

D^0 Tagged Jets at ePIC

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ePIC Jet & HF Working Group Meeting

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Analysis Details

Dataset location:

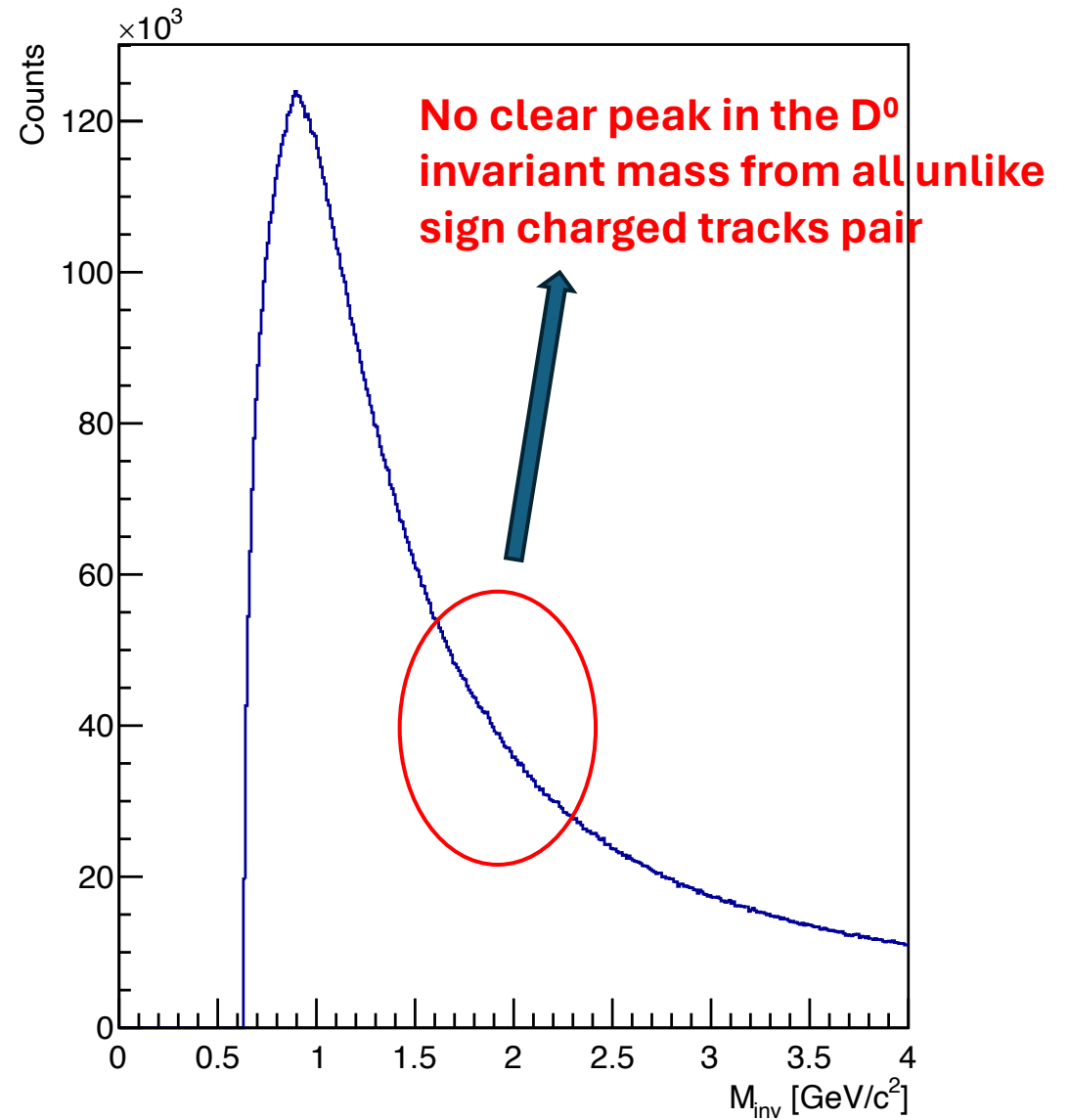
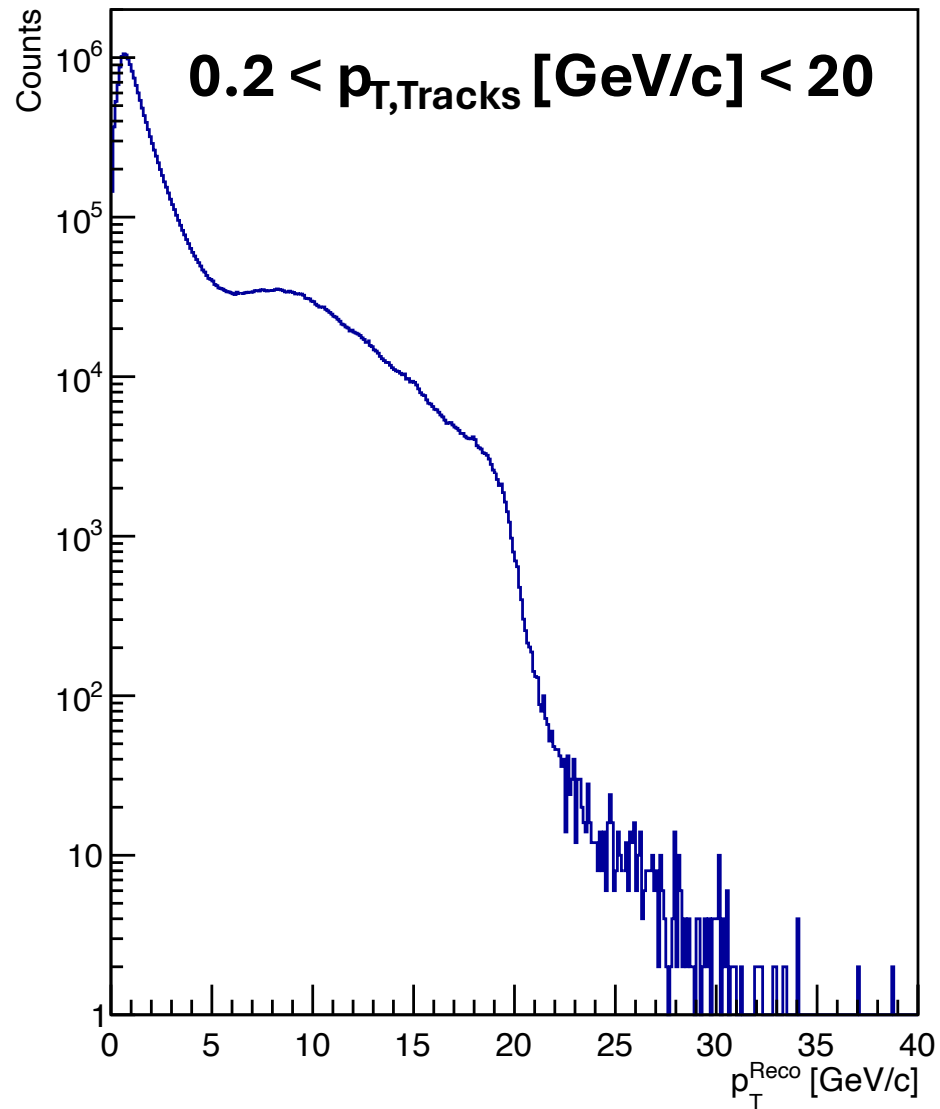
`/gpfs/mnt/gpfs02/eic/bpage/home/EPIC/fromOlga/d0Sample/recoOut/individual`

