PFA0: Fine Tune Parameters

Hadronic Calorimeters

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OVERVIEW

•Results from the earlier PFA0 single-particle tuning for the EM calorimeters were presented in the Jets & HF working group (slides).

•**Goal:** find the optimal merging window (ΔR) that fully captures a single-particle shower in PFA0.

•**Method:** E/p and purity are used to determine ΔR. Details are in the slides.

•**Identifying fragmented clusters:** in the significance distribution, a dip on the left side of the main peak marks the boundary between fragmented and unfragmented clusters. Clusters classified as fragmented are then merged.

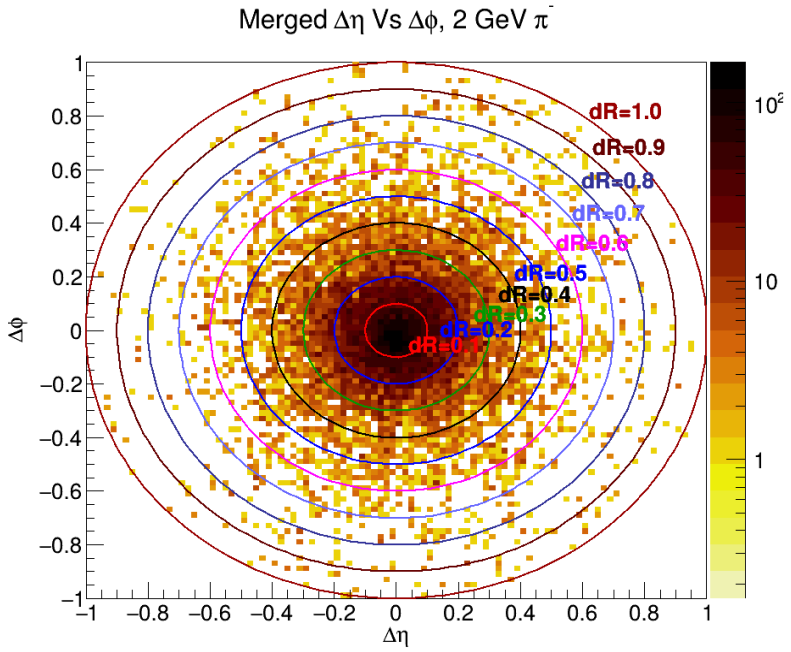
•**Results so far:**

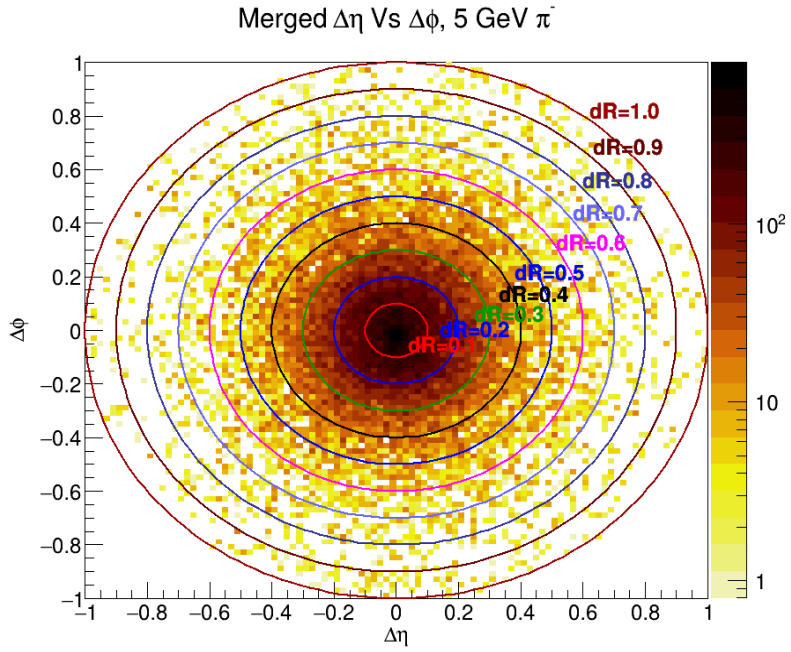
- •EM calorimeters: ΔR ≈ 0.2 to 0.3
- •LFHCAL and BHCAL: ΔR ≈ 0.6

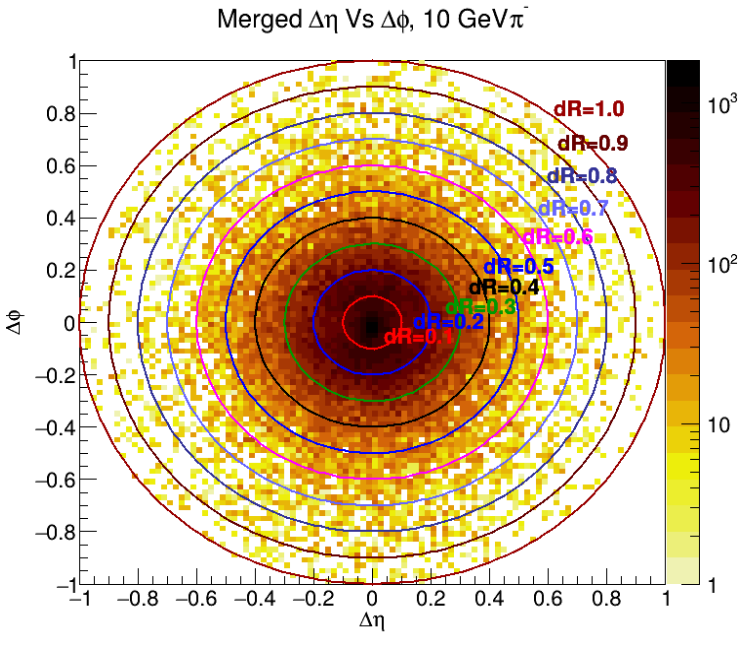
•**Open question (NHCAL):** the significance distribution shows no visible separation between the fragmented and unfragmented populations, so the boundary-based approach cannot be applied. I would like help understanding why, and how to proceed. I have attached the results for HCals in the upcoming slides

