Lab setup update

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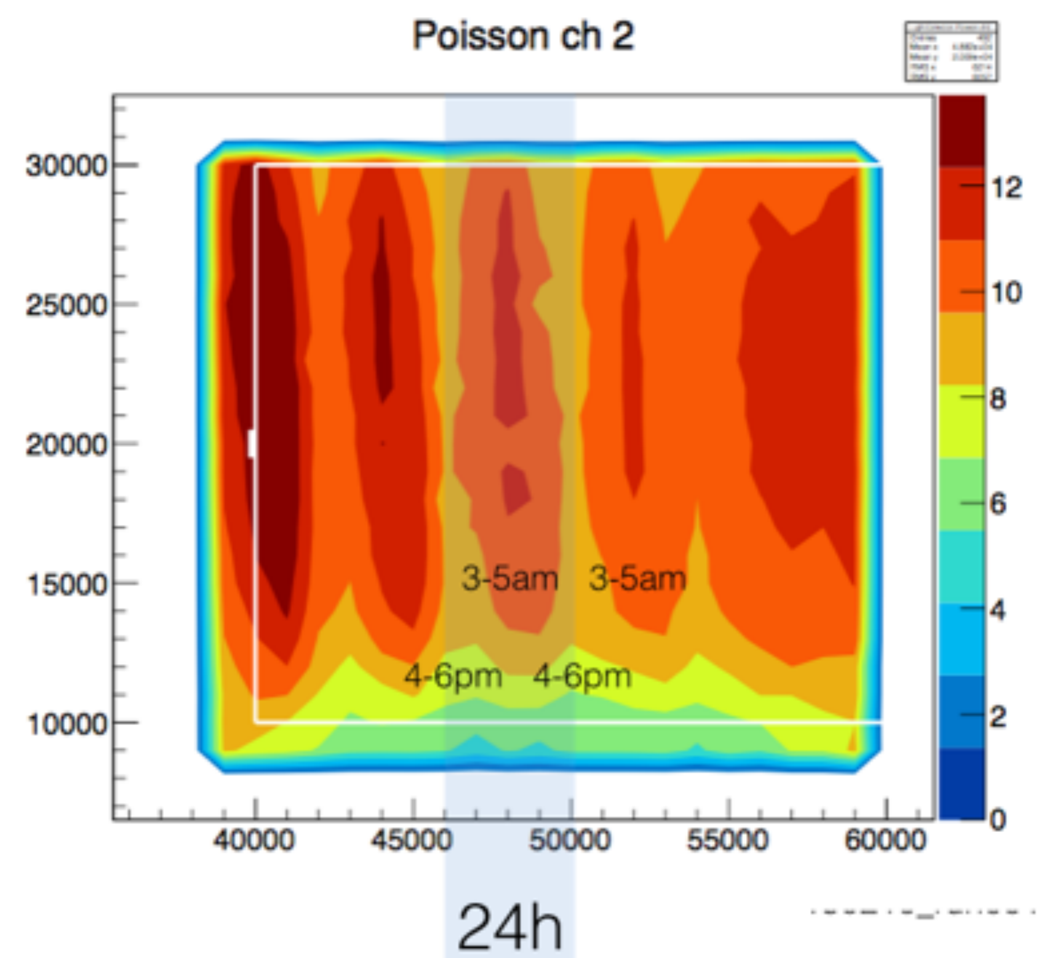
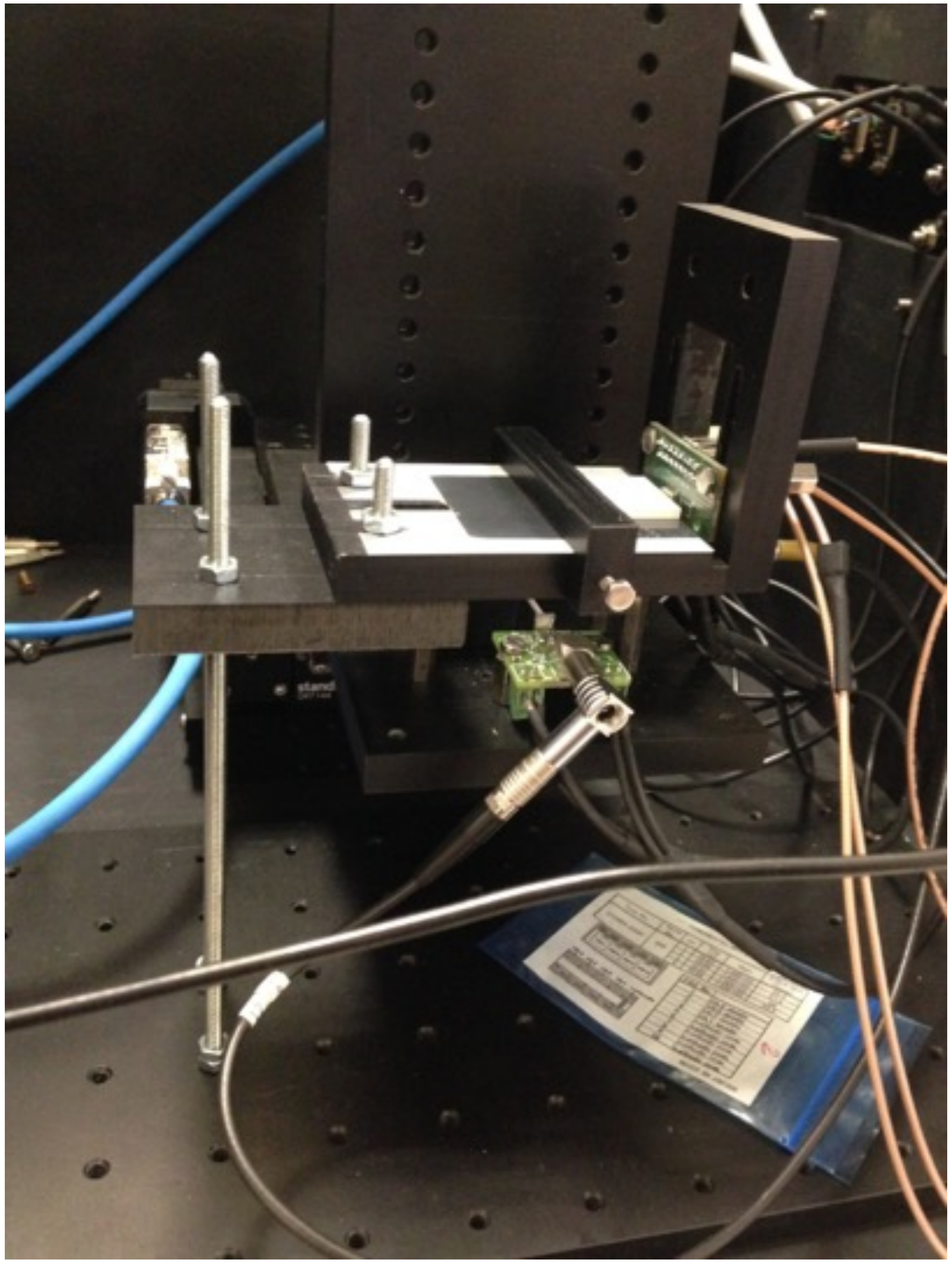
150203

Temperature control

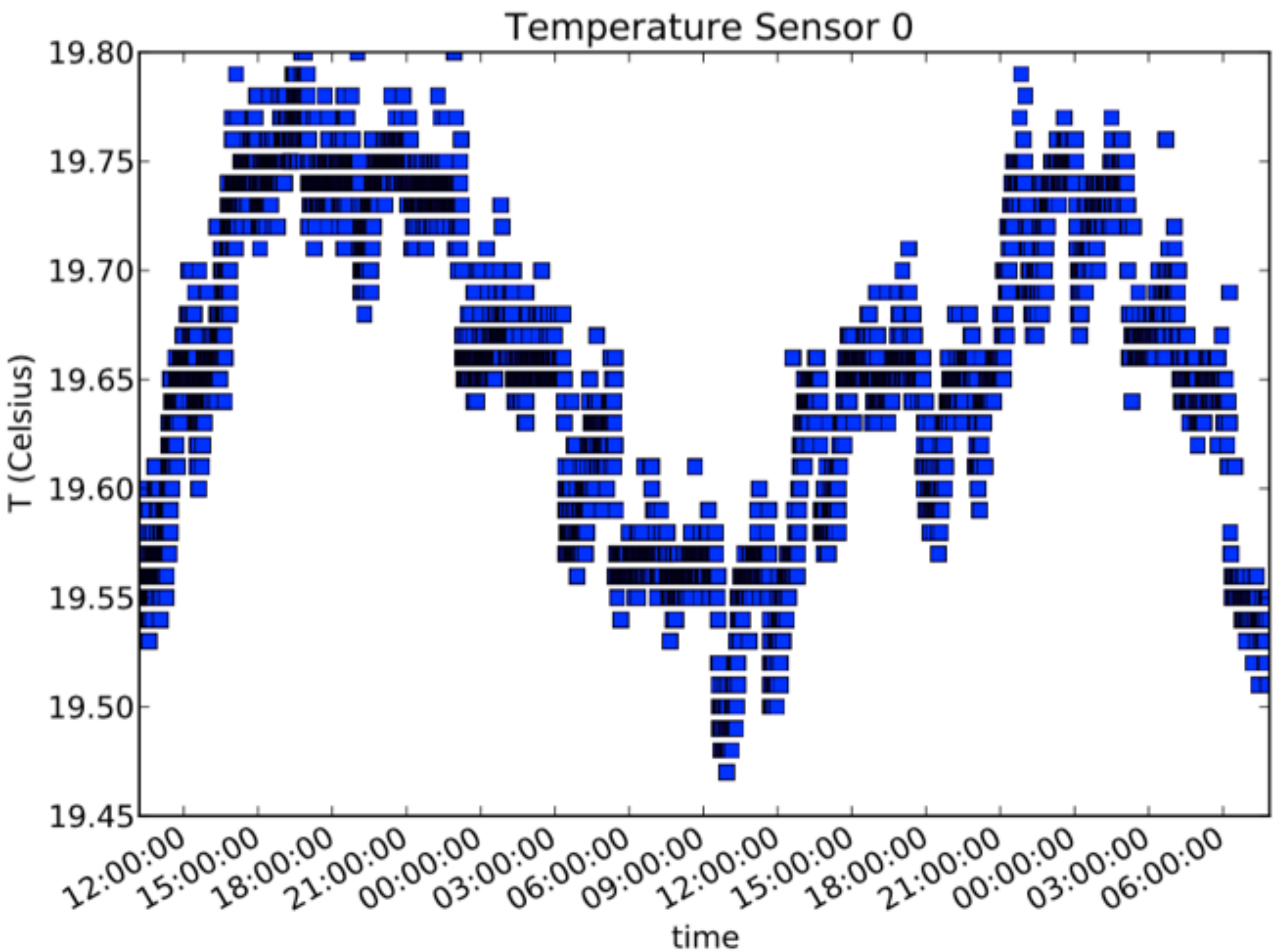
- during last presentation at this LAB meeting, two solution at our reach were discussed and adopted to take into account the important temperature dependance of gain vs temperature of SiPMs:
    - the mounting of the measurement box into the thermostatic chamber.
    - the introduction of temperature sensors in the measurement setup.



