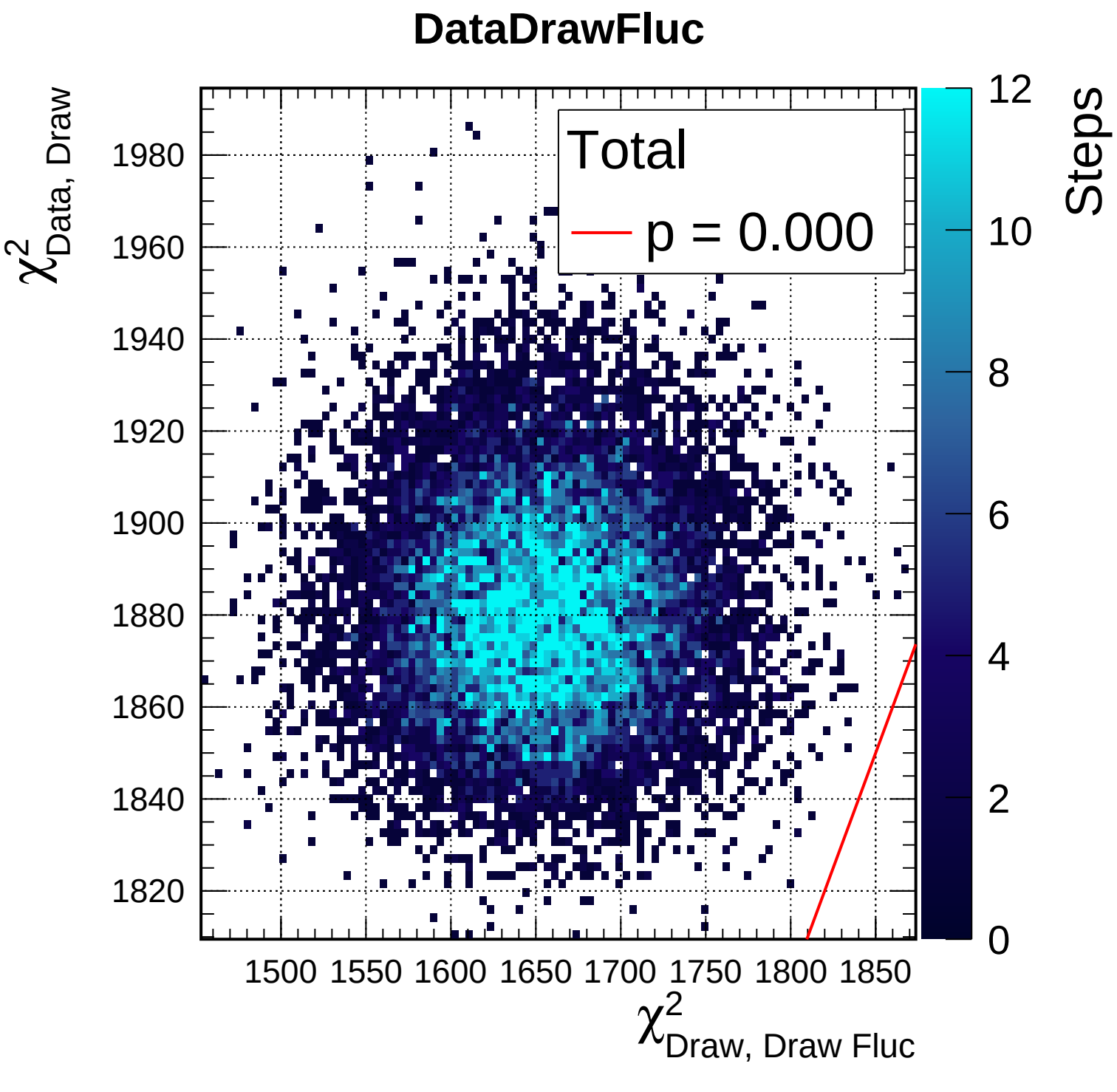
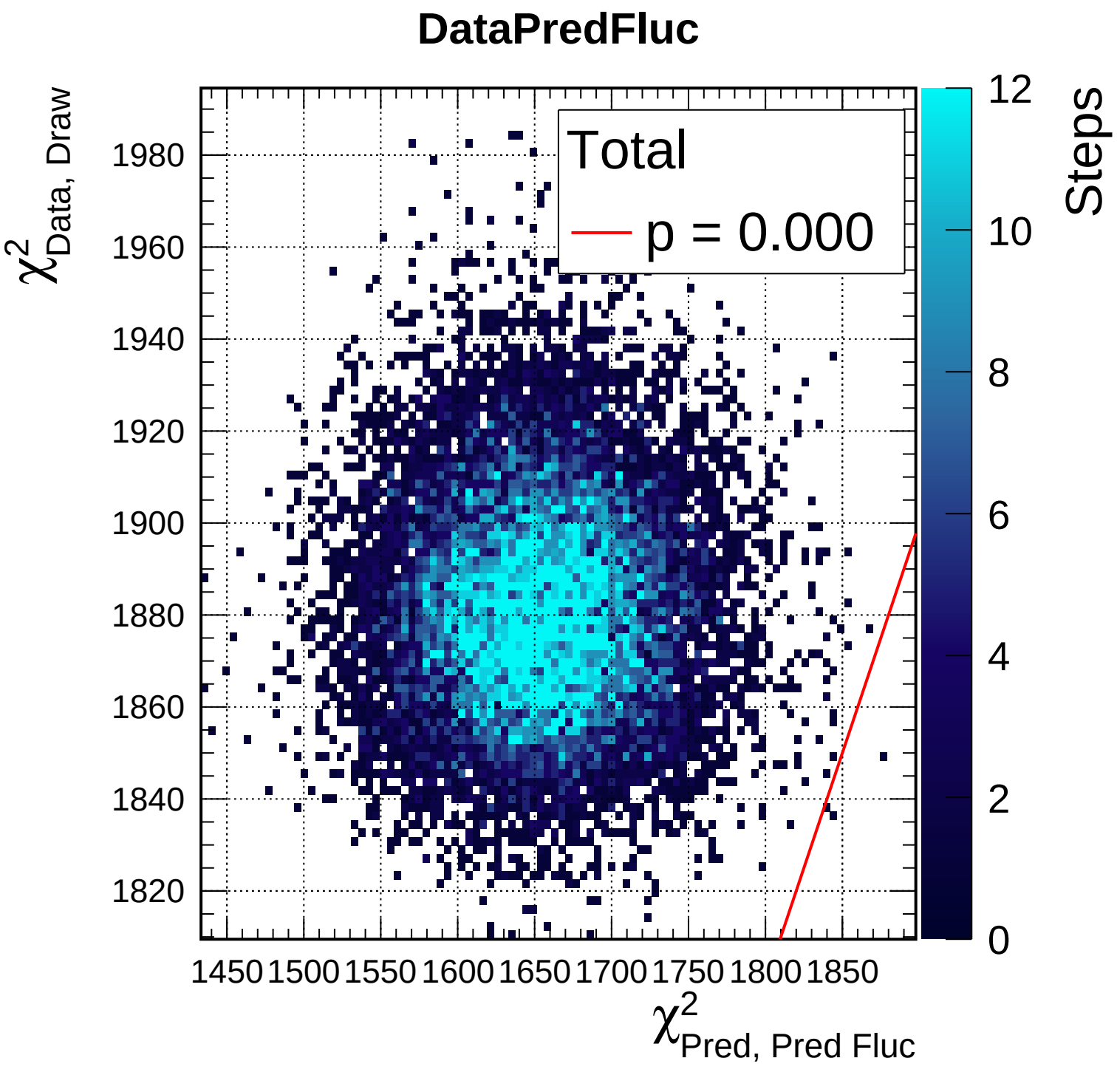
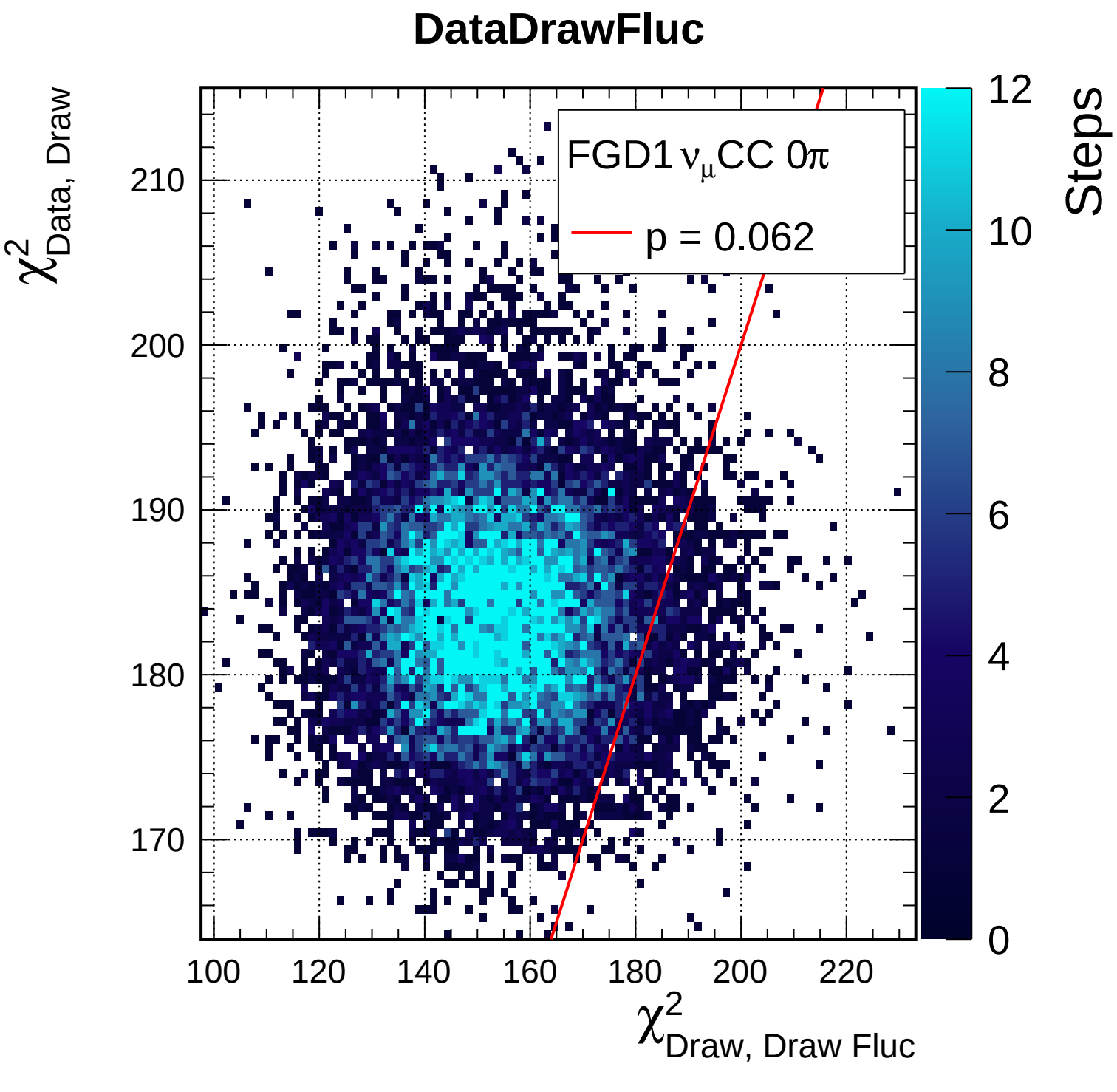
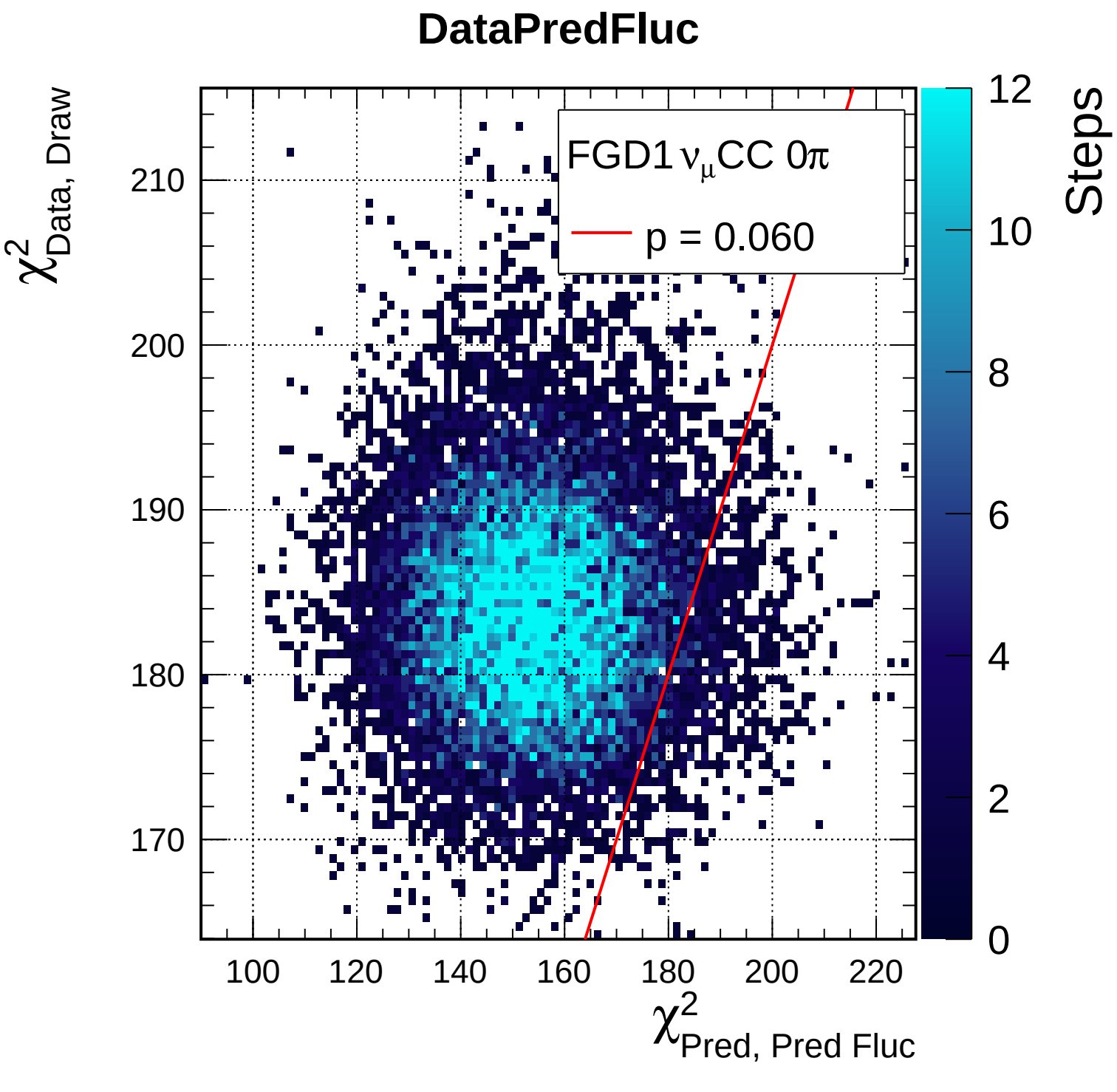
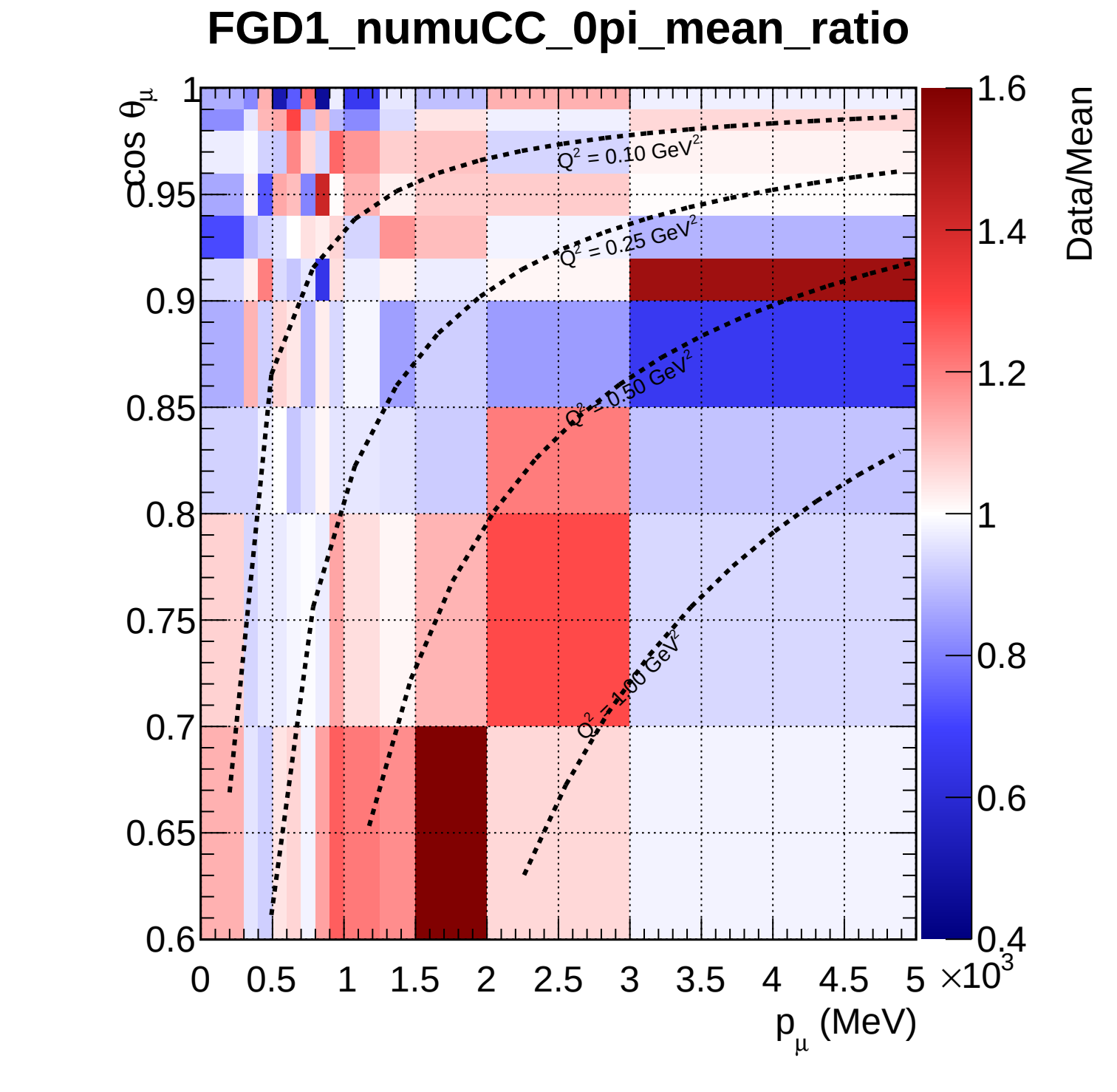
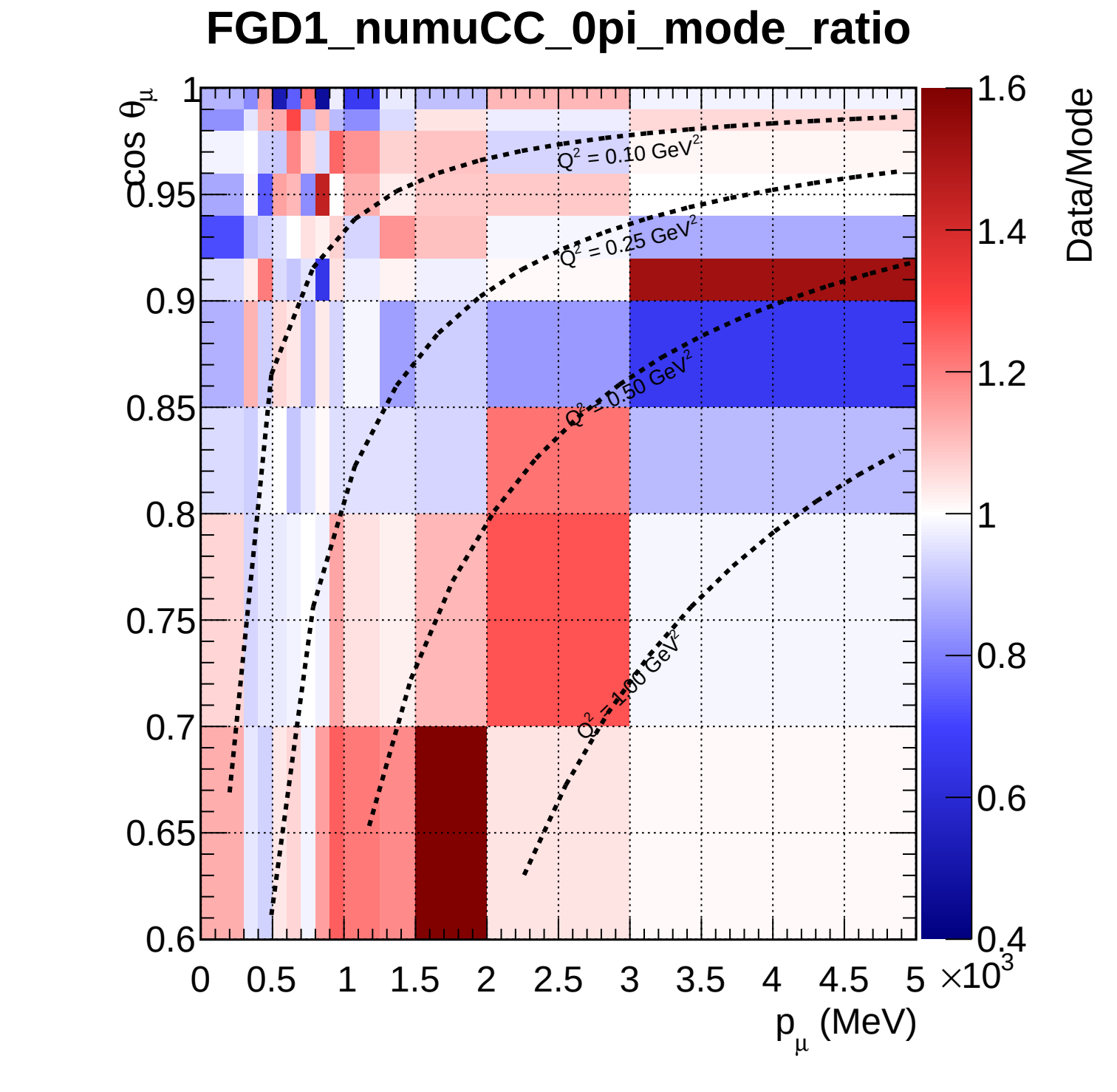

DataDrawFluc
Total
p = 0.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Draw, Draw Fluc}}$
Steps
1980
1960
1940
1920
1900
1880
1860
1840
1820
1500 1550 1600 1650 1700 1750 1800 1850
12
10
8
6
4
2
0

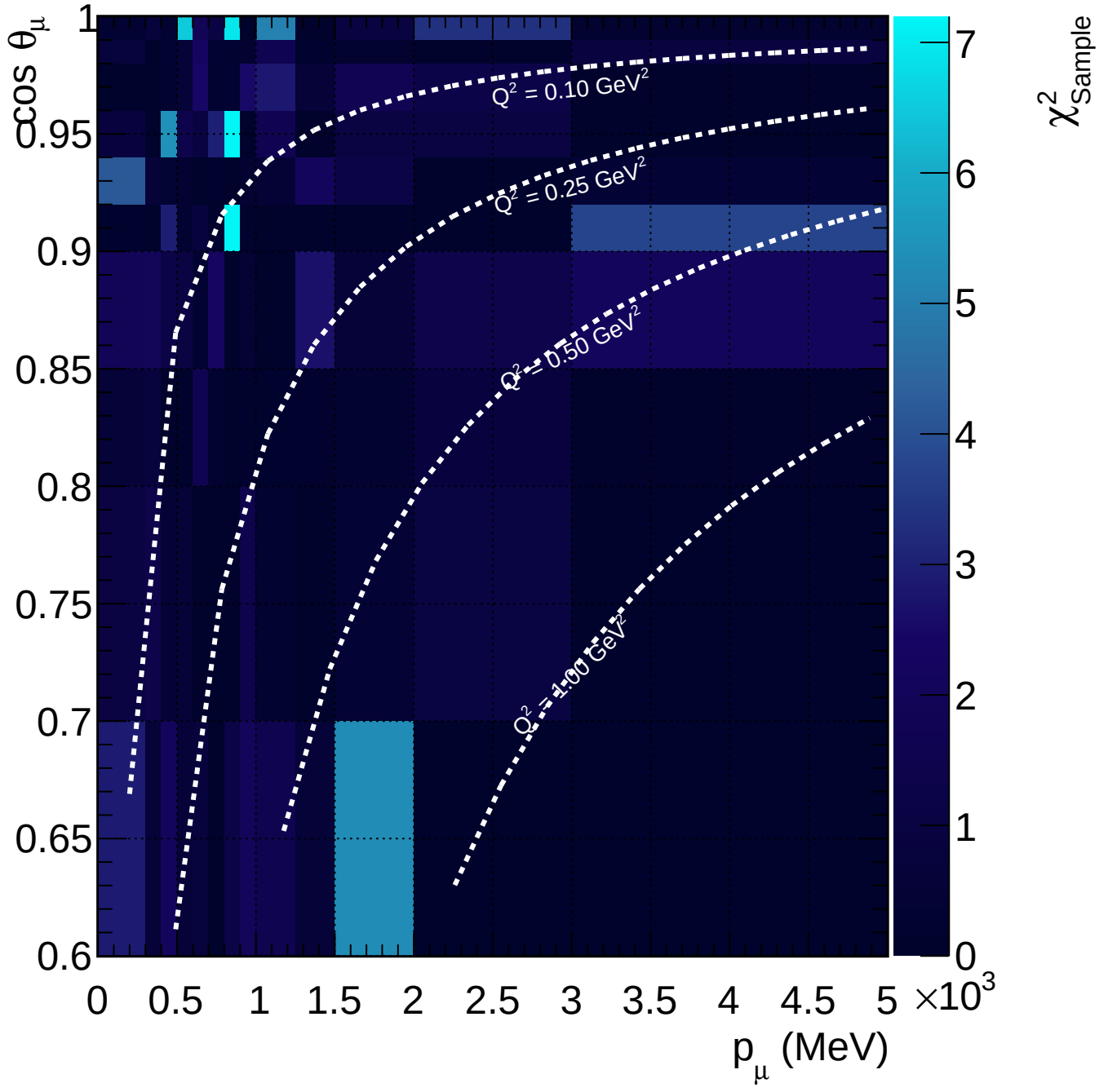

DataPredFluc
Total
p = 0.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
1980
1960
1940
1920
1900
1880
1860
1840
1820
1450
1500
1550
1600
1650
1700
1750
1800
1850
12
10
8
6
4
2
0

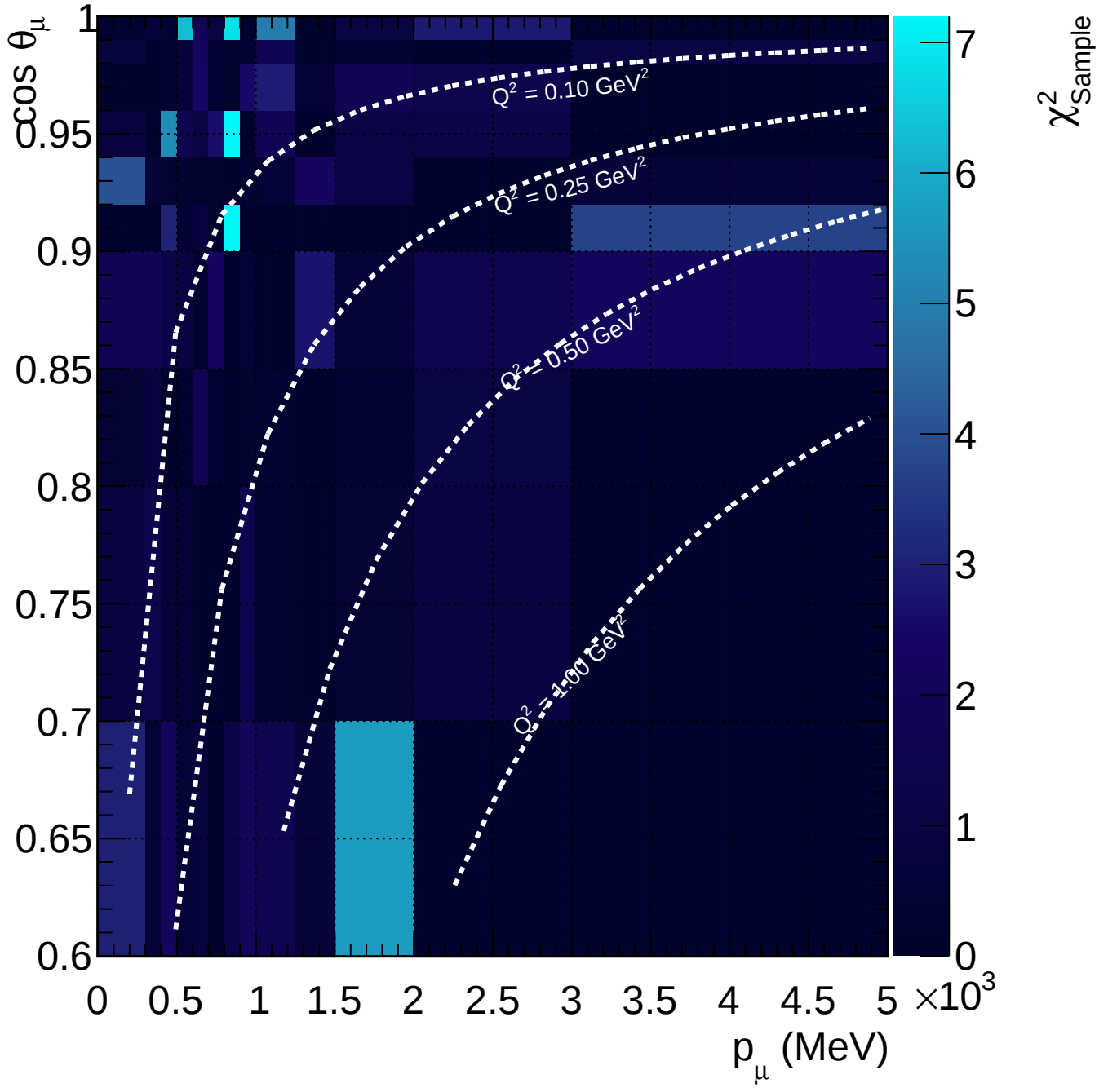

DataDrawFluc
FGD1 ν_μCC 0π
p = 0.062
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
210
200
190
180
170
100
120
140
160
180
200
220
12
10
8
6
4
2
0

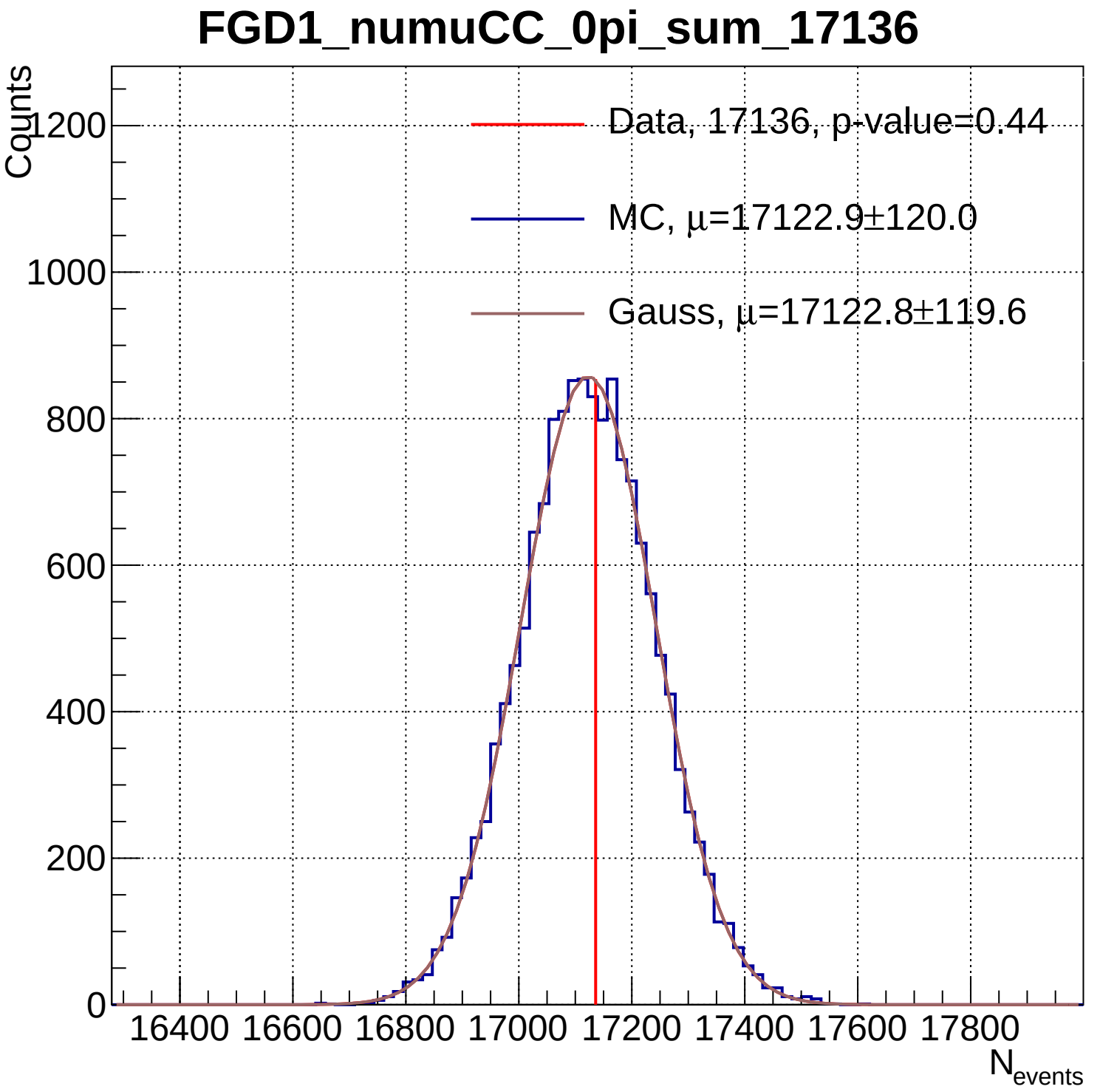

DataPredFluc
FGD1 ν_μCC 0π
p = 0.060
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
210
200
190
180
170
100
120
140
160
180
200
220
12
10
8
6
4
2
0

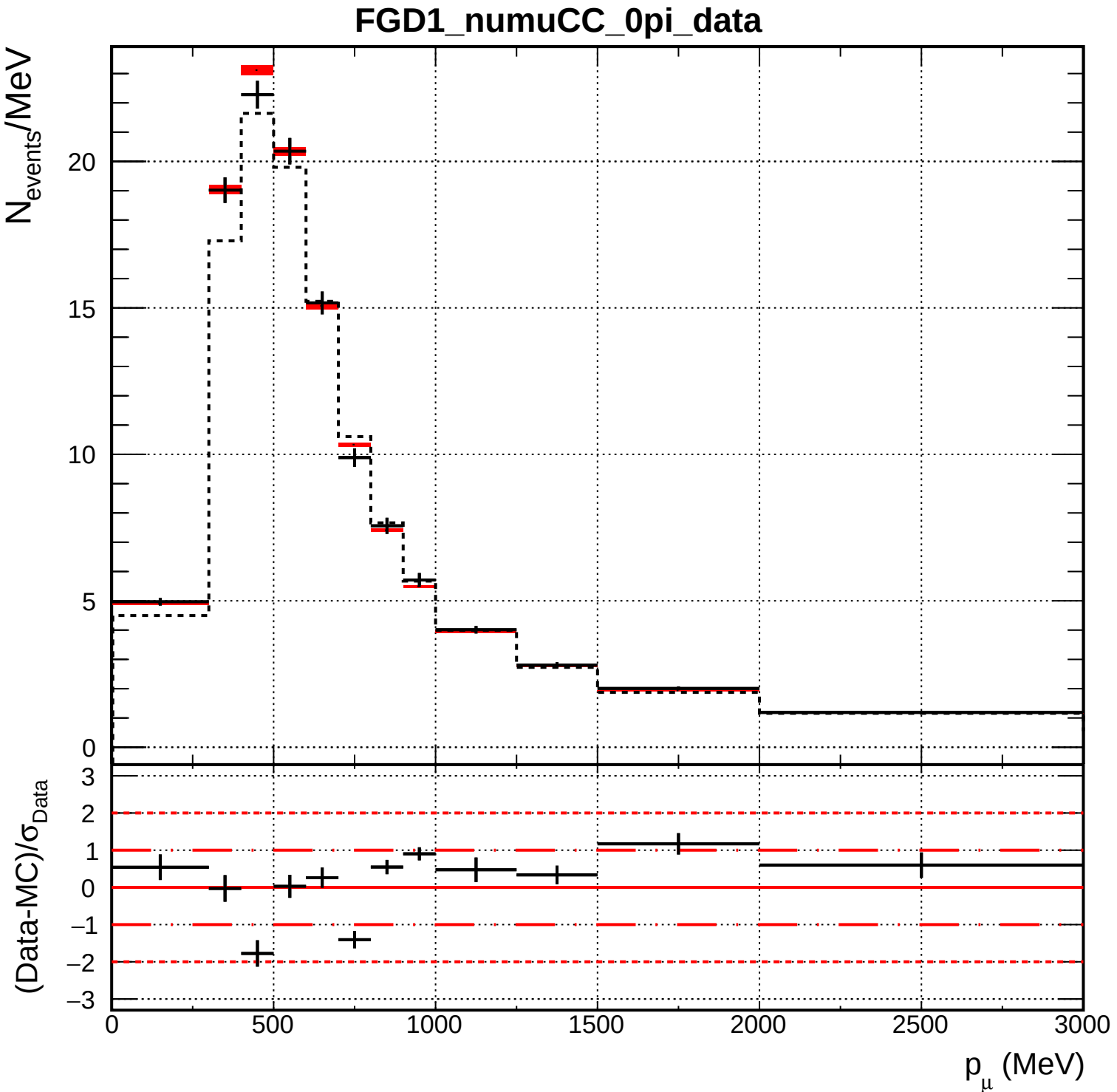

FGD1_numuCC_0pi_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10^3
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

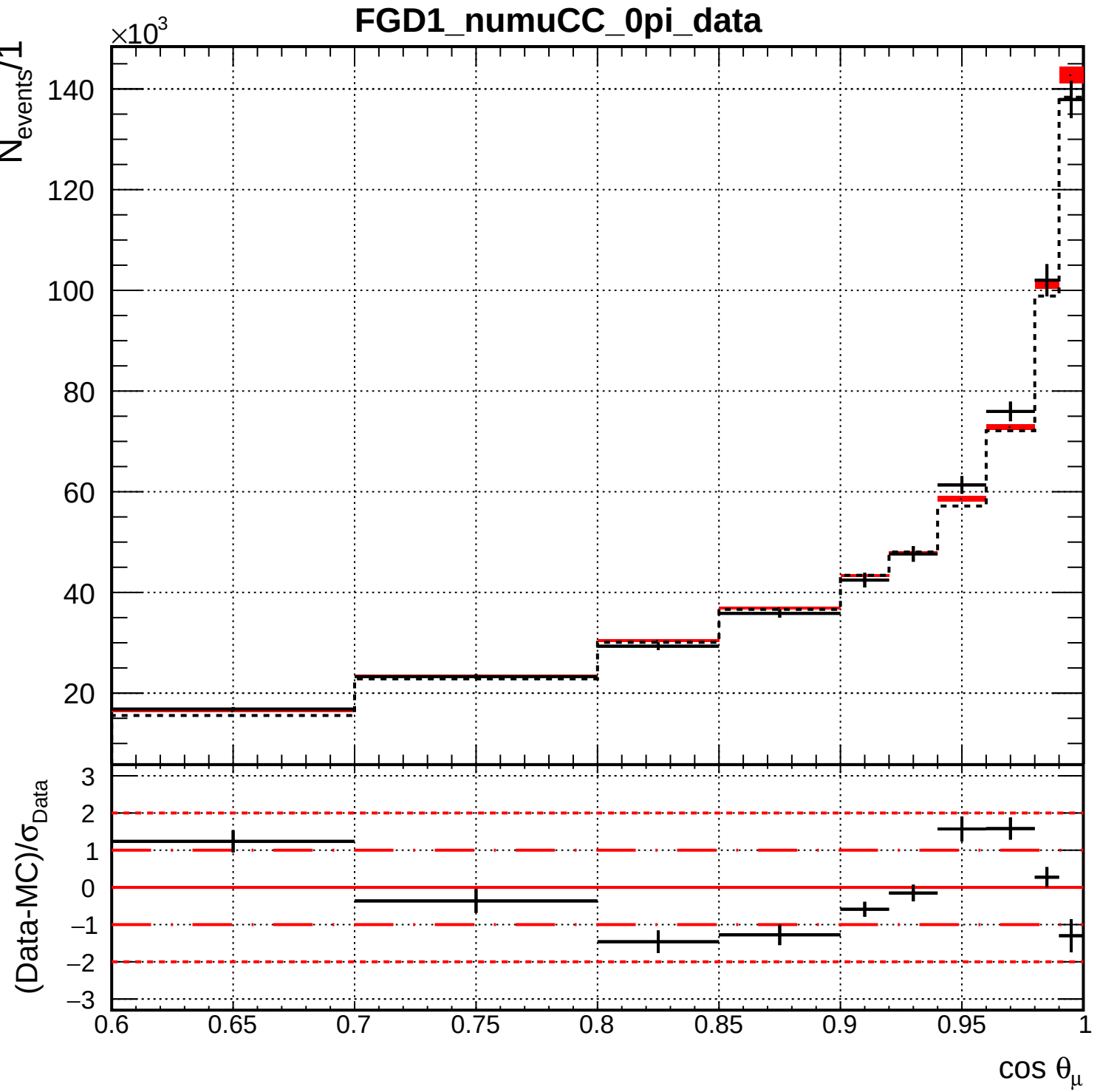

FGD1_numuCC_0pi_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

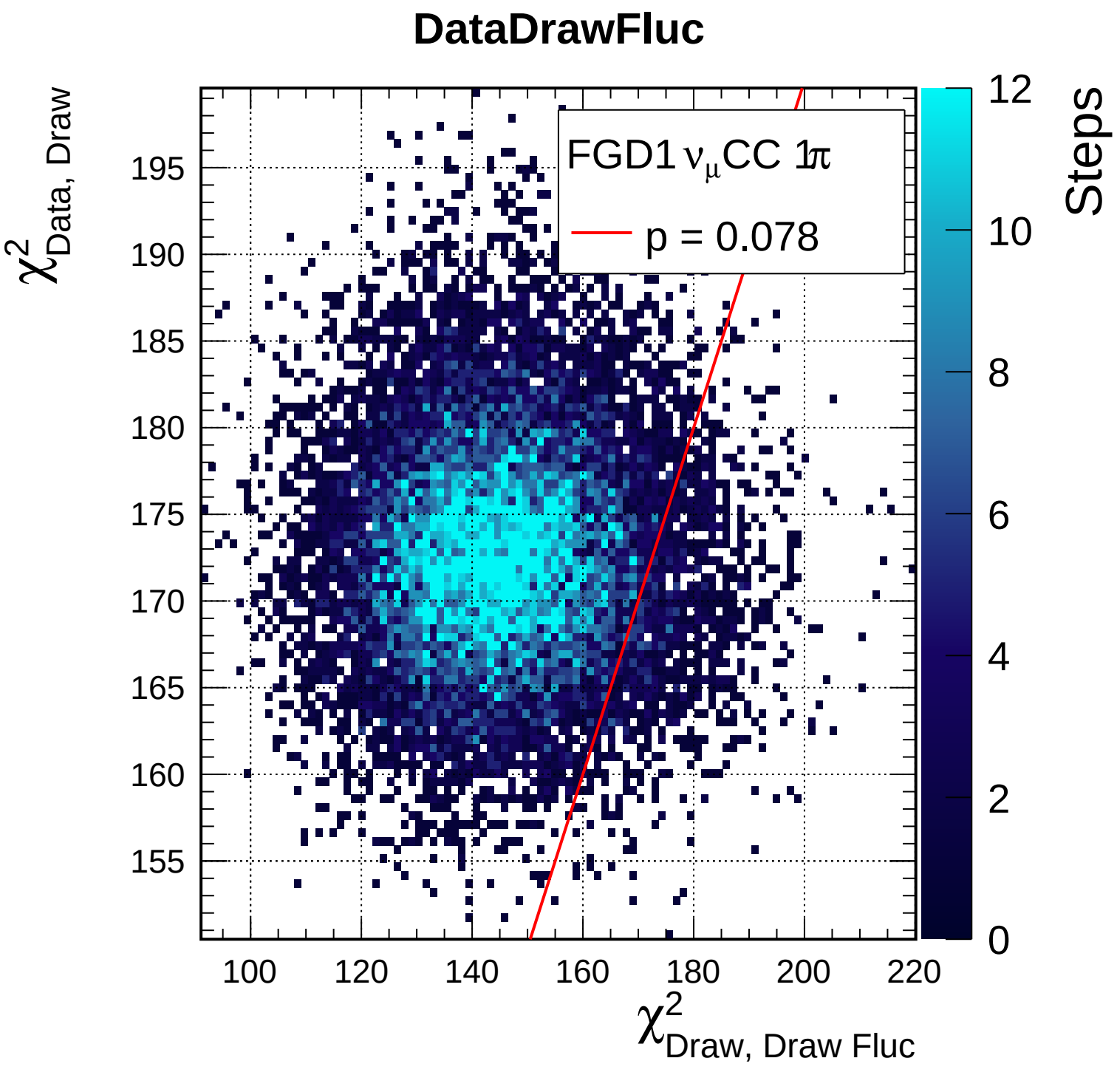

FGD1_numuCC_0pi_MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
χ²Sample
7
6
5
4
3
2
1
0

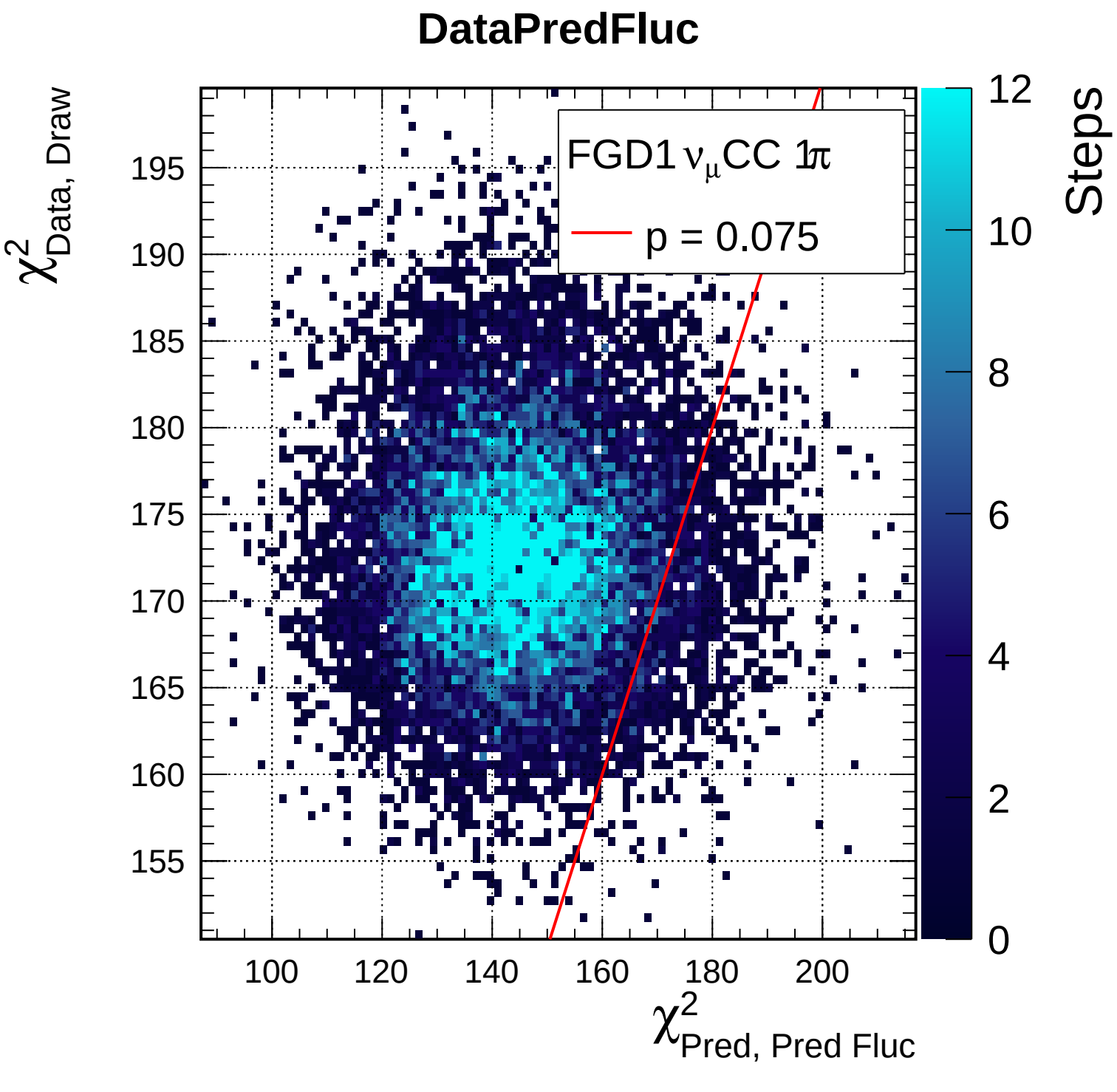

FGD1_numuCC_0pi_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
χ²Sample
7
6
5
4
3
2
1
0

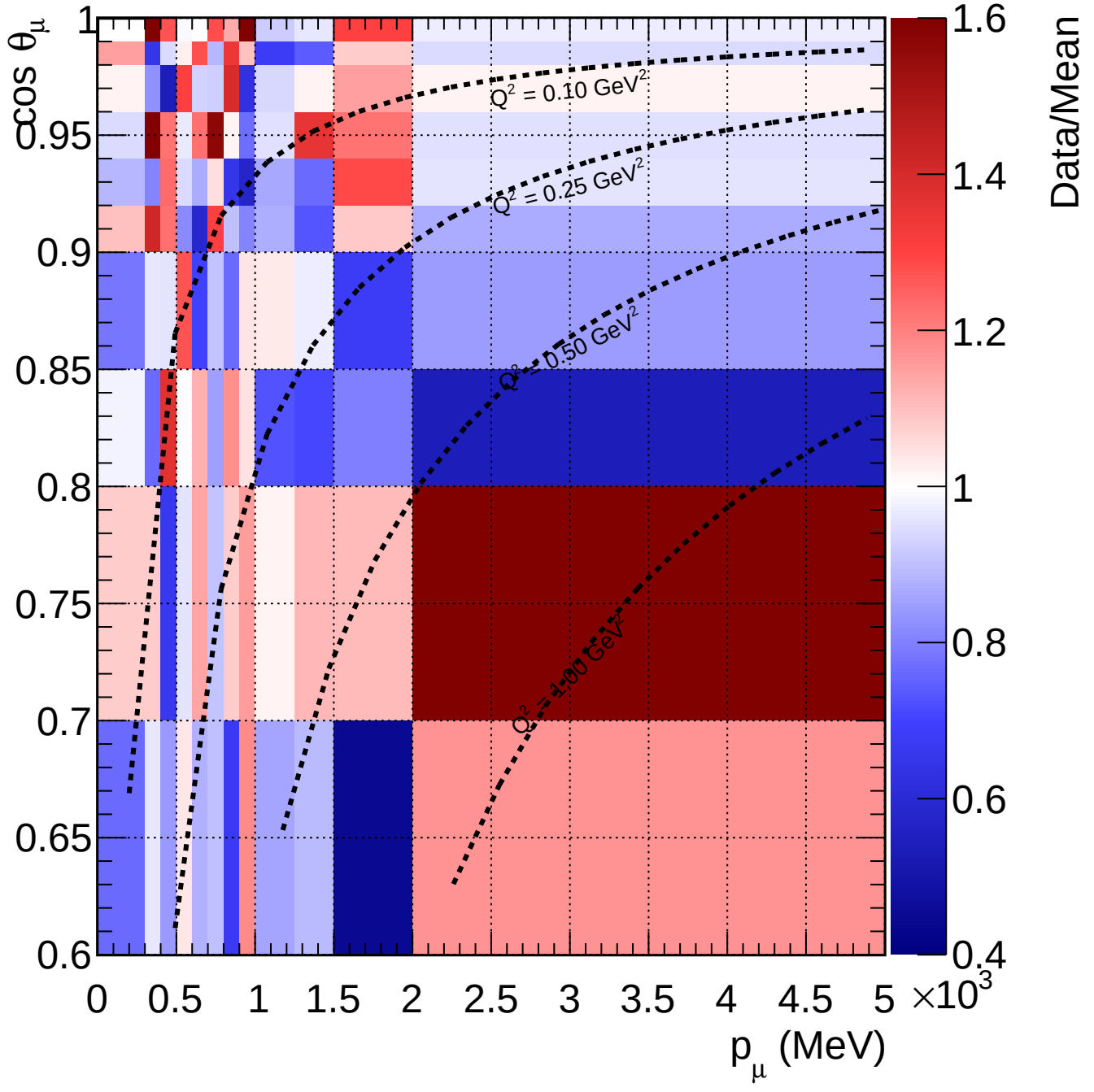

FGD1_numuCC_0pi_sum_17136
Counts
Data, 17136, p-value=0.44
MC, μ=17122.9±120.0
Gauss, μ=17122.8±119.6
1200
1000
800
600
400
200
0
16400
16600
16800
17000
17200
17400
17600
17800
N events

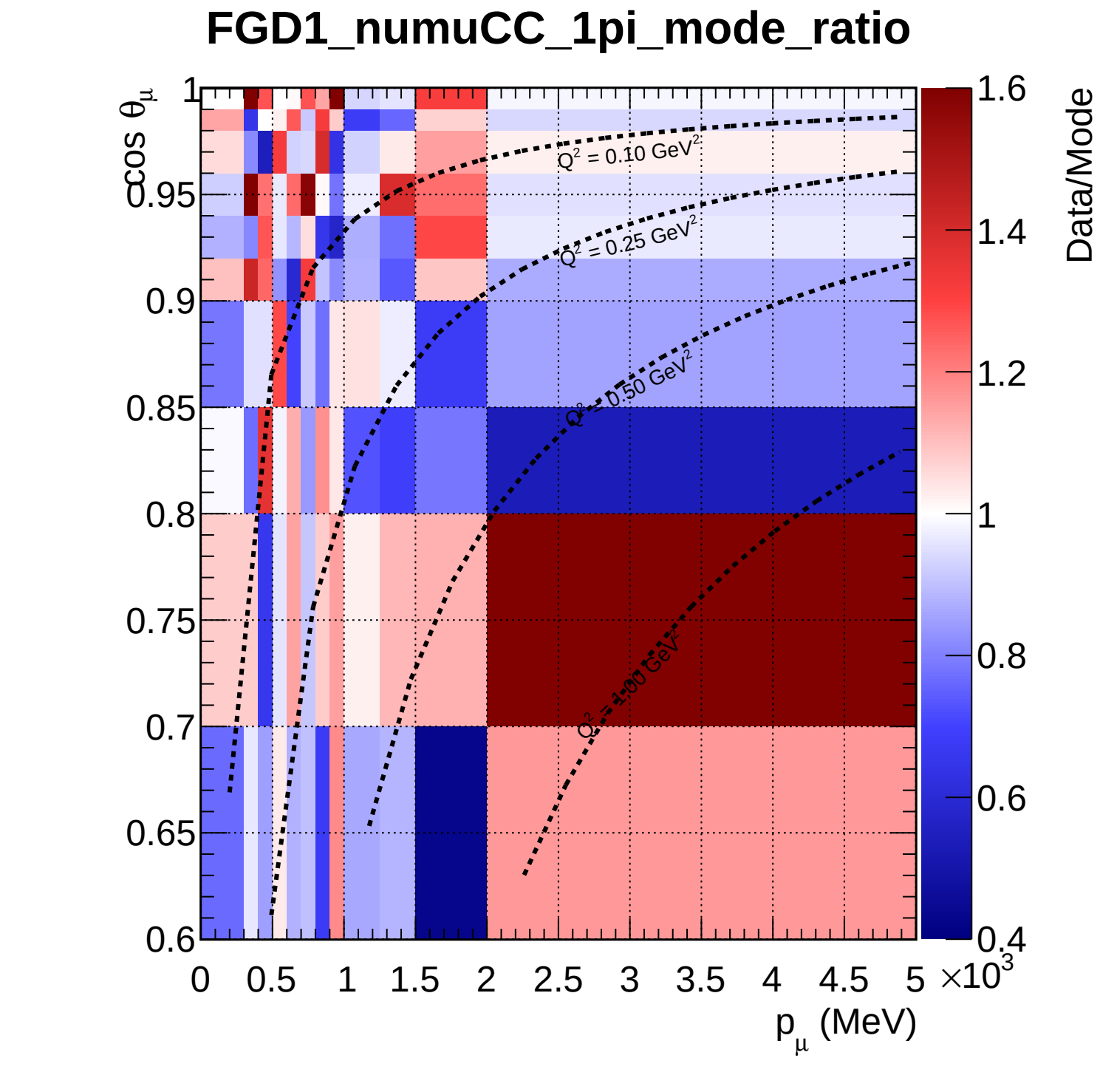

FGD1_numuCC_0pi_data
N_events/MeV
0
5
10
15
20
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
500
1000
1500
2000
2500
3000
p_μ (MeV)

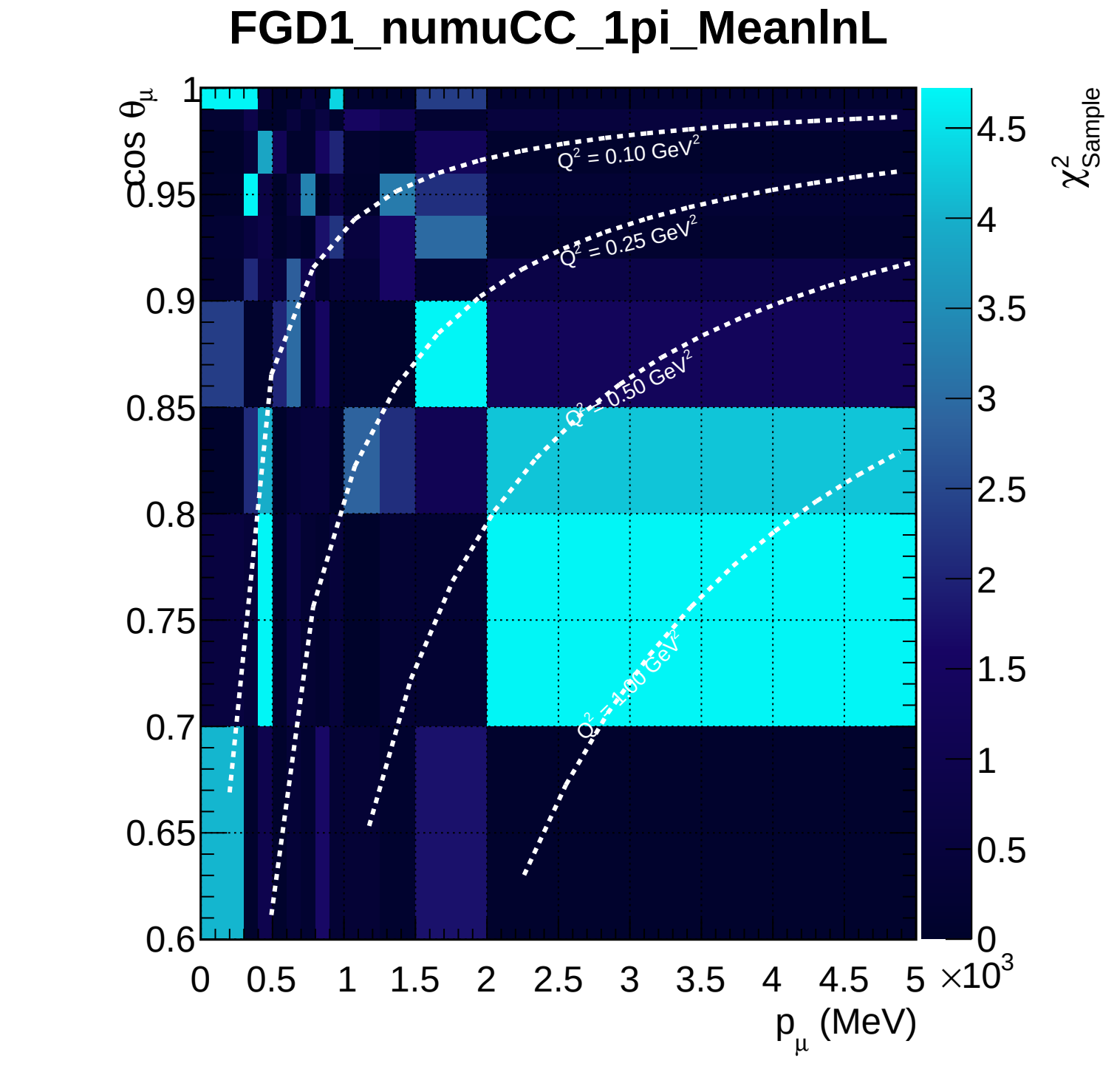

FGD1_numuCC_0pi_data
×10^3
N_events/1
140
120
100
80
60
40
20
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

