Date: 02/21/2020

J/ψ production from ^{4}He

Electron beam energy: 11 GeV
Luminosity: 1.2×10^{37} eN cm^{-2} s^{-1}
Target: 15-cm liquid ^{4}He (~ 2% radiation length)
Acceptance: p > 300 MeV, 6° < θ < 29°, full azimuthal
Cross section model: grids "duke-jpsi-02-19-2020" with and without the restriction "p" (initial nucleon in ^{4}He) < 300 MeV
coverage: 6.2 ~ 9.2 GeV photon, 0° ~ 20° J/ψ polar angle w.r.t. photon

Electroproduction:
Scattered electron with 1.8 < p < 4.8 GeV, 6° < θ < 29°
Subthreshold cut:

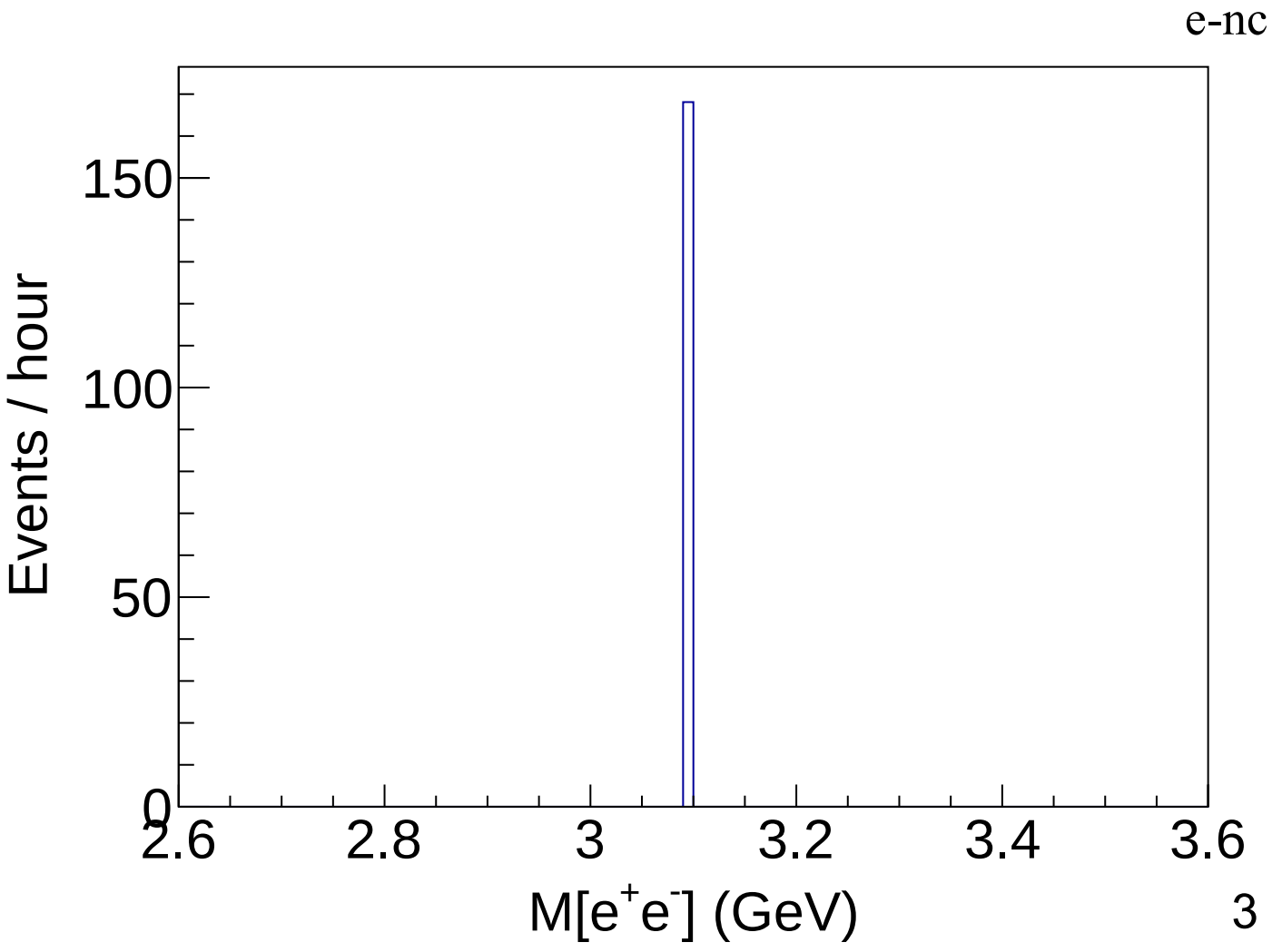
$$E_{\gamma^*} < M_{J/\psi} + \frac{M_{J/\psi}^2 + Q^2}{2M_p}$$

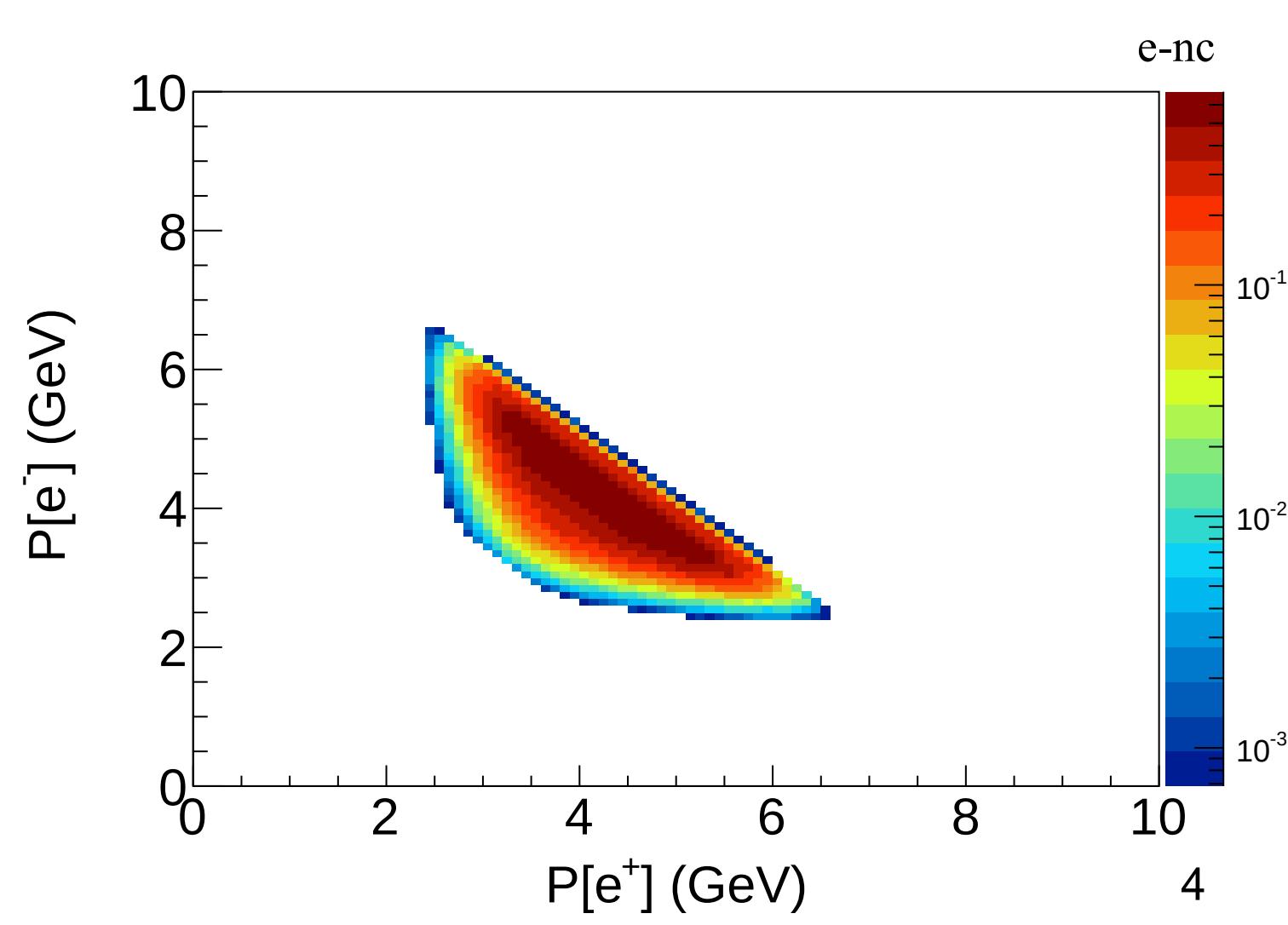
Photoproduction:
Bremsstrahlung photon with target as the radiator, select 6.2 < E_γ <9.2GeV
Subthreshold cut: E_γ < 8.2 GeV
Note: E_γ is known in simulation

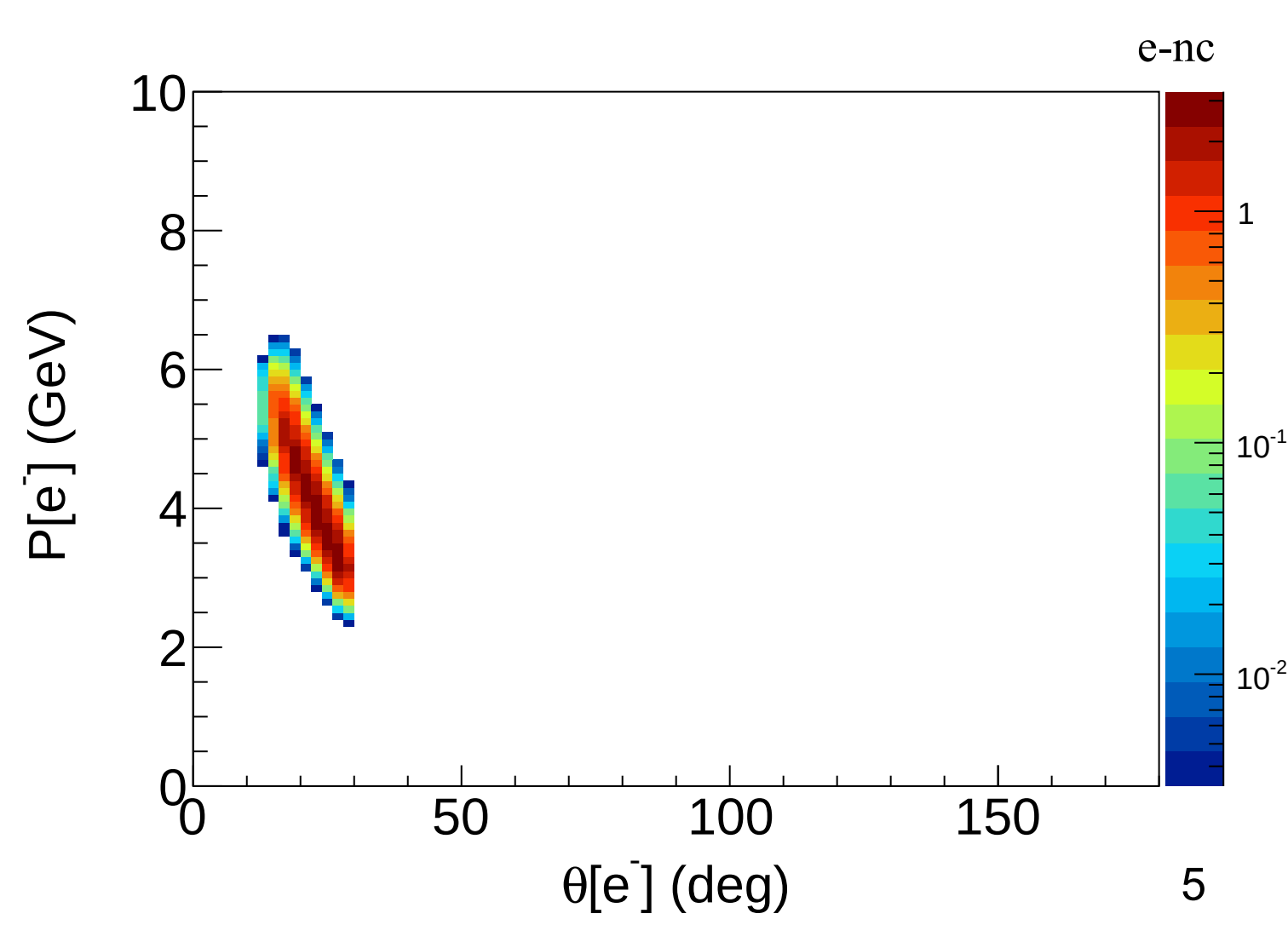
J/ψ production from ^{4}He

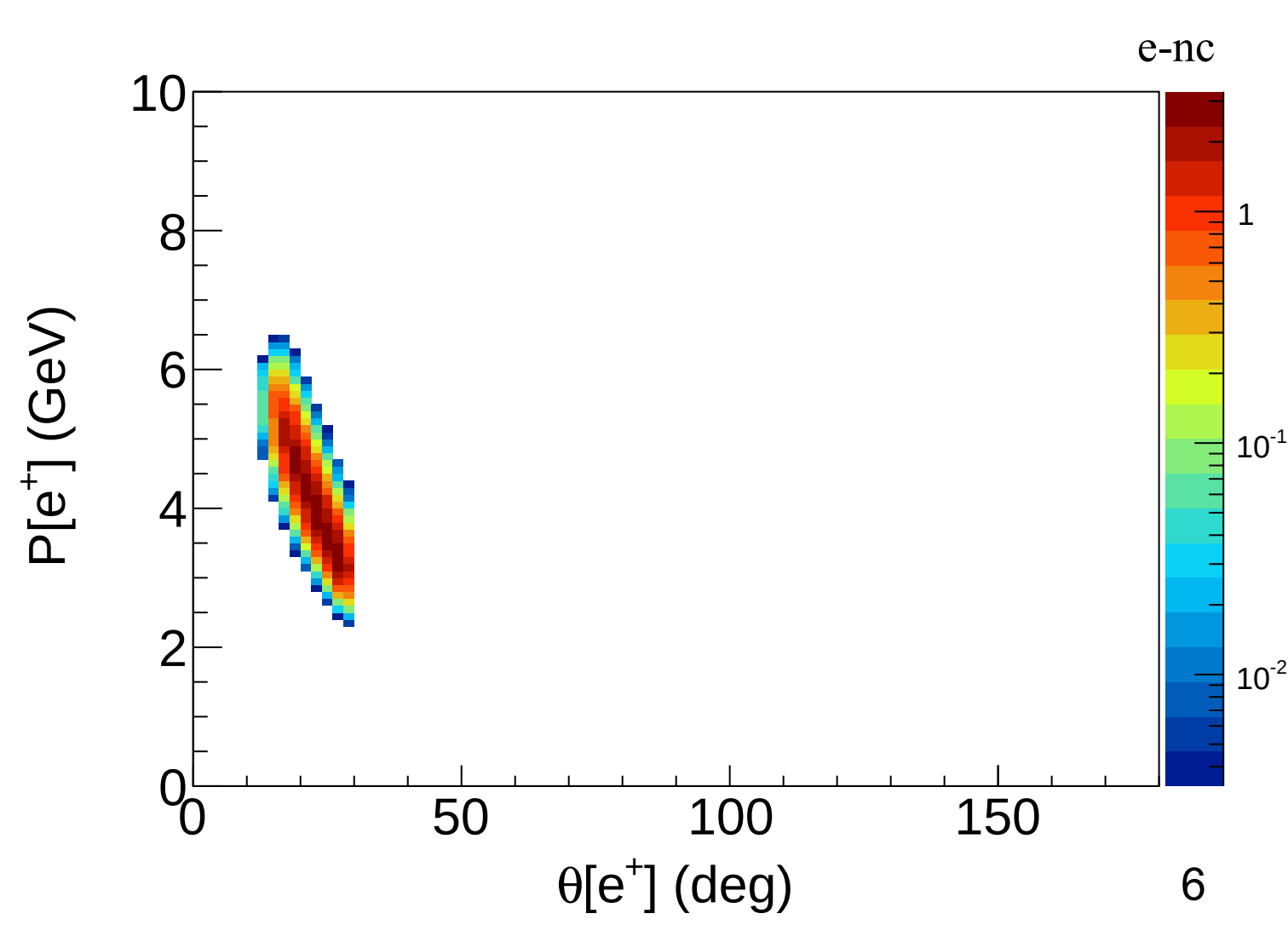
Simulated cases

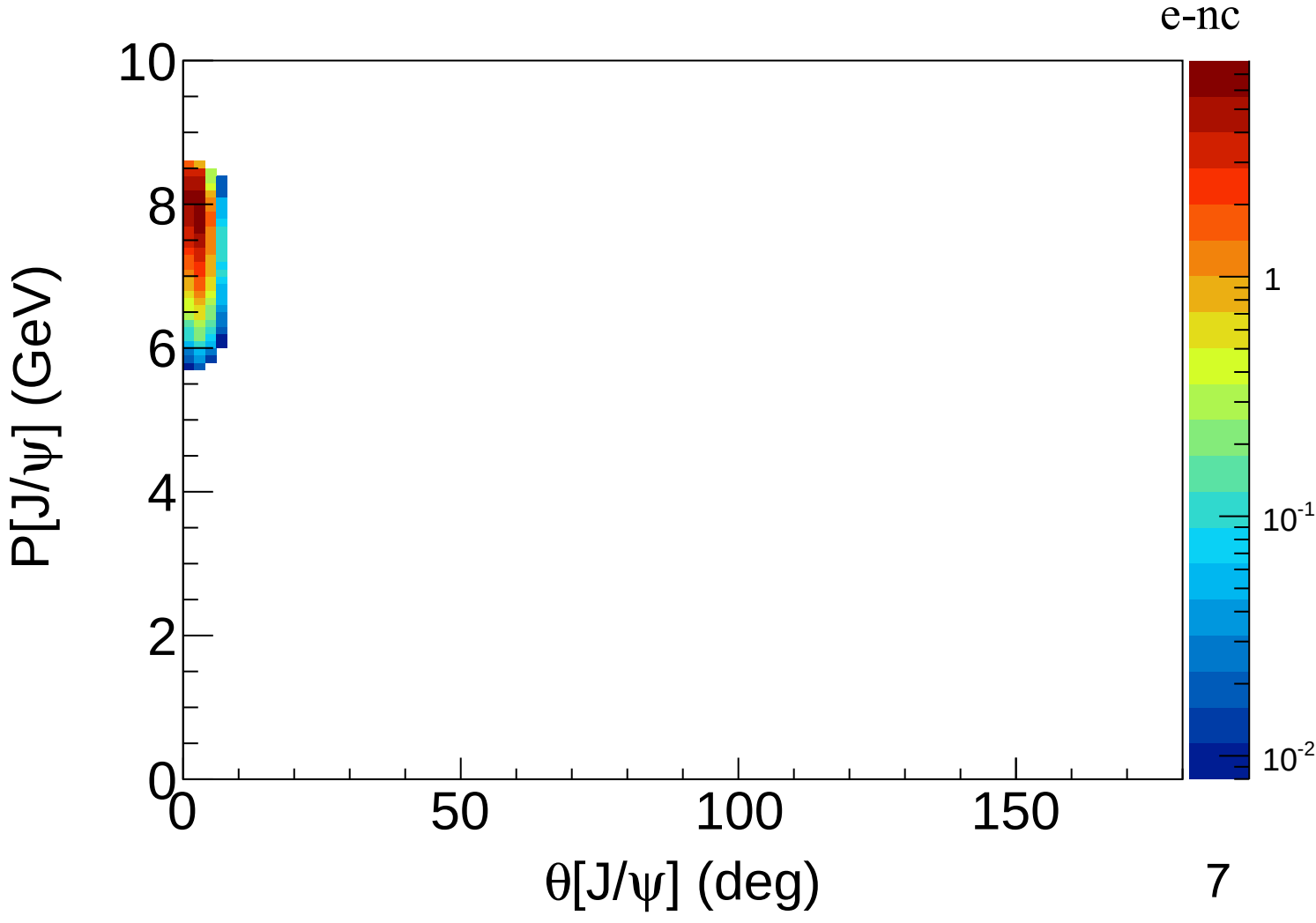
Label	γ or e^-	initial "p"	subthreshold
e-nc	e^-	No cut	No cut
e-nc-sub	e^-	No cut	sub
e-300	e^-	< 300 MeV	No cut
e-300-sub	e^-	< 300 MeV	sub
γ-nc	γ	No cut	No cut
γ-nc-sub	γ	No cut	sub
γ-300	γ	< 300 MeV	No cut
γ-300-sub	γ	< 300 MeV	sub