Sample: 18x275 GeV², **Campaign:** 23.12.0

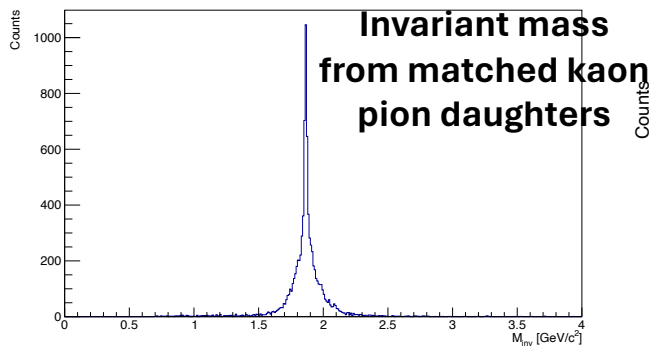
Basic Cuts:

- **D⁰ reconstructed from *Kpi* channel only** (*We can revisit other channels, but ideally all D⁰s should decay to Kpi in simulation*)
- No cuts on D⁰ kinematics
- No cuts on pion/kaon kinematics
- R = 1 anti-k_T Jets
- Jet E > 5 GeV
- $\Delta R_{\text{Jet}, D^0} < 0.8$
- No cuts on jet kinematics

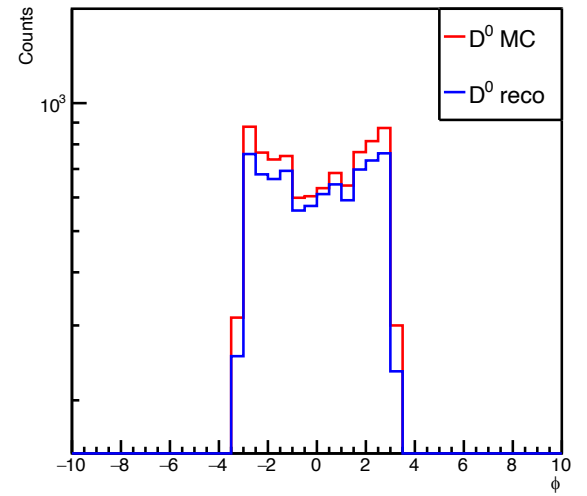
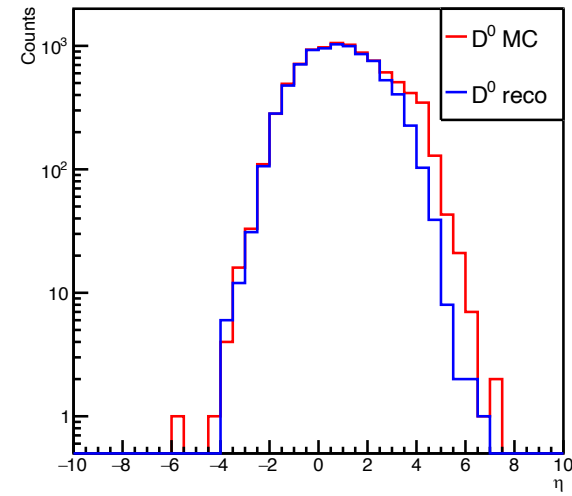
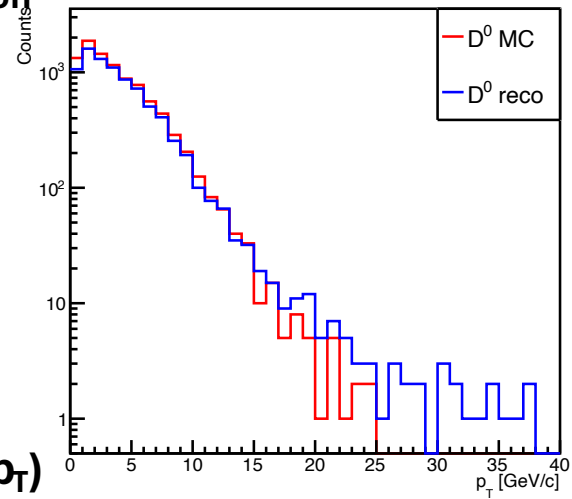
Invariant Mass Reconstruction From Charged Particles



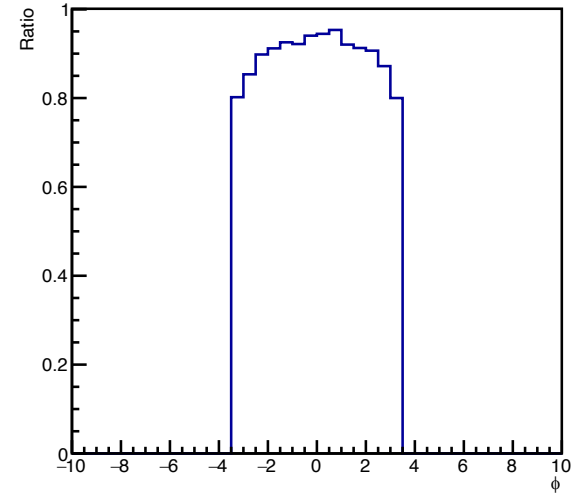
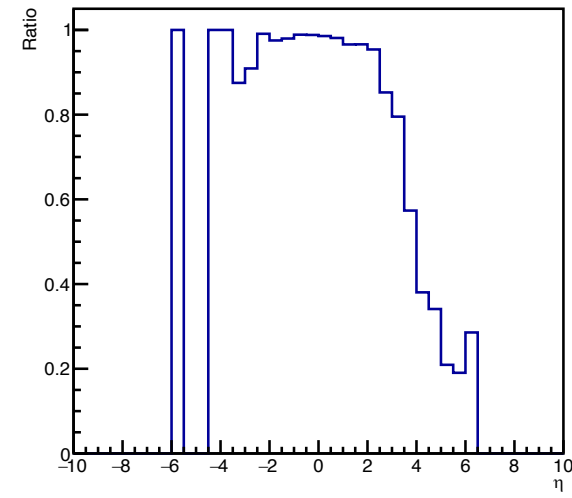
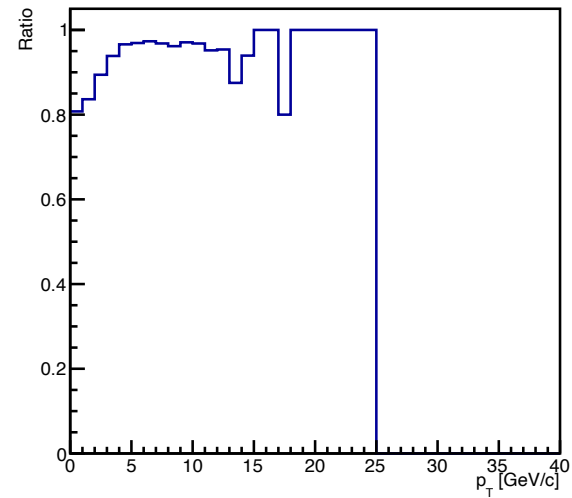
Reconstructing D^0 Using Truth Level Information