The new setup

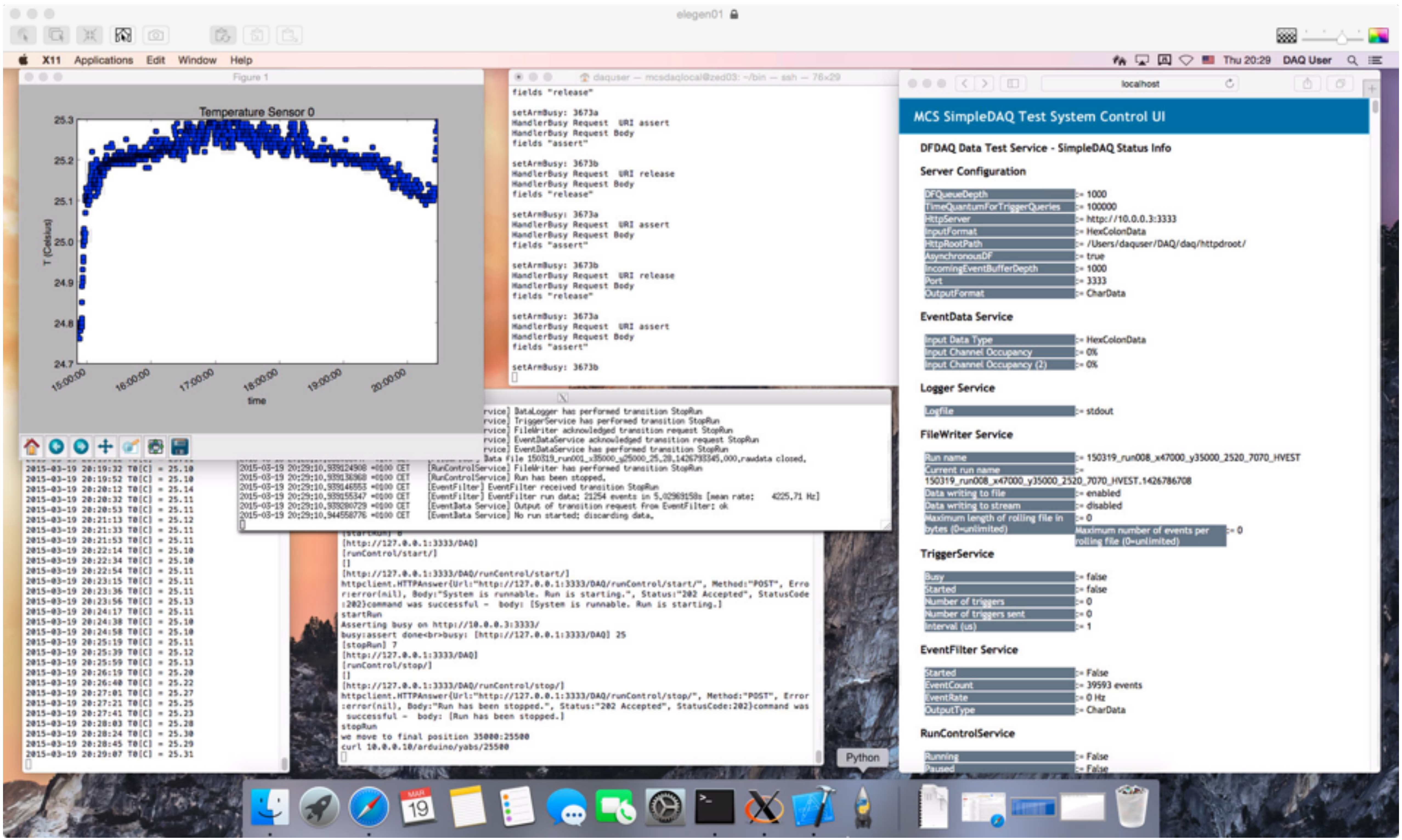


Temperature stability



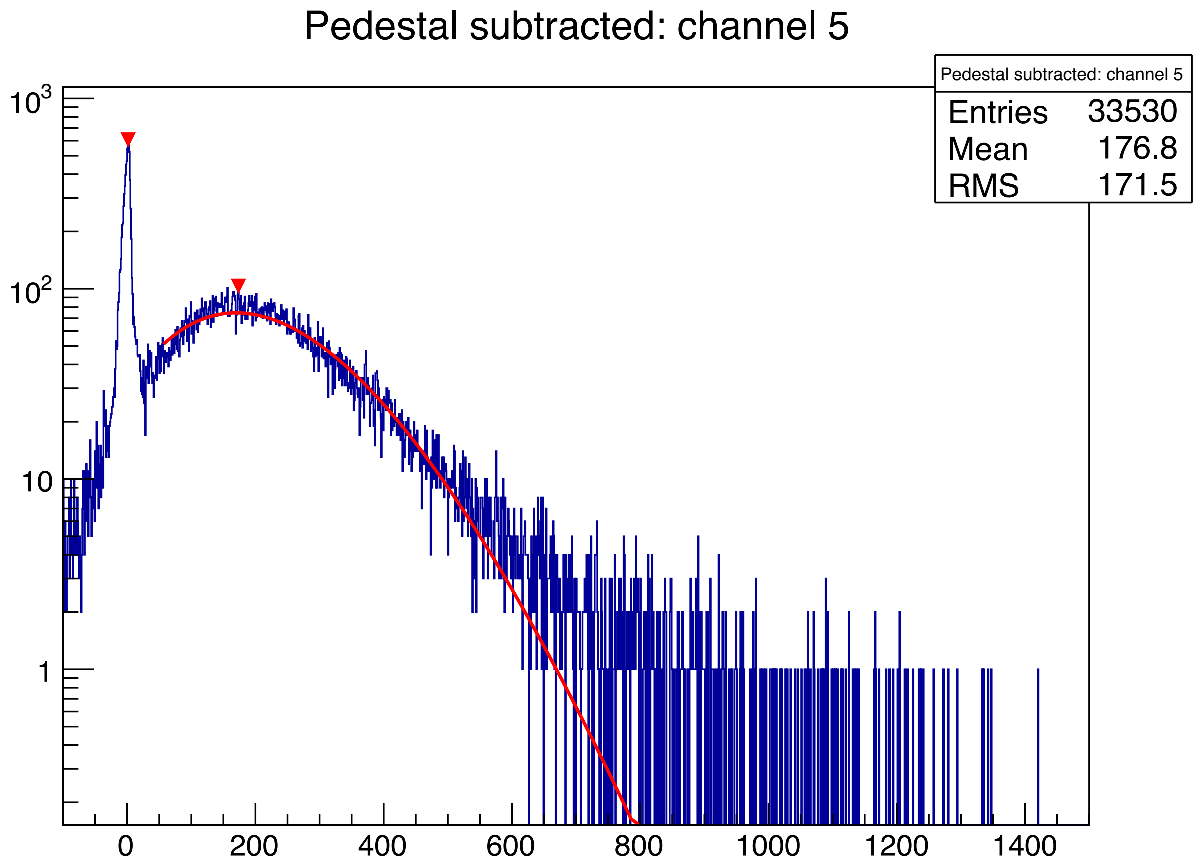
- similar behaviour of our chamber tested so far between 13 and 25 C.

current DAQ setup



Our beta source

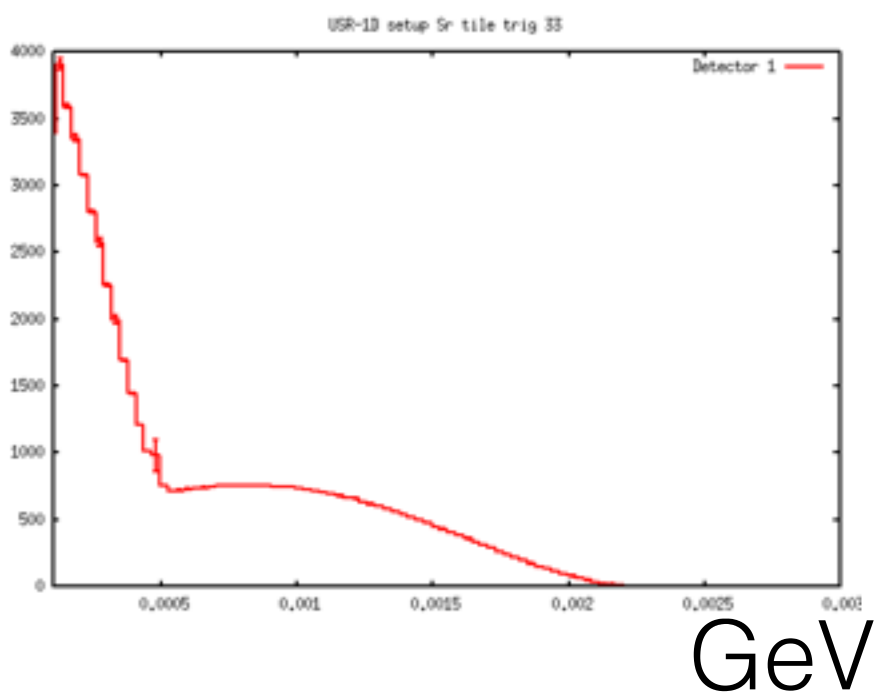
- A discussion done during last meeting suggested to improve the collimation of our Sr90 source.
  - S. Fiore setup a Fluka Montecarlo describing our source and measurement setup. We discussed and tested some options.

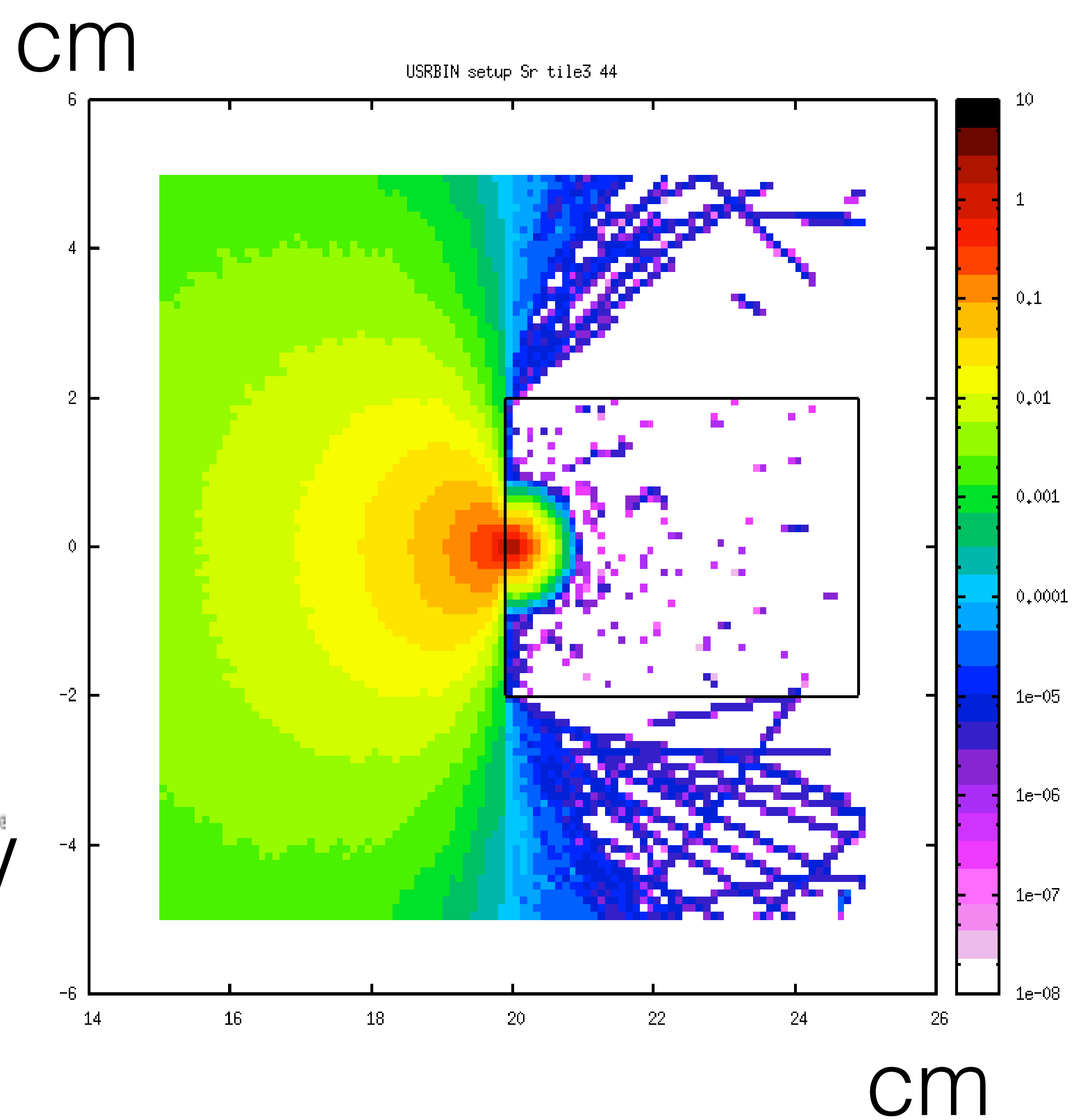


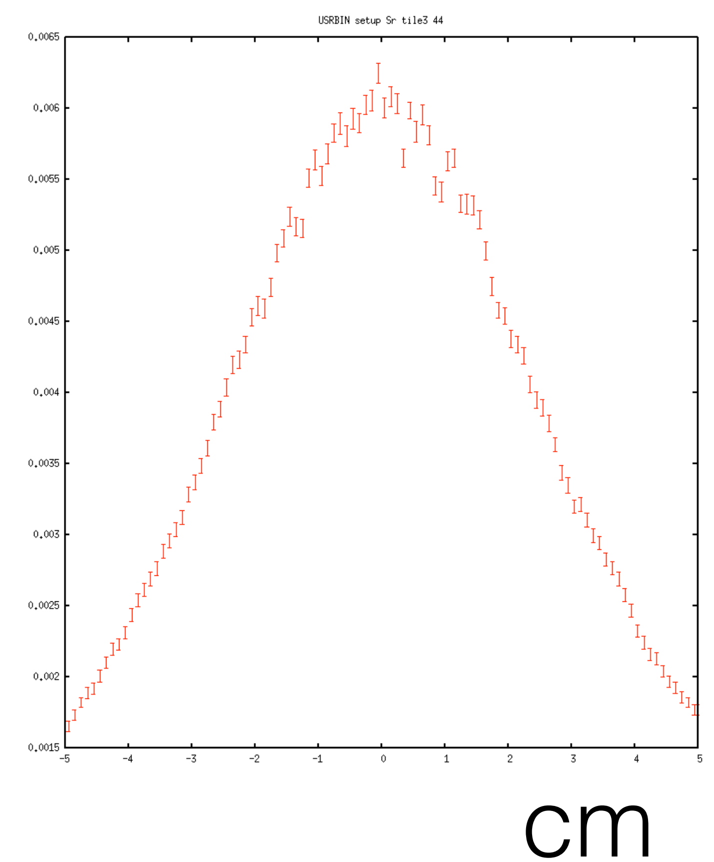
large tail below pedestal

First simulations: Our source

Sr90-Y90 Fluka spectra



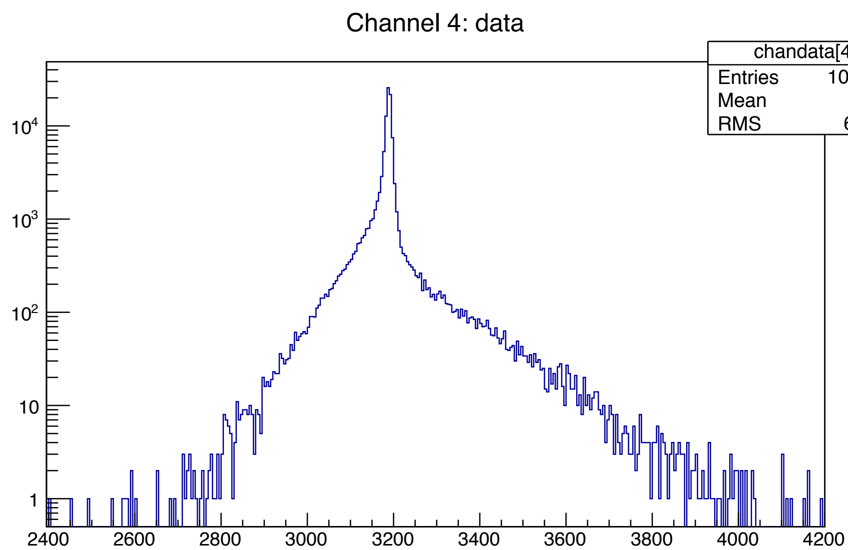


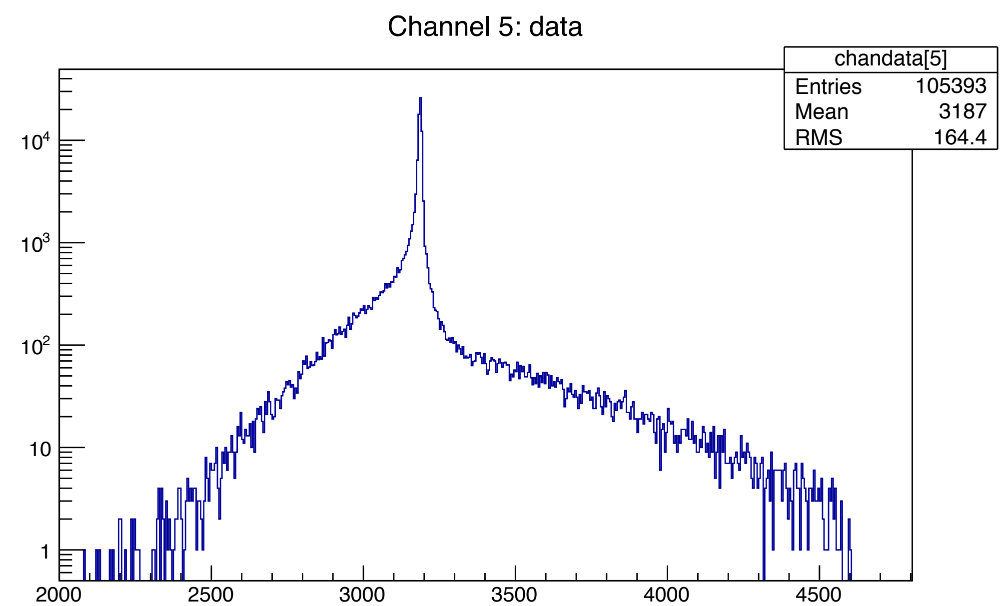


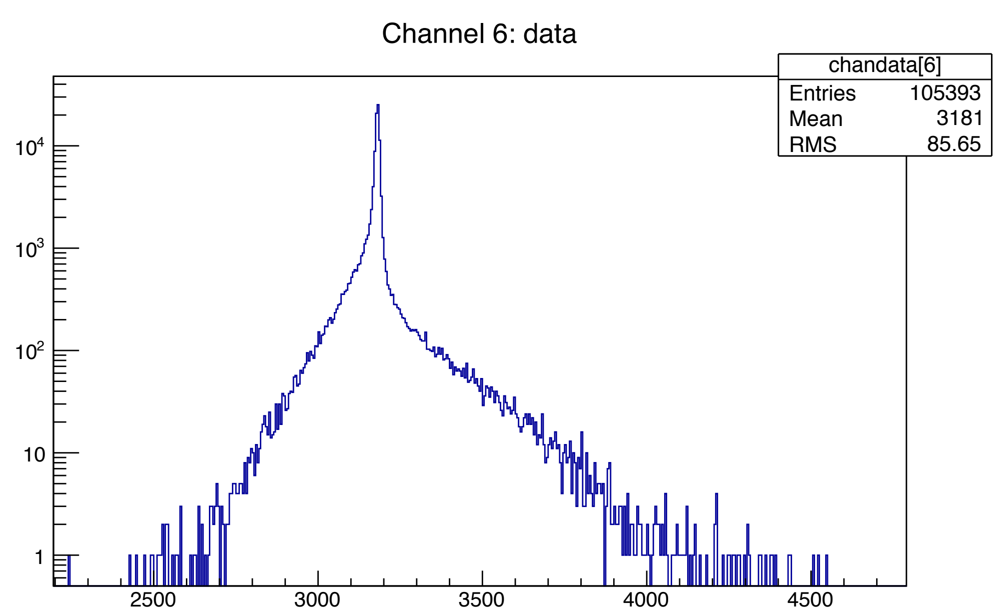
- simulation showing uncollimated source illumination

