Understanding the invariant mass (W) mismatch between H(e, e’) and H(e, e’p)

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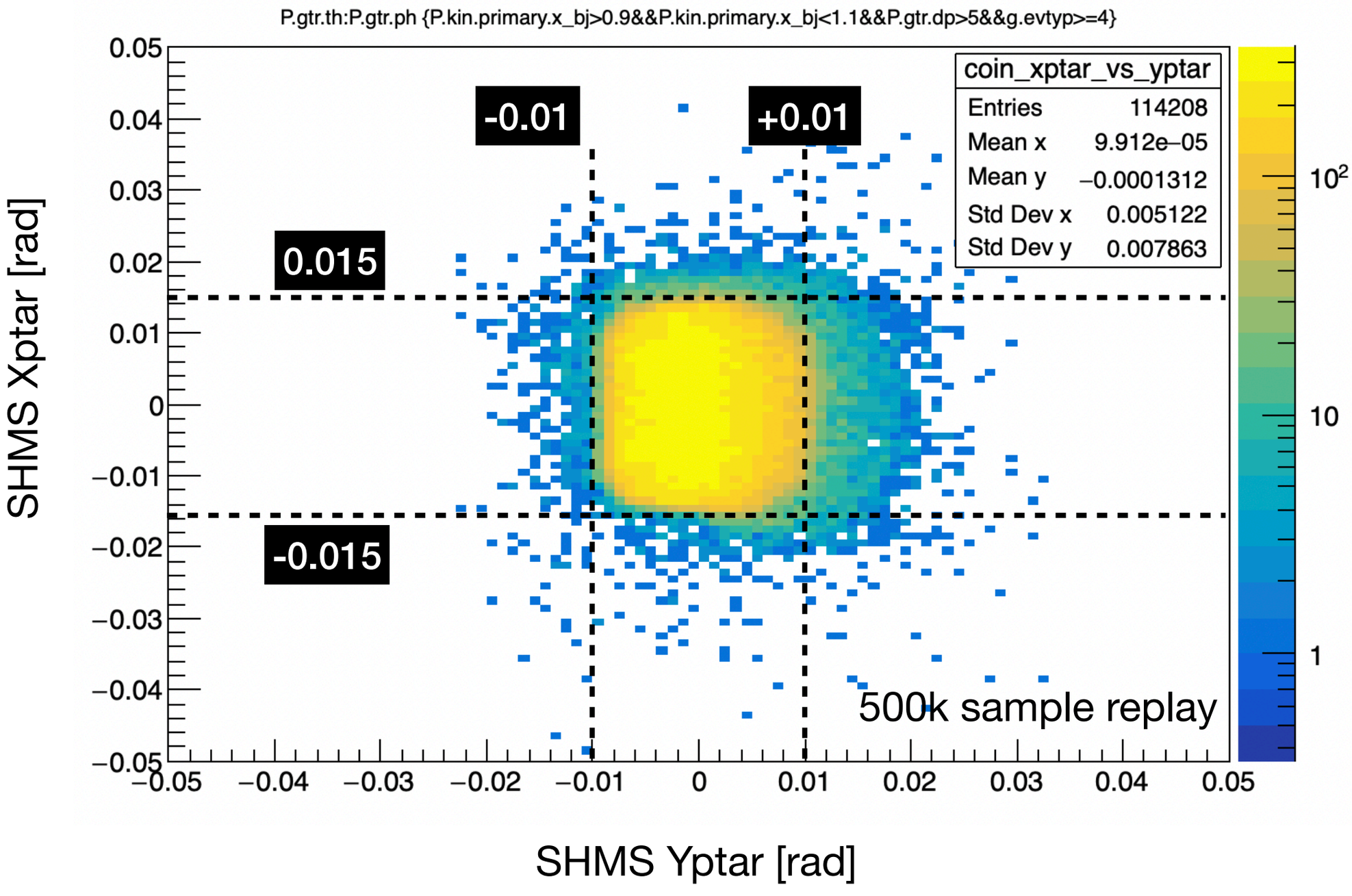
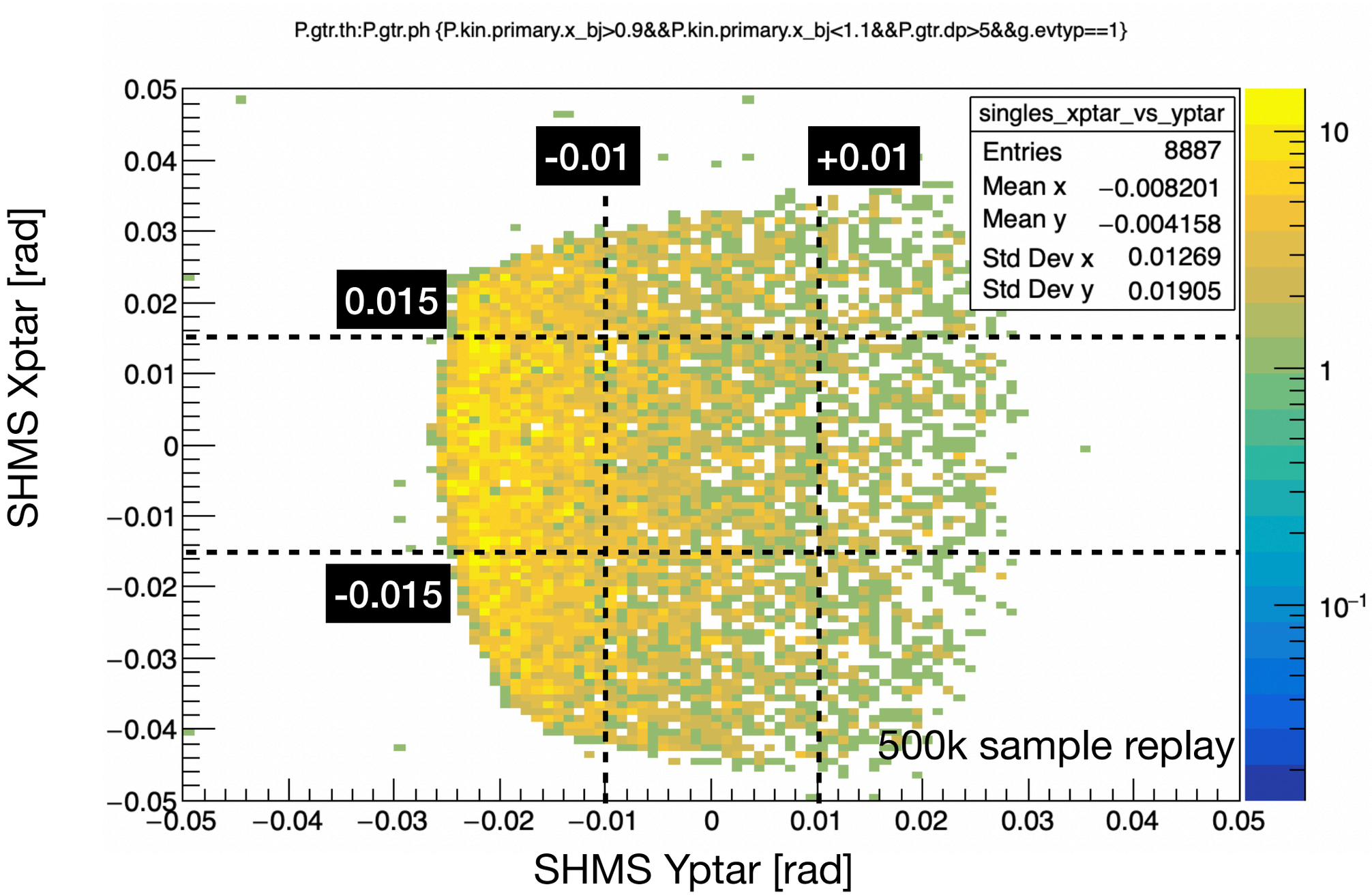
Coincidence Run 16962 H(e, e'p)

