$B^+ \to \rho^+\rho^0$ status

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Status

Mismodelling:

- verify if independent per-track reweighing and 2D reweighing are different ✅
(do we need to account for pion momenta correlations)
- find unbiased weights for track momenta (and π^0?) **#1**
- study mismodeling charge-dependency #2

Fit:

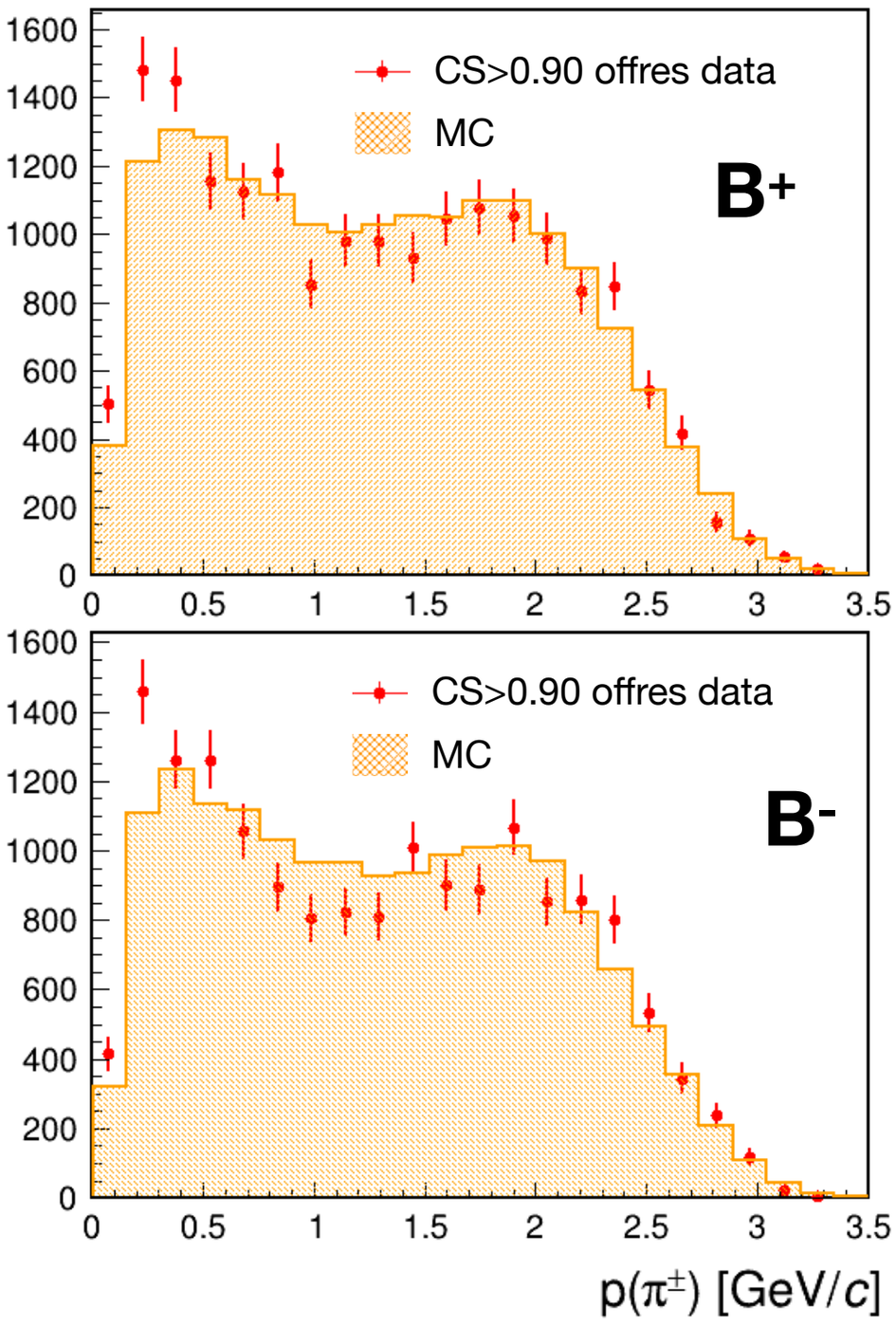
- review angular models — cure bias in f_L when fitting realistic MC ✅
- check fit parameters correlations #4
- improve $\pi\pi$ invariant mass modeling

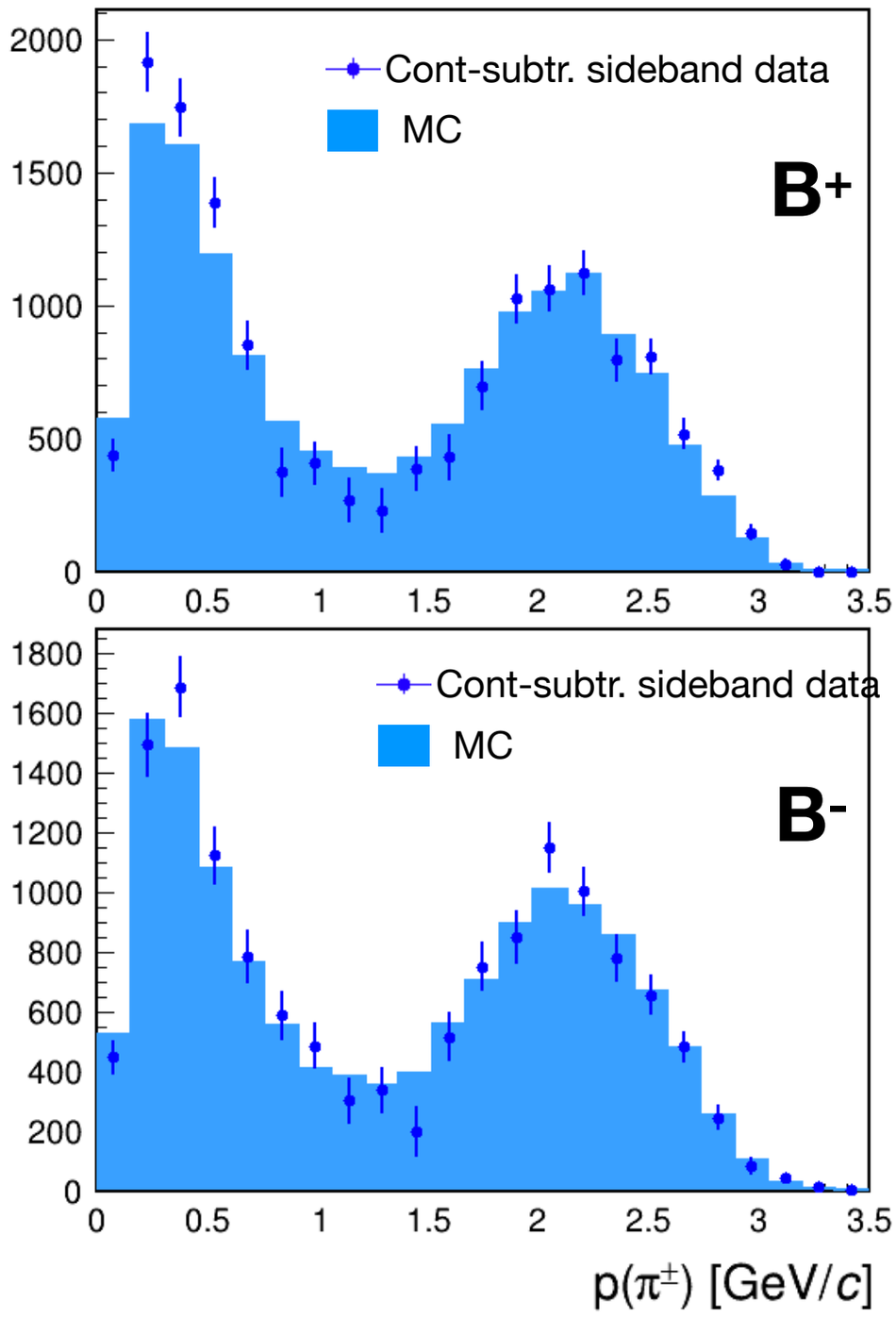
Technicalities:

- fit with conditional histograms #3
- add degrees of freedom to histograms

Average momenta distributions

Fill histograms (continuum and BBbar as usual) with all tracks of each event.



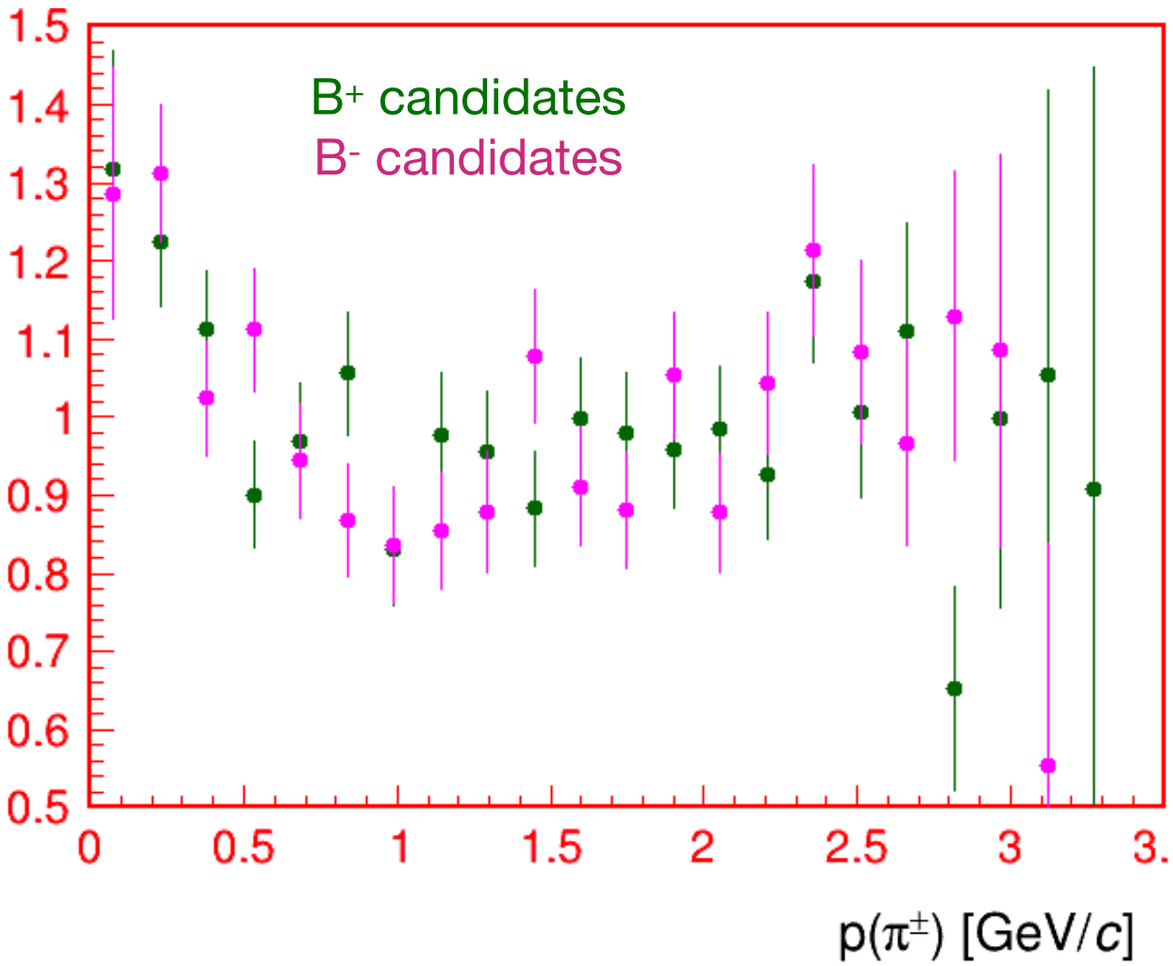


Data shapes look a bit different in a few low-*p* bins.

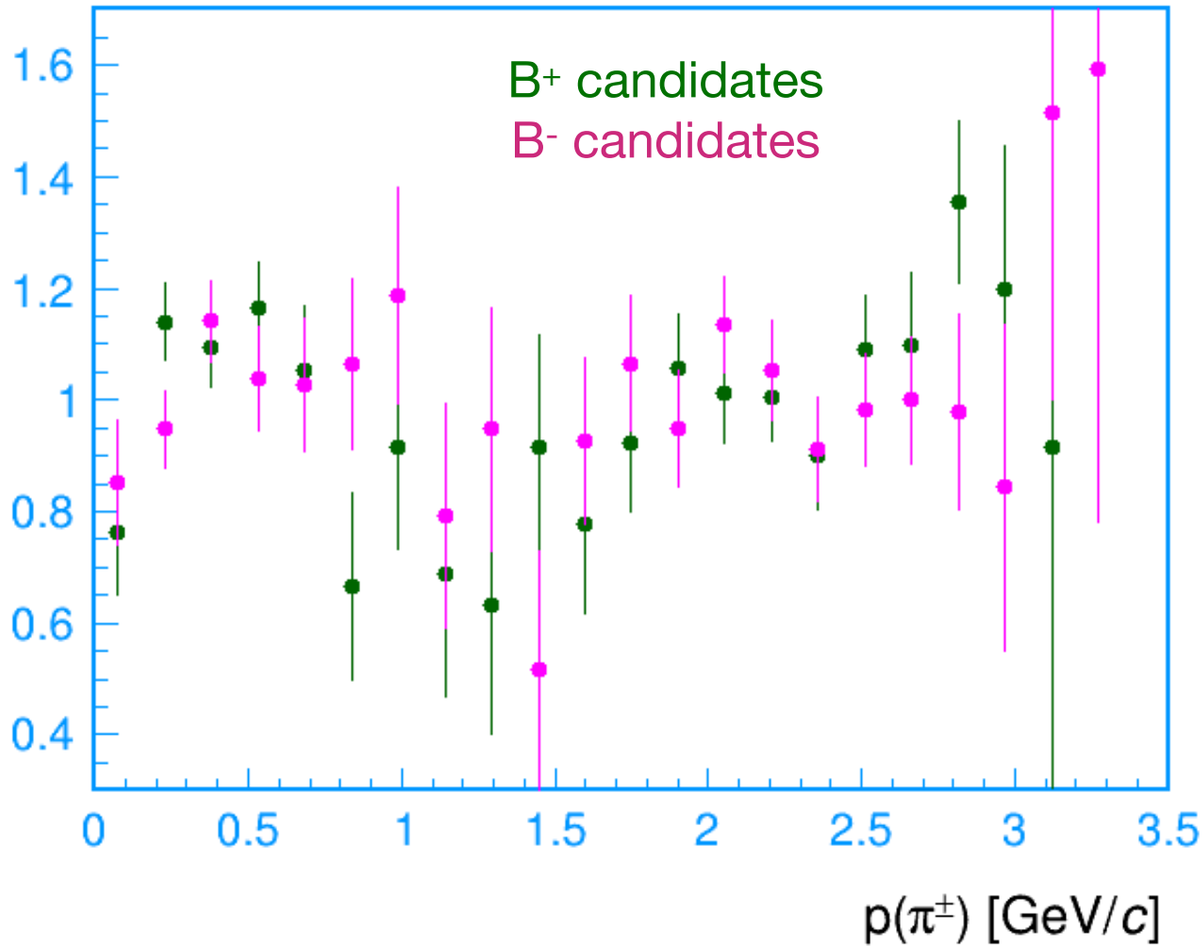
Average momenta data/MC

Charge specific data/MC ratios.

