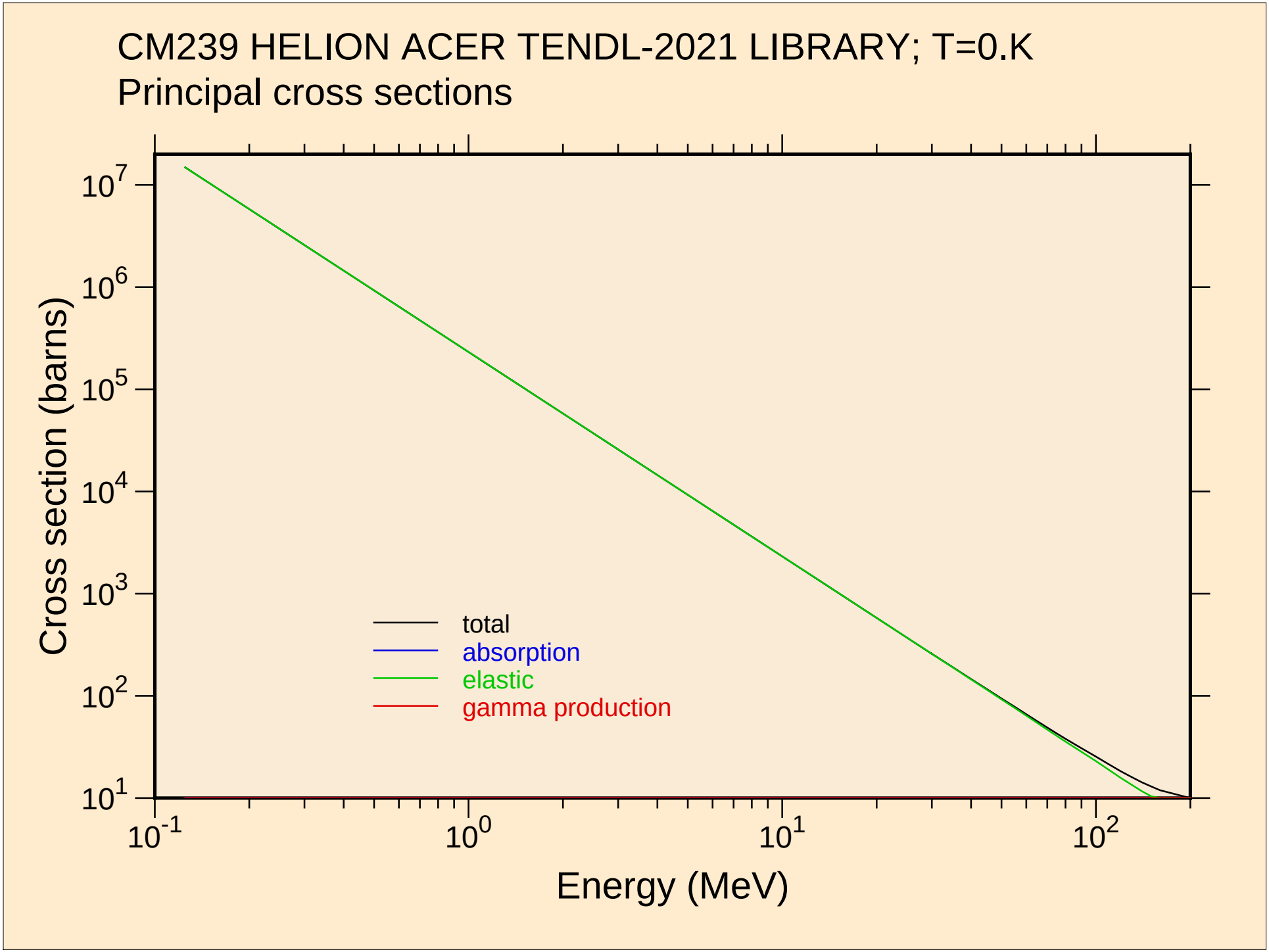
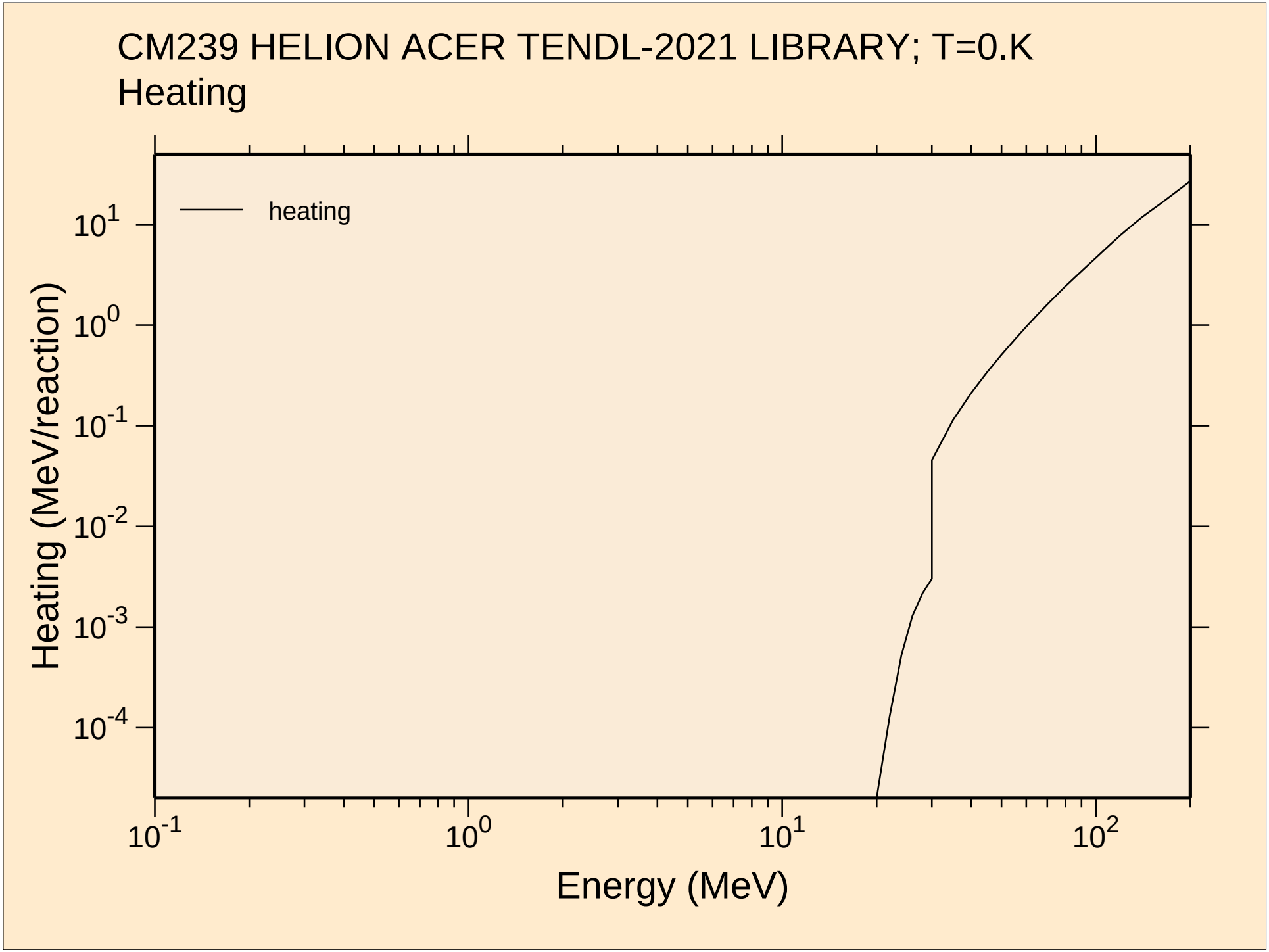
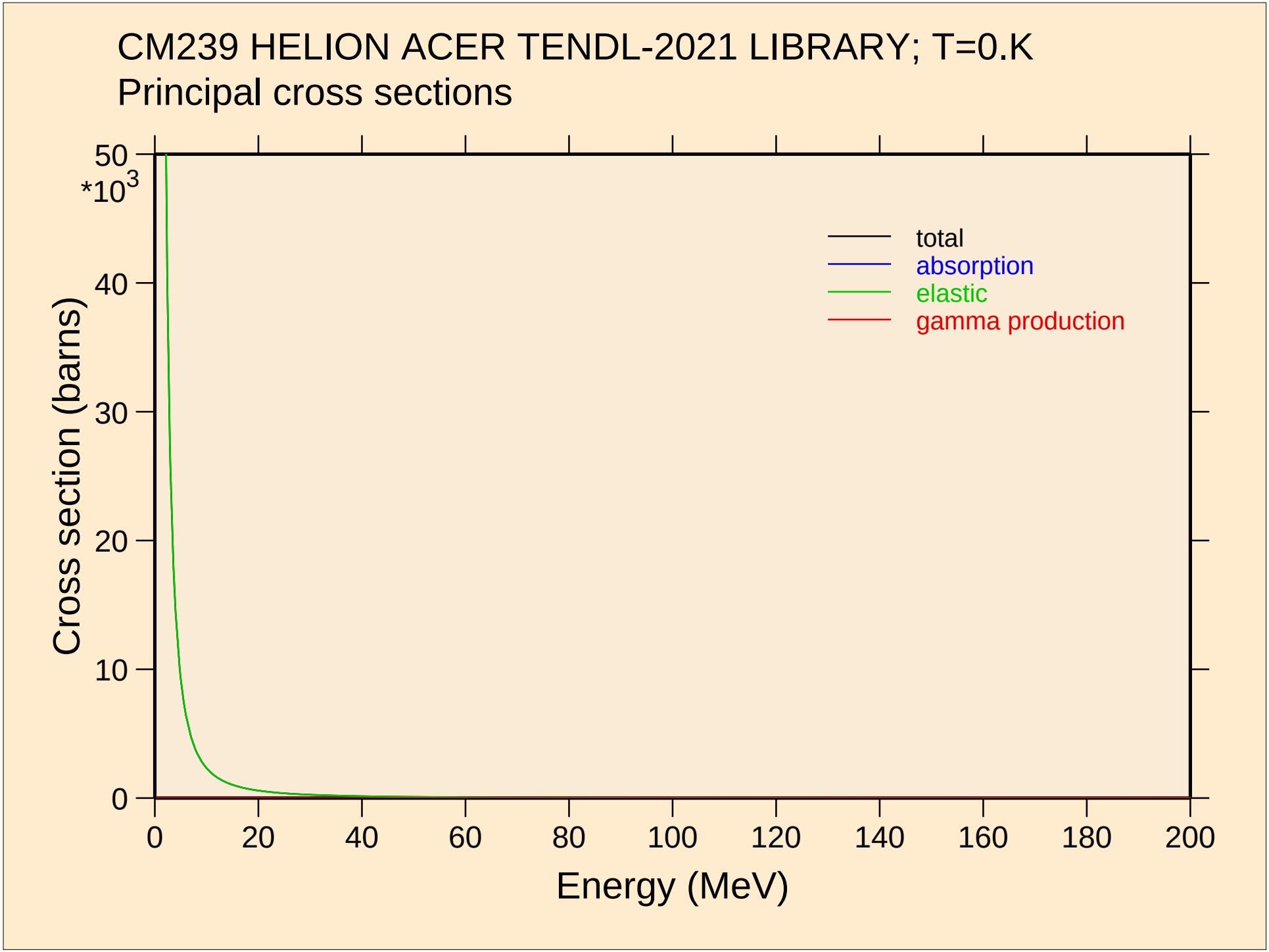
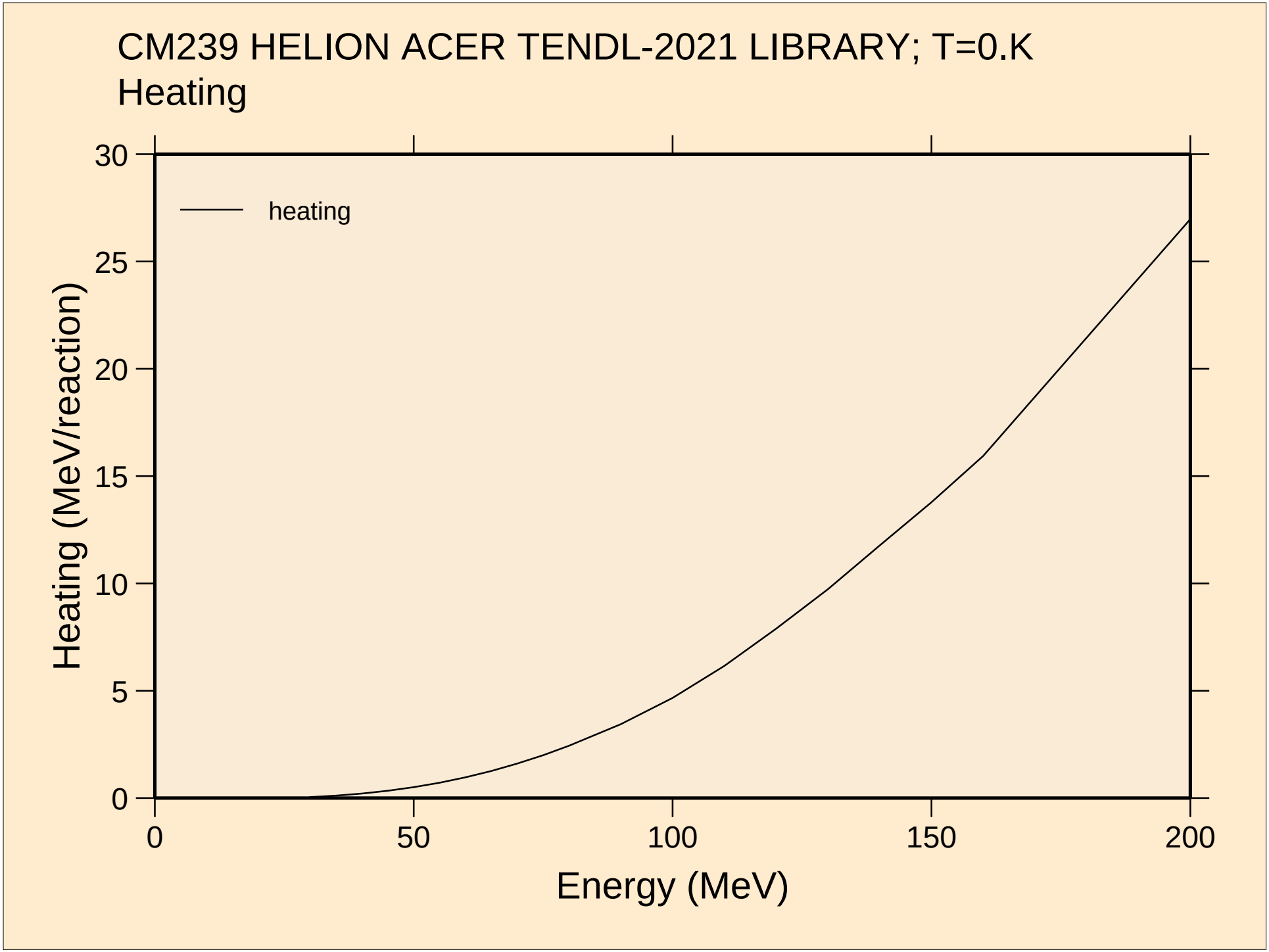
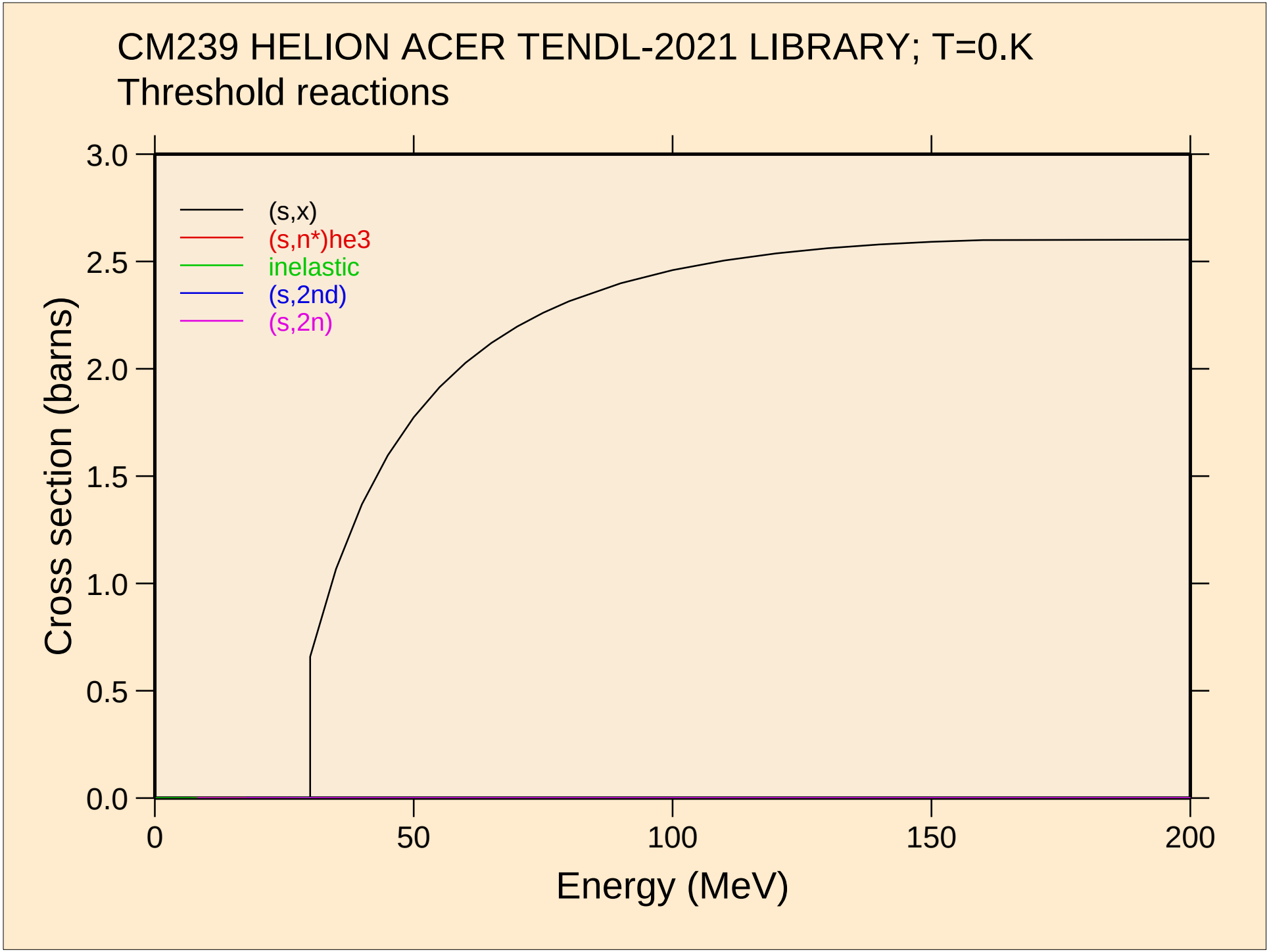
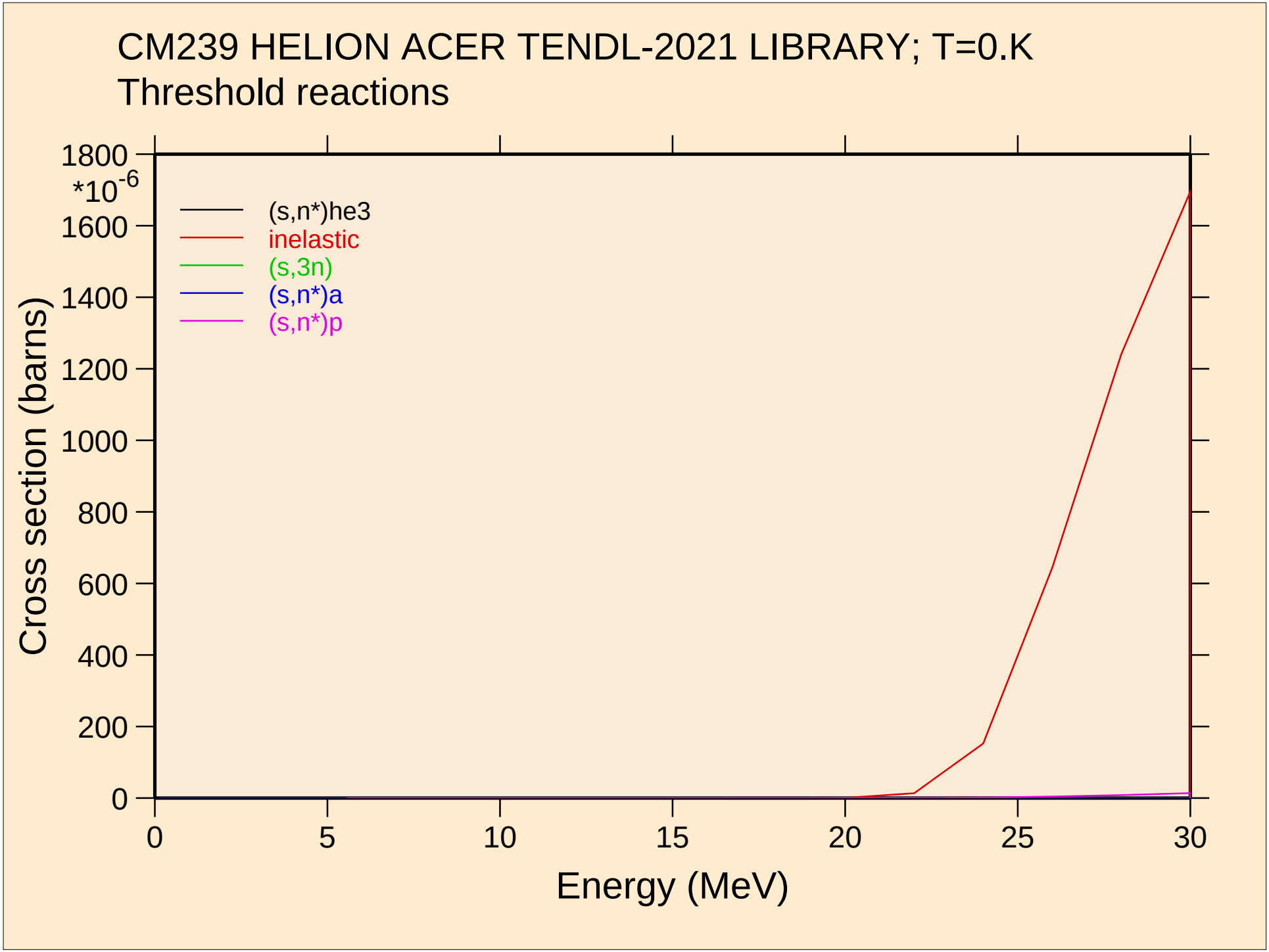

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Principal cross sections
Cross section (barns)
$10^7$
$10^6$
$10^5$
$10^4$
$10^3$
$10^2$
$10^1$
$10^{-1}$
$10^0$
$10^1$
$10^2$
Energy (MeV)
total
absorption
elastic
gamma production

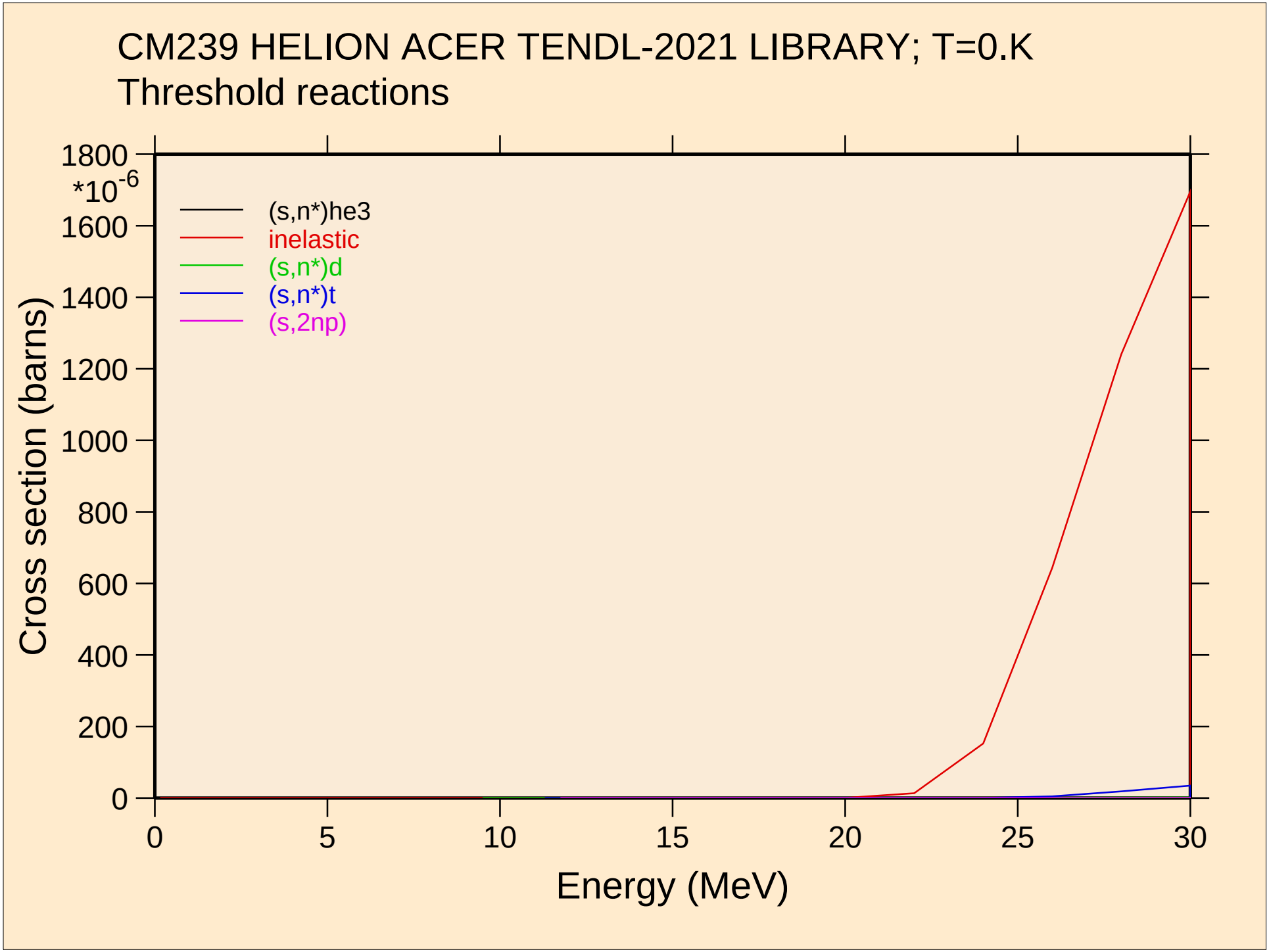

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Heating
heating
Heating (MeV/reaction)
$10^{1}$
$10^{0}$
$10^{-1}$
$10^{-2}$
$10^{-3}$
$10^{-4}$
$10^{-1}$
$10^{0}$
$10^{1}$
$10^{2}$
Energy (MeV)

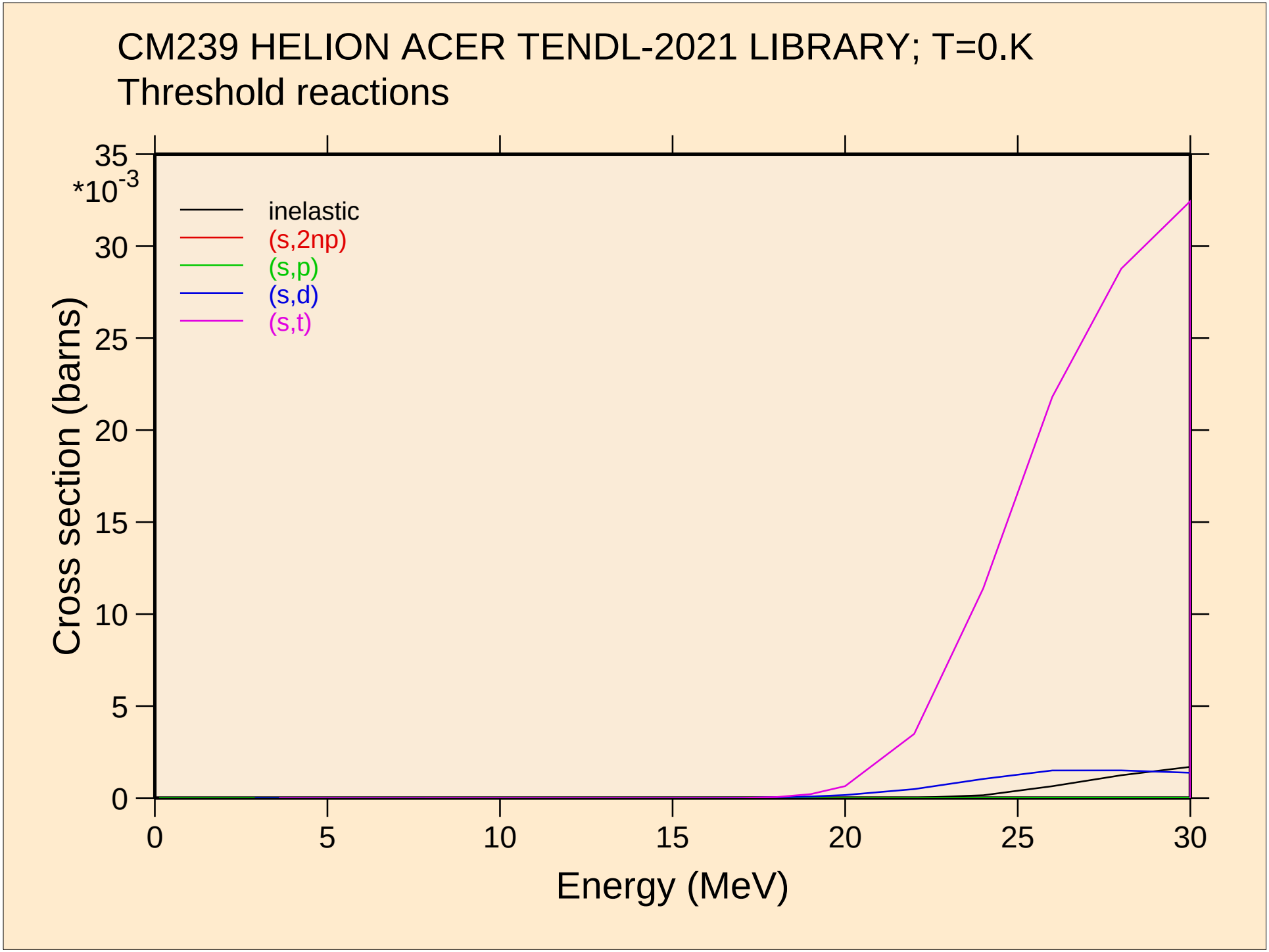

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Principal cross sections
Cross section (barns)
*10^3
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
200
Energy (MeV)
total
absorption
elastic
gamma production

