GARLIC
and
ILDopt

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GARLIC

Pre-Clustering via hit distance: RoI

Remove hits close to extrapolated tracks

Per RoI:

Seed finding: 2-dim energy projection of 7X0

Per Seed:

Core building (hits close to seed axis)

Neighbor clustering (front to back)

Simple verification (min.En/hits, distance track)

Gap correction

ANN rejection

Satellite merging

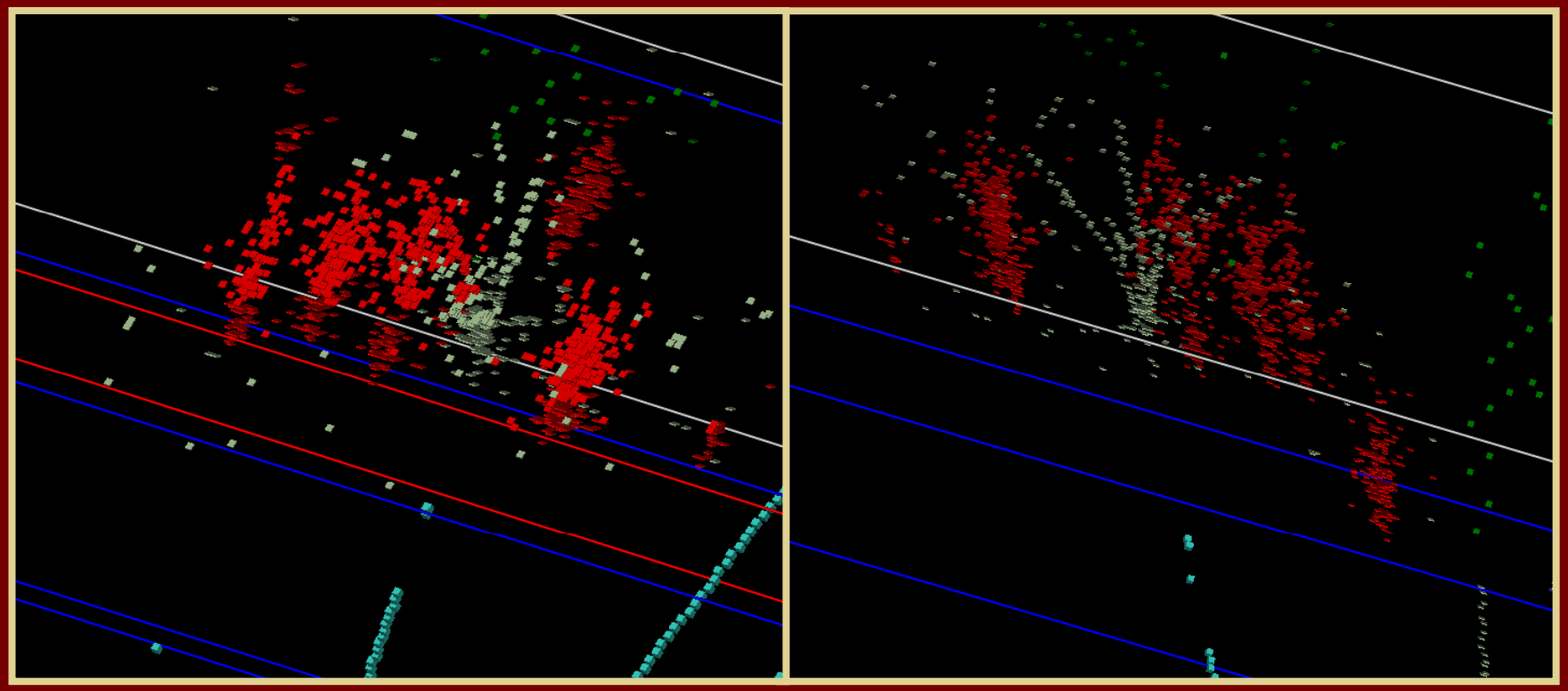
Additional iteration for big clusters

Final energy estimation

Whats new in GARLIC?

- Leakage correction: very difficult to parametrise
- PreShower hits in projection of the TPC endcap
  - X0 = 0.168 (with projection on TPC electronics)
  - X0 = 0.034 (elsewhere)
- Works on all cell sizes including gap correciton
  - Tested 5x5,10x10, 20x20 mm^2

GARLIC for ILD



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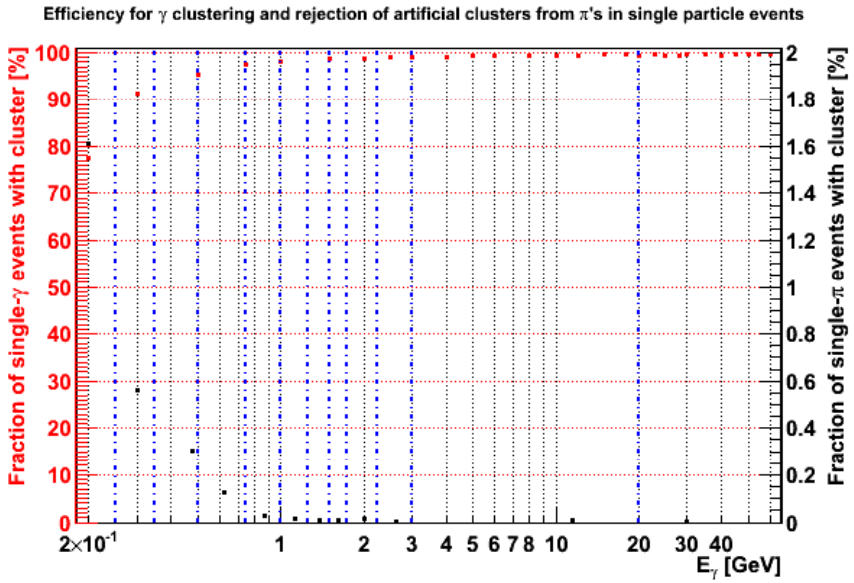
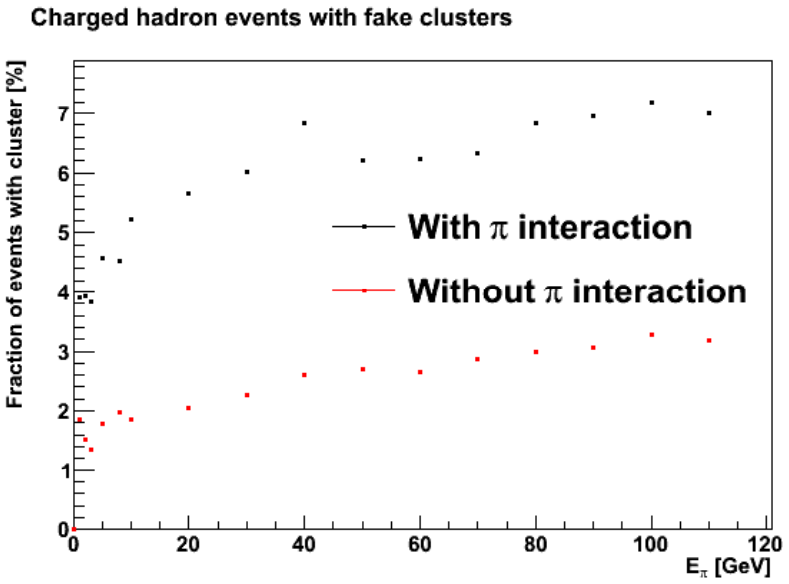
Single particle efficiencies with cuts





