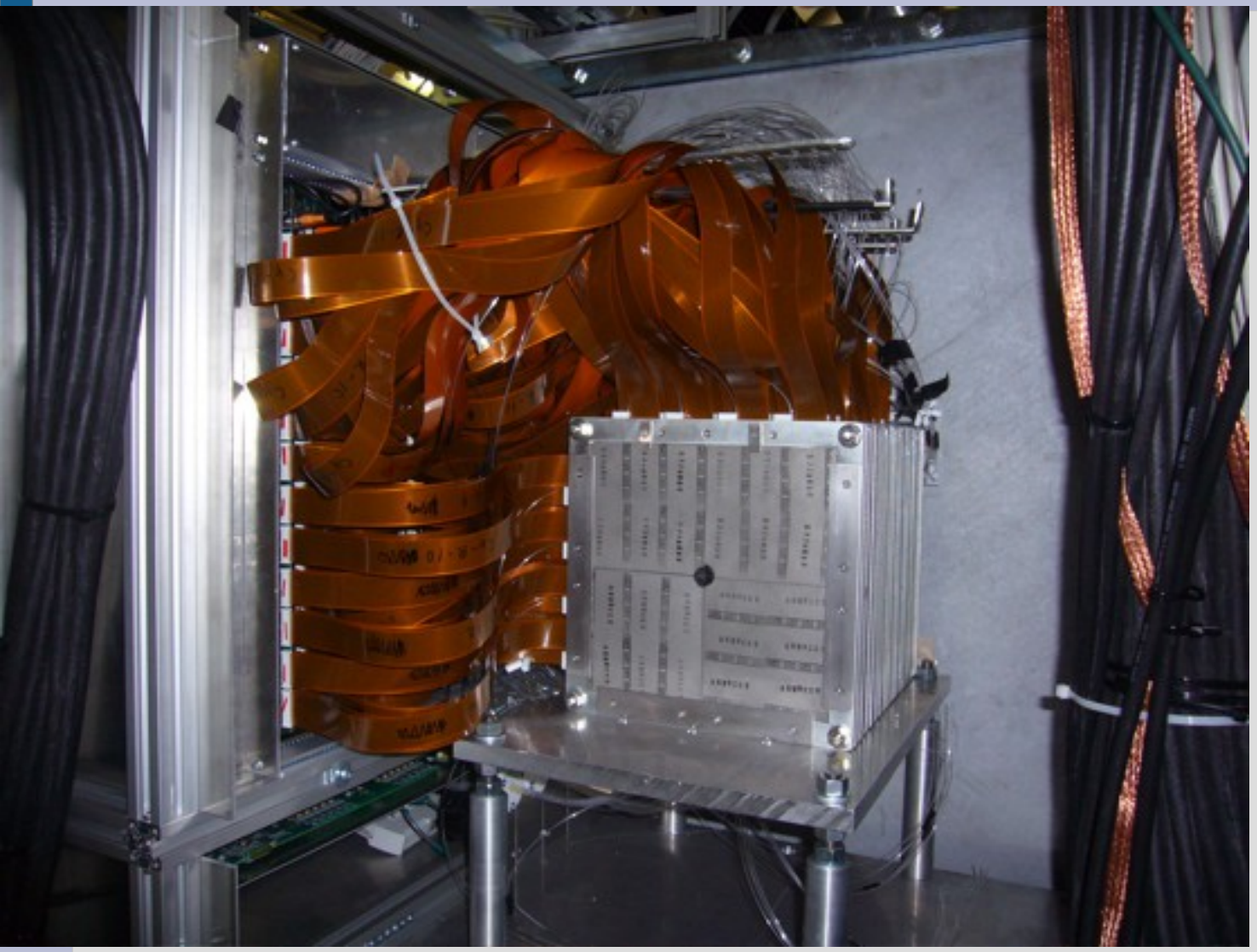
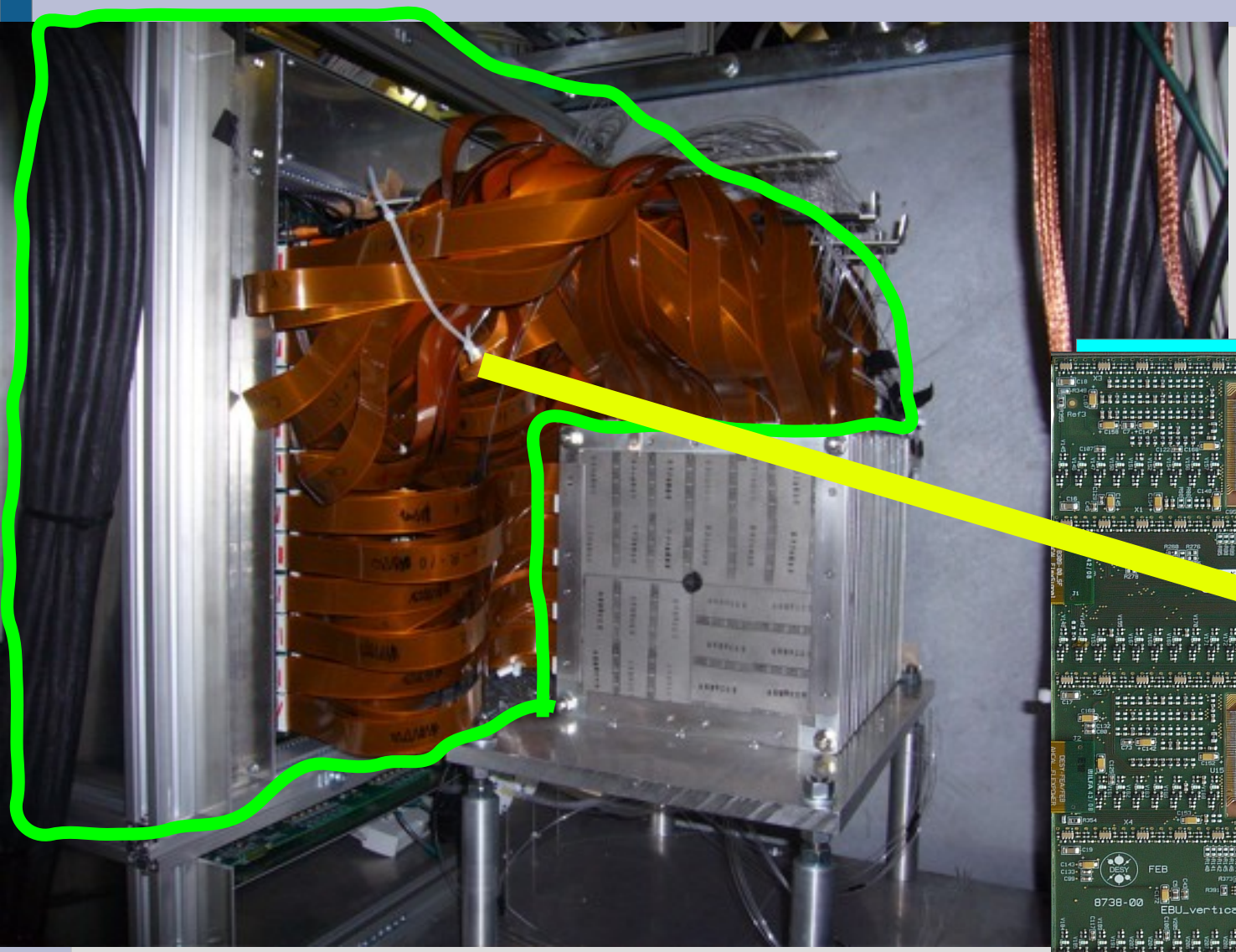
Commissioning of scintillator ECAL in DESY

