

Jets and missing ET in high pT events episode II: p13

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- Goals
- Overview of the method
- Results with p13
- Prospects

Goals

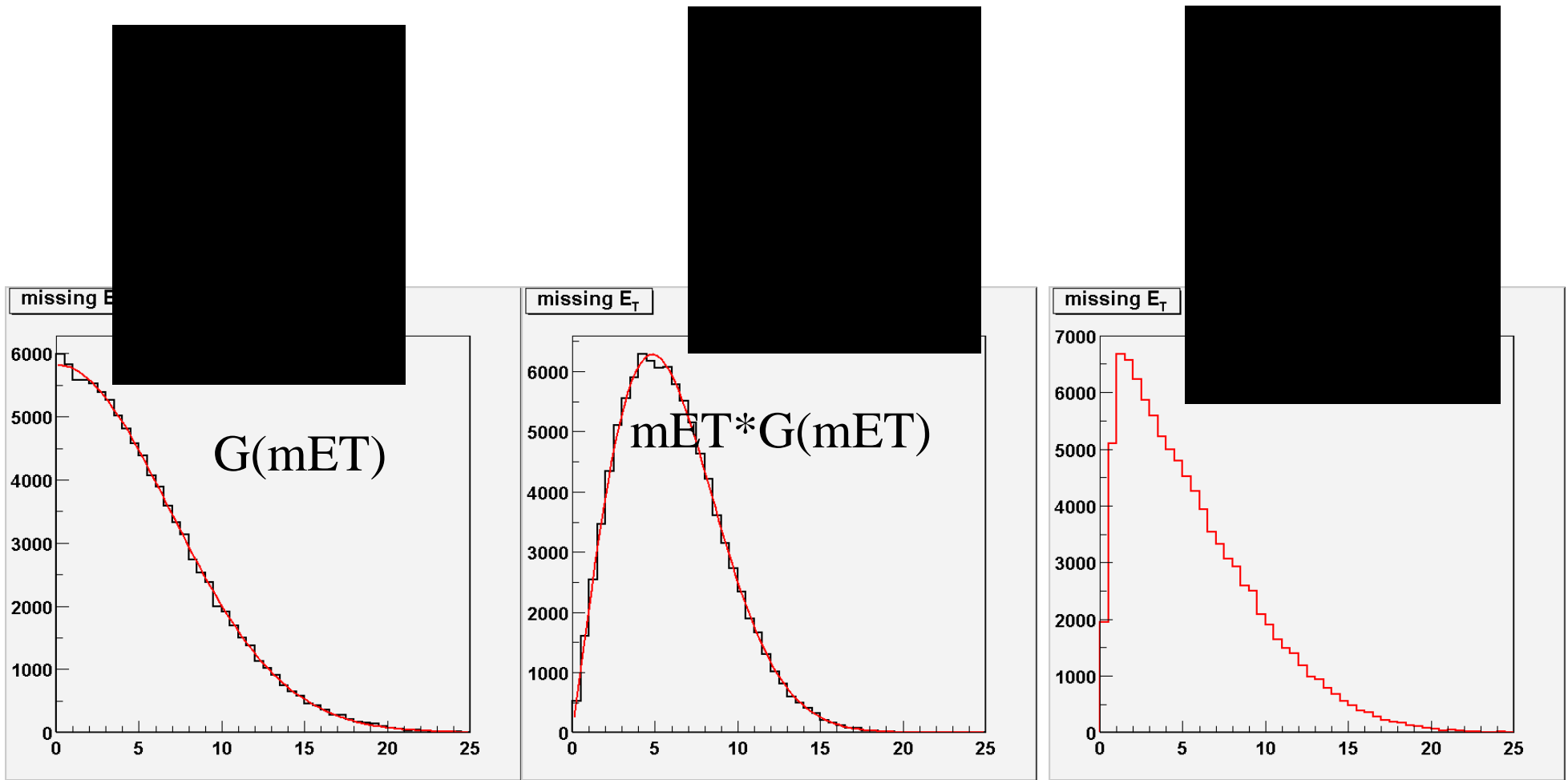
- We would like to understand as thoroughly as possible the jets and missing ET in high p_T events:
 - Jet quality
 - MET from “first principles”:
 - From measured resolutions
 - No reliance on Monte Carlo
- Following the p10 analyses: d0notes 4020 and 4030
- This is the first step in the direction of a multijet + MET analysis for squarks and gluinos

The method

- Starts from high p_T jet events, mostly QCD
- No genuine missing ET in (most) QCD events
 - \Rightarrow Missing ET from resolution effects
- Starts from the total scalar ET (sET), take into account the event topology, and use resolutions measured from data to try and reproduce the observed missing ET

Generating expected mET distributions

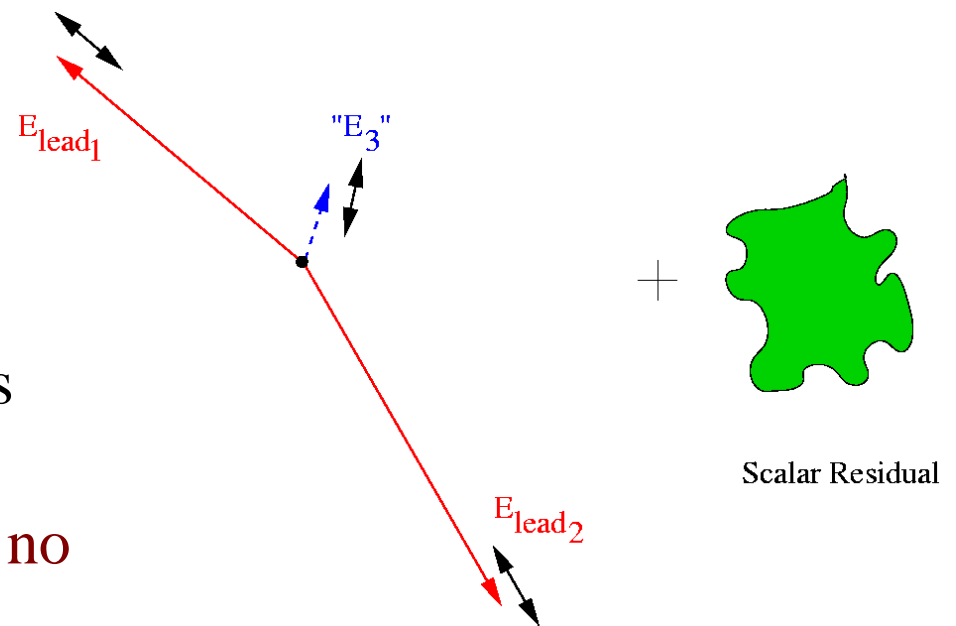
$\langle mET \rangle$ depends linearly on sET but sET not enough to predict the mET distribution \Rightarrow take into account the individual event topology



Generating the expected mE_T distribution for a given event

Decomposition of the event:
the measured good jets
a calculated “balancing jet”
the residual scalar E_T (isotropic)
($\text{ResSET} = sET - HT - pT_bal$)

Fluctuate with measured resolutions
and obtain the **expected** mET
distribution assuming the event has no
genuine mET



Jets in p13

- We have investigated the quality of jets in p13 data
 - p13 data seems cleaner than p11 data (zero suppression back to 2.5 sigmas)
 - Made a list of bad runs that have spikes in the (eta,phi) distribution of jets
- Similar conclusions in QCD / JetMet / CalTF
- No p13 MC samples, cannot reproduce the analysis of d0note 4020, but jets with (uncorrected) pT above 15 GeV look fine.
- No electron/muon veto yet (effect was small)

Data sample

- Skim events that fired JT95_TT from thumbnails and produce TMBtrees (few pb⁻¹) [have looked at JT125_TT but large overlap with JT95_TT]
- Remove bad runs.
- No energy scale for p13, use uncorrected jets.
- Use the p10 criteria for jet quality cuts (f90 cannot be calculated from p13.02 thumbnails). Should be fine as the zero suppression is back to 2.5 σ . Require pT>15
 - All other jets are considered bad.

