Data-MC comparison

Comparing $\pi^+\pi^-\pi^0$ events to colinear events

Data-MC comparison

- Aim:
  - Produce a comprehensive set of distributions from variables in PROD2NTU and STENTU
  - **Investigate and quantify possible discrepancies between Data and Monte Carlo.**
- Studies have so far been **conducted on using STENTU** root-tuples.
- The root-tuples use the last ~ 5-7 of 2005 data.
- Distribution comparisons have been done for momentum and position variables as well as other track and cluster variables.
- Data and MC agree to varying degrees depending on the variables. **Investigations are underway on discrepancies found.**

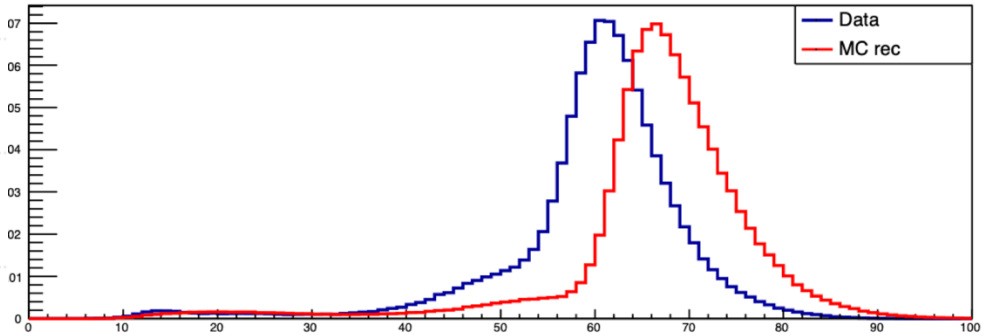
STENTU Variables Overview

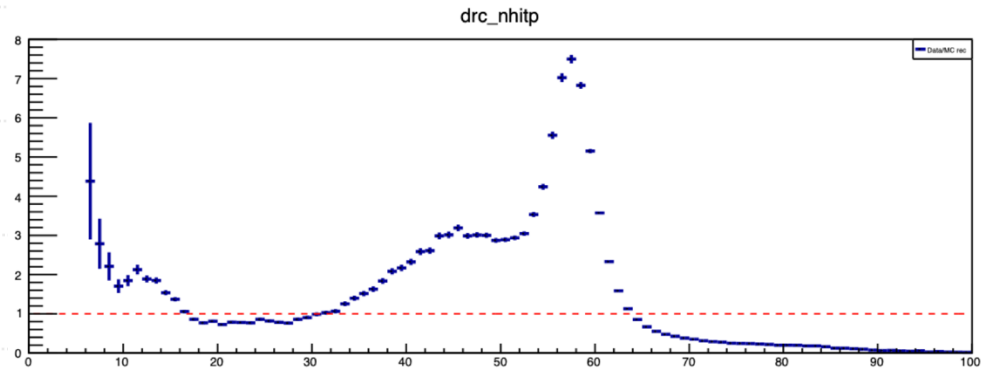
Variable	Consistent	Inconsistent	V.Inconsistent
Momentum			
p_x	•		
p_y	•		
p_z		•	
$p_t = \sqrt{p_x^2 + p_y^2}$:		•	
$p_{tot} = \lvert\boldsymbol{p}_+\rvert + \lvert\boldsymbol{p}_-\rvert$:		•	
Position			
x_{first}		•	
y_{first}	•		
z_{first}		•	
x_{last}		•	
y_{last}	•		
z_{last}	•		
x_{pca}			•
y_{pca}			•
z_{pca}		•	
θ (polar)		•	
ϕ (azimuth)	•		
x_{clu}	•		
y_{clu}	•		
z_{clu}		•	
Tracks			
M_{trk}			•
n_{hits}			•
n_{vtx}	•		
Clusters			
n_{prompt}		•	
E_{clu}			•
T_{clu}		•	
$E_{\text{total,clu}}$			•
$Q^2_{\pi\pi}$		•	
Trgtype	•		

Recap

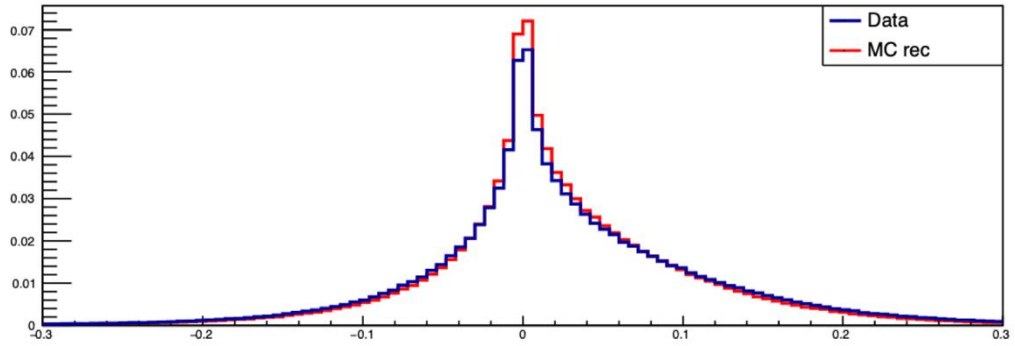
- Some variables show clear discrepancy and are being investigated starting with the track variables.
- Distributions are presented separately for positive and negative tracks. Below are examples of variables which are different between data and MC but are consistent for negative and positive tracks (as to be expected).