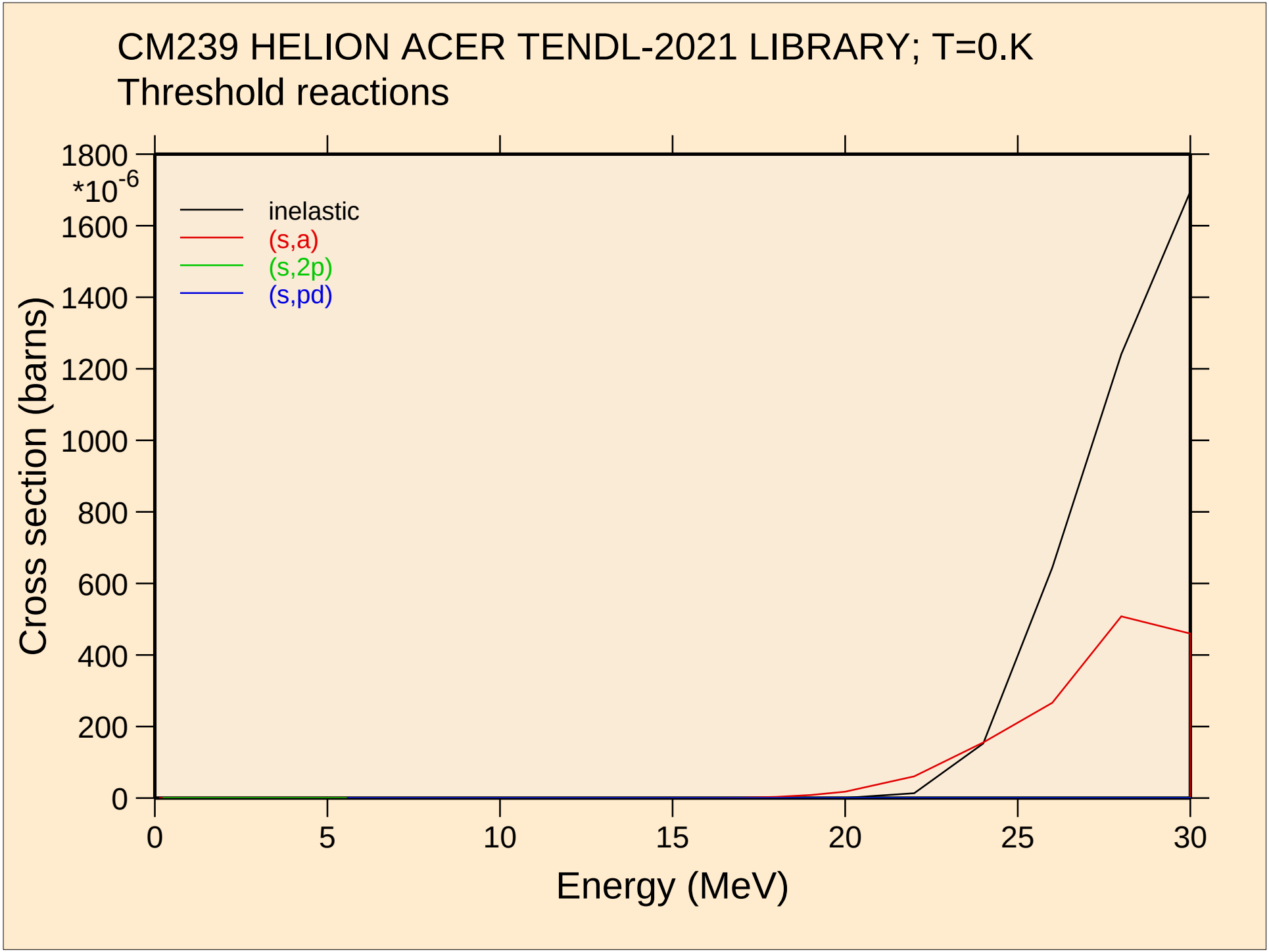

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Heating
heating
Heating (MeV/reaction)
Energy (MeV)
0
5
10
15
20
25
30
0
50
100
150
200

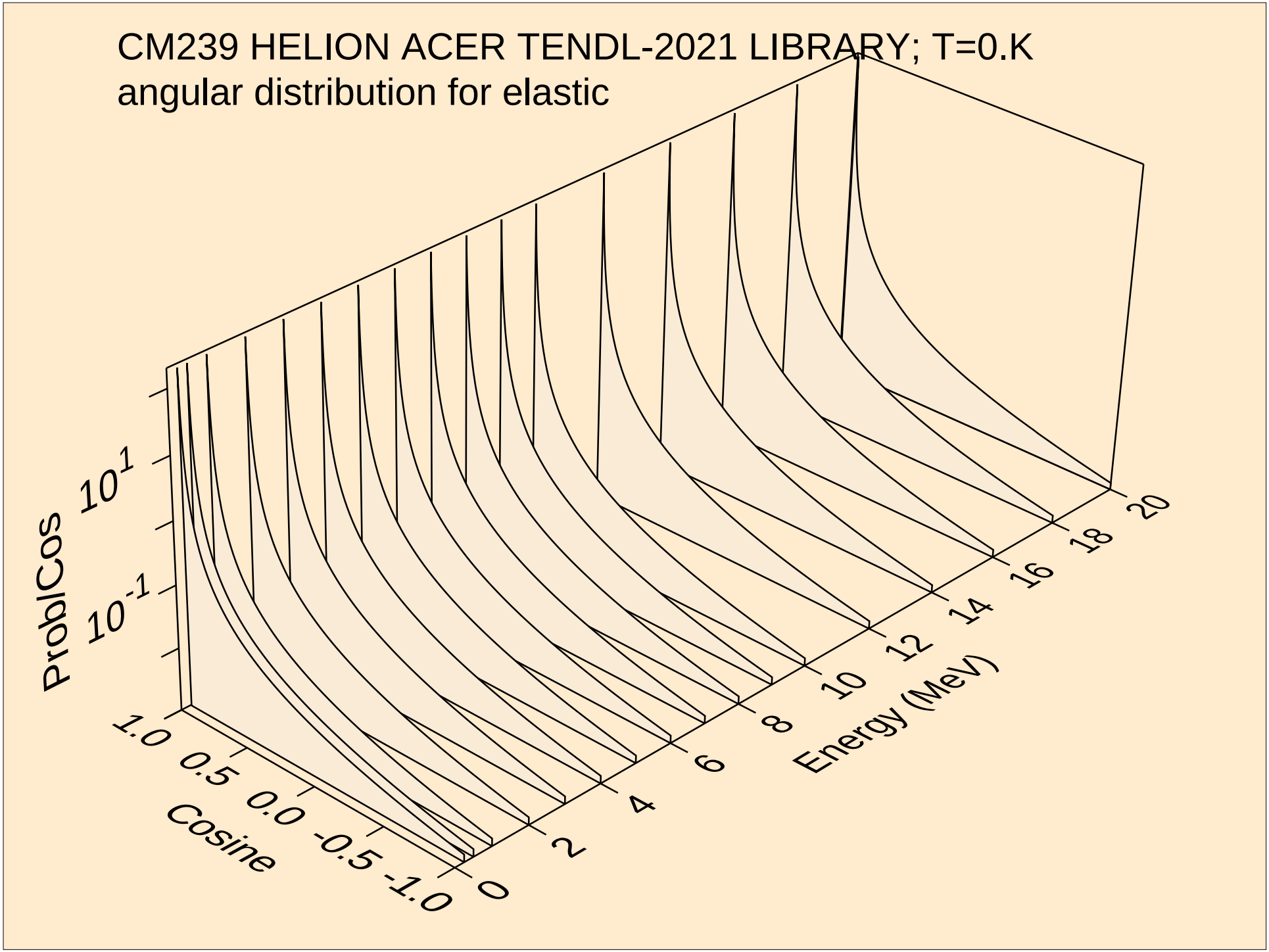

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Threshold reactions
(s,x)
(s,n*)he3
inelastic
(s,2nd)
(s,2n)
Cross section (barns)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
50
100
150
200
Energy (MeV)

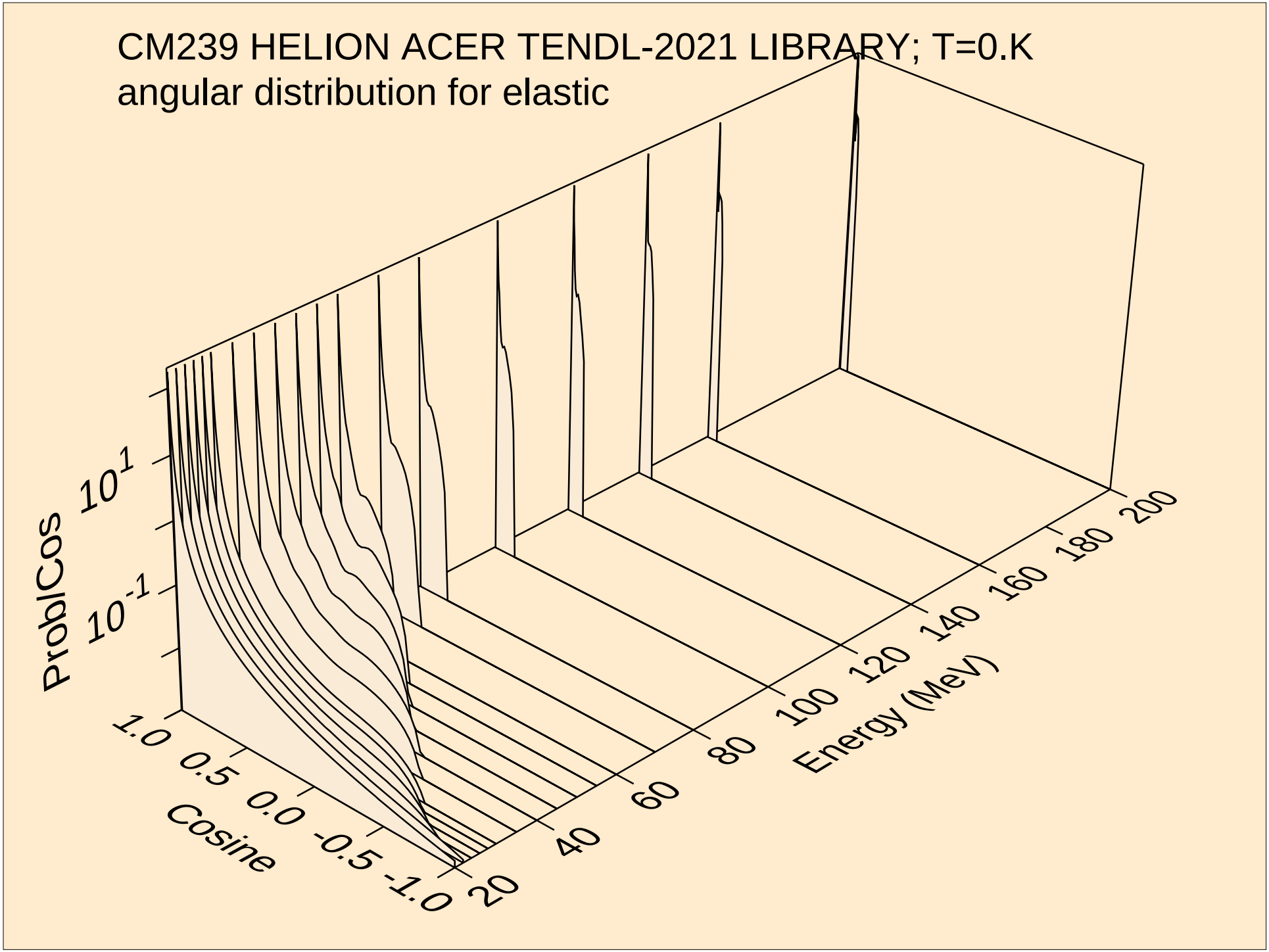

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Threshold reactions
1800
*10-6
1600
1400
1200
1000
800
600
400
200
0
Cross section (barns)
(s,n*)he3
inelastic
(s,3n)
(s,n*)a
(s,n*)p
0
5
10
15
20
25
30
Energy (MeV)

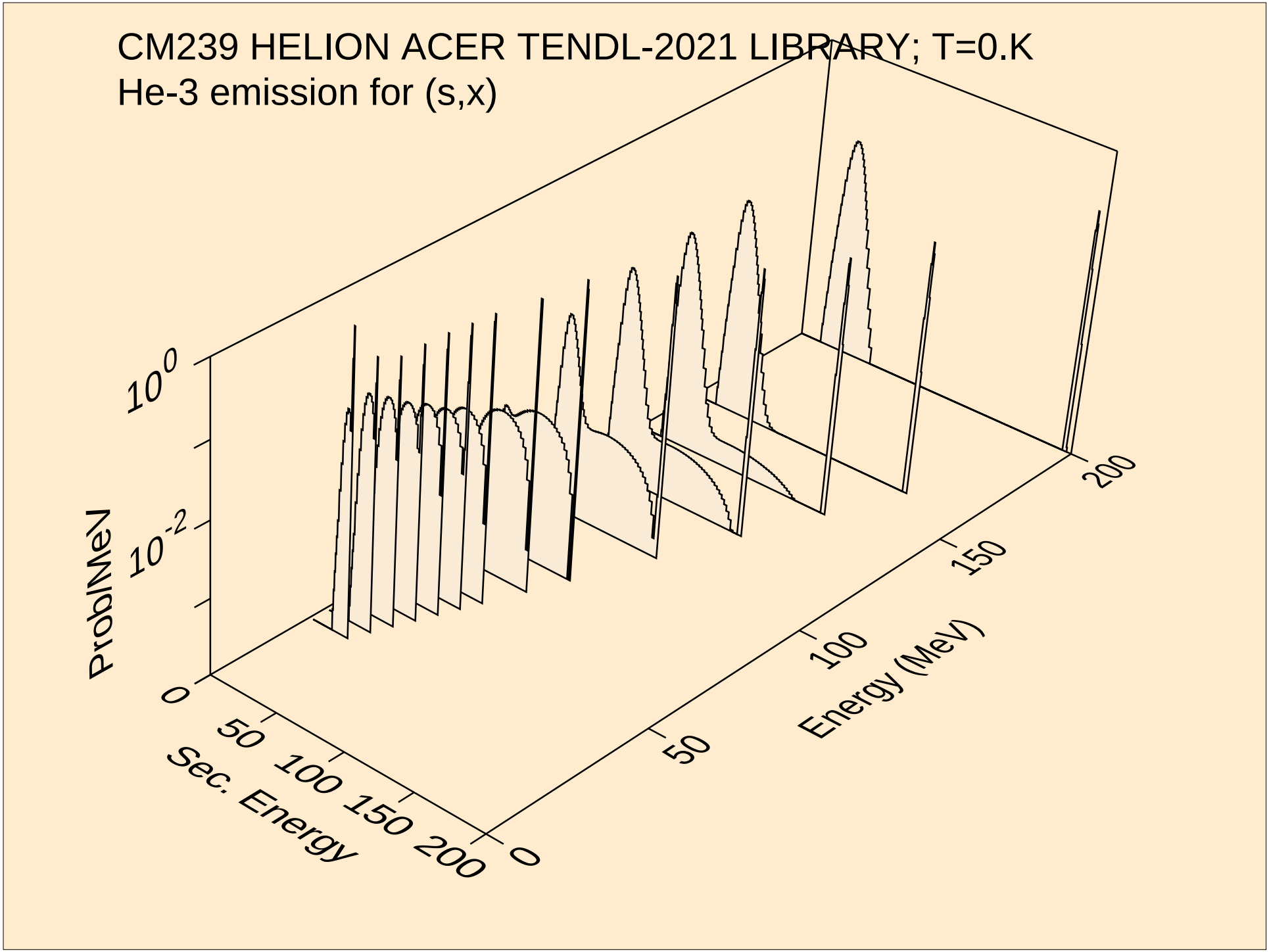

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Threshold reactions
1800
*10-6
1600
1400
1200
1000
800
600
400
200
0
Cross section (barns)
(s,n*)he3
inelastic
(s,n*)d
(s,n*)t
(s,2np)
0
5
10
15
20
25
30
Energy (MeV)

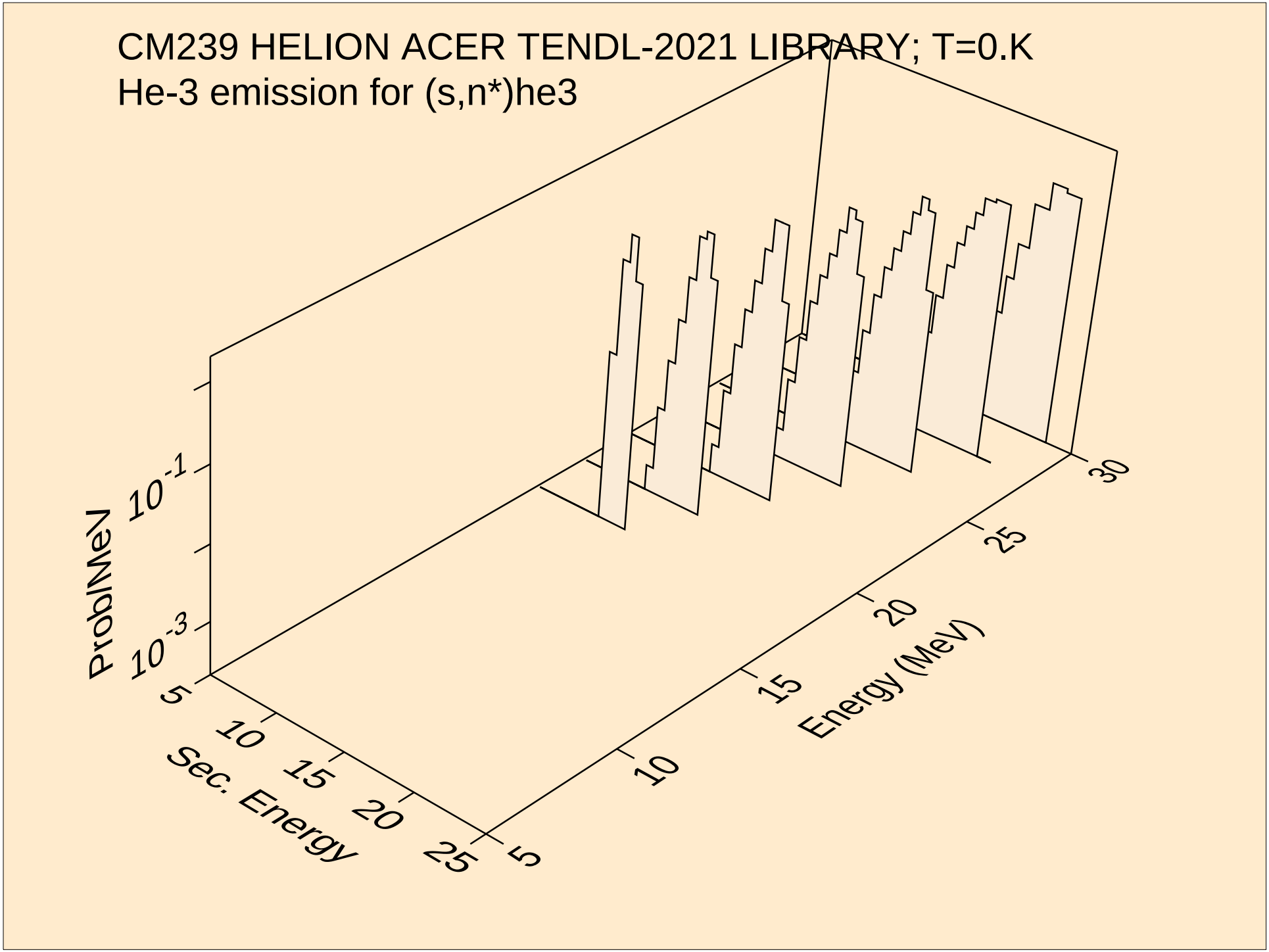

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Threshold reactions
*10-3
35
30
25
20
15
10
5
0
Cross section (barns)
inelastic
(s,2np)
(s,p)
(s,d)
(s,t)
0
5
10
15
20
25
30
Energy (MeV)

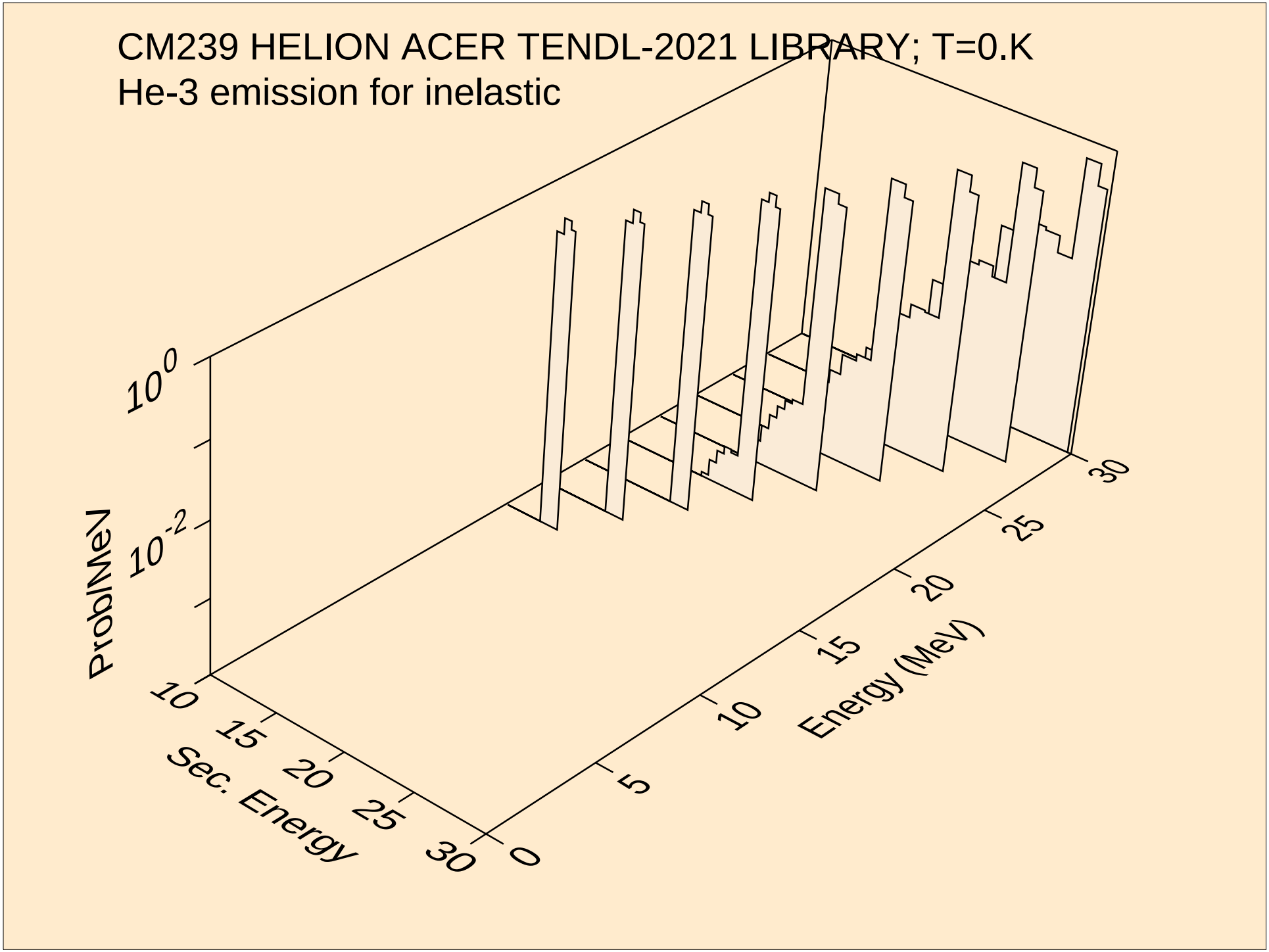

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Threshold reactions
1800
*10-6
1600
1400
1200
1000
800
600
400
200
0
Cross section (barns)
inelastic
(s,a)
(s,2p)
(s,pd)
0
5
10
15
20
25
30
Energy (MeV)

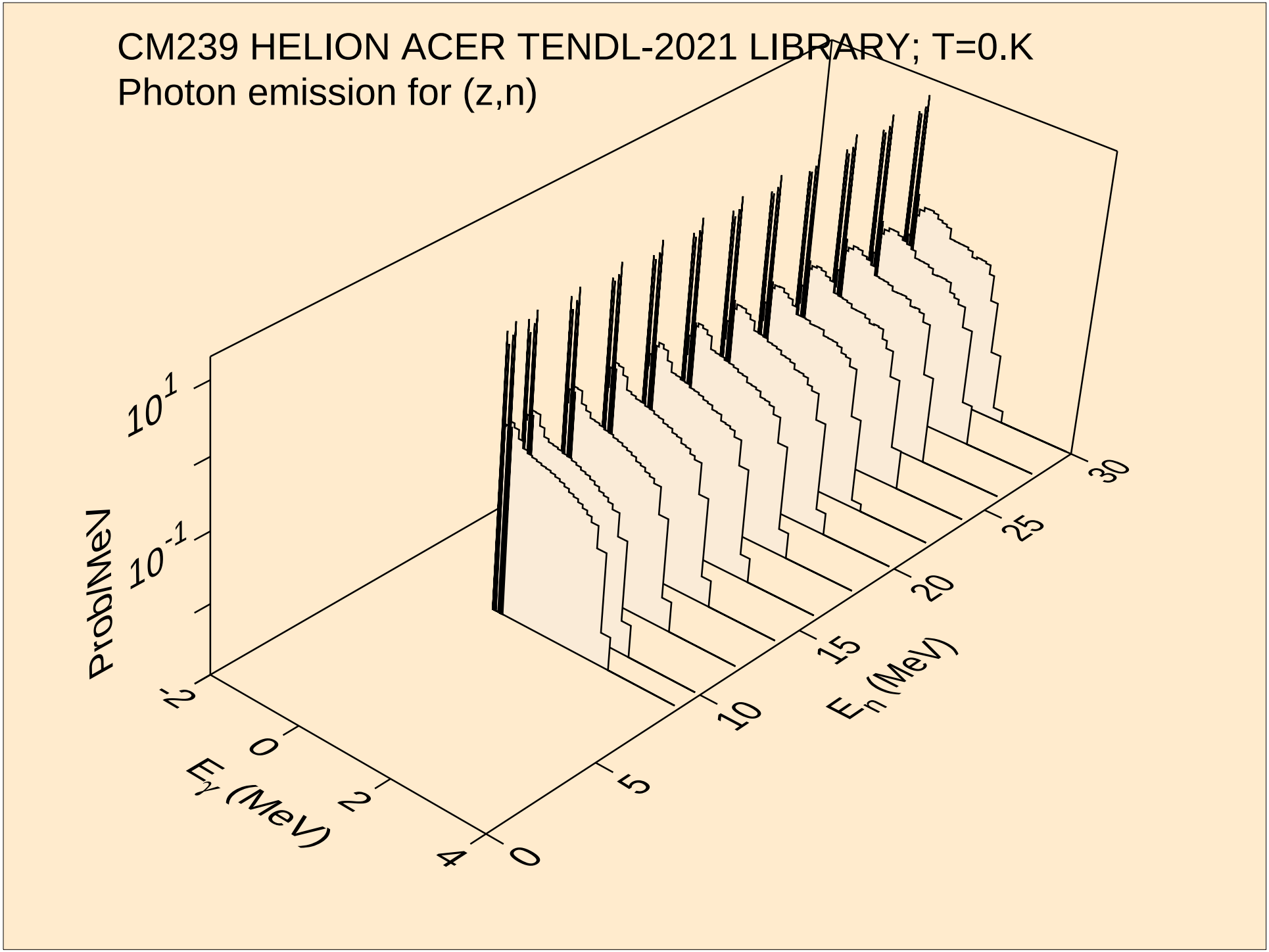

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
angular distribution for elastic
ProbICos
10^1
10^-1
1.0
0.5
0.0
-0.5
-1.0
Cosine
0
2
4
6
8
10
12
14
16
18
20
Energy (MeV)

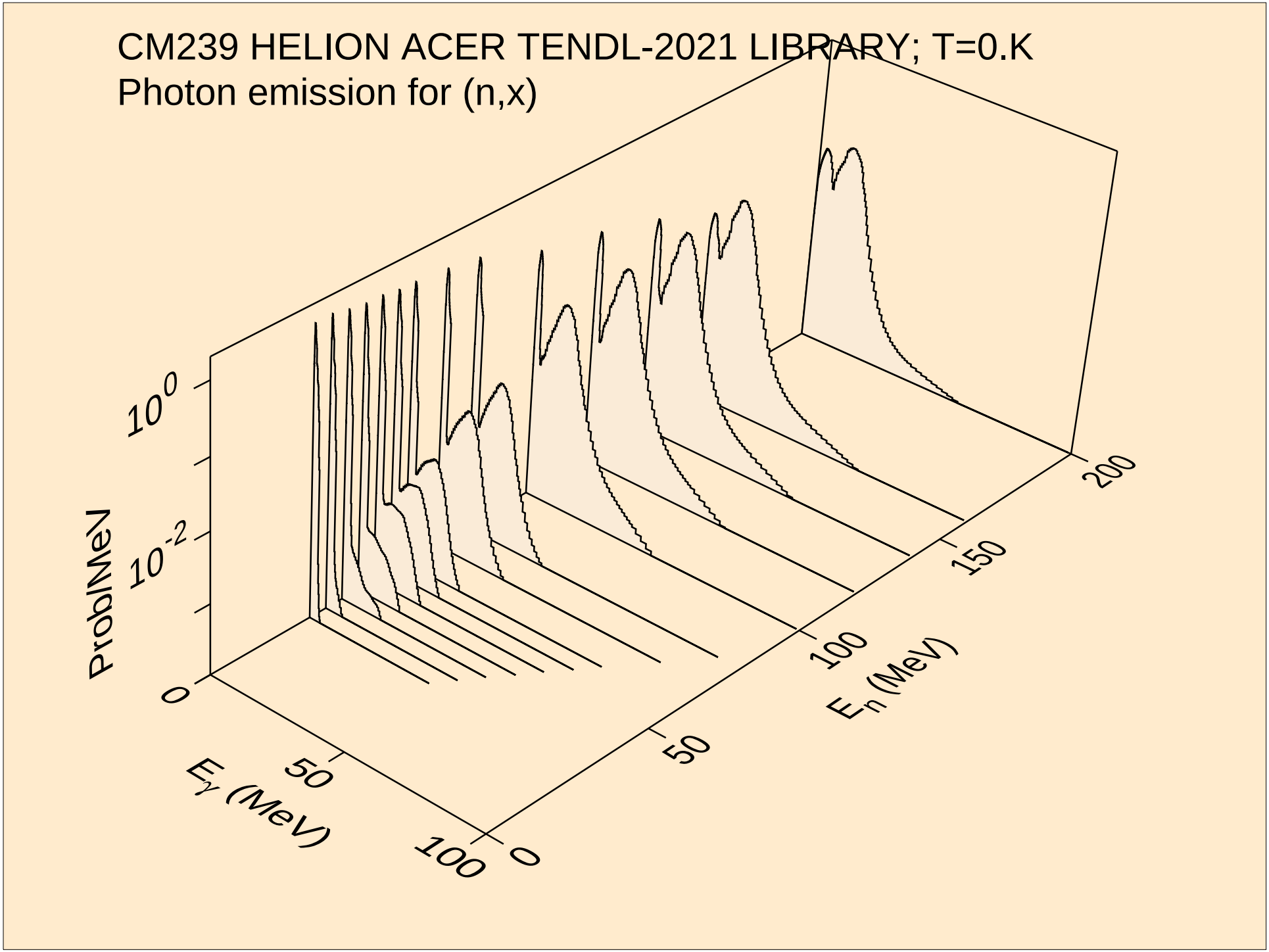

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
angular distribution for elastic
ProbICos
10^1
10^-1
1.0
0.5
0.0
-0.5
-1.0
Cosine
20
40
60
80
100
120
140
160
180
200
Energy (MeV)

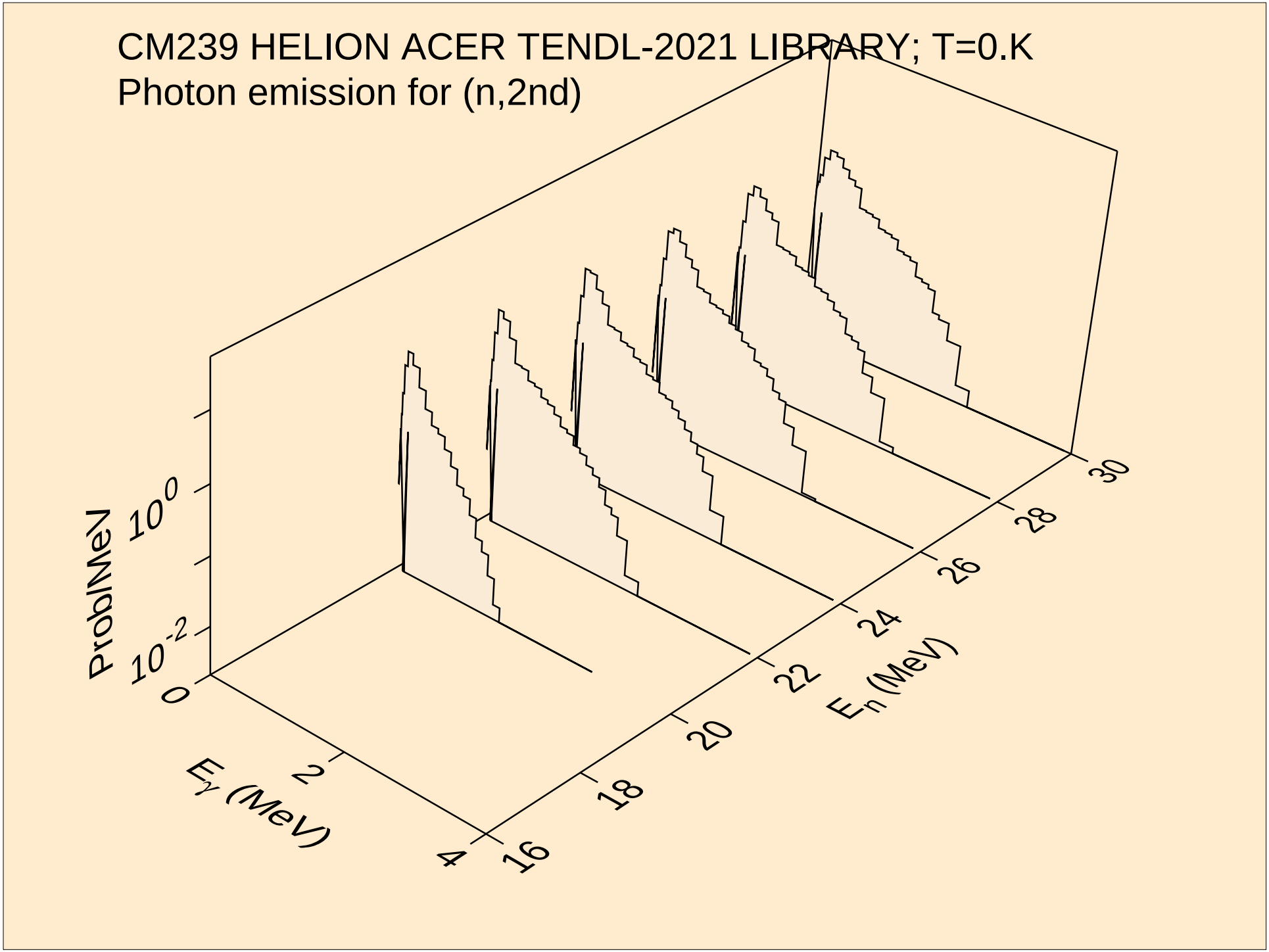

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
He-3 emission for (s,x)
Prob/MeV
10^0
10^-2
0
50
100
150
200
Sec. Energy
0
50
100
150
200
Energy (MeV)