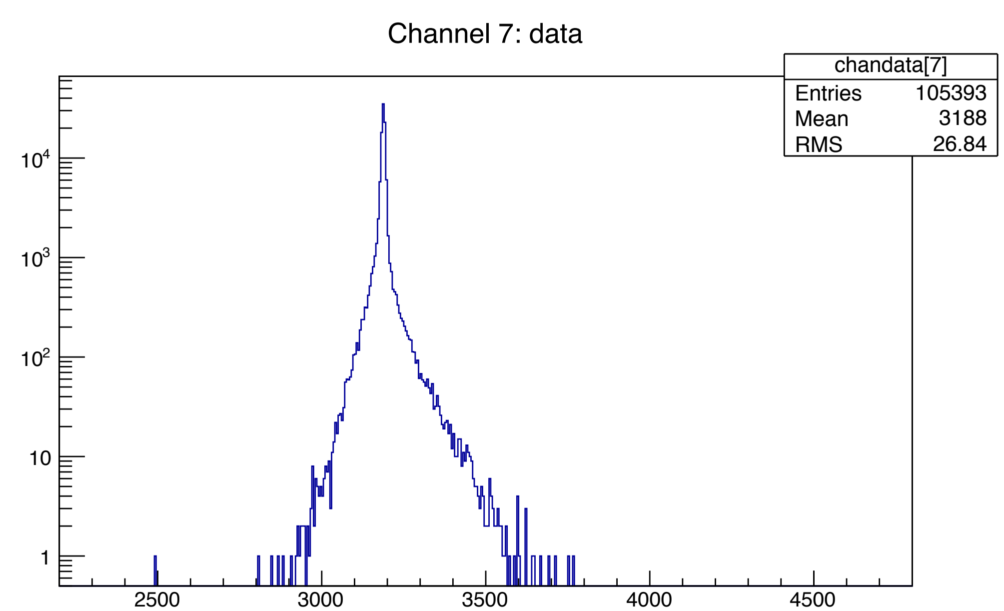
Old collimation: random triggers

1cm plastic, 5mm hole



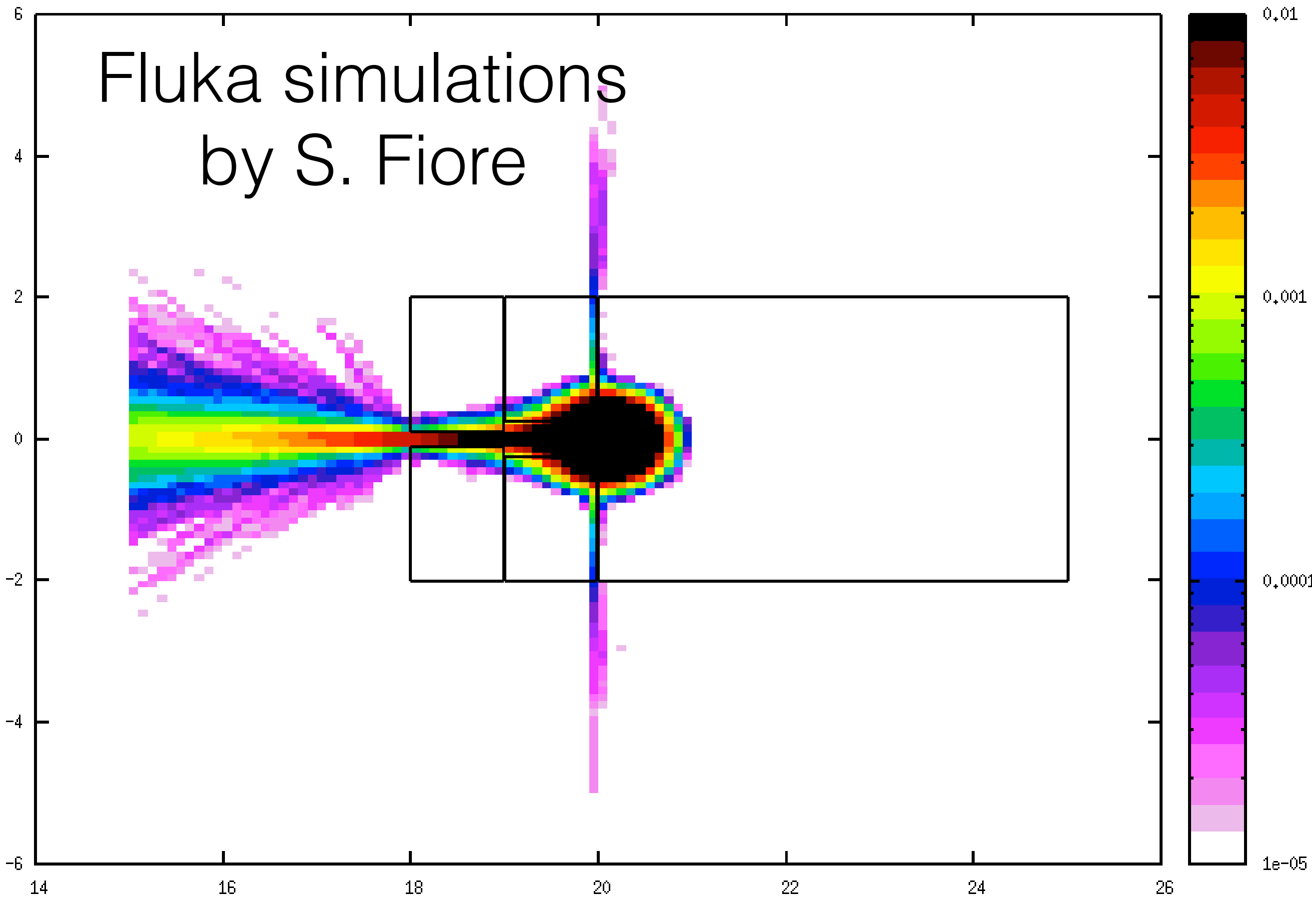


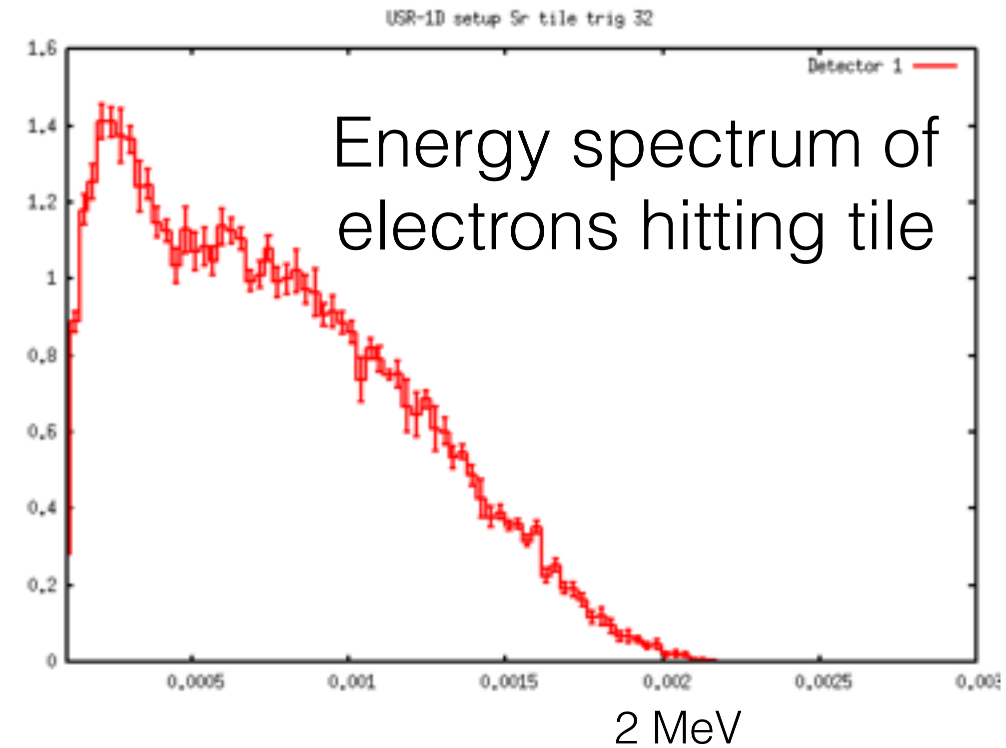


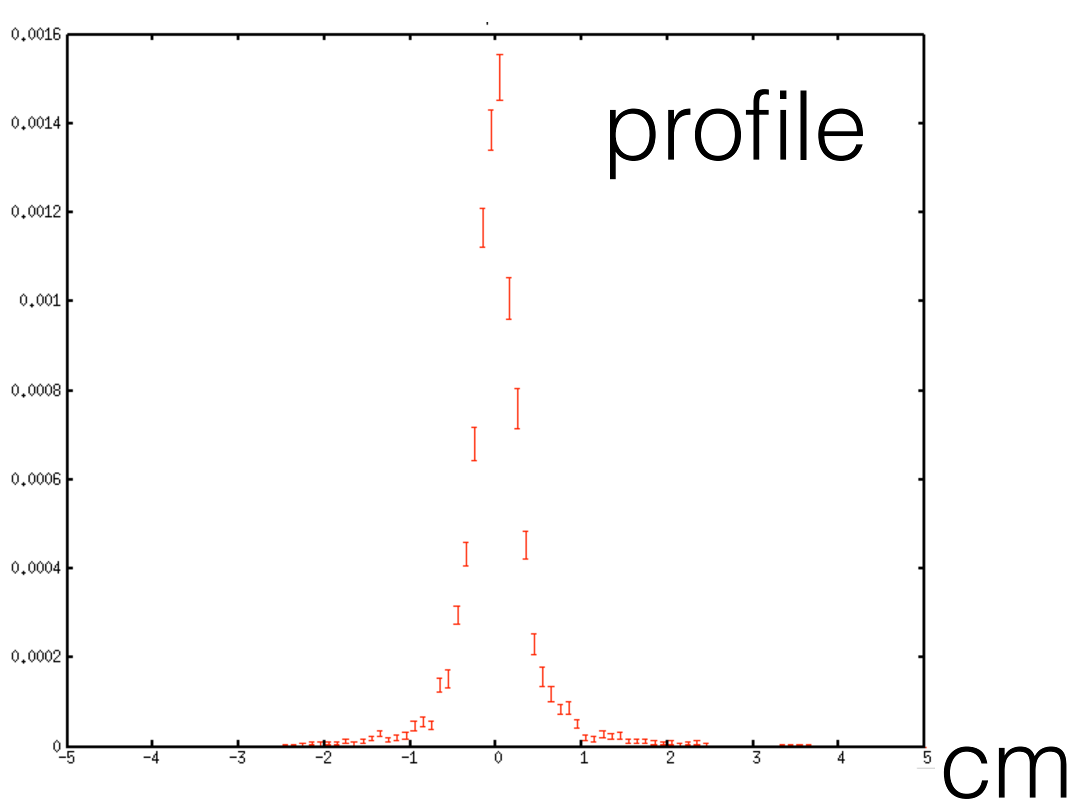


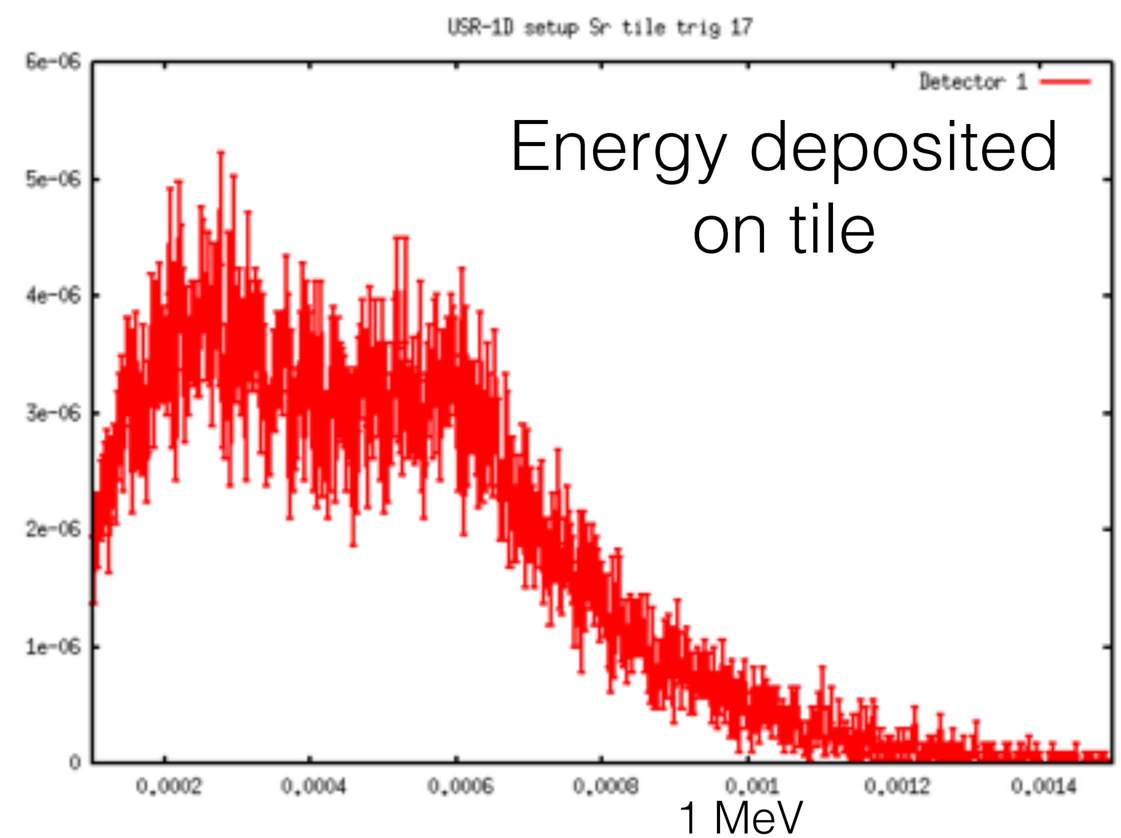
- large tails around pedestal have been measured (150227_run002)

