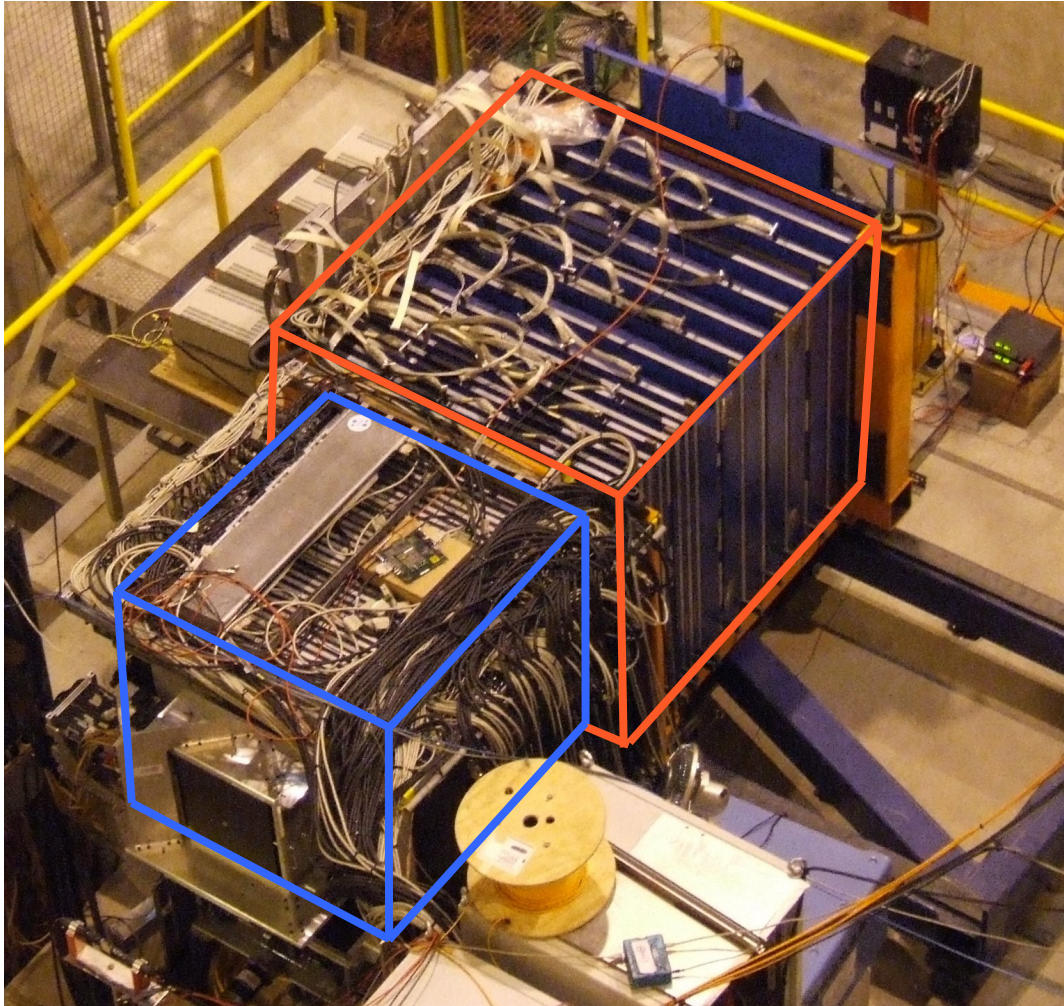


# First look into AHCAL and TCMT test-beam data

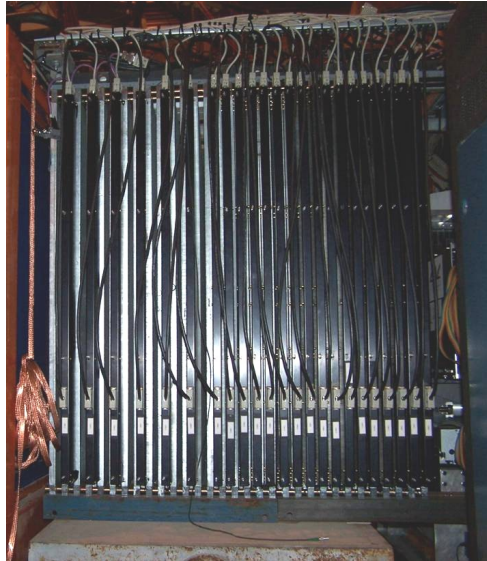
# content

- CERN installation of AHCAL & TCMT
- muon calibration
- electromagnetic shower in HCAL
- hadron shower
- combined response

# AHCAL & TCMT in operation



# One talk for two detectors? Yes, there is a reason!



Analog Hadronic CALorimeter  
is an  
iron-scintillator-sandwich calorimeter  
using SiPM readout



TailCatcher and MuonTracker  
is an  
iron-scintillator-sandwich-calorimeter  
using SiPM readout