Resolutions

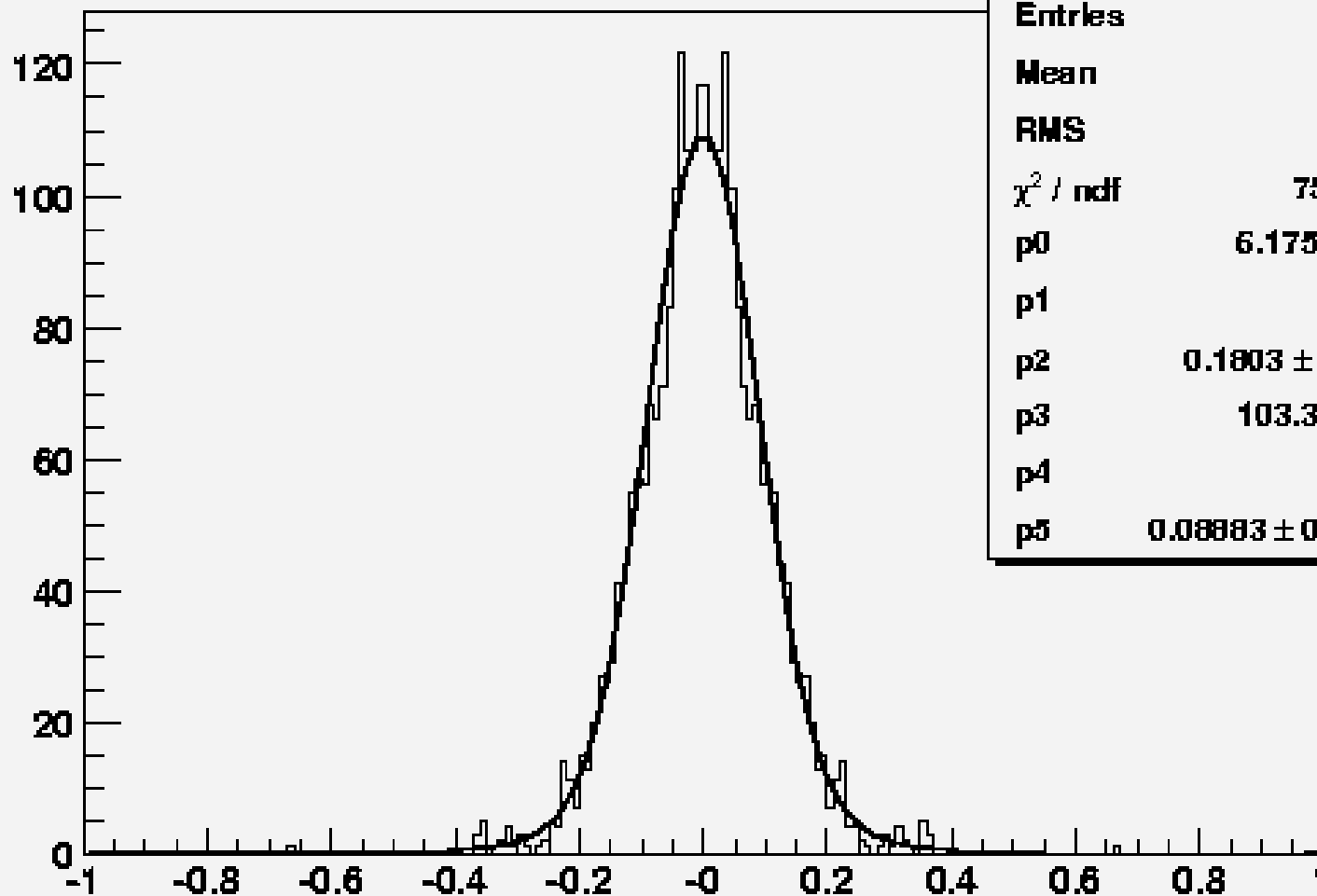
- The jet energy resolutions are measured by selecting dijet back-to-back events with no bad jets. The p_T asymmetry distribution gives access to the jet energy resolution:

$$\frac{\sigma_{p_T}}{p_T} = \sqrt{2} \sigma_A$$

Then we measure k :

$$\frac{\sigma_{p_T}}{p_T} = \frac{k}{\sqrt{p_T}}$$

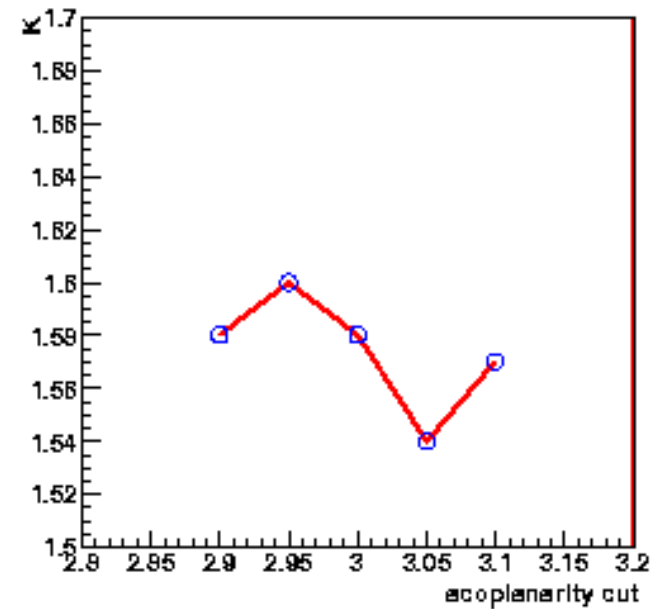
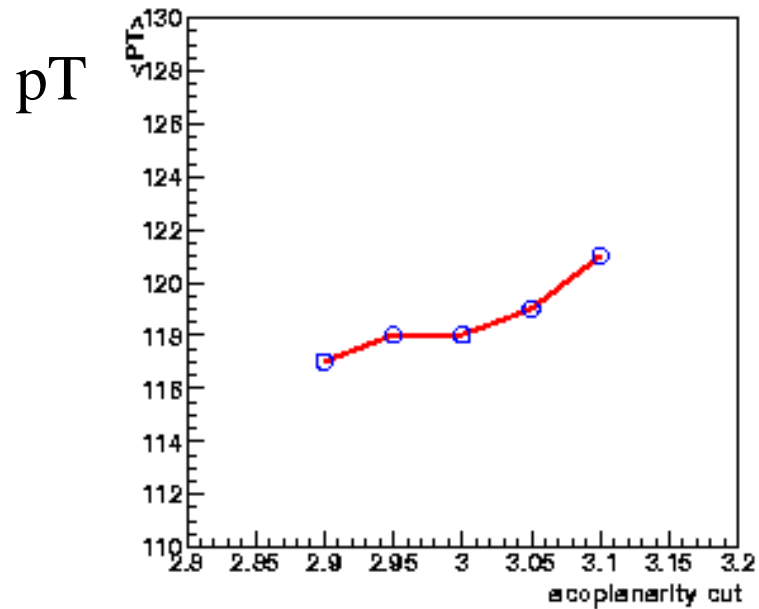
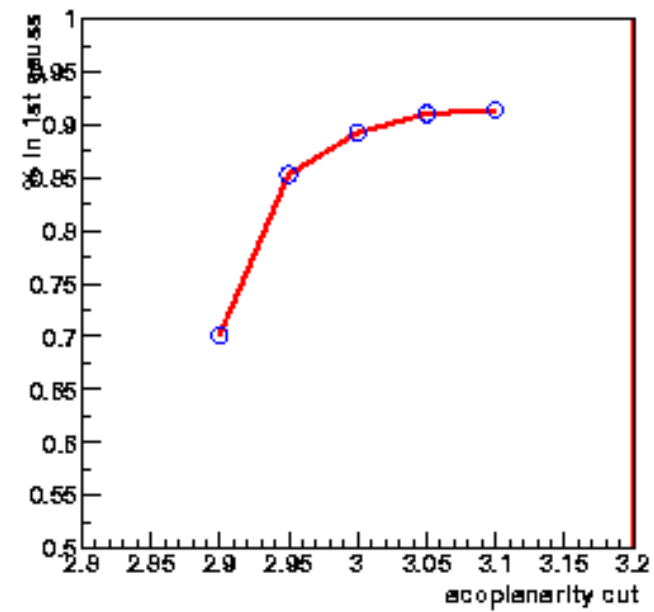
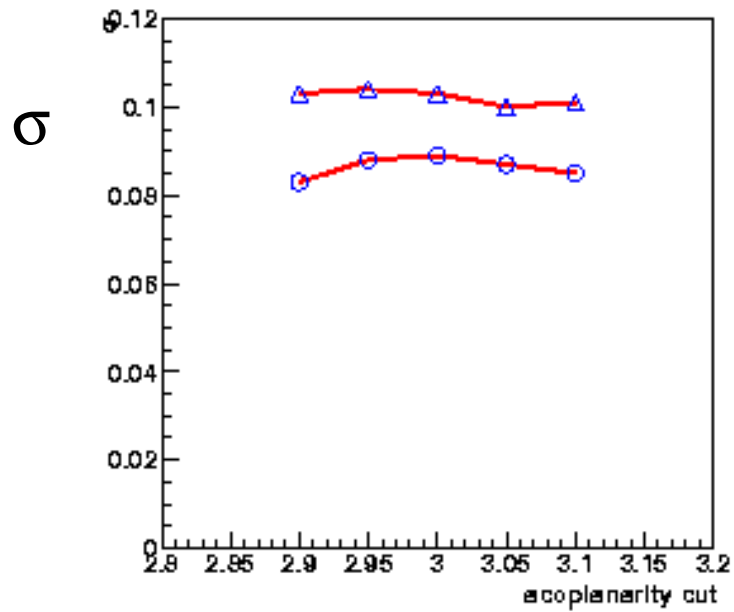
PT asymmetry



| asym | |
|-----------------------|--------------------|
| Entries | 2580 |
| Mean | 0 |
| RMS | 0.1025 |
| χ^2 / ndf | 75.87 / 68 |
| p0 | 6.175 ± 2.847 |
| p1 | 0 ± 0 |
| p2 | 0.1803 ± 0.01834 |
| p3 | 103.3 ± 3.526 |
| p4 | 0 ± 0 |
| p5 | 0.08883 ± 0.002646 |

