SoLID pi/e ratio and rejection

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method

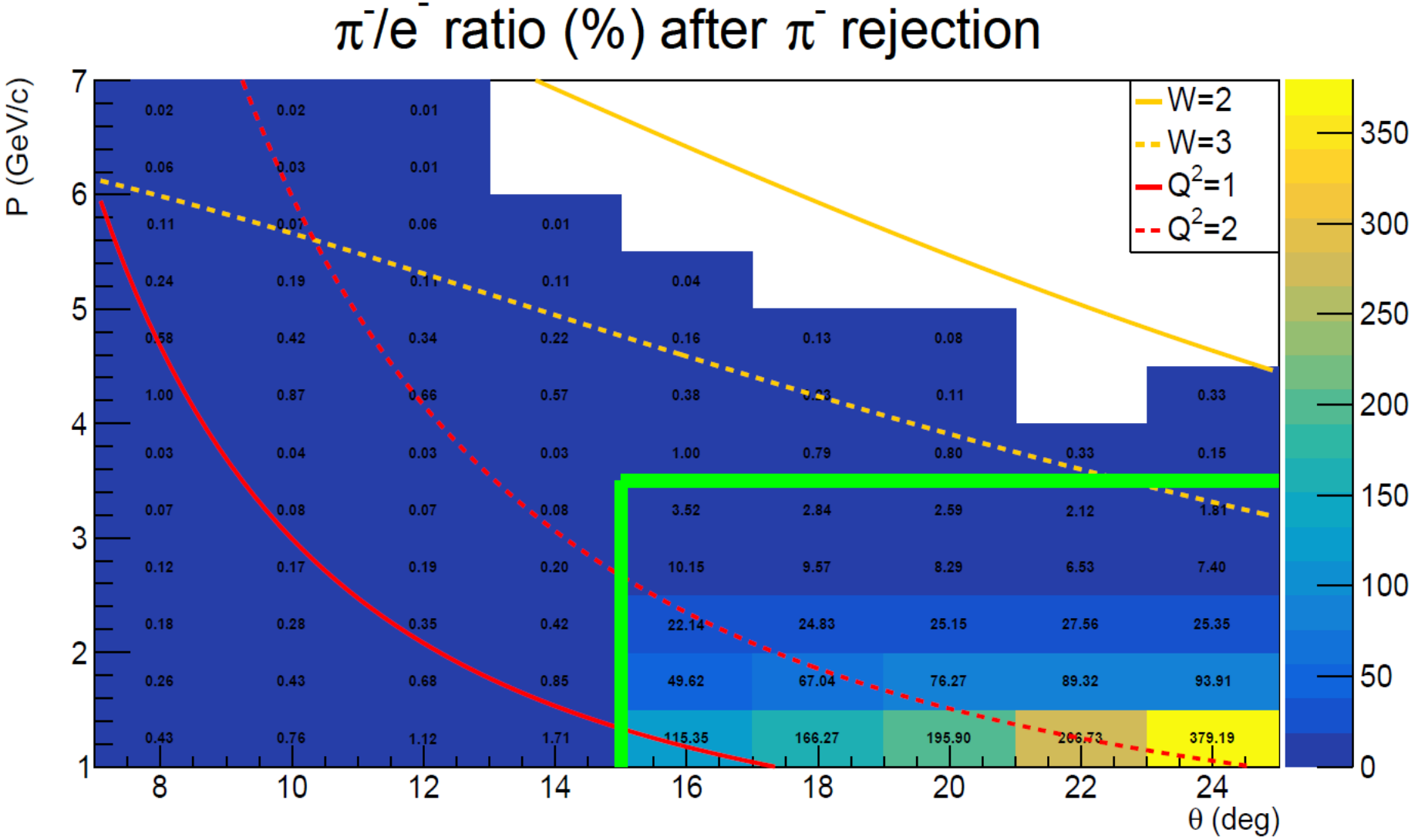
Code and log in https://github.com/JeffersonLab/solid_gemc/tree/master/analysis/pid

- pi/e ratio after pi rejection is obtained from
  - pi and e inclusive generator
    - pi inclusive generator, latest "evgen_bggen"
    - e inclusive generator, latest "evgen_inclusive_e" (eAll) without radiation correction
  - (under work) SoLID detector simulation (at least EC+LGC) for e detection and pi rejection
    - Online performance: trigger rate study shows general pi rejection factor 1e-2 for EC (6+1module) and additional 6e-3 for LGC (2 pe in each of 2 PMT, P<4GeV), total ~6e-5?
    - Offline performance: 5e-3 for EC? Additional 1e-3 for LGC? total 1e-5 or 1e-6?
  - (for now) use conservative simple factors to estimate offline performance
    - e detection factor 100%
    - pi rejection factor
      - 1e-4 (FA P<4GeV EC+LGC) and 5e-3 (FA P>4GeV EC) and 5e-3 (LA EC), for SIDIS_He3 and JPsi_LH2
      - 1e-4 (FA P<4GeV EC+LGC) and 5e-3 (FA P>4GeV EC), for PVDIS_LD2
- pi/e ratio after pi rejection can be controlled below 1%
  - Except for JPsi_LH2, P<3GeV at LA, but invariant mass and kinematic fitting can help

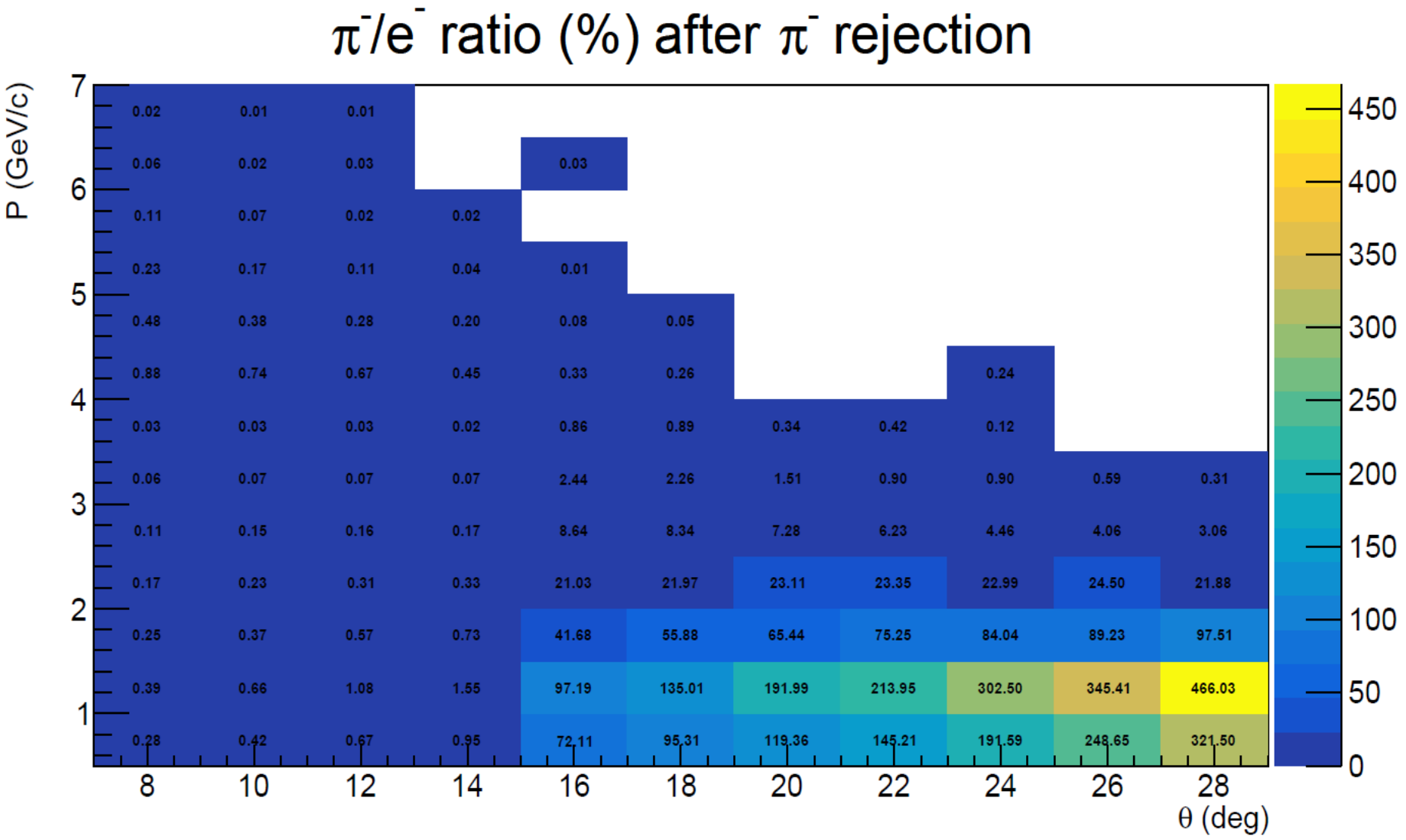
LGC using N2 instead of CO2, could have rejection much higher than 4GeV?