# active layer layout

AHCAL TCMT

	19/79		31/79		43/79		55/79		67/79		
1/67	13/73	19/73	25/73	31/73	37/73	43/73	49/73	55/73	61/73	67/73	73/73
	13/67	19/67	25/67	31/67	37/67	43/67	49/67	55/67	61/67	67/67	73/67
1/55	13/61	19/61	25/61	31/61	37/61	43/61	49/61	55/61	61/61	67/61	73/61
	13/55	19/55	25/55						61/55	67/55	73/55
1/43	13/49	19/49	25/49						61/49	67/49	73/49
	13/43	19/43	25/43						61/43	67/43	73/43
1/31	13/37	19/37	25/37						61/37	67/37	73/37
	13/31	19/31	25/31						61/31	67/31	73/31
1/19	13/25	19/25	25/25	31/25	37/25	43/25	49/25	55/25	61/25	67/25	73/25
	13/19	19/19	25/19	31/19	37/19	43/19	49/19	55/19	61/19	67/19	73/19
	13/13	19/13	25/13	31/13	37/13	43/13	49/13	55/13	61/13	67/13	73/13
	13/1	25/1	37/1	49/1	61/1						



**216 cells per layer**

**3x3cm<sup>2</sup>, 6x6cm<sup>2</sup>, 12x12cm<sup>2</sup> – 0.5cm thick**

**23 (of 38) layers**

**~5000 (of 8000) channels**

**2 cm sampling**

**20 strips per layer**

**5x100cm<sup>2</sup> – 0.5cm thick**

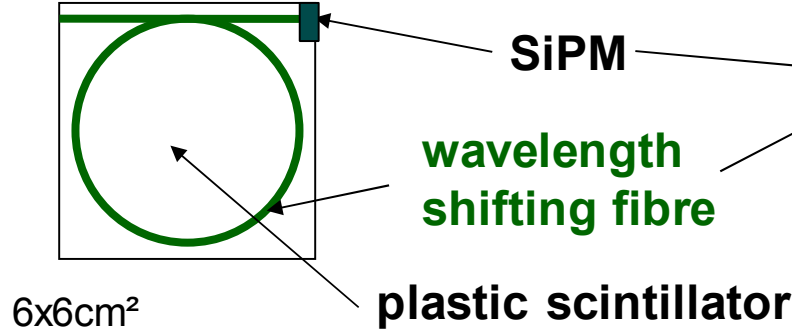
**16 layers**

**320 channels**

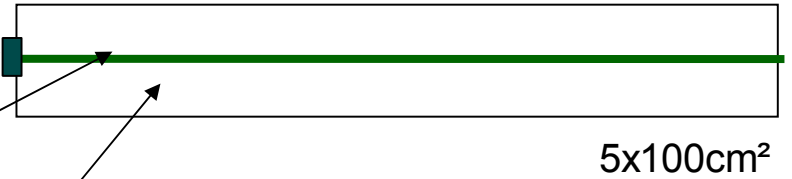
**2 & 10 cm sampling**

# different shape same technology

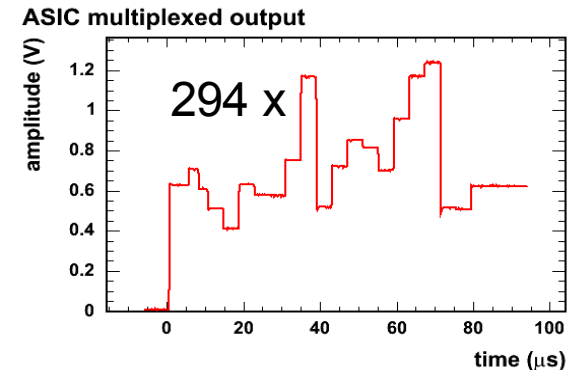
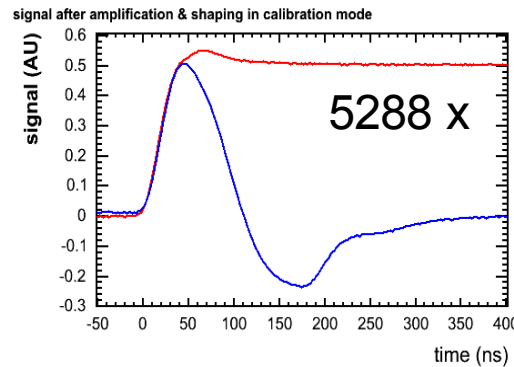
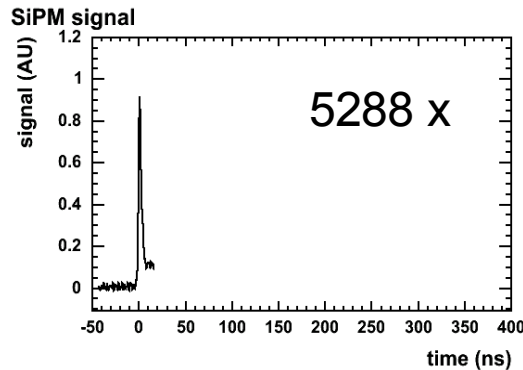
AHCAL



