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

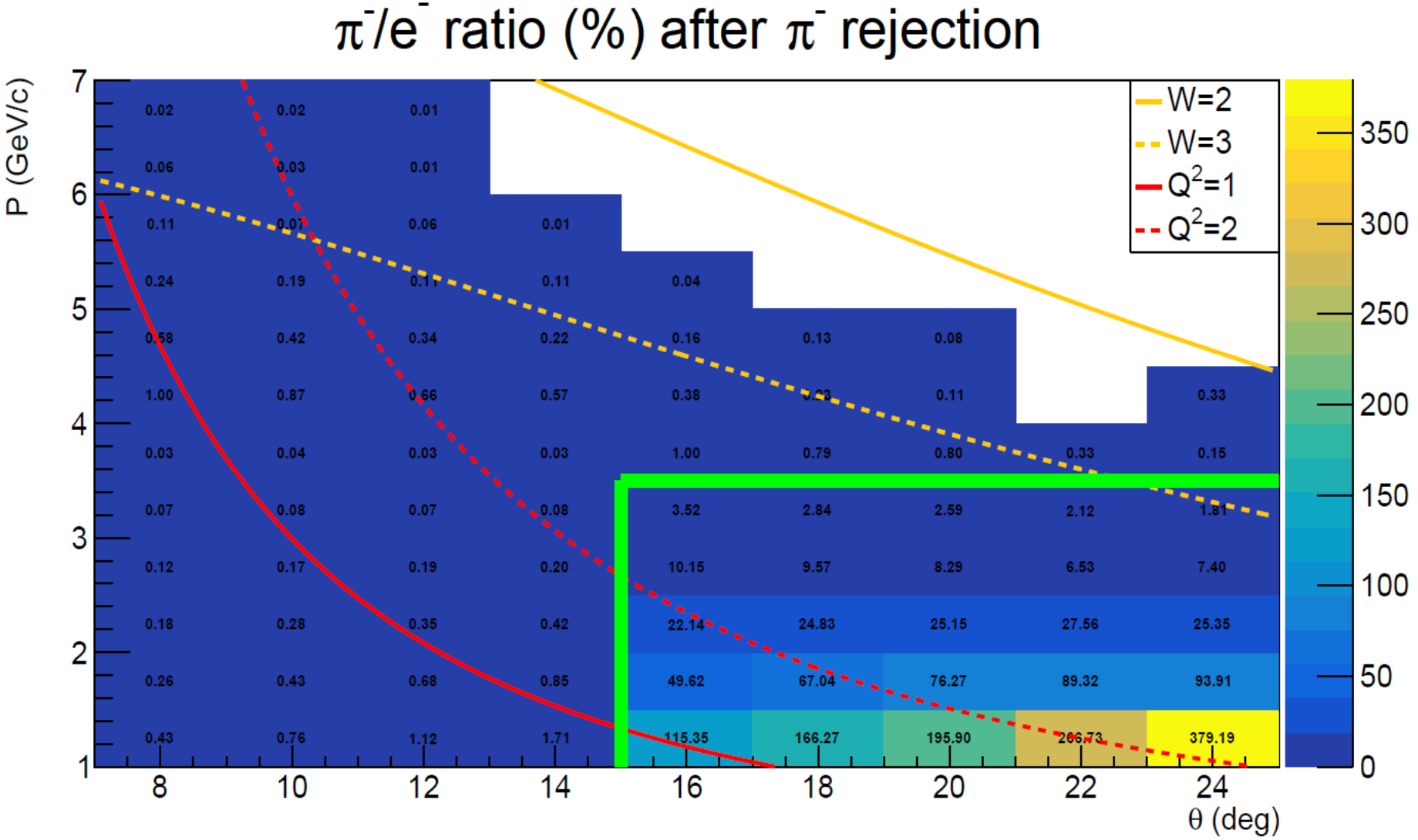
- pi/e ratio after pi rejection is obtained from
  - pi and e inclusive generator
    - pi inclusive generator, latest "evgen_bggen"
    - e inclusive generator, latest "evgen_inclusive_e" (eAll) without radiation correction
  - (under work) SoLID detector simulation (at least EC+LGC) for e detection 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
    - Proton rejection factor
      - 1e-4 (FA), for PVDIS_LD2

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

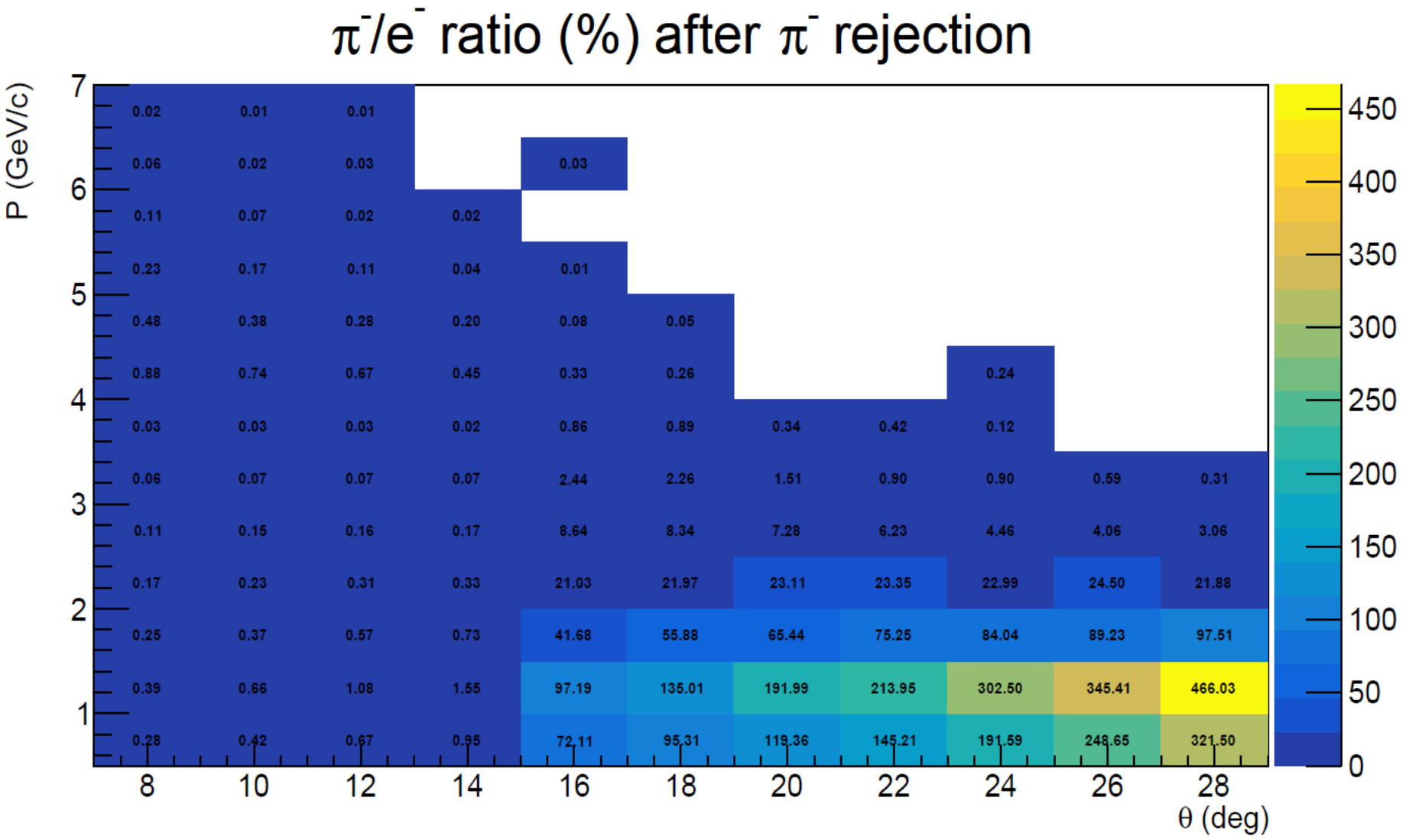
- pi/e ratio after pi rejection can be controlled below 1%
  - Except for JPsi_LH2, P<3GeV at LA, but invariant mass and kinematic fitting can help

