Study of energy resolution vs energy, number of layers and sampling

A.-M. Magnan
Imperial College London

21/08/2008, Calice-MAPS RAL

Outline

Introduction

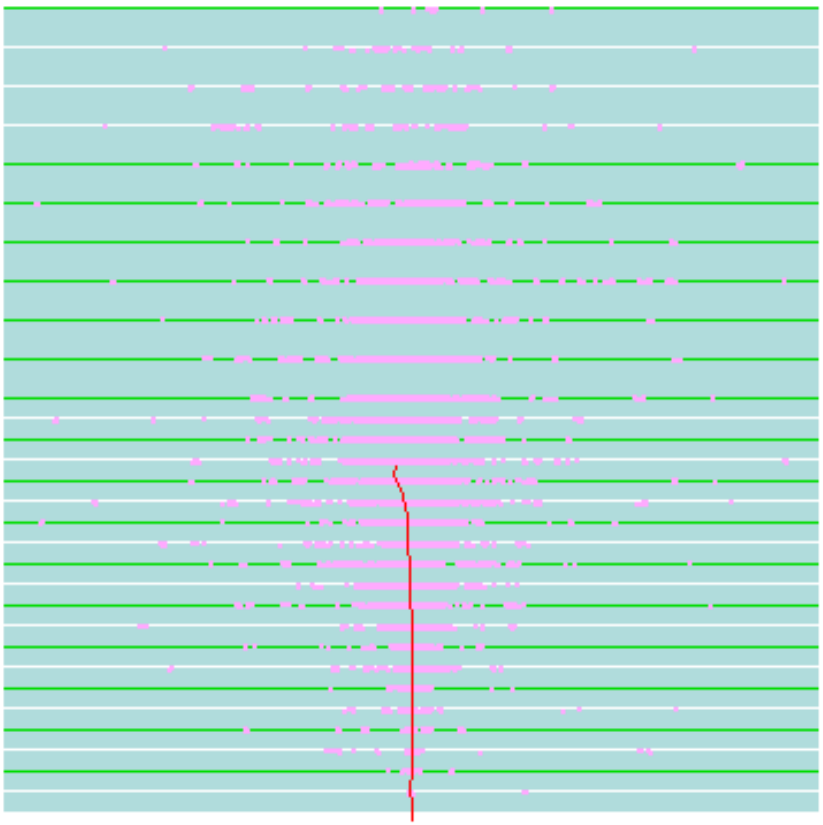
Samples

Total is always 24 X_0:

- Energy: 30 layers, 20 @ 0.6 X_0, 10 @ 1.2 X_0:
  - 2 500 events at 1,2,5,10,15,20 GeV,
  - 1 000 events at 30,40,50 GeV,
  - 500 events at 60,75,100 GeV,
  - 200 events at 150 GeV, 100 events at 200 GeV.
- Number of layers: 1 000 events at 10 GeV, with N layers, 2/3N @ $0.6 \times 30/\mathrm{N}$ X_0, 1/3N @ $1.2 \times 30/\mathrm{N}$ X_0:
  - N=30,28,26,24,22,20,18,16,15,14,13,12,11,10,9,8.
- Sampling: 1 000 events at 10 GeV, with 30 layers, following $20 \times a + 10 \times a \times (1 + b) = 24$ X_0:
  - b = 0, a = 0.80 X_0, b = 0.5, a = 0.69 X_0,
  - b = 1, a = 0.60 X_0, b = 1.5, a = 0.53 X_0,
  - b = 2, a = 0.48 X_0, b = 2.5, a = 0.44 X_0.

