CTB04: electron Data vs MC

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LAr CTB04 WG 25-Aug-05

Outline

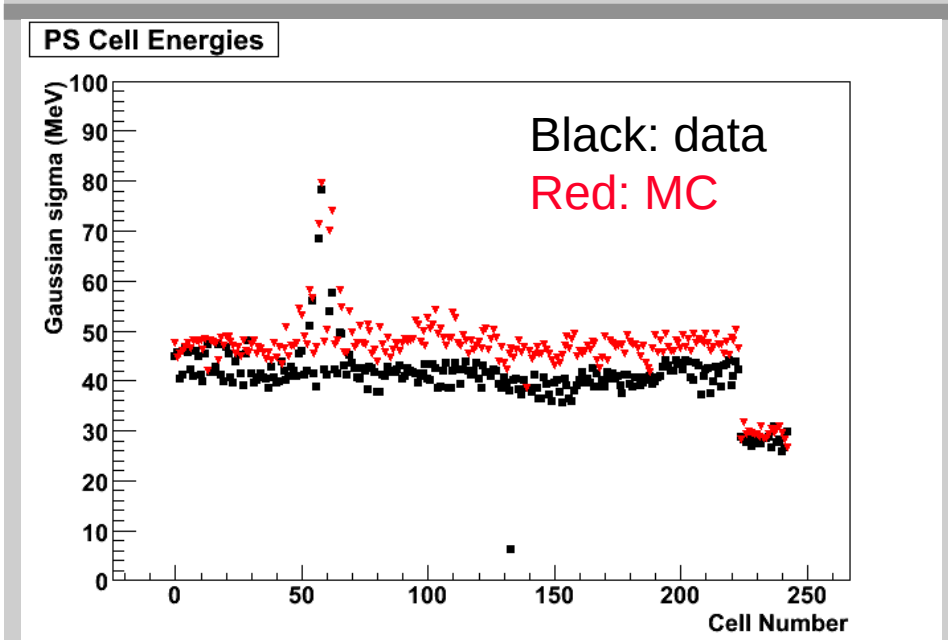
- Trying to determine to what extend our CTB simulation (material) describes the data
  - Tricky because data reconstruction issues (intercalibration, OFC timing etc.) may cause smearing not in the MC.
- Present some Data vs MC control plots
- Report on non-simulated extra material in the beamline far upstream our CTB
- Rerun simulation with extra far and close material, compare to the data and draw first conclusions.

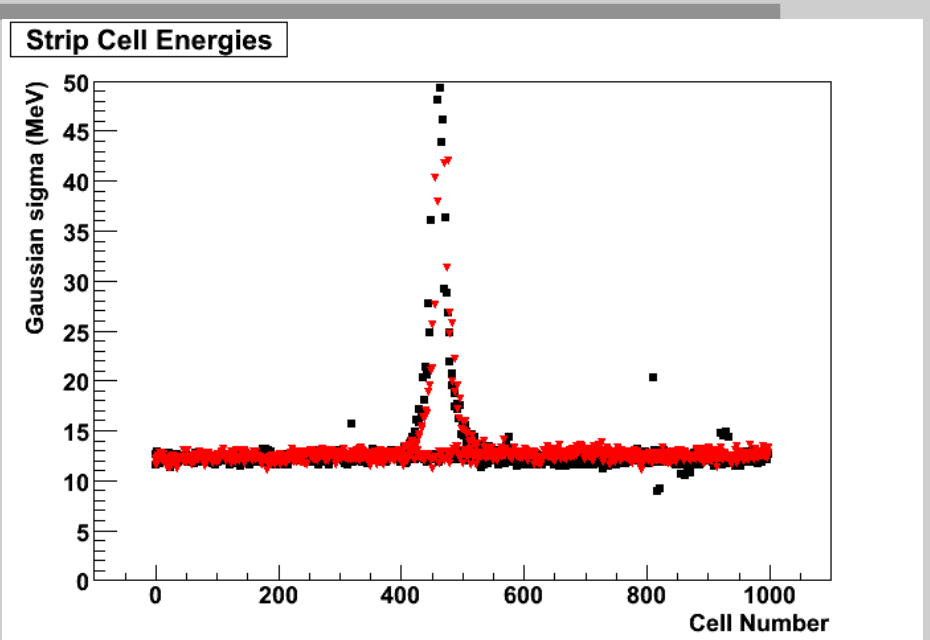
Control Plots (data vs MC)

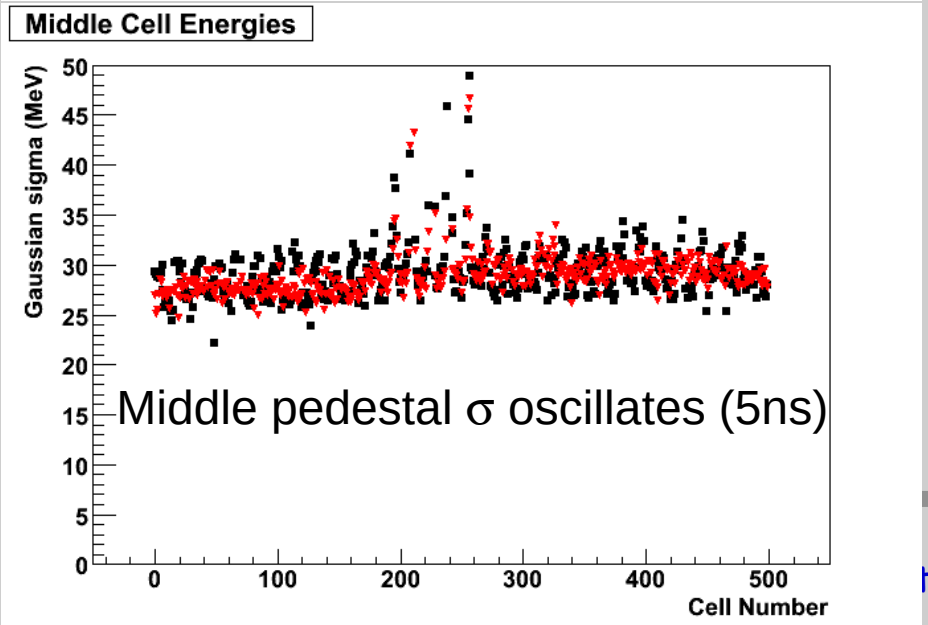
- Pedestal Distributions
- Cluster eta, phi (i.e. beam) profiles
- E0, E1, E2, E3 and Erec for different energies
- E0/E1, E1/E2
- Frac = $E_{7strips}/E_{3strips}$ - 1

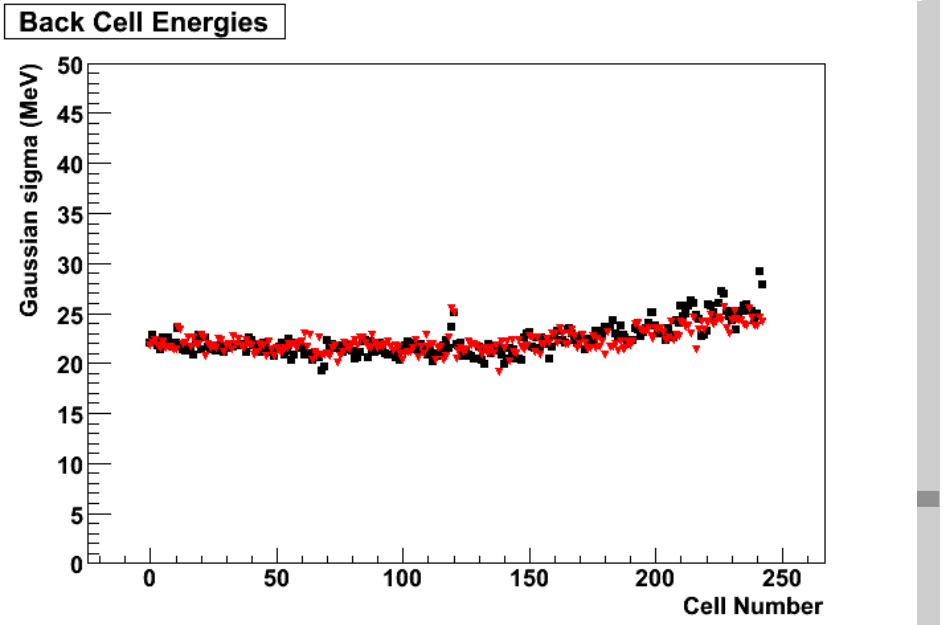
- Check the "Clock" (0-25ns) dependence

Pedestal Gaussian Sigma (Run: 1000952)

