

HCal Running Experience

*Current status of HCal monitoring
and calibration*

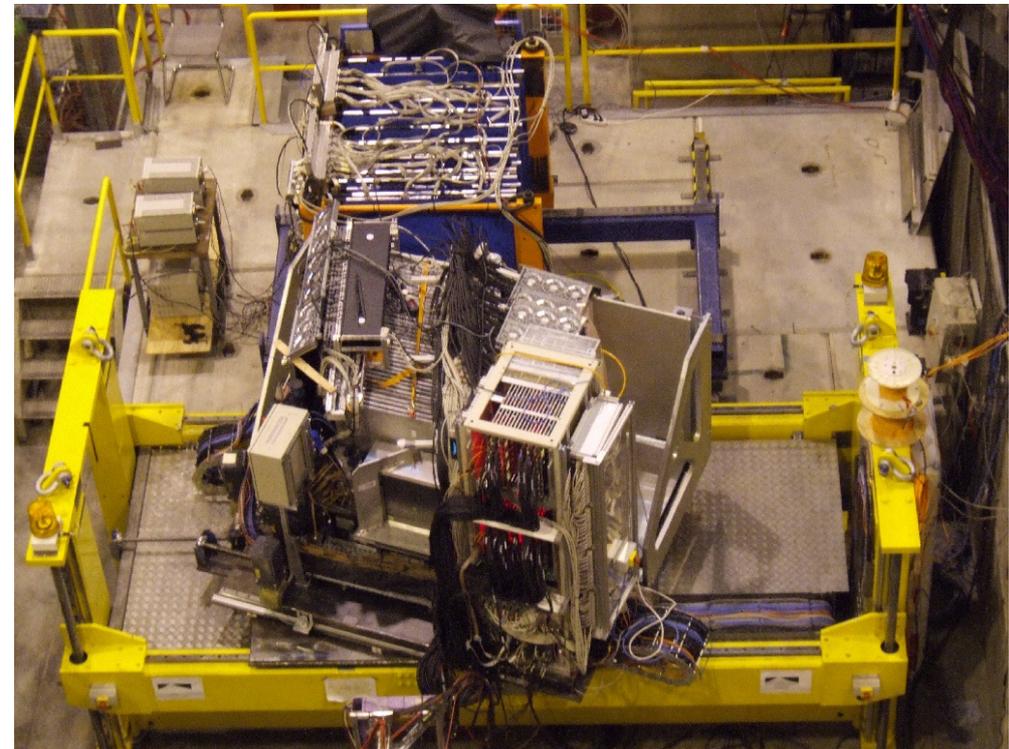
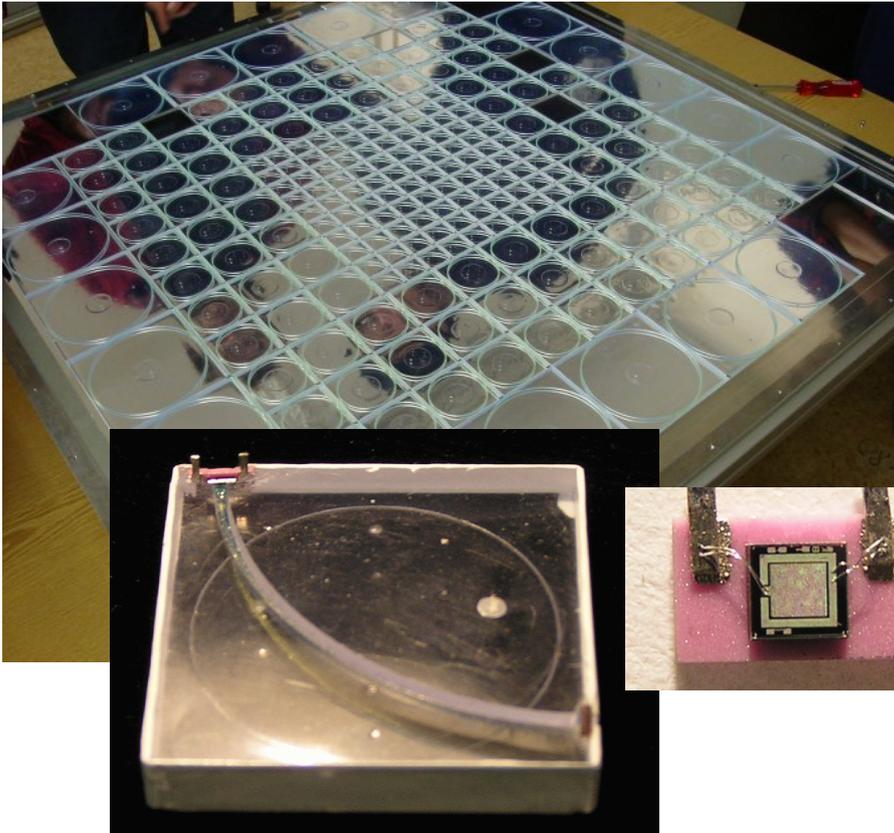