the pion generator would take too much time to generate events at high P and large theta

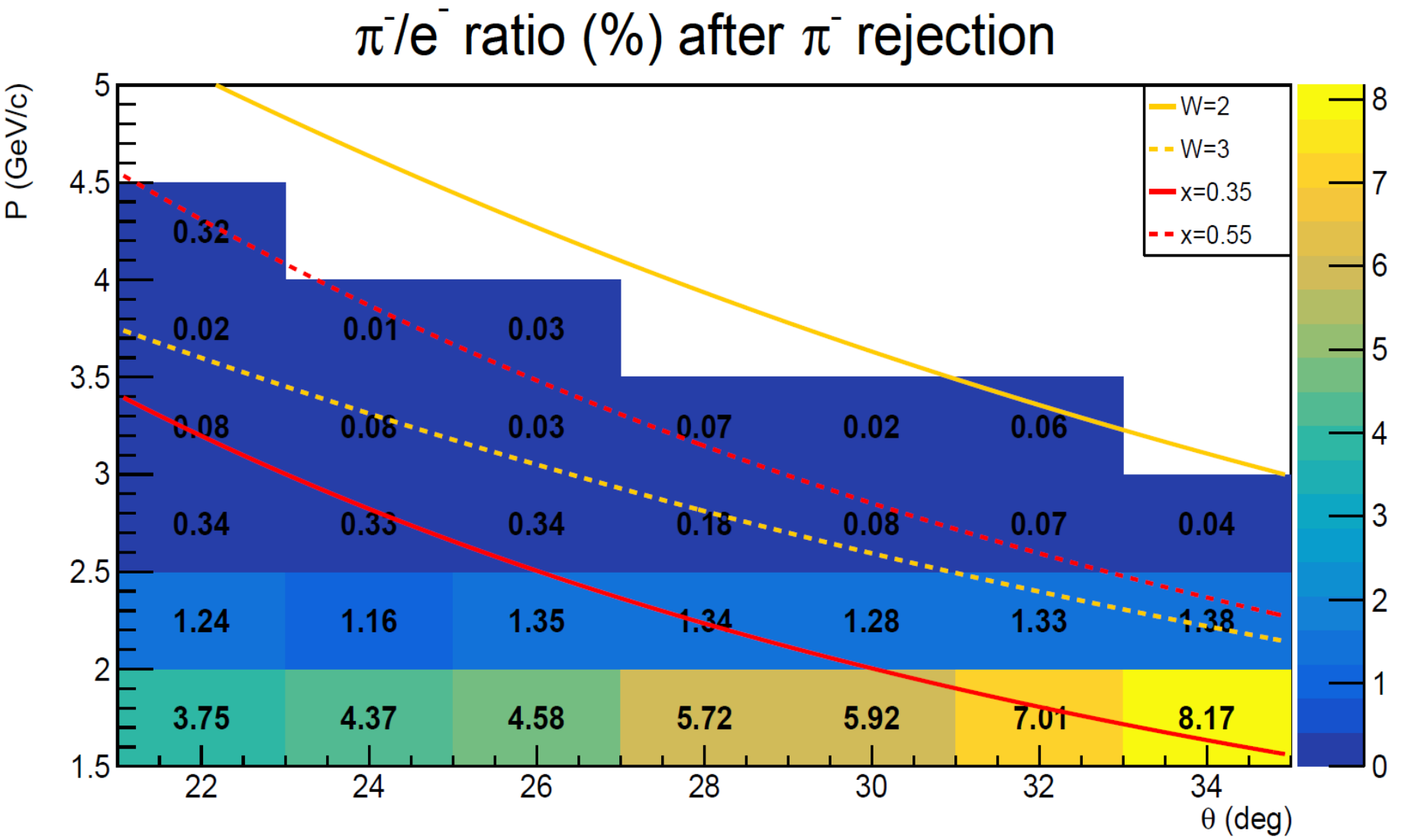
SIDIS He3


π⁻/e⁻ ratio (%) after π⁻ rejection
P (GeV/c)
θ (deg)
W=2
W=3
Q²=1
Q²=2
0.02 0.02 0.01
0.06 0.03 0.01
0.11 0.07 0.06 0.01
0.24 0.19 0.11 0.11 0.04
0.58 0.42 0.34 0.22 0.16 0.13 0.08
1.00 0.87 0.66 0.57 0.38 0.23 0.11 0.33
0.03 0.04 0.03 0.03 1.00 0.79 0.80 0.33 0.15
0.07 0.08 0.07 0.08 3.52 2.84 2.59 2.12 1.81
0.12 0.17 0.19 0.20 10.15 9.57 8.29 6.53 7.40
0.18 0.28 0.35 0.42 22.14 24.83 25.15 27.56 25.35
0.26 0.43 0.68 0.85 49.62 67.04 76.27 89.32 93.91
0.43 0.76 1.12 1.71 115.35 166.27 195.90 206.73 379.19