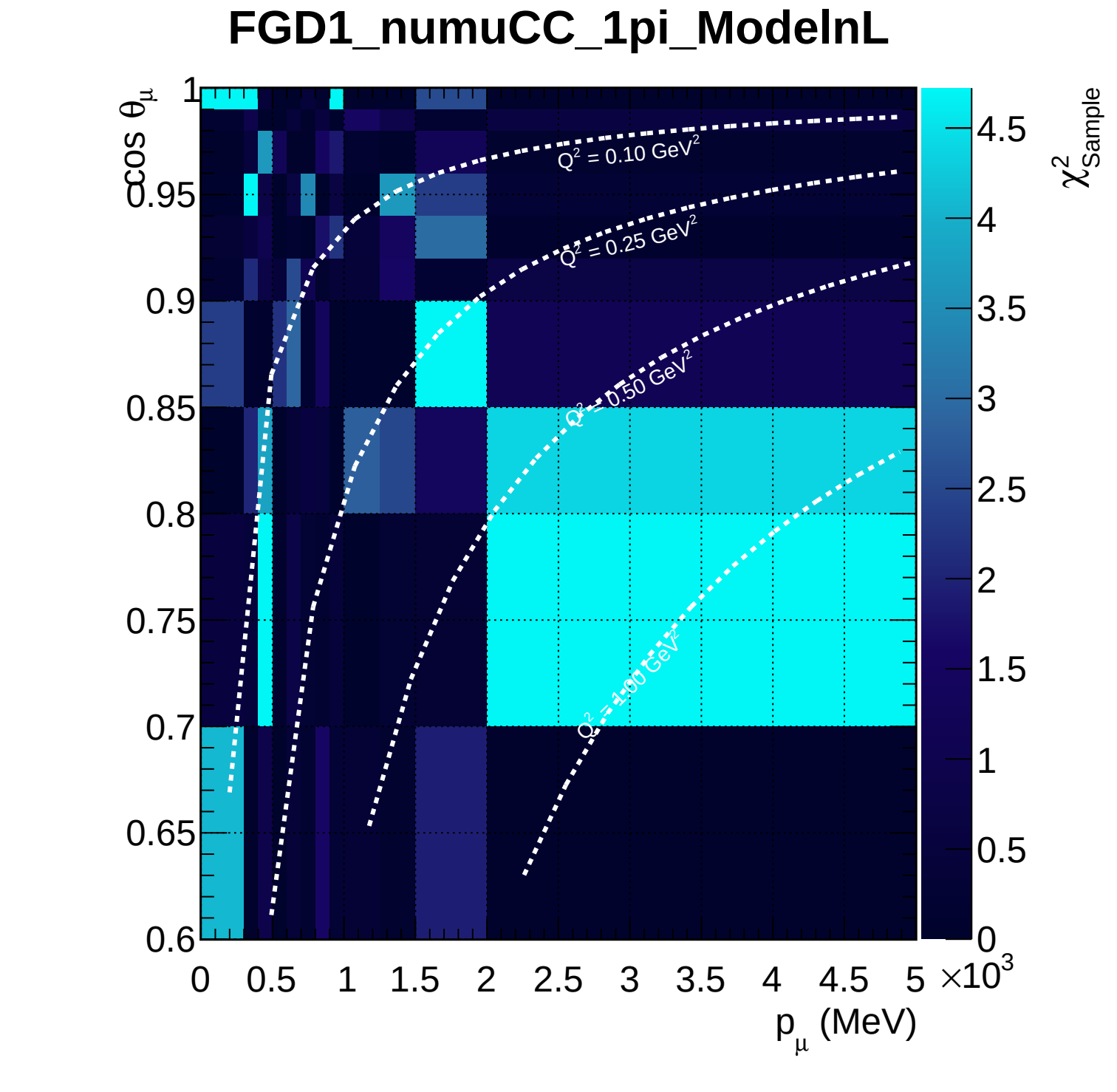

DataDrawFluc
FGD1 ν_μCC 1π
p = 0.078
$\chi^2_{Data,\ Draw}$
$\chi^2_{Draw,\ Draw\ Fluc}$
Steps
195
190
185
180
175
170
165
160
155
100
120
140
160
180
200
220
12
10
8
6
4
2
0

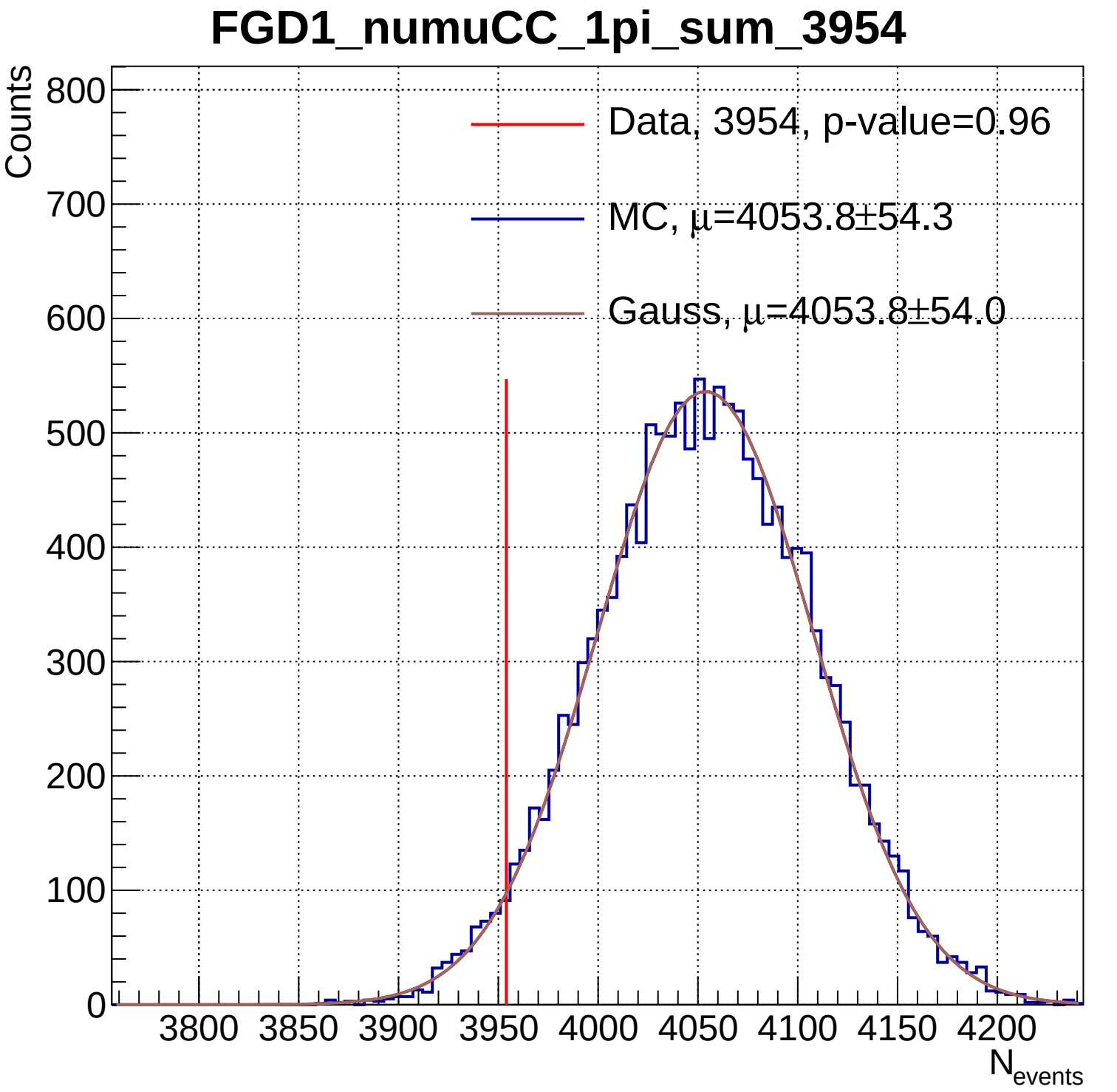

DataPredFluc
FGD1 ν_μCC 1π
p = 0.075
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
195
190
185
180
175
170
165
160
155
100
120
140
160
180
200
12
10
8
6
4
2
0

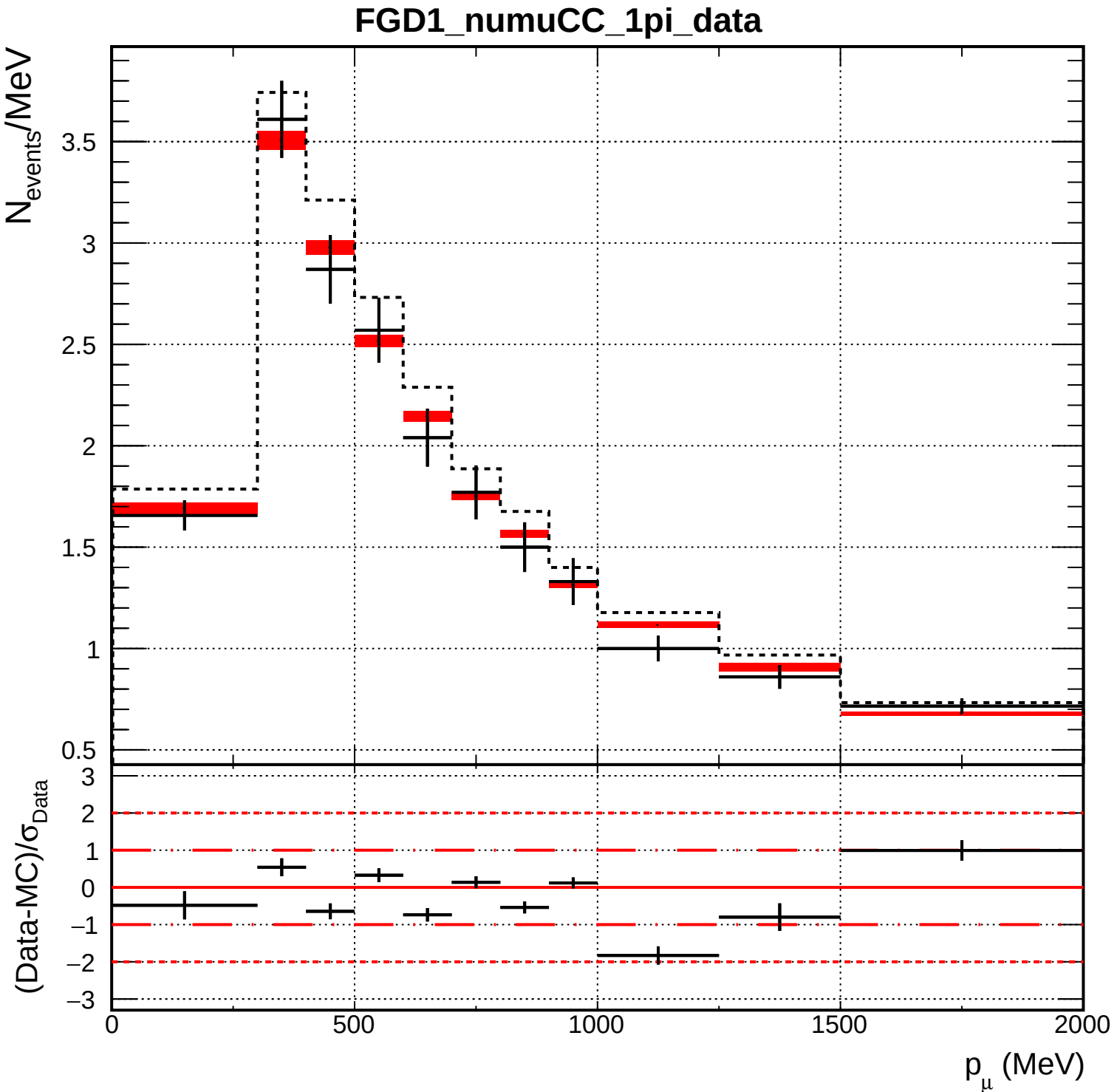

FGD1_numuCC_1pi_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

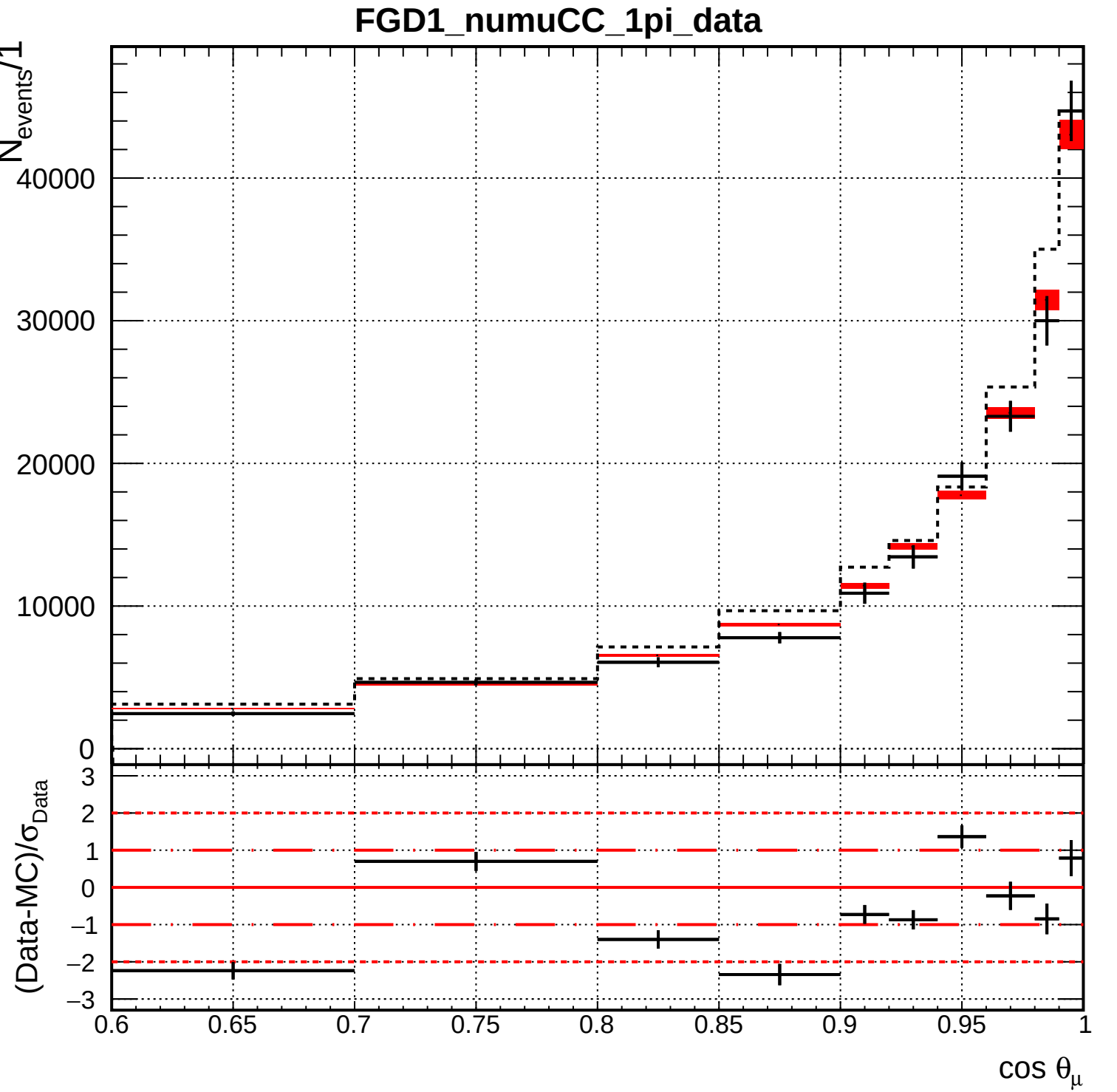

FGD1_numuCC_1pi_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

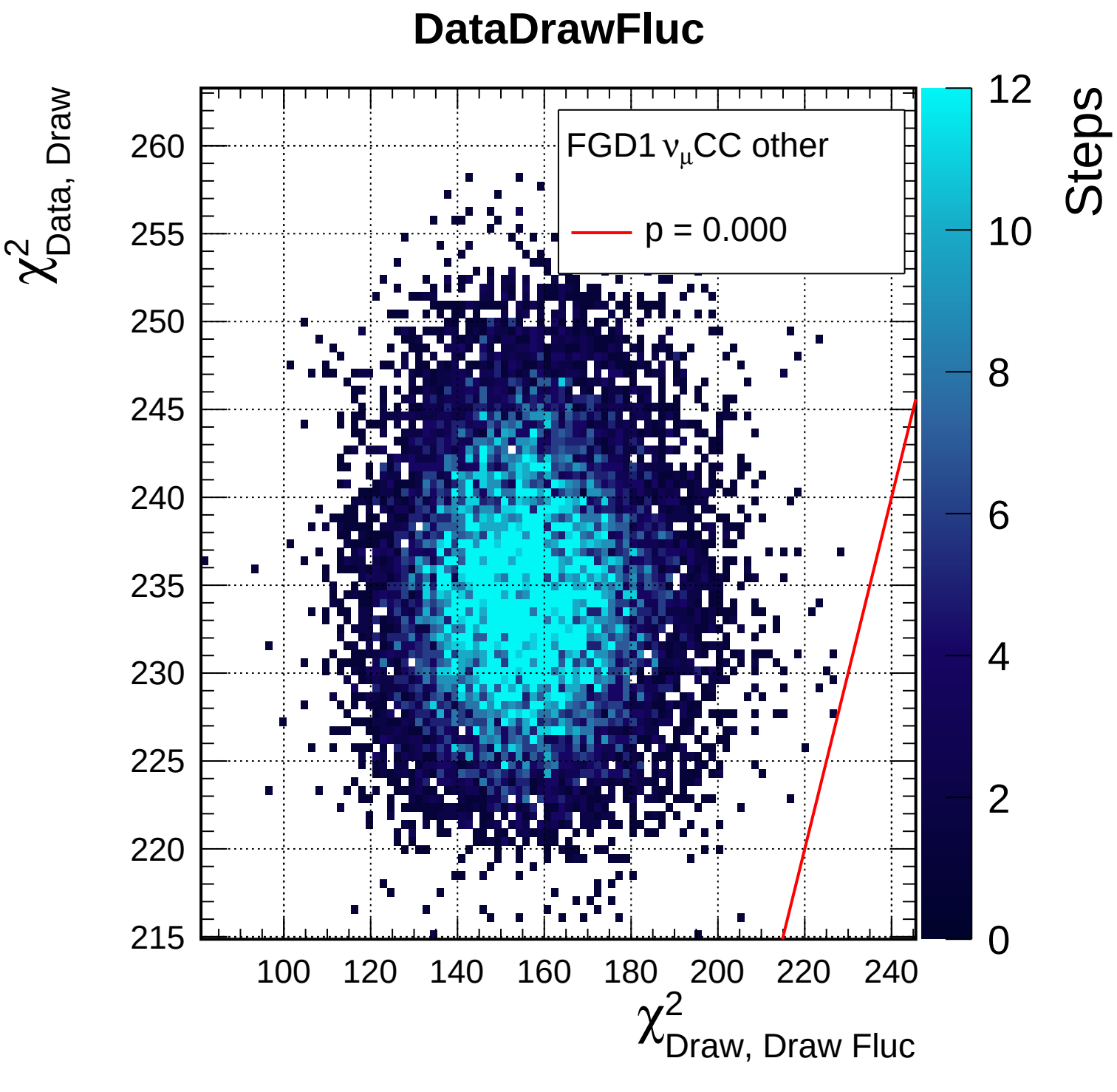

FGD1_numuCC_1pi_MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
χ²Sample
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

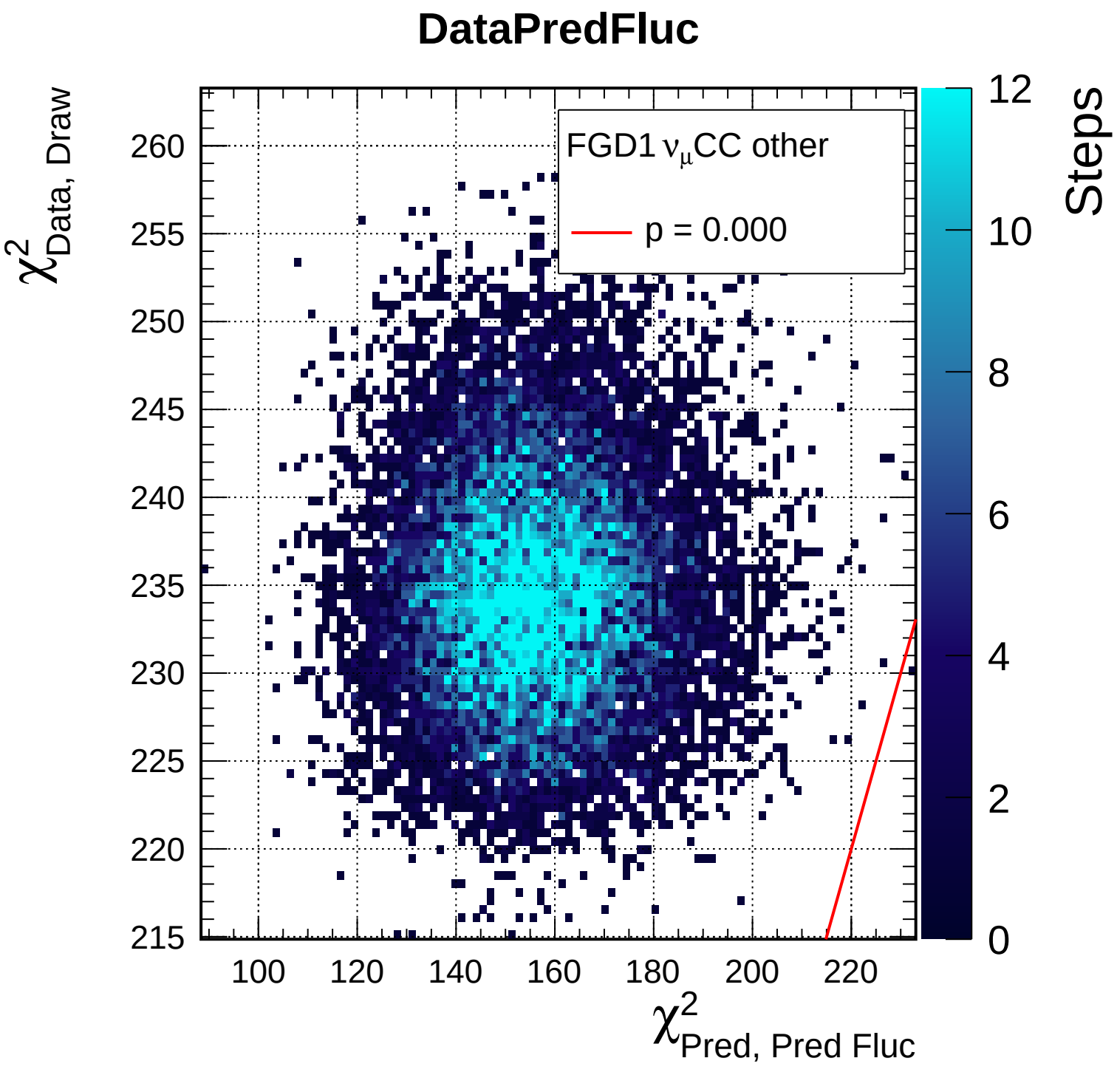

FGD1_numuCC_1pi_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
χ²Sample
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

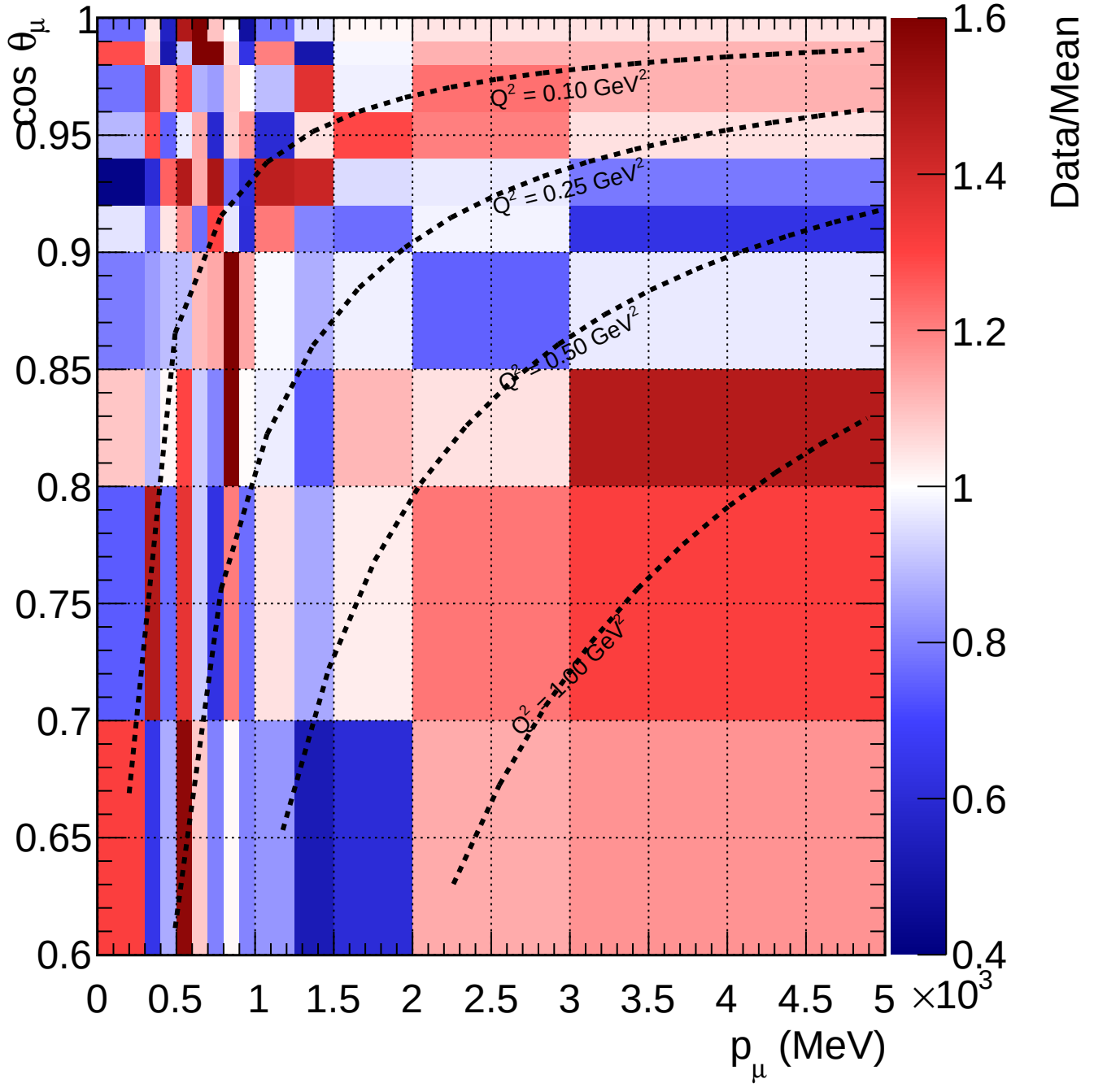

FGD1_numuCC_1pi_sum_3954
Counts
800
700
600
500
400
300
200
100
0
Data, 3954, p-value=0.96
MC, μ=4053.8±54.3
Gauss, μ=4053.8±54.0
3800
3850
3900
3950
4000
4050
4100
4150
4200
N events

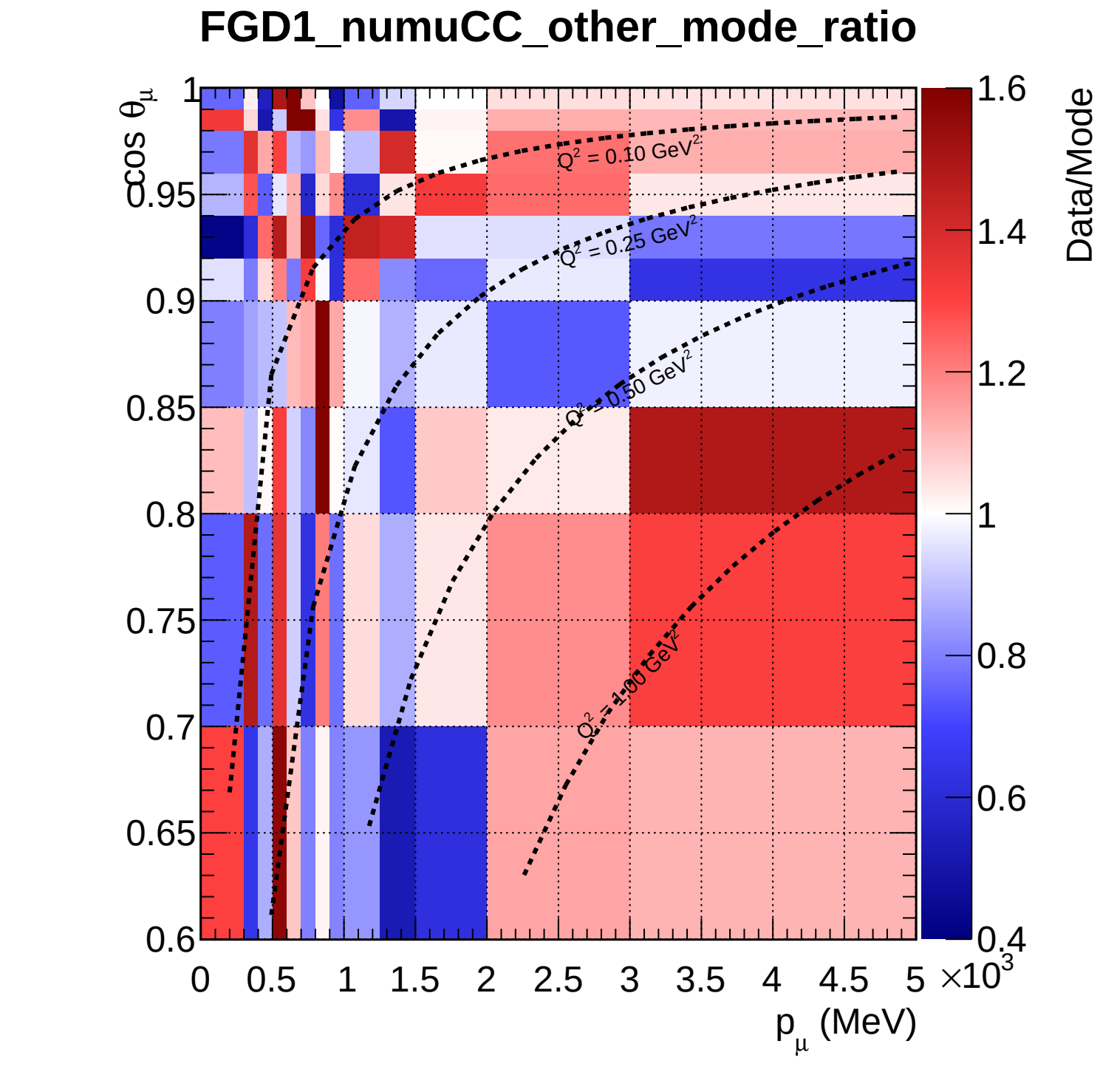

FGD1_numuCC_1pi_data
N_events/MeV
3.5
3
2.5
2
1.5
1
0.5
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
500
1000
1500
2000
p_μ (MeV)

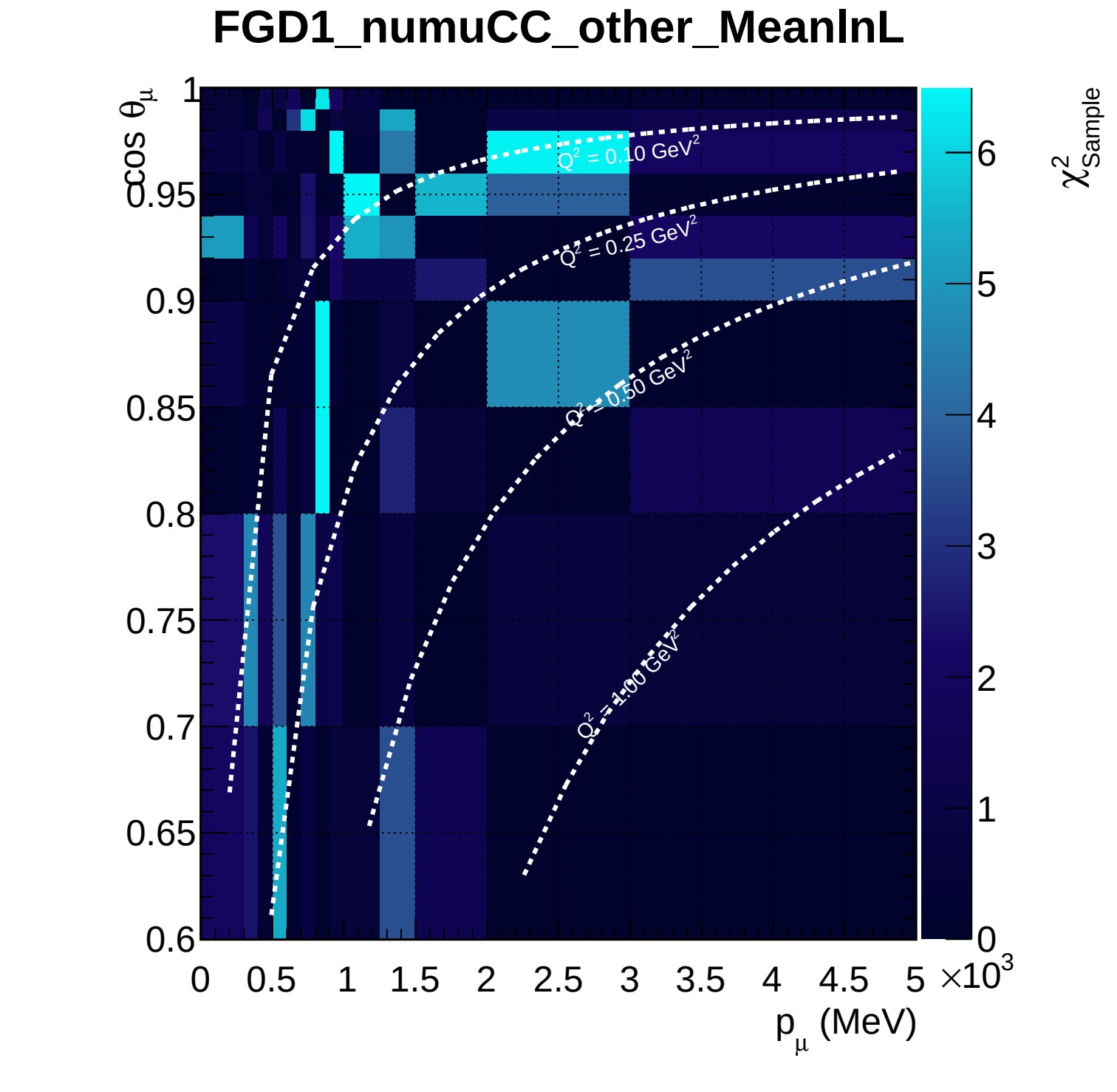

FGD1_numuCC_1pi_data
N_events/1
40000
30000
20000
10000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

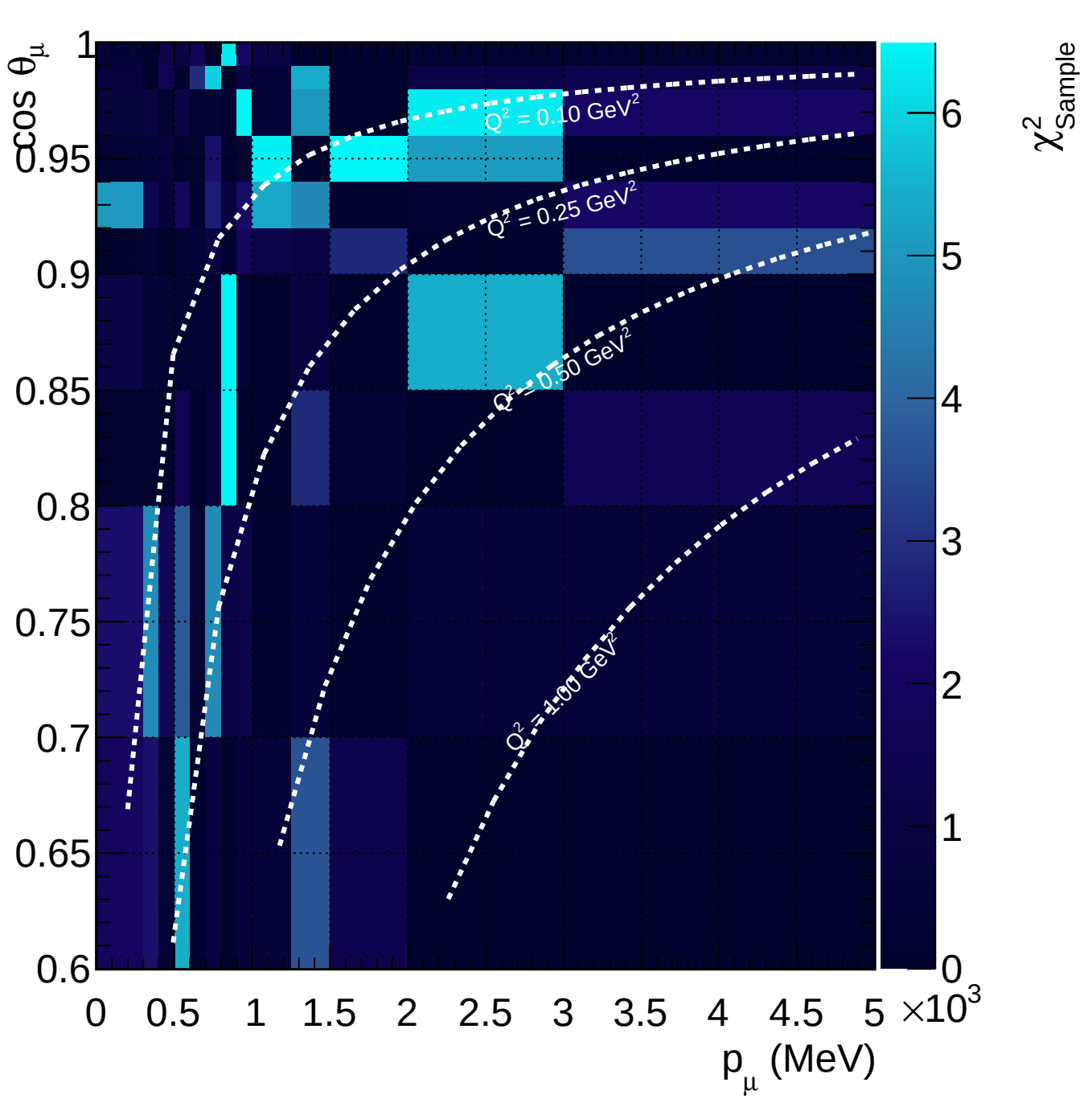

DataDrawFluc
FGD1 ν_μCC other
p = 0.000
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
260
255
250
245
240
235
230
225
220
215
100
120
140
160
180
200
220
240
12
10
8
6
4
2
0

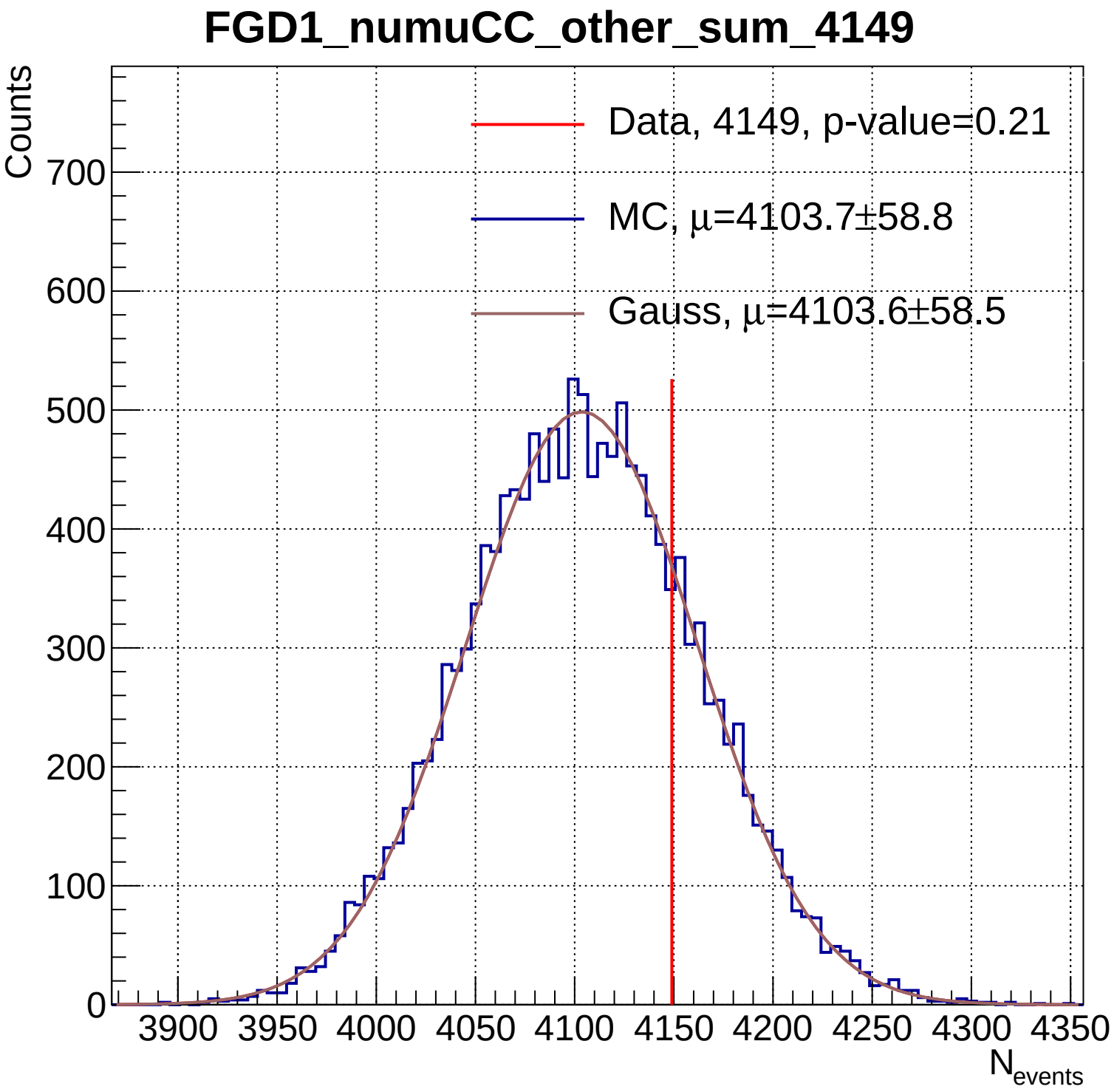

DataPredFluc
FGD1 ν_μCC other
p = 0.000
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
260
255
250
245
240
235
230
225
220
215
100
120
140
160
180
200
220
12
10
8
6
4
2
0

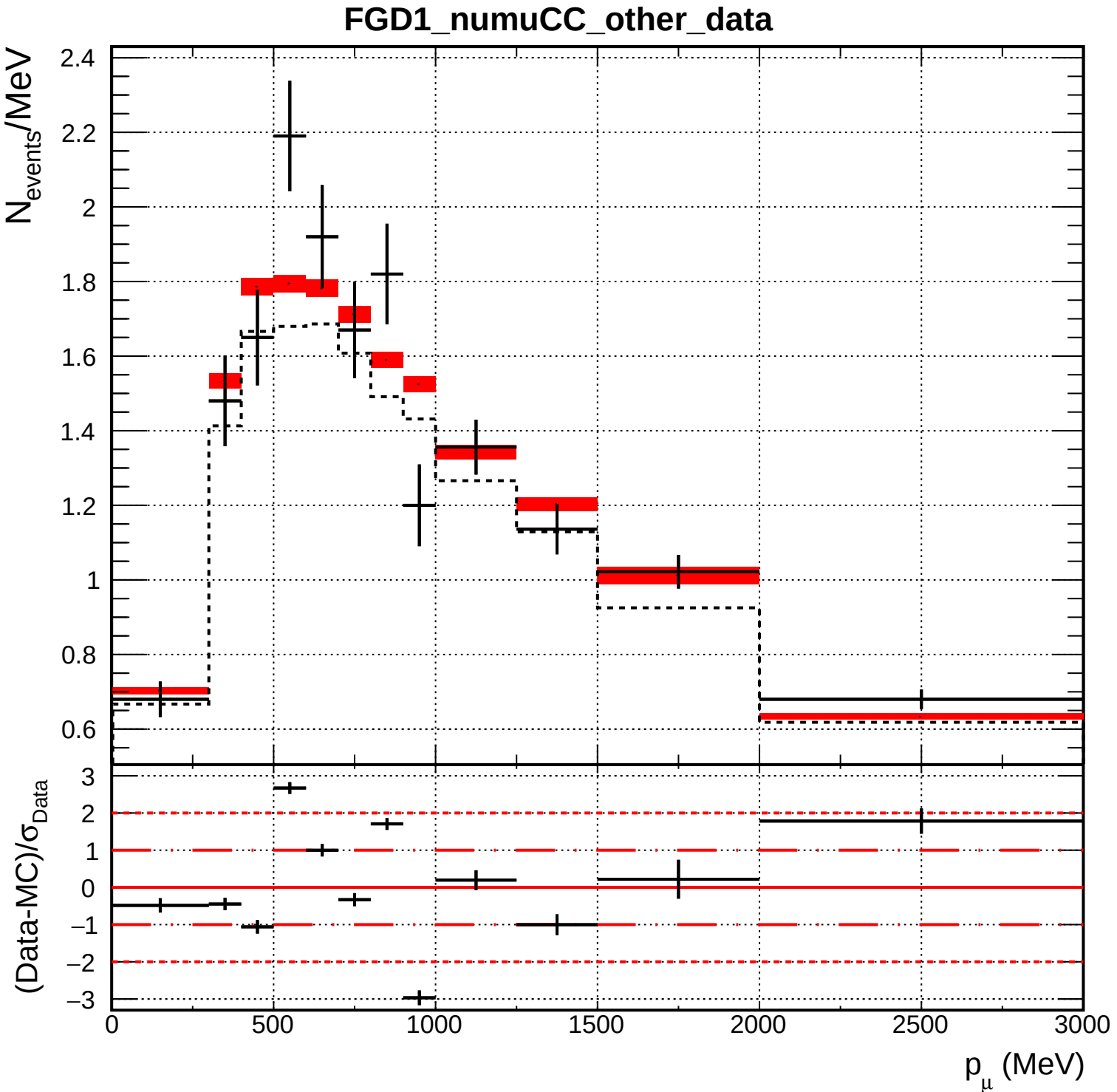

FGD1_numuCC_other_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
1.6
1.4
1.2
1
0.8
0.6
0.4
Data/Mean

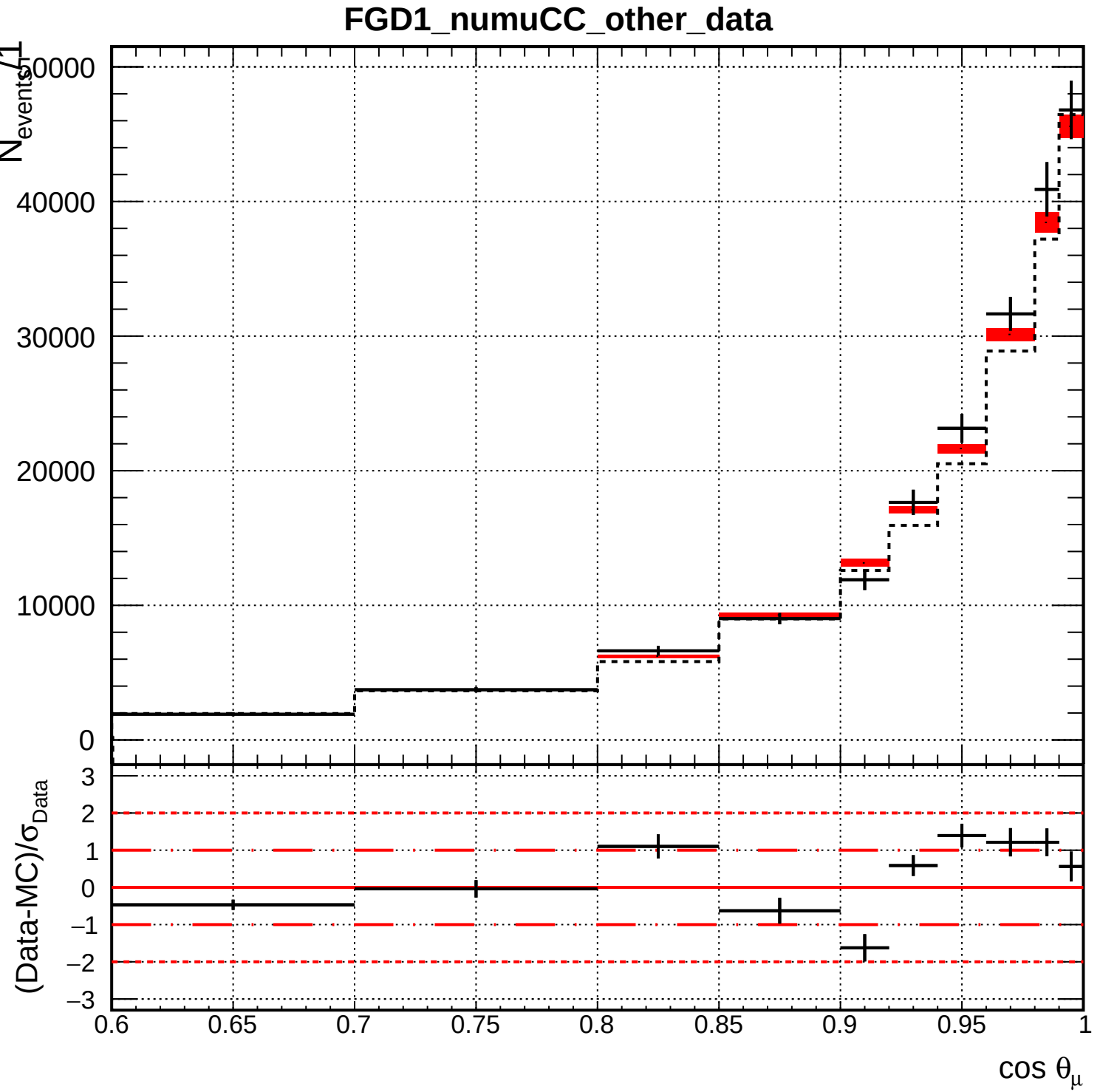

FGD1_numuCC_other_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

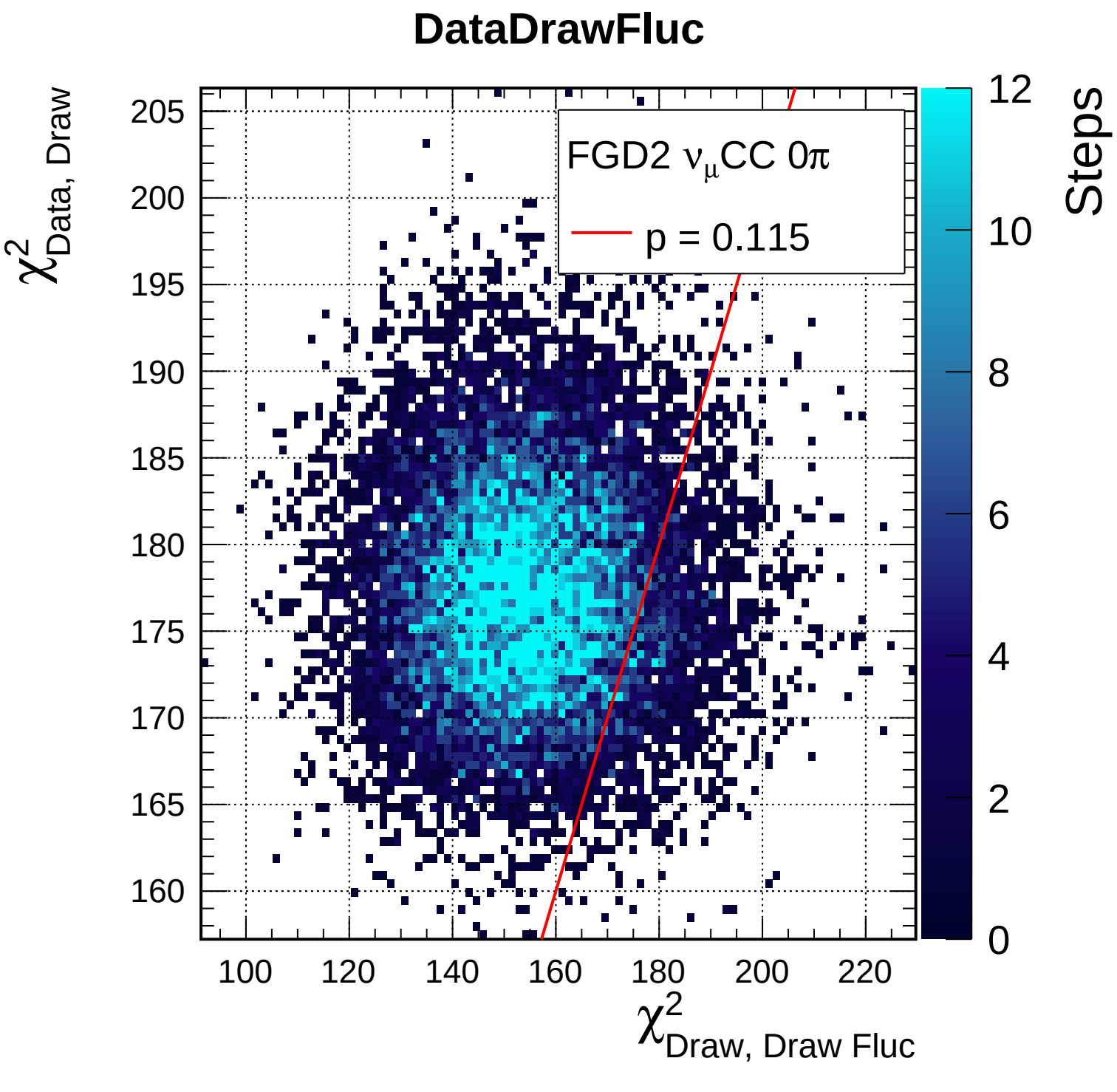

FGD1_numuCC_other_MeanInL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
χ²Sample
6
5
4
3
2
1
0

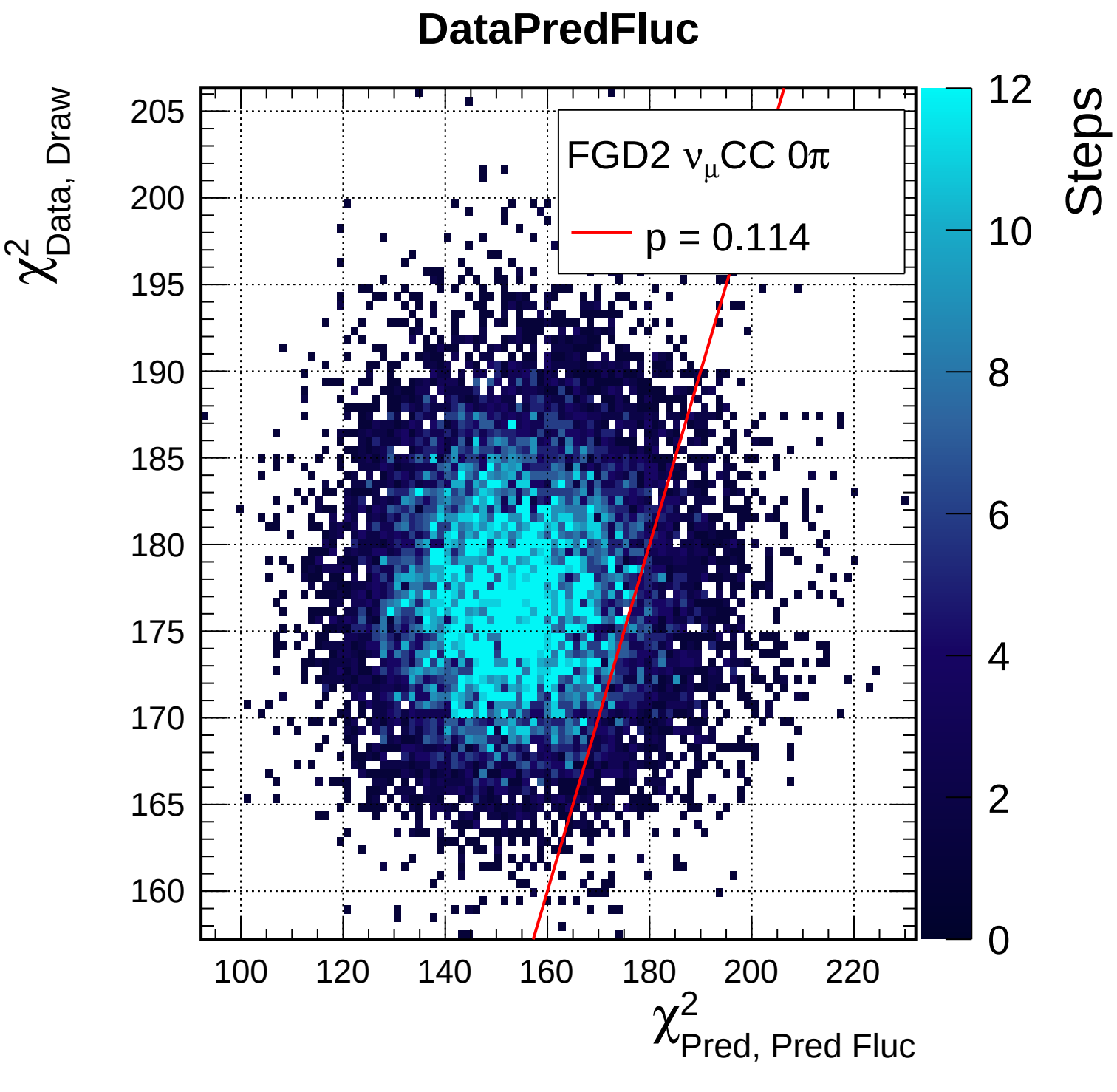

FGD1_numuCC_other_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
χ²Sample
0
1
2
3
4
5
6

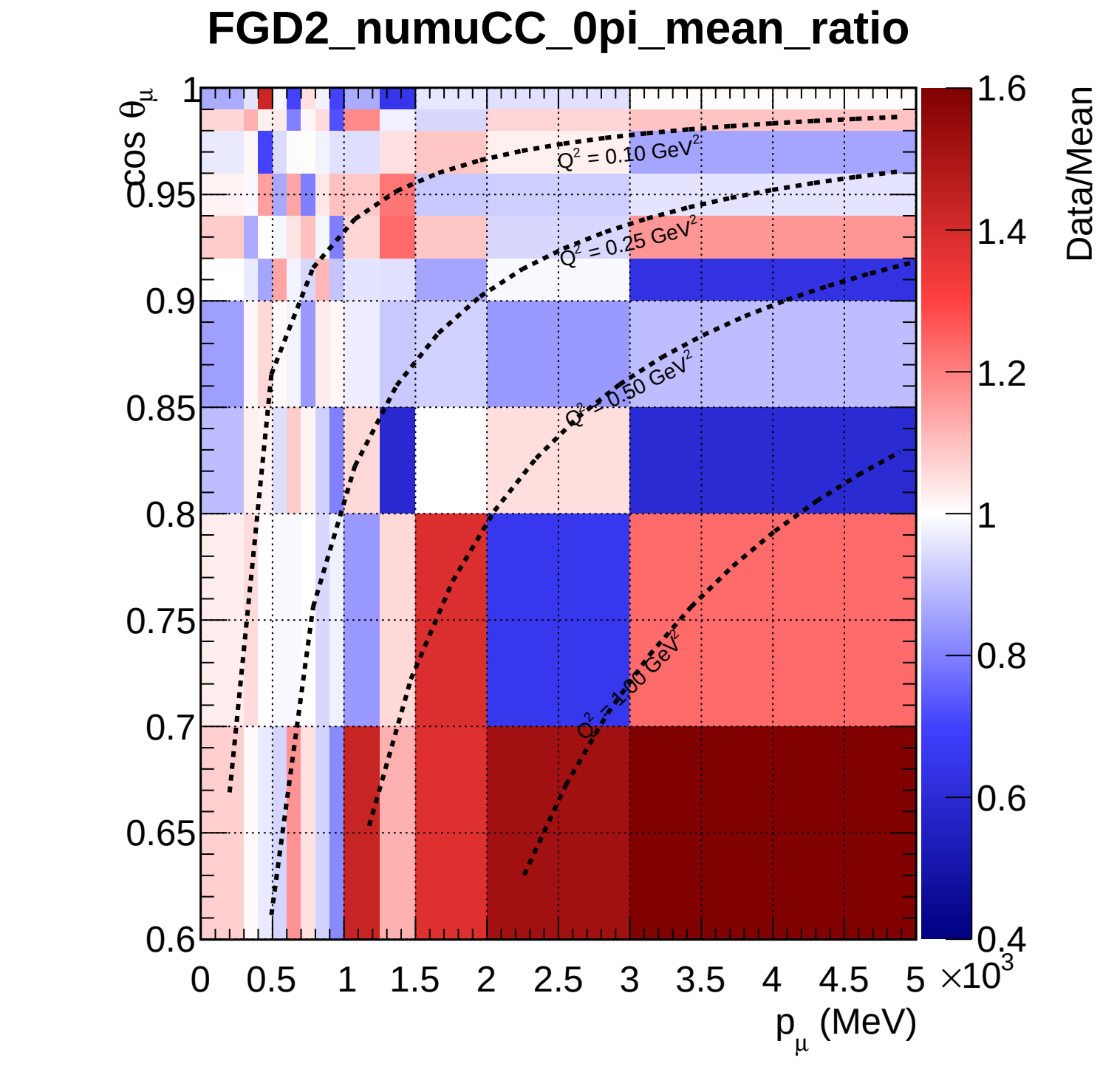

FGD1_numuCC_other_sum_4149
Counts
Data, 4149, p-value=0.21
MC, μ=4103.7±58.8
Gauss, μ=4103.6±58.5
0
100
200
300
400
500
600
700
3900
3950
4000
4050
4100
4150
4200
4250
4300
4350
N_events