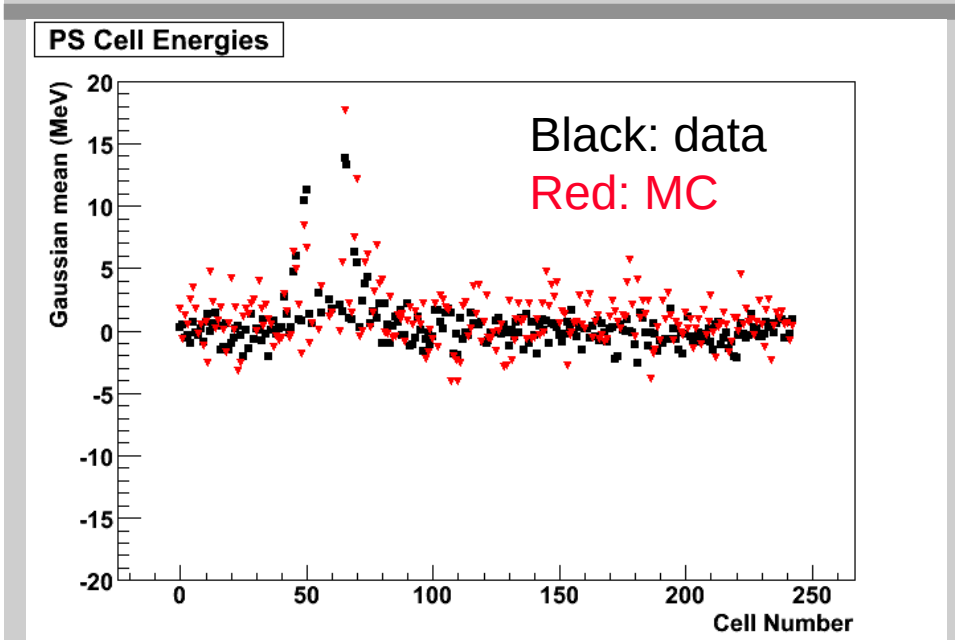


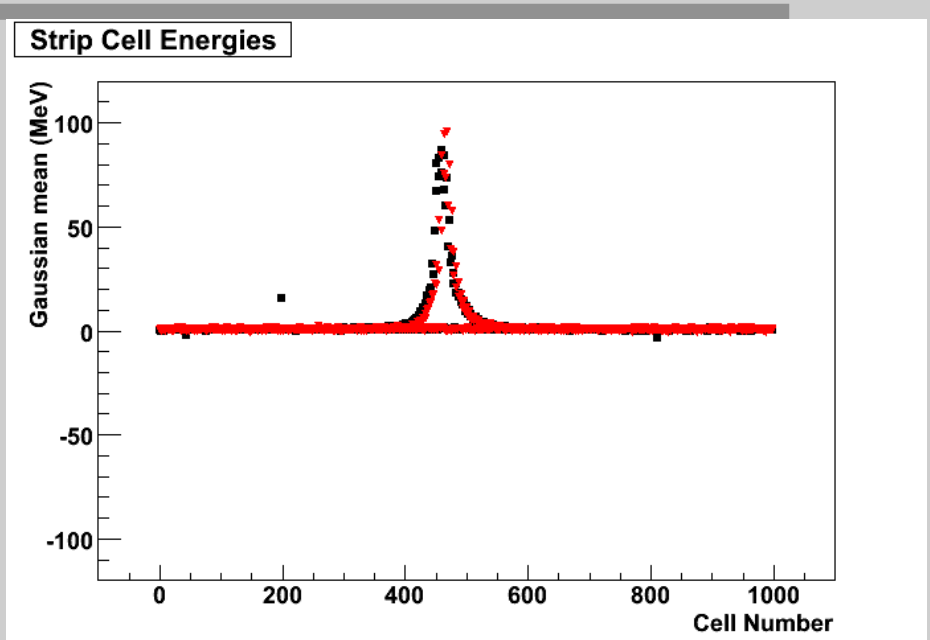


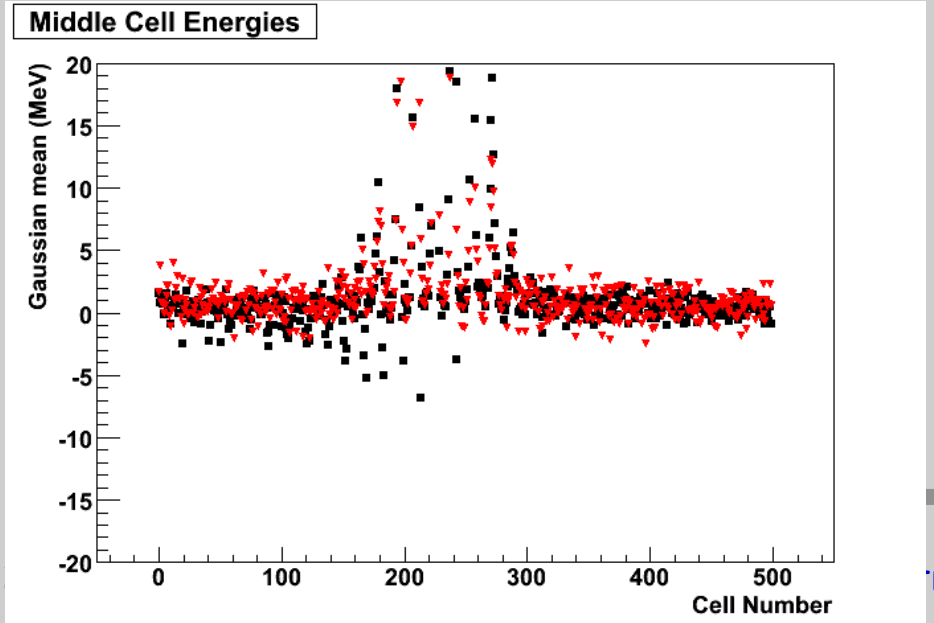


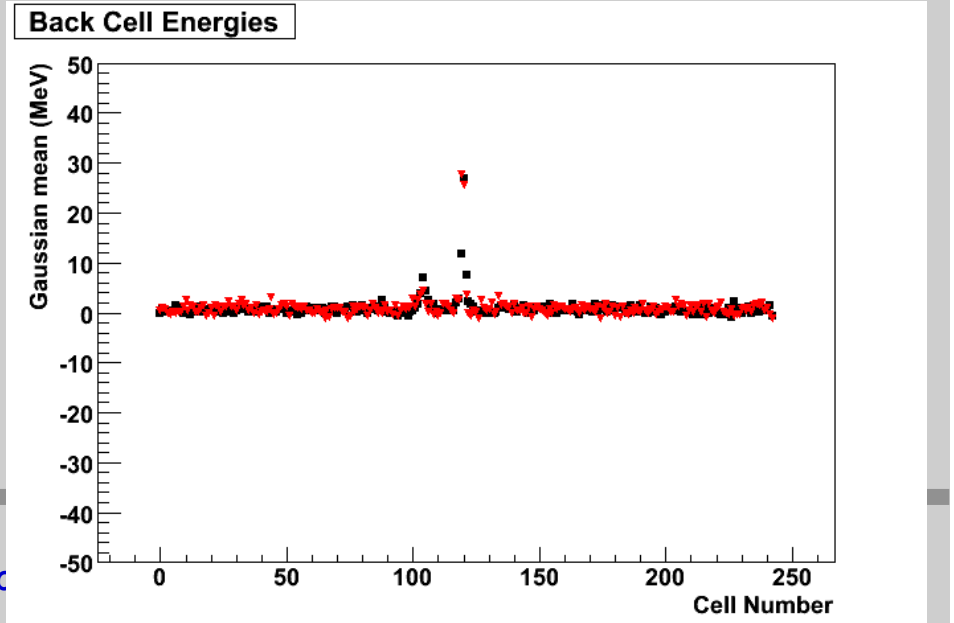


Pedestal (subtracted) Gaussian mean









Far Upstream material (1)

- Beam line has a main target T4 and a secondary target 137m later to run in the “filter mode” for tertiary beam production (10-150GeV).
- The Calorimeter sits at about 577m from T4
- The CTB Simulation starts at ~542m (not perfectly sure here)
- From 137 to 541m we have a series of beampipes separated by Air. There are also pitch and quad magnets, FISCs and MWCAs for beam monitoring (they go in and out, see beam logbook), Trig. Counters (in/out) and 2 Cherenkovs (one upstream the NA45 and one upstream of ATLAS)
- I tried to estimate the material from 137m to 541m

Air	: 27meters/303.92	= 0.089X0
Aluminum	: 0.07cm/8.9	= 0.008X0
Mylar	: 0.24cm/28.7	= 0.0083X0
Cherenkov	: 2*0.01X0	= 0.02X0
TRIG5	: 3mm	= 0.008X0
MWPCs	: 6	= ?

		~0.134±0.02 X0

NOT Simulated

Far Upstream material (2)

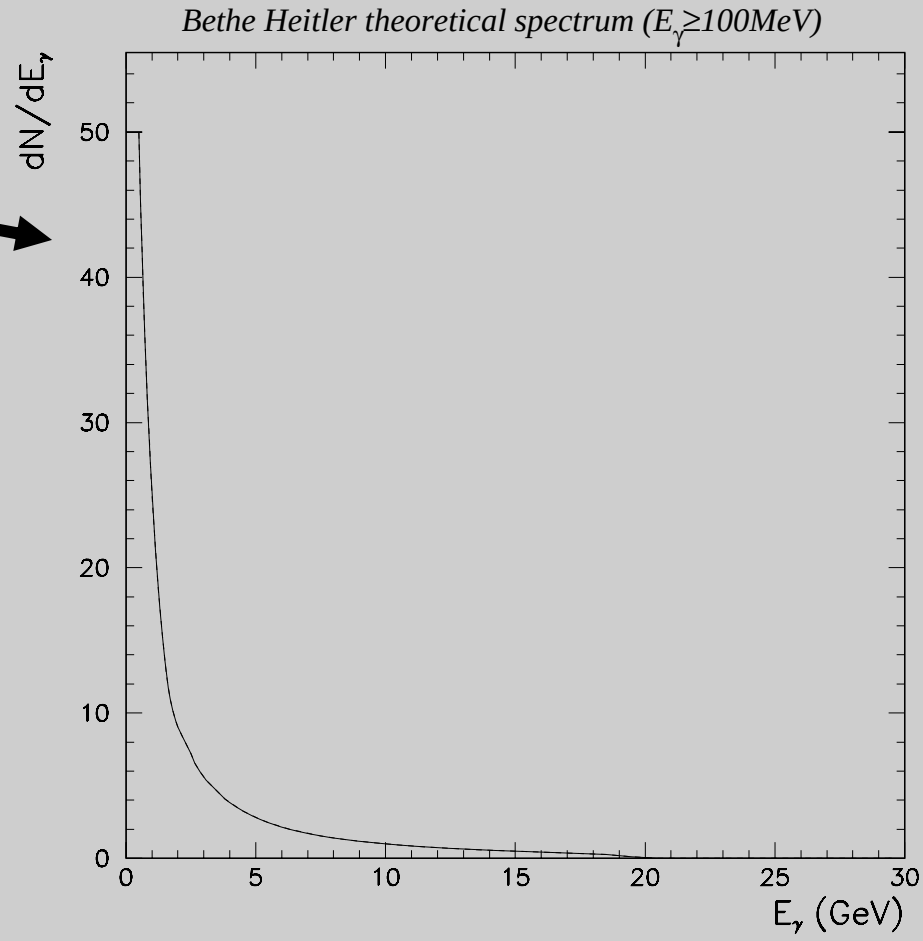
Electrons undergo Bremsstrahlung in the beam line according to the B-H cross-section (see plot for 20GeV e).

Most Brem photons are soft (<2GeV).

A few % of these photons will convert and the resulting e-pairs can be swept out of acceptance due to B-fields in the beam line.

This gives less MIPs in the Presampler and results in a softer than expected energy distribution in the Presampler.

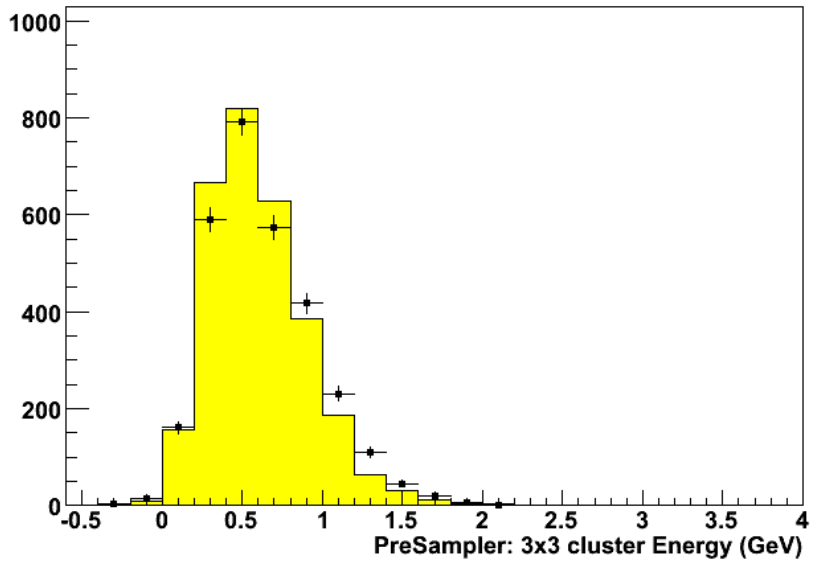
The effect is also e-Energy dependent.

