PWG-HF:
D^0-hadron Correlations In pPb Collision With ALICE Detector

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Outline

- Motivation for the Analysis
- Data Set for the Analysis
- Review of Analysis Method
- Invariant Mass Plots
- D^0-hadron Correlation plots
- Fitting of the Correlation plots
- Study of
  - Yield vs $\Delta\eta$
  - Sigma vs $\Delta\eta$
  - Yield vs Associated track p_t threshold
- Summary

Motivation for the Analysis:

Three main goals:

- Study the fragmentation of jets originating from HF
- Study the c-cbar pair production
- For the pPb study: this could be ideal reference for PbPb and ideal system for testing and validating the analysis as we have higher multiplicity than pp but not as PbPb -> Smaller background and less phi inhomogeneities.

Angular correlations ($\Delta\eta$, $\Delta\phi$) are done between the trigger particle in a given pt range and particles in another range (typically at lower pt).

Associated yields and shapes of correlation peaks are sensitive to:

- Medium modifications to jets properties

Review of the Analysis Method:

- D^0 Reconstructed in the D^0->K+pi decay channel using D2H tools and cuts.
- Associated tracks are selected as AOD tracks with ITS (2 hits) and TPC (min 80 cluster) with different pt requirements.
- Contribution of background D^0 removed using side-bands in D^0 invariant mass distribution.
- Detector effect (acceptance, dead zone) correlated for trigger and associated particles -> corrected using Event Mixing.
- Not yet included: correlation for associated track efficiency ,
  D^0 reconstruction efficiency,
  D^0 feed down from B-mesons.

Data Set for the Analysis:

Data	Period	AOD	Number of Events analyzed
	LHC13b	AOD126	~20M
	LHC13c	AOD126	~58M

Run numbers for the data sets:

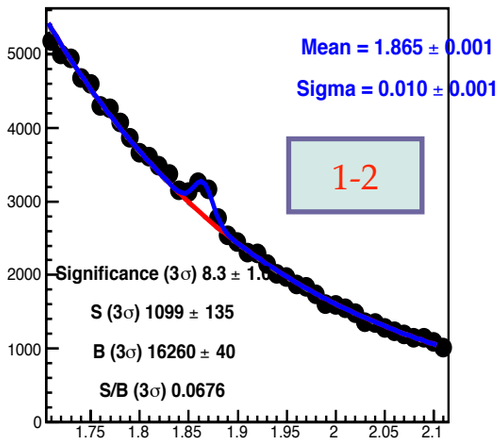
LHC13b:195344, 195346, 195351, 195389, 195390, 195391, 195478, 195479, 195480, 195481, 195482, 195483

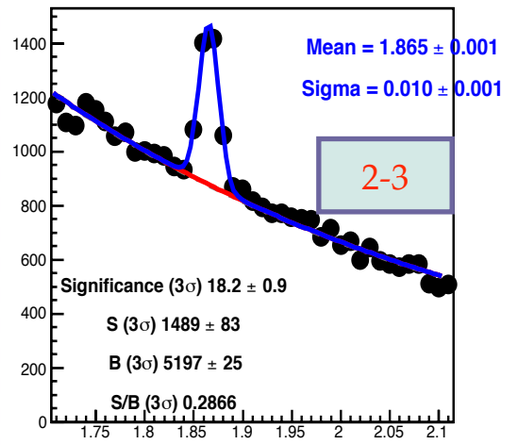
LHC13c:195529, 195531, 195566, 195567, 195568, 195592, 195593, 195596,195633, 195635, 195644, 195673, 195675, 195677

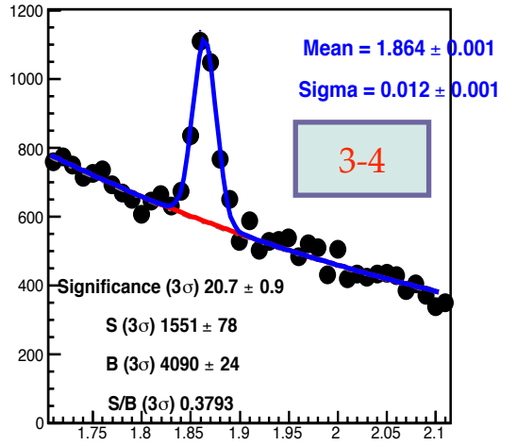
Invariant Mass plots for the Trigger particle:

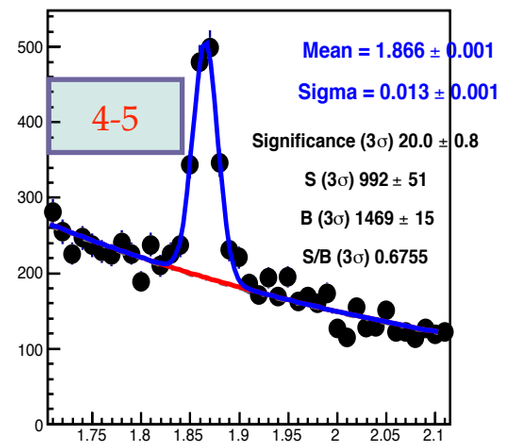
D^0 p_t 2 to 16 GeV/c

Low p_t 2-5 GeV/c

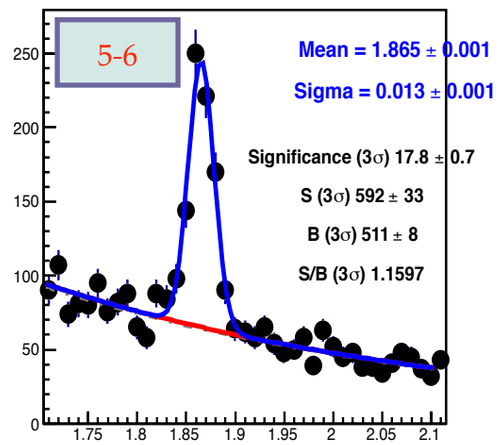


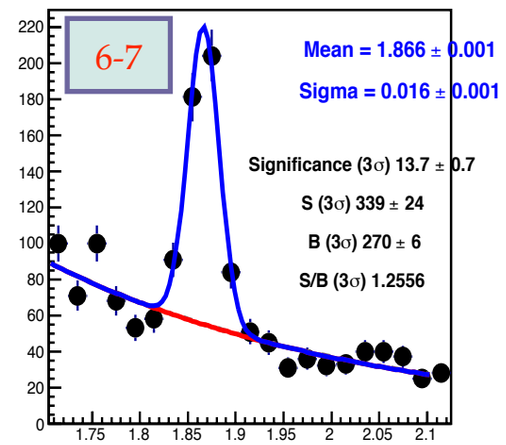


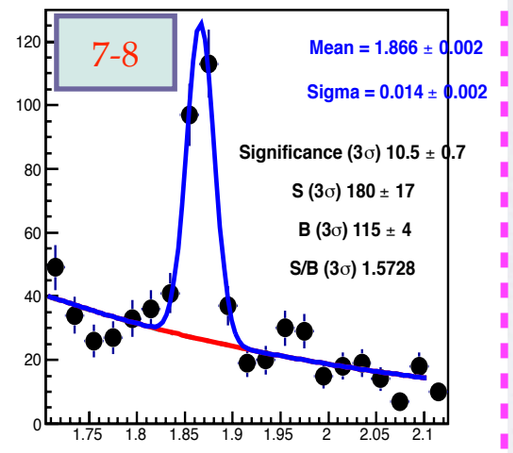




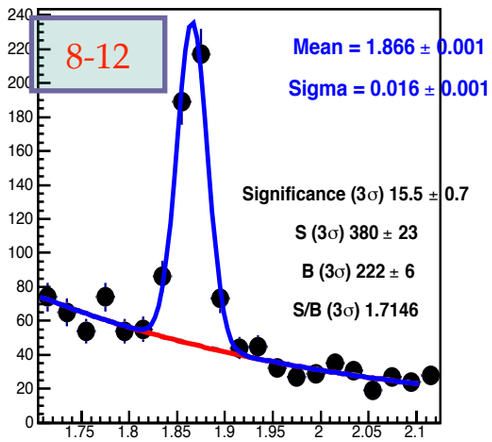
Mid p_t 5-8 GeV/c

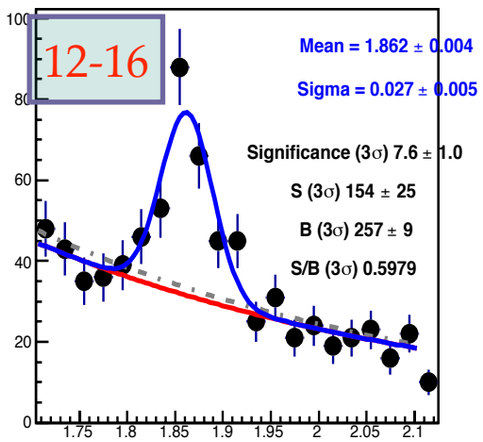


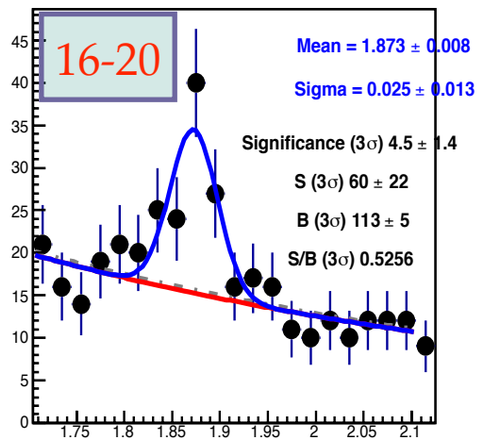




High p_t 8-16 GeV/c







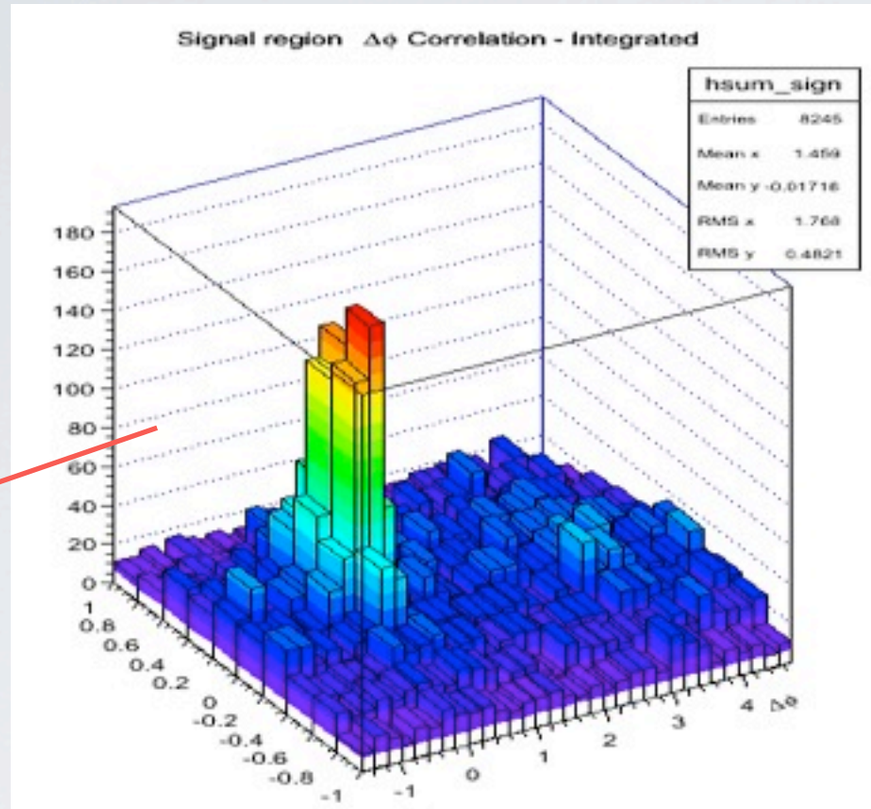
D^0-hadron Correlation plots:

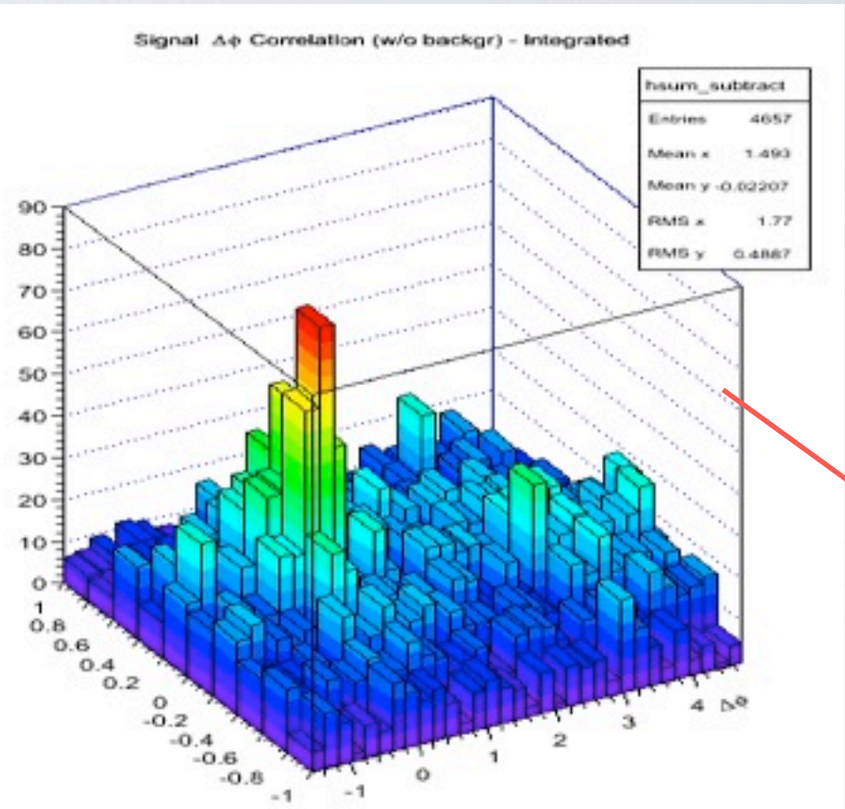
Ass. p_t >1 GeV/c

Raw $\Delta\eta$, $\Delta\Phi$ correlation distribution (SE)

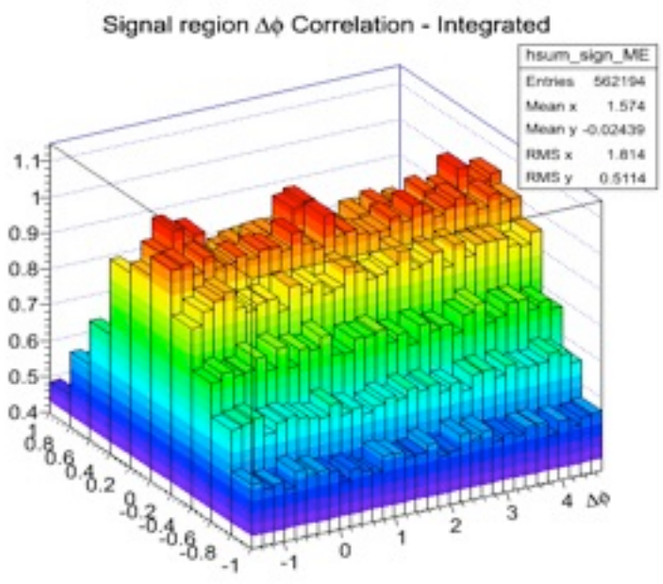
D^0 p_t 8-16 GeV/c

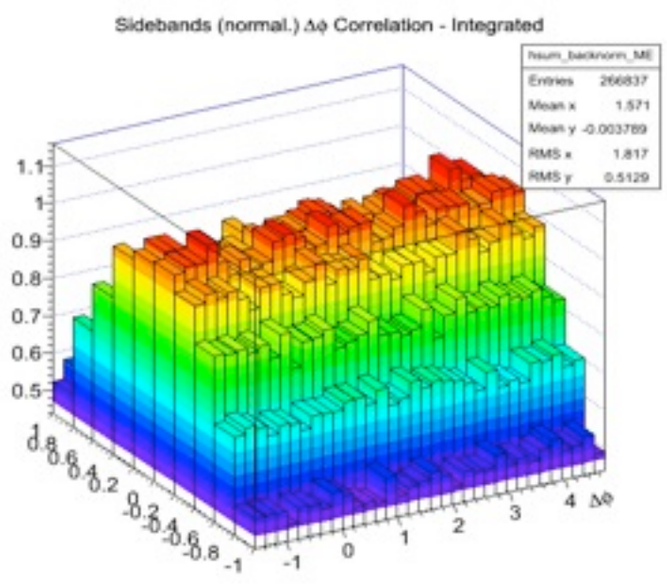
Inv. Mass
Signal region:
Signal+bkg





Sidebands:
Bkg only





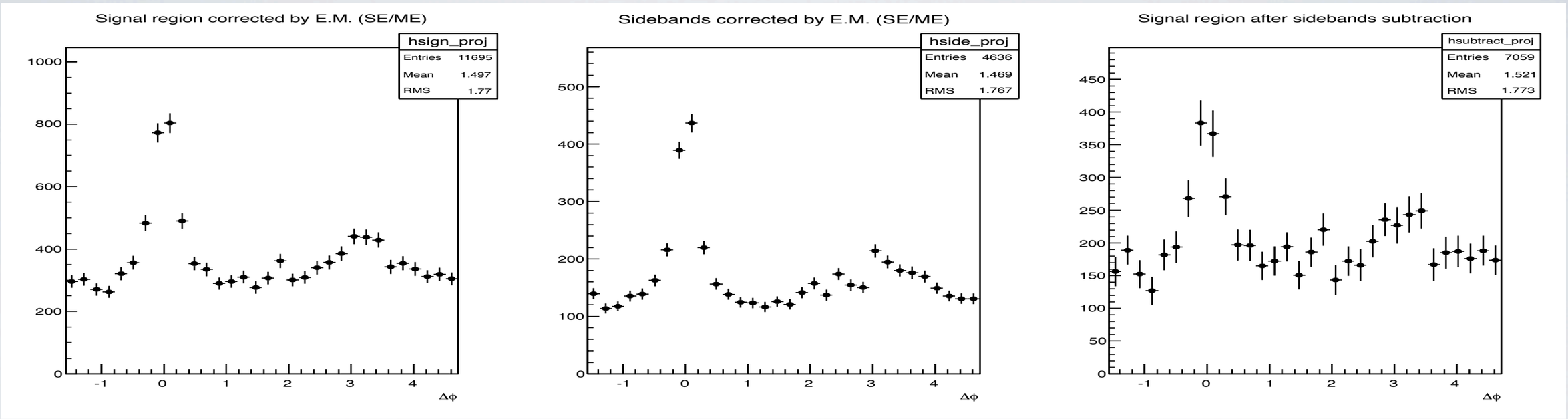
Triangular shape in $\Delta\eta$ induced by typical detector acceptance.

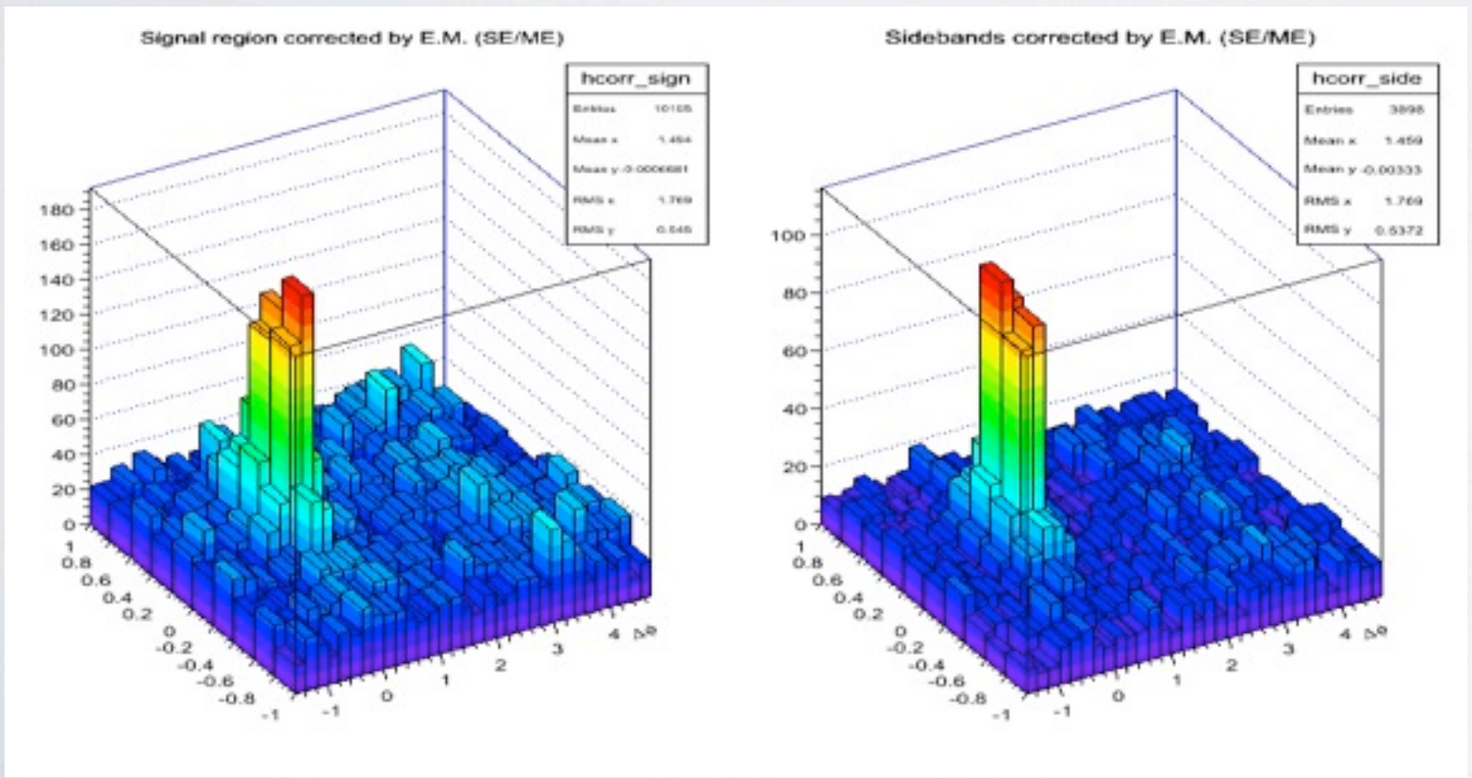
Event mixing procedure adopted from pp: still to be tuned for pPb case

