SYSTEMATIC STUDIES
(Part II)

Variational Cuts Effect on Missing Momentum Yield Ratio for Q2: (4,5) GeV2 and th_nq: (35, 45) deg

The DATA / SIMC Missing Momentum Yield Ratio is compared for nominal, loose and tight cuts to study the systematics on the analysis cuts applied.

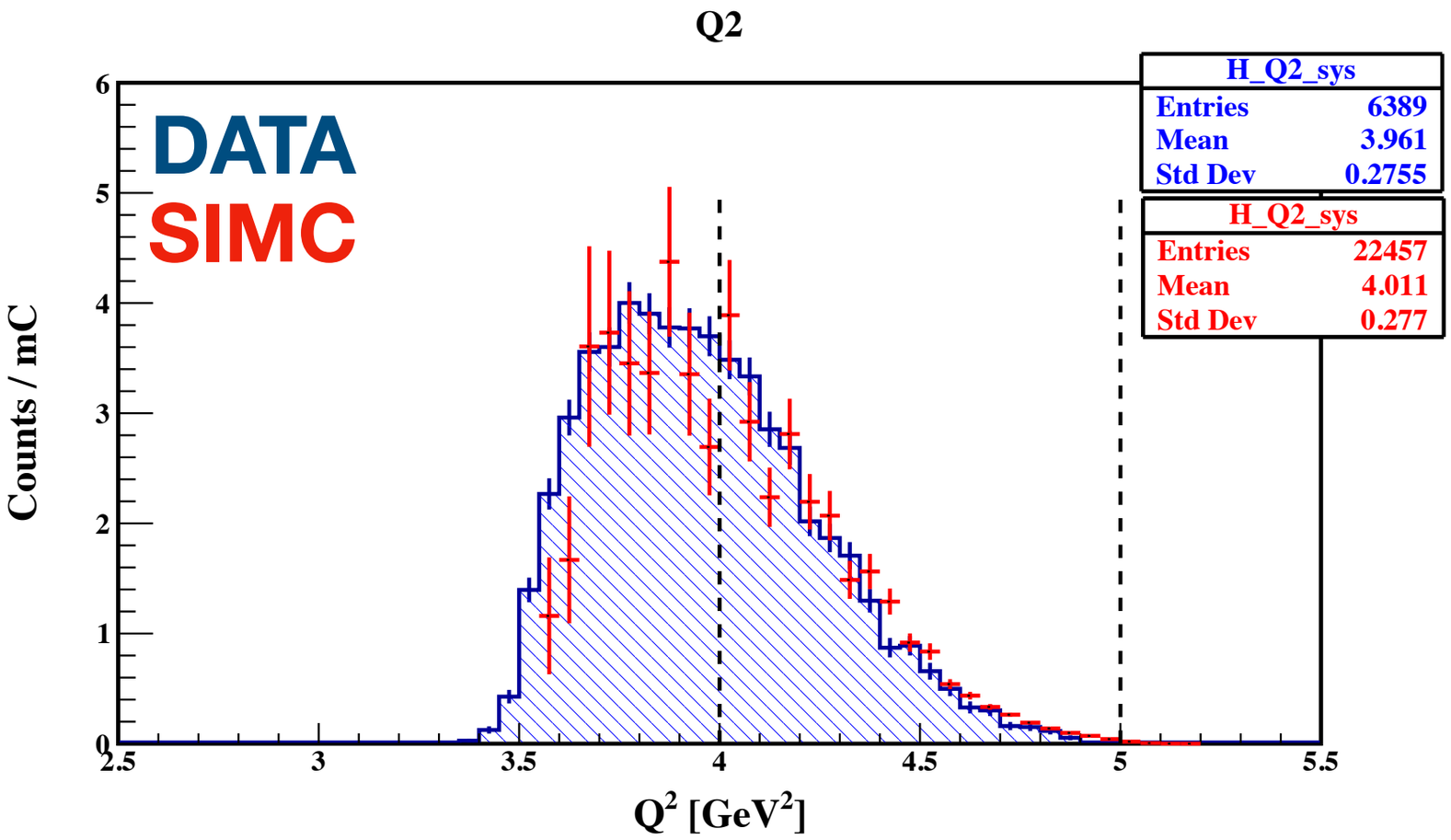
NOMINAL CUTS APPLIED

Pm: 80 MeV
Model: Laget PWIA
Radiative Effects (not corrected)

Em:	**(-20, 40) MeV**
HMS Delta:	**(-8, 8) %**
SHMS Delta:	**(-10,22)%**
Ztar_Diff:	**(-2,2) cm**
Q2:	**(4, 5) GeV2**
theta_nq:	**(35, 45) deg**
HMS Coll. Cut:	**Scale 1 (collimator geometry cut)**

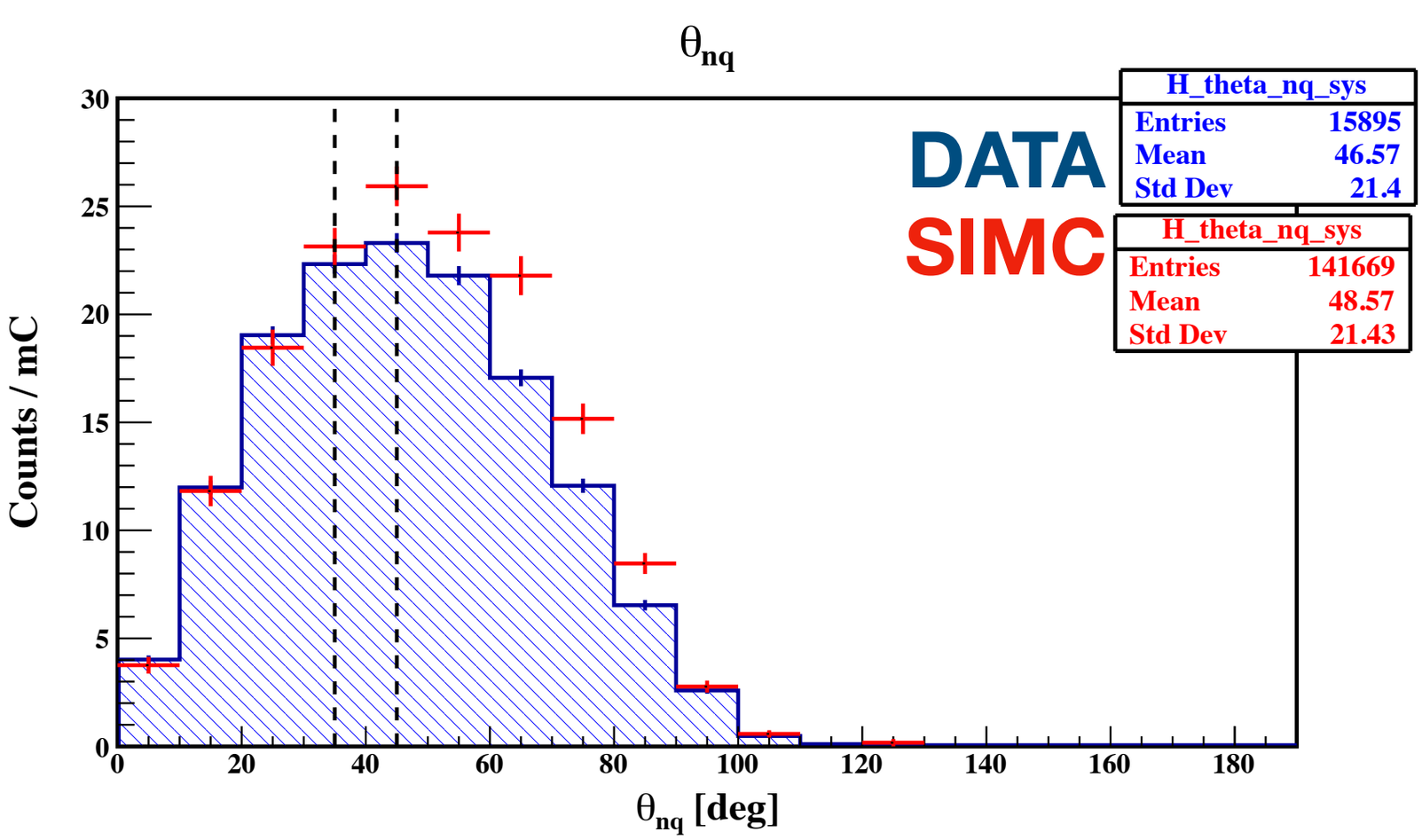
Cuts ONLY on DATA:

