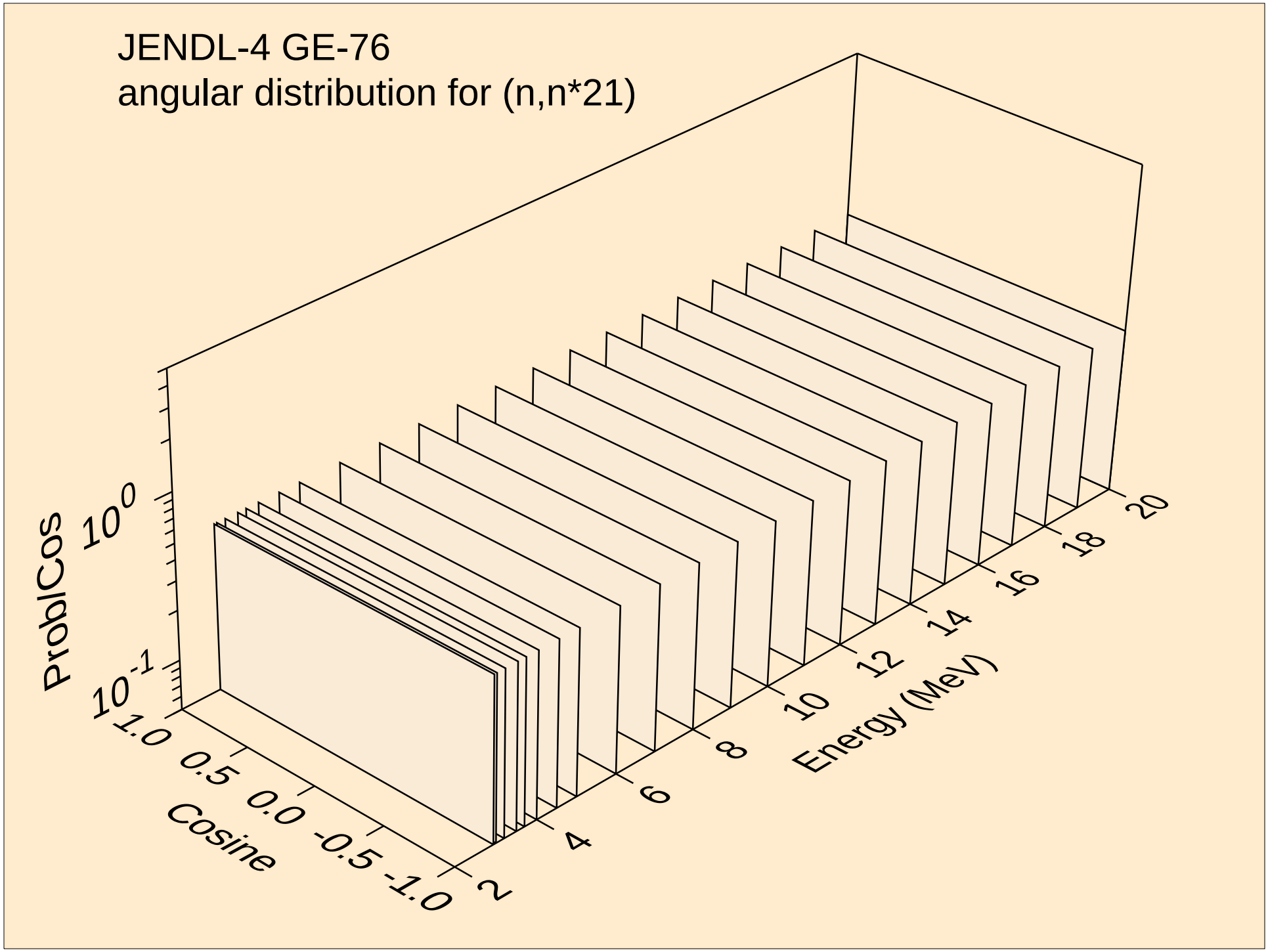

JENDL-4 GE-76
angular distribution for (n,n*16)
ProbCos
10^0
10^{-1}
Cosine
1.0
0.5
0.0
-0.5
-1.0
Energy (MeV)
2
4
6
8
10
12
14
16
18
20

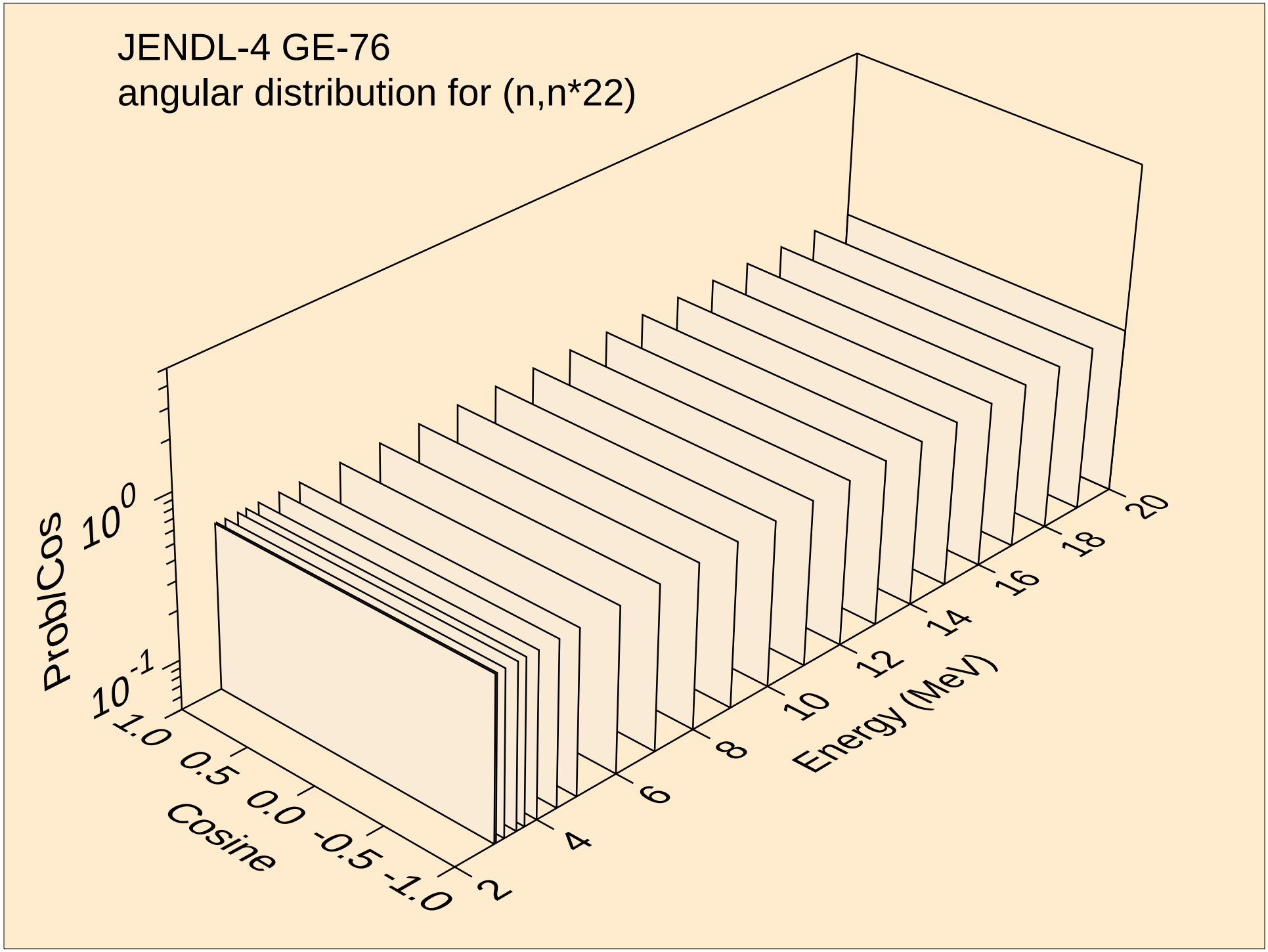

JENDL-4 GE-76
angular distribution for (n,n*17)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

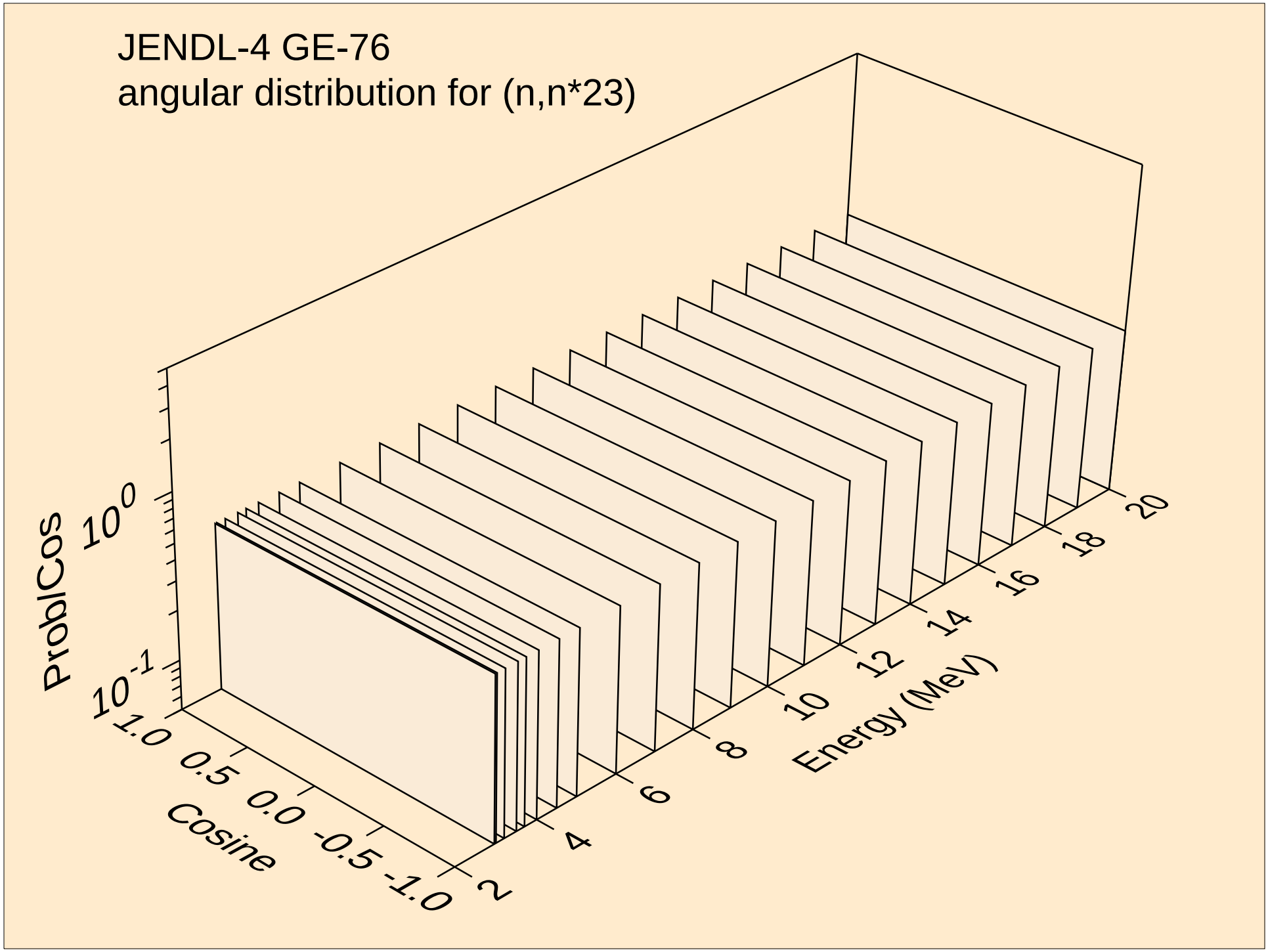

JENDL-4 GE-76
angular distribution for (n,n*18)
ProbCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

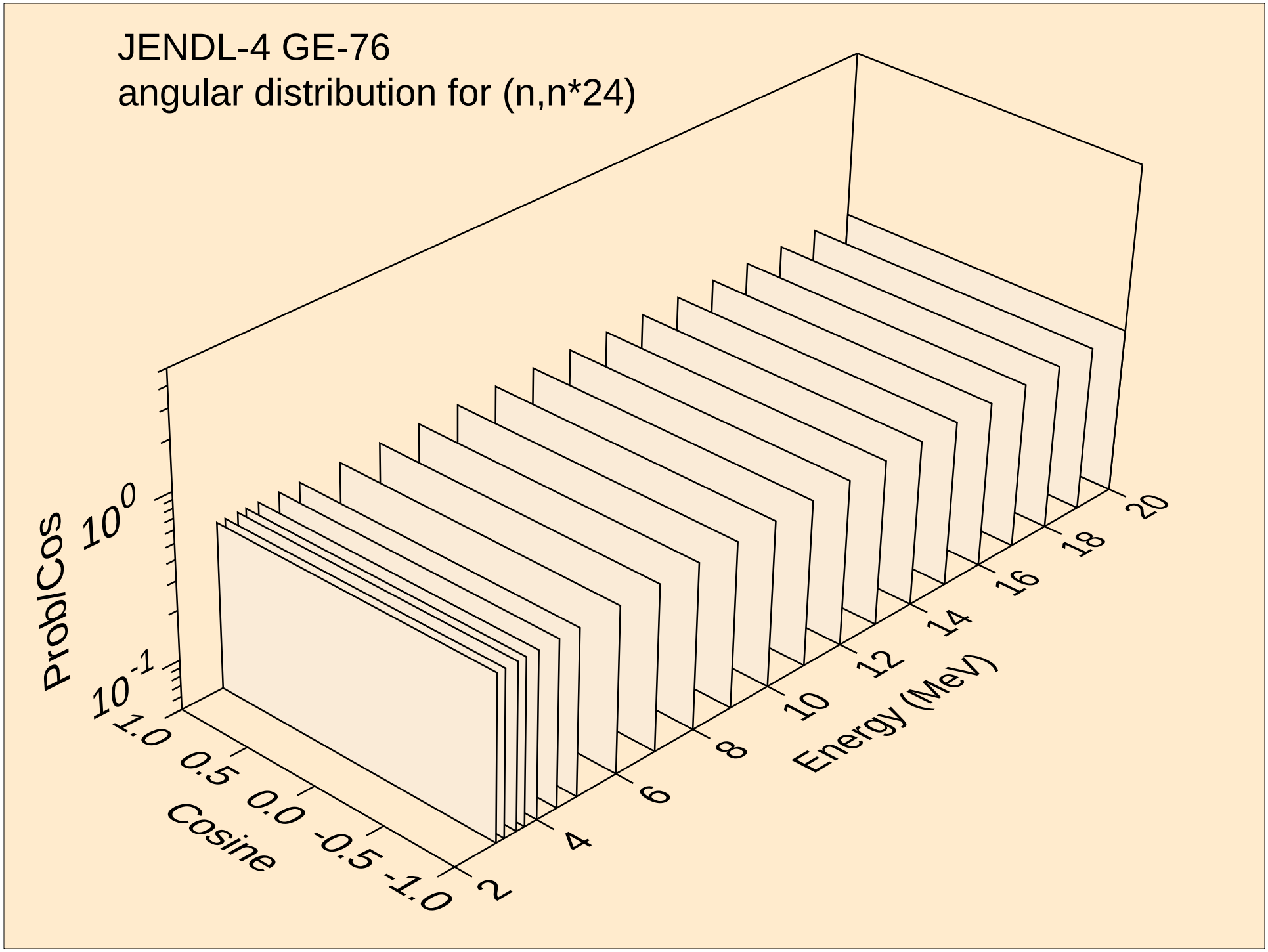

JENDL-4 GE-76
angular distribution for (n,n*19)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

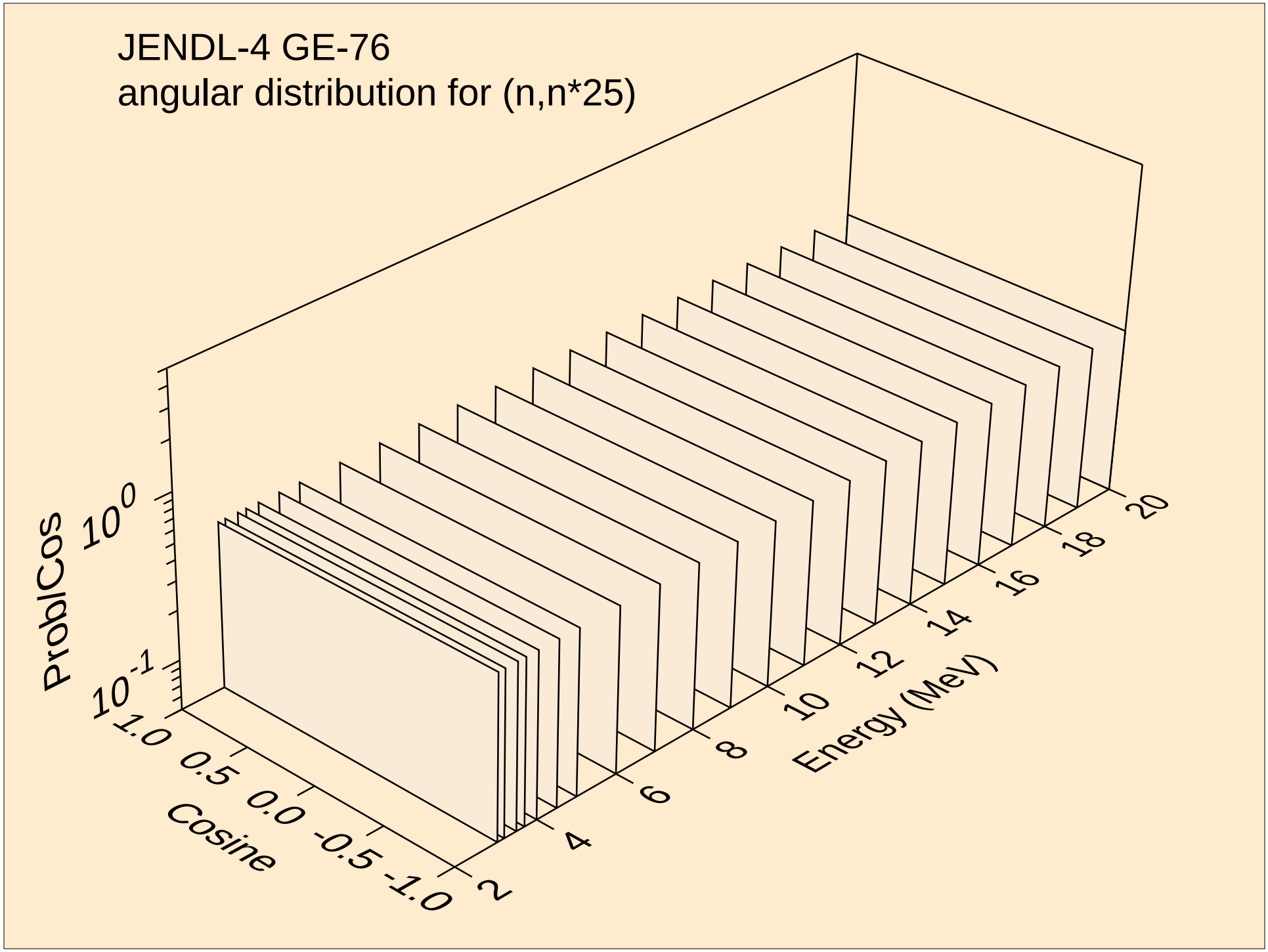

JENDL-4 GE-76
angular distribution for (n,n*20)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

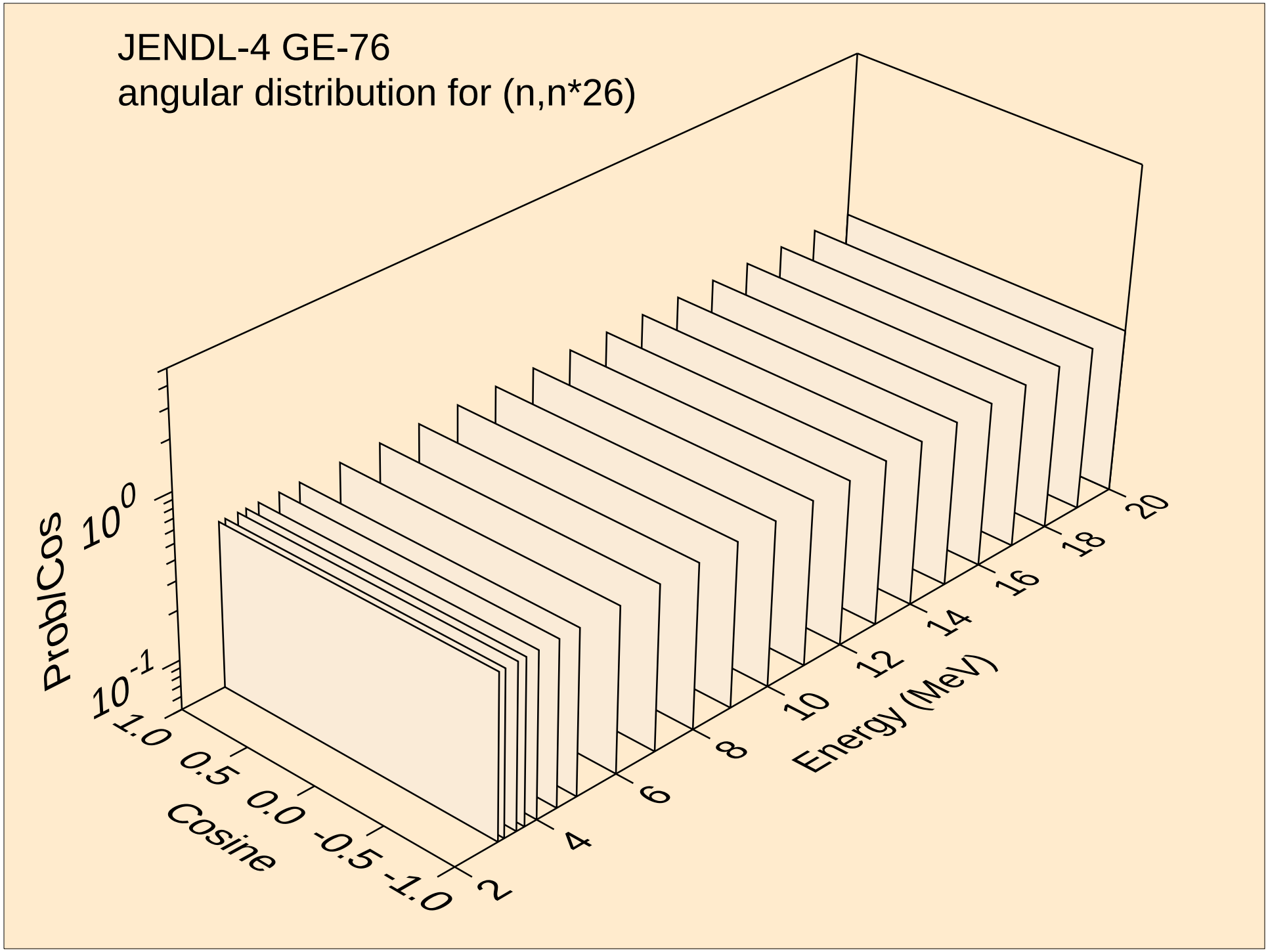

JENDL-4 GE-76
angular distribution for (n,n*21)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

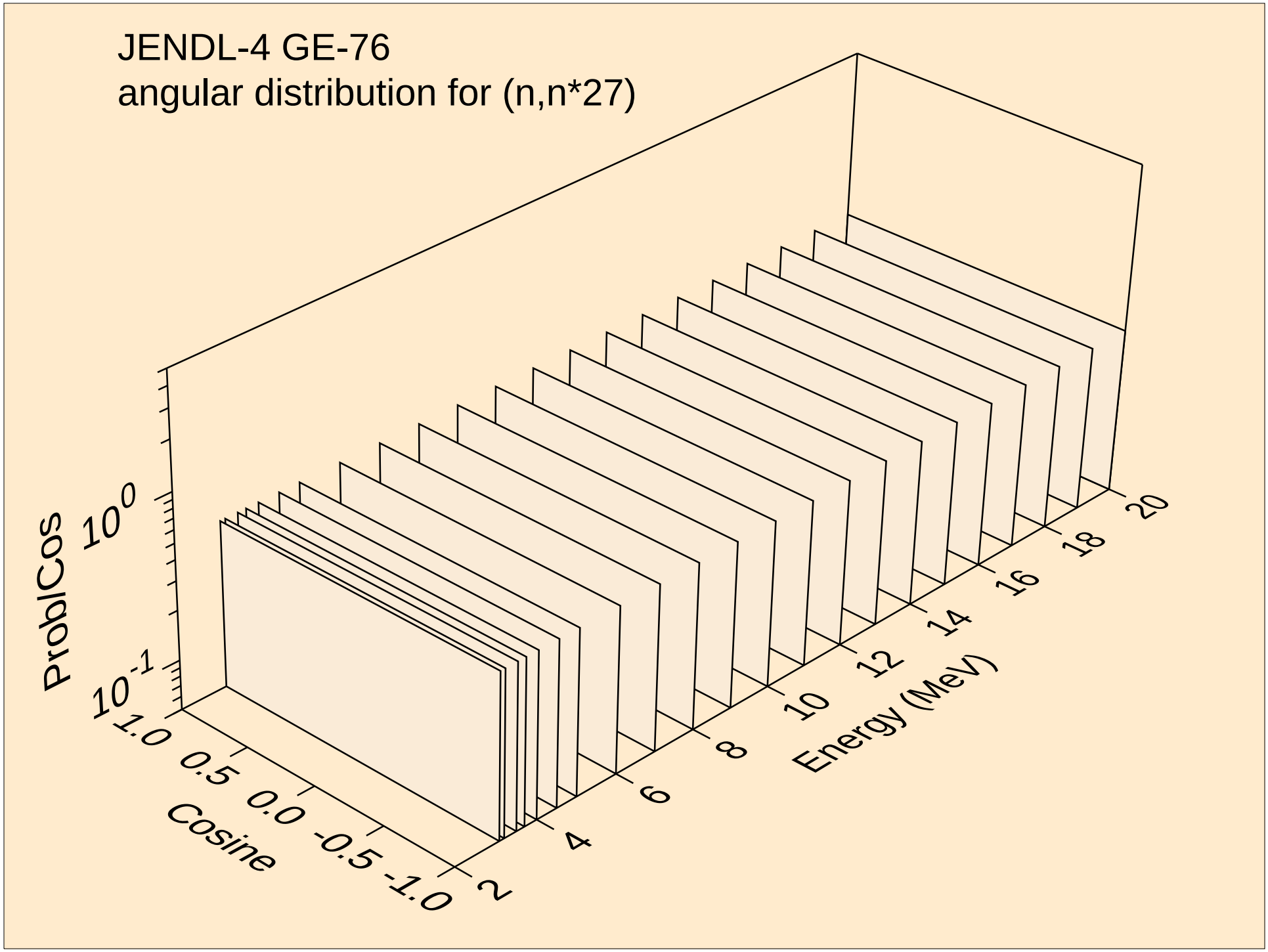

JENDL-4 GE-76
angular distribution for (n,n*22)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