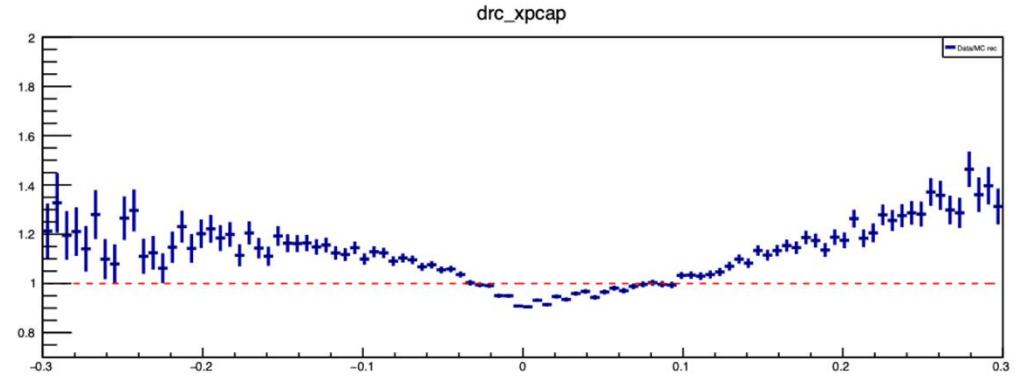
nhits





pca



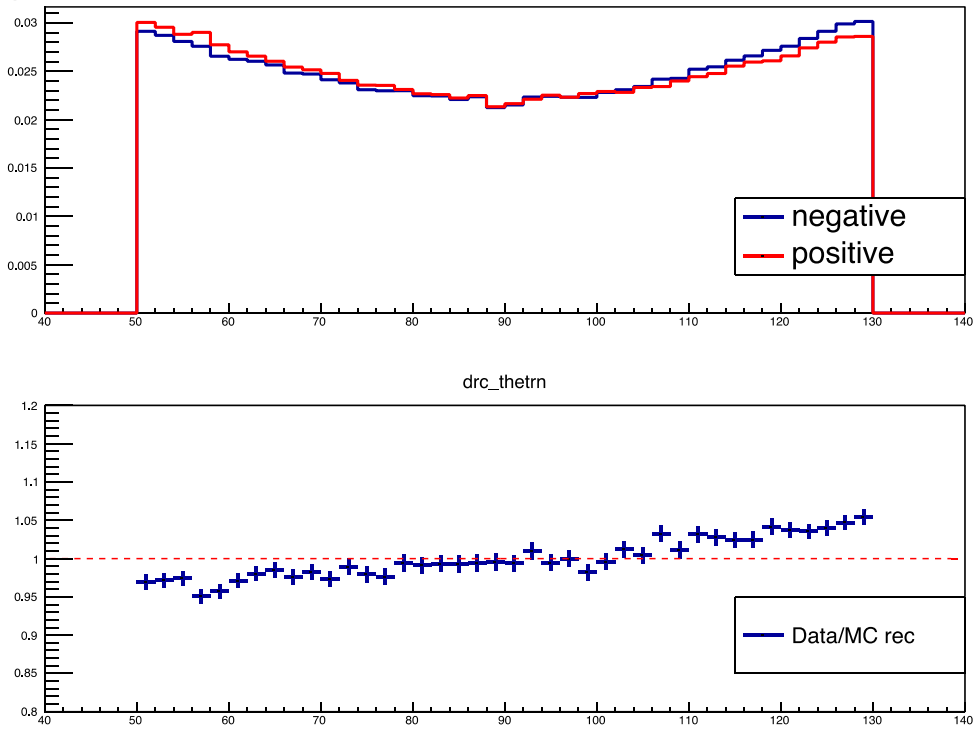


Recap

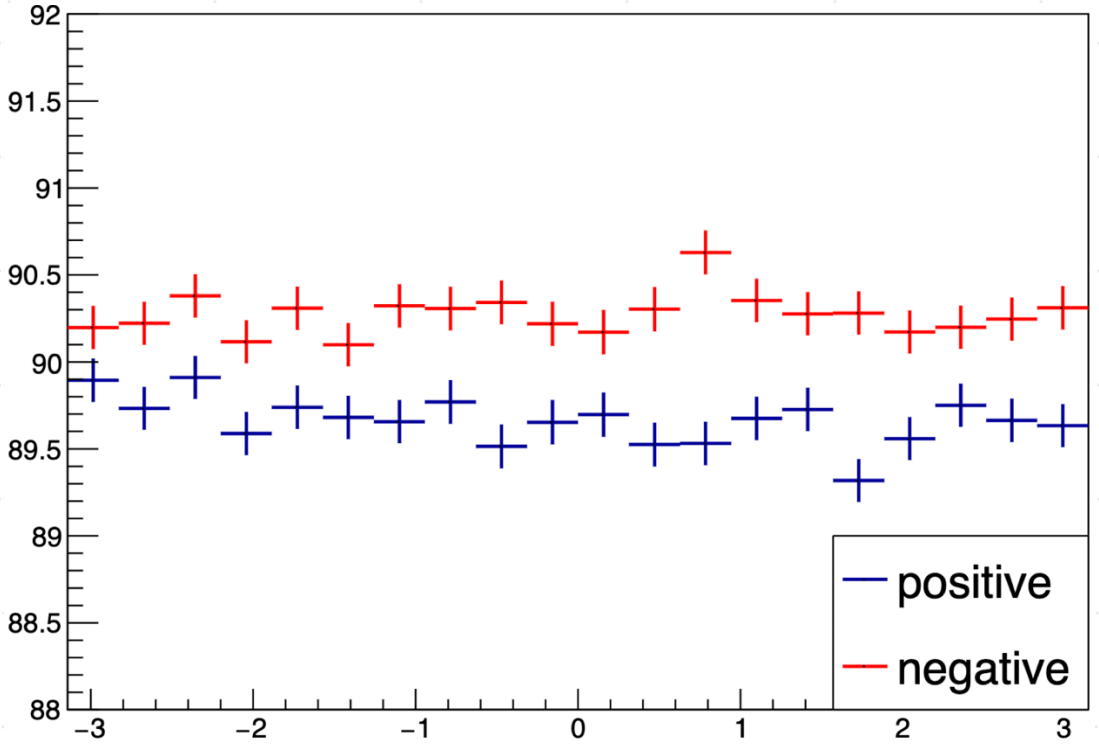
- Distributions for variable show an interesting discrepancy between positive and negative tracks in Data. MC doesn't exhibit the same feature.

- This has a clear effect on distributions calculated along the z axis ($p_z = p_T \cot(\theta)$), this is both for tracks (first hit, last hit, position, momentum)and calorimeter clusters.

θ_{track}



θ_{track} vs ϕ



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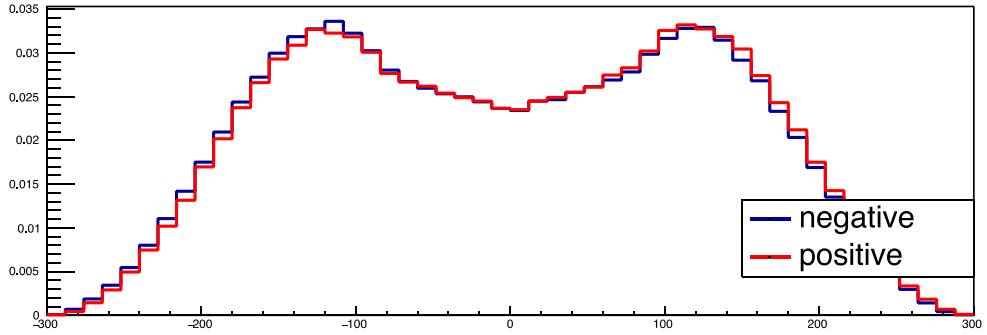
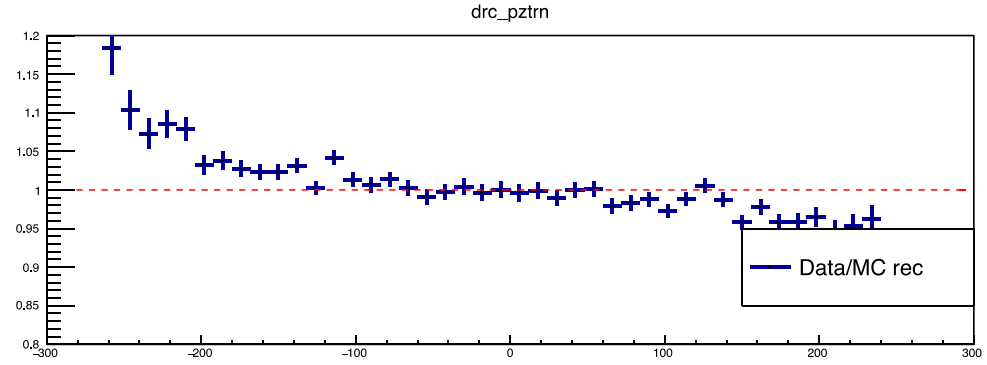
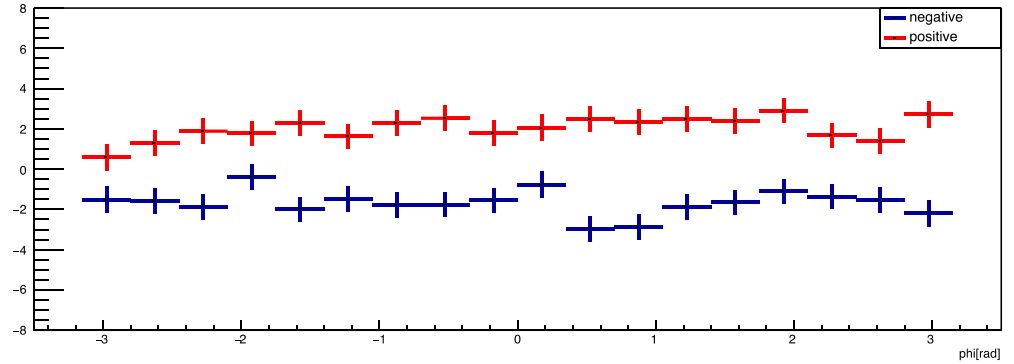
p_z