Shinshu Univ. High Energy Physics Lab.
Inayoshi Shinji

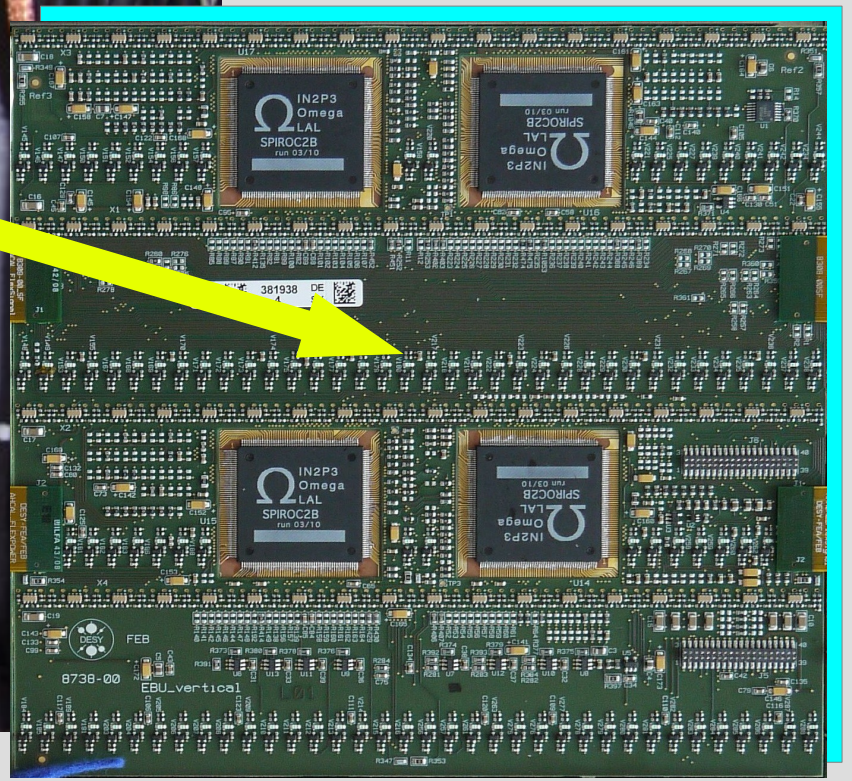
Physics Prototype Testbeam at FNAL on 2009



Physics Prototype Testbeam at FNAL on 2009



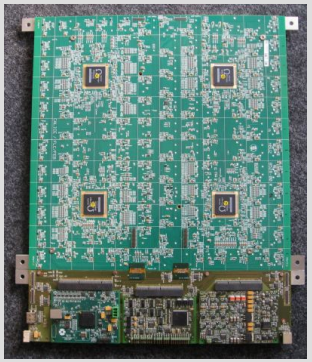
Electronics (readout) into ECAL



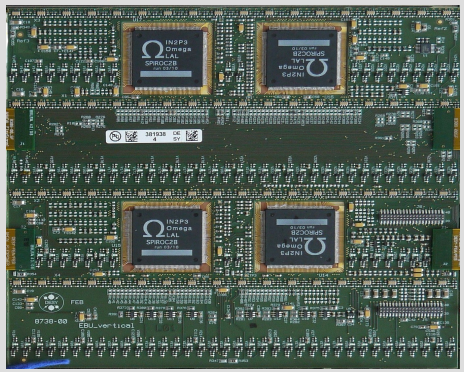
Purpose

- Our purpose is the commissioning of one layer of scintillator ECAL that includes electronics(EBU).
- This is the first test using EBU (ECAL Base Unit) made from the technology of the electronics of AHCAL.

HBU 36cmx36cm
(HCAL Base Unit)

