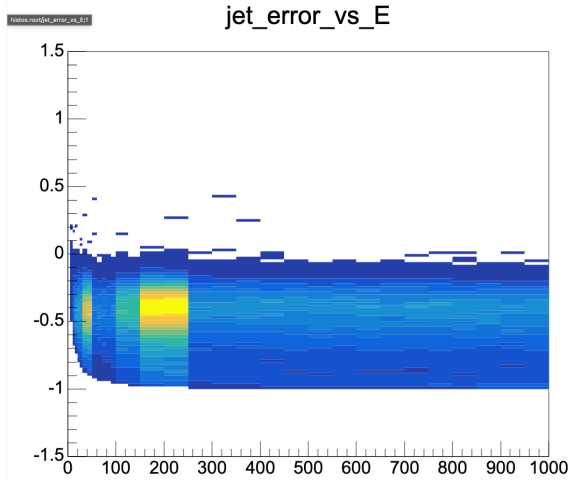
Single Neutron Studies without BIB

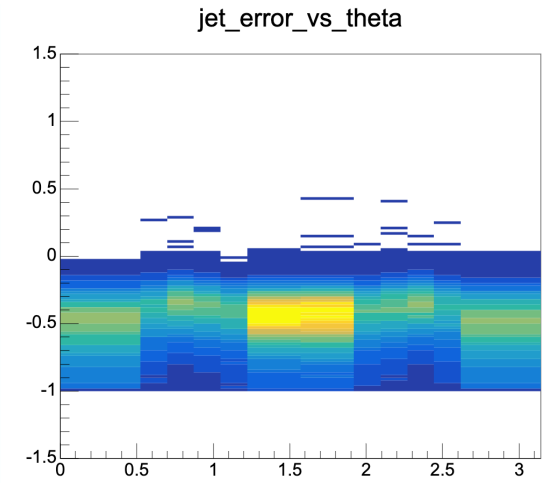
Last presentation

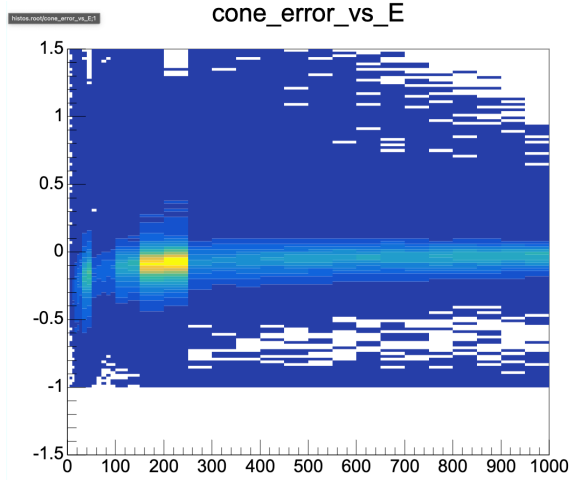
- **Summary**
  - Looked at reconstruction resolution/response for 0-50 GeV neutron samples
    - There were some binning issues to be fixed (I followed Tova's suggestions for this week's plots)
    - There were also range issues in the fitting process that I has been fixed
    - I have not switched to a 0.4 cone yet because my cone clustering is using truth information, and I want to ensure there is not a better way to do this before moving forwards
- **Next Steps**
  - Extend resolution and response plots
  - Look at jet reconstruction efficiency

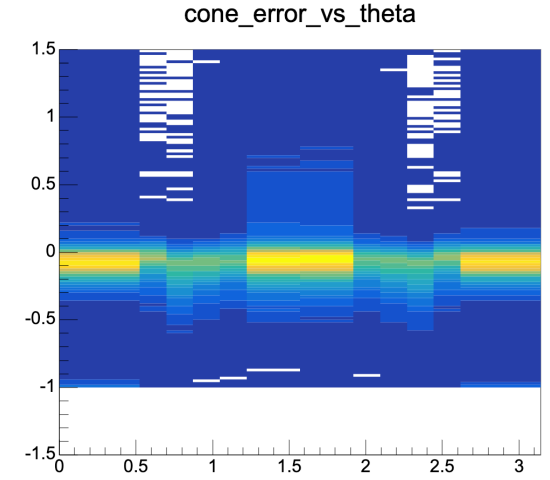
2D Error Histograms

- **2D Histos**
  - Following Tova's suggestions, I used these 2D histograms to generate the resolution and response plots later
  - These plots are from the total samples 0-1000 GeV
    - The high number of samples at 50 and 200-250 GeV are artifacts or the sampling choices



