Thoughts on Pedistal subtraction and Pulse Shape

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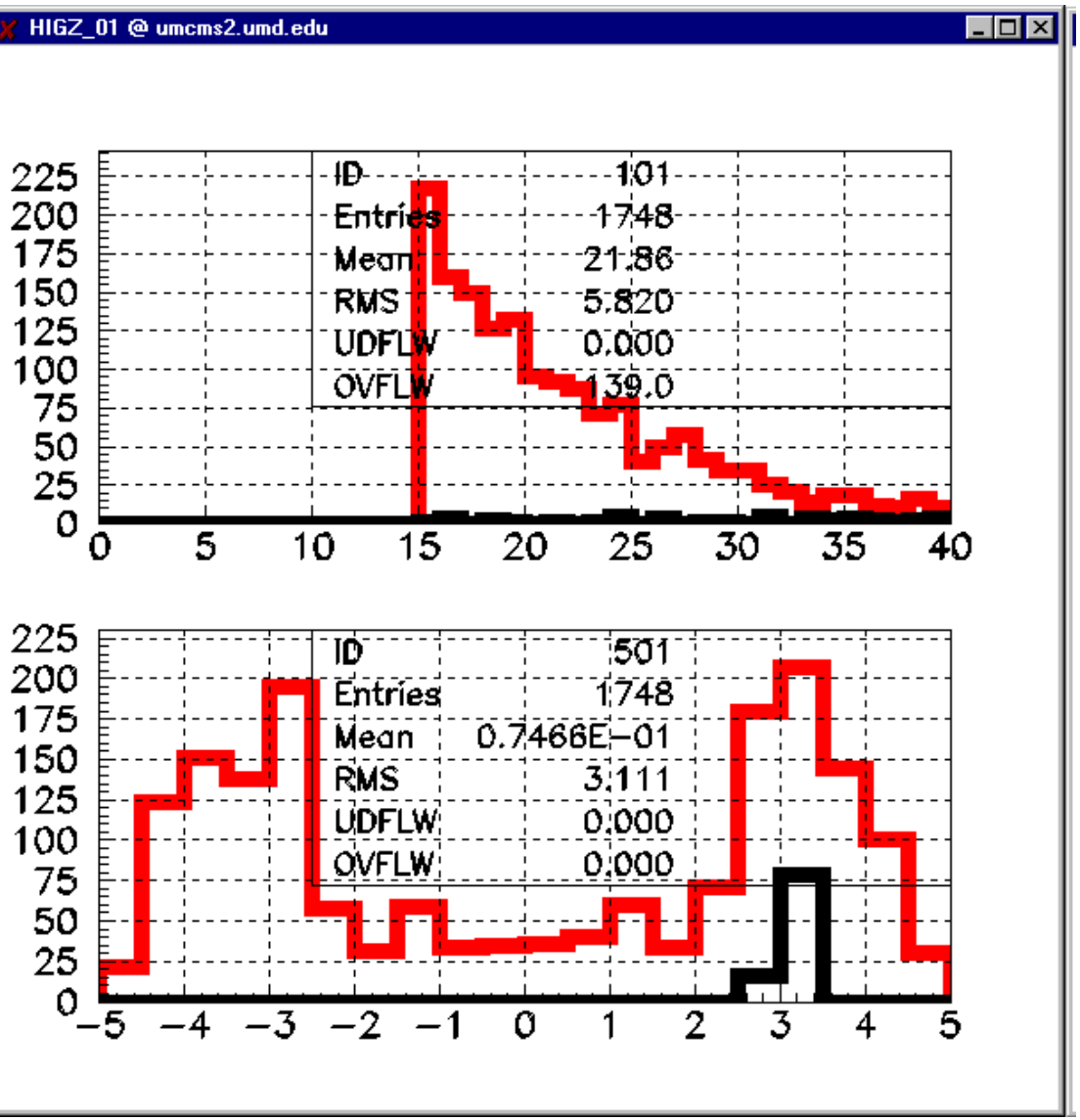
Start