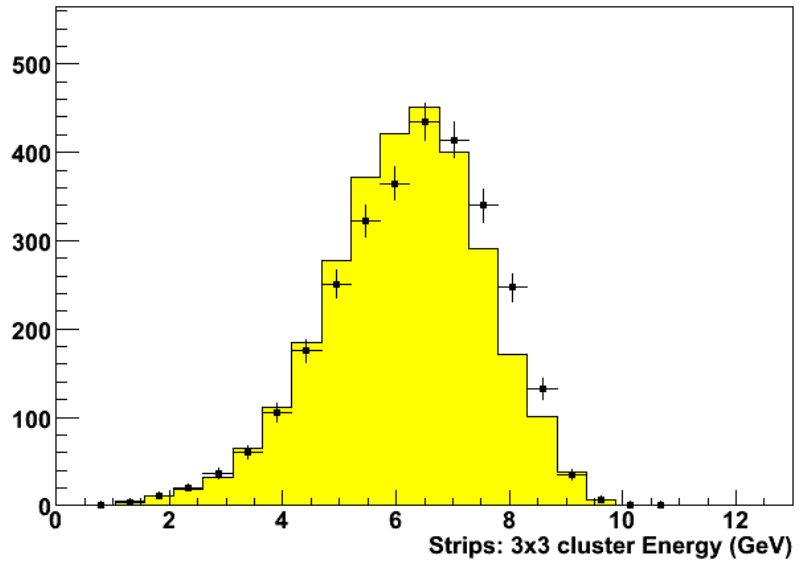


Sim/Recon details (run 1000952 20GeV)

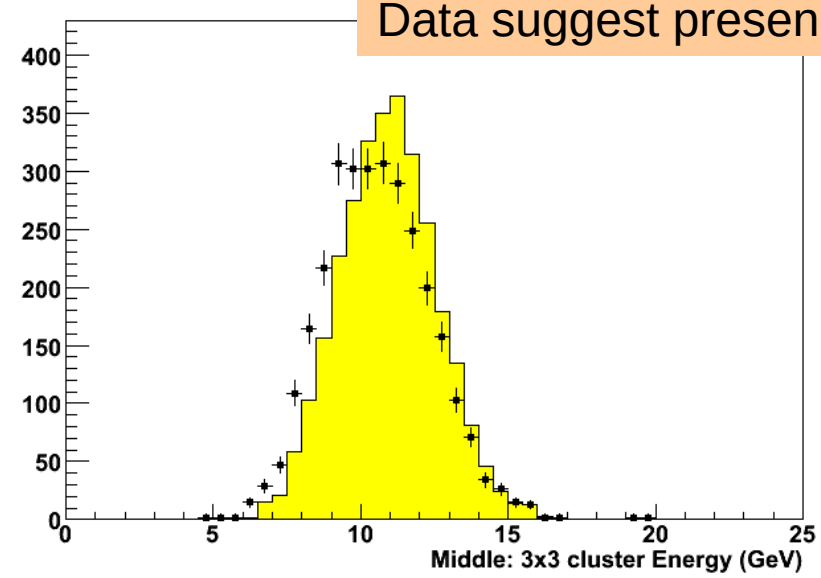
- Simul: 10.0.4
  - PS E-field extends 13/11 longer in MC.
  - Strips Sampling depth is 1mm too short (in 10.0.4)
- Recon: 10.0.4 + Tags by Marco
  - OFCs : TB04-2
  - Pedestals: HEAD, Ramps, ADC2uA: TB04-default
  - uA2MeV: "old set" ->
  - EMTB 3x3 cluster (but also tried modified 3x3 and other sizes), no weight corrections yet.
- Final Analysis (keep it simple):
  - 0.9*Estrips (Data: first rough cross-talk approximation)
  - 11/13*Eps (MC: to account for E-field extend)
  - 0.96*Erec (MC: just a normalization)

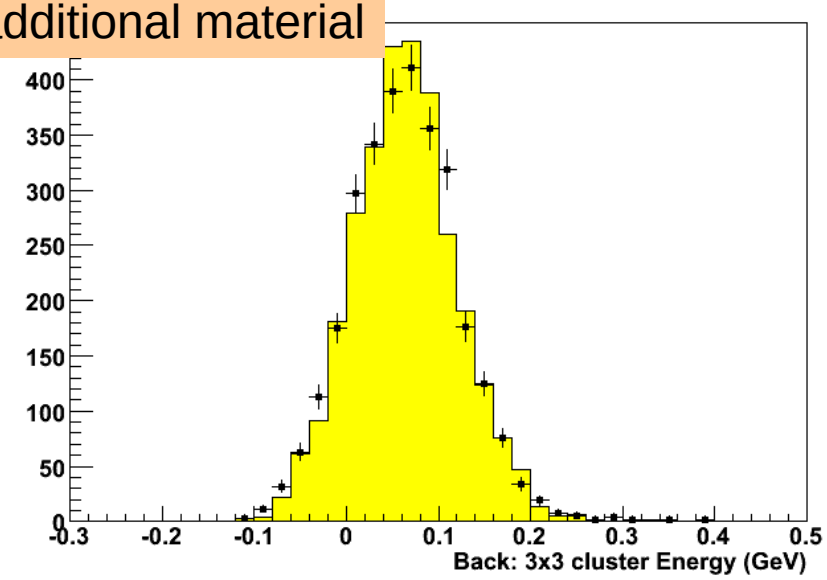
Data vs MC with extra 0.15X0 far upstream



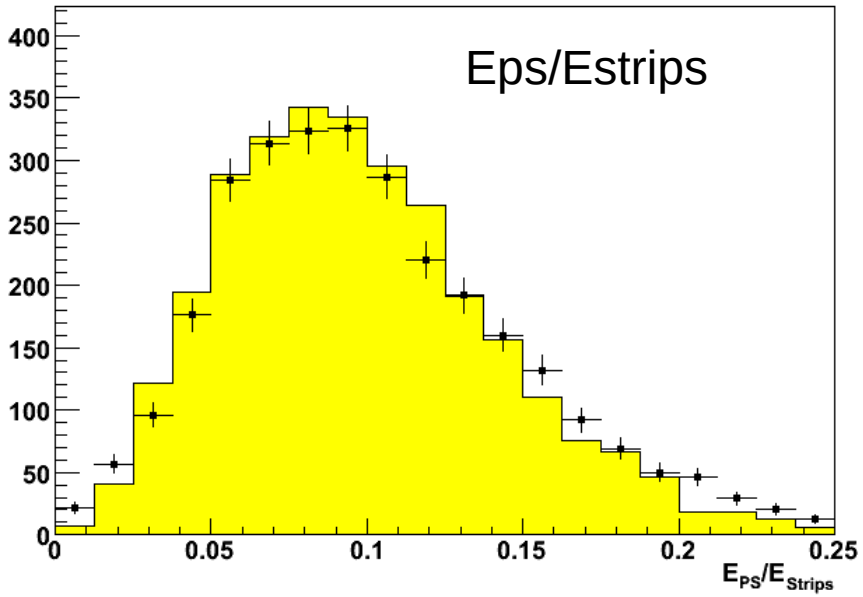


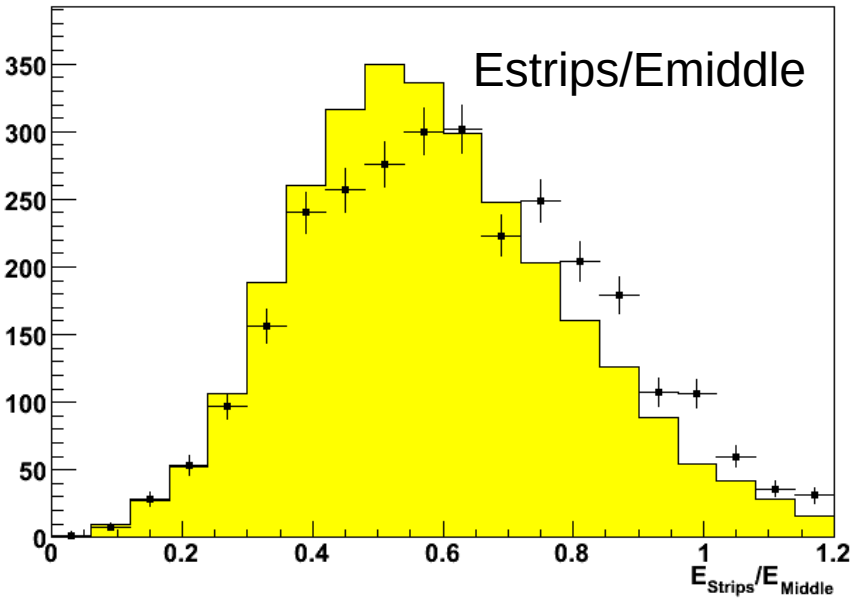
Data suggest presence of additional material



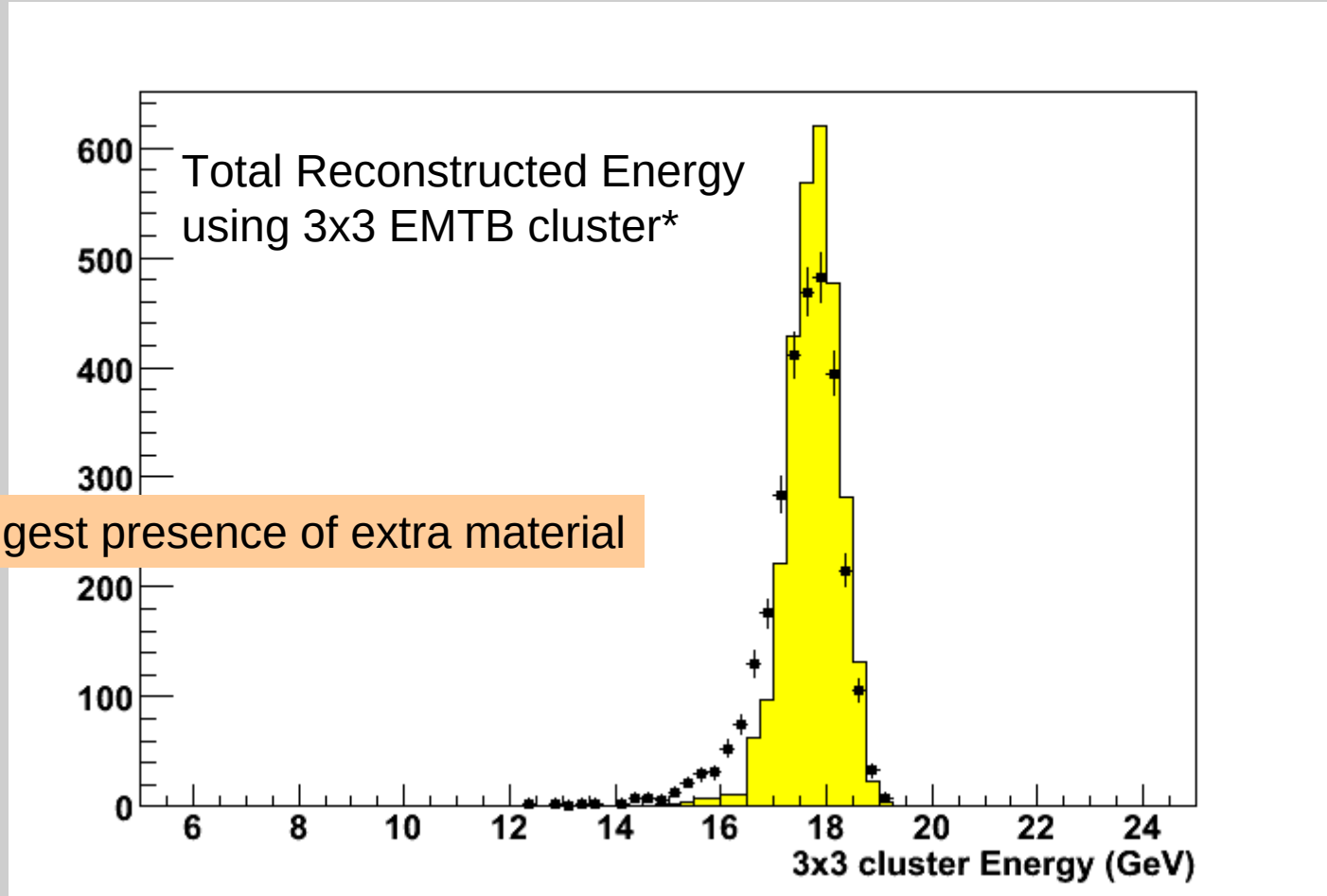


Data vs MC with extra 0.15X0 far upstream





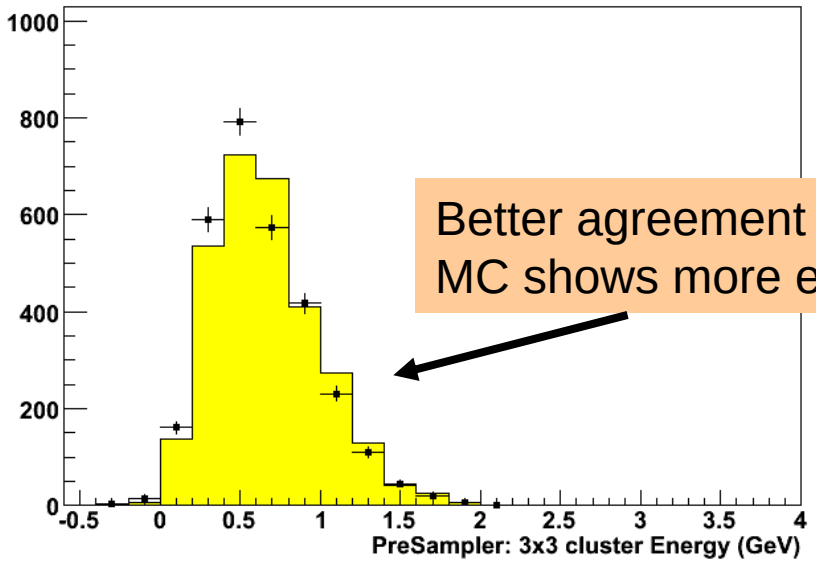
Data vs MC with extra 0.15X0 far upstream