Continuum

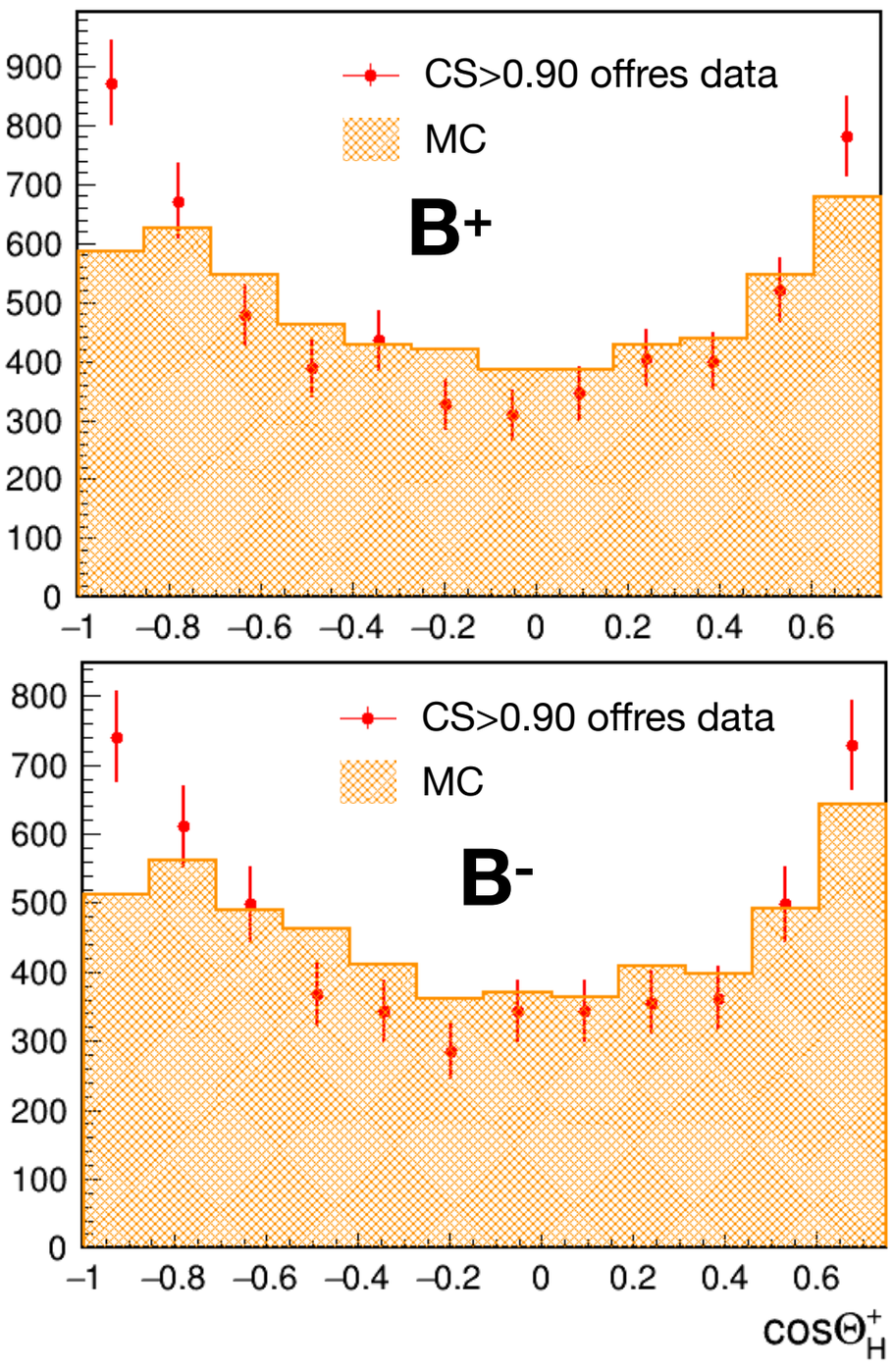


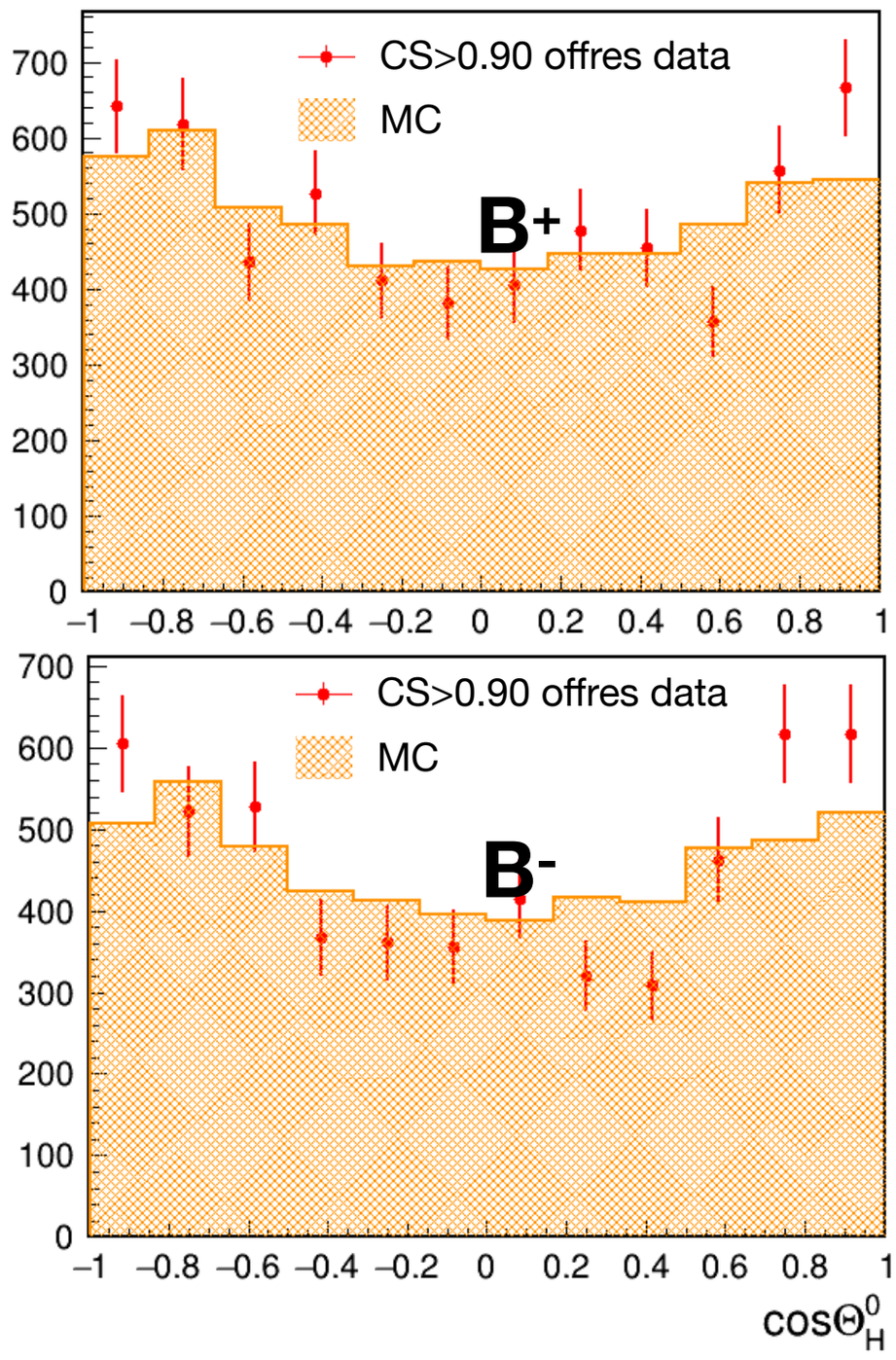
BBbar



Mismodelling looks charge-independent in the momentum (?)

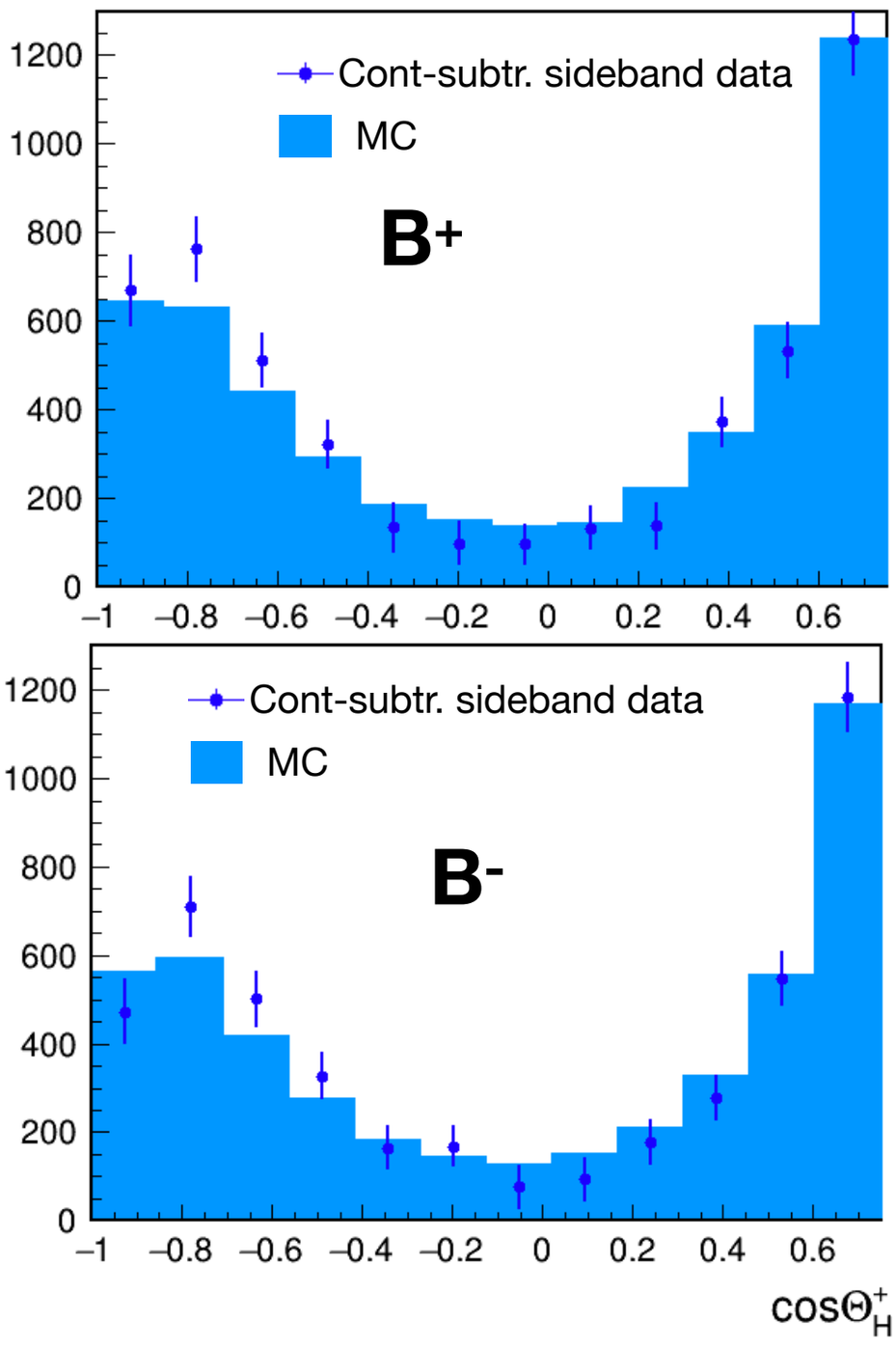
Continuum angles

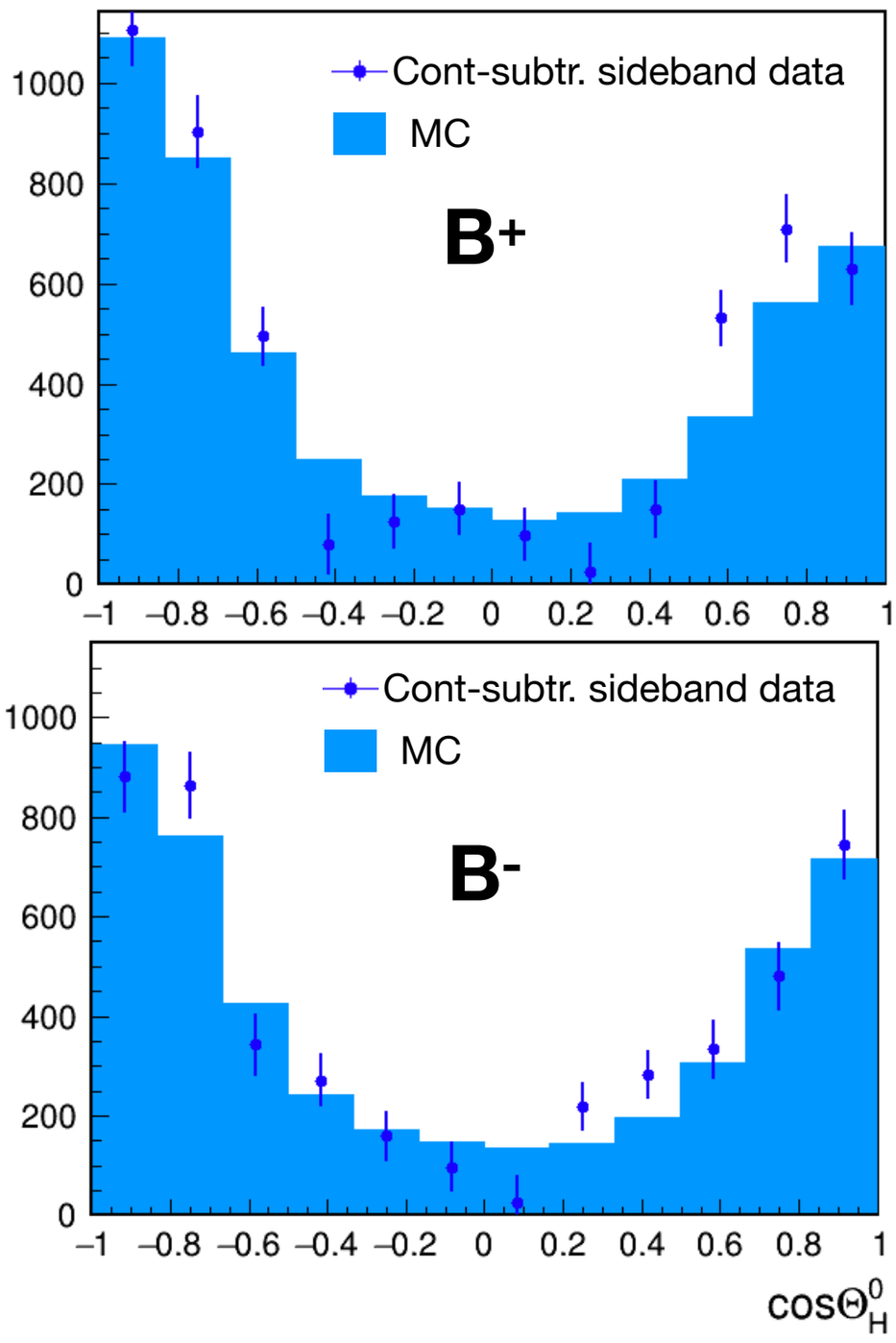




Shapes of $\cos\theta_\rho^+$ looks different in B^+ and B^- (instrumental A_{CP} effect).

