Updates on the ECAL Electron Analyis

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Summary

- The detailed & up-to-date results were circulated in a CALICE note before CALOR08. See

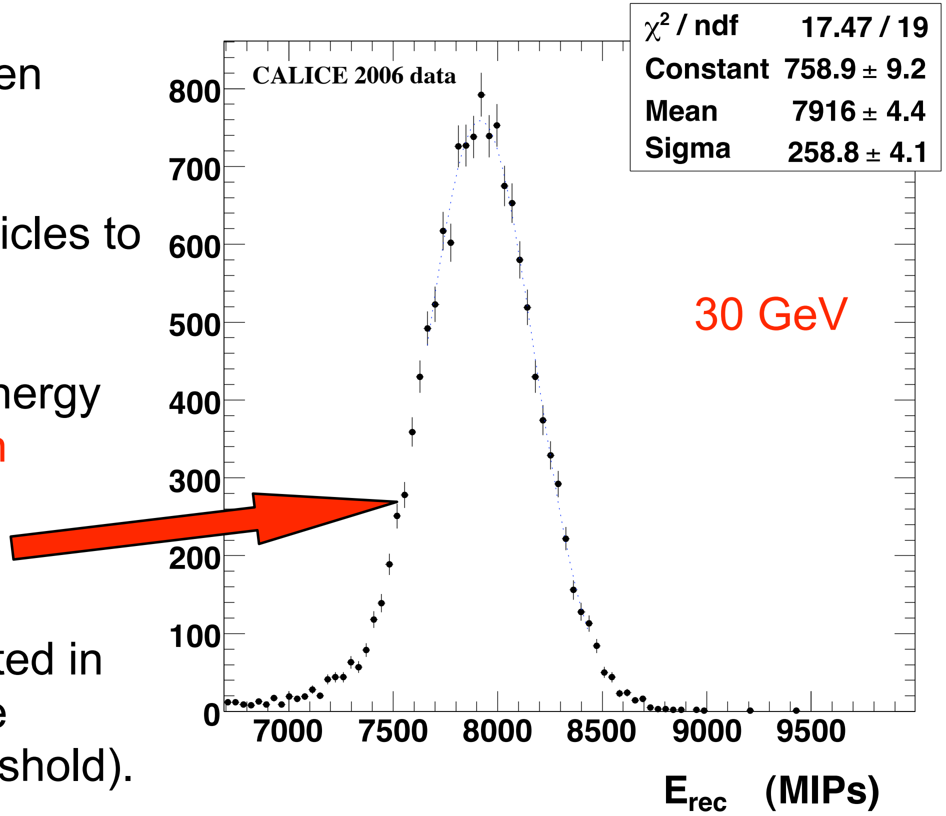
  http://carlogan.web.cern.ch/carlogan/EcalPaper/CaliceTB.pdf

- Review of some (conceptually) difficult points of the analysis.

- First comparisons Monte Carlo / data.

Recipe to estimate ECAL linearity & resolution

- record charges (in ADC counts) when exposed to electrons
- use energy deposit by MIP-like particles to convert ADC counts to MIPs
- make distribution of the recorded energy (using sampling factors). IF Gaussian
  - E_{mean} ~ the mean response
  - σ gives the resolution
- However, part of the energy deposited in the active area is lost (lower than the detection threshold OR the DAQ threshold). Some is added (electronics noise).
- Generally $E_{meas} = E_{mean}$ + corrections (estimated from MC or calibrated with data)



Mokka

- beam generated with a momentum spread
  - seems to be the average of the different data spreads, as expected from collimator settings.
  - it should probably take into account the significant difference in statistics between the different runs
- the precise alignment of the ECAL not checked
- the MC calibration factor fixed to 0.0001424