Niels Meyer, DESY
EUDET 2008, Amsterdam
October 6, 2008

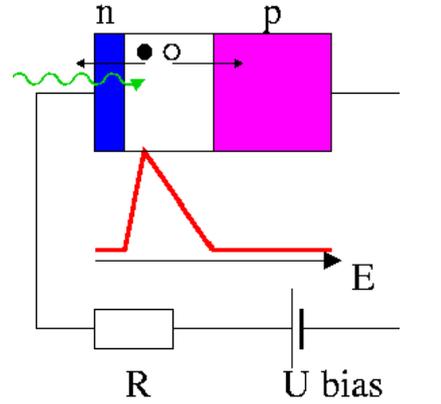
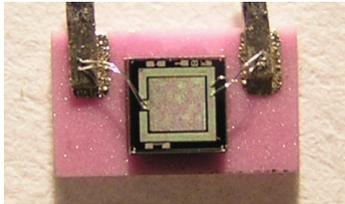


38 layers, 2cm steel
216 or 141 cells/layer $3 \times 3 \text{cm}^2$ to $12 \times 12 \text{cm}^2$
Readout via SiPM

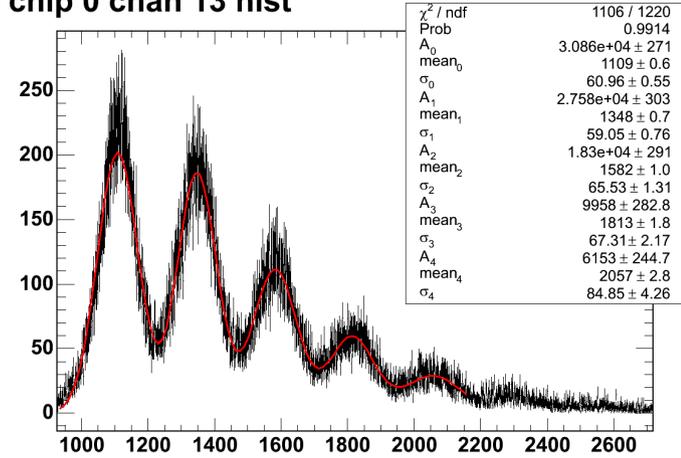
Test beam operation at CERN and FNAL since 2006, combined running with SiW or SciW Ecal and TCMT



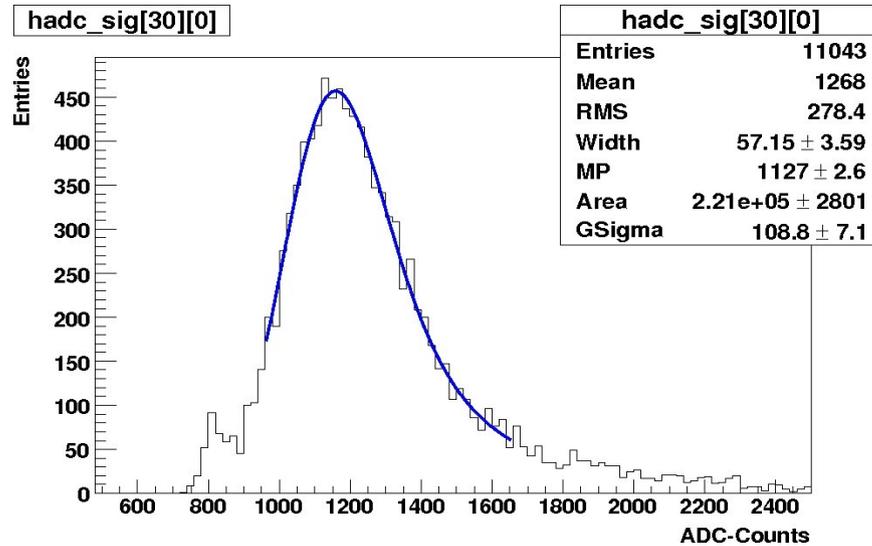
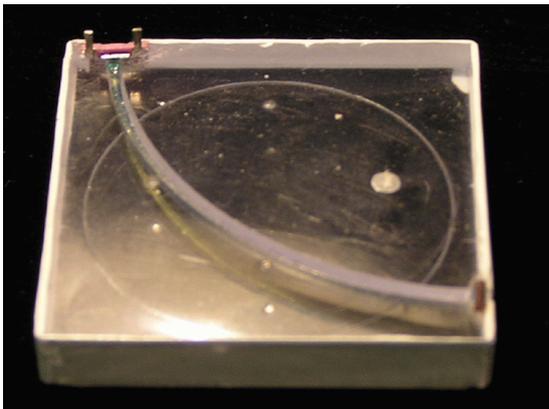
SiPM scale: single-pixel amplitude (gain)