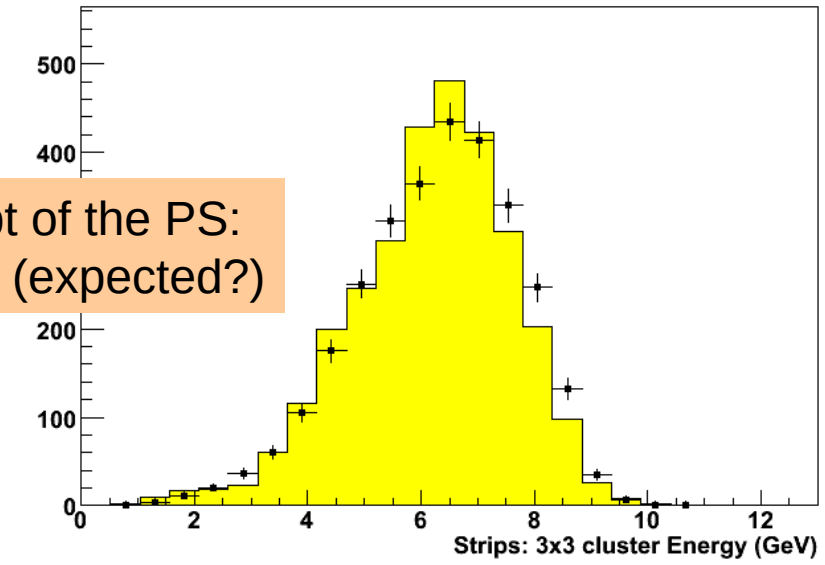
Data suggest presence of extra material

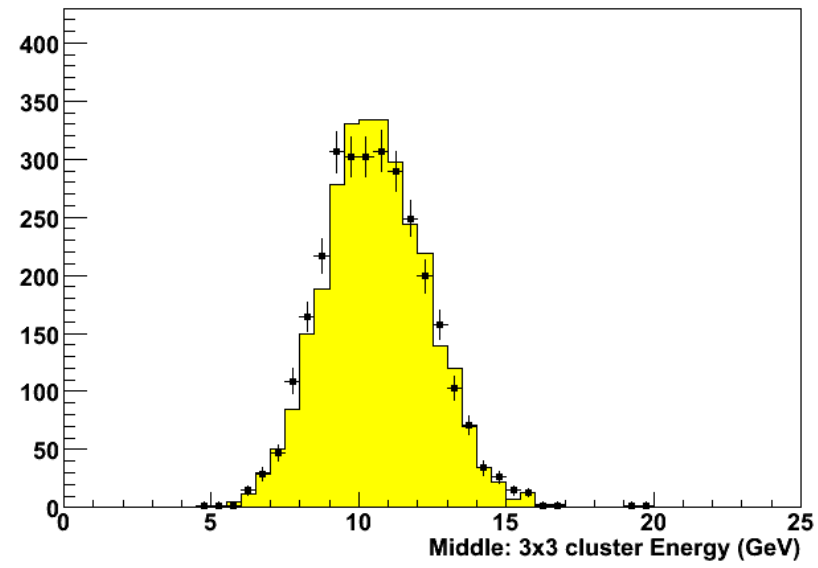
(*) I have tried different cluster sizes and modified 3x3 but control plots don't change

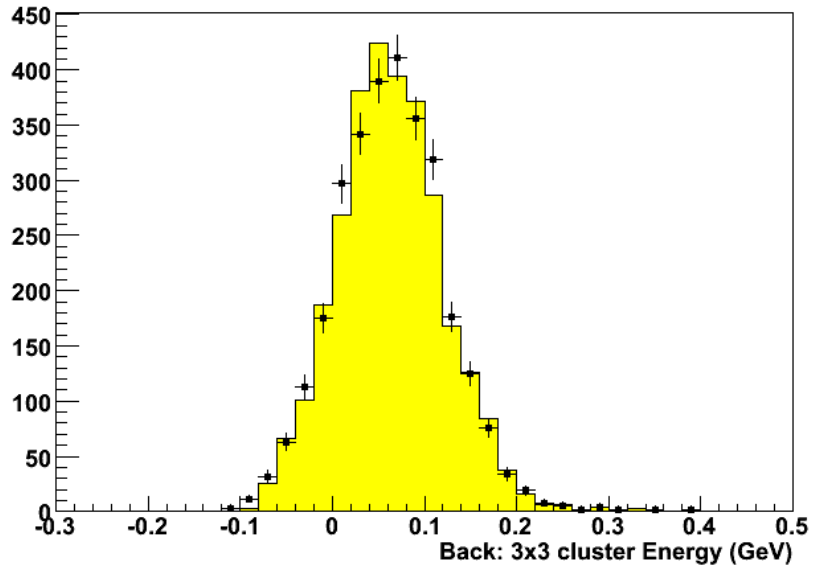
Data vs MC with extra 0.3X0 far upstream



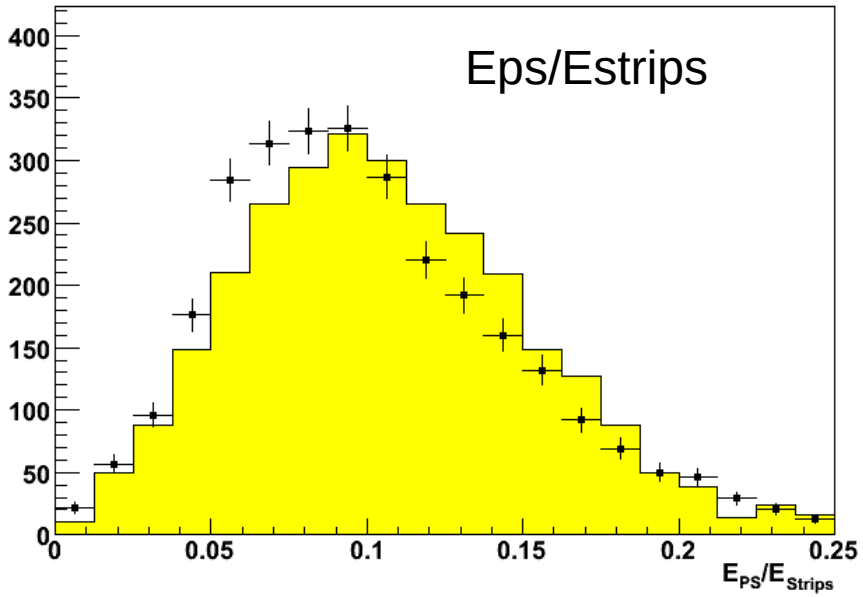
Better agreement except of the PS:
MC shows more energy (expected?)

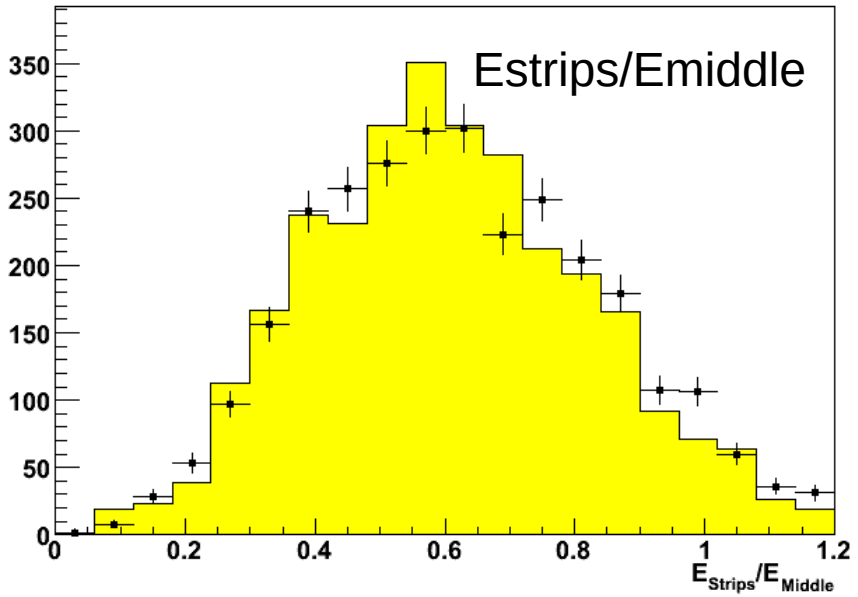






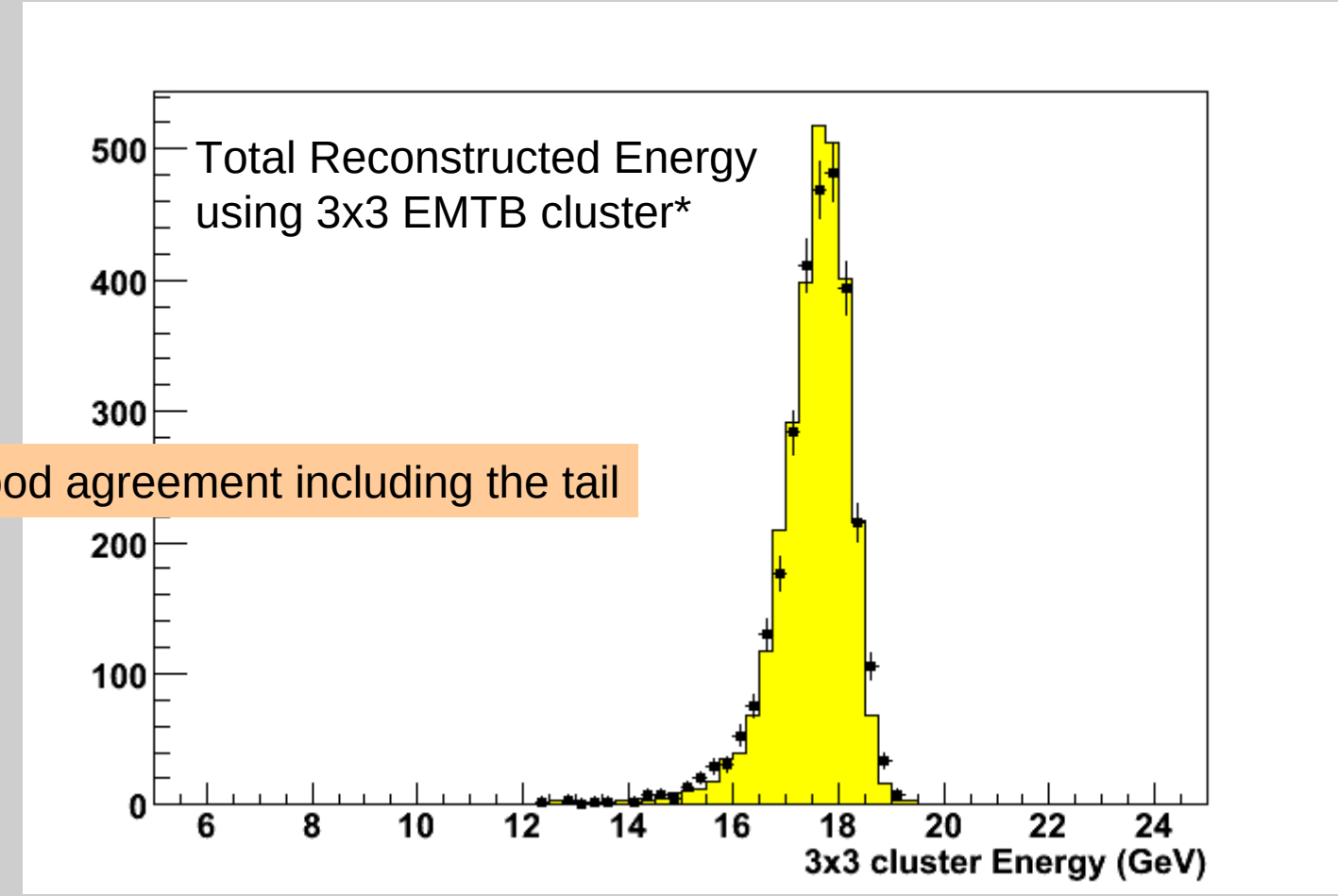
Data vs MC with extra 0.3X0 far upstream





