ALICE Collaboration Meeting
28th April 2013, IIT Bombay

Analysis Overview : **PWGHF - HFCJ**

D^+ - Hadron azimuthal correlations in pp @ 7 TeV with ALICE at LHC

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IIT Bombay

Outline:

- ☑ Physics Motivation

- ☑ Analysis Details (Data || MC Production)
  - Data Set
  - Cuts

- ☑ D+ Mass Signal
- ☑ D+ - Hadron Correlation
- ☑ Background Subtraction
  - Methods
  - Validation
  - Efficiency

- ☑ More on D+ - Hadron Correlation
- ☑ Future Plan and Summary

Physics Motivation

Heavy flavor in high-energy heavy ion collisions

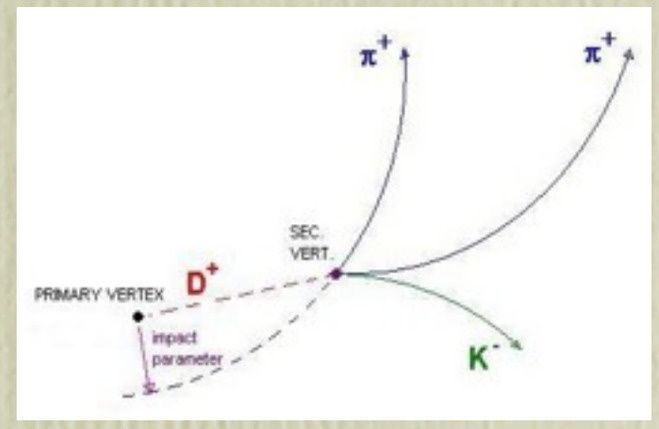
- ☑ Heavy quarks produced initial stage of collision (production time 0.05-0.15fm/c). So they are well suited probe for studying the properties of QGP.
- ☑ We can investigate the properties of the dense matter by studying its influence on open heavy flavor production.

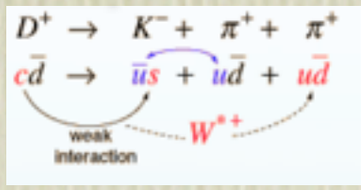
About D+

Mass (D+) = 1.869.62 ± 0.20 GeV/c2

Decay channel ⟹

Branching ratio = 9.22 ± 0.21%





Physics Motivation

Why azimuthal correlations ?

- Path length dependence of energy loss (larger loss for partons traversing more in matter):

  “away side suppression”

- Possible medium modifications to parton shower and fragmentation: can influence associated yields and peak widths & shape

Nuclear Modification Factor: $I_{AA} = Y_{PbPb} / Y_{pp}$

Azimuthal correlations with D Meson ?

- Heavy flavor jets and provide a more detailed picture of heavy flavor energy loss
- HF partons interact differently with the medium w.r.t. gluons and light quarks

Some Challenge with HF

- ☑ Require a lot of statistics (~ 10D^+/M events)
- ☑ High combinatorial background (in invariant mass analysis) ->
  - *strong selection applied on D^+ (D^+ mesons Efficiency)
  - *need to subtract correlations of background :
- ☑ Contamination of D from B

Analysis Details

Data Set **2010 pp data**

Sr	Data	AOD	MC	AOD
1	LHC10b	AOD038	LHC10d1	AOD56
2	LHC10c	AOD038	LHC10d4	AOD56
3	LHC10d	AOD057	LHC10f6a	AOD41
4	LHC10e	AOD057		

D^+ Reconstruction Cuts : StandardPP2010 Publish cuts

$ALICE_ROOT/PWGHF/vertexingHF/AliRDHFCutsDplustoKpipi.cxx

Hadron Cuts:

$ALICE_ROOT/PWGHF/correlationHF/macros/makeTFileAssociatedTrackCuts.C

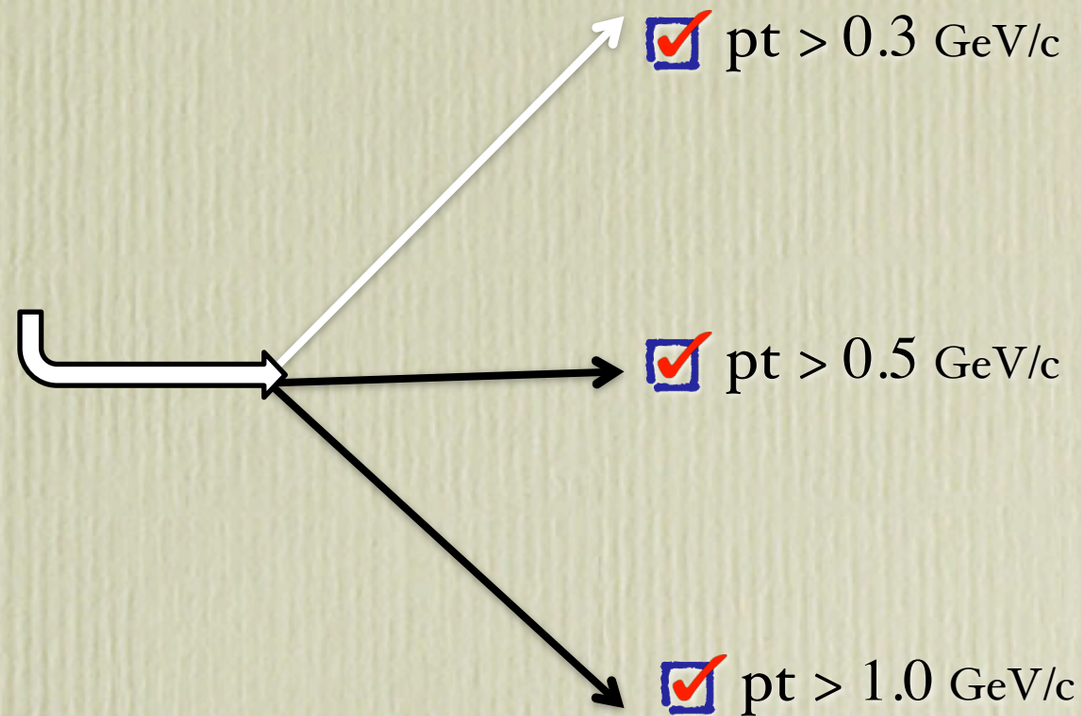
esdTrackCuts->SetRequireTPCRefit(kTRUE);
esdTrackCuts->SetRequireITSRefit(kTRUE);
esdTrackCuts->SetMinNClustersTPC(80);
esdTrackCuts->SetMinNClustersITS(2);
PID, others.

pT Range and Threshold

Dplus pT

- ☑ 2 < D+ pt (GeV/c) < 5
- ☑ 5 < D+ pt (GeV/c) < 8
- ☑ 8 < D+ pt (GeV/c) <16

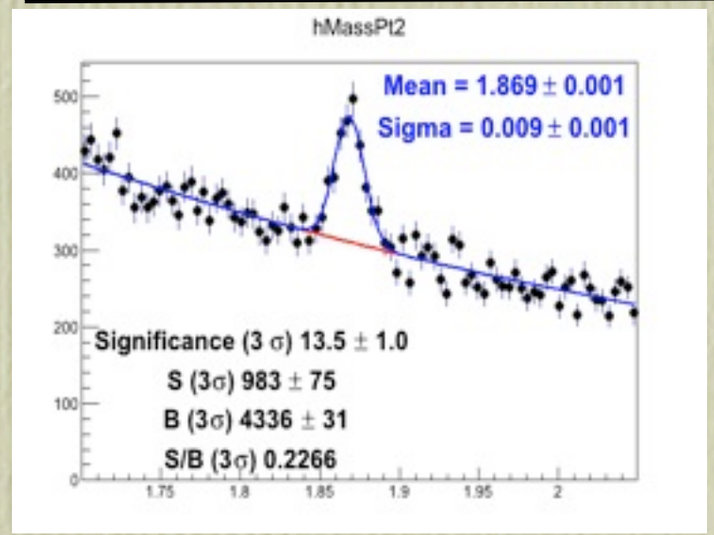
Hadron pT



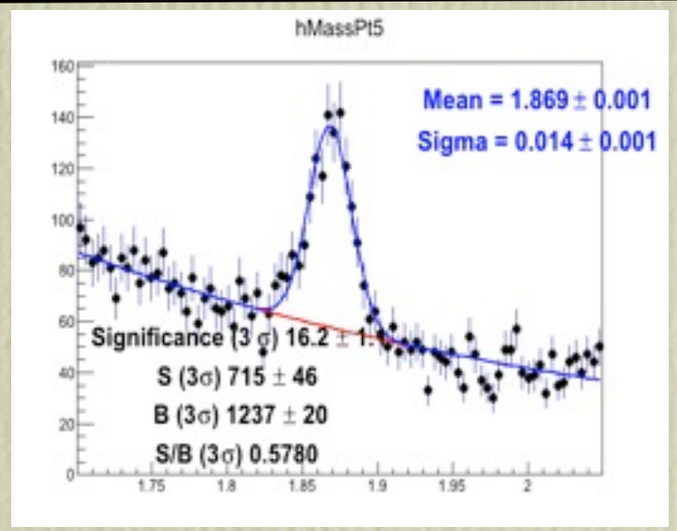
D+ Inv Mass Spectra:

