

# Status on material before LAr as seen from LAr response

- Remember: Long history of comparison data/MC (energies per layer in EM calo), not so good description with “default” simulation => Added more upstream matter
- As of few months ago:
  - “Upstream” matter (before CTB setup)  $\sim 0.15X_0$ .
    - Put in the simulation just before Atlas CTB setup (not correct)
    - This matter is in the beam line, but before the final magnets, so the impact on the electron energy is not straightforward.
  - Matter close to the calorimeter (just upstream PS):
    - Added  $\sim 0.17X_0$  “ad-hoc” before calorimeter (25mm LAr equ.)
    - Is there room for more upstream LAr between excluder and presampler than measured at warm ?
      - Measurements indicate that it is not likely (cf Martin’s presentations at former CTB meetings)
  - Note: assume that the tracker description is perfect

# This presentation:

- Discussion of what has changed in the simulation and what the impact is
- Short compilation of latest results by Stathes and Per (see also talk by Tancredi for very low energy point studies)
- Some estimates of the systematic uncertainties in data/MC comparison

# Monte-Carlo changes (from 10.5.0 to 11.4.0)

- Move to GeoModel:
  - Pick-up more up to date lead thickness at warm from geometry database => ~ 1% difference
  - Artifact of G4 tracking from memory optimisation ~0.2% effect in total response (no effect on shower shape)
- Effect of absorber contraction at cold
  - 0.3% contraction => 0.6% density change

=>Overall effect of ~ 1.6% in absorber X0

  - ~1.5 % reduction in on total response
  - ~3-4 % increase in strip/middle
- Current map for presampler
  - Expect ~10% reduction in presampler response in MC
- Change of G4 version: 4.7.01 vs 4.7.01.pach01-atlas01
  - Neutron bug correction mostly.
  - Small effect (few %) on E(Presampler)

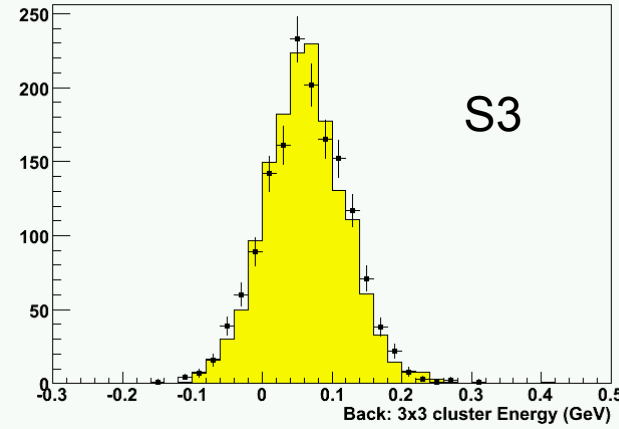
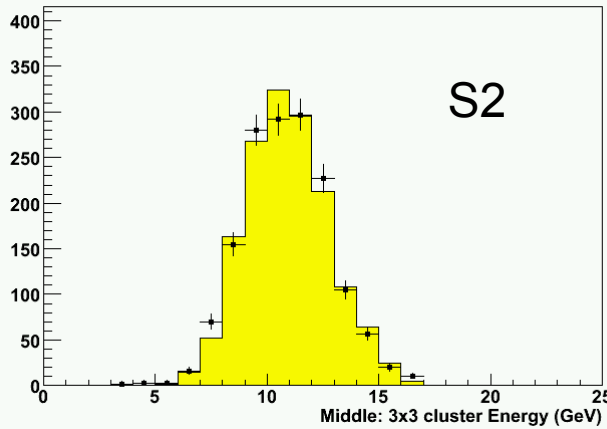
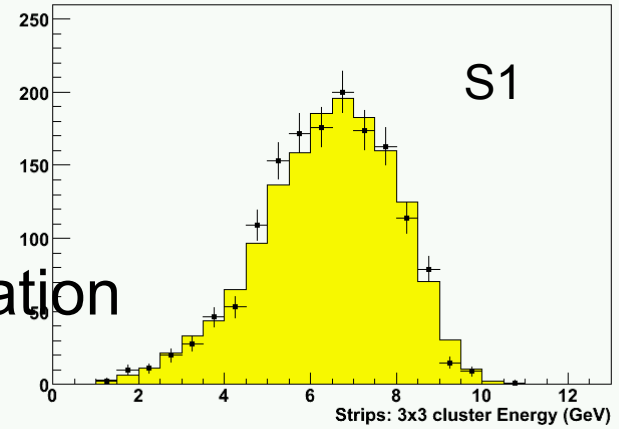
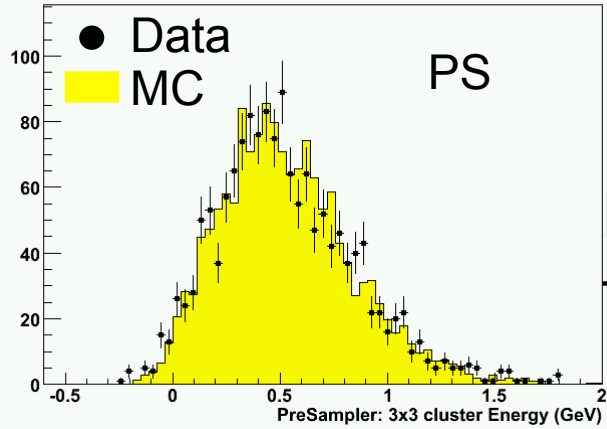
## Results Data/MC as shown at last e/gamma meeting end of May

