Photon(s) reconstruction with GARLIC

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GARLIC

REPLIC

- Pre-Clustering via hit distance: RoI
- Remove hits close to extrapolated tracks

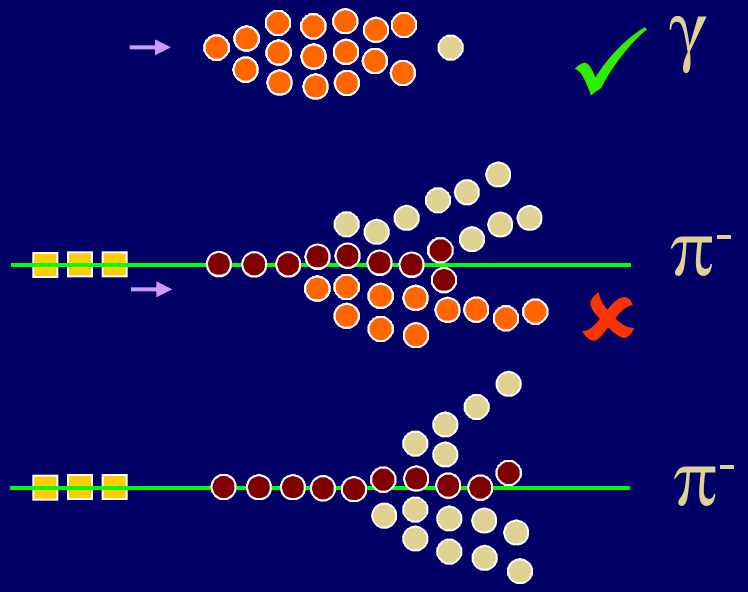
Per RoI:

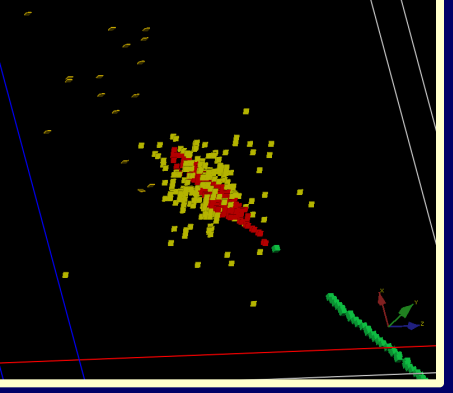
- Seed finding: 2-dim energy projection

Per Seed:

- Core building (hits close to seed axis)
- Neighbor clustering (front to back)
- Simple verification (min.en/hits,dist track)

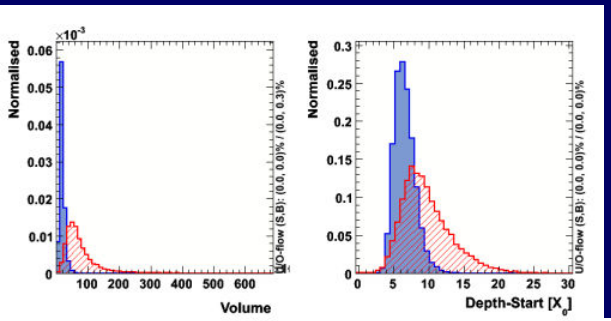
- Gap correction (not in REPLIC)
- ANN rejection (HLM used in REPLIC)
- Satellite merging (Not in REPLIC)
- Final energy estimation





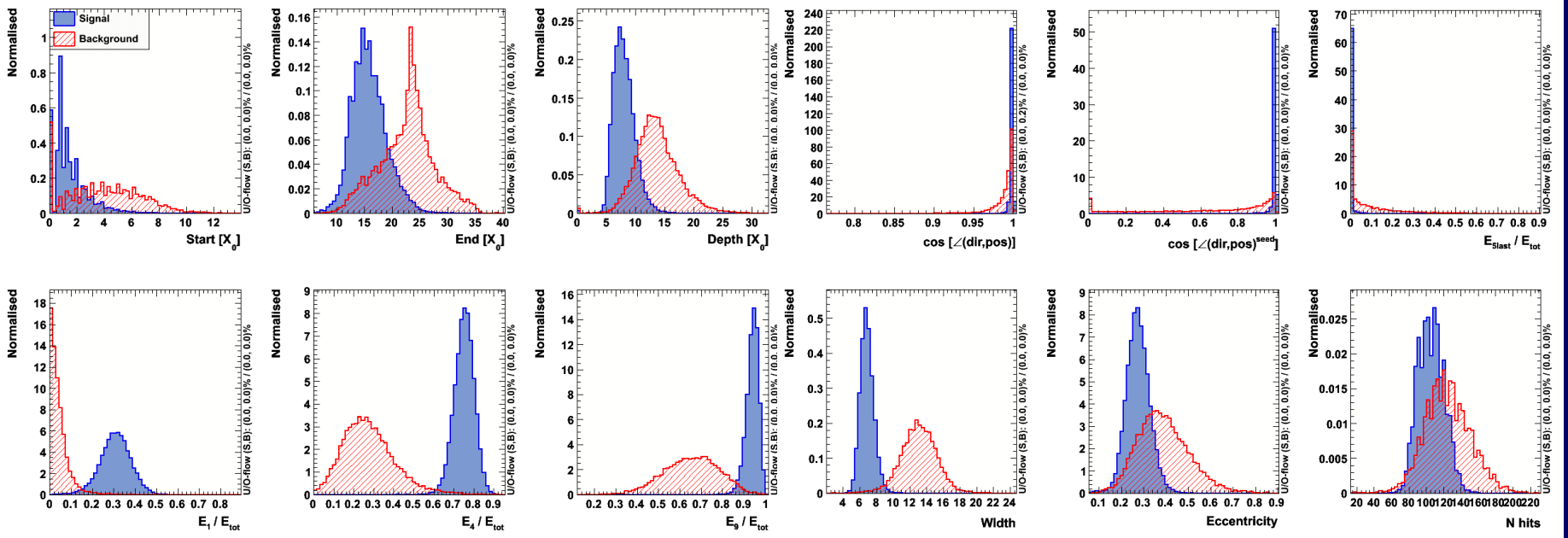
- **Distance variable (default: 2 times cell-size)**