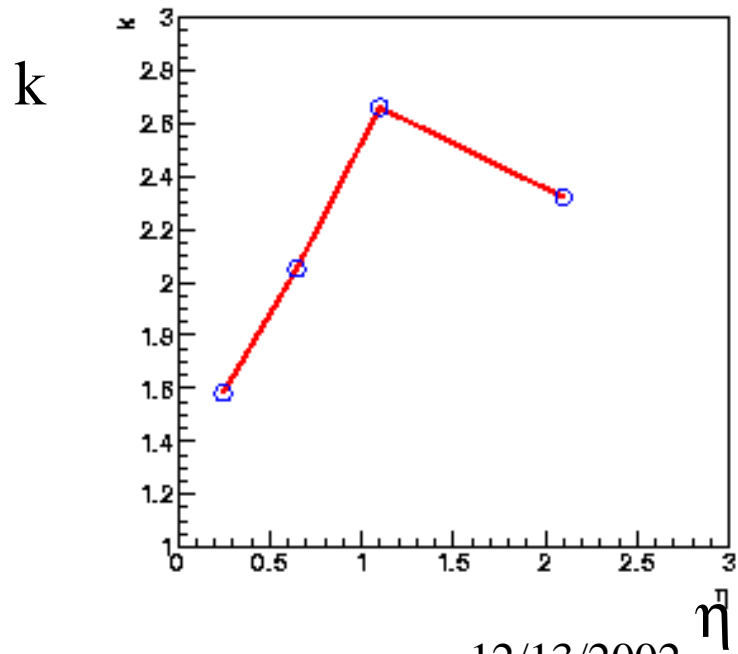
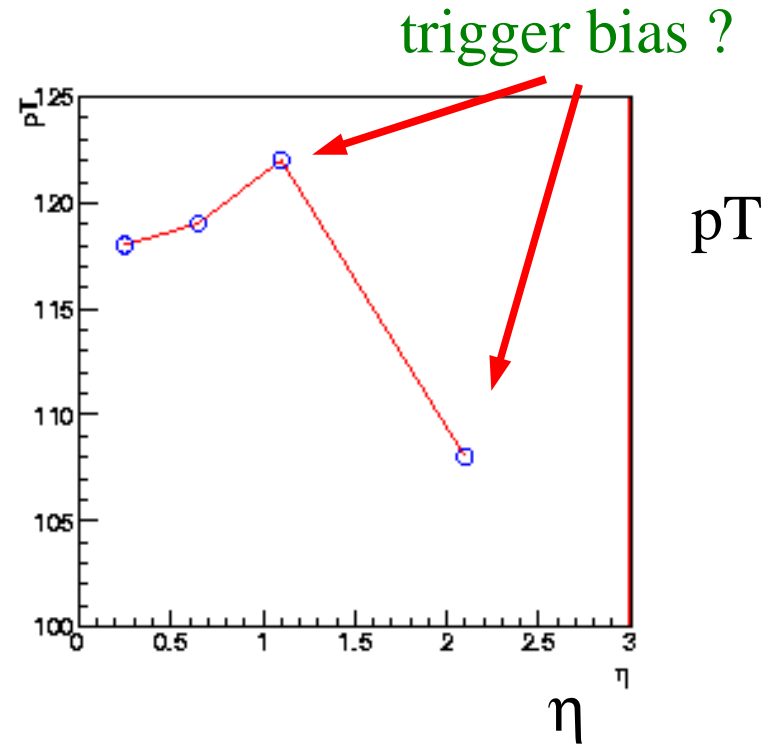
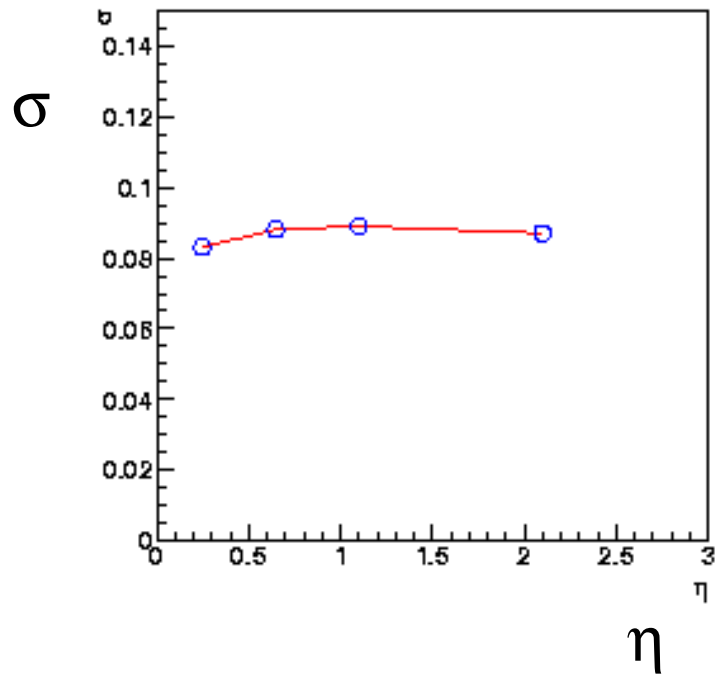
Very central jets

- First, concentrate on very central jets: $|\eta_d| < 0.5$. They should be well contained in CC, thus expect fairly gaussian resolutions, but for physics effects (e.g. muons or neutrinos).
- Events slightly acoplanar can have jets below thresholds and hence bias the resolutions
- Investigate resolution as a function of the acoplanarity cut.
- No strong dependance with acoplanarity found, choose a cut at 3.0 rad to keep some statistics.



Other η regions

- We have divided the detector in 4 regions: $|\eta_d| < 0.5$, $0.5 < |\eta_d| < 0.8$, $0.8 < |\eta_d| < 1.4$ and $|\eta_d| > 1.4$
- We still require exactly two jets back-to-back, with one jet in the very central region.
- In each bin, correct for average response (only significant for ICR) and measure the asymmetry, then the resolution. We can deconvolute the resolution of the very central jets.
- Resolution worse in other regions, **concentrate on very central jets for now.**



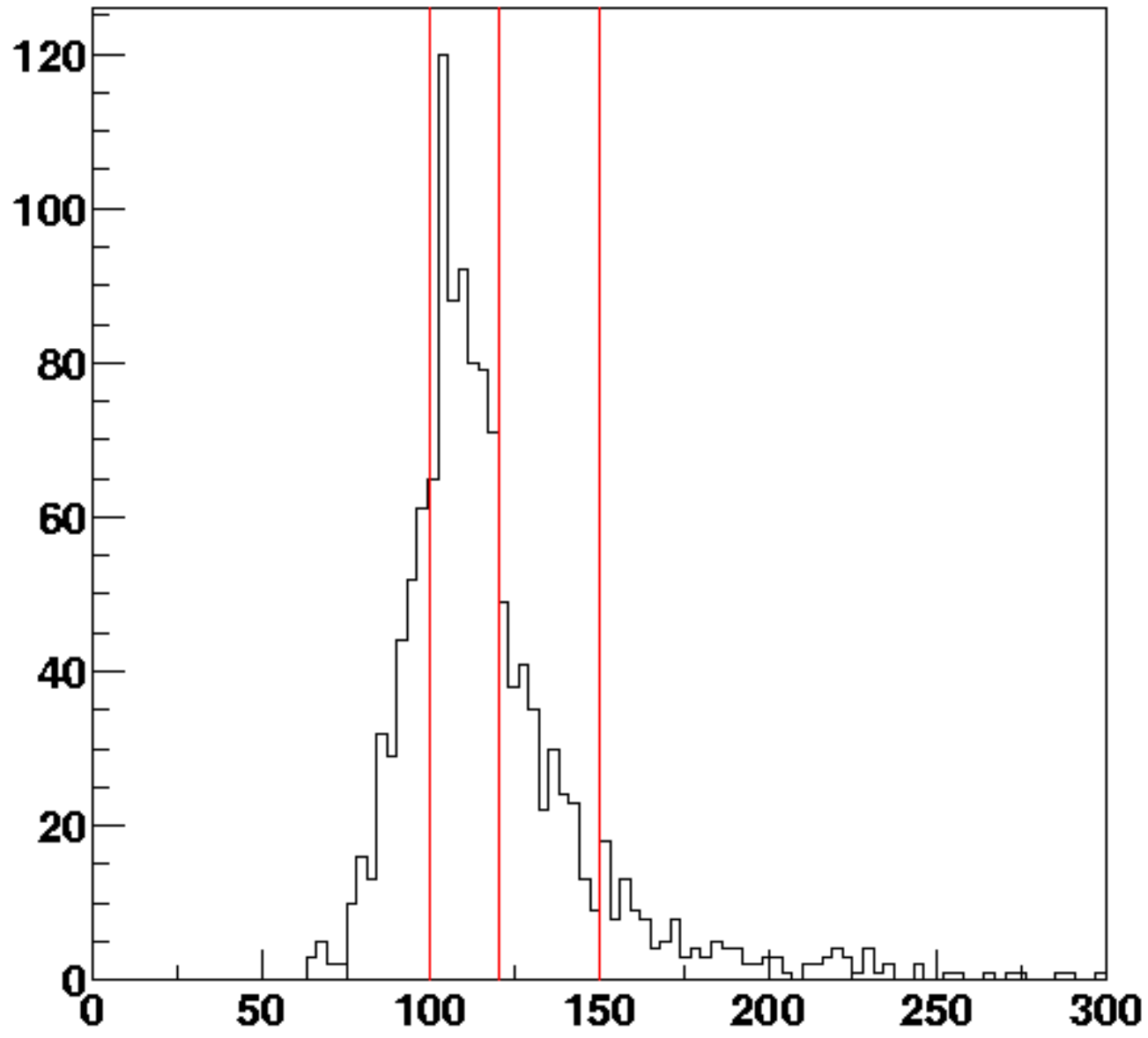
resolution worse in other eta regions (in particular ICD)