We recover most of the D^0 mesons (especially at high p_T)

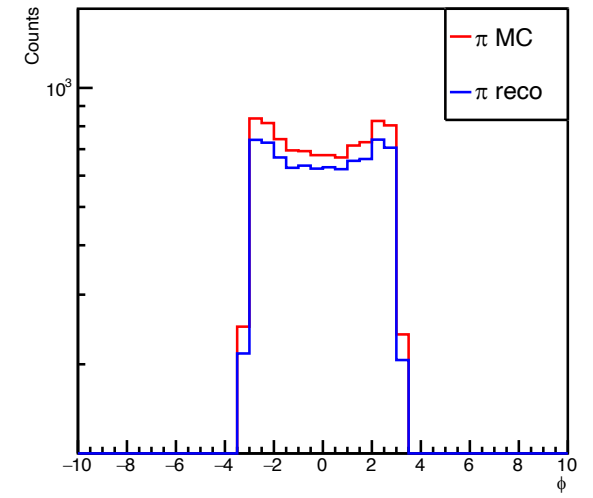
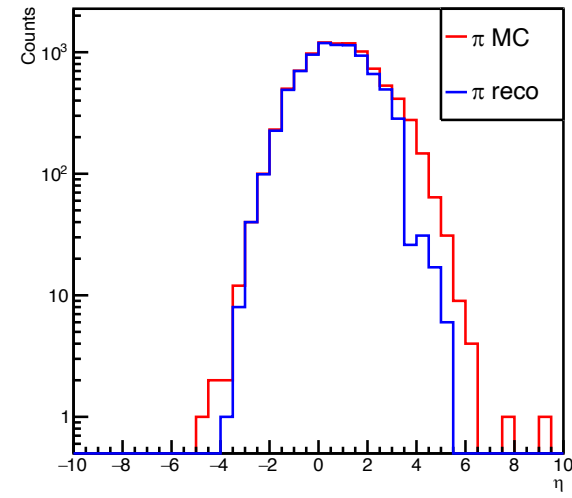
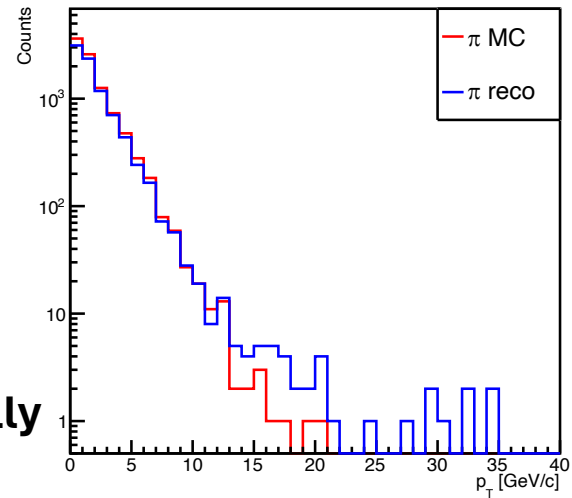


Ratio plot made with truth level p_T only.

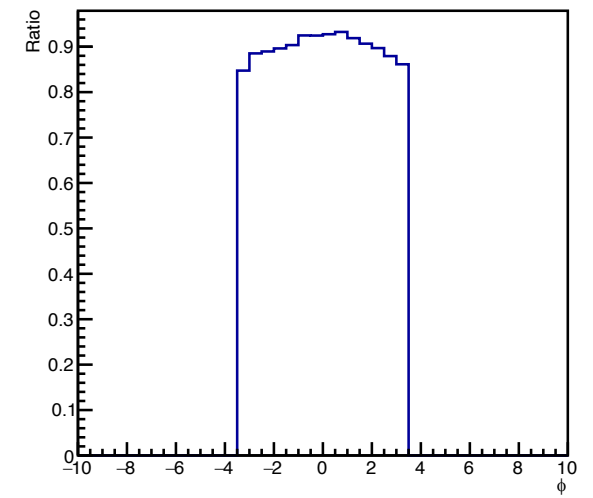
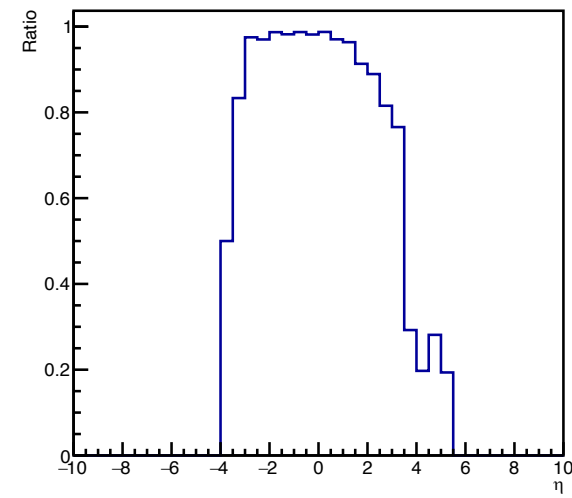
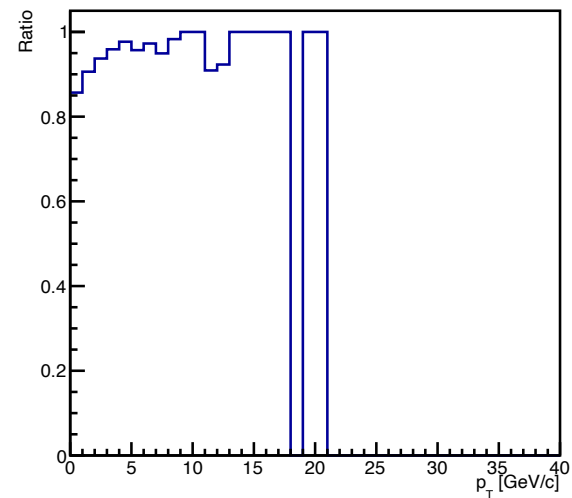


D⁰ Daughter - Pion

Pion efficiency ~ 1 (especially at high p_T)