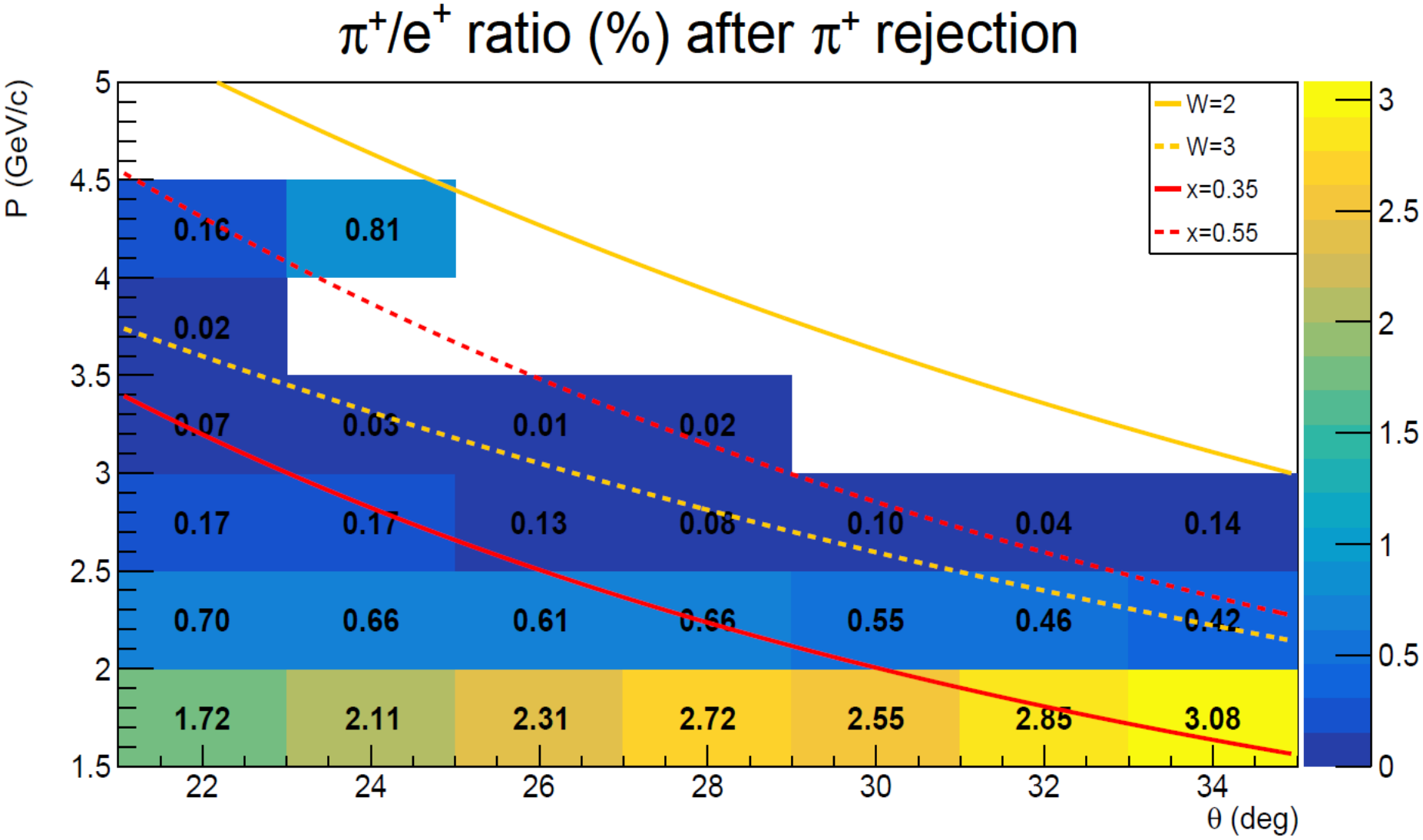
JPsi_LH2


π⁻/e⁻ ratio (%) after π⁻ rejection
P (GeV/c)
θ (deg)
0.02 0.01 0.01
0.06 0.02 0.03 0.03
0.11 0.07 0.02 0.02
0.23 0.17 0.11 0.04 0.01
0.48 0.38 0.28 0.20 0.08 0.05
0.88 0.74 0.67 0.45 0.33 0.26 0.24
0.03 0.03 0.03 0.02 0.86 0.89 0.34 0.42 0.12
0.06 0.07 0.07 0.07 2.44 2.26 1.51 0.90 0.90 0.59 0.31
0.11 0.15 0.16 0.17 8.64 8.34 7.28 6.23 4.46 4.06 3.06
0.17 0.23 0.31 0.33 21.03 21.97 23.11 23.35 22.99 24.50 21.88
0.25 0.37 0.57 0.73 41.68 55.88 65.44 75.25 84.04 89.23 97.51
0.39 0.66 1.08 1.55 97.19 135.01 191.99 213.95 302.50 345.41 466.03
0.28 0.42 0.67 0.95 72.11 95.31 119.36 145.21 191.59 248.65 321.50
1 2 3 4 5 6 7
8 10 12 14 16 18 20 22 24 26 28
0 50 100 150 200 250 300 350 400 450

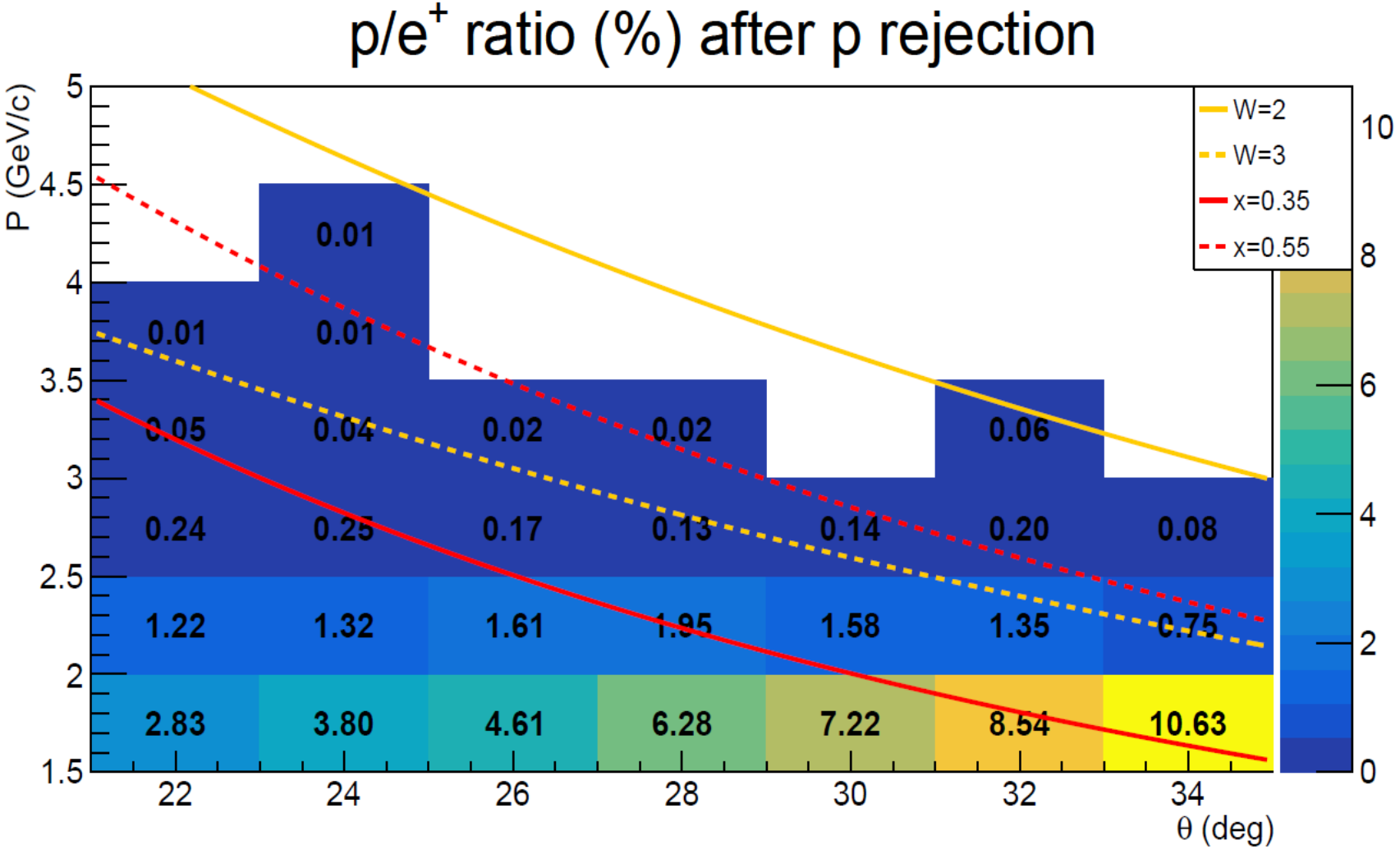
PVDIS_LD2


π⁻/e⁻ ratio (%) after π⁻ rejection
P (GeV/c)
θ (deg)
W=2
W=3
x=0.35
x=0.55
0.32
0.02
0.01
0.03
0.08
0.08
0.03
0.07
0.02
0.06
0.34
0.33
0.34
0.18
0.08
0.07
0.04
1.24
1.16
1.35
1.34
1.28
1.33
1.38
3.75
4.37
4.58
5.72
5.92
7.01
8.17