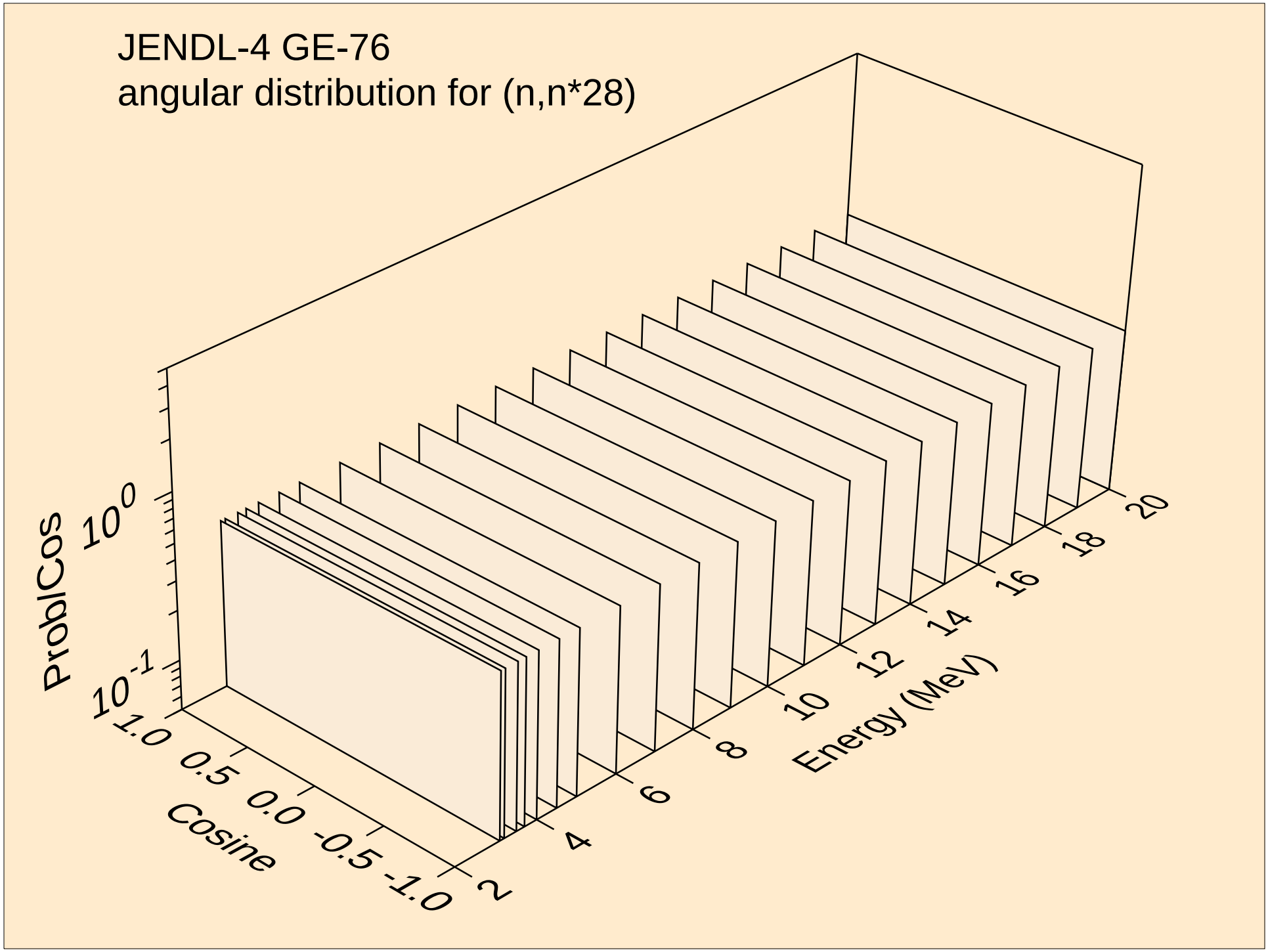

JENDL-4 GE-76
angular distribution for (n,n*23)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

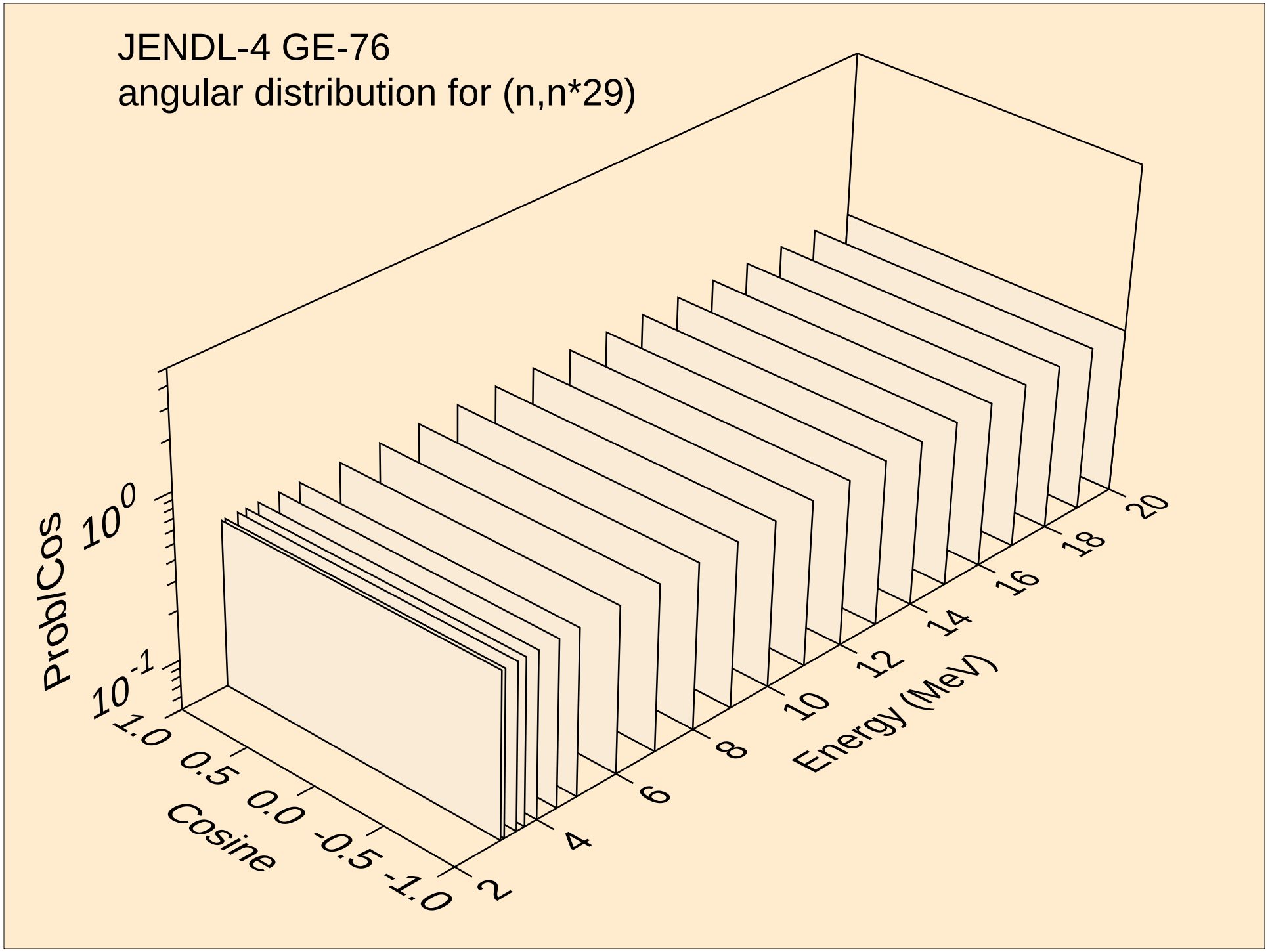

JENDL-4 GE-76
angular distribution for (n,n*24)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

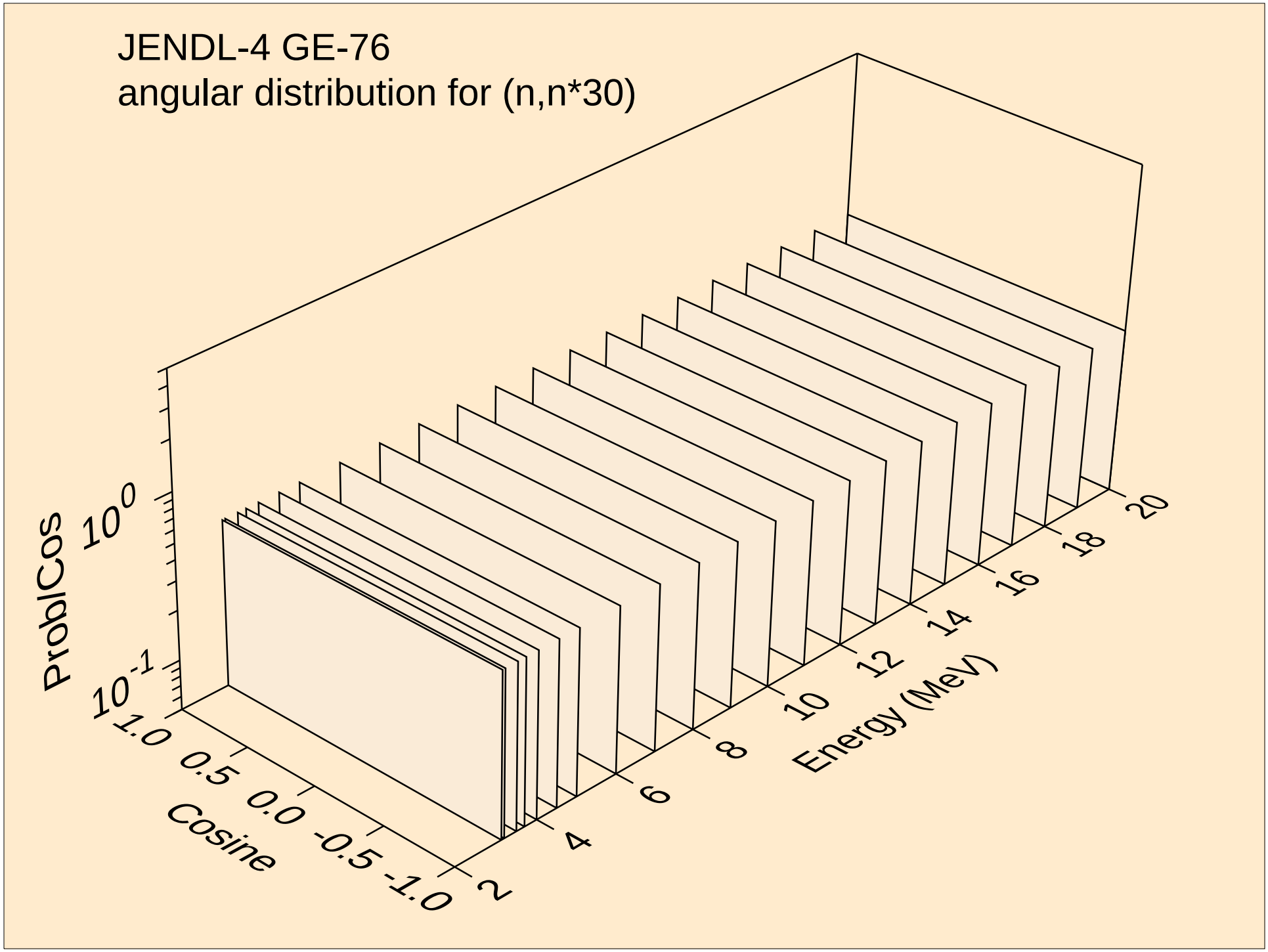

JENDL-4 GE-76
angular distribution for (n,n*25)
Prob/Cos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

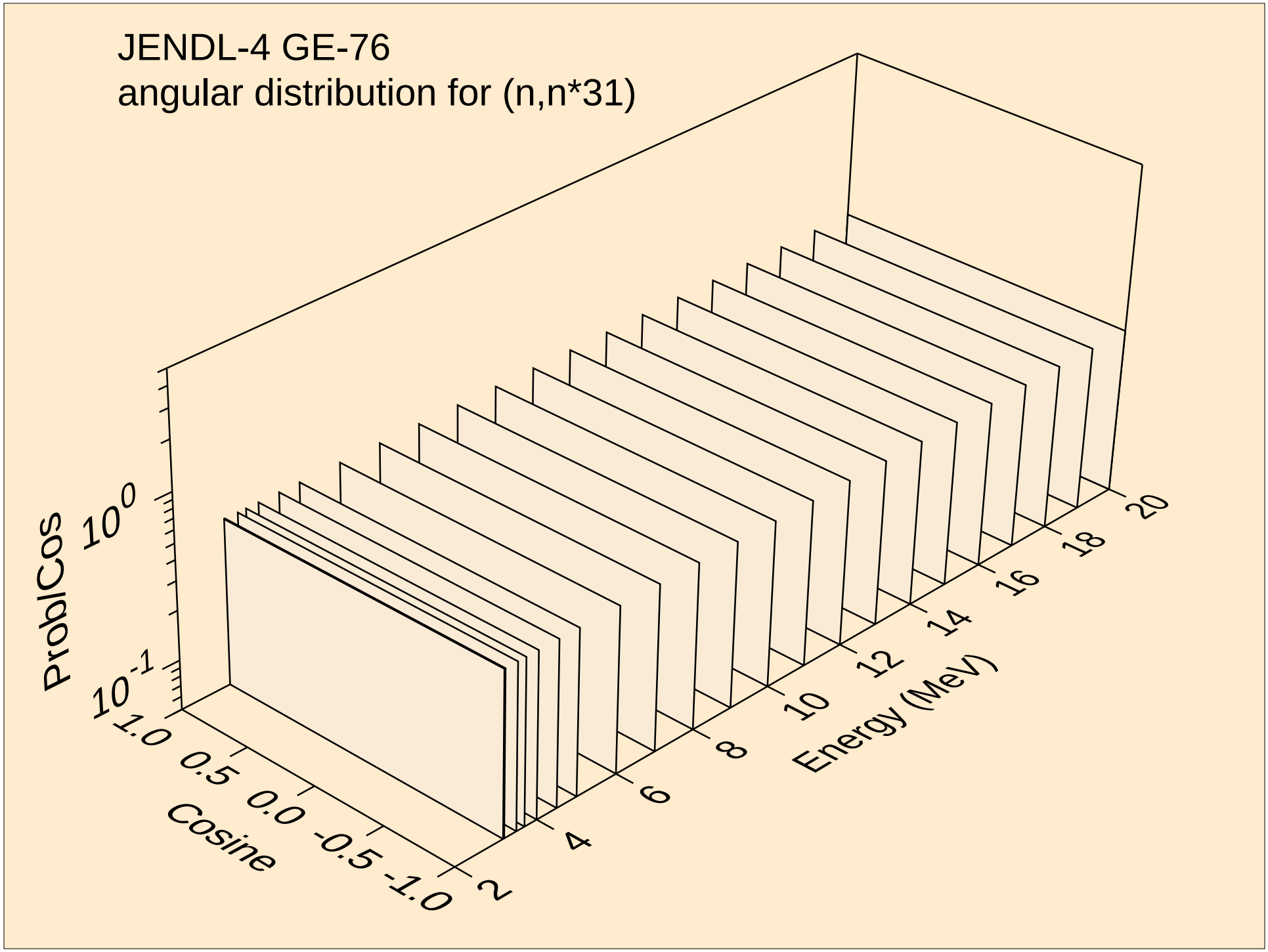

JENDL-4 GE-76
angular distribution for (n,n*26)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

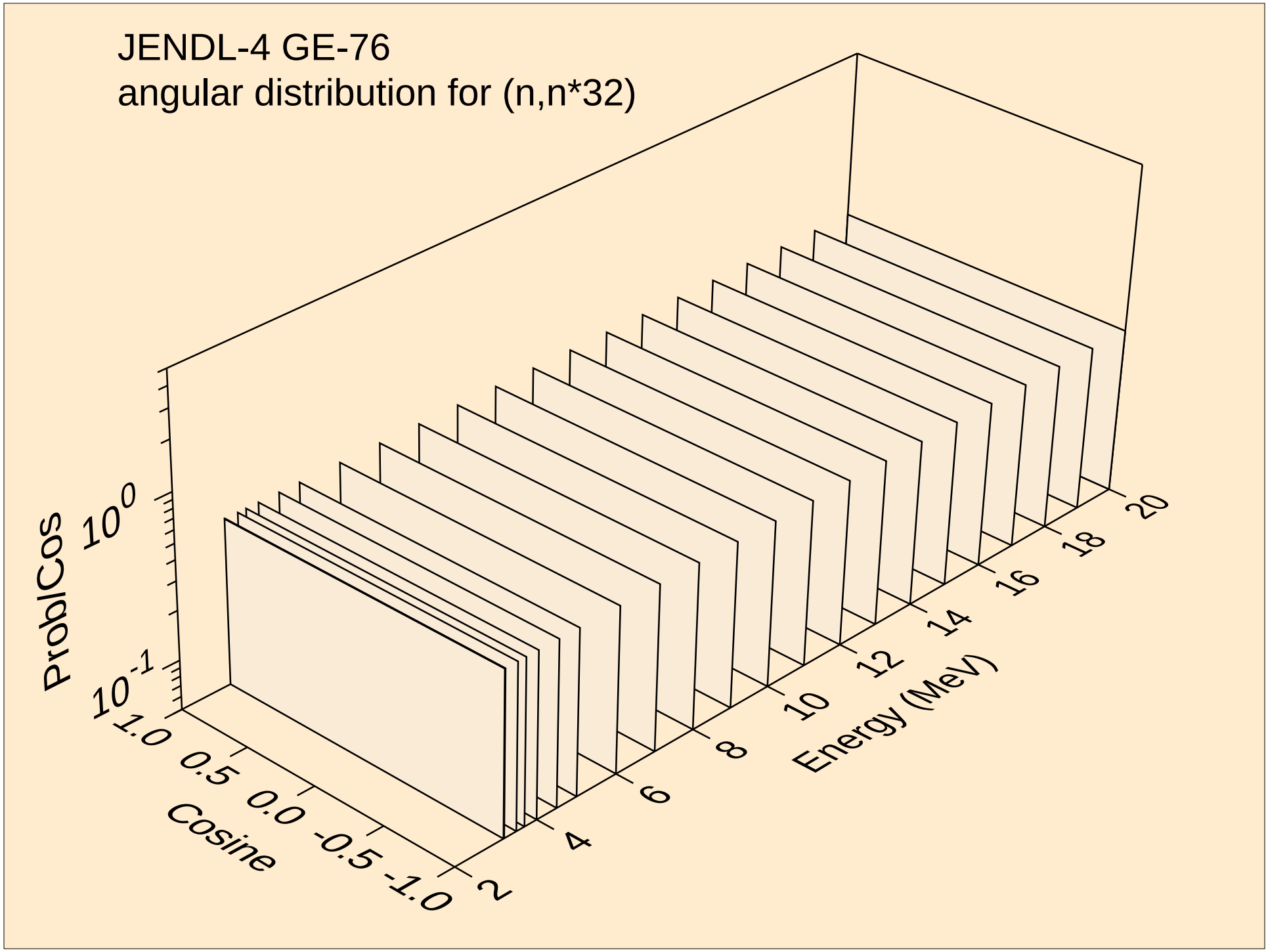

JENDL-4 GE-76
angular distribution for (n,n*27)
Prob/Cos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

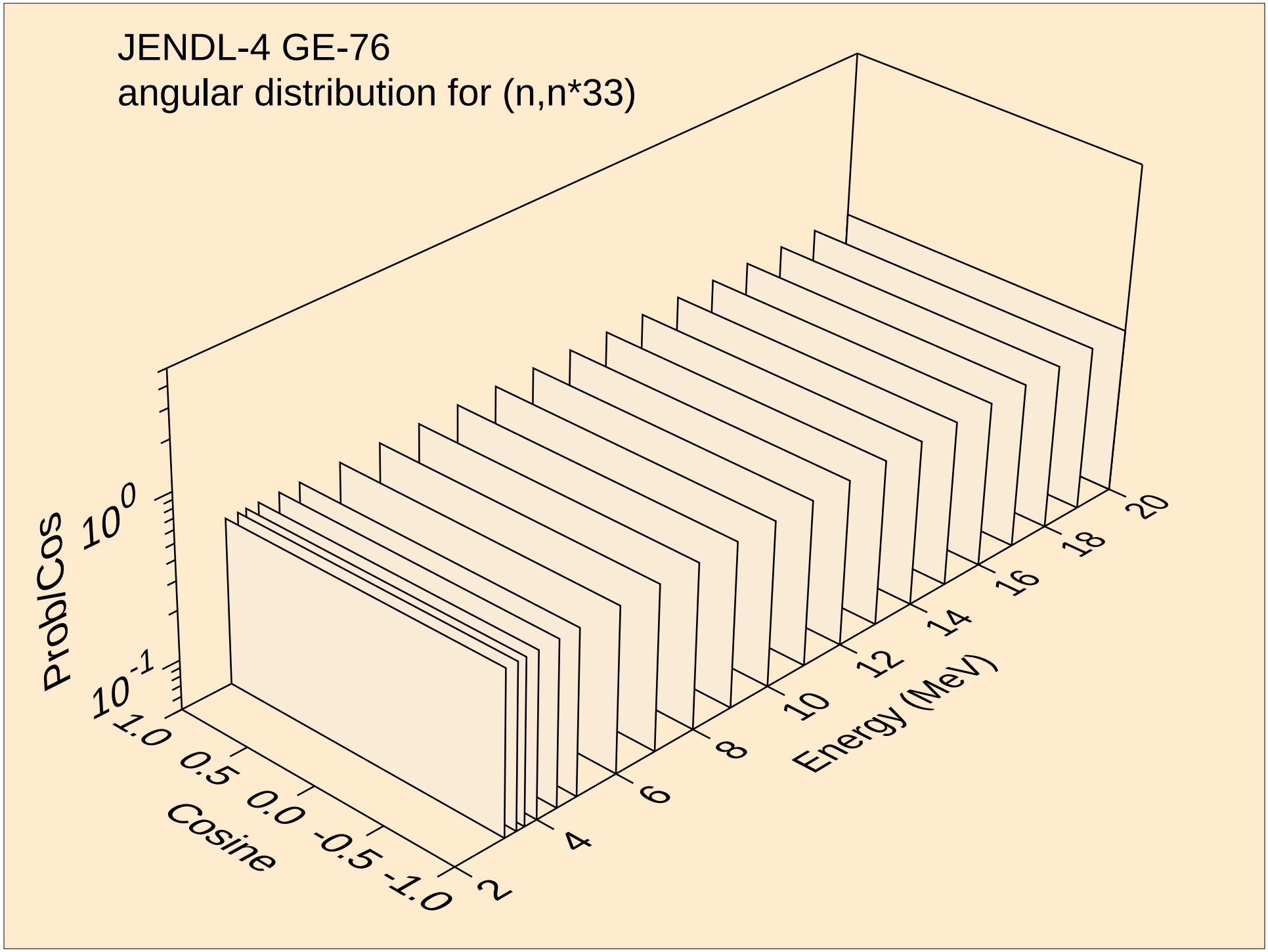

JENDL-4 GE-76
angular distribution for (n,n*28)
Prob/Cos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

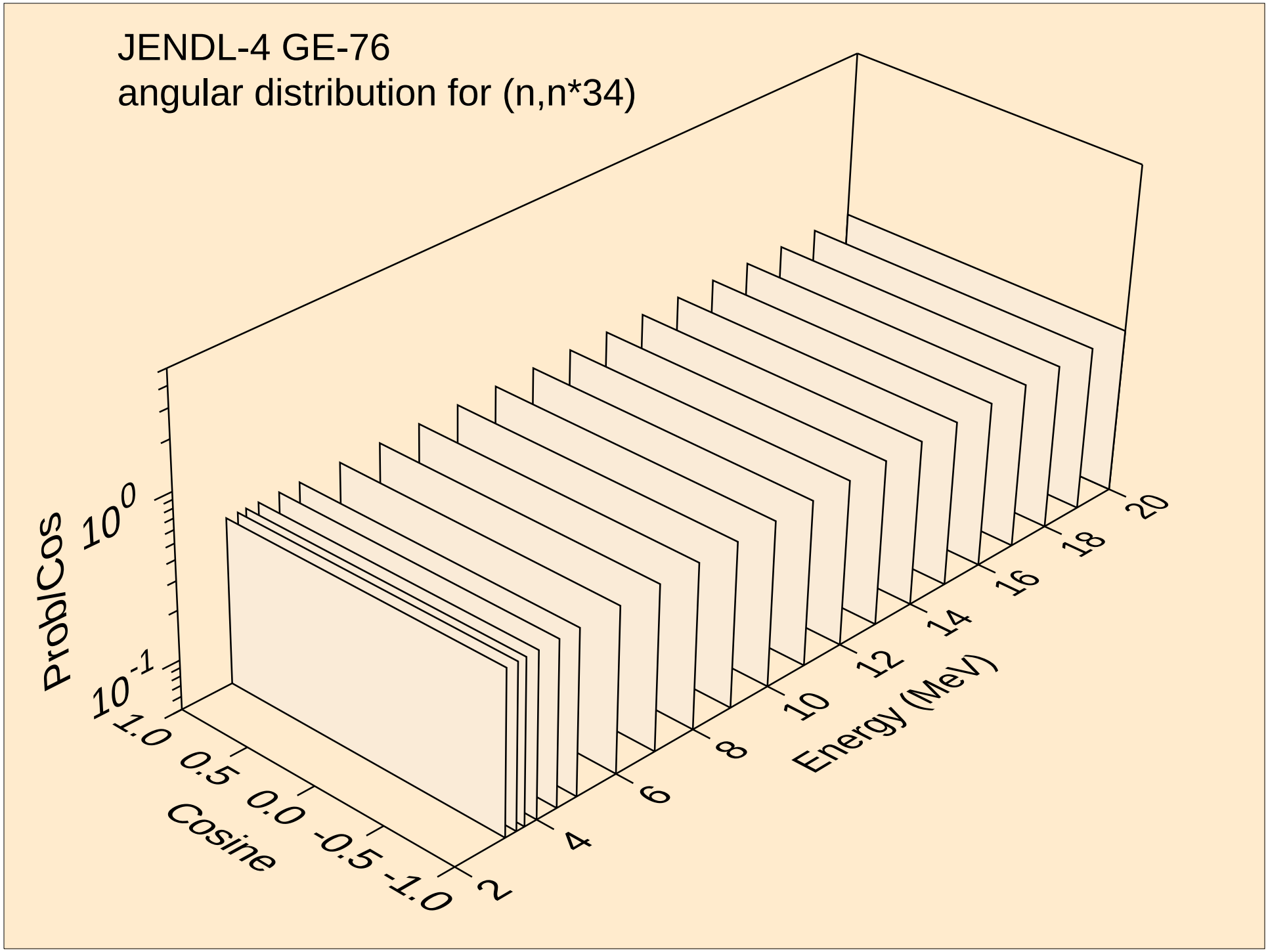

JENDL-4 GE-76
angular distribution for (n,n*29)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