PT dependence

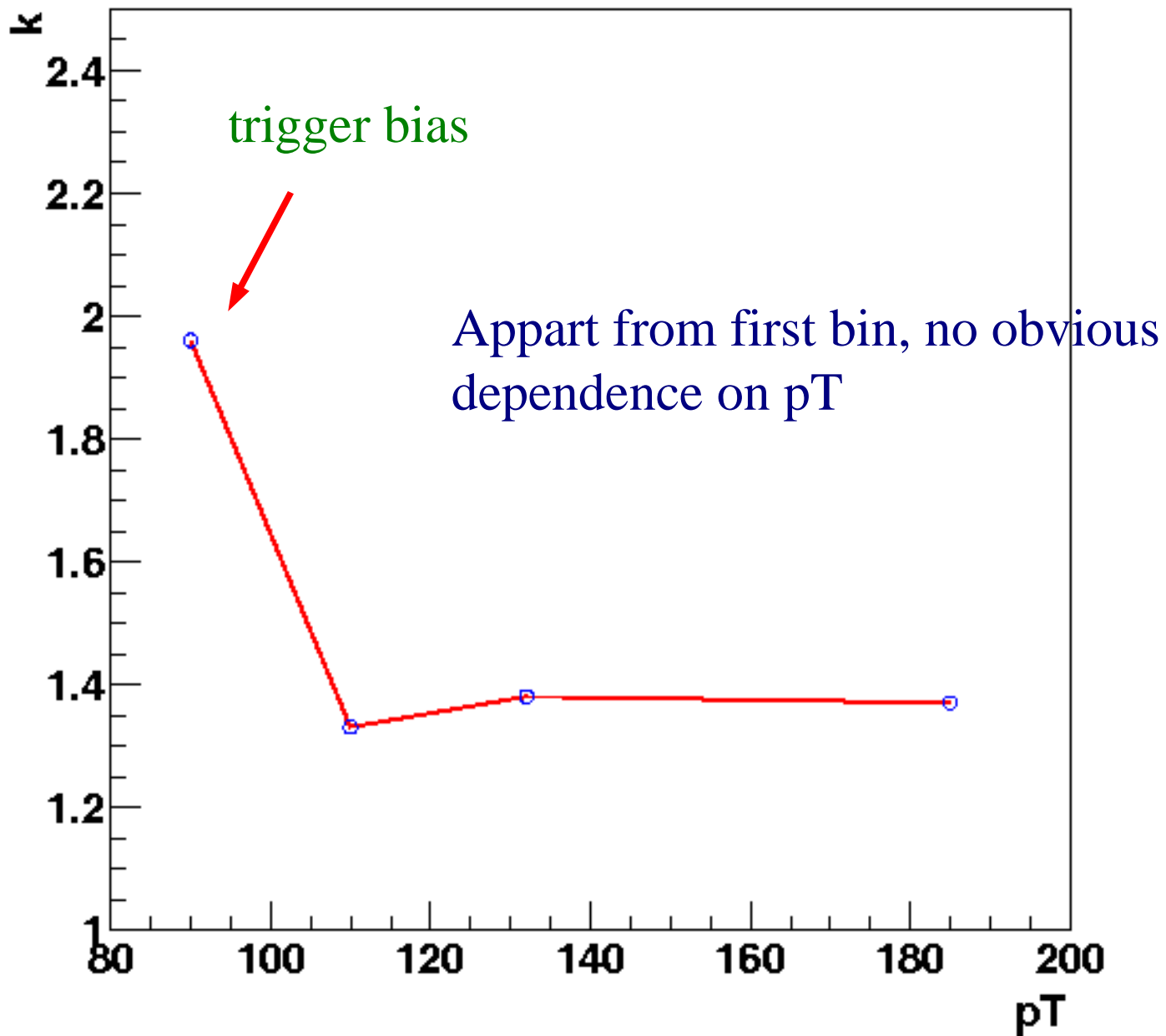
- It is known that the response is biased when the jets are close to the trigger threshold. The resolutions might be biased as well.
- If the constant term is large, this will introduce a dependence of k on p_T .
- We divided the sample in 4 p_T bins and measured the resolution independently.
- Except for the first bin, we don't see any dependence of k on p_T , we will use $k=1.35$