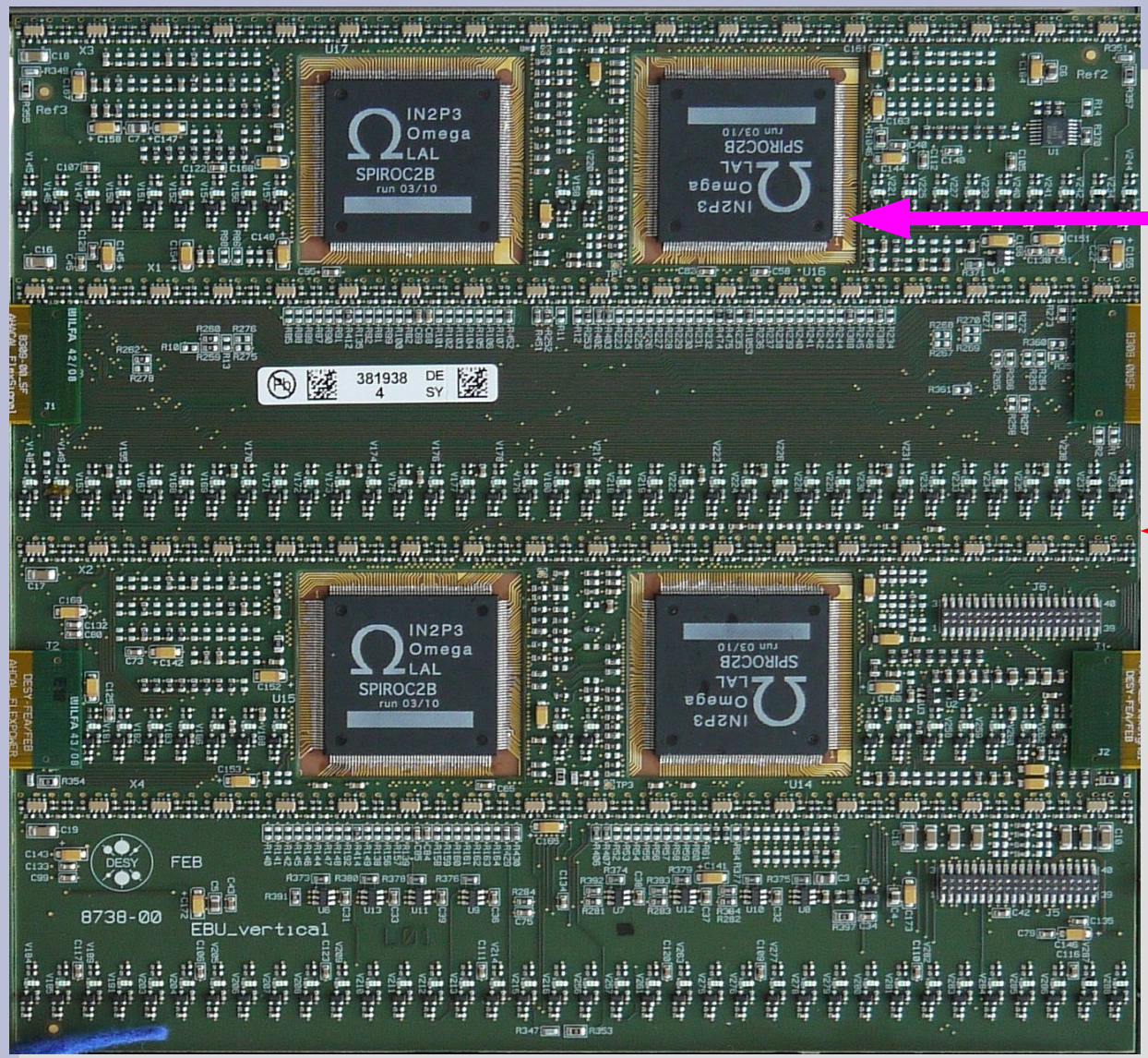


4 times
dense



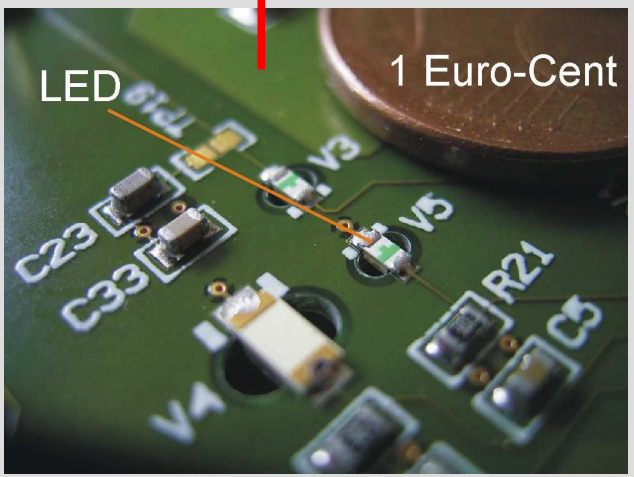
EBU 18cmx18cm
(ECAL Base Unit)

EBU (ECAL Base Unit)



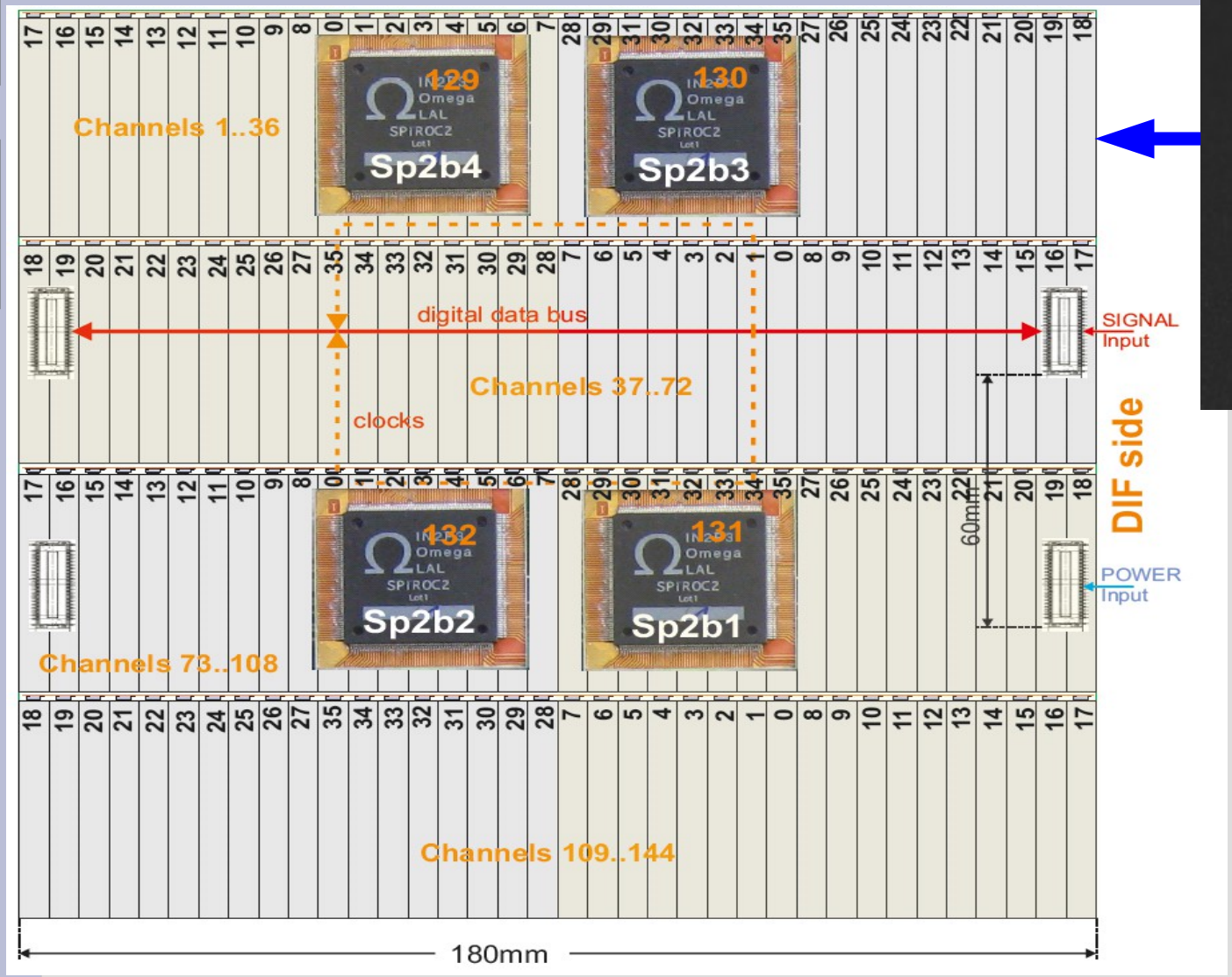
SPIROC2b

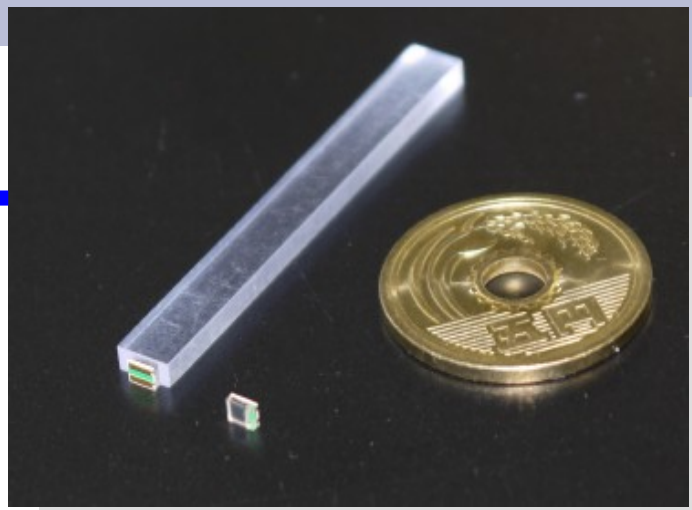
LED(Gain monitor)



Four integrated circuits called SPIROC2b are carried in EBU.