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

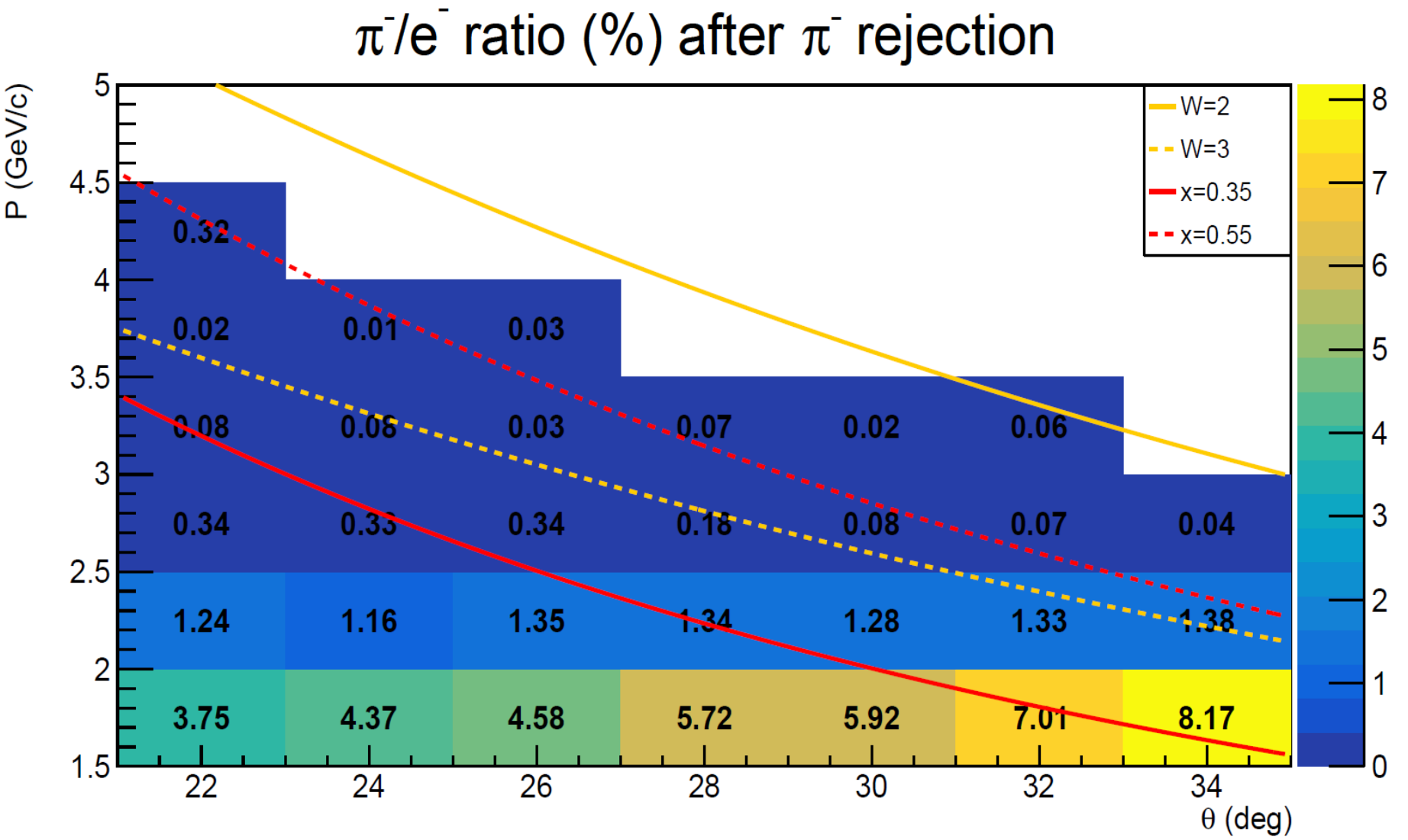
SIDIS He3


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

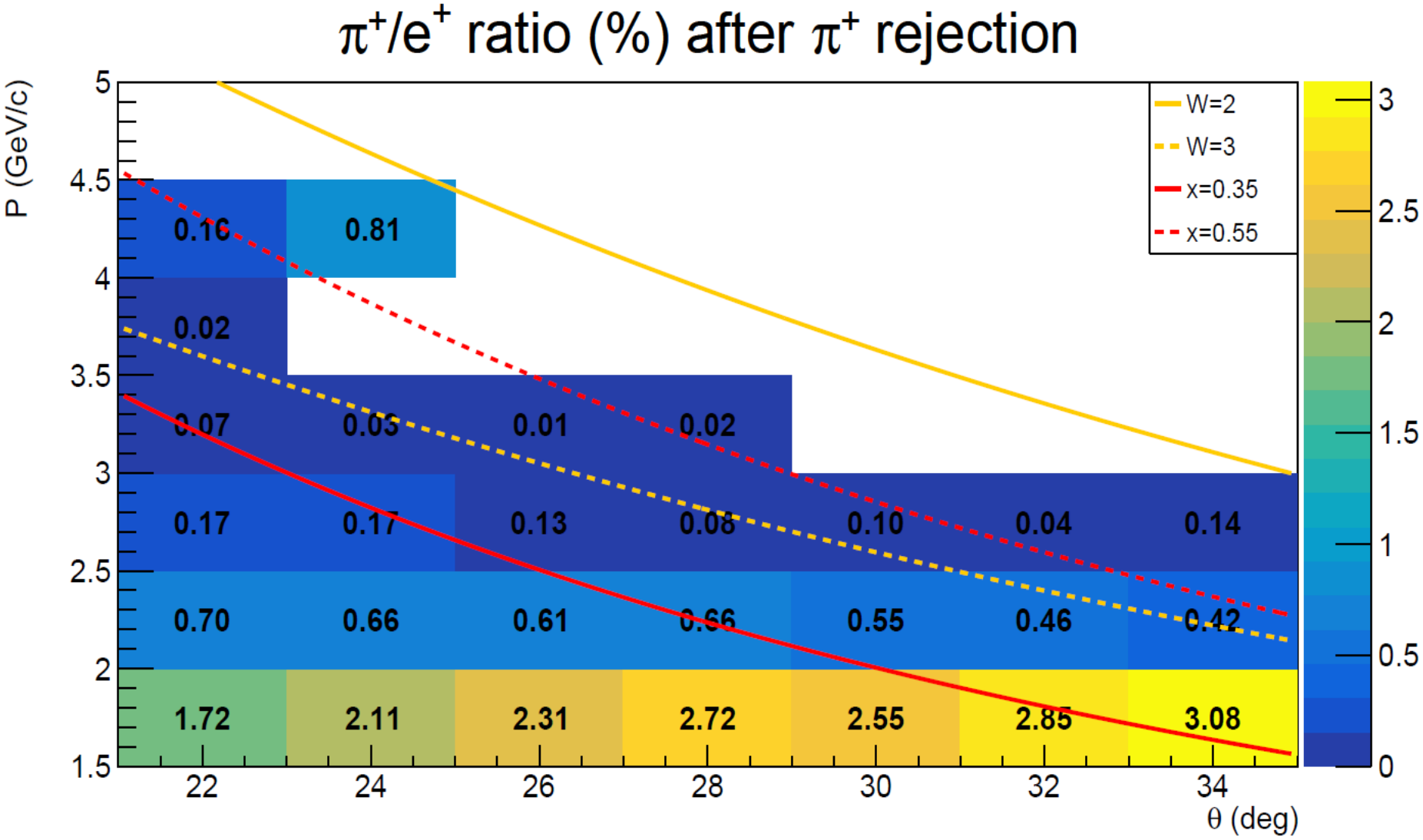
JPsi_LH2


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

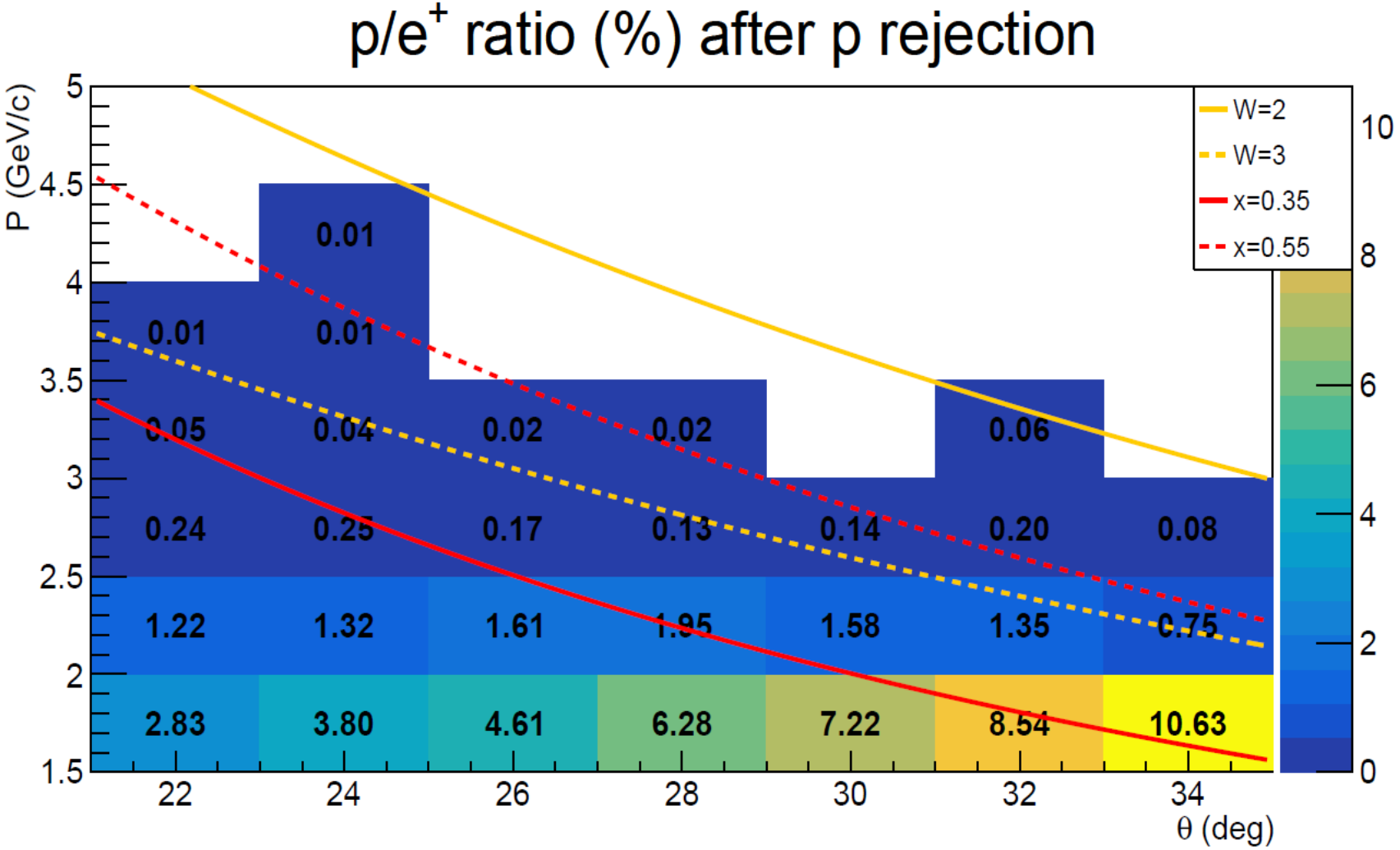
