



Particle Flow Reconstruction Performance - Developing a Simplified Track Extrapolation Method as an Alternative to Offline Reconstruction

Update on Progress
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Developing a Simplified Track Extrapolation Method and Assessing Performance Loss: Recapitulation



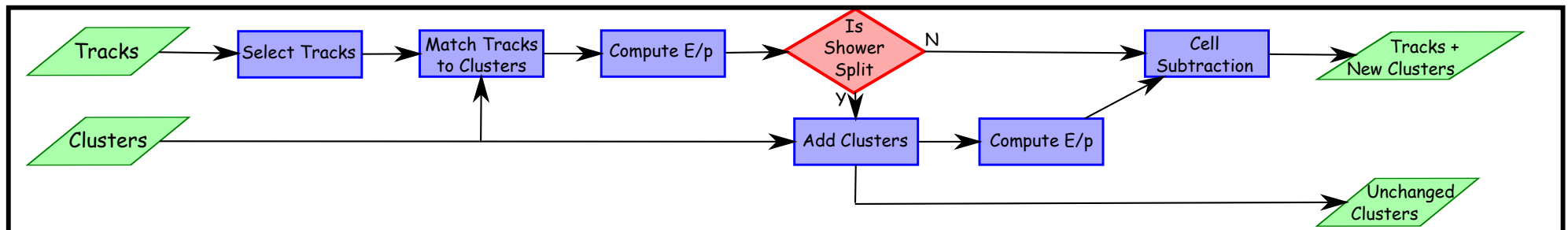
1. CPU timing constraints of the HLT
2. Questions:
 - How does jet reconstruction depend on the precision with which track extrapolation is carried out?
 - Can we develop a simplified track extrapolation method that matches the benefits of offline reconstruction with PFlow?
3. Simplified Method: Find a parameterization that approximates tracks from the offline reconstruction



Brief Outline of Project



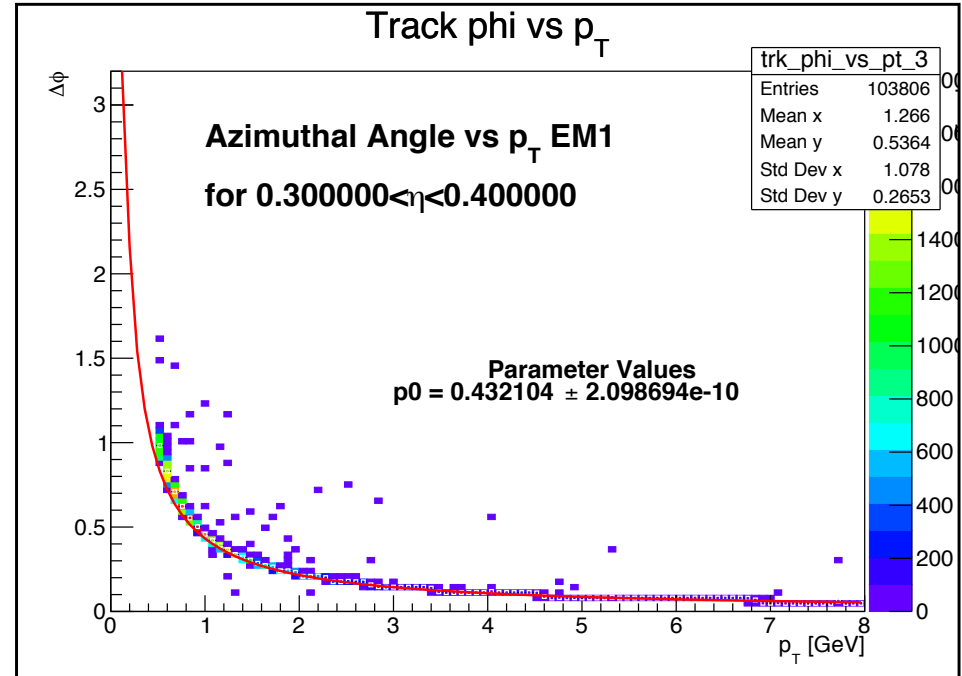
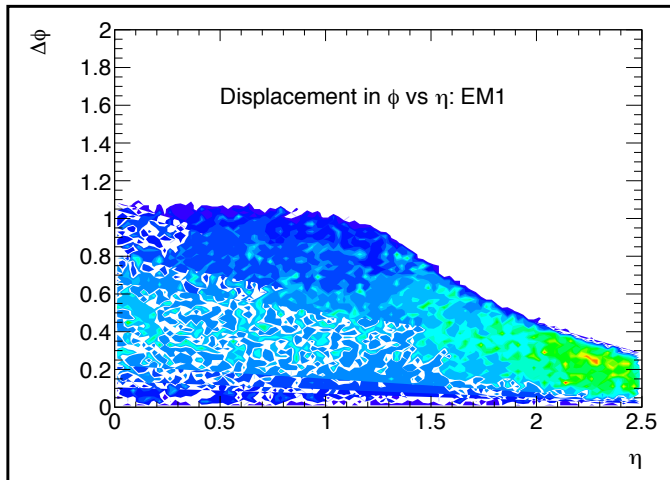
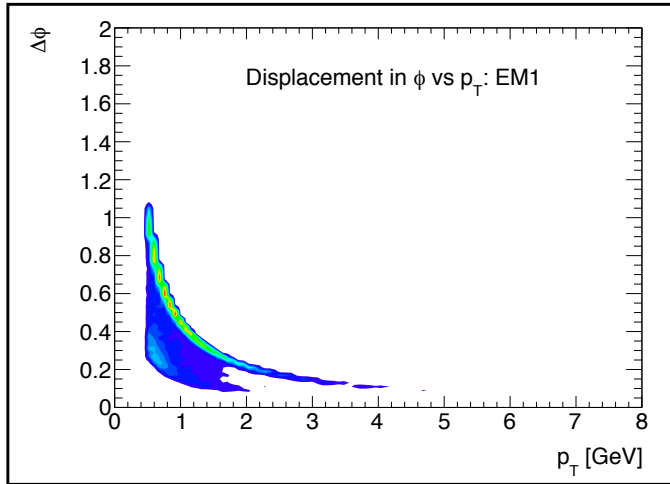
1. Find a parameterization for $\Delta\phi$ in terms of p_T and η for ID tracks from offline reconstruction.
2. Build simplified track extrapolation and assess performance loss by comparing properties of PFlow objects, matching jets to truth jets and computing jet response and resolution