SHMS Calorimeter:	**(0.7, 5)**
epCoinTime:	**(10.5, 14.5) ns**



The Yield Ratio Systematic Studies were done at:

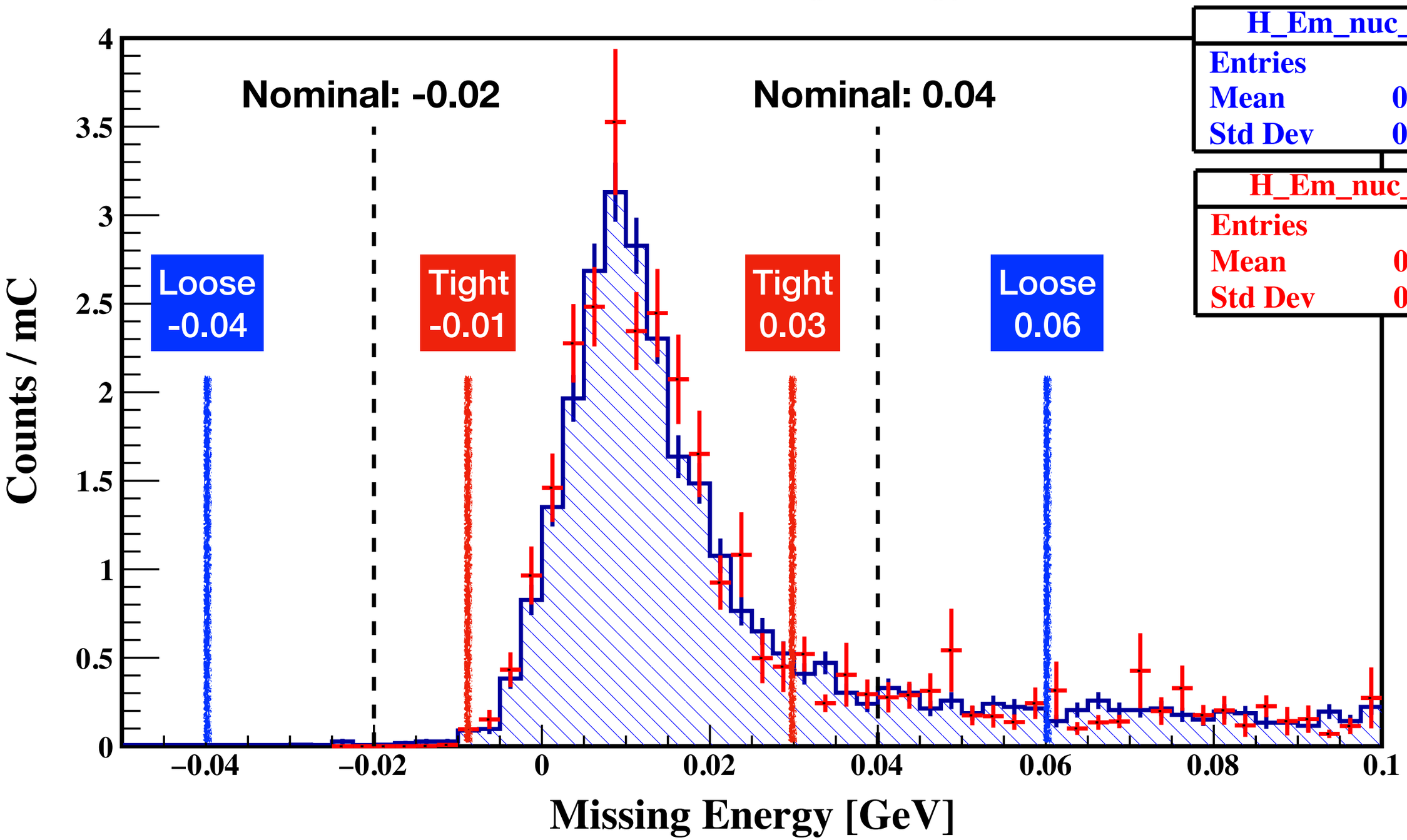
Q2: (4, 5) GeV2 and theta_nq: (35, 45) deg