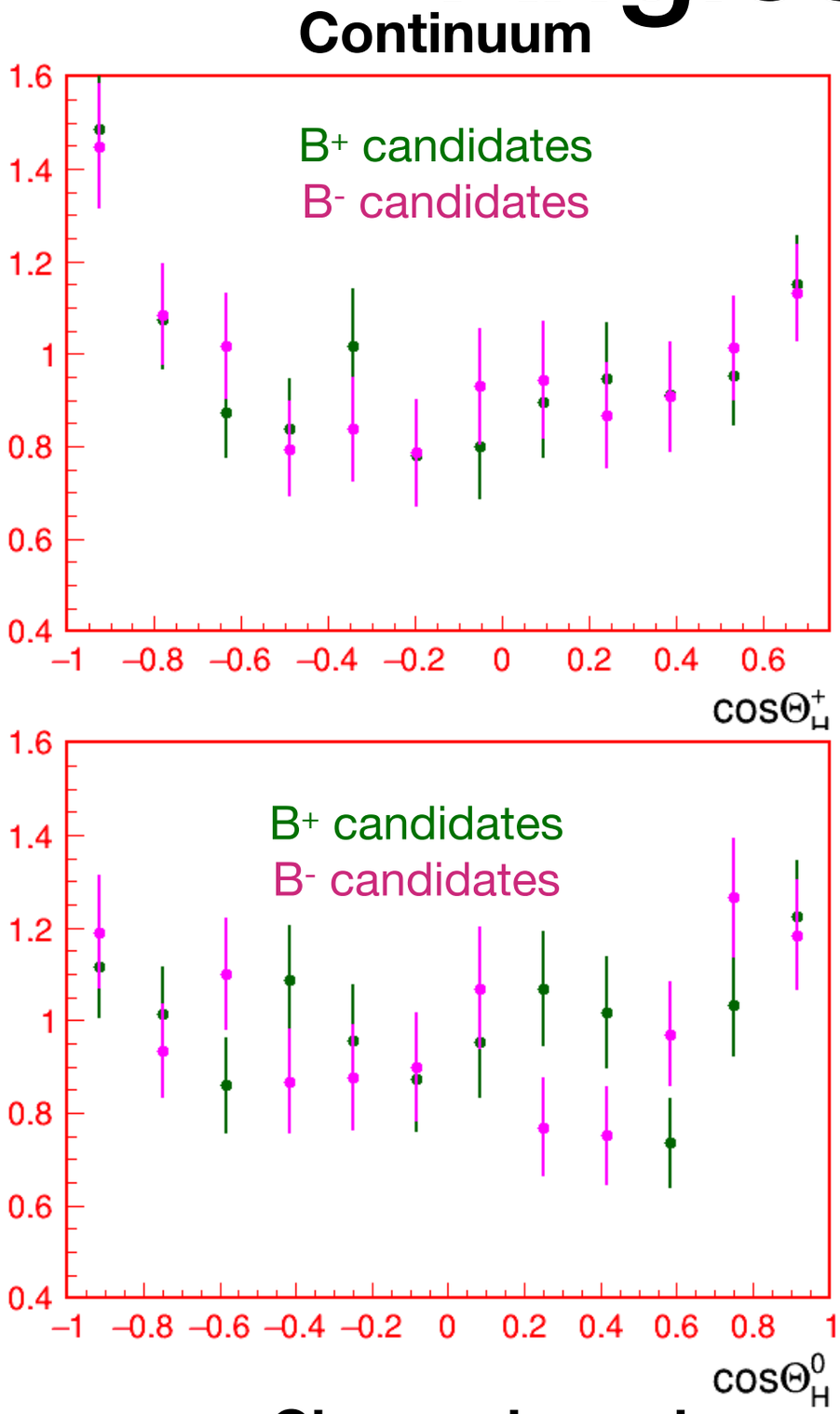
BBbar angles

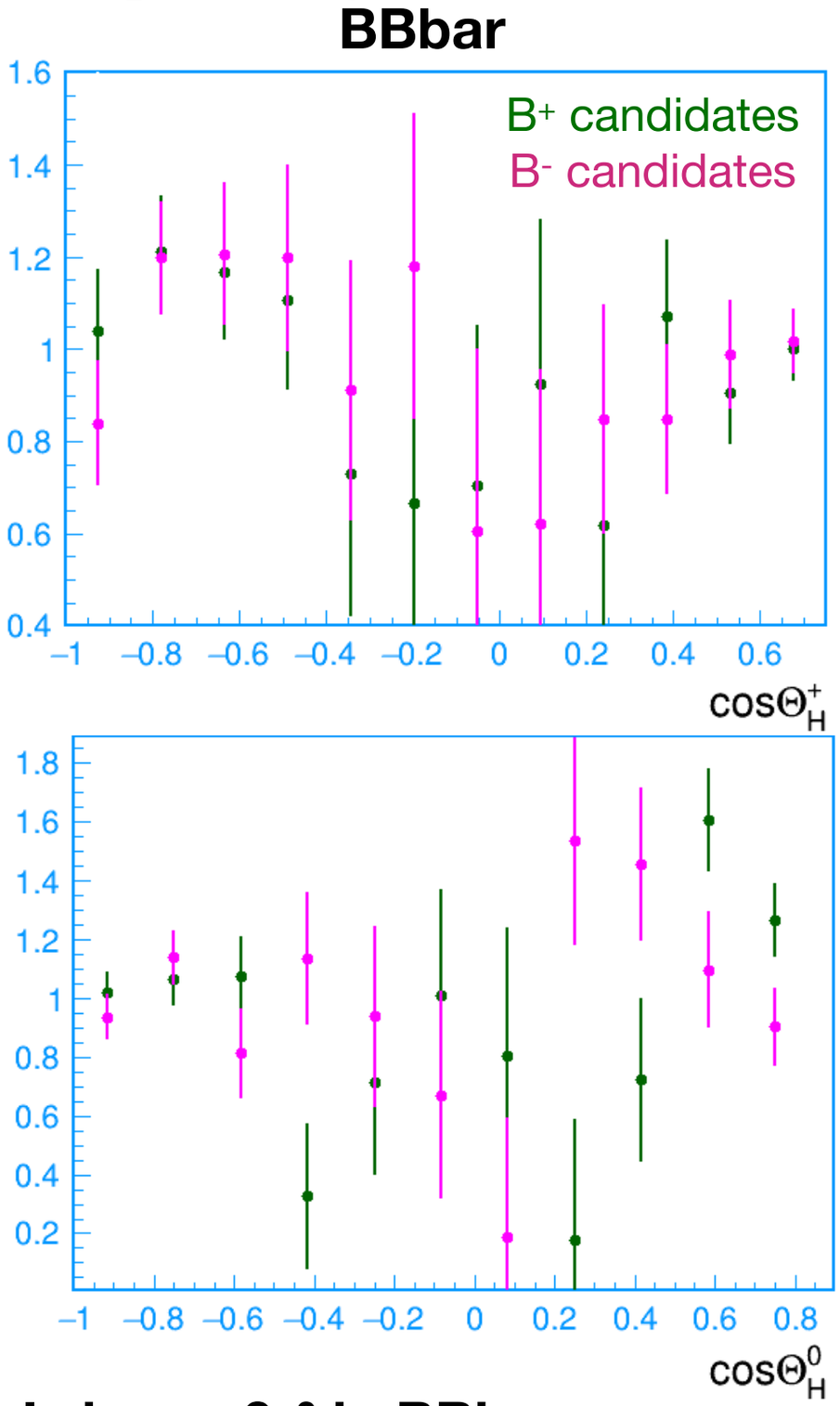




Same here. But why shapes look different also for $\cos\theta_\rho^0$?

Angles data/MC



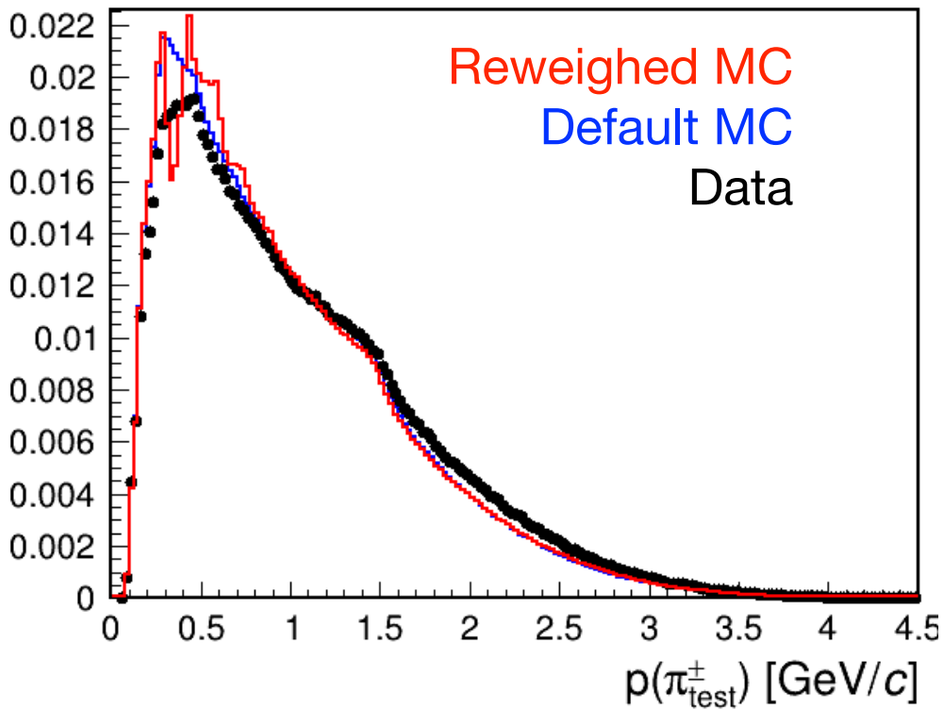


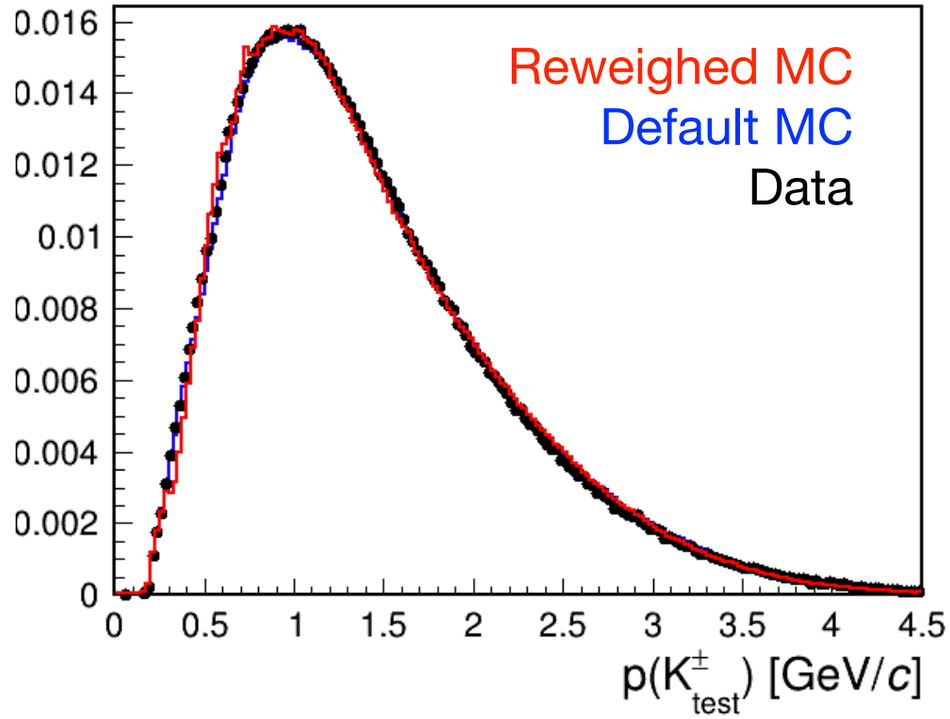
Charge-dependency maybe only in $\cos\theta_\rho^0$ in BBbar.
Should check in some higher-statistics samples.

weights from D decay

Bug in last time plots

Validation plots on “other” tracks were strange for momentum.
The background subtraction was not correct. I fixed it.





Now they look fine.

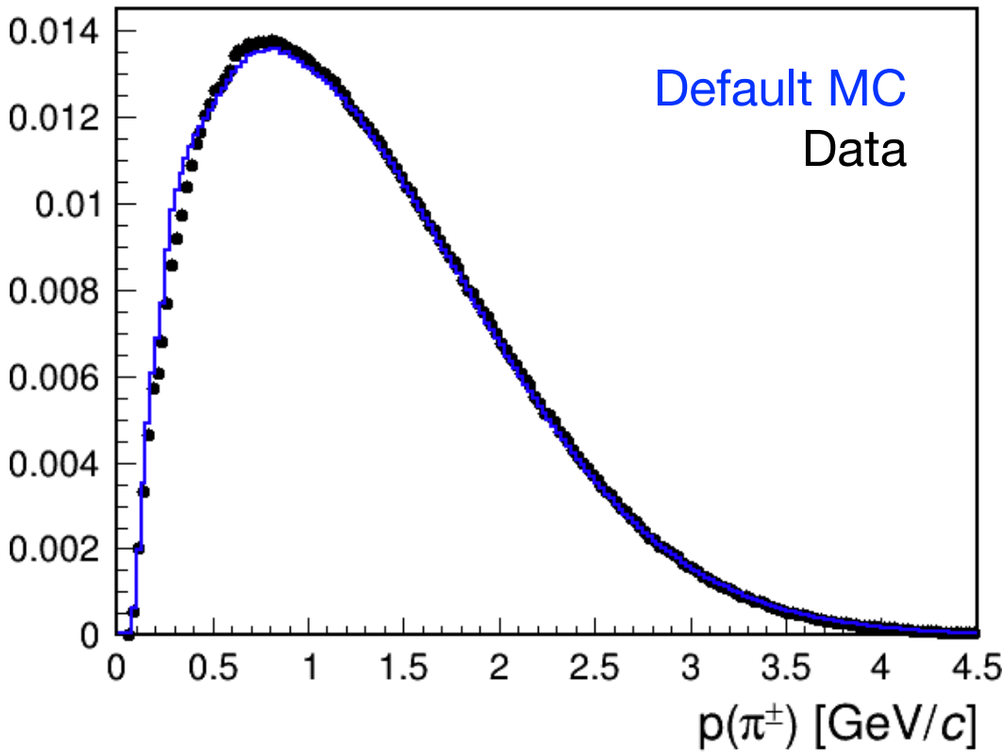
Why do weights not really work on other tracks?

Take weights as data/MC ratios using all 3 tracks.

