Progress on A_N of Pi0 TSSA using FCS

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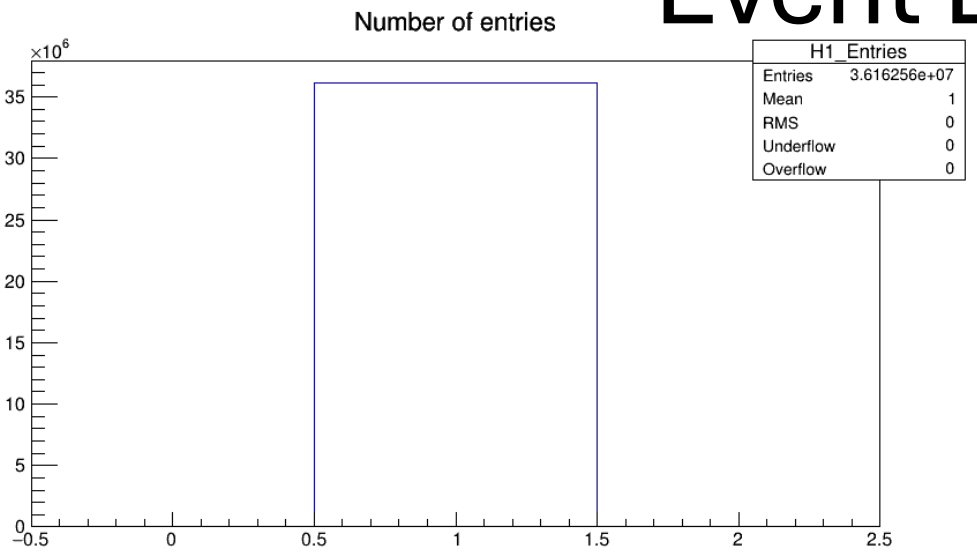
October 9, 2024