Selecting angular acceptance with (e, e'p) events

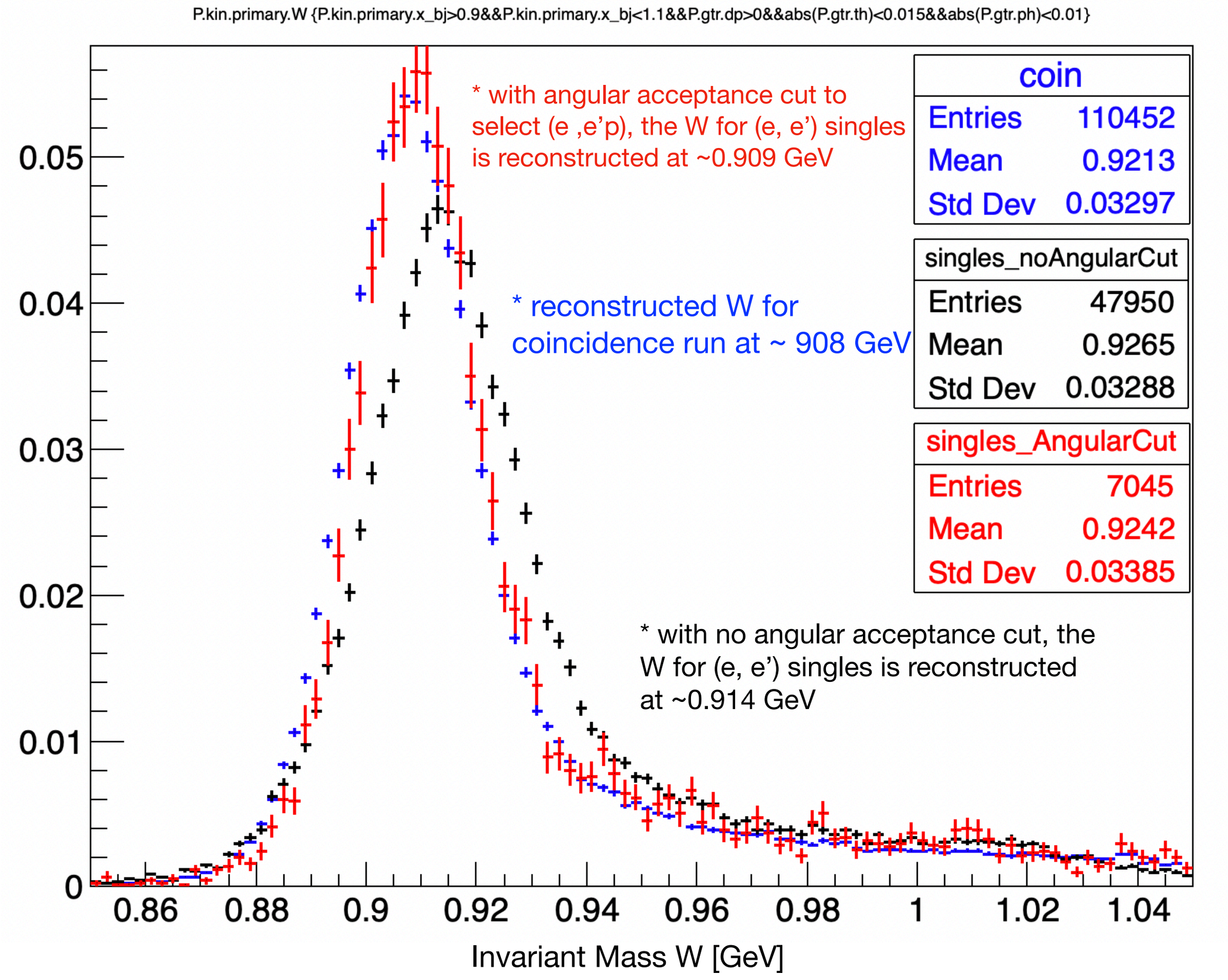


Singles Run 16036 H(e, e’)