D^0-hadron Correlation plots:

Ass. p_t >1 GeV/c

D^0 p_t 8-16 GeV/c



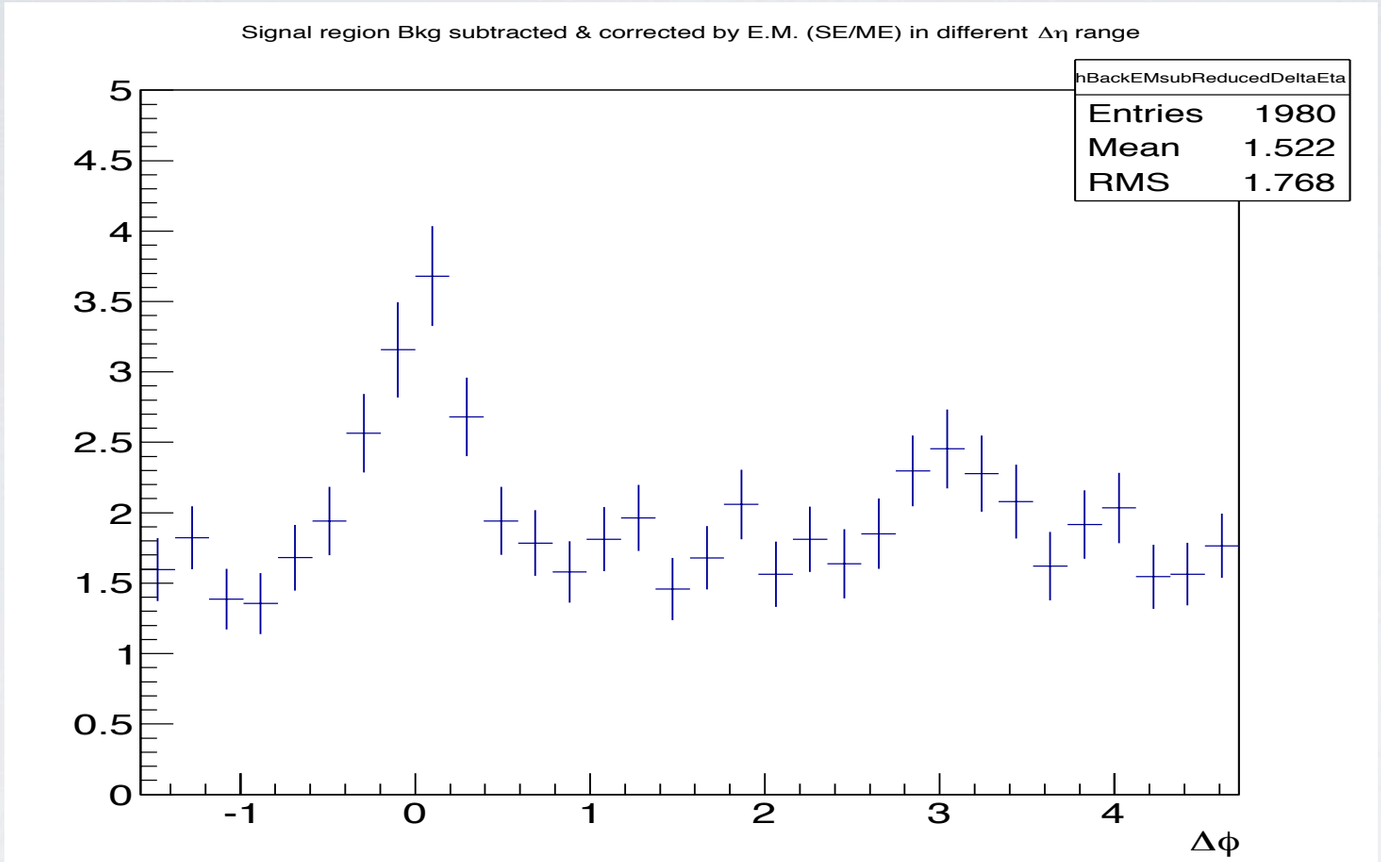


- Here the above plot shows the ME corrected ΔΦ corr, in Signal region, sideband region,and signal region sideband subtracted.
- The bottom left plot shows Signal region(with bkg), sideband region ME corrected (Δη,ΔΦ) lego plots.

D^0-hadron Correlation plots:

Ass. p_t >1 GeV/c

D^0 p_t 8-16 GeV/c



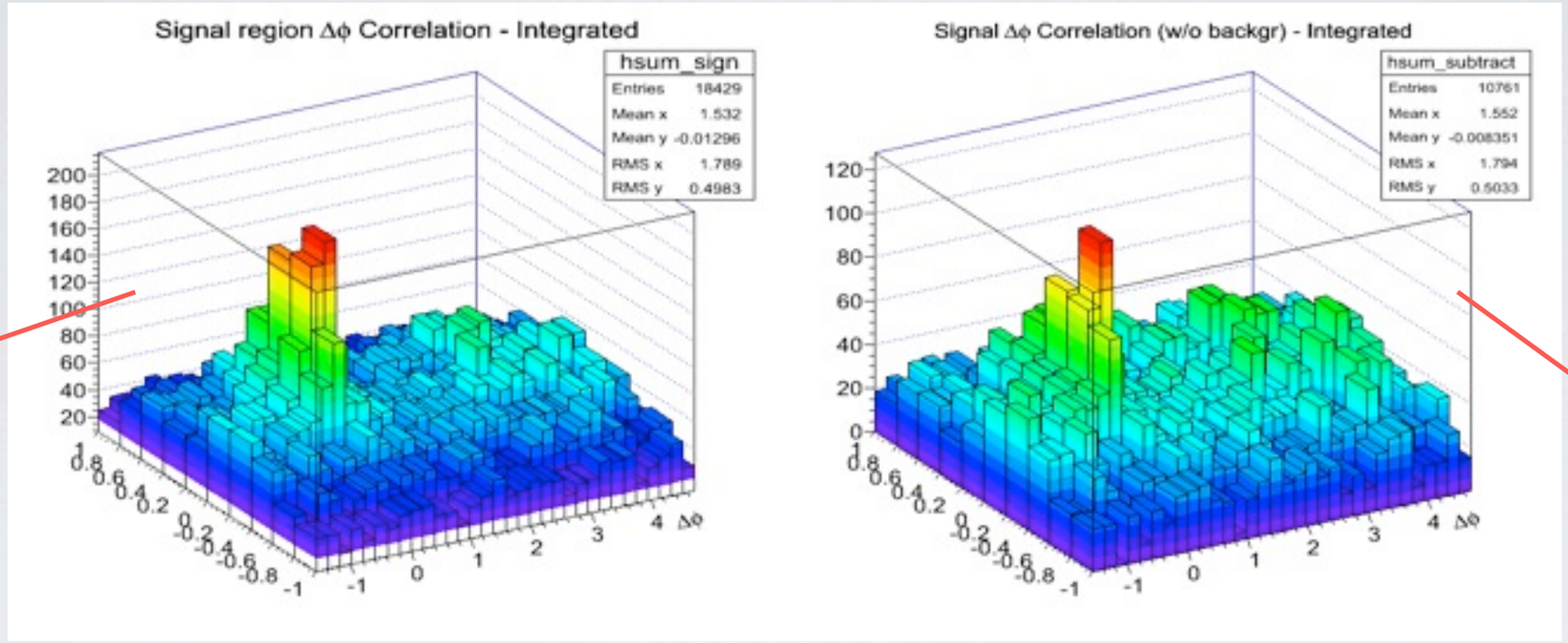
Signal region side band subtracted and normalized per trigger and binwidth. The near side peak is visible over the pedestal from uncorrelated (D0, hadron) pairs but yet to conclude further.

D^0-hadron Correlation plots:

Ass. p_t >1 GeV/c

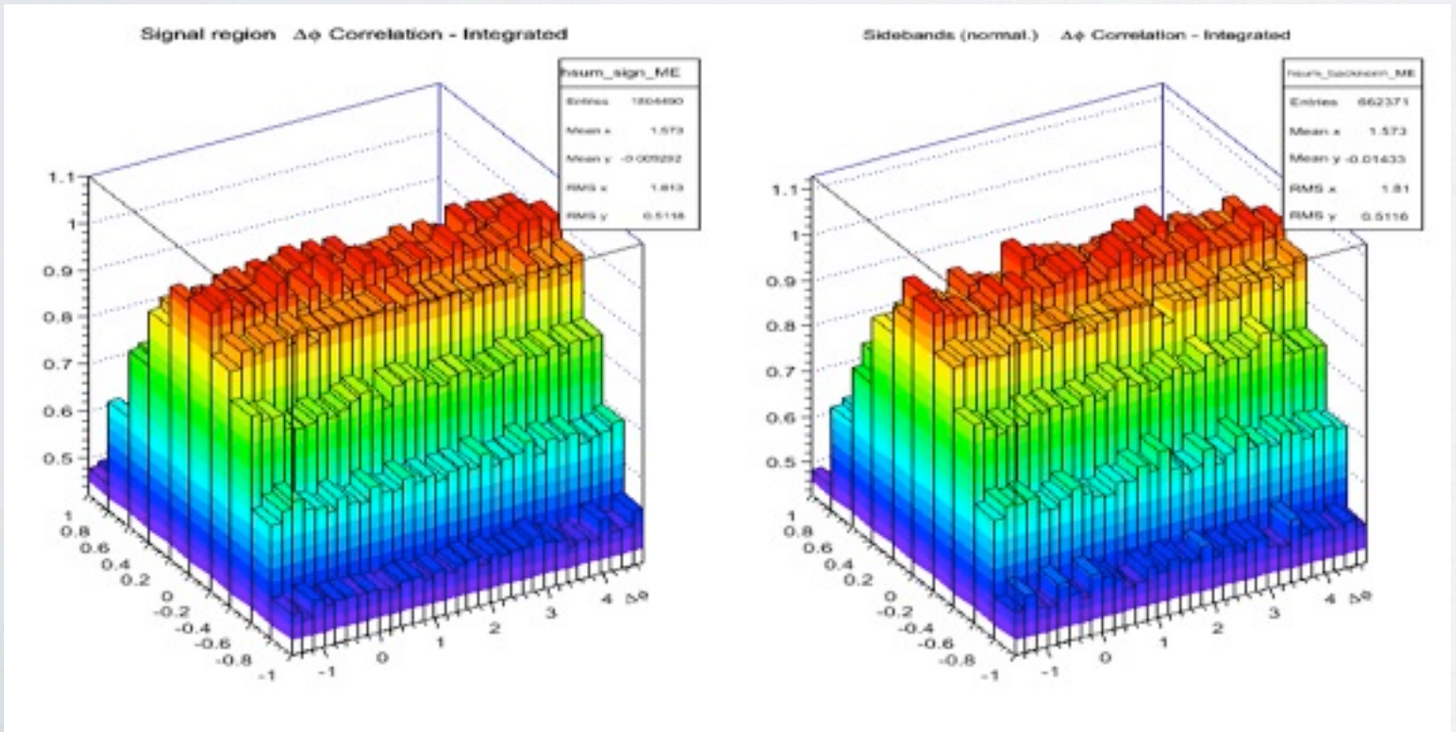
Raw Δη,ΔΦ correlation distribution(SE)

D^0 p_t 5-8GeV/c



Inv. Mass
Signal region:
Signal+bkg

Sidebands:
Bkg only

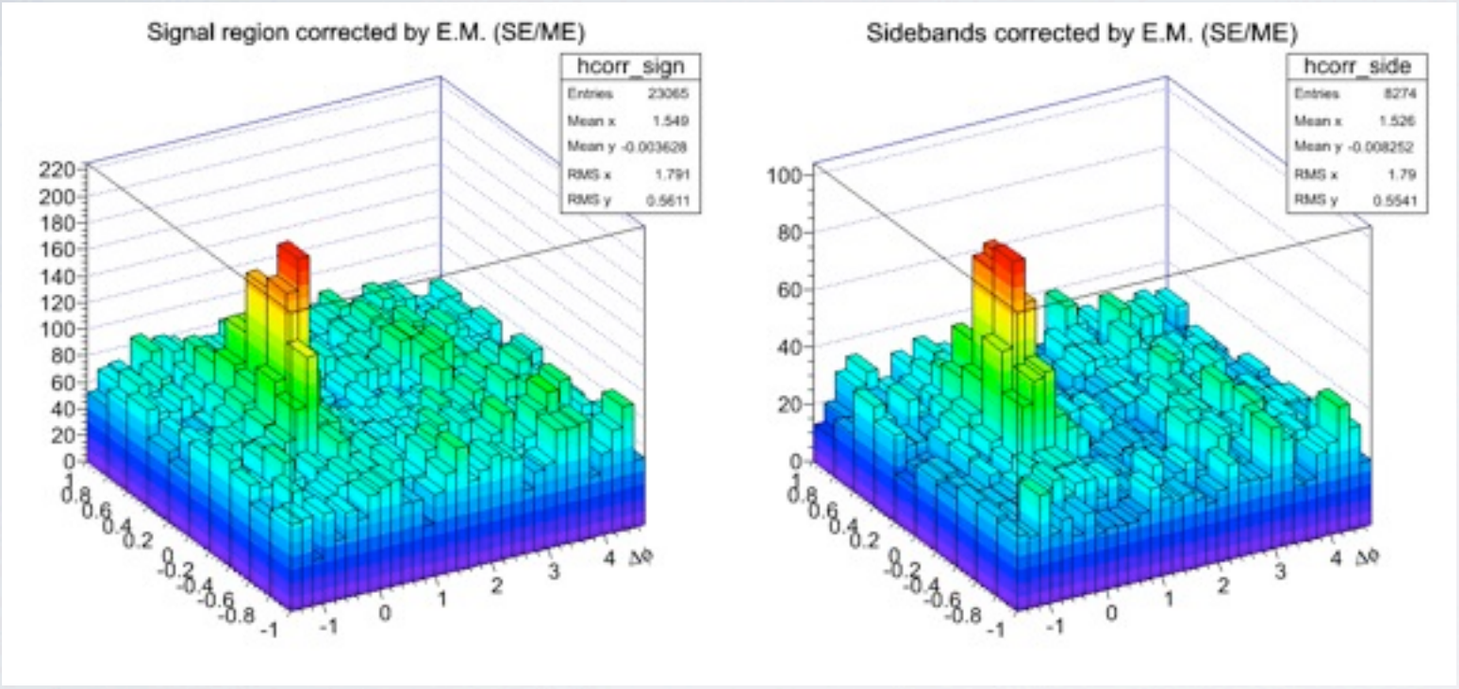


This is the event mixing correlation plot.

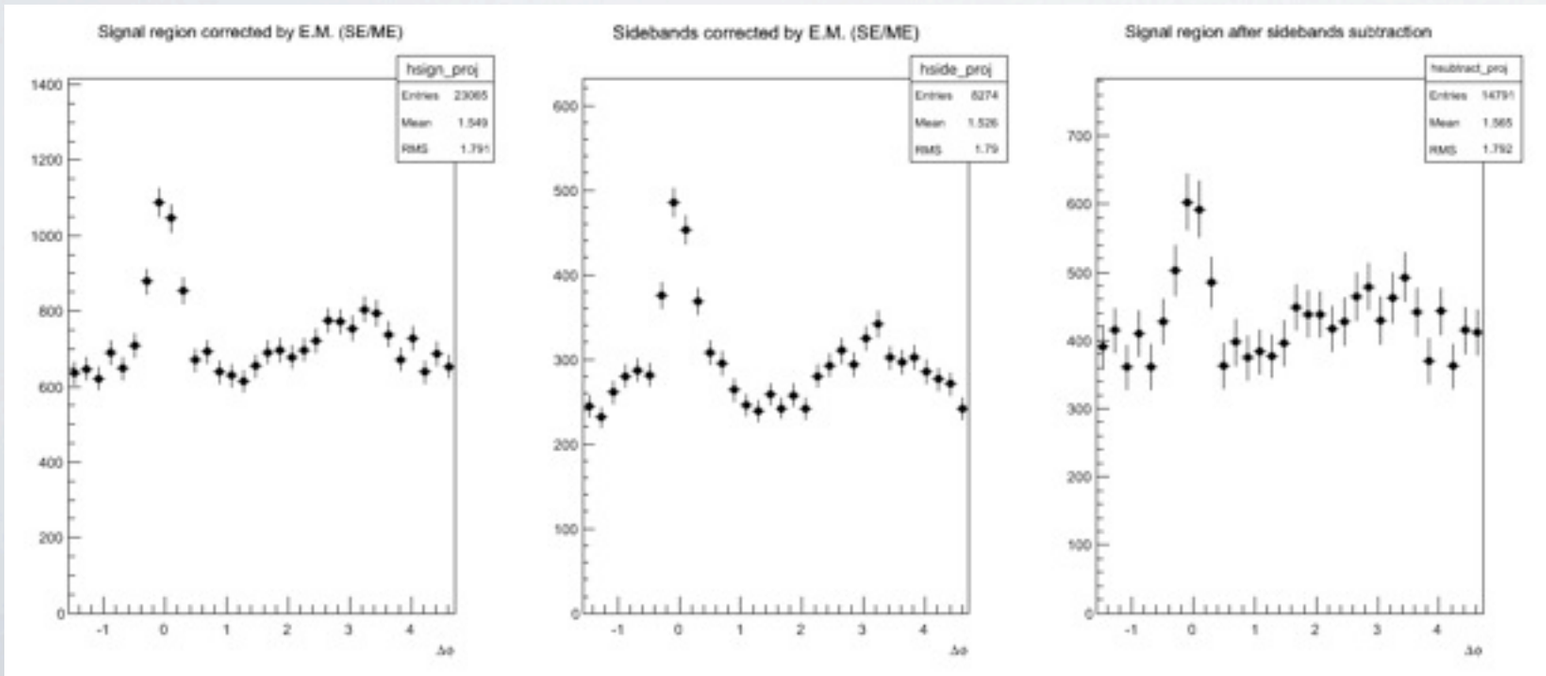
D0-hadron Correlation plots:

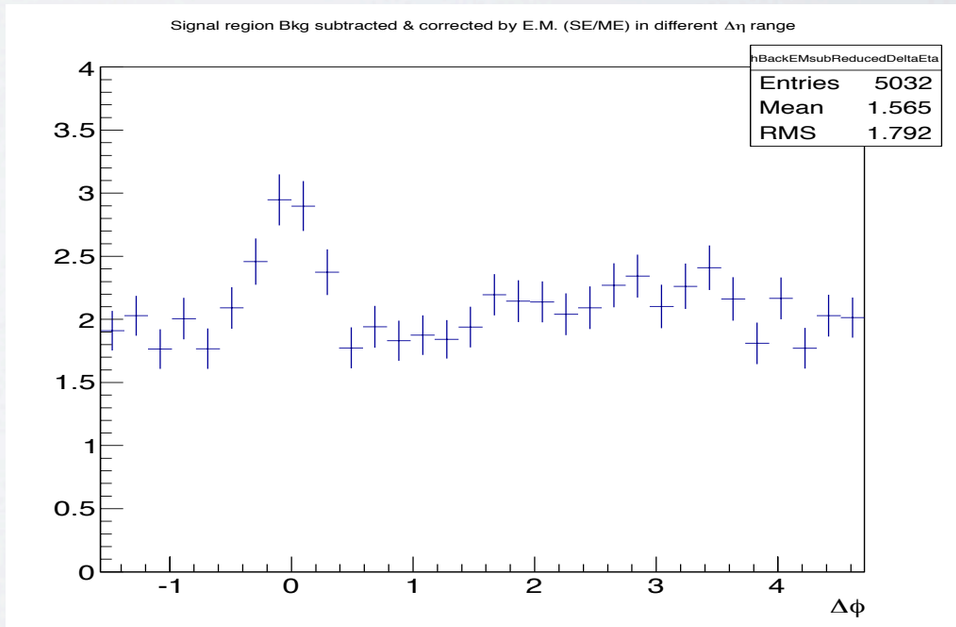
Ass. p_t >1 GeV/c

D^0 p_t 5-8GeV/c



- The upper left plot shows Signal region(with bkg), sideband region ME corrected (Δη, Δφ) lego plots
- The bottom left plot shows the ME corrected Δφ corr, in Signal region (with bkg), sideband region,and signal region sideband subtracted.
- The bottom right is the signal region side band subtracted and normalized per trigger and binwidth. The near side peak visible over the pedestal from uncorrelated (D0,hadron) pairs.