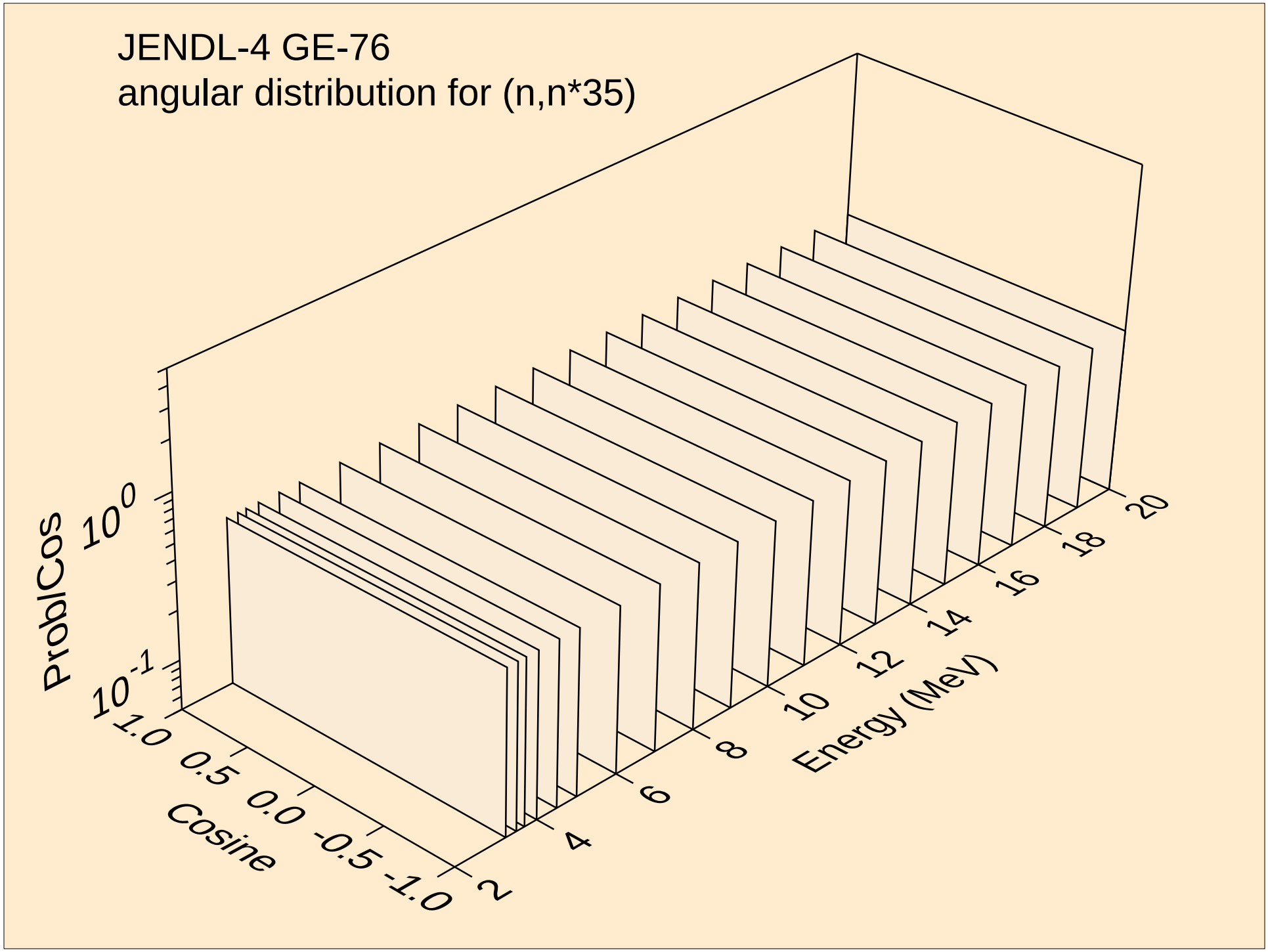

JENDL-4 GE-76
angular distribution for (n,n*30)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

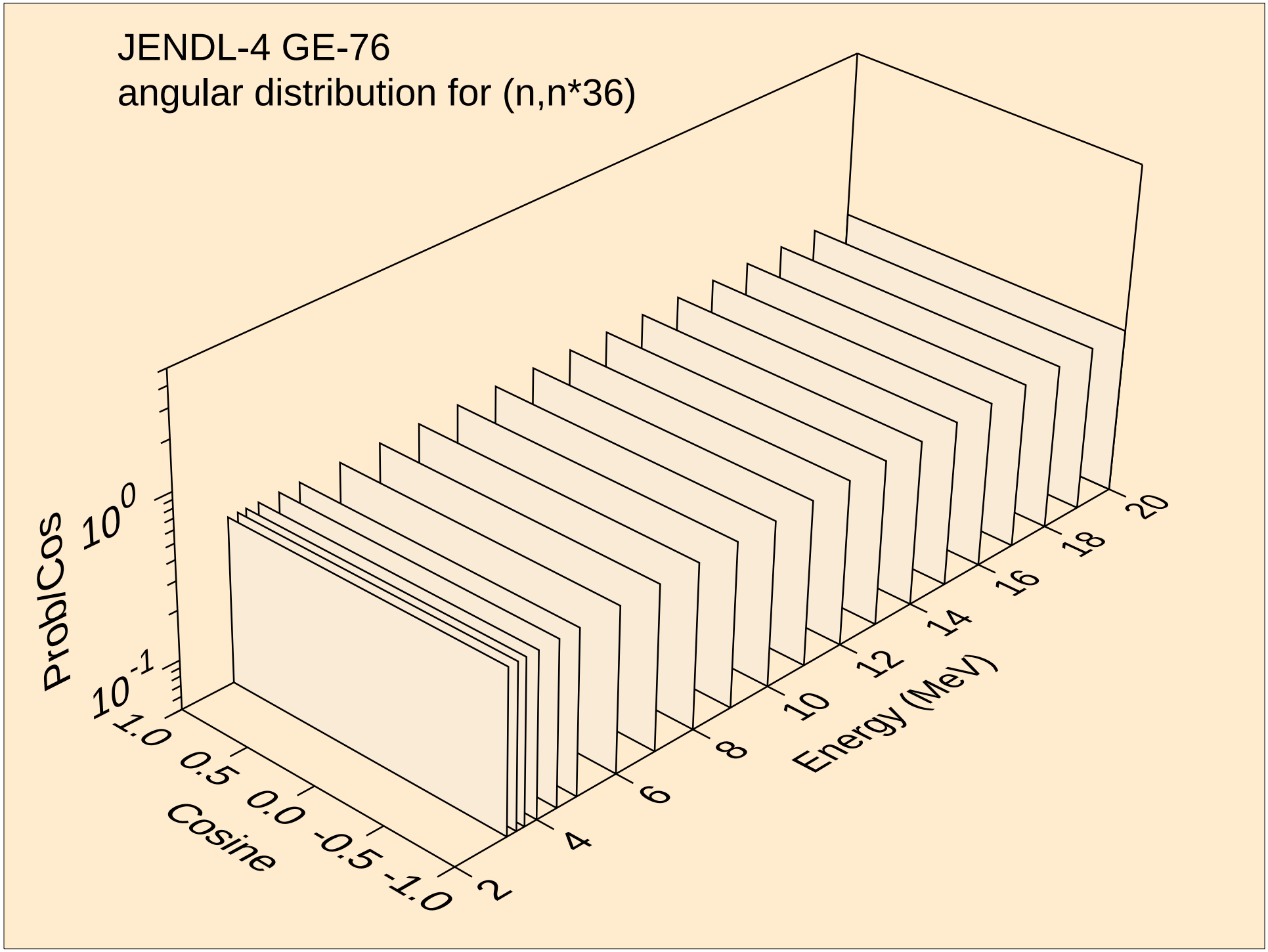

JENDL-4 GE-76
angular distribution for (n,n*31)
ProblCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

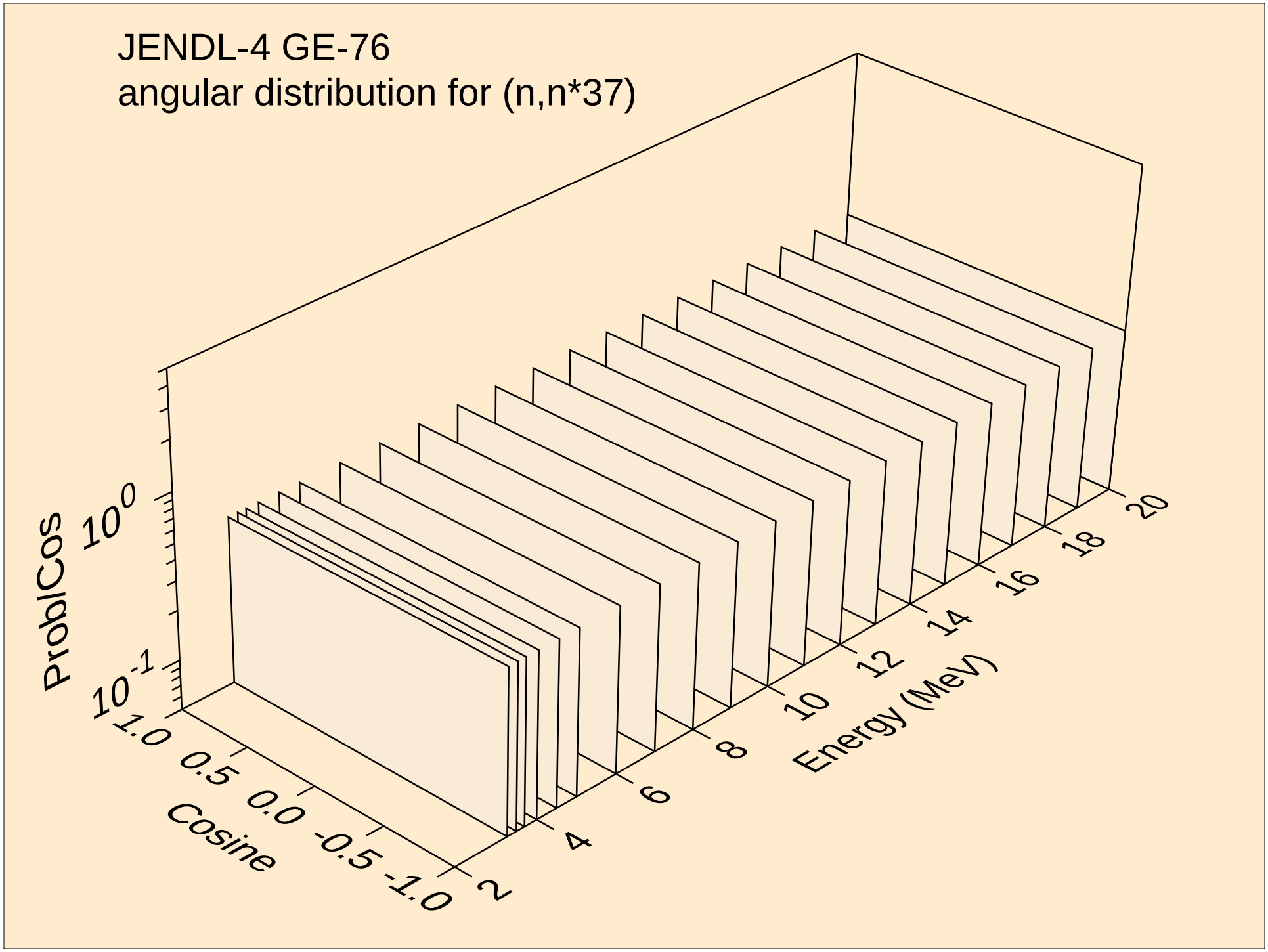

JENDL-4 GE-76
angular distribution for (n,n*32)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

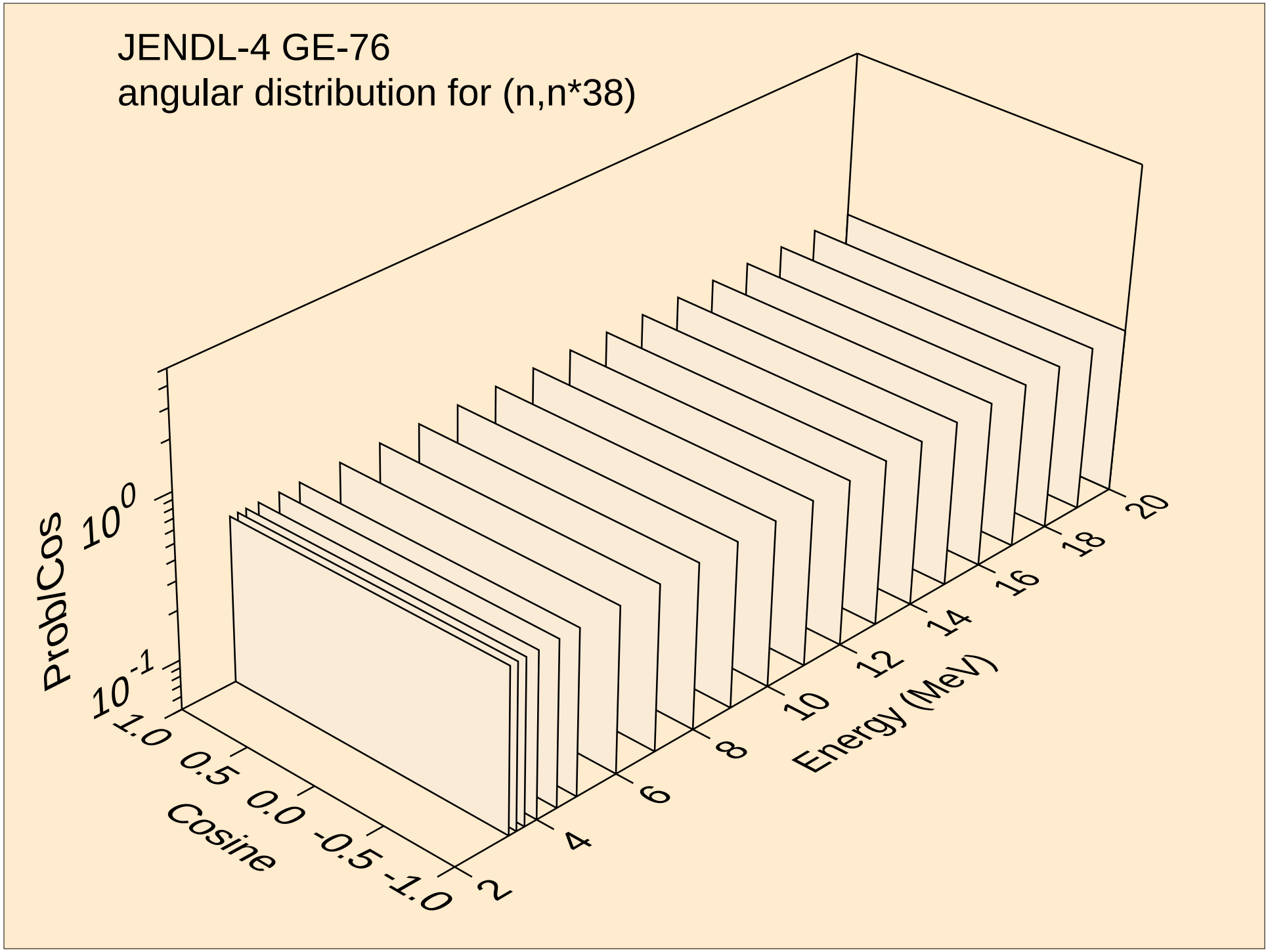

JENDL-4 GE-76
angular distribution for (n,n*33)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

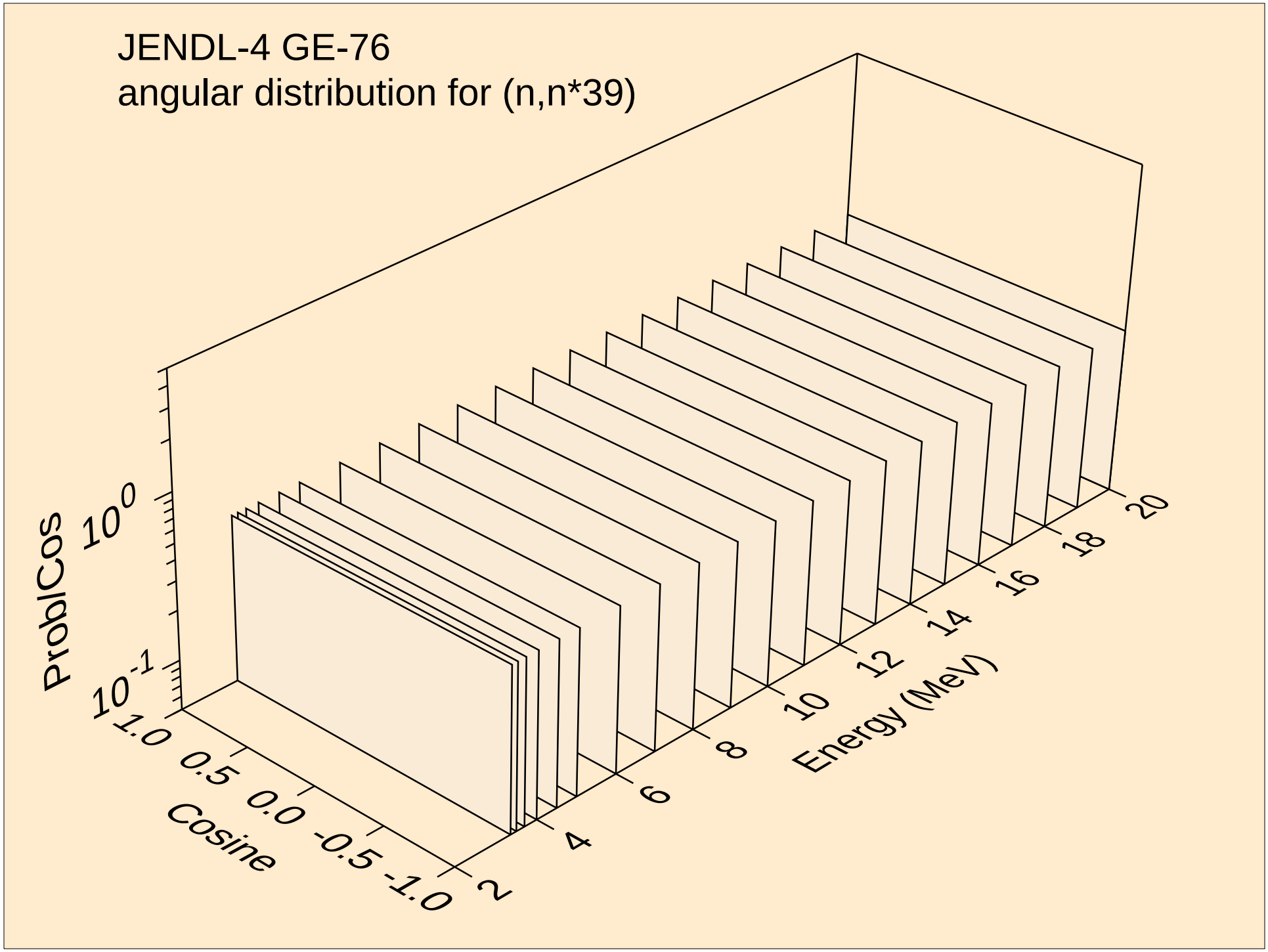

JENDL-4 GE-76
angular distribution for (n,n*34)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

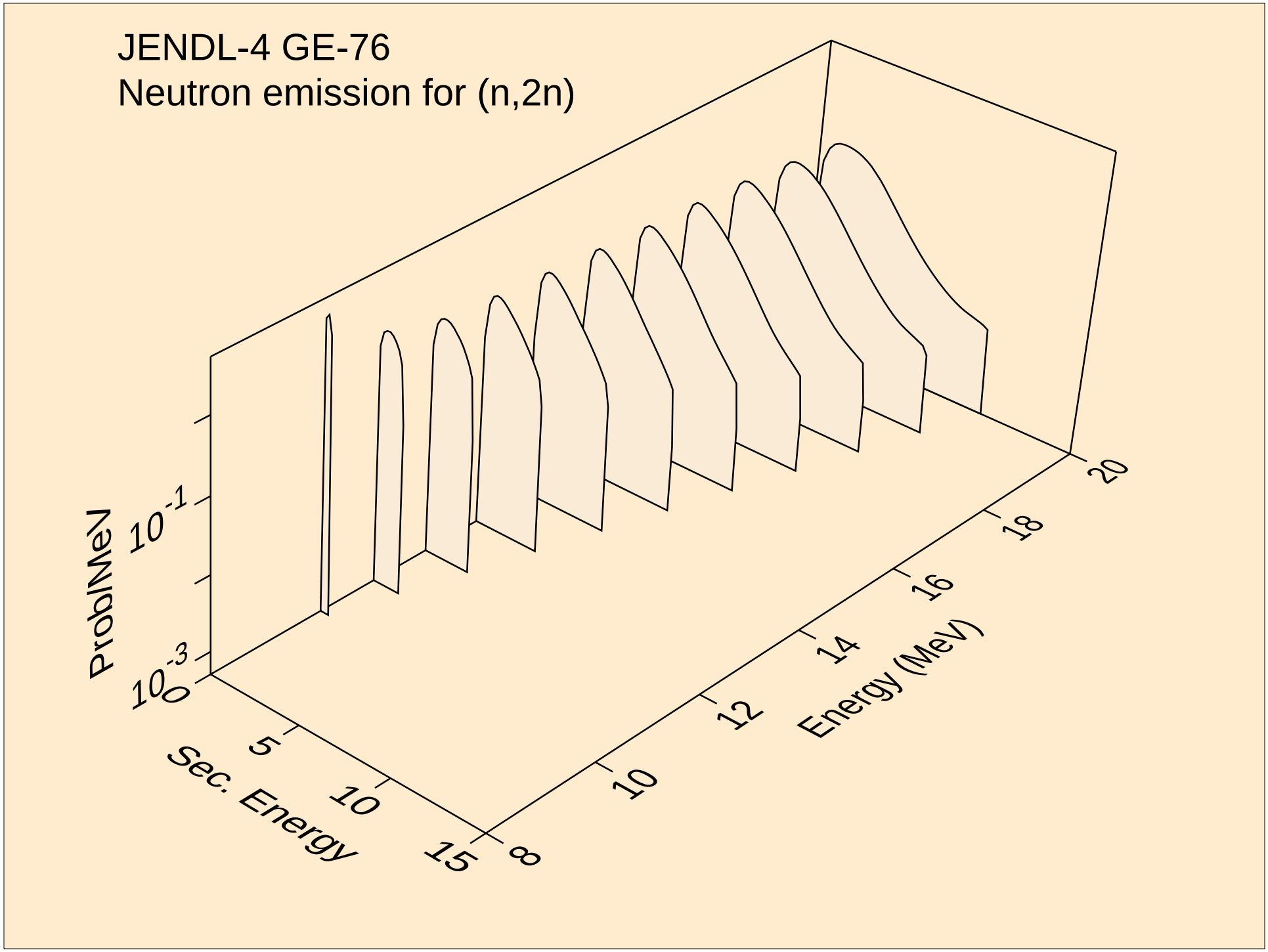

JENDL-4 GE-76
angular distribution for (n,n*35)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

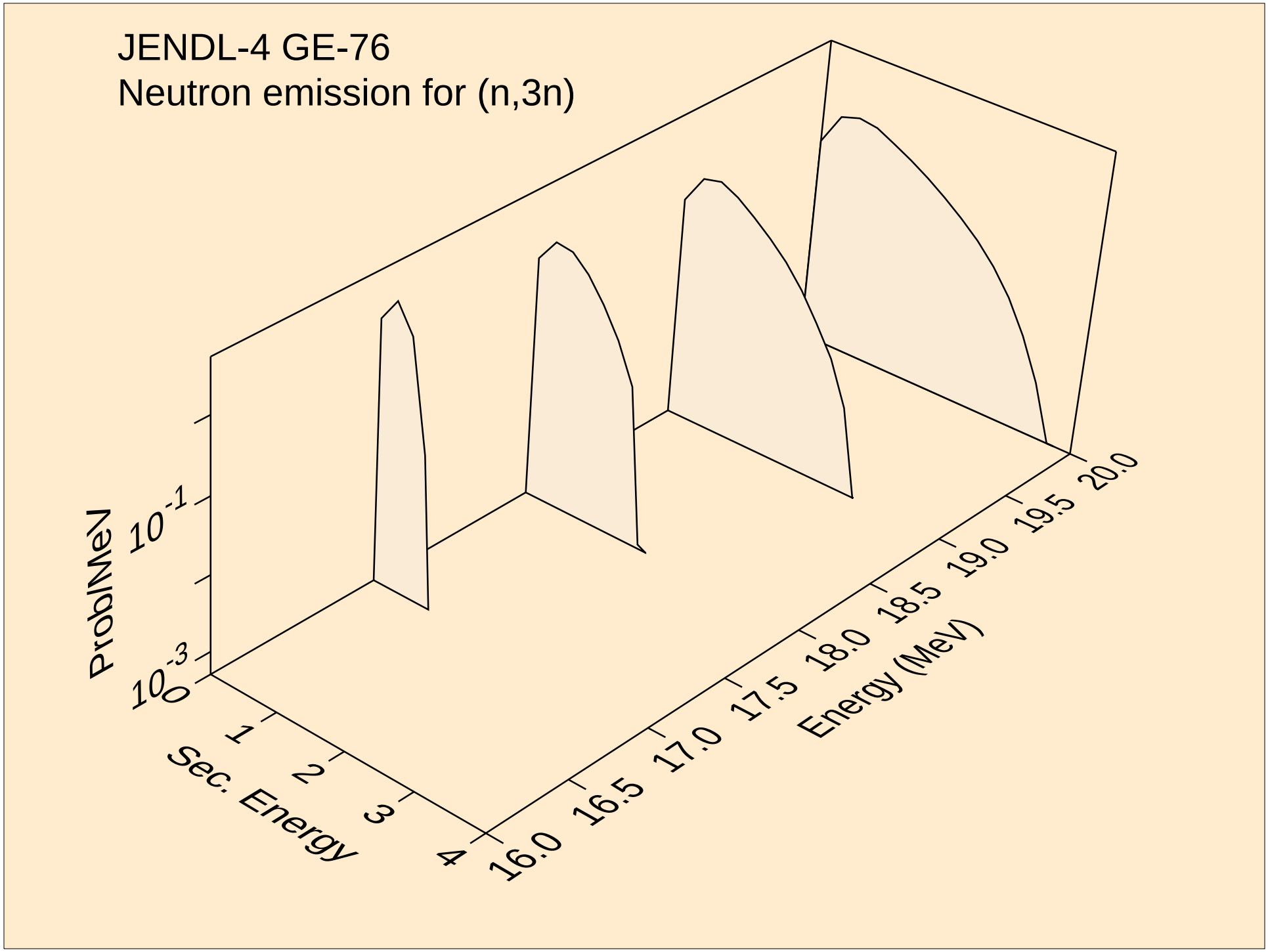

JENDL-4 GE-76
angular distribution for (n,n*36)
Prob/Cos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)