EBU (ECAL Base Unit)



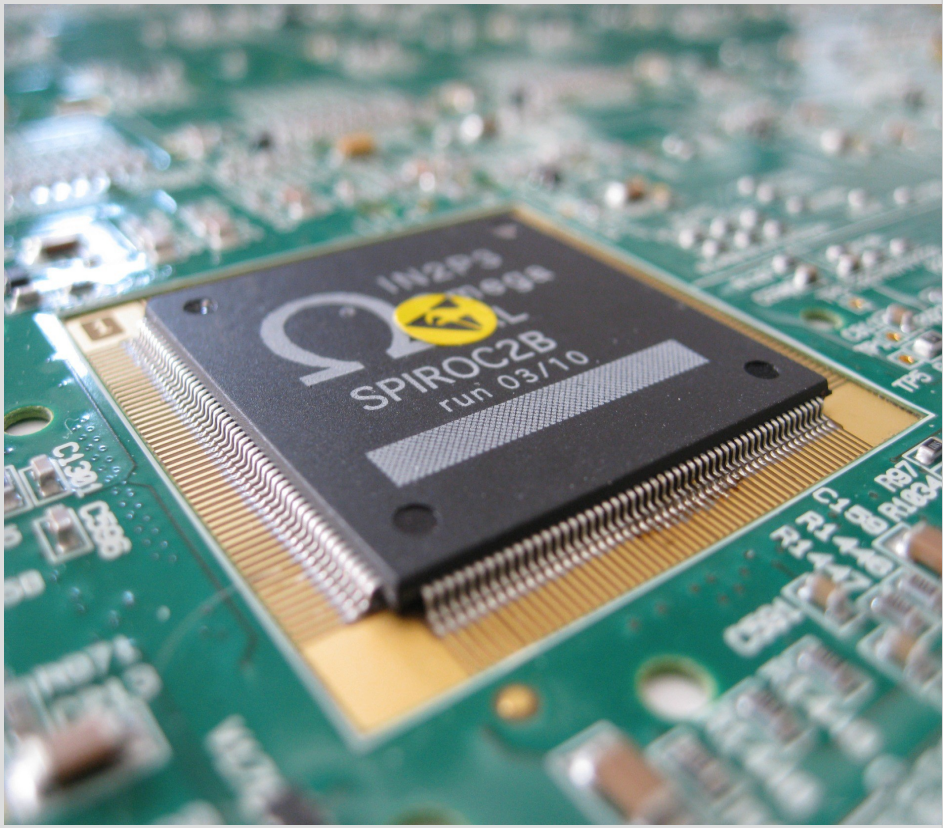


144sets

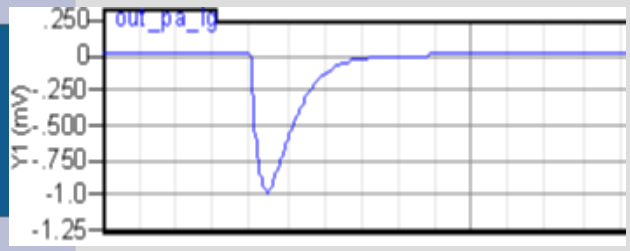
144 sets of scintillators and MPPCs are attached to the back side of this EBU.

SPIROC2b

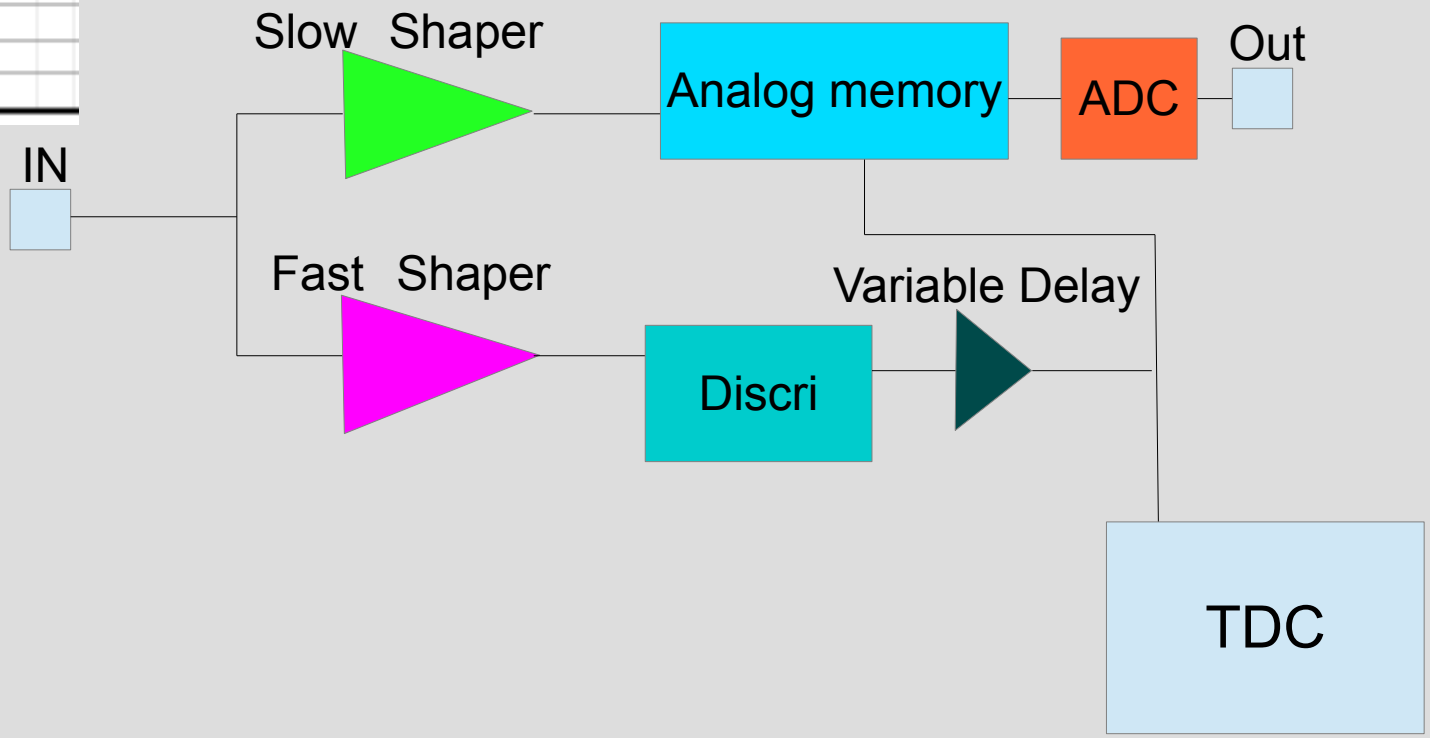
- SPIROC2b is an abbreviation for Slicon Photomultiplier Integrated ReadOut.
- The integrated circuit which specialized in data acquisition of calorimeter.
- This performs ADC, TDC, SelfTrigger, setting of voltage of MPPCs, data read-out, etc.
- 36ch is controllable by one.