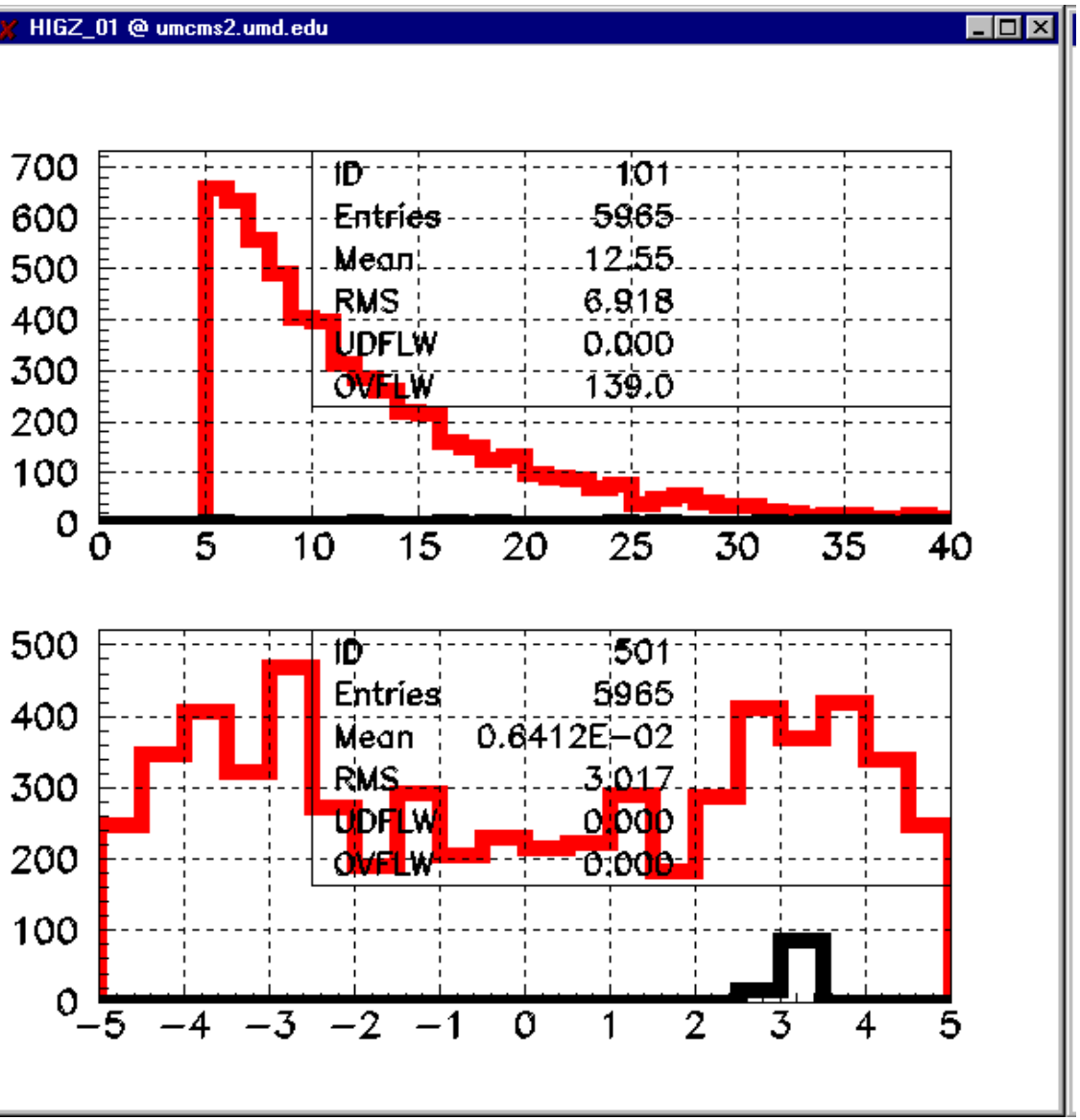
I was using "signal" events that consist of 30 GeV single pions at eta=3.0. (for "historical" reasons)

Start with the ORCA default settings with no pileup. Onething to note: The ECAL people, at least, do not intend to read out all the ECAL channels. They intend to do something called "selective readout". Right now, we do a poor-man's selective readout. We only consider digis whose Et is above a threshold. Thedefault is 60 MeV in the EB, 300 in the EE, 100 in HCAL. I use this, except I use 0 in HCAL for my default.

The top plot shows Et of reconstructed jets (iterative cone, size 0.5, made from digis). The black is my default ORCA settings no pile-up, the red is the same, but with 17.4 in-time pileup events. Note that when you only have intime pileup, there is no pedestal subtraction (ie, the bins that are used to estimate the pedestal are always zero).