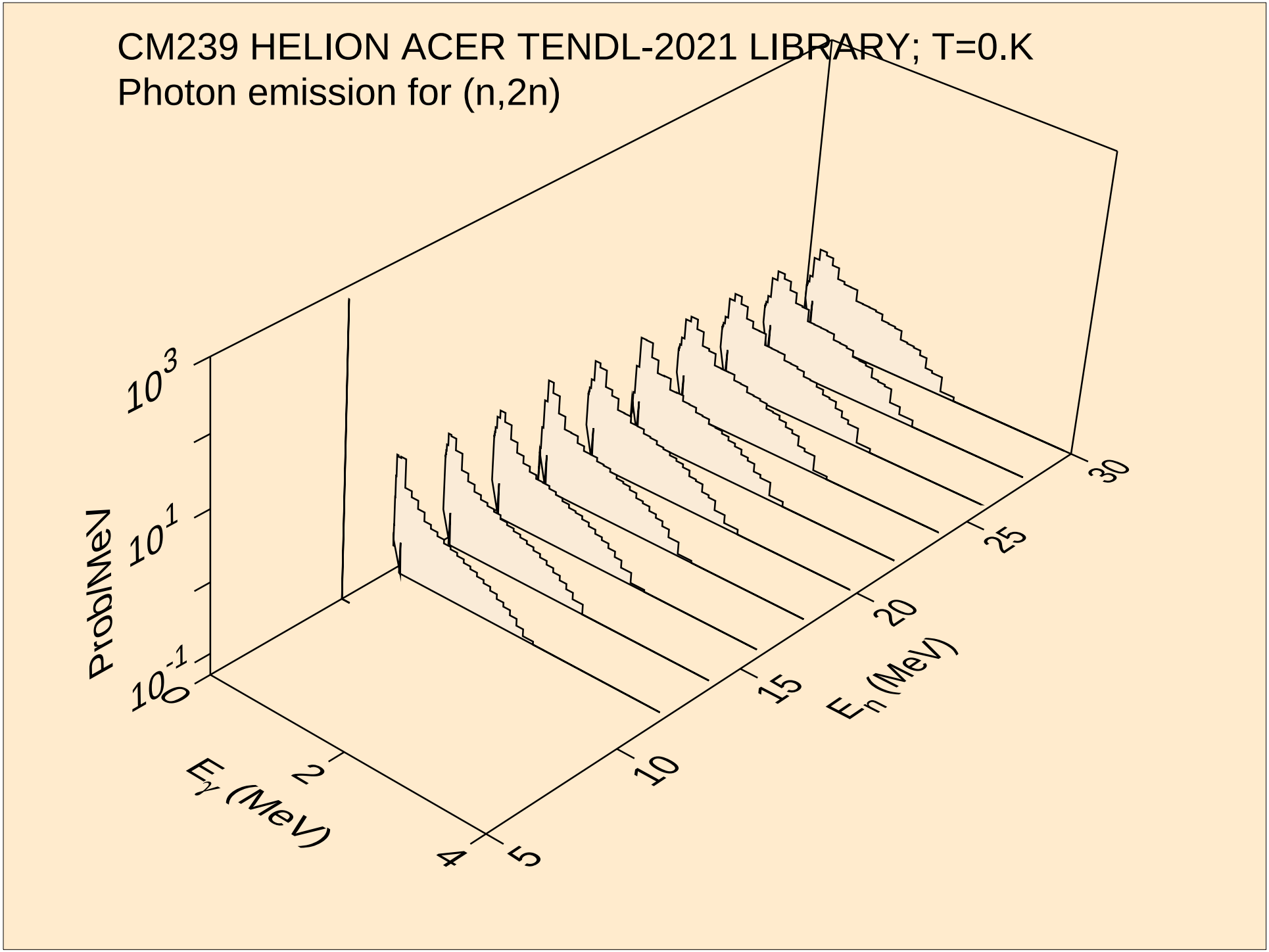

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
He-3 emission for (s,n*)he3
Prob/MeV
10-1
10-3
5
10
15
20
25
Sec. Energy
5
10
15
20
25
30
Energy (MeV)

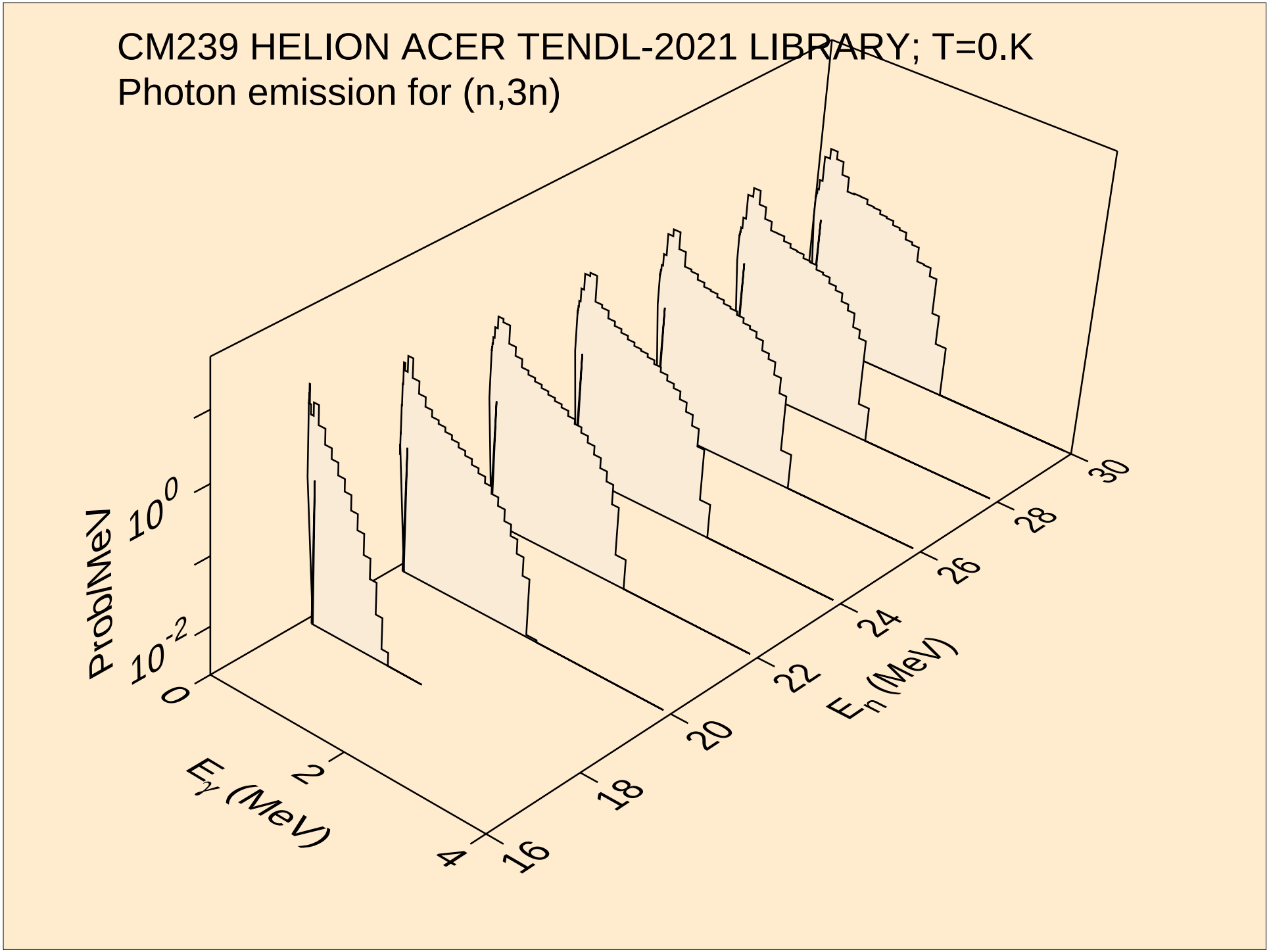

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
He-3 emission for inelastic
Prob/MeV
10^0
10^-2
Sec. Energy
10
15
20
25
30
Energy (MeV)
0
5
10
15
20
25
30

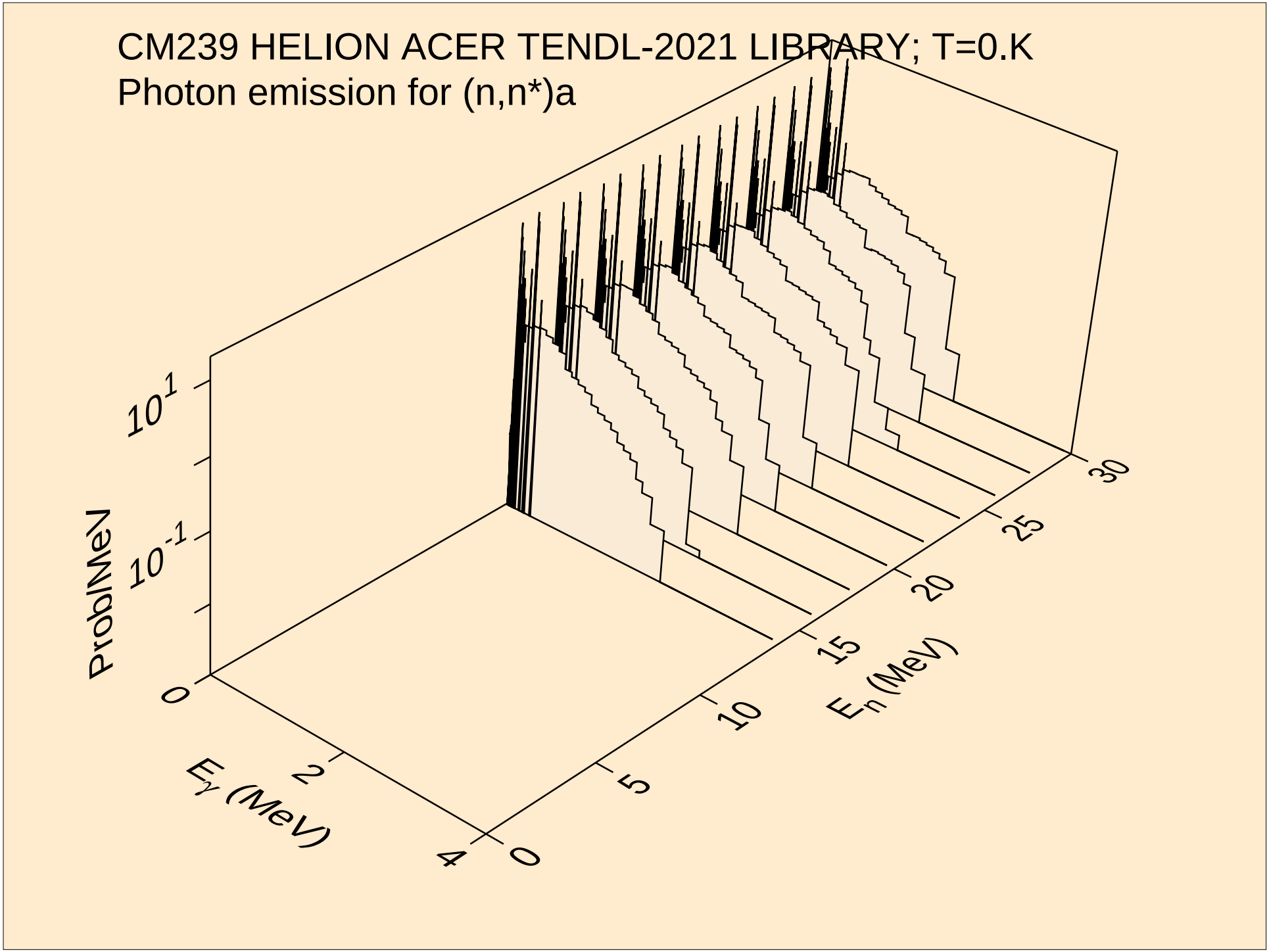

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (z,n)
Prob/MeV
$10^{1}$
$10^{-1}$
-2
0
2
4
$E_\gamma$ (MeV)
0
5
10
15
20
25
30
$E_n$ (MeV)

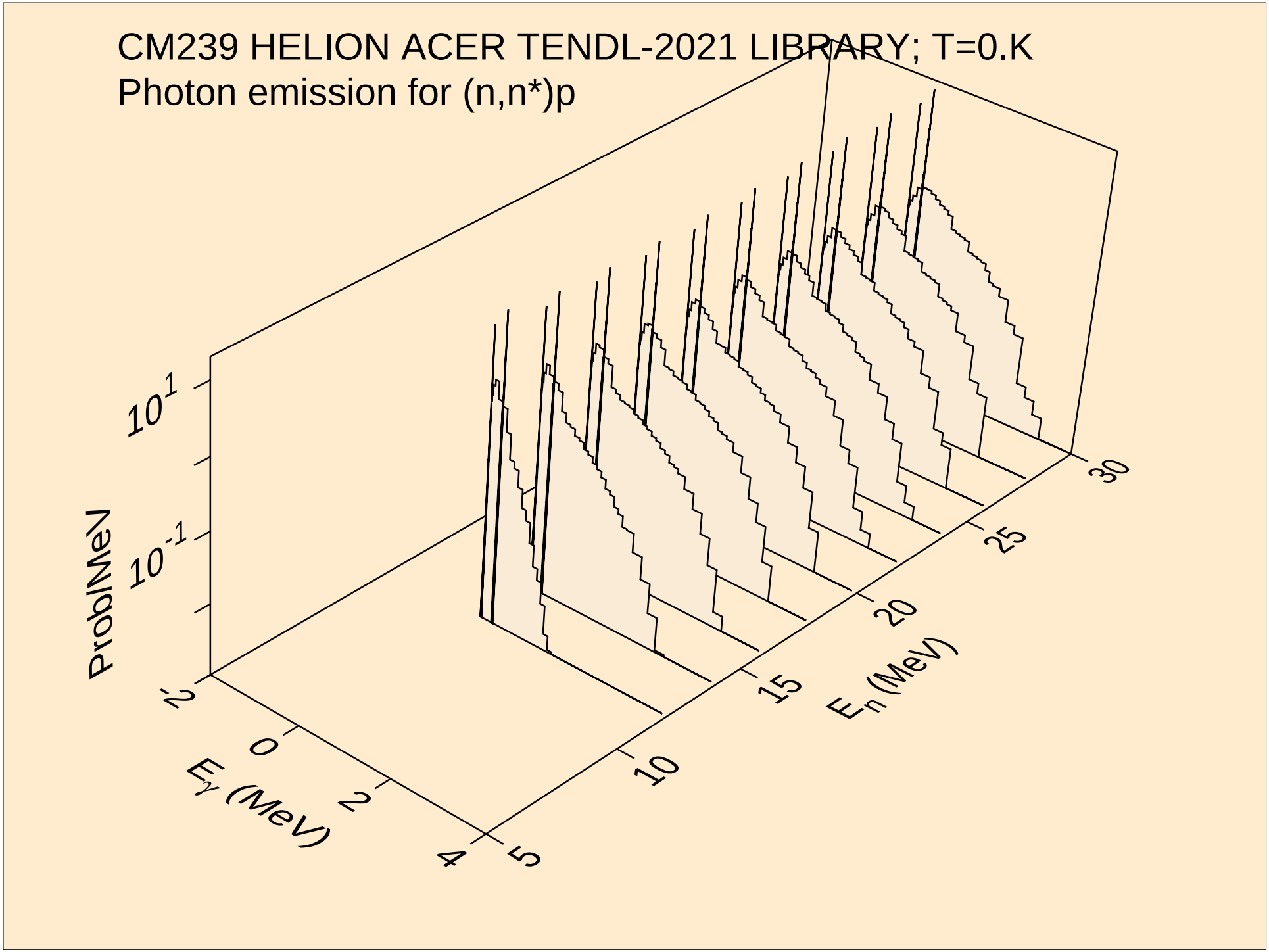

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,x)
Prob/MeV
$10^{0}$
$10^{-2}$
0
50
100
$E_\gamma$ (MeV)
0
50
100
150
200
$E_n$ (MeV)

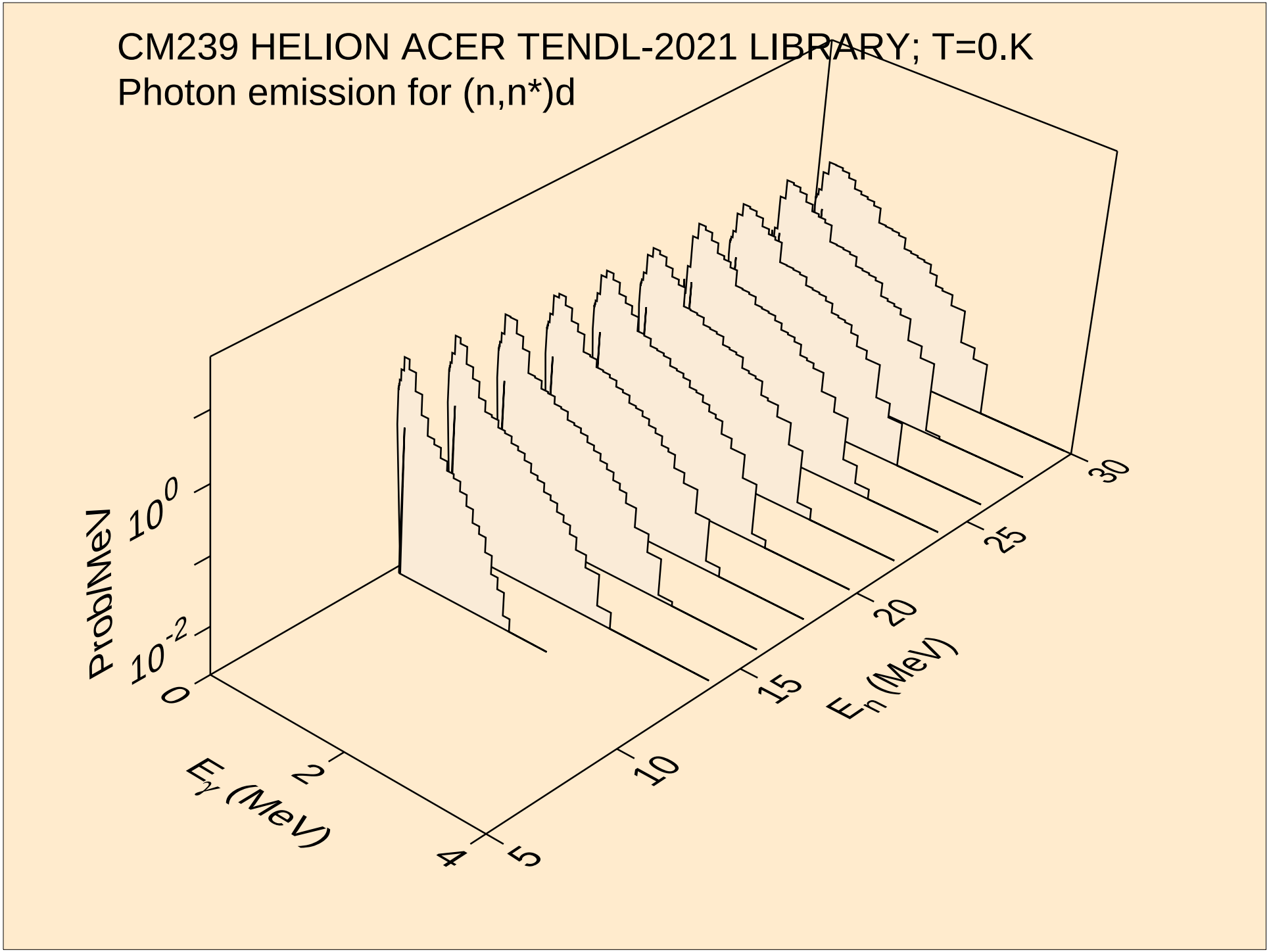

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,2nd)
Prob/MeV
10^0
10^-2
0
2
4
E_γ (MeV)
16
18
20
22
24
26
28
30
E_n (MeV)

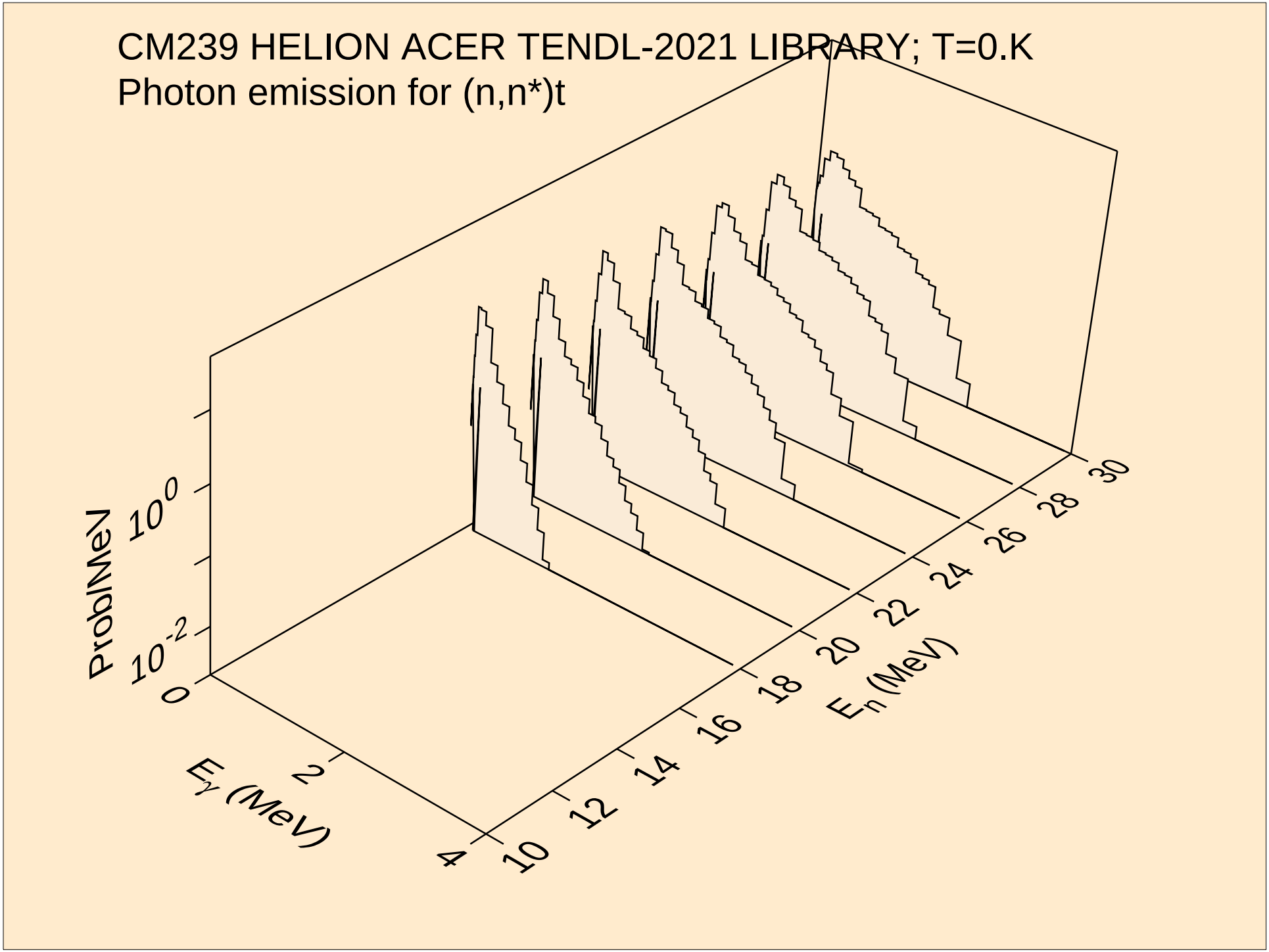

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,2n)
Prob/MeV
$10^{3}$
$10^{1}$
$10^{-1}$
0
2
4
$E_\gamma$ (MeV)
5
10
15
20
25
30
$E_n$ (MeV)

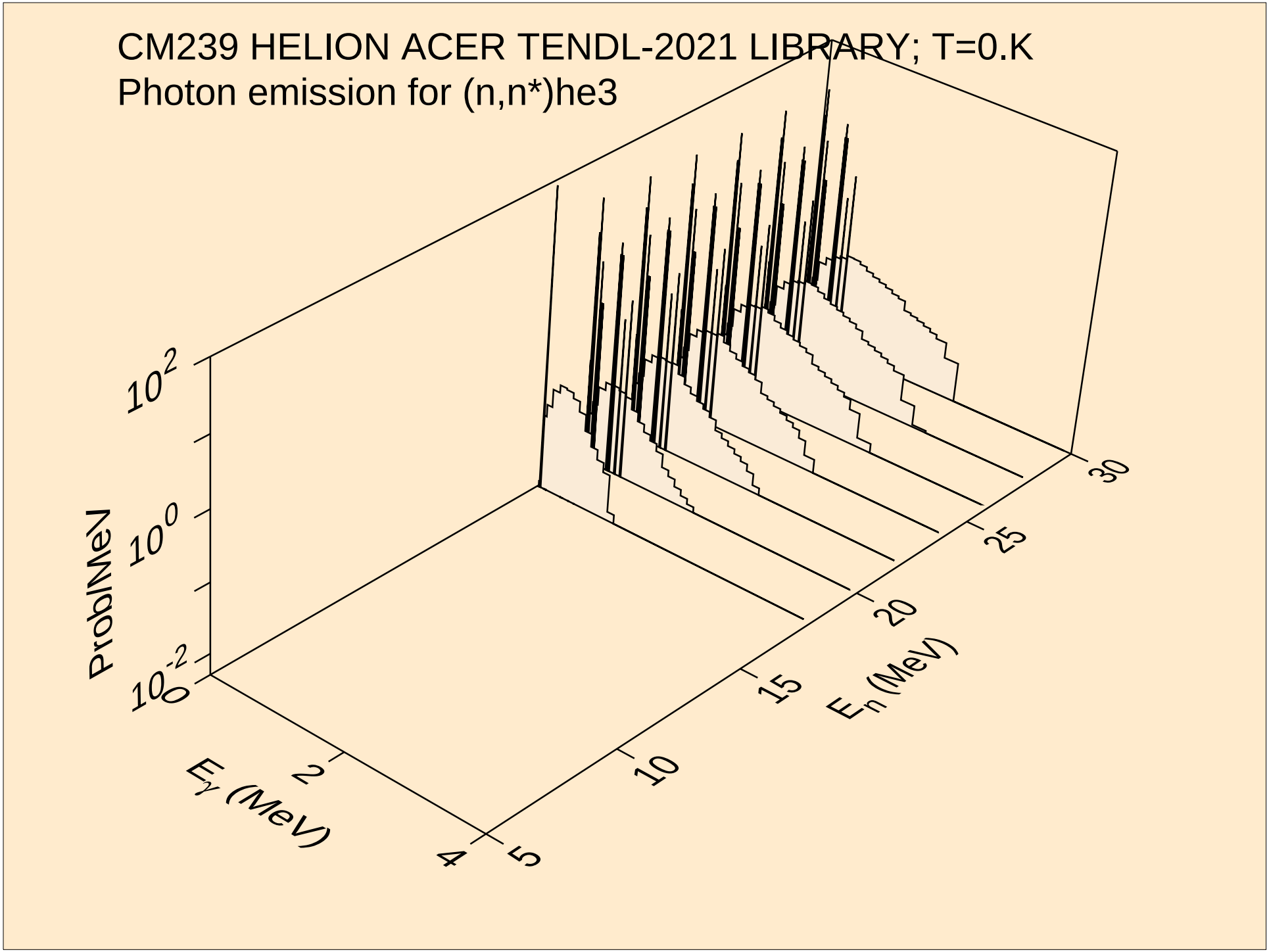

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,3n)
Prob/MeV
10^0
10^-2
0
2
4
E_γ (MeV)
16
18
20
22
24
26
28
30
E_n (MeV)

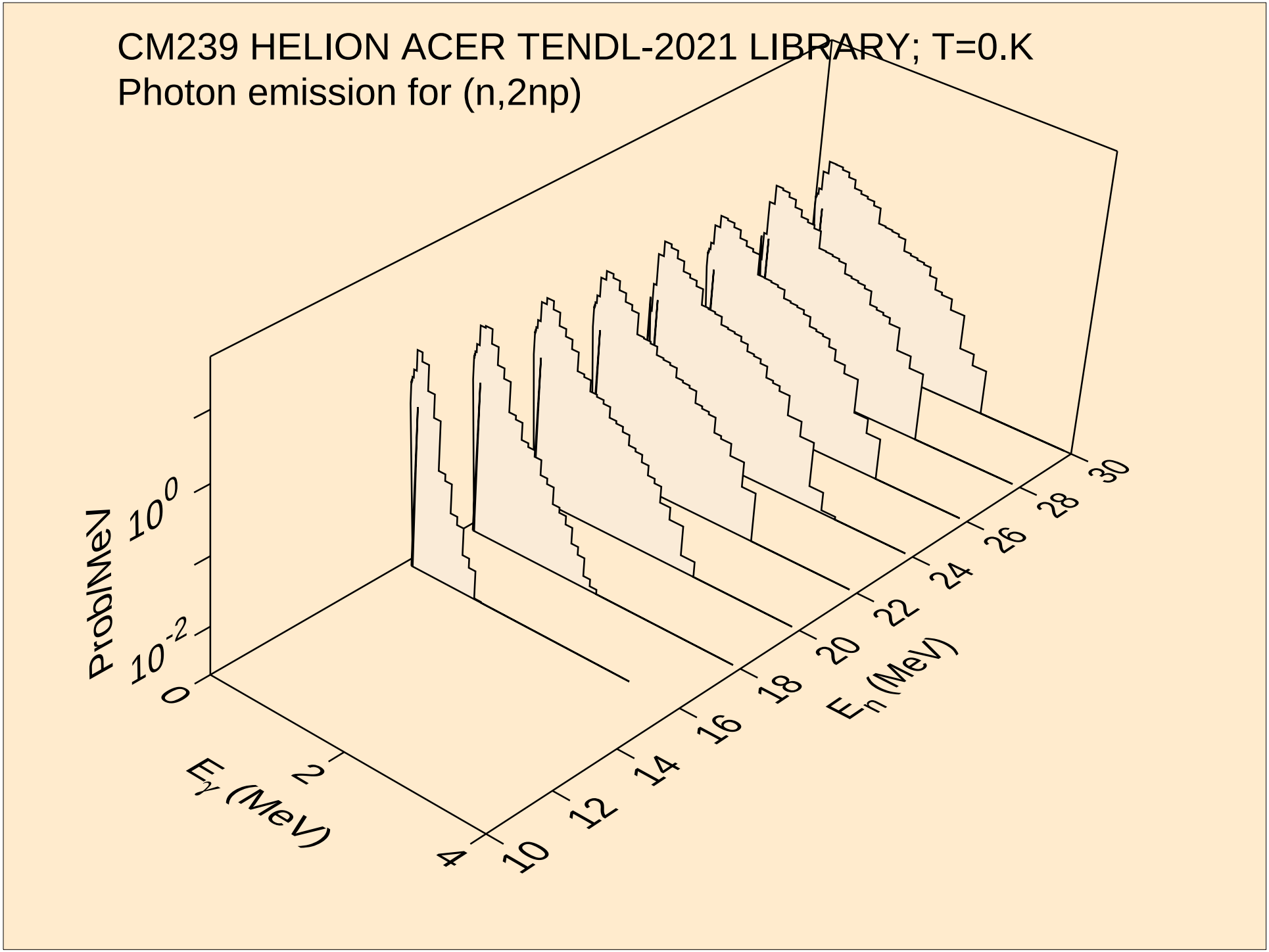

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,n*)a
Prob/MeV
10^1
10^-1
0
2
4
E_γ (MeV)
0
5
10
15
20
25
30
E_n (MeV)