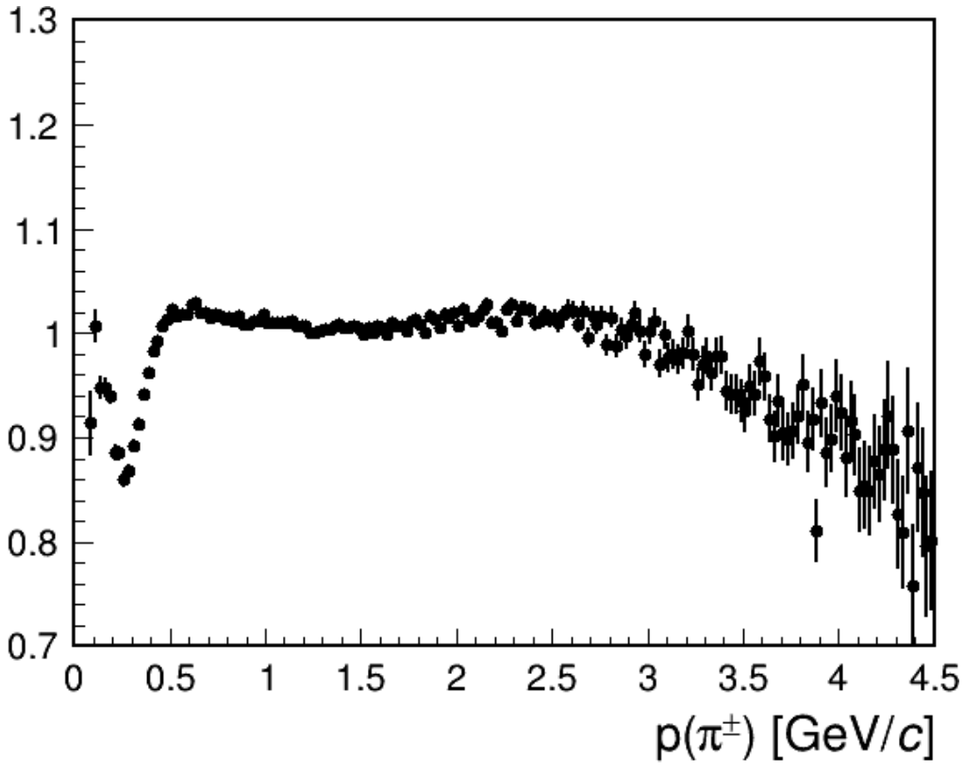
Use all tracks

Fill histograms with all 3 tracks from D→Kππ decays.
Data are background-subtracted from m(*Kππ*) sidebands.

Distributions



data/MC ratio



Drop in the 0.2 < p < 0.5 GeV/*c* range.
This is exactly where we see increase in *ρρ* sideband!

Are we wrongly interpreting the sideband plots?
Is it effect of Dalitz mismodeling?

Next steps

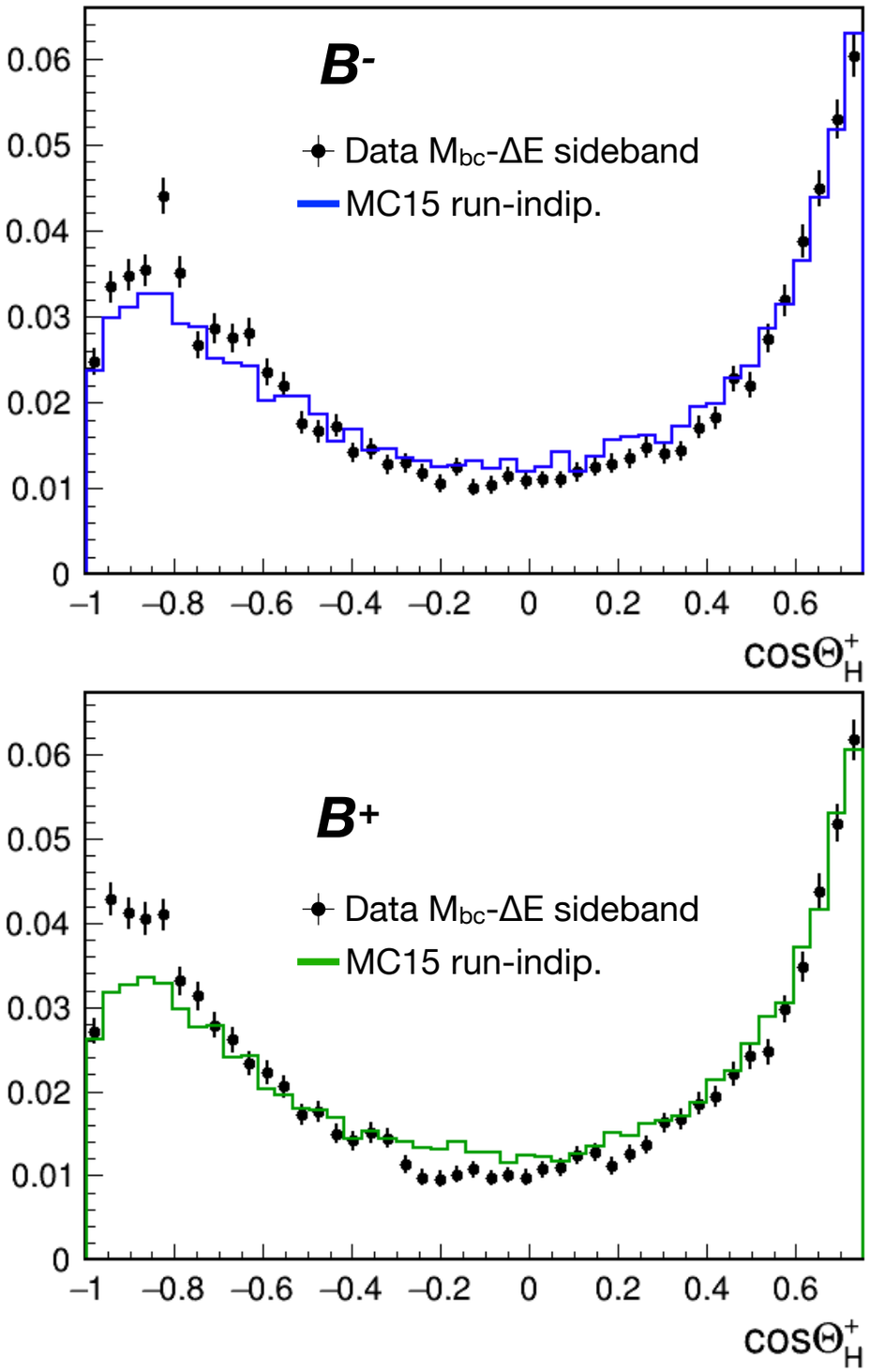
Mismodelling:
- verify if independent per-track reweighing and 2D reweighing are different ✅
- use 2-body sample with low-p coverage **#1**
- study charge-dependency at higher statistics #2

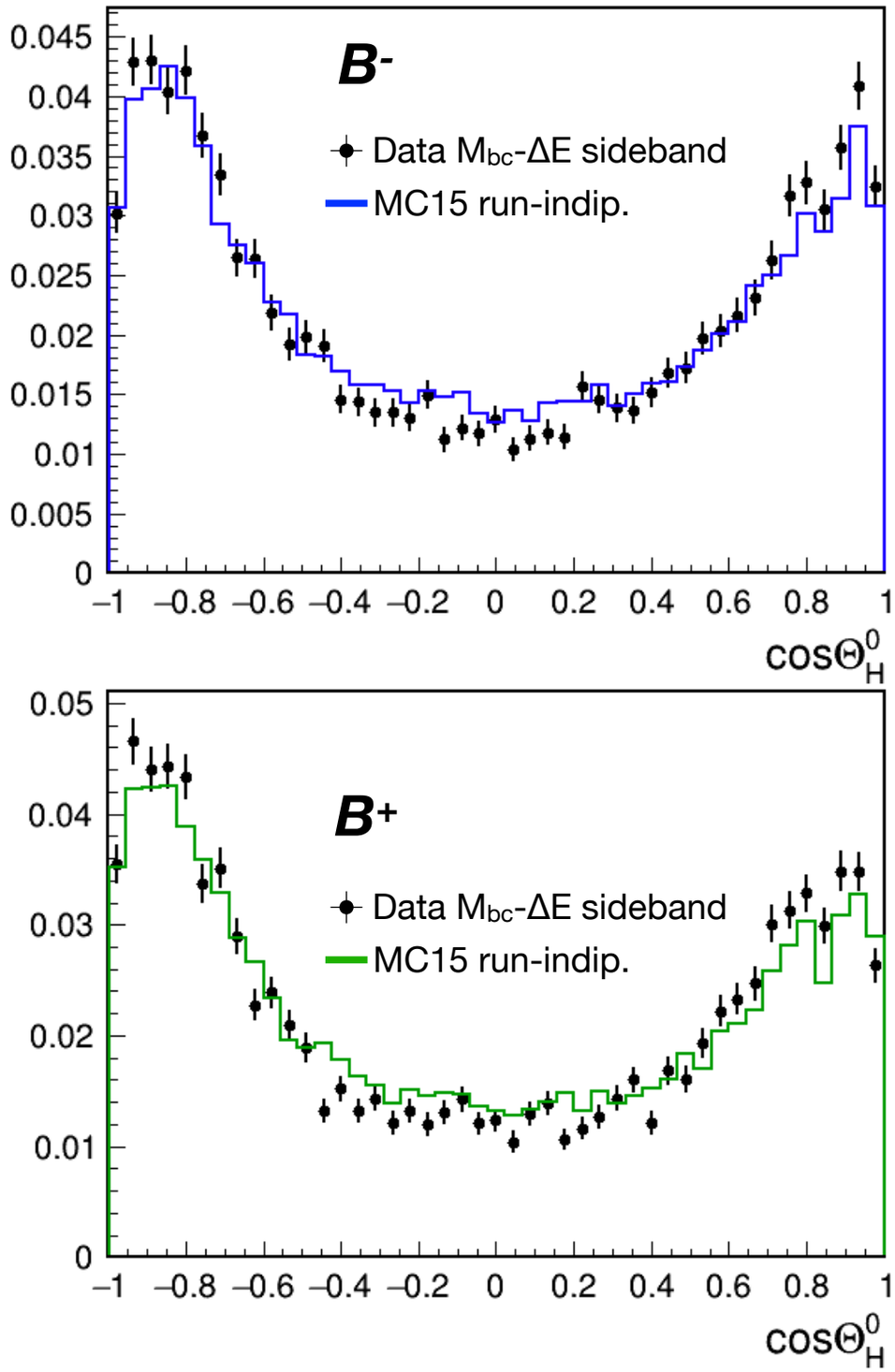
Fit:
- check fit parameters correlations
- improve $\pi\pi$ invariant mass modeling #4

Technicalities:
- fit with conditional histograms
- add degrees of freedom to histograms #3