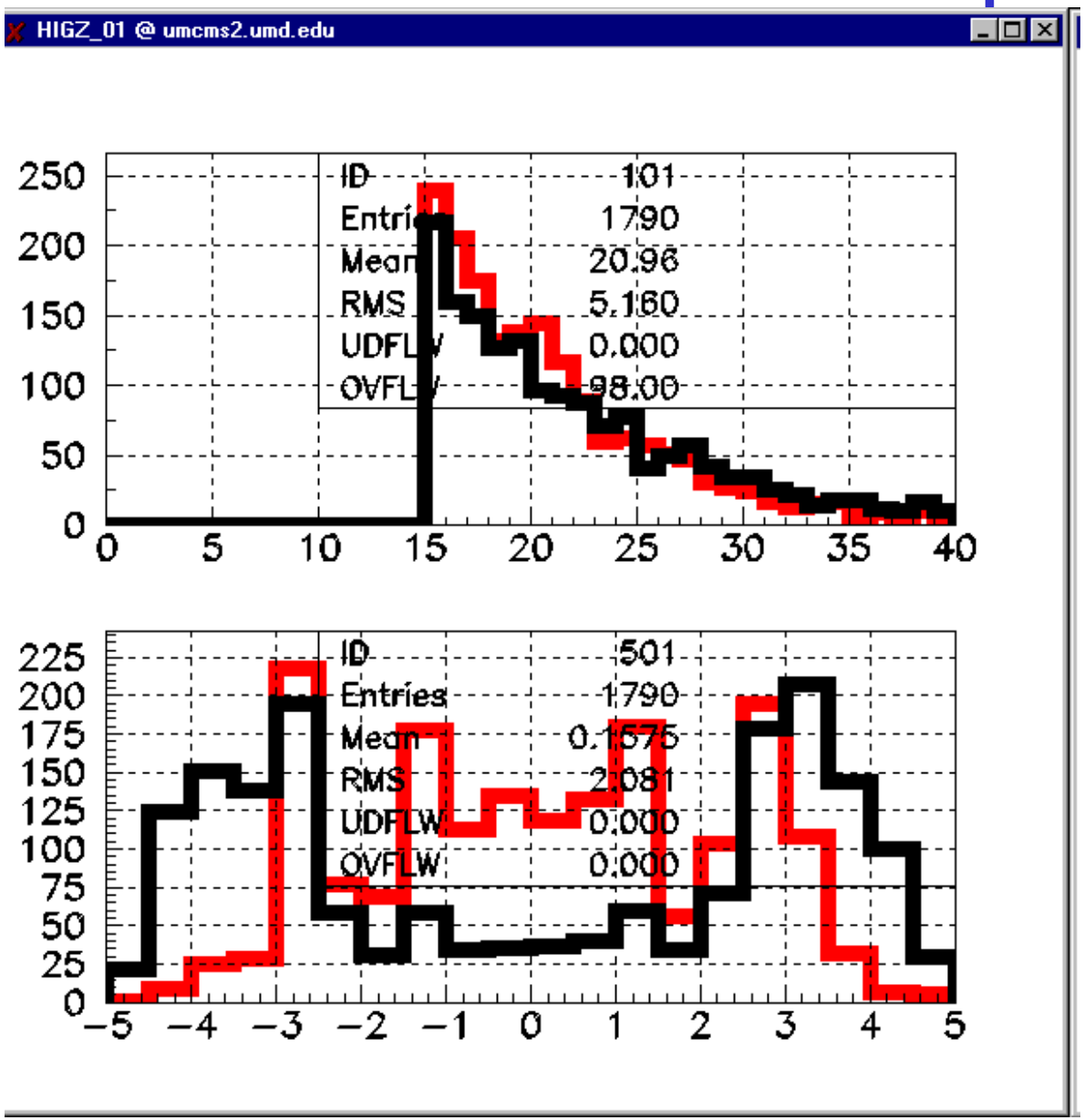
You can see that there are more jets in the HF region than in the HB/HE region. Some of this is probably due to a difference in energy scale, due to a difference in the way they were calibrated.

ditto



Same, but with lower jet et cut. This kind of shows that the weird shape is an artifact of the energy scale. If you allow lower et jets, the shape gets flatter...