PT

definition of pT bins



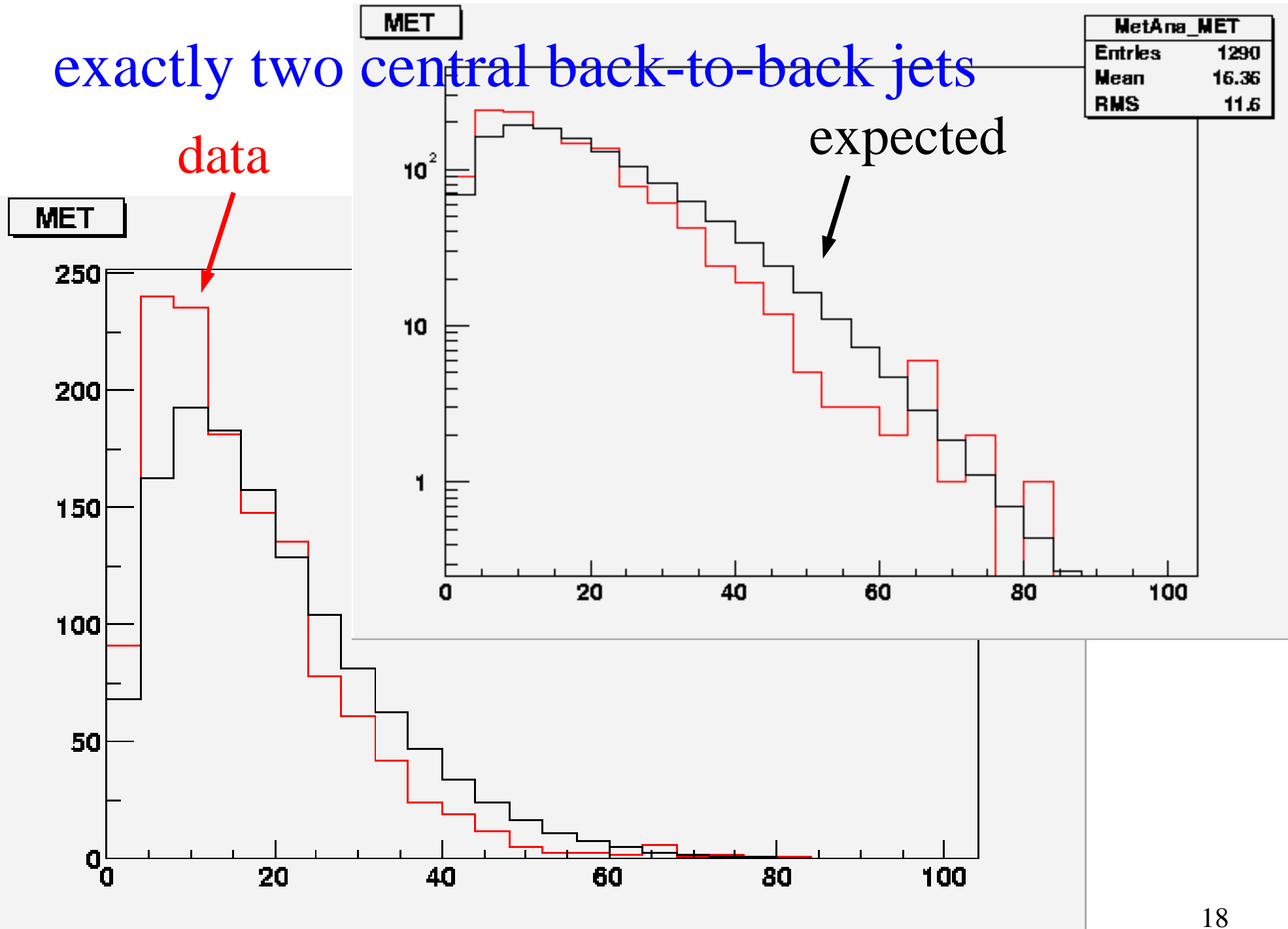
12/13/2002



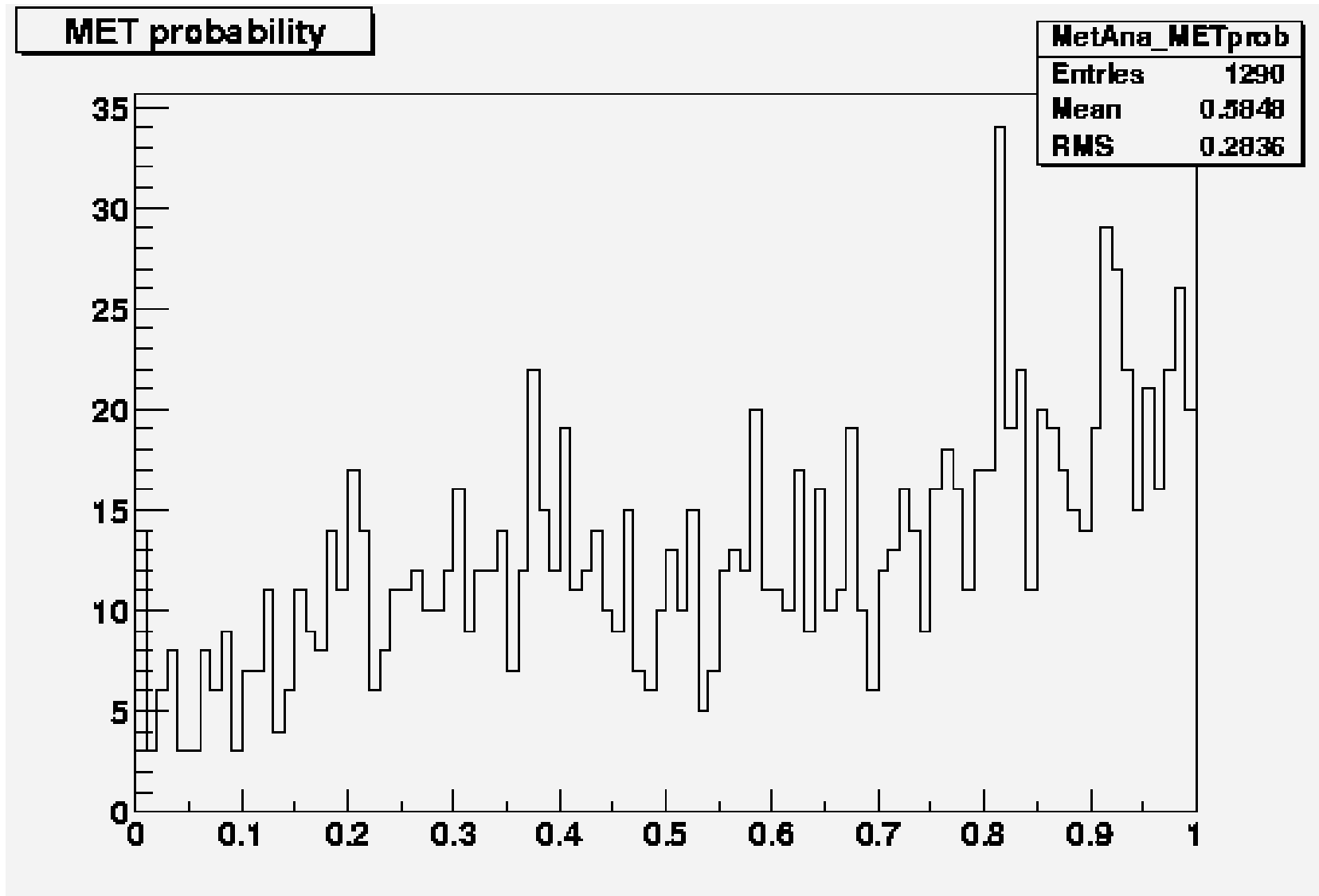
Missing ET

- We will generate the expected mET with the procedure outlined above, using a resolution of $k=1.35$ for the measured and balancing jets, and for the unclustered energy.
- While simulating the gedanken experiments, we can calculate the fraction of experiments that result in a simulated mET larger than the measured mET. This is called the “missing ET probability”. If all events were multijet events with no genuine mET, the mET probability distribution should be flat if the resolutions are correct.

exactly two central back-to-back jets



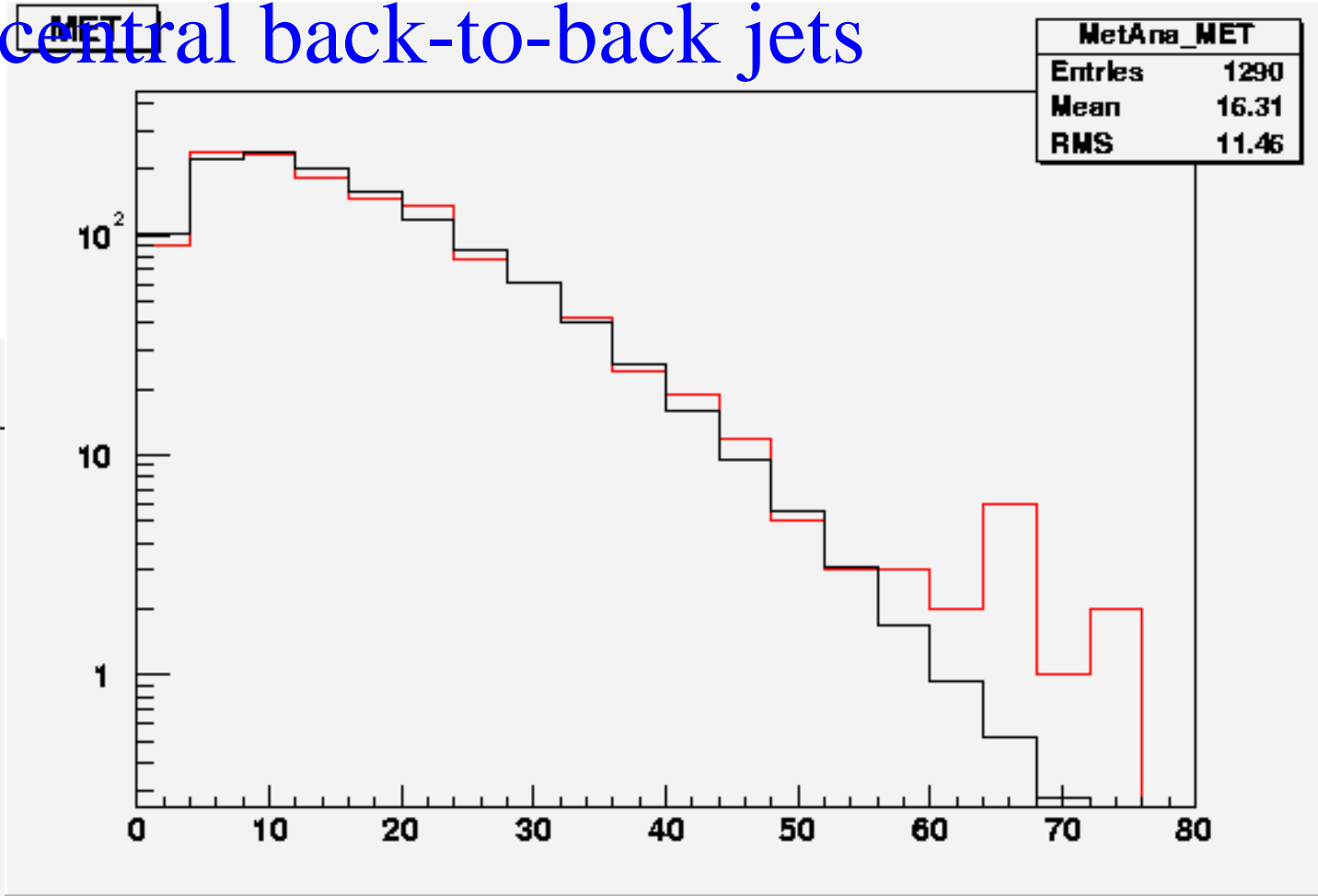
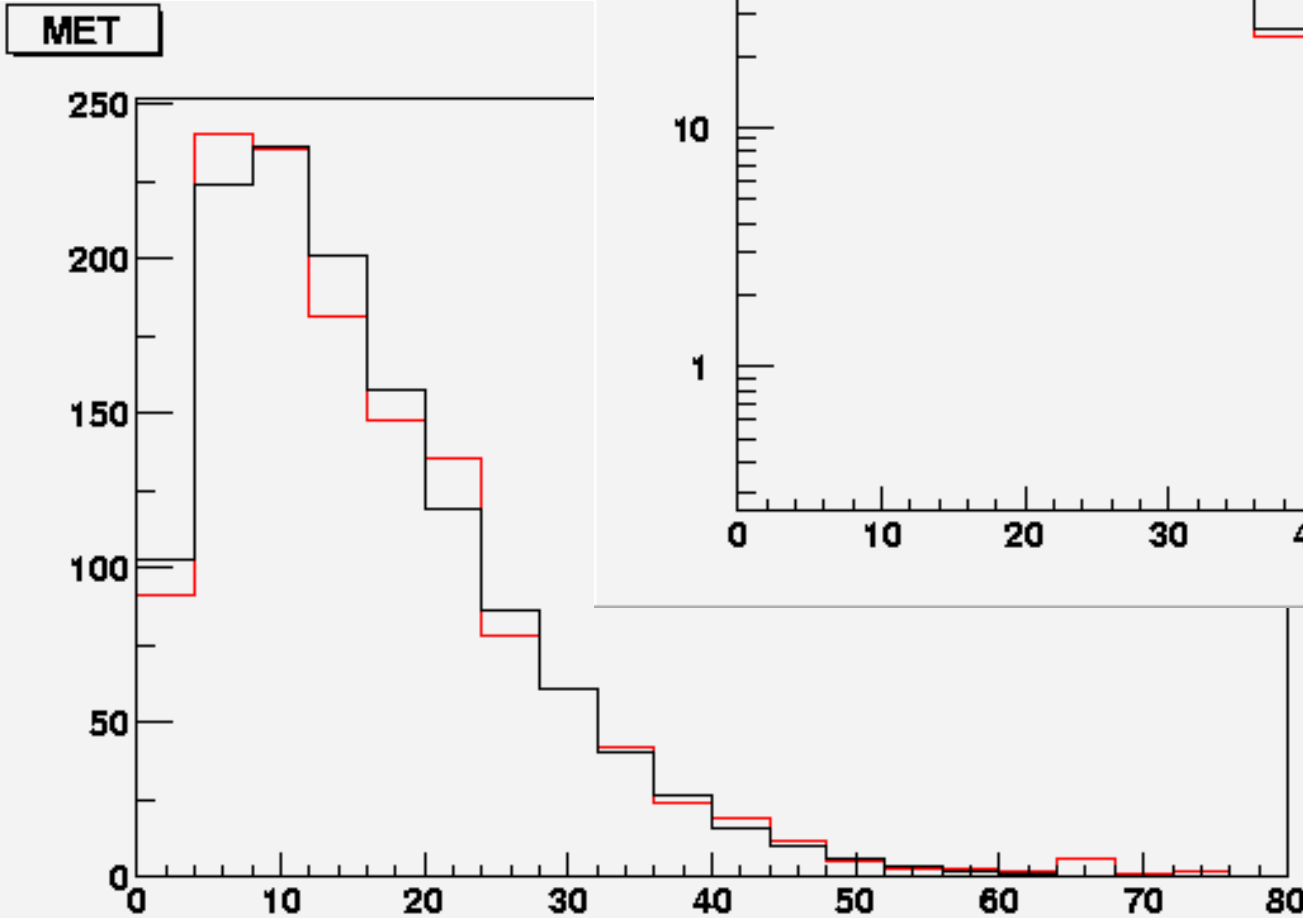
exactly two central back-to-back jets