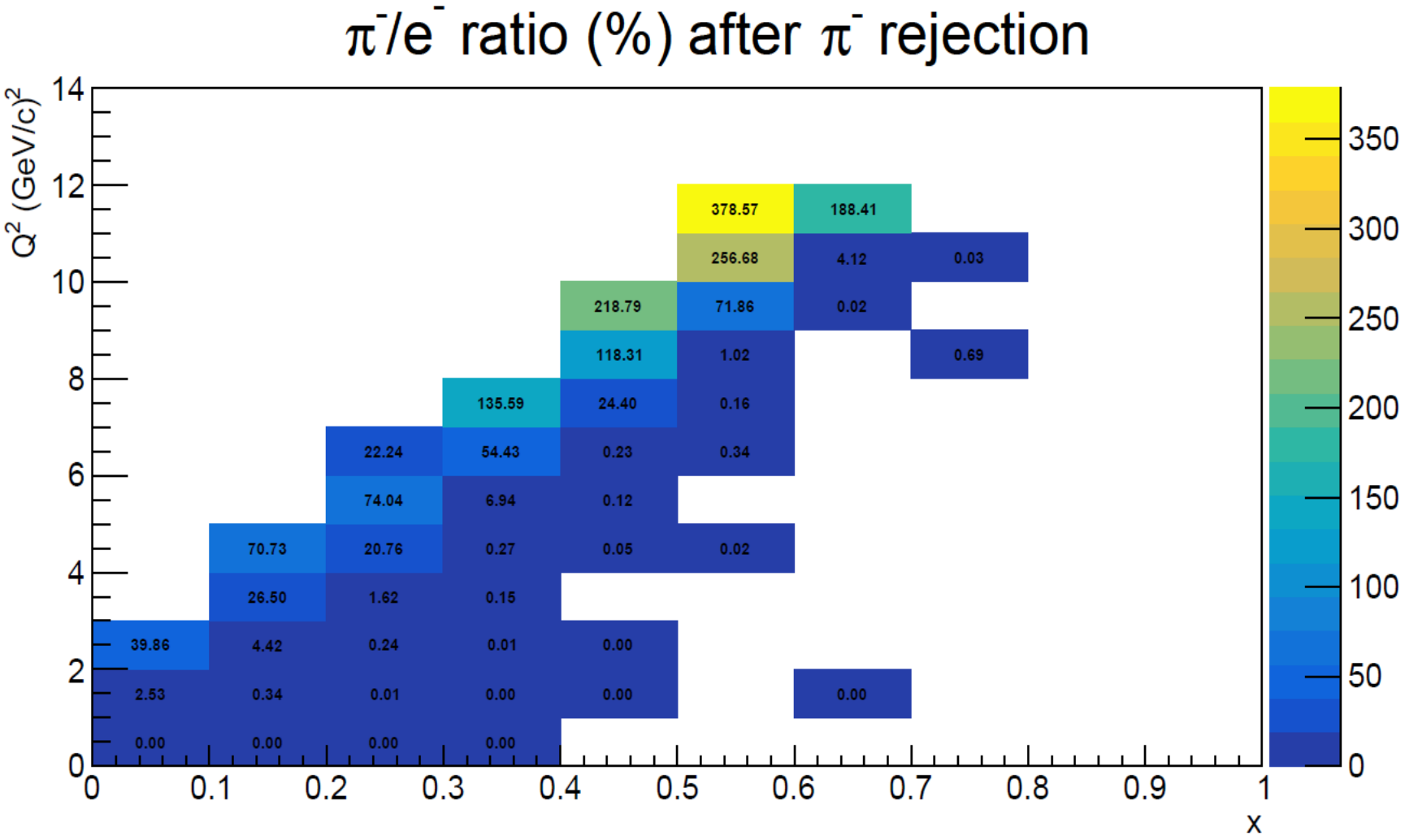
PVDIS_LD2


π+/e+ ratio (%) after π+ rejection
P (GeV/c)
θ (deg)
W=2
W=3
x=0.35
x=0.55
0.16
0.81
0.02
0.07
0.03
0.01
0.02
0.17
0.17
0.13
0.08
0.10
0.04
0.14
0.70
0.66
0.61
0.66
0.55
0.46
0.42
1.72
2.11
2.31
2.72
2.55
2.85
3.08

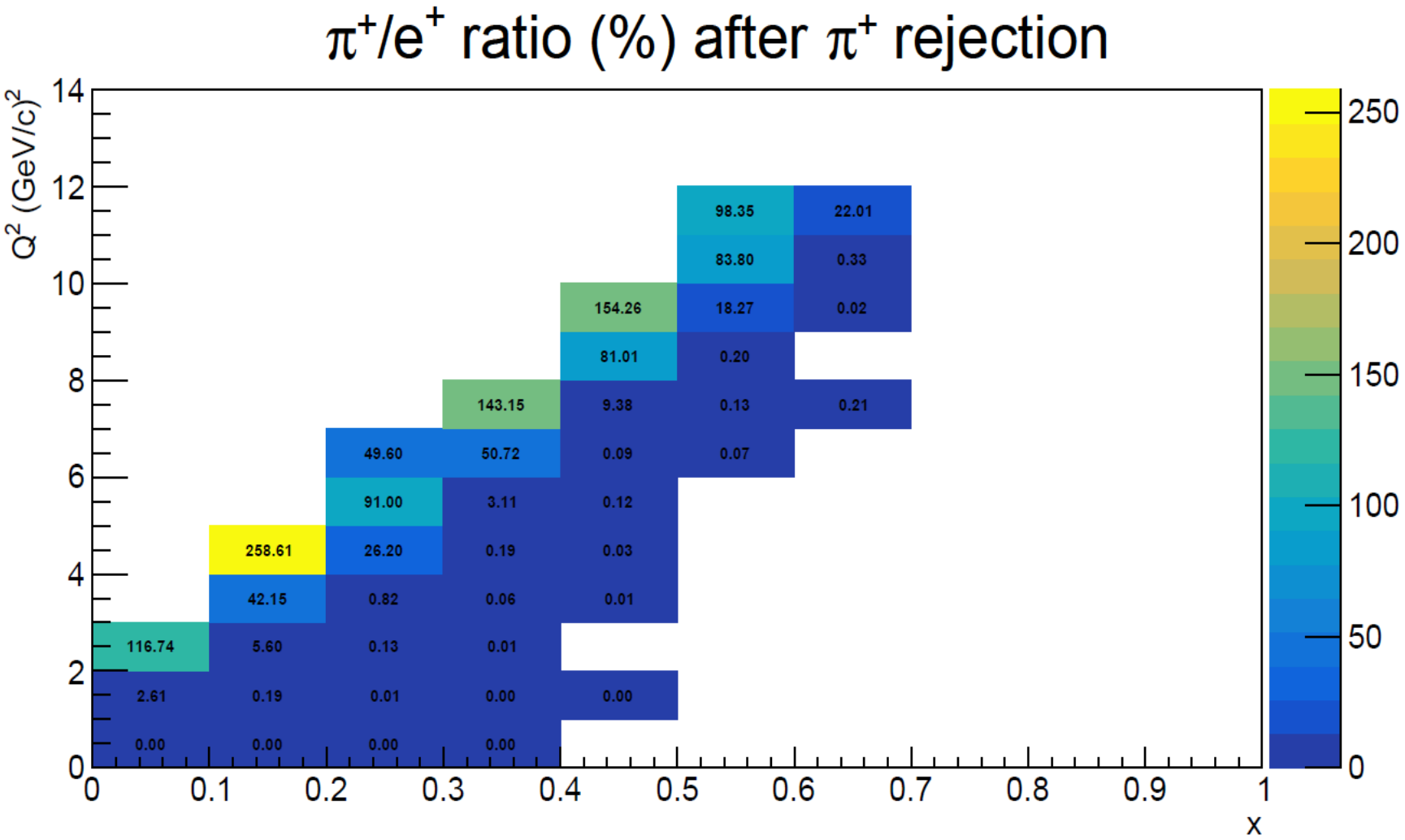
PVDIS_LD2


p/e+ ratio (%) after p rejection
P (GeV/c)
θ (deg)
W=2
W=3
x=0.35
x=0.55
0.01
0.01
0.01
0.05
0.04
0.02
0.02
0.06
0.24
0.25
0.17
0.13
0.14
0.20
0.08
1.22
1.32
1.61
1.95
1.58
1.35
0.75
2.83
3.80
4.61
6.28
7.22
8.54
10.63