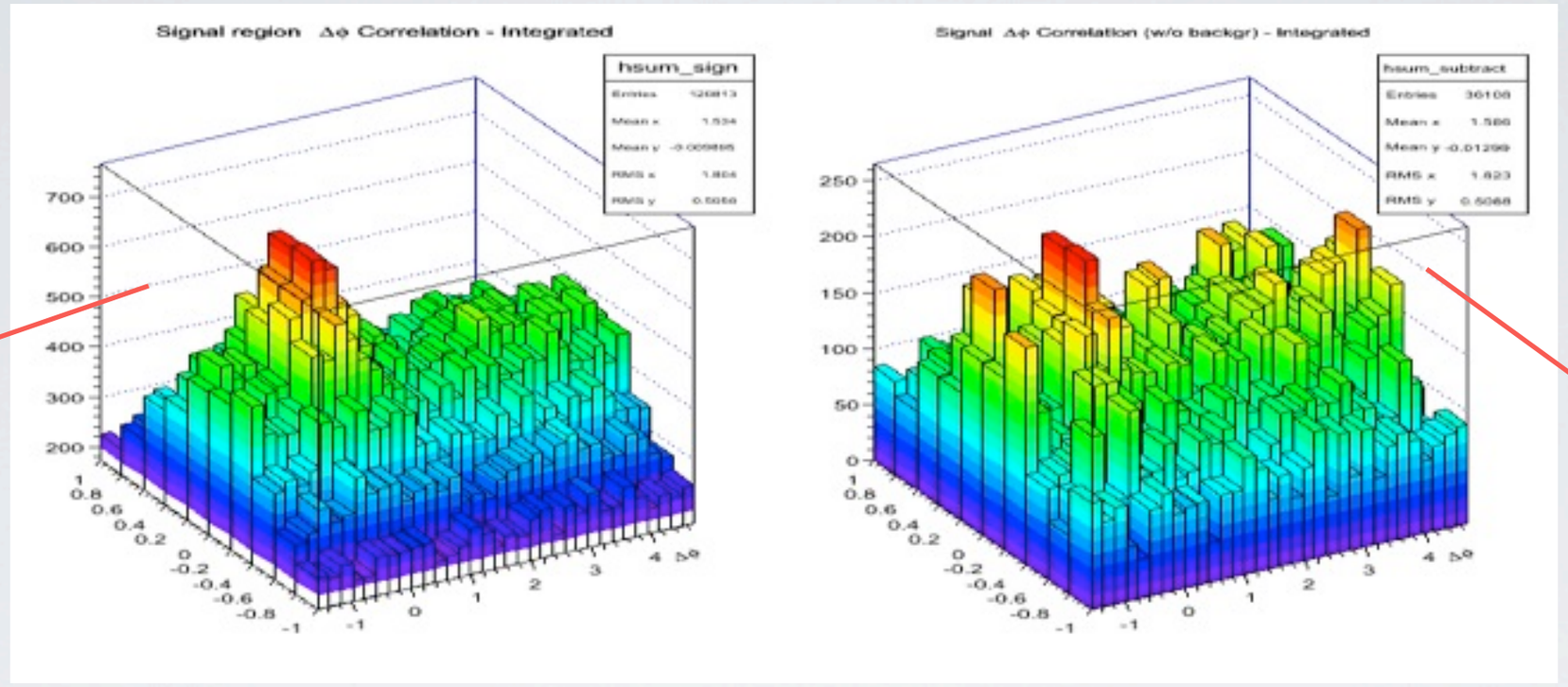


D^0-hadron Correlation plots:

Ass. p_t >1 GeV/c

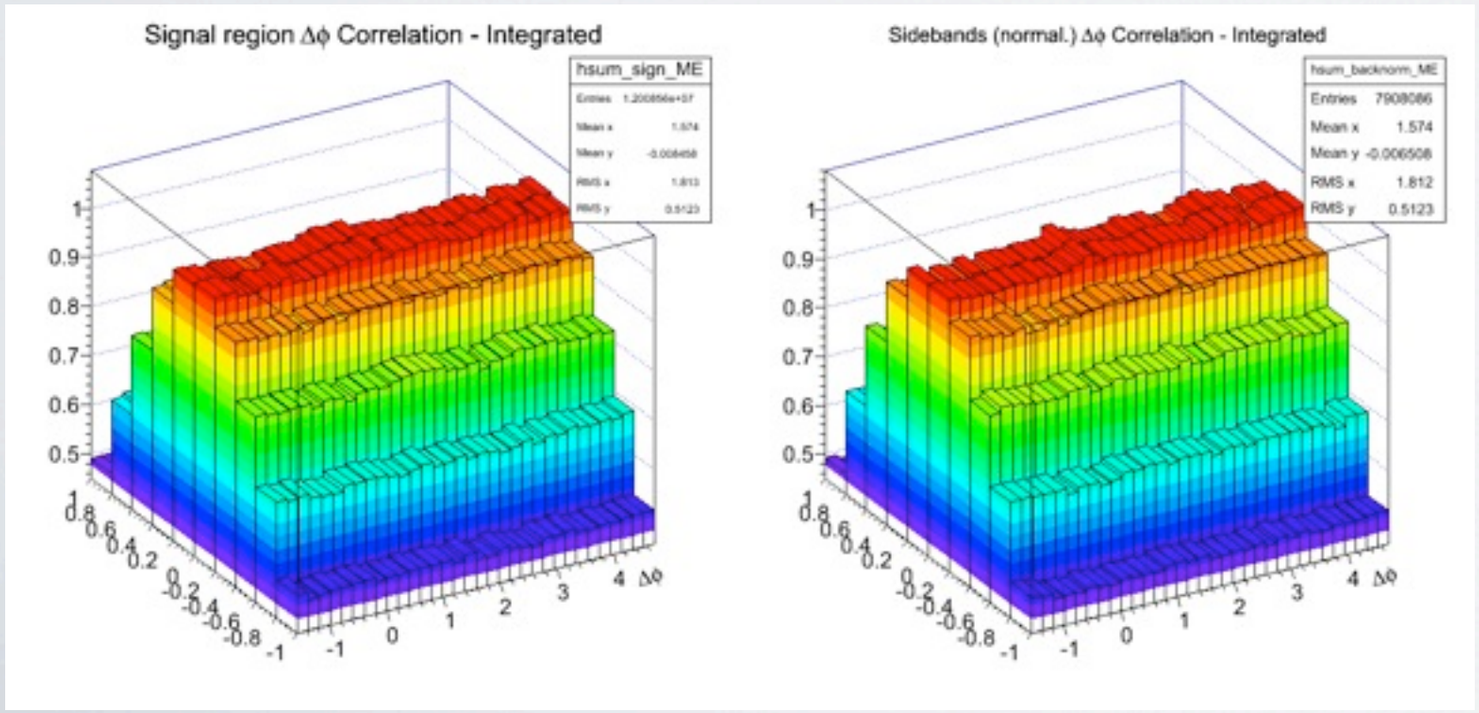
Raw $\Delta\eta,\Delta\Phi$ correlation distribution (SE)

D^0 p_t 2-5GeV/c



Inv. Mass
Signal region:
Signal+bkg

Sidebands:
Bkg only



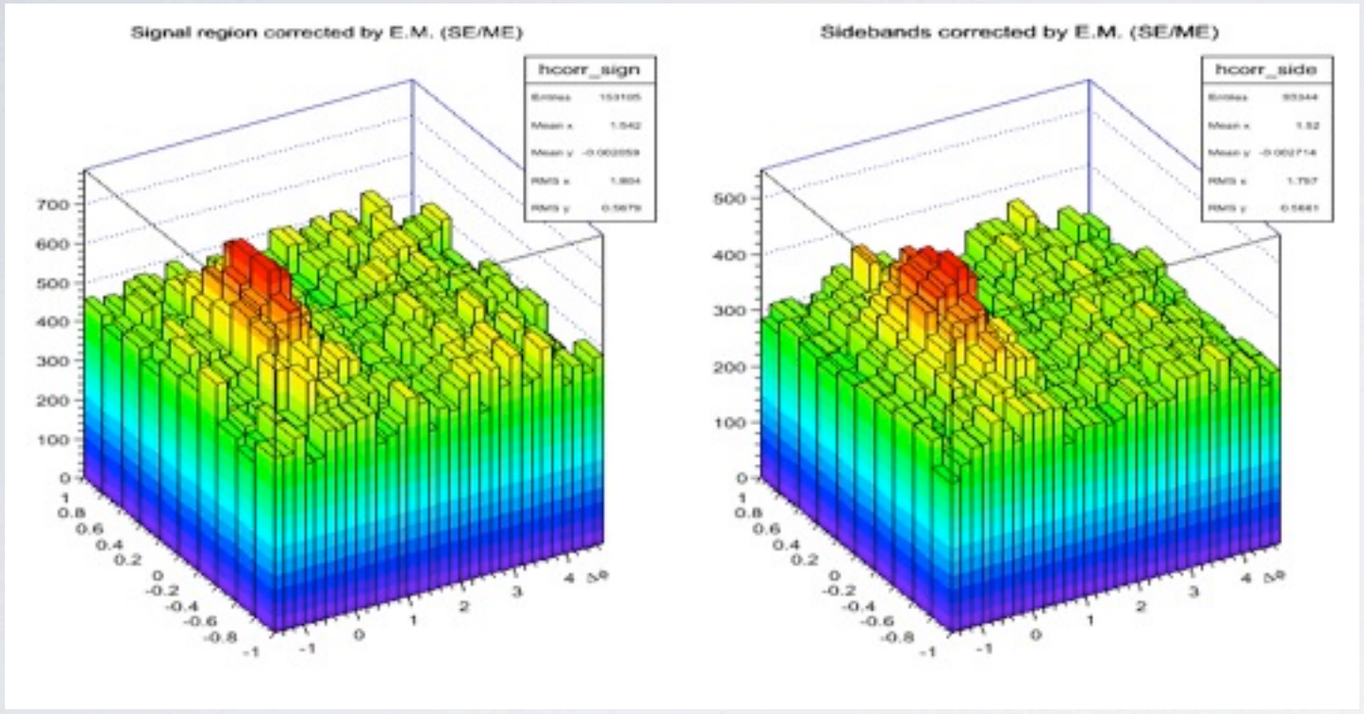
Here we can see that with the low D^0 p_t we have much more background fluctuation.

The bottom left is the event mixing correlation plot.

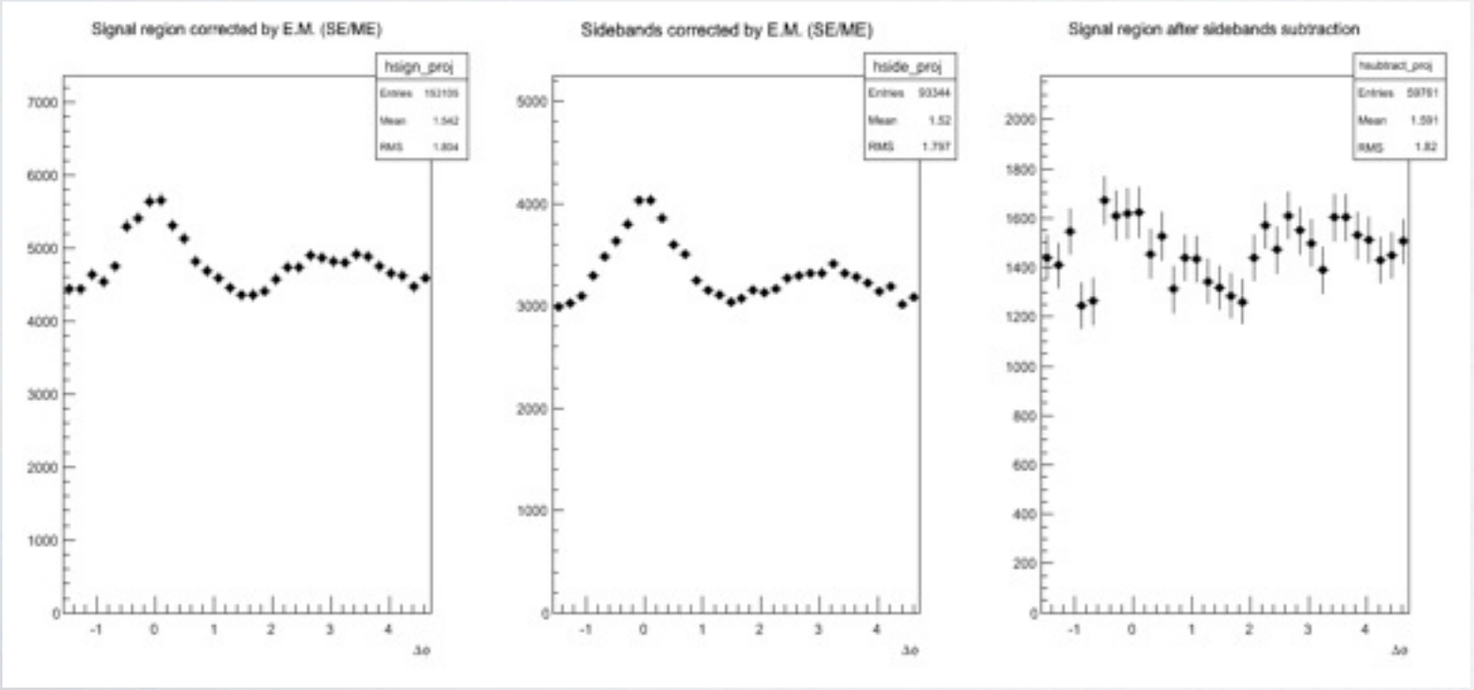
D^0-hadron Correlation plots:

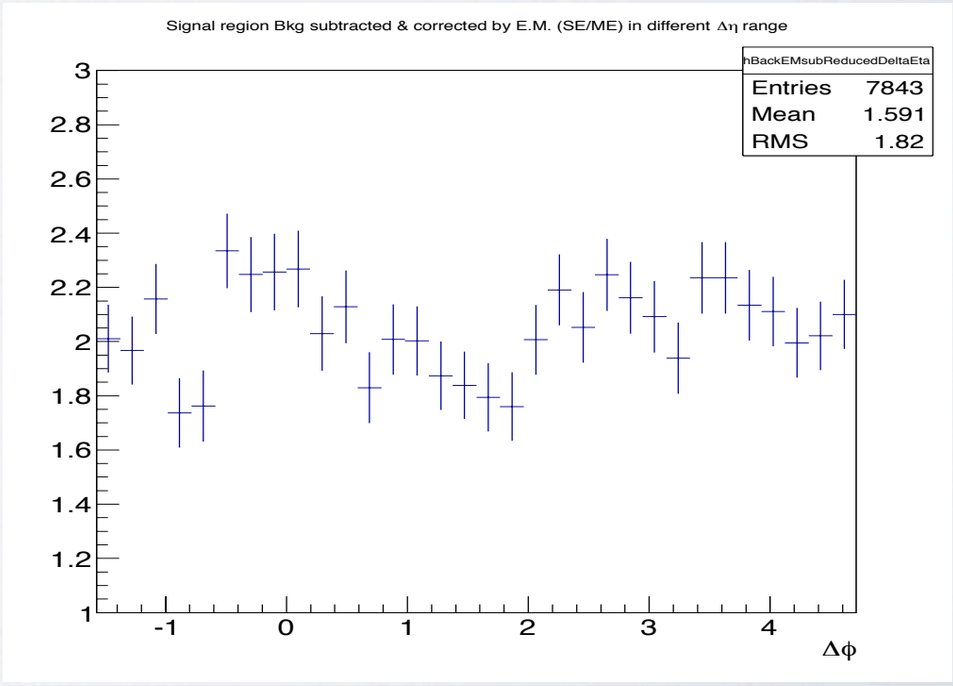
Ass. p_t >1 GeV/c

D^0 p_t 2-5GeV/c



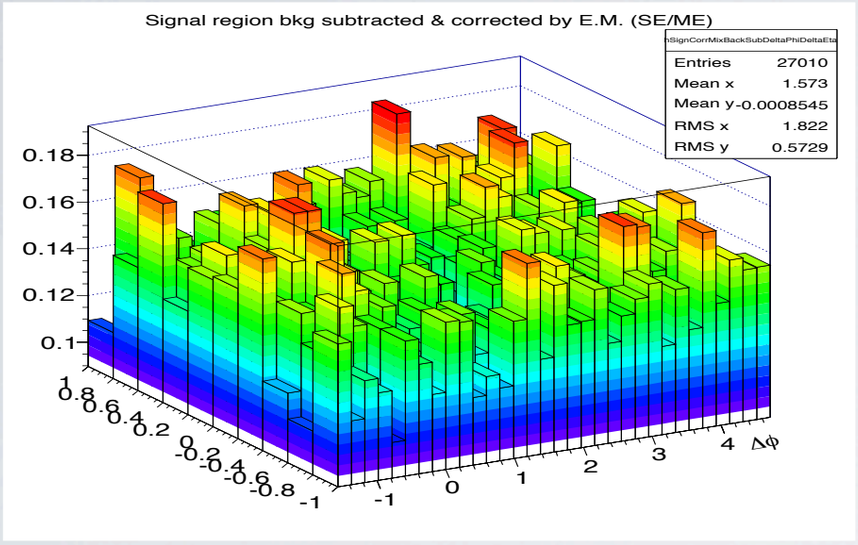
- The bottom left plot shows Signal region(with bkg), sideband region ME corrected (ΔΗ,ΔΦ) lego plots.
- The bottom left plot shows the ME corrected ΔΦ corr, in Signal region, sideband region,and signal region sideband subtracted.
- The bottom right is the side band subtracted and normalized per trigger and binwidth.

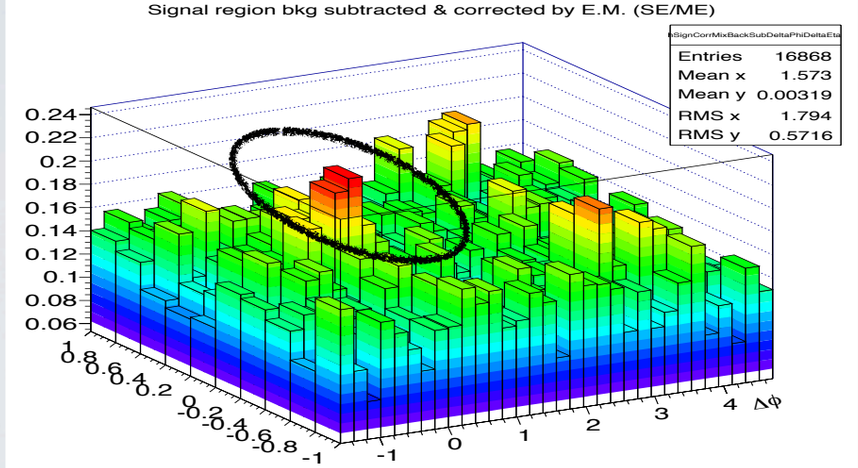


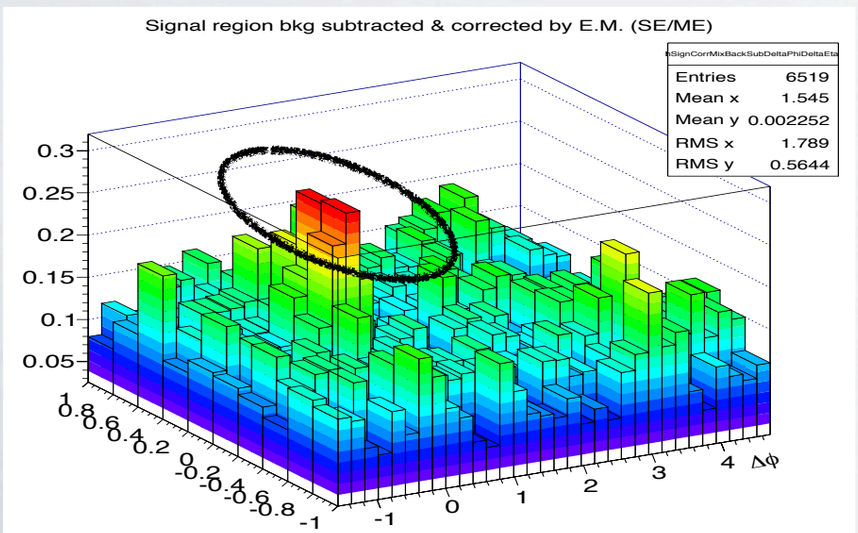


The same plots for the Associated p_t threshold 0.3 and 0.5 and 2GeV/c are done and 0.3GeV/c case showed in the backup slides.Now we are going to show comparison of correlation lego plots with different Ass. pt threshold.

Ass. p_t >0.3 GeV/c







2-5 Gev/c

Here in the low p_t range no visible corr. peaks on near and away side for both Ass.Track p_t thresholds

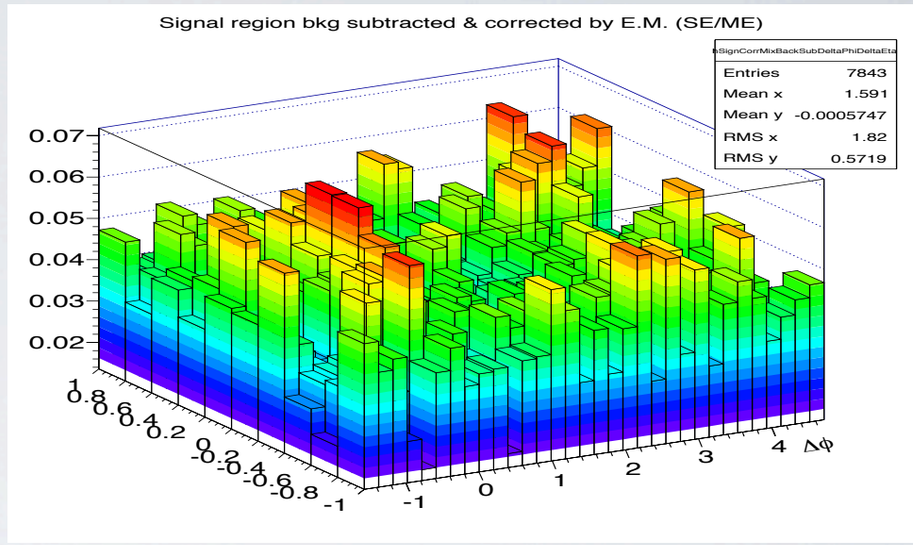
5-8 GeV/c

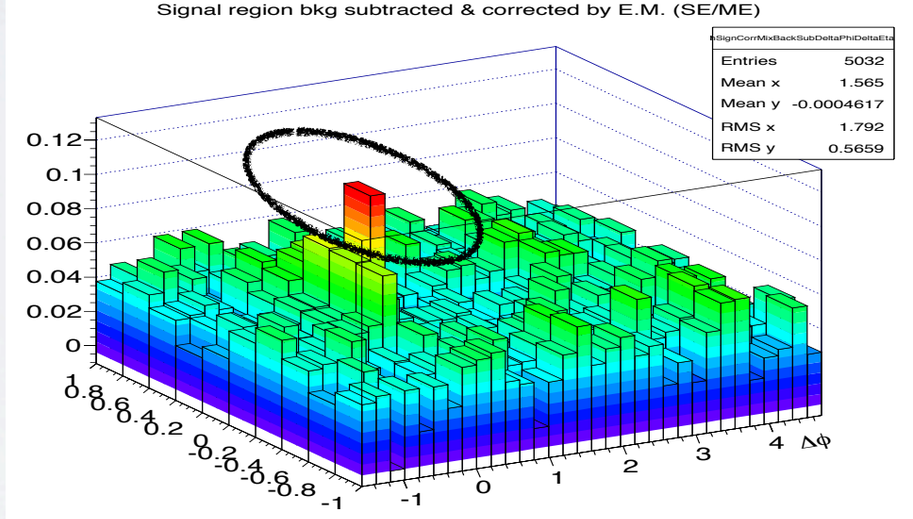
Here in the mid p_t range we have some visibility of corr. peaks on near side for both p_t thresholds, better with higher p_t threshold but yet to conclude more.