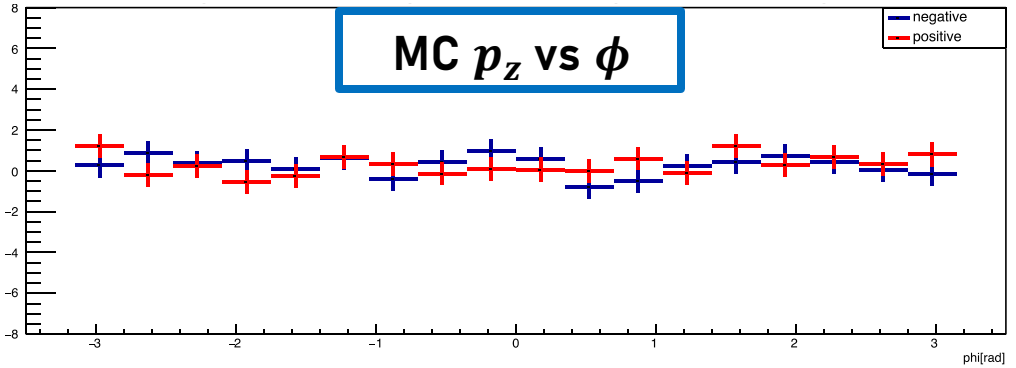




Data p_z vs ϕ



MC p_z vs ϕ



3π dataset vs colinear dataset

Dataset 1

- $\phi \to \pi^+\pi^-\pi^0$
- RPI (Stream 3)

Scalar sum of the momenta $|p_+| + |p_-|$ GeV

- RPI stream cuts:
  - $0.45 < P_\Sigma < 0.85$;
  - $-0.060 - e^{(P_\Sigma - 0.4)/0.1}/1000 < \Delta E_\gamma < -0.010 - e^{(P_\Sigma - 0.4)/0.11}/1000$;
  - $E_{tot} > 10$ MeV;

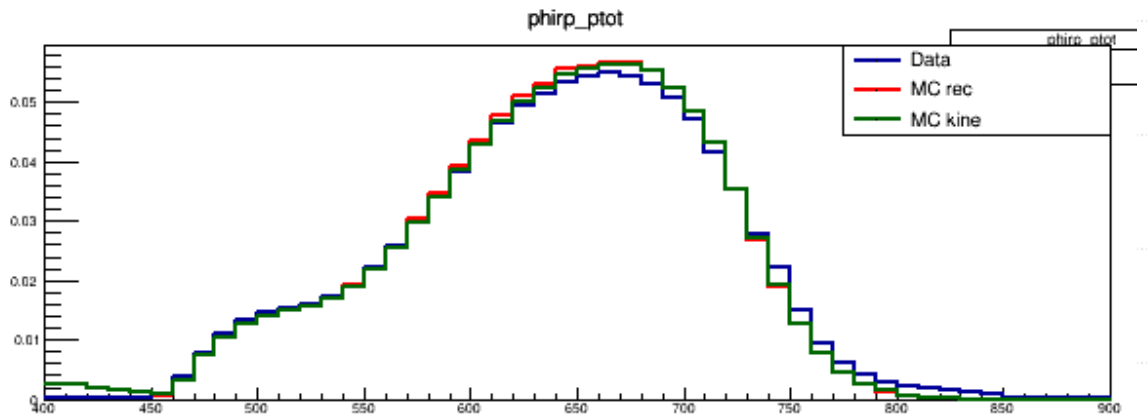
$$\delta E = |P_1 + P_2| - (m_\phi - \sqrt{m_\pi^2 + |P_1|^2}\sqrt{m_\pi^2 + |P_2|}$$

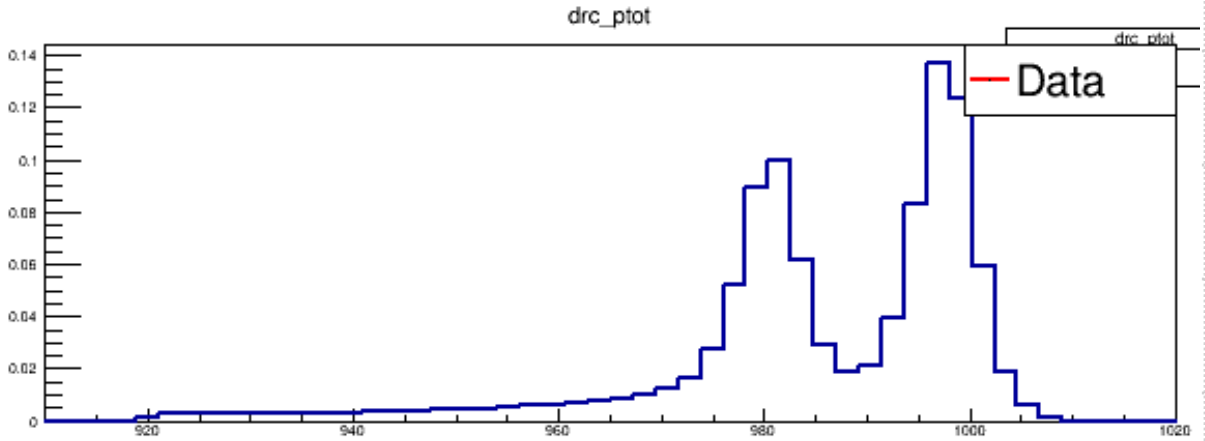
Dataset 2

- $e^+e^- \to \pi^+\pi^-$
- CLB (Stream 5)

- CLB stream cuts:
  - $0.97 < P_\Sigma < 1.01$;
  - $E_{tot} < 900$;
  - $n_\gamma = 0$;

