Signal Vs Control channel

1.0 M events for both signal and control channel.

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

$\tau^- \rightarrow \pi^- \nu_\tau$

$B^+ \rightarrow J/\psi\, K^+$

$J/\psi \rightarrow \mu^+ \mu^-$

For both Signal and Control channel.

$B^- \rightarrow$ generic

30 Nov. 2023

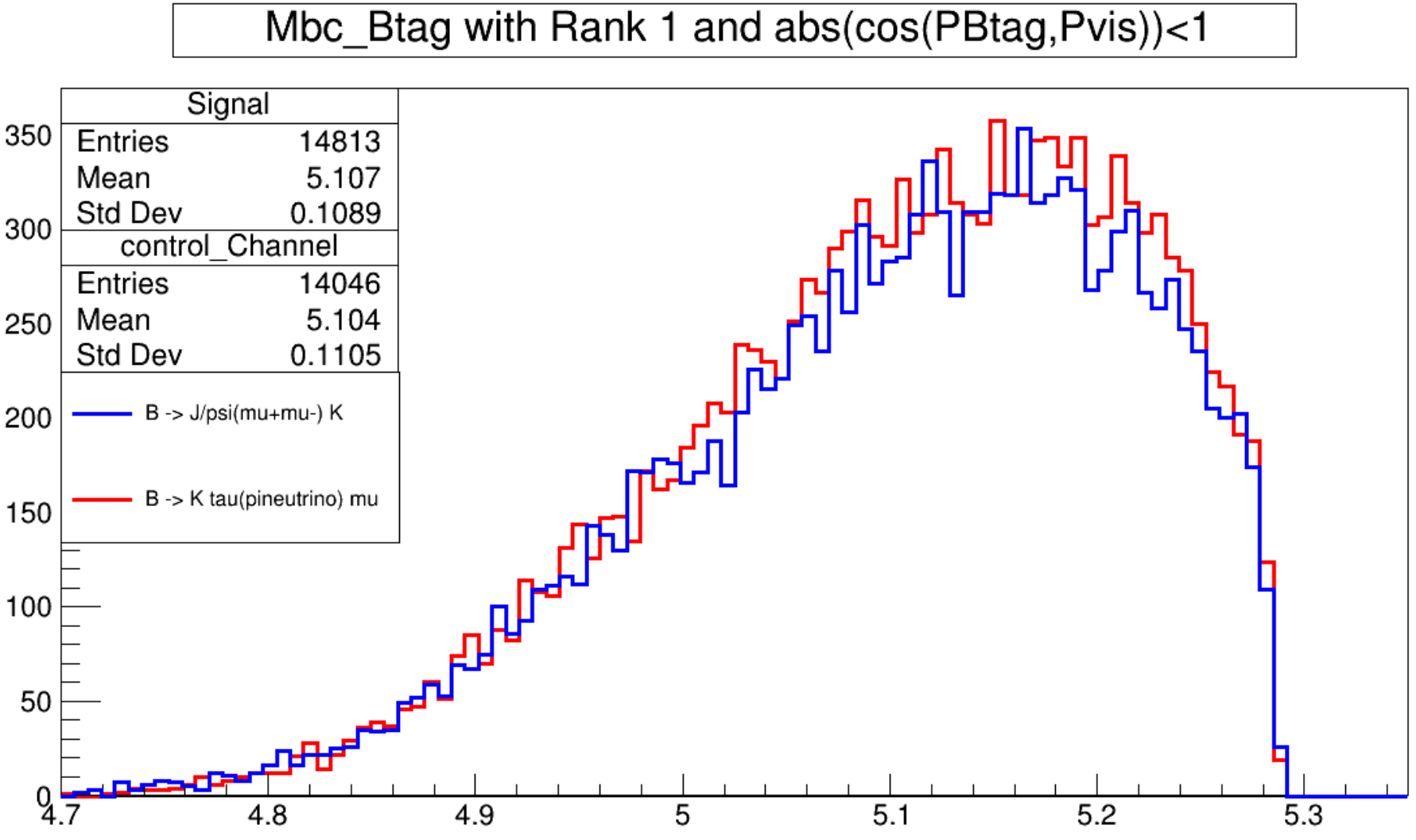
Cuts in the signal reconstruction program

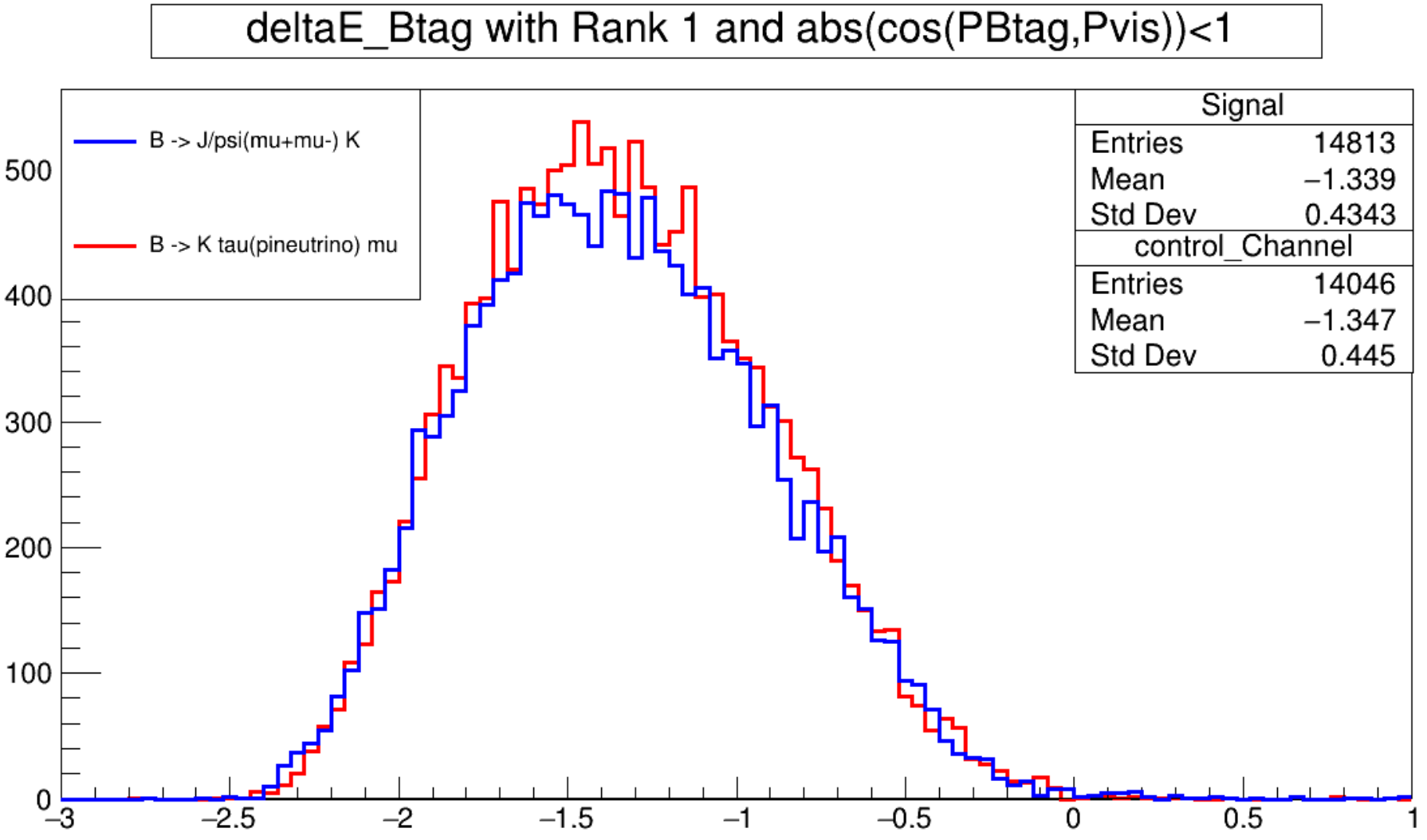
- $M_{kpi} > 0.7$ GeV
- $abs(m_{lpi}-3.1) > 0.015$ GeV
- $1.6 < m_{hadROE} < 2.4$ GeV
- $abs(cos(P_{Btag},P_{tag,vis})) < 2$
- $abs(sin(Phi)) < 1.5$