Source Collimation

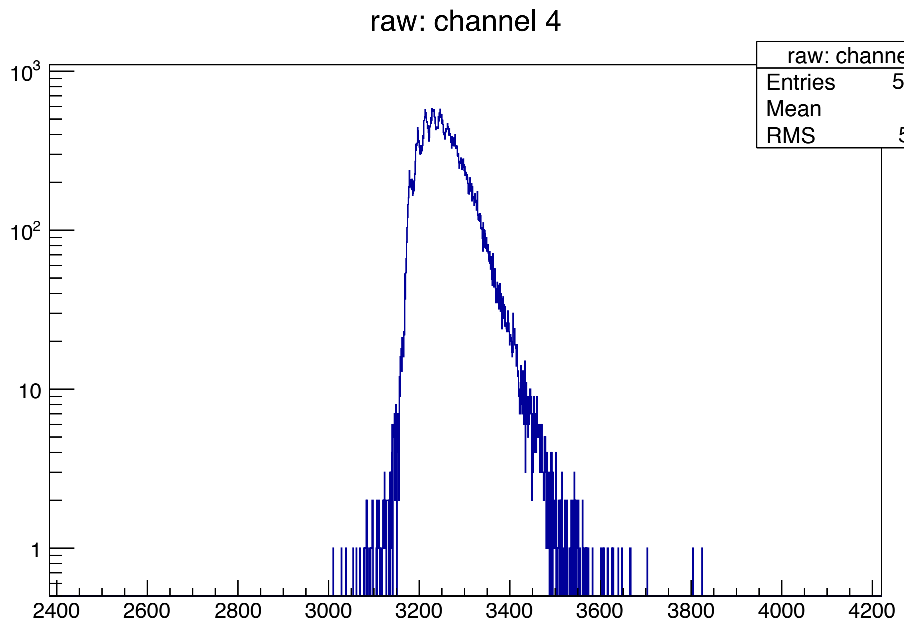


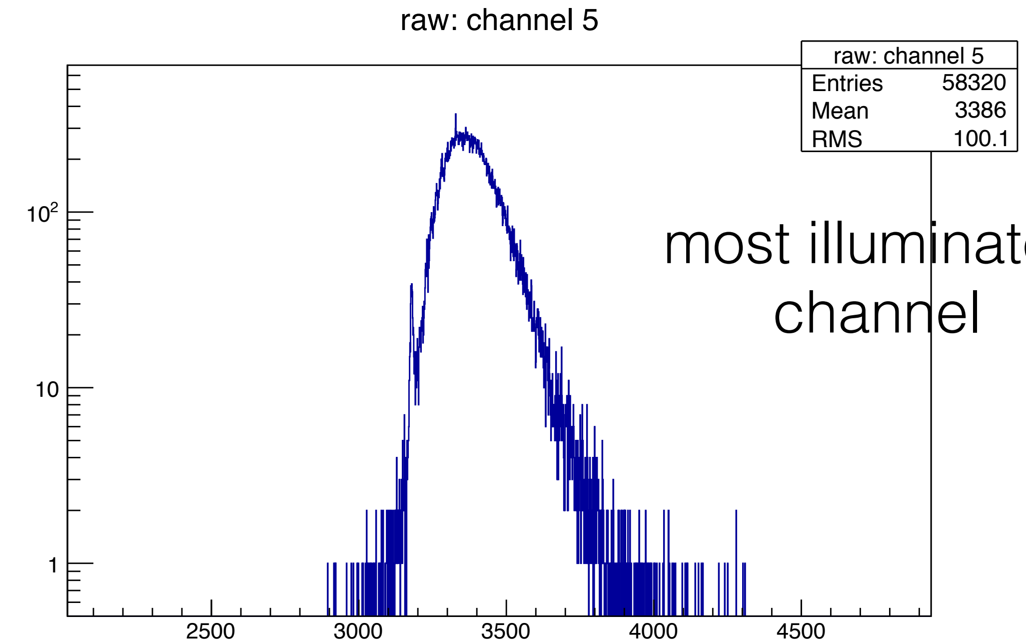






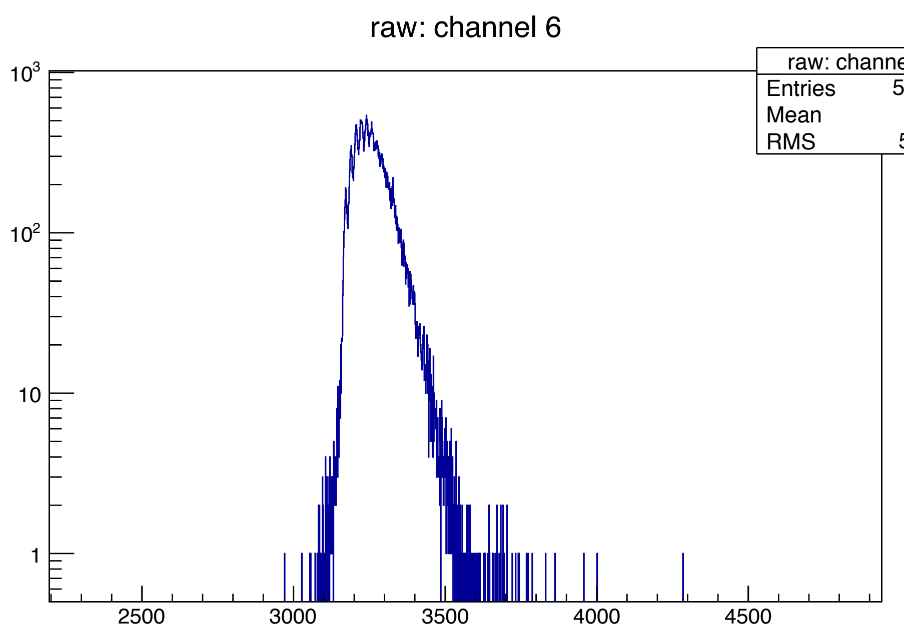
New collimation: data

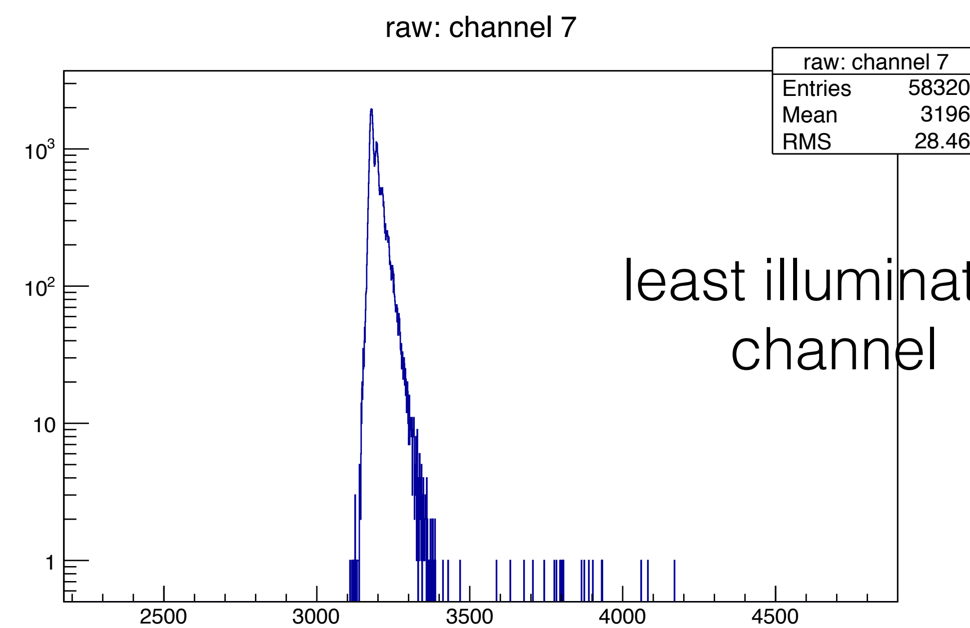




most illuminated channel

1cm plastic, 5mm hole + 1cm plastic, 2mm hole





least illuminated channel

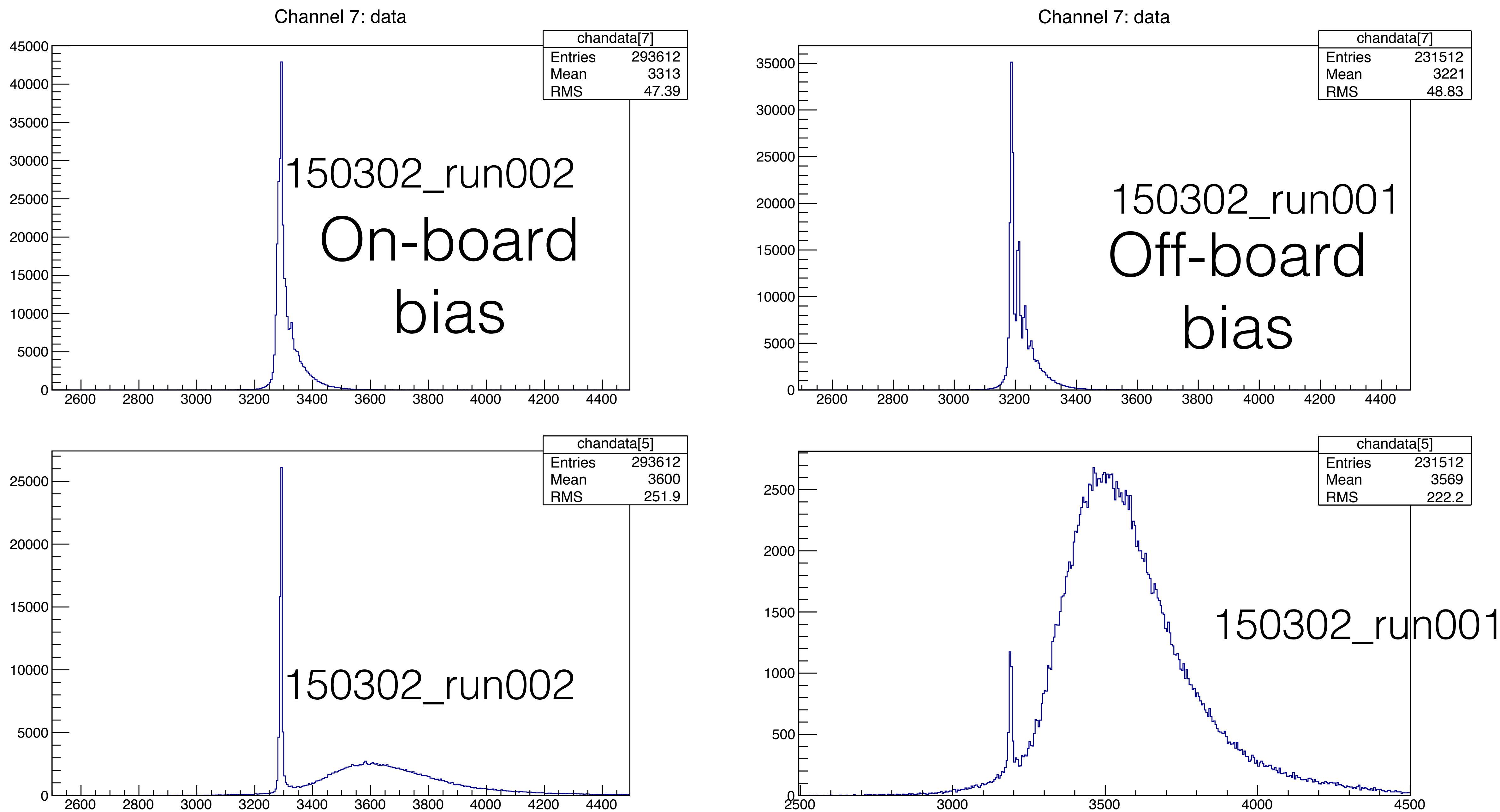
- Collimation is effective to cleanup our spectra

Pedestal

- During last presentation, a large ratio of pedestal events over total number of events was found, even in case our trigger was selecting electrons in the middle of the tile.

External vs Internal Bias

- large pedestal peaks have been observed when on-board bias is used.



- roughly same behaviour if external bis is given with precision power supply or from a second readout board
- it seems that our bias circuit is ok, but some crosstalk is present if bias and front-end live on same board.

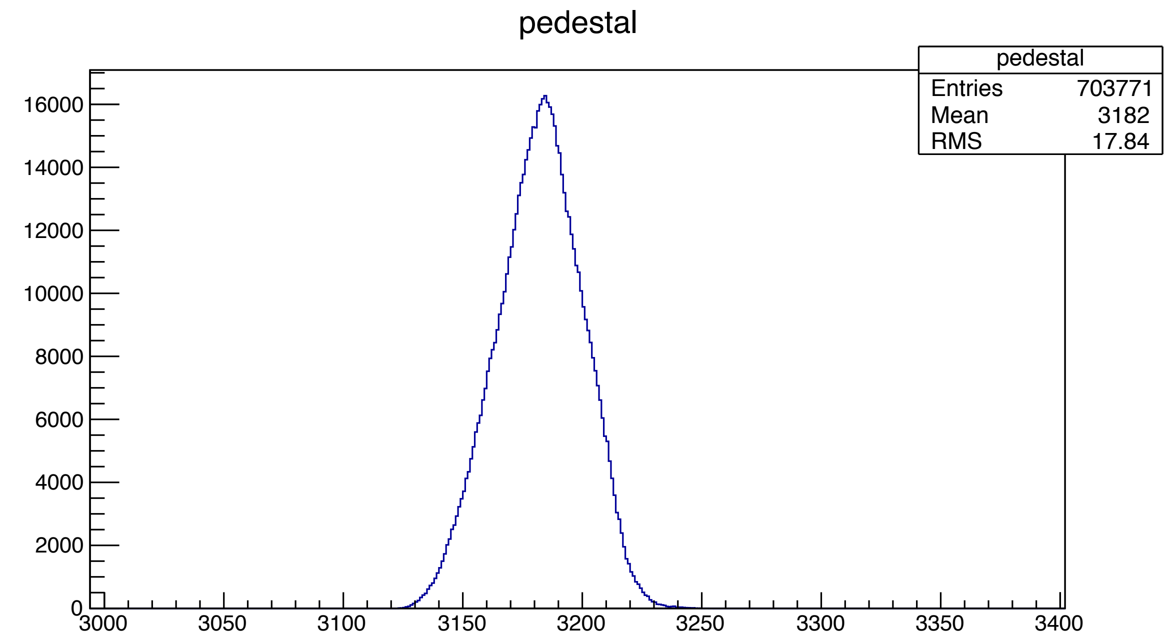
New scans: data analysis

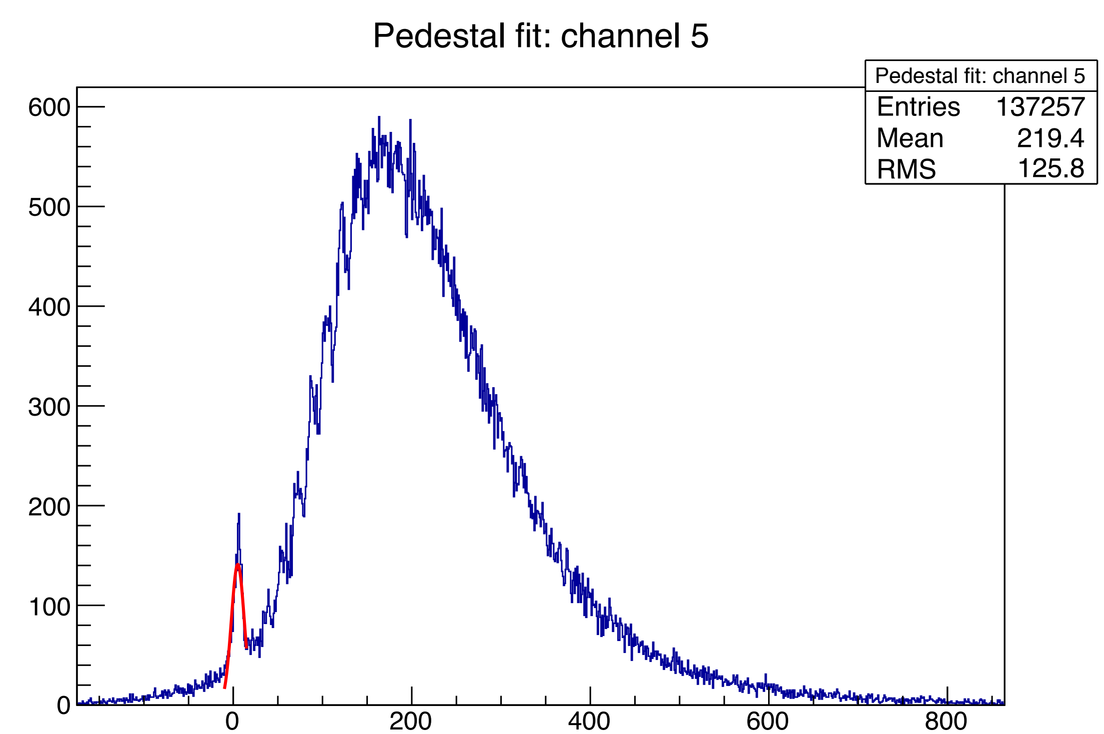
- the 32 input EASIROC inputs are divide into « signal inputs » and « pedestal inputs ».