Very simple detector: only Si and W

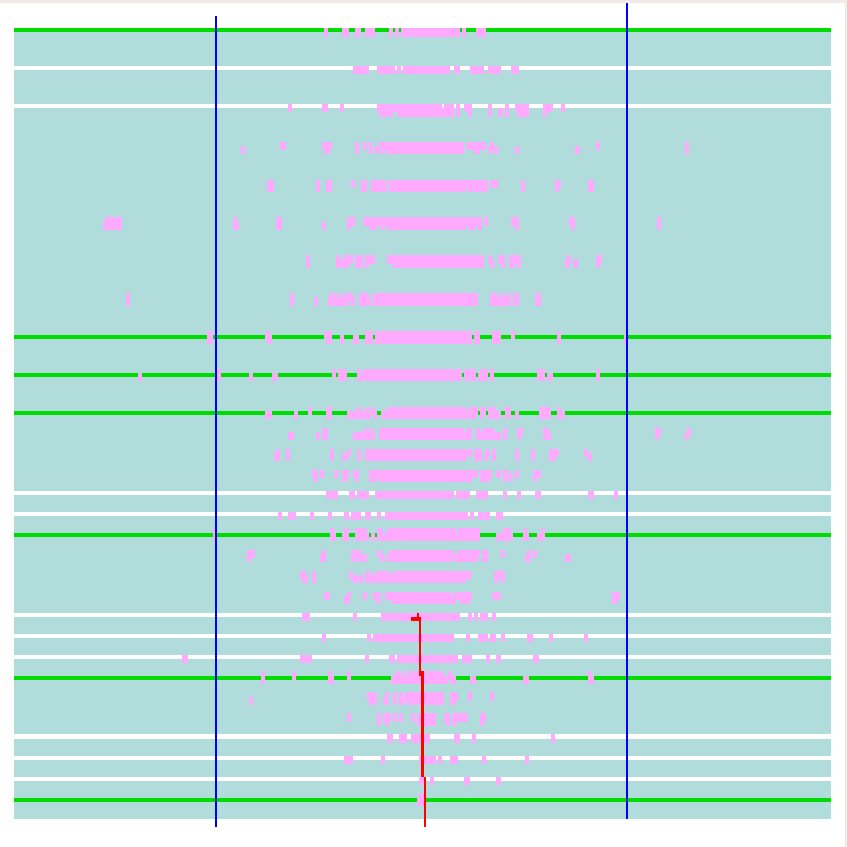
e^- 100 GeV, $10 \times 10 \times 10\,cm^3$



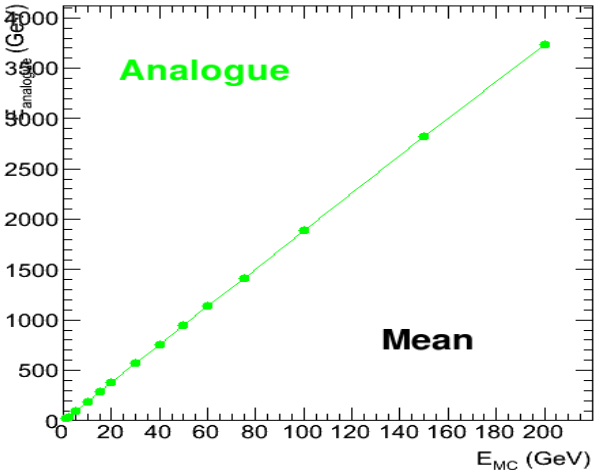
e^- 200 GeV, $10 \times 10 \times 10\,cm^3$

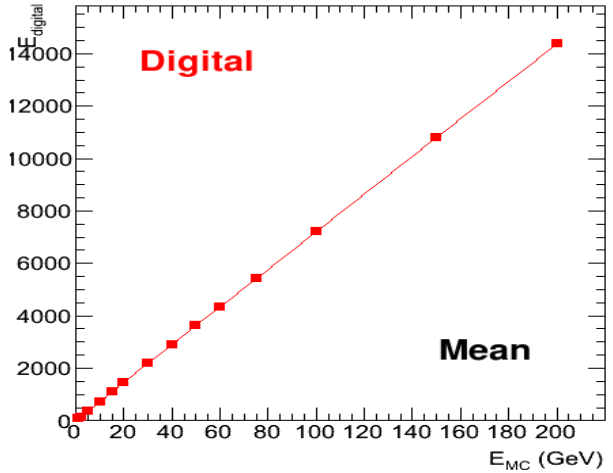
10×10 cm too small ??