backup

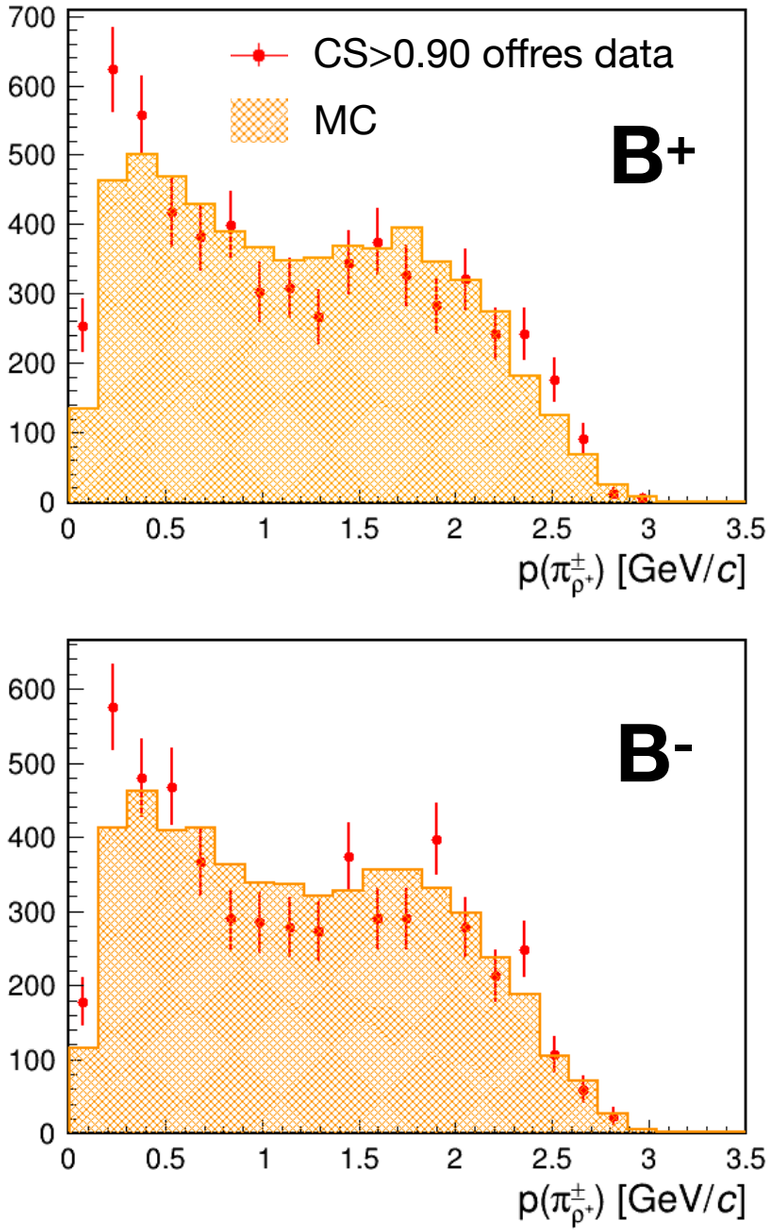
Charge dependency

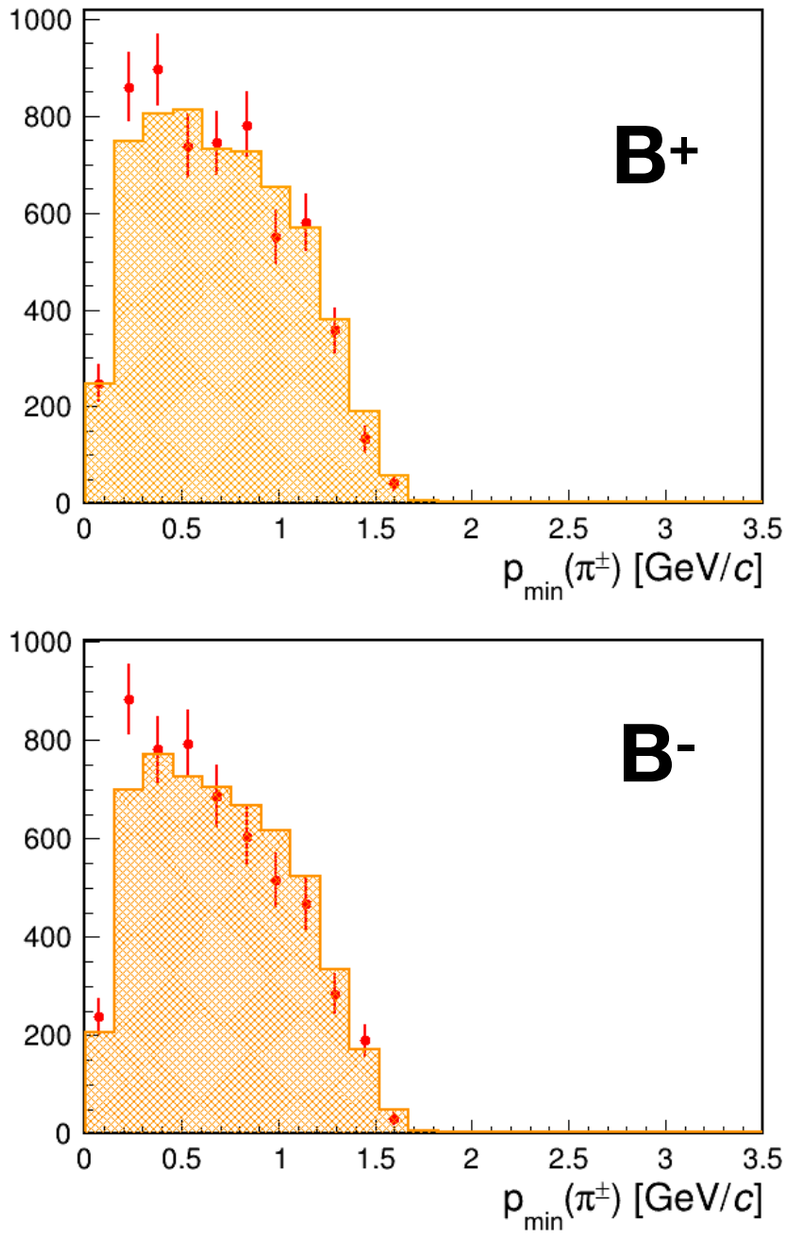


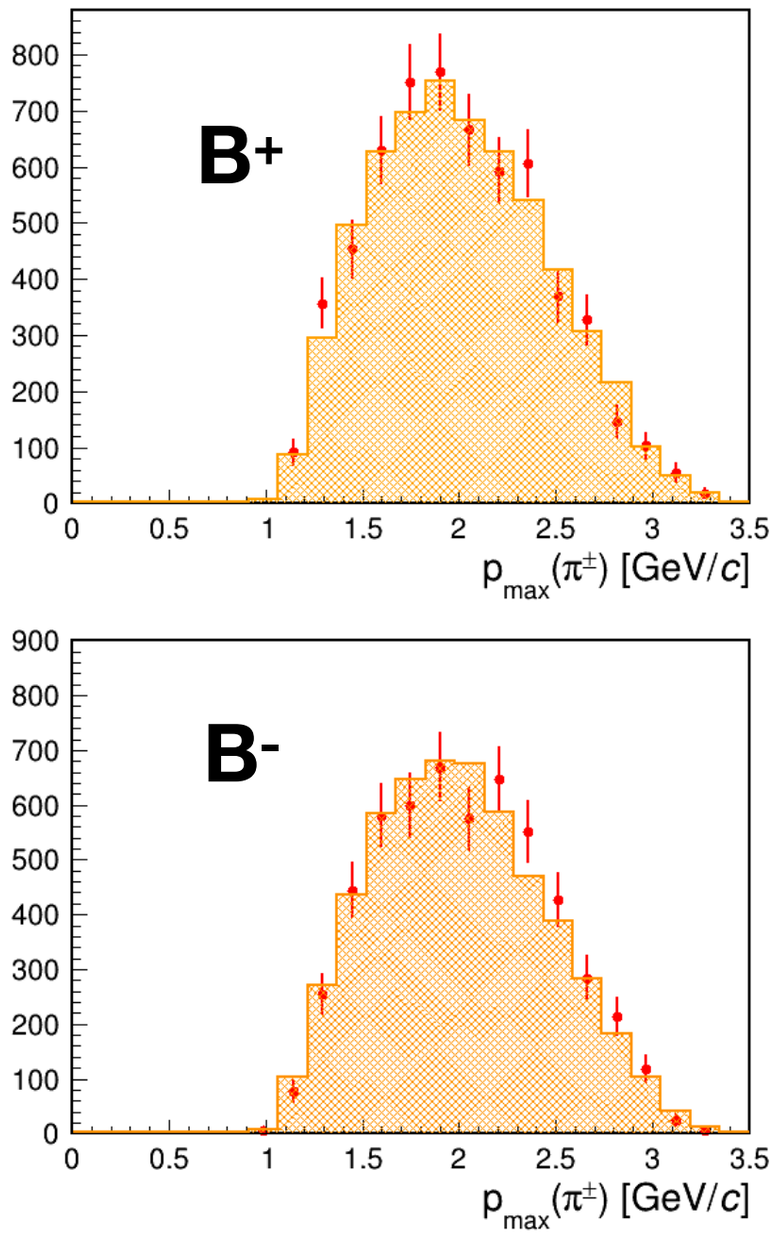


Shapes seem different in $\cos\theta_\rho^0$.

Continuum: momenta







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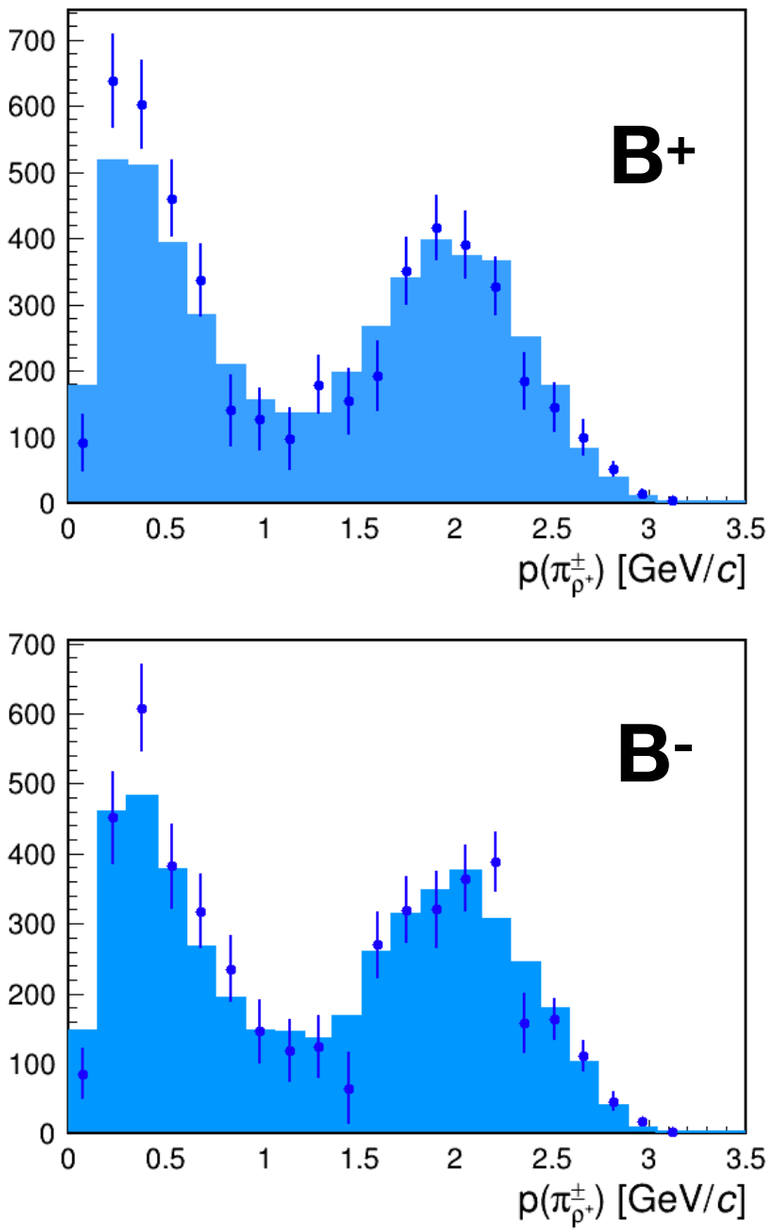
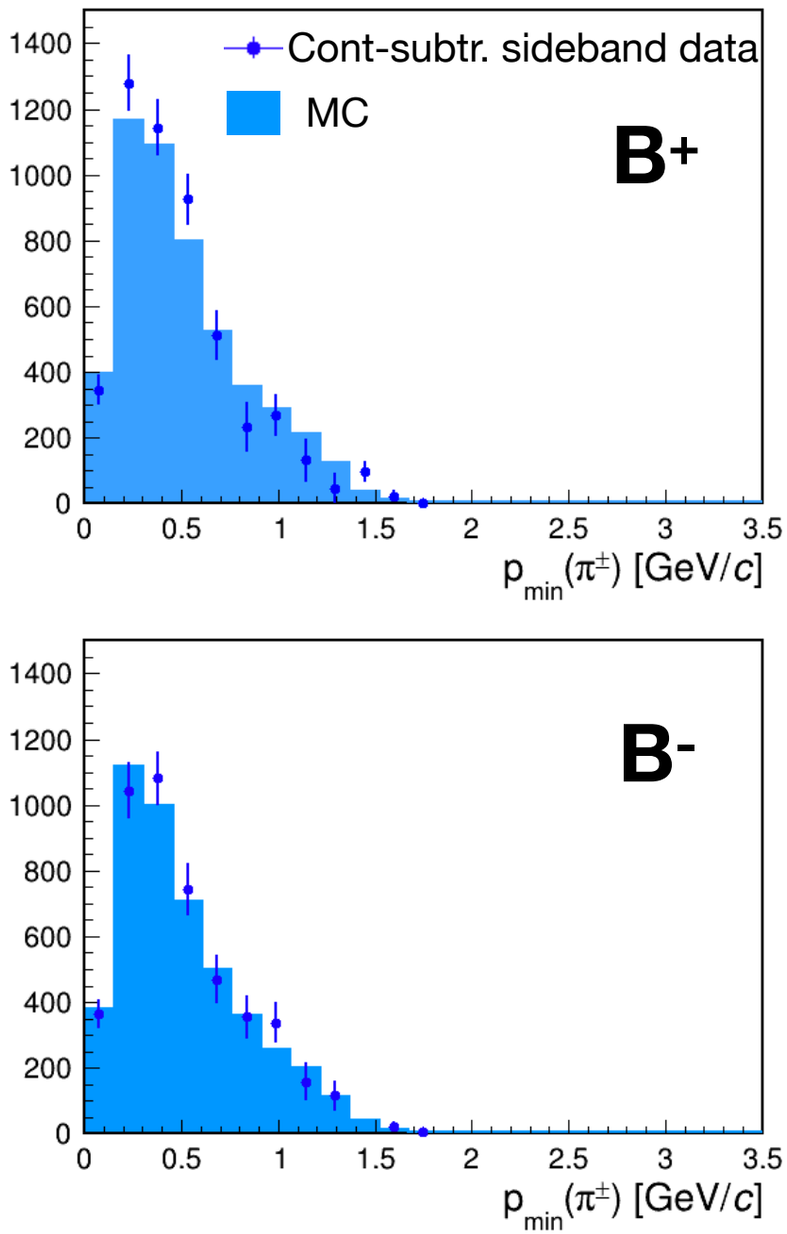
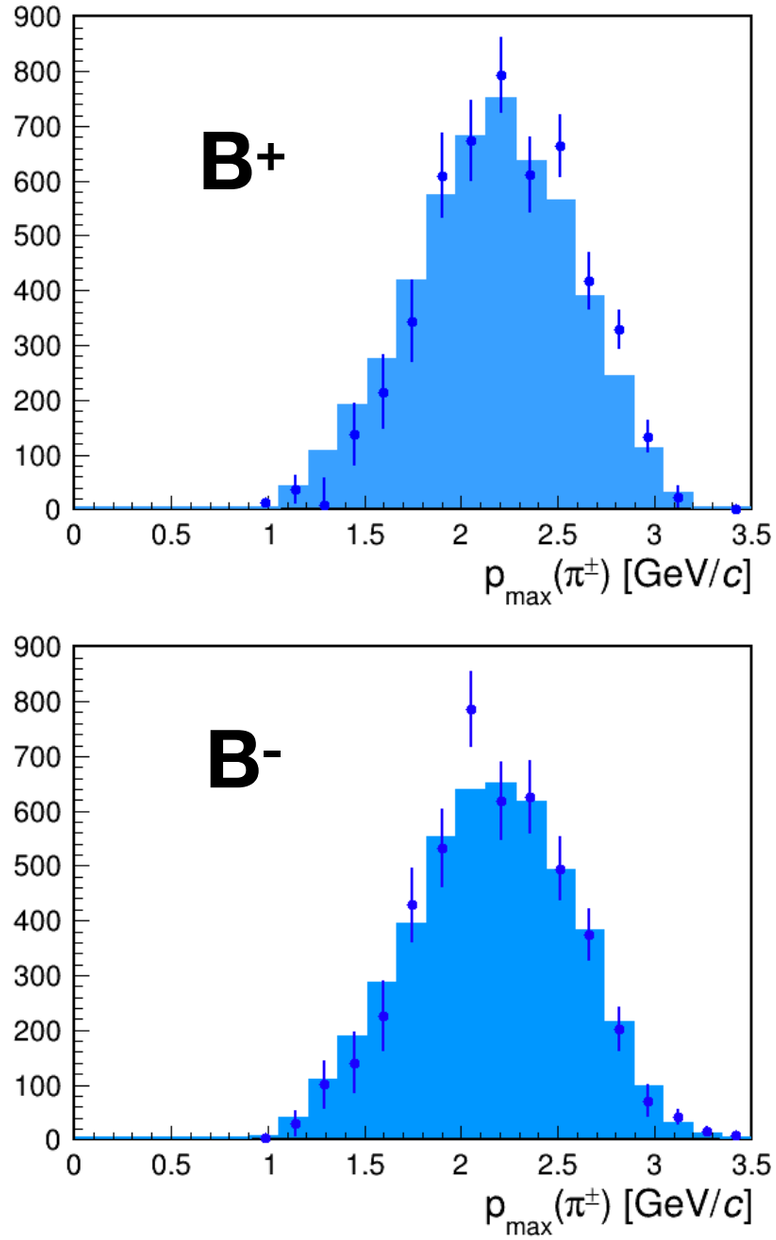
BBbar: momenta