PVDIS_LD2


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

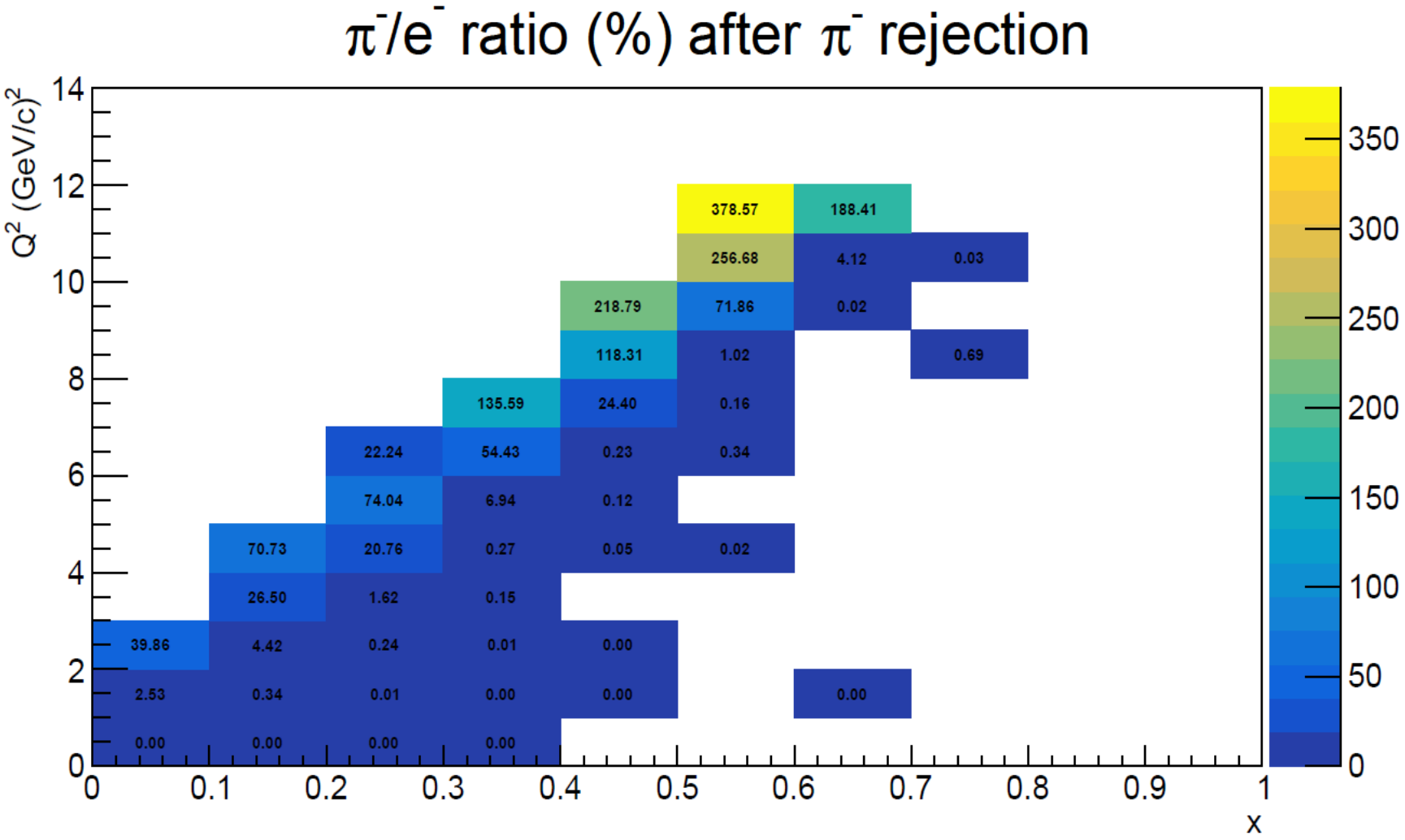
PVDIS_LD2


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

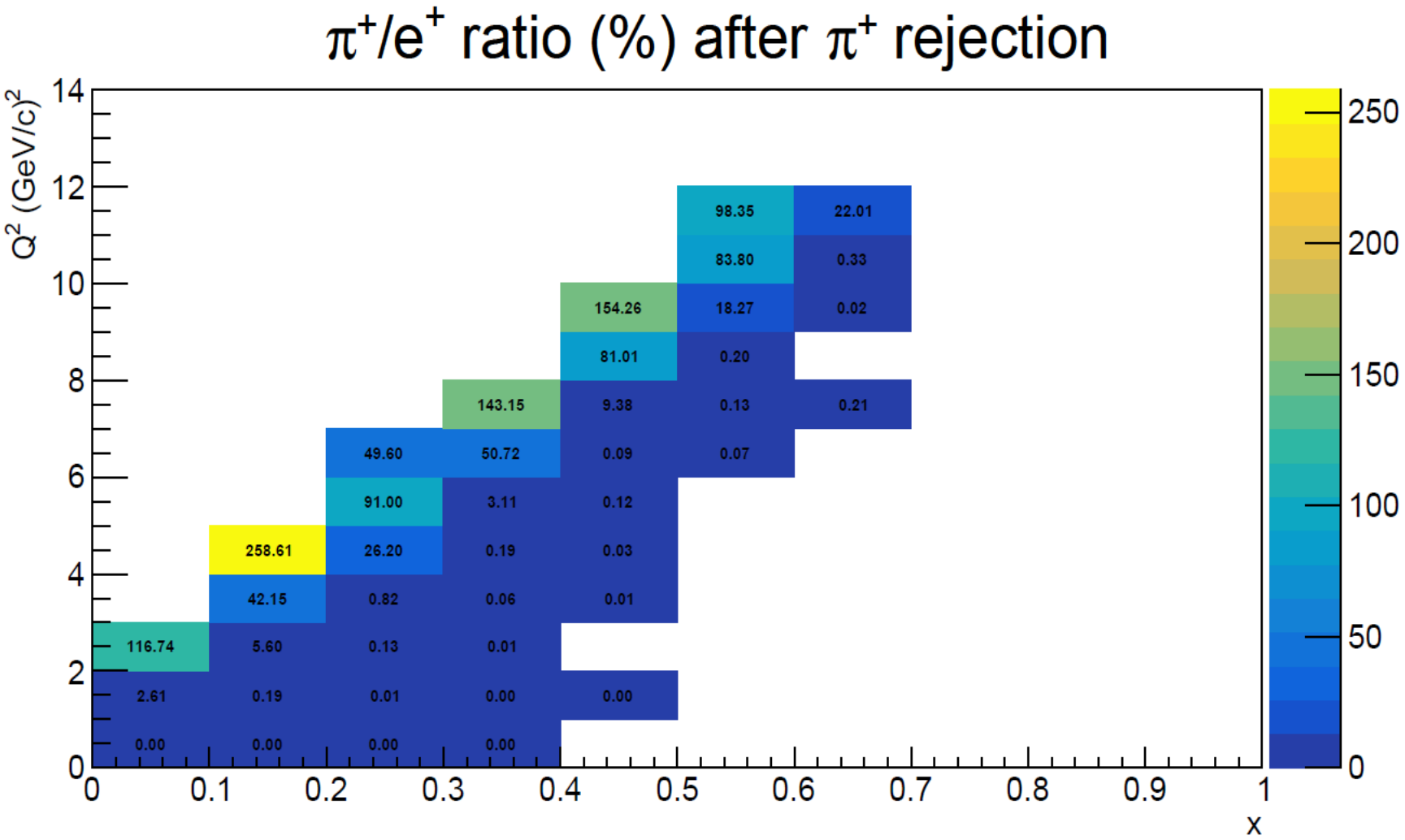
PVDIS_LD2


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

