Using the quality factor to remove bad objects (update)

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Introduction

Energy measurement in LAr Calorimeters :

- N (5, 7, ..., 32) samples (time, amplitude (ADC)) every 25ns.

For cosmics events : Iteration over time with predicted shape :

- Optimal Filtering Coefficients (OFC) to optimise time and energy calculation
- Quality factor calculation as quadratic difference between measured signal and predicted shape.

But Quality factor not calculated if :

- $| E_{cell} | < 250$ MeV.
- Cell in gain medium or low

Current use of the quality factor

The quality factor is already used in the reconstruction.

To find “hot” cells in the reprocessed cosmic data. One example is the “sporadic noise” cells : energy of the cell previously identified as such is put to zero whenever the quality is bigger than 4000.

=> already reduce the rate of fake photons.

The quality factor will also be used online as a monitoring tool.

Our goal

Use the quality factor to reduce fake MET and fake jets :

- but the quality factor is not simulated in the MC.
- We just have cosmics data
- Hard to evaluate the effect of the cross-talk between cells on the Quality Factor

Starting point :

- Use more compact objects with independent quality criteria : Photons
- Study with random triggers : very few candidates (good !) but low stat
- Study with egamma stream (20 runs, 160000 photons candidates).

Reminder from last time

During the Last Jet/Etmiss data preparation task force we tried to select “good” candidates photons using the photon ID cuts.

Those ID cuts are efficient to separate photons from jets.

But it was hard to separate good energy deposit from noise so we seek another way to select “real” photons.

We decide to use objects in the photon container with an energy deposit along the track of a particle with at least 8 hits in the SCT (thanks to J-B de Vivie).

Details of the study

We use a sample of “good” photons : pointing muons, so we lose a lot of statistics and more than 5 GeV of energy (484 candidates).

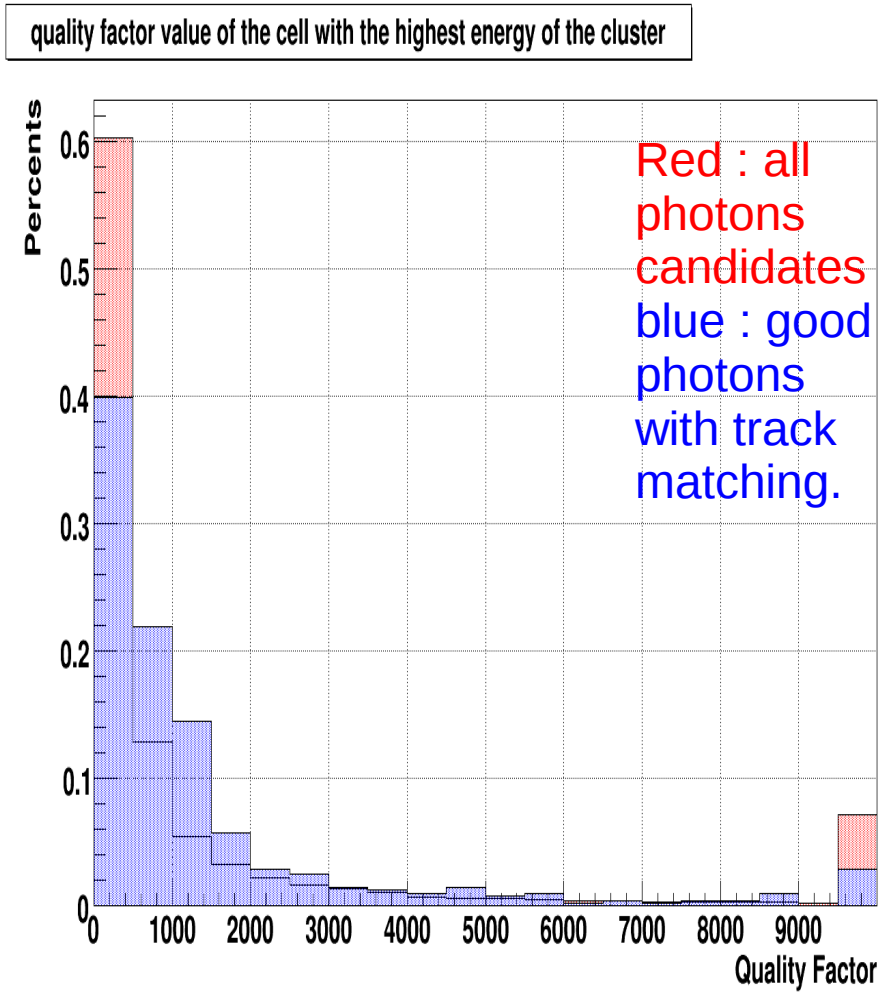
Cuts :