- See Stathes presentation at e/gamma meeting during last T&P week
- Corrections/Scale factor applied:
  - Data:
    - PS: use  $\mu\text{A} \rightarrow \text{MeV} = 1235$  instead of 1149 (extrapolation from accordion using G4.8 for fSampl)
    - Strip correction 0.91 (Xtalk)
    - Improvement in the analysis (beam profile, etc..)
  - MC
    - Overall scale for accordion 0.975 (*how well we would have predicted the absolute scale from 2002 TB ?*)
    - PS scale: 0.946
      - Absorb effect of crack at  $\phi=0$  (?)
      - Residual uncertainties in  $\mu\text{A} \rightarrow \text{MeV}$  normalisation (?)
    - Only “non nominal” upstream matter: 0.15X0 for the far upstream matter
    - Rinj value for DAC  $\rightarrow \mu\text{A}$  could be improved (~% effect)

# Data vs MC

**ONLY** far material

Period5  
from Stathes presentation



## RATIOS

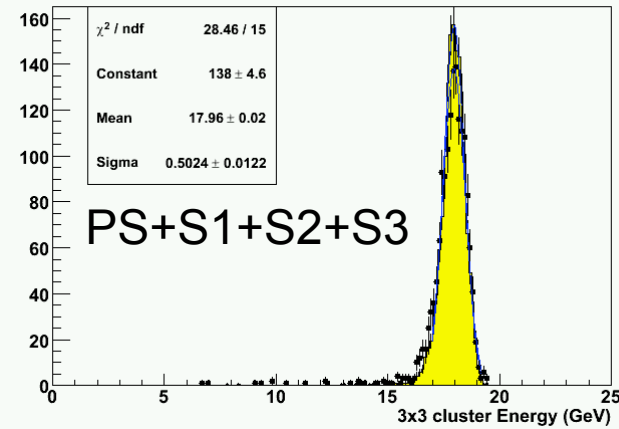
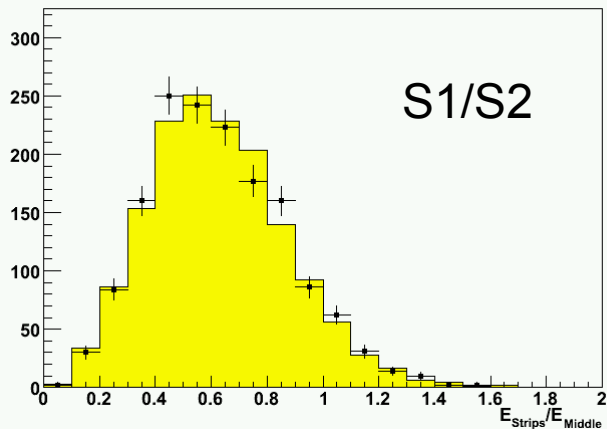
Data/MC

E=20GeV  
R=1000952

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E	1.0	(0.001)
PS	0.993	(0.018)
S1	0.992	(0.007)
S2	0.995	(0.005)
S3	1.014	(0.030)
<b>S1/S2</b>	<b>0.997</b>	<b>(0.012)</b>

