D0 Jets in AuAu 200 GeV

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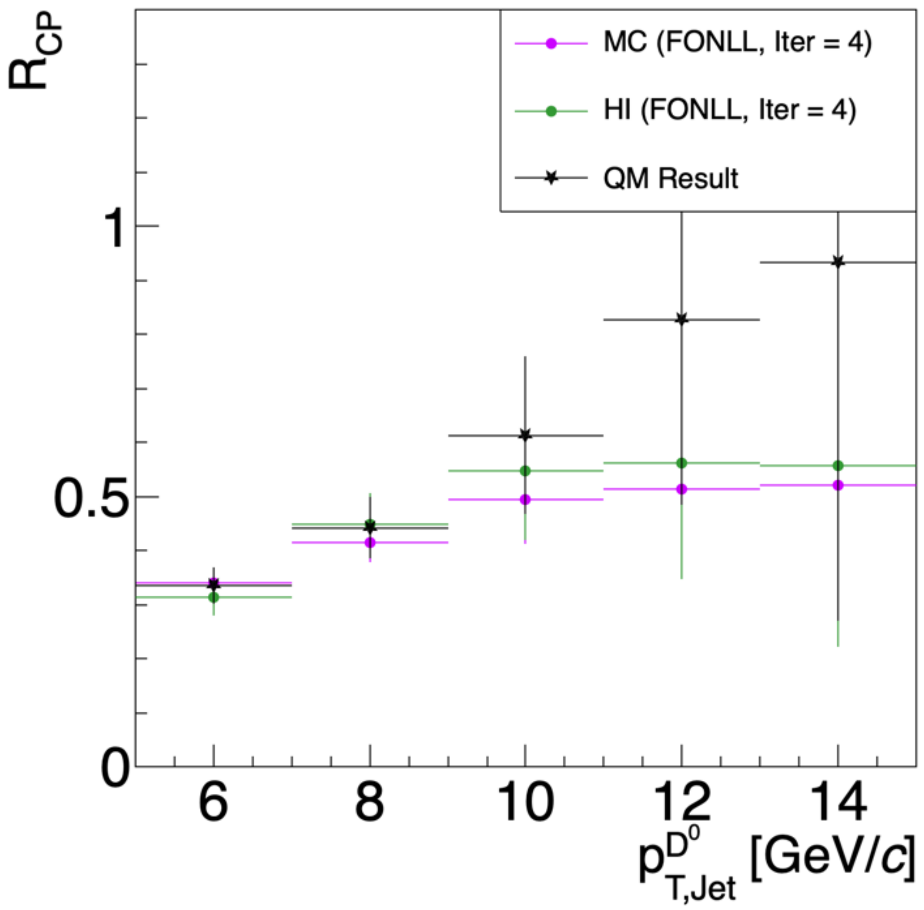
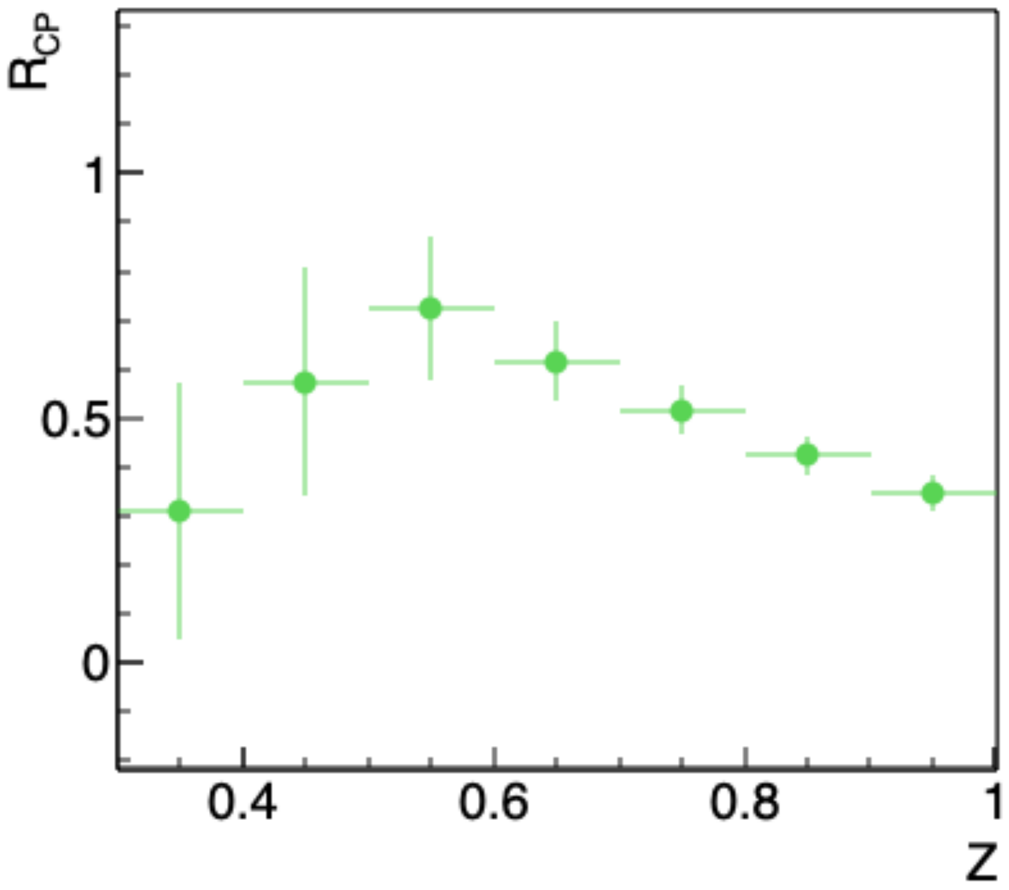
Hard Probes

Current Status: Unfolded Distributions for pT,D0 > 5 GeV/c

STAR, Au + Au $\sqrt{s_{NN}}$ = 200 GeV





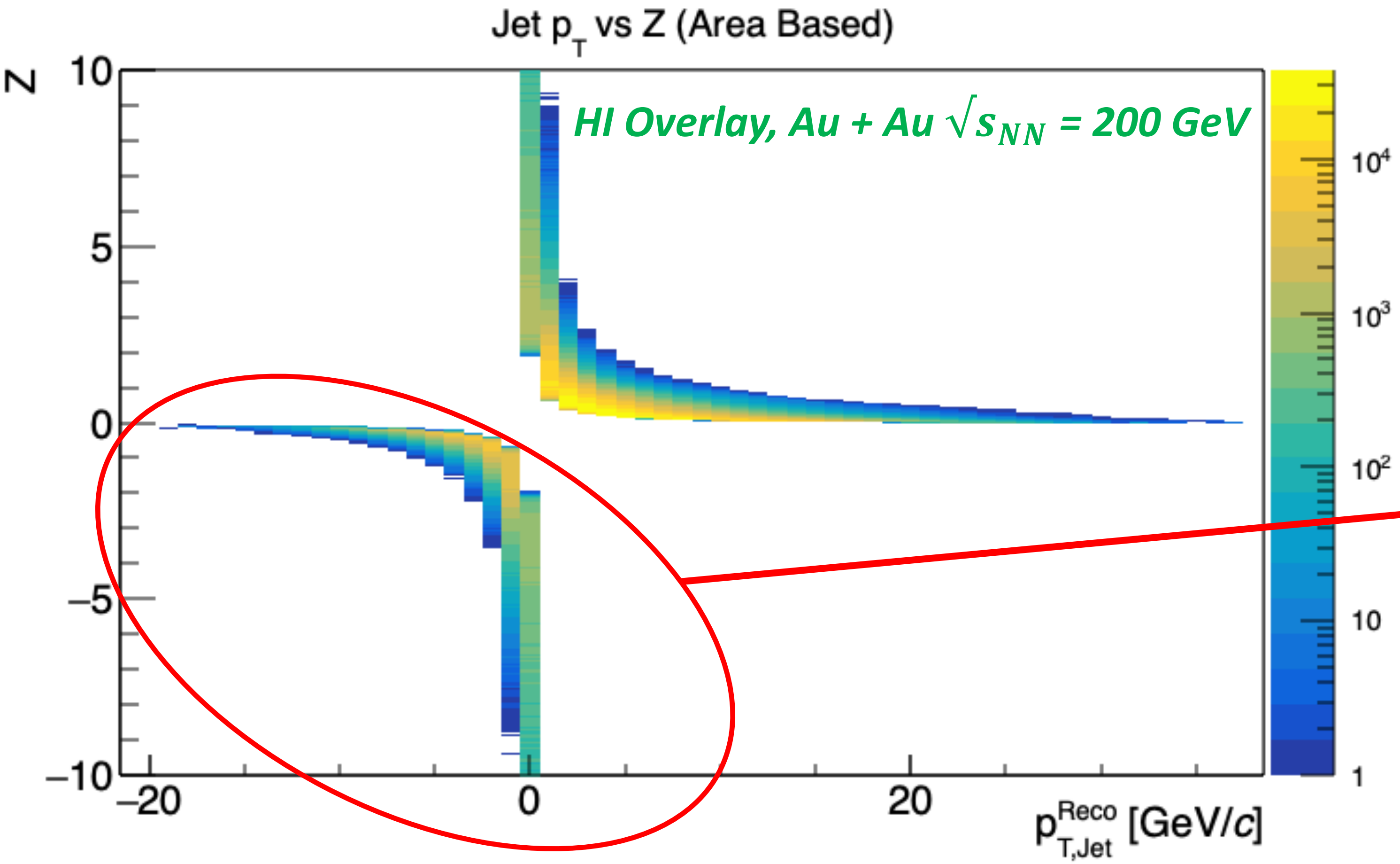
More details here

Using Heavy Ion Overlay Method

Problem with Area Based Background Subtraction

- $p_{T,D^0} > 1$ GeV/c
- All jet-like objects with $\mathbf{p_{T,Jet}^{Gen}}$ **> 1 GeV/c**

$$z = \frac{\vec{p}_{T,D0} \cdot \vec{p}_{T,Jet}}{|p_{T,Jet}|^2}$$



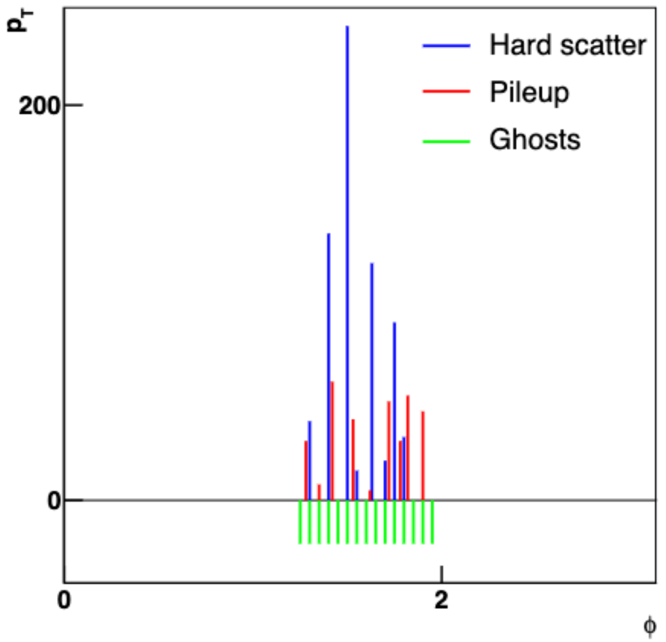
- **Unphysical regions of z < 0 and z > 1**
- z depends on uncorrected jet pT
- Unfolding difficult with disjoint regions
- Since we are dealing with low pT jets, can't ignore the low end completely.
- Smearing: Central ~ 6-7 GeV, Peripheral ~ 2-3 GeV

Constituent Background Subtraction

arXiv:1403.3108

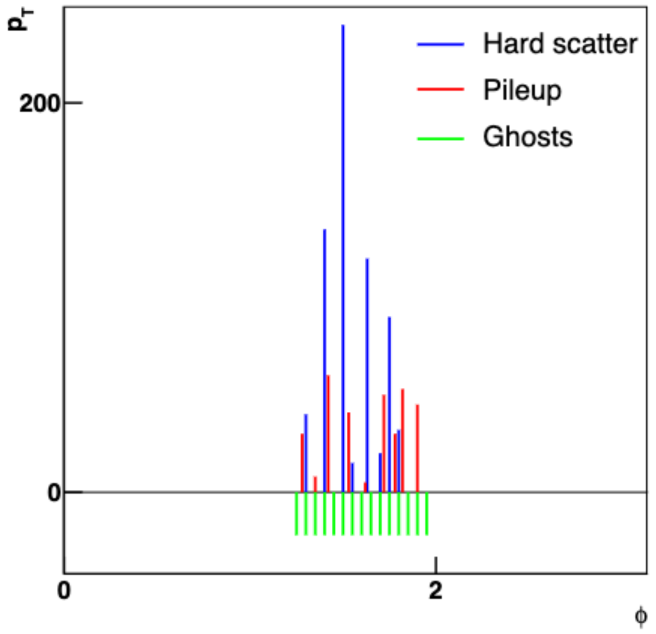
- Background density calculated as: $\rho = \mathrm{Median}\left(\frac{p_{T,Jet}}{A_{Jet}}\right)$.
- Jets considered for above calculation are k_T-jets with the two hardest jets dropped in the event.

Step 1: Add ghost particles to the event and cluster jets



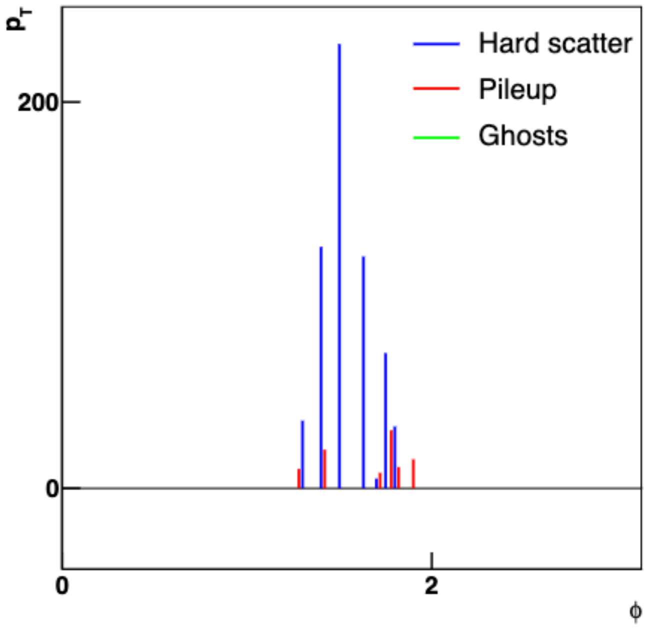
Leading jet before correction

Step 2: Set ghost particles pT to negative value corresponding to ρ



Leading jet before correction

Step 3: Match particles to ghosts and correct pT of constituents



Leading jet after correction

$$R_{\mathrm{part}}^{\mathrm{ghost}} = \sqrt{\Delta y^2 + \Delta\phi^2}$$

If $p_T^{part} > p_T^{ghost}$:

- $p_T^{part} \rightarrow p_T^{part} - p_T^{ghost}$
- $p_T^{ghost} \rightarrow 0$

Else:

- $p_T^{part} \rightarrow 0$

More details here (Presentation by P. Berta)

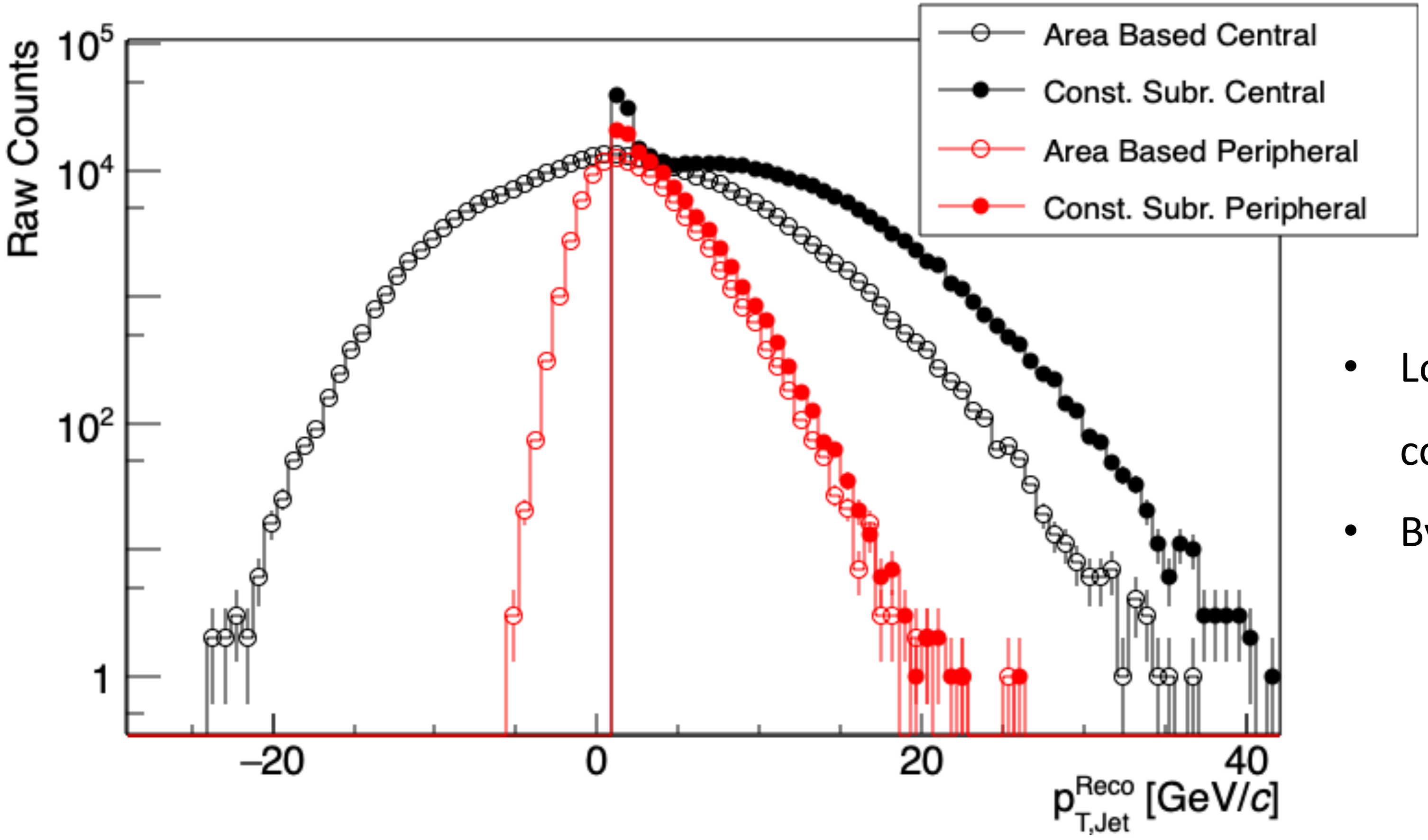
Constituent Background Subtraction

$$z = \frac{\vec{p}_{T,D0} \cdot \vec{p}_{T,Jet}}{|p_{T,Jet}|^2}$$

- D^0 candidates p_T well determined from Kaon Pion with HFT hits
- **Constituent subtraction done only on the non-D^0 portion of the jet**
- Median background density estimated with D^0 candidate instead of KPi

$1 < p_{T,\text{ D0 Candidate}}$ GeV/c < 10

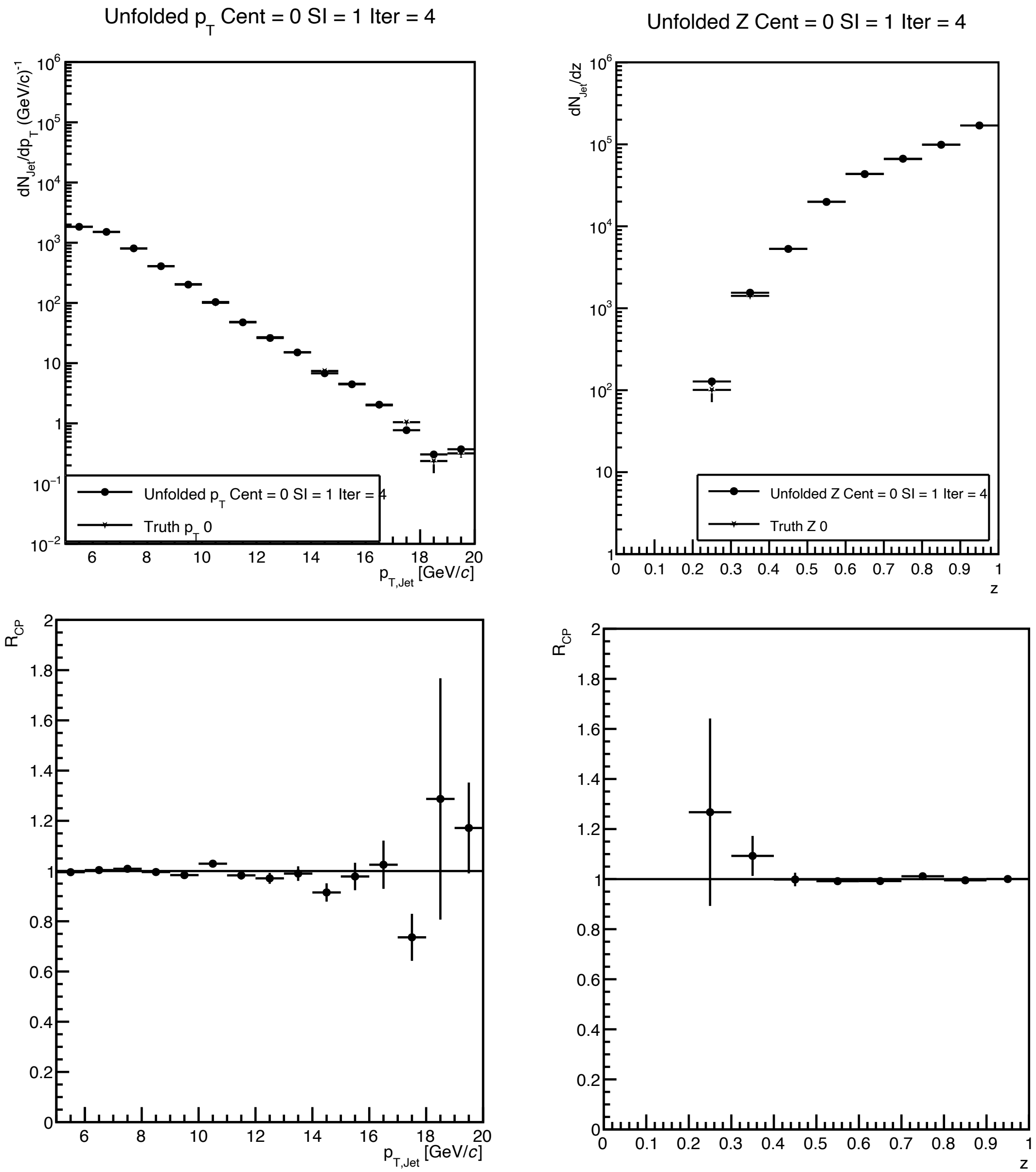
STAR, Au + Au $\sqrt{s_{NN}}$ = 200 GeV



- Low Jet p_T end populated with single constituent jets
- By definition, z is bounded between 0 and 1

Closure with Constituent Background Subtraction

HI Overlay, Au + Au $\sqrt{s_{NN}}$ = 200 GeV



- **PYTHIA 8 Detroit Tune**
- **5 < p_{T,D^0} < 10 GeV/*c***
- 5 < $p_{T,Jet}^{Gen}$ < 20 GeV/c
- 5 < $p_{T,Jet}^{Reco}$ (CS) < 50 GeV/c
- $\left|\eta_{Jet}^{Gen,Reco}\right|$ < 0.6
- **Misses**: Everything outside the acceptance in p_T and η

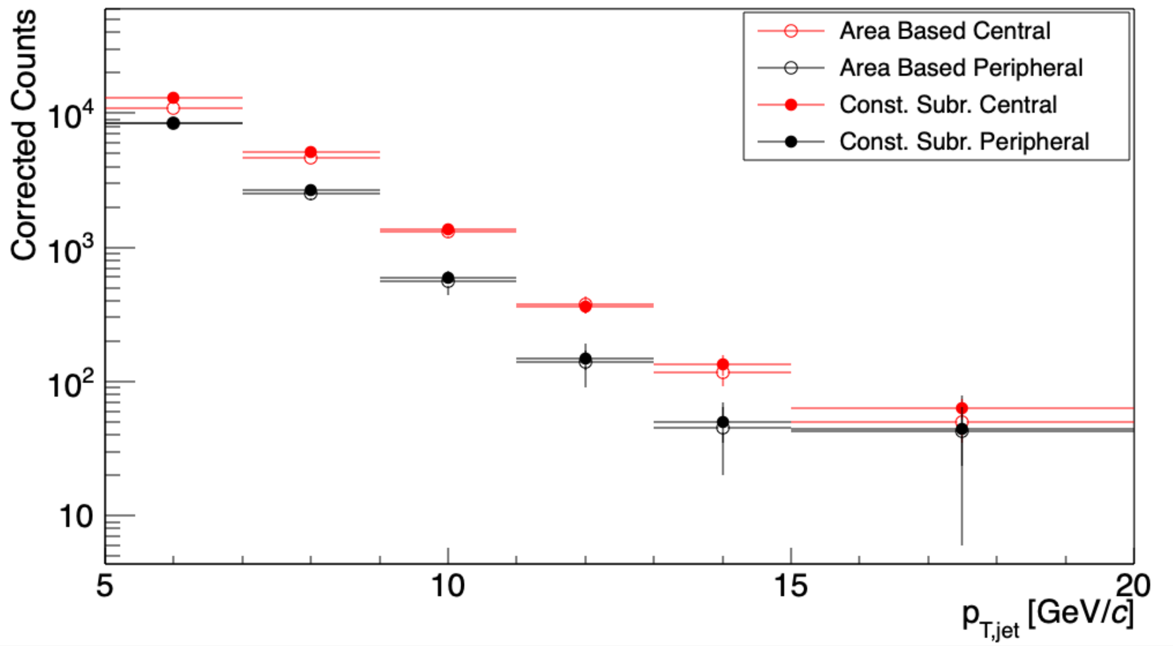
z

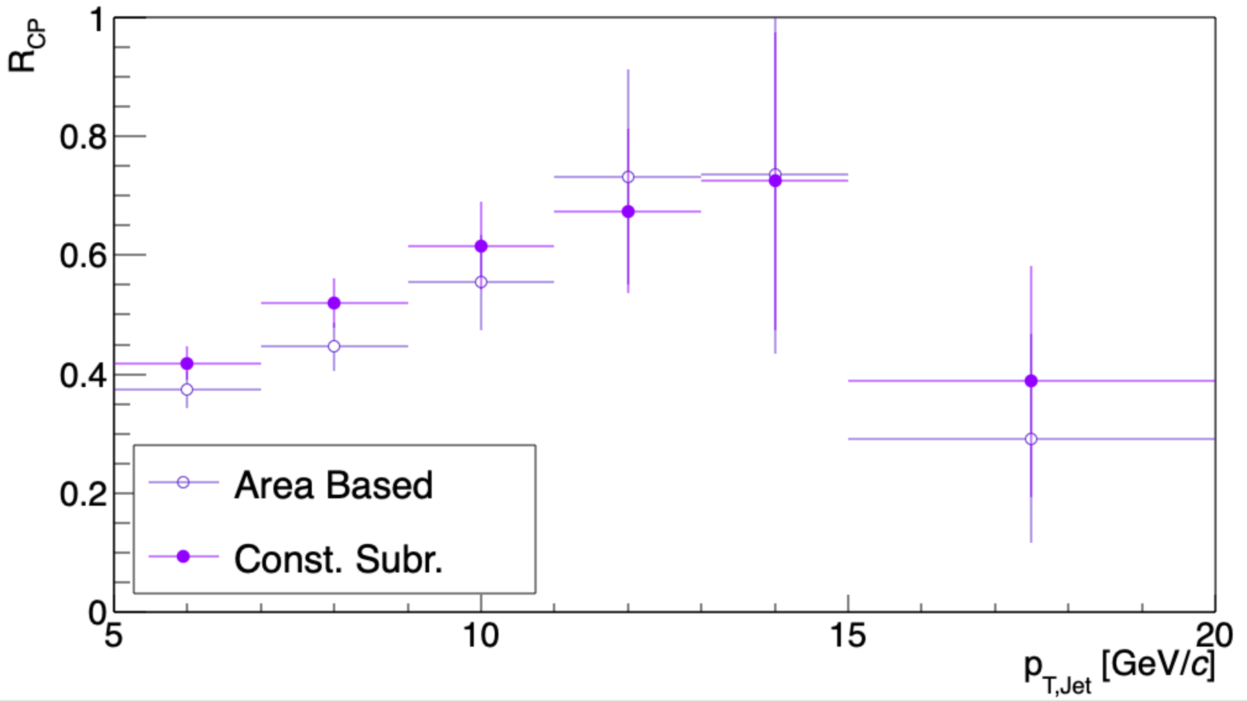
Good closure with Constituent Subtraction

Unfolding with Constituent Background Subtraction

- $5 < p_{T,Jet}^{Uncorrected}$ (CS) < 50 GeV/c → $5 < p_{T,Jet}^{Corrected}$ < 20 GeV/c
- $5 < p_{T,D^0} < 10$ GeV/c

STAR, Au + Au $\sqrt{s_{NN}}$ = 200 GeV





Similar Spectra Compared to Area Based Method

Unfolding with Constituent Background Subtraction

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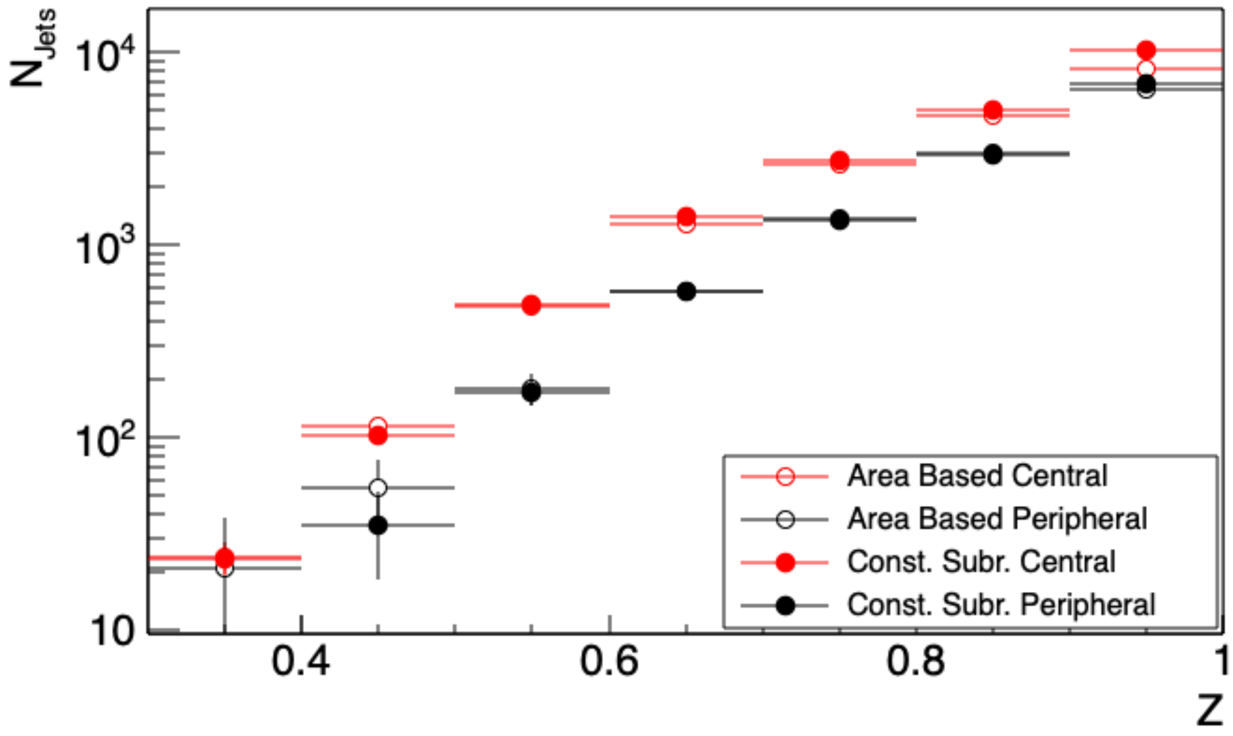

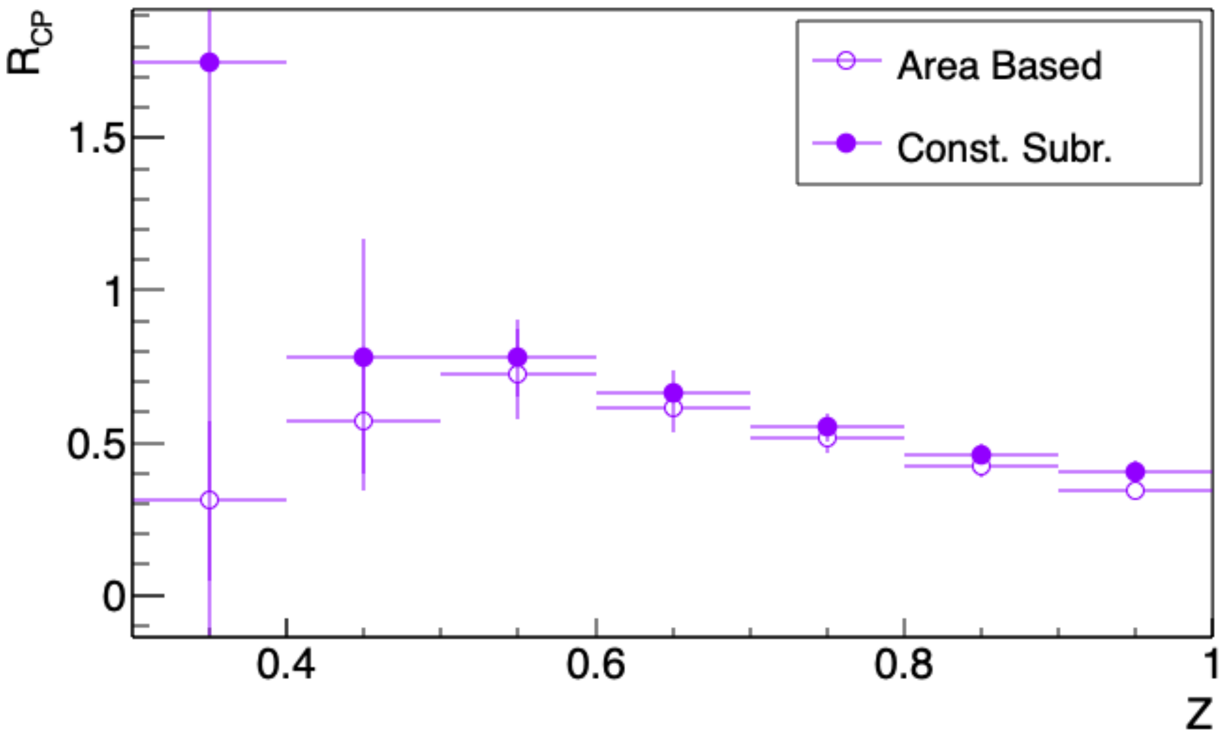

Similar Spectra Compared to Area Based Method

Next Steps

- Using CS Background Subtraction to go down to $p_{T,D0} > 1$ GeV/c
- Average background subtracted from D0 might give us a lower bound of D0 pT we can access.
- Varying Fragmentation Function for the low pT range

Background Density From D0 Candidate Tagged Events