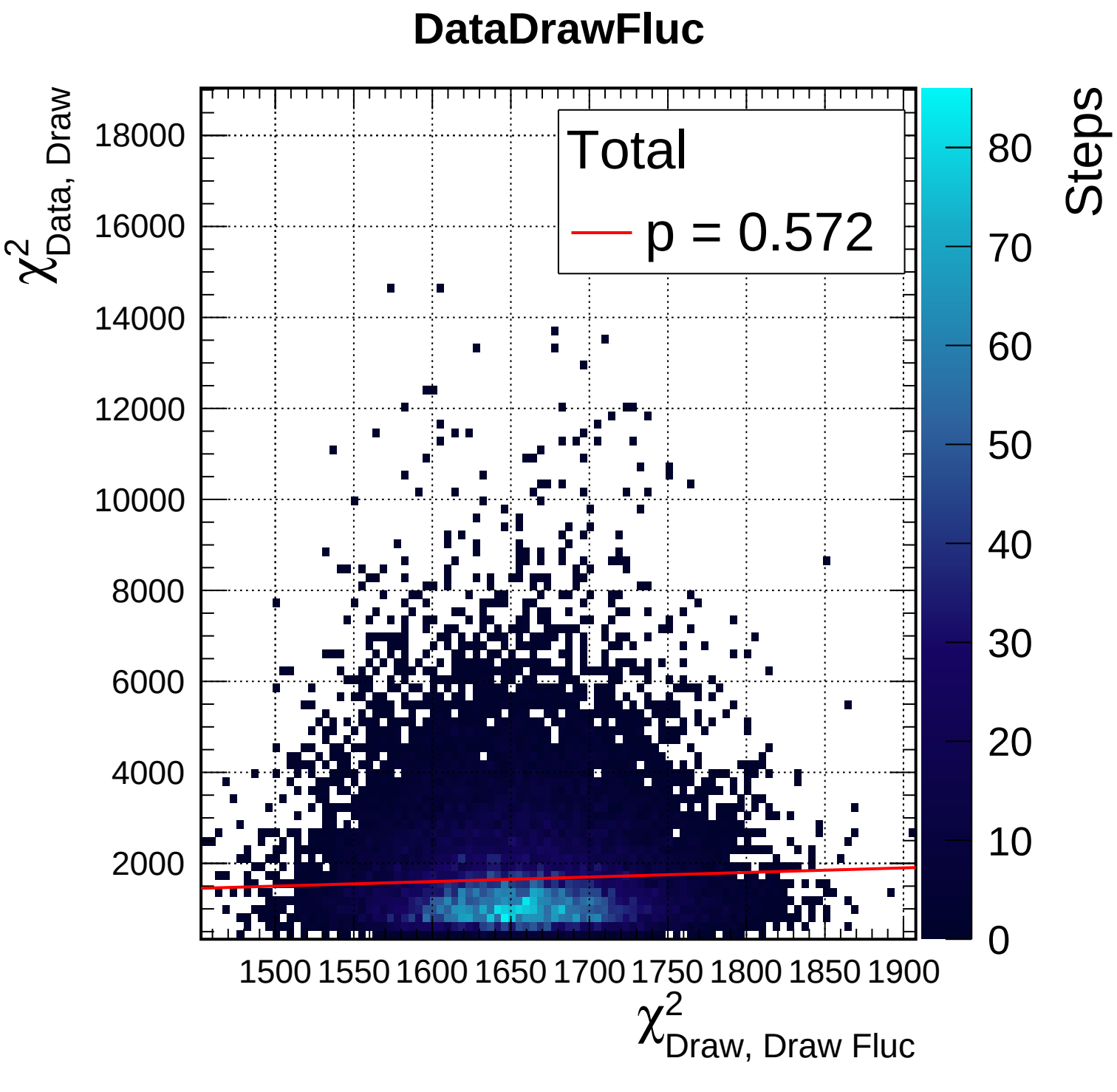
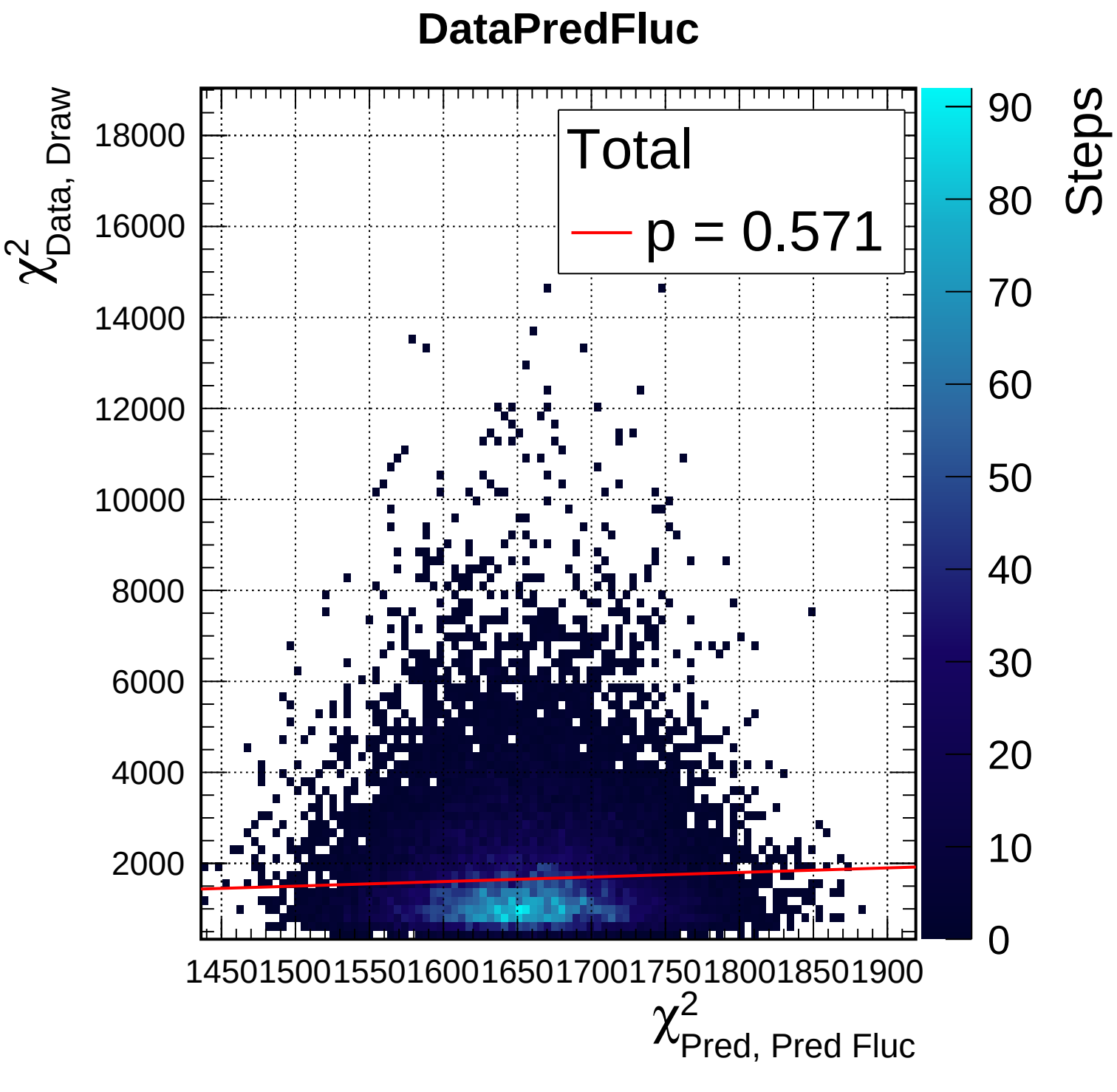
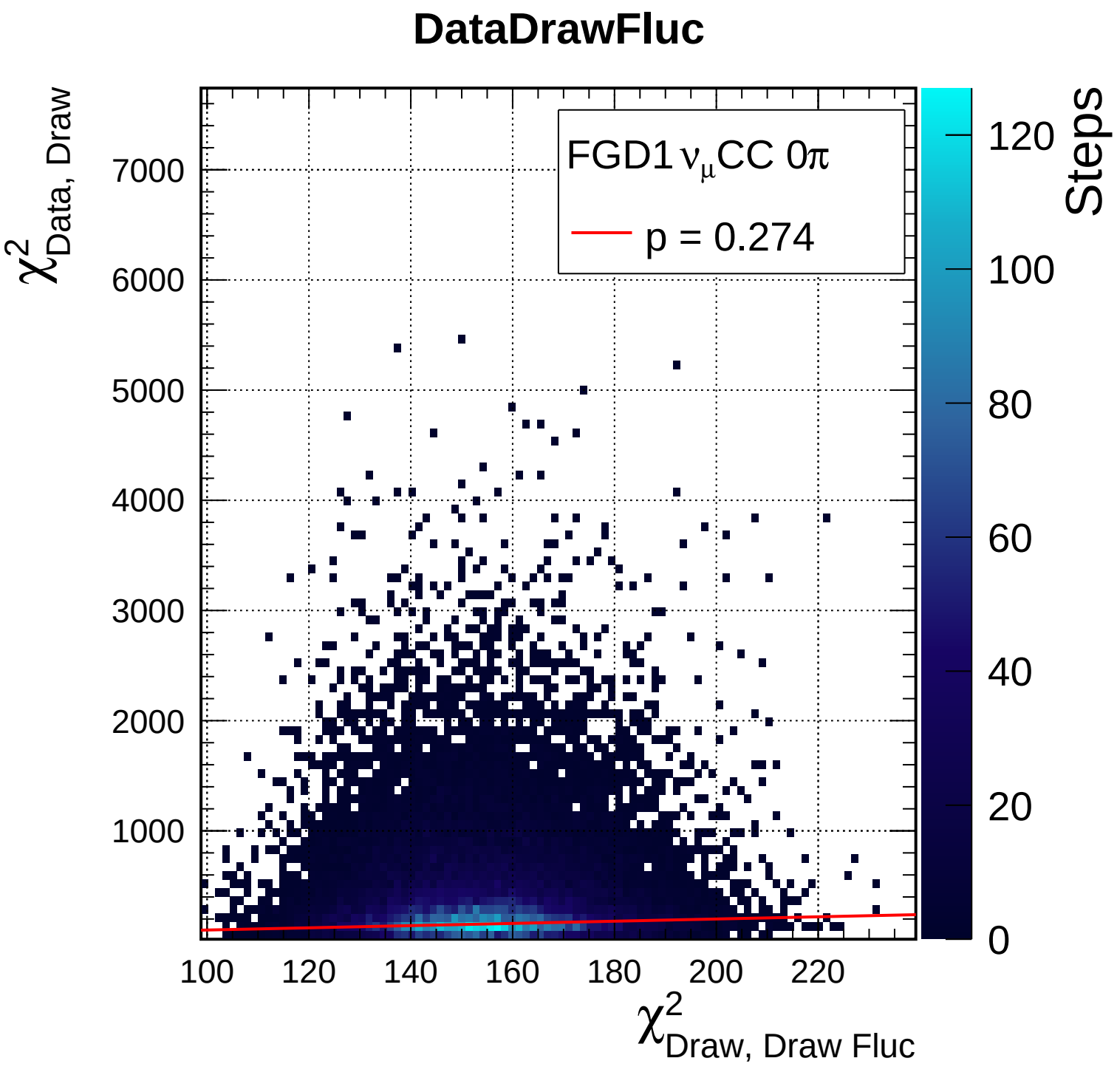
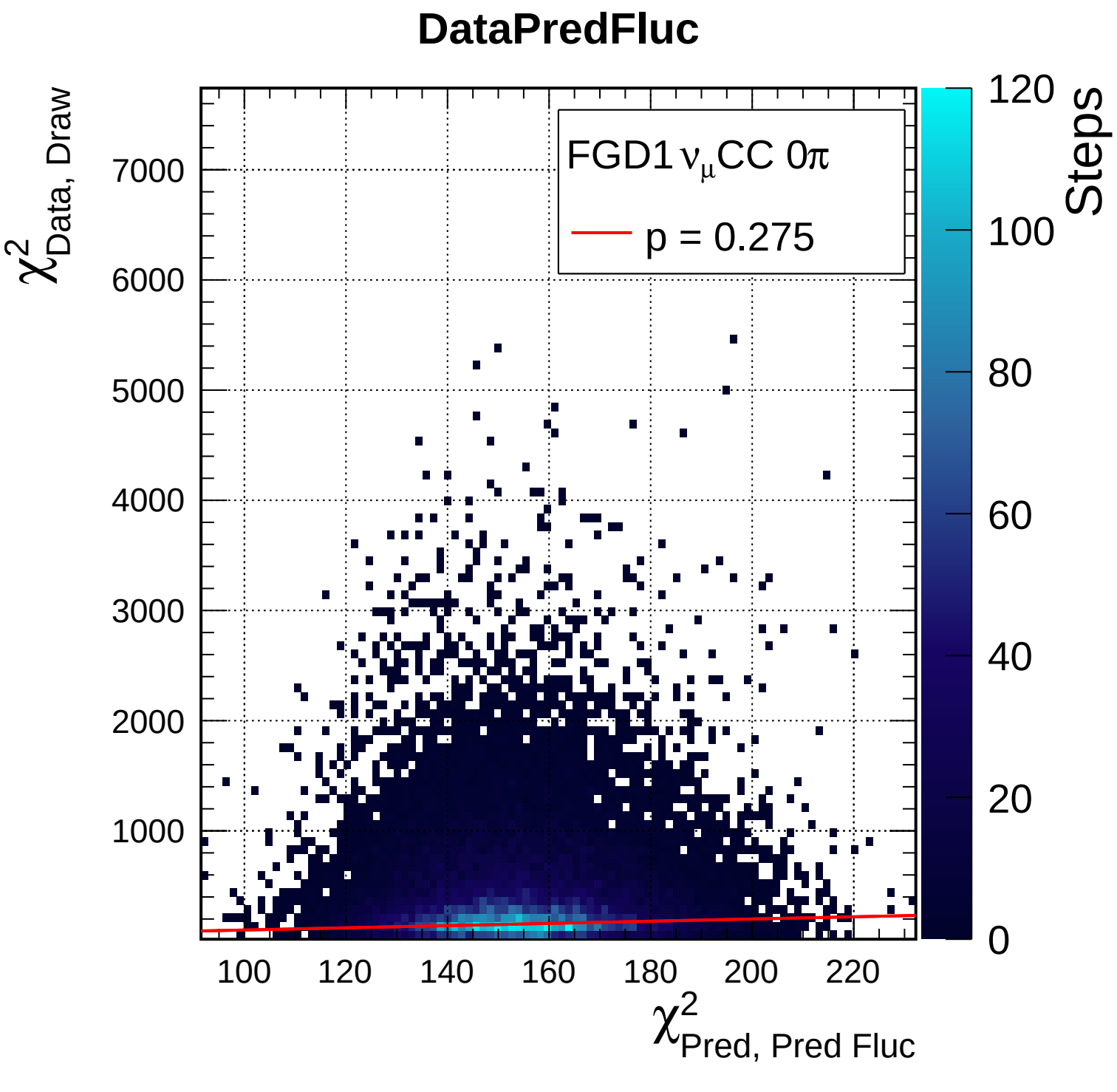
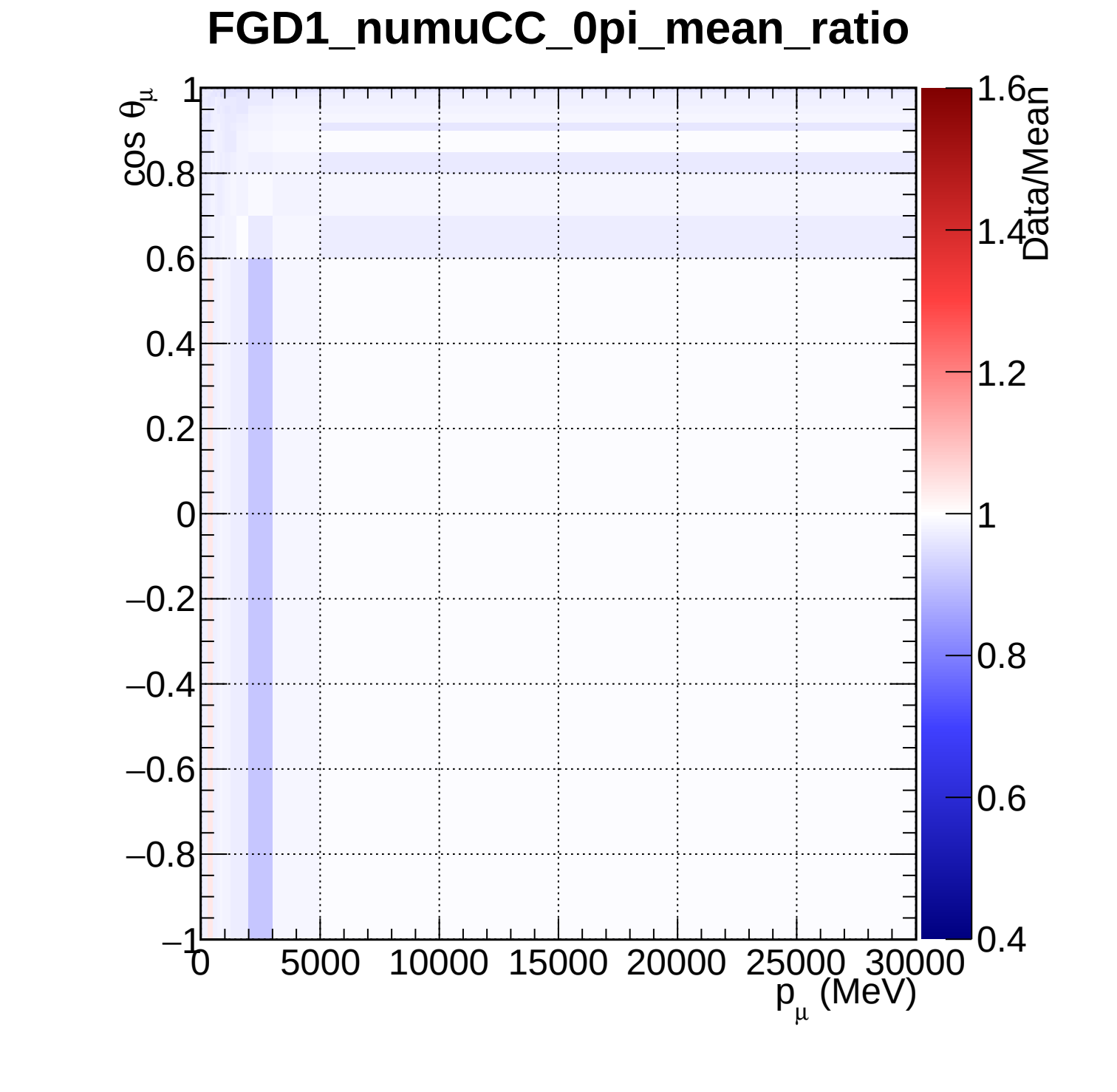
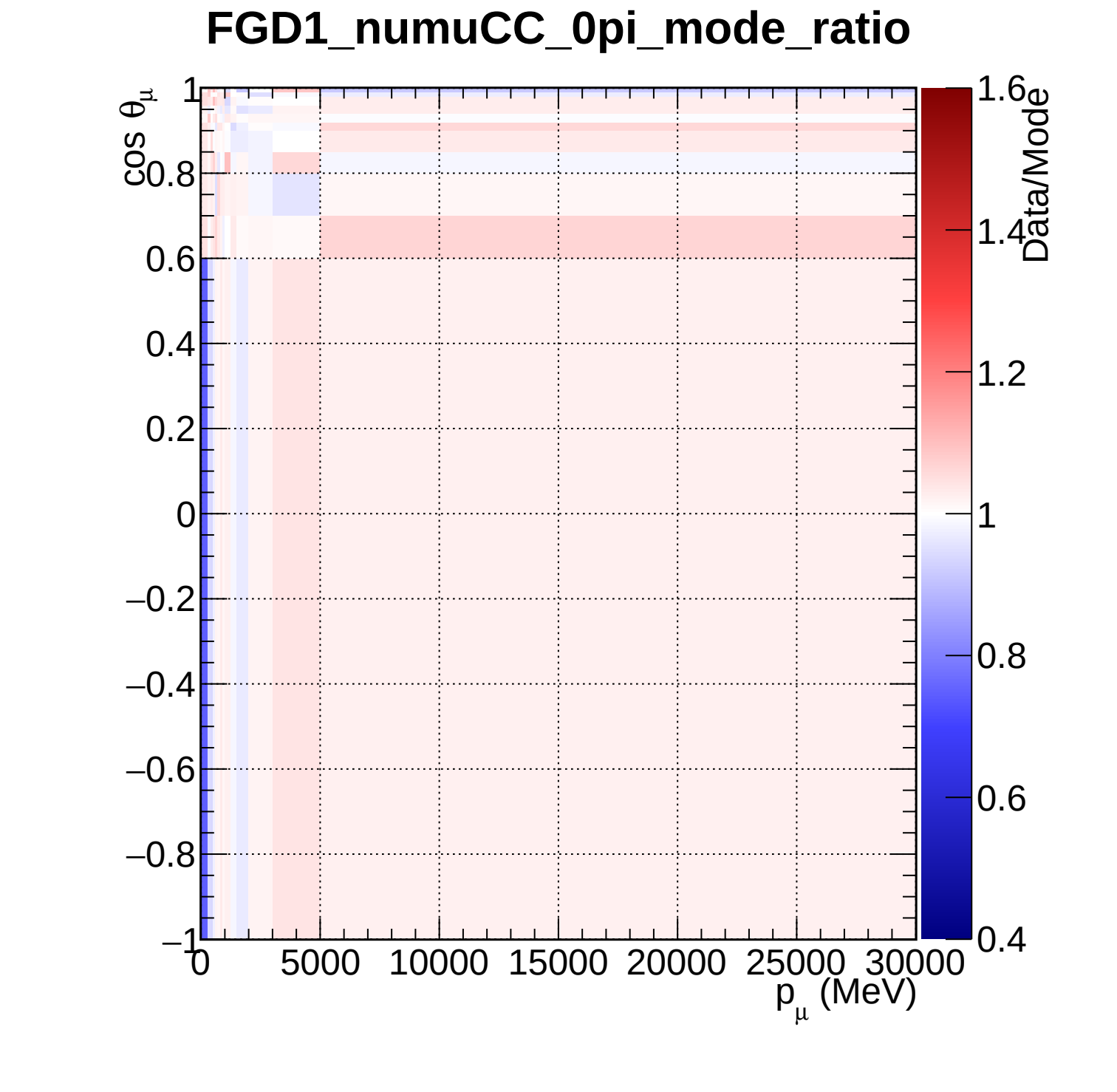

DataDrawFluc
Total
p = 0.572
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Draw, Draw Fluc}}$
Steps
18000
16000
14000
12000
10000
8000
6000
4000
2000
1500 1550 1600 1650 1700 1750 1800 1850 1900
80
70
60
50
40
30
20
10
0

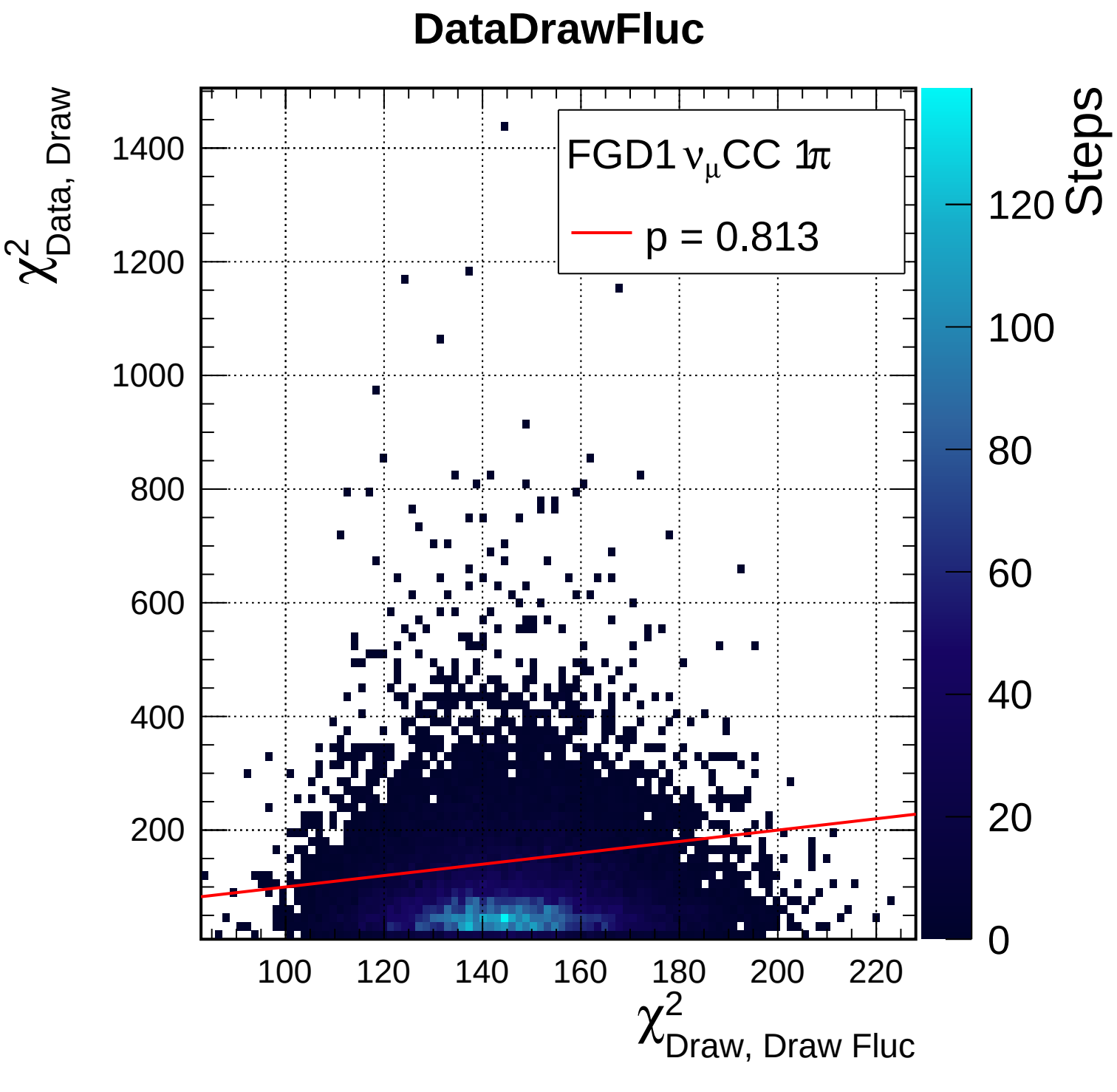

DataPredFluc
Total
p = 0.571
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
18000
16000
14000
12000
10000
8000
6000
4000
2000
1450
1500
1550
1600
1650
1700
1750
1800
1850
1900
90
80
70
60
50
40
30
20
10
0