BHCAL

Distribution of clusters around seed cluster



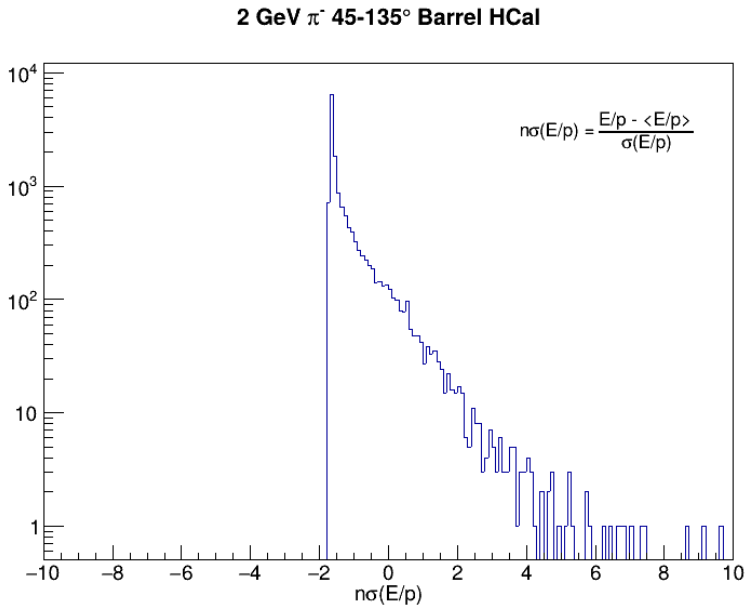


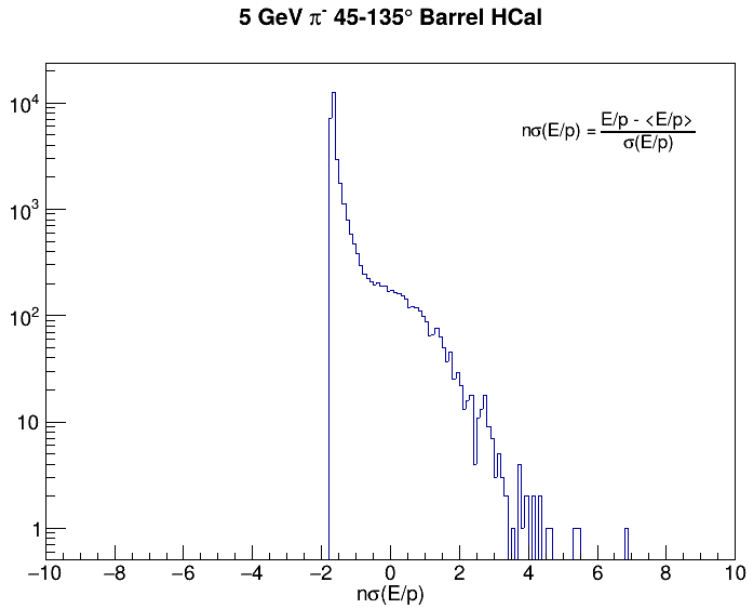


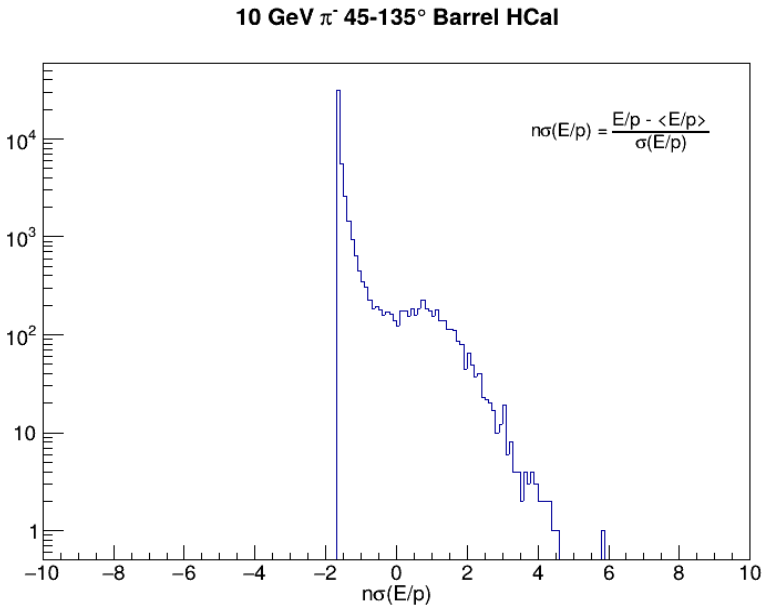
Spatial distribution suggests **ΔR ~ 0.6** to capture most of the shower