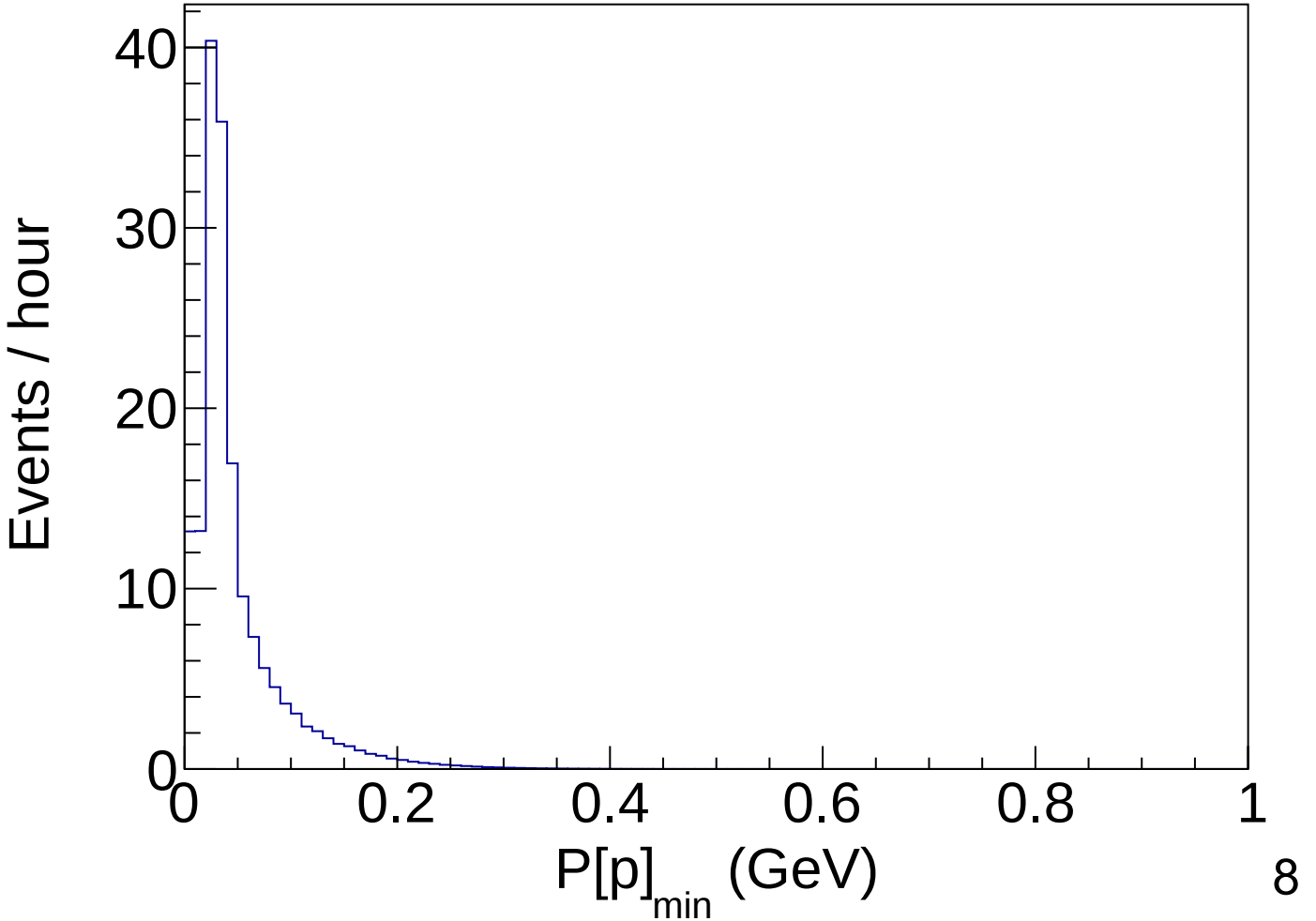

e-nc
150
100
50
0
Events / hour
2.6
2.8
3
3.2
3.4
3.6
M[e+e-] (GeV)
3

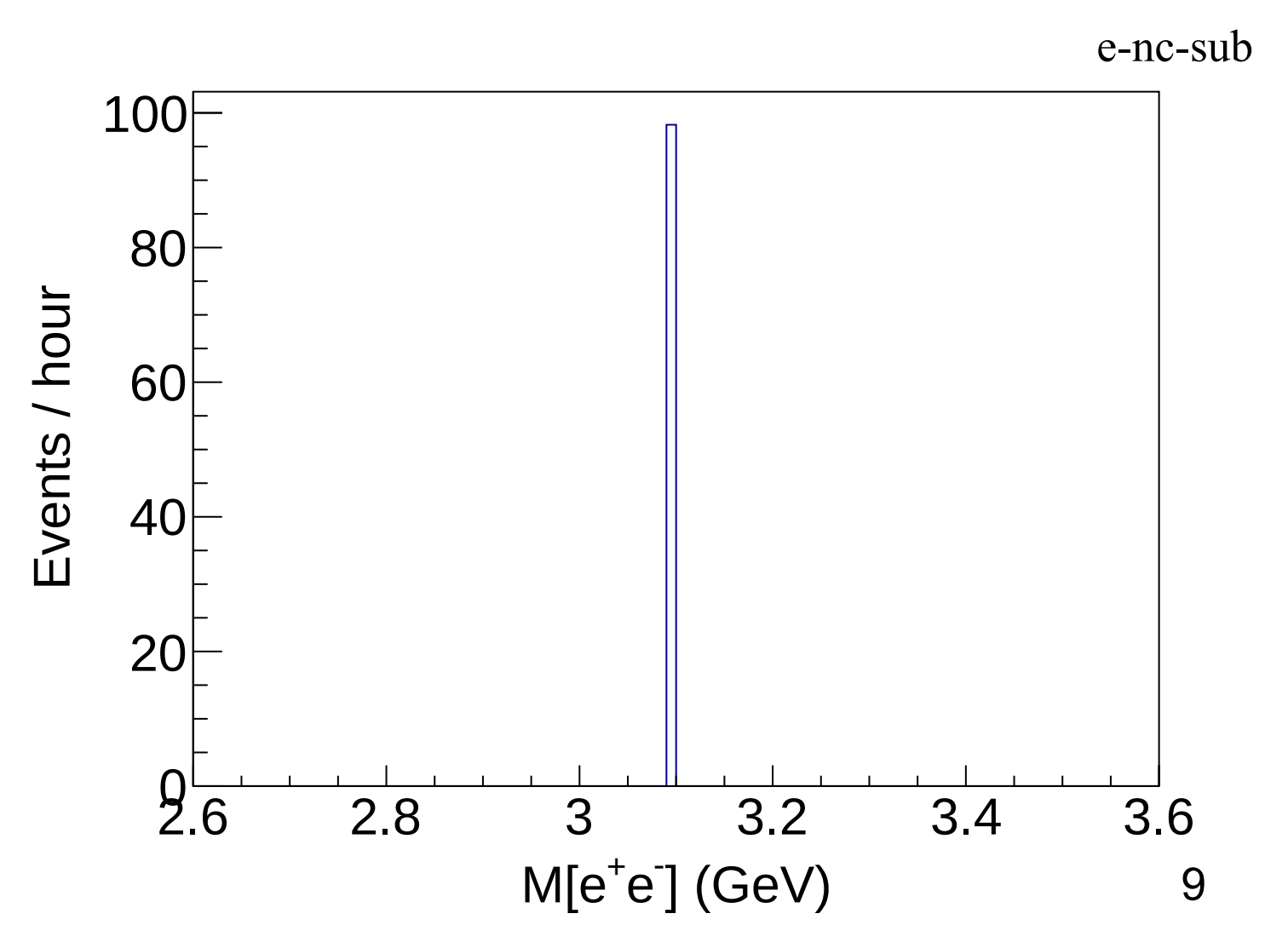

e-nc
P[e⁻] (GeV)
P[e⁺] (GeV)
0
2
4
6
8
10
10⁻¹
10⁻²
10⁻³

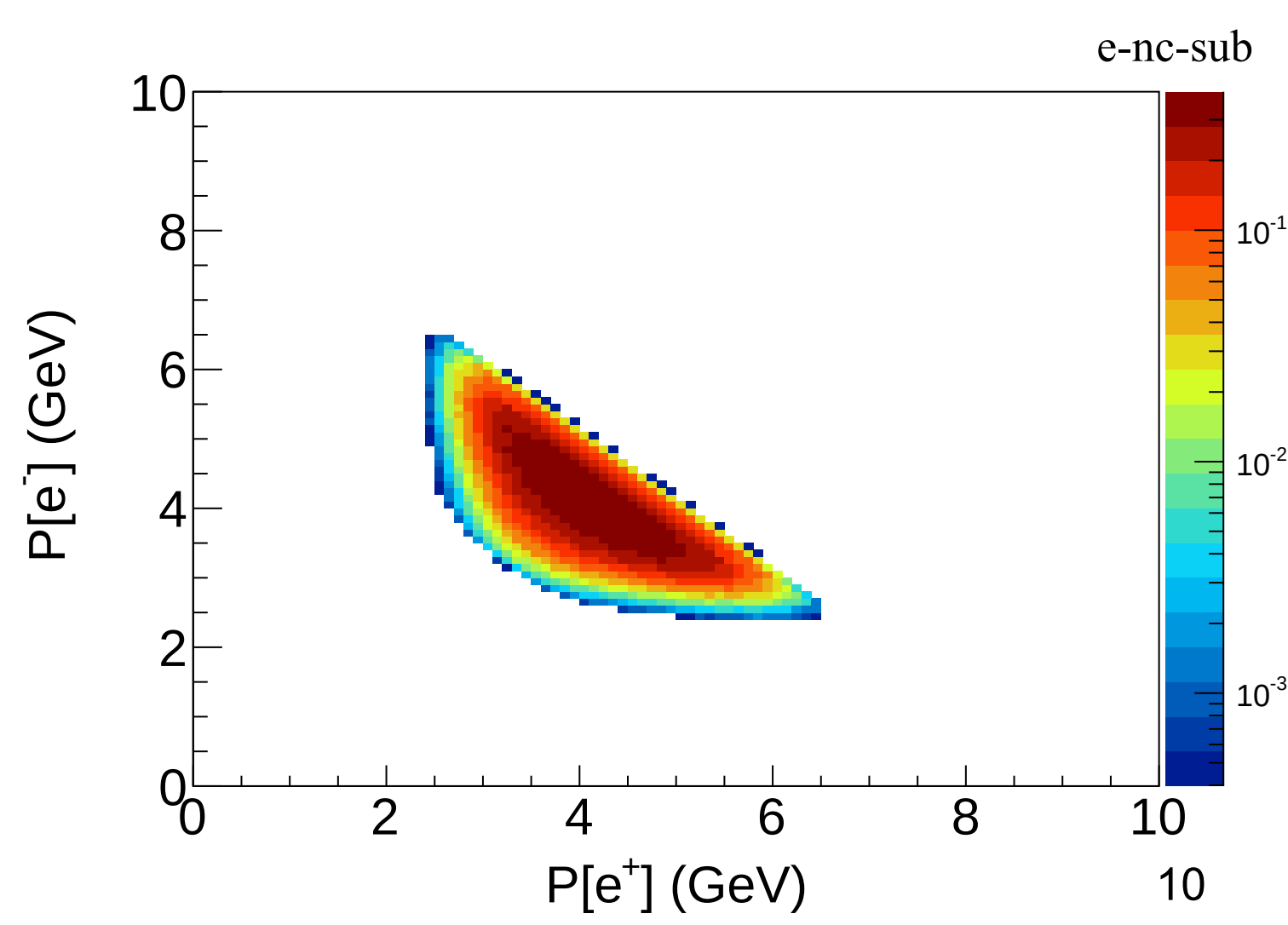

e-nc
10
8
6
4
2
0
0
50
100
150
P[e⁻] (GeV)
θ[e⁻] (deg)
1
10⁻¹
10⁻²
5

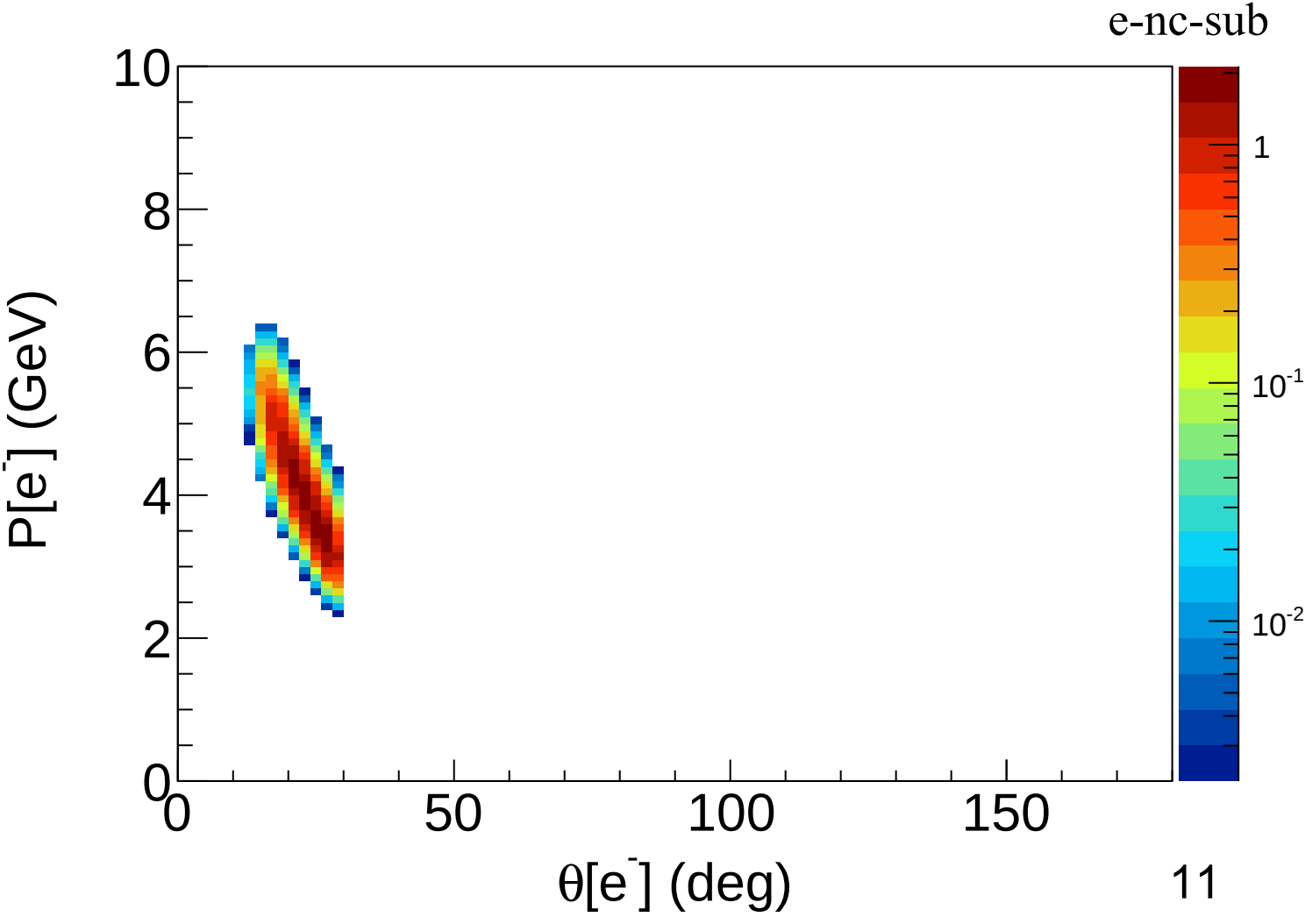

e-nc
10
8
6
4
2
0
0
50
100
150
P[e+] (GeV)
θ[e+] (deg)
1
10-1
10-2

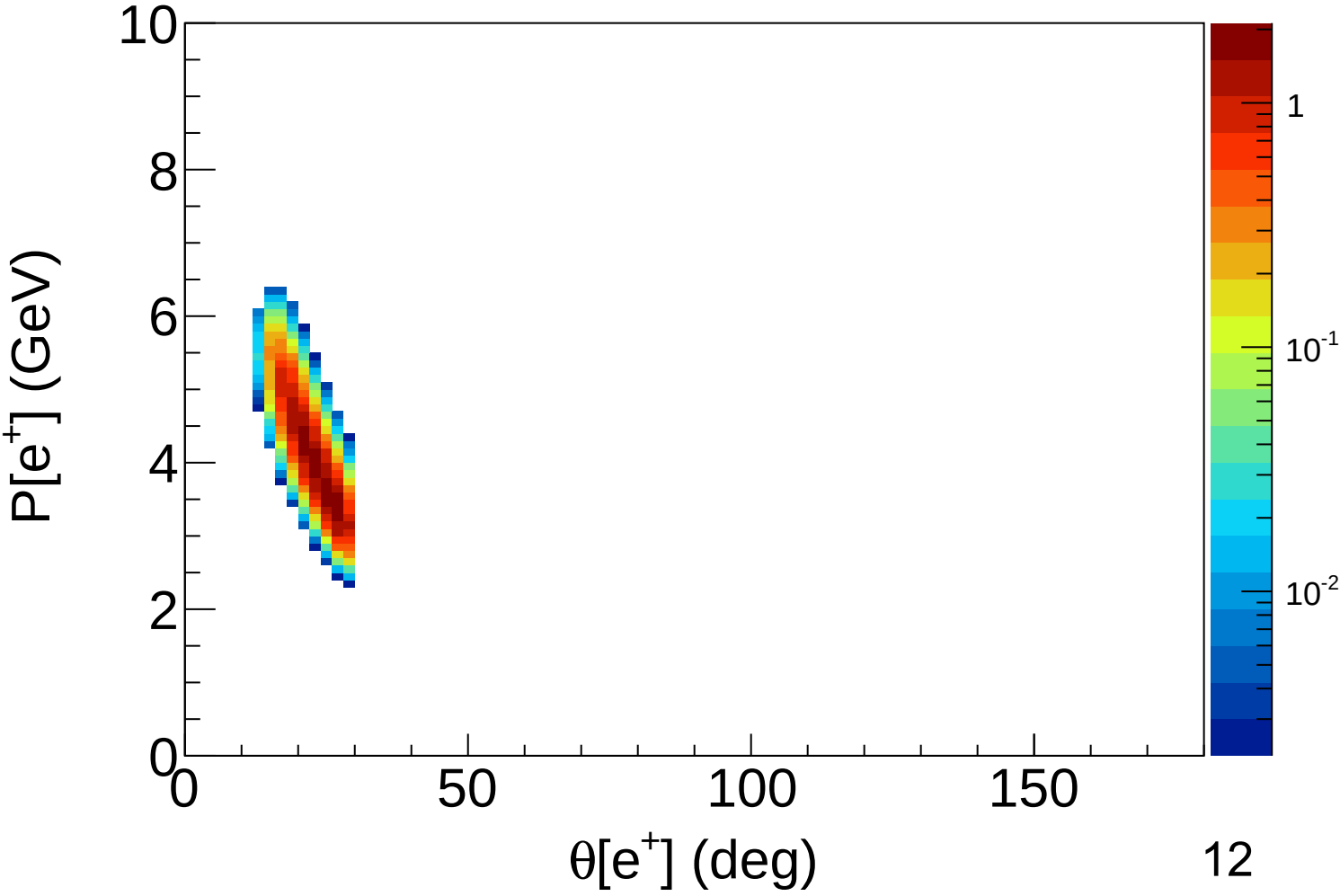

e-nc
10
8
6
4
2
0
P[J/ψ] (GeV)
0
50
100
150
θ[J/ψ] (deg)
1
10^{-1}
10^{-2}

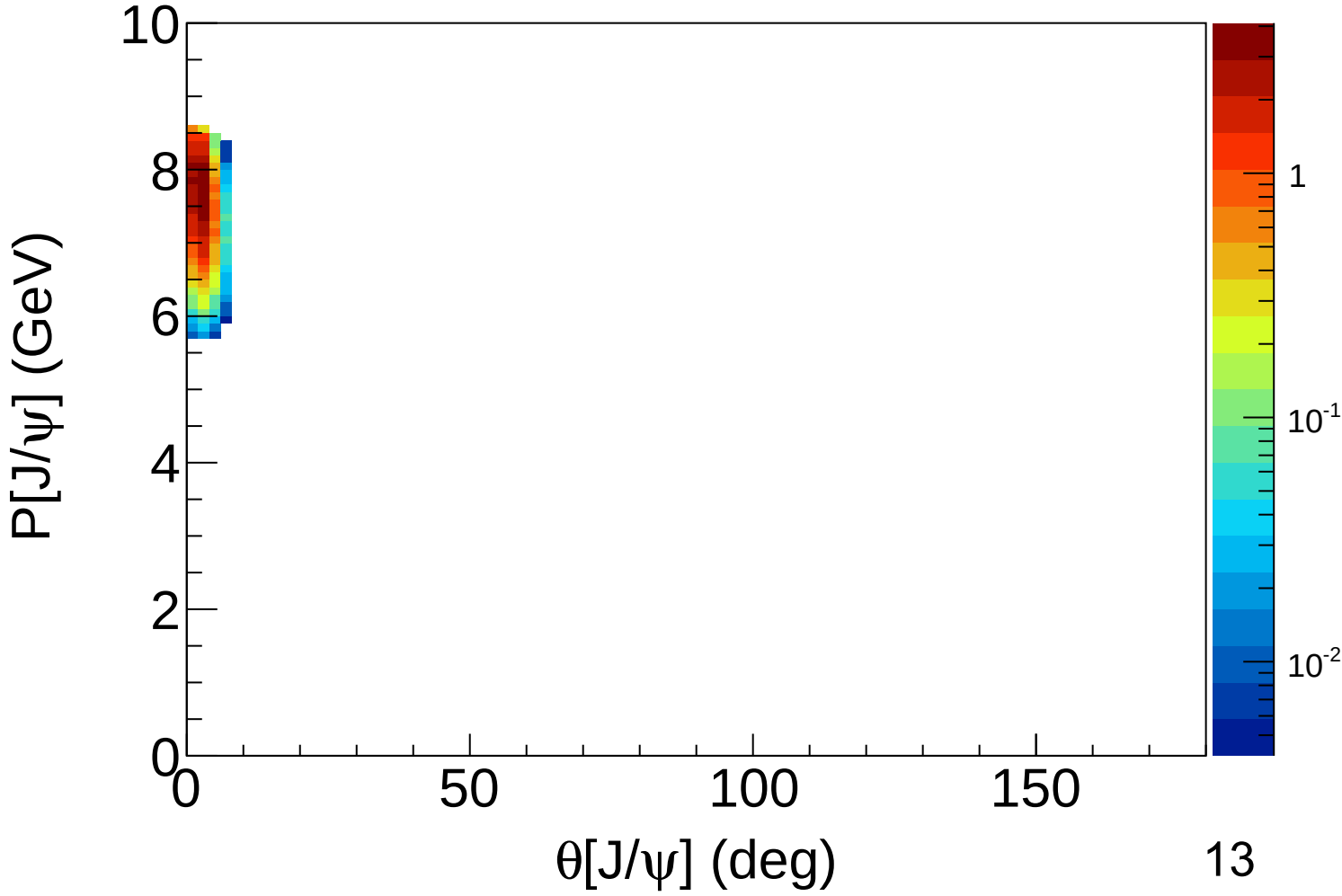

Events / hour
40
30
20
10
0
0
0.2
0.4
0.6
0.8
1
P[p]min (GeV)