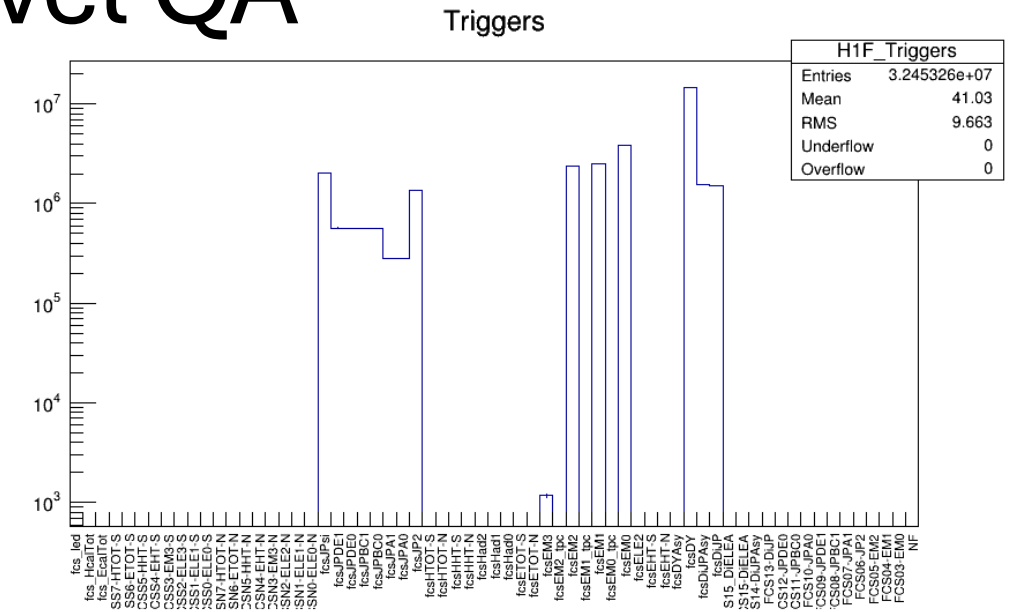
STAR Spin PWG Meeting

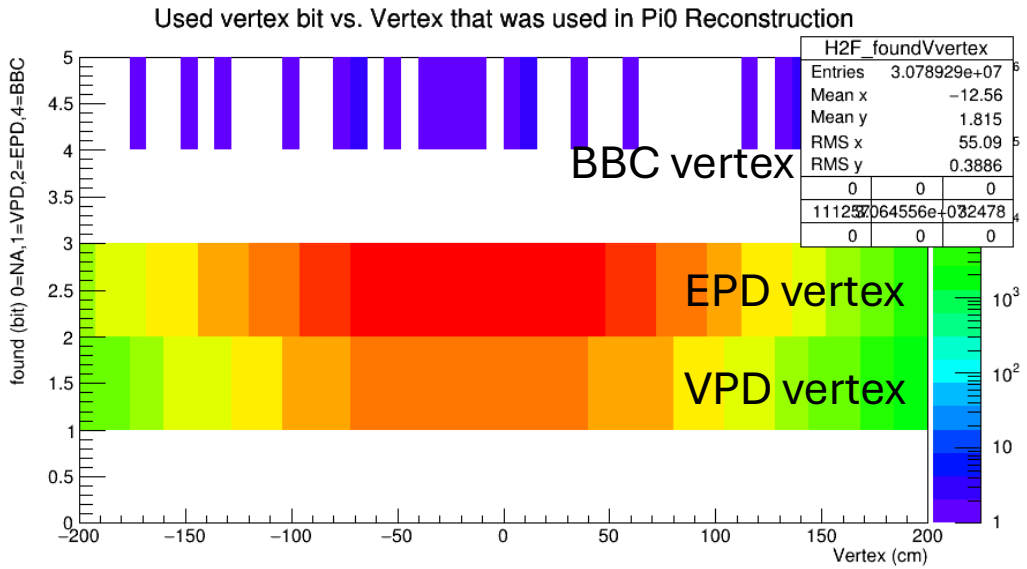
Recap and Outline

- Looking at Run 22 fwd_stream production
  - Production finished
  - Filling spin database in progress
  - Request page: https://drupal.star.bnl.gov/STAR/blog/dkap7827/Run-22-Data-Production-Request
  - Used a file from every single run number greater than 23005043
    - Only runs after and including this run are calibrated
    - When I included runs before this one got bad results
  - Trigger list is in backup, focuses on all EM calorimeter triggers
- Last update: showed some results of A_N of pi0s by picking the pair closest to the mass
- This update: refining pi0 selection
  - Using only highest energy pair of points with energy>1 GeV
  - Also cutting on EPD nmip<0.7

Event Level QA





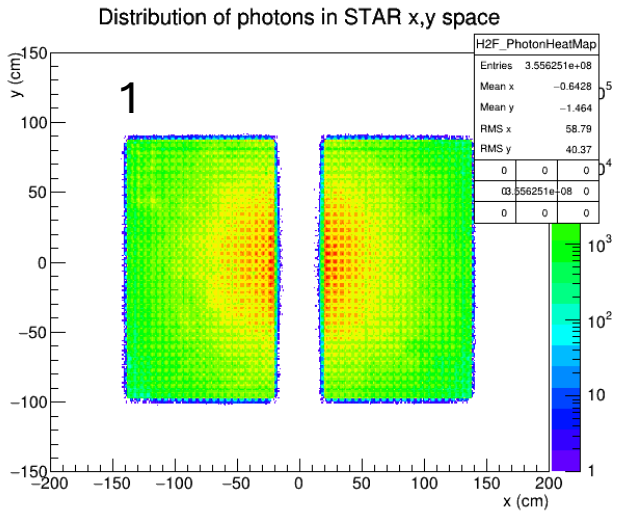


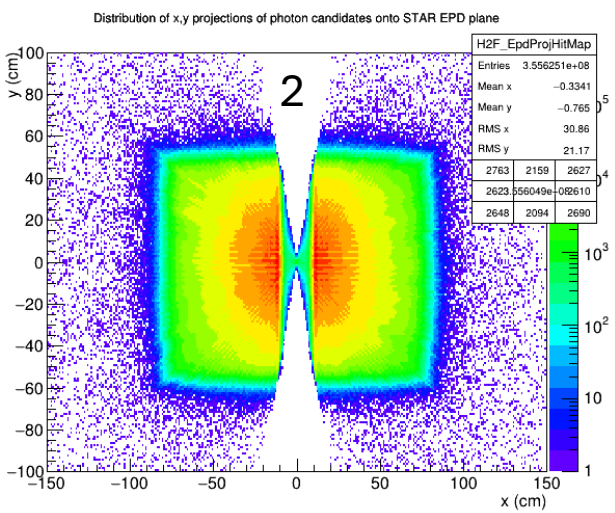
- Triggers are mostly coming from JP
- Vertex is mostly from EPD and VPD
  - BBC is much rarer
- Can use TPC vertex information to calibrate EPD vertex but I don't know if such data exists

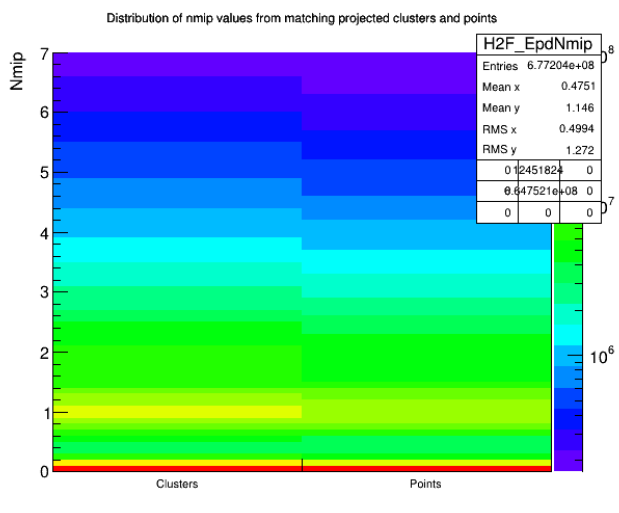
Point Level QA

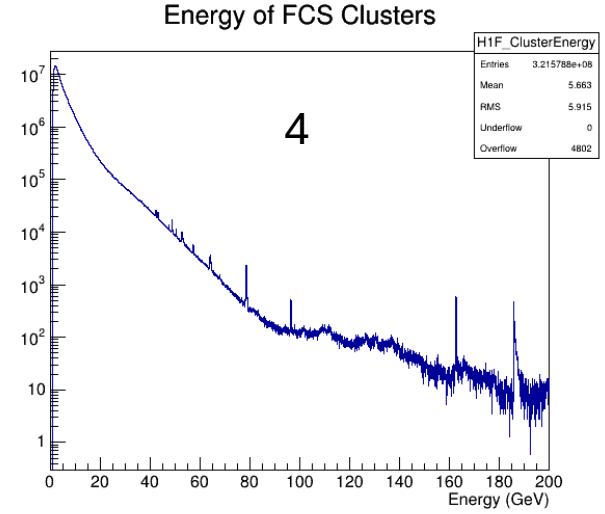
Plot descriptions from top left going clockwise