- an event-by-event average pedestal is calculated using « pedestal inputs » an subtracted to all channels to reduce noise. New histogram is produced.

- From each new histogram, a channel pedestal is fit and subtracted to raw data.

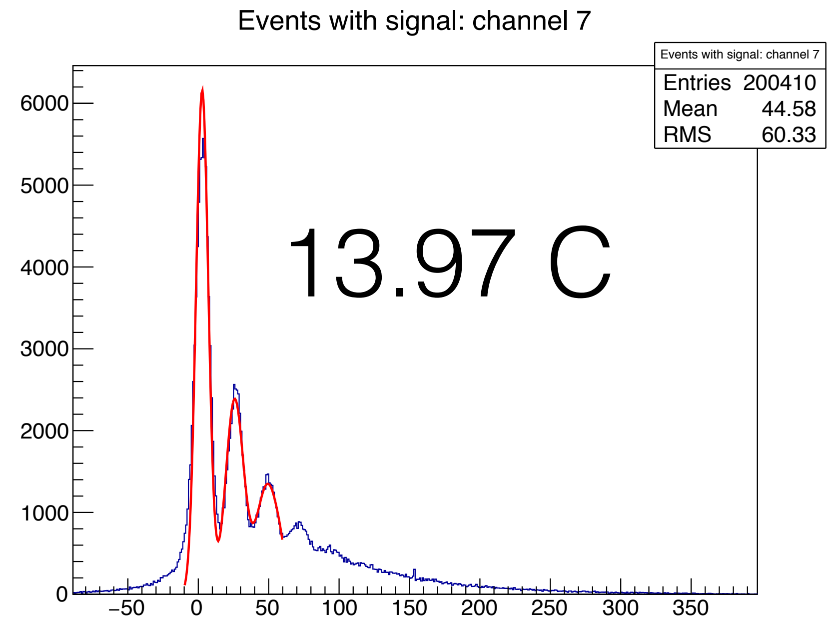
- resulting final distribution are used for calibration and measurements.

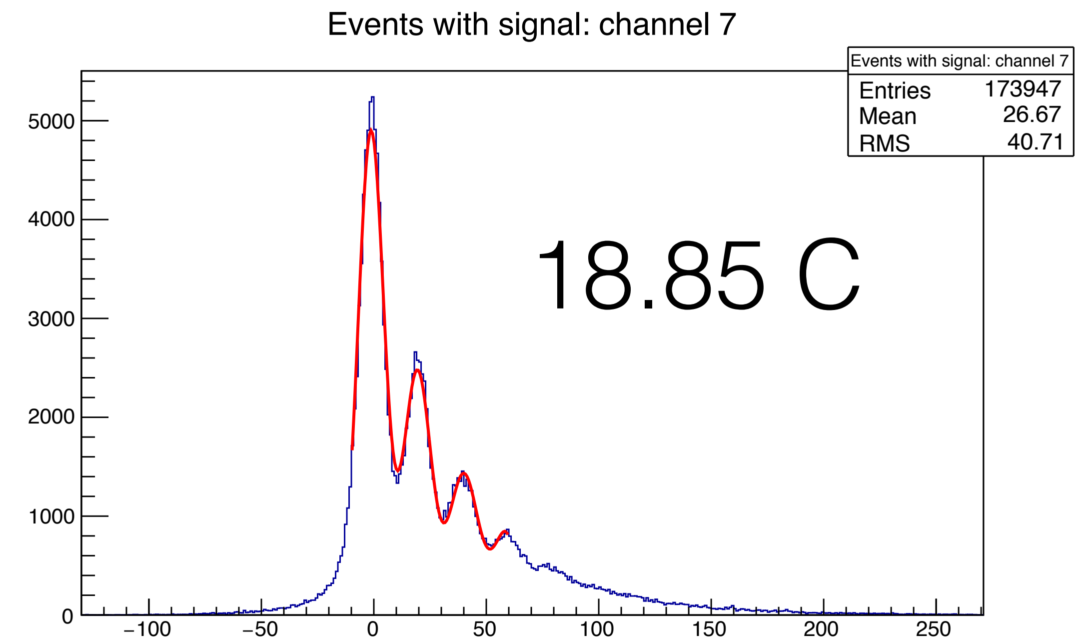


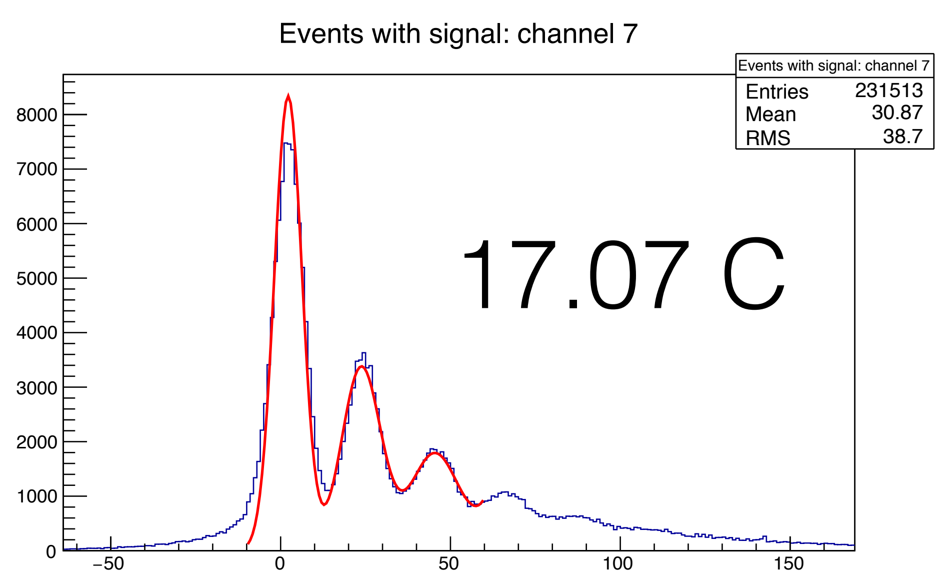


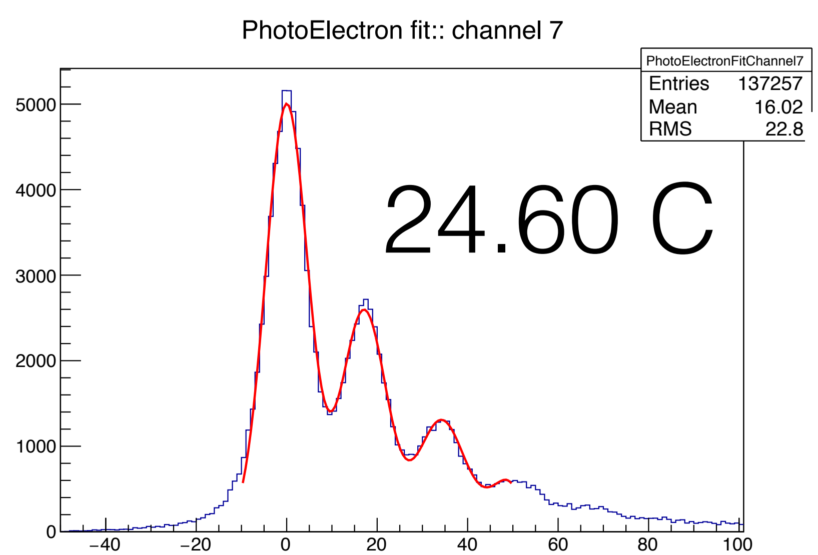
Calibration procedure

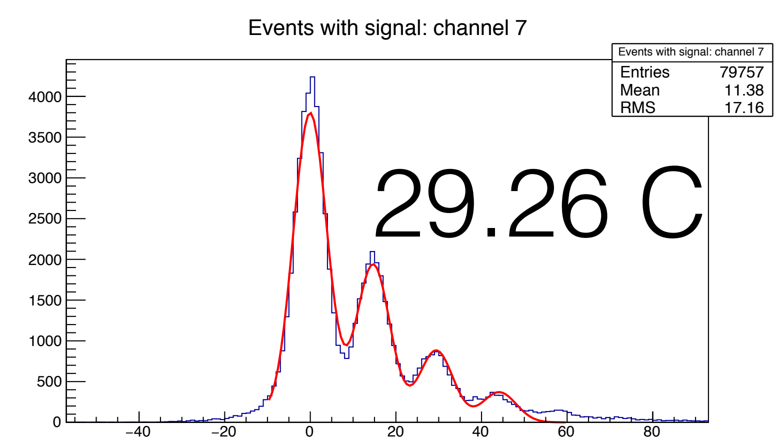
- calibration values range 13-24 ADC counts/P.E.
- bad P(chi2): need to improve on fitting



