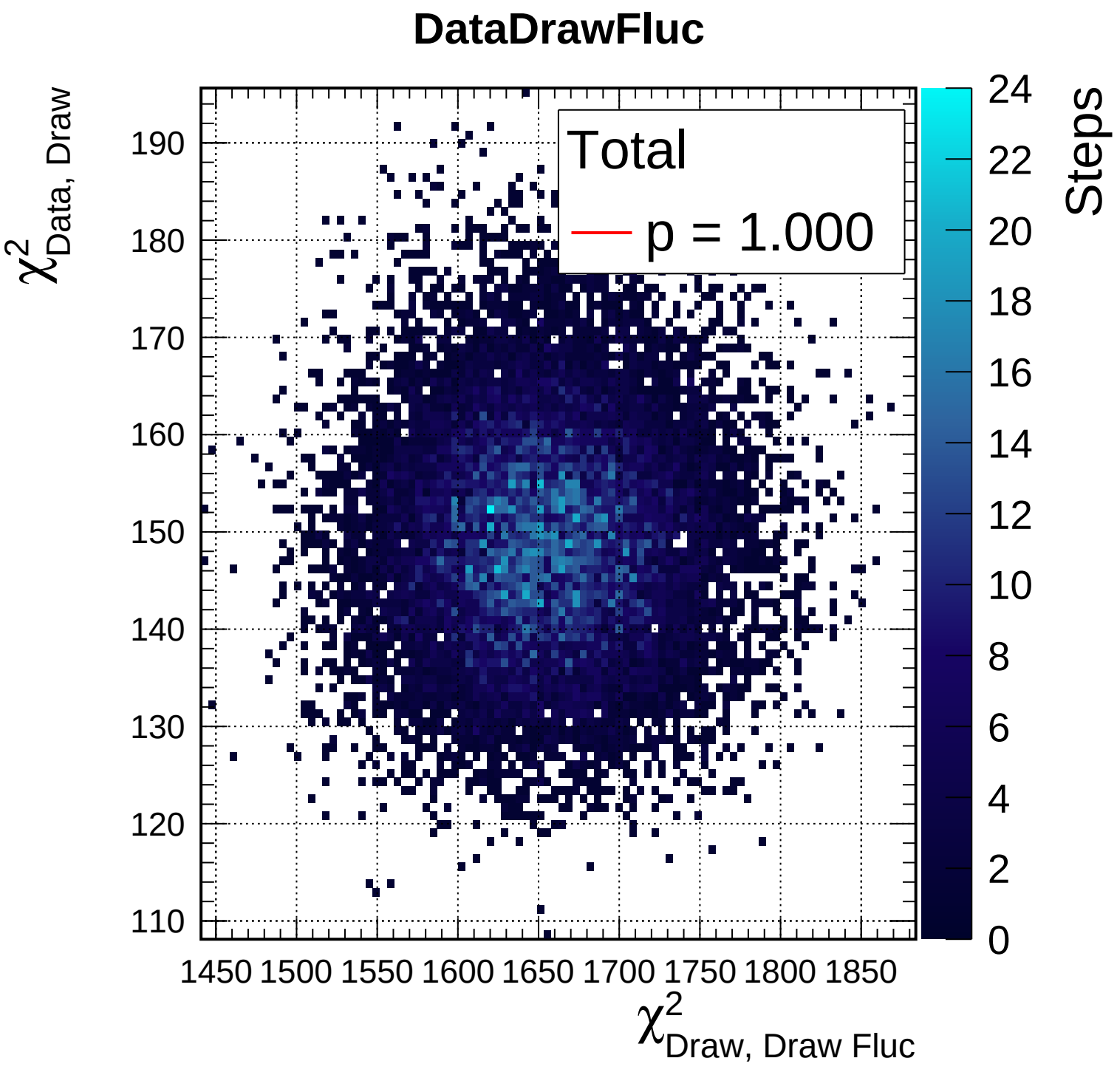
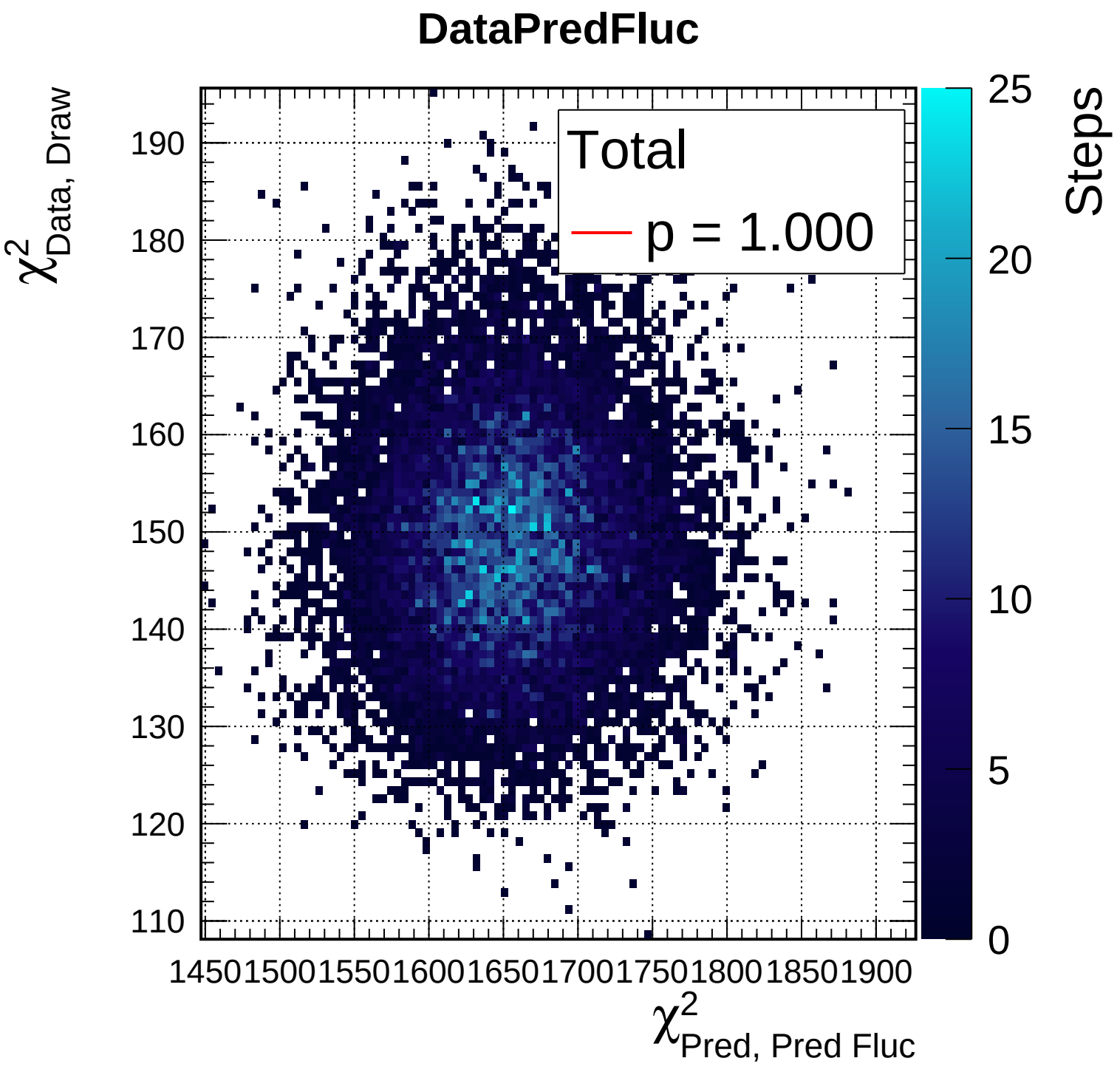
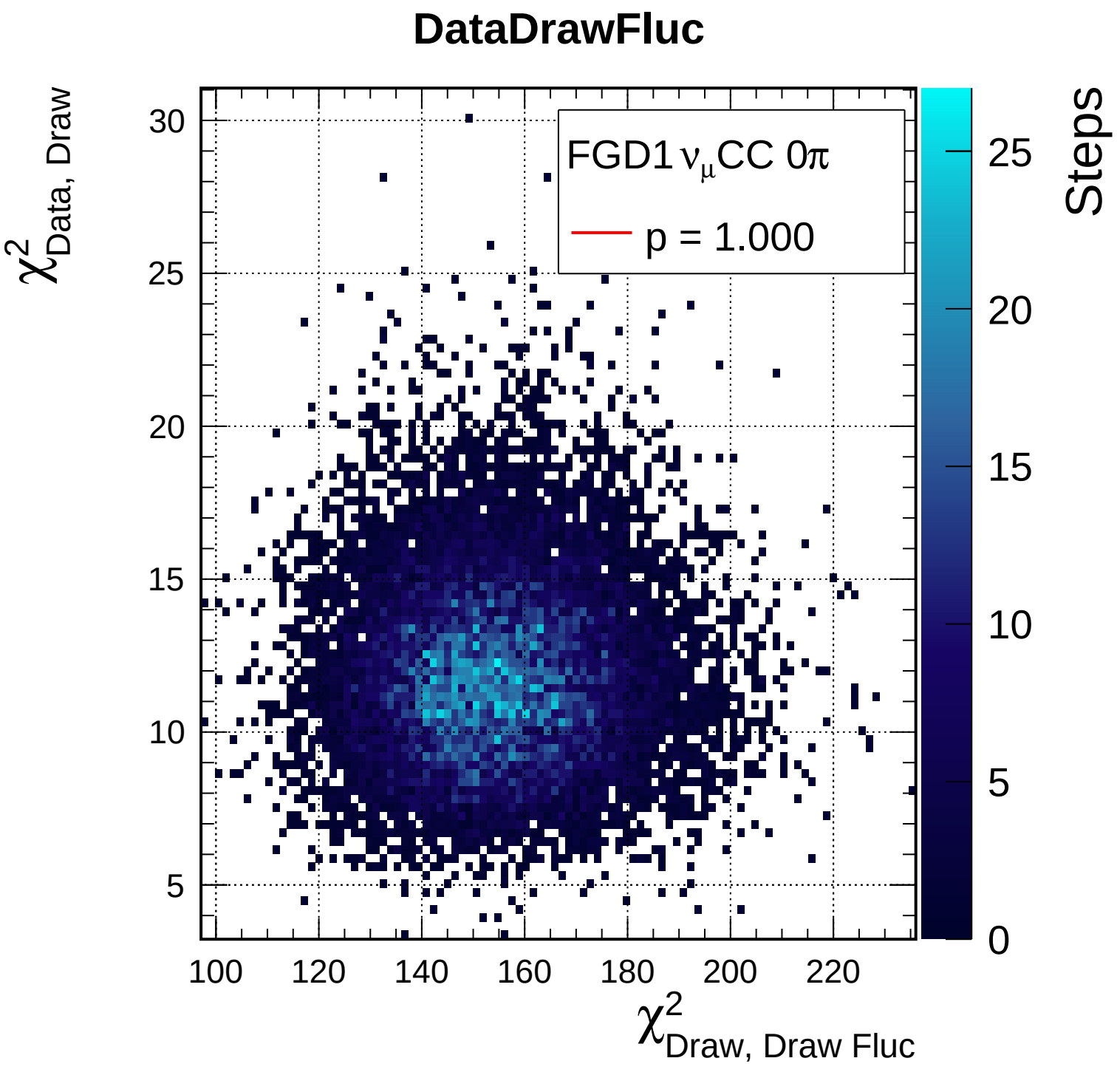
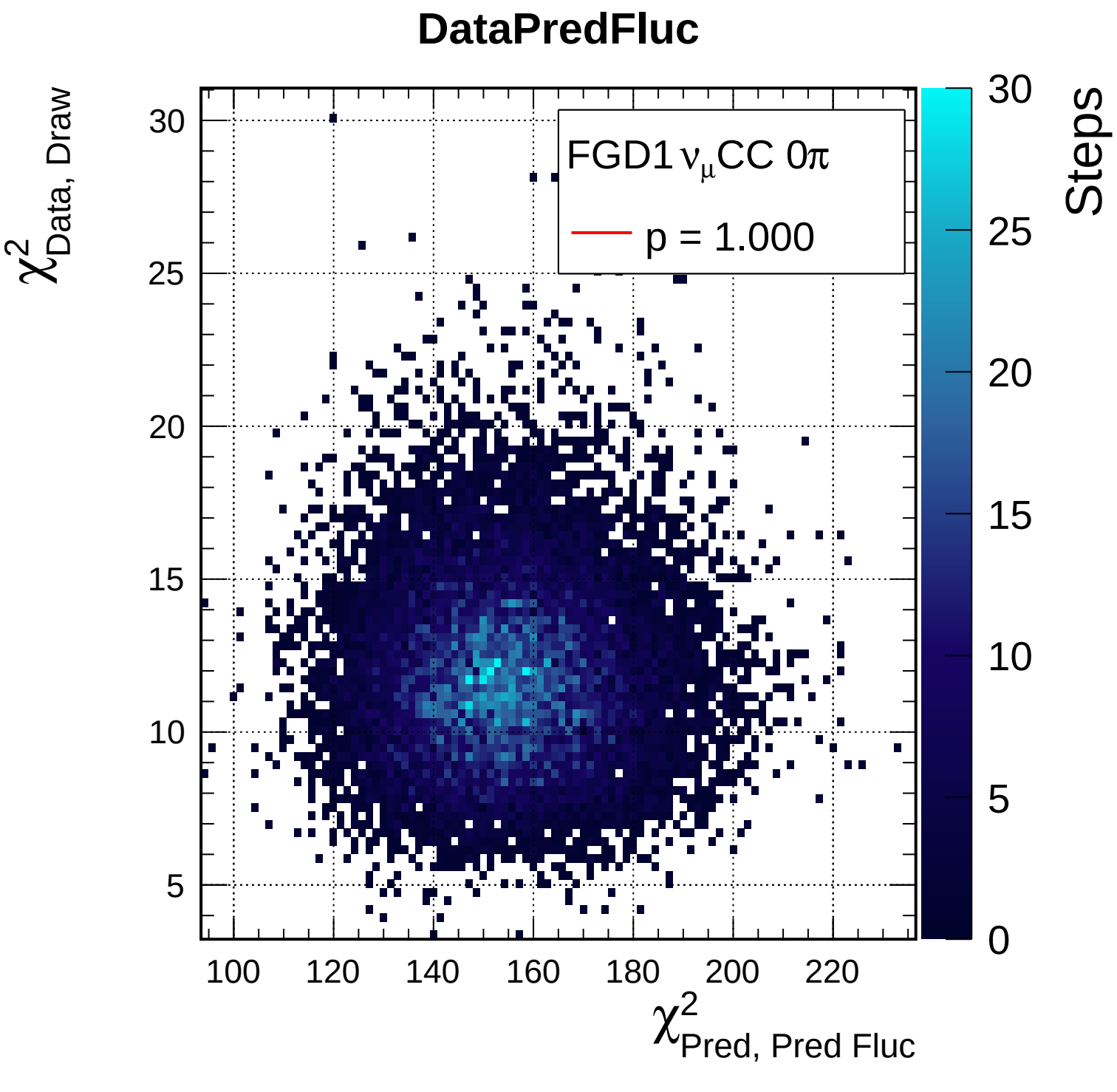
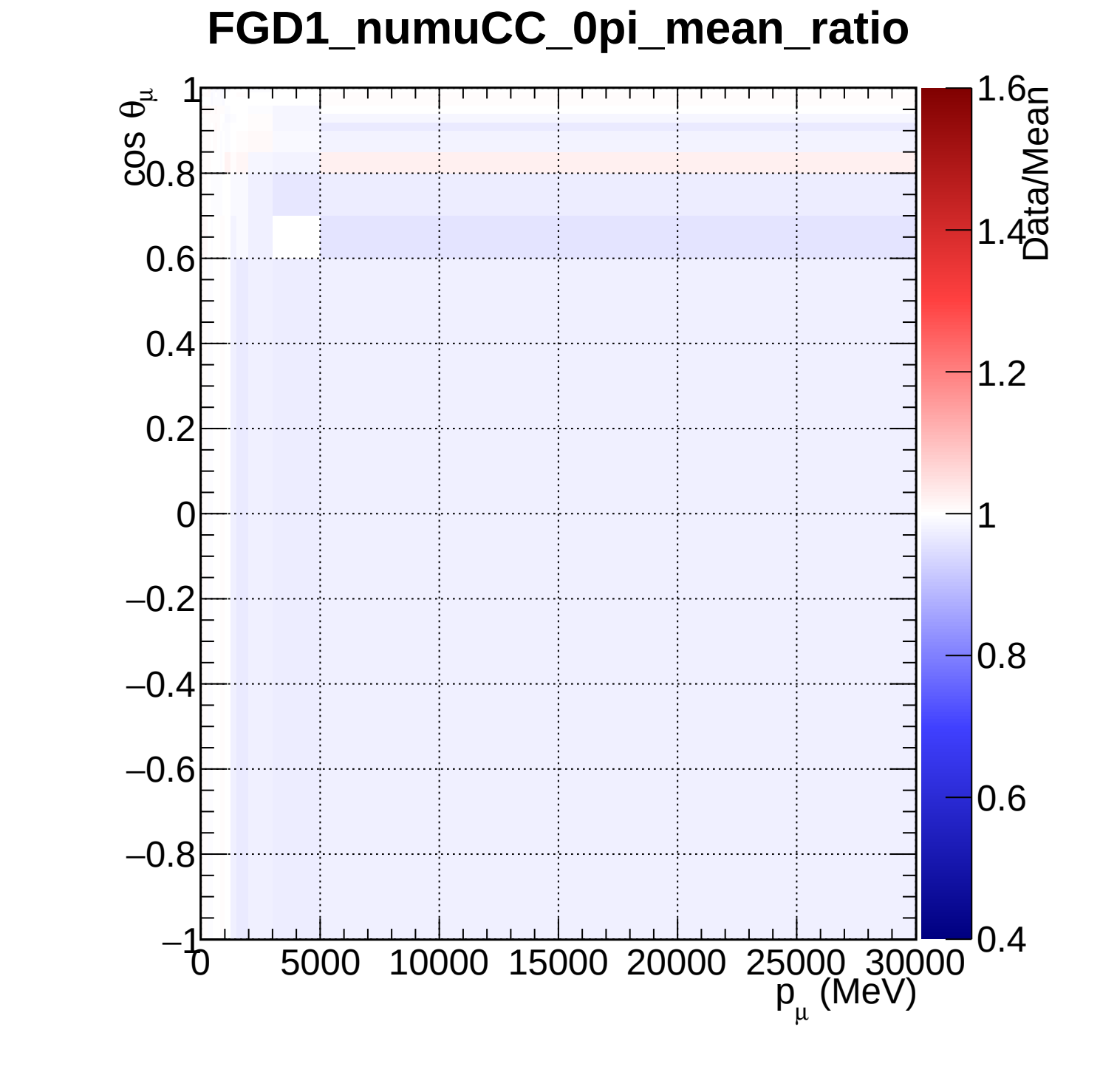
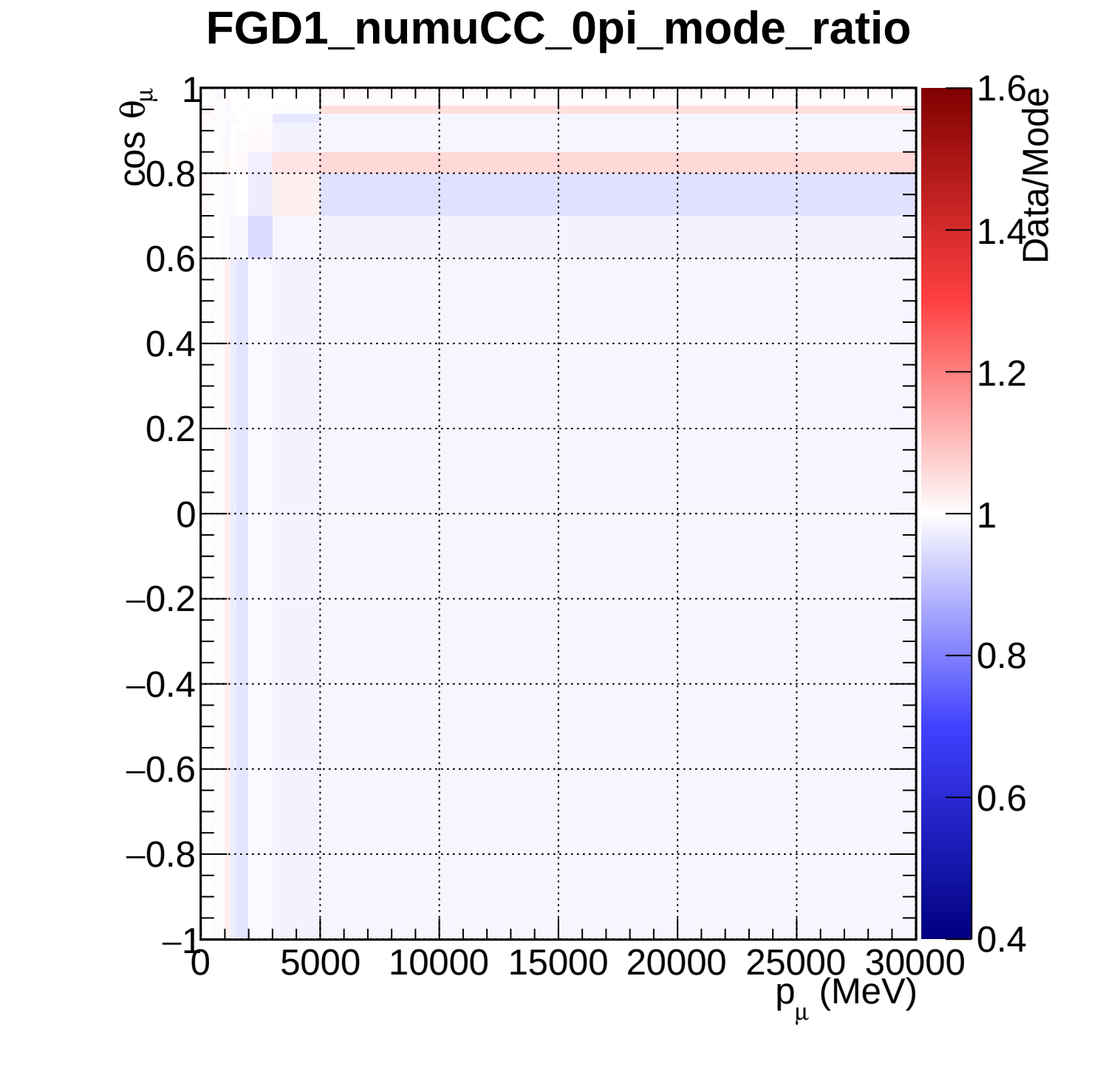

DataDrawFluc
Total
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Draw, Draw Fluc}}$
Steps
190
180
170
160
150
140
130
120
110
1450 1500 1550 1600 1650 1700 1750 1800 1850
24
22
20
18
16
14
12
10
8
6
4
2
0

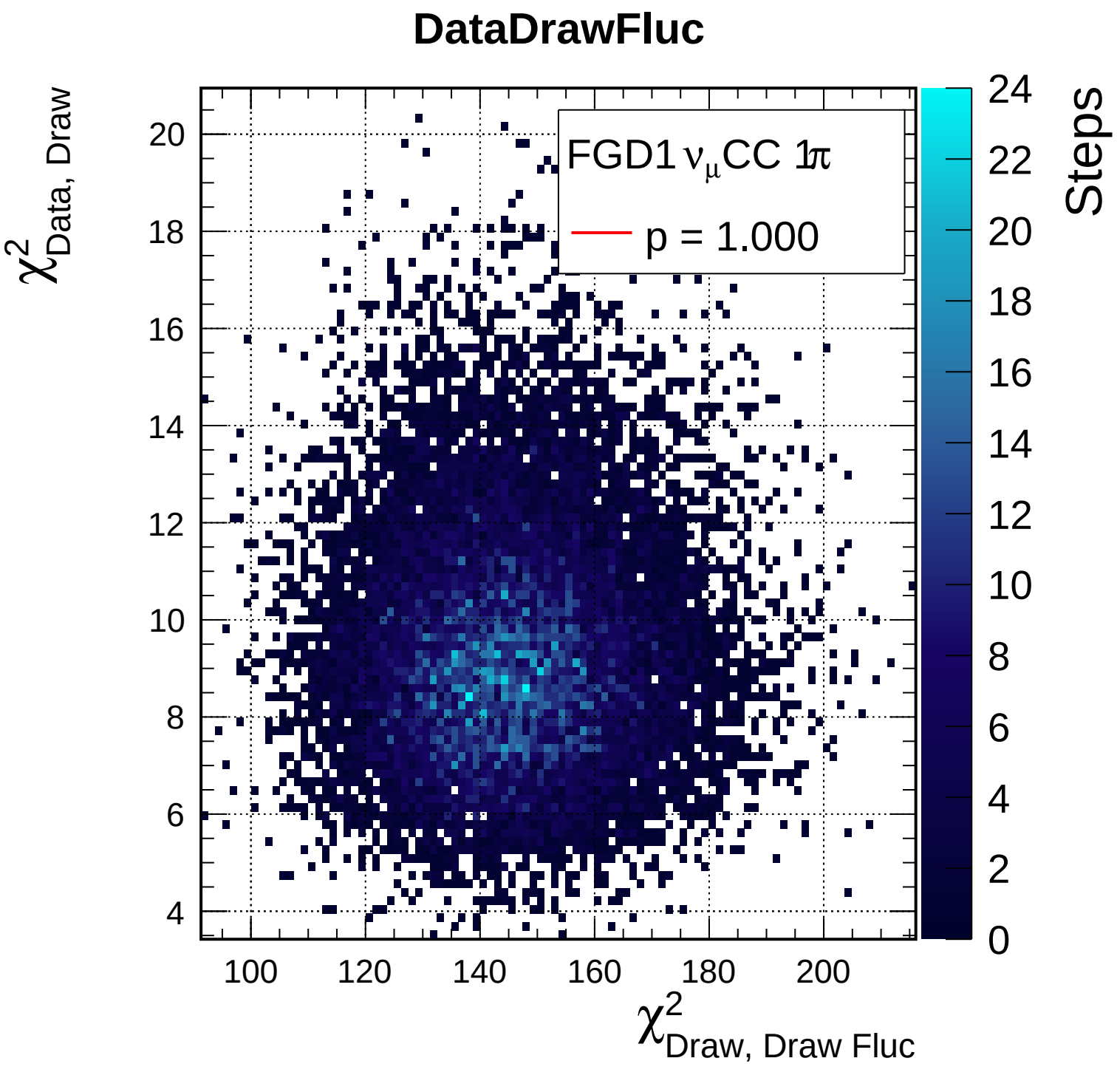

DataPredFluc
Total
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
110
120
130
140
150
160
170
180
190
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
0
5
10
15
20
25