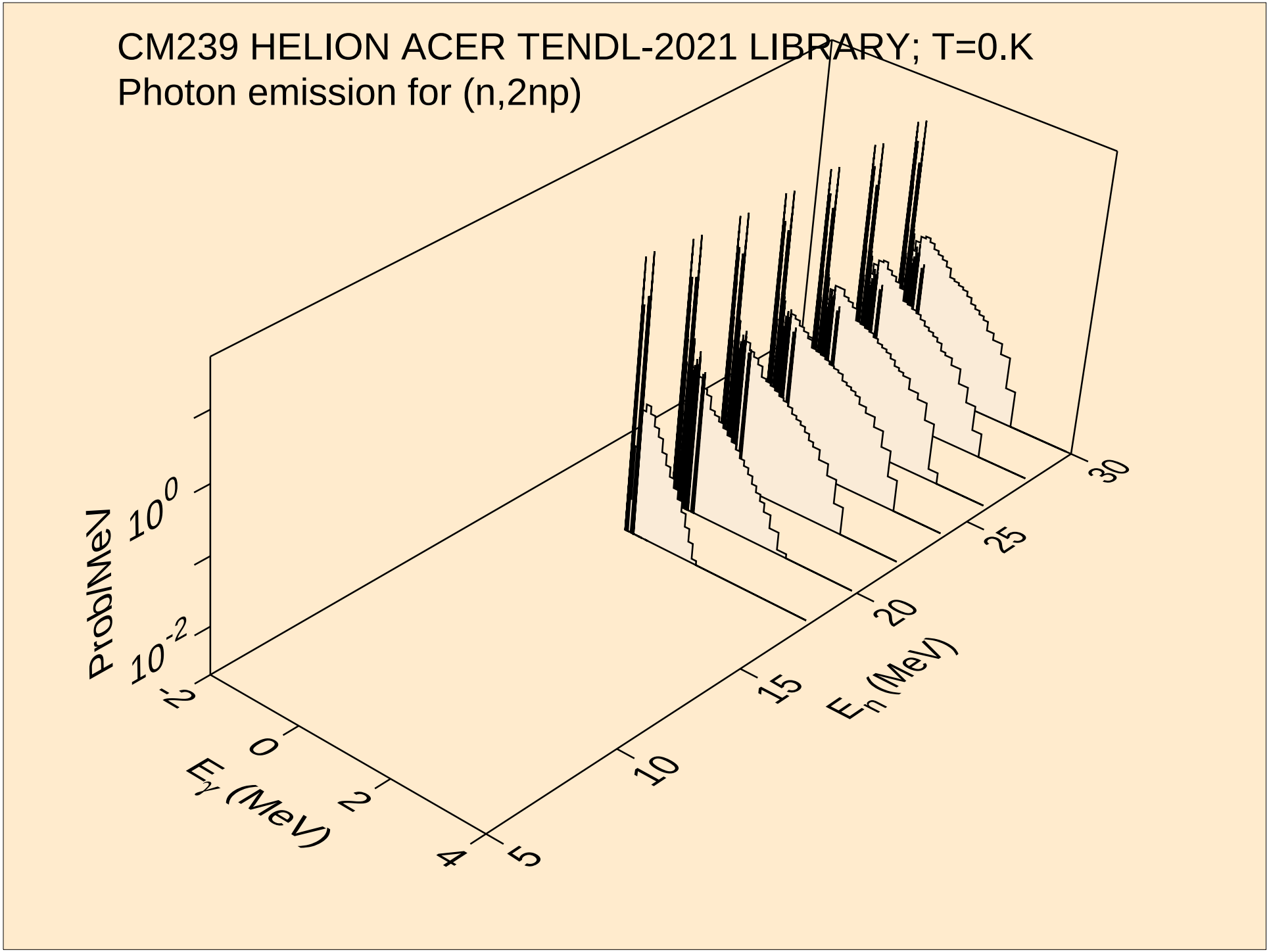

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,n*)p
Prob/MeV
$10^{1}$
$10^{-1}$
-2
0
2
4
$E_\gamma$ (MeV)
5
10
15
20
25
30
$E_n$ (MeV)

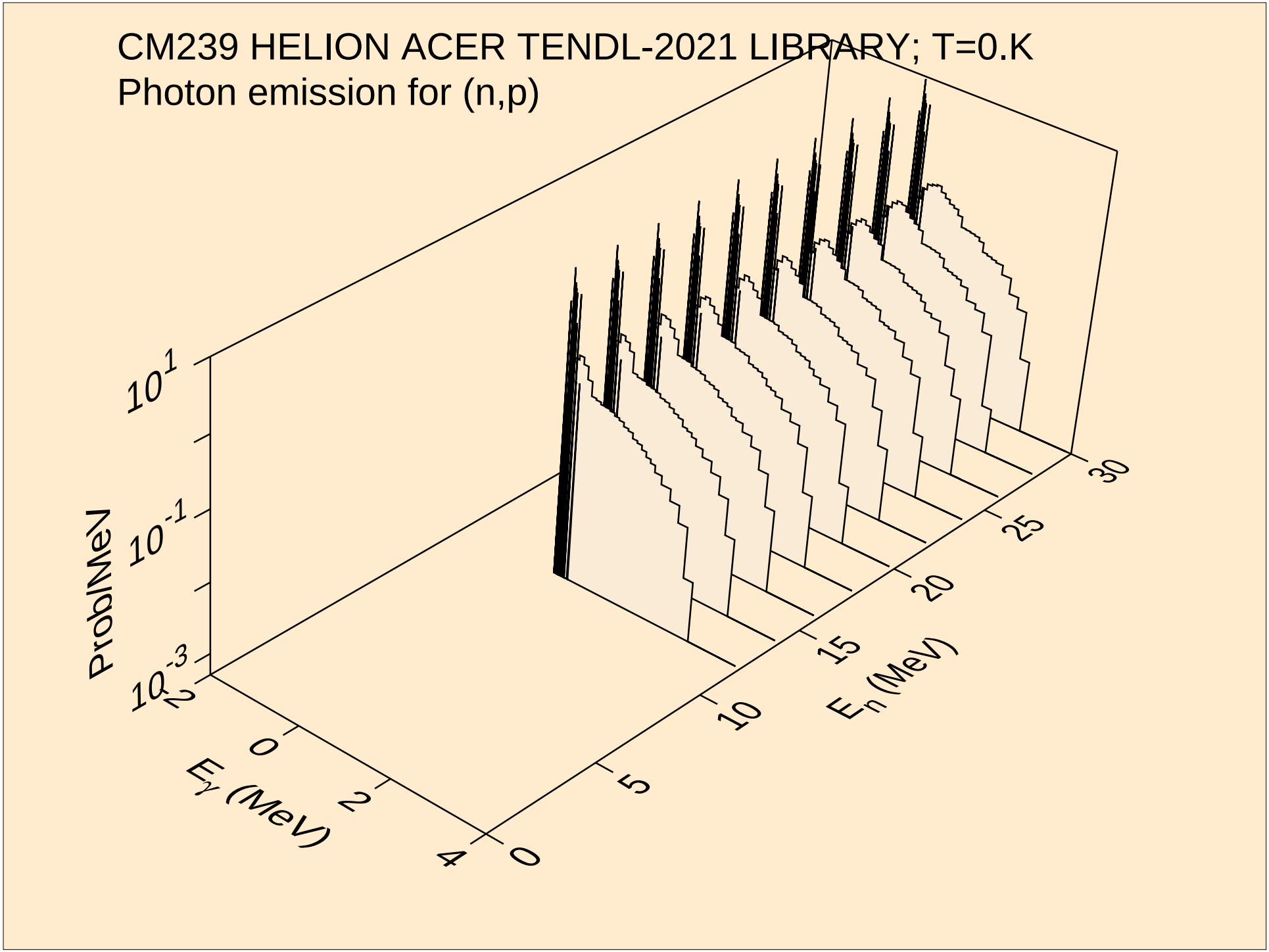

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,n*)d
Prob/MeV
10^0
10^-2
0
2
4
E_γ (MeV)
10
15
20
25
30
E_n (MeV)

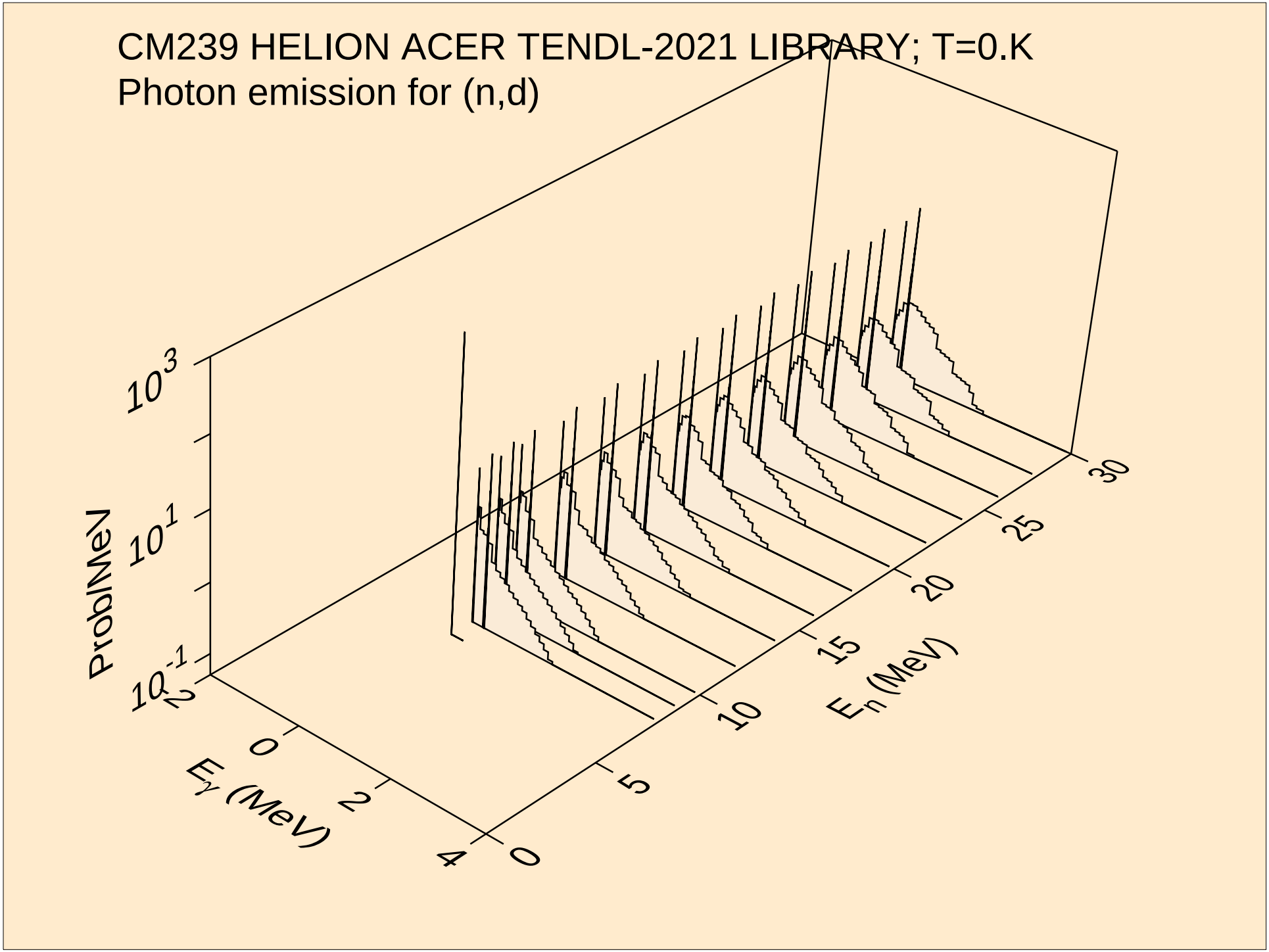

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,n*)t
Prob/MeV
10^0
10^-2
0
2
4
E_γ (MeV)
10
12
14
16
18
20
22
24
26
28
30
E_n (MeV)

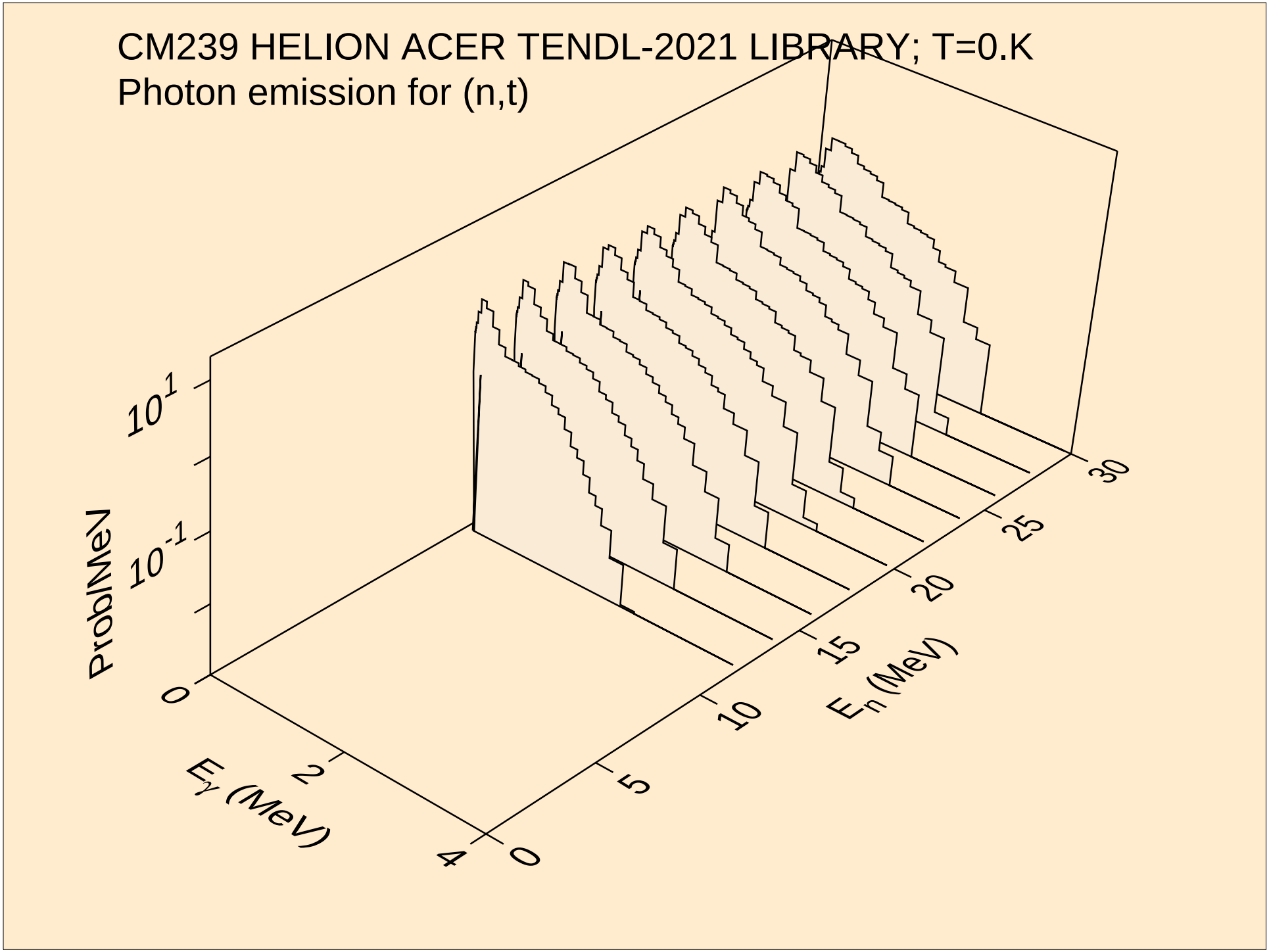

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,n*)he3
Prob/MeV
$10^{2}$
$10^{0}$
$10^{-2}$
0
2
4
$E_\gamma$ (MeV)
5
10
15
20
25
30
$E_n$ (MeV)

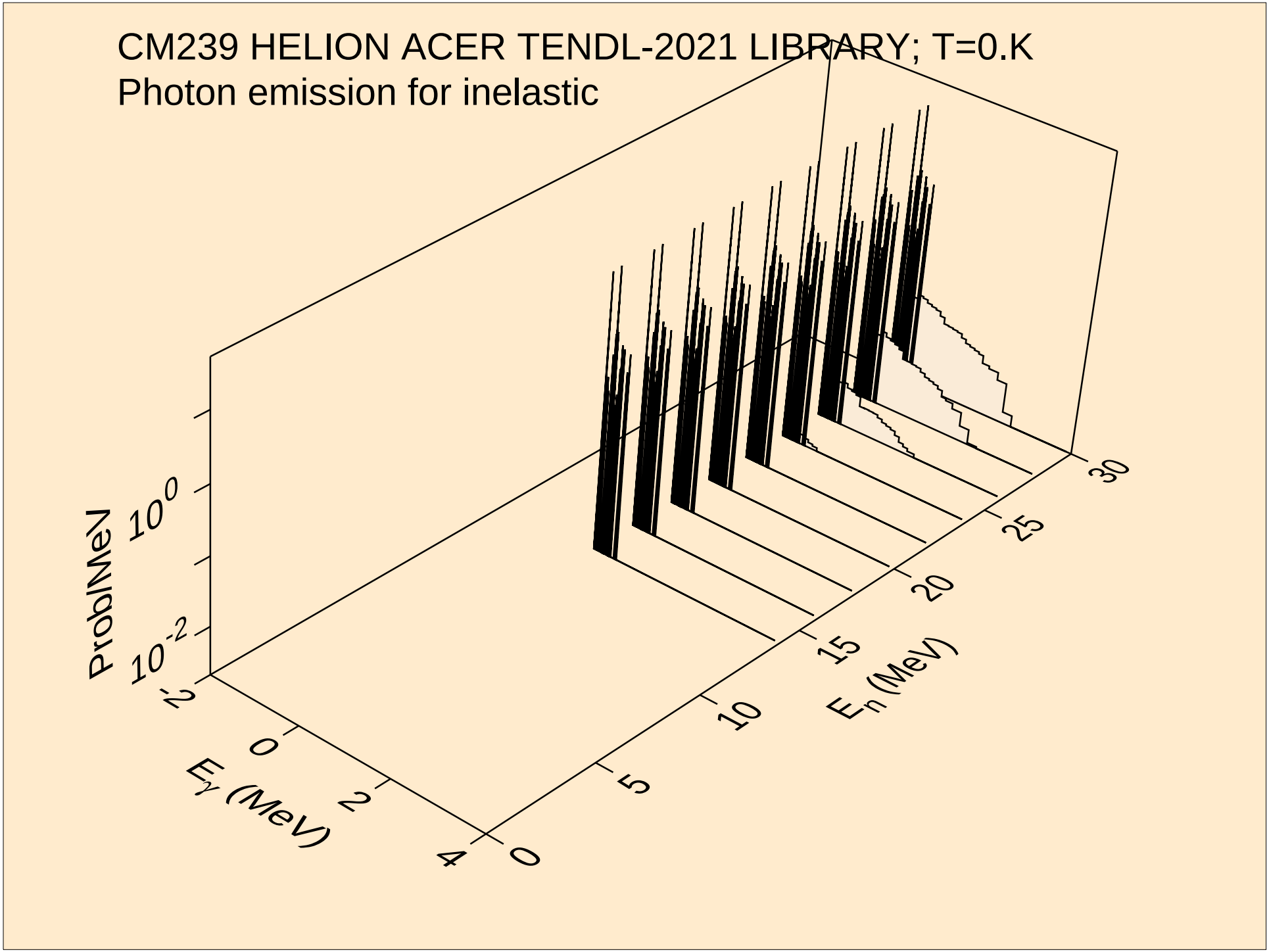

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,2np)
Prob/MeV
$10^{0}$
$10^{-2}$
0
$E_\gamma$ (MeV)
2
4
10
12
14
16
18
20
22
24
26
28
30
$E_n$ (MeV)

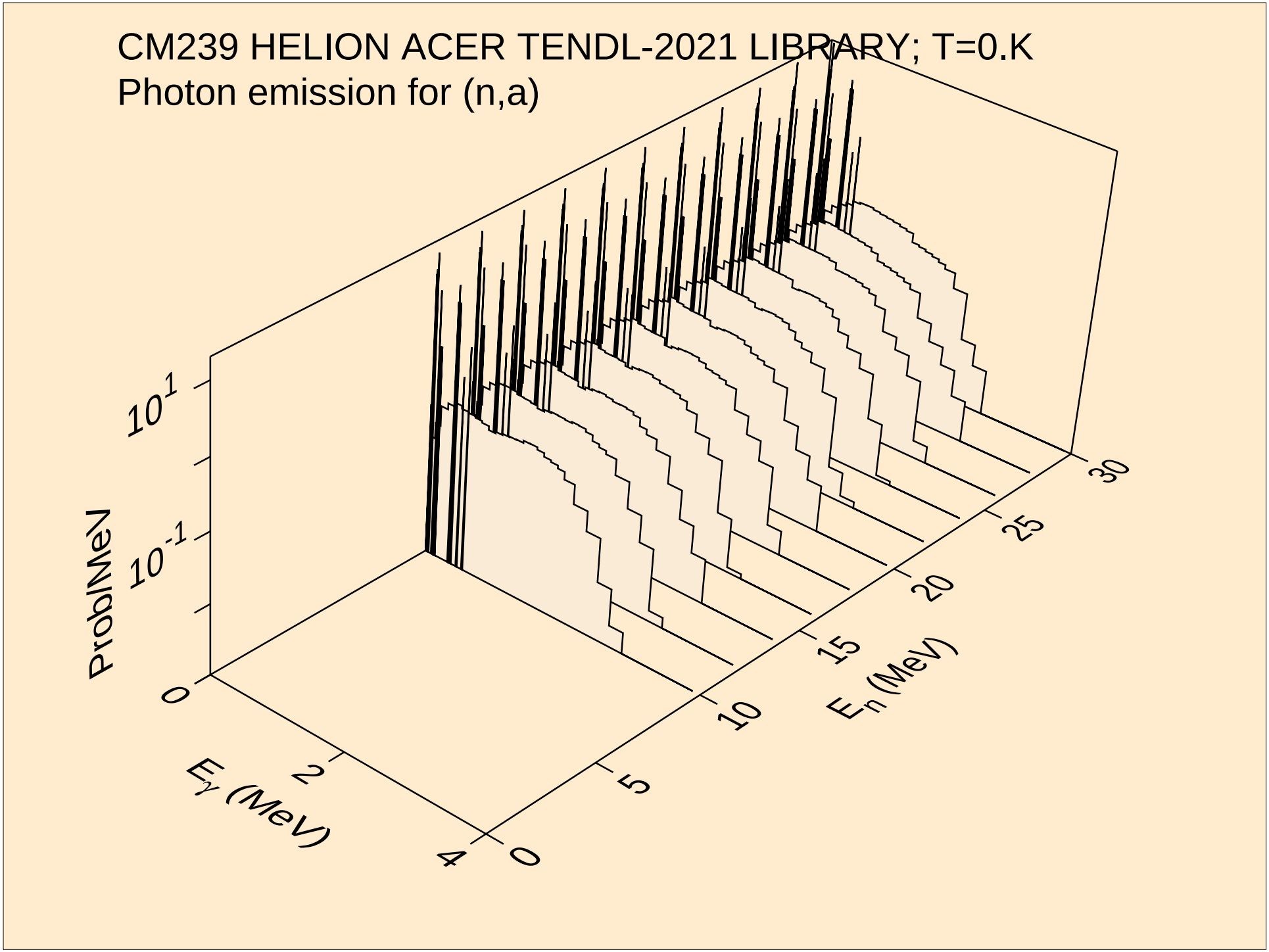

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,2np)
Prob/MeV
$10^{0}$
$10^{-2}$
-2
0
2
4
$E_\gamma$ (MeV)
5
10
15
20
25
30
$E_n$ (MeV)

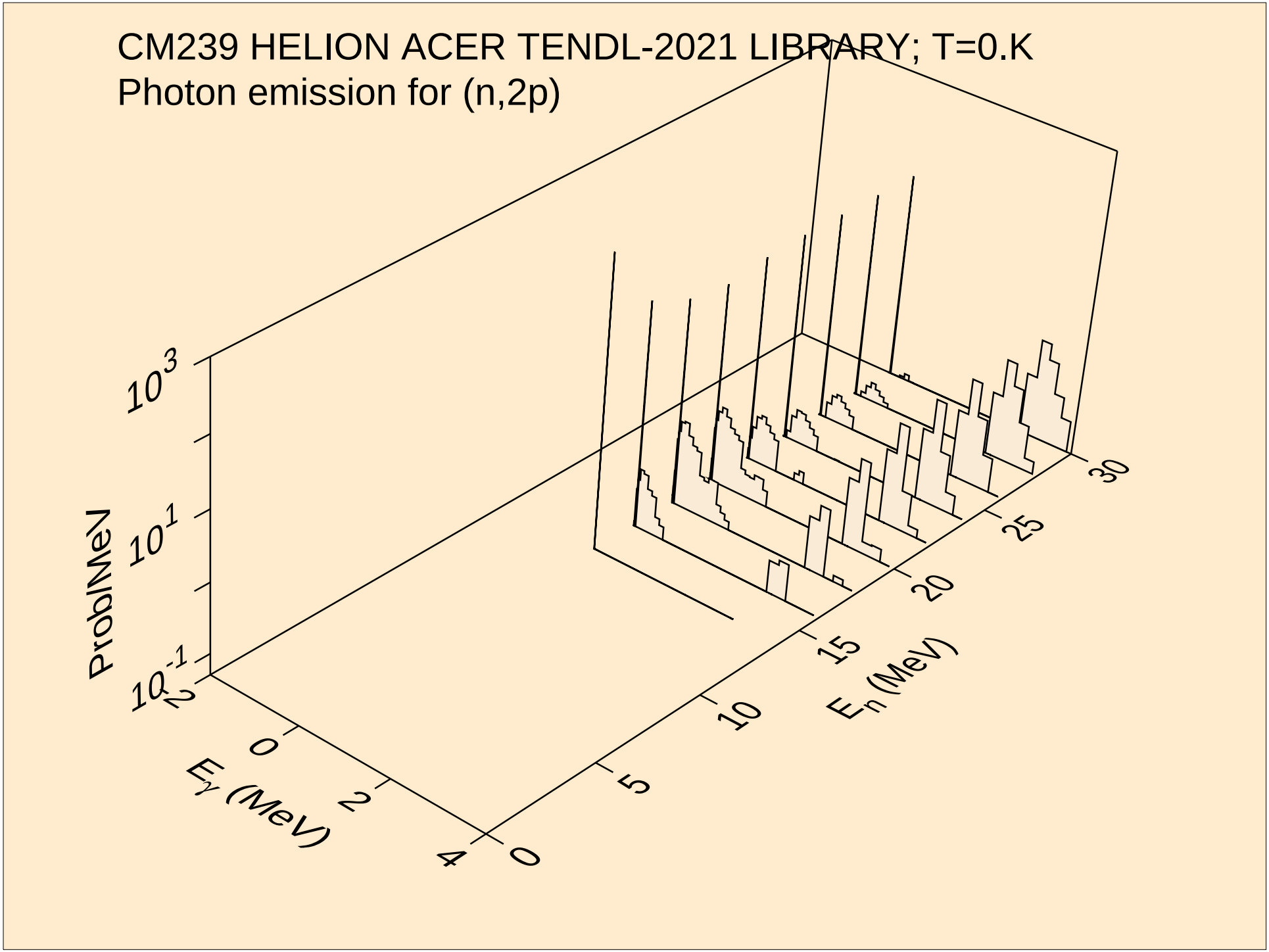

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,p)
Prob/MeV
$10^{1}$
$10^{-1}$
$10^{-3}$
$E_\gamma$ (MeV)
0
2
4
$E_n$ (MeV)
0
5
10
15
20
25
30

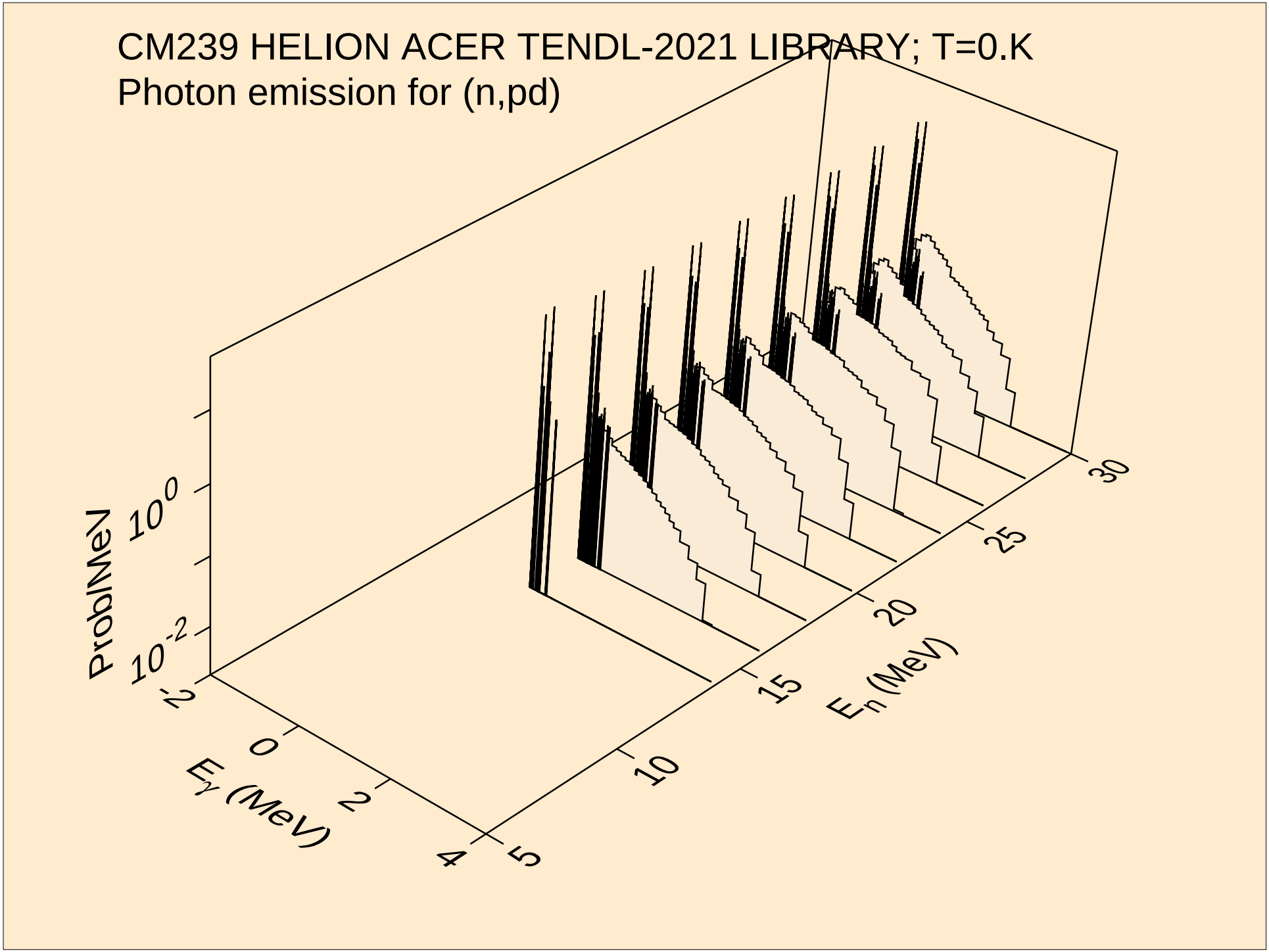

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,d)
Prob/MeV
$10^{3}$
$10^{1}$
$10^{-1}$
$E_\gamma$ (MeV)
0
2
4
$E_n$ (MeV)
0
5
10
15
20
25
30