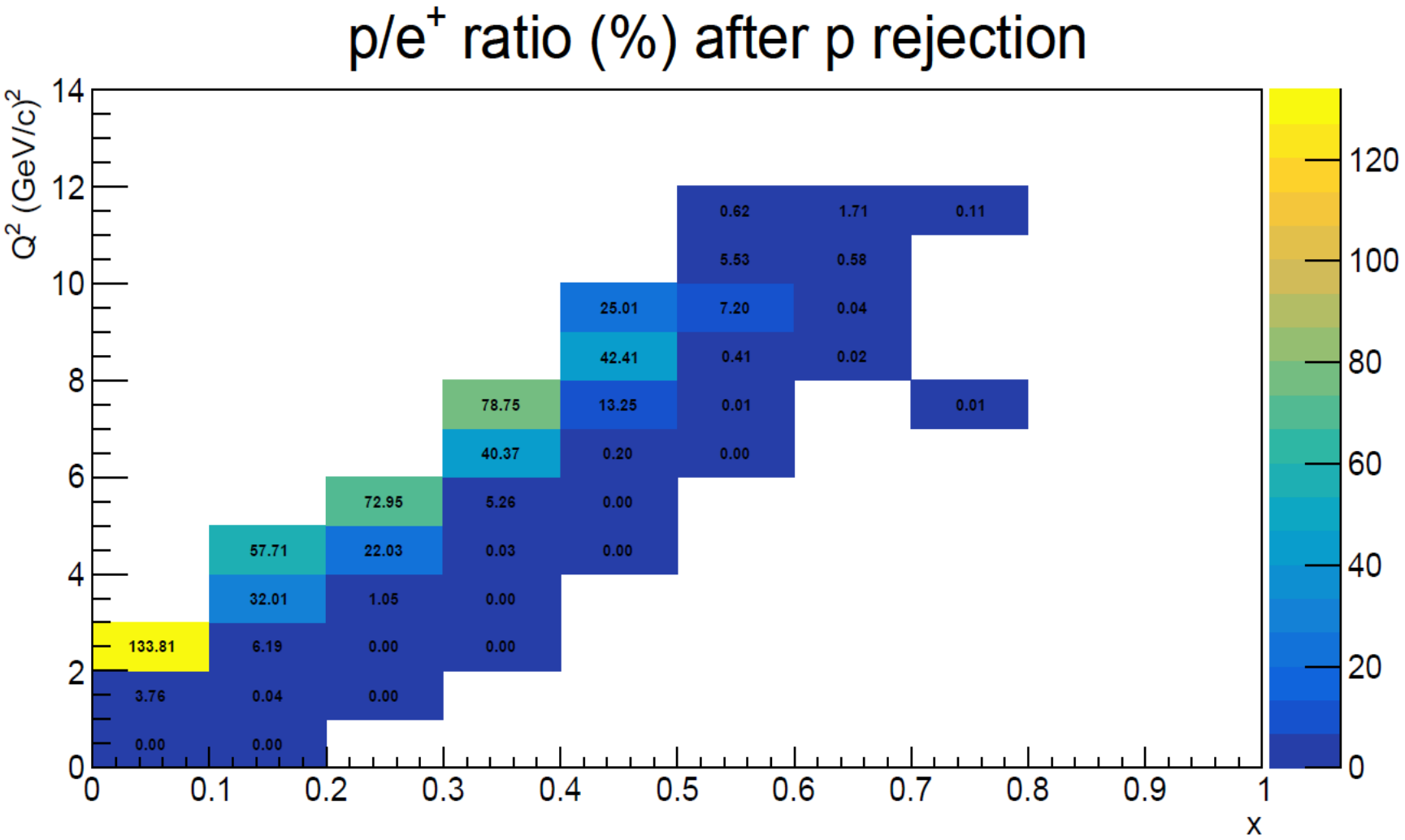
PVDIS_LD2


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

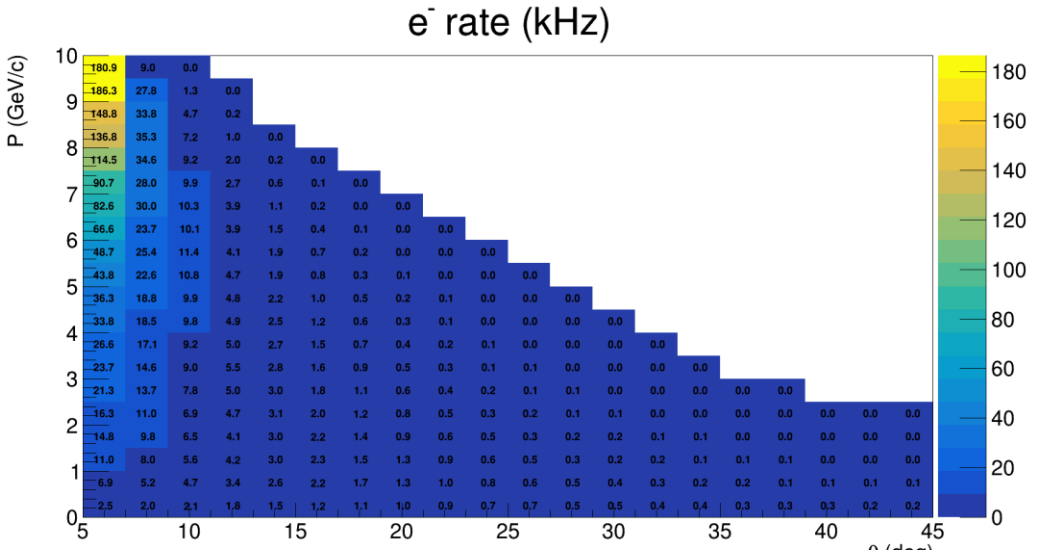
PVDIS_LD2

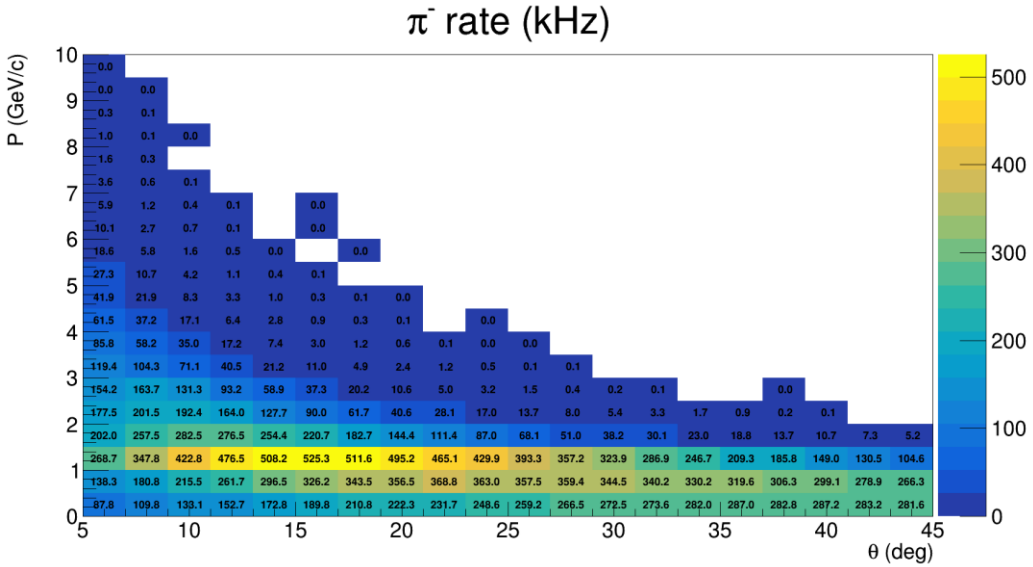

p/e+ ratio (%) after p rejection
Q2 (GeV/c)2
x
0.62
1.71
0.11
5.53
0.58
25.01
7.20
0.04
42.41
0.41
0.02
78.75
13.25
0.01
0.01
40.37
0.20
0.00
72.95
5.26
0.00
57.71
22.03
0.03
0.00
32.01
1.05
0.00
133.81
6.19
0.00
0.00
3.76
0.04
0.00
0.00
0.00
0
2
4
6
8
10
12
14
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1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