Selecting angular acceptance with (e, e’p) events based on the coincidence run 16962



** Coincidence run told us where the (e, e’p) events corresponding to the HMS acceptance were located for this particular kinematics (SHMS 8.55 GeV/c, 8.3 deg)


P.kin.primary.W {P.kin.primary.x_bj>0.9&&P.kin.primary.x_bj<1.1&&P.gtr.dp>0&&abs(P.gtr.th)<0.015&&abs(P.gtr.ph)<0.01}
* with angular acceptance cut to select (e ,e'p), the W for (e, e') singles is reconstructed at ~0.909 GeV
* reconstructed W for coincidence run at ~ 908 GeV
coin
Entries 110452
Mean 0.9213
Std Dev 0.03297
singles_noAngularCut
Entries 47950
Mean 0.9265
Std Dev 0.03288
singles_AngularCut
Entries 7045
Mean 0.9242
Std Dev 0.03385
* with no angular acceptance cut, the W for (e, e') singles is reconstructed at ~0.914 GeV
0.05
0.04
0.03
0.02
0.01
0
0.86
0.88
0.9
0.92
0.94
0.96
0.98
1
1.02
1.04
Invariant Mass W [GeV]

P.kin.primary.W {P.kin.primary.x_bj>0.9&&P.kin.primary.x_bj<1.1&&P.gtr.dp>0&&abs(P.gtr.th)<0.015&&abs(P.gtr.ph)<0.01}

* with angular acceptance cut to select (e ,e'p), the W for (e, e') singles is reconstructed at ~0.909 GeV

* reconstructed W for coincidence run at ~ 908 GeV

* with no angular acceptance cut, the W for (e, e') singles is reconstructed at ~0.914 GeV

coin	
Entries	110452
Constant	0.05364 ± 0.00029
Mean	0.9078 ± 0.0001
Sigma	0.0117 ± 0.0001

singles_AngularCut	
Entries	7045
Constant	0.05541 ± 0.00119
Mean	0.9092 ± 0.0003
Sigma	0.01073 ± 0.00036

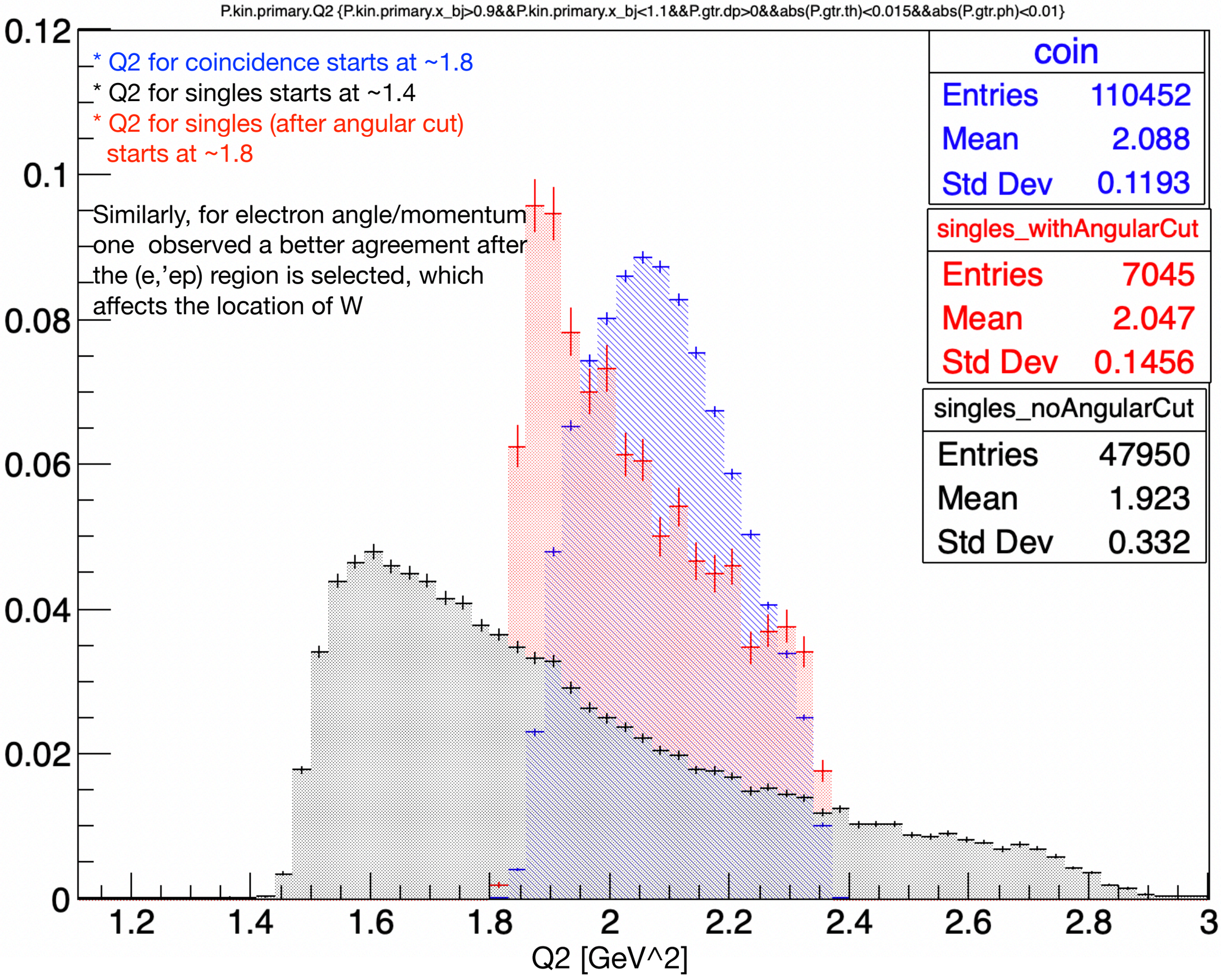
singles_noAngularCut	
Entries	47950
Constant	0.04523 ± 0.00040
Mean	0.914 ± 0.000
Sigma	0.01335 ± 0.00024

0.05
0.04
0.03
0.02
0.01
0

0.86 0.88 0.9 0.92 0.94 0.96 0.98 1 1.02 1.04

Invariant Mass W [GeV]

4-Momentum Transfer



SHMS (e-) scattering angle

P.kin.primary.scat_ang_deg {P.kin.primary.x_bj>0.9&&P.kin.primary.x_bj<1.1&&P.gtr.dp>0&&abs(P.gtr.th)<0.015&&abs(P.gtr.ph)<0.01}

* angle for coincidence starts at ~7.7
* angle for singles starts at ~6.8
* angle for singles (after angular cut) starts at ~7.7

coin	
Entries	110452
Mean	8.295
Std Dev	0.2634

singles_withAngularCut	
Entries	7045
Mean	8.204
Std Dev	0.3242

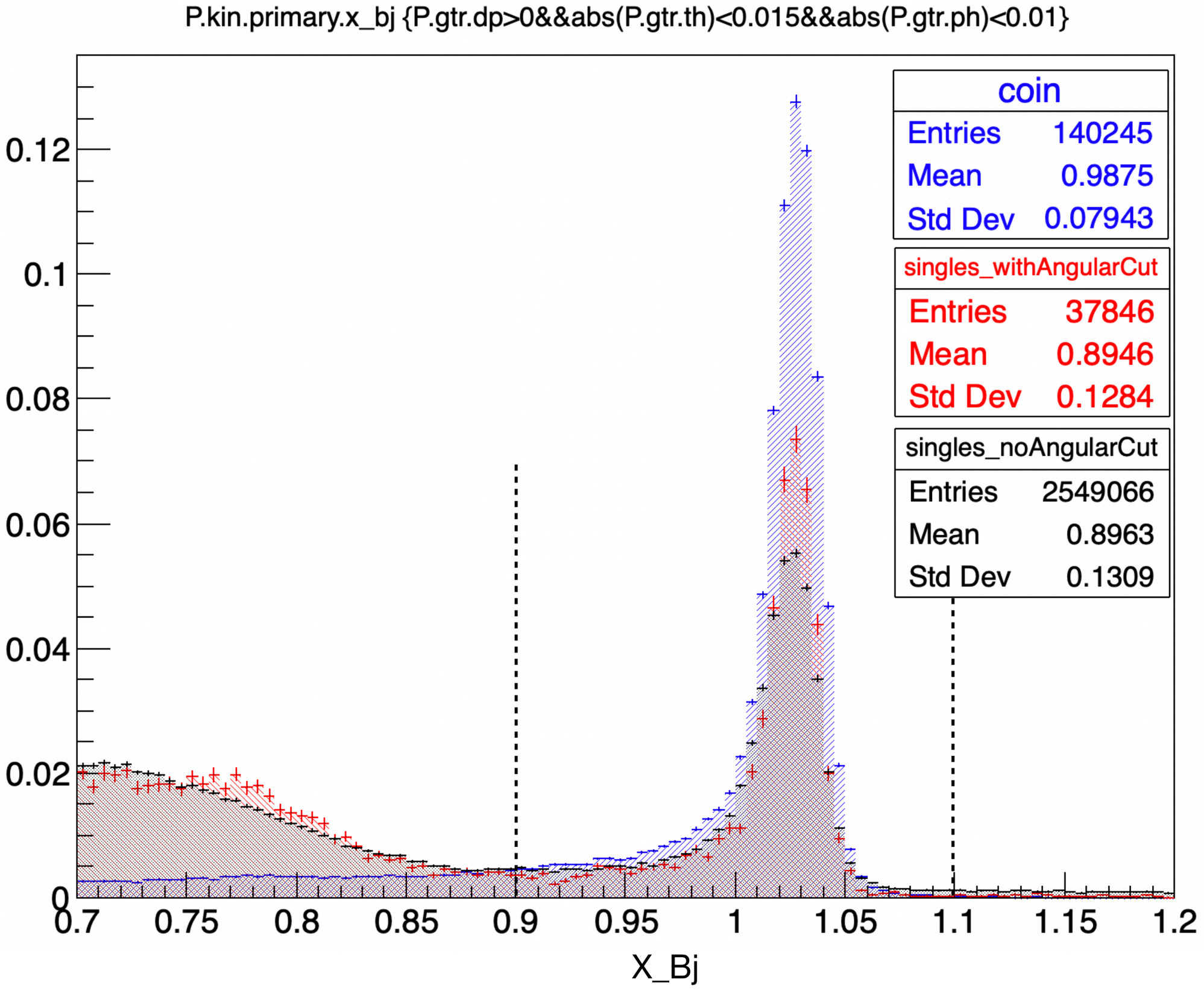
singles_noAngularCut	
Entries	47950
Mean	7.905
Std Dev	0.7422

0.07
0.06
0.05
0.04
0.03
0.02
0.01
0

5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10

SHMS angle [deg]

x-Bjorken


P.kin.primary.x_bj {P.gtr.dp>0&&abs(P.gtr.th)<0.015&&abs(P.gtr.ph)<0.01}
coin
Entries 140245
Mean 0.9875
Std Dev 0.07943
singles_withAngularCut
Entries 37846
Mean 0.8946
Std Dev 0.1284
singles_noAngularCut
Entries 2549066
Mean 0.8963
Std Dev 0.1309
0.12
0.1
0.08
0.06
0.04
0.02
0
0.7
0.75
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
1.2
X_Bj

Summary

- discrepancy (offset) in W for H(e, e’) and H(e, e’p) was observed

- reason for offset due to different angular acceptance for singles/coincidence runs

- fix: use the coincidence run to select angular range with (e, e’p) events and apply to singles

  ** This is important to keep in mind when optimizing singles/coincidence data and comparing them

To-Do

For both data/simc

- E’ vs theta_e fit
- W vs theta_e
- dE’=E’meas-E’calc vs. theta_e
- delta_theta_e vs E’
- Solve the W vs Y’tar dependence