BHCAL

Significance distribution of all clusters



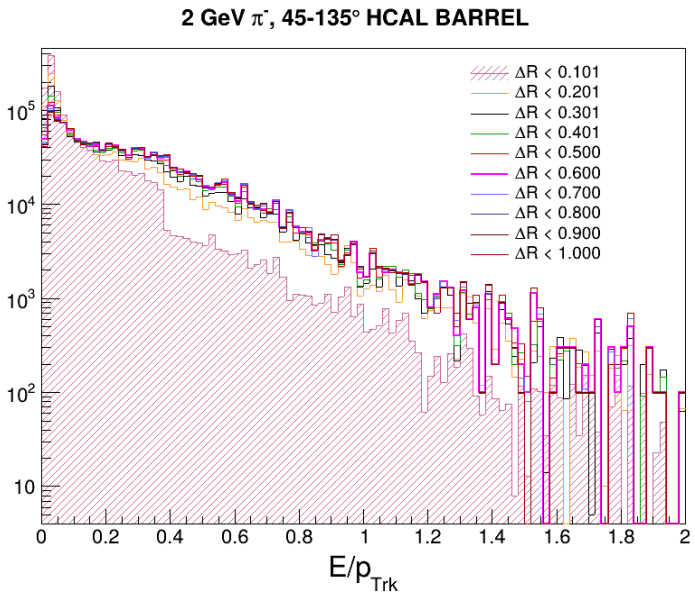


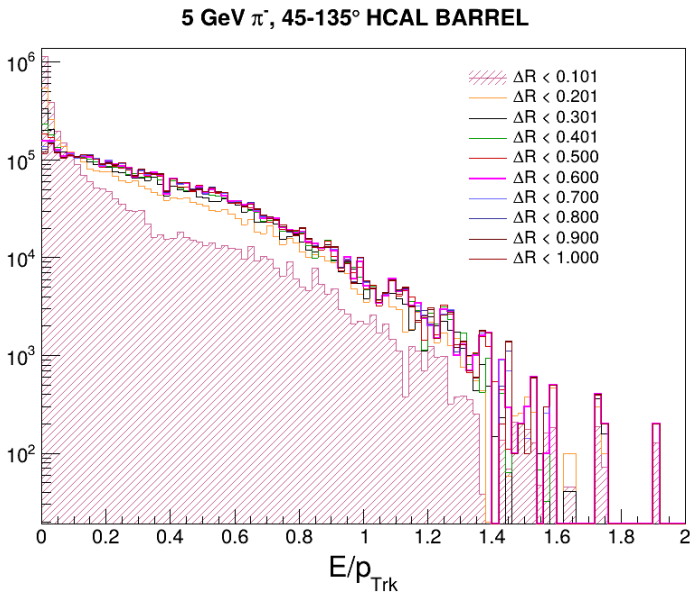


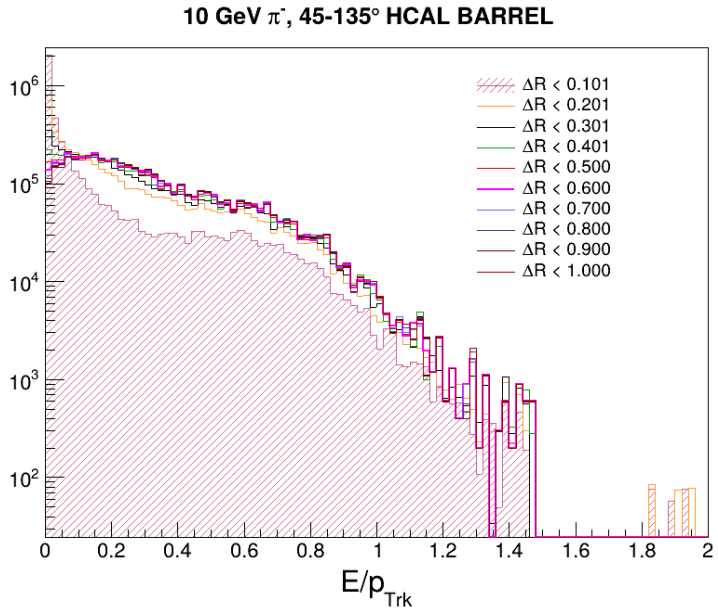
By eye, I picked **Sig = -1** to be the boundary between fragmented and unfragmented clusters

BHCAL

Evolution of E/p as we merge fragmented clusters within a cone of radius ΔR



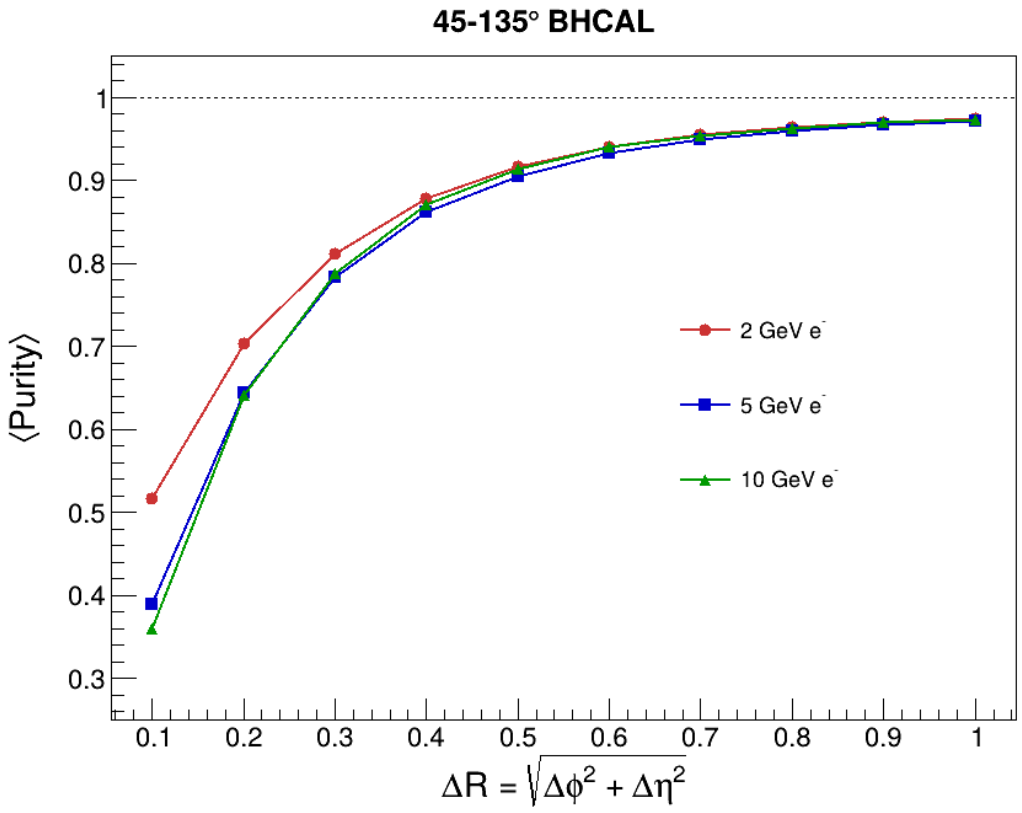




I chose the pink bold line at **ΔR = 0.6**

BHCAL

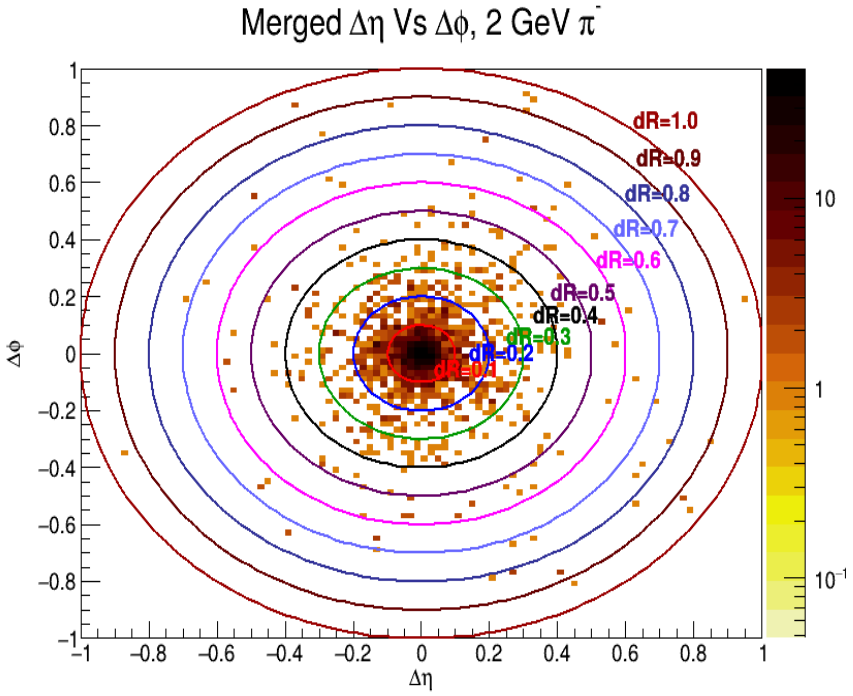
Evolution of Purity as we merge fragmented clusters within a cone of radius ΔR, for different energies

