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Improvement of jet reconstruction in forward region with time information from HGTD

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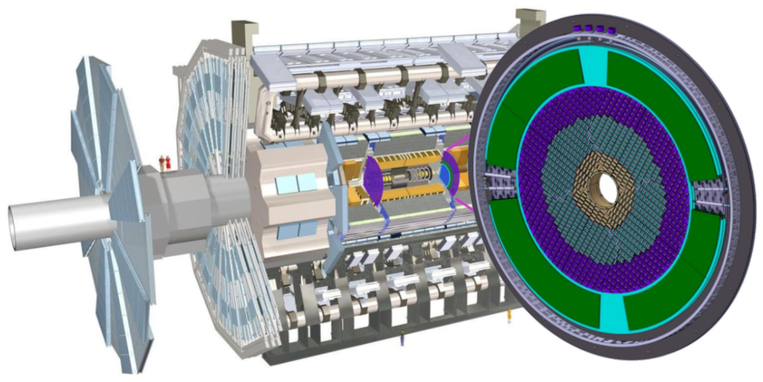
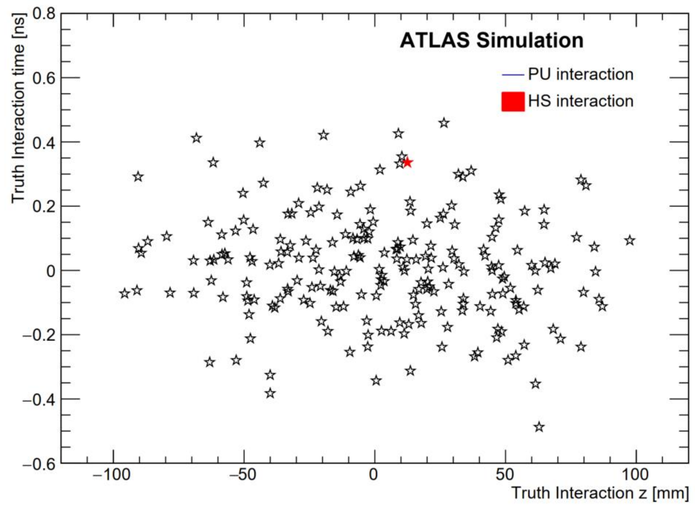
Introduction to HGTD

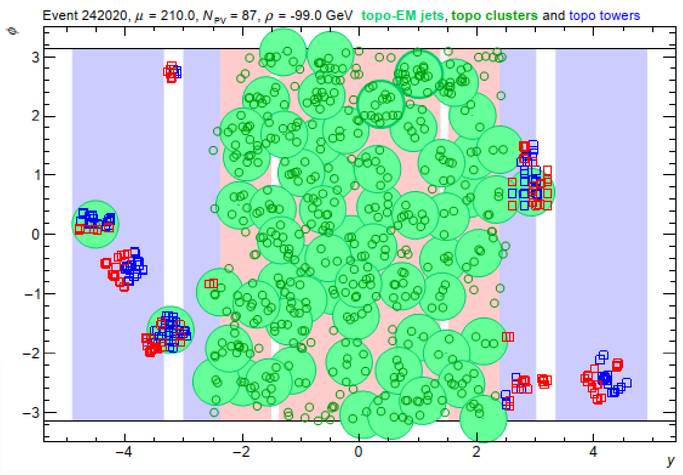


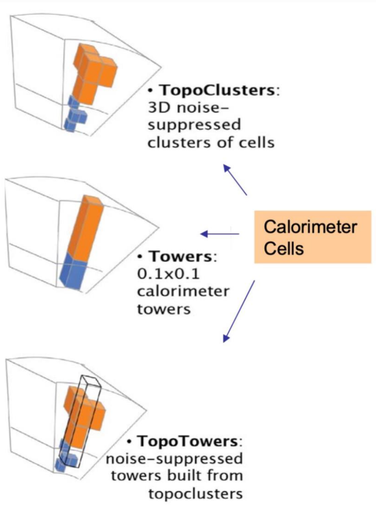
High Granularity Timing Detector (HGTD) is to be installed on each of two EC calorimeters, as parts of upgraded Inner Tracker (ITk).
HGTD can provide precise time information of forward tracks (35 ps), which can be used to reject tracks from in-time pileup vertices.



Jet Reconstruction

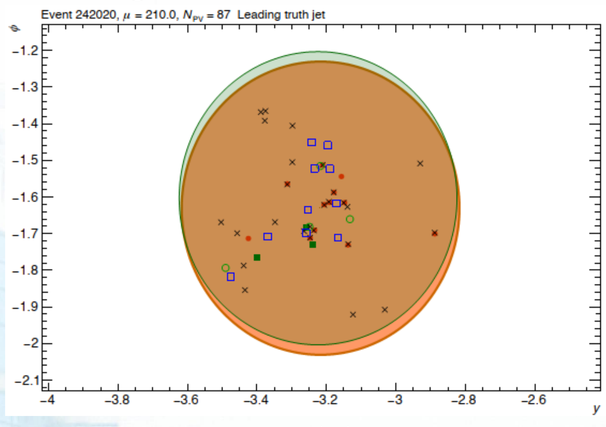
We use MC samples to study forward jets. Jets are reconstructed by FwdTopoTowers and tracks in detector level.