Taken from “Jet Reconstruction and Performance Using Particle Flow with the ATLAS Detector,”
ATLAS Paper



Parametrization: $\Delta\phi$ dependence on p_T and η



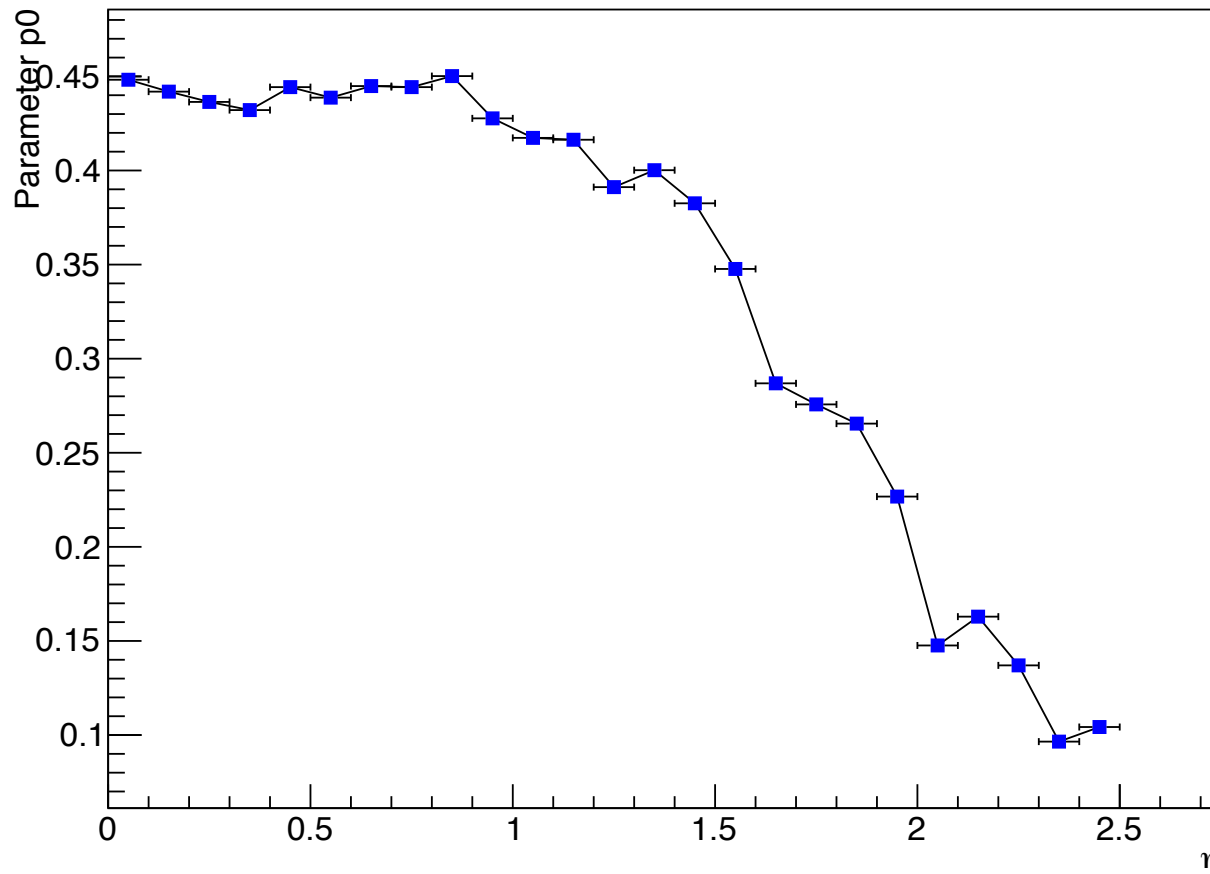
- Visible dependence on both p_T and η (with η dependence changing with layer)
- Parametrization carried out in terms of p_T with appropriate bins in η since dependence on η significantly more complicated



Parametrization (cont.)