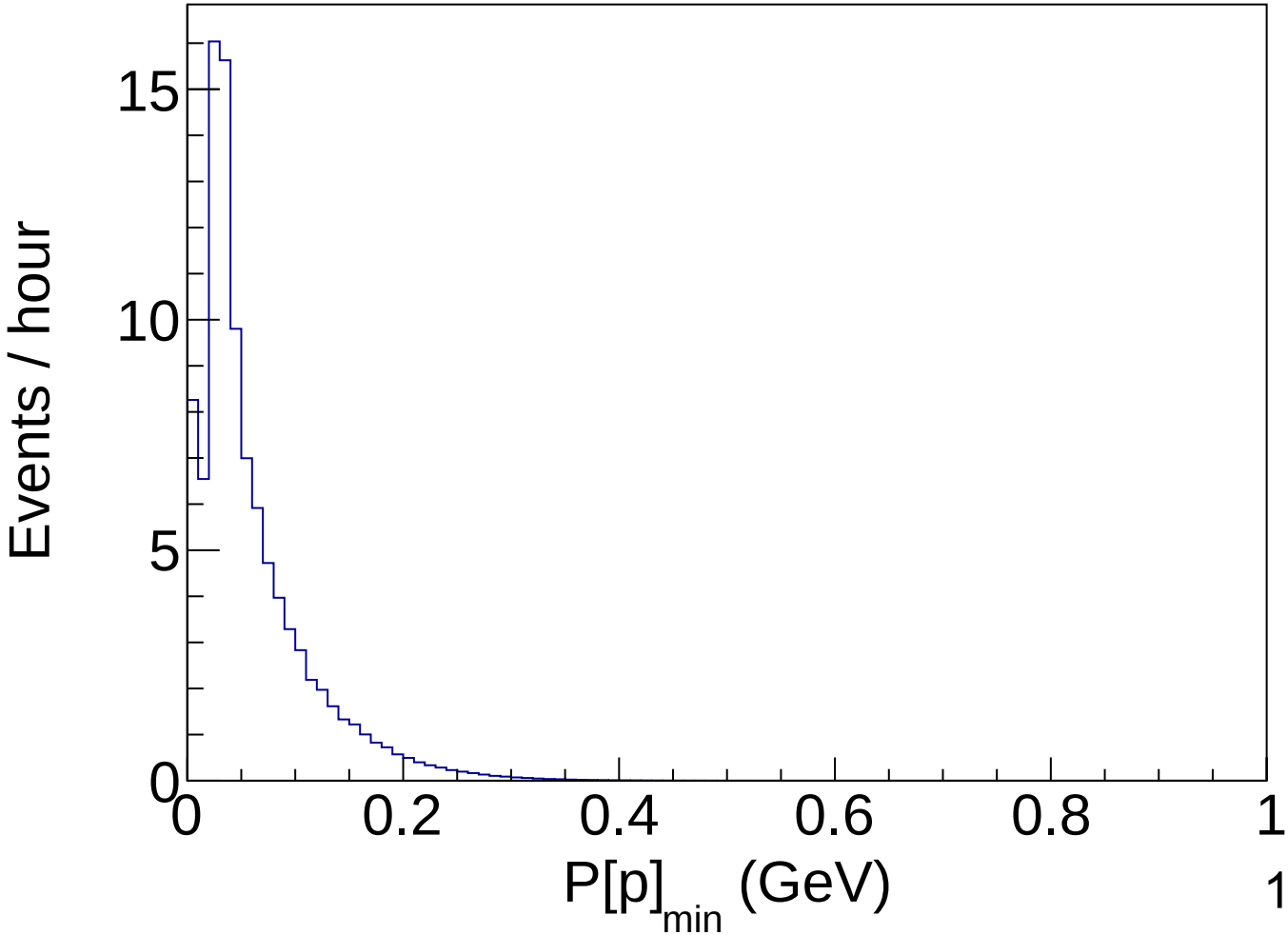

e-nc-sub
100
80
60
40
20
0
Events / hour
2.6
2.8
3
3.2
3.4
3.6
M[e+e-] (GeV)
9

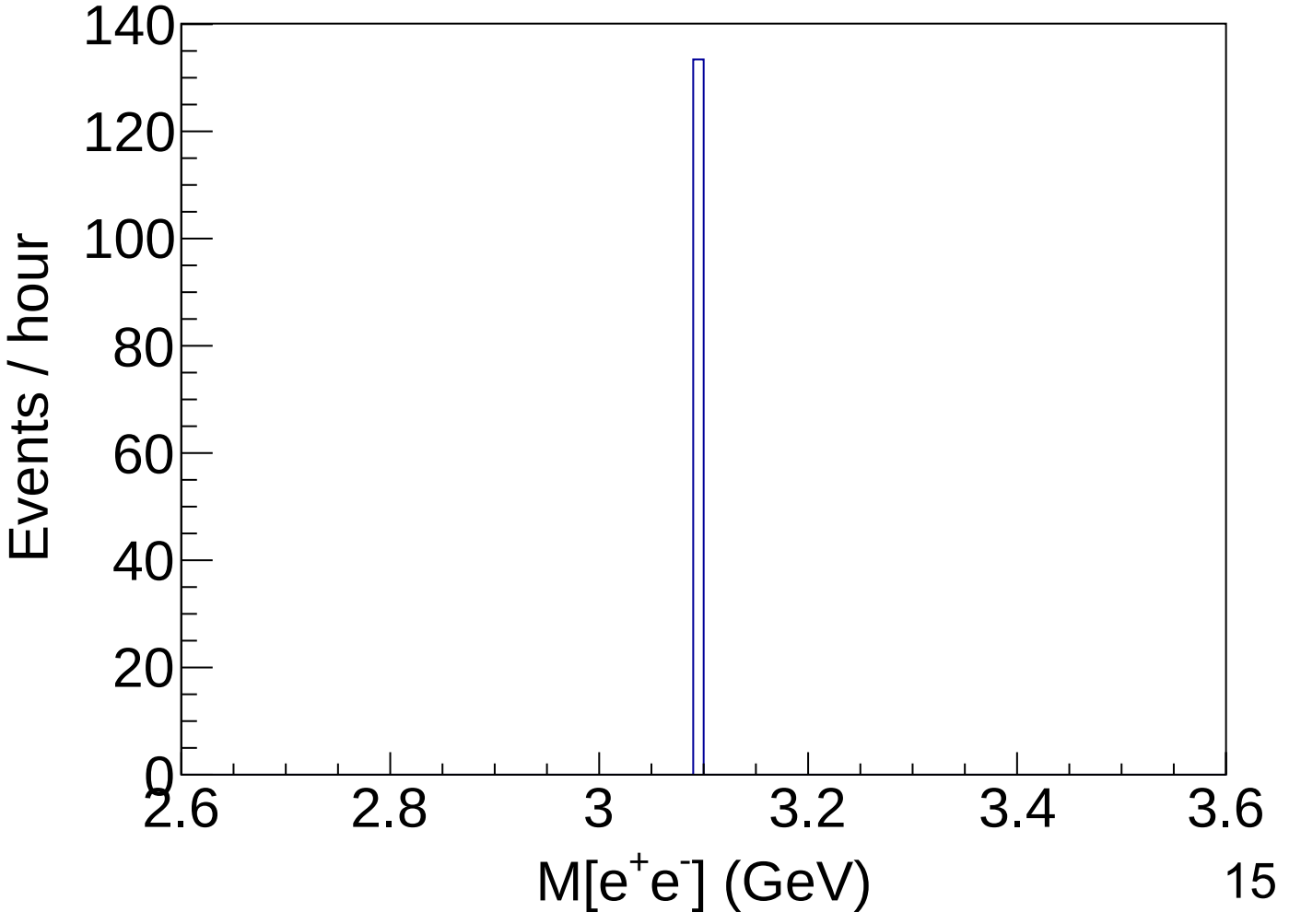

e-nc-sub
P[e⁻] (GeV)
P[e⁺] (GeV)
0
2
4
6
8
10
10⁻¹
10⁻²
10⁻³

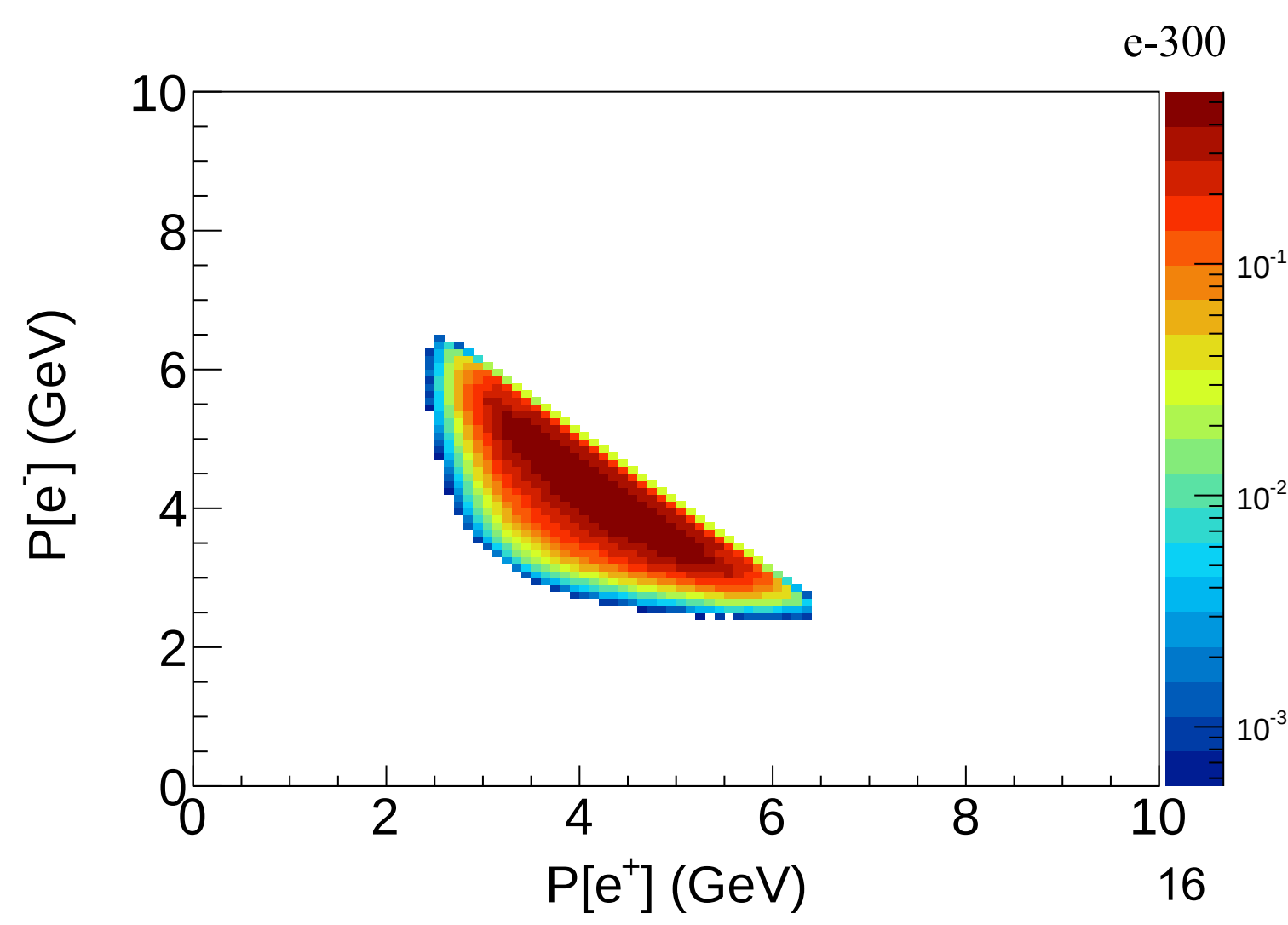

e-nc-sub
10
8
6
4
2
0
P[e⁻] (GeV)
0
50
100
150
θ[e⁻] (deg)
1
10⁻¹
10⁻²
11

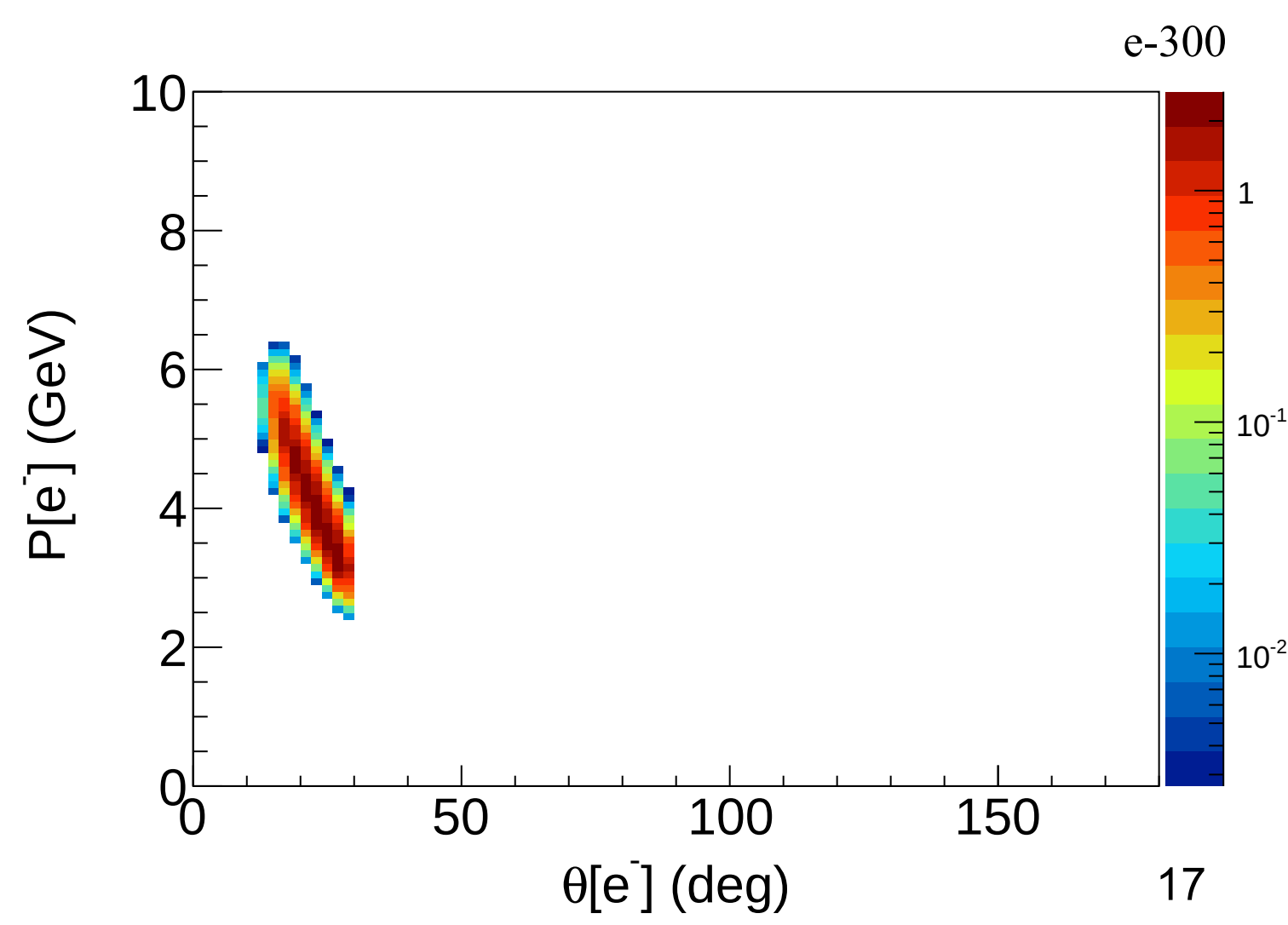

e-nc-sub
P[e+] (GeV)
θ[e+] (deg)
0
2
4
6
8
10
0
50
100
150
1
10-1
10-2

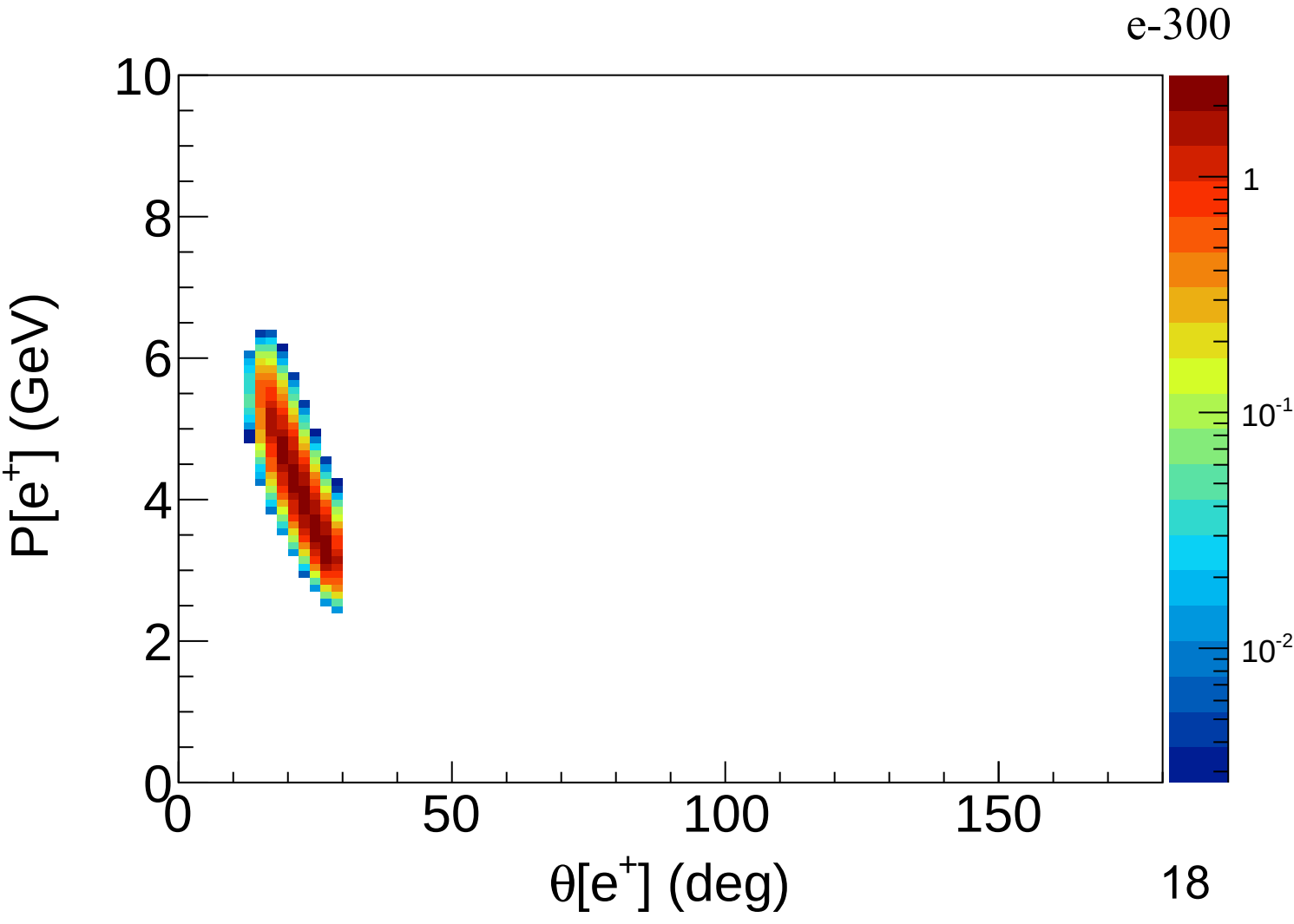

e-nc-sub
P[J/ψ] (GeV)
θ[J/ψ] (deg)
0
2
4
6
8
10
0
50
100
150
1
10^-1
10^-2

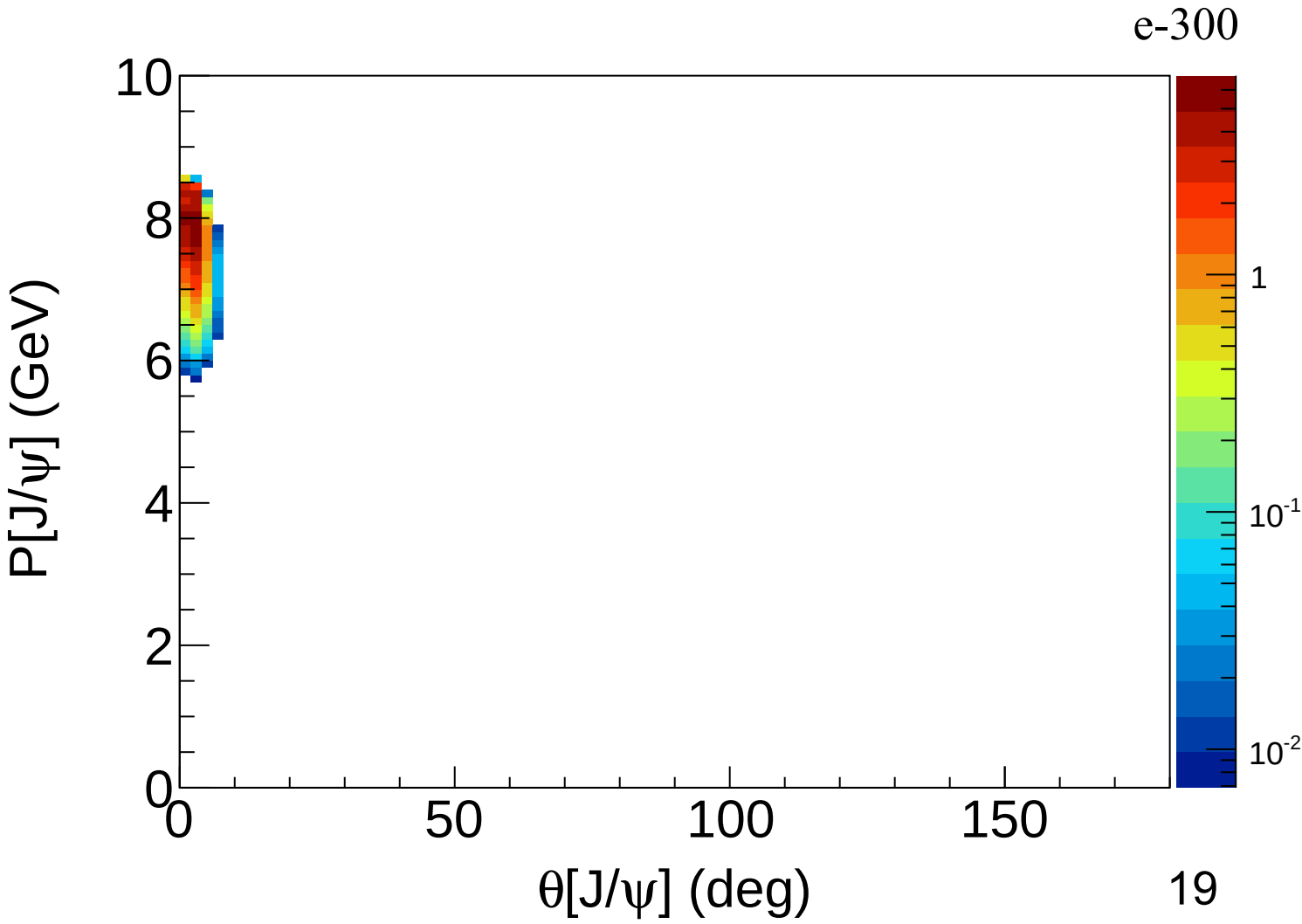

Events / hour
15
10
5
0
0
0.2
0.4
0.6
0.8
1
P[p]min (GeV)

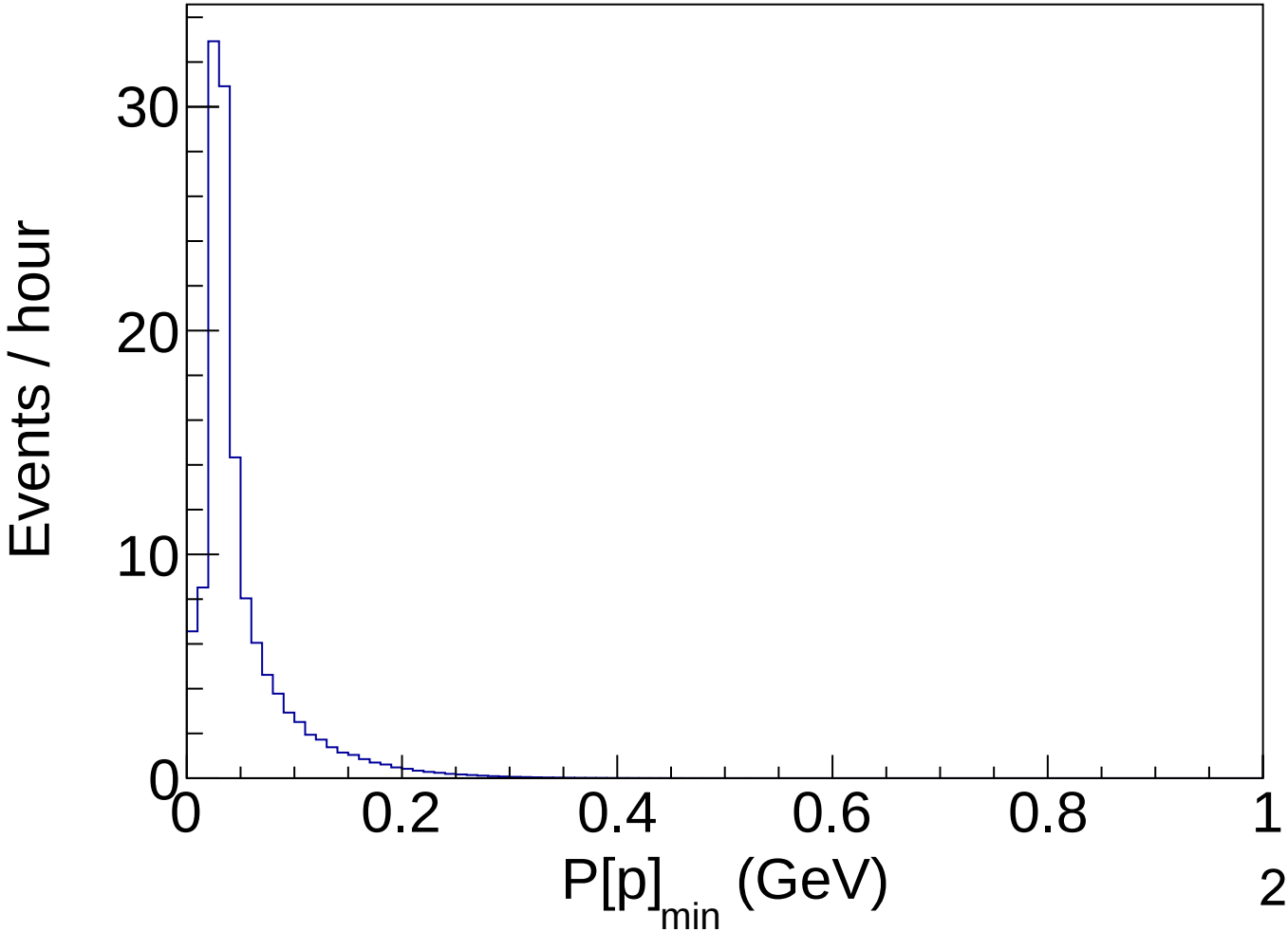

e-300
140
120
100
80
60
40
20
0
Events / hour
2.6
2.8
3
3.2
3.4
3.6
M[e+e-] (GeV)
15