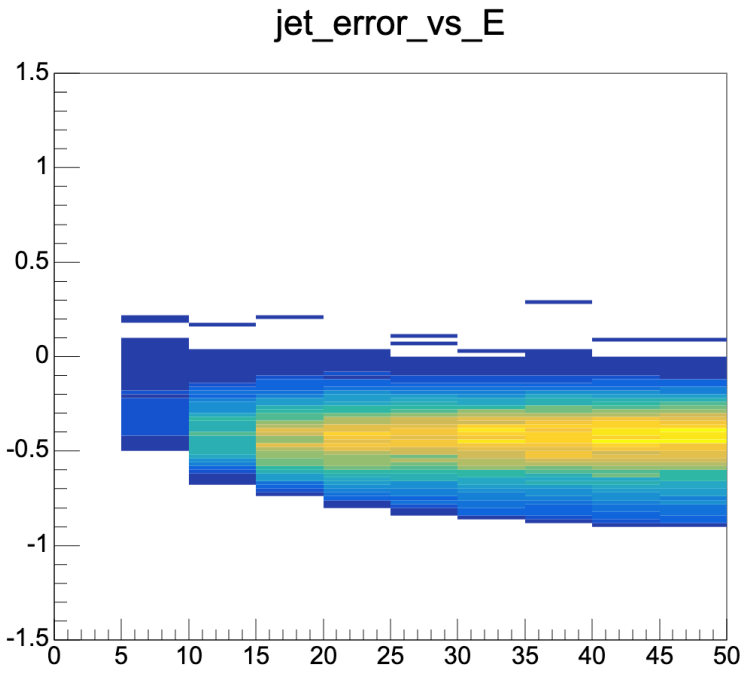




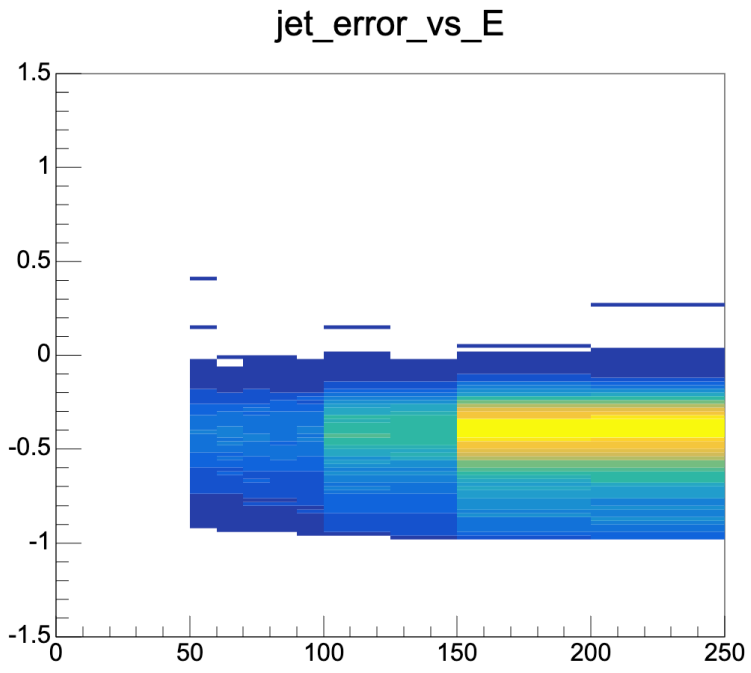


2D Error Histograms for sample bins

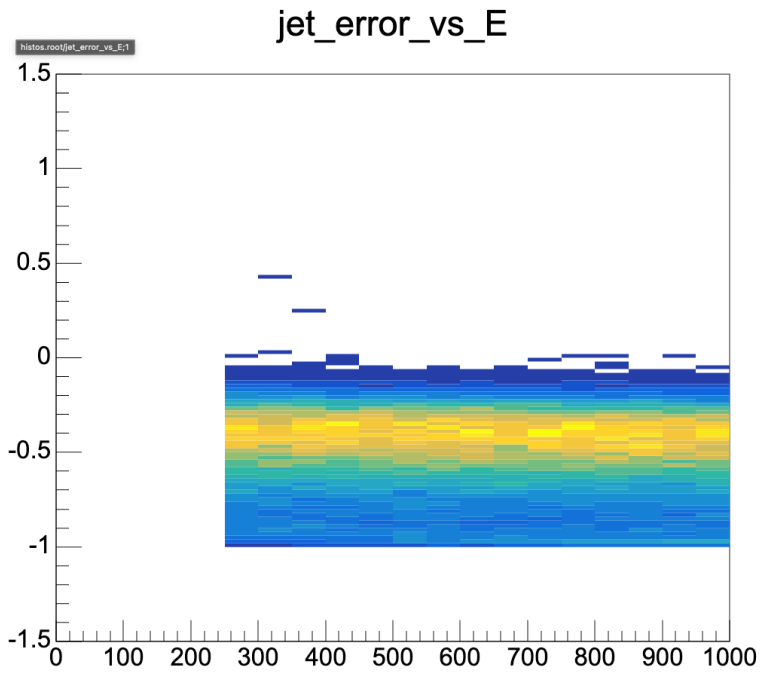
0-50 GeV



50-250 GeV

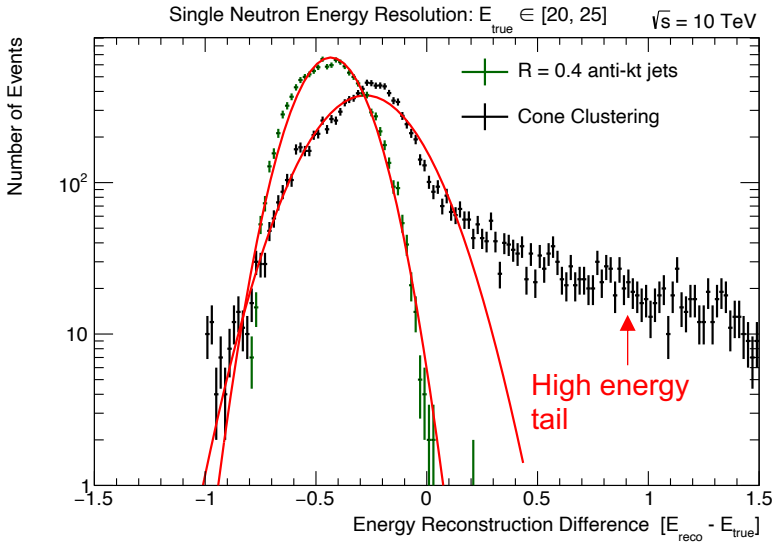


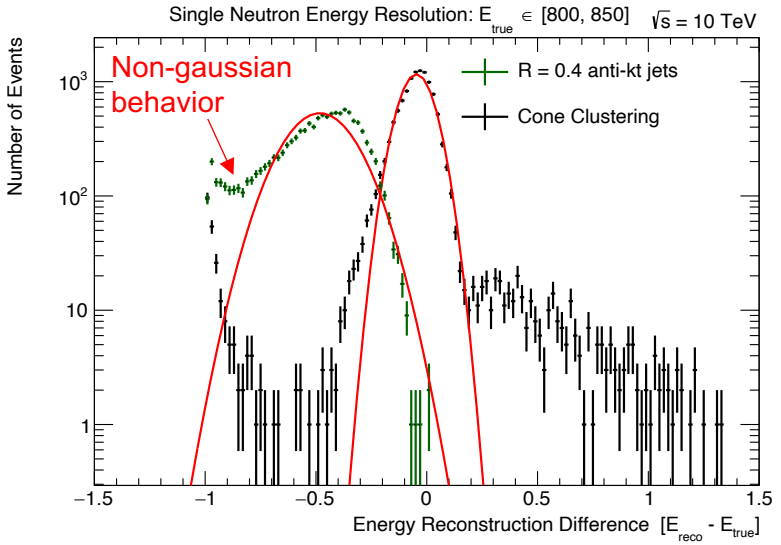
250-1000 GeV



Fitting Notes

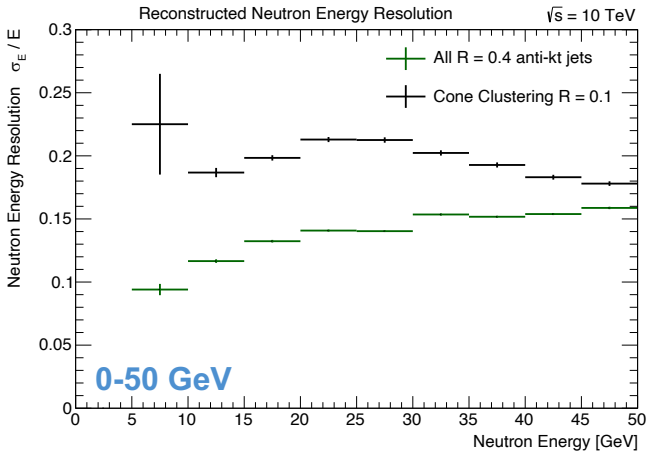
- **Notes**
  - This fits come from projections of the 2D error histograms
  - The high energy tail in the cone clustering is still present
  - There is some non-gaussian behavior in the high energy bins that is not significantly present in the lower energy samples
    - This behavior also exists for the theta bins at higher energies

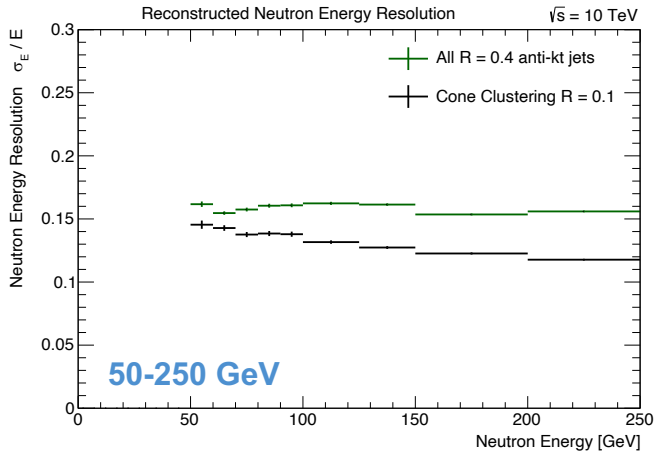


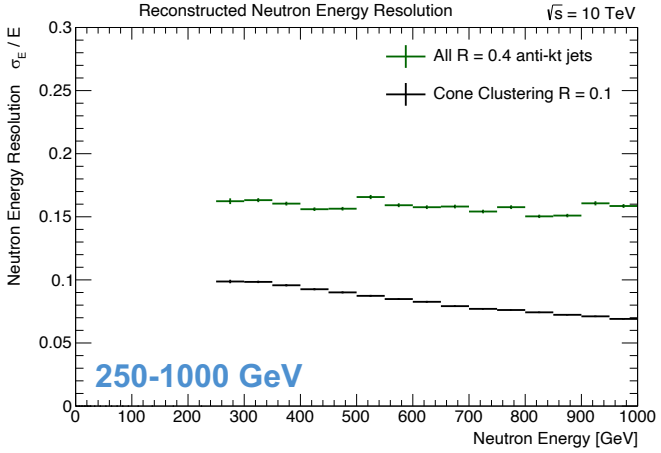


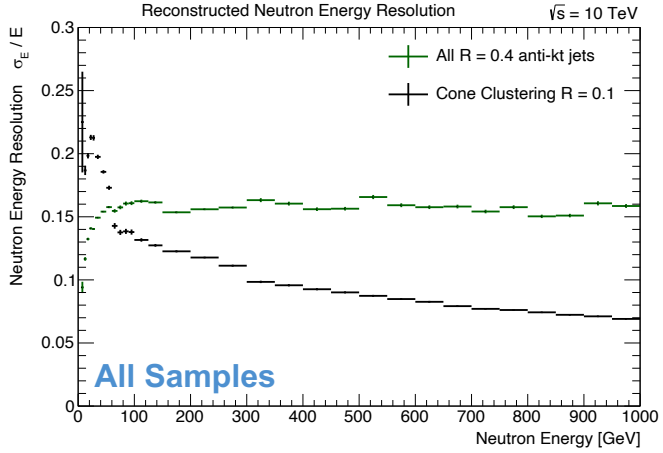
Neutron Energy Resolution vs Energy

- **Resolution Plots**
  - I am no longer splitting between barrel/endcap jets because that did not seem to have a large effect from my previous studies
    - I can go back to doing this is it is a good idea
  - The jets seem to be behaving as expected!
    - Is it normal for the resolution to plateau at a maxima? Rose's plots seem to approach a minimum value for photon resolution