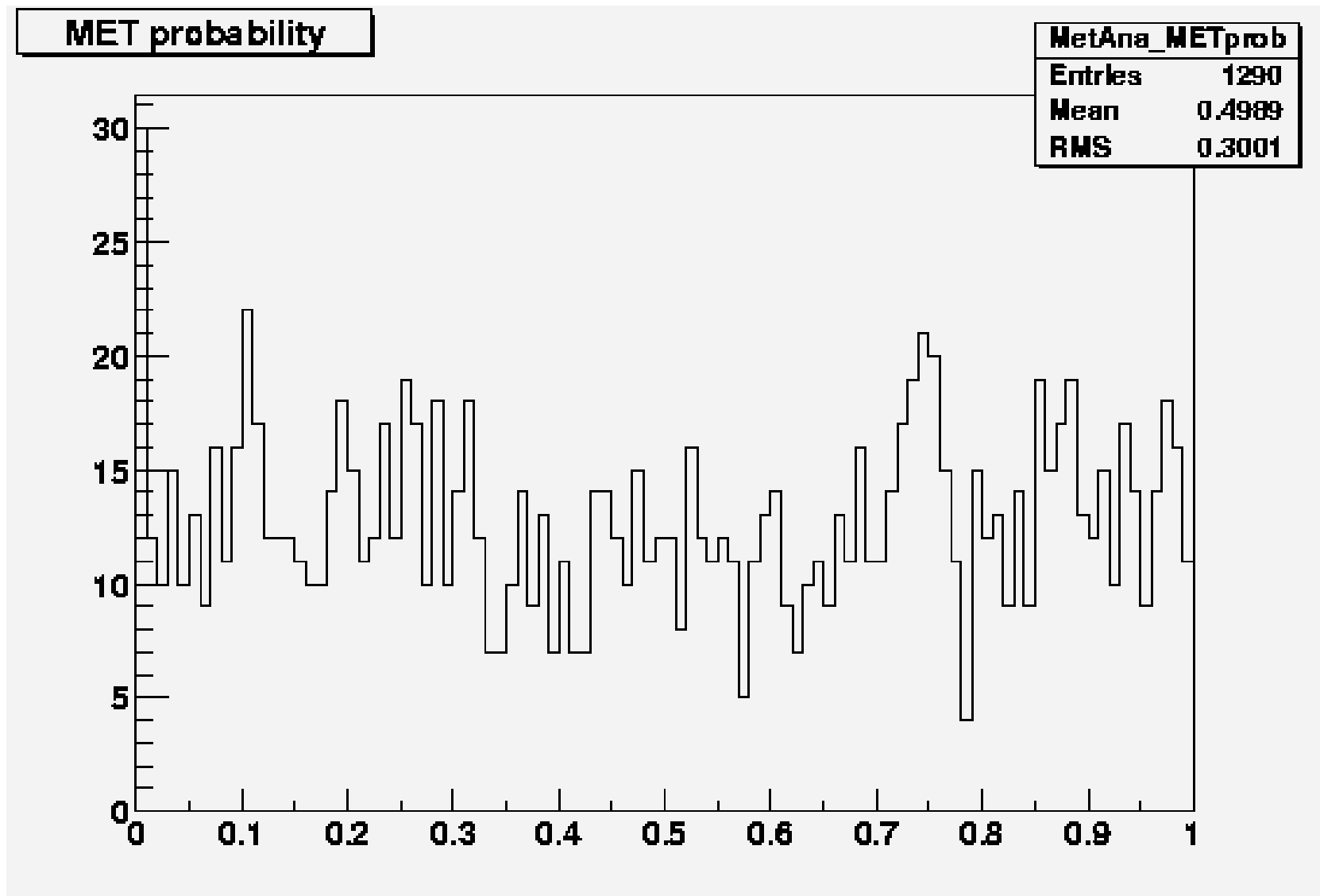
- Although we are running on the sample on which we measured the resolutions, the expected mET distribution does not fit well the data. The resolution seems to be overestimated.
- In d0note 4030, a **scale factor κ** on the resolution was introduced and adjusted to the data. The interpretation was that **out-of-cone fluctuations anticorrelate jets and unclustered energy**, so that **the resolution on the sum is better than the resolutions of the individual contributions**.

exactly two central back-to-back jets

$\kappa=0.8$

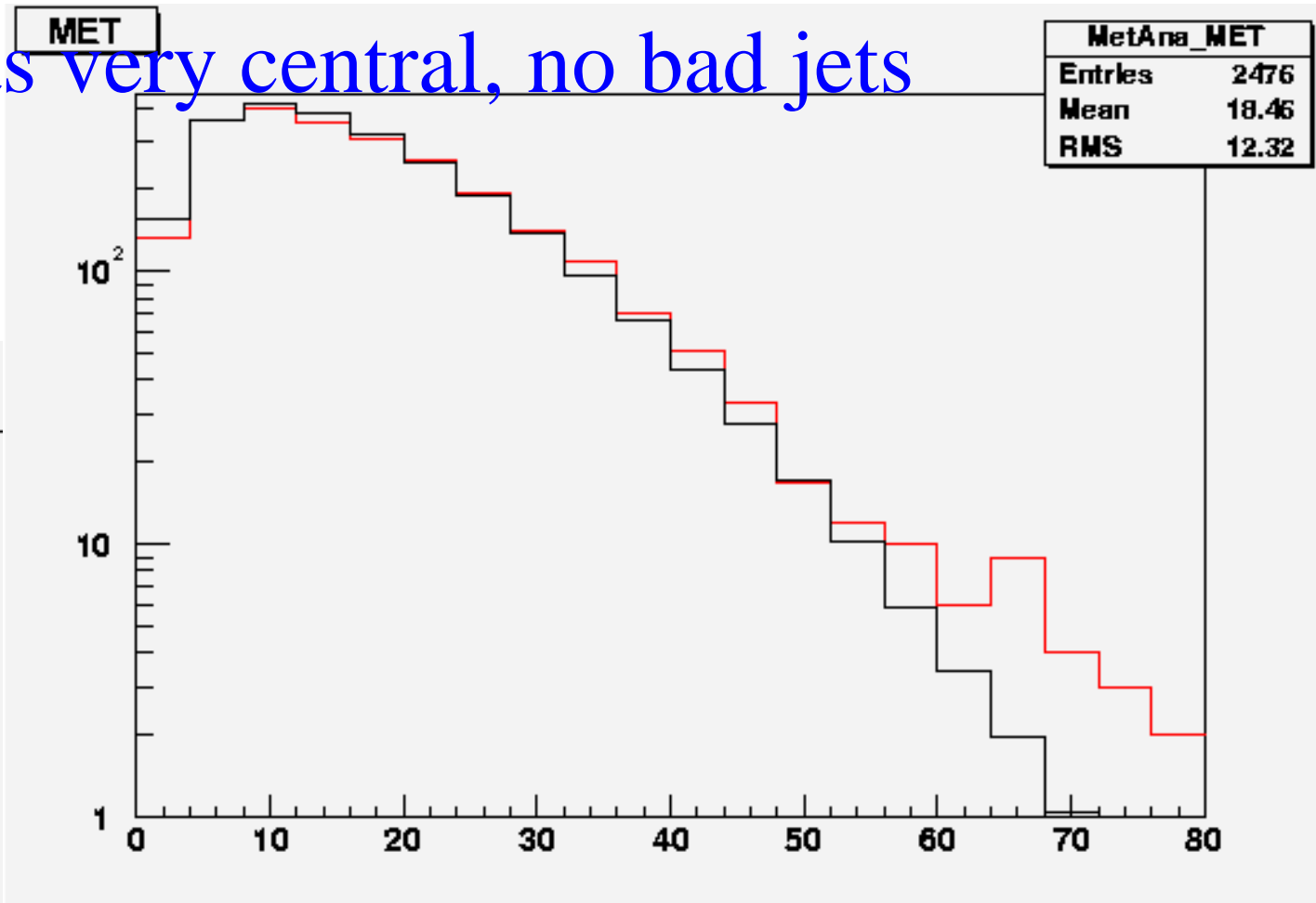
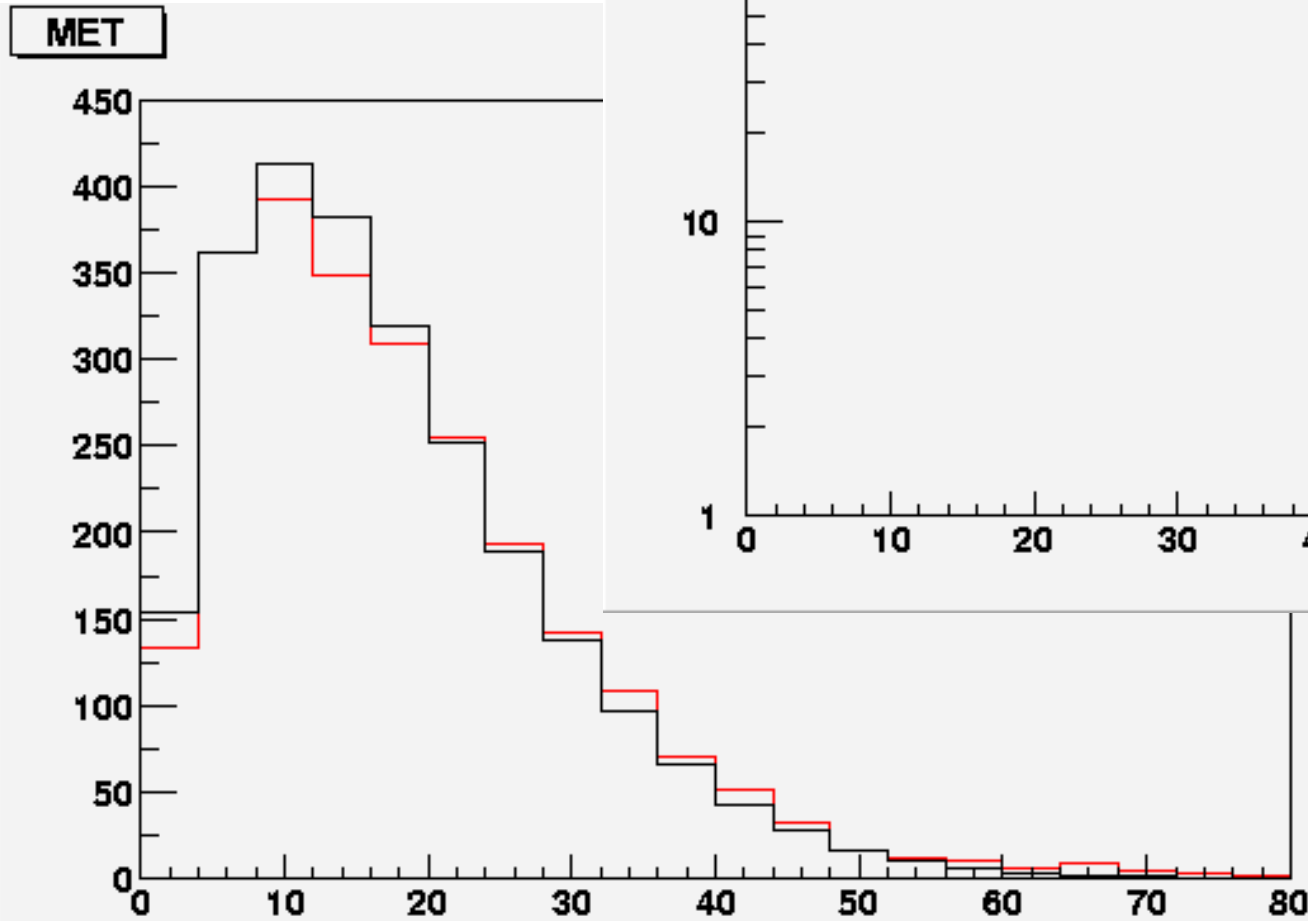