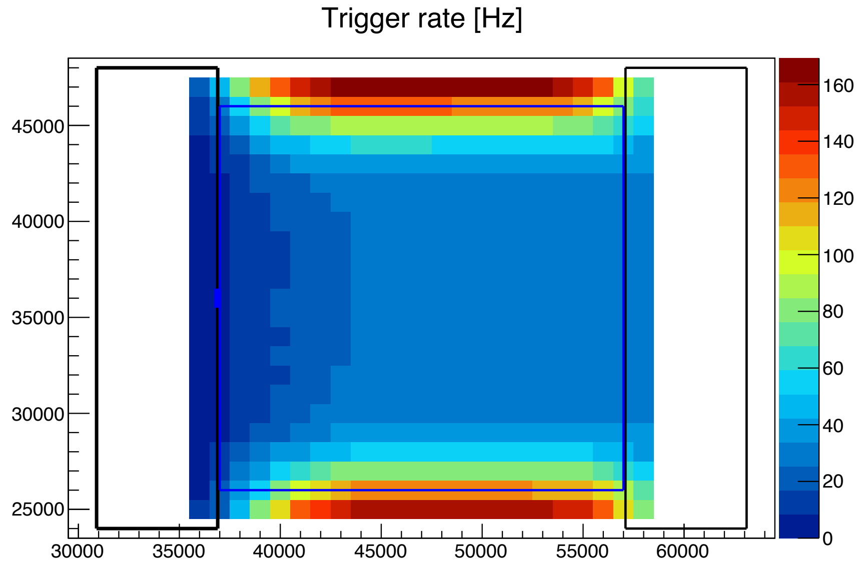




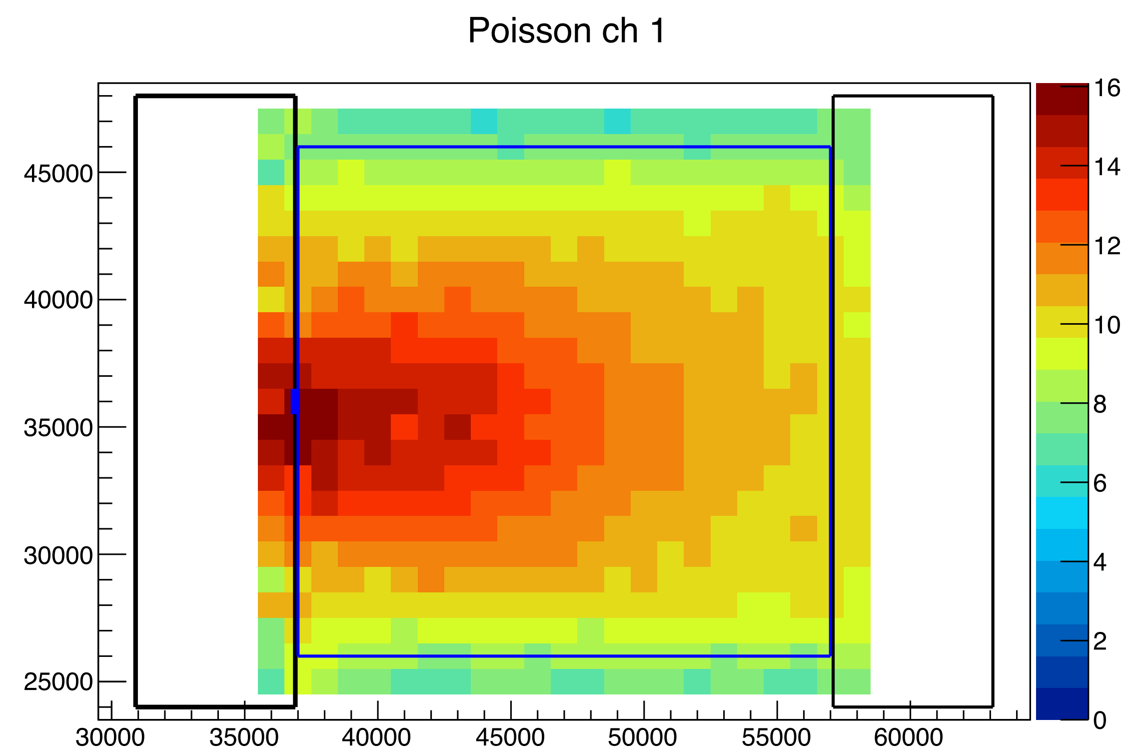


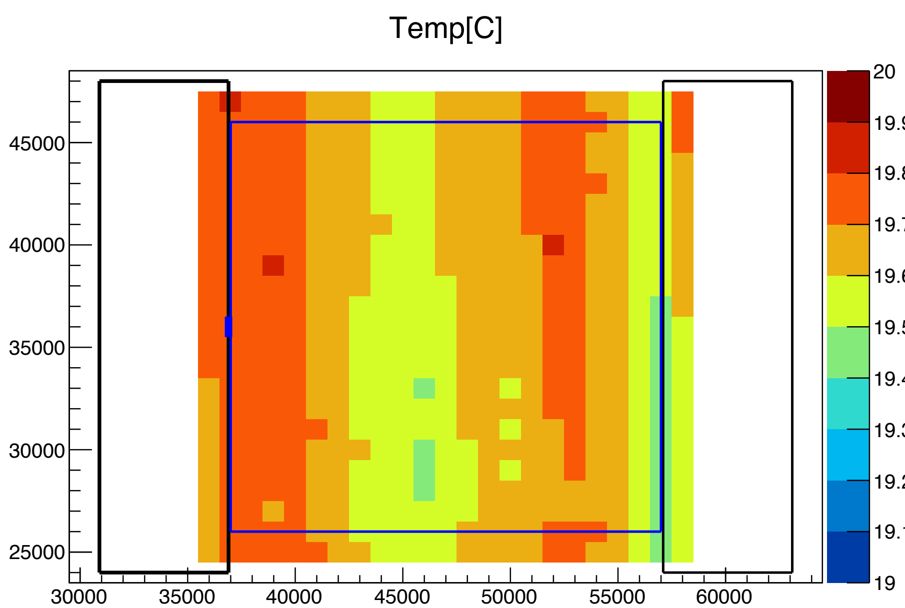


Scan results, external trigger



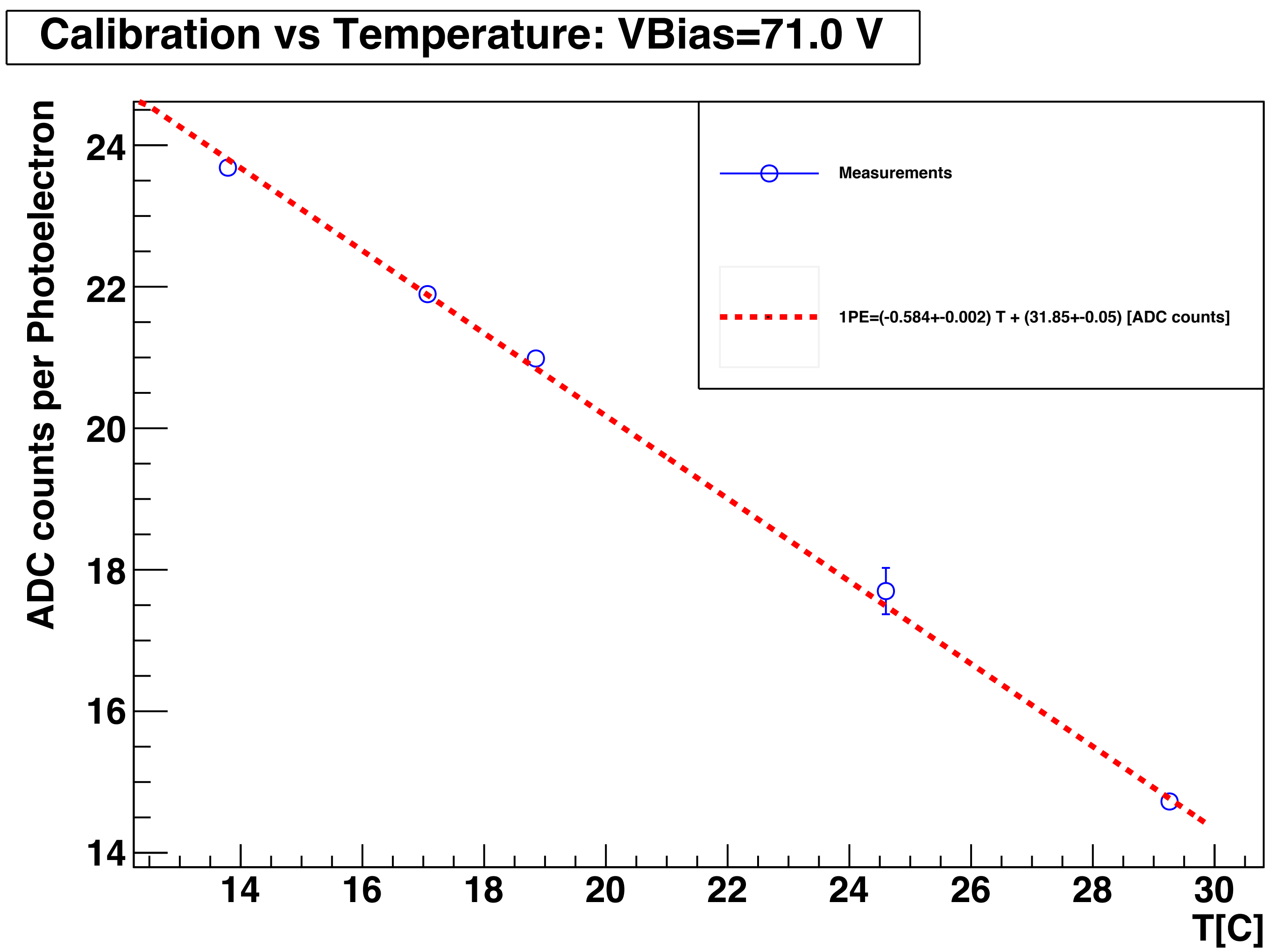
300s/point



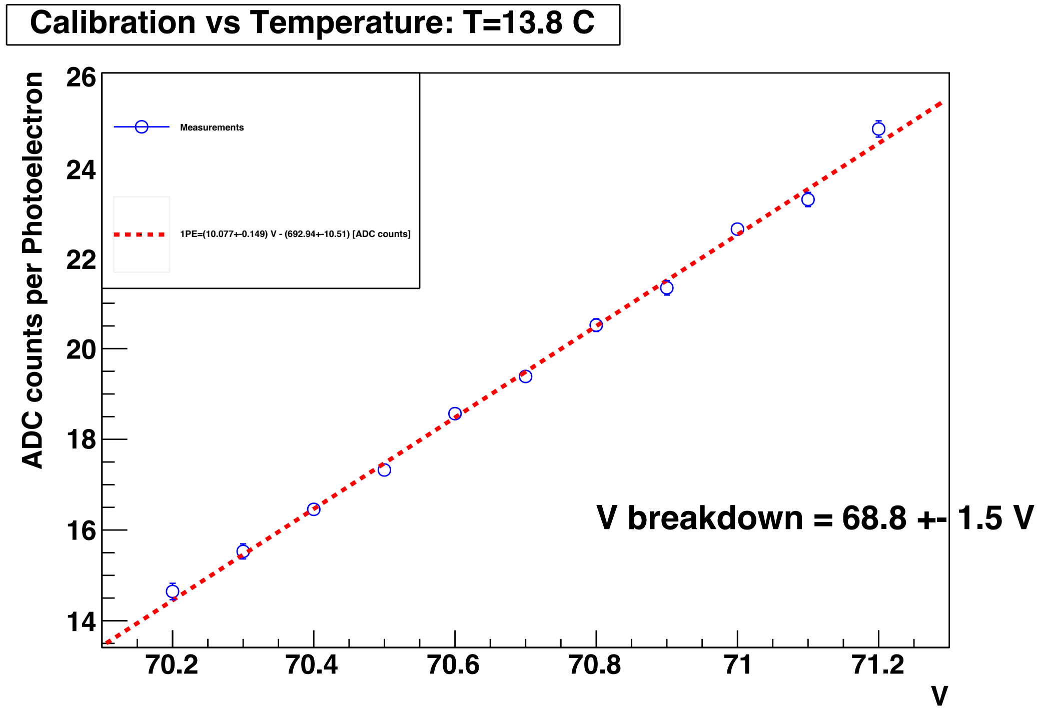


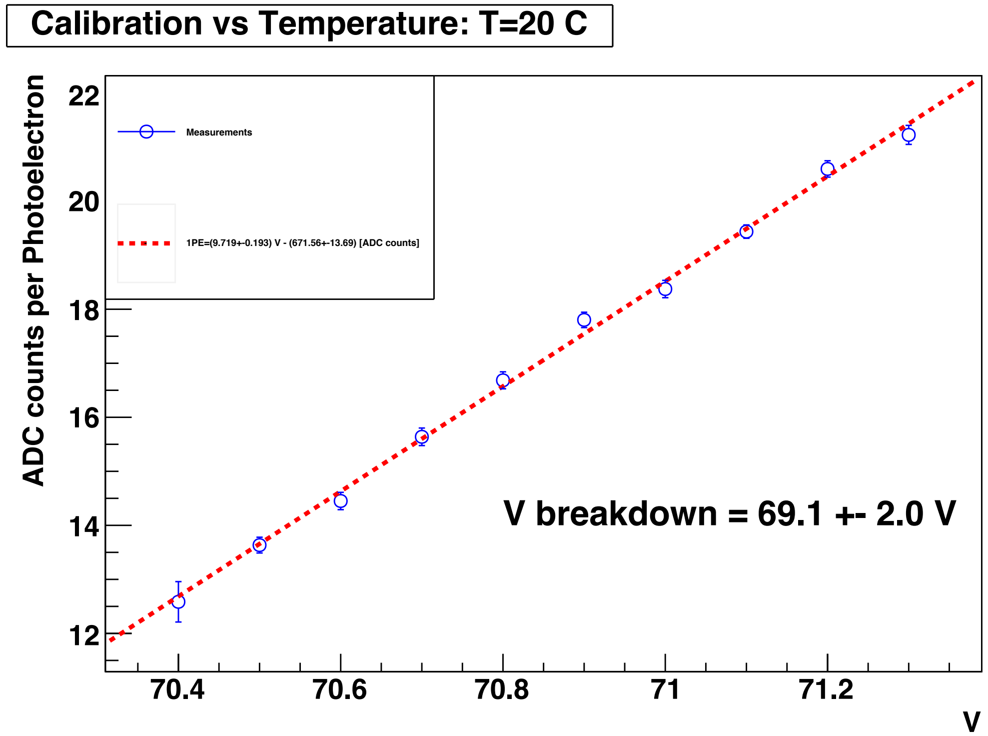
Gain vs Temperature

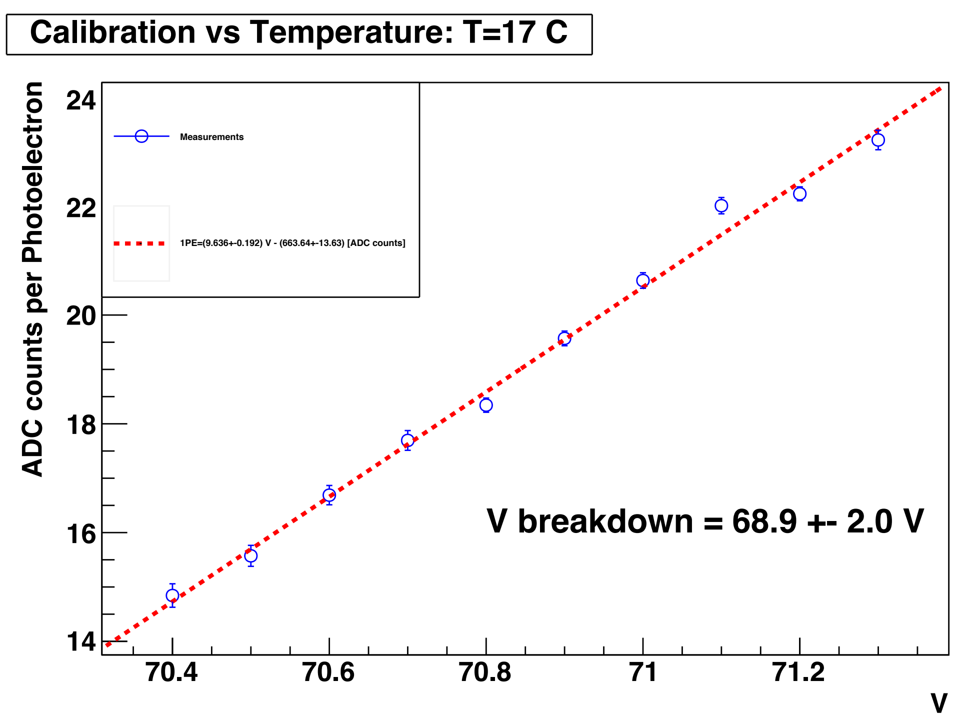
- First studies have started to implement an active control of bias voltage.