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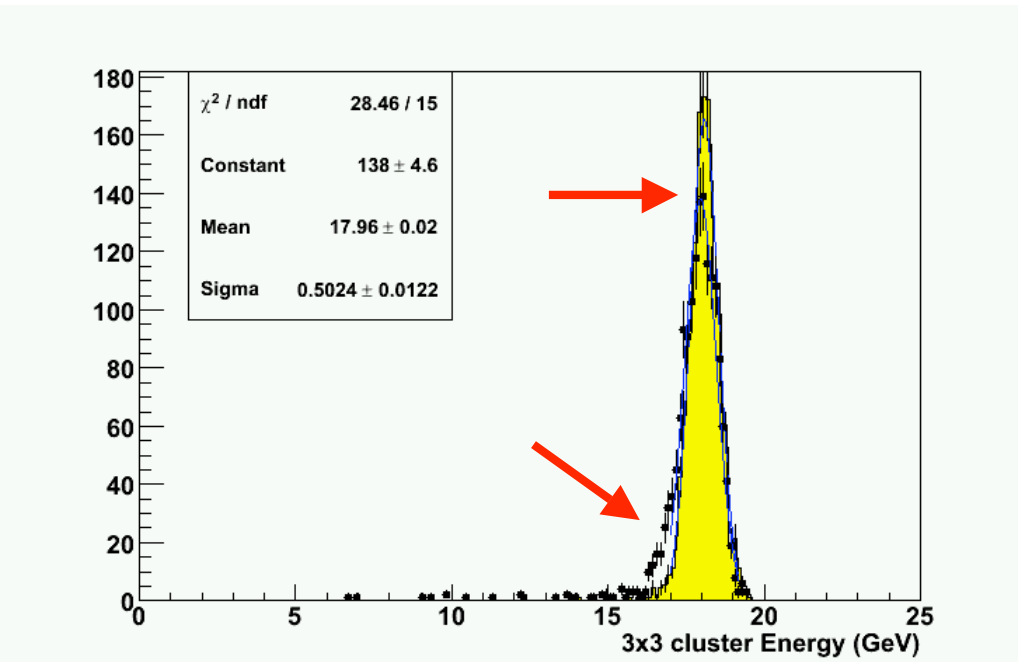
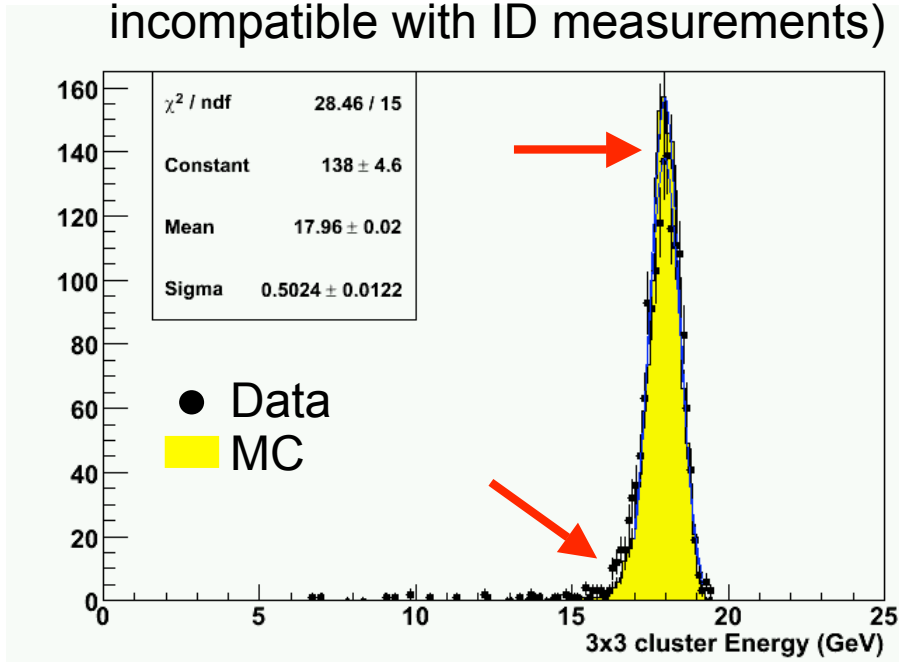


- Agreement at the 1-2% level
- Same situation in period 8 (ID+Calo) from Per
- Becoming worse if far material is ignored
  - ~5% on Estrip/Emiddle
  - ~10% on E(Presampler)
- But:
  - “Far” material simulation is not correct from “*first principles*”
  - ID studies (1/p tails) don’t seem consistent with this far material implementation
- Consider systematic uncertainties in LAr predictions
- Difficult to tell if “far” material should be really far or could be (partially) closer (=> resolution tails ? cf next slide)

(from Stathes presentation)

15%  $X_0$  extra material at -20m  
(inadequate for tail description and  
incompatible with ID measurements)