In data

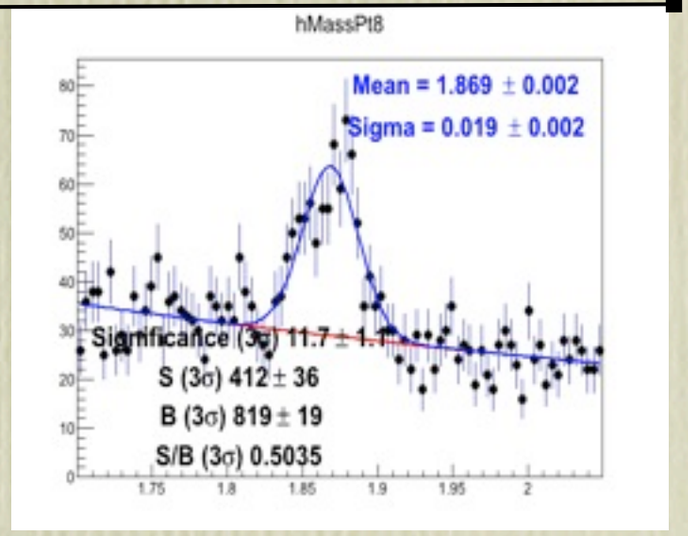
☑ 2 < D+ pt (GeV/c) < 5



☑ 6 < D+ pt (GeV/c) < 8



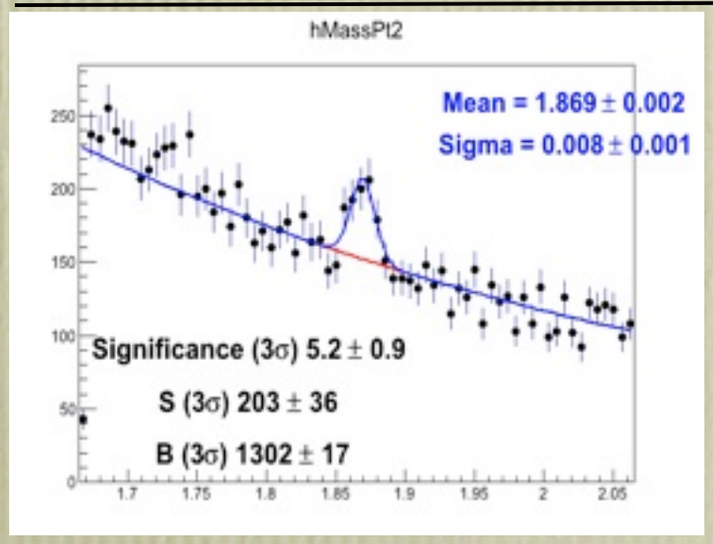
☑ 8 < D+ pt (GeV/c) < 16

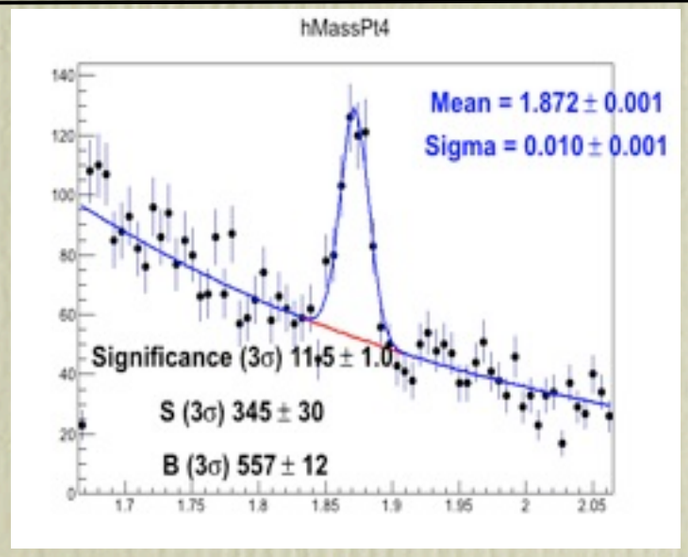


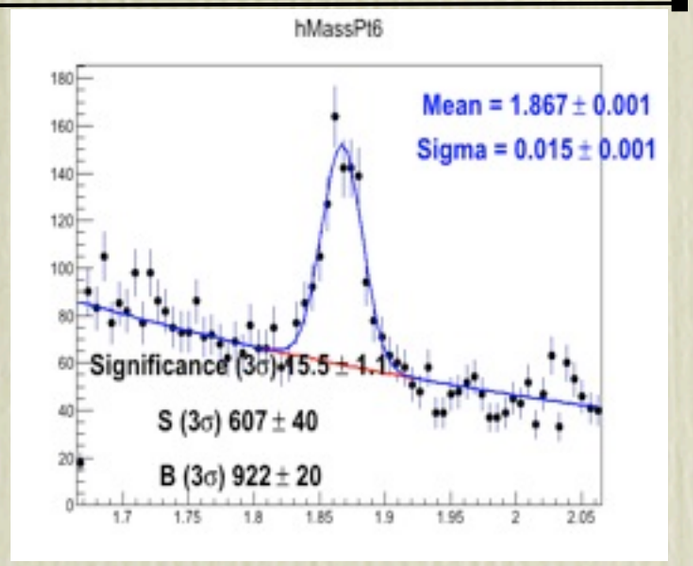
count #

mass(D^+) (GeV/c^2)

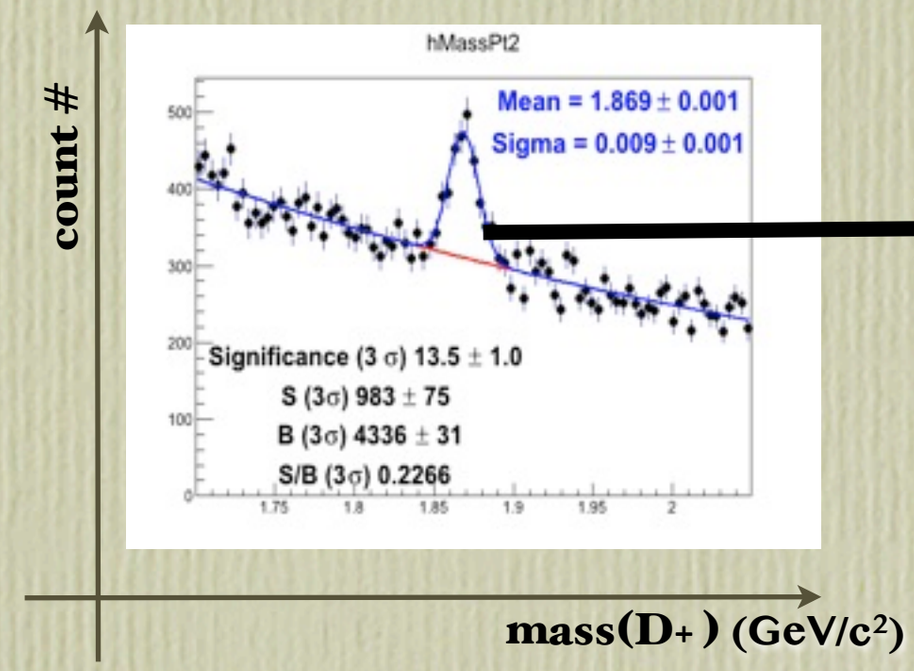
In MC Production







need of correlation study



ϕ_1 of D+ Candidates

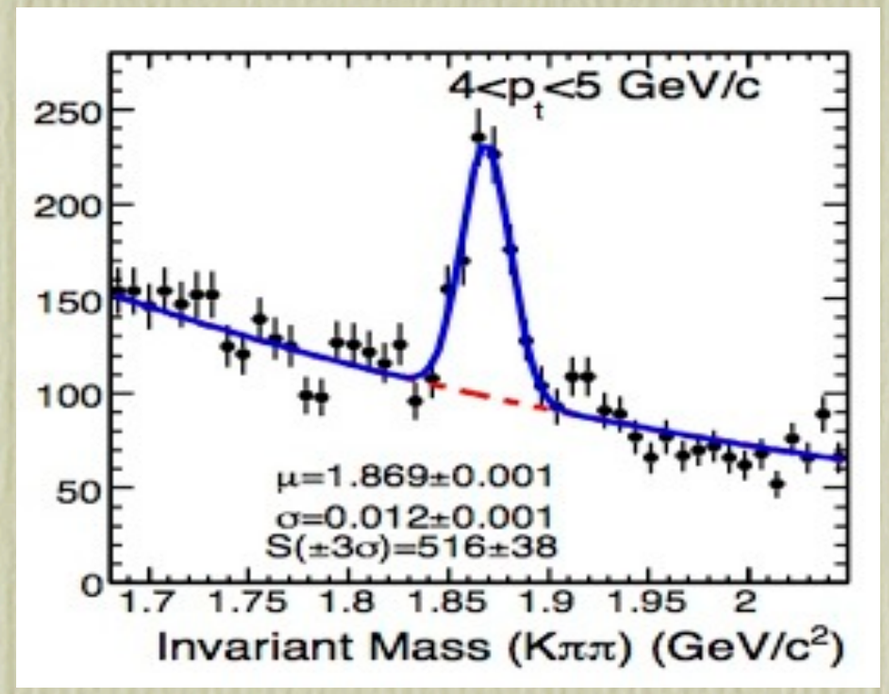
ϕ_2 of **Selected** Hadron

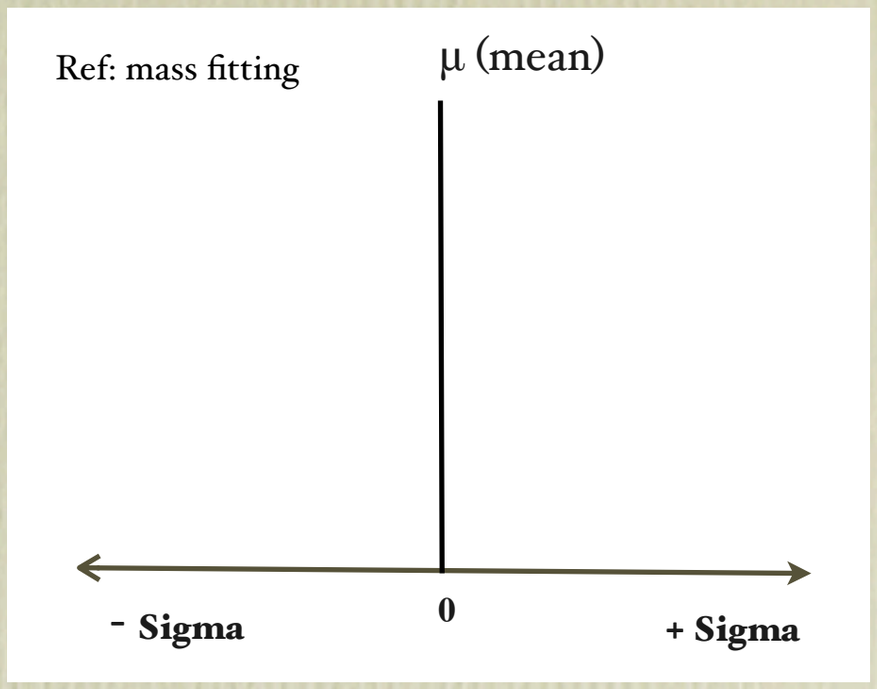
$\Delta\phi$

Corrected by

- ☑ **SB Technique**
- ☑ Mixed Event

Estimation of Side Band and Bkg Subtraction:





Subtraction of B_0 from signal

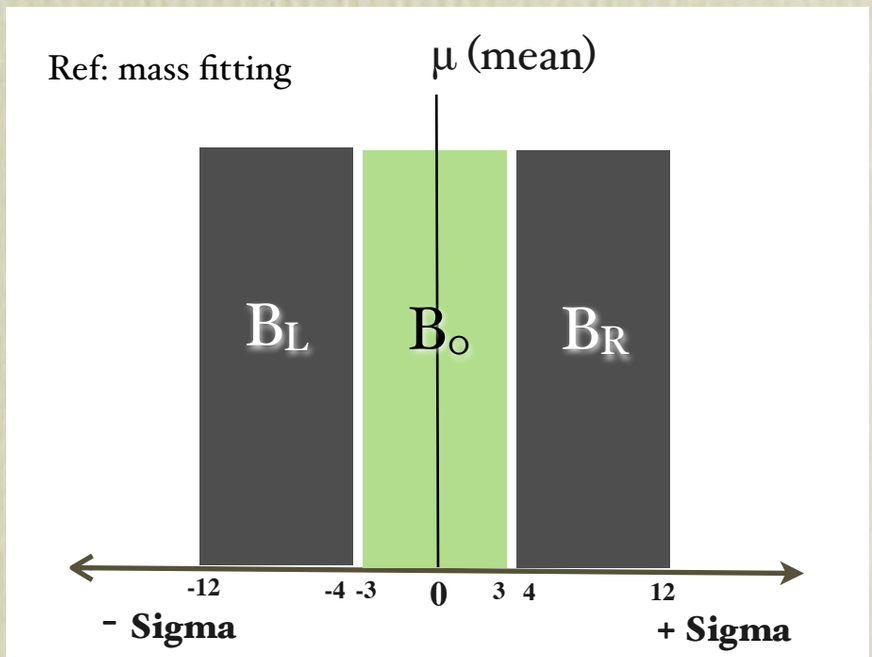
↓

Side band technique

↓

$WB_L + WB_R \sim B_0$ (±3σ)

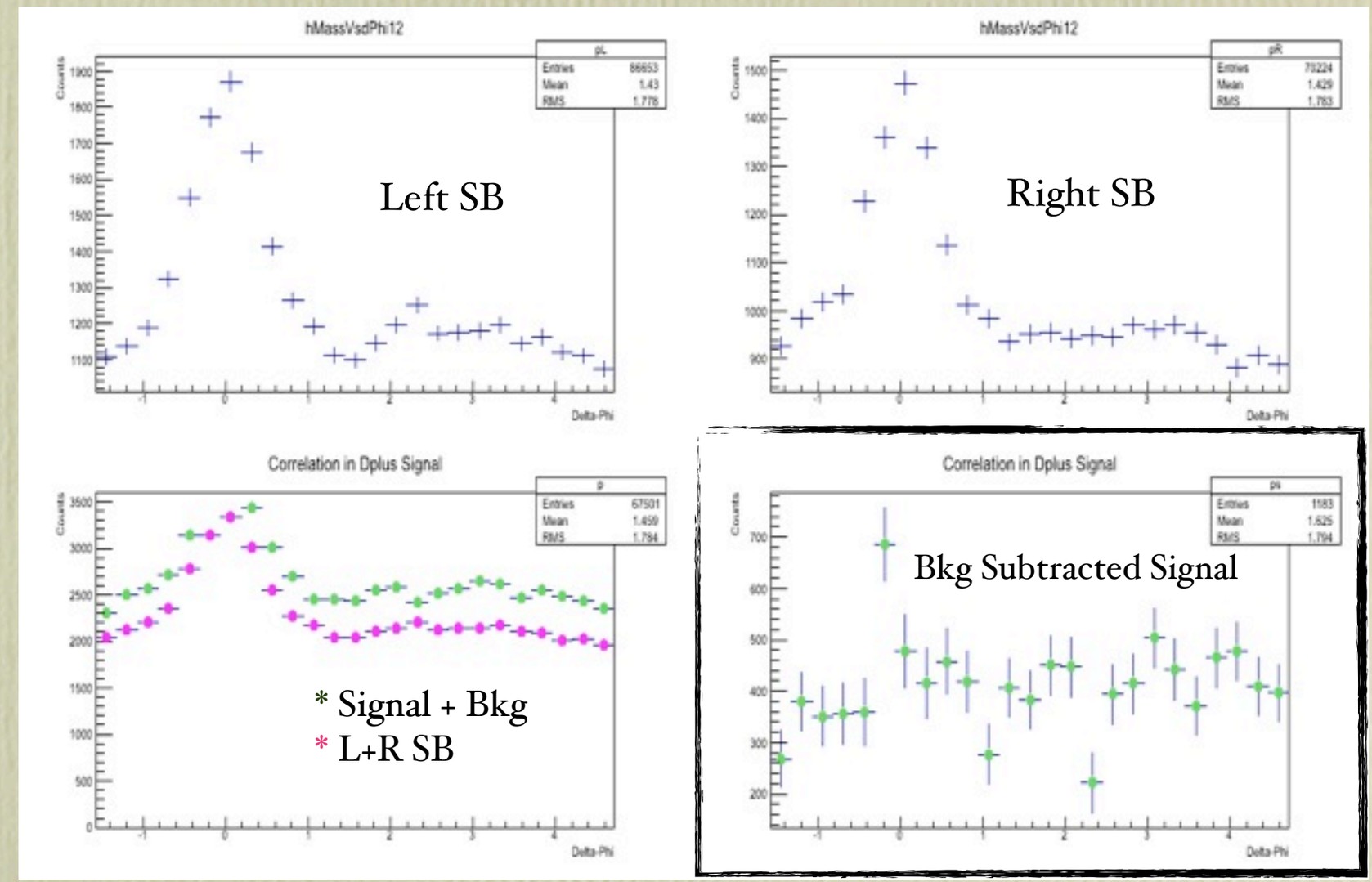
$W = B_0/(B_L + B_R)$



Azimuthal - Correlation in D+ - Hadron: [Data]