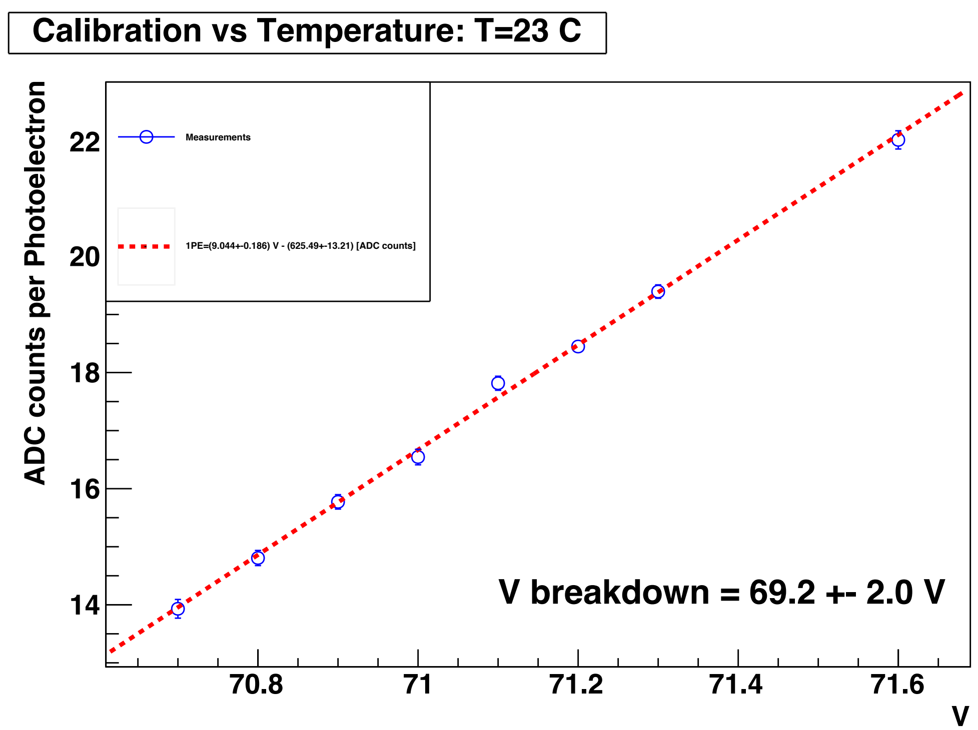


Gain vs Bias





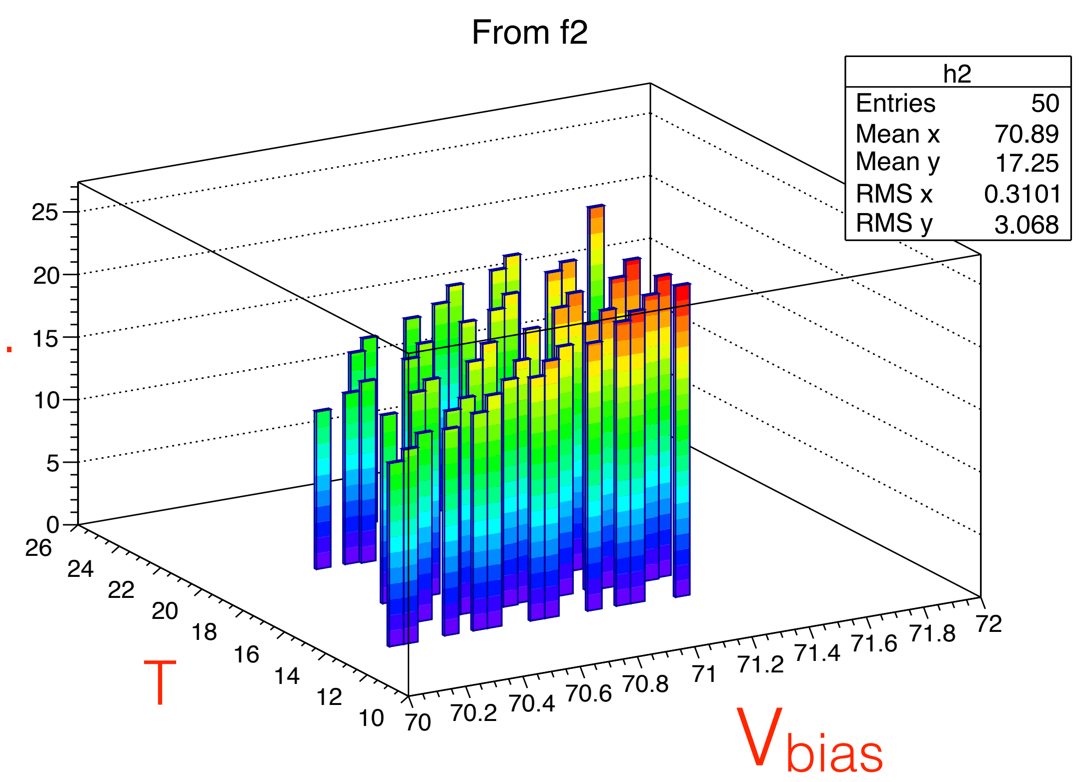


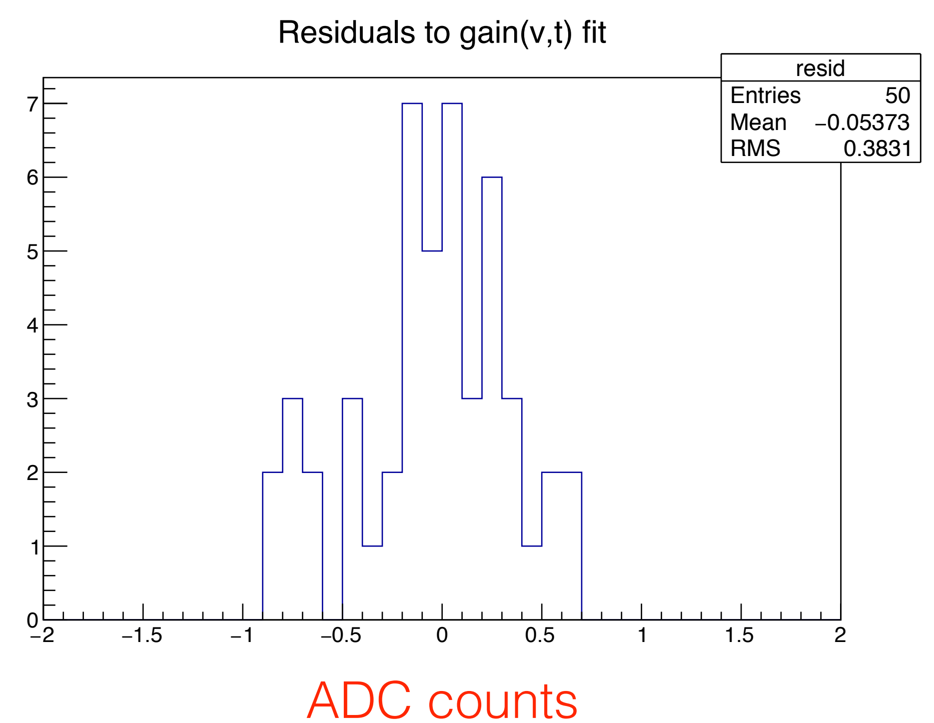


- same analysis used as for XY scan.

Towards a realtime gain control

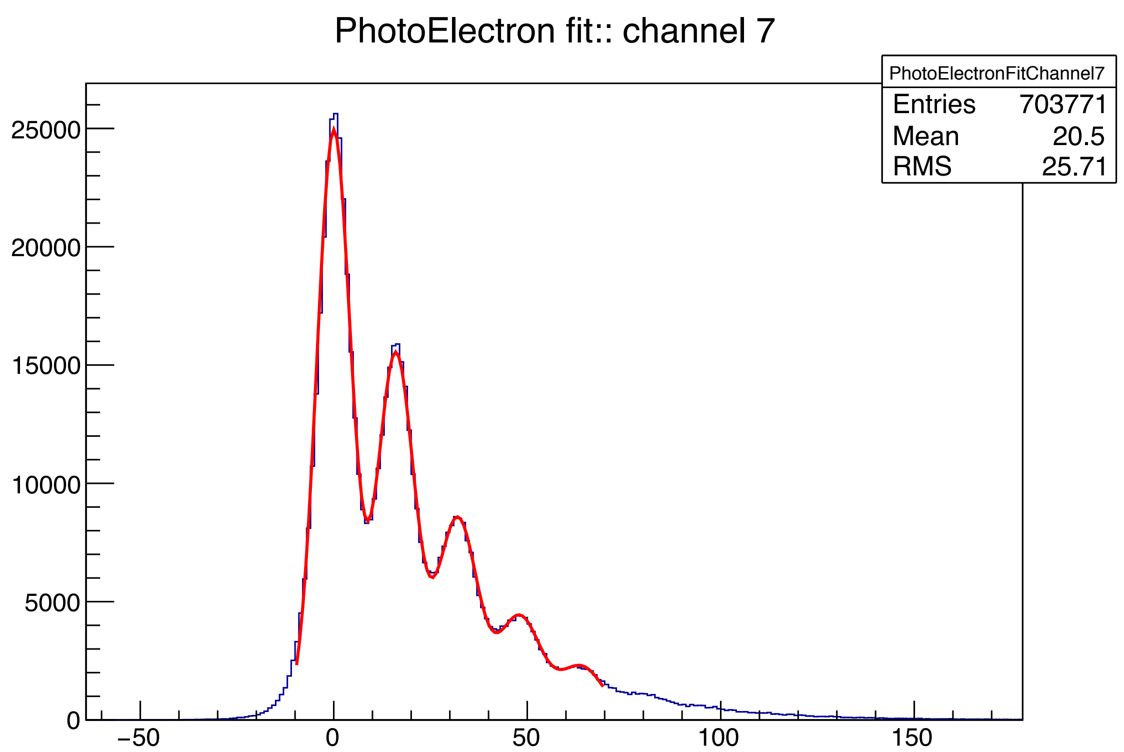
- since:
  - Gain = alpha (V_{bias} - $V_{overvoltage}$)
  - $V_{overvoltage}$ = beta + gamma (T)
- Previous data sets have been used in a common fit to:
  - Gain(V,T) = a + b V + c T
- Choosing an appropriate gain, Voltage corrections vs Temperature can be applied online.
- Current status.
  - Temperature sensors able to achieve better than 0.1 C resolution (better by averaging O(100) measurements).
  - Granularity on Vbias achievable is O(100 mV).
  - A Python script will be our realtime gain control running on ZYNQ, accessing temperature sensor over Ethernet and controlling on-board bias system.





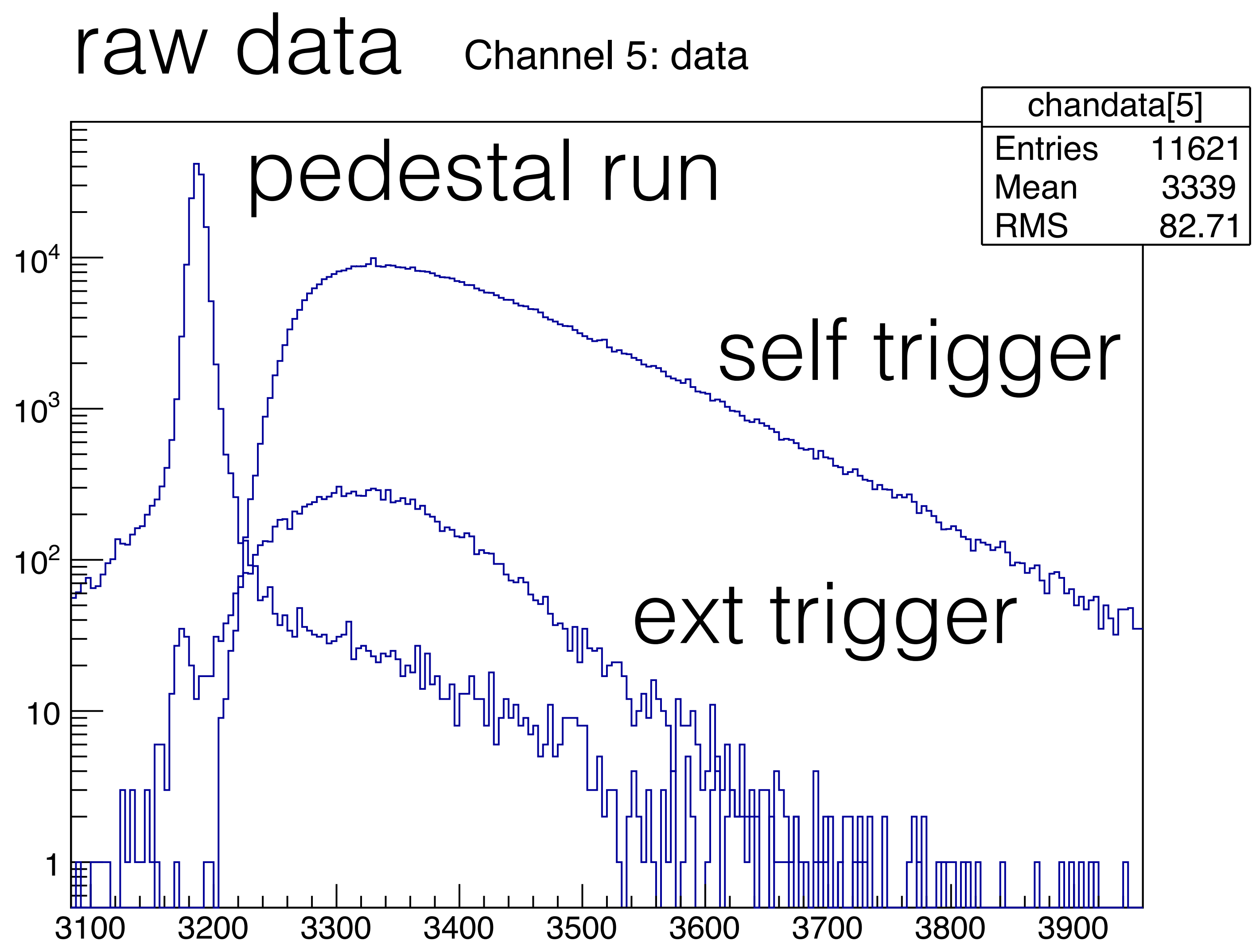
Fine scan with self-trigger

- trying to improve trigger rate 10 Hz -> 10 kHz by using self-trigger capabilities of EASIROC.
- trigger on most illuminated SiPM signal.
- Distributions are now different. Pedestal values measured from dedicated pedestal run using a random trigger.
- calibration constant from long run at T and V scan values from poorly illuminated SiPM (channel 3).



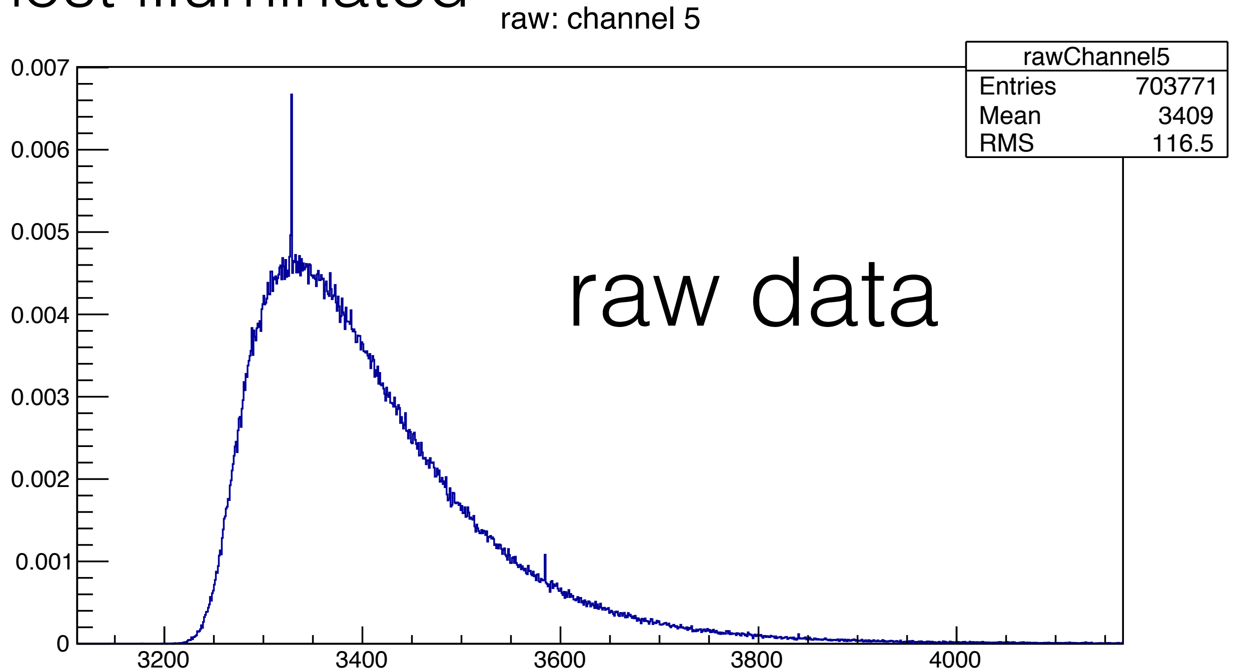
Self-triggered event sample

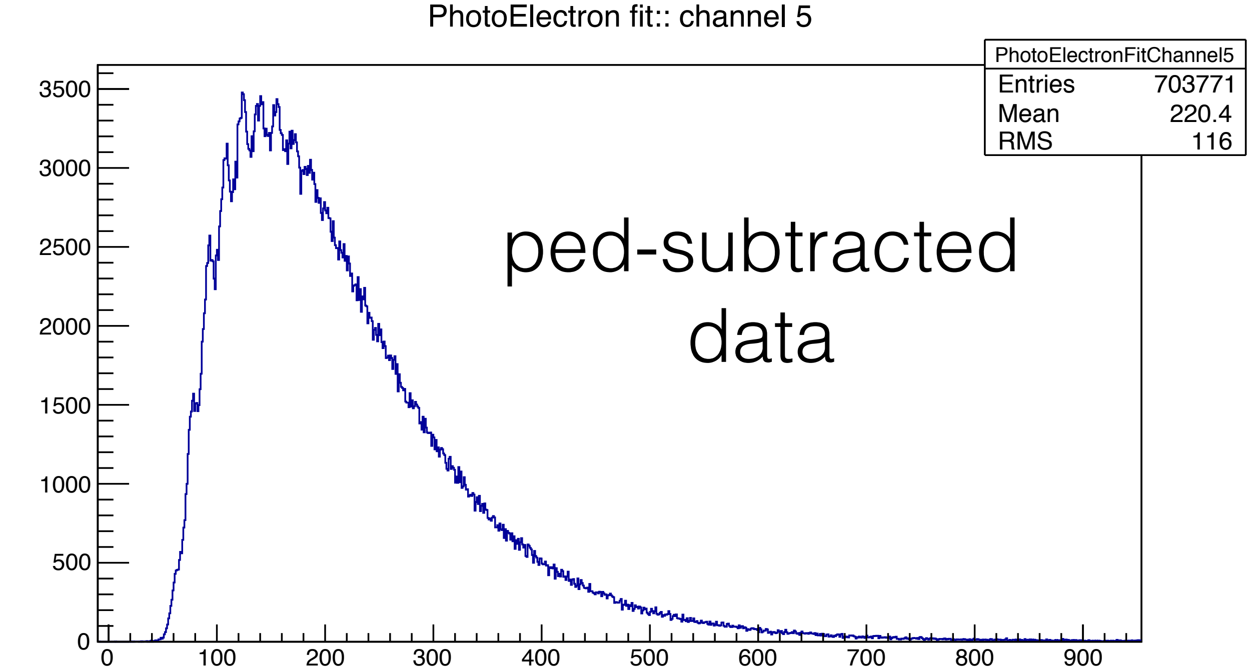
- XY scan is obtaining by plotting average of distribution, in units of P.E.
- Threshold is set just above pedestal, see figure.