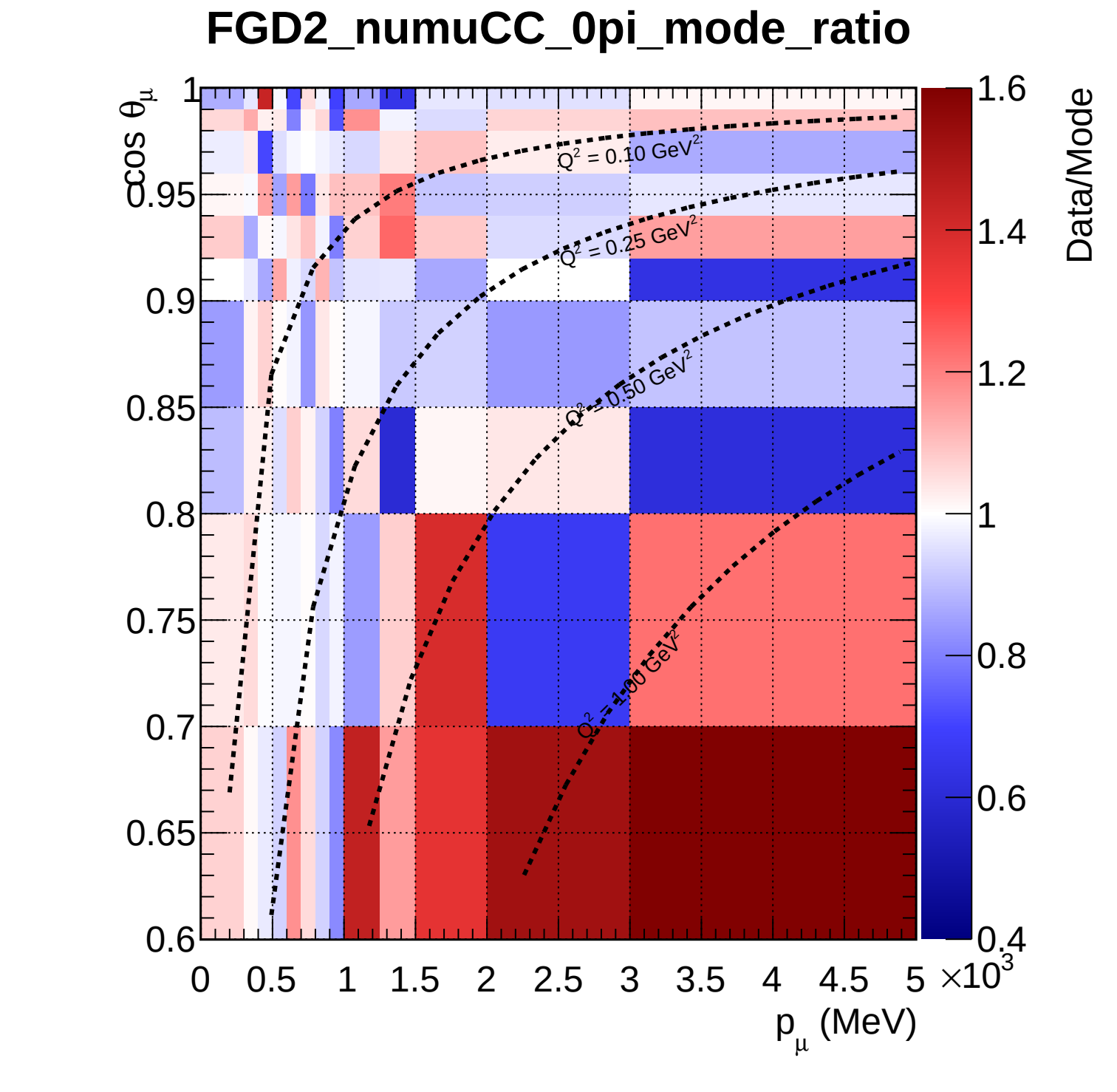

FGD1_numuCC_other_data
N_events/MeV
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
500
1000
1500
2000
2500
3000
p_μ (MeV)

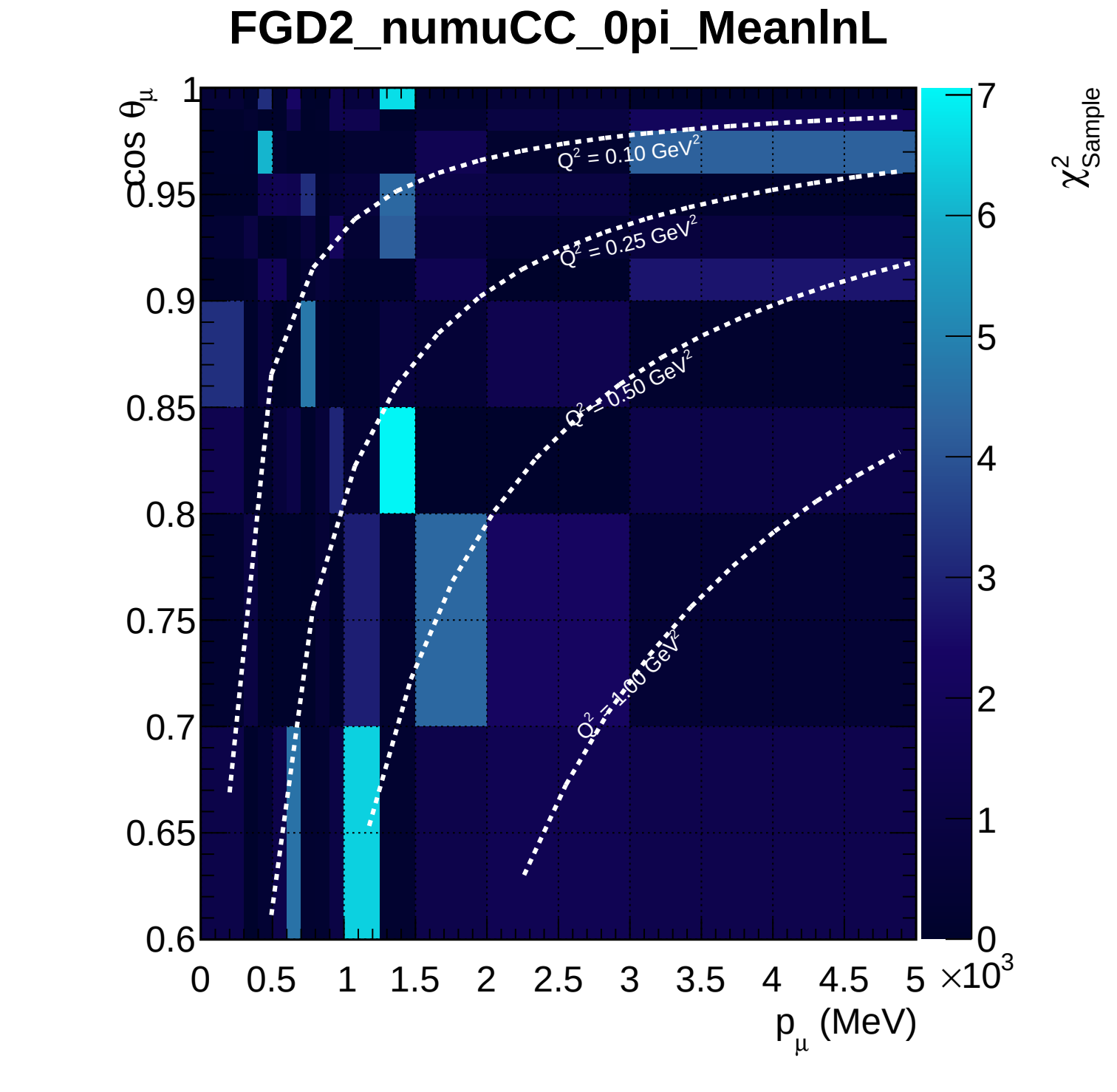

FGD1_numuCC_other_data
N_events/1
50000
40000
30000
20000
10000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

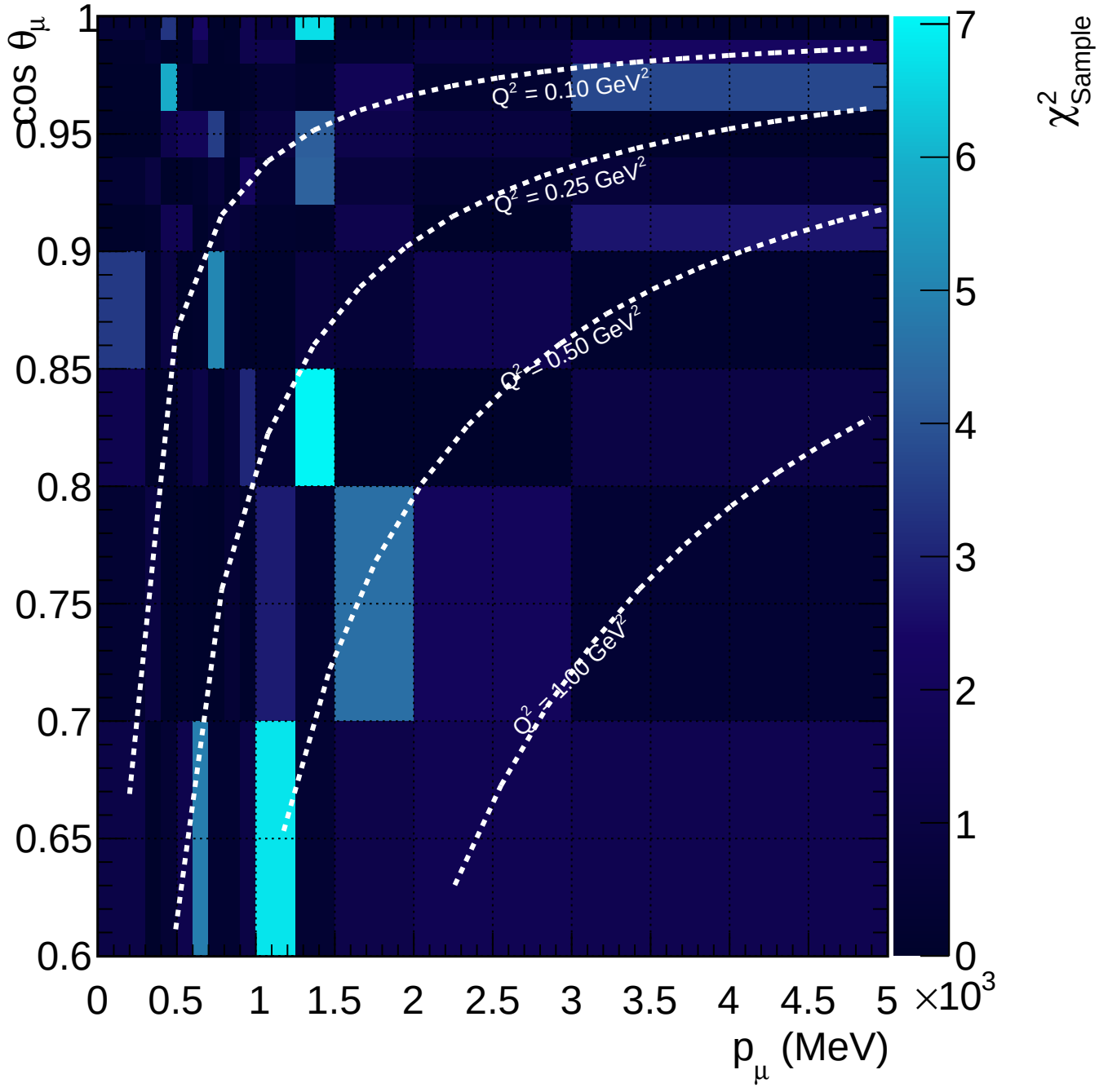

DataDrawFluc
FGD2 ν_μCC 0π
p = 0.115
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
205
200
195
190
185
180
175
170
165
160
100
120
140
160
180
200
220
12
10
8
6
4
2
0

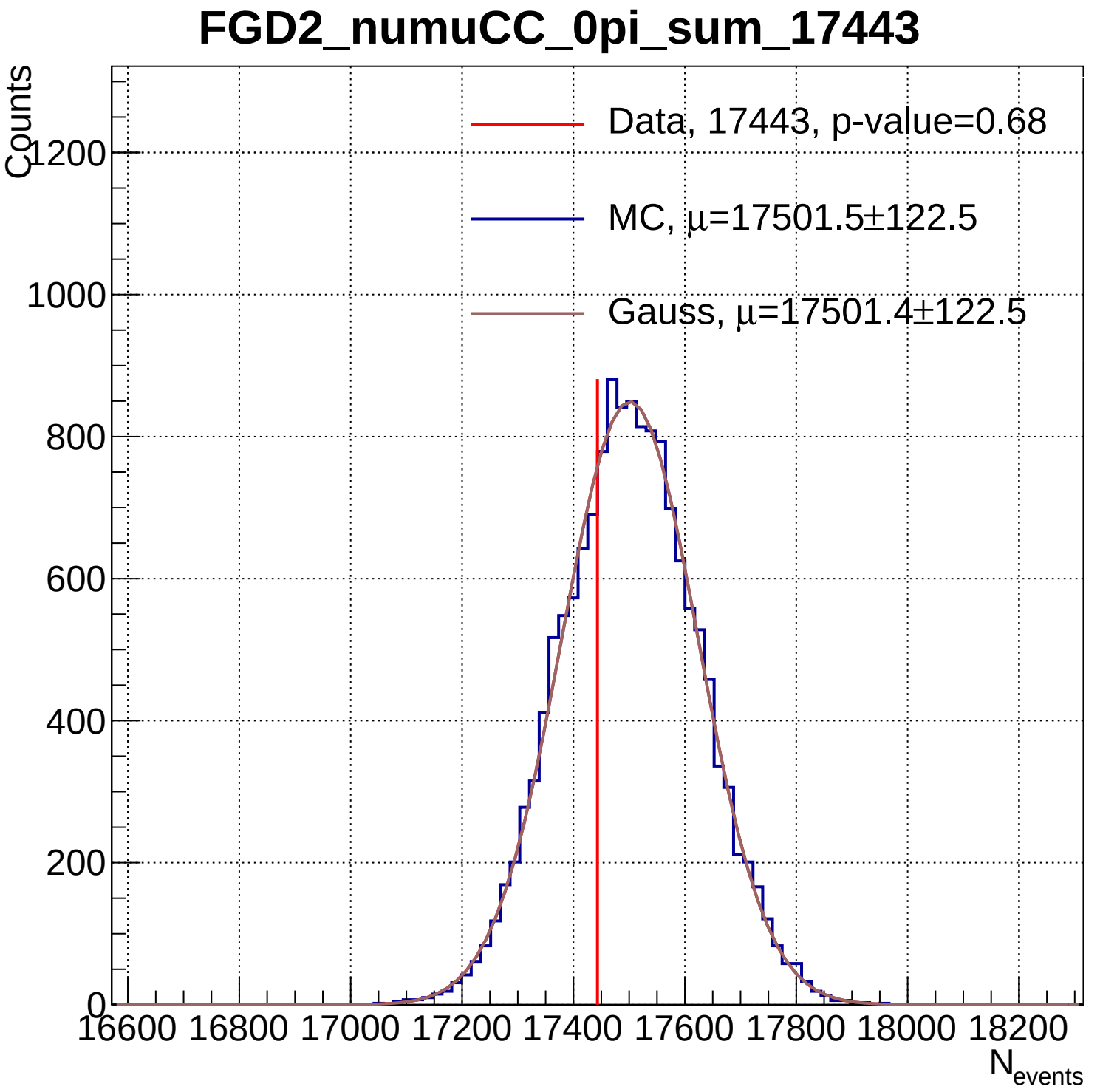

DataPredFluc
FGD2 ν_μCC 0π
p = 0.114
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
205
200
195
190
185
180
175
170
165
160
100
120
140
160
180
200
220
12
10
8
6
4
2
0

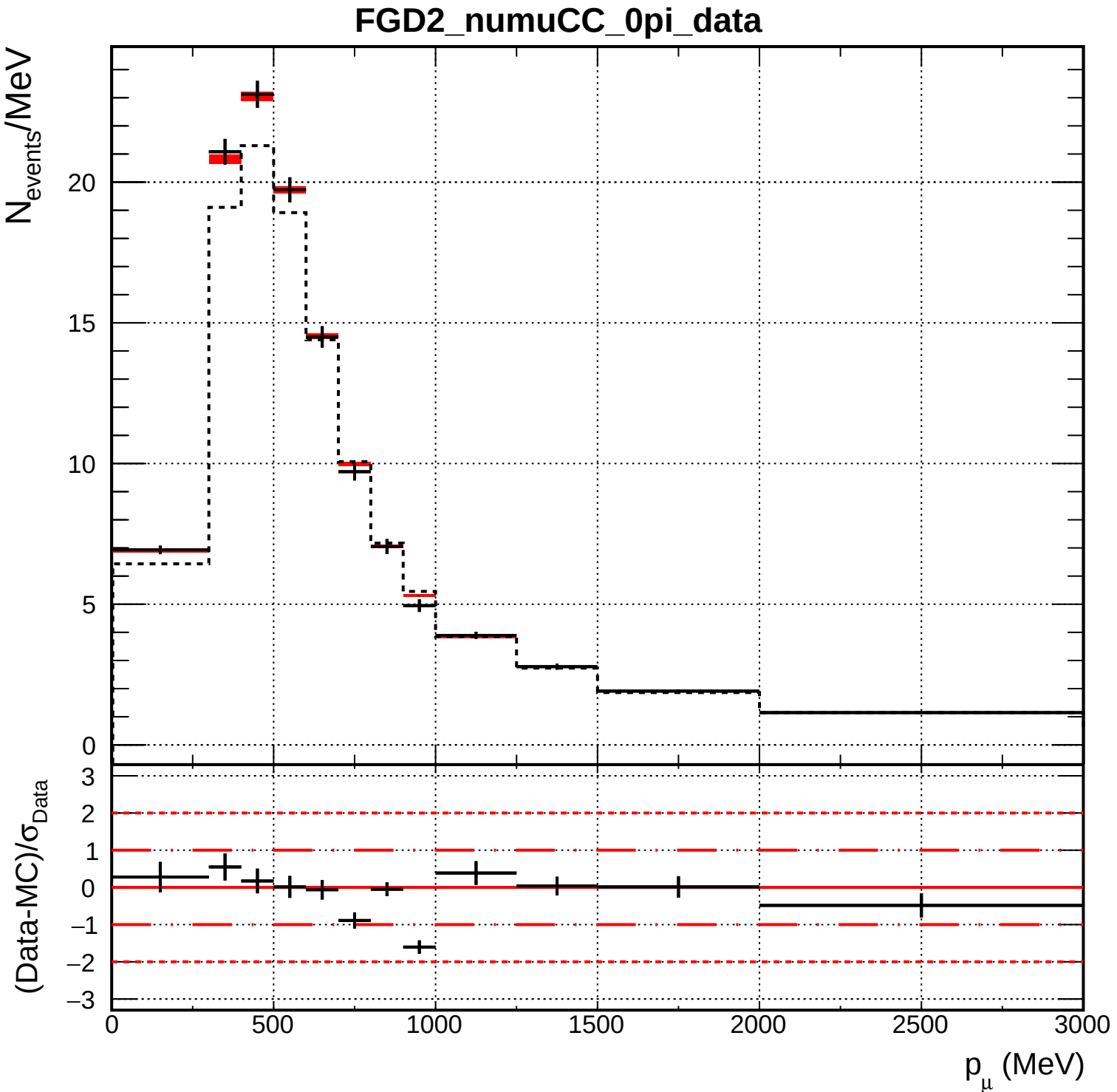

FGD2_numuCC_0pi_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

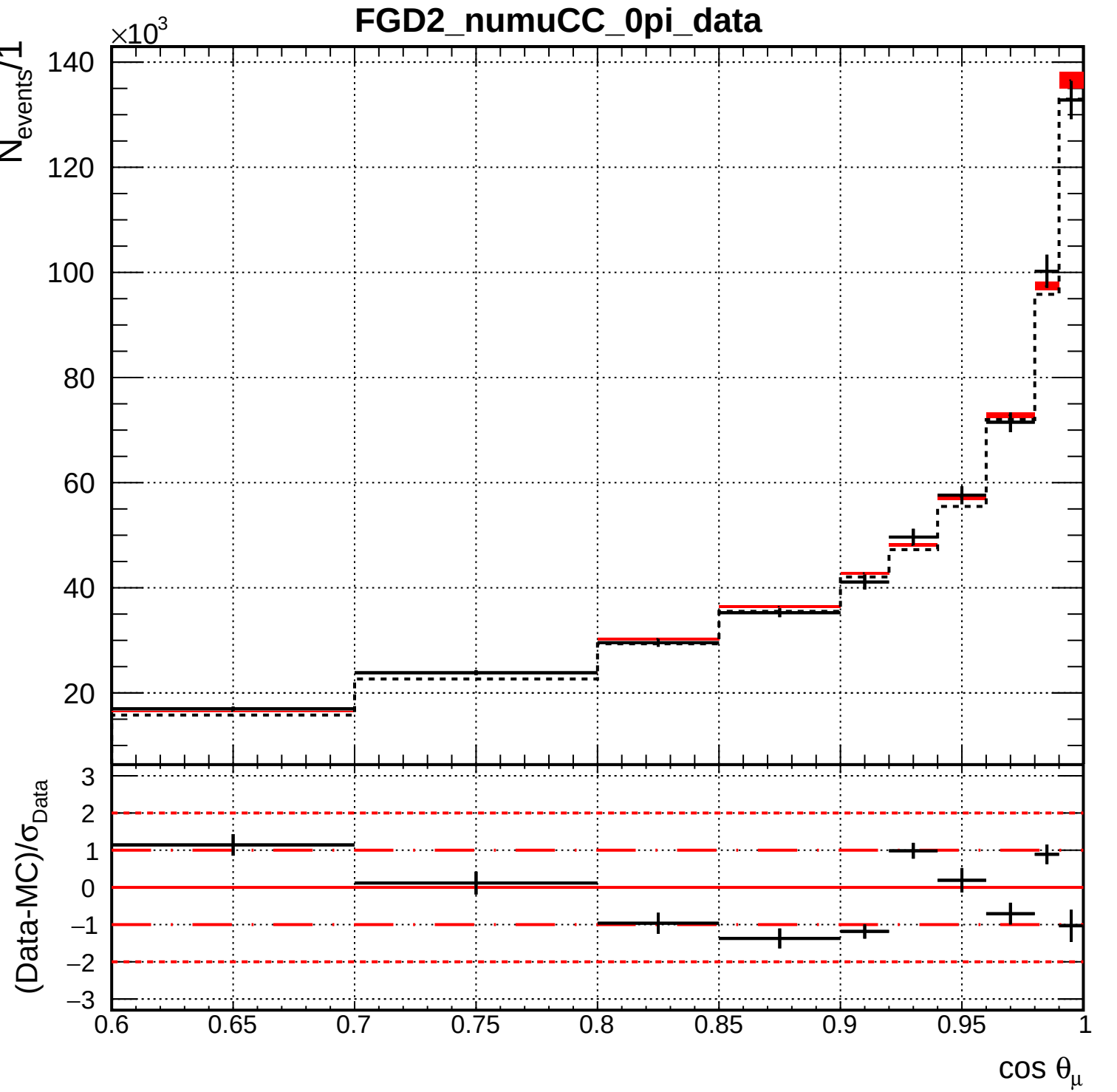

FGD2_numuCC_0pi_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

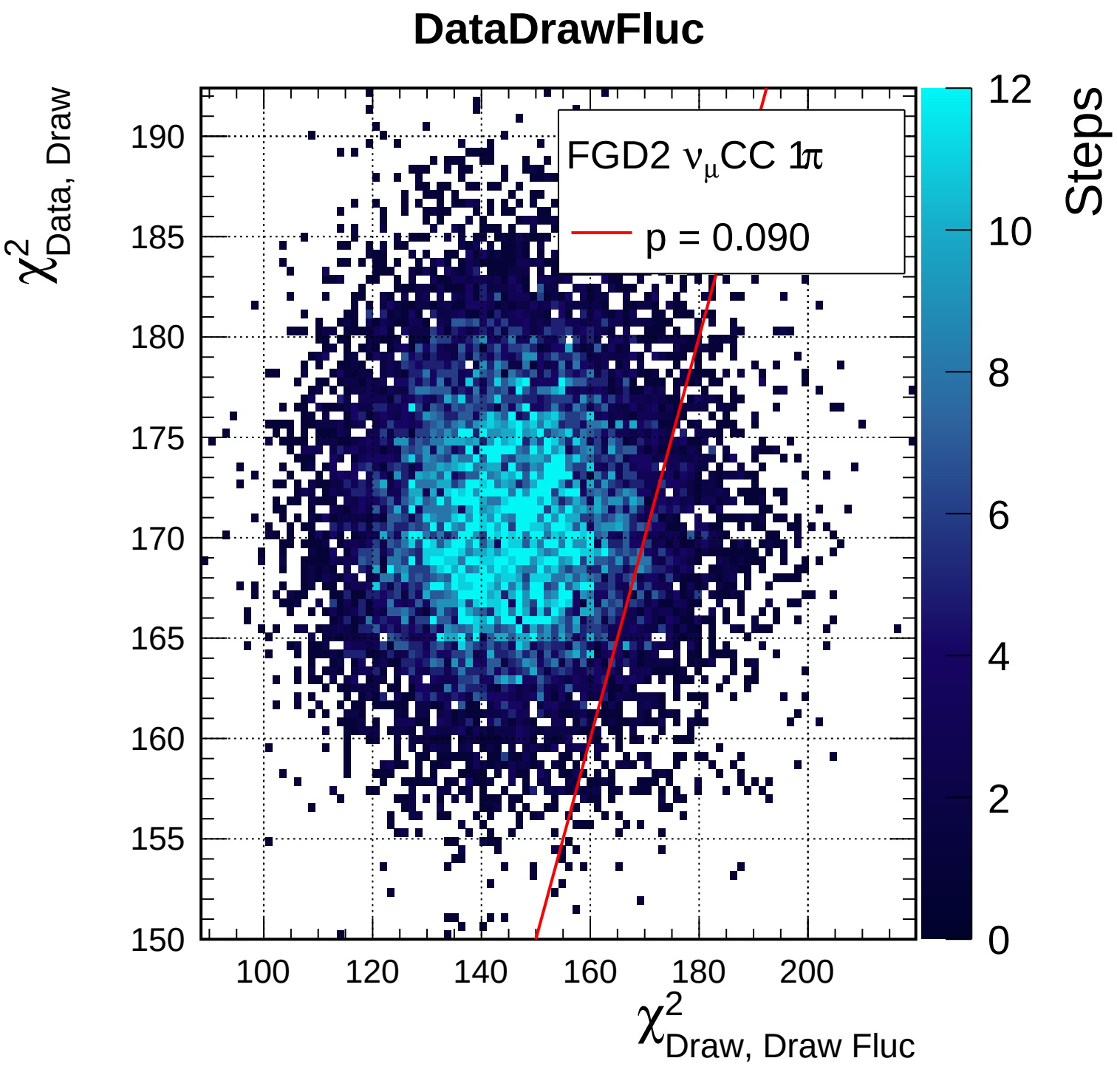

FGD2_numuCC_0pi_MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
7
6
5
4
3
2
1
0
χ²Sample

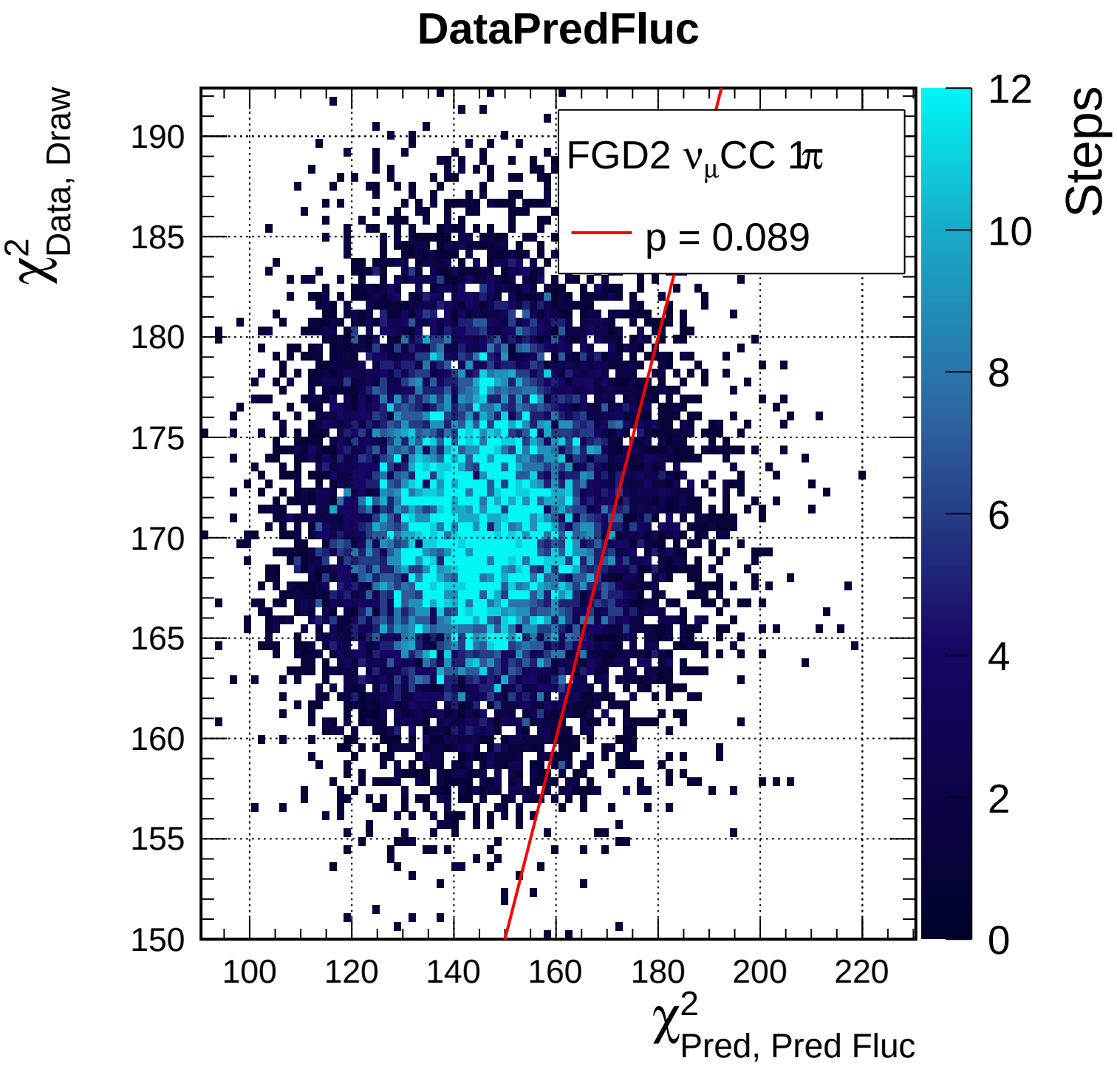

FGD2_numuCC_0pi_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
7
6
5
4
3
2
1
0
χ²Sample

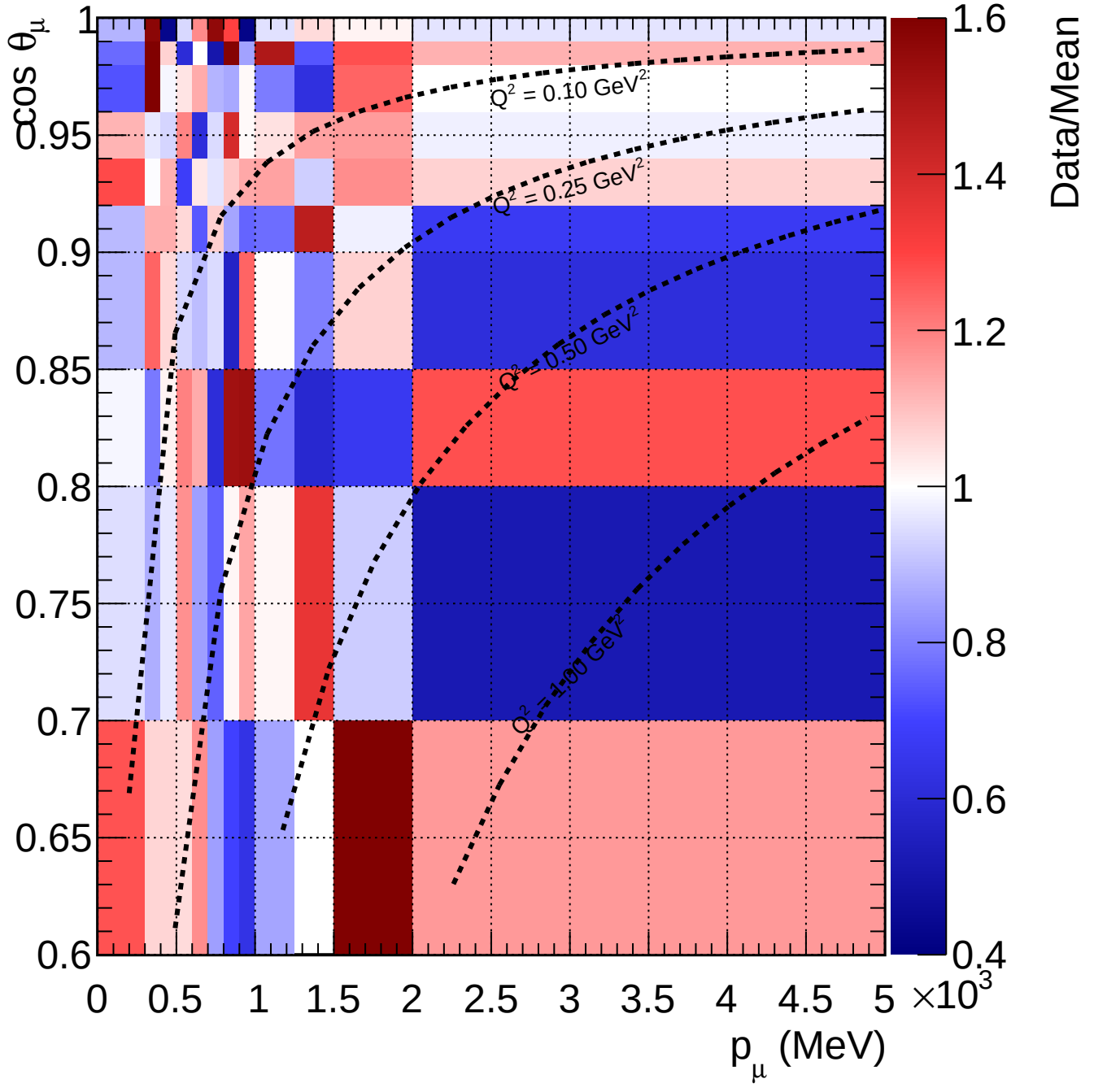

FGD2_numuCC_0pi_sum_17443
Counts
Data, 17443, p-value=0.68
MC, μ=17501.5±122.5
Gauss, μ=17501.4±122.5
0
200
400
600
800
1000
1200
16600
16800
17000
17200
17400
17600
17800
18000
18200
N events

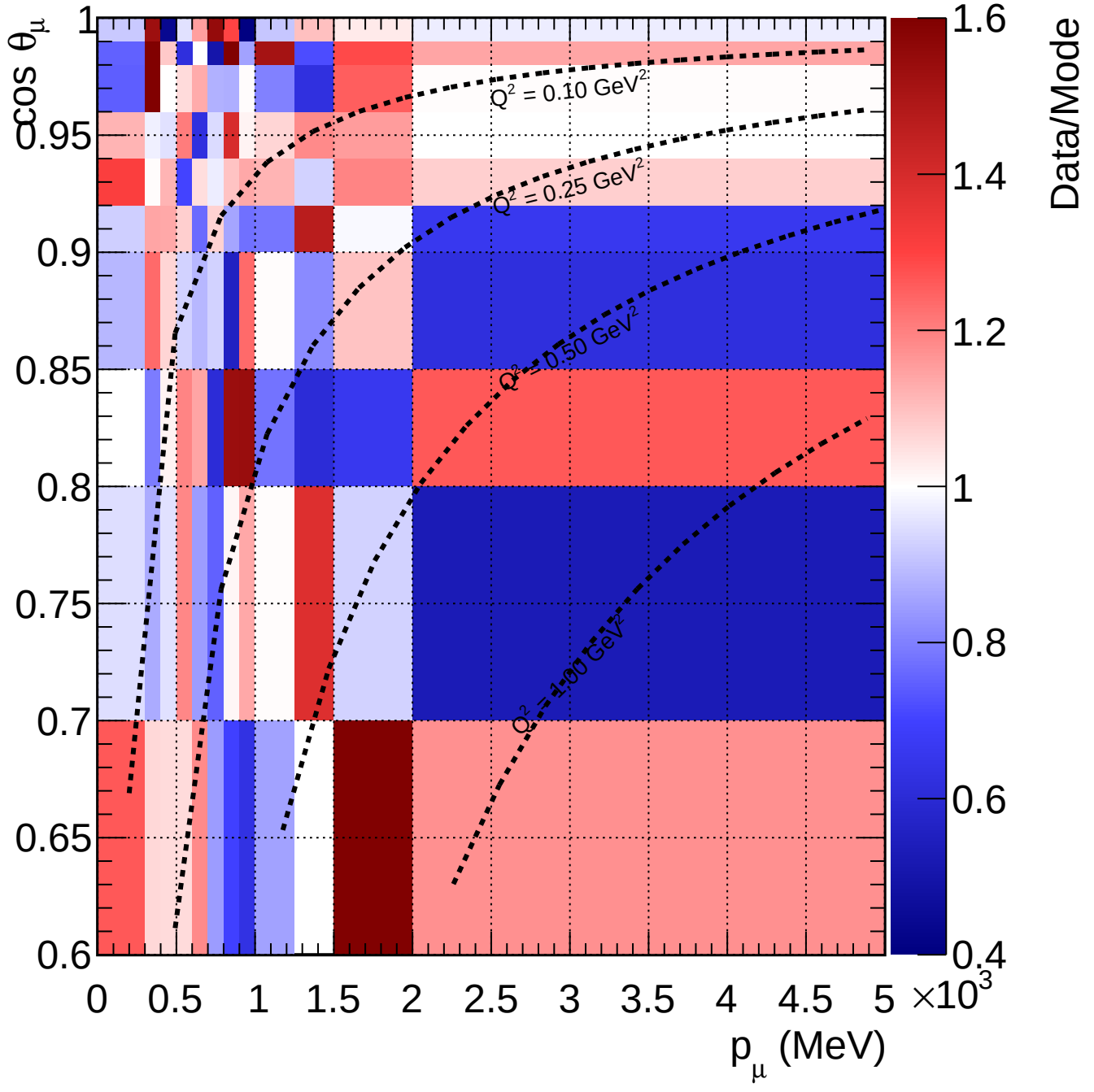

FGD2_numuCC_0pi_data
N_events/MeV
20
15
10
5
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
500
1000
1500
2000
2500
3000
p_μ (MeV)

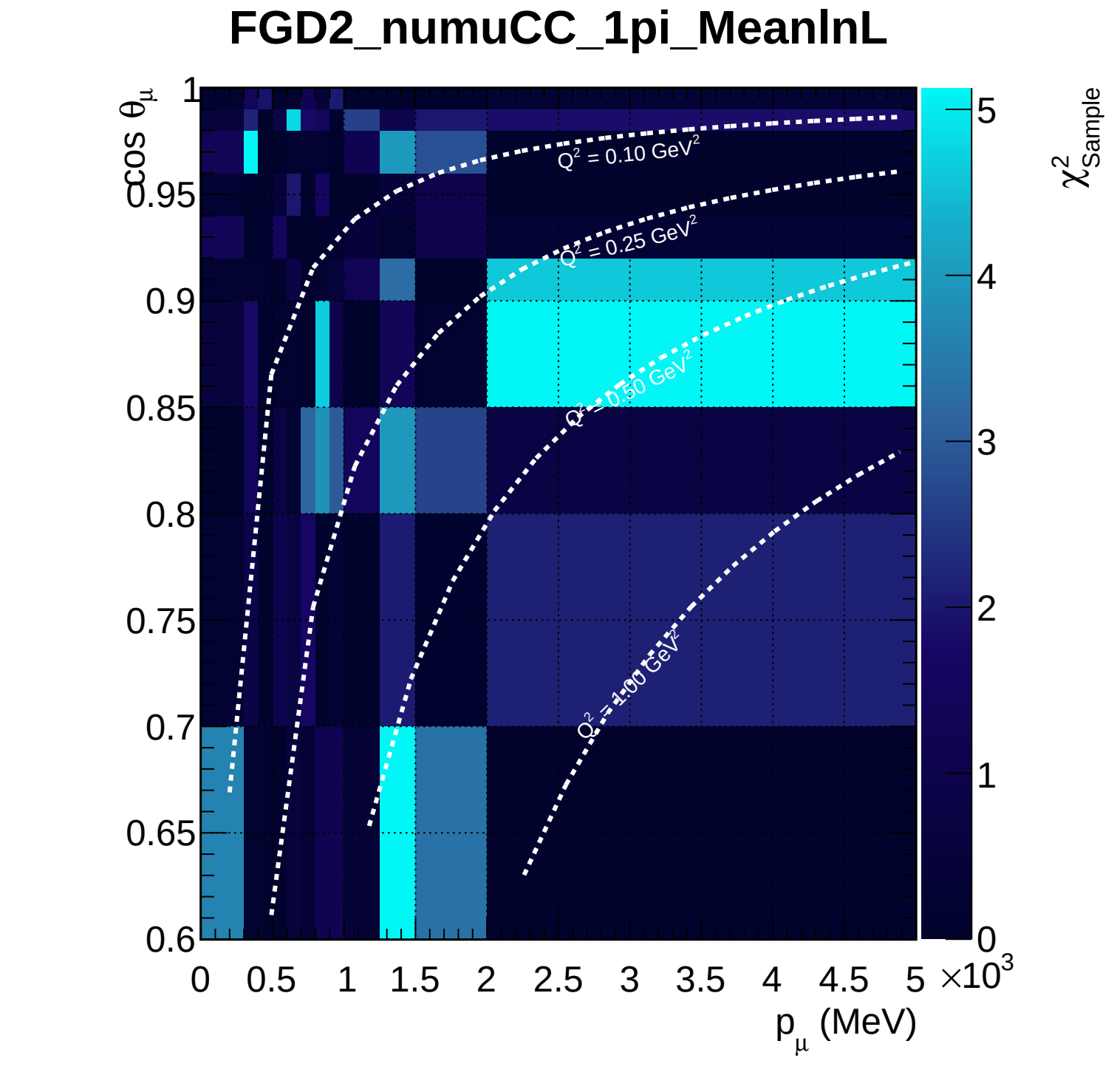

FGD2_numuCC_0pi_data
×10^3
N_events/1
140
120
100
80
60
40
20
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

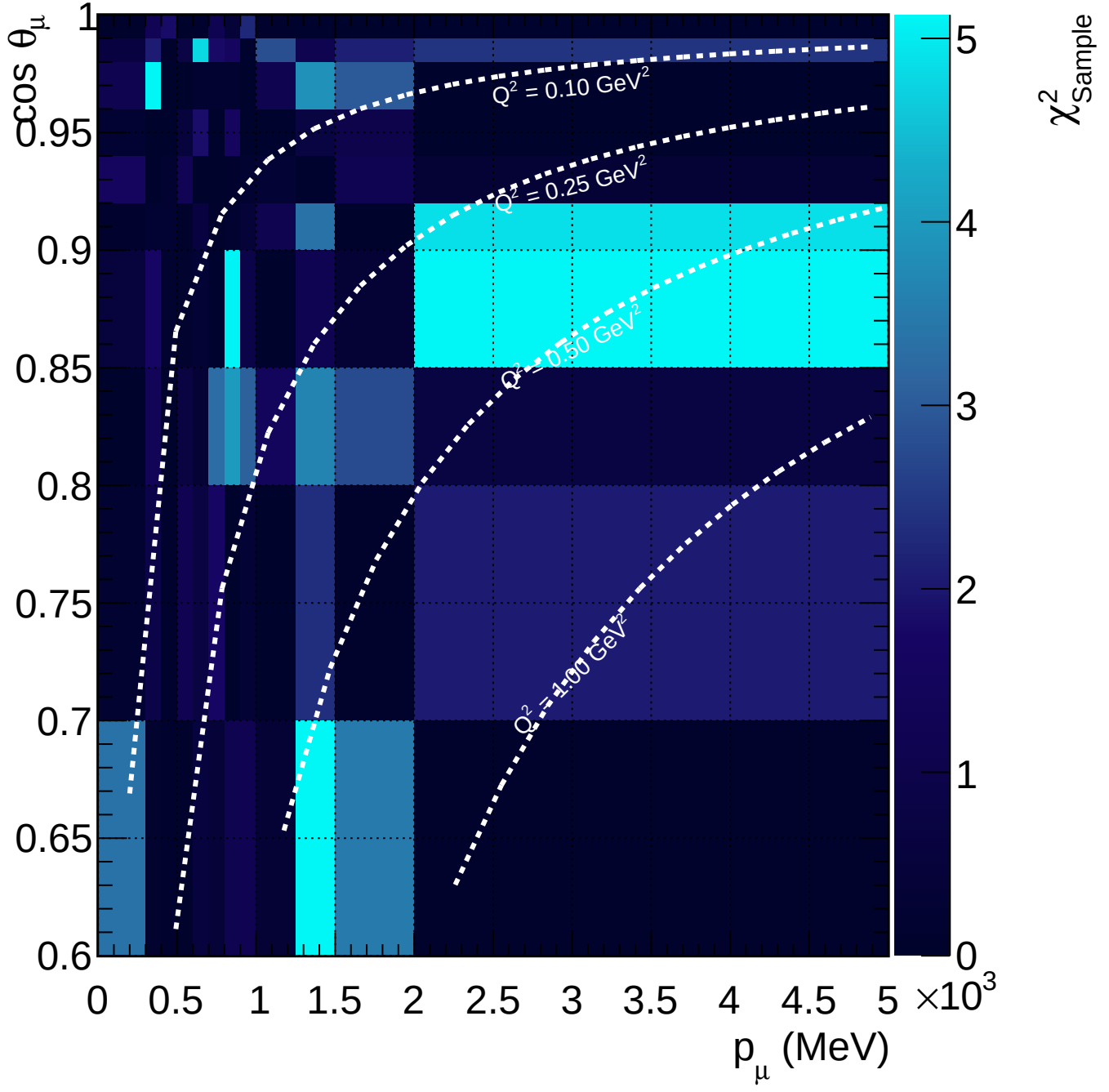

DataDrawFluc
FGD2 ν_μCC 1π
p = 0.090
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
190
185
180
175
170
165
160
155
150
100
120
140
160
180
200
12
10
8
6
4
2
0

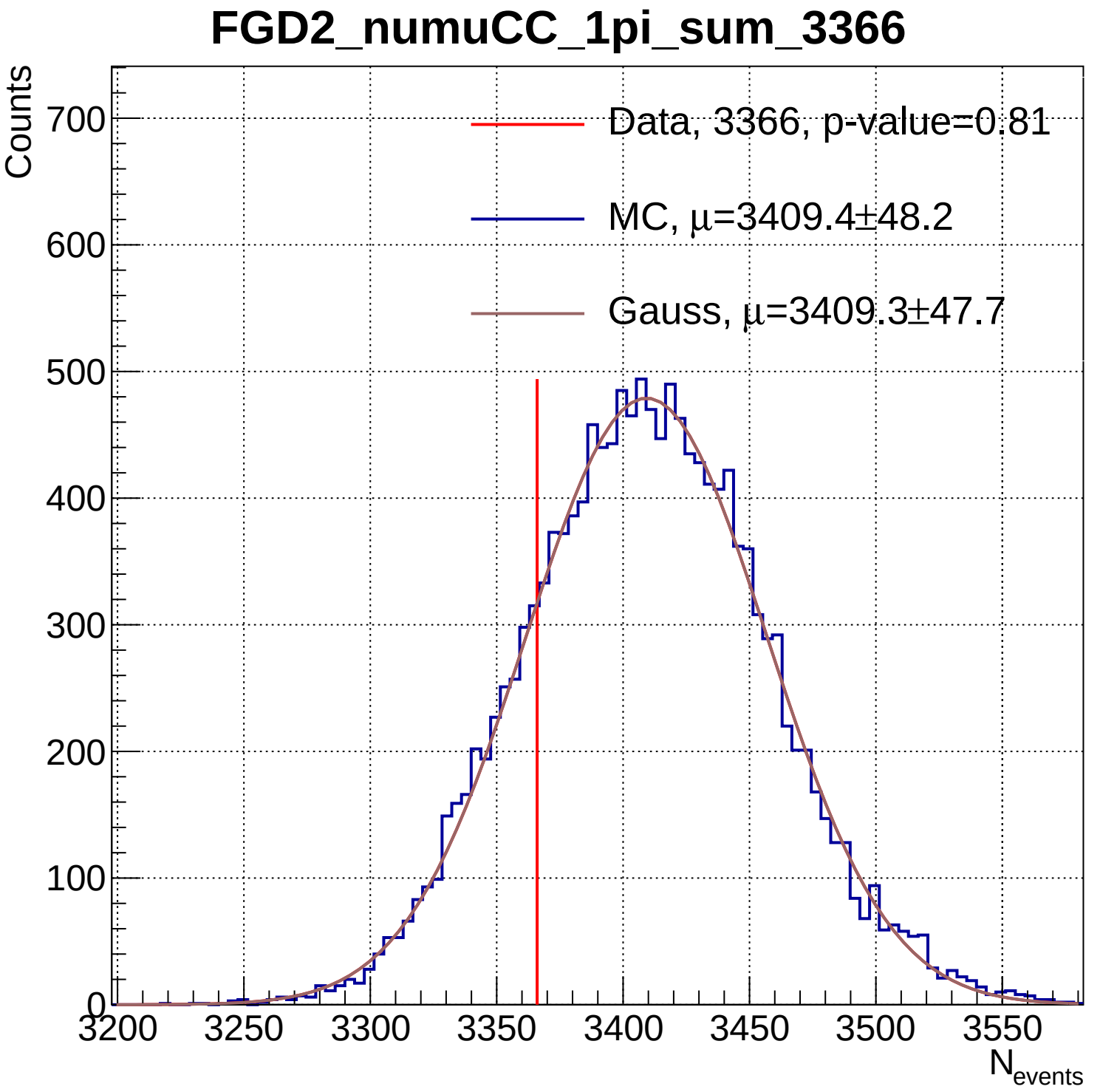

DataPredFluc
FGD2 ν_μCC 1π
p = 0.089
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
190
185
180
175
170
165
160
155
150
100
120
140
160
180
200
220
12
10
8
6
4
2
0

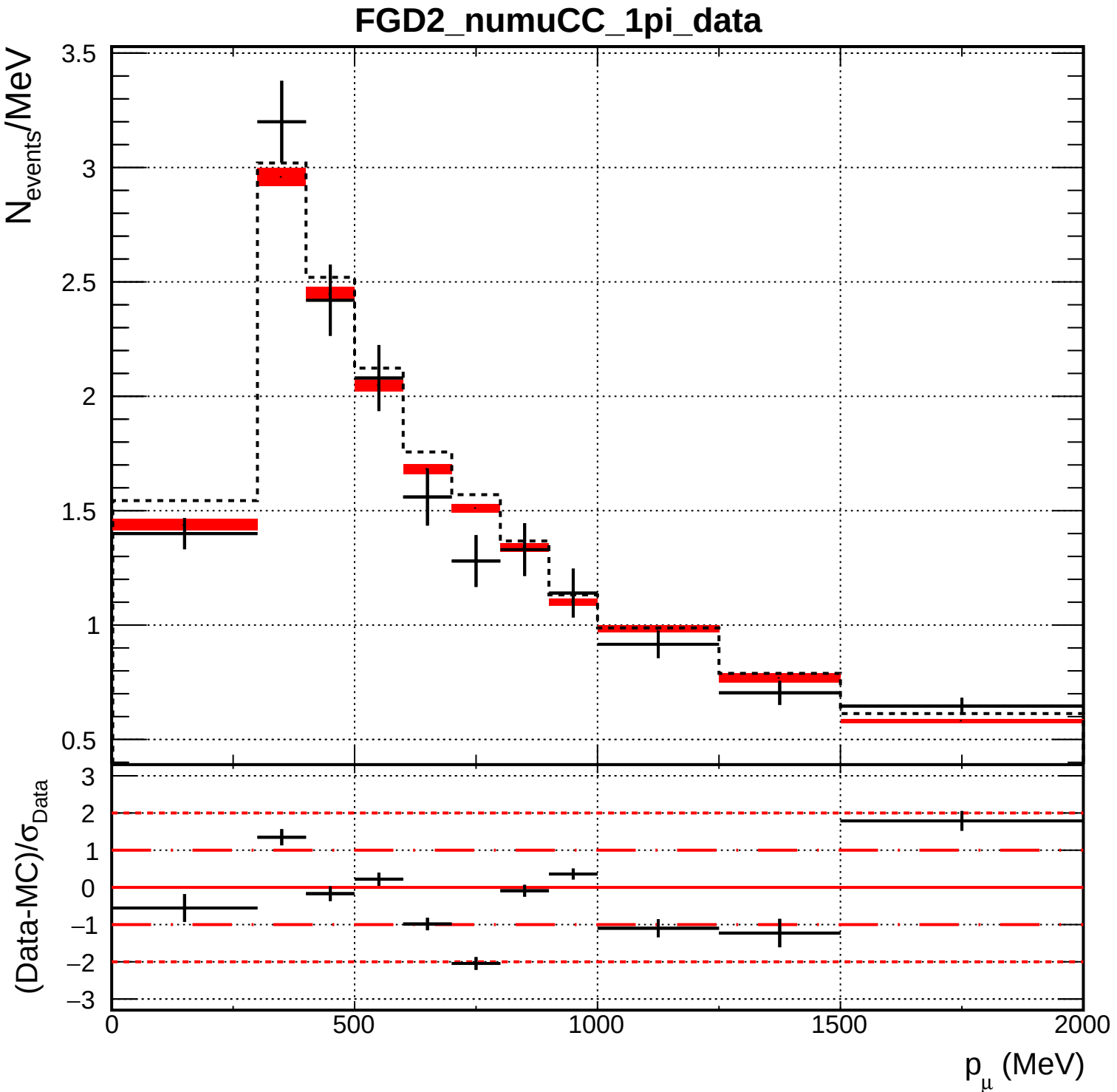

FGD2_numuCC_1pi_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

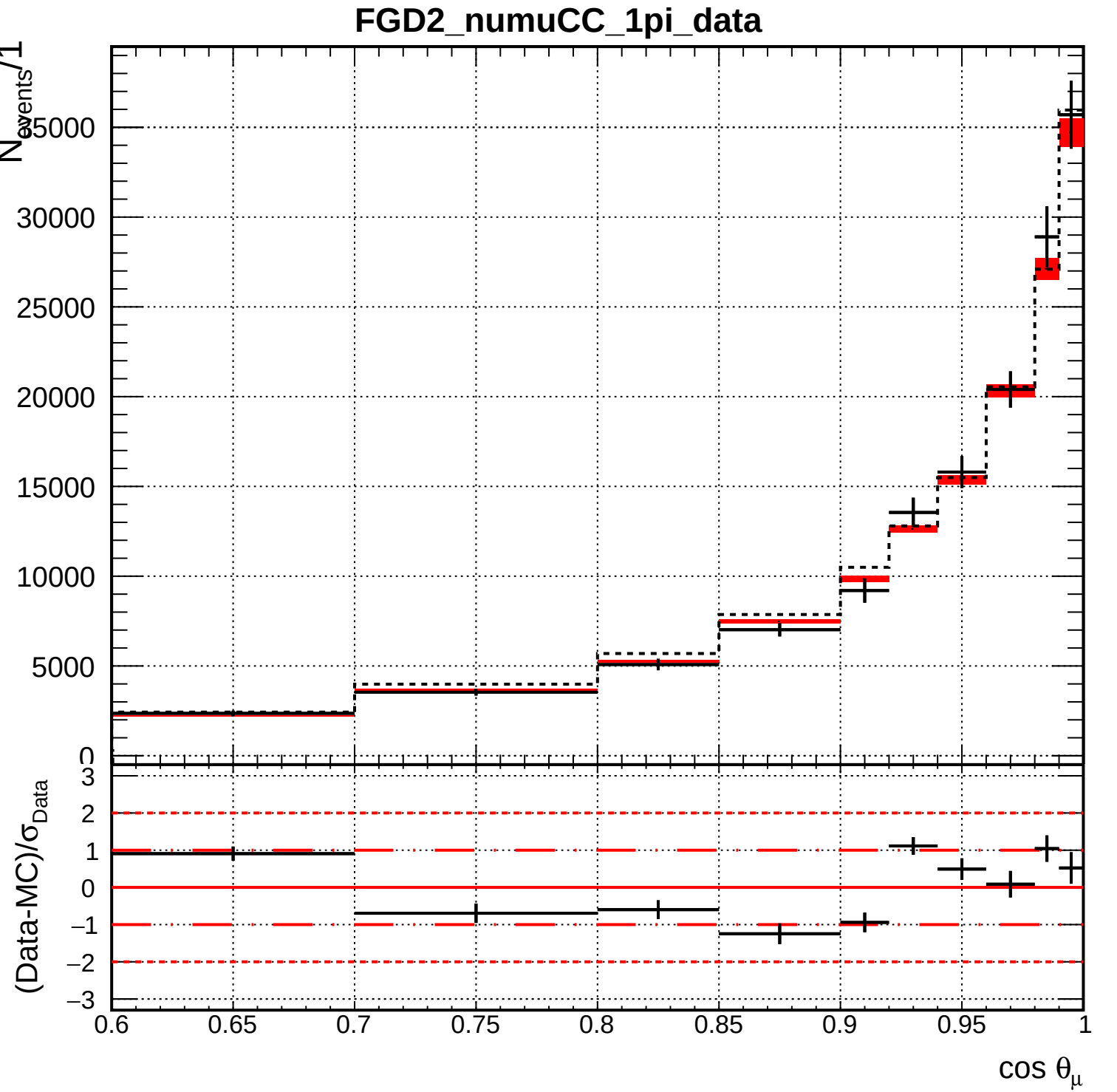

FGD2_numuCC_1pi_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

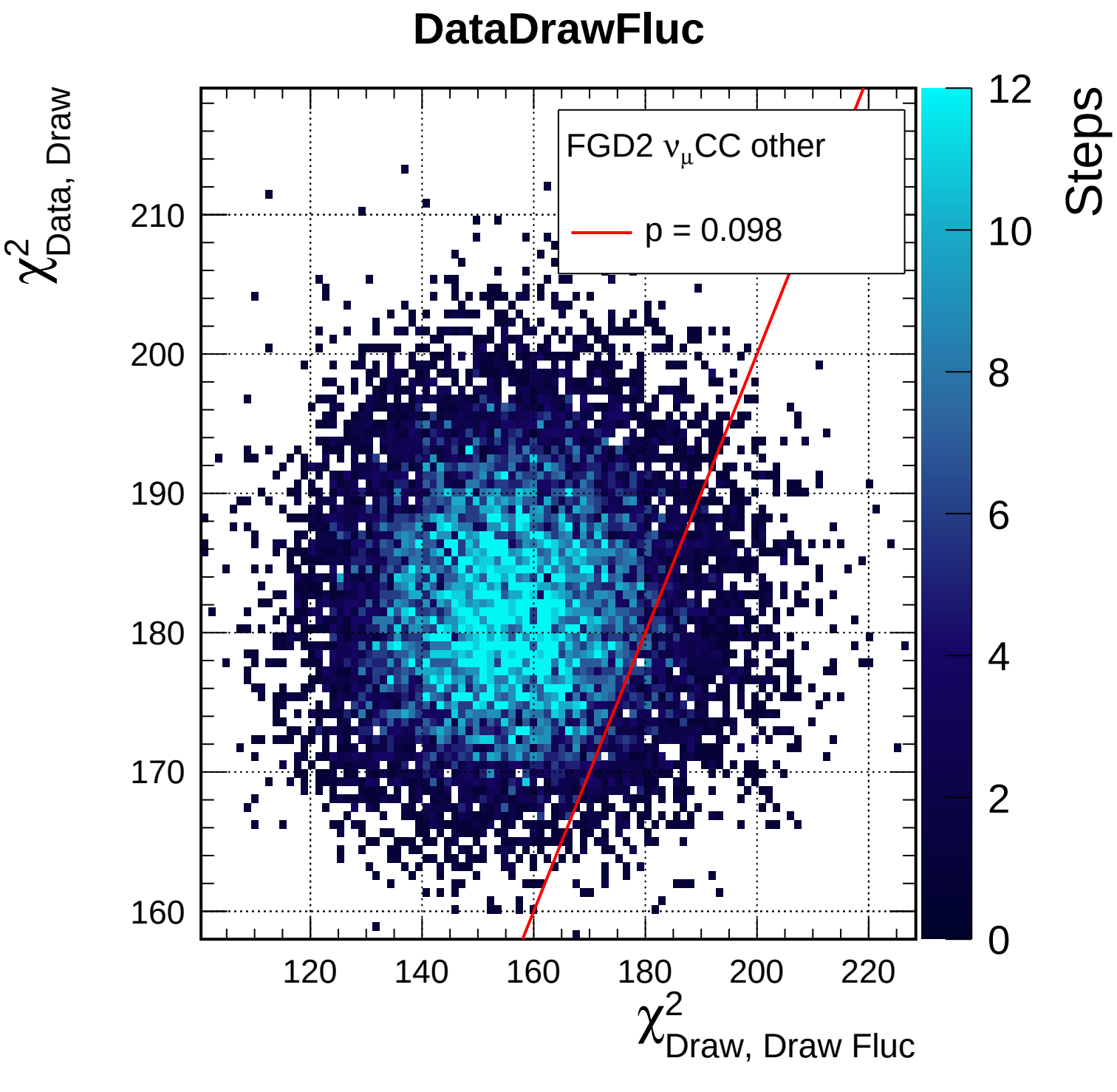

FGD2_numuCC_1pi_MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
χ²Sample
5
4
3
2
1
0

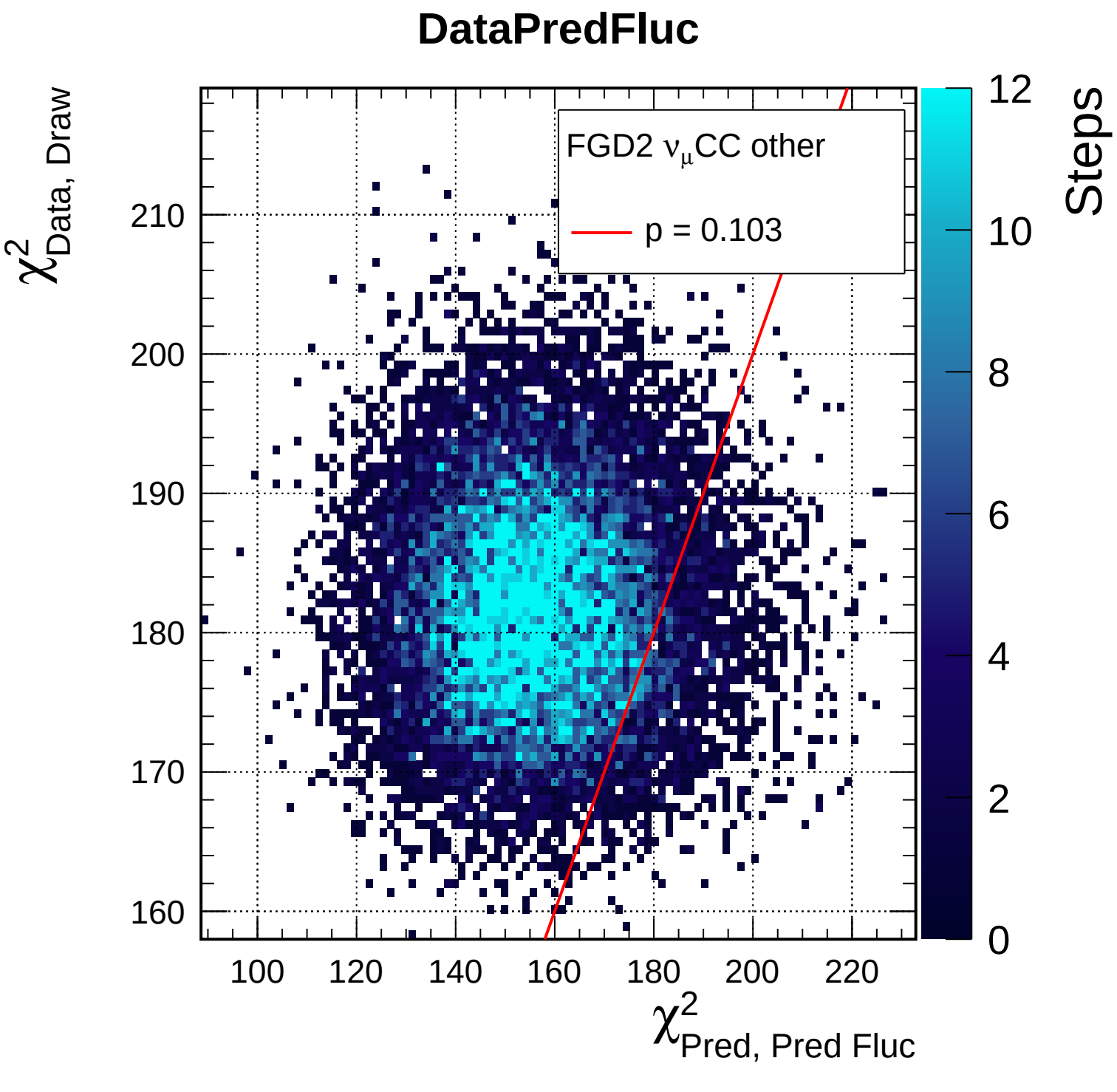

FGD2_numuCC_1pi_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
χ²Sample
5
4
3
2
1
0