☑ **2 < D+ pt (GeV/c) < 5**

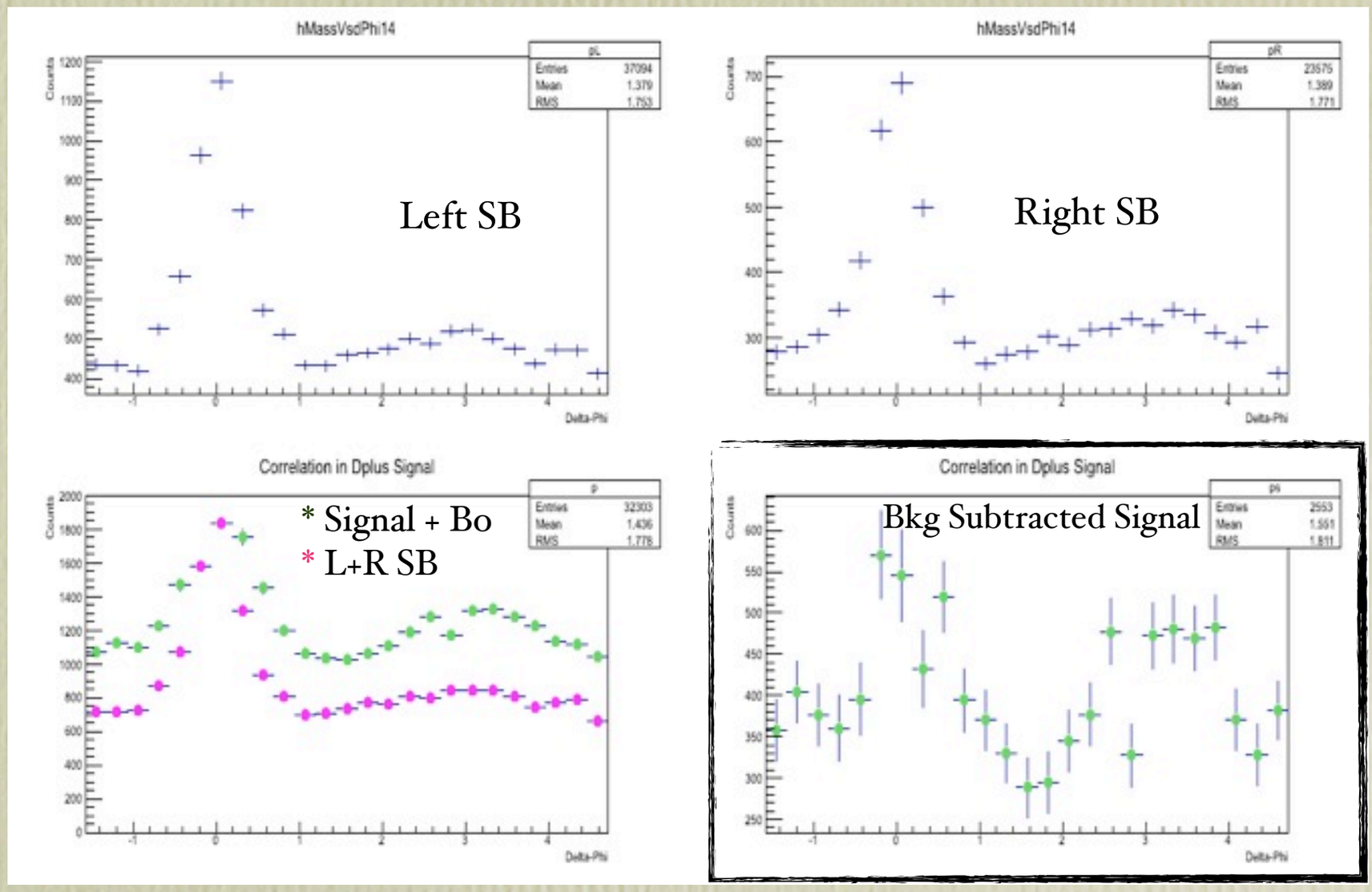
☑ Hadron pt > 0.3 GeV/c



Azimuthal - Correlation in D^+ - Hadron: [Data]

☑ **6 < D+ pt (GeV/c) < 8**

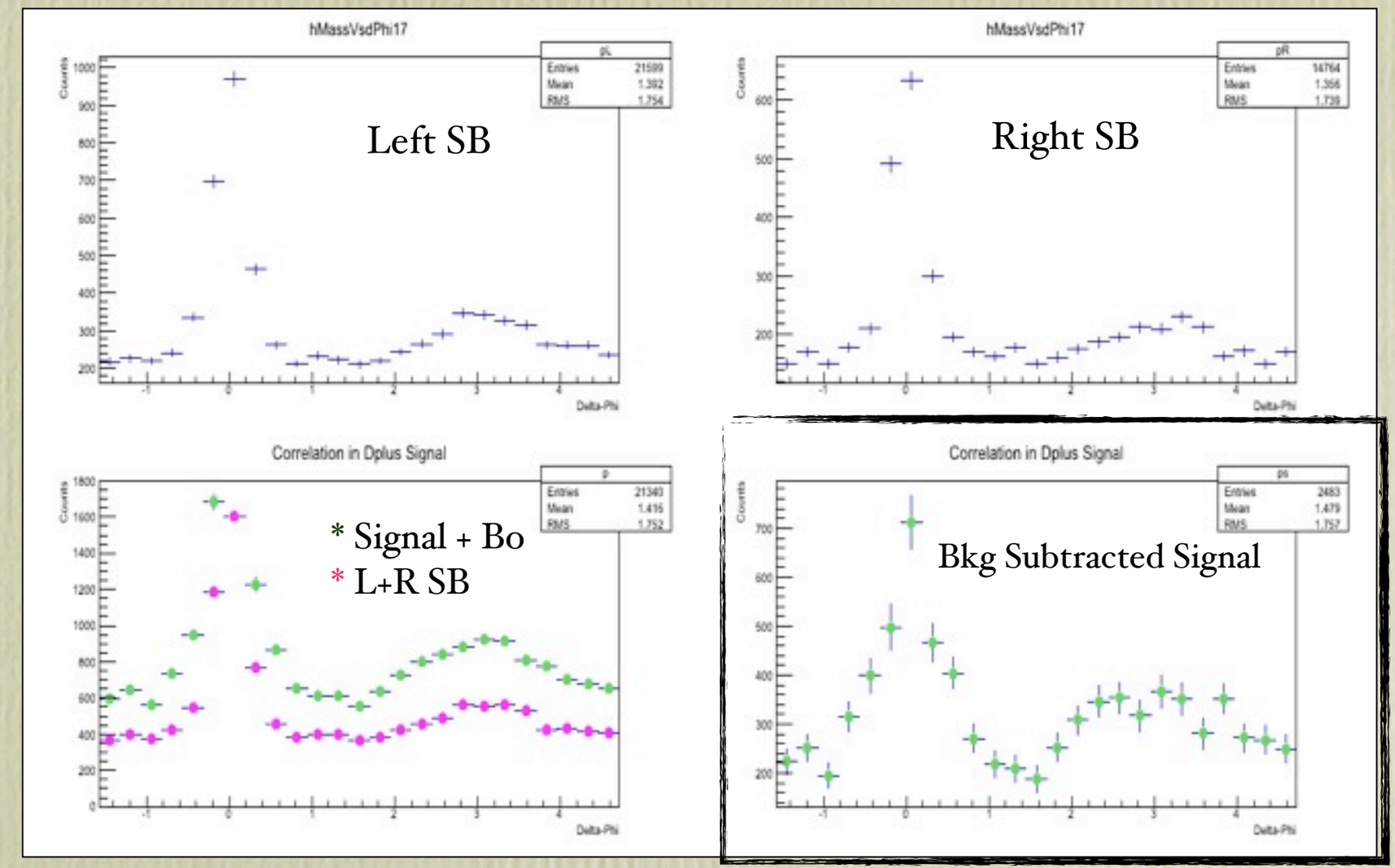
☑ Hadron pt > 0.3 GeV/c



Azimuthal - Correlation in D+ - Hadron: [Data]

☑ Hadron pt > 0.3 GeV/c

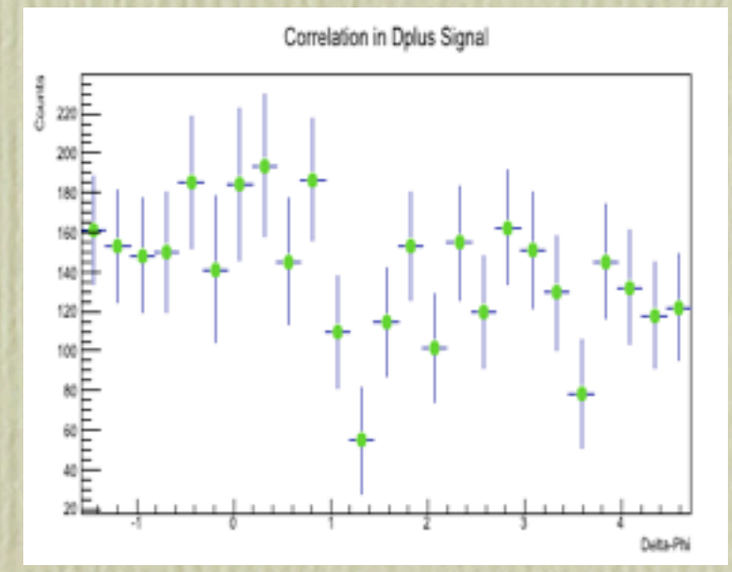
☑ **8 < D+ pt (GeV/c) < 16**



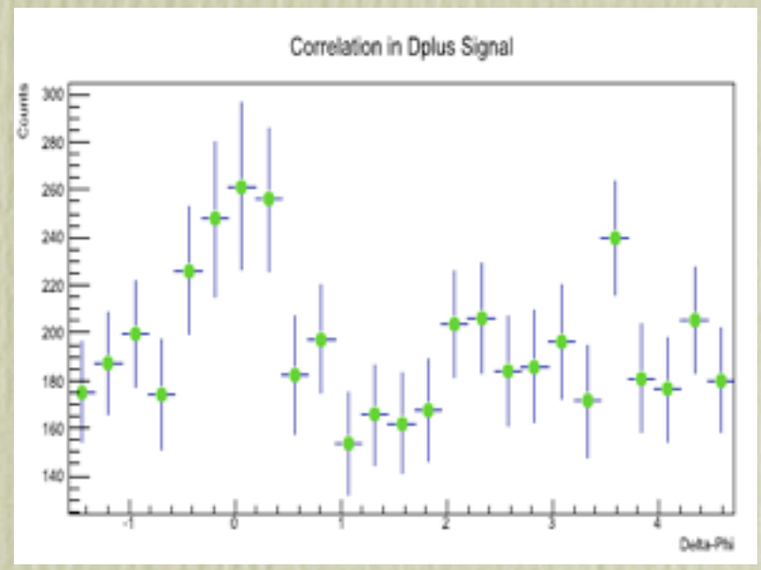
Azimuthal - Correlation in D^+ - Hadron: [Data]