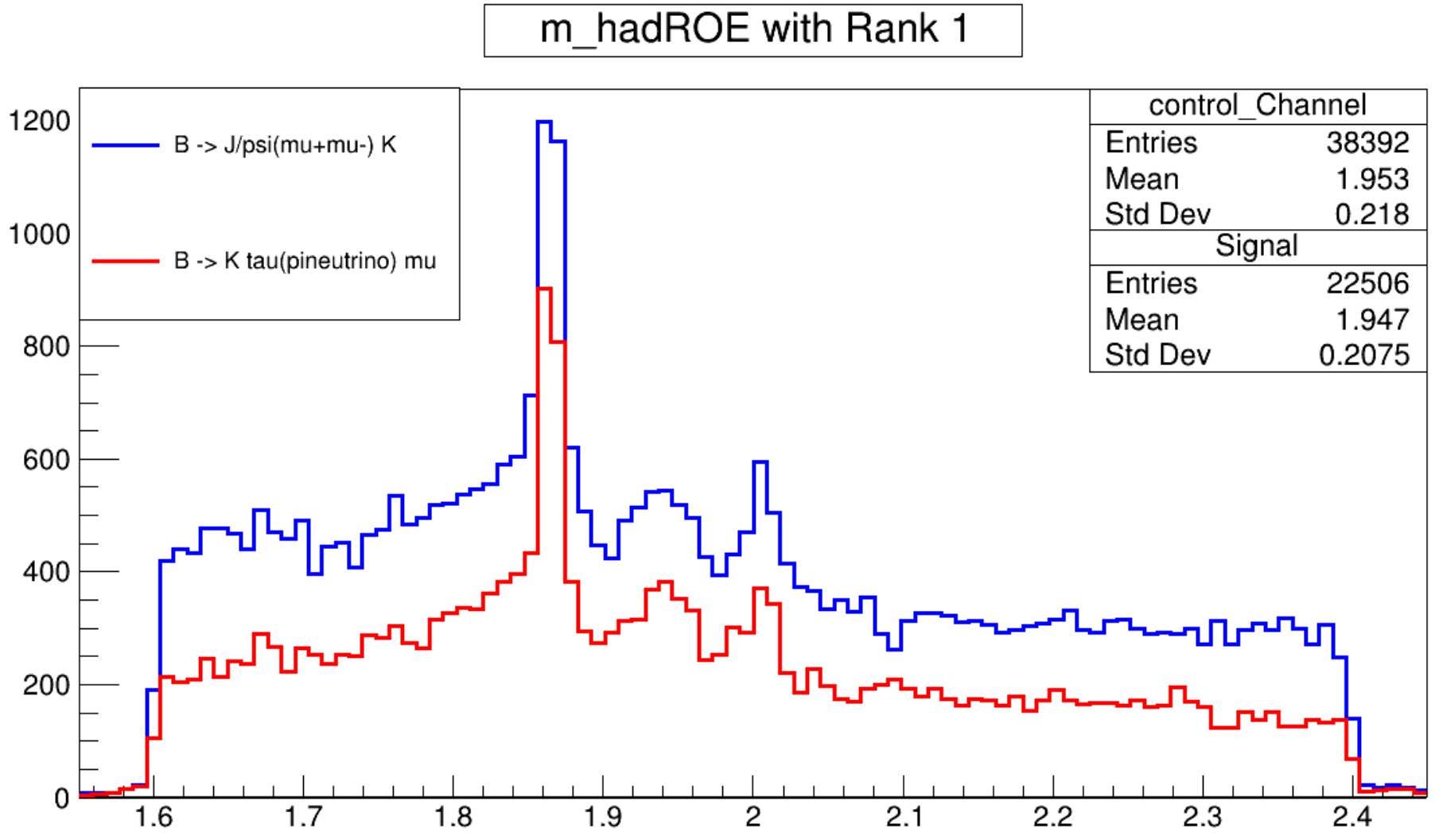
Cuts in the control channel reconstruction program