exactly two central back-to-back jets $\kappa=0.8$

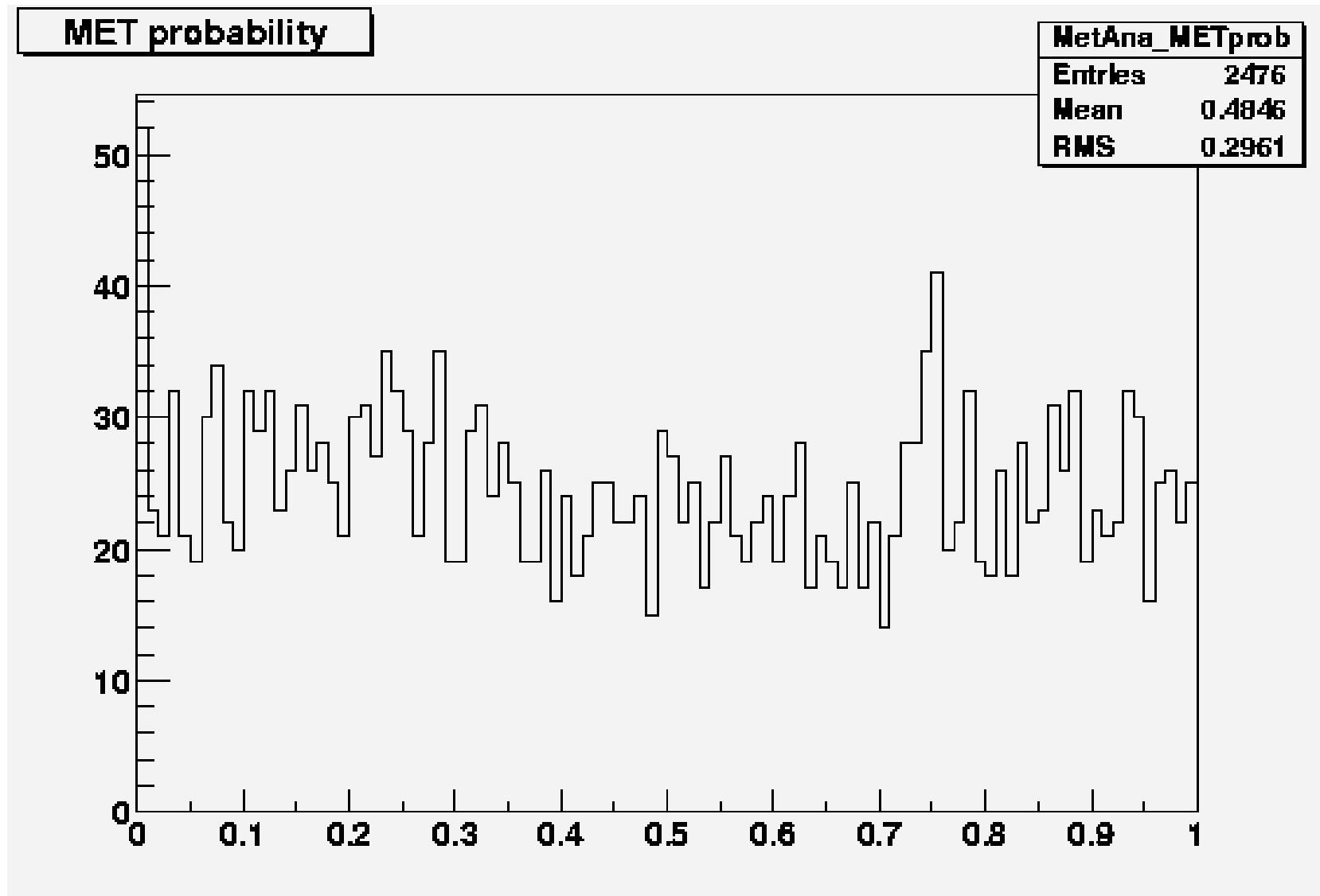


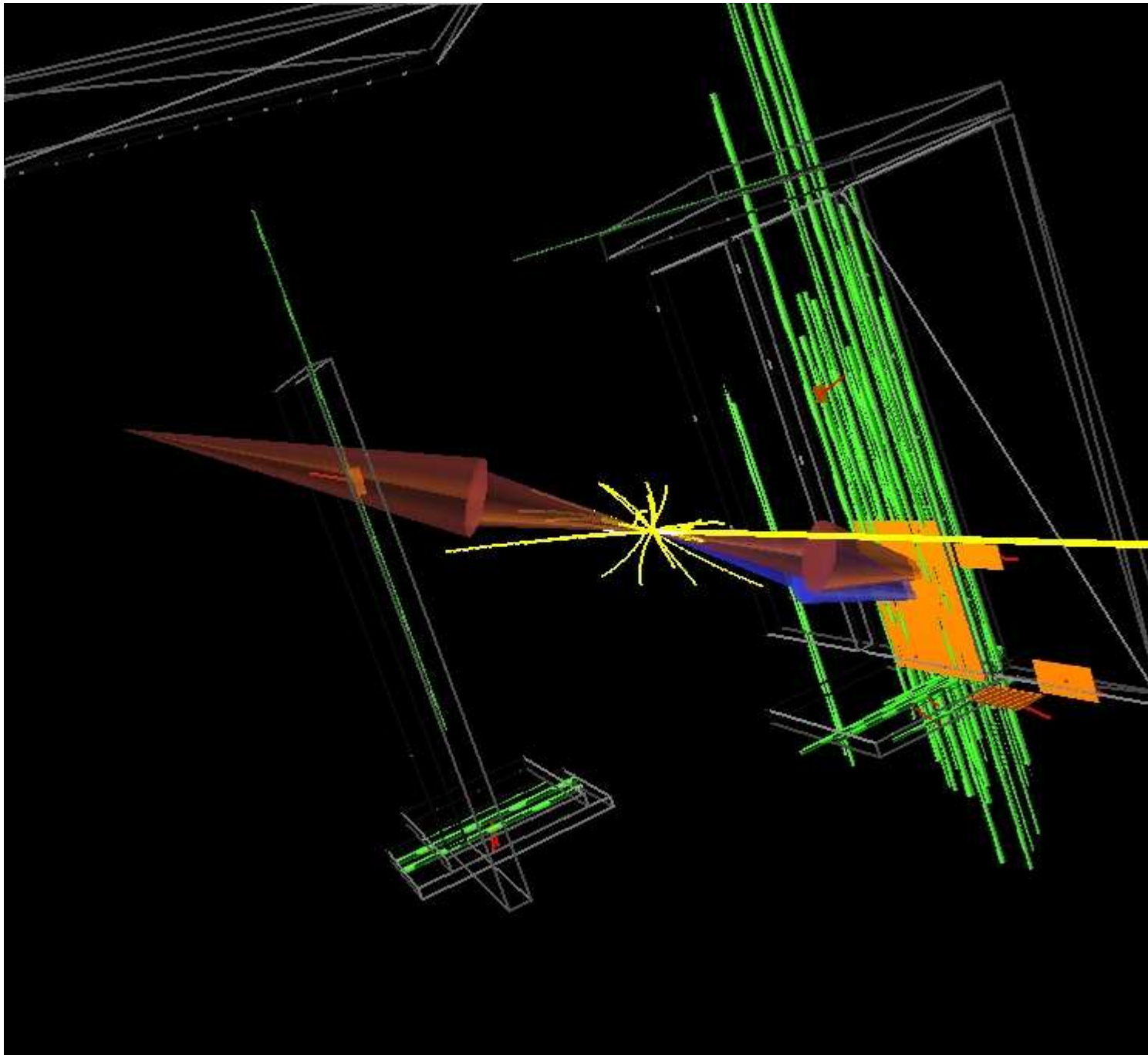
2 leading jets very central, no bad jets