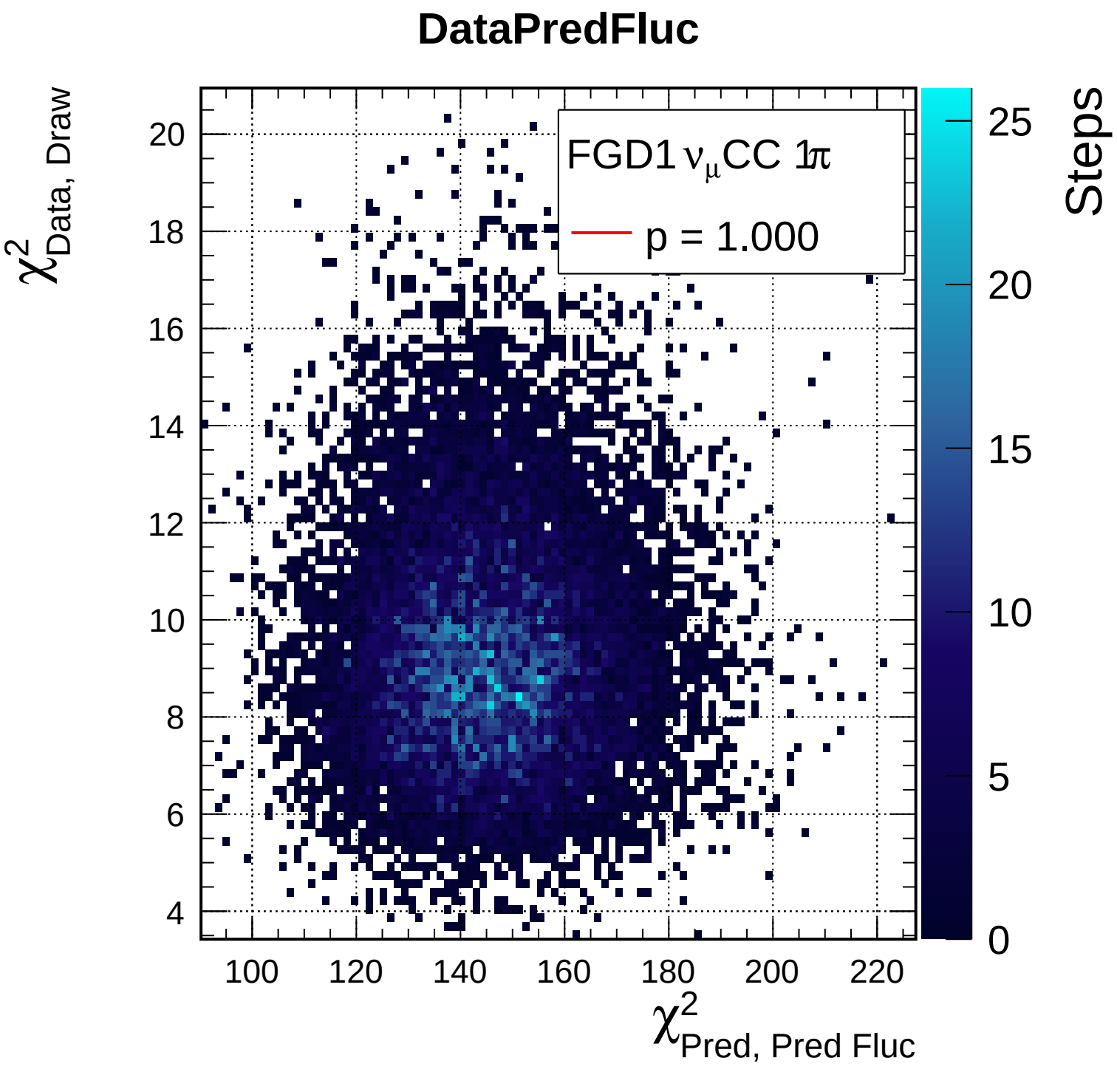

DataDrawFluc
FGD1 ν_μCC 0π
p = 1.000
$\chi^2_{Data,\ Draw}$
$\chi^2_{Draw,\ Draw\ Fluc}$
Steps
30
25
20
15
10
5
100
120
140
160
180
200
220
25
20
15
10
5
0


DataPredFluc
FGD1 ν_μCC 0π
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
30
25
20
15
10
5
0
100
120
140
160
180
200
220


FGD1_numuCC_0pi_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD1_numuCC_0pi_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4


DataDrawFluc
FGD1 ν_μCC 1π
p = 1.000
$\chi^2_{Data,\ Draw}$
$\chi^2_{Draw,\ Draw\ Fluc}$
Steps
20
18
16
14
12
10
8
6
4
100
120
140
160
180
200
24
22
20
18
16
14
12
10
8
6
4
2
0


DataPredFluc
FGD1 ν_μCC 1π
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
20
18
16
14
12
10
8
6
4
100
120
140
160
180
200
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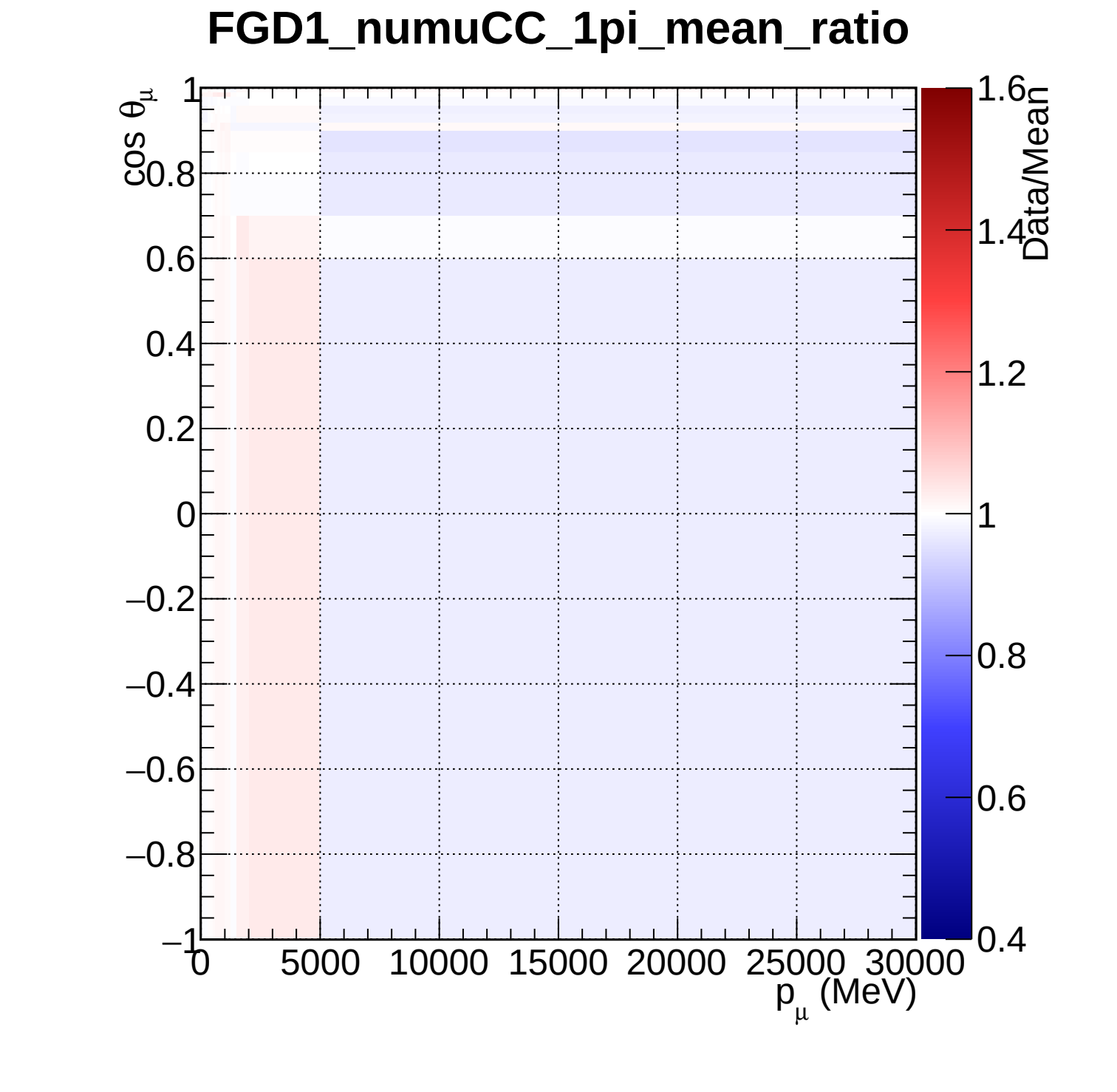
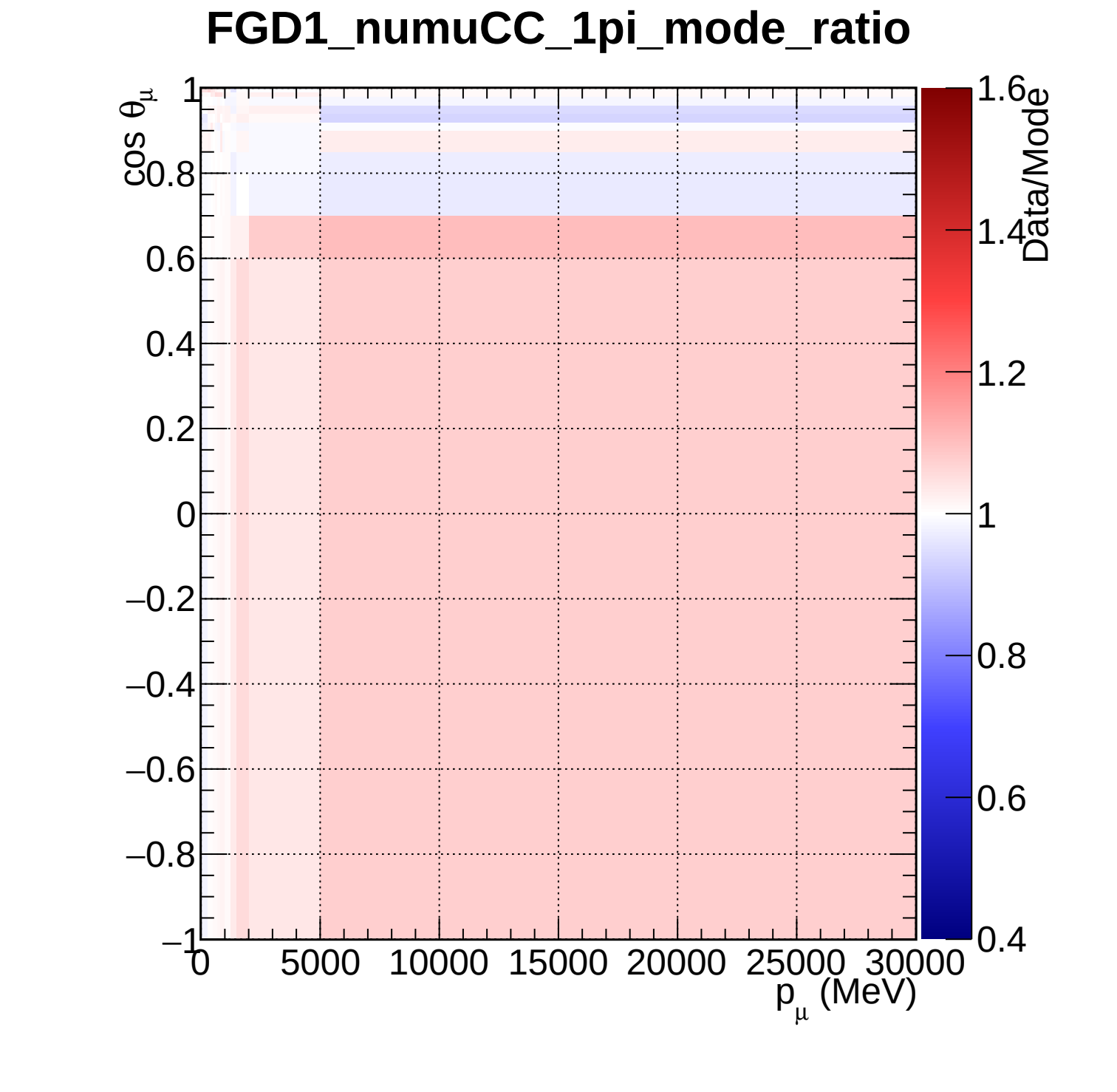
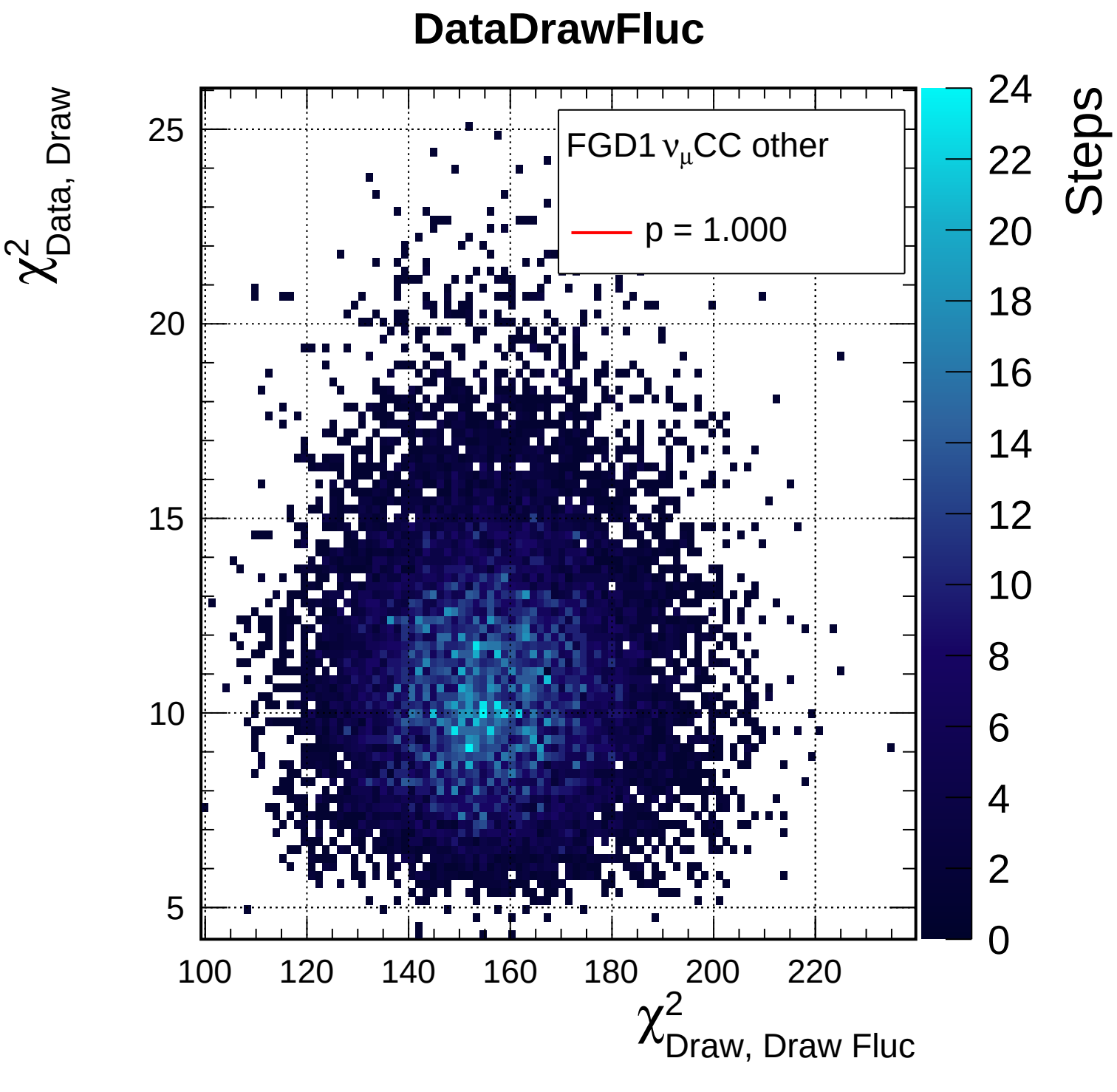
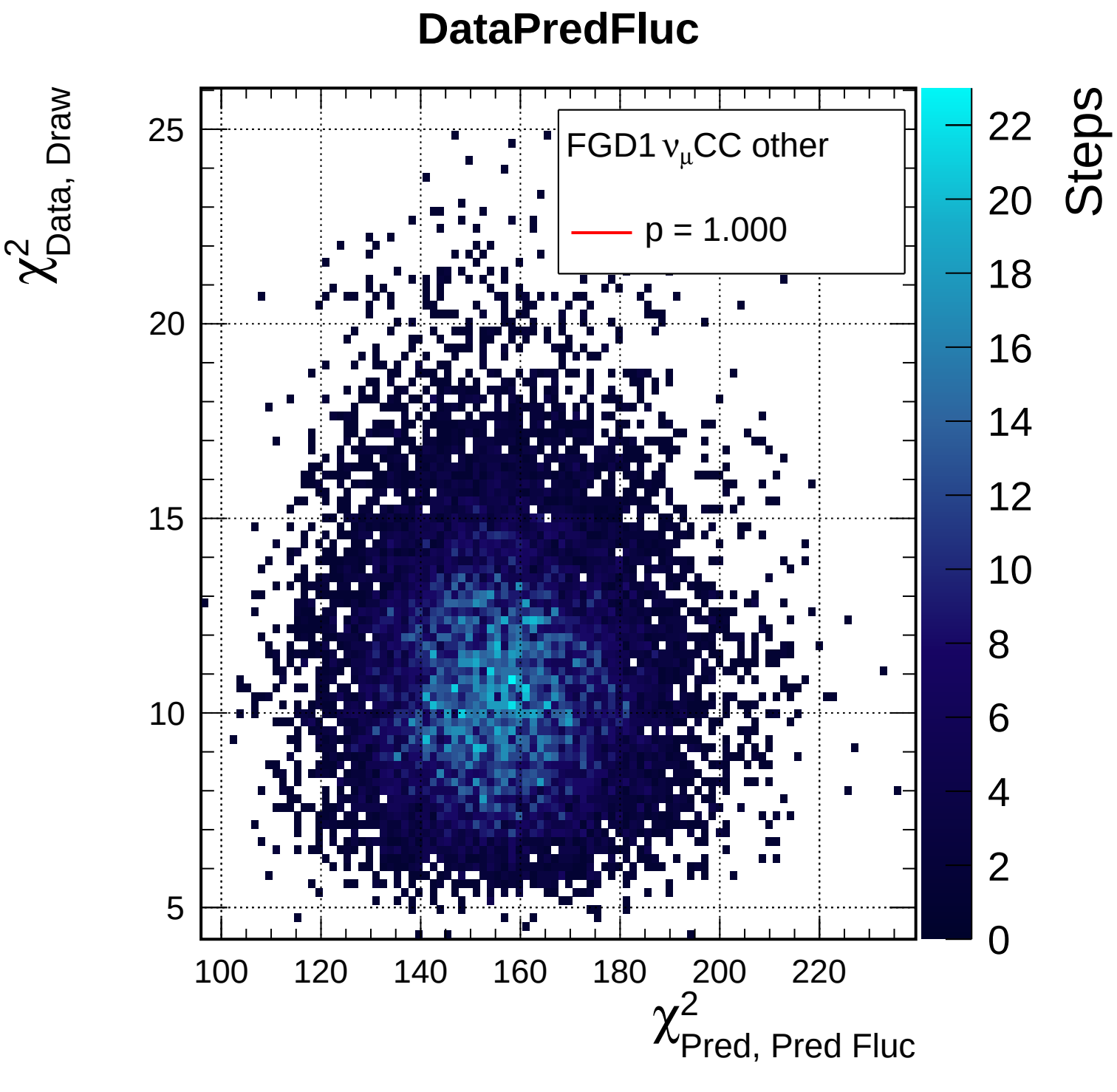
15
10
5
0


FGD1_numuCC_1pi_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD1_numuCC_1pi_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4


DataDrawFluc
FGD1 ν_μCC other
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Draw, Draw Fluc}}$
Steps
25
20
15
10
5
100
120
140
160
180
200
220
24
22
20
18
16
14
12
10
8
6
4
2
0


DataPredFluc
FGD1 ν_μCC other
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
25
20
15
10
5
100
120
140
160
180
200
220
22
20
18
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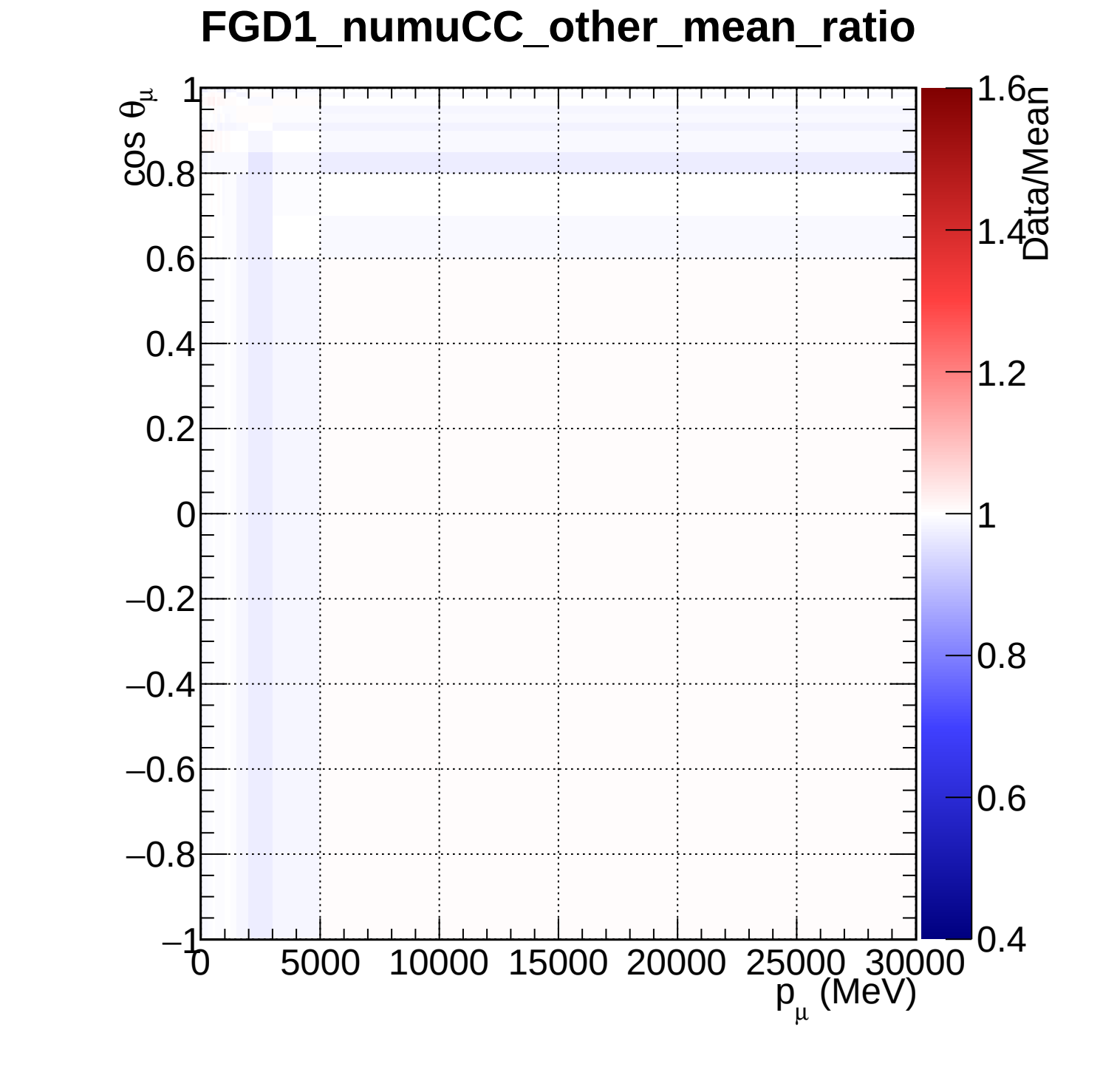
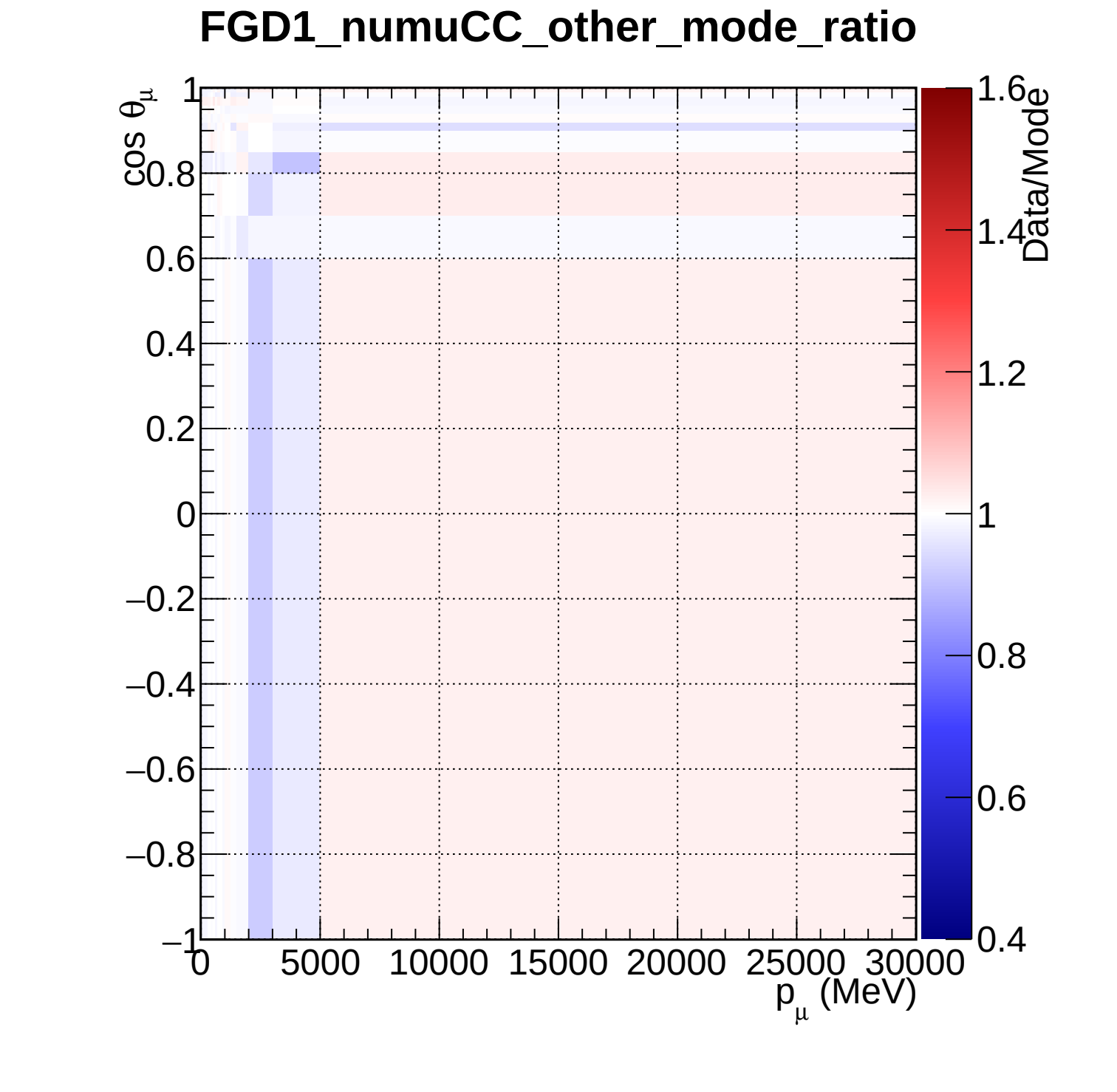
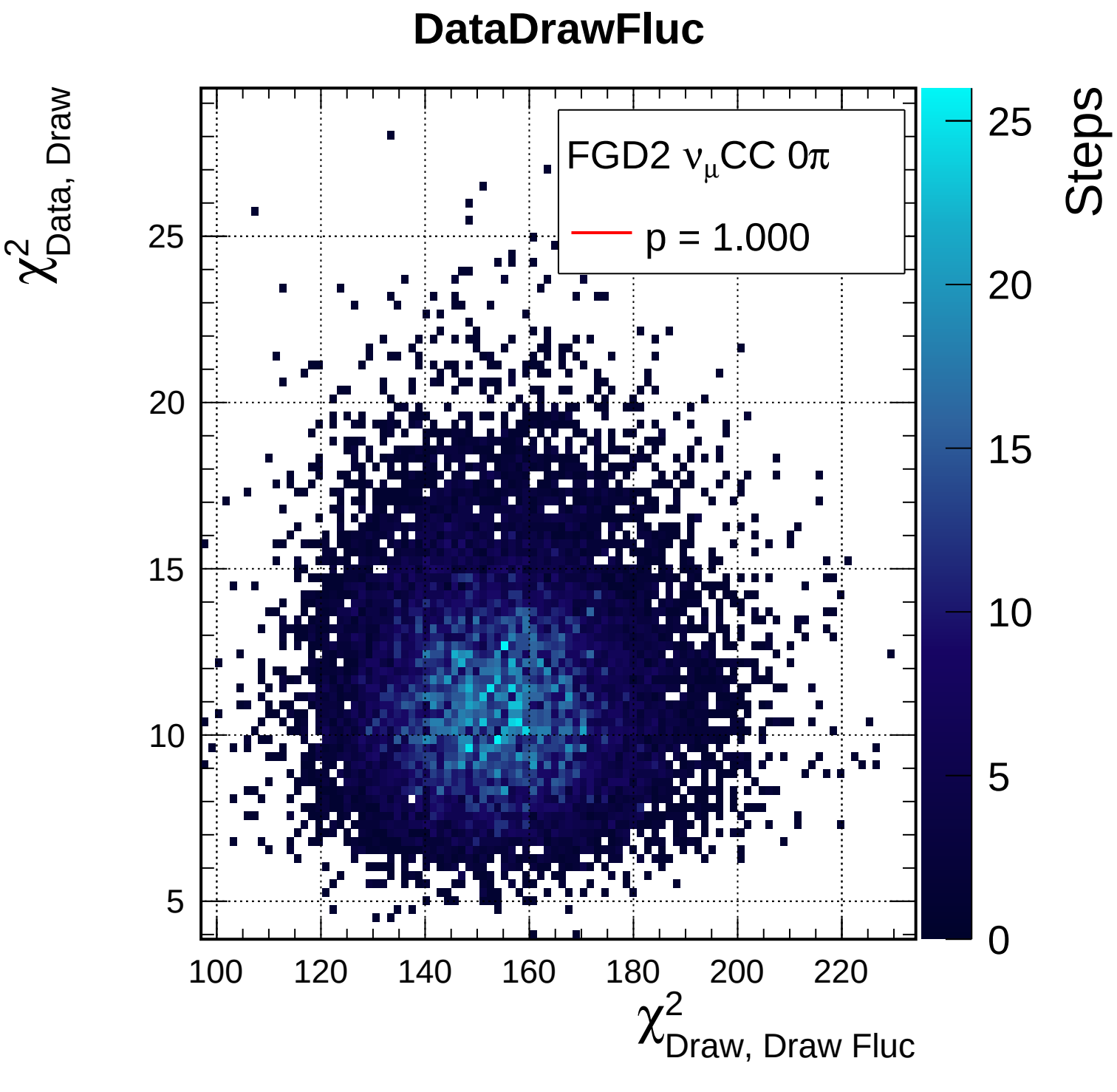
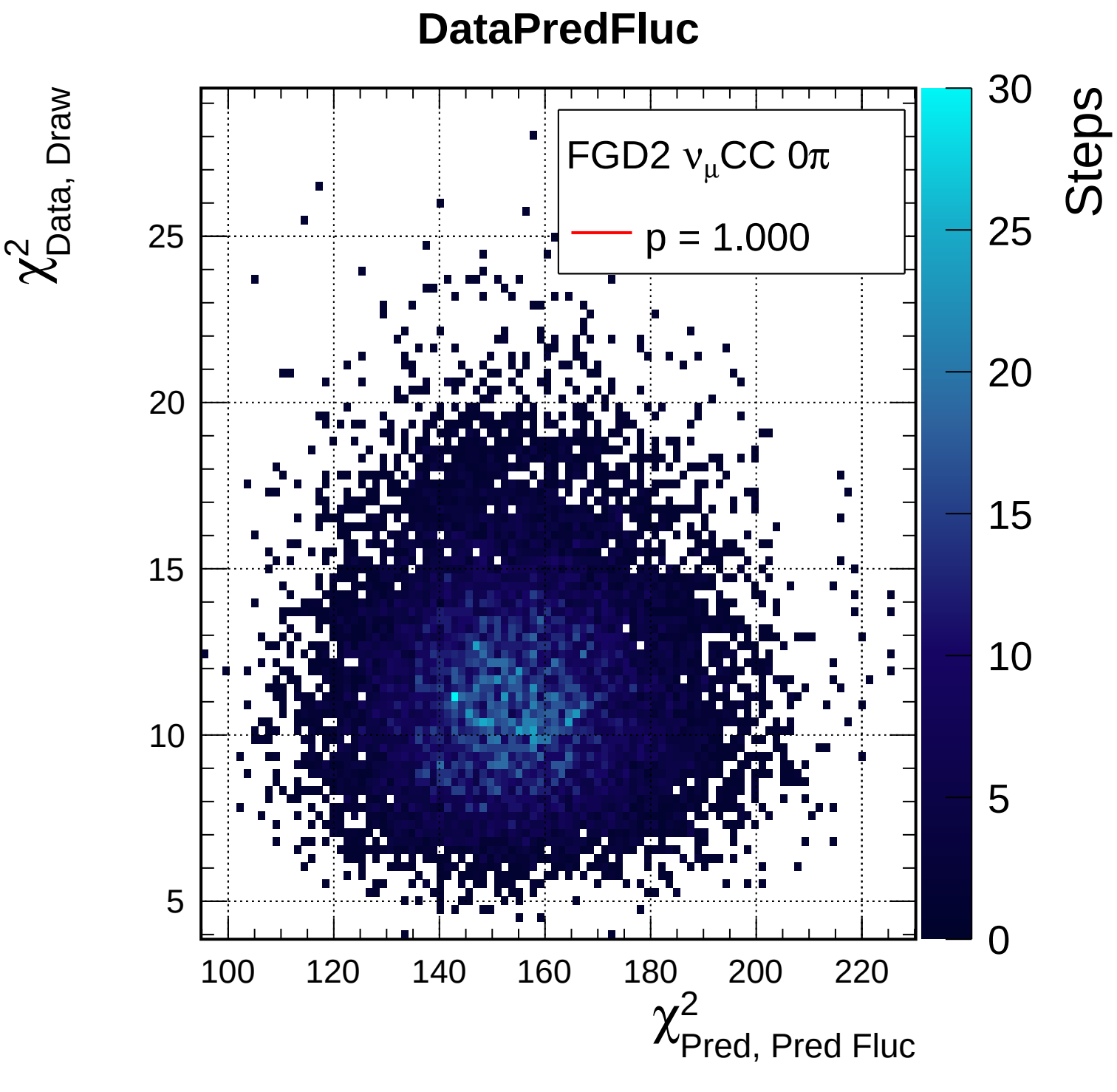
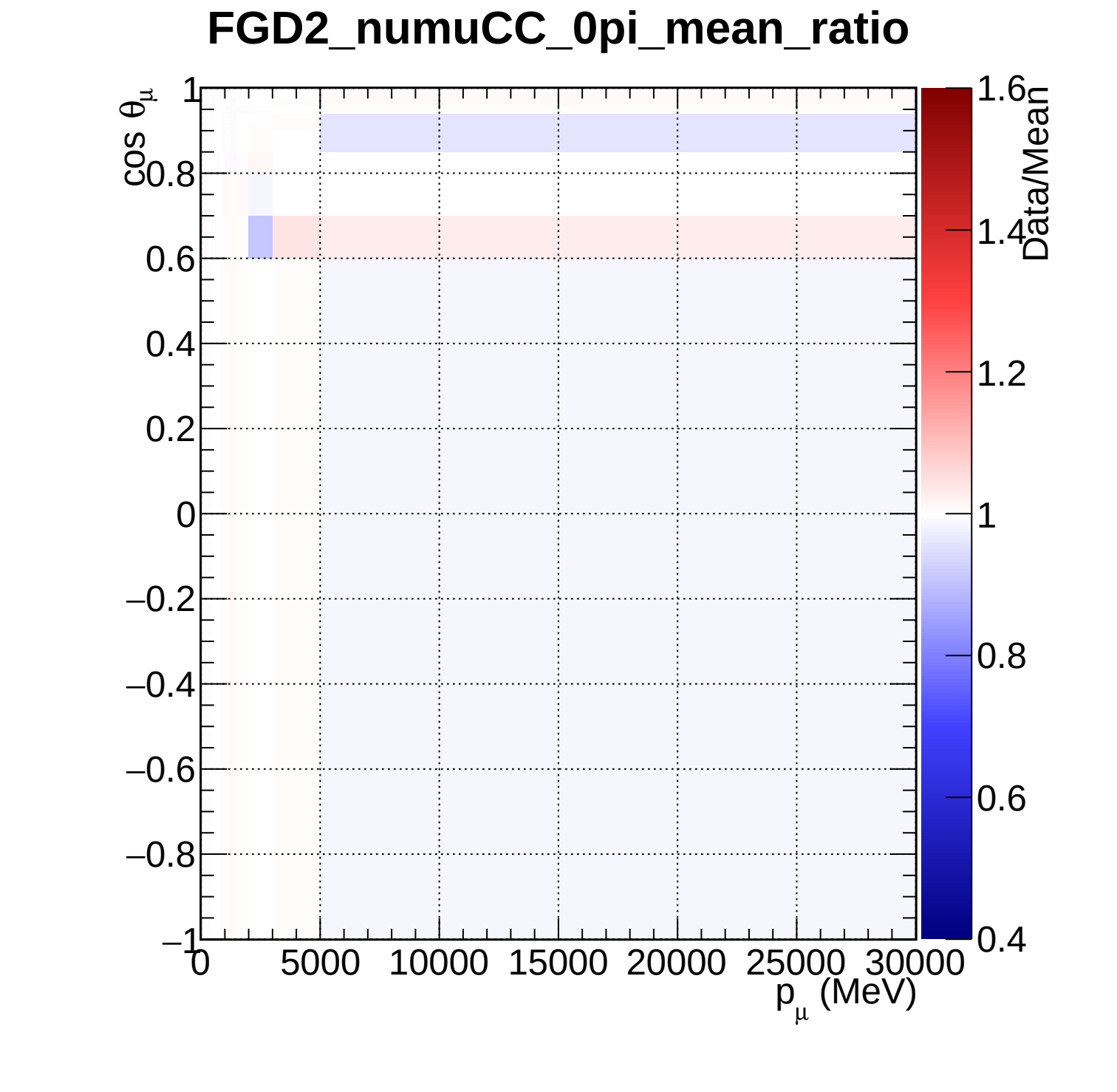
6
4
2
0