No. of prompt photons



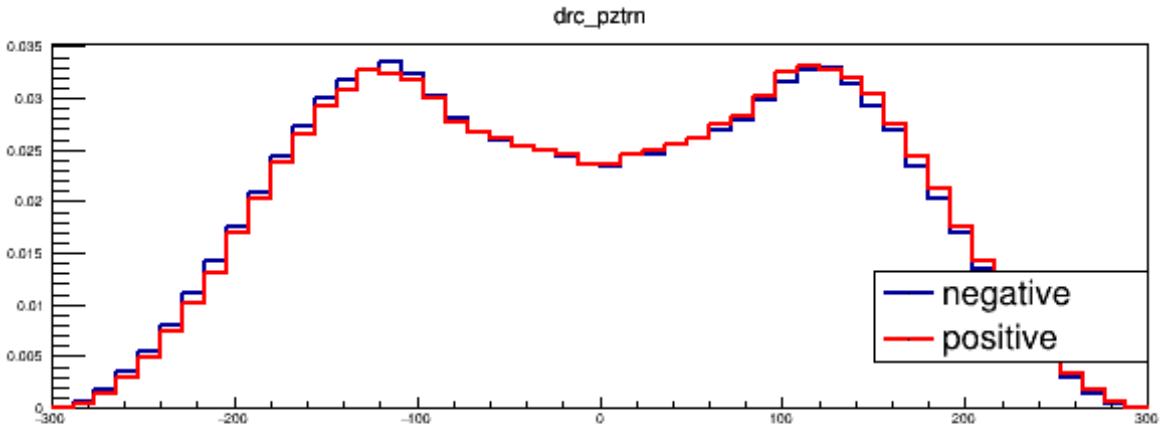


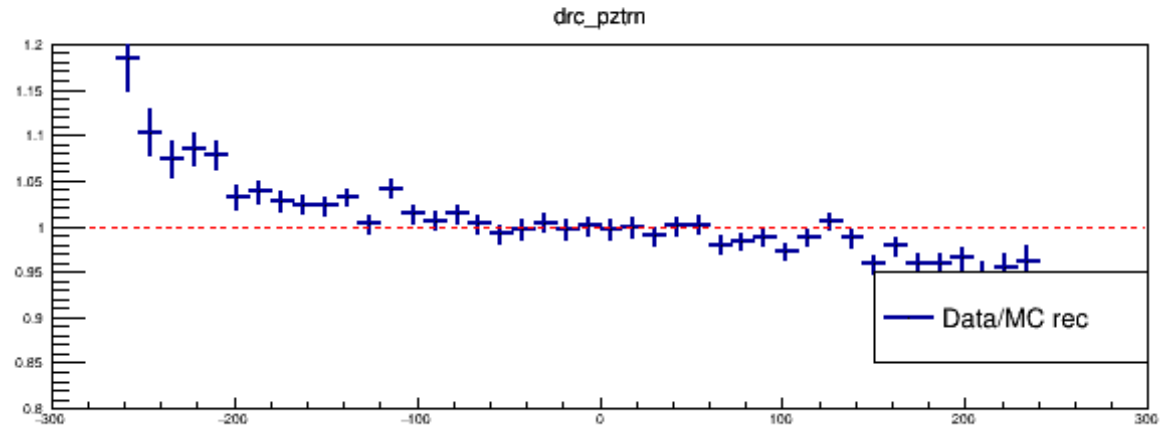
We do not have a CLB Monte Carlo sample. This means we can't do comparisons but we can study +ve and –ve tracks in data…

Does this data sample behave differently ?

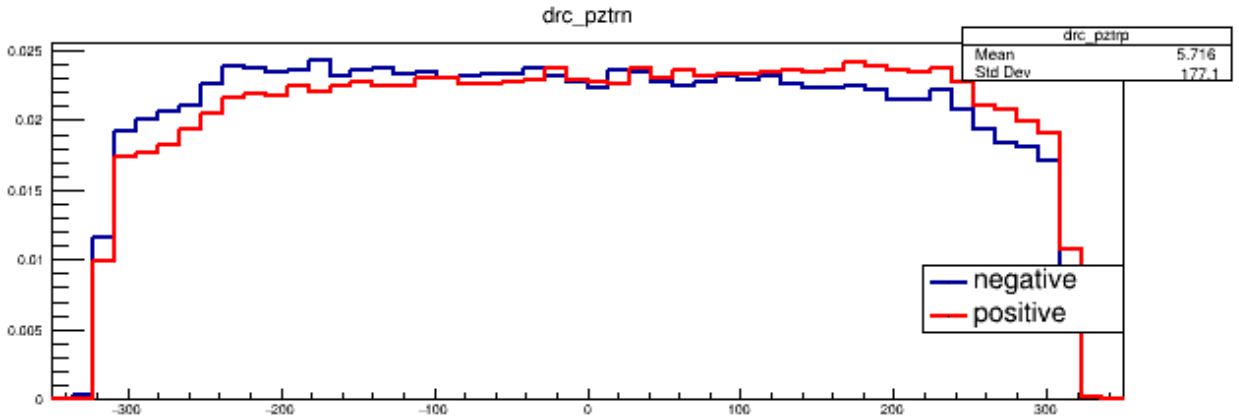
Data p_z for negative and positive tracks

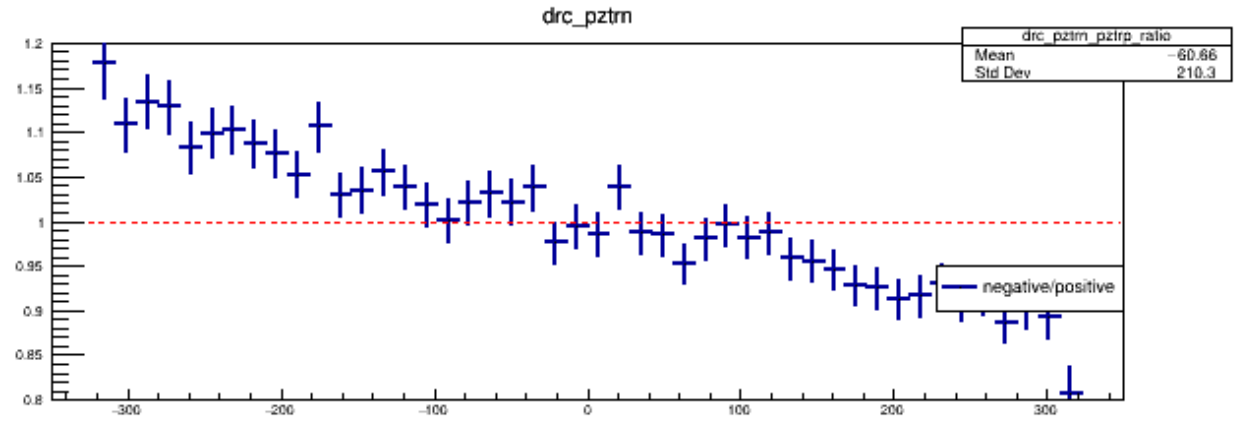
3 π





colinear

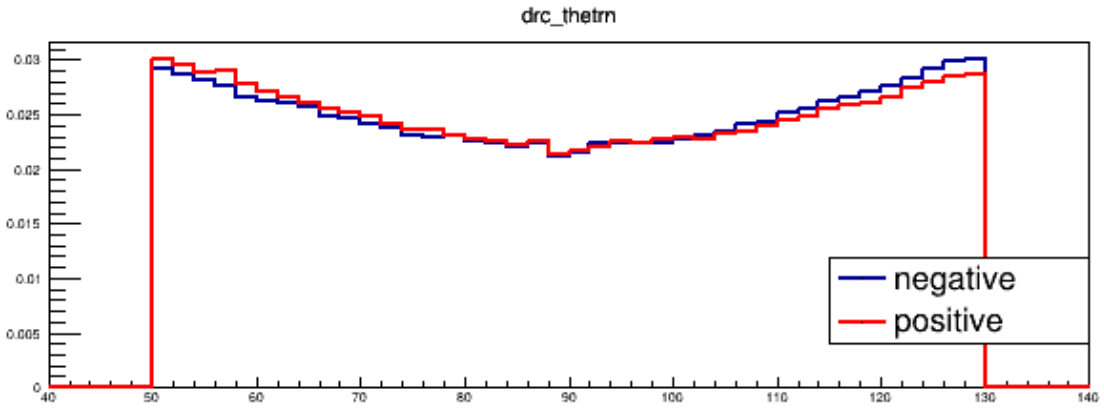


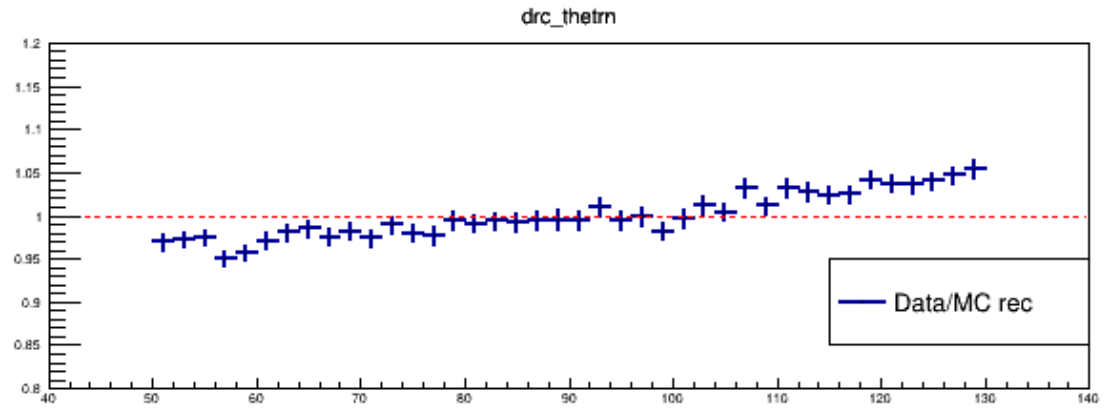


Does this data sample behave differently ?