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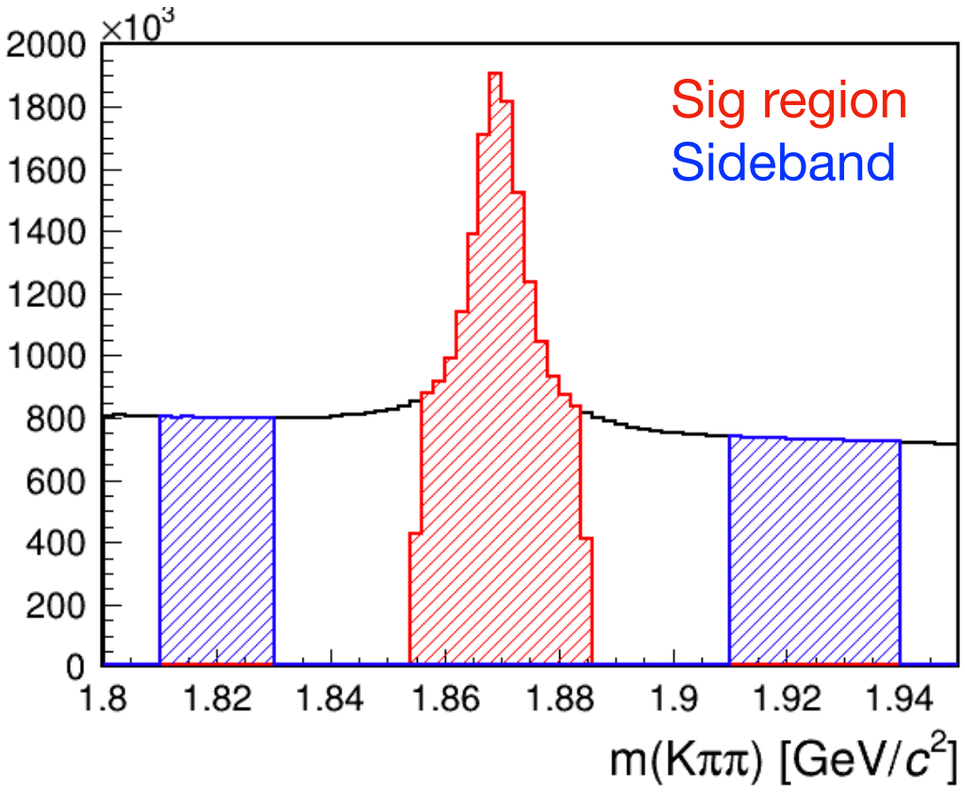
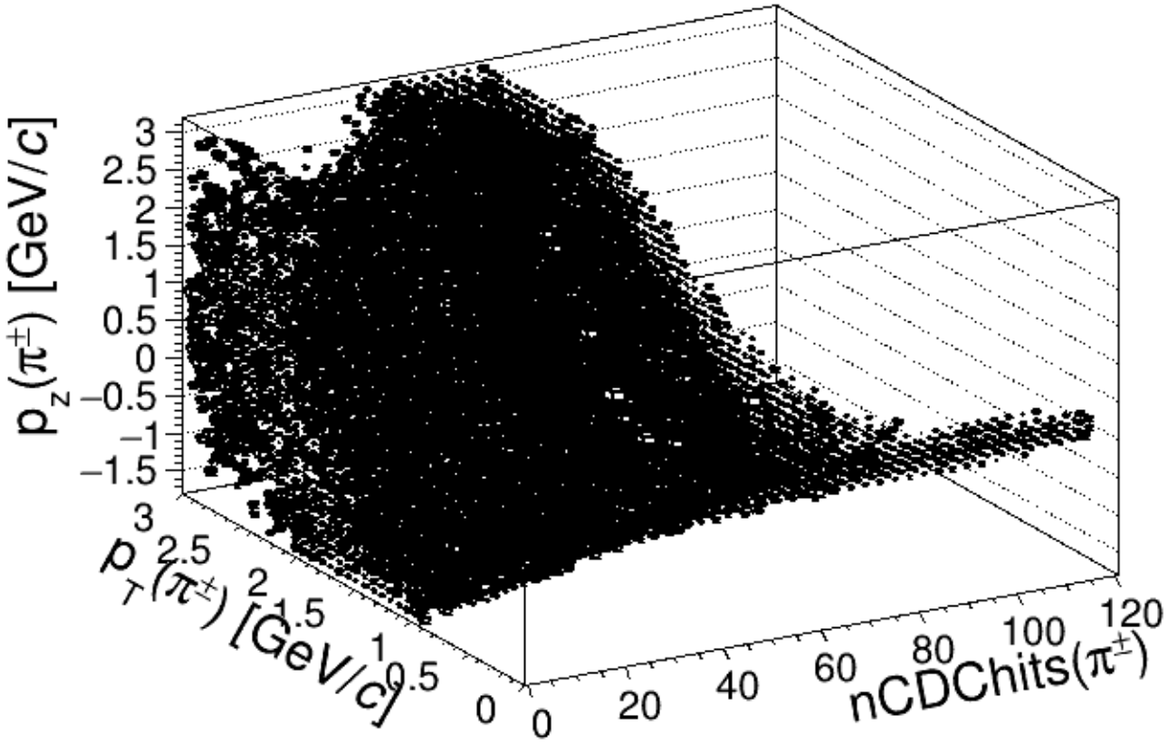
Recap: weight from charm decays

$D^+ \to K^-\pi^+\pi^+$: momentum covers the $B \to \rho\rho$ signal distributions.
Restrict in D mass peak, subtract scaled bkg from sidebands.
Get 3D weights from the nCDChits, p_T and p_z distributions.
Add also cut on nCDChits>20.

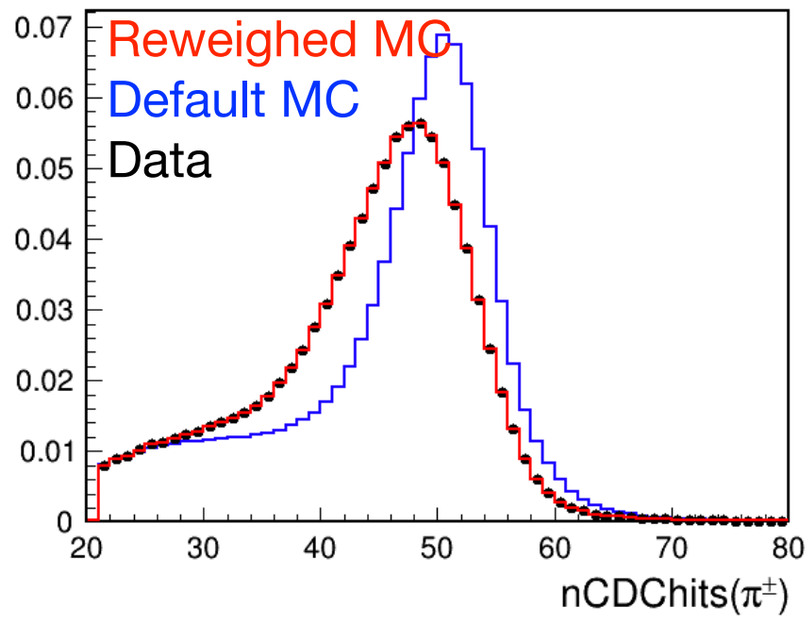


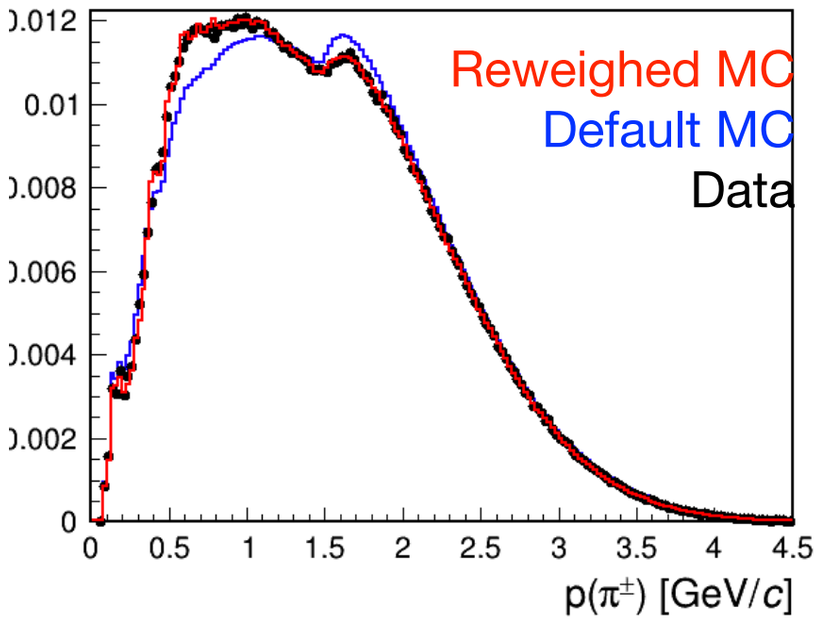
3D histogram of weights

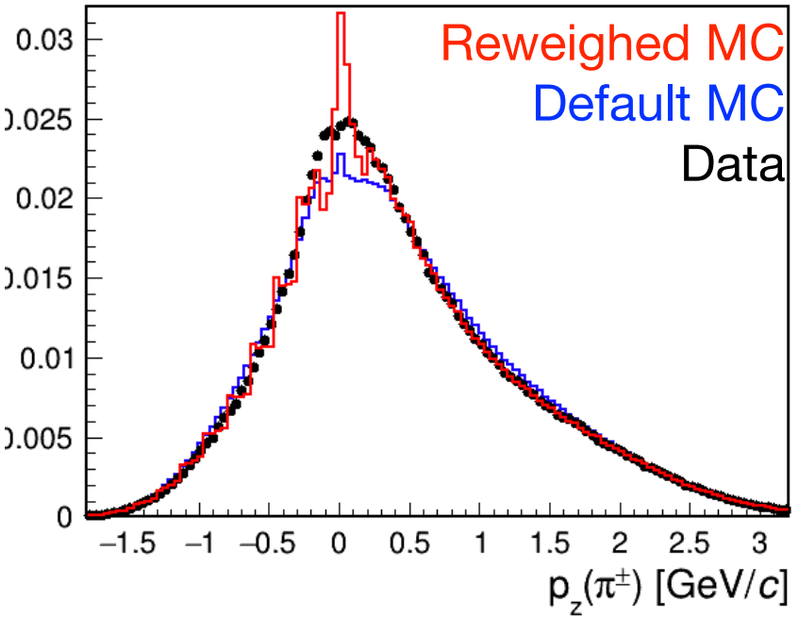


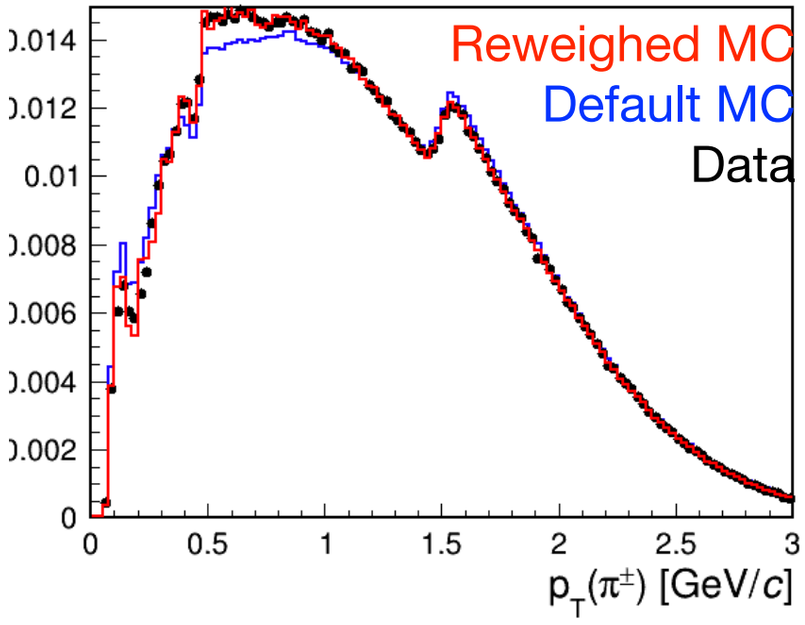
Verify reweighing works properly

Reweight the same distributions used to extract weights: should work properly.



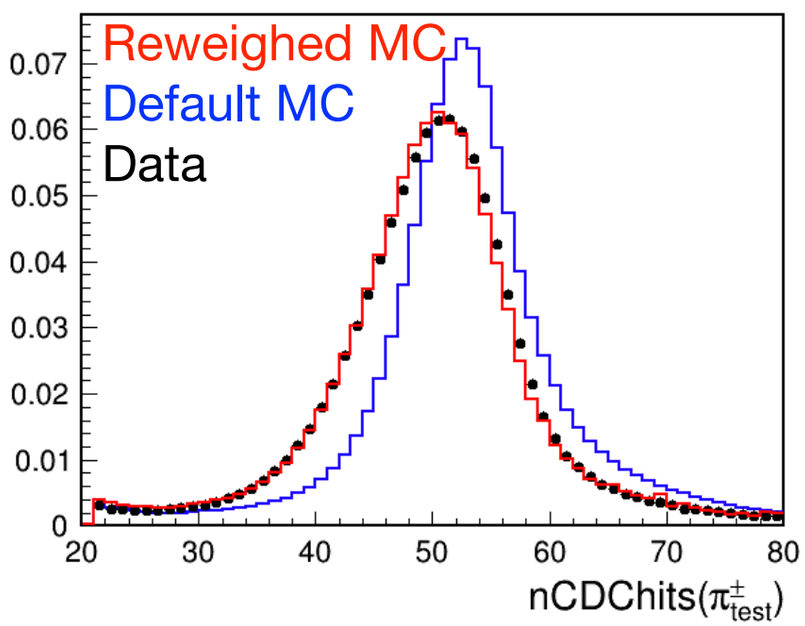


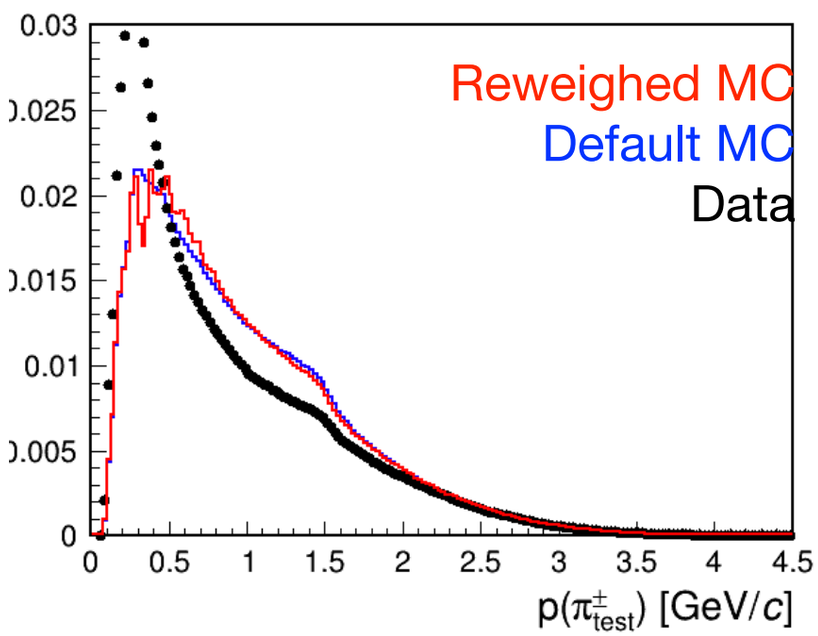


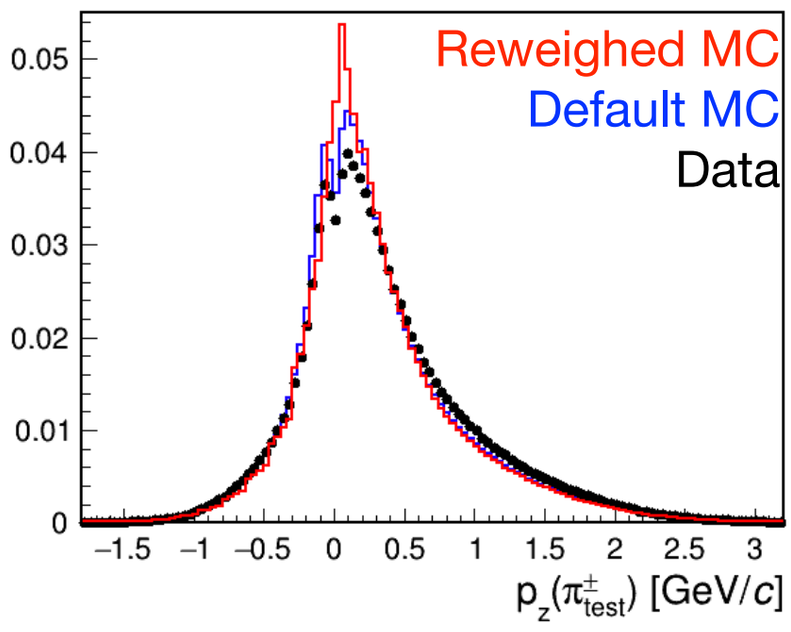


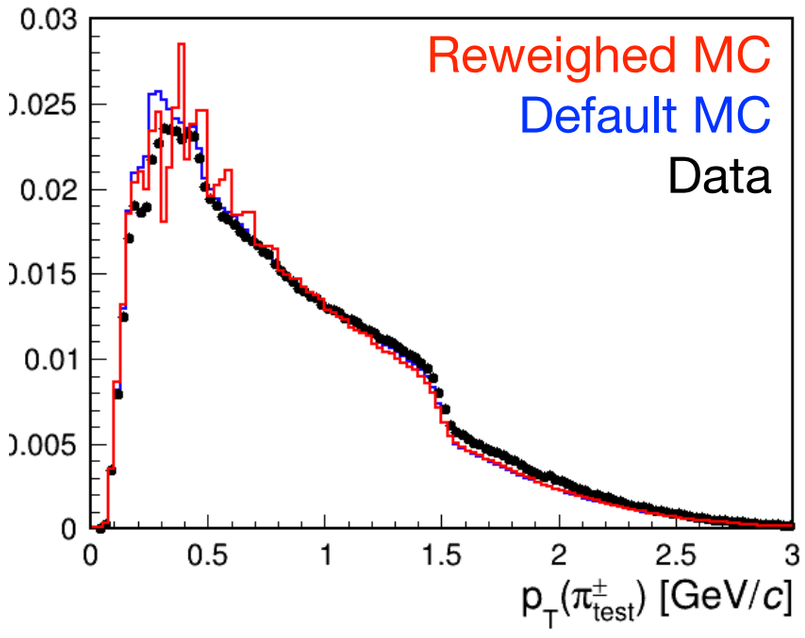
Everything's fine but the reweighed shape of p_z.