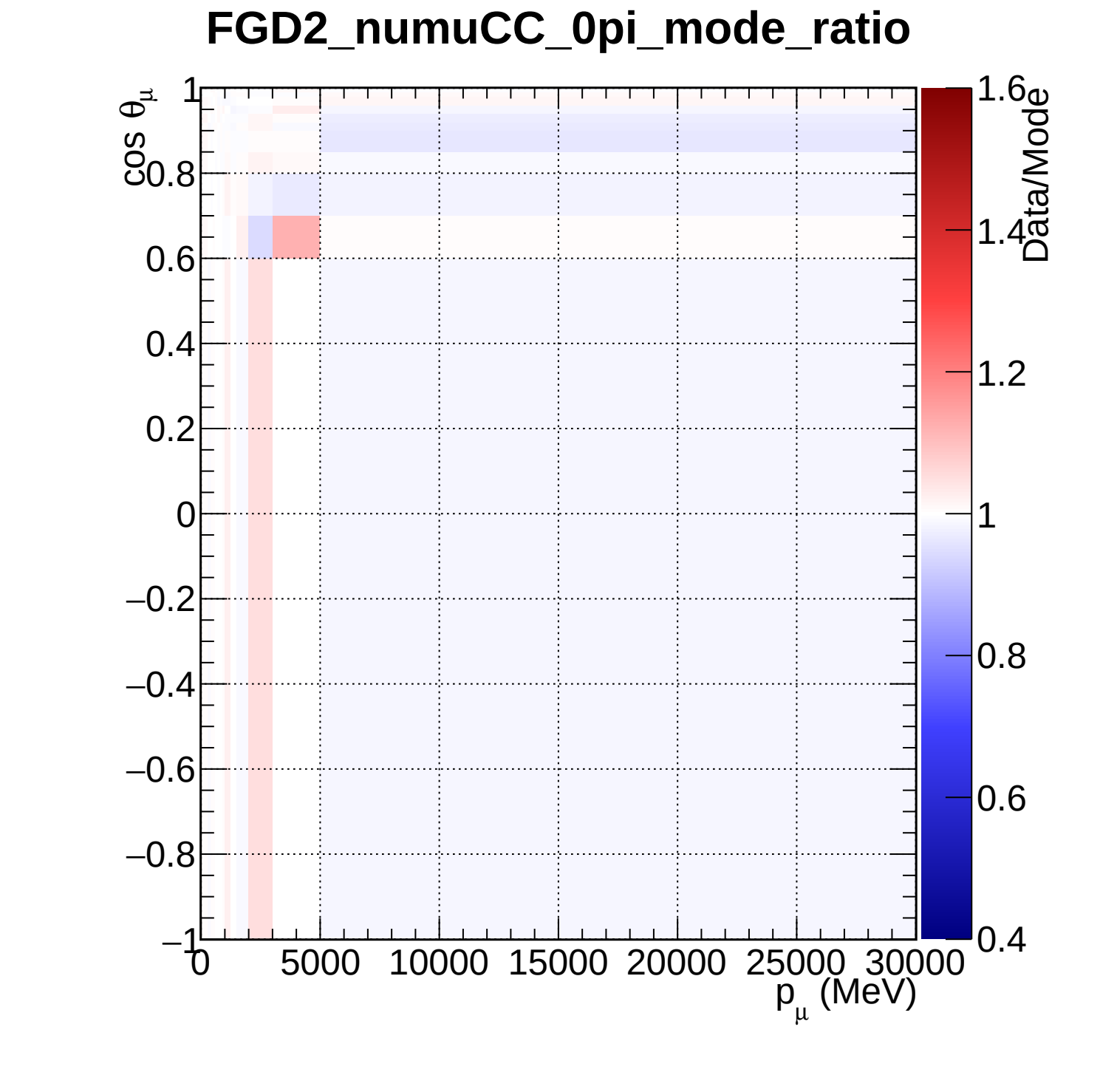

FGD1_numuCC_other_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

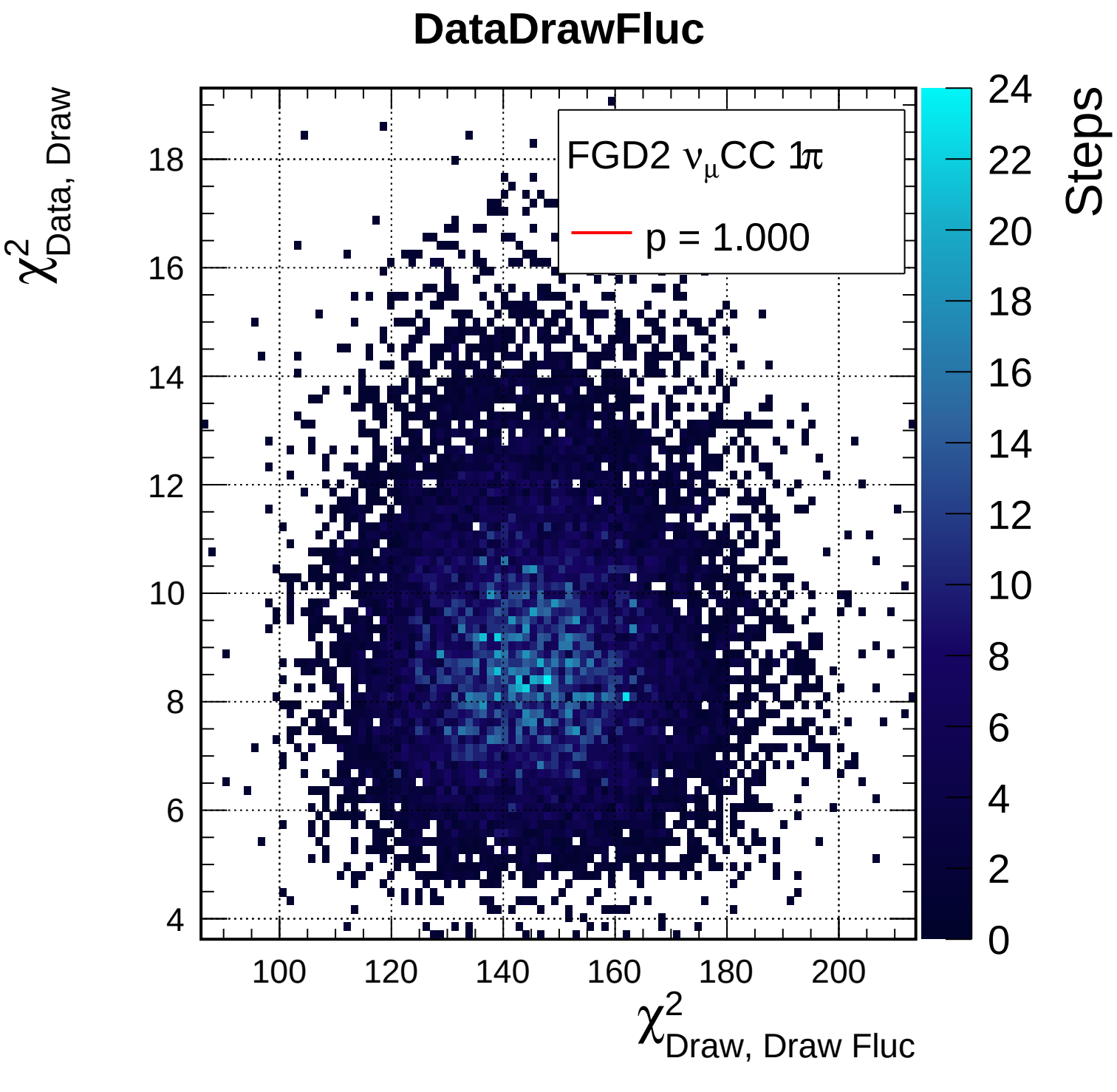

FGD1_numuCC_other_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

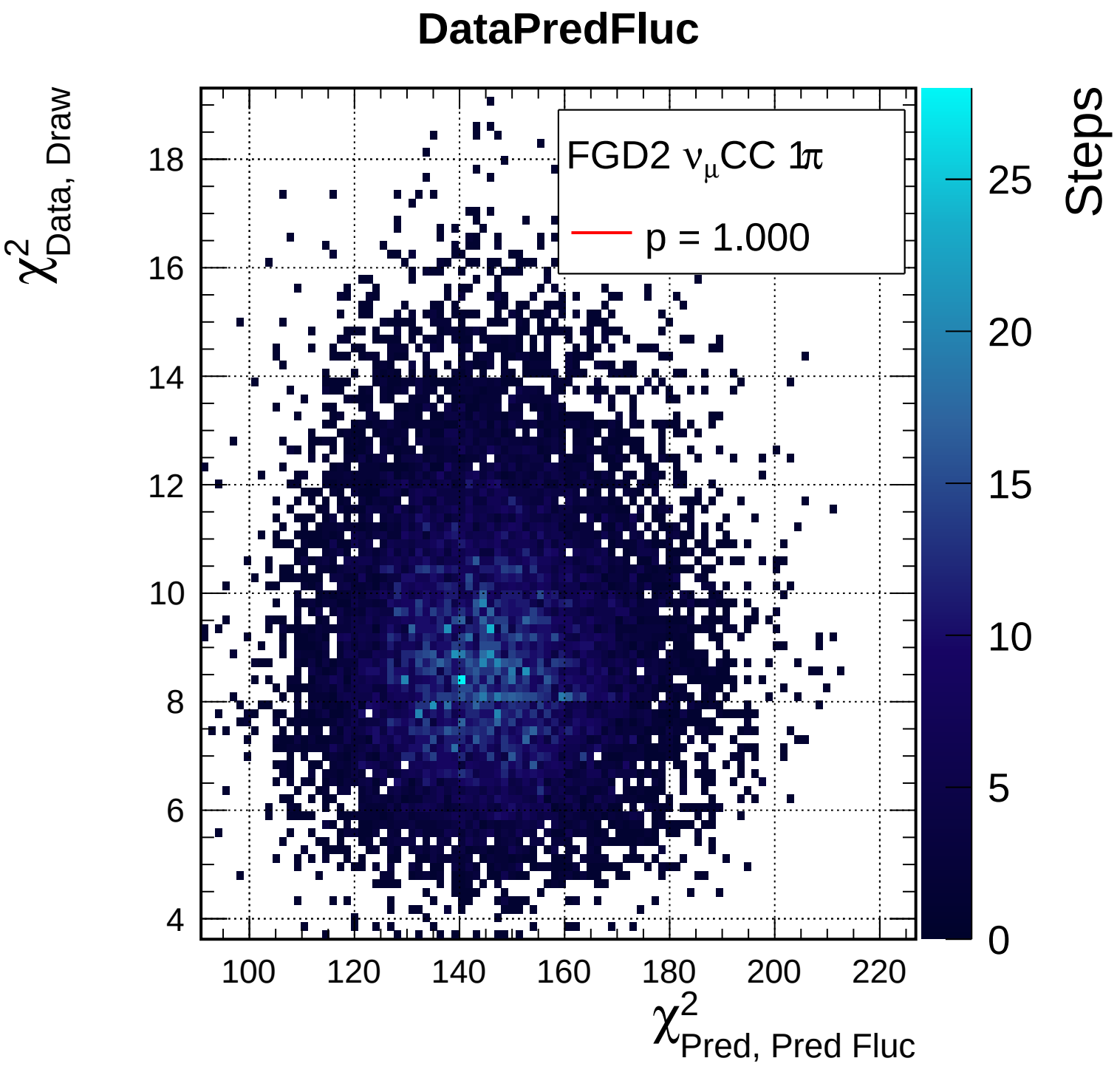

DataDrawFluc
FGD2 ν_μCC 0π
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Draw, Draw Fluc}}$
Steps
25
20
15
10
5
0
100
120
140
160
180
200
220

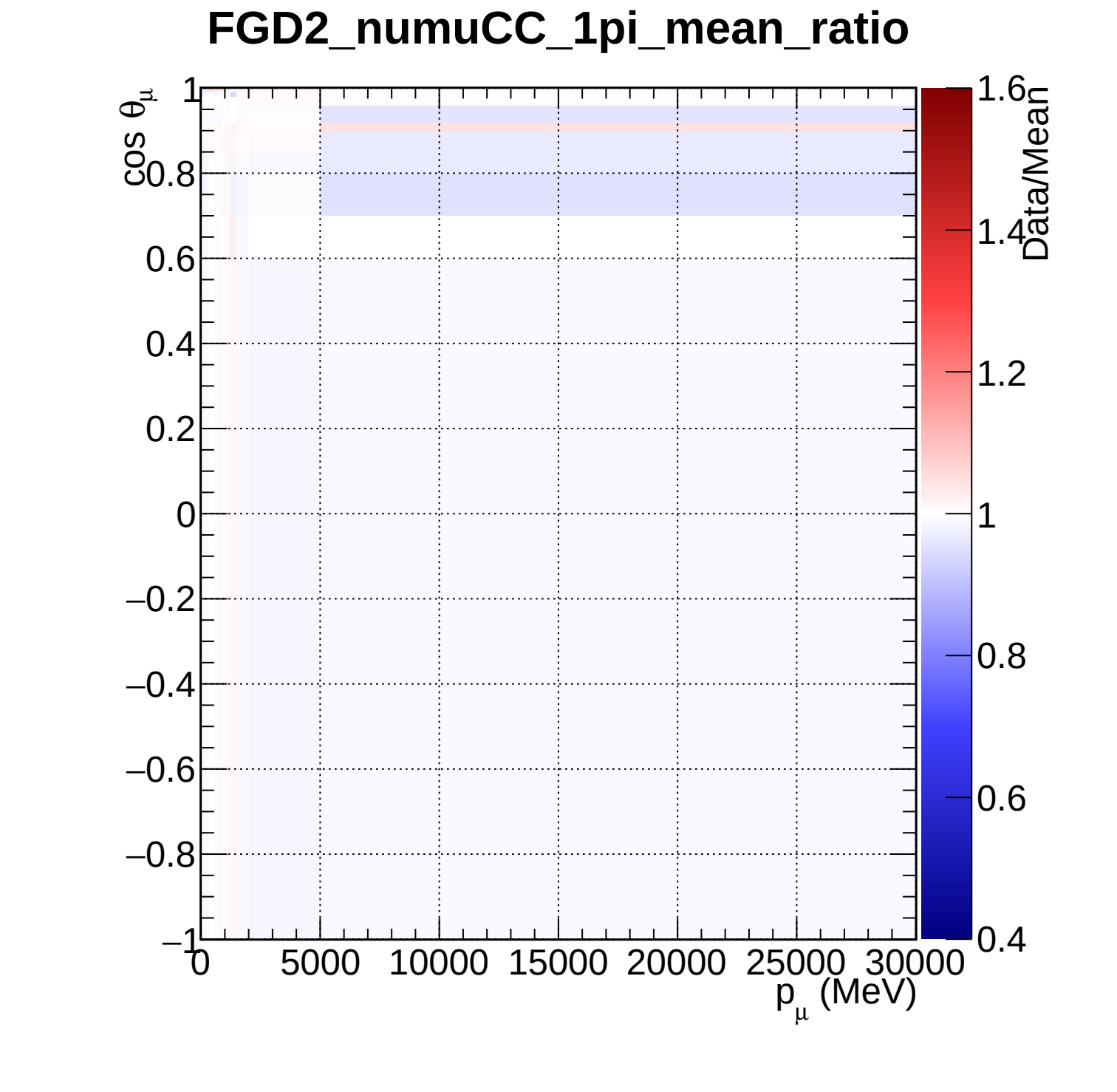

DataPredFluc
FGD2 ν_μCC 0π
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
5
10
15
20
25
100
120
140
160
180
200
220
0
5
10
15
20
25
30