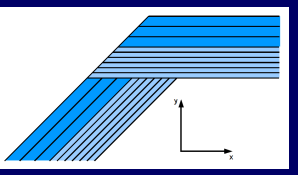
+



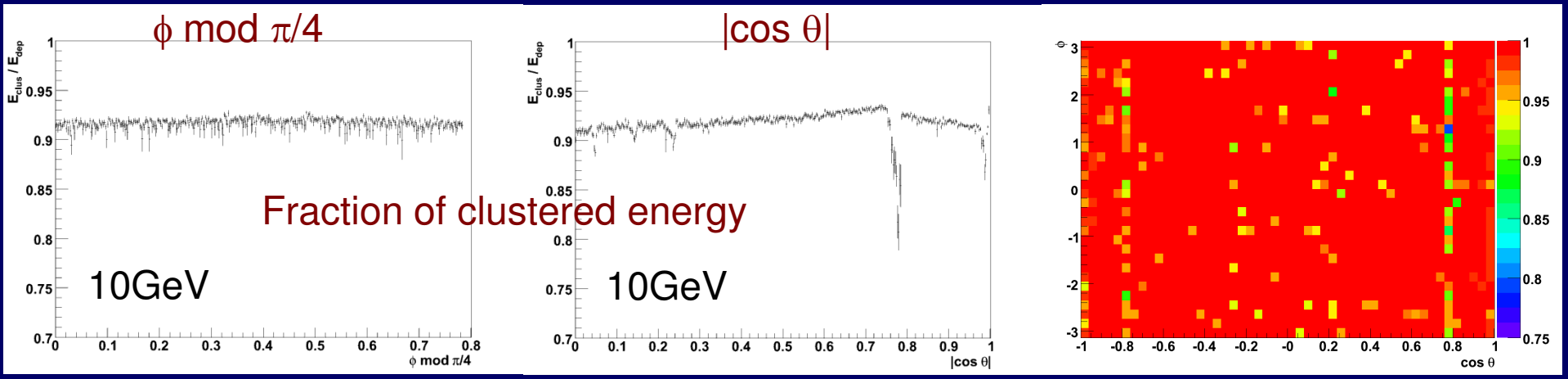
- ANN rejection of fake photon

3-5 GeV

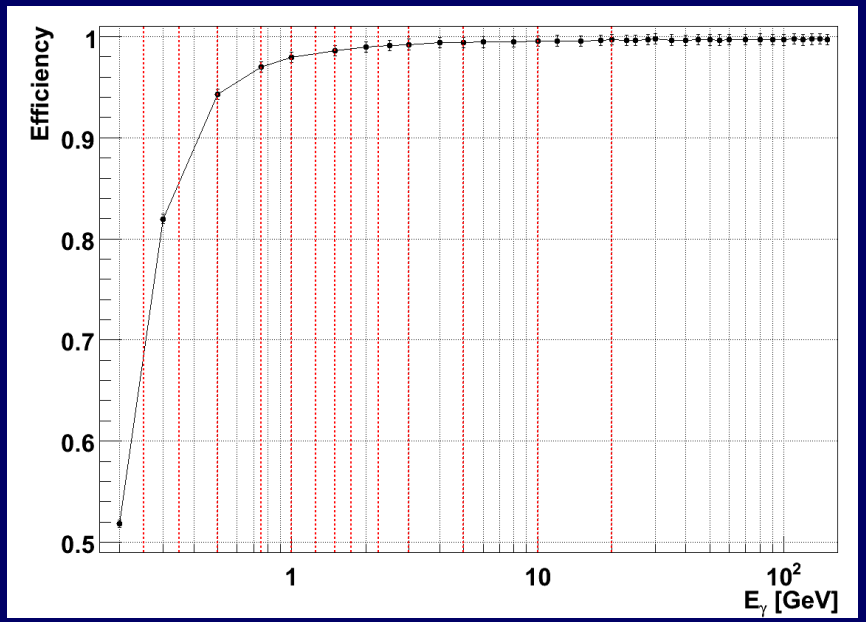




Single photon efficiencies



Uniform fraction of collected energy in ϕ, slight dependence on θ
Uniform efficiency, except critical areas: barrel-endcap overlap, module transitions