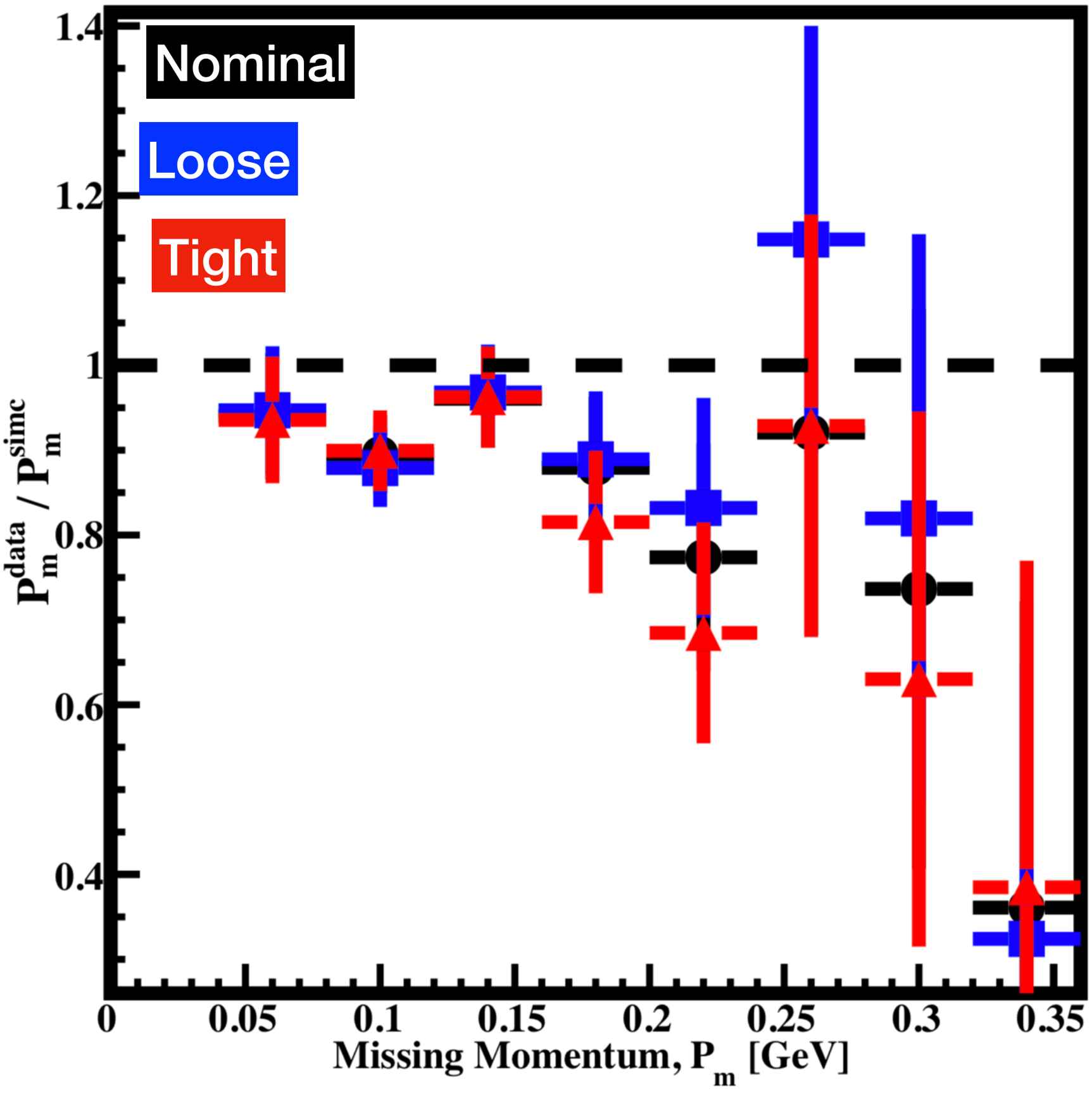
DATA

SIMC

Nuclear Missing Energy



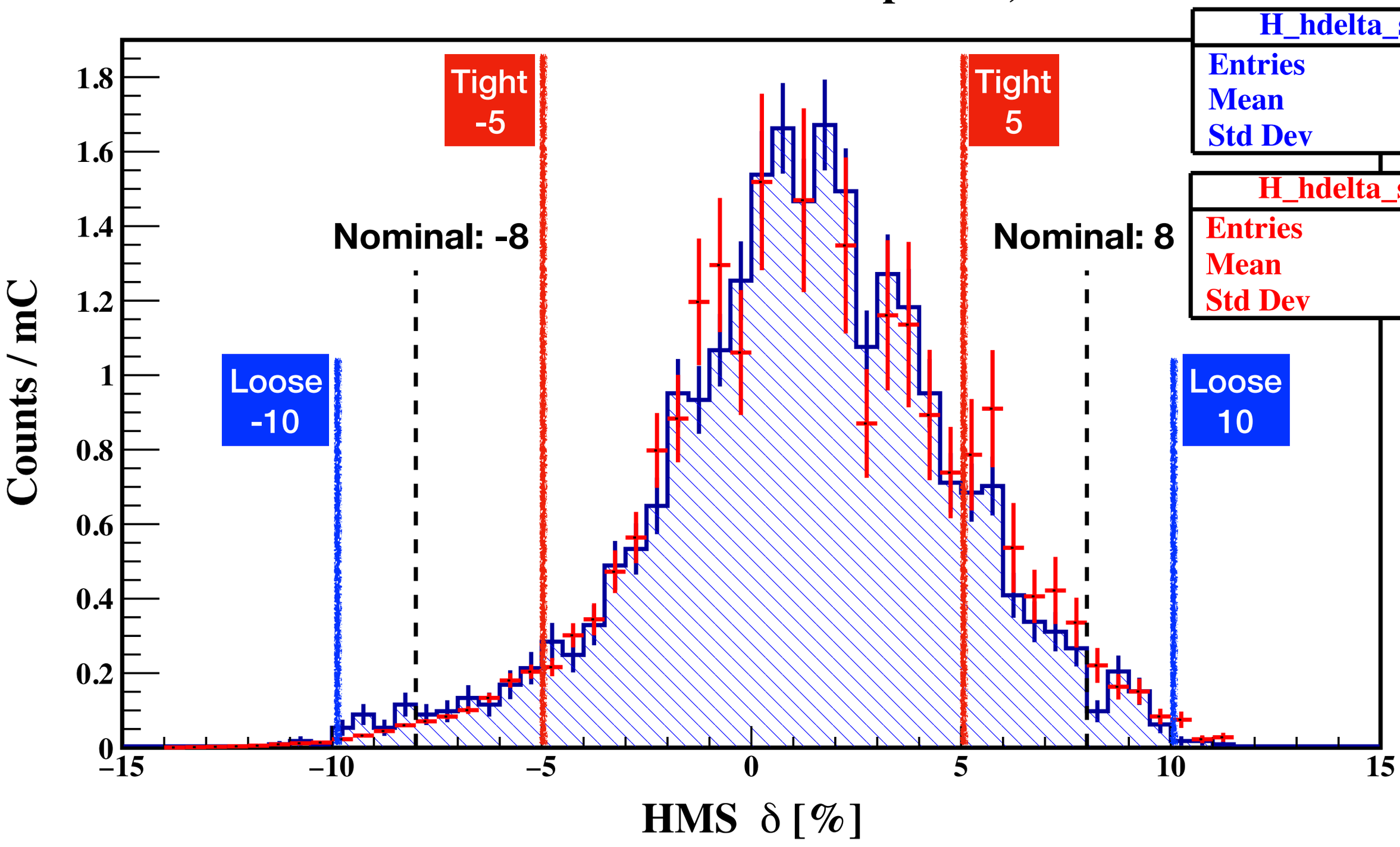
P_m Yield Ratio: E_{miss} Systematics



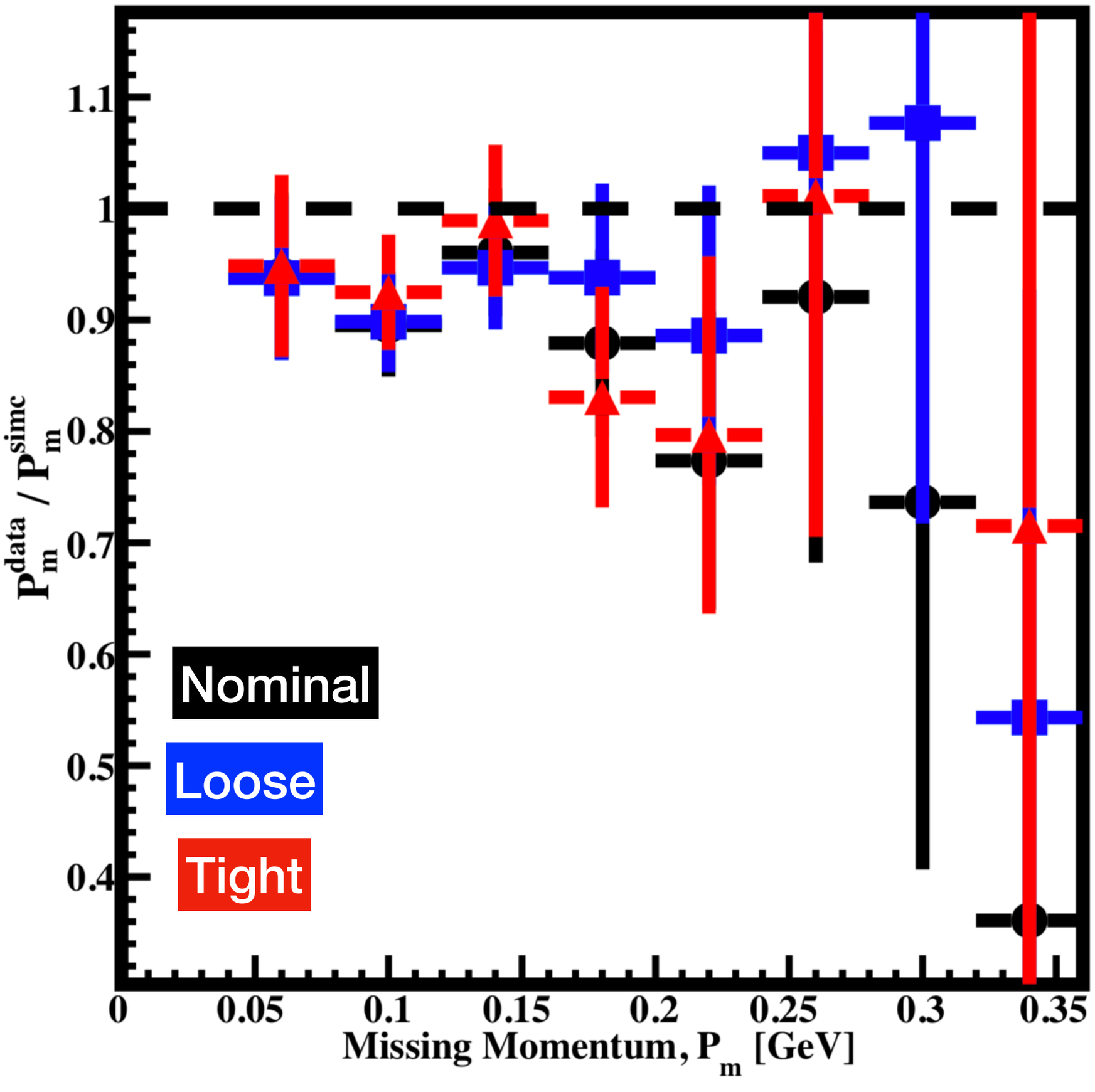
DATA

SIMC

HMS Momentum Acceptance, δ



P_m Yield Ratio: HMS δ Systematics

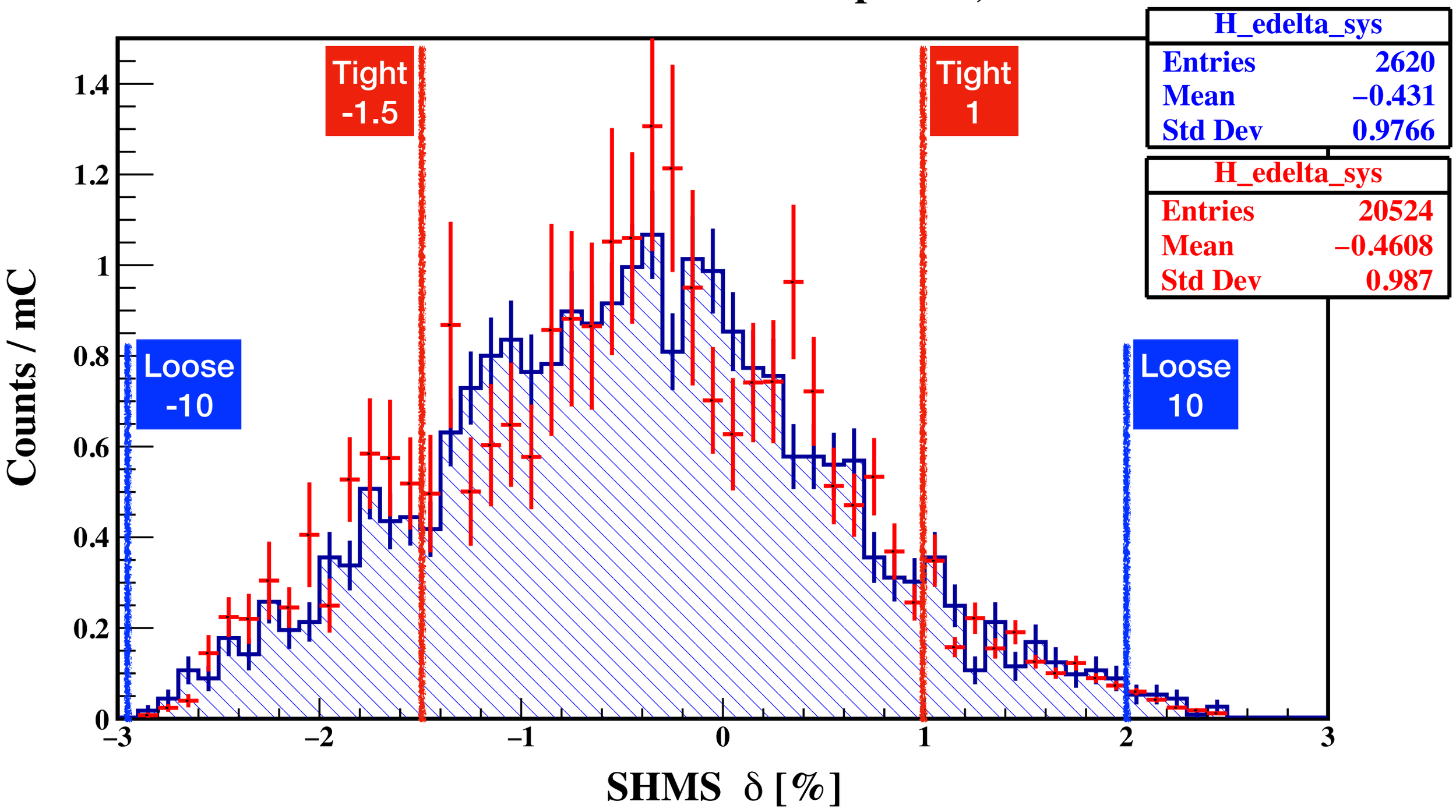


DATA

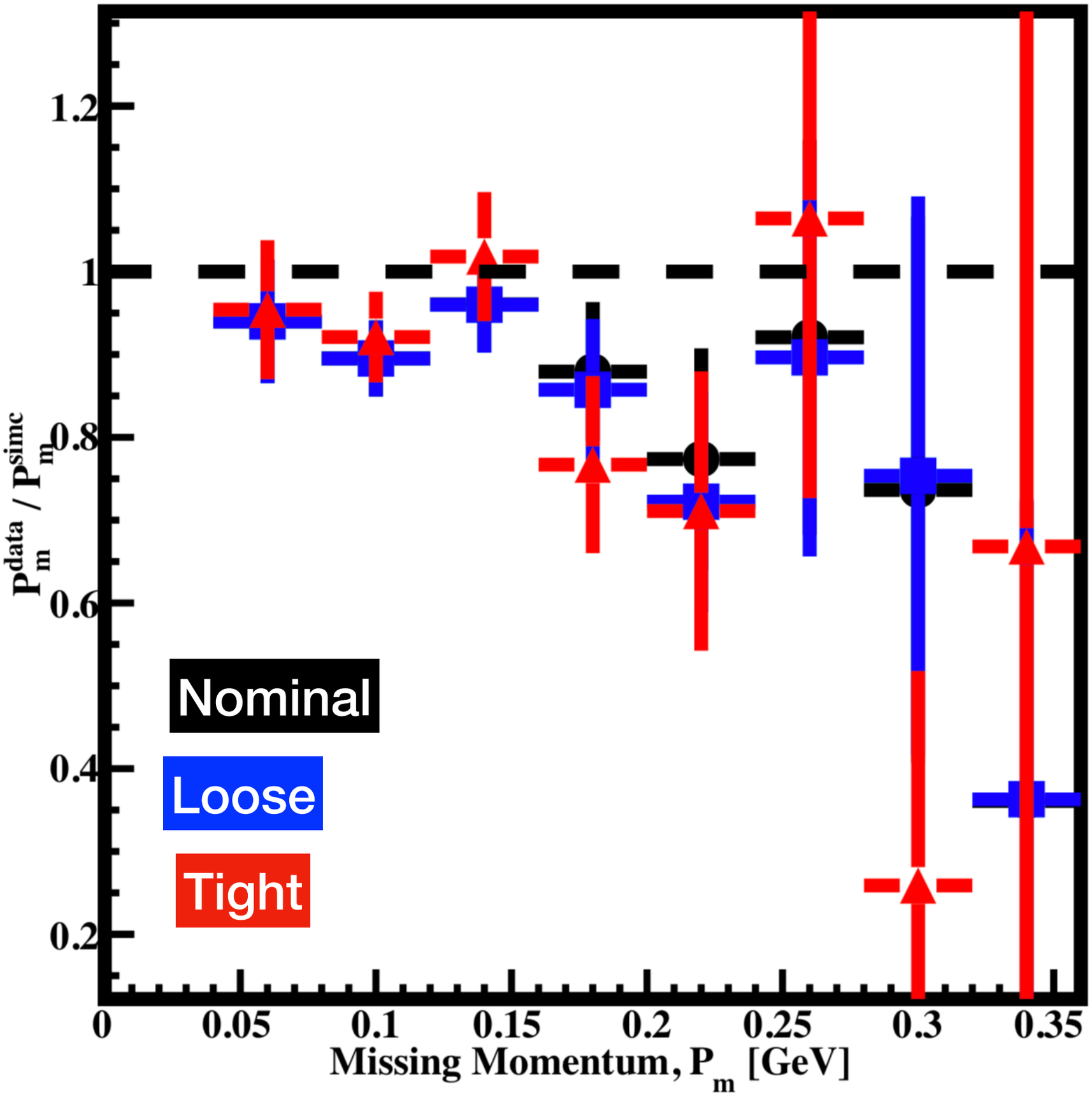