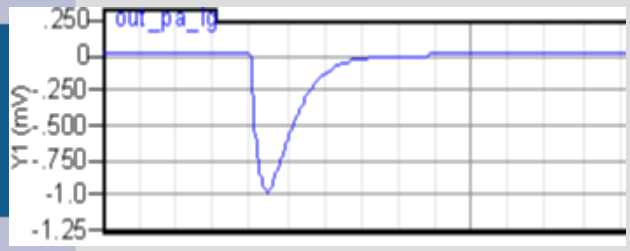
Signal path of SPIROC2b



MPPC signal
Analog signal



Signal path of SPIROC2b



MPPC signal
Analog signal

IN

Slow Shaper

Fast Shaper

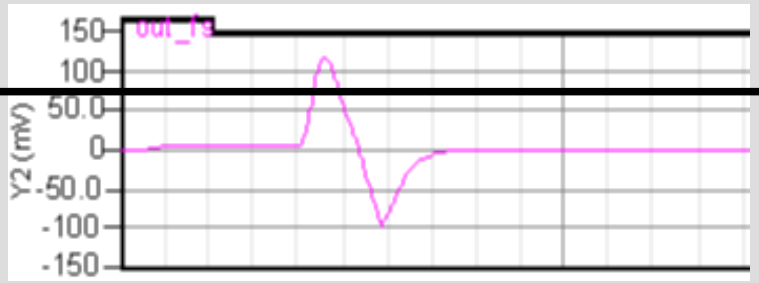
Analog memory

ADC

Out

Variable Delay

Discri



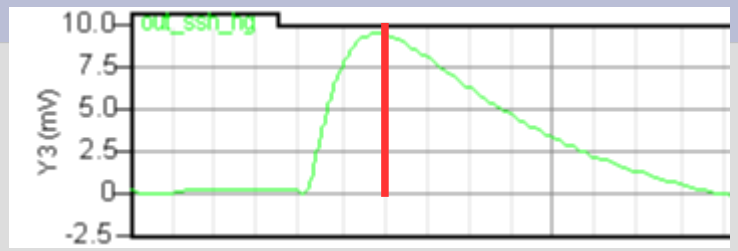
Threshold
of auto trigger

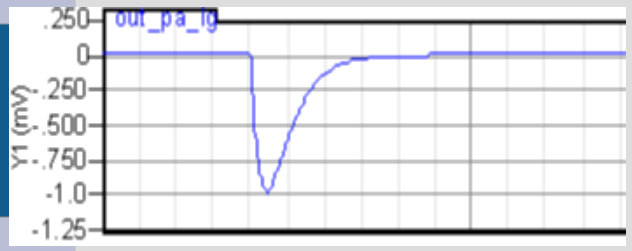
TDC

Fast Shaper signal
It is used for a trigger.

Signal path of SPIROC2b

Slow Shaper signal





MPPC signal
Analog signal

Slow Shaper

Analog memory

ADC

Out

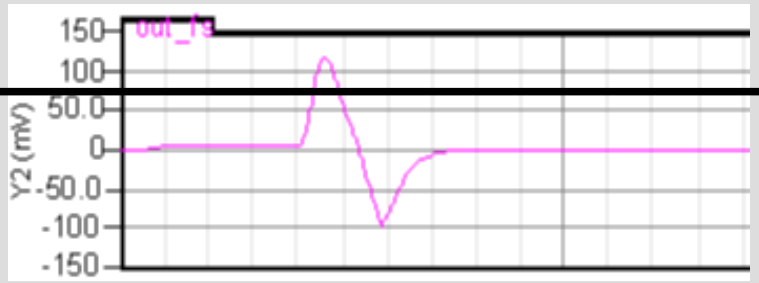
IN

Fast Shaper

Variable Delay

Hold

Discri



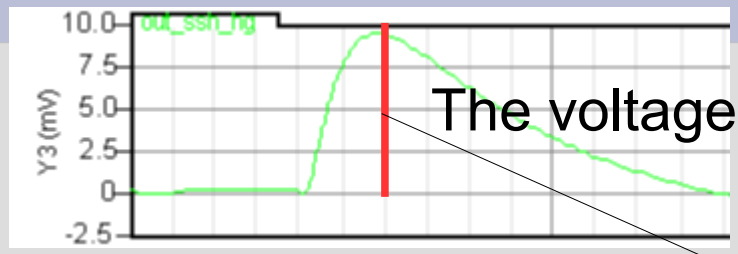
Threshold
of auto trigger

TDC

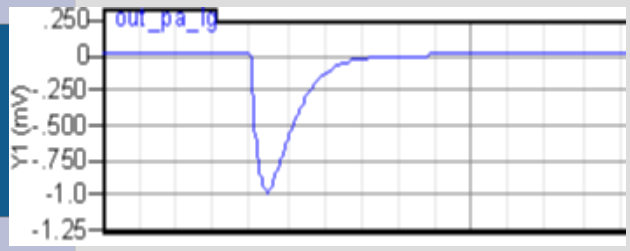
Fast Shaper signal
It is used for a trigger.

Signal path of SPIROC2b

Slow Shaper signal



The voltage of this timing is recorded.



