Update on A_N for π^0's from FCS Run 22 production

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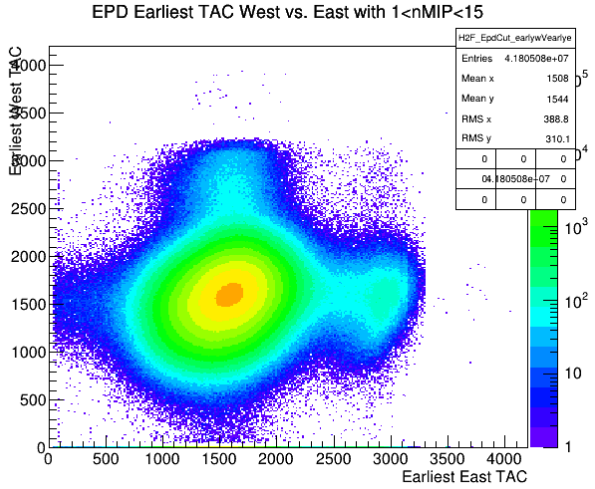
STAR Spin PWG Meeting

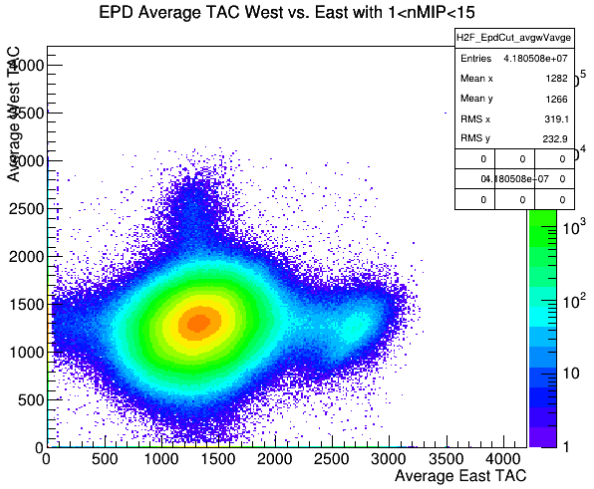
Recap and Outline

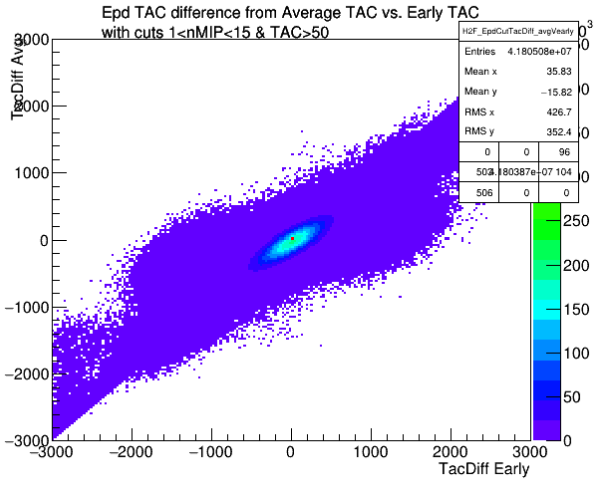
- Looking at Run 22 fwd_stream production
  - Production has been completed
  - Spin database needs to be filled
- Request page: https://drupal.star.bnl.gov/STAR/blog/dkap7827/Run-22-Data-Production-Request
- Last update showed EPD vertex determination
  - EPD vertex is useable
  - I will discuss a little bit about the quality today
- Started looking at Pi0s to compute Transverse Single Spin Asymmetry (A_N)