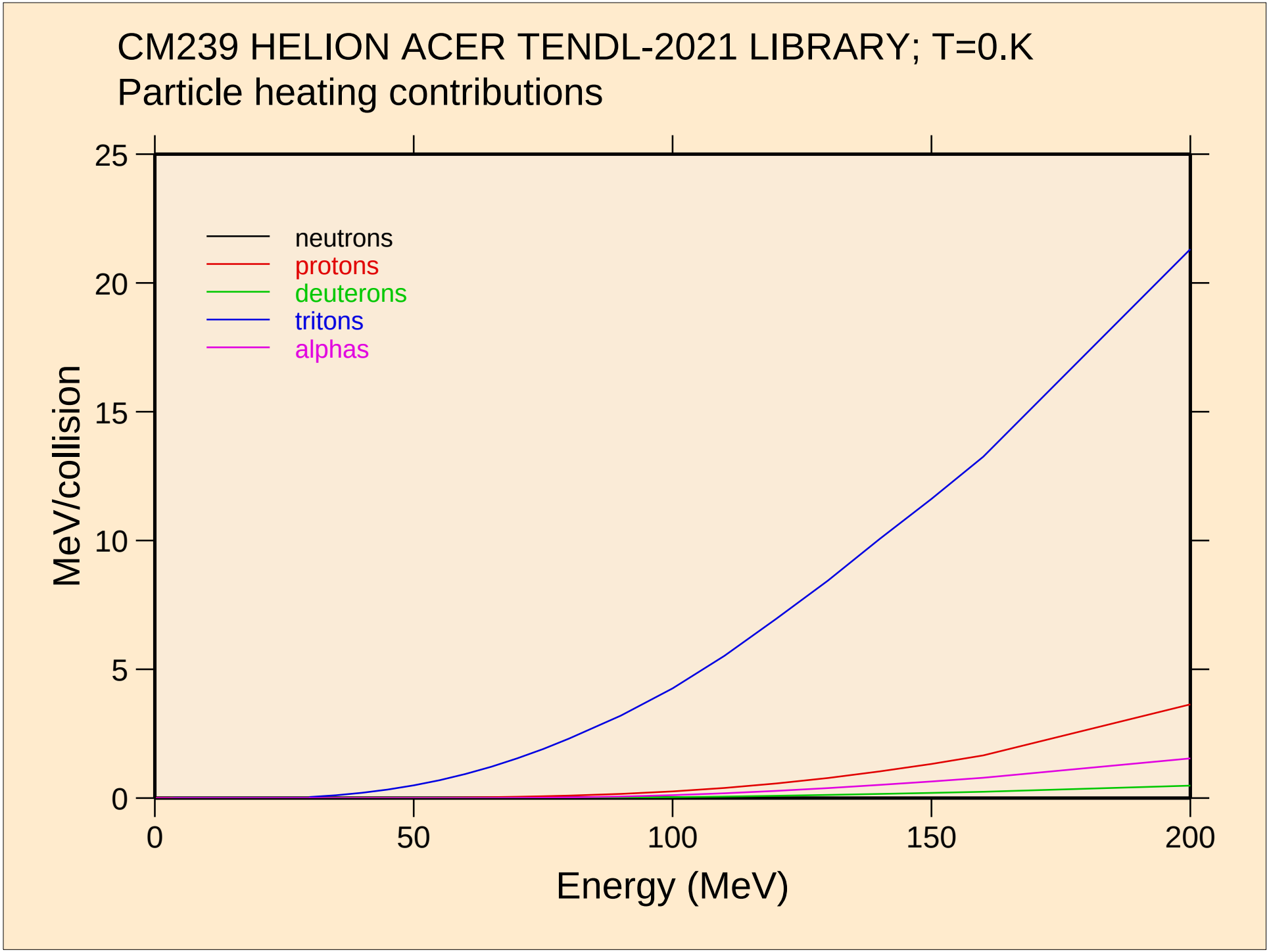

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,t)
Prob/MeV
$10^{1}$
$10^{-1}$
0
2
4
$E_\gamma$ (MeV)
0
5
10
15
20
25
30
$E_n$ (MeV)

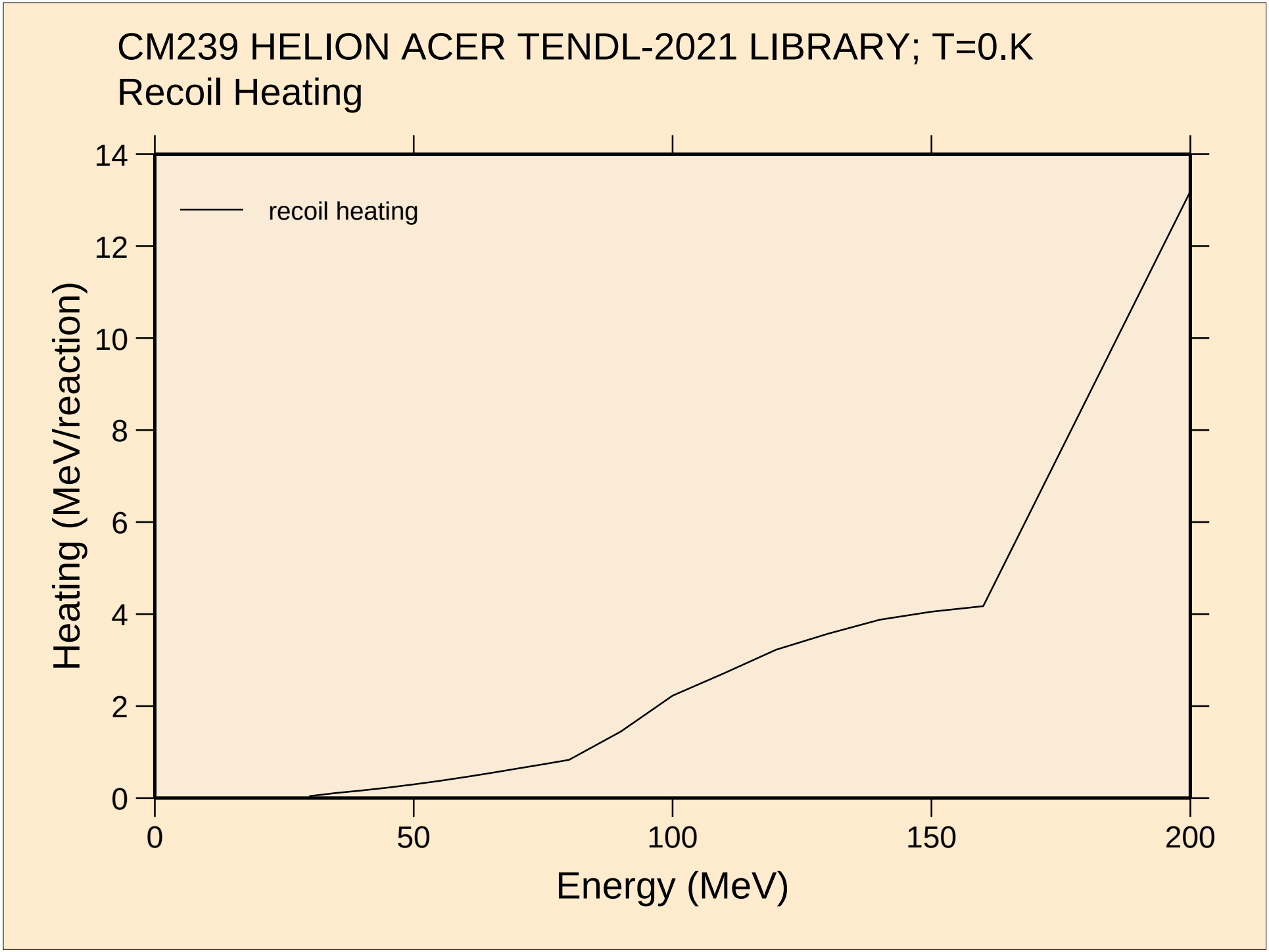

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for inelastic
Prob/MeV
$10^{0}$
$10^{-2}$
-2
0
2
4
$E_\gamma$ (MeV)
0
5
10
15
20
25
30
$E_n$ (MeV)

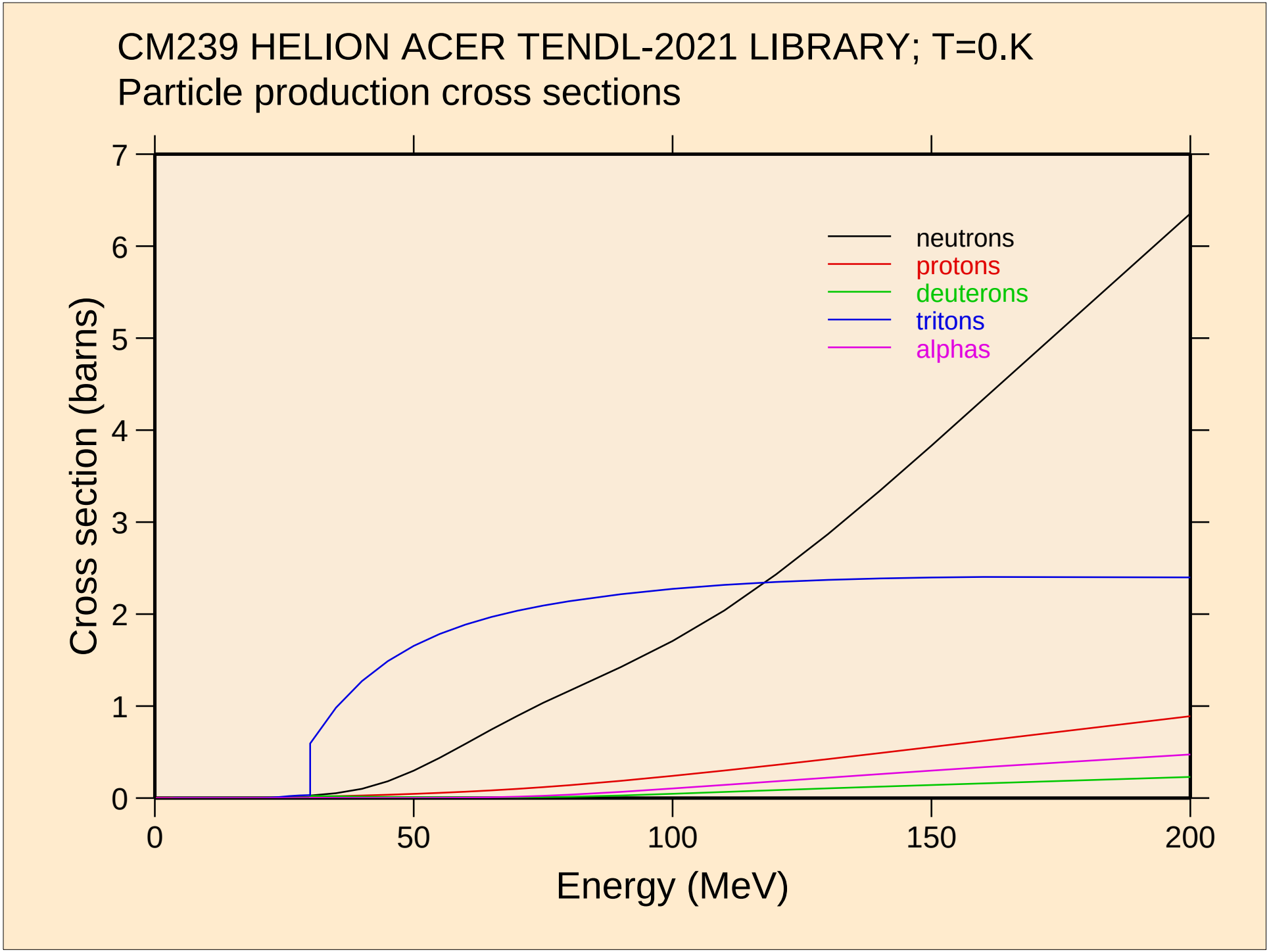

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,a)
Prob/MeV
$10^{1}$
$10^{-1}$
0
2
4
$E_\gamma$ (MeV)
0
5
10
15
20
25
30
$E_n$ (MeV)

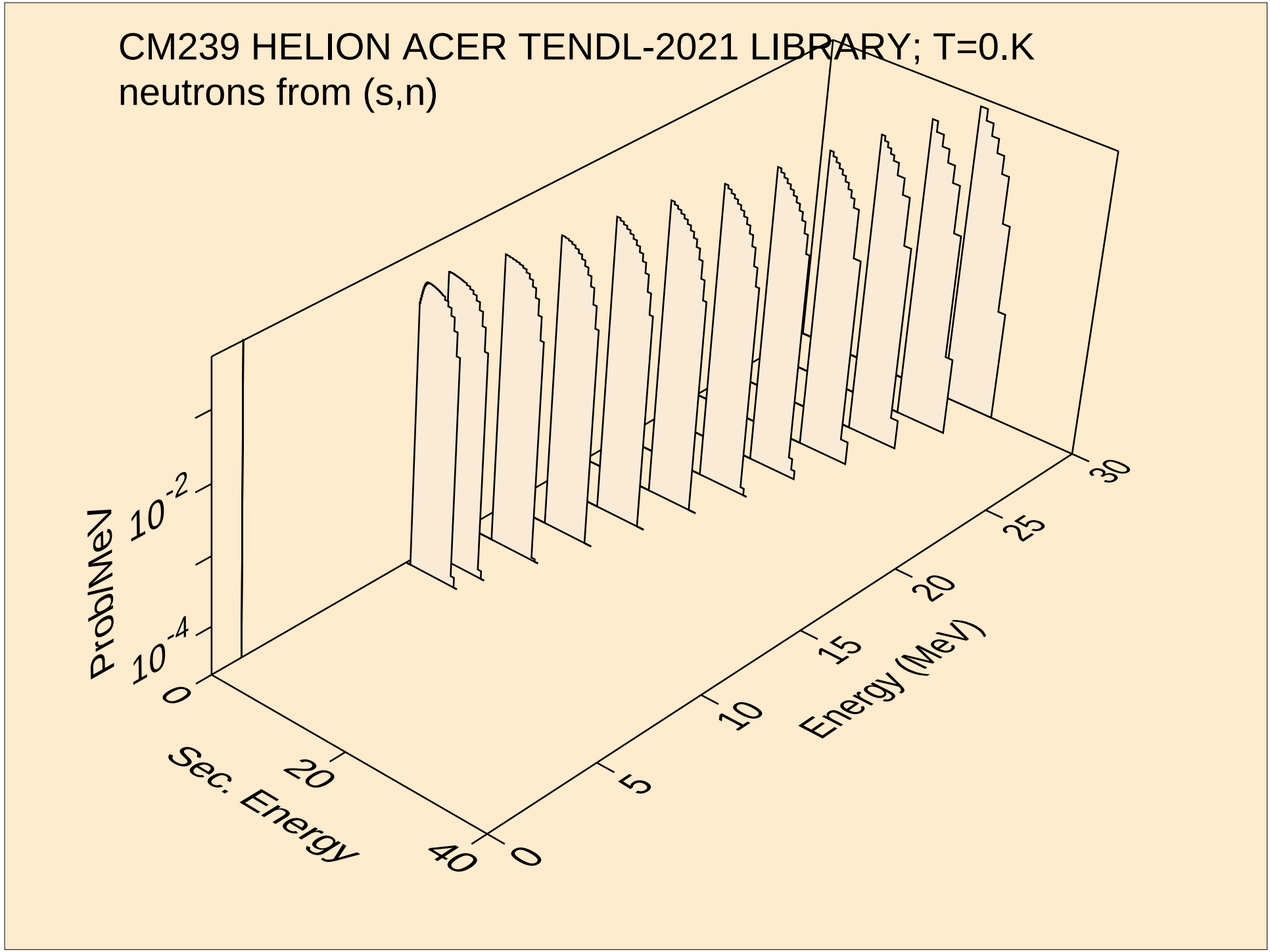

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,2p)
Prob/MeV
$10^{3}$
$10^{1}$
$10^{-1}$
$E_\gamma$ (MeV)
0
2
4
$E_n$ (MeV)
0
5
10
15
20
25
30

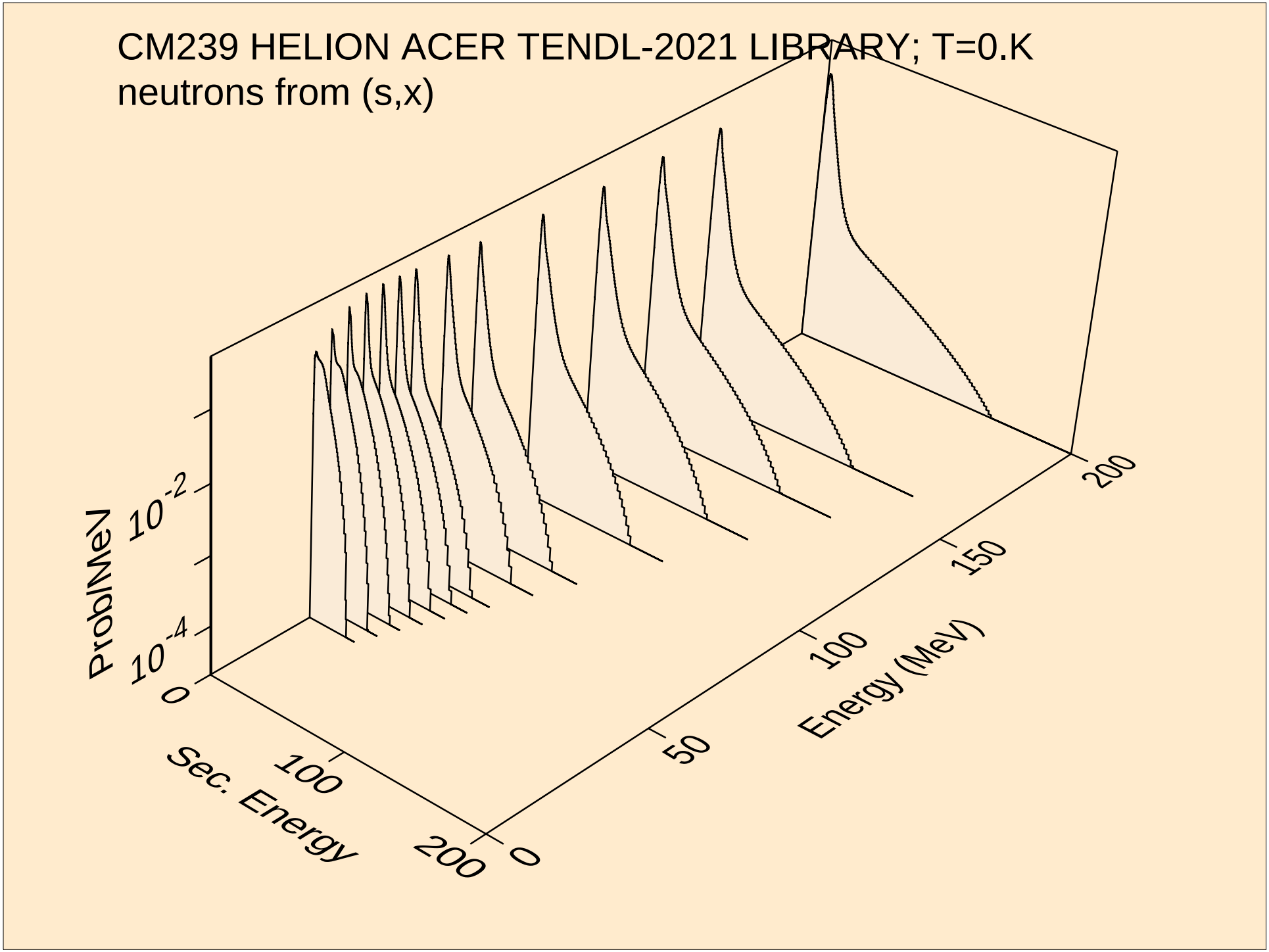

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Photon emission for (n,pd)
Prob/MeV
$10^{0}$
$10^{-2}$
-2
0
2
4
$E_\gamma$ (MeV)
5
10
15
20
25
30
$E_n$ (MeV)

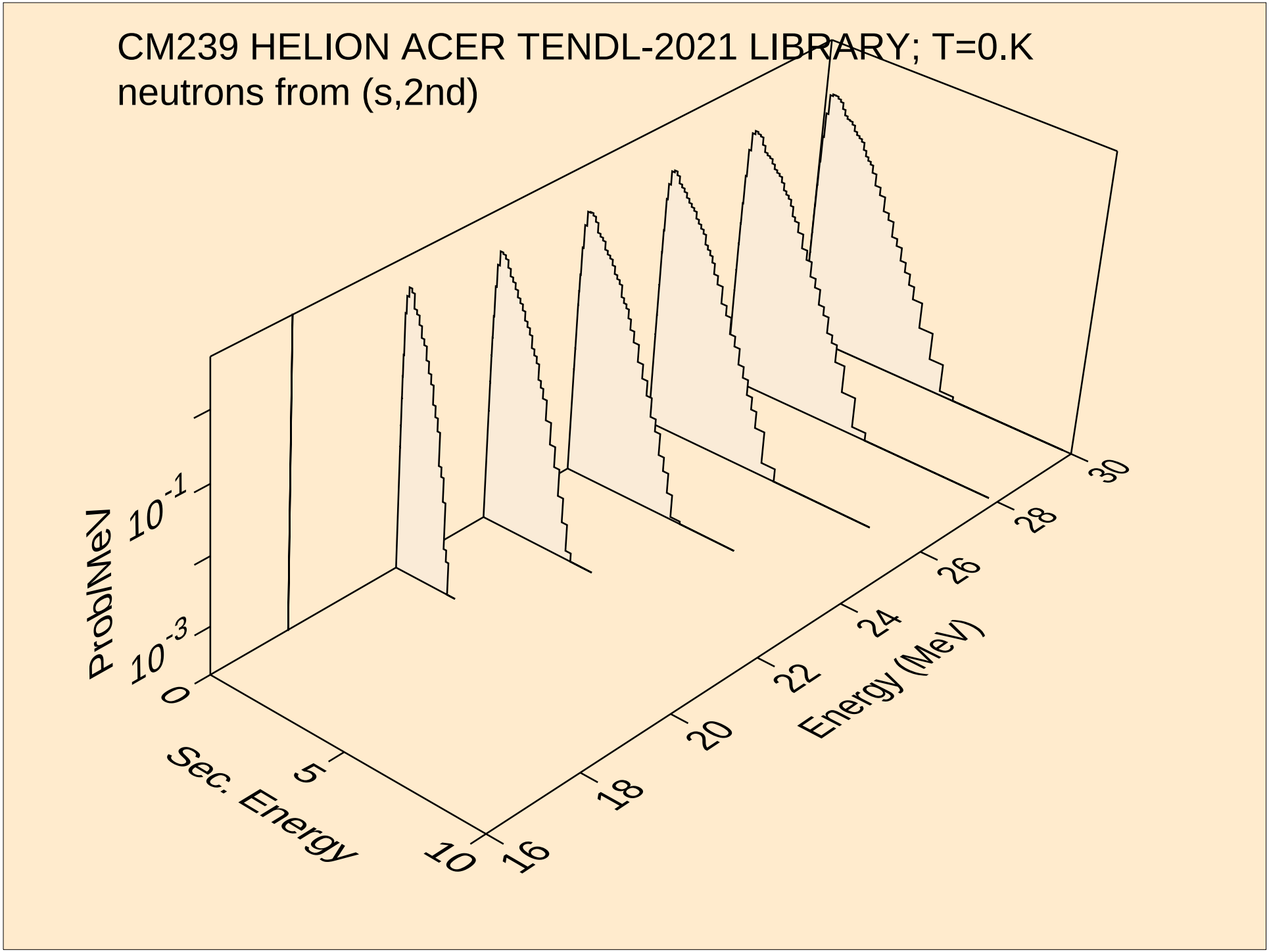

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Particle heating contributions
neutrons
protons
deuterons
tritons
alphas
MeV/collision
Energy (MeV)
0
5
10
15
20
25
0
50
100
150
200

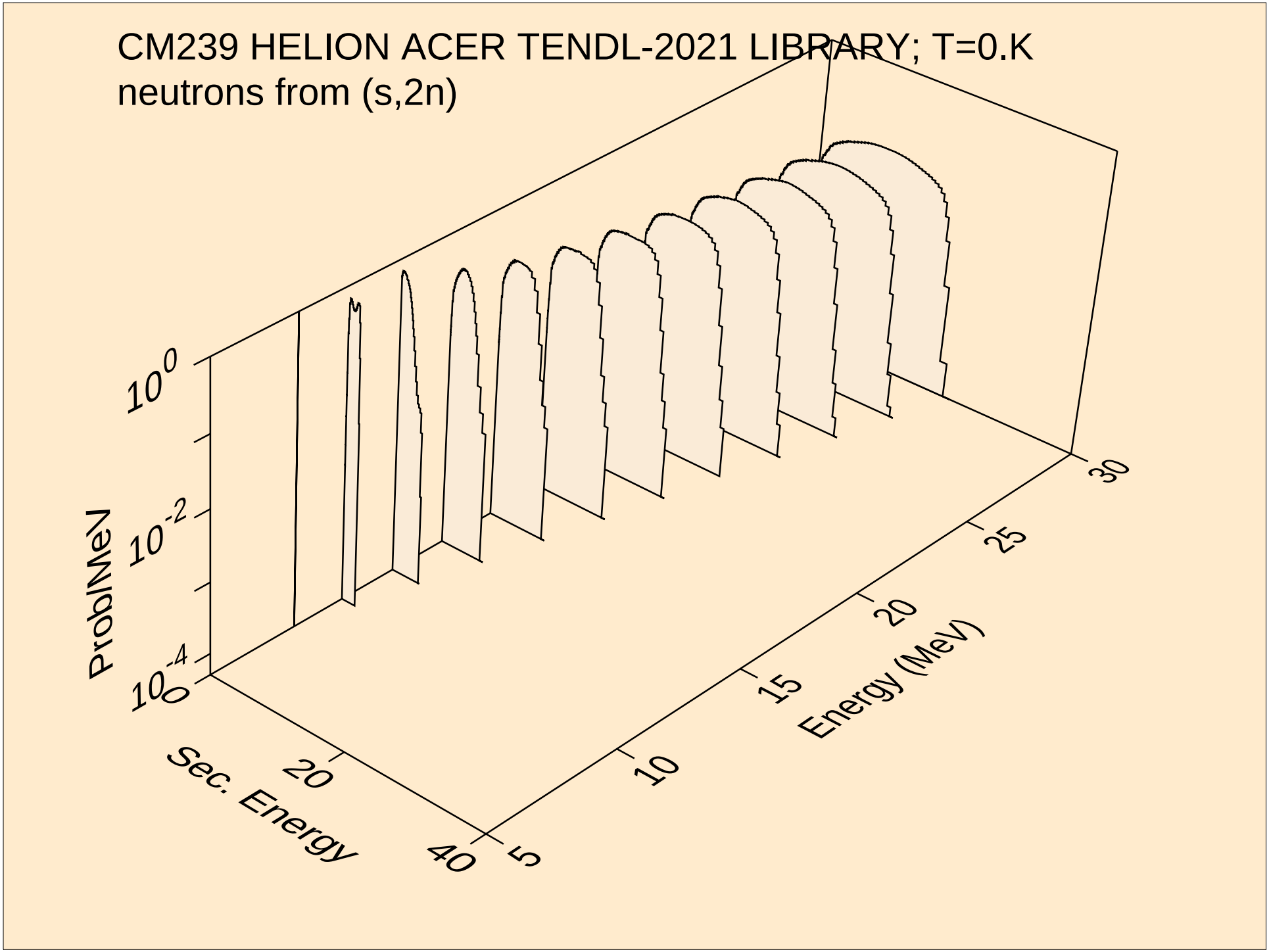

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Recoil Heating
recoil heating
Heating (MeV/reaction)
Energy (MeV)
0
2
4
6
8
10
12
14
0
50
100
150
200

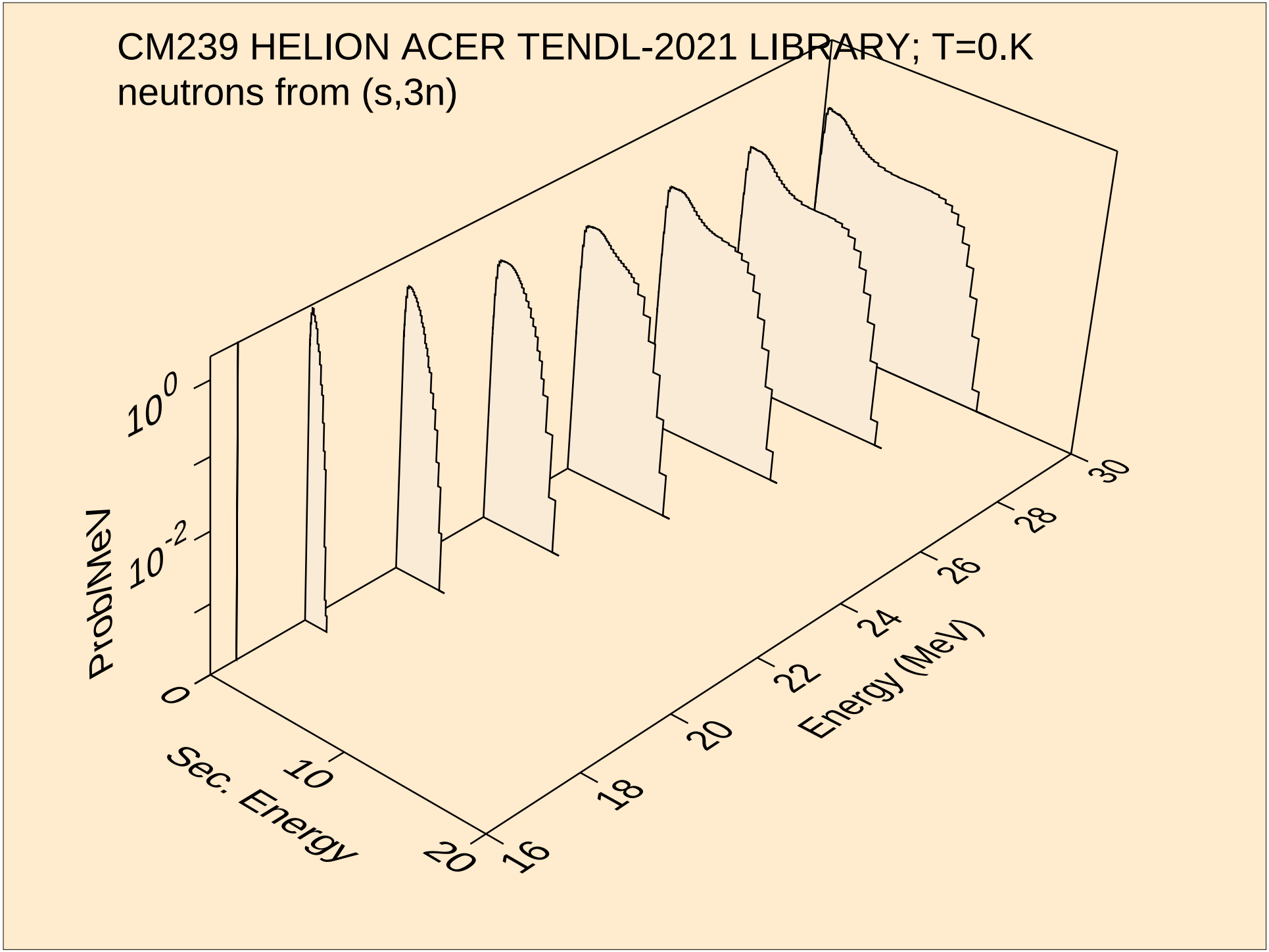

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
Particle production cross sections
Cross section (barns)
Energy (MeV)
0
1
2
3
4
5
6
7
0
50
100
150
200
neutrons
protons
deuterons
tritons
alphas