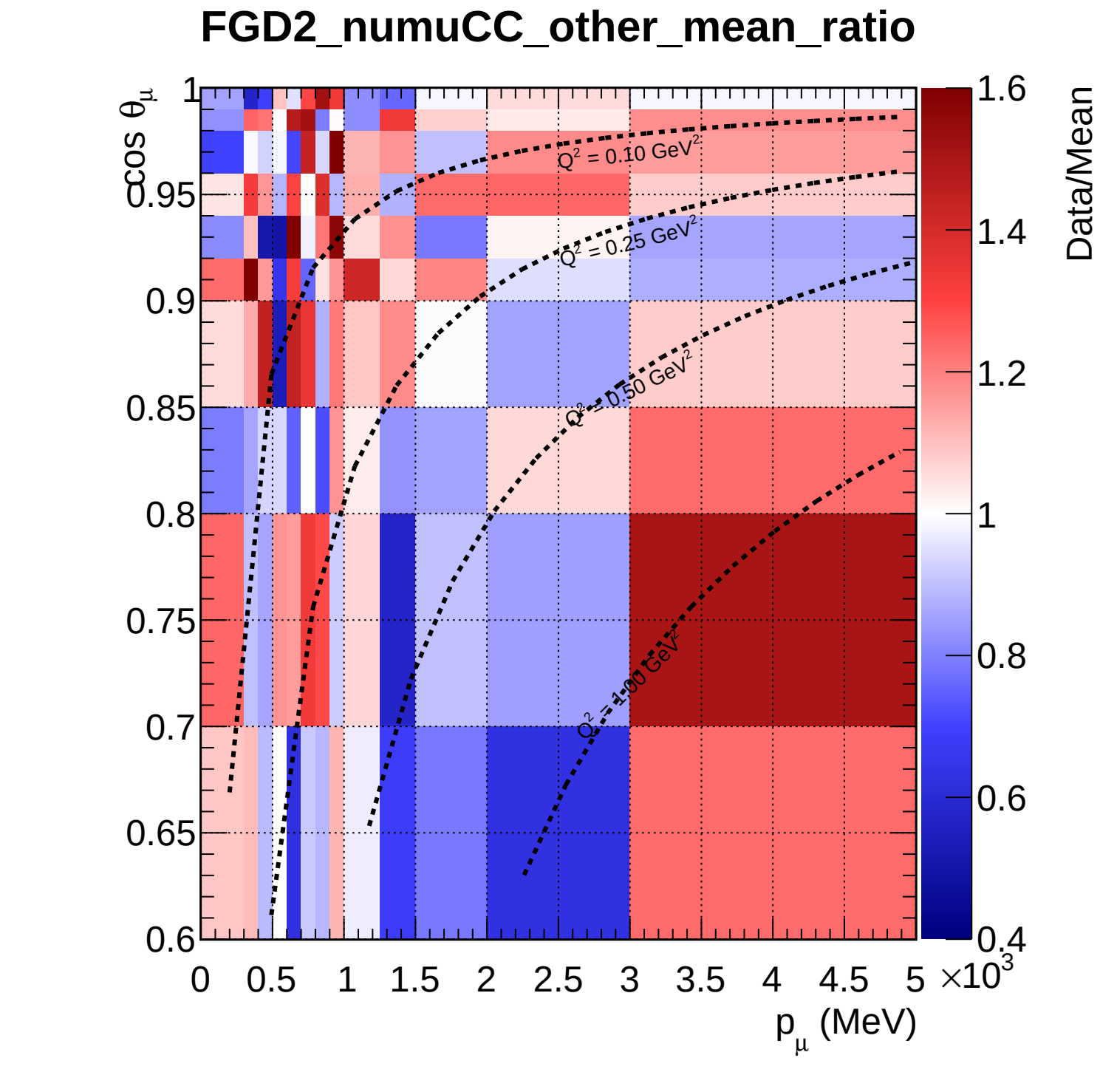

FGD2_numuCC_1pi_sum_3366
Counts
Data, 3366, p-value=0.81
MC, μ=3409.4±48.2
Gauss, μ=3409.3±47.7
700
600
500
400
300
200
100
0
3200
3250
3300
3350
3400
3450
3500
3550
N events

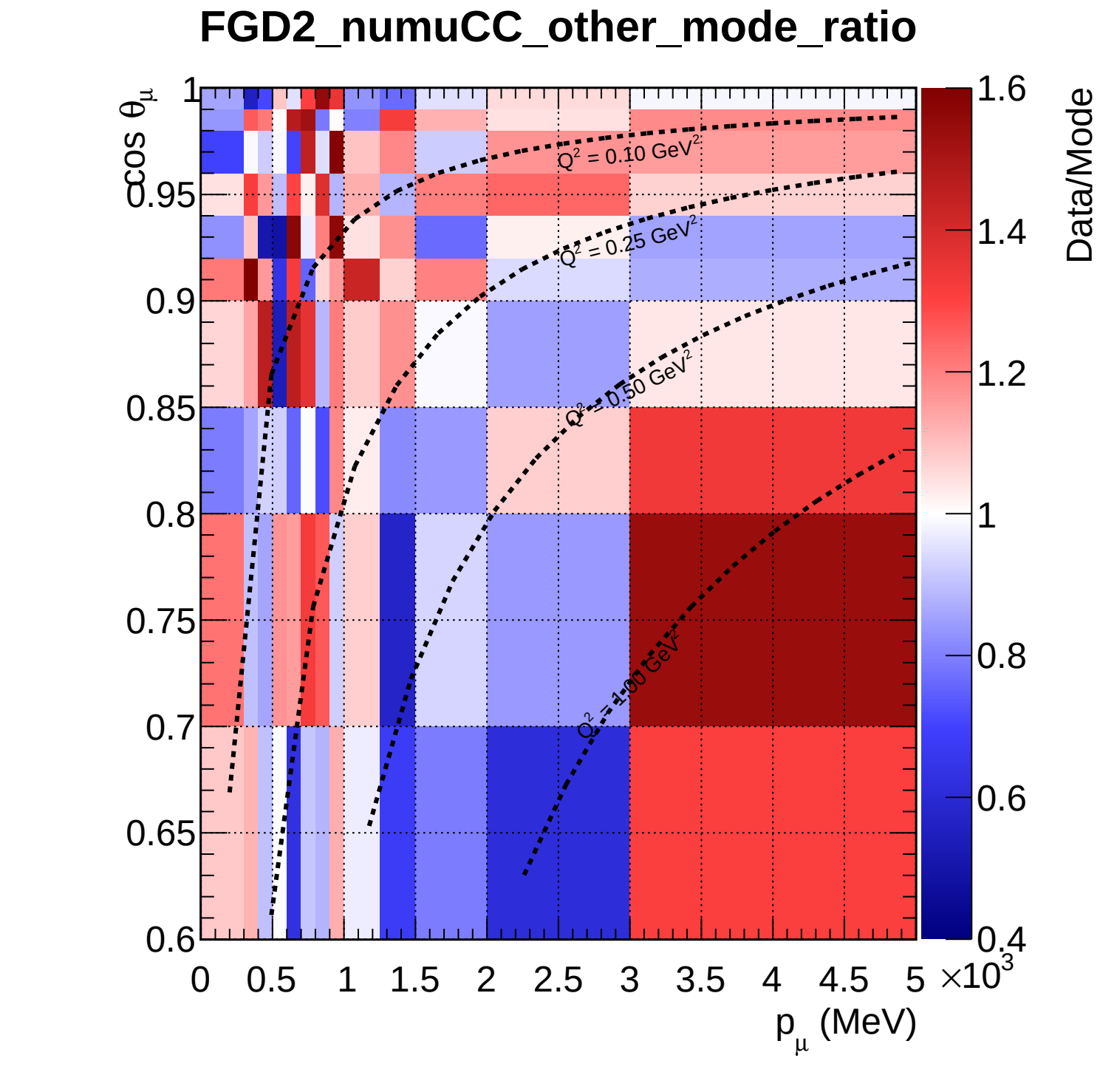

FGD2_numuCC_1pi_data
N_events/MeV
3.5
3
2.5
2
1.5
1
0.5
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
500
1000
1500
2000
p_μ (MeV)

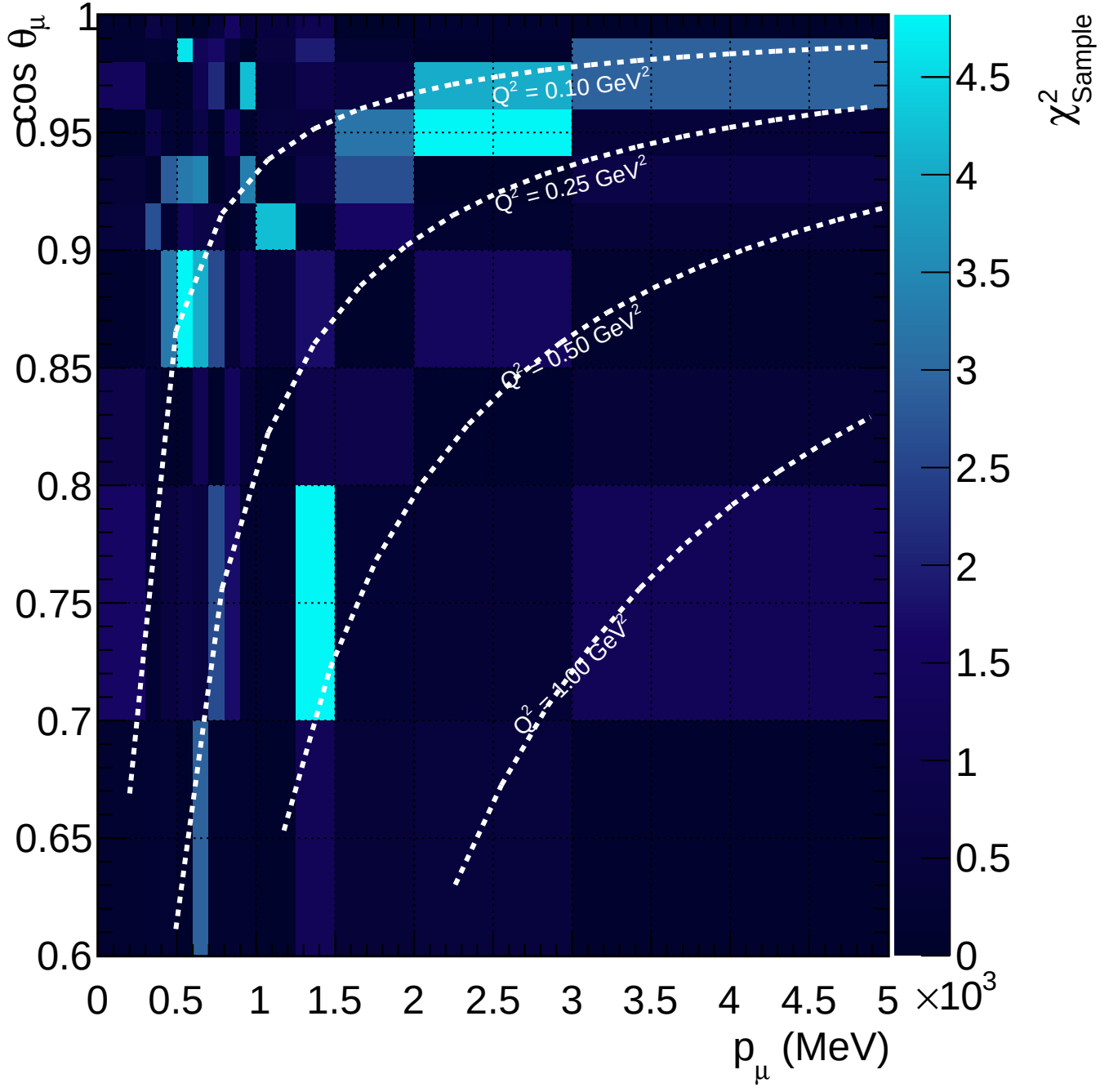

FGD2_numuCC_1pi_data
N_events/1
35000
30000
25000
20000
15000
10000
5000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

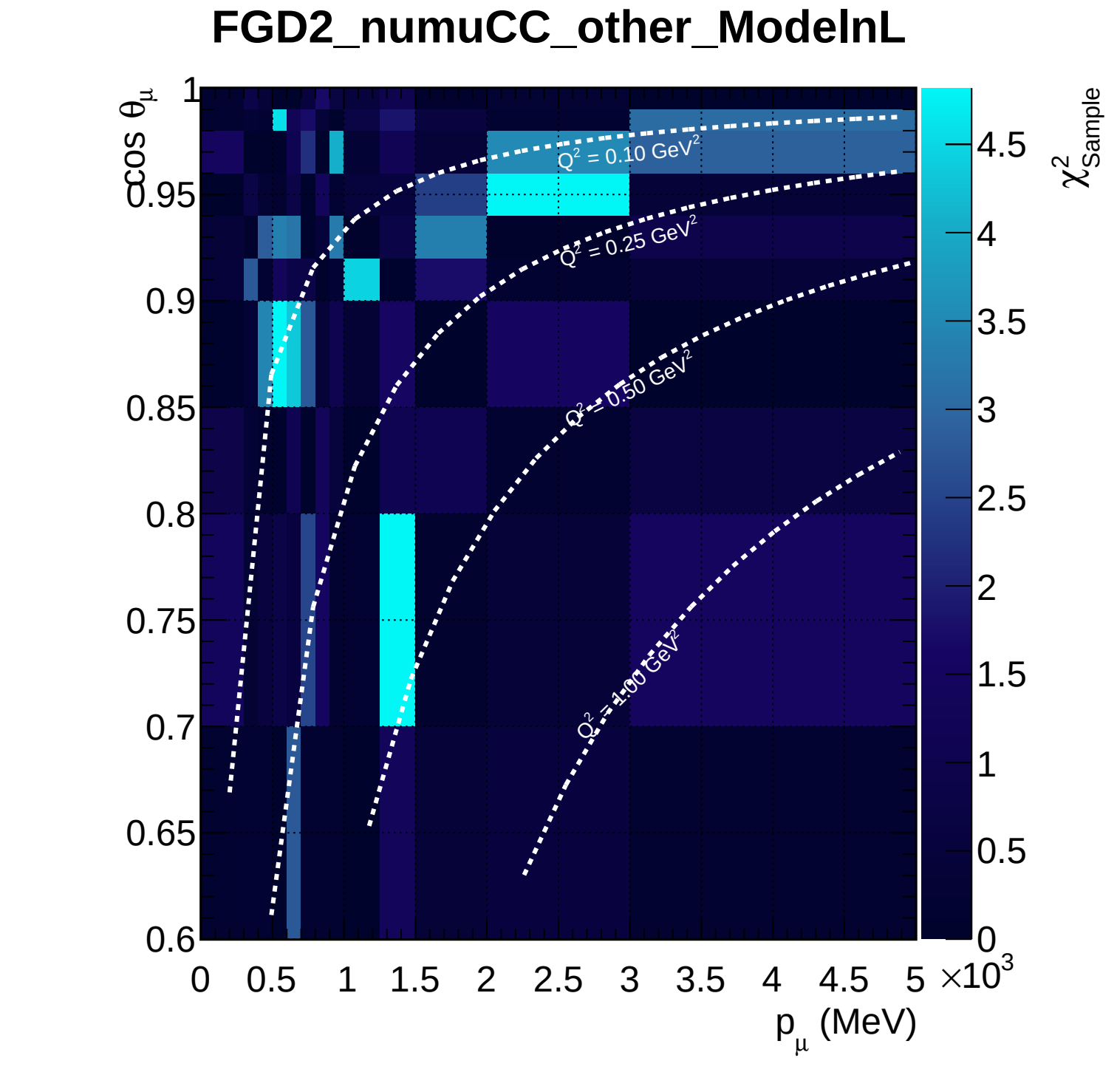

DataDrawFluc
FGD2 ν_μCC other
p = 0.098
$\chi^2_{Data,\ Draw}$
$\chi^2_{Draw,\ Draw\ Fluc}$
Steps
210
200
190
180
170
160
120
140
160
180
200
220
12
10
8
6
4
2
0

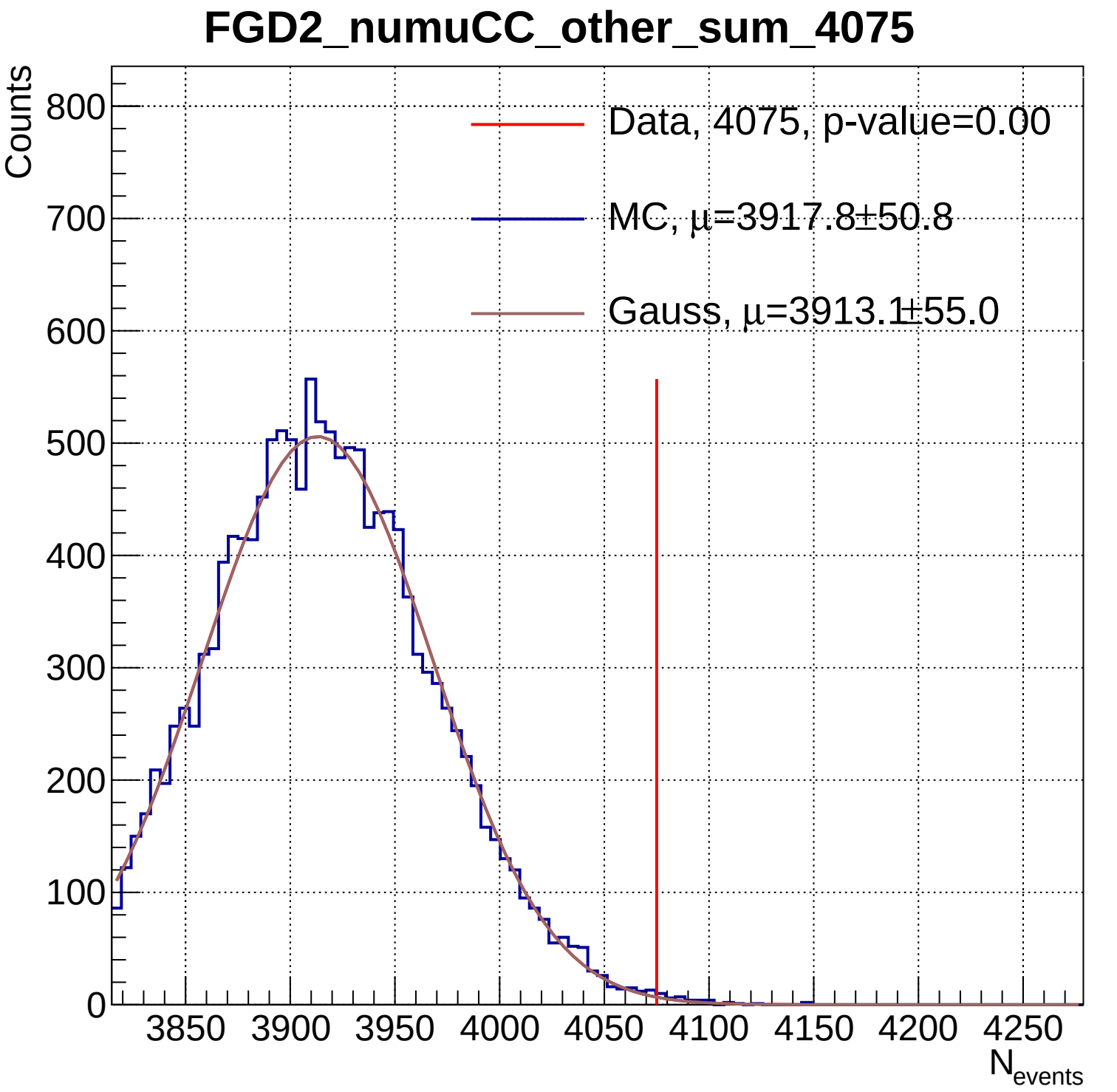

DataPredFluc
FGD2 ν_μCC other
p = 0.103
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
210
200
190
180
170
160
100
120
140
160
180
200
220
12
10
8
6
4
2
0

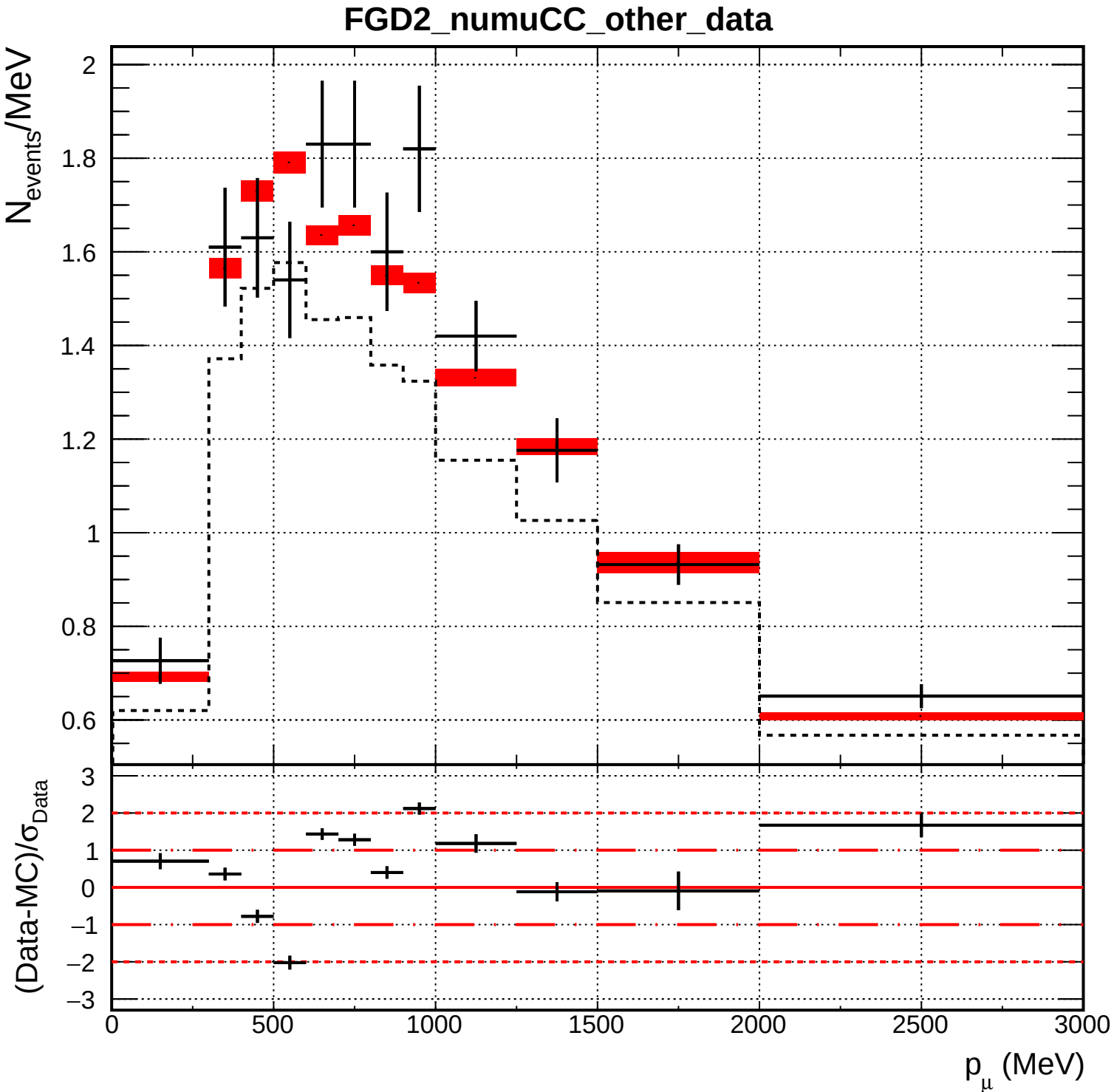

FGD2_numuCC_other_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

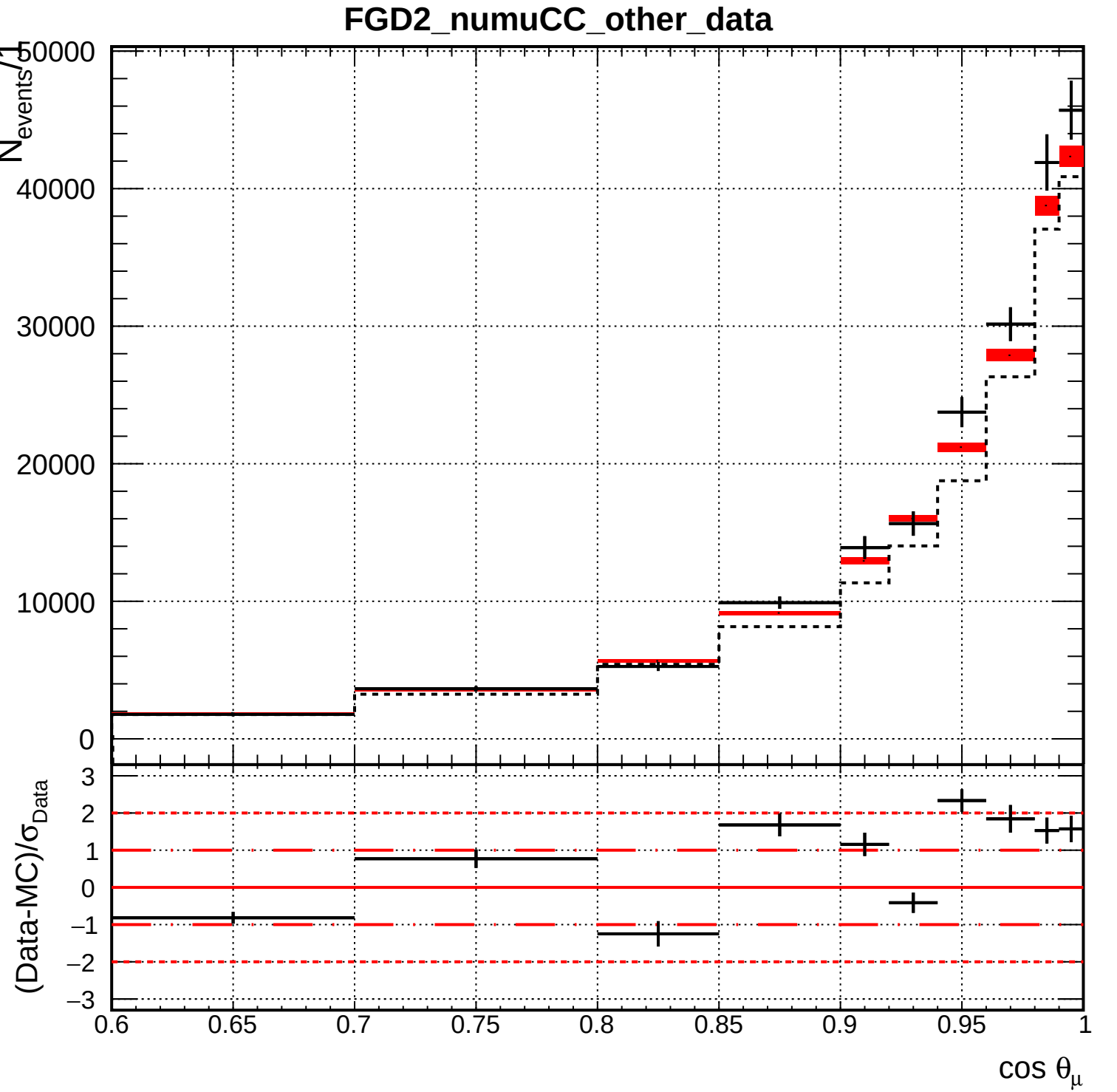

FGD2_numuCC_other_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

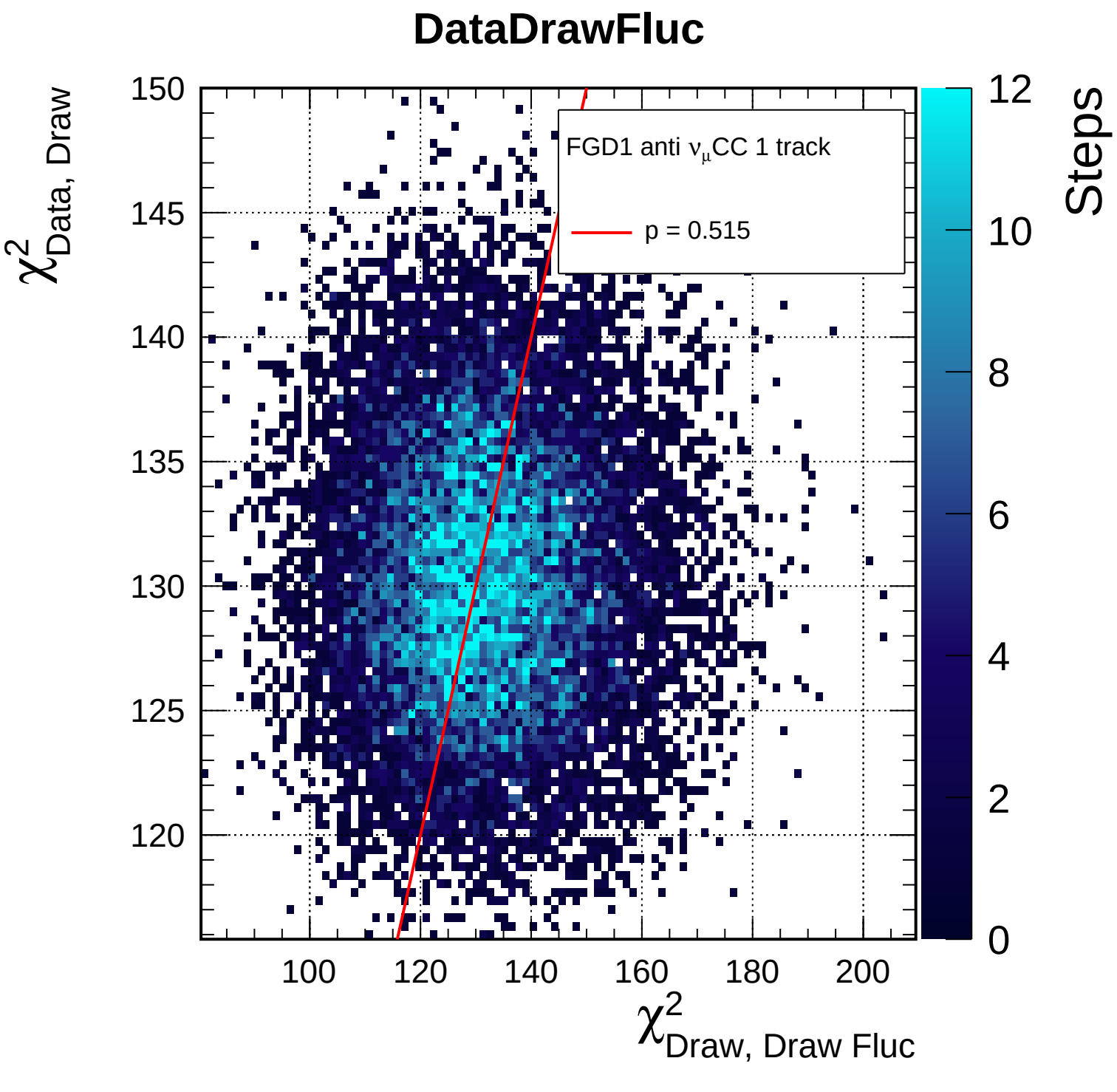

FGD2_numuCC_other_MeanInL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
χ²Sample
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

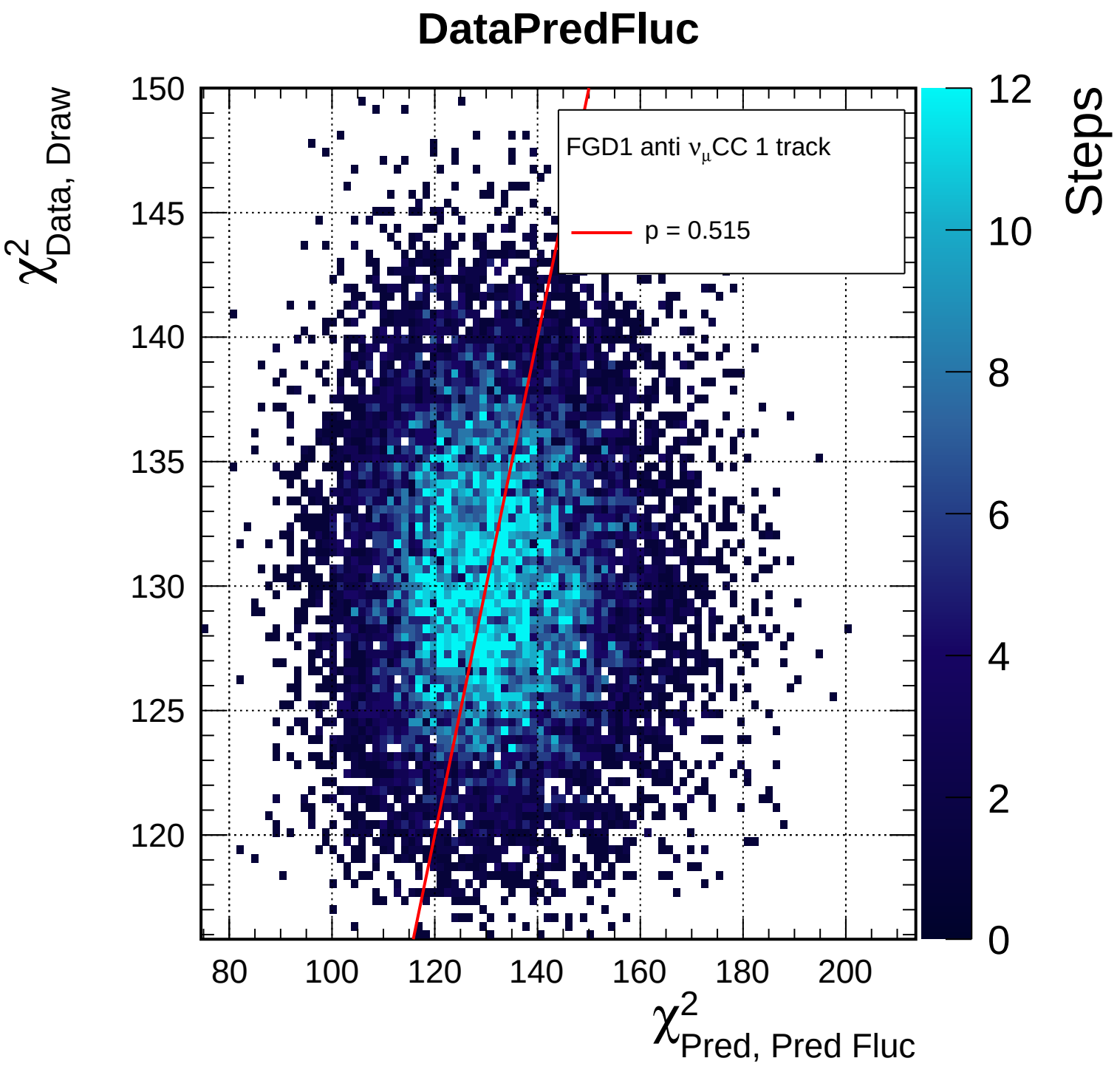

FGD2_numuCC_other_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
×10³
pμ (MeV)
χ²Sample
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

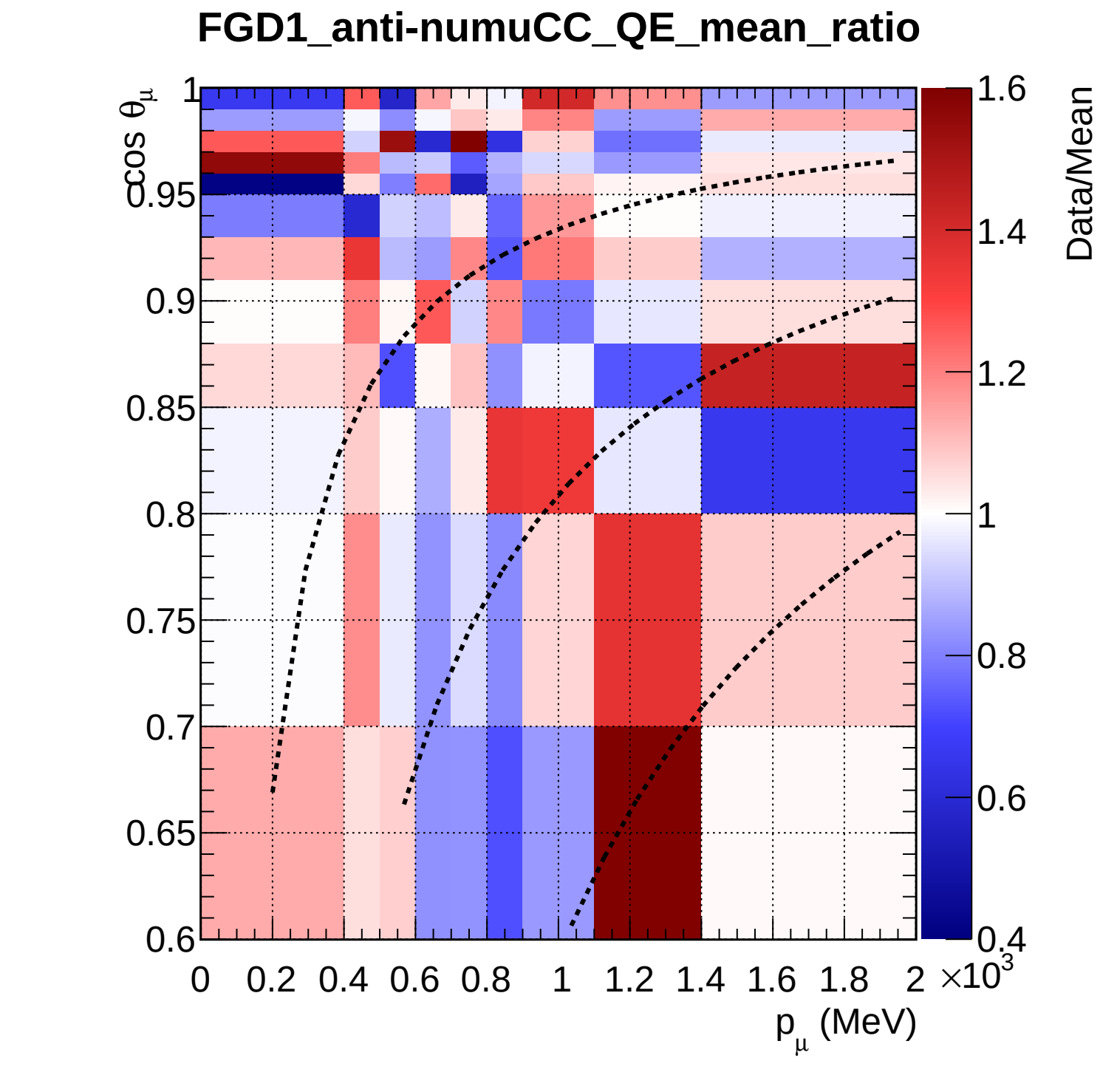

FGD2_numuCC_other_sum_4075
Counts
Data, 4075, p-value=0.00
MC, μ=3917.8±50.8
Gauss, μ=3913.1±55.0
0
100
200
300
400
500
600
700
800
3850
3900
3950
4000
4050
4100
4150
4200
4250
N events

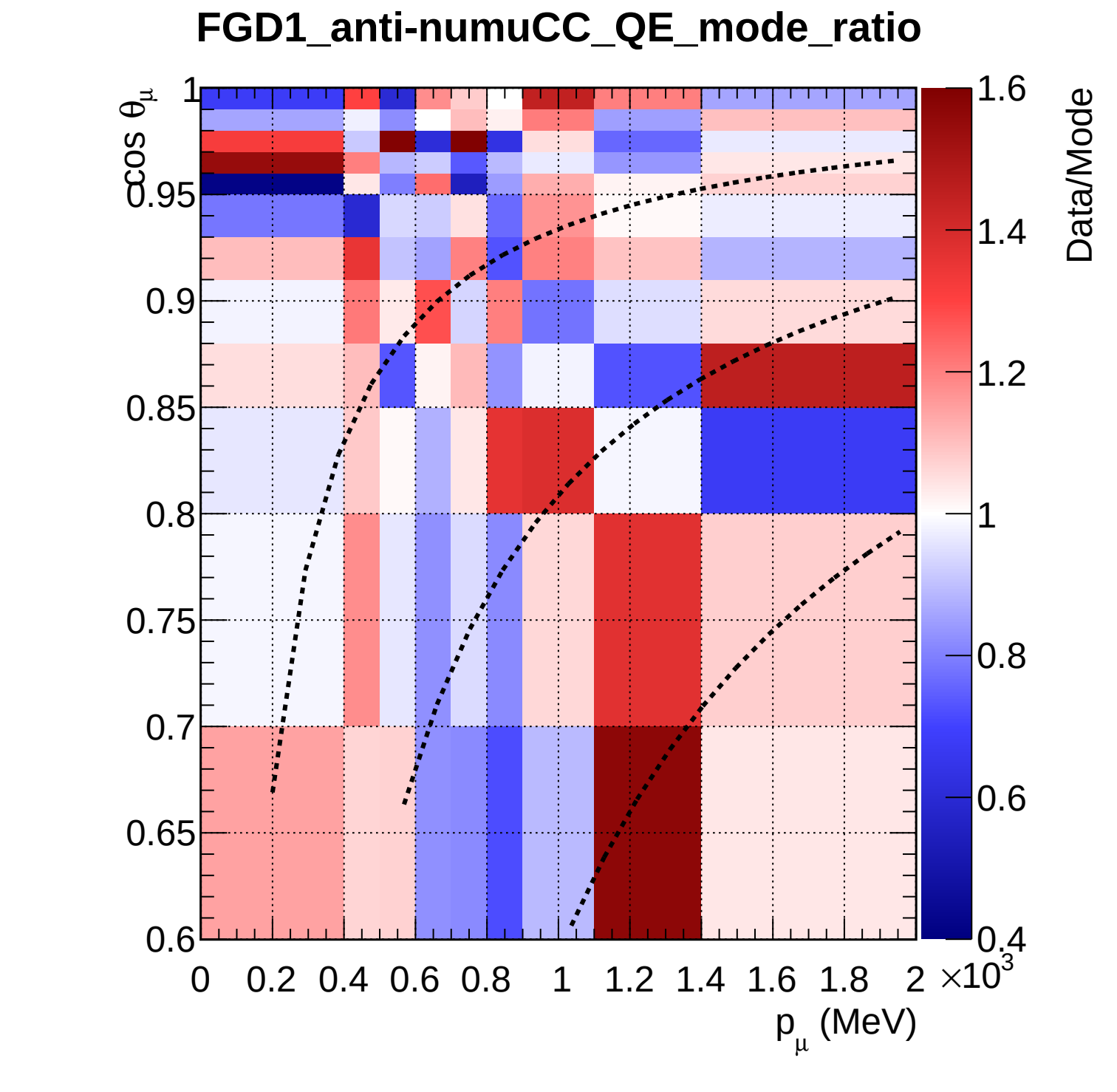

FGD2_numuCC_other_data
N_events/MeV
2
1.8
1.6
1.4
1.2
1
0.8
0.6
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
500
1000
1500
2000
2500
3000
p_μ (MeV)

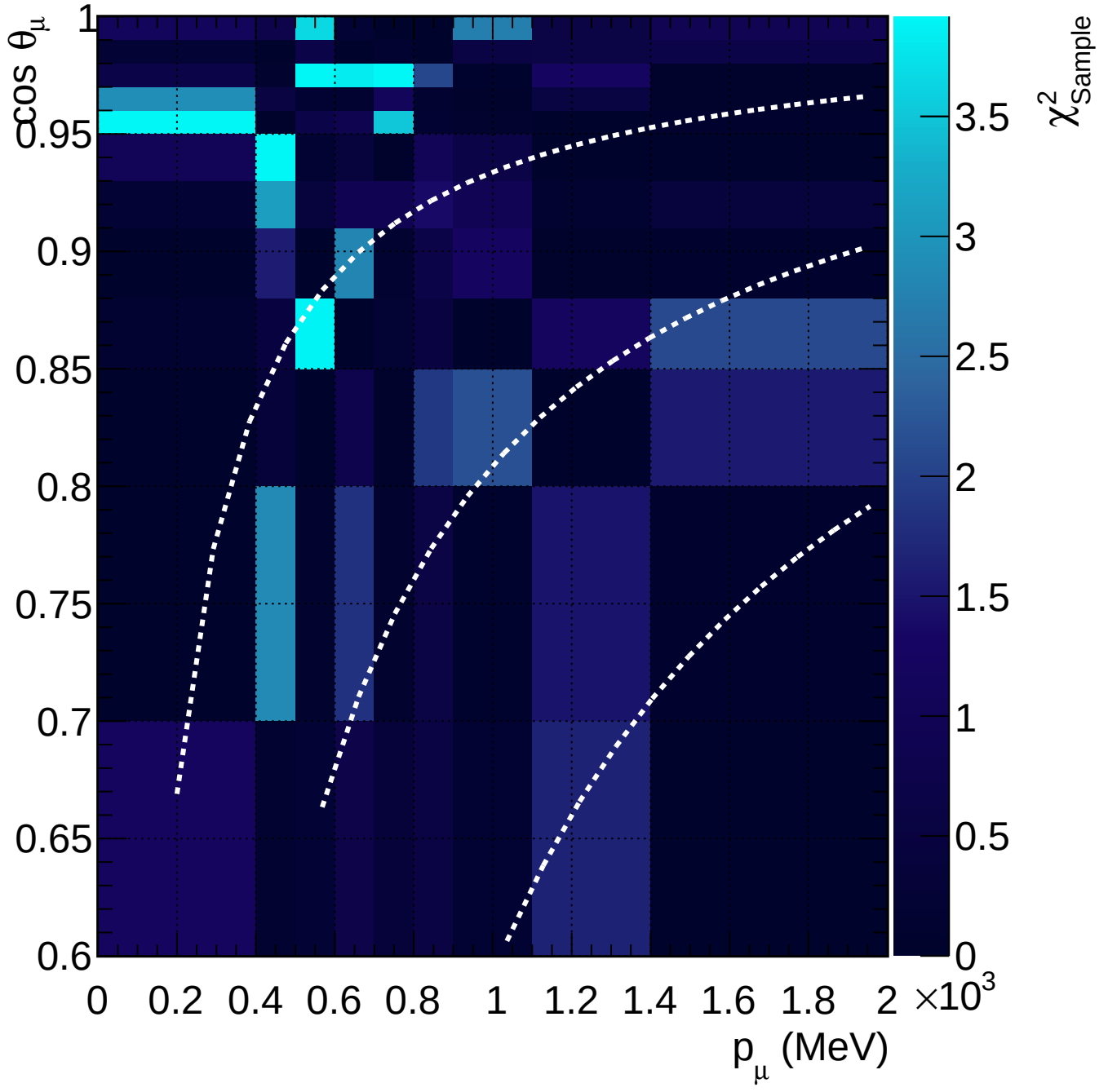

FGD2_numuCC_other_data
N_events/1
50000
40000
30000
20000
10000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

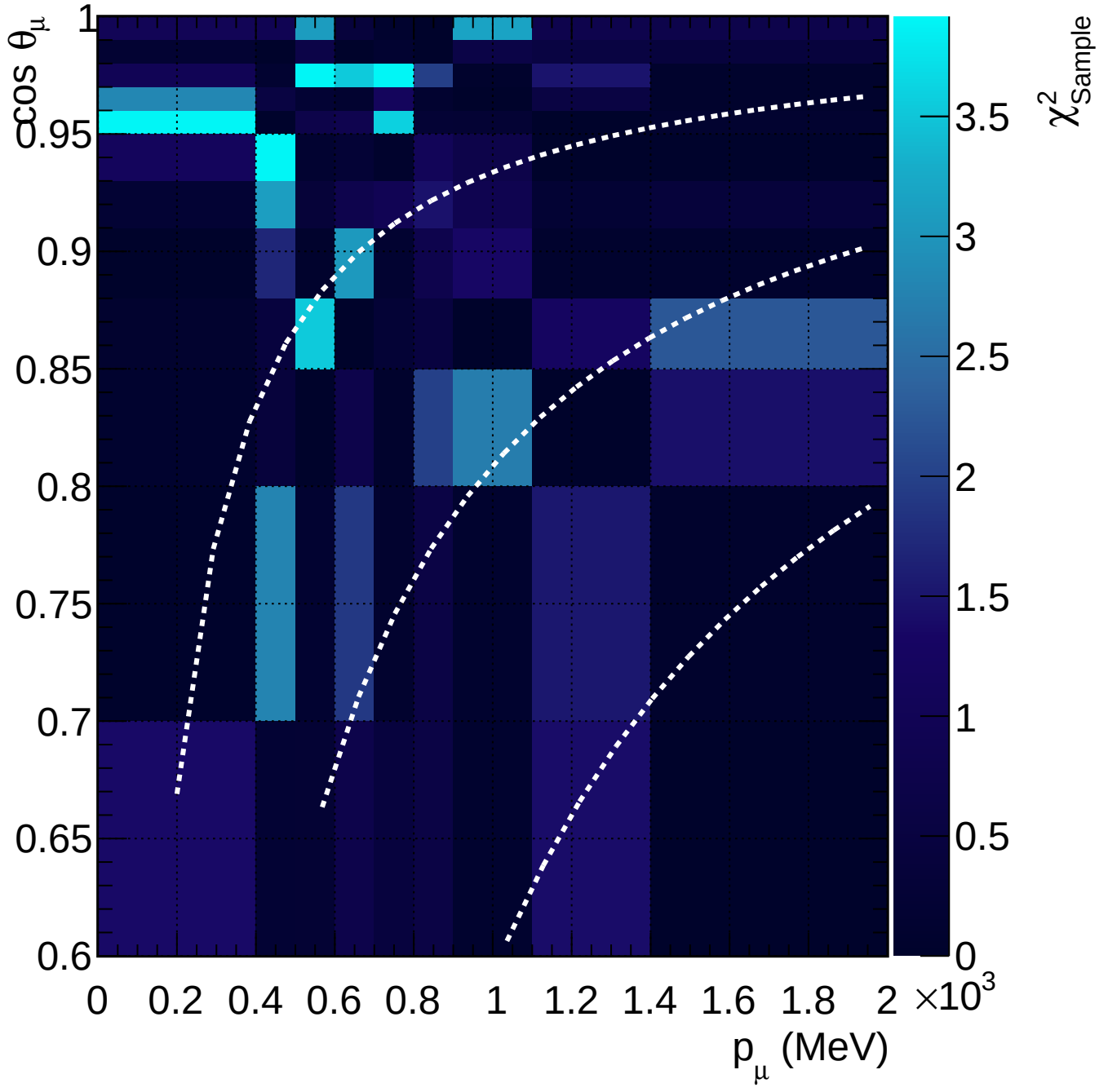

DataDrawFluc
FGD1 anti ν_μCC 1 track
p = 0.515
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
150
145
140
135
130
125
120
100
120
140
160
180
200
12
10
8
6
4
2
0

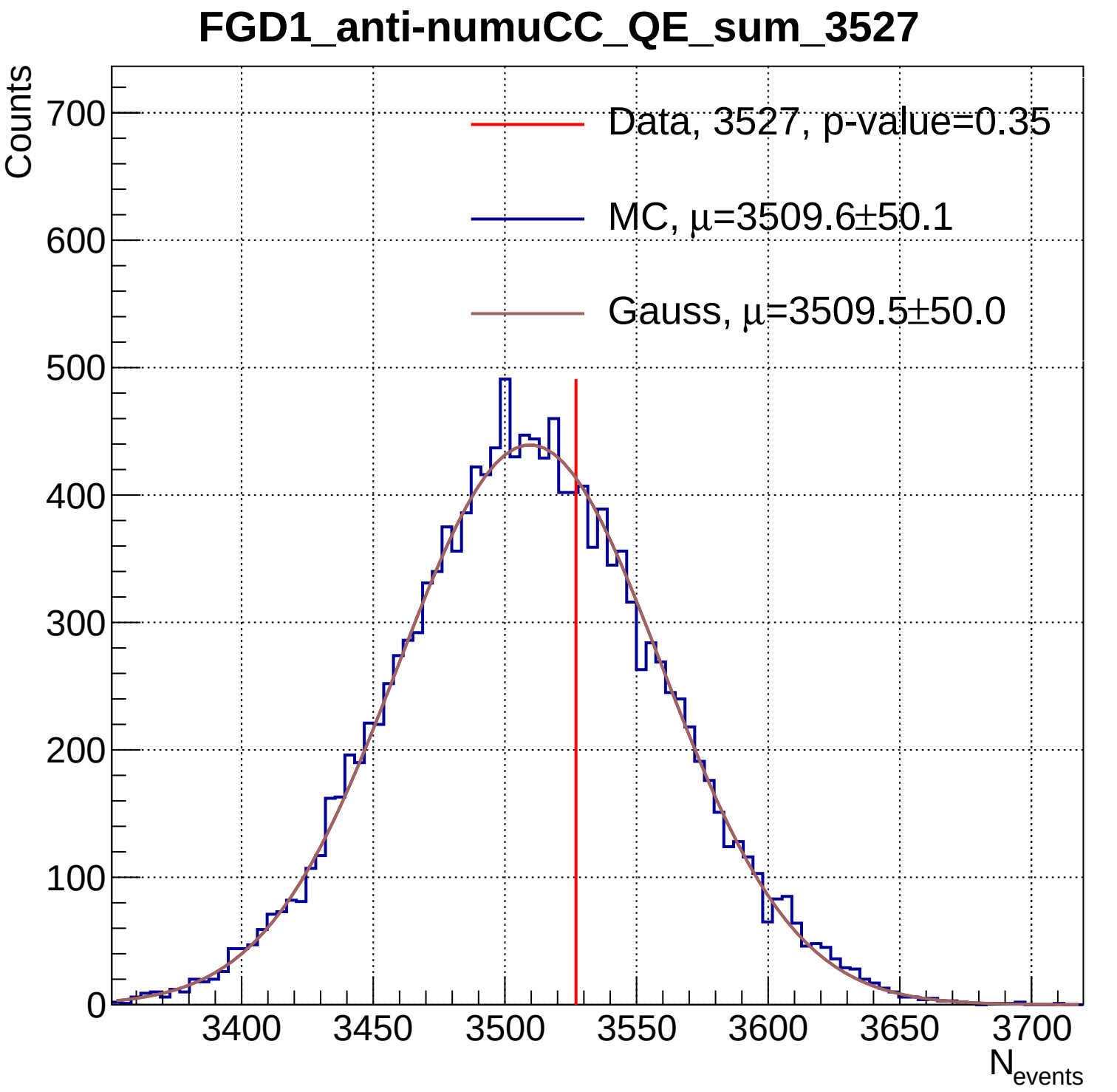

DataPredFluc
FGD1 anti ν_μCC 1 track
p = 0.515
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
150
145
140
135
130
125
120
80
100
120
140
160
180
200
12
10
8
6
4
2
0

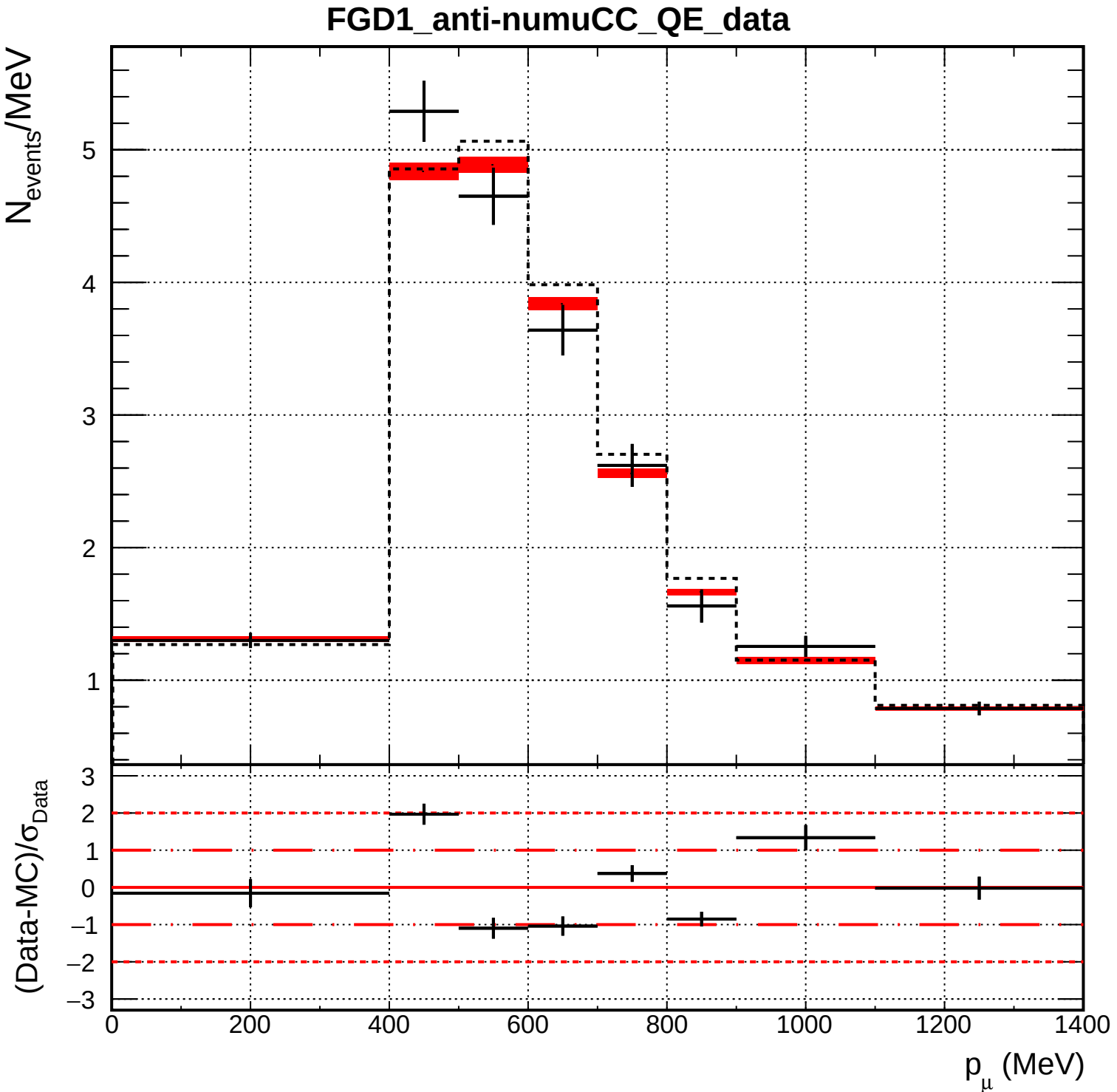

FGD1_anti-numuCC_QE_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

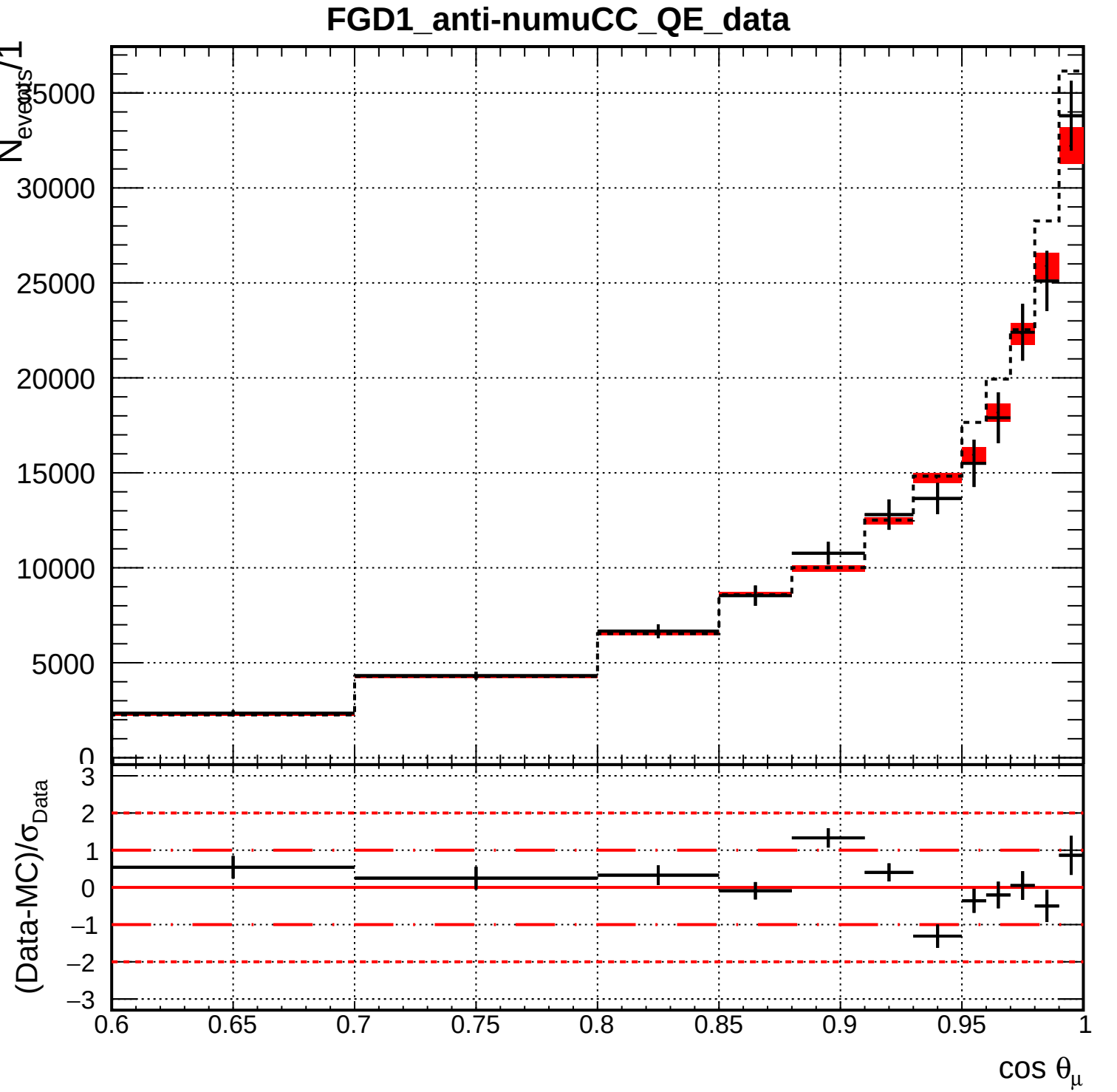

FGD1_anti-numuCC_QE_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

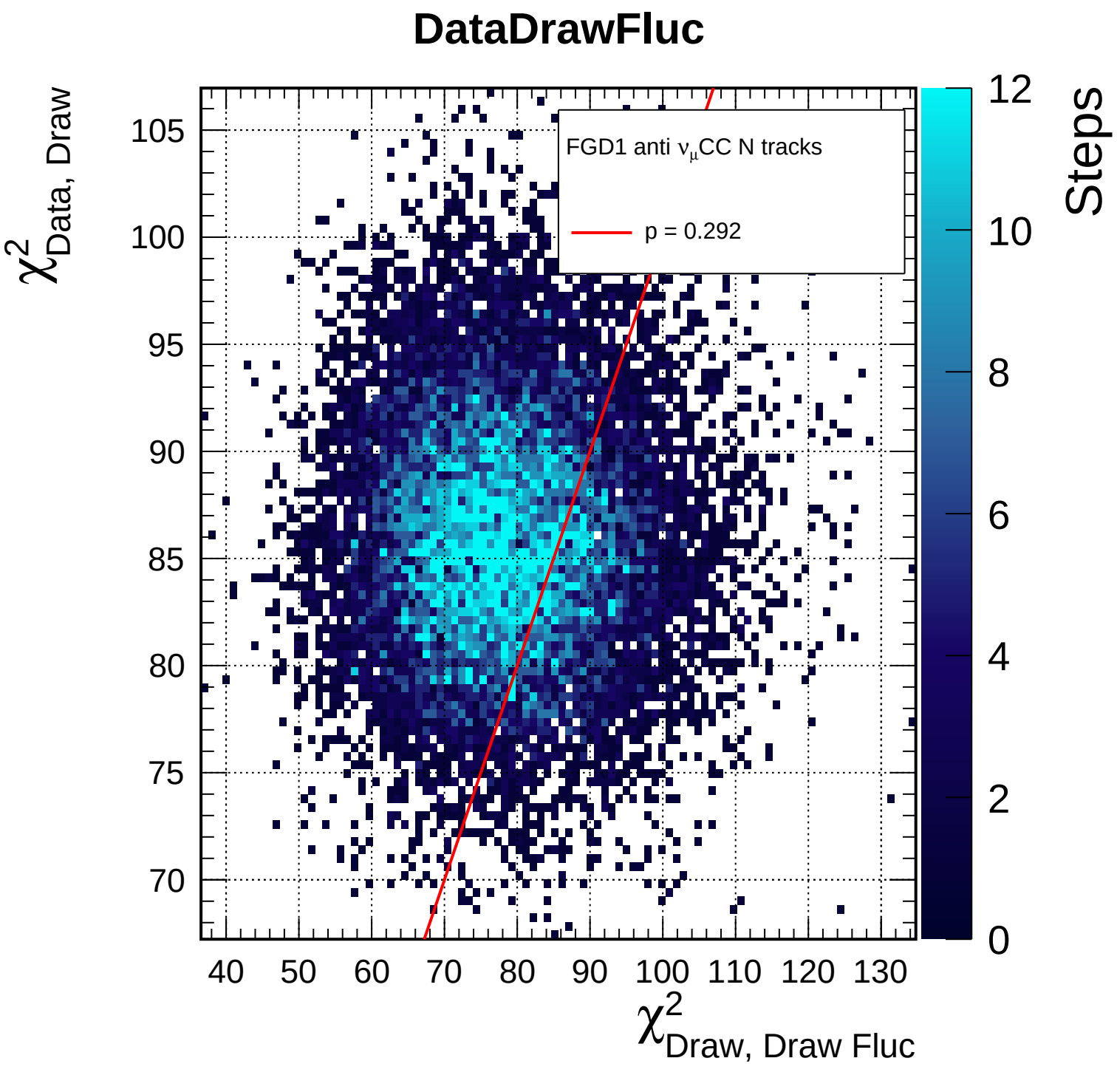

FGD1_anti-numuCC_QE_MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
χ²Sample
3.5
3
2.5
2
1.5
1
0.5
0