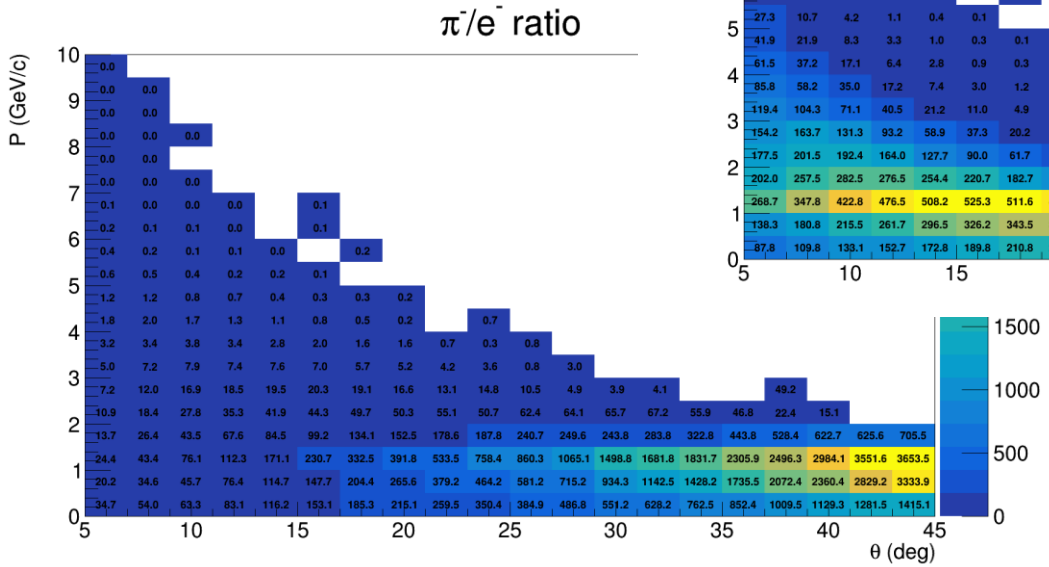
PVDIS_LD2

backup

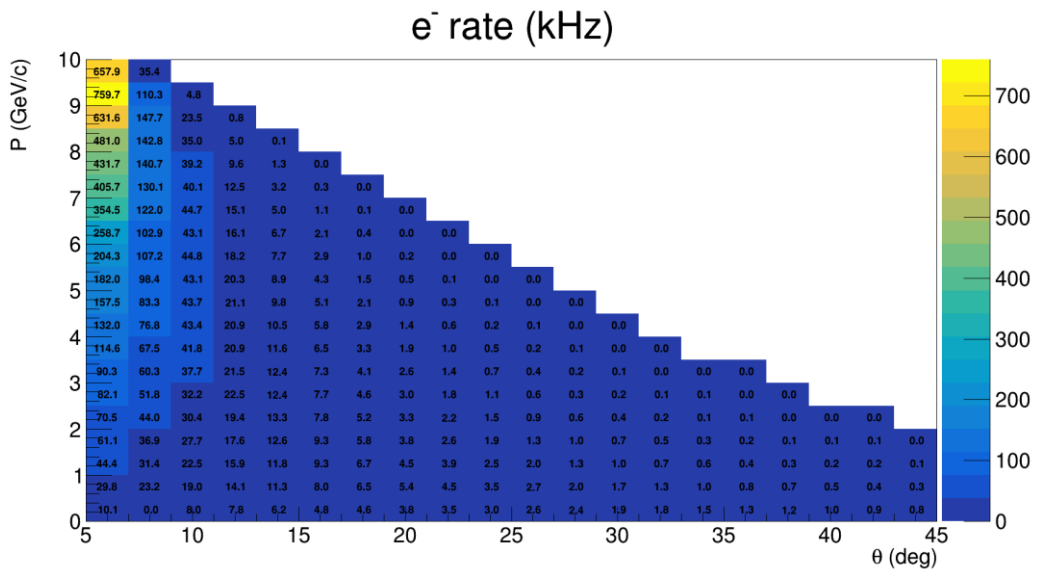
SIDIS_He3

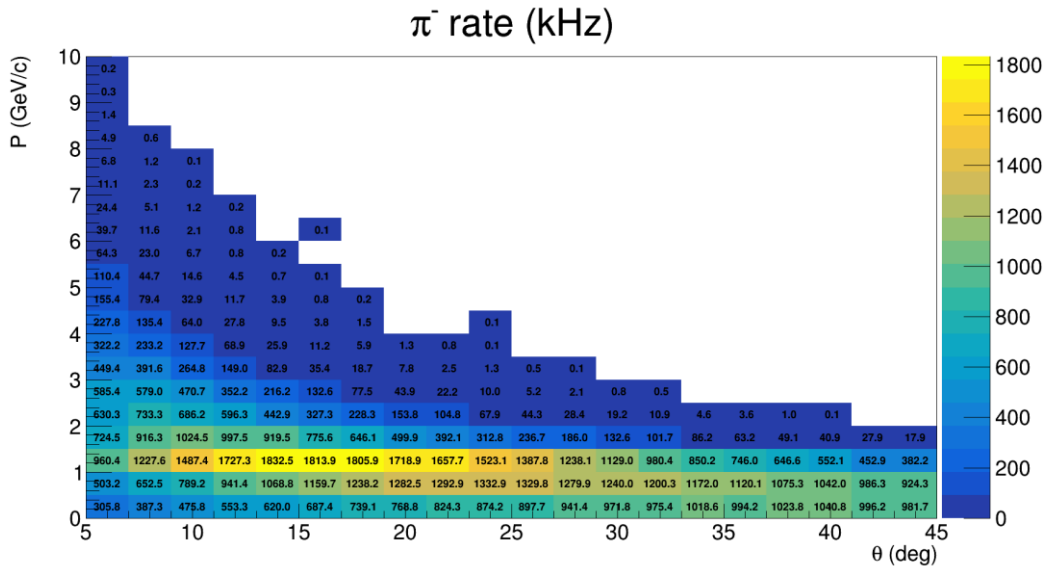


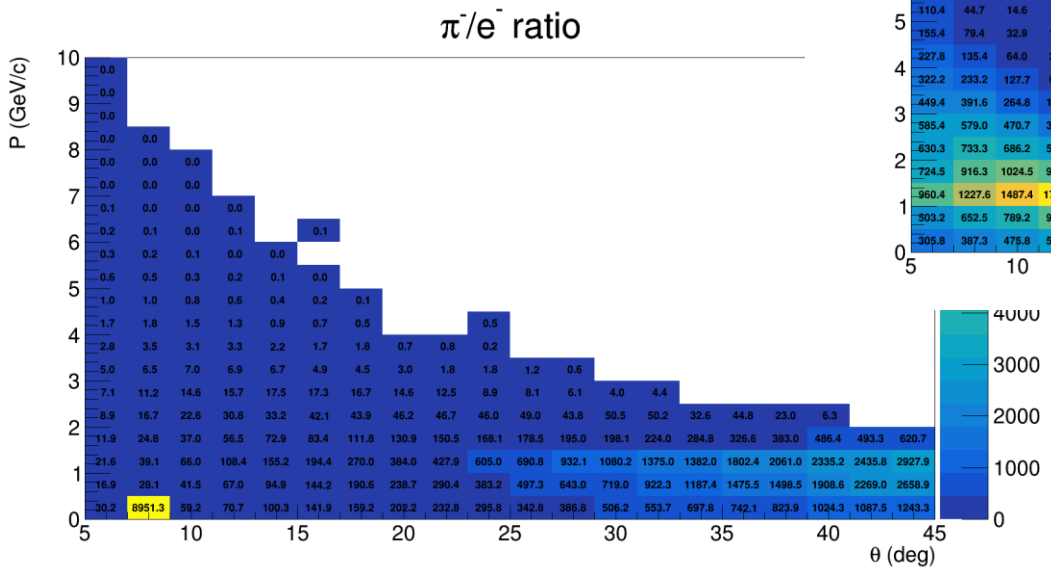