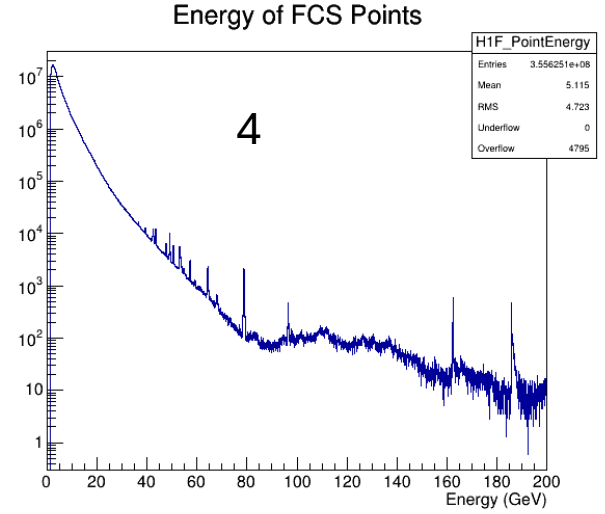
1. Point distributions look normal
2. EPD projections of points do show some some outside a central region
   - This may be due to vertex
3. EPD nmip of projected points normal
4. Energy distribution of points and clusters have large spikes
   - Possibly from hot spots
5. Energy distribution of two highest energy pairs look normal but show same spikes as energy