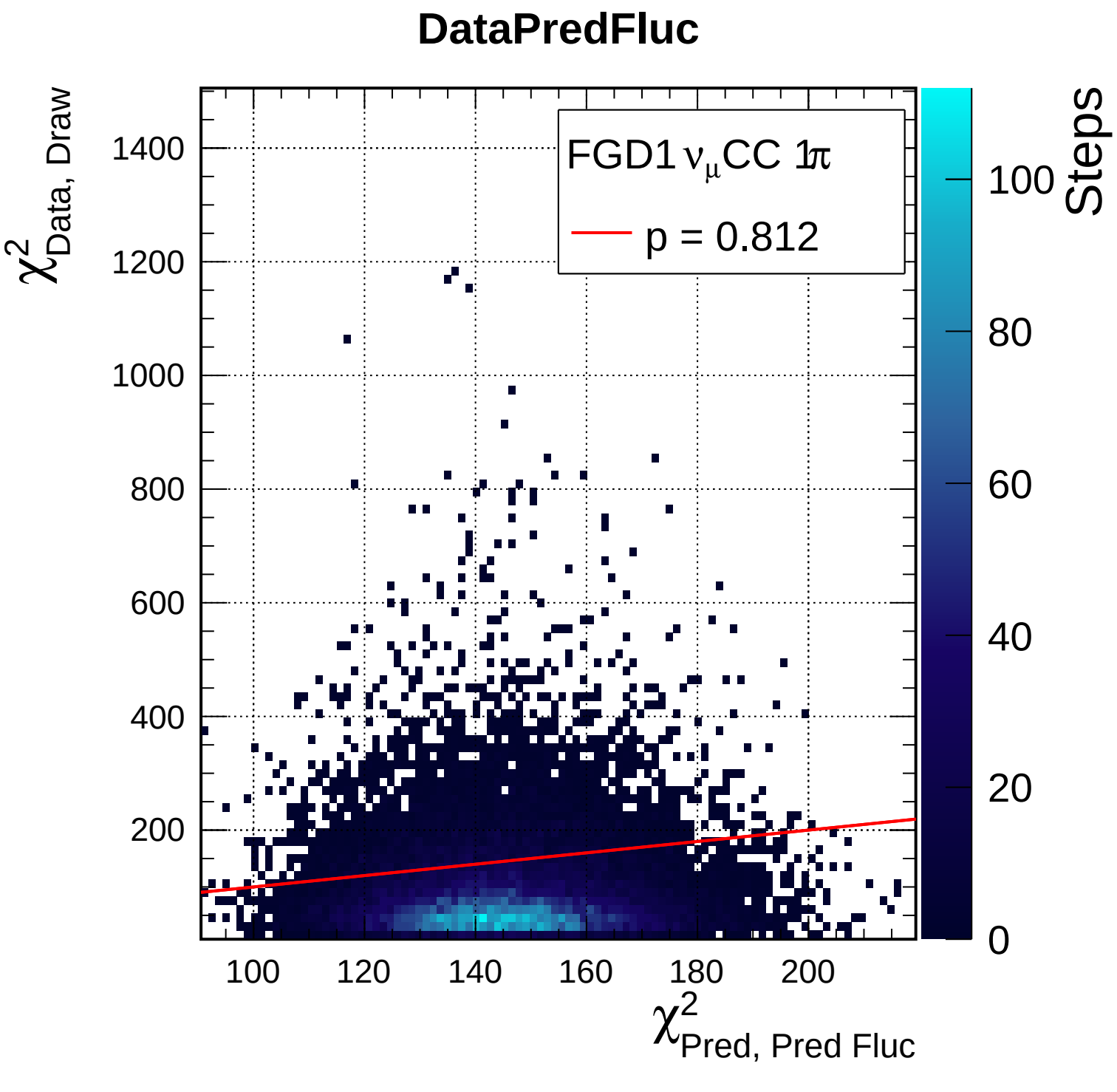

DataDrawFluc
FGD1 ν_μCC 0π
p = 0.274
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
7000
6000
5000
4000
3000
2000
1000
100
120
140
160
180
200
220
120
100
80
60
40
20
0

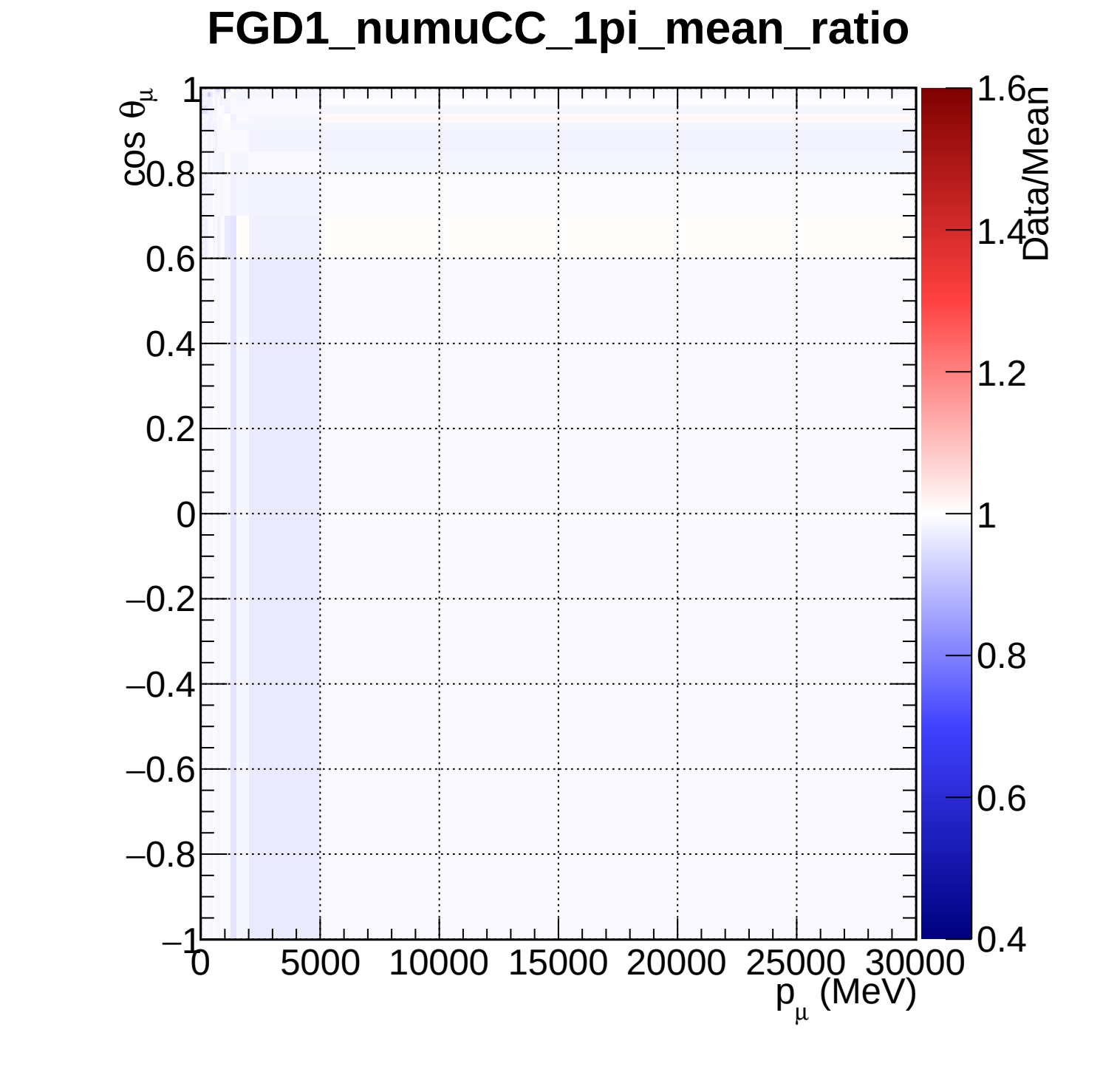

DataPredFluc
FGD1 ν_μCC 0π
p = 0.275
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
7000
6000
5000
4000
3000
2000
1000
100
120
140
160
180
200
220
120
100
80
60
40
20
0

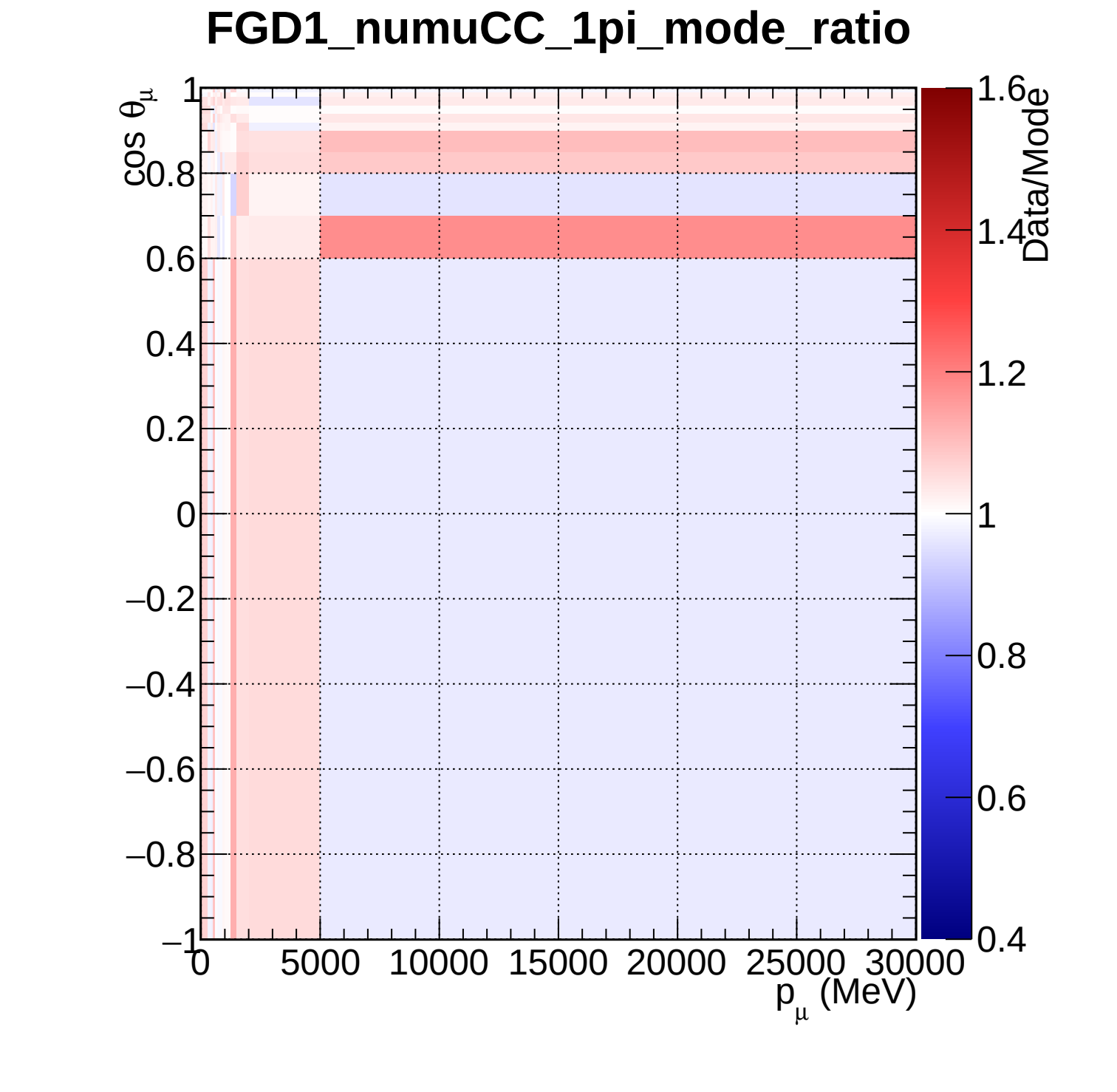

FGD1_numuCC_0pi_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

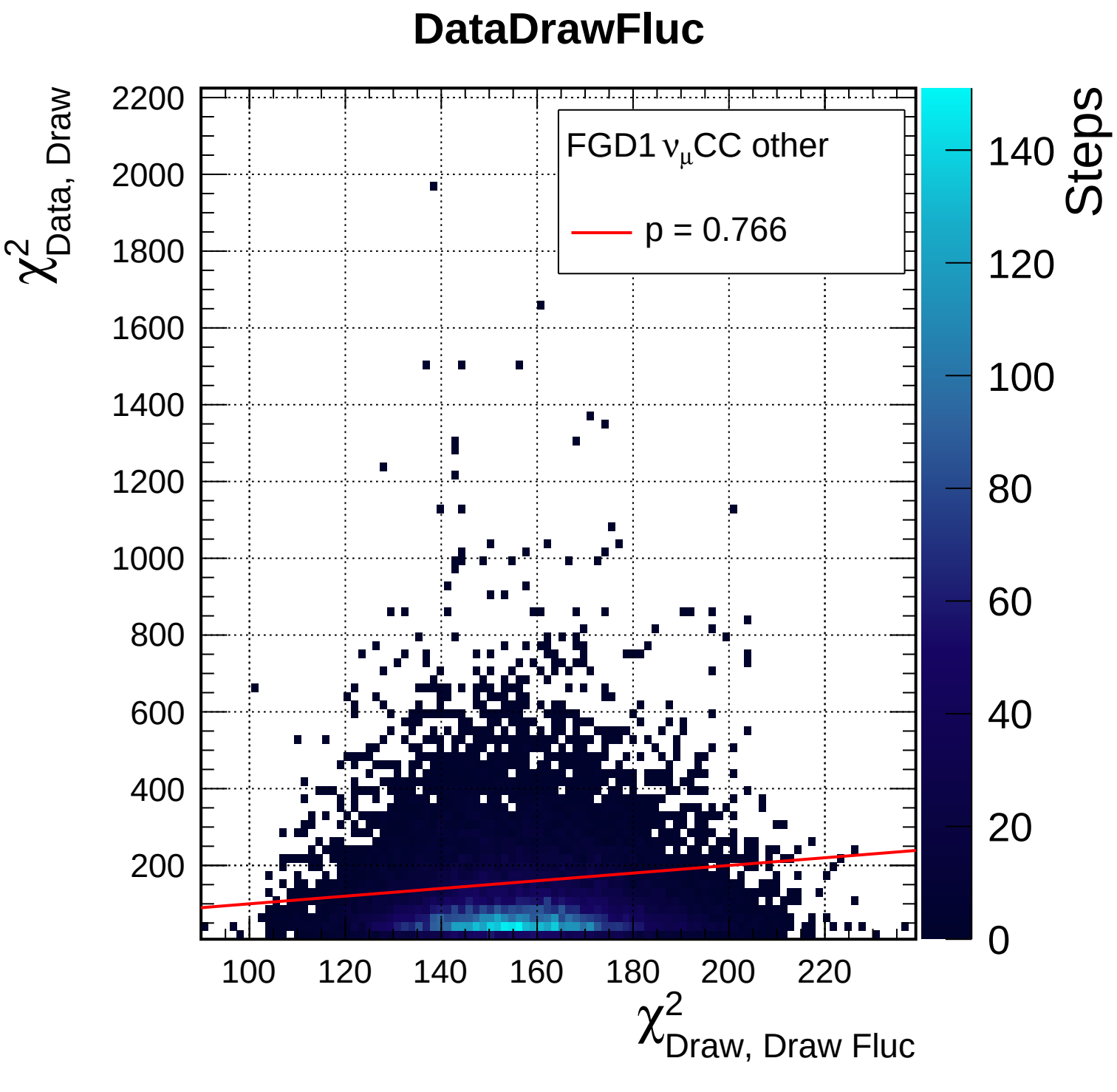

FGD1_numuCC_0pi_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

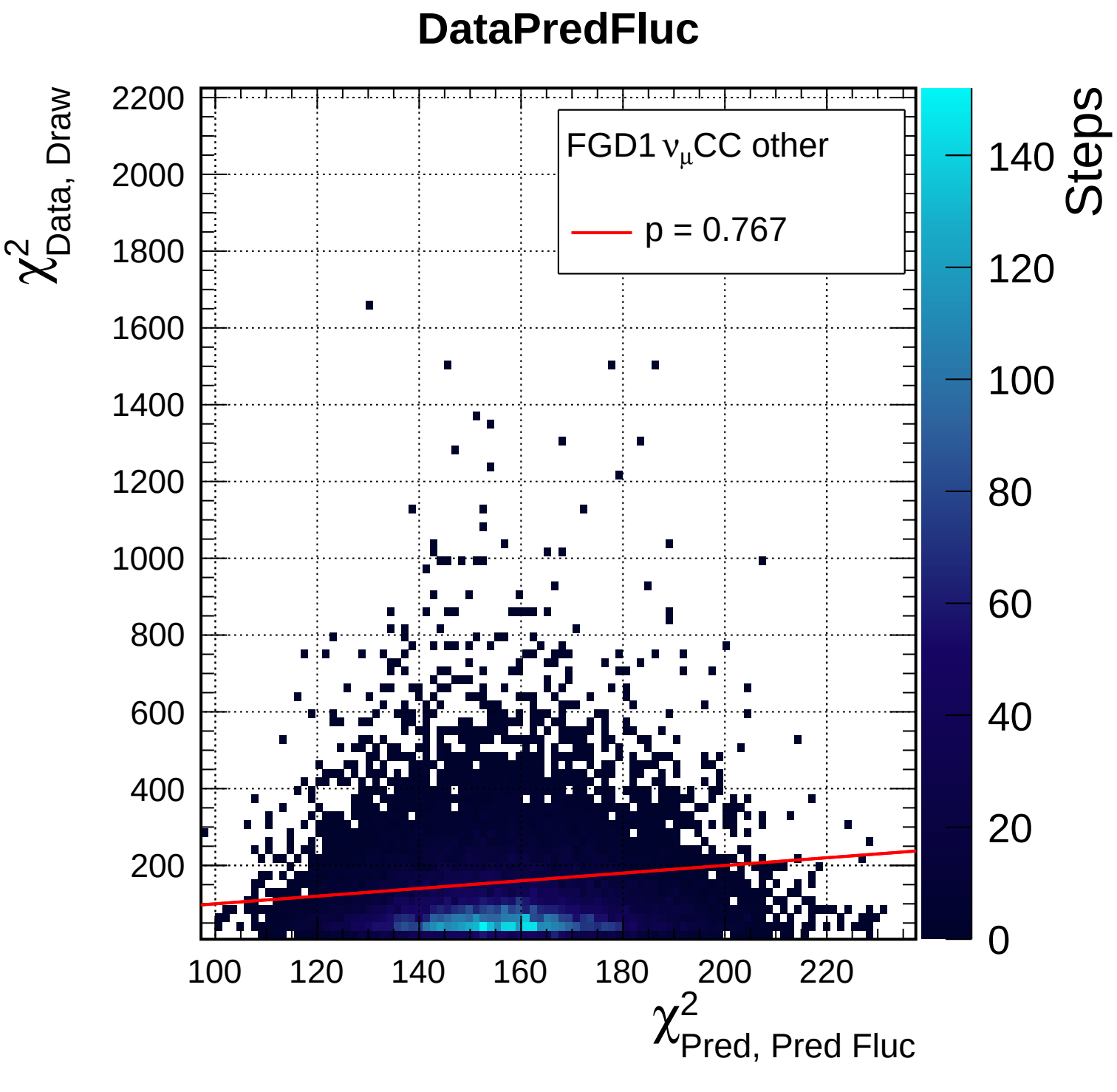

DataDrawFluc
FGD1 ν_μCC 1π
p = 0.813
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Draw, Draw Fluc}}$
Steps
1400
1200
1000
800
600
400
200
100
120
140
160
180
200
220
120
100
80
60
40
20
0

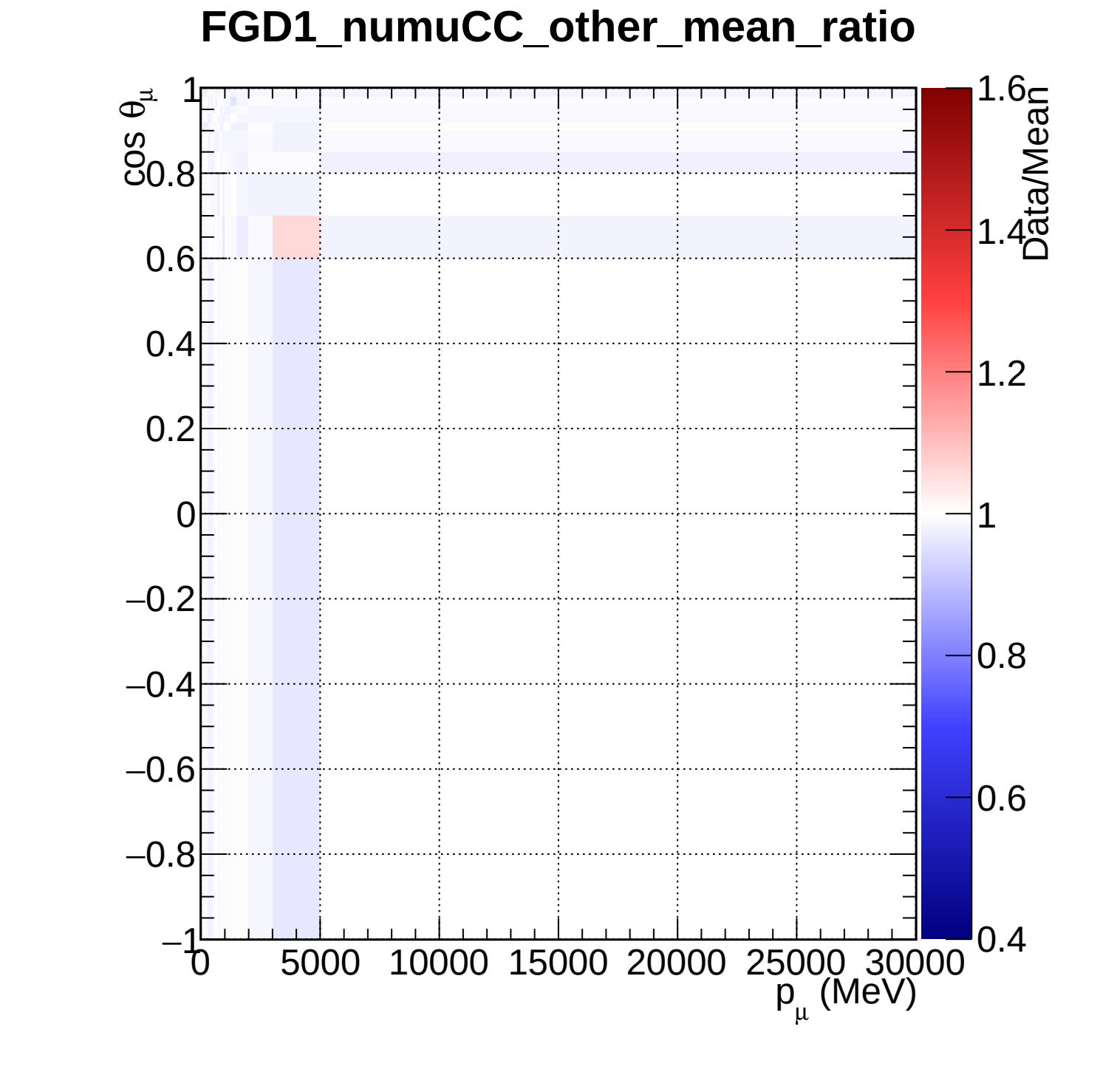

DataPredFluc
FGD1 ν_μCC 1π
p = 0.812
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
1400
1200
1000
800
600
400
200
100
120
140
160
180
200
100
80
60
40
20
0