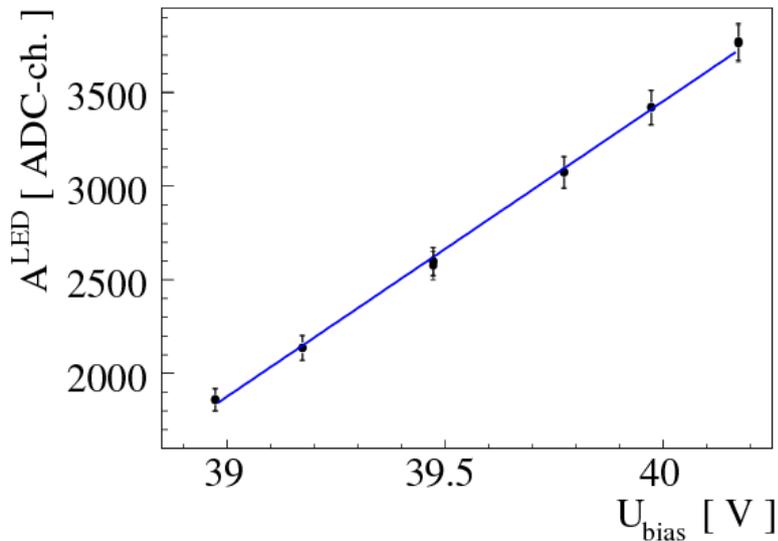
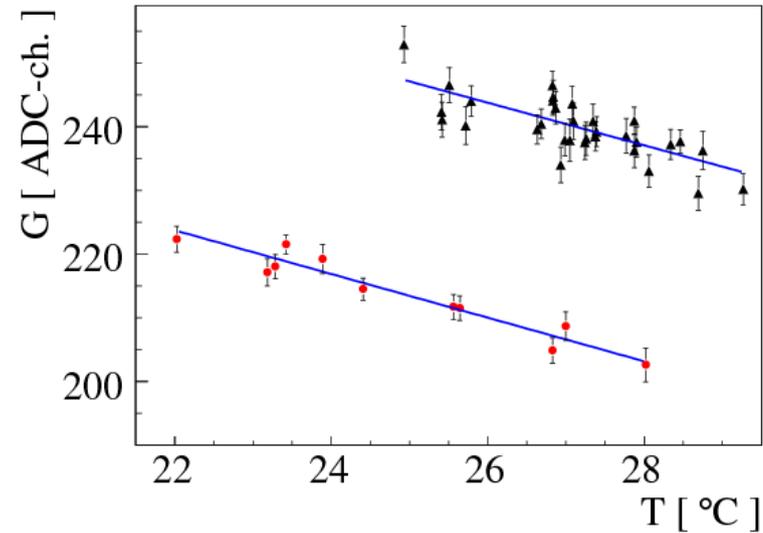
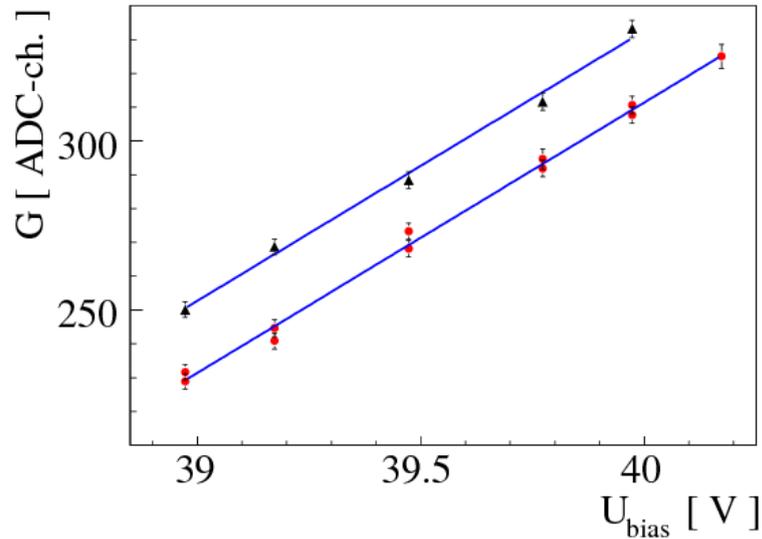
FE 0 chip 0 chan 13 hist



Physics scale: tile response to MIP



Lightyield: MIP response on the SiPM scale [pixel/MIP]