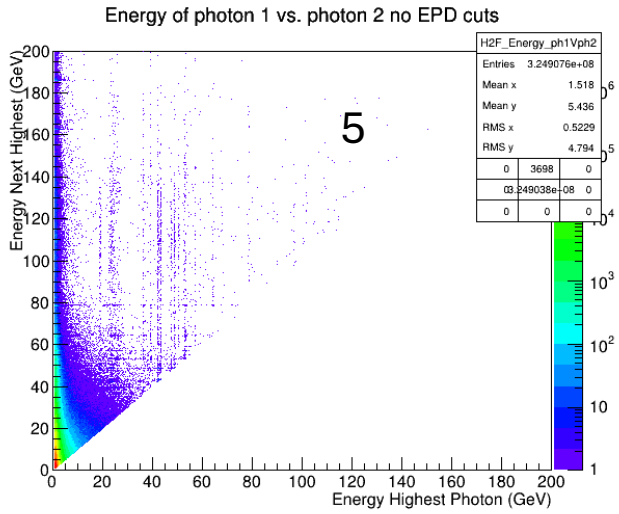




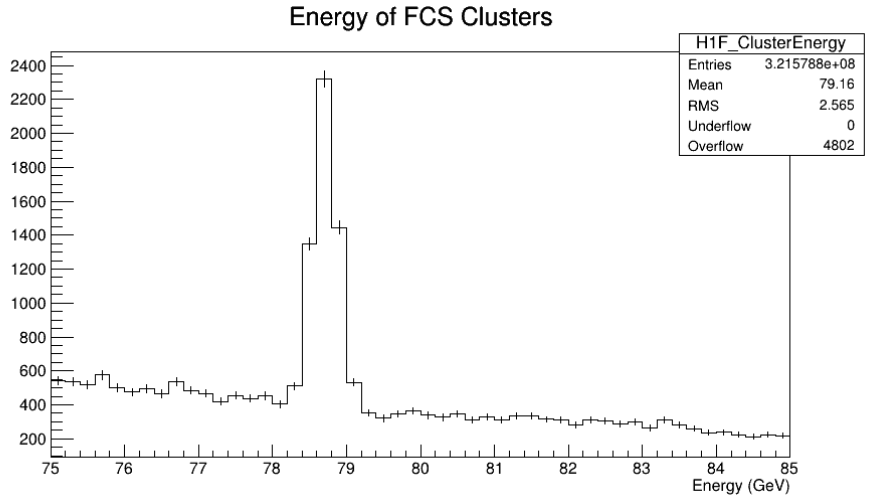


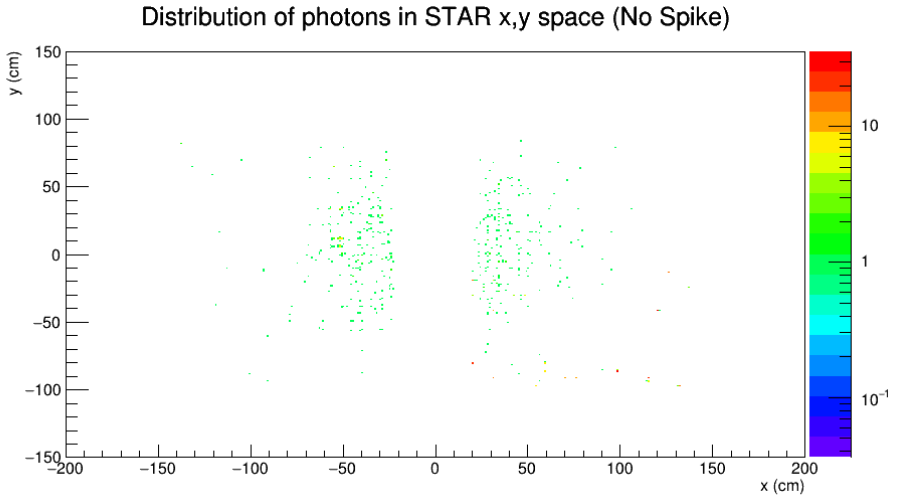


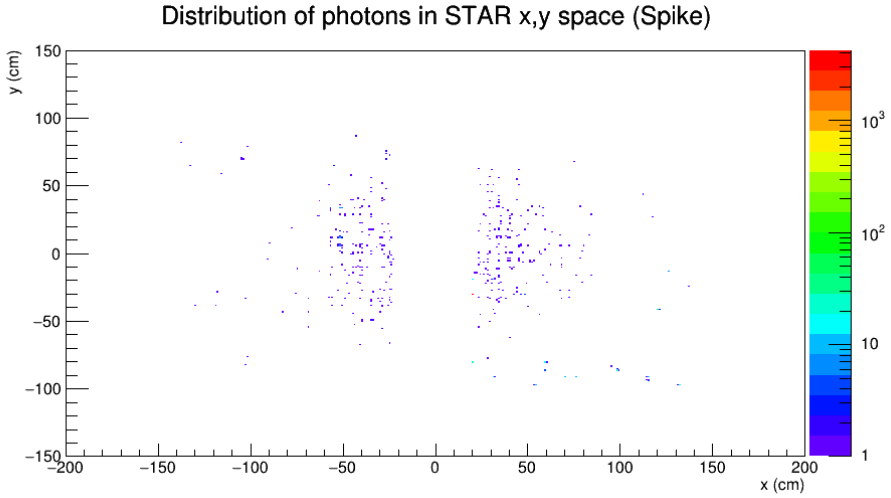




Zoom in on ~80 GeV Points



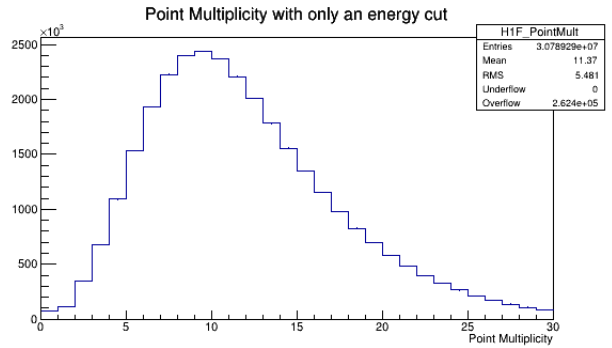


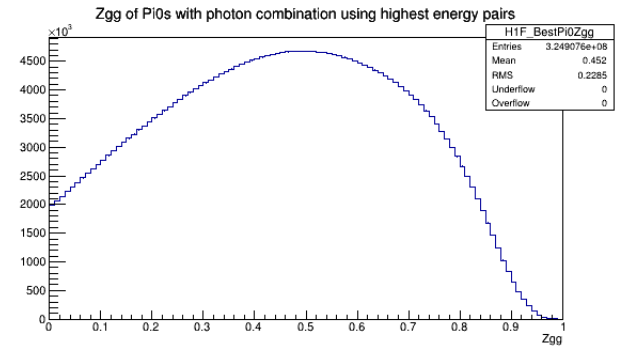


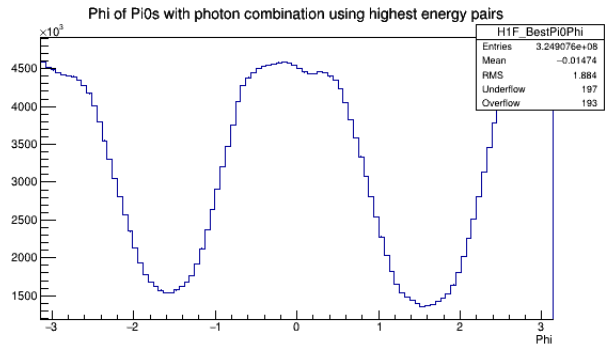
- Point position reconstruction in energy region without spike is uniform
- Point position reconstruction in energy region with spike has a hot spot at near beam pipe