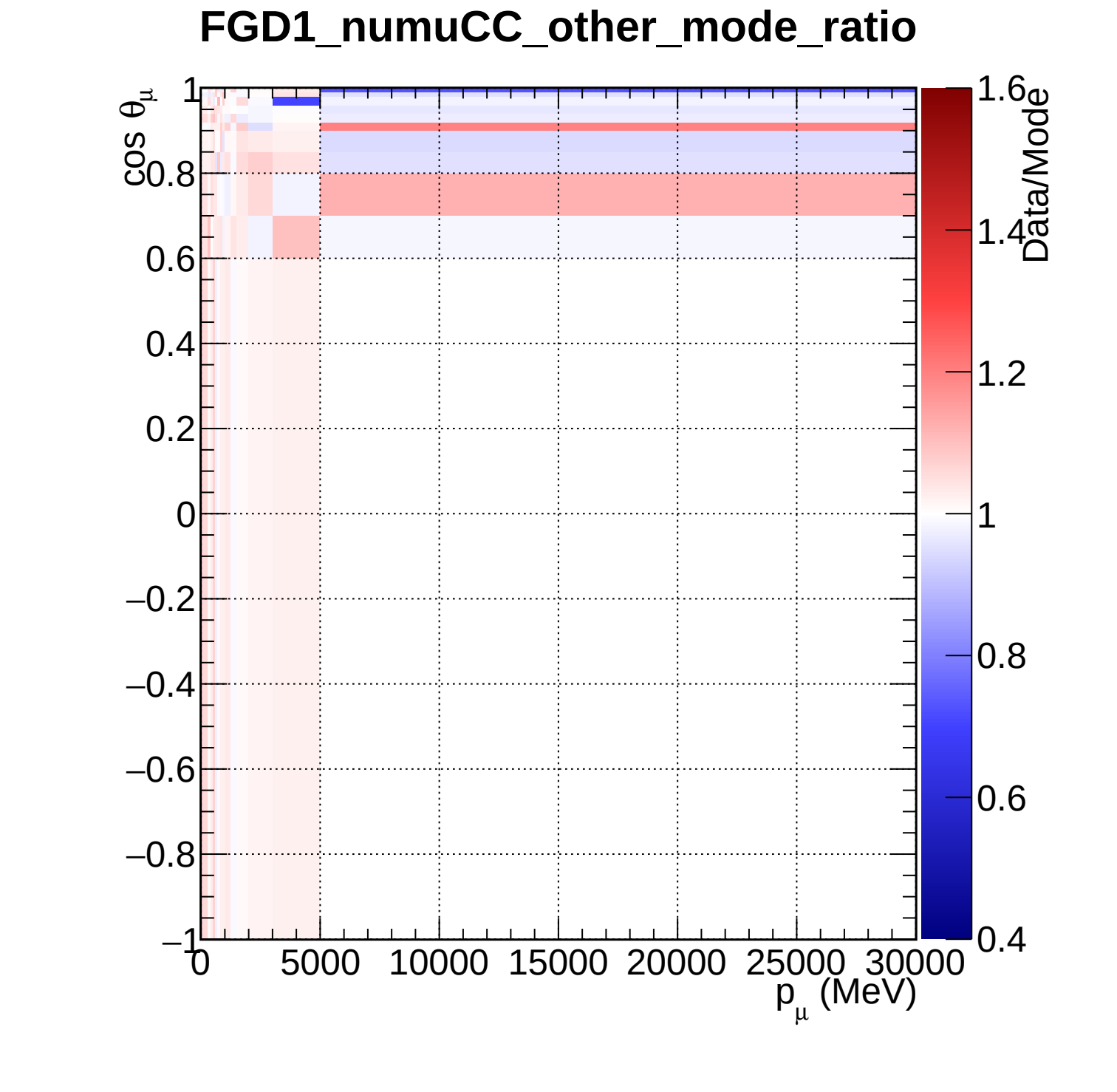

FGD1_numuCC_1pi_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

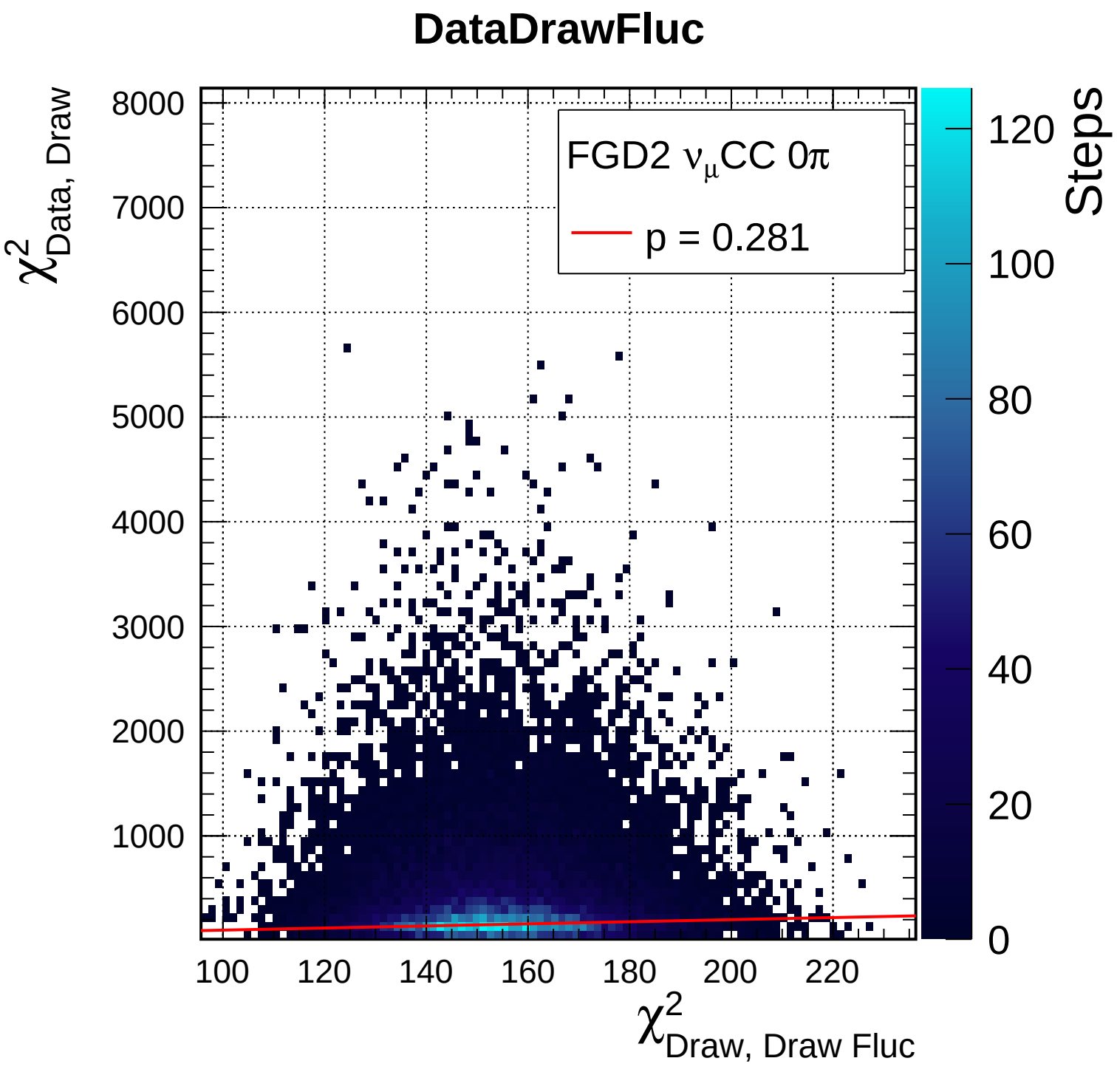

FGD1_numuCC_1pi_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

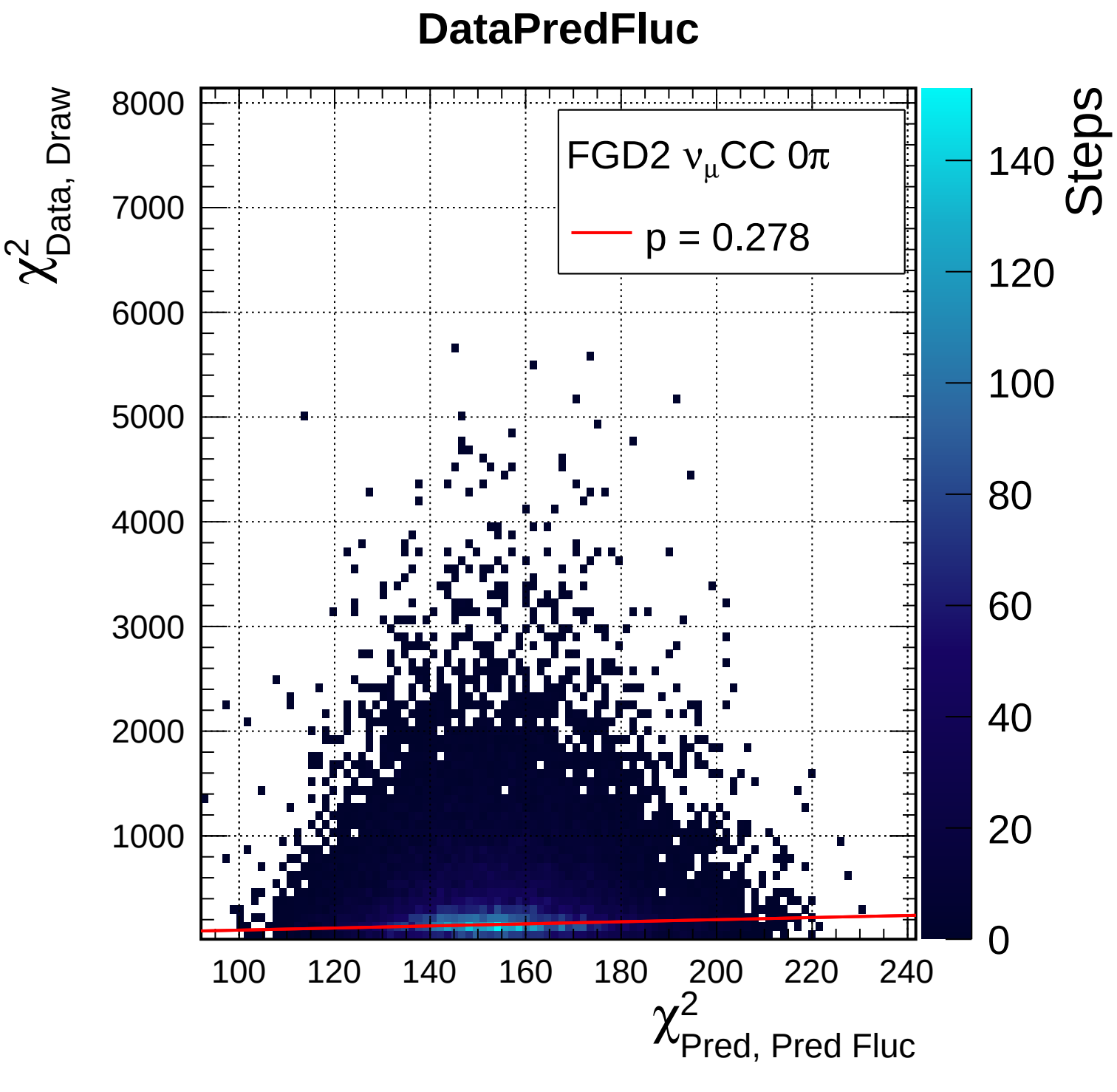

DataDrawFluc
FGD1 ν_μCC other
p = 0.766
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Draw, Draw Fluc}}$
Steps
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
100
120
140
160
180
200
220
140
120
100
80
60
40
20
0

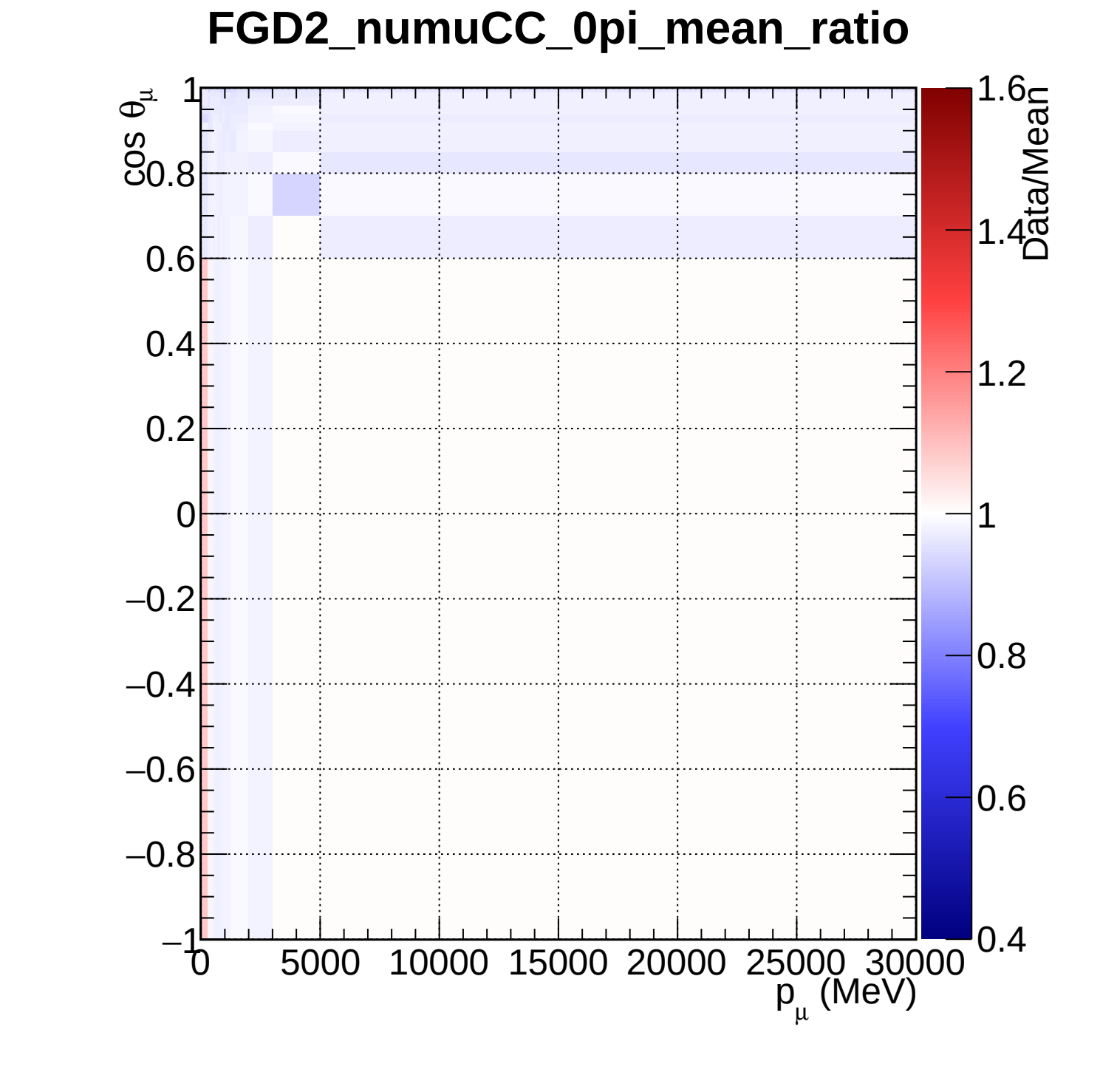

DataPredFluc
FGD1 ν_μCC other
p = 0.767
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
100
120
140
160
180
200
220
140
120
100
80
60
40
20
0

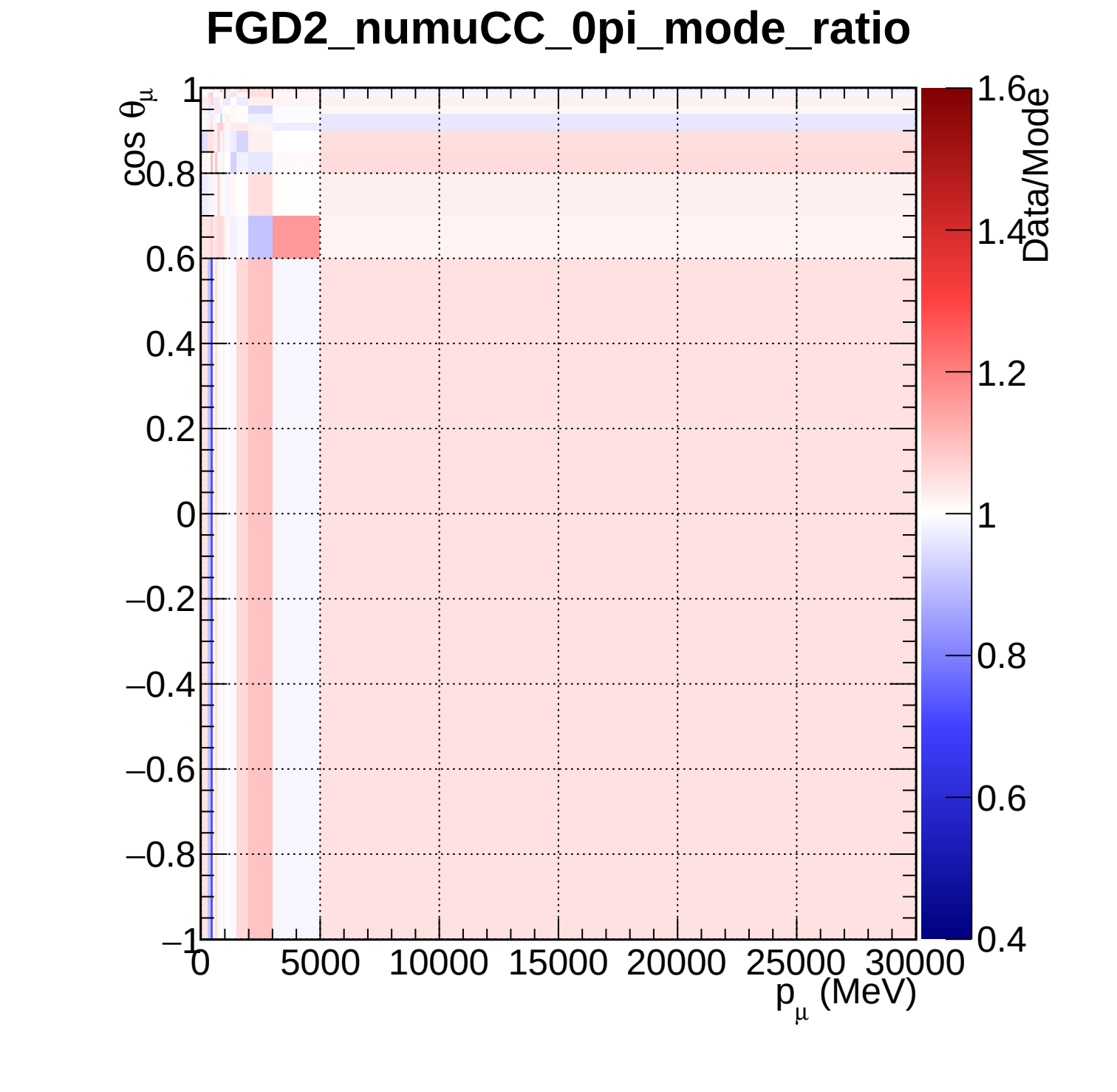

FGD1_numuCC_other_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

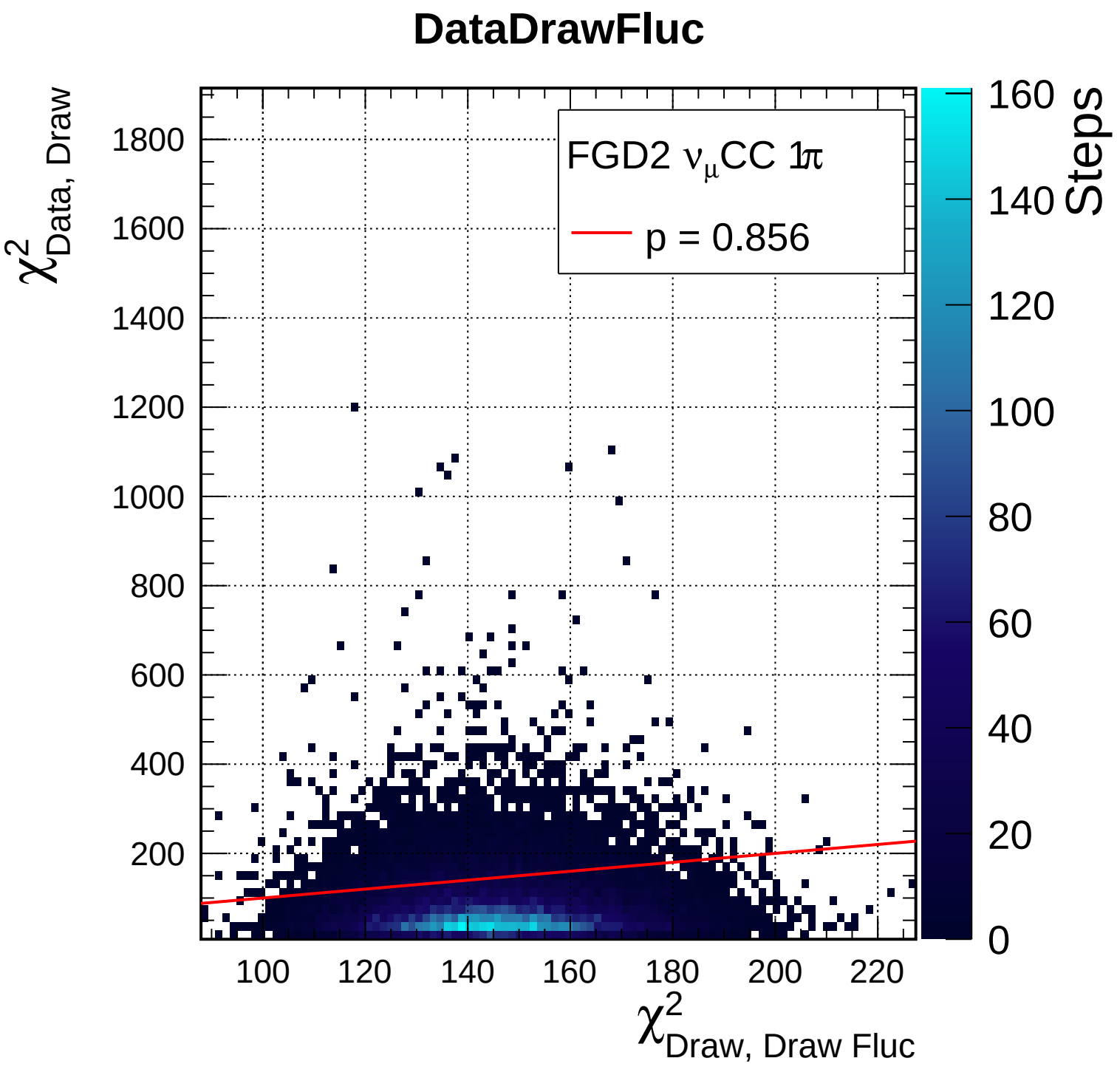

FGD1_numuCC_other_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

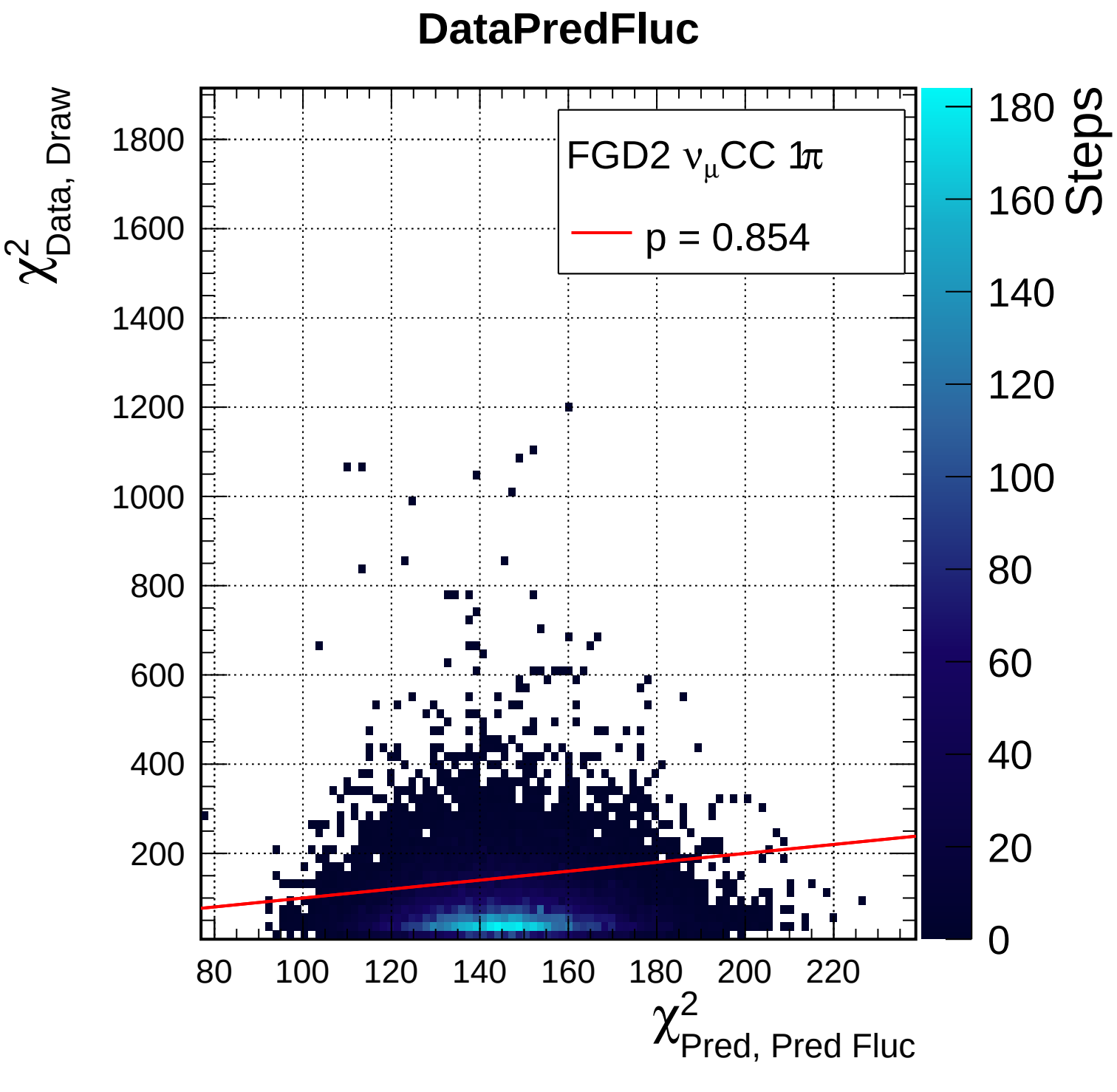

DataDrawFluc
FGD2 ν_μCC 0π
p = 0.281
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
8000
7000
6000
5000
4000
3000
2000
1000
100
120
140
160
180
200
220
120
100
80
60
40
20
0

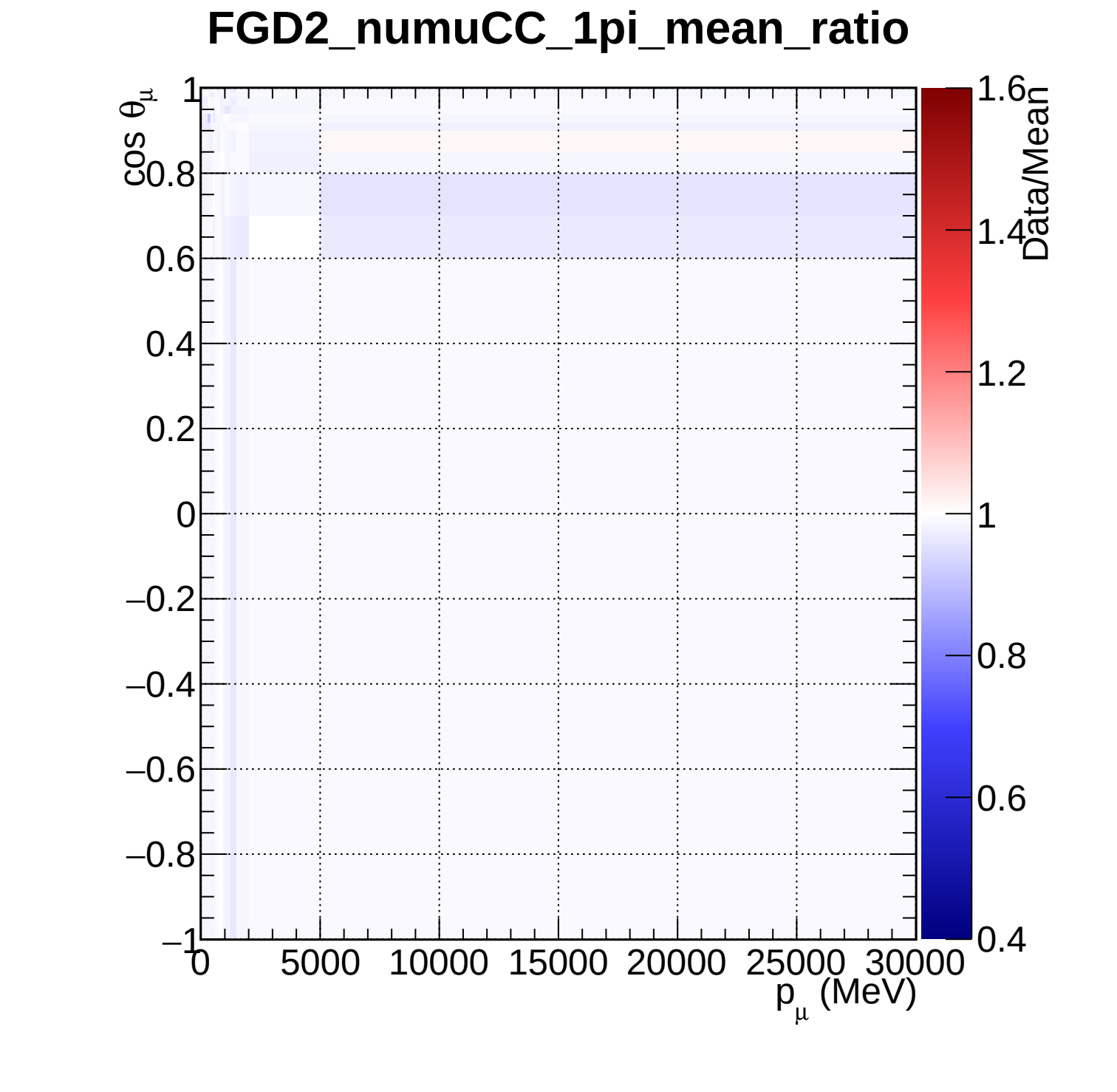

DataPredFluc
FGD2 ν_μCC 0π
p = 0.278
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
8000
7000
6000
5000
4000
3000
2000
1000
100
120
140
160
180
200
220
240
140
120
100
80
60
40
20
0