MPPC signal
Analog signal

IN

Slow Shaper

Fast Shaper

Analog memory

ADC

Out

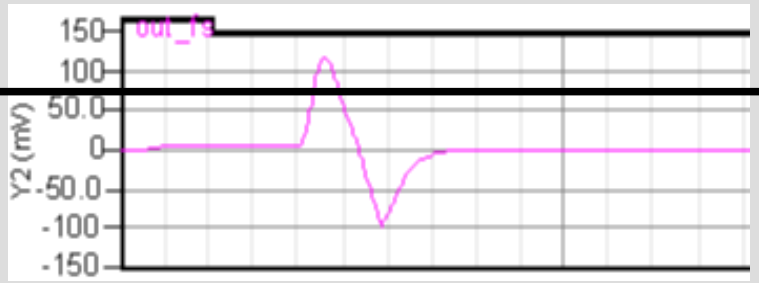
Digital signal

Variable Delay

Hold

Discri

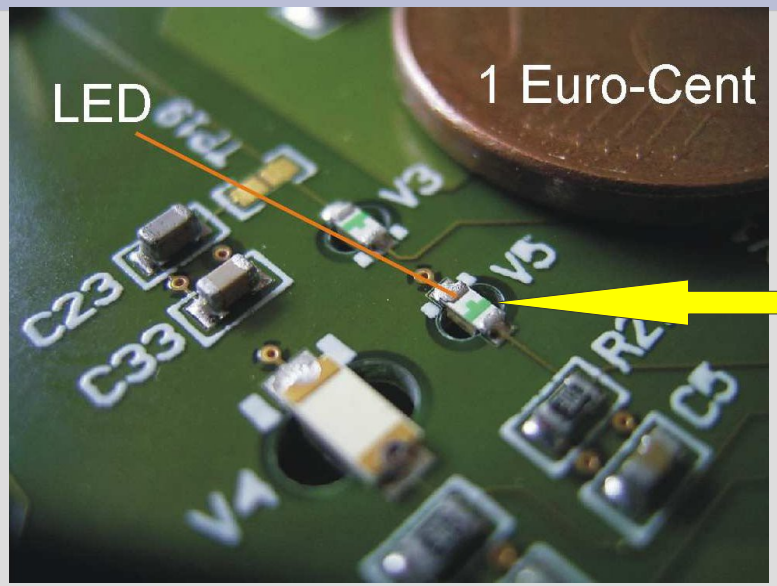
TDC

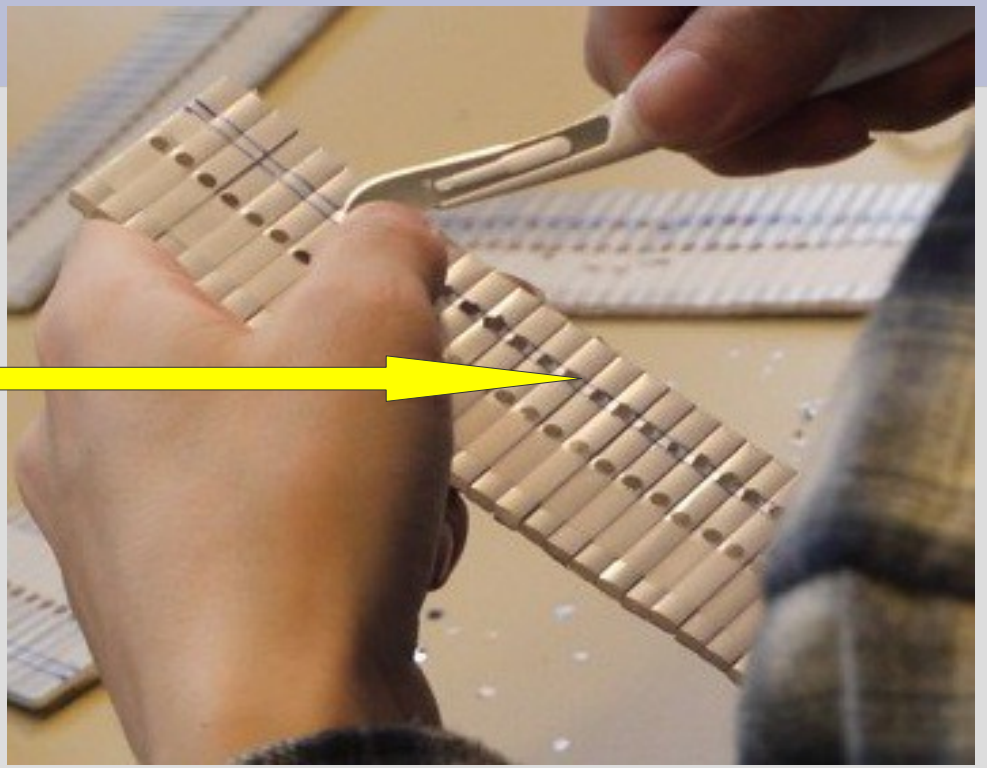


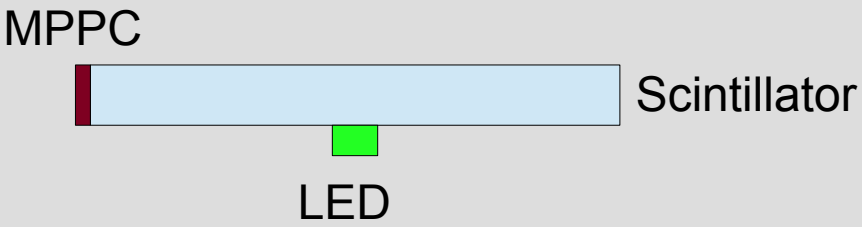
Threshold of auto trigger

Fast Shaper signal
It is used for a trigger.