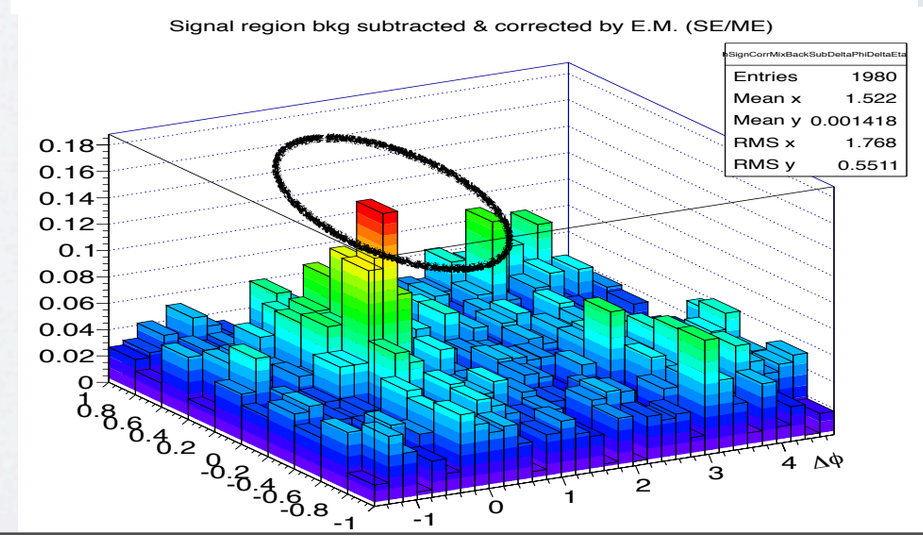
8-16 GeV/c

Here in the high p_t range we have some visibility of corr. peak on near side but can not say anything about away side.

Ass. p_t >1 GeV/c







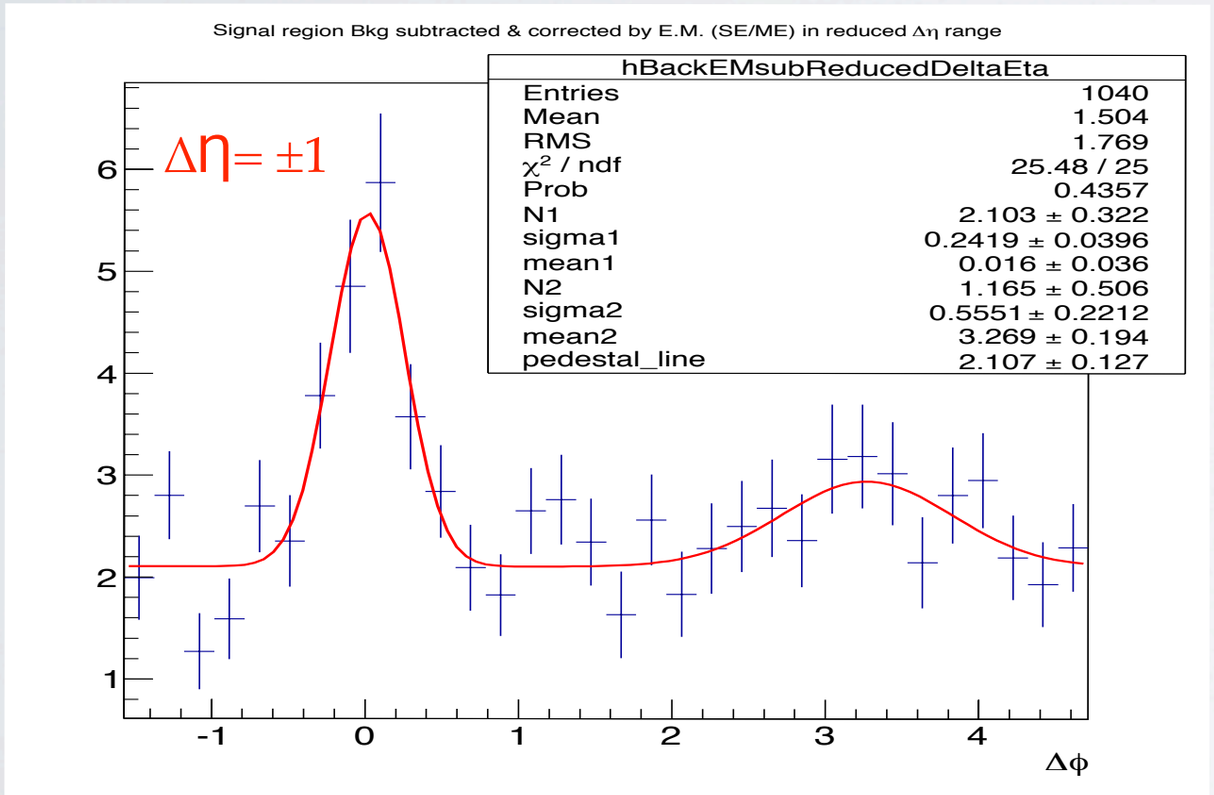
Fitting of the Correlation plots:

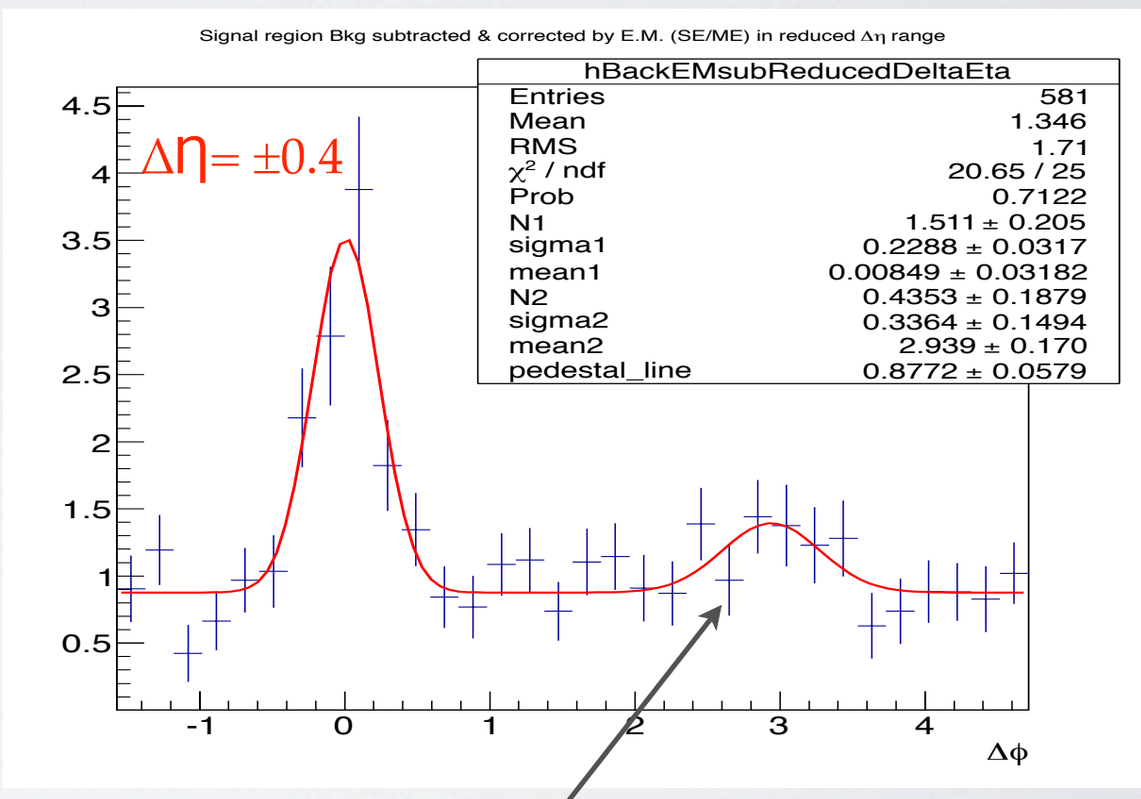
We fit the correlation distributions with a sum of two gaussians(near and away side peak) and one constant(for the base line).We project the 2D correlation plots on ΔΦ restricting to different Δη ranges. We show only the plots with Ass.Track pt>1 GeV/c and from the fitted gaussian curve we take the near side yield and sigma for further study.

ΔΦ Correlation Plots in different Δη range with norm. per Trigger and bin width

Ass p_t>1 GeV/c

D^0 p_t 8-16 GeV/c





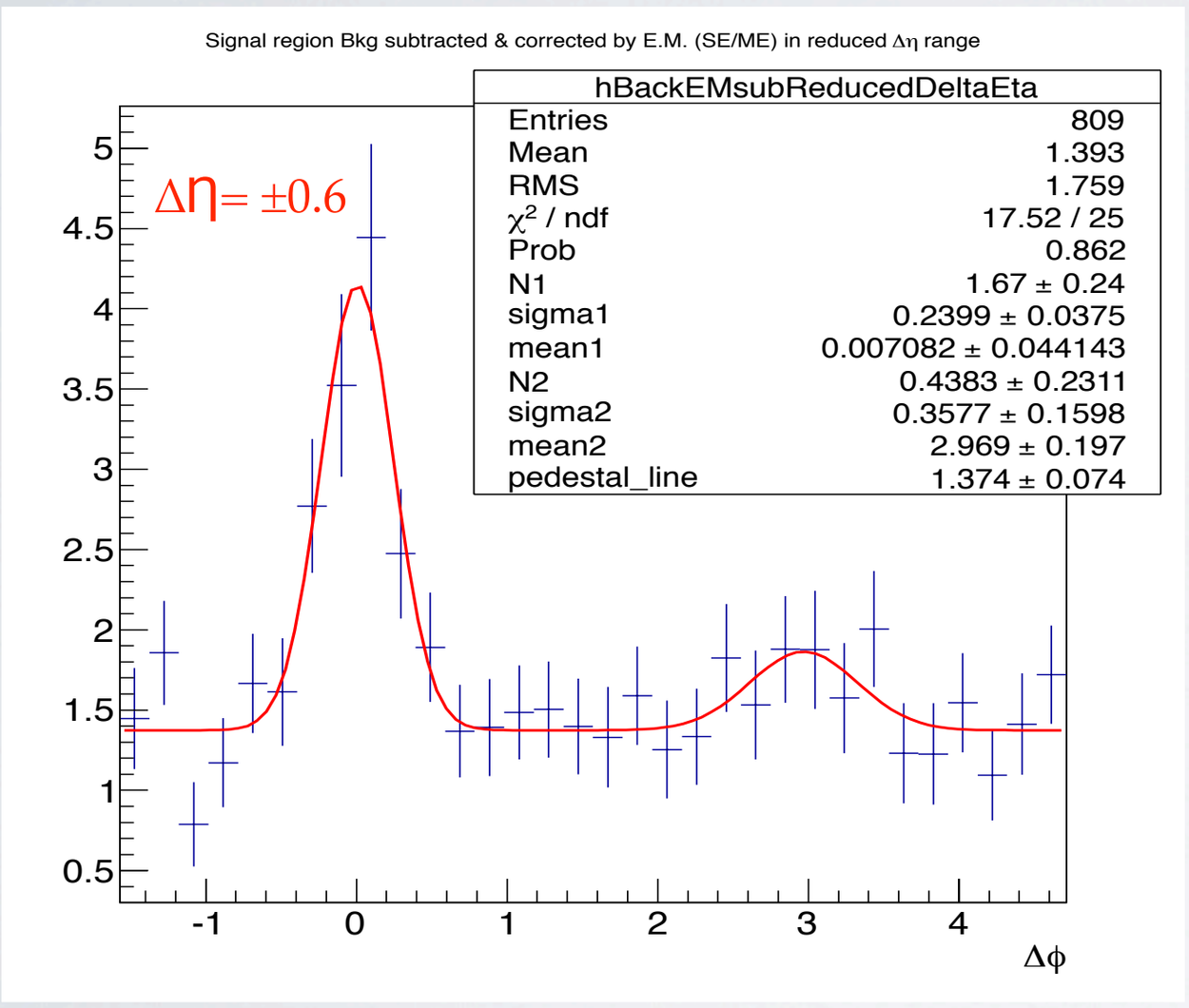
away side peak reduces as expected when reducing the range of Δη because of the recoiling jet is distributed in the wide Δη range

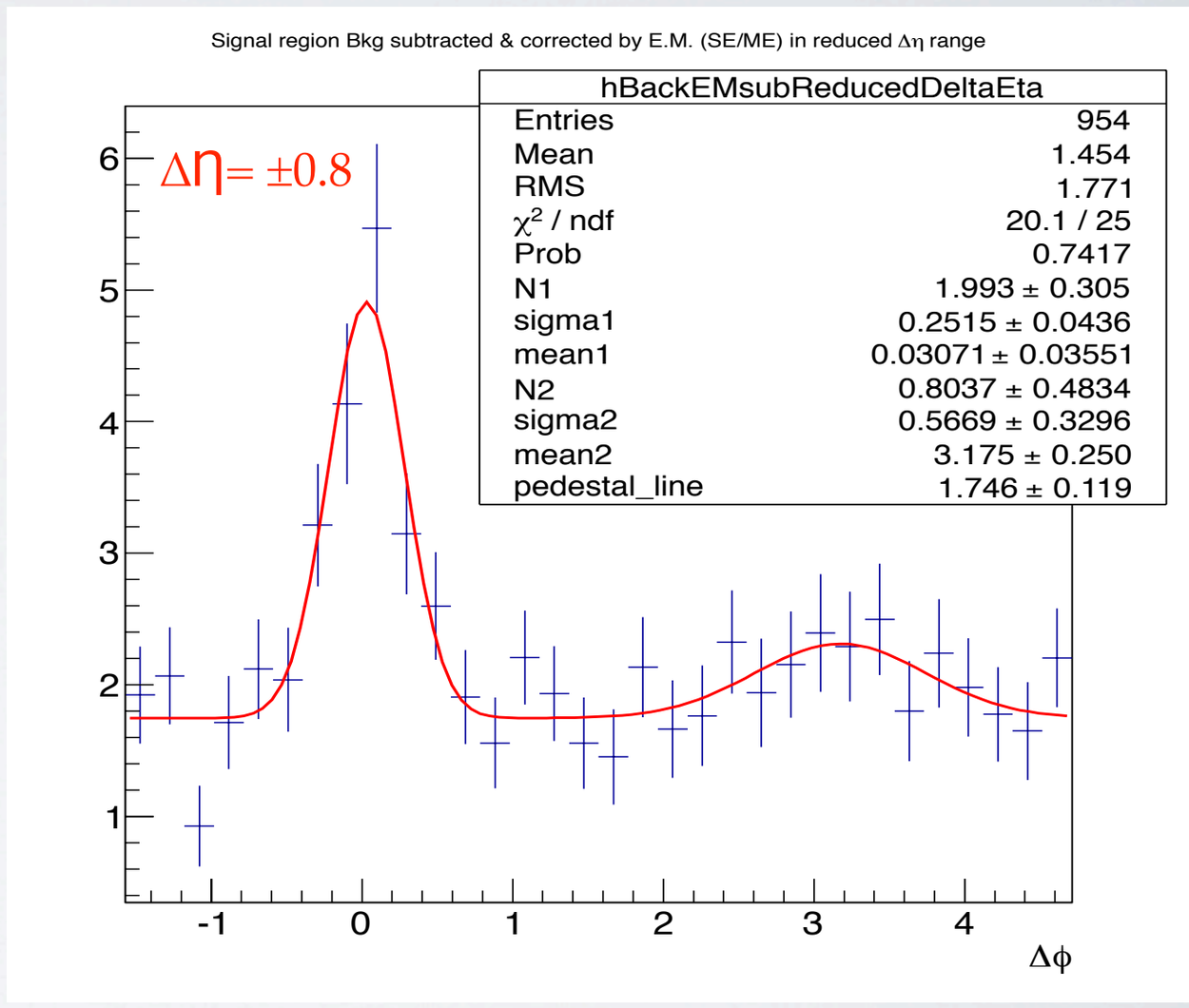
Fitting of the Correlation plots:

ΔΦ Correlation Plots in different Δη range with norm. per Trigger and bin width

Ass p_t>1 GeV/c

D^0 p_t 8-16 GeV/c



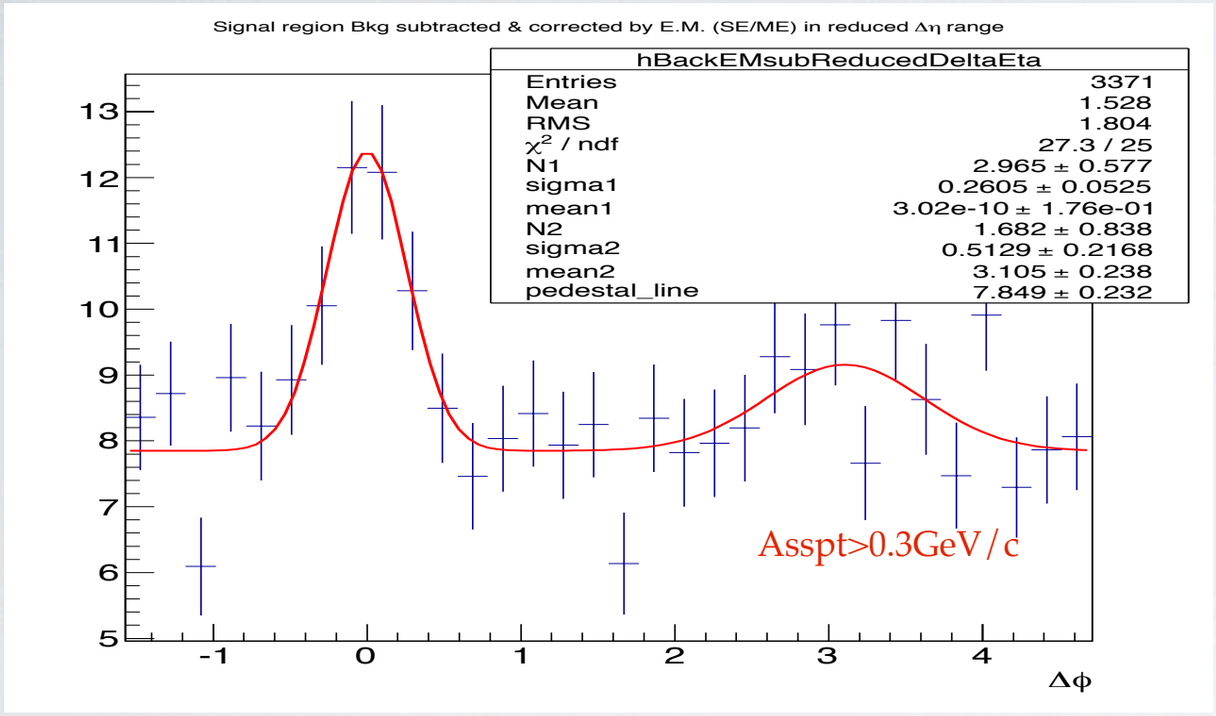


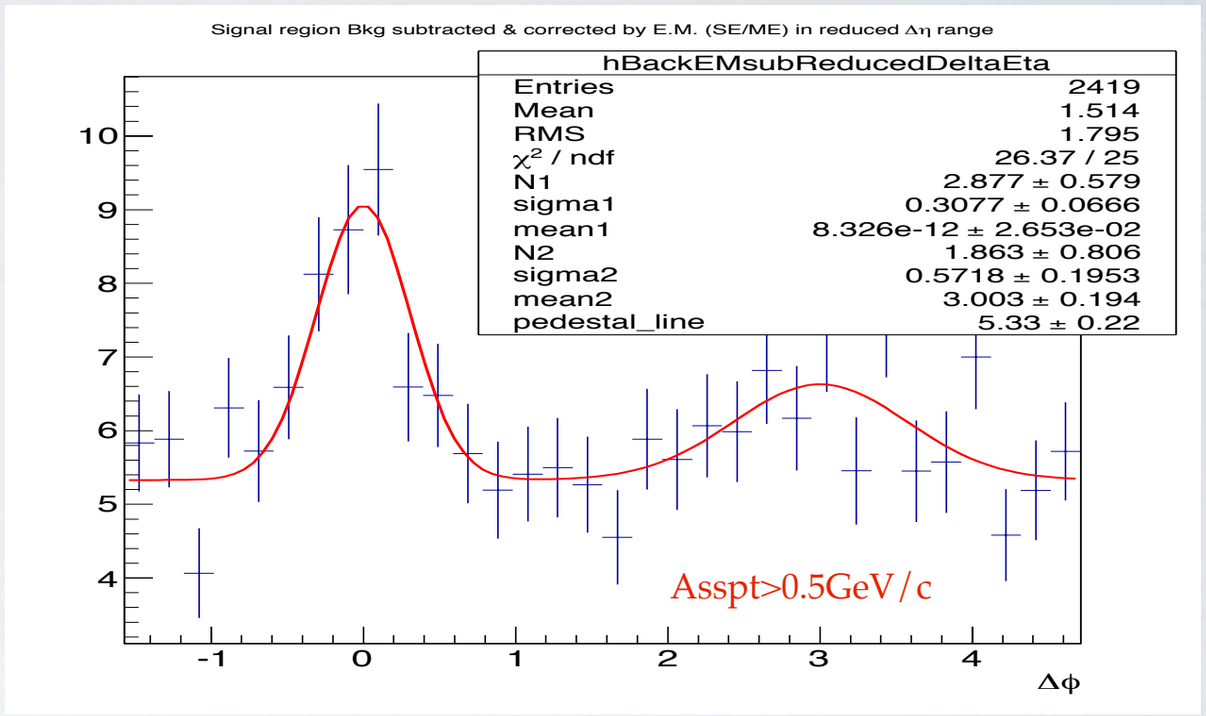
ΔΦ Correlation Plots Δη= ±1 with diff. Ass.pt threshold with norm. per Trg and bin width:

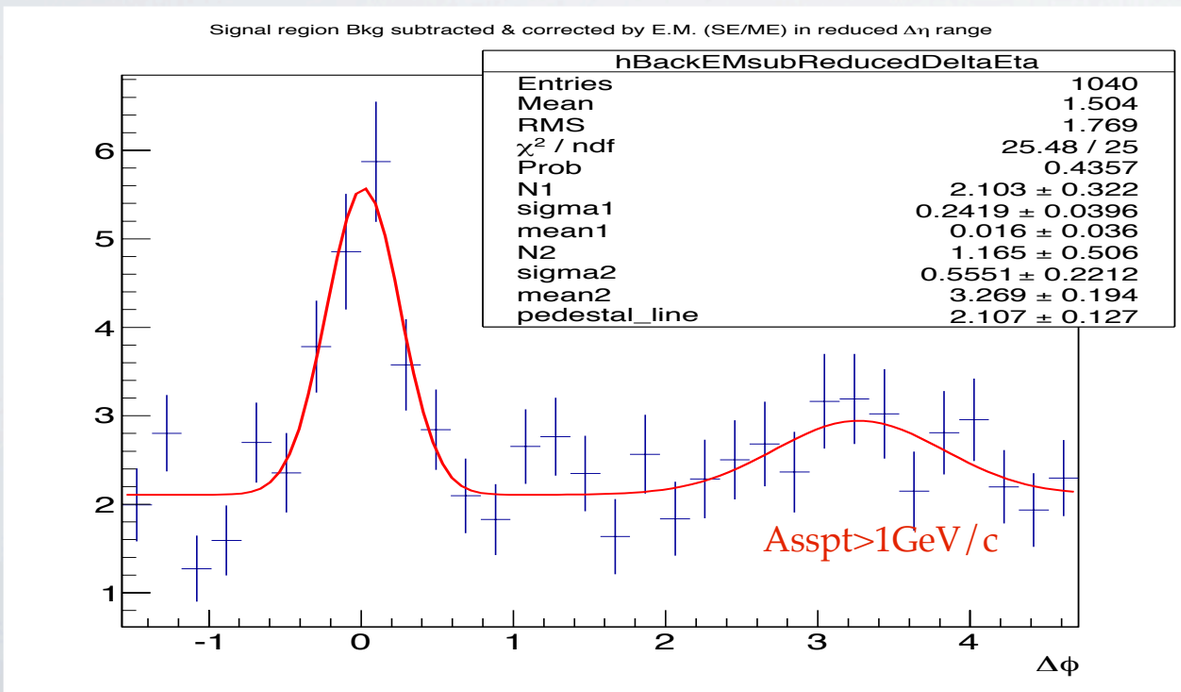
Ass p_t>1 GeV/c

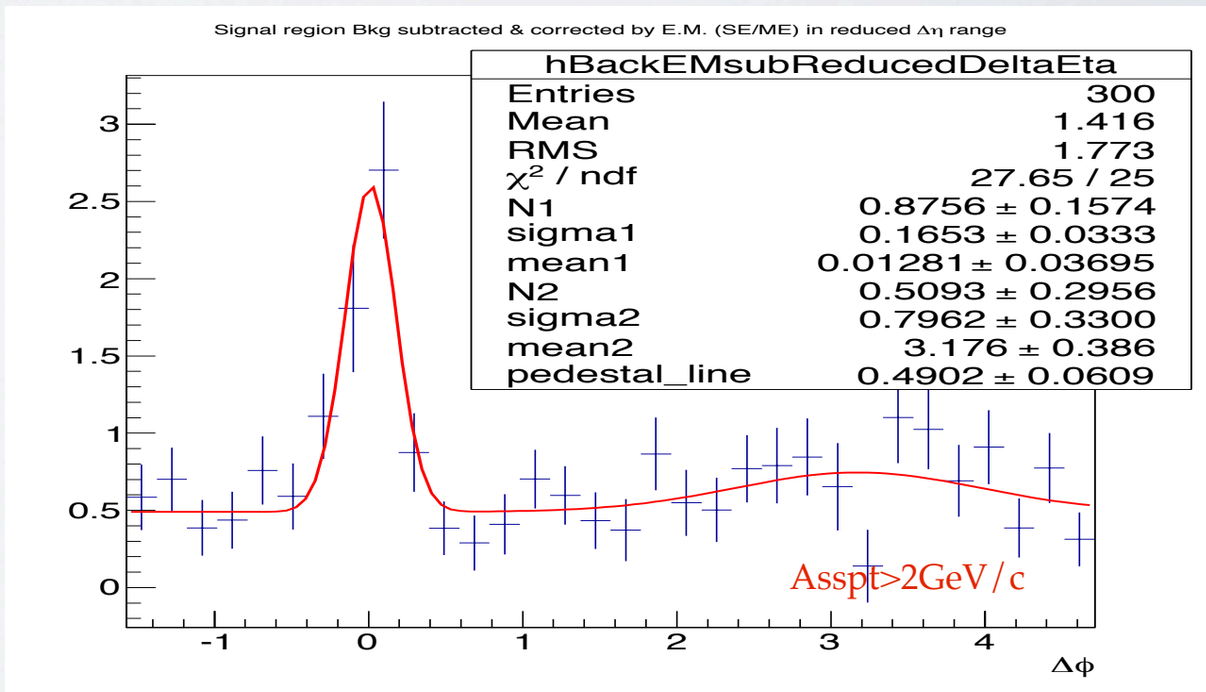
Δη=±1

D^0 p_t 8-16 GeV/c

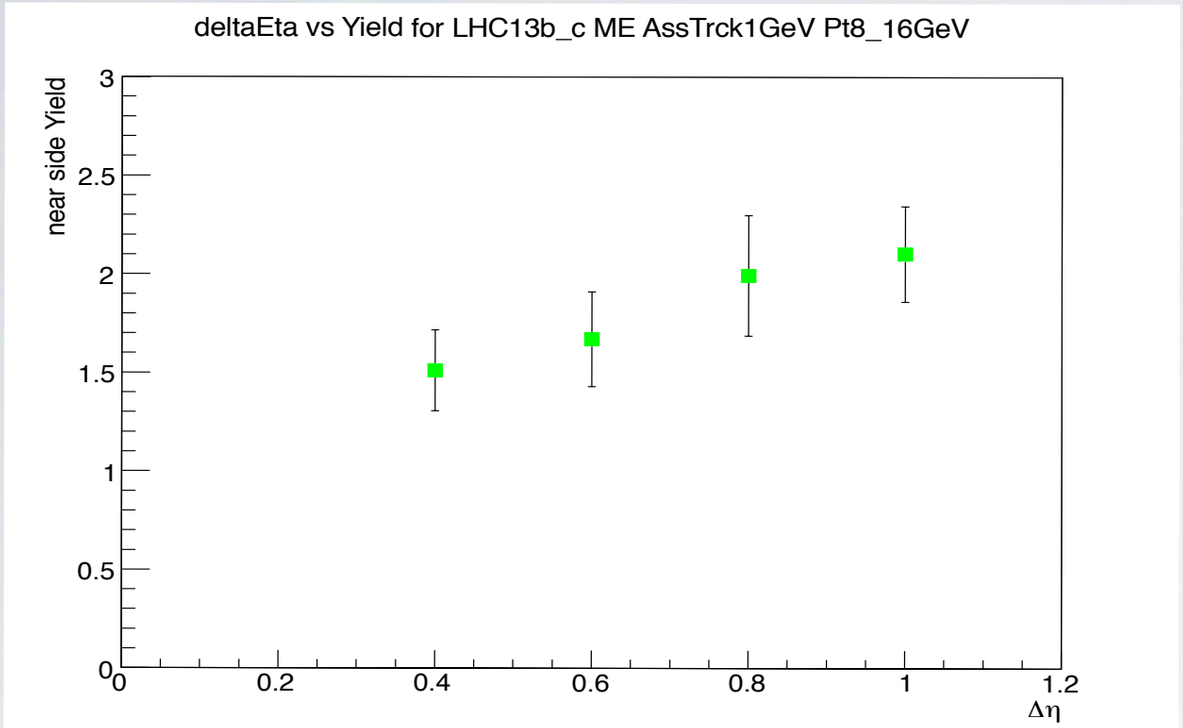


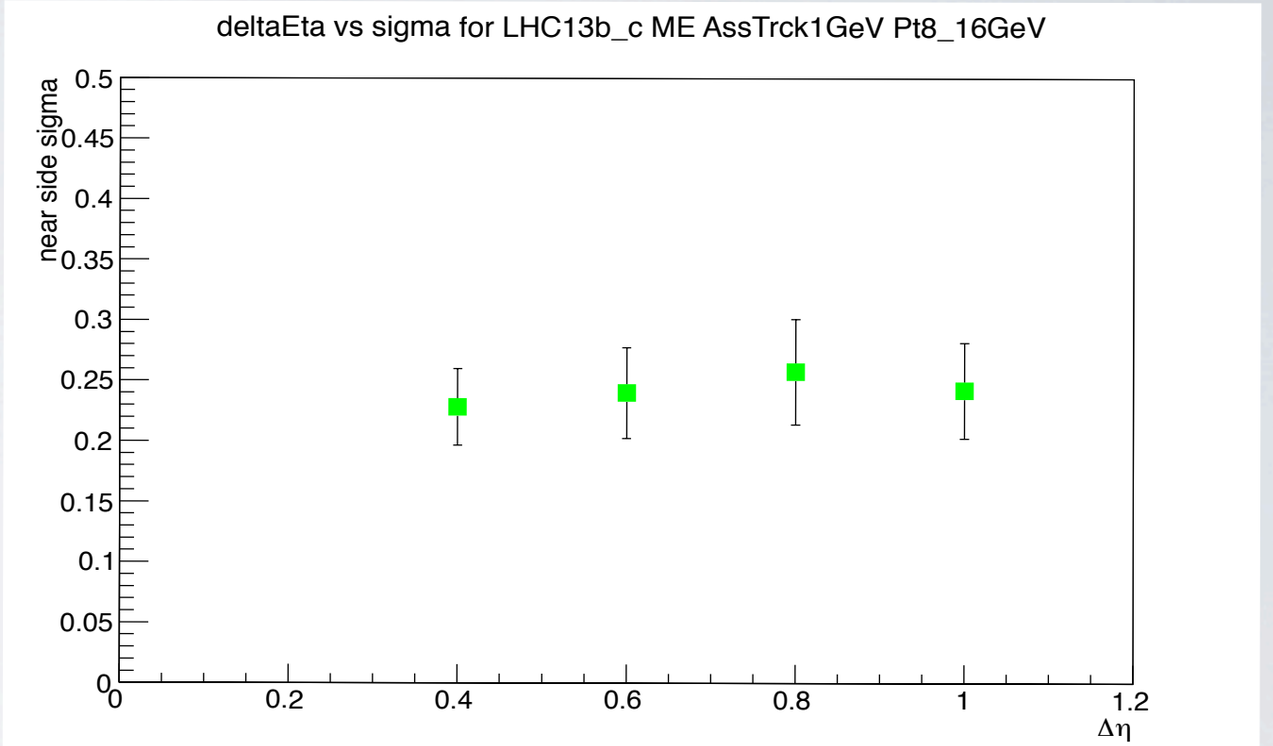






Yield and Sigma value plots with Δη and Associated p_t threshold for the near side correlation peak:

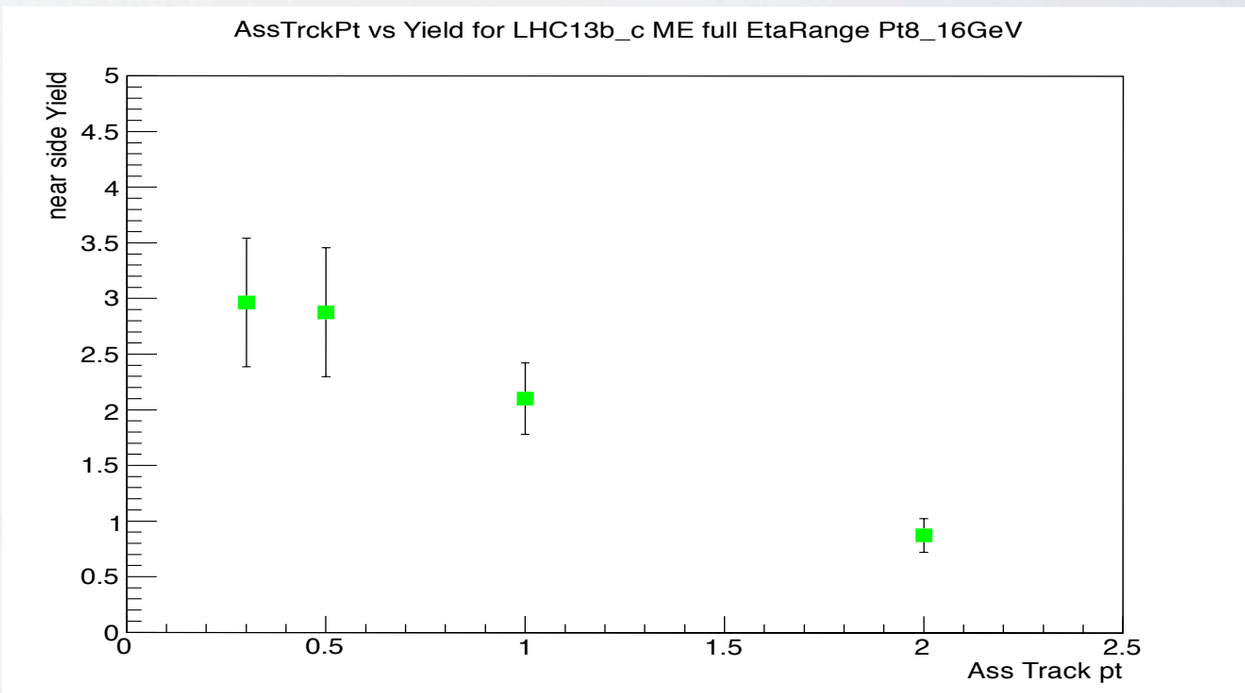




- Here the top left plot shows the near side yield values in different Δη range and with the larger Δη the no. of correlated track per trigger increases almost linearly.

- The sigma values plot shows almost no variation with different Δη ranges.

- The bottom right plot shows yield decreases with the tighter Ass. pt threshold which is expected

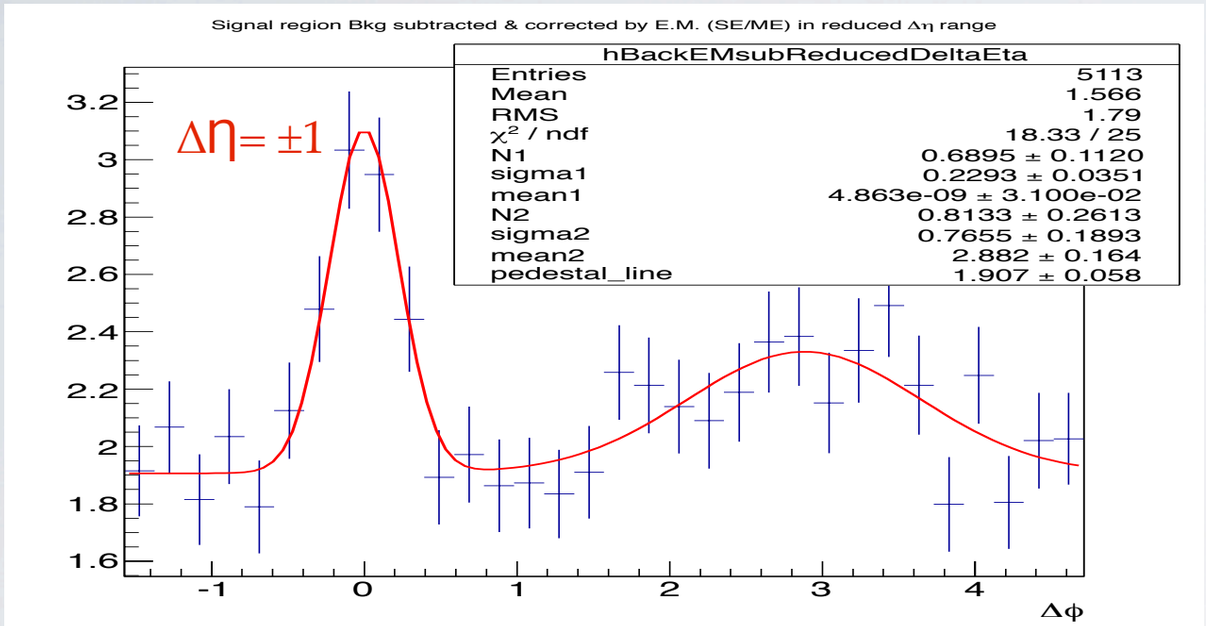


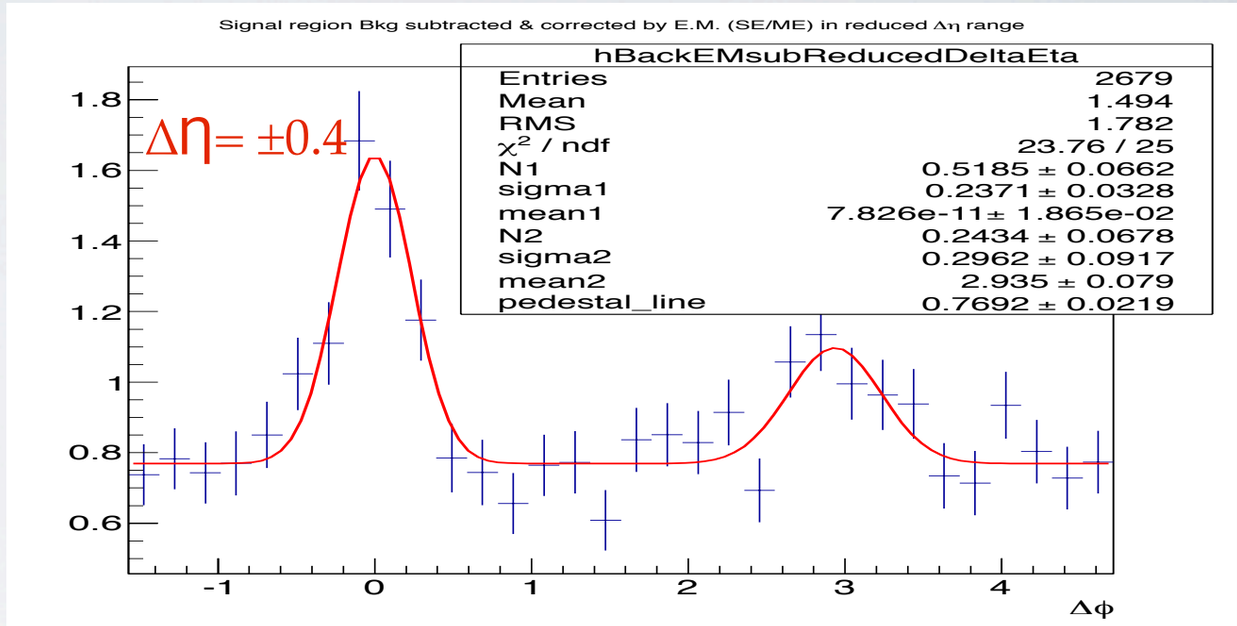
Fitting of the Correlation plots:

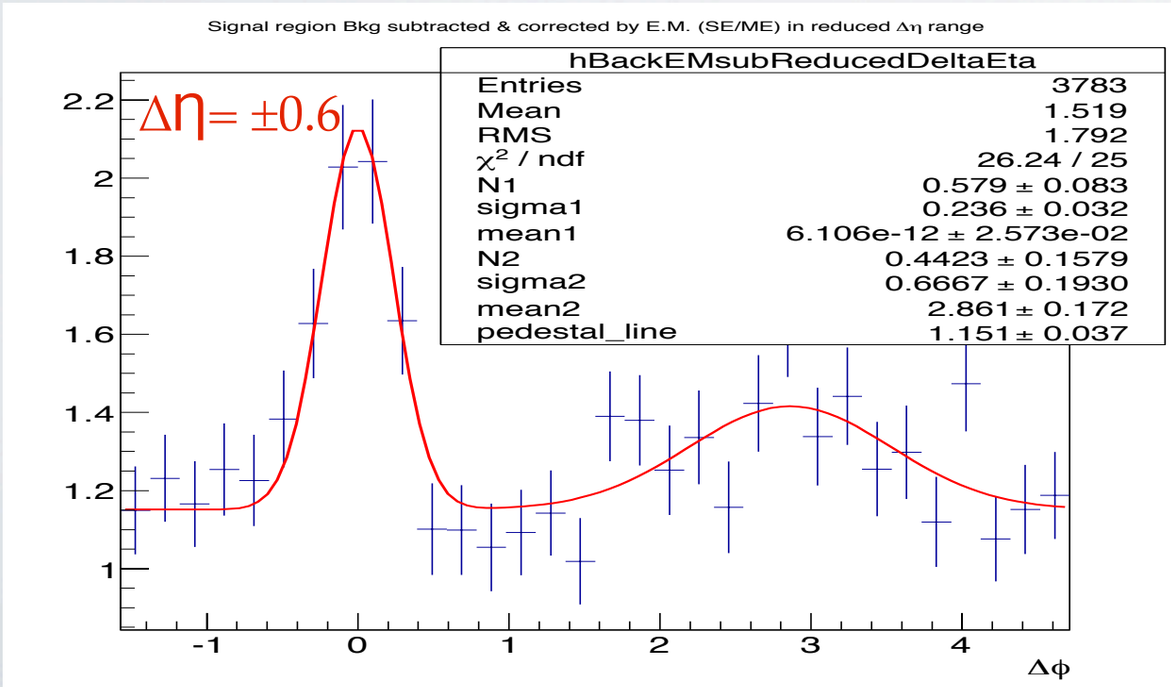
ΔΦ Correlation Plots in different Δη range with norm. per trigger and bin width