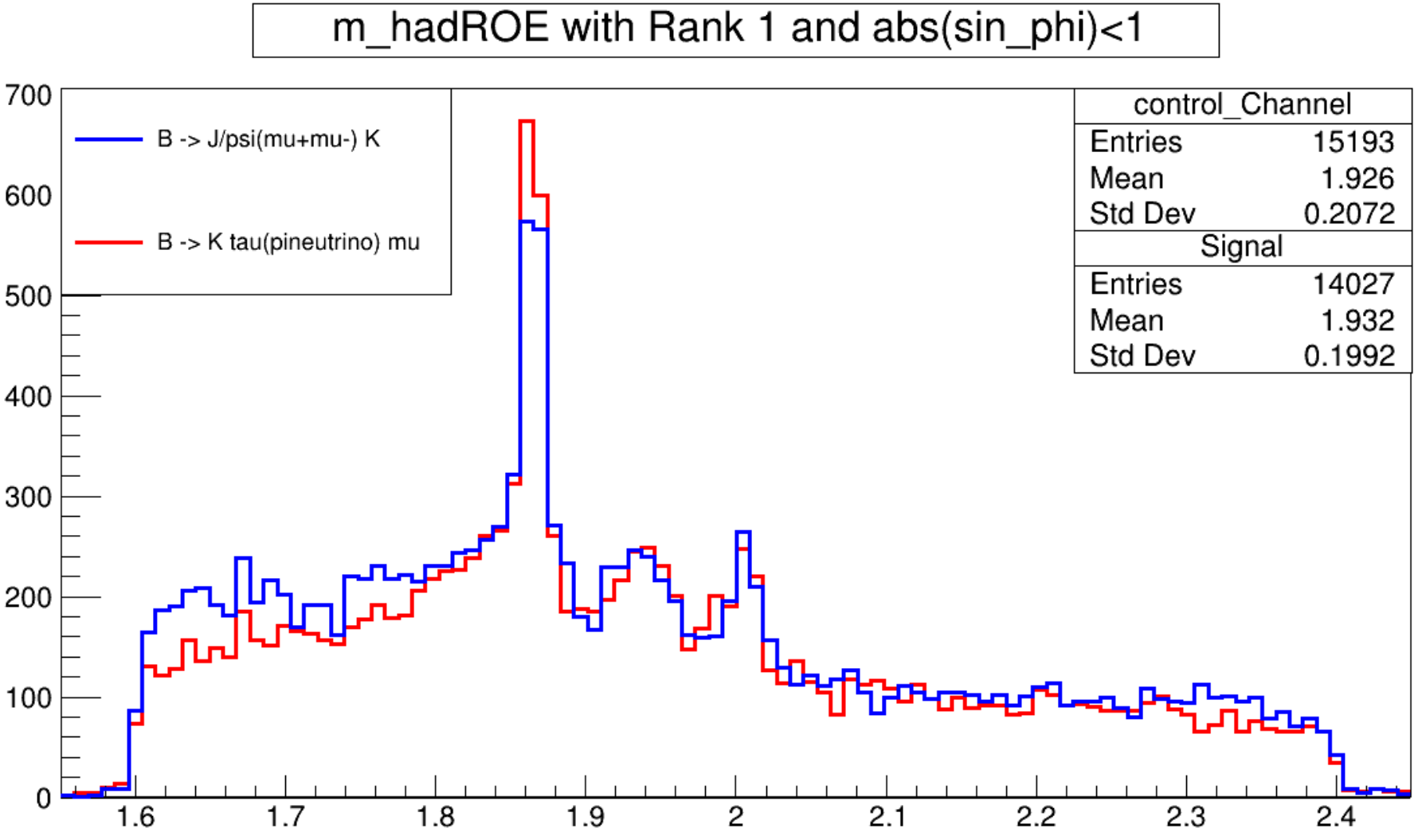
- MVA photon cuts

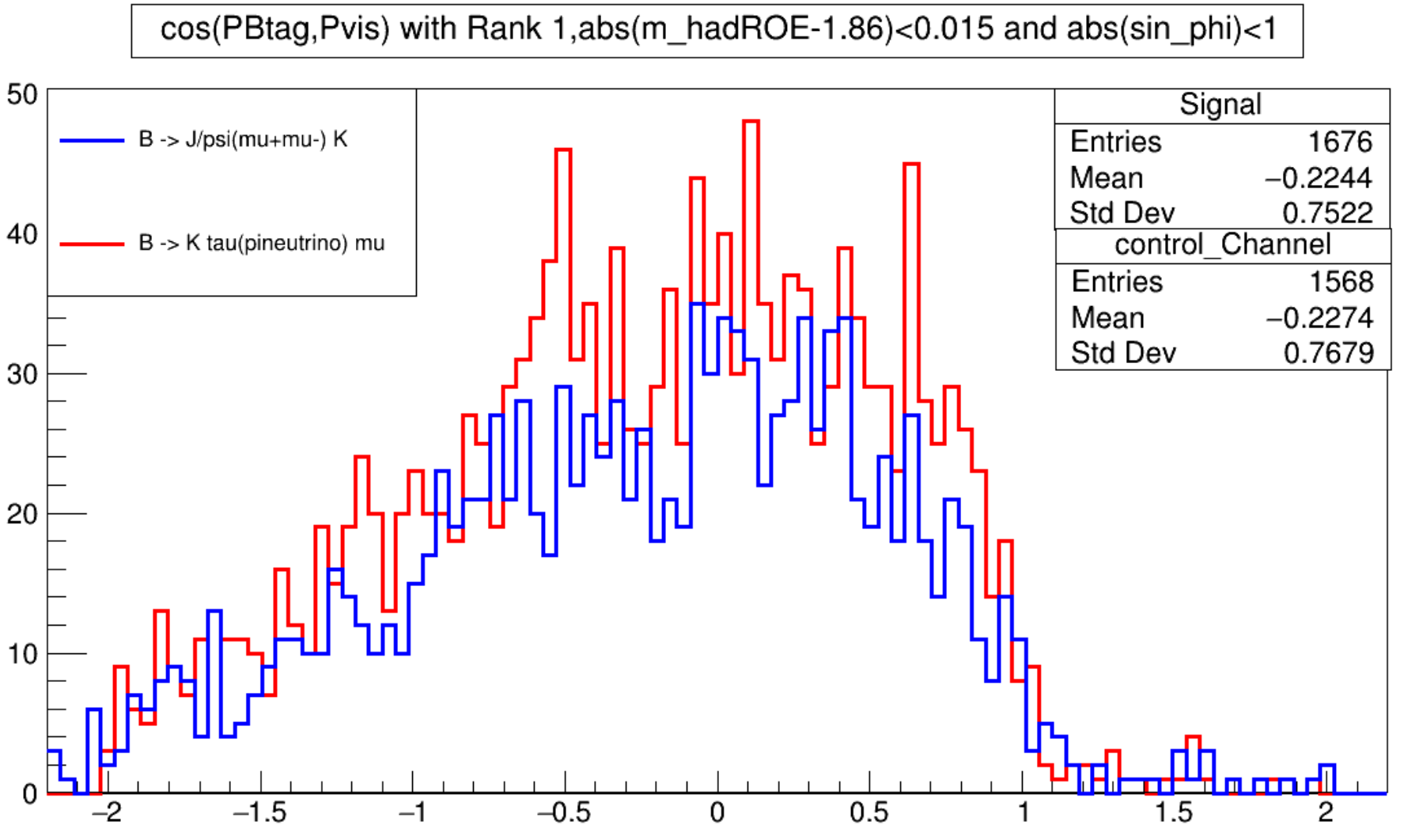
- $1.6 < m_{hadROE} < 2.4$ GeV

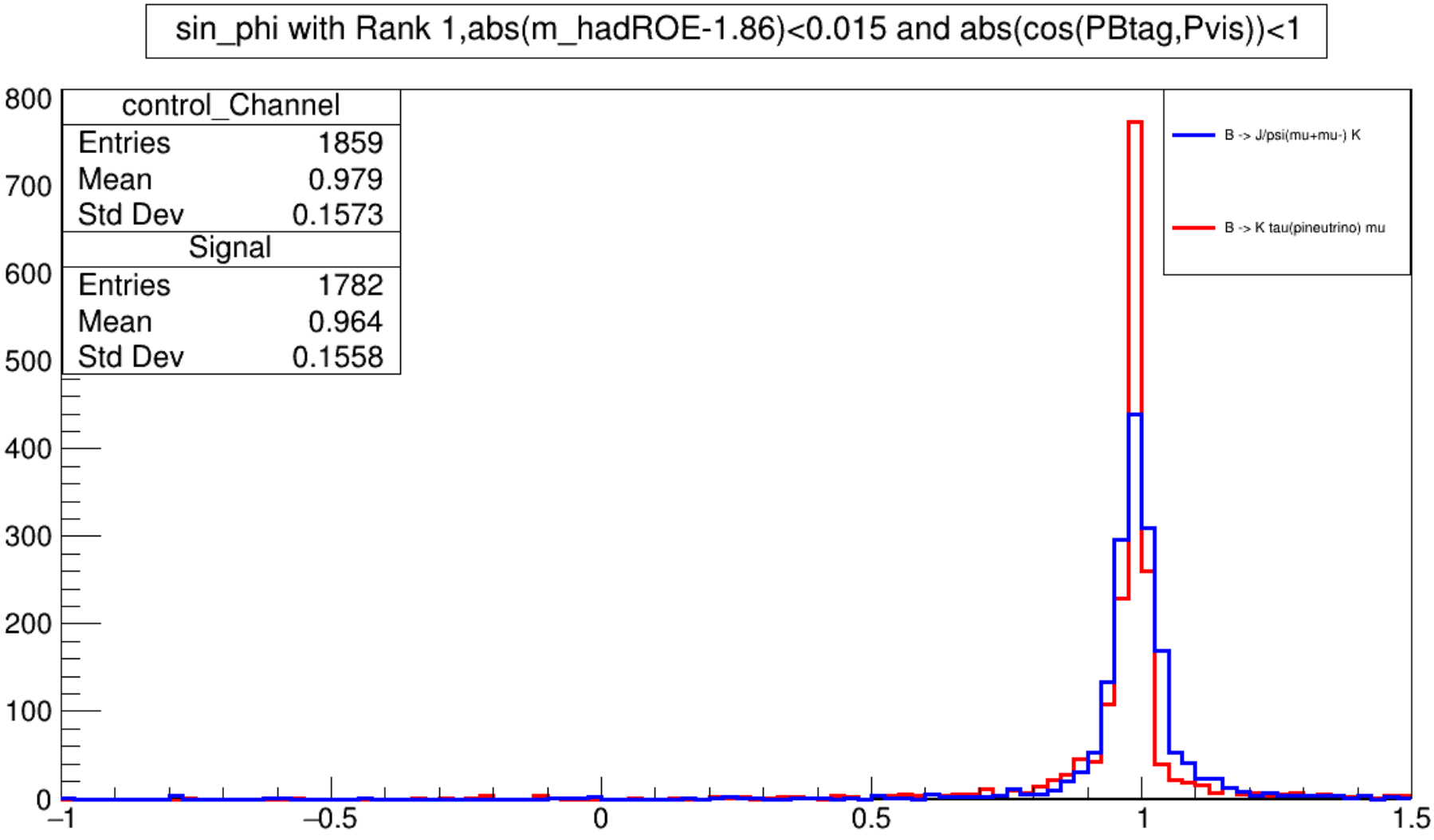

Mbc_Btag with Rank 1 and abs(cos(PBtag,Pvis))<1
Signal
Entries 14813
Mean 5.107
Std Dev 0.1089
control_Channel
Entries 14046
Mean 5.104
Std Dev 0.1105
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