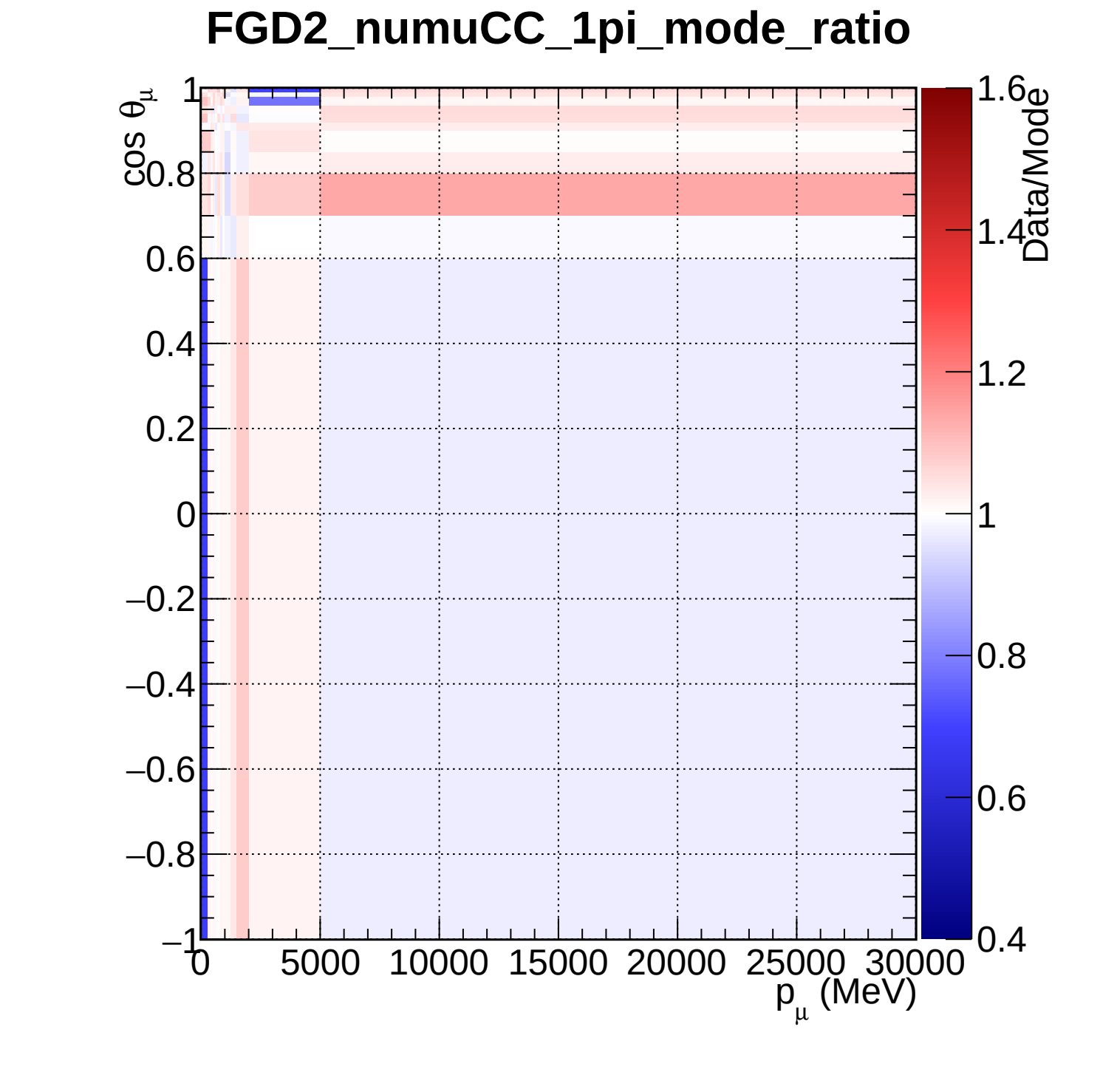

FGD2_numuCC_0pi_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

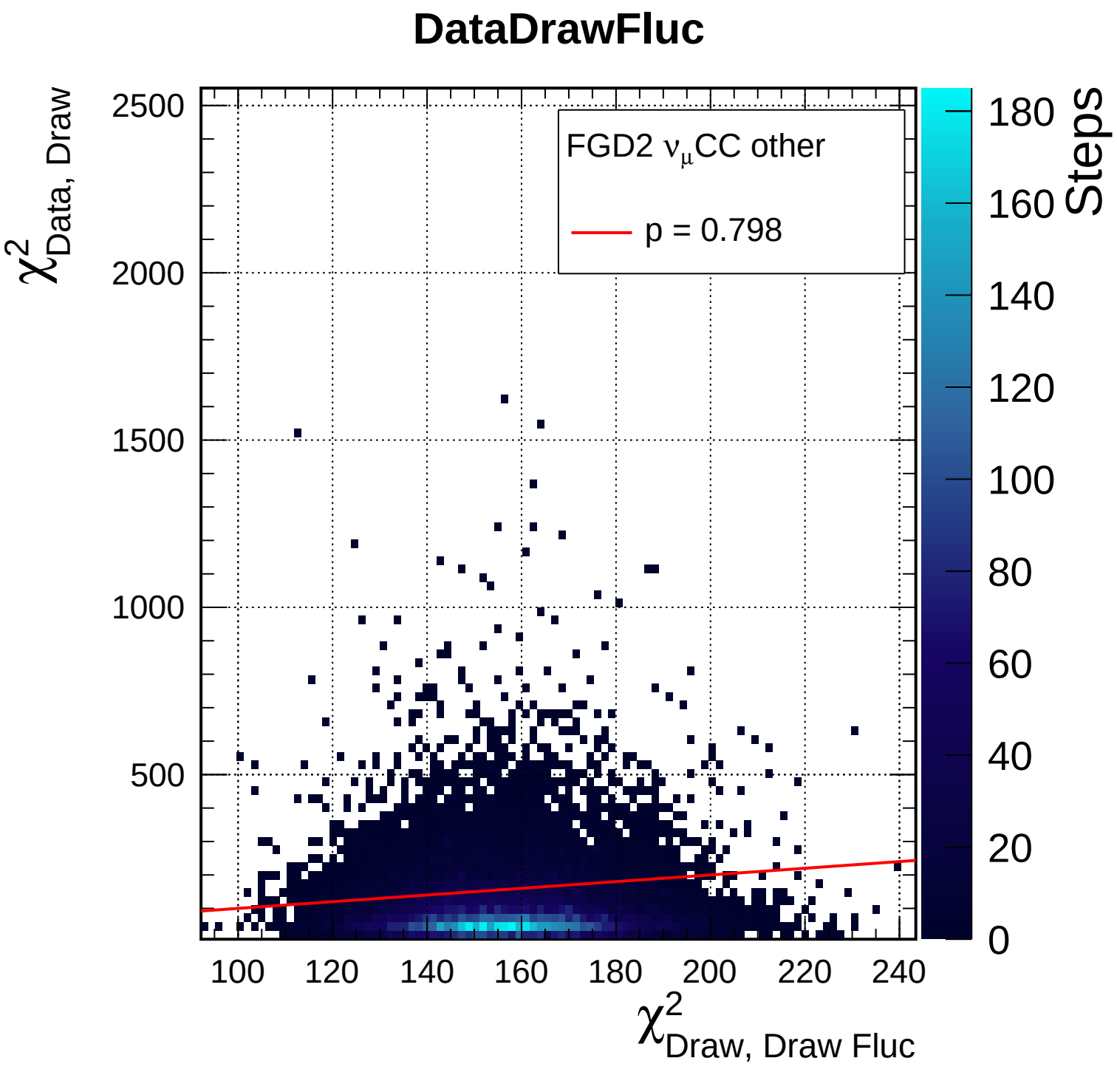

FGD2_numuCC_0pi_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

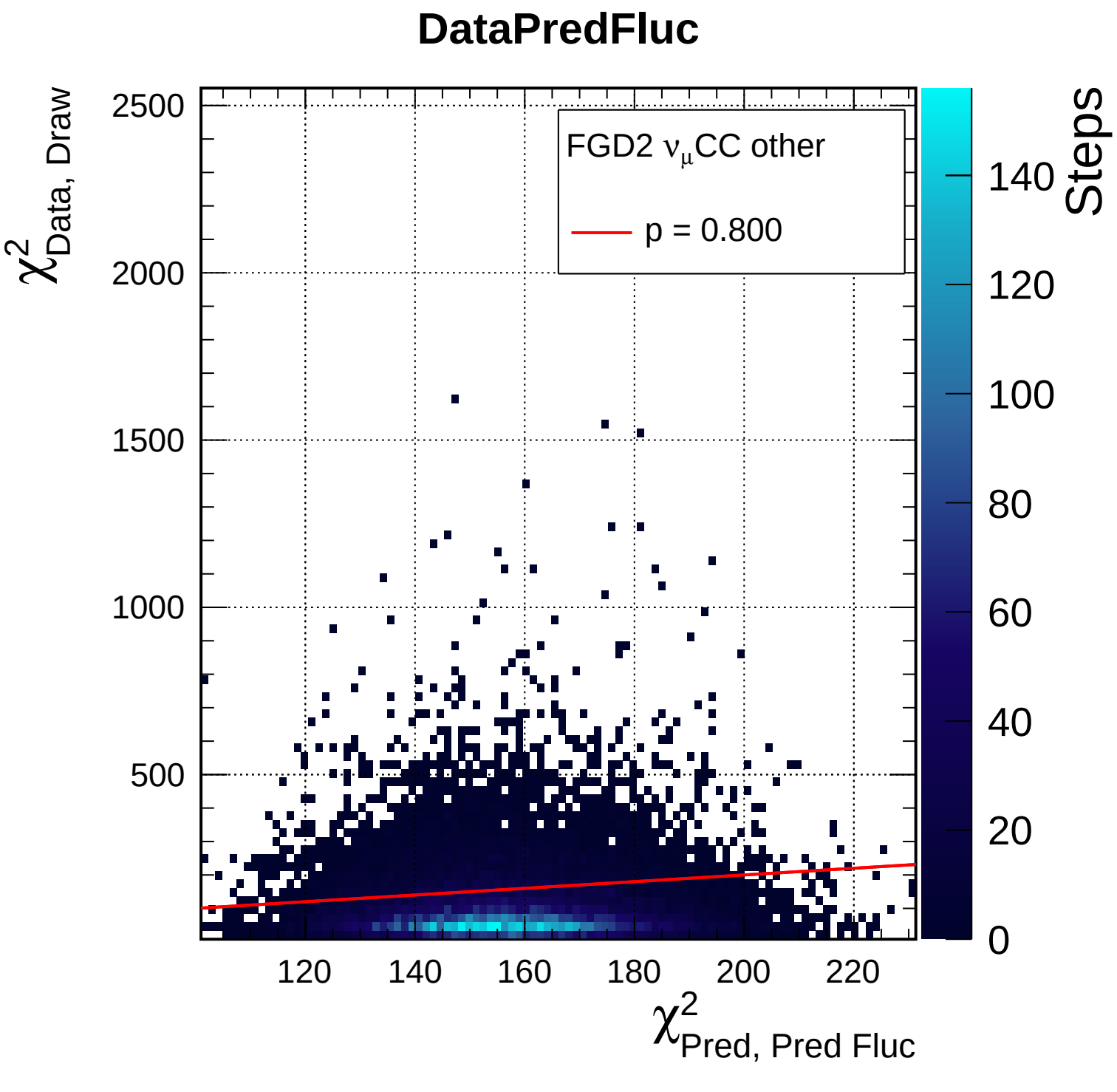

DataDrawFluc
FGD2 ν_μCC 1π
p = 0.856
$\chi^2_{Data,\ Draw}$
$\chi^2_{Draw,\ Draw\ Fluc}$
Steps
1800
1600
1400
1200
1000
800
600
400
200
100
120
140
160
180
200
220
160
140
120
100
80
60
40
20
0

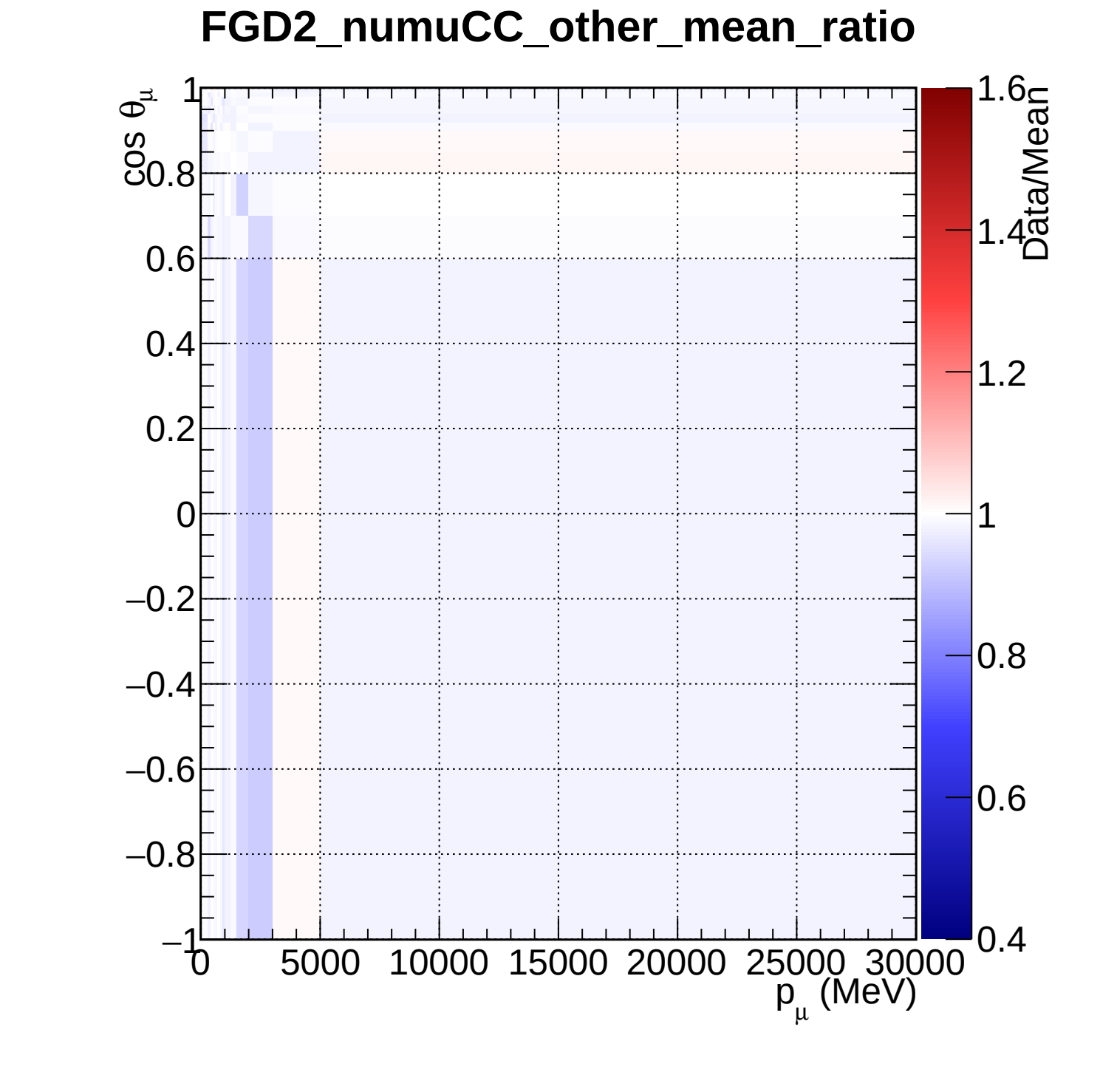

DataPredFluc
FGD2 ν_μCC 1π
p = 0.854
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
1800
1600
1400
1200
1000
800
600
400
200
80
100
120
140
160
180
200
220
180
160
140
120
100
80
60
40
20
0

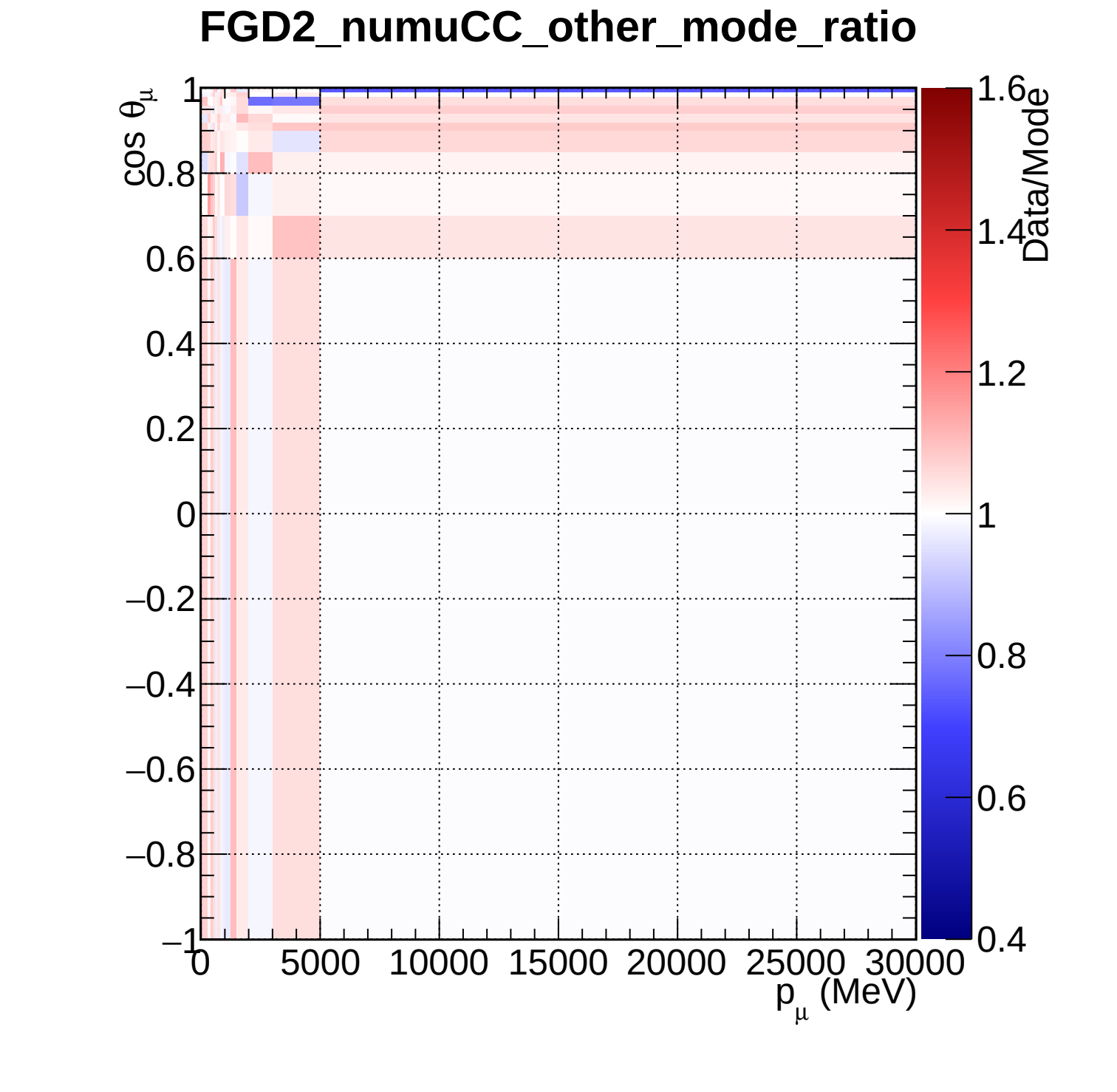

FGD2_numuCC_1pi_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

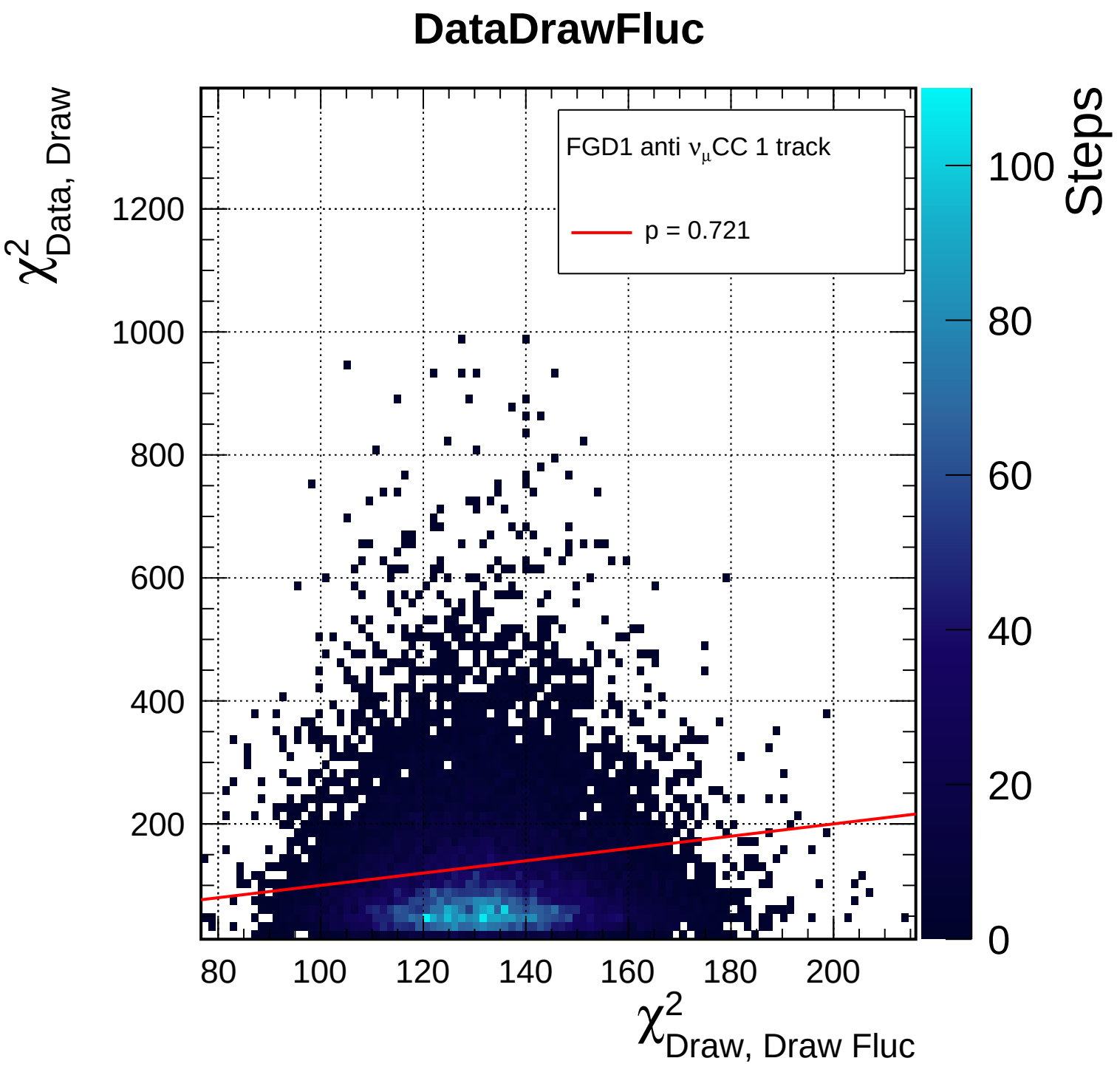

FGD2_numuCC_1pi_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

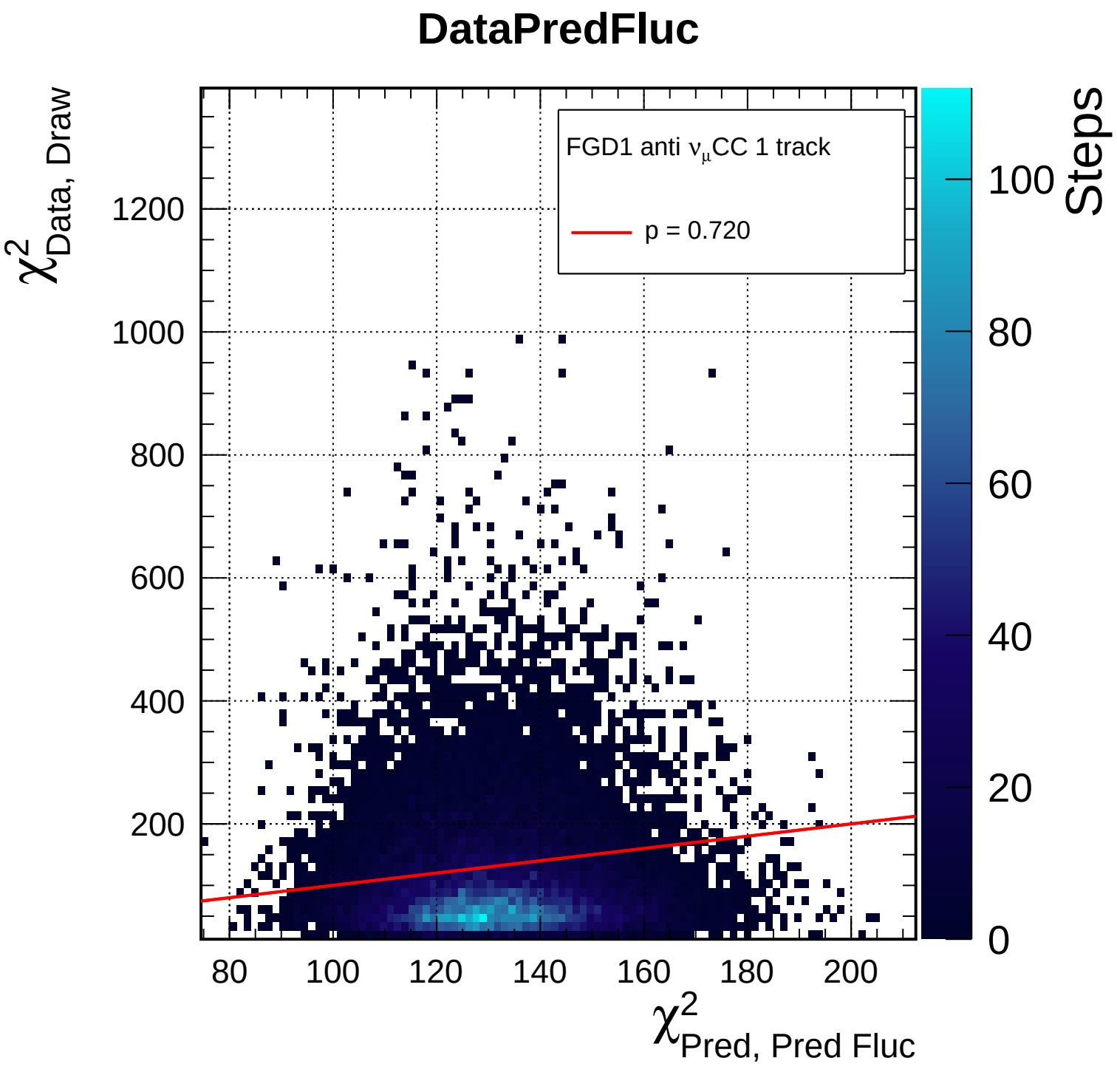

DataDrawFluc
FGD2 ν_μCC other
p = 0.798
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
2500
2000
1500
1000
500
100
120
140
160
180
200
220
240
180
160
140
120
100
80
60
40
20
0

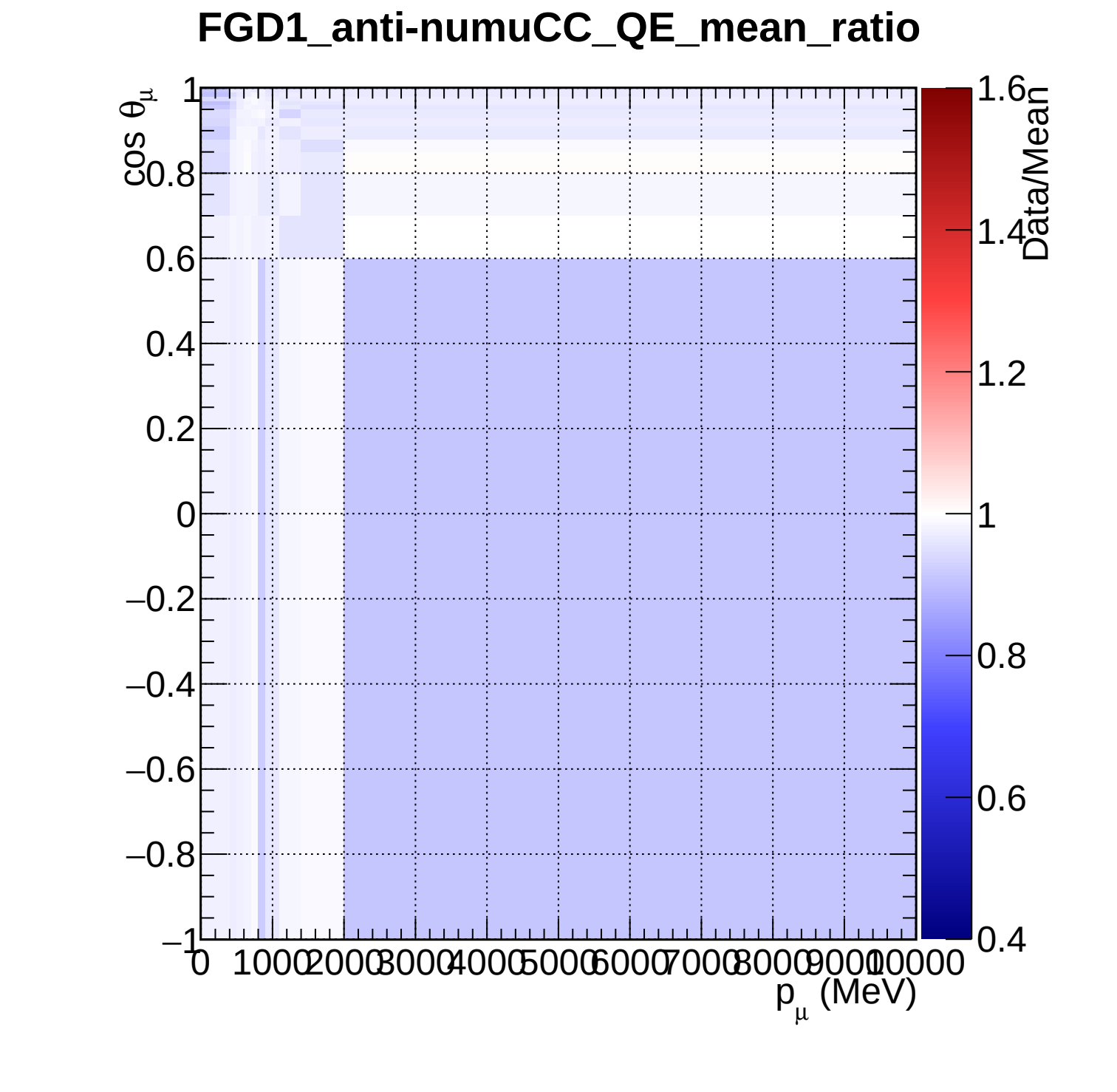

DataPredFluc
FGD2 ν_μCC other
p = 0.800
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
2500
2000
1500
1000
500
120
140
160
180
200
220
140
120
100
80
60
40
20
0