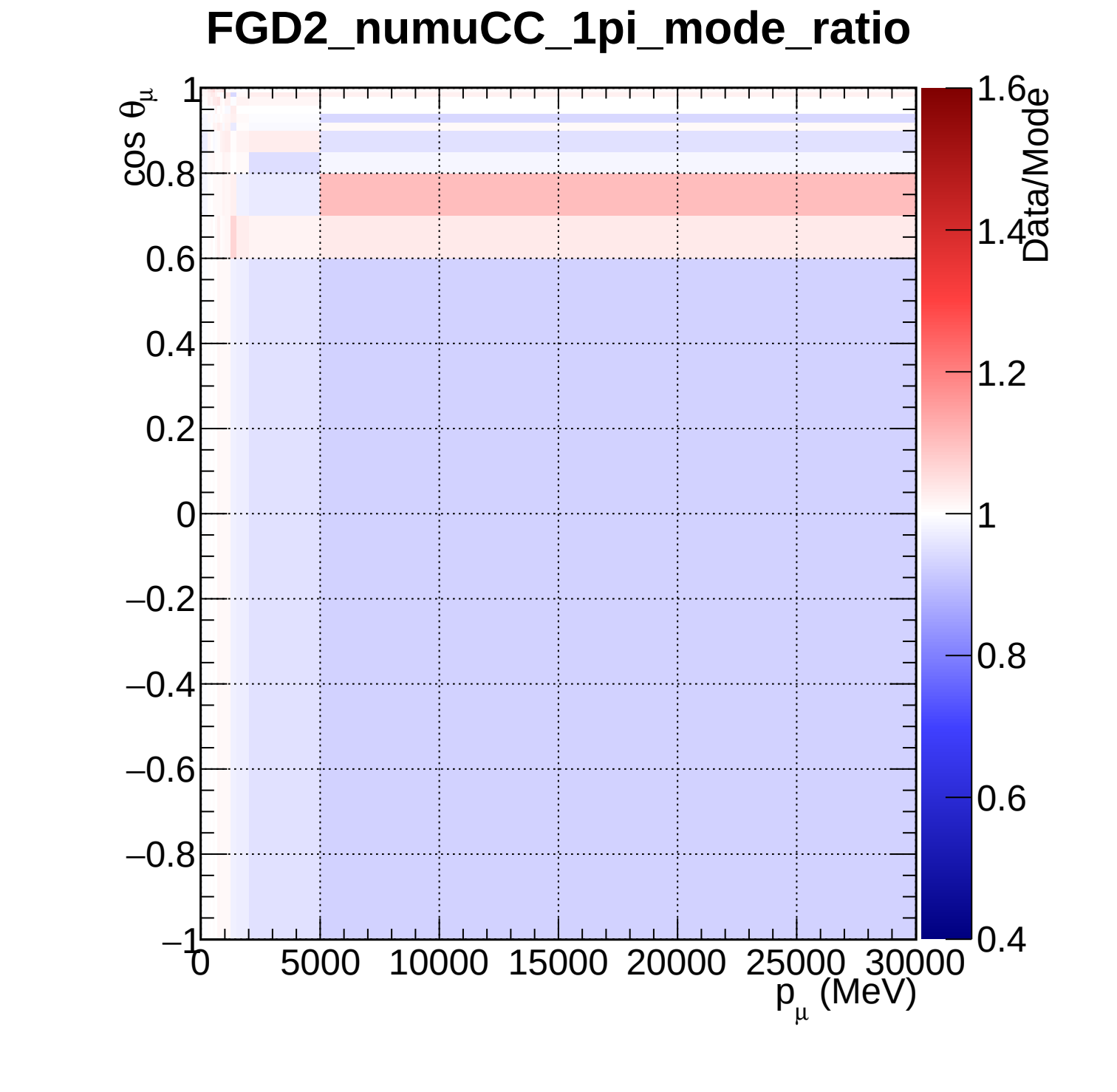

FGD2_numuCC_0pi_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

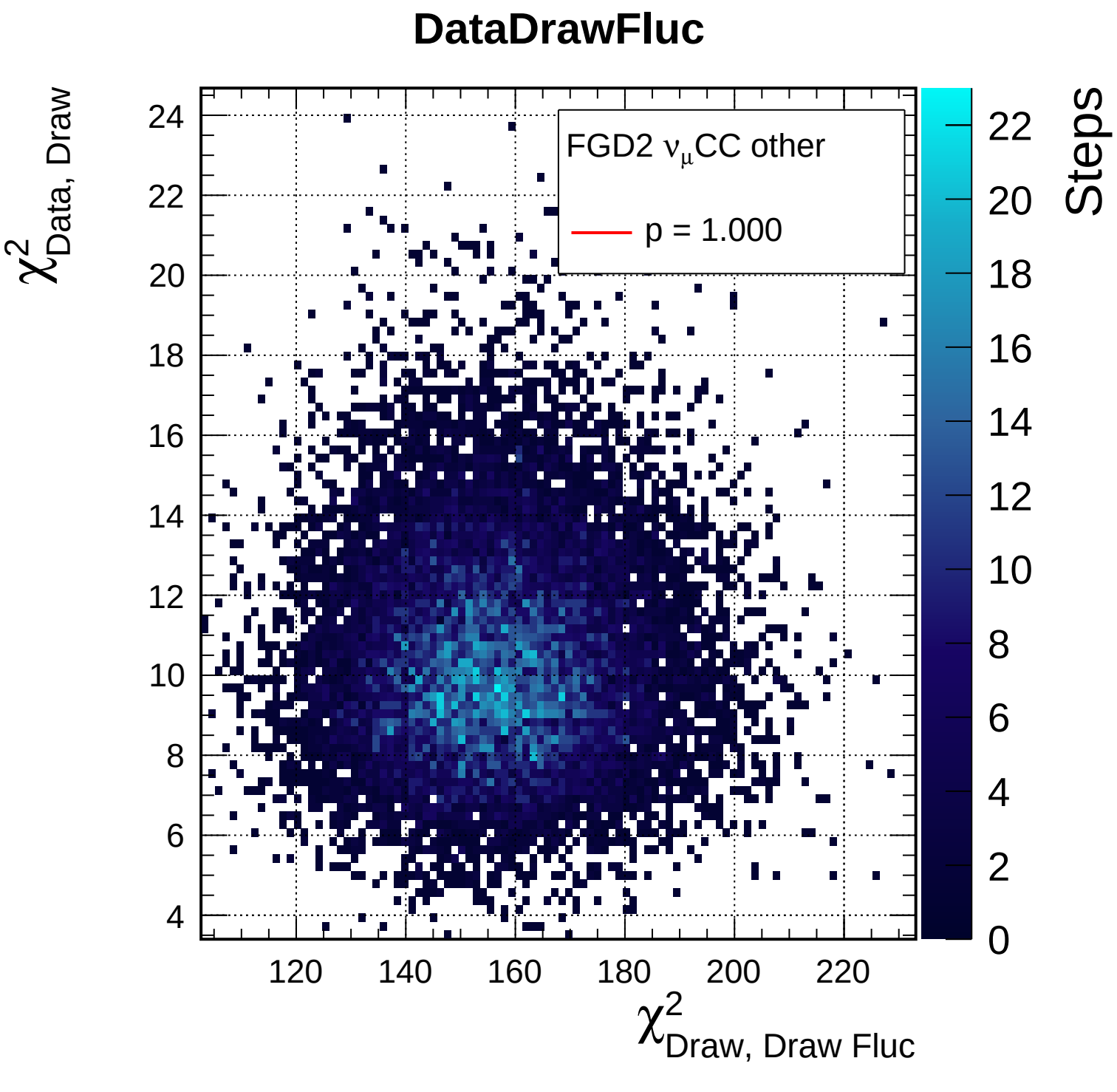

FGD2_numuCC_0pi_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

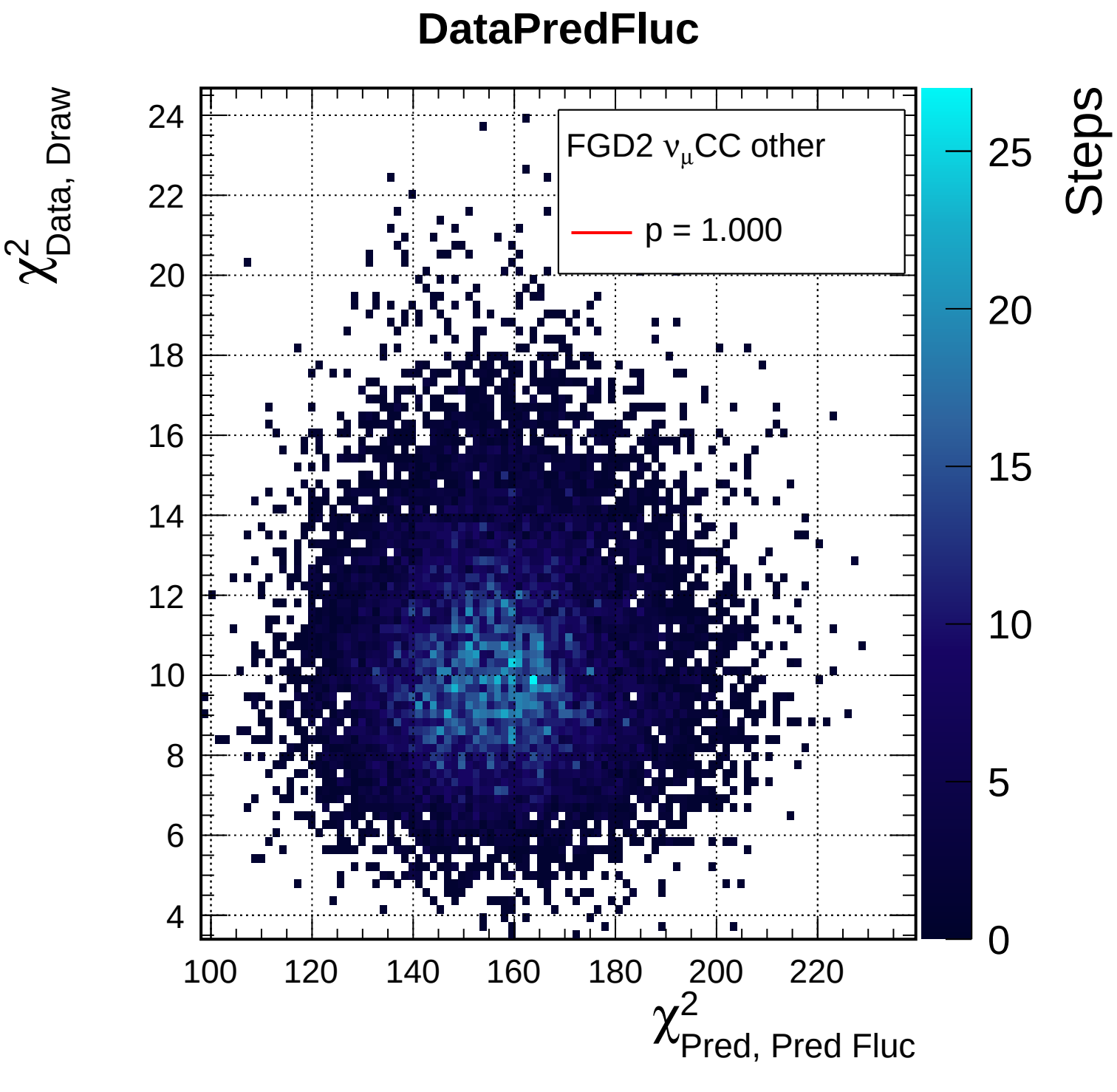

DataDrawFluc
FGD2 ν_μCC 1π
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Draw, Draw Fluc}}$
Steps
18
16
14
12
10
8
6
4
100
120
140
160
180
200
24
22
20
18
16
14
12
10
8
6
4
2
0

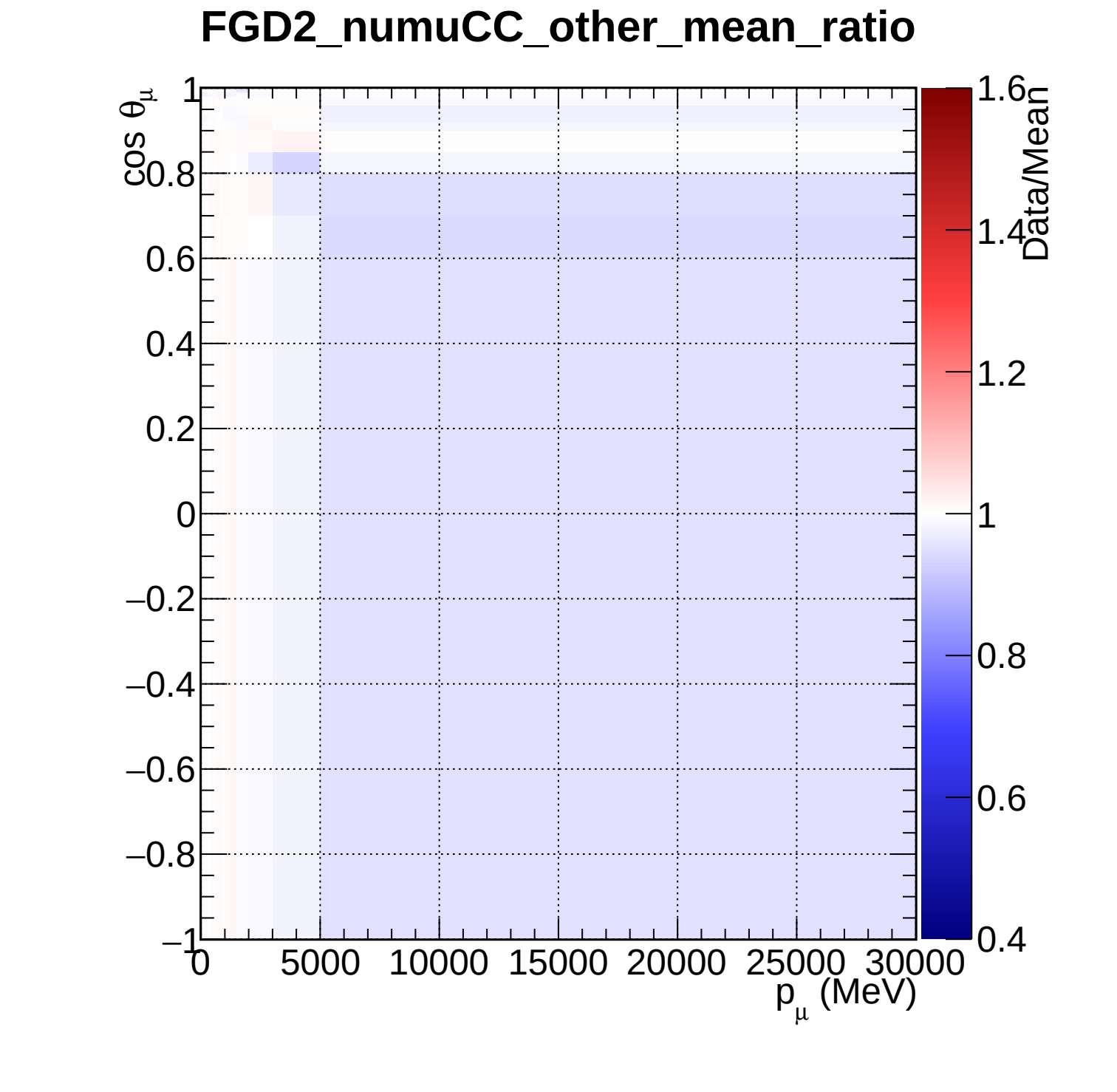

DataPredFluc
FGD2 νμCC 1π
p = 1.000
χ²Data, Draw
χ²Pred, Pred Fluc
Steps
18
16
14
12
10
8
6
4
100
120
140
160
180
200
220
25
20
15
10
5
0

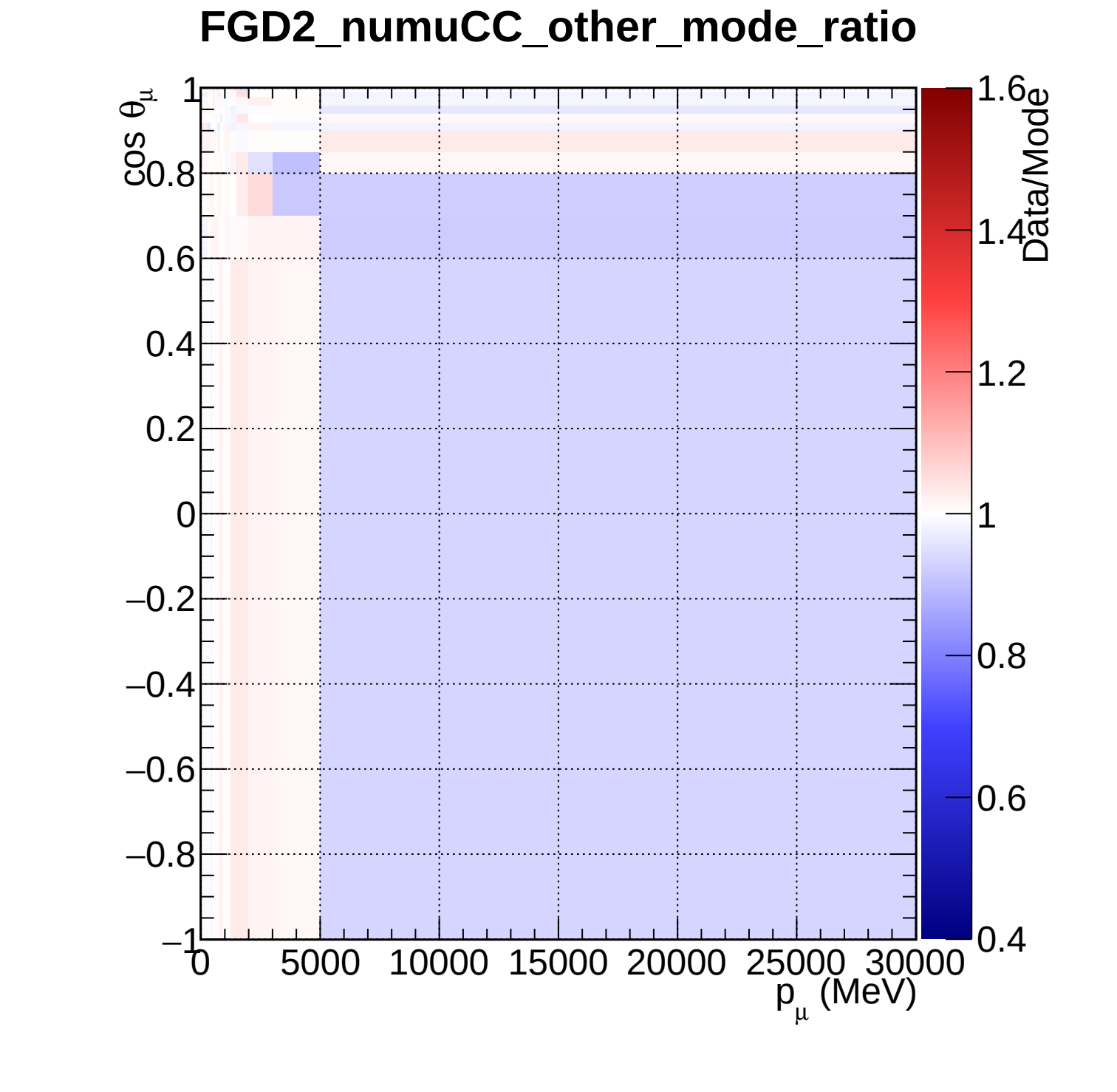

FGD2_numuCC_1pi_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

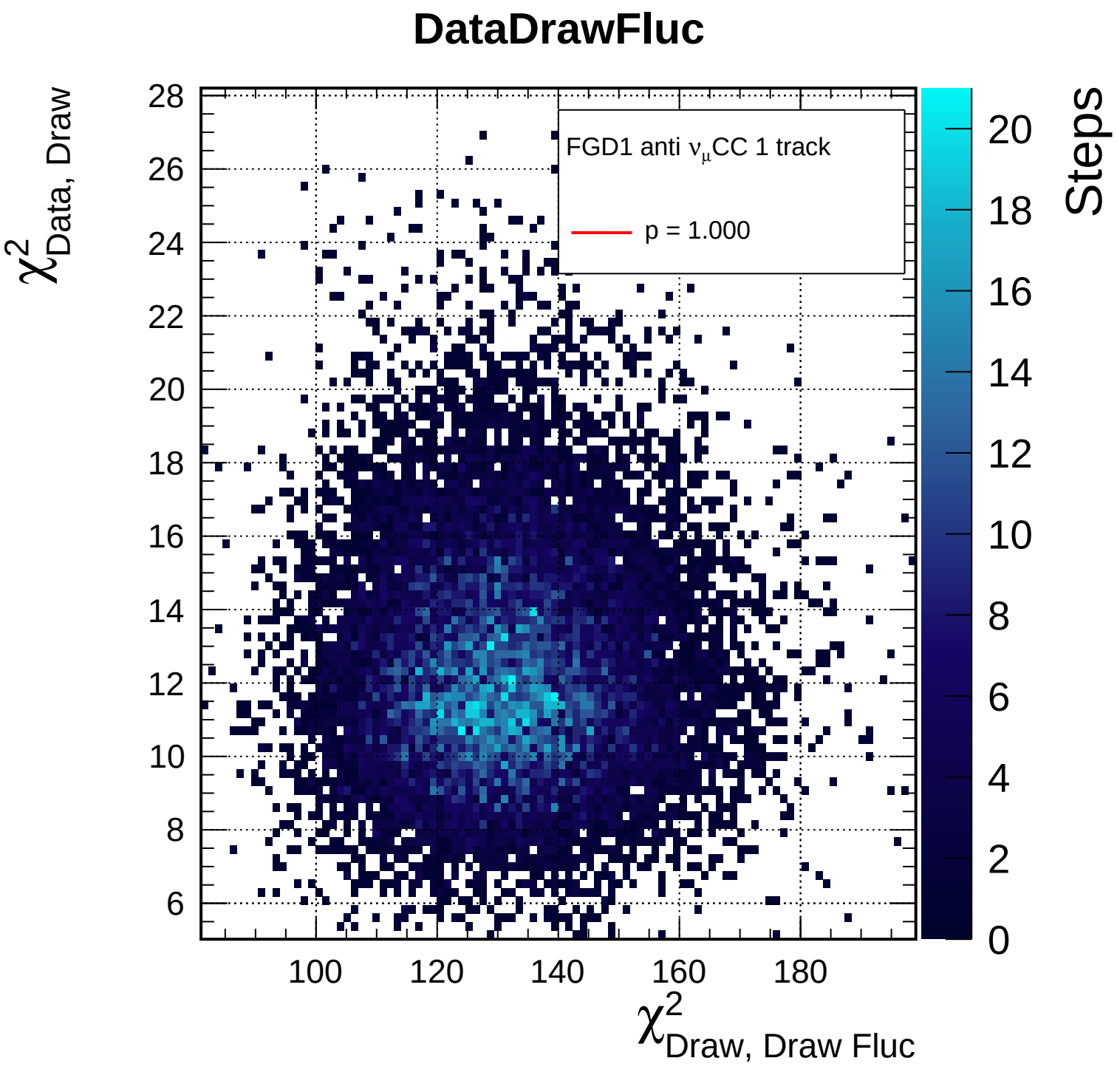

FGD2_numuCC_1pi_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

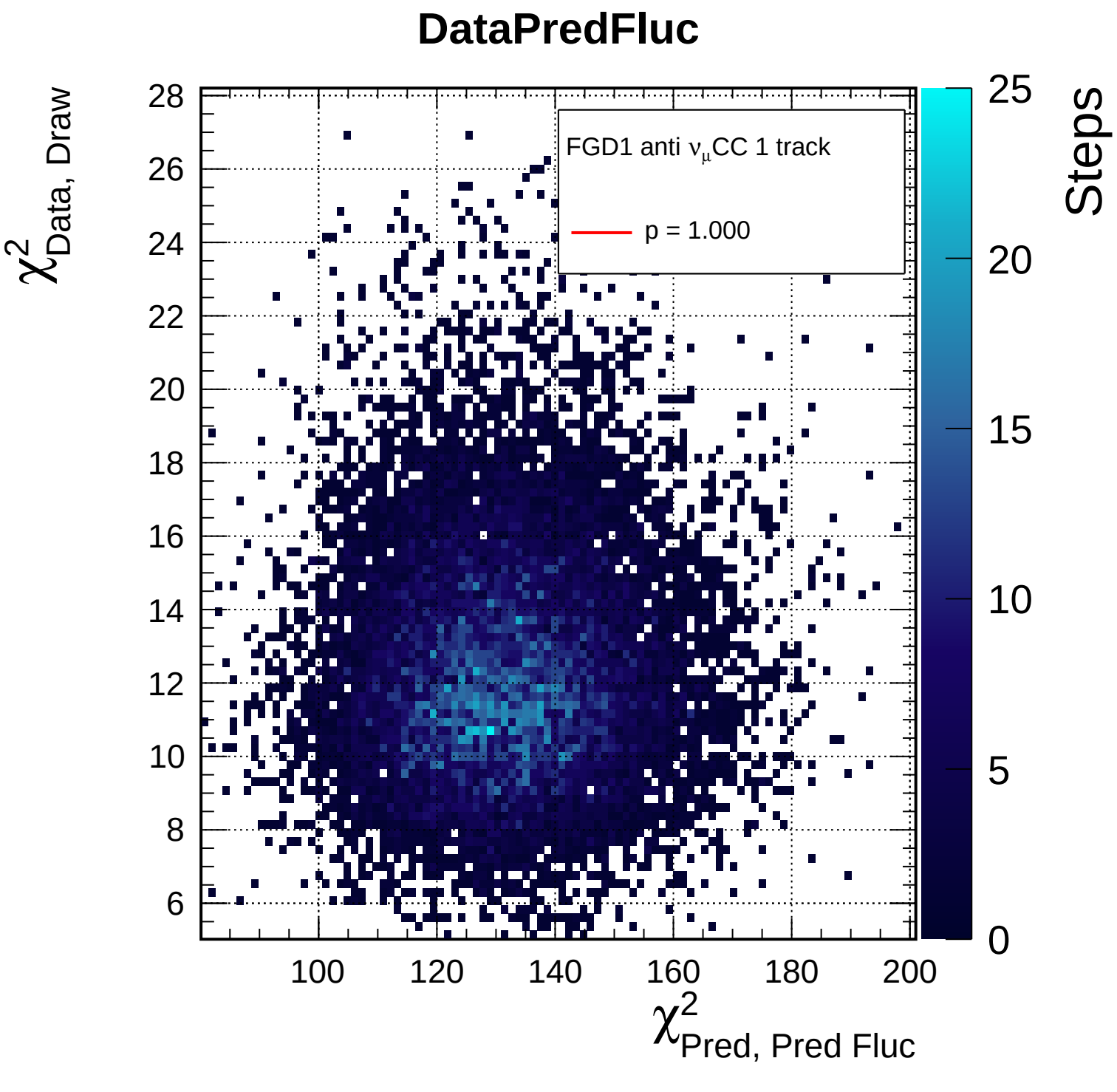

DataDrawFluc
FGD2 ν_μCC other
p = 1.000
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
24
22
20
18
16
14
12
10
8
6
4
120
140
160
180
200
220
0
2
4
6
8
10
12
14
16
18
20
22


DataPredFluc
FGD2 ν_μCC other
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
24
22
20
18
16
14
12
10
8
6
4
100
120
140
160
180
200
220
25
20
15
10
5
0


FGD2_numuCC_other_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD2_numuCC_other_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4


DataDrawFluc
FGD1 anti ν_μCC 1 track
p = 1.000
χ²Data, Draw
χ²Draw, Draw Fluc
Steps
28
26
24
22
20
18
16
14
12
10
8
6
100
120
140
160
180
20
18
16
14
12
10
8
6
4
2
0