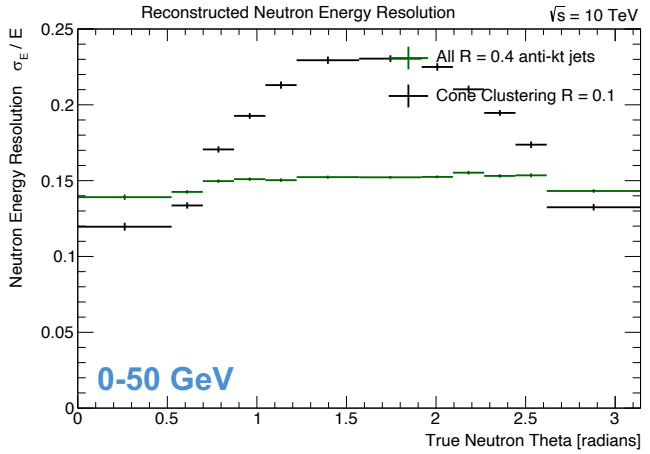


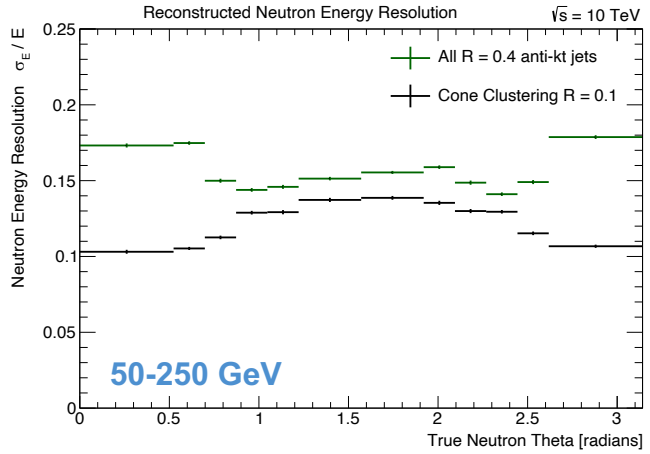


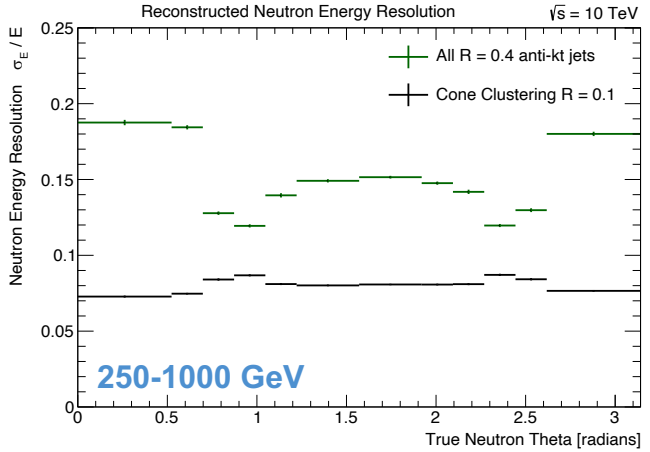


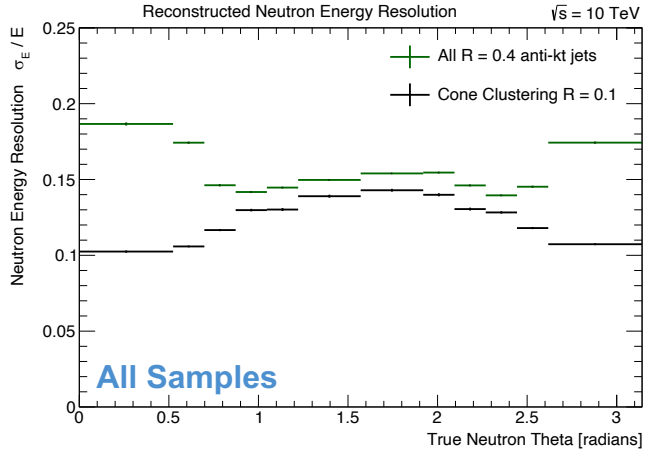
Neutron Energy Resolution vs Theta

- **Resolution Plots**
  - I am surprised by the behavior near the barrel with a larger discrepancy between the anti-kt jets and the cone clustering
  - Is it time to move forward with using these plots (and the resolution vs energy ones) as a correction curve?



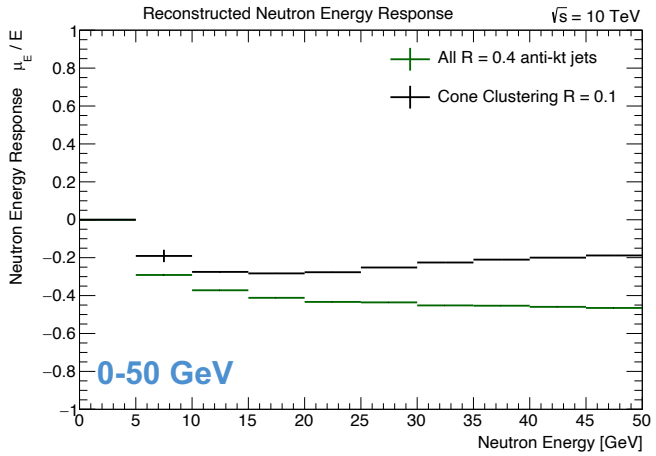


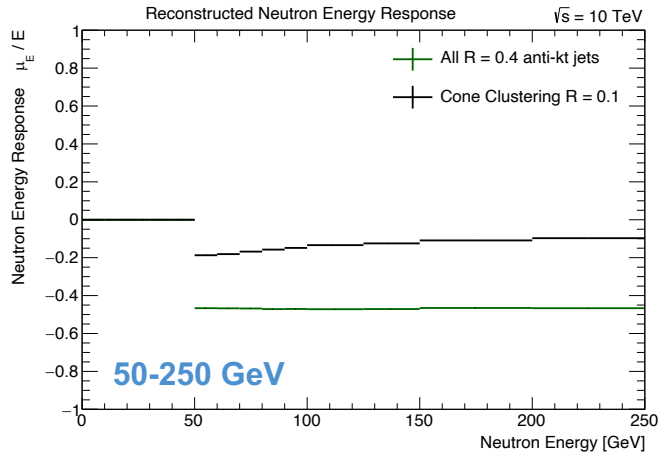


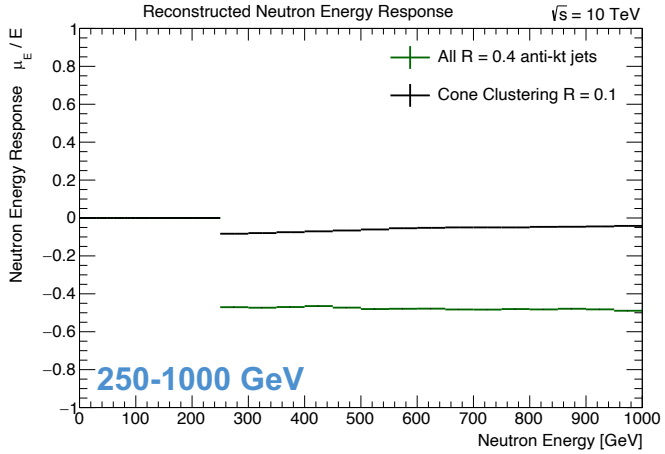


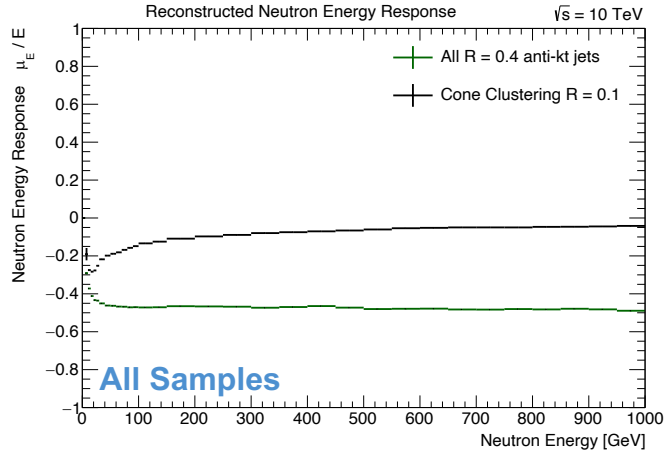
Neutron Energy Response vs Energy

- **Response Plots**
  - These plots are very similar to previous presentations



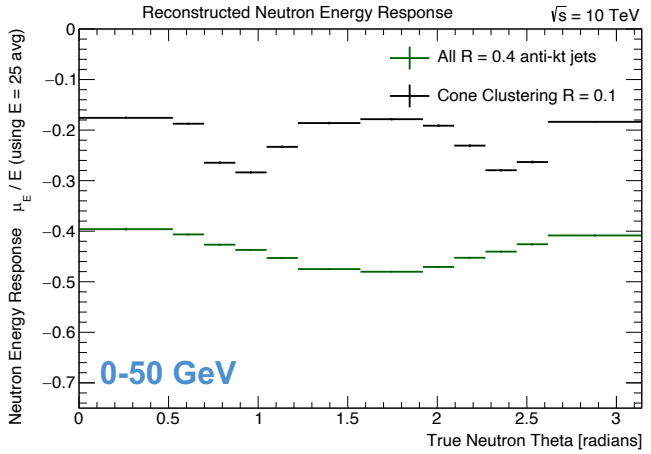


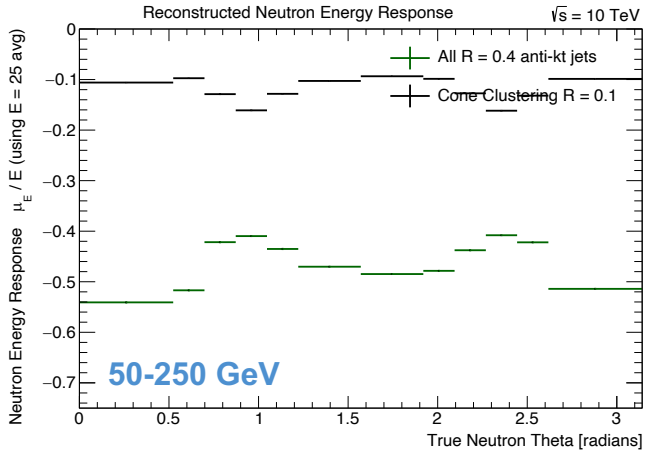


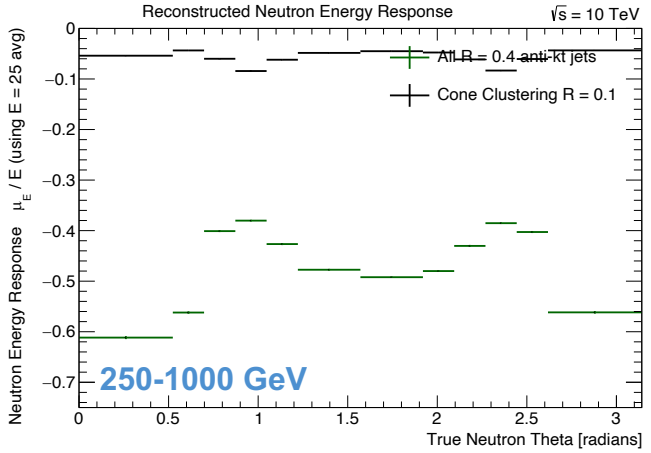


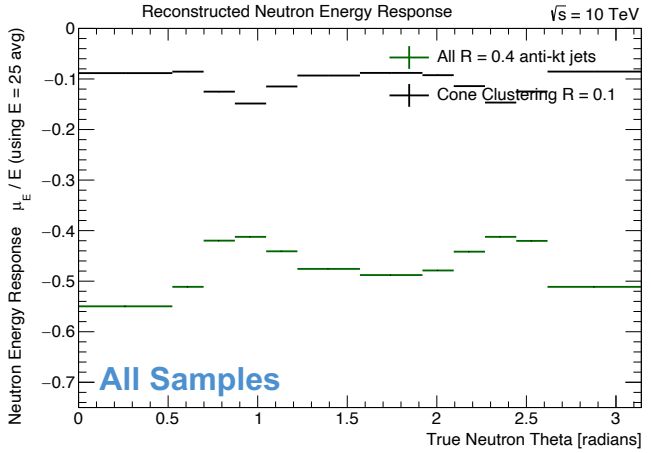
Neutron Energy Response vs Theta

- **Response Plots**
  - It's interesting that, for the anti-kt jets, the endcap performs better that average at low-E and worse at high-E