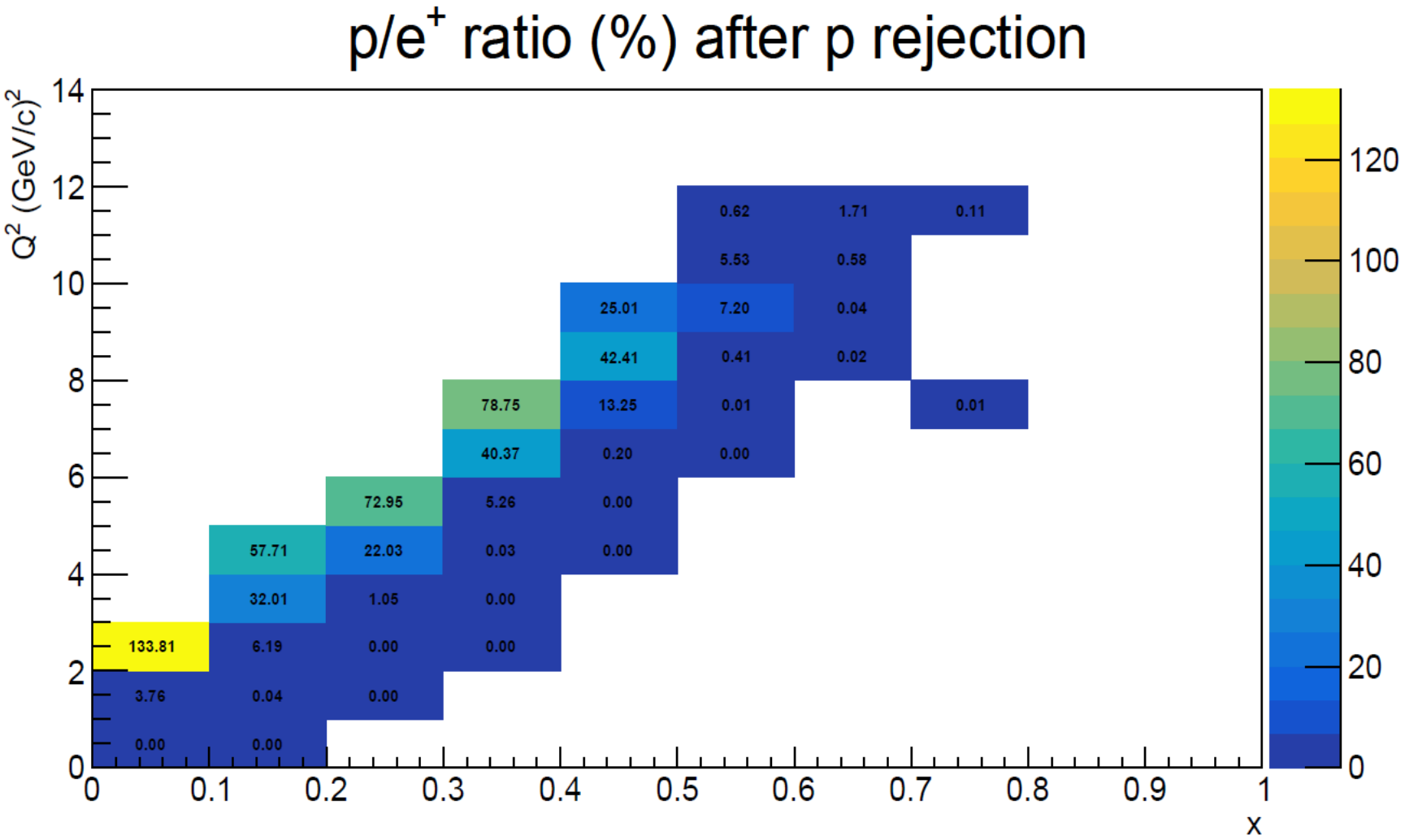
PVDIS_LD2


π⁻/e⁻ ratio (%) after π⁻ rejection
Q² (GeV/c)²
x
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
2
4
6
8
10
12
14
350
300
250
200
150
100
50
0
378.57
188.41
256.68
4.12
0.03
218.79
71.86
0.02
118.31
1.02
0.69
135.59
24.40
0.16
22.24
54.43
0.23
0.34
74.04
6.94
0.12
70.73
20.76
0.27
0.05
0.02
26.50
1.62
0.15
39.86
4.42
0.24
0.01
0.00
2.53
0.34
0.01
0.00
0.00
0.00
0.00
0.00
0.00
0.00
0.00

PVDIS_LD2


π+/e+ ratio (%) after π+ rejection
Q2 (GeV/c)2
x
98.35
22.01
83.80
0.33
154.26
18.27
0.02
81.01
0.20
143.15
9.38
0.13
0.21
49.60
50.72
0.09
0.07
91.00
3.11
0.12
258.61
26.20
0.19
0.03
42.15
0.82
0.06
0.01
116.74
5.60
0.13
0.01
2.61
0.19
0.01
0.00
0.00
0.00
0.00
0.00
0.00
0
2
4
6
8
10
12
14
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
250
200
150
100
50
0