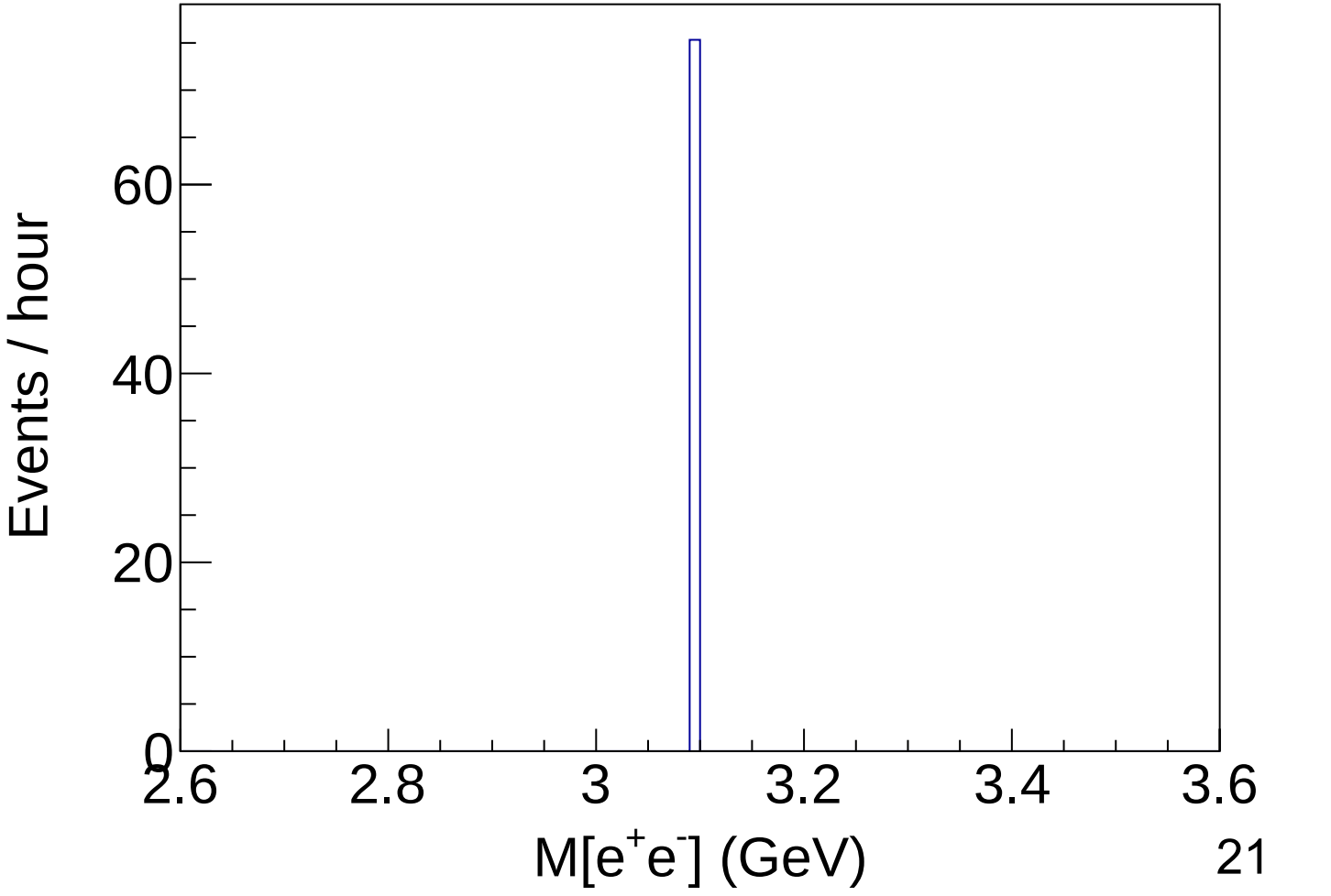

e-300
P[e⁻] (GeV)
P[e⁺] (GeV)
0
2
4
6
8
10
10⁻¹
10⁻²
10⁻³

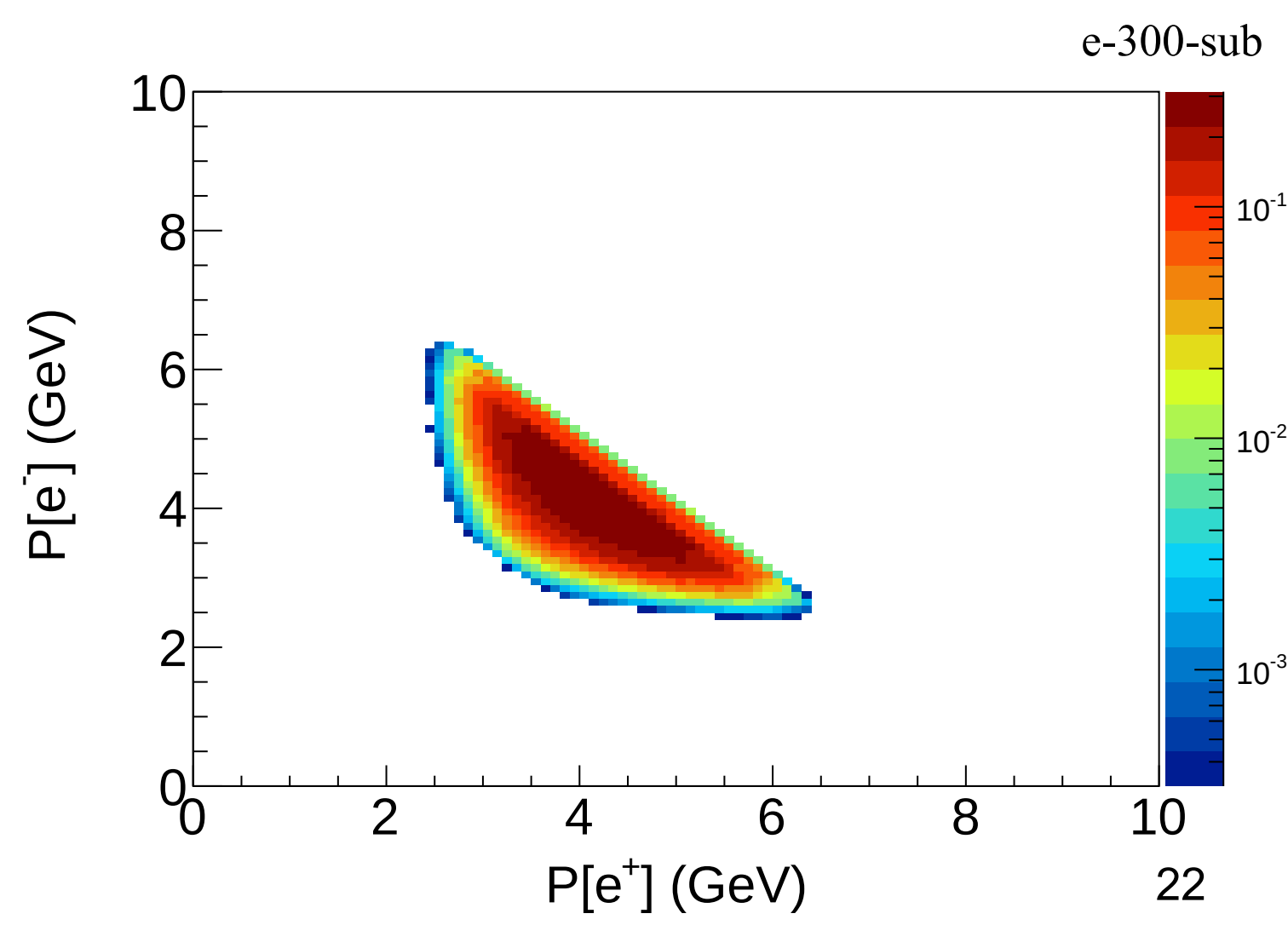

e-300
10
8
6
4
2
0
0
50
100
150
P[e⁻] (GeV)
θ[e⁻] (deg)
1
10⁻¹
10⁻²
17

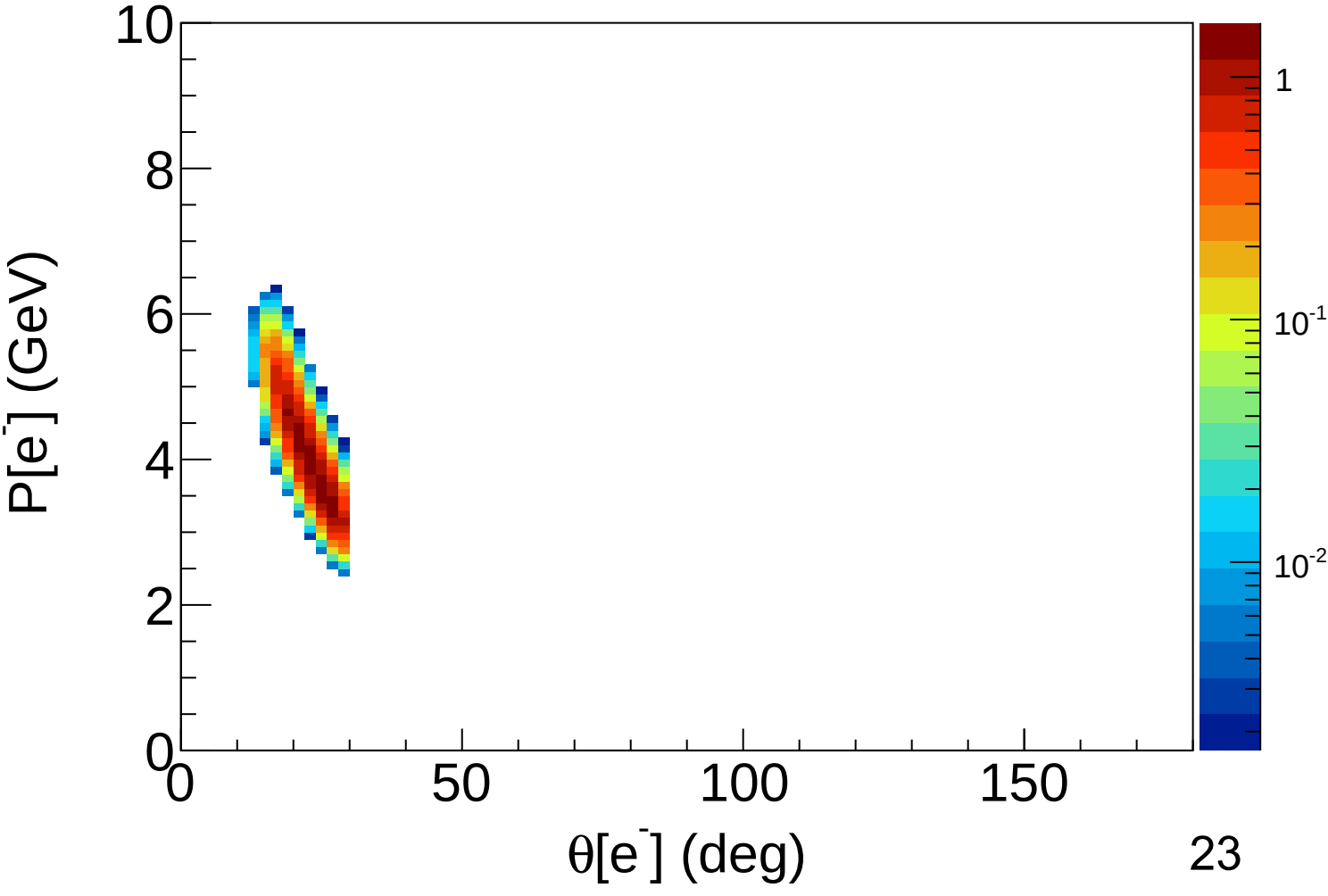

e-300
10
8
6
4
2
0
0
50
100
150
P[e+] (GeV)
θ[e+] (deg)
1
10-1
10-2

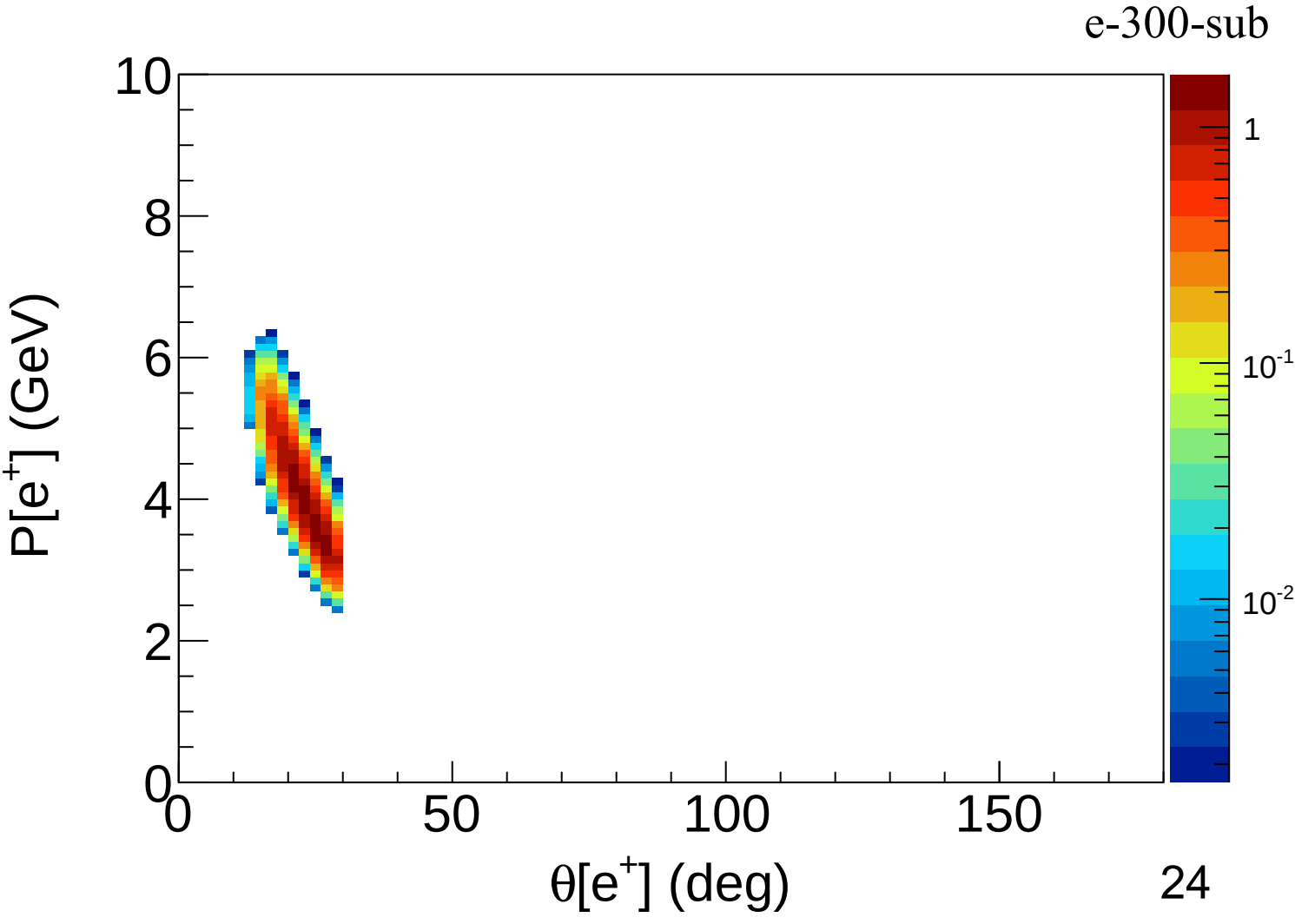

e-300
P[J/ψ] (GeV)
θ[J/ψ] (deg)
0
2
4
6
8
10
0
50
100
150
1
10-1
10-2

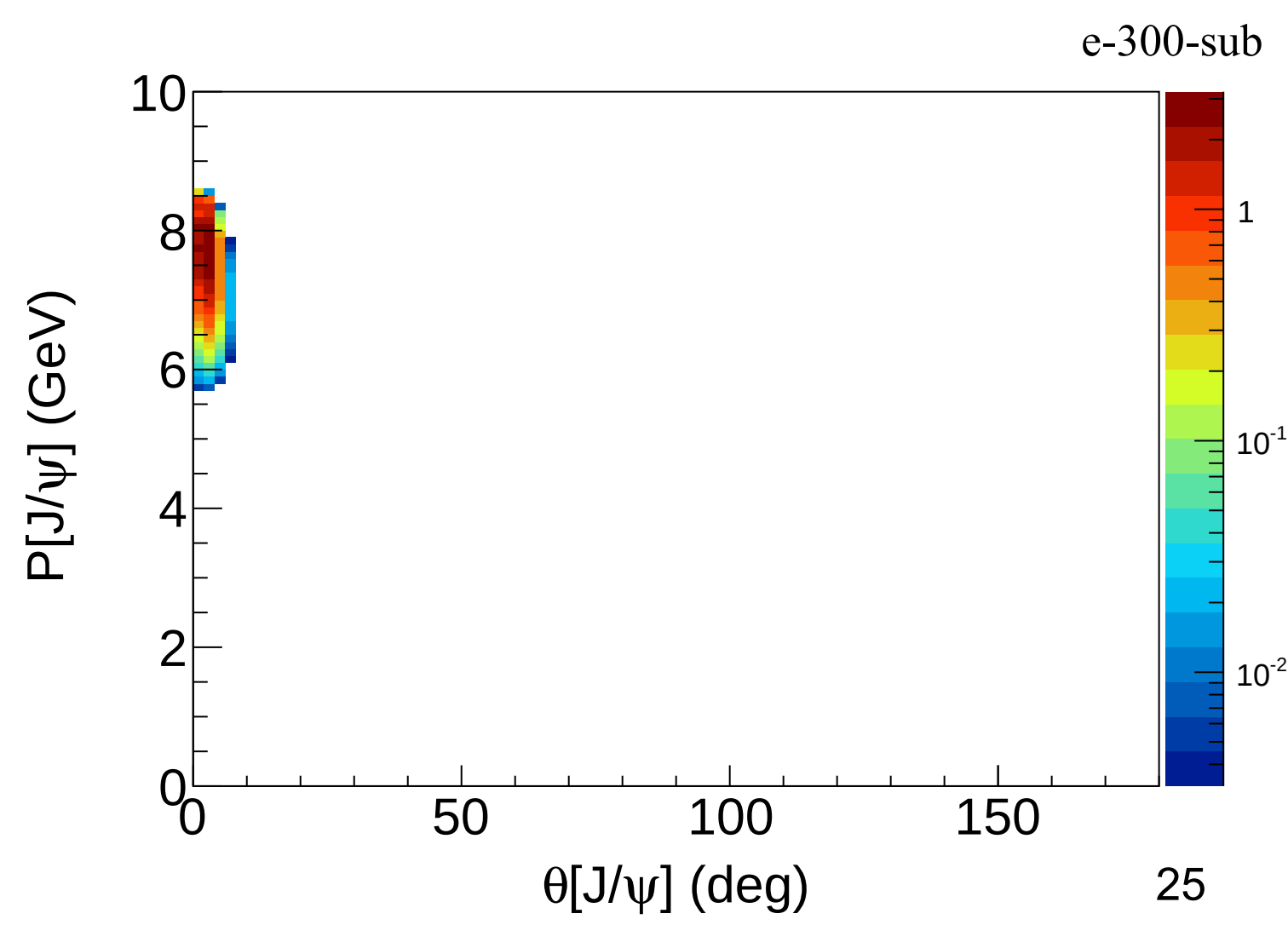

Events / hour
30
20
10
0
0
0.2
0.4
0.6
0.8
1
P[p]min (GeV)