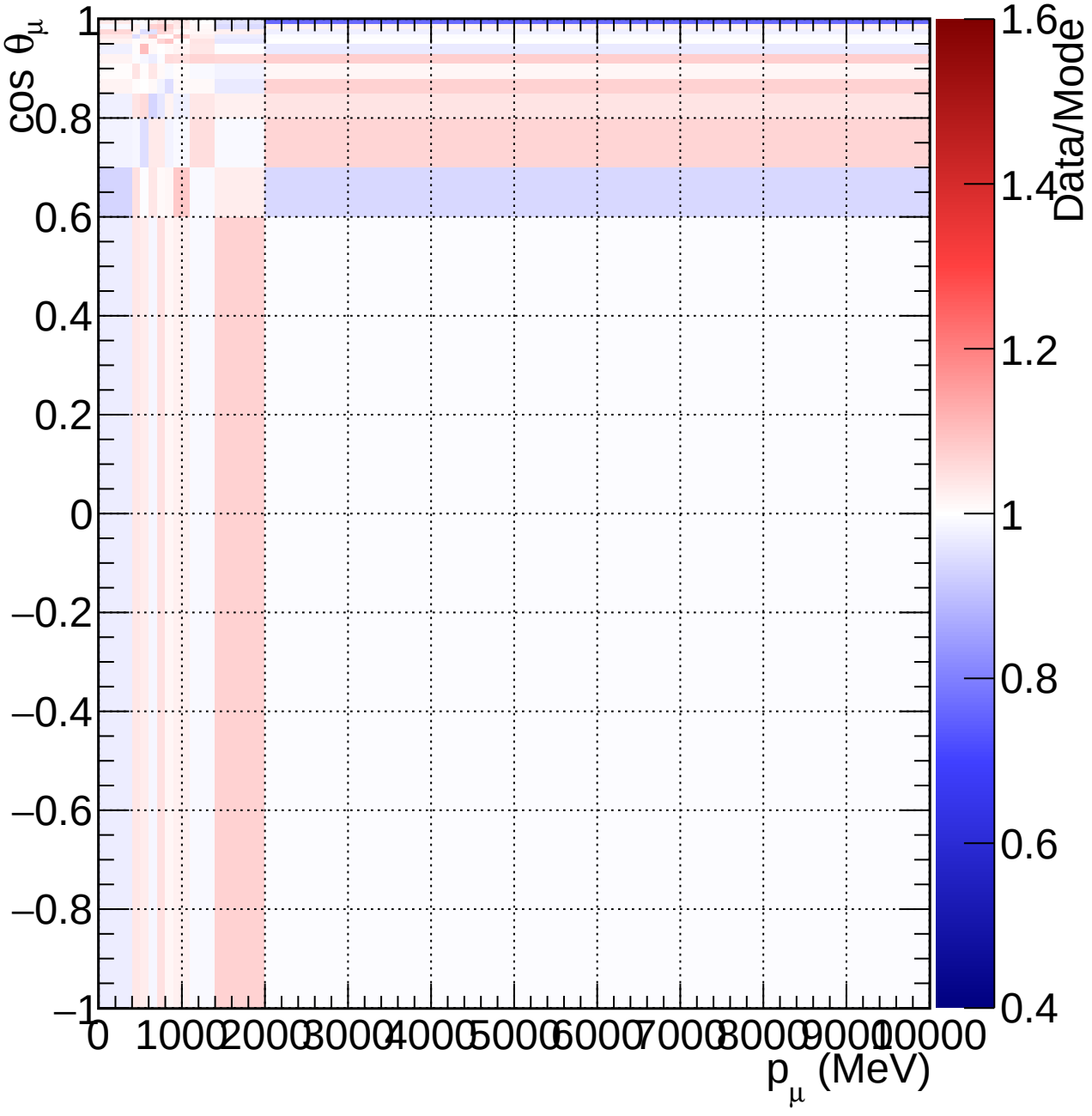

FGD2_numuCC_other_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

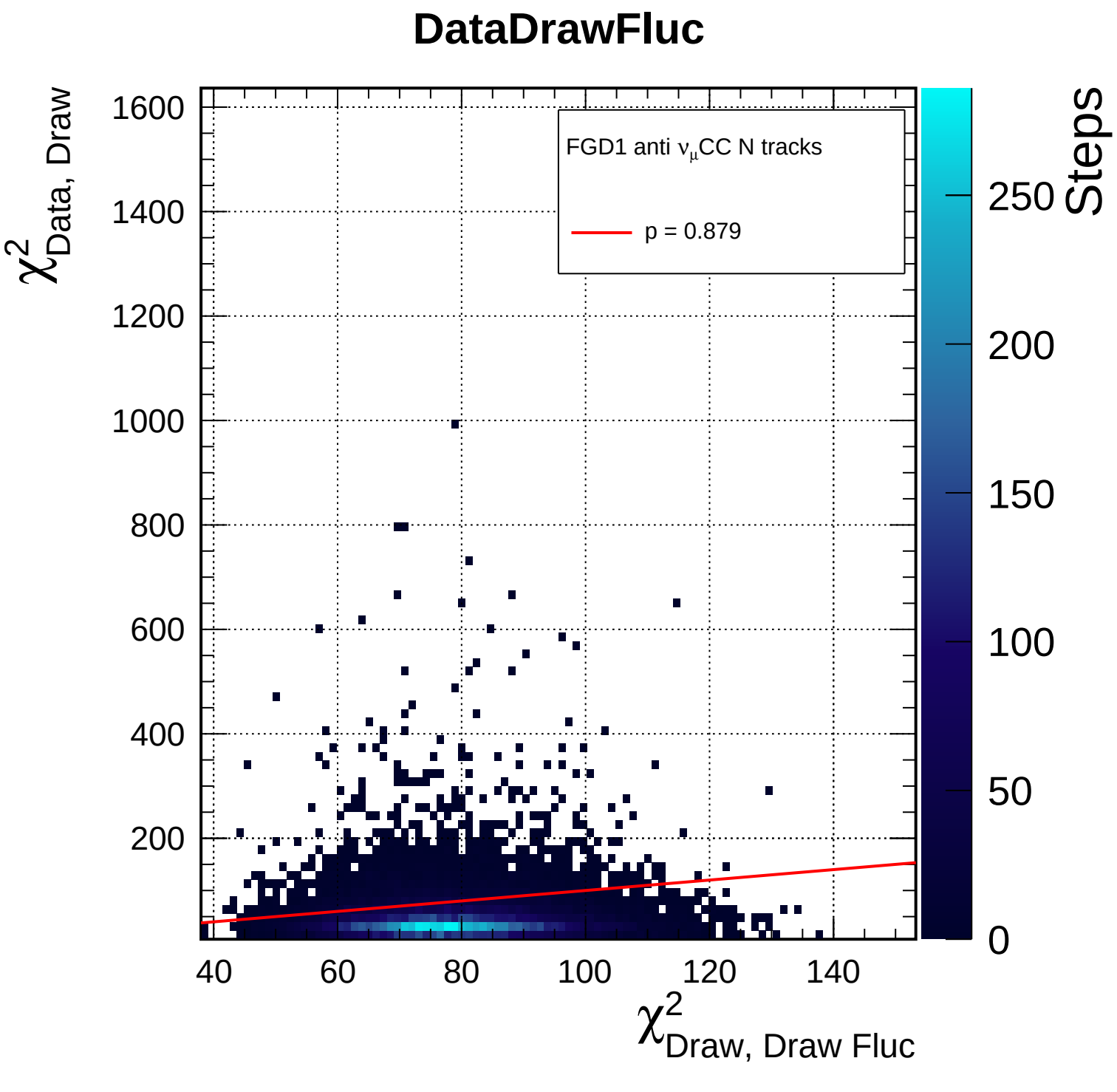

FGD2_numuCC_other_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
5000
10000
15000
20000
25000
30000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

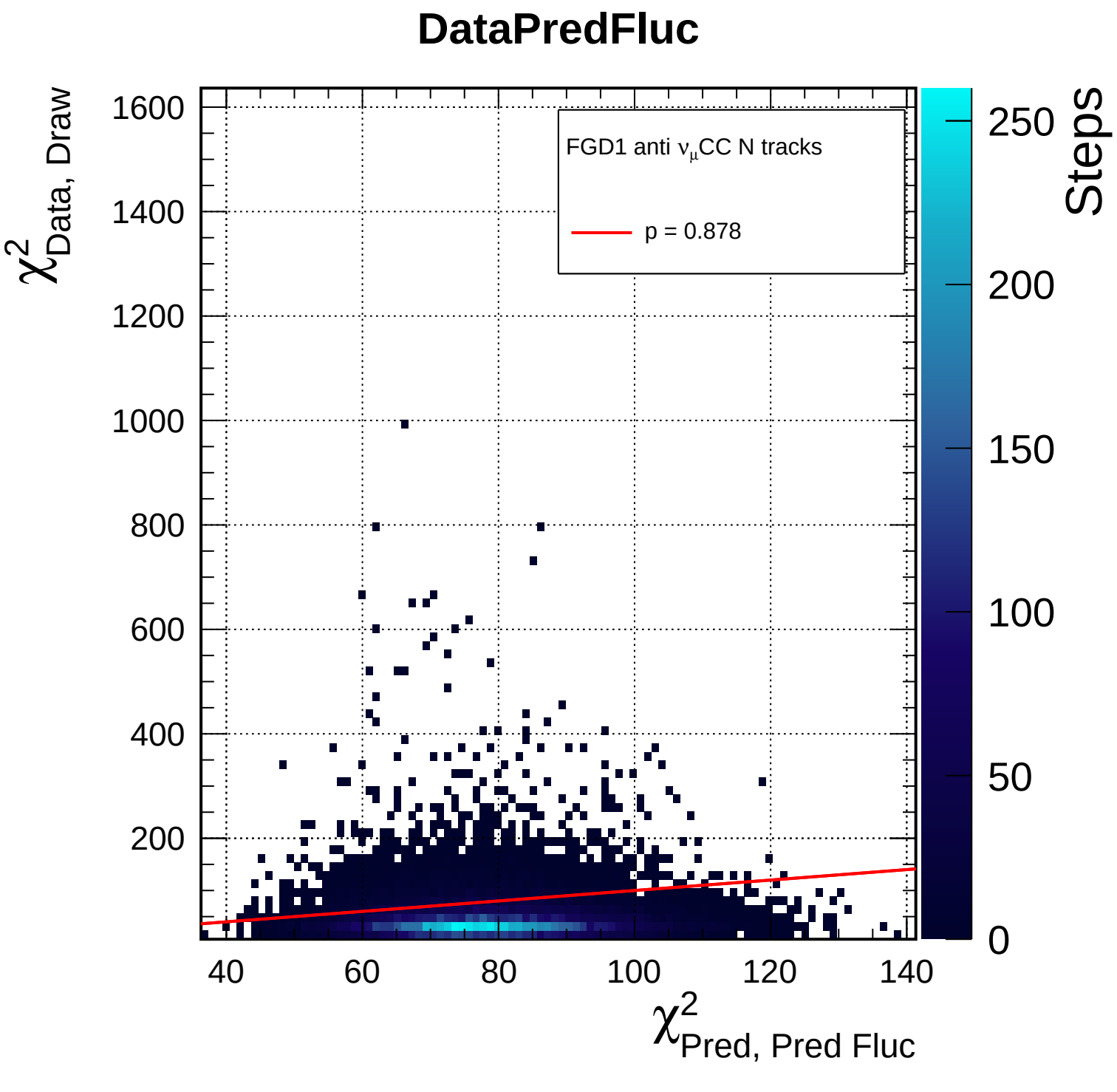

DataDrawFluc
FGD1 anti ν_μCC 1 track
p = 0.721
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
200
400
600
800
1000
1200
80
100
120
140
160
180
200
0
20
40
60
80
100

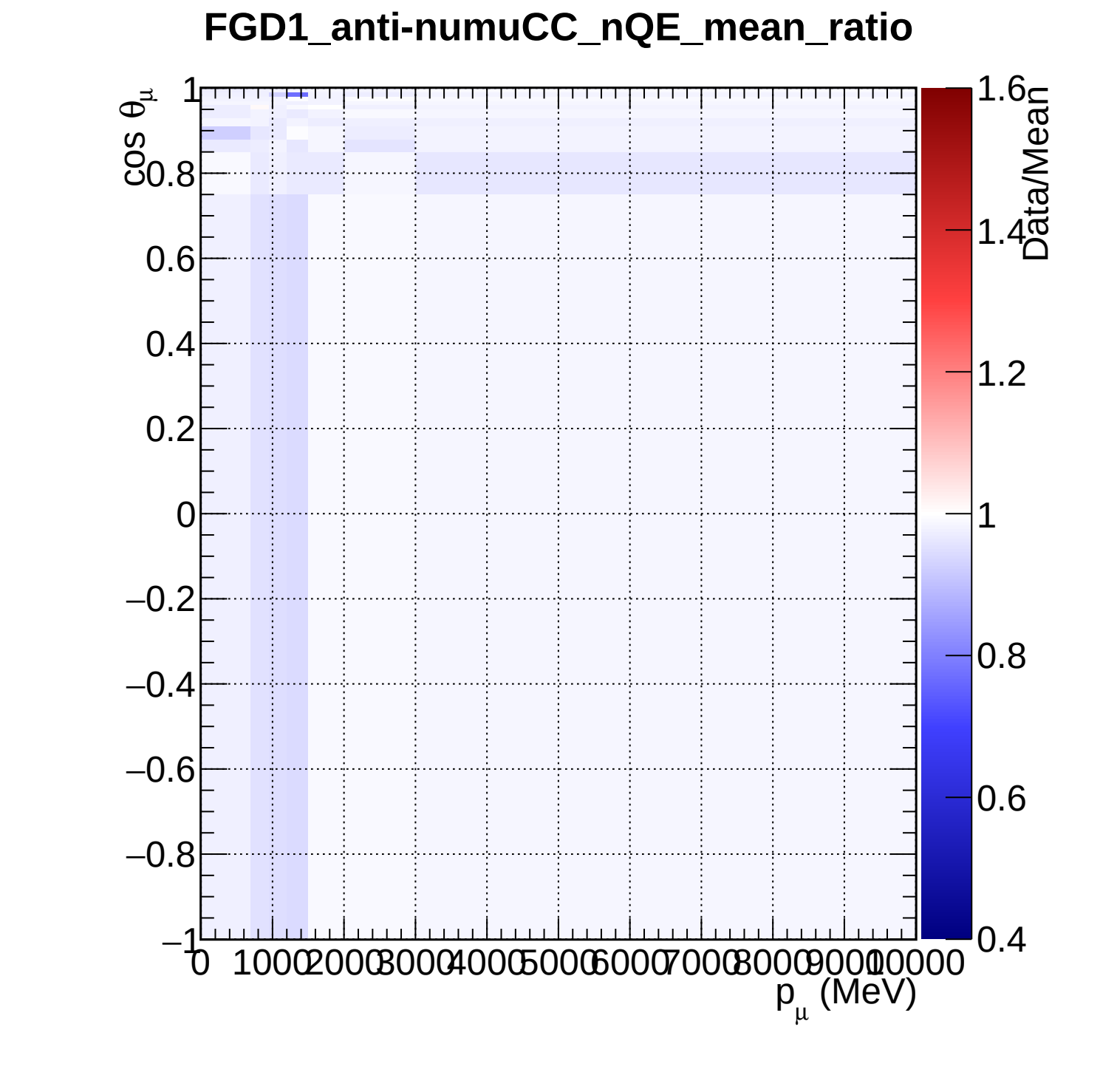

DataPredFluc
FGD1 anti ν_μCC 1 track
p = 0.720
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
1200
1000
800
600
400
200
80
100
120
140
160
180
200
100
80
60
40
20
0

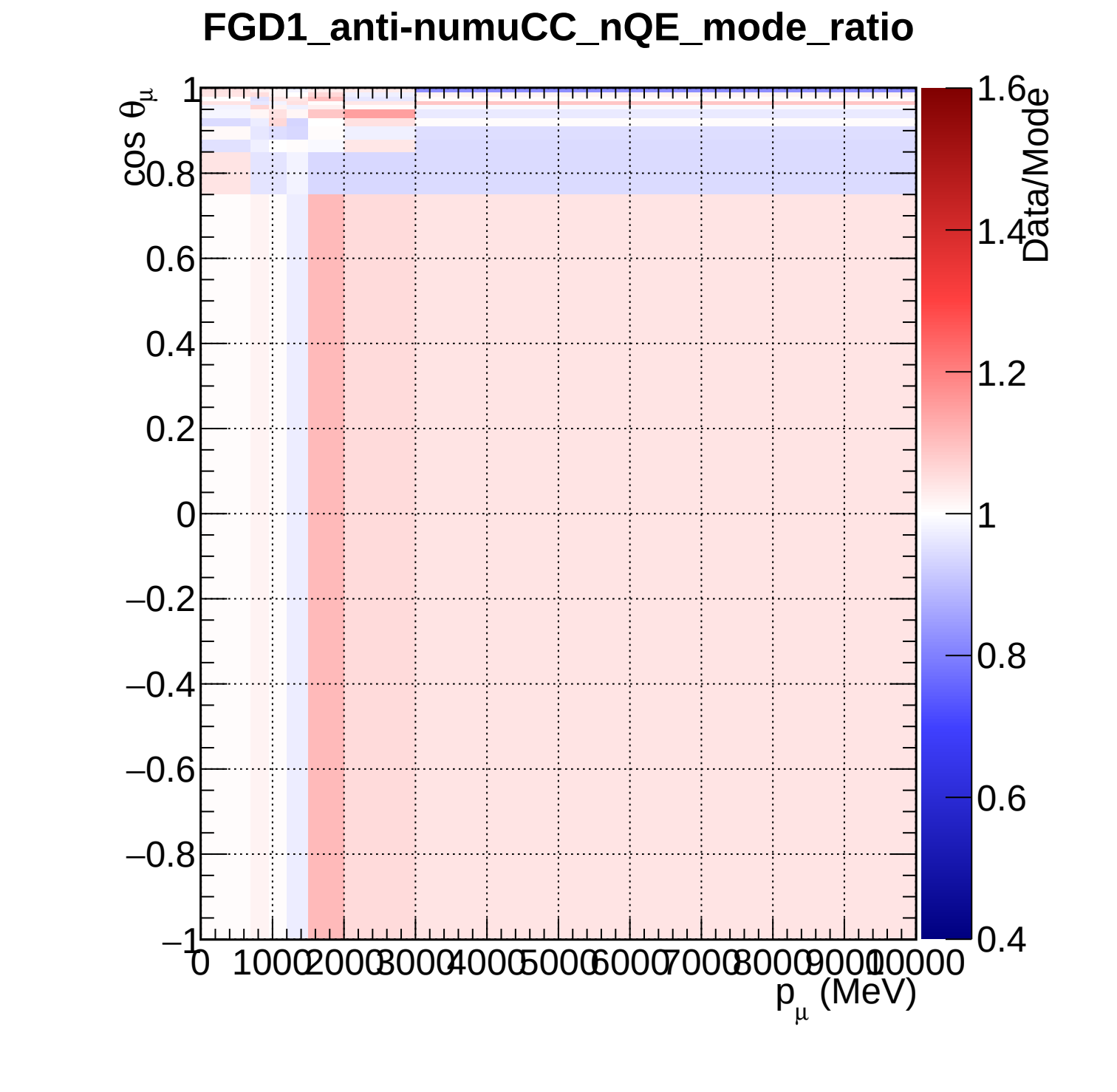

FGD1_anti-numuCC_QE_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

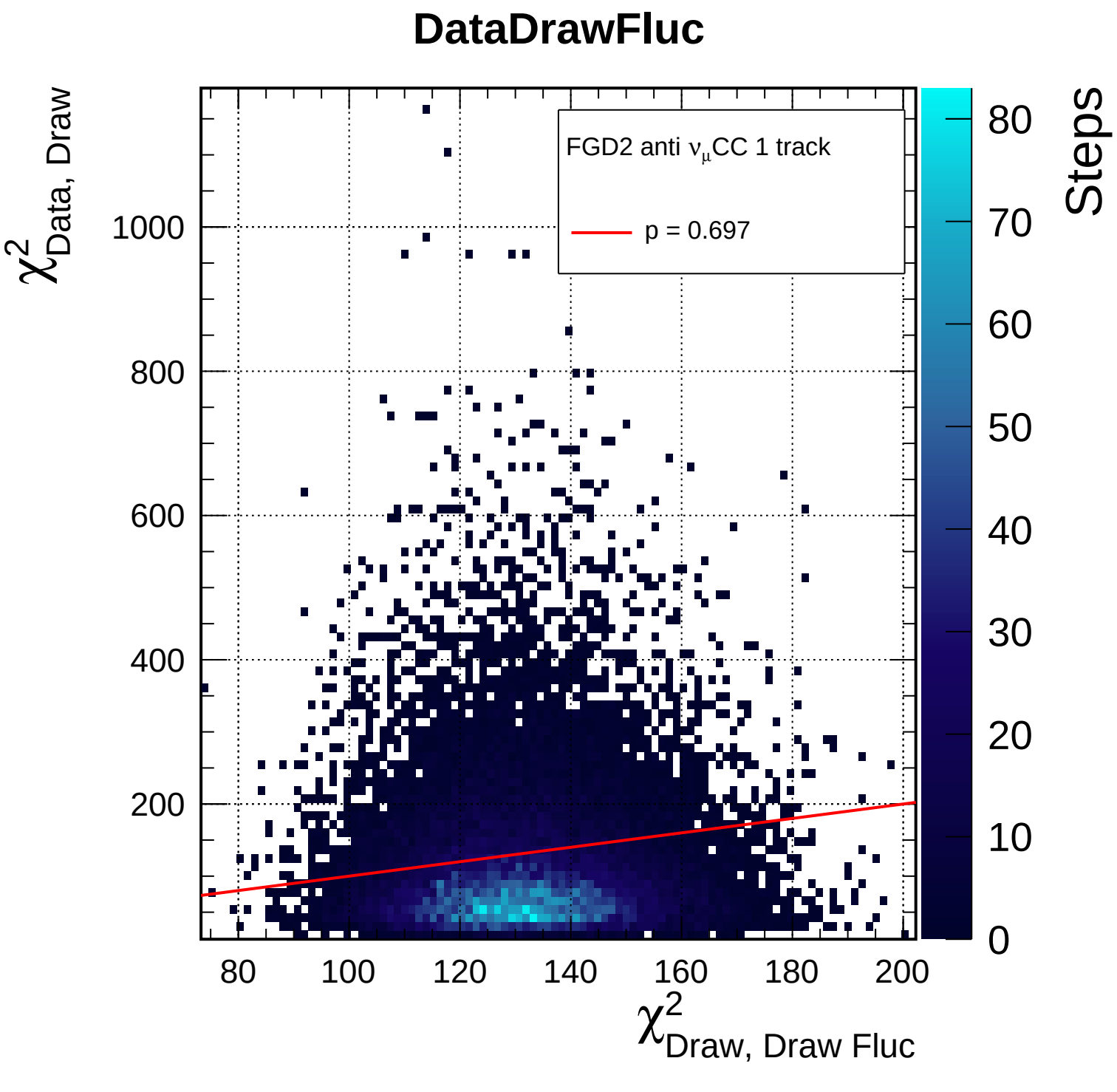

FGD1_anti-numuCC_QE_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

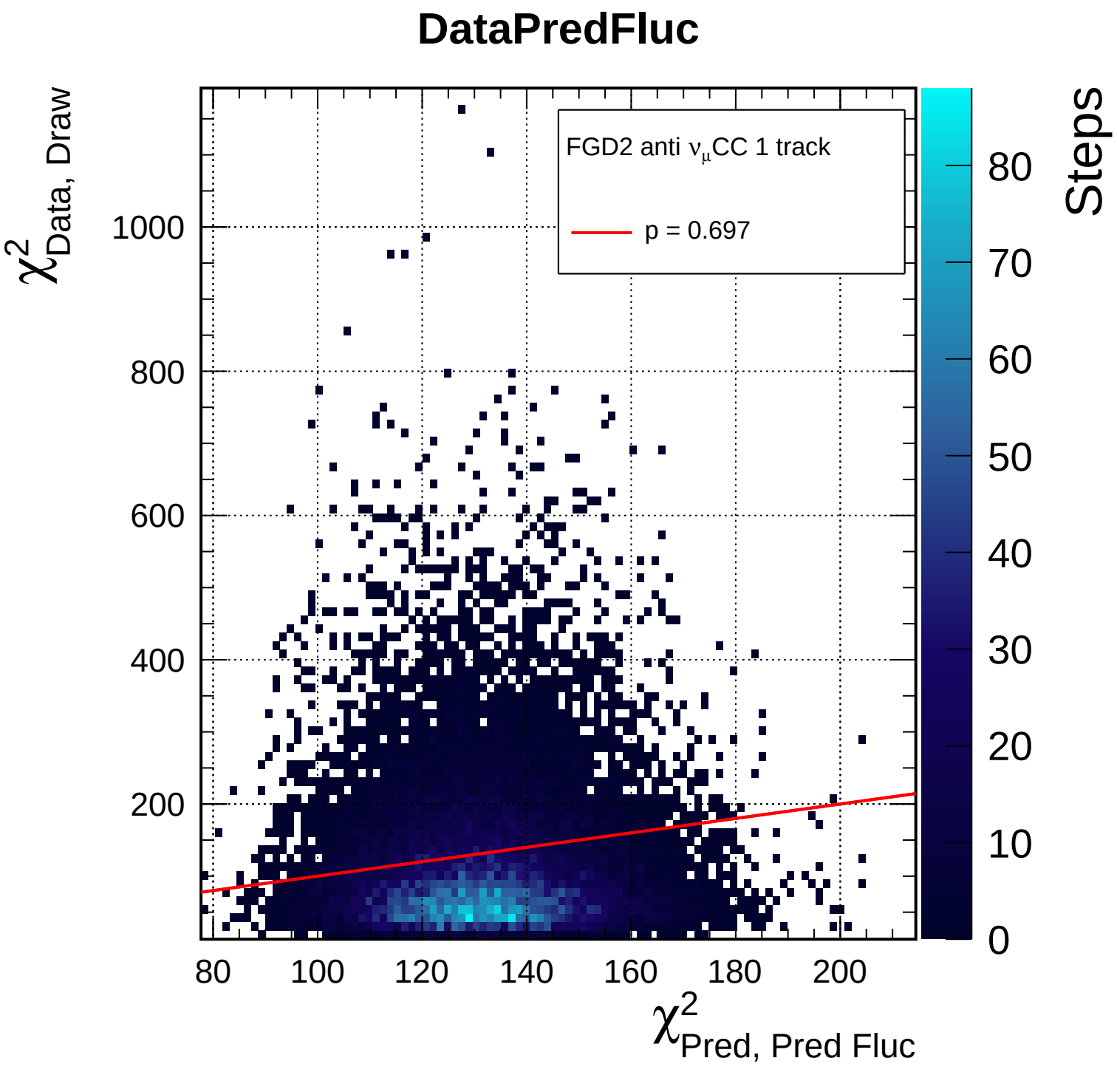

DataDrawFluc
FGD1 anti ν_μCC N tracks
p = 0.879
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
1600
1400
1200
1000
800
600
400
200
40
60
80
100
120
140
250
200
150
100
50
0