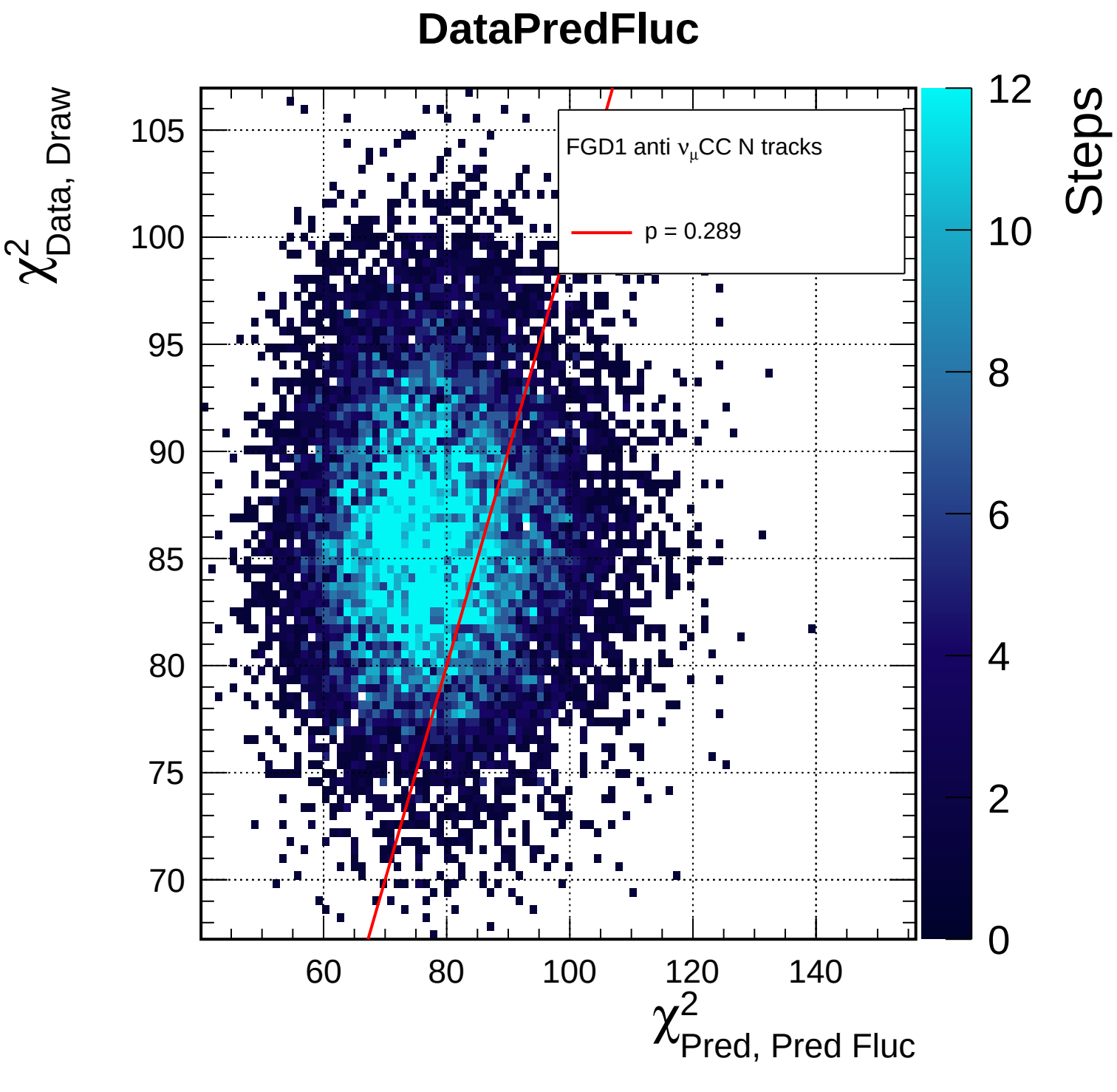

FGD1_anti-numuCC_QE_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
χ²Sample
3.5
3
2.5
2
1.5
1
0.5
0

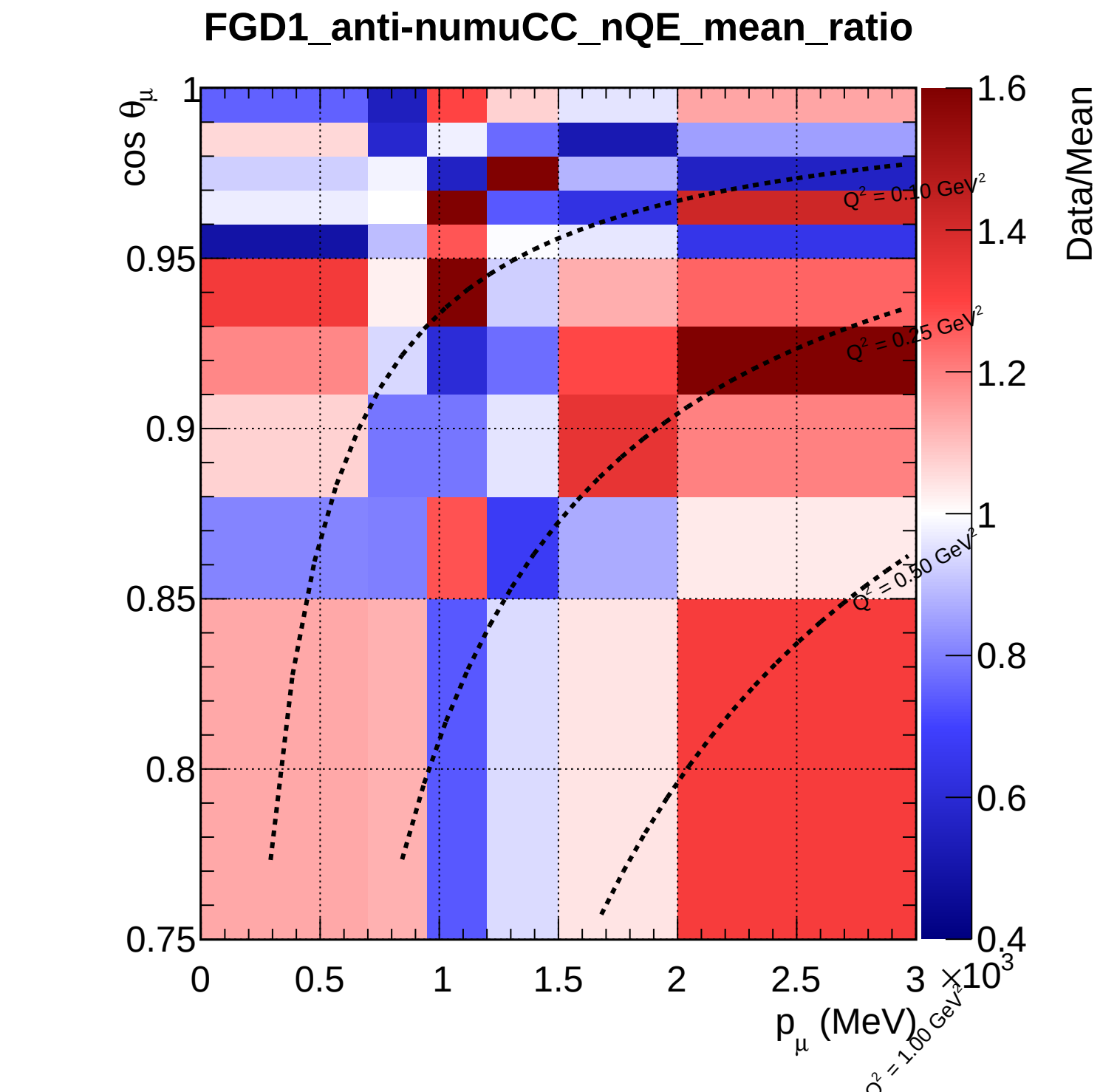

FGD1_anti-numuCC_QE_sum_3527
Counts
700
600
500
400
300
200
100
0
3400
3450
3500
3550
3600
3650
3700
N events
Data, 3527, p-value=0.35
MC, μ=3509.6±50.1
Gauss, μ=3509.5±50.0

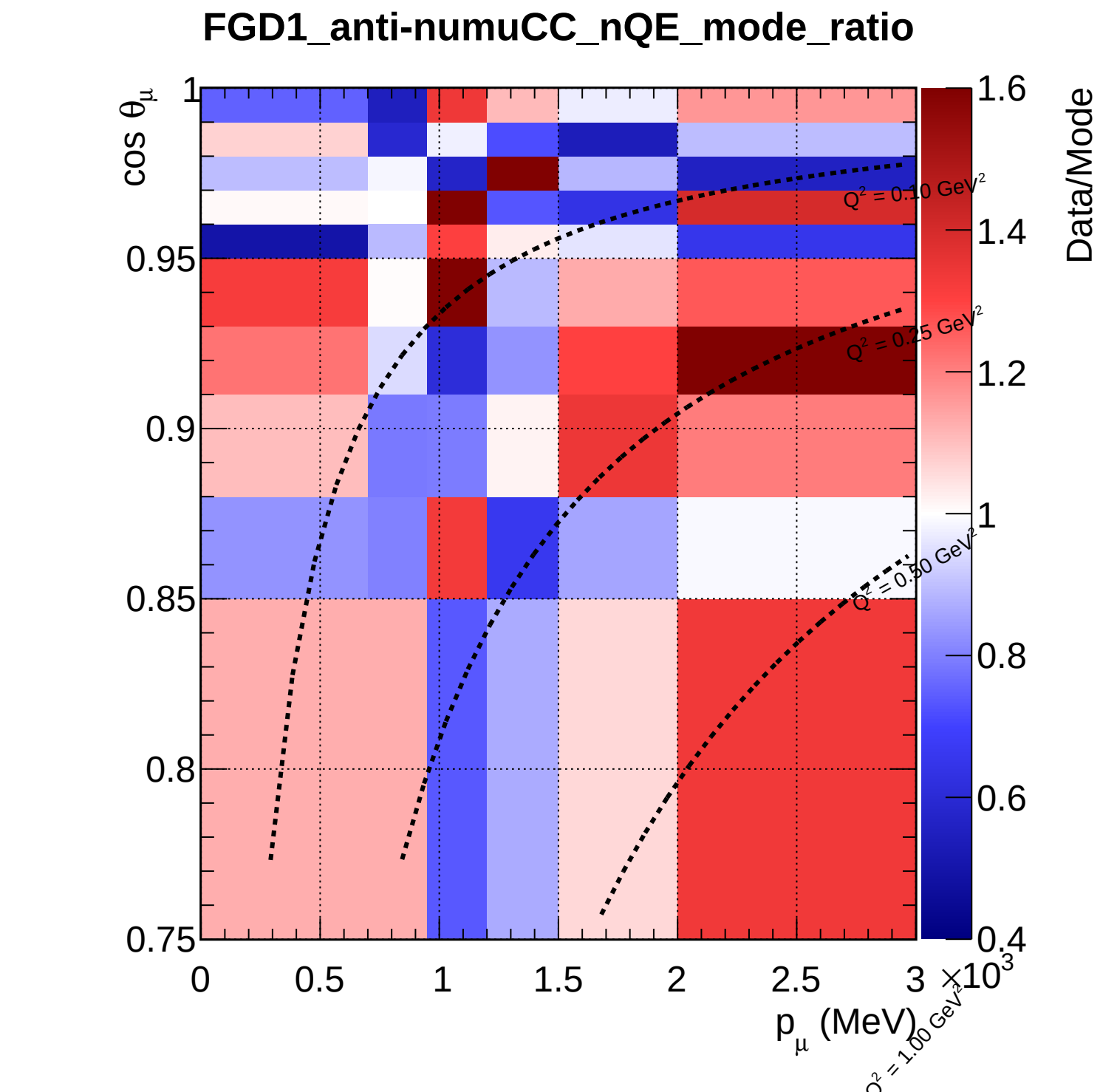

FGD1_anti-numuCC_QE_data
N_events/MeV
(Data-MC)/σ_Data
p_μ (MeV)
0
200
400
600
800
1000
1200
1400
1
2
3
4
5
−1
−2
−3

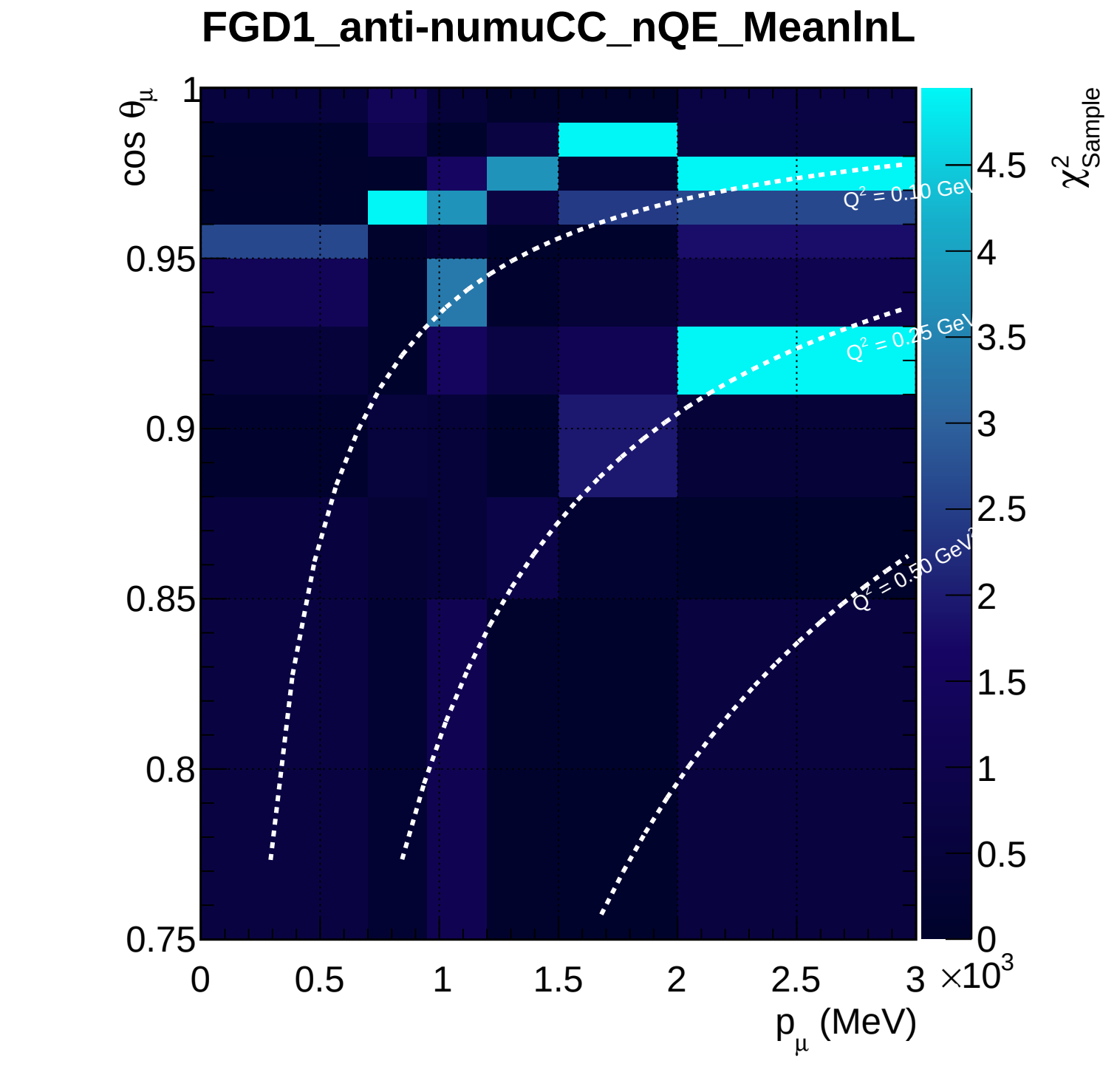

FGD1_anti-numuCC_QE_data
N_events/1
35000
30000
25000
20000
15000
10000
5000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

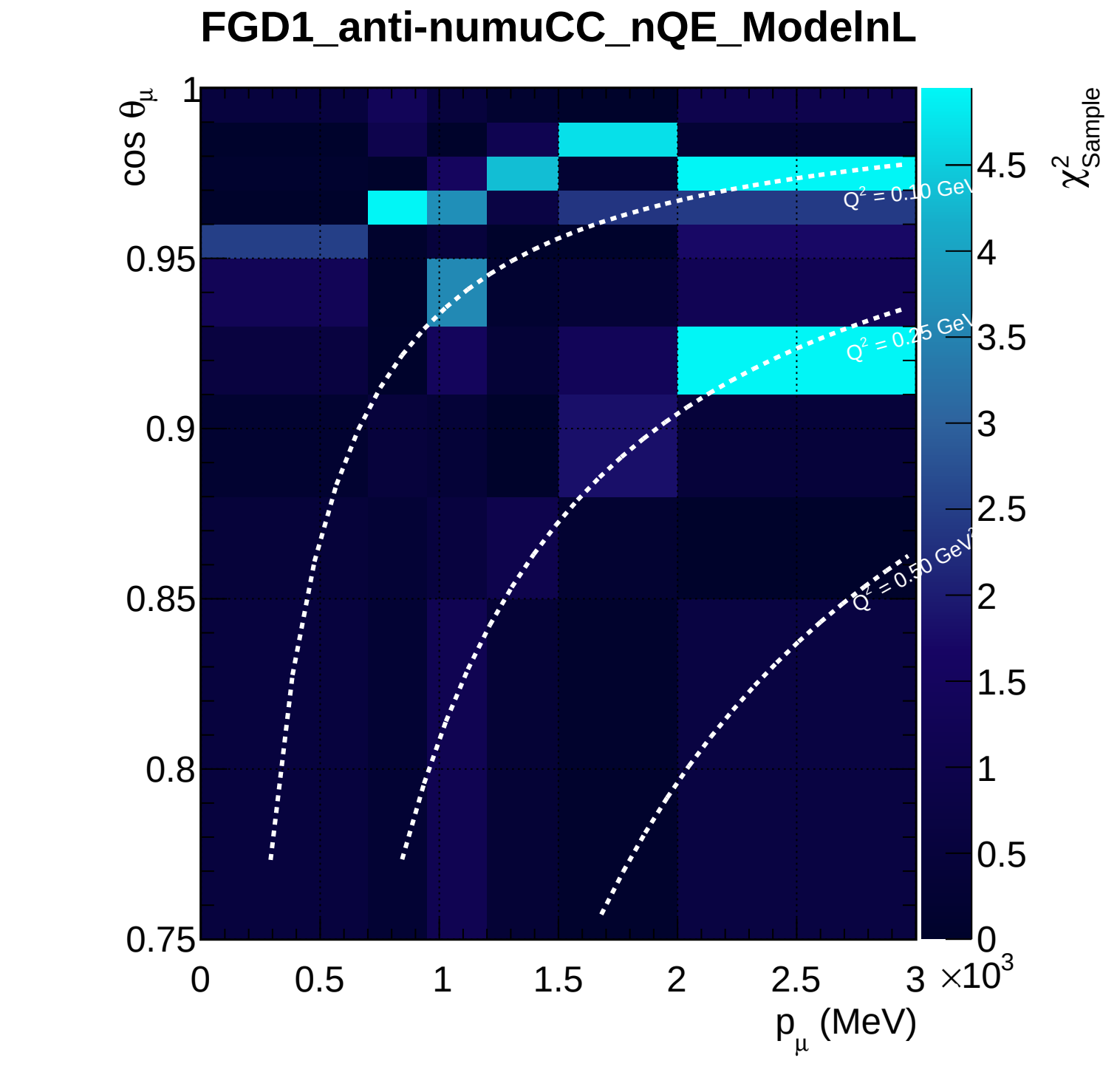

DataDrawFluc
FGD1 anti ν_μCC N tracks
p = 0.292
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
105
100
95
90
85
80
75
70
40
50
60
70
80
90
100
110
120
130
12
10
8
6
4
2
0

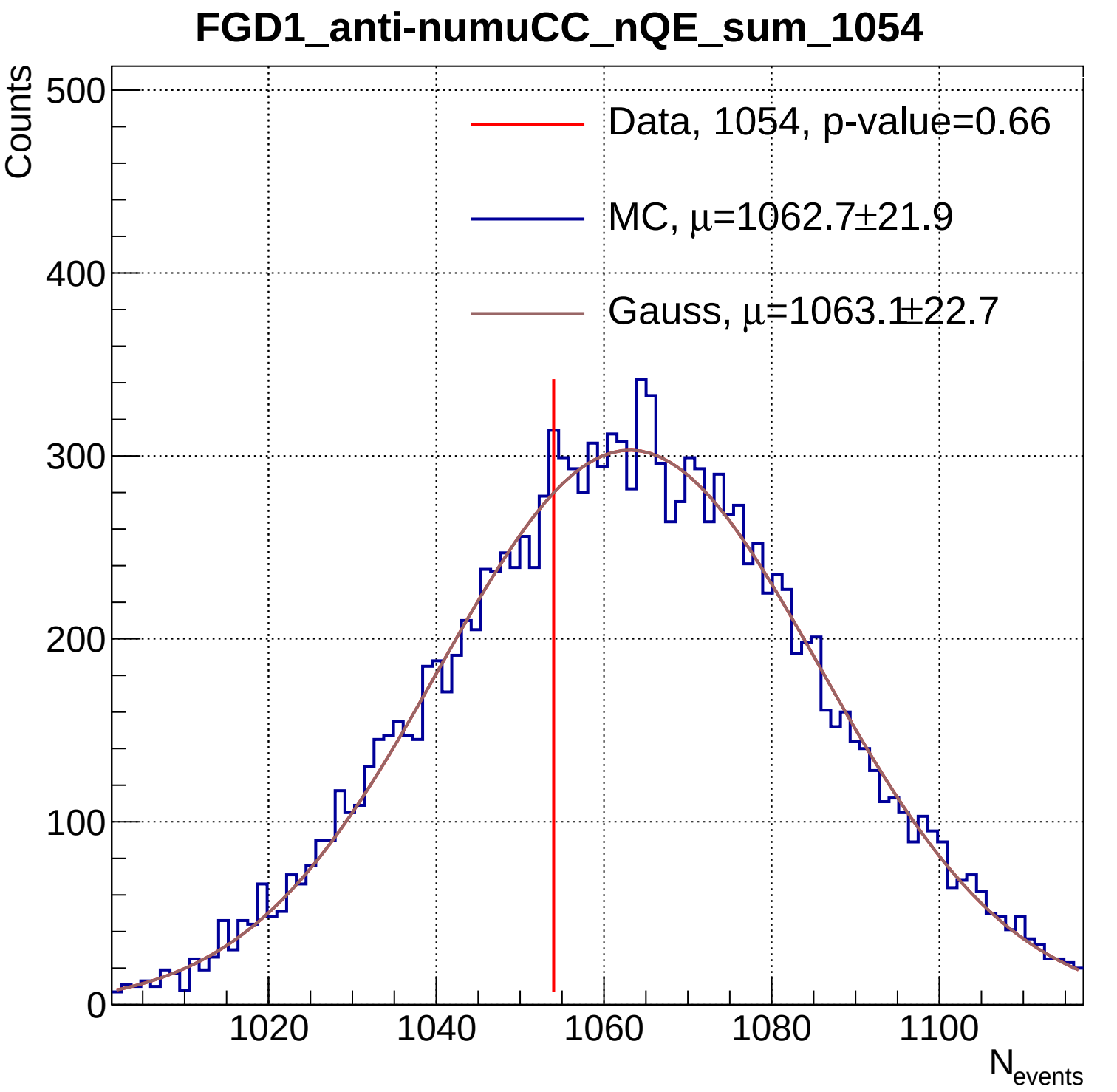

DataPredFluc
FGD1 anti ν_μCC N tracks
p = 0.289
$\chi^2_{Data,\ Draw}$
$\chi^2_{Pred,\ Pred\ Fluc}$
Steps
105
100
95
90
85
80
75
70
60
80
100
120
140
12
10
8
6
4
2
0

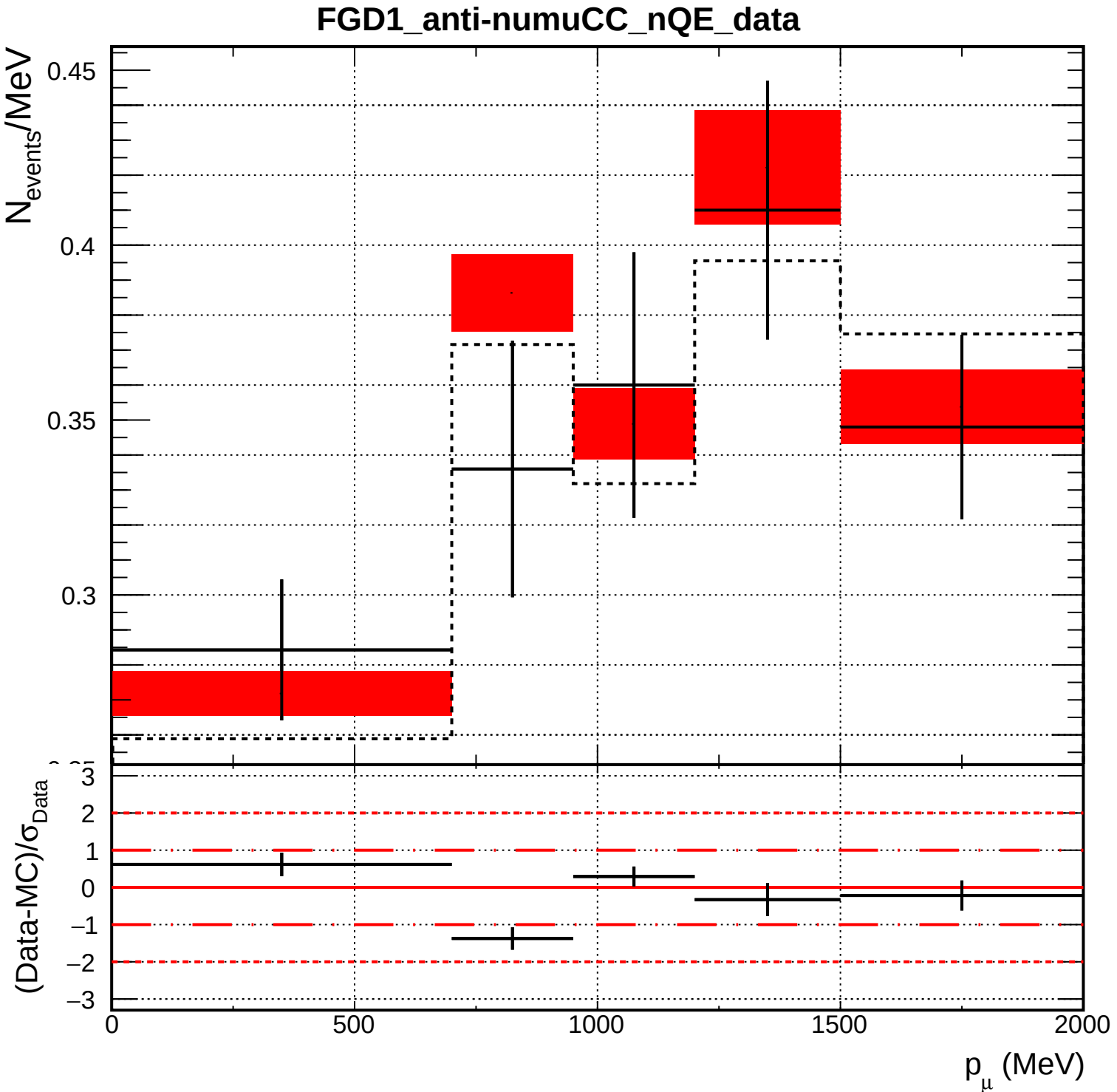

FGD1_anti-numuCC_nQE_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0
0.5
1
1.5
2
2.5
3
×10³
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

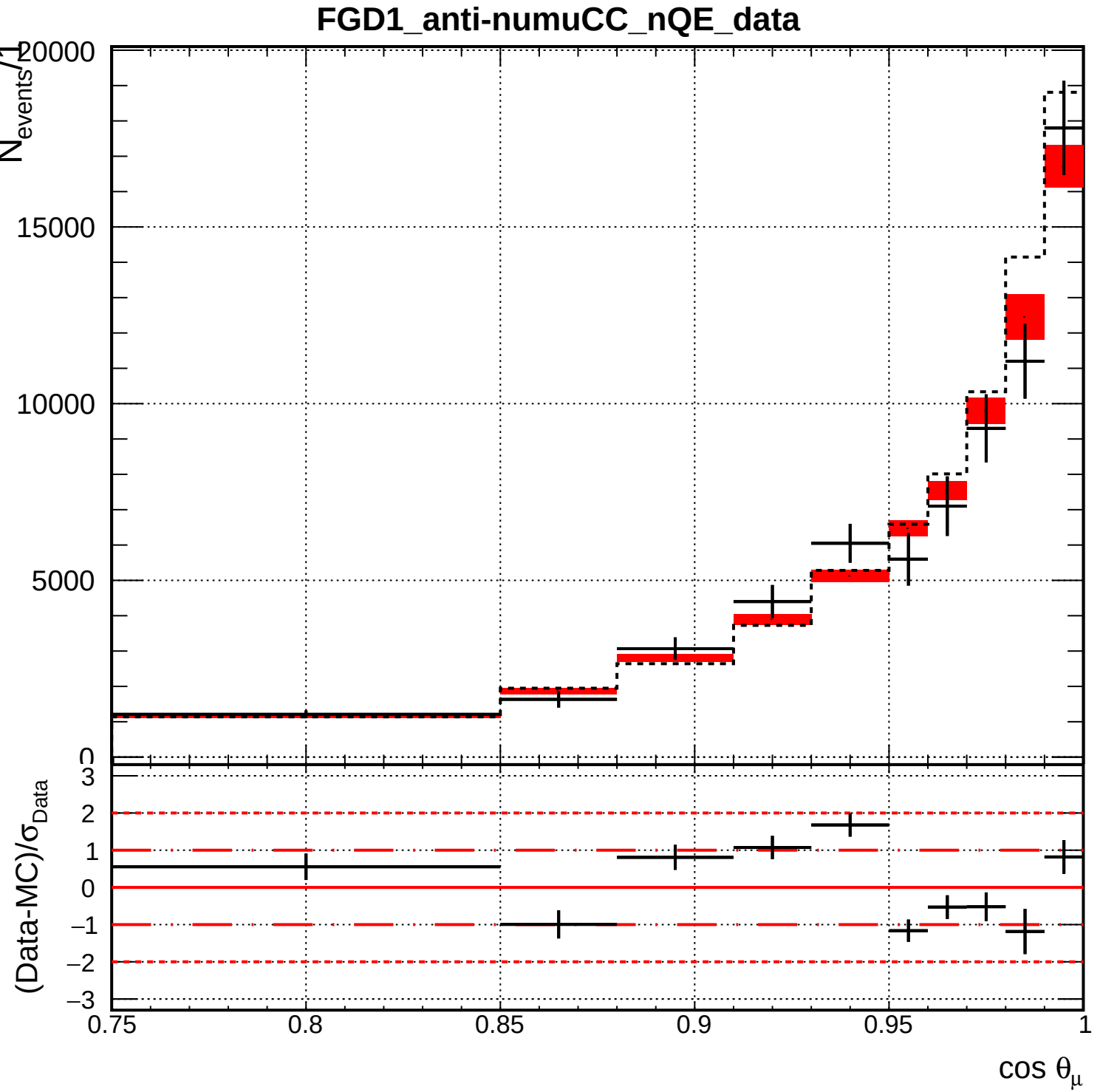

FGD1_anti-numuCC_nQE_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0
0.5
1
1.5
2
2.5
3
×10³
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

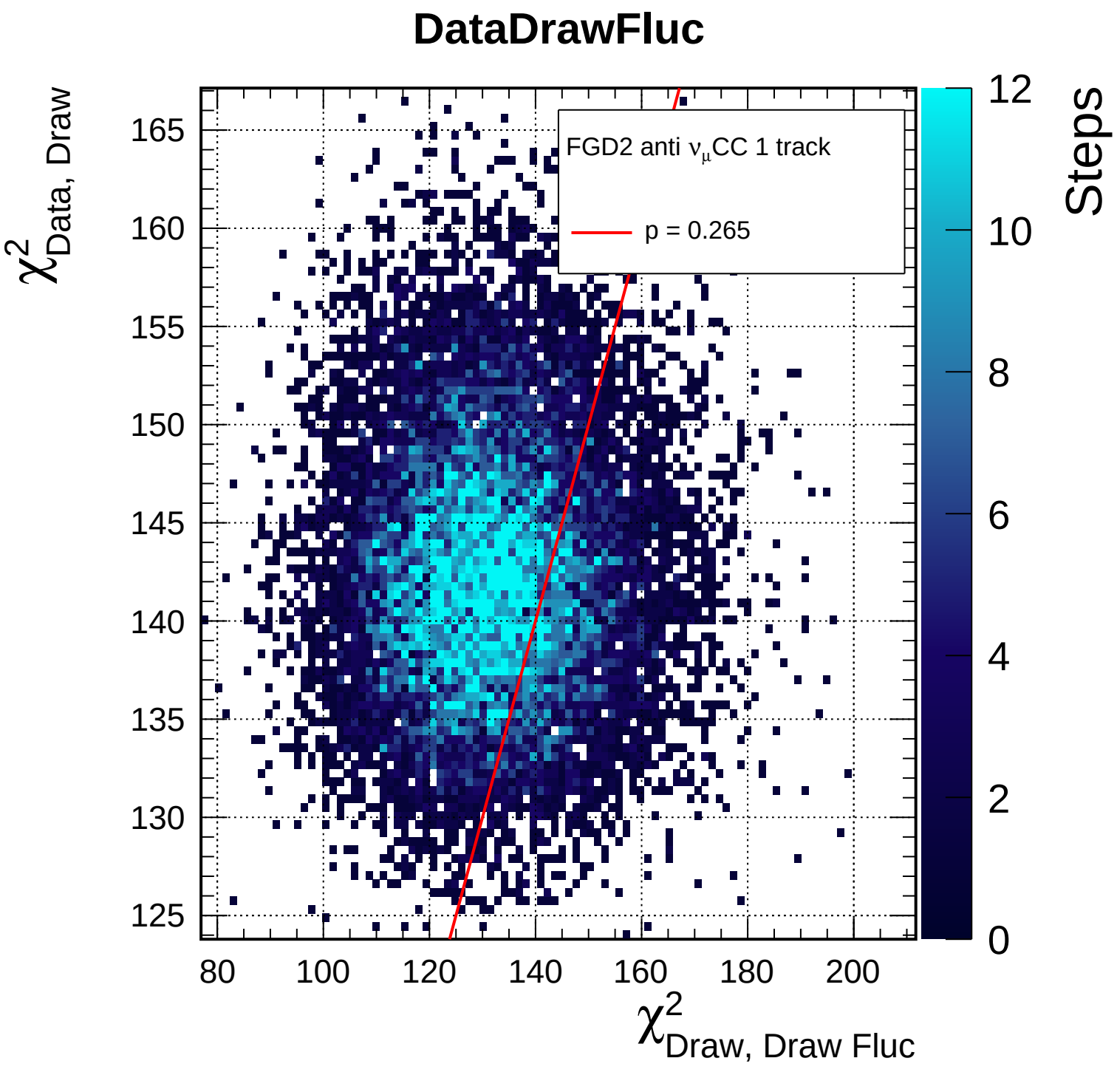

FGD1_anti-numuCC_nQE_MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0
0.5
1
1.5
2
2.5
3
×10^3
pμ (MeV)
Q² = 0.10 GeV
Q² = 0.25 GeV
Q² = 0.50 GeV
χ²Sample
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

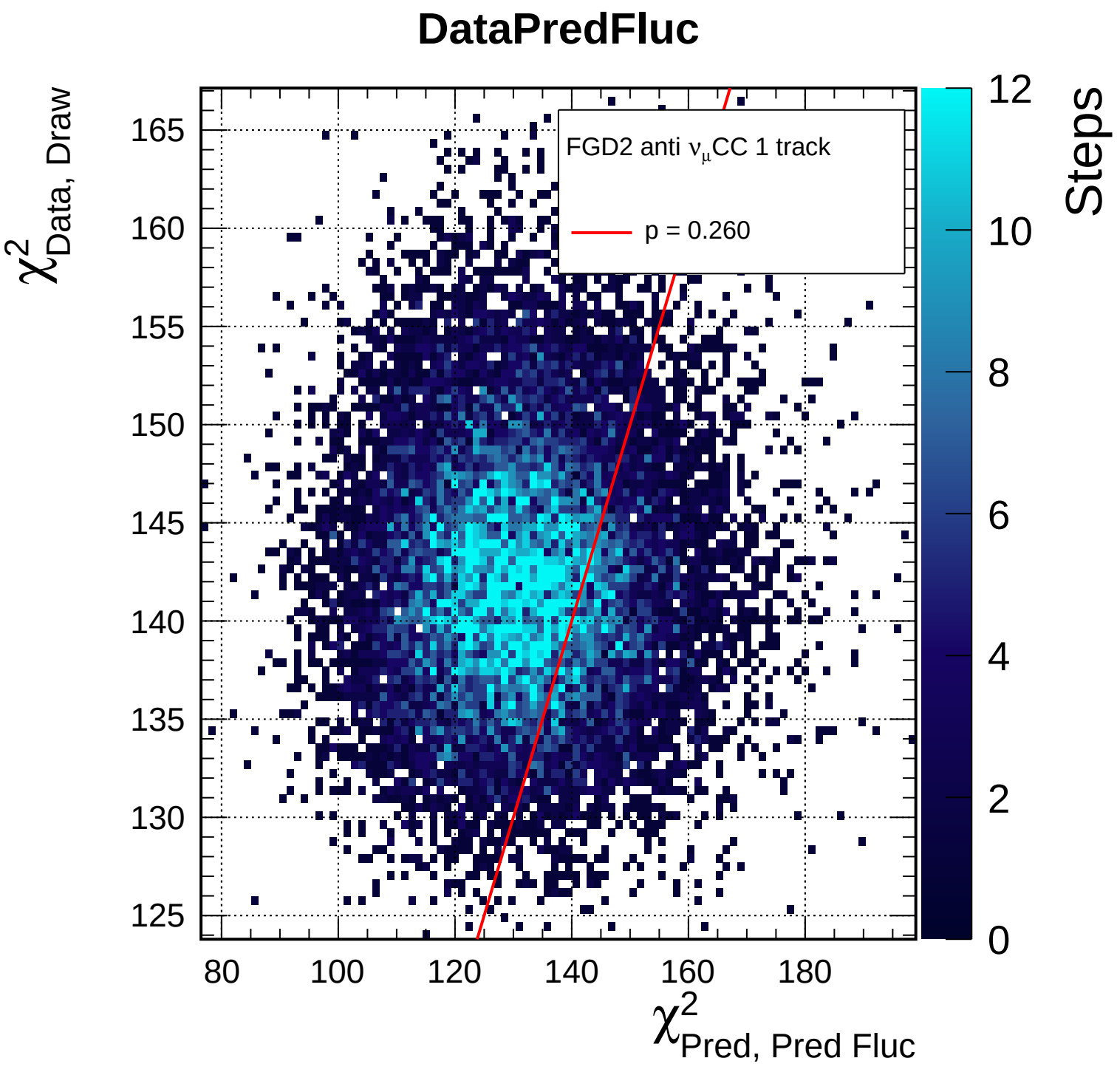

FGD1_anti-numuCC_nQE_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0
0.5
1
1.5
2
2.5
3
×10^3
pμ (MeV)
Q² = 0.10 GeV
Q² = 0.25 GeV
Q² = 0.50 GeV
χ²Sample
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0

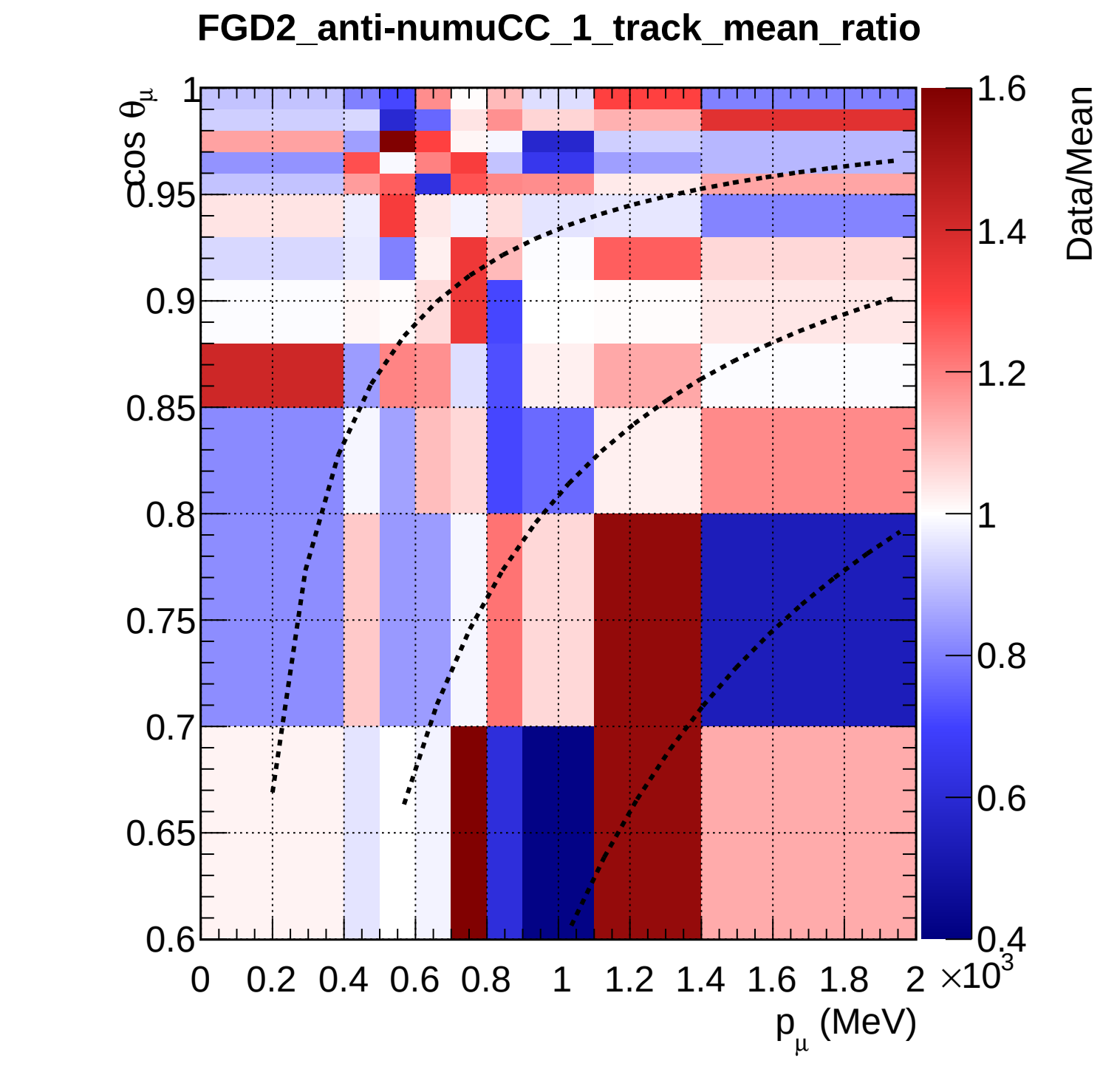

FGD1_anti-numuCC_nQE_sum_1054
Counts
500
400
300
200
100
0
1020
1040
1060
1080
1100
N events
Data, 1054, p-value=0.66
MC, μ=1062.7±21.9
Gauss, μ=1063.1±22.7

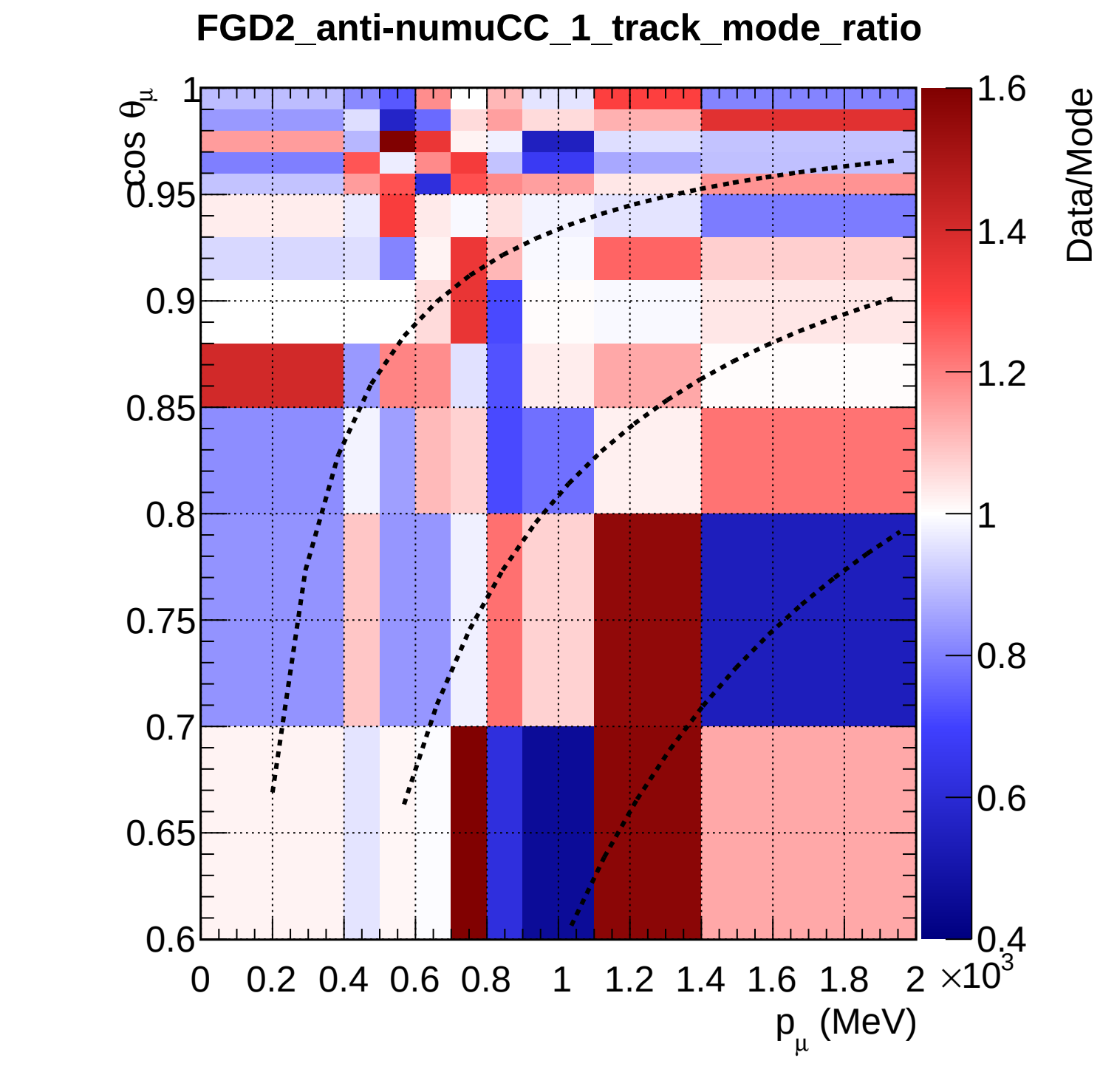

FGD1_anti-numuCC_nQE_data
N_events/MeV
0.45
0.4
0.35
0.3
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
500
1000
1500
2000
p_μ (MeV)

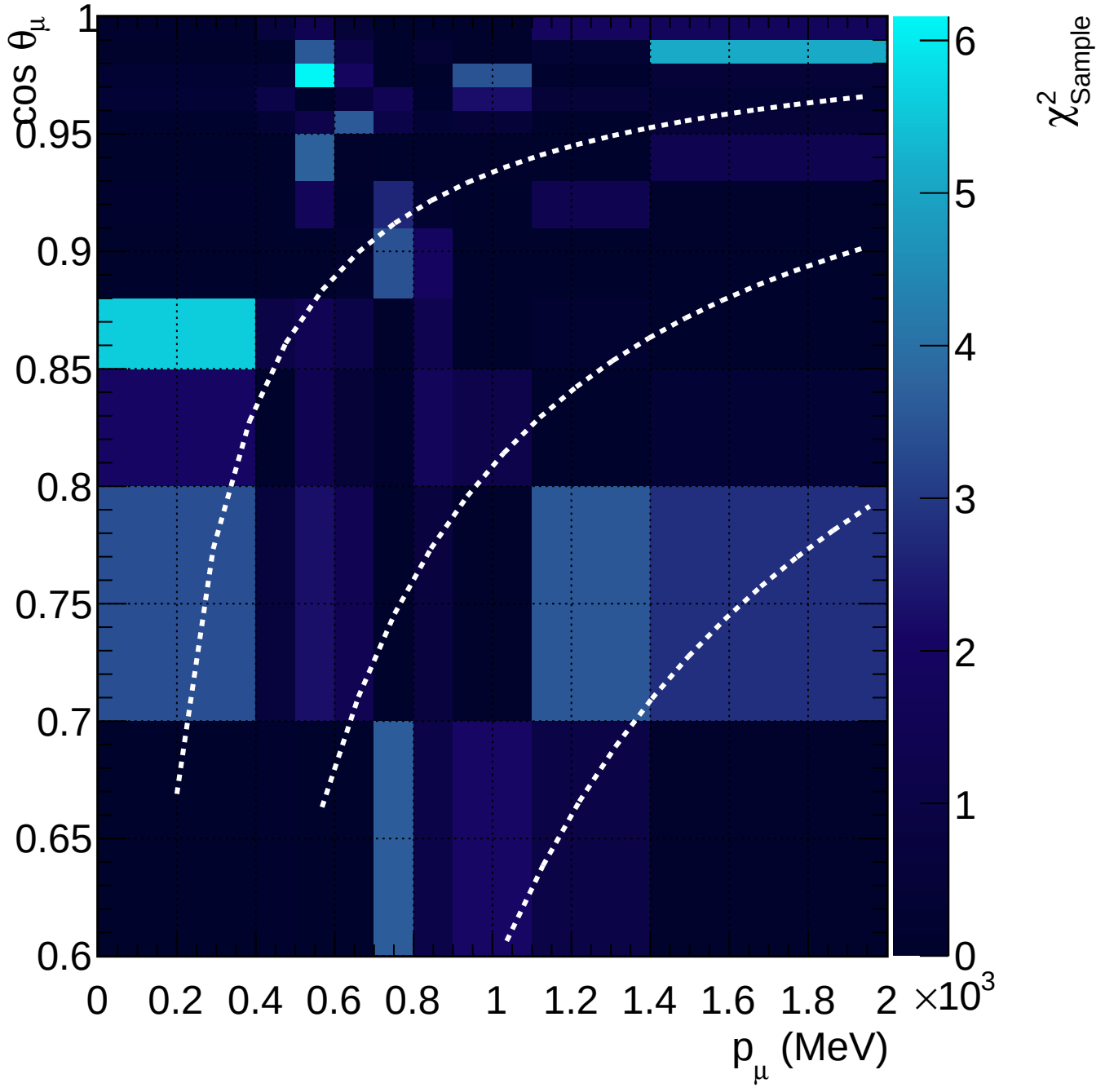

FGD1_anti-numuCC_nQE_data
N_events/1
20000
15000
10000
5000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

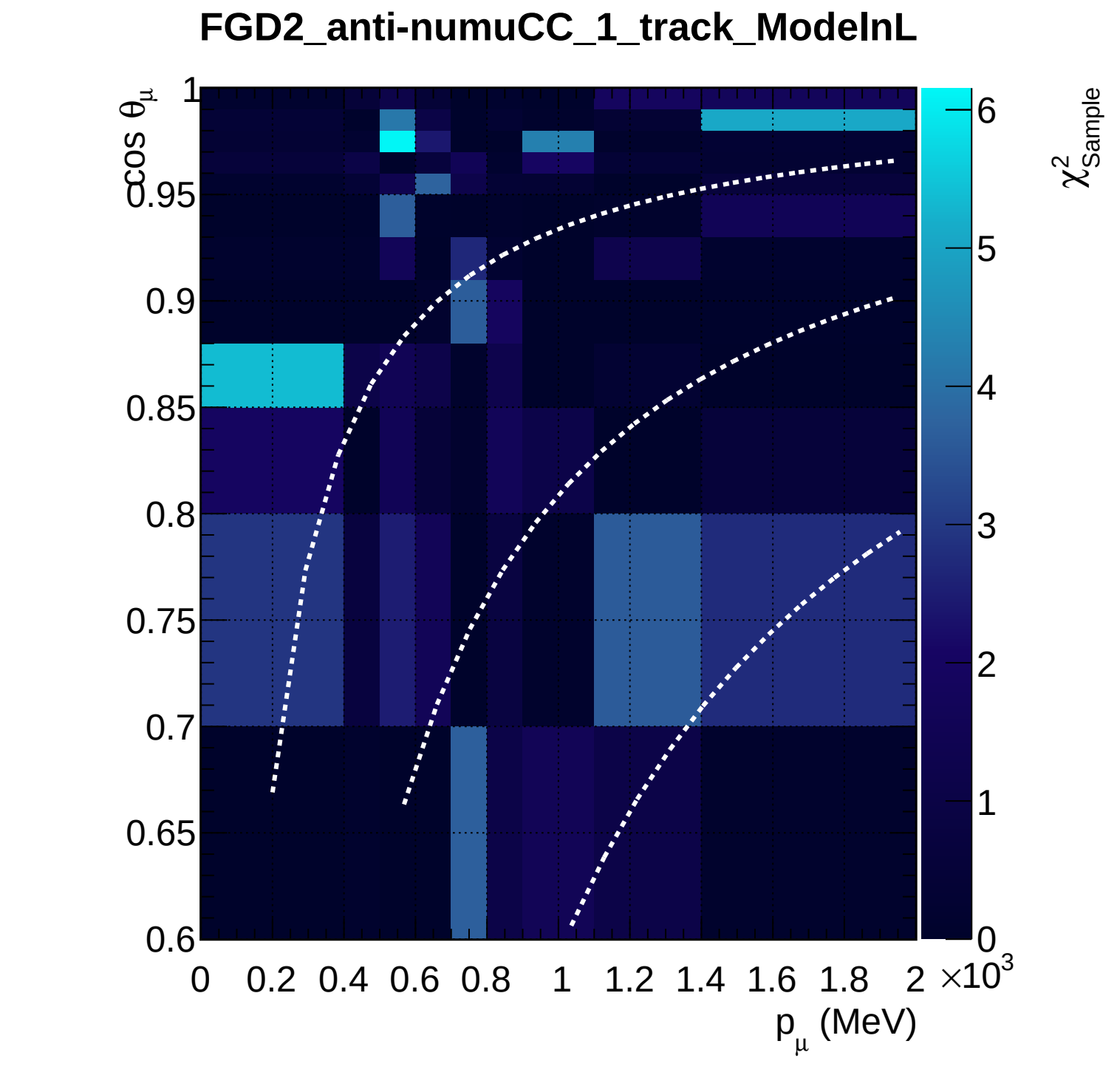

DataDrawFluc
FGD2 anti ν_μCC 1 track
p = 0.265
χ²Data, Draw
χ²Draw, Draw Fluc
Steps
165
160
155
150
145
140
135
130
125
80
100
120
140
160
180
200
12
10
8
6
4
2
0

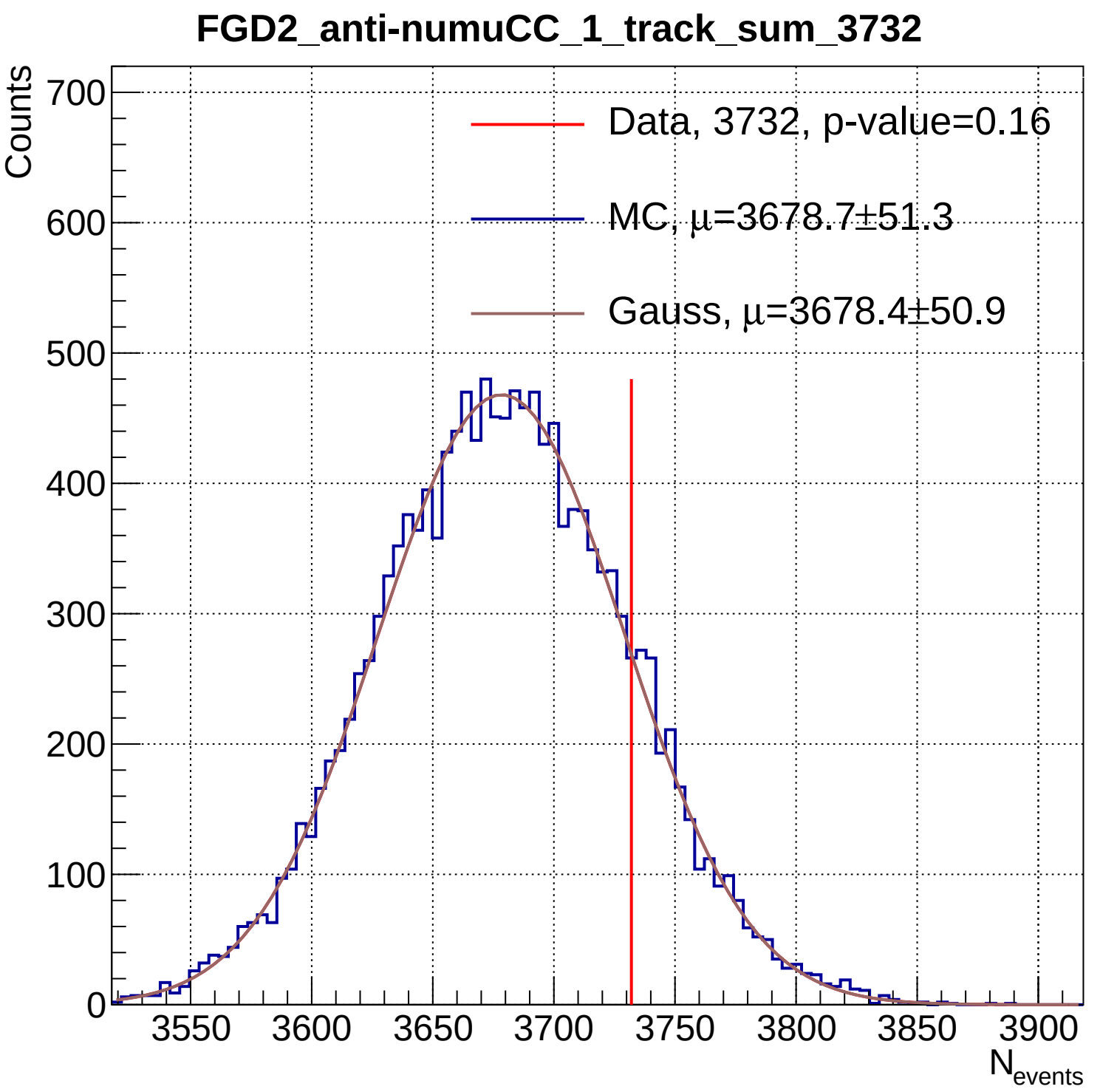

DataPredFluc
FGD2 anti ν_μCC 1 track
p = 0.260
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
165
160
155
150
145
140
135
130
125
80
100
120
140
160
180
12
10
8
6
4
2
0