Hadron pt > 0.5

☑ **2 < D+ pt (GeV/c) < 5**



☑ **6 < D+ pt (GeV/c) < 8**



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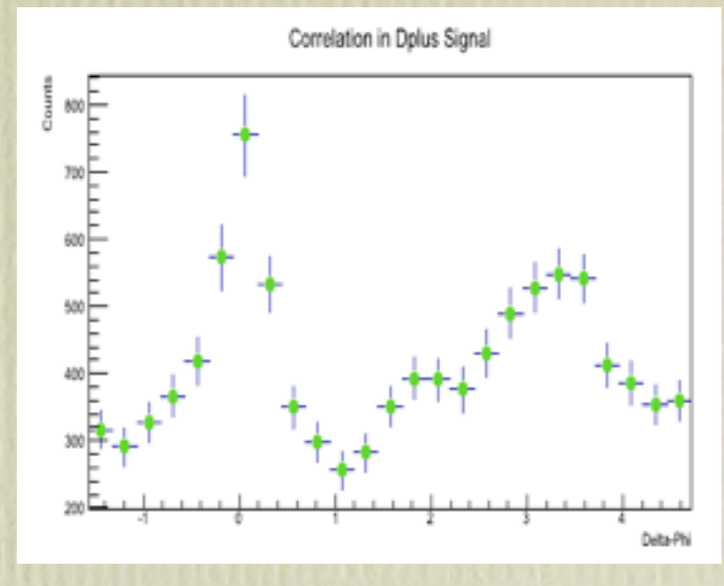
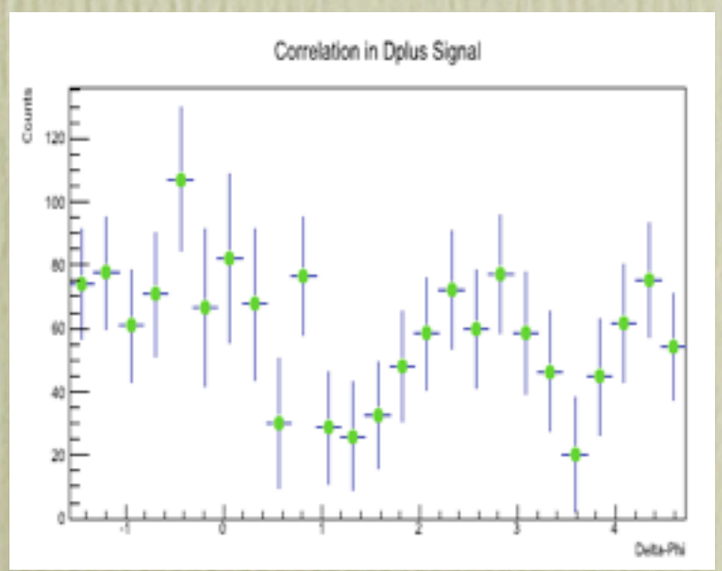
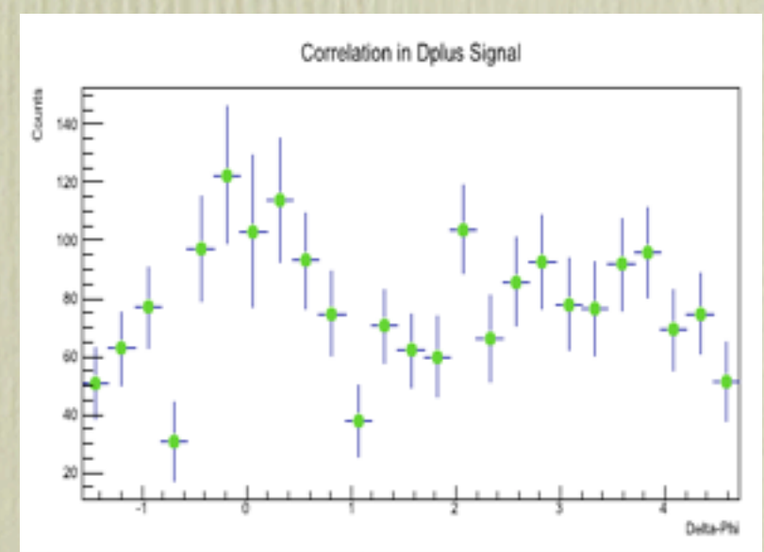
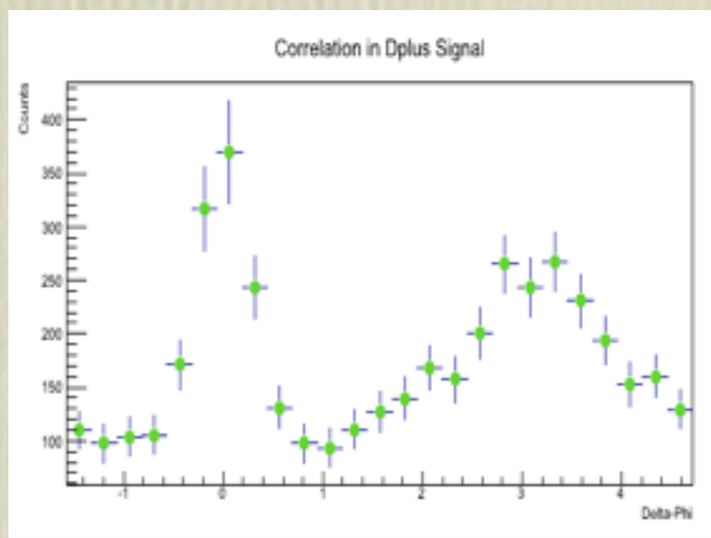


Hadron > 1.0



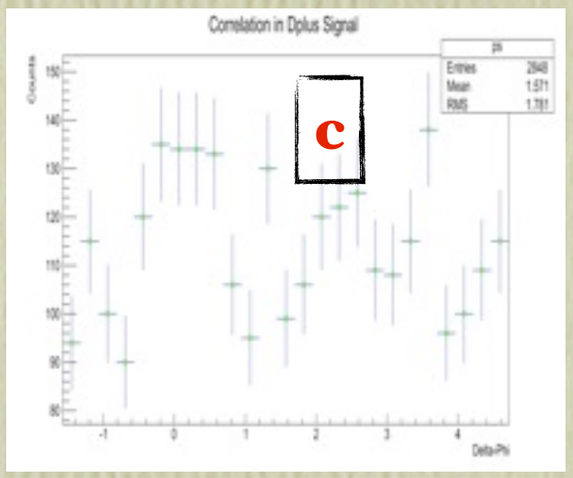


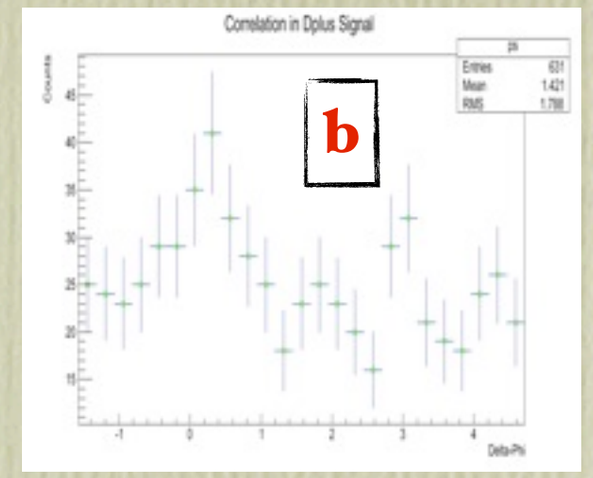


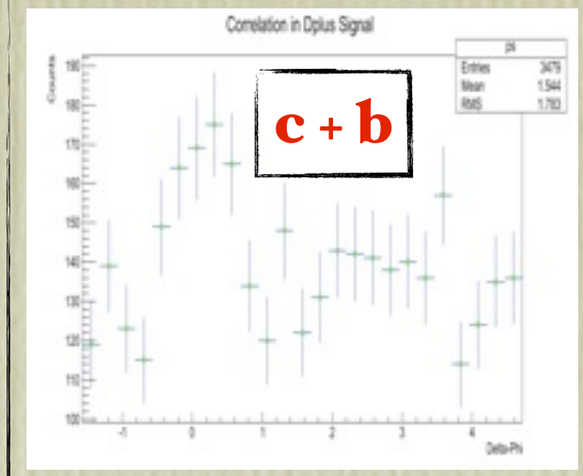
Azimuthal - Correlation in D+ - Hadron: [MC]