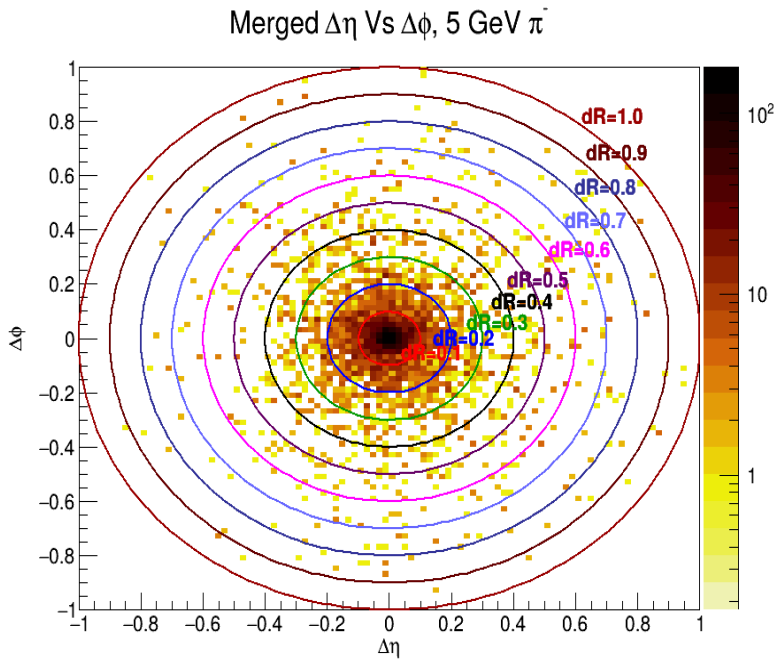


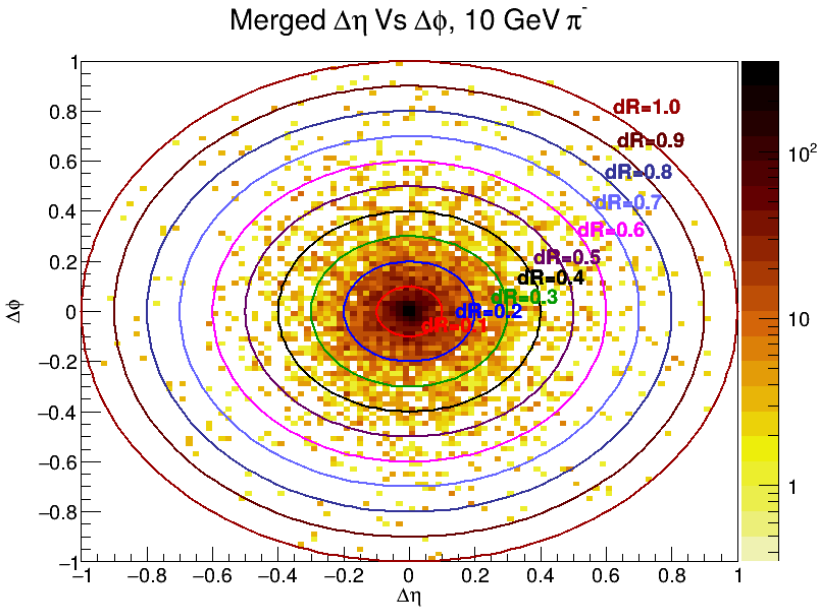
More than 90% purity is achieved at **ΔR = 0.6** serves as optimal merging window