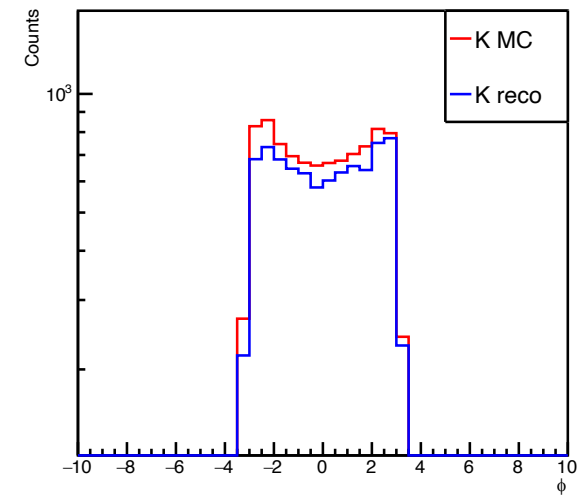
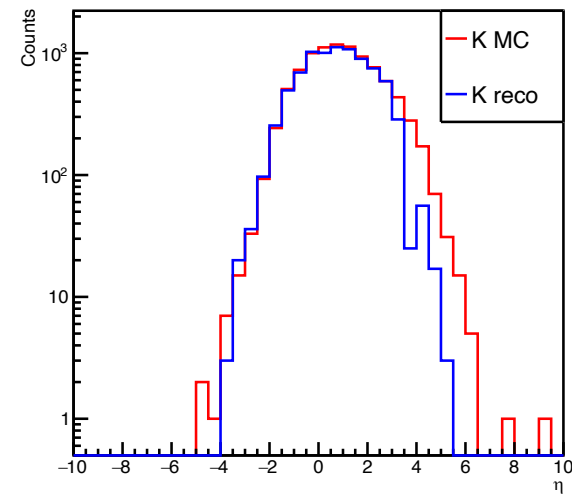
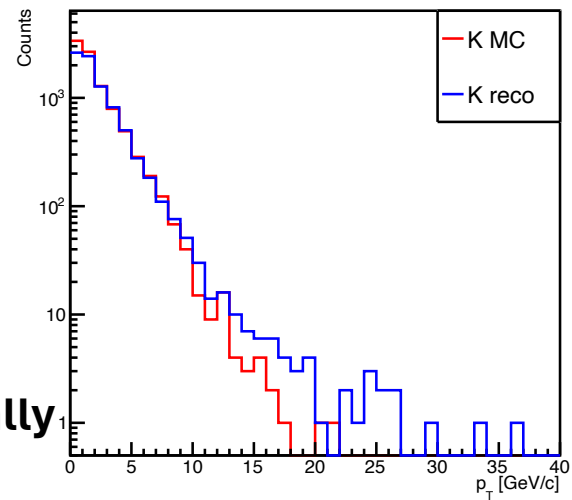


Ratio plot made with truth level p_T only.

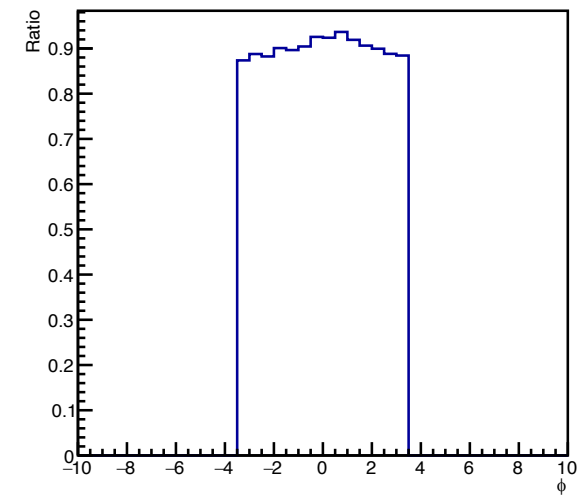
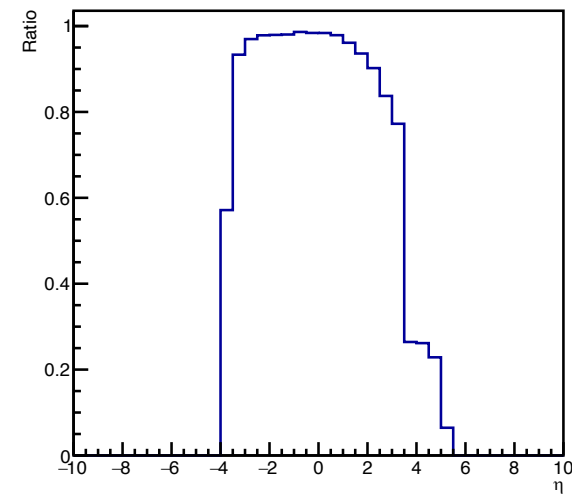
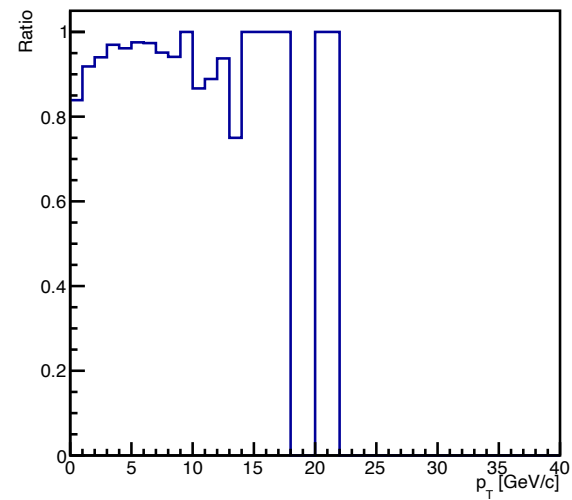