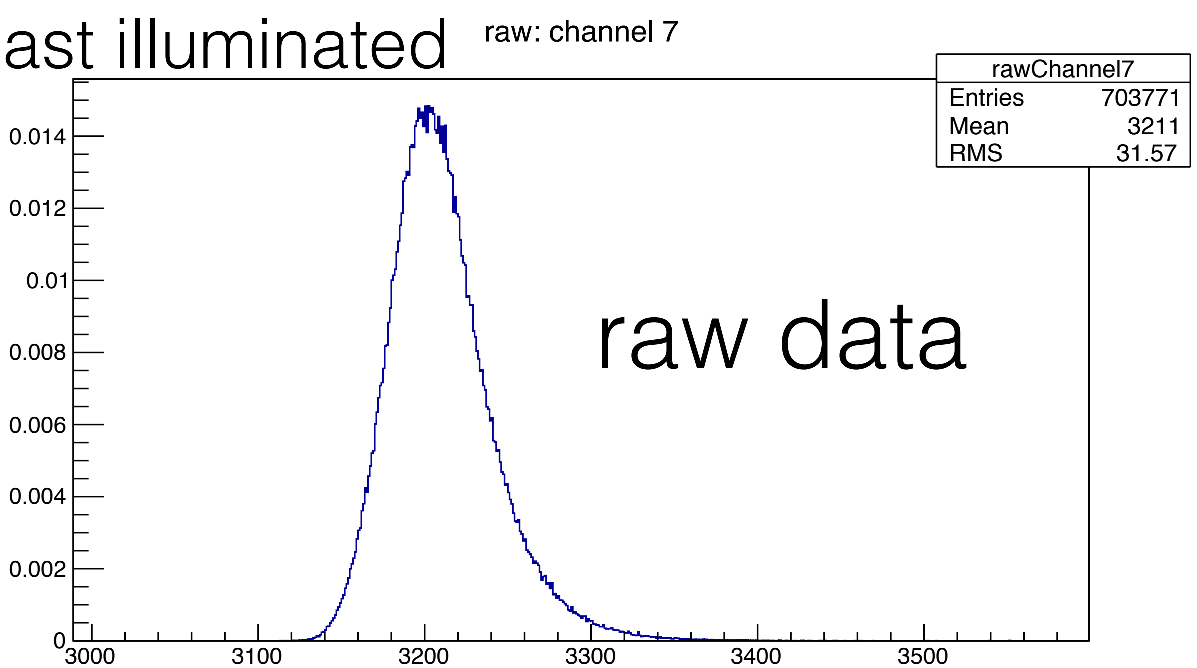
Event-by-event pedestal subtraction

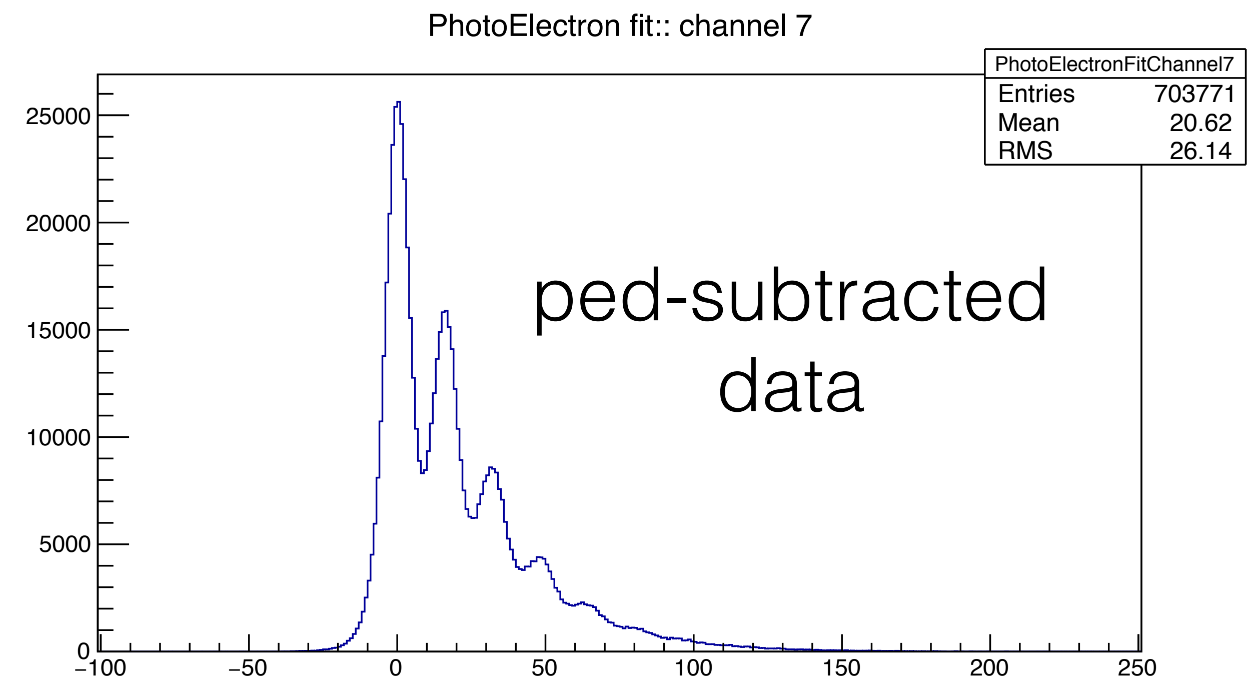
ch5: most illuminated





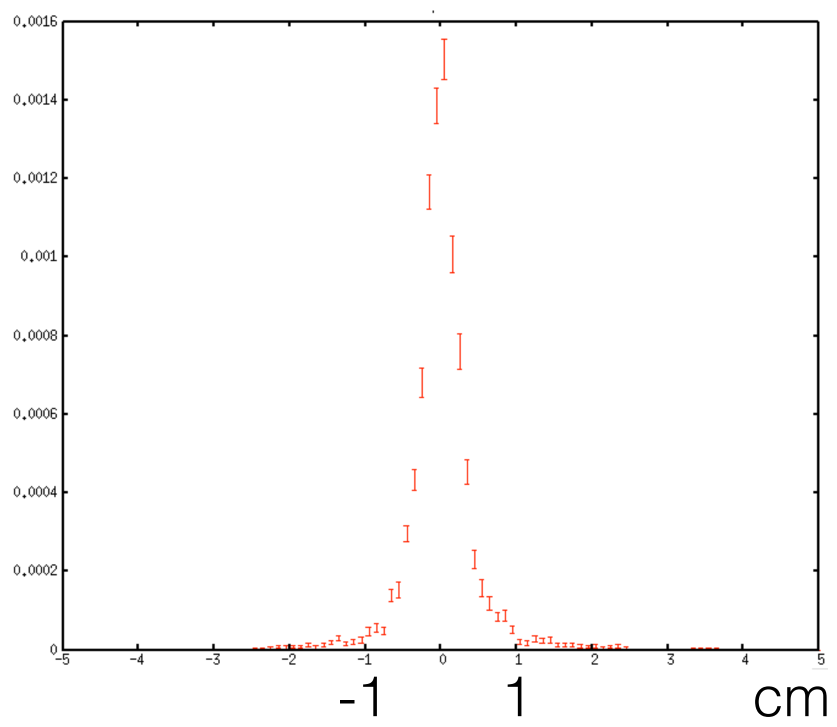
ch7: least illuminated



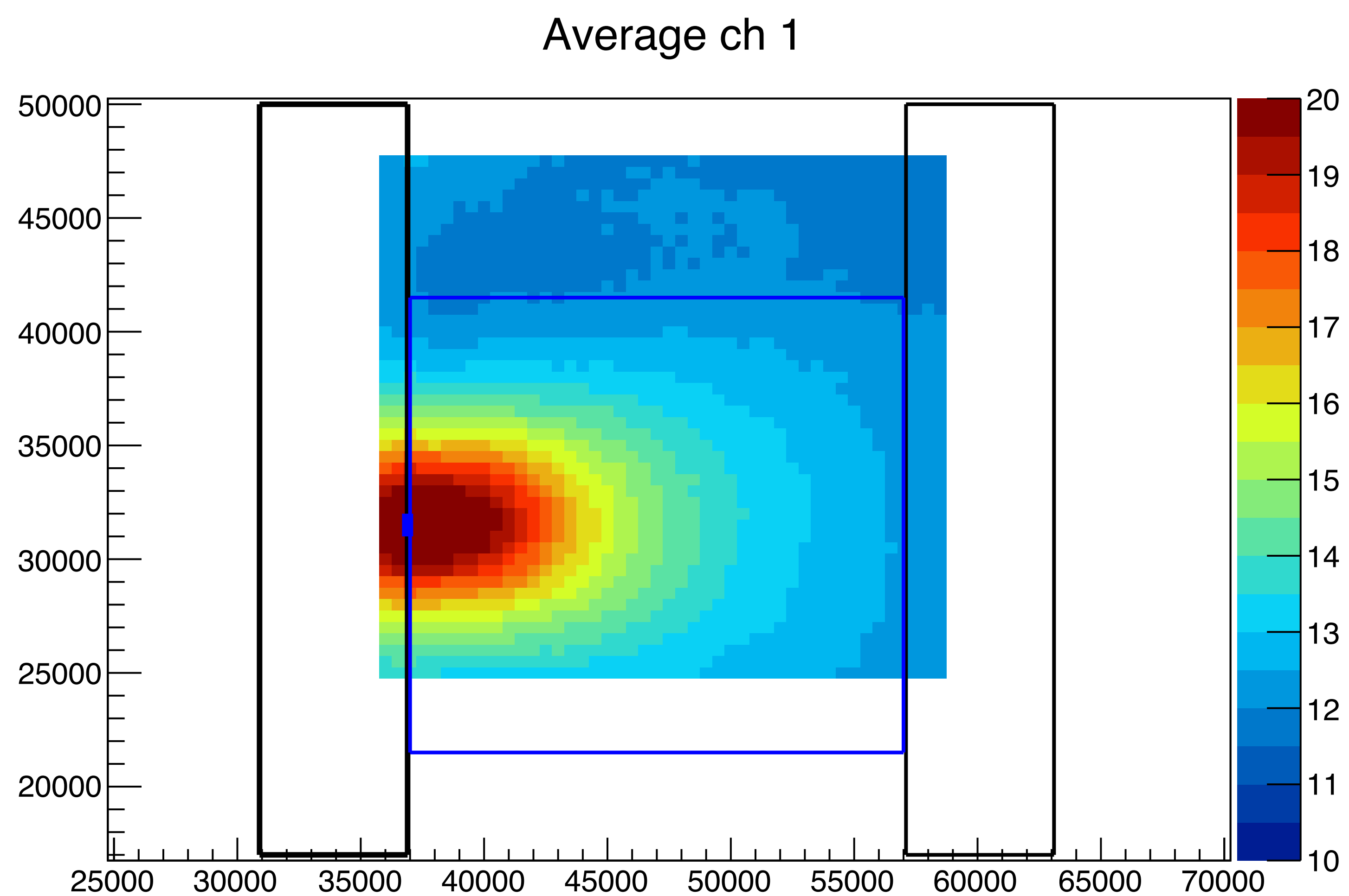


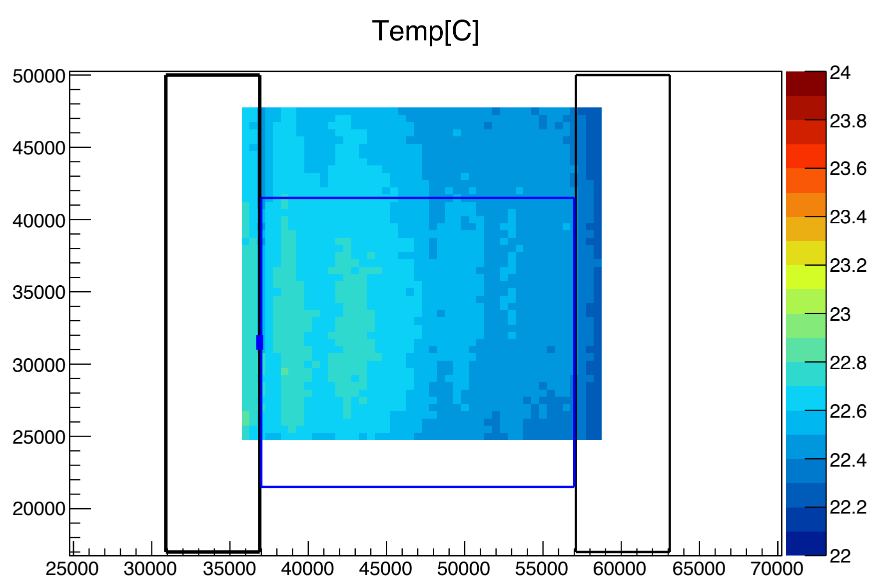
- it works, similar to baseline subtraction from waveform

Fine scan, first results with self-trigger



Sr90 source collimation
from Fluka





- data acquired in 5 seconds, about 50k events per point
- distribution averages are plotted, calibrated but no fit