350
300
250
200
150
100
50
0
4.7
4.8
4.9
5
5.1
5.2
5.3

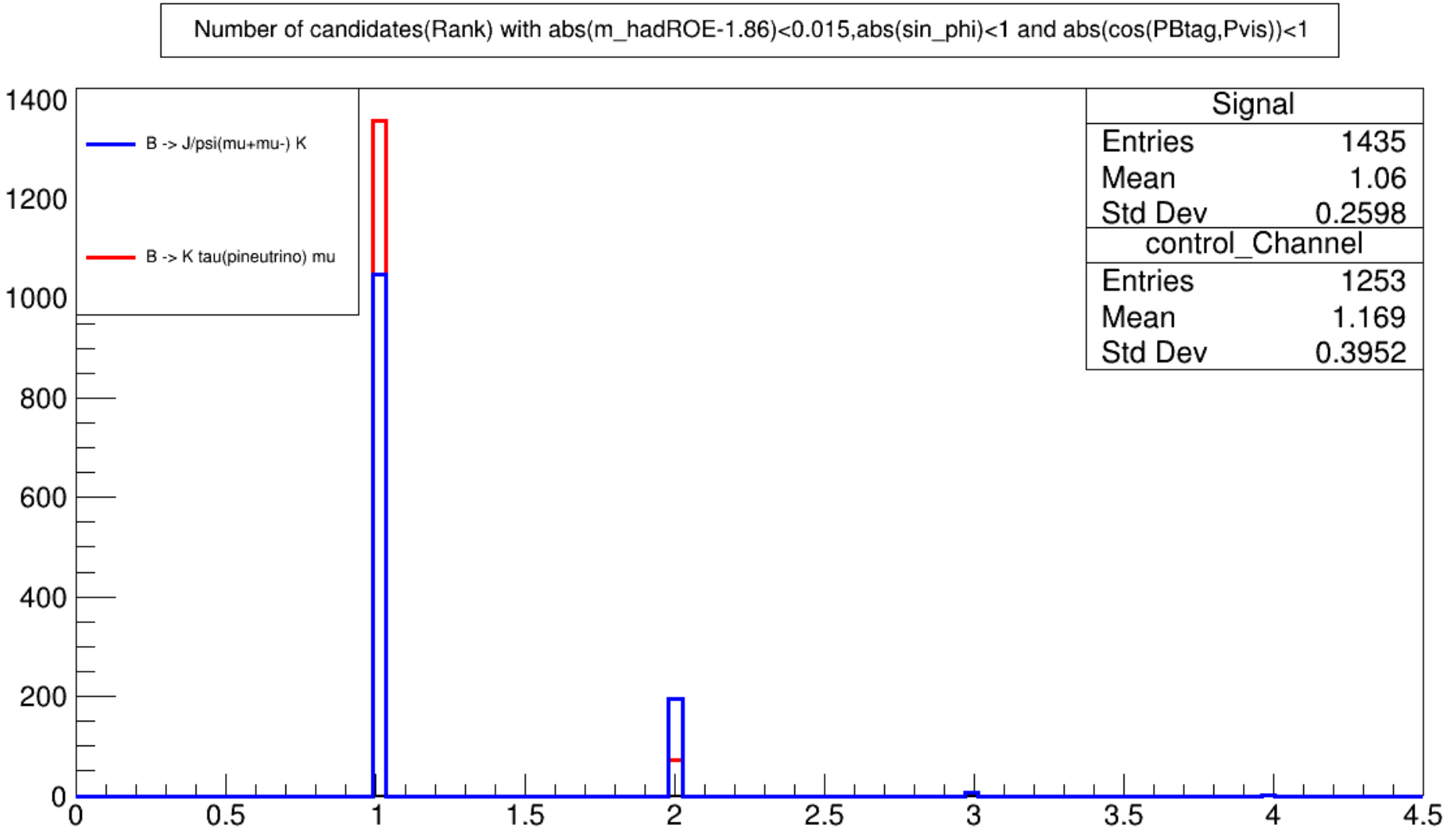

deltaE_Btag with Rank 1 and abs(cos(PBtag,Pvis))<1
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
Signal
Entries 14813
Mean −1.339
Std Dev 0.4343
control_Channel
Entries 14046
Mean −1.347
Std Dev 0.445
500
400
300
200
100
0
−3
−2.5
−2
−1.5
−1
−0.5
0
0.5
1