The problem is also evident in the Eps/Estrips control plot (but caution with strip section depth and cross-talk)

Data vs MC with extra 0.3X0 far upstream



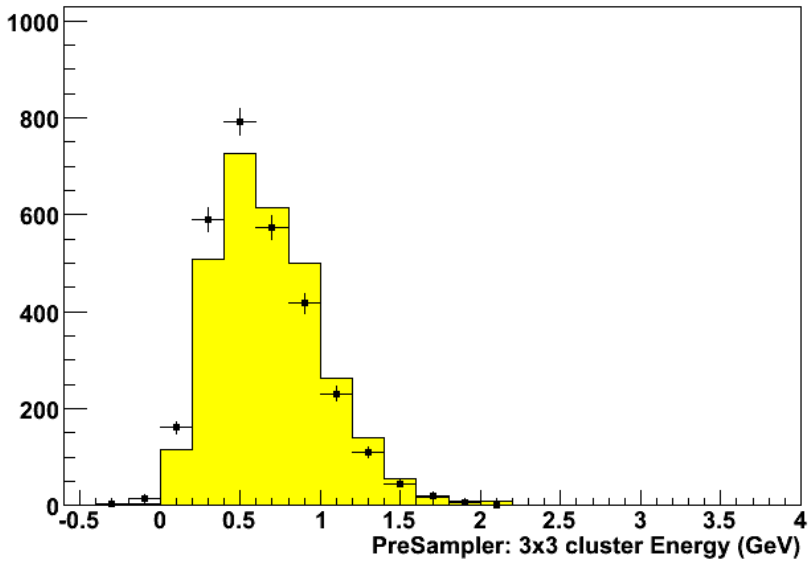
Good agreement including the tail

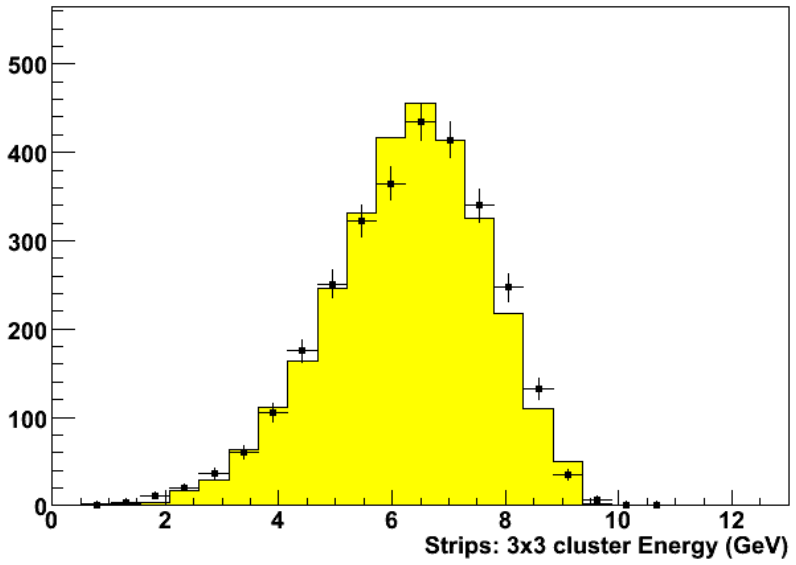
Caution: other effects in the data reconstruction may be contributing in the width. These must be decoupled (i.e. should not absorb everything to the material increase)

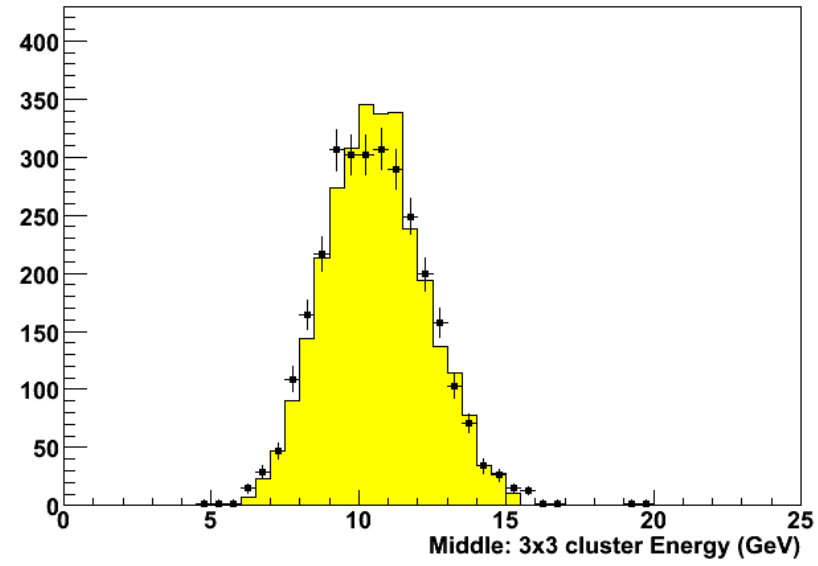
Close Material:

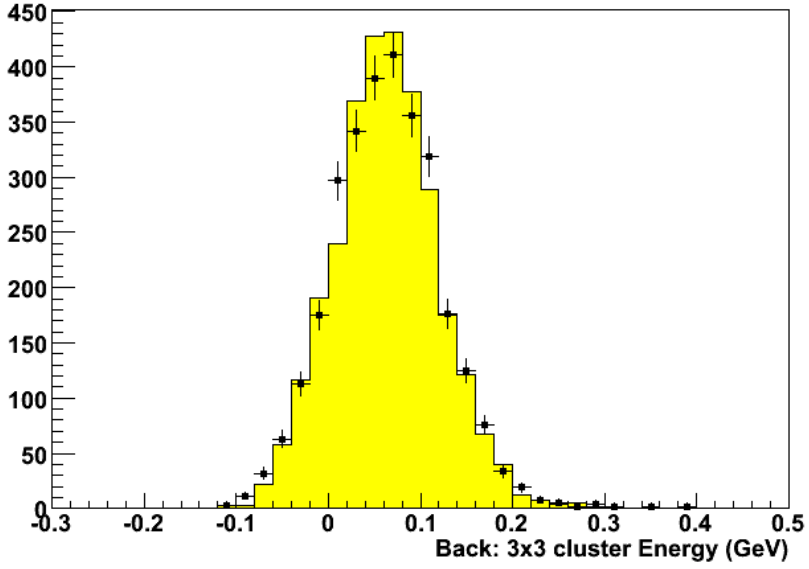
- However we have measured 0.15±0.02 X0s far upstream material
- There is evidence (Karl-Johan's talk) that there is extra material in the calorimeter in front of the PS:
  - Cryostat thickness measurements have mm errors
  - Longer extend of the Argon in front of the PS
- We need 0.1 - 0.2X0 in front of the PS.
- We should extract this from the data.