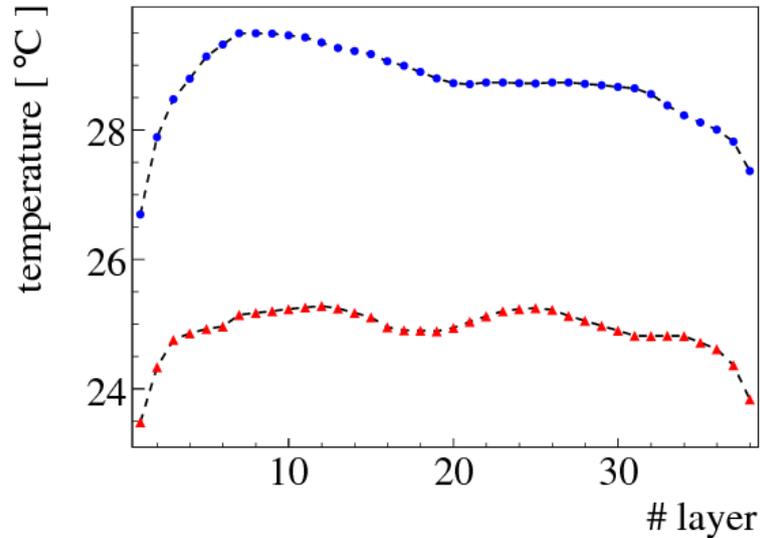


Gain depends on over-voltage above breakdown, thus is sensitive to bias-voltage and temperature

Amplitude dependence even stronger due to same-sign effect on Geiger efficiency

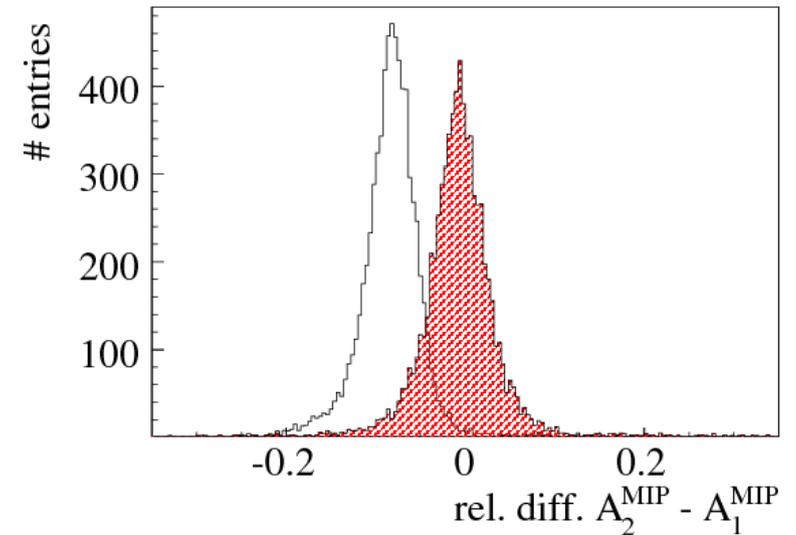
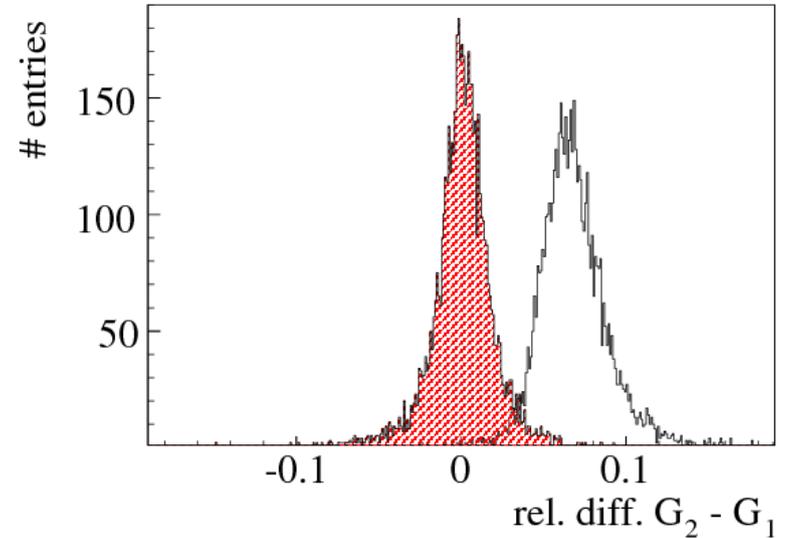
Bias voltage adjusted to compensate for temperature in order to stabilize light yield

Compensate for T Drifts



Temperature variations over one measurement period (few weeks) can be substantial