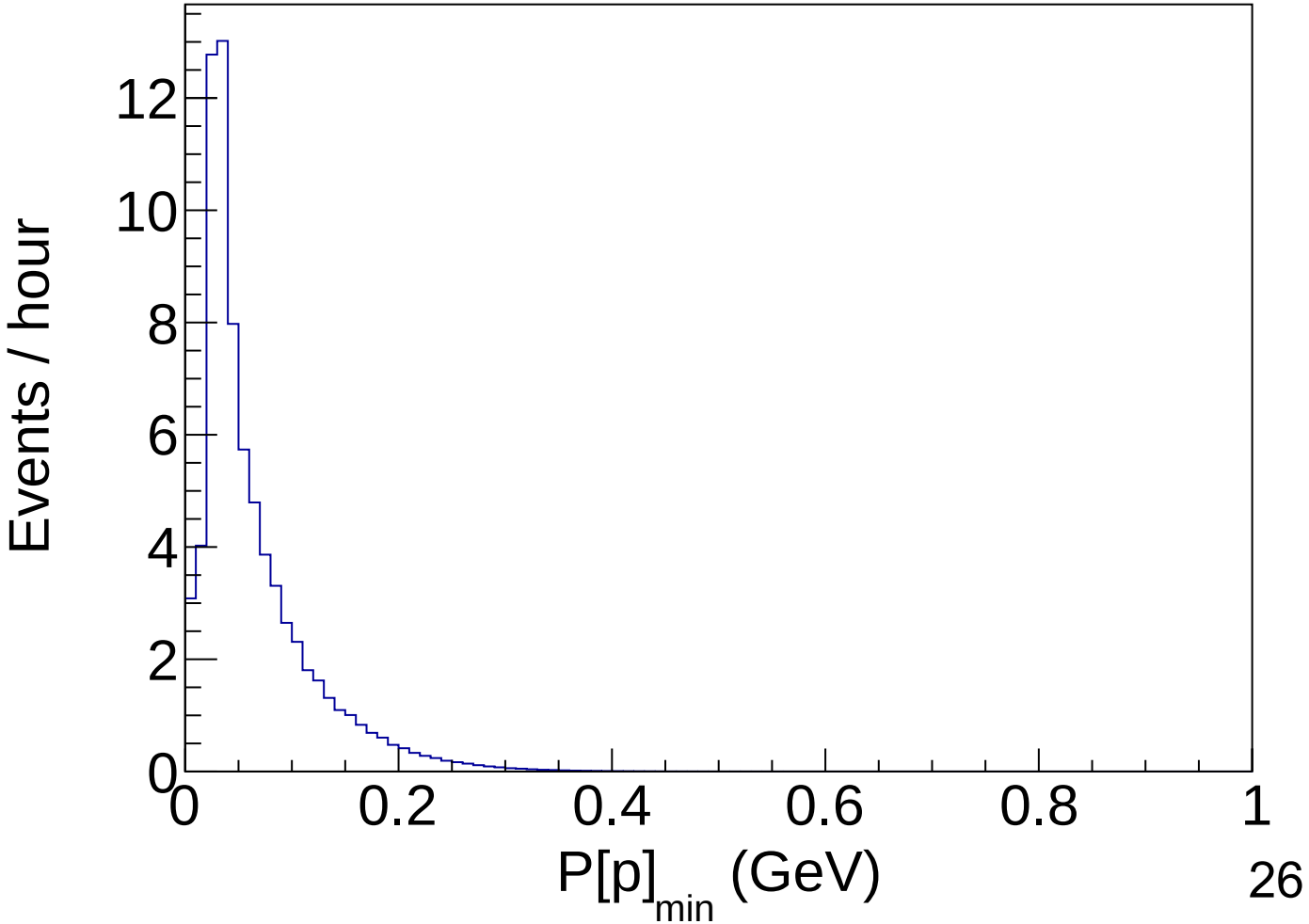

e-300-sub
Events / hour
0
20
40
60
2.6
2.8
3
3.2
3.4
3.6
M[e+e-] (GeV)
21

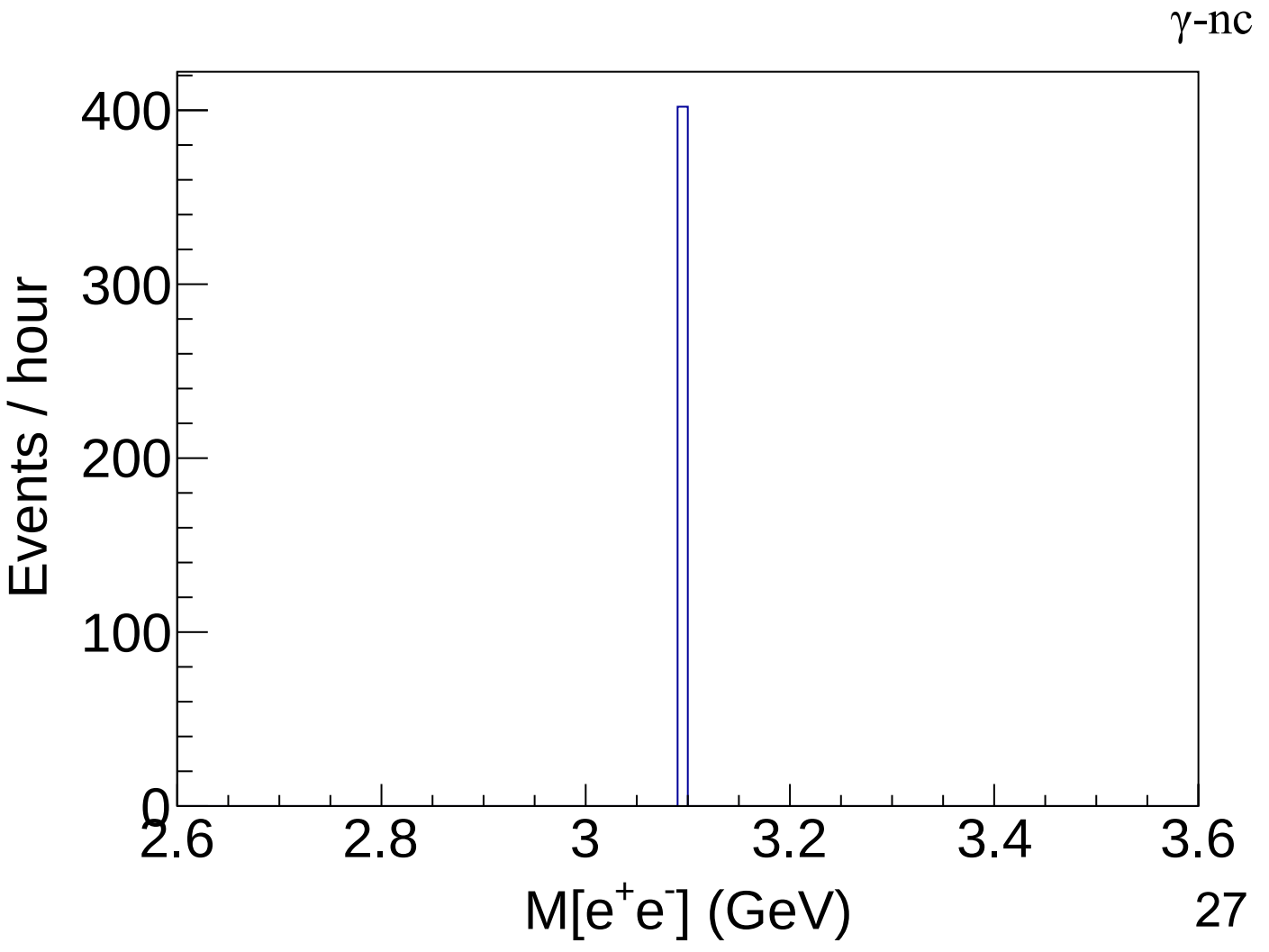

e-300-sub
P[e⁻] (GeV)
P[e⁺] (GeV)
0
2
4
6
8
10
10⁻¹
10⁻²
10⁻³
22

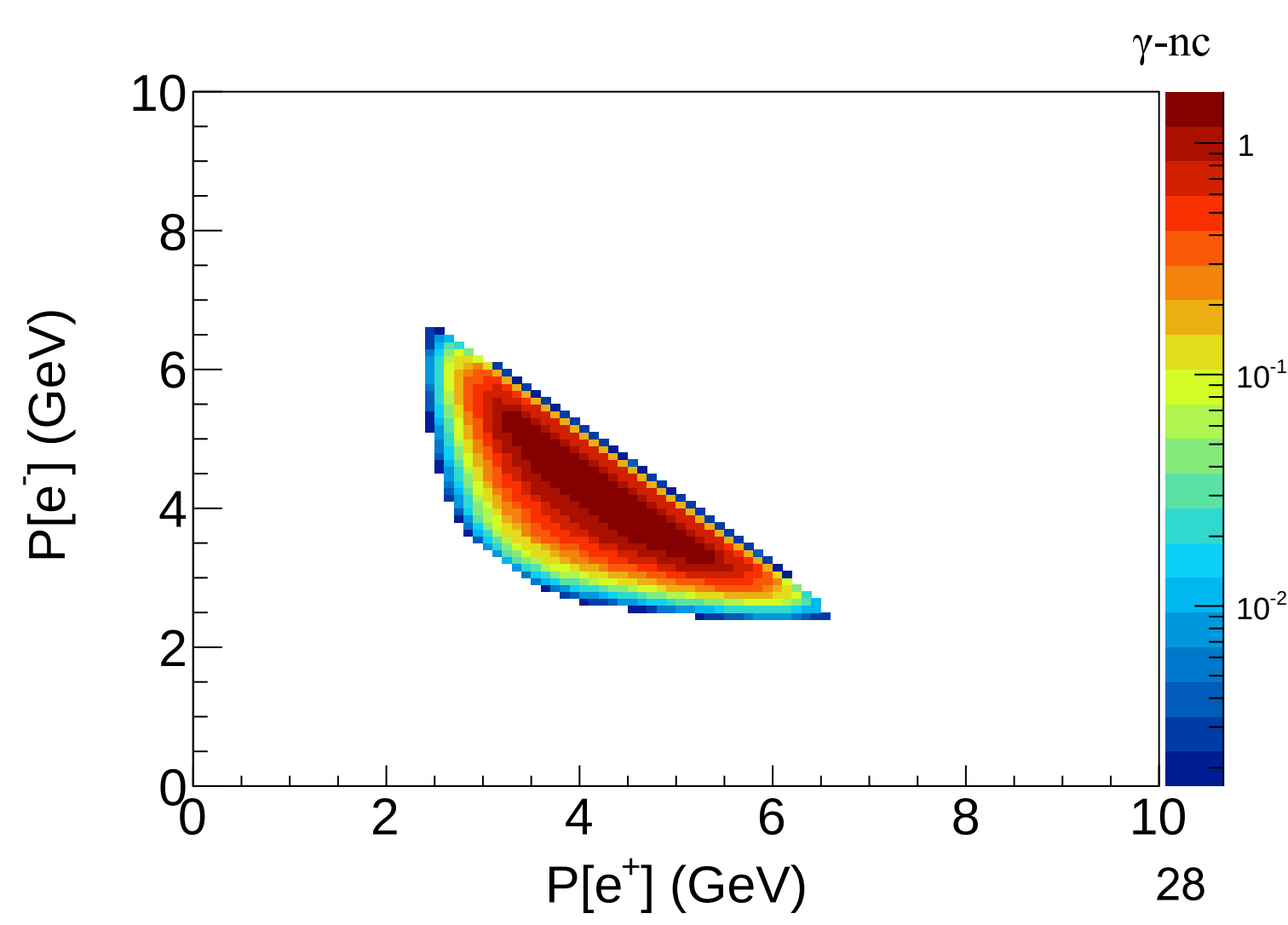

e-300-sub
P[e⁻] (GeV)
θ[e⁻] (deg)
0
2
4
6
8
10
0
50
100
150
1
10⁻¹
10⁻²

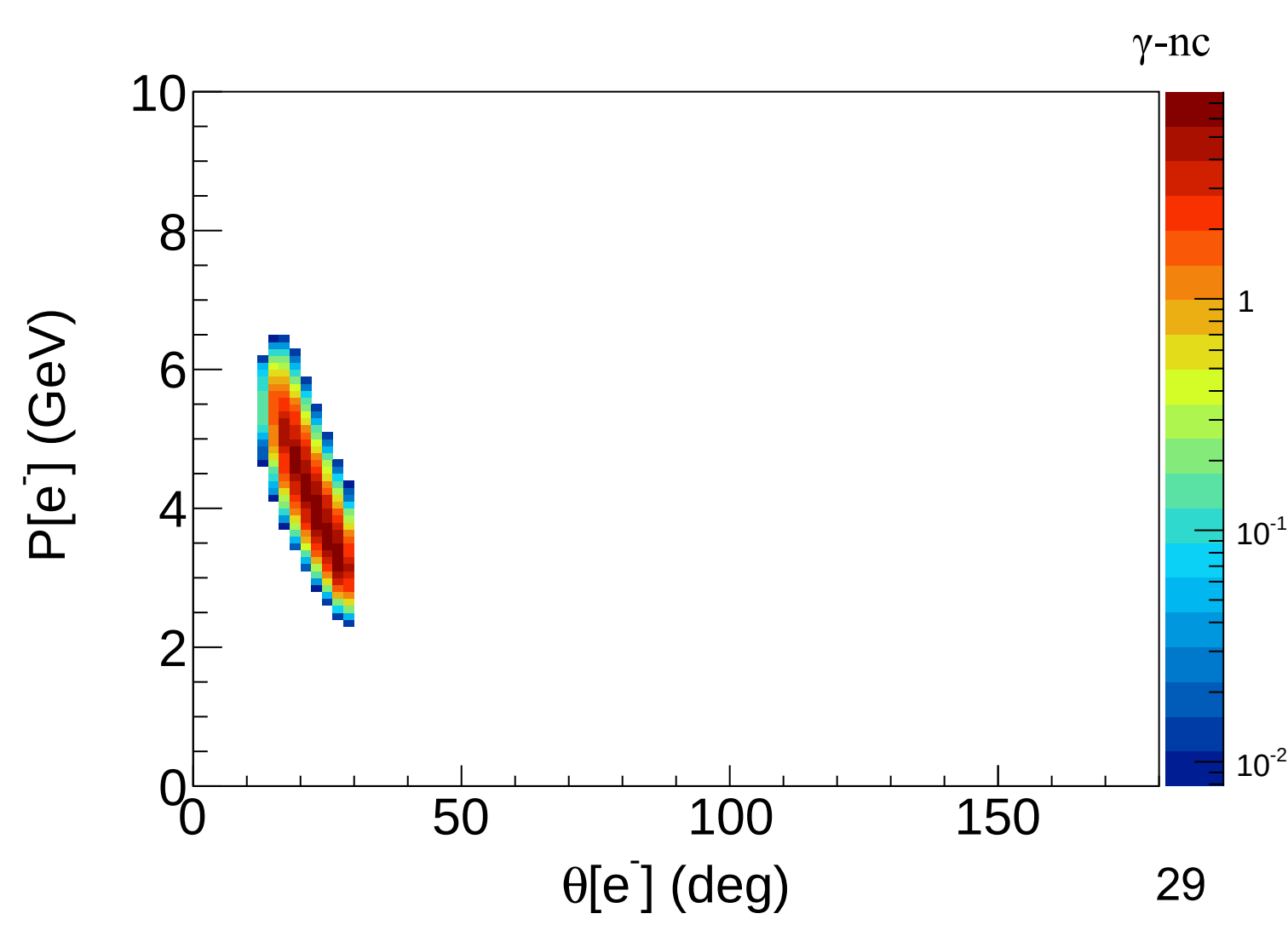

e-300-sub
P[e+] (GeV)
θ[e+] (deg)
0
2
4
6
8
10
0
50
100
150
1
10-1
10-2

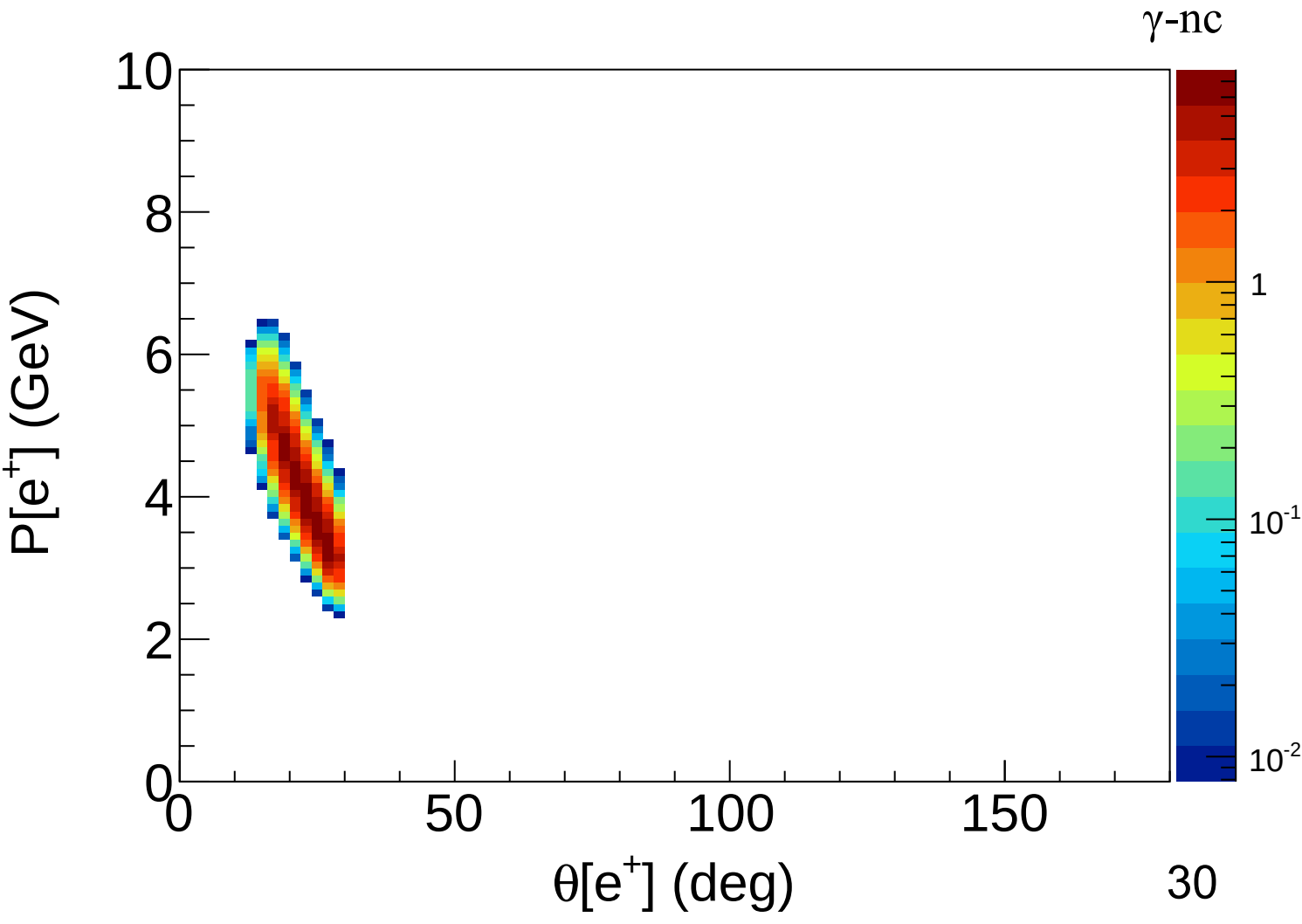

e-300-sub
P[J/ψ] (GeV)
θ[J/ψ] (deg)
0
2
4
6
8
10
0
50
100
150
1
10-1
10-2
25

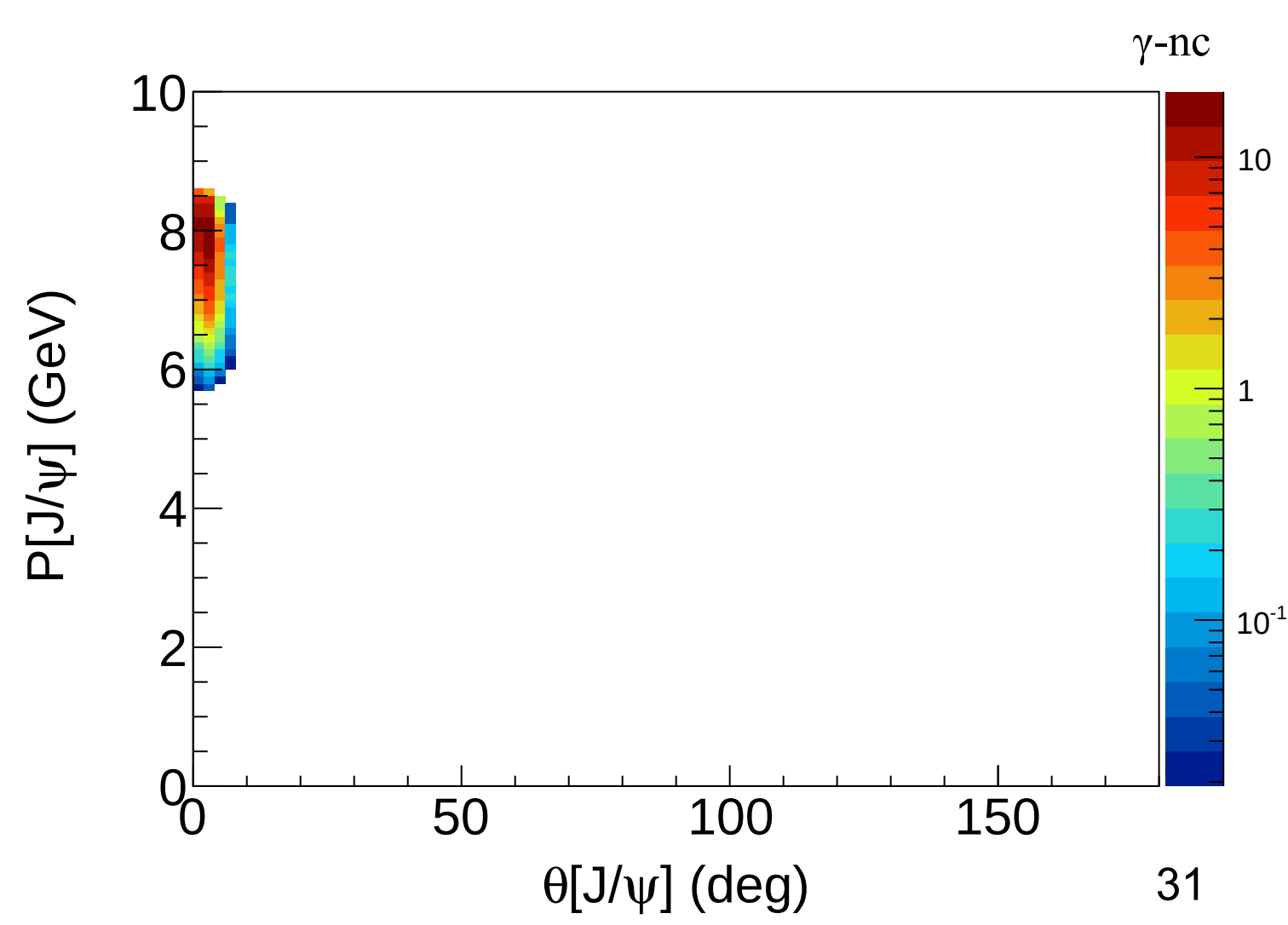

Events / hour
0
2
4
6
8
10
12
0
0.2
0.4
0.6
0.8
1
P[p]min (GeV)

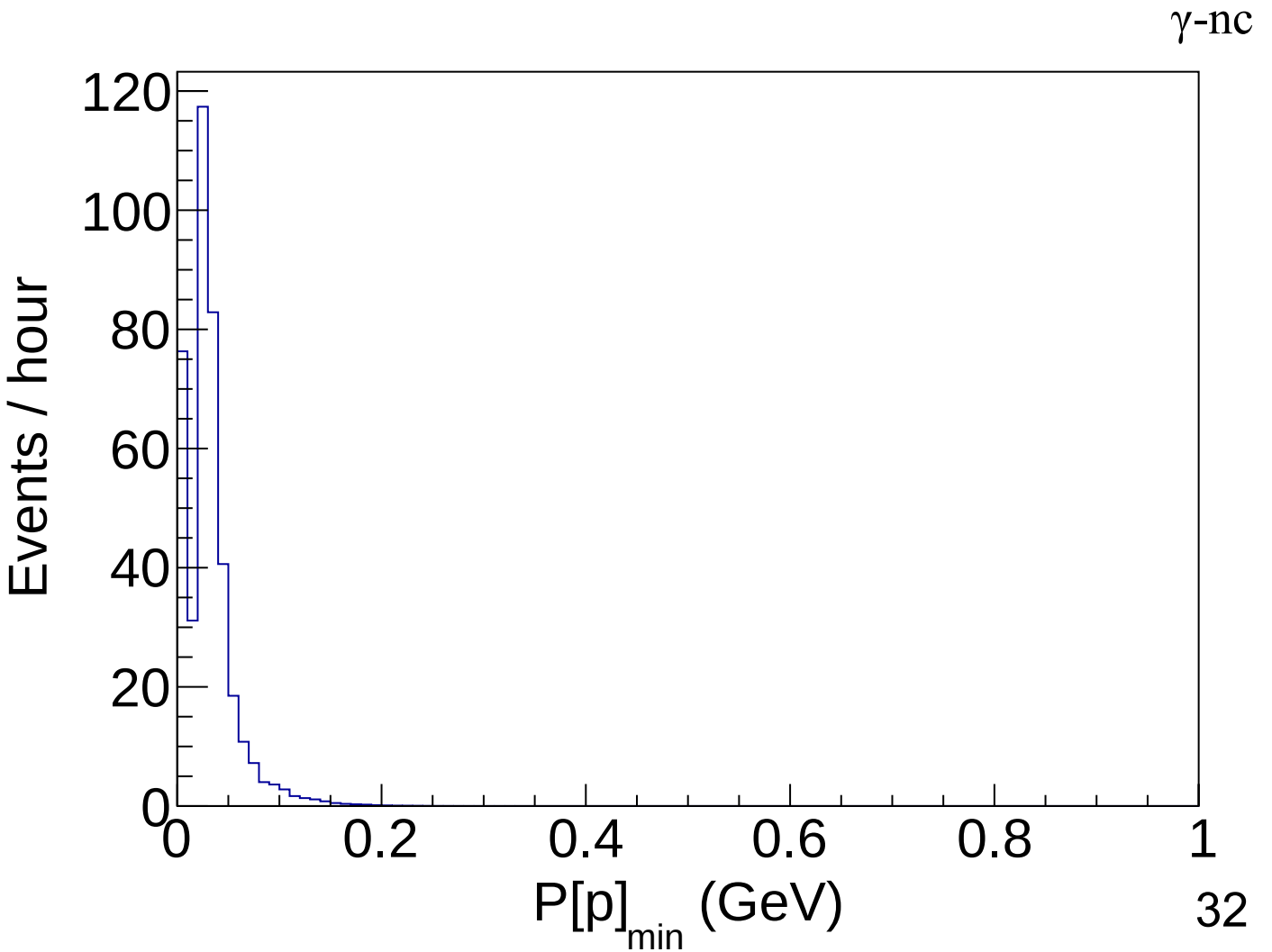

γ-nc
400
300
200
100
0
Events / hour
2.6
2.8
3
3.2
3.4
3.6
M[e+e-] (GeV)