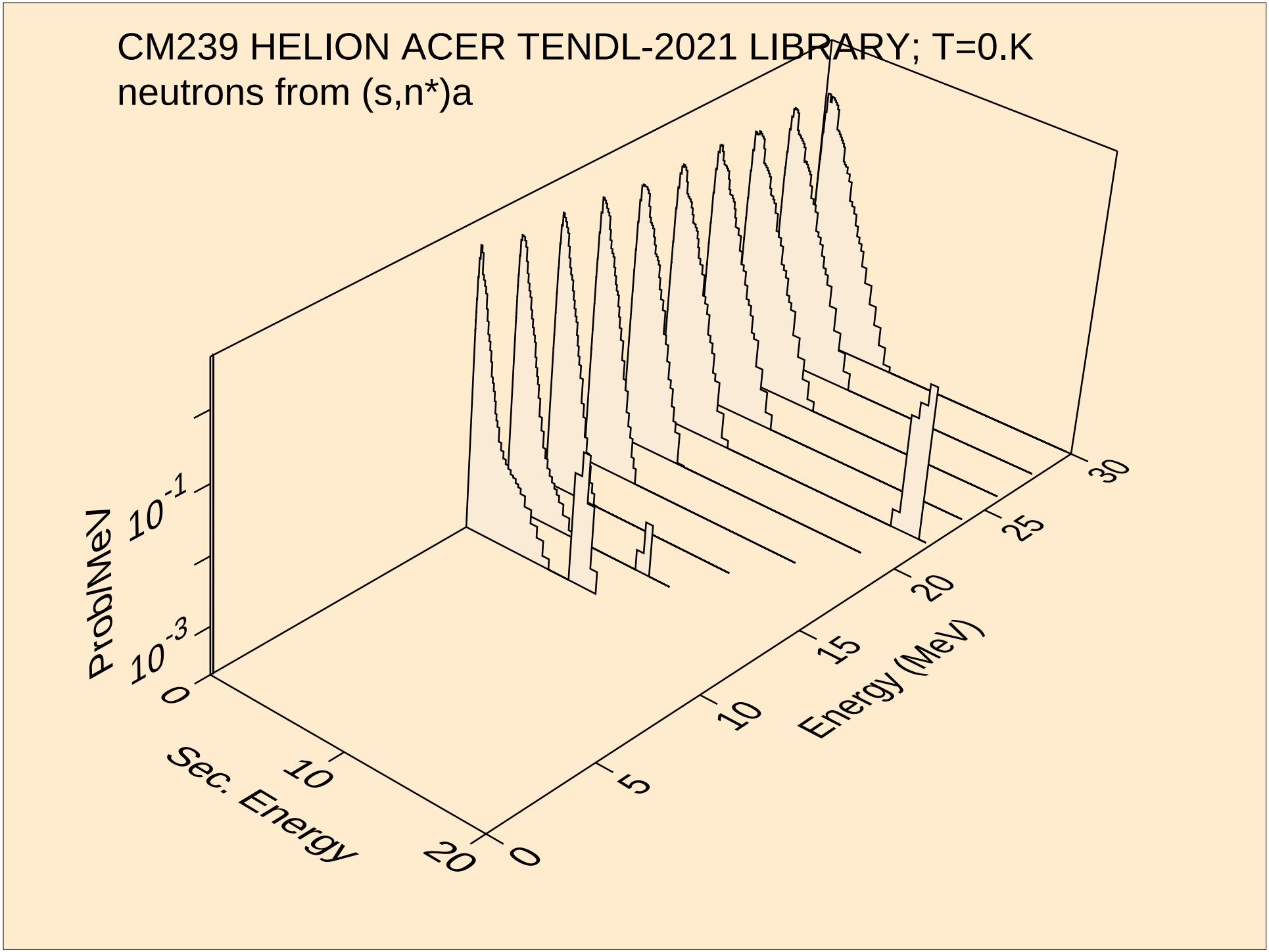

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,n)
Prob/MeV
10-2
10-4
0
Sec. Energy
20
40
0
5
10
15
20
25
30
Energy (MeV)

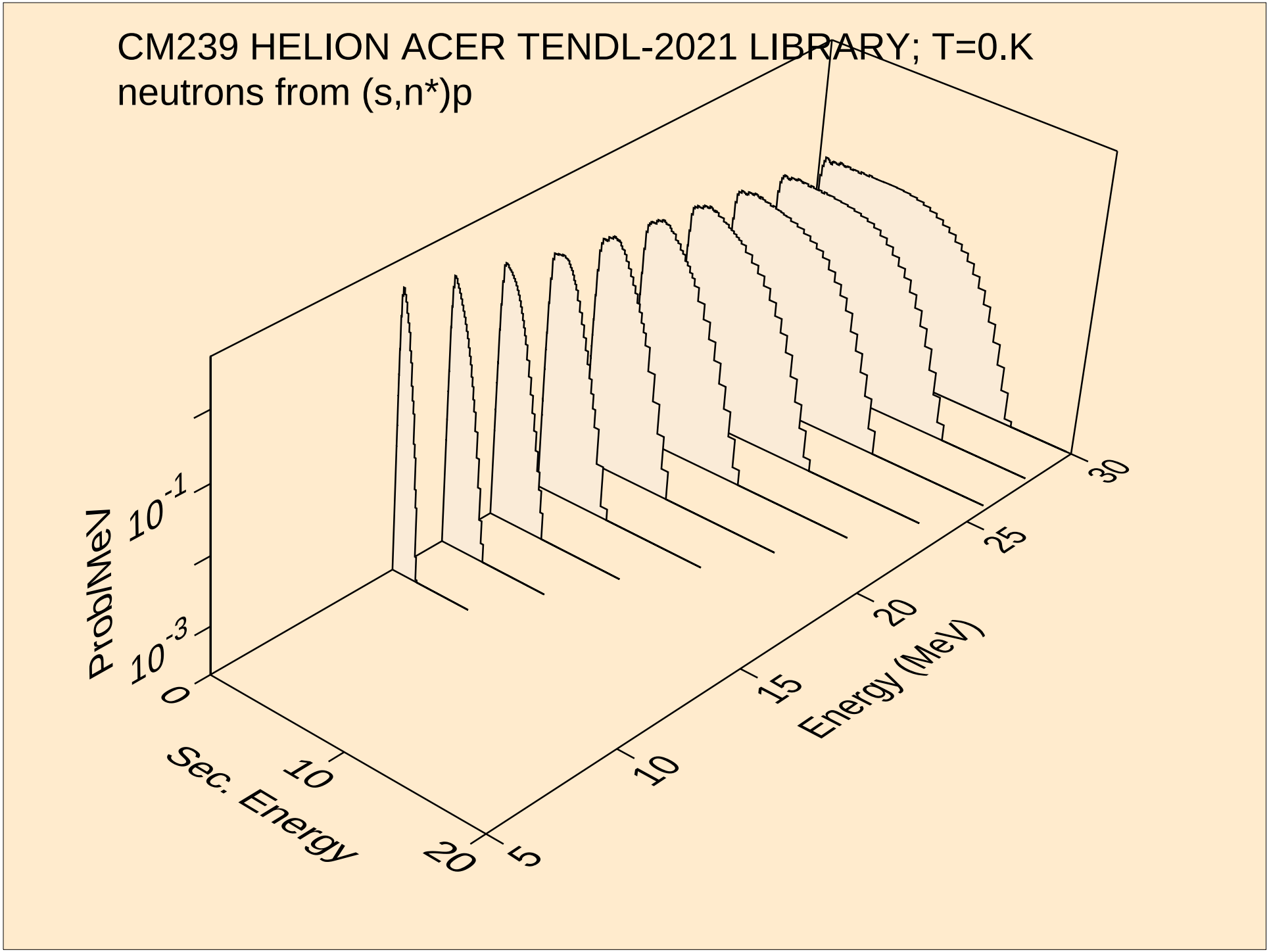

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,x)
Prob/MeV
10-2
10-4
0
Sec. Energy
100
200
0
50
100
150
200
Energy (MeV)

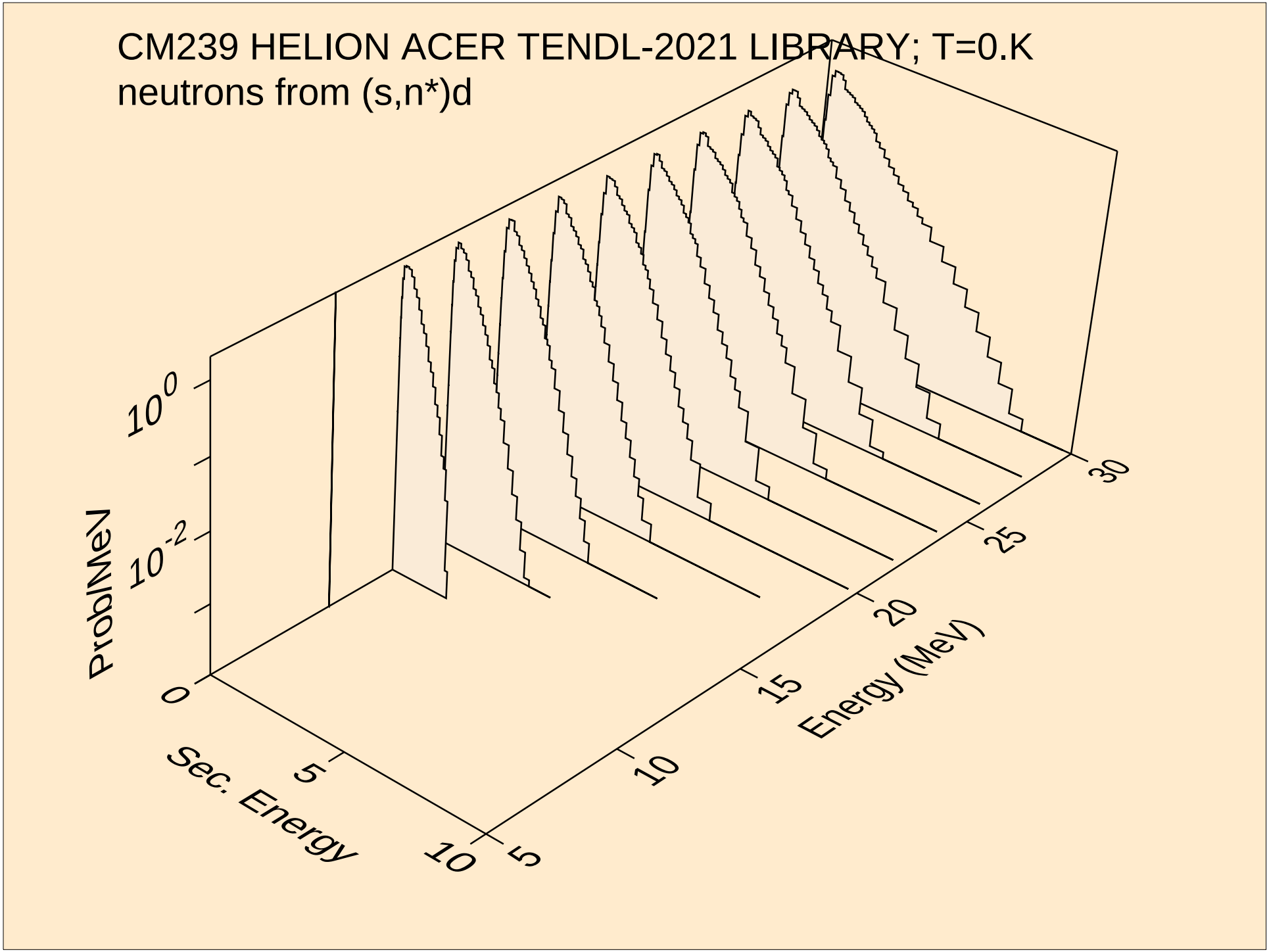

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,2nd)
Prob/MeV
10-1
10-3
0
Sec. Energy
5
10
16
18
20
22
24
26
28
30
Energy (MeV)

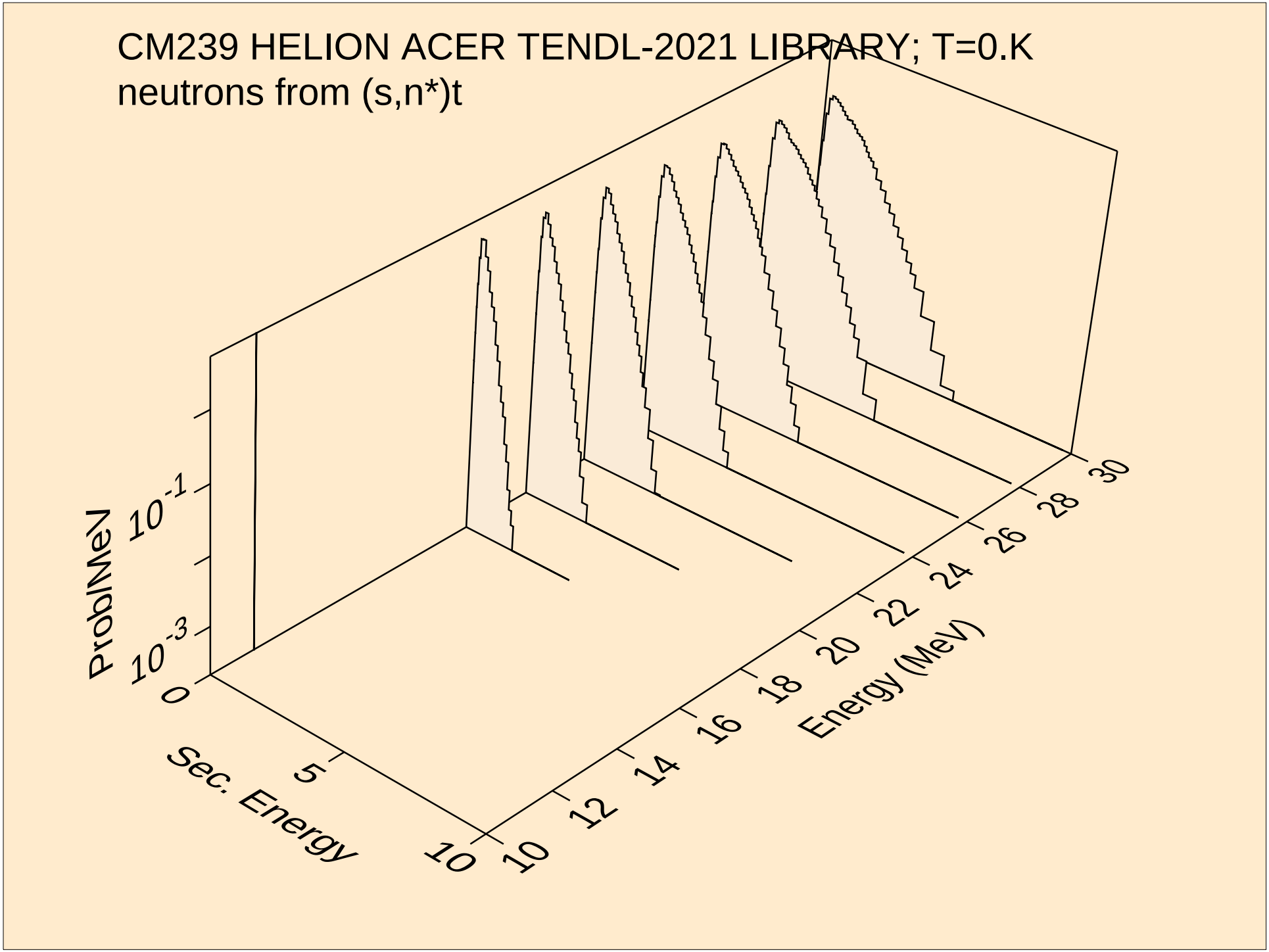

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,2n)
Prob/MeV
10^0
10^-2
10^-4
0
Sec. Energy
20
40
5
10
15
Energy (MeV)
20
25
30

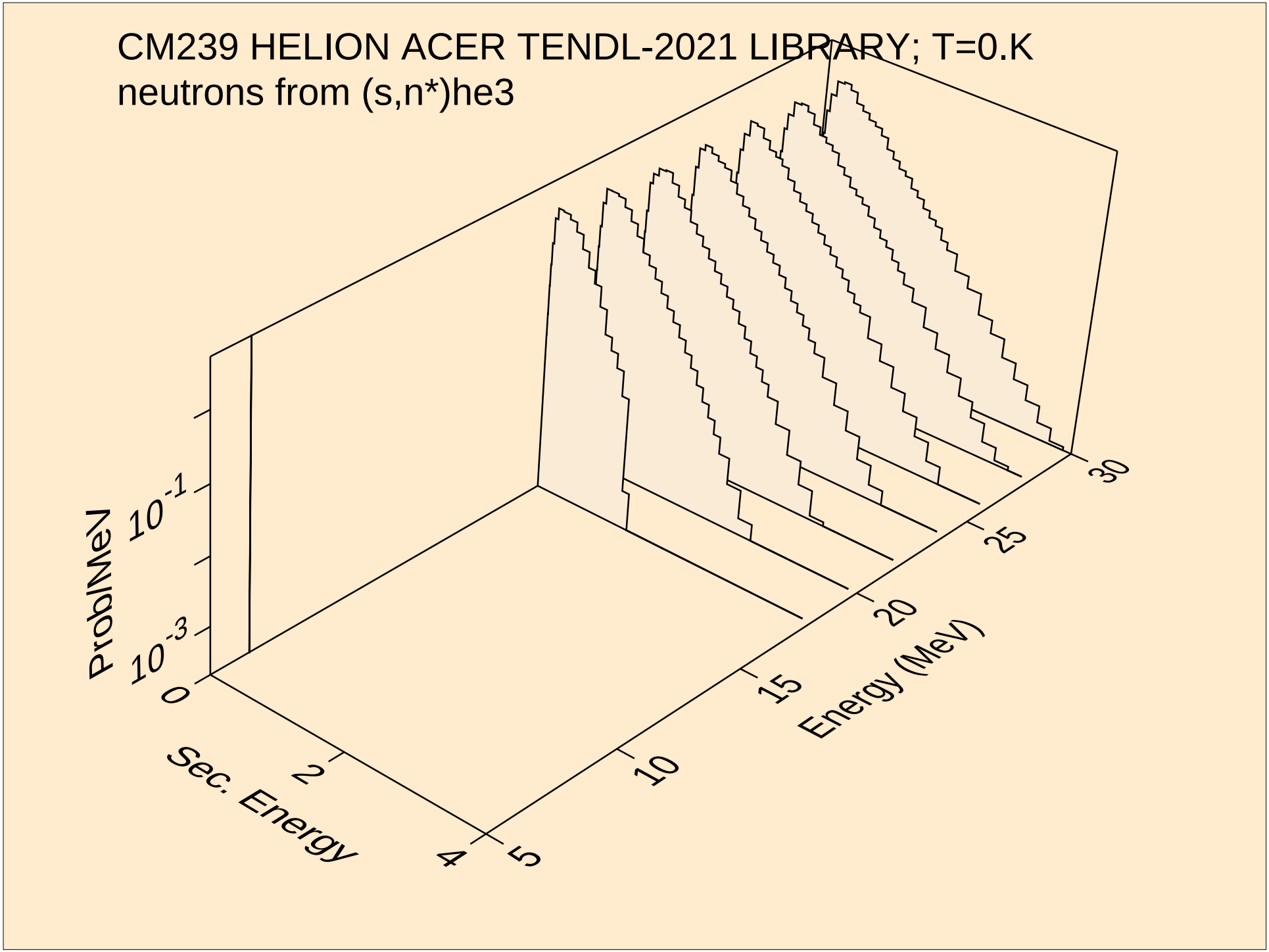

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,3n)
Prob/MeV
10^0
10^-2
0
Sec. Energy
10
20
16
18
20
22
24
26
28
30
Energy (MeV)

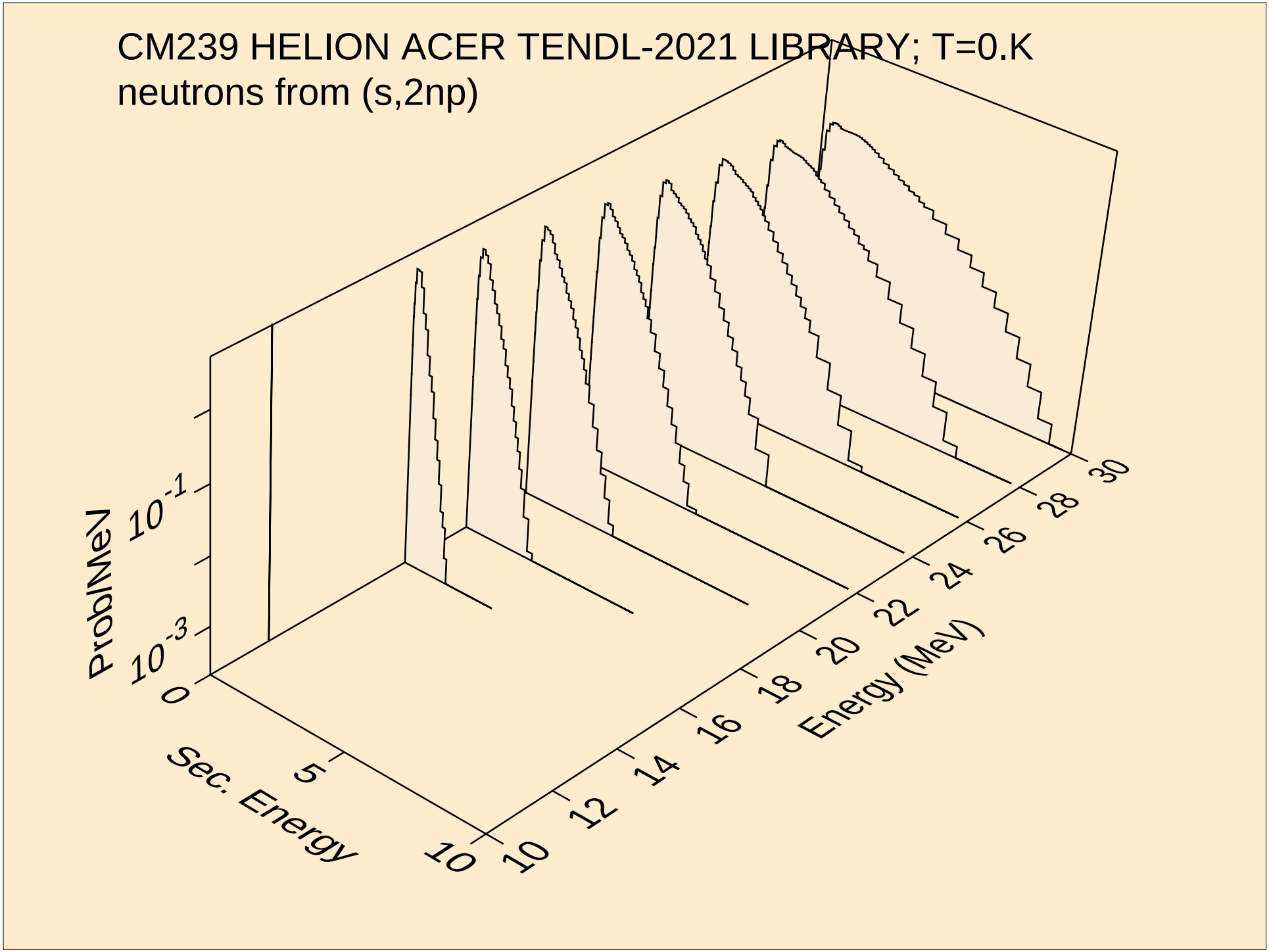

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,n*)a
Prob/MeV
10-1
10-3
0
Sec. Energy
10
20
0
5
10
15
20
25
30
Energy (MeV)

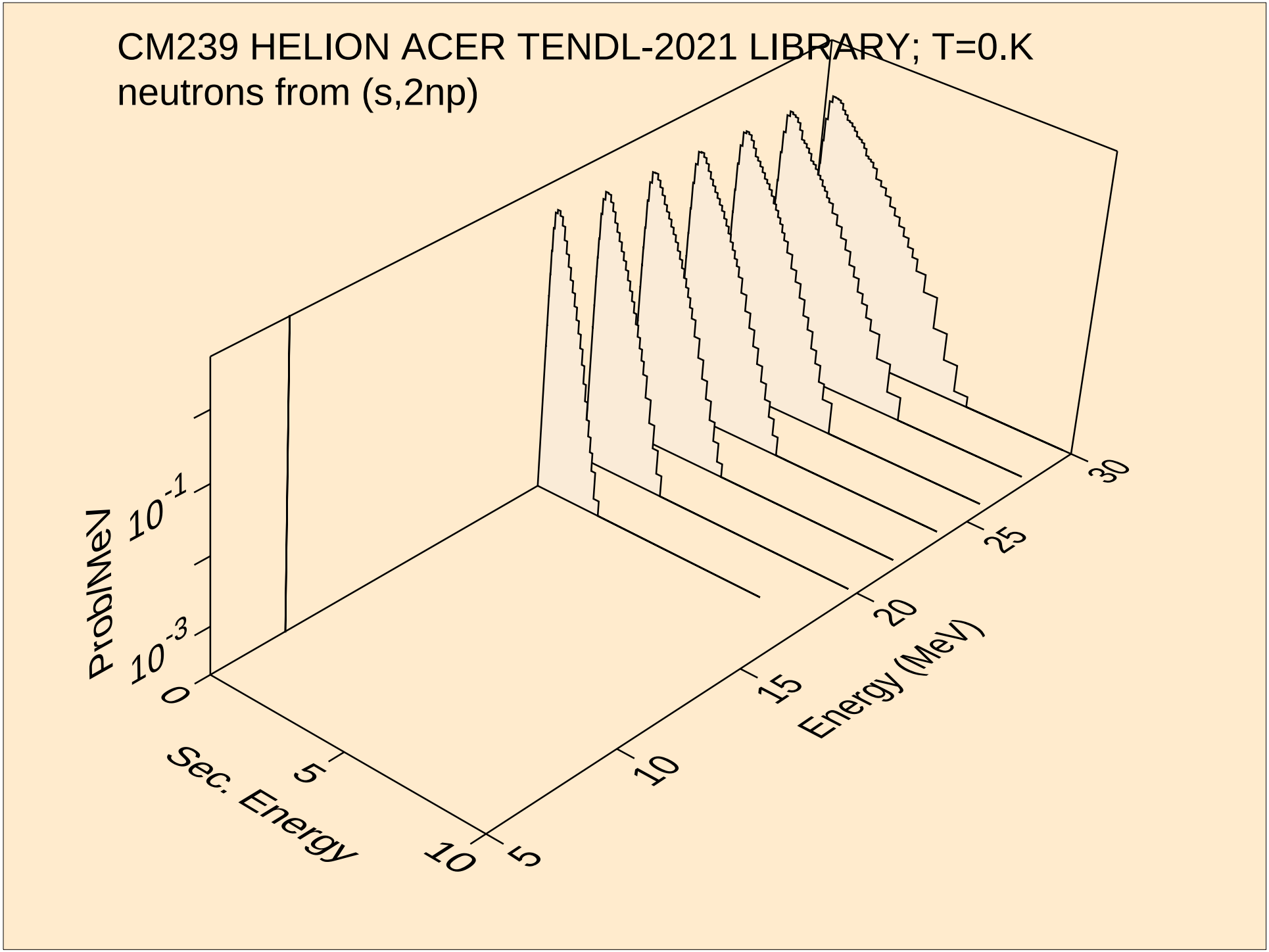

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,n*)p
Prob/MeV
10-1
10-3
0
Sec. Energy
10
20
5
10
15
20
25
30
Energy (MeV)

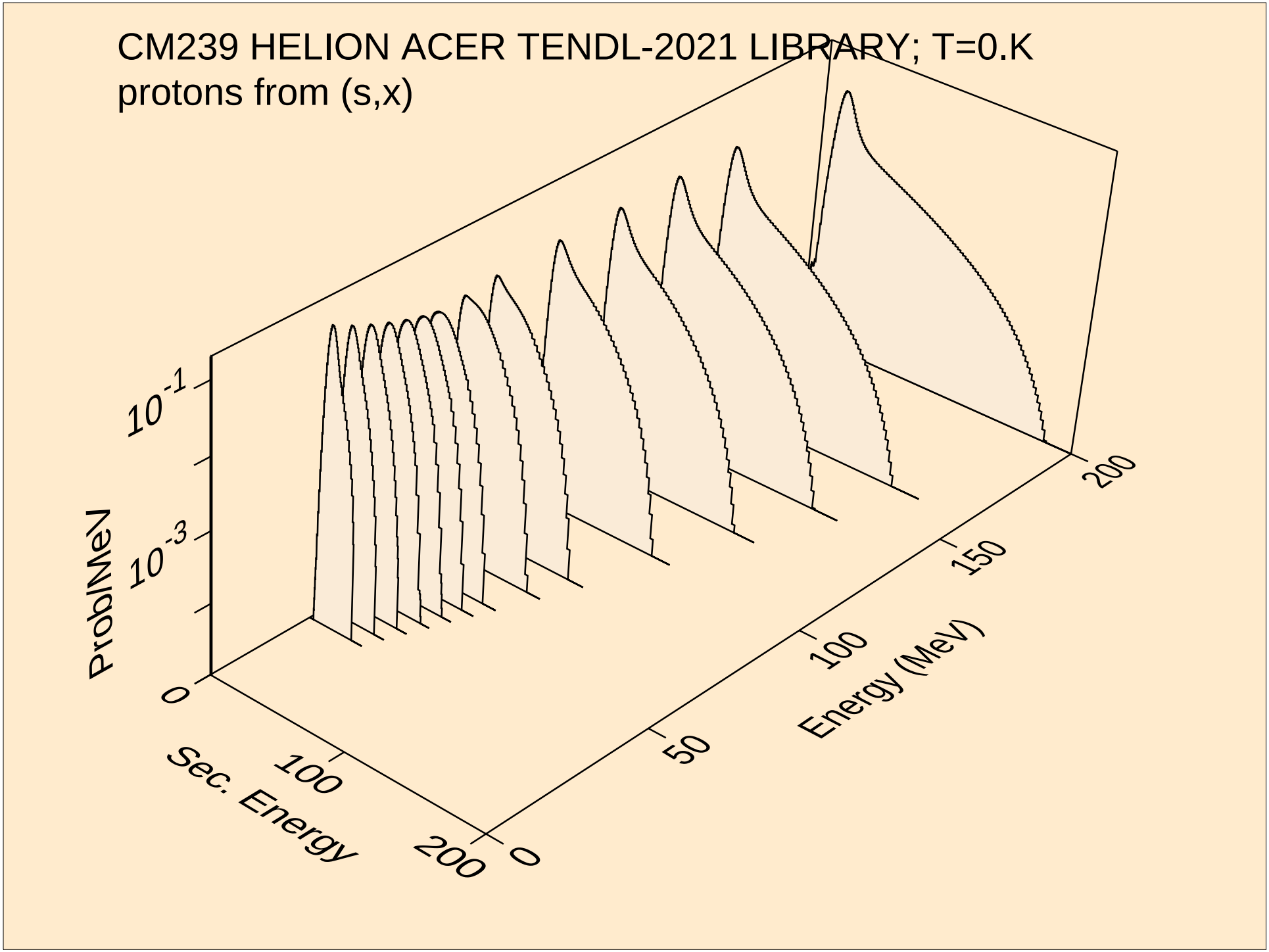

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,n*)d
Prob/MeV
10^0
10^-2
0
Sec. Energy
5
10
5
10
15
20
25
30
Energy (MeV)

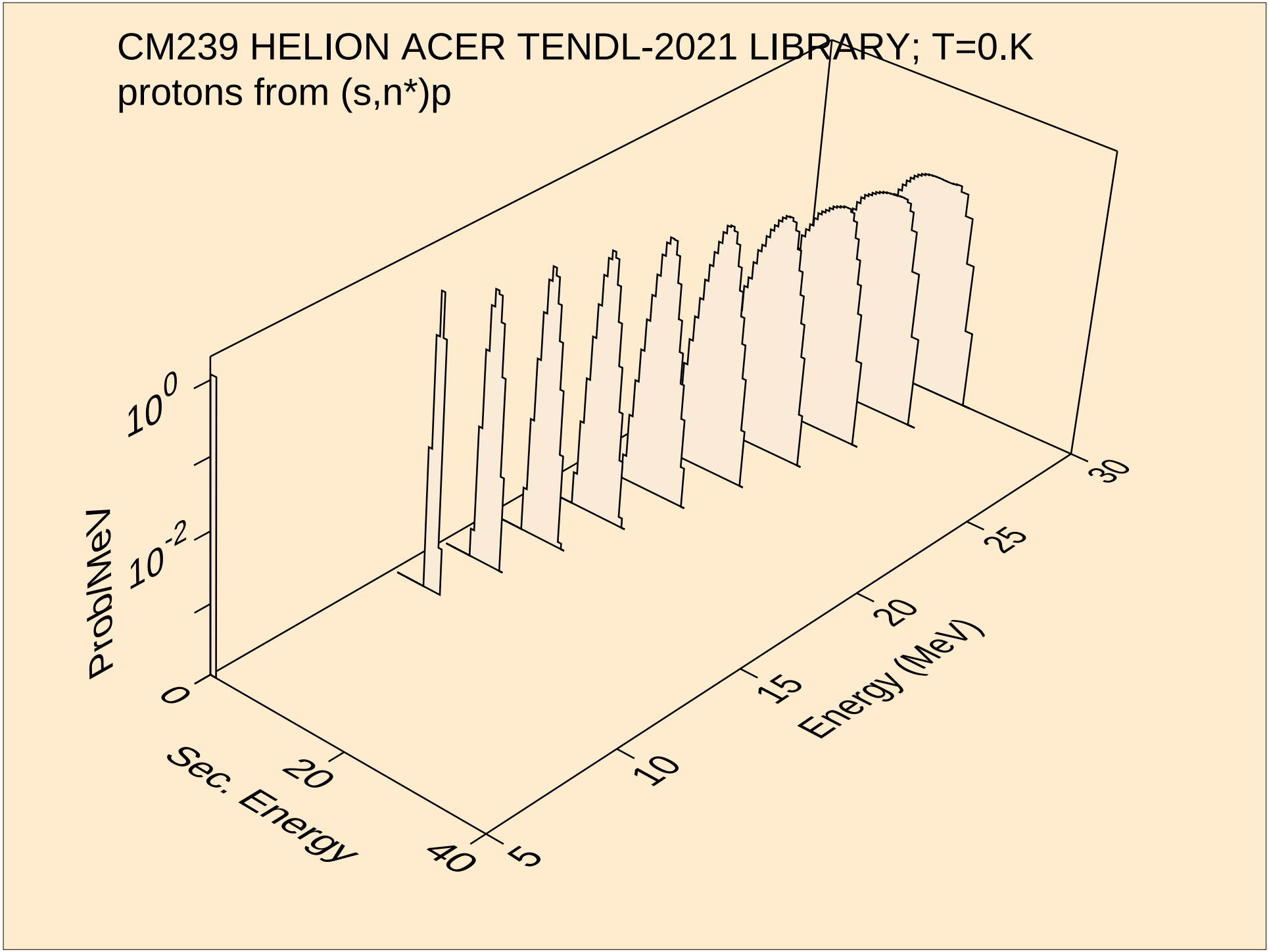

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,n*)t
Prob/MeV
10-1
10-3
0
Sec. Energy
5
10
10
12
14
16
18
20
22
24
26
28
30
Energy (MeV)