Applying measured slopes corrects coefficients correctly

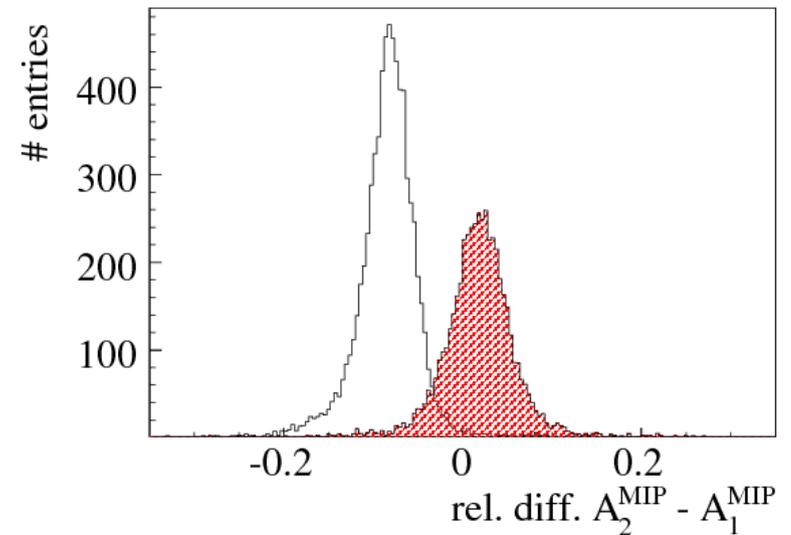


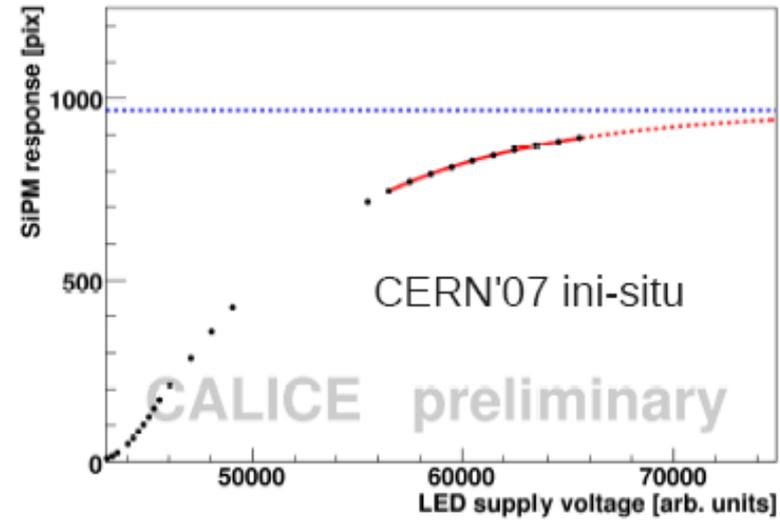
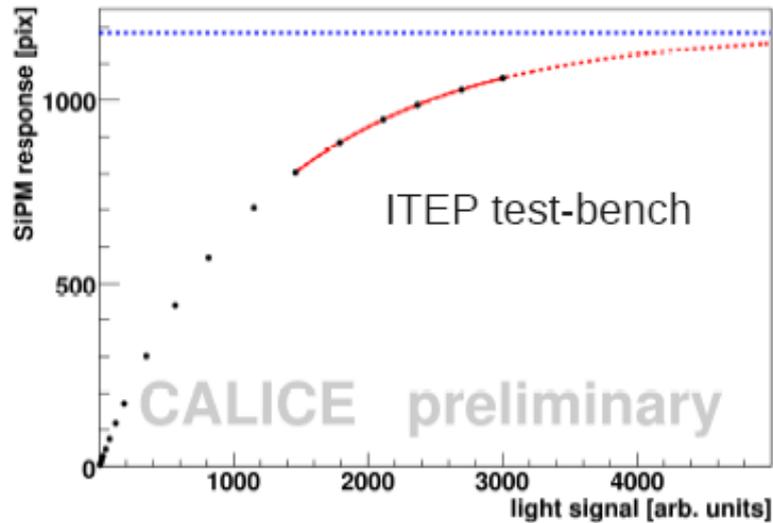
Indirect Extrapolation

Taking full MIP calibration is much more effort, measuring T-slopes not feasible for full detector