DataPredFluc
FGD1 anti ν_μCC 1 track
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
28
26
24
22
20
18
16
14
12
10
8
6
100
120
140
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180
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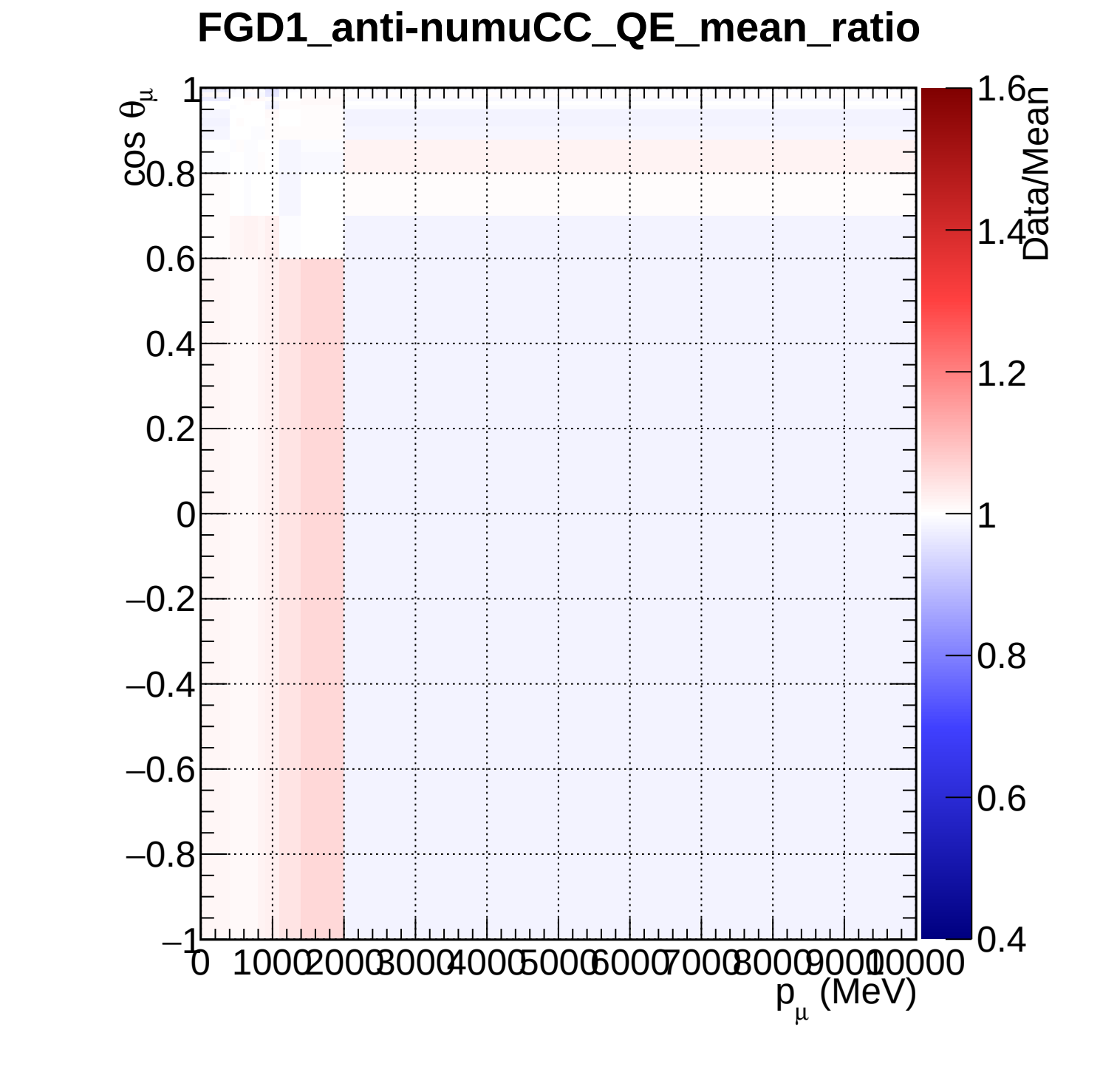
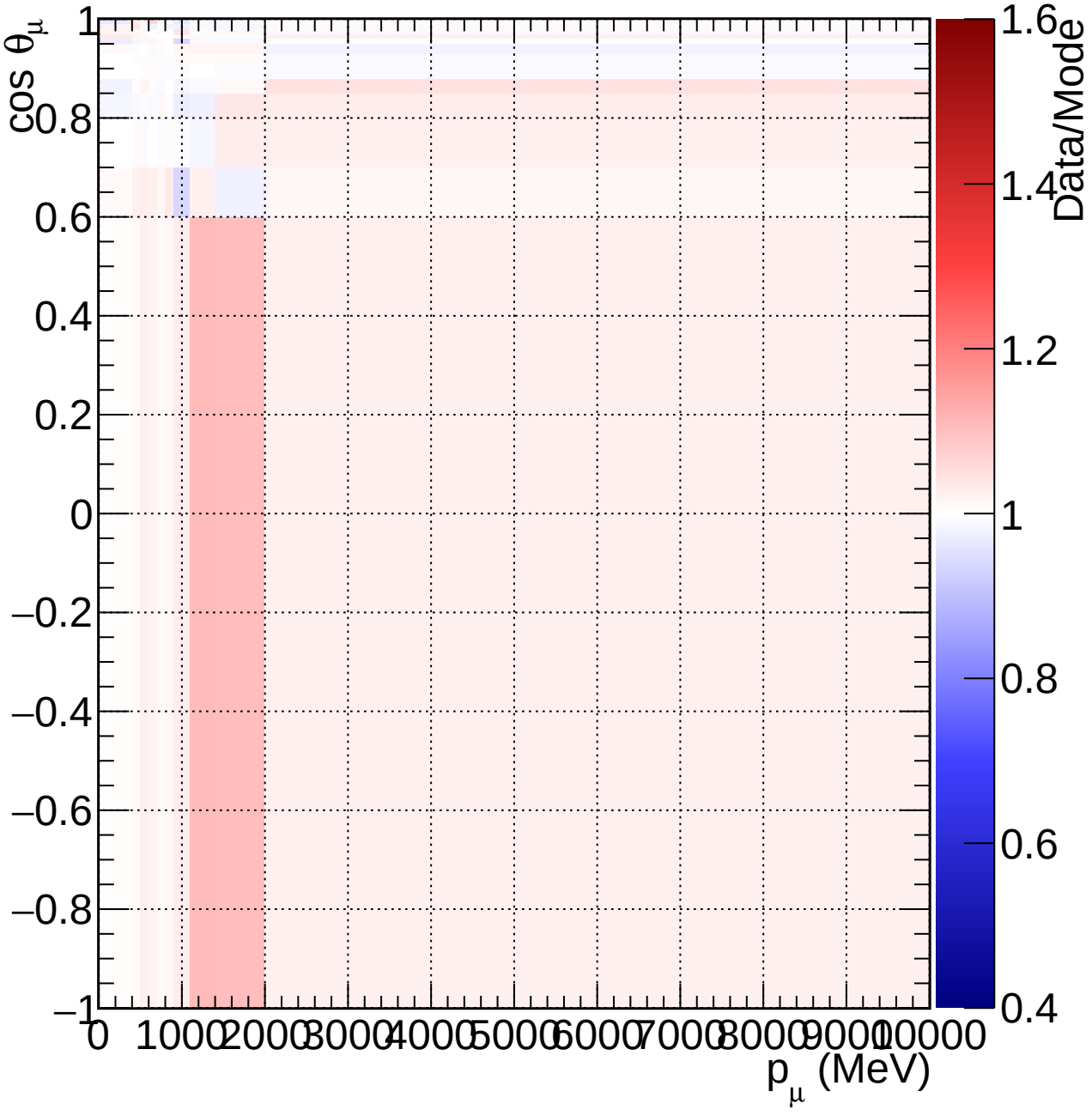
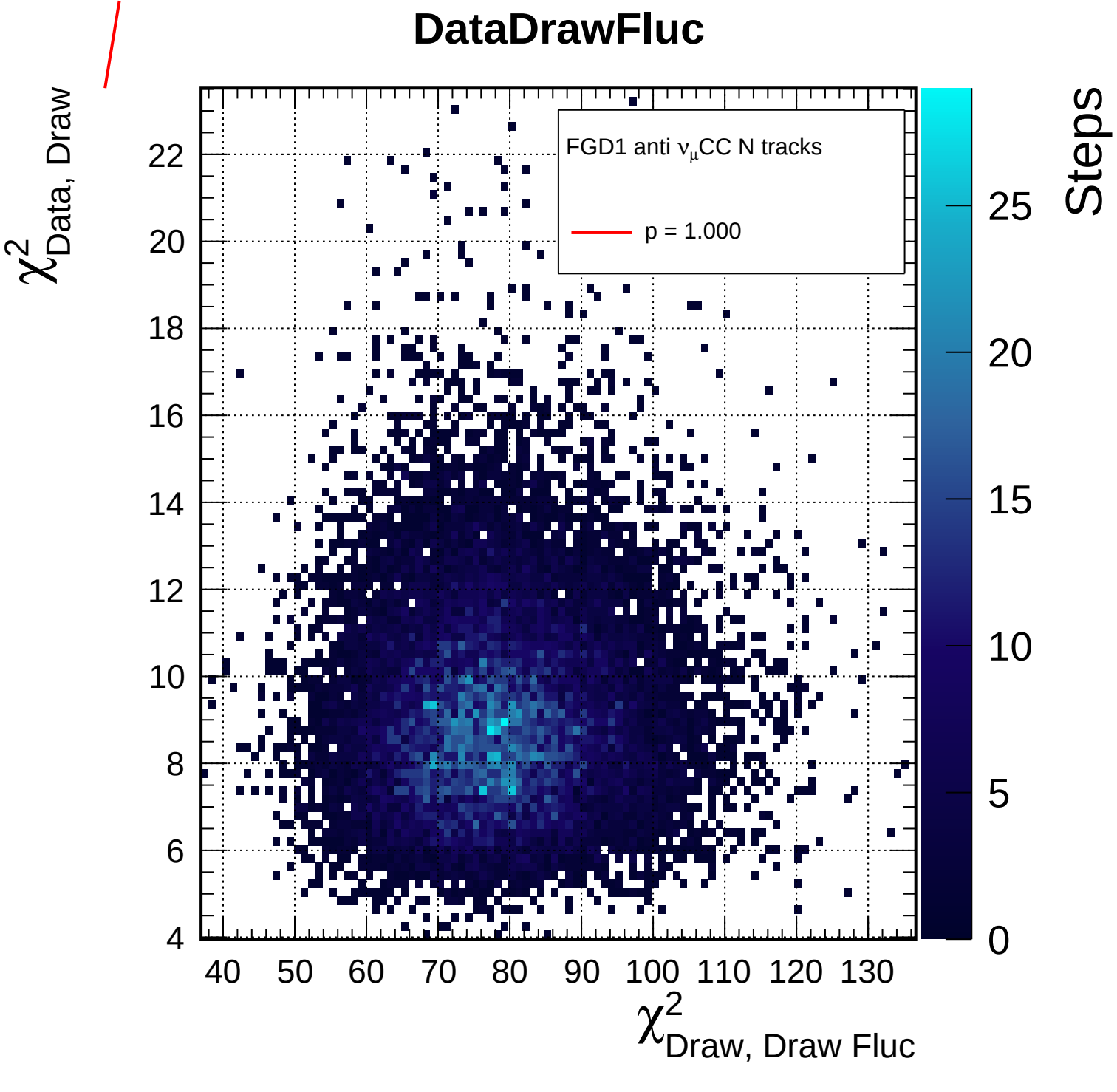
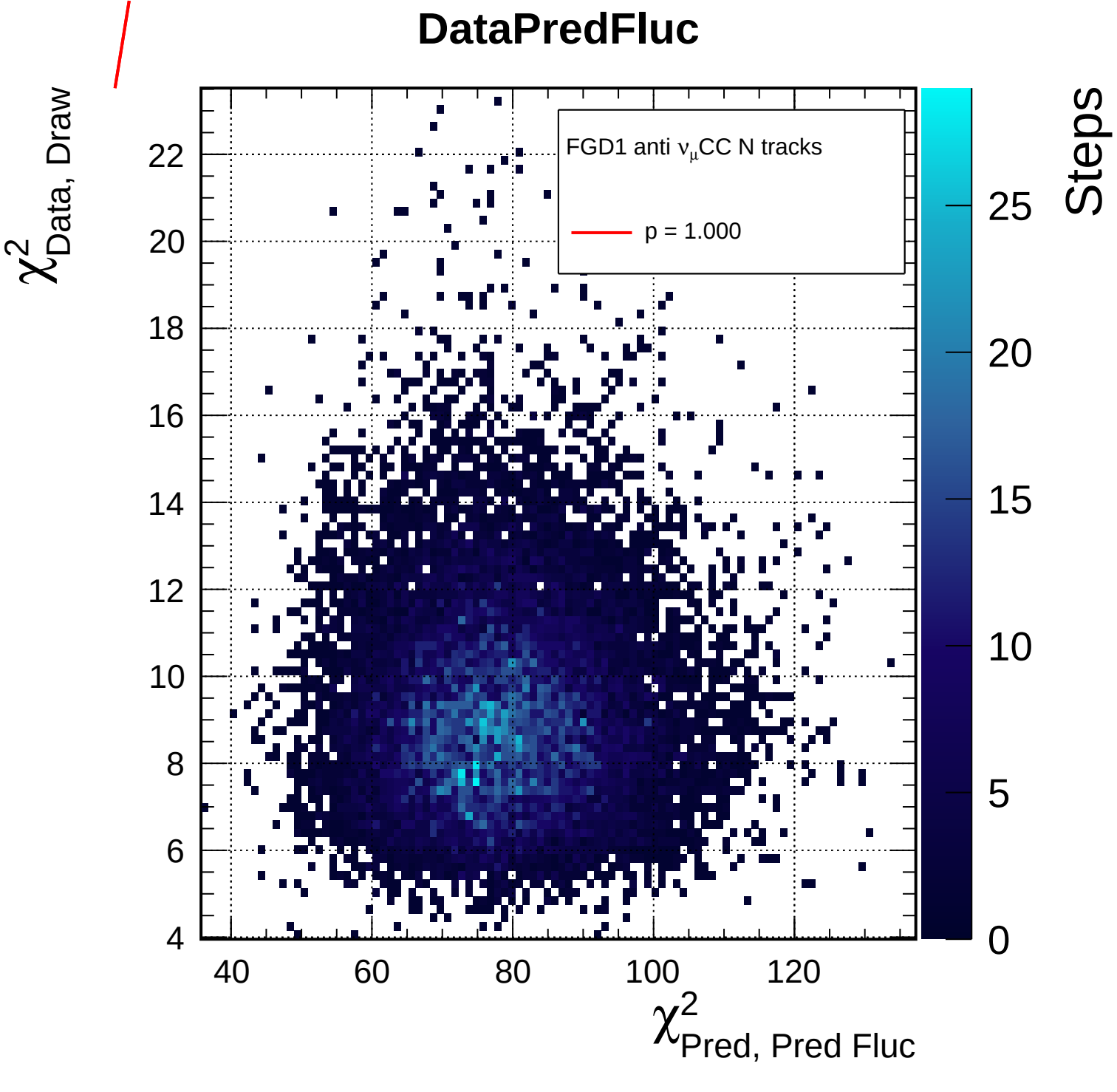
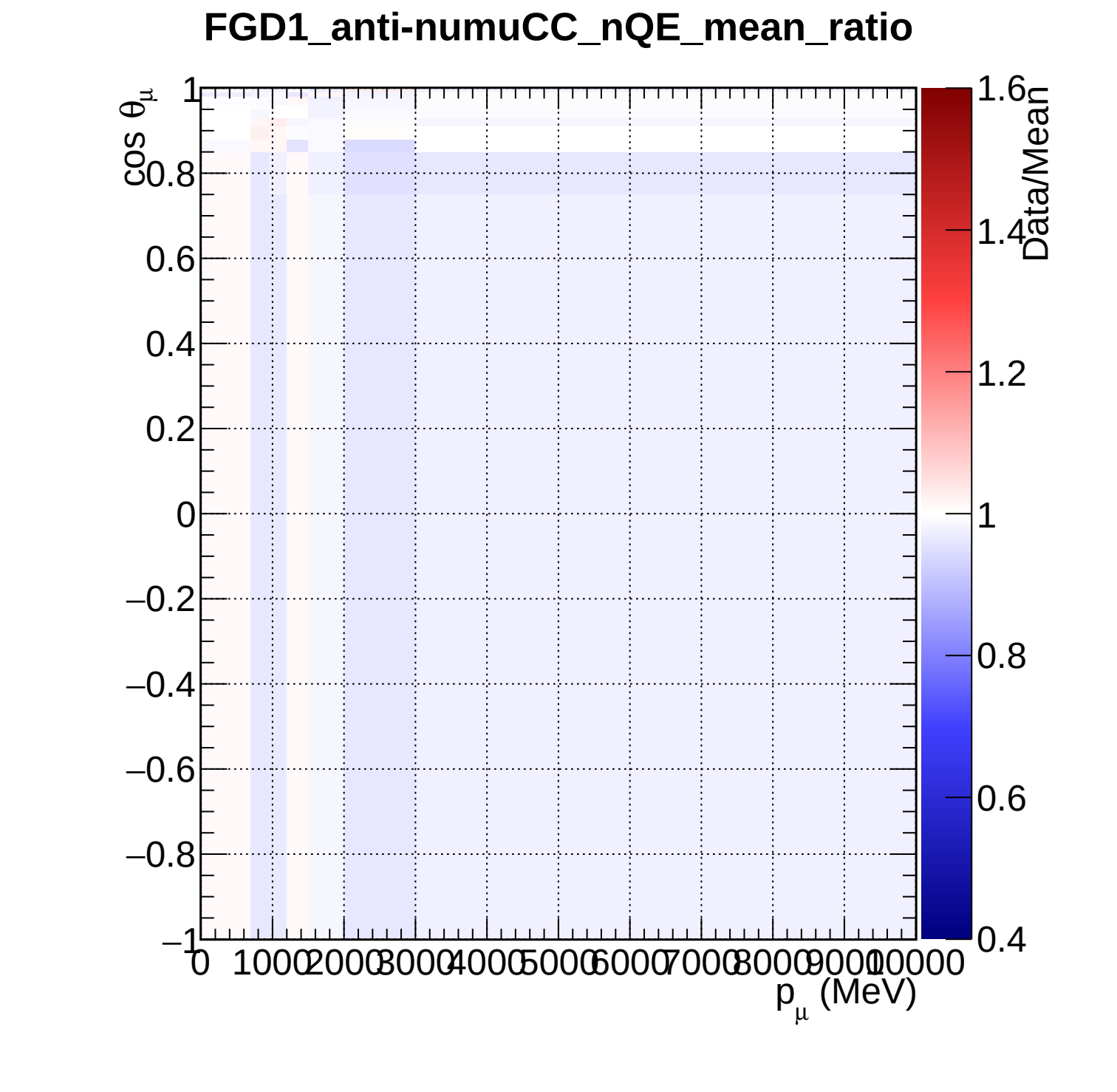
20
15
10
5
0

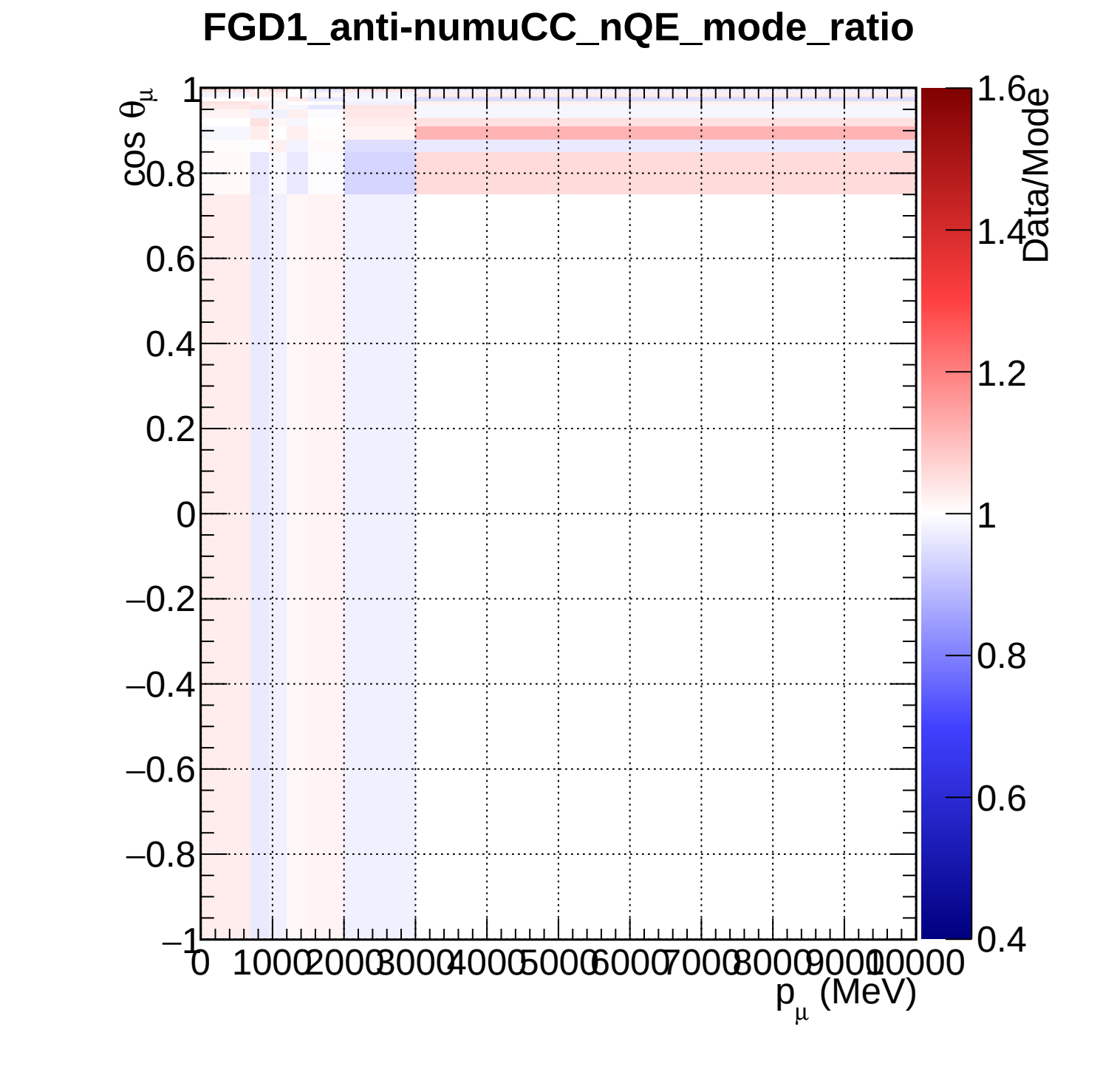

FGD1_anti-numuCC_QE_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

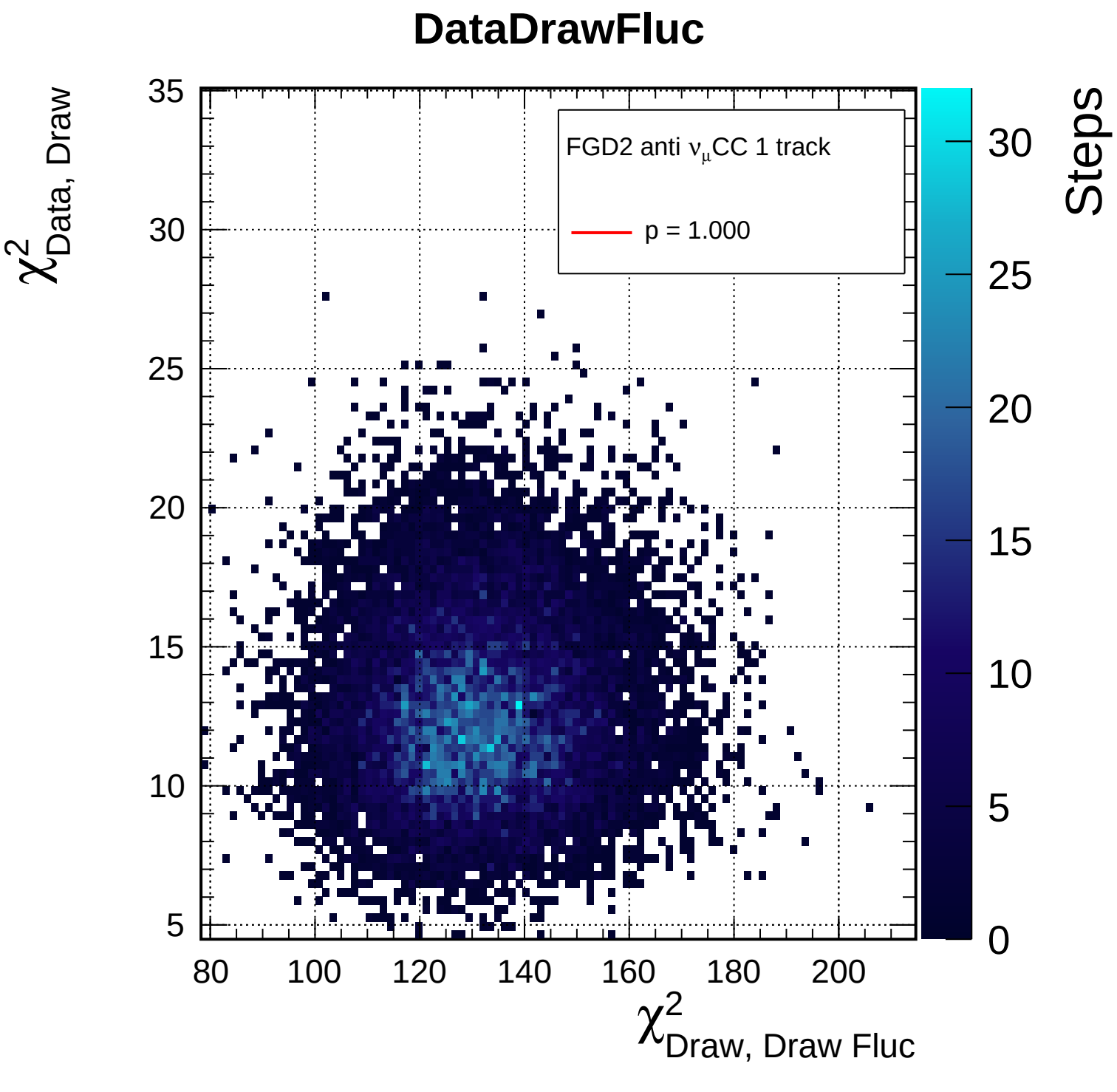

FGD1_anti-numuCC_QE_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

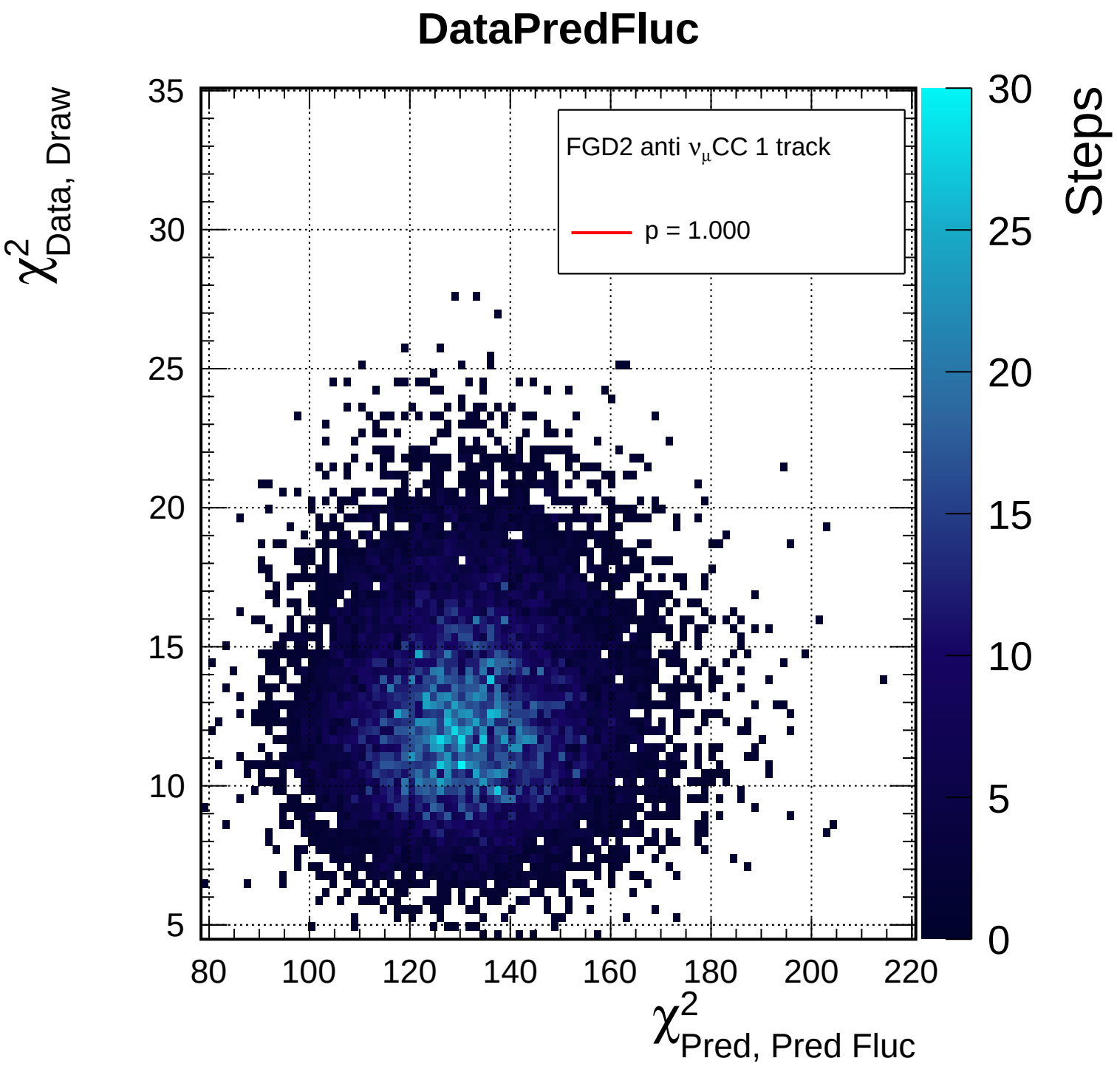

DataDrawFluc
FGD1 anti ν_μCC N tracks
p = 1.000
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
22
20
18
16
14
12
10
8
6
4
40
50
60
70
80
90
100
110
120
130
25
20
15
10
5
0


DataPredFluc
FGD1 anti ν_μCC N tracks
p = 1.000
$\chi^2_{Data,\ Draw}$
$\chi^2_{Pred,\ Pred\ Fluc}$
Steps
4
6
8
10
12
14
16
18
20
22
40
60
80
100
120
0
5
10
15
20
25


FGD1_anti-numuCC_nQE_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD1_anti-numuCC_nQE_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4


DataDrawFluc
FGD2 anti ν_μCC 1 track
p = 1.000
χ²Data, Draw
χ²Draw, Draw Fluc
Steps
35
30
25
20
15
10
5
80
100
120
140
160
180
200
30
25
20
15
10
5
0