Works down to 150MeV
Efficiency:
>96% @ 500 MeV
98.2% @ 1GeV
>99% for E>2GeV

Pion interactions in tracker create fake clusters that are impossible to reject

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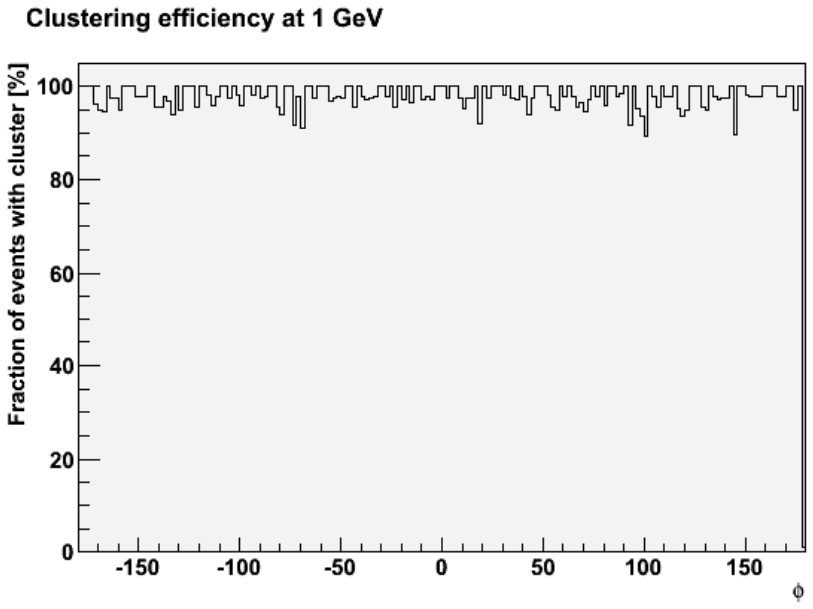
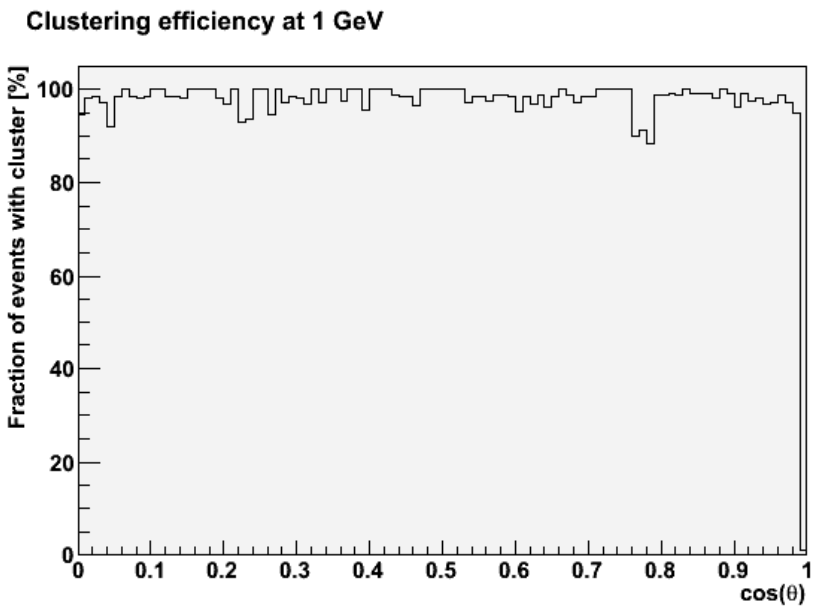
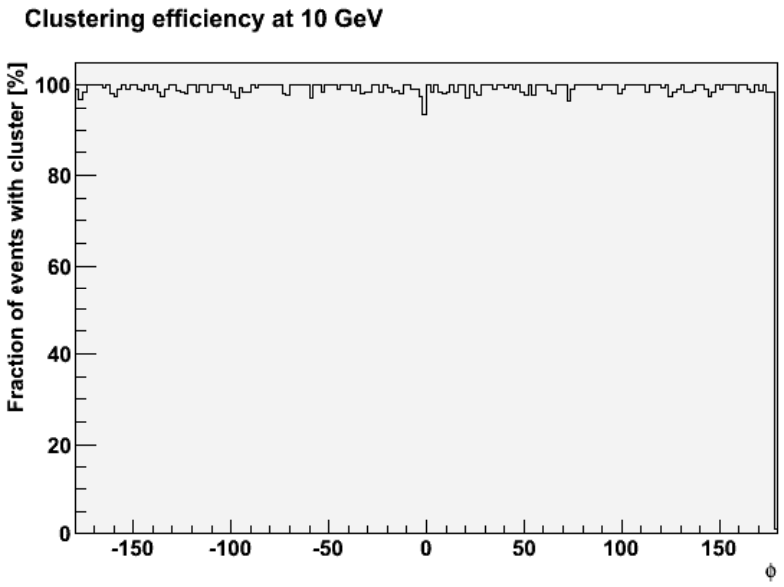
Efficiencies by angle: 1GeV