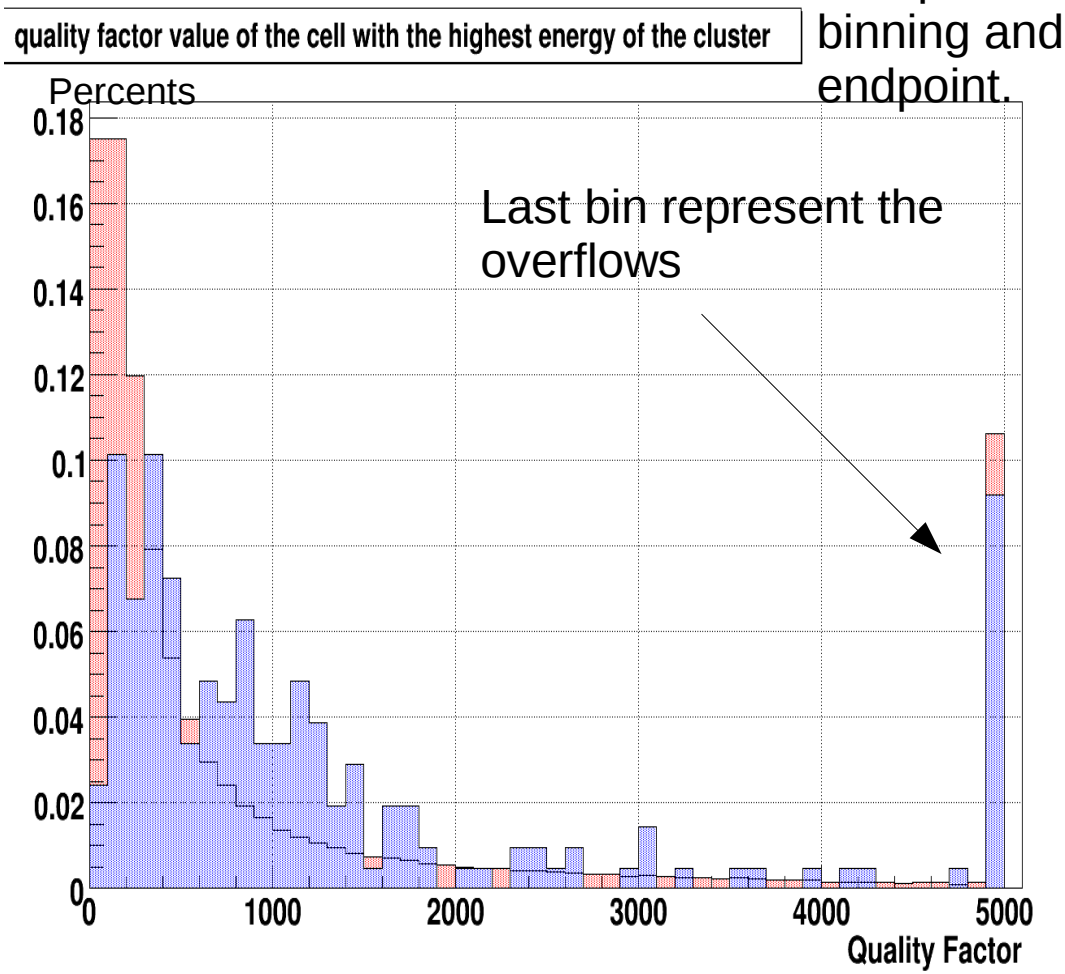
- photons with $|\eta| < 0.8$
- $E_{gamma} > 5$ GeV
- No cells with medium or low gain in the cluster (because Q = 0), no sporadic noise cells (E = 0 if Q > 4000) because we still do not know the effect of crosstalk on the quality factor....

We have investigated several variables to define quality of the cluster (with and without energy weighting):
Q of the most energetic cell, worst Q factor,
average Q factor (on cells forming 90 percents of the energy).