$\kappa=0.8$

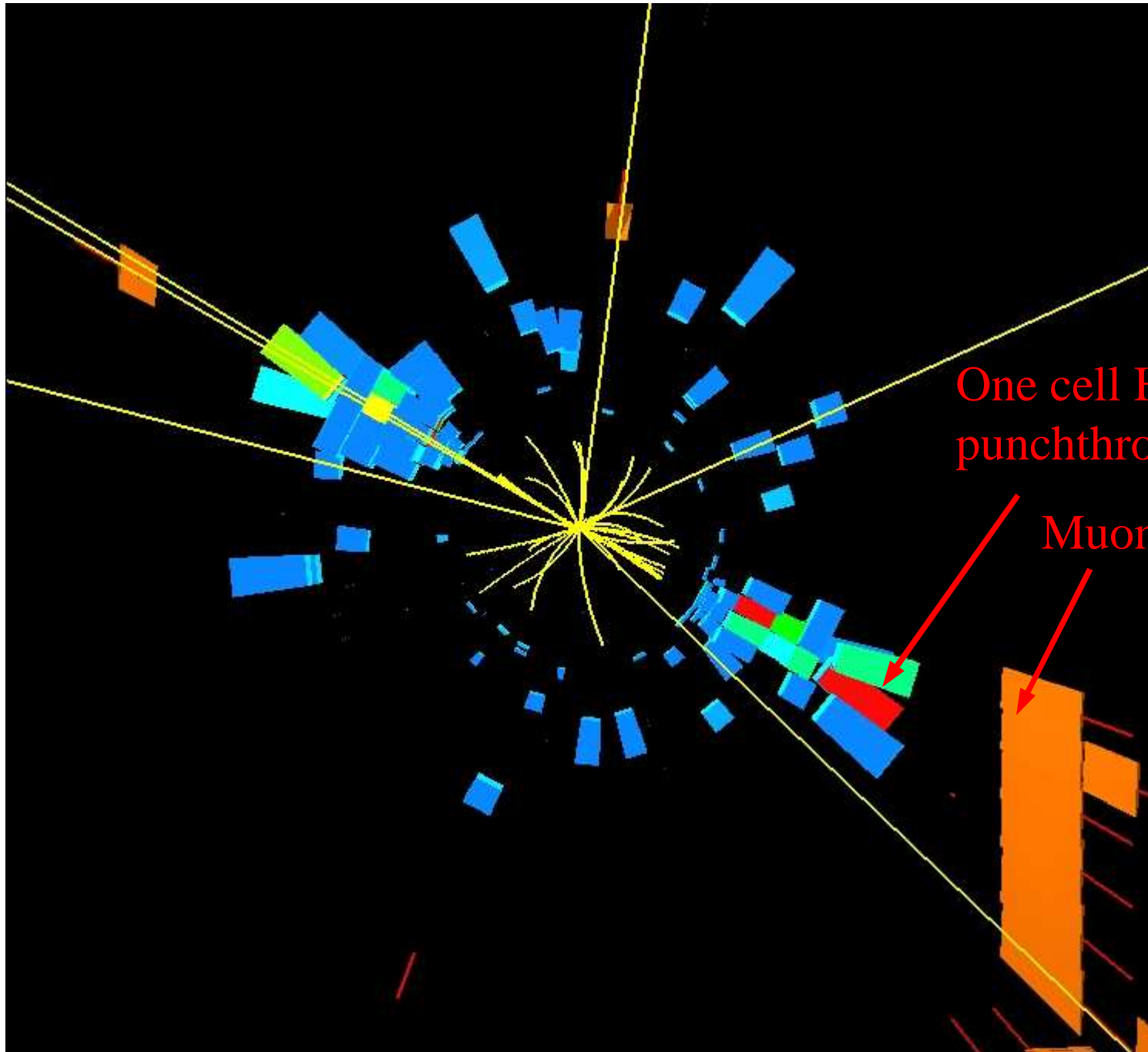


2 leading jets very central, no bad jets $\kappa=0.8$





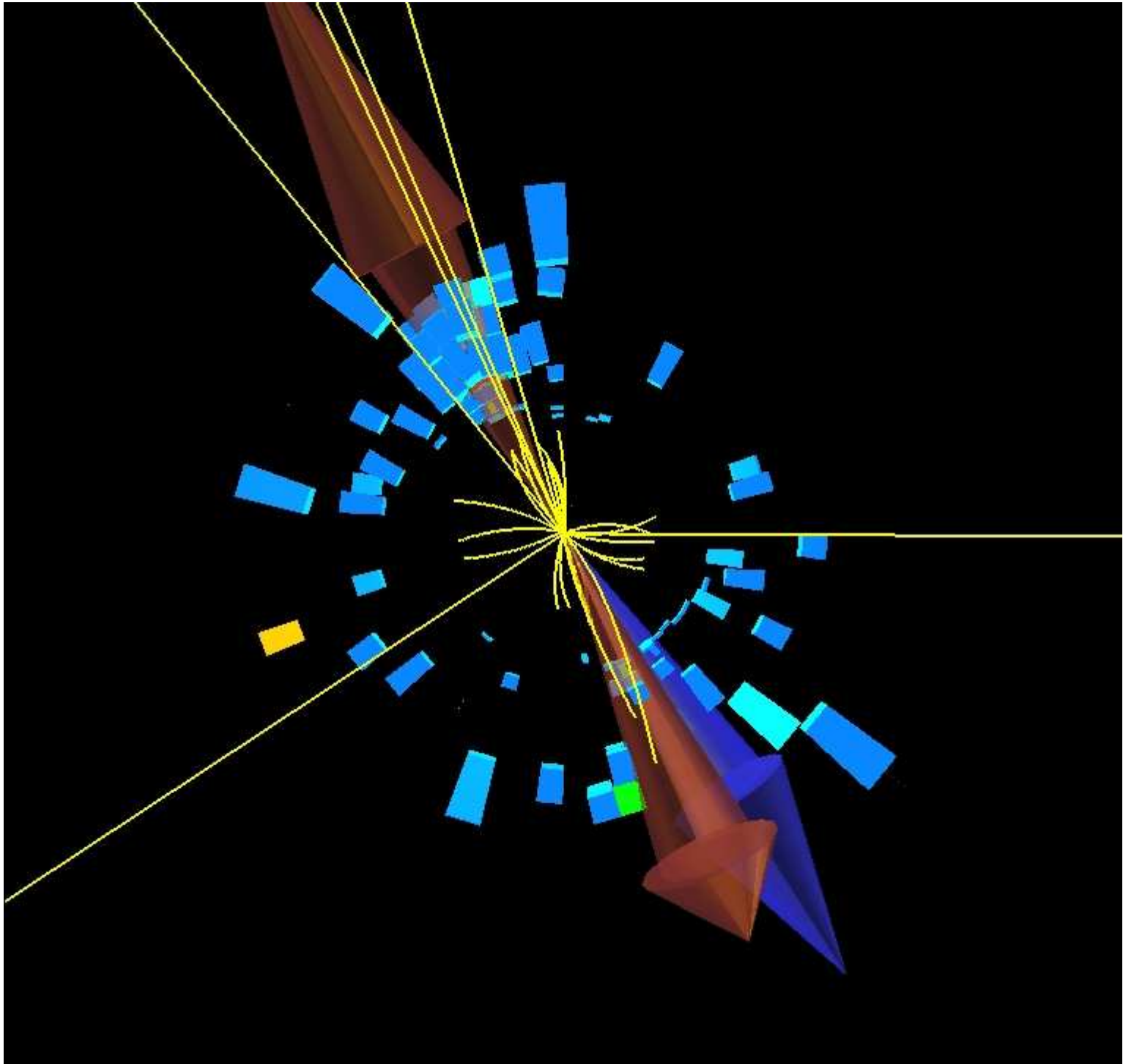
Laurent Duhot NP workshop
12/13/2002



One cell HT 12 GeV
punchthrough ?

Muon lit up !

12/15/2002



12/13/2002

Perspective

- The model seems to be consistent for very central jets.
- The origin of the κ factor needs to be understood. In principle it might not be the same for the jets and the unclustered energy.
- The study will be extended to central, forward and IC regions.