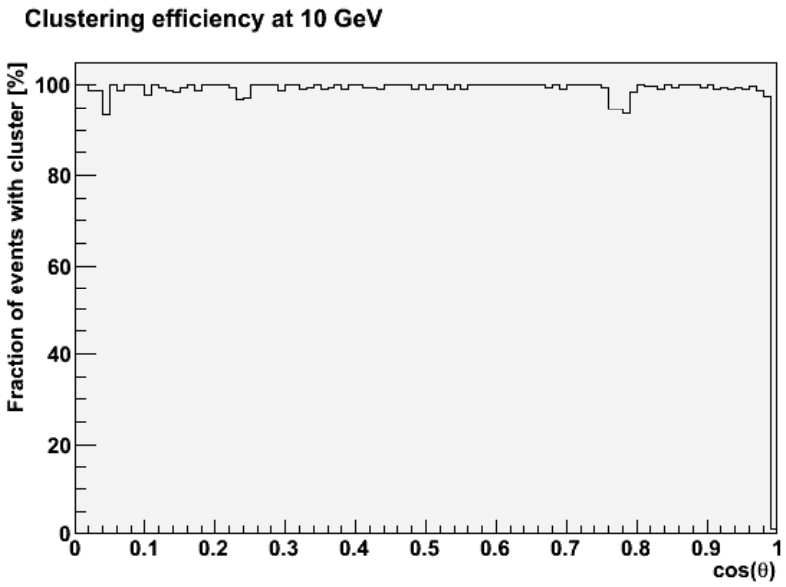




Flat in Φ
Gaps visible in θ

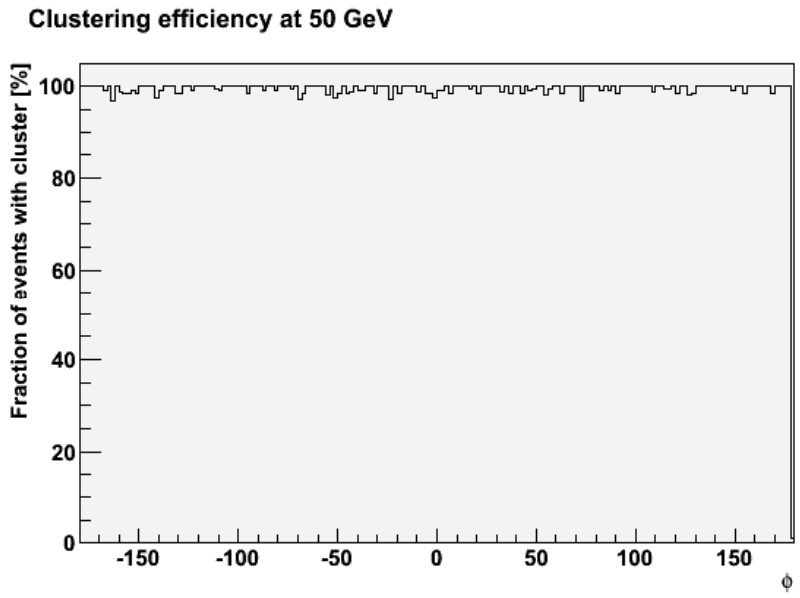
Efficiencies by angle: 10GeV

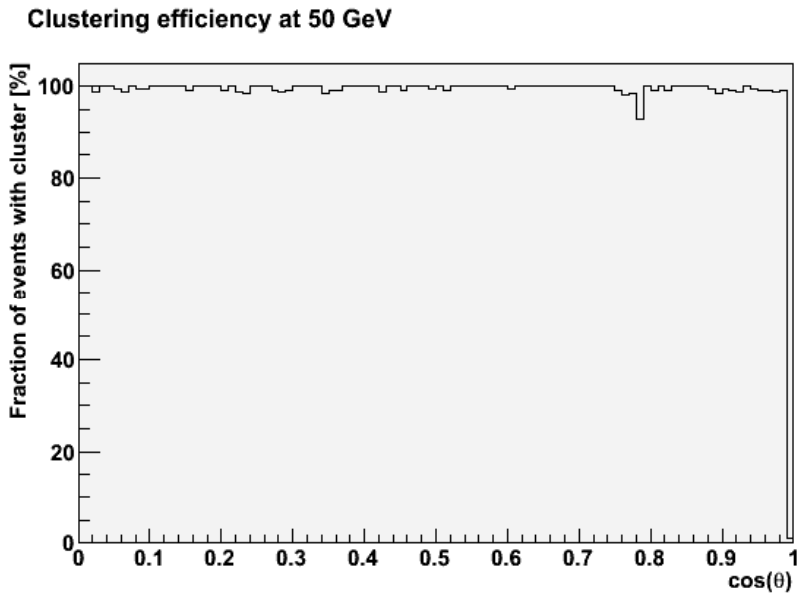




Flat in Φ
Gaps visible in θ

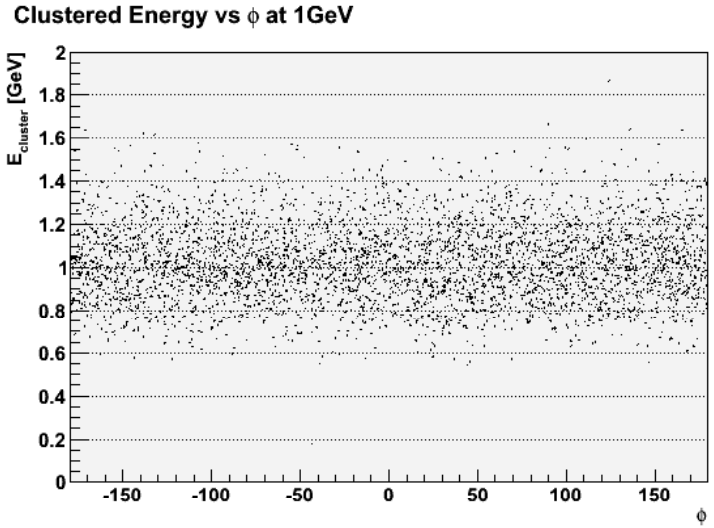
Efficiencies by angle: 50GeV

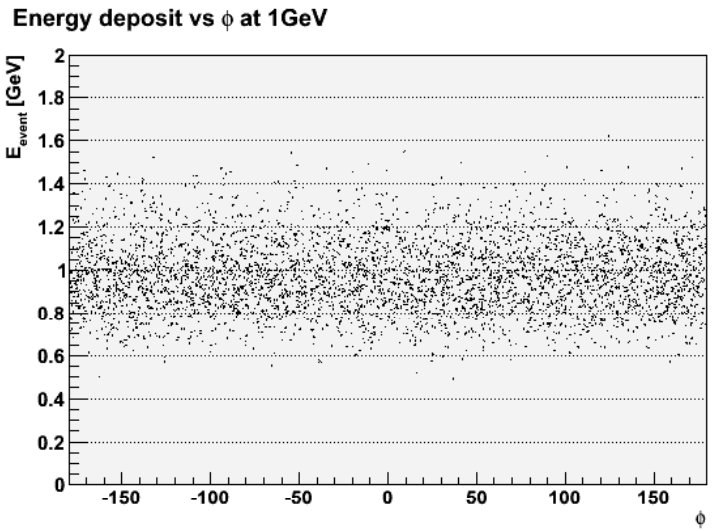