Try to use Gain behaviour be used to extrapolate MIP coefficients

Promising ansatz, but large uncertainty dominated

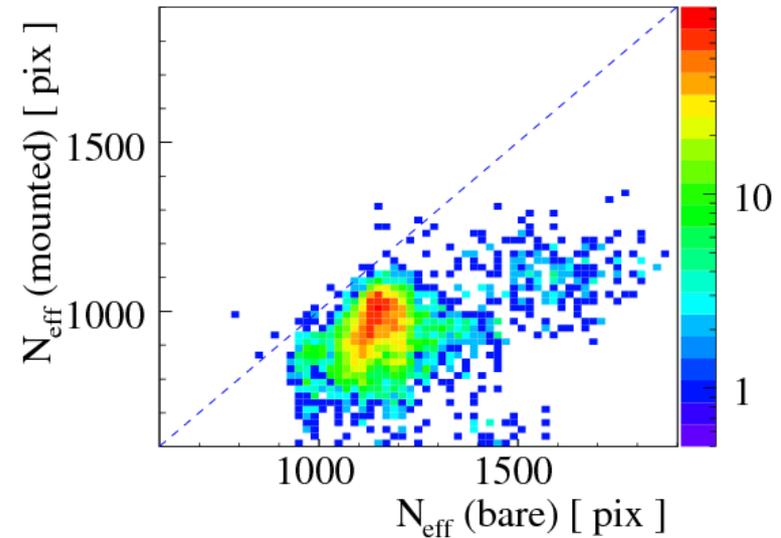


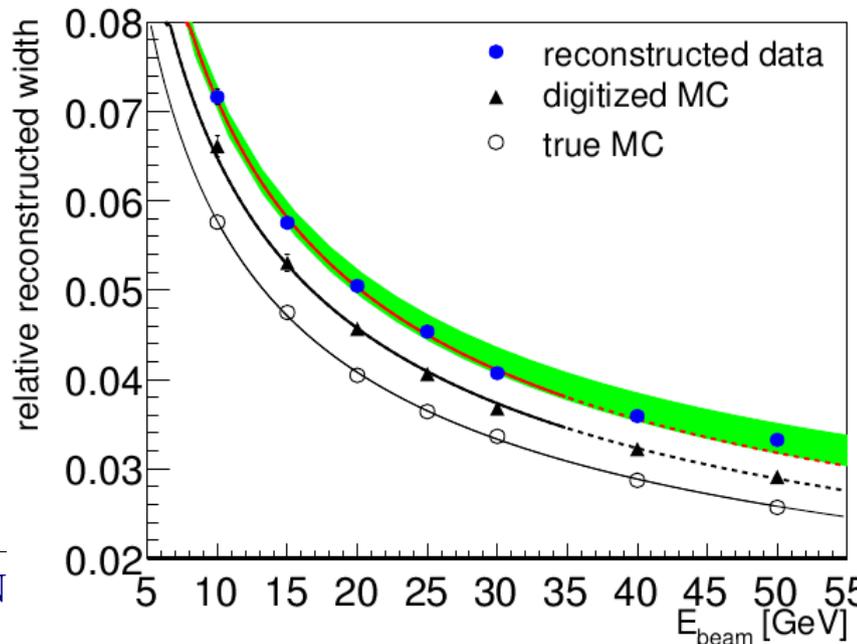
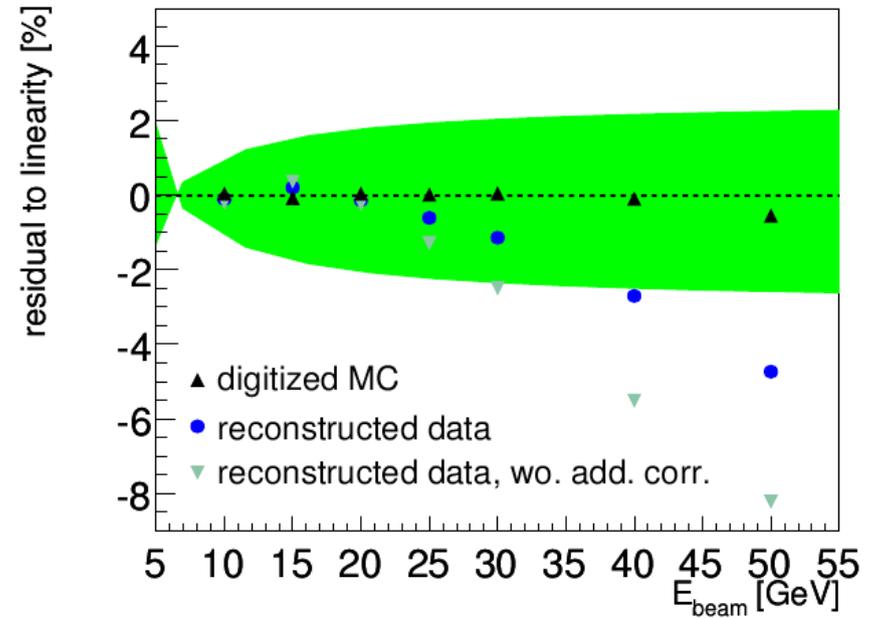
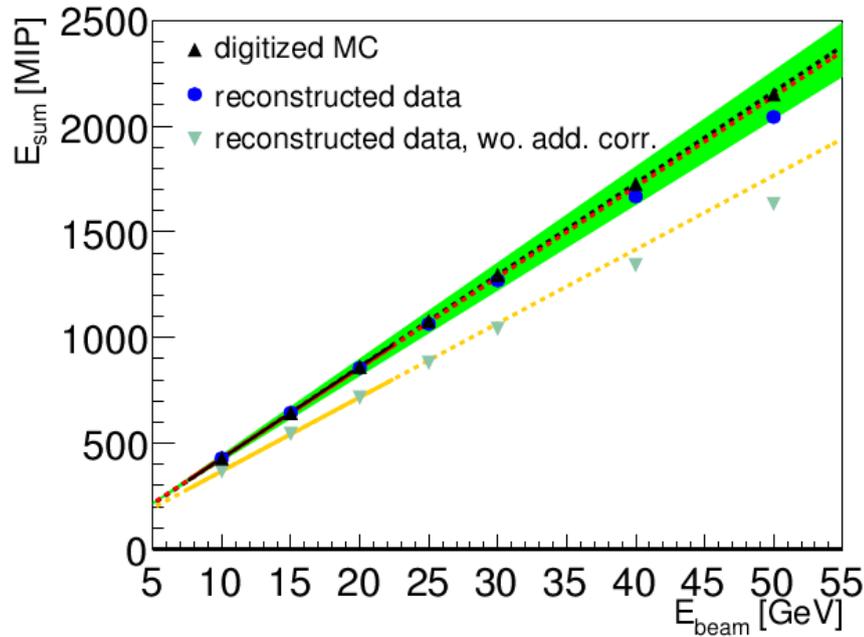