LFHCAL

Distribution of clusters around seed cluster



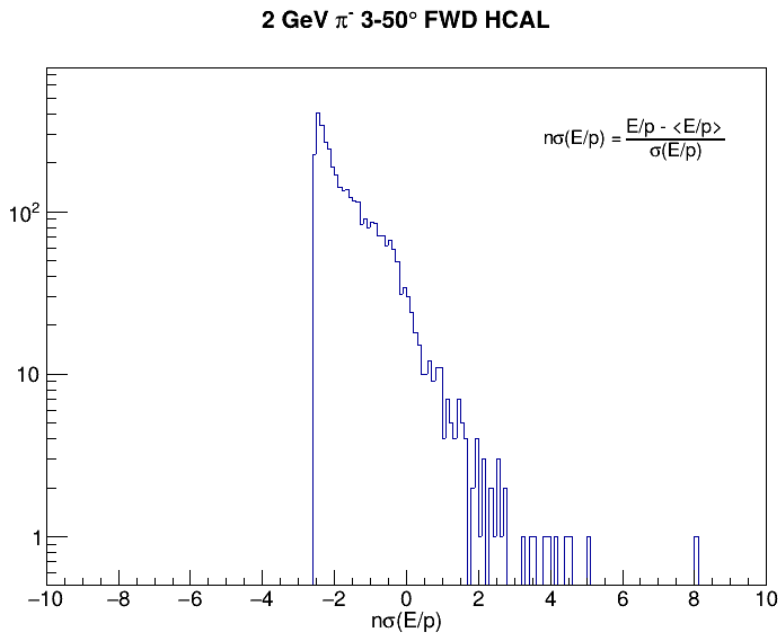


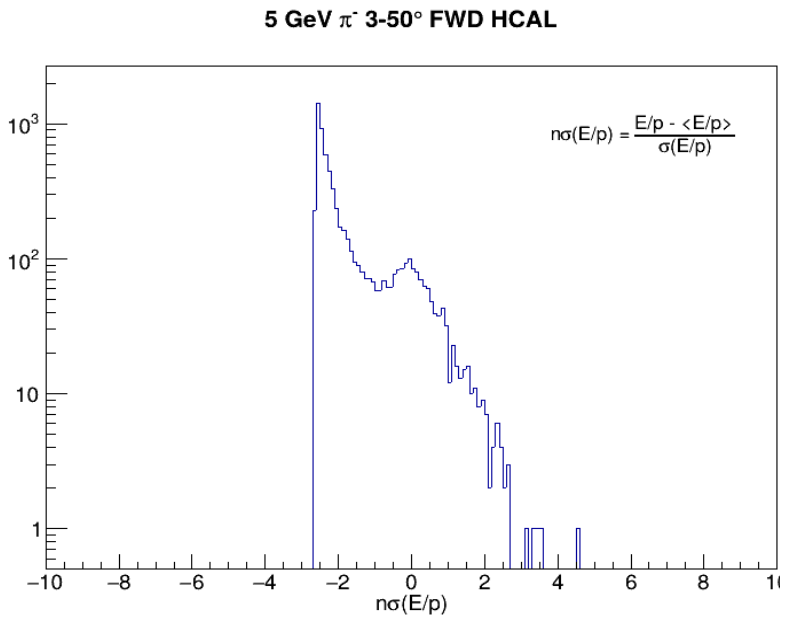


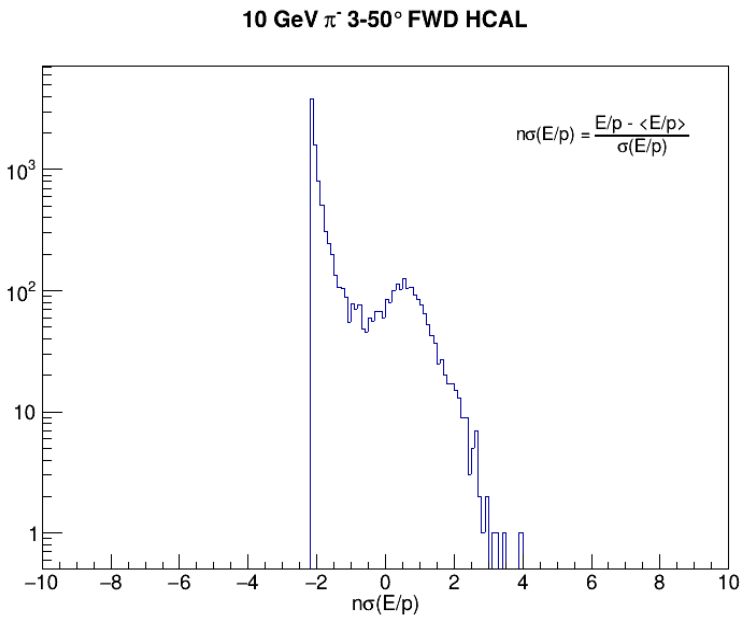
Spatial distribution suggests **ΔR ~ 0.6** to capture most of the shower

LFHCAL

Significance distribution of all clusters



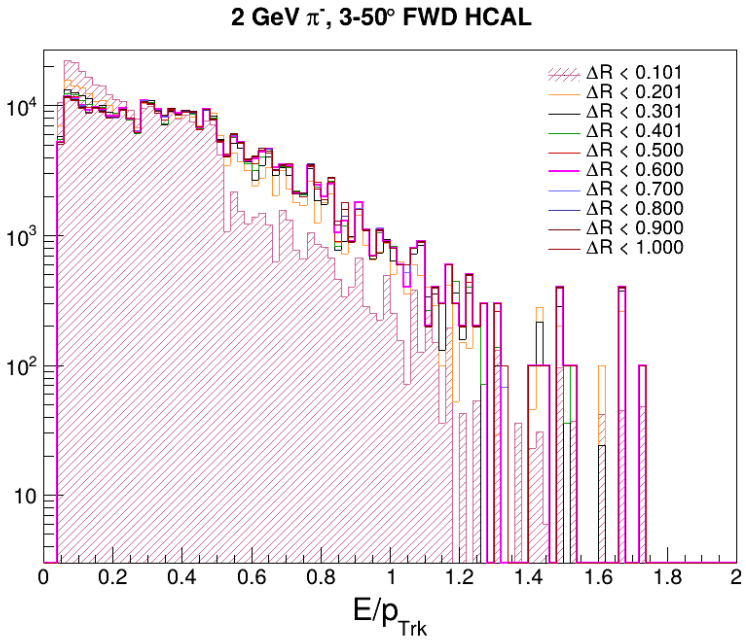


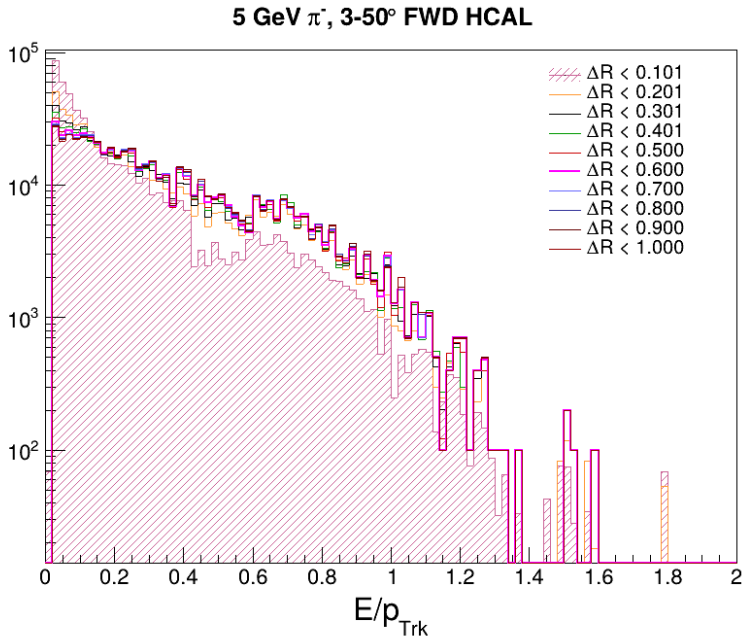


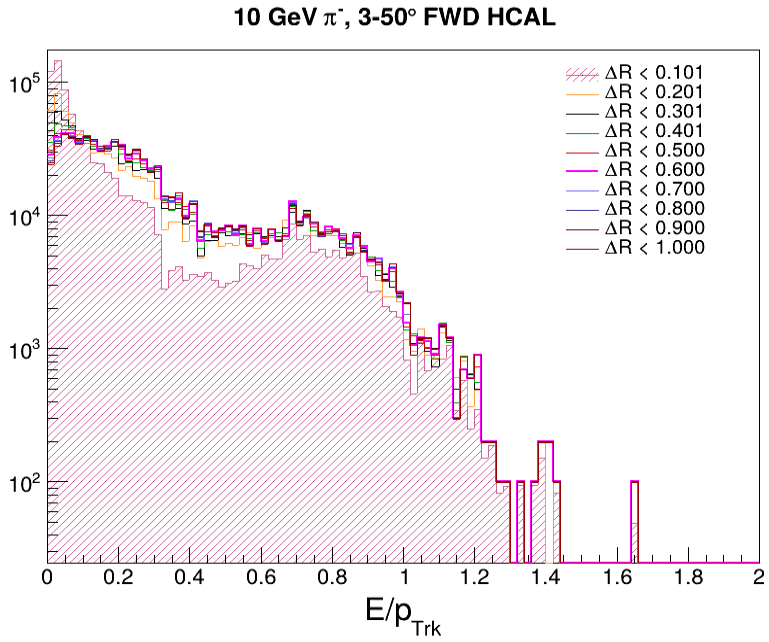
By eye, I picked **Sig = -1** to be the boundary between fragmented and unfragmented clusters