JENDL-4 GE-76
angular distribution for (n,n*37)
ProbCos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

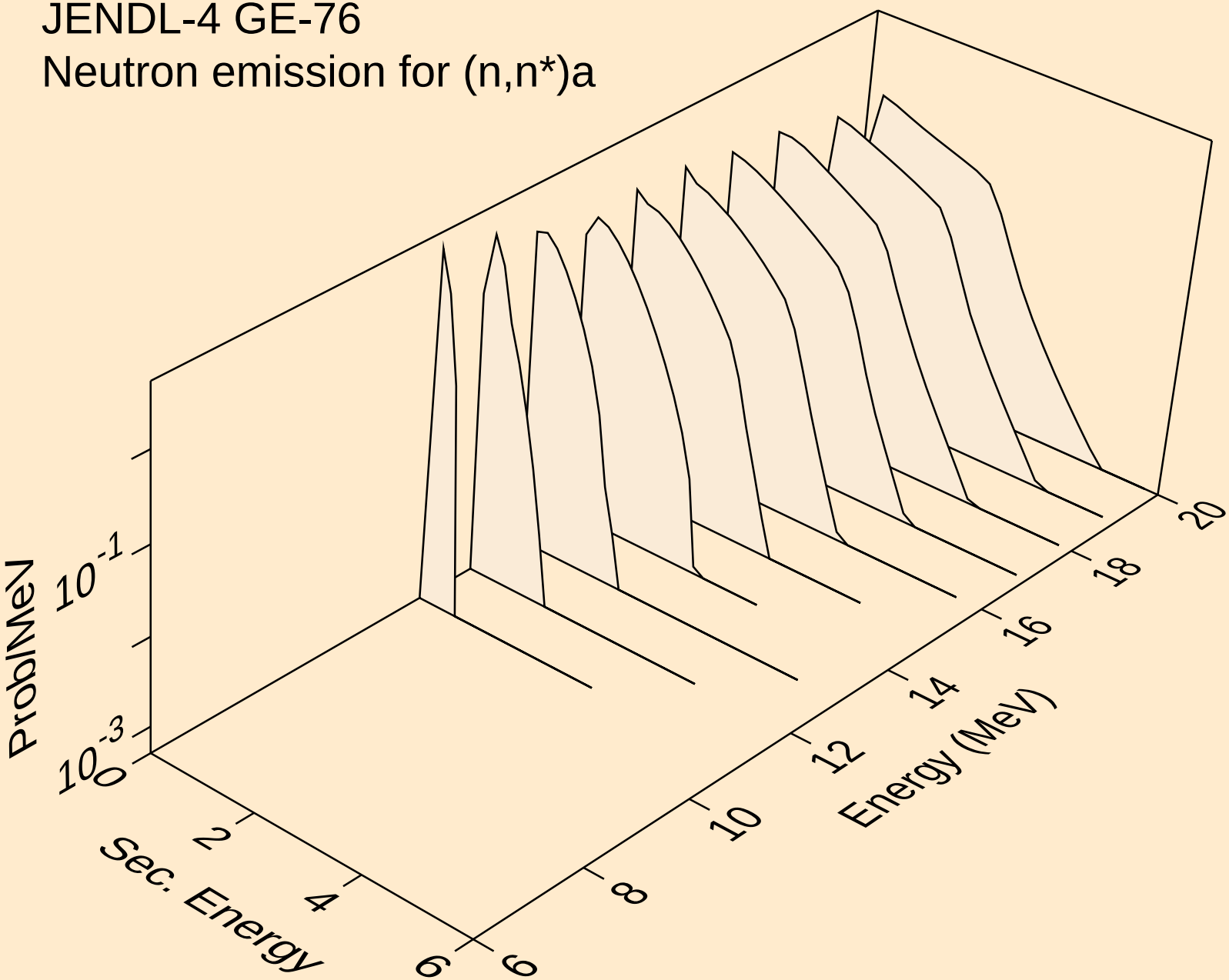

JENDL-4 GE-76
angular distribution for (n,n*38)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)


JENDL-4 GE-76
angular distribution for (n,n*39)
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

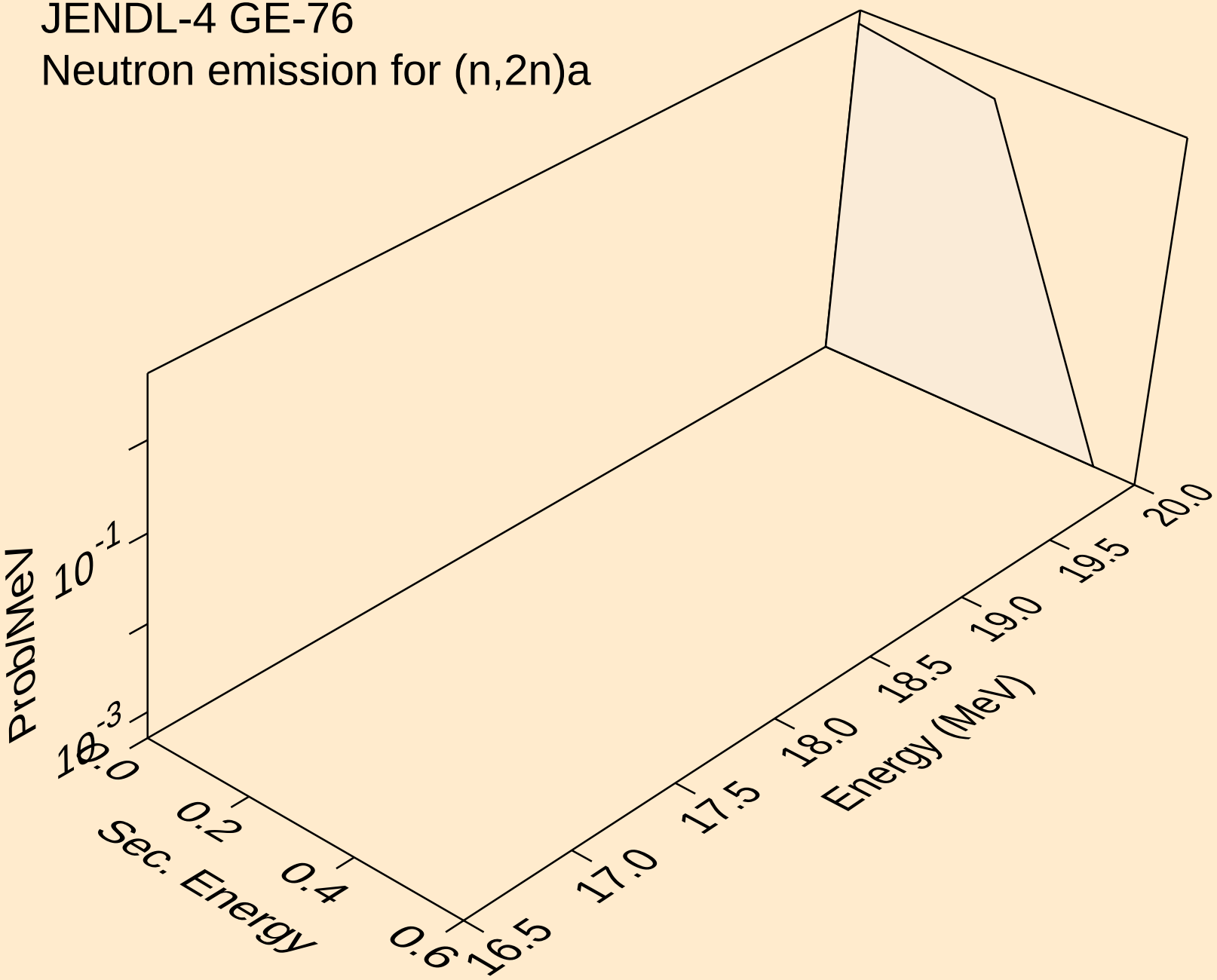

JENDL-4 GE-76
Neutron emission for (n,2n)
Prob/MeV
10^{-1}
10^{-3}
0
5
10
15
Sec. Energy
8
10
12
14
16
18
20
Energy (MeV)

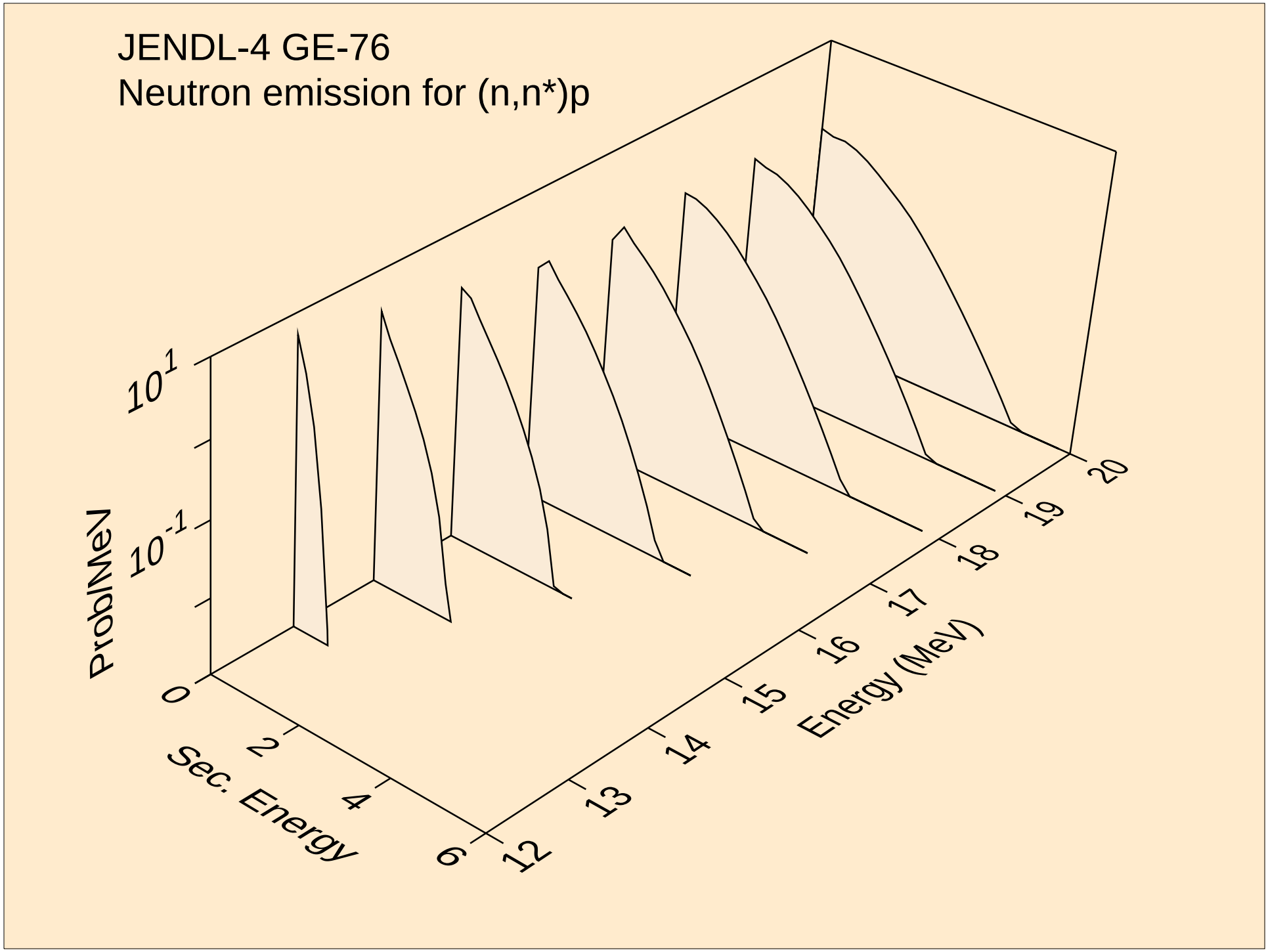

JENDL-4 GE-76
Neutron emission for (n,3n)
Prob/MeV
10^-1
10^-3
0
1
2
3
4
Sec. Energy
16.0
16.5
17.0
17.5
18.0
18.5
19.0
19.5
20.0
Energy (MeV)

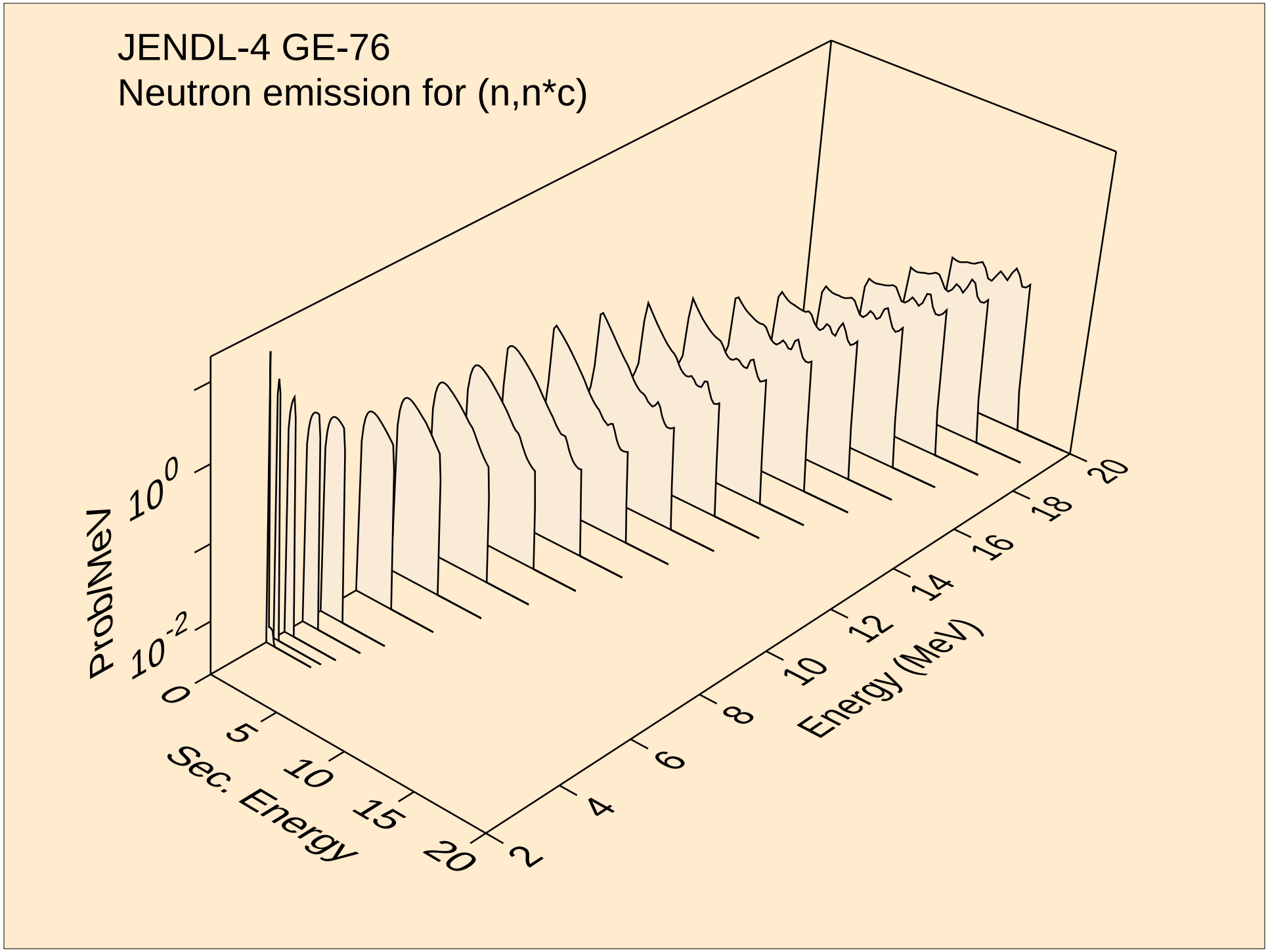
JENDL-4 GE-76
Neutron emission for (n,n*)a

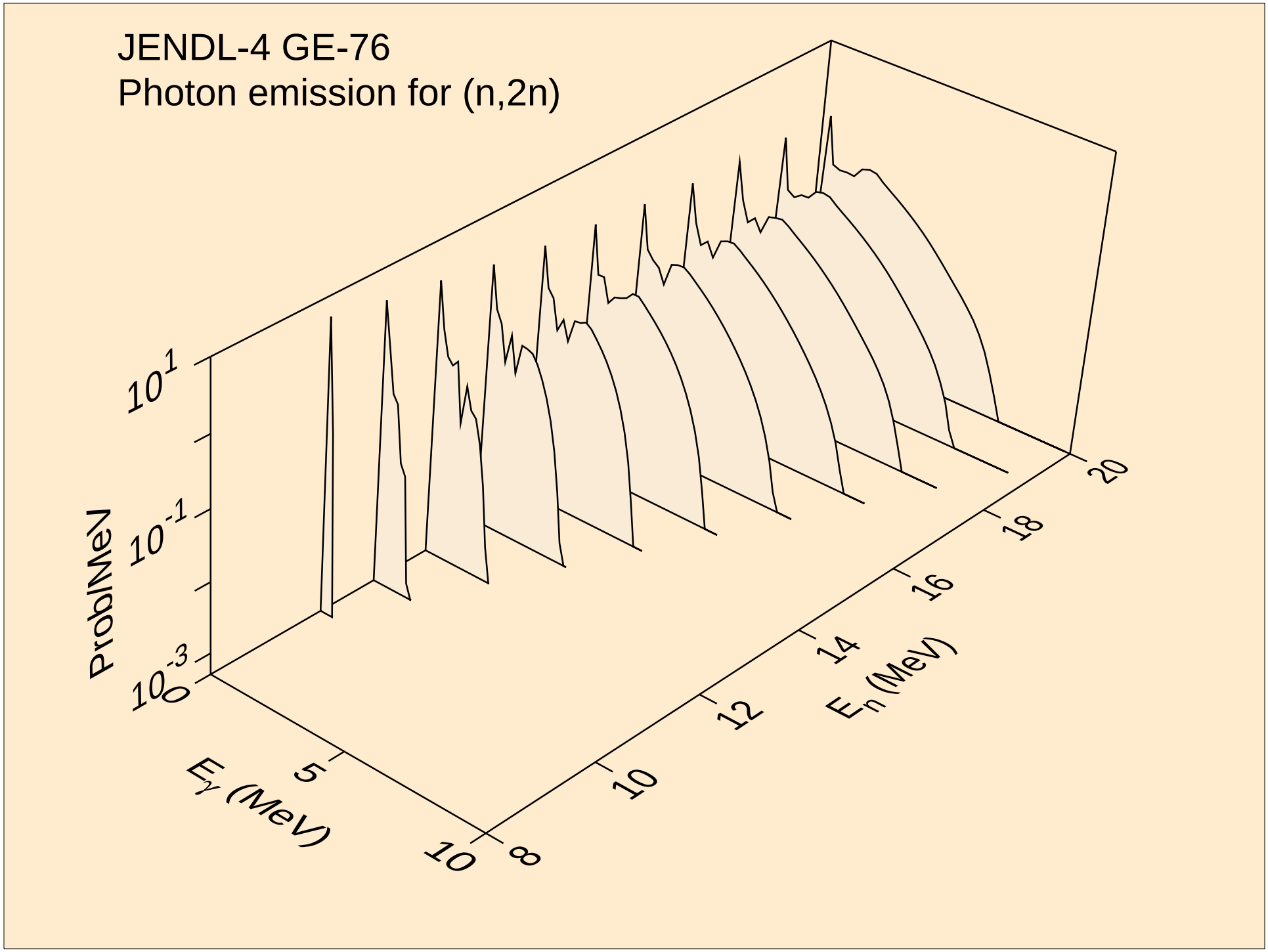


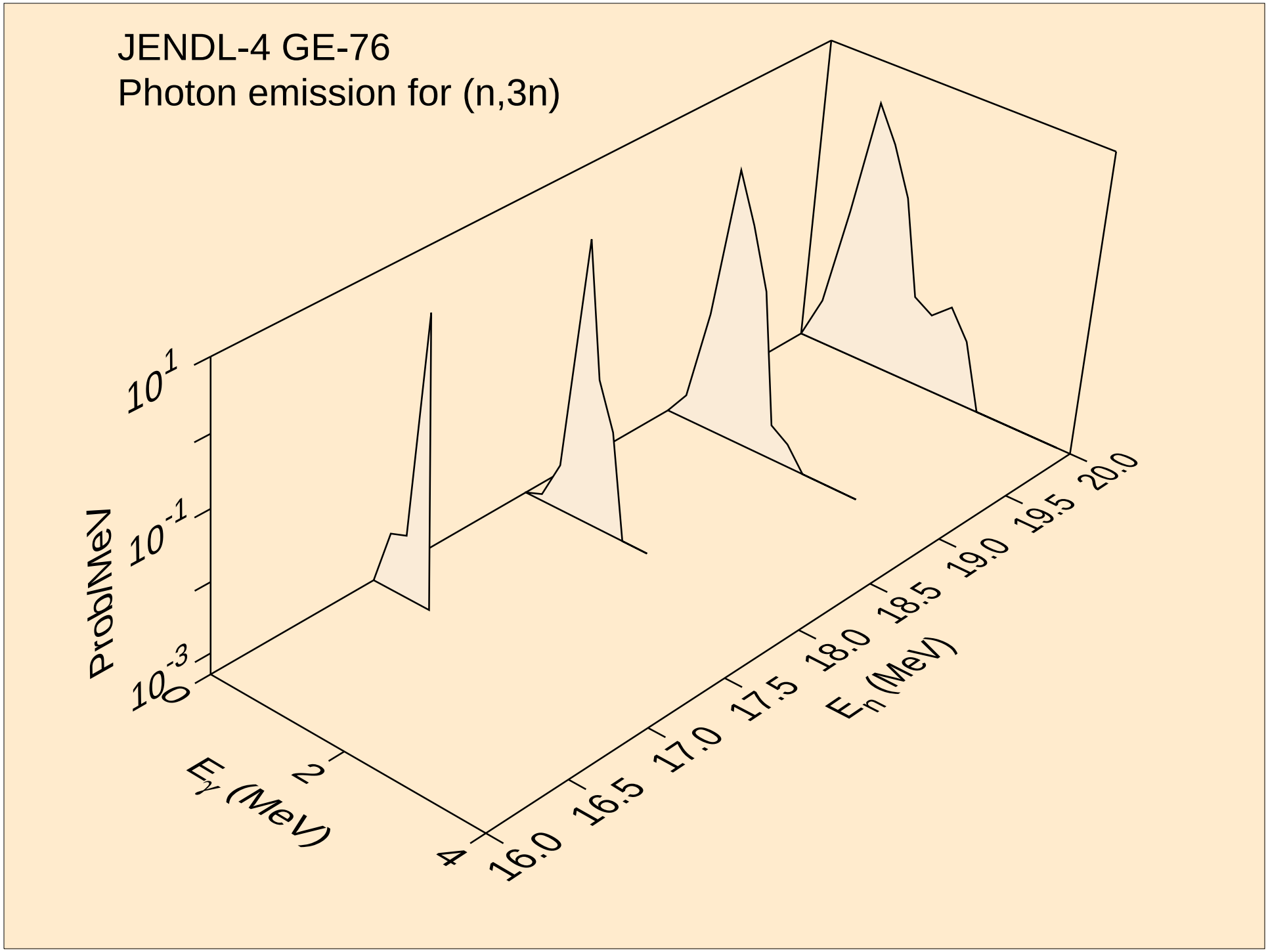
JENDL-4 GE-76
Neutron emission for (n,2n)a