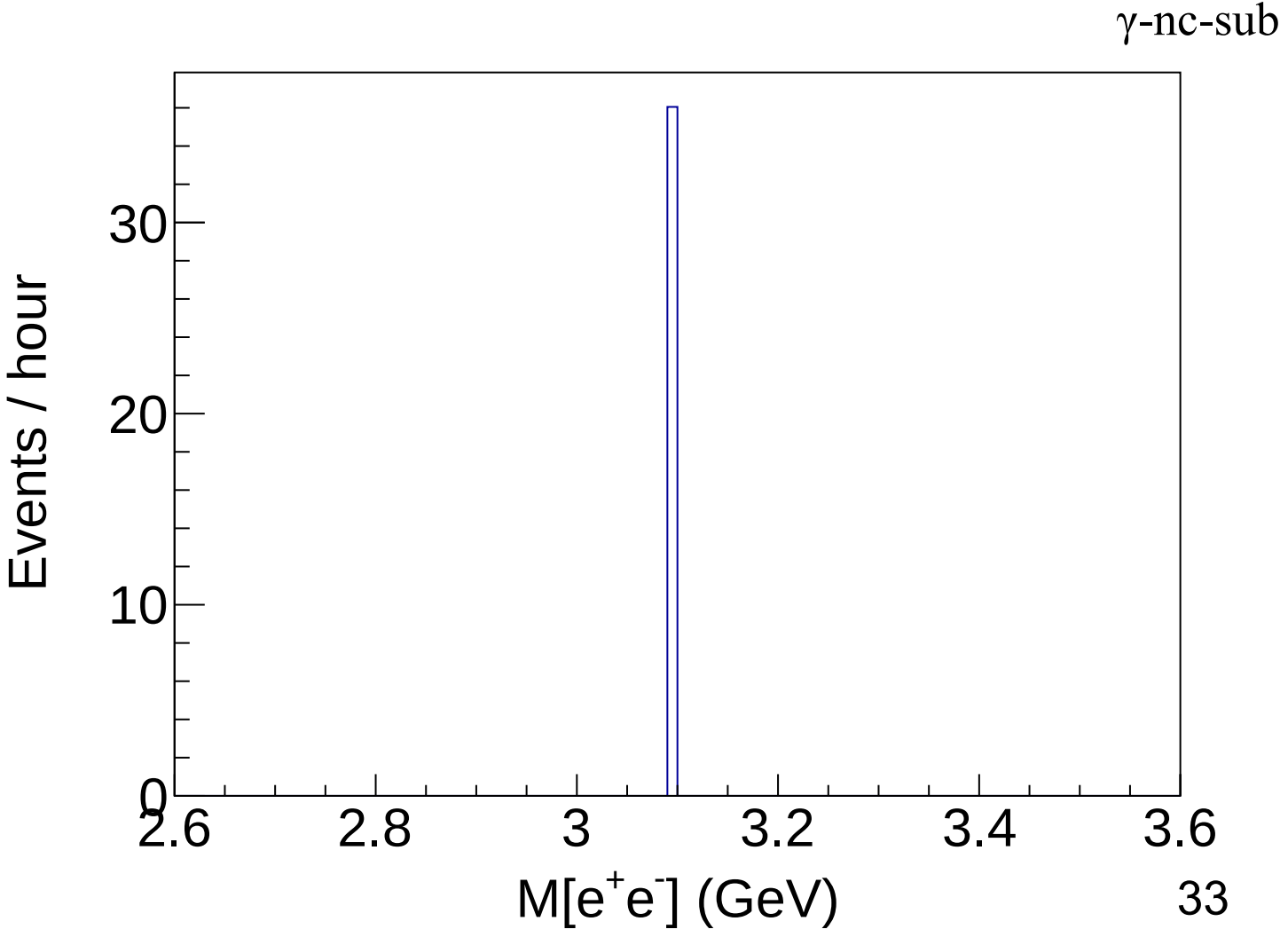

γ-nc
10
8
6
4
2
0
0
2
4
6
8
10
P[e⁻] (GeV)
P[e⁺] (GeV)
1
10⁻¹
10⁻²
28

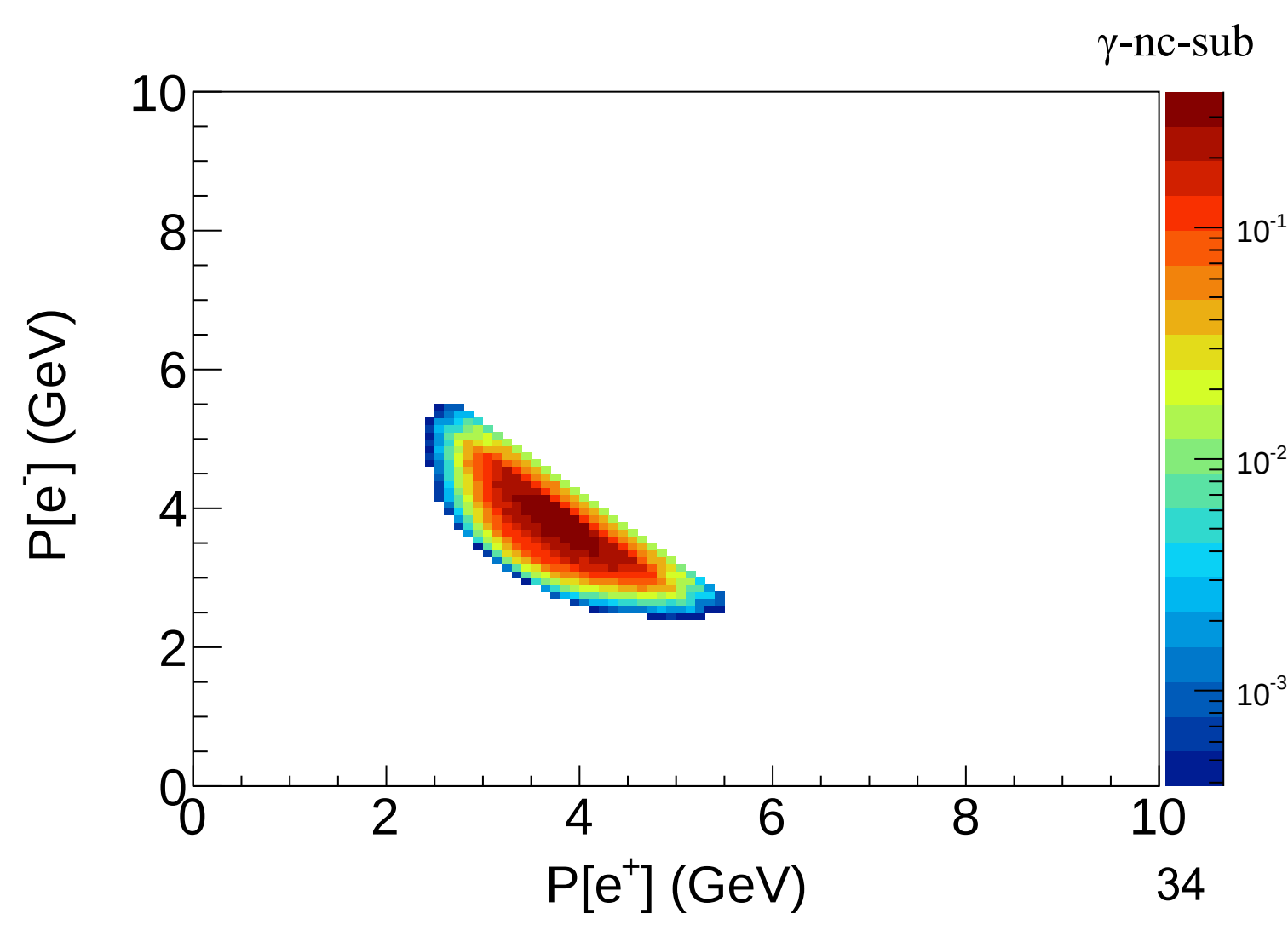

γ-nc
10
8
6
4
2
0
P[e⁻] (GeV)
0
50
100
150
θ[e⁻] (deg)
1
10⁻¹
10⁻²

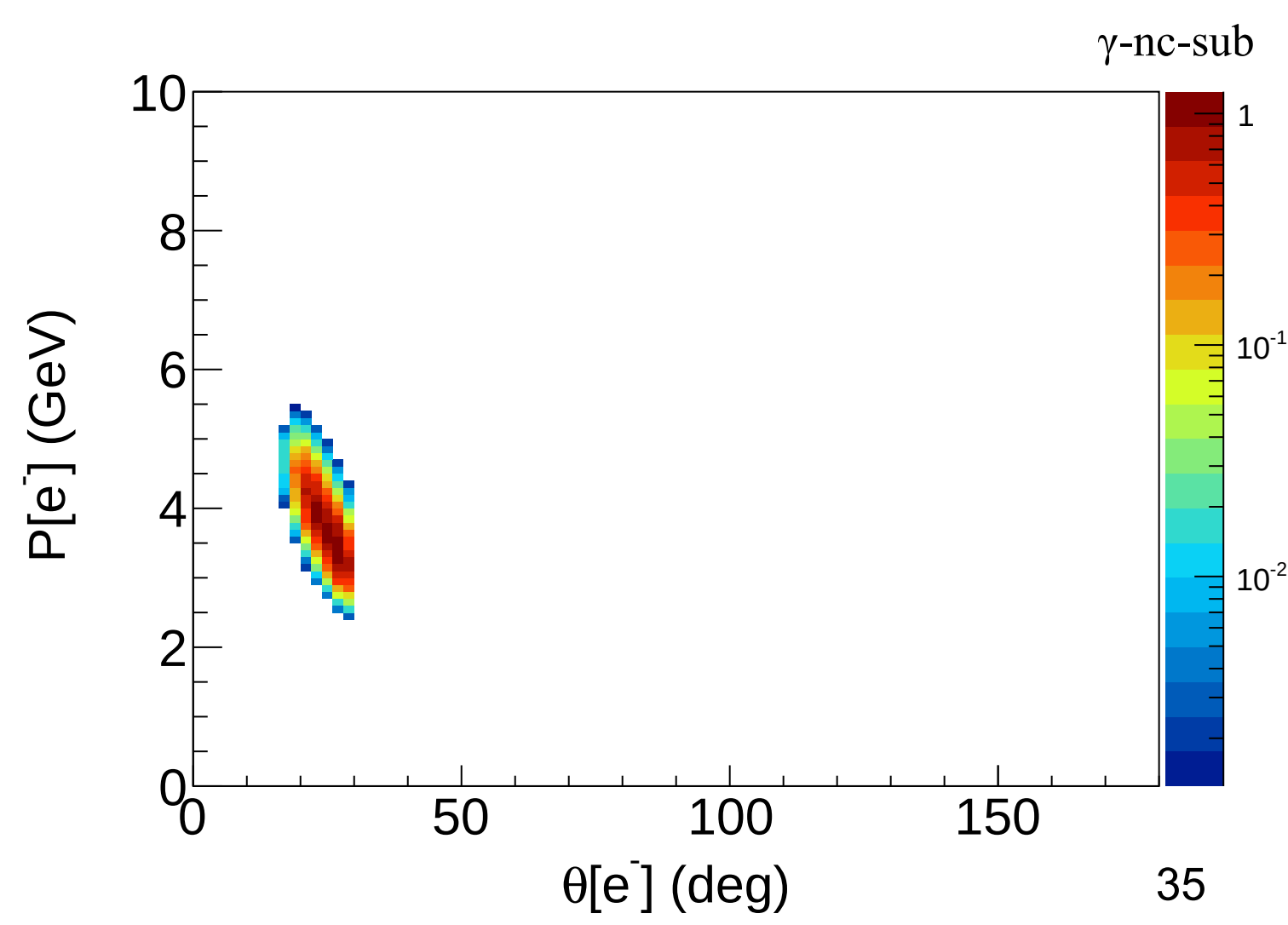

γ-nc
10
8
6
4
2
0
P[e+] (GeV)
0
50
100
150
θ[e+] (deg)
1
10-1
10-2

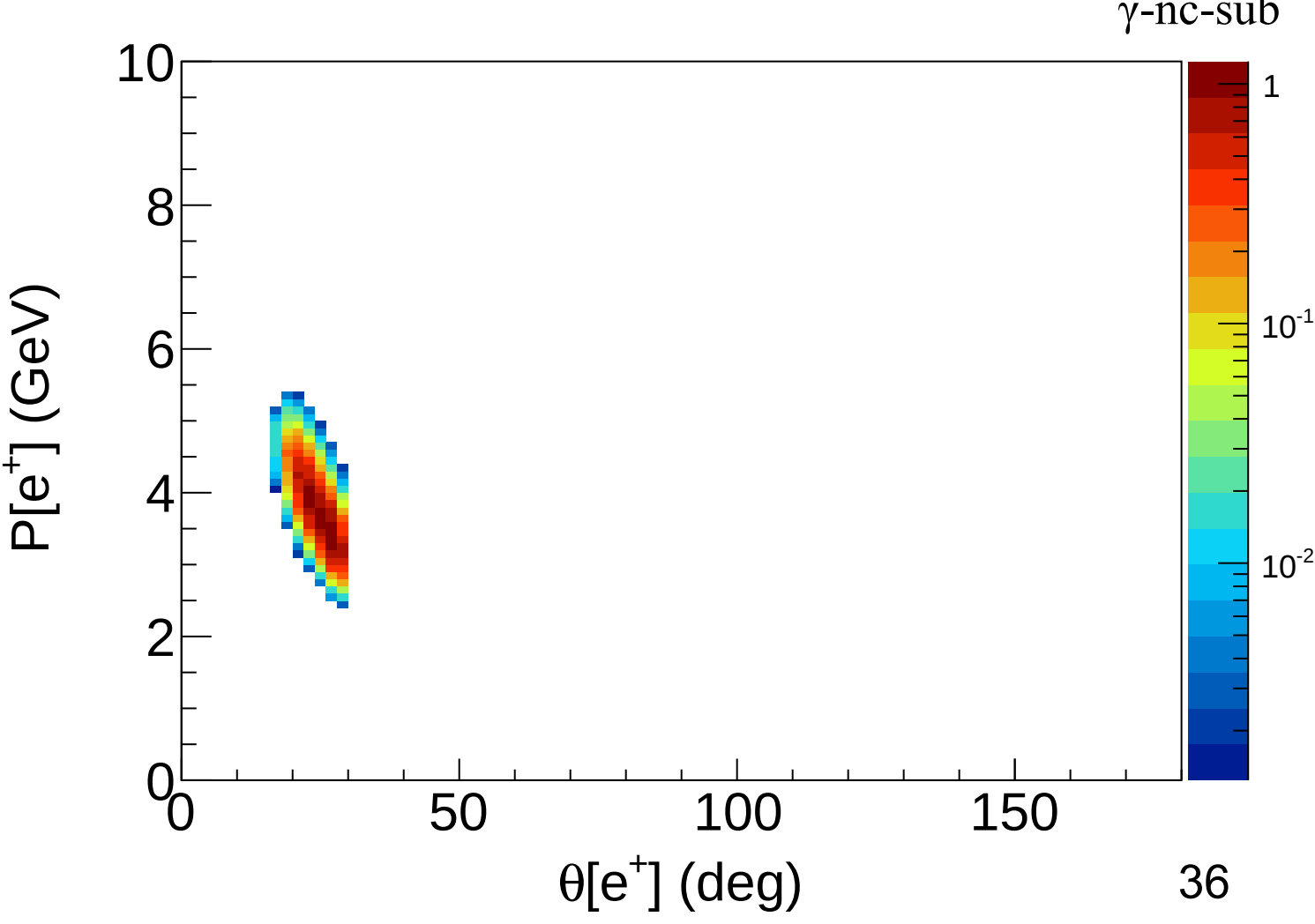

γ-nc
10
8
6
4
2
0
P[J/ψ] (GeV)
0
50
100
150
θ[J/ψ] (deg)
10
1
10^-1
31

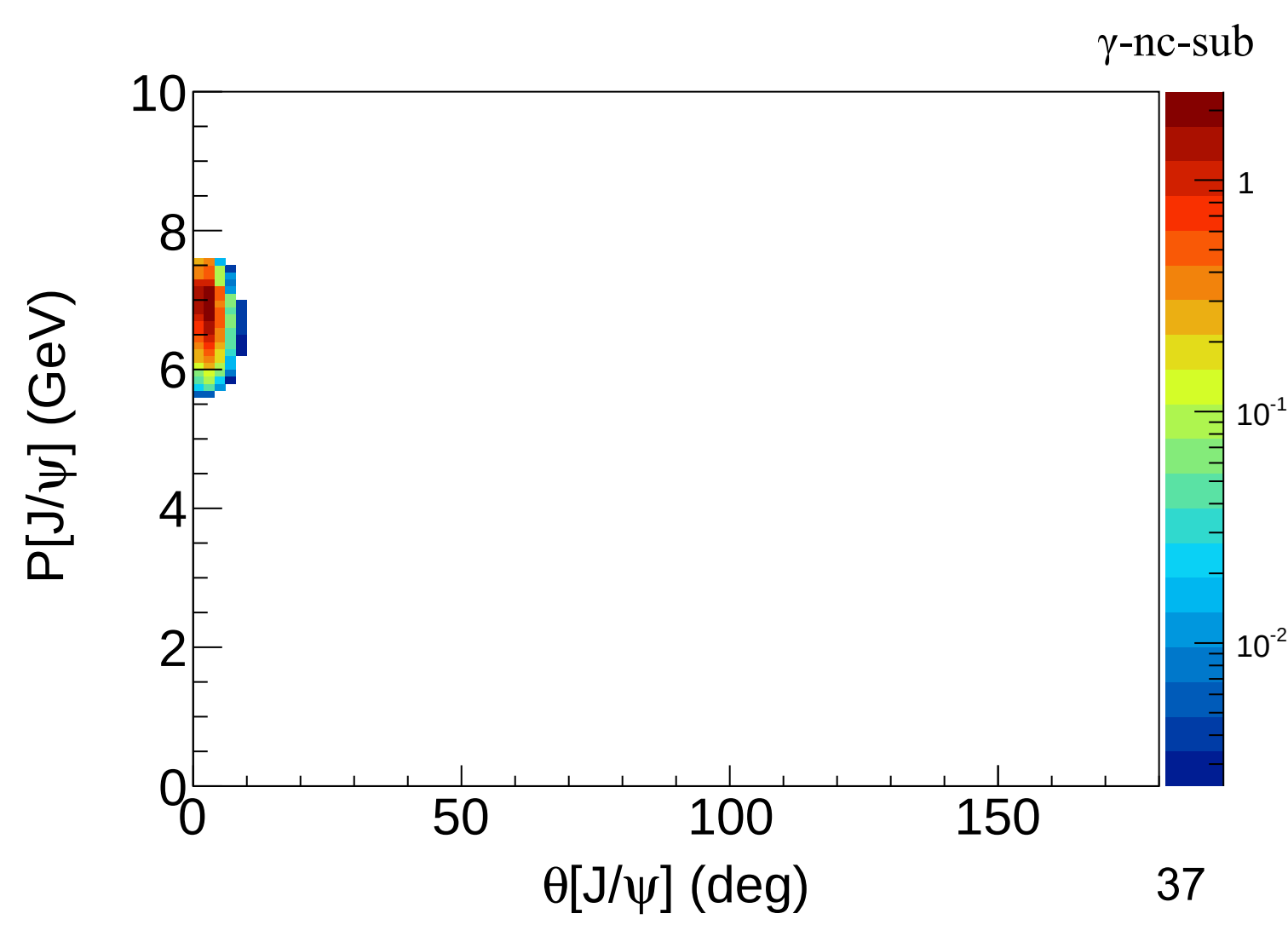

γ-nc
120
100
80
60
40
20
0
Events / hour
0
0.2
0.4
0.6
0.8
1
P[p]min (GeV)

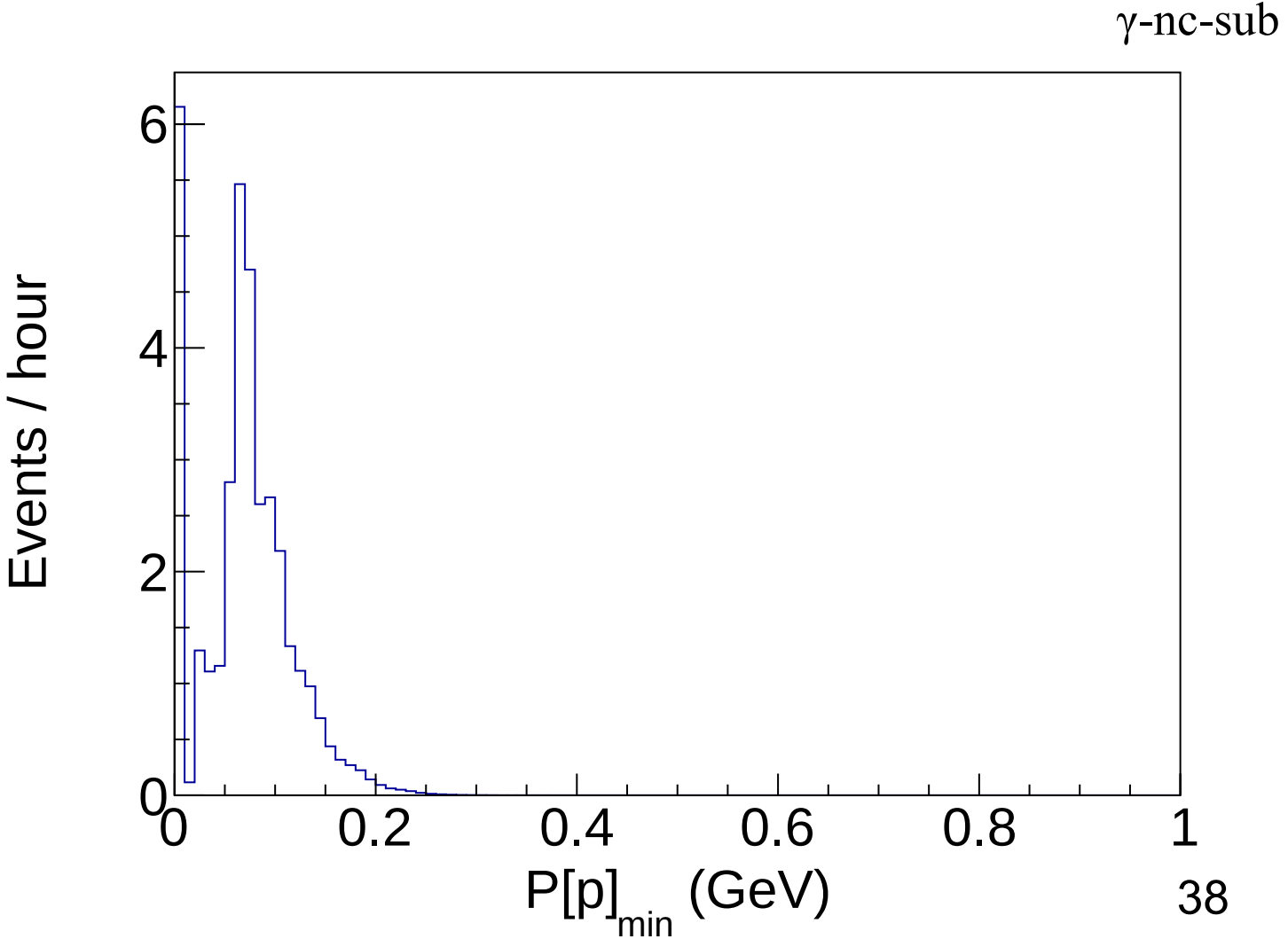

γ-nc-sub
Events / hour
0
10
20
30
2.6
2.8
3
3.2
3.4
3.6
M[e+e-] (GeV)