SIMC

Nominal: (-10, 22)%

SHMS Momentum Acceptance, δ



P_m Yield Ratio: SHMS δ Systematics



Ztar Difference

DATA

SIMC

-2 Nominal +2

Tight -1

Tight 1

Loose -4

Loose 4

H_ztar_diff_sys	
Entries	2905
Mean	−0.6434
Std Dev	1.316

H_ztar_diff_sys	
Entries	21091
Mean	−0.1337
Std Dev	0.7132

Counts / mC

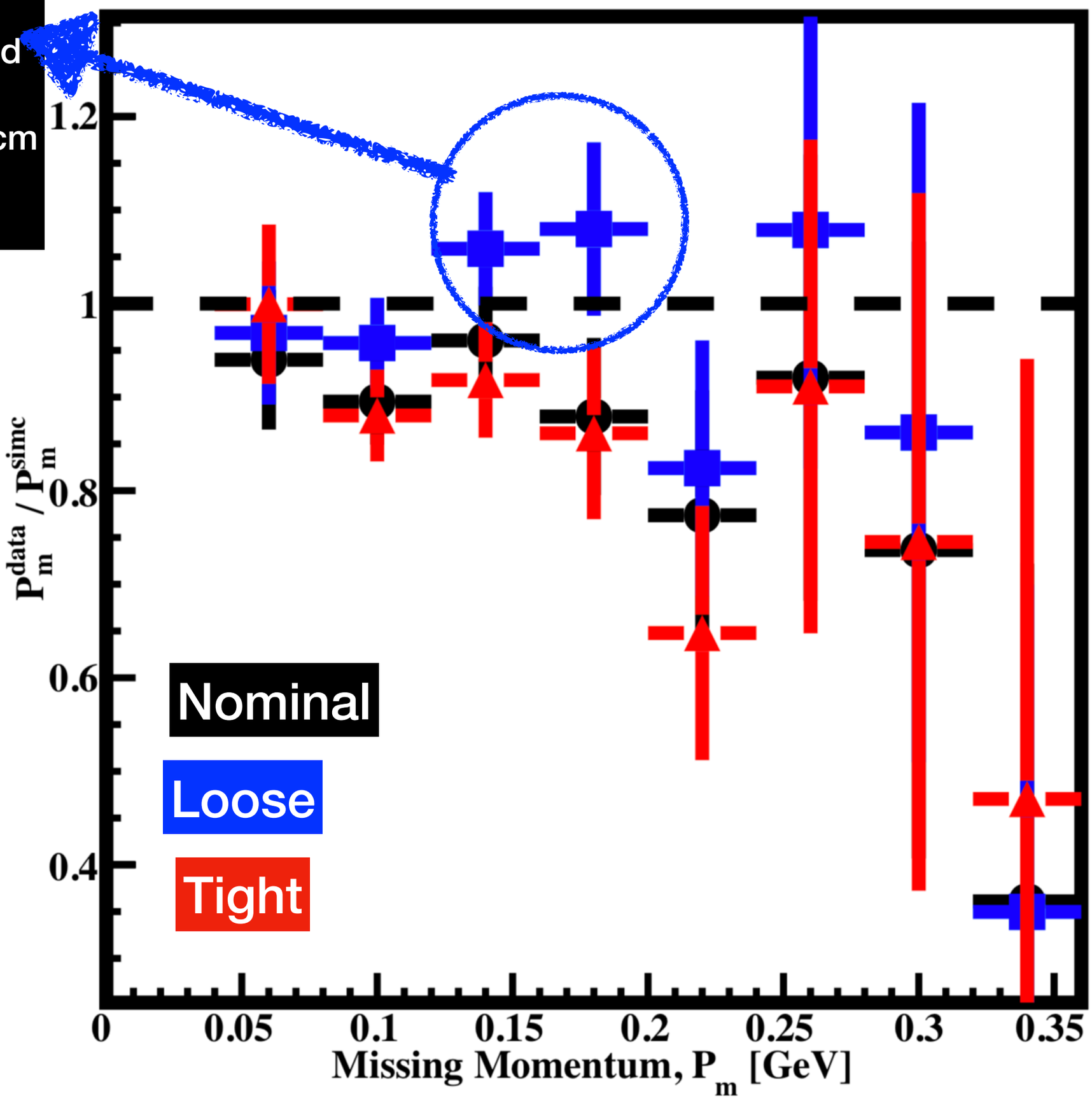
0 1 2 3 4 5 6 7 8

−10 −8 −6 −4 −2 0 2 4 6 8 10

Z_{tar} Difference [cm]

I think this is directly related to the background observed in Data below -2 cm on previous slide

P_m Yield Ratio: Z_{tar} Diff Systematics



Q2

DATA
SIMC

H_Q2_sys	
Entries	6389
Mean	3.961
Std Dev	0.2755

H_Q2_sys	
Entries	22457
Mean	4.011
Std Dev	0.277

Counts / mC

0 1 2 3 4 5 6

2.5 3 3.5 4 4.5 5 5.5

Q^2 [GeV^2]