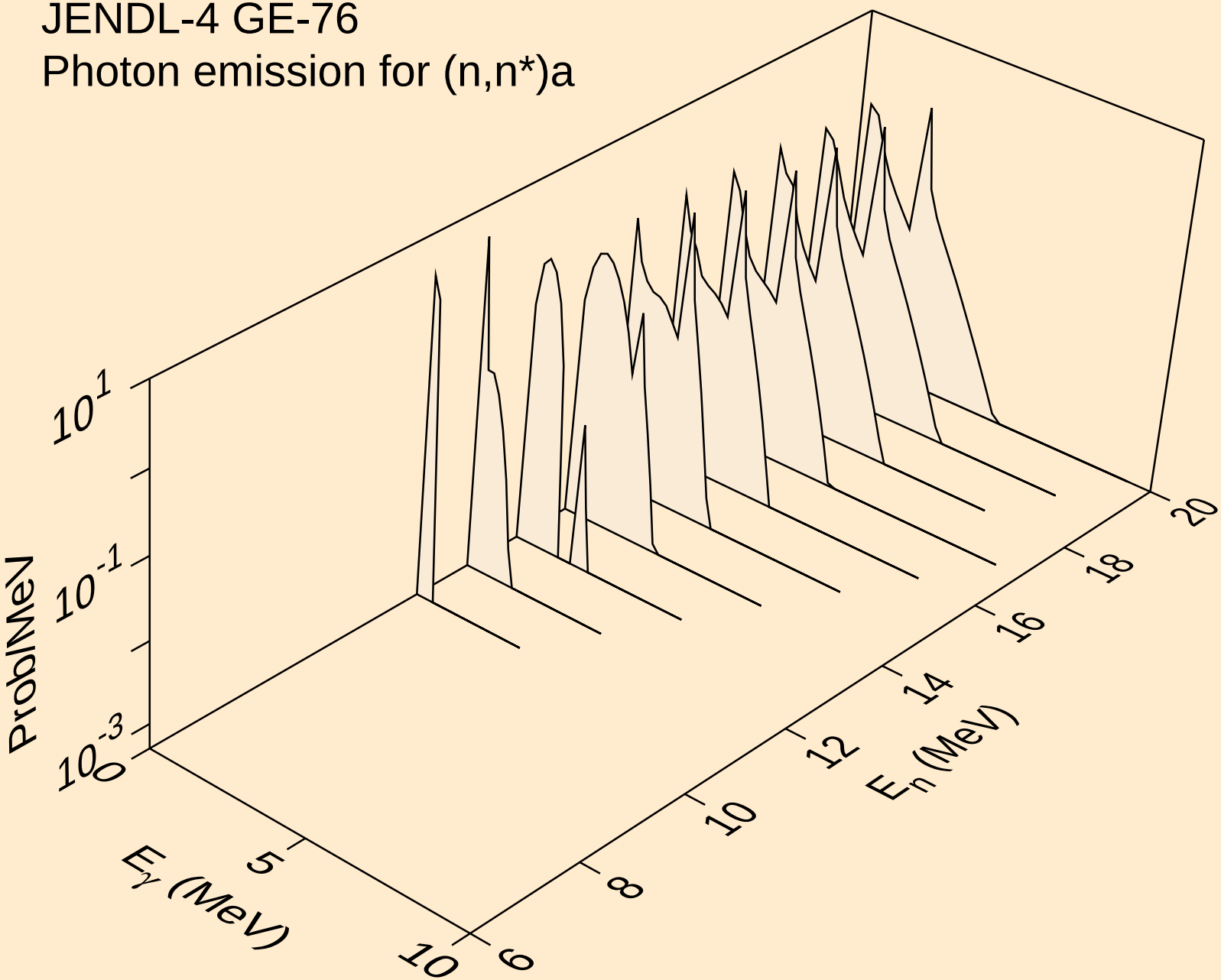

JENDL-4 GE-76
Neutron emission for (n,n*)p
Prob/MeV
10^1
10^-1
0
Sec. Energy
2
4
6
Energy (MeV)
12
13
14
15
16
17
18
19
20


JENDL-4 GE-76
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)

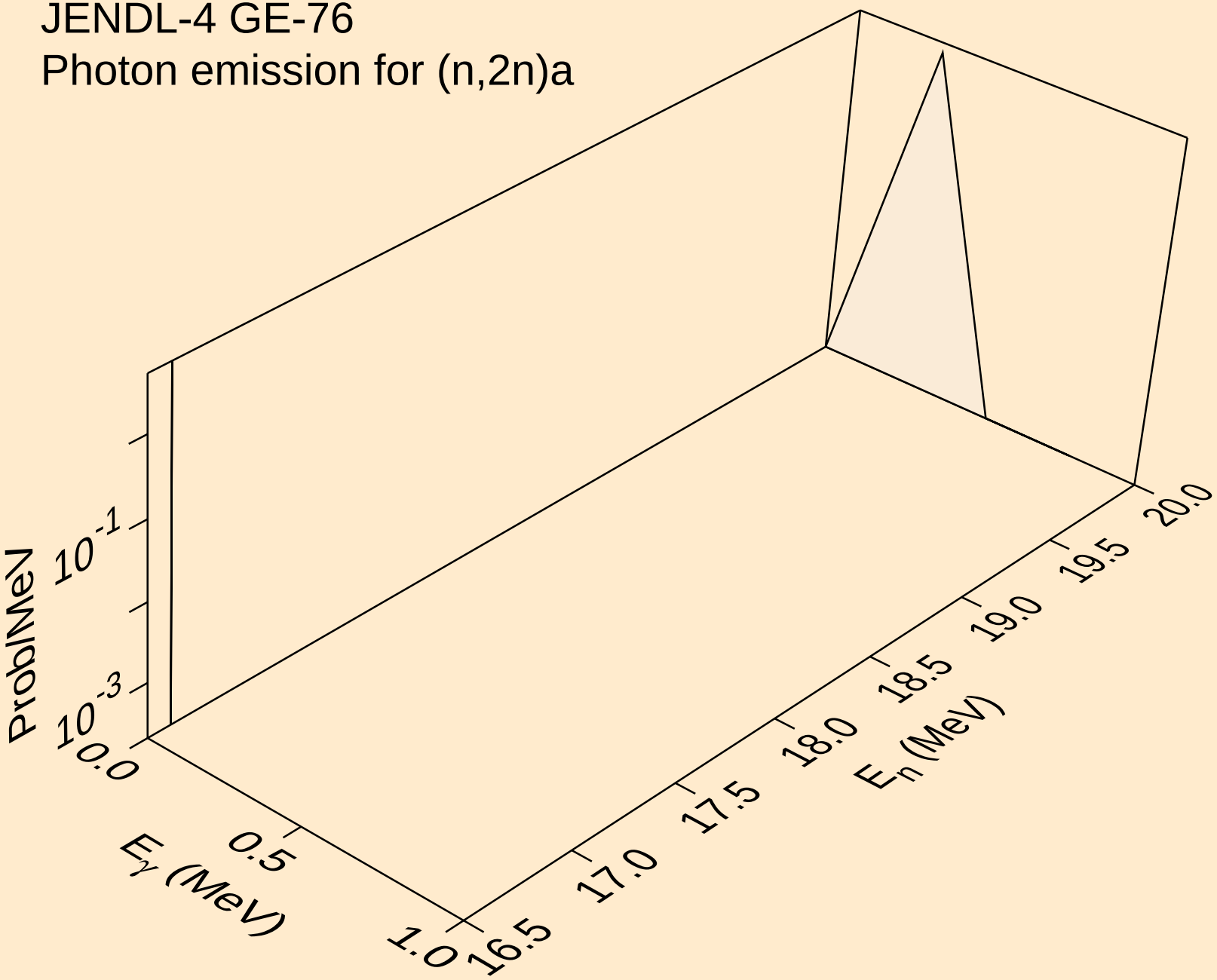

JENDL-4 GE-76
Photon emission for (n,2n)
Prob/MeV
10^{1}
10^{-1}
10^{-3}
0
5
10
E_γ (MeV)
8
10
12
14
16
18
20
E_n (MeV)

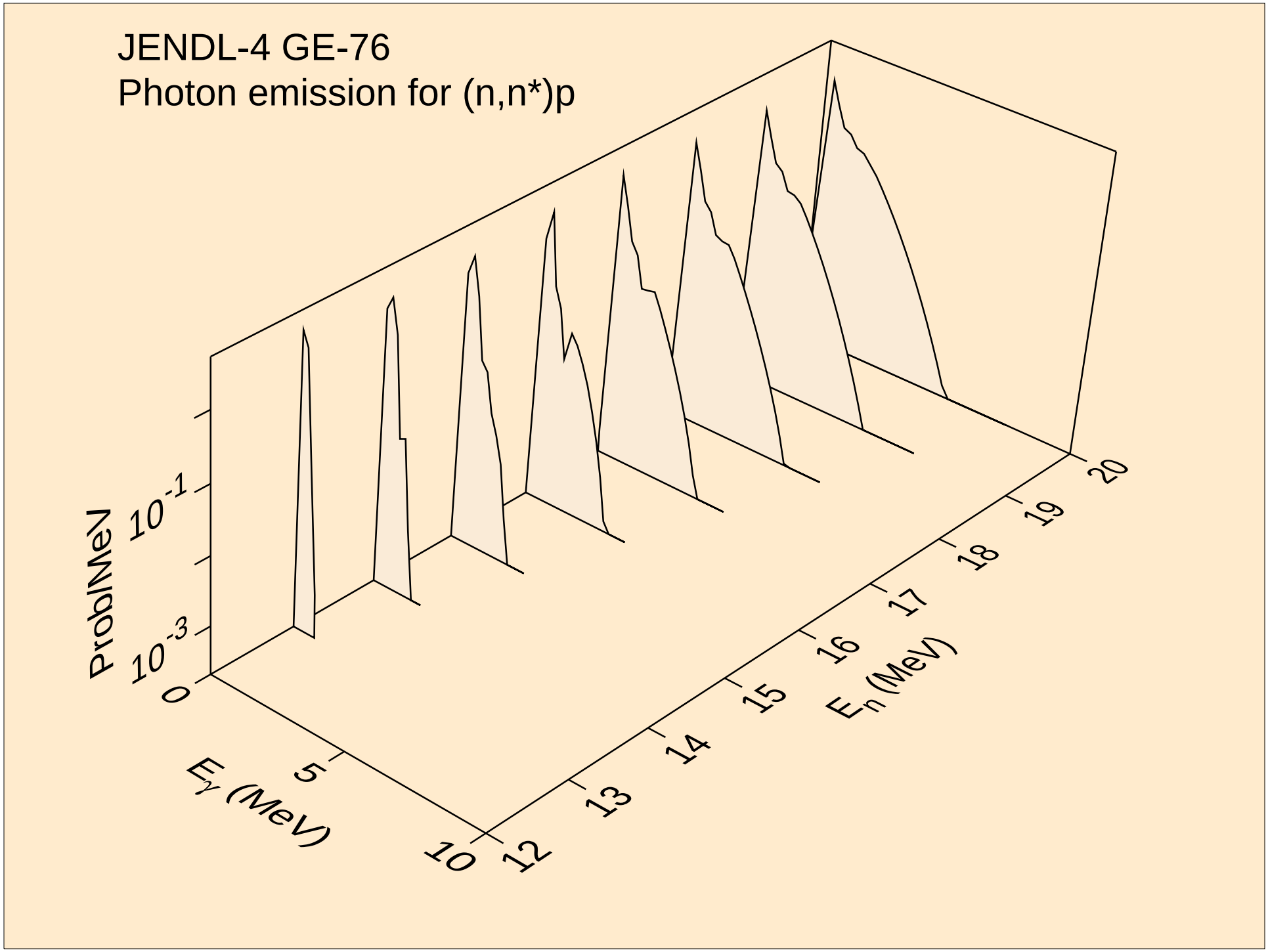

JENDL-4 GE-76
Photon emission for (n,3n)
Prob/MeV
10^{1}
10^{-1}
10^{-3}
0
2
4
E_γ (MeV)
16.0
16.5
17.0
17.5
18.0
18.5
19.0
19.5
20.0
E_n (MeV)

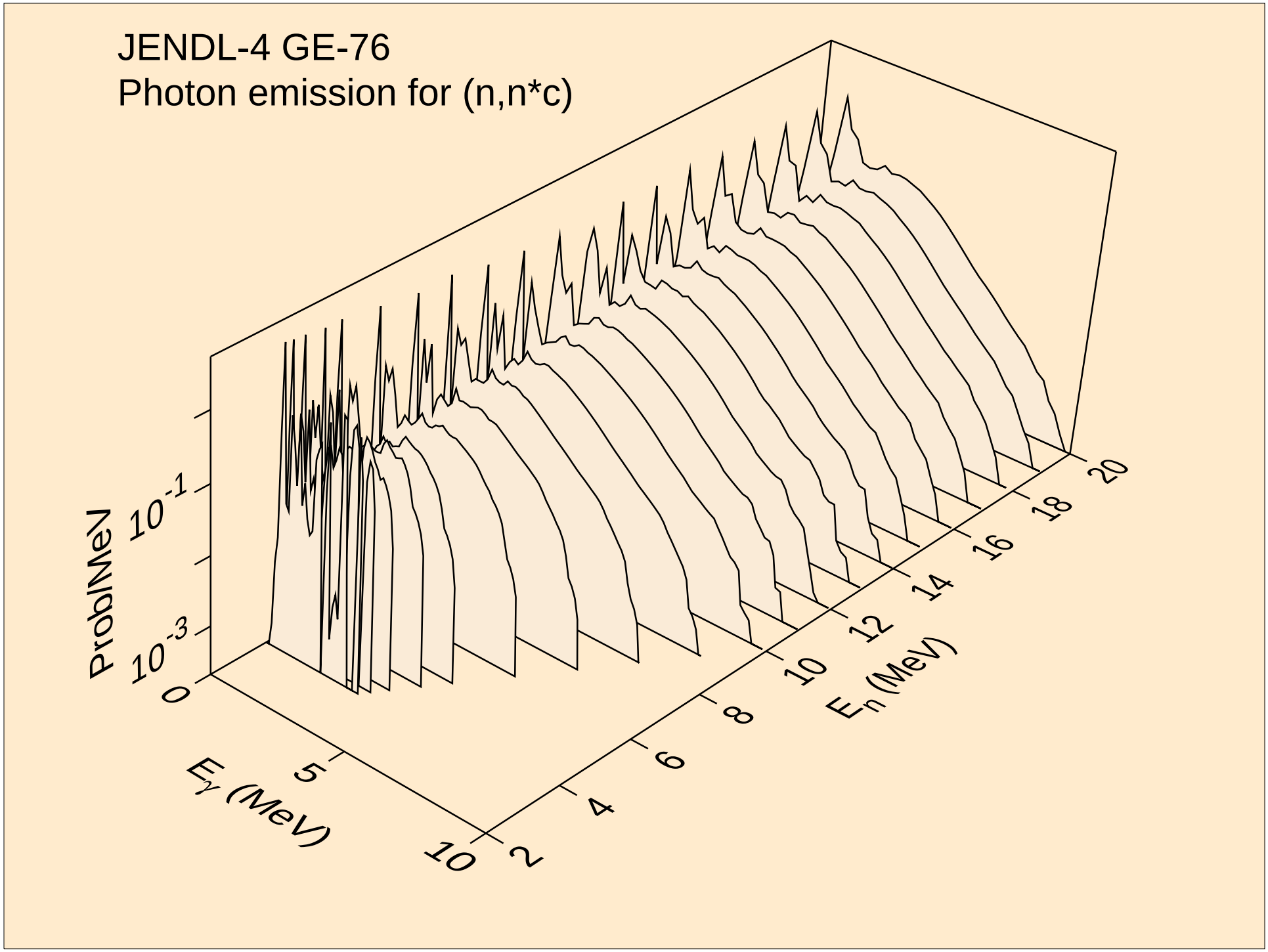
JENDL-4 GE-76
Photon emission for (n,n*)a



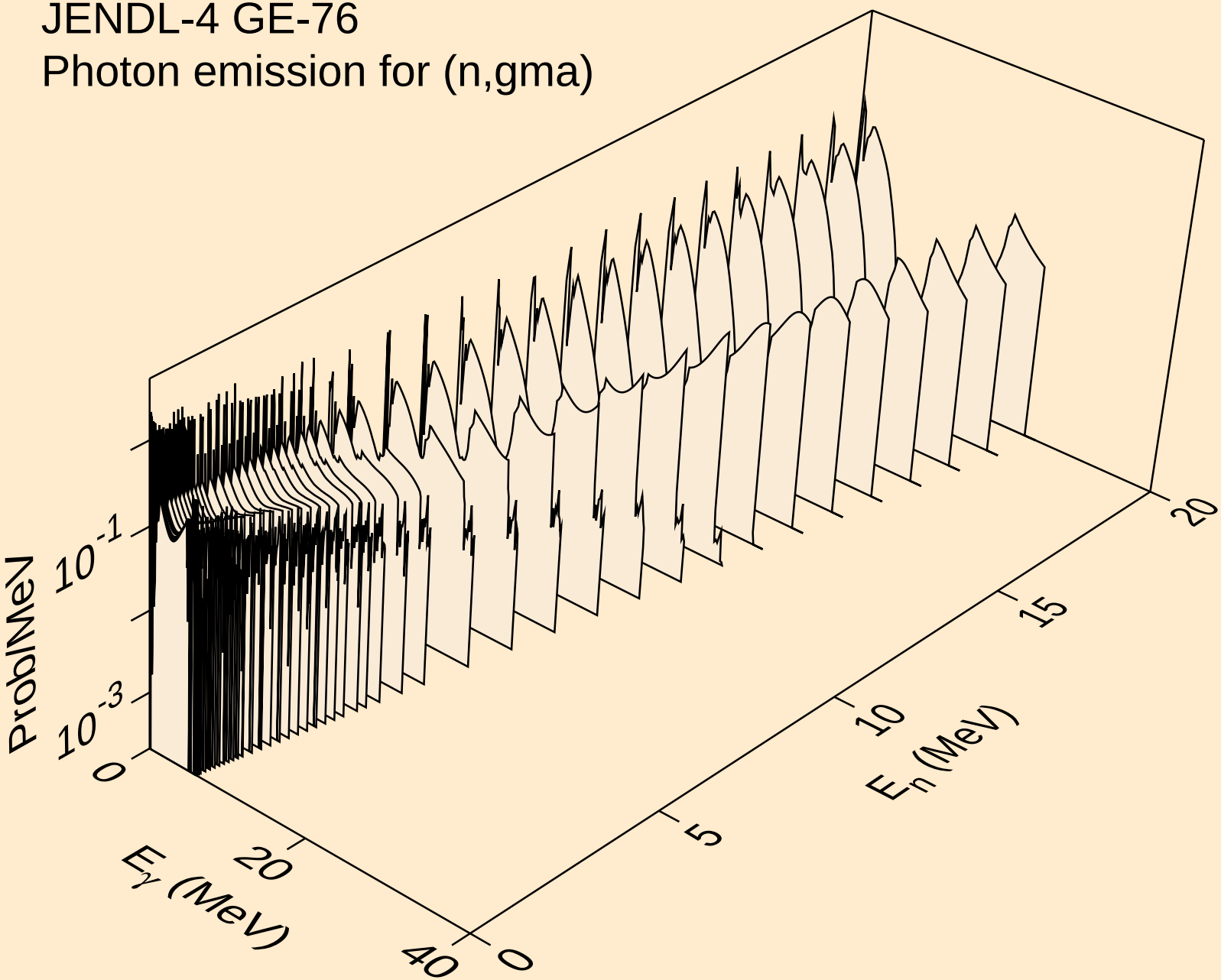
JENDL-4 GE-76
Photon emission for (n,2n)a

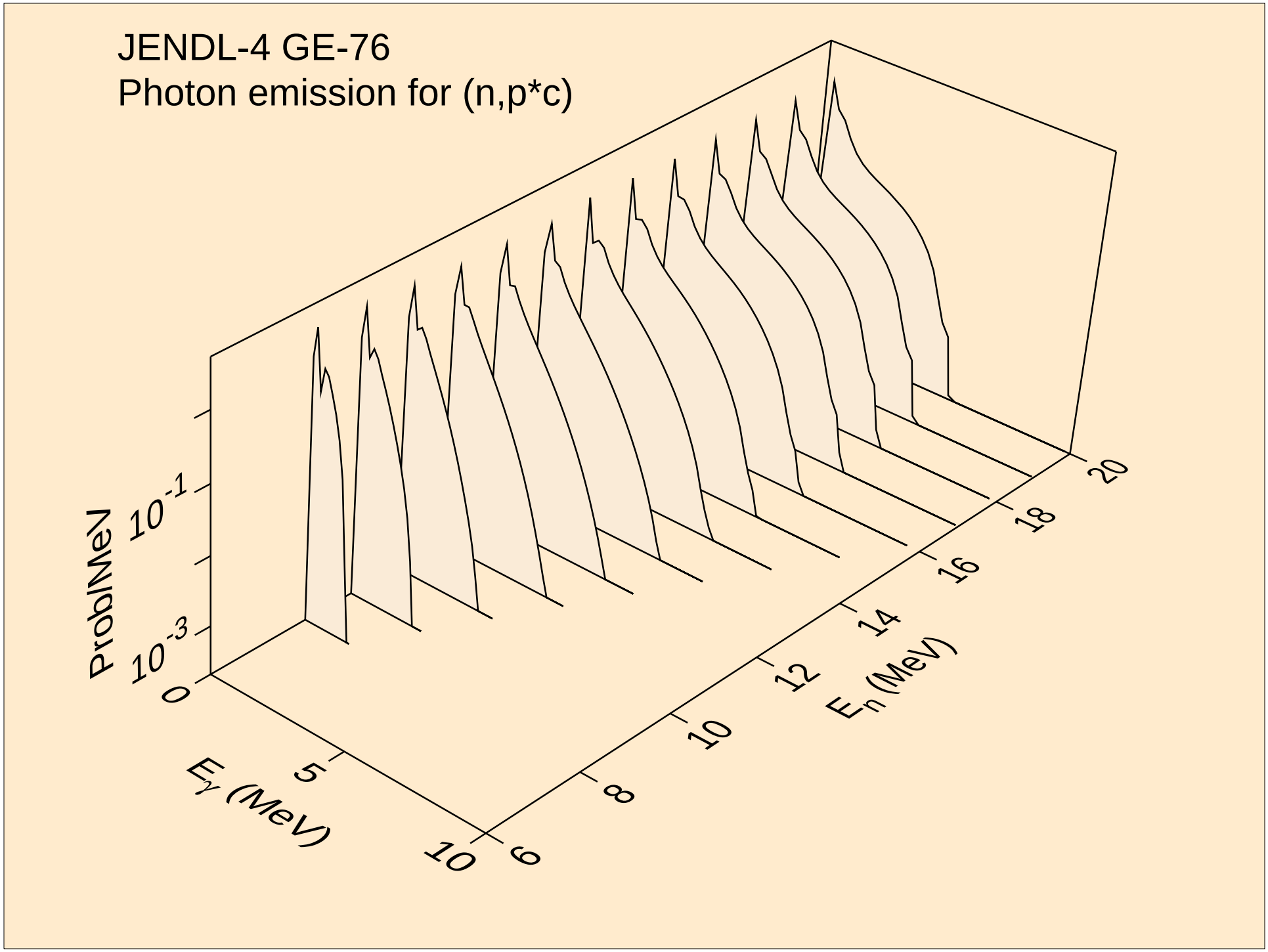


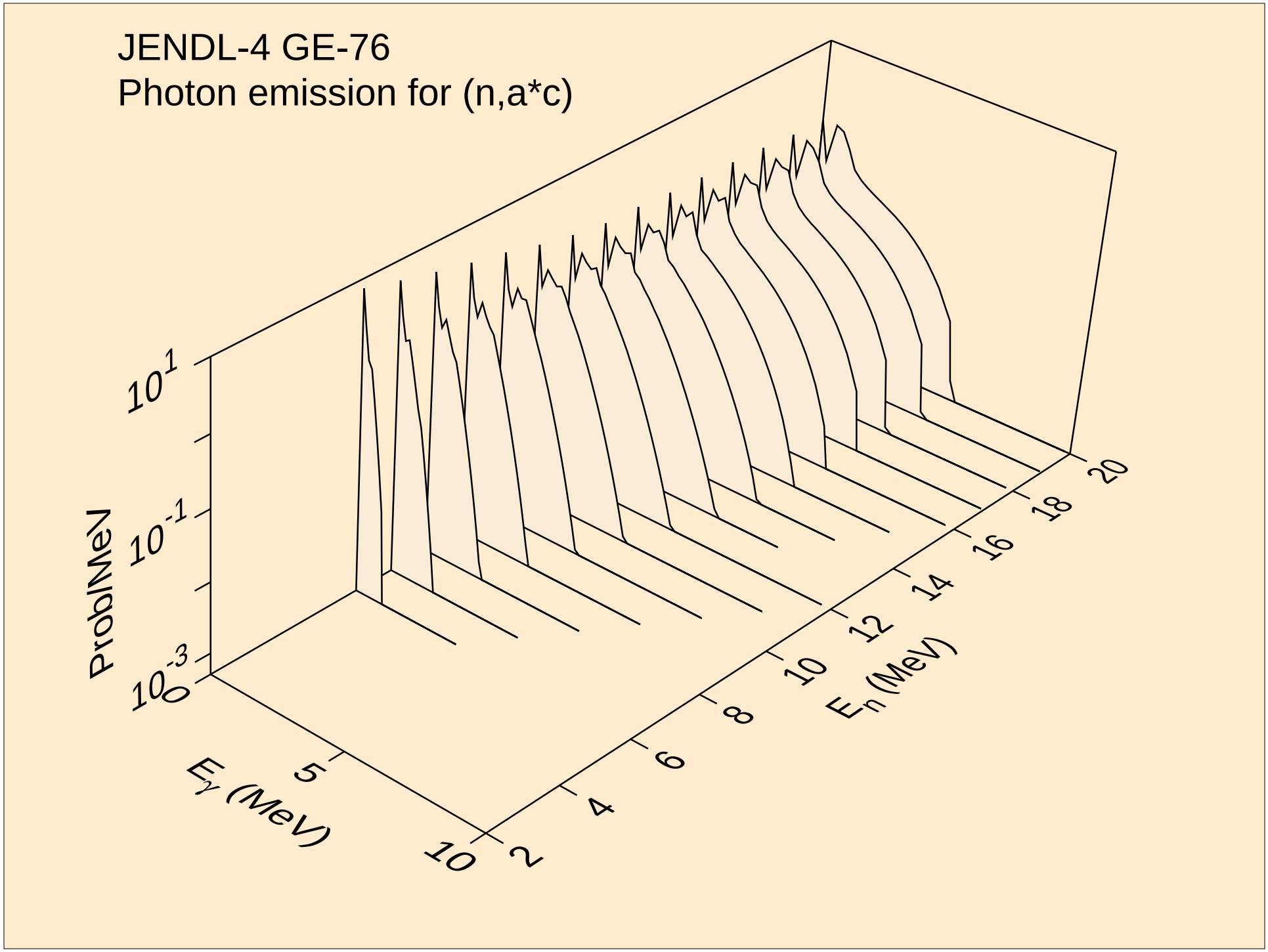

JENDL-4 GE-76
Photon emission for (n,n*)p
Prob/MeV
10^-1
10^-3
0
5
10
Eγ (MeV)
12
13
14
15
16
17
18
19
20
En (MeV)