- Fiducial volume cut may get rid of this

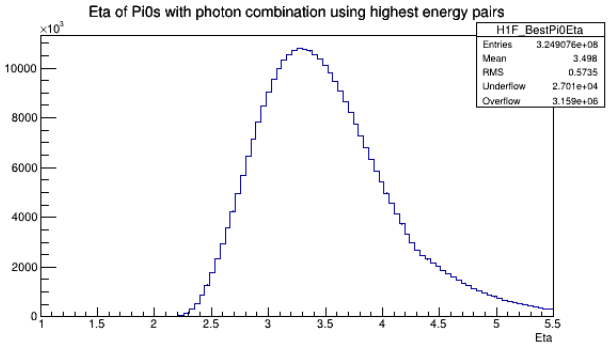
Highest Energy Pairs No cuts

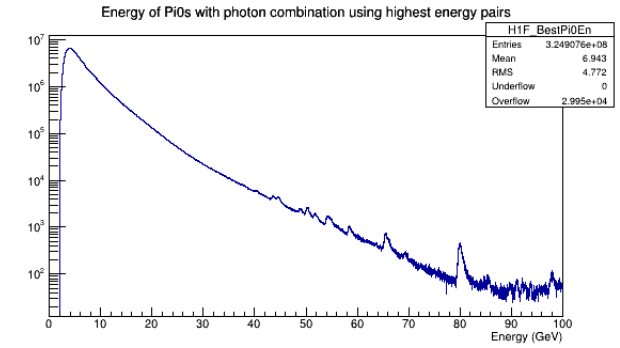
- Most distributions look normal
- Energy spikes same as the photon energy distributions
- Invariant mass with just highest pairs shows bump at pi0 mass over Gaussian background
- Invariant mass of all point pairs has similar shape but different Gaussian as background