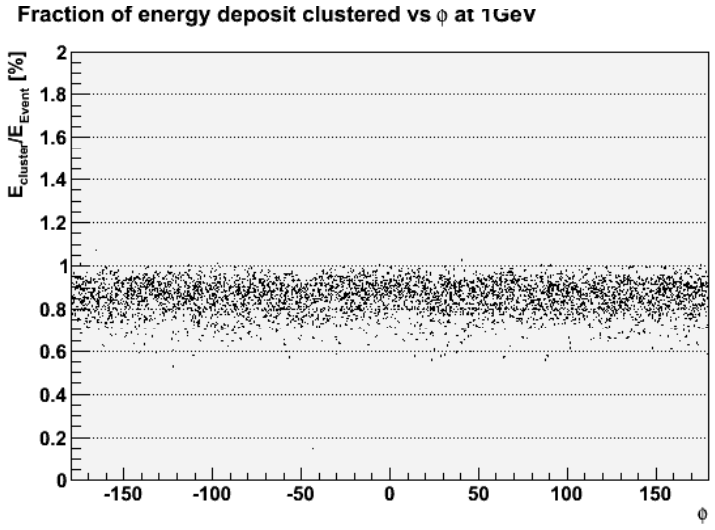


Flat in Φ
Barrel-Endcap overlap visible in θ

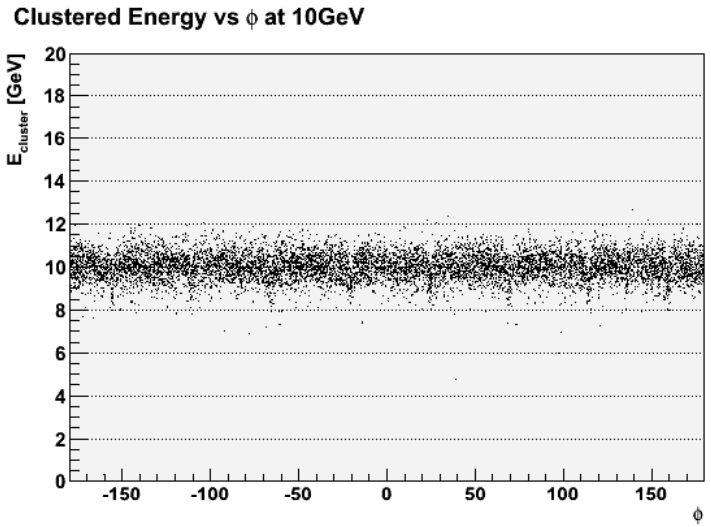
Cluster energy in Φ: 1GeV

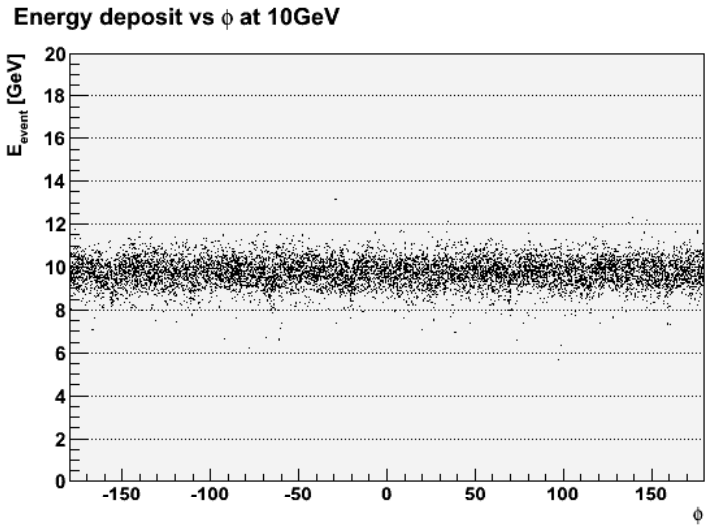


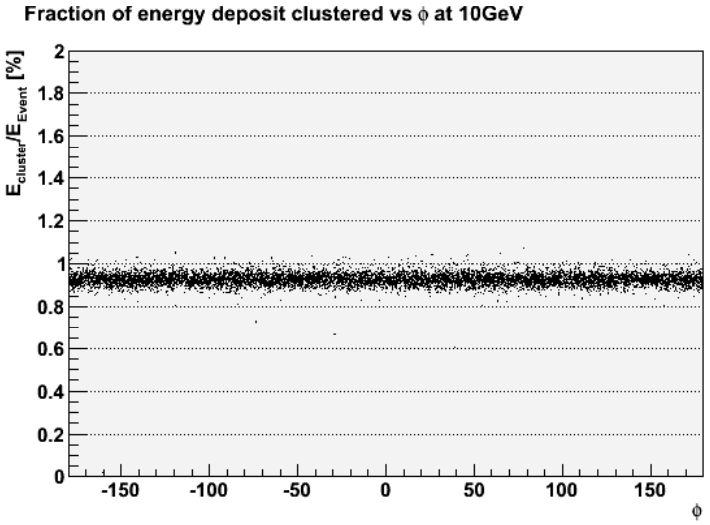




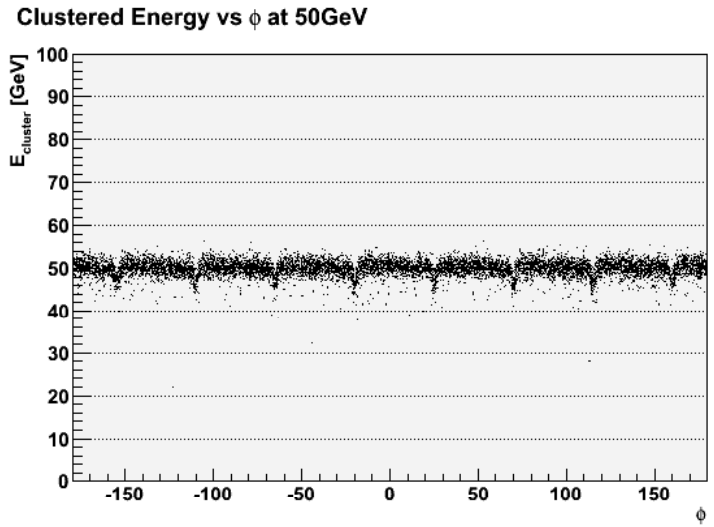
Cluster energy in Φ: 10GeV