θ_{nq}

DATA

SIMC

H_theta_nq_sys	
Entries	15895
Mean	46.57
Std Dev	21.4

H_theta_nq_sys	
Entries	141669
Mean	48.57
Std Dev	21.43

Counts / mC

0 5 10 15 20 25 30

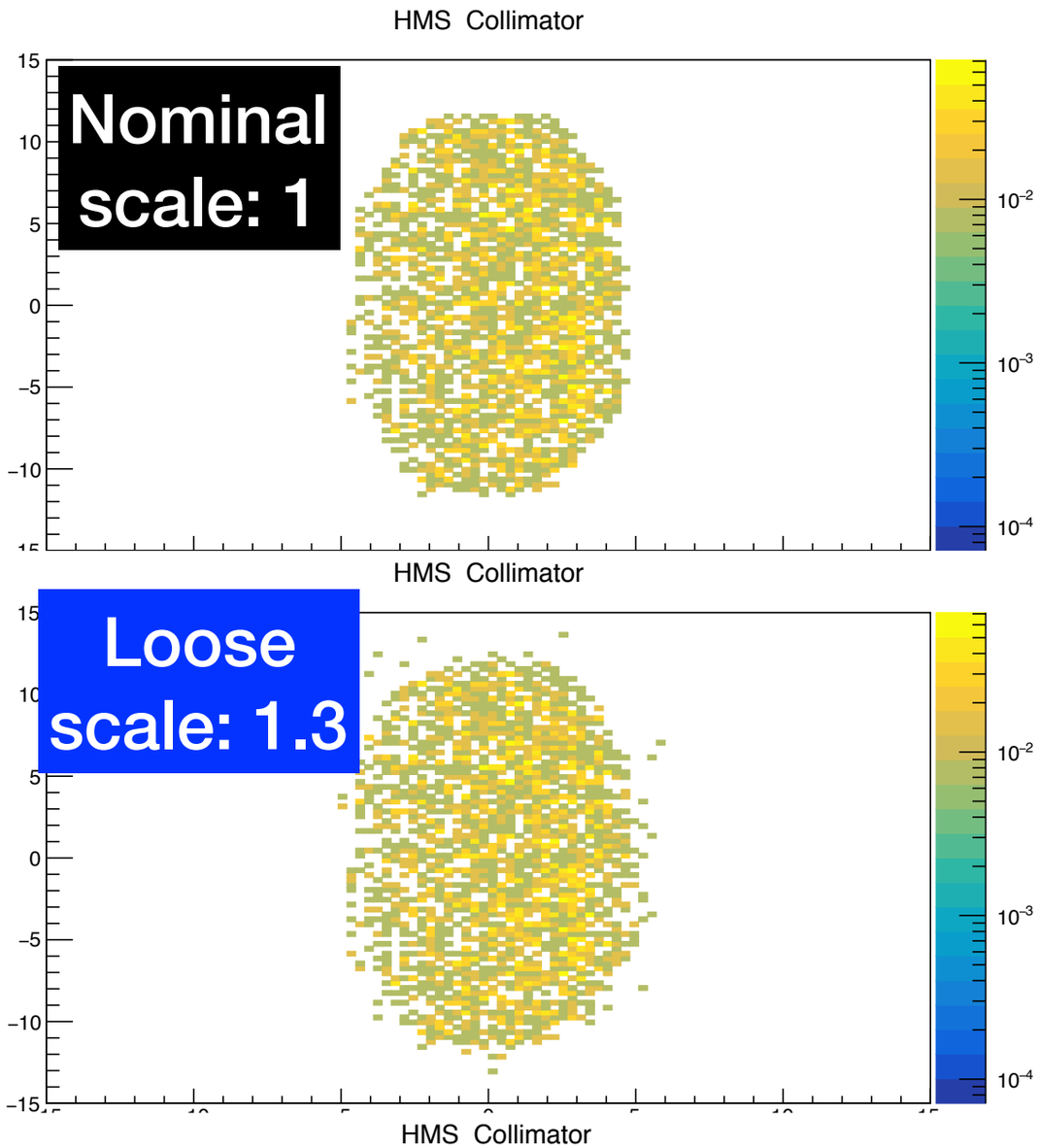
0 20 40 60 80 100 120 140 160 180

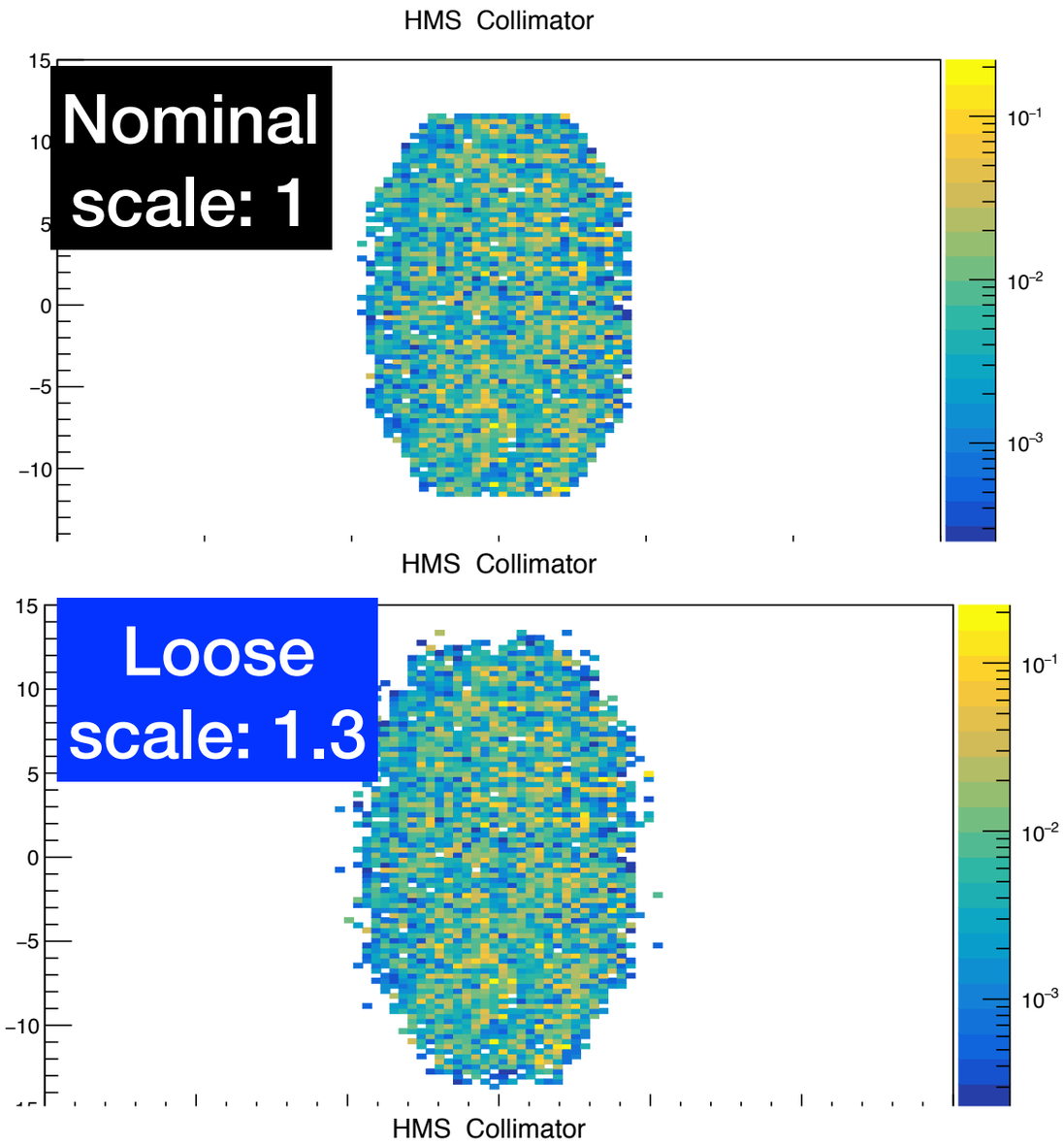
θ_{nq} [deg]