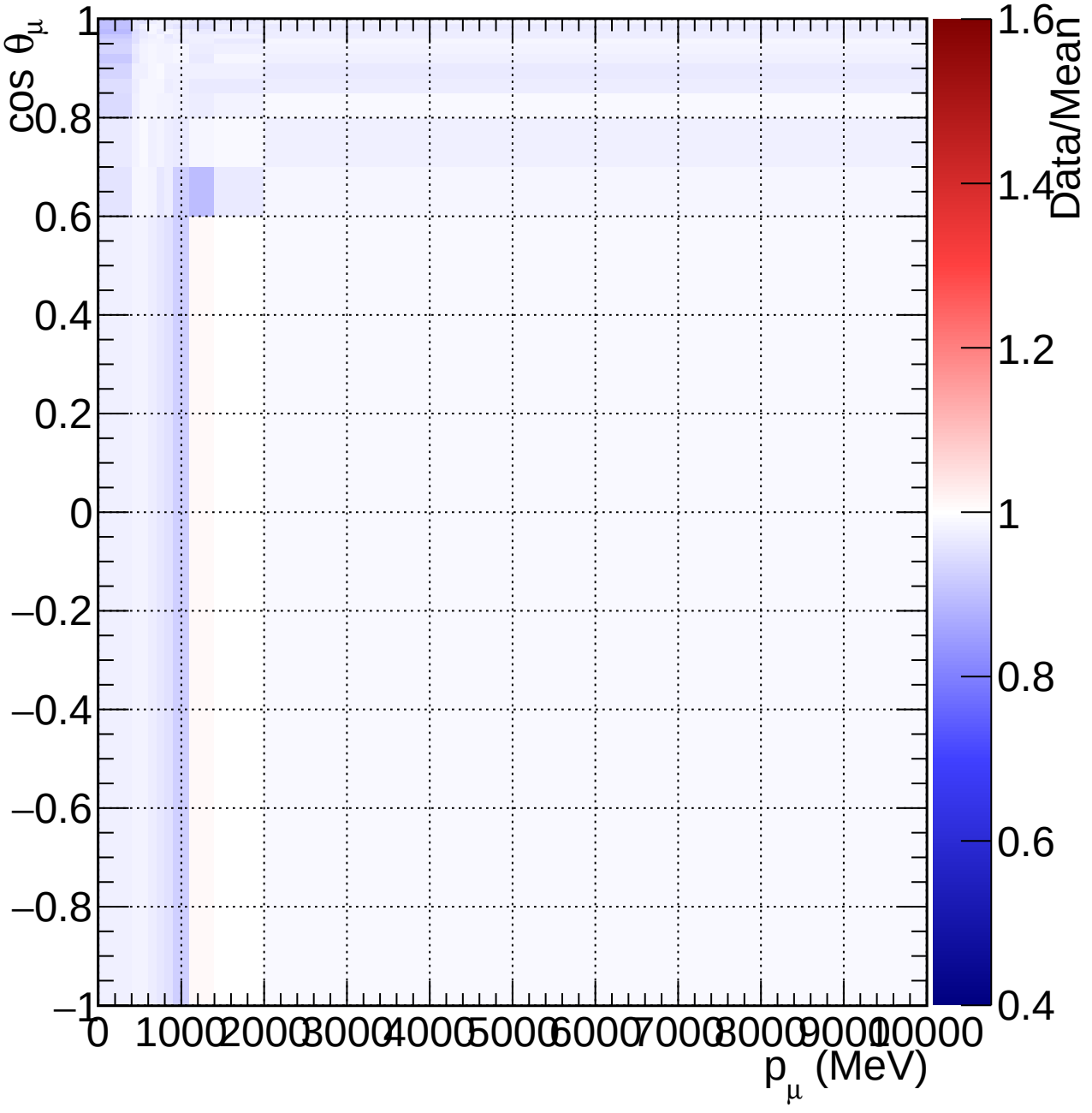

DataPredFluc
FGD1 anti ν_μCC N tracks
p = 0.878
$\chi^2_{Data,\ Draw}$
$\chi^2_{Pred,\ Pred\ Fluc}$
Steps
1600
1400
1200
1000
800
600
400
200
40
60
80
100
120
140
250
200
150
100
50
0

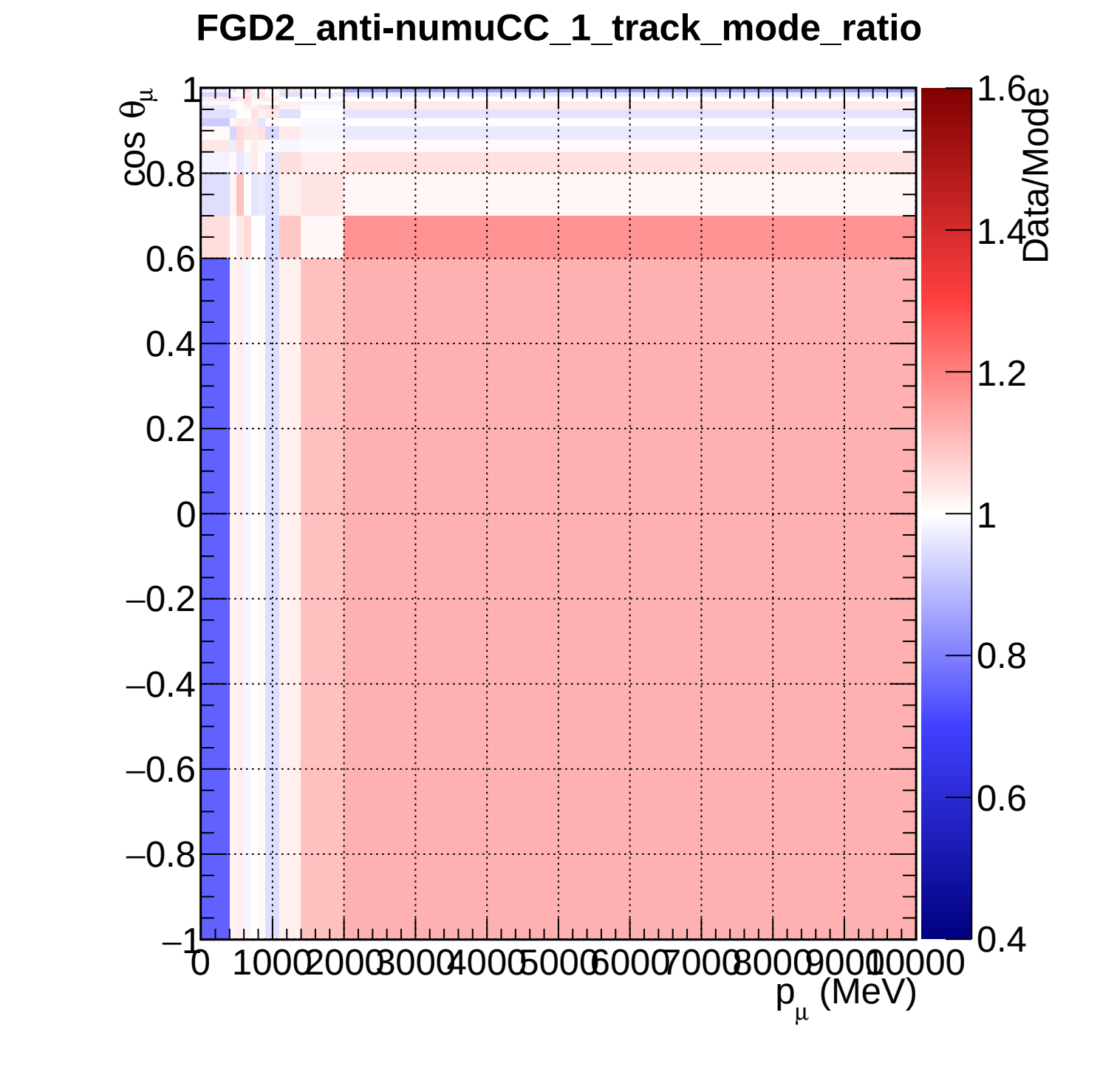

FGD1_anti-numuCC_nQE_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

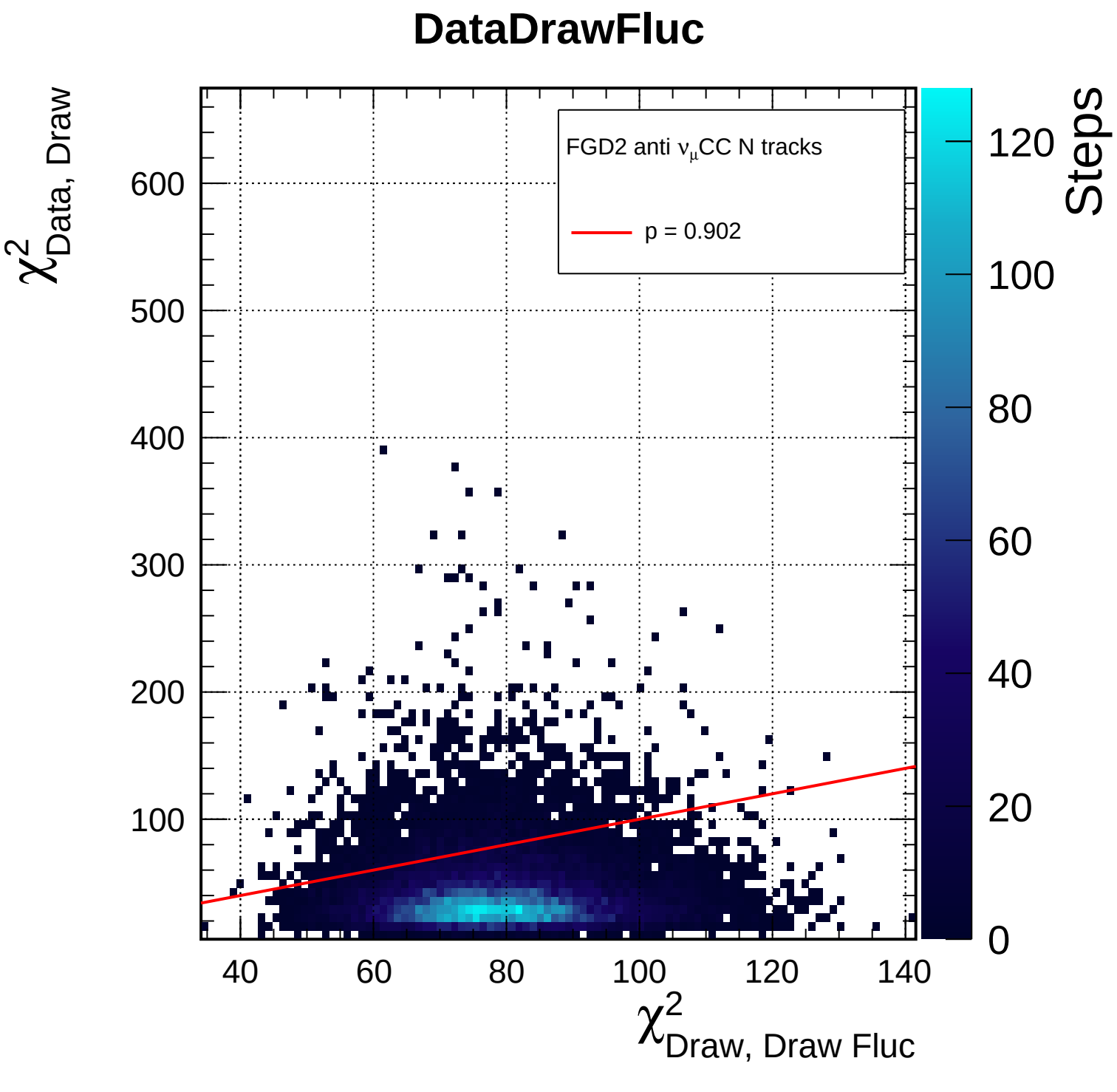

FGD1_anti-numuCC_nQE_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

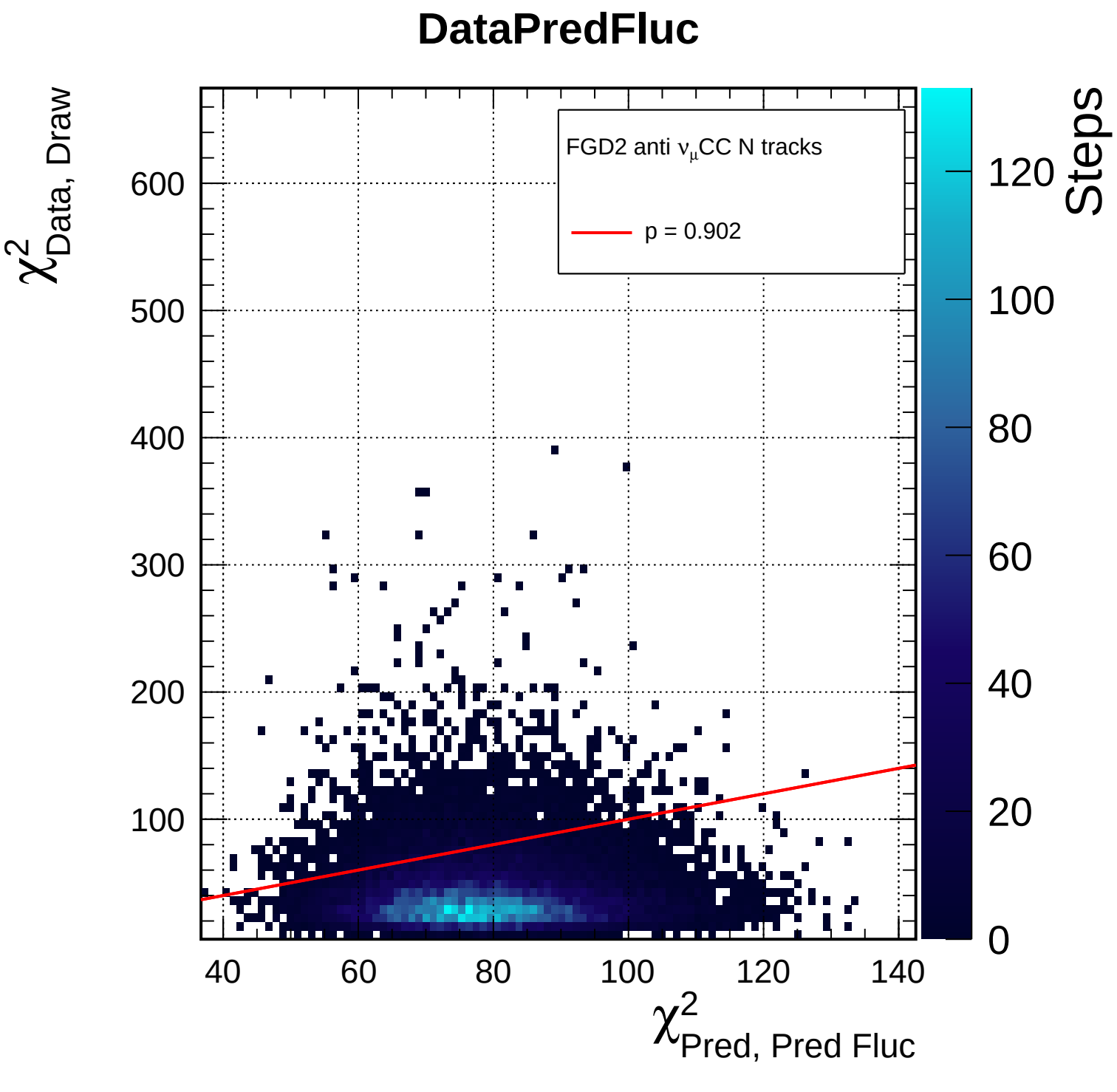

DataDrawFluc
FGD2 anti ν_μCC 1 track
p = 0.697
$\chi^2_{Data,\ Draw}$
$\chi^2_{Draw,\ Draw\ Fluc}$
Steps
1000
800
600
400
200
80
100
120
140
160
180
200
0
10
20
30
40
50
60
70
80

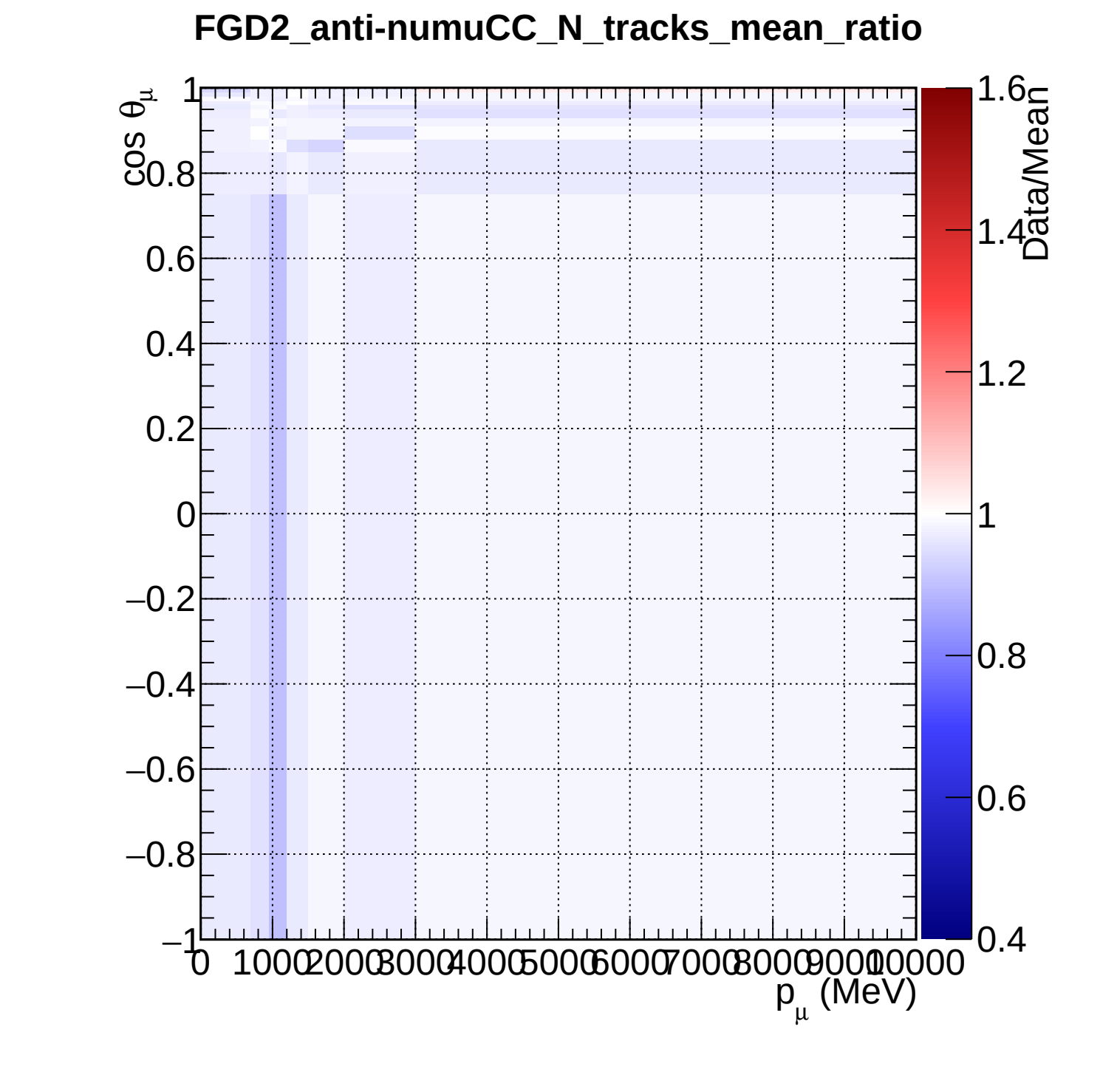

DataPredFluc
FGD2 anti ν_μCC 1 track
p = 0.697
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
1000
800
600
400
200
80
100
120
140
160
180
200
0
10
20
30
40
50
60
70
80

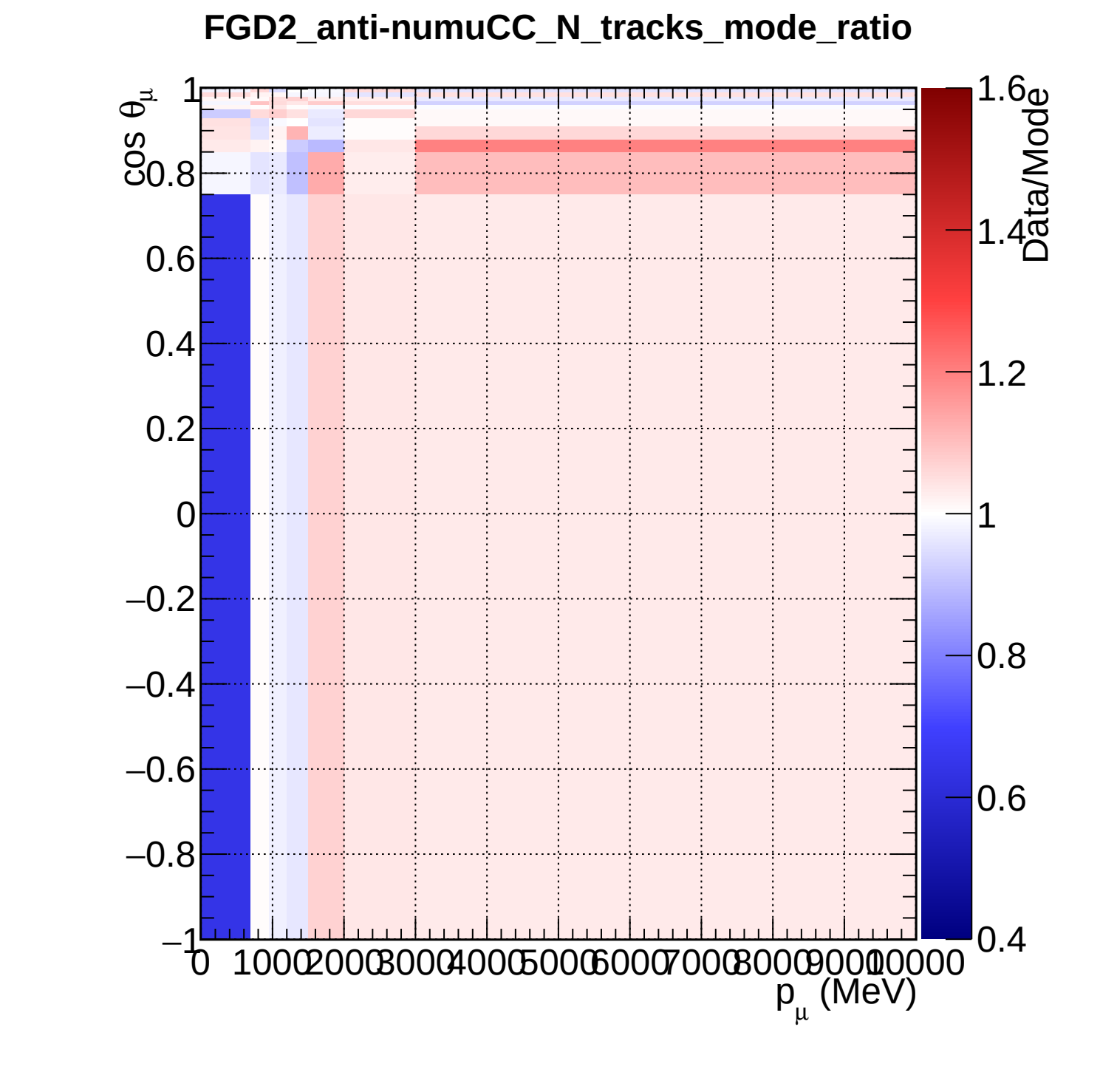

FGD2_anti-numuCC_1_track_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

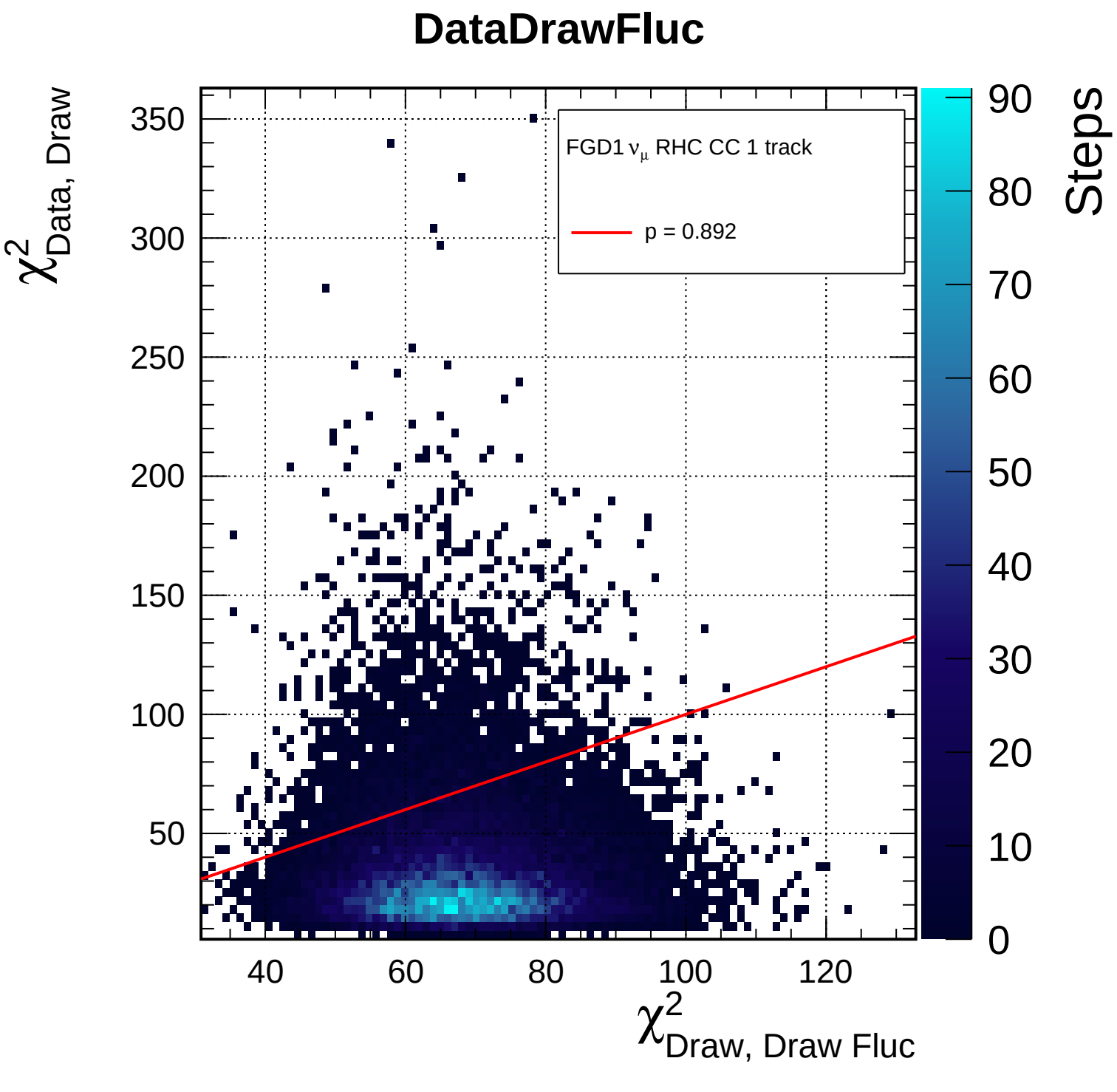

FGD2_anti-numuCC_1_track_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

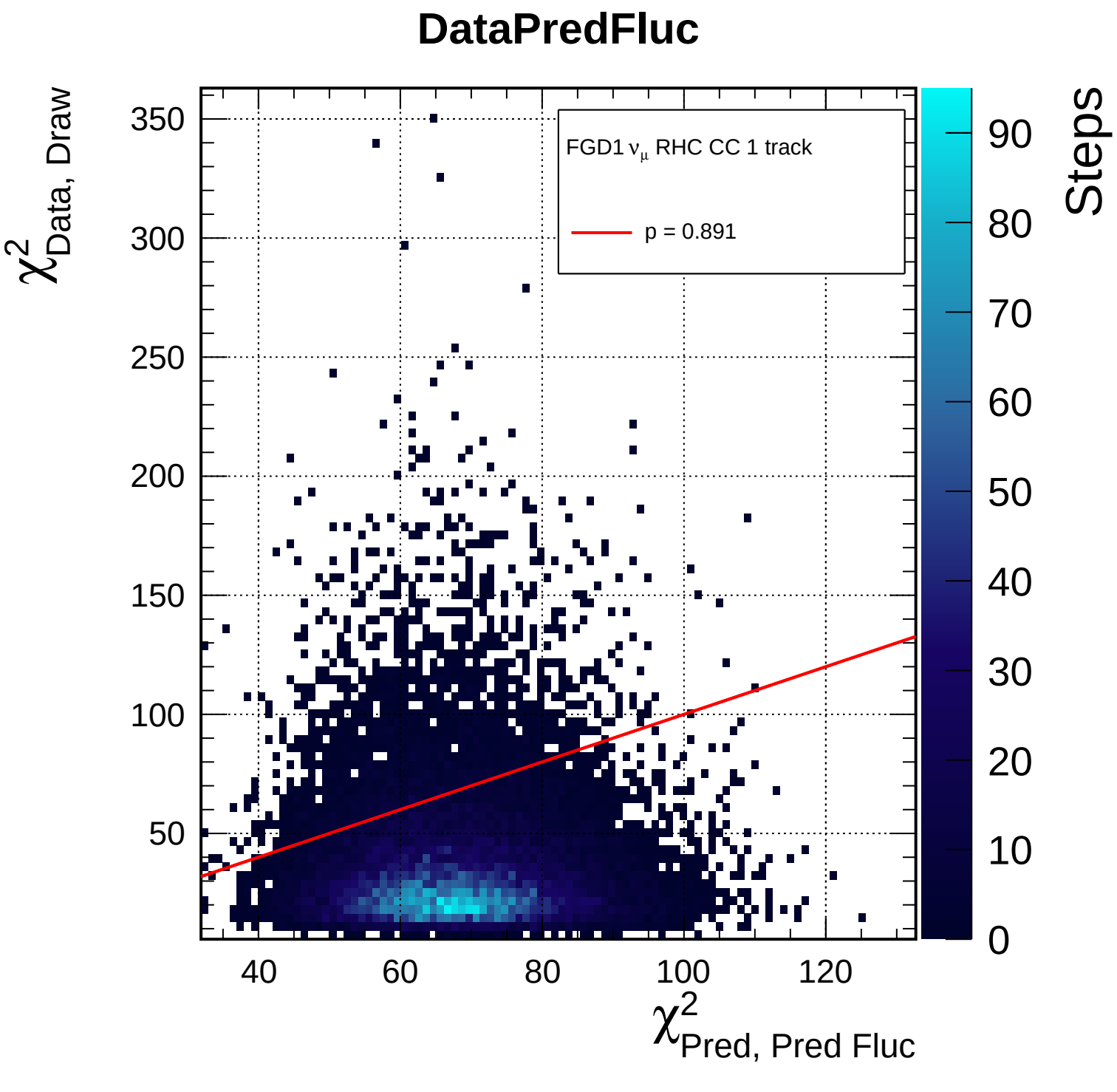

DataDrawFluc
FGD2 anti ν_μCC N tracks
p = 0.902
χ²Data, Draw
χ²Draw, Draw Fluc
Steps
600
500
400
300
200
100
40
60
80
100
120
140
120
100
80
60
40
20
0