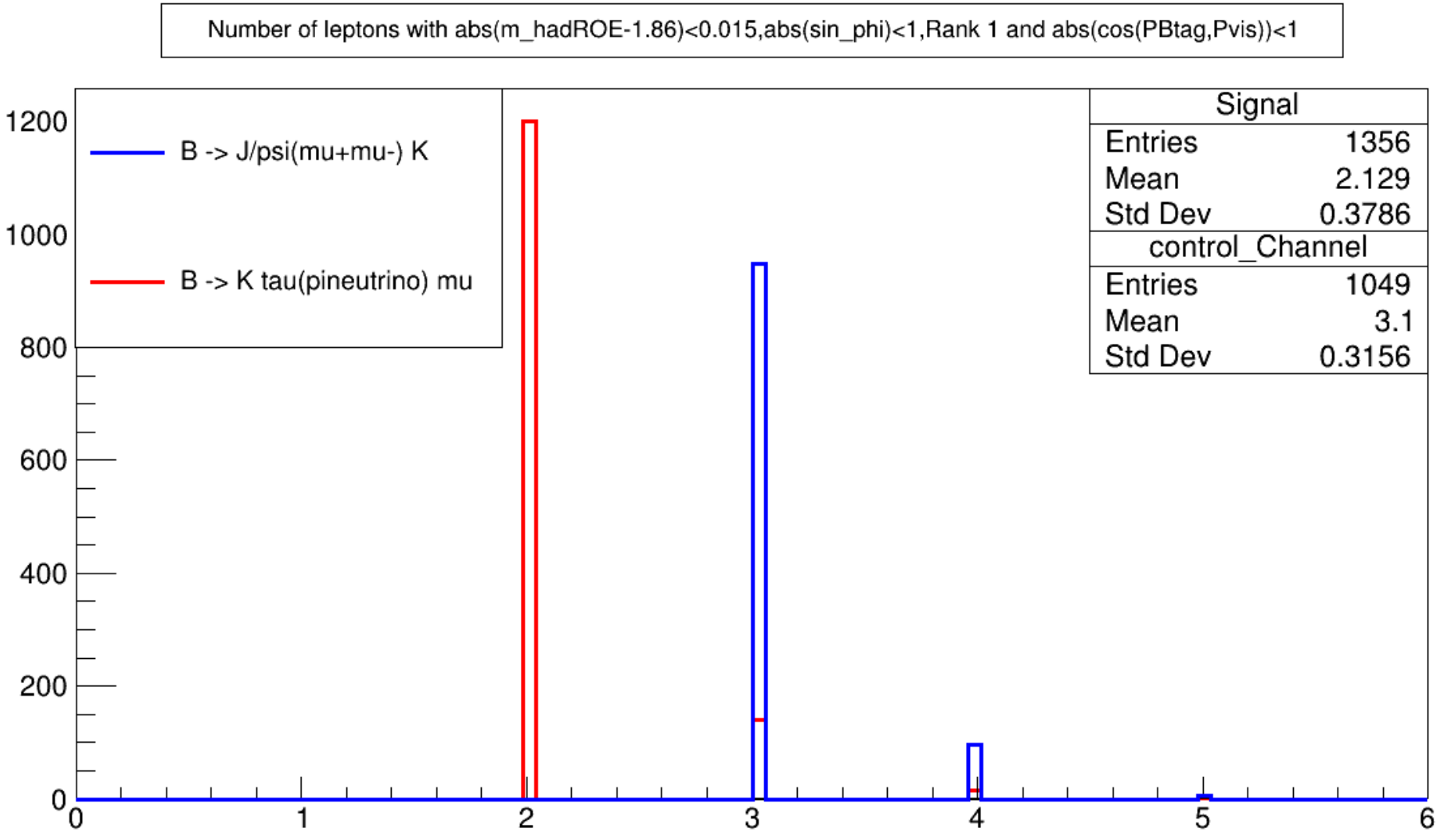

m_hadROE with Rank 1
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
control_Channel
Entries 38392
Mean 1.953
Std Dev 0.218
Signal
Entries 22506
Mean 1.947
Std Dev 0.2075
1200
1000
800
600
400
200
0
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4

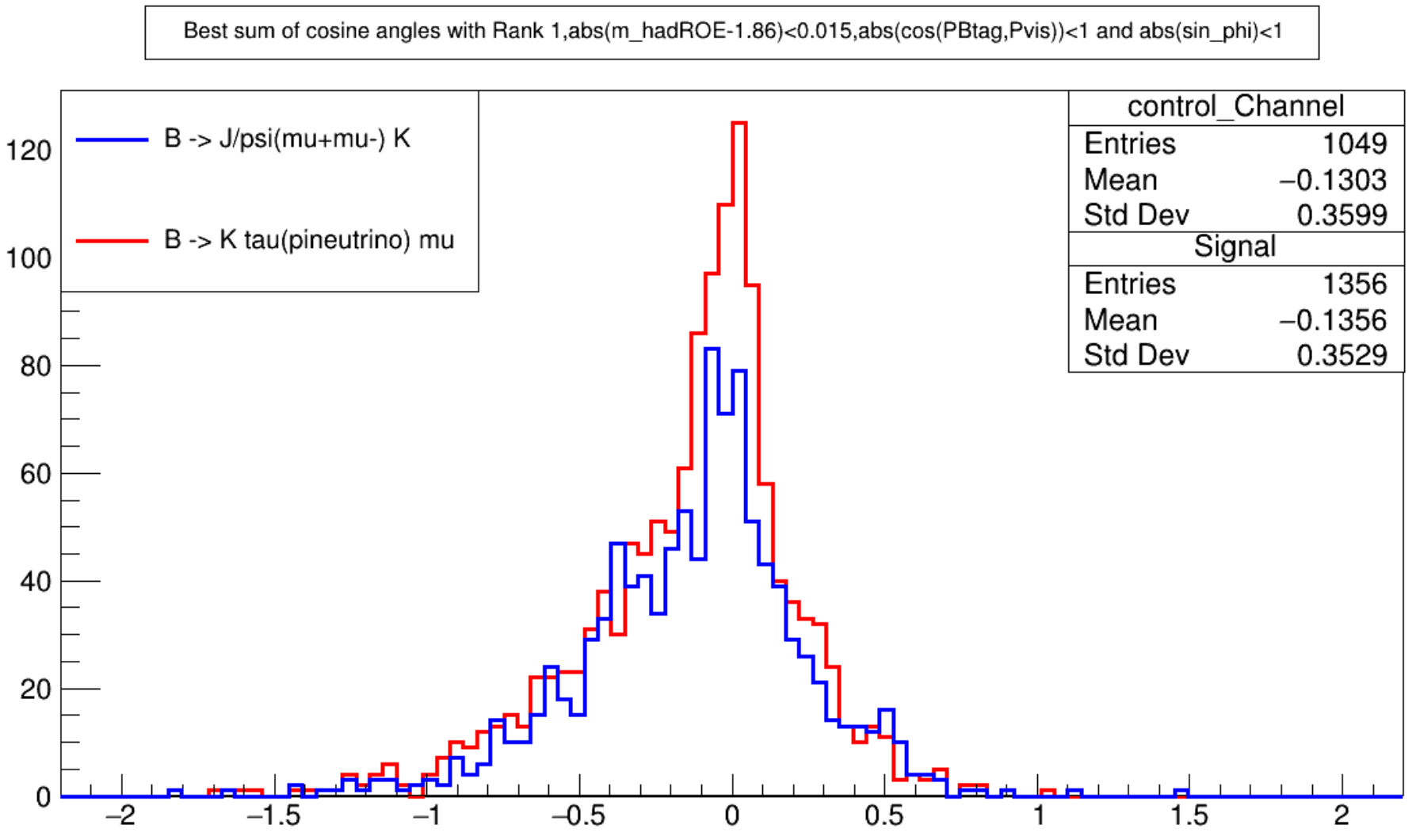

m_hadROE with Rank 1 and abs(sin_phi)<1
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
control_Channel
Entries 15193
Mean 1.926
Std Dev 0.2072
Signal
Entries 14027
Mean 1.932
Std Dev 0.1992
700
600
500
400
300
200
100
0
1.6
1.7
1.8
1.9
2
2.1
2.2
2.3
2.4


cos(PBtag,Pvis) with Rank 1,abs(m_hadROE-1.86)<0.015 and abs(sin_phi)<1
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
Signal
Entries 1676
Mean −0.2244
Std Dev 0.7522
control_Channel
Entries 1568
Mean −0.2274
Std Dev 0.7679
50
40
30
20
10
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2