Test on the other pion



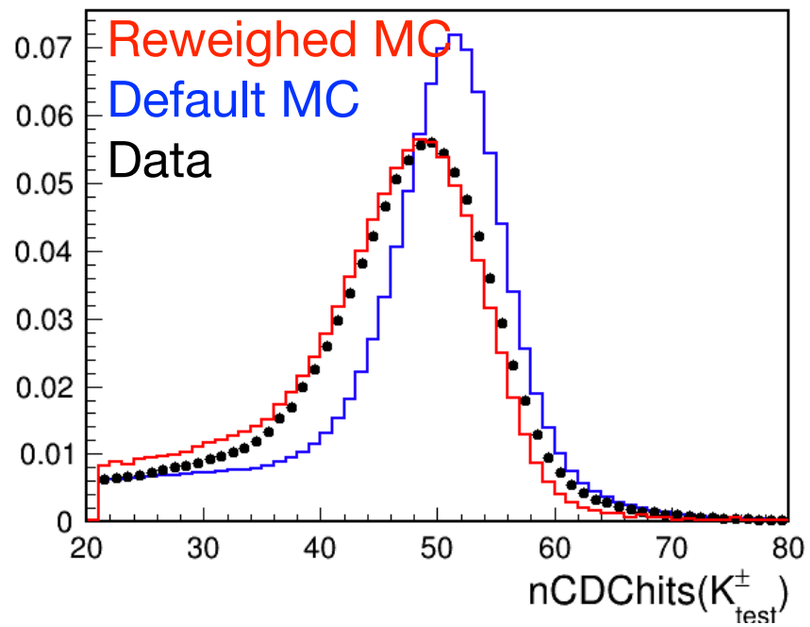


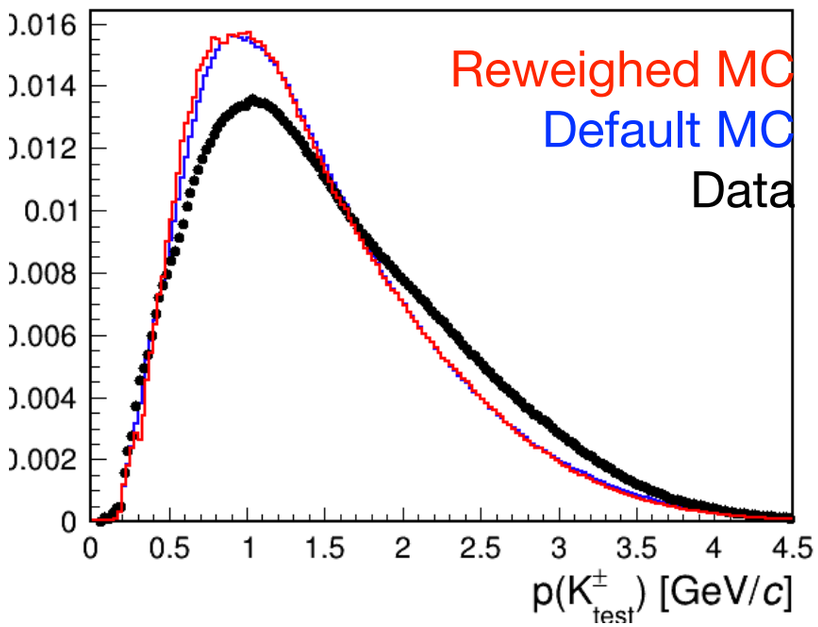


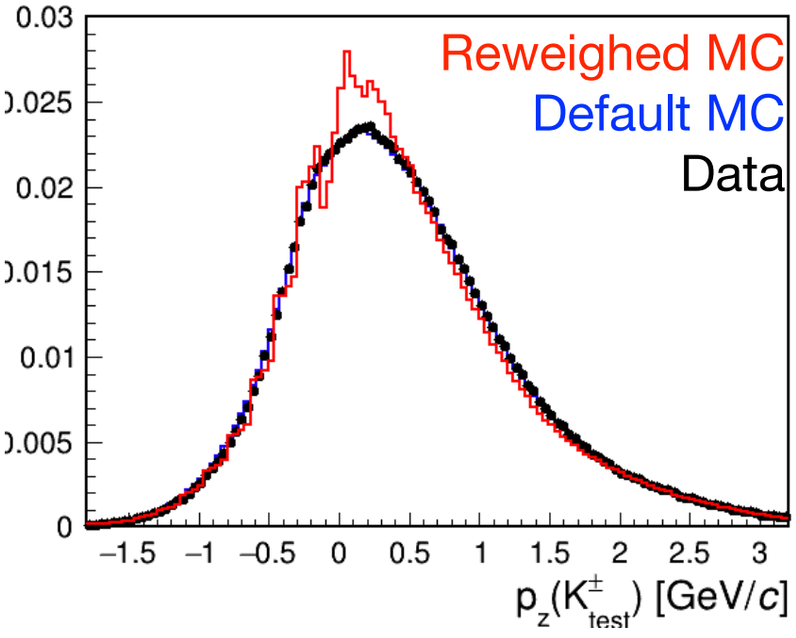


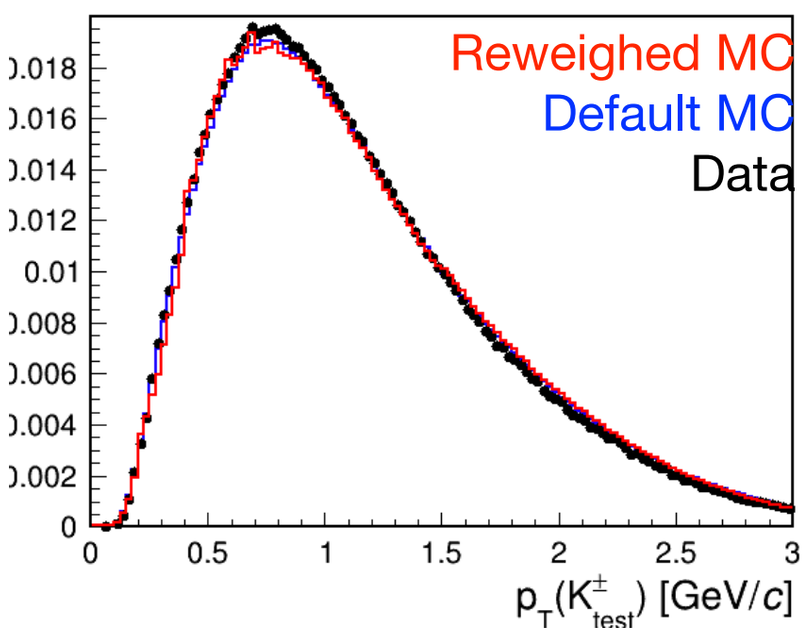
Fine for CDC hits, bad for p. Strange structures in p_z and p_T.

Test on the Kaon









Seems to have no effect. Still strange structures in p_z.

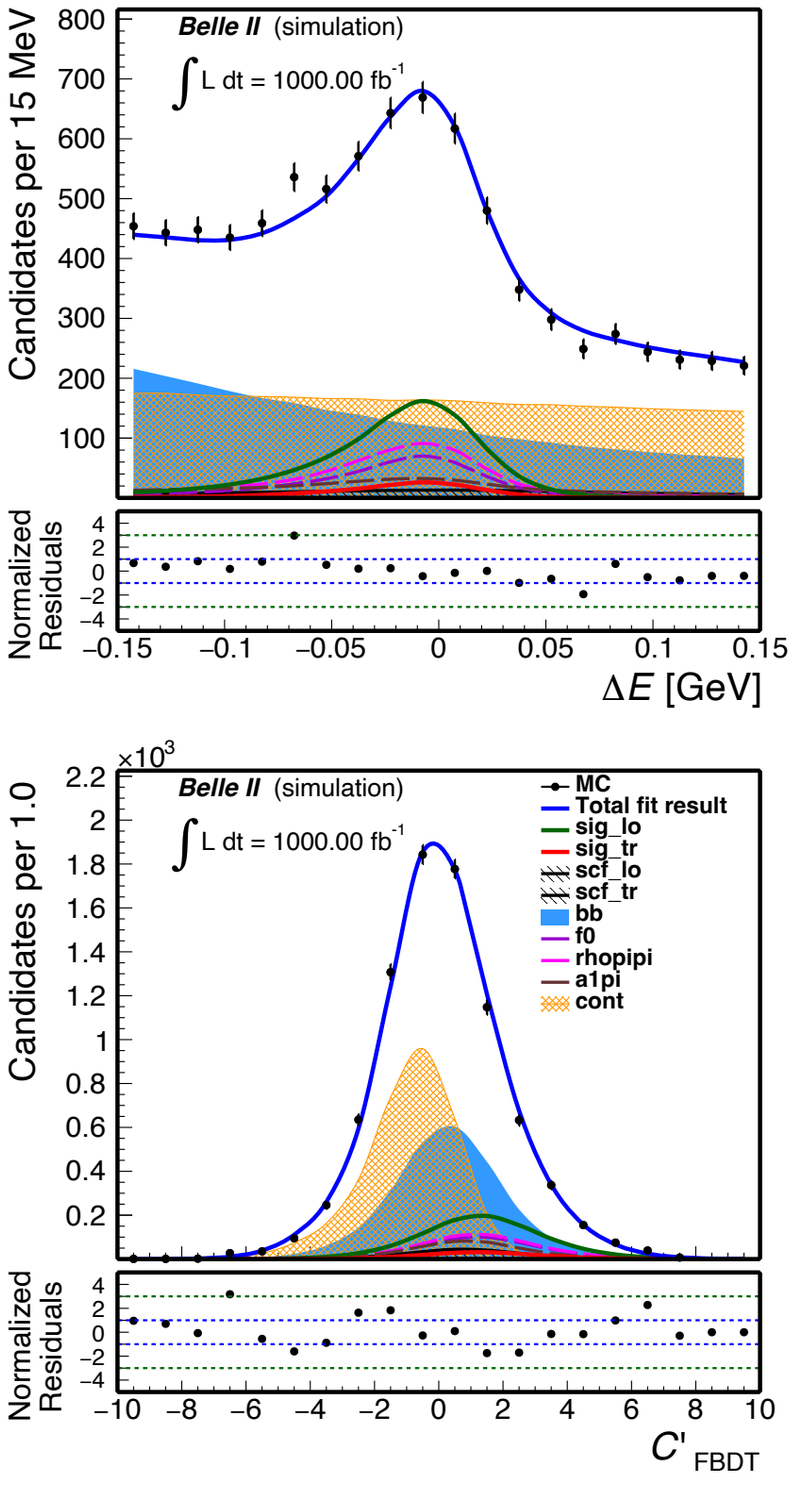
Fit of 1ab^{-1} realistic MC

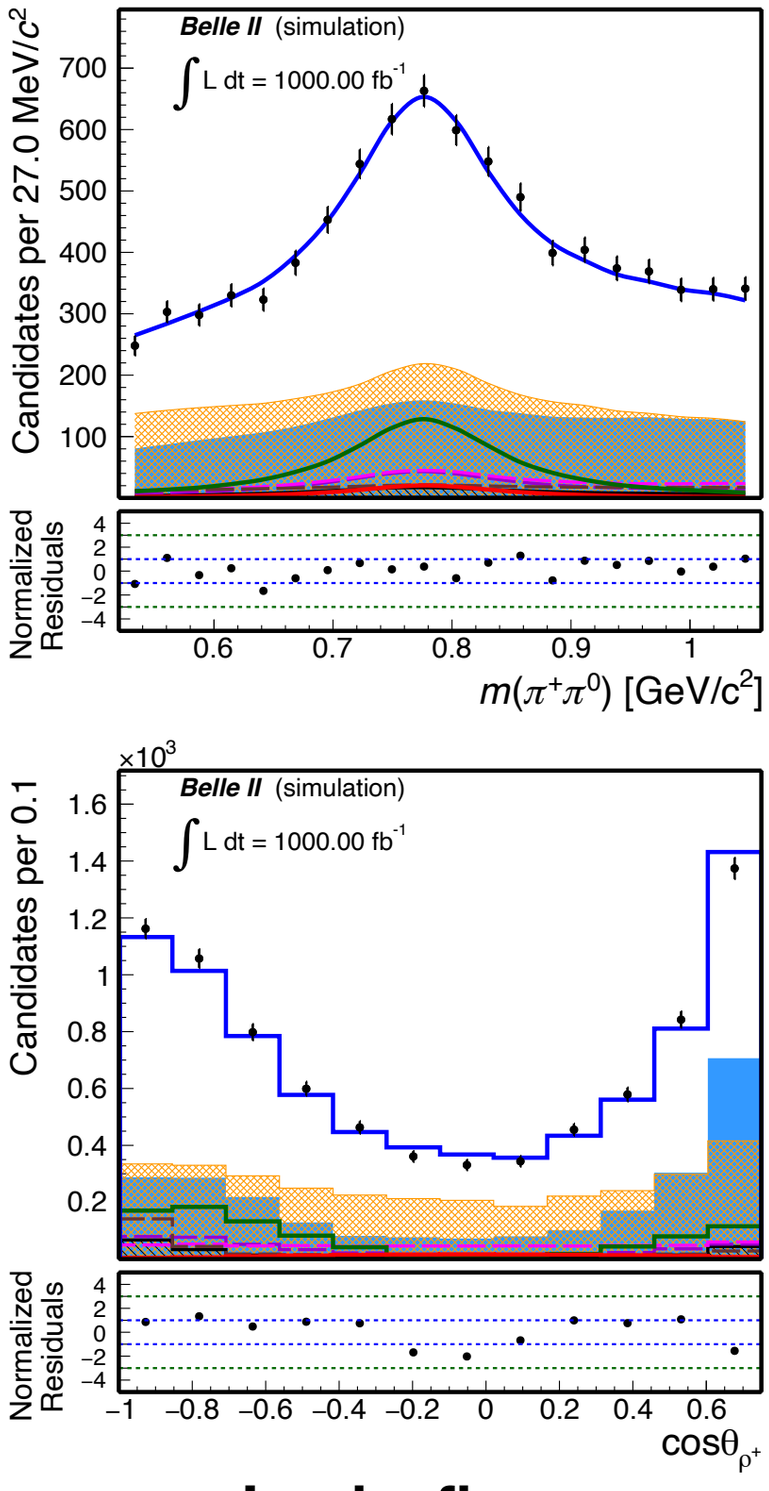
	Fit result	MC truth	Pull	
A_{CP} signal	-0.020 ± 0.039	0	-0.52σ	
BF [10^{-6}]	24.2 ± 1.0	24.0	+0.20σ	
f_L	0.924 ± 0.016	0.95	-1.63σ	
A_{CP} $B \to f_0 X$	-0.050 ± 0.066	0	-0.76σ	
A_{CP} $B \to \rho\pi\pi$	0.054 ± 0.104	0	+0.52σ	
A_{CP} $B \to a_1\pi$	-0.030 ± 0.135	0	-0.22σ	
Long. SxF fraction	0.218 ± 0.002	0.218	+0σ	*
Trans. SxF fraction	0.062 ± 0.002	0.062	+0σ	*
Yield *BB* bkg.	5028 ± 142	5181	-1.08σ	
Yield $B \to f_0 X$	896 ± 60	927	-0.52σ	
Yield $B \to \rho\pi\pi$	1105 ± 151	1186	-0.54σ	
Yield $B \to a_1\pi$	710 ± 21	715	-0.24σ	*