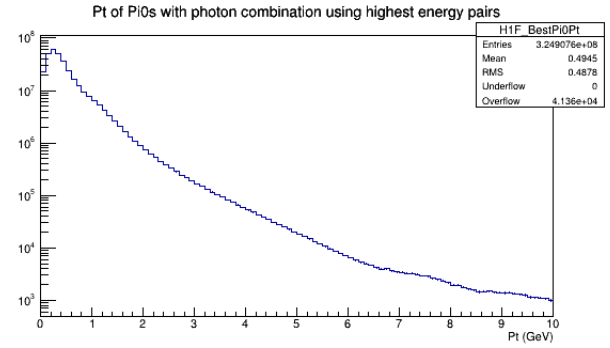


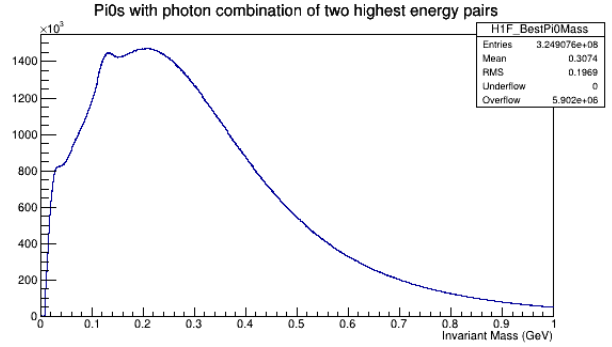


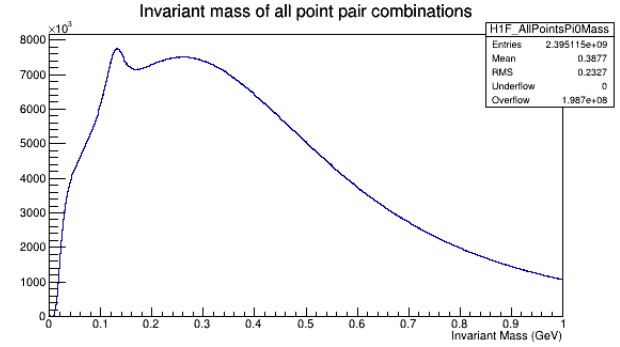






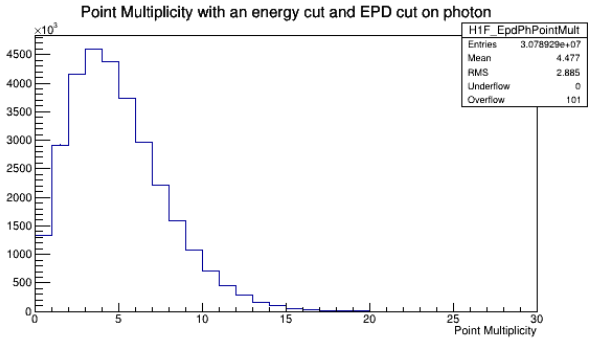


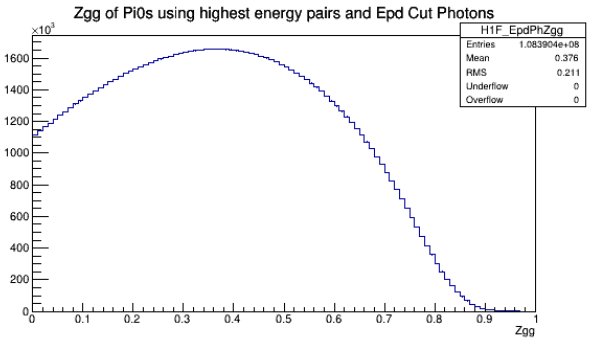


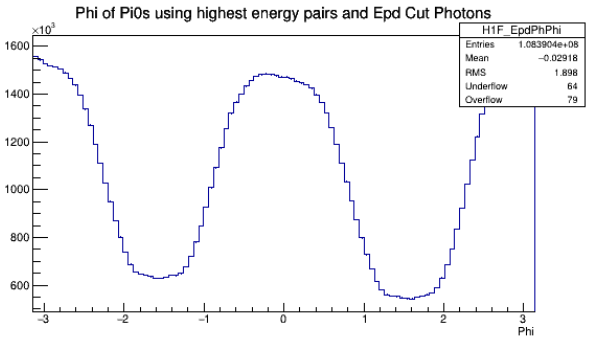


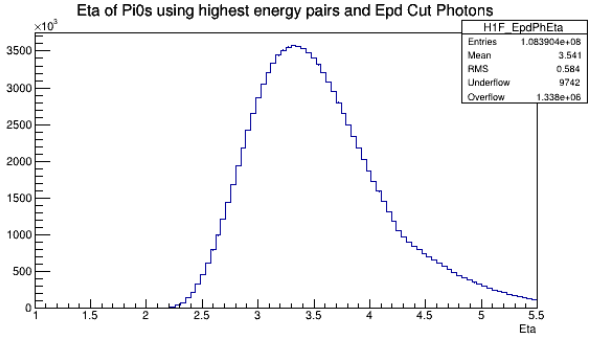
Highest Energy Pairs both EPD projections 0.001<nmip<0.7