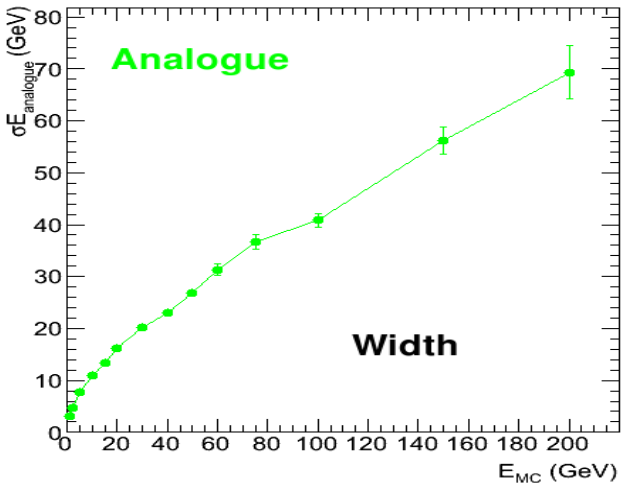
e^- 200 GeV, $20 \times 20 \times 20\,cm^3$

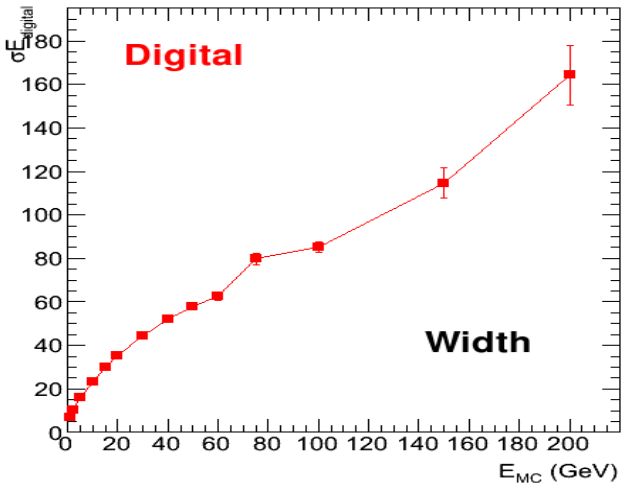