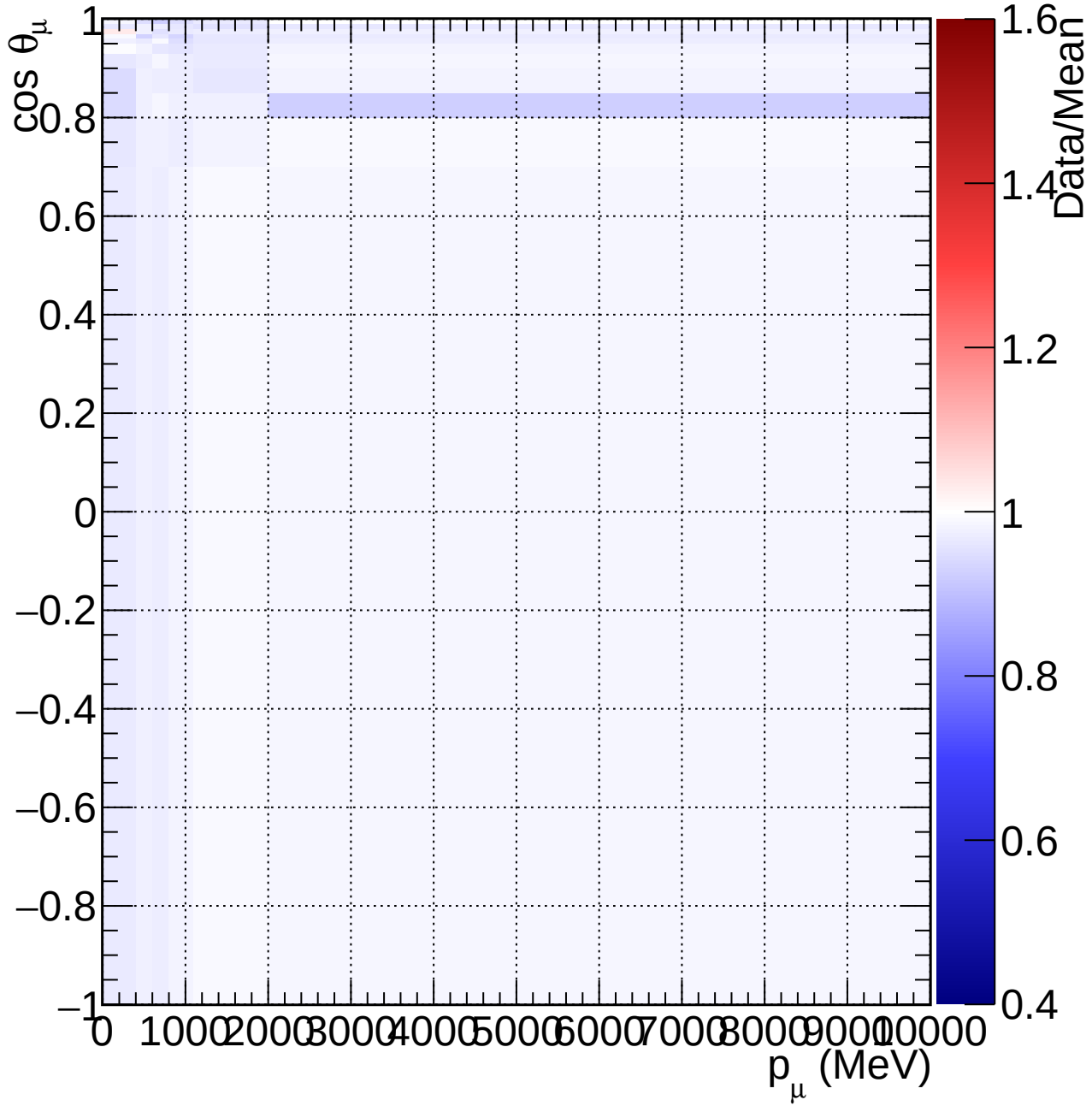

DataPredFluc
FGD2 anti ν_μCC N tracks
p = 0.902
$\chi^2_{Data,\ Draw}$
$\chi^2_{Pred,\ Pred\ Fluc}$
Steps
600
500
400
300
200
100
40
60
80
100
120
140
120
100
80
60
40
20
0

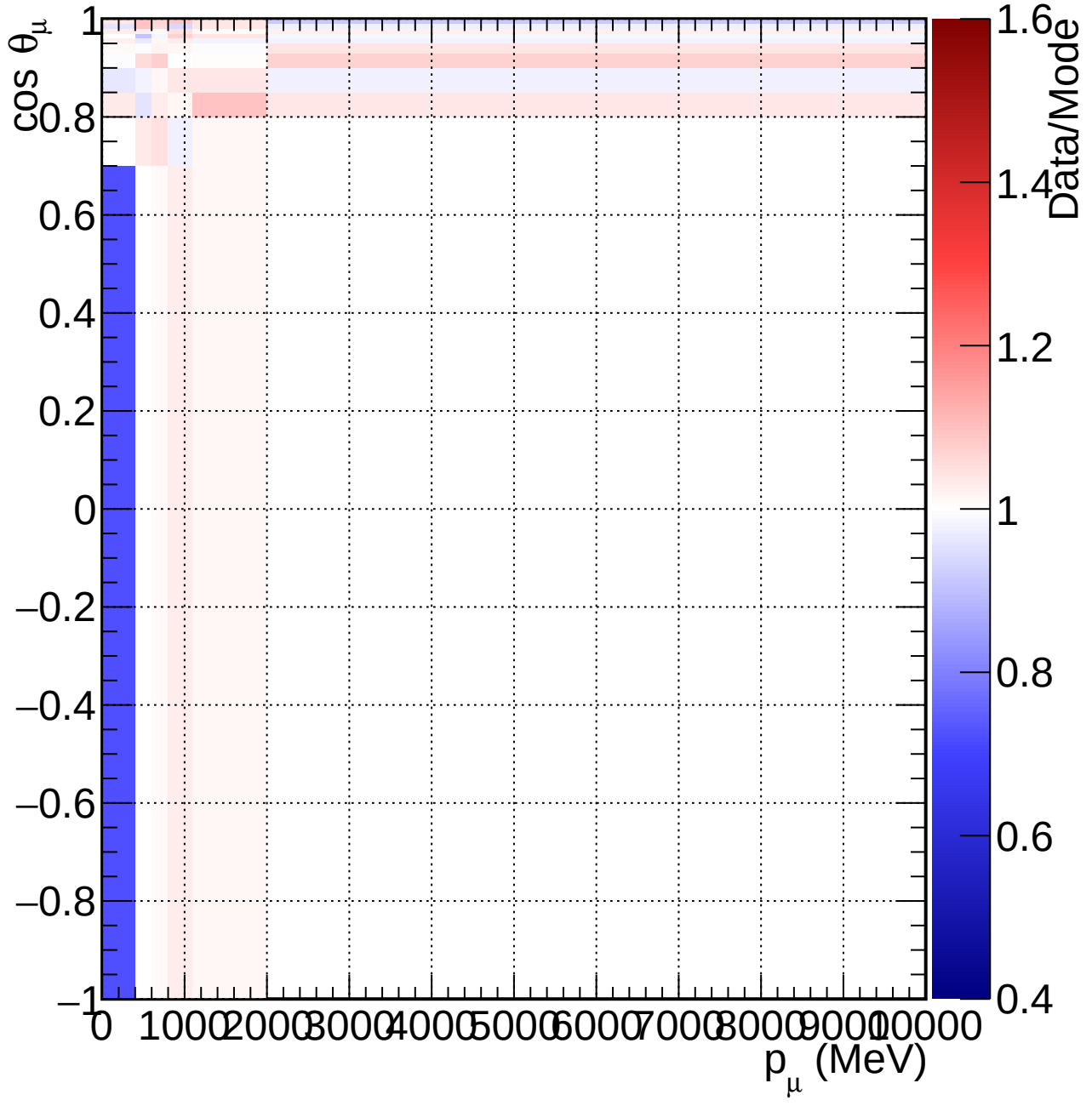

FGD2_anti-numuCC_N_tracks_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

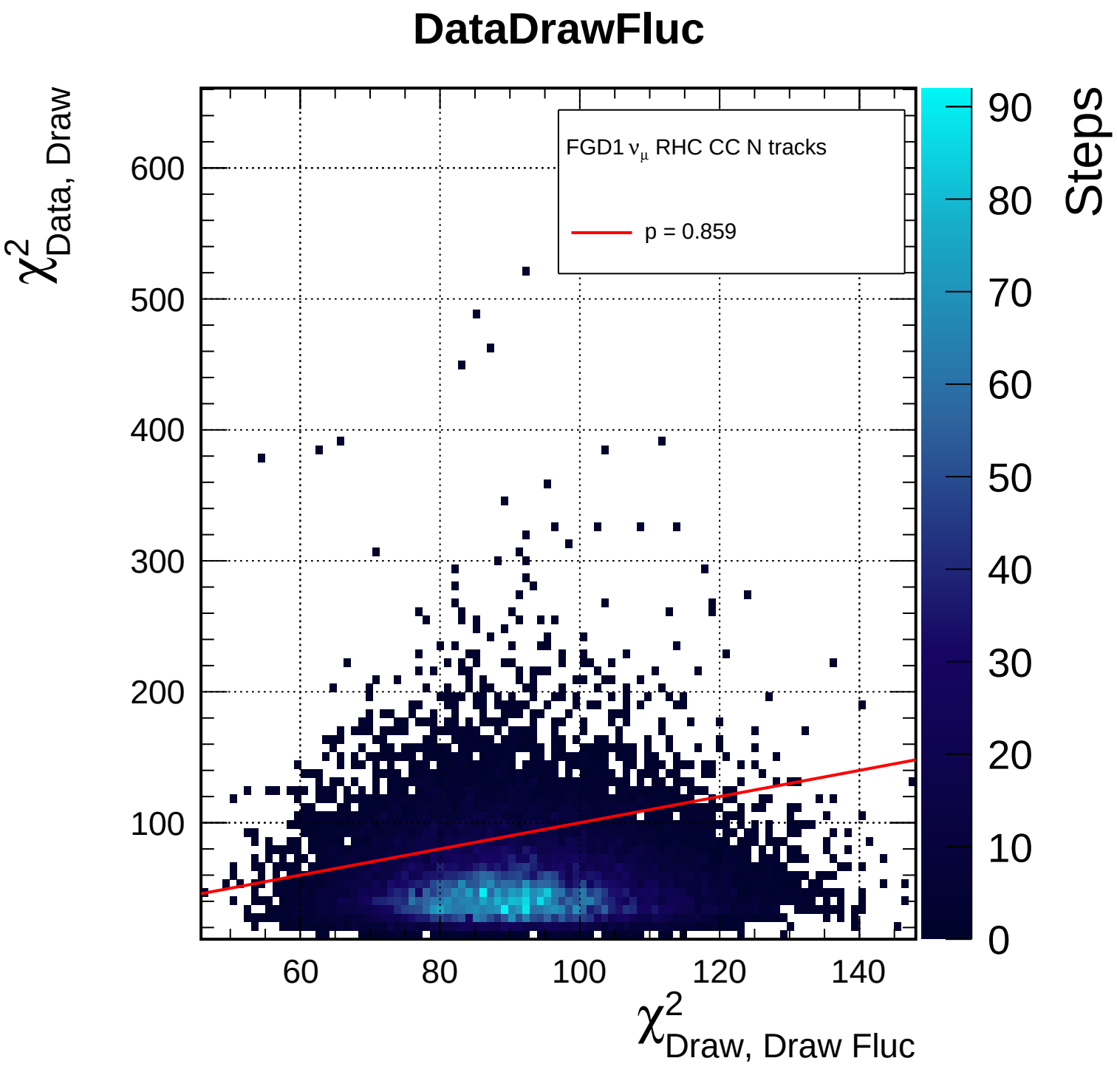

FGD2_anti-numuCC_N_tracks_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

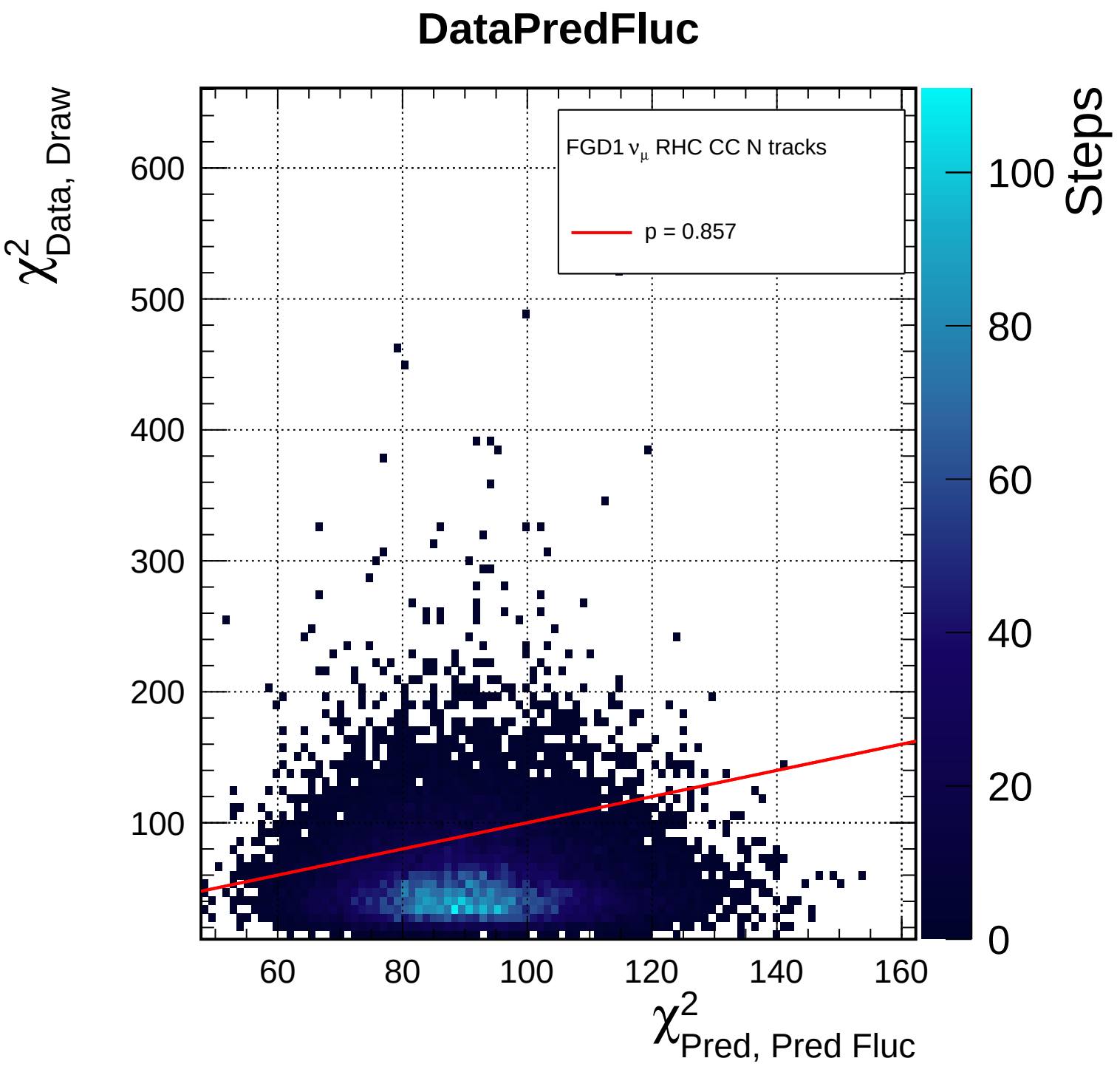

DataDrawFluc
FGD1 ν_μ RHC CC 1 track
p = 0.892
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
350
300
250
200
150
100
50
40
60
80
100
120
90
80
70
60
50
40
30
20
10
0

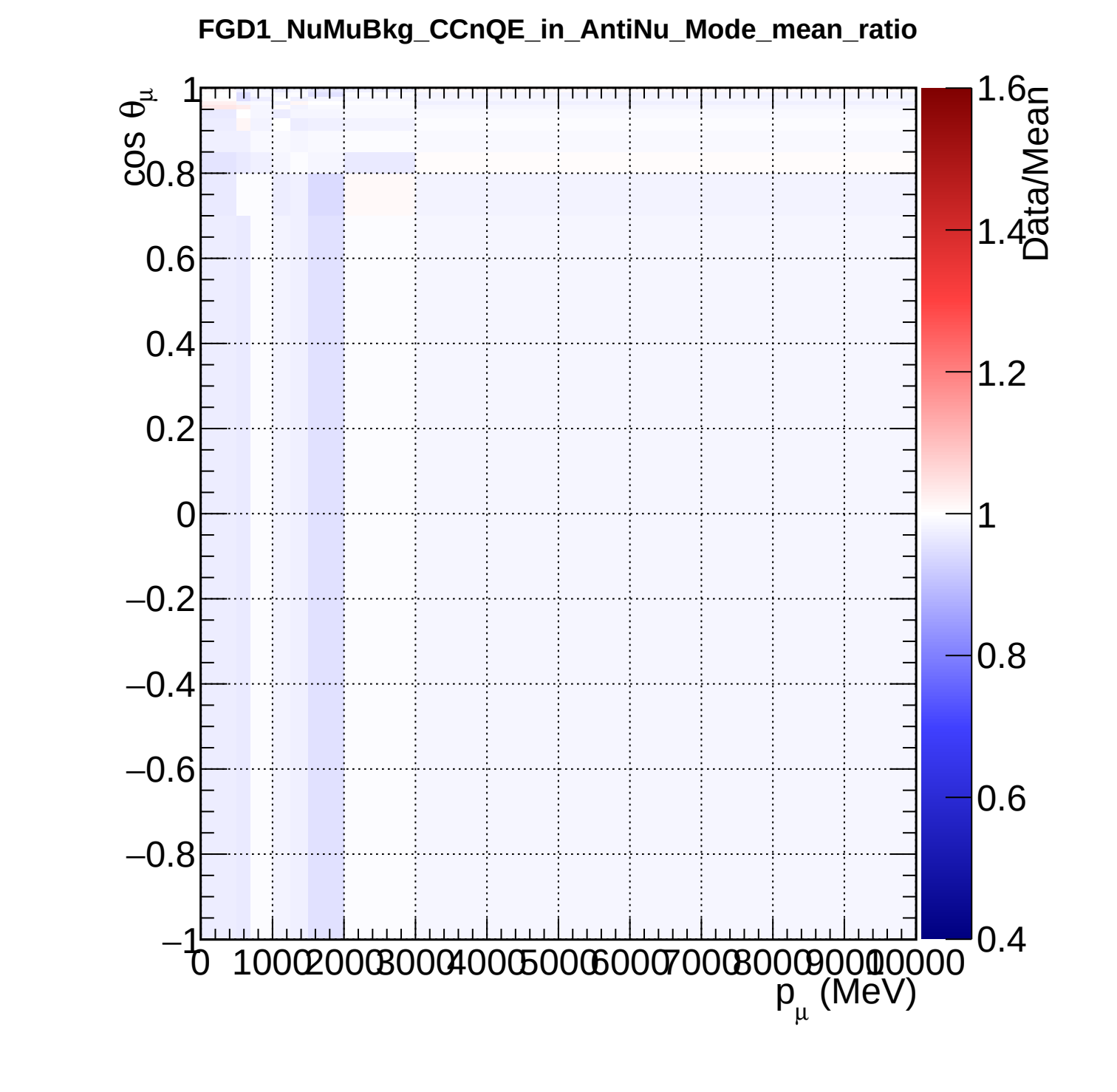

DataPredFluc
FGD1 ν_μ RHC CC 1 track
p = 0.891
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
350
300
250
200
150
100
50
40
60
80
100
120
90
80
70
60
50
40
30
20
10
0