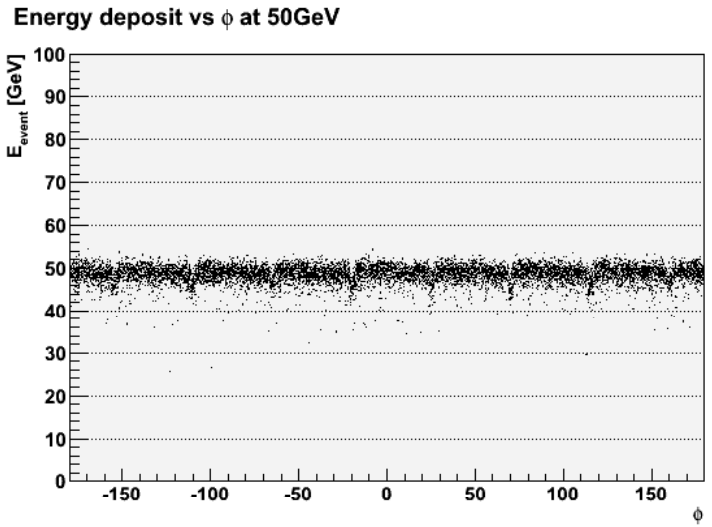


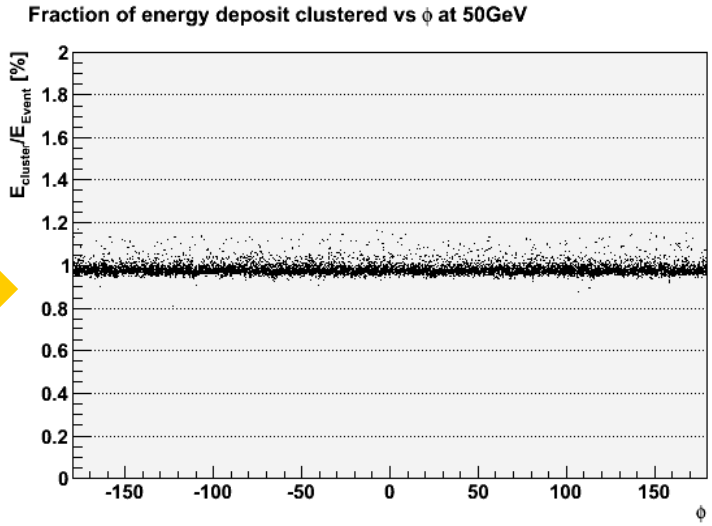




Cluster energy in Φ: 50GeV

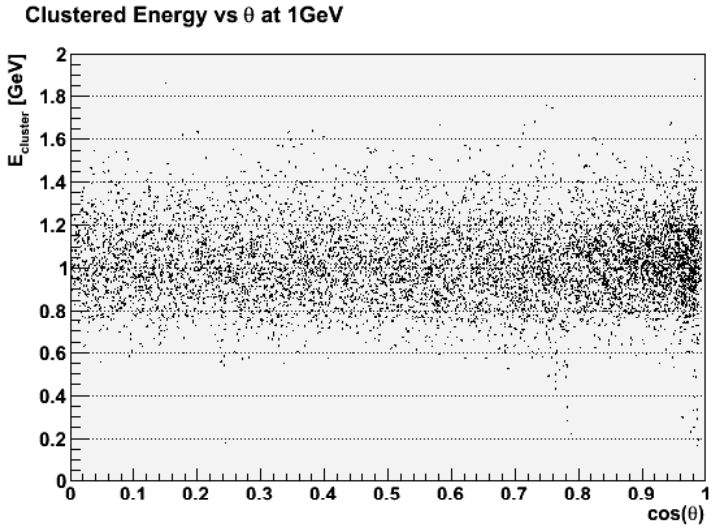


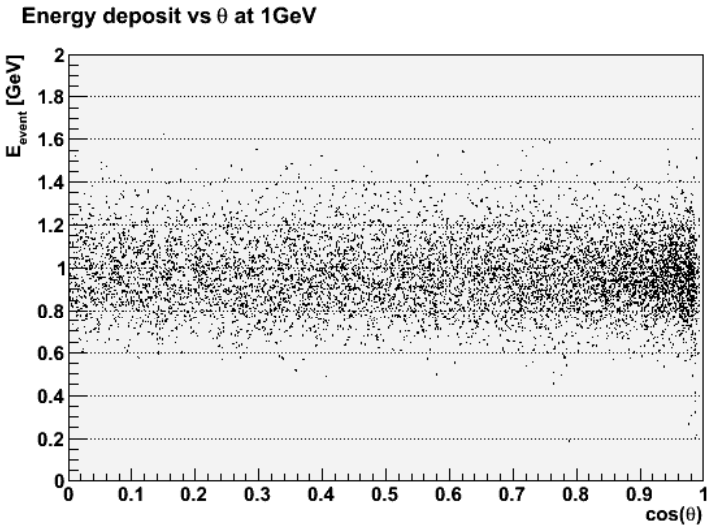


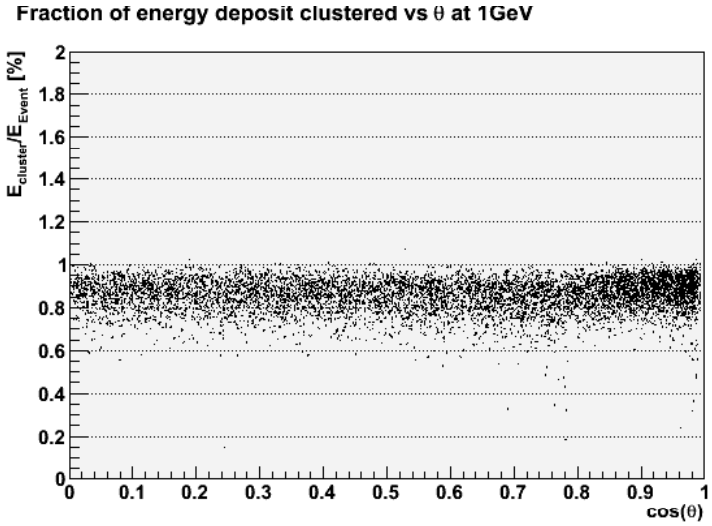


Impact on resolution?
Local correction sufficient?
8 vs. 12-fold geometry?