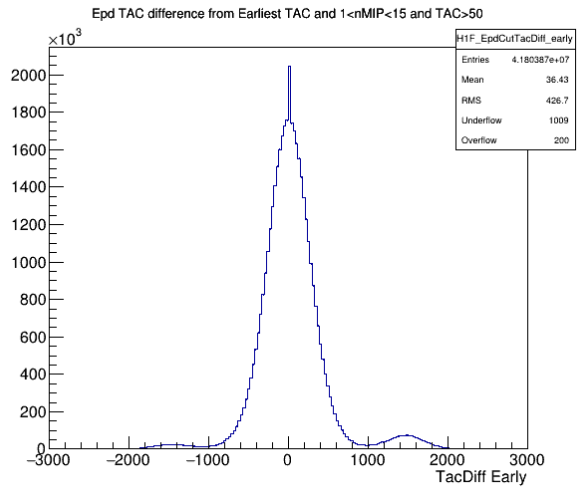
Getting Best EPD vertex

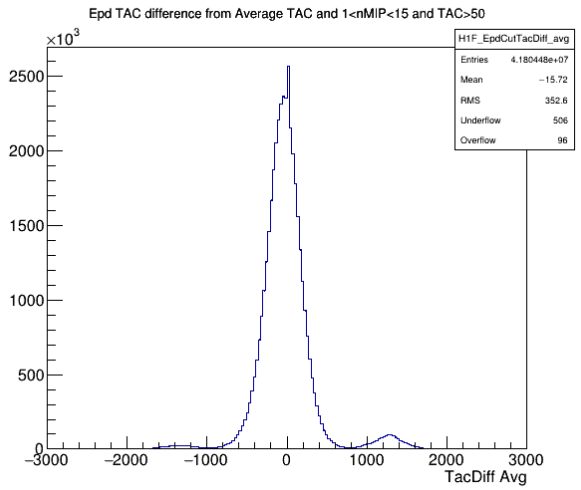
Applying nMIP and TAC cuts cleans up averages. I will use the average TAC West minus East as the best EPD vertex