LFHCAL

Evolution of E/p as we merge fragmented clusters within a cone of radius ΔR



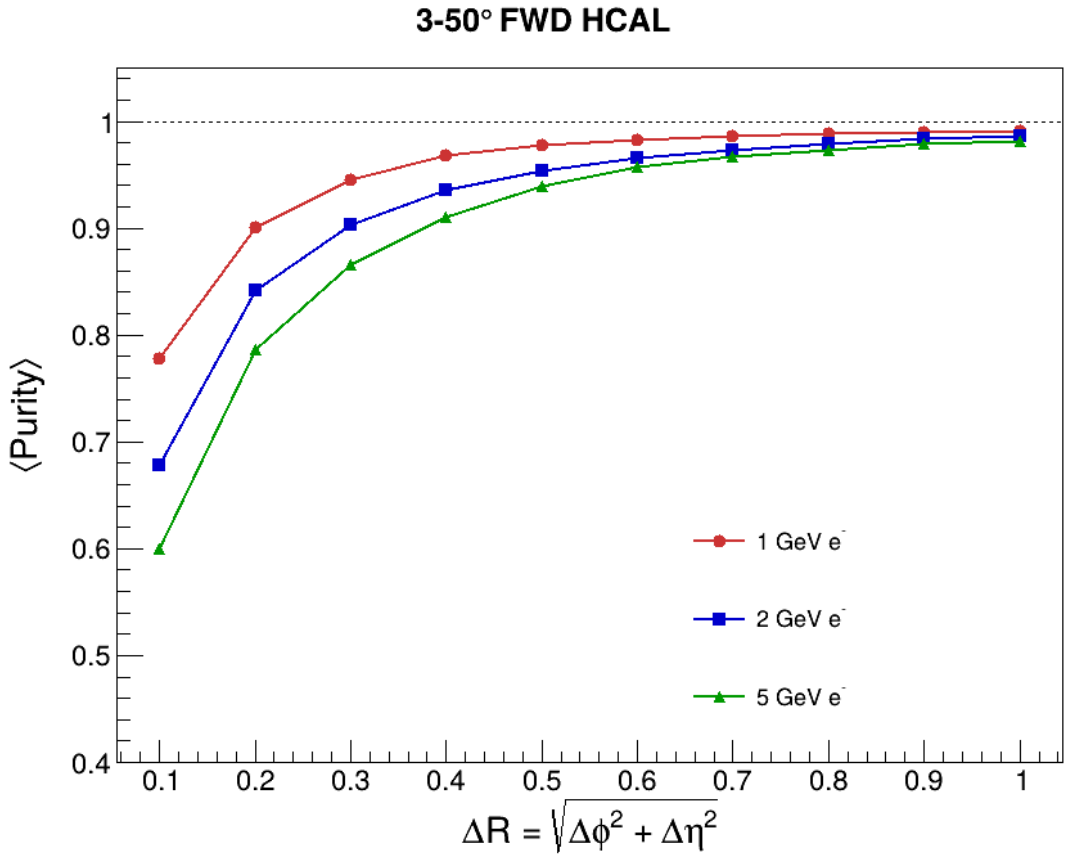




I chose the pink bold line at **ΔR = 0.6**

LFHCAL

Evolution of Purity as we merge fragmented clusters within a cone of radius ΔR, for different energies

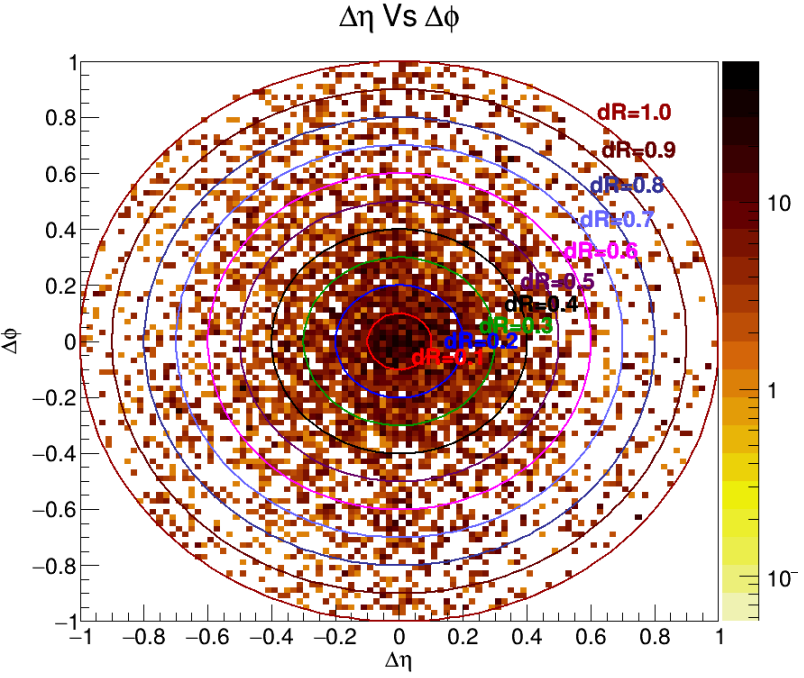


More than 90% purity is achieved at **ΔR = 0.5 ~ 0.6** serves as optimal merging window. If we intend to pick a consistent value, **ΔR = 0.6**