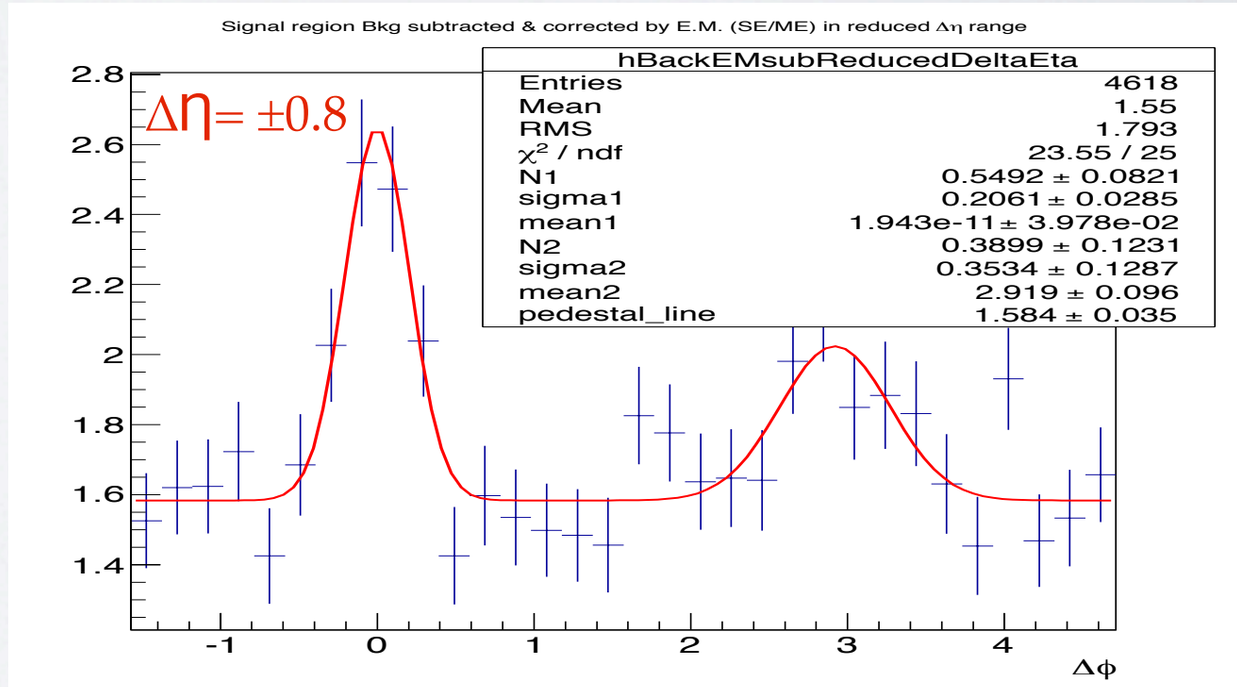
Ass p_t>1 GeV/c

D^0 p_t 5-8 GeV/c





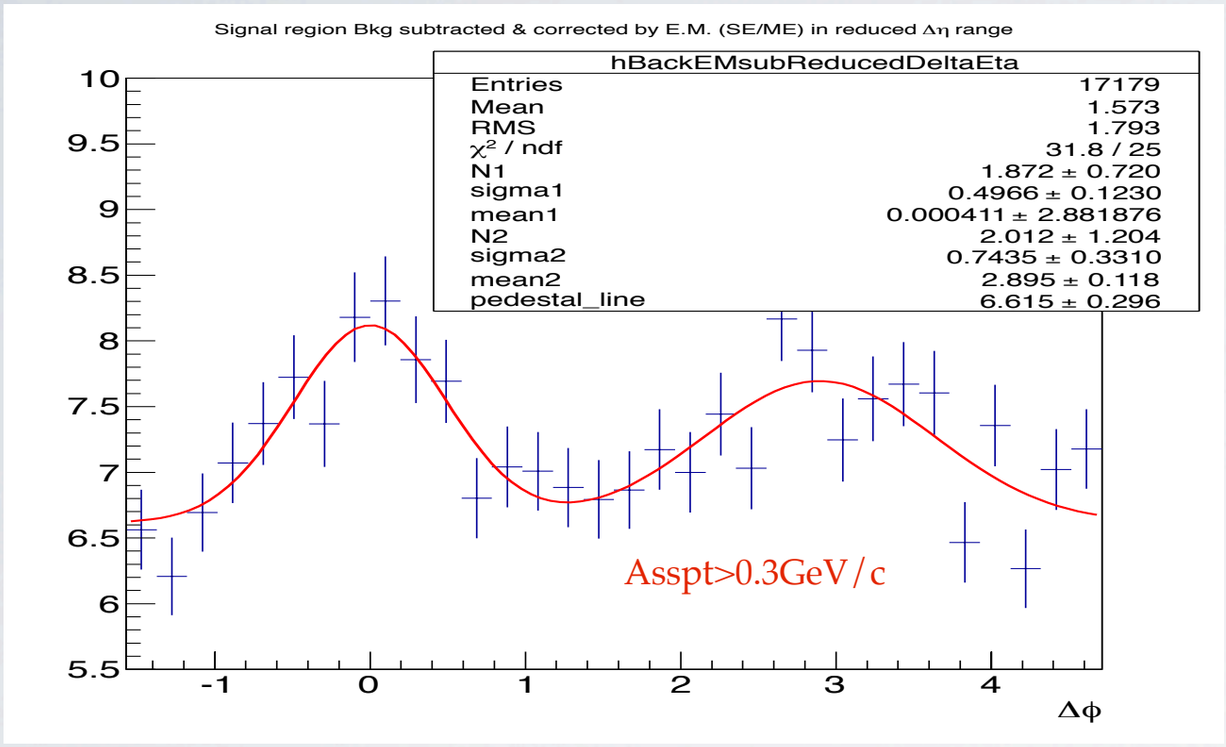


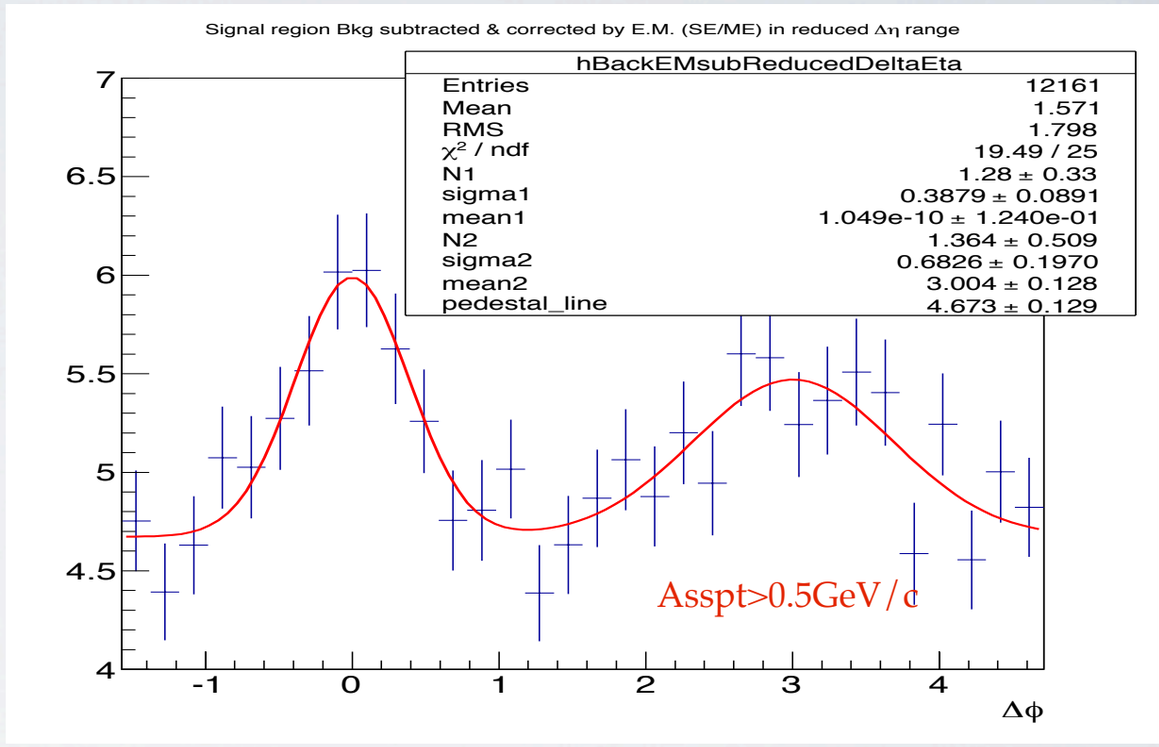


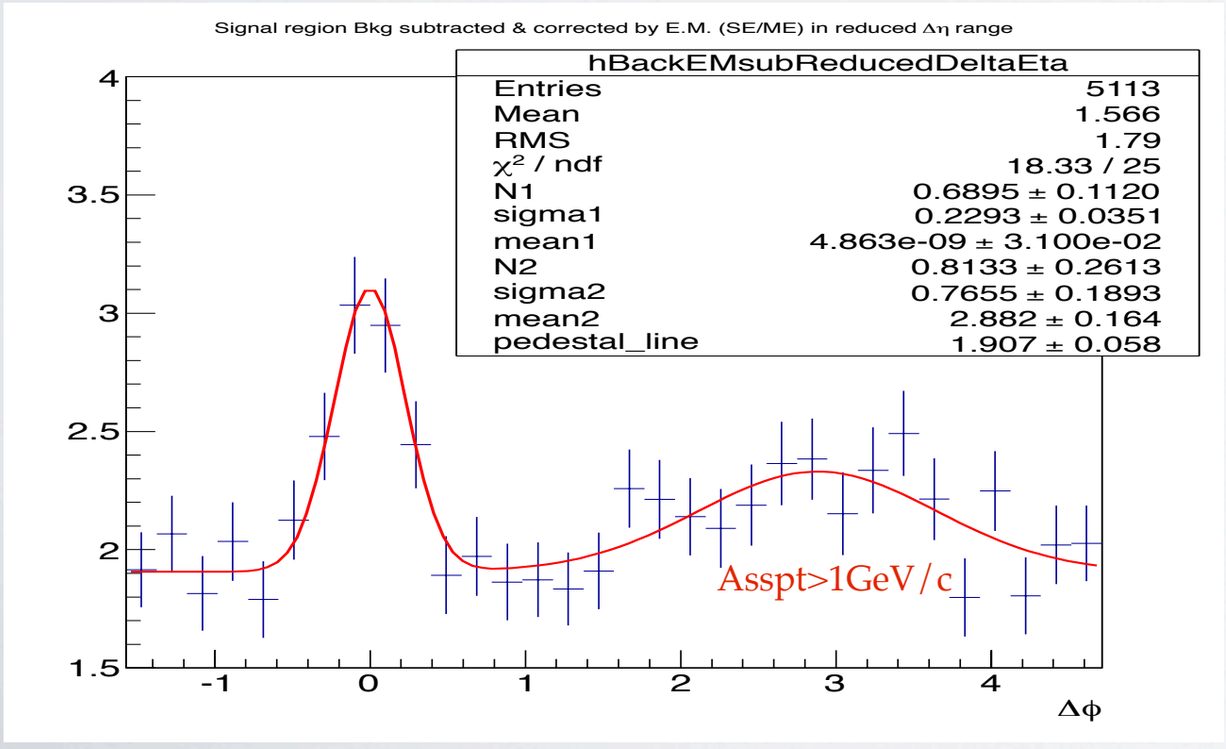
ΔΦ Correlation Plots Δη= ±1 with diff. Ass.pt threshold with norm. per Trg and bin width:

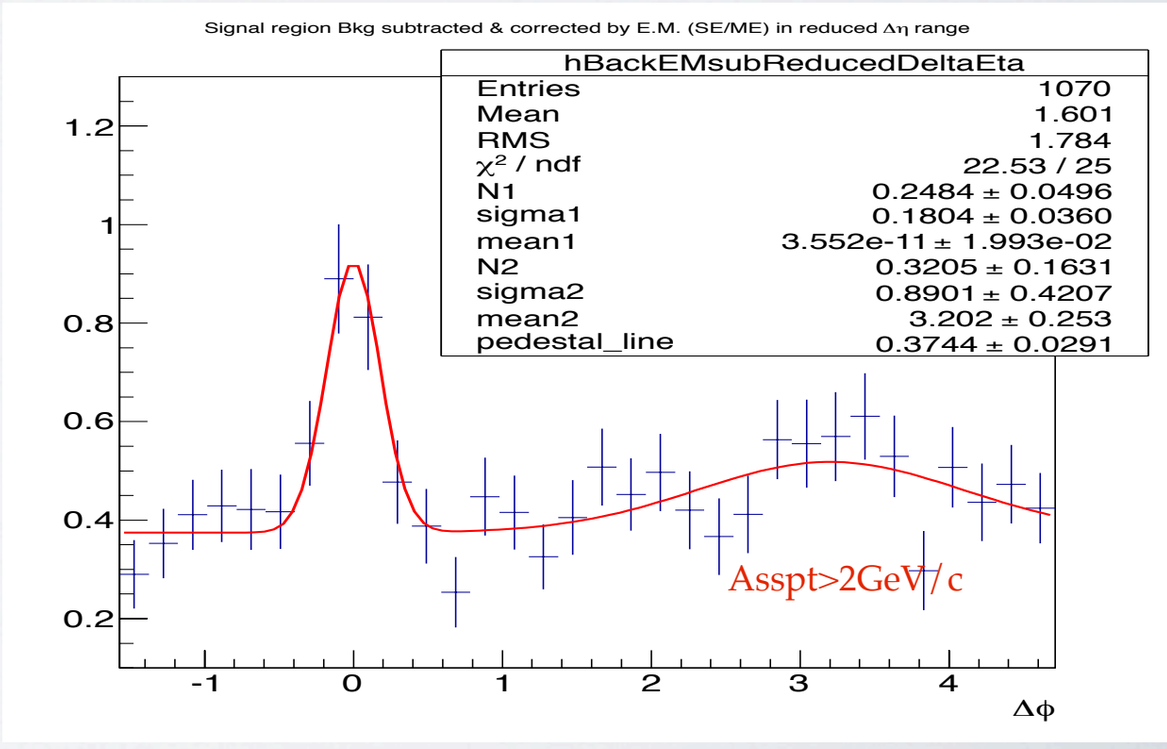
Δη= ±1

D^0 p_t 5-8 GeV/c

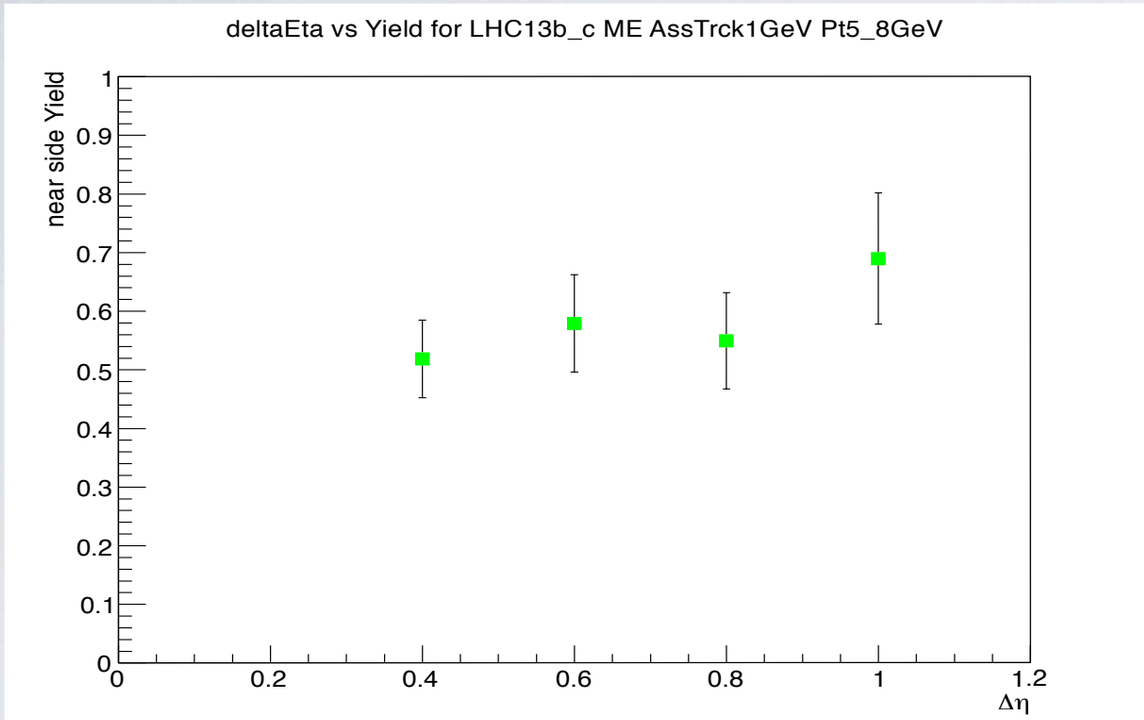


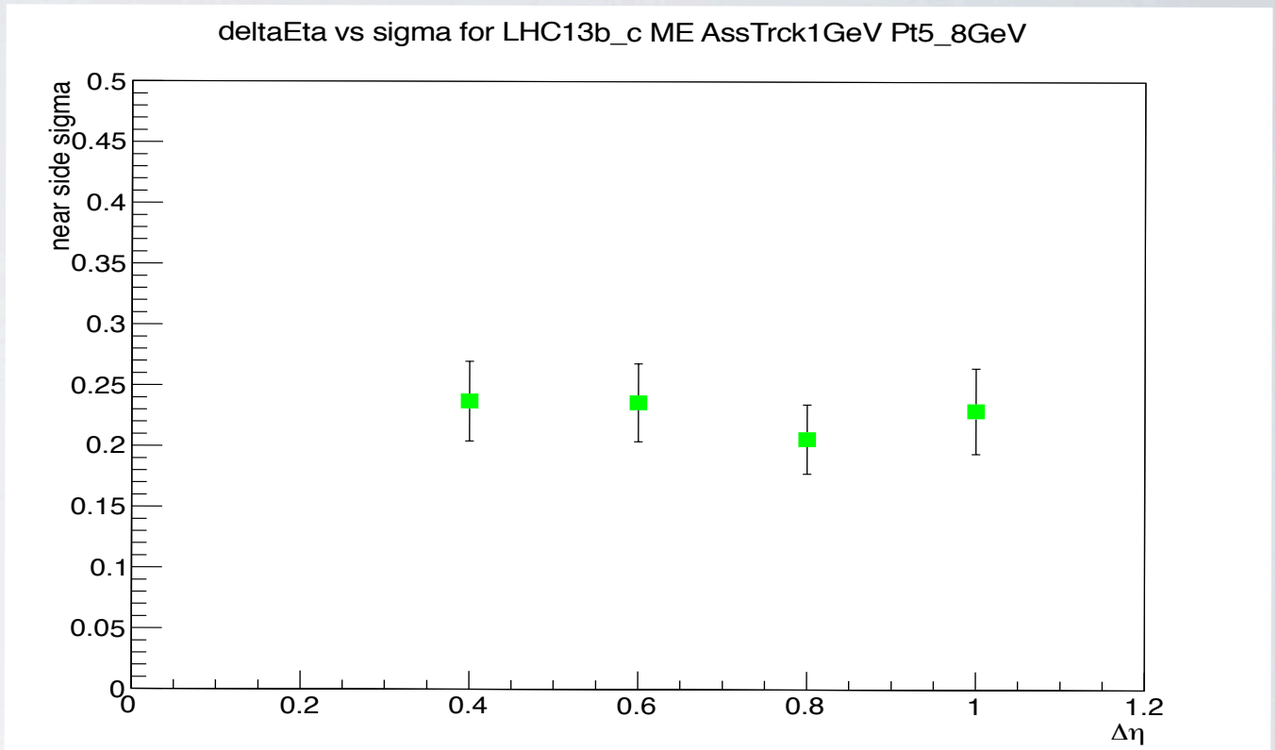






Yield and Sigma value plots with different Δη and different Ass. p_t threshold for the near side correlation peak:

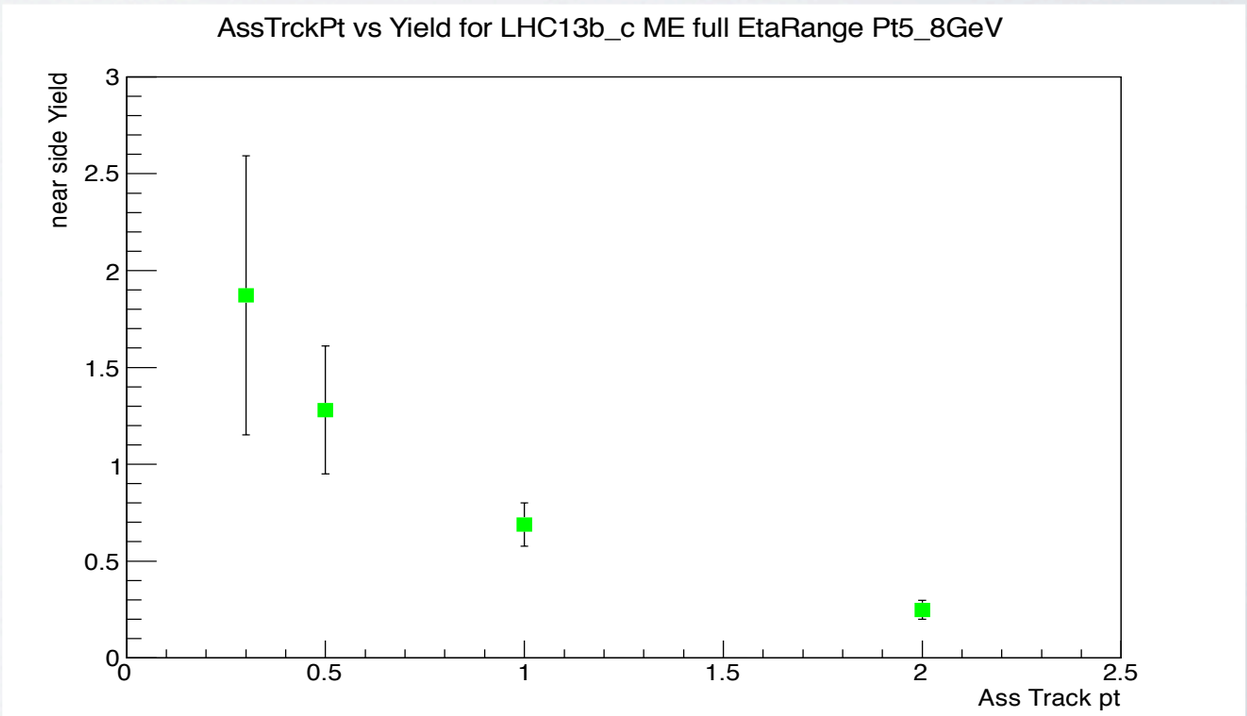




- Here the top left plot shows the near side yield values in different Δη ranges and with the larger Δη the no. of correlated tracks per trigger particle increases almost linear.