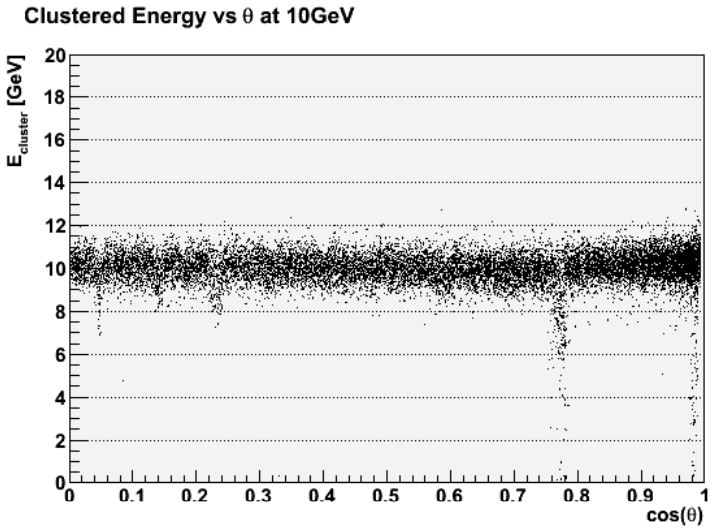
Cluster energy in θ: 1GeV

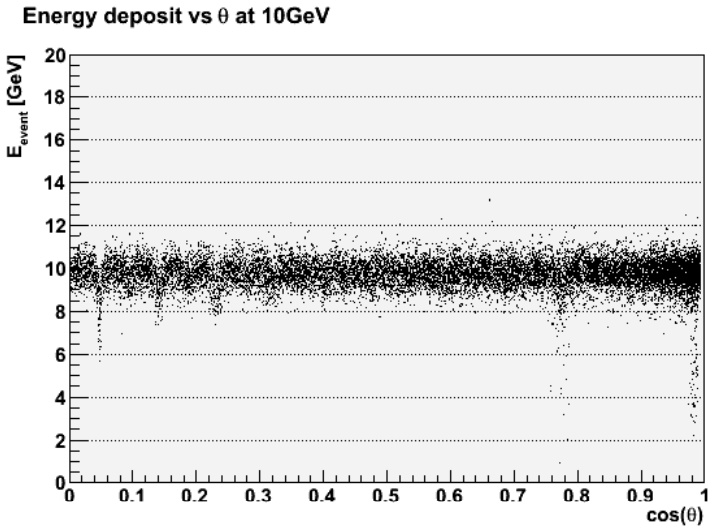


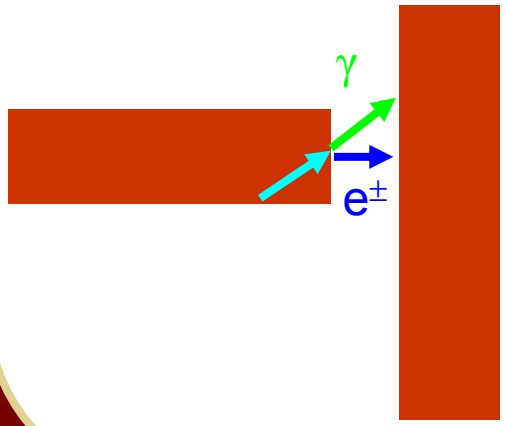


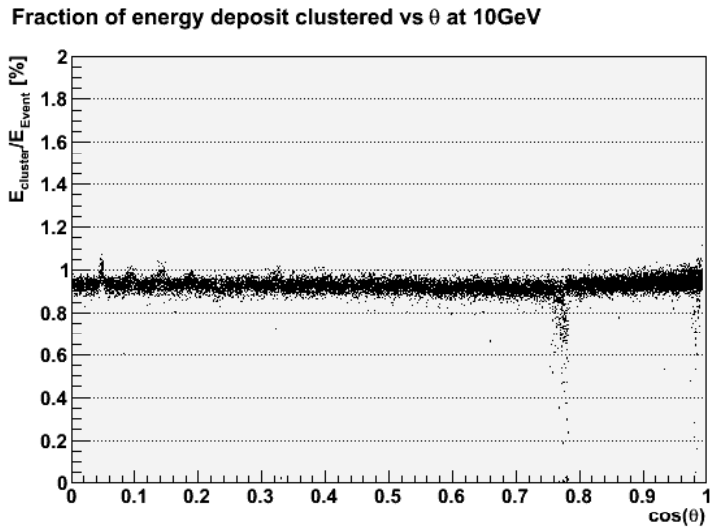


Cluster energy in θ: 10GeV

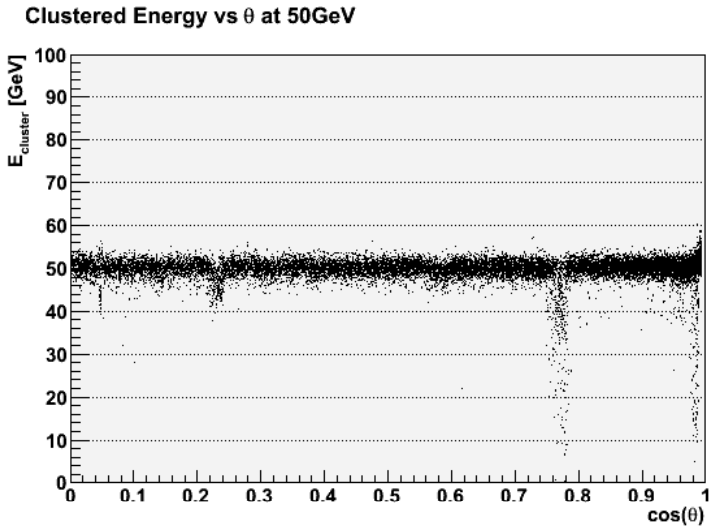


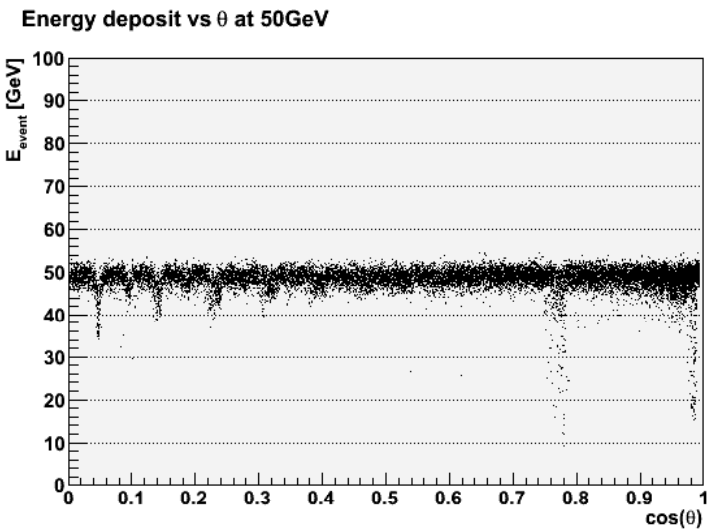


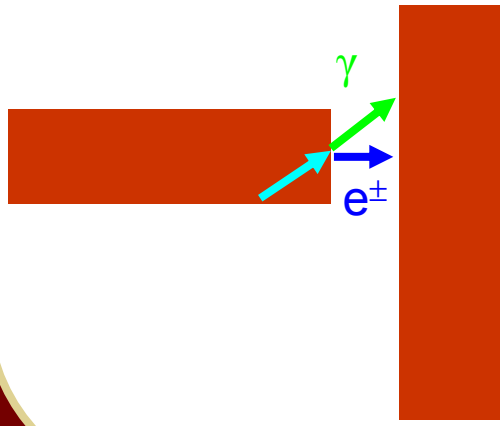


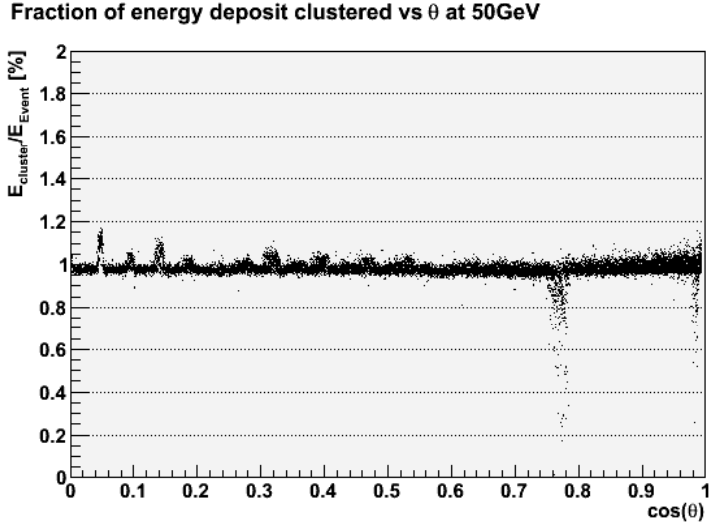


Cluster energy in θ: 50GeV



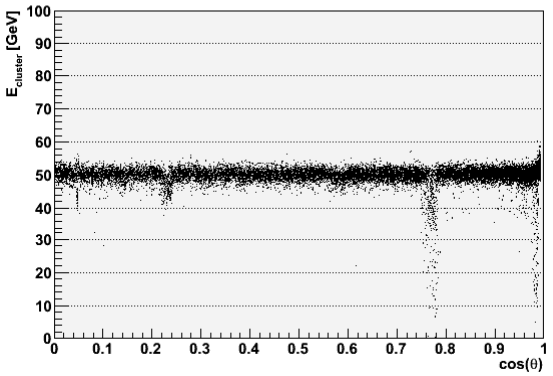




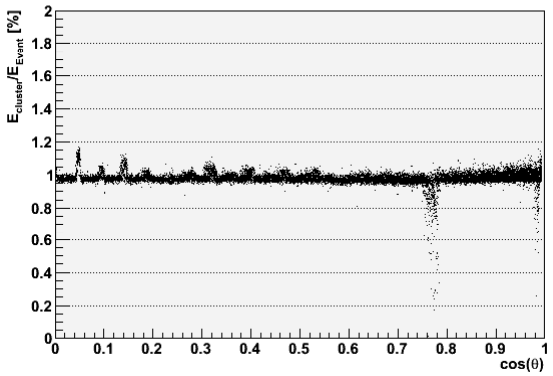


Reduce Barrel-Endcap gap: 40mm

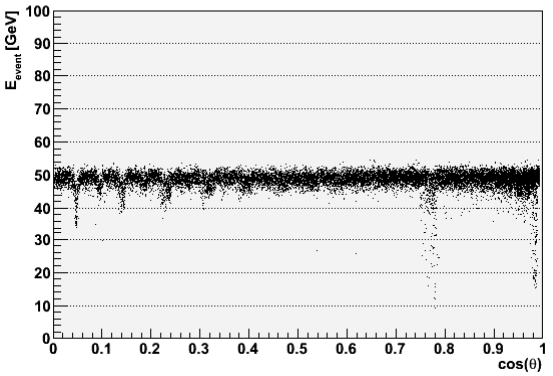
Clustered Energy vs θ at 50GeV



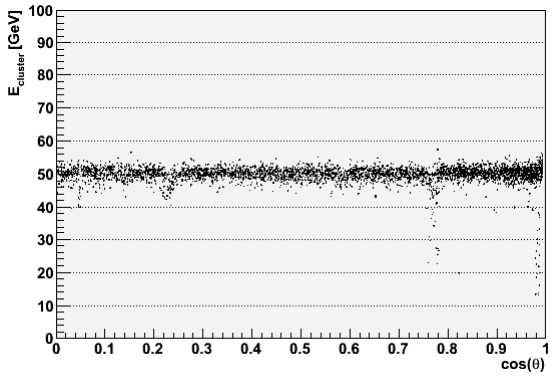
Fraction of energy deposit clustered vs θ at 50GeV



