Excl. and incl. reconstruction

A sample of 100K following events generated.

$$B^+ \rightarrow K^+ \tau^- \mu^+$$
$$\tau^- \rightarrow \pi^- \nu_\tau$$

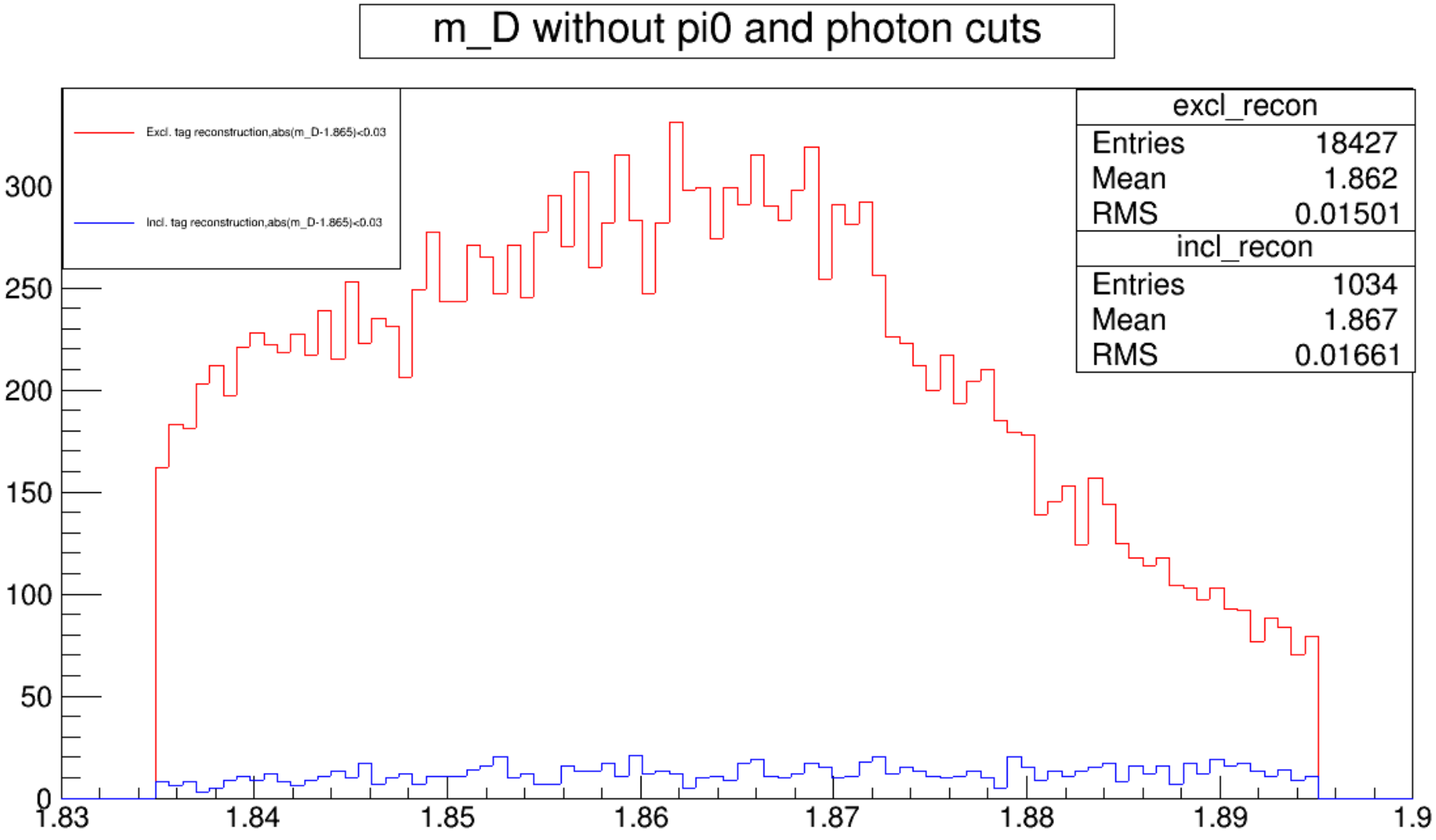
$$B^- \rightarrow D^0 \mu^- \bar{\nu}_\mu$$
$$D^0 \rightarrow K^- \pi^+ \pi^0$$