Response curves measured on bare SiPM on test-bench

In-situ tests show lower maximum amplitude (SiPM not fully illuminated)

In-situ response not normalizable to photon intensity over full dynamic range
 \Rightarrow use test-bench curve and scale by ratio of saturation levels





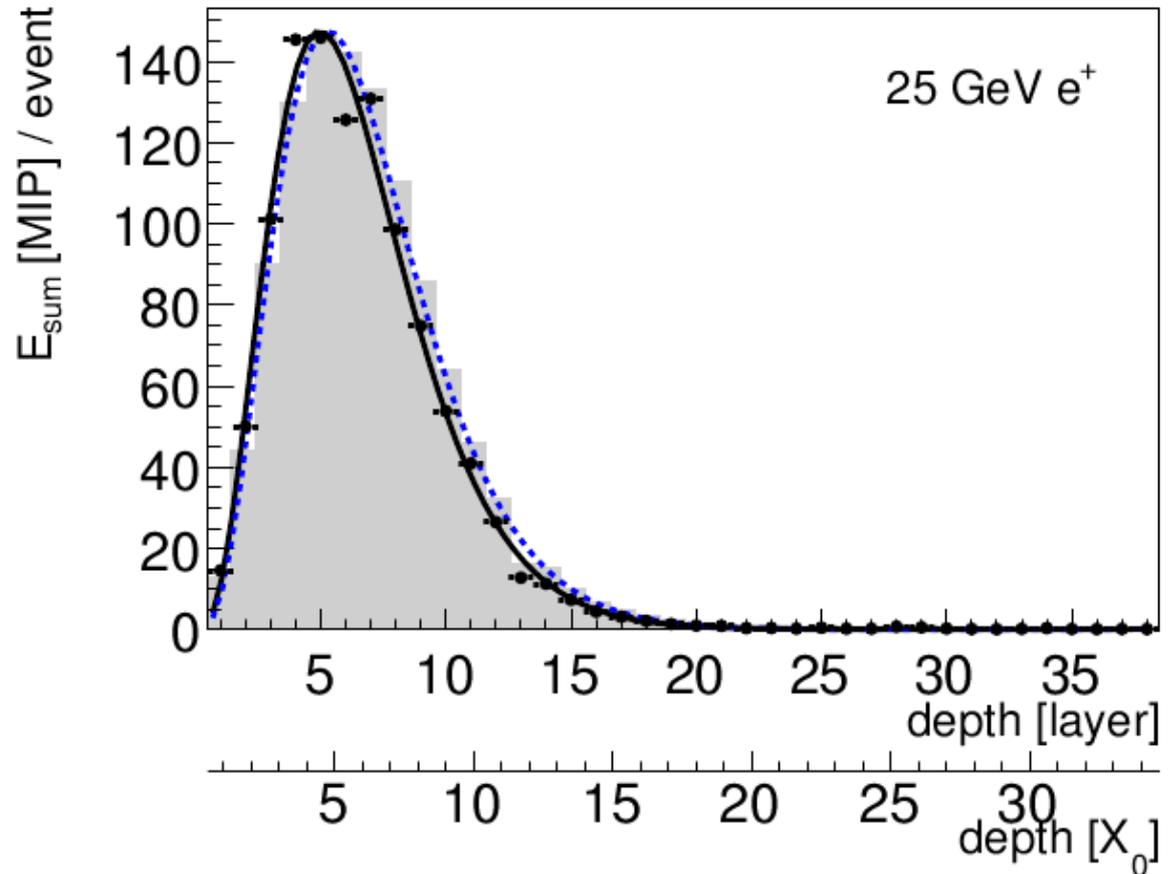
Average corrections for temperature and saturation effects