Reconstructed energy and width vs generated energy

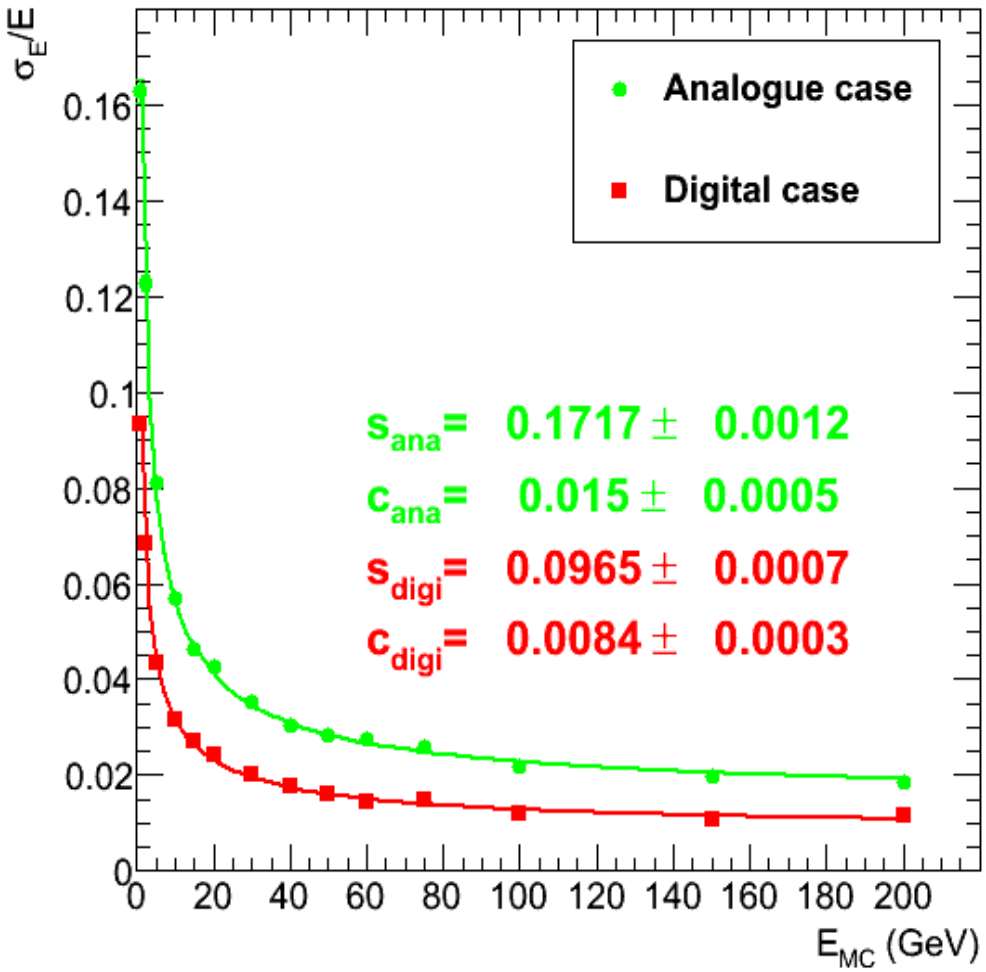




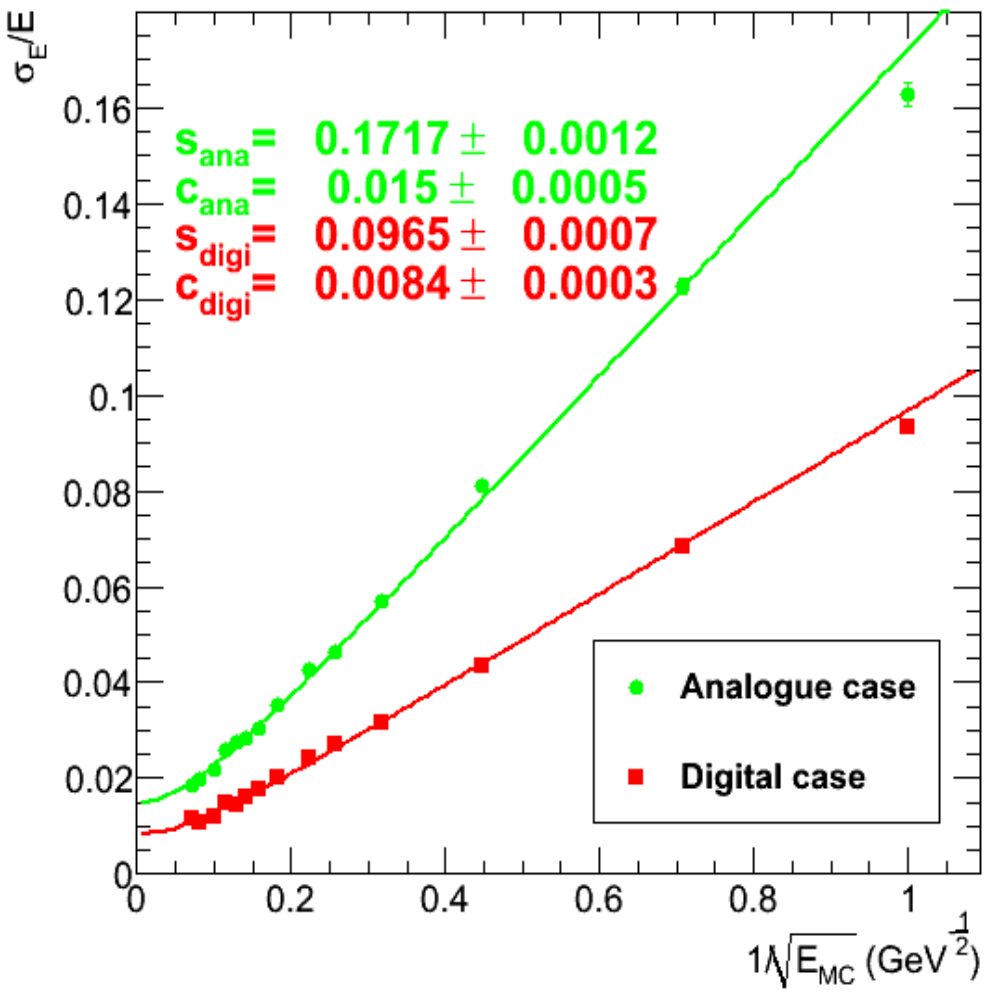