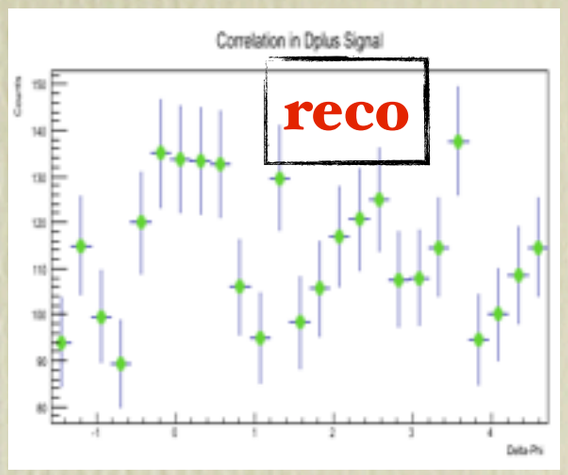
D+ Origin

☑ **2 < D+ pt (GeV/c) < 5**

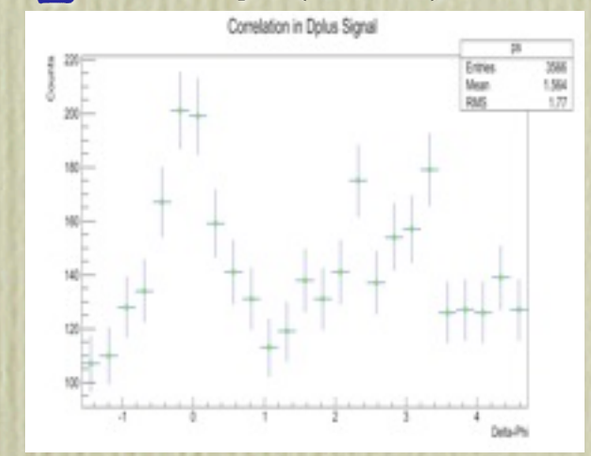


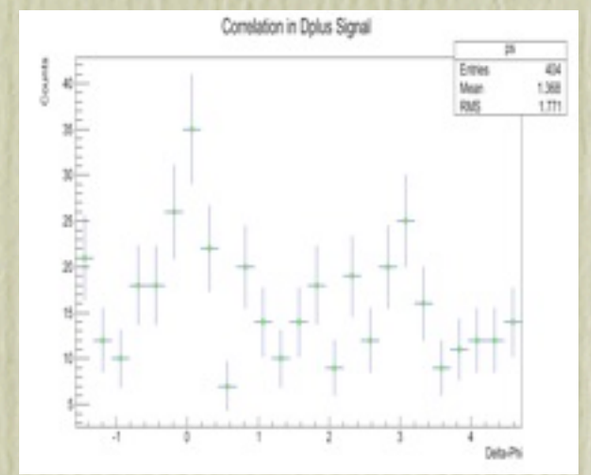


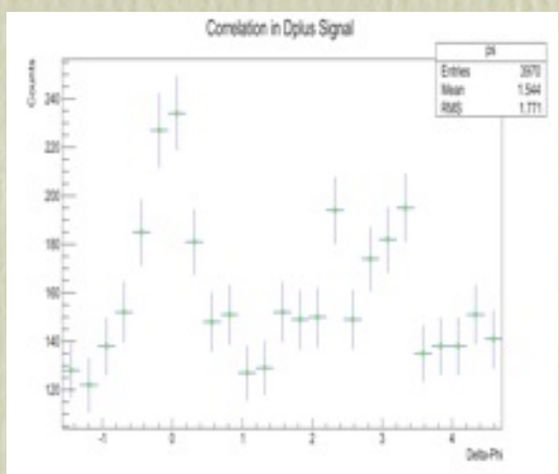


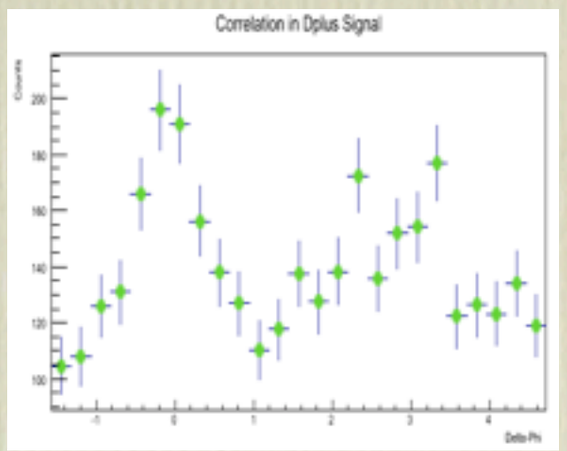


☑ **6 < D+ pt (GeV/c) < 8**

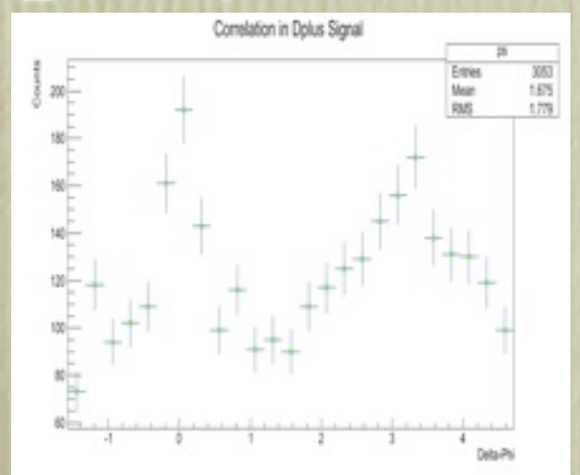


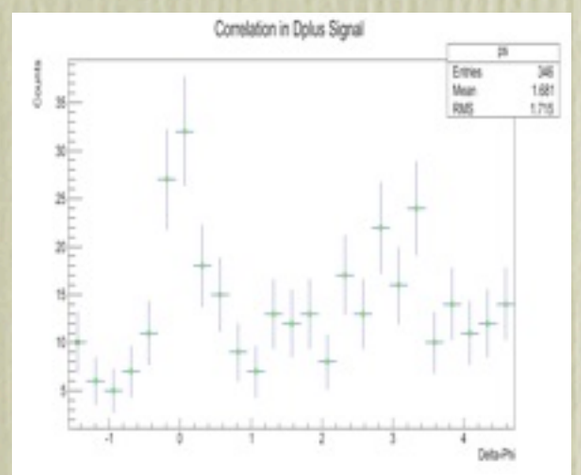


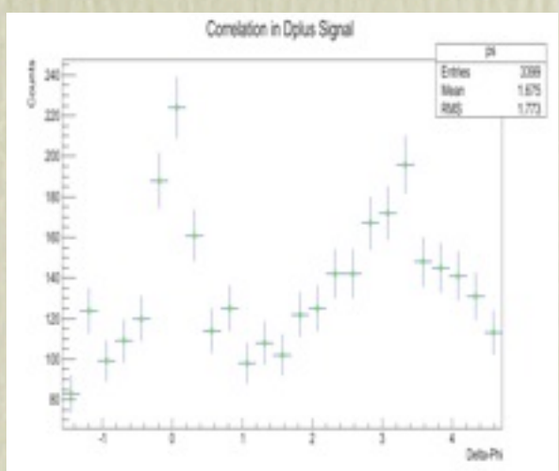


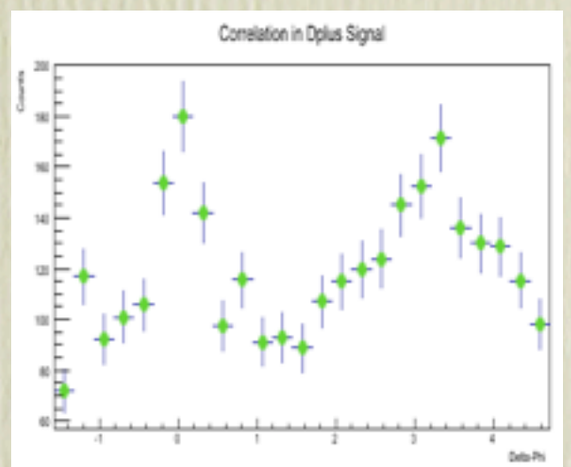


☑ **8 < D+ pt (GeV/c) < 16**

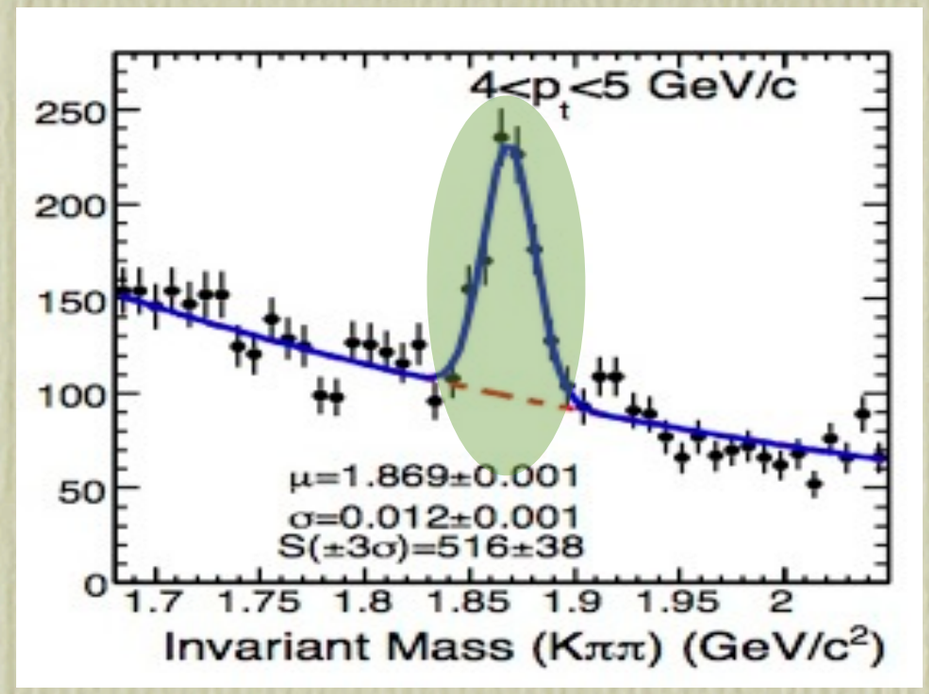


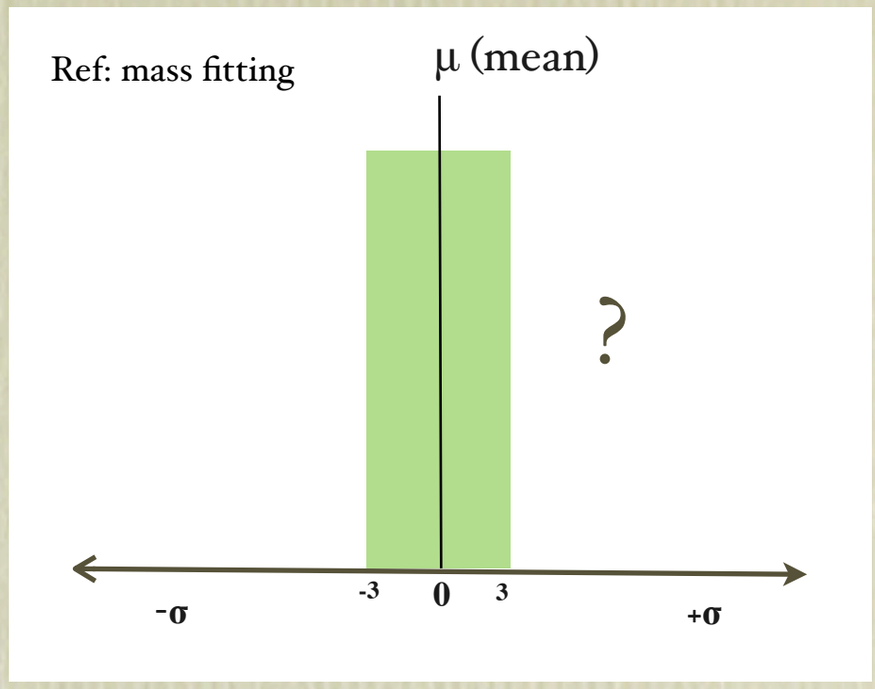


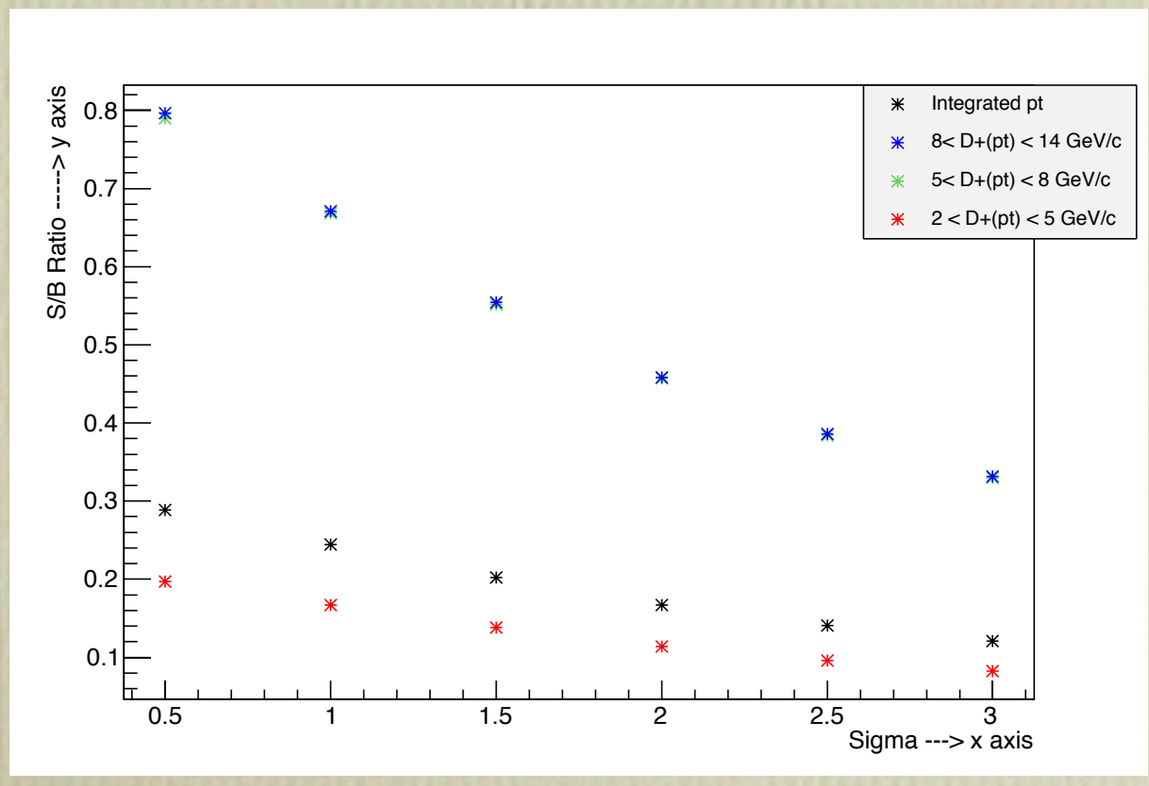