Most energetic cell of the cluster

Same plot on left and right except for binning and endpoint.



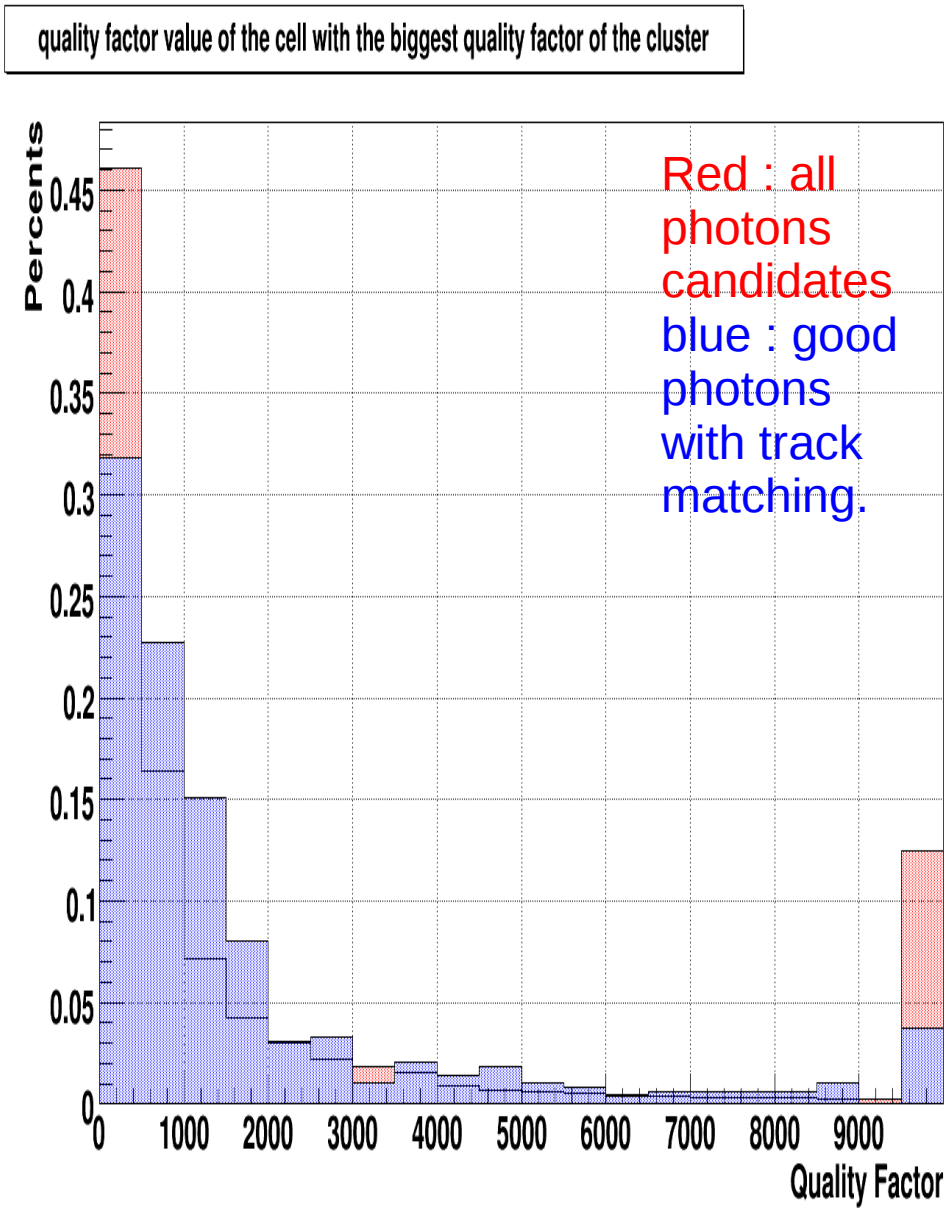


7% in the last bin for red
2% in the last bin for blue

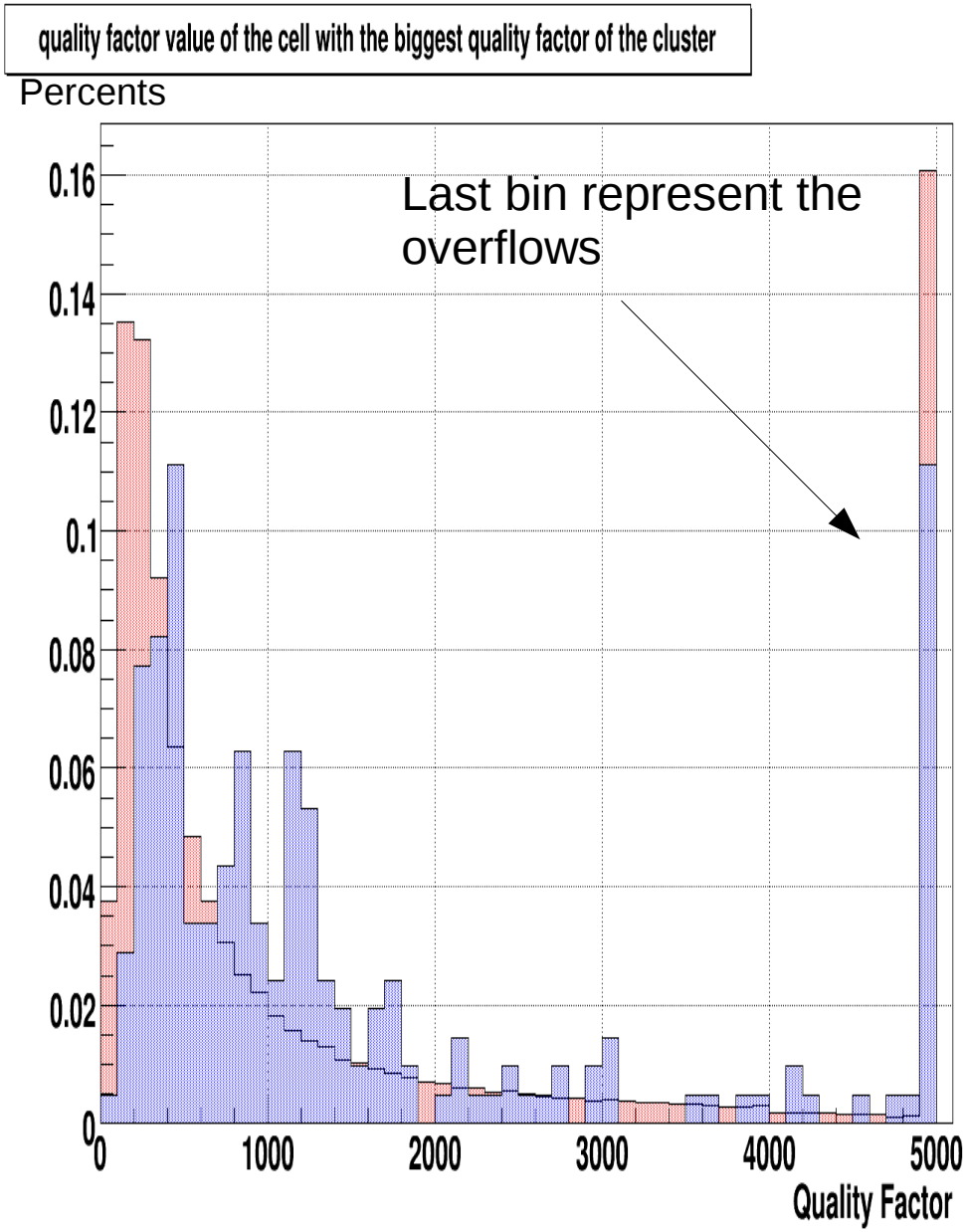
11% in the last bin for red
9% in the last bin for blue

The two populations are normalised. Since there is much less statistics (209 events vs 160000) the blue population (good photons) has much less entries per bins. But one can see that for a given cut (5000 or 10000) we remove much more tails in the “all photons candidates” population than in the “good” photons.