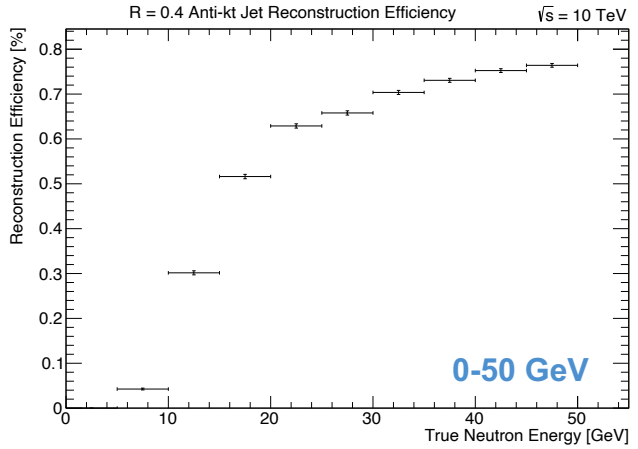


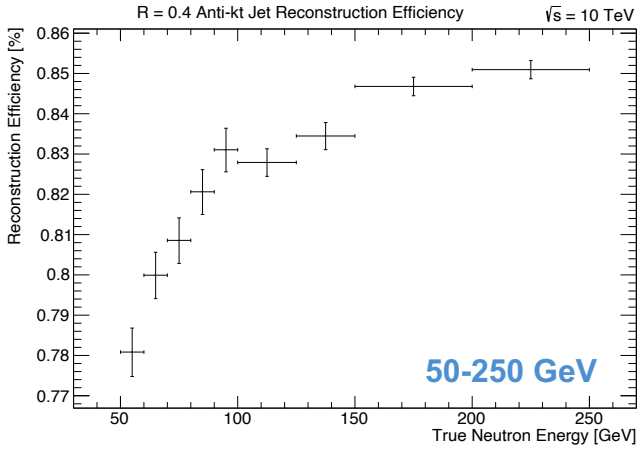


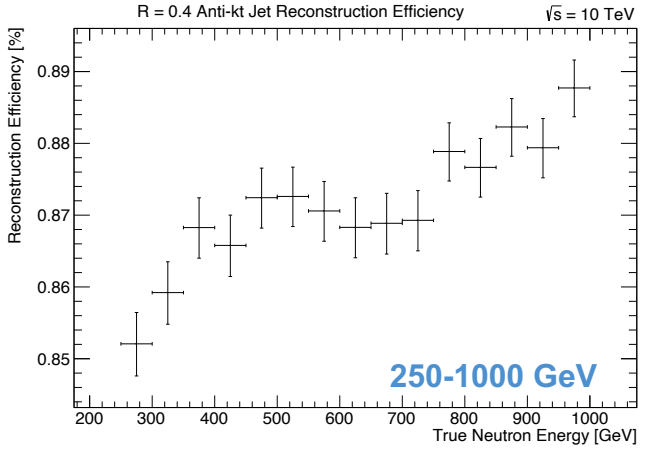


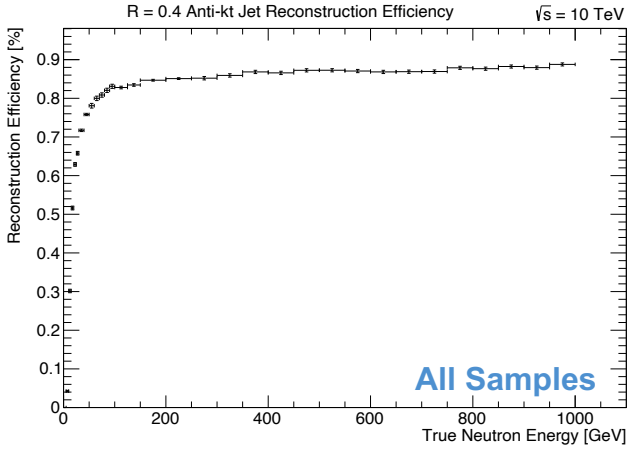
Jet Reconstruction Efficiency vs Energy

- **Efficiency Plots**
  - These seem to agree with Federico's efficiency plots for 0-50 GeV neutron samples
  - Approaching 85-90% reconstruction efficiency seems quite good to me!



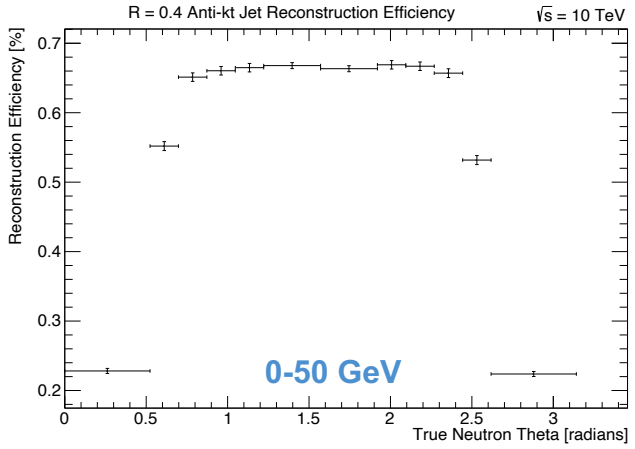


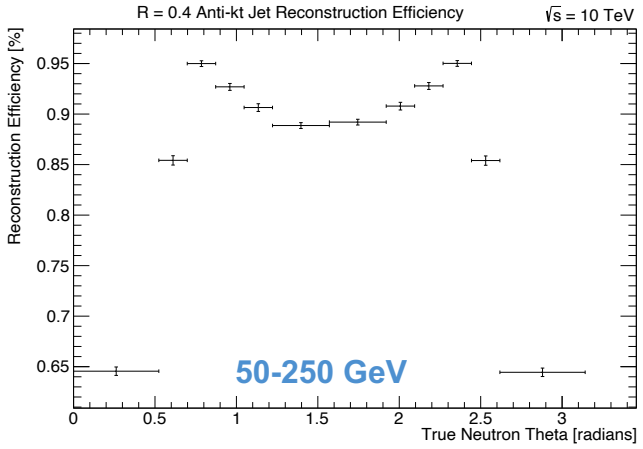


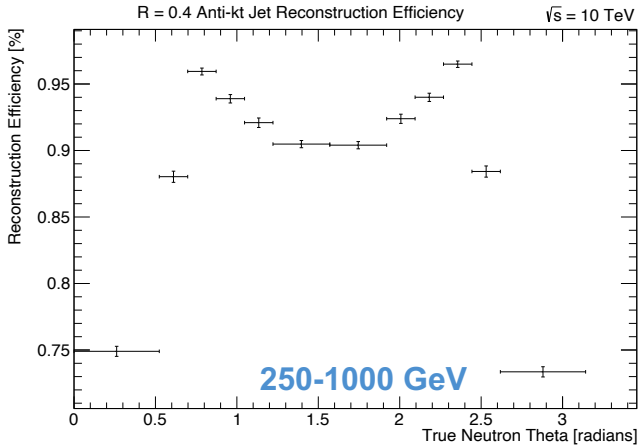


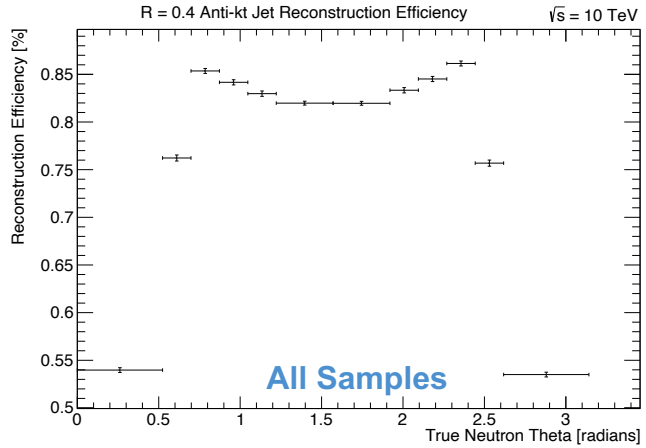
Jet Reconstruction Efficiency vs Theta

- **Efficiency Plots**
  - These also seem to agree with Federico's efficiency plots for 0-50 GeV neutron samples
  - The endcap is performing significantly worse, especially at lower energies
  - The performance in the main section of the barrel, however, looks great!