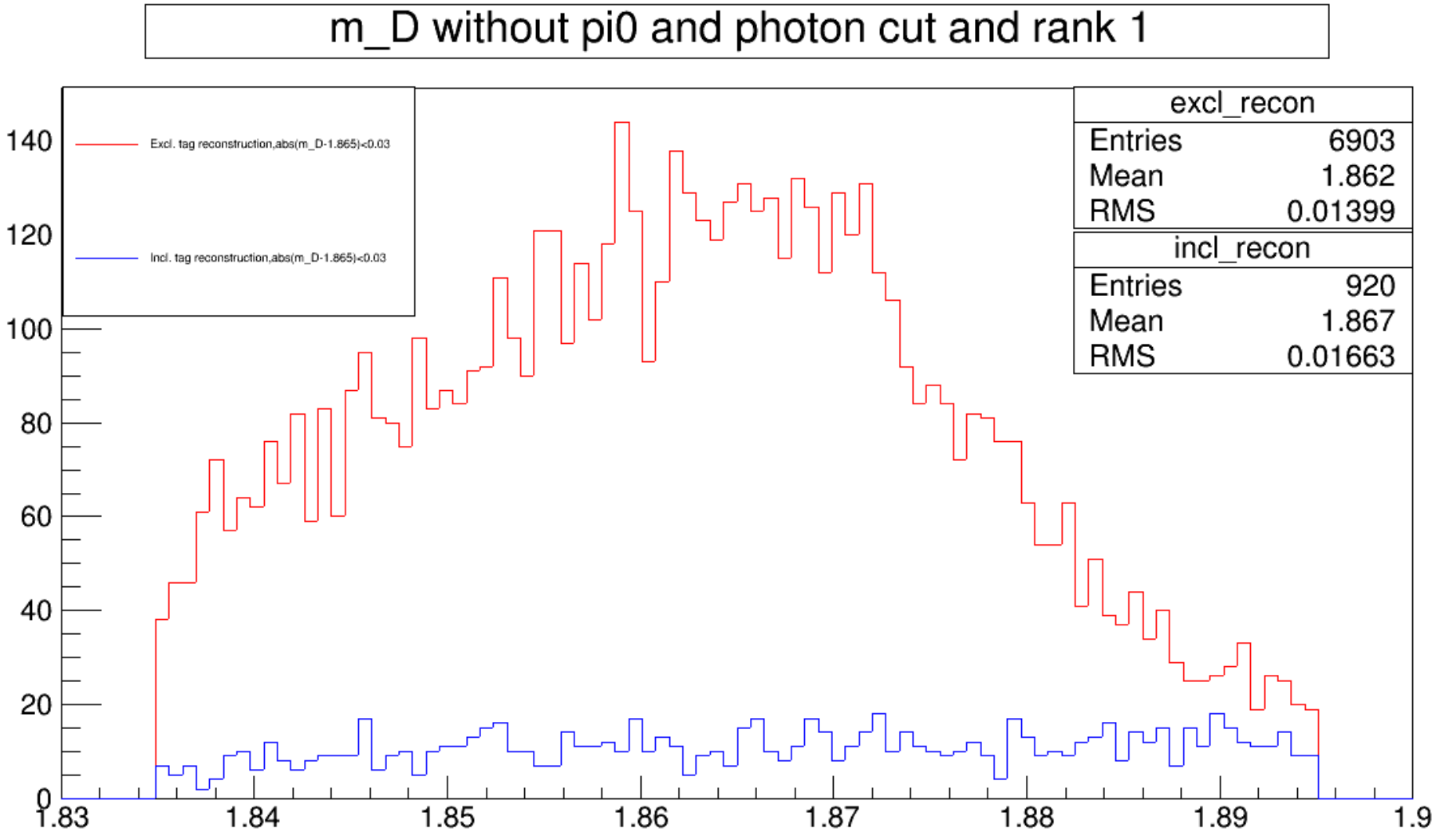
20/10/2023

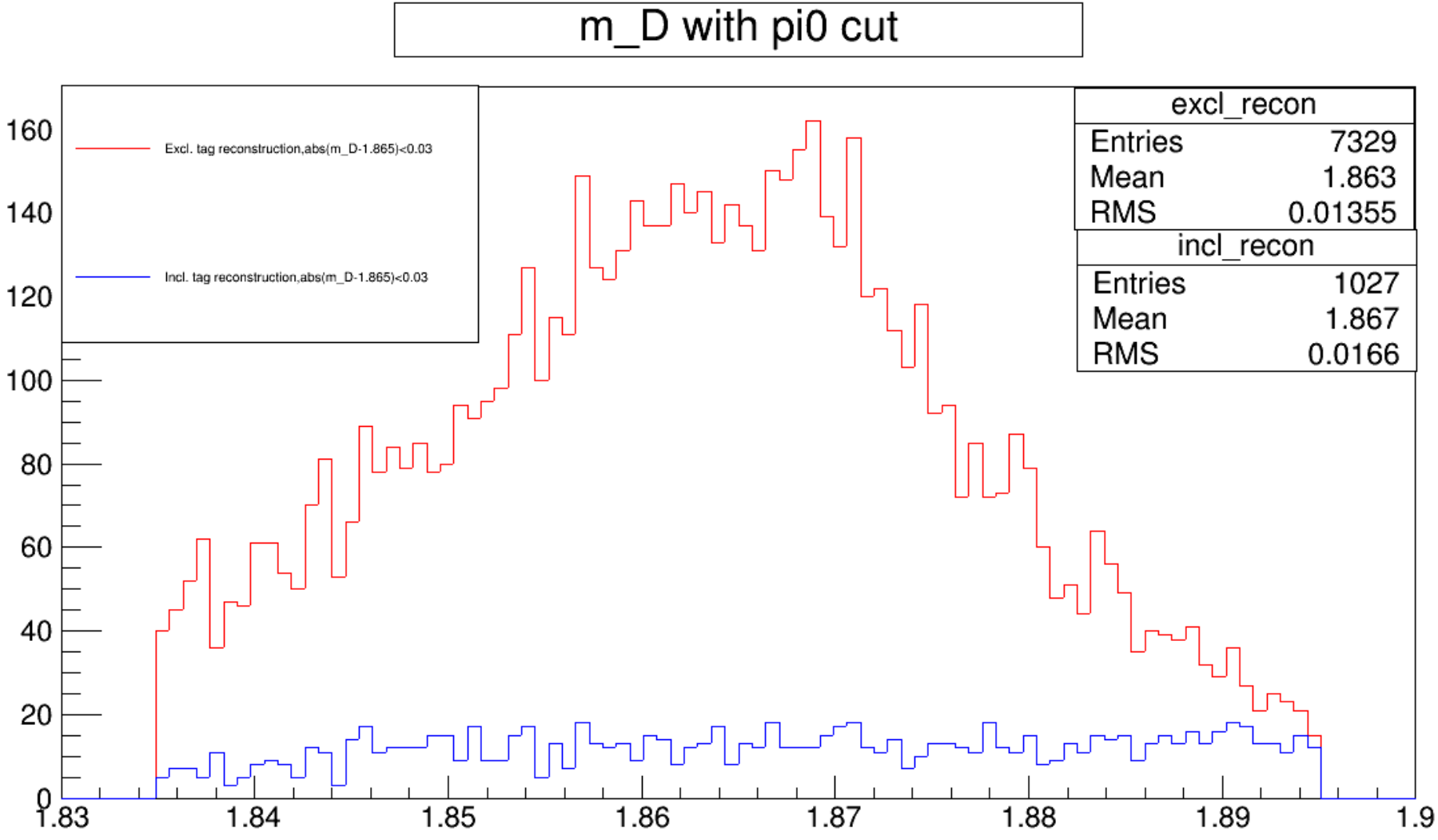
Reconstruction approach

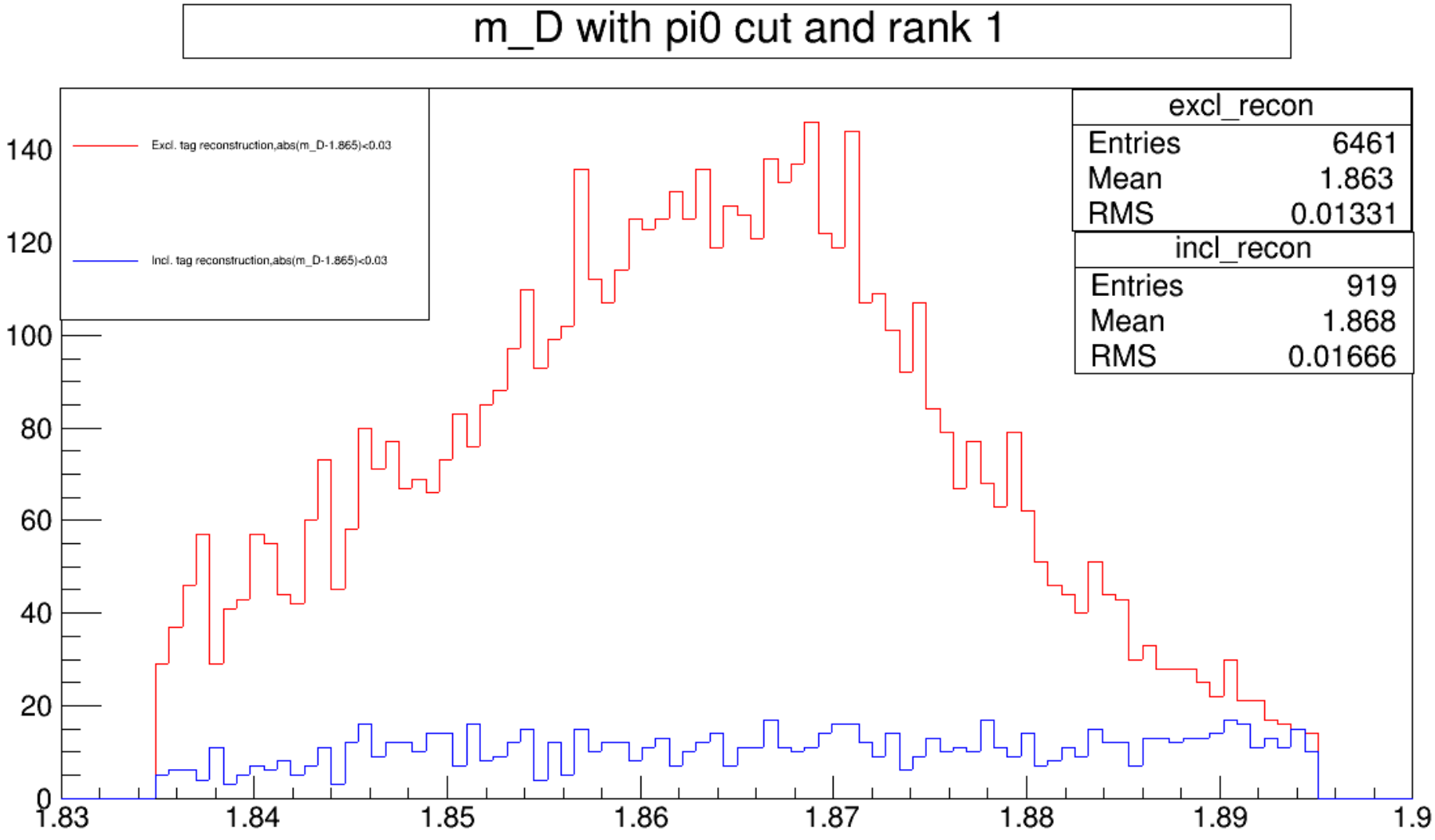
- Reconstructed both inclusively and exclusively.
- Furthermore, the following π^0 cuts are also checked.

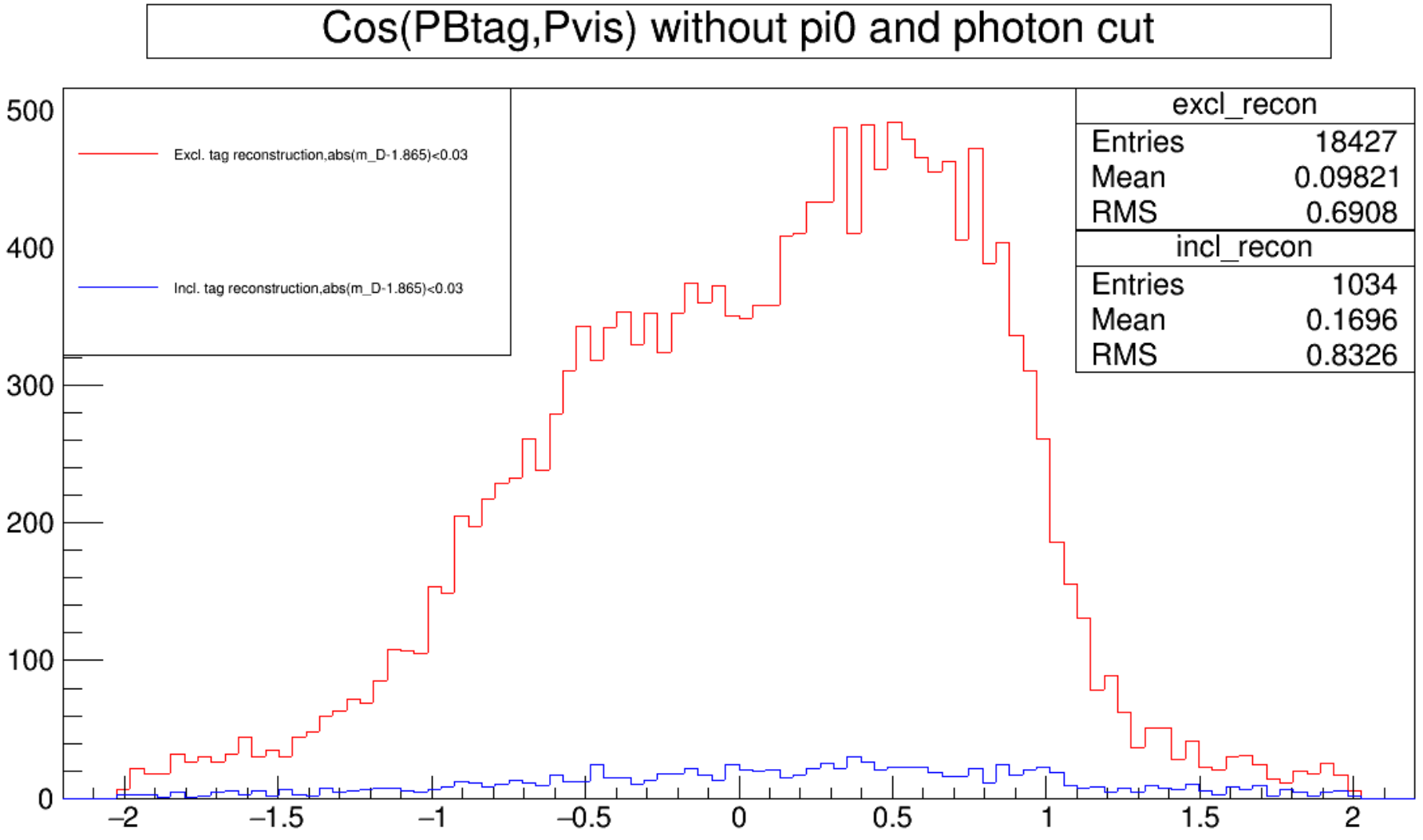
```
# pi0 selection

gamma1_cut = 'passesCut( -1.00 < daughter(0, cosTheta) <= -0.63 and daughter(0, E) > 0.100 ) \
          or  passesCut( -0.63 < daughter(0, cosTheta) <=  0.85 and daughter(0, E) > 0.060 ) \
          or  passesCut(  0.85 < daughter(0, cosTheta) <   1.00 and daughter(0, E) > 0.120 )'

gamma2_cut = 'passesCut( -1.00 < daughter(1, cosTheta) <= -0.63 and daughter(1, E) > 0.100 ) \
          or  passesCut( -0.63 < daughter(1, cosTheta) <=  0.85 and daughter(1, E) > 0.060 ) \
          or  passesCut(  0.85 < daughter(1, cosTheta) <   1.00 and daughter(1, E) > 0.120 )'

pi0_cut = 'passesCut(' + gamma1_cut + ' ) and passesCut( ' + gamma2_cut + ' )'

applyCuts('pi0:mdst', cut=pi0_cut, path=mypath)
```

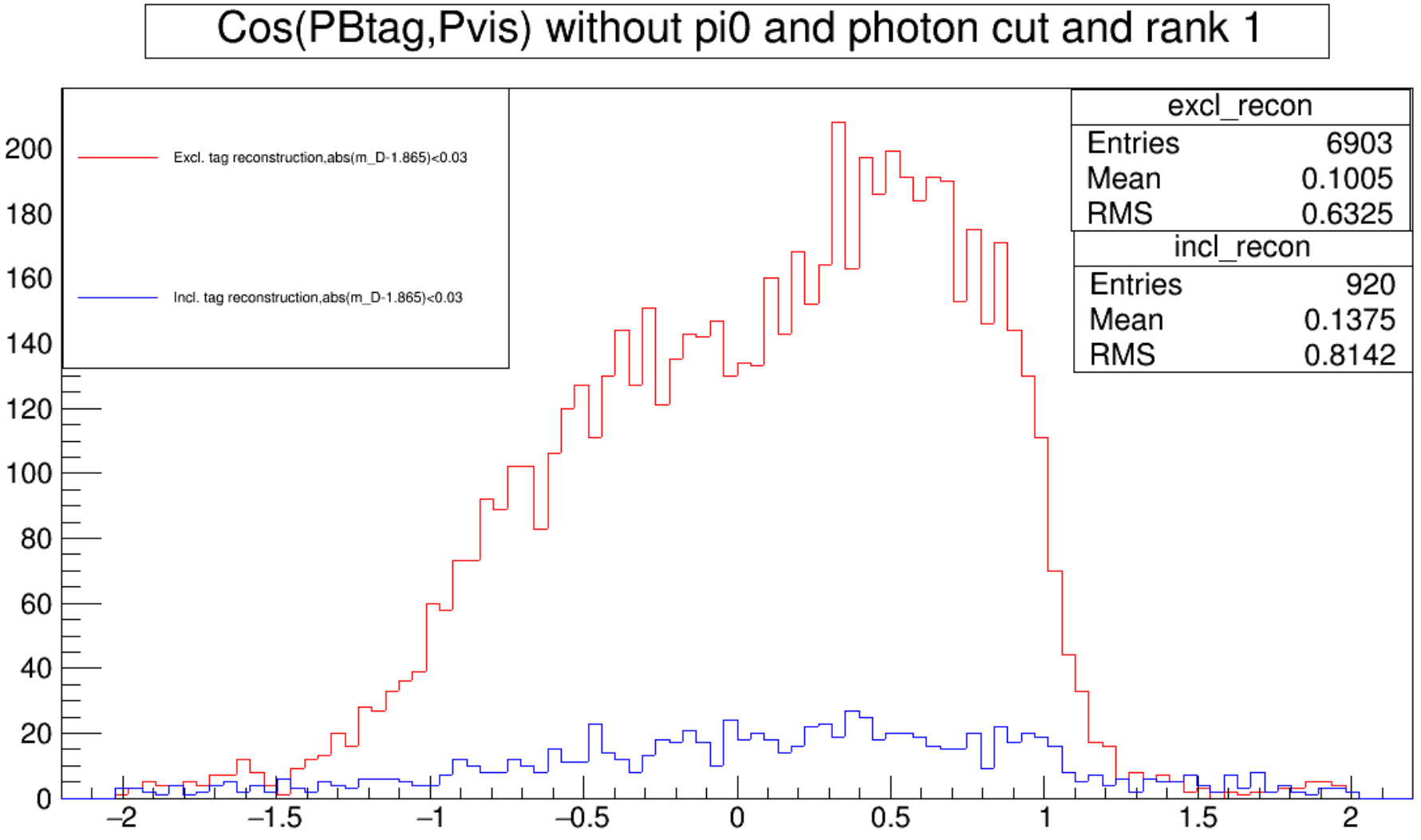

m_D without pi0 and photon cuts
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 18427
Mean 1.862
RMS 0.01501
incl_recon
Entries 1034
Mean 1.867
RMS 0.01661
300
250
200
150
100
50
0
1.83
1.84
1.85
1.86
1.87
1.88
1.89
1.9