Resolution vs E



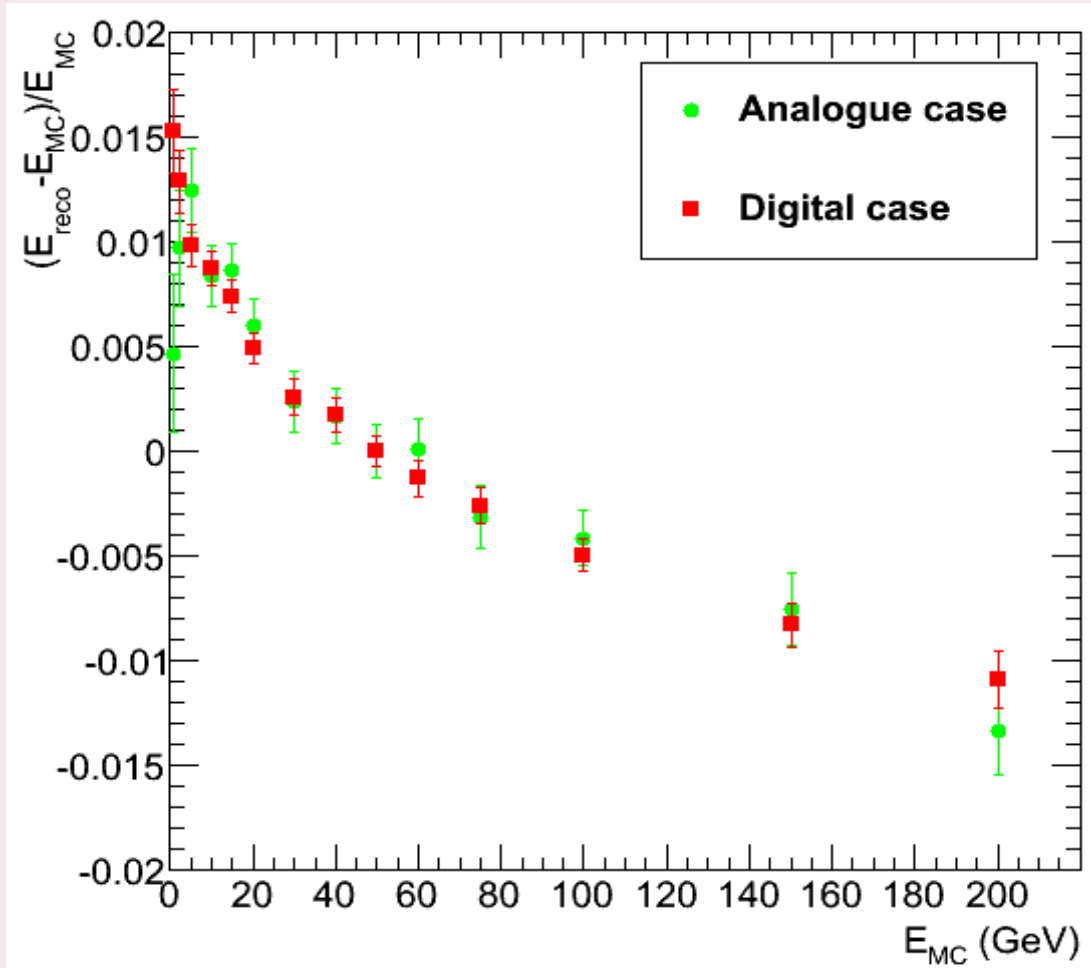
Resolution vs $1/\sqrt{E}$



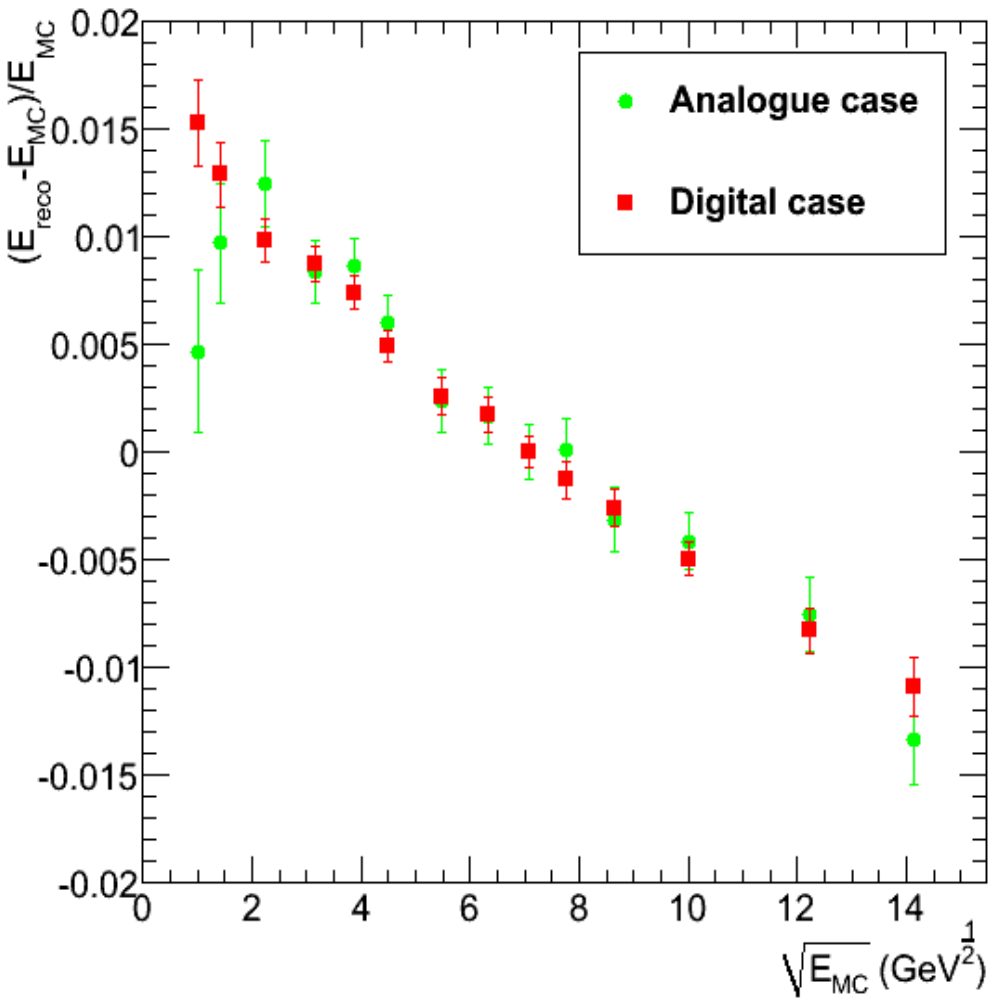