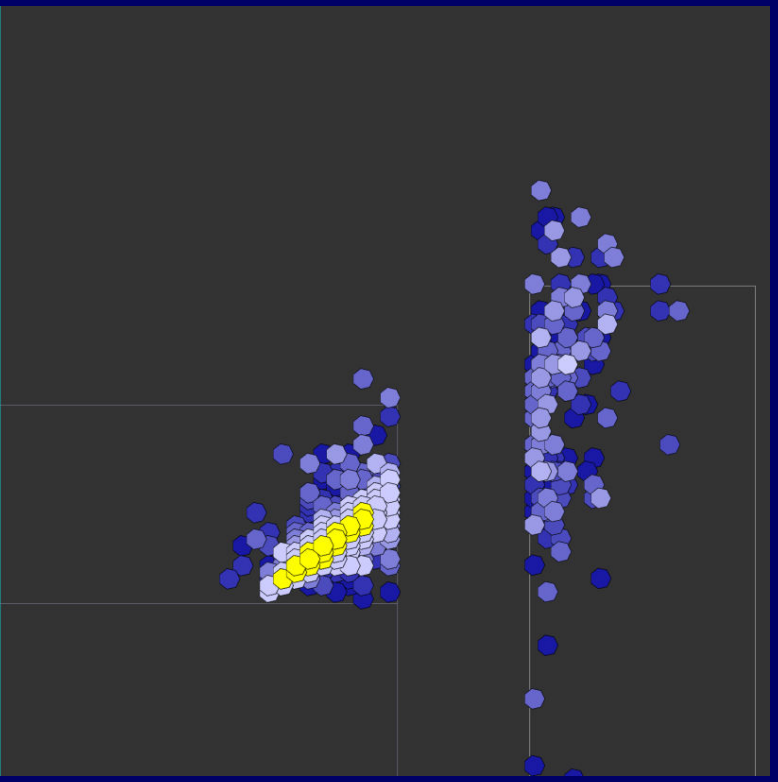
Works down to 150MeV

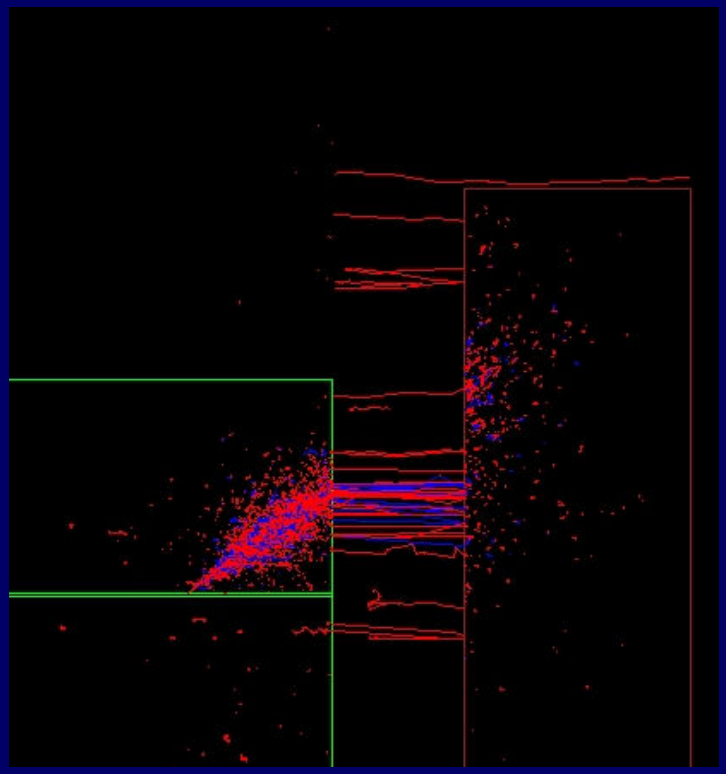
Efficiency:
>94% @ 500 MeV

98% @ 1GeV

>99% for E>2GeV

Barrel-Endcap overlap



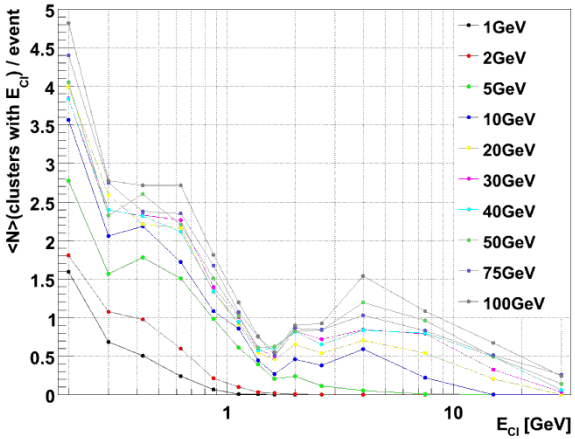


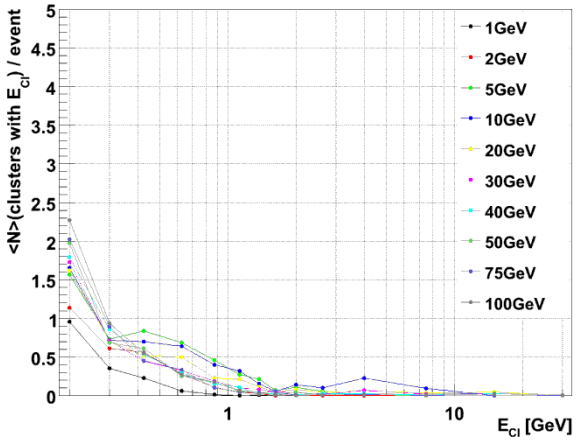
- Absence of high density material (in ILD-MOKKA model) suspends shower development
- γ's continue straight, e^+/e^- are trapped in the B field
- Effective enlargement of the shower in the endcap