Paramter_vs_eta_EM1



- Equation of fit:

$$f(x) = p_0 \frac{1}{x}$$

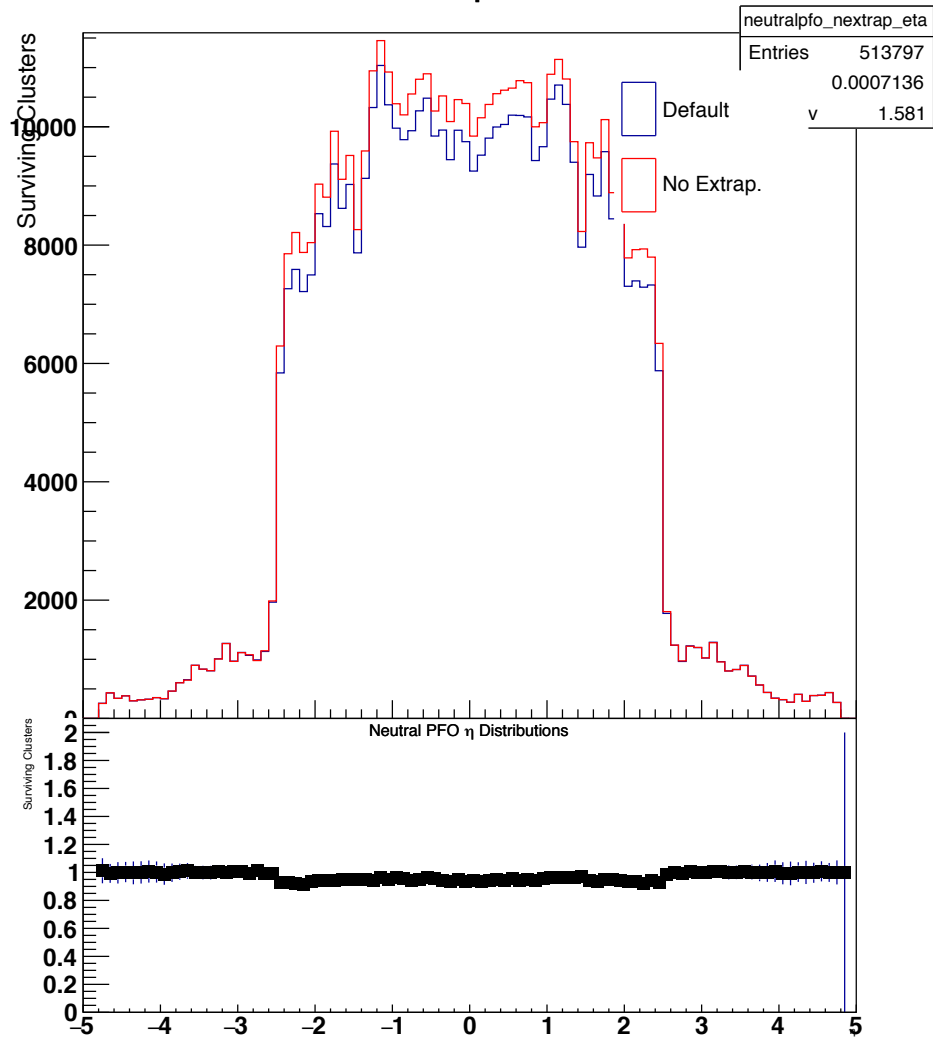
- Irregularities in the form of ‘bumps’
- Parameter value at $\eta = 0$ increase with layer depth (magnetic field becomes weaker)