D⁰ Daughter - Kaon

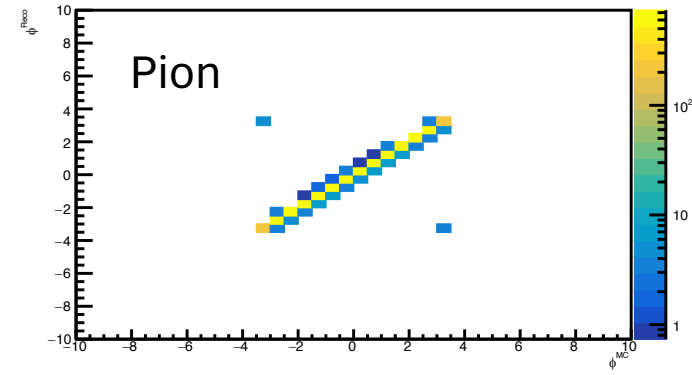
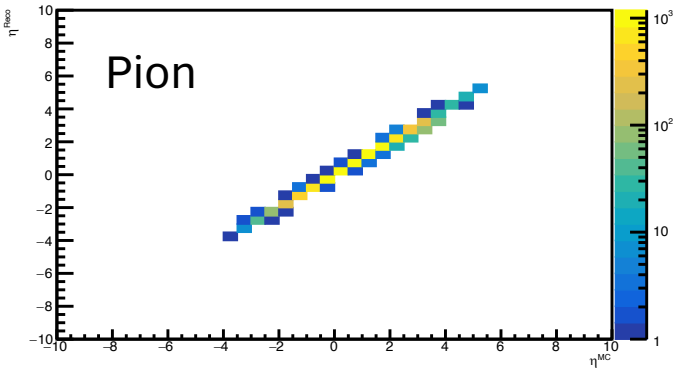
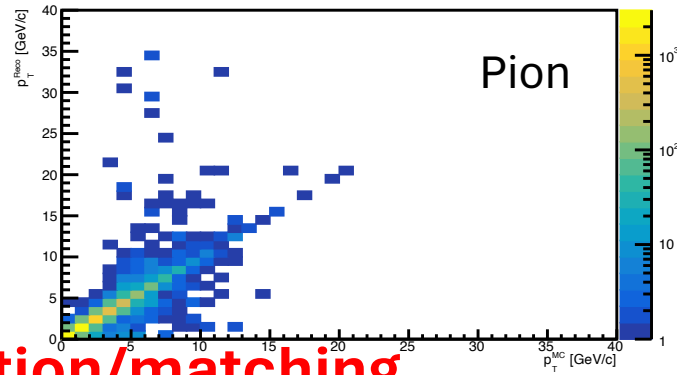
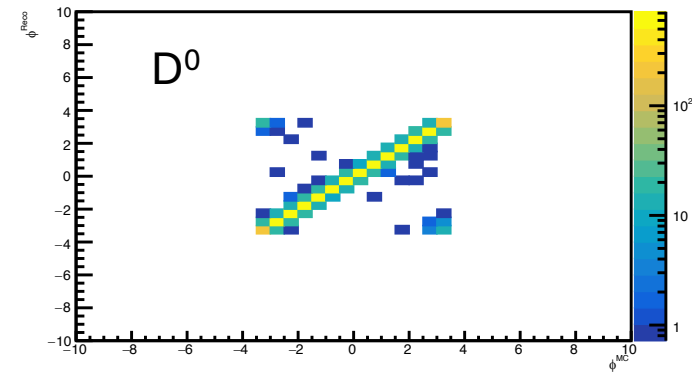
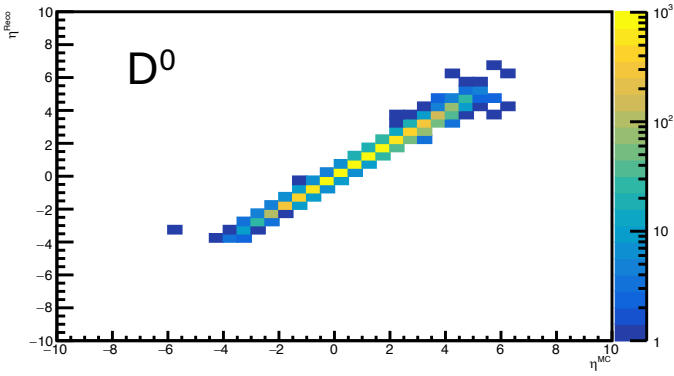
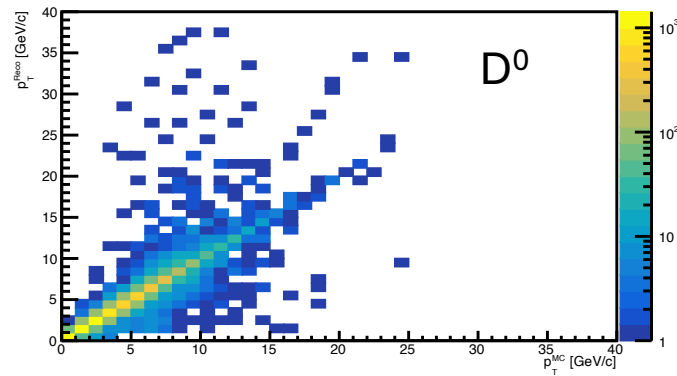
Kaon efficiency ~ 1 (especially at high p_T)



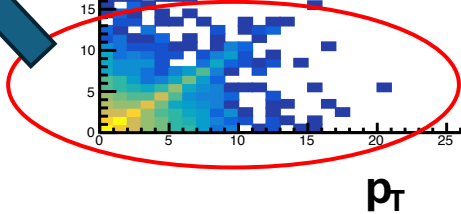
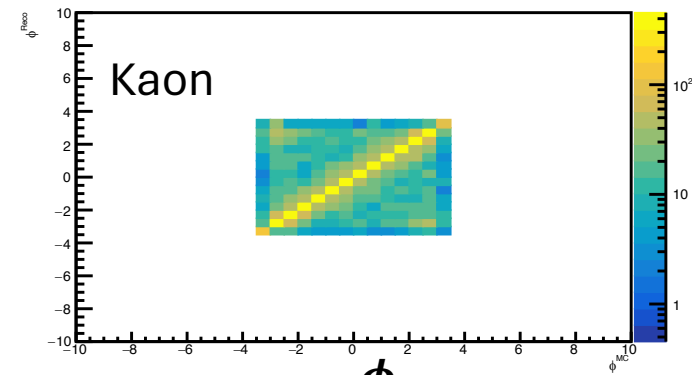
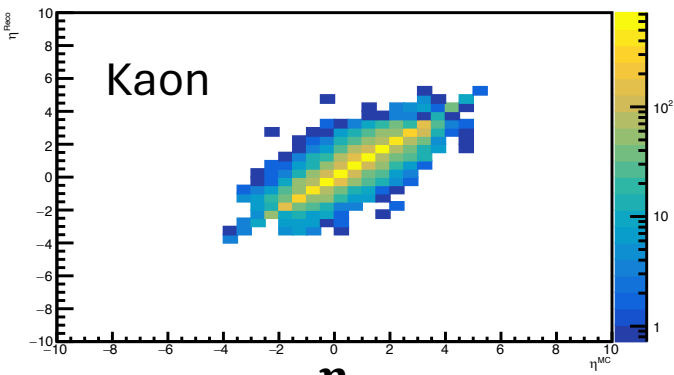
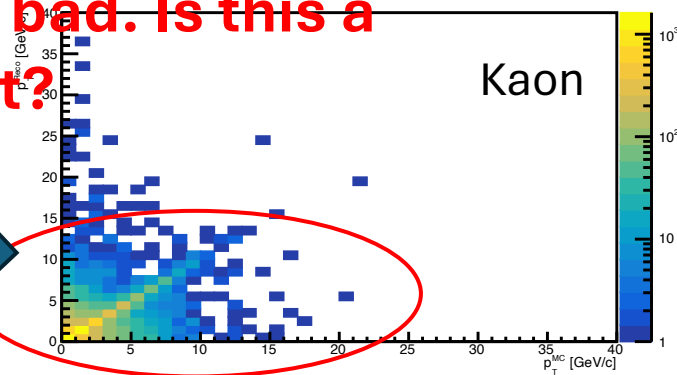
Ratio plot made with truth level p_T only.



Resolution From MC-Reco Matched D^0 and Daughters



Kaon resolution/matching seems to be bad. Is this a known effect?