- The sigma values plot shows almost no variation with different Δη ranges.

- Here also in the bottom right plot shows yield decreases with the tighter Ass. pt threshold.



Summary:

- ☑ We Studied the pPb data for the D^0-hadron correlation and we have the signal region bkg subtracted with ME corrected, for different D^0 pt bins with softPion removal. After the bkg subtractions the correlation plots look promising.

- ☑ We also investigated the correlation plots without SoftPion removal coming from D* particle (D*->D^0+pi) ==>not shown here.

- ☑ We did the fitting of ΔΦ correlation plots with different Δη ranges. From the fitted plots we took here the yield and sigma values for near side peak only.

- ☑ As expected the near side yield increases with increasing Δη ranges for mid and higher D^0 pt ,quite clearly visible and decreases with tighter Associated track p_t threshold.

- ☑ We will further check these plots with efficiency correction.

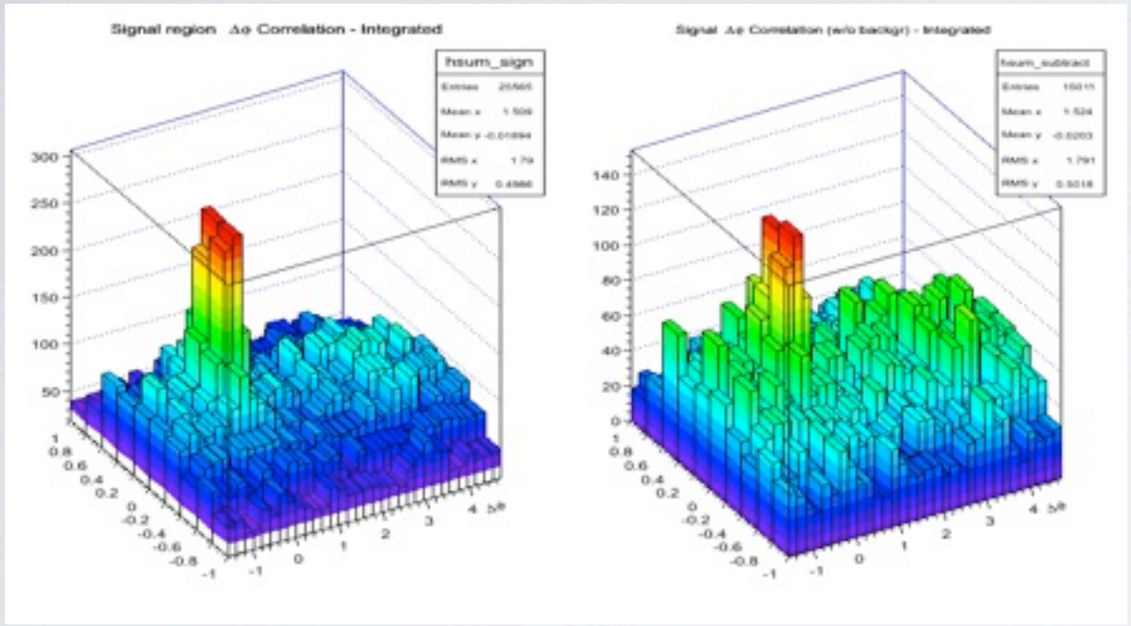
THANK YOU

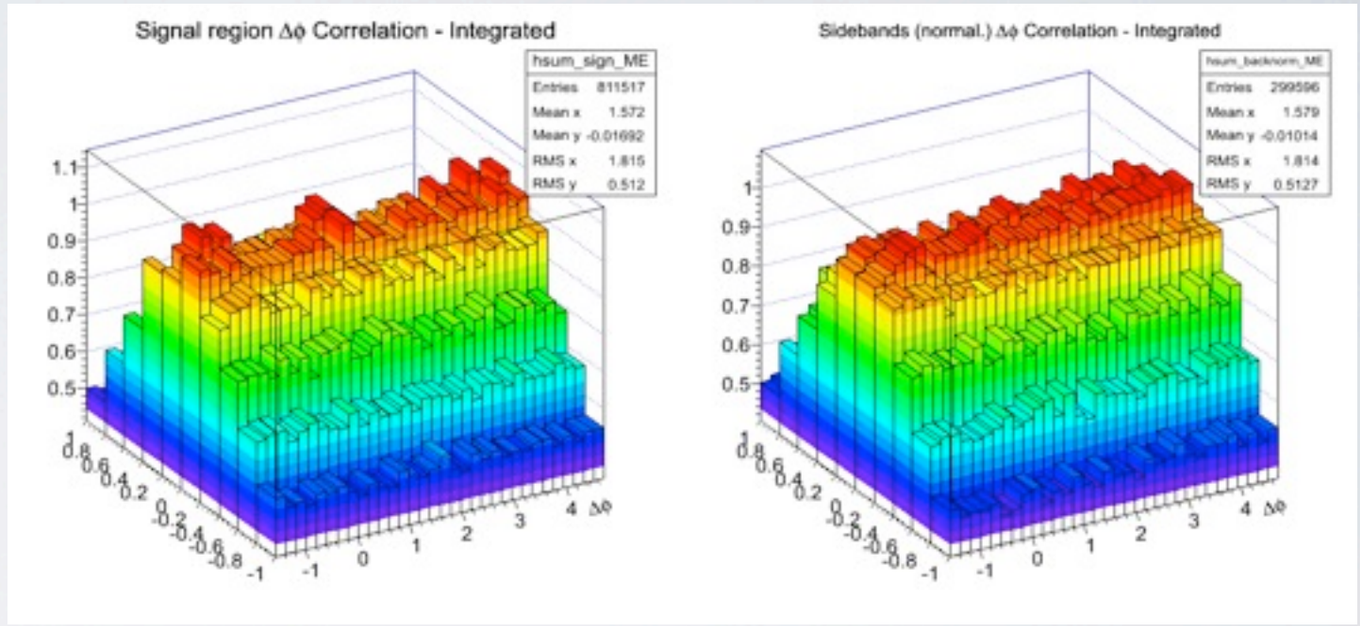
Backup Slides

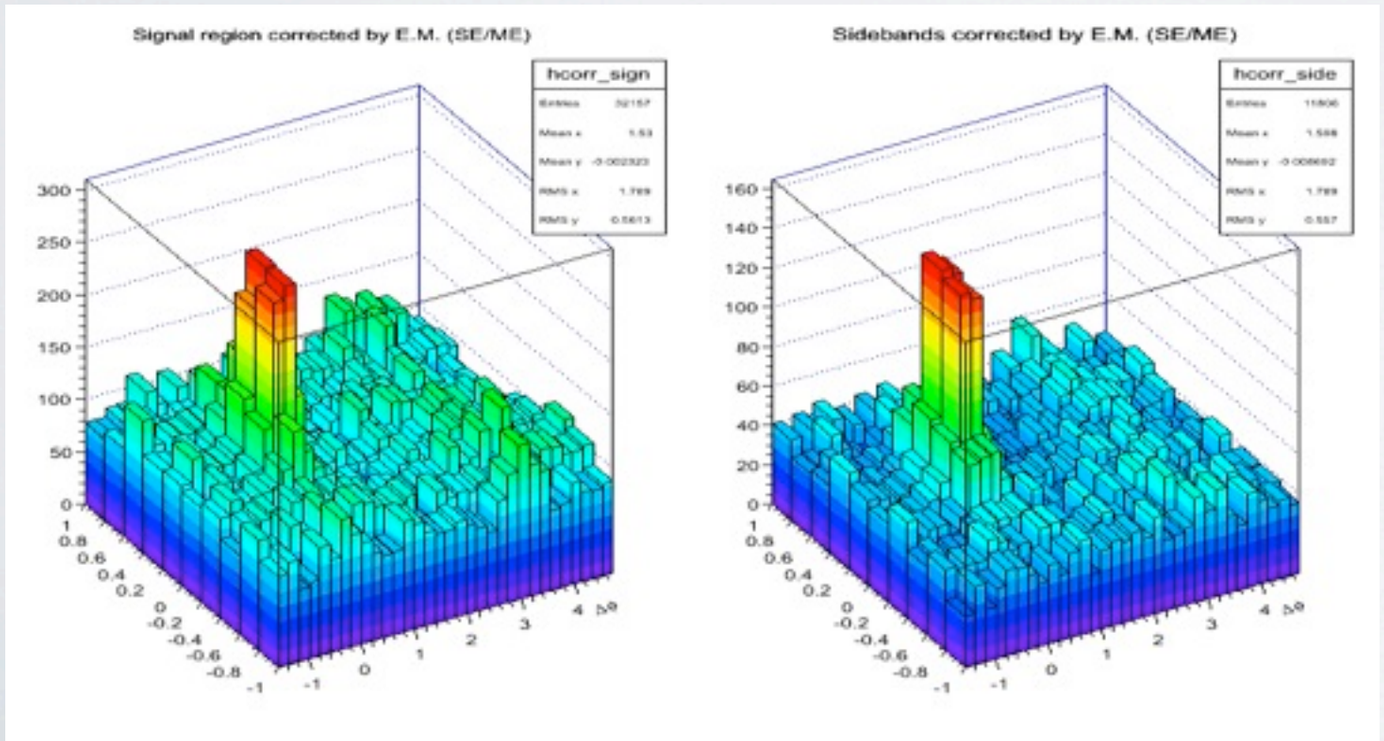
D0-hadron Correlation plots:

Ass. pt >0.3 GeV/c

D0 pt 8-16GeV/c





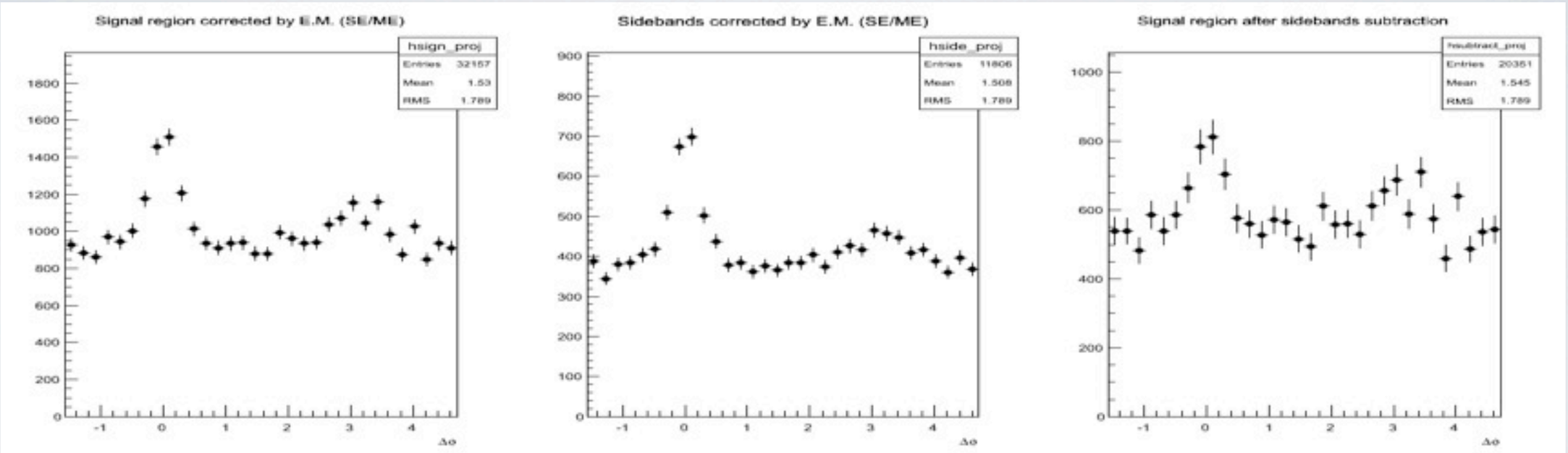


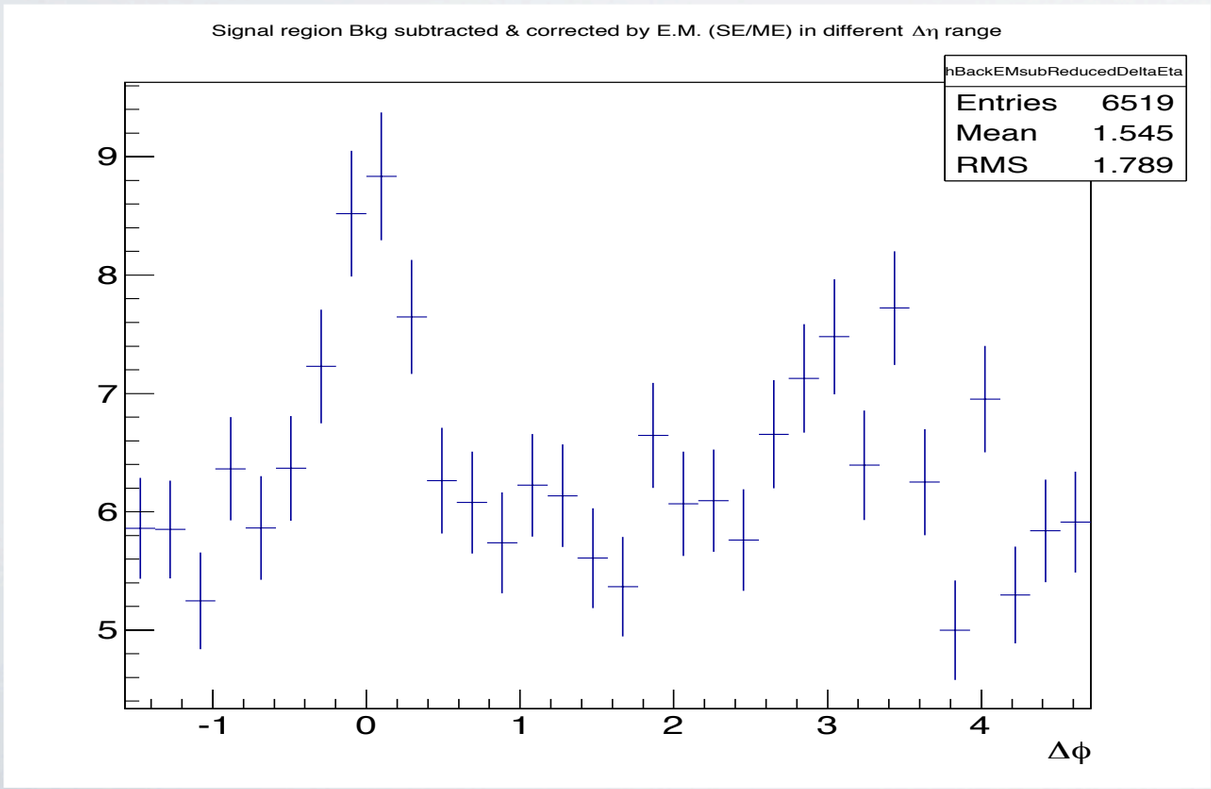
Here the above plot shows the ME correlation (ΔΗ-ΔΦ) Signal region, sideband region,and then by dividing SE correlation by ME we got the ME corrected ΔΗ-ΔΦ correlation shown in the lower left plot.

D0-hadron Correlation plots: (ΔΦ correlation)

Ass. pt >0.3 GeV/c

D0 pt 8-16GeV/c





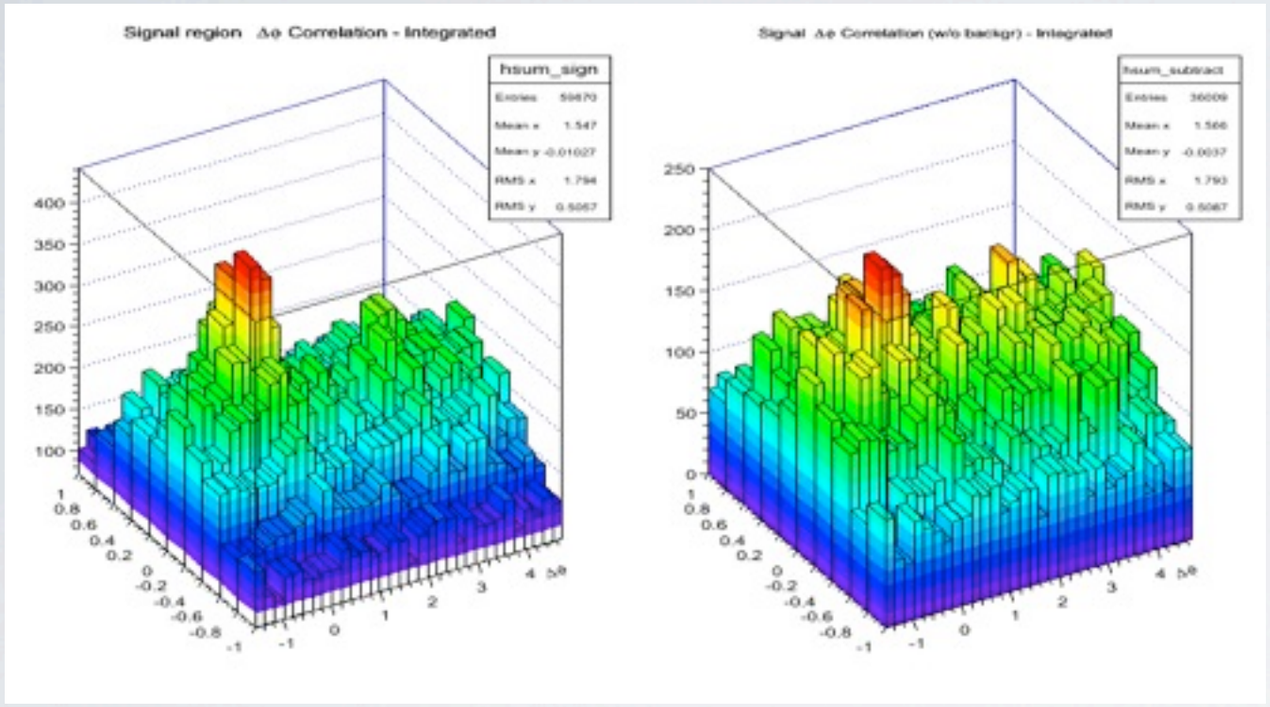
- Here the above plot shows the ME corrected Signal region, sideband region,and signal region sideband subtracted.

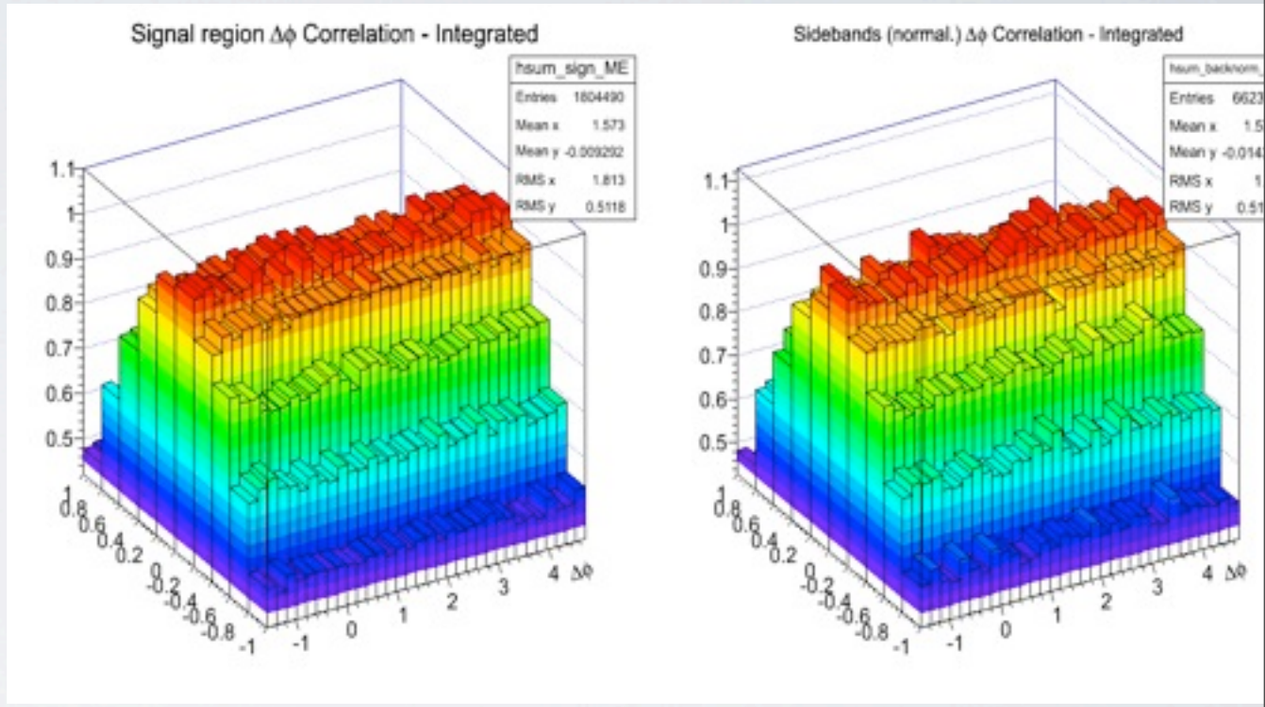
- The lower left is the side band subtracted and normalized per trigger and binwidth.
The near side peaks is likely visible over the pedestal.