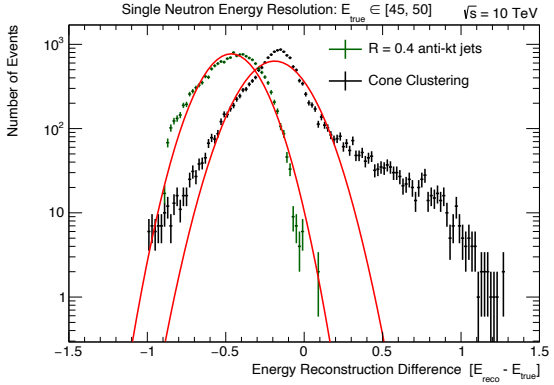
Summary and Next Steps

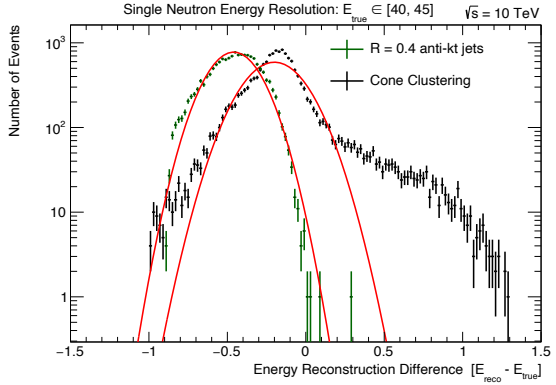
- **Summary**
  - The response, resolution, and efficiency plots have been extended to all 0-1000 GeV neutron samples

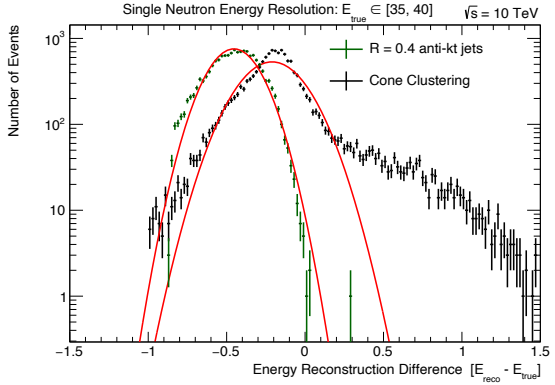
- **Next Steps**
  - Compare today's results with the previous 3 TeV plots to better understand the relative performance differences
  - Adapt the cone-clustering to use non-truth information (if possible!)
  - Add in energy response correction factor and re-do analysis
  - Add in more cuts (eg: remove events in the nozzle)

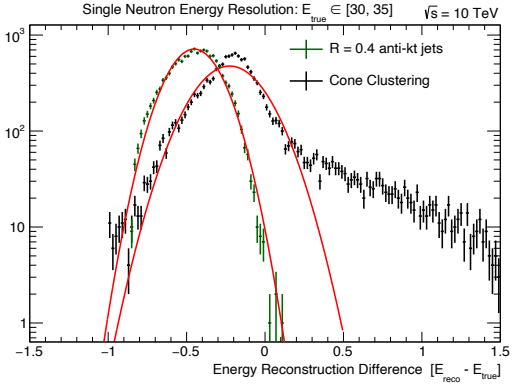
Supplementary Slides

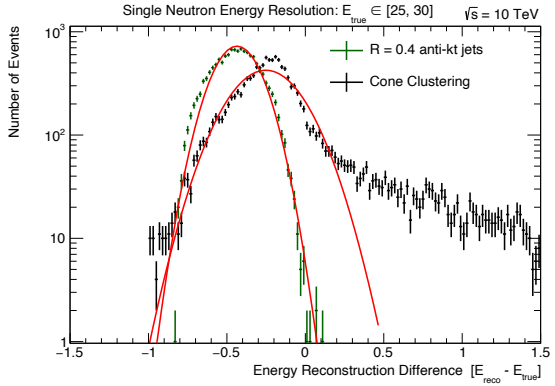
0-50 GeV Subfits

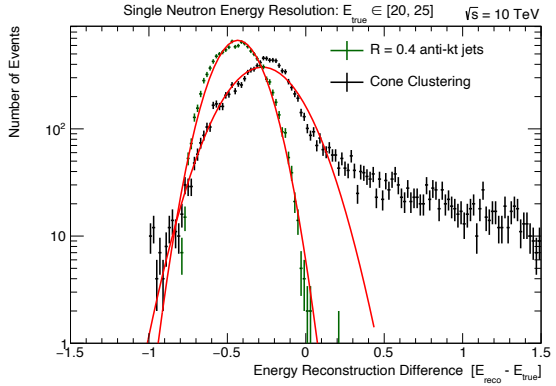

Single Neutron Energy Resolution: E_true ∈ [45, 50]
√s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

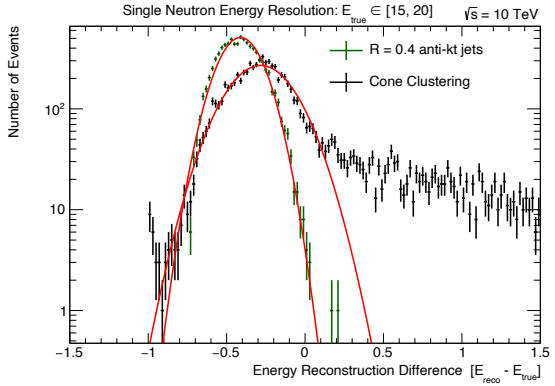

Single Neutron Energy Resolution: E_true ∈ [40, 45]
√s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

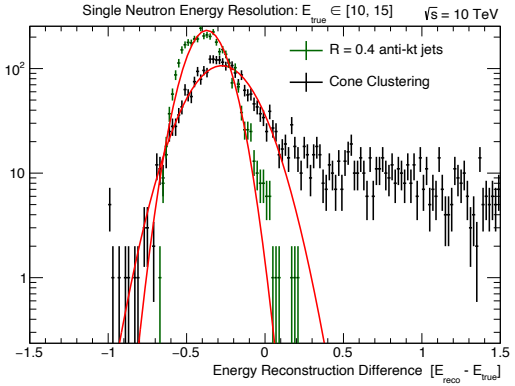

Single Neutron Energy Resolution: E_true ∈ [35, 40]
√s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

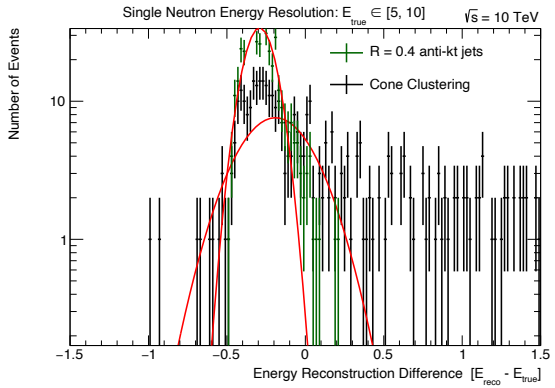

Single Neutron Energy Resolution: E_true ∈ [30, 35]
√s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

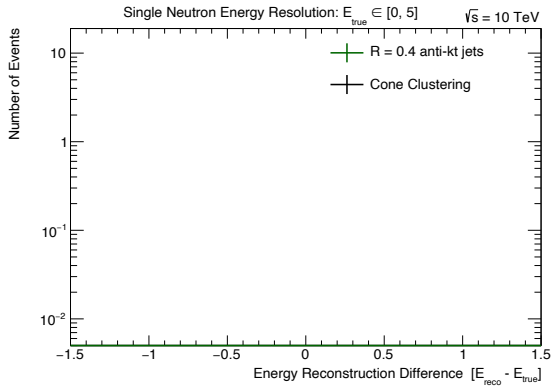

Single Neutron Energy Resolution: E_true ∈ [25, 30]
√s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

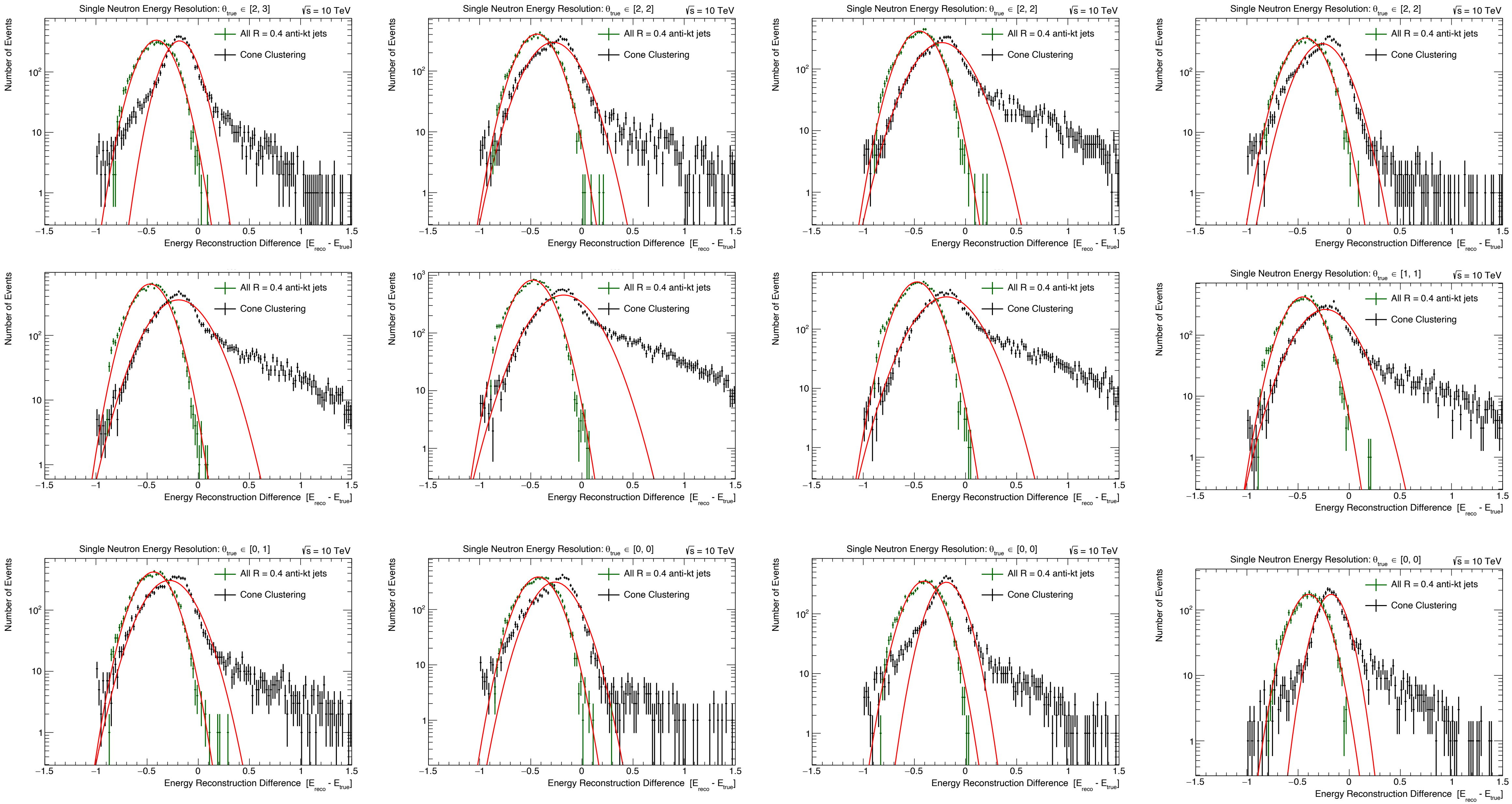

Single Neutron Energy Resolution: E_true ∈ [20, 25]
√s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]