Out of time pileup



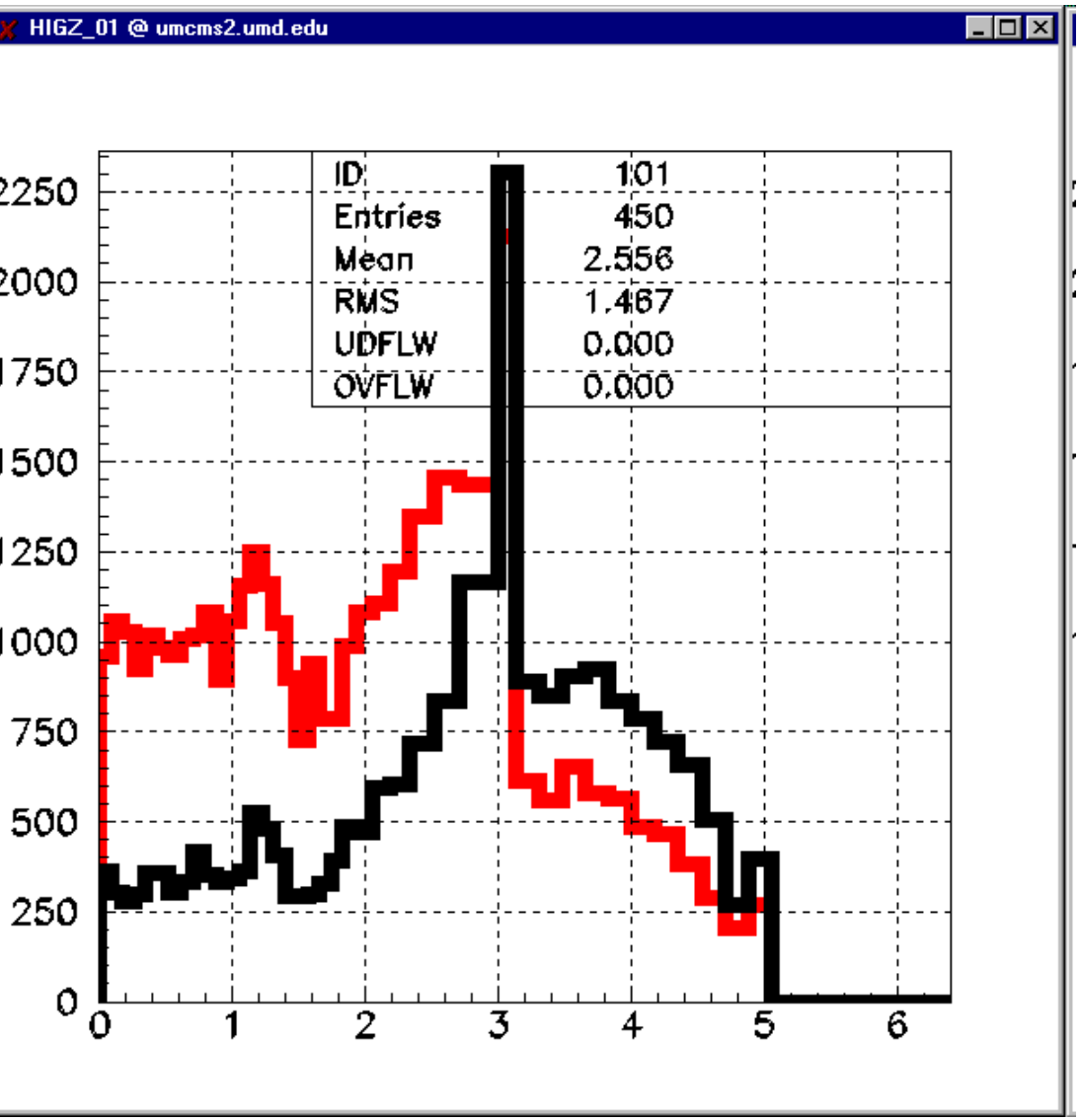
Let's see what happens when we add out-of-time pileup. Suppose we add 17.4 pileup events at crossings staring at -5 before "the" crossing, and continuing 3 beyond "the" crossing.

The black is in-time pileup only. The red includes the out-of-time pileup. You can see an interesting thing. In the HF, there are fewer jets when you add the out-of-time, while in the central there are more jets. Its like the pedestal subtraction is removing the jets in the HF.

What are the difference between the two regions? The HF is part of the HCAL, and uses the short HCAL pulse shape. The central, however, includes the ECAL, which has a long pulse shape.

Why does the central get lots of jets? It is an artifact of the "poor mans "selective readout. Let's see...