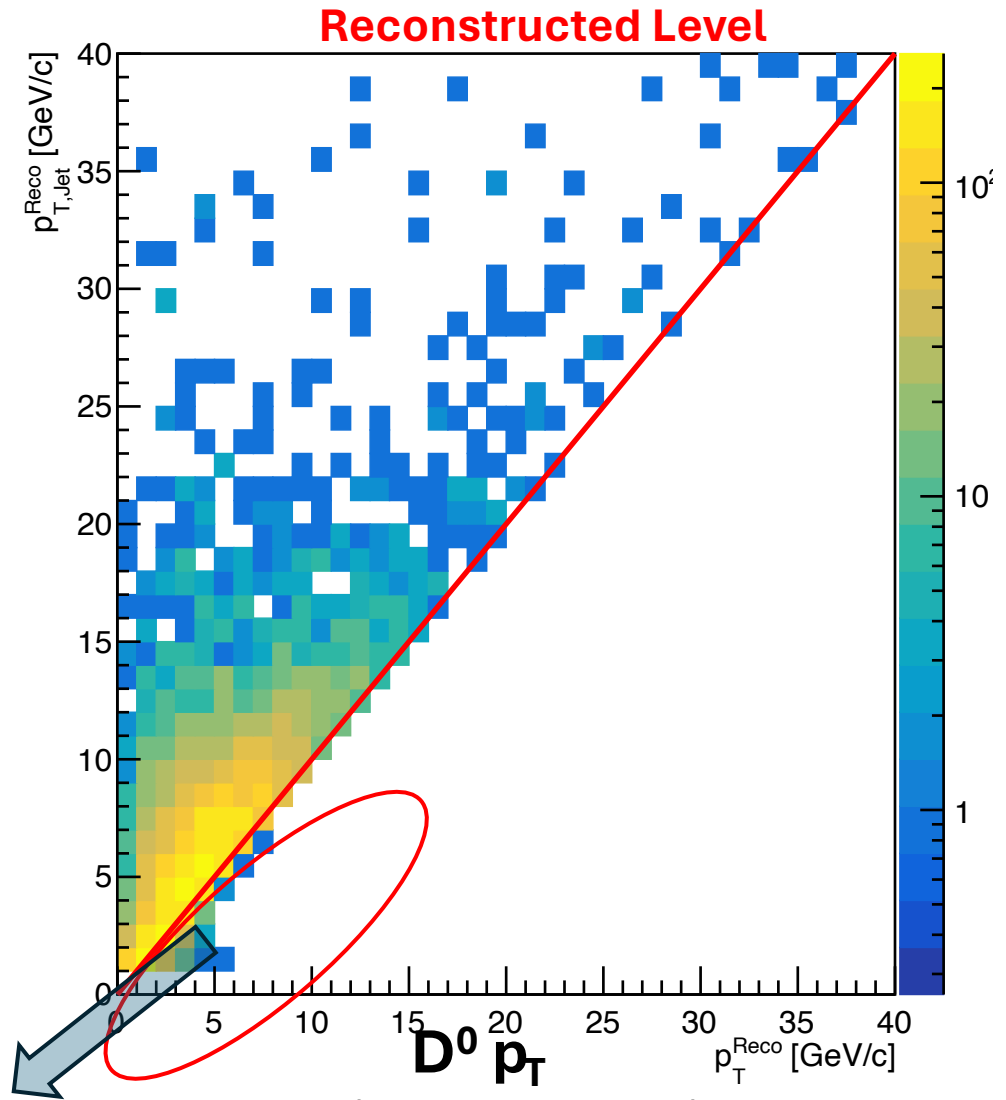
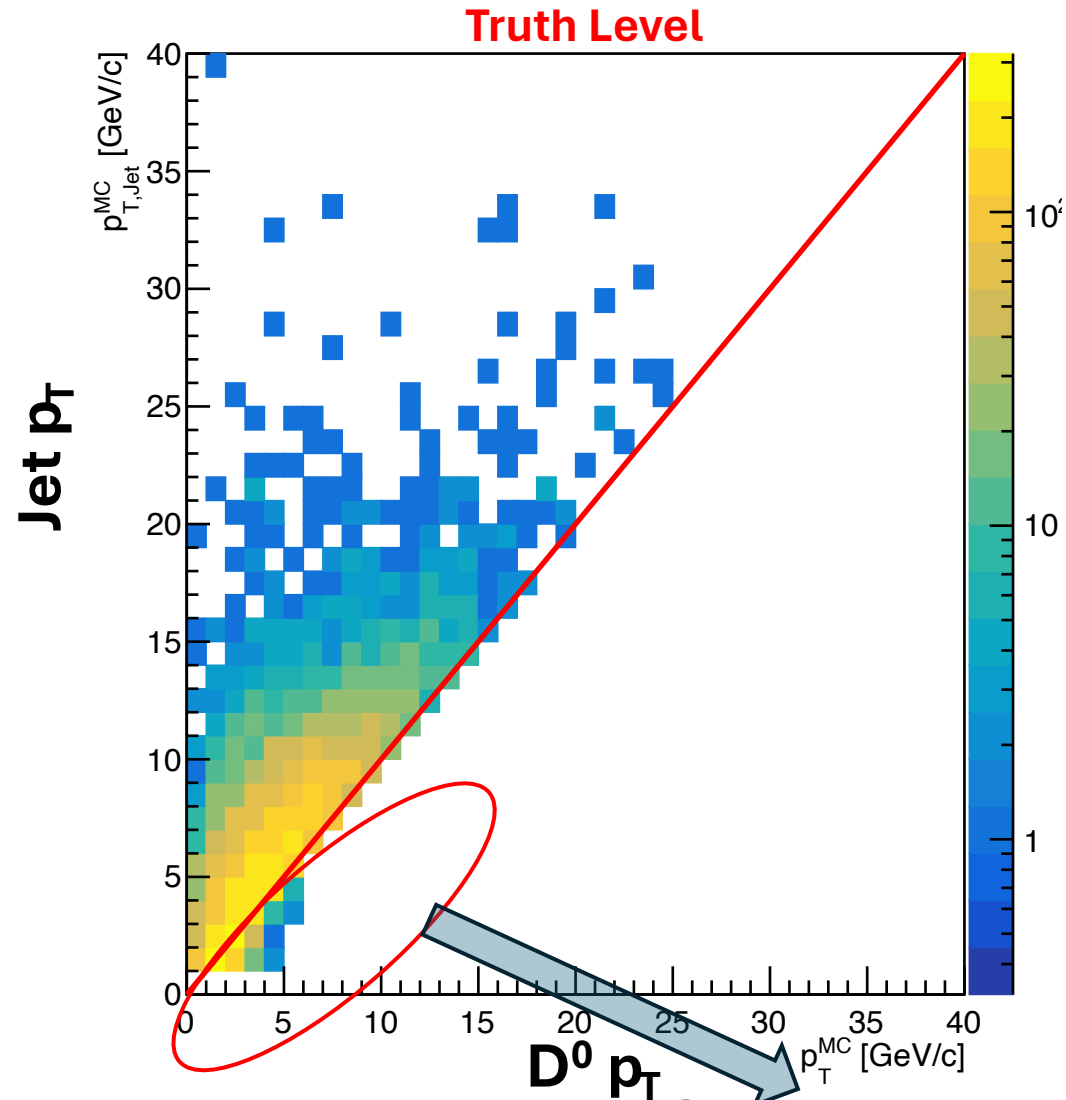
p_T

η

ϕ

D⁰-Jet Matching

Matching Condition $\rightarrow \Delta R < 0.8$ for R = 1 Jets (arbitrary, can play around with the cutoff)