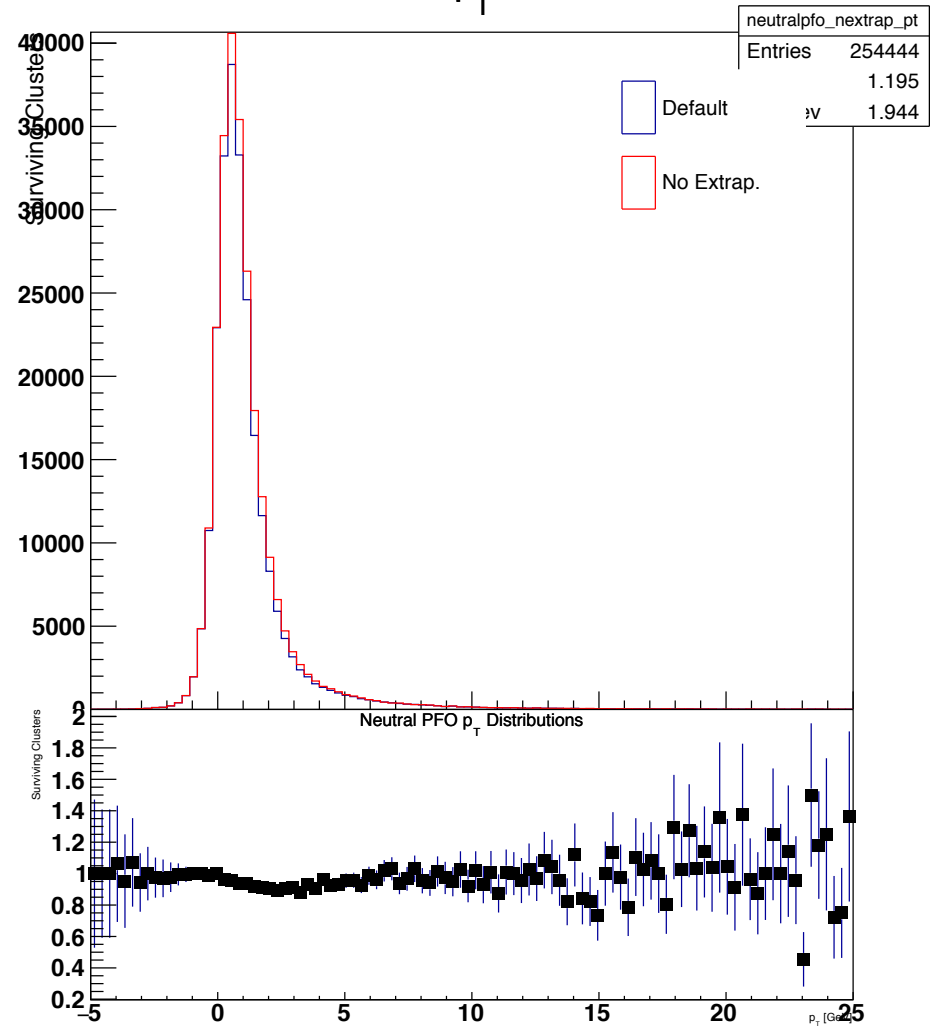
Comparison of PFlow Object Properties



Neutral PFO η Distributions



Neutral PFO p_T Distributions

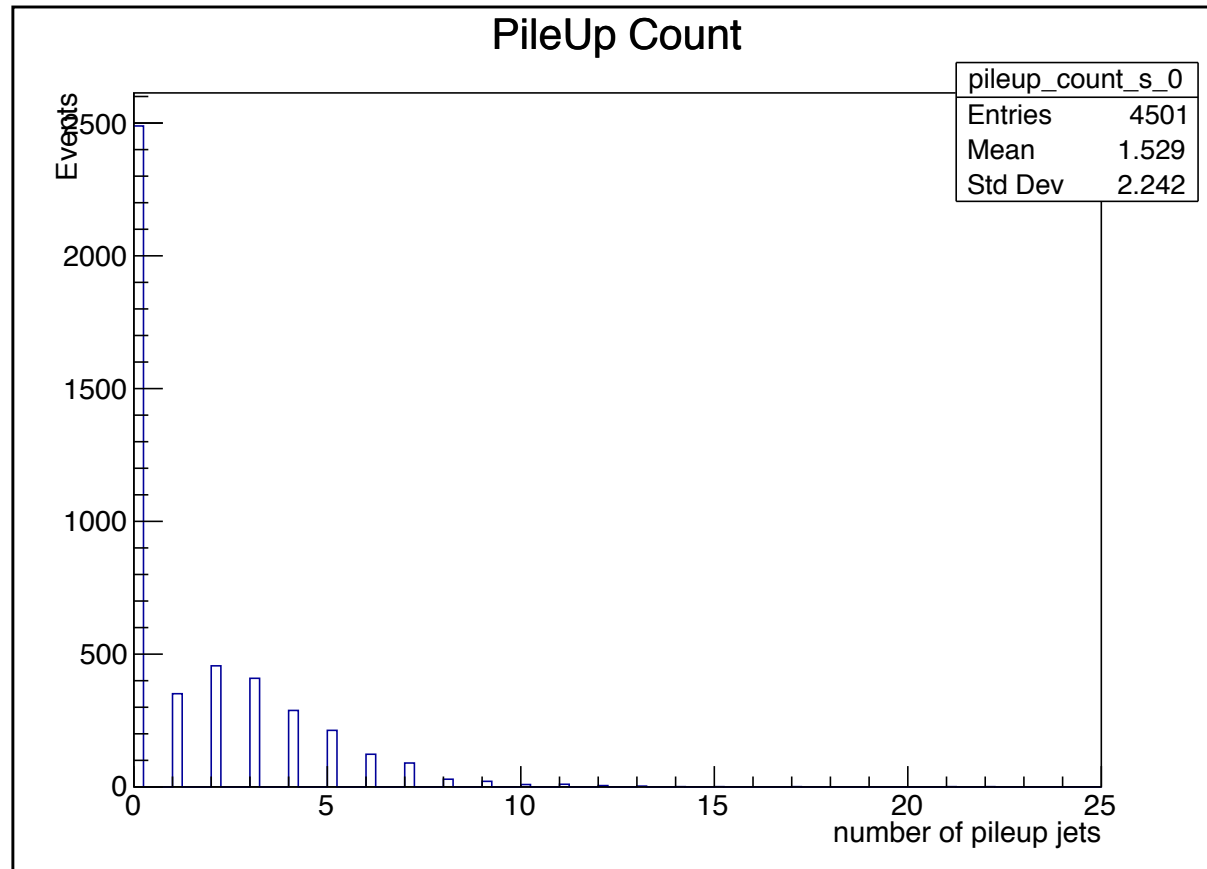