Energy Flow

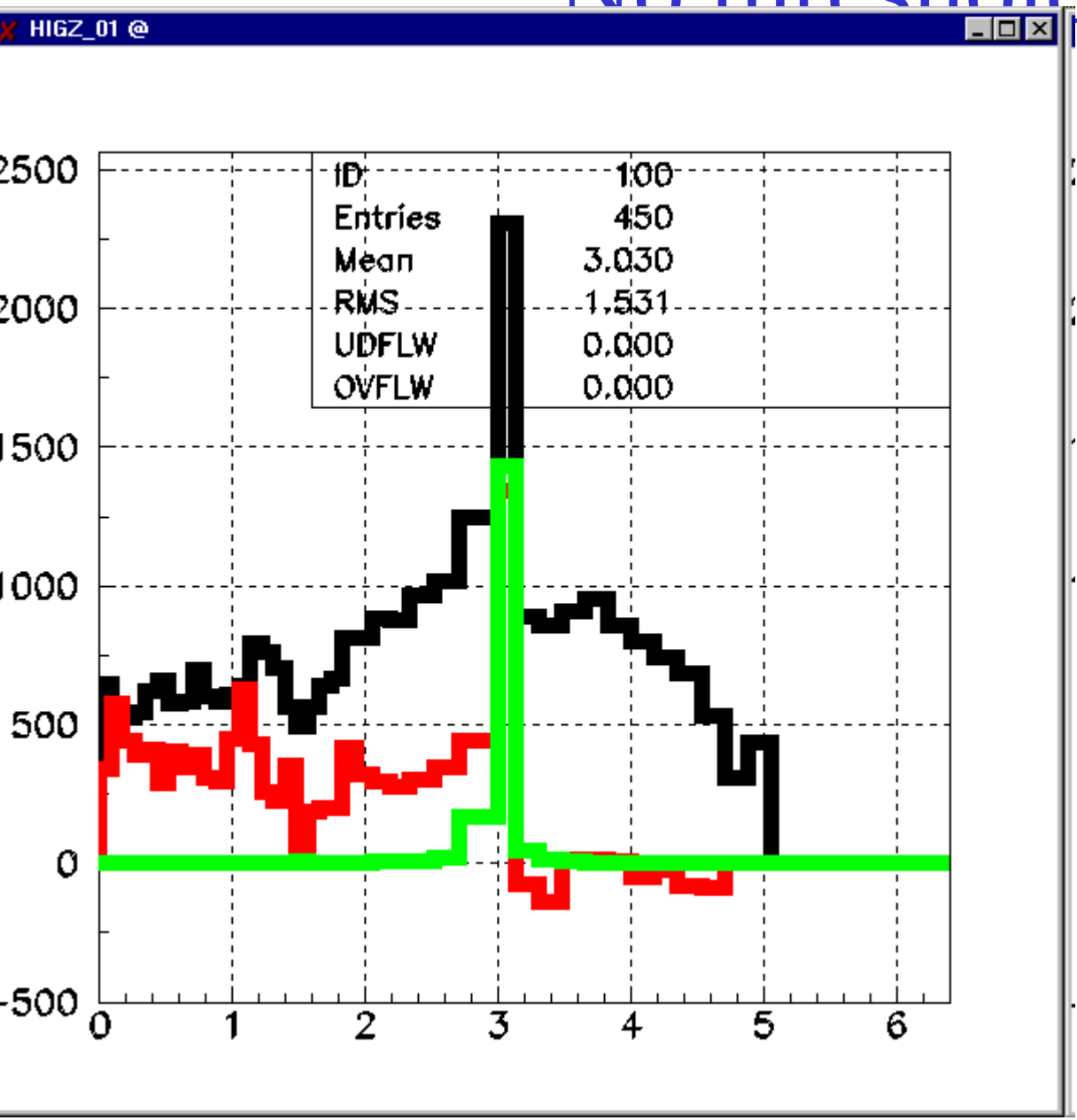


We will remove the thresholds. This will mean that sometimes the energy in a tower will be negative, due to the pedestal subtraction. Negative energy causes the jet finder to hang, so we'll switch to plots that show the mean energy/tower_size_in_eta versus eta (energy density plots)

here is the energy flow plots with the thresholds. Black is intime only. Red includes out-of-time. Again, you see diminished energy flow in the forward, but enhanced in the central (large peak at eta=3 because of the single 30 GeV pion "signal" events)

so, if we remove the thresholds...