Search for appropriate σ







(S/B) Ratio Vs # of σ

Validity of Side Band Subtraction

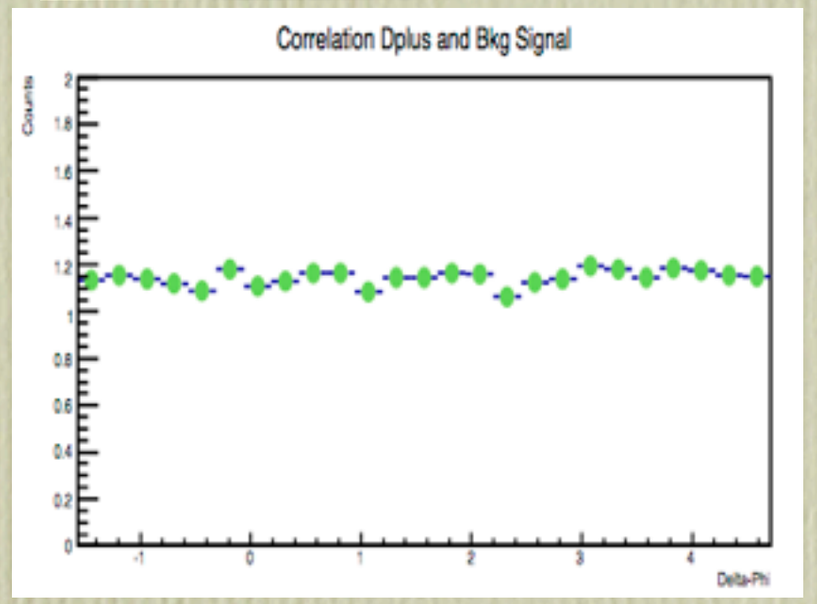
CHECK1: Shapes of correlation in S+B and B region

CHECK2: Correlation shapes in both side band background

CHECK3: Signal Ratio of (Tagged/Reco) Correlation

Shape of correlation in S+B and B Region (signal+B_o)/(B_L+B_R)

☑ **2 < D+ pt (GeV/c) < 5**



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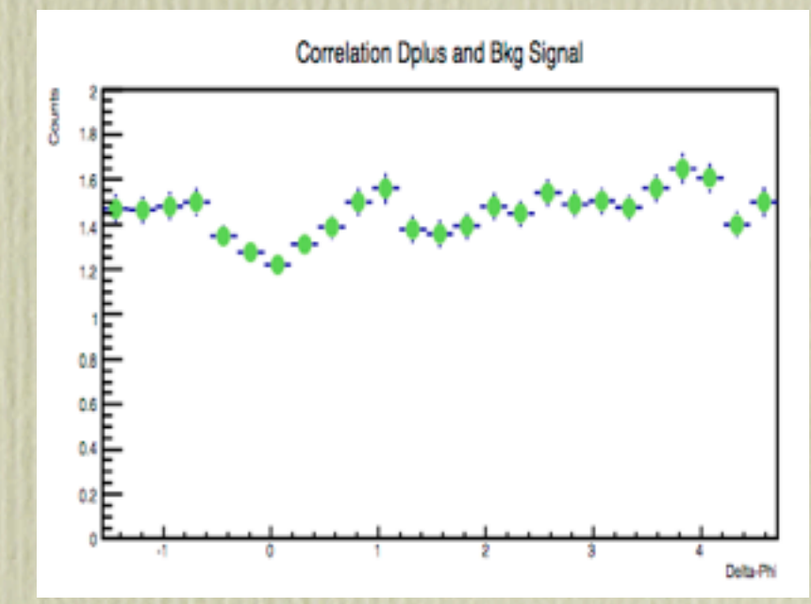

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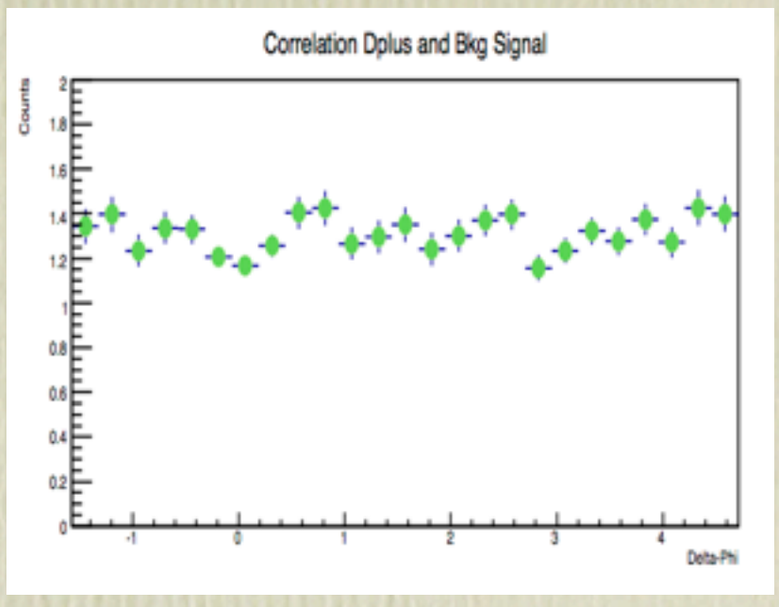
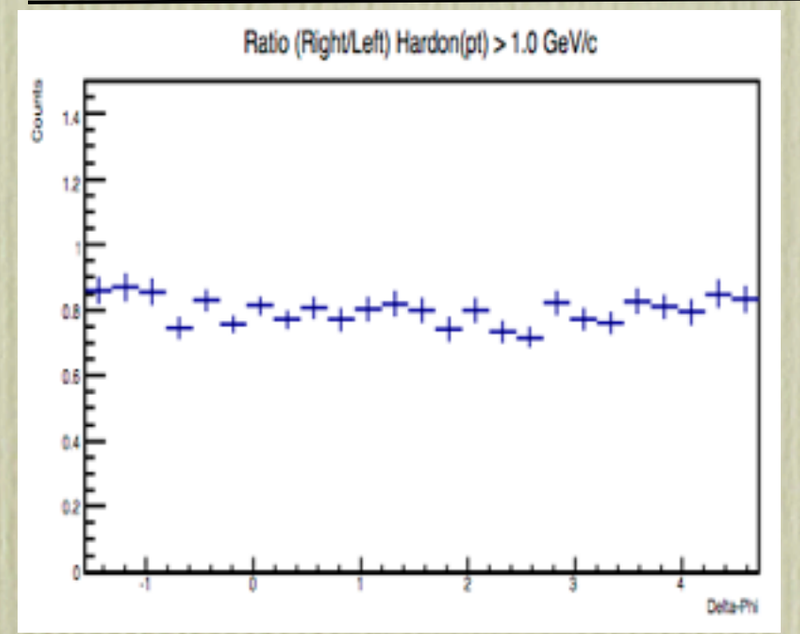