Jet Matching - Number of Pile-Up Jets



Number of pileup jets = number of reconstructed jets not matched to a truth jet





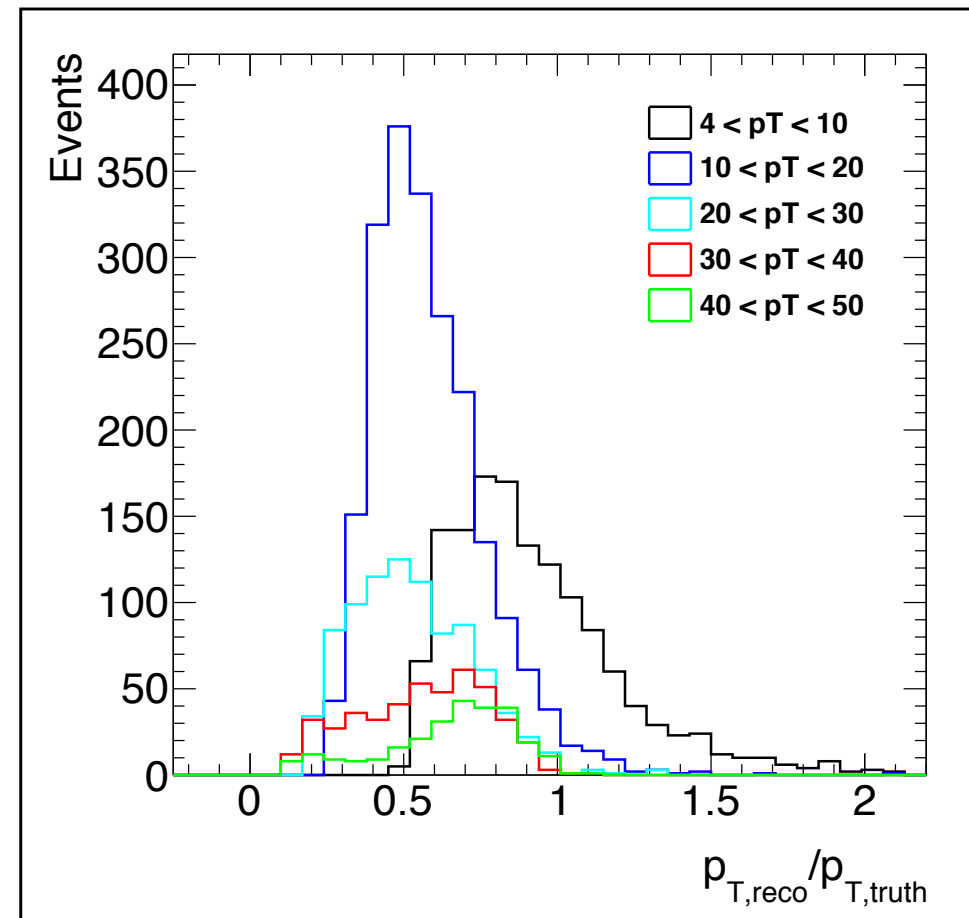
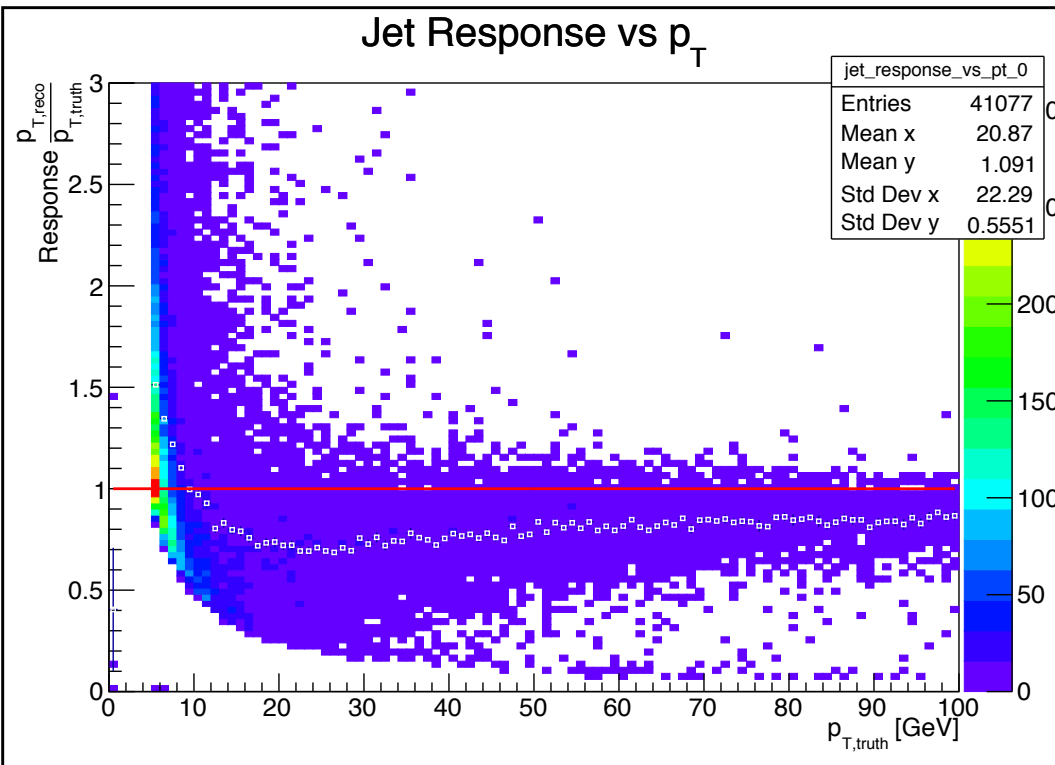
Jet Matching -