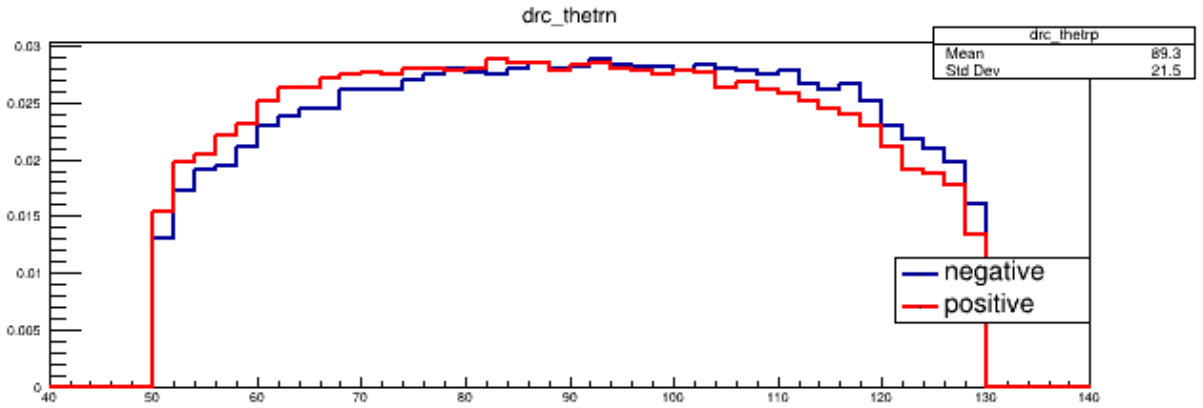
Data θ for negative and positive tracks

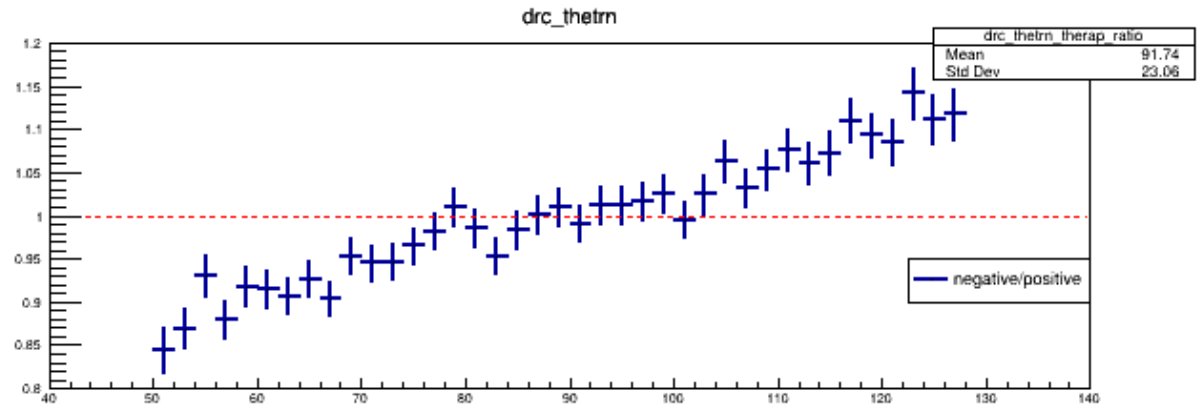
3 π





colinear

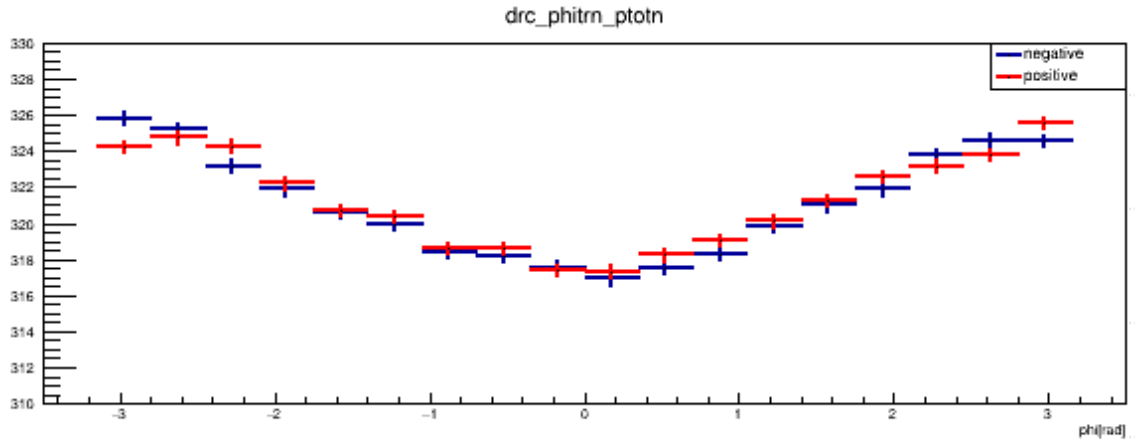


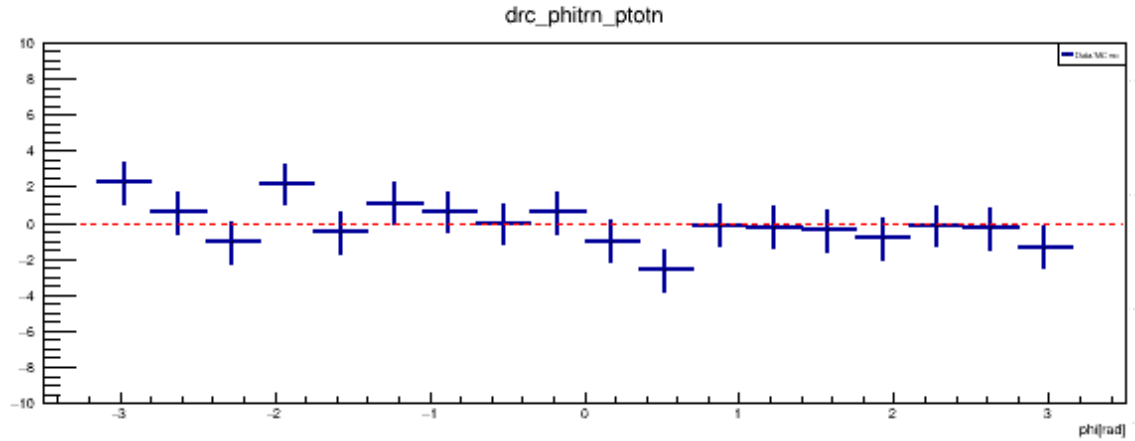


Does this data sample behave differently ?