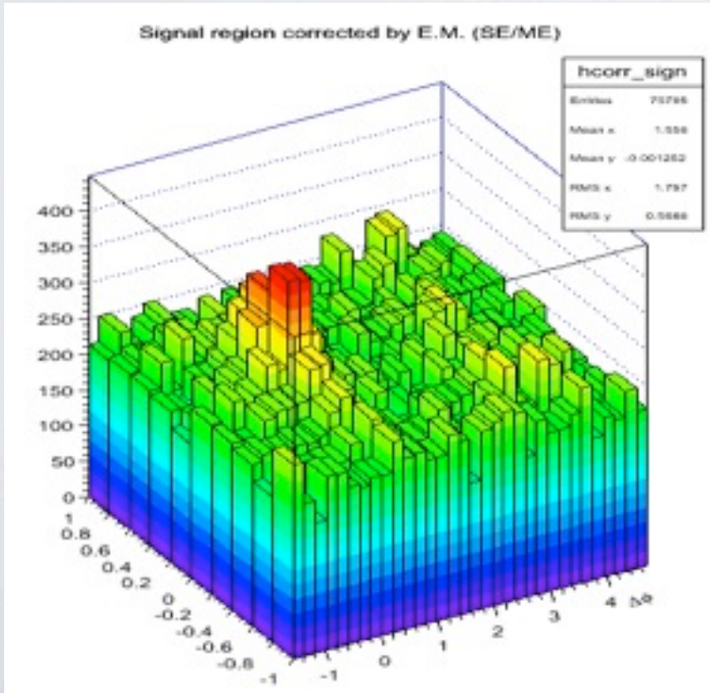
D0-hadron Correlation plots:

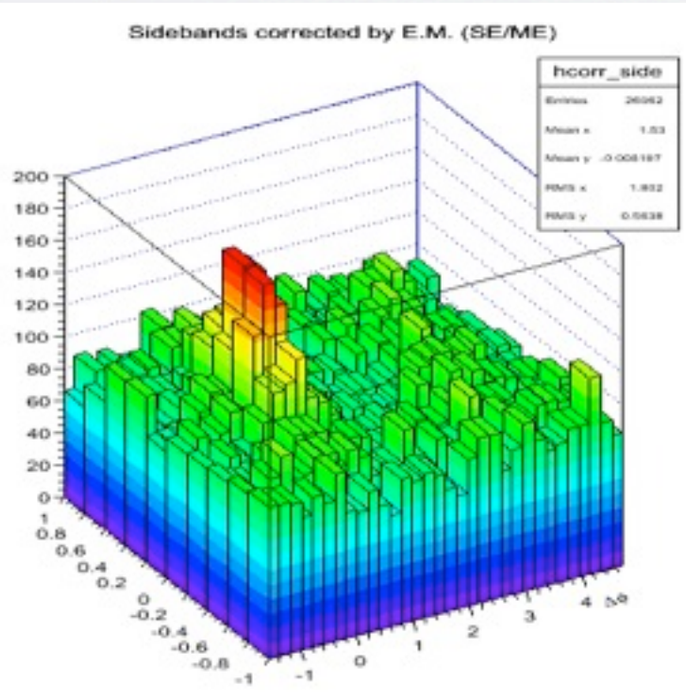
Ass. pt >0.3 GeV/c

D0 pt 5-8GeV/c







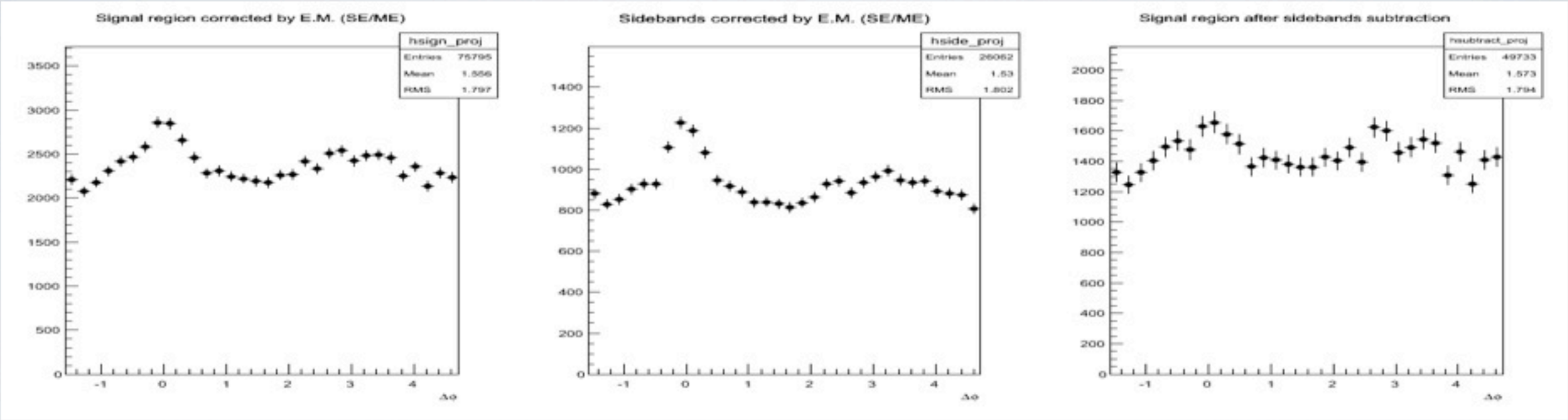


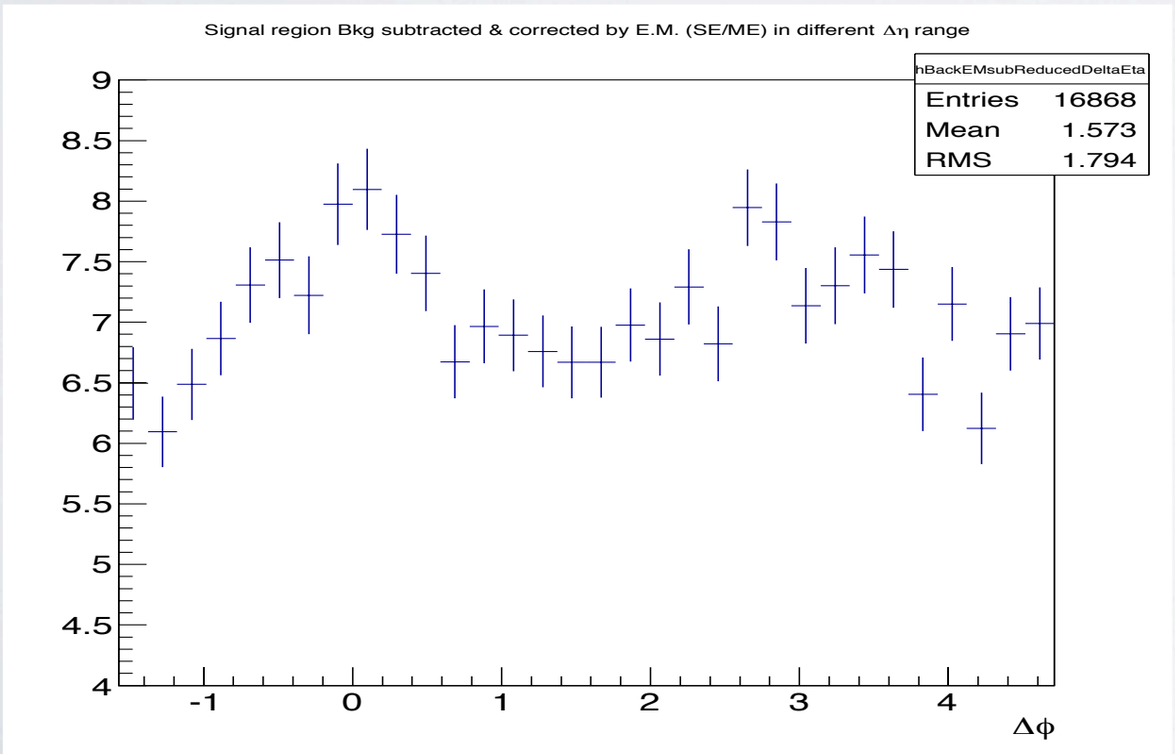
Here the above plot shows the ME correlation (Δη-ΔΦ) Signal region, sideband region,and then by dividing SE correlation by ME we got the ME corrected Δη-ΔΦ correlation shown in the lower left plot.

D0-hadron Correlation plots: (ΔΦ correlation)

Ass. pt >0.3 GeV/c

D0 pt 5-8GeV/c





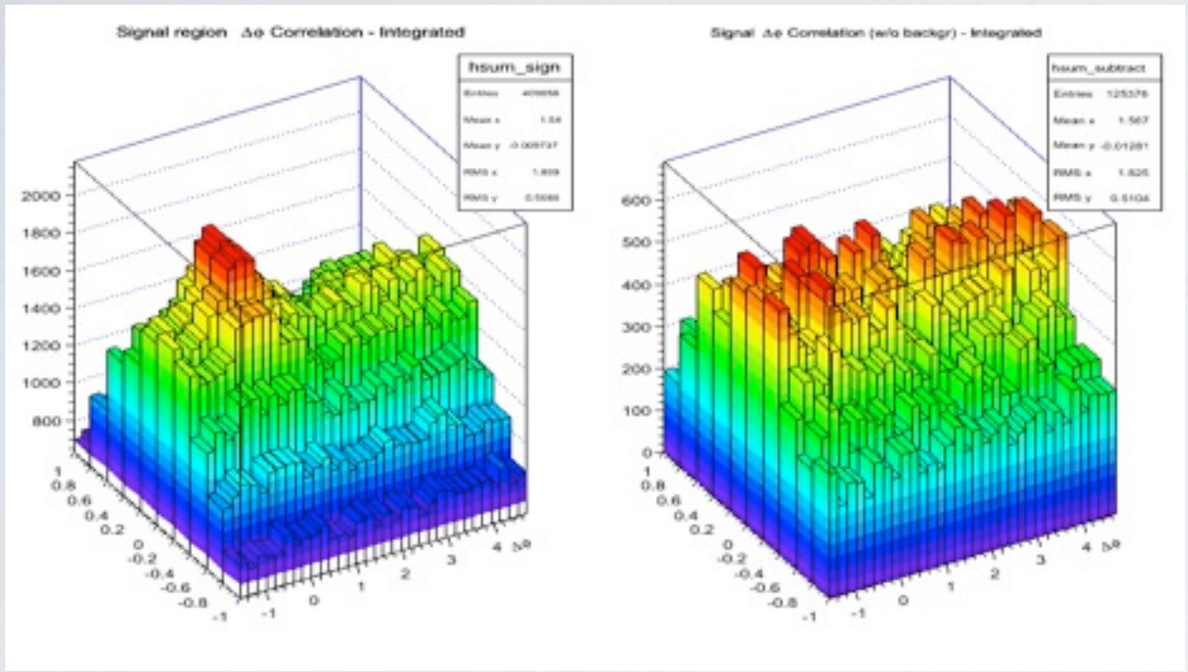
✷Here the above plot shows the ME corrected Signal region, sideband region,and signal region sideband subtracted.

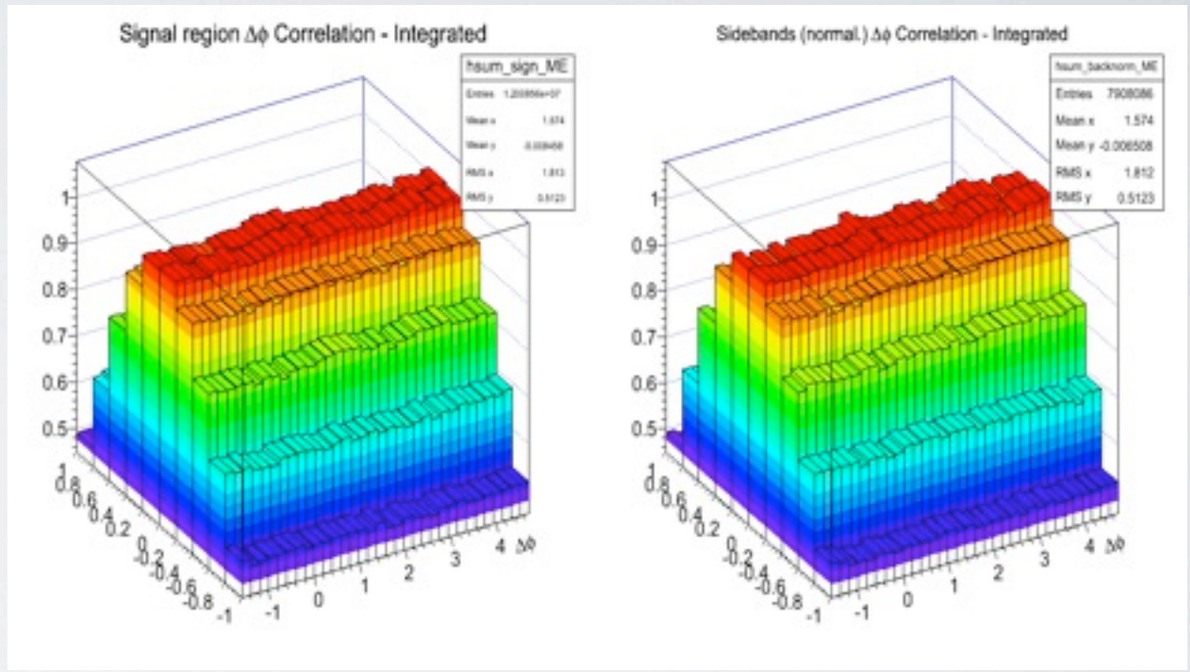
✷The lower left is the side band subtracted and normalized per trigger and binwidth.

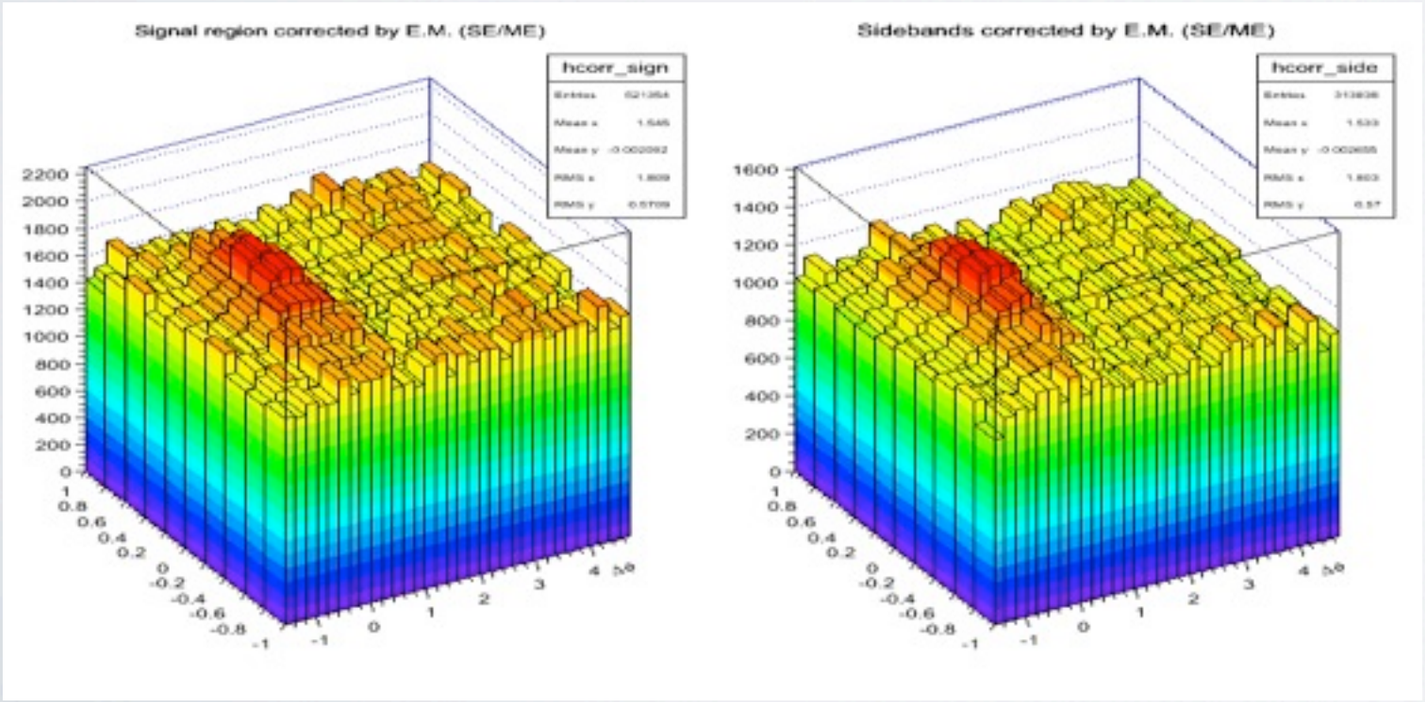
D0-hadron Correlation plots:

Ass. pt >0.3 GeV/c

D0 pt 2-5GeV/c





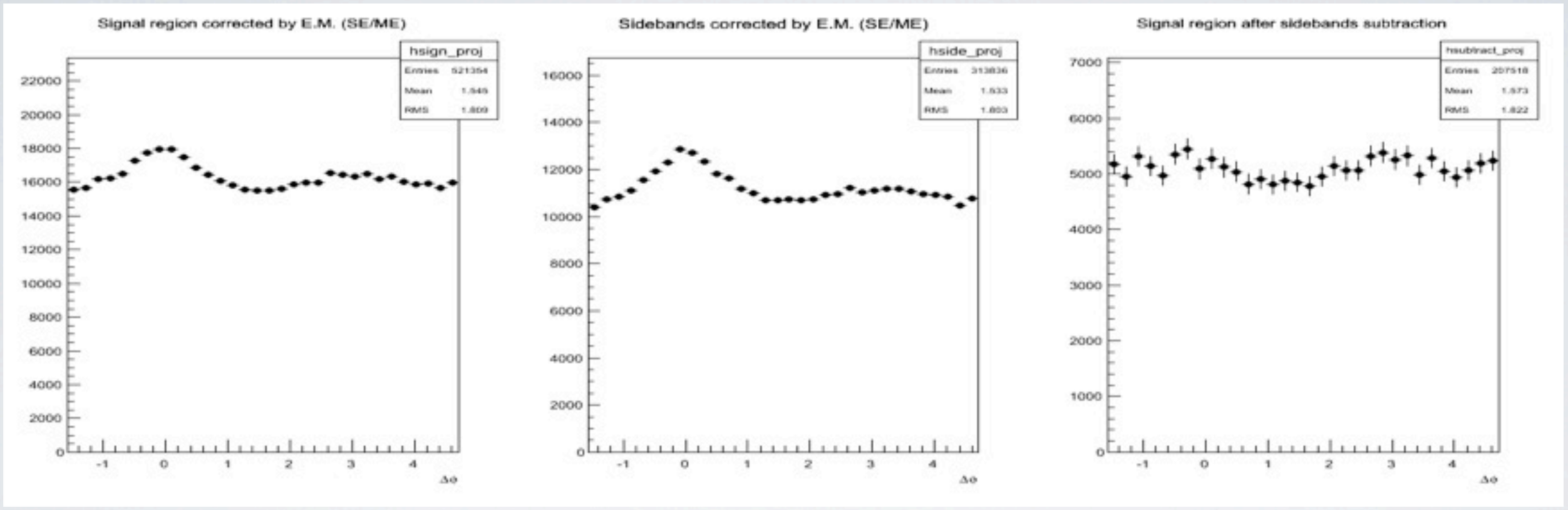


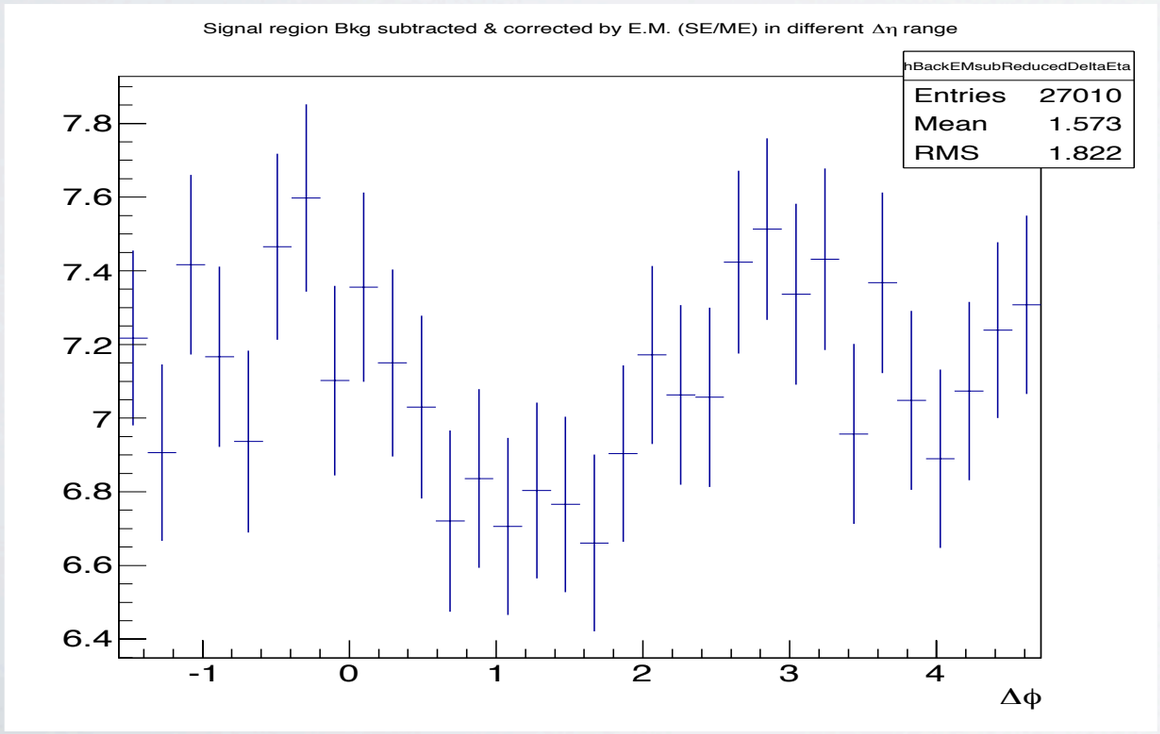
Here the above plot shows the ME correlation (Δη-ΔΦ) Signal region, sideband region,and then by dividing SE correlation by ME we got the ME corrected Δη-ΔΦ correlation shown in the lower left plot.

D0-hadron Correlation plots: (ΔΦ correlation)

Ass. pt >0.3 GeV/c

D0 pt 8-16GeV/c





- Here the above plot shows the ME corrected Signal region, sideband region,and signal region sideband subtracted.

- The lower left is the side band subtracted and normalized per trigger and binwidth.