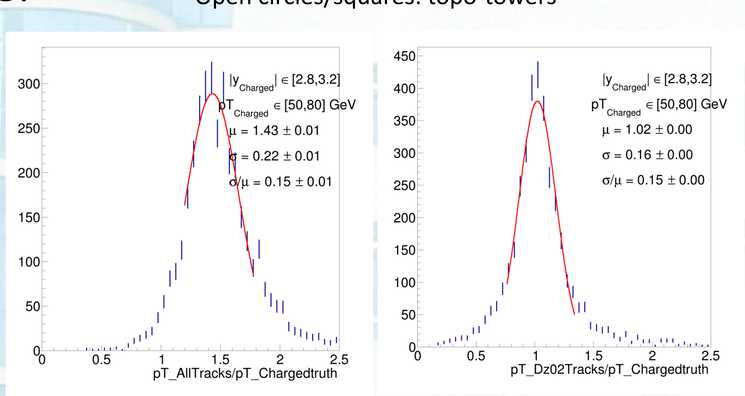
Frequently used EMTopoJet and PflowJet are reconstructed from topo-clusters. We use topo-towers which is split from topoclusters because they have larger multiplicity and can be better used in track matching.

Tracks can match to topo-towers. With the time information from HGTD, we can reject pileup tracks and their calorimeter component, so as to improve Jet energy resolution.



Labels
Crosses: tracks
Full circles/squares: charged/neutral particles
Open circles/squares: topo-towers

Spatial (Delta z) cut: require the tracks to be within 2mm from vertex.
Time cut: Require the tracks to be within a time window of vertex time.

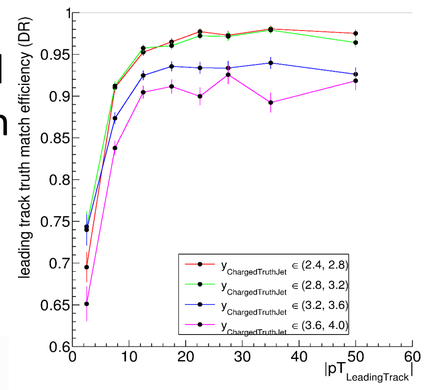


Distribution of track-jet pT over truth-jet (built from charged truth particles) pT. Left shows results from all tracks, while right shows tracks under delta z cut.

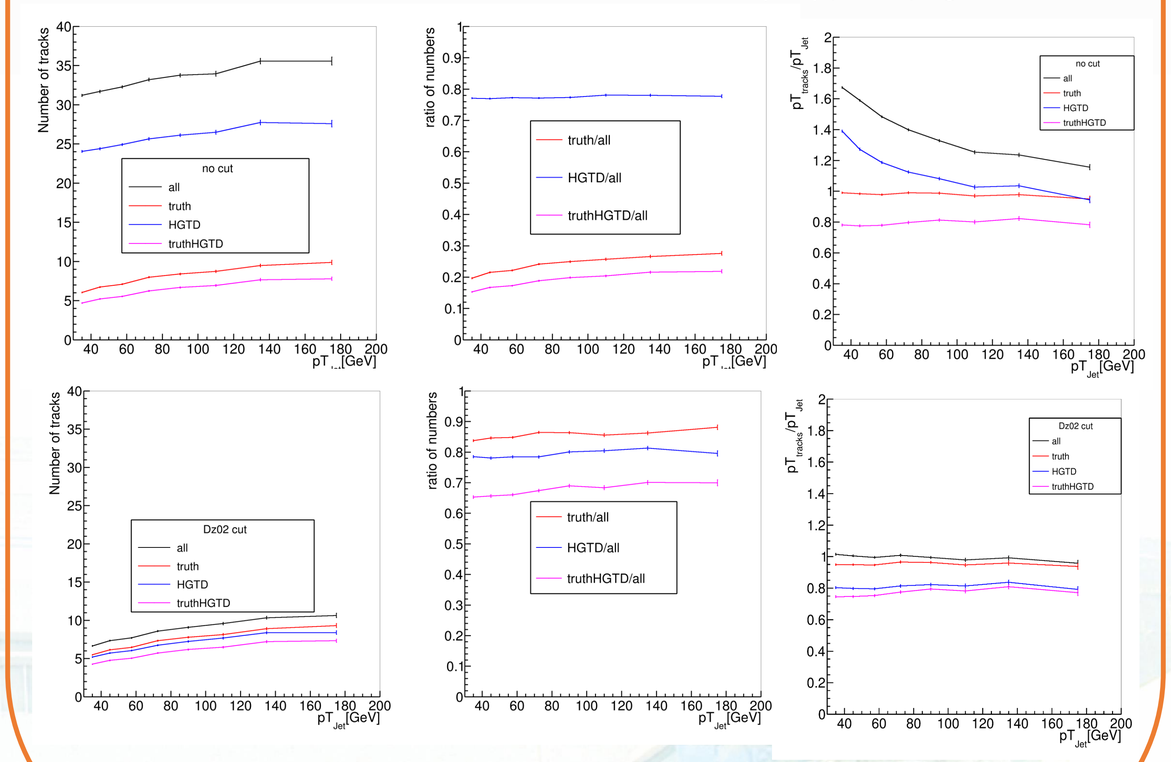
Preliminary Results

To further study the efficiency of our cuts rejecting pileup tracks, we looked how often the leading track can match to a truth particle, with the multiplicity and pT fraction of tracks associated to truth Jets.

Track labels
All: all tracks
Truth: tracks that can match to truth particles
HGTD: tracks that have one HGTD hit
TruthHGTD: both “truth” and “HGTD”



Leading tracks are more likely to be truth matching in high pT and low rapidity (central) region.



Above (bottom) plots show the results before (after) spatial cut.
Track multiplicity and pT fraction are improved (near truth lines) under delta z cut.

Conclusions and Outlook

HGTD is expected to help reject pileup tracks by time cut. We have checked the spatial cut can do a good job and is looking for how much the HGTD can improve the results.

Further studies on matching tracks and topo-towers are in progress.

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