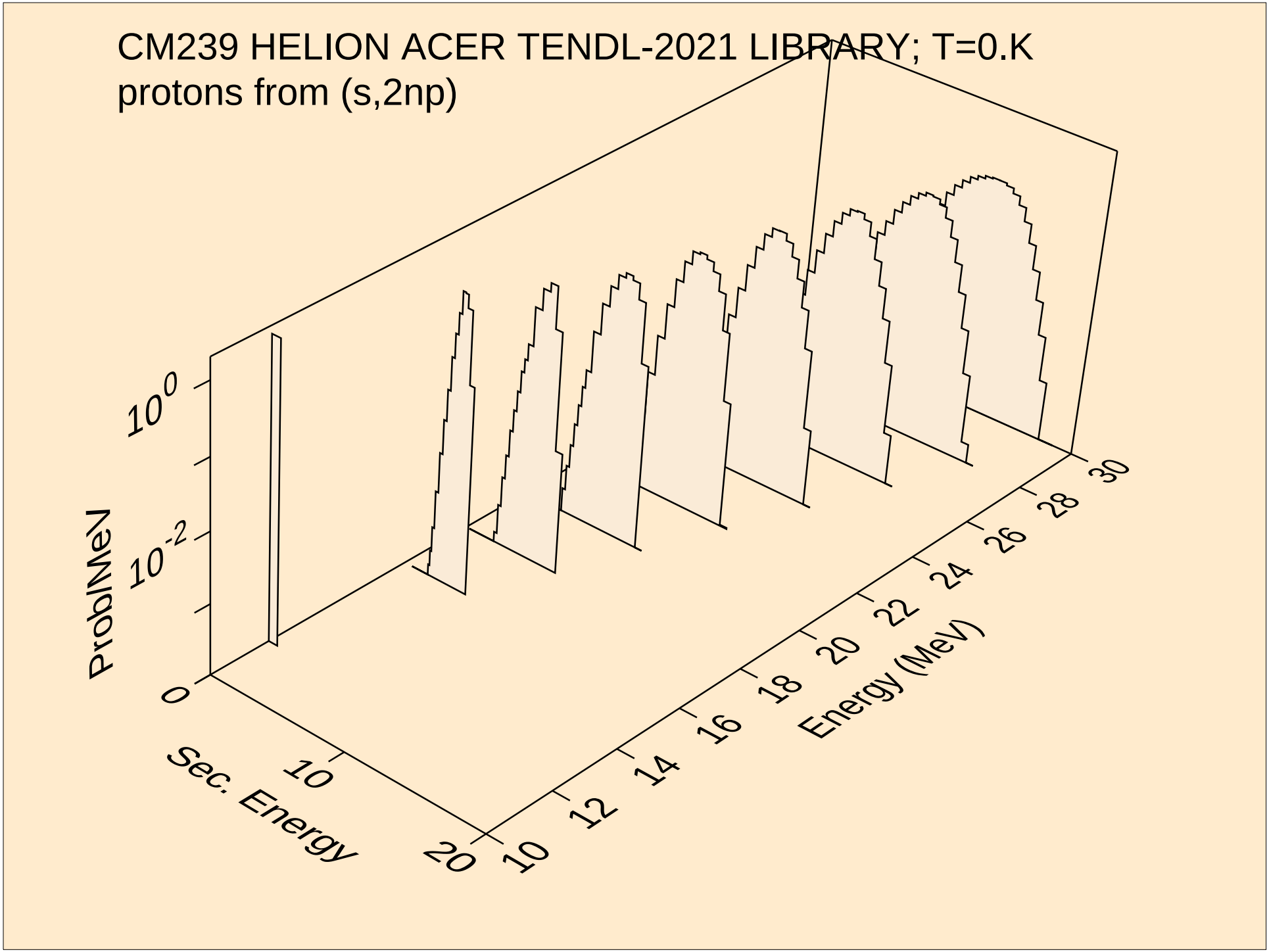

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,n*)he3
Prob/MeV
10-1
10-3
0
Sec. Energy
2
4
5
10
15
20
25
30
Energy (MeV)

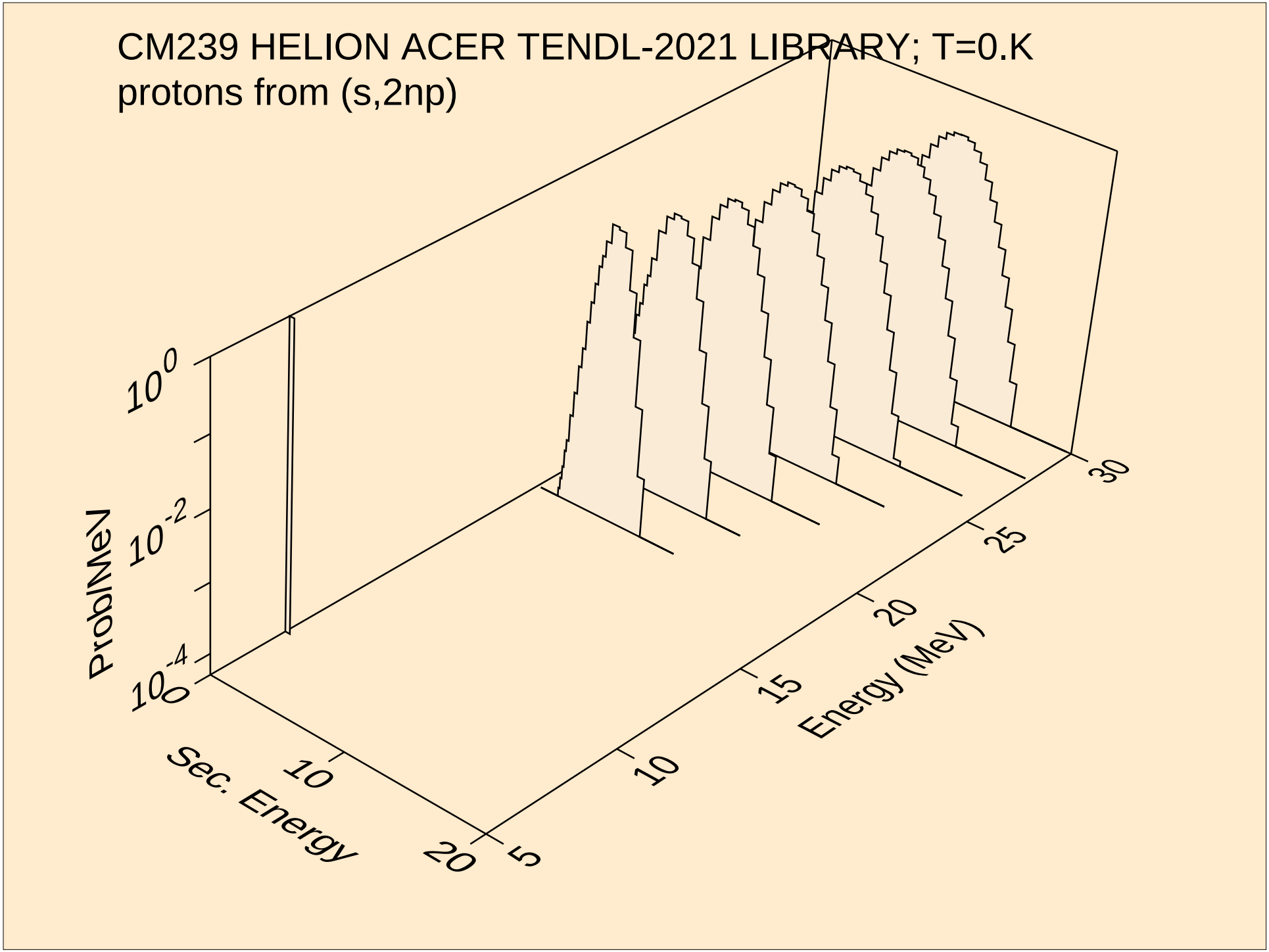

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,2np)
Prob/MeV
10-1
10-3
0
Sec. Energy
5
10
10
12
14
16
18
20
22
24
26
28
30
Energy (MeV)

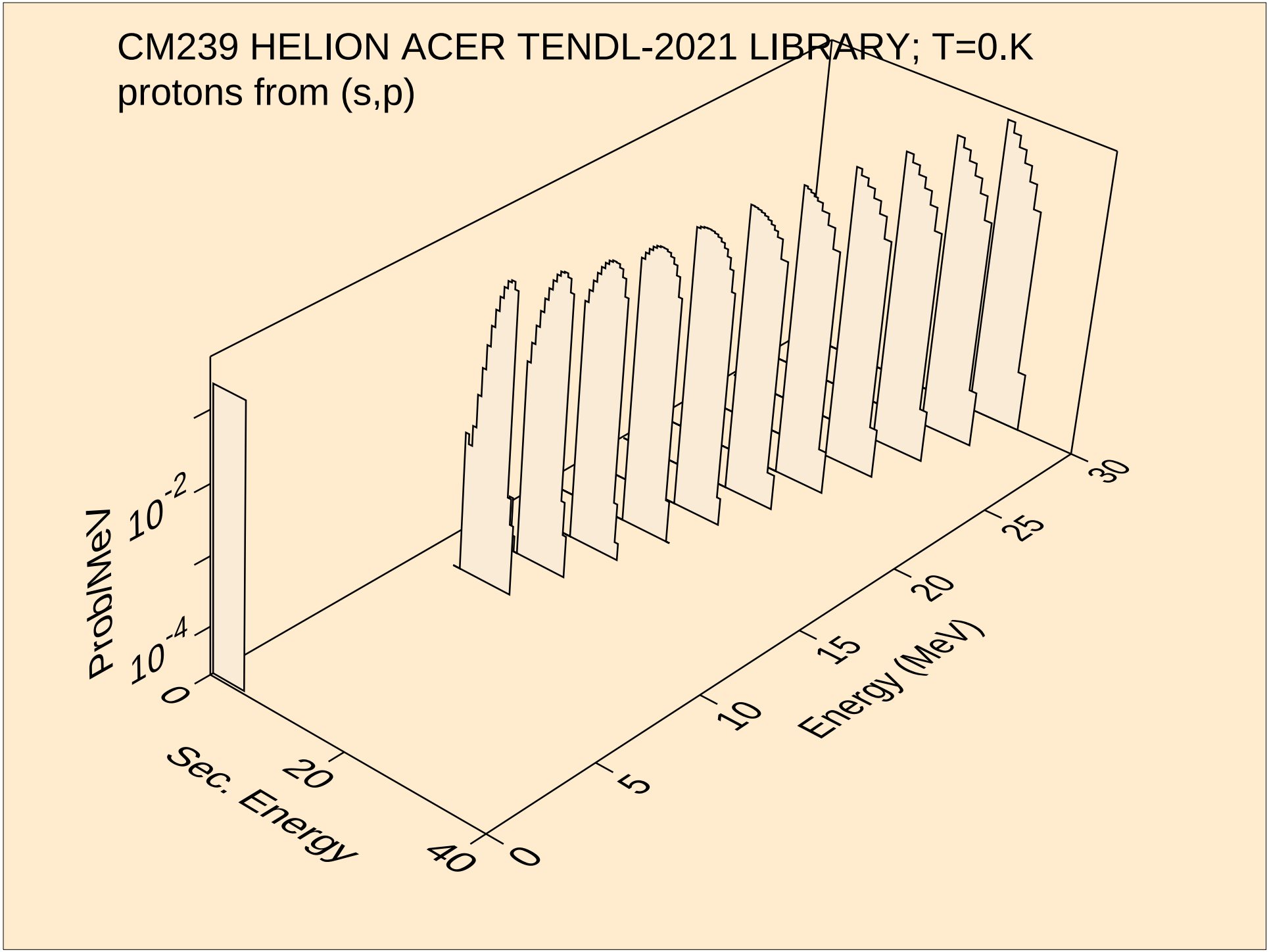

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
neutrons from (s,2np)
Prob/MeV
10-1
10-3
0
Sec. Energy
5
10
5
10
15
20
25
30
Energy (MeV)

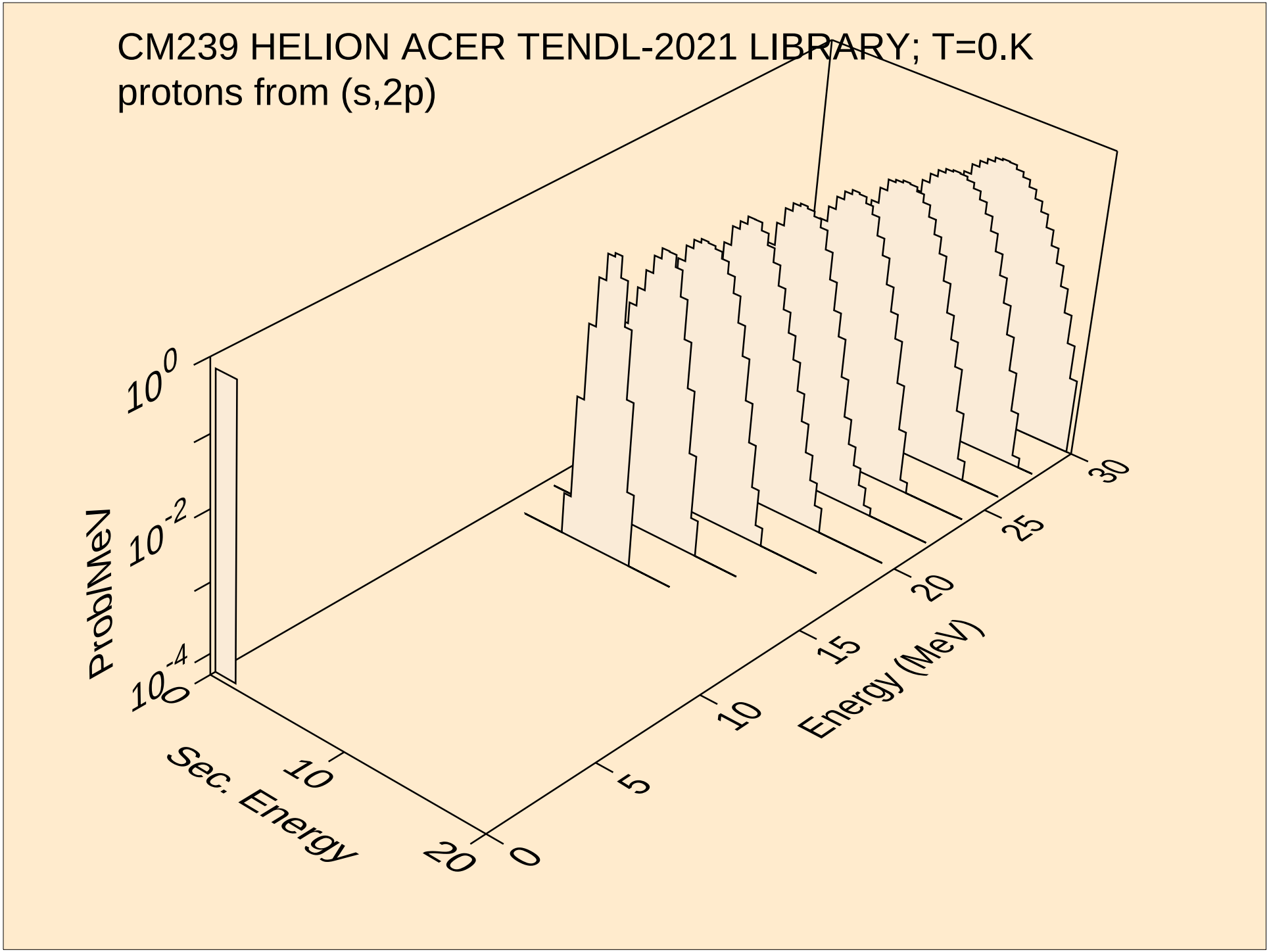

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
protons from (s,x)
Prob/MeV
10-1
10-3
0
Sec. Energy
100
200
0
50
100
150
200
Energy (MeV)

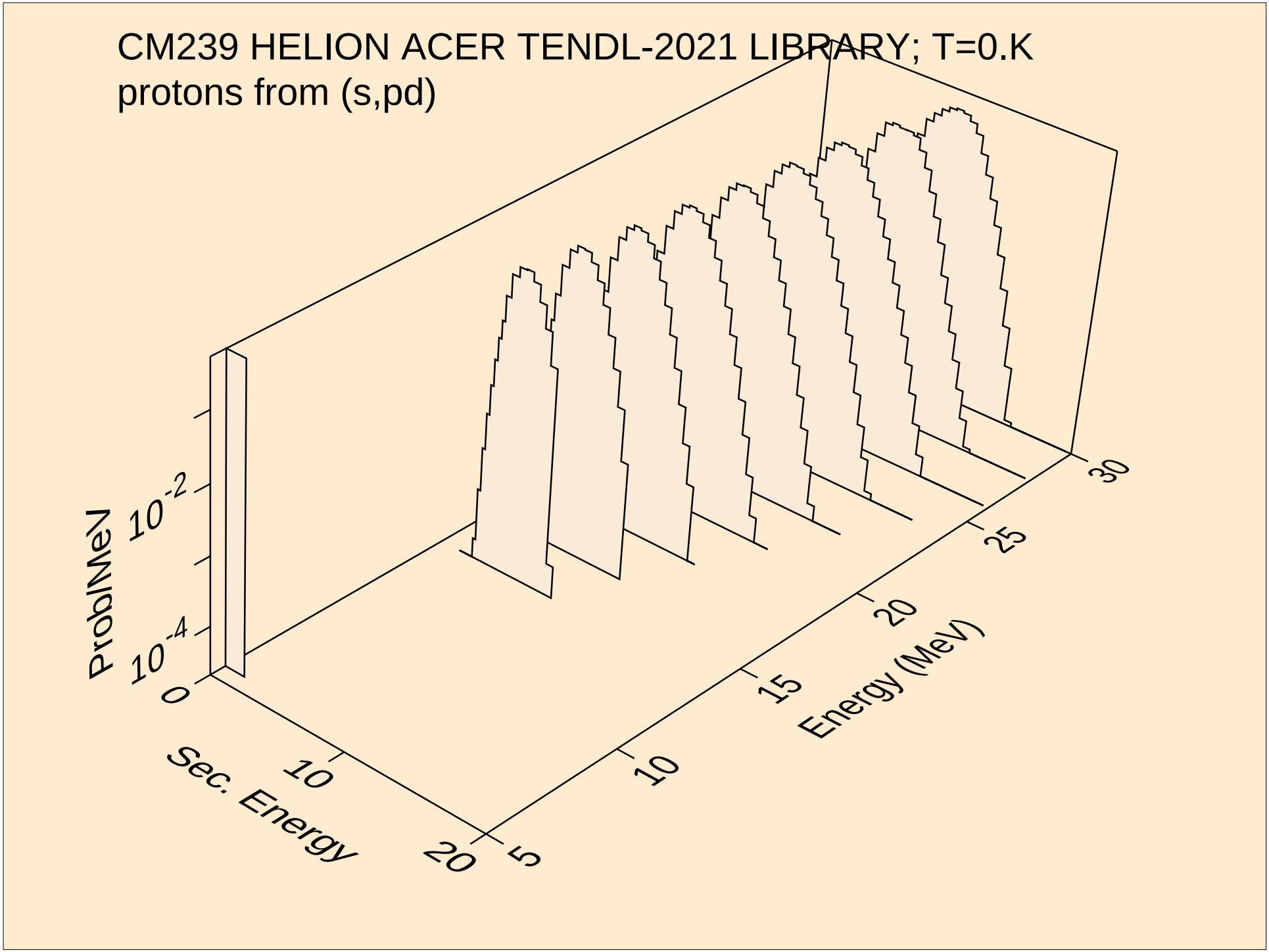

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
protons from (s,n*)p
Prob/MeV
10^0
10^-2
0
Sec. Energy
20
40
5
10
15
Energy (MeV)
20
25
30

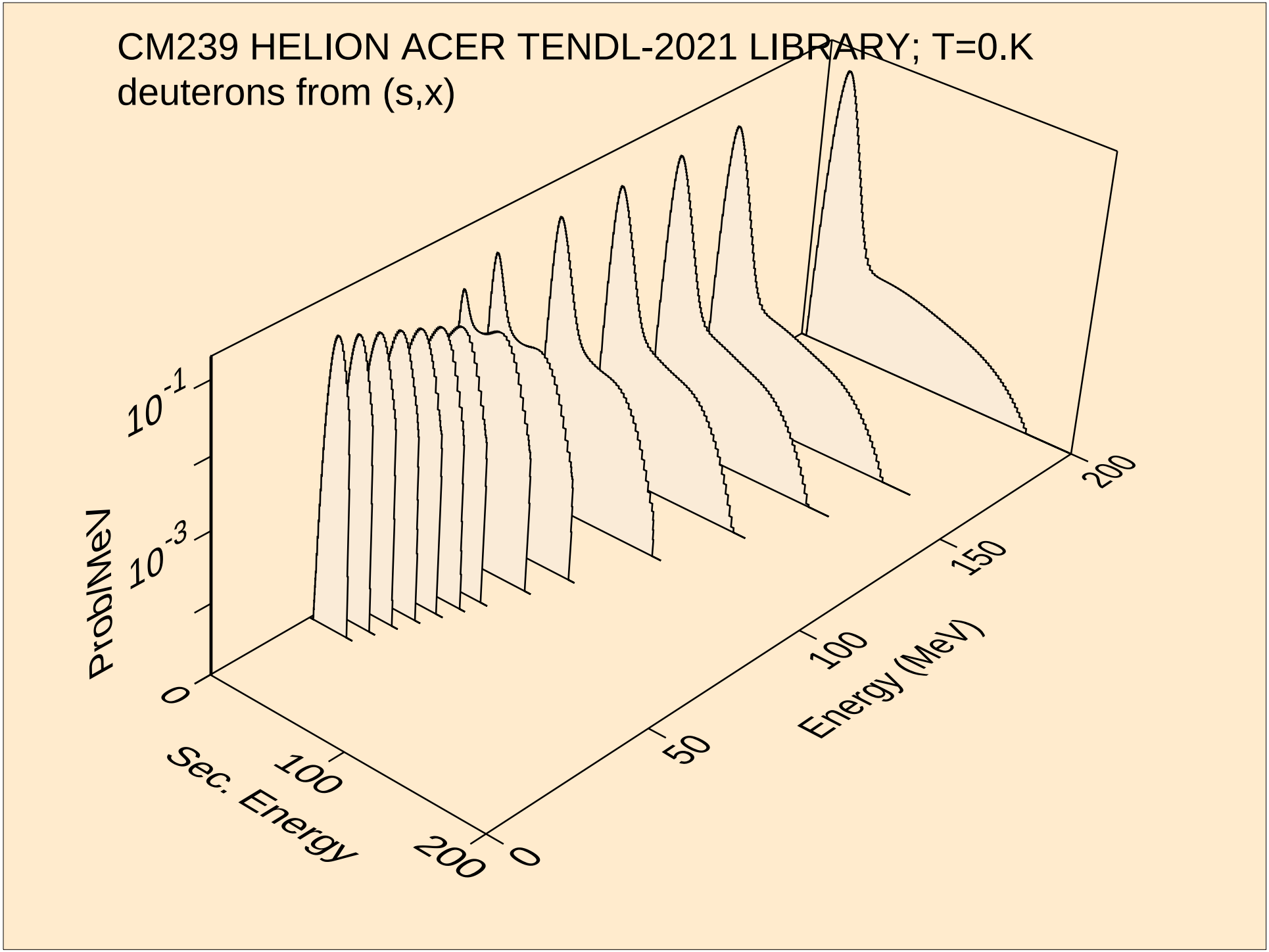

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
protons from (s,2np)
Prob/MeV
10^0
10^-2
0
Sec. Energy
10
20
Energy (MeV)
10
12
14
16
18
20
22
24
26
28
30

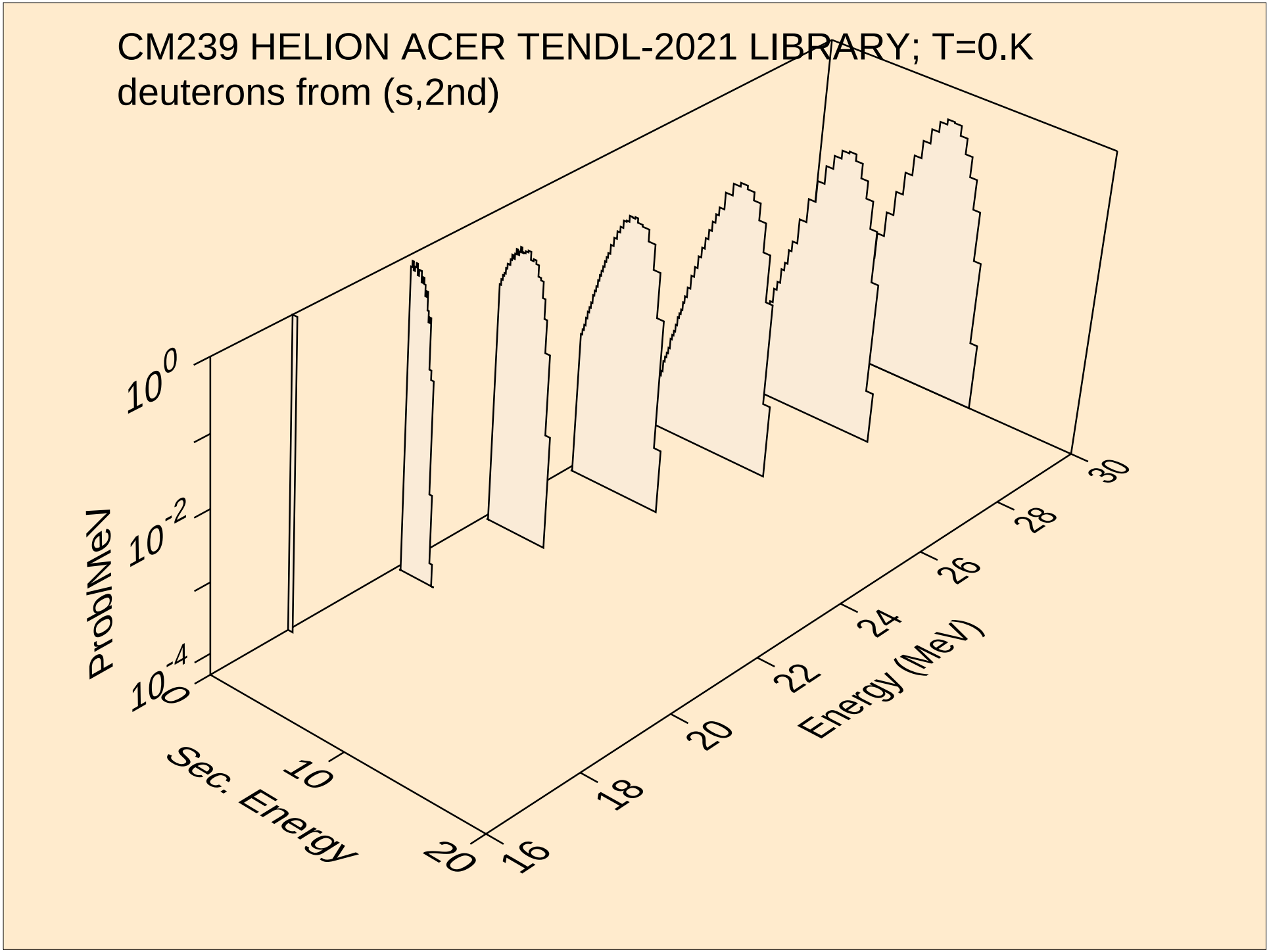

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
protons from (s,2np)
Prob/MeV
$10^{0}$
$10^{-2}$
$10^{-4}$
0
10
20
Sec. Energy
5
10
15
20
25
30
Energy (MeV)

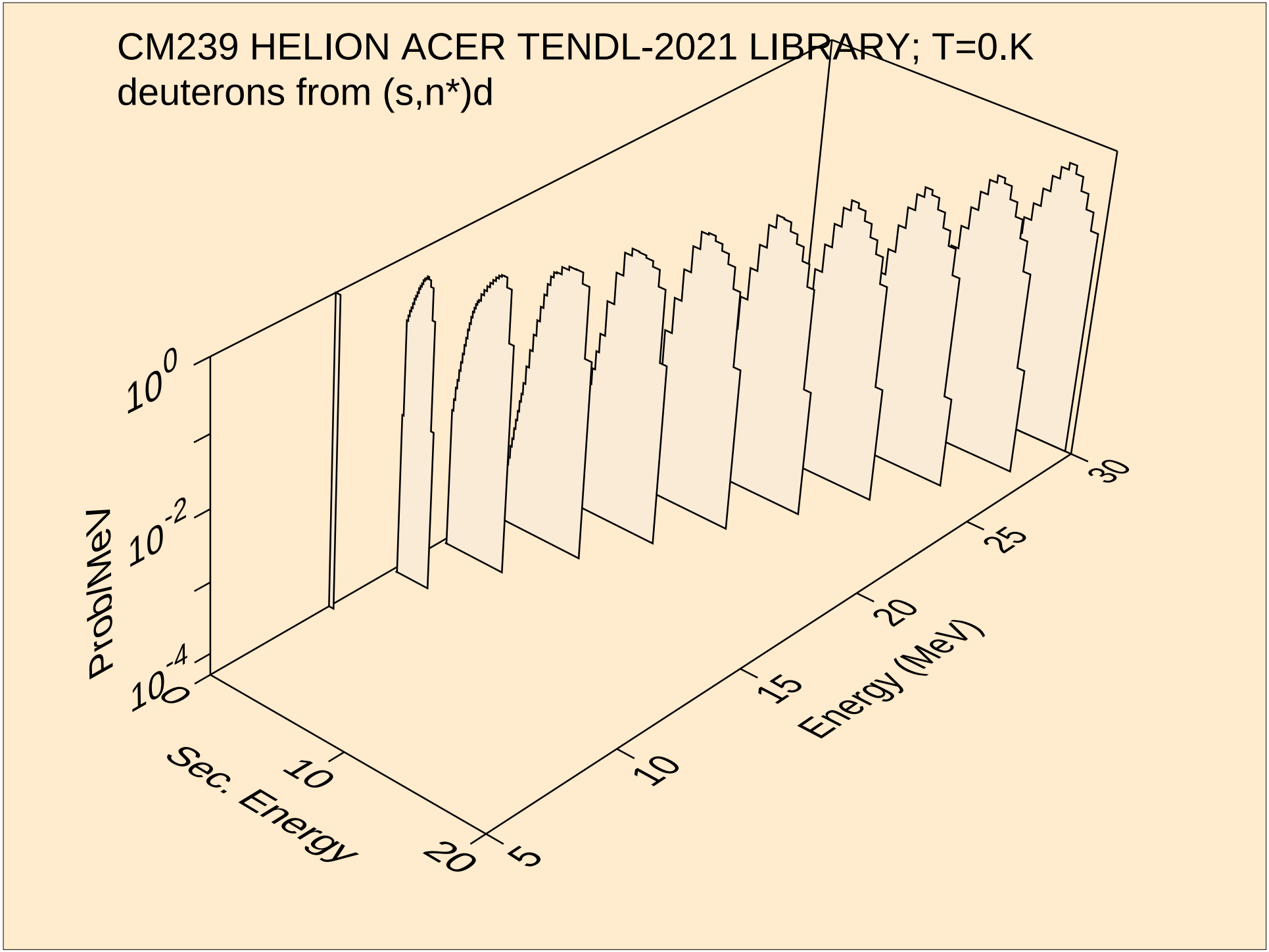

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
protons from (s,p)
Prob/MeV
10-2
10-4
0
Sec. Energy
20
40
0
5
10
15
20
25
30
Energy (MeV)