Single Neutron Energy Resolution: E_true ∈ [15, 20]
√s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

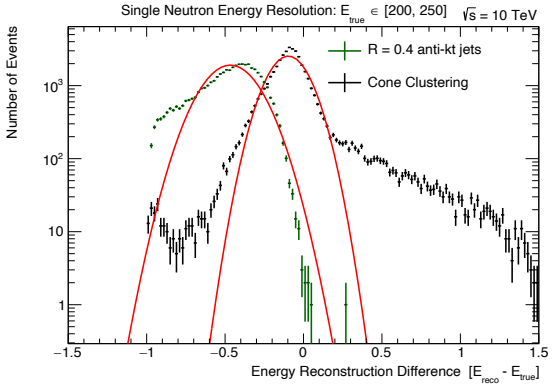

Single Neutron Energy Resolution: E_true ∈ [10, 15]
√s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

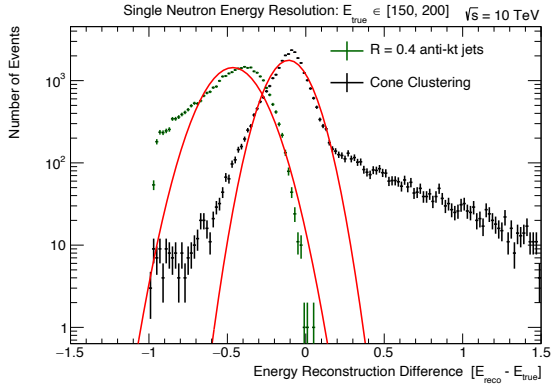

Single Neutron Energy Resolution: E_true ∈ [5, 10]
√s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

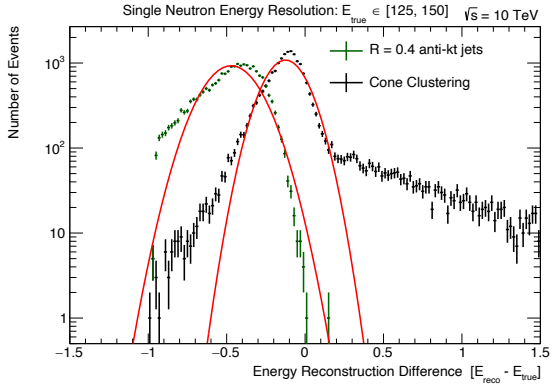

Single Neutron Energy Resolution: E_true ∈ [0, 5]
√s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

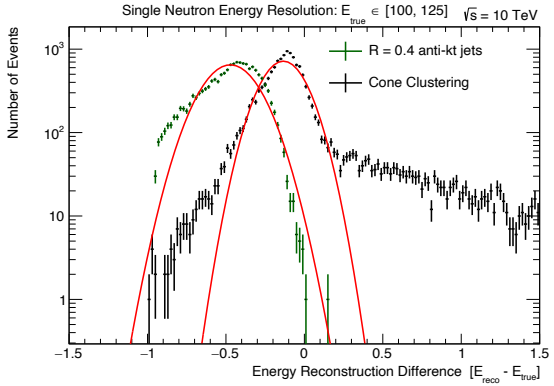

Single Neutron Energy Resolution: θ_true ∈ [2, 3]
√s = 10 TeV
Single Neutron Energy Resolution: θ_true ∈ [2, 2]
Single Neutron Energy Resolution: θ_true ∈ [1, 1]
Single Neutron Energy Resolution: θ_true ∈ [0, 1]
Single Neutron Energy Resolution: θ_true ∈ [0, 0]
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

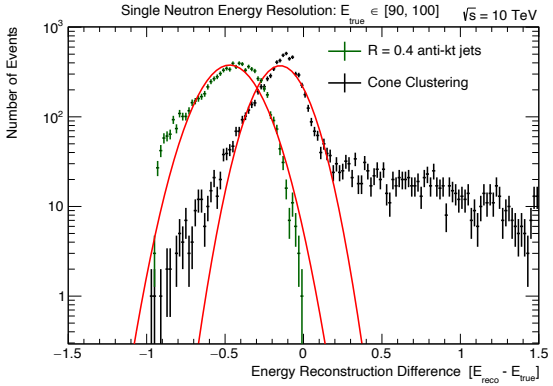
50-250 GeV Subfits

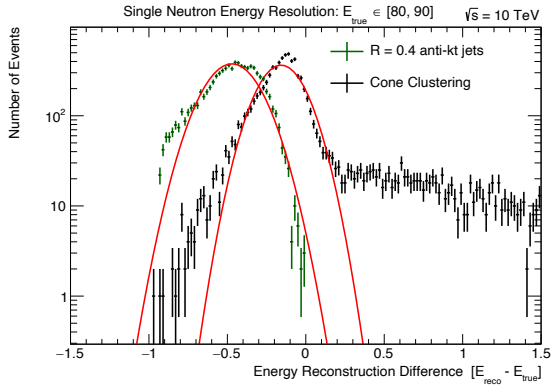

Single Neutron Energy Resolution: E_true ∈ [200, 250] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

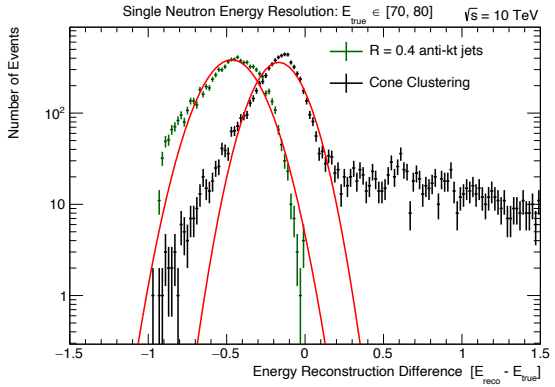

Single Neutron Energy Resolution: E_true ∈ [150, 200] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

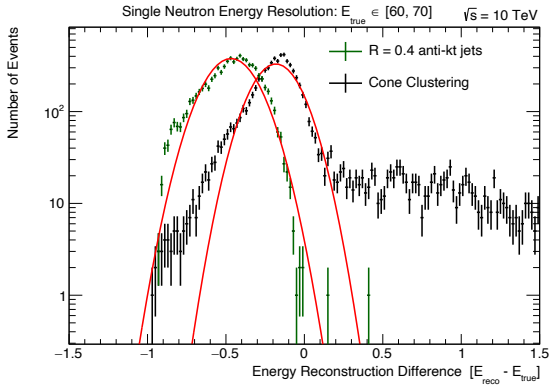

Single Neutron Energy Resolution: E_true ∈ [125, 150] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

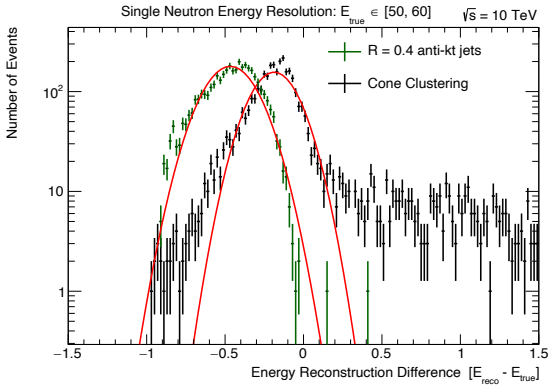

Single Neutron Energy Resolution: E_true ∈ [100, 125] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