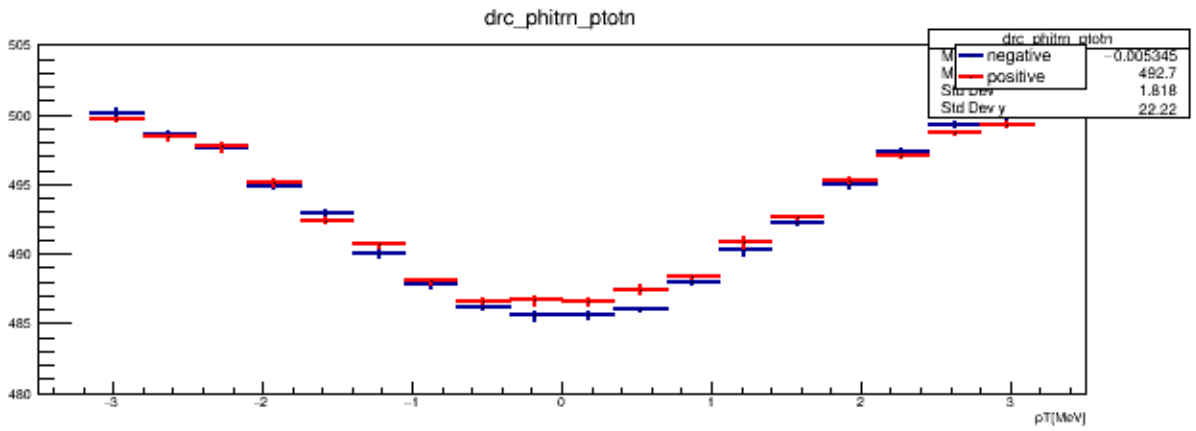
Data $|p|$ vs ϕ for negative and positive tracks

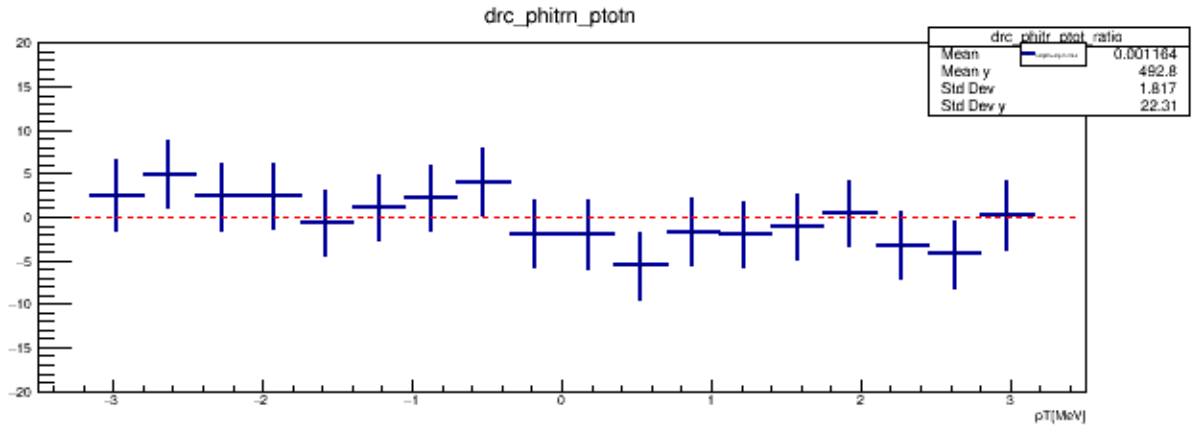
3 π





colinear

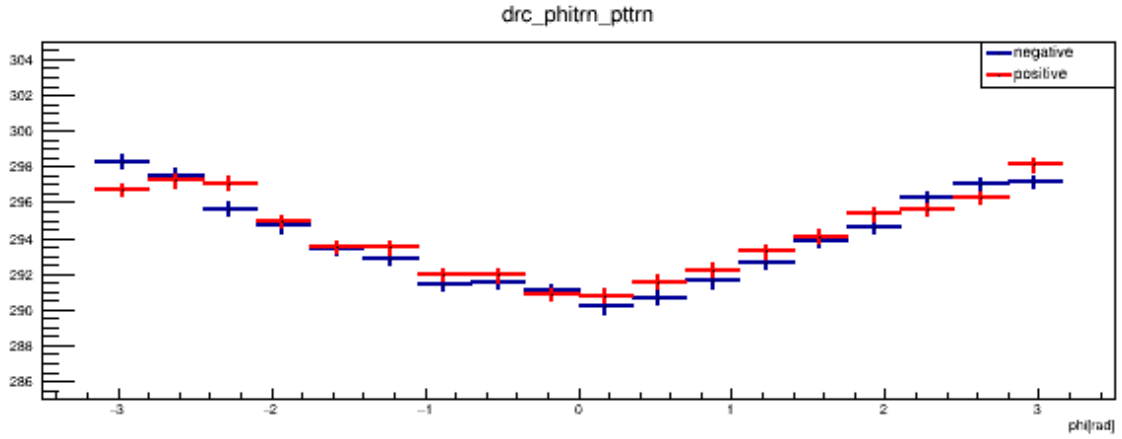


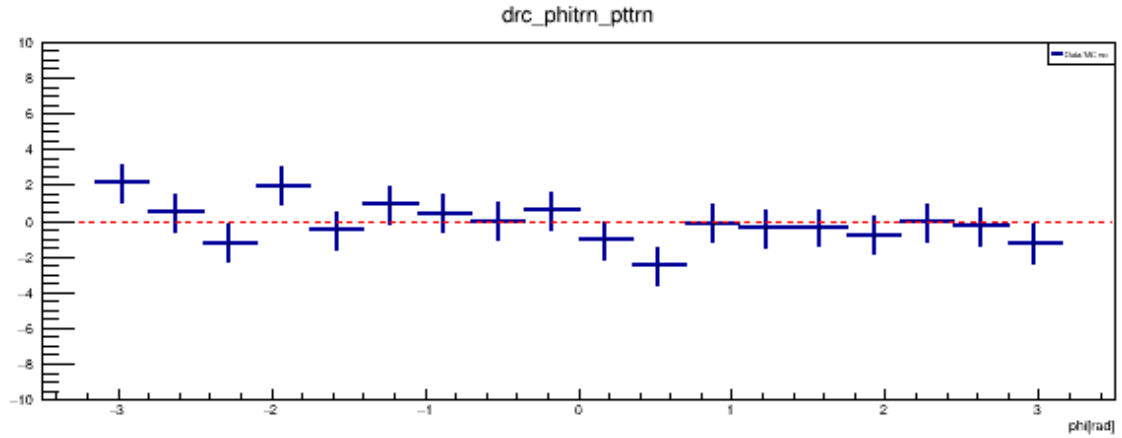


Does this data sample behave differently ?

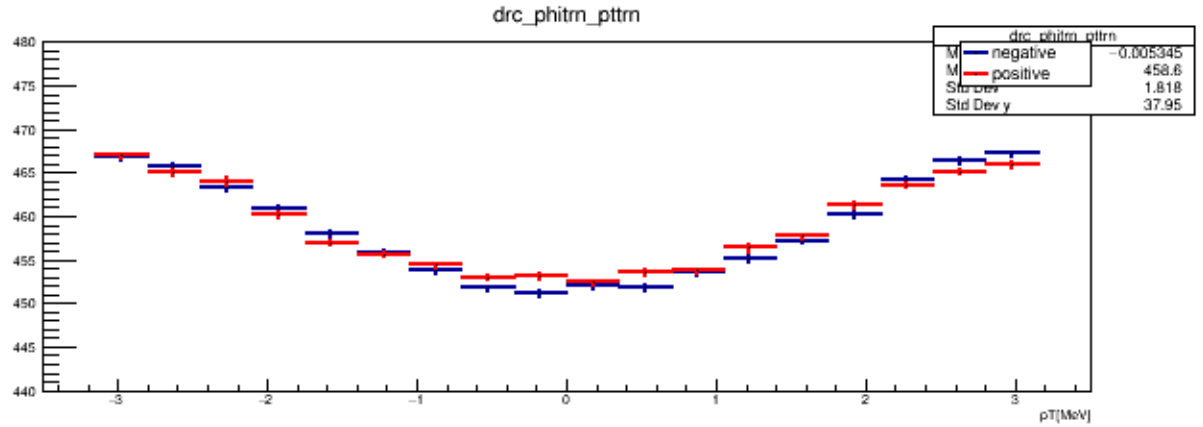
Data p_{xy}vs ϕ for negative and positive tracks