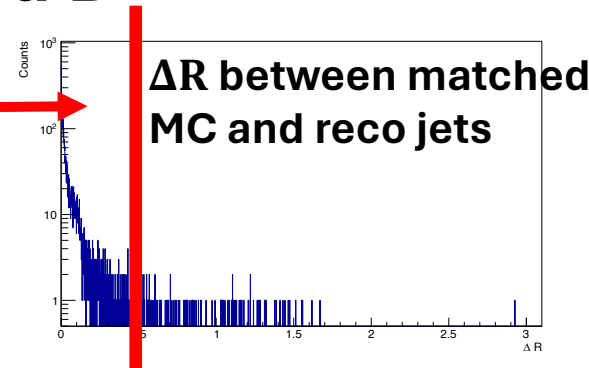
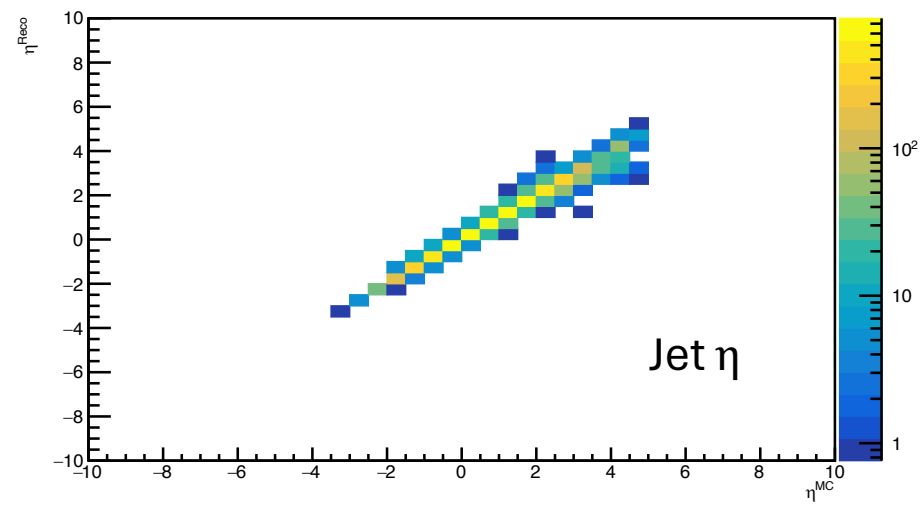
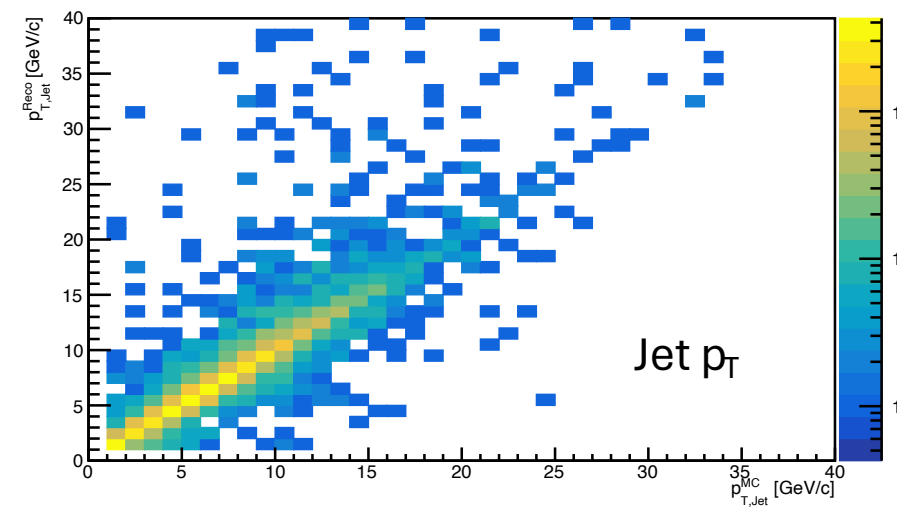
Can remove excess here with more stringent matching

Will explore reconstructing D⁰ and using that in clustering

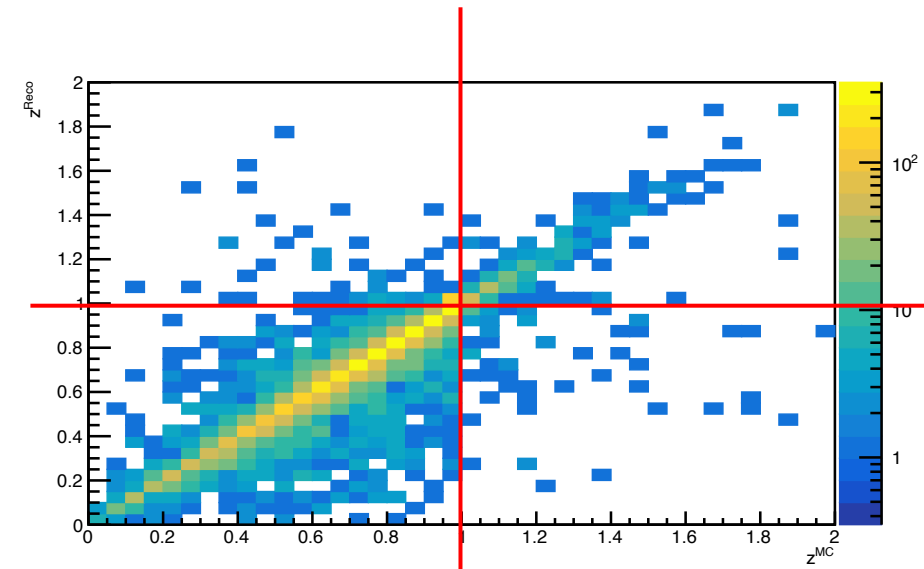
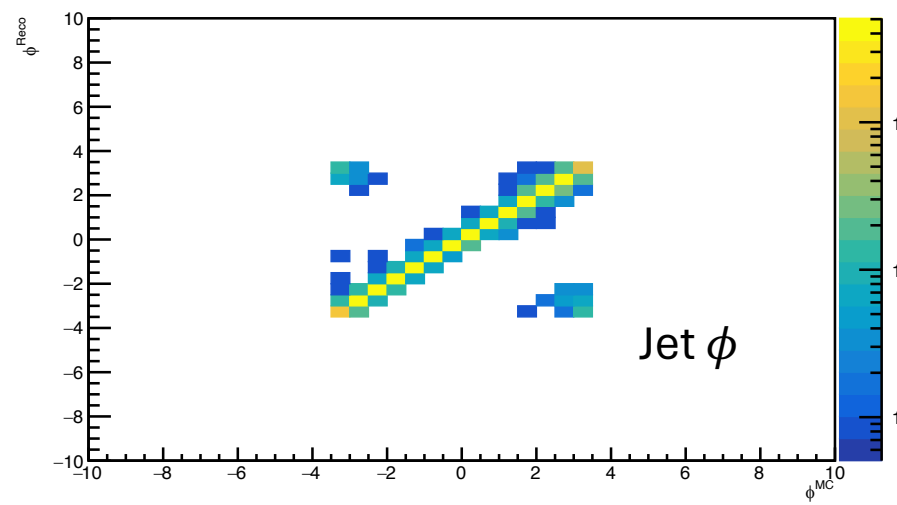
Resolution From Matched Jets in MC and Reco for matched D^0