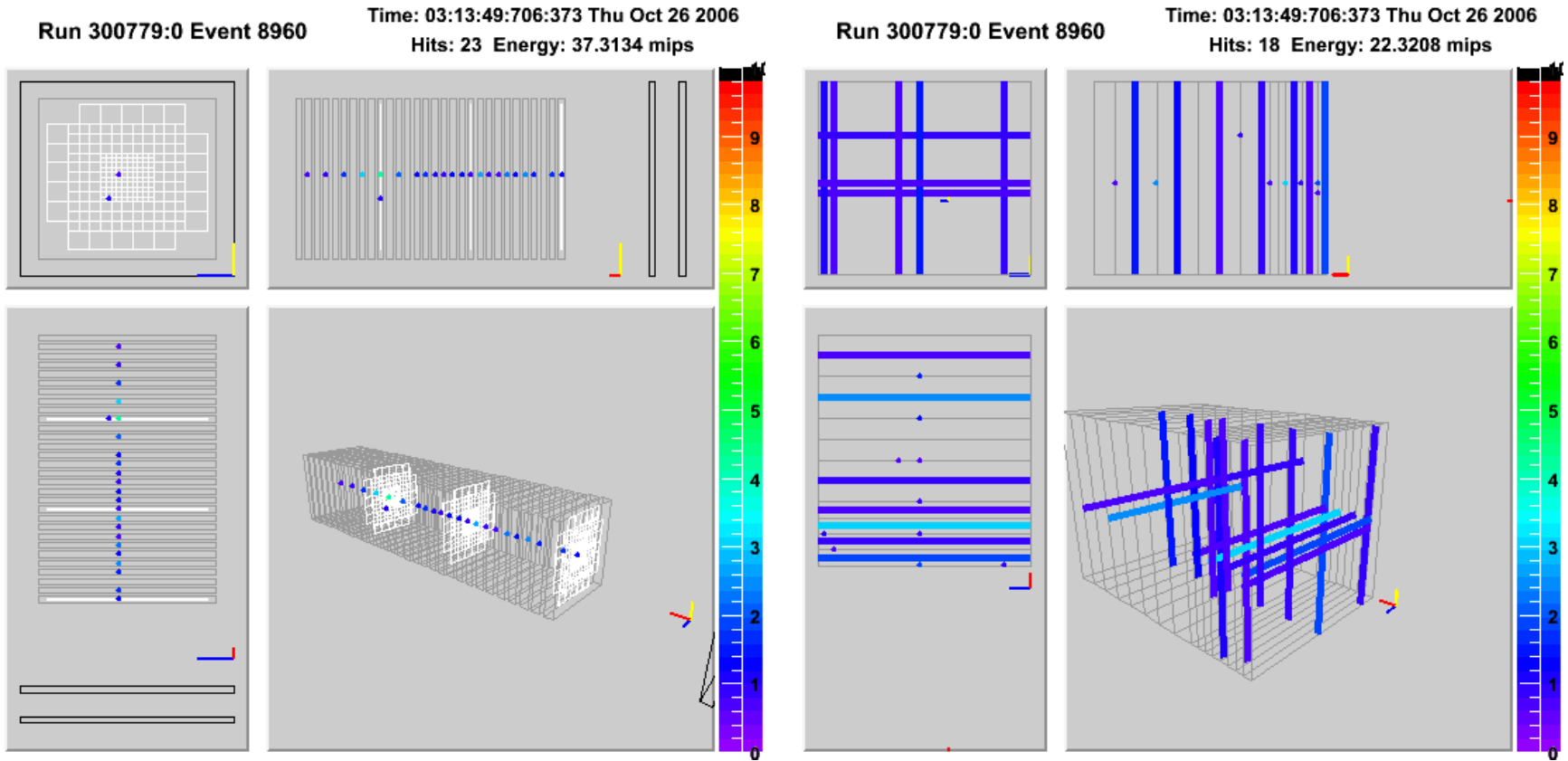
TCMT



→ both detectors use the same readout-electronics



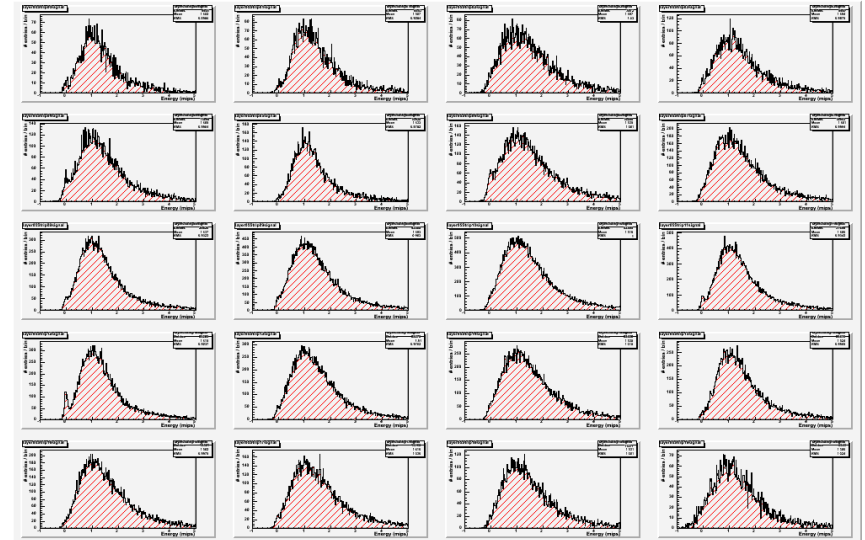
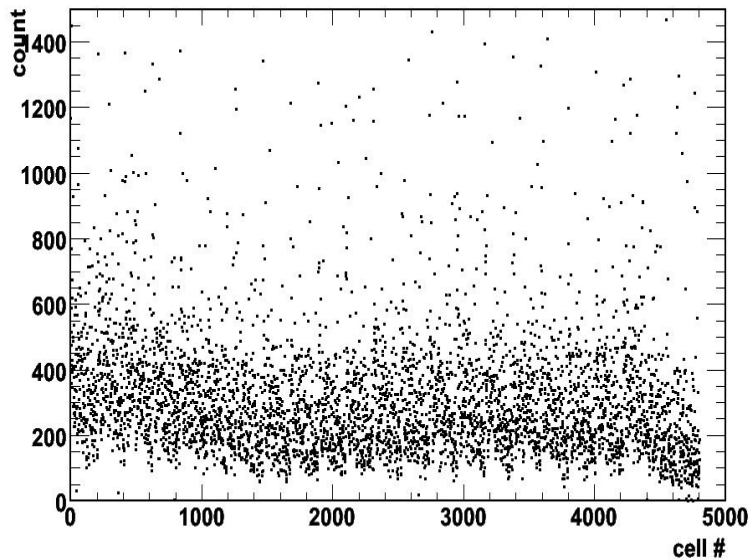
# muon calibration



