Jetcorr Update May 14

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Planned Figures To Show

- Semi-inclusive z_g analysis using CHARGED jets
- Planning to show 3 figures at minimum:
  - A) SE and ME scaled jet pT reco plots
  - B) Raw SE z_g and scaled ME z_g to demonstrate combinatorial subtraction
  - C) Combinatorial Subtracted z_g for 3 pT bins, (10-15, 15-20, 20-25)
- No Pythia dijet embedding for Run14, only have single track embedding

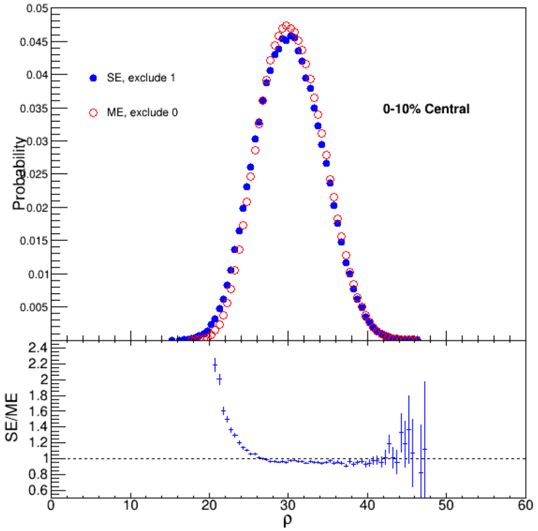
- The plan: Use efficiency and momentum resolution from single track embedding to smear PYTHIA6 and embed into MB data to compare to my combinatorial subtracted z_g distribution

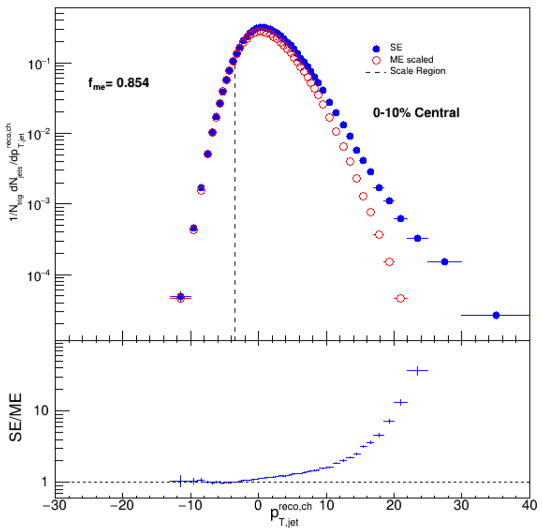
Systematic Due to Estimation of Combinatorial Jet Contribution

- My analysis relies on modelling the combinatorial jet contribution using mixed events

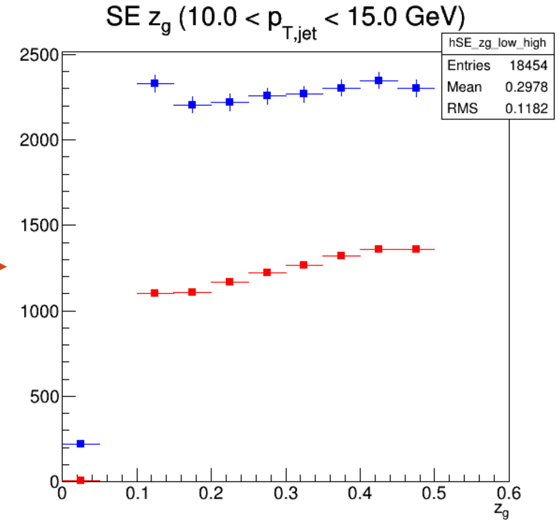
- Multiple ways of varying analysis choices to alter calculated percentage of combinatorial jets within a given signal jet pT range
  - Change rho definition (changing amount of jets to exclude in rho calculation
  - Implement rho shift of ME
  - Change range of scaling region for scaling ME jet reco down
- A shift or change in rho definition also yield a different f_{me} scaling factor
- To calculate the systematic I am changing the rho definition of my ME, which is on the order of a 300 MeV shift of the ME rho

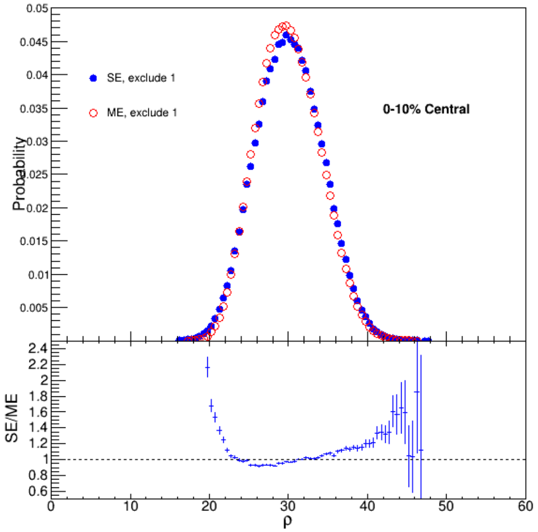
Alternate Rho Definition

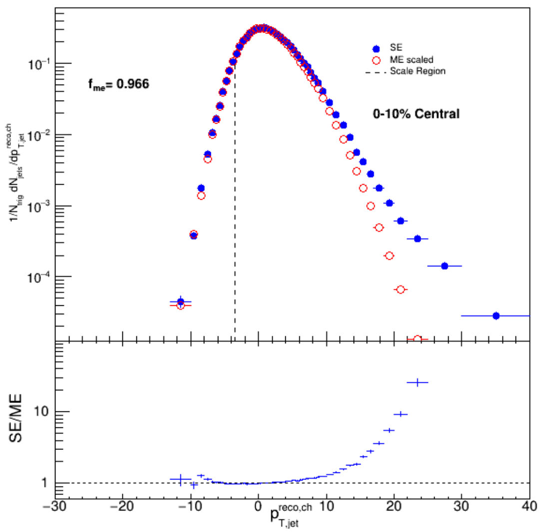




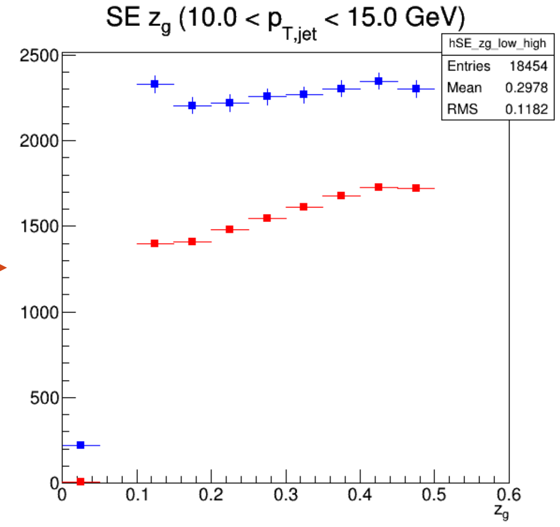
Estimated **53.70%** of jets in SE are combinatorial



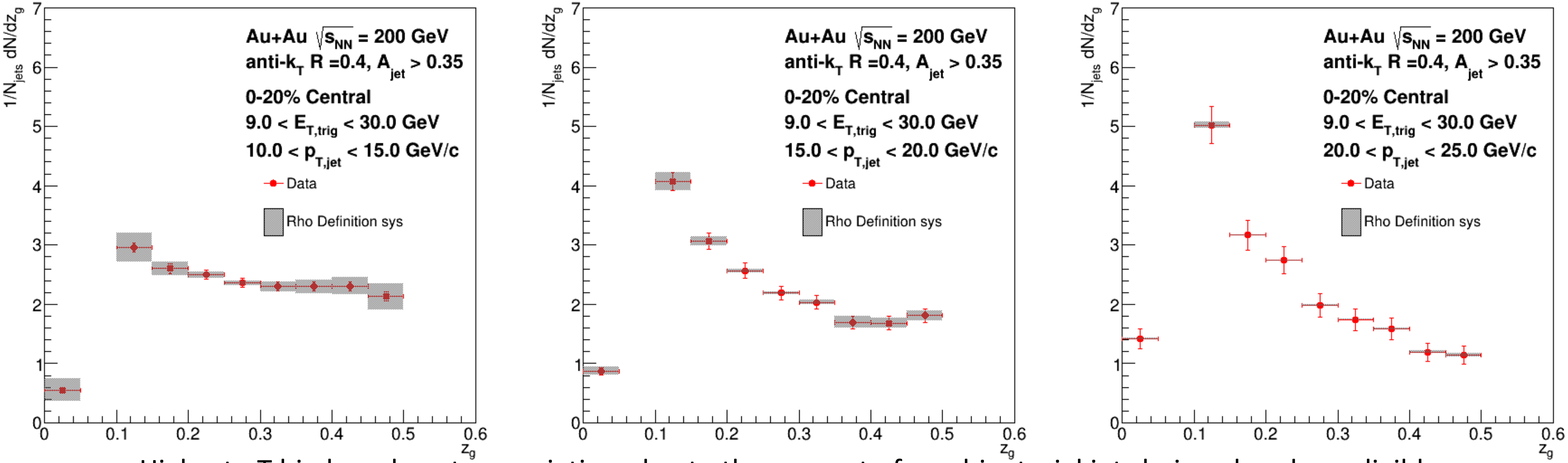




Estimated **68.13%** of jets in SE are combinatorial

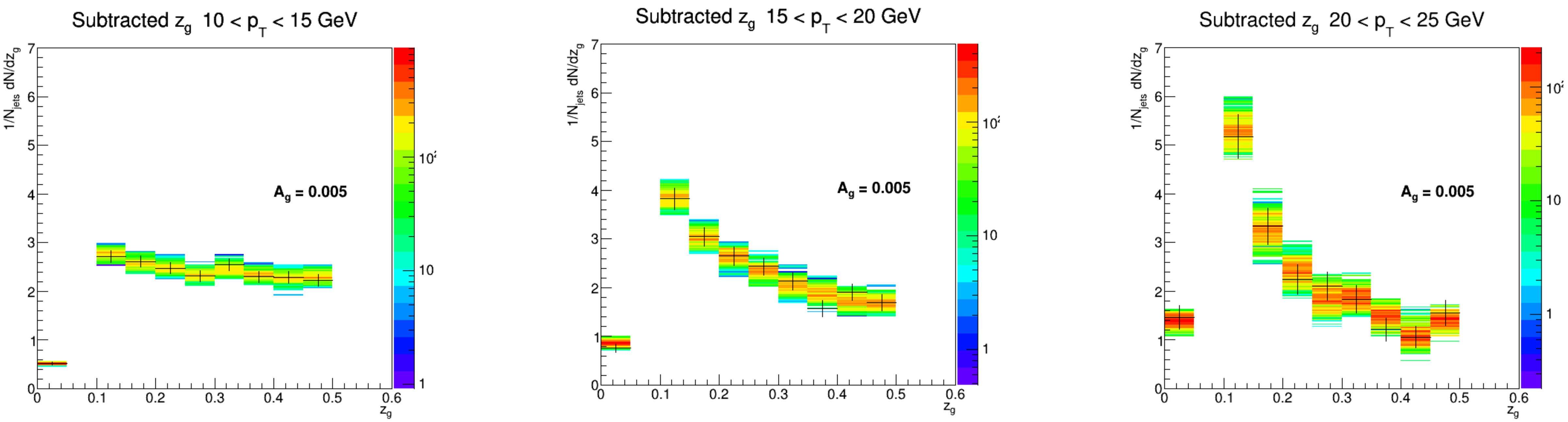


Systematic Due to Rho Definition (Combinatorial Contribution Estimation)



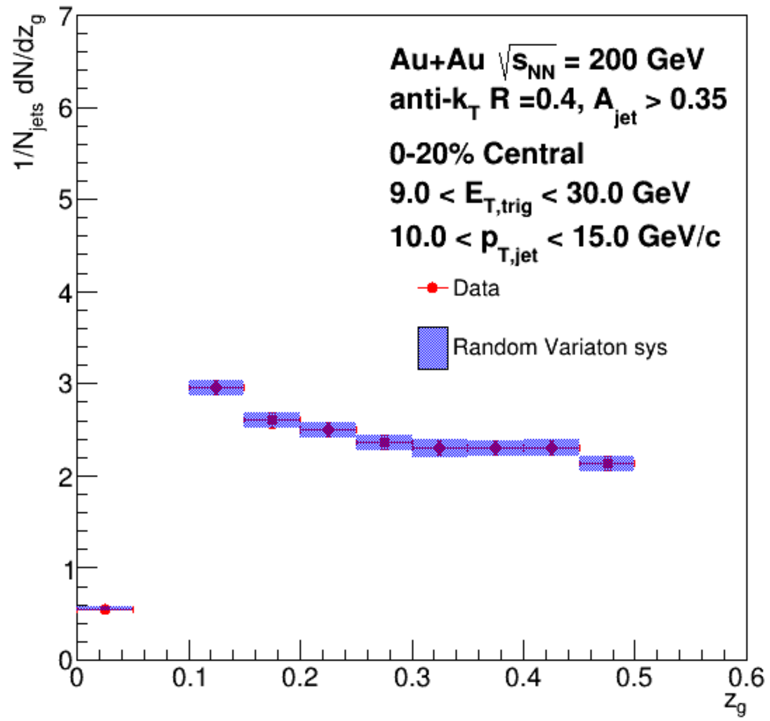
- Highest pT bin has almost no variation, due to the amount of combinatorial jets being already negligible
- Left and right most points have largest variation
- Despite there being almost no entries in the 0 bin for ME, the bin shifts indirectly due to scaling

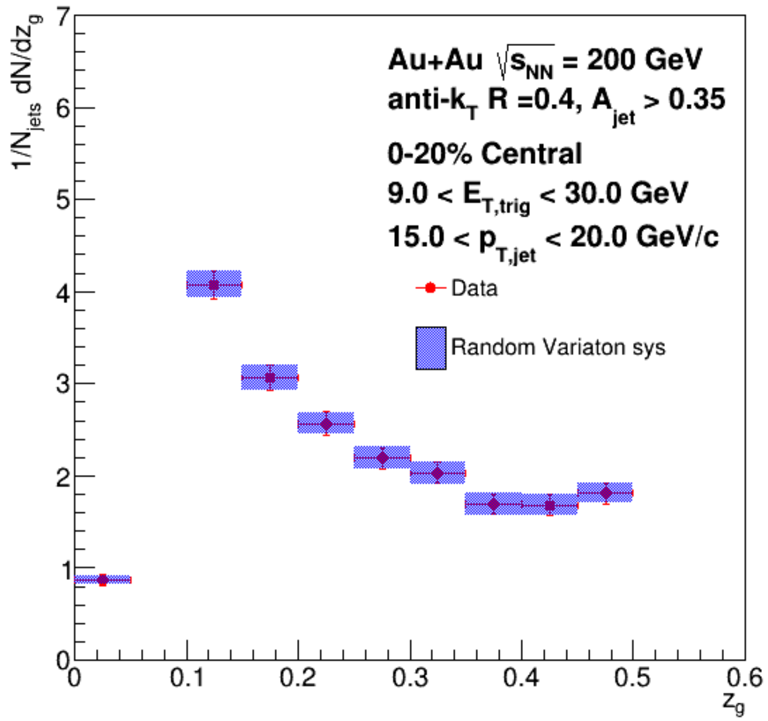
Variation Due to Ghosts

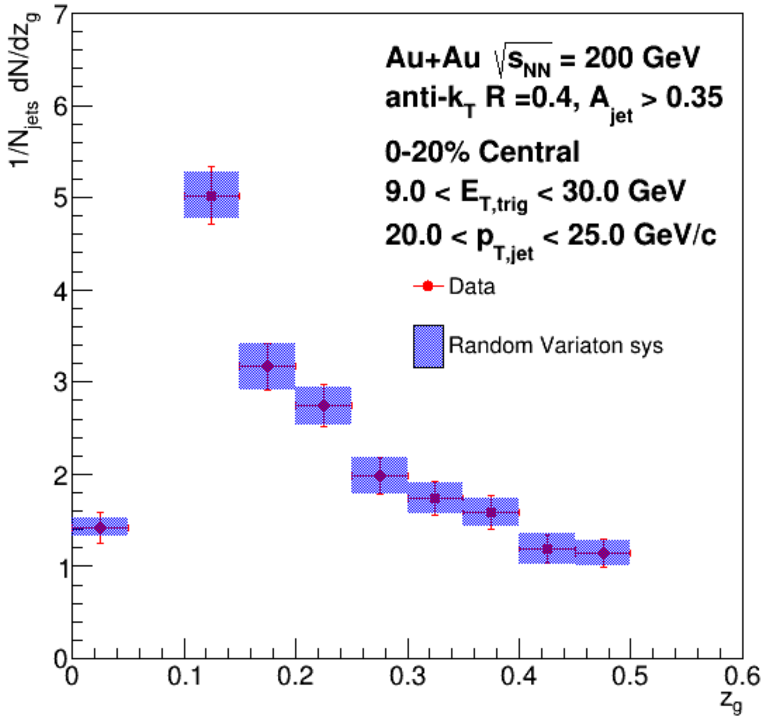


- Jet Areas are calculated using ghost particles, which are randomly smeared in eta and phi
- The random smearing of ghosts propagates, smearing observables slightly
- Shown is my analysis run ~2k times for 0-10% central, which the black points being a randomly chosen seed
- Should this be a separate systematic? For now I am taking the RMS of each bin as a systematic

Systematic Due to Ghosts

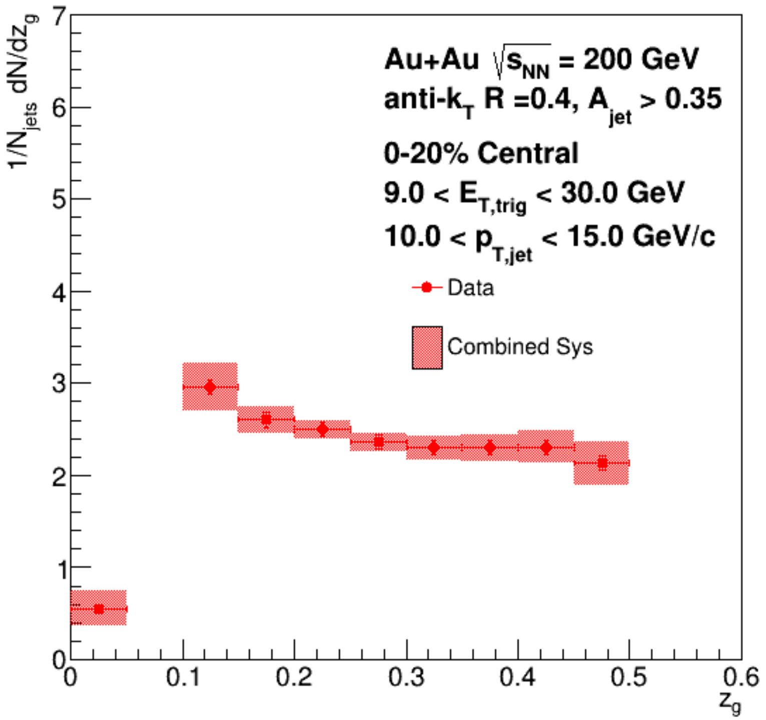


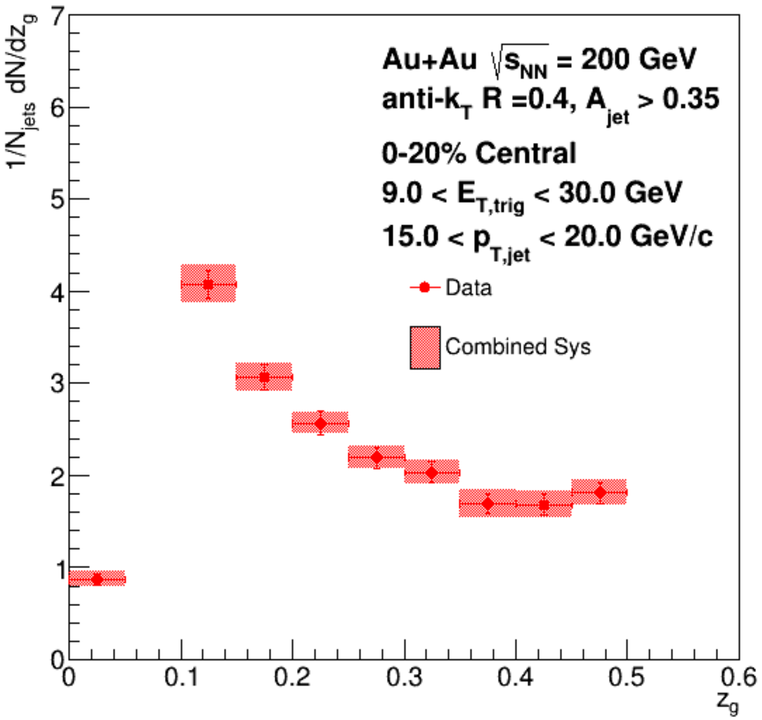


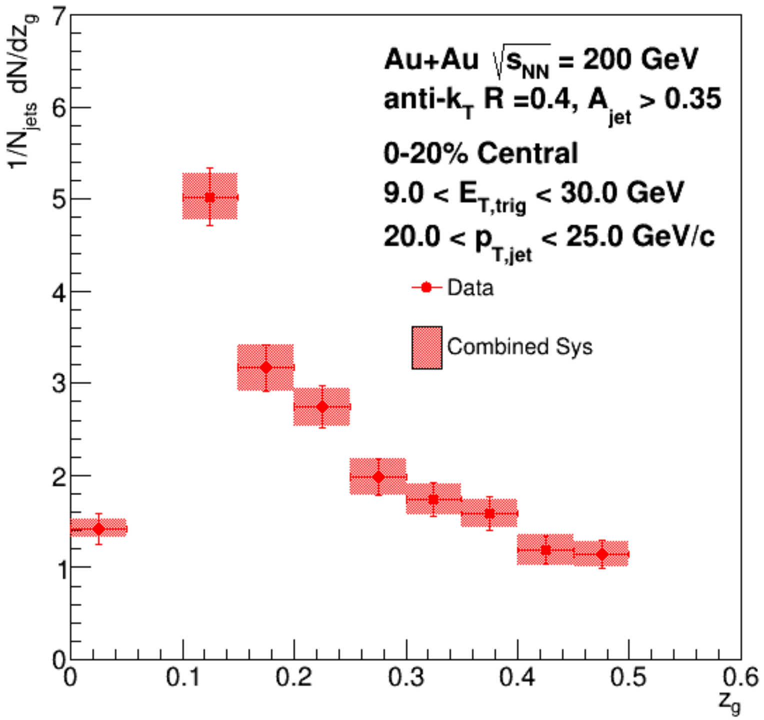


- The systematic error I attribute due to random variation is of the same order as the statistical error bars
- An increase in statistics decreases the effect of random variation, is this counting the statistical error as part of the systematic error?

Combined Systematics



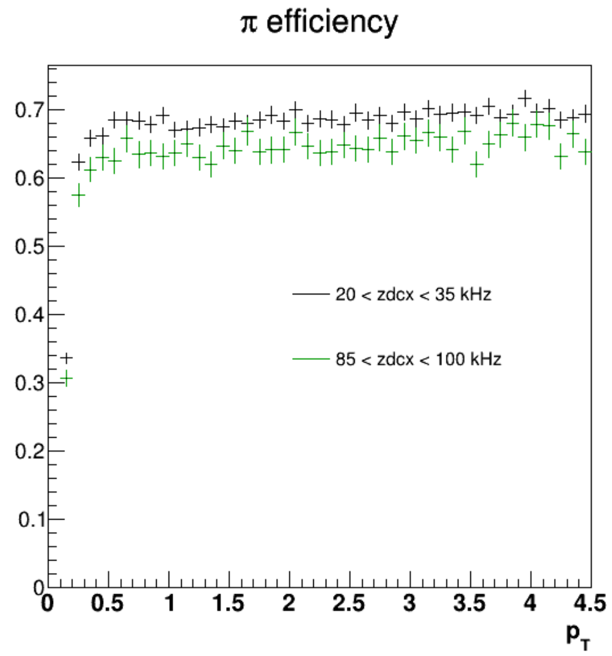


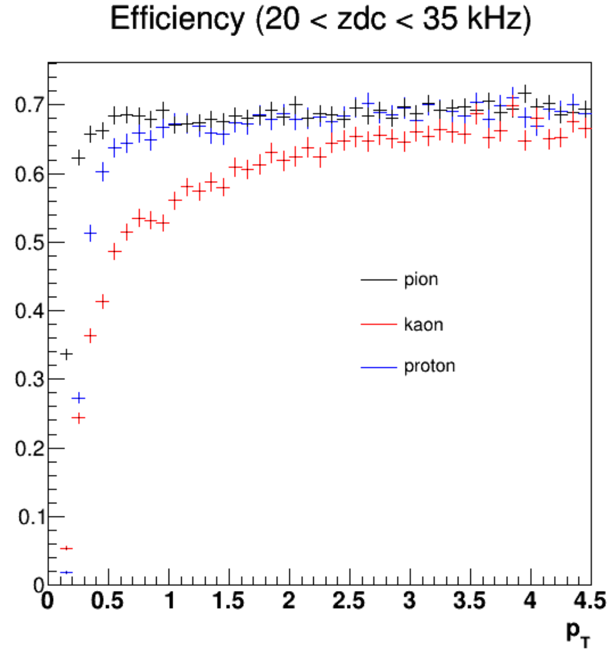


Fast Simulation

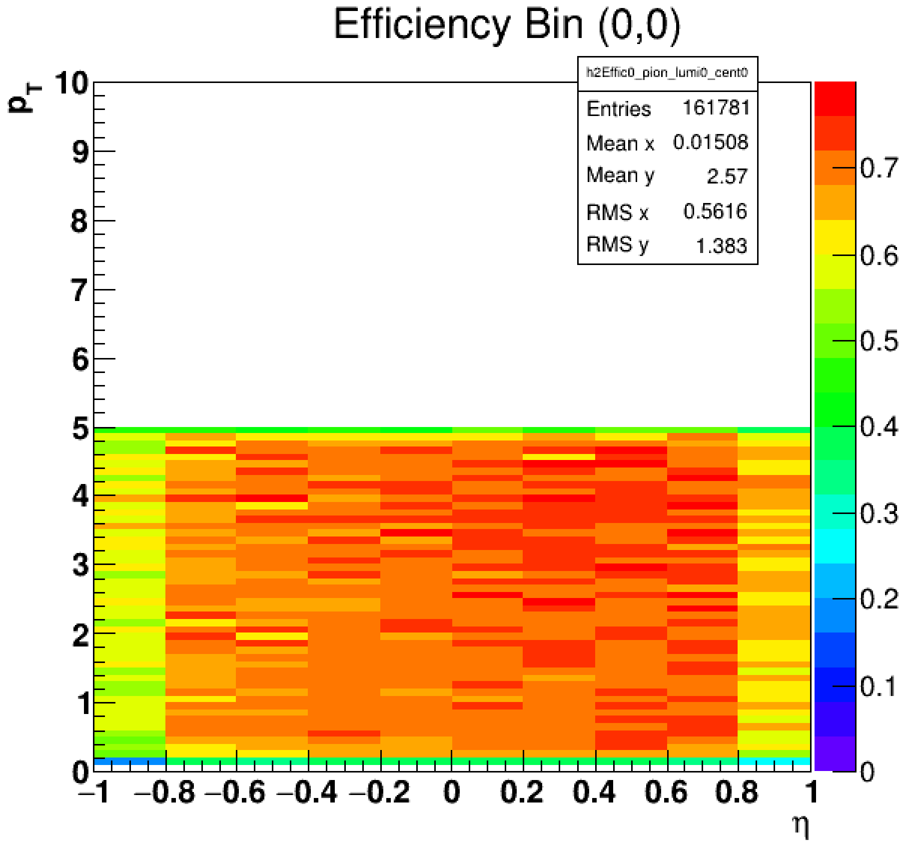
- Generate STAR tune PYTHIA6 events and reconstruct jets
- Simulate detector effects by randomly dropping tracks based on single track efficiency and smearing the surviving tracks pT by the momentum resolution
  - I keep the efficiency and resolution separate for pi/k/p and use the PYTHIA6 PID to determine which efficiency or resolution to sample
- Embed smeared PYTHIA6 events into Minbias events
- Reconstruct jets and require that the jets have a minimum required pT fraction of the pure PYTHIA event

Efficiency

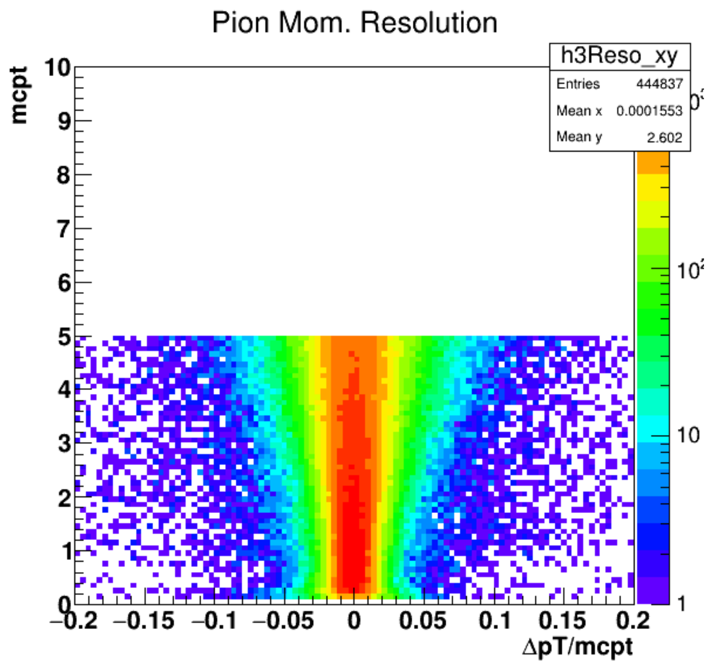


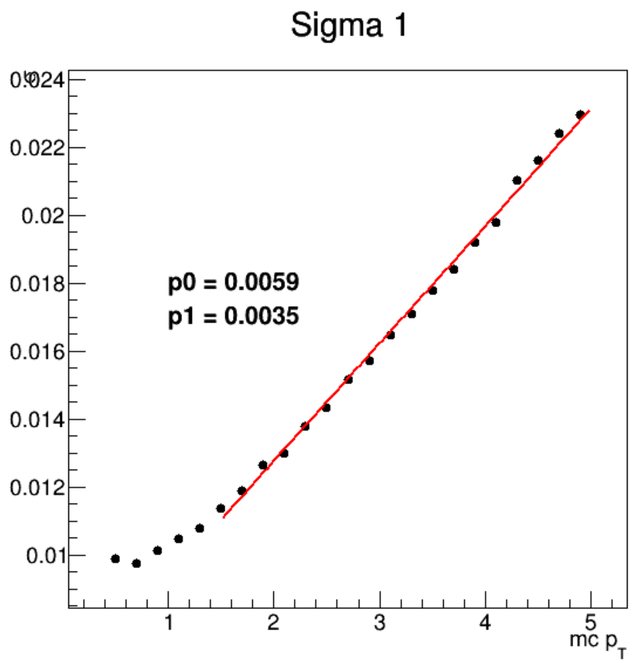


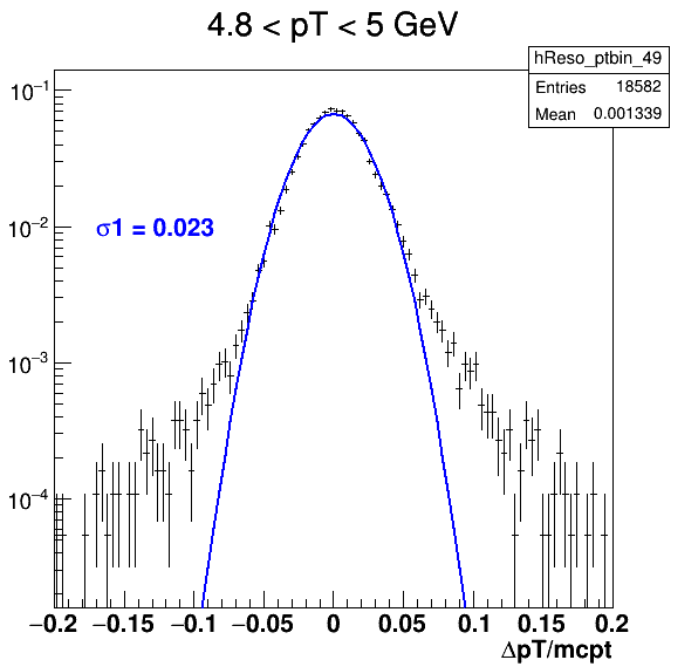
- Efficiency for particles is calculated in bins of (species, centrality, luminosity, eta, pT)
- **Left**: Selections of efficiency to demonstrate species and luminosity dependence
- **Right**: Example efficiency bin (for pions)
- For each particle in the pythia6 event, drop randomly based on its expected efficiency
- For particles with pT > 4.5 GeV, use 4.5 GeV bin (assuming efficiency constant at high pT)



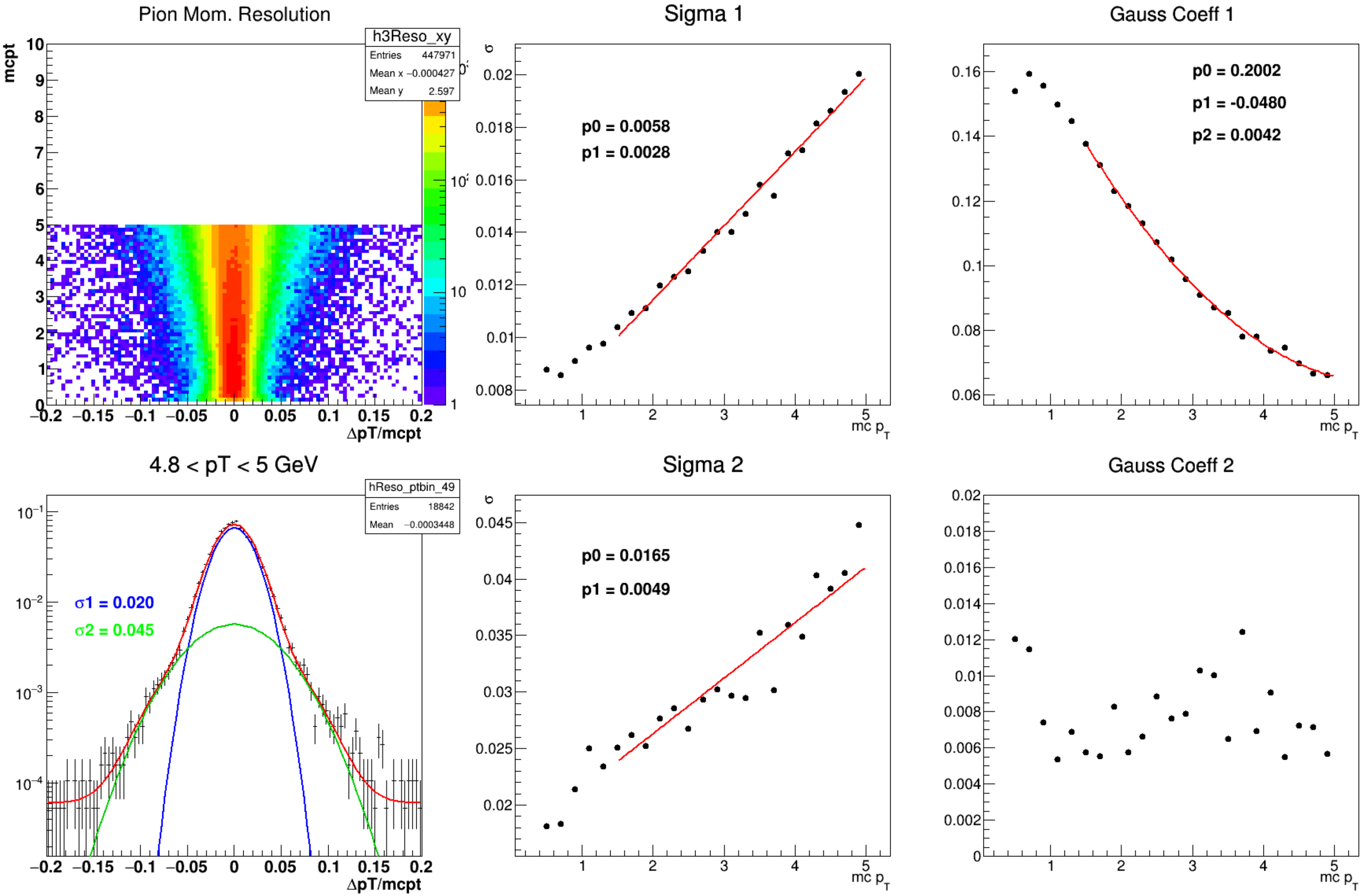
Momentum Resolution



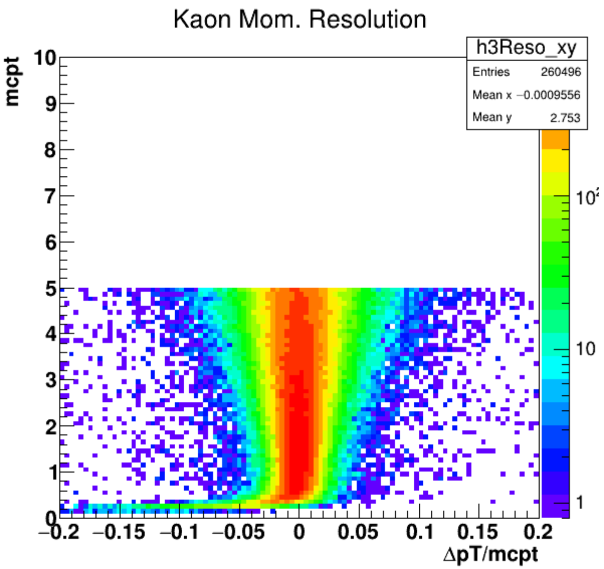


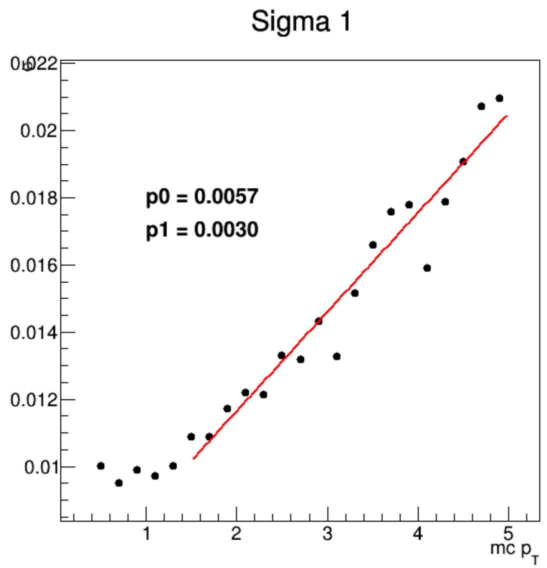


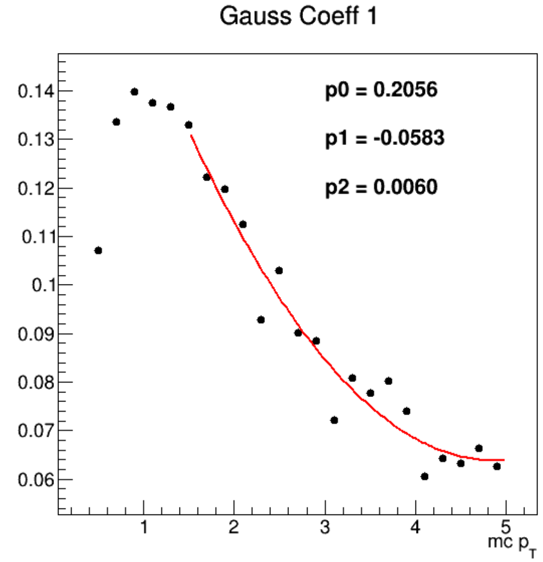
- Momentum resolution is not constant at "high" pT, need to parametrize the dependence
  - Can sample from histograms below 5 GeV, cannot do so directly for particles above 5 GeV
- Expected to be somewhat Gaussian however I seem to have nontrivial tails
- To account for these tails, I investigated a more complicated parametrization

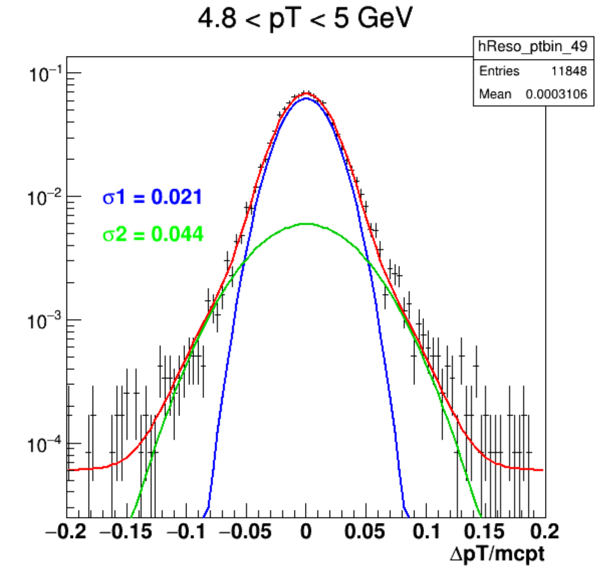


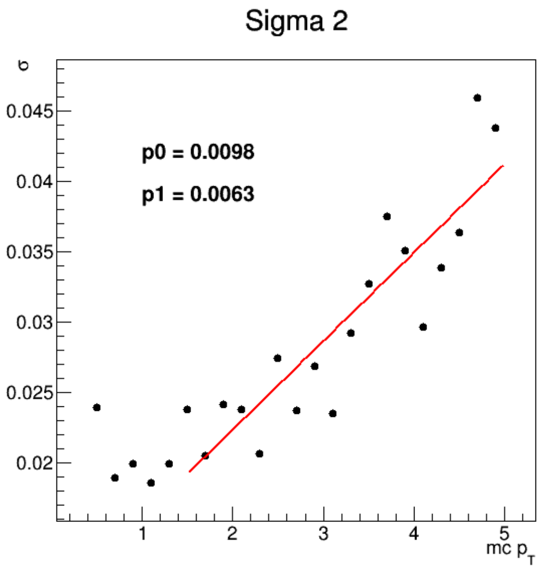
- Fitting momentum resolution with TWO Gaussians and a small fixed flat pedestal (pedestal not explicitly shown)
- Second Gaussian captures the behavior at the tails, however evolution of width is not as smooth as a function of pT as the first Gaussian
- Assuming the second Gaussian coefficient is roughly constant

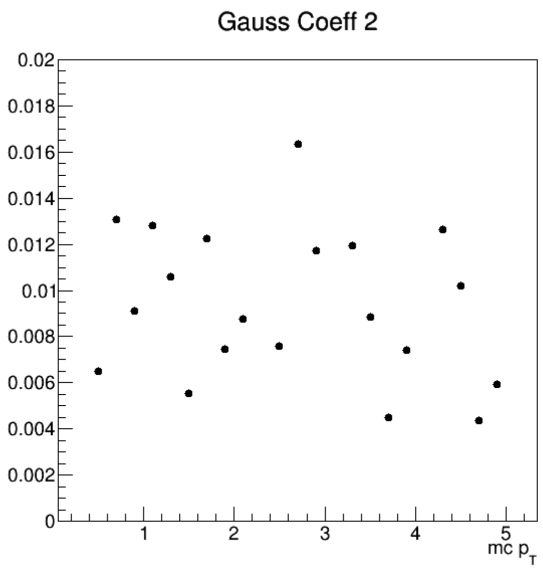




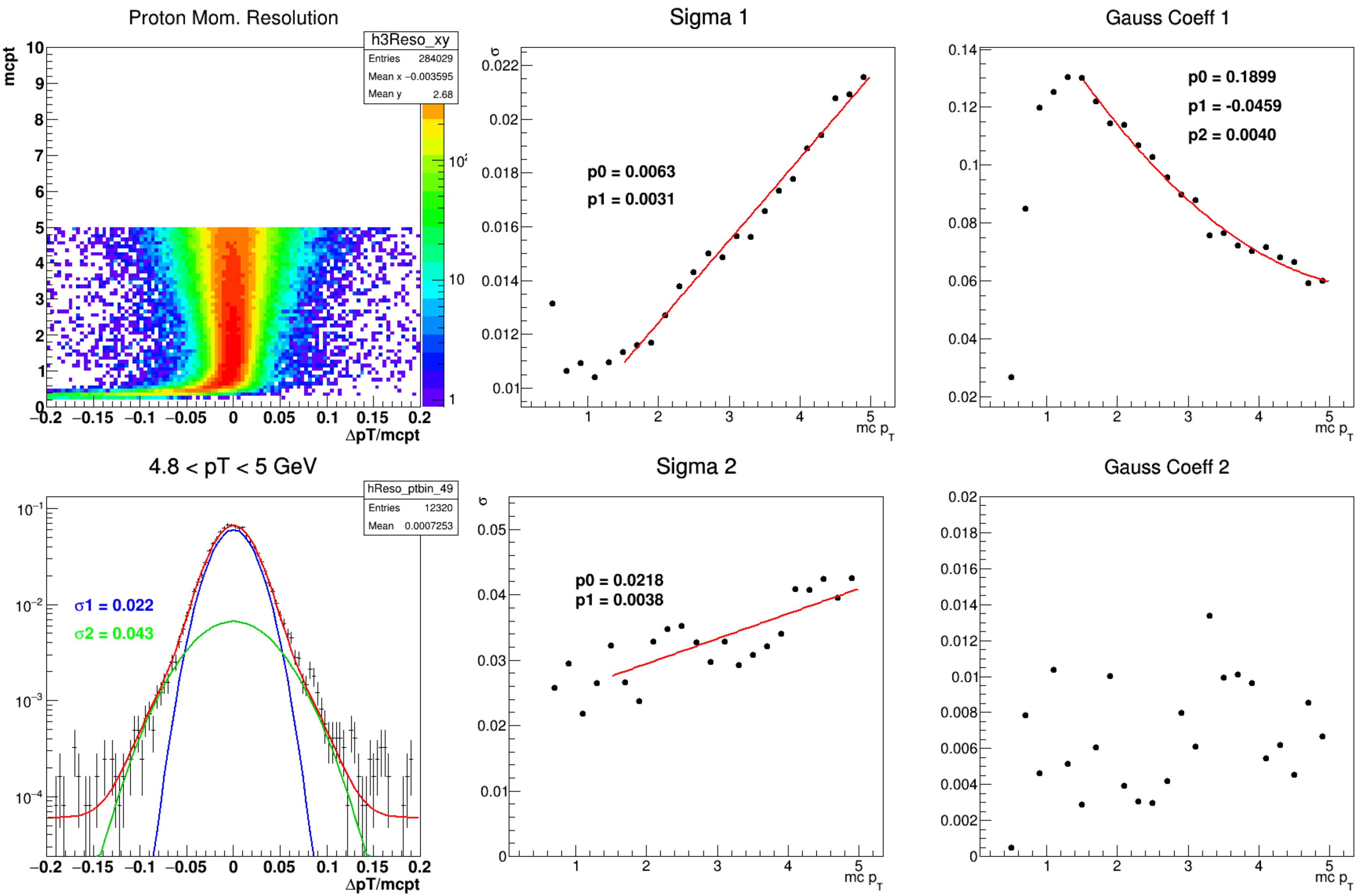








- Same as previous slide except for Kaons

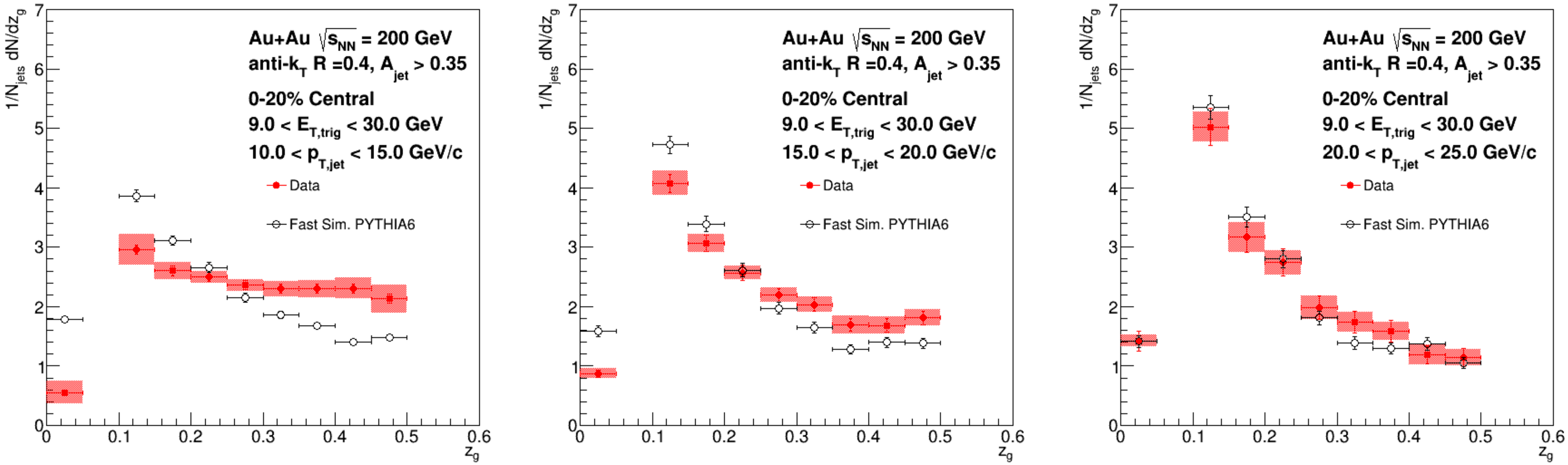


- Same as previous two slides except for protons/antiprotons
- Very similar momentum resolution widths for all three species, though evolution with pT varies
- Shown is inclusive, for the actual fast simulation I bin in centrality and zdc as well as the species
- Two gaussian parameterization fails when statistics is low, for kaons and protons I have wider bins in zdcx

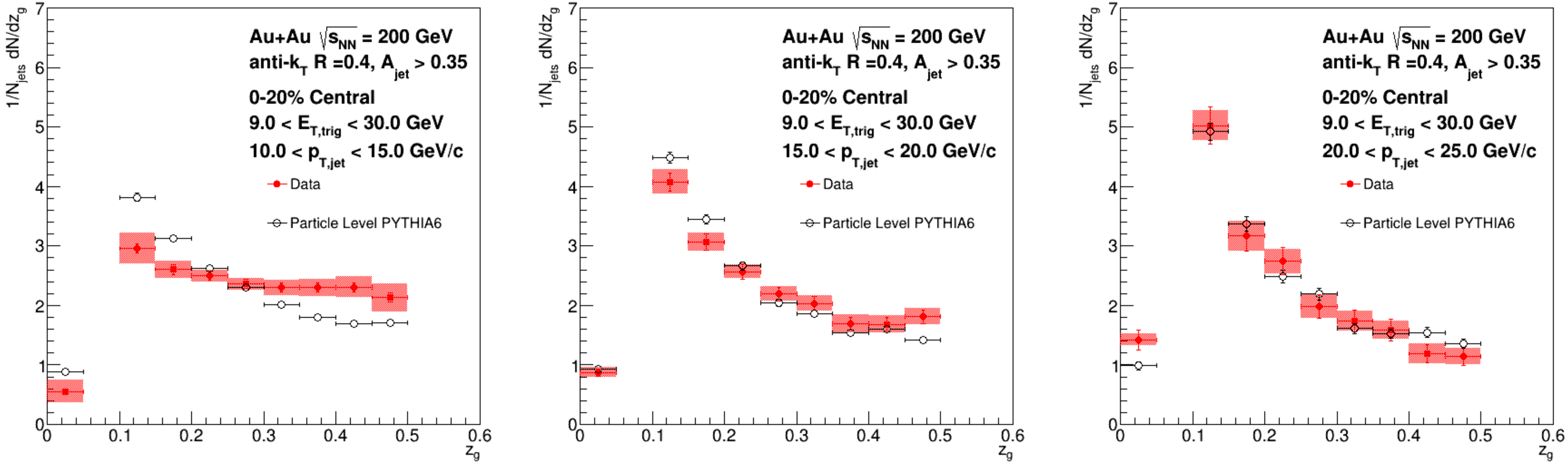
Embedding into MinBias

- Events in the analysis are required to have a tower with $\mathrm{E_T} > 9\ \mathrm{GeV}$, which selects a different sample of events than inclusive minbias
- In order to appropriately sample events to embed to, I randomly select an event from a centrality/production (presplit, low, mid, high) weighted by the amount of triggers found in each bin
  - This biases towards higher luminosity production and more central events
- I require that the jets reconstructed in the embedded event have greater than 25% of a particle level Pythia jet
- Currently running more statistics, for now the PYTHIA events have error bars

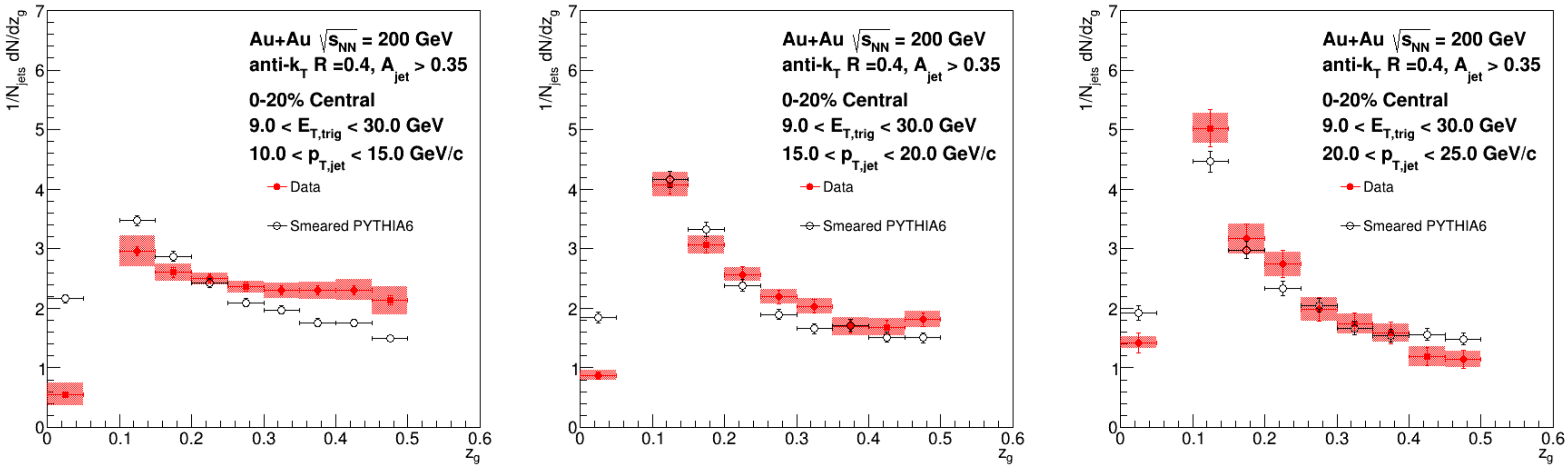
Comparison to Fast Simulated PYTHIA6 (smeared + embedded)



Comparison to Particle Level PYTHIA6



Comparison to Smeared PYTHIA6 (smeared but not embedded into MB)



Note: The 0 bin shifts somewhat significantly

Discussion

- Large disagreement in lowest pT bin between my measurement and PYTHIA6 (particle-level, smeared, smeared+embedded)
- The data agrees with uncertainties in the highest-pT bin, where virtually no combinatorial subtraction occurs
- I am cautiously suspicious of the estimation of fraction of combinatorial jets, but am not sure why the disagreement
  - Currently the data points include the systematic of estimating 68% of jets within $10 < pT < 15$ GeV are combinatorial jets
  - If one were to work backwards and ask what percentage of jets within $10 < pT < 15$ GeV need to be combinatorial to arrive at the Pythia result, the answer would be 80%, which I don't believe I can get to with a sound definition of rho
- I am considering only showing the highest-pT bin in my HP poster, while I investigate further