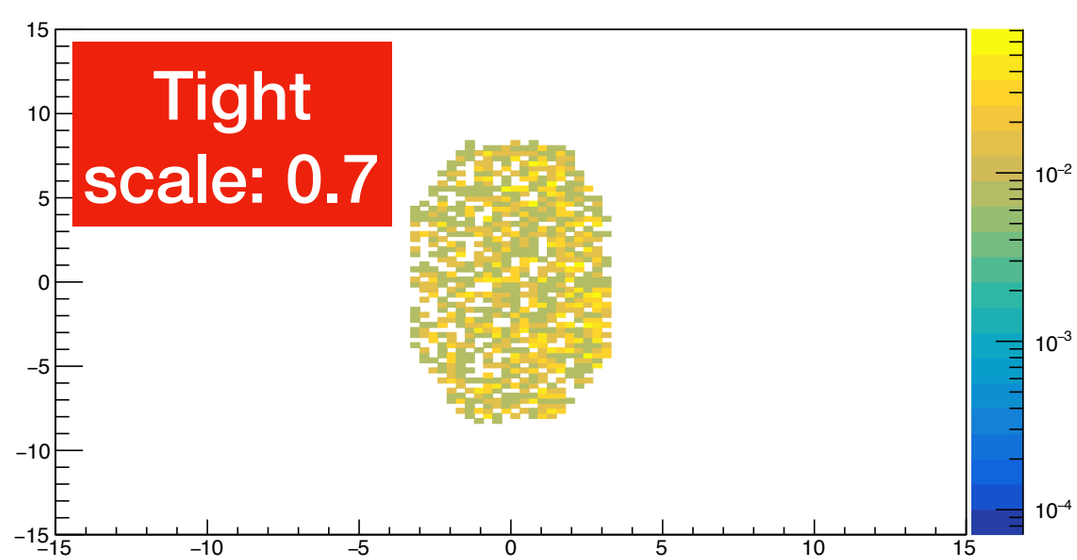
DATA

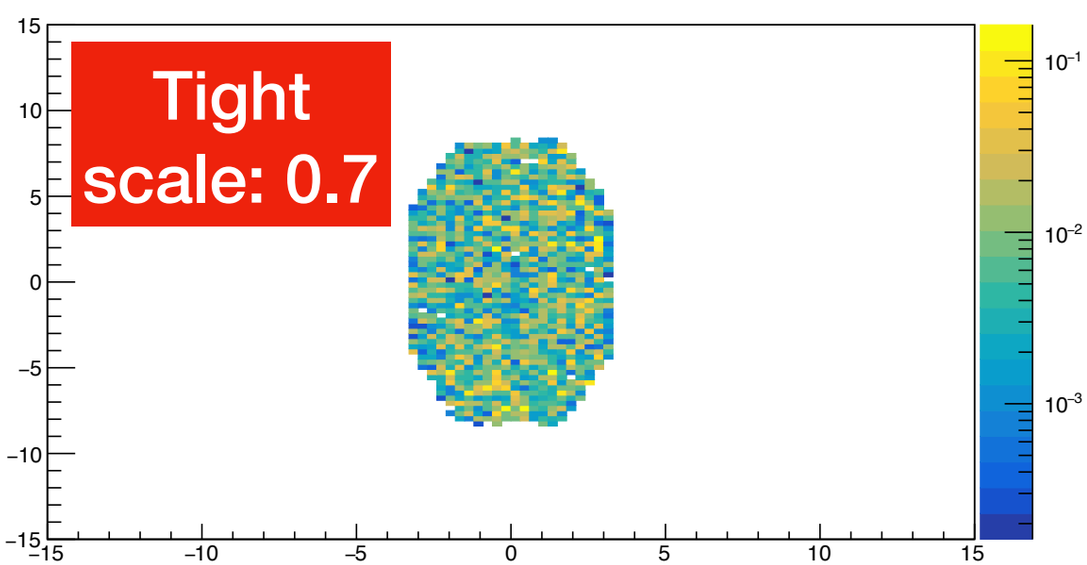
HMS Collimator

SIMC

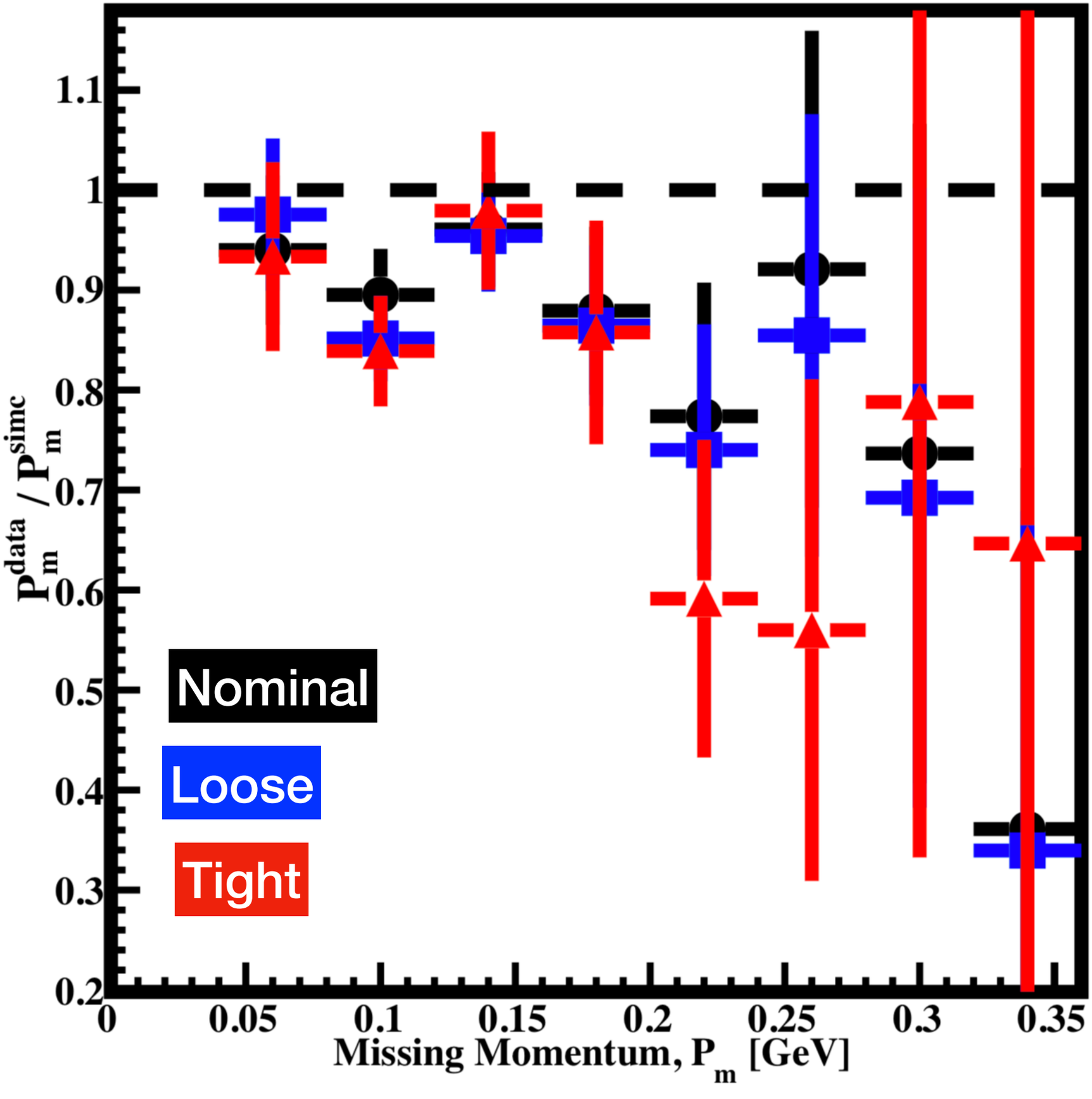








P_m Yield Ratio: HMS Collimator Systematics



DATA

SHMS Cal. EtotTrackNorm

H_pcal_etotTrkNorm_sys	
Entries	2626
Mean	1.033
Std Dev	0.07911

Loose >0.8

Tight >0.9

Nominal: >0.7

Counts / mC

1

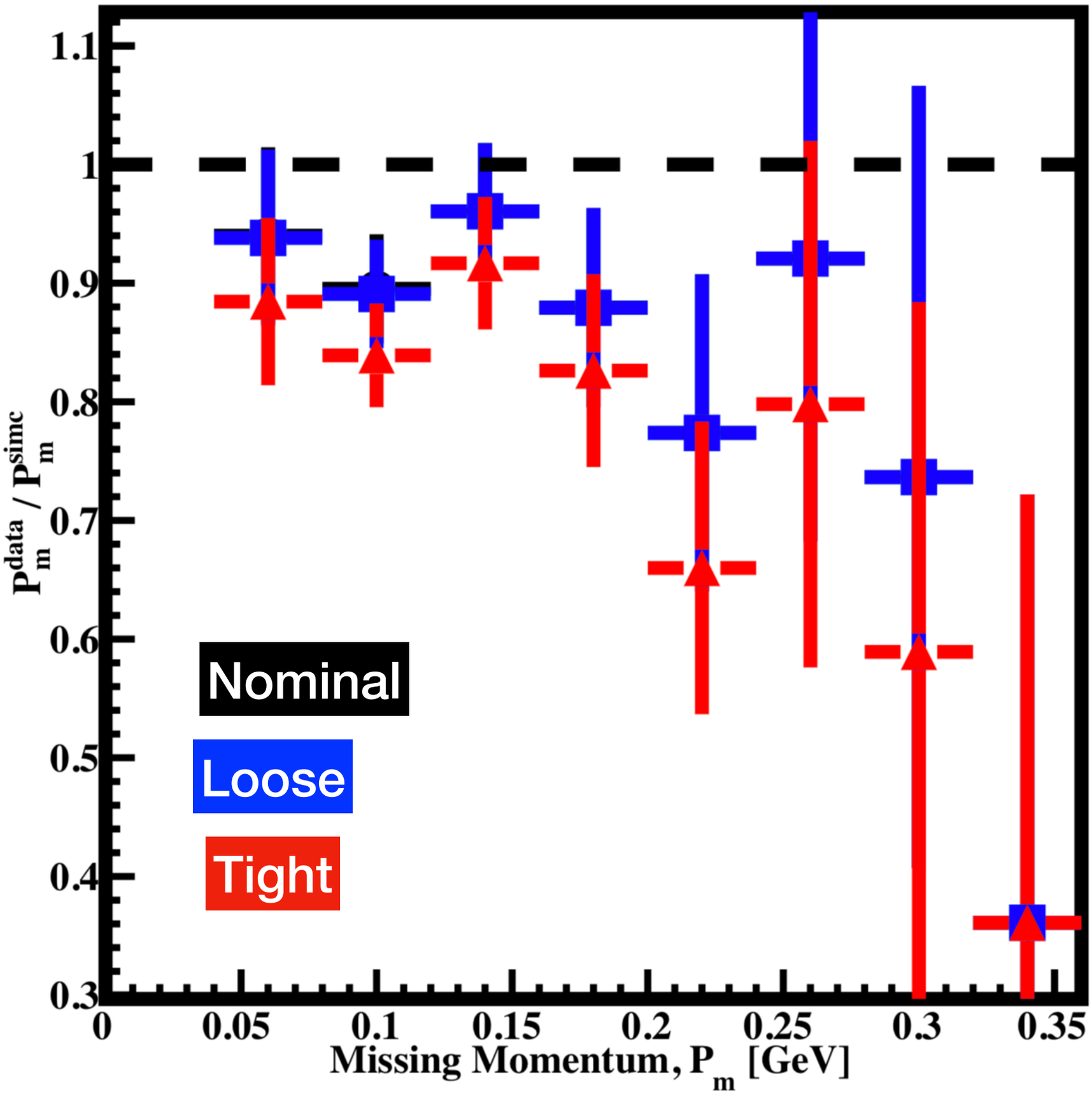
10^{-1}

10^{-2}

0.2 0.4 0.6 0.8 1 1.2 1.4

Normalized Calorimeter Total Track Energy

P_m Yield Ratio: E_{tot}TrkNorm Systematics



DATA

ep Coincidence Time

H_ctime_sys	
Entries	2686
Mean	12.92