# muon calibration

TCMT example layer 5:

distribution of 50k muons over AHCAL cells

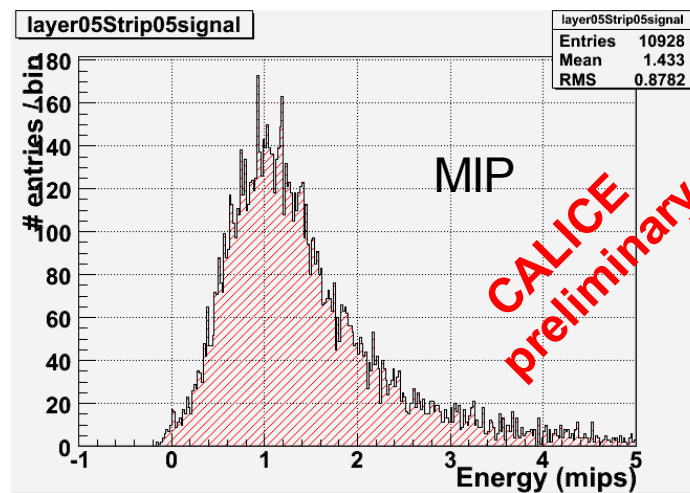
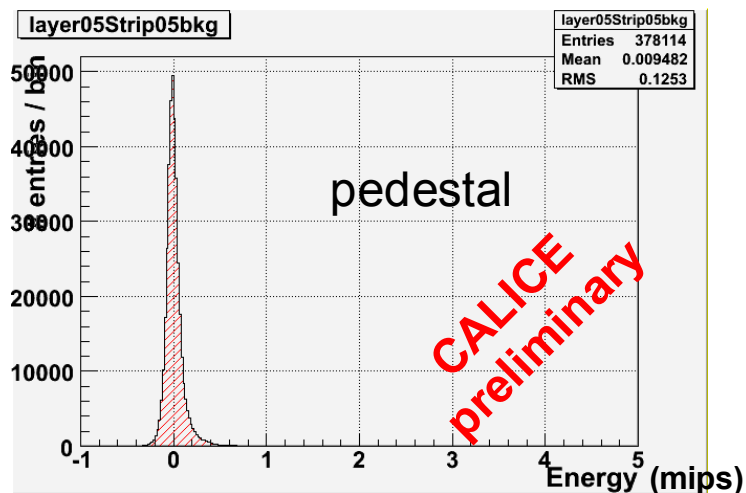


a good calibration needs enough muons in **all** channels

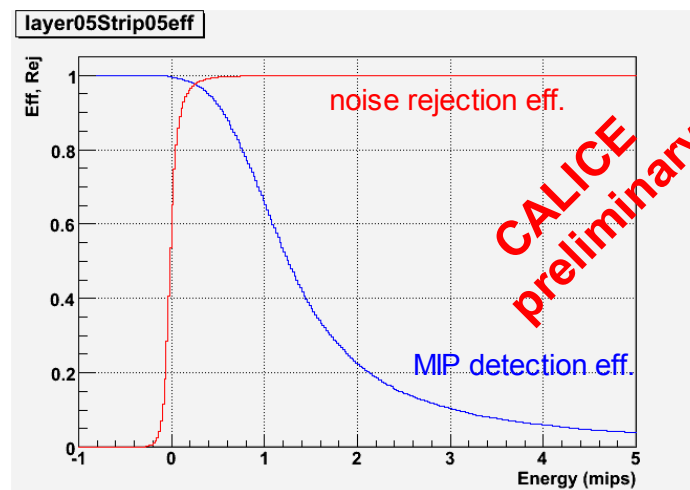
→ the CERN test-beam offers a muon calibration of the full detector with maximum data taking rate