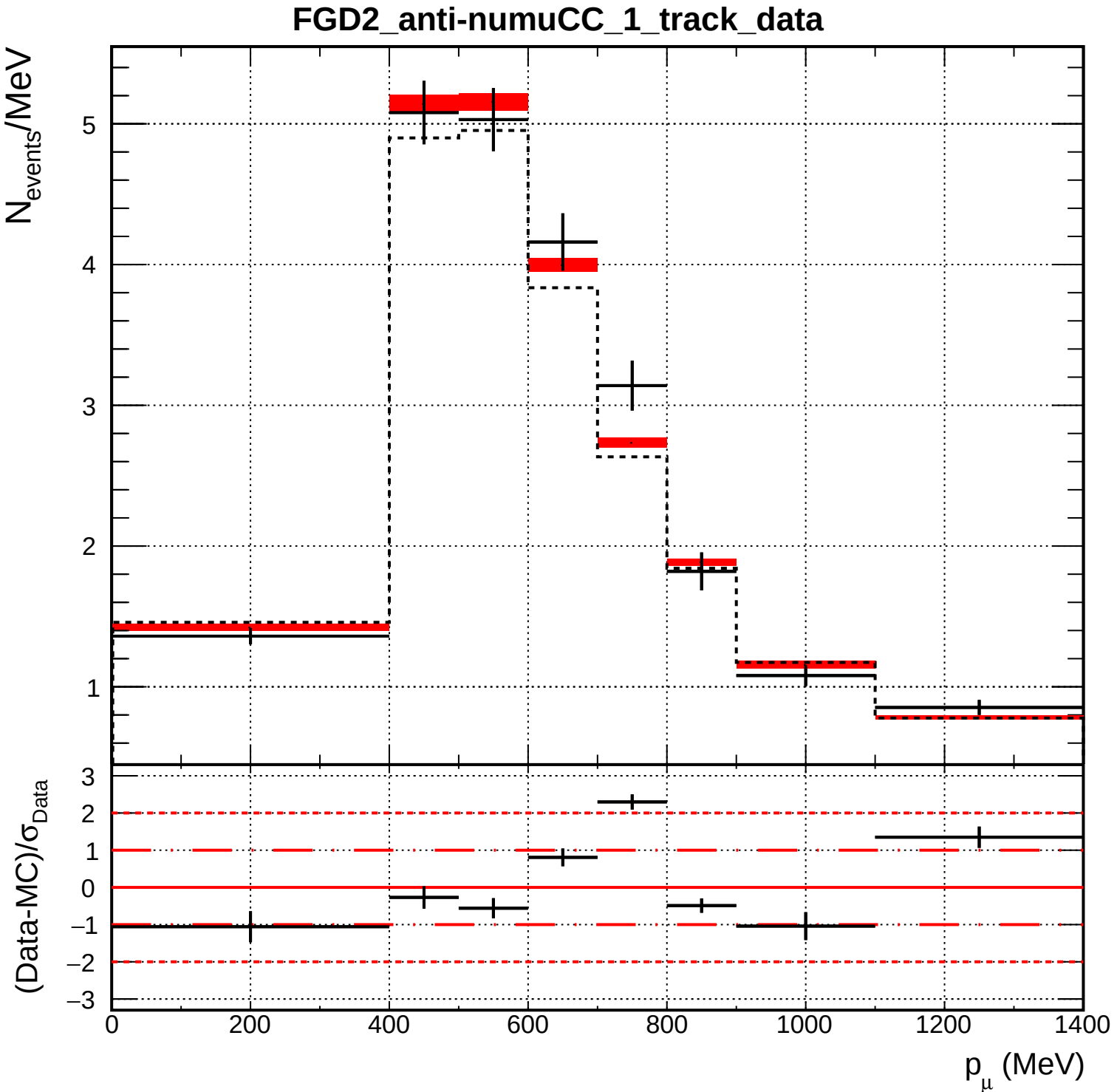

FGD2_anti-numuCC_1_track_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

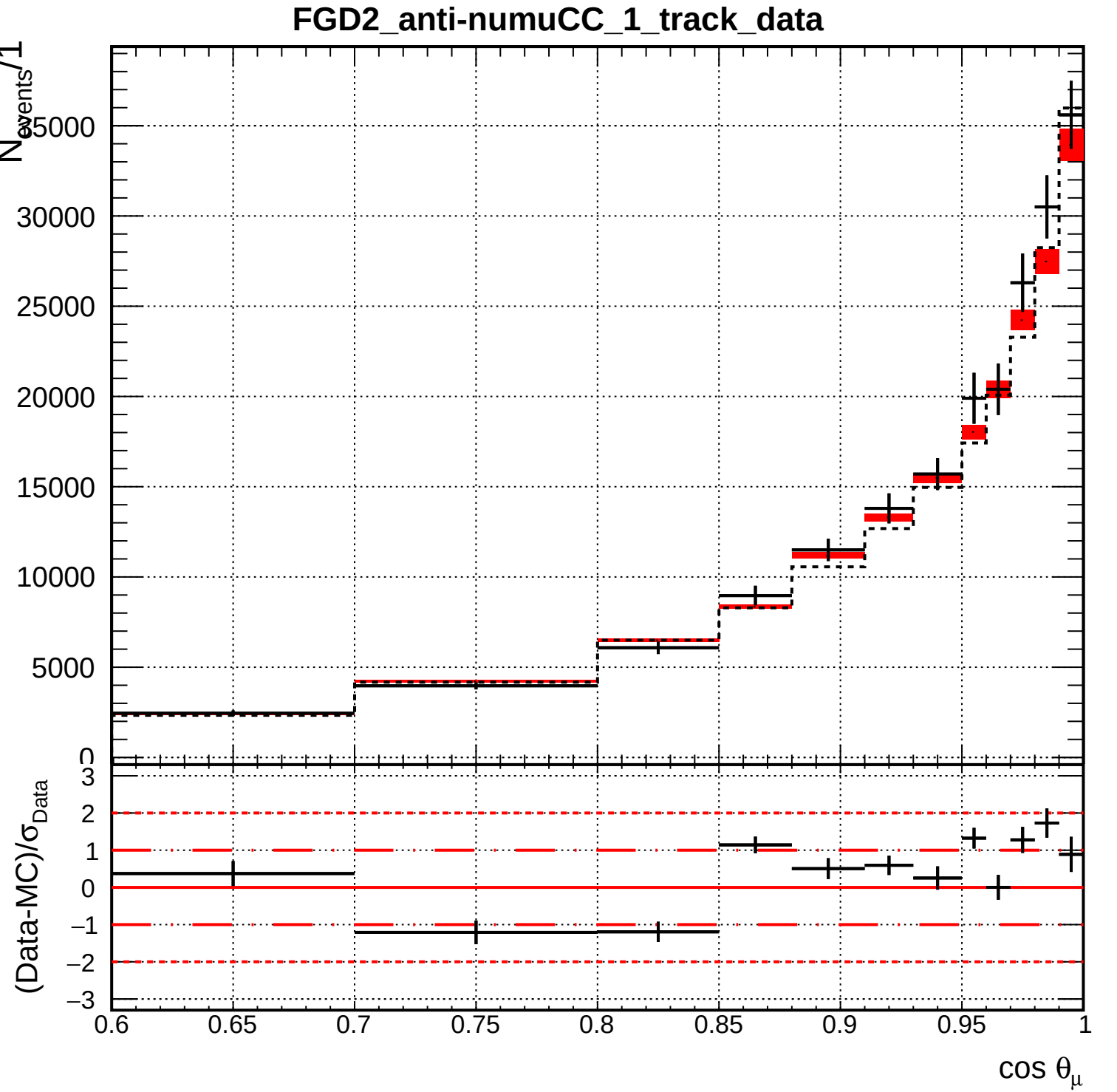

FGD2_anti-numuCC_1_track_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

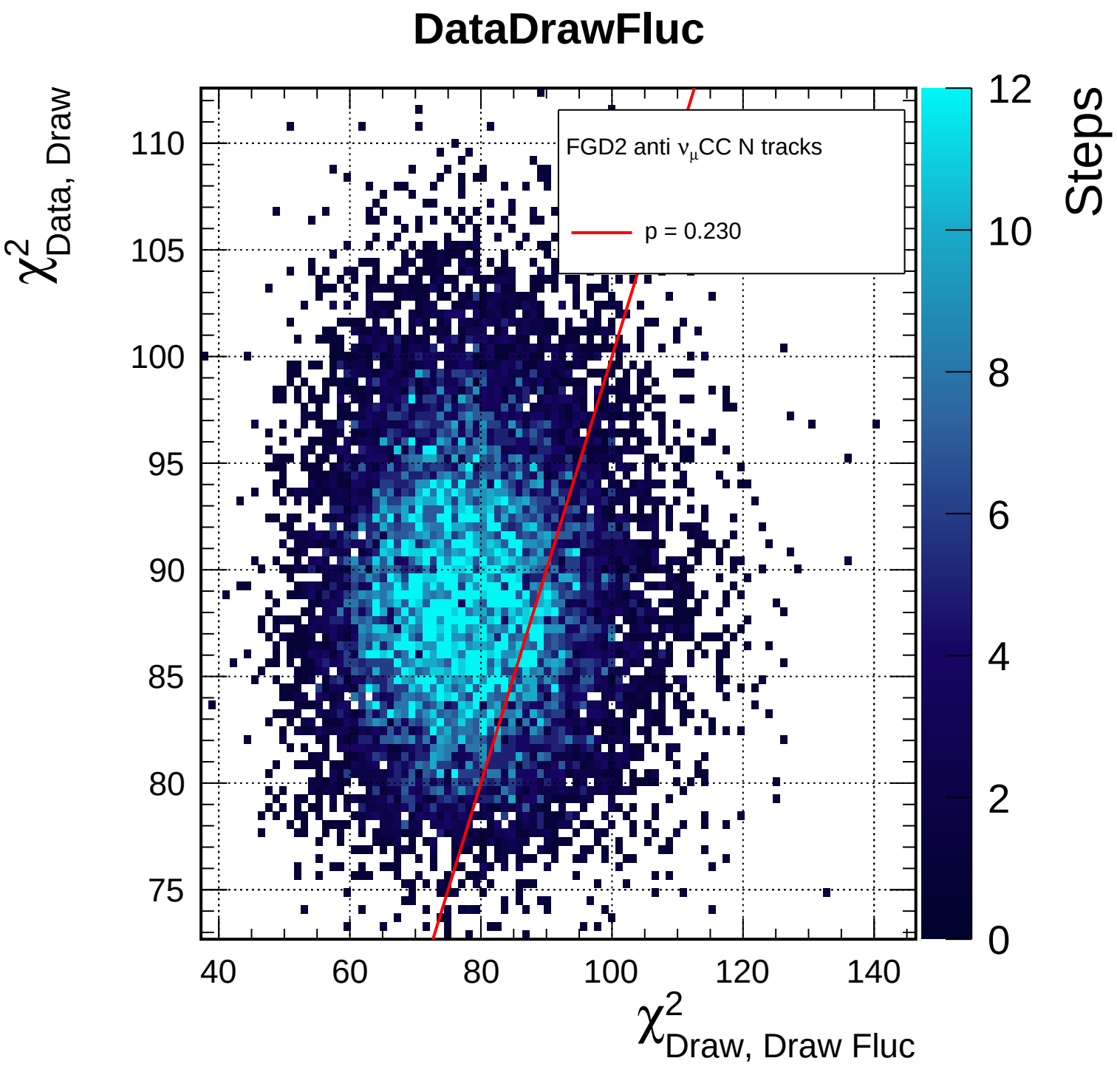

FGD2_anti-numuCC_1_track_MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
6
5
4
3
2
1
0
χ²Sample

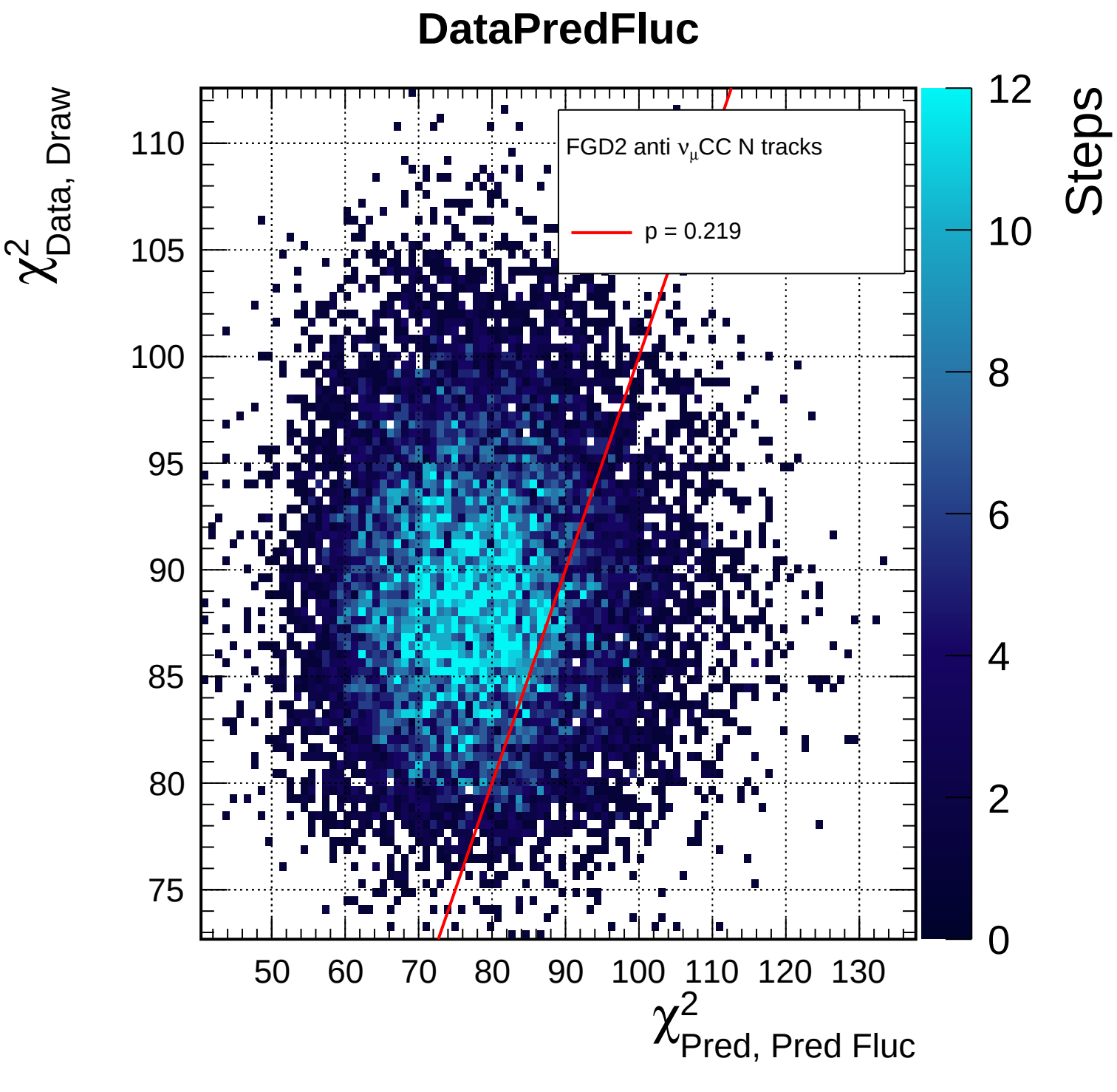

FGD2_anti-numuCC_1_track_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
6
5
4
3
2
1
0
χ²Sample

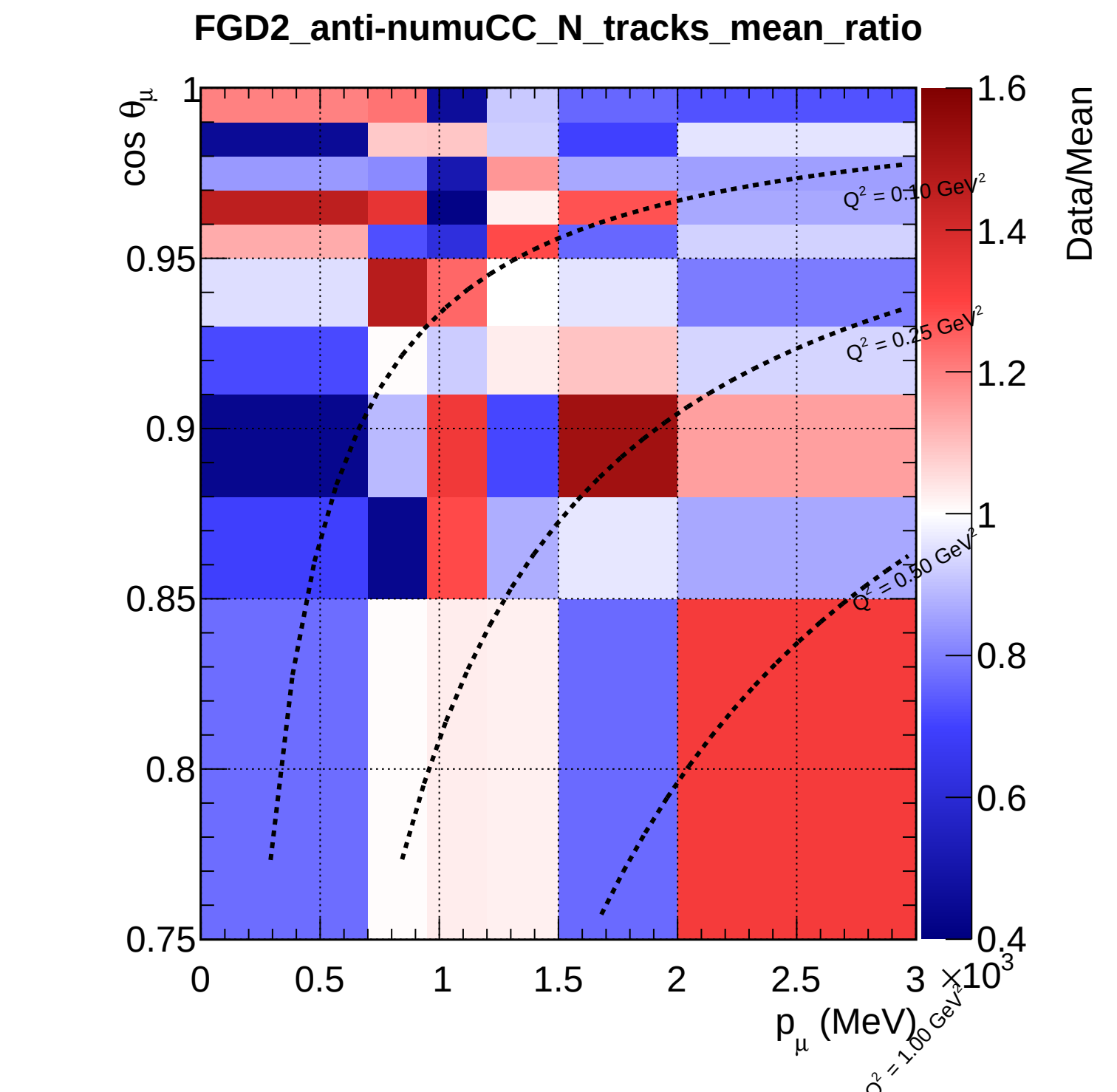

FGD2_anti-numuCC_1_track_sum_3732
Counts
700
600
500
400
300
200
100
0
Data, 3732, p-value=0.16
MC, μ=3678.7±51.3
Gauss, μ=3678.4±50.9
3550
3600
3650
3700
3750
3800
3850
3900
N events

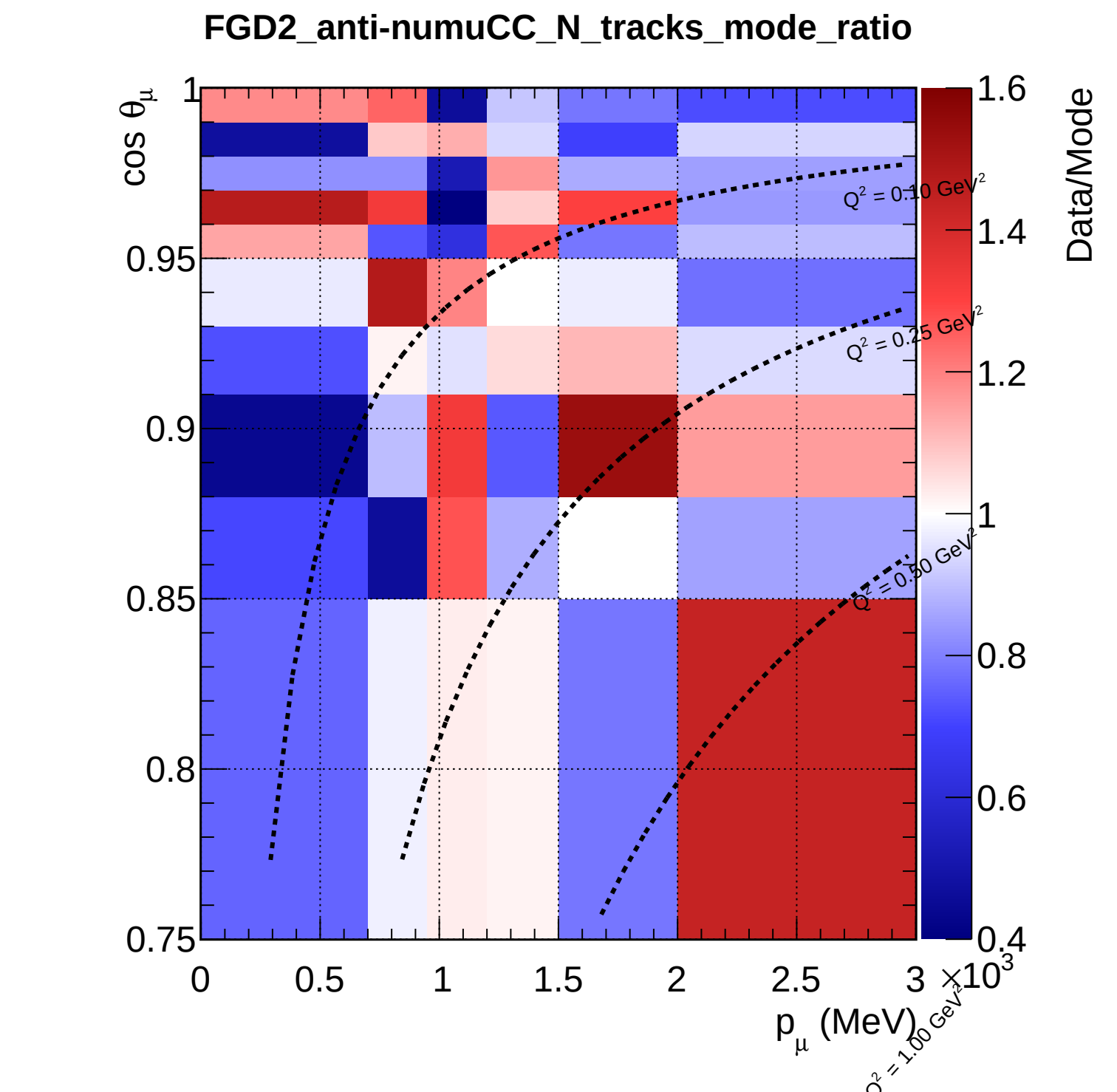

FGD2_anti-numuCC_1_track_data
N_events/MeV
(Data-MC)/σ_Data
p_μ (MeV)
0
200
400
600
800
1000
1200
1400
1
2
3
4
5
−1
−2
−3

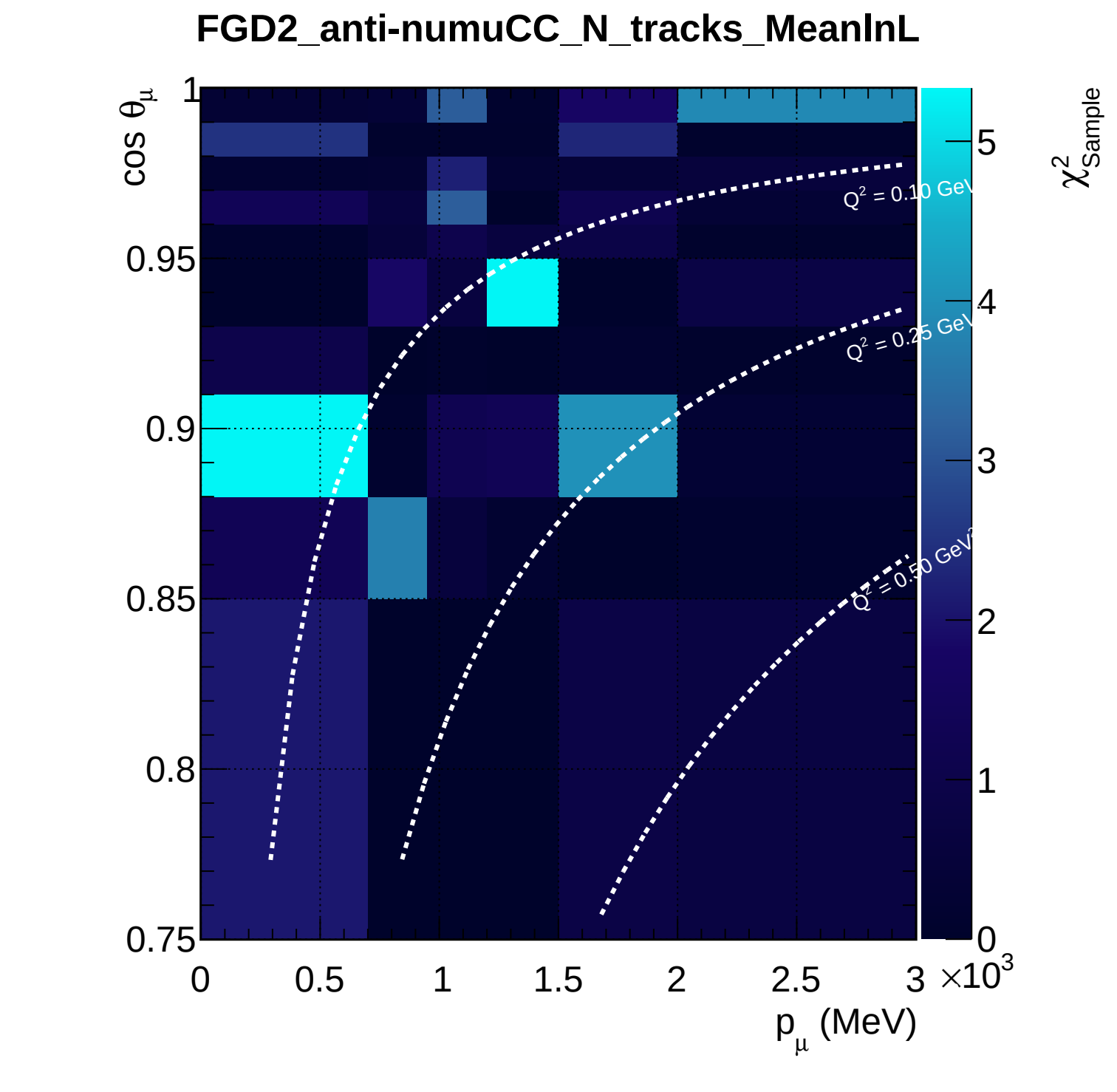

FGD2_anti-numuCC_1_track_data
N_events/1
35000
30000
25000
20000
15000
10000
5000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.6
0.65
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

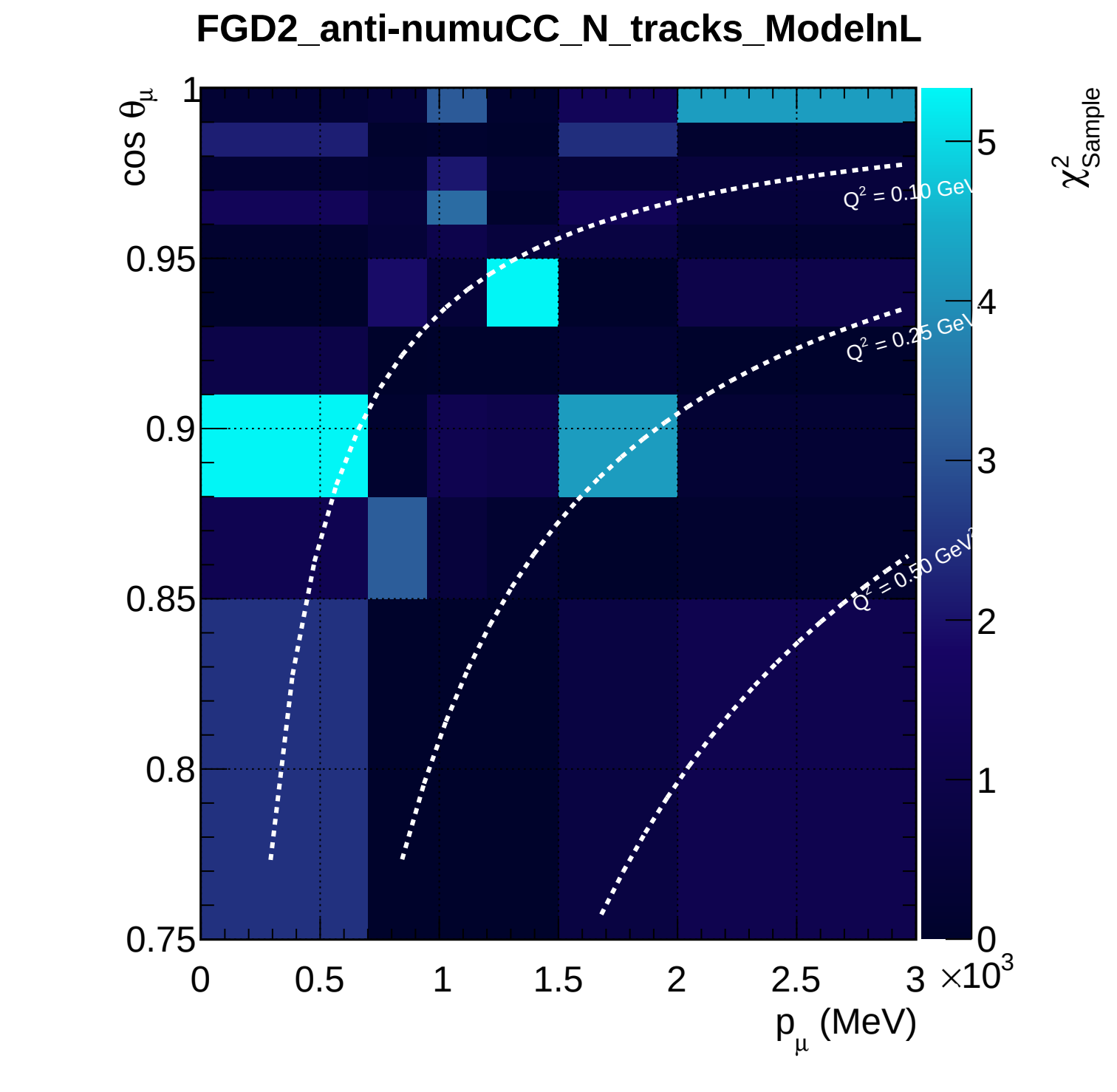

DataDrawFluc
FGD2 anti ν_μCC N tracks
p = 0.230
$\chi^2_{Data,\ Draw}$
$\chi^2_{Draw,\ Draw\ Fluc}$
Steps
110
105
100
95
90
85
80
75
40
60
80
100
120
140
12
10
8
6
4
2
0

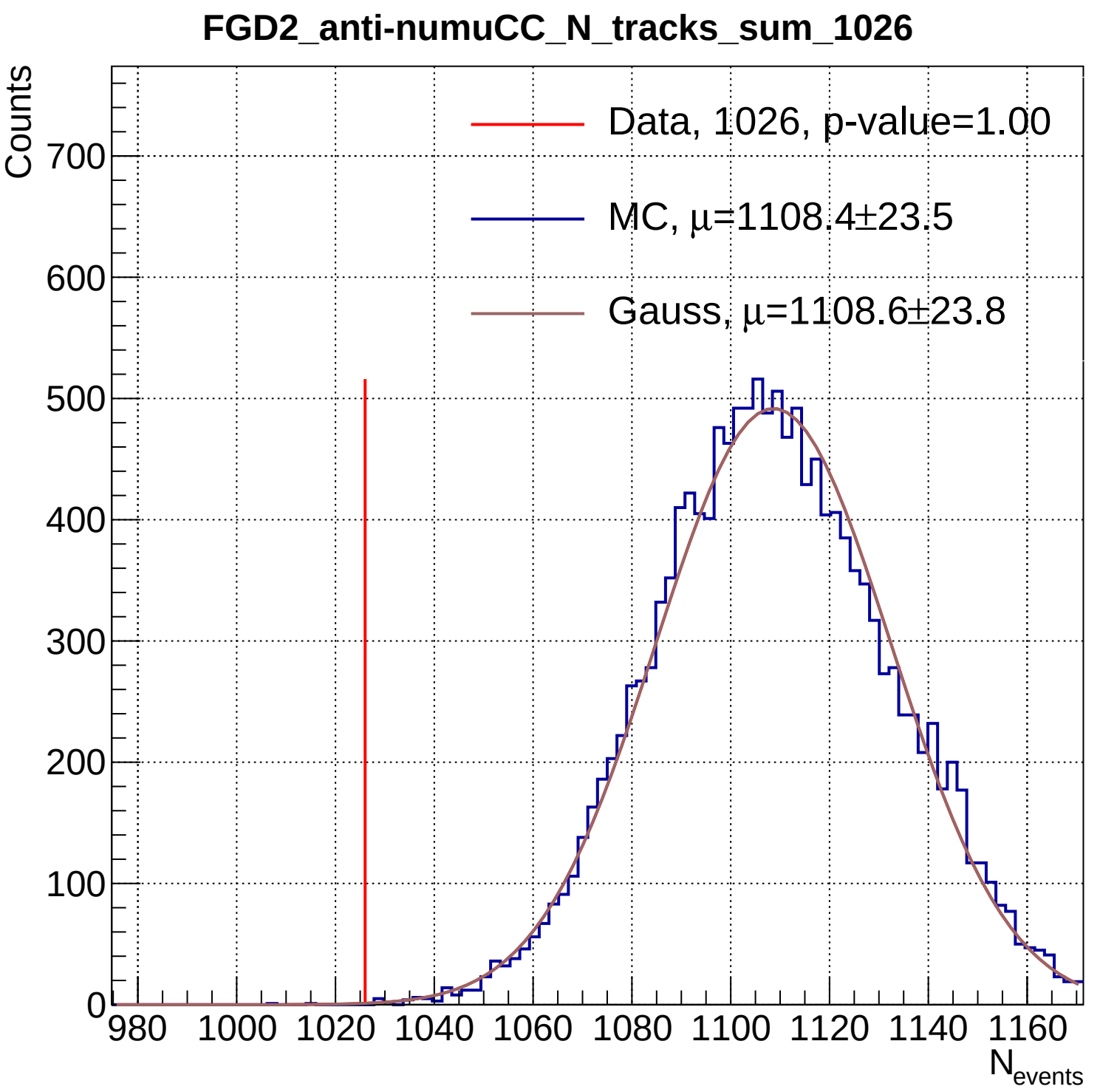

DataPredFluc
FGD2 anti ν_μCC N tracks
p = 0.219
$\chi^2_{Data,\ Draw}$
$\chi^2_{Pred,\ Pred\ Fluc}$
Steps
110
105
100
95
90
85
80
75
50
60
70
80
90
100
110
120
130
12
10
8
6
4
2
0

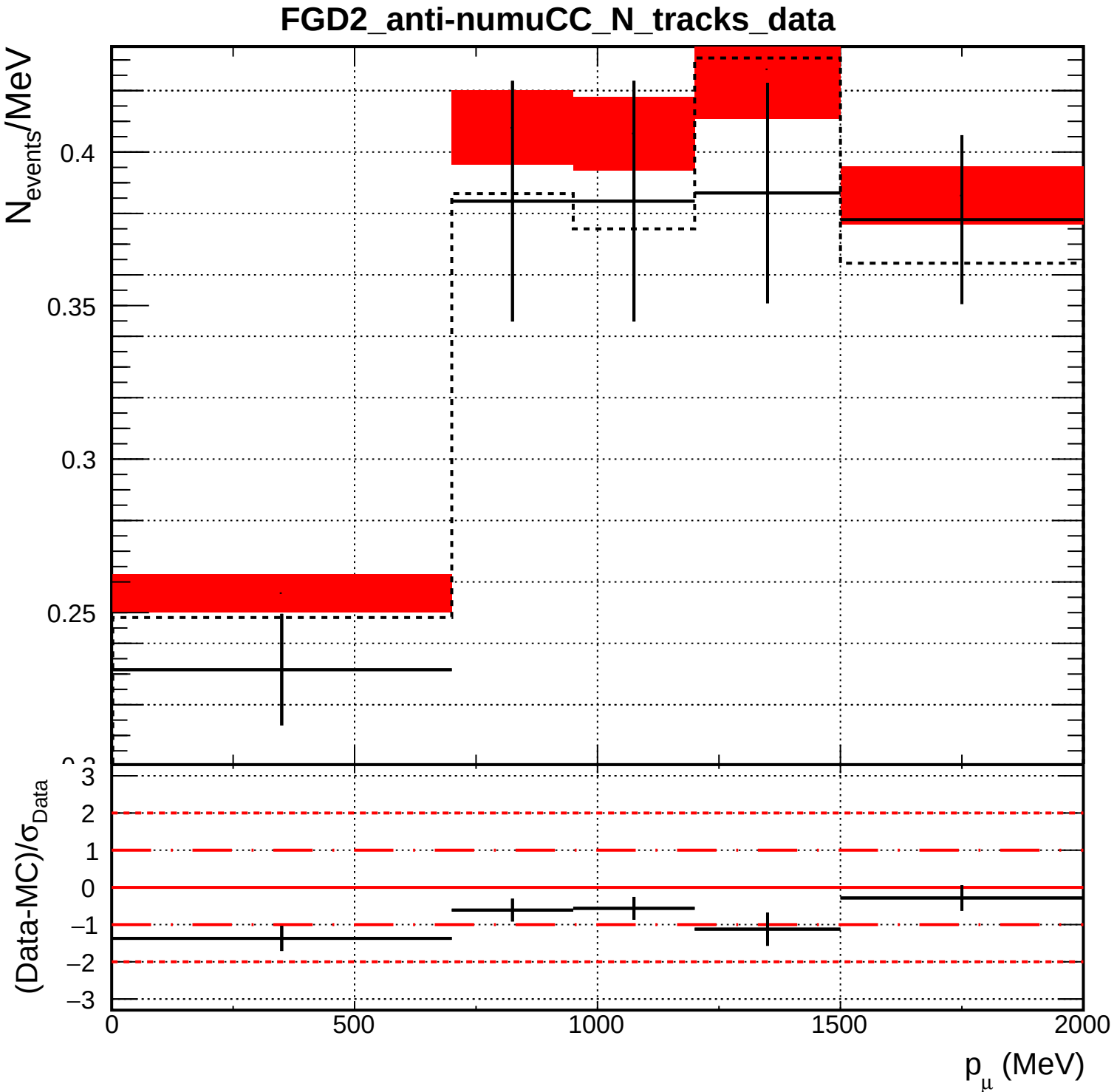

FGD2_anti-numuCC_N_tracks_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0
0.5
1
1.5
2
2.5
3
×10³
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

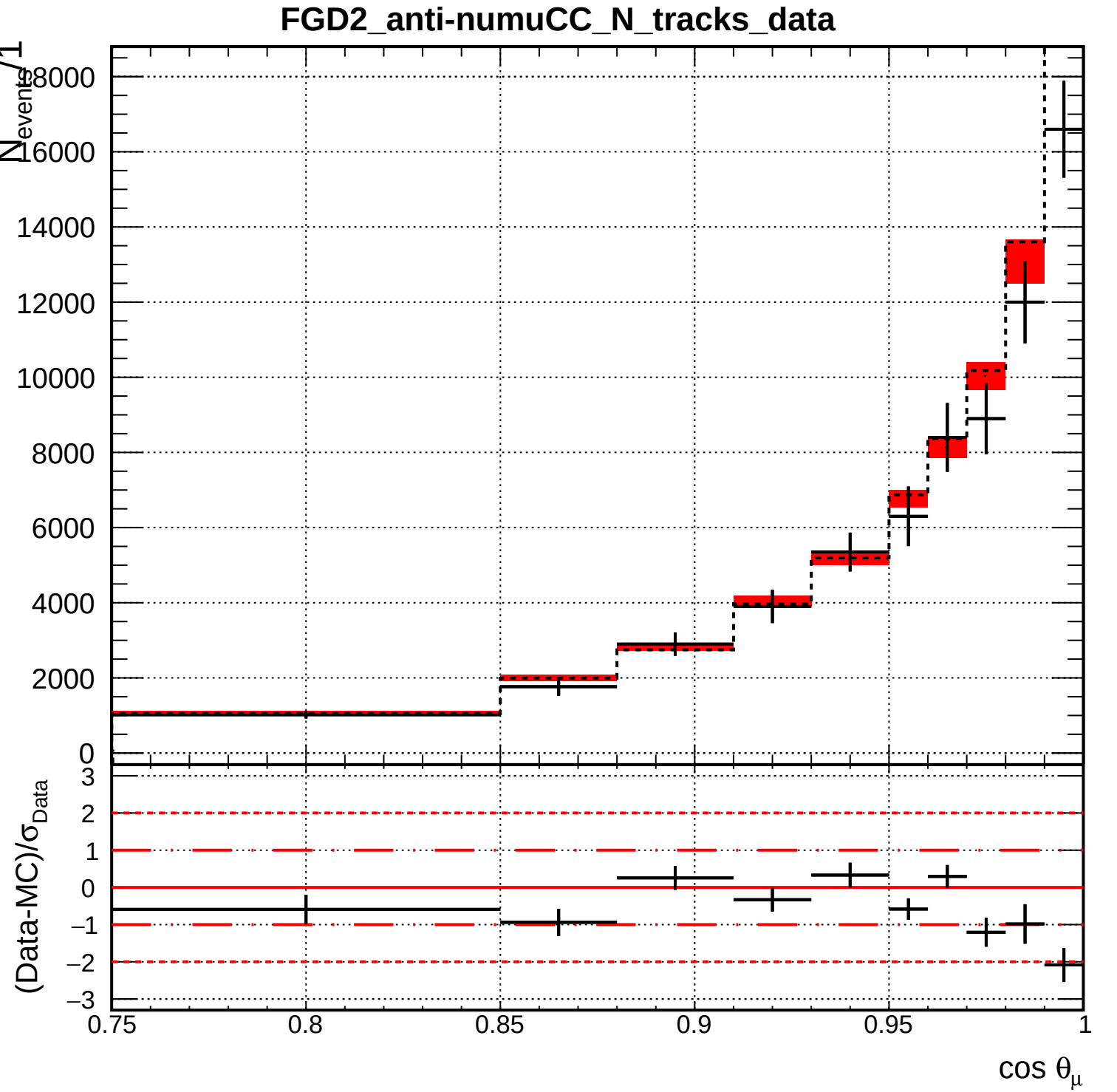

FGD2_anti-numuCC_N_tracks_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0
0.5
1
1.5
2
2.5
3
×10³
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

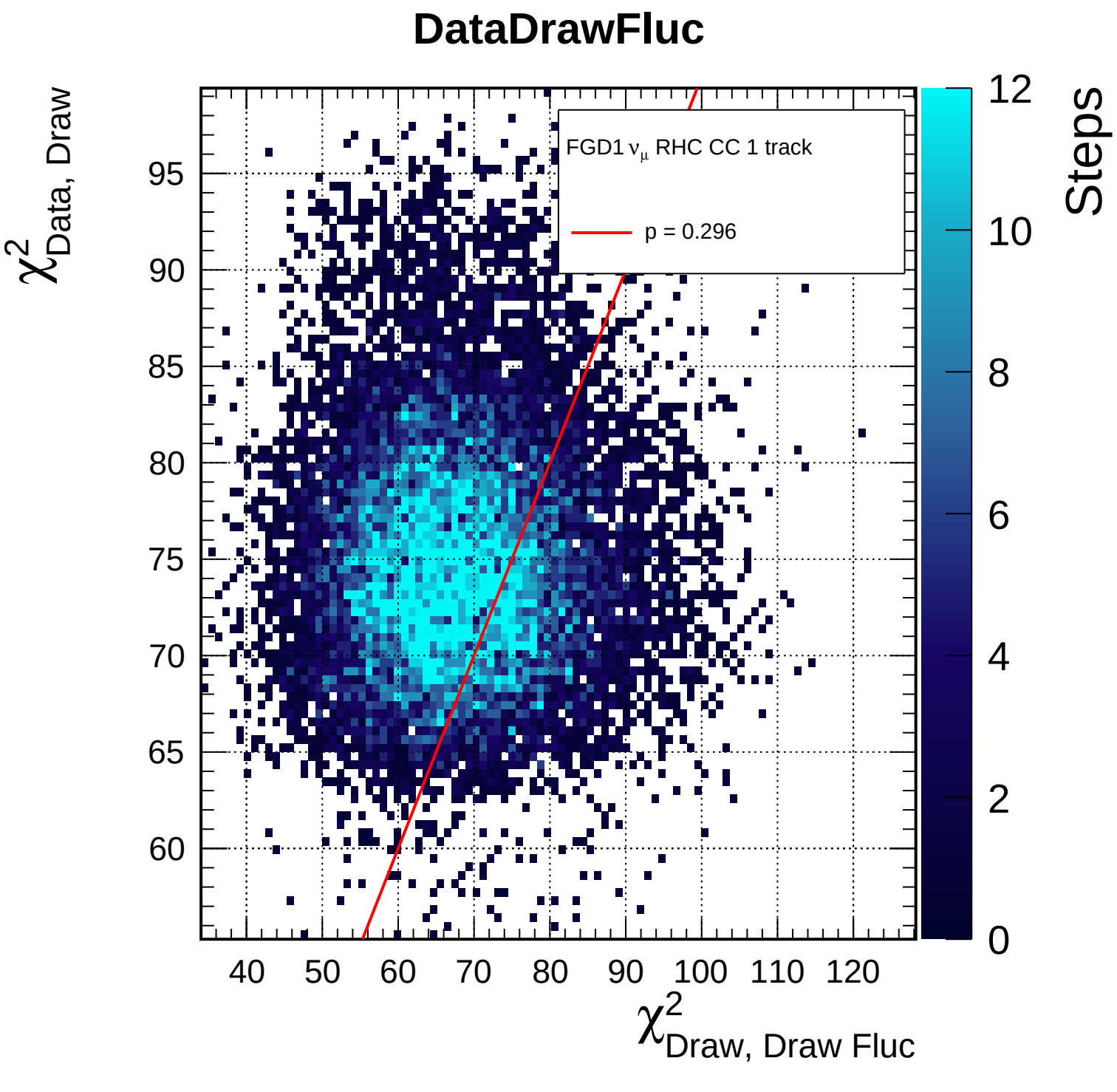

FGD2_anti-numuCC_N_tracks_MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0
0.5
1
1.5
2
2.5
3
×10^3
pμ (MeV)
Q² = 0.10 GeV
Q² = 0.25 GeV
Q² = 0.50 GeV
χ²Sample
5
4
3
2
1
0

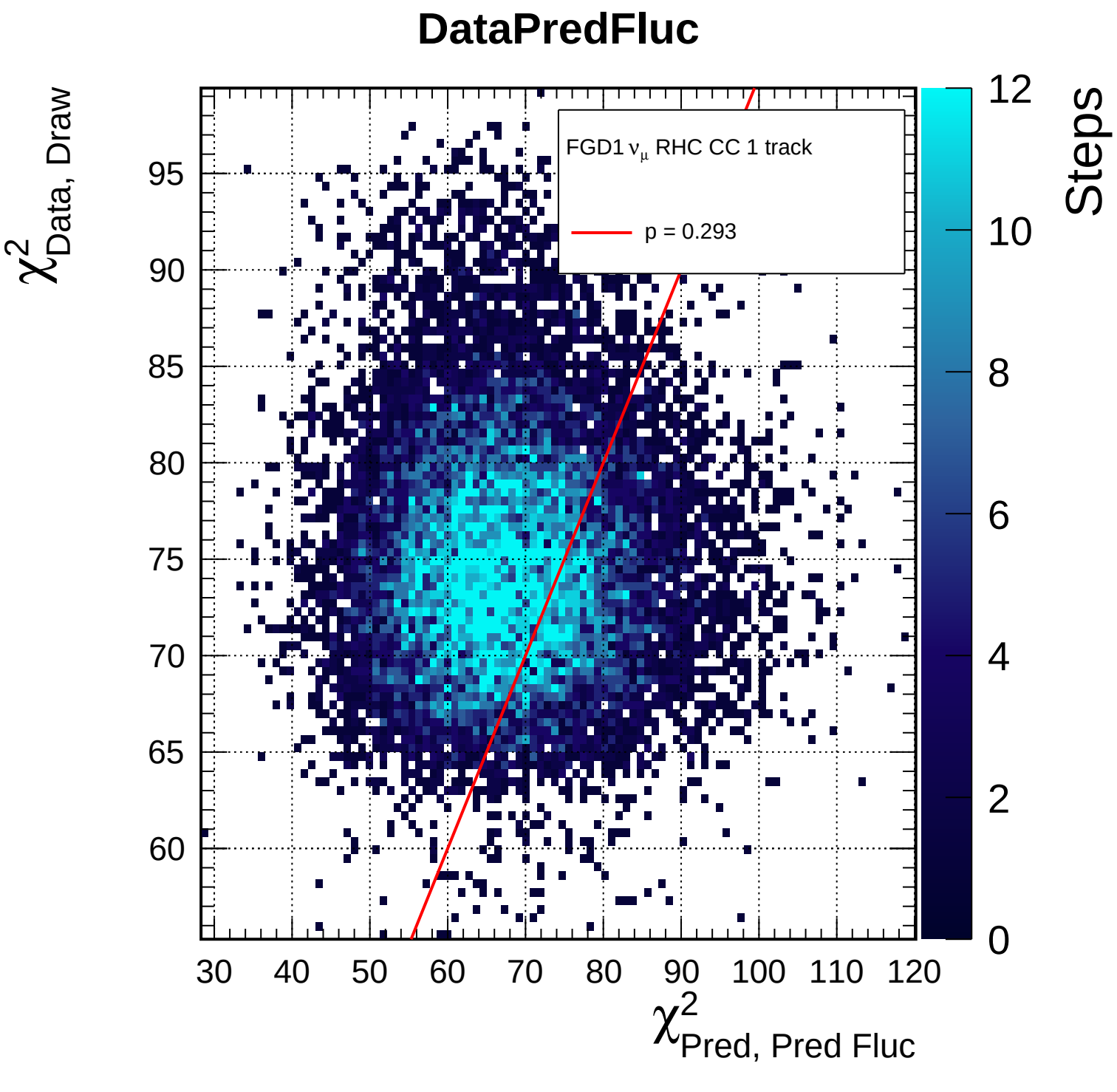

FGD2_anti-numuCC_N_tracks_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0
0.5
1
1.5
2
2.5
3
×10^3
pμ (MeV)
Q² = 0.10 GeV
Q² = 0.25 GeV
Q² = 0.50 GeV
χ²Sample
5
4
3
2
1
0

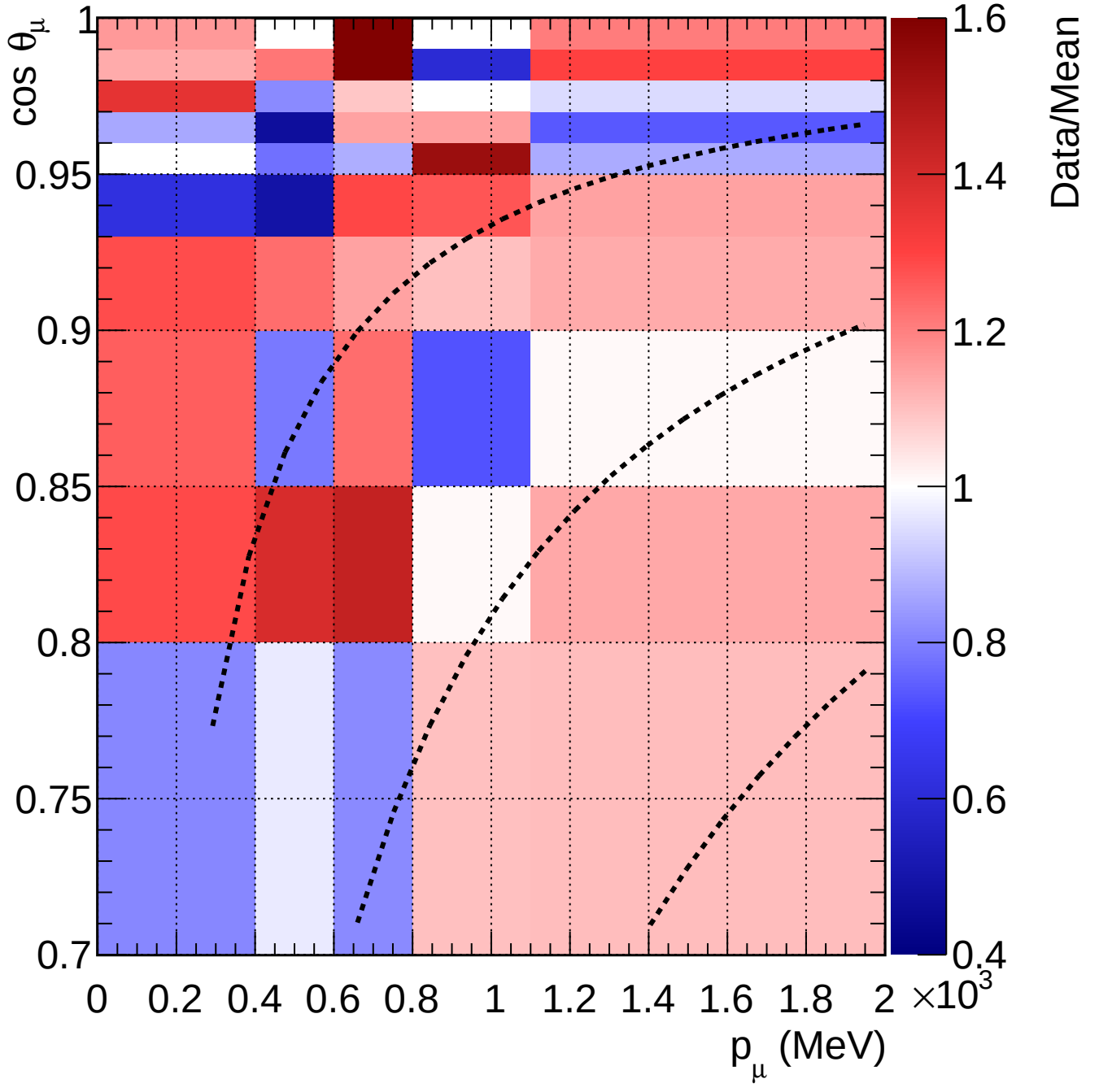

FGD2_anti-numuCC_N_tracks_sum_1026
Counts
Data, 1026, p-value=1.00
MC, μ=1108.4±23.5
Gauss, μ=1108.6±23.8
0
100
200
300
400
500
600
700
980
1000
1020
1040
1060
1080
1100
1120
1140
1160
N events

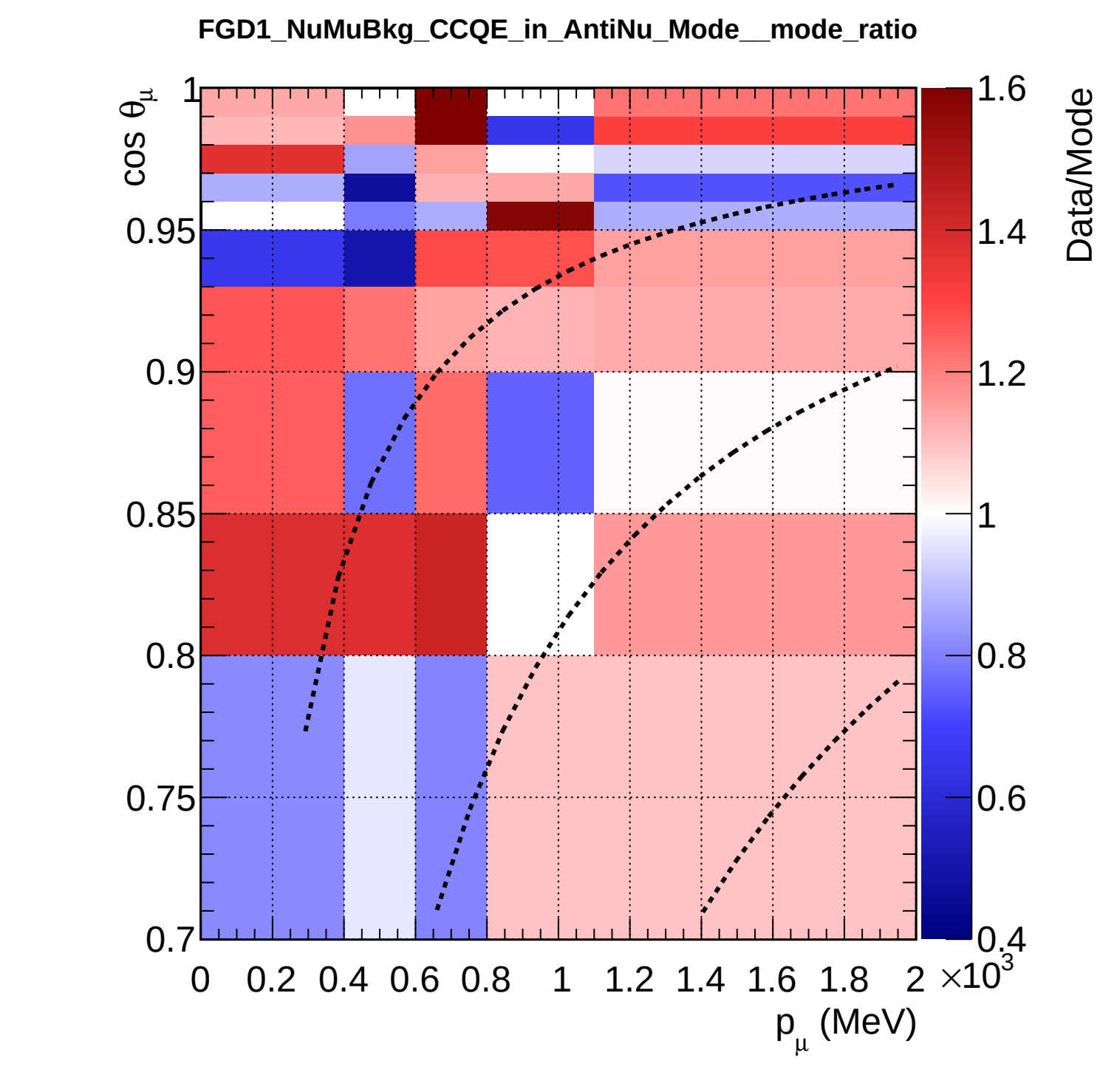

FGD2_anti-numuCC_N_tracks_data
N_events/MeV
0.4
0.35
0.3
0.25
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
500
1000
1500
2000
p_μ (MeV)

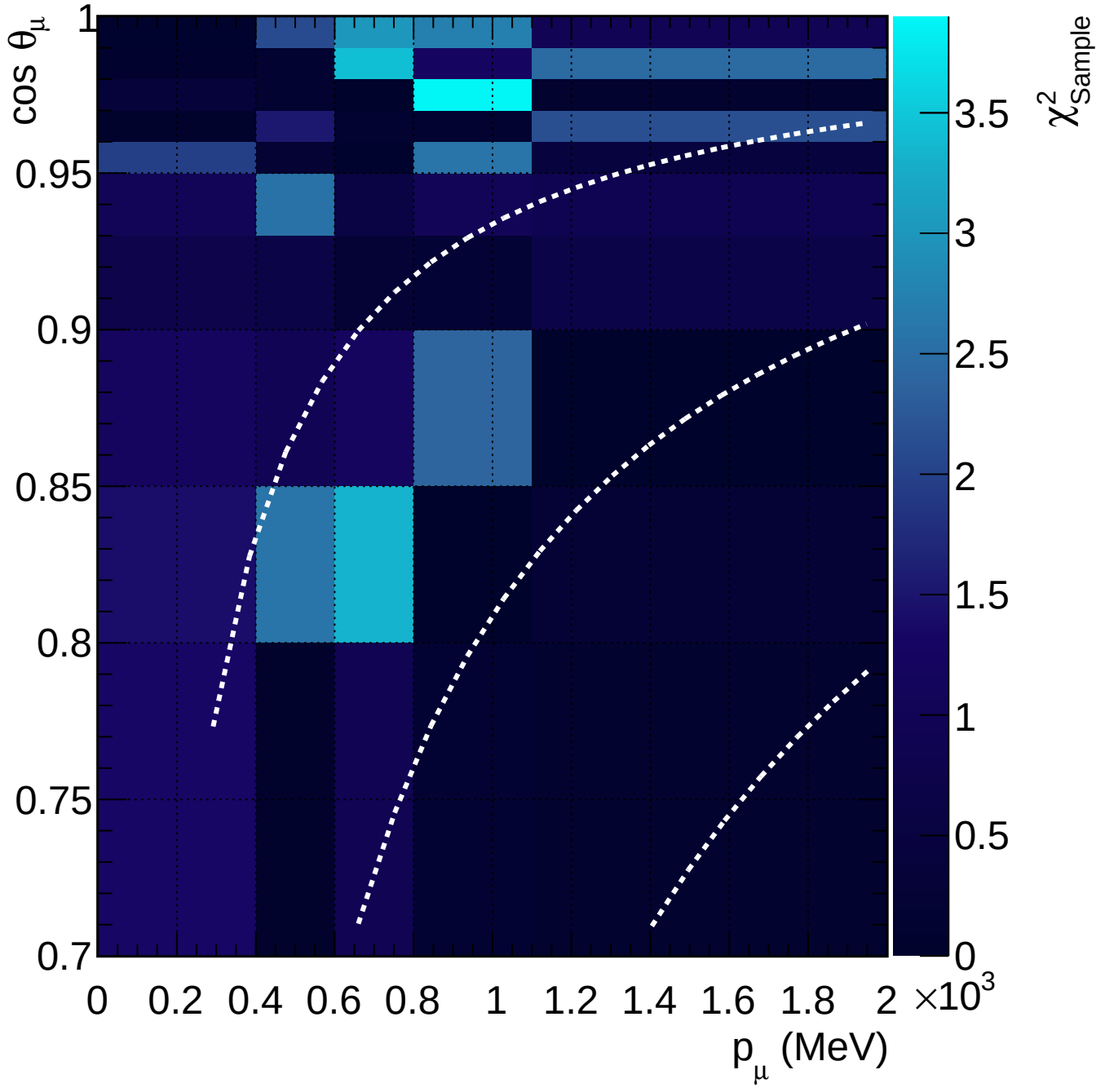

FGD2_anti-numuCC_N_tracks_data
N_events/1
8000
16000
14000
12000
10000
8000
6000
4000
2000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