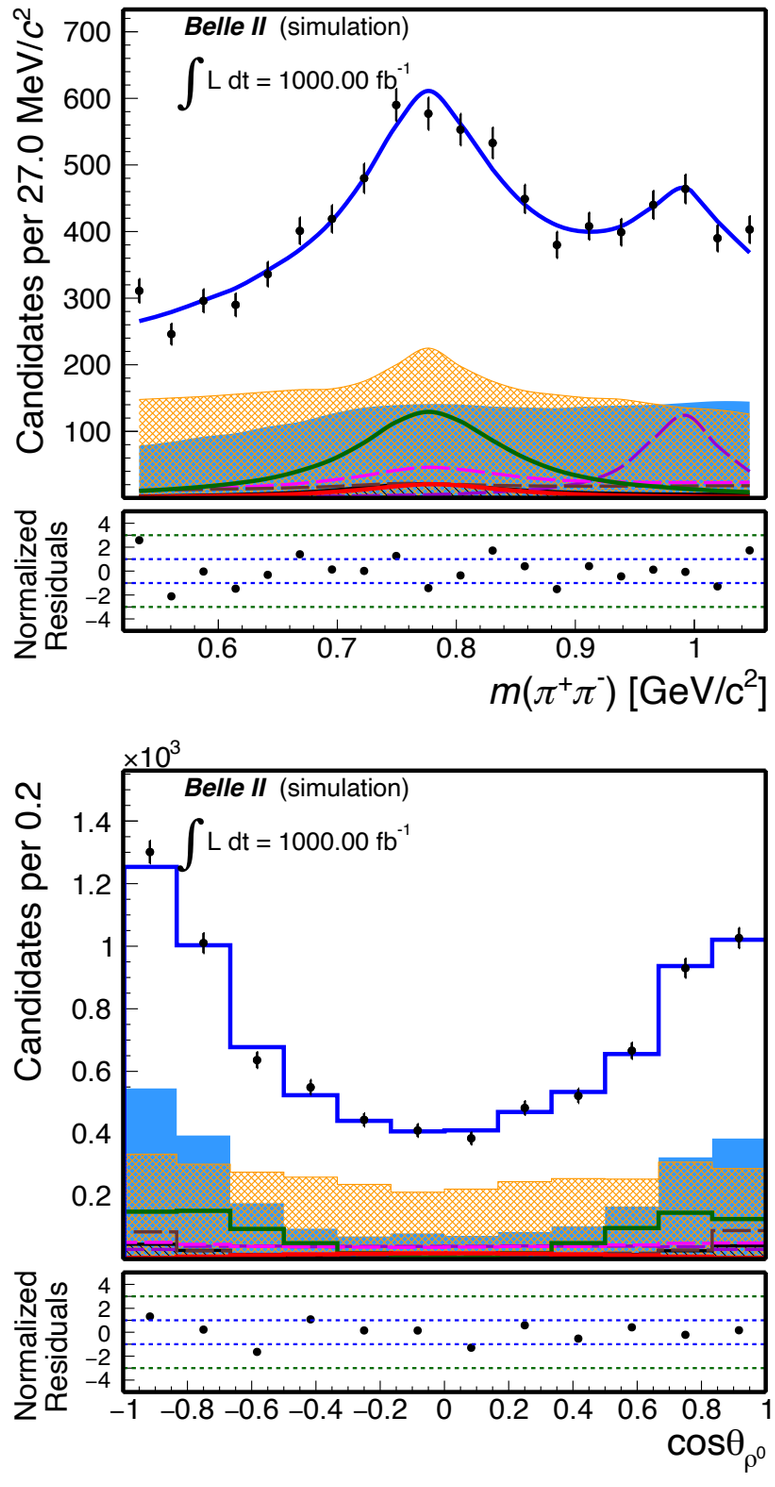
* = gaussian constrained to MC

The >3σ discrepancy in f_L from last week is gone with the tighter CS cut.

Projections B^+ (1ab^{-1} MC)

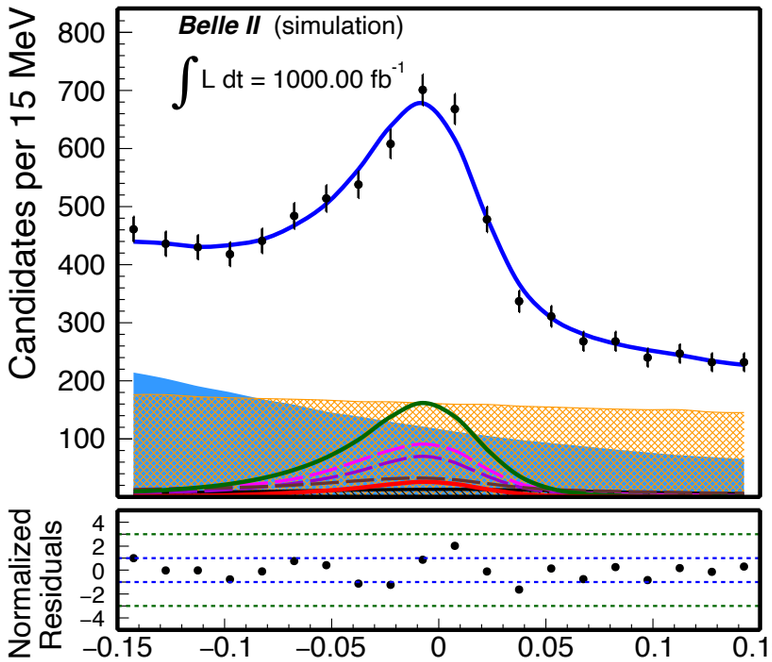


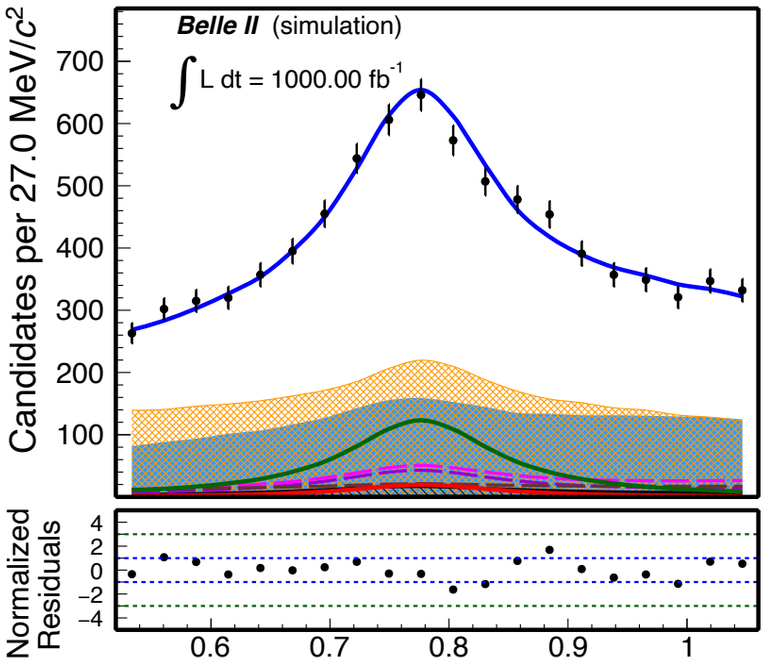


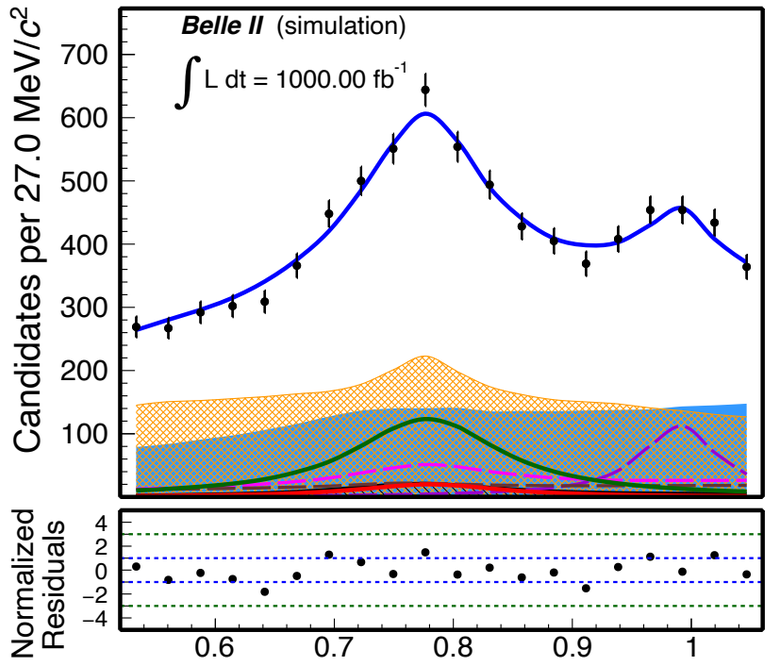


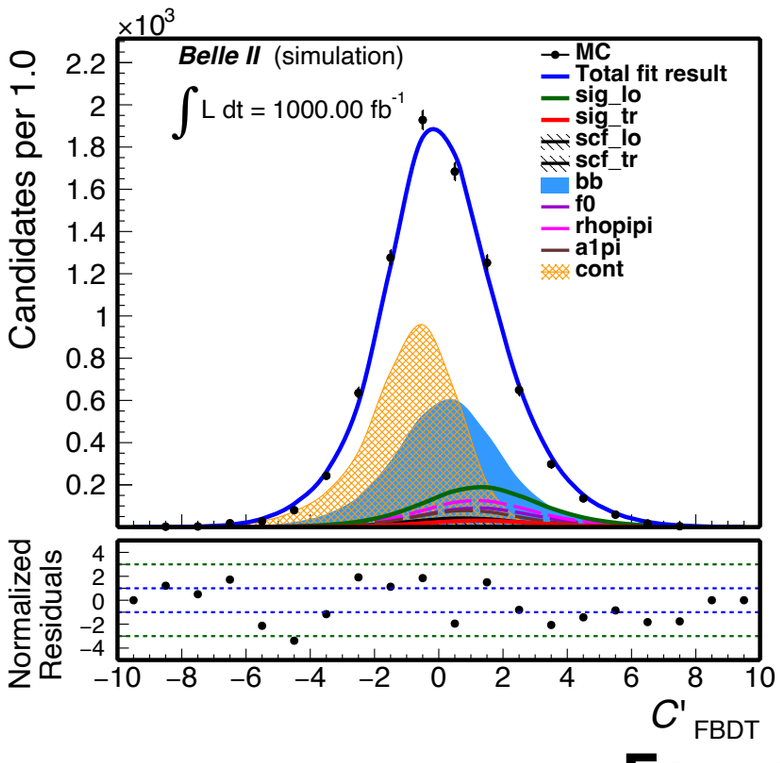
Looks fine.

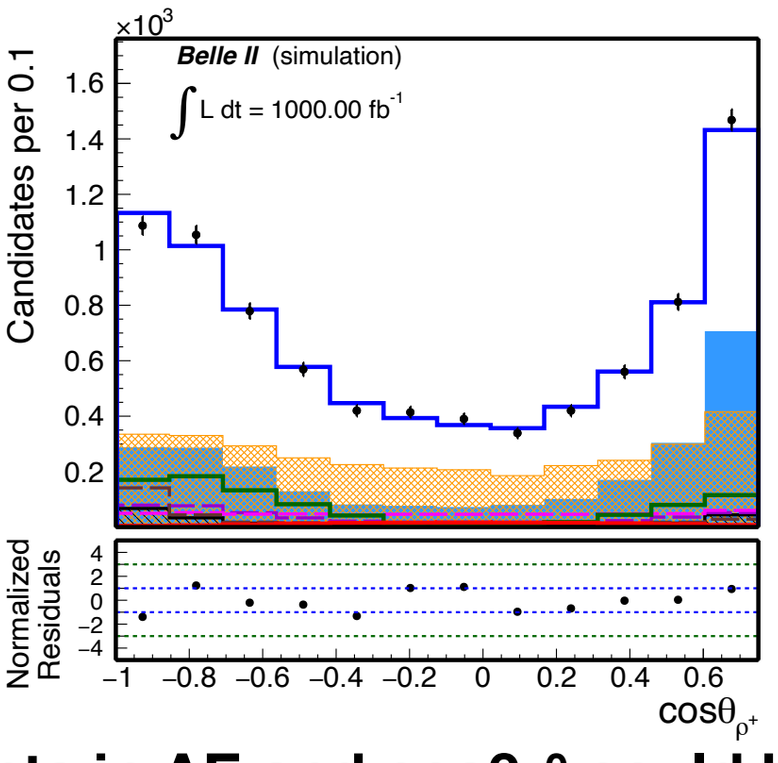
Projections B^- (1ab^{-1} MC)

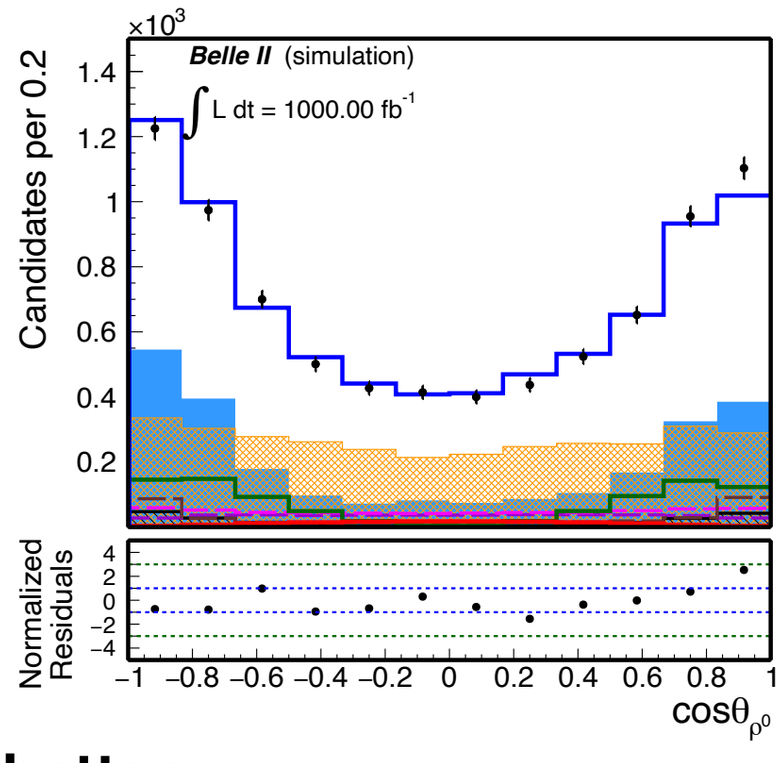












Few points in ΔE and $\cos\theta_{\rho^0}$ could be better.