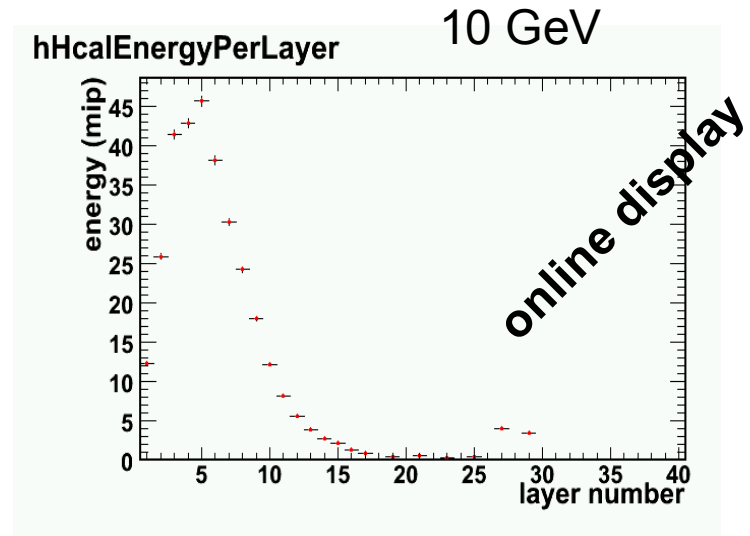
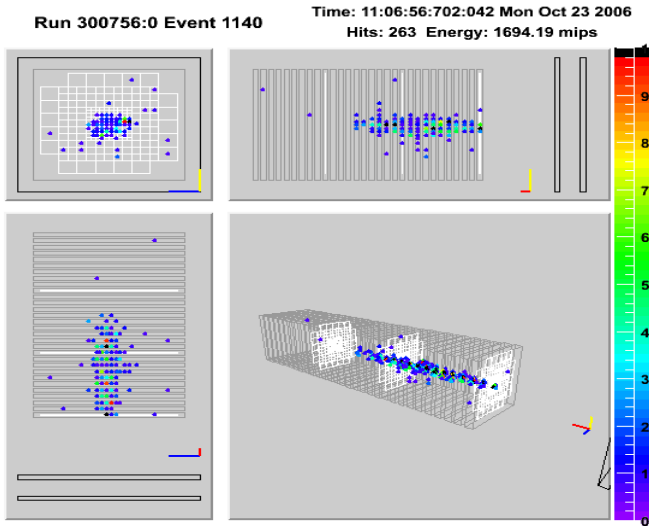
# muon efficiency for TCMT



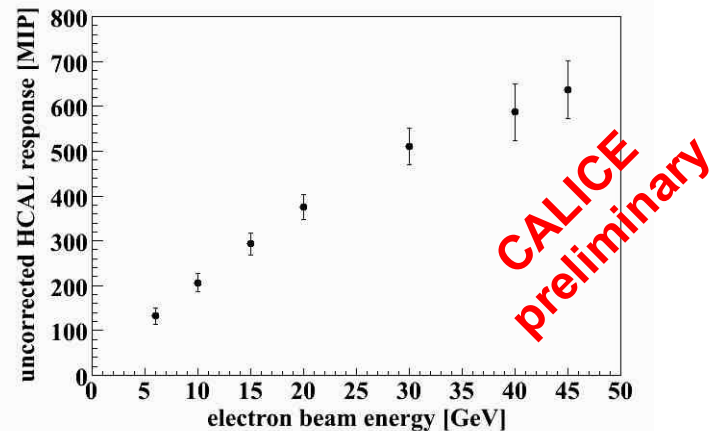
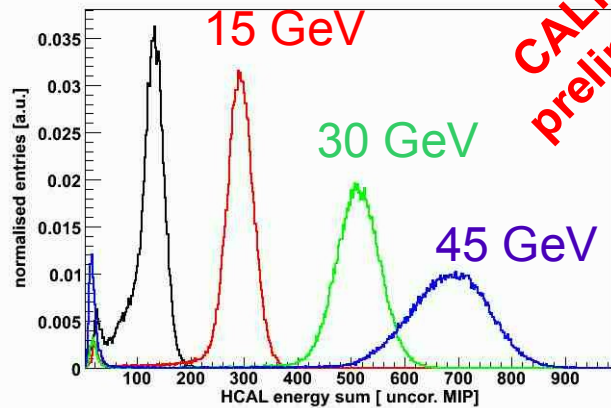
**CALICE preliminary:**  
**Efficiency vs. rejection**  
 for TCMT strips:  
 \* for  $E > 0.4$  mips,  
 typically  $> 95\%$  effic  
 with  $> 95\%$  rejection