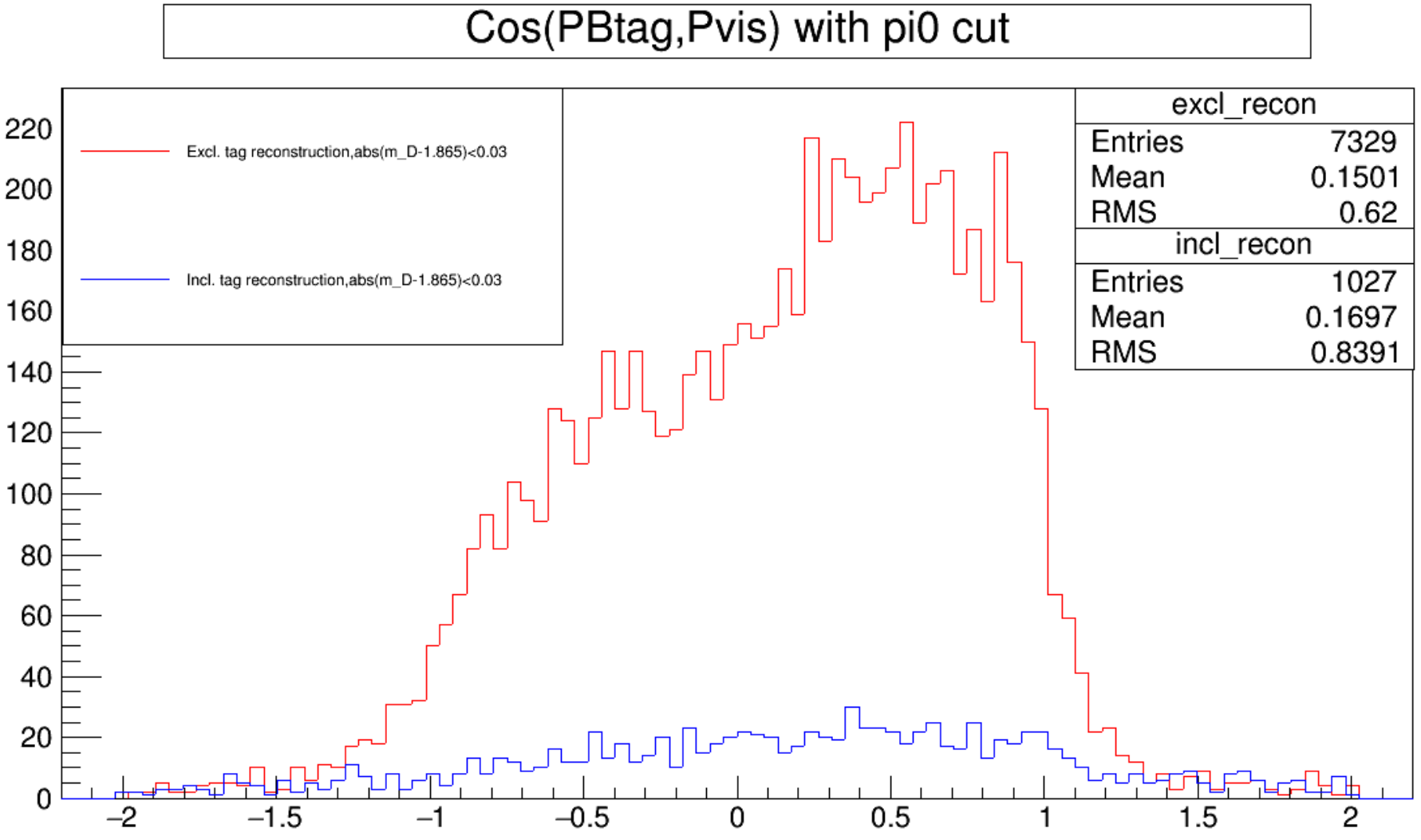

m_D without pi0 and photon cut and rank 1
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 6903
Mean 1.862
RMS 0.01399
incl_recon
Entries 920
Mean 1.867
RMS 0.01663
140
120
100
80
60
40
20
0
1.83
1.84
1.85
1.86
1.87
1.88
1.89
1.9

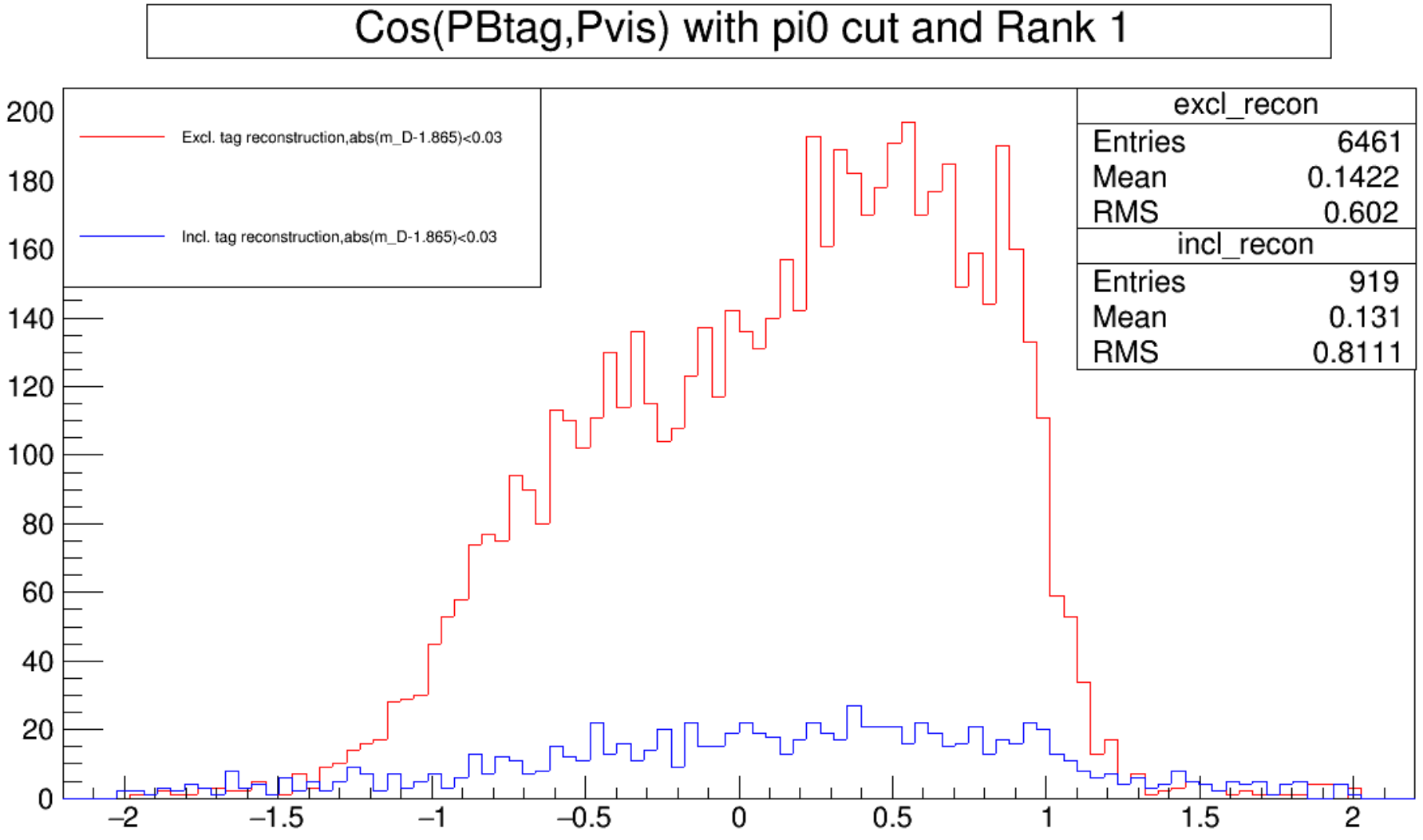

m_D with pi0 cut
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 7329
Mean 1.863
RMS 0.01355
incl_recon
Entries 1027
Mean 1.867
RMS 0.0166
160
140
120
100
80
60
40
20
0
1.83
1.84
1.85
1.86
1.87
1.88
1.89
1.9


m_D with pi0 cut and rank 1
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 6461
Mean 1.863
RMS 0.01331
incl_recon
Entries 919
Mean 1.868
RMS 0.01666
140
120
100
80
60
40
20
0
1.83
1.84
1.85
1.86
1.87
1.88
1.89
1.9

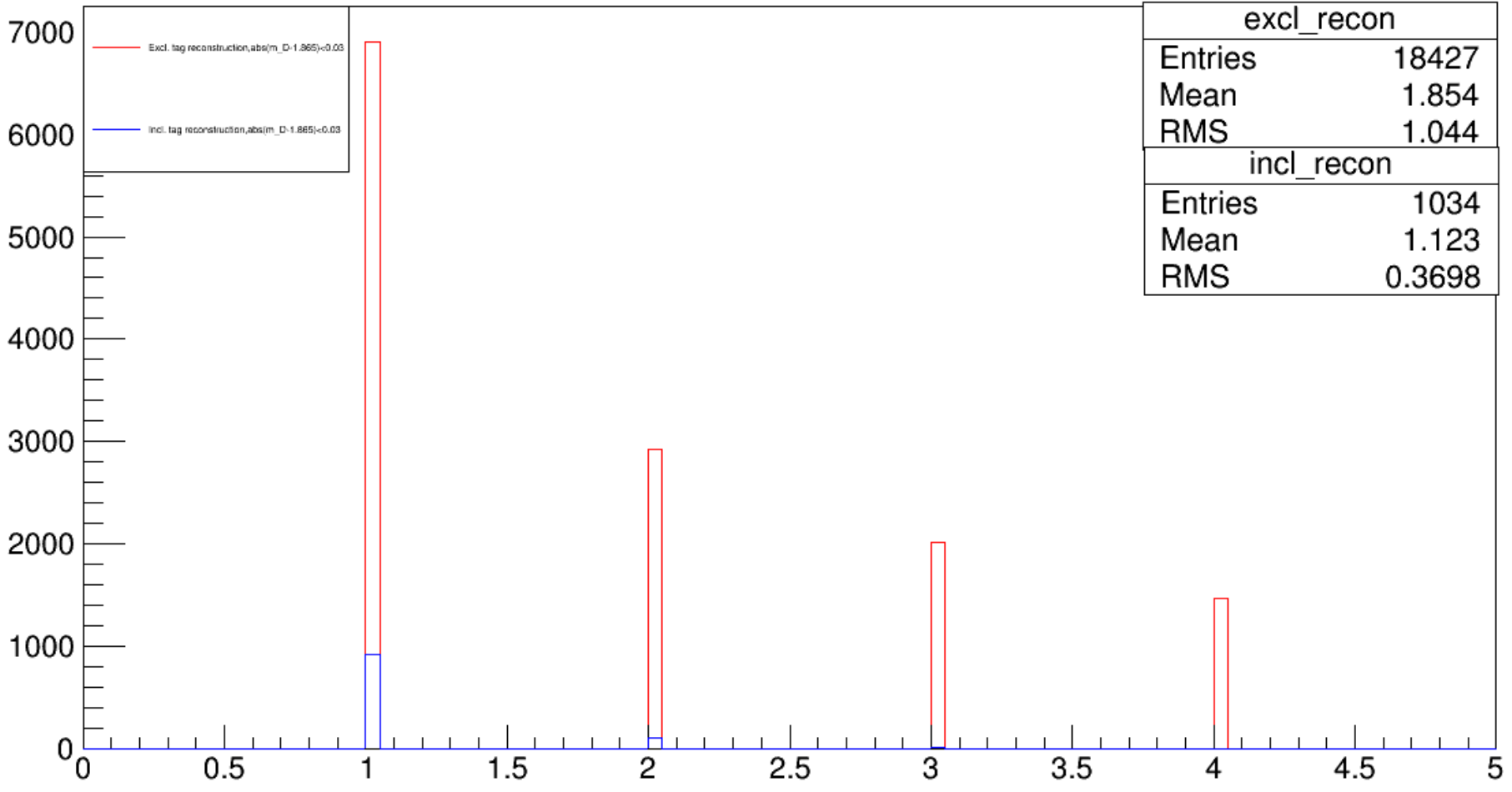

Cos(PBtag,Pvis) without pi0 and photon cut
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 18427
Mean 0.09821
RMS 0.6908
incl_recon
Entries 1034
Mean 0.1696
RMS 0.8326
500
400
300
200
100
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2