LED Calibration System

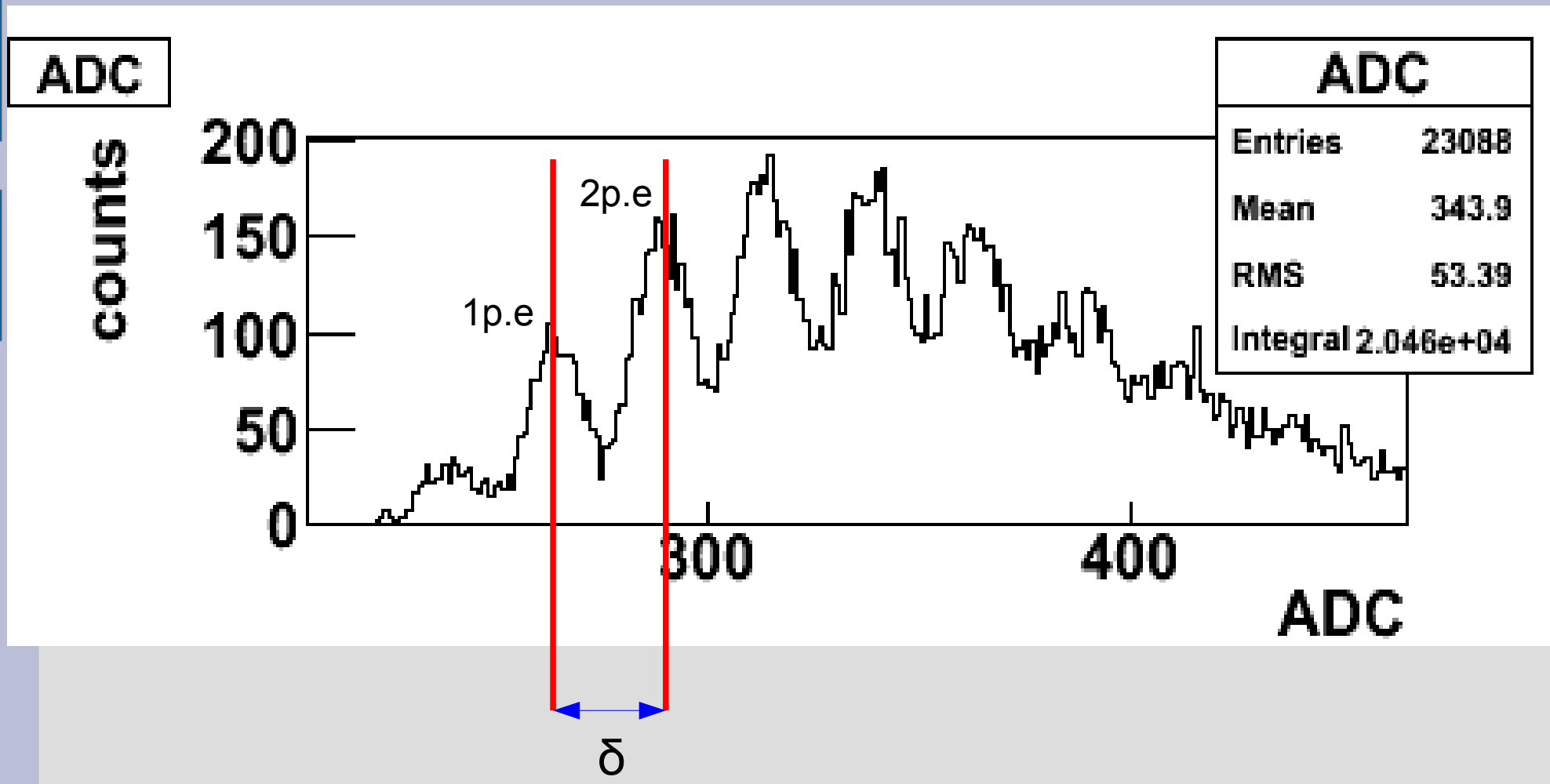






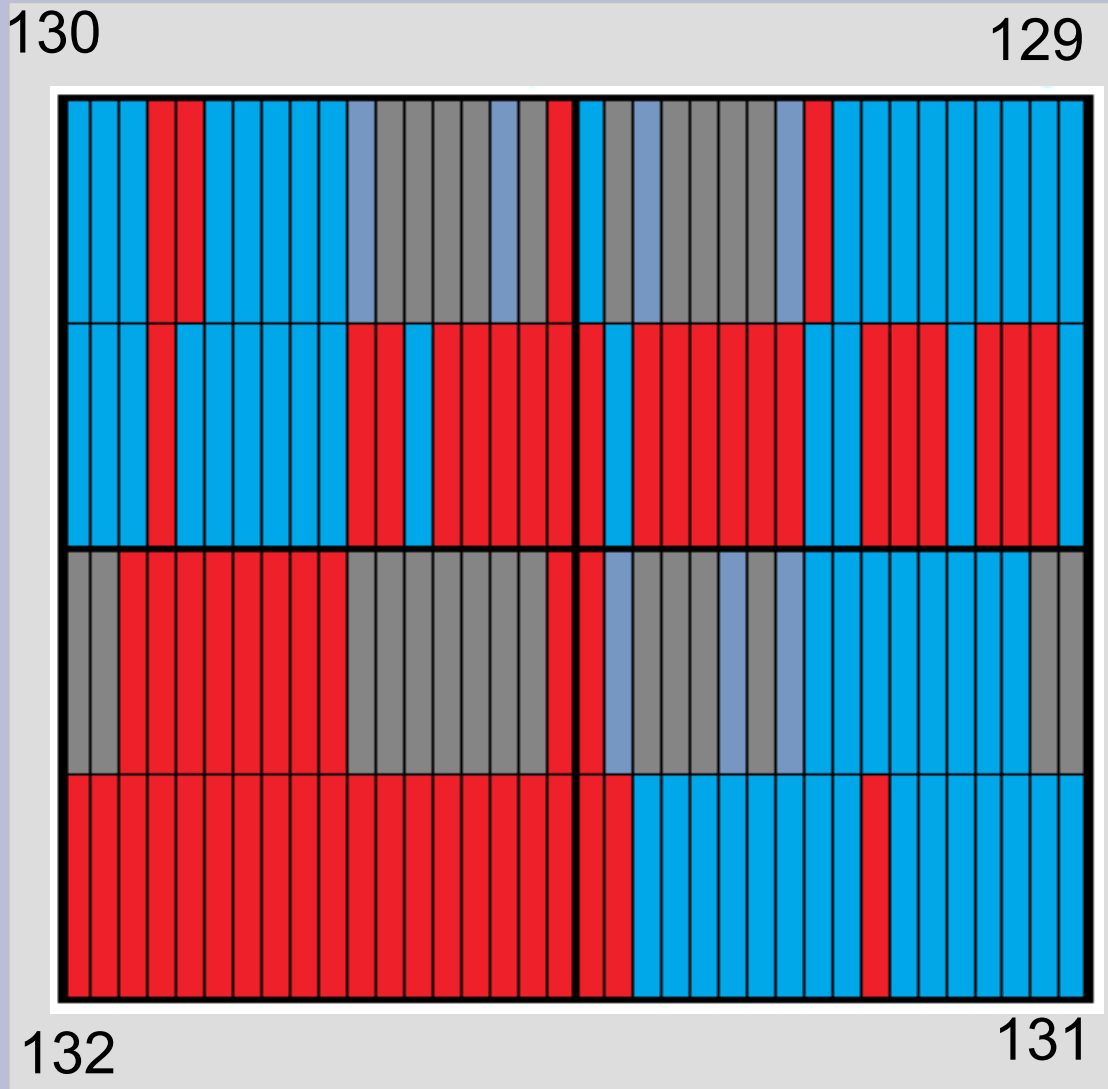
We made a hole in the reflective material of each scintillator according to the position of LED.

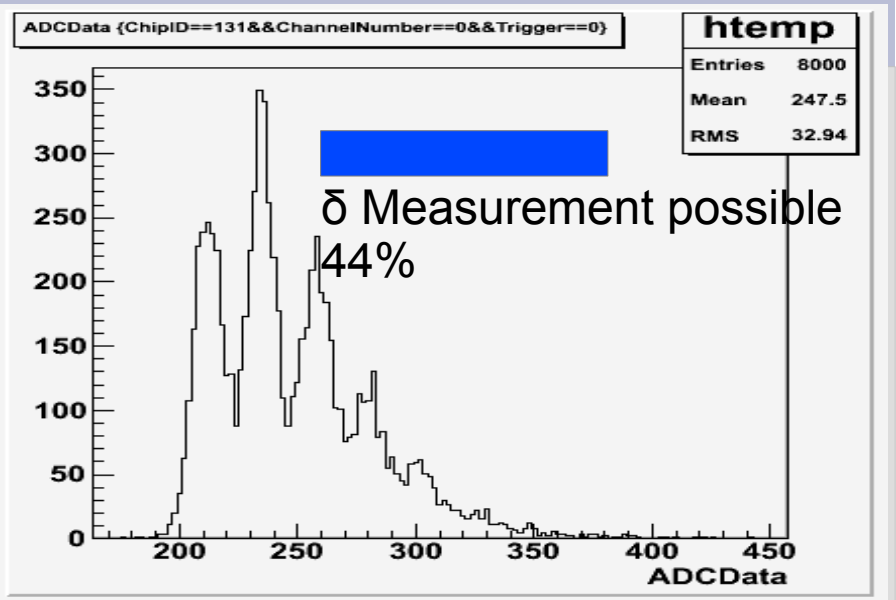
LED Calibration Test

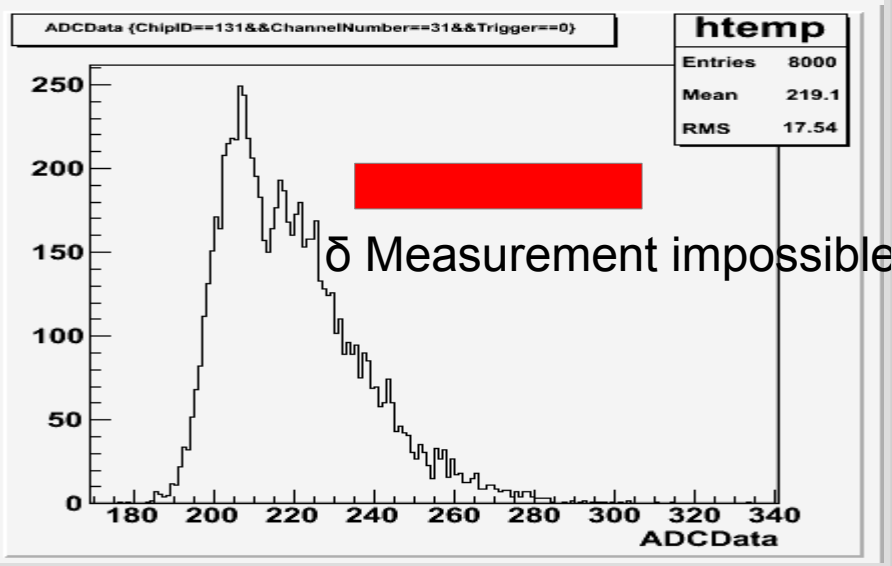


With the light of LED, the value (delta) of ADC per one photon is mesured.