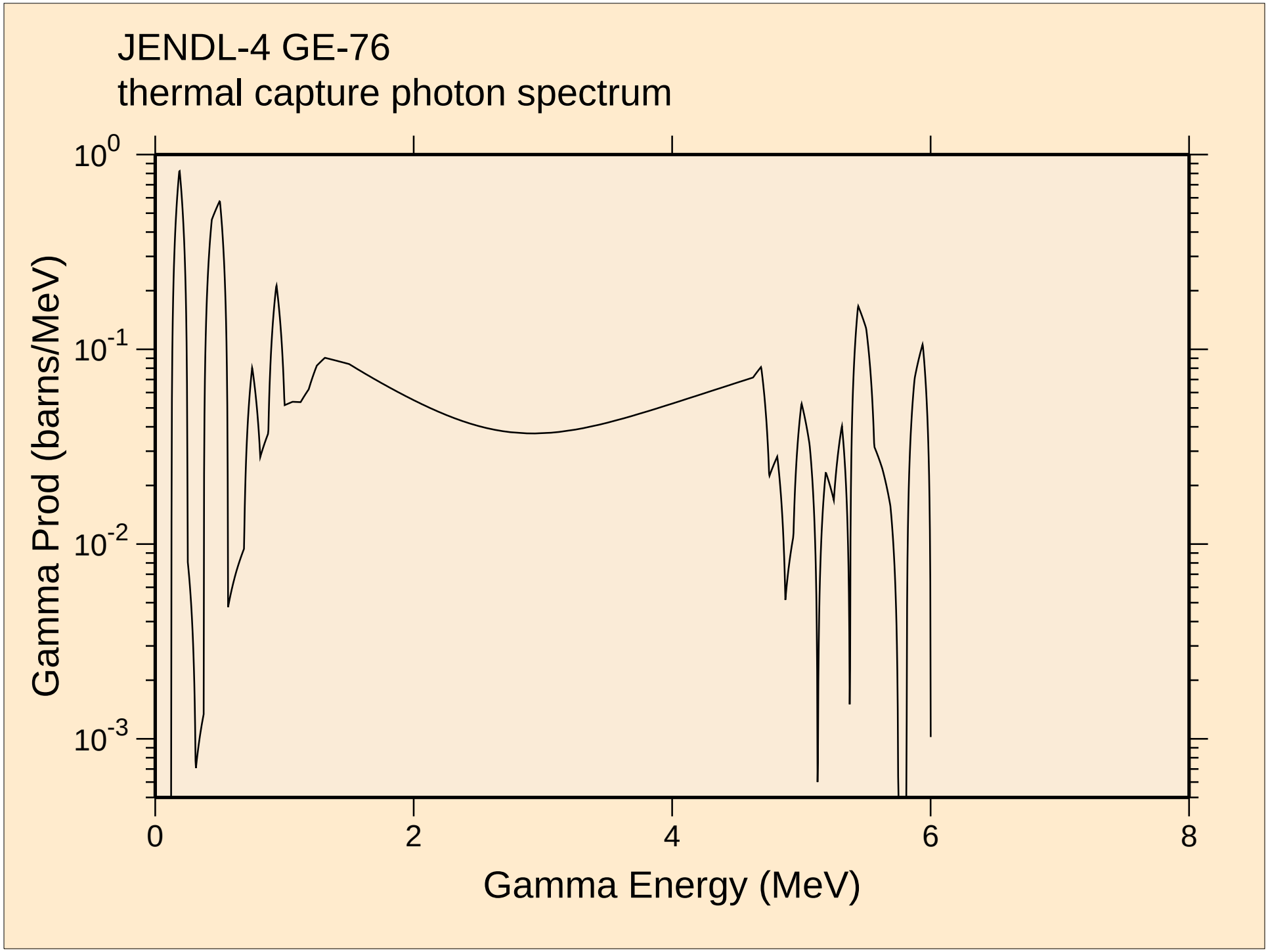

JENDL-4 GE-76
Photon emission for (n,n*c)
Prob/MeV
10^-1
10^-3
0
5
10
Eγ (MeV)
2
4
6
8
10
12
14
16
18
20
En (MeV)

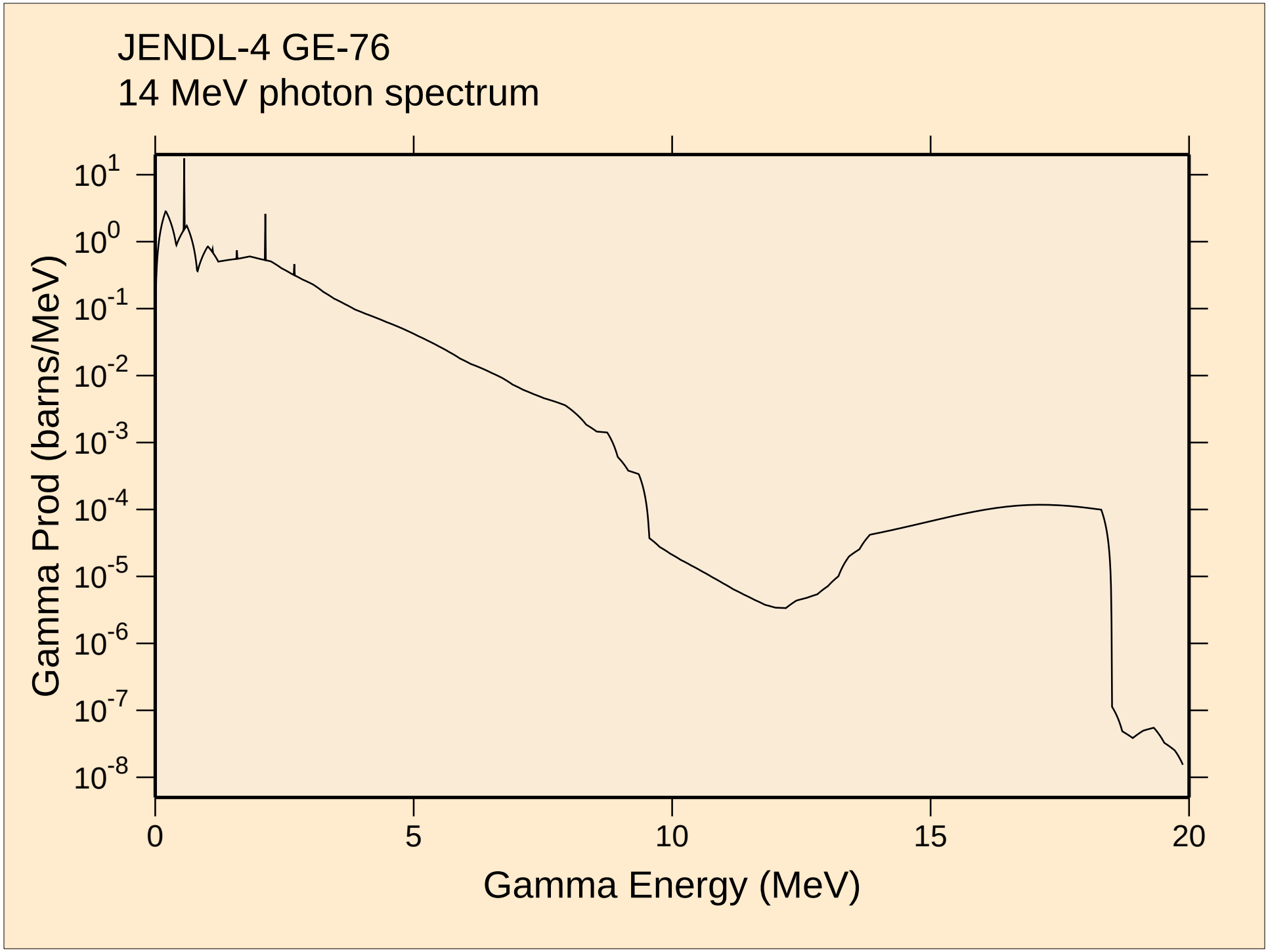
JENDL-4 GE-76
Photon emission for (n,gma)

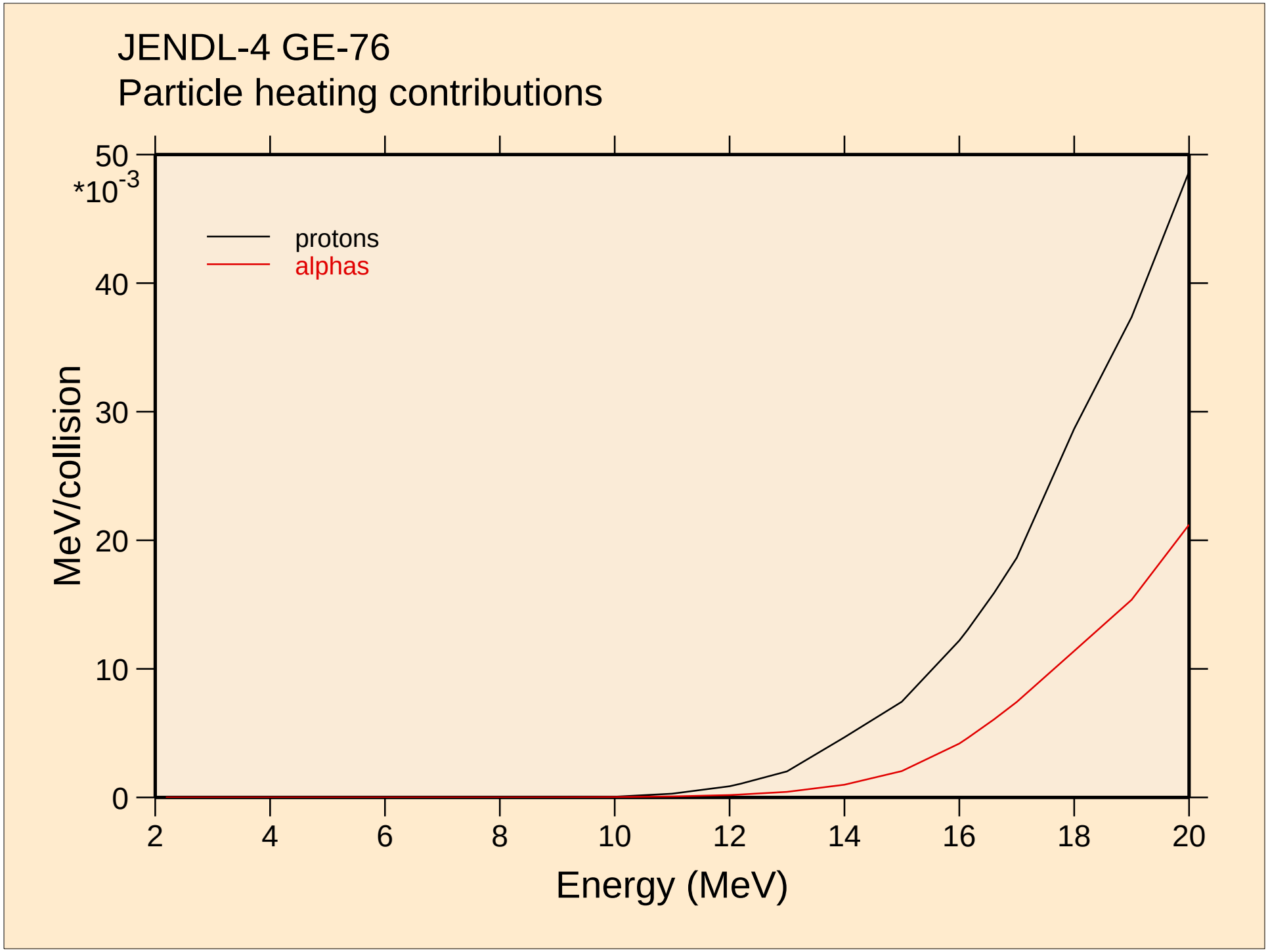


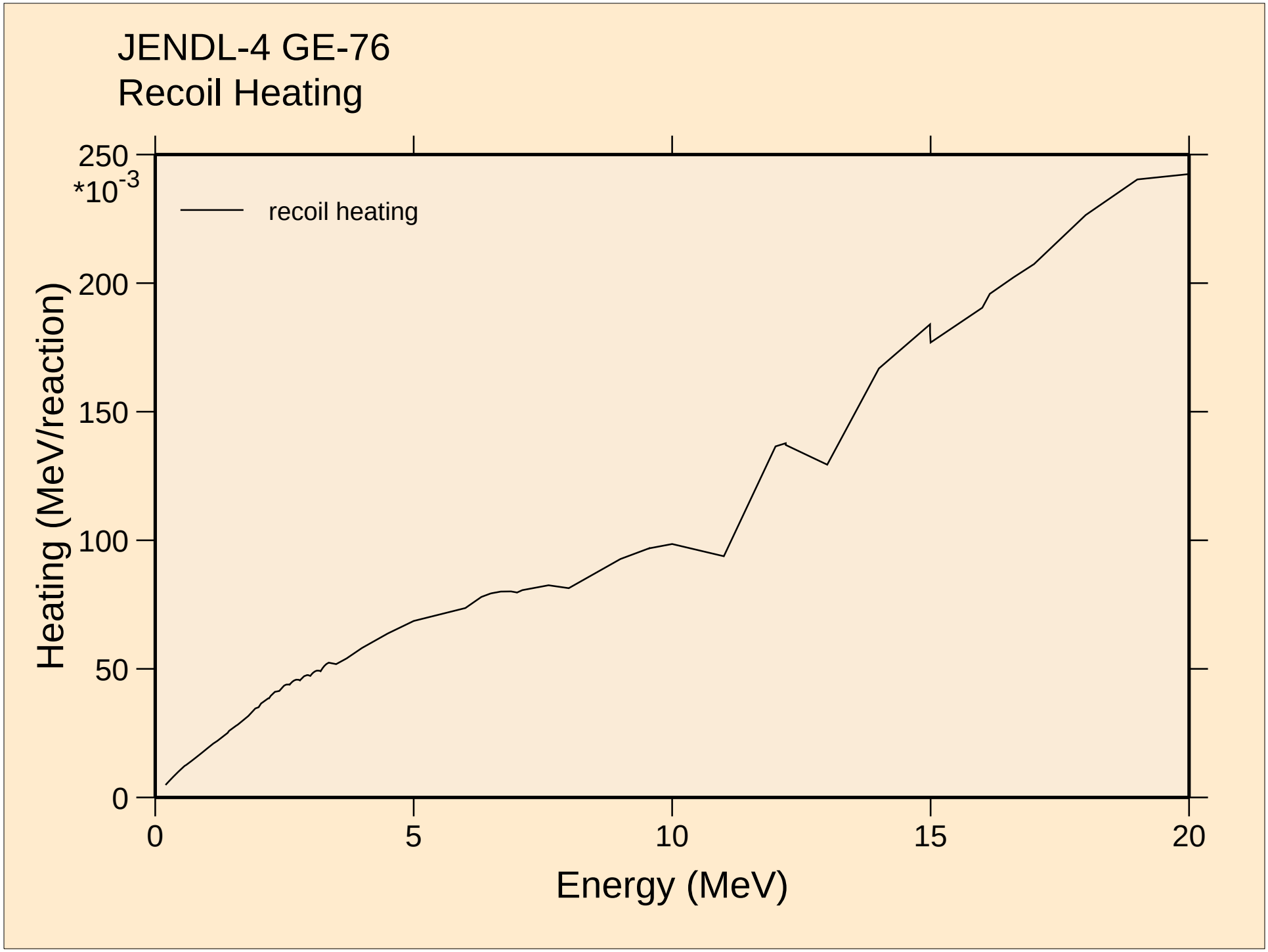

JENDL-4 GE-76
Photon emission for (n,p*c)
Prob/MeV
10^-1
10^-3
0
5
10
Eγ (MeV)
6
8
10
12
14
16
18
20
En (MeV)

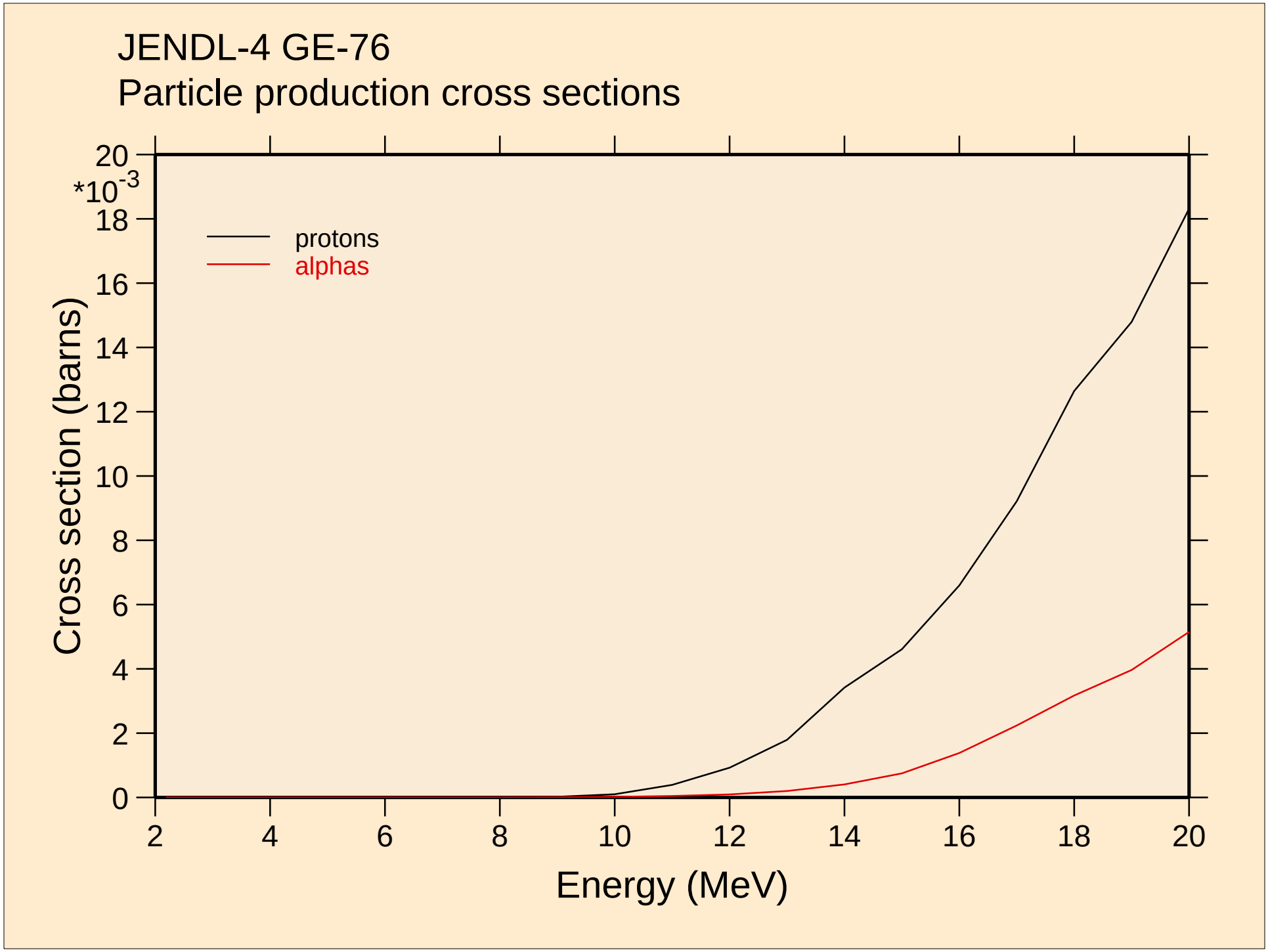

JENDL-4 GE-76
Photon emission for (n,a*c)
Prob/MeV
10^{1}
10^{-1}
10^{-3}
E_γ (MeV)
0
5
10
E_n (MeV)
2
4
6
8
10
12
14
16
18
20

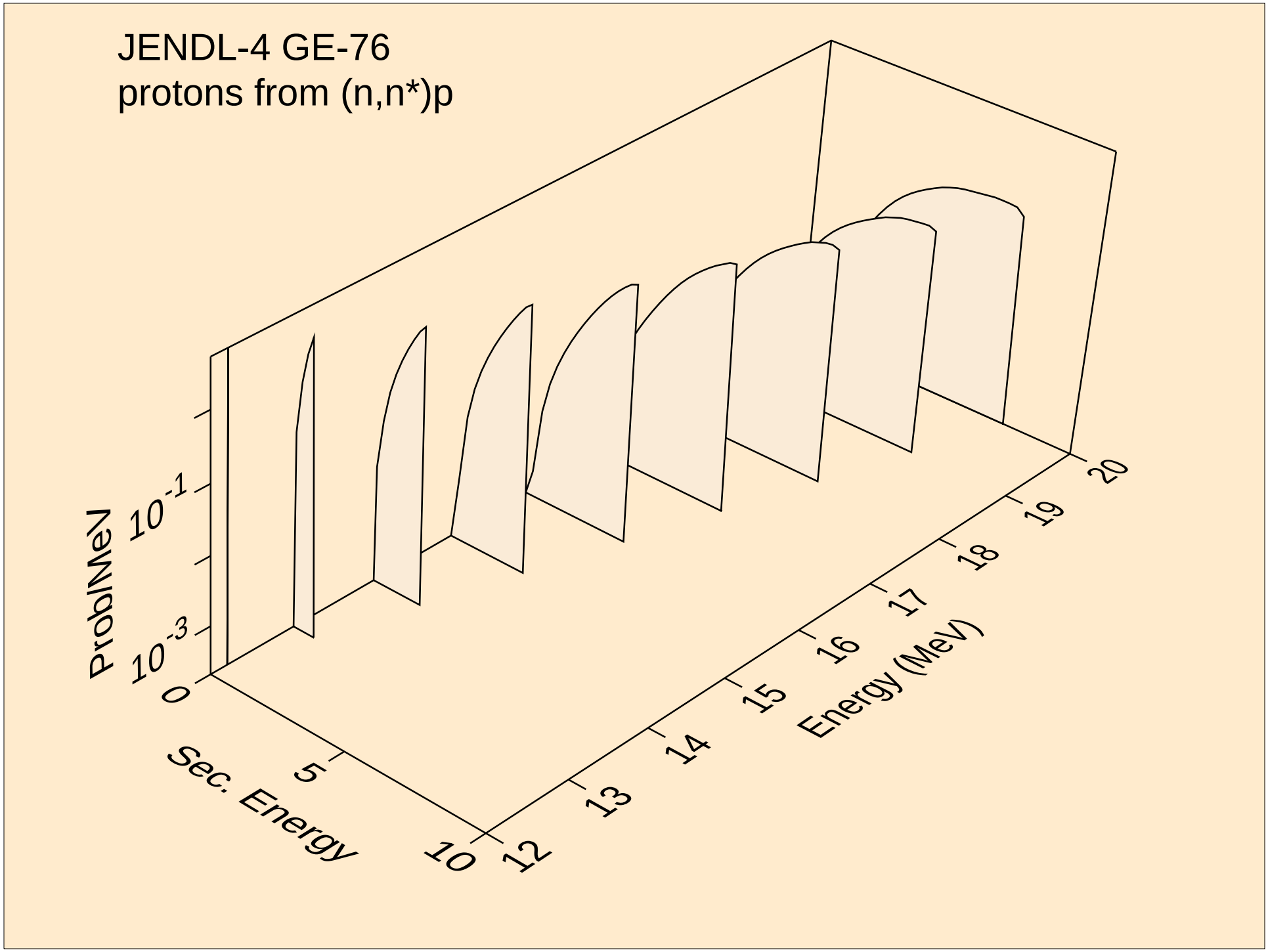

JENDL-4 GE-76
thermal capture photon spectrum
Gamma Prod (barns/MeV)
10^0
10^-1
10^-2
10^-3
0
2
4
6
8
Gamma Energy (MeV)

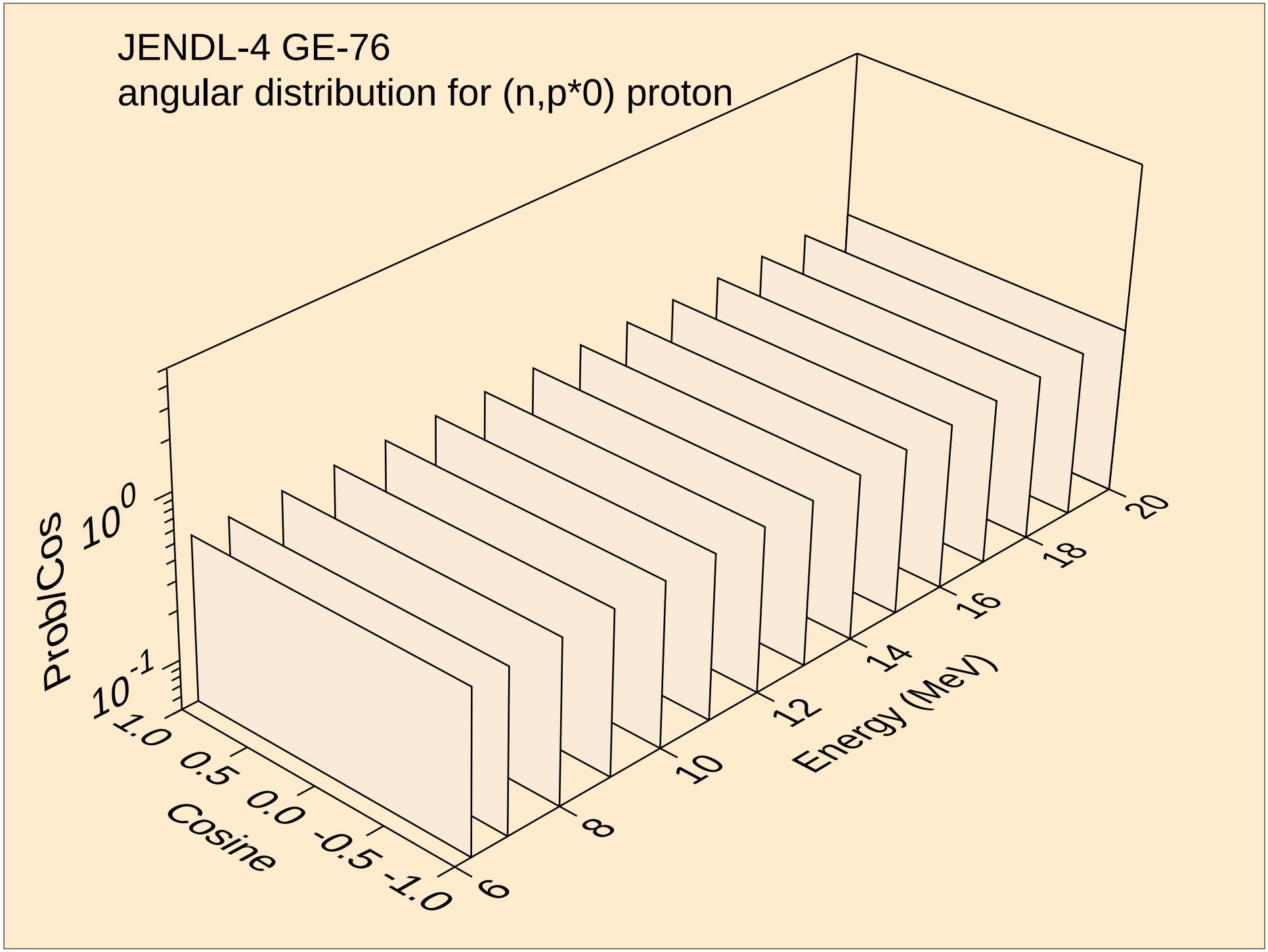

JENDL-4 GE-76
14 MeV photon spectrum
Gamma Prod (barns/MeV)
10^1
10^0
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
10^-8
0
5
10
15
20
Gamma Energy (MeV)