Cos(PBtag,Pvis) without pi0 and photon cut and rank 1
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 6903
Mean 0.1005
RMS 0.6325
incl_recon
Entries 920
Mean 0.1375
RMS 0.8142
200
180
160
140
120
100
80
60
40
20
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2

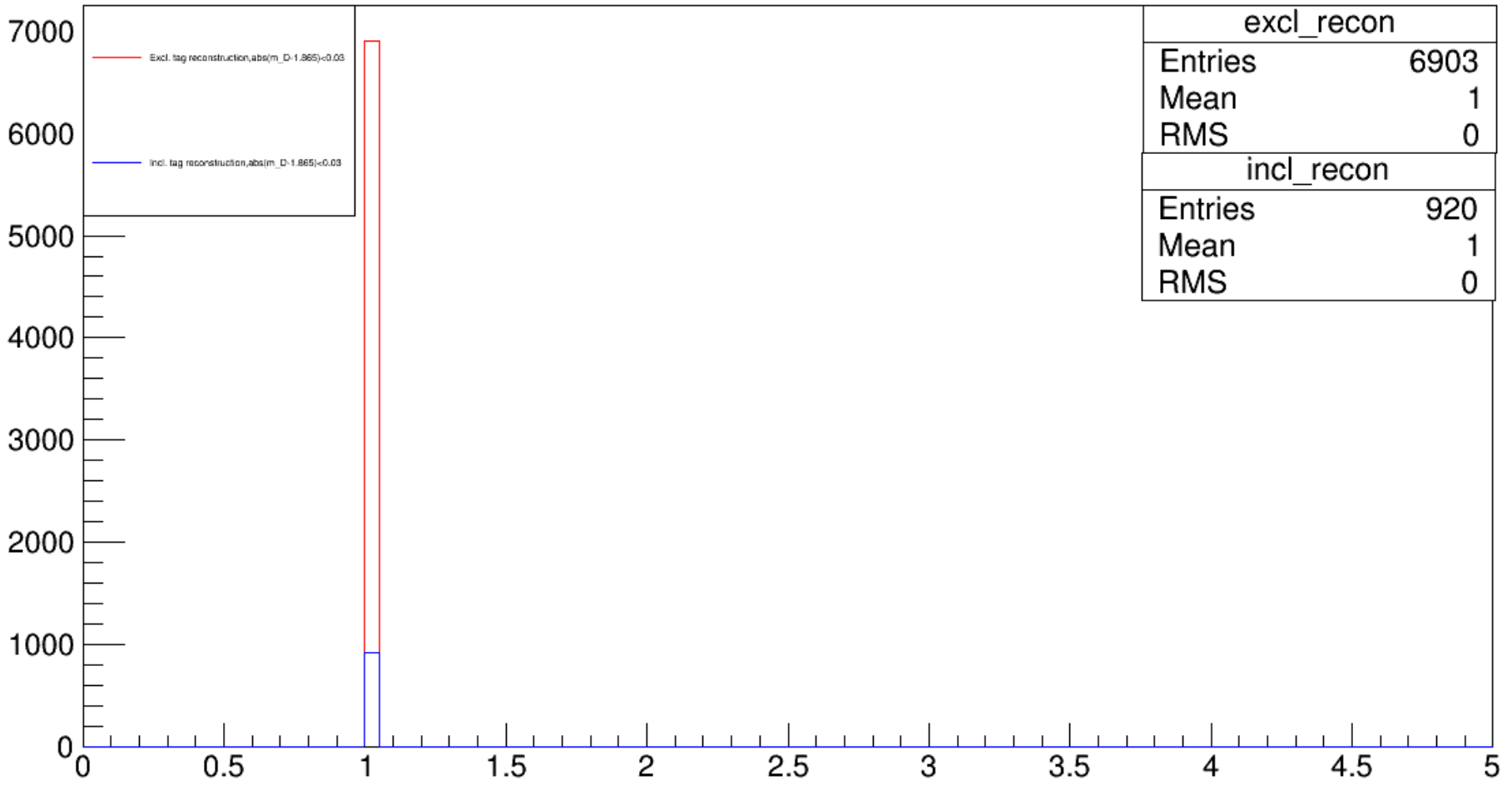

Cos(PBtag,Pvis) with pi0 cut
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 7329
Mean 0.1501
RMS 0.62
incl_recon
Entries 1027
Mean 0.1697
RMS 0.8391
220
200
180
160
140
120
100
80
60
40
20
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2


Cos(PBtag,Pvis) with pi0 cut and Rank 1
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 6461
Mean 0.1422
RMS 0.602
incl_recon
Entries 919
Mean 0.131
RMS 0.8111
200
180
160
140
120
100
80
60
40
20
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2