Jet Response Distributions (PFJets matched to Truth Jets)



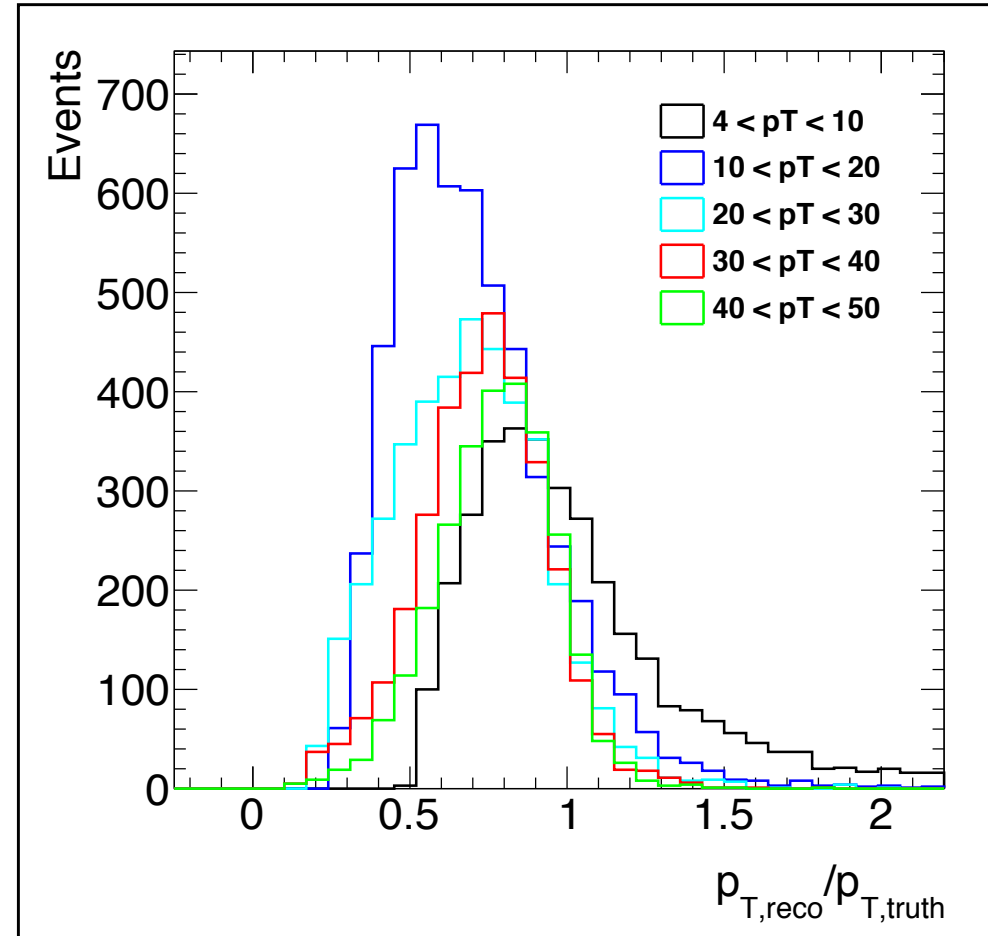
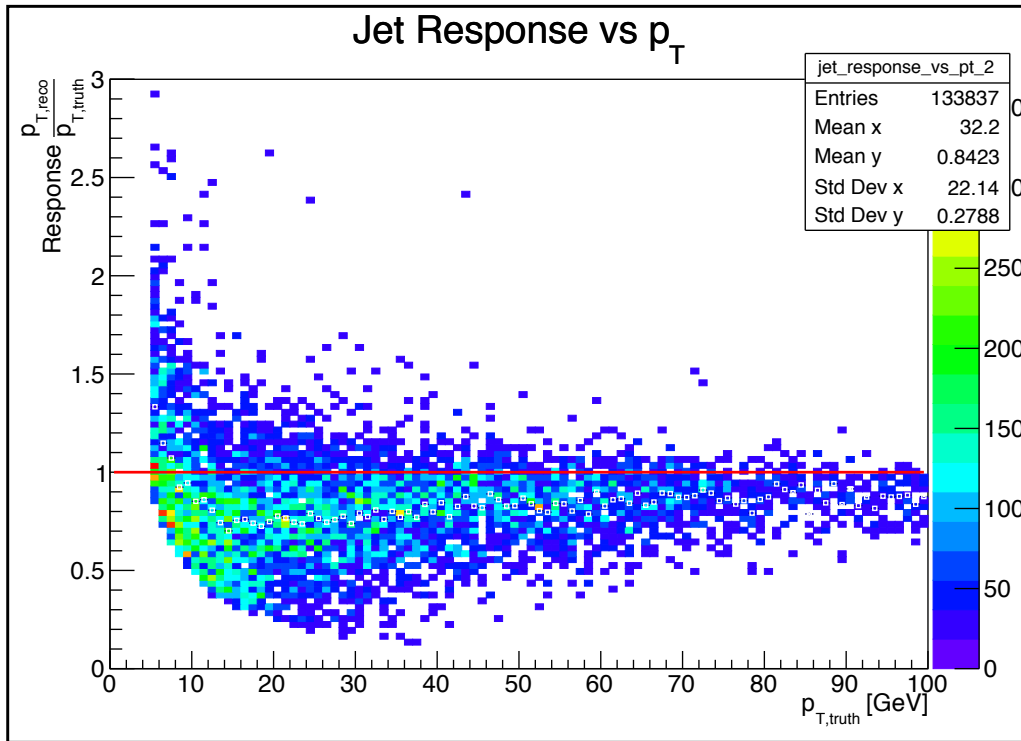
Reconstructed jets matched to MC-simulated jets according to the criterion $dR < 0.2$,