Worst quality factor cell of the cluster

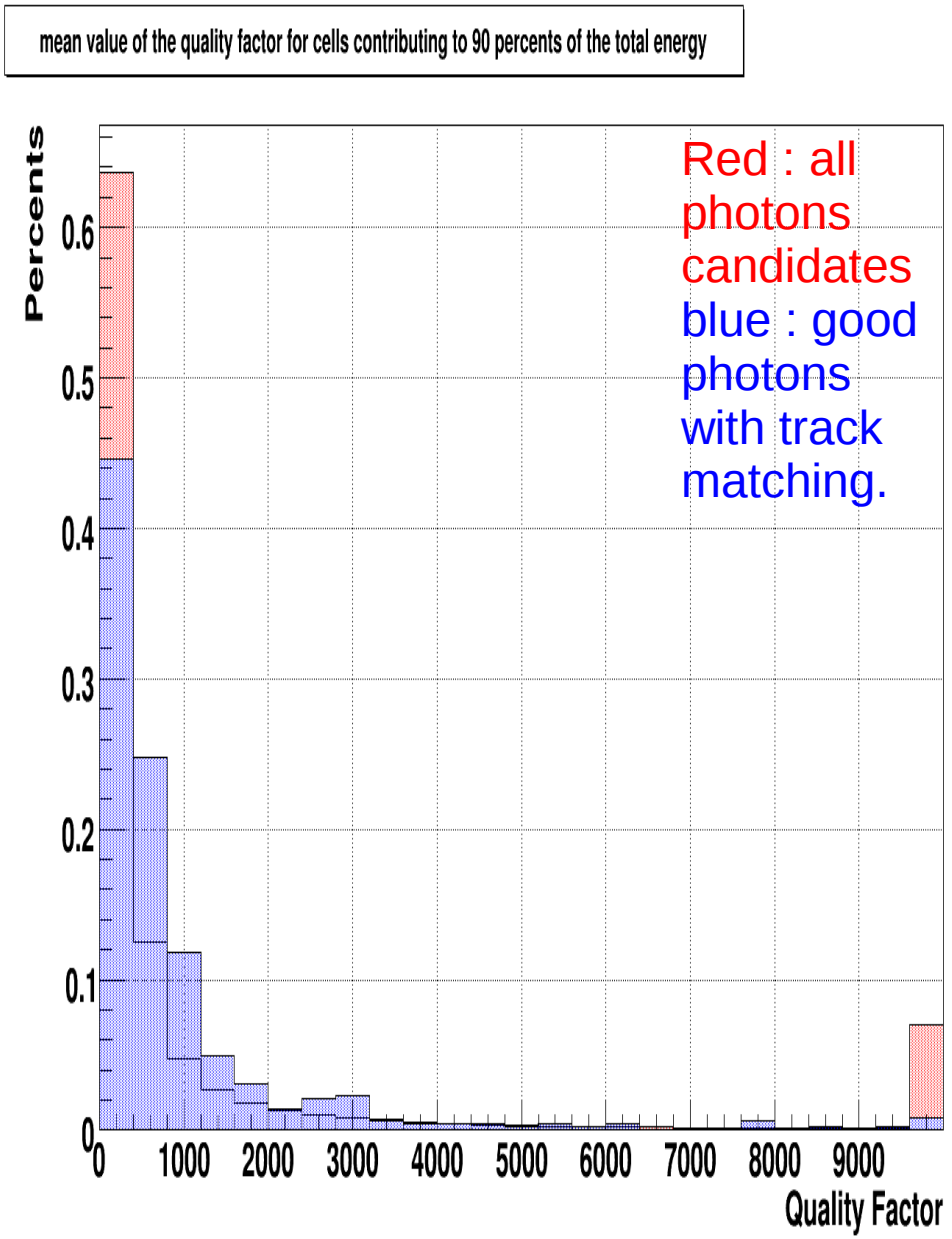


13% in the last bin for red
4% in the last bin for blue

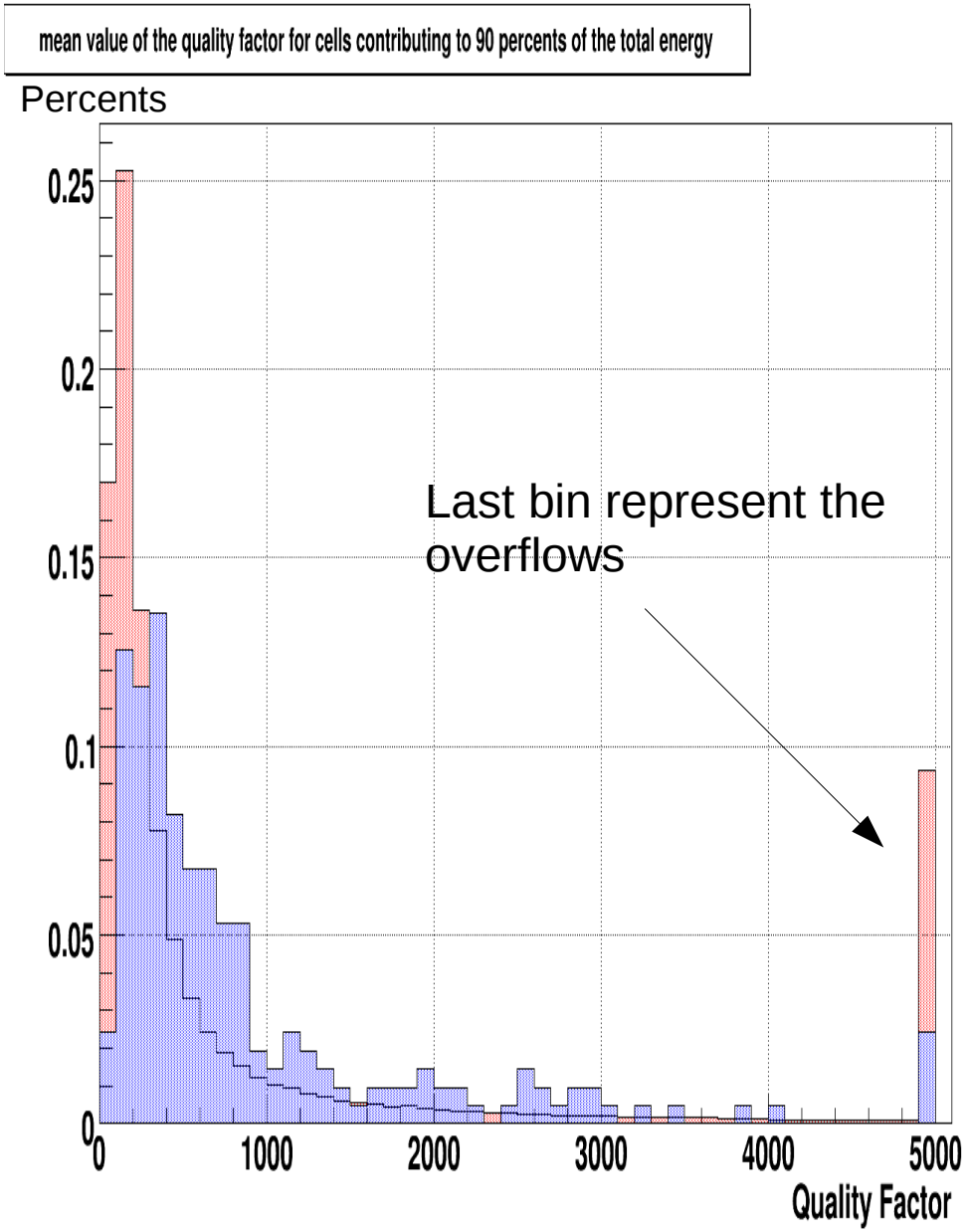


16% in the last bin for red
11.5% in the last bin for blue

Average on the cells forming 90 percents of the energy



7% in the last bin for red
0.2% in the last bin for blue



9% in the last bin for red
2% in the last bin for blue

summary

3 variables have been studied :

We could put a cut on the last bin (ie Q>5000 or 10000) or perhaps select a Quality Factor value below which 90 or 95% of good photons are. See tables below :

	90% of good photons are below :	% of photons candidates above this value
most energetic cell	3900	11,9
highest quality factor	4850	16
mean quality (90% total energy)	2150	14

	95% of good photons are below :	% of photons candidates above this value
most energetic cell	6650	9
highest quality factor	8350	13
mean quality (90% total energy)	3100	11,5

Conclusion

With this kind of study in may be possible to define criteria to remove bad objects (coming from noise) by using the quality factor.

We need to improve our selection on photons. Use higher statistics and try to use more loose selection to have more “good” photons.

Ongoing study to improve the quality factor measurement using time of the cells (with fit).

Next step will be to make this kind of study on topoclusters and jets.