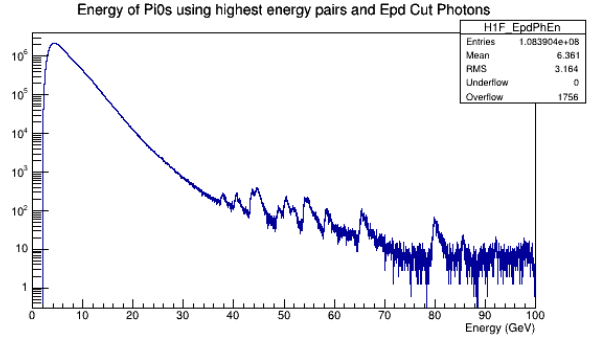
- Distributions very similar to the highest energy case
- Point multiplicity has decreased significantly
- Pi0 bump slightly enhanced (Overlay plot will be shown soon)

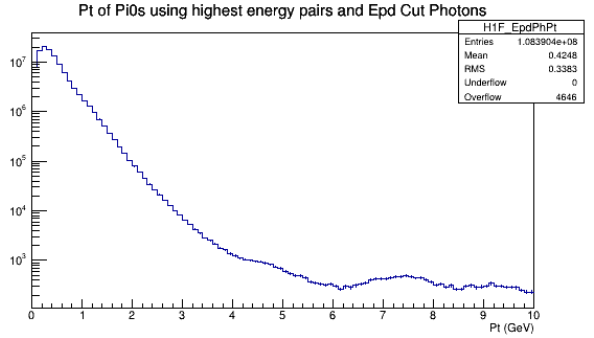


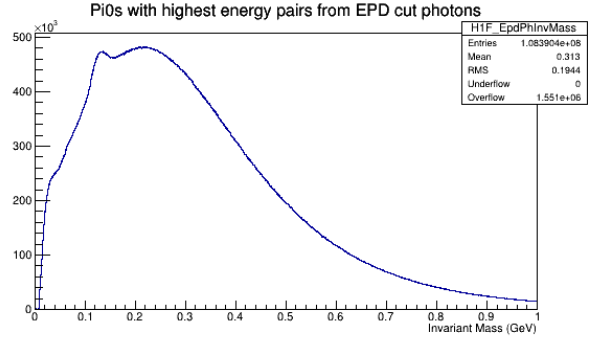


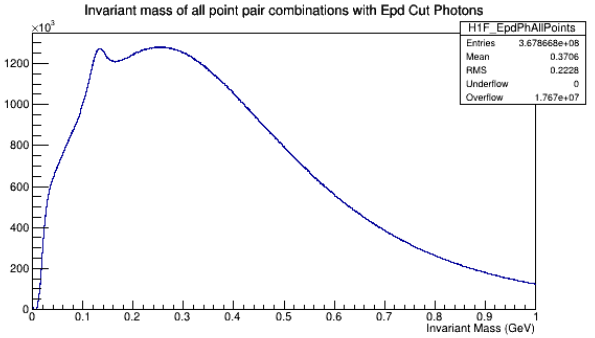






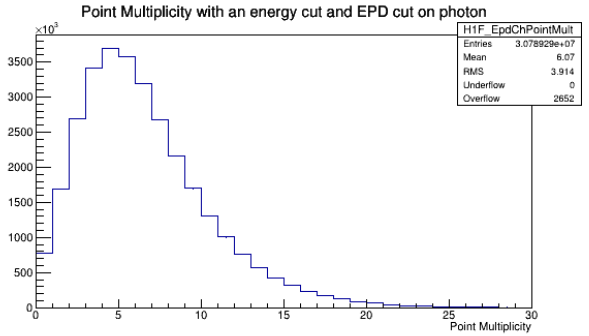


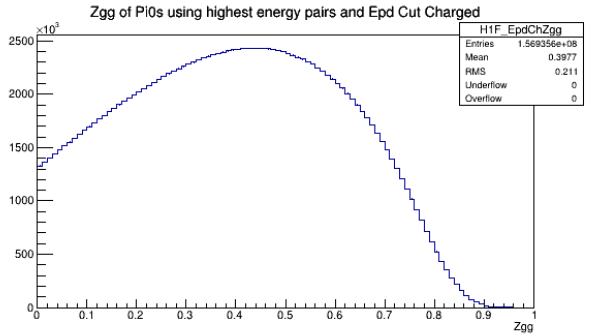


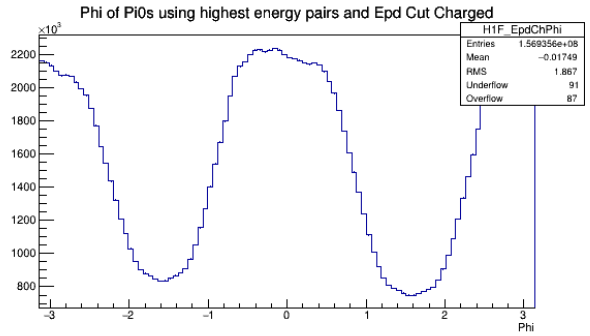


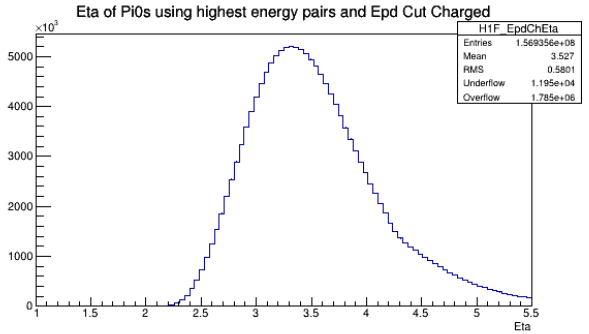
Highest energy Pairs both EPD projections and nmip>=0.7

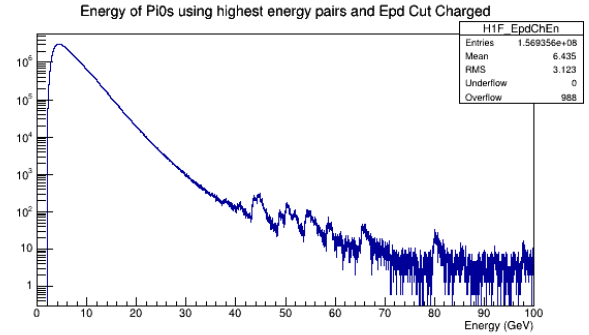
- Most distributions look similar to the “less than” nmip cut ones
- Here I extended the range of invariant mass to 5 to see if J/psi is visible
  - Nothing obvious at first glance

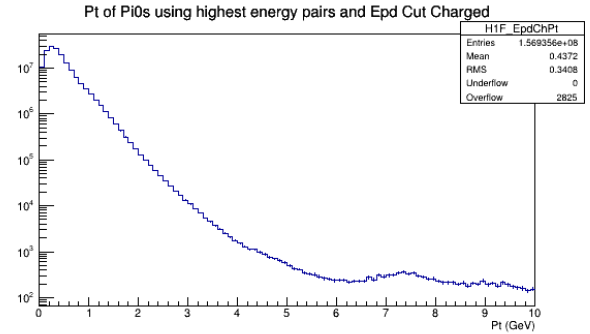


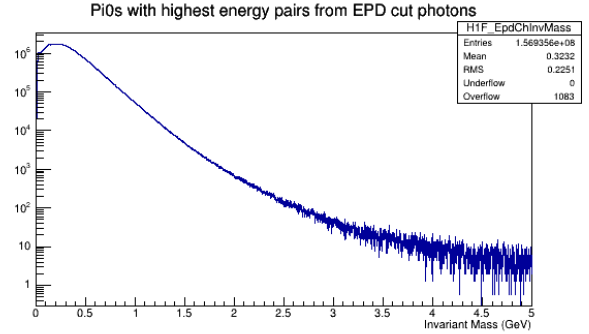


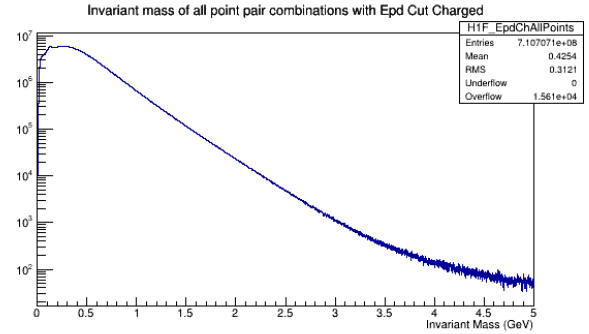




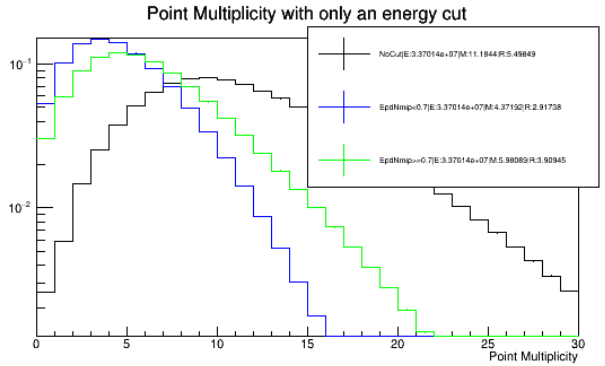


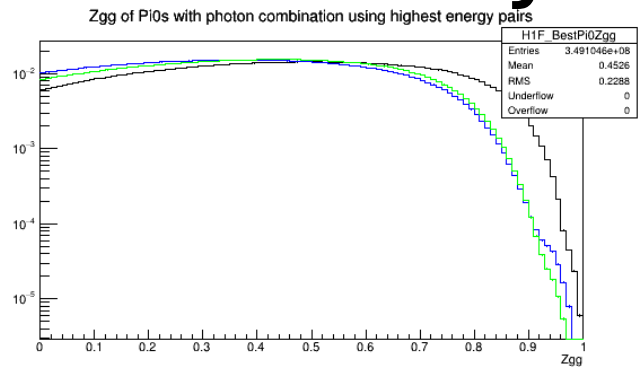


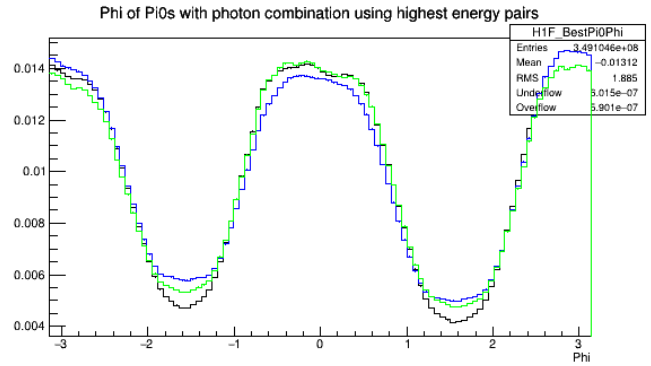


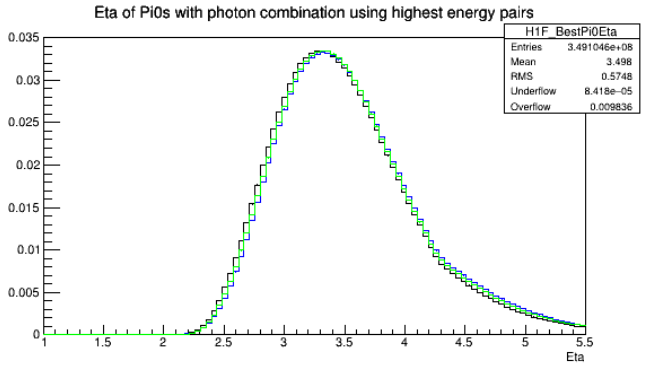


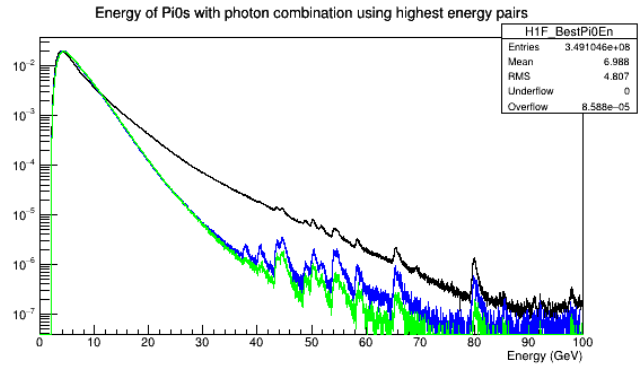
Overlay Plots

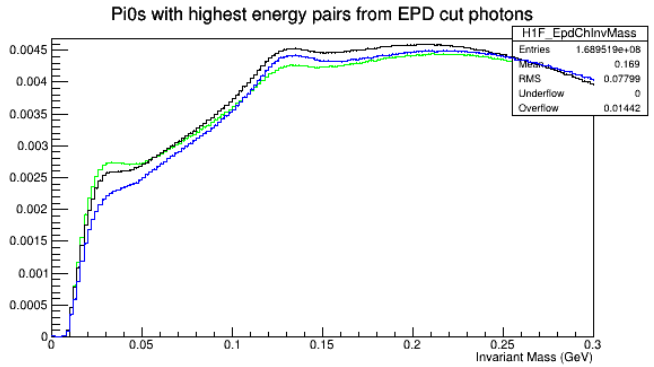


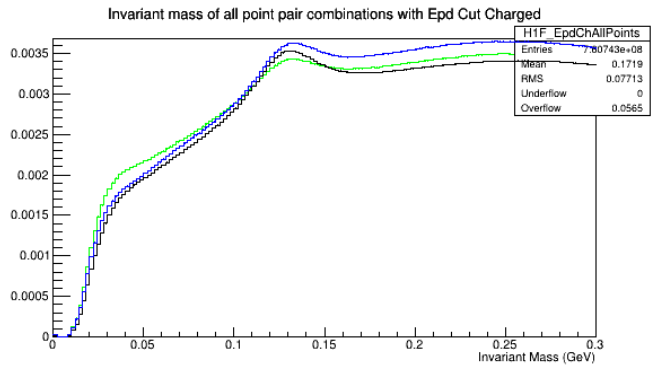












- Black histograms have no cut
- Blue histogram is EPD nmip<0.7 cut
- Green histogram is EPD nmip>=0.7 cut
- Point multiplicity clearly reduced
- Looking at just highest pairs of points see a clear suppression of pi0 mass peak with EPD nmip cut
- Even the all point combinations shows a suppression

Conclusions

- Vertex information coming mostly from VPD and EPD
  - Resolution may be improved if we had TPC calibrated vertex data
- Point reconstruction shows spikes in energy distribution
  - This is also evidenced from the pi0 reconstruction
  - It may be coming from hot spots in the detector
- EPD nmip cut working to give cleaner pi0s
  - More cuts need to be added

Backup

List of triggers

- fcsJPsi
- fcsJPDE1
- fcsJPDE0
- fcsJPBC1
- fcsJPBC0
- fcsJPA1
- fcsJPA0
- fcsJP2
- fcsEM3
- fcsEM2
- fcsEM1
- fcsEM0
- fcsEHT-N/S
- fcsDYAsy
- fcsDY
- fcsDiJPAsy
- fcsDiJP