where $dR = g_{ij} x^i x^j = \frac{1}{\sigma_i \sigma_j} x^i x^j$, $i, j \in \{\eta, \phi\}$.





Jet Matching - Jet Response Distributions (NonExtrapolated Jets matched to Truth Jets)



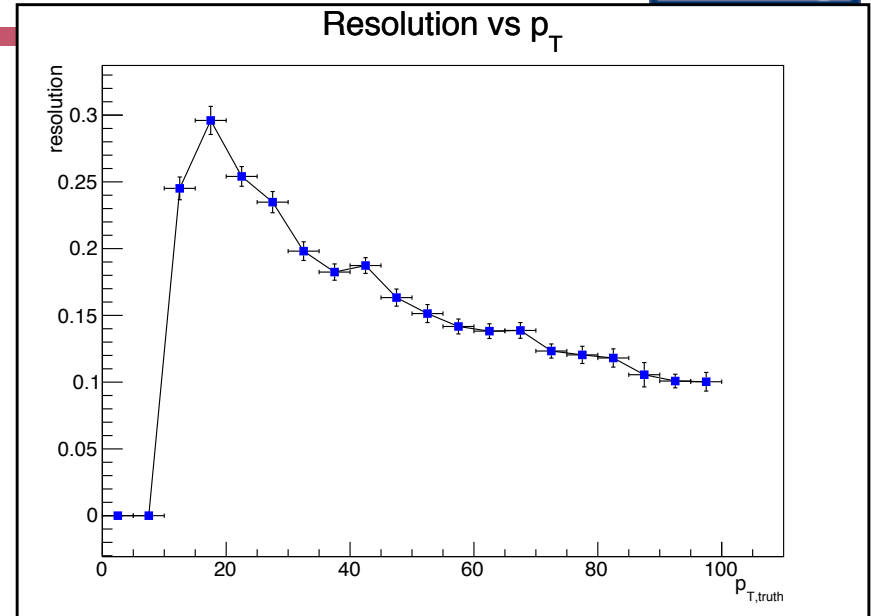
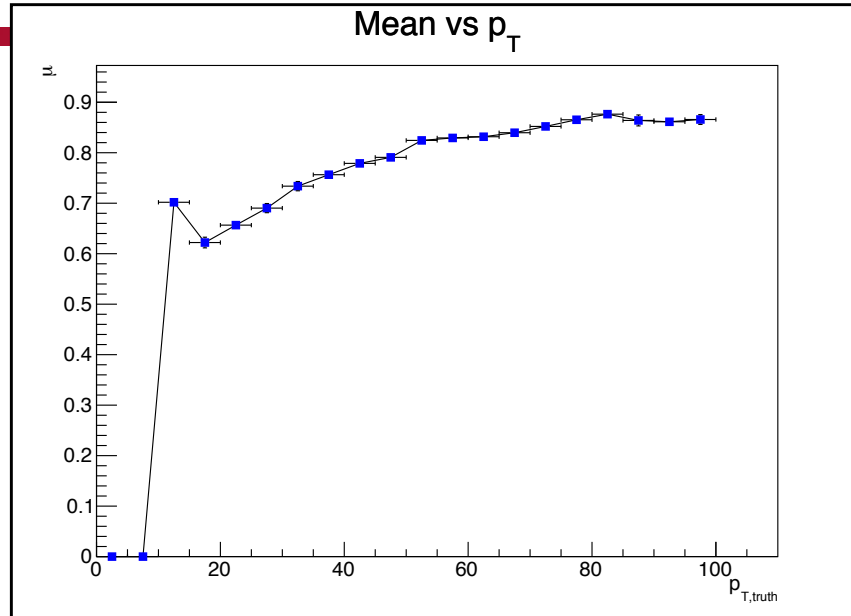


Jet Matching -

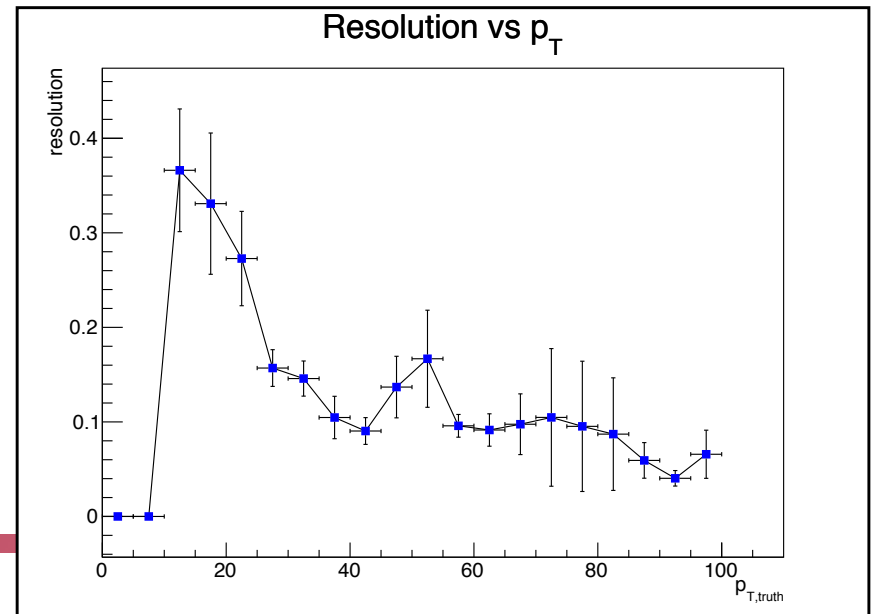
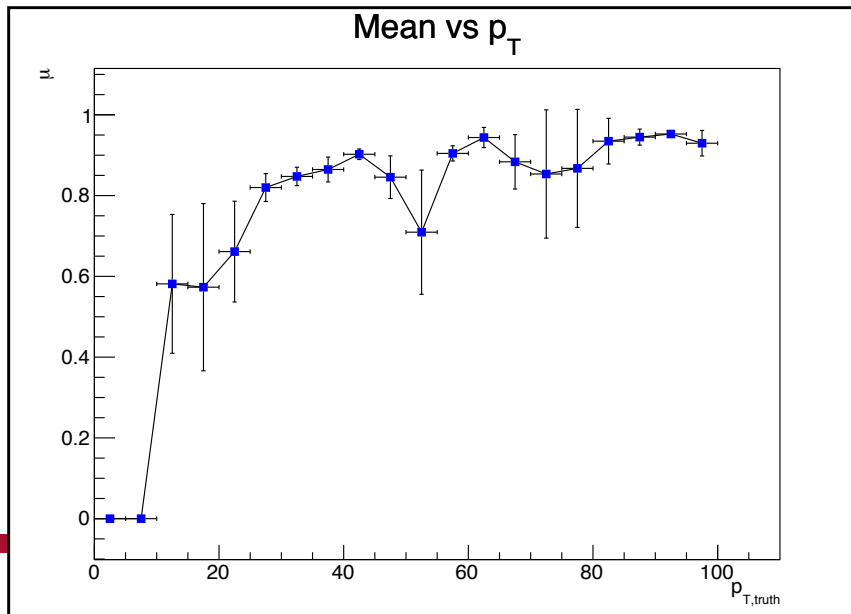
Jet Mean and Resolution (PFJets Matched to Truth Jets)



Offline
Track
Jets



Simplified
Track
Jets





Future Prospects



1. Apply similar analysis to tracks and jets from simplified extrapolation
2. Ideally, would like to work with fully calibrated jets
3. Benjamin Jaeger will complement this work with FTK tracks