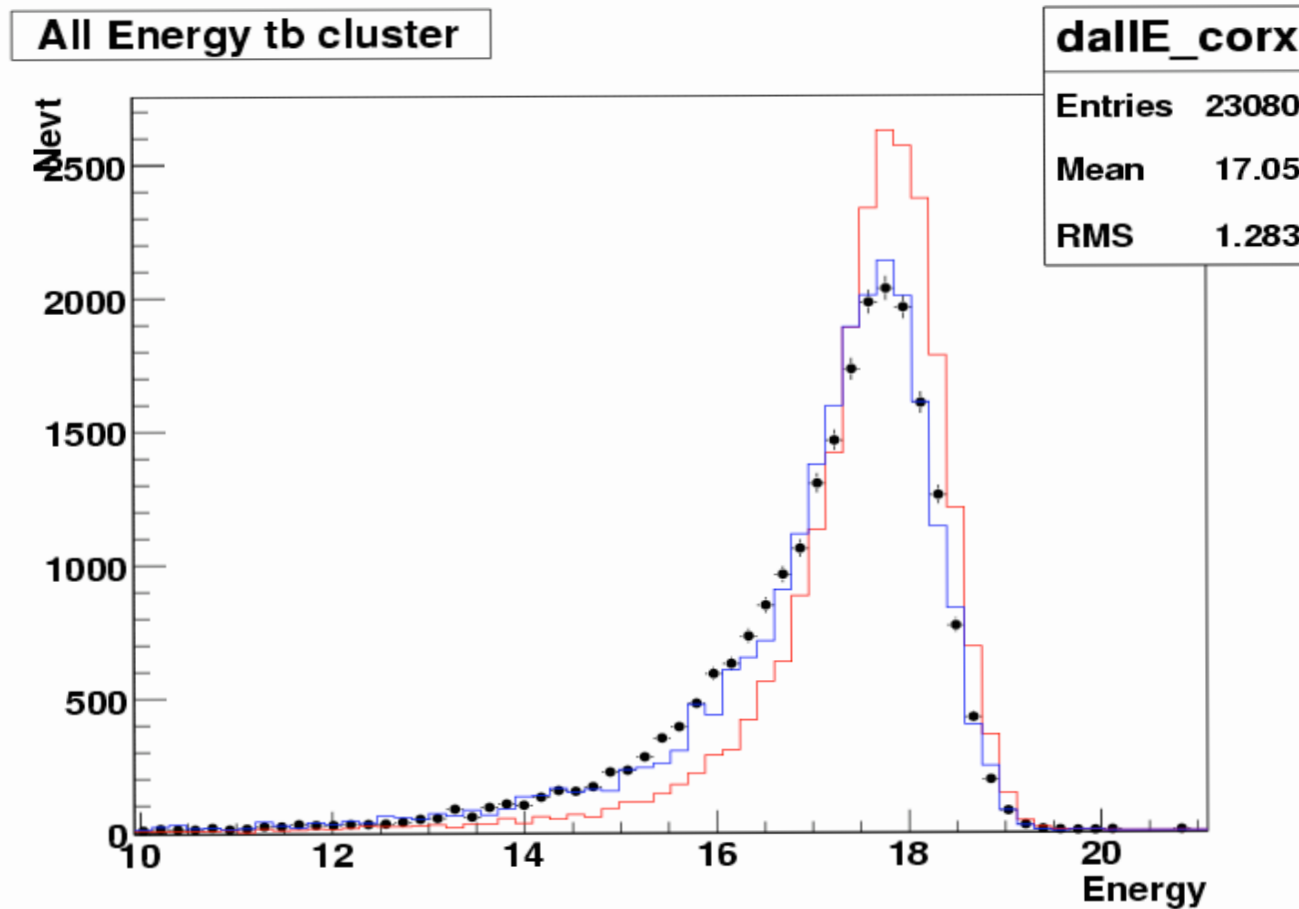
No extra material



Maybe tail is due to (1) lost photons  
converting before the focusing magnets,  
and (2) photons converting after  
focusing with the electron lost.

Significant difference in shape  
MC needs **8-10%** increase in PS response  
MC needs **5-6%** increase in S1/S2

From Per: run2413, 20 GeV elec, period with mag field,  
select events with only elec. hitting the calo



Need better treatment in the simulation  
(a la 2002 linearity analysis?)

# Systematics on data/MC

- Presampler:
  - ADC2MeV : 5% (half G4.7-G4.8 difference)
  - Current/Energy map: 1-2%
  - $\pm 5$ mm Lar upstream: 5%
  - Crack at  $\phi=0$  (to be studied)

} ~ 7%
- E(strip)/E(middle)
  - Lead thickness: 1-2%
  - Strip/middle separation 1%
  - $\pm 5$ mm Lar upstream: 5%
  - Energy/Current simulation 1%
  - Strip Xtalk correction 1-2%
  - 5% X0 between PS and strips 1-2%
  - Using correct Rinj values 1%
  - Cross-talk middle-strip (to be checked)

} ~ 6%
- **Far upstream matter is ~1-2 sigmas of this but:**
- Complicated correlations and energy dependence...
  - Should not effect much non-Gaussian energy tails