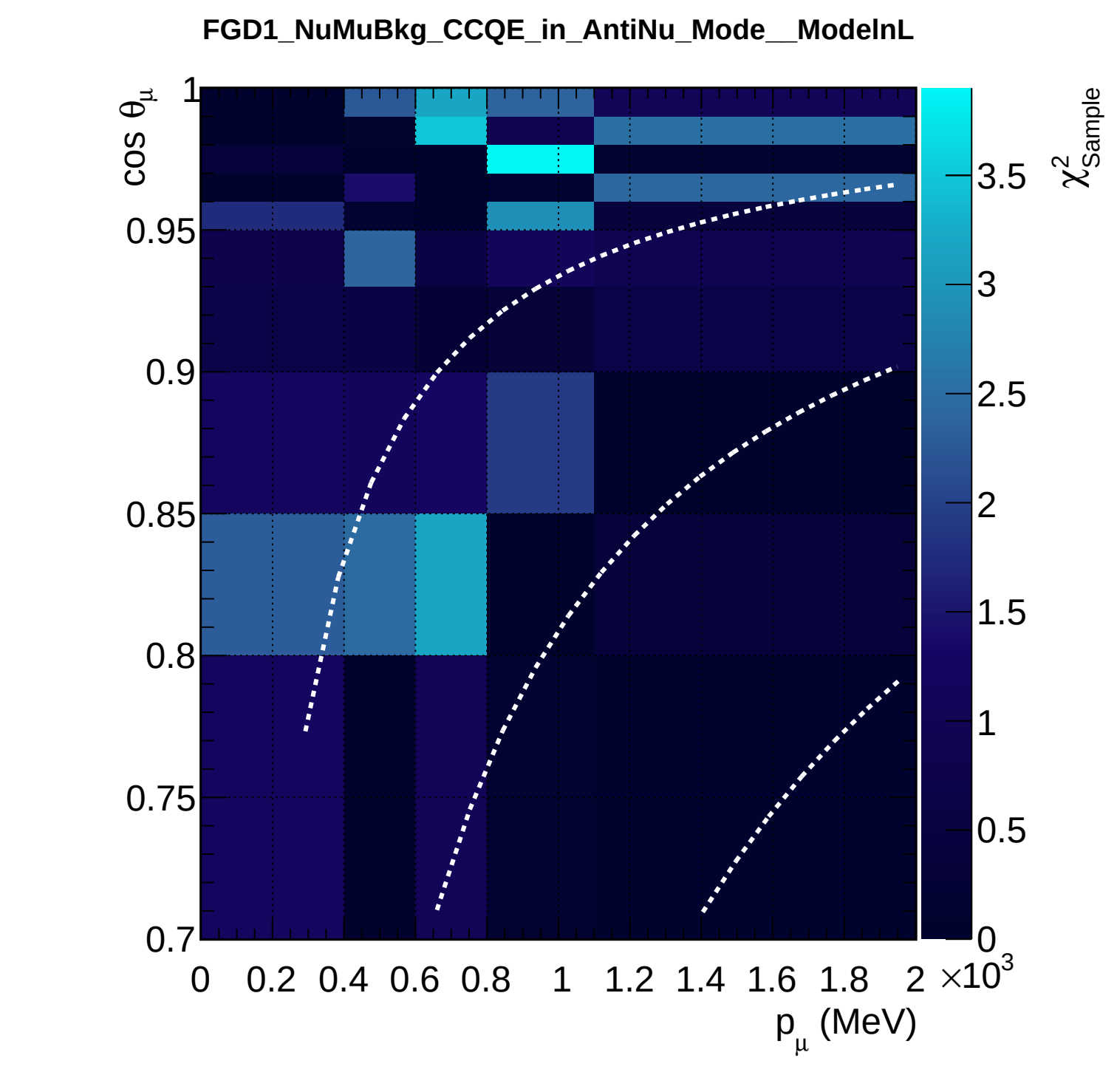

DataDrawFluc
FGD1 ν_μ RHC CC 1 track
p = 0.296
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
95
90
85
80
75
70
65
60
40
50
60
70
80
90
100
110
120
12
10
8
6
4
2
0

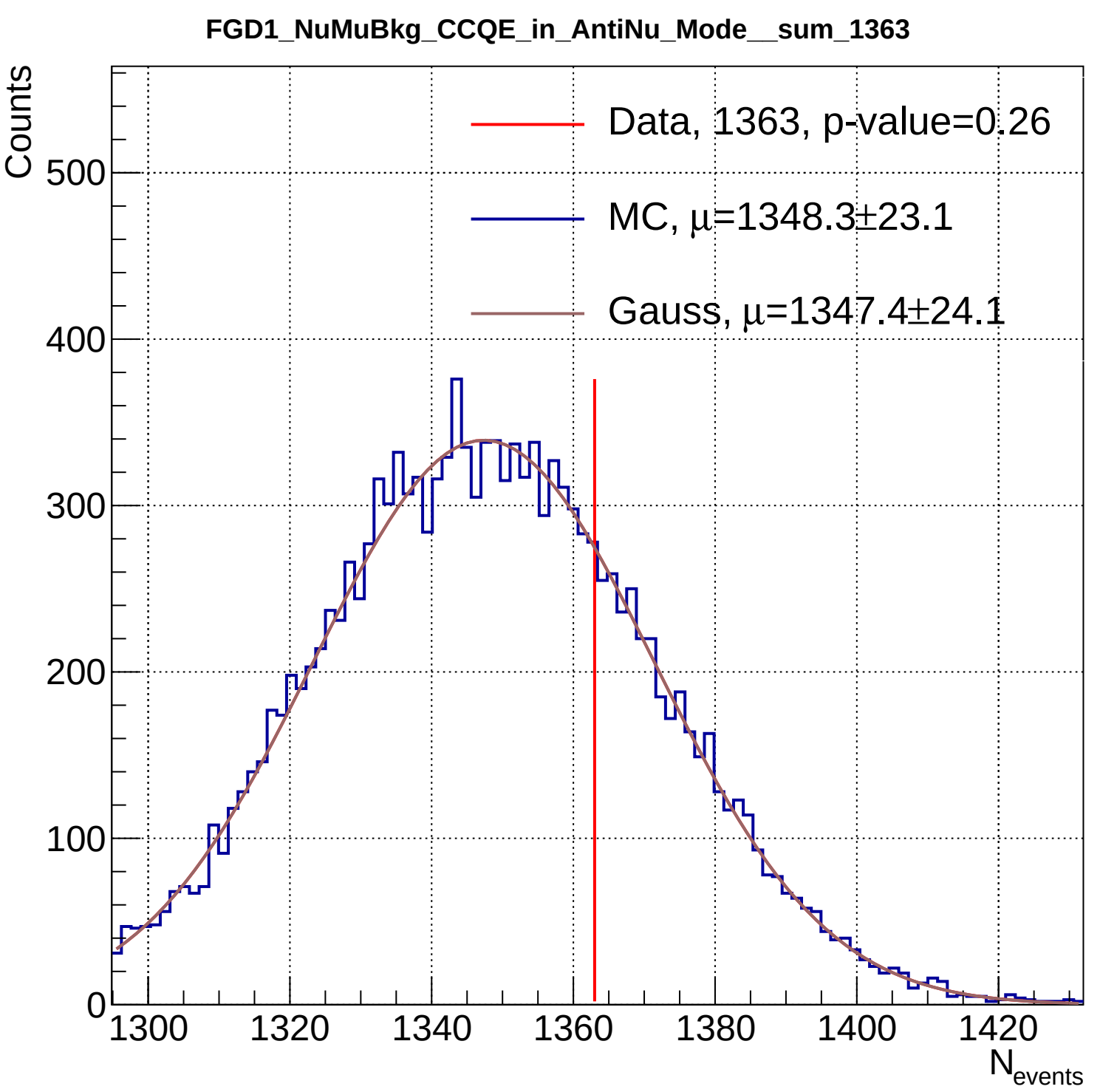

DataPredFluc
FGD1 ν_μ RHC CC 1 track
p = 0.293
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
95
90
85
80
75
70
65
60
30
40
50
60
70
80
90
100
110
120
12
10
8
6
4
2
0

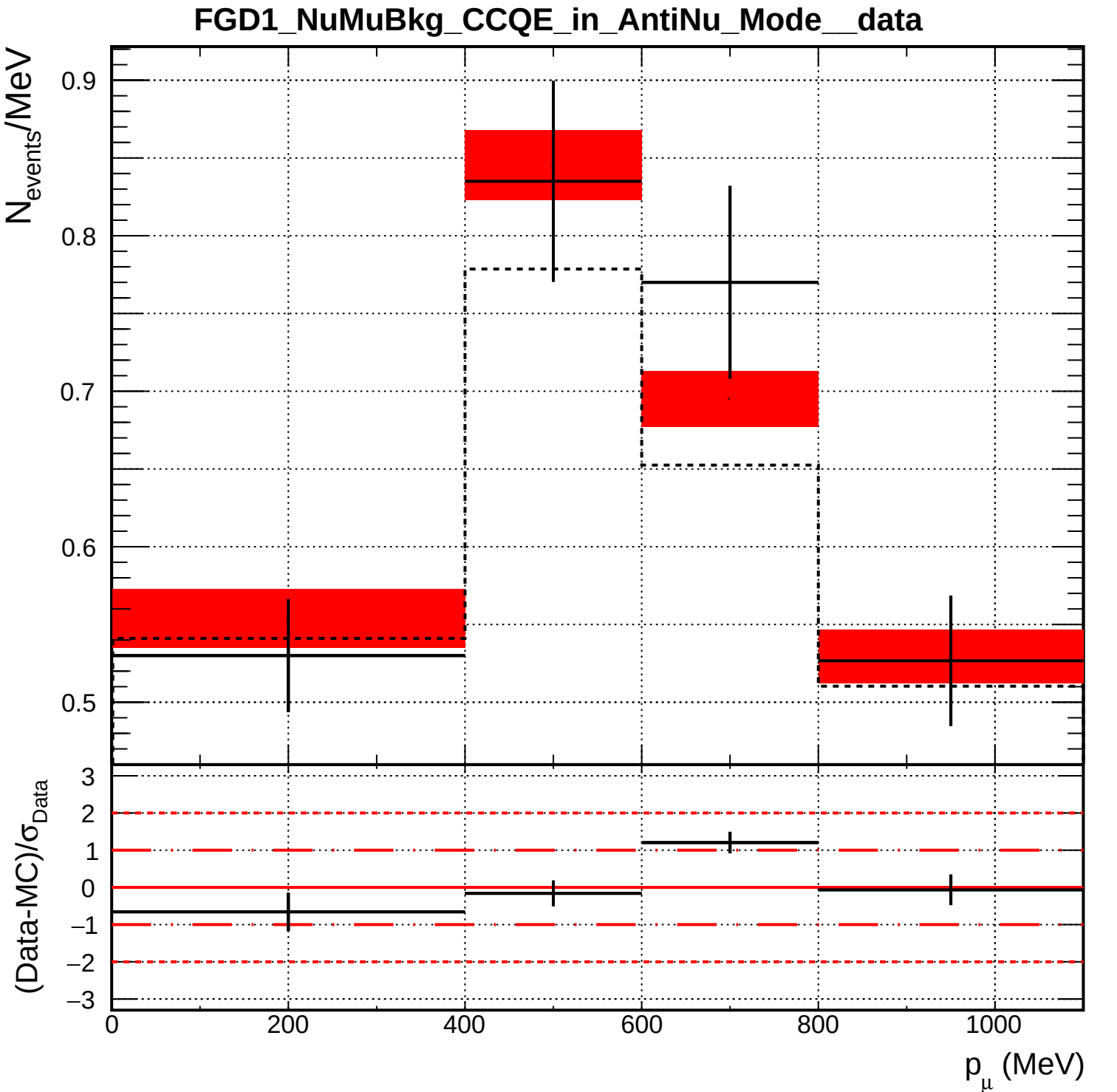

FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

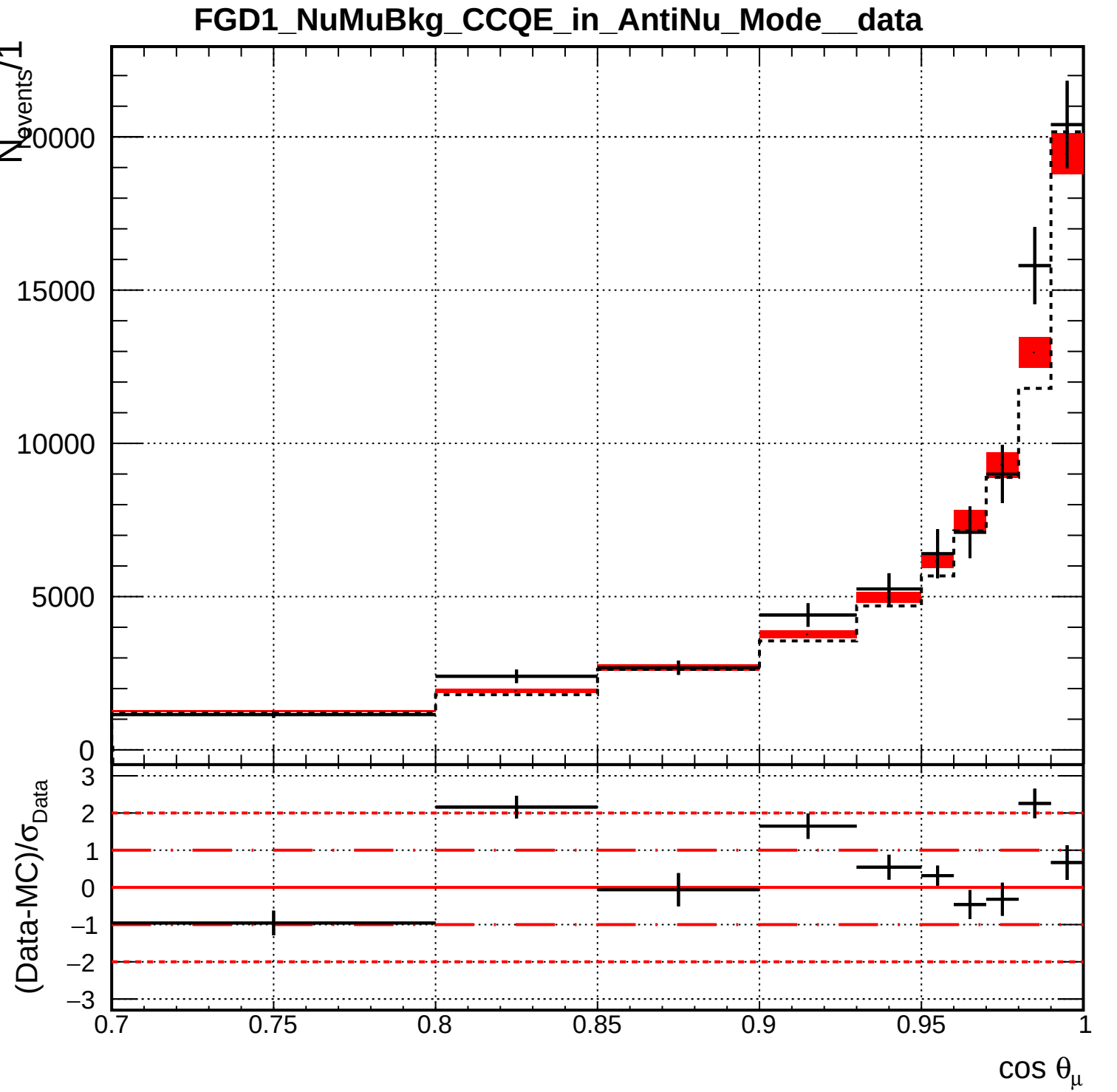

FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

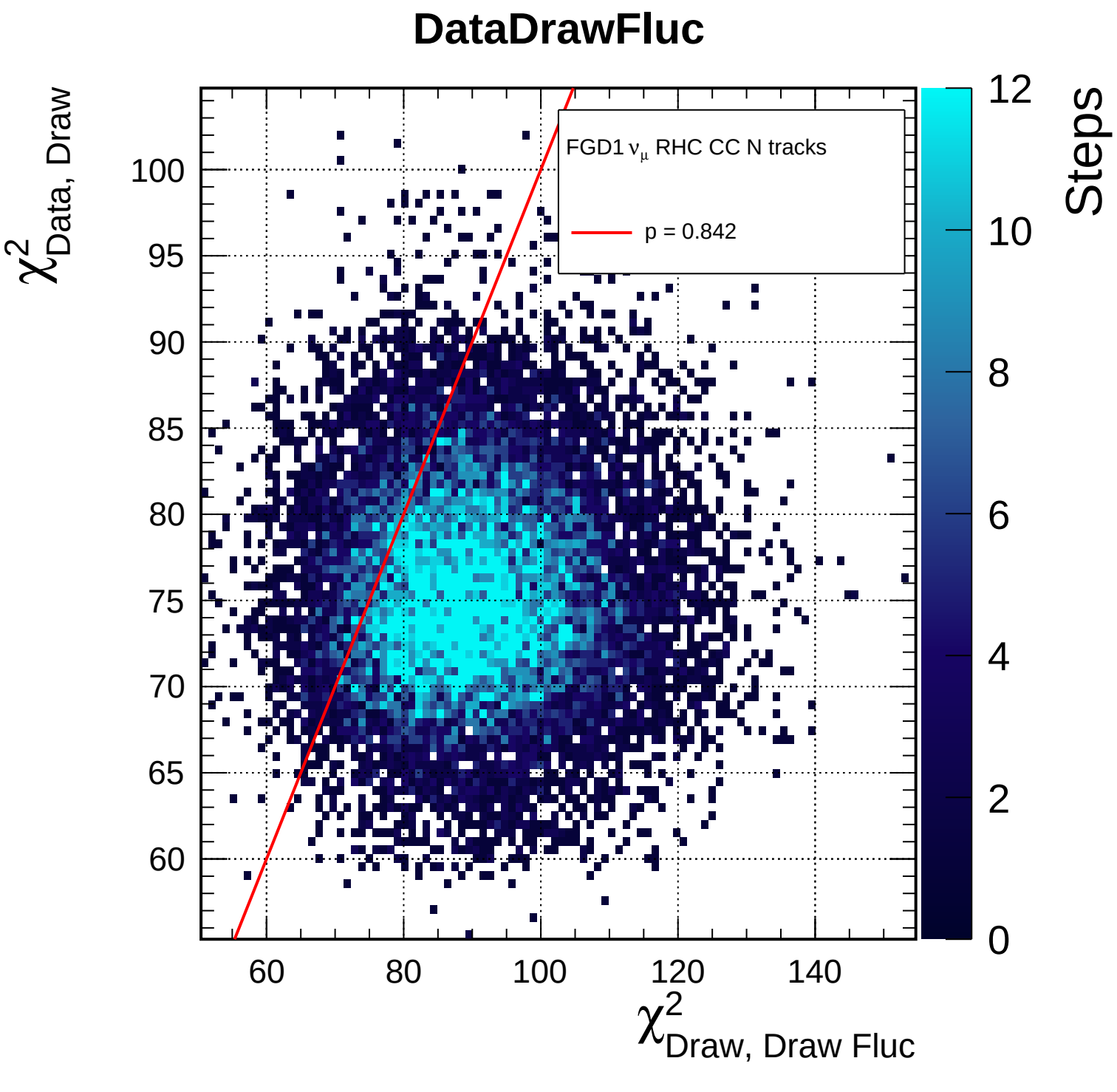

FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
χ²Sample
3.5
3
2.5
2
1.5
1
0.5
0

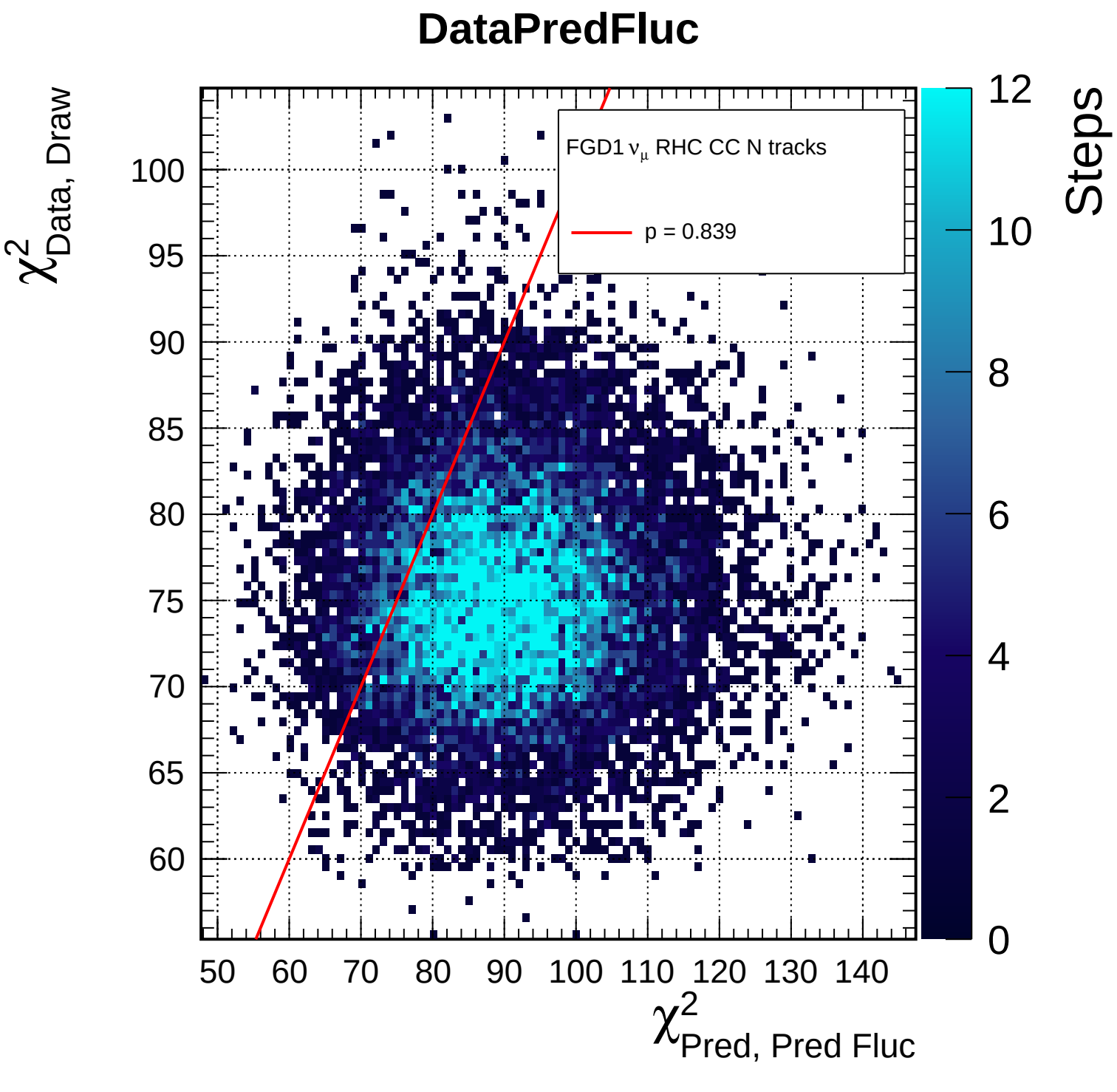

FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
χ²Sample
3.5
3
2.5
2
1.5
1
0.5
0

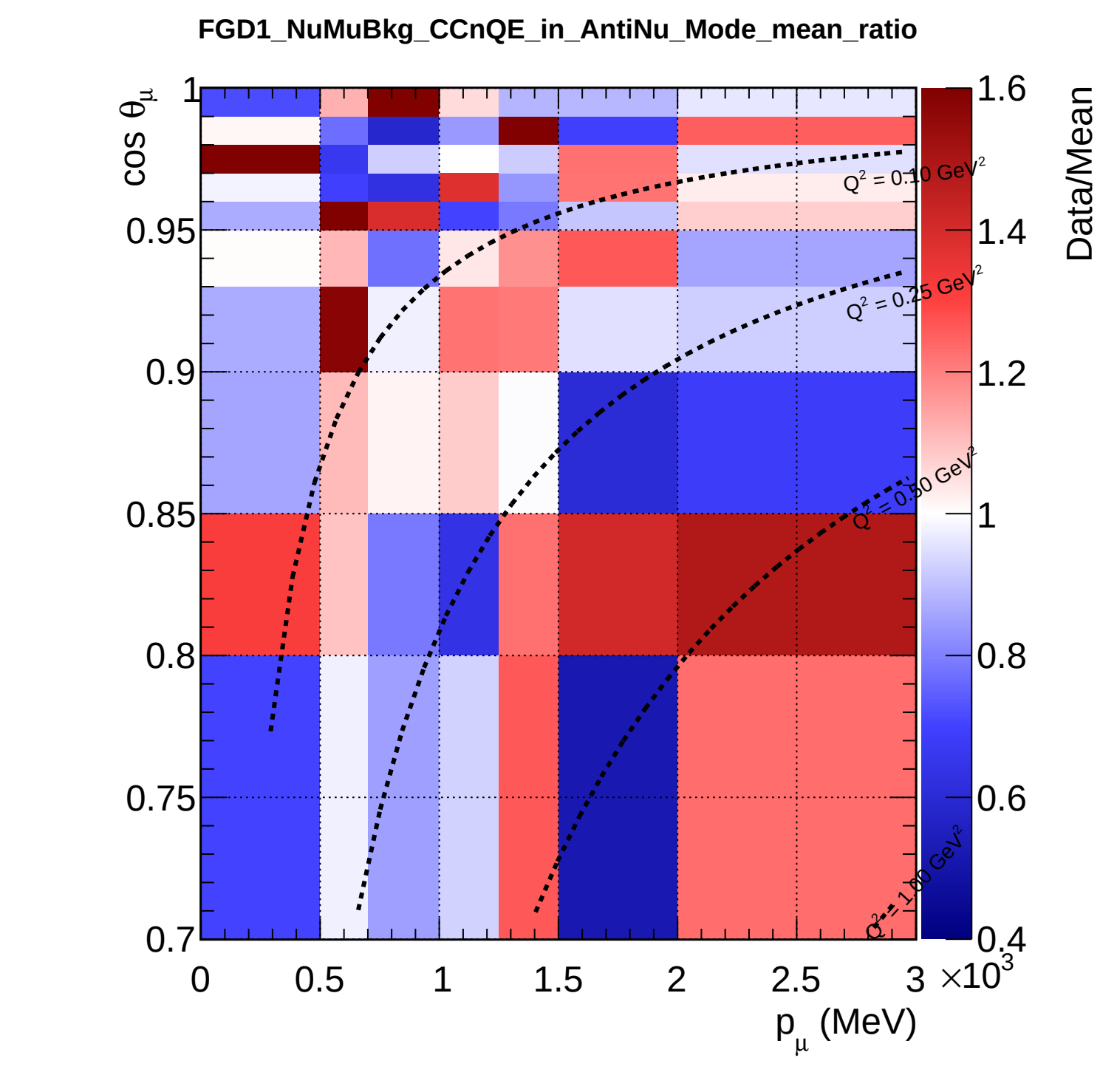

FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__sum_1363
Counts
Data, 1363, p-value=0.26
MC, μ=1348.3±23.1
Gauss, μ=1347.4±24.1
0
100
200
300
400
500
1300
1320
1340
1360
1380
1400
1420
N_events

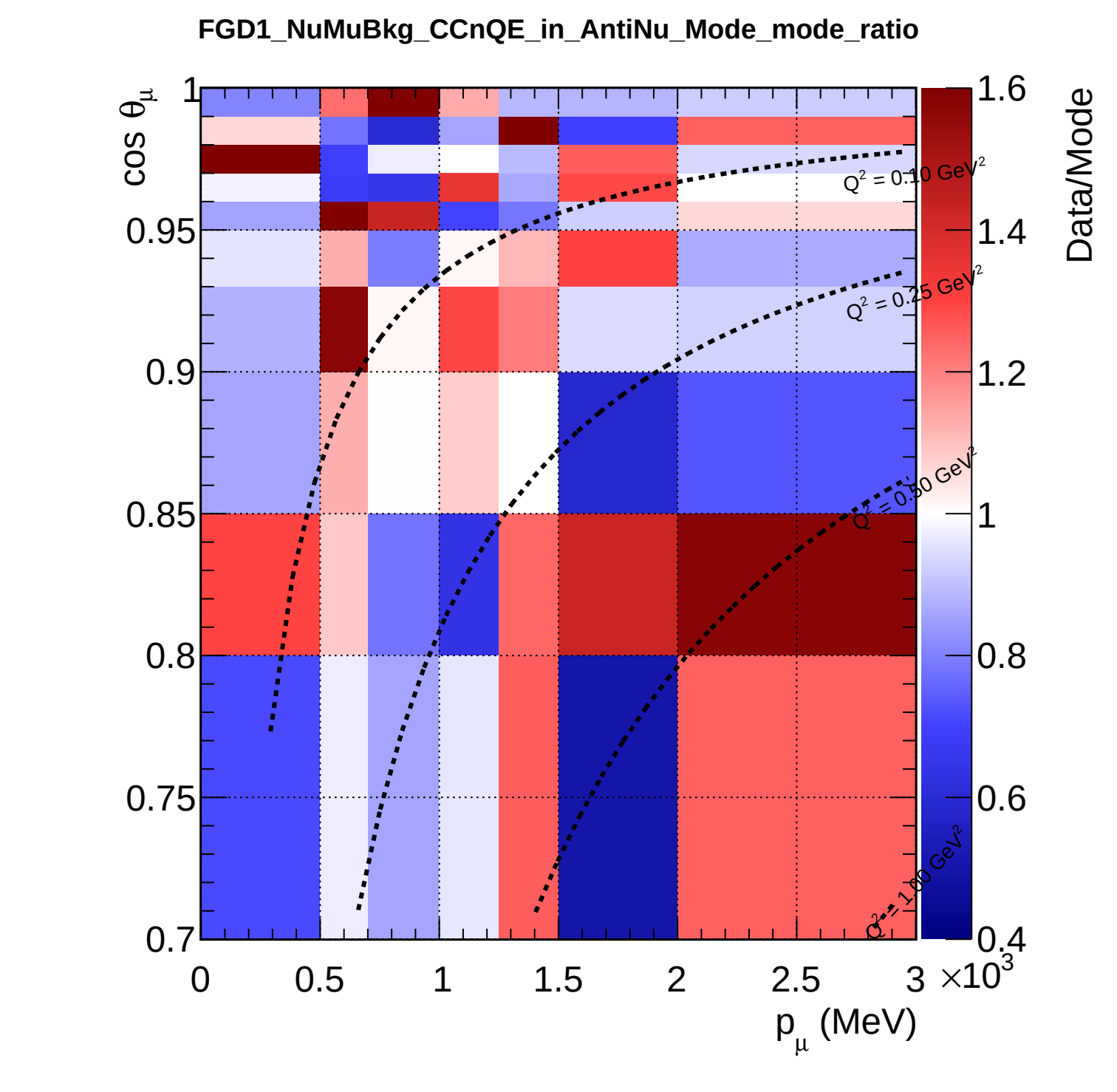

FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__data
N_events/MeV
0.9
0.8
0.7
0.6
0.5
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
200
400
600
800
1000
p_μ (MeV)

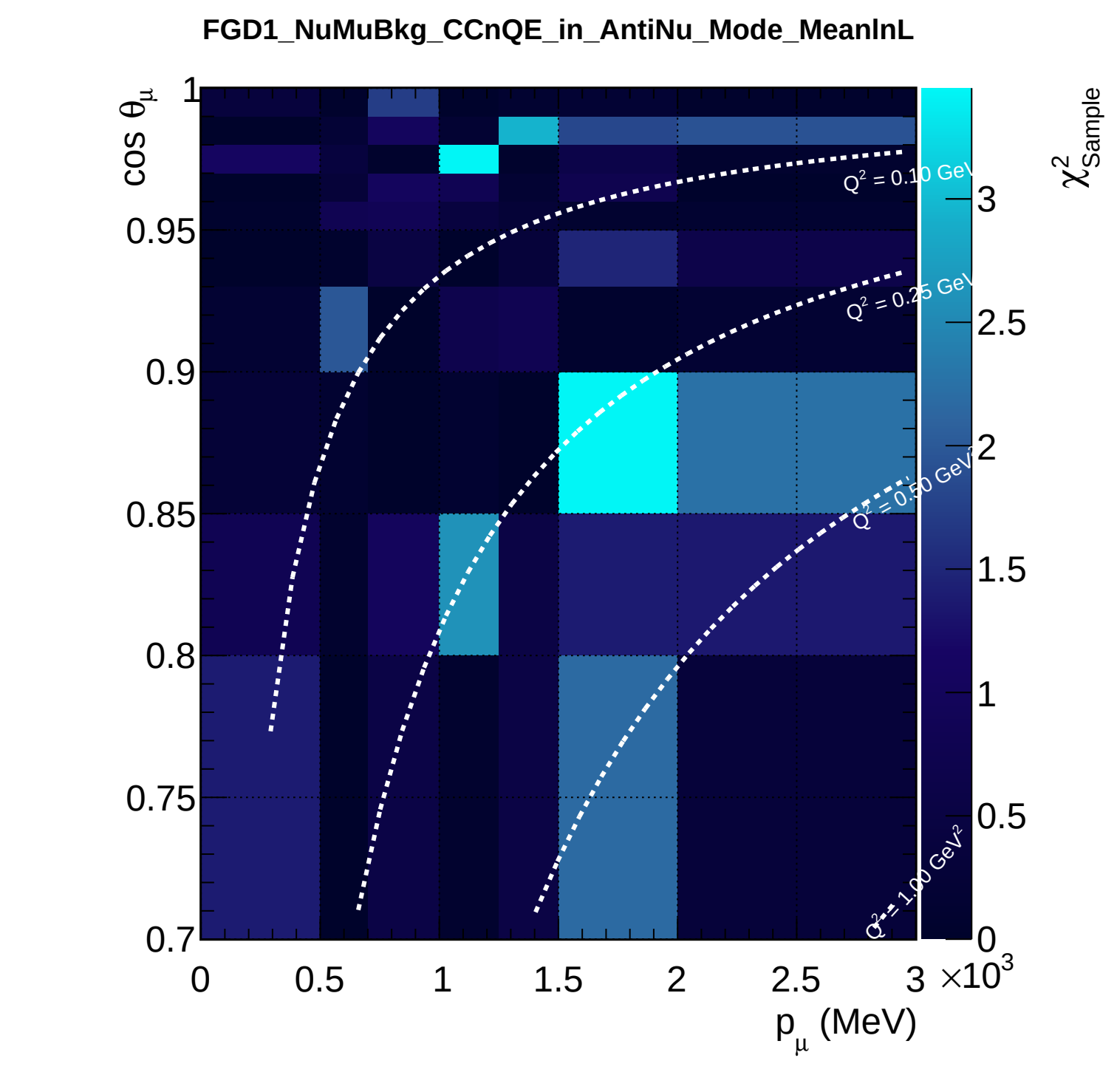

FGD1_NuMuBkg_CCQE_in_AntiNu_Mode__data
N_events/1
20000
15000
10000
5000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

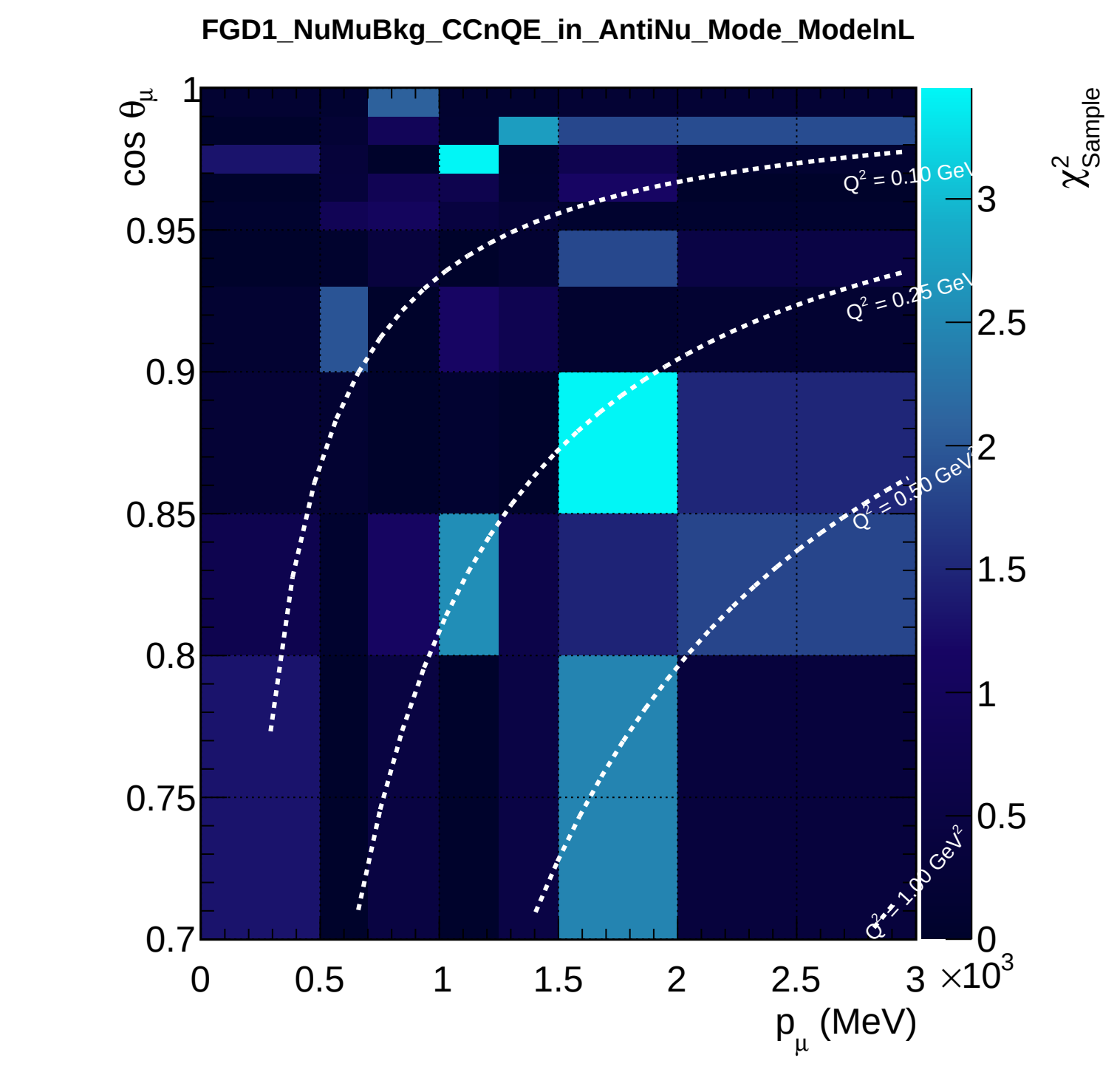

DataDrawFluc
FGD1 ν_μ RHC CC N tracks
p = 0.842
$\chi^2_{Data,\ Draw}$
$\chi^2_{Draw,\ Draw\ Fluc}$
Steps
100
95
90
85
80
75
70
65
60
60
80
100
120
140
12
10
8
6
4
2
0

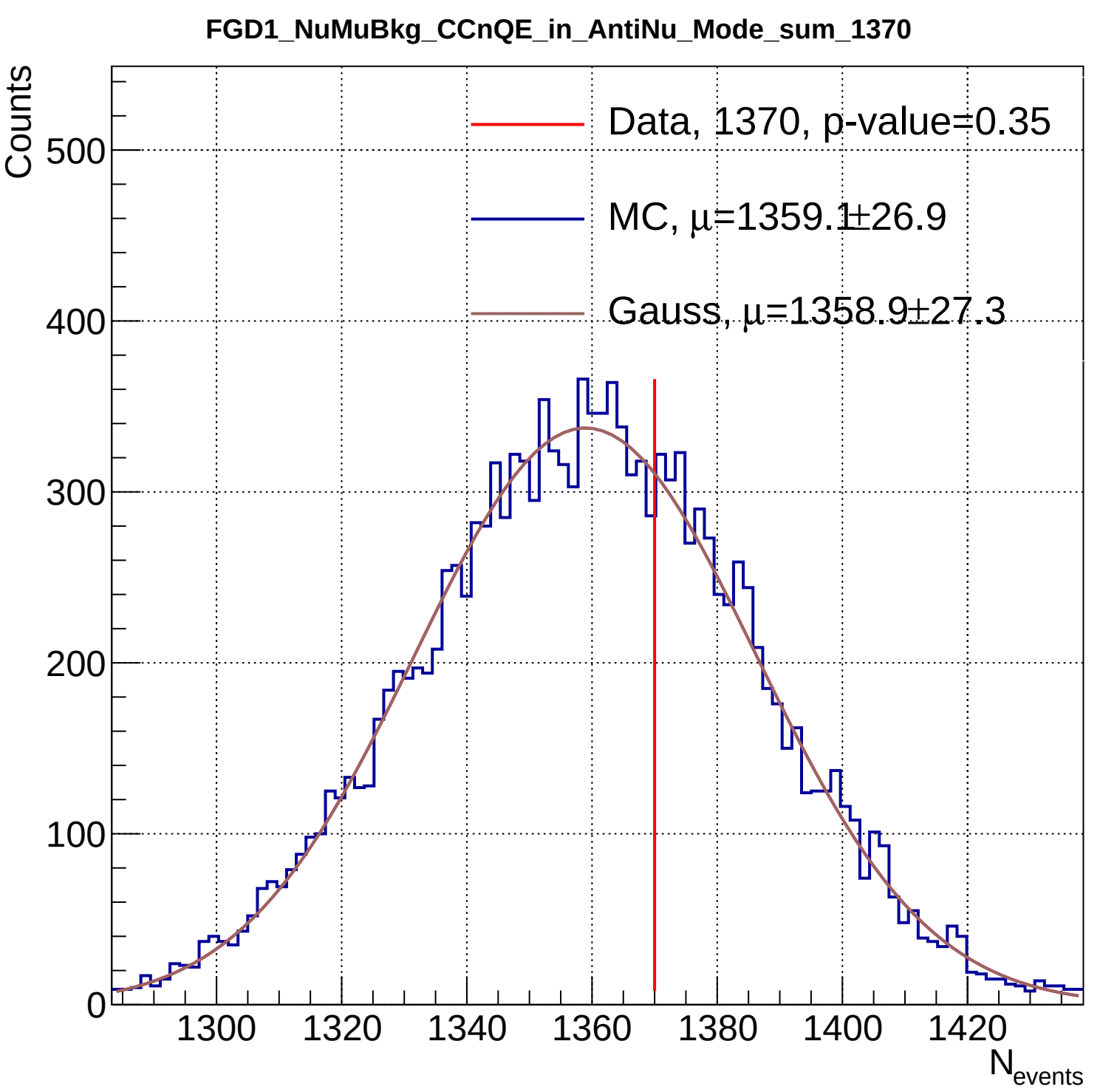

DataPredFluc
FGD1 ν_μ RHC CC N tracks
p = 0.839
$\chi^2_{Data,\ Draw}$
$\chi^2_{Pred,\ Pred\ Fluc}$
Steps
100
95
90
85
80
75
70
65
60
50
60
70
80
90
100
110
120
130
140
12
10
8
6
4
2
0

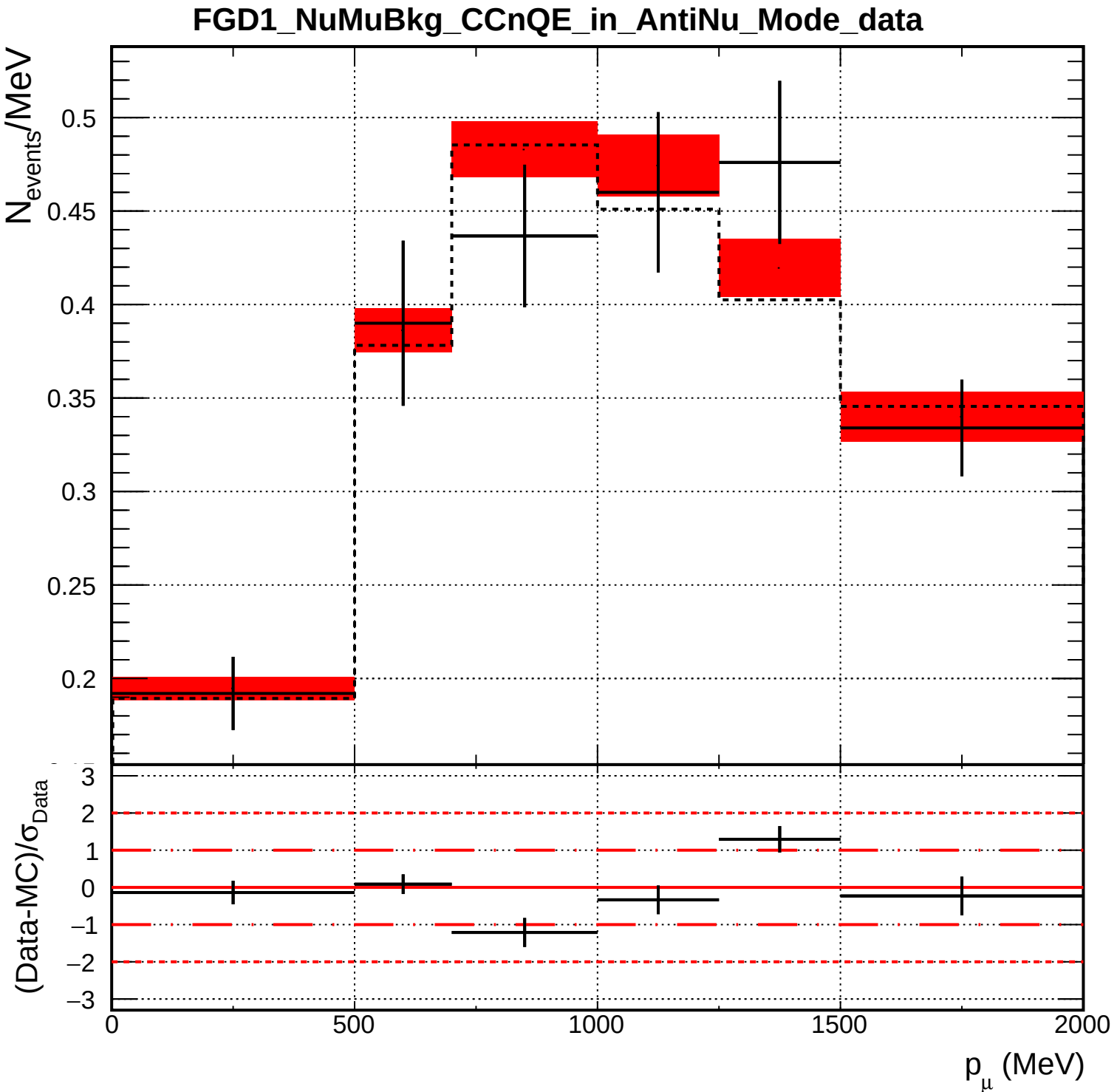

FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.5
1
1.5
2
2.5
3
×10³
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

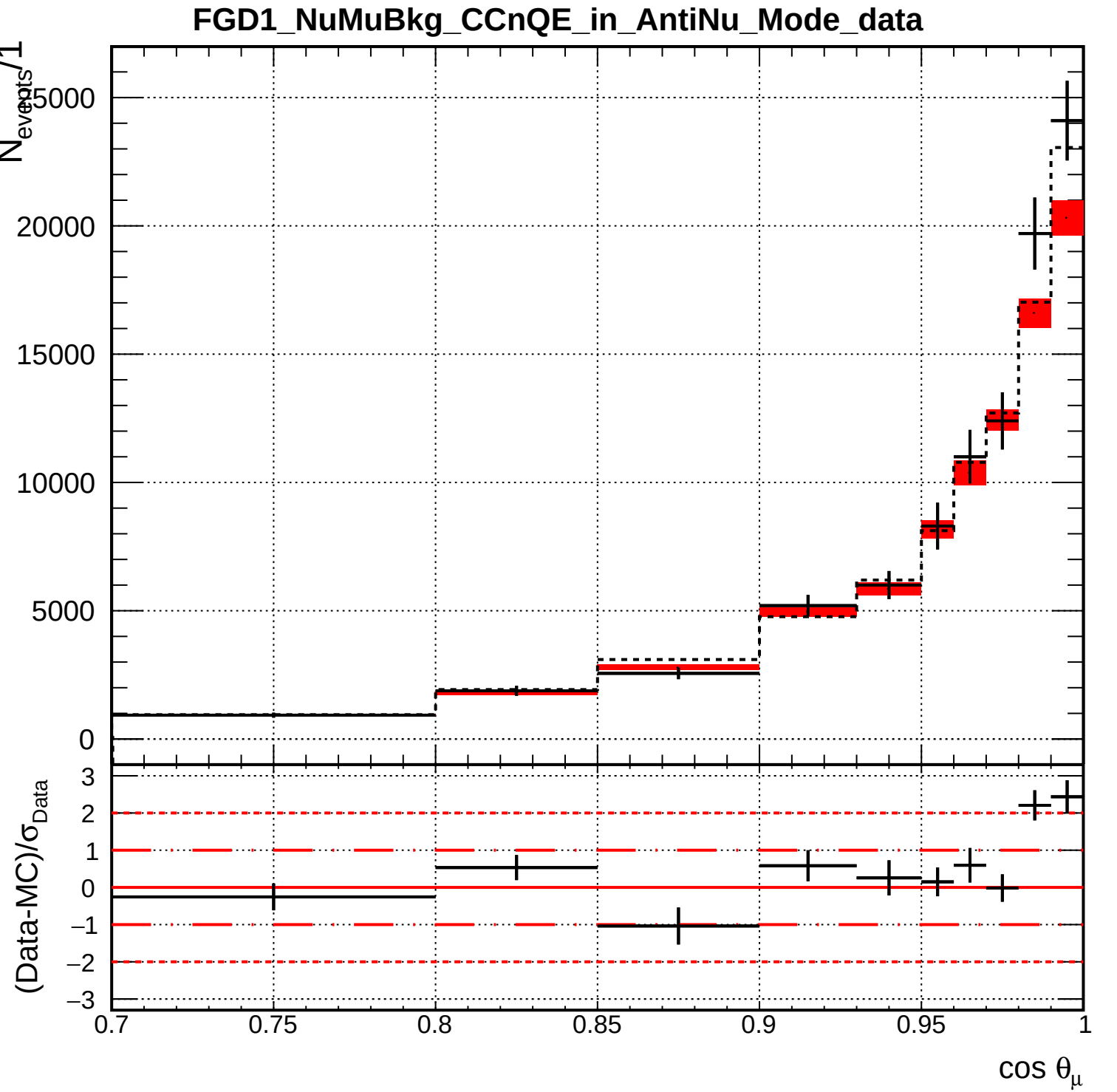

FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.5
1
1.5
2
2.5
3
×10^3
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

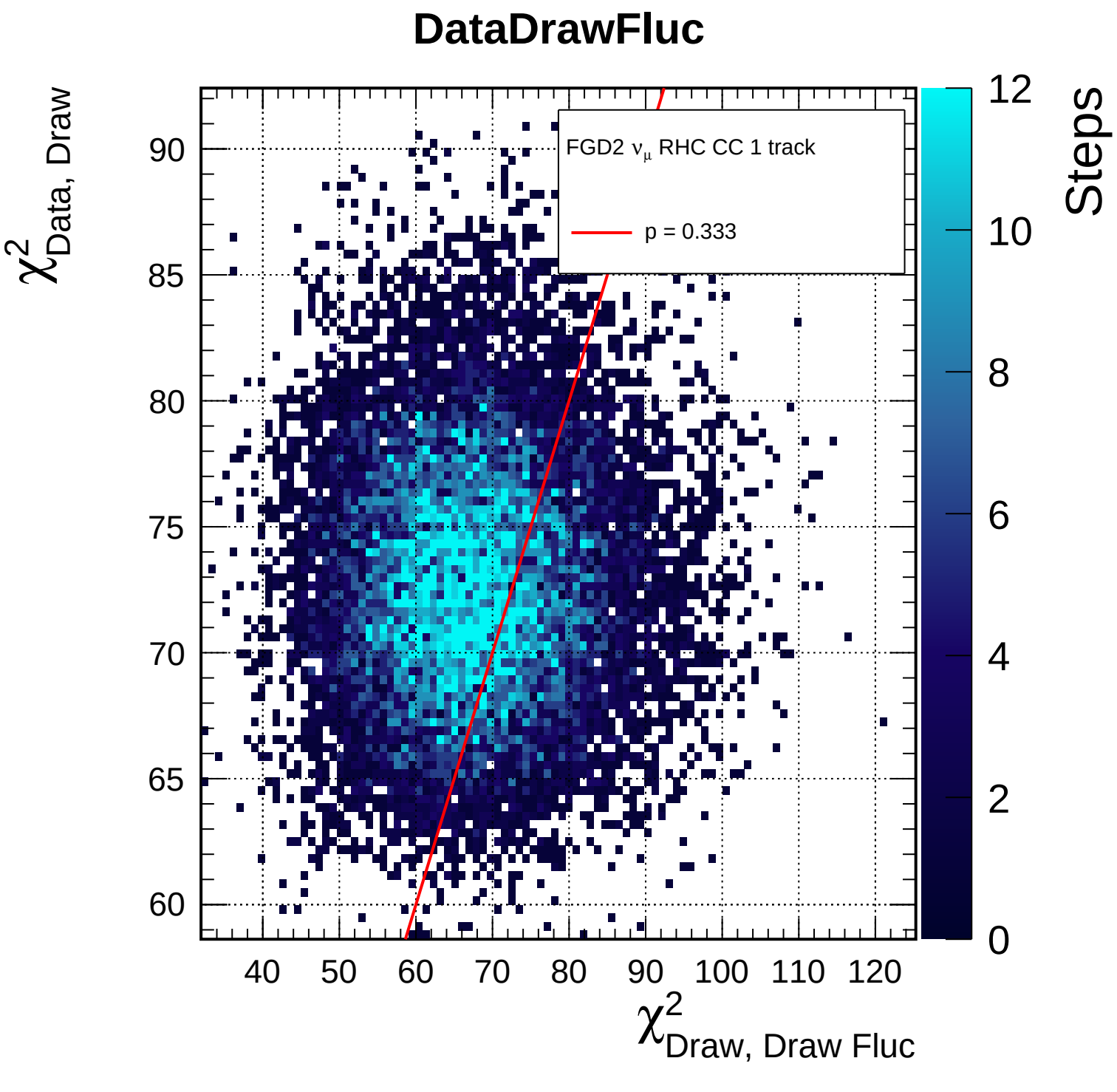

FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.5
1
1.5
2
2.5
3
×10³
pμ (MeV)
Q² = 0.10 GeV
Q² = 0.25 GeV
Q² = 0.50 GeV²
Q² = 1.00 GeV²
χ²Sample
3
2.5
2
1.5
1
0.5
0

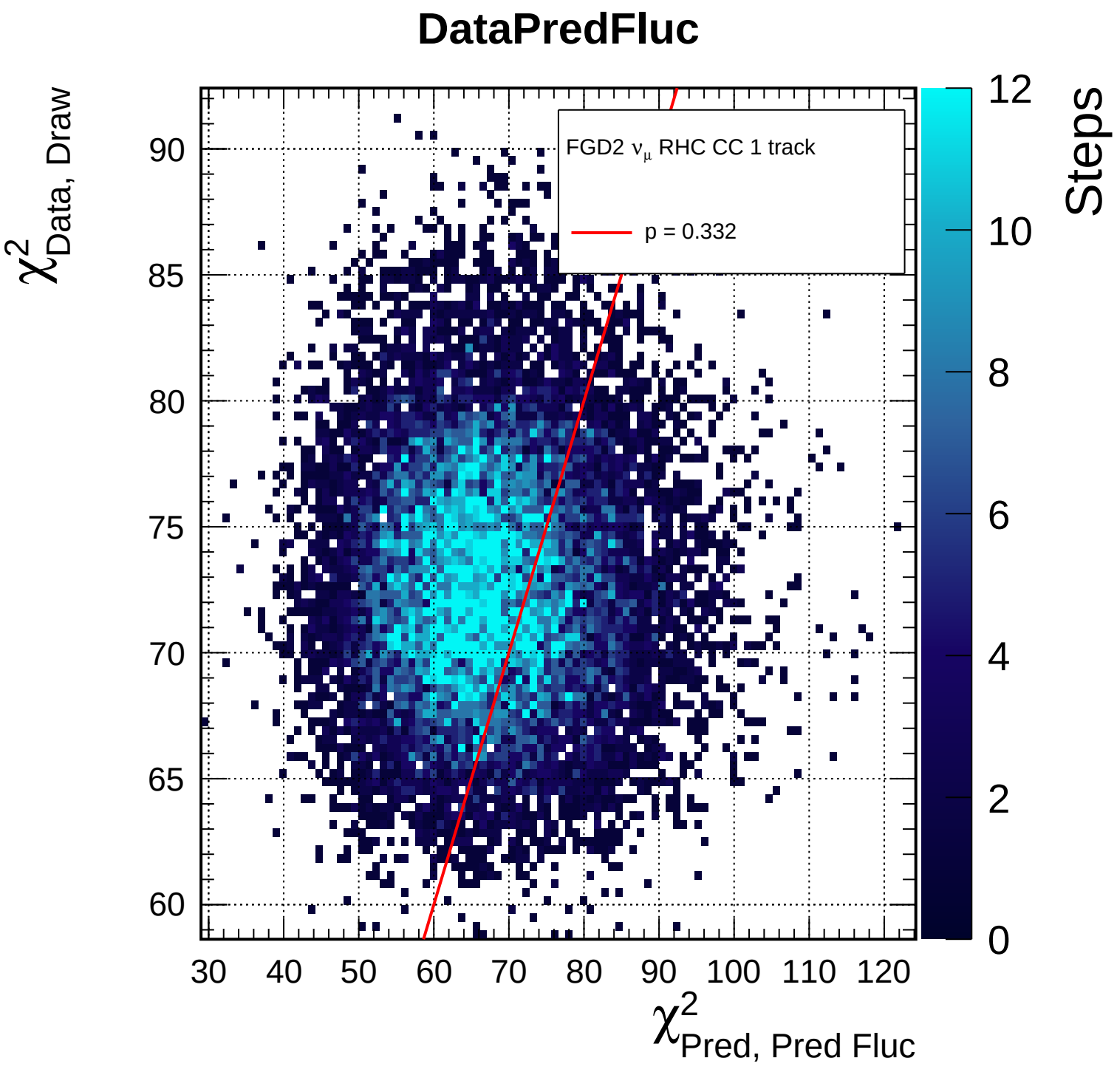

FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.5
1
1.5
2
2.5
3
×10^3
pμ (MeV)
Q² = 0.10 GeV
Q² = 0.25 GeV
Q² = 0.50 GeV²
Q² = 1.00 GeV²
χ²Sample
3
2.5
2
1.5
1
0.5
0

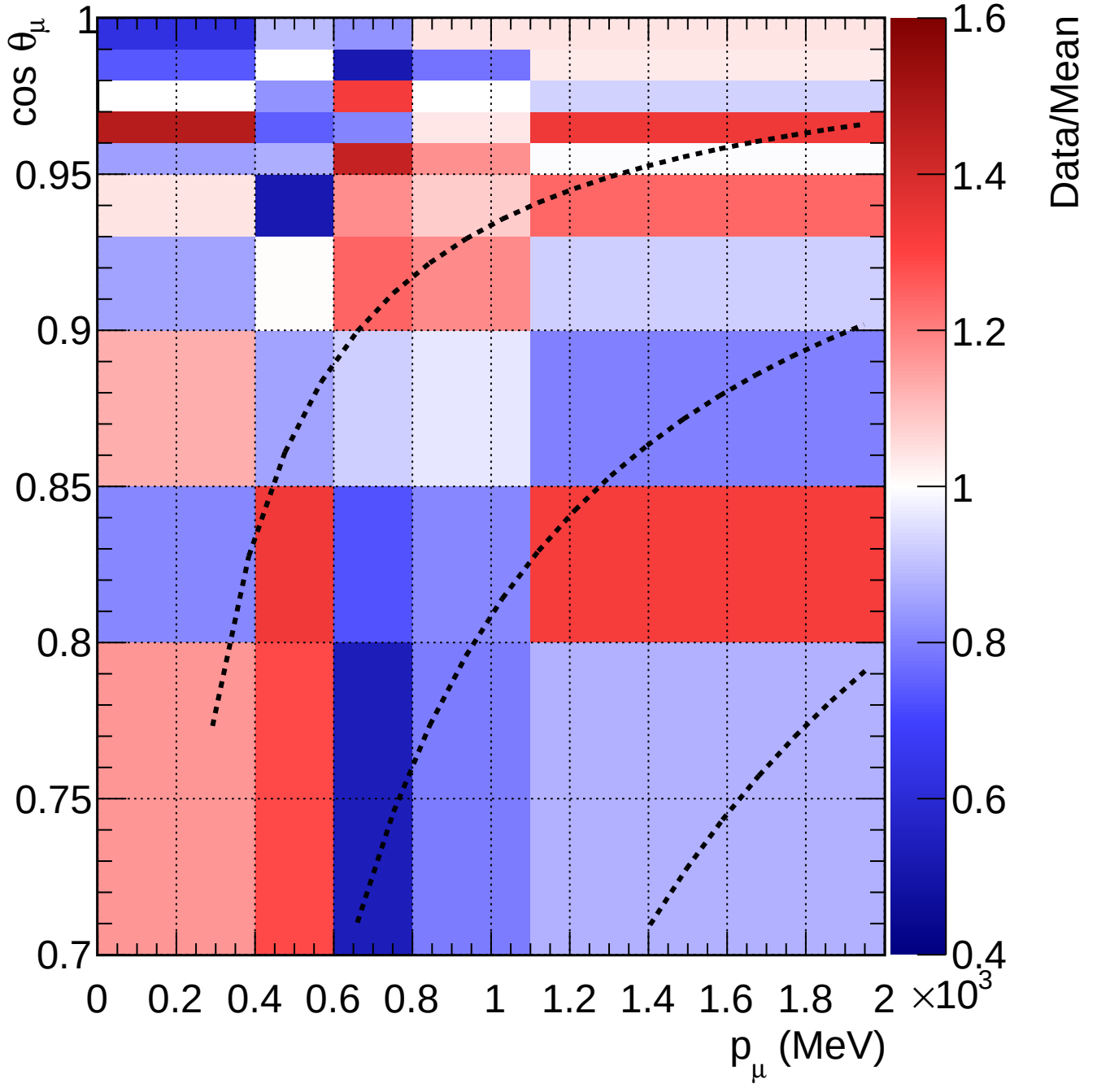

FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_sum_1370
Counts
Data, 1370, p-value=0.35
MC, μ=1359.1±26.9
Gauss, μ=1358.9±27.3
0
100
200
300
400
500
1300
1320
1340
1360
1380
1400
1420
N events