Rejection efficiencies

10^2 x <N> of clusters with E_{Cl} created per event

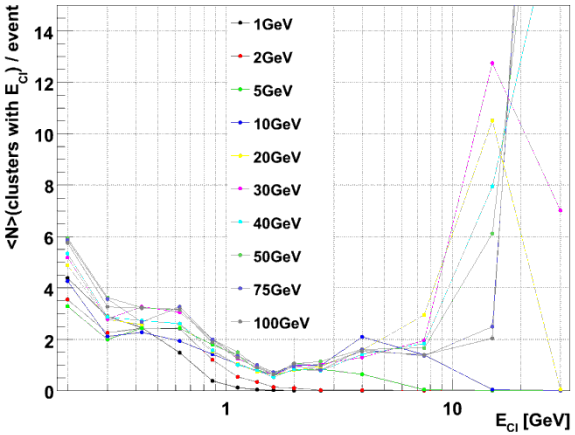
π^-

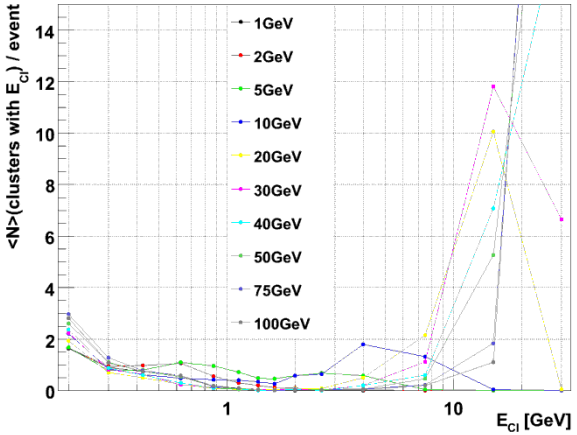




w/o interaction in tracker volume

K^0_L

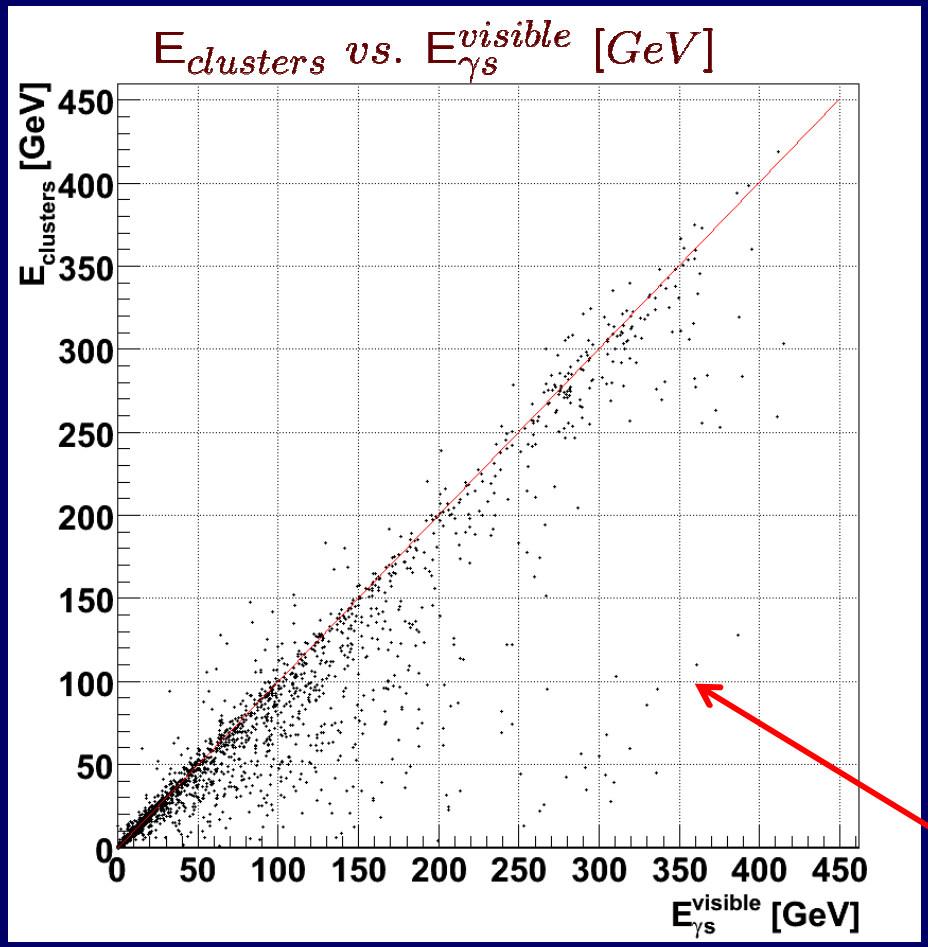


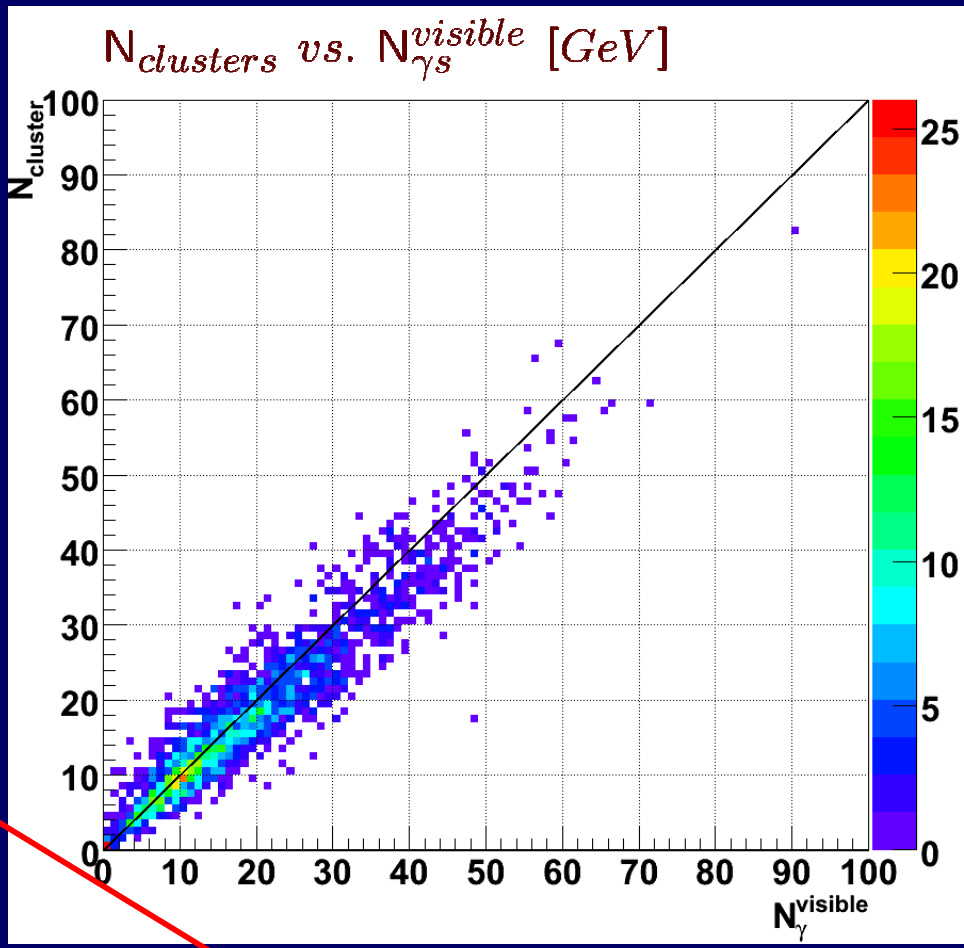