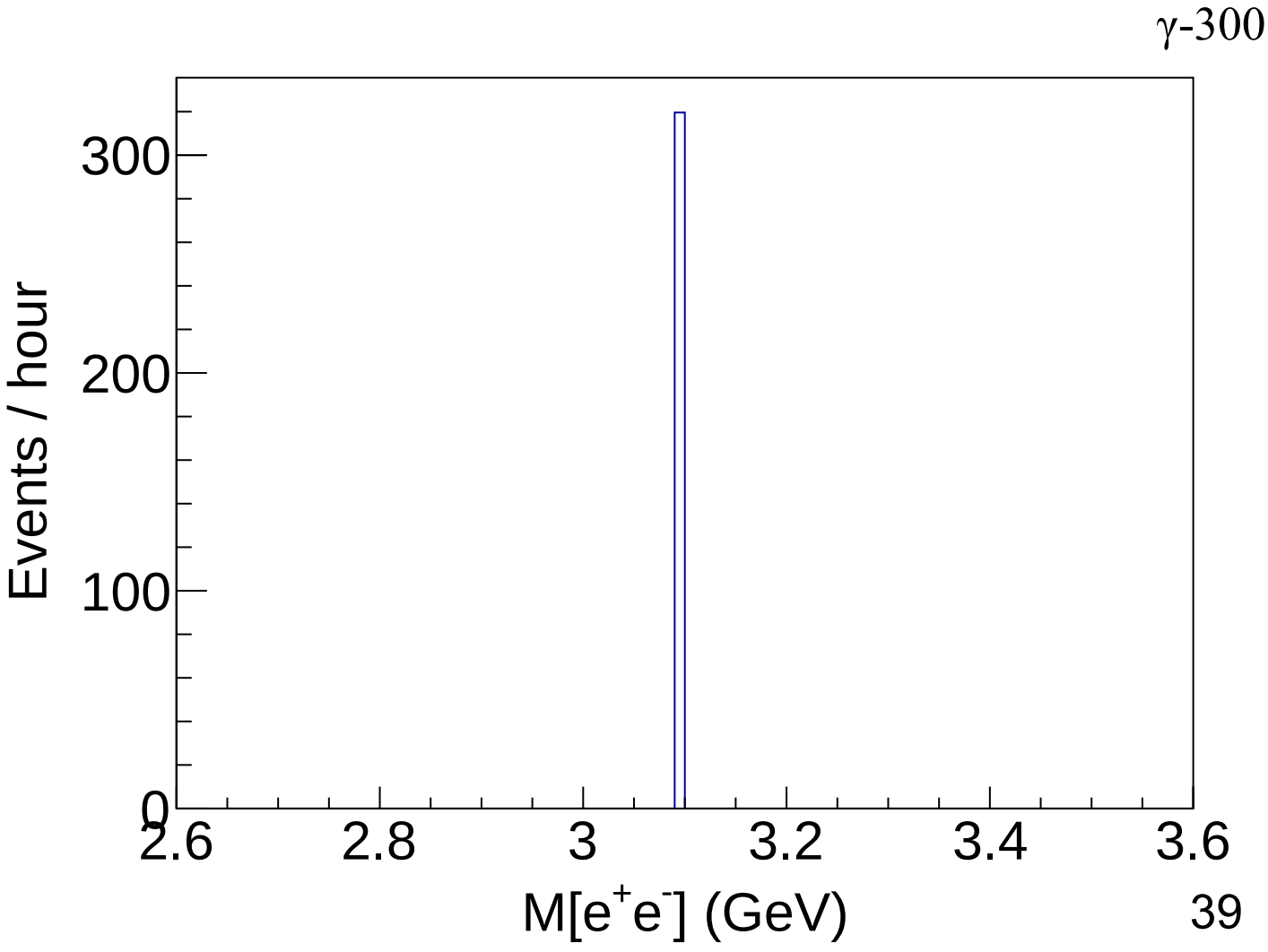

γ-nc-sub
P[e⁻] (GeV)
P[e⁺] (GeV)
0
2
4
6
8
10
10⁻¹
10⁻²
10⁻³

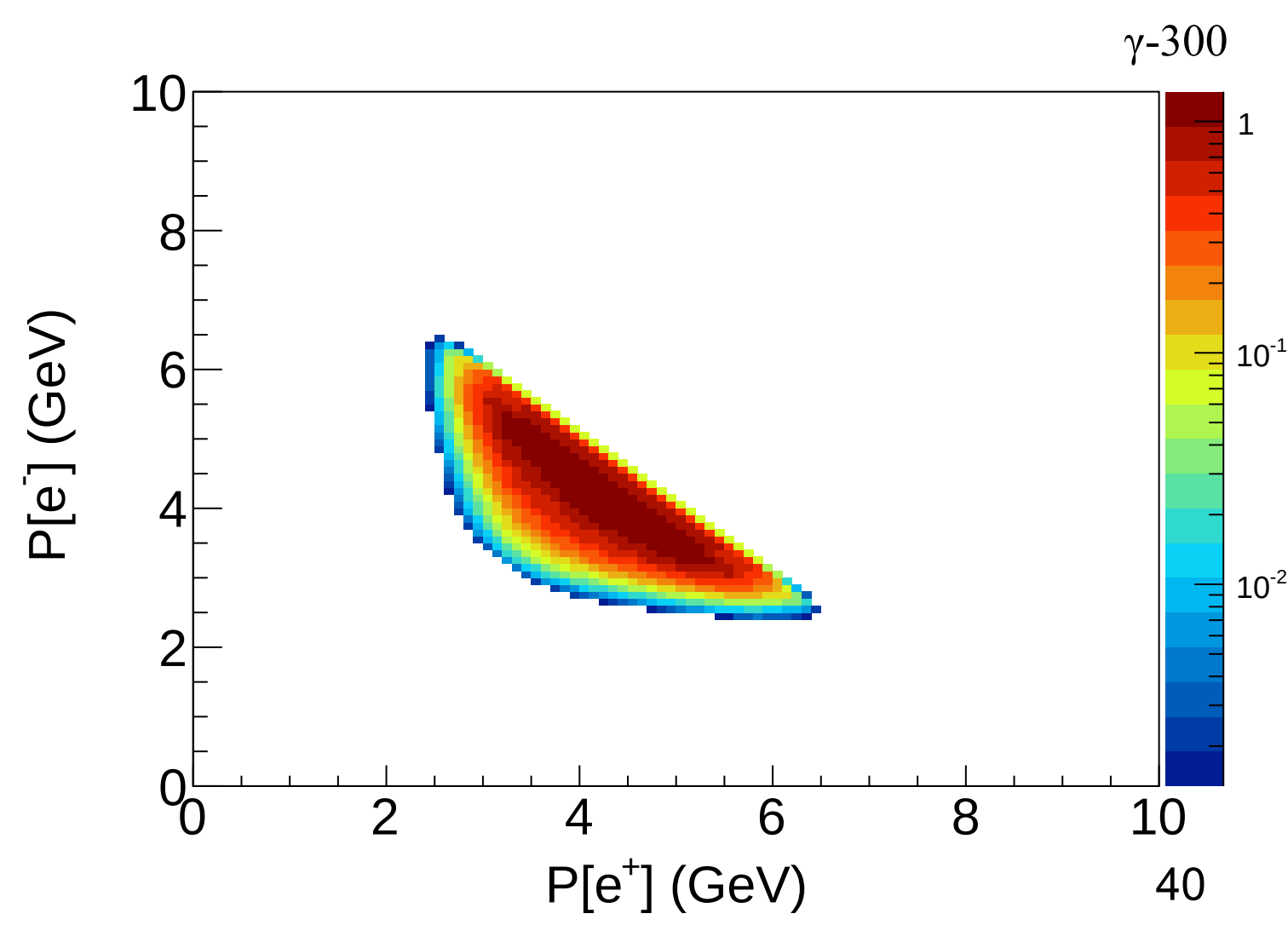

γ-nc-sub
P[e⁻] (GeV)
θ[e⁻] (deg)
0
2
4
6
8
10
0
50
100
150
1
10⁻¹
10⁻²
35

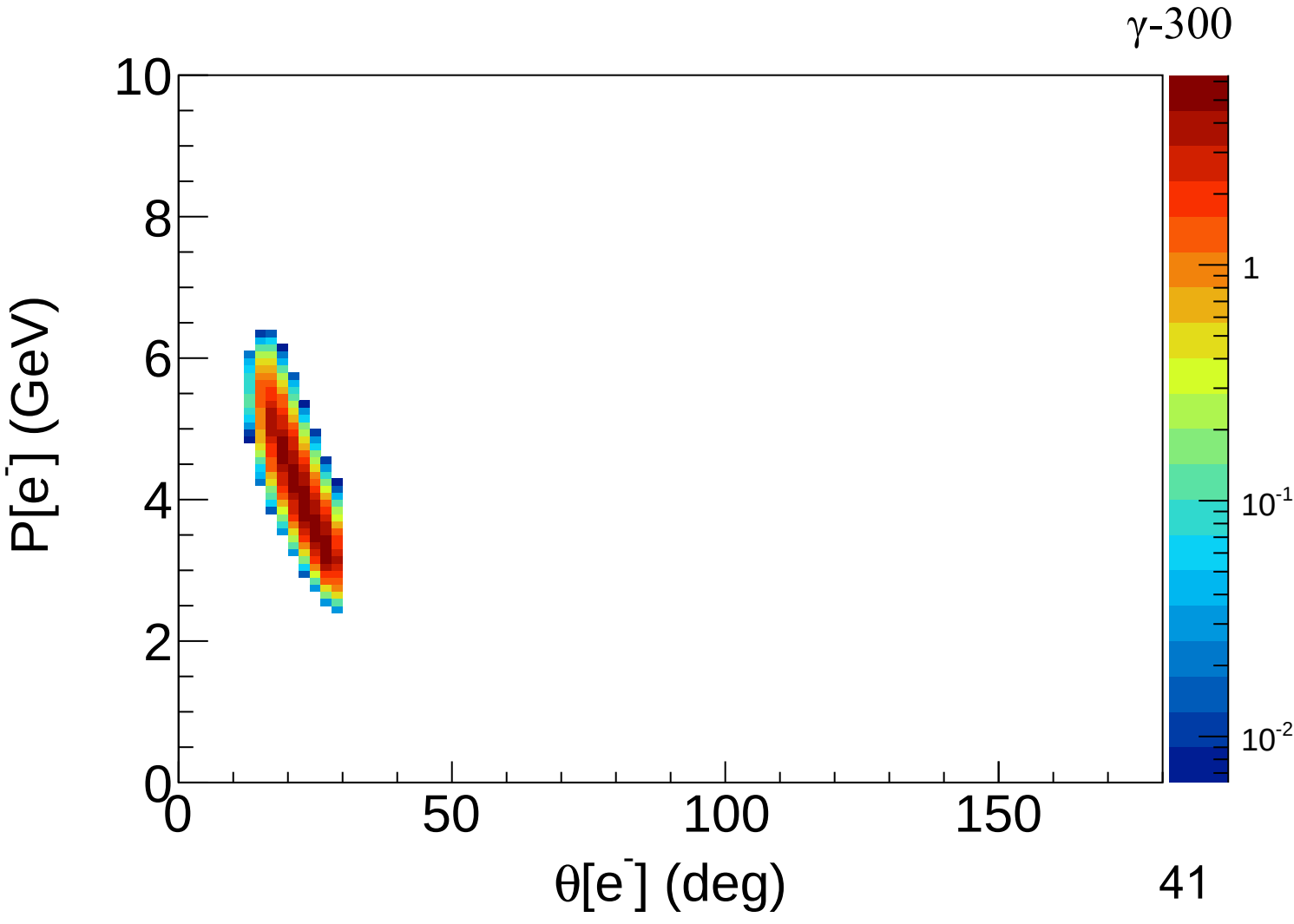

γ-nc-sub
P[e+] (GeV)
θ[e+] (deg)
0
2
4
6
8
10
0
50
100
150
1
10-1
10-2

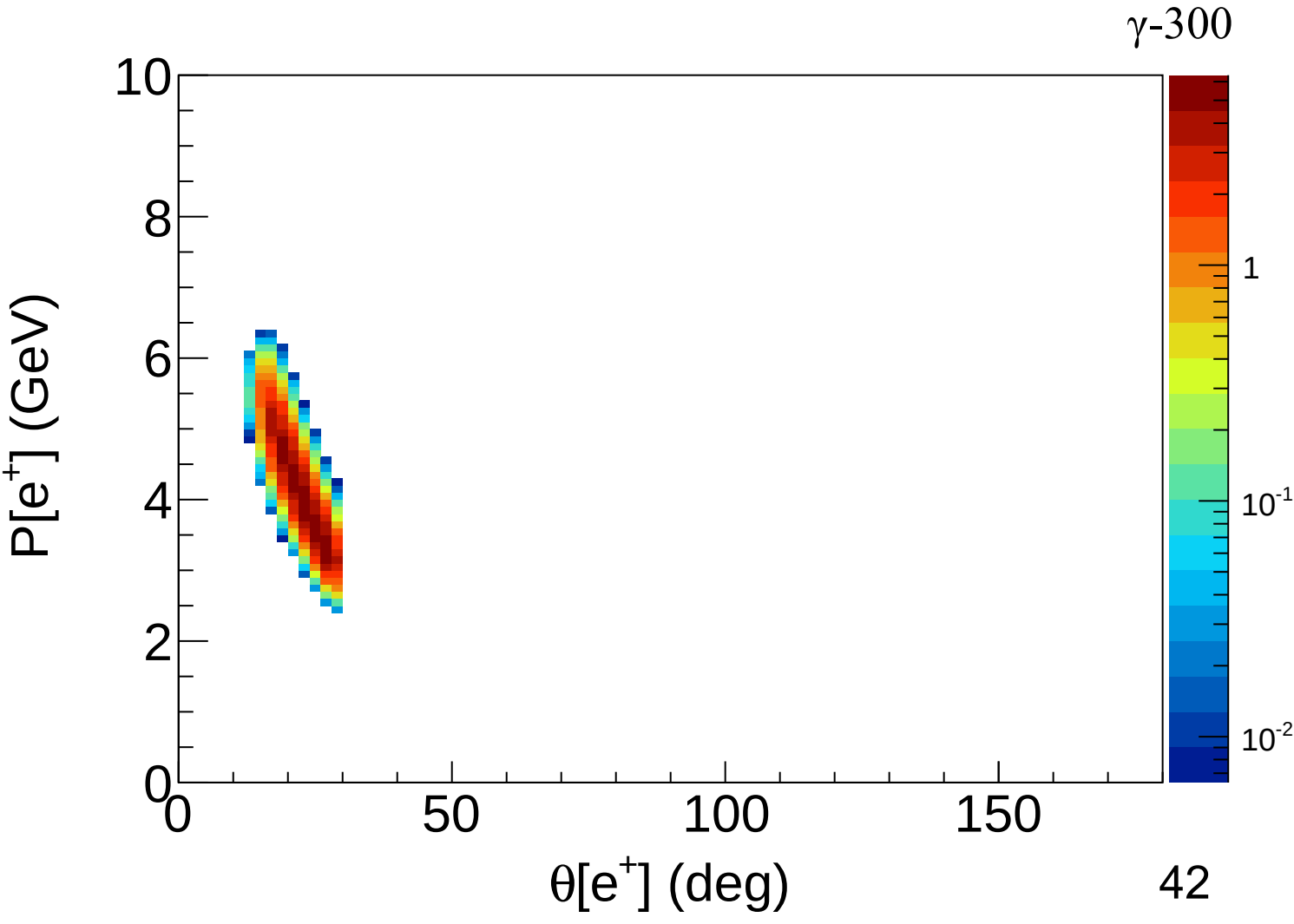

γ-nc-sub
P[J/ψ] (GeV)
θ[J/ψ] (deg)
0
2
4
6
8
10
0
50
100
150
1
10-1
10-2

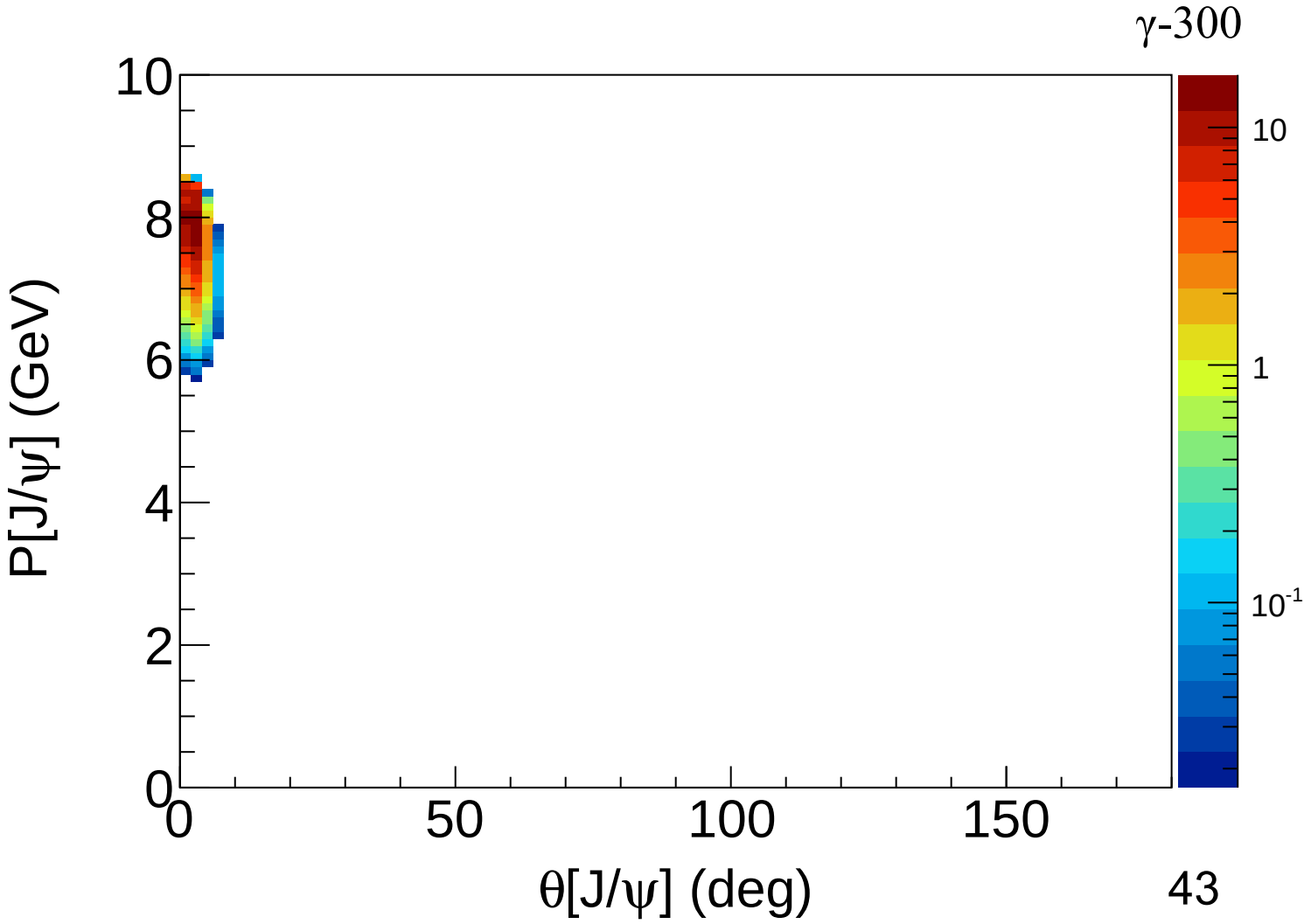

γ-nc-sub
Events / hour
0
2
4
6
0
0.2
0.4
0.6
0.8
1
P[p]min (GeV)

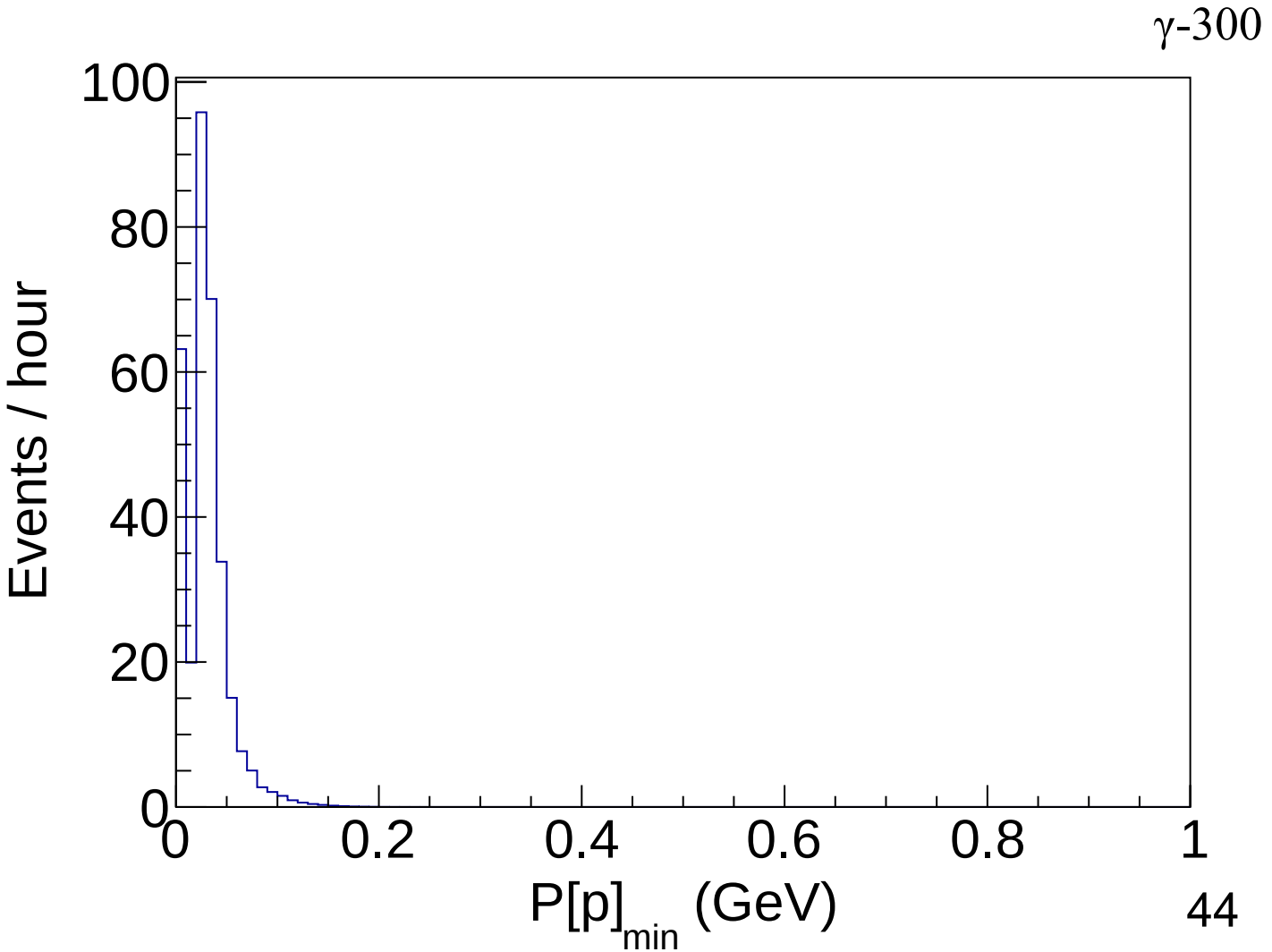

γ-300
300
200
100
0
Events / hour
2.6
2.8
3
3.2
3.4
3.6
M[e+e-] (GeV)