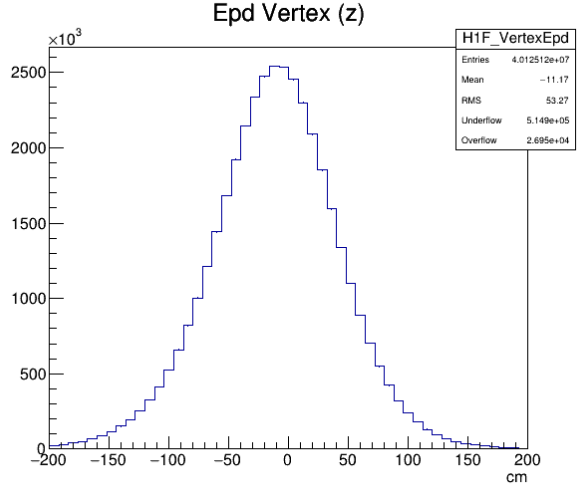








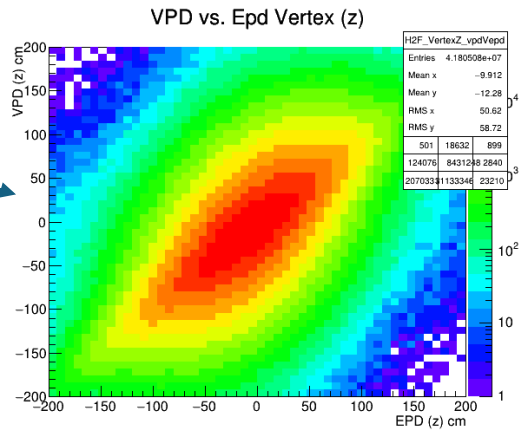


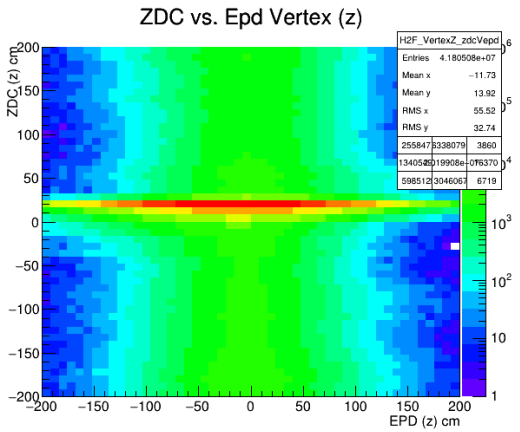


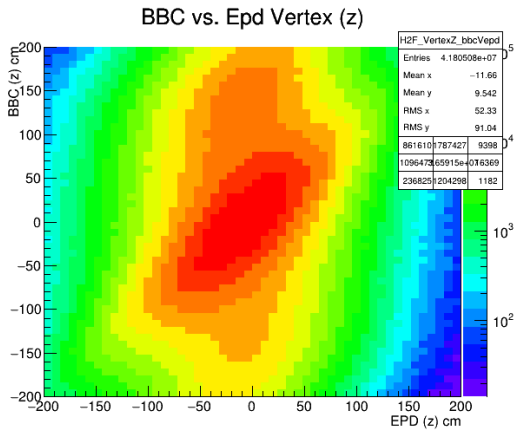
EPD Vertex Correlations

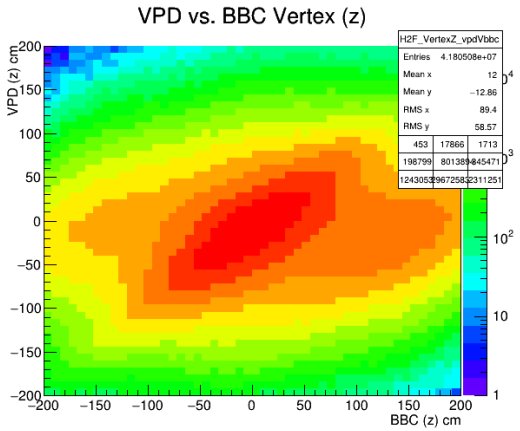
Good Correlation between VPD and EPD vertex

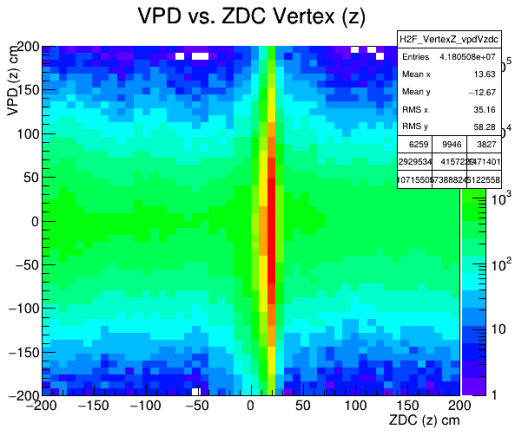
BBC has decent correlations when using VPD as reference

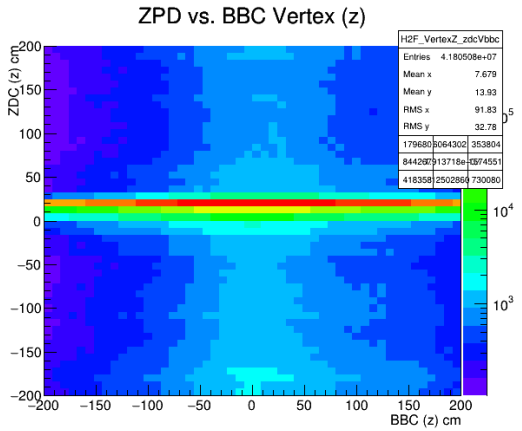












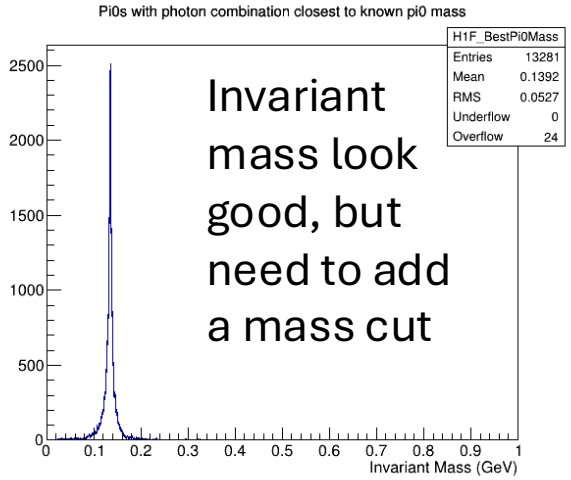
ZDC Vertex shows no correlations only a spike at 20 cm

Based on this information decided to use VPD vertex, if no VPD vertex then use EPD, then finally BBC

Looking at Pi0s

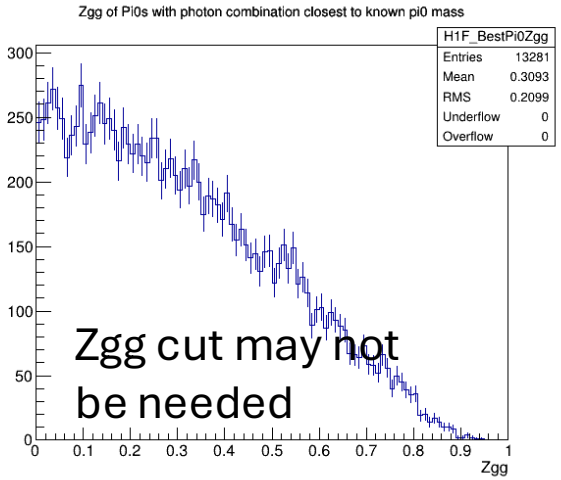
- Looked at one file from one run so far to test how code is working
- Grab all pairs of points in the FCS
  - Only apply a 1 GeV energy cut to the points
- Find pair with mass closest to pi0 mass
- Compute the angle using ArcTan(Py/Px)
- Use cross ratio formula for computing A_N
  - Split by 8 phi bins
  - Spin pattern is randomized

Results for Pi0 A_N



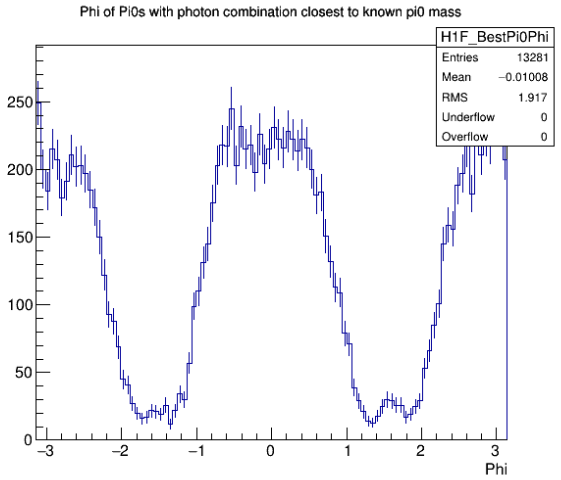
Invariant mass look good, but need to add a mass cut

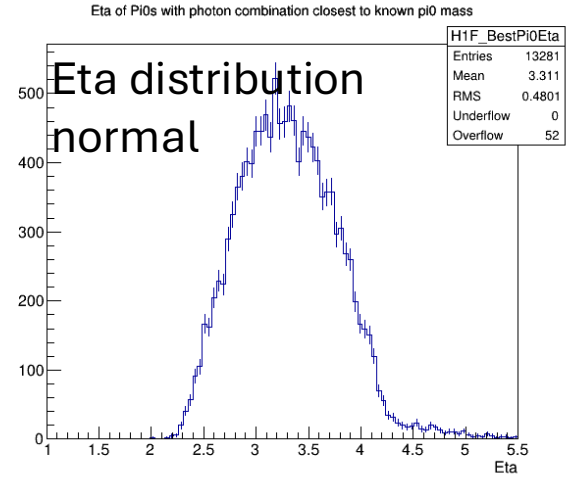
Zgg=|E1-E2|/E1+E2



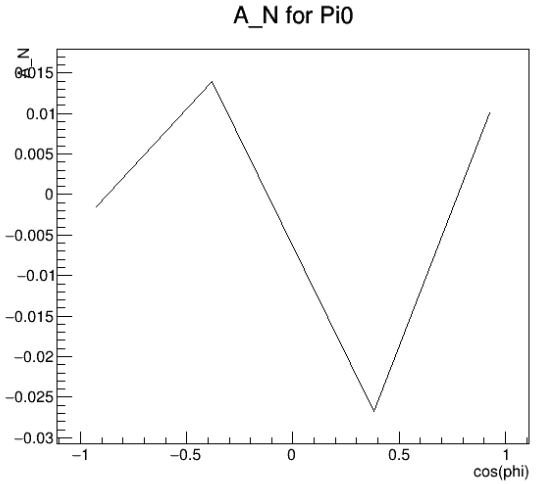
Zgg cut may not be needed

Phi distribution normal





Eta distribution normal



← A_N from the found Pi0s

- Too few bins
- Has some kind of oscillating structure

Conclusions

- EPD vertex has good correlations with VPD
  - Could use some TPC data to calibrate but good enough for now
- Initial Pi0 eta, phi, and mass distributions look good
- Code to compute A_N from cross ratio formula in place
  - Using Random spin information
  - Has some oscillating structure
- Questions
  - Cuts to apply?
    - Zgg, mass, vertex, etc.
  - What binning to use
    - Phi bins, energy bins, x_F bins, etc.