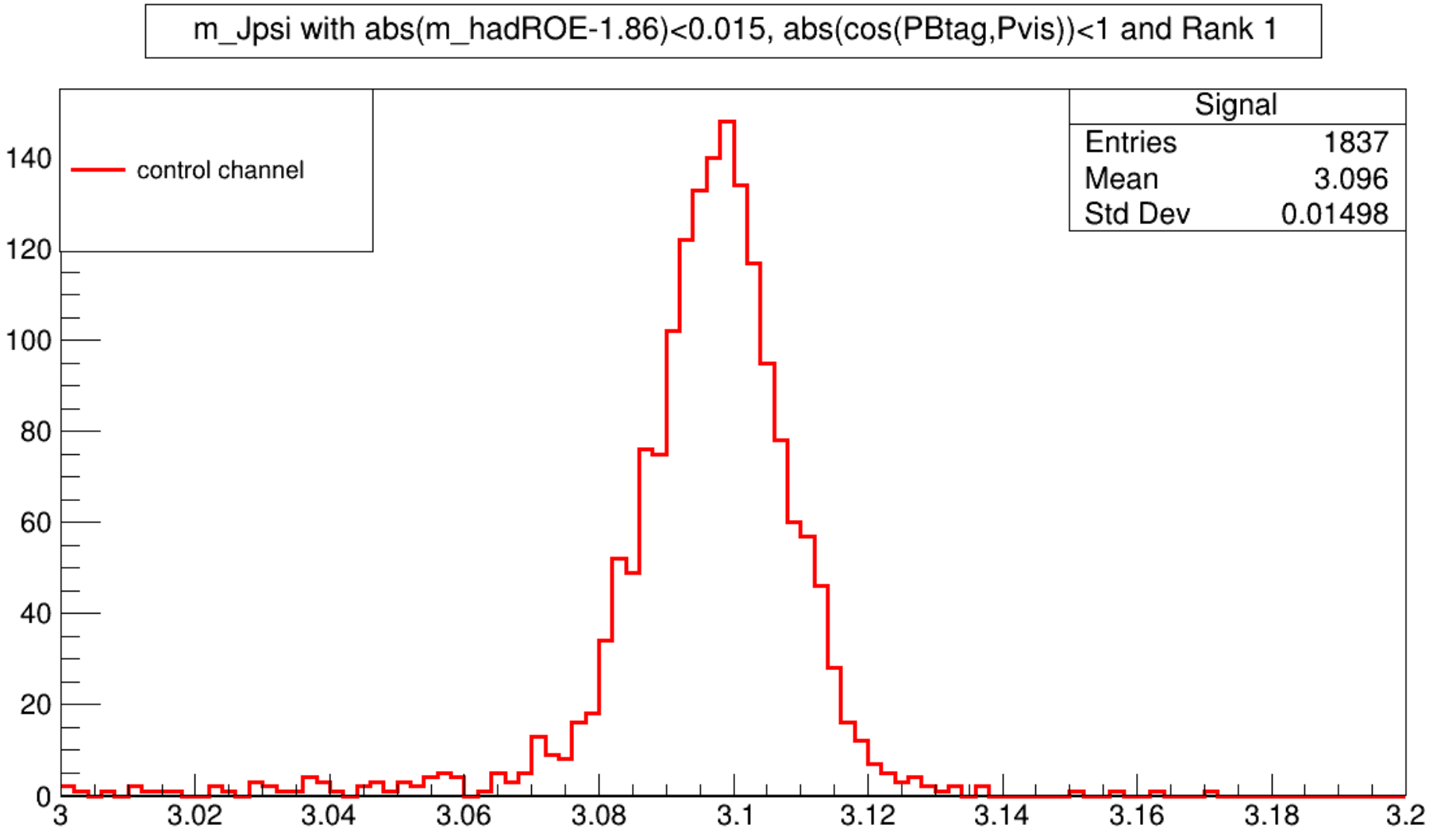

sin_phi with Rank 1,abs(m_hadROE-1.86)<0.015 and abs(cos(PBtag,Pvis))<1
control_Channel
Entries 1859
Mean 0.979
Std Dev 0.1573
Signal
Entries 1782
Mean 0.964
Std Dev 0.1558
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
800
700
600
500
400
300
200
100
0
–1
–0.5
0
0.5
1
1.5

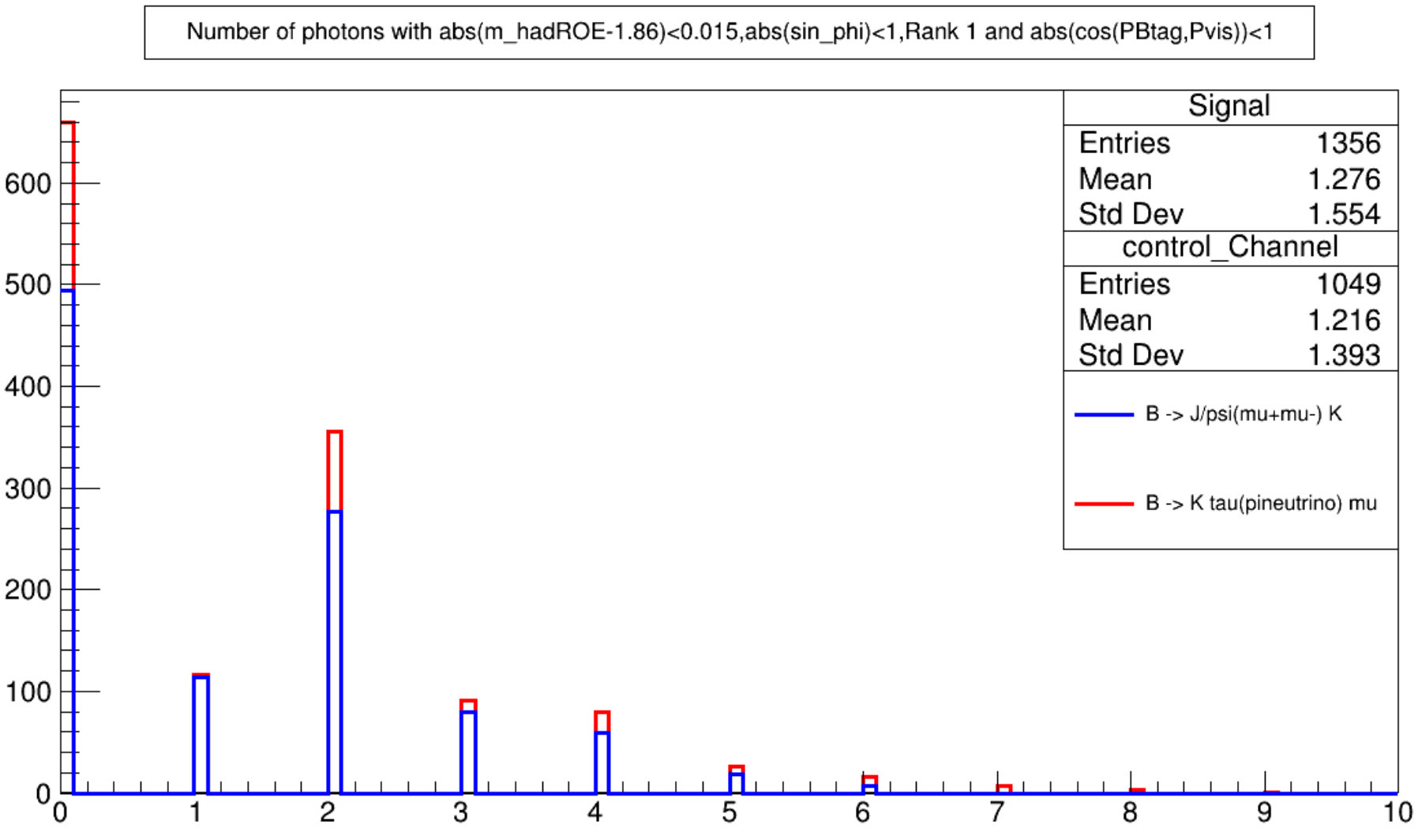

Number of candidates(Rank) with abs(m_hadROE-1.86)<0.015,abs(sin_phi)<1 and abs(cos(PBtag,Pvis))<1
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
Signal
Entries 1435
Mean 1.06
Std Dev 0.2598
control_Channel
Entries 1253
Mean 1.169
Std Dev 0.3952
1400
1200
1000
800
600
400
200
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5