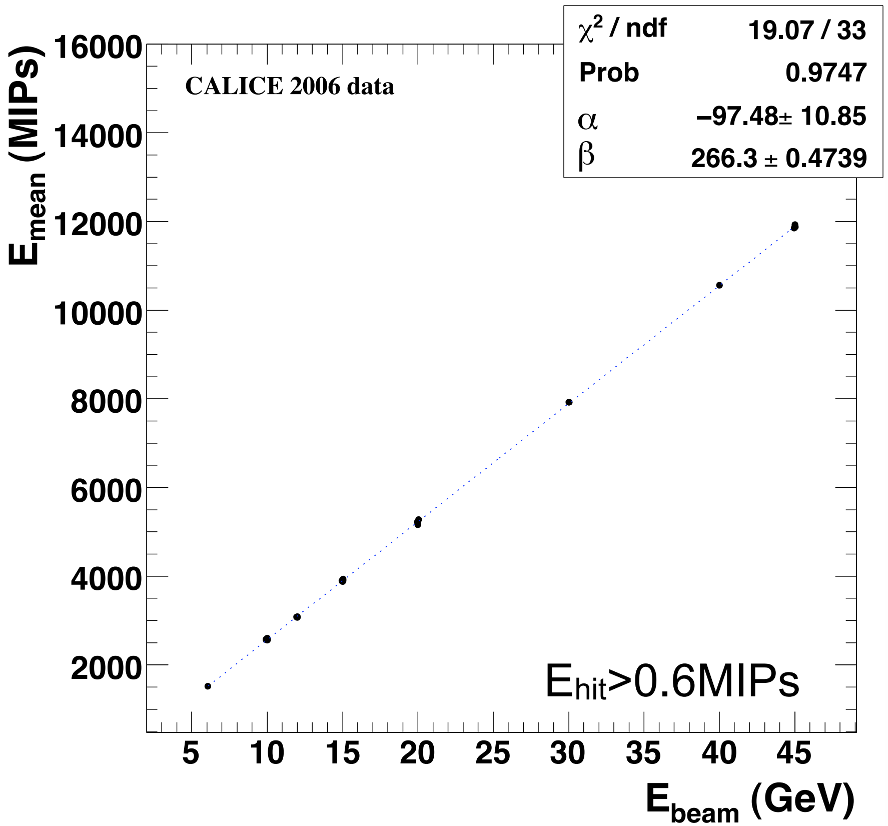
Digitisation

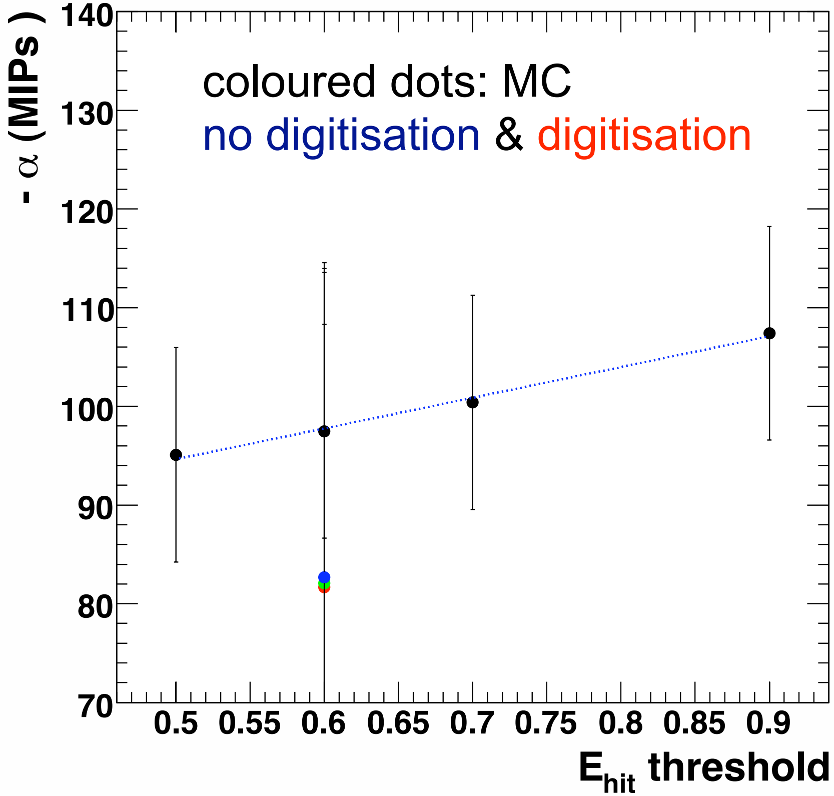
- very simplified, it does not use the detailed detector description
- assumes perfect pedestal subtraction and calibration
- assumes Gaussian noise, different from cell to cell.
- assumes that the noise distribution in the detector cells is a Gaussian of mean 0.13 MIPs and sigma 0.012 MIPs.
- since Ehit>0.6MIPs, noise generated only in cells with signal hits