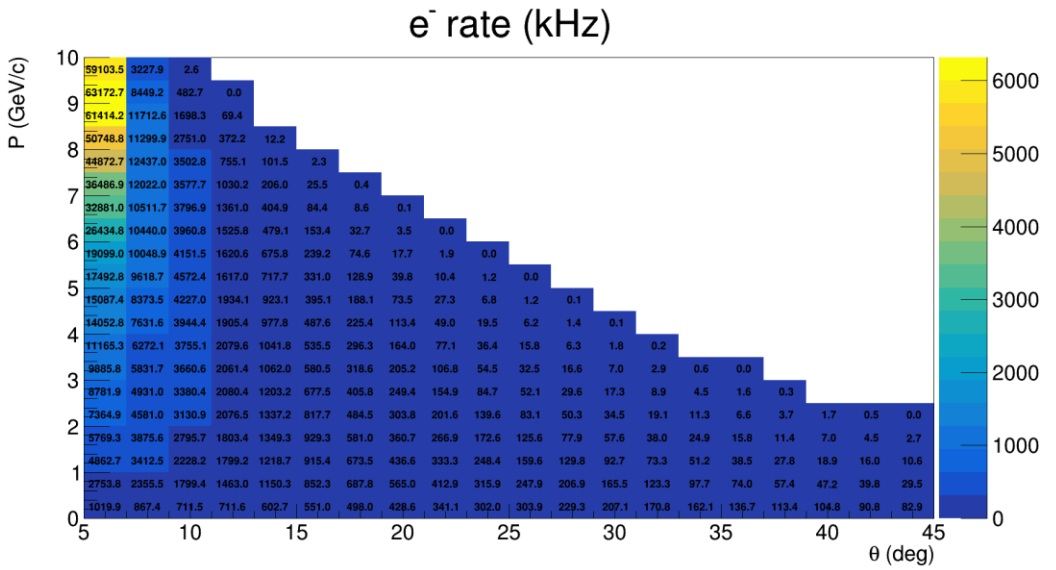
JPsi_LH2

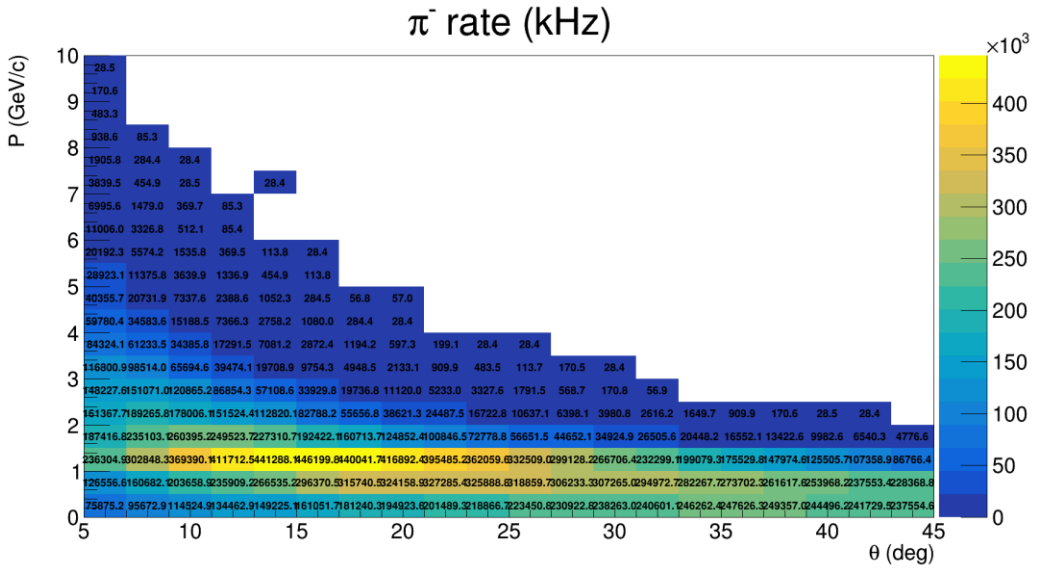

e⁻ rate (kHz)
P (GeV/c)
θ (deg)

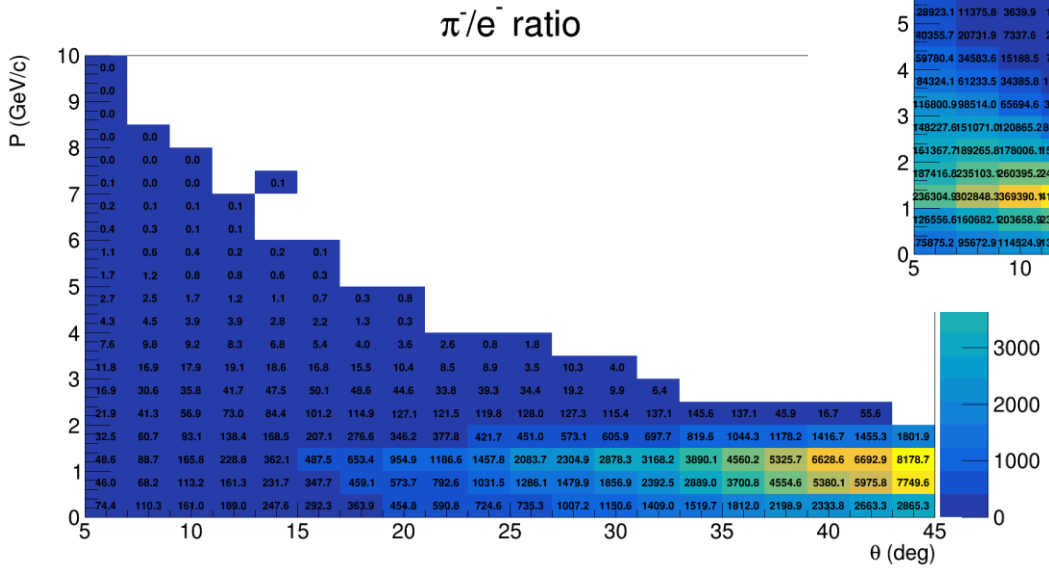

π⁻ rate (kHz)
P (GeV/c)
θ (deg)