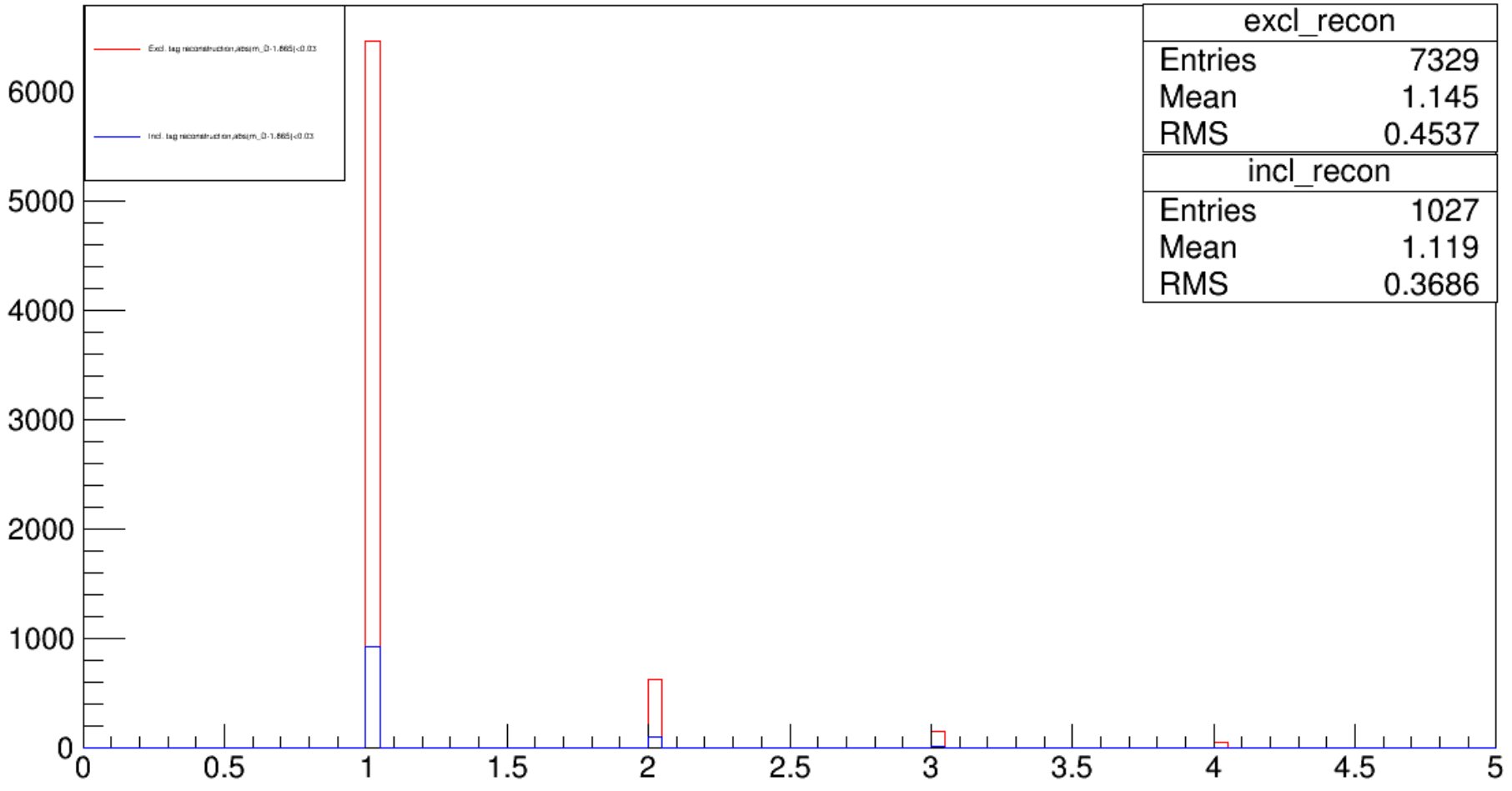
Rank without pi0 and photon cut

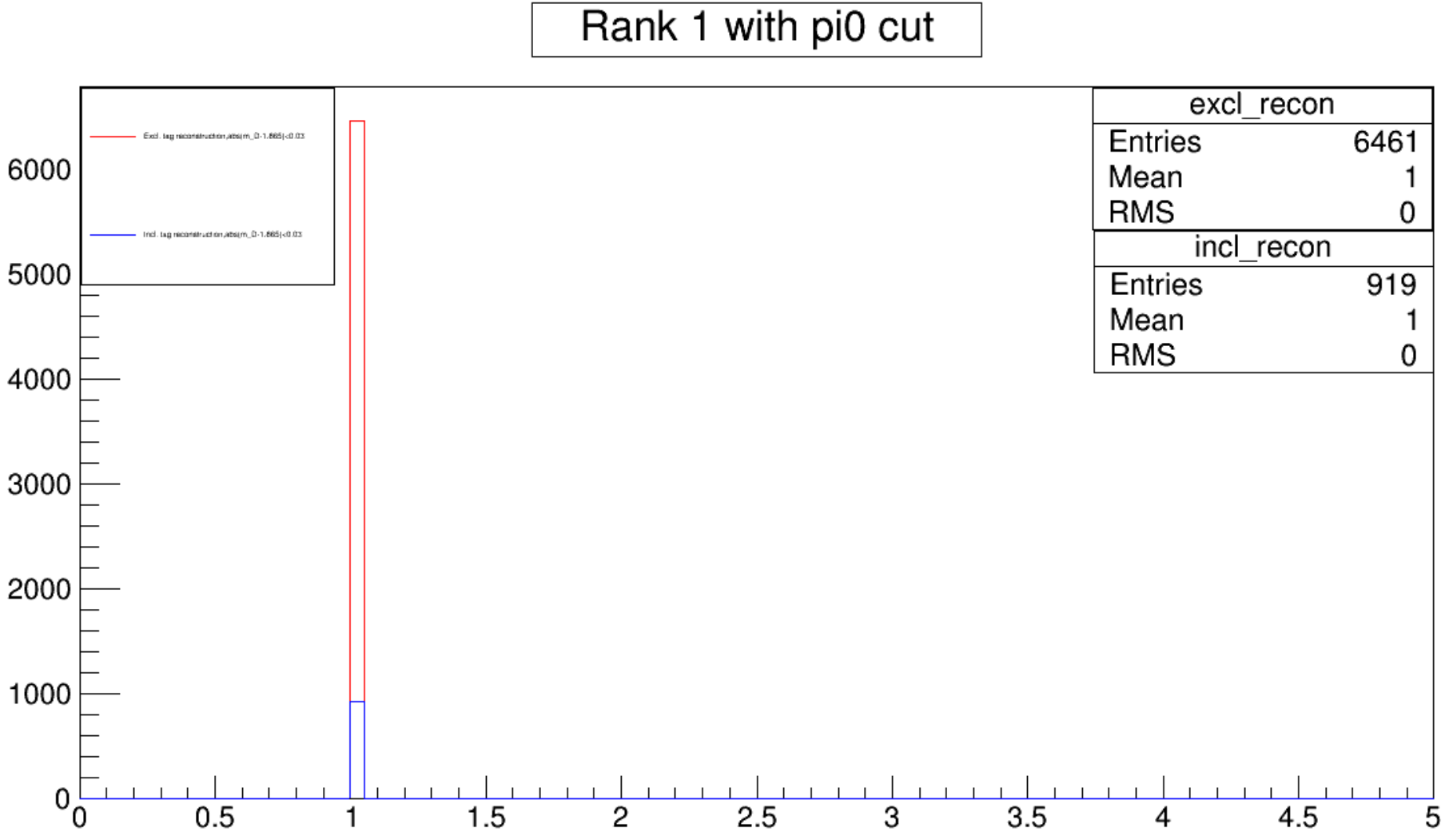


Rank 1 without pi0 and photon cut

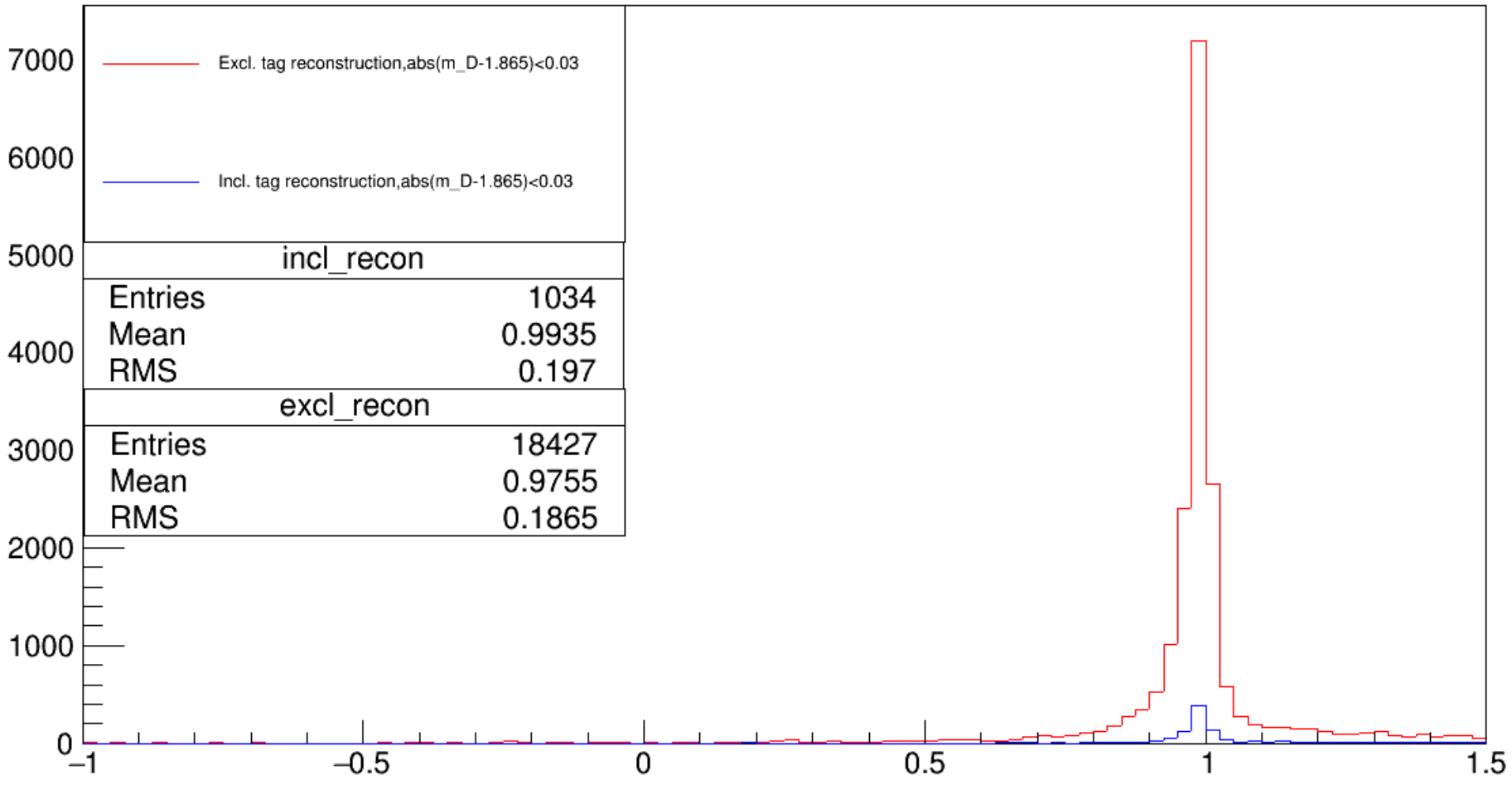


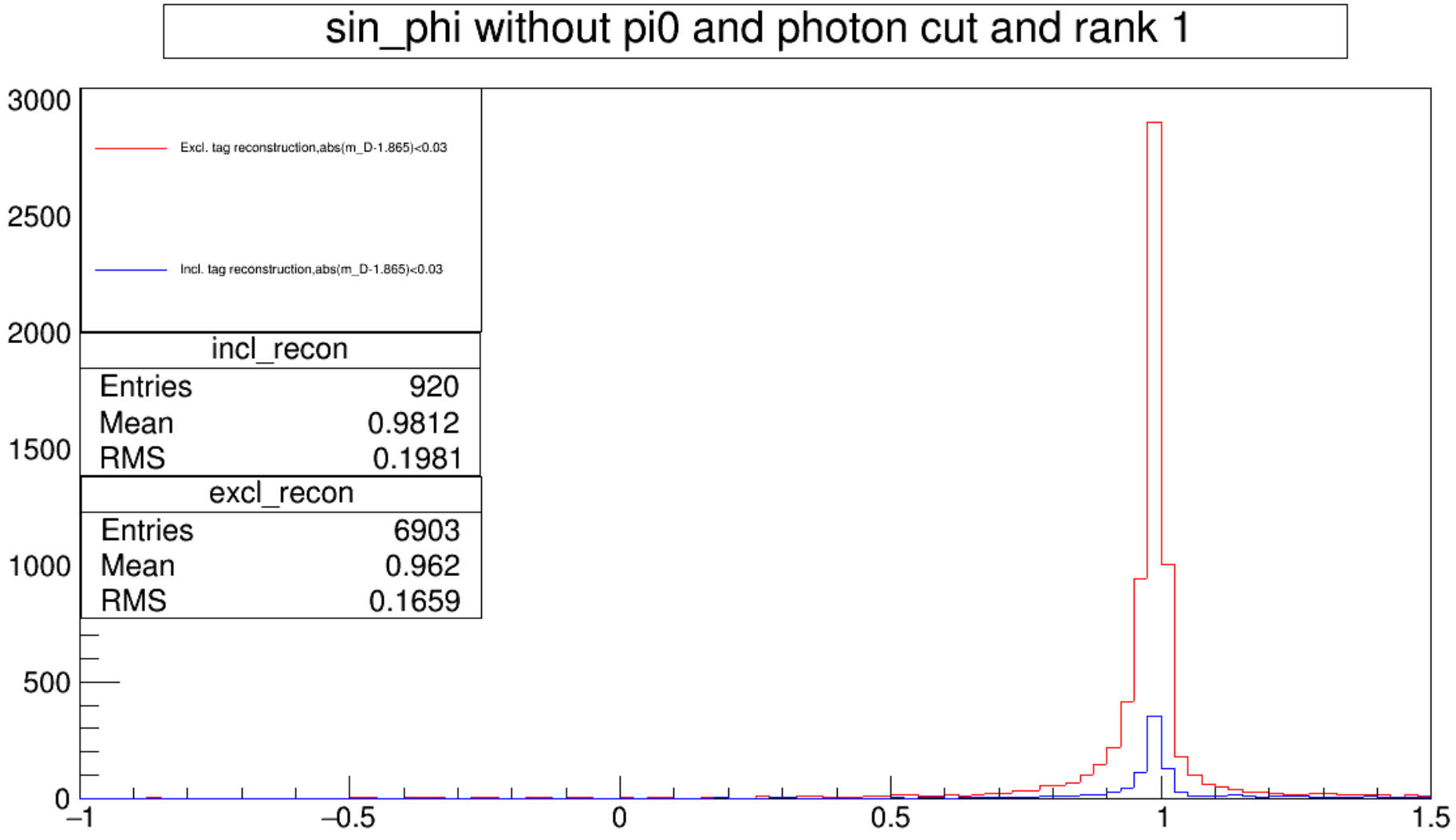
Rank with pi0 cut

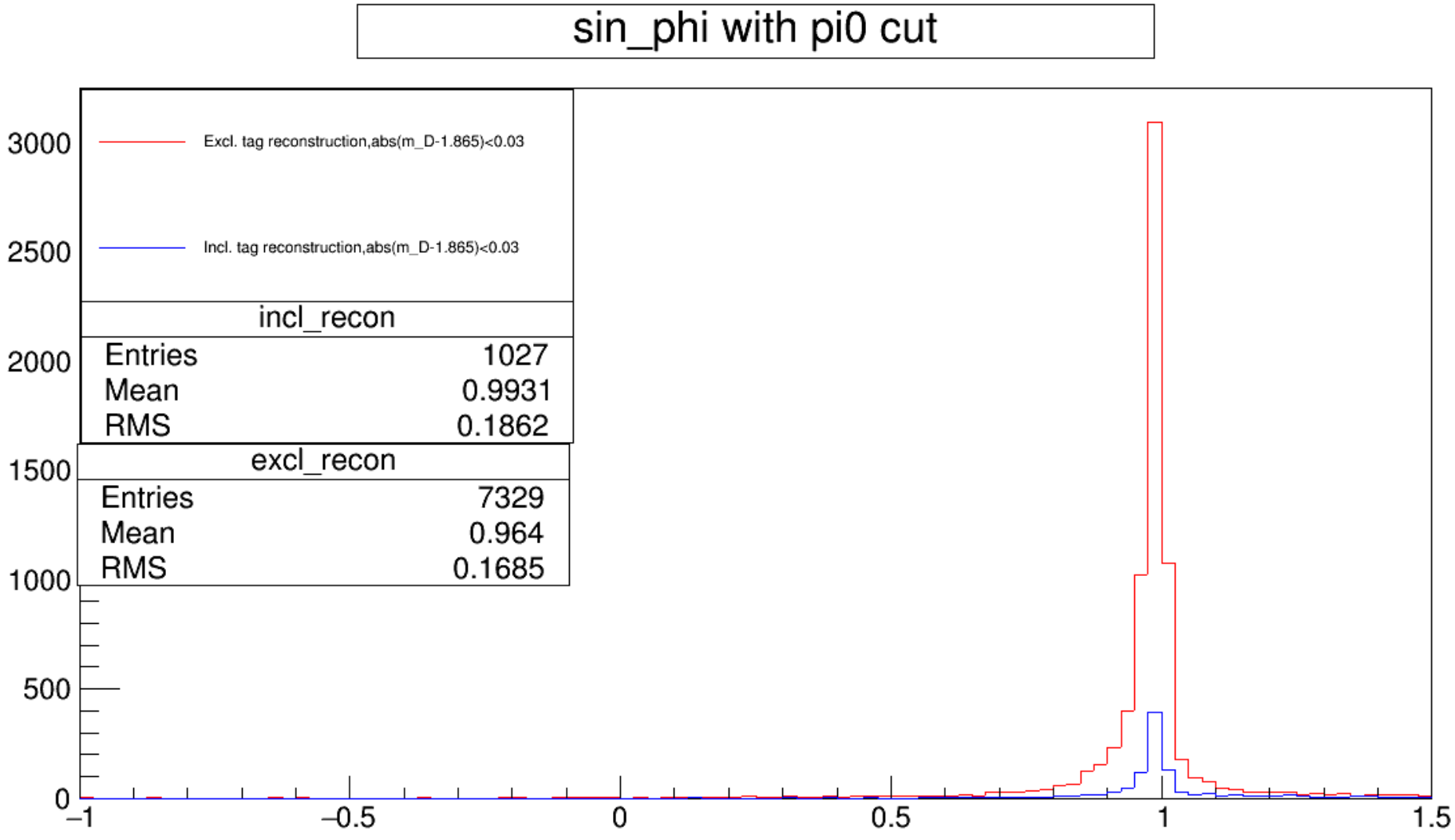