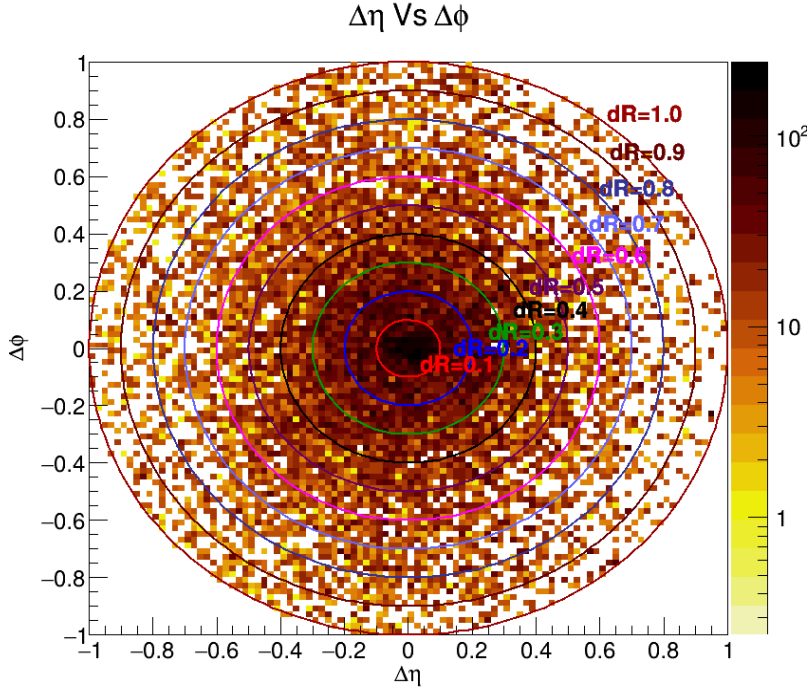
NHCAL

Distribution of clusters around seed cluster

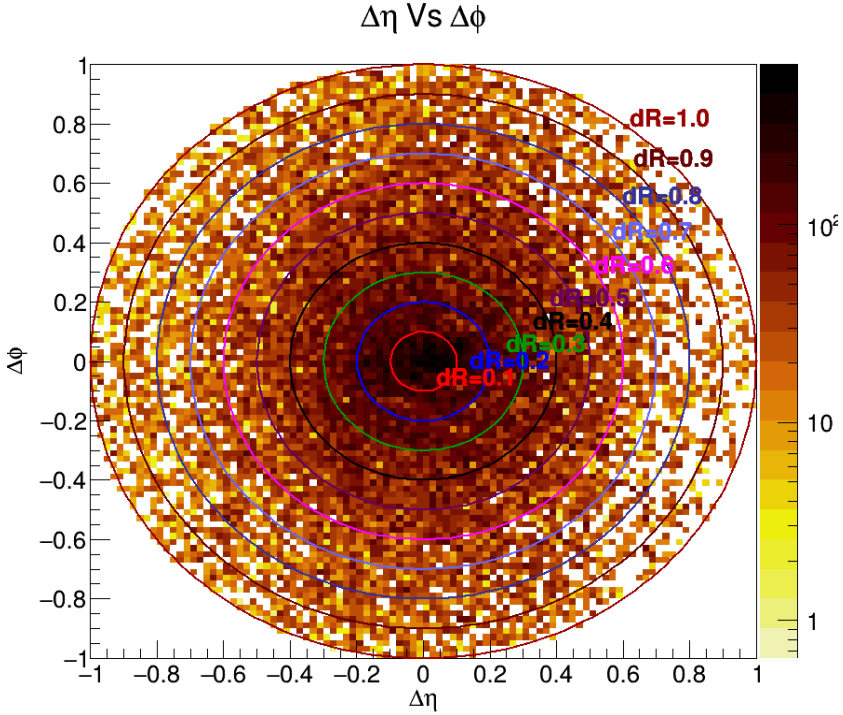
2 GeV pi-



5 GeV pi-



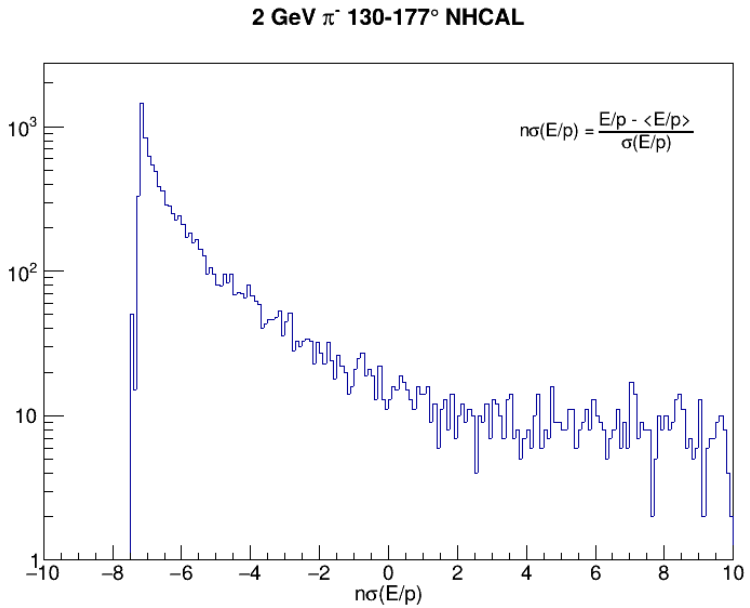
10 GeV pi-

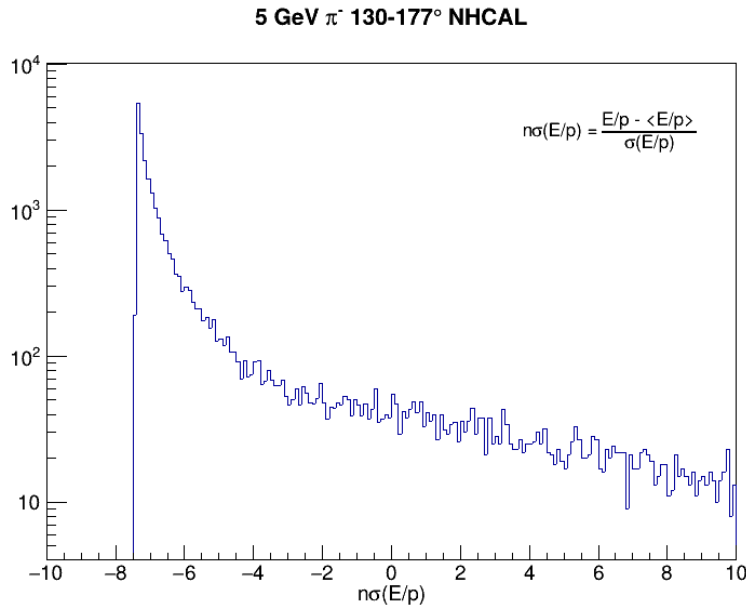


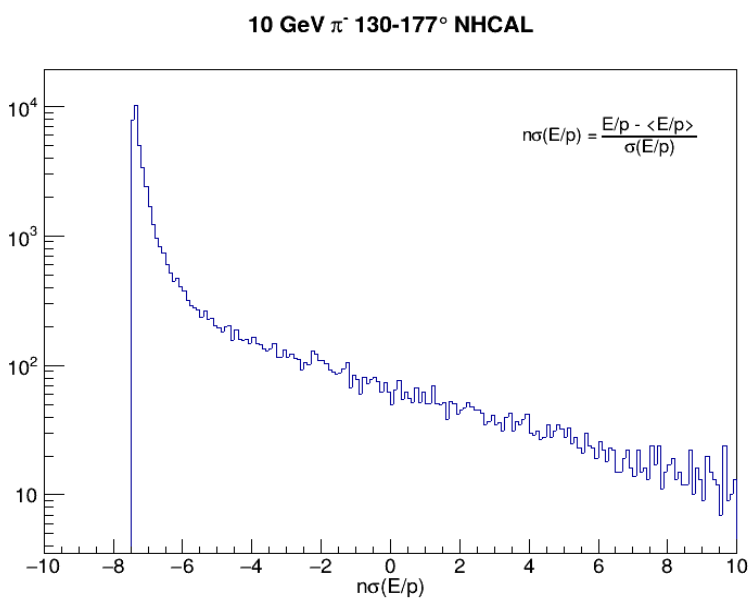
It looks like there's too much spread in clusters, is that expected?

