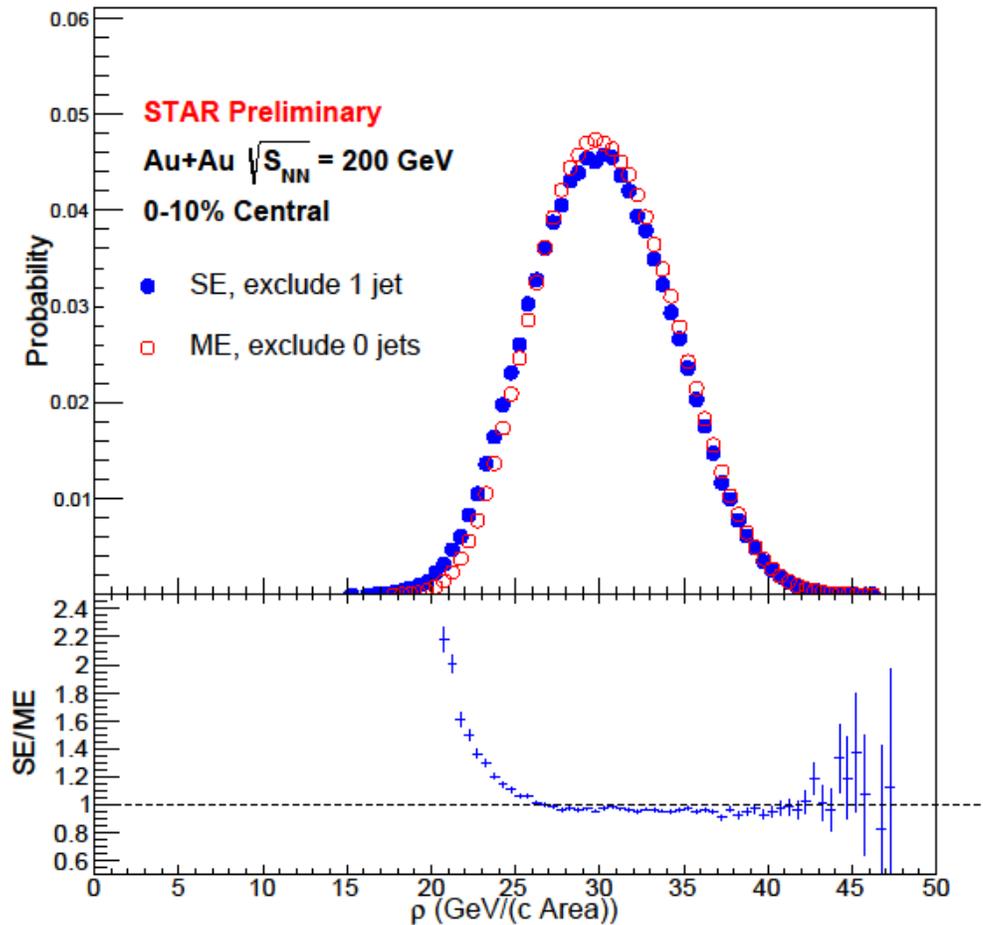


Analysis Status Update: October 8, 2020

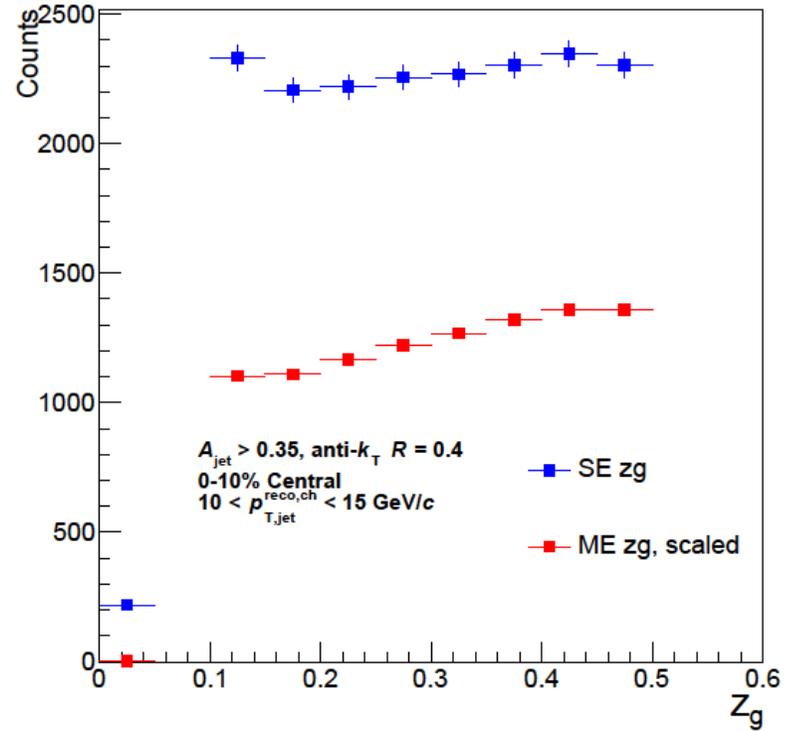
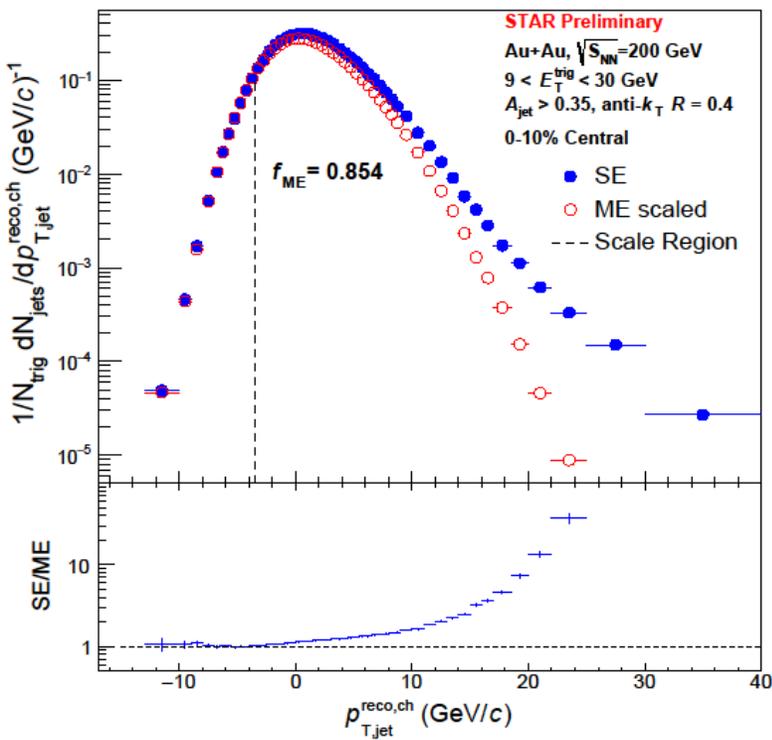
DAN NEMES

Reminder: Analysis Details



- Using a semi-inclusive approach to measure z_g
- Minimal discrimination on a jet-by-jet basis, instead subtracting contribution from combinatorial jets at the level on ensemble distributions
- Same Events (SE) are HT2 events with a tower $E_T > 9$ GeV
- Mixed Events (ME) are MinBias events, mixed in bins of multiplicity, EP angle, v_z , and z_{dcx} such that jets reconstructed in ME are purely combinatorial in nature

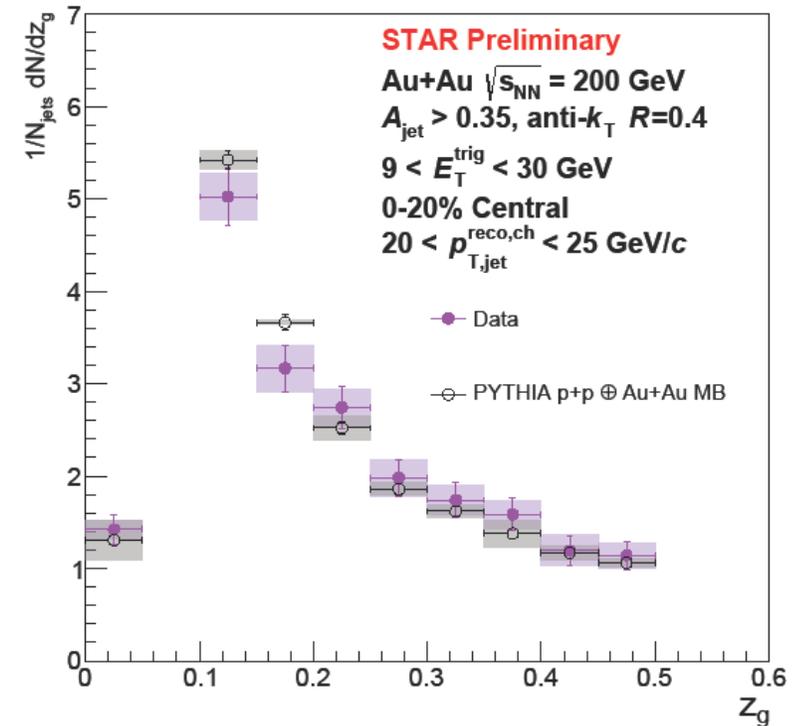
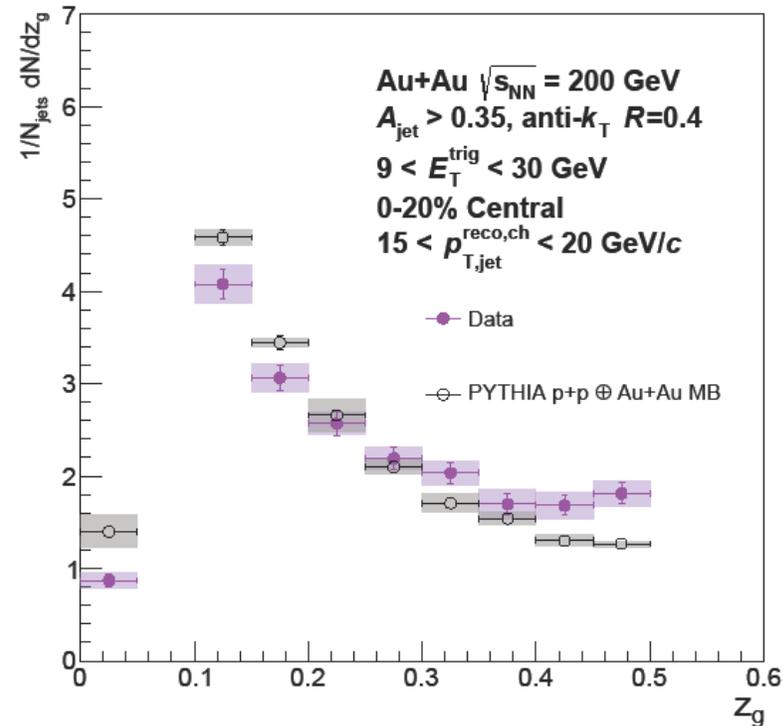
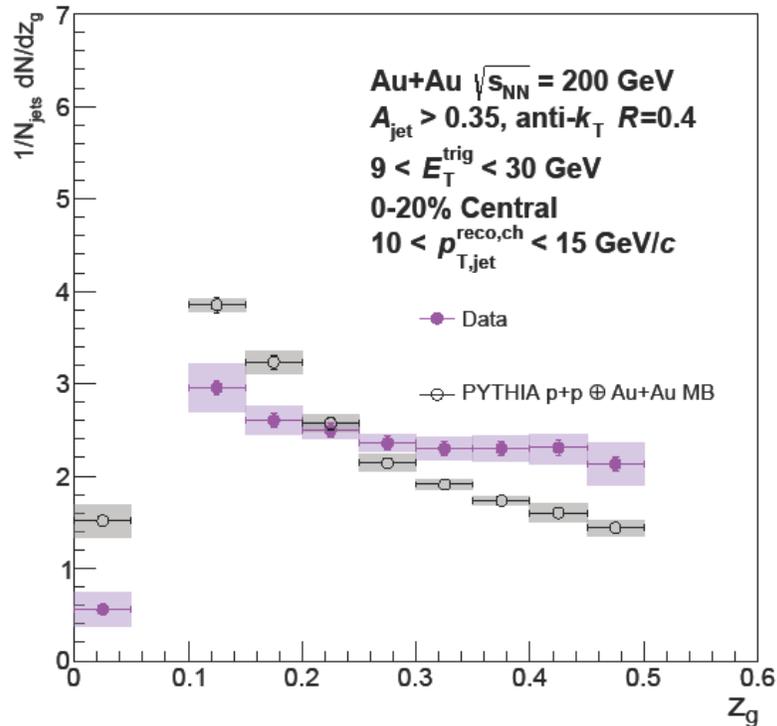
Reminder: Analysis Details



- Jets (charged) are reconstructed in both **SE** and **ME** within recoil region of high- E_T trigger from **SE**
- Per-trigger recoil jet yield in **ME** has to be scaled down by factor f_{ME} , due to conservation of number of jets reconstructed
- Using the ratio of **SE/ME** jet yields, can estimate the amount of combinatorial jet contribution within a given jet p_T bin
- After measuring the distribution of **SE** and **ME** z_g , scale the ME z_g distribution and subtract from the SE distribution, to get the combinatorial-subtracted z_g distribution

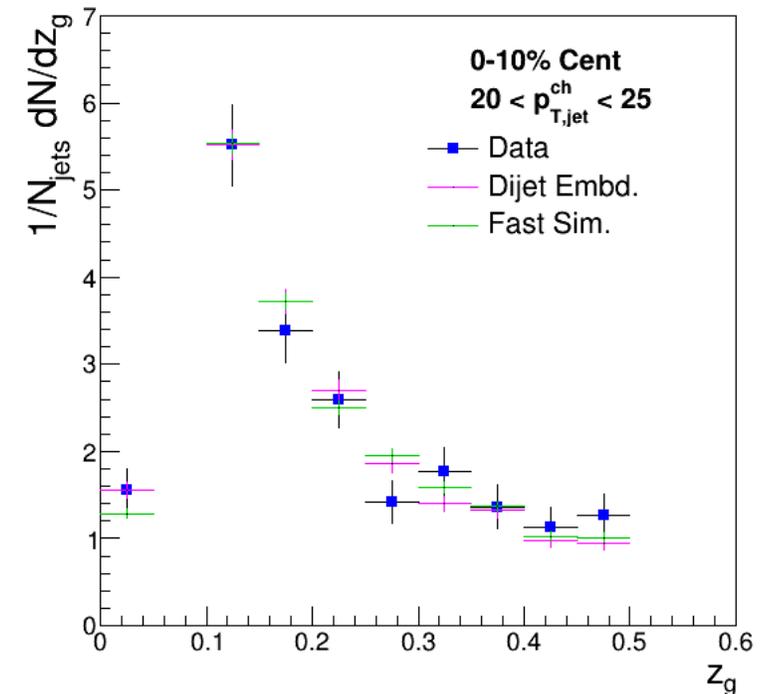
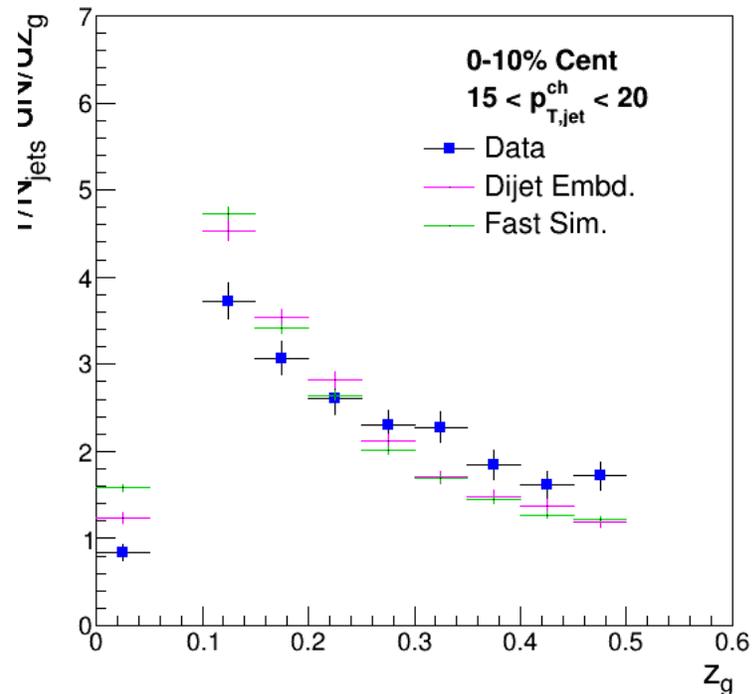
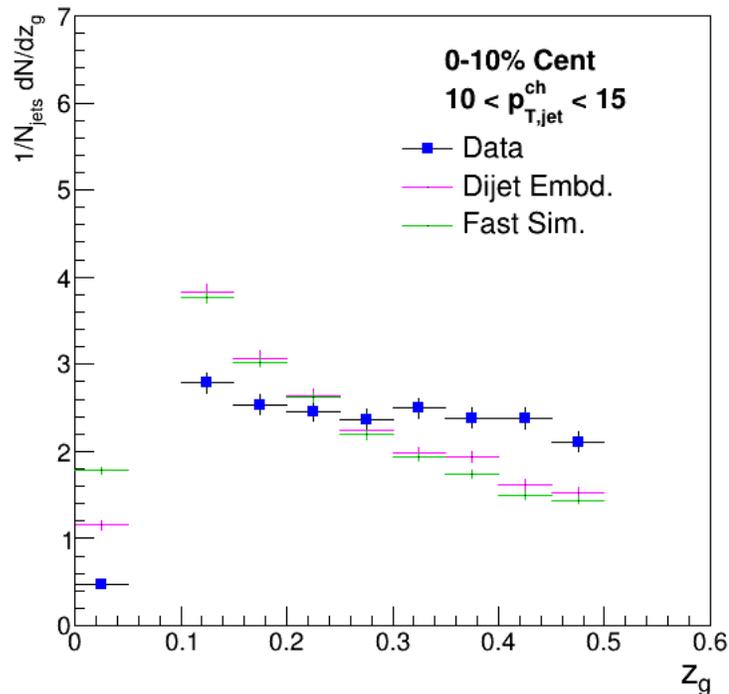
Reminder: Combinatorial-Subtracted z_g Compared to Fast Sim.

- Discrepancy between Data and Fast Sim. for lower two jet p_T bins, which COULD be consistent with underestimating combinatorial jet contribution or mischaracterization of combinatorial jet z_g
- Only showed the highest jet p_T bin in Hard Probes poster

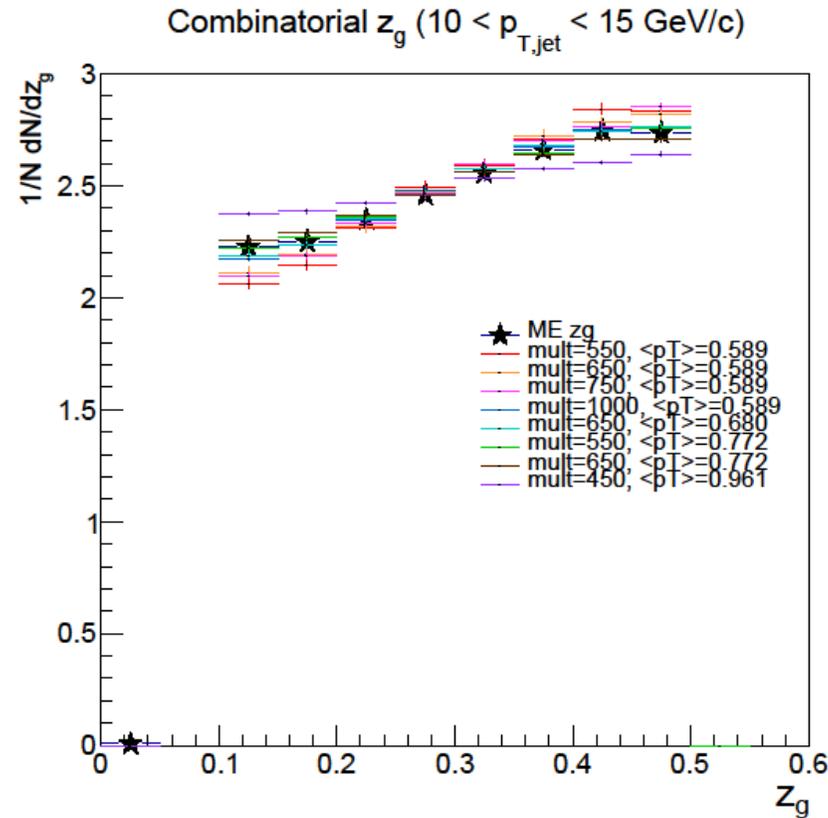
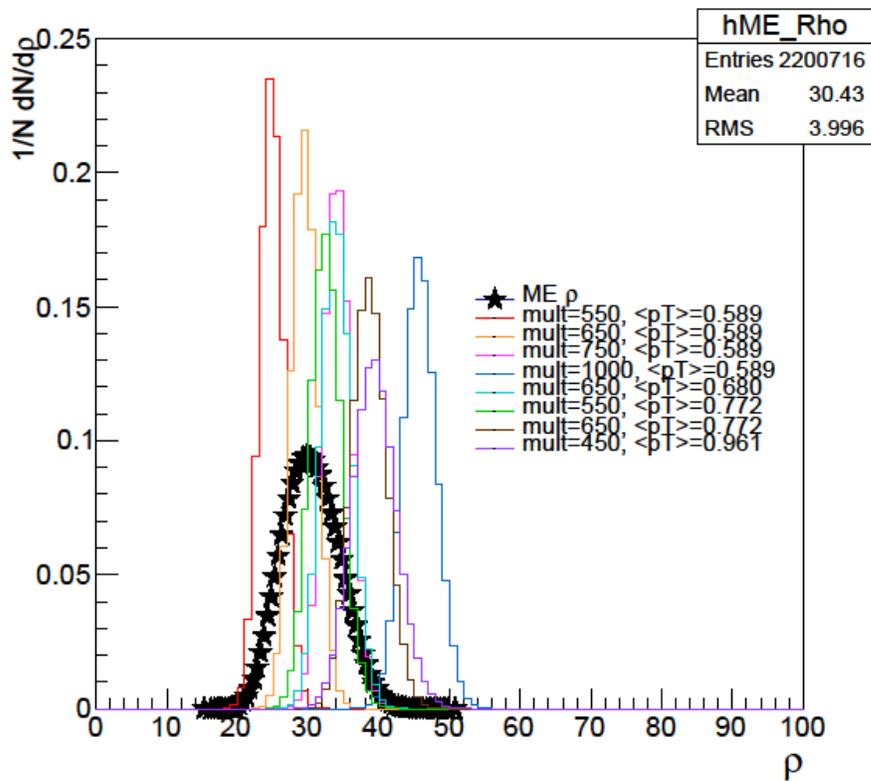


Including Dijet Comparison (0-10% Central)

- With Pythia6 Dijet embedding, can sanity check my Fast Sim. Framework
- Dijet embedding currently not a perfectly fair comparison, need to weight events by z_{dcx} and also impose low multiplicity cutoff to mimic analysis
- Both simulation comparisons yield similar results, pointing to the data containing the interesting feature



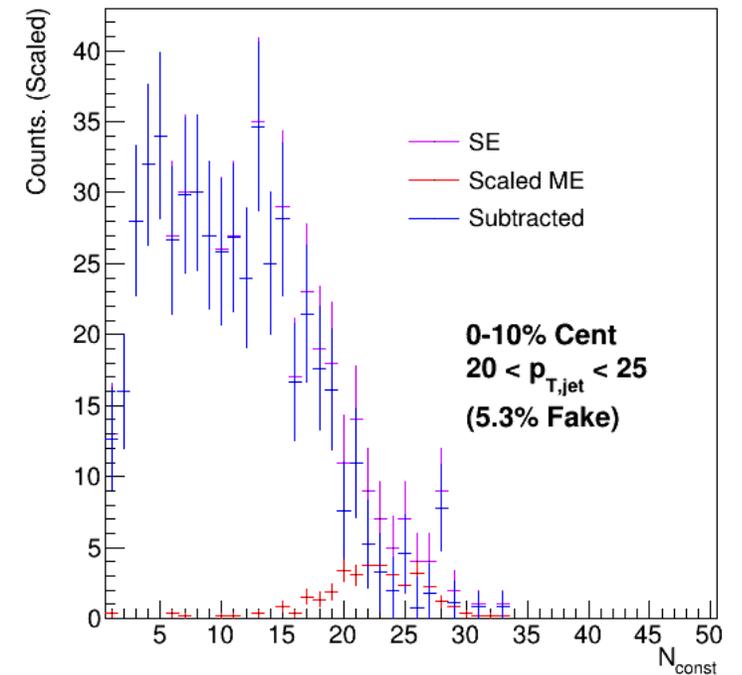
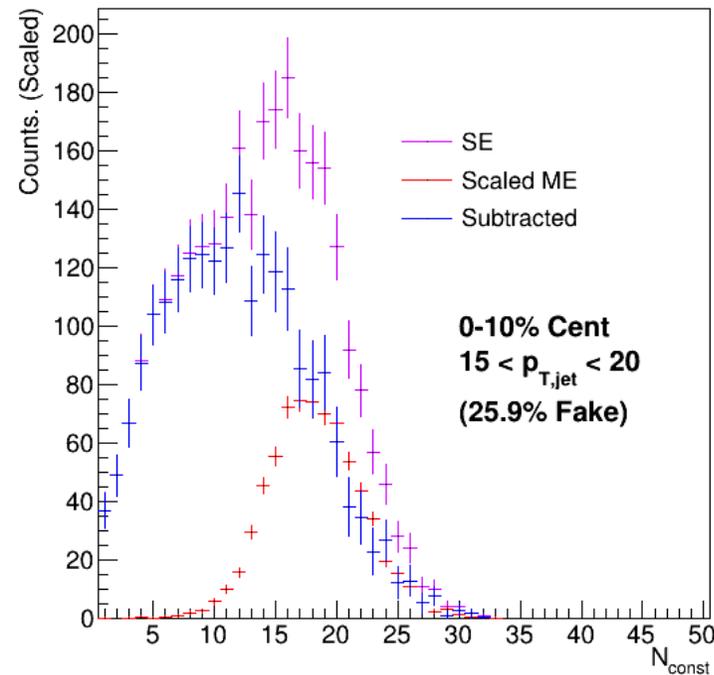
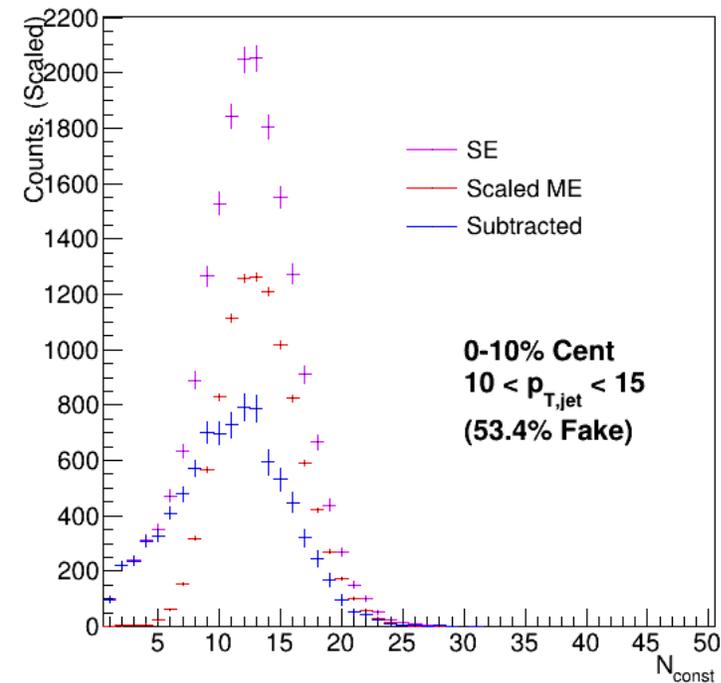
Shape of ME z_g Investigation



- Tracks are thrown randomly in phi-eta with thermal p_T distribution, and jets are reconstructed and constituent subtracted
- Small p_T dependence of combinatorial z_g distribution
- Very little multiplicity dependence
- ME z_g distribution similar to thermal background
- Might include as a systematic

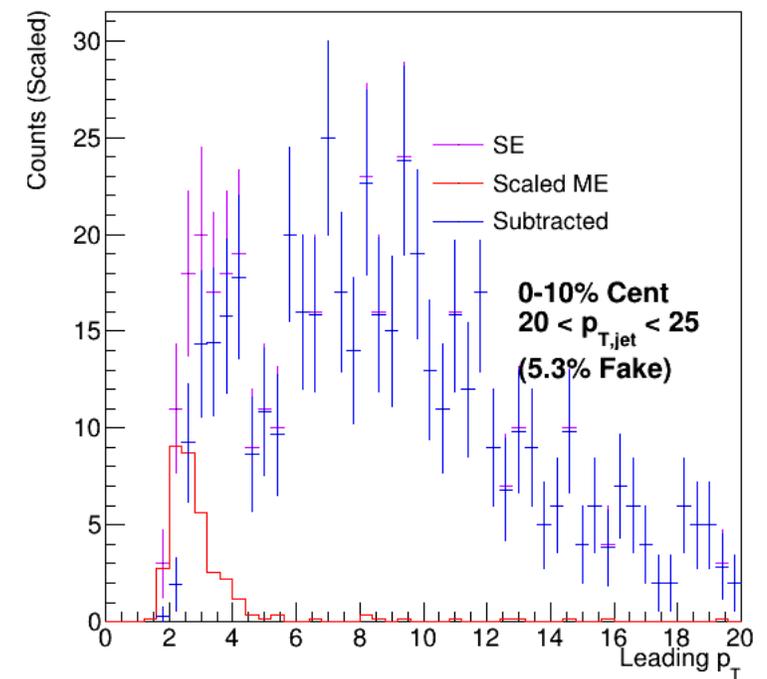
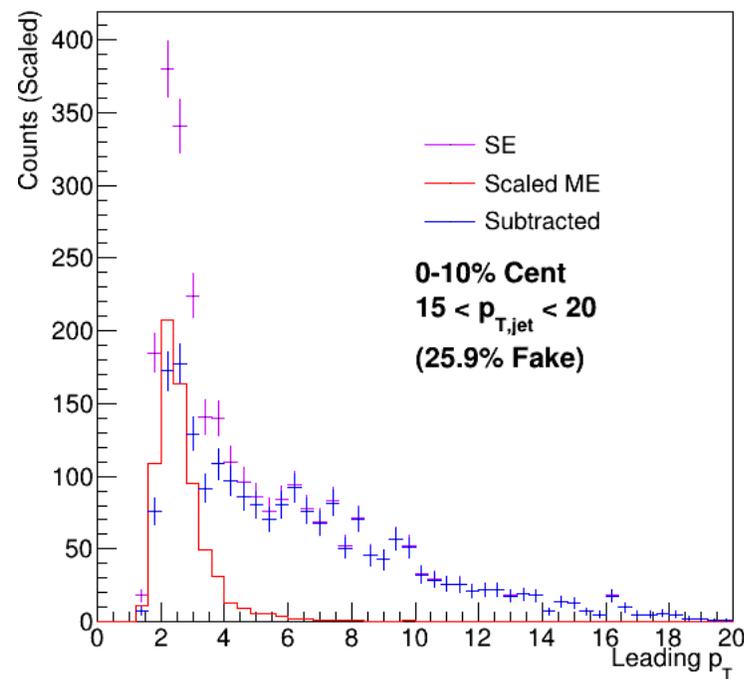
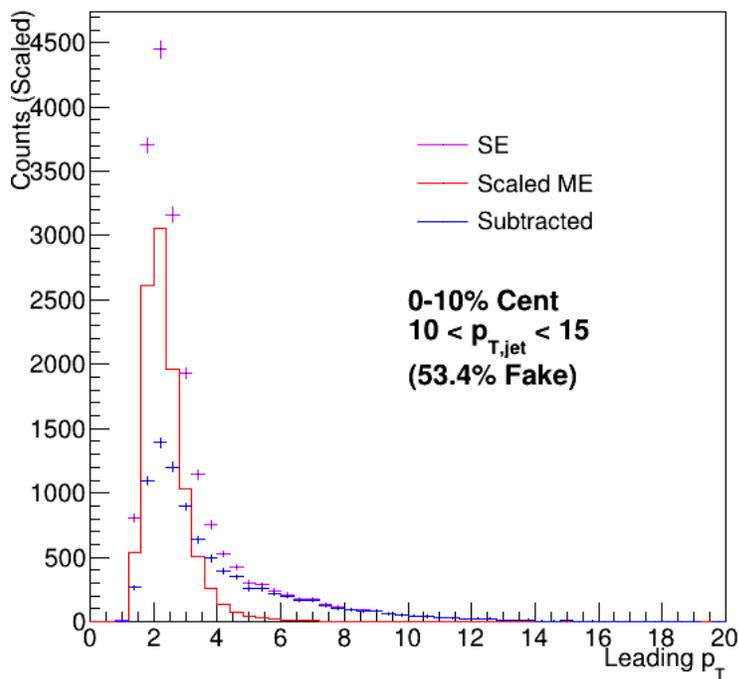
Investigating Properties of Jets: Number of Constituents

- Since I do not discriminate fake jets on jet-by-jet basis in the analysis, I need to perform the same ensemble level subtraction to any observable I want to use to investigate the properties of my signal jets in data
- Mean number of constituents found in the jet DECREASES with increasing jet p_T



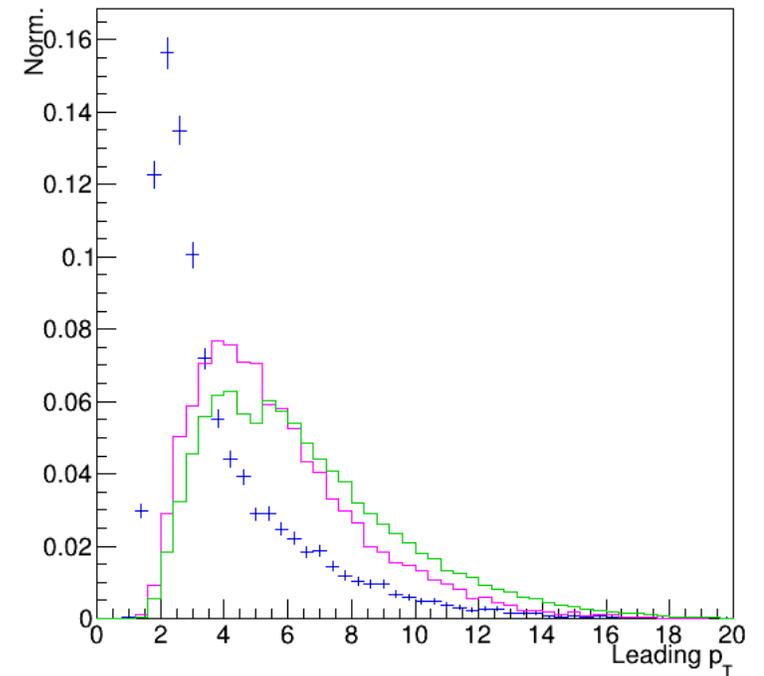
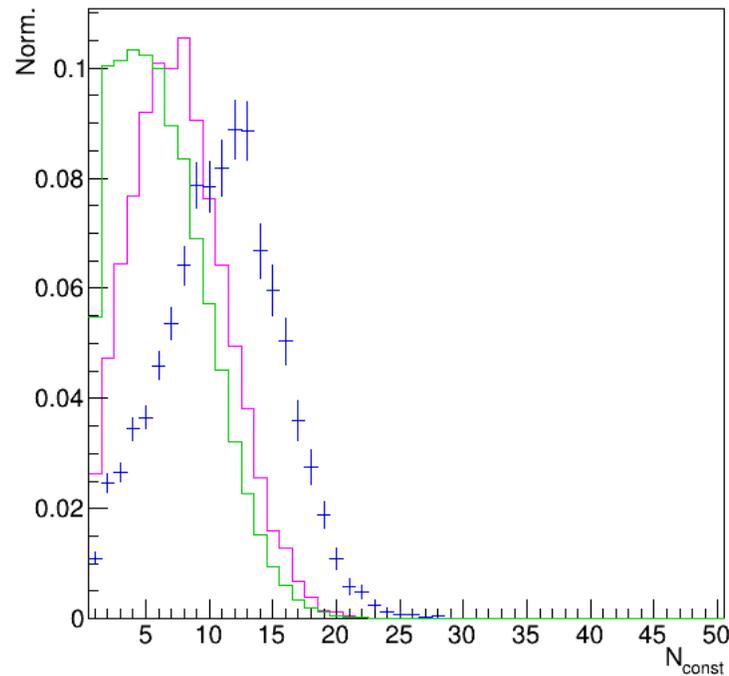
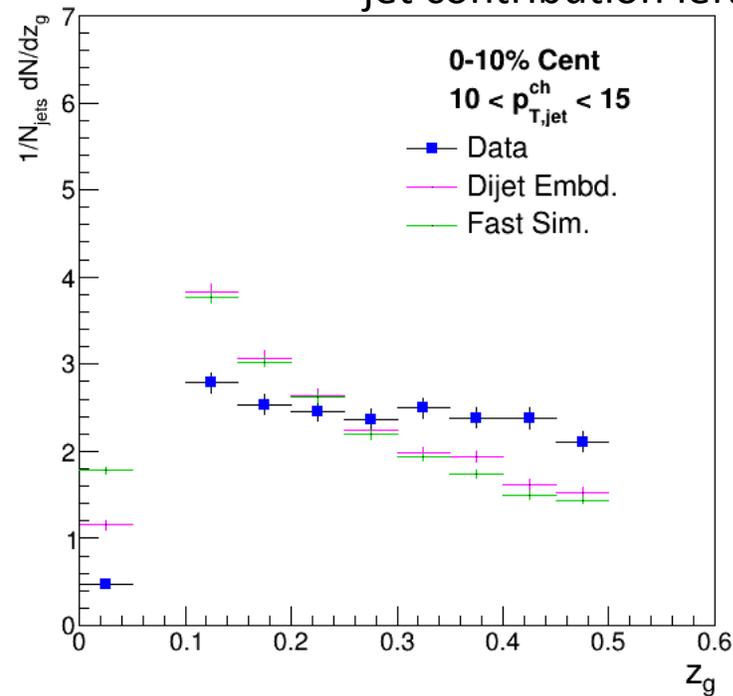
Investigating Properties of Jets: Leading Track p_T

- Same procedure is done, except looking at the leading p_T track in the jet
- Leading track p_T in ME is highly peaked at ~ 2 GeV
- Same peak at ~ 2 GeV can also be seen in the combinatorial-subtracted distribution, which may point to leftover combinatorial contributions



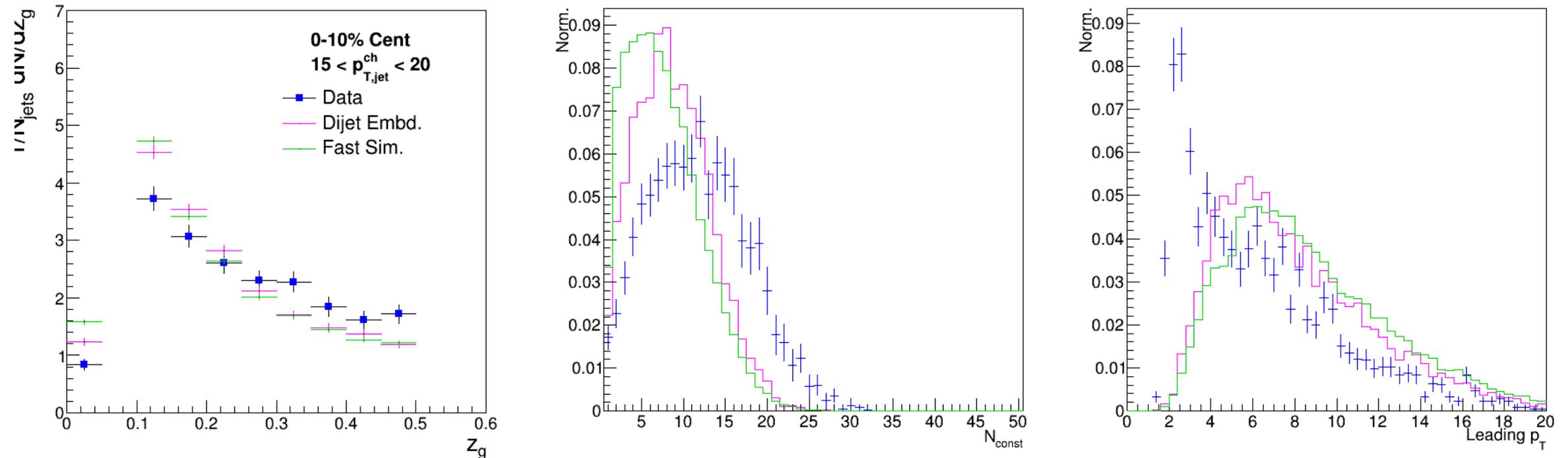
$10 < p_{T,\text{jet}} < 15$ Bin Comparison

- The Data should not necessarily “agree” with the simulation as these jets are expected to experience some degree of jet quenching
- Looking for a sign that the combinatorial-subtracted distributions might have combinatorial jet contribution left over



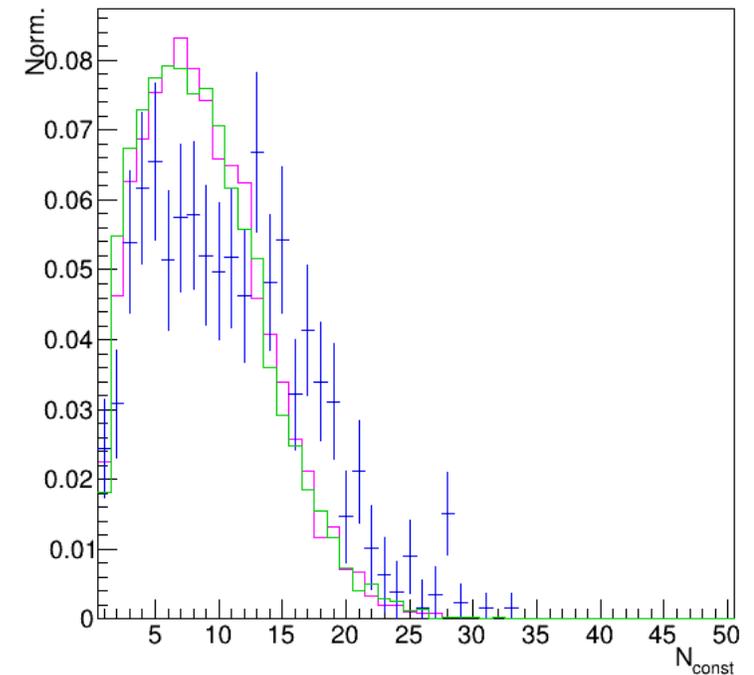
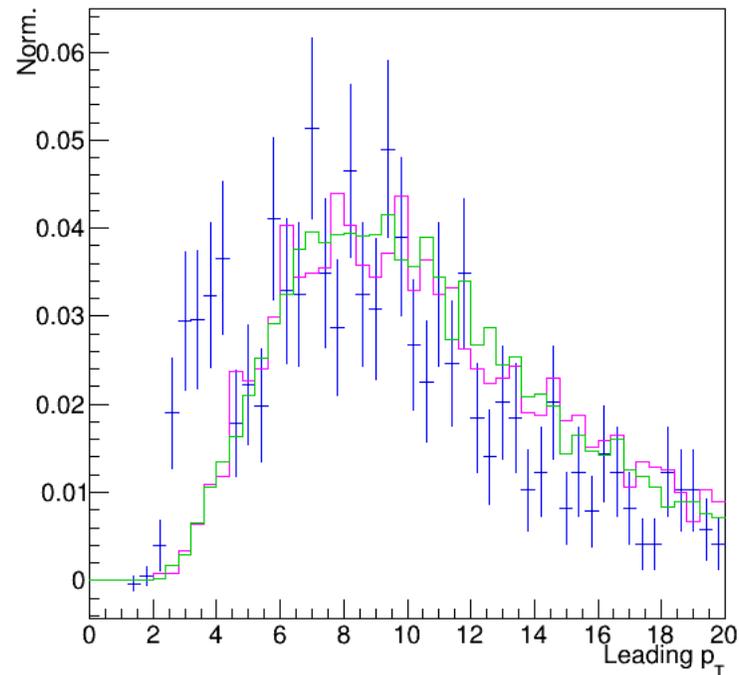
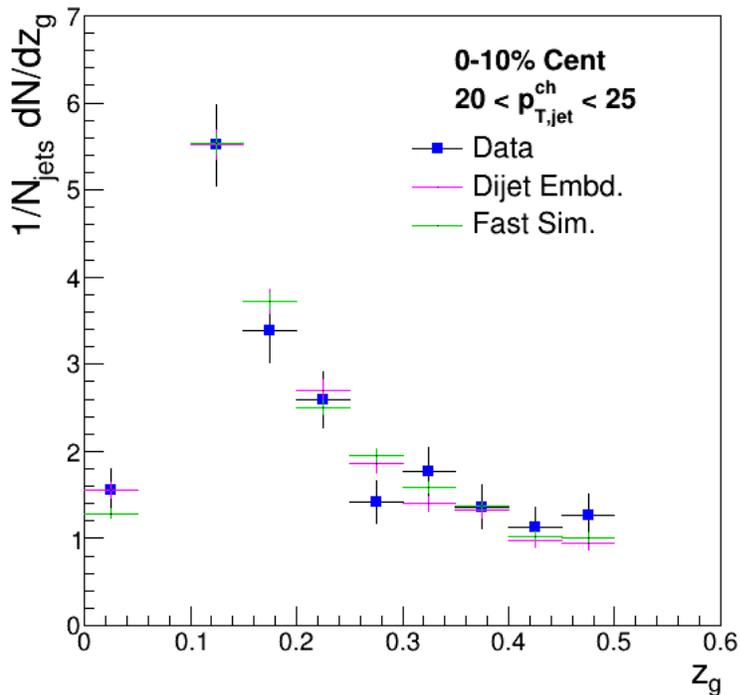
$15 < p_{T,\text{jet}} < 20$ Bin Comparison

- Peak at ~ 2 GeV in Leading p_T for Data looks suspiciously like combinatorial-jet contribution



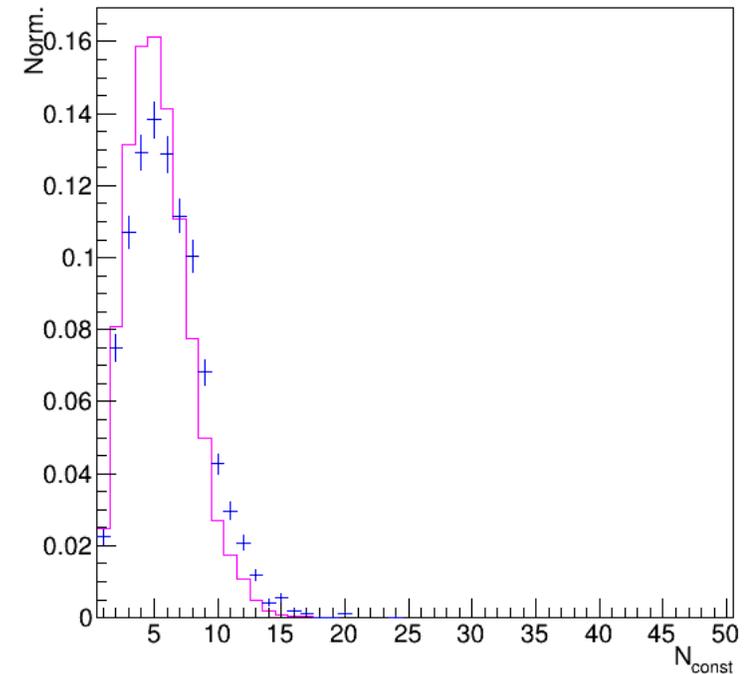
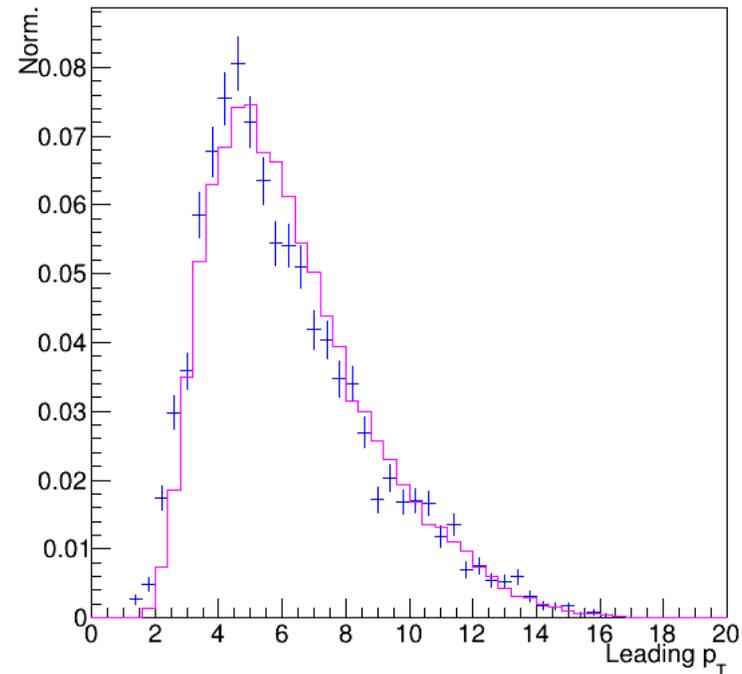
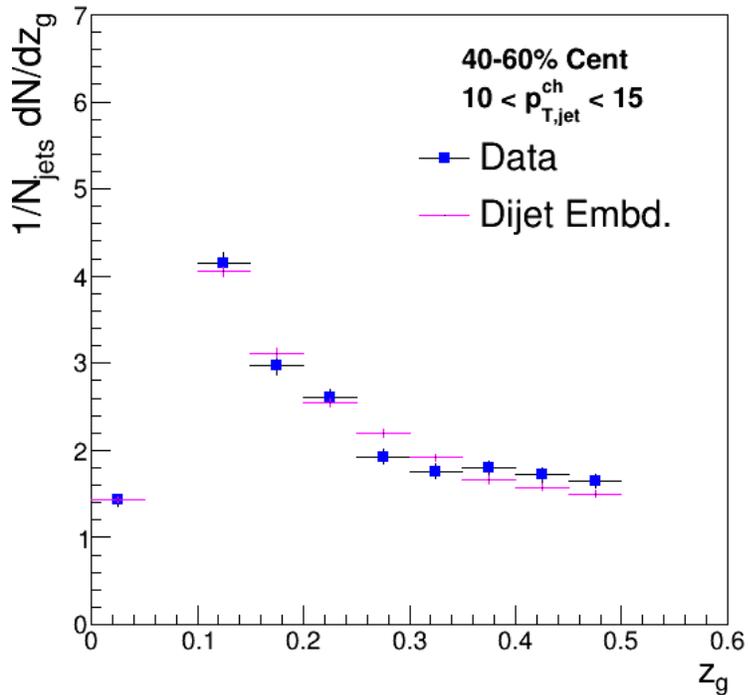
$20 < p_{T,\text{jet}} < 25$ Bin Comparison

- Poor statistics due to only looking at 0-10% central
- Agreement between Data and Simulation for all three histograms



40-60% Cent Comparison

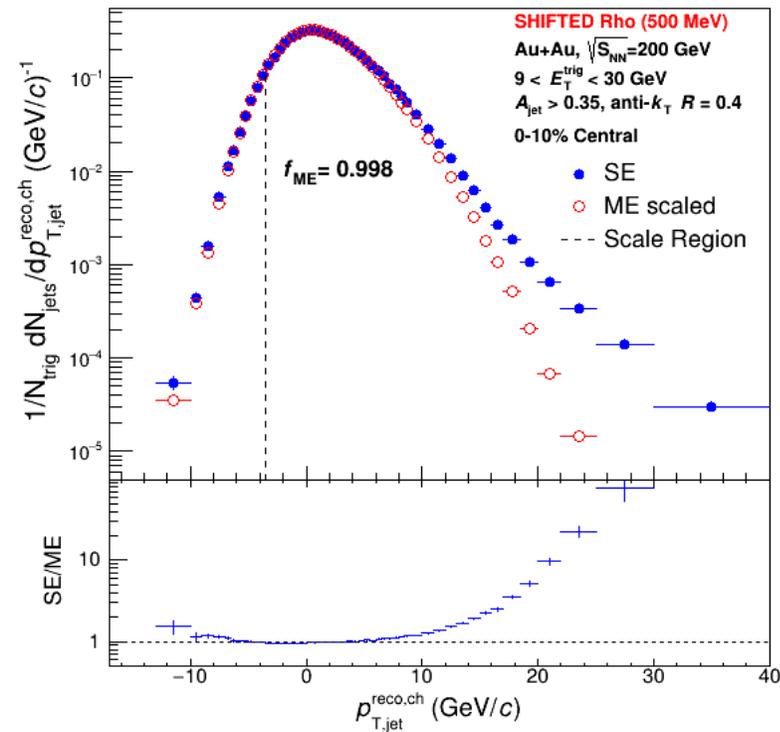
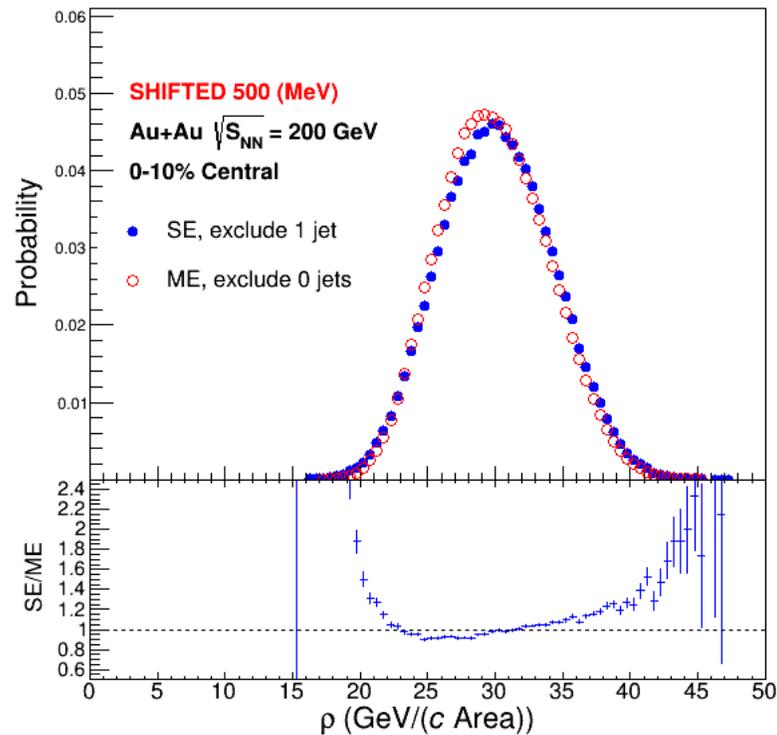
- For this centrality only showing Dijet embedding for now, need to update Fast Sim for non-central centralities
- Very consistent agreement between data and the embedding



Discussion

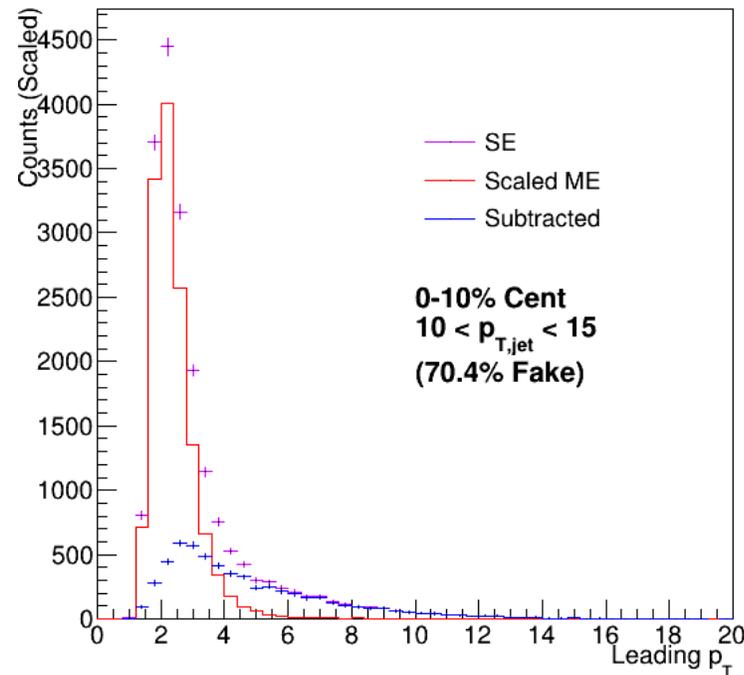
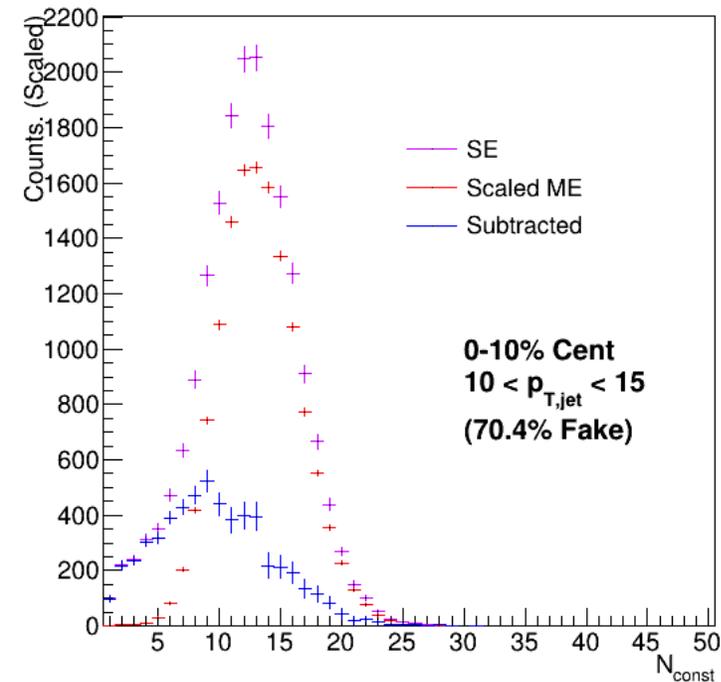
- Based on the peak at ~ 2 GeV in the leading part comparisons, I am lead to believe that I am under subtracting the contribution of combinatorial jets
- The estimation of the number of combinatorial jets within a given p_T is sensitive to the relative definition of ρ between **SE** and **ME** event classes
 - Current choice of ρ chosen such that **SE/ME** ratio is consistent and close to unity as much as possible
 - Alternate choice of ρ is used as a systematic, however is not significant enough of a change to capture the behavior
- How different would my definition of ρ be in order to subtract out the leading p_T peak at ~ 2 GeV?

Upper Bound of Shifting ρ



- Shifting **ME** ρ to lower values causes a shift of the reconstructed **ME** jet p_T spectra to higher values, increasing the amount of combinatorial jets estimated within a given jet p_T bin
- Number of jets reconstructed is driven by geometric factors, and is roughly equal between **SE** and **ME**
- Lack of yield of high jet p_T in **ME** causes and enhancement of the **ME** spectra relative to **SE**, and needs to be scaled down by factor f_{ME}
- Having $f_{ME} \geq 1$ is nonsensical and I am considering it an upper limit

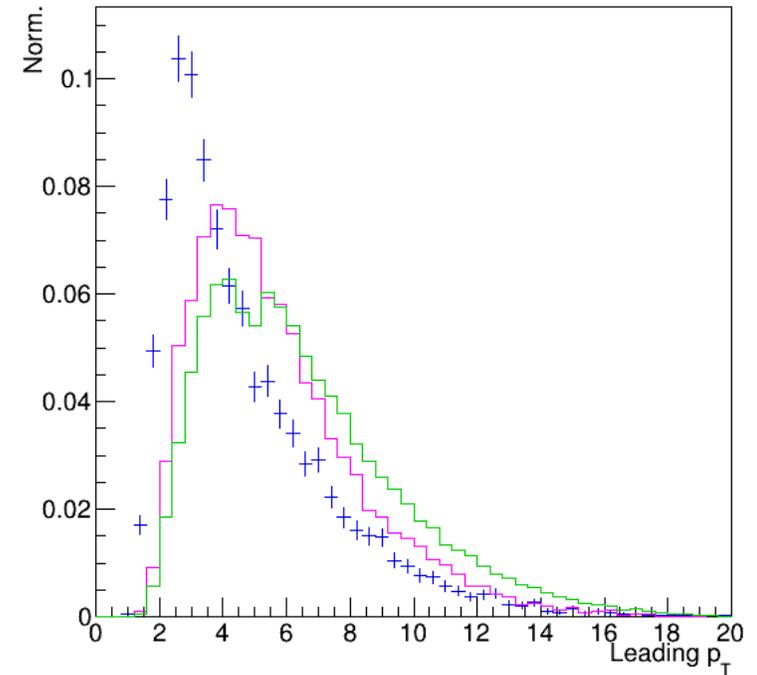
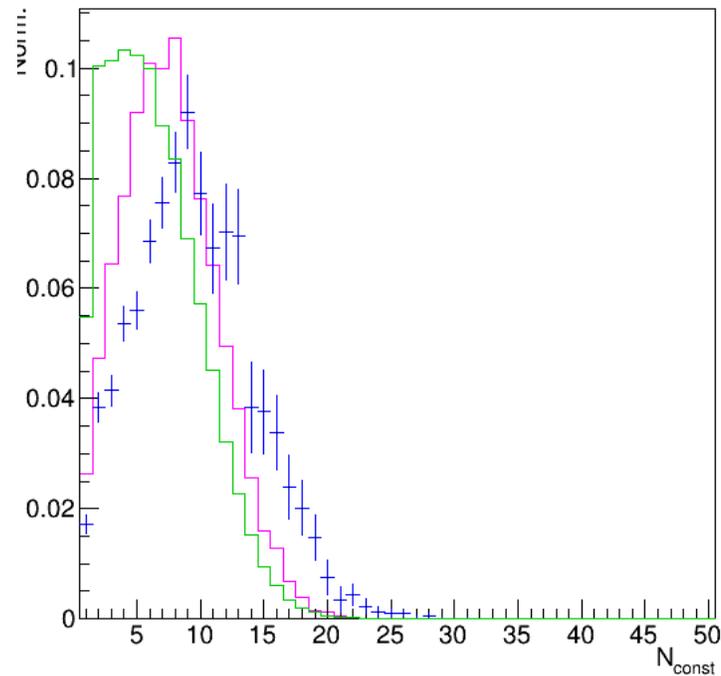
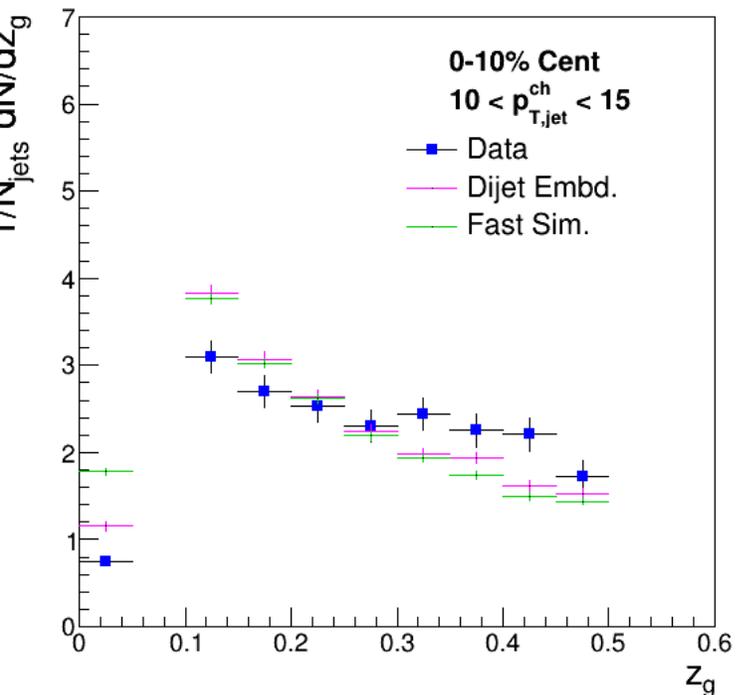
$10 < p_{T,\text{jet}} < 15$, Shifted ρ



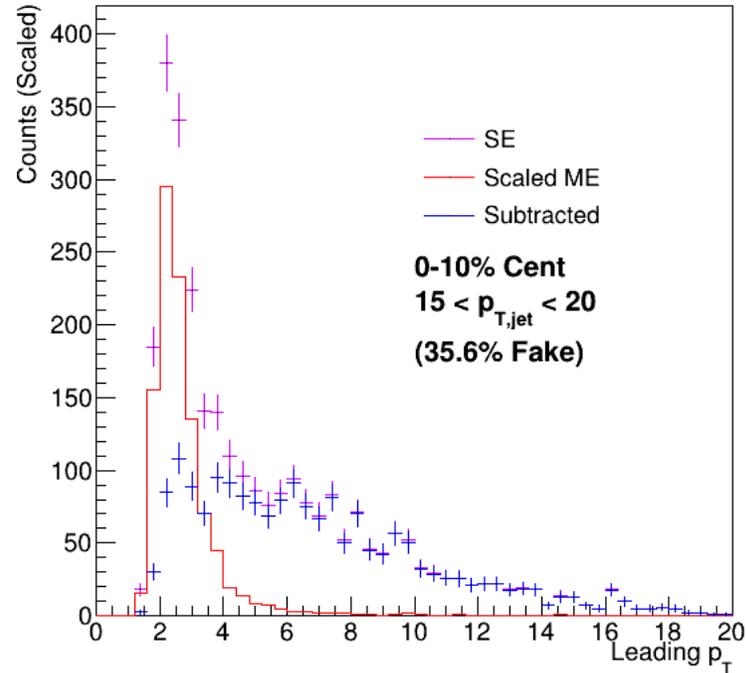
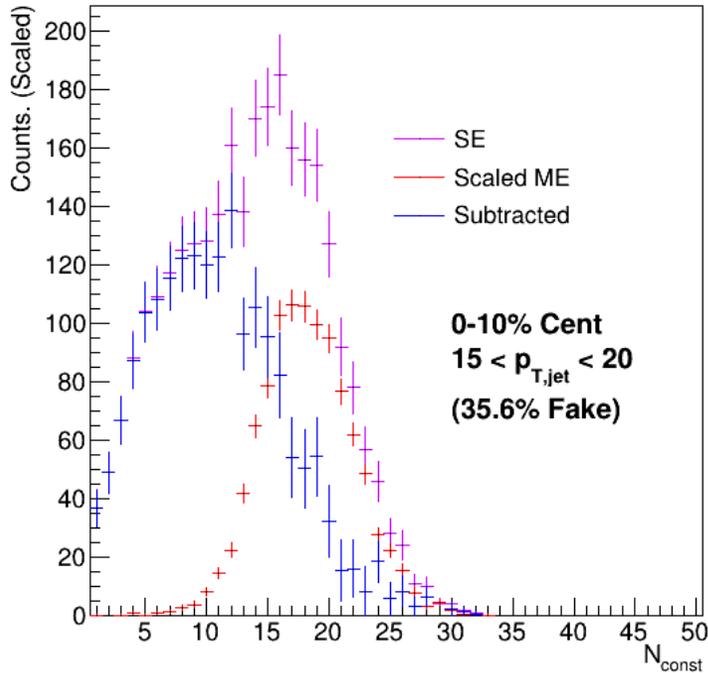
- With using what I assign to be the upper bound on shifting ρ , the peaks in **SE** which coincide with the **ME** peaks are mostly subtracted off, but remnants still seem to remain?
- Reminder: Fake rate using unshifted ρ is $\sim 53\%$ this $p_{T,\text{jet}}$ bin

$10 < p_{T,\text{jet}} < 15$, Shifted ρ

- z_g and comparison to simulation using the shifted values of ρ
- Even with a drastic and unreasonable shift, still features remain, though more subtle



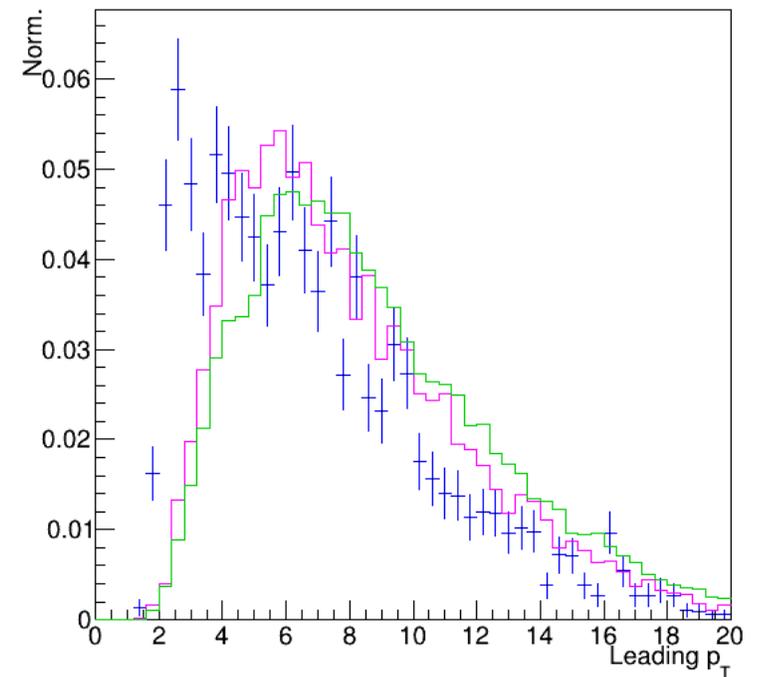
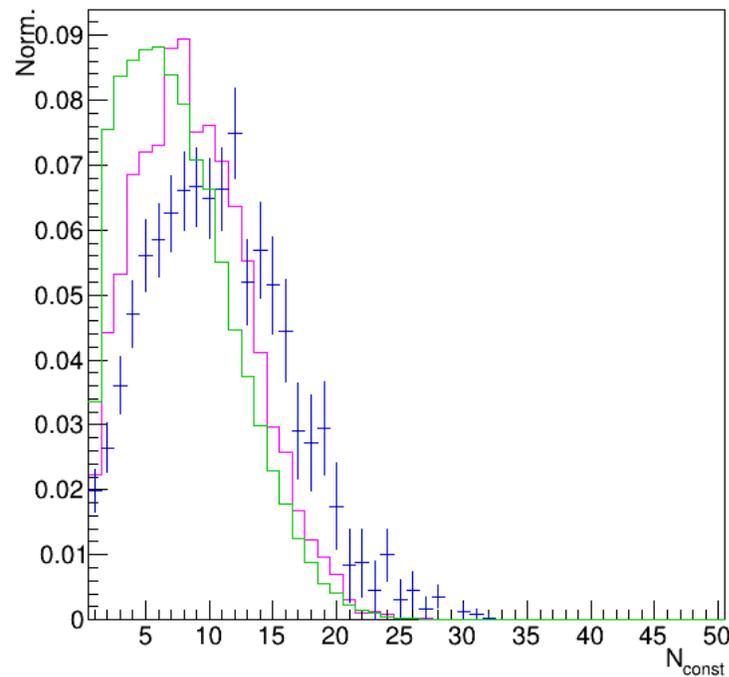
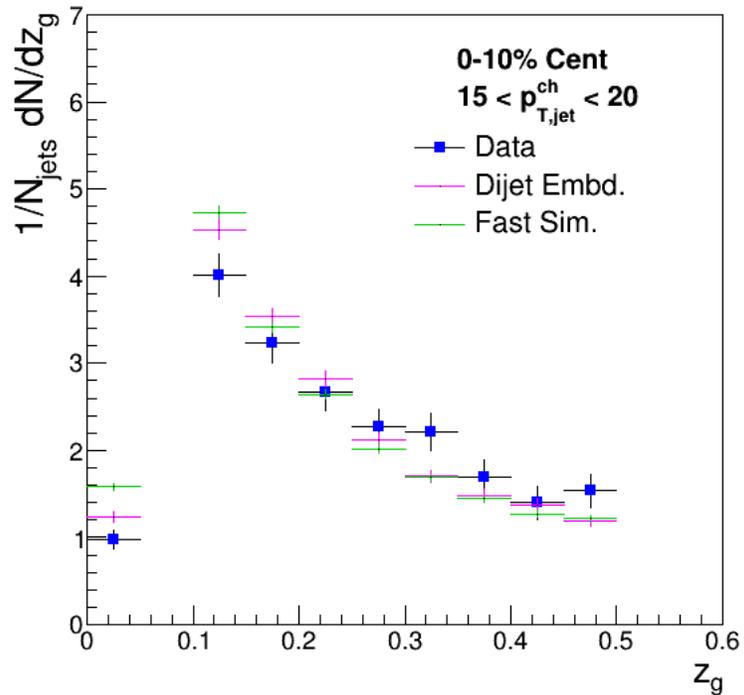
$15 < p_{T,\text{jet}} < 20$, Shifted ρ



- Reminder: Fake rate using unshifted ρ is $\sim 26\%$ for this $p_{T,\text{jet}}$ bin

$15 < p_{T,\text{jet}} < 20$, Shifted ρ

- Still slight differences in Data compared to simulation, even with large shifted ρ
- Can still see hint of peak in leading part p_T at 2 GeV



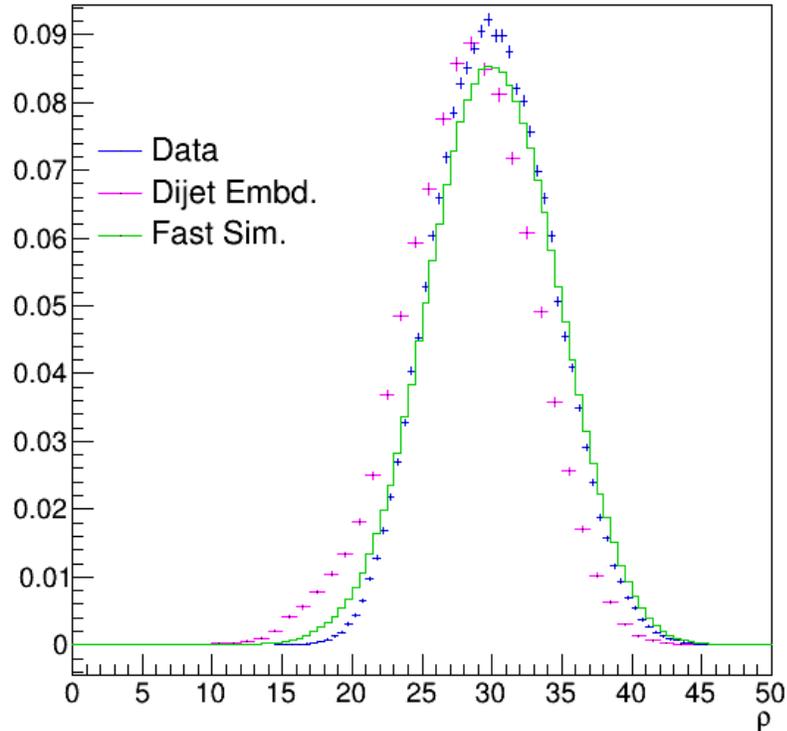
Summary

- There are signs that I am not subtracting entirely the contribution of the combinatorial jets from the final distribution
- Shifting ρ alone doesn't seem to be the cause, as even with an absurd shift such features remain (though significantly diminished)
- Need to investigate and resolve this issue before moving forward
- Probably won't show the two lower jet p_T bins at DNP

Backup

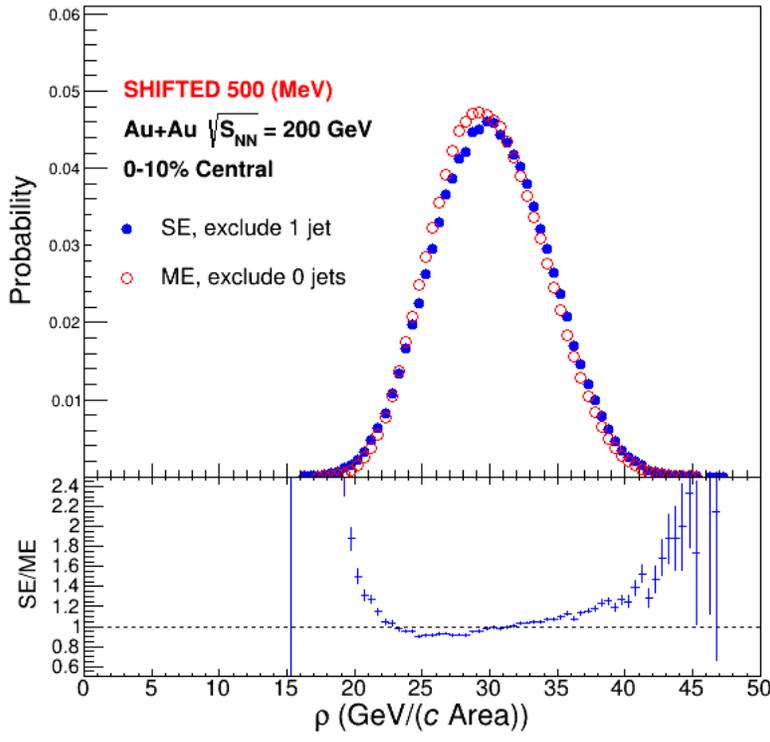
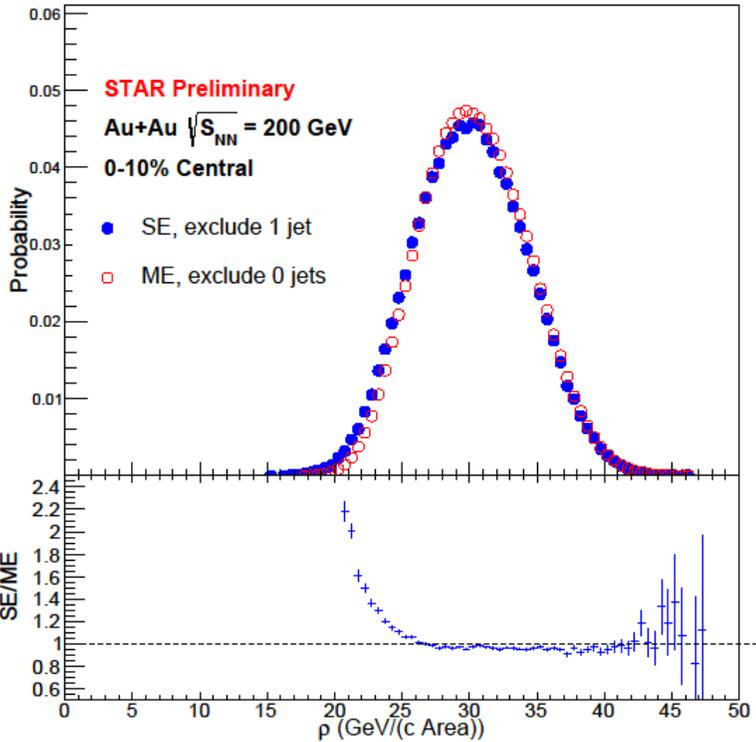
Rho Simulation Comparisons

Rho (0-10% Cent)

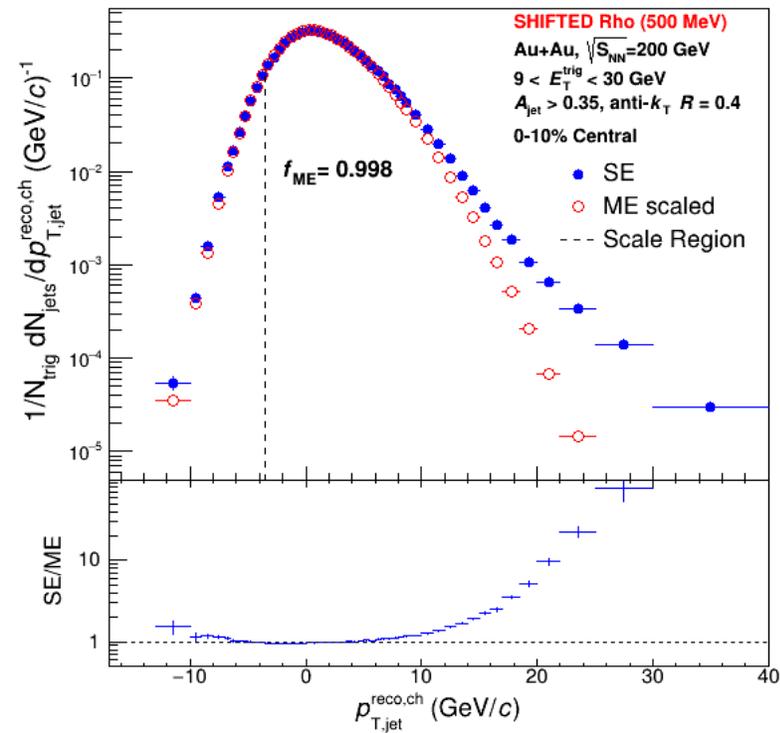
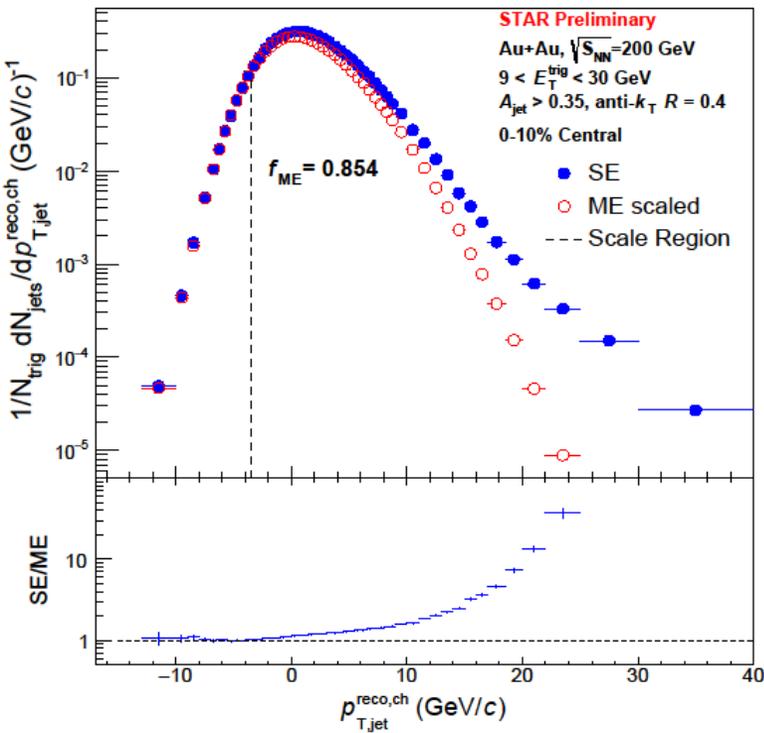


- Dijet Embedding needs work not a perfect comparison yet
- Dijet embedding ZDCx not representative of triggered sample
- Have not yet imposed low multiplicity cutoff for central events to match my data

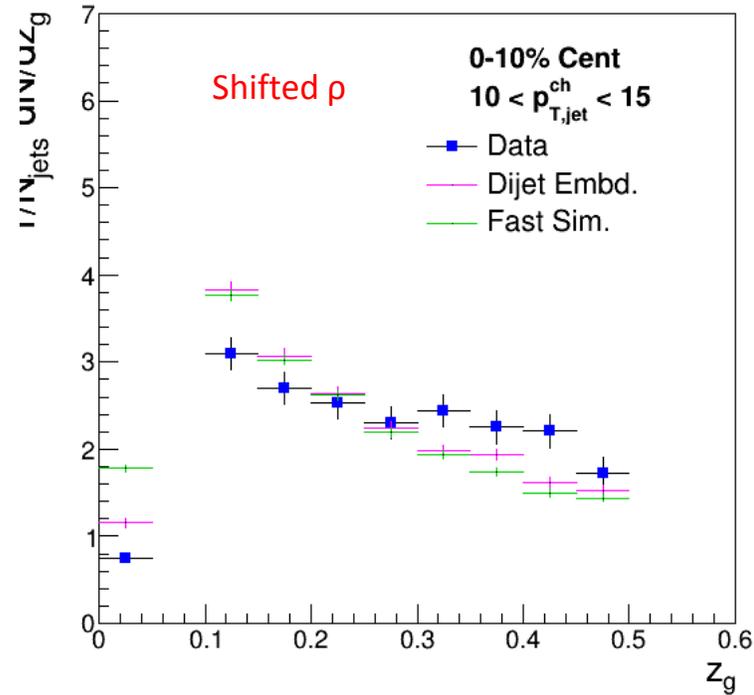
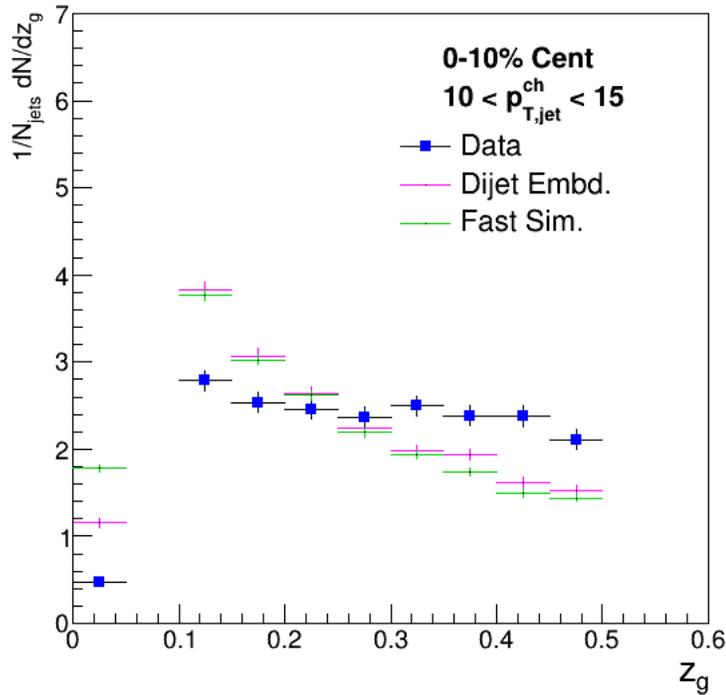
Side by Side Comparison: Rho and Rho Shift



Side by Side Comparison: Recoil Yields with and without Rho Shift



Side by Side Comparison: z_g with and without Rho Shift



Side by Side Comparison: z_g with and without Rho Shift