Linearity vs E

Definition

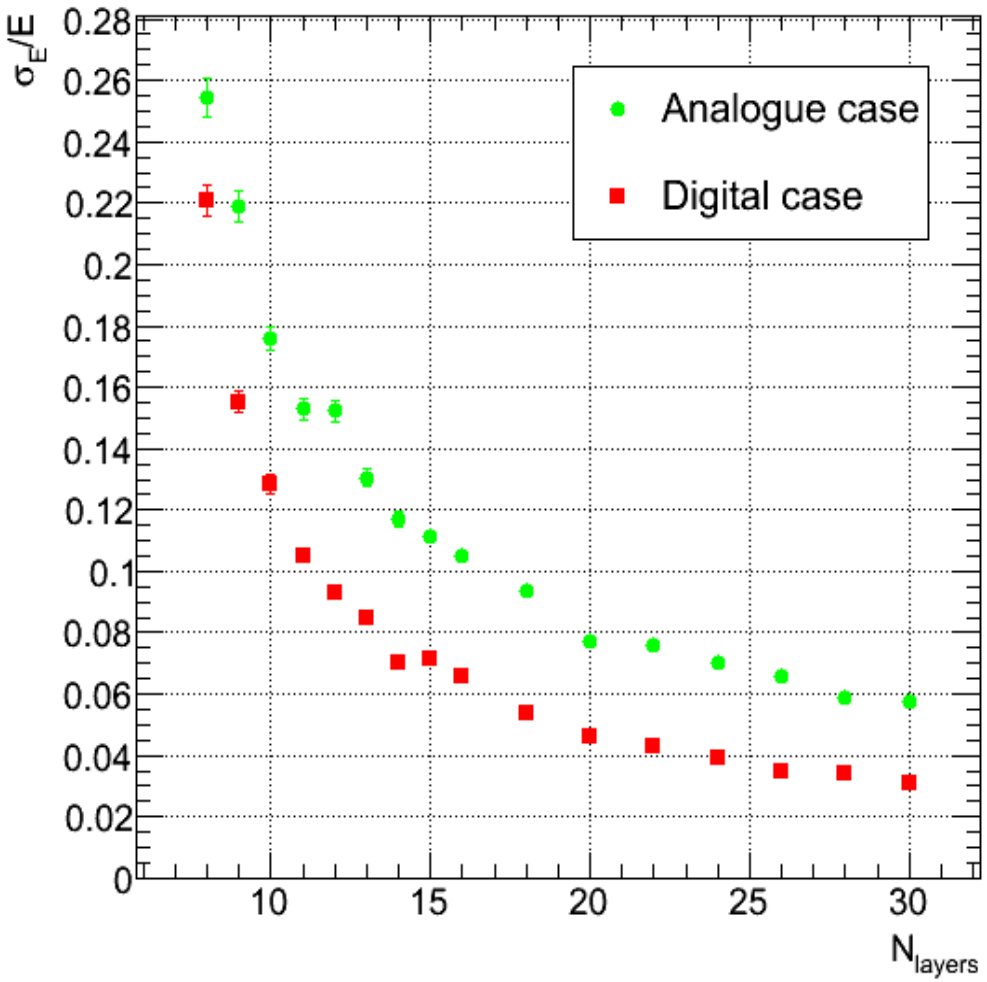
- Calibrate E_{epi} and E_{bulk} on E_{MC} at 50 GeV.
- Draw $\frac{E_{reco}^{calib} - E_{MC}}{E_{MC}}$ vs E_{MC}.



Linearity vs $\sqrt{E}$



Resolution vs N_{layers}



Resolution vs sampling