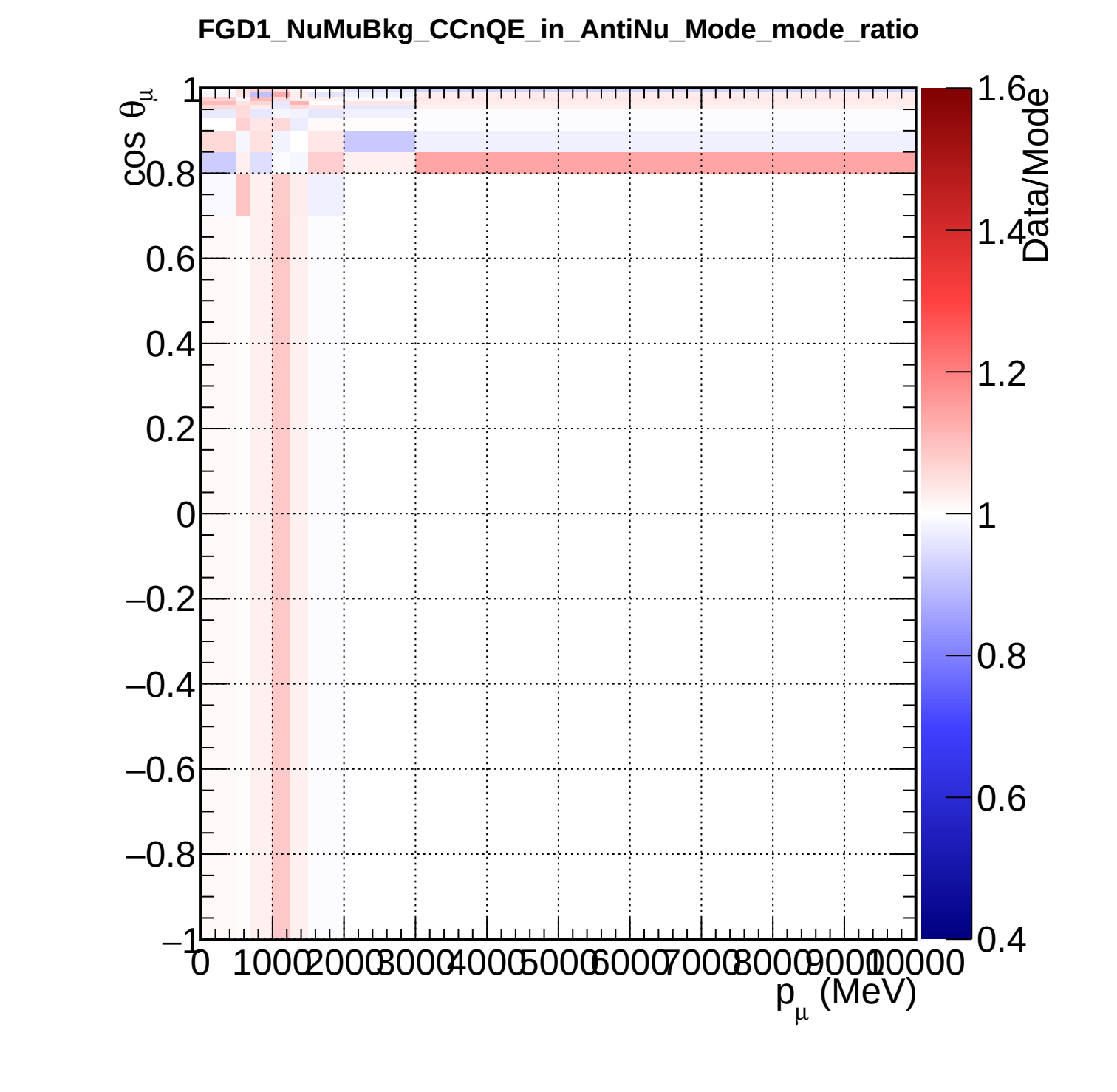

FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

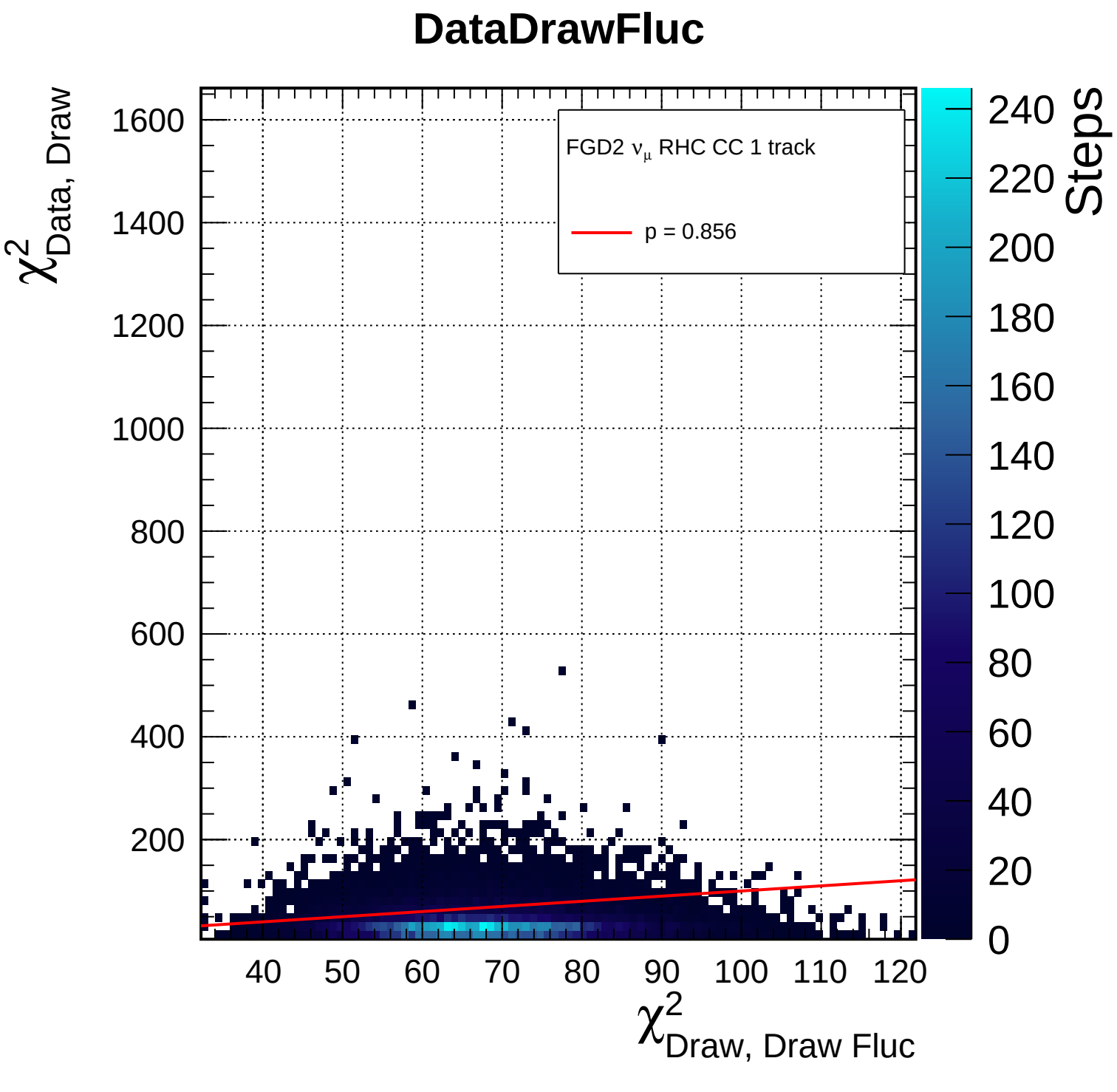

FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

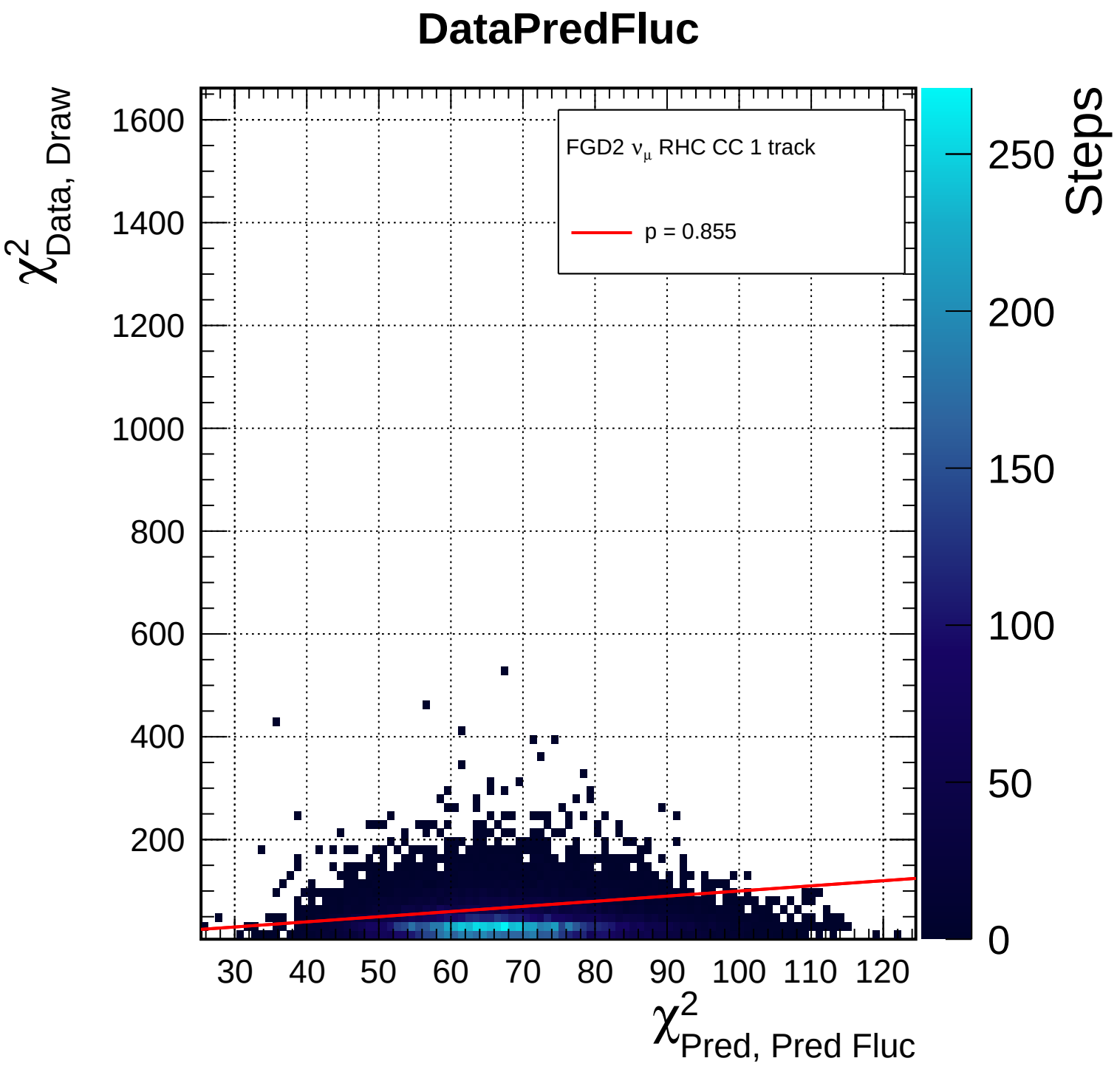

DataDrawFluc
FGD1 ν_μ RHC CC N tracks
p = 0.859
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
600
500
400
300
200
100
60
80
100
120
140
90
80
70
60
50
40
30
20
10
0

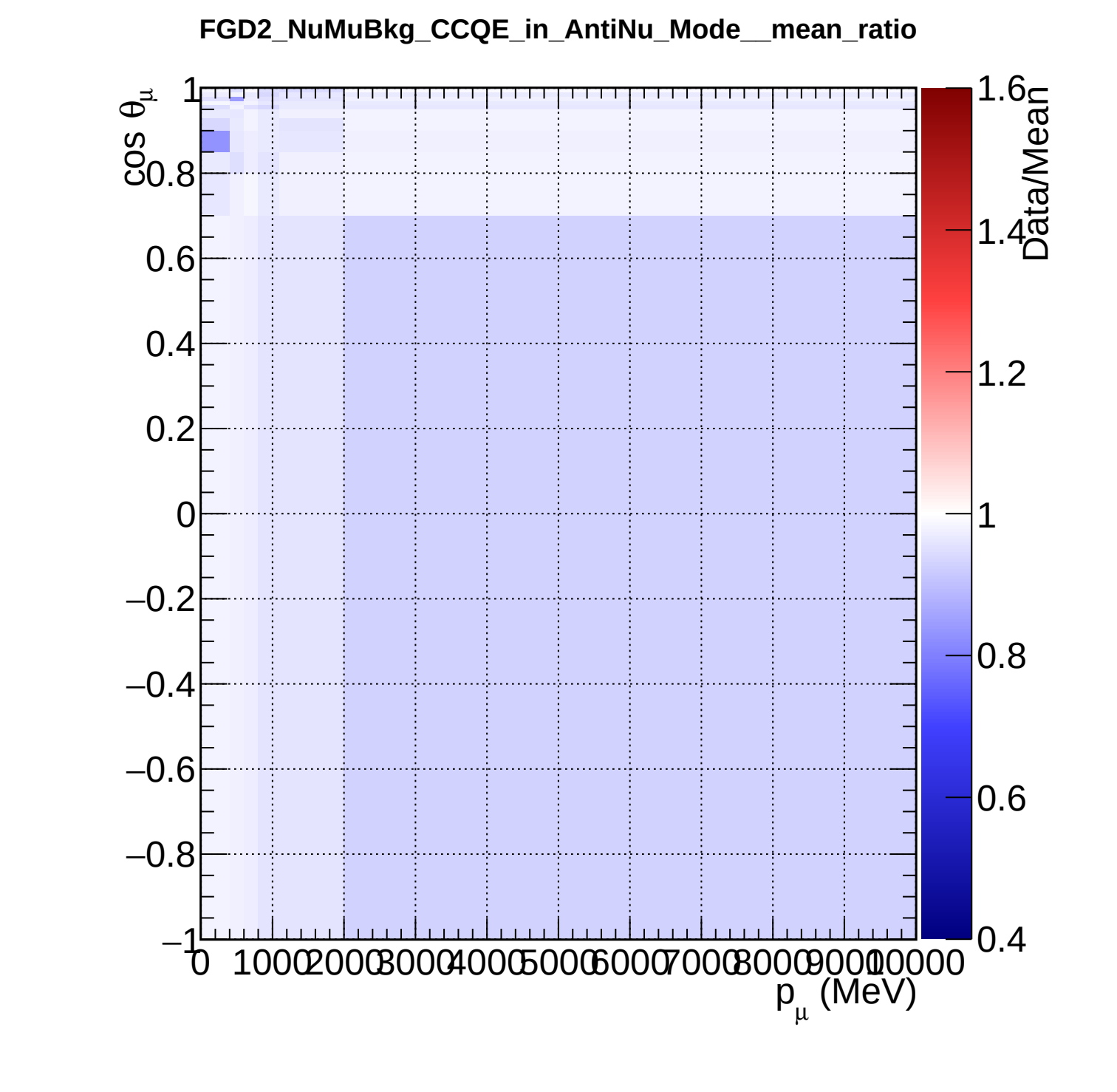

DataPredFluc
FGD1 ν_μ RHC CC N tracks
p = 0.857
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
600
500
400
300
200
100
60
80
100
120
140
160
100
80
60
40
20
0

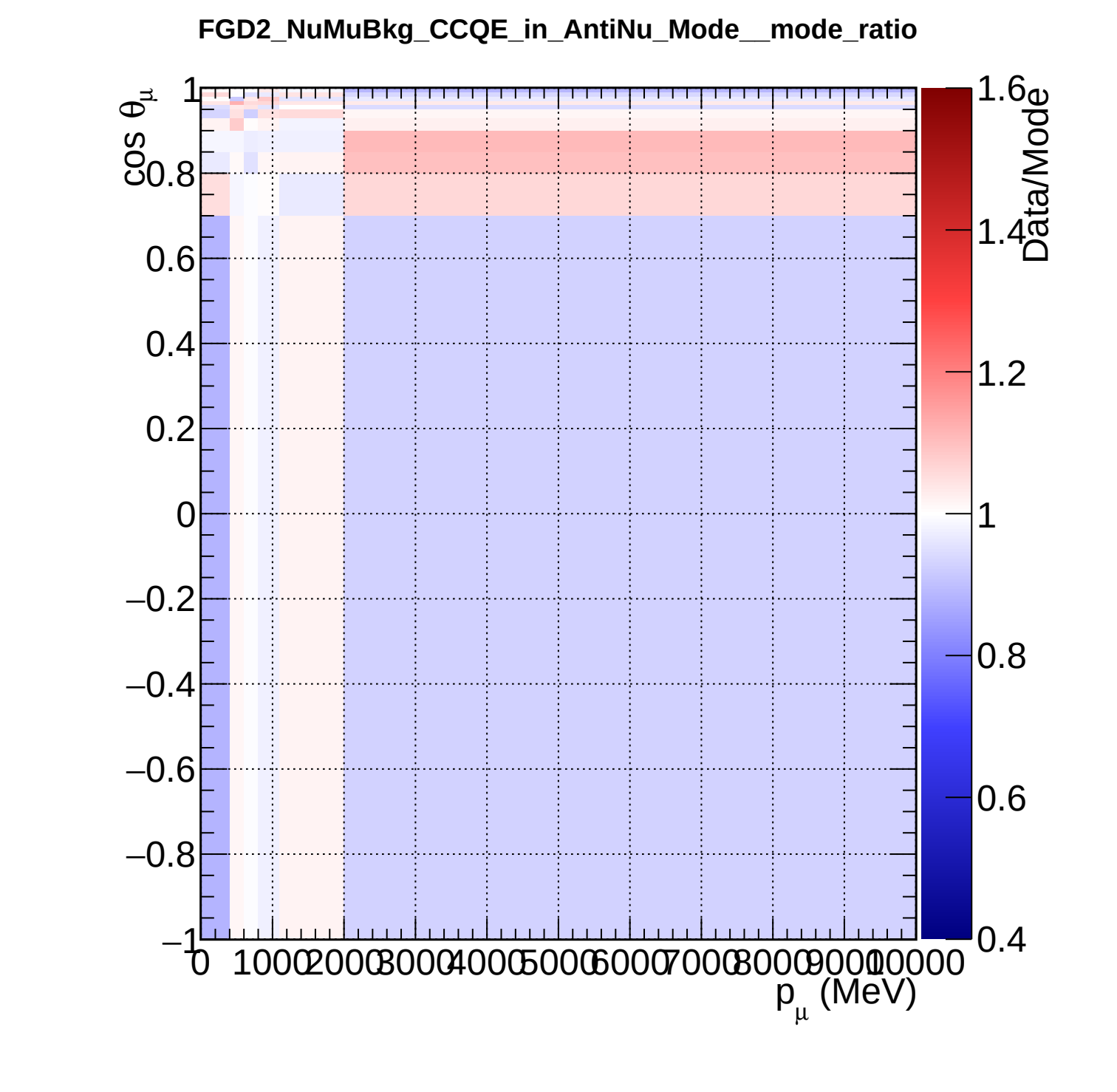

FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

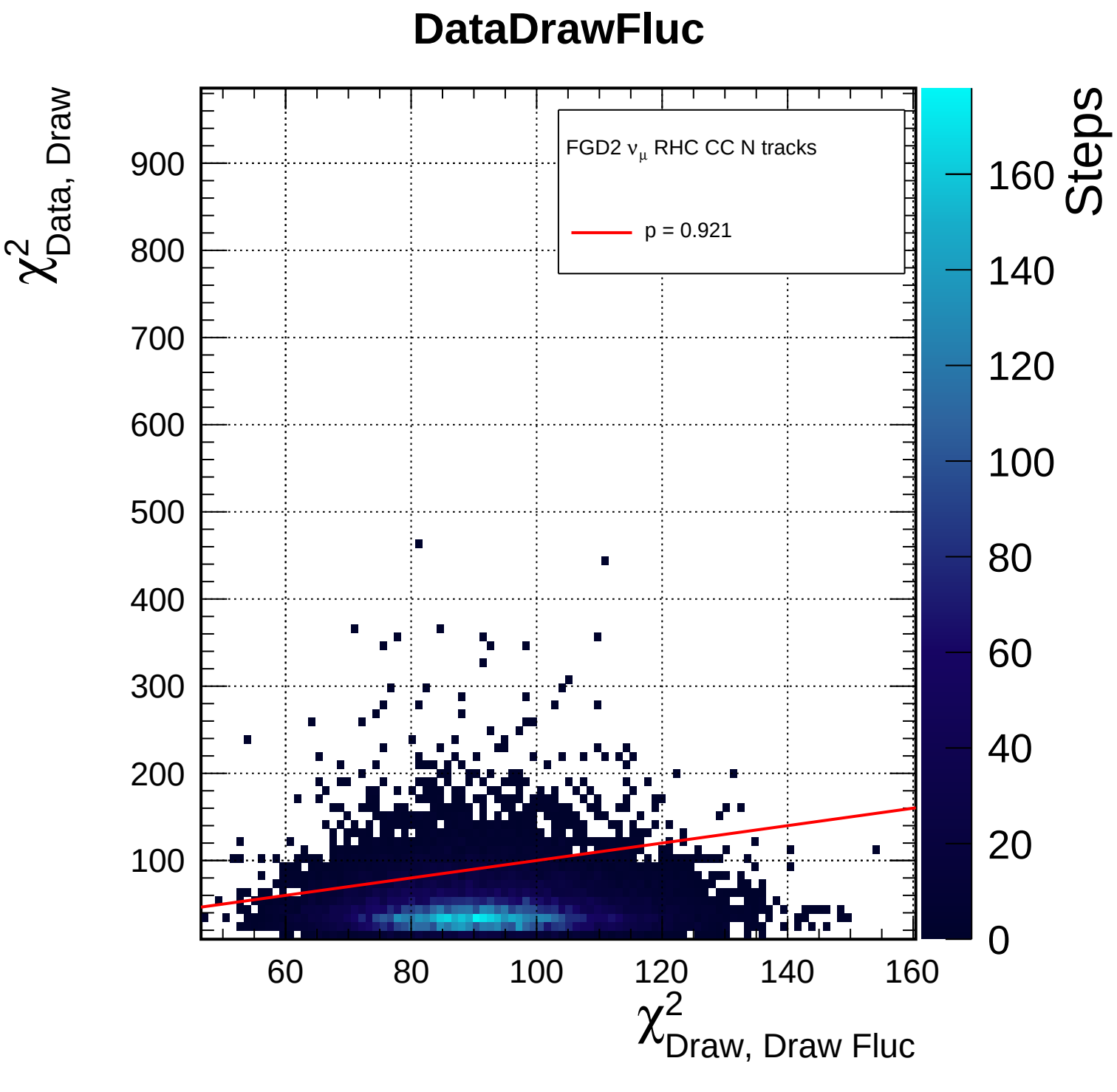

FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_mode_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

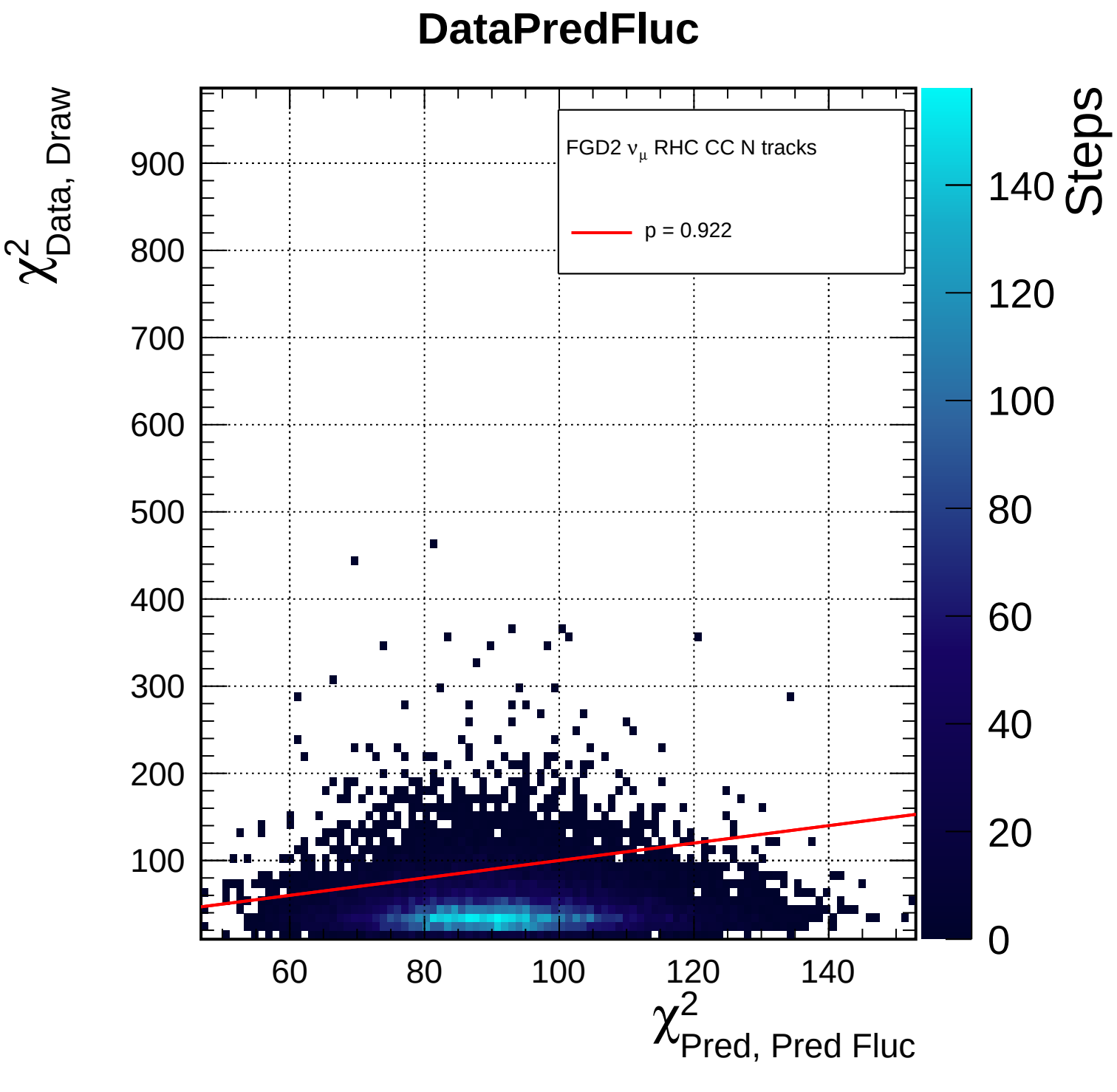

DataDrawFluc
FGD2 ν_μ RHC CC 1 track
p = 0.856
$\chi^2_{Data,\ Draw}$
$\chi^2_{Draw,\ Draw\ Fluc}$
Steps
1600
1400
1200
1000
800
600
400
200
40
50
60
70
80
90
100
110
120
240
220
200
180
160
140
120
100
80
60
40
20
0

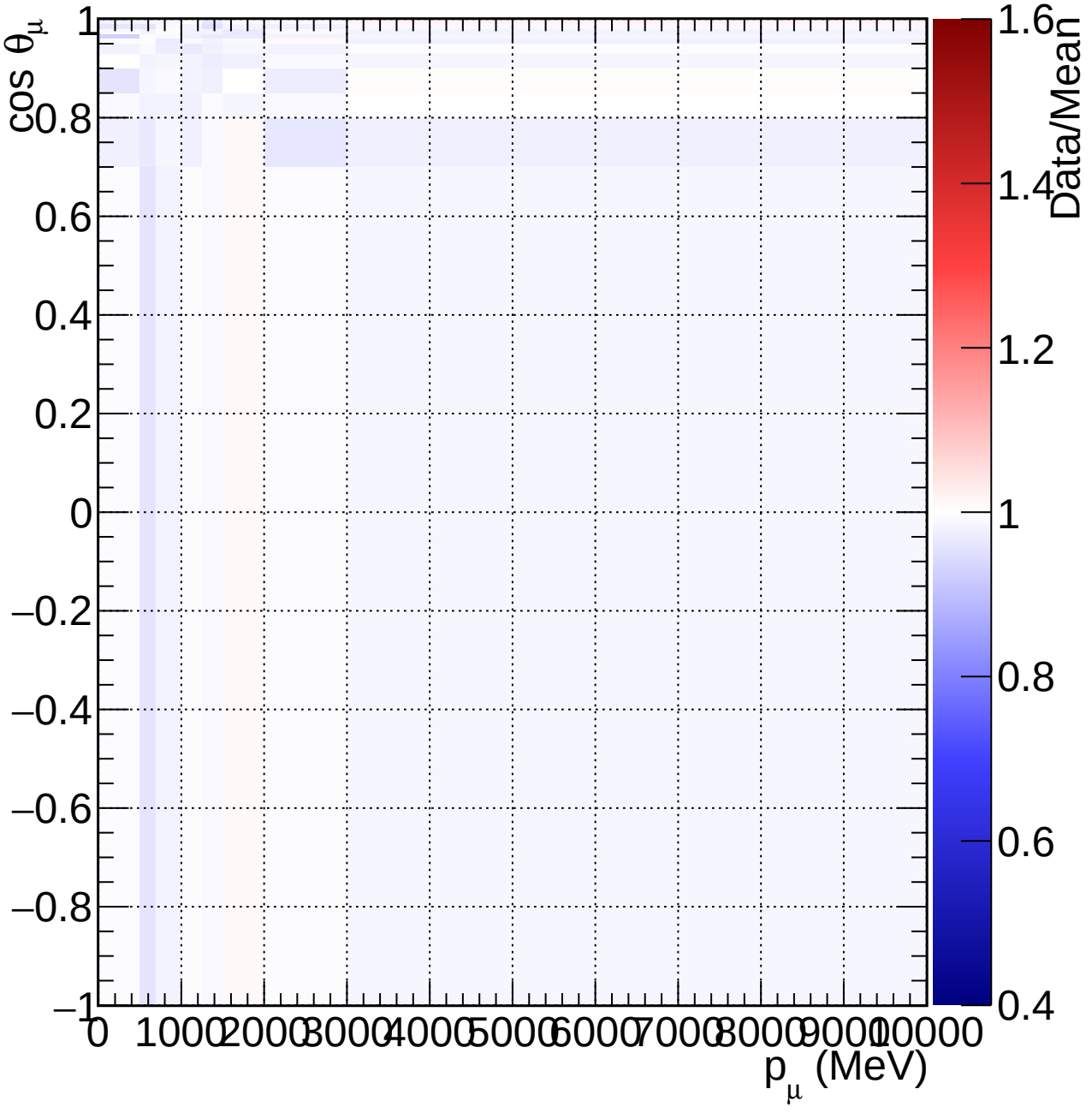

DataPredFluc
FGD2 ν_μ RHC CC 1 track
p = 0.855
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
1600
1400
1200
1000
800
600
400
200
30
40
50
60
70
80
90
100
110
120
250
200
150
100
50
0

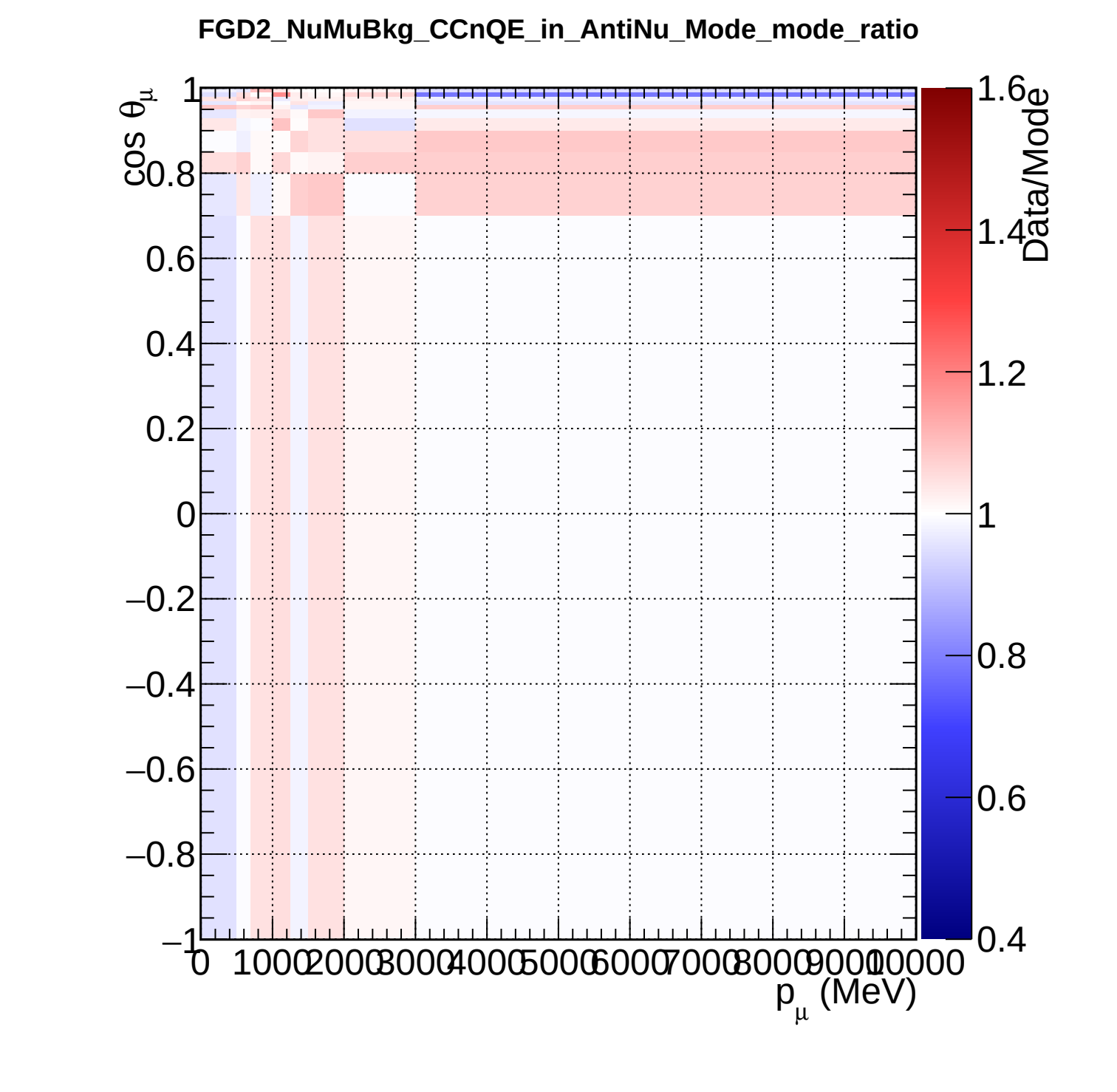

FGD2_NuMuBkg_CCQE_in_AntiNu_Mode__mean_ratio
cos θμ
1
0.8
0.6
0.4
0.2
0
–0.2
–0.4
–0.6
–0.8
–1
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4


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 = 0.921
χ²Data, Draw
χ²Draw, Draw Fluc
Steps
900
800
700
600
500
400
300
200
100
60
80
100
120
140
160
0
20
40
60
80
100
120
140
160


DataPredFluc
FGD2 ν_μ RHC CC N tracks
p = 0.922
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
900
800
700
600
500
400
300
200
100
60
80
100
120
140
0
20
40
60
80
100
120
140


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