⇒ **Material budget of the tracker !!!**

Performances in jets: uubar at 500GeV

Visible photons: E>150MeV, in the ECAL acceptance





Correlations look good

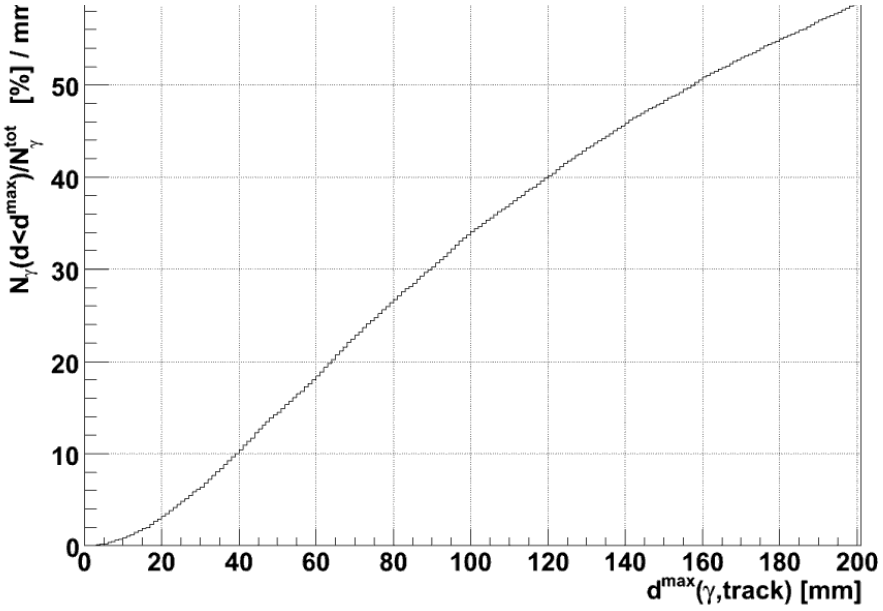
Several cases where a big photon from radiative return to Z pole is lost