Data vs MC with extra 0.15X0 far 0.15X0 close

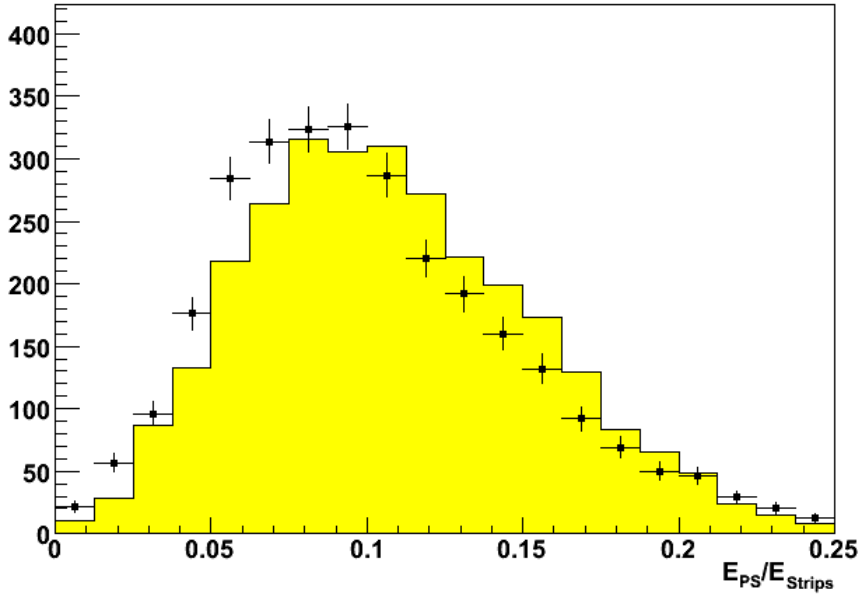


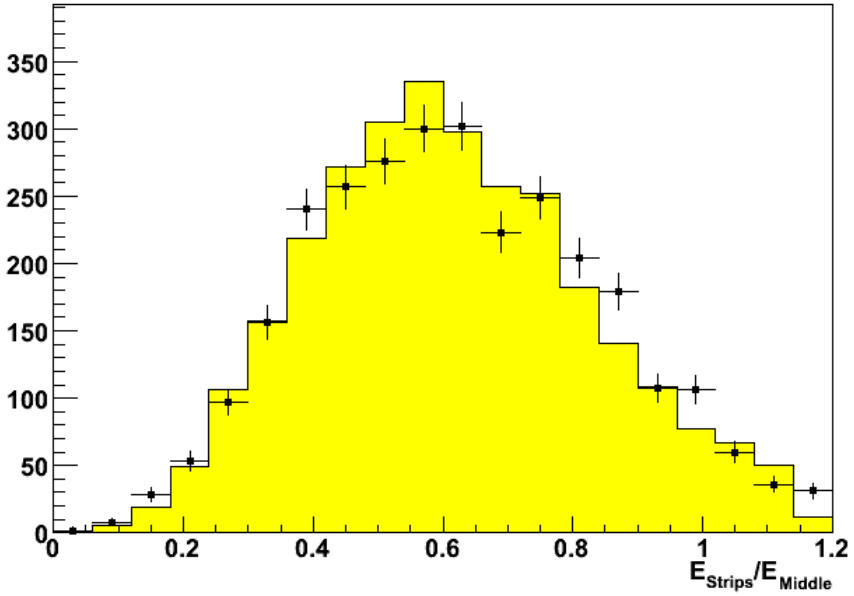




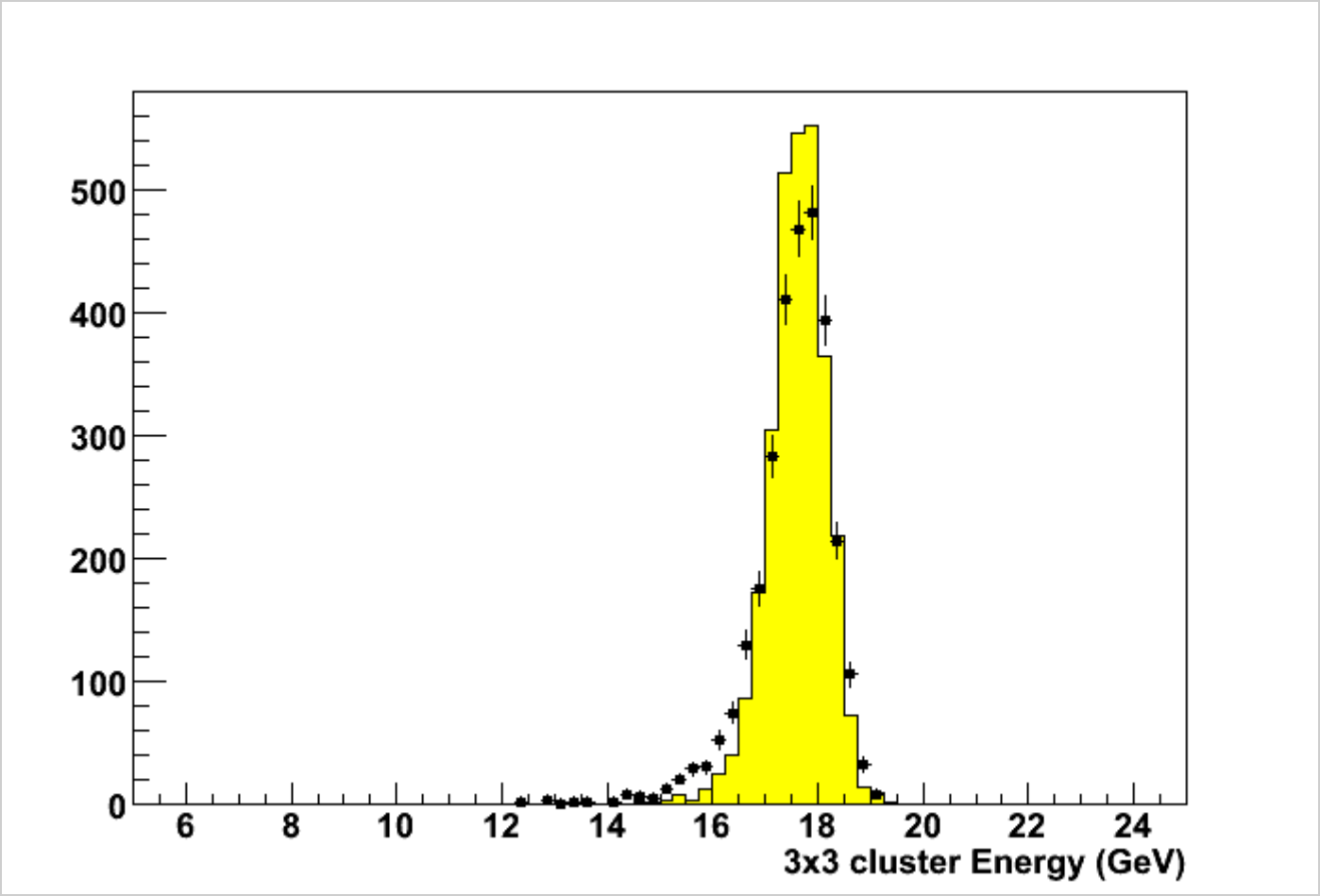


Data vs MC with extra 0.15X0 far 0.15X0 close



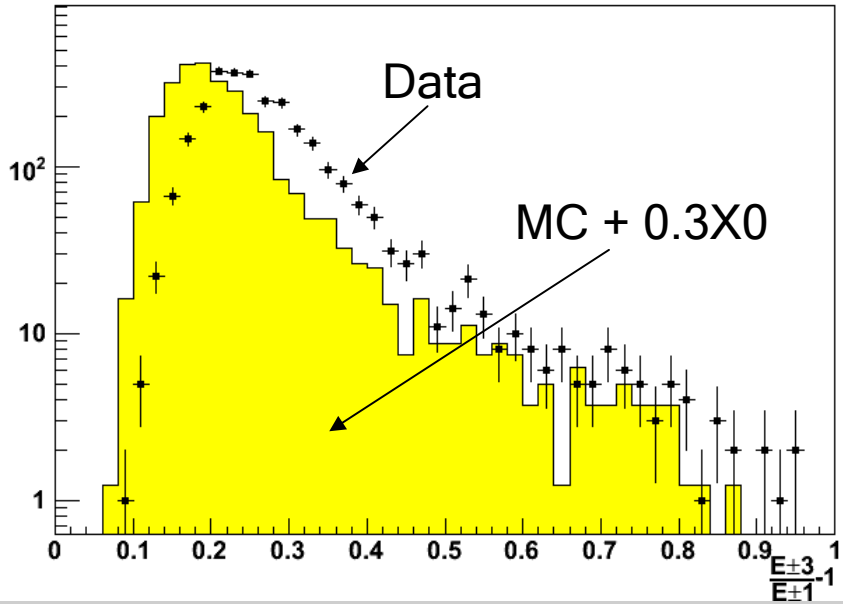


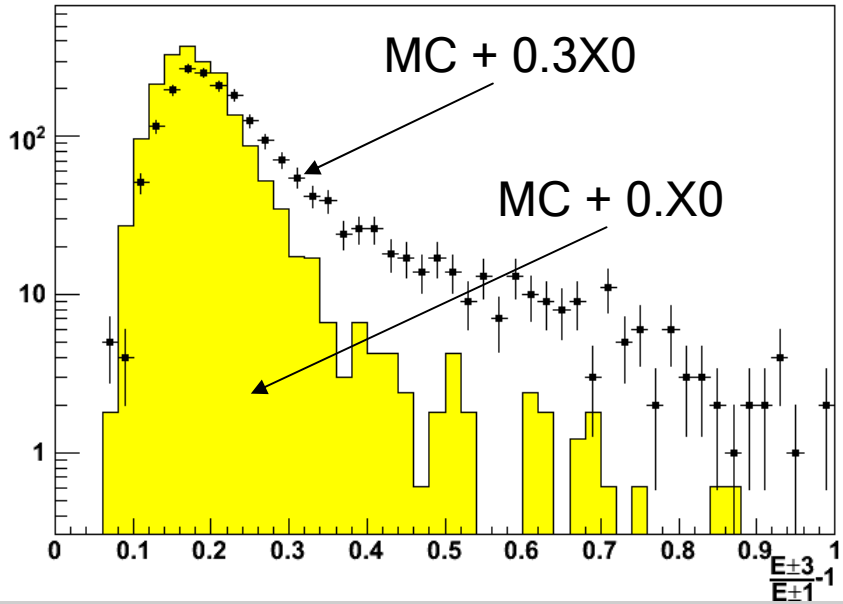
Data vs MC with extra 0.15X0 far 0.15X0 close



So, LAr performance is worse if 0.3X0s are far (-20m) instead of 0.15 far and 0.15 close!

Strips Shower shape: energy outside 3strip core



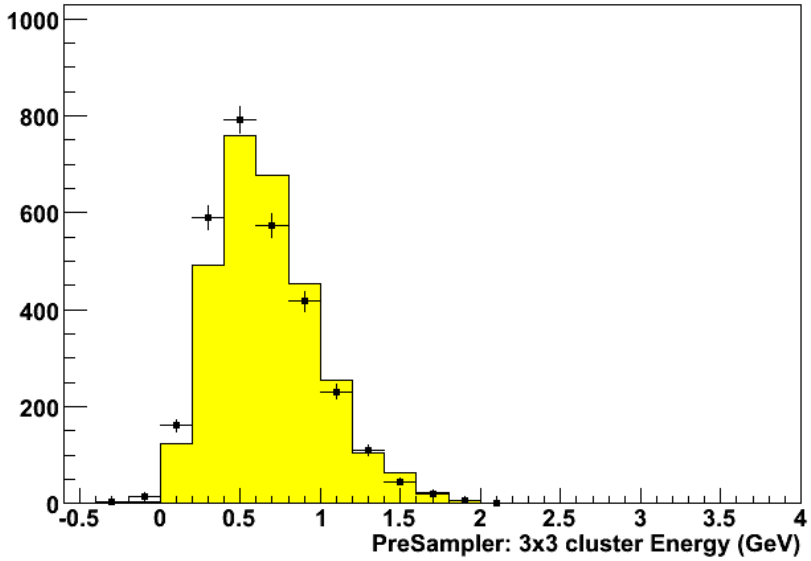


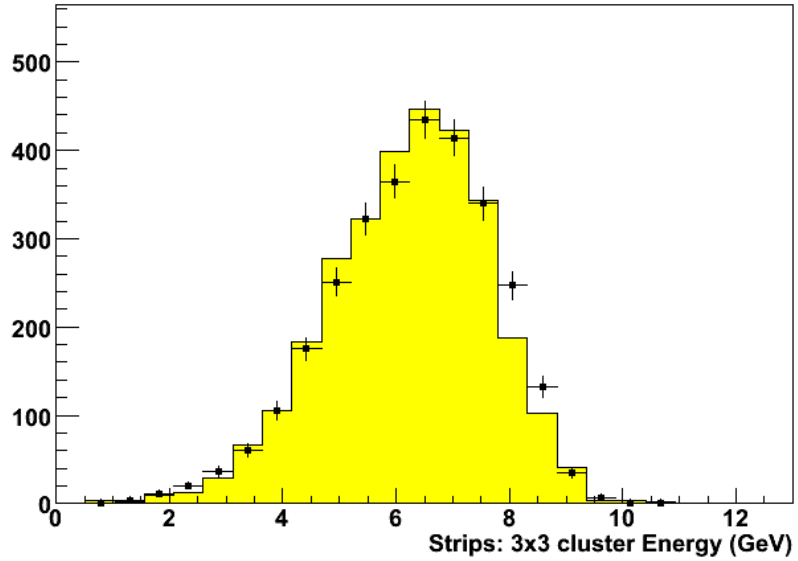
Shape difference between data and MC in strips (energy outside 3 strip core) must be due to the cross-talk simulation. Eta position dependence is an issue but to the extend I have checked, I didn't see significance changes.