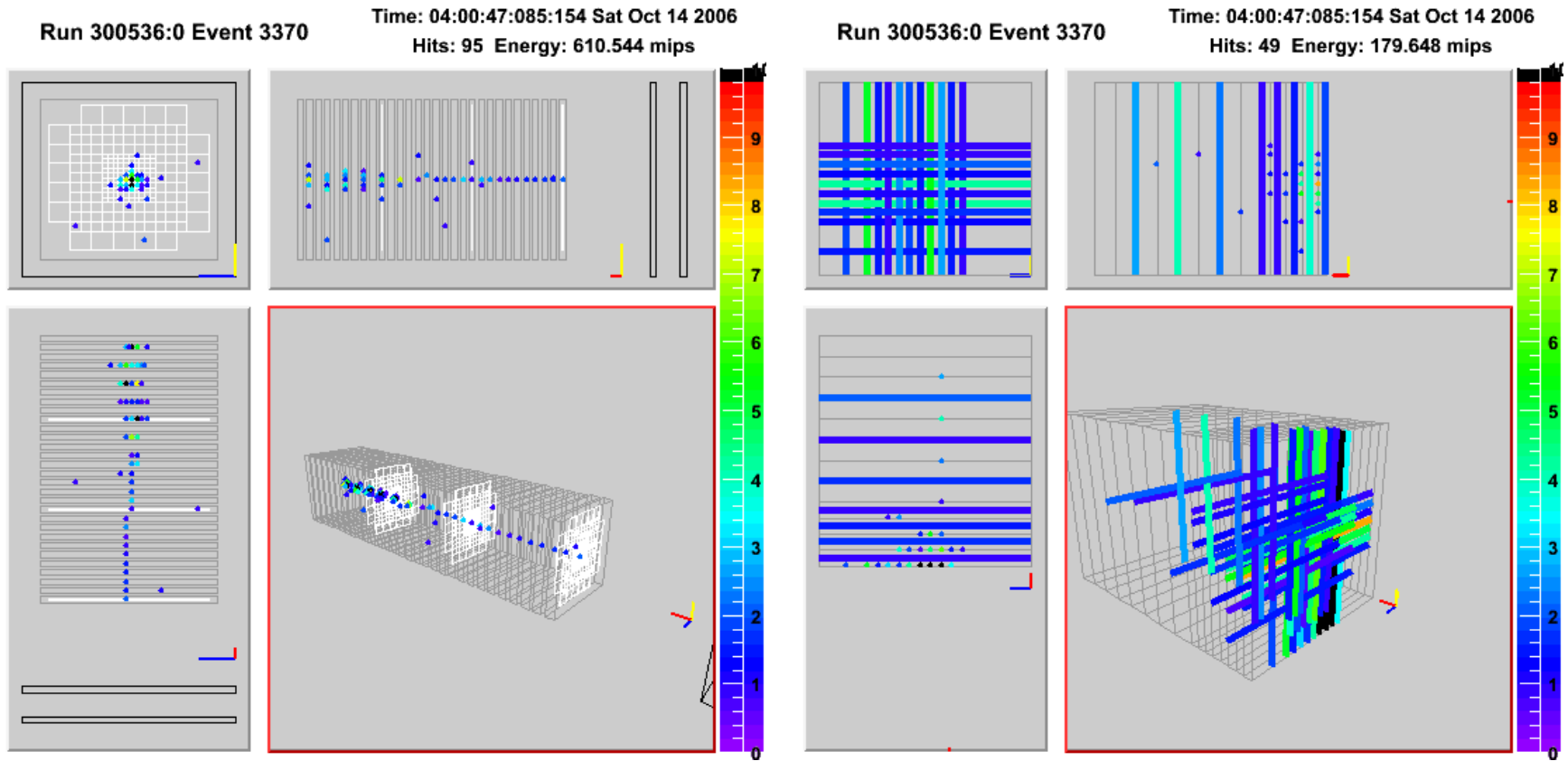
# HCAL positron signal



6 GeV



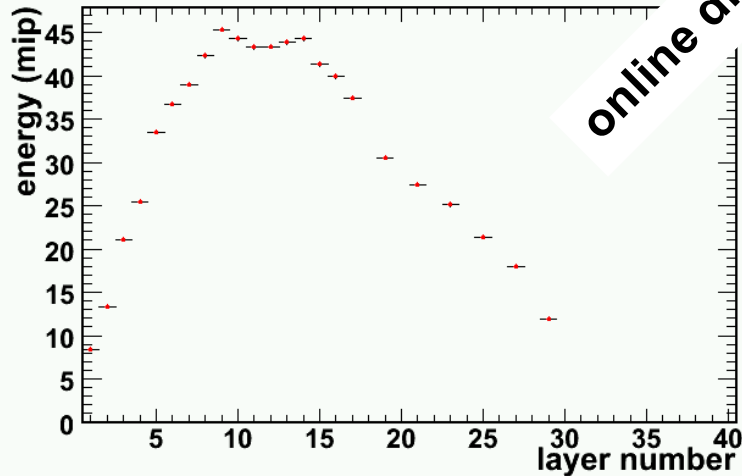
# pions in AHCAL & TCMT



# longitudinal shower distribution in HCAL

40 GeV pion

hHcalEnergyPerLayer



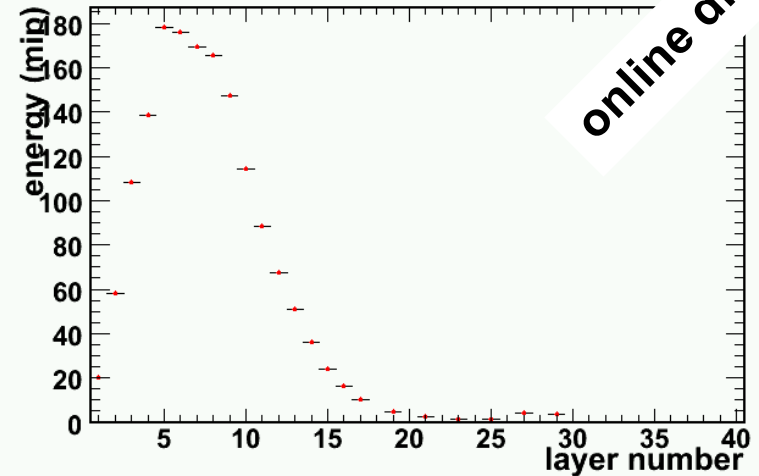
online display

not contained

→ need tailcatcher

50 GeV positron

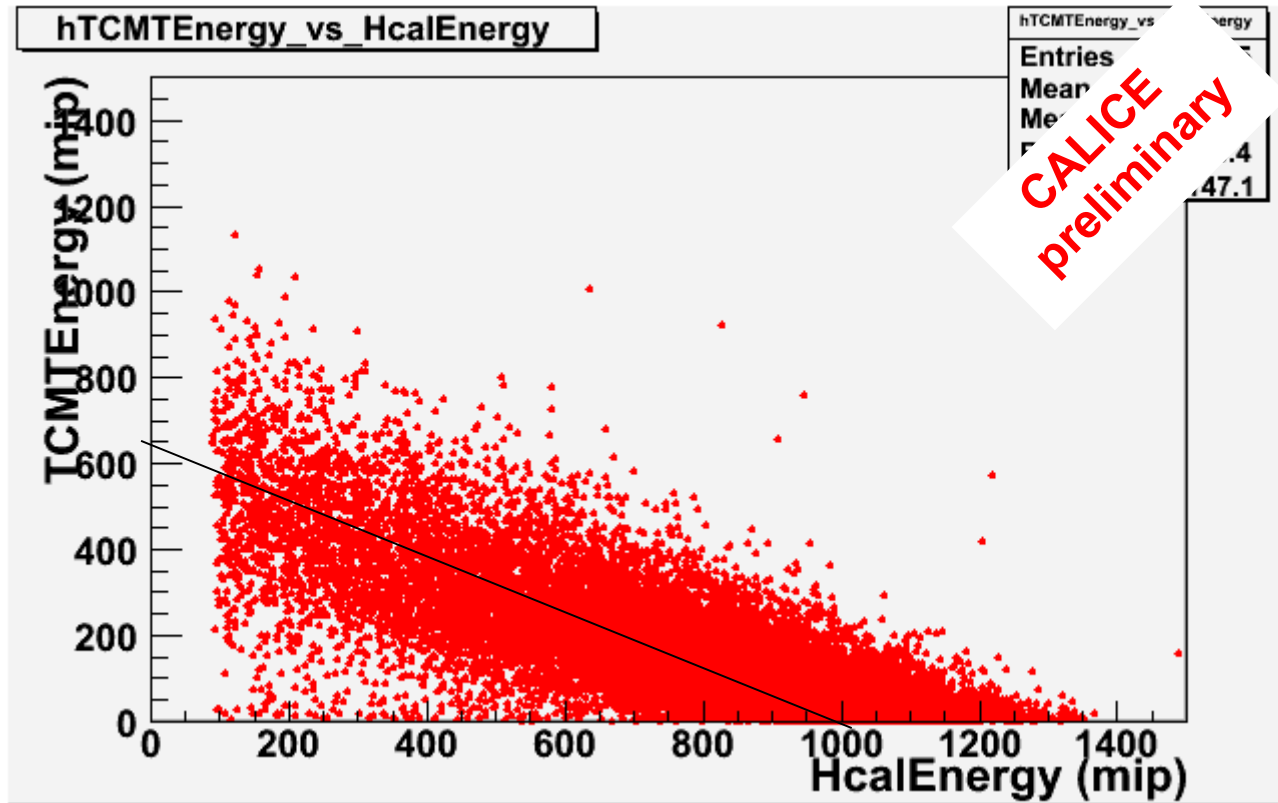
hHcalEnergyPerLayer



online display

contained

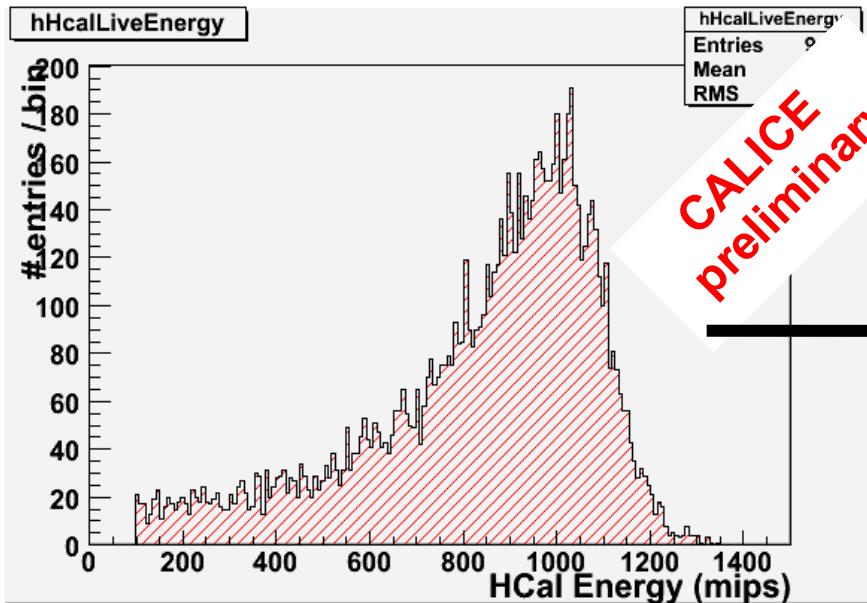
# 80 GeV pions signal of AHCAL & TCMT



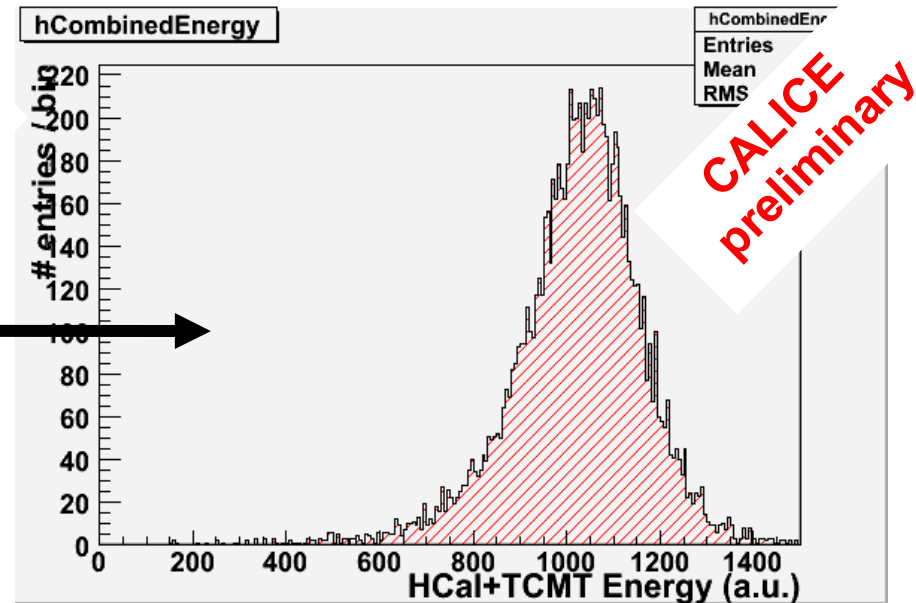
# Combining the HCAL and TCMT response

The MIP-calibrated energy is summed on event-base.  
Different sampling fractions are corrected with a constant factor between HCAL and TCMT.

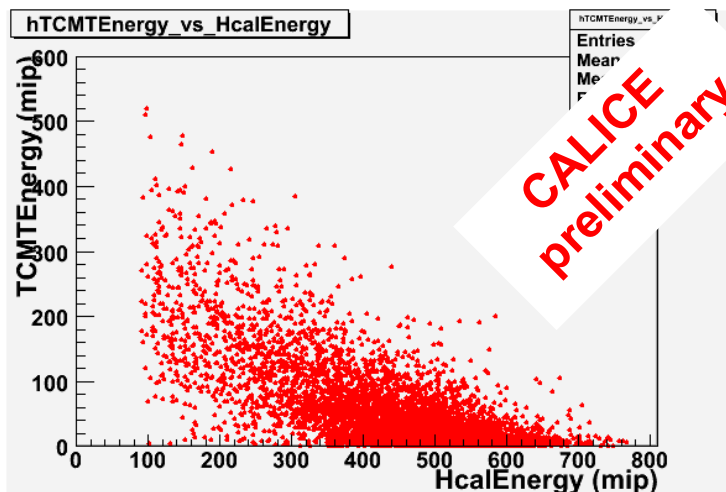
HCAL alone



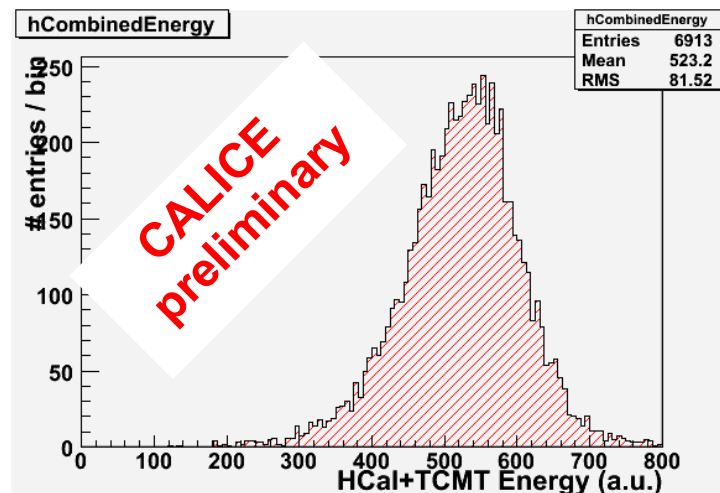
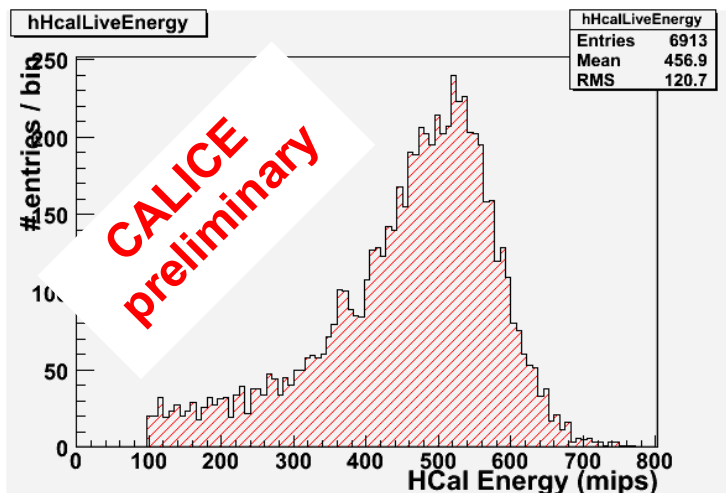
HCAL & TCMT



# 30 GeV pion



improvement still visible !



## summary & outlook

- successful integration of AHCAL & TCMT into the same readout electronics
- we have all data for calibration and understanding of the detectors in hand
- promising first results of the combined detectors
- soon: complete analysis of the data taken so far
- next year: full performance test with complete detectors @ CERN & FNAL