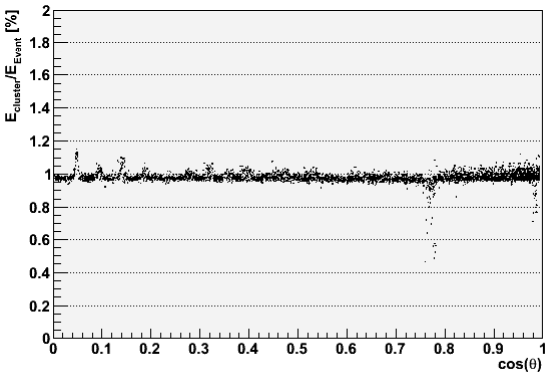
Energy deposit vs θ at 50GeV



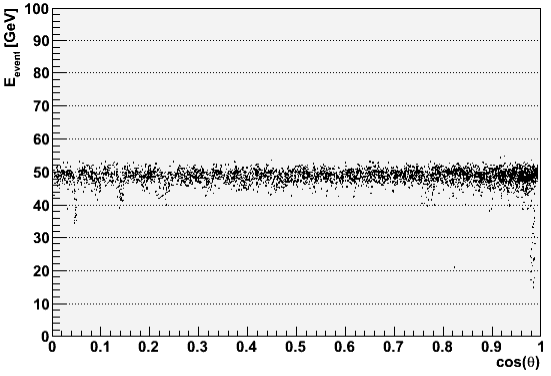
Clustered Energy vs θ at 50GeV_and reduced cable gap



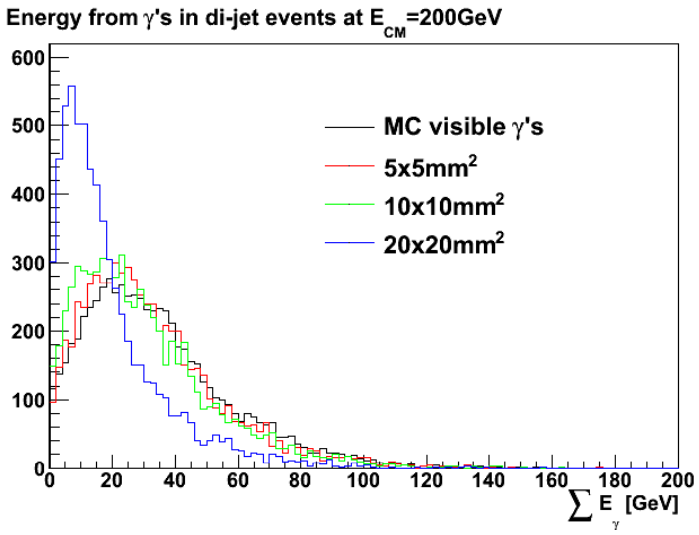
Fraction of energy deposit clustered vs θ at 50GeV_and reduced cable gap

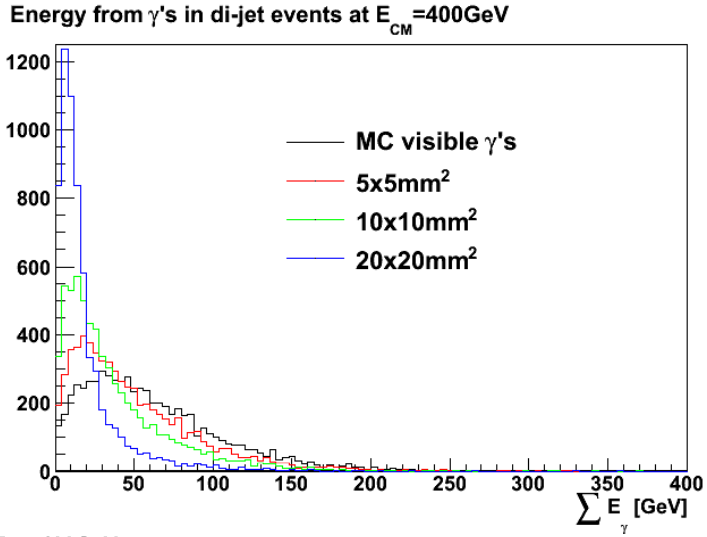


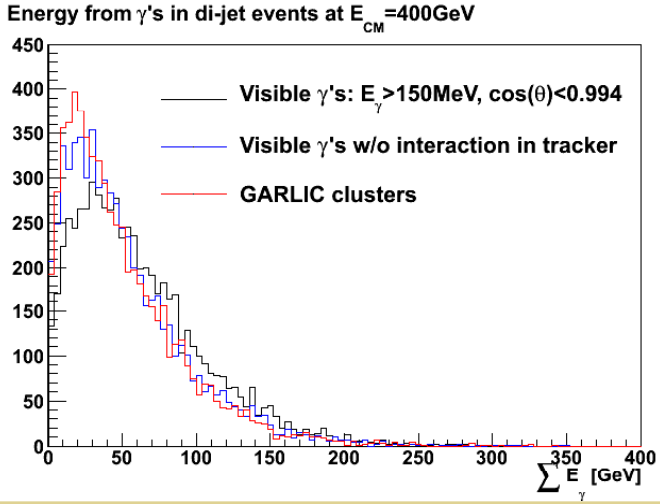
Energy deposit vs θ at 50GeV_and reduced cable gap