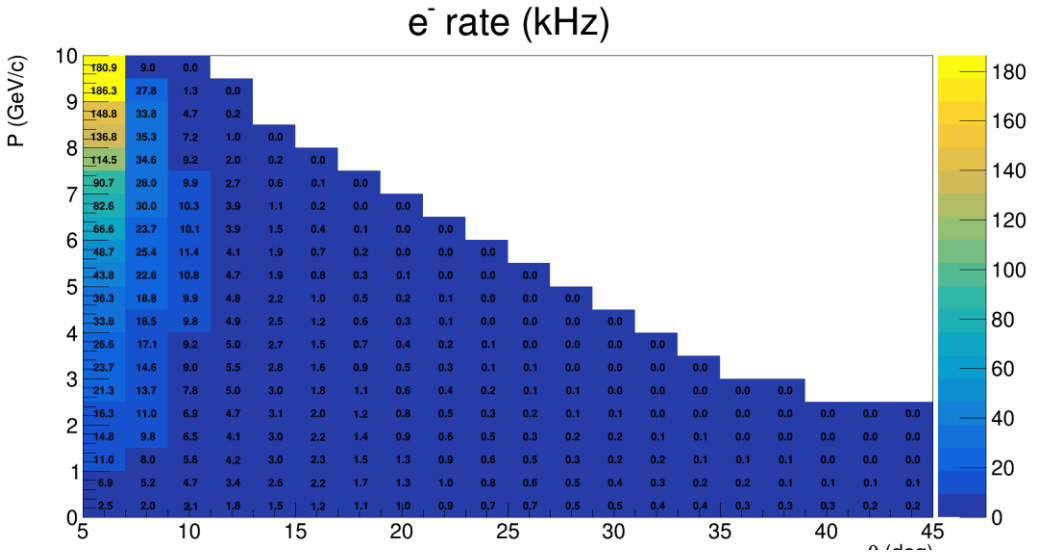
PVDIS_LD2

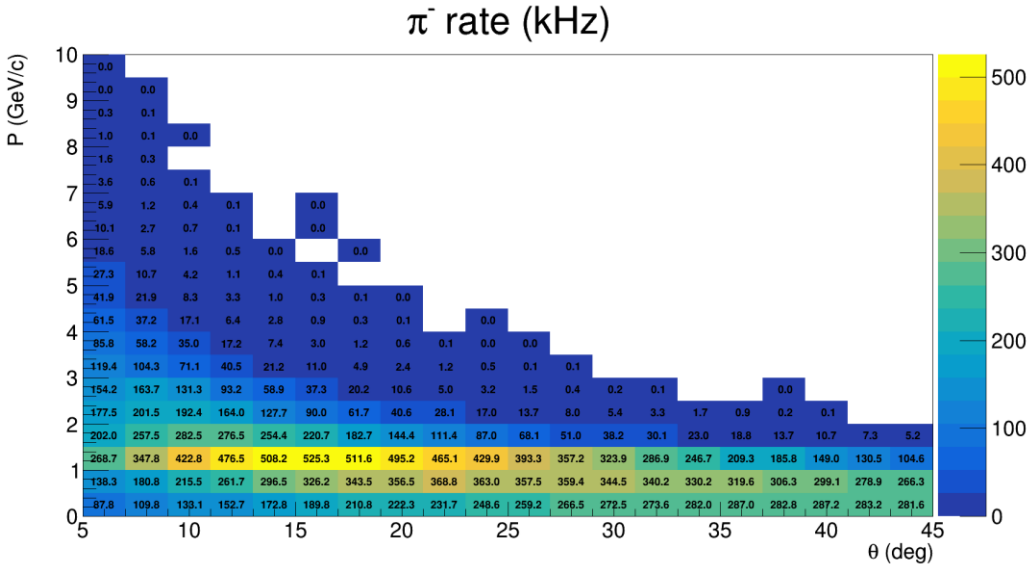

p/e+ ratio (%) after p rejection
Q2 (GeV/c)2
x
0.62
1.71
0.11
5.53
0.58
25.01
7.20
0.04
42.41
0.41
0.02
78.75
13.25
0.01
0.01
40.37
0.20
0.00
72.95
5.26
0.00
57.71
22.03
0.03
0.00
32.01
1.05
0.00
133.81
6.19
0.00
0.00
3.76
0.04
0.00
0.00
0.00
0
2
4
6
8
10
12
14
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
20
40
60
80
100
120