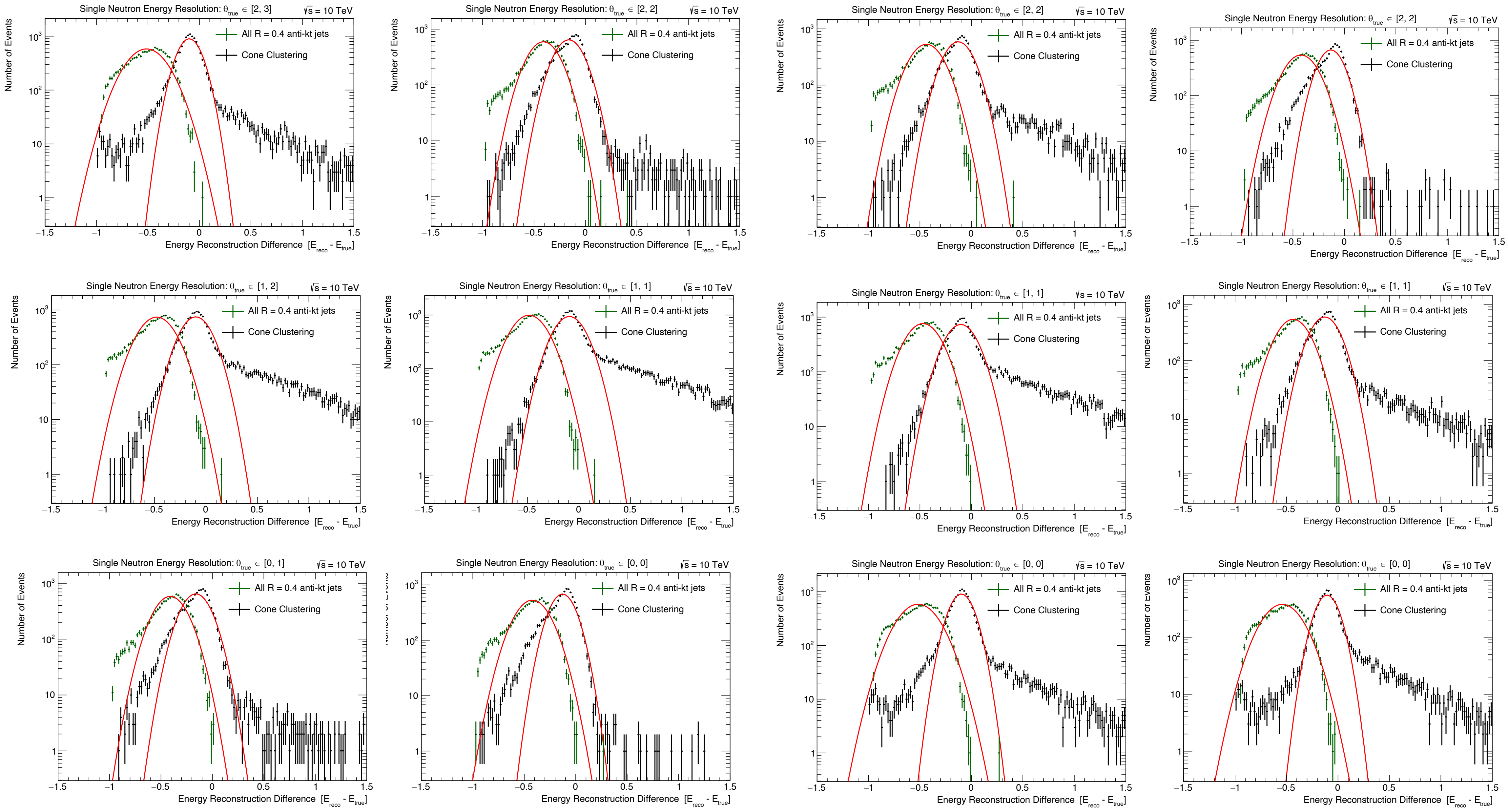

Single Neutron Energy Resolution: E_true ∈ [90, 100] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]


Single Neutron Energy Resolution: E_true ∈ [80, 90] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]


Single Neutron Energy Resolution: E_true ∈ [70, 80] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]


Single Neutron Energy Resolution: E_true ∈ [60, 70] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]


Single Neutron Energy Resolution: E_true ∈ [50, 60] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]


Single Neutron Energy Resolution: $\theta_{true} \in [2, 3]$
Single Neutron Energy Resolution: $\theta_{true} \in [2, 2]$
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Single Neutron Energy Resolution: $\theta_{true} \in [2, 2]$
Single Neutron Energy Resolution: $\theta_{true} \in [1, 2]$
Single Neutron Energy Resolution: $\theta_{true} \in [1, 1]$
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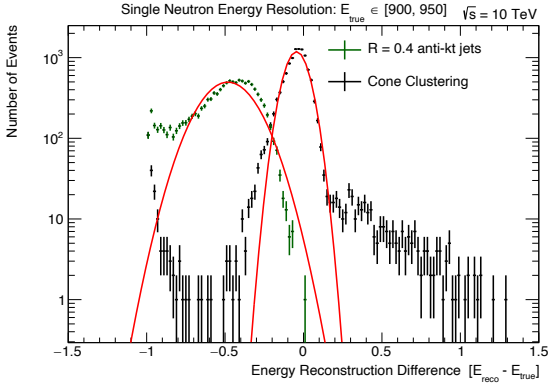
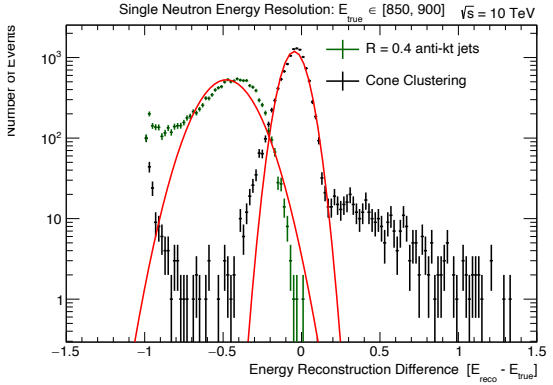
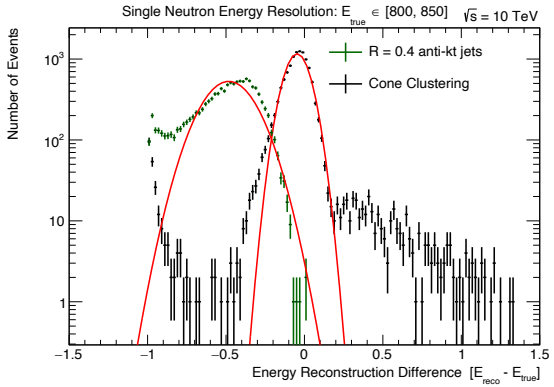
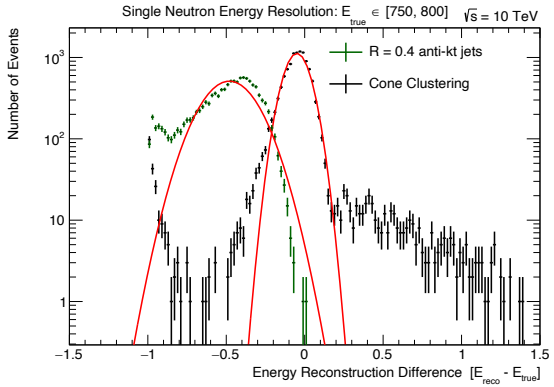
Single Neutron Energy Resolution: $\theta_{true} \in [0, 1]$
Single Neutron Energy Resolution: $\theta_{true} \in [0, 0]$
Single Neutron Energy Resolution: $\theta_{true} \in [0, 0]$
Single Neutron Energy Resolution: $\theta_{true} \in [0, 0]$
$\sqrt{s}$ = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference $[E_{reco} - E_{true}]$

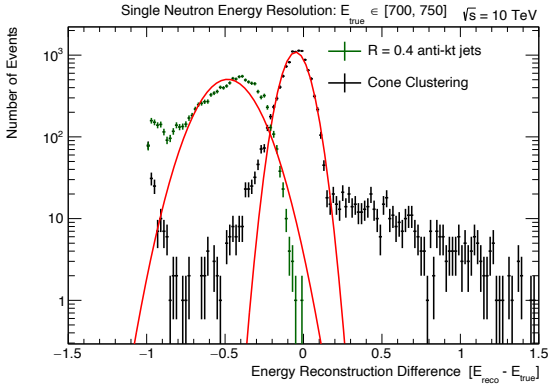
250-1000 GeV Subfits

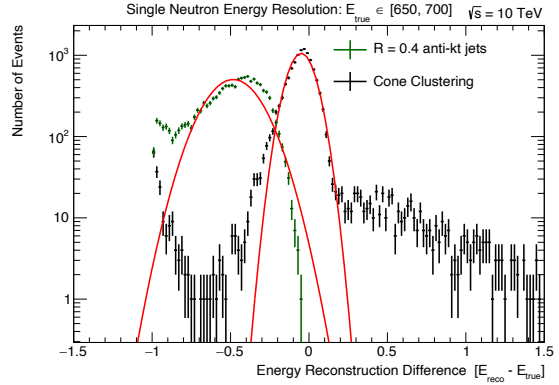

Single Neutron Energy Resolution: E_true ∈ [900, 950] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

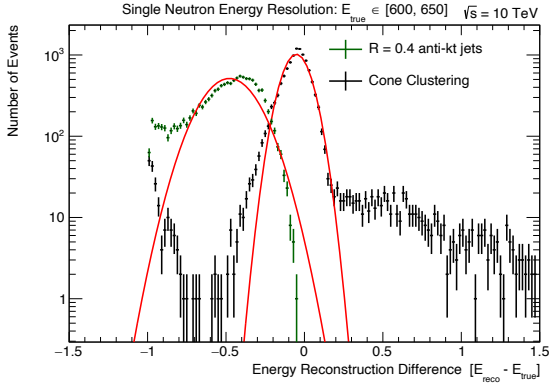

Single Neutron Energy Resolution: E_true ∈ [850, 900] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

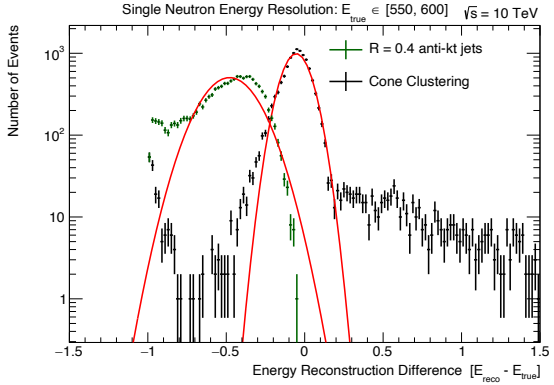

Single Neutron Energy Resolution: E_true ∈ [800, 850] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

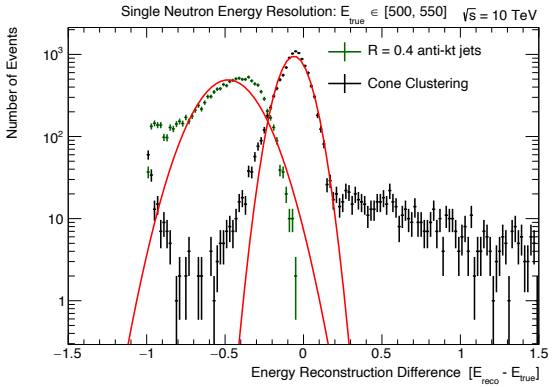

Single Neutron Energy Resolution: E_true ∈ [750, 800] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