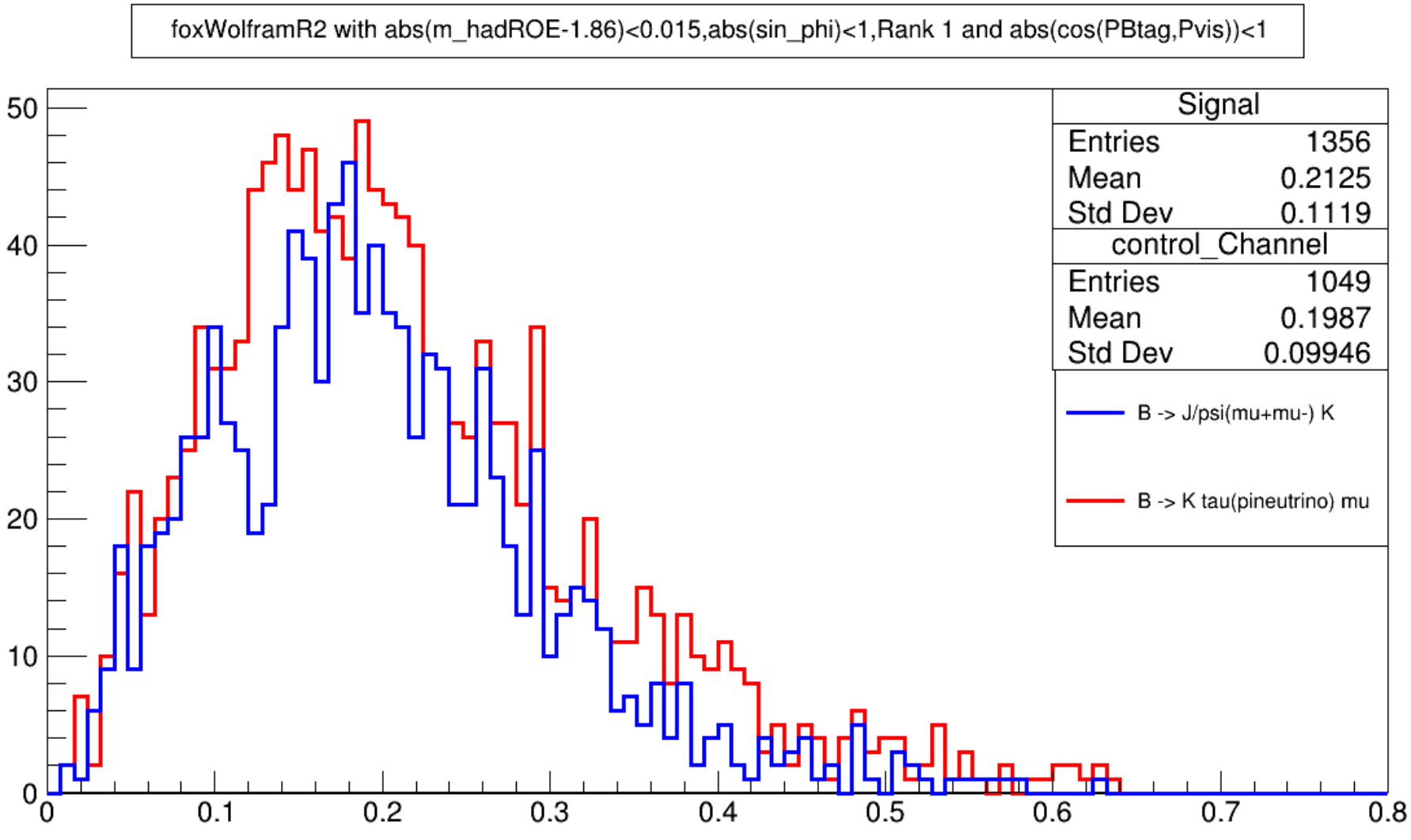

Number of leptons with abs(m_hadROE-1.86)<0.015,abs(sin_phi)<1,Rank 1 and abs(cos(PBtag,Pvis))<1
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
Signal
Entries 1356
Mean 2.129
Std Dev 0.3786
control_Channel
Entries 1049
Mean 3.1
Std Dev 0.3156
1200
1000
800
600
400
200
0
0
1
2
3
4
5
6

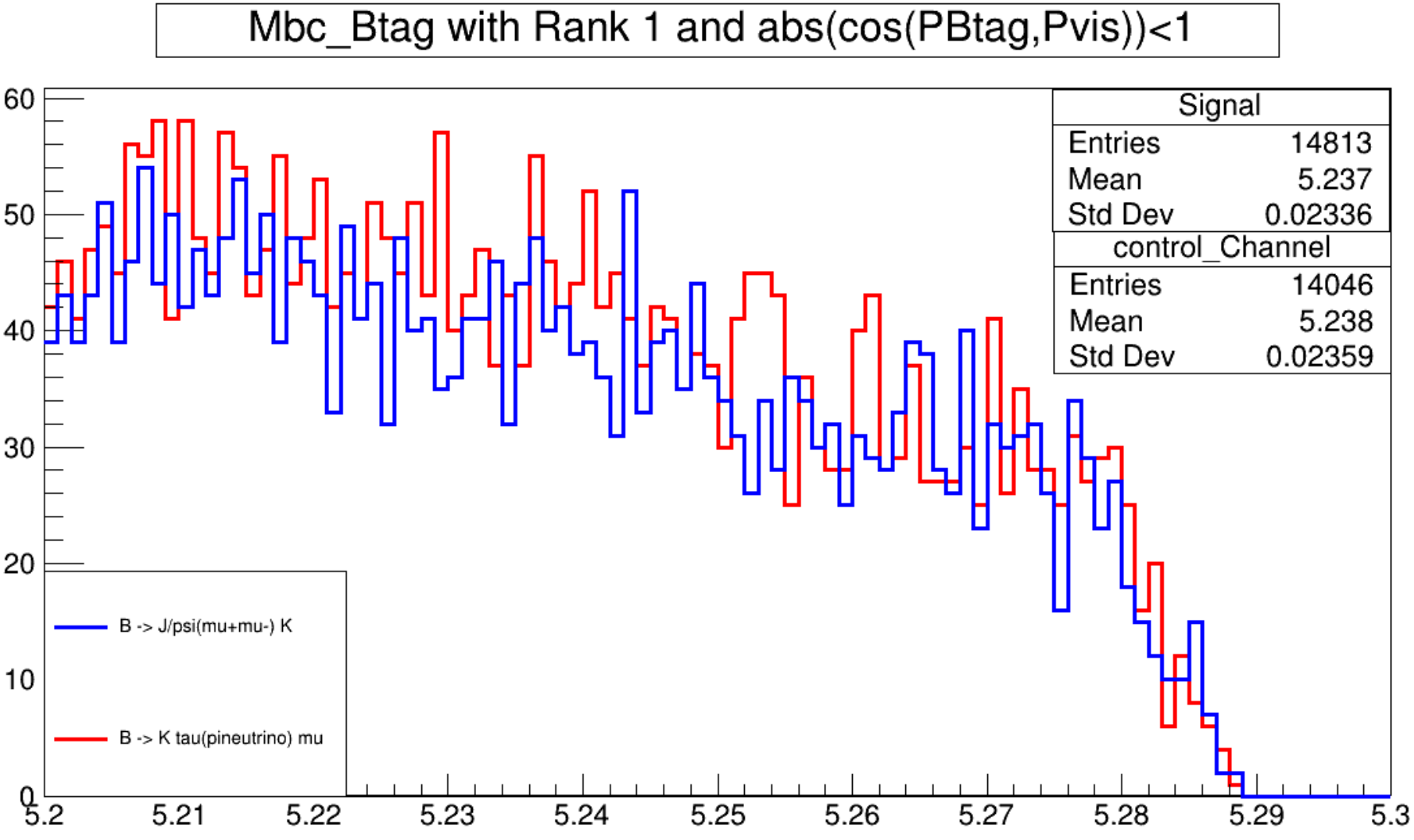

Best sum of cosine angles with Rank 1,abs(m_hadROE-1.86)<0.015,abs(cos(PBtag,Pvis))<1 and abs(sin_phi)<1
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
control_Channel
Entries 1049
Mean −0.1303
Std Dev 0.3599
Signal
Entries 1356
Mean −0.1356
Std Dev 0.3529
120
100
80
60
40
20
0
−2
−1.5
−1
−0.5
0
0.5
1
1.5
2