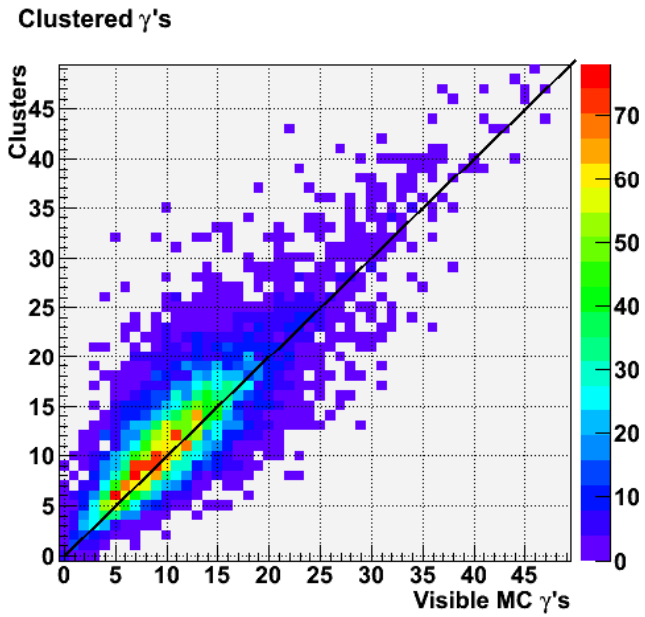
Cell-size: $q\bar{q}$ events

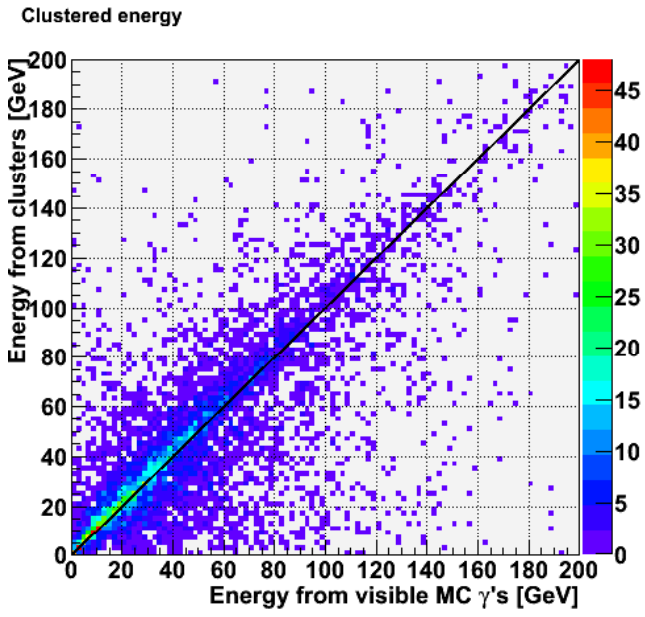






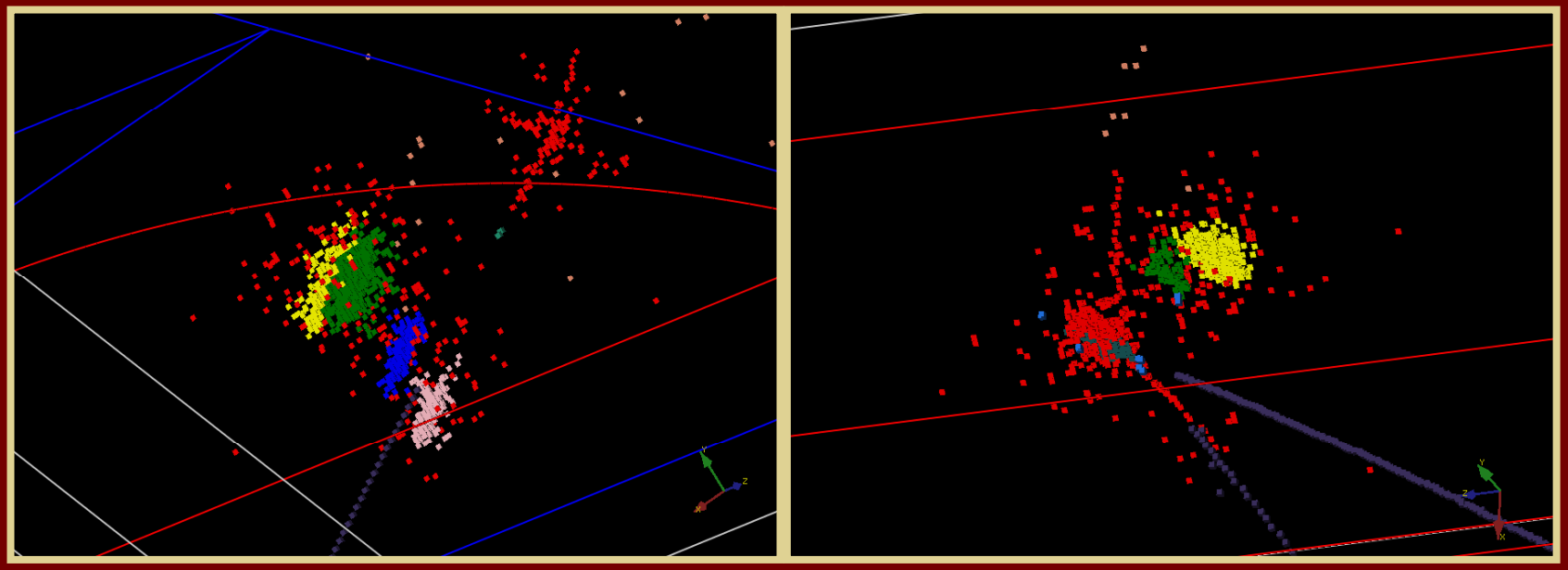
Performance: $q\bar{q}$ at 400GeV



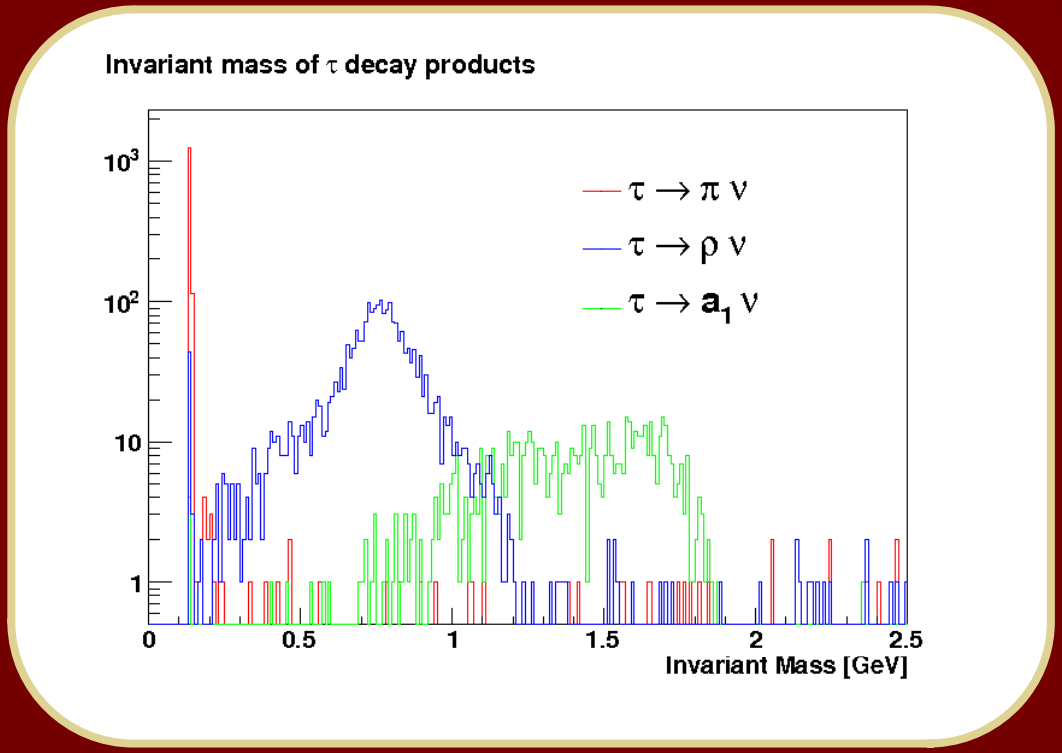


Pion interactions not suppressed
Reasonable performance

GARLIC on τ's



ZH → μμ ττ



	π sim	ρ sim	A1 sim
π Rec	90.8	1.9	0.6
ρ Rec	1.1	86.5	10.9
a1 Rec	8.1	11.6	88.5

Outlook

- Refine gap-correction
- Use hit count for low energy
- Develop better leakage correction
- PreShower hits negligible for resolution, differences in populations need to be checked
- 8 or 12-fold geometry? Need to look at loss in energy resolution
- How much can the Barrel-Endcap-gap be reduced? Alternatively need an approach to cluster among “2 ways”
- How to deal with π interactions?
- $\pi/\rho/a_1$ separation for different cell-sizes