Std Dev	1.018

Loose 5

10.5 Nominal 14.5

Tight 12

Tight 14

Loose 20

Counts / mC

10

1

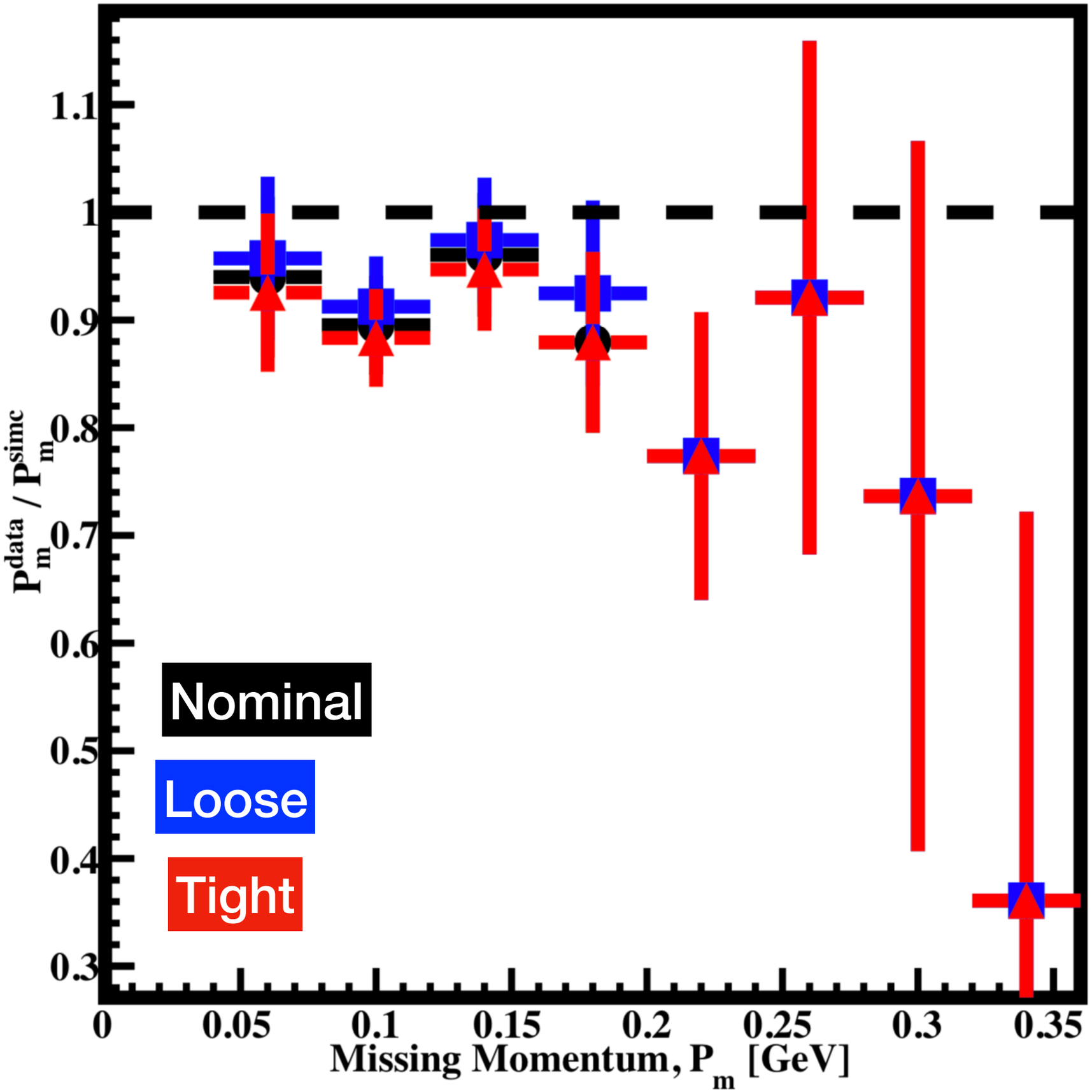
10^{-1}

10^{-2}

0 5 10 15 20 25 30

ep Coincidence Time [ns]

P_m Yield Ratio: Coin. Time Systematics



SUMMARY

Overall, I think the systematic variation for most of the cuts (except ZtarDiff) Are well within statistical uncertainty, and no large variations in the DATA/SIMC Yield Ratio were observed, which is expected.

With respect to the Ztar_difference background on DATA, I can try putting a tighter cut on the collimator and see it reduces this background.