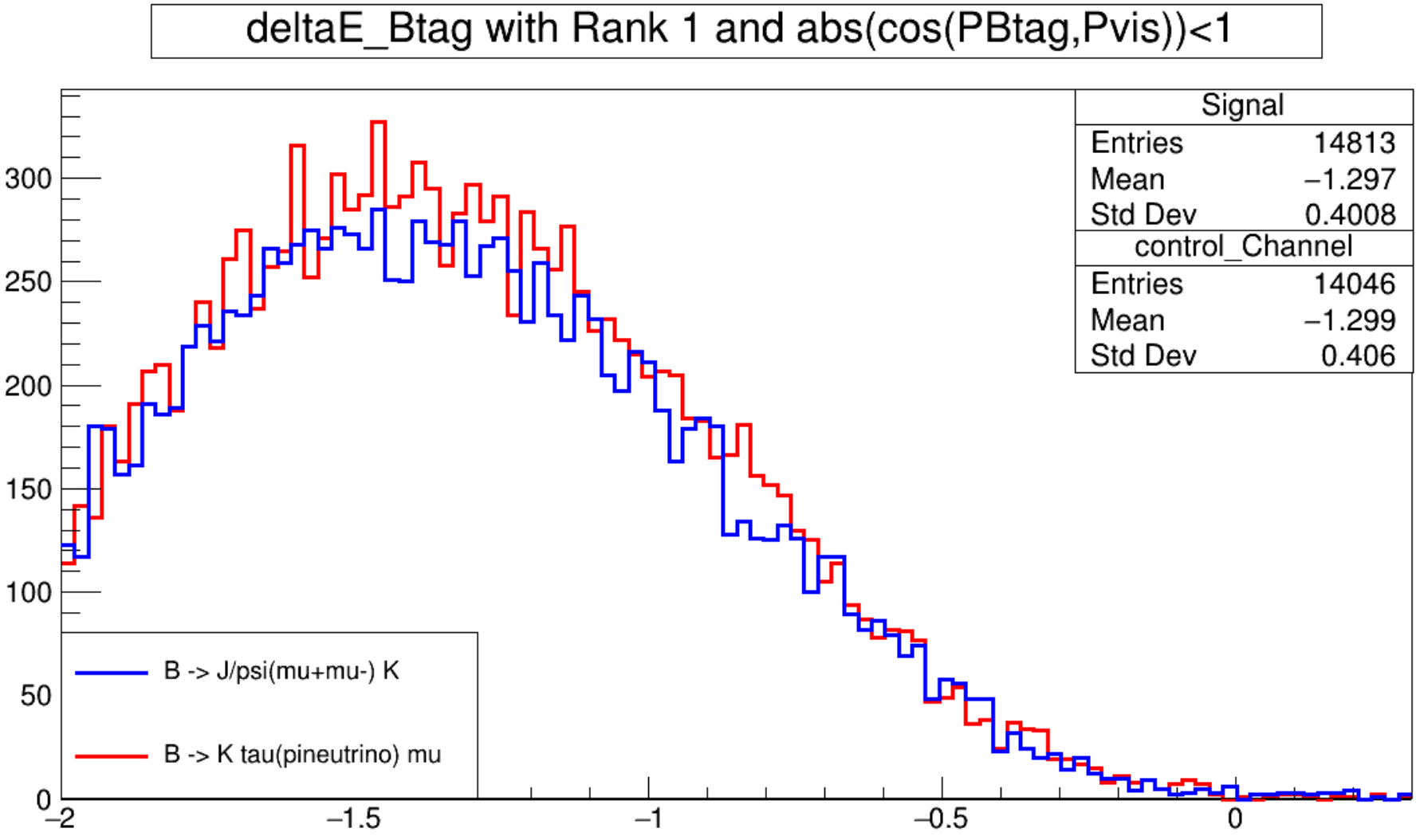
Backup


m_Jpsi with abs(m_hadROE-1.86)<0.015, abs(cos(PBtag,Pvis))<1 and Rank 1
control channel
Signal
Entries 1837
Mean 3.096
Std Dev 0.01498
140
120
100
80
60
40
20
0
3
3.02
3.04
3.06
3.08
3.1
3.12
3.14
3.16
3.18
3.2


Number of photons with abs(m_hadROE-1.86)<0.015,abs(sin_phi)<1,Rank 1 and abs(cos(PBtag,Pvis))<1
Signal
Entries 1356
Mean 1.276
Std Dev 1.554
control_Channel
Entries 1049
Mean 1.216
Std Dev 1.393
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
0
100
200
300
400
500
600
0
1
2
3
4
5
6
7
8
9
10


foxWolframR2 with abs(m_hadROE-1.86)<0.015,abs(sin_phi)<1,Rank 1 and abs(cos(PBtag,Pvis))<1
Signal
Entries 1356
Mean 0.2125
Std Dev 0.1119
control_Channel
Entries 1049
Mean 0.1987
Std Dev 0.09946
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
0
10
20
30
40
50
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8


Mbc_Btag with Rank 1 and abs(cos(PBtag,Pvis))<1
Signal
Entries 14813
Mean 5.237
Std Dev 0.02336
control_Channel
Entries 14046
Mean 5.238
Std Dev 0.02359
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
60
50
40
30
20
10
0
5.2
5.21
5.22
5.23
5.24
5.25
5.26
5.27
5.28
5.29
5.3


deltaE_Btag with Rank 1 and abs(cos(PBtag,Pvis))<1
Signal
Entries 14813
Mean −1.297
Std Dev 0.4008
control_Channel
Entries 14046
Mean −1.299
Std Dev 0.406
B -> J/psi(mu+mu-) K
B -> K tau(pineutrino) mu
300
250
200
150
100
50
0
−2
−1.5
−1
−0.5
0

Number of candidates(Rank) calculation

```
variables.addAlias('chiProbsig', 'daughter(0, chiProb)')
variables.addAlias('chiProbtag', 'daughter(1, chiProb)')
variables.addAlias('chiProbD0', 'daughter(1, daughter(0, chiProb))')
variables.addAlias('chiProb_mix', 'formula(chiProbsig*chiProbD0)')

ma.rankByHighest(particleList='Upsilon(4S):all_e_mu',
                 variable='chiProb_mix',
                 outputVariable='incl_chiProb_all',
                 path=mypath)
vm.addAlias('Yincl_rank_all', 'extraInfo(incl_chiProb_all)')
```

chiProb

A context-dependent χ^2 probability for 'the fit' related to this particle.

- If this particle is track-based, then this is the pvalue of the track fit (identical to **pValue**).
- If this particle is cluster-based then this variable is currently unused.
- If this particle is composite and a vertex fit has been performed, then this is the χ^2 probability of the vertex fit result.