No thresholds



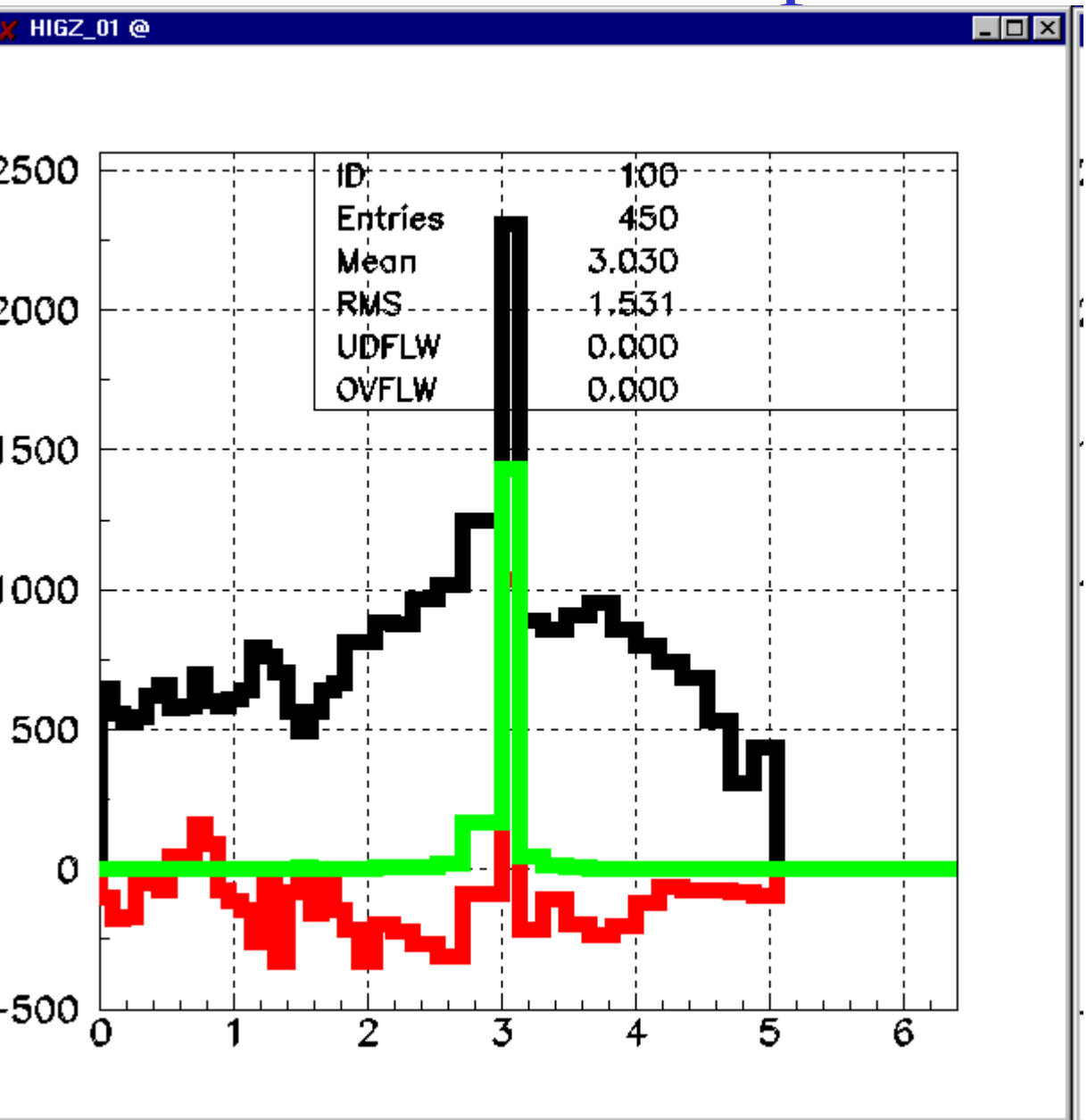
We remove the thresholds from the digis (the “poor mans” readout). (the green here is no pileup, just signal)

You can see here that the excess in the central has gone away. It was an artifact of this. However, we will have some sort of selective readout.

The fact that it only happens in the central (where we have the long ECAL pulses), but not in the HF, where the default ORCA pulse shape is much shorter, makes me think that this is a problem only for long pulses.