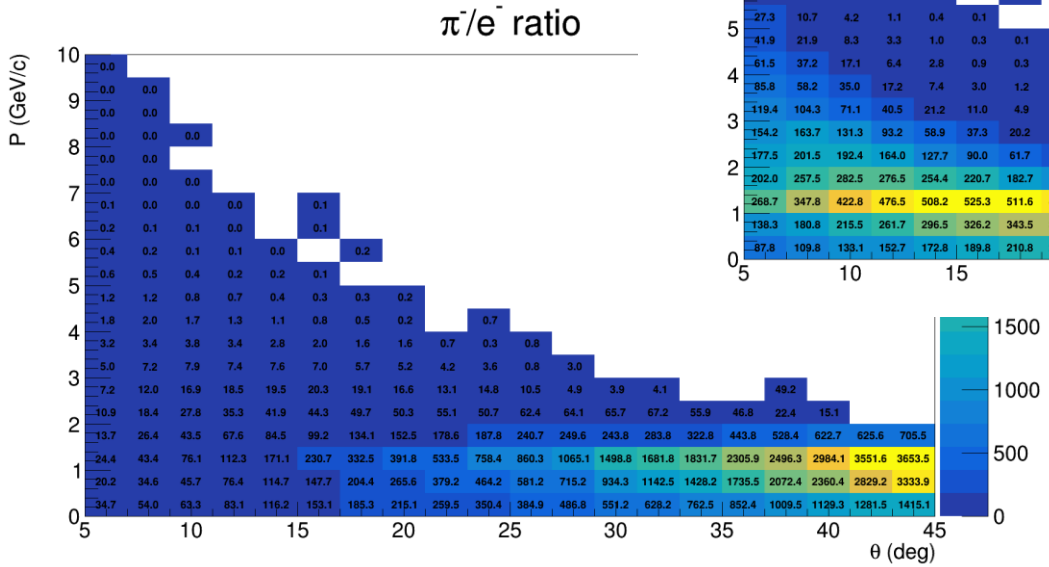
PVDIS_LD2

backup

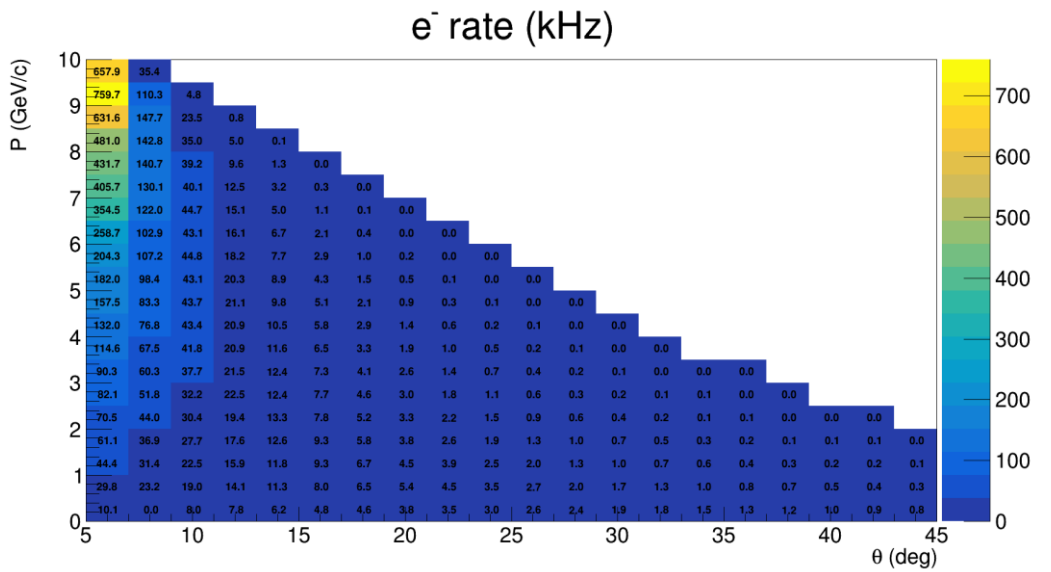
SIDIS_He3

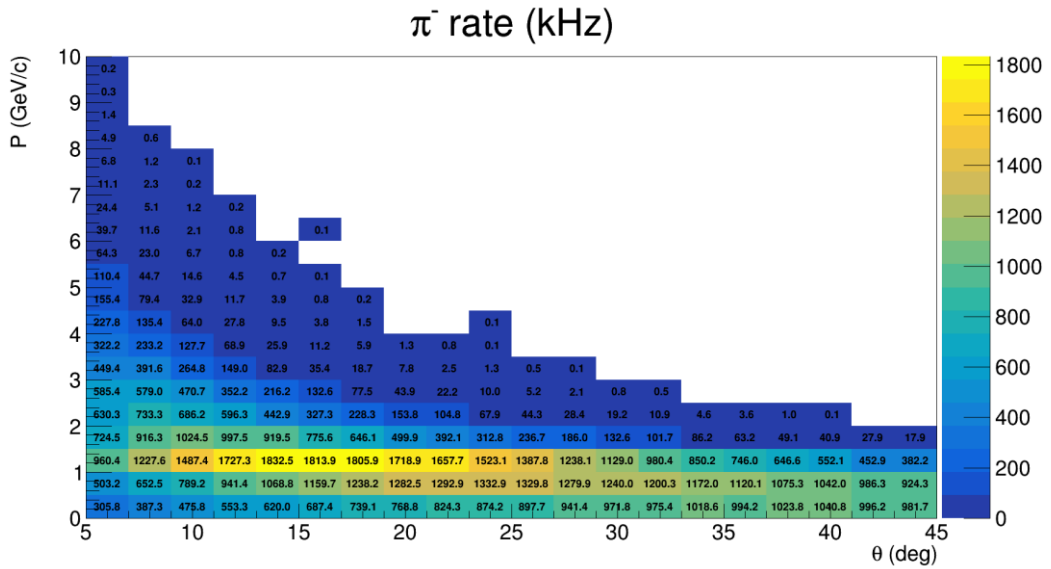


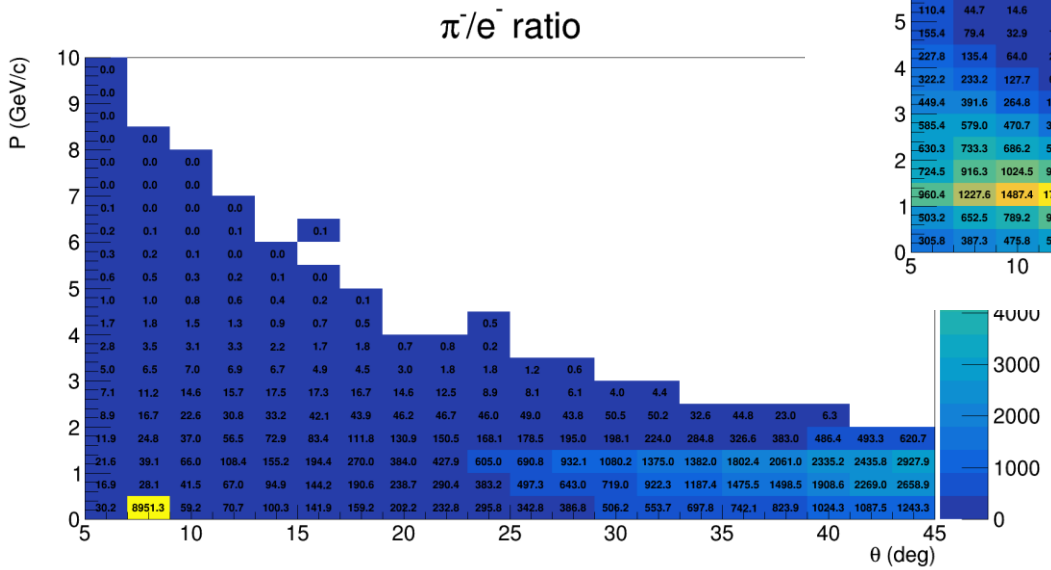




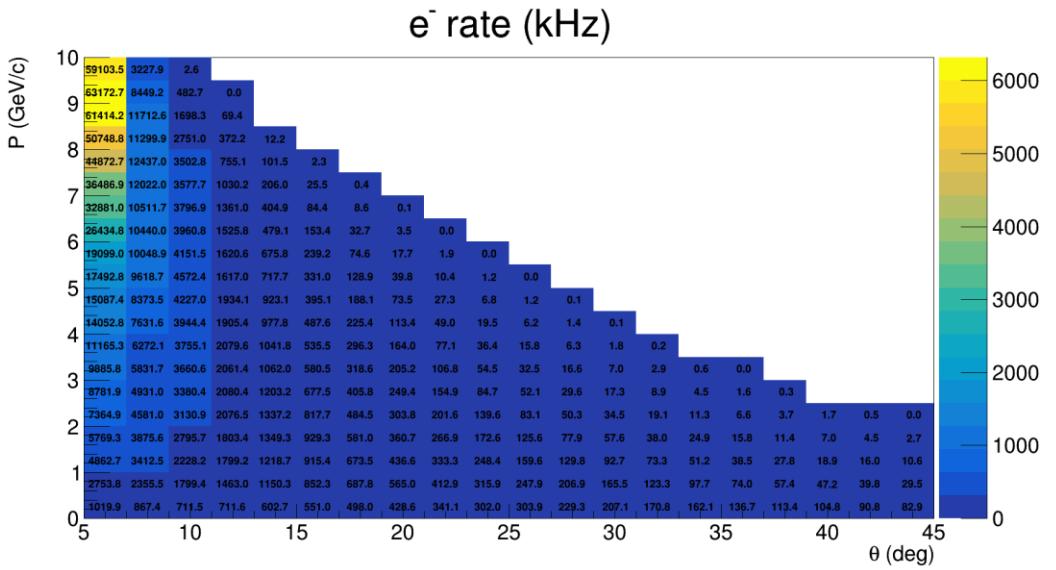
JPsi_LH2

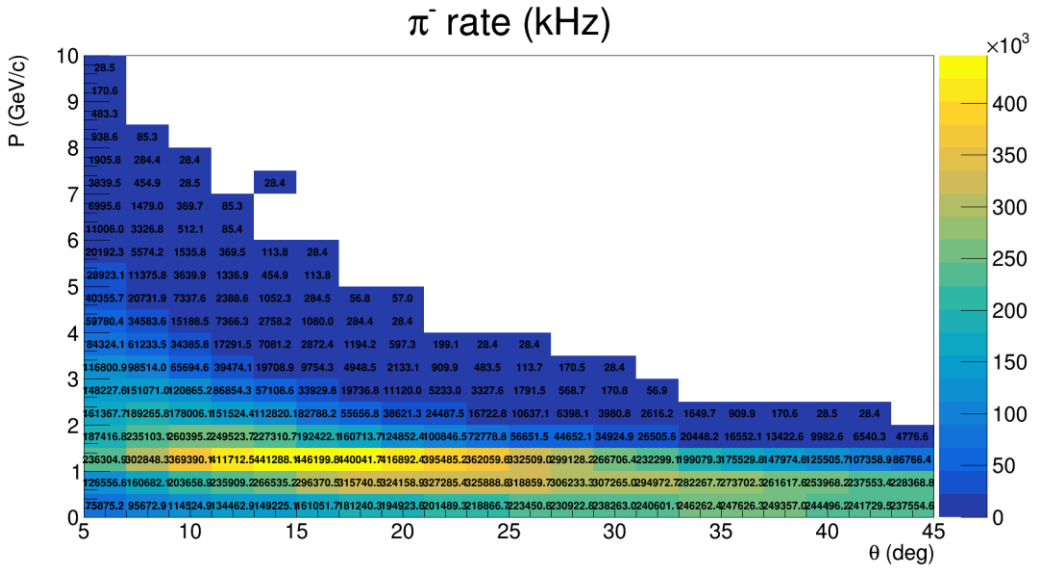

e⁻ rate (kHz)
P (GeV/c)
θ (deg)