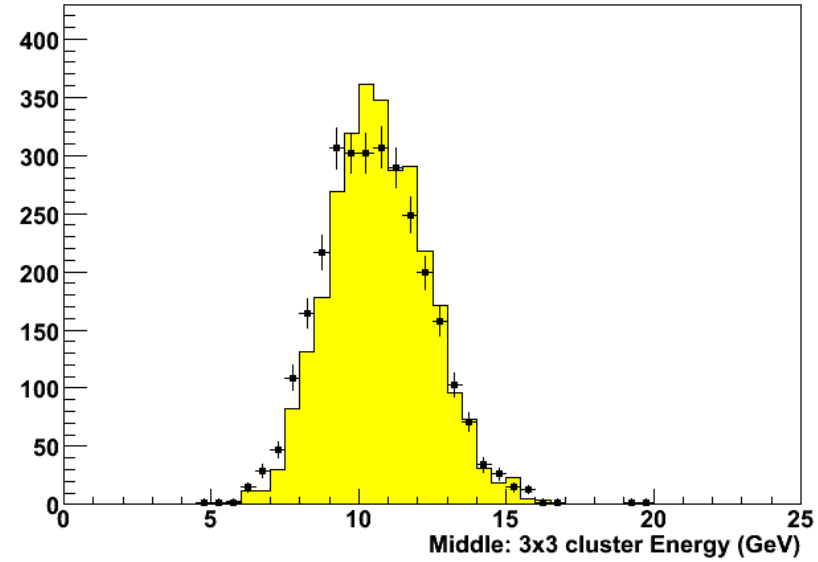
Summary

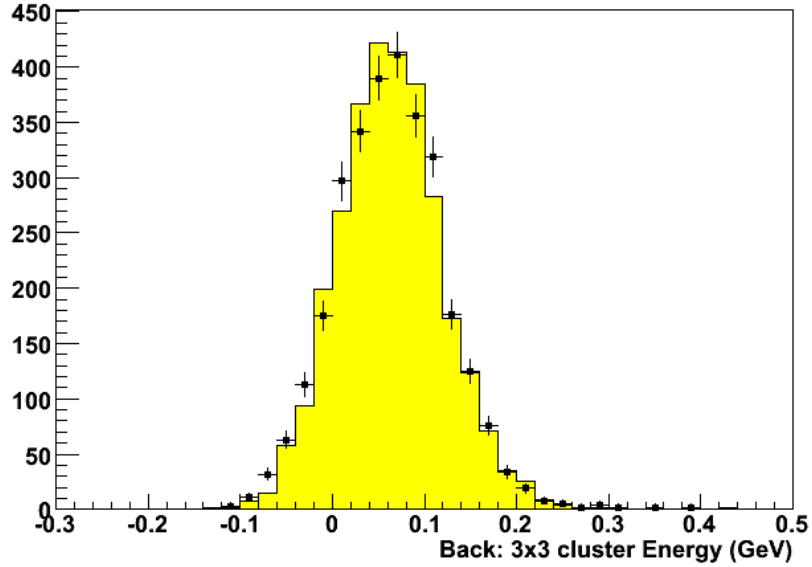
- From beamline: 0.15±0.02 X0 of additional far material needs to be simulated
  - Lost soft e+e- from Brem conversions far upstream may alter the expected Eps distribution (make it softer). This effect is not simulated.
- From data: an addition of ~0.15X0 of material in front of the Presampler is needed
  - Notice the more upstream the material is located, the worse the LAr performance becomes (so 0.15X0 spread in the beamline that we don't simulate, could have larger impact than 0.15X0 in front of the PS).
- Cross-talk: strip shower shape is shifted for data indicating that ctalk in the simulation must be revisited.
  - Energy reconstruction not affected
  - Shower shape cuts extremely biased
- We should decide on a "standard" MC which includes the extra material (tests with more energy points)