No calibration uncertainties in digitization, yet

EM Shower Profile

Good agreement w/ MC in general, confirm early shower start in data observed already by SiW Ecal (additional material in CERN beamline)

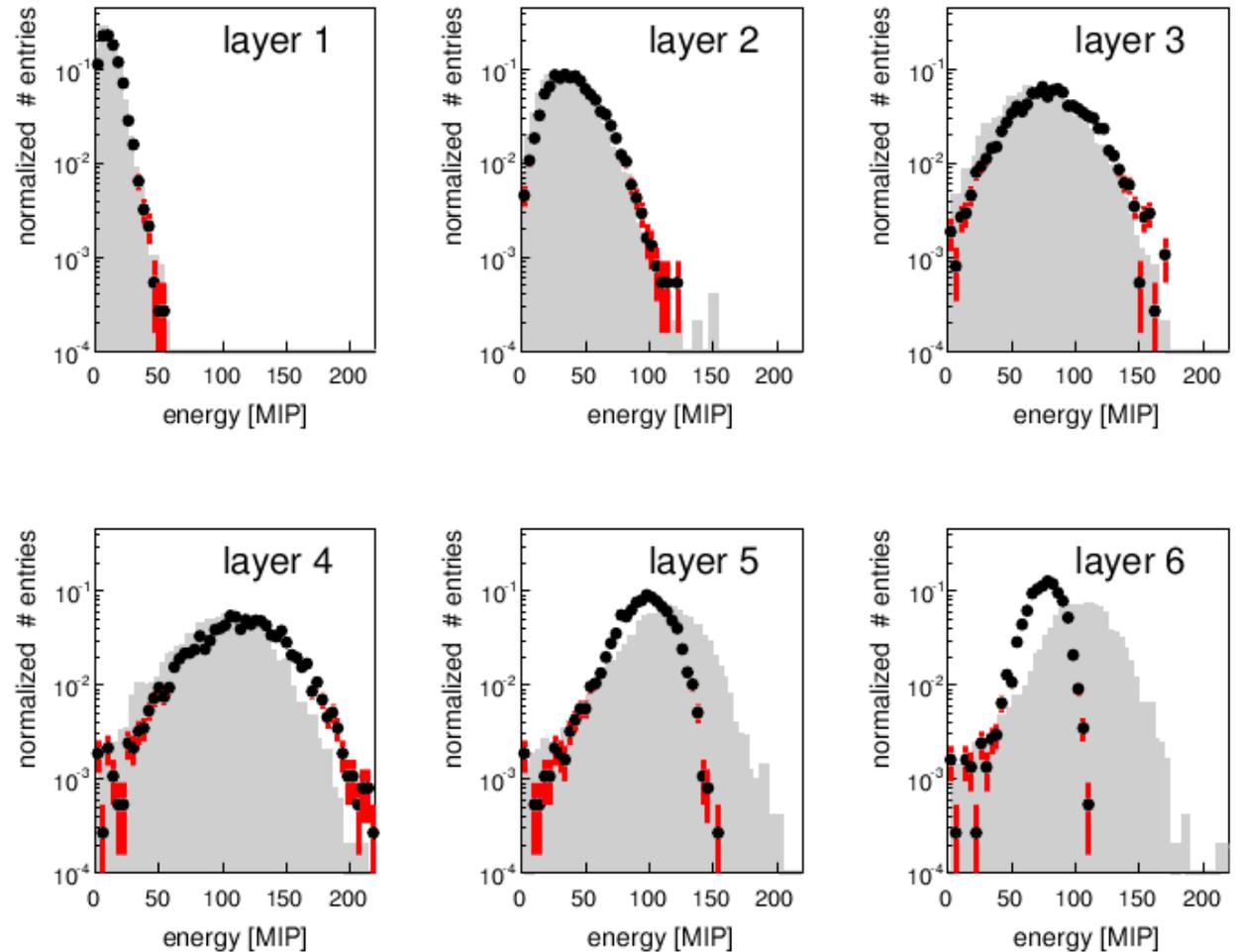
Few layers show relatively large deviations, however



Select particles hitting center-tile and look at spectra along shower axis

Some cells show large data/MC discrepancy

Average corrections insufficient on level of individual cells - more complex



- Smooth and stable operation in 3rd year of combined test-beam running
- Studied temperature and voltage dependence in detail, use voltage adjustment to compensate for large temperature shifts
- More detailed adjustment by extrapolating calibration coefficients over T-difference between data and calib runs necessary
- Average slopes already give satisfactory results on global quantities, with remaining data/MC differences on single-cell level