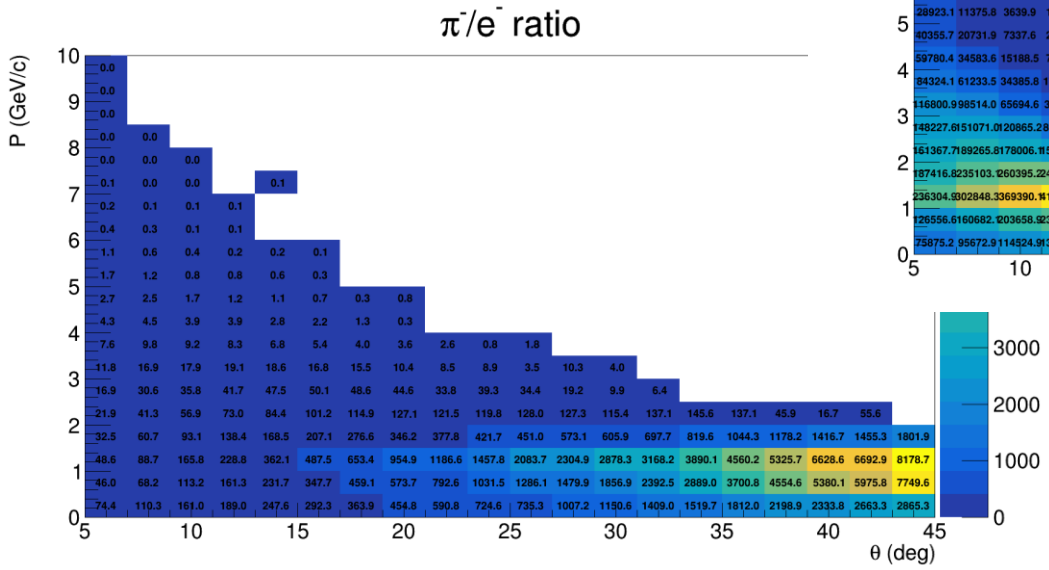

π⁻ rate (kHz)
P (GeV/c)
θ (deg)


π⁻/e⁻ ratio
P (GeV/c)
θ (deg)

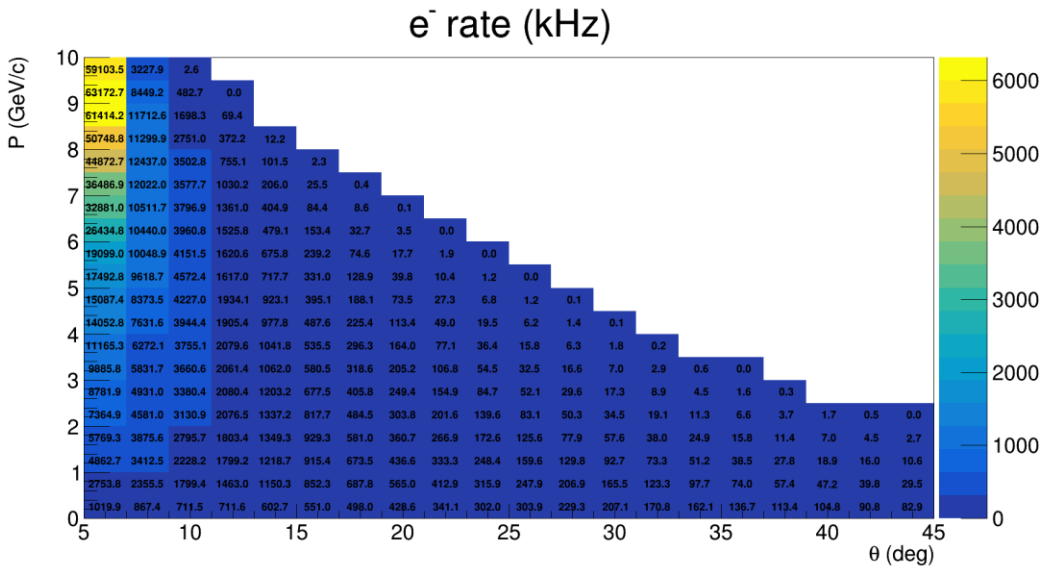
PVDIS_LD2

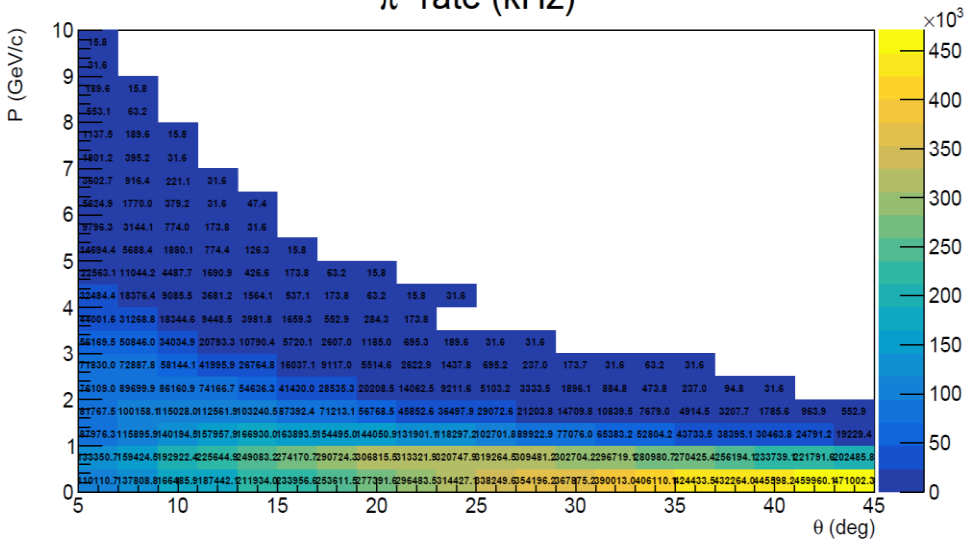

e⁻ rate (kHz)
P (GeV/c)
θ (deg)

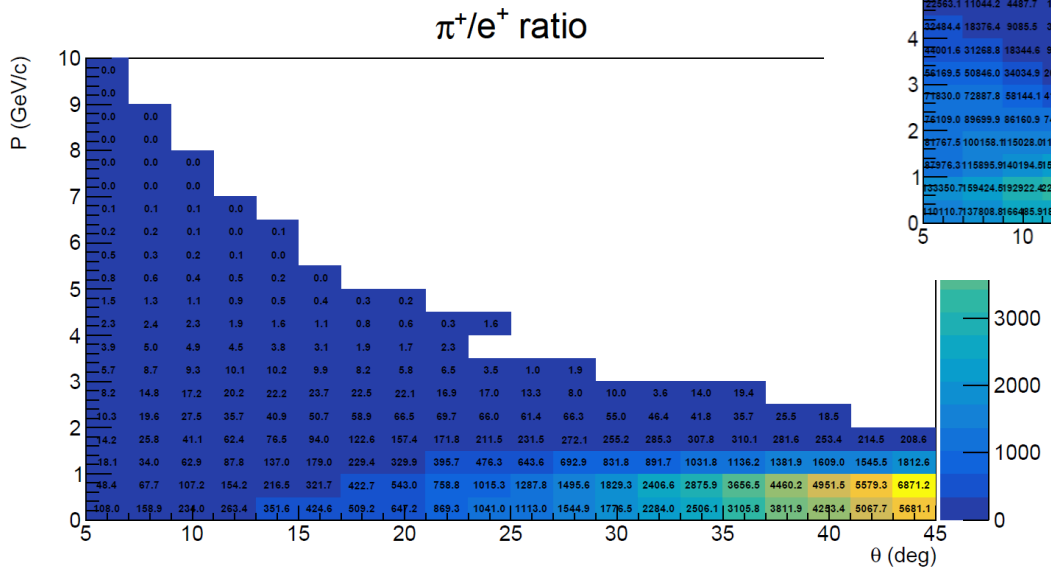

π⁻ rate (kHz)
P (GeV/c)
θ (deg)
×10³


π⁻/e⁻ ratio
P (GeV/c)
θ (deg)

PVDIS_LD2


e⁻ rate (kHz)
P (GeV/c)
θ (deg)


π⁺ rate (kHz)
P (GeV/c)
θ (deg)


π⁺/e⁺ ratio
P (GeV/c)
θ (deg)