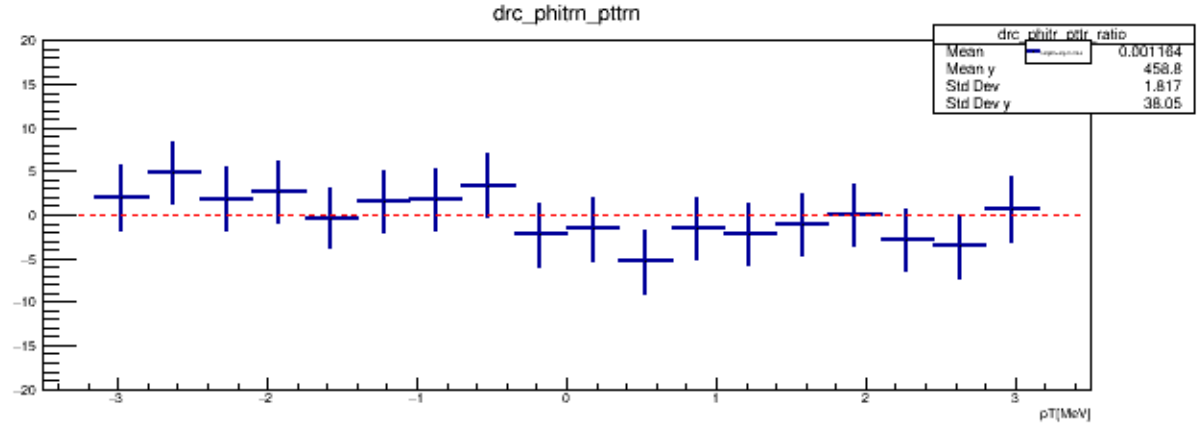
3 π





colinear

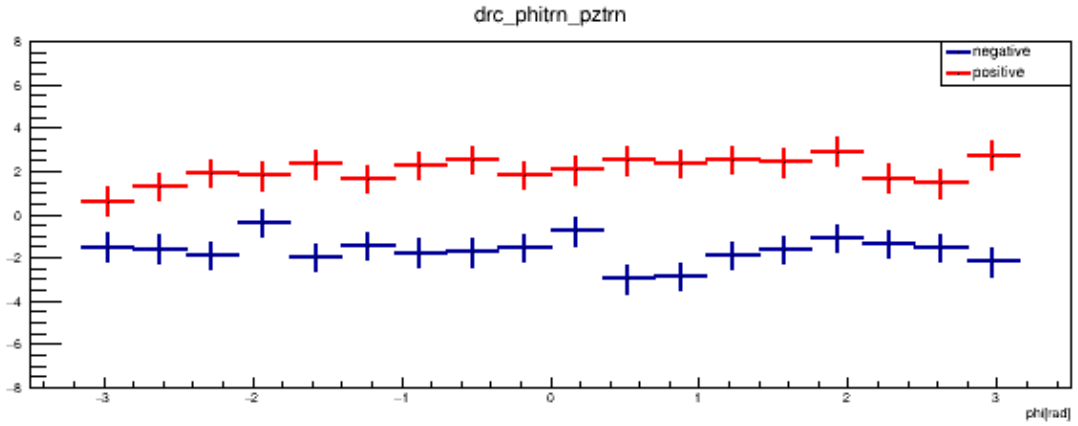


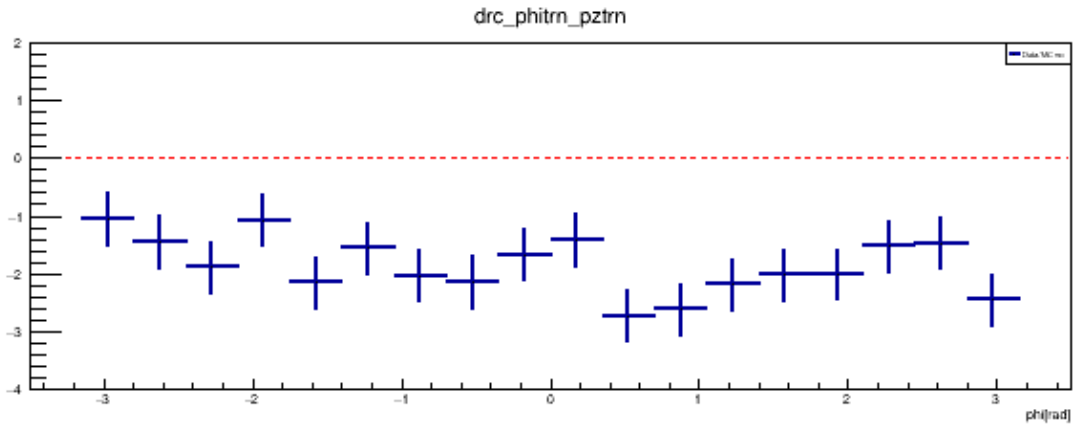


Does this data sample behave differently ?

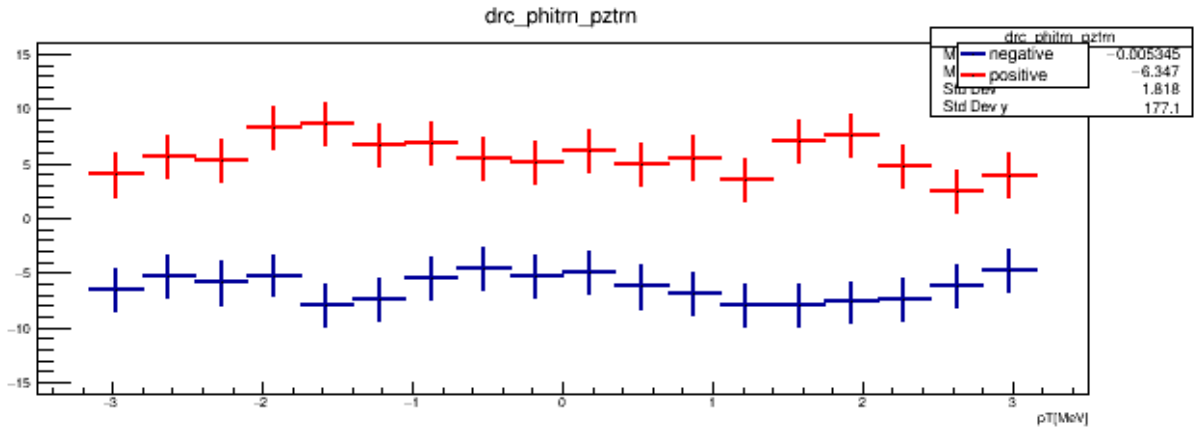
Data p_z vs ϕ for negative and positive tracks