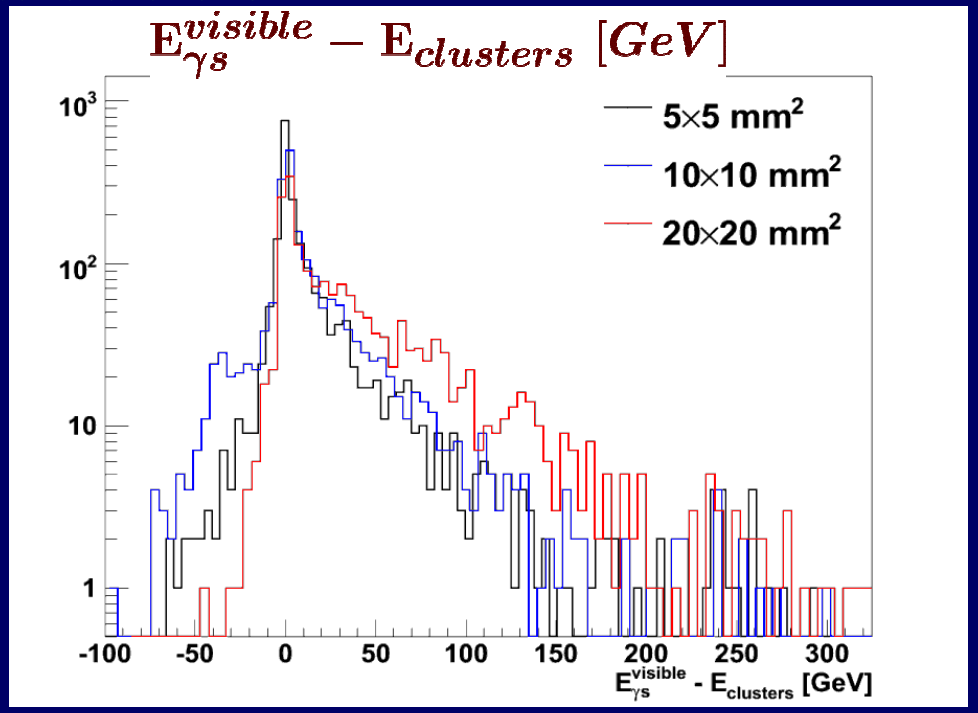
Performances versus the cell sizes

Retuned GARLIC for different cell sizes and run on same sample of

uubar jets at 500GeV

Fraction of γ's with distance **d** to nearest track

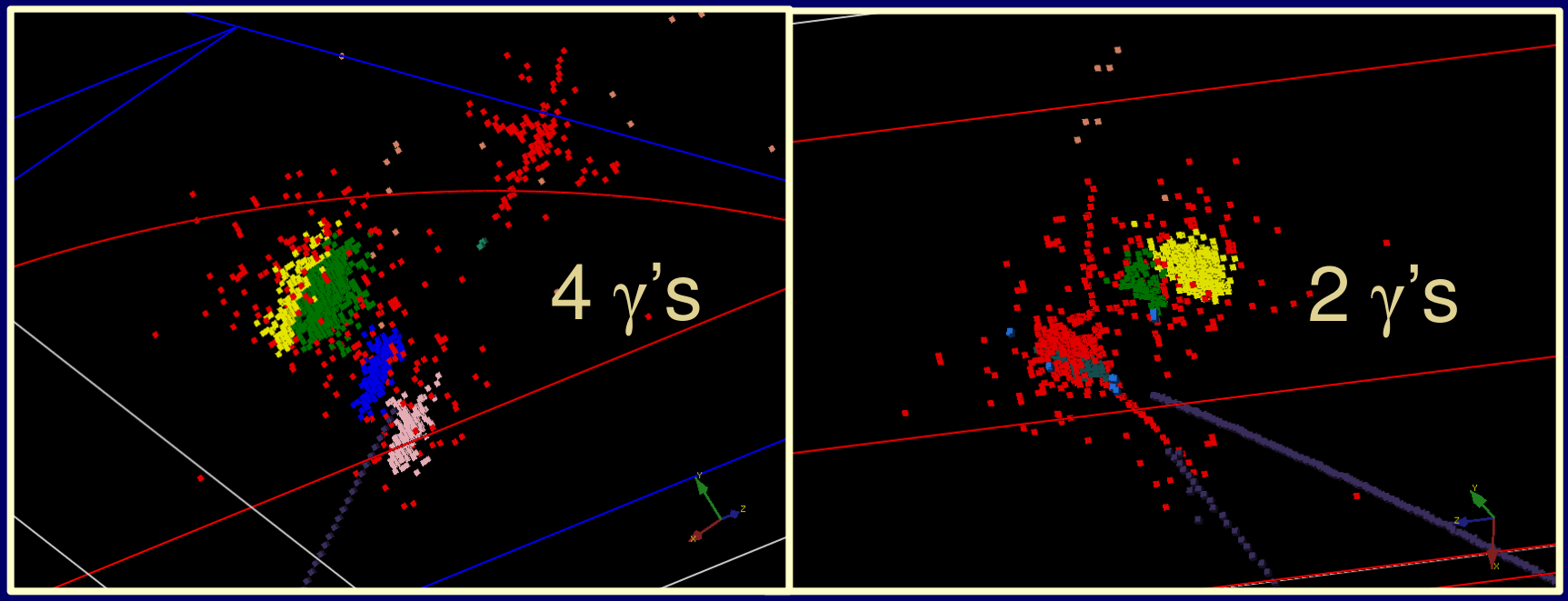




Cell size	Median [GeV]	Half width [GeV]
5 × 5 mm²	1.85	15.34
10 × 10 mm²	2.85	18.54
20 × 20 mm²	17.71	40.56