DataPredFluc
FGD2 anti ν_μCC 1 track
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
35
30
25
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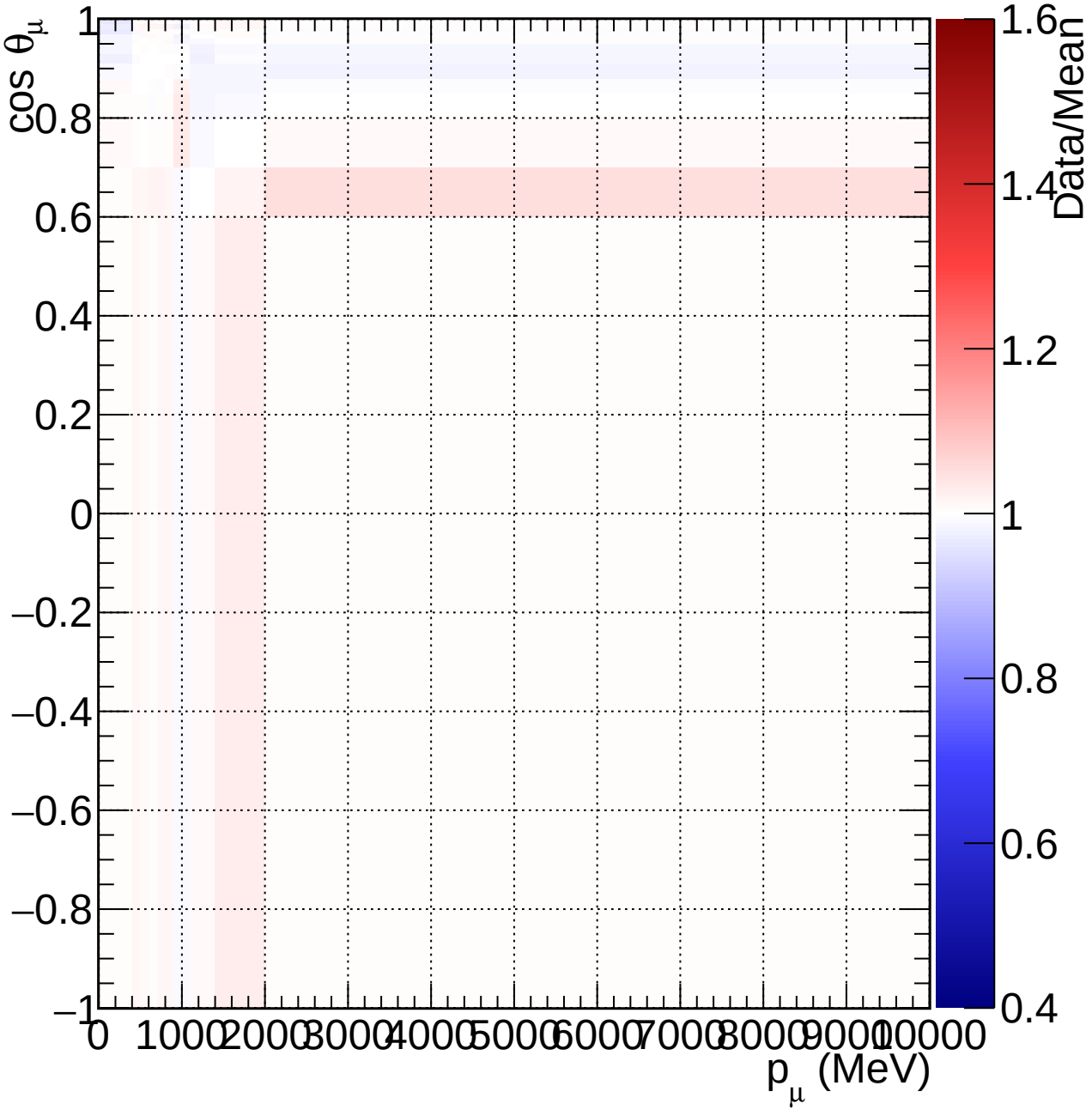
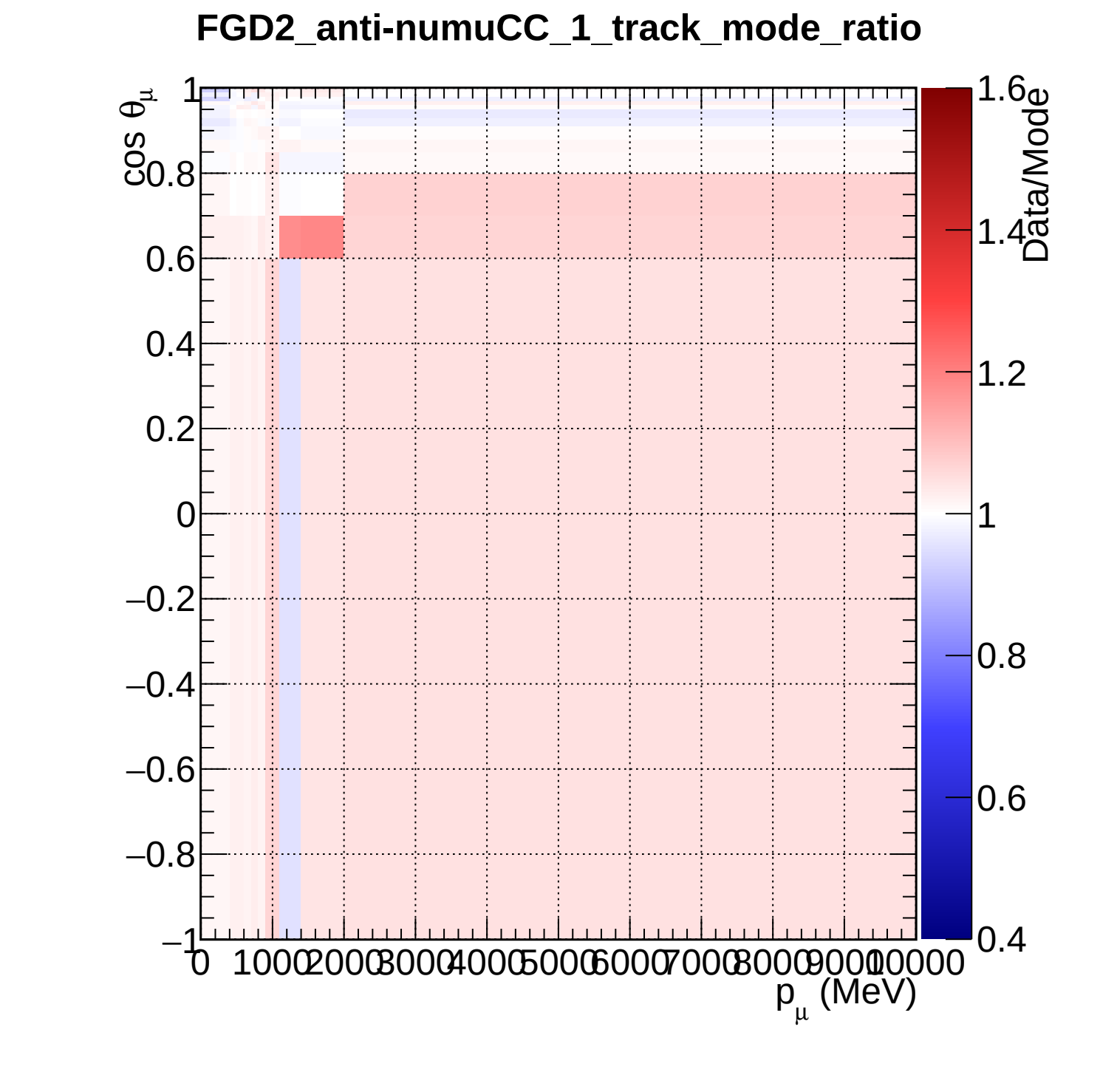
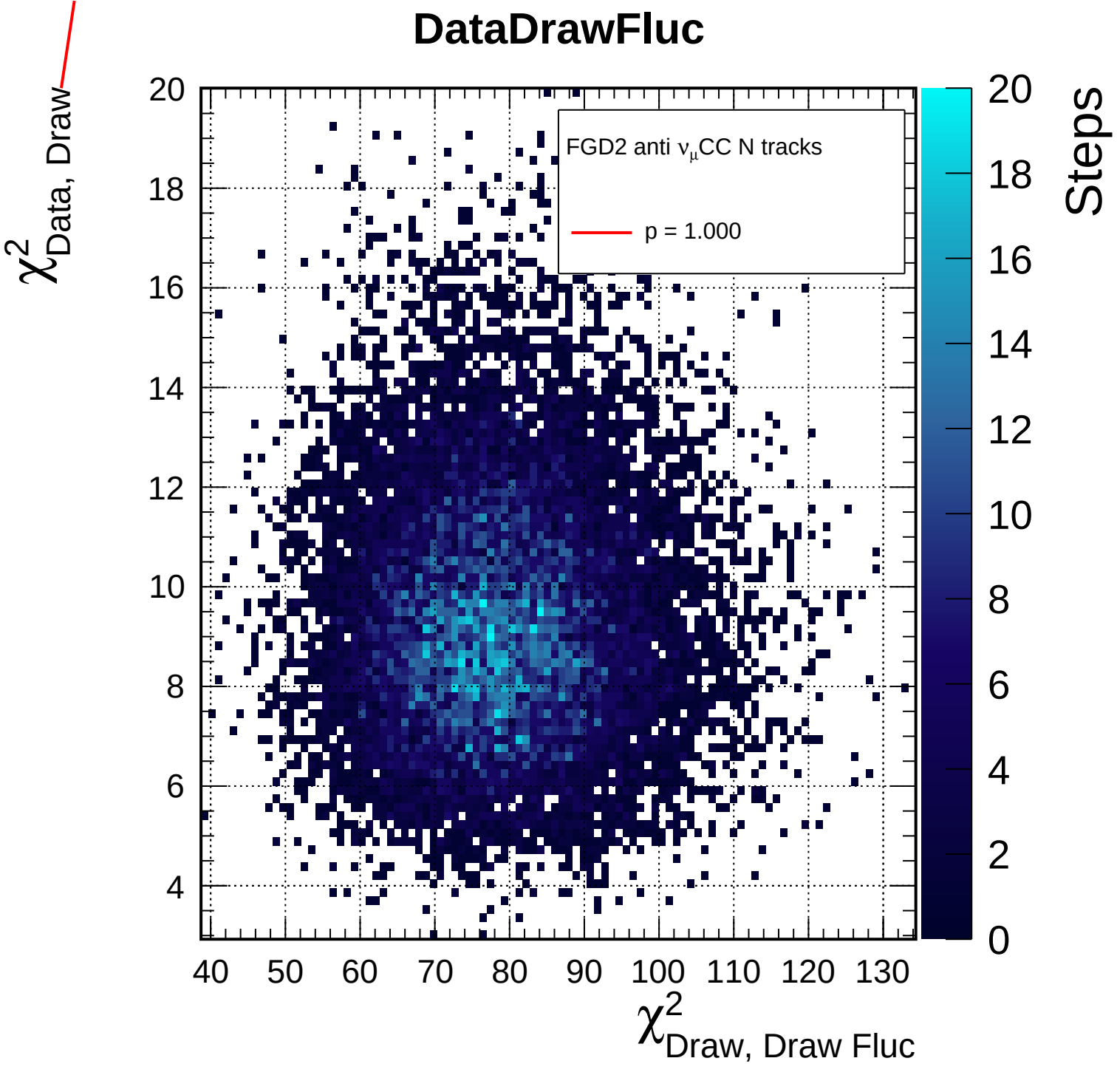
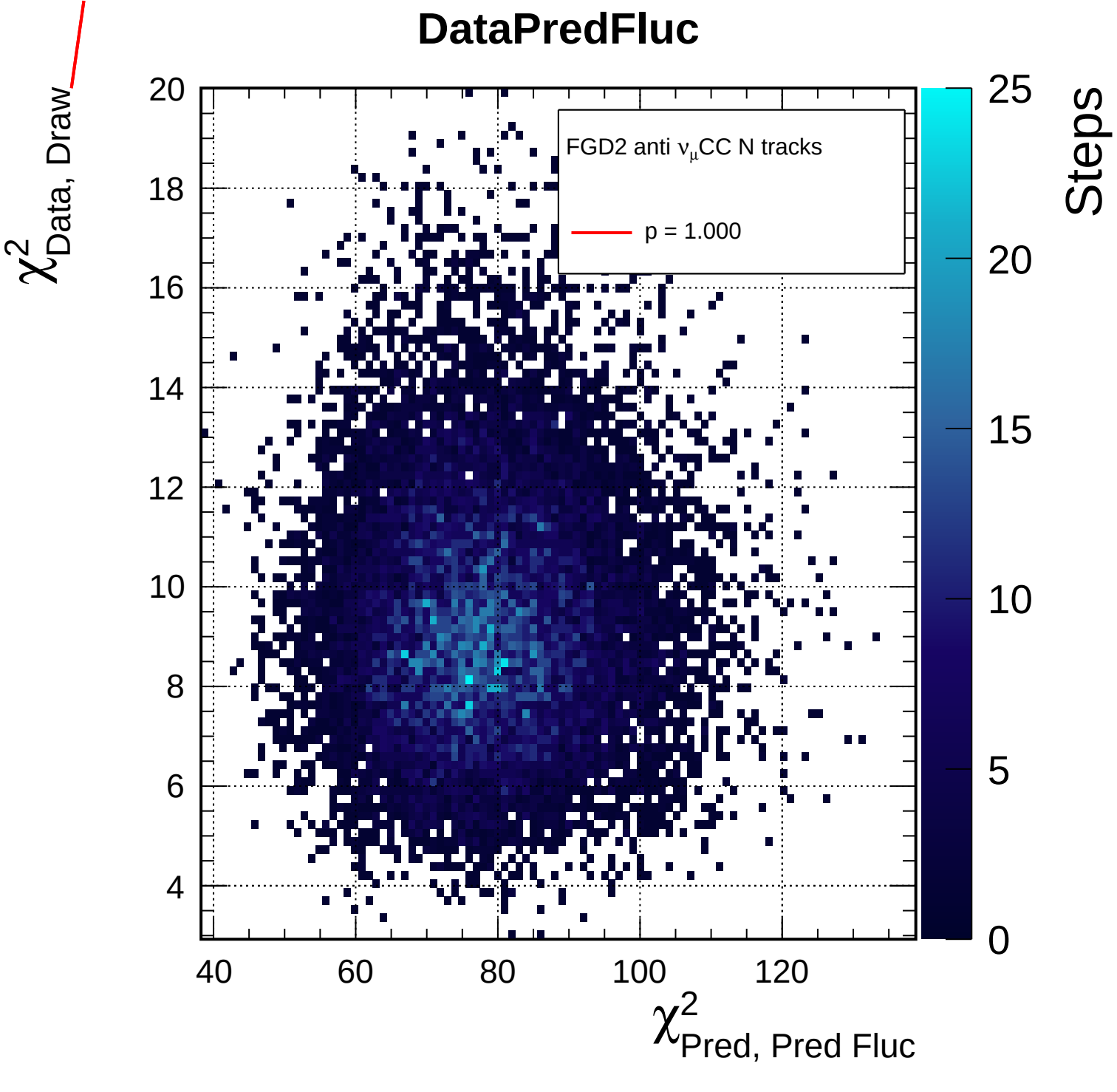
180
200
220
30
25
20
15
10
5
0


FGD2_anti-numuCC_1_track_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD2_anti-numuCC_1_track_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4


DataDrawFluc
FGD2 anti ν_μCC N tracks
p = 1.000
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
20
18
16
14
12
10
8
6
4
2
0
40
50
60
70
80
90
100
110
120
130


DataPredFluc
FGD2 anti ν_μCC N tracks
p = 1.000
$\chi^2_{Data,\ Draw}$
$\chi^2_{Pred,\ Pred\ Fluc}$
Steps
20
18
16
14
12
10
8
6
4
40
60
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100
120
25
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15
10
5
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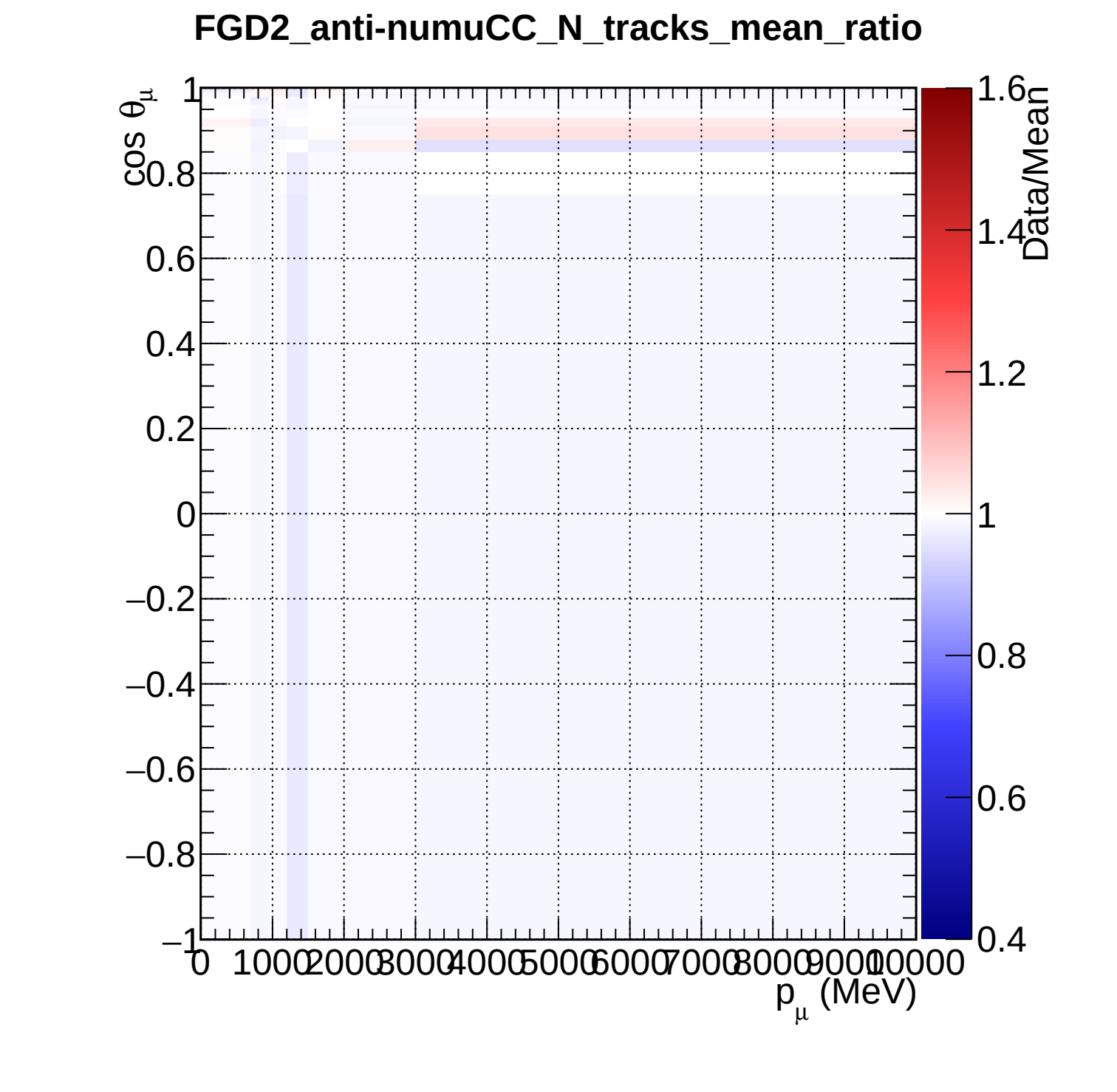
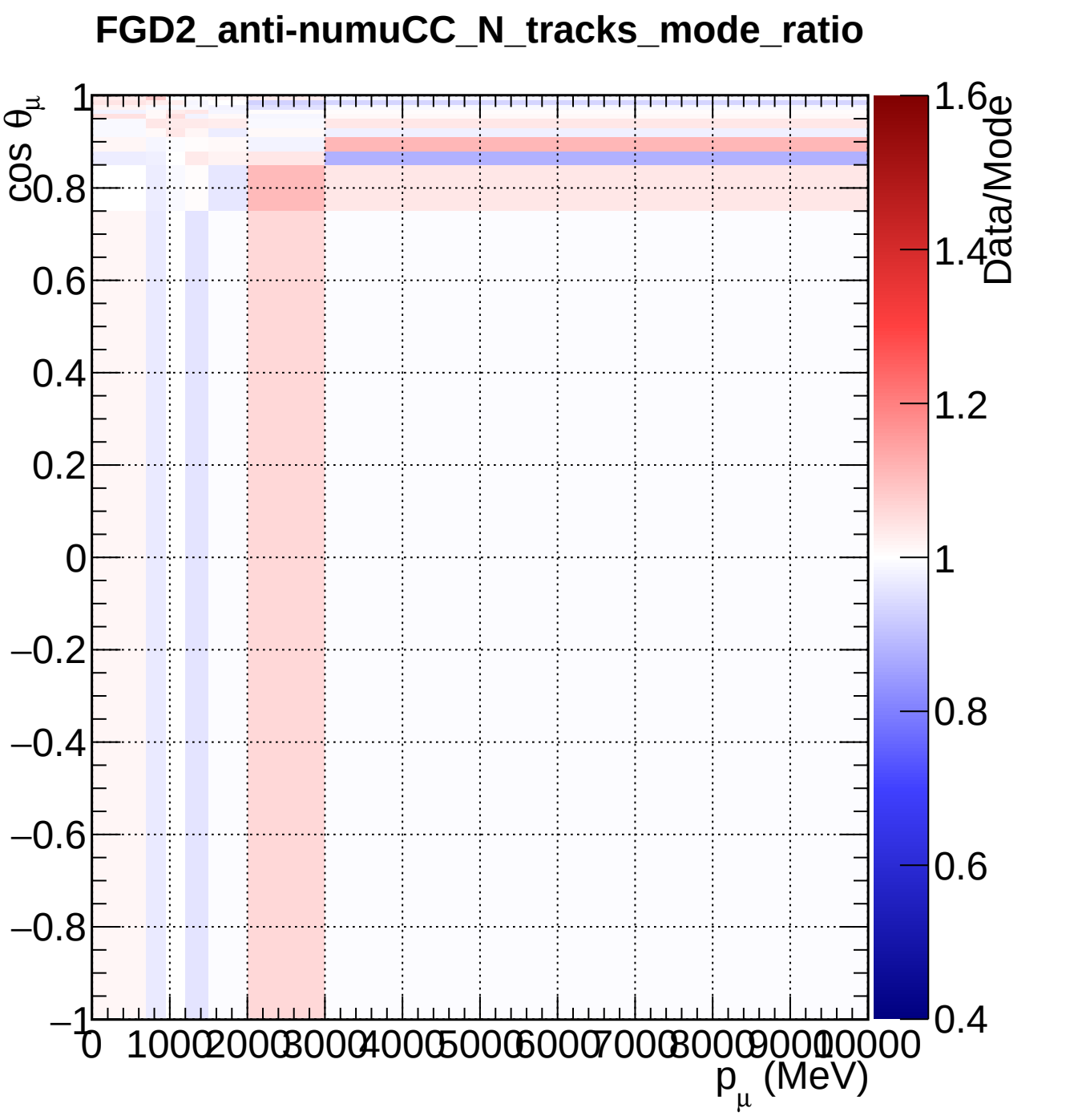
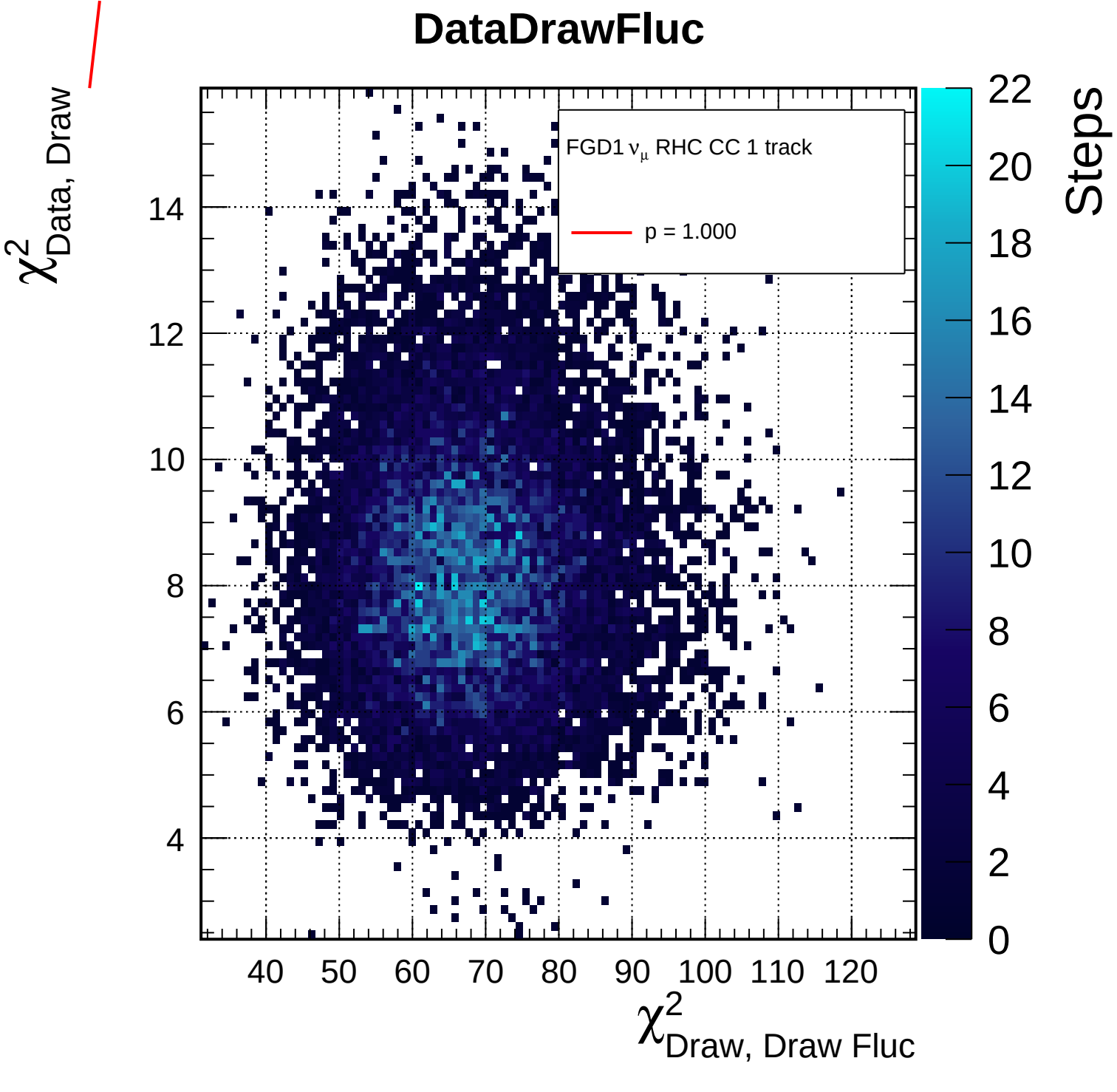

FGD2_anti-numuCC_N_tracks_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD2_anti-numuCC_N_tracks_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4


DataDrawFluc
FGD1 ν_μ RHC CC 1 track
p = 1.000
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
4
6
8
10
12
14
40
50
60
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90
100
110
120
0
2
4
6
8
10
12
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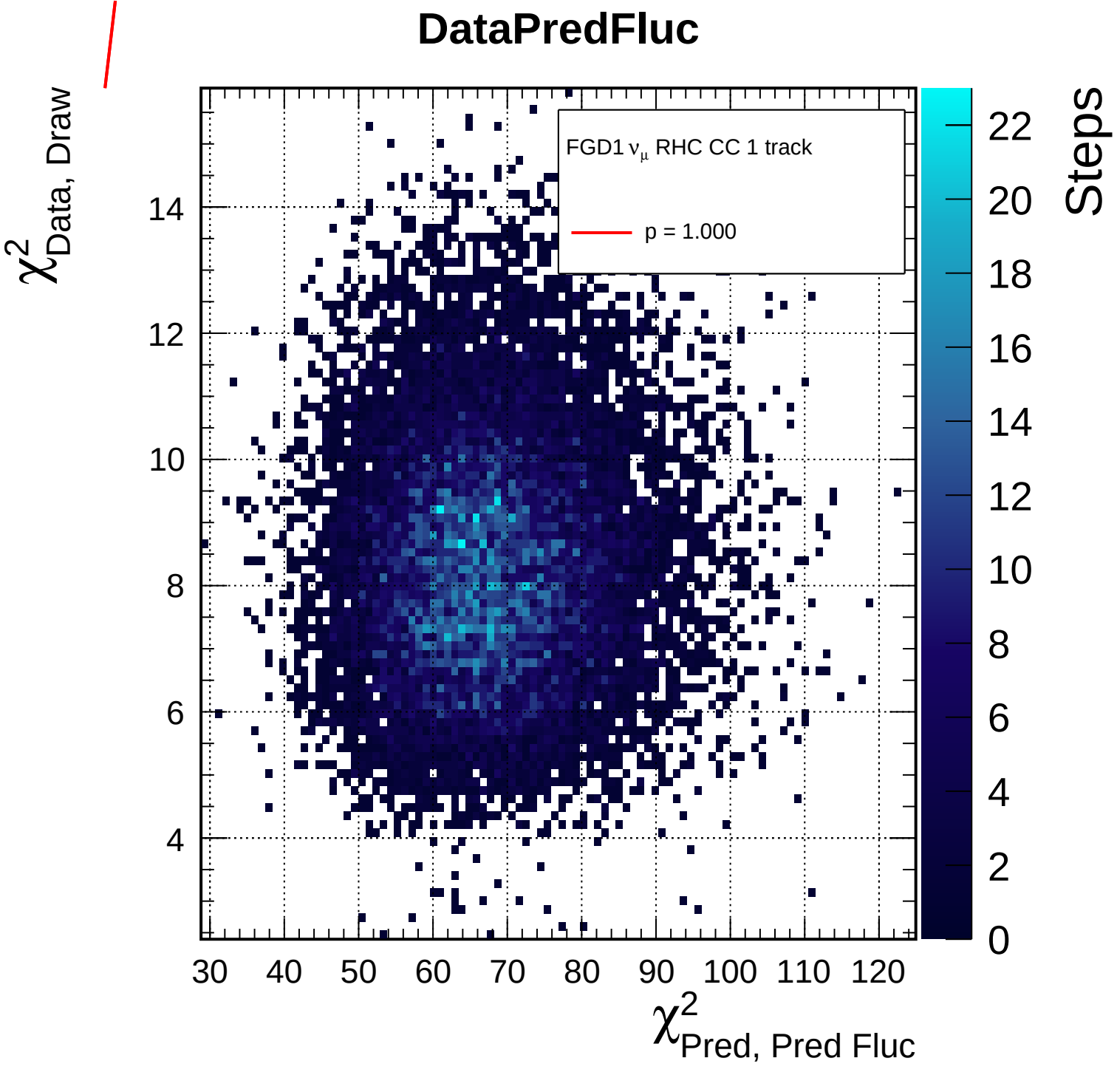
16
18
20
22