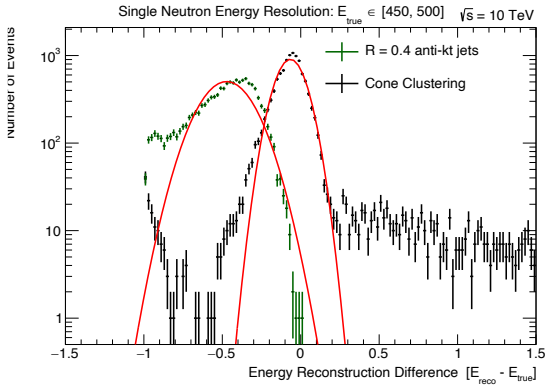

Single Neutron Energy Resolution: E_true ∈ [700, 750] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

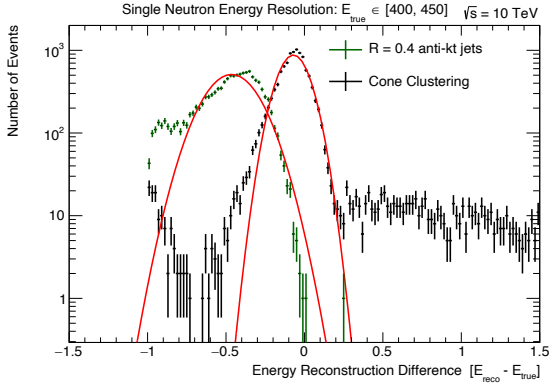

Single Neutron Energy Resolution: E_true ∈ [650, 700] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

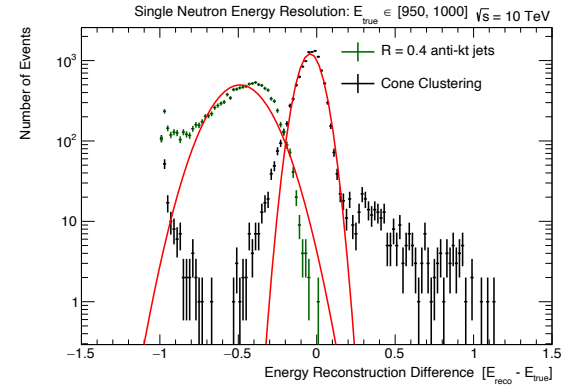

Single Neutron Energy Resolution: E_true ∈ [600, 650] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

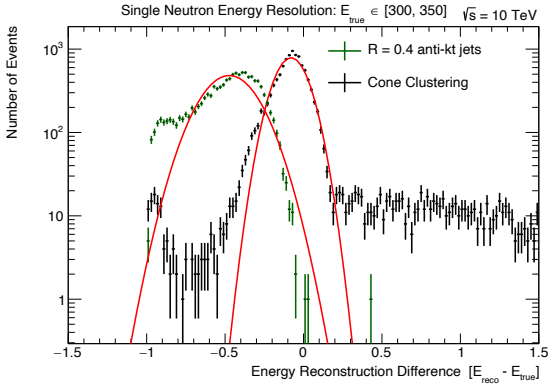

Single Neutron Energy Resolution: E_true ∈ [550, 600] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

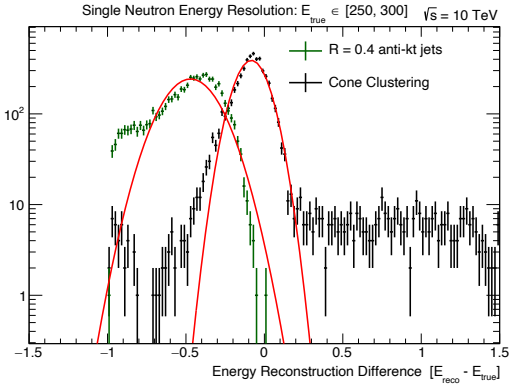

Single Neutron Energy Resolution: E_true ∈ [500, 550] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

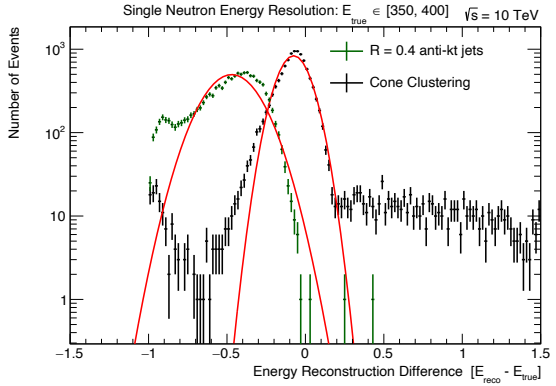

Single Neutron Energy Resolution: E_true ∈ [450, 500] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]

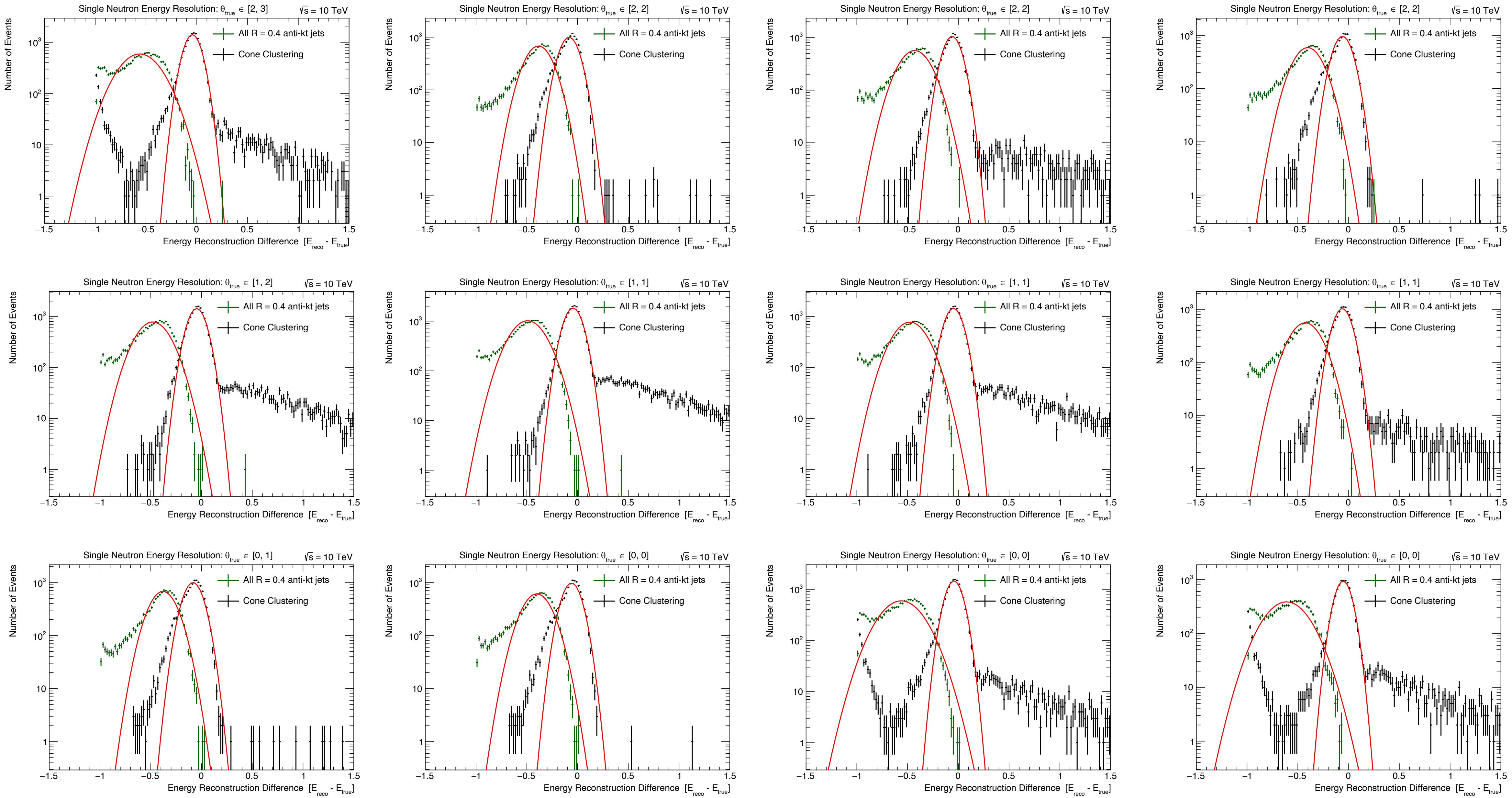

Single Neutron Energy Resolution: E_true ∈ [400, 450] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]


Single Neutron Energy Resolution: E_true ∈ [950, 1000] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]


Single Neutron Energy Resolution: E_true ∈ [300, 350] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]


Single Neutron Energy Resolution: E_true ∈ [250, 300] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Energy Reconstruction Difference [E_reco - E_true]


Single Neutron Energy Resolution: E_true ∈ [350, 400] √s = 10 TeV
R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]



Single Neutron Energy Resolution: θ_true ∈ [2, 3]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [2, 2]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [2, 2]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [2, 2]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [1, 2]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [1, 1]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [1, 1]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [1, 1]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [0, 1]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [0, 0]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [0, 0]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]
Single Neutron Energy Resolution: θ_true ∈ [0, 0]
√s = 10 TeV
All R = 0.4 anti-kt jets
Cone Clustering
Number of Events
Energy Reconstruction Difference [E_reco - E_true]