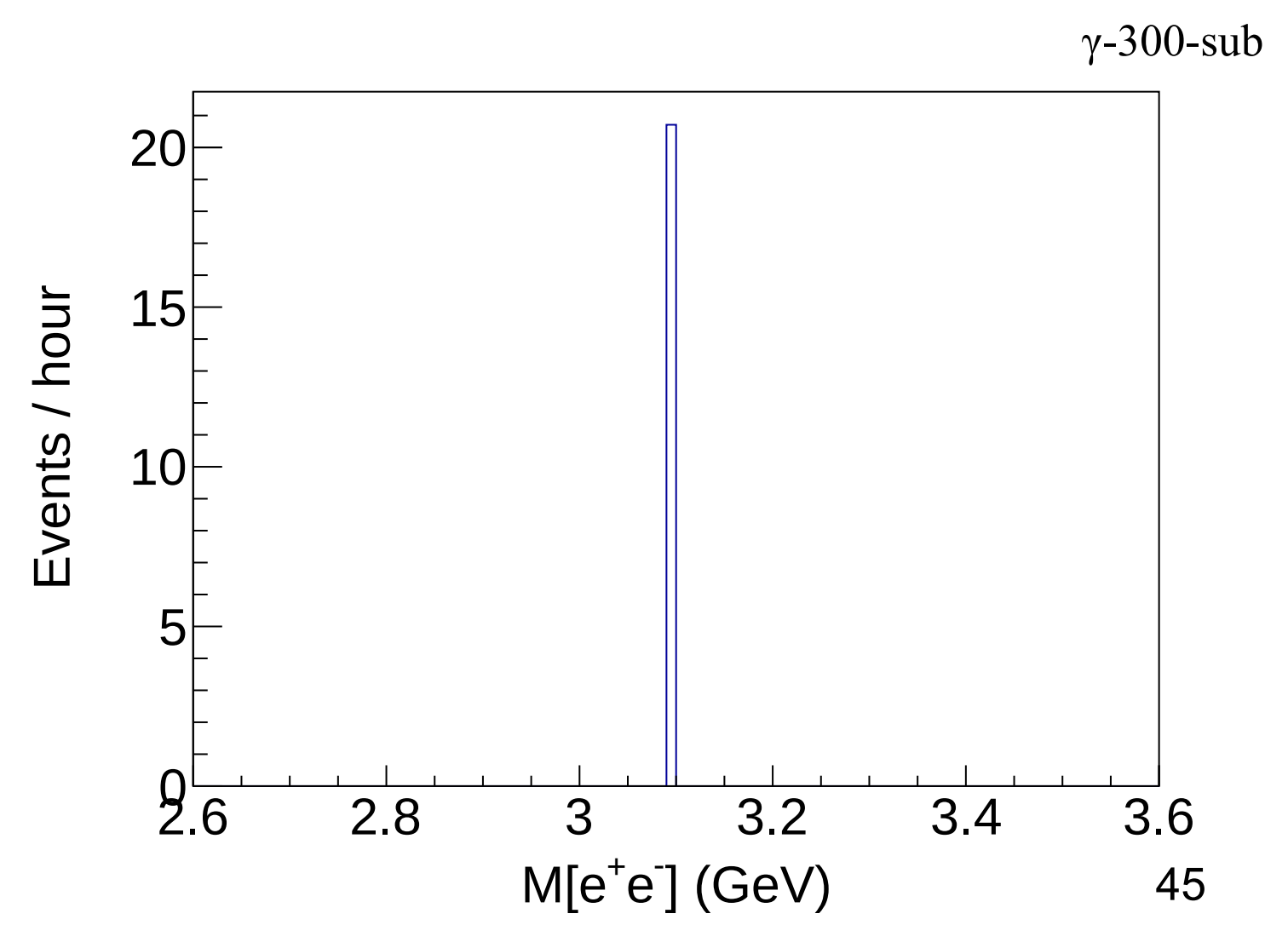

γ-300
P[e⁻] (GeV)
P[e⁺] (GeV)
0
2
4
6
8
10
1
10⁻¹
10⁻²
40

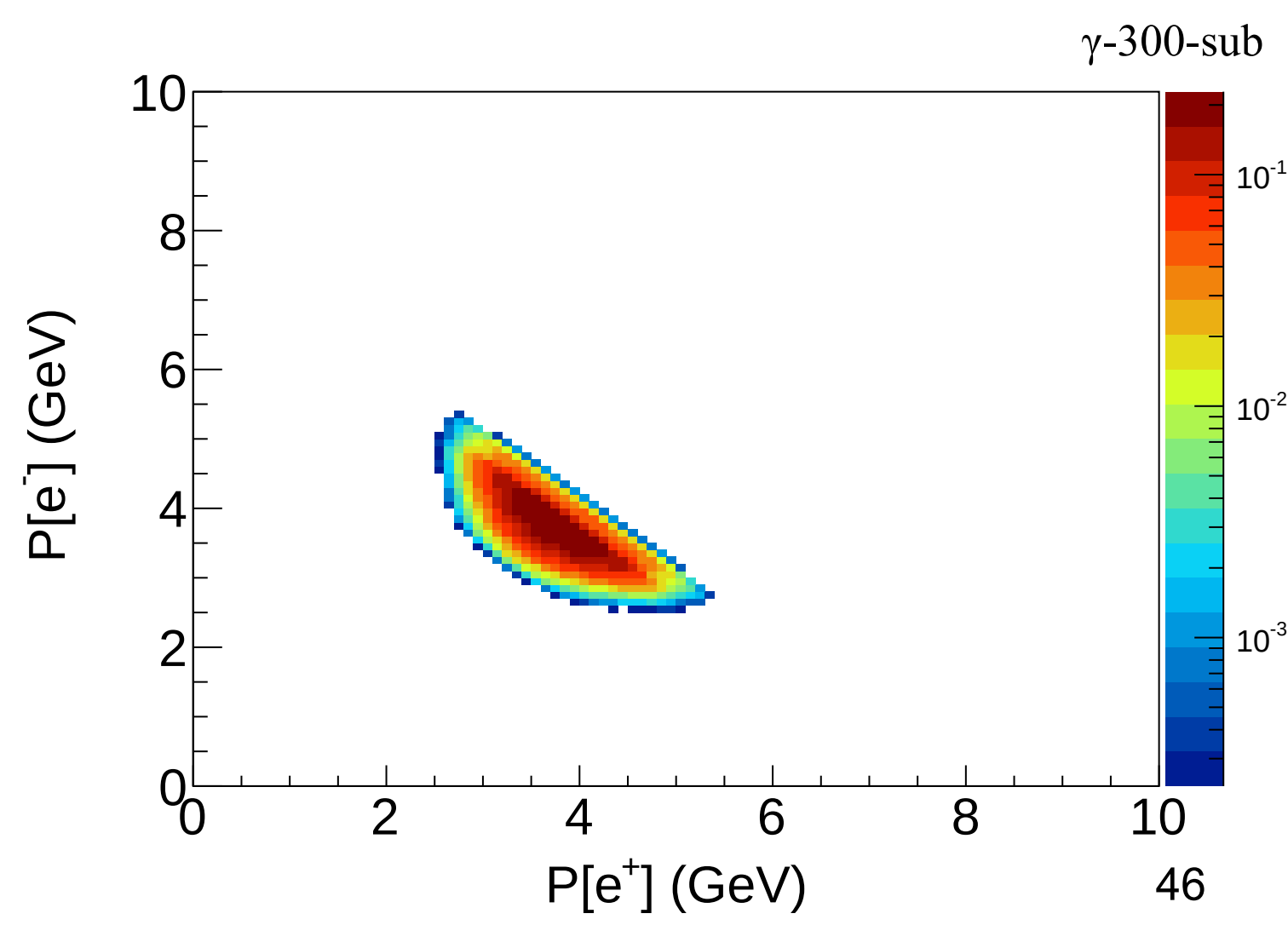

γ-300
10
8
6
4
2
0
0
50
100
150
P[e⁻] (GeV)
θ[e⁻] (deg)
1
10⁻¹
10⁻²
41

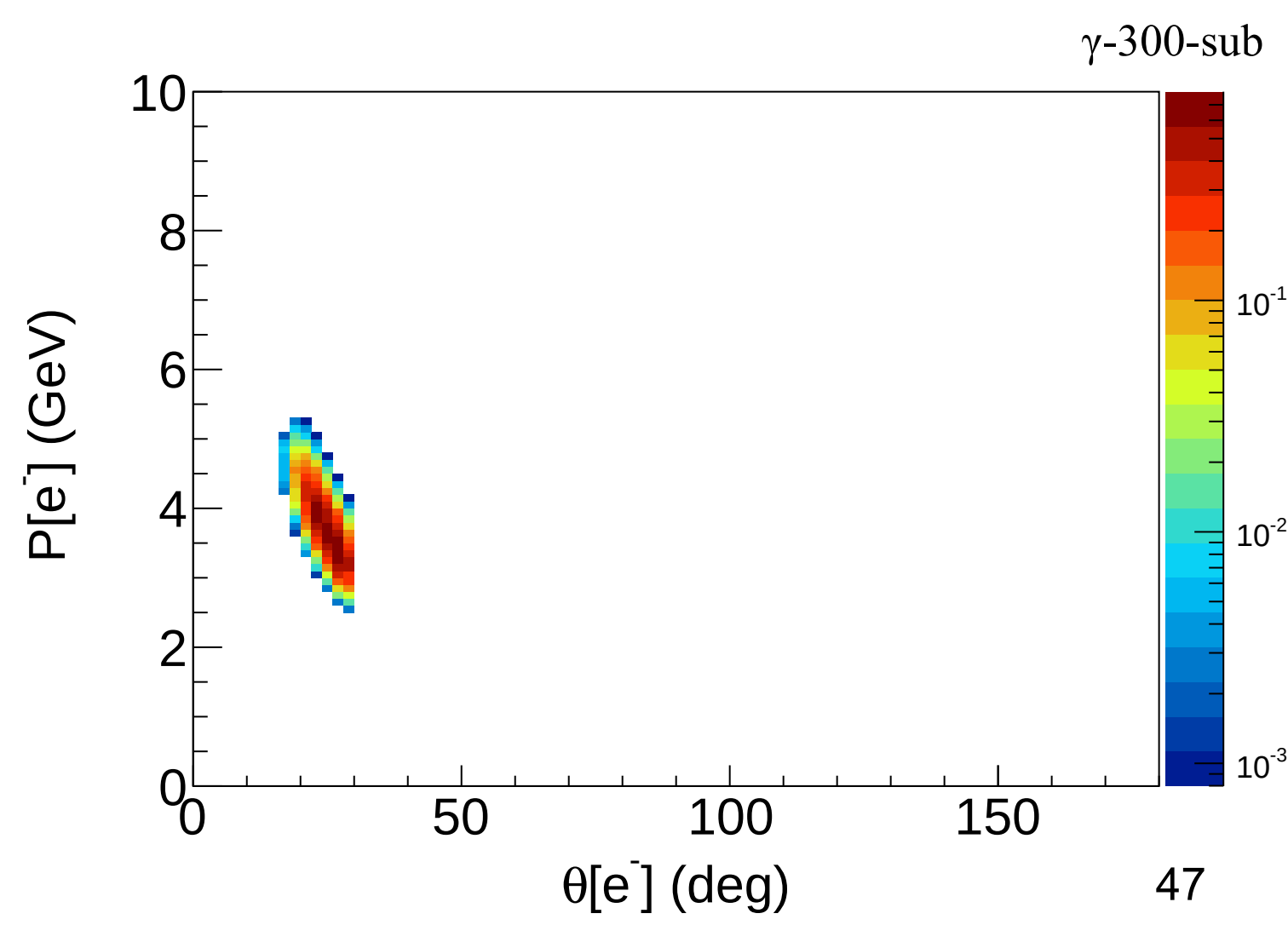

γ-300
10
8
6
4
2
0
P[e+] (GeV)
0
50
100
150
θ[e+] (deg)
1
10-1
10-2
42

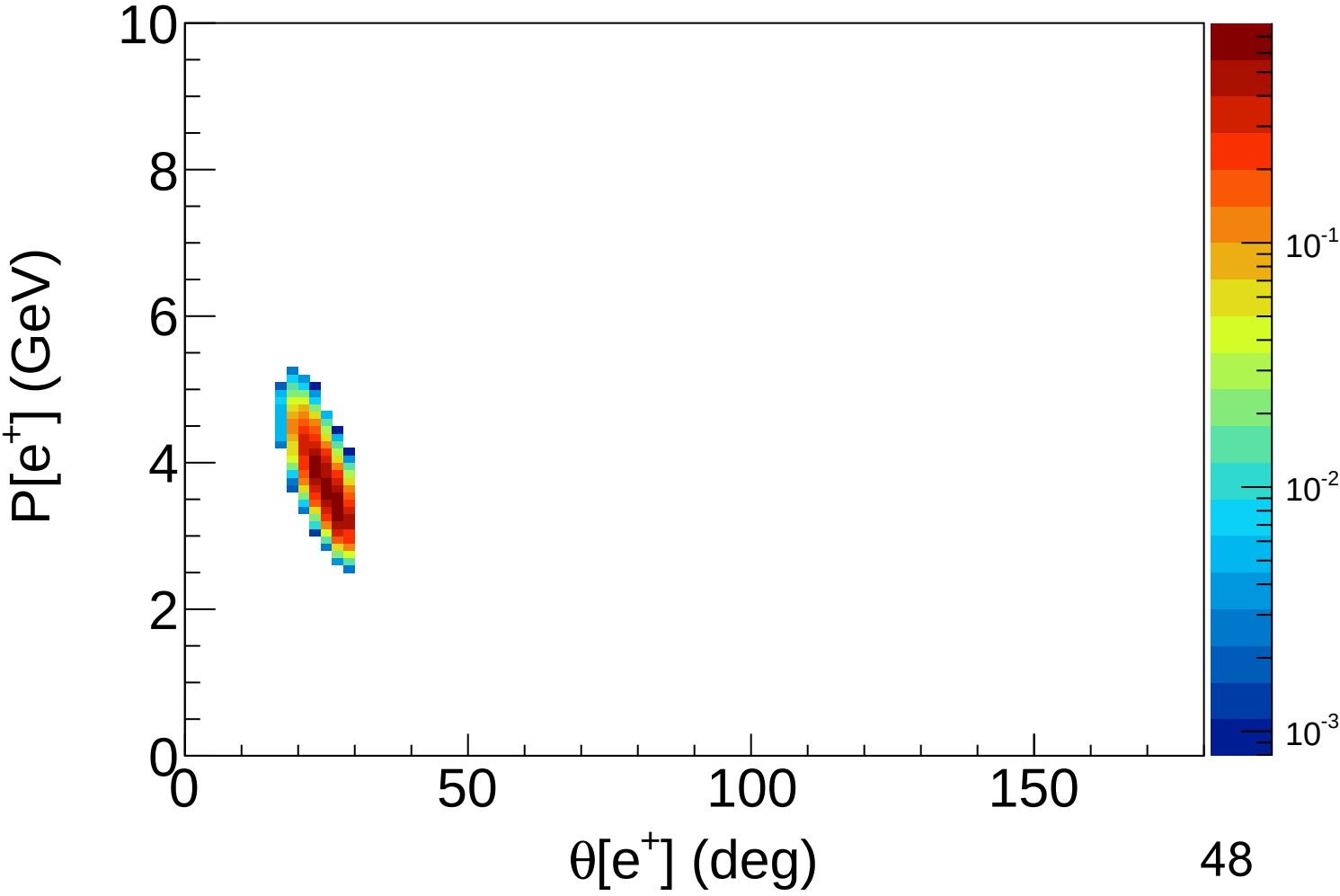

γ-300
P[J/ψ] (GeV)
θ[J/ψ] (deg)
0
2
4
6
8
10
0
50
100
150
10
1
10-1

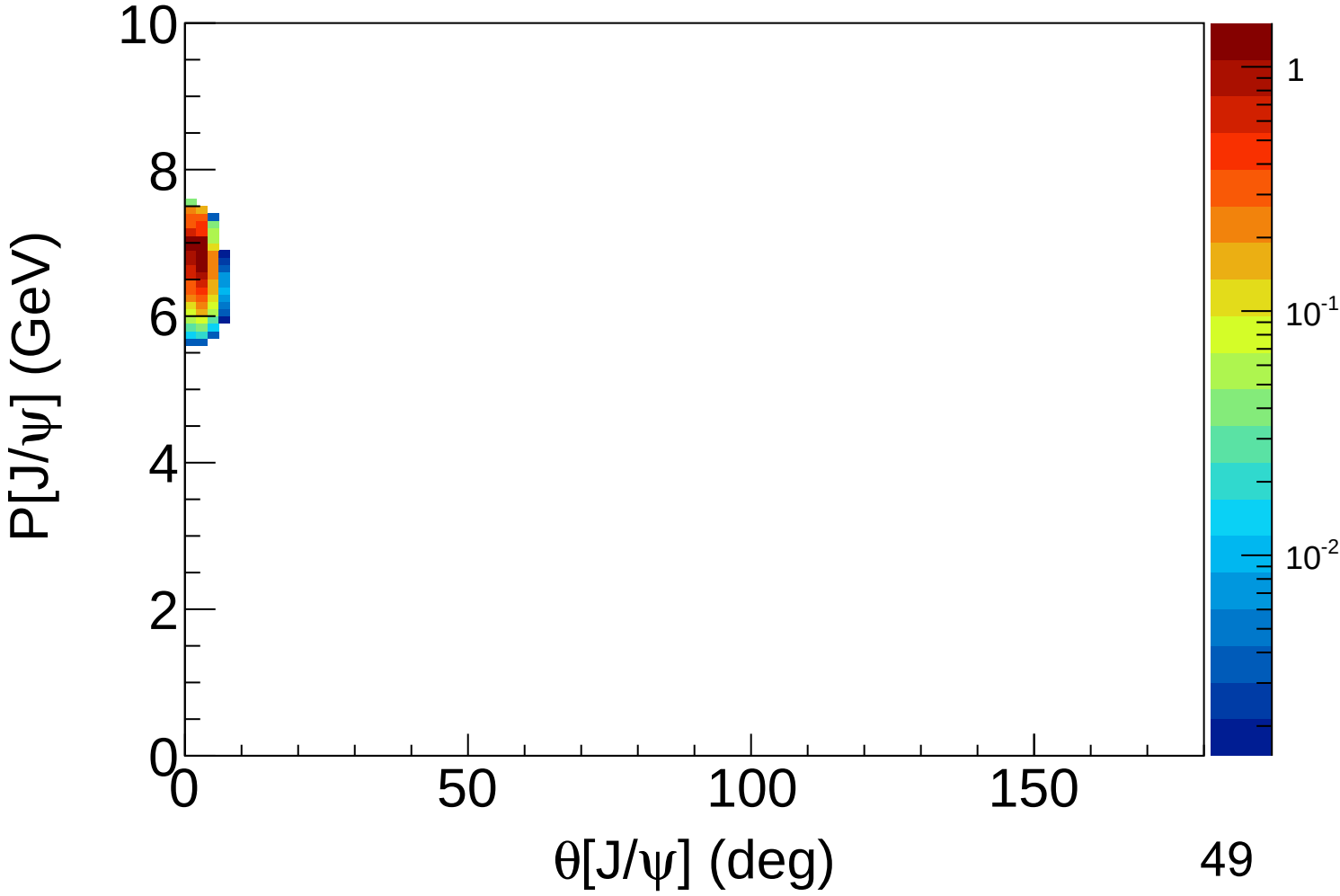

γ-300
100
80
60
40
20
0
Events / hour
0
0.2
0.4
0.6
0.8
1
P[p]min (GeV)
44

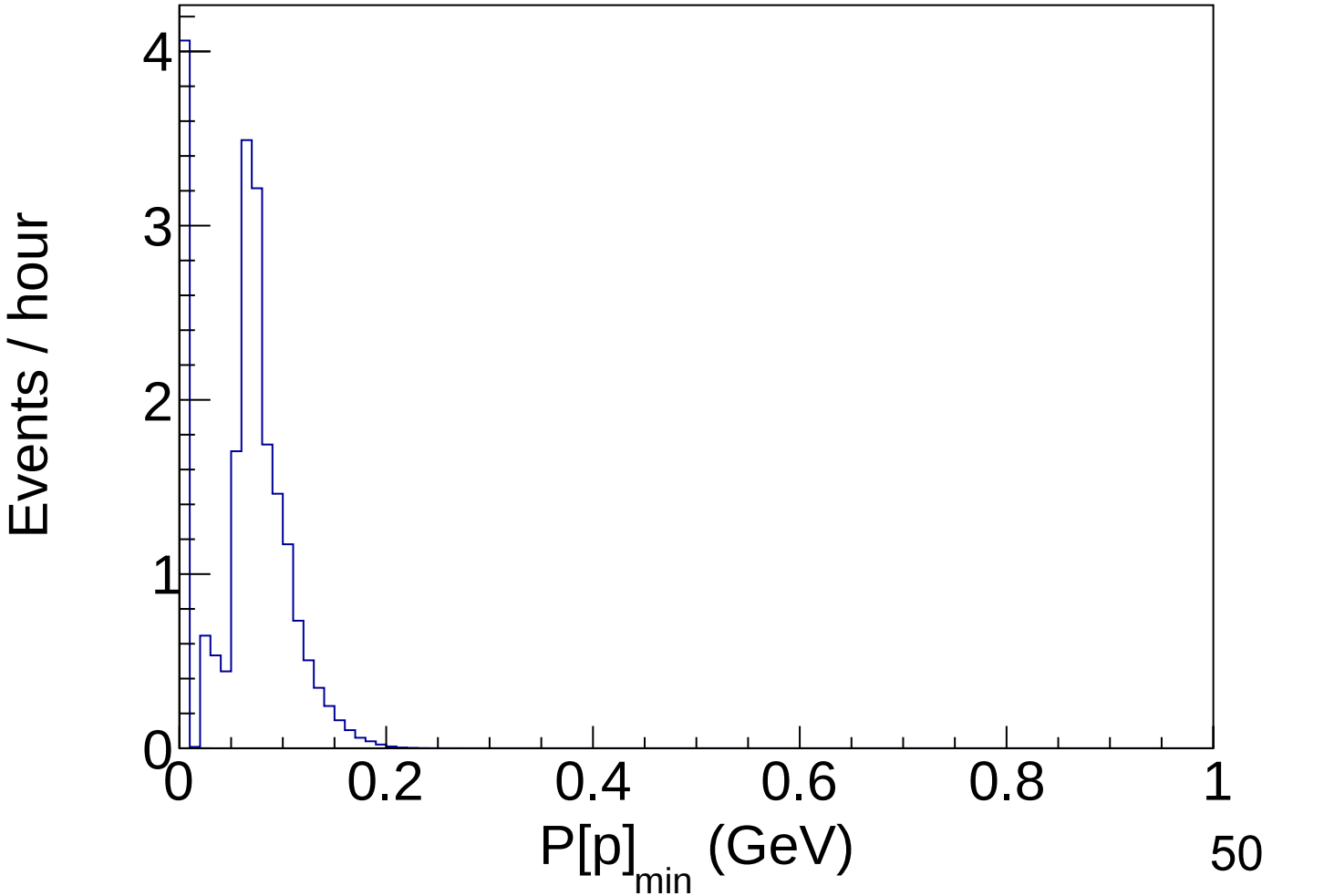

γ-300-sub
Events / hour
0
5
10
15
20
2.6
2.8
3
3.2
3.4
3.6
M[e+e-] (GeV)
45


γ-300-sub
P[e⁻] (GeV)
P[e⁺] (GeV)
0
2
4
6
8
10
10⁻¹
10⁻²
10⁻³


γ-300-sub
P[e⁻] (GeV)
θ[e⁻] (deg)
0
2
4
6
8
10
0
50
100
150
10⁻¹
10⁻²
10⁻³


γ-300-sub
P[e+] (GeV)
θ[e+] (deg)
0
2
4
6
8
10
0
50
100
150
10-1
10-2
10-3


γ-300-sub
P[J/ψ] (GeV)
θ[J/ψ] (deg)
0
2
4
6
8
10
0
50
100
150
1
10-1
10-2


γ-300-sub
Events / hour
0
1
2
3
4
0
0.2
0.4
0.6
0.8
1
P[p]min (GeV)
50