DataPredFluc
FGD1 ν_μ RHC CC 1 track
p = 1.000
$\chi^2_{Data,\ Draw}$
$\chi^2_{Pred,\ Pred\ Fluc}$
Steps
4
6
8
10
12
14
30
40
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60
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80
90
100
110
120
0
2
4
6
8
10
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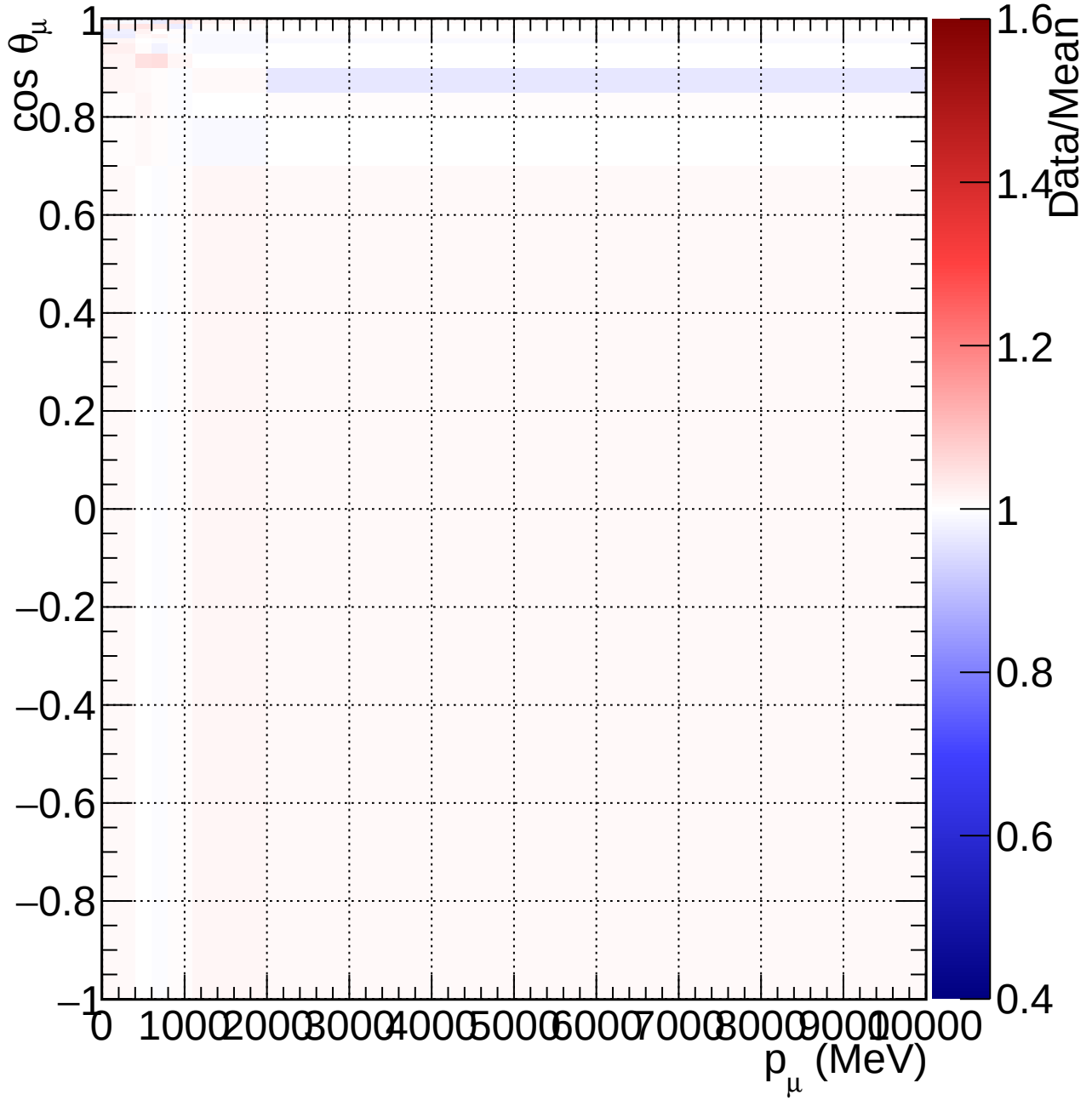
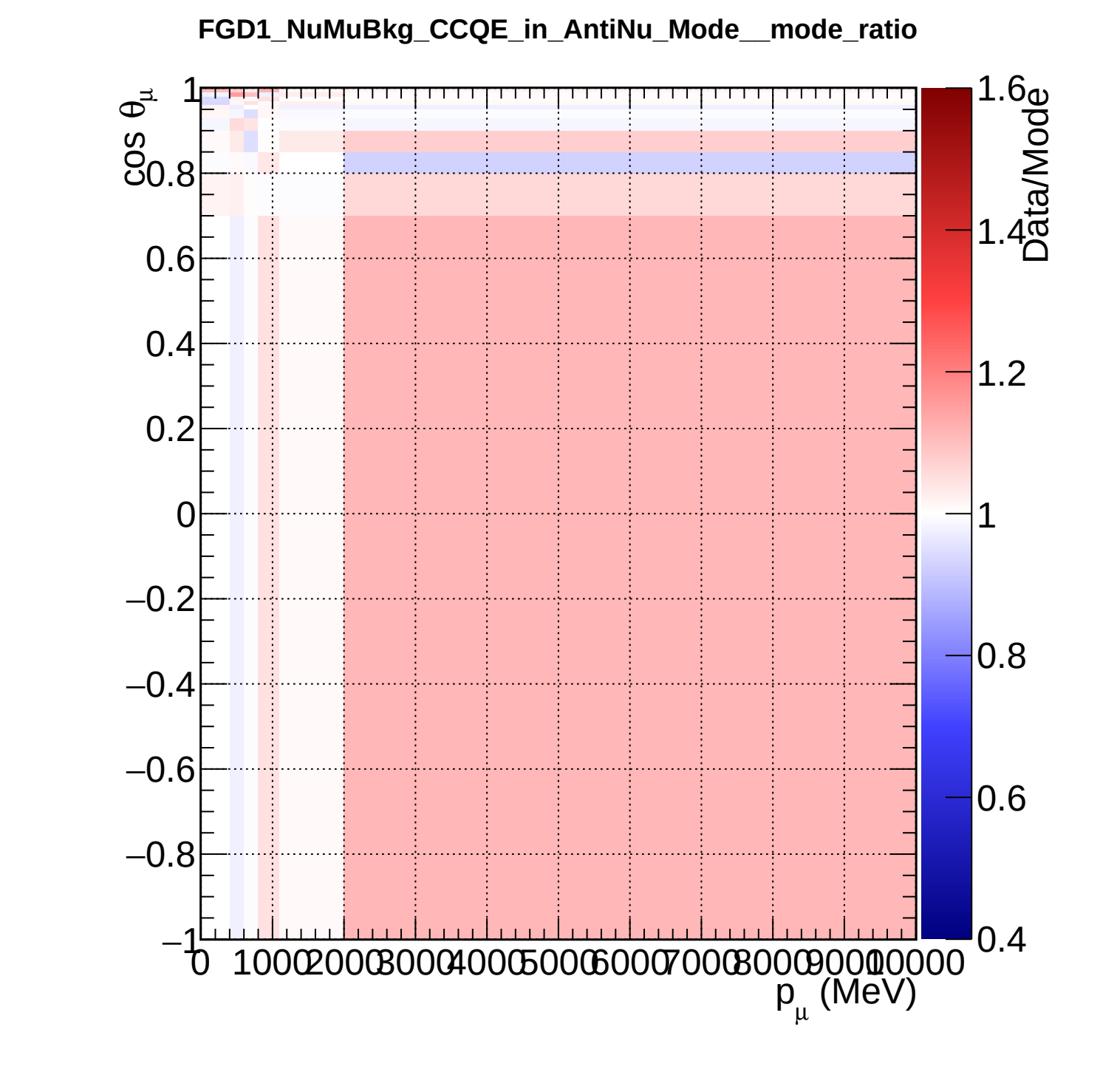
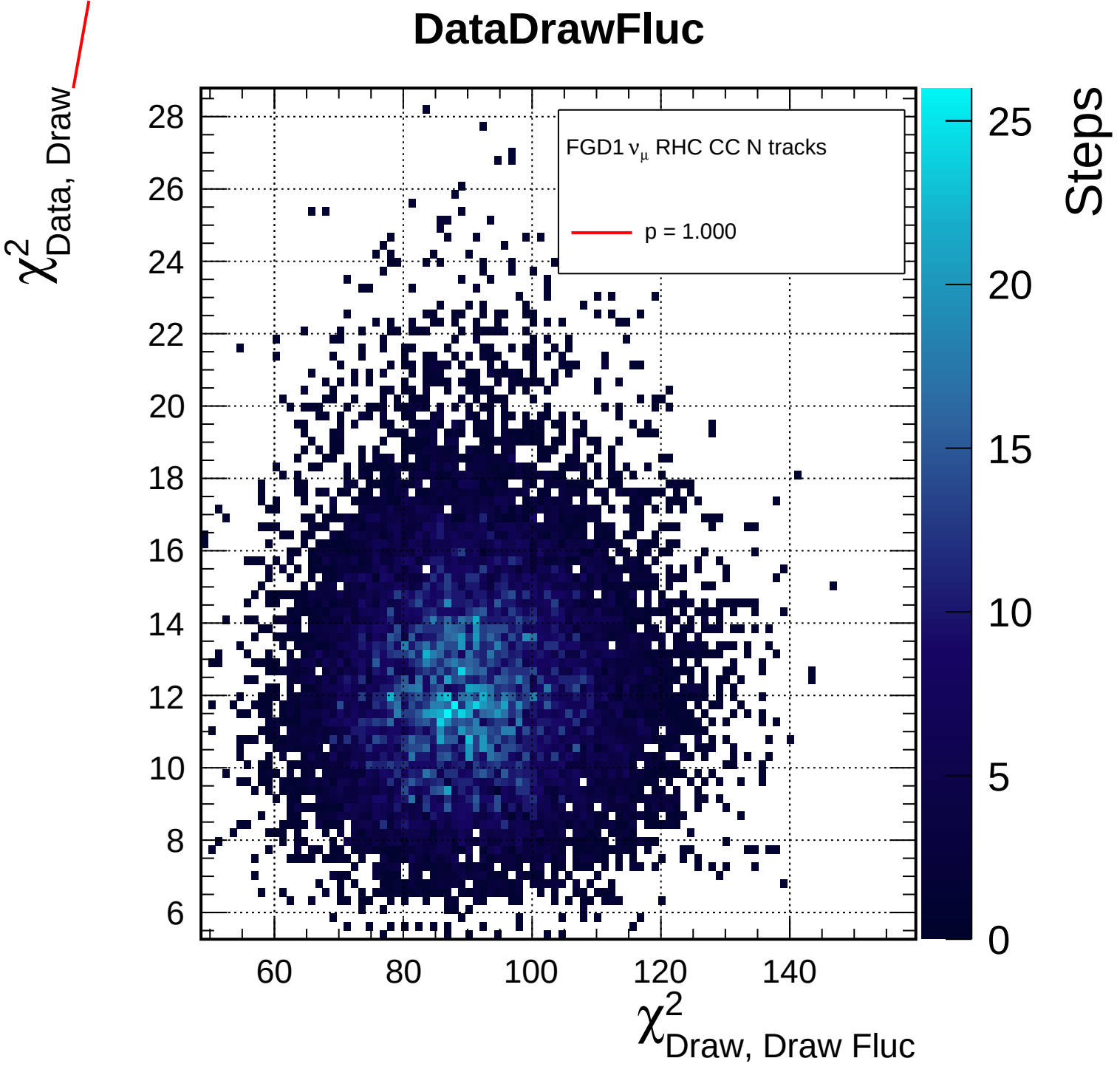
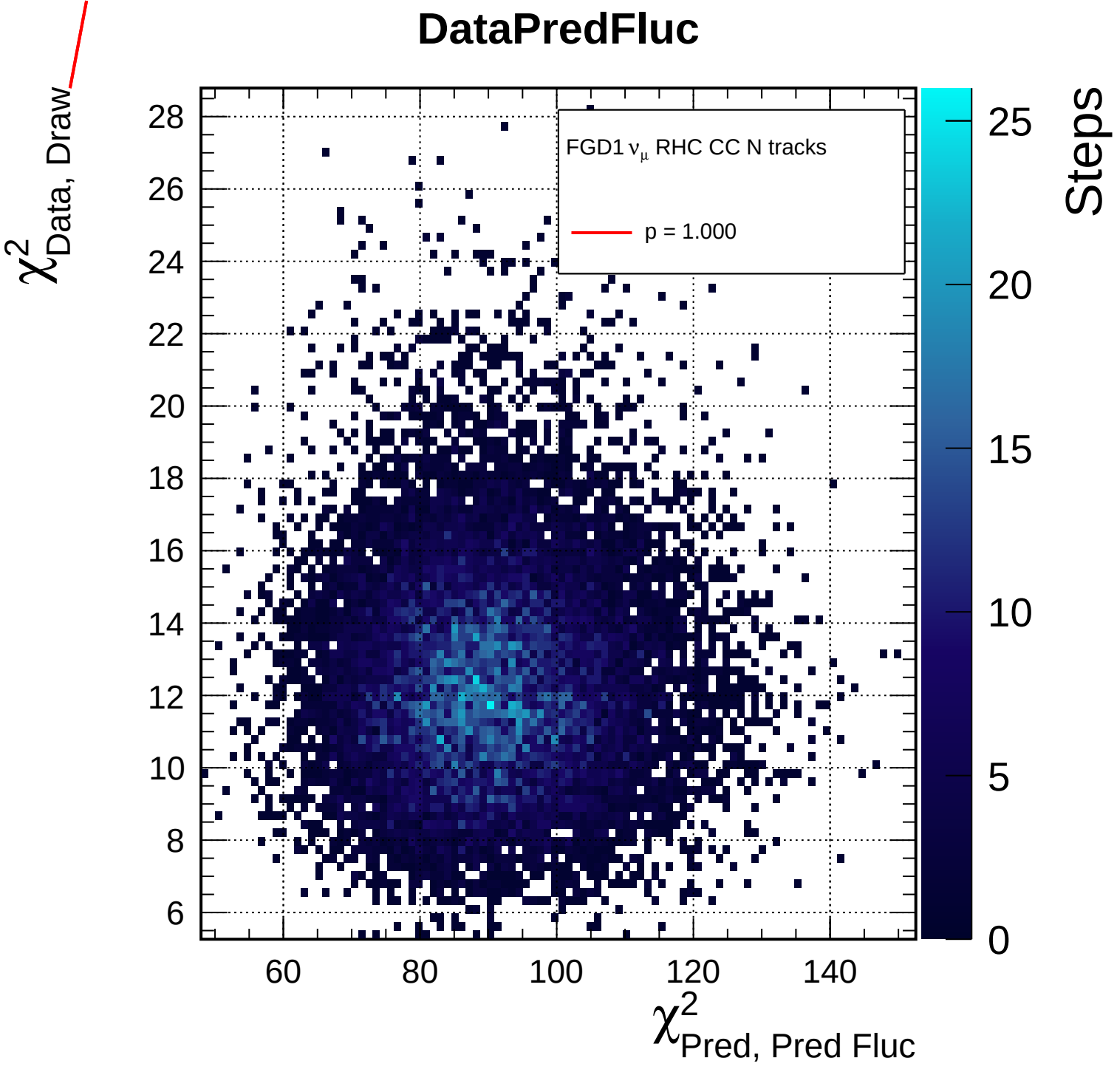
16
18
20
22


FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4


DataDrawFluc
FGD1 ν_μ RHC CC N tracks
p = 1.000
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
28
26
24
22
20
18
16
14
12
10
8
6
60
80
100
120
140
25
20
15
10
5
0


DataPredFluc
FGD1 ν_μ RHC CC N tracks
p = 1.000
$\chi^2_{Data,\ Draw}$
$\chi^2_{Pred,\ Pred\ Fluc}$
Steps
28
26
24
22
20
18
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14
12
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8
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60
80
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120
140
25
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15
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5
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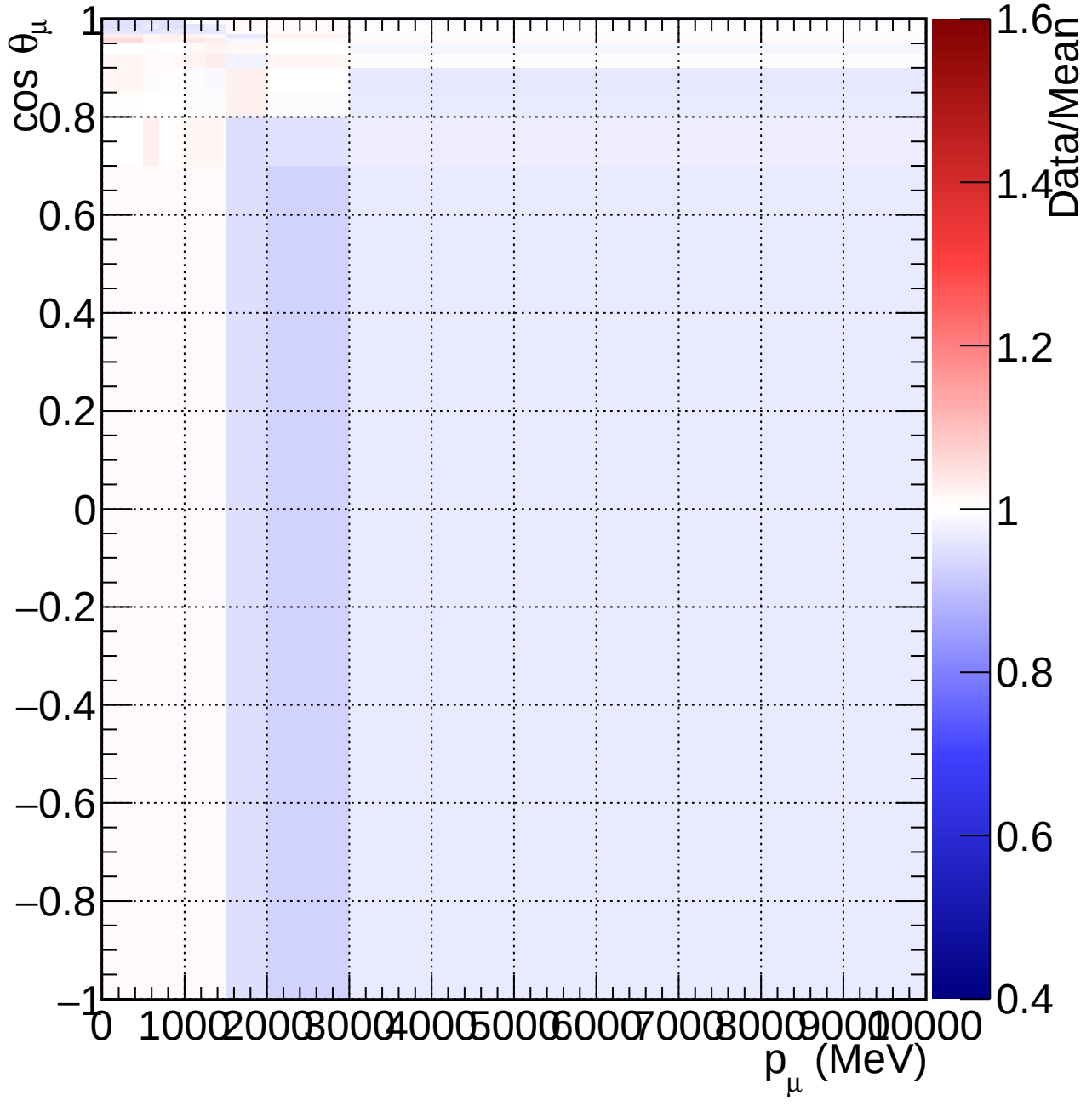
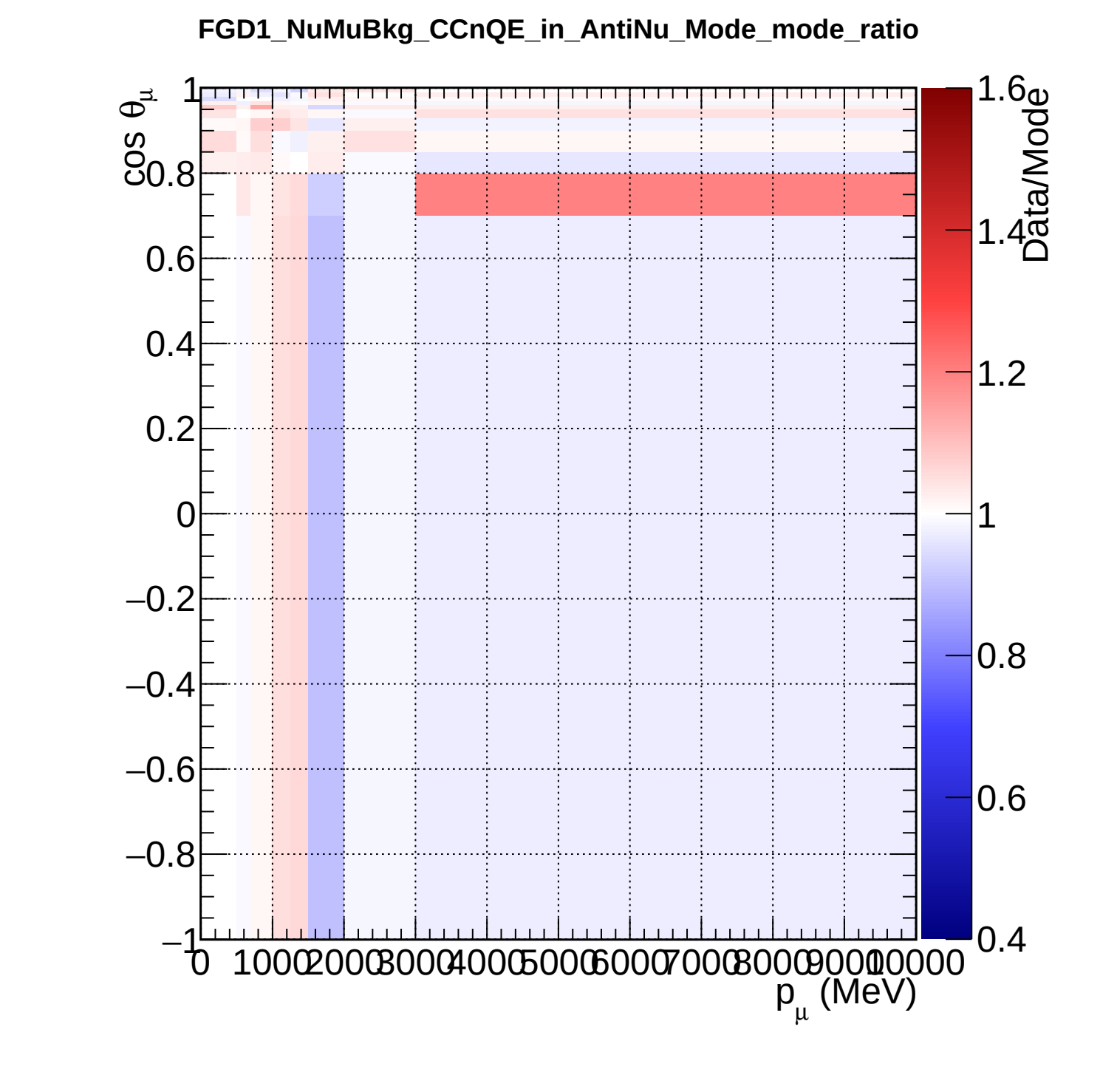
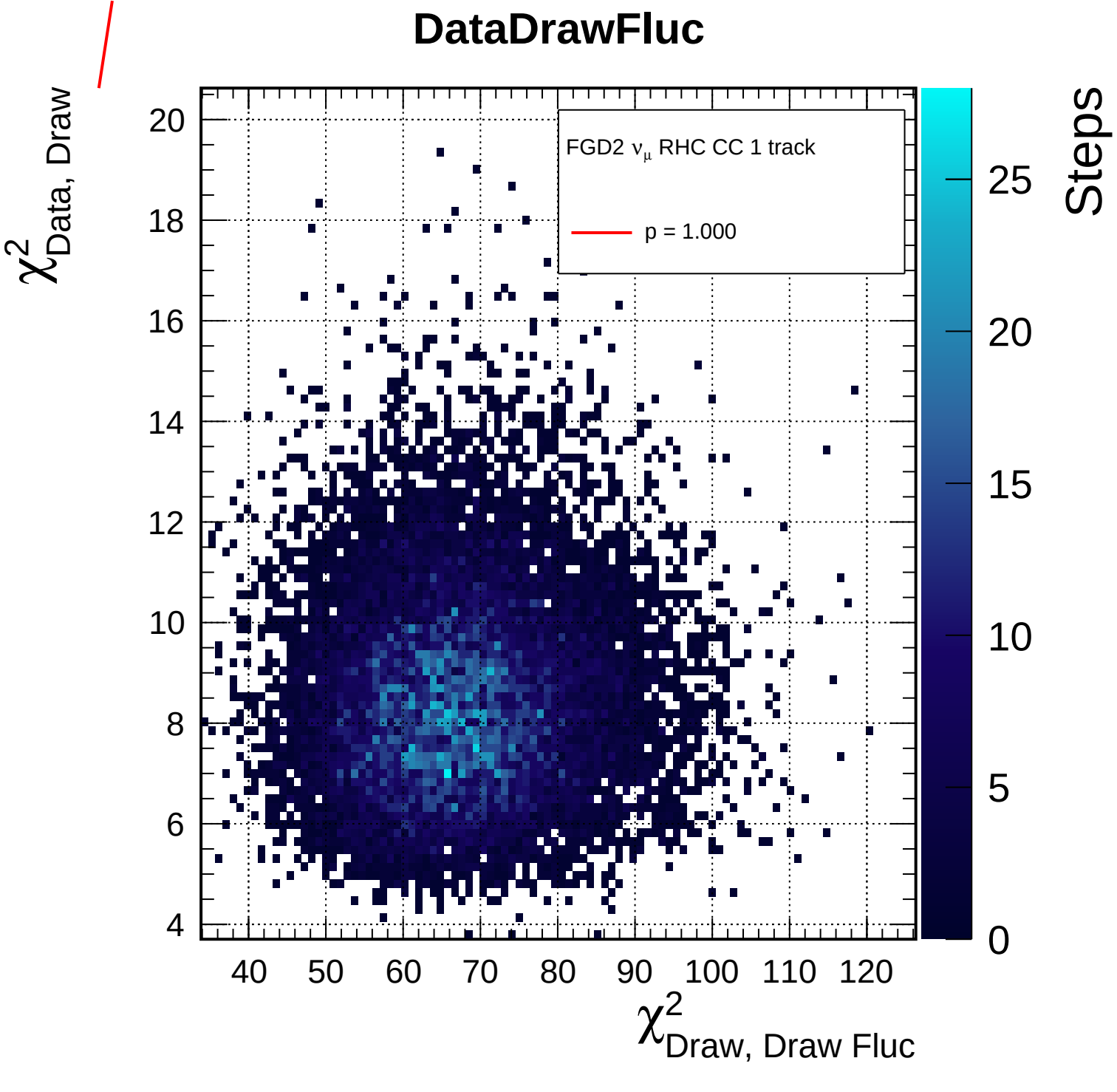
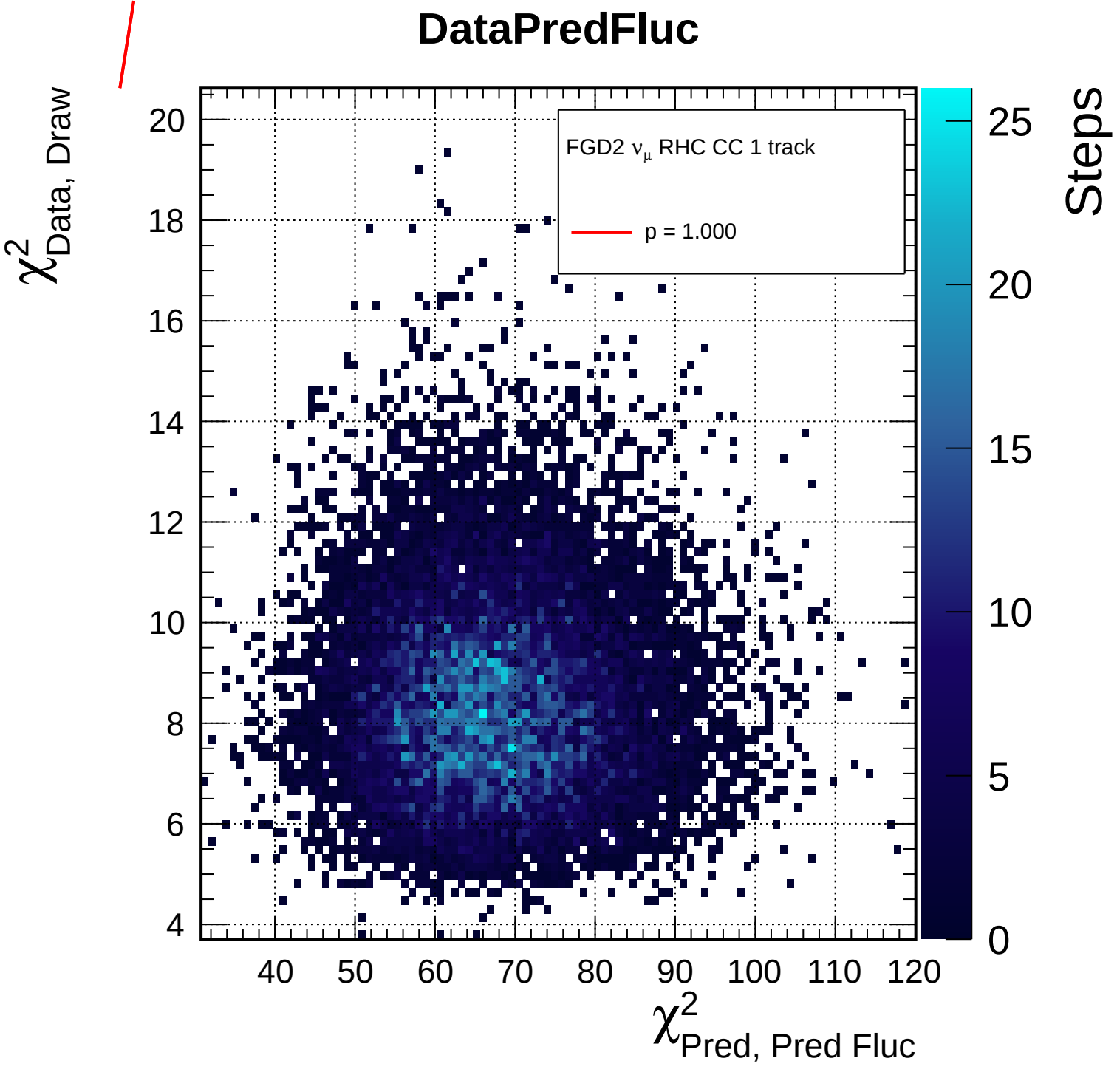

FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4


DataDrawFluc
FGD2 ν_μ RHC CC 1 track
p = 1.000
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
20
18
16
14
12
10
8
6
4
40
50
60
70
80
90
100
110
120
25
20
15
10
5
0


DataPredFluc
FGD2 ν_μ RHC CC 1 track
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
20
18
16
14
12
10
8
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4
40
50
60
70
80
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100
110
120
25
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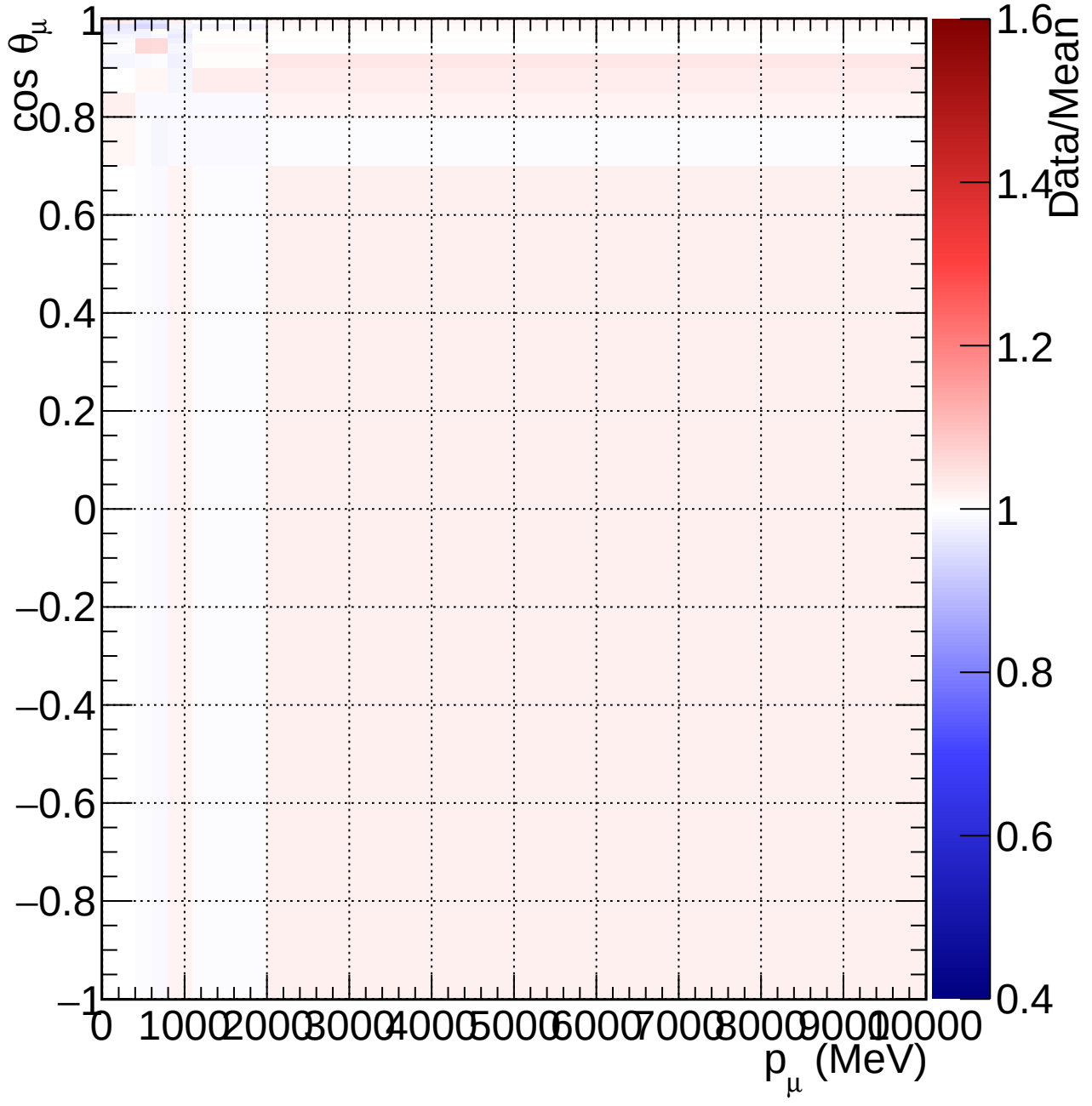
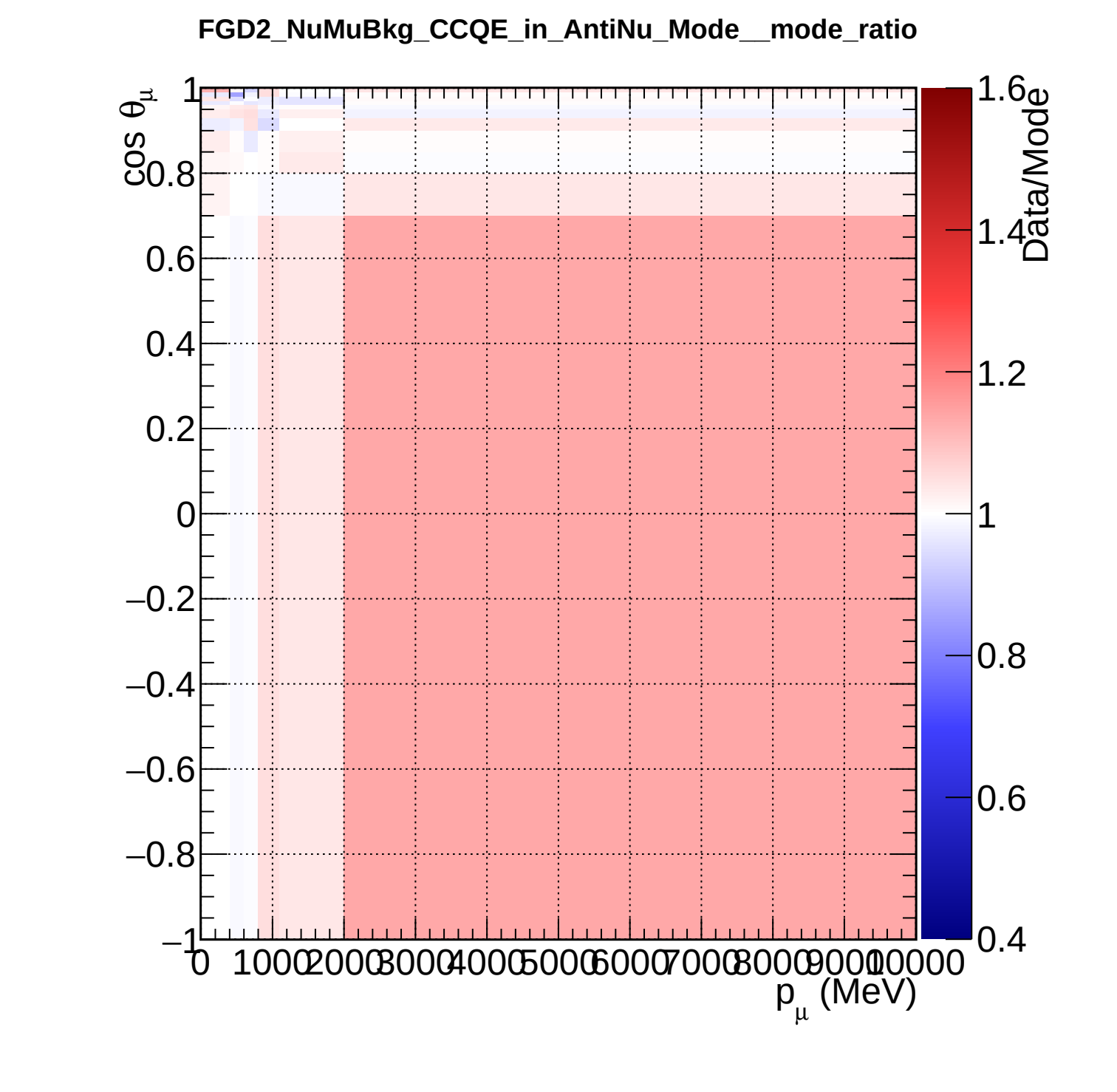
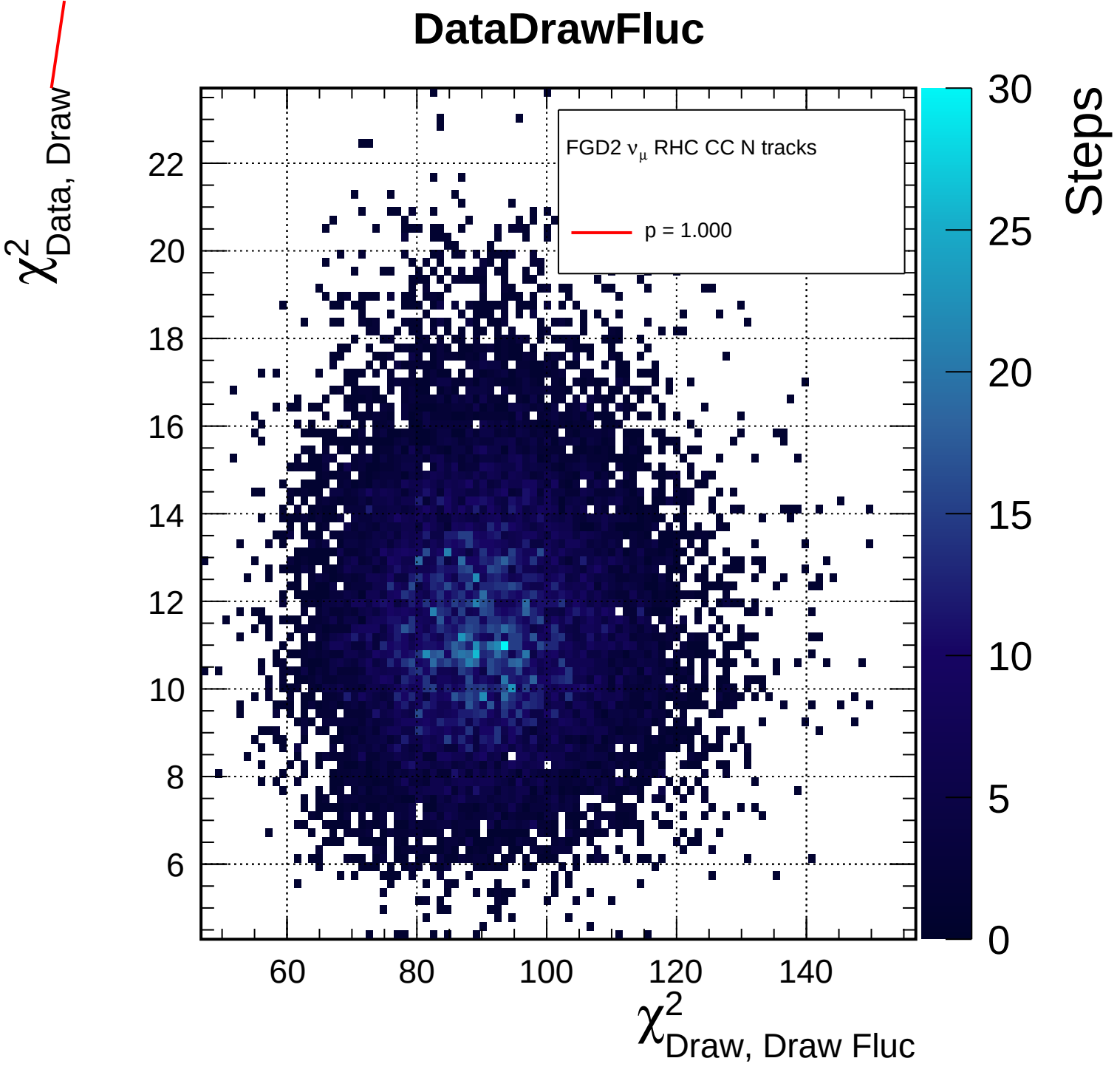
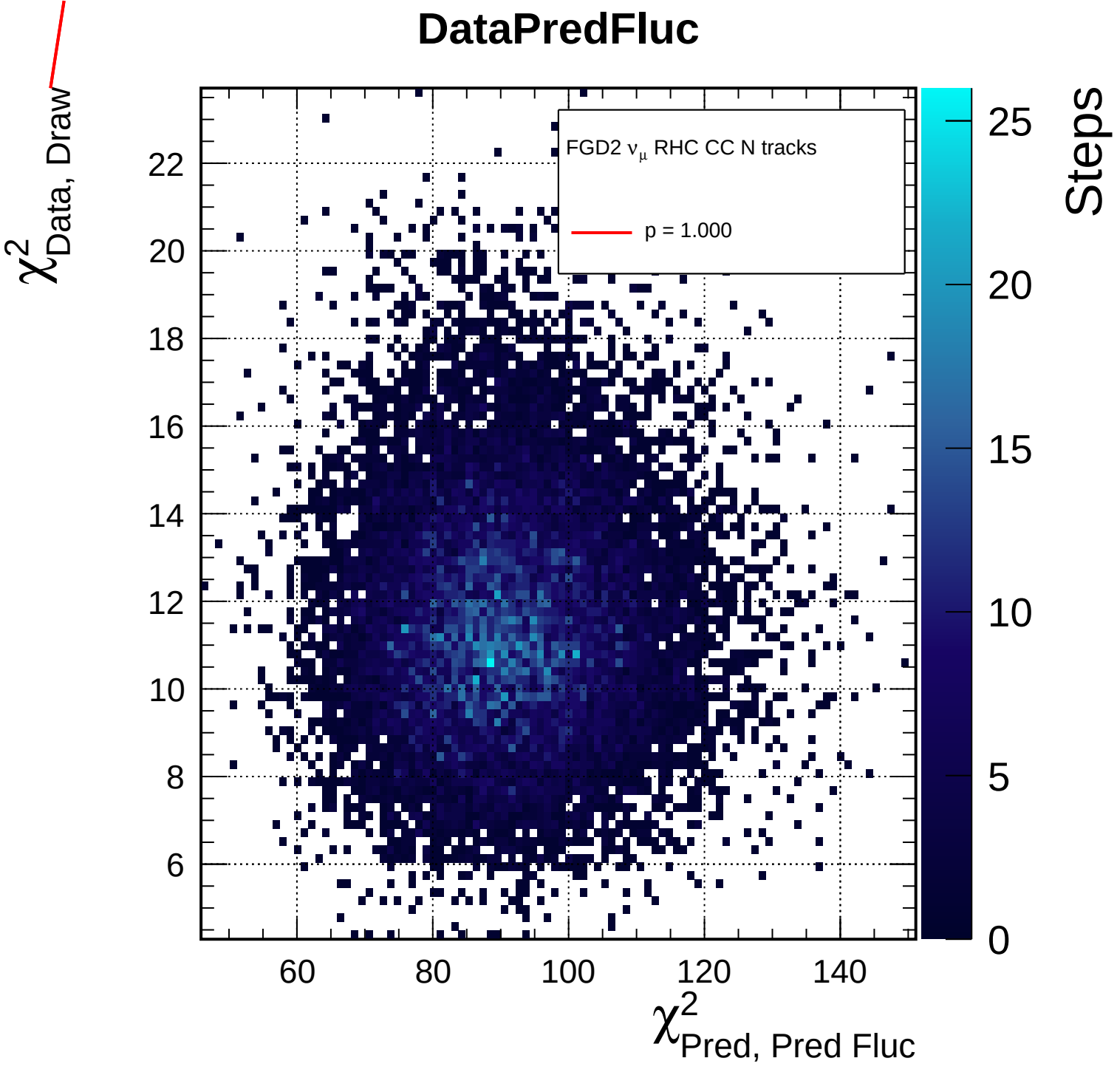

FGD2_NuMuBkg_CCQE_in_AntiNu_Mode__mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD2_NuMuBkg_CCQE_in_AntiNu_Mode__mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4


DataDrawFluc
FGD2 ν_μ RHC CC N tracks
p = 1.000
χ²Data, Draw
χ²Draw, Draw Fluc
Steps
22
20
18
16
14
12
10
8
6
60
80
100
120
140
30
25
20
15
10
5
0


DataPredFluc
FGD2 ν_μ RHC CC N tracks
p = 1.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
22
20
18
16
14
12
10
8
6
60
80
100
120
140
25
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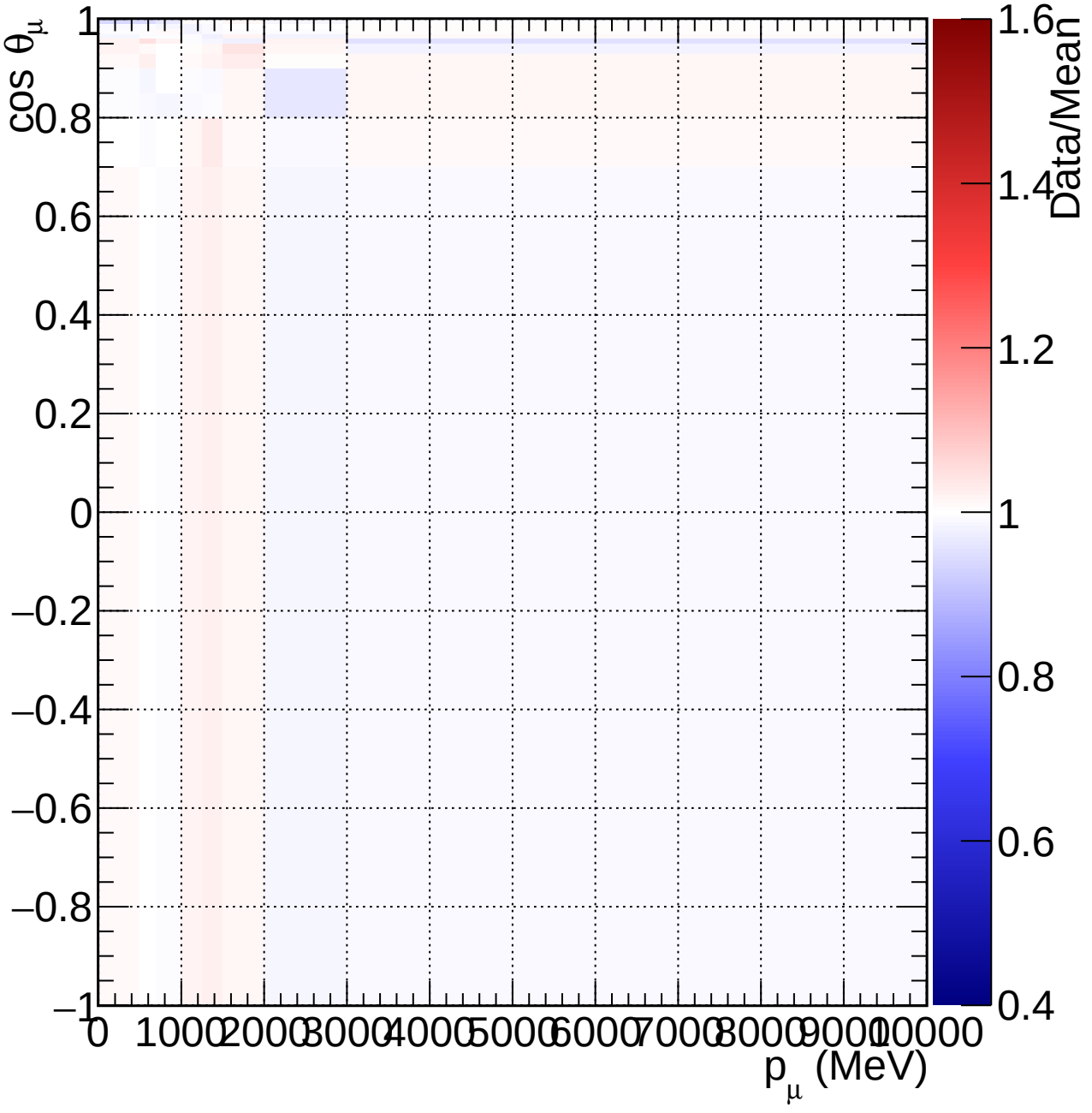
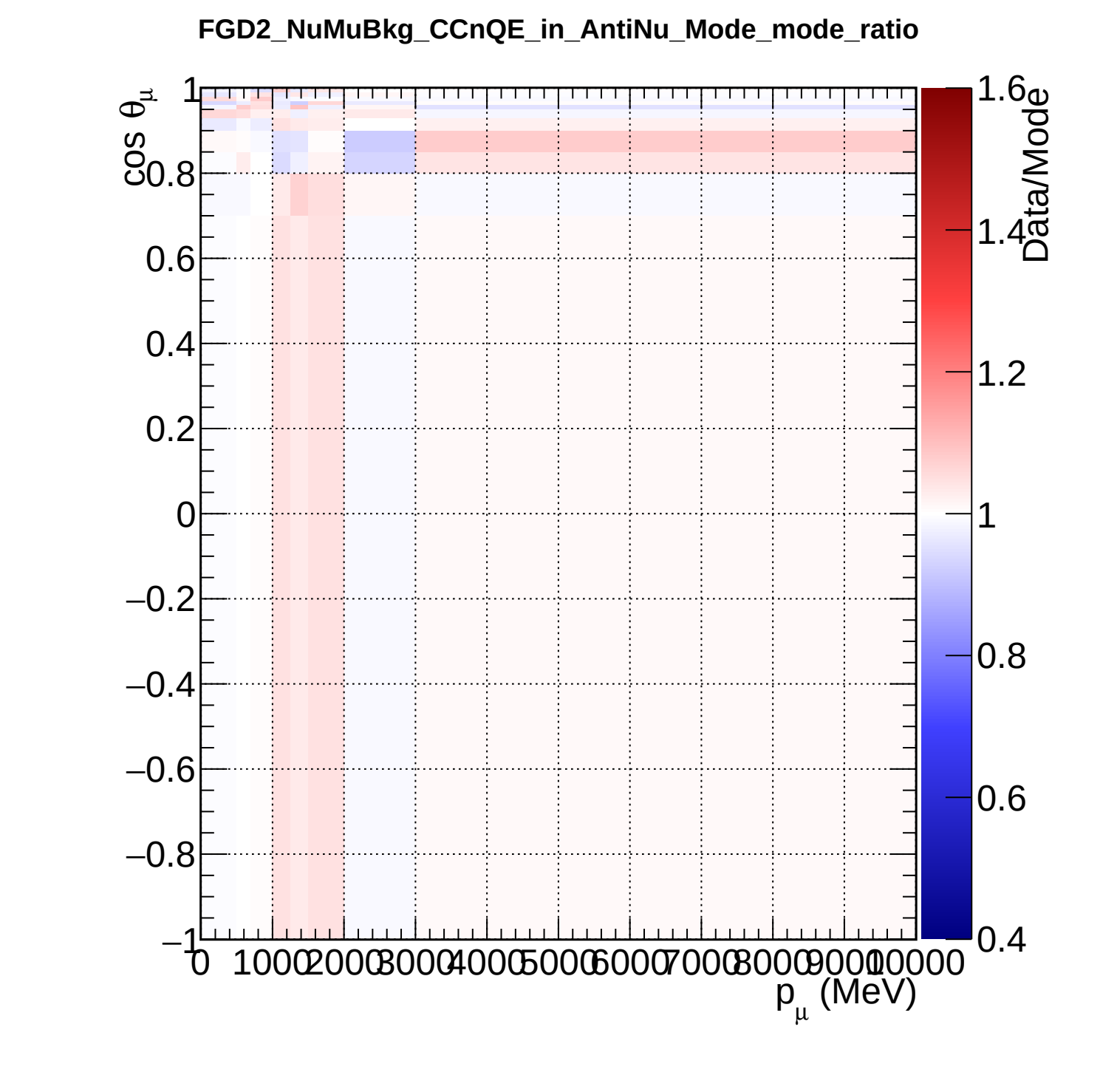
15
10
5
0


FGD2_NuMuBkg_CCnQE_in_AntiNu_Mode_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD2_NuMuBkg_CCnQE_in_AntiNu_Mode_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4