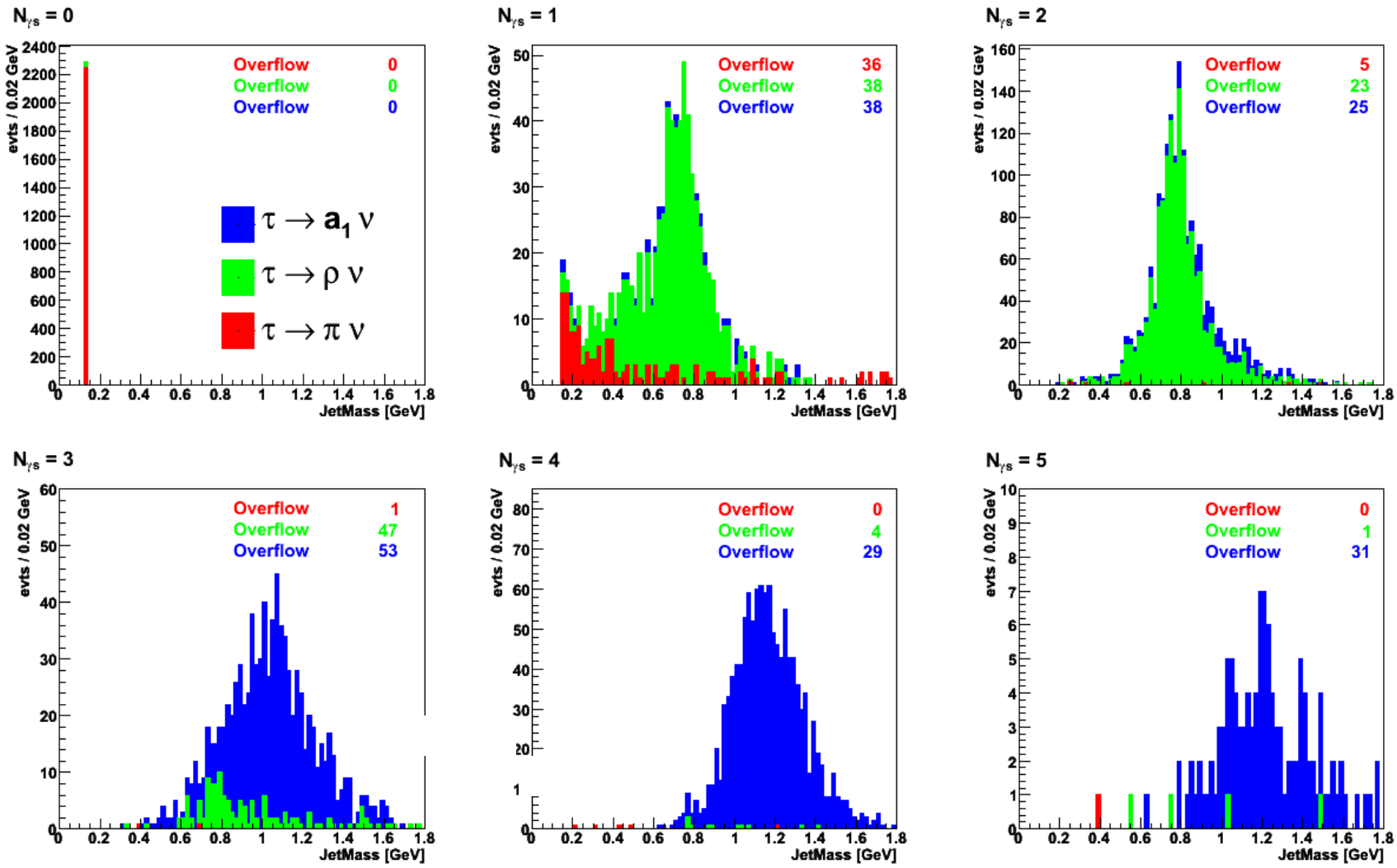
What about GARLIC on τ's

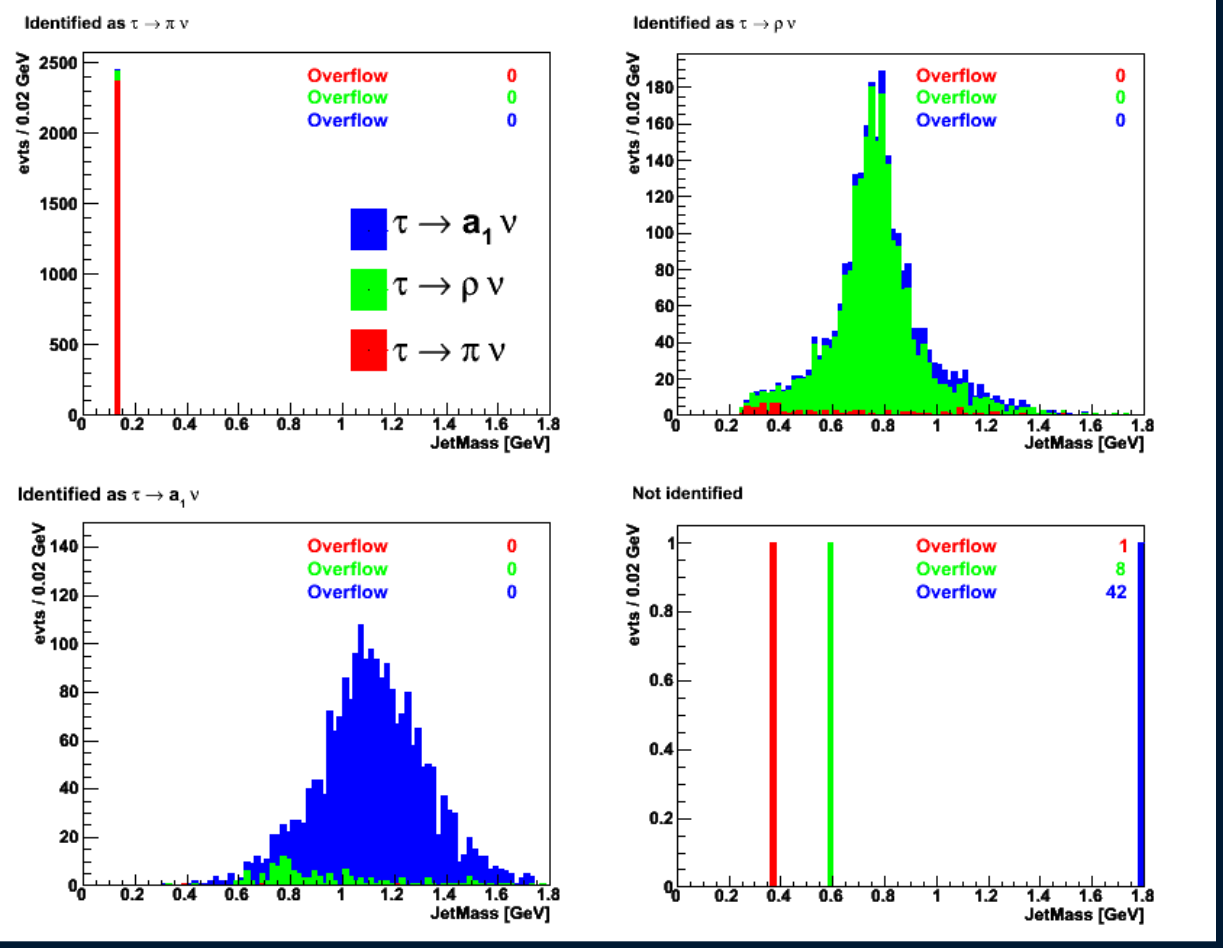
$\tau \rightarrow \nu_\tau a_1$ $\tau \rightarrow \nu_\tau \rho$



Distinguish between hadronic decay channels by counting associated photons and jet mass !