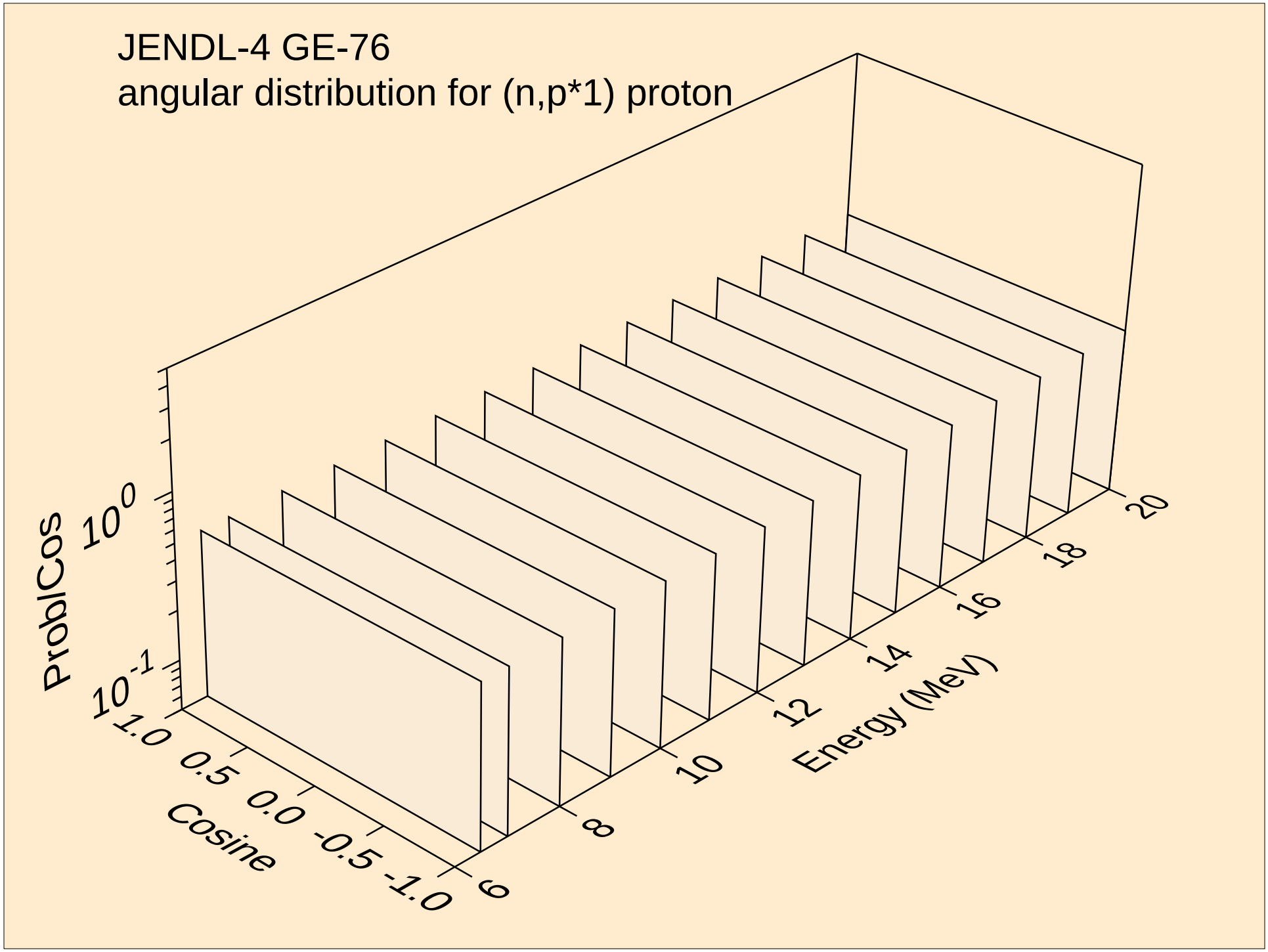

JENDL-4 GE-76
Particle heating contributions
*10-3
50
40
30
20
10
0
MeV/collision
protons
alphas
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

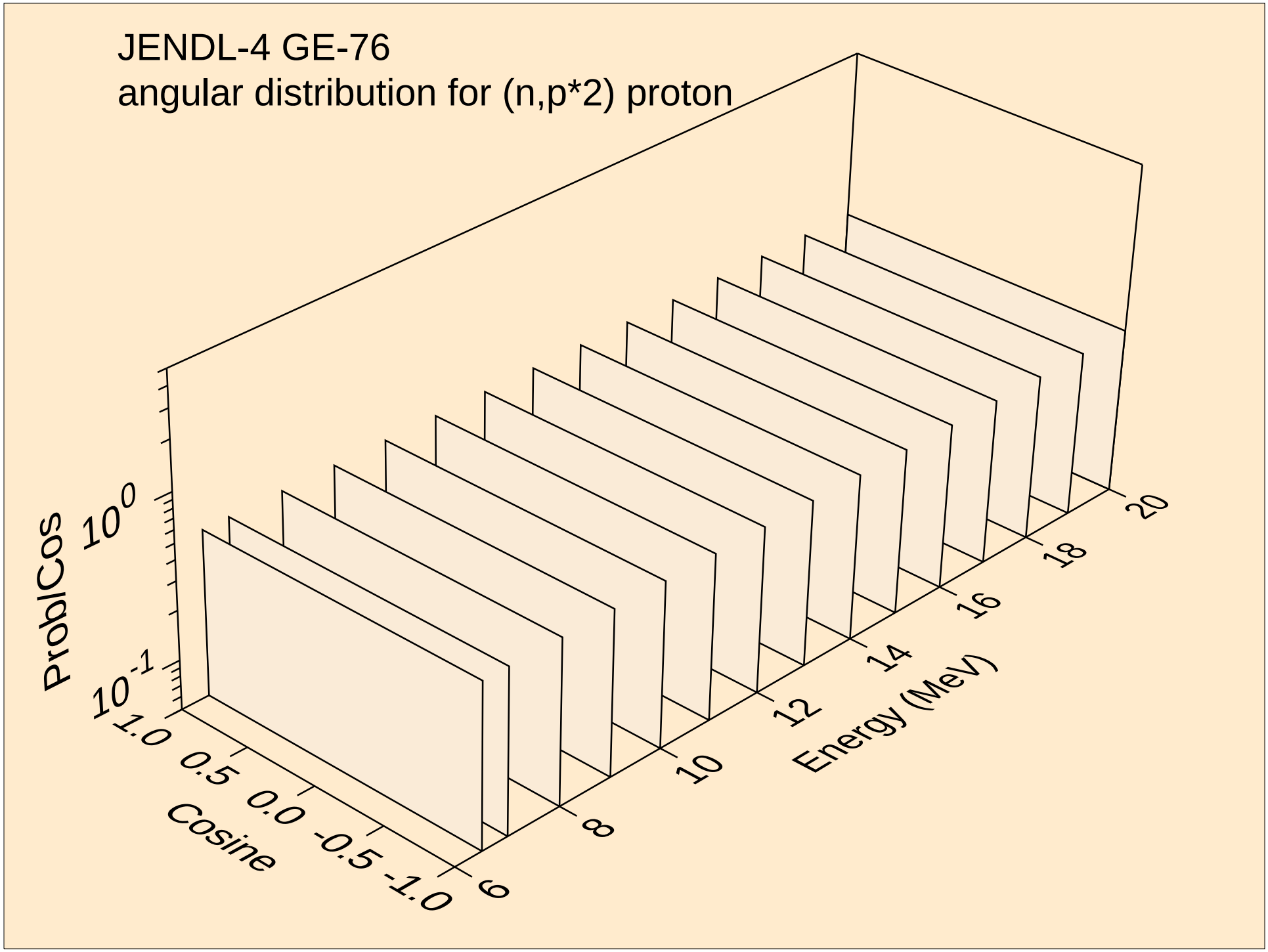

JENDL-4 GE-76
Recoil Heating
recoil heating
Heating (MeV/reaction)
*10-3
250
200
150
100
50
0
0
5
10
15
20
Energy (MeV)

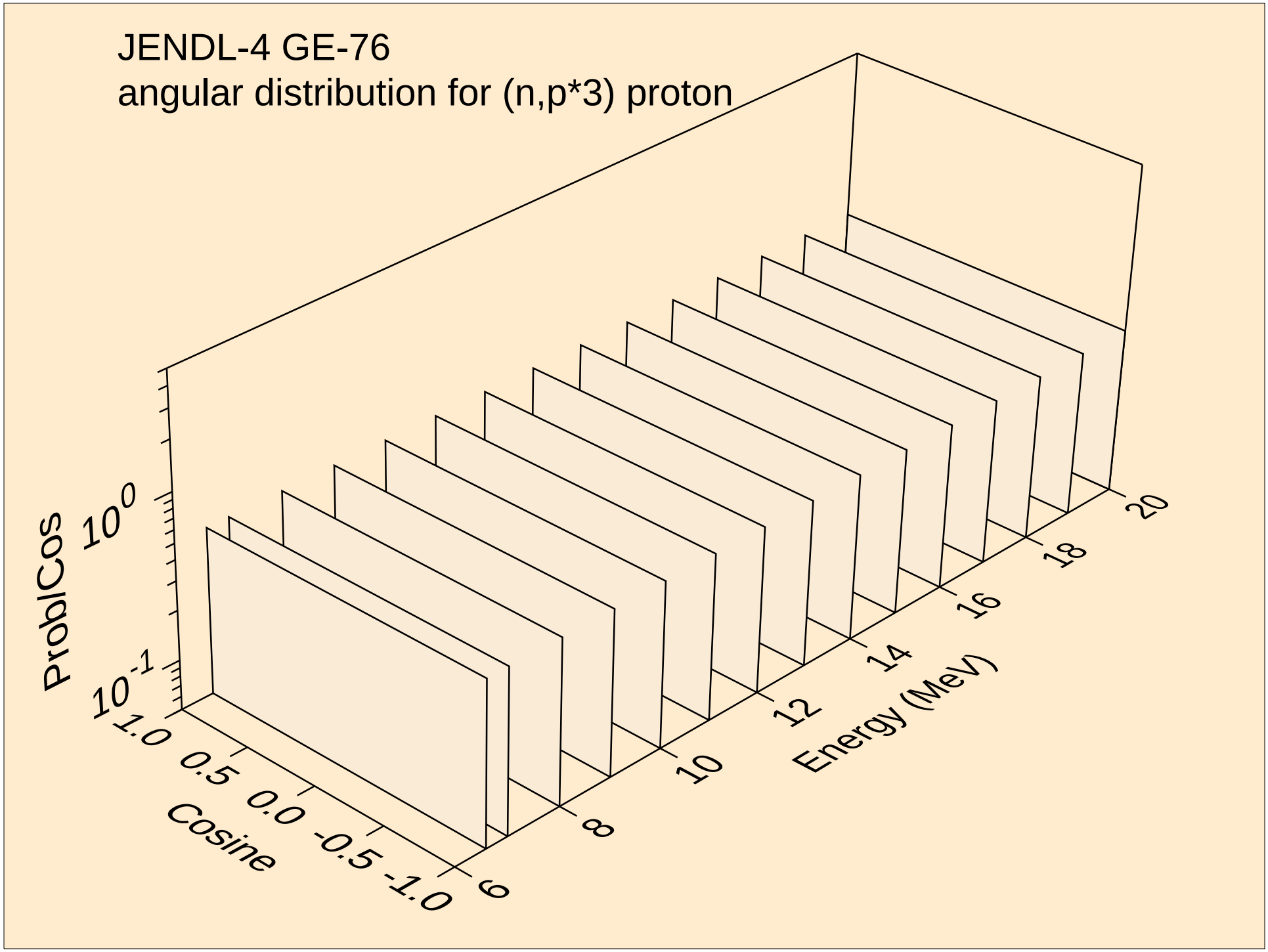

JENDL-4 GE-76
Particle production cross sections
protons
alphas
Cross section (barns)
*10-3
20
18
16
14
12
10
8
6
4
2
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

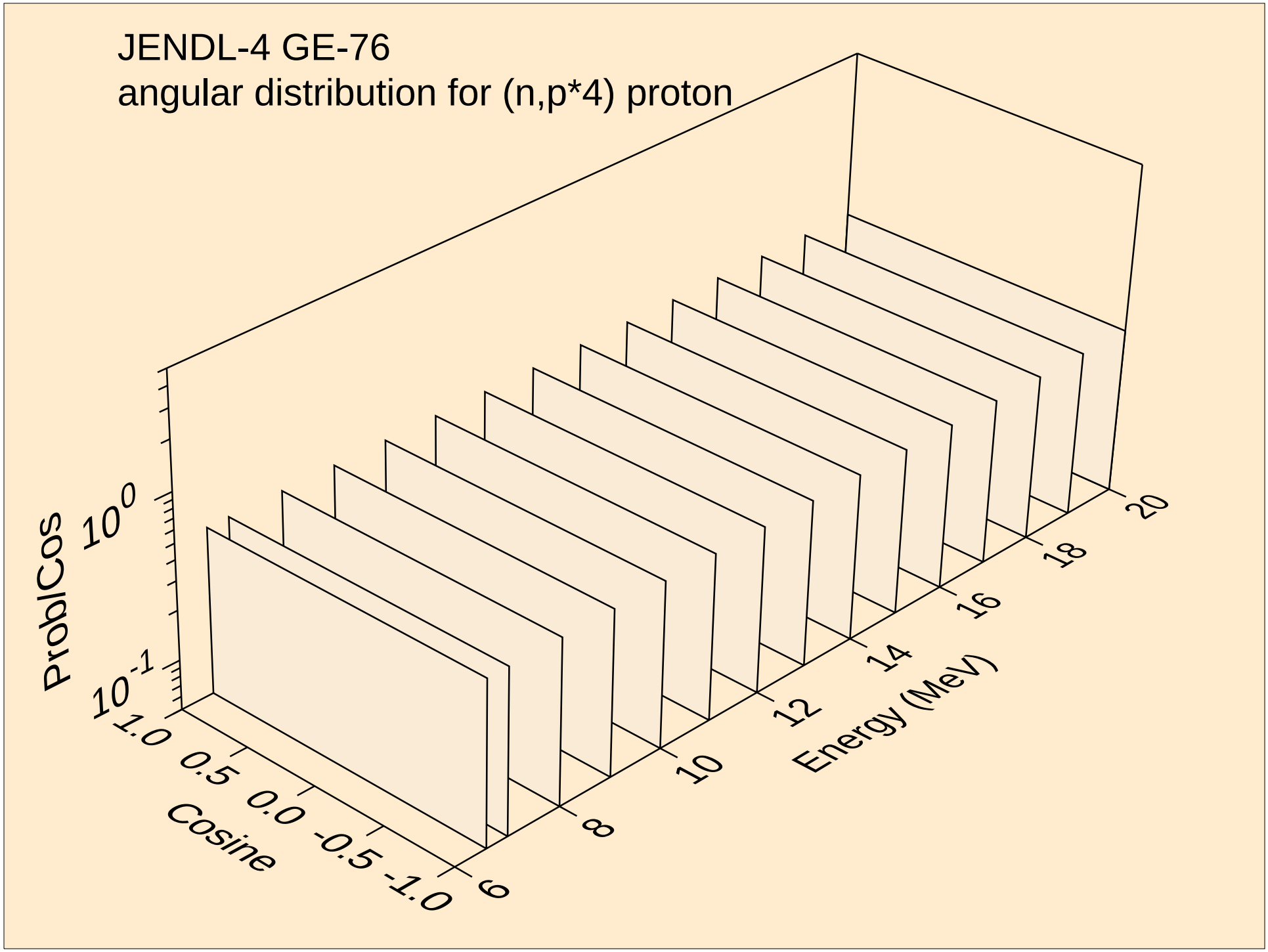

JENDL-4 GE-76
protons from (n,n*)p
Prob/MeV
10^-1
10^-3
0
Sec. Energy
5
10
12
13
14
15
16
17
18
19
20
Energy (MeV)

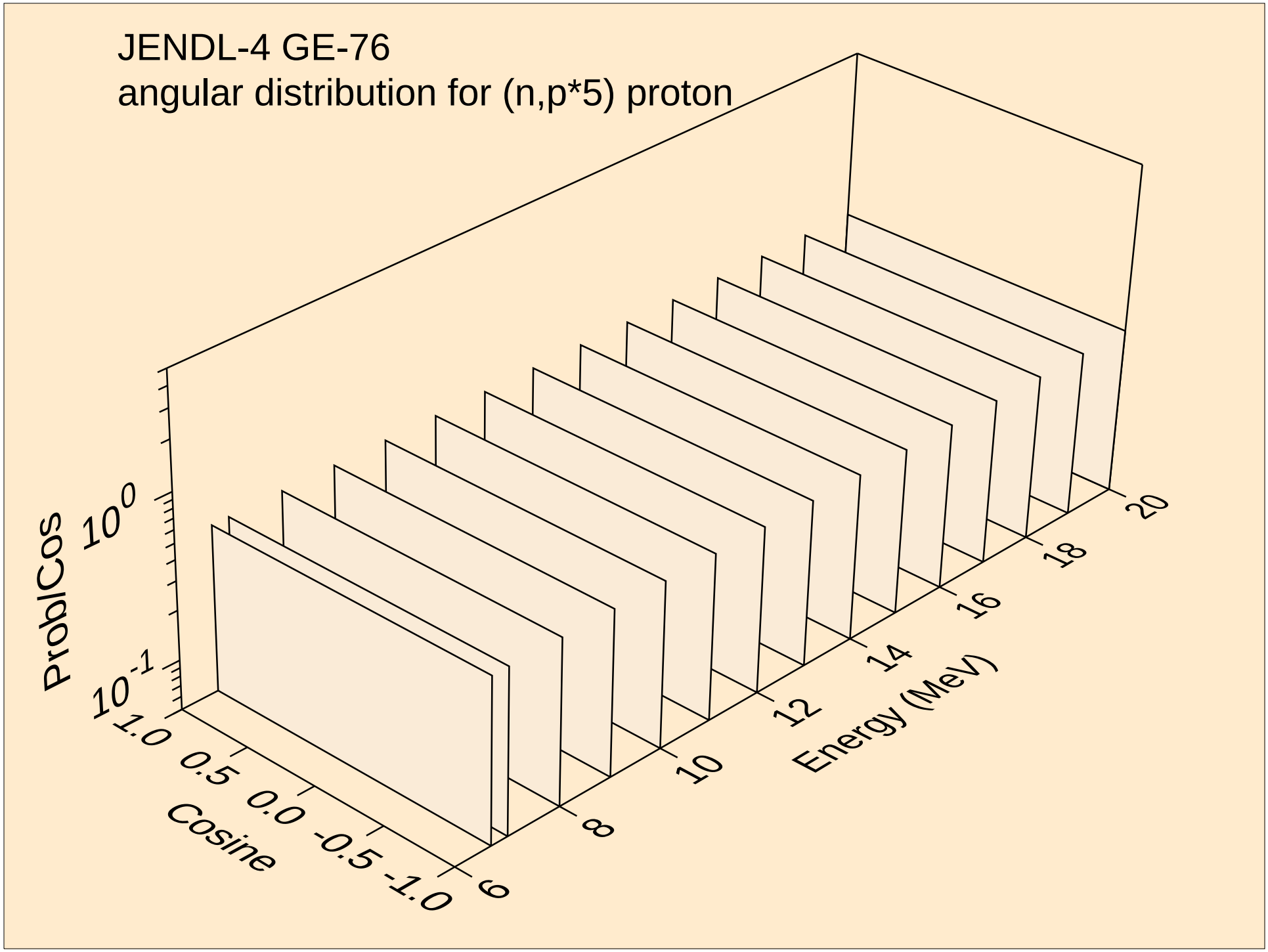

JENDL-4 GE-76
angular distribution for (n,p*0) proton
ProbCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

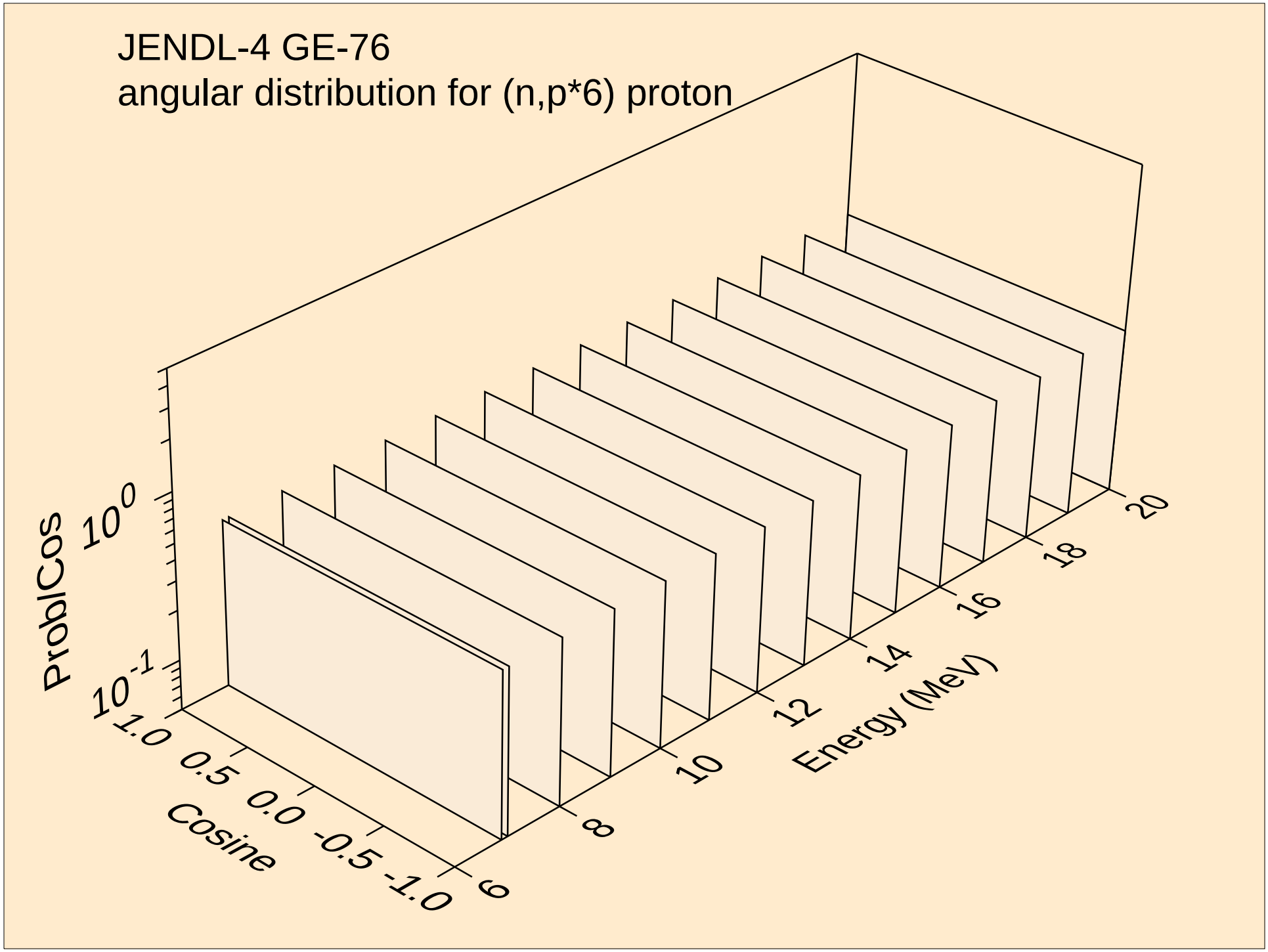

JENDL-4 GE-76
angular distribution for (n,p*1) proton
ProblCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