NHCAL

Significance distribution of all clusters



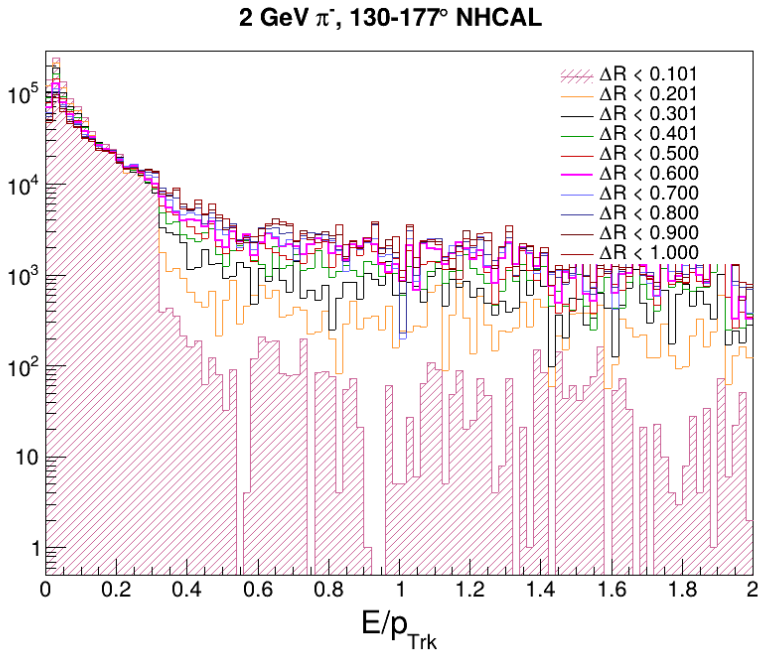


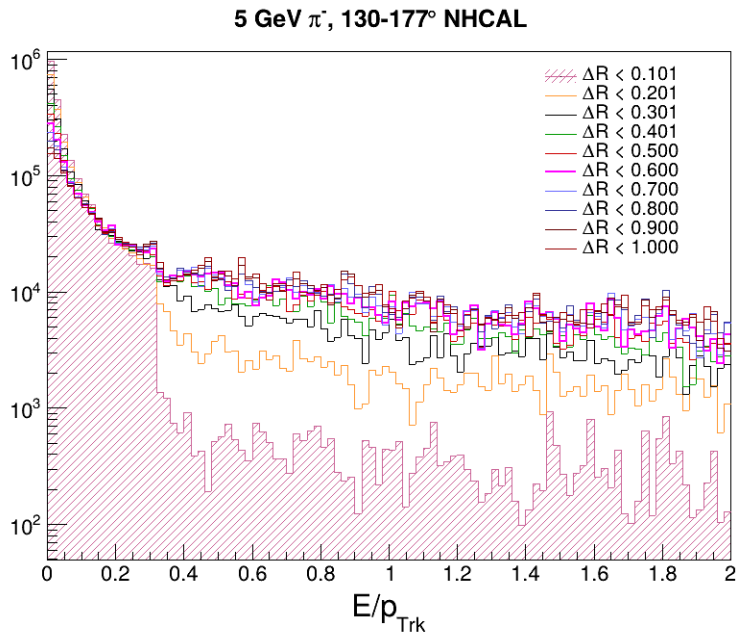


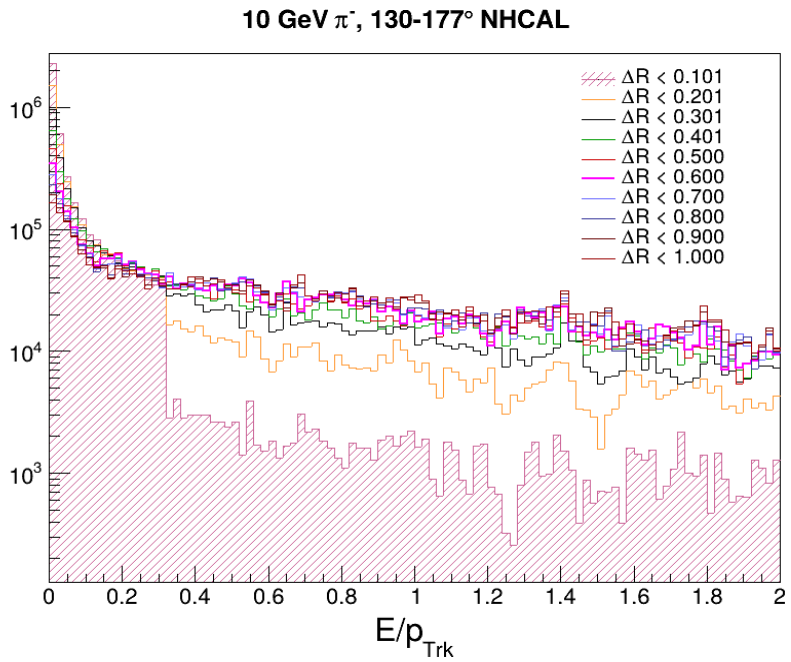
There is no distinction between unfragmented and fragmented clusters

NHCAL

Evolution of Purity as we merge fragmented clusters within a cone of radius ΔR, for different energies







Although I couldn't pick a sigma value from previously attached Sig distributions, I tried to obtain these plots by taking Sig = -2 following my analysis in EMCal and HCal. Similar results have been obtained for Sig = -1 as well. *Again very out of pattern behavior as compared to other Cals*.

Things I need help understanding

- Is this an expected behavior with NHCAL
- Could I get any material to read and understand more about it
- Has anybody else seen such behaviors

All comments and suggestions are appreciated.

THANK YOU