No separate matching condition on jets in MC-Reco due to D^0 being used as a tag

Reconstructed Level



$\Delta R < 0.5$ between most truth and reco jets



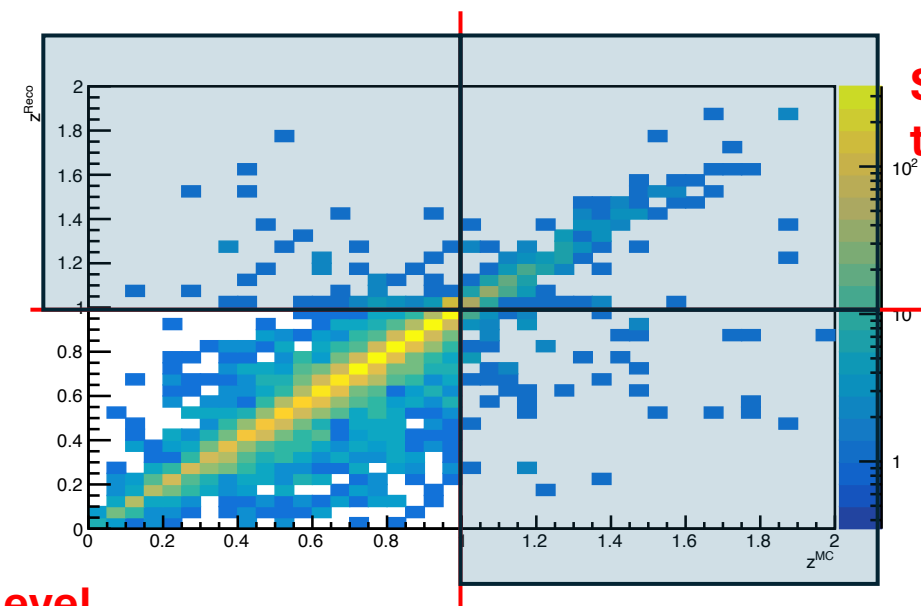
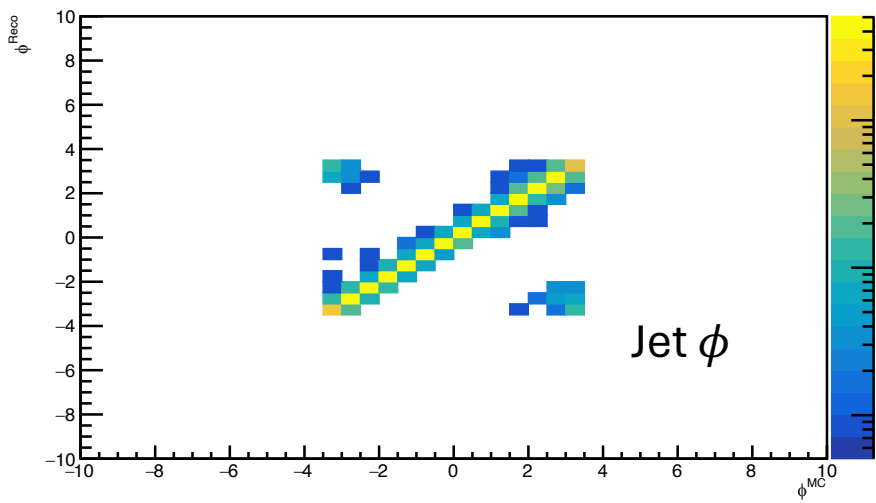
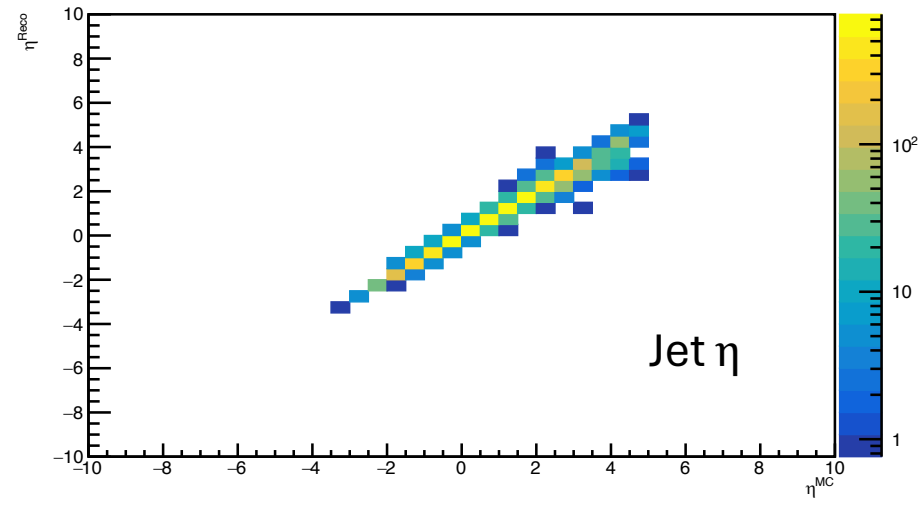
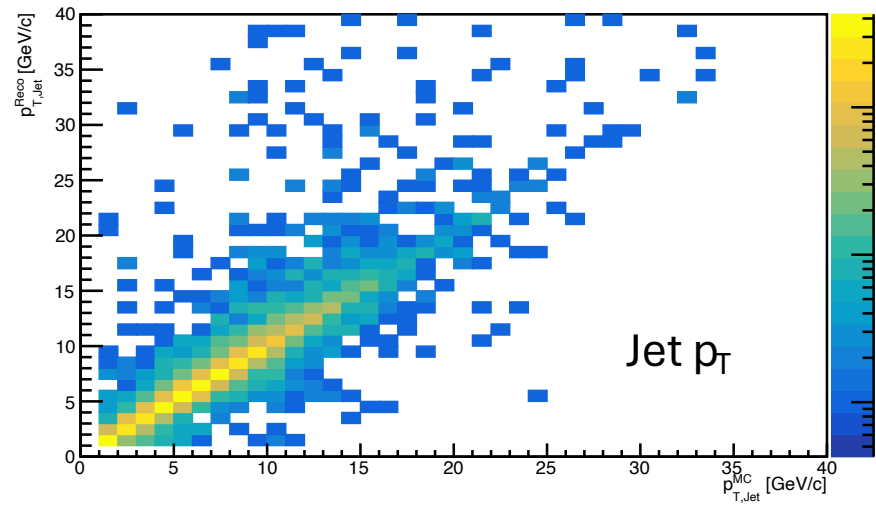
$$z = \frac{\vec{p}_{T,D^0} \cdot \vec{p}_{T,Jet}}{|\vec{p}_{T,Jet}|^2}$$

Truth Level

Resolution From Matched Jets in MC and Reco for matched D^0

No separate matching condition on jets in MC-Reco due to D^0 being used as a tag

Reconstructed Level



Shaded regions can be trimmed with tighter cuts

$$z = \frac{\vec{p}_{T,D^0} \cdot \vec{p}_{T,Jet}}{|\vec{p}_{T,Jet}|^2}$$

Truth Level

Outlook

1. Larger sample for a more systematic study
2. Optimizing cuts for best D^0 -Jet matching
3. Optimizing cuts for best MC-Reco level Jet Matching
4. Explore invariant mass from unlike sign charged track pairs. Current plots different (?) from results presented in January 2024
5. Explore using D^0 instead of Kpi daughters in the jet clustering

Backup

Matched Jets 1D Distributions in MC and Reco for matched D^0