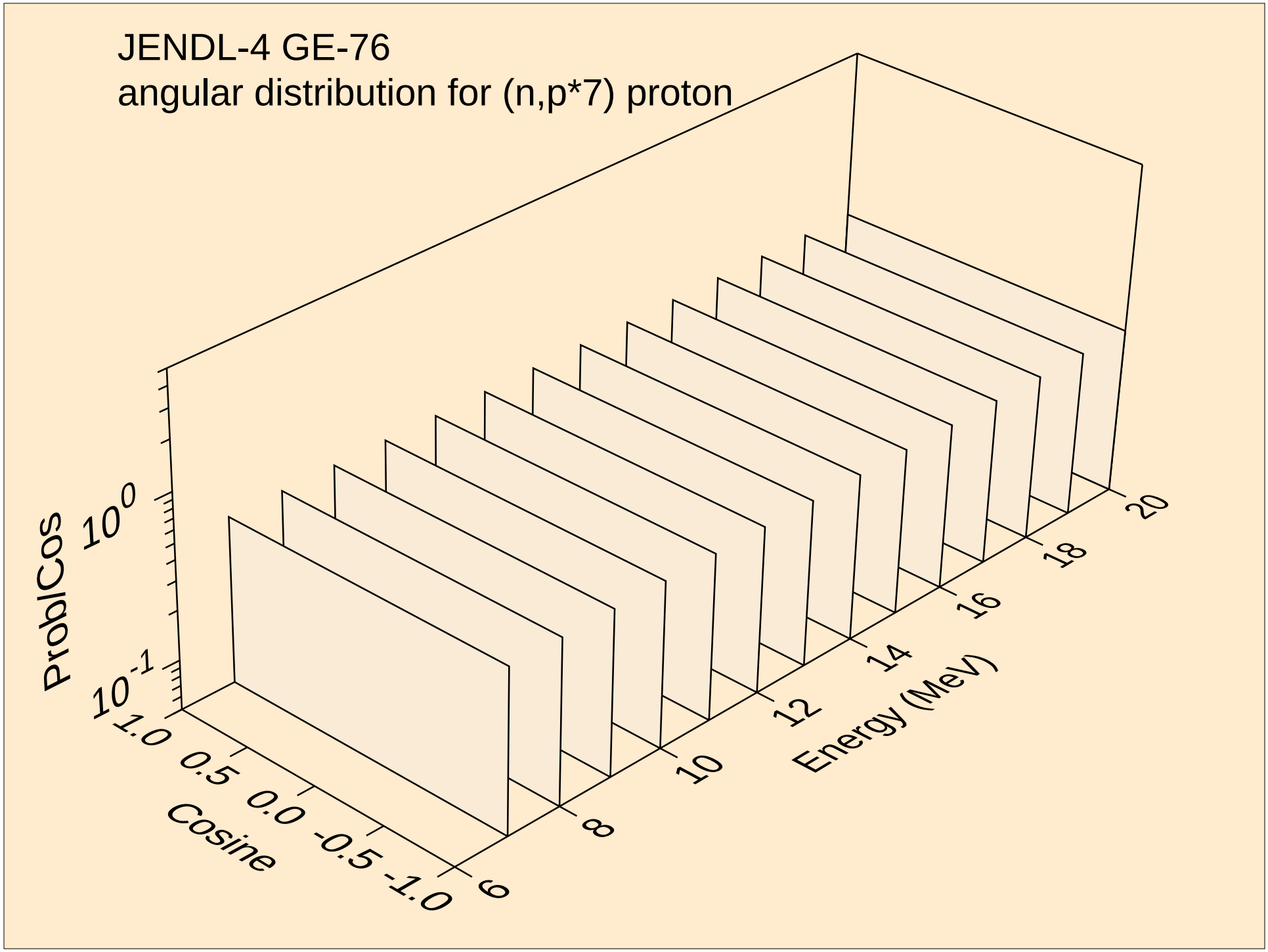

JENDL-4 GE-76
angular distribution for (n,p*2) proton
ProbCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

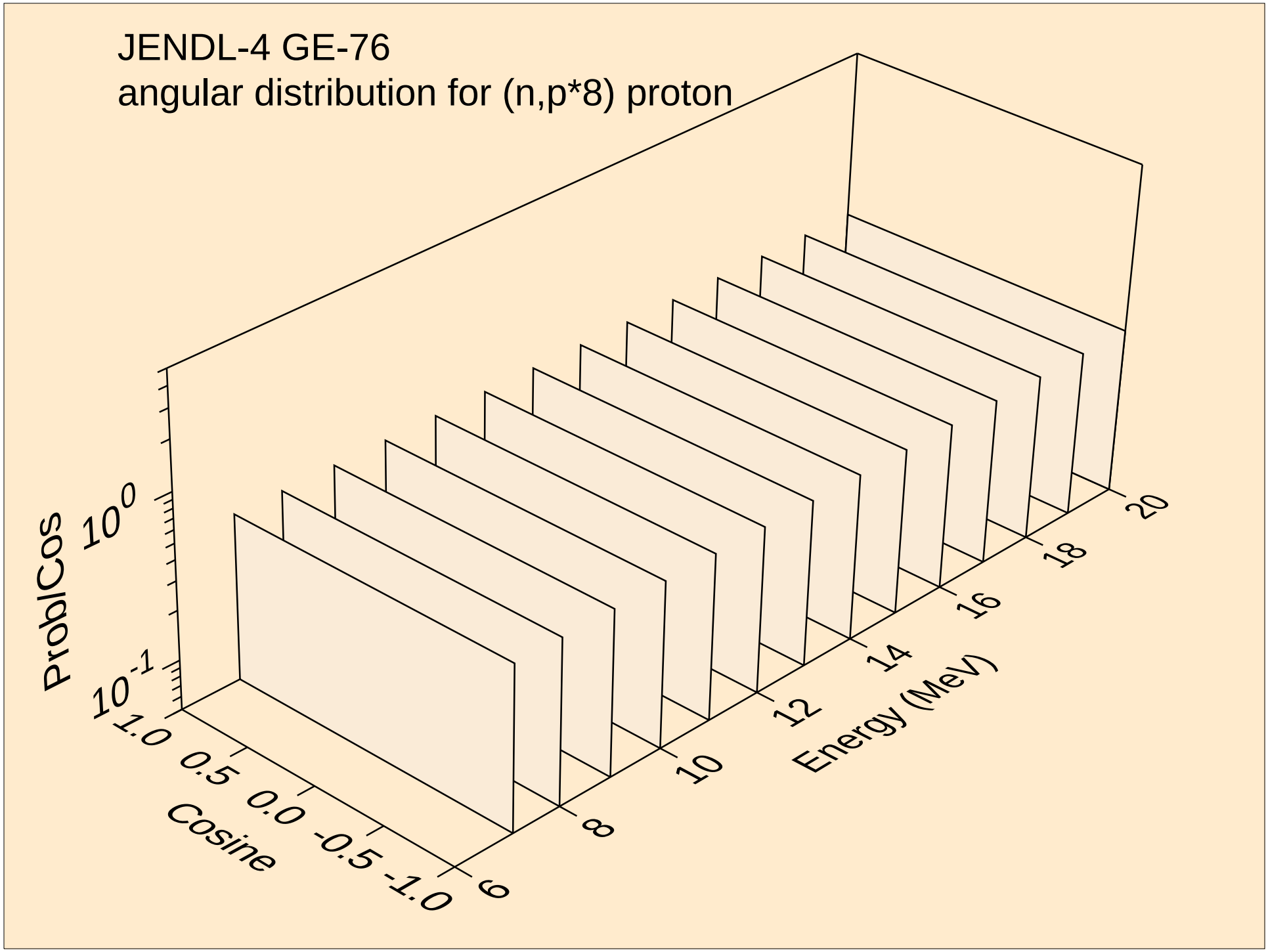

JENDL-4 GE-76
angular distribution for (n,p*3) proton
Prob/Cos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

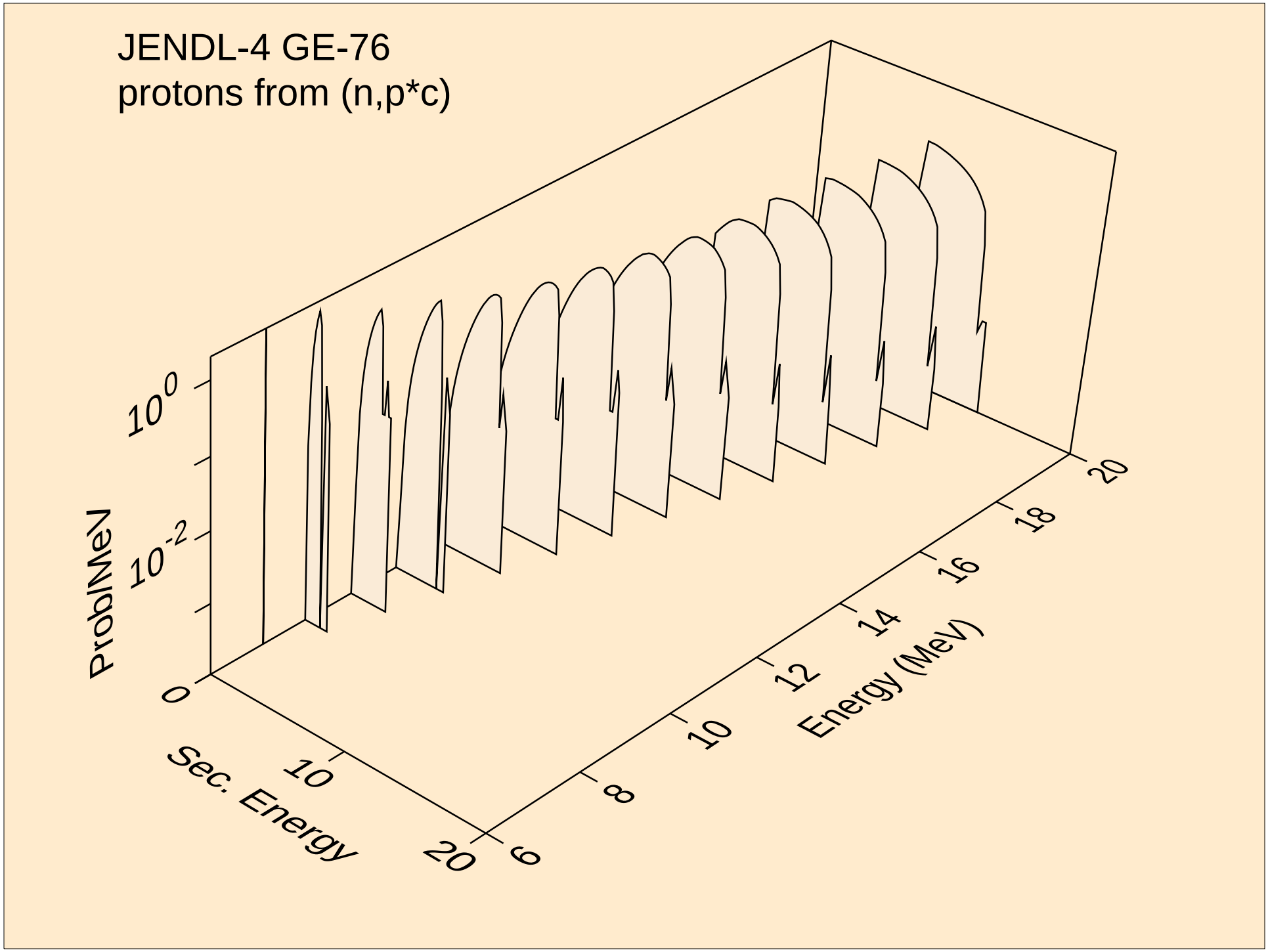

JENDL-4 GE-76
angular distribution for (n,p*4) proton
ProblCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

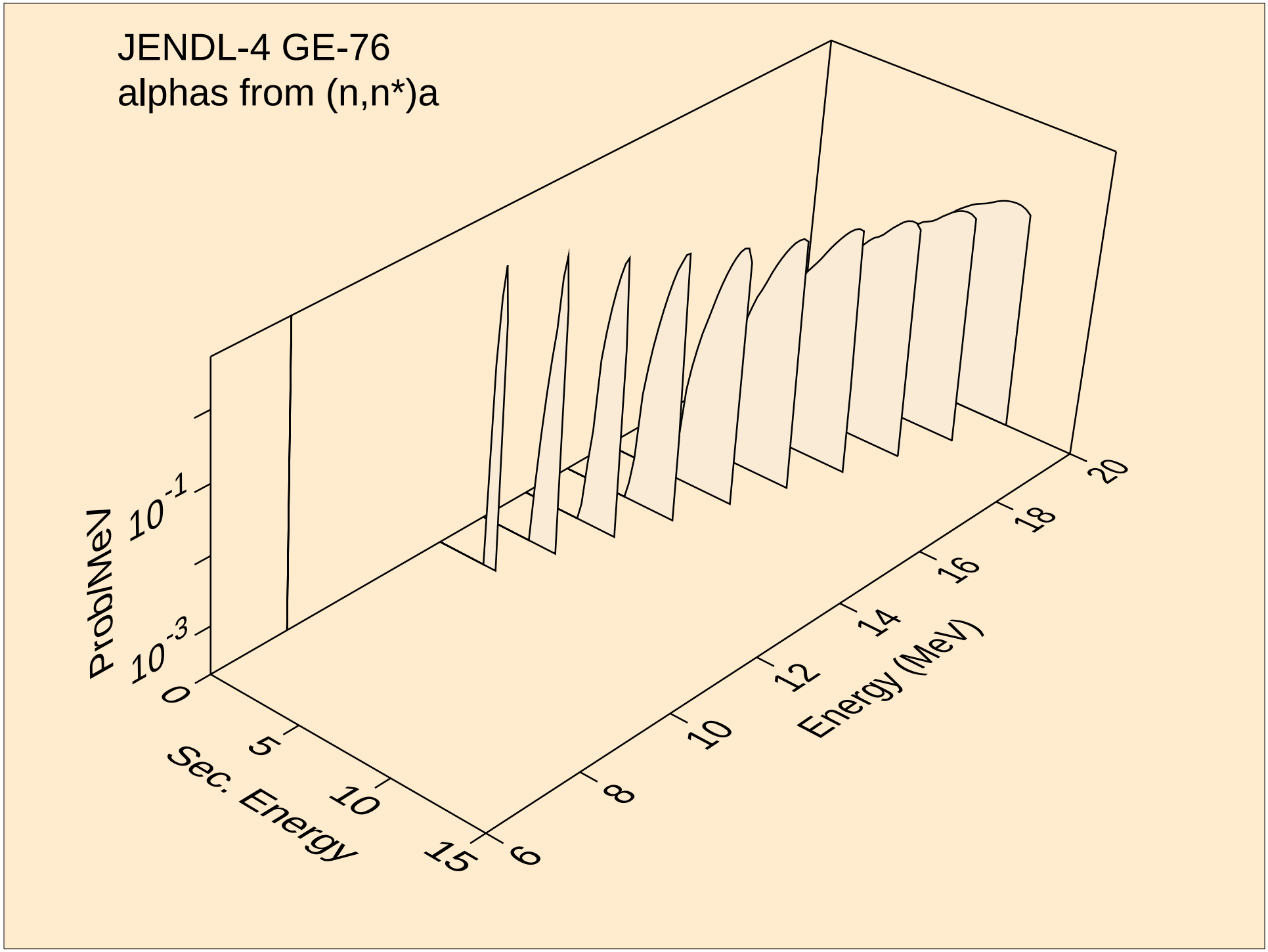

JENDL-4 GE-76
angular distribution for (n,p*5) proton
ProblCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

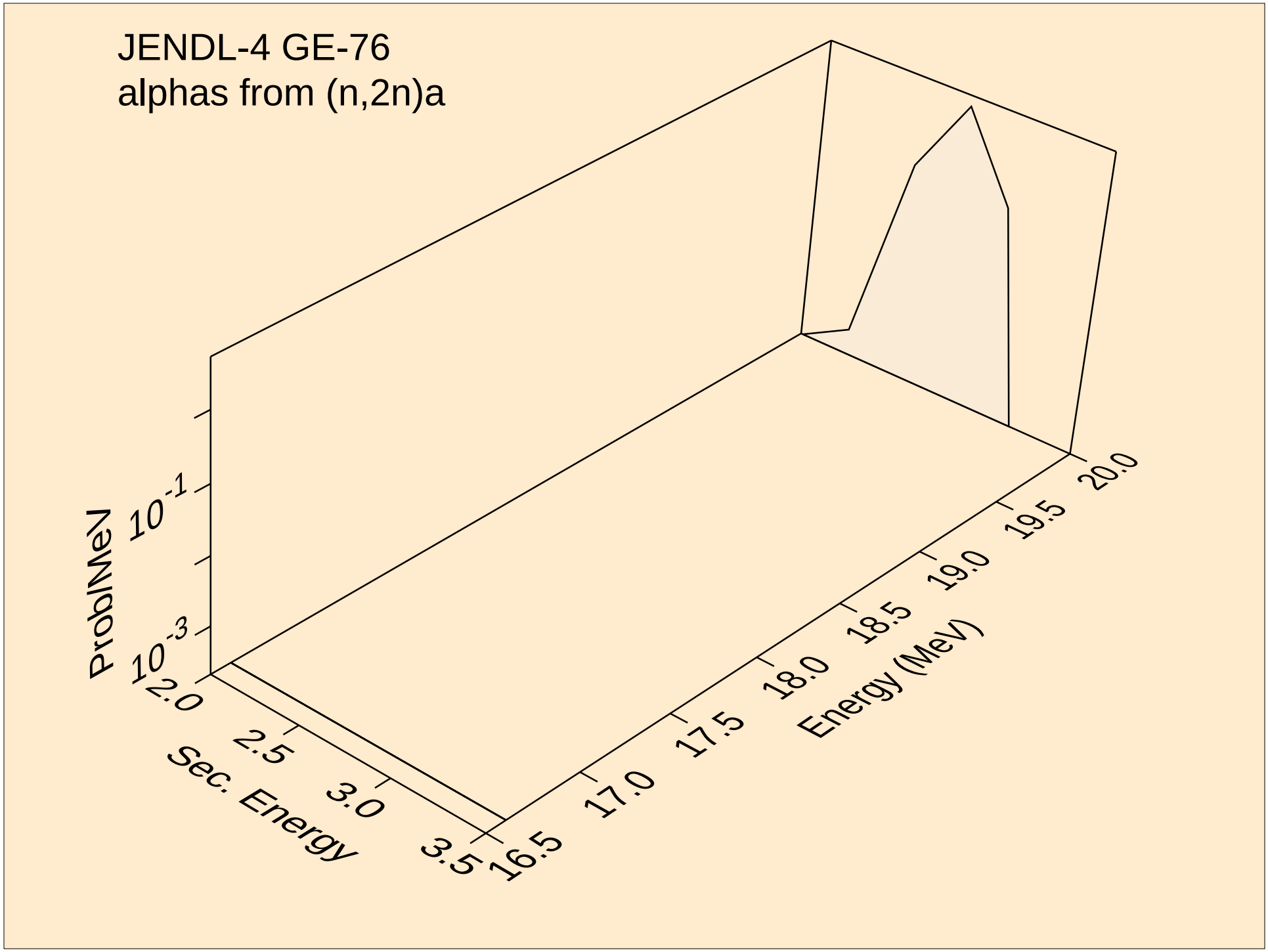

JENDL-4 GE-76
angular distribution for (n,p*6) proton
ProblCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

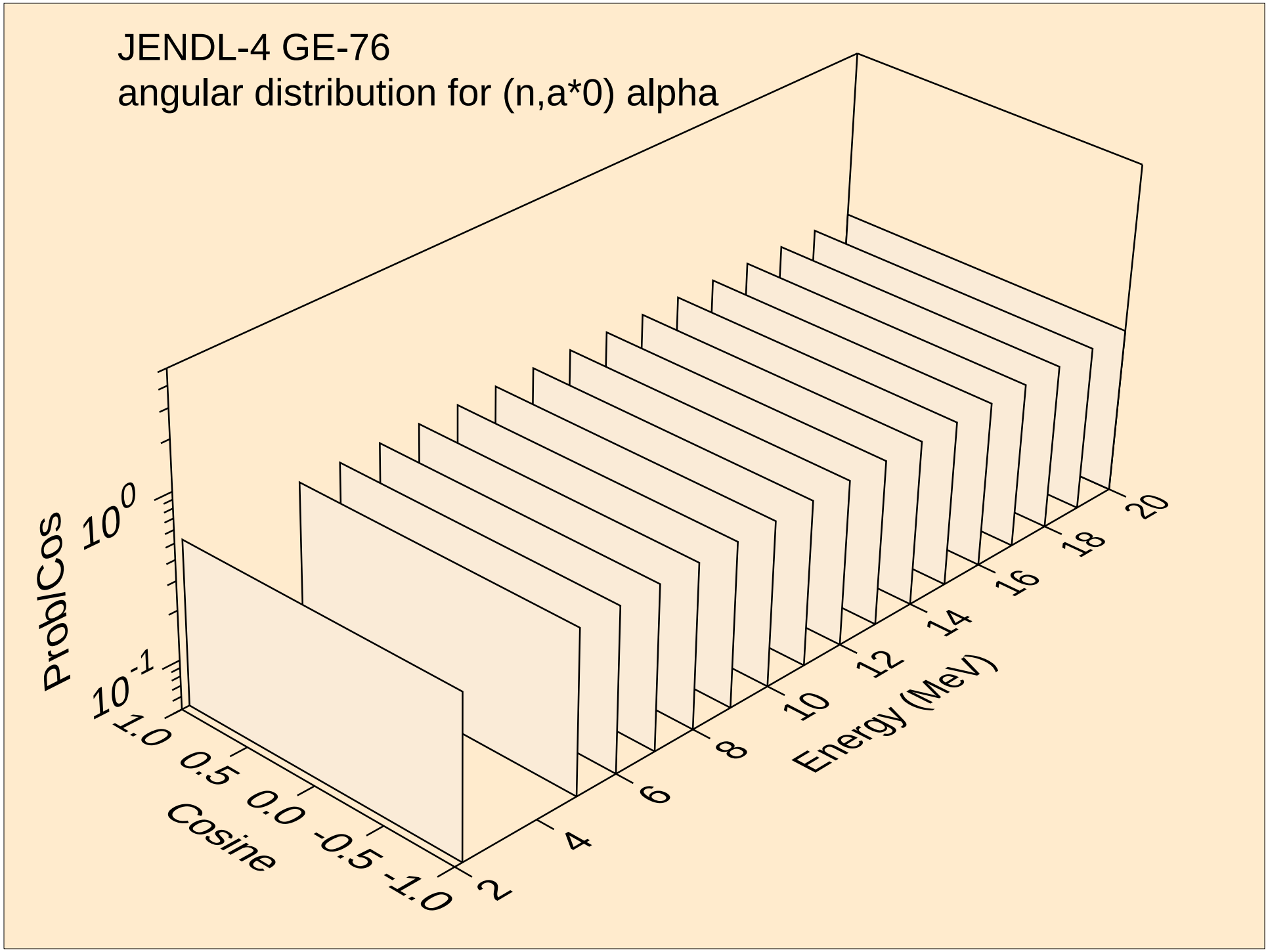

JENDL-4 GE-76
angular distribution for (n,p*7) proton
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)

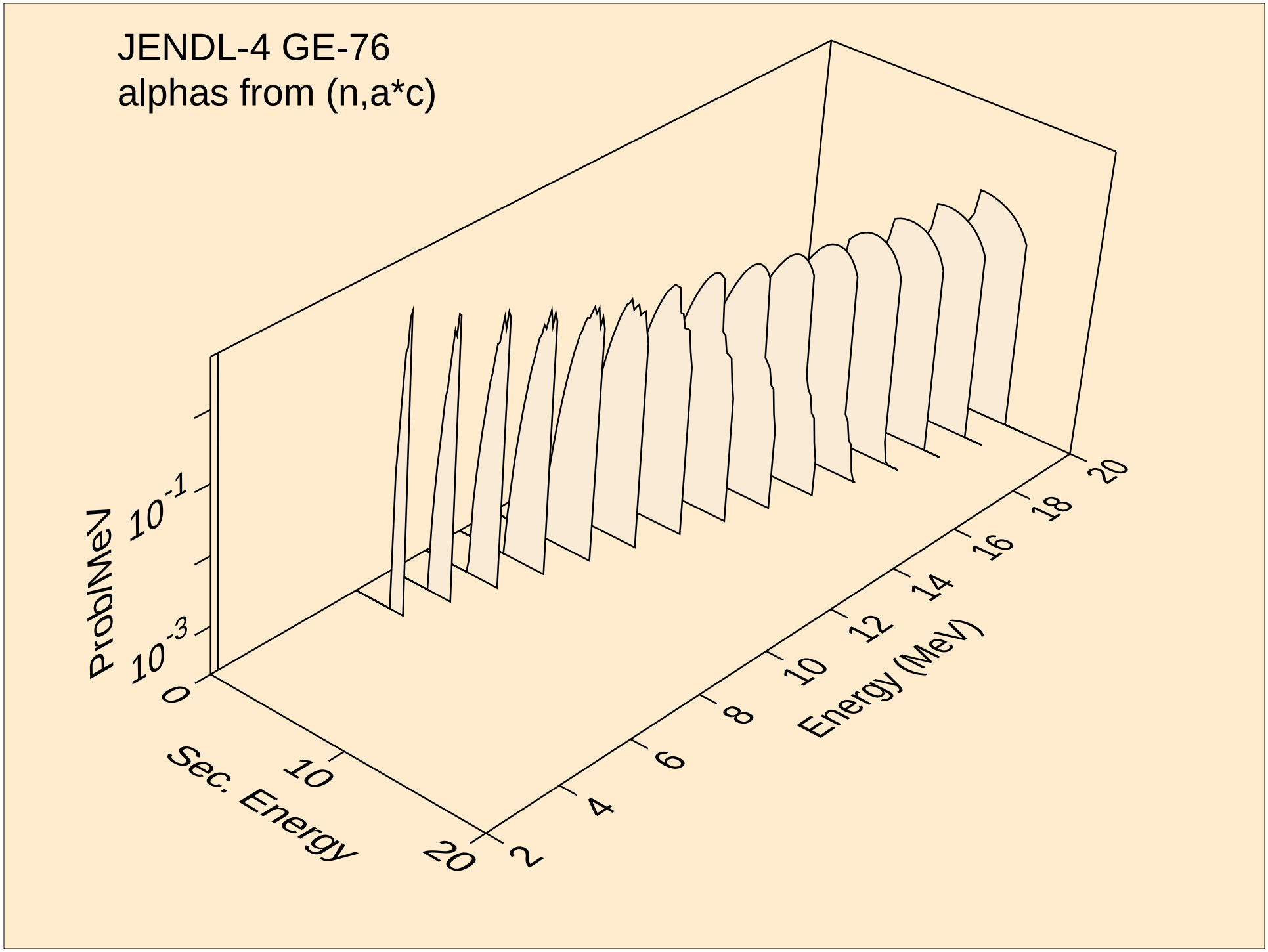

JENDL-4 GE-76
angular distribution for (n,p*8) proton
Prob/Cos
10^0
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
6
8
10
12
14
16
18
20
Energy (MeV)


JENDL-4 GE-76
protons from (n,p*c)
Prob/MeV
10^0
10^{-2}
0
10
20
Sec. Energy
6
8
10
12
14
16
18
20
Energy (MeV)


JENDL-4 GE-76
alphas from (n,n*)a
Prob/MeV
10^-1
10^-3
0
5
10
15
Sec. Energy
6
8
10
12
14
16
18
20
Energy (MeV)


JENDL-4 GE-76
alphas from (n,2n)a
Prob/MeV
10-1
10-3
2.0
2.5
3.0
3.5
Sec. Energy
16.5
17.0
17.5
18.0
18.5
19.0
19.5
20.0
Energy (MeV)


JENDL-4 GE-76
angular distribution for (n,a*0) alpha
ProbCos
10^{0}
10^{-1}
1.0
0.5
0.0
-0.5
-1.0
Cosine
2
4
6
8
10
12
14
16
18
20
Energy (MeV)


JENDL-4 GE-76
alphas from (n,a*c)
Prob/MeV
10^-1
10^-3
0
Sec. Energy
10
20
2
4
6
8
10
12
14
16
18
20
Energy (MeV)