Data vs MC with extra 0.15X0 far 0.1X0 close

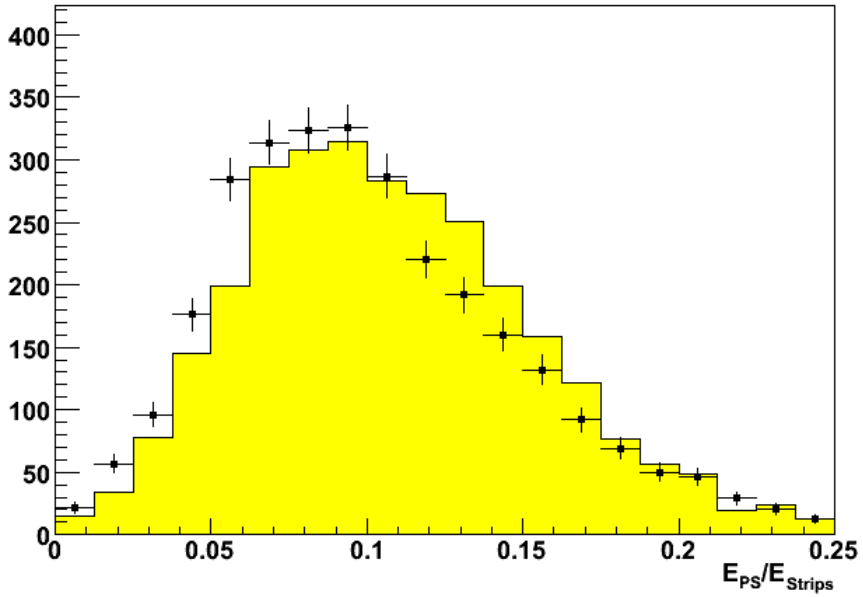


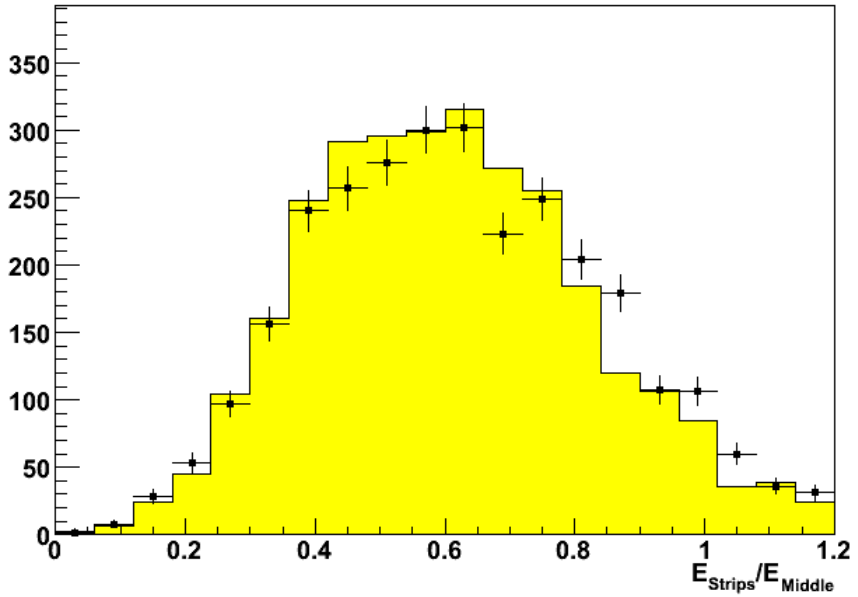




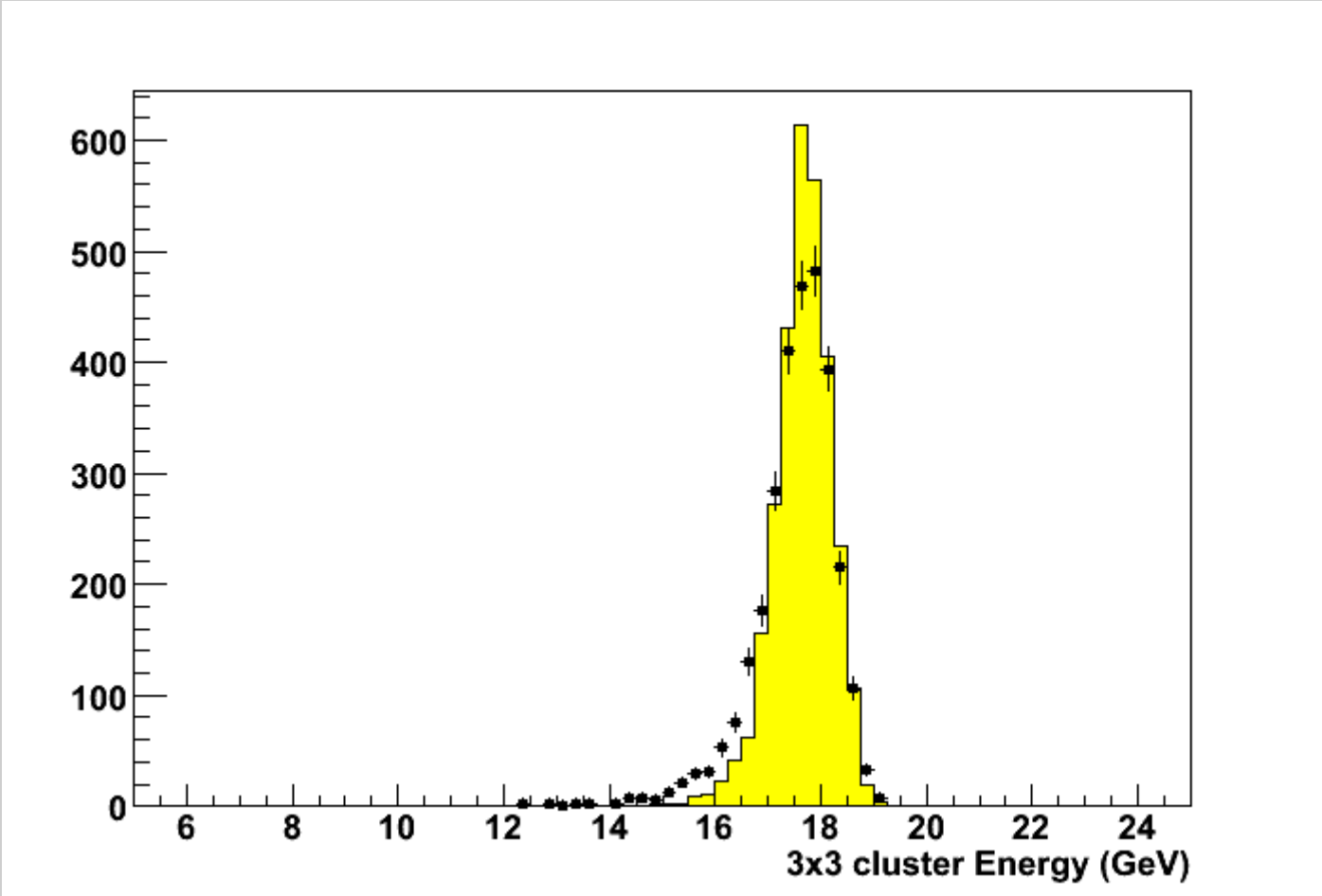


Data vs MC with extra 0.15X0 far 0.1X0 close

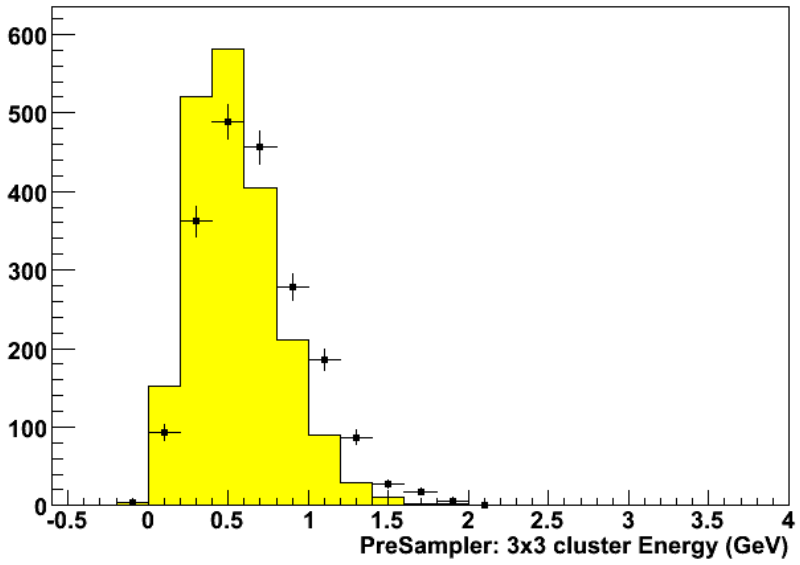


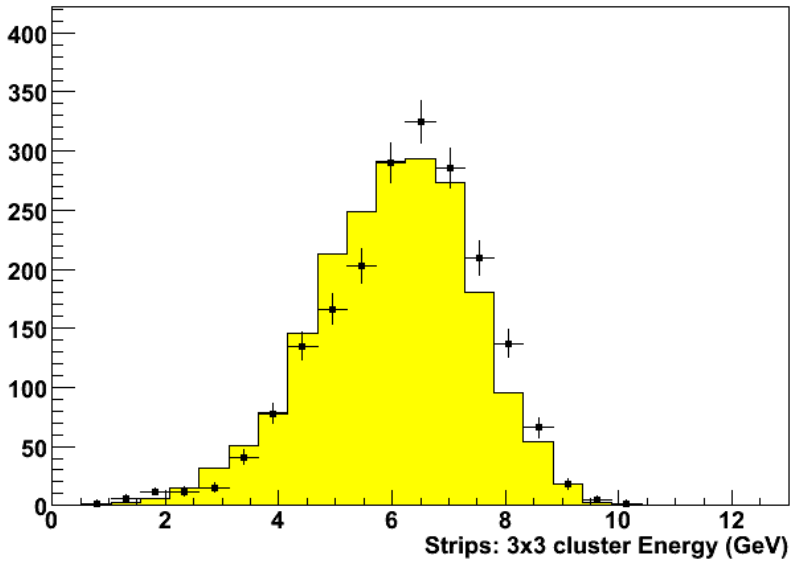


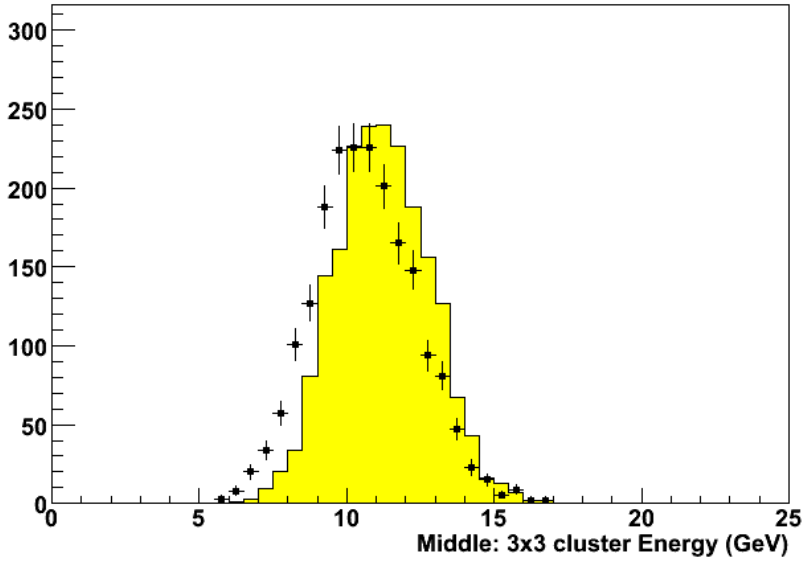
Data vs MC with extra 0.15X0 far 0.1X0 close

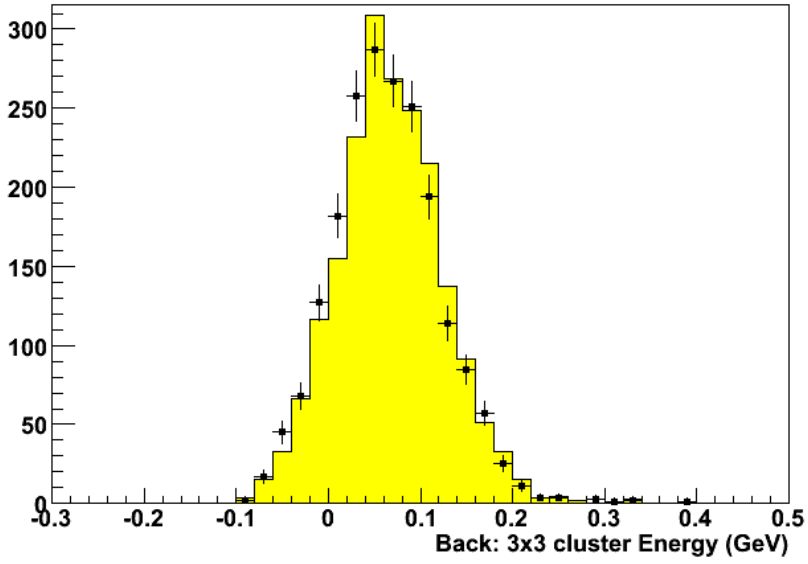


MC+0.3X0 vs MC default: 20GeV

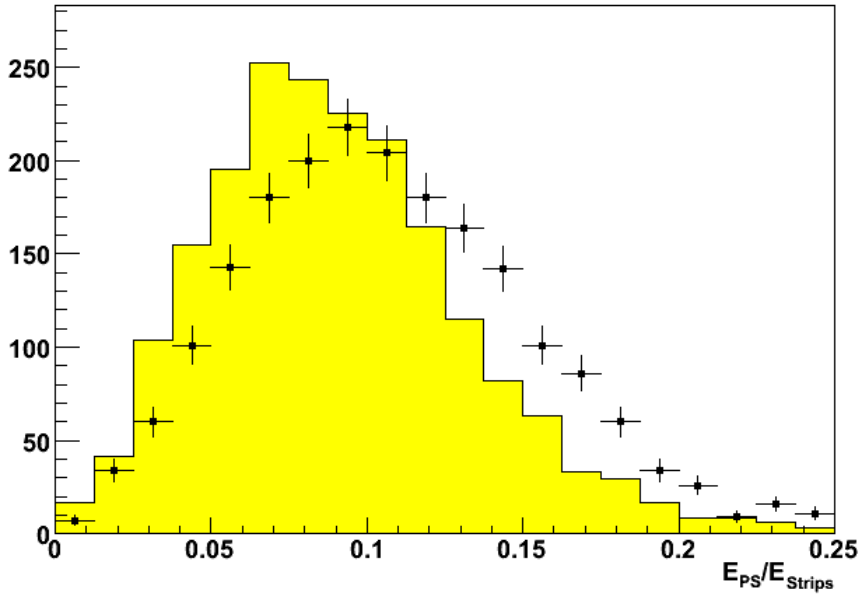


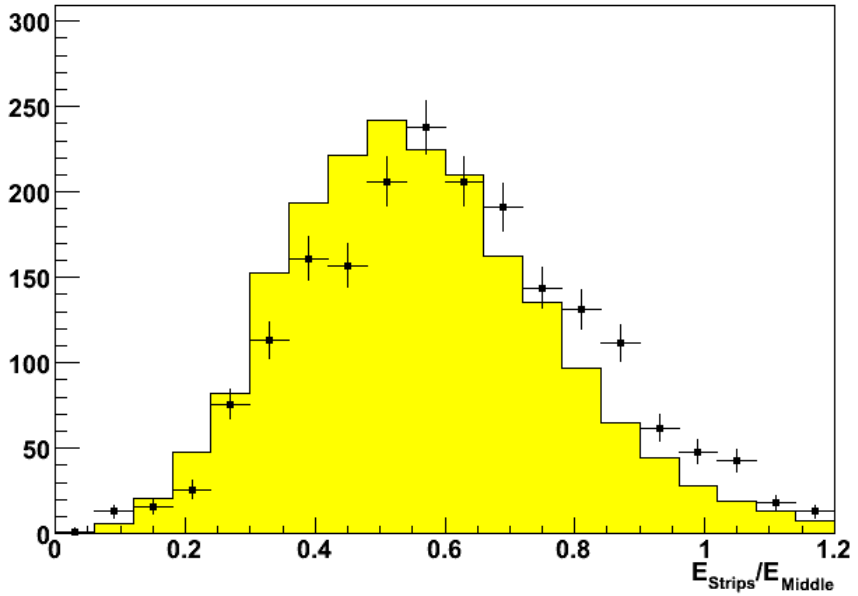




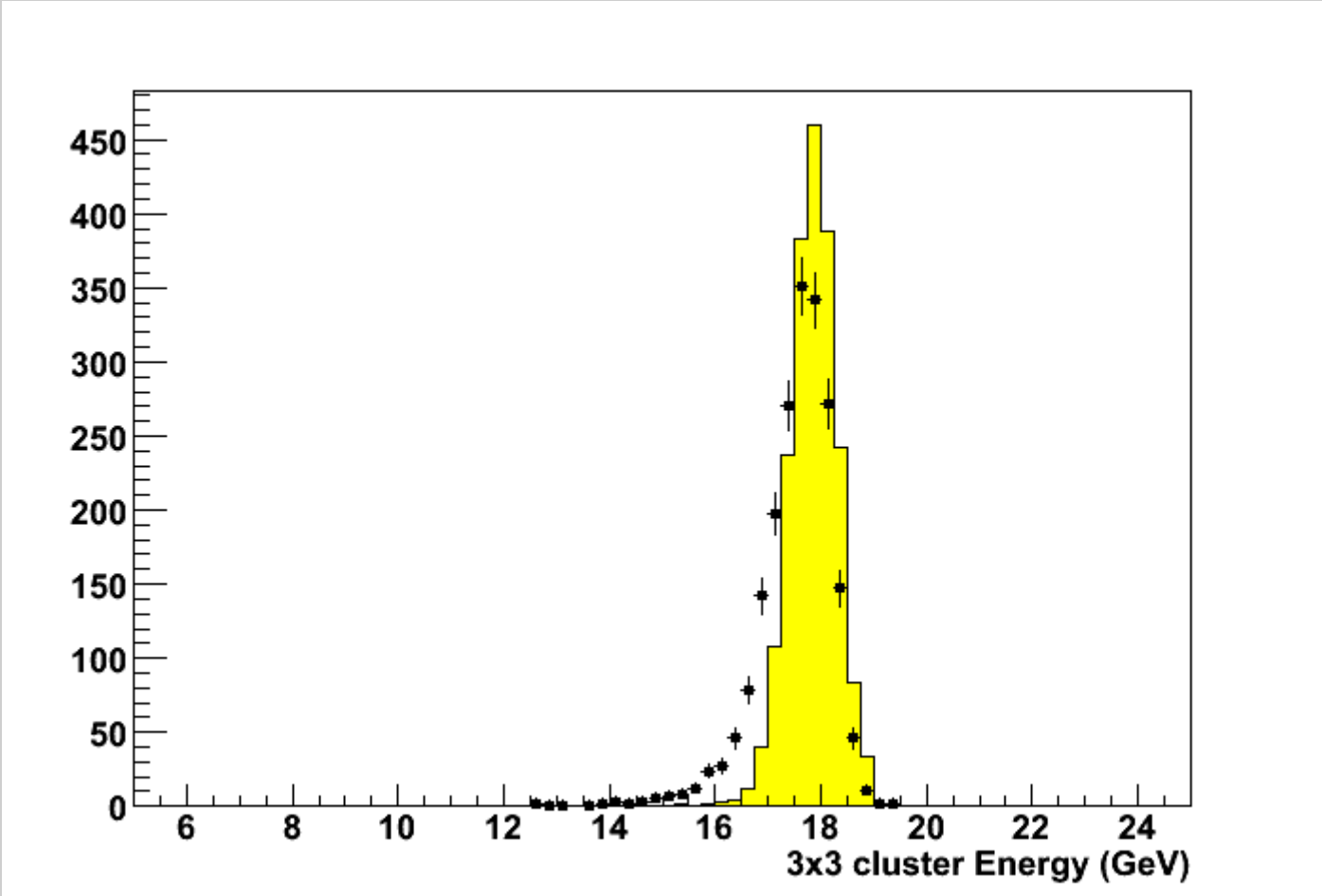


MC+0.3X0 vs MC default





MC+0.3X0 vs MC default



MC+0.3X0 vs MC default