Correlation shape in side bands (B_L/B_R)

☑ 2 < D+ pt (GeV/c) < 5



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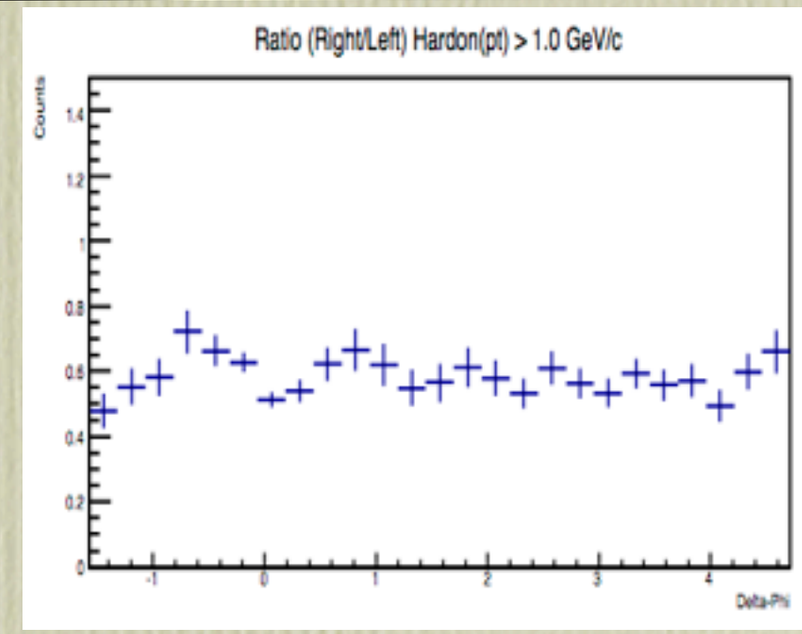

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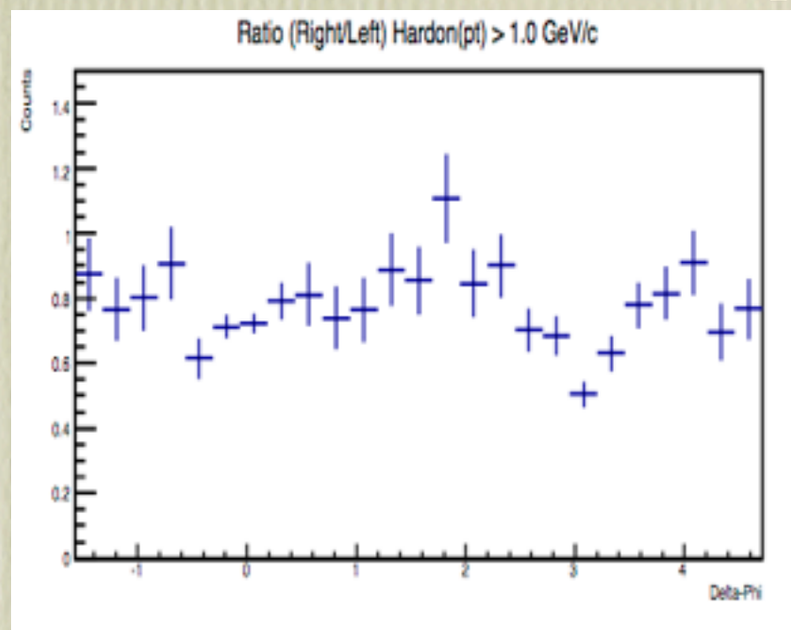
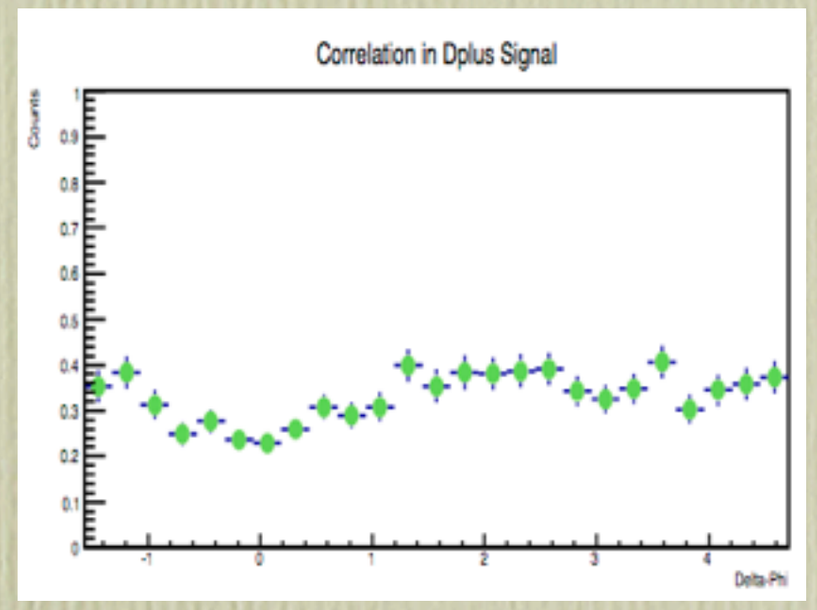
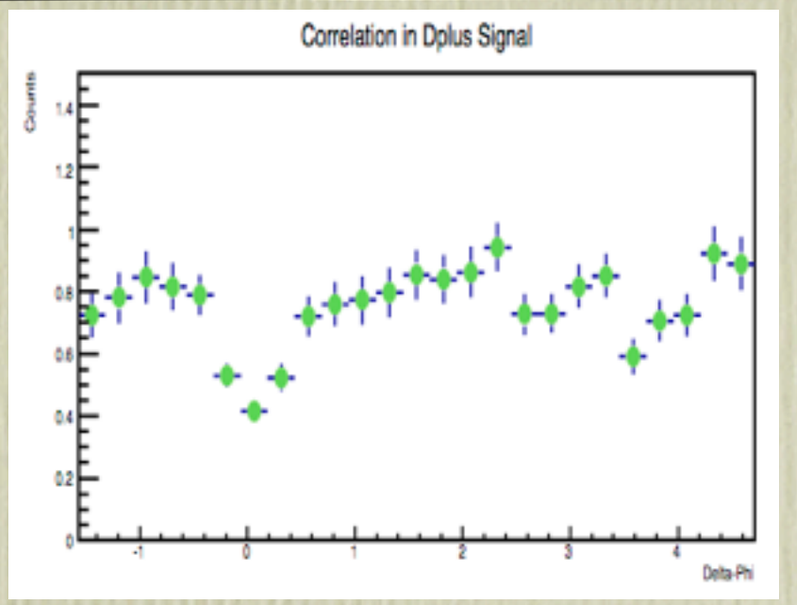


Signal Ratio of (Tagged/Rec) MC Correlation

☑ 2 < D+ pt (GeV/c) < 5



☑ 6 < D+ pt (GeV/c) < 8



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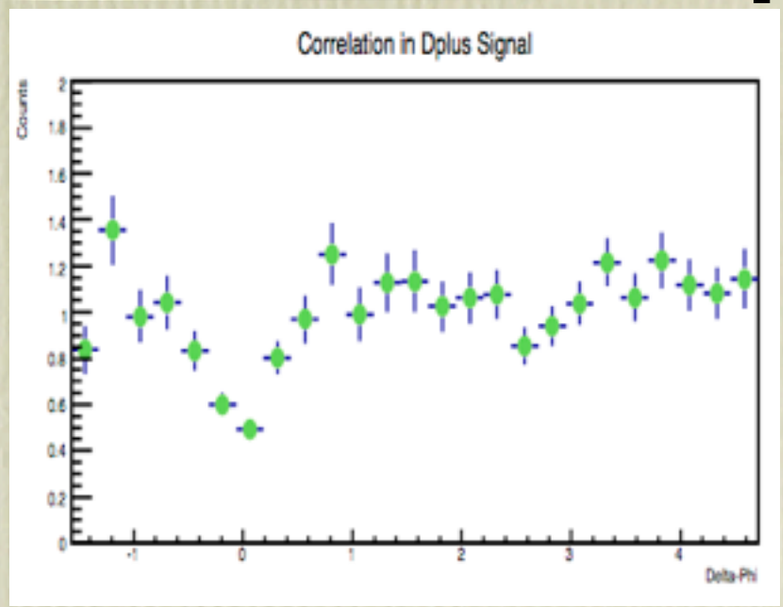

More on D+ Hadron Correlation

- ☑ Single track efficiency correction framework ready (need to apply on this analysis -> Next Check)
- ☑ Also D Meson efficiency (Next Check)
- ☑ Mixed Event Technique is also applied (not shown in ppt)
- ☑ Study of the correlations in MC vs the production process is ongoing.

Summary:

- ☑ D+ Invariant mass distribution nicely observed.
- ☑ Side band technique for background subtraction is performed.
- ☑ Check on validity of SB Technique have good agreement.
- ☑ Ingredients for correction is also ready.

Thanks: