CMB Commissioning

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HCAL Main Meeting
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Present Setup

- HCAL tent, hall 5 (next to module assembly)
- 1 lower half of CMB ("CMB-B") connected to module 5
- 3 LEDs, 12 PINs
- PIN read-out via separate "test board" with ASIC

- LED voltage amplitude set from DAQ (V_{calib})
- LED voltage width set from SlowControl computer (via CAN bus):
  - 13.2(2) ns (LED9) for DAC setting 80

- have to reset SlowControl after "playing with CMB" (turning voltage off/on, connecting scope, ...)
- PIN signal depends heavily on whether scope connected or not (e.g., 10k ADC ch. when connected, 2k when disconnected)

CMB Requirements

1. Gain measurement (single pixel spectra)

   need peaks in all SiPMs for one light intensity setting

2. Saturation curve monitoring (light intensity scans)

   The **PIN diode** signal is needed to correct LED fluctuations.

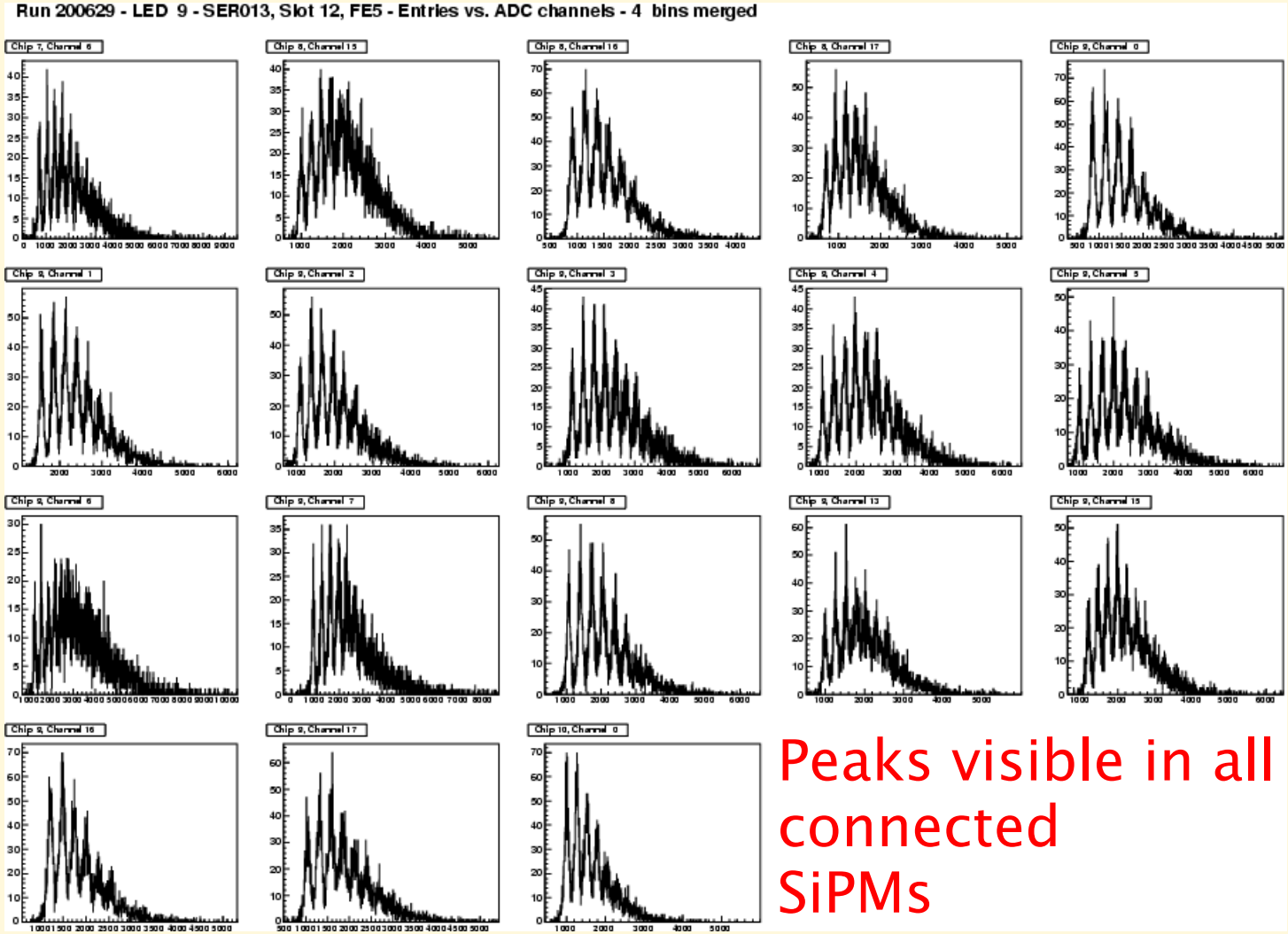
Gain Measurement

LED 9

V_{calib}=15800

↑

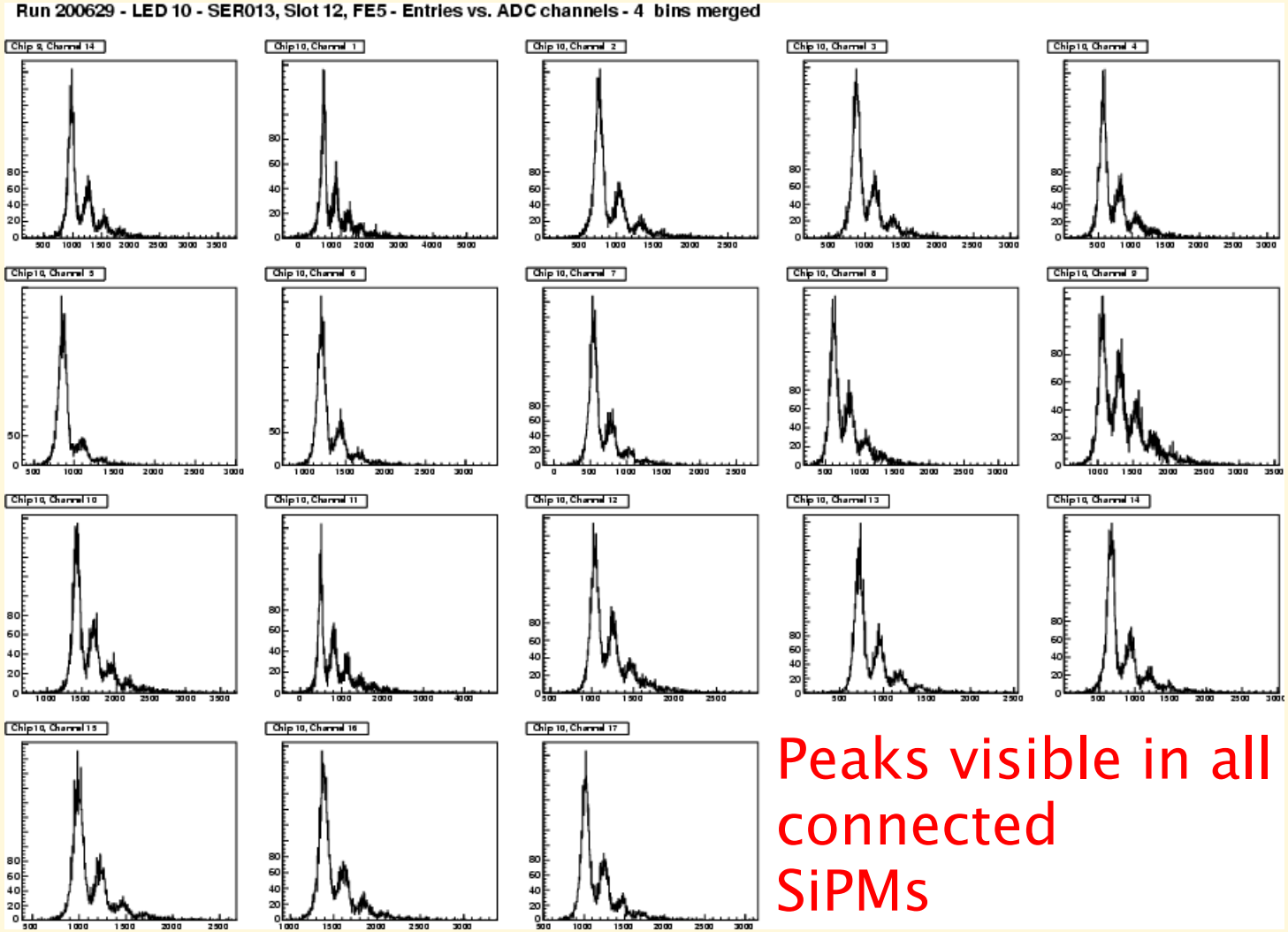
(measure for light intensity)



Gain Measurement

LED 10

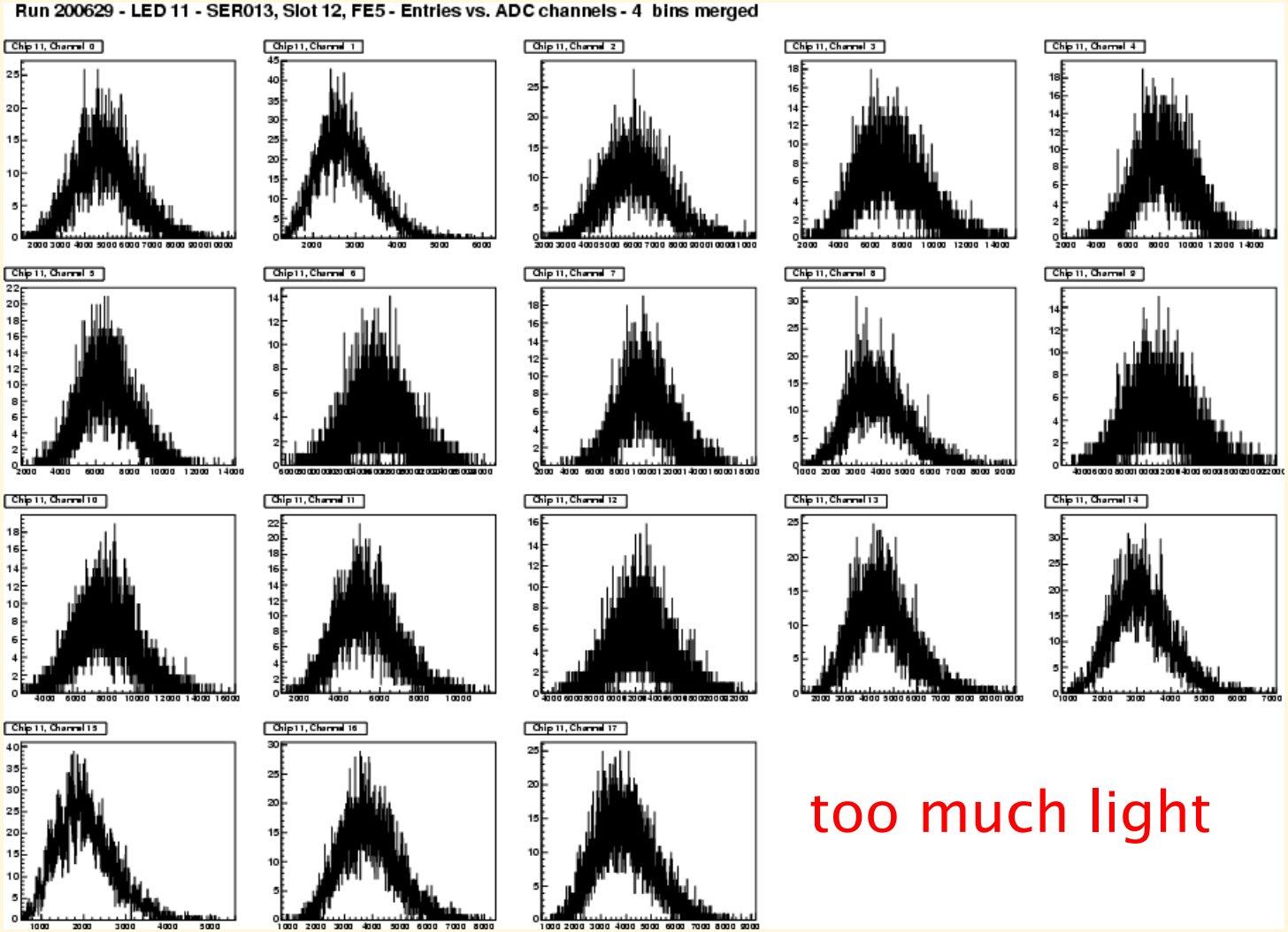
V_{calib}=15800



Gain Measurement

LED 11

V_{calib}=15800



LED Voltage Uniformity

$V_{calib} = 15800$

LED	amplitude (V)	width (ns)
9	3.6(1)	9.2(5)
10	3.6(1)	9.6(5)
11	3.7(1)	13.2(5)

need more uniformity in width to observe peaks in all SiPMs of one module for one V_{calib} setting

Required:

- all LED pulses with same width (within ~0.5ns) and amplitude (within ~0.1V)
- all LED pulses at the same time (within ~1ns)

CMB Requirements

1. Gain measurement (single pixel spectra)

   need peaks in all SiPMs for one light intensity setting

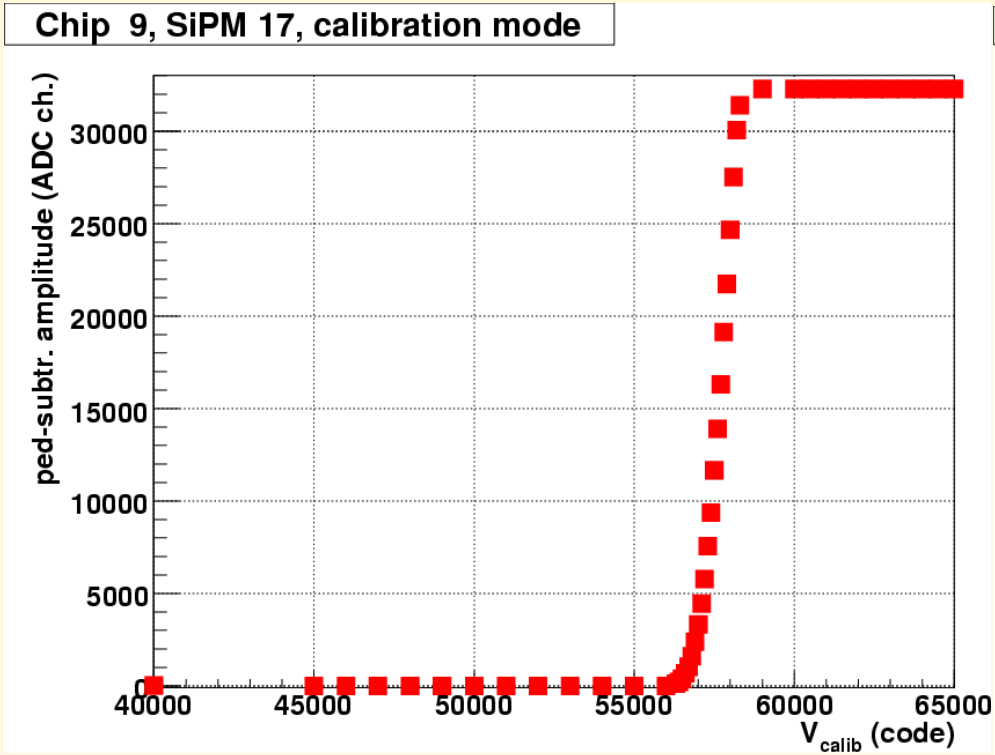
   ➡ more uniform LED voltage needed

2. Saturation curve monitoring (light intensity scans)

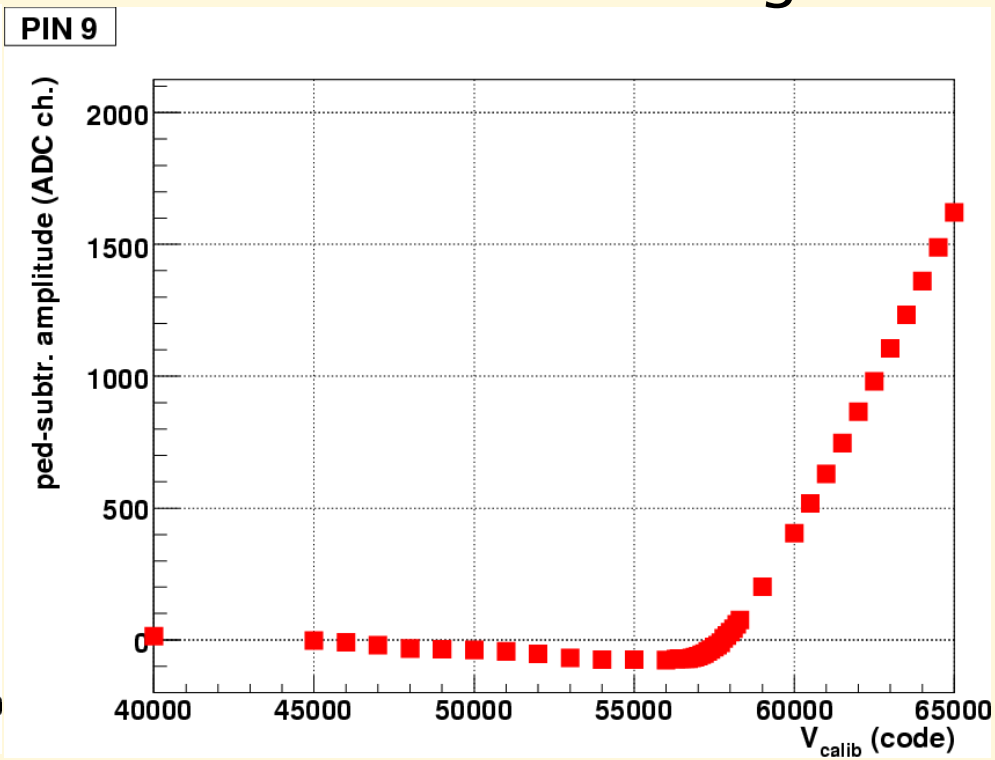
   The **PIN diode** signal is needed to correct LED fluctuations.

Light intensity scan

SiPM ASIC signal



PIN diode ASIC signal

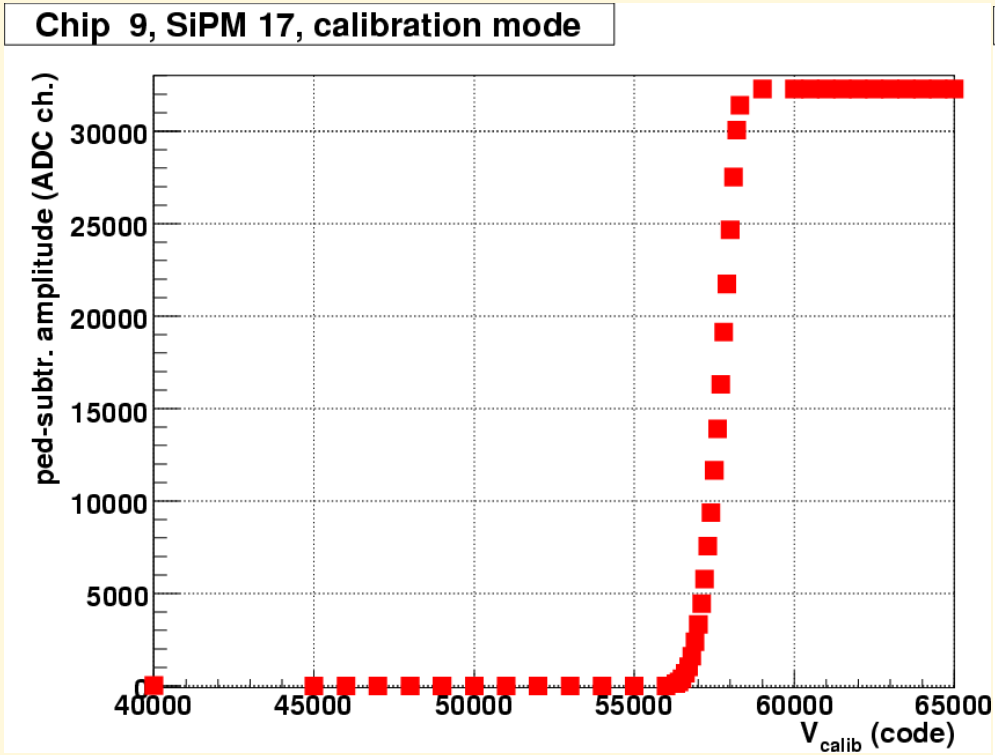


V_{calib} value was shifted during CAN bus connection work, cannot compare with the 15800 from previous slides!

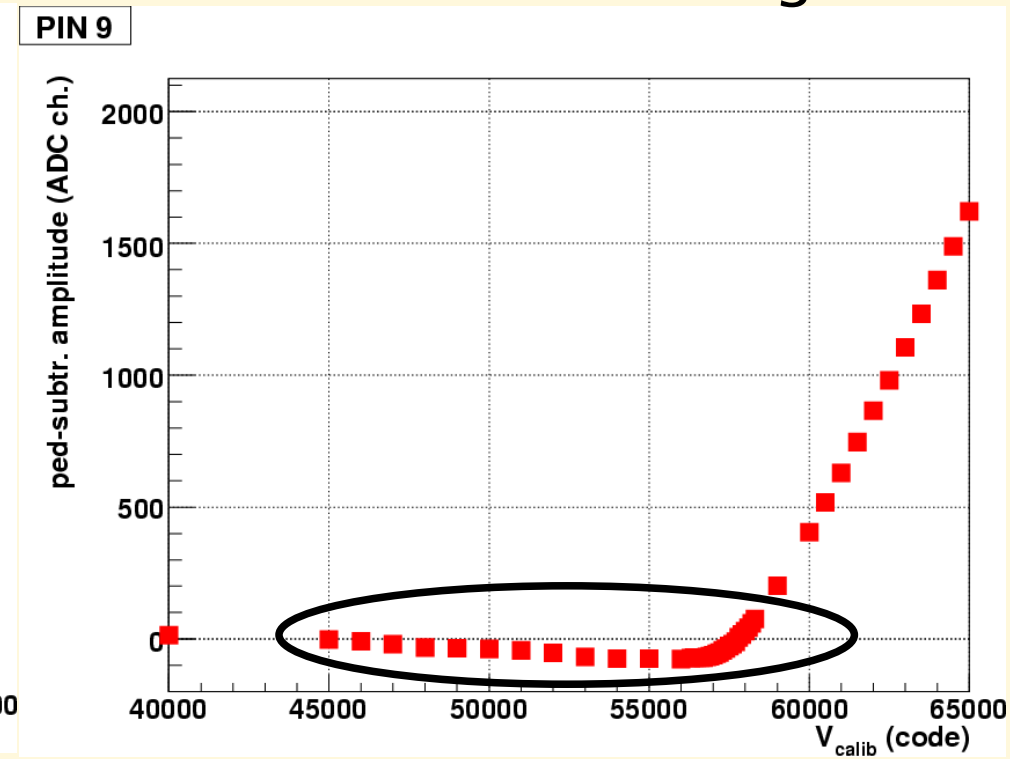
no scope connected

Light intensity scan

SiPM ASIC signal



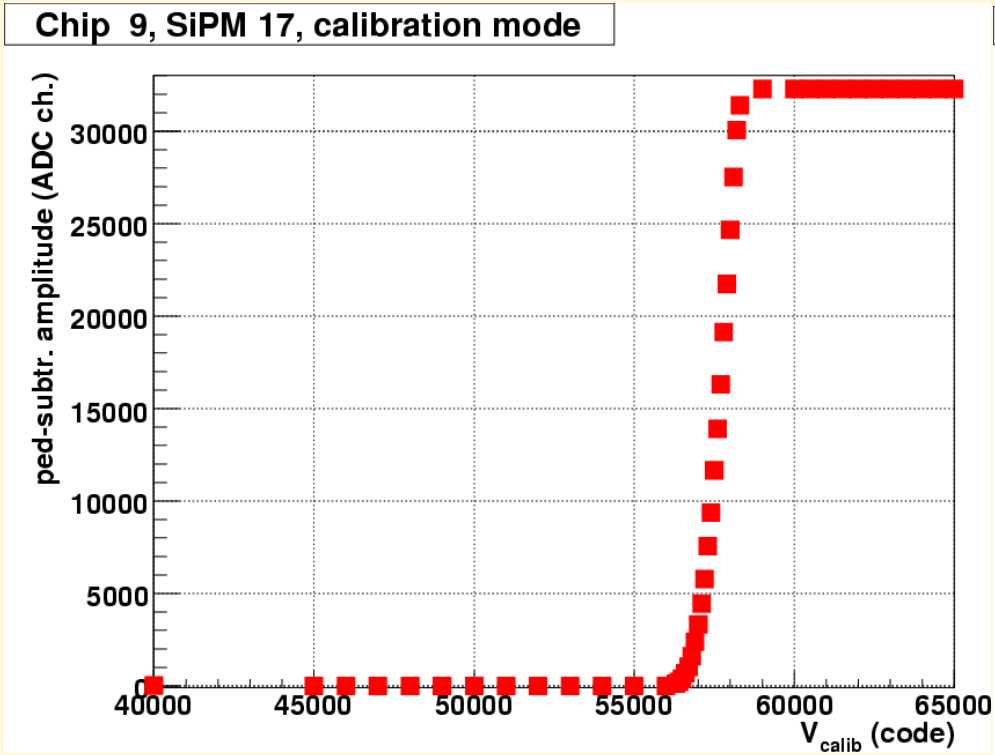
PIN diode ASIC signal



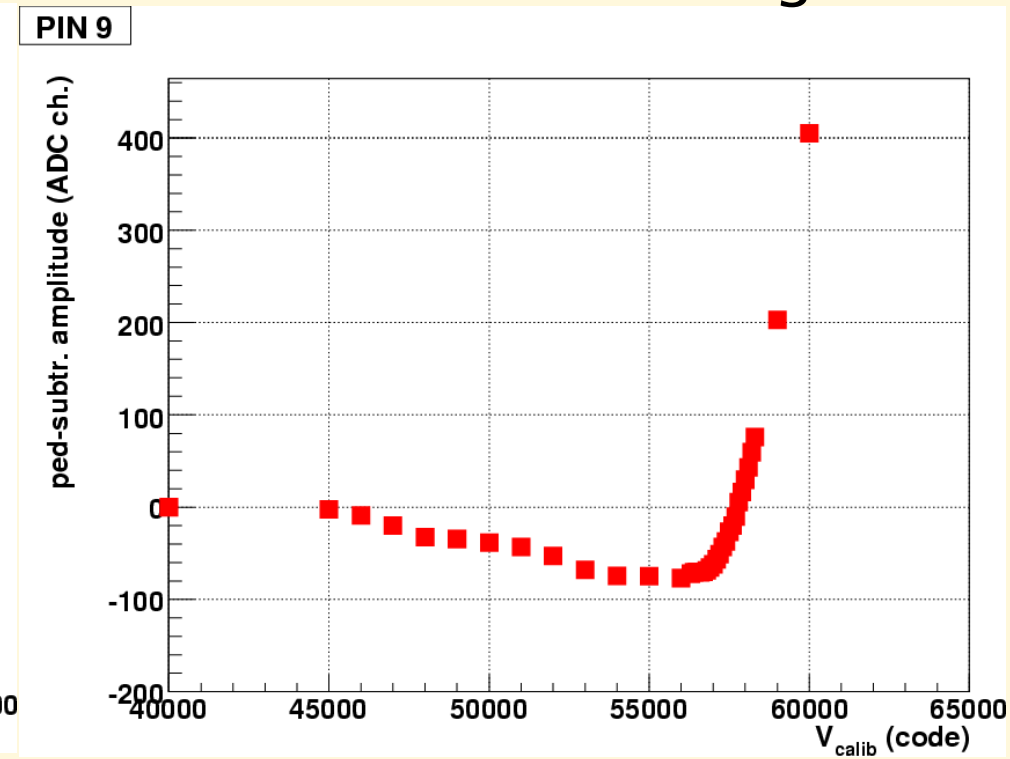
Pedestal shift (-80 ch.)

Light intensity scan

SiPM ASIC signal



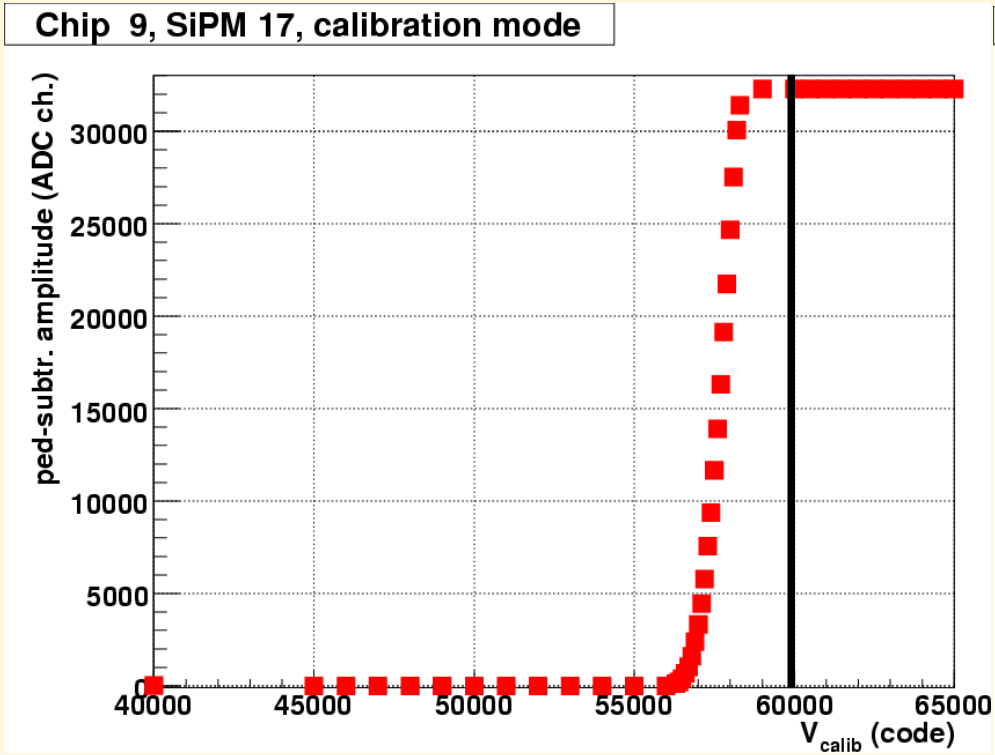
PIN diode ASIC signal



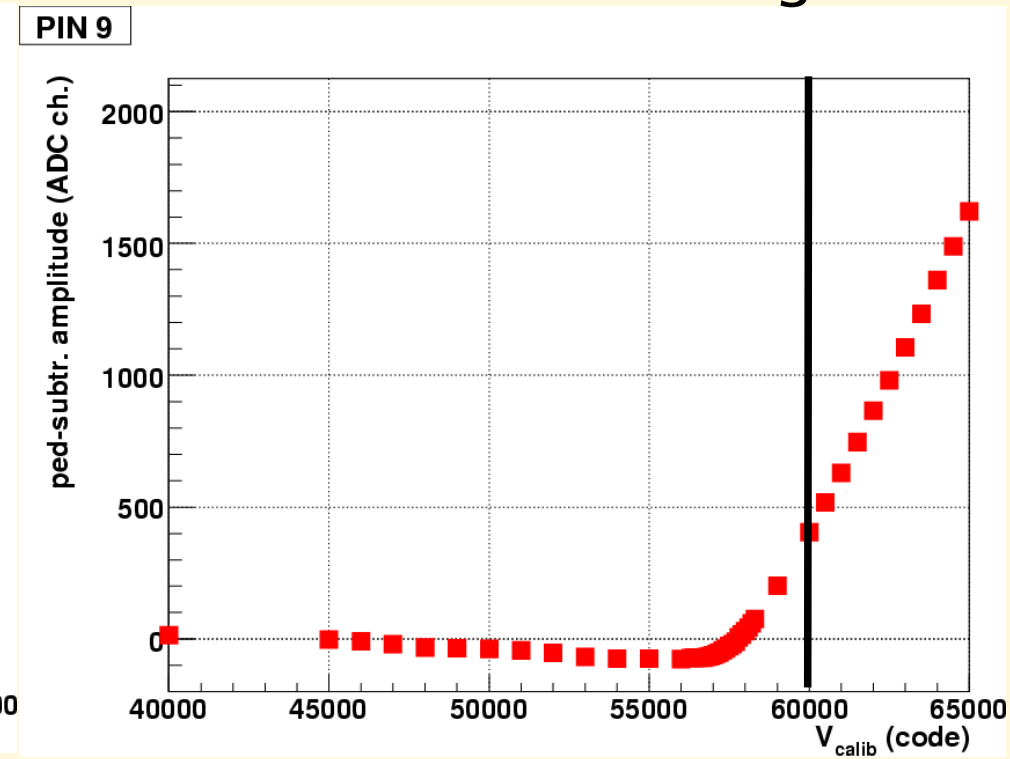
Pedestal shift (-80 ch.)

Light intensity scan

SiPM ASIC signal

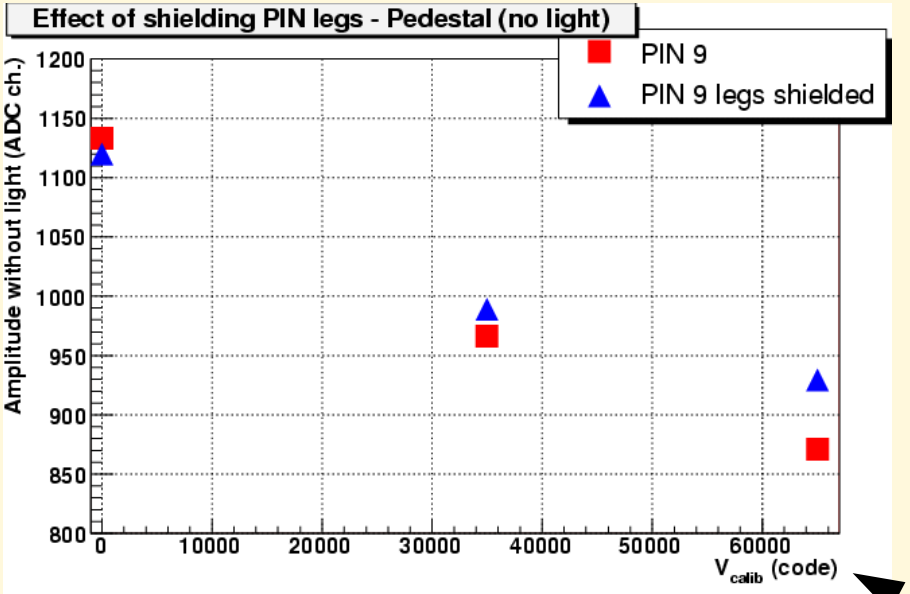


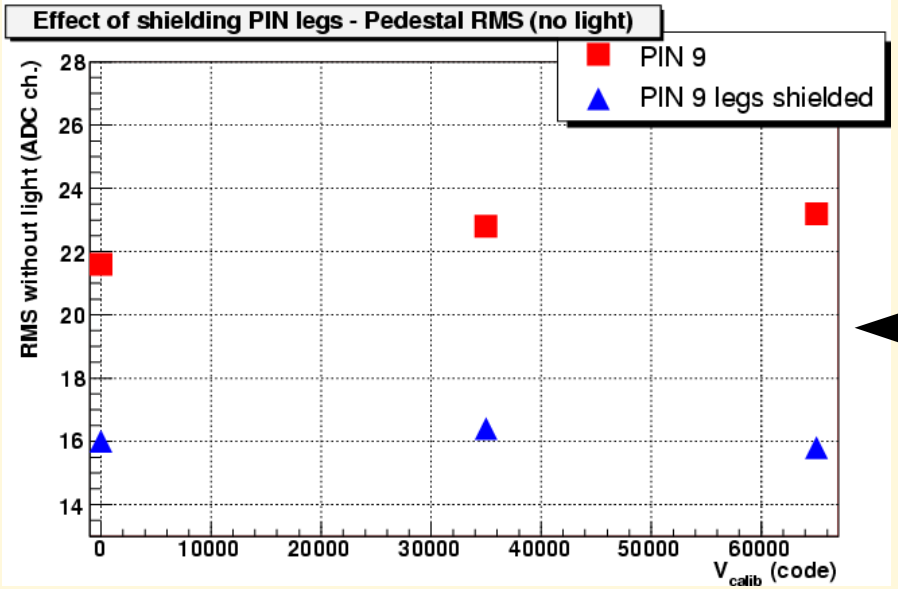
PIN diode ASIC signal



PIN signal useful only in physics mode

PIN pickup noise





- LED9 light blocked with paper
- scope connected
- compare pedestal dependence on V_{calib} for unshielded and shielded PIN legs (foil wrapped around legs)

shielded PIN has reduced pedestal shift

shielded PIN has significantly smaller RMS: ~16 vs. ~22 ch.

shielding improves PIN signal

CMB Requirements

1. Gain measurement (single pixel spectra)

need peaks in all SiPMs for one light intensity setting

➡ more uniform LED voltage needed

2. Saturation curve monitoring (light intensity scans)

The **PIN diode** signal is needed to correct LED fluctuations.

➡ PIN pedestal depends on V_{calib}
Can we still use the PIN as it is now?

PIN pedestal shift

3 possibilities:

- remove shift (probably electrical cross-talk and/or grounding problem)
- measure the shift and take into account (for every PIN)
  need to block light → not possible when CMB covered;
  shift changes when covered?
- do nothing: use PIN to only monitor LED fluctuations
  (at fixed V_{calib} points) but not to measure light intensity

open for thinking and discussion

Summary

1. Gain measurement (single pixel spectra)

need peaks in all SiPMs for one light intensity setting

➡ more uniform LED voltage needed

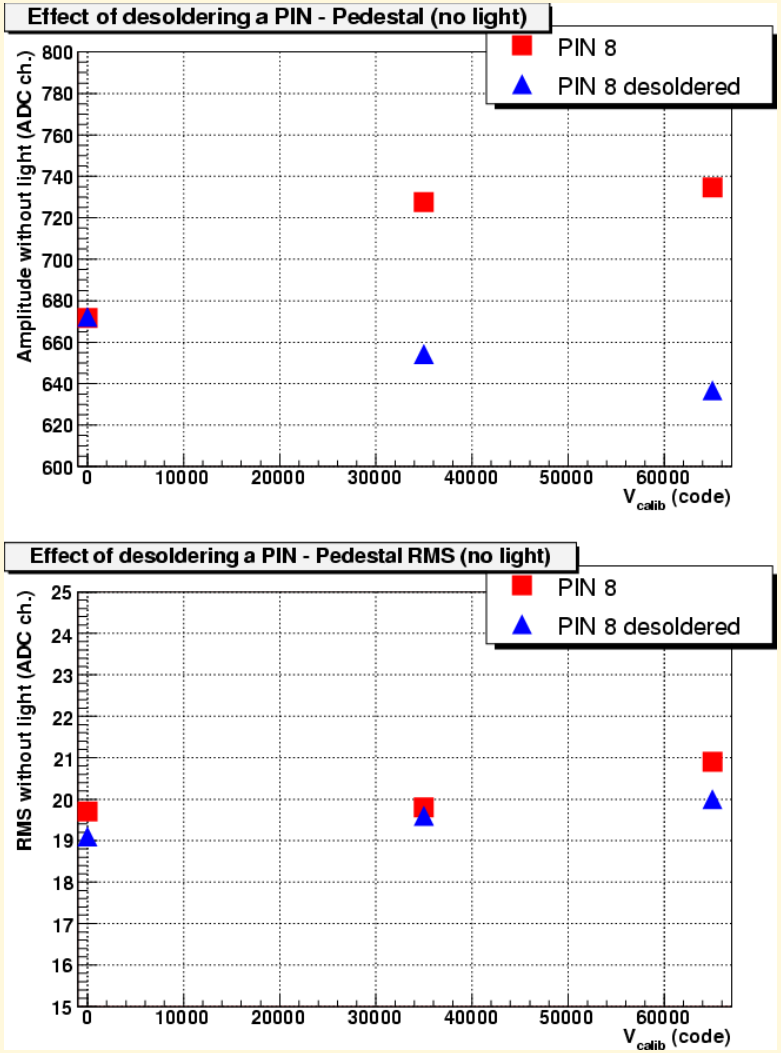
2. Saturation curve monitoring (light intensity scans)

The **PIN diode** signal is needed to correct LED fluctuations.

➡ PIN pedestal depends on V_{calib}
Can we still use the PIN as it is now?

Backup slides

PIN pickup noise



effect of desoldering a PIN

PIN8 (no LED)

pedestal shift is reduced

pedestal RMS slightly reduced