Decay selection: signal channels





Excellent separation and mass peaks!

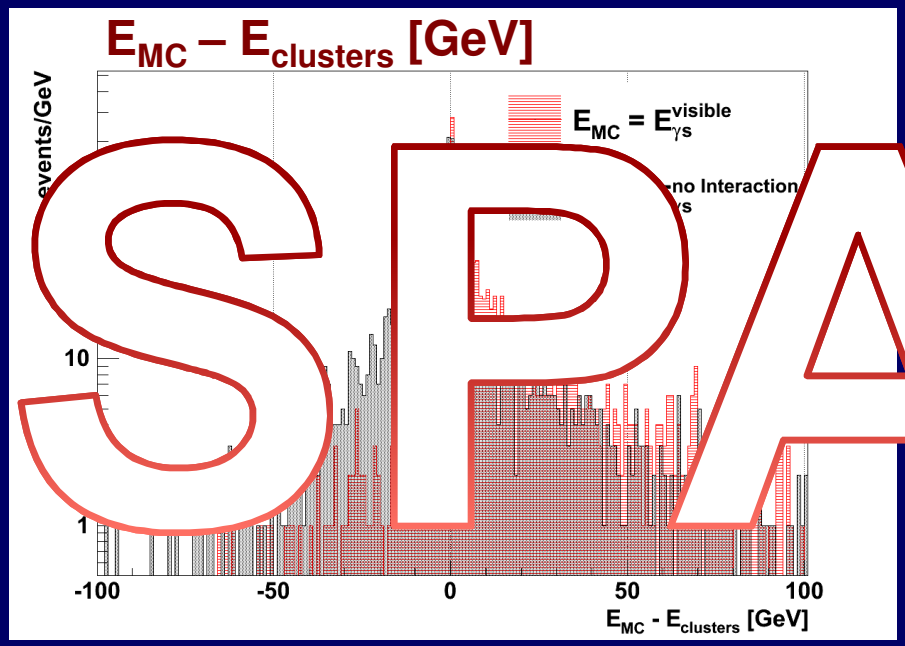
[%]	π^{sim}	ρ^{sim}	a_1^{sim}
π^{rec}	95.9	2.8	0.6
ρ^{rec}	3.9	90.8	11.2
a_1^{rec}	0.1	6.1	86.8
not identified	0.1	0.3	1.4

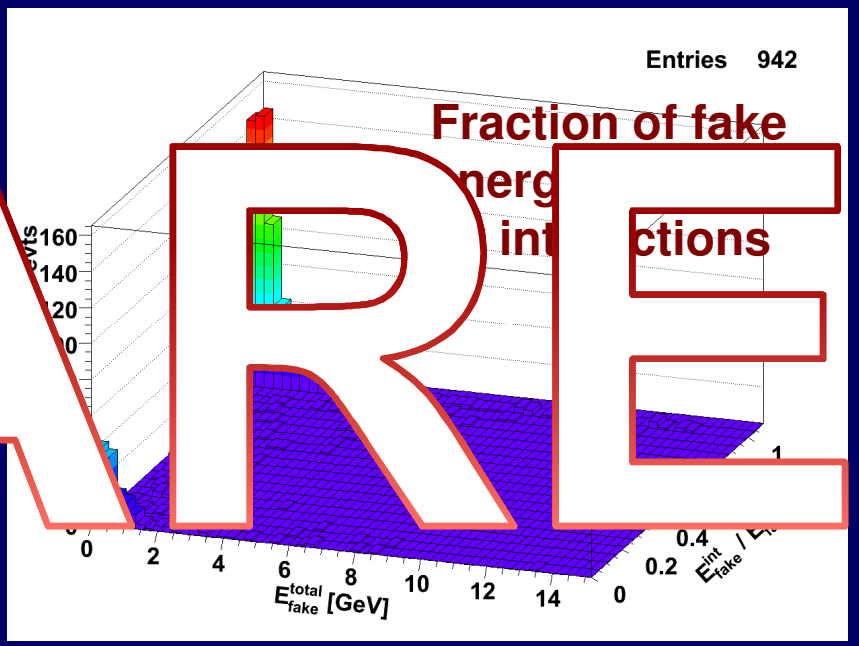
It was about
70 – 75 % in ALEPH

CONCLUSION

- The algorithm is optimized for em /hadron showers separation
- It gives excellent and well understood performances (not a black box)
- It could be used in stand-alone or as a part of a larger software tool (PANDORA or successor)
- GARLIC is a processor MARLIN → reconst. Particle
- Will be put on Public access (Ask for to Franck where to put it)
- It will be used for ECAL optimisation by ECAL ILD project groups

Jets: uū at 500GeV





SPARE

- Fraction of photons lost due to inefficiency and interaction
- Part wise recovering of converted photons + fake clusters

Performance depends strongly on interactions in the tracker