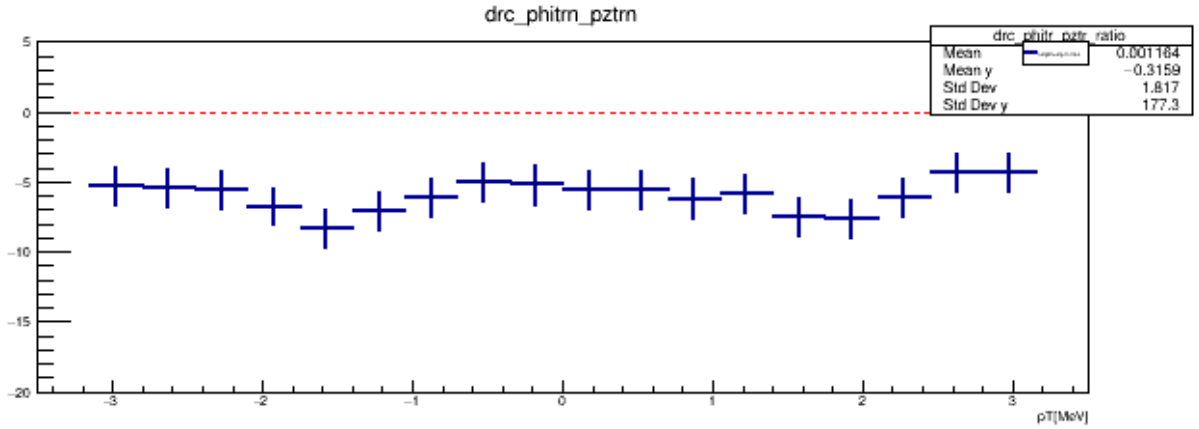
3 π





colinear





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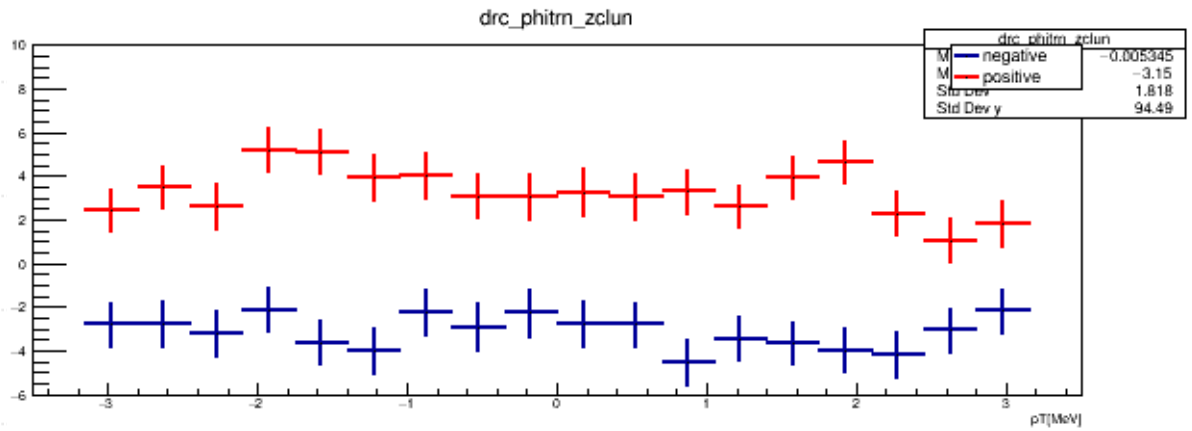
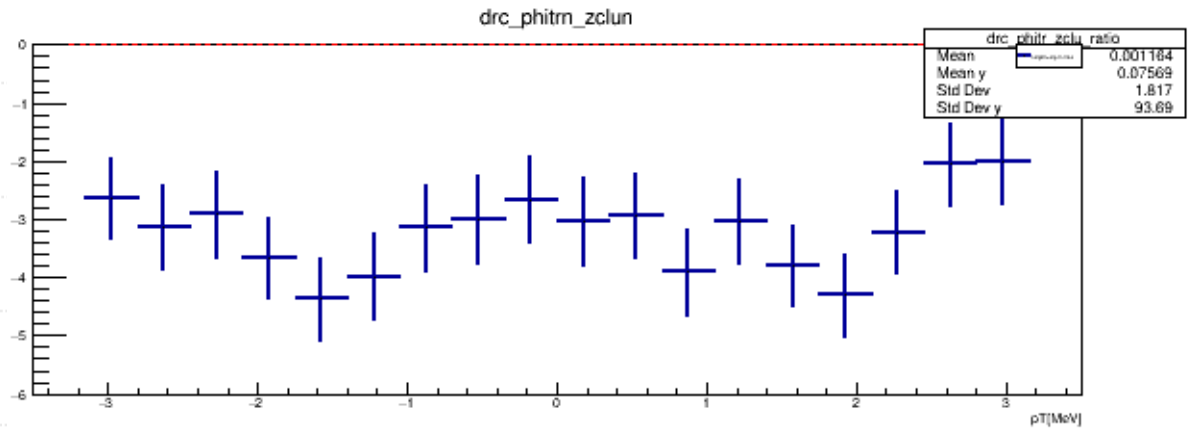
Data Clu_z vs ϕ for negative and positive tracks

3 π





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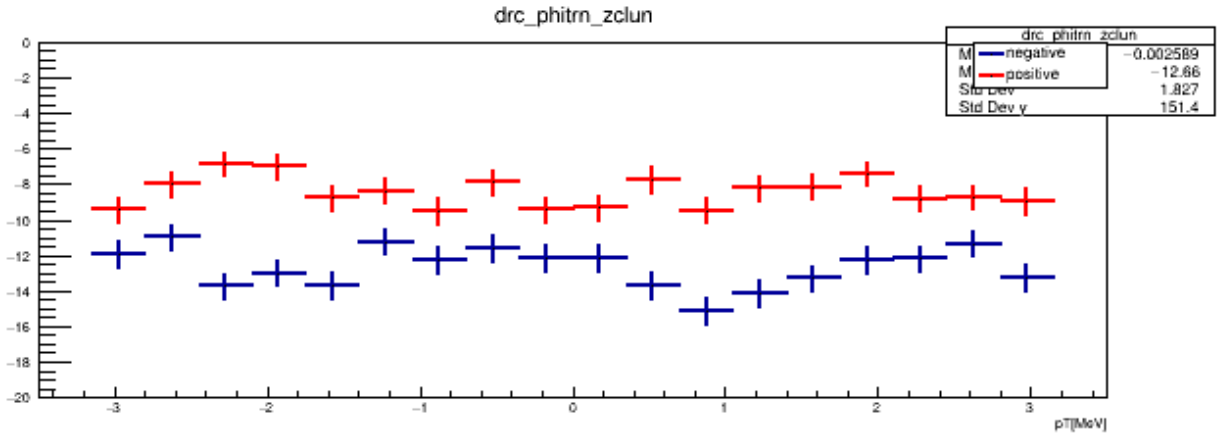

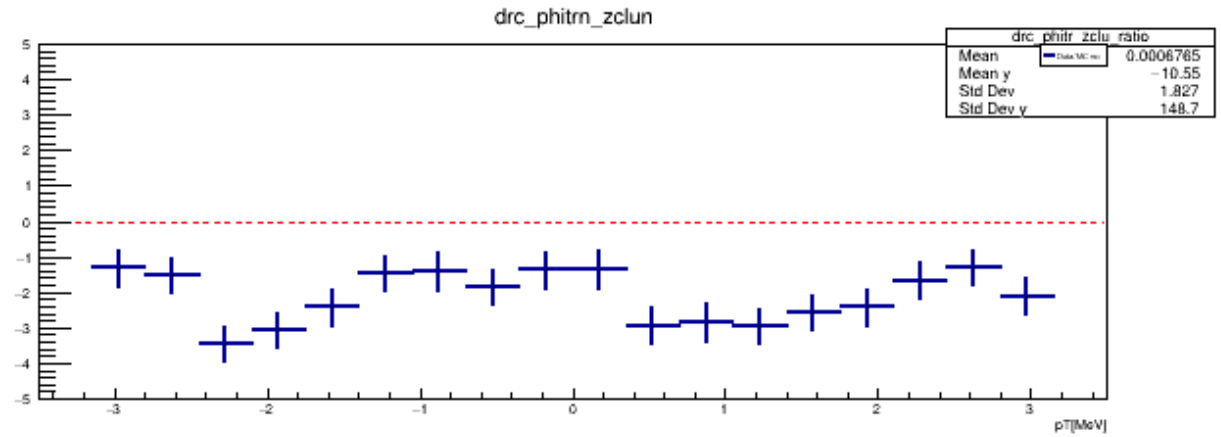

Summary

- CLB Data sample studied in conjunction with 3pi sample.
- CLB sample shows similar behaviour between positive and negative tracks in longitudinal variables
- MC sample needed for further MC–data comparisons.