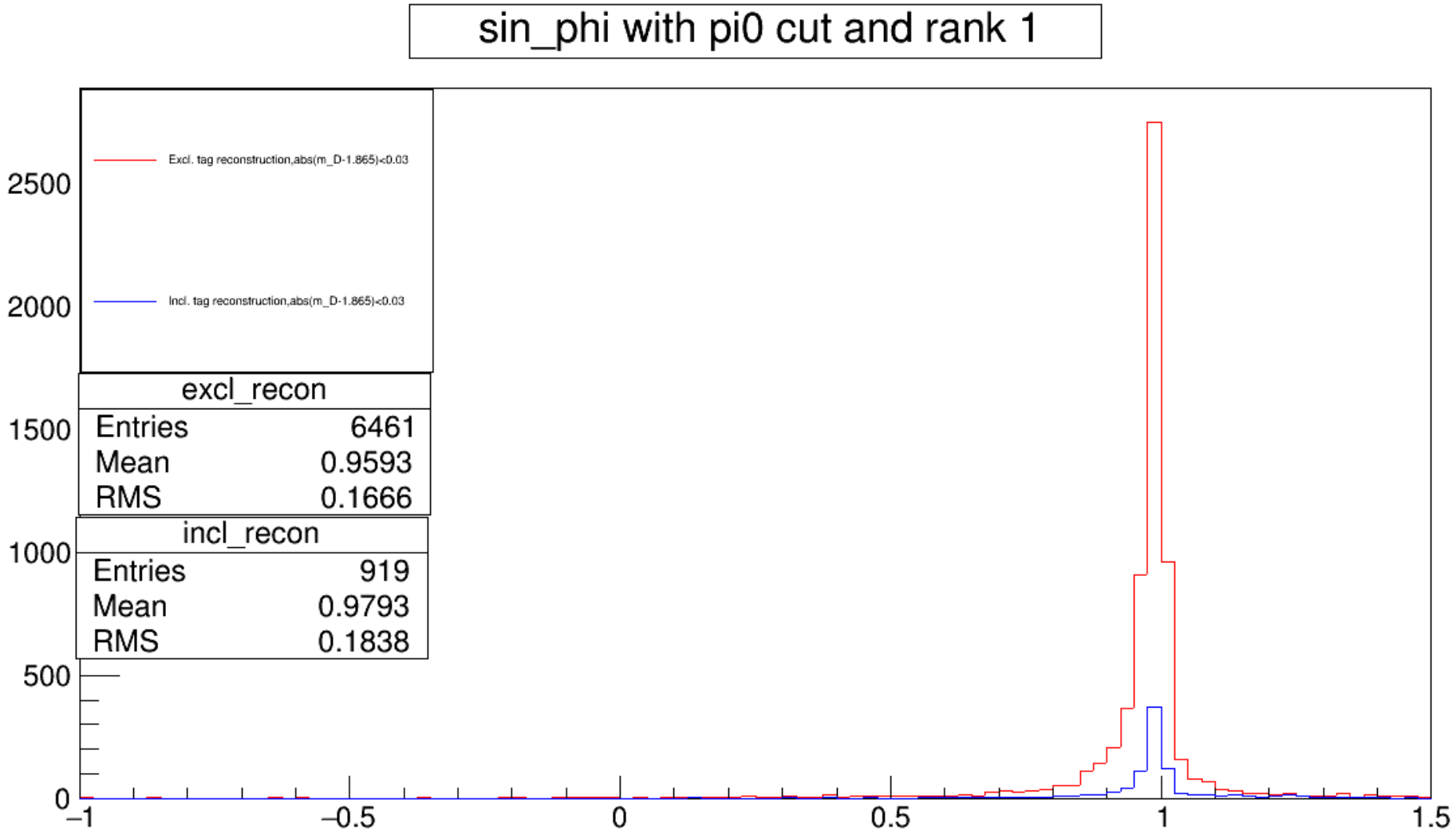

Rank 1 with pi0 cut
Excl. tag reconstruction,abs(m_D-1.865|<0.03
Incl. tag reconstruction,abs(m_D-1.865|<0.03
excl_recon
Entries 6461
Mean 1
RMS 0
incl_recon
Entries 919
Mean 1
RMS 0
6000
5000
4000
3000
2000
1000
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

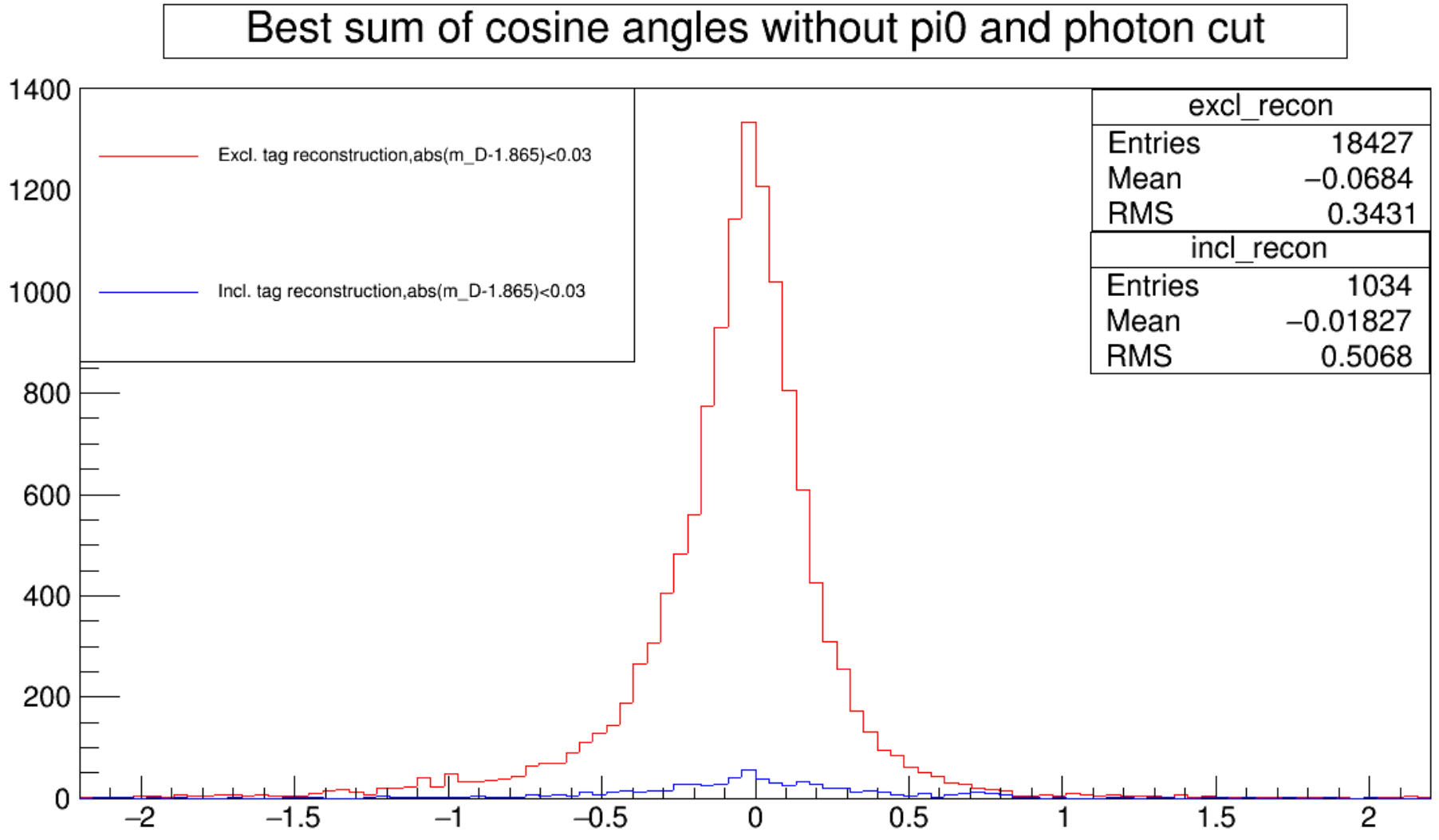
sin_phi without pi0 and photon cut

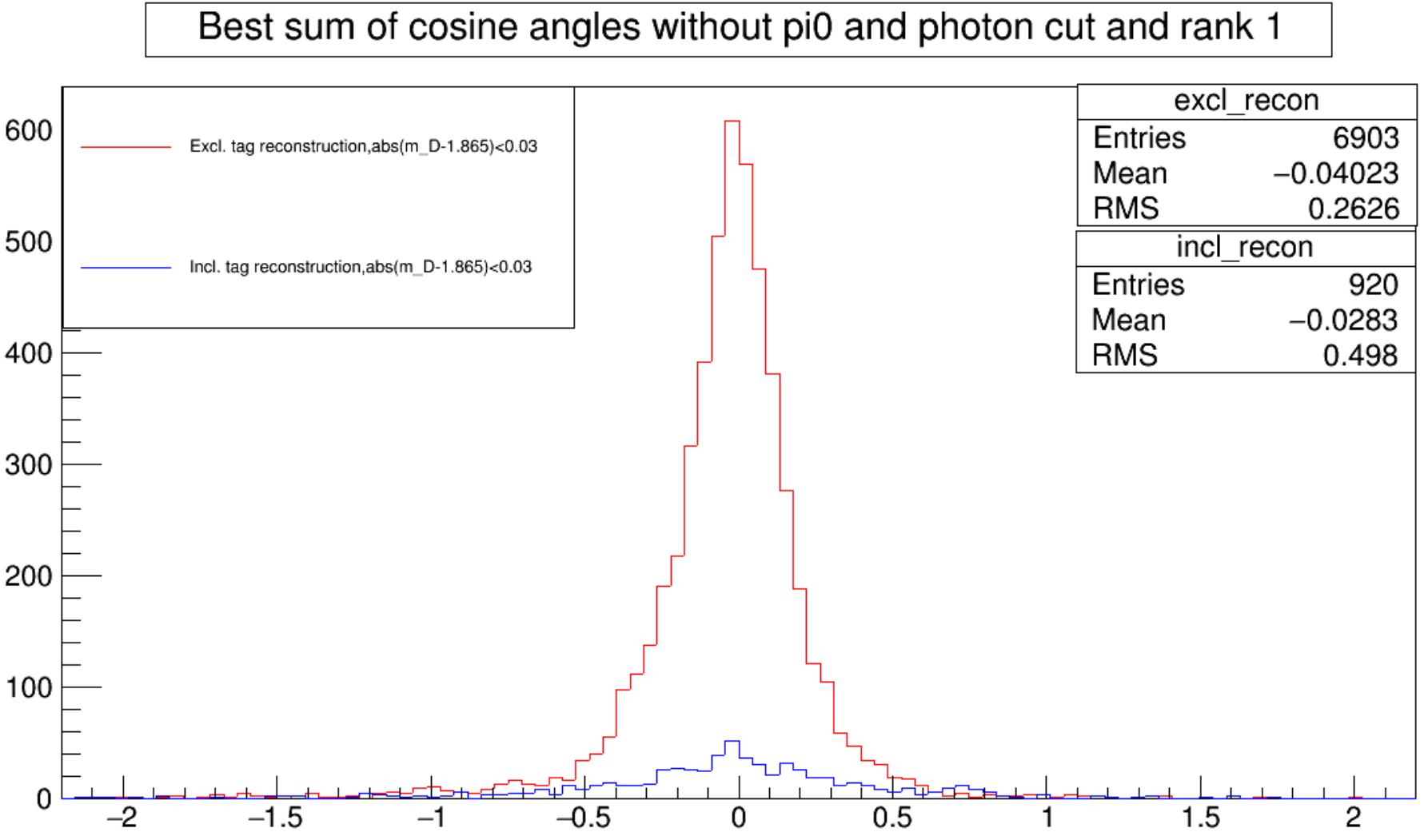


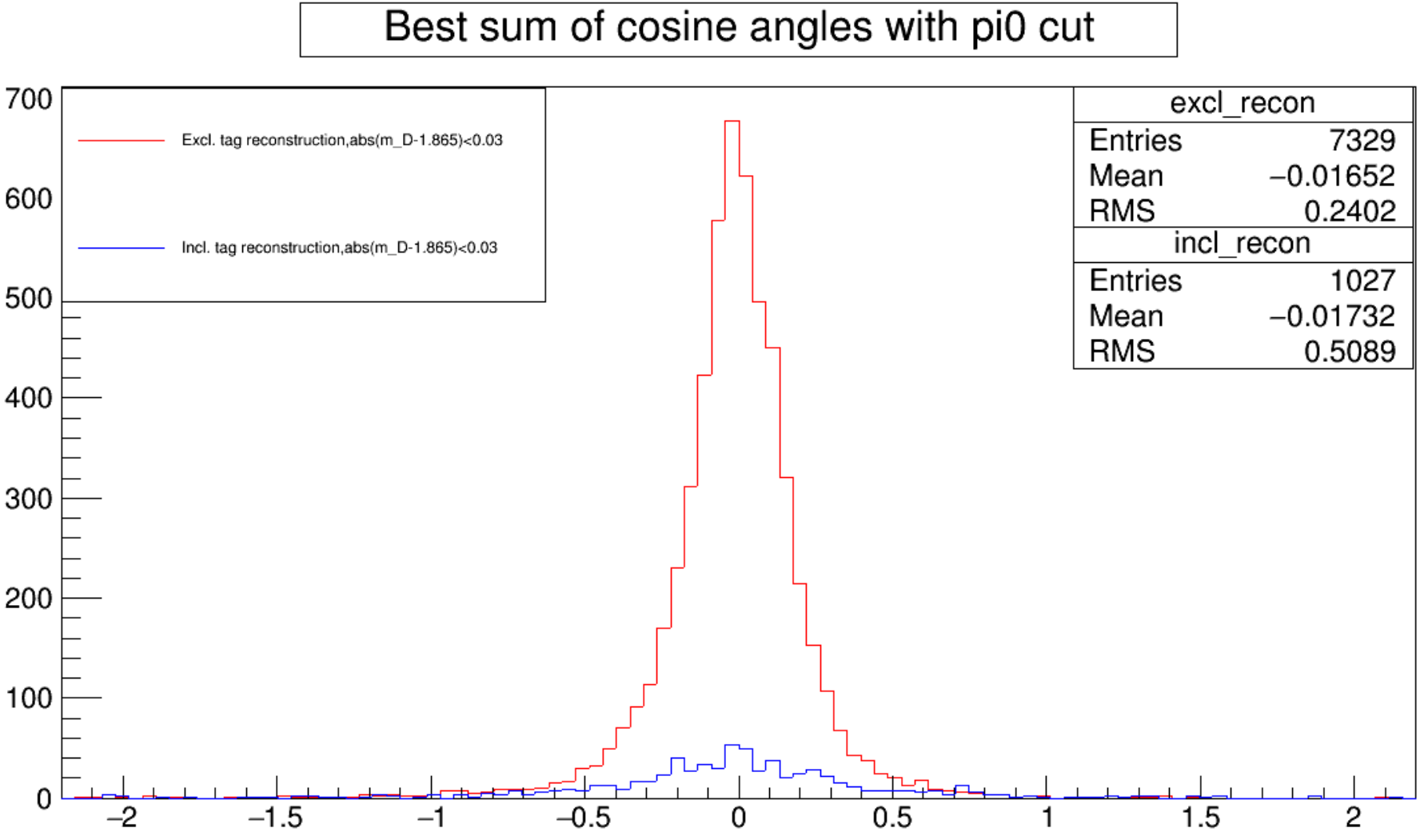

sin_phi without pi0 and photon cut and rank 1
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
incl_recon
Entries 920
Mean 0.9812
RMS 0.1981
excl_recon
Entries 6903
Mean 0.962
RMS 0.1659
3000
2500
2000
1500
1000
500
0
−1
−0.5
0
0.5
1
1.5

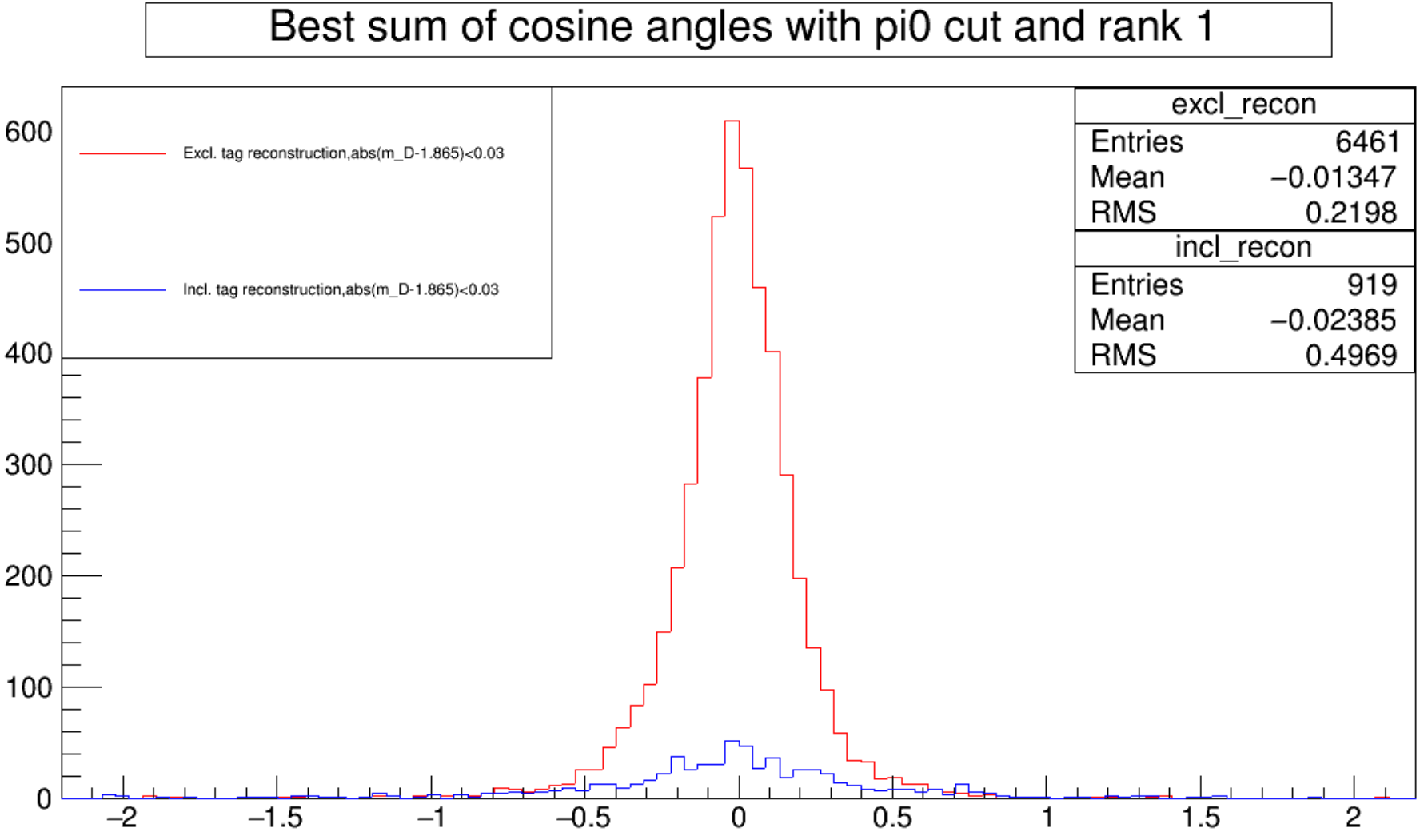

sin_phi with pi0 cut
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
incl_recon
Entries 1027
Mean 0.9931
RMS 0.1862
excl_recon
Entries 7329
Mean 0.964
RMS 0.1685
3000
2500
2000
1500
1000
500
0
−1
−0.5
0
0.5
1
1.5


sin_phi with pi0 cut and rank 1
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 6461
Mean 0.9593
RMS 0.1666
incl_recon
Entries 919
Mean 0.9793
RMS 0.1838
2500
2000
1500
1000
500
0
−1
−0.5
0
0.5
1
1.5


Best sum of cosine angles without pi0 and photon cut
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 18427
Mean −0.0684
RMS 0.3431
incl_recon
Entries 1034
Mean −0.01827
RMS 0.5068
1400
1200
1000
800
600
400
200
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2


Best sum of cosine angles without pi0 and photon cut and rank 1
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 6903
Mean −0.04023
RMS 0.2626
incl_recon
Entries 920
Mean −0.0283
RMS 0.498
600
500
400
300
200
100
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2


Best sum of cosine angles with pi0 cut
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 7329
Mean −0.01652
RMS 0.2402
incl_recon
Entries 1027
Mean −0.01732
RMS 0.5089
700
600
500
400
300
200
100
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2


Best sum of cosine angles with pi0 cut and rank 1
Excl. tag reconstruction,abs(m_D-1.865)<0.03
Incl. tag reconstruction,abs(m_D-1.865)<0.03
excl_recon
Entries 6461
Mean −0.01347
RMS 0.2198
incl_recon
Entries 919
Mean −0.02385
RMS 0.4969
600
500
400
300
200
100
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2

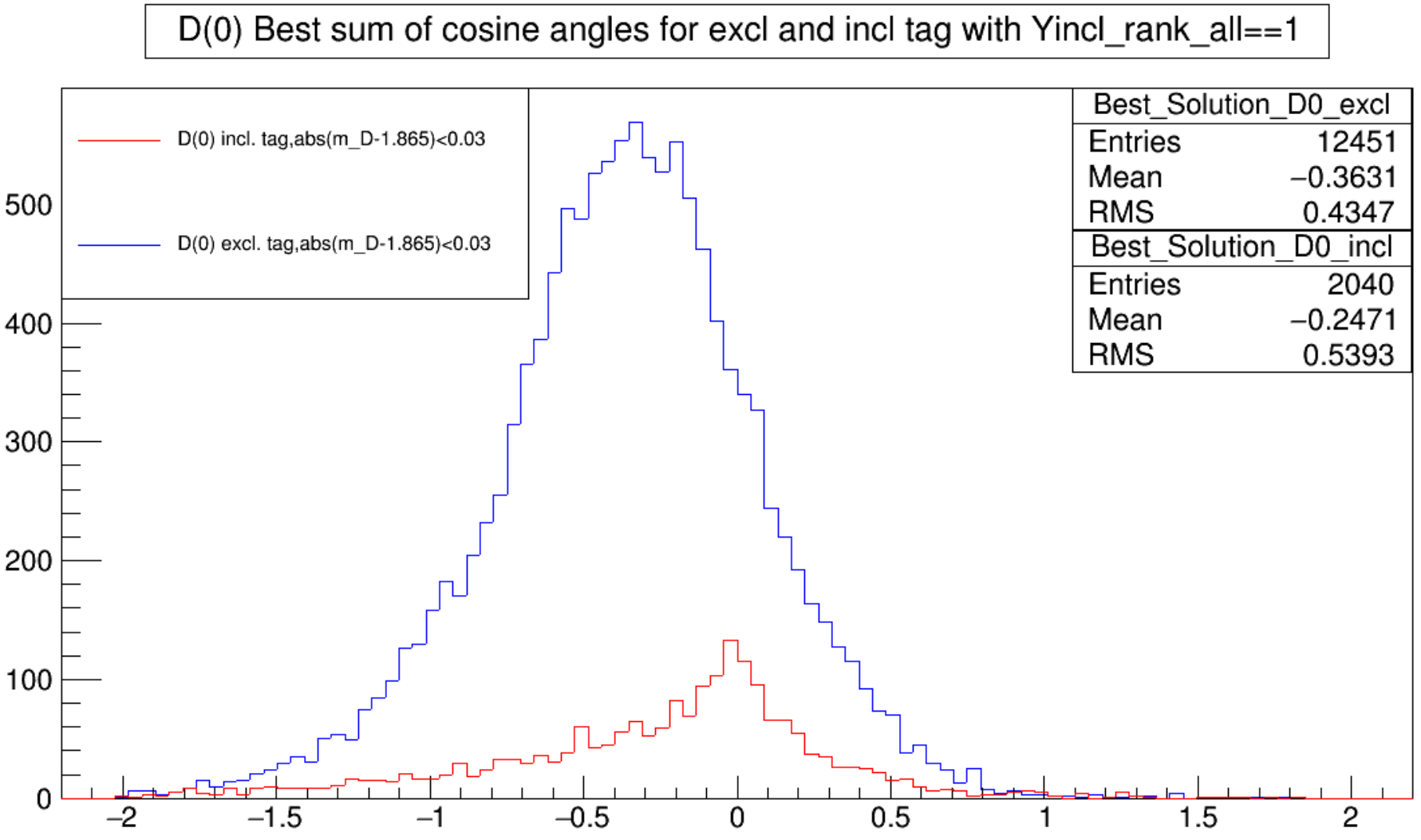
Backup

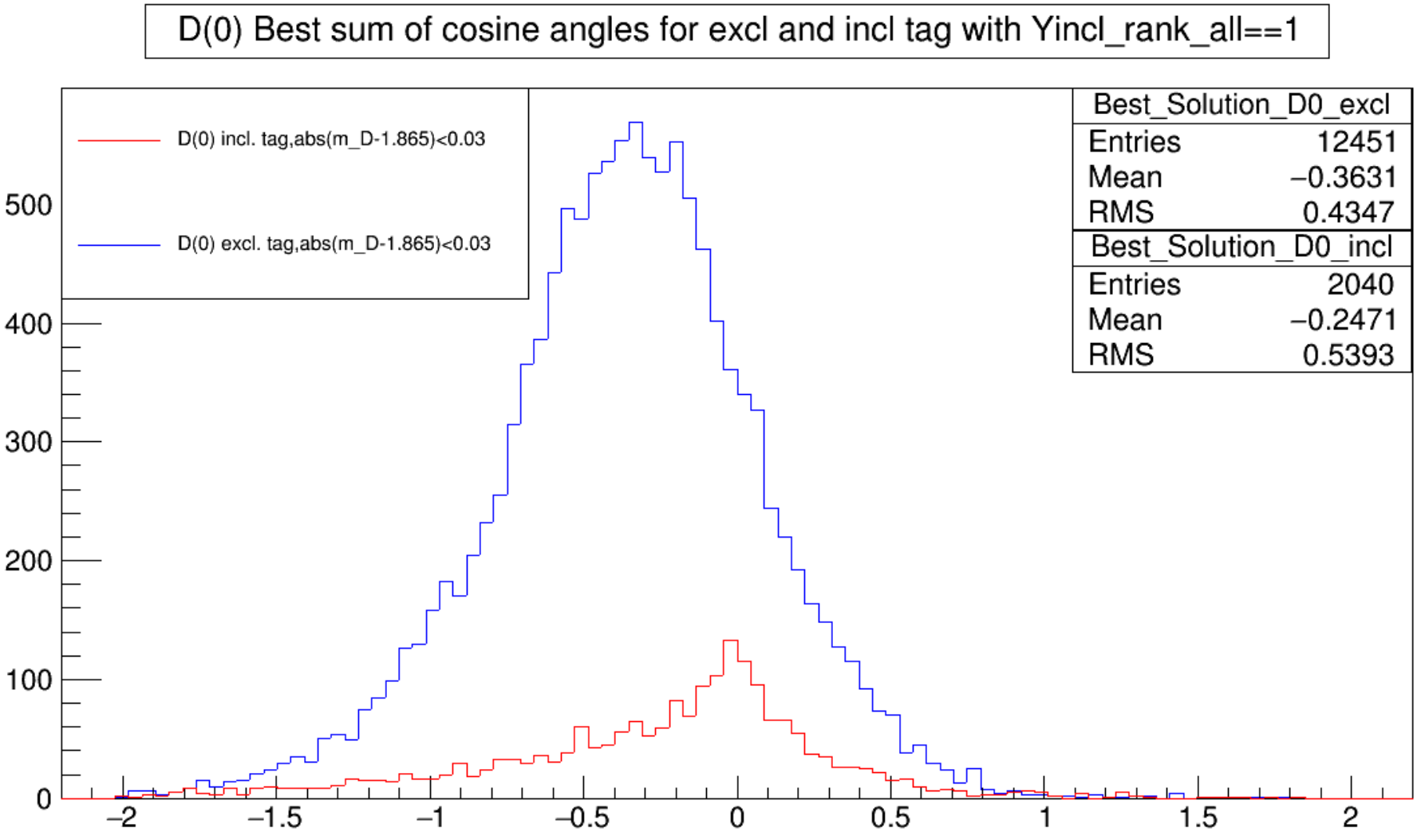
(Yesterday slides)

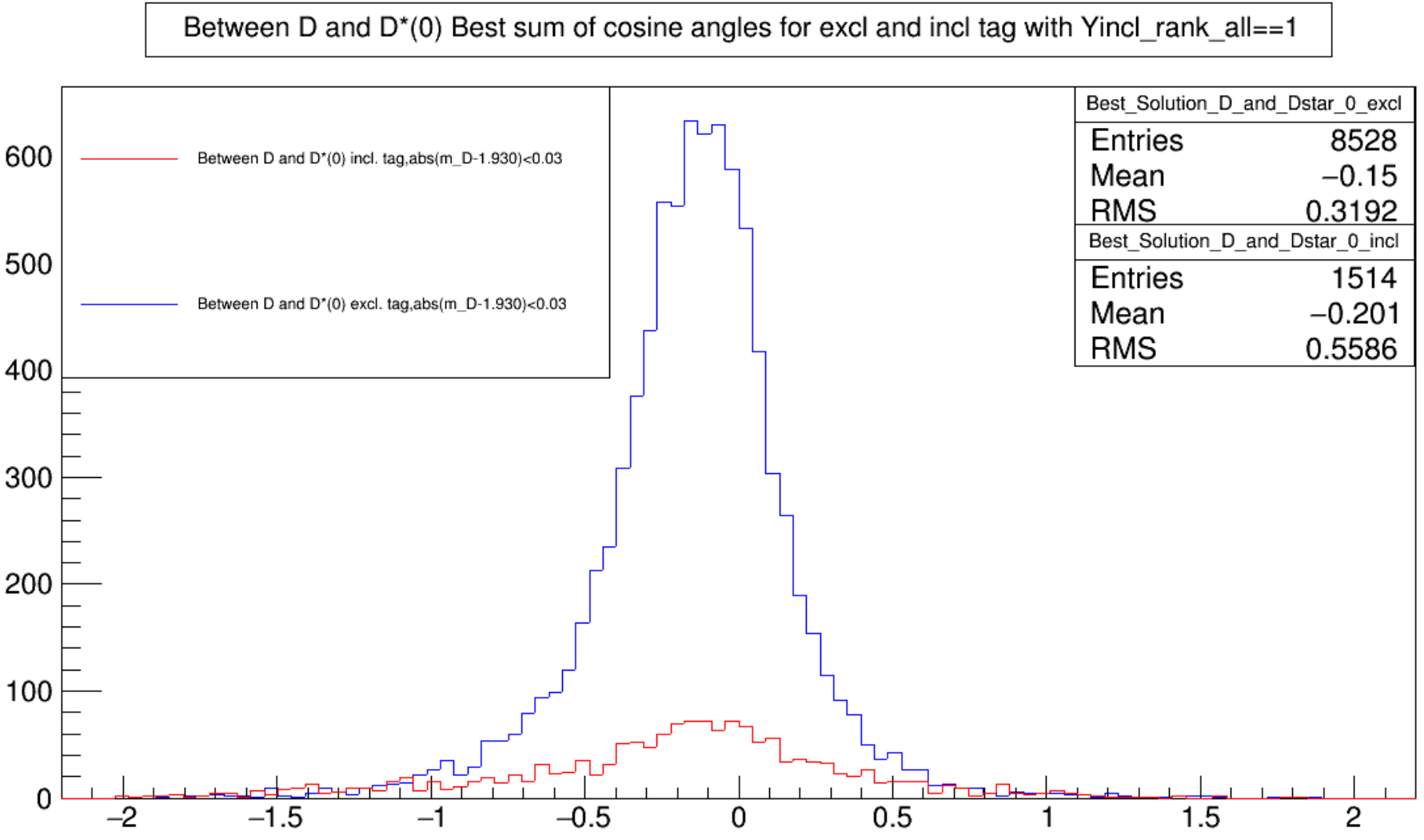
Some slides for the excl. and incl. sample

- Sample of 1M signal events with the inclusive tag side.
- Sample of 400K events with the following exclusive tag side.

```
Decay B-tag
0.5   D*0       e-   anti-nu_e   PHOTOS  HQET2 1.3 1.18 0.71;
0.5   D*0       mu-  anti-nu_mu  PHOTOS  HQET2 1.3 1.18 0.71;
Enddecay
CDecay B+tag

# Decay D*0
Decay D*0
0.5 D0      gamma                                   VSP_PWAVE; #[Reconstructed PDG2011]
0.5 D0      pi0                                     VSS; #[Reconstructed PDG2011]
Enddecay
CDecay anti-D*0

#Decay D0
Decay D0
1.0 K-      pi+                                     PHSP;
Enddecay
CDecay anti-D0
```


D(0) Best sum of cosine angles for excl and incl tag with Yincl_rank_all==1
D(0) incl. tag,abs(m_D-1.865)<0.03
D(0) excl. tag,abs(m_D-1.865)<0.03
Best_Solution_D0_excl
Entries 12451
Mean −0.3631
RMS 0.4347
Best_Solution_D0_incl
Entries 2040
Mean −0.2471
RMS 0.5393
500
400
300
200
100
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2


D(0) Best sum of cosine angles for excl and incl tag with Yincl_rank_all==1
D(0) incl. tag,abs(m_D-1.865)<0.03
D(0) excl. tag,abs(m_D-1.865)<0.03
Best_Solution_D0_excl
Entries 12451
Mean −0.3631
RMS 0.4347
Best_Solution_D0_incl
Entries 2040
Mean −0.2471
RMS 0.5393
500
400
300
200
100
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2


Between D and D*(0) Best sum of cosine angles for excl and incl tag with Yincl_rank_all==1
Between D and D*(0) incl. tag,abs(m_D-1.930)<0.03
Between D and D*(0) excl. tag,abs(m_D-1.930)<0.03
Best_Solution_D_and_Dstar_0_excl
Entries 8528
Mean −0.15
RMS 0.3192
Best_Solution_D_and_Dstar_0_incl
Entries 1514
Mean −0.201
RMS 0.5586
600
500
400
300
200
100
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2