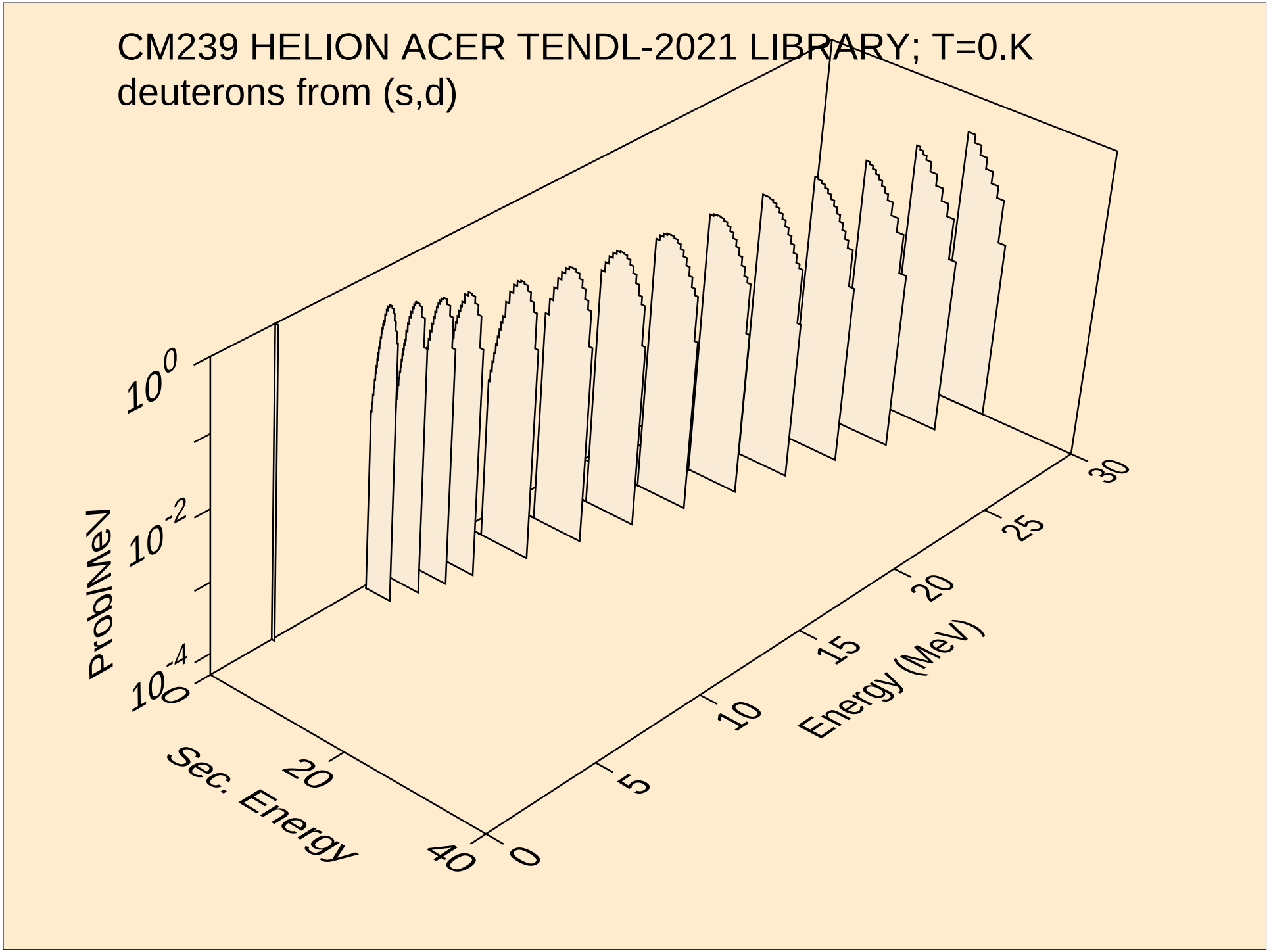

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
protons from (s,2p)
Prob/MeV
10^0
10^-2
10^-4
0
10
20
Sec. Energy
0
5
10
15
20
25
30
Energy (MeV)

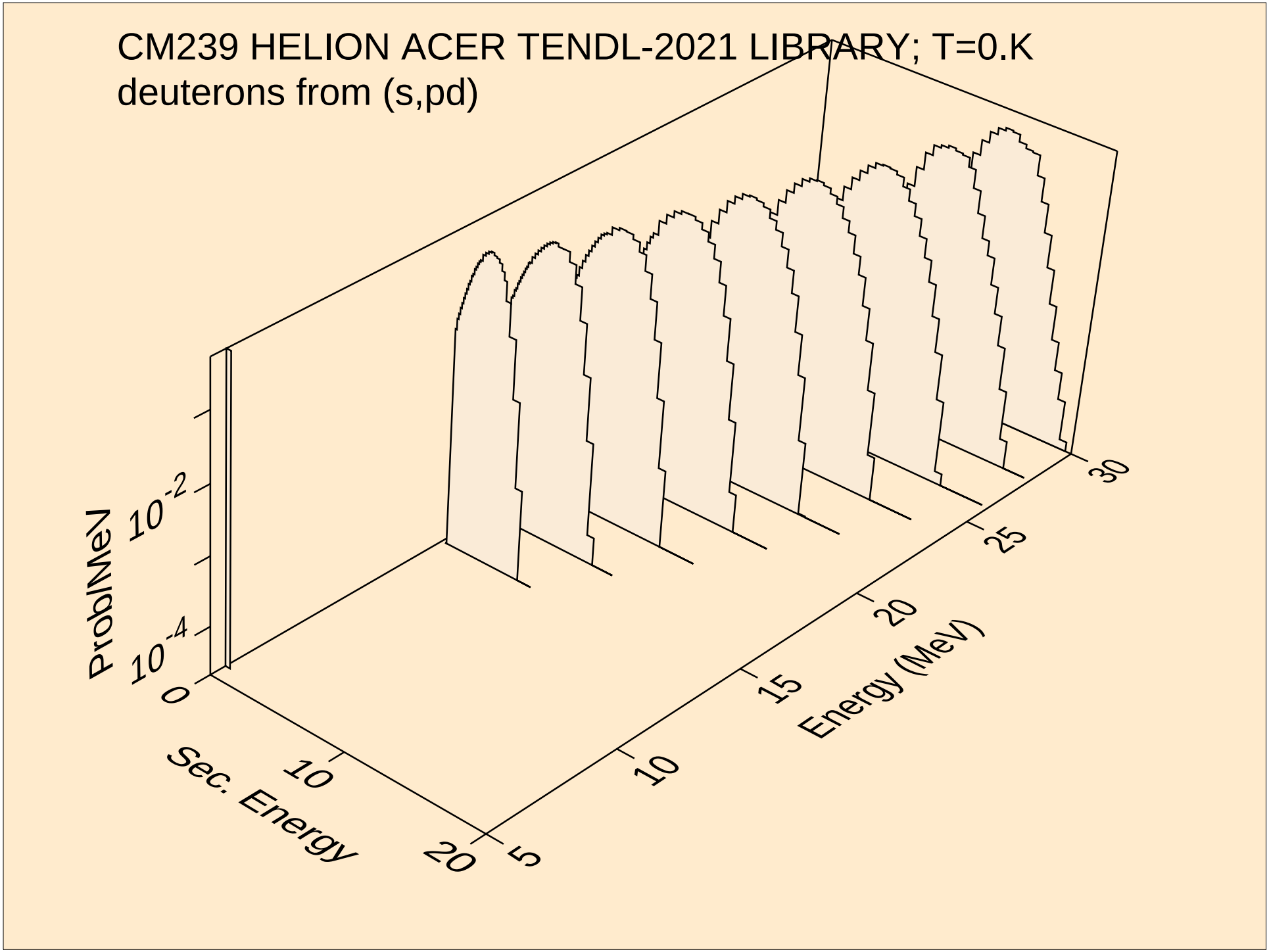

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
protons from (s,pd)
Prob/MeV
10-2
10-4
0
Sec. Energy
10
20
5
10
15
20
25
30
Energy (MeV)

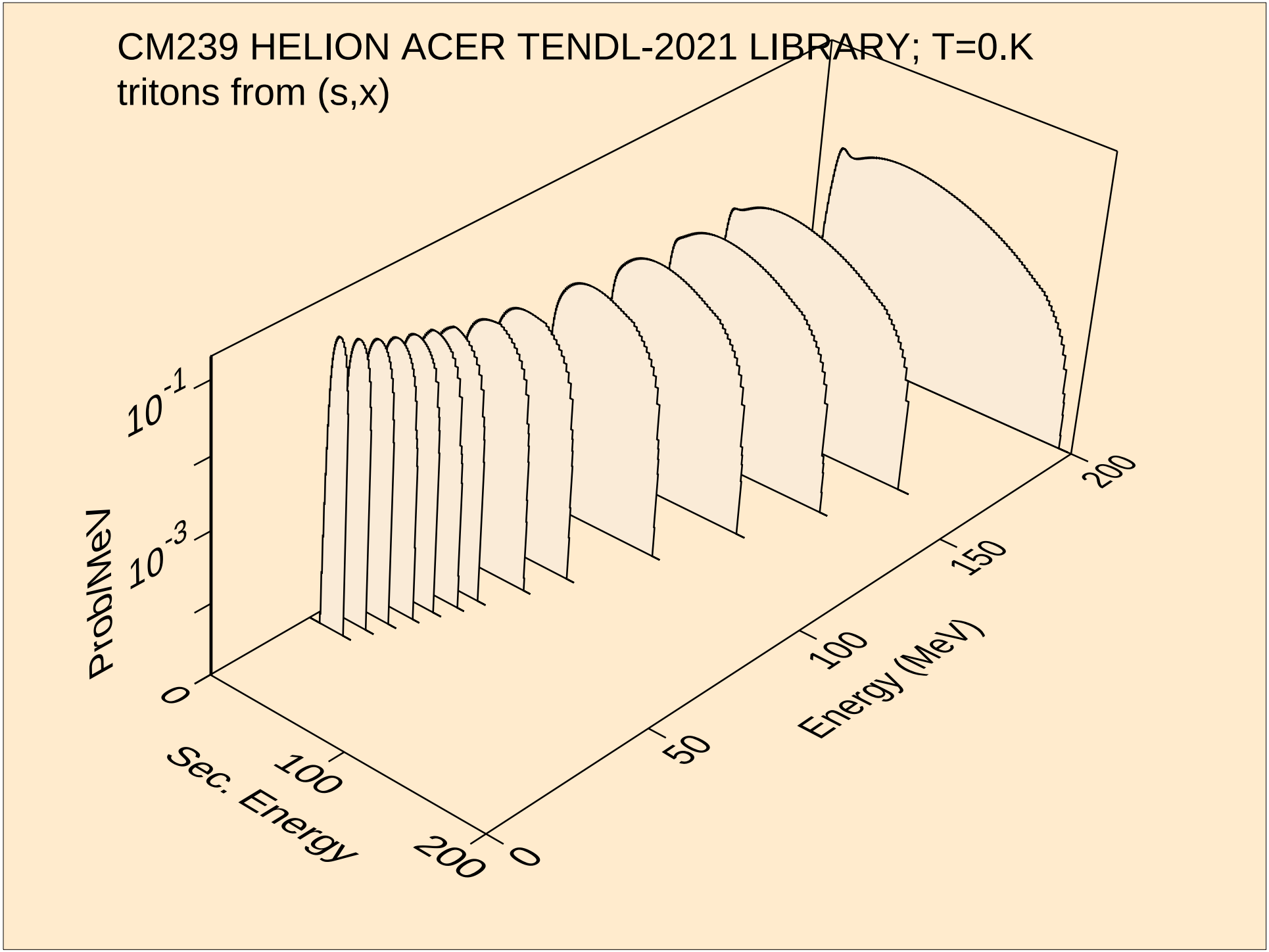

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
deuterons from (s,x)
Prob/MeV
10-1
10-3
0
Sec. Energy
100
200
0
50
100
150
200
Energy (MeV)

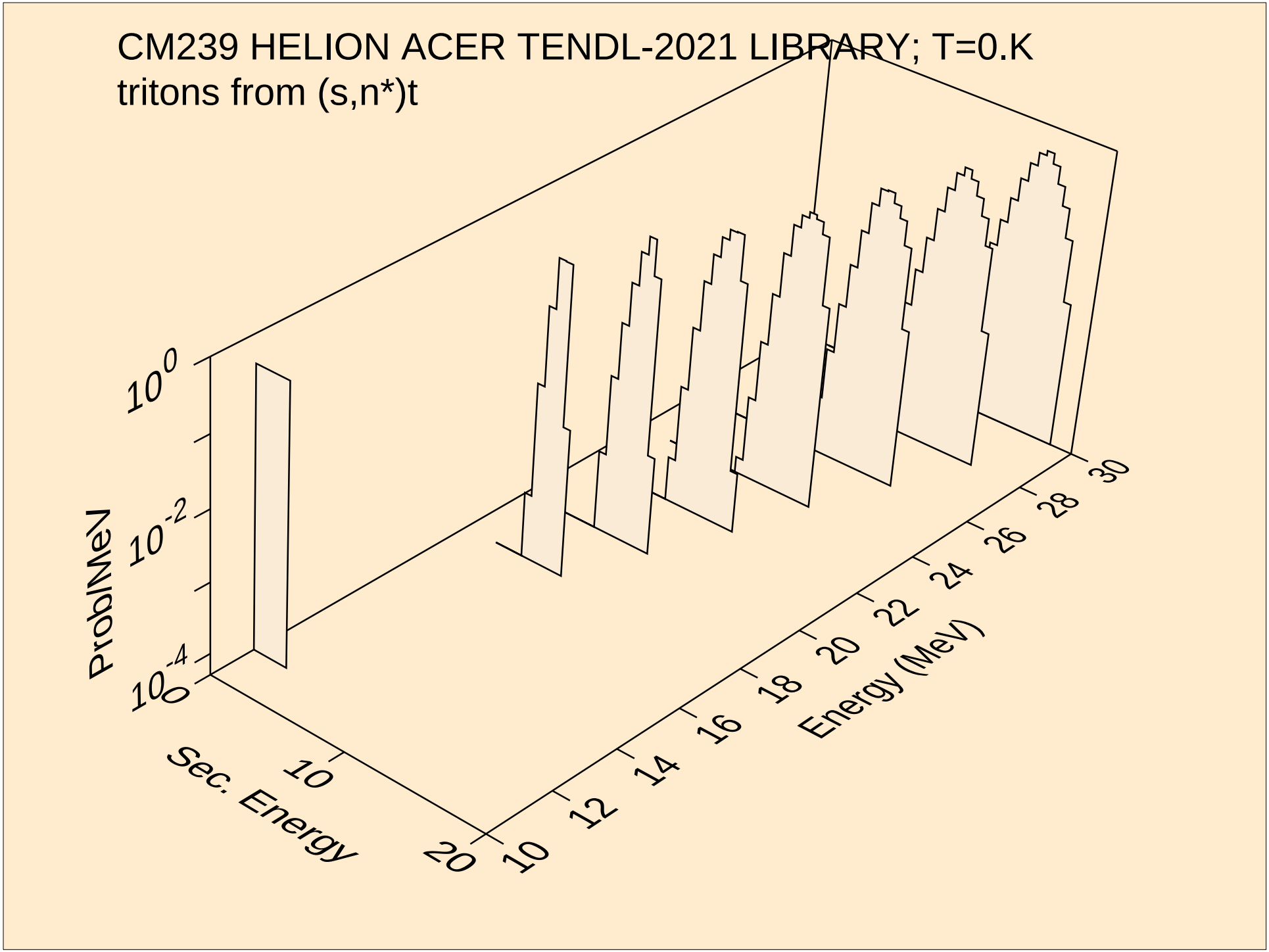

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
deuterons from (s,2nd)
Prob/MeV
10^0
10^-2
10^-4
0
Sec. Energy
10
20
Energy (MeV)
16
18
20
22
24
26
28
30

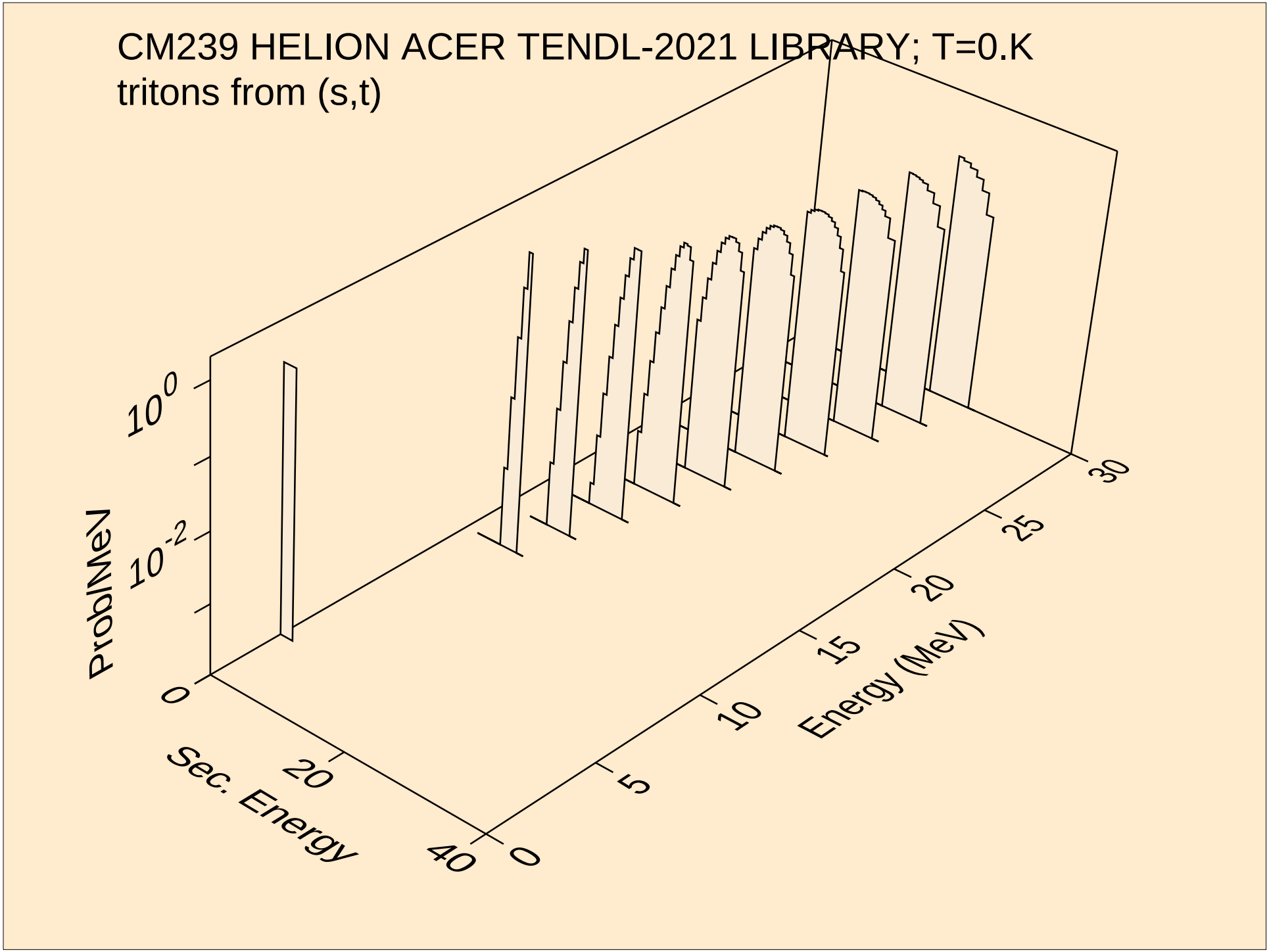

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
deuterons from (s,n*)d
Prob/MeV
10^0
10^-2
10^-4
Sec. Energy
0
10
20
Energy (MeV)
5
10
15
20
25
30

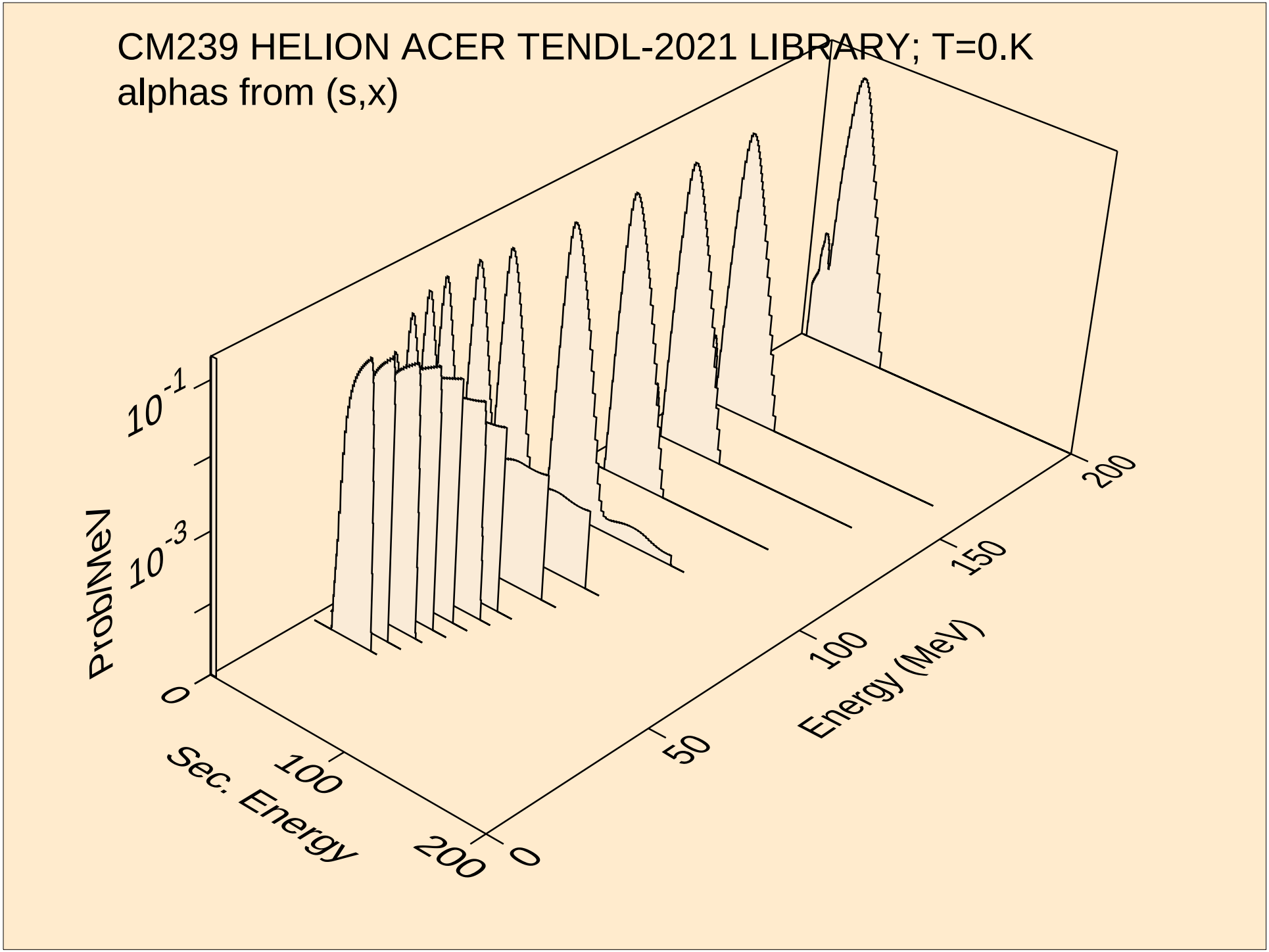

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
deuterons from (s,d)
Prob/MeV
10^0
10^-2
10^-4
0
20
40
Sec. Energy
0
5
10
15
20
25
30
Energy (MeV)

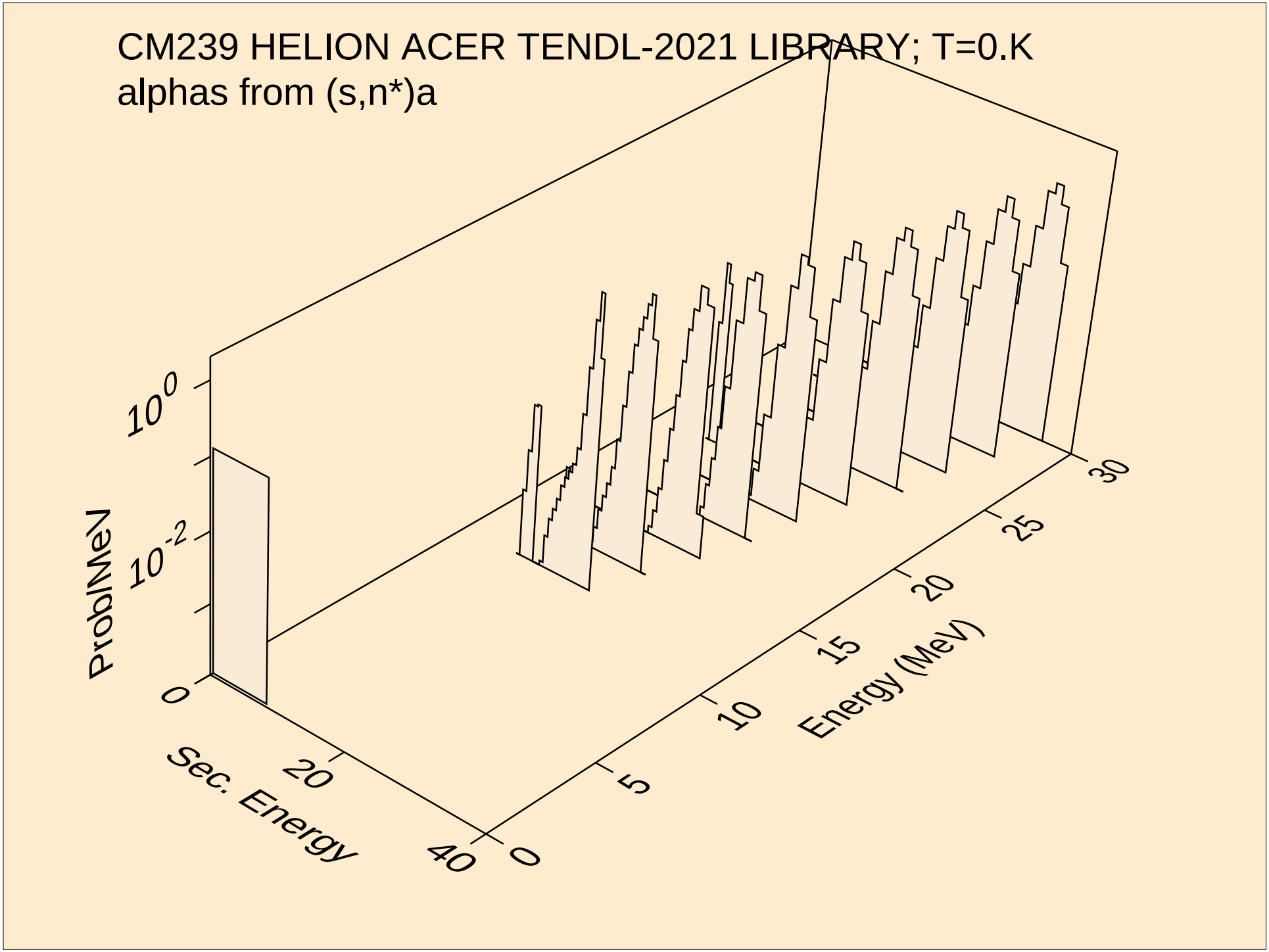

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
deuterons from (s,pd)
Prob/MeV
10-2
10-4
0
Sec. Energy
10
20
5
10
15
20
25
30
Energy (MeV)

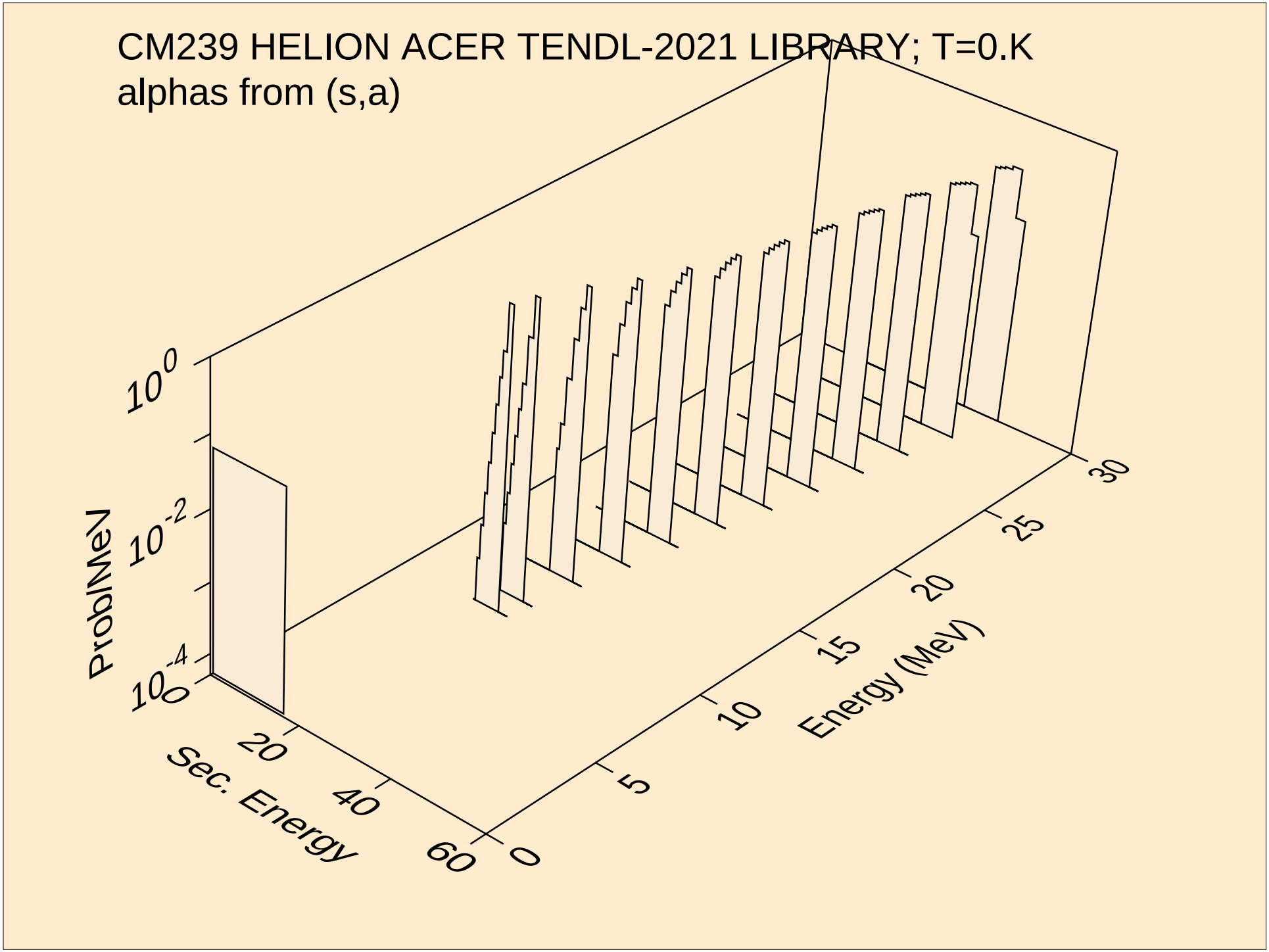

CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
tritons from (s,x)
Prob/MeV
10-1
10-3
0
Sec. Energy
100
200
0
50
100
150
200
Energy (MeV)


CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
tritons from (s,n*)t
Prob/MeV
10^0
10^-2
10^-4
Sec. Energy
10
20
Energy (MeV)
10
12
14
16
18
20
22
24
26
28
30


CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
tritons from (s,t)
Prob/MeV
10^0
10^-2
0
Sec. Energy
20
40
0
5
10
15
20
25
30
Energy (MeV)


CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
alphas from (s,x)
Prob/MeV
10-1
10-3
0
Sec. Energy
100
200
0
50
100
150
200
Energy (MeV)


CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
alphas from (s,n*)a
Prob/MeV
10^0
10^-2
0
Sec. Energy
20
40
0
5
10
15
Energy (MeV)
20
25
30


CM239 HELION ACER TENDL-2021 LIBRARY; T=0.K
alphas from (s,a)
Prob/MeV
10^0
10^-2
10^-4
0
20
40
60
Sec. Energy
0
5
10
15
20
25
30
Energy (MeV)