π⁻/e⁻ ratio
P (GeV/c)
θ (deg)

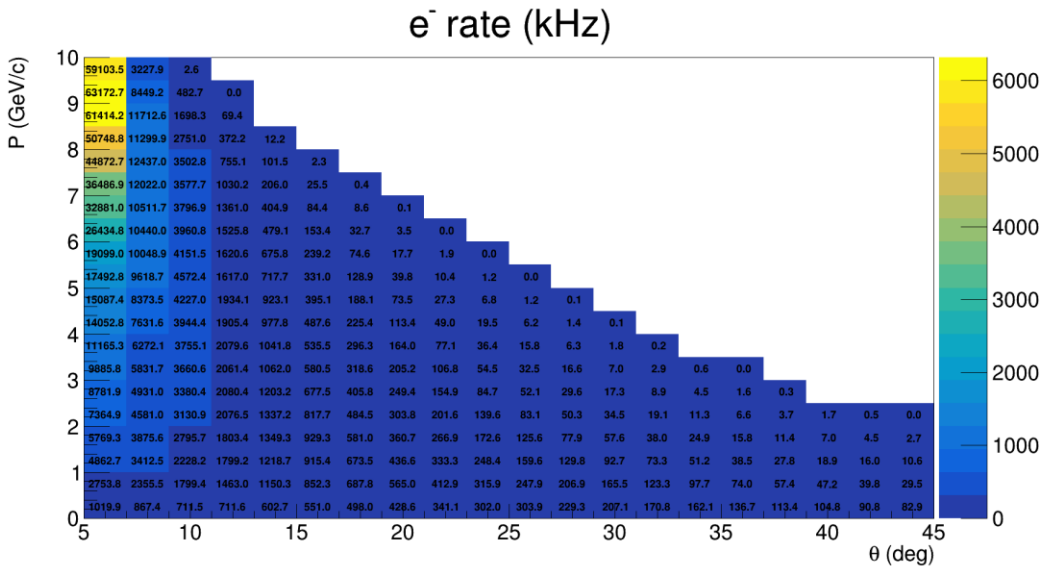
PVDIS_LD2

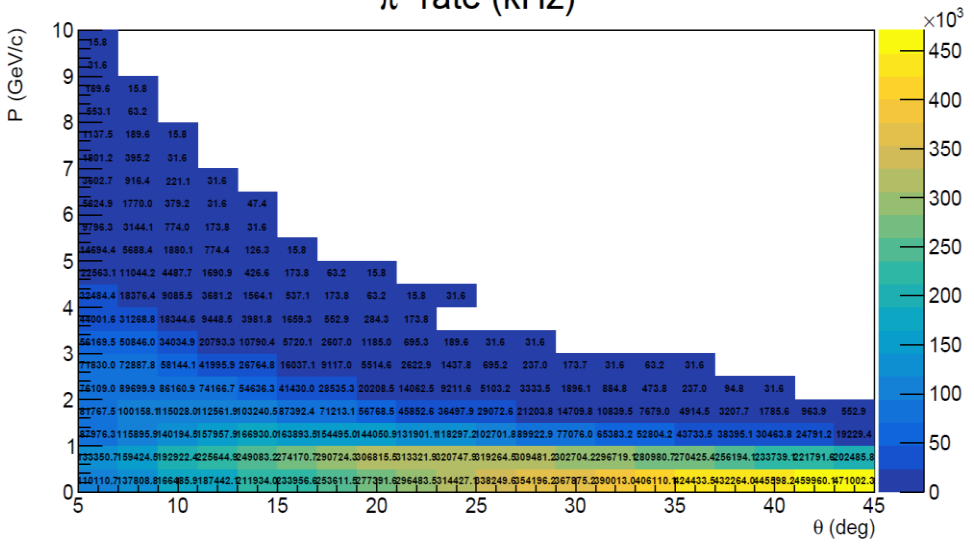

e⁻ rate (kHz)
P (GeV/c)
θ (deg)

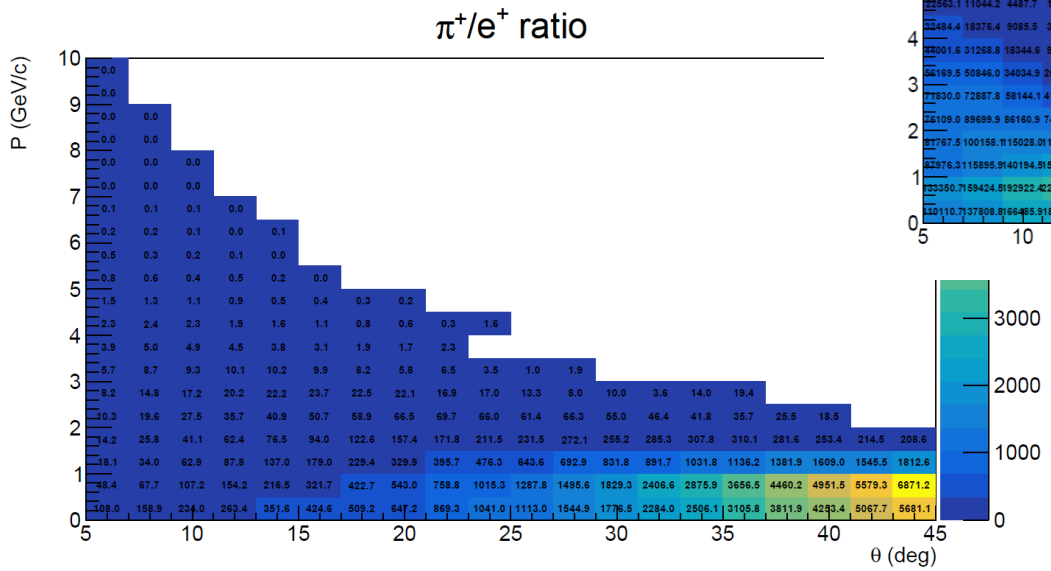

π⁻ rate (kHz)
P (GeV/c)
θ (deg)
×10³


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)