Analysis

- same as for data, kept even the uncertainty on the mean energy of the beam

Linearity

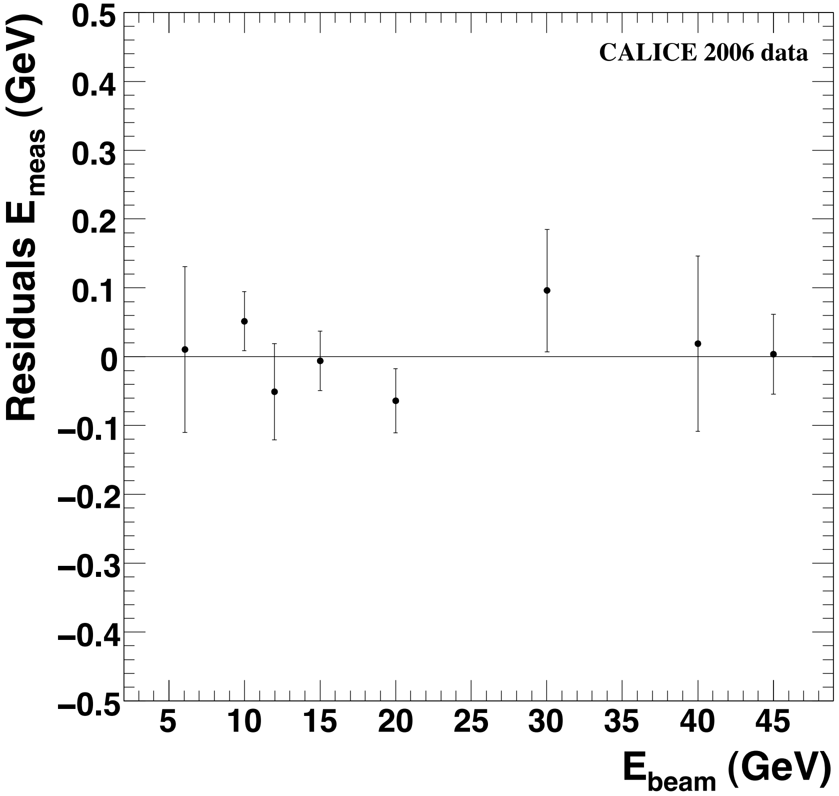


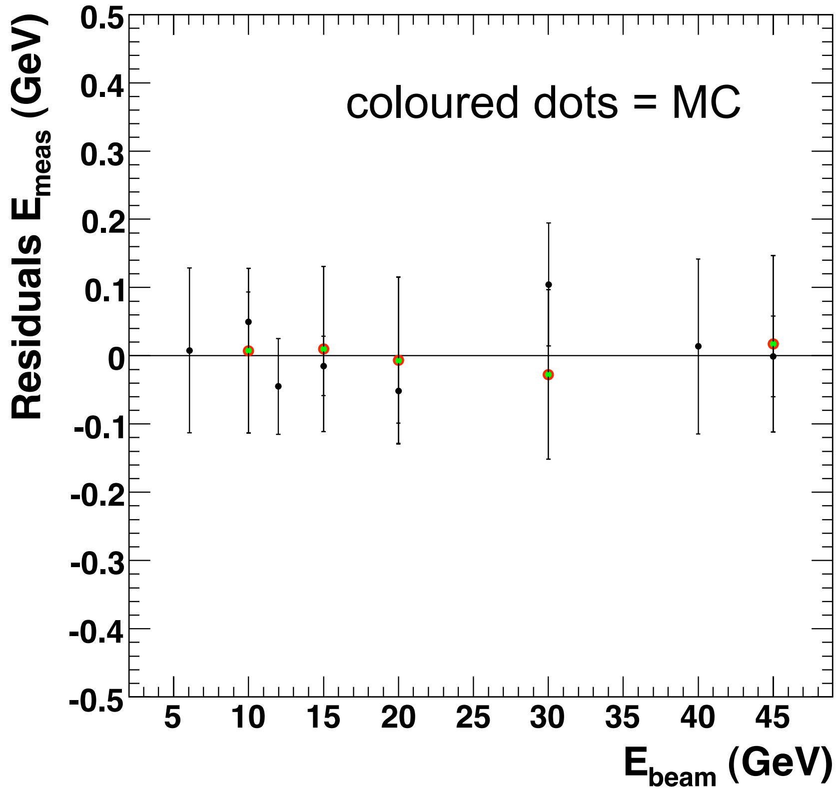


E_{mean} (MIPs) = $(E_{beam}+\alpha)*\beta$
and
$E_{meas} = E_{mean} - \alpha$

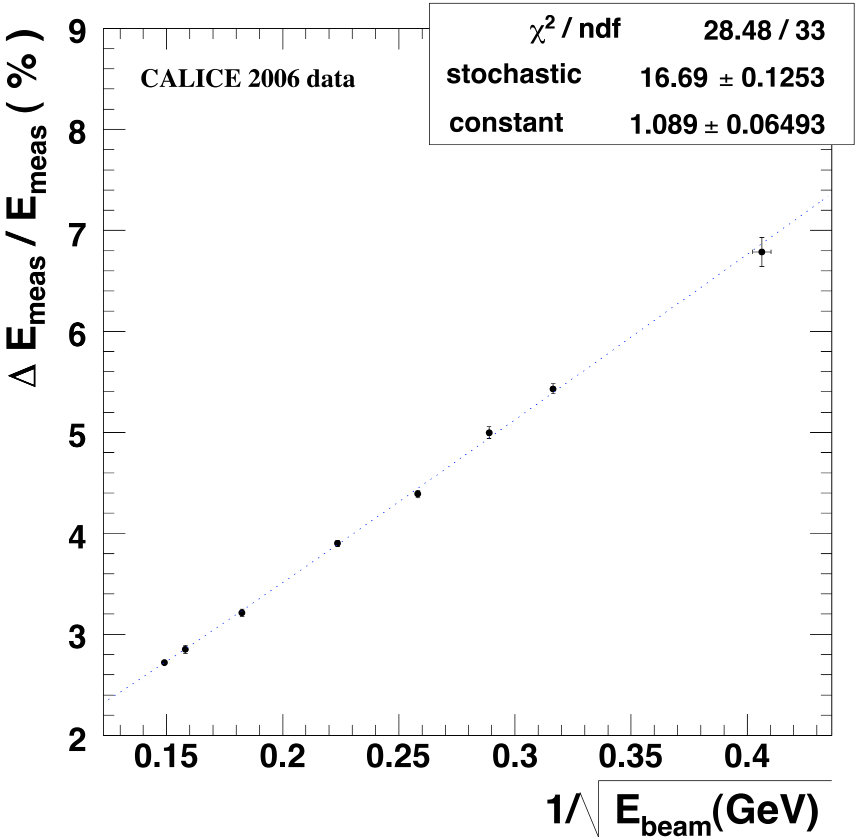
Error bars for MC much larger than for data, likely since fewer energies available...

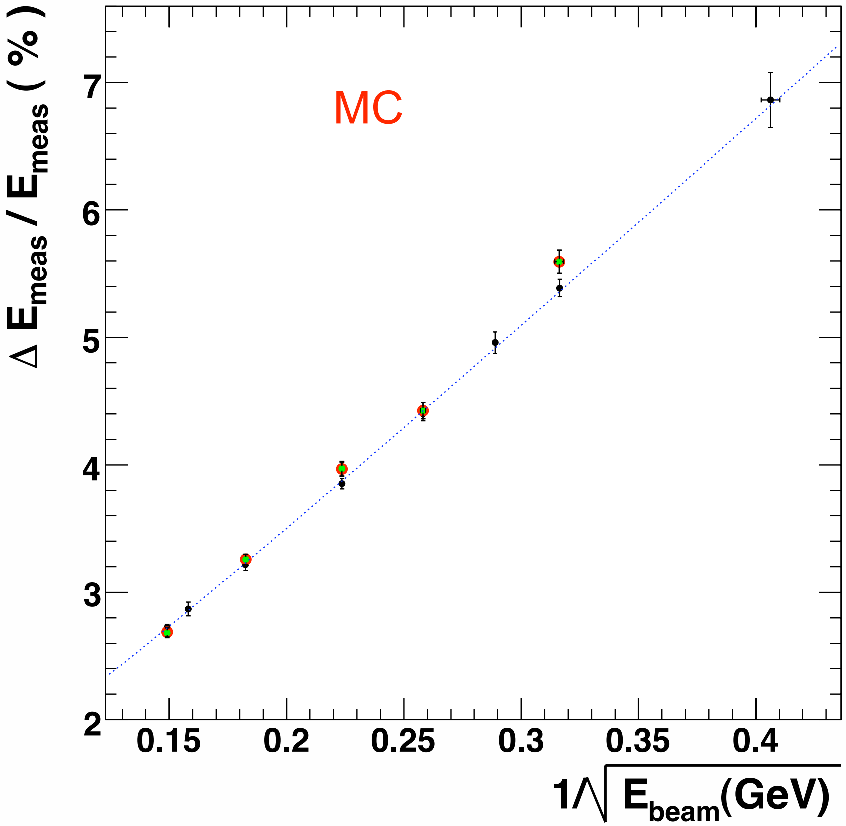
Linearity


CALICE 2006 data
Residuals E_{meas} (GeV)
E_{beam} (GeV)
0.5
0.4
0.3
0.2
0.1
0
−0.1
−0.2
−0.3
−0.4
−0.5
5
10
15
20
25
30
35
40
45


coloured dots = MC
Residuals E_{meas} (GeV)
E_{beam} (GeV)
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
-0.5
5
10
15
20
25
30
35
40
45

Resolution





$$\frac{\Delta E}{E}(\%) = \frac{16.7 \pm 0.1}{\sqrt{E\,(GeV)}} \oplus (1.1 \pm 0.1)$$

$$\frac{\Delta E}{E}(\%) = \frac{17.2 \pm 0.3}{\sqrt{E\,(GeV)}} \oplus (0.8 \pm 0.2)$$

Conclusion

• If no convinced by the way to define E_{meas}, please, speak up NOW !

• The agreement between data and MC seems reasonable considering the level of detail for the simulation.

• Systematic studies including errors in cell calibration/ pedestal subtraction or/ and trigger jitters easy to perform with the simplified digitisation

• Generally lot's of work to be done on MC ...