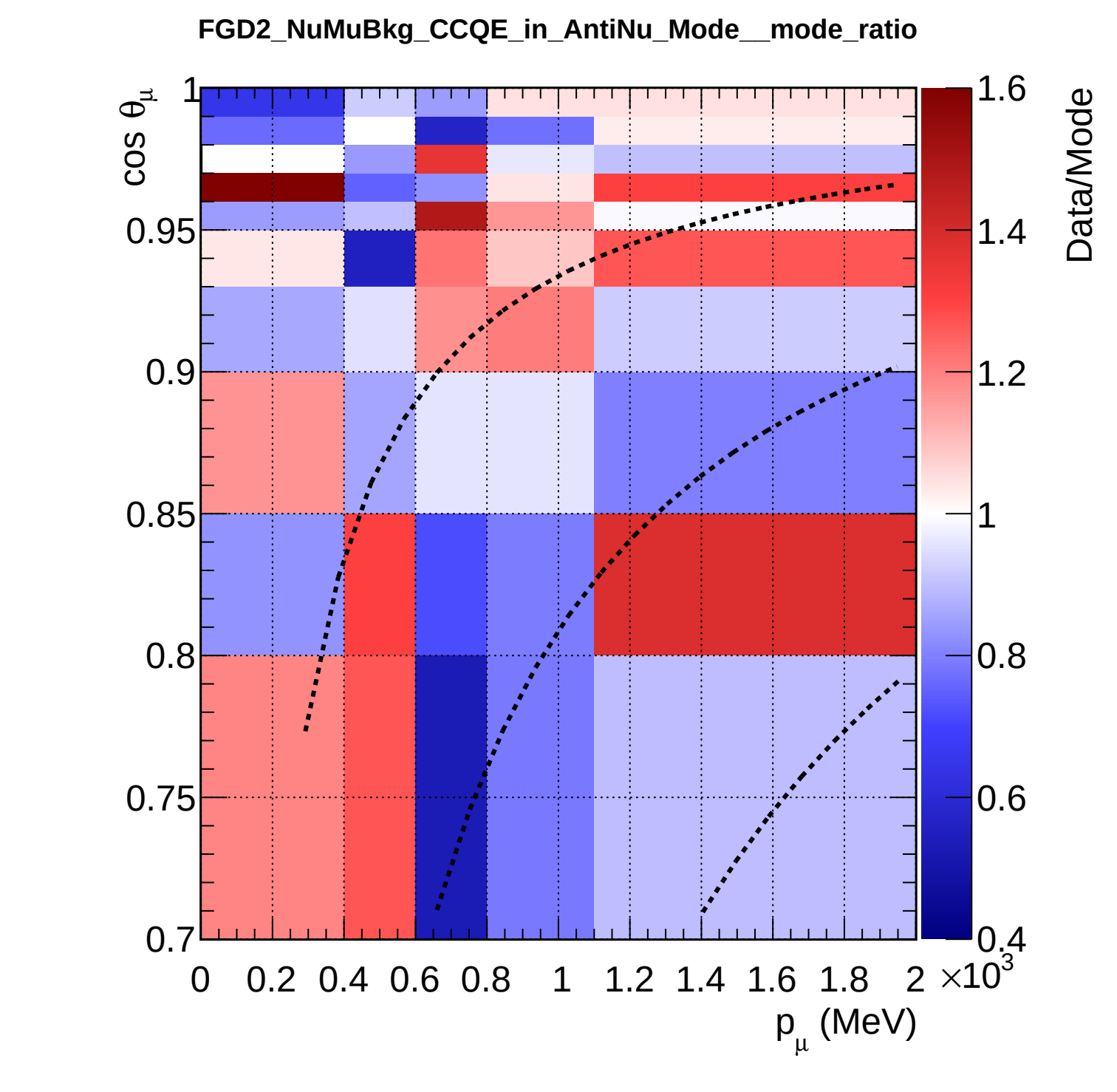

FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_data
N_events/MeV
0.5
0.45
0.4
0.35
0.3
0.25
0.2
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
500
1000
1500
2000
p_μ (MeV)

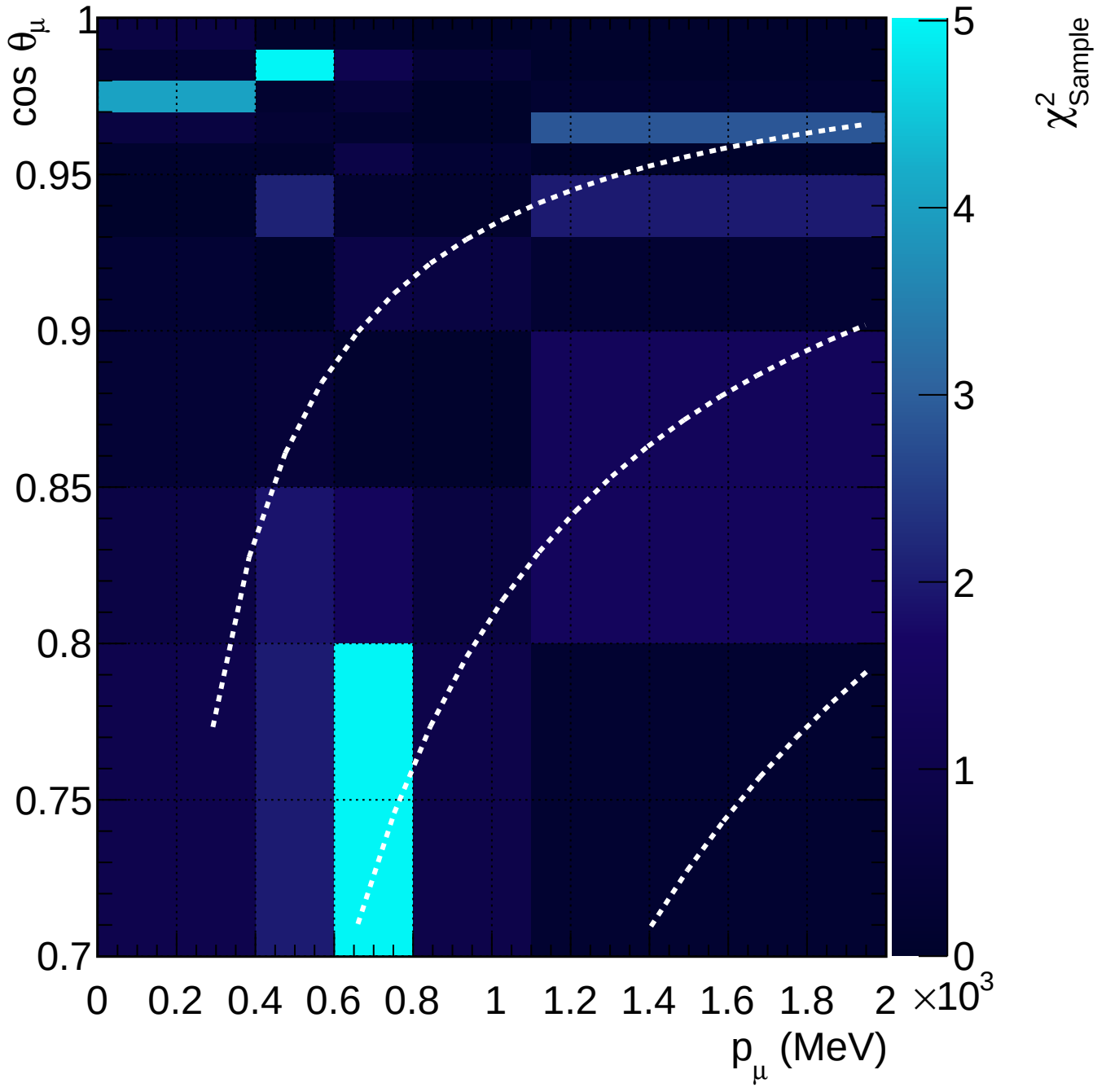

FGD1_NuMuBkg_CCnQE_in_AntiNu_Mode_data
N_events/1
25000
20000
15000
10000
5000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

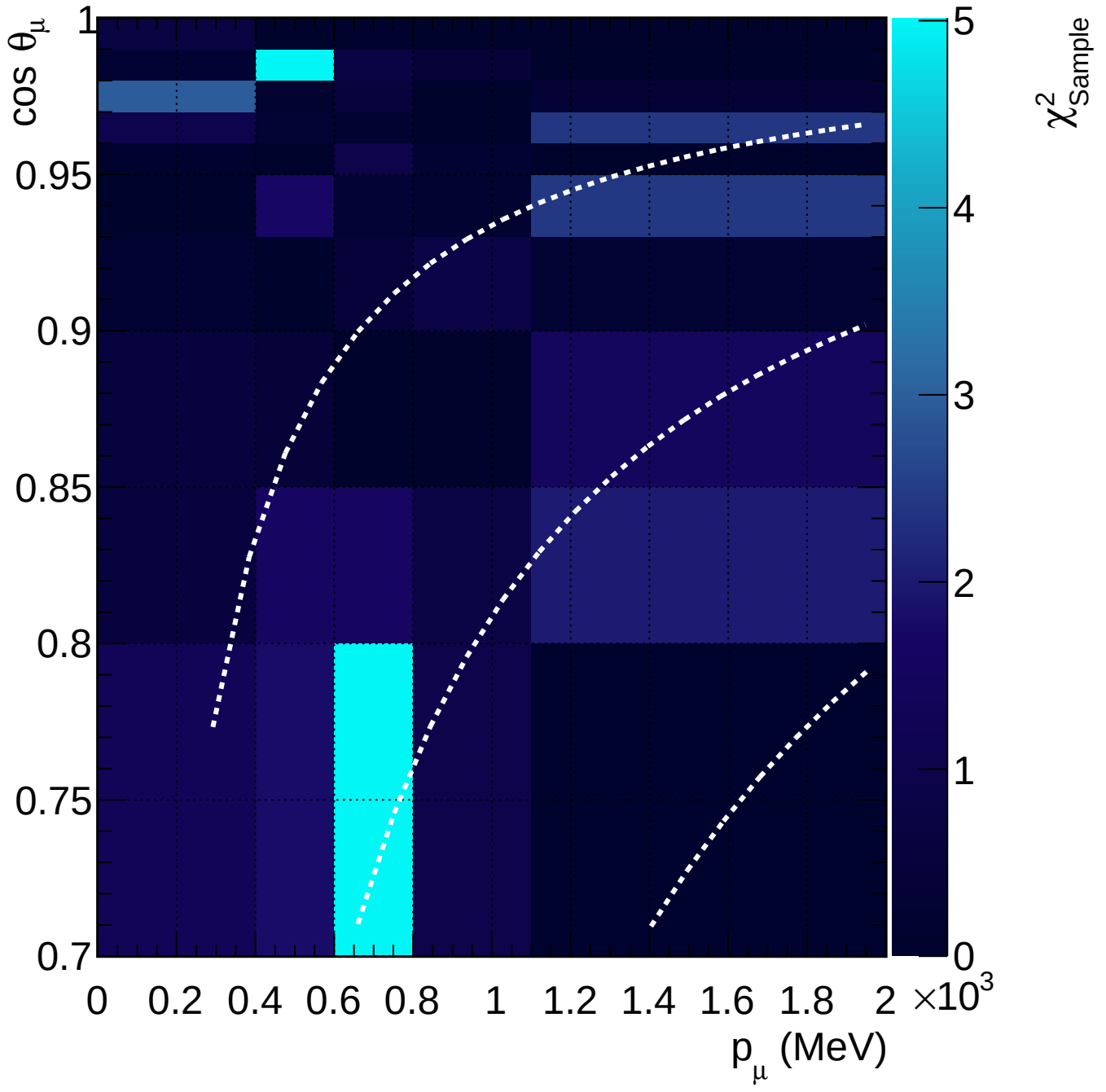

DataDrawFluc
FGD2 ν_μ RHC CC 1 track
p = 0.333
$\chi^2_{Data, Draw}$
$\chi^2_{Draw, Draw Fluc}$
Steps
90
85
80
75
70
65
60
40
50
60
70
80
90
100
110
120
12
10
8
6
4
2
0

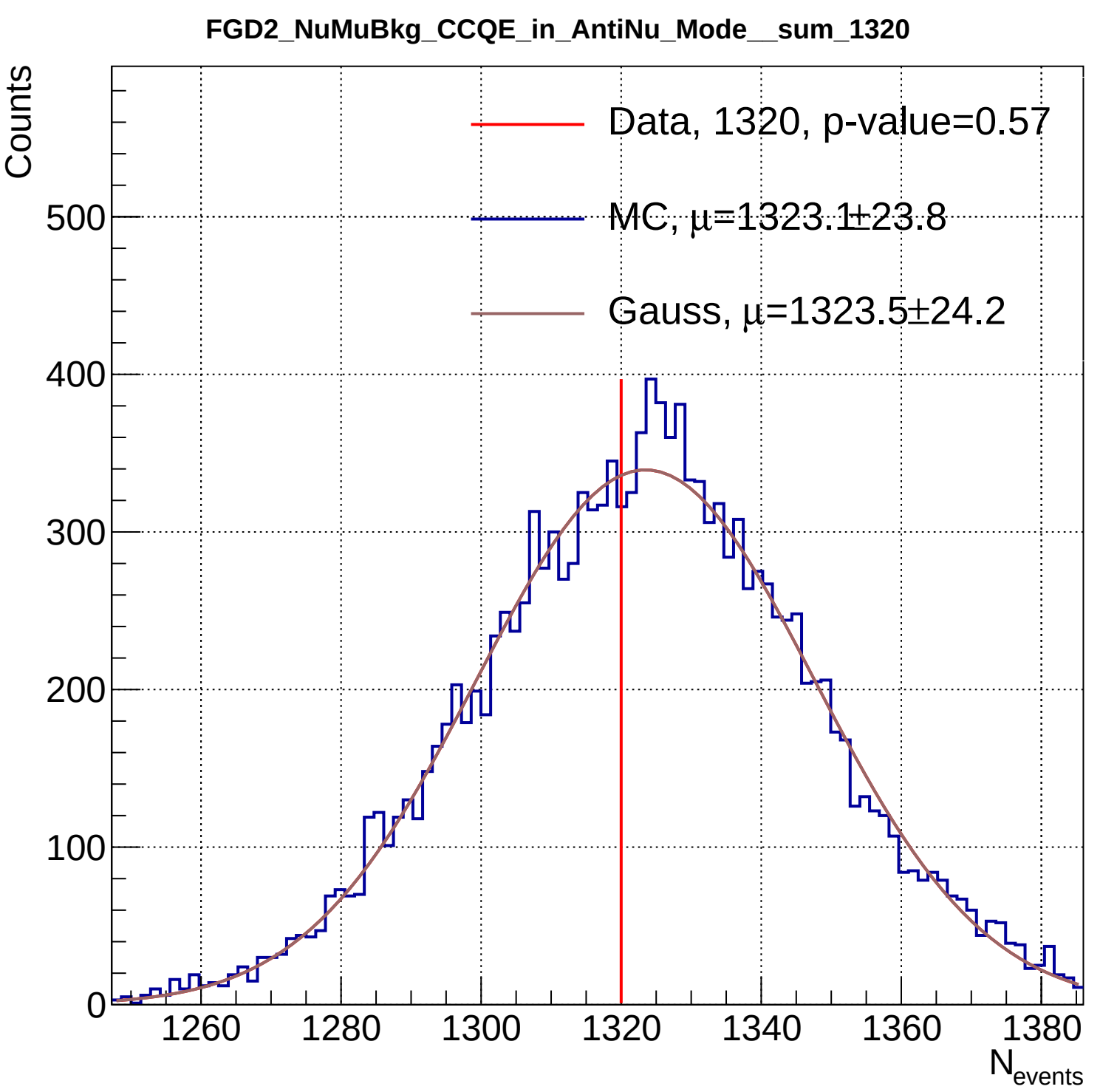

DataPredFluc
FGD2 ν_μ RHC CC 1 track
p = 0.332
$\chi^2_{Data,\ Draw}$
$\chi^2_{Pred,\ Pred\ Fluc}$
Steps
90
85
80
75
70
65
60
30
40
50
60
70
80
90
100
110
120
12
10
8
6
4
2
0

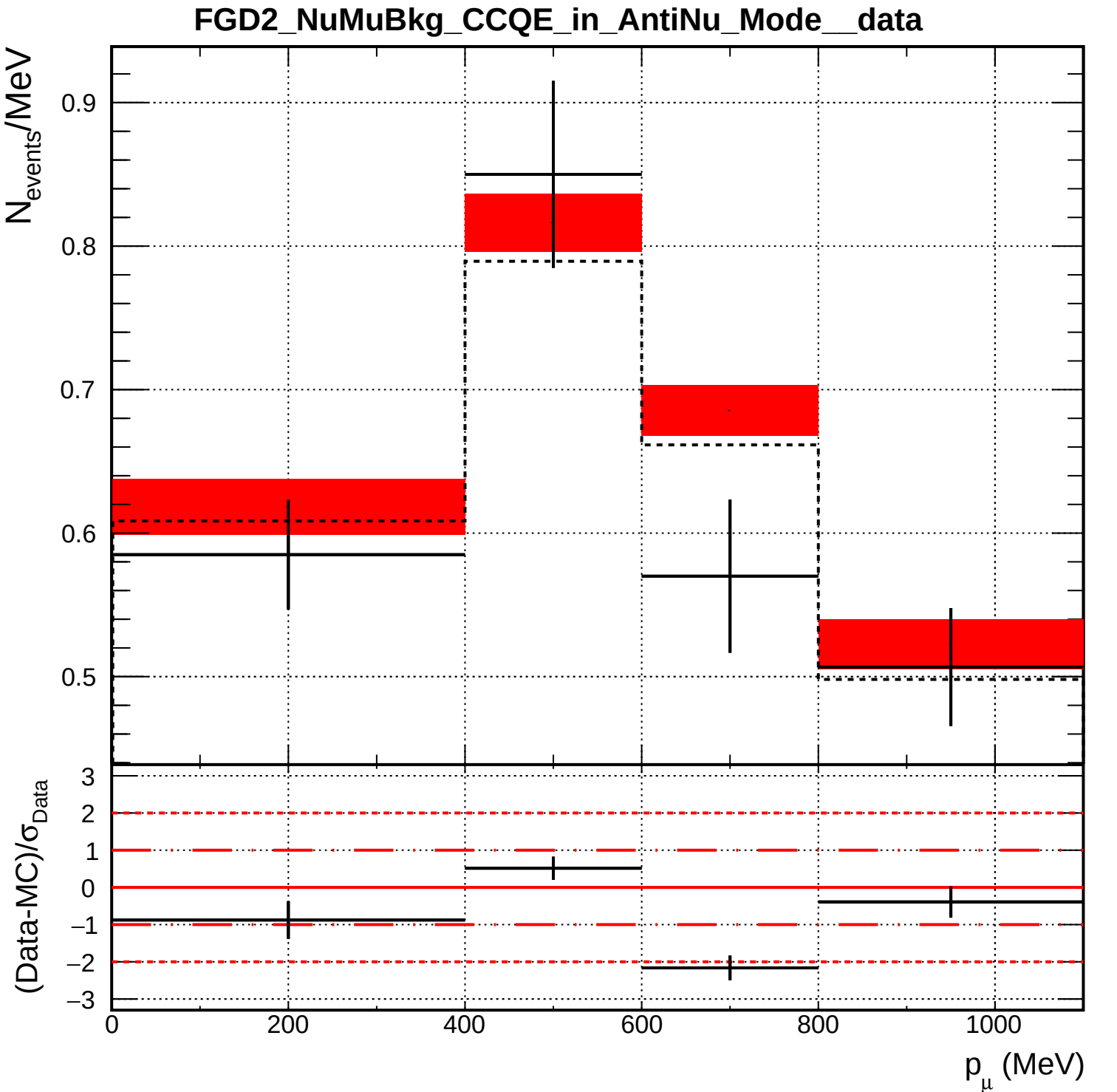

FGD2_NuMuBkg_CCQE_in_AntiNu_Mode__mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

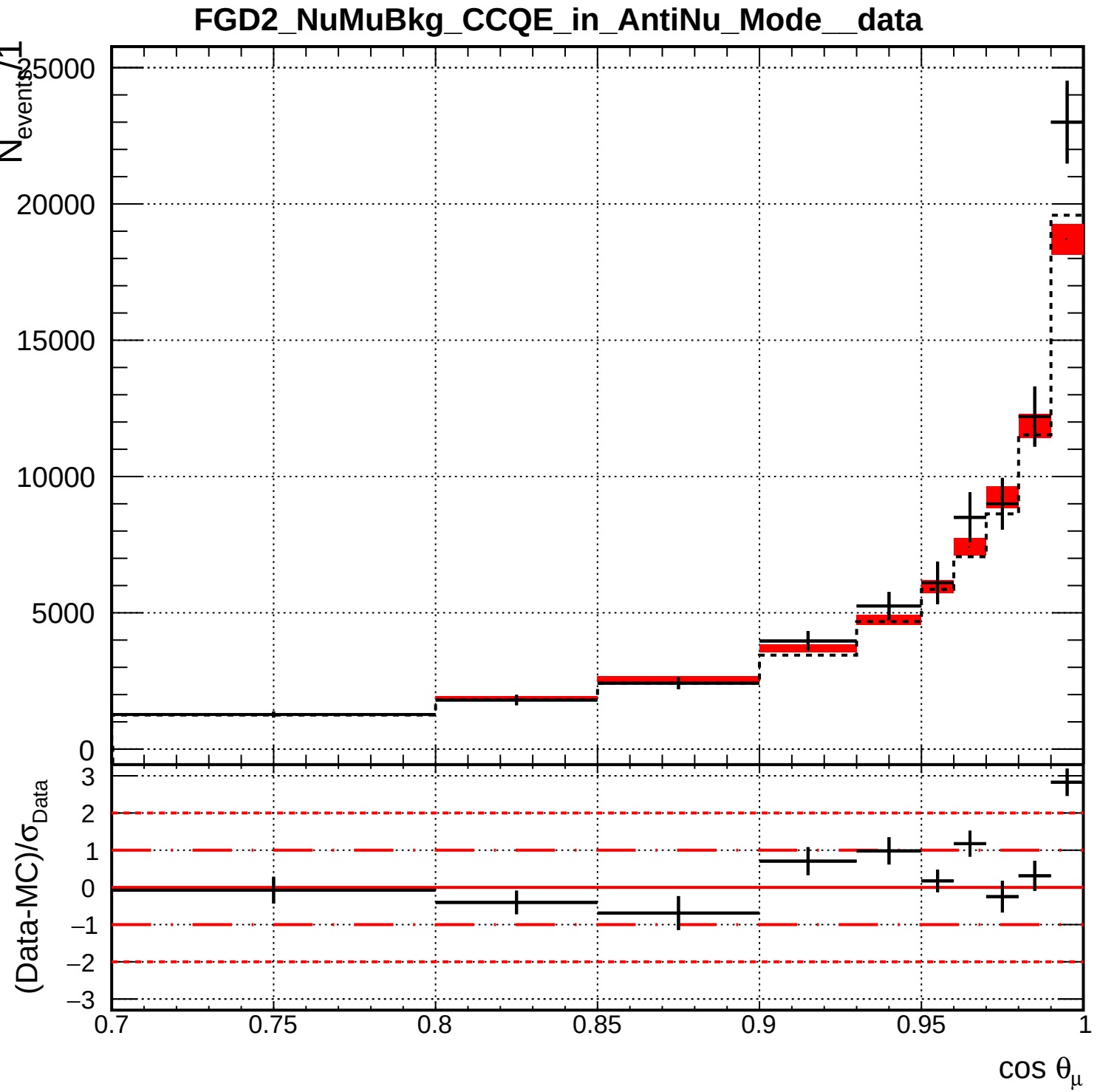

FGD2_NuMuBkg_CCQE_in_AntiNu_Mode__mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4

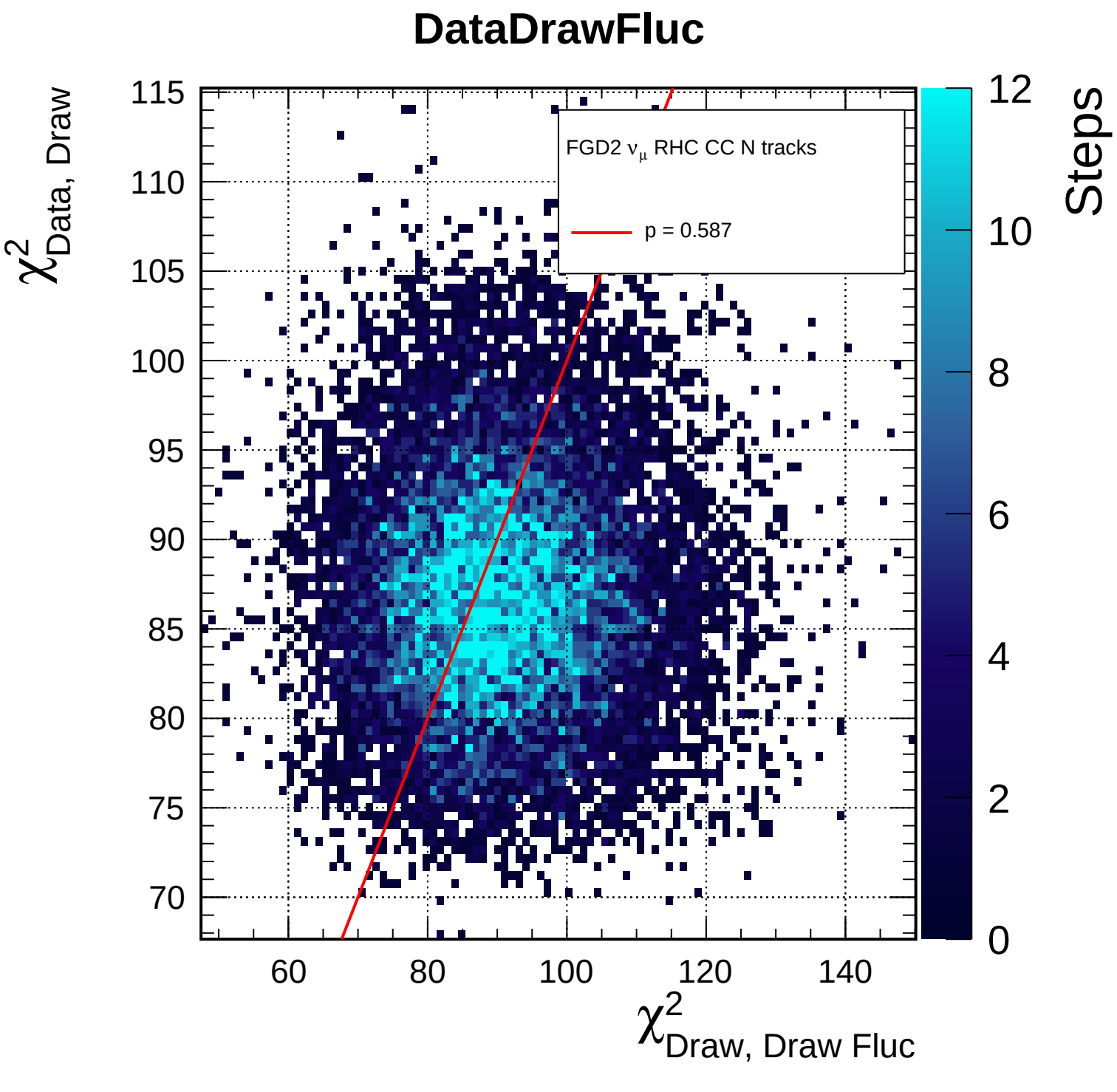

FGD2_NuMuBkg_CCQE_in_AntiNu_Mode__MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
5
4
3
2
1
0
χ²Sample

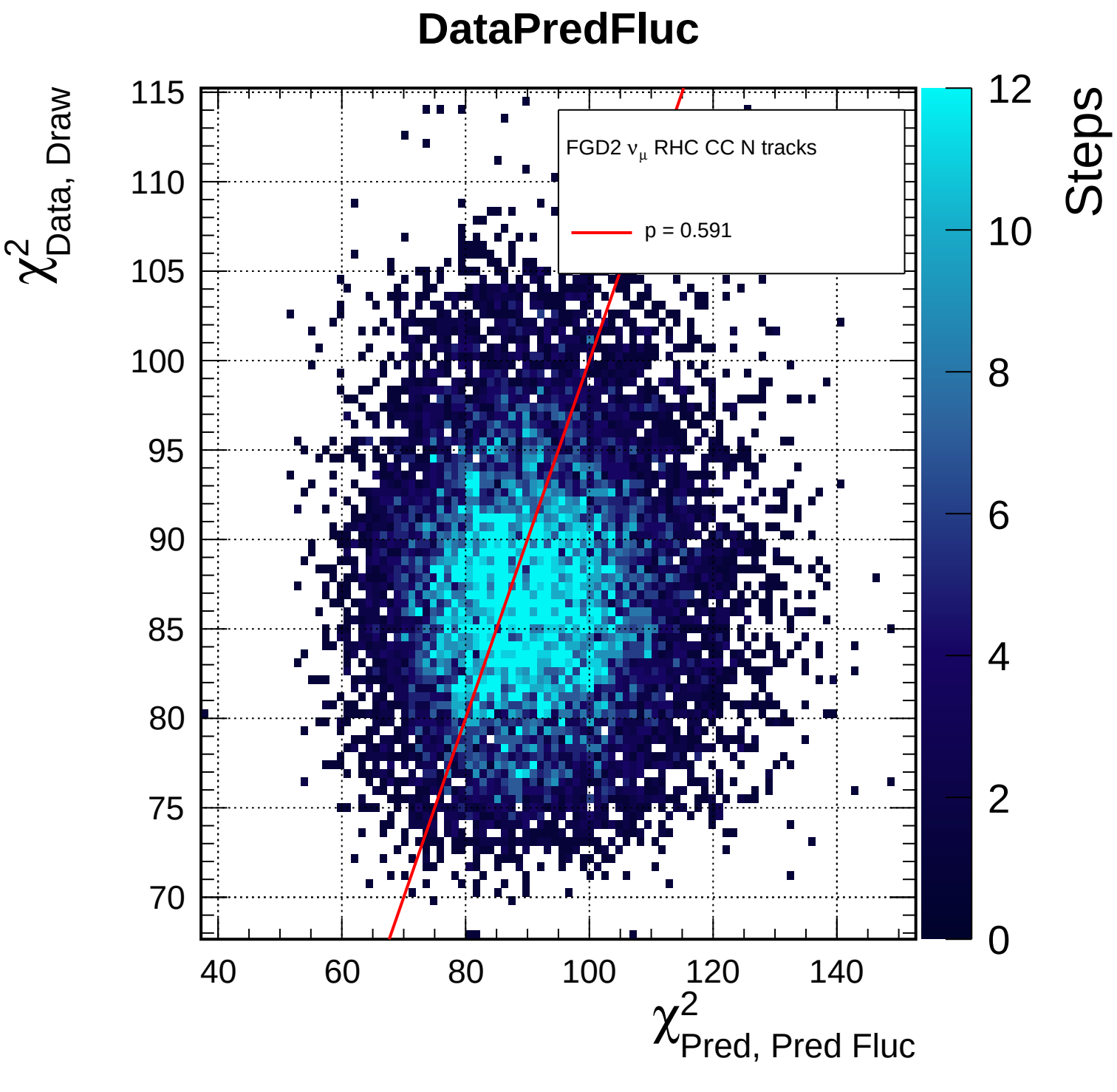

FGD2_NuMuBkg_CCQE_in_AntiNu_Mode__ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
×10^3
pμ (MeV)
5
4
3
2
1
0
χ²Sample

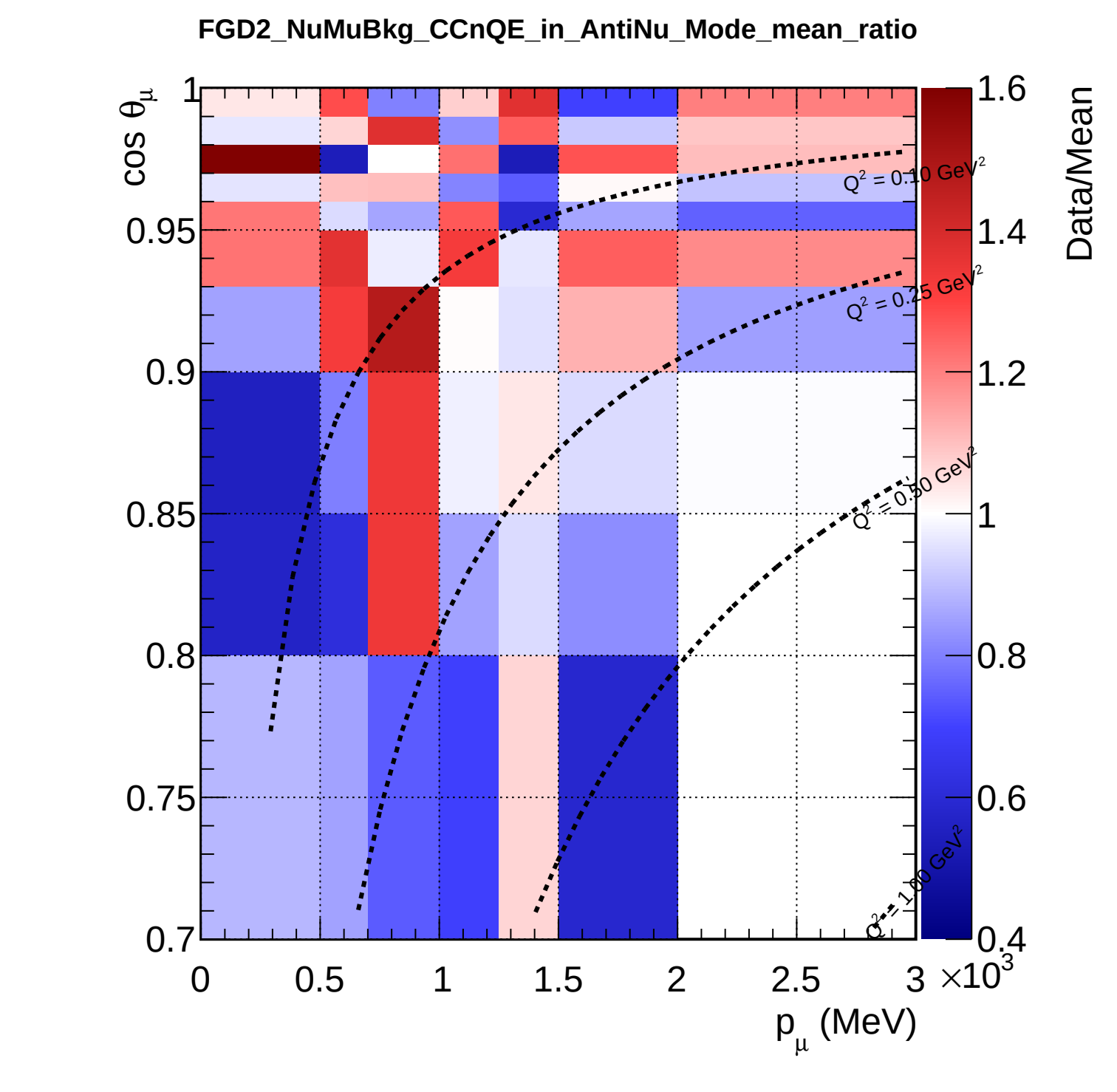

FGD2_NuMuBkg_CCQE_in_AntiNu_Mode__sum_1320
Counts
Data, 1320, p-value=0.57
MC, μ=1323.1±23.8
Gauss, μ=1323.5±24.2
0
100
200
300
400
500
1260
1280
1300
1320
1340
1360
1380
N events

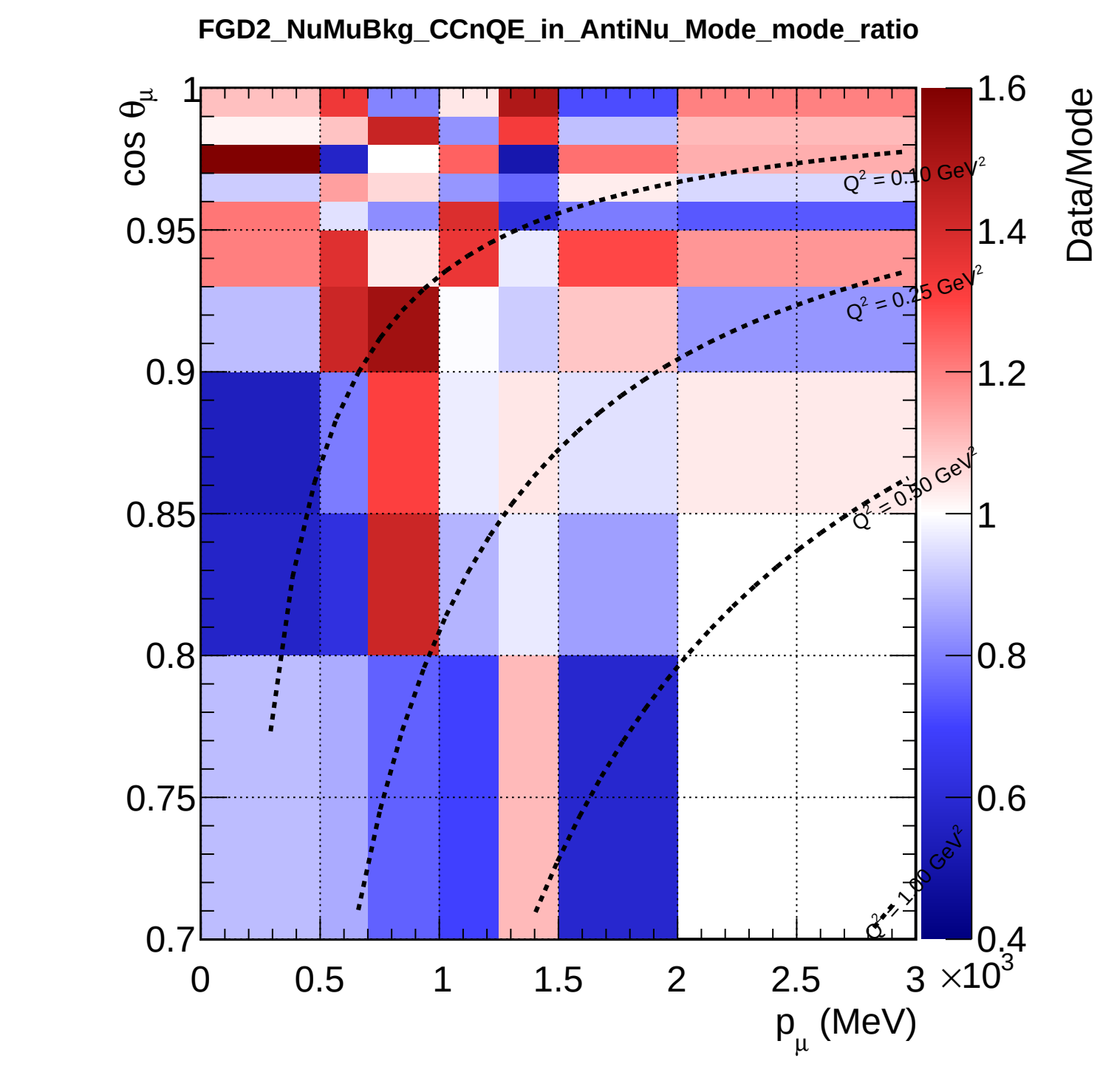

FGD2_NuMuBkg_CCQE_in_AntiNu_Mode__data
N_events/MeV
0.9
0.8
0.7
0.6
0.5
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
200
400
600
800
1000
p_μ (MeV)

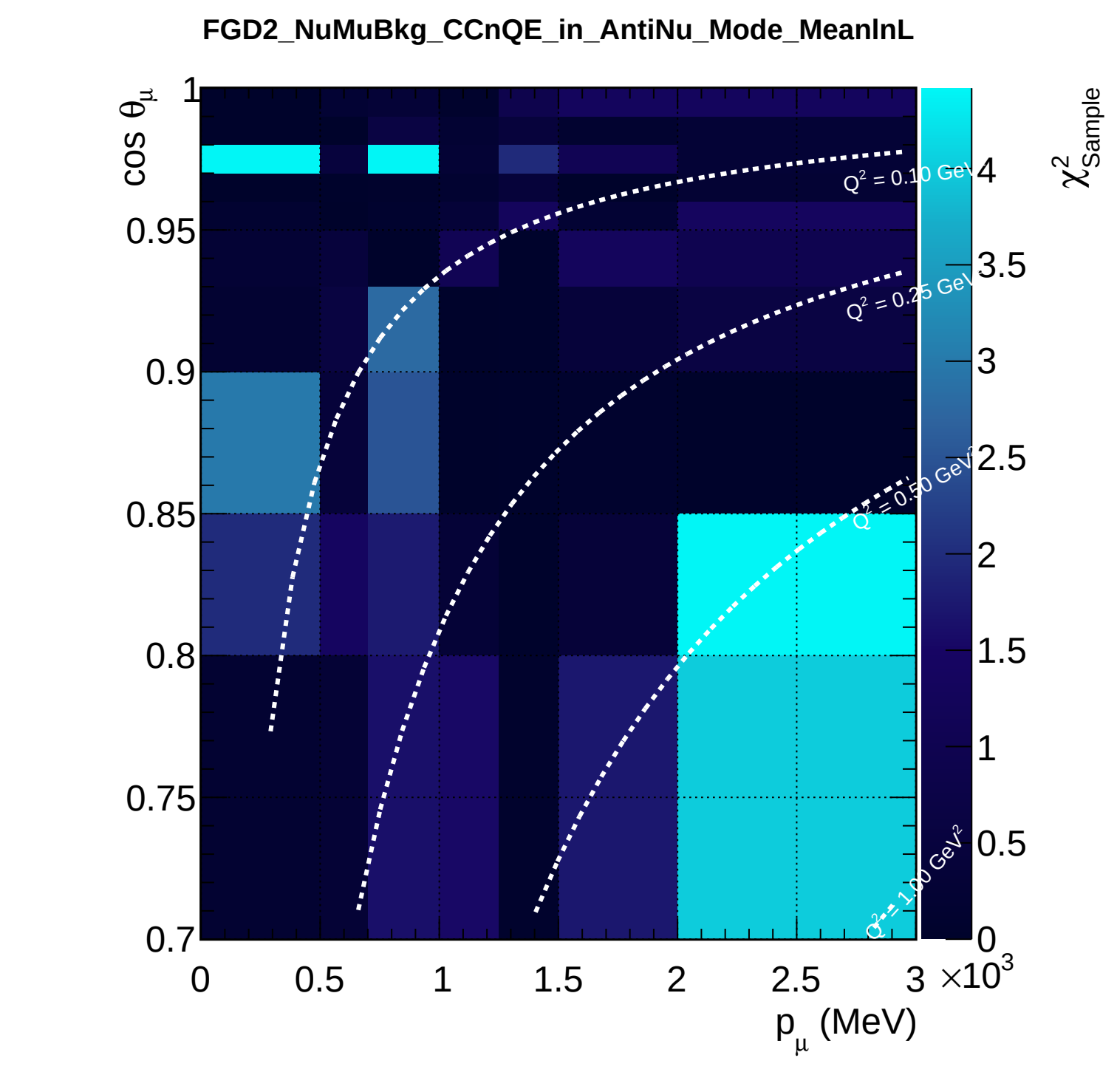

FGD2_NuMuBkg_CCQE_in_AntiNu_Mode__data
N_events/1
25000
20000
15000
10000
5000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ

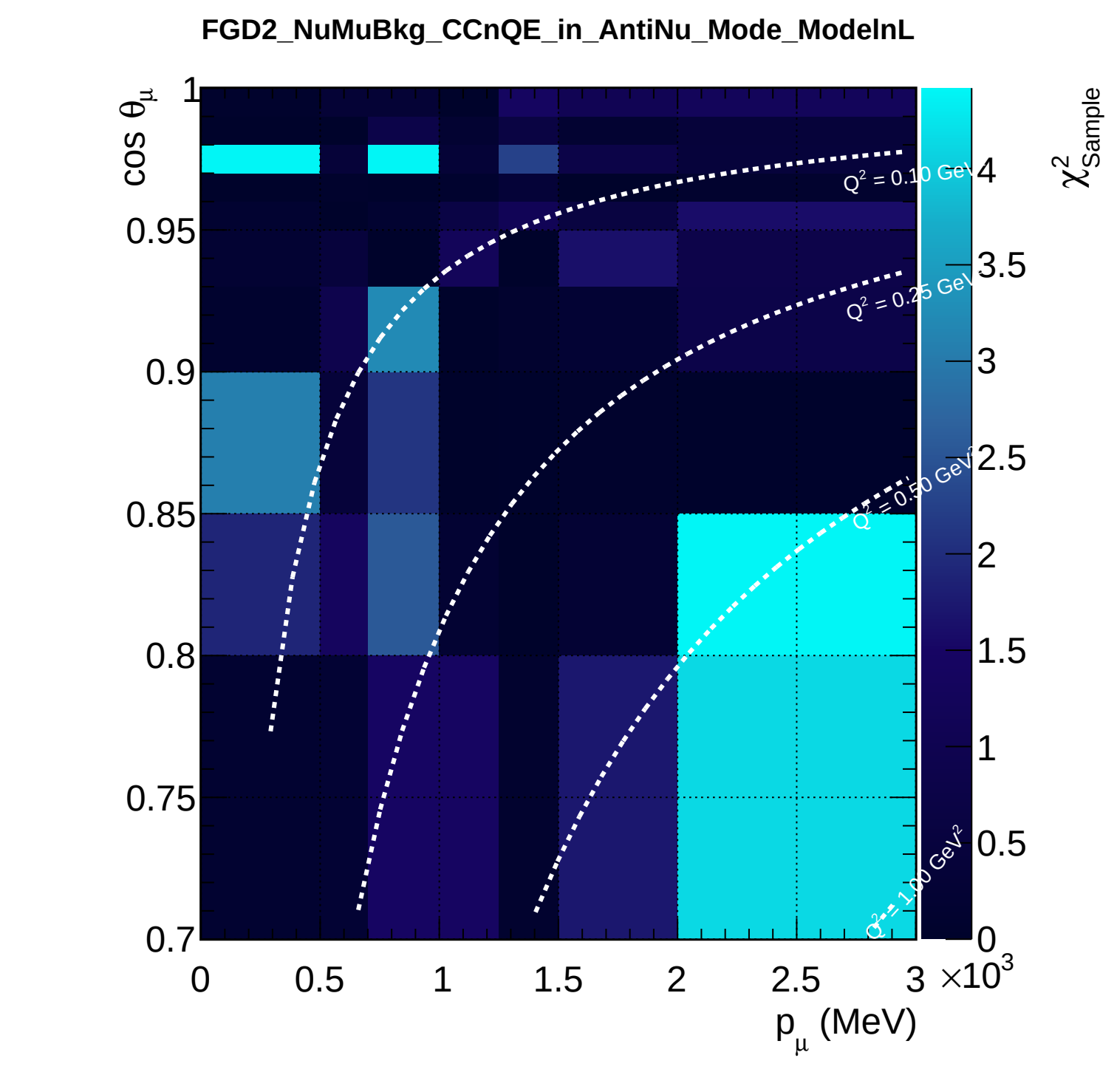

DataDrawFluc
FGD2 ν_μ RHC CC N tracks
p = 0.587
χ²Data, Draw
χ²Draw, Draw Fluc
Steps
115
110
105
100
95
90
85
80
75
70
60
80
100
120
140
12
10
8
6
4
2
0

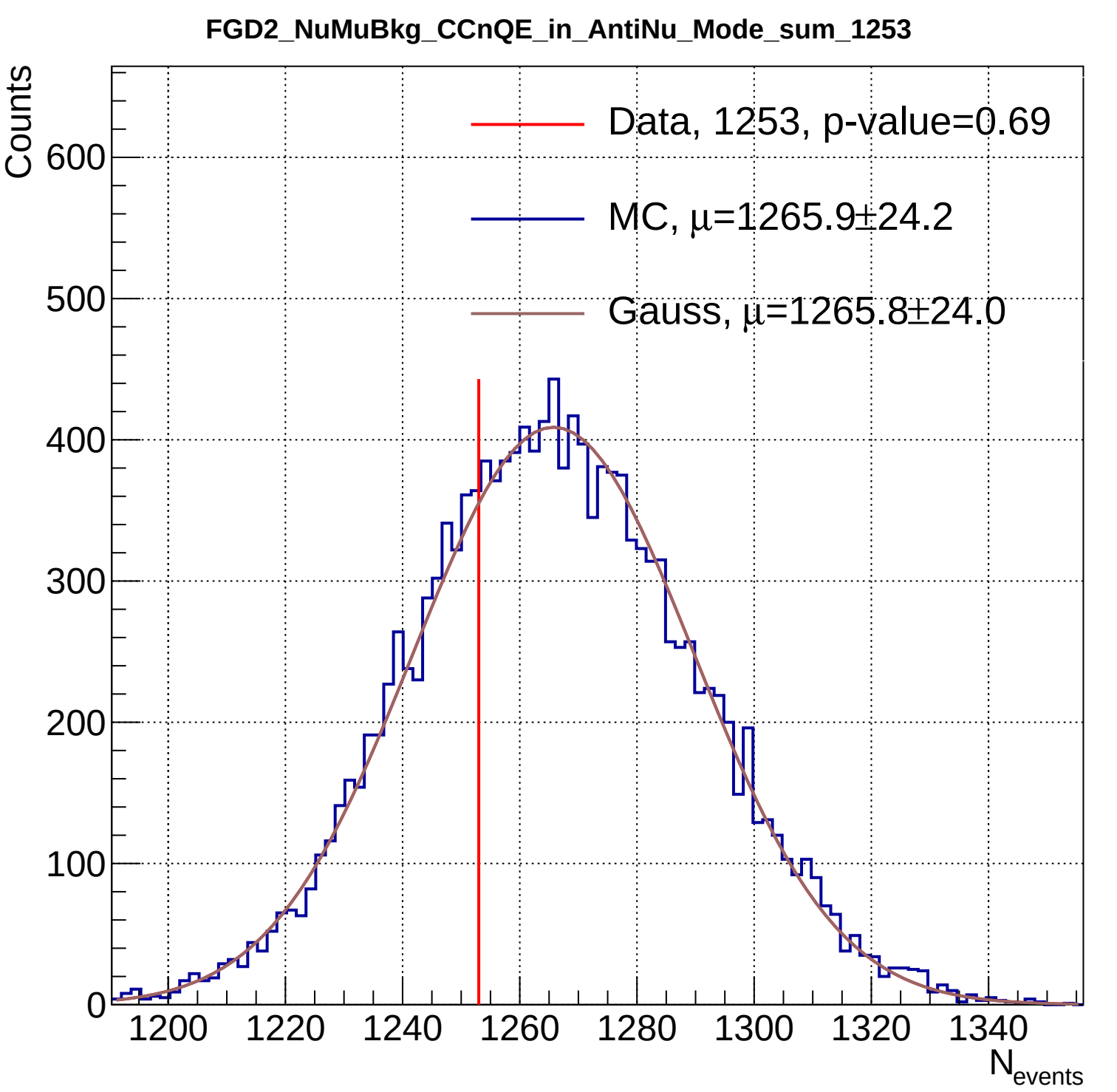

DataPredFluc
FGD2 ν_μ RHC CC N tracks
p = 0.591
$\chi^2_{\text{Data, Draw}}$
$\chi^2_{\text{Pred, Pred Fluc}}$
Steps
115
110
105
100
95
90
85
80
75
70
40
60
80
100
120
140
12
10
8
6
4
2
0

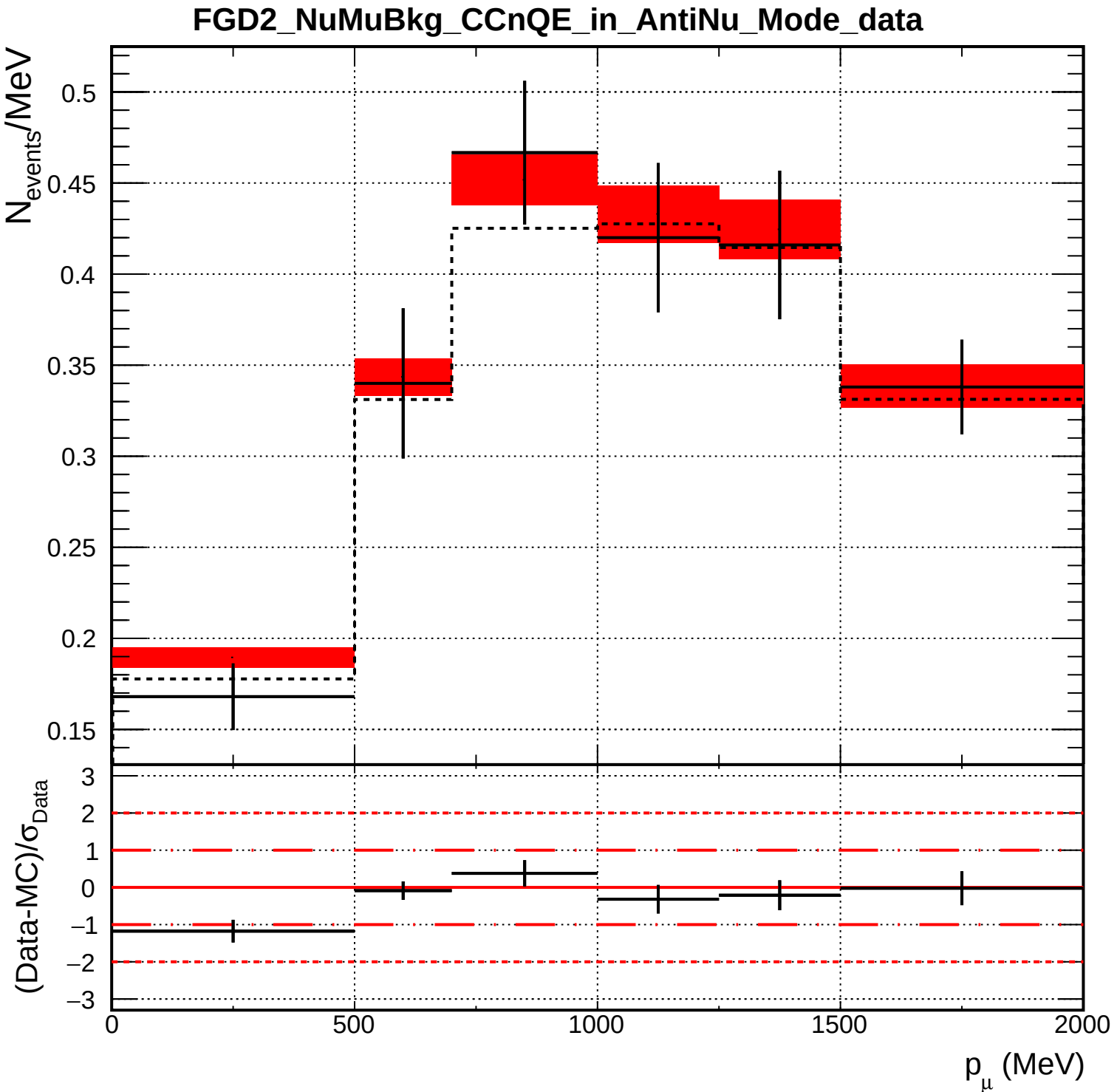

FGD2_NuMuBkg_CCnQE_in_AntiNu_Mode_mean_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.5
1
1.5
2
2.5
3
×10³
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
Data/Mean
1.6
1.4
1.2
1
0.8
0.6
0.4

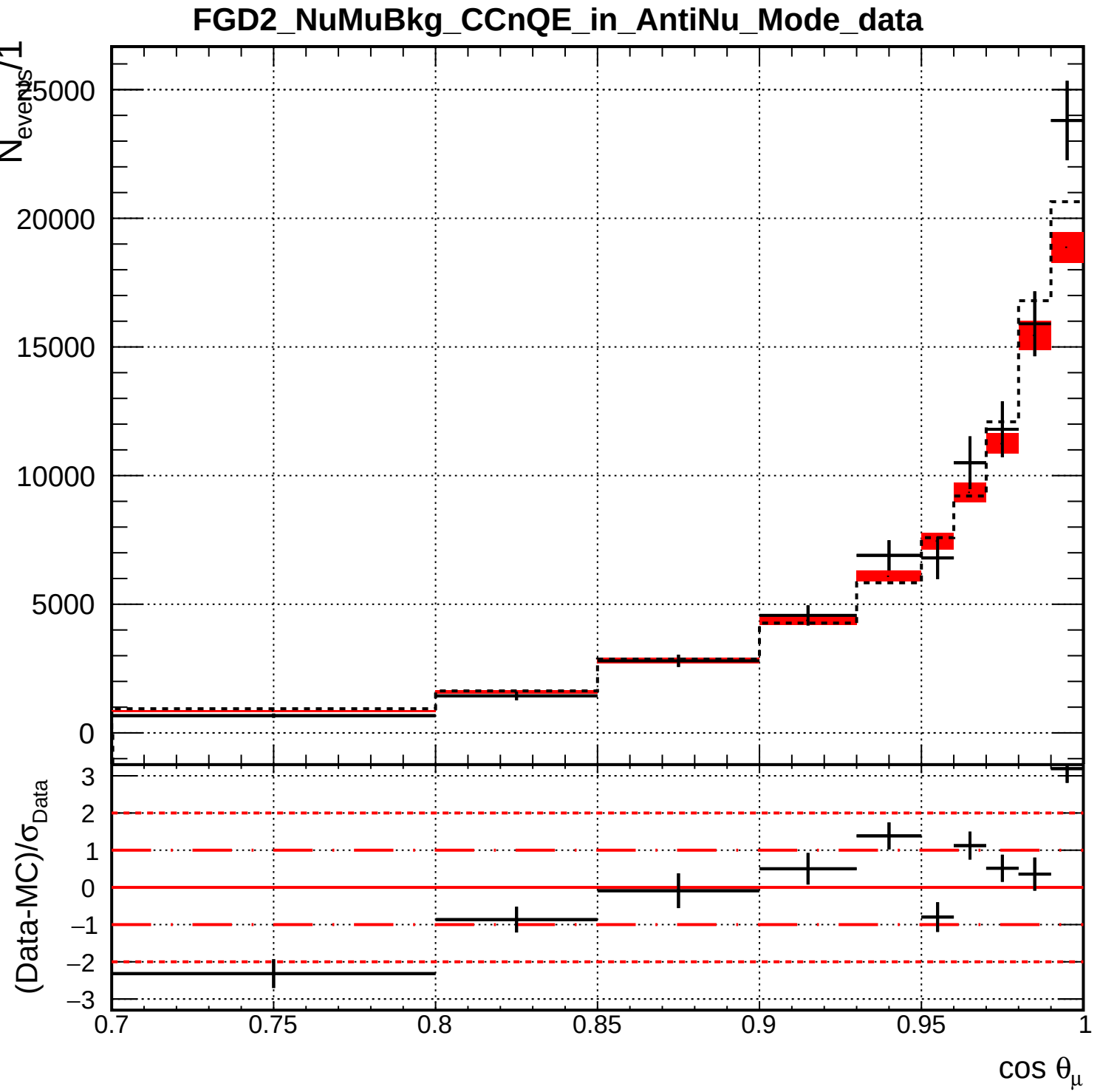

FGD2_NuMuBkg_CCnQE_in_AntiNu_Mode_mode_ratio
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.5
1
1.5
2
2.5
3
×10^3
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
Data/Mode
1.6
1.4
1.2
1
0.8
0.6
0.4


FGD2_NuMuBkg_CCnQE_in_AntiNu_Mode_MeanlnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.5
1
1.5
2
2.5
3
×10³
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
χ²Sample
4
3.5
3
2.5
2
1.5
1
0.5
0


FGD2_NuMuBkg_CCnQE_in_AntiNu_Mode_ModelnL
cos θμ
1
0.95
0.9
0.85
0.8
0.75
0.7
0
0.5
1
1.5
2
2.5
3
×10^3
pμ (MeV)
Q² = 0.10 GeV²
Q² = 0.25 GeV²
Q² = 0.50 GeV²
Q² = 1.00 GeV²
χ²Sample
4
3.5
3
2.5
2
1.5
1
0.5
0


FGD2_NuMuBkg_CCnQE_in_AntiNu_Mode_sum_1253
Counts
Data, 1253, p-value=0.69
MC, μ=1265.9±24.2
Gauss, μ=1265.8±24.0
0
100
200
300
400
500
600
1200
1220
1240
1260
1280
1300
1320
1340
N events


FGD2_NuMuBkg_CCnQE_in_AntiNu_Mode_data
N_events/MeV
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0
500
1000
1500
2000
p_μ (MeV)


FGD2_NuMuBkg_CCnQE_in_AntiNu_Mode_data
N_events/1
25000
20000
15000
10000
5000
0
(Data-MC)/σ_Data
3
2
1
0
−1
−2
−3
0.7
0.75
0.8
0.85
0.9
0.95
1
cos θ_μ