Present status of LED Calibration

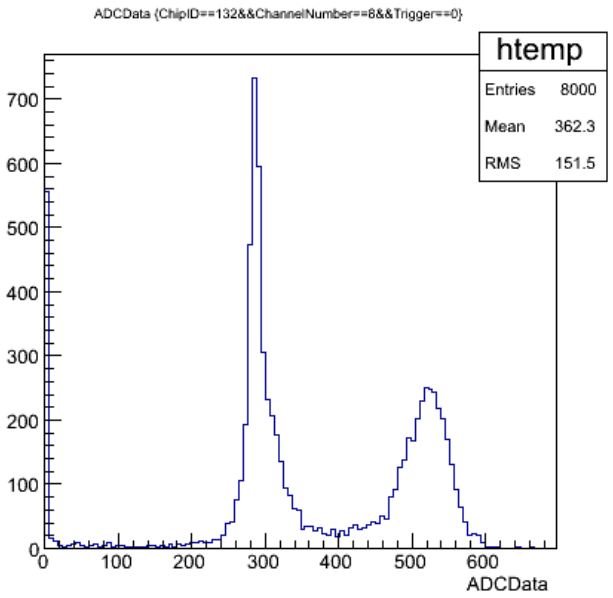


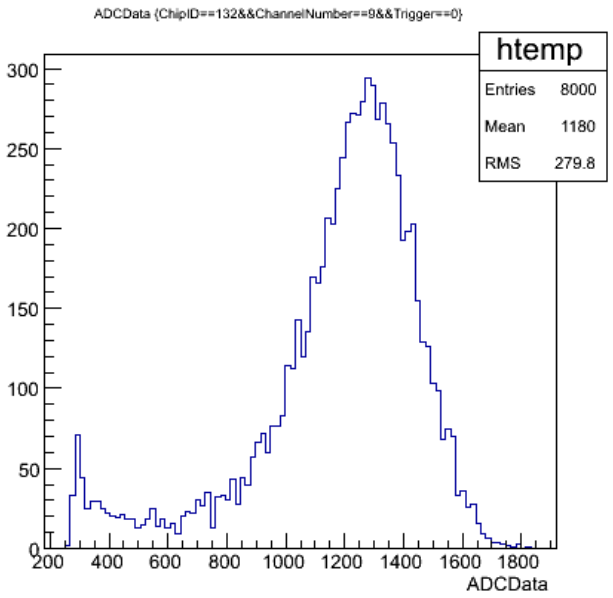


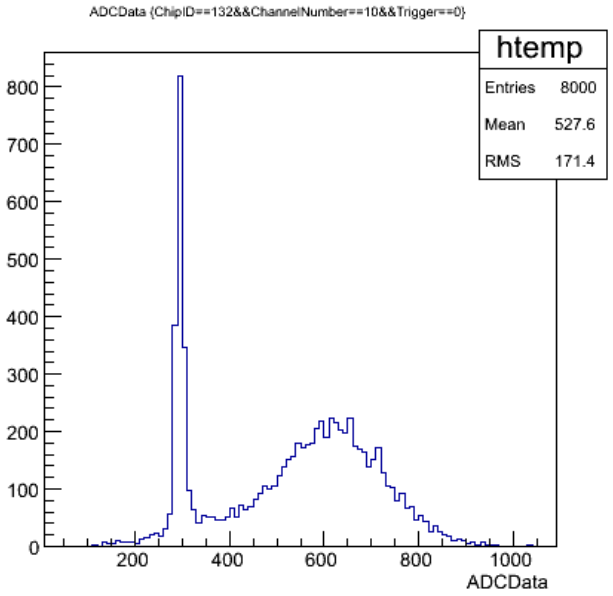


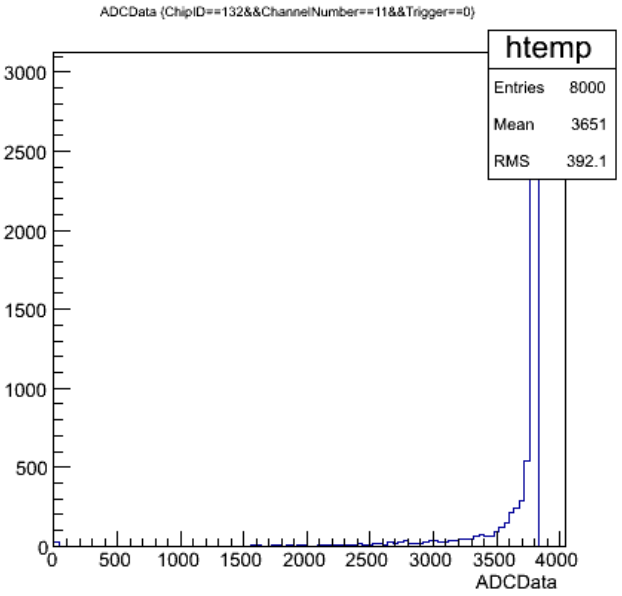
The channel which has no LED.

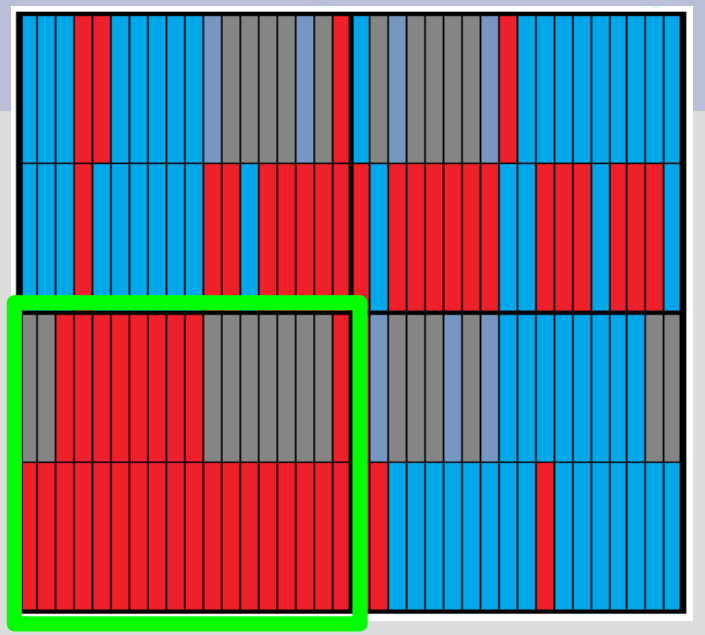
Malfunction of Control Area of SPIROC2b 132









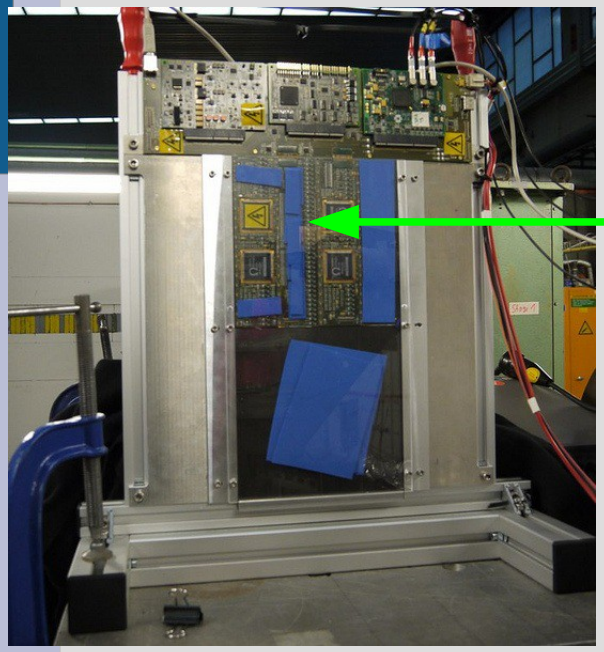


132