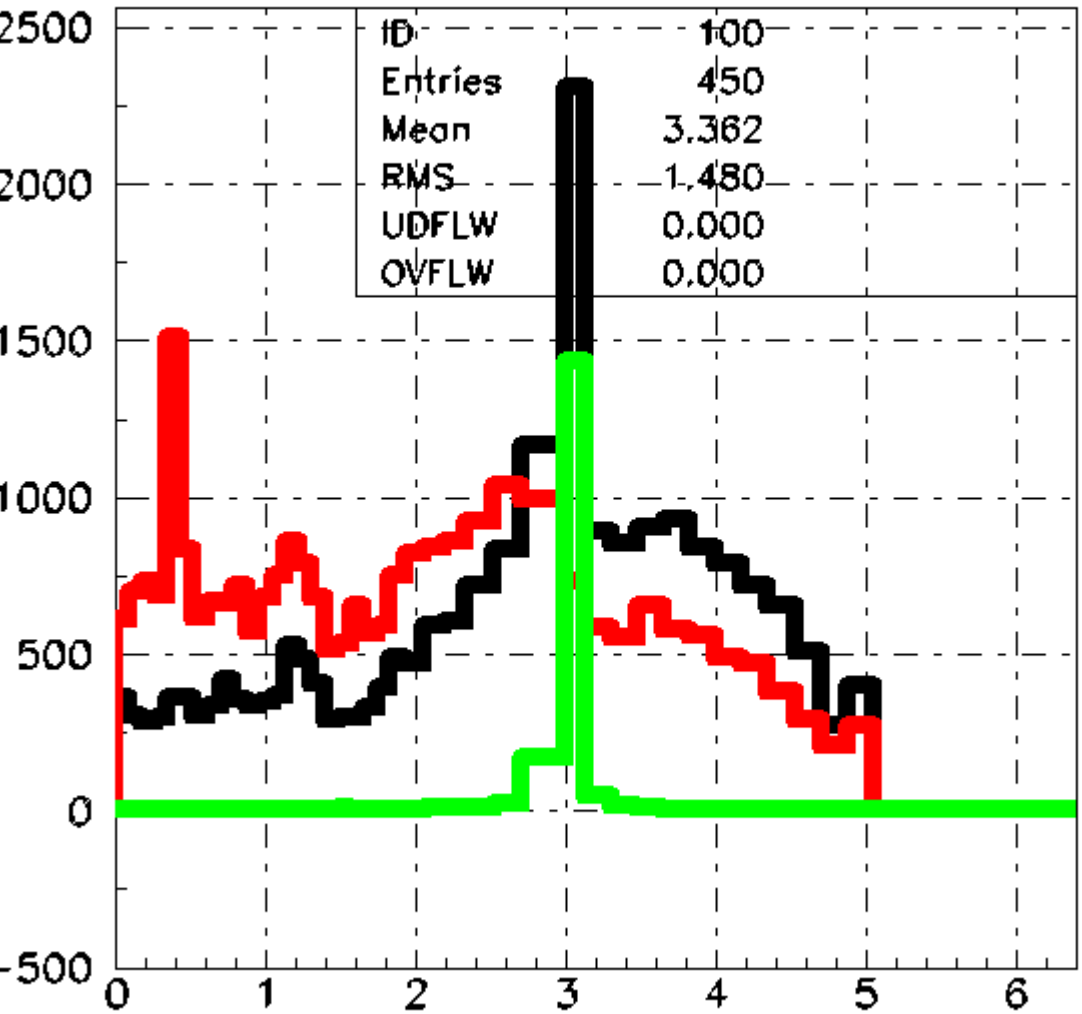
We can probably live with this. Previous studies shows that the jet et resolution at high et (et>40) is basically the same with and without intime pileup. But, it is ugly, and would be better without it...

ped



Here we expand from -5 to +3 to -12 to +4. (no thresholds) You can see you get a better subtraction (especially in the central). The problem is, with only -5 to +3, you are not really setting up the pedestal bins correctly. You need to go early enough in time to set these up correctly... (-5:+3 is the default for ORCA production)

hcal pulse shape in ecal



if we use the short hcal pulse shape in the ecal, we get a diminished effect (with thresholds, -5+3, compare to 3 slides earlier…)

moral: long pulse shape means big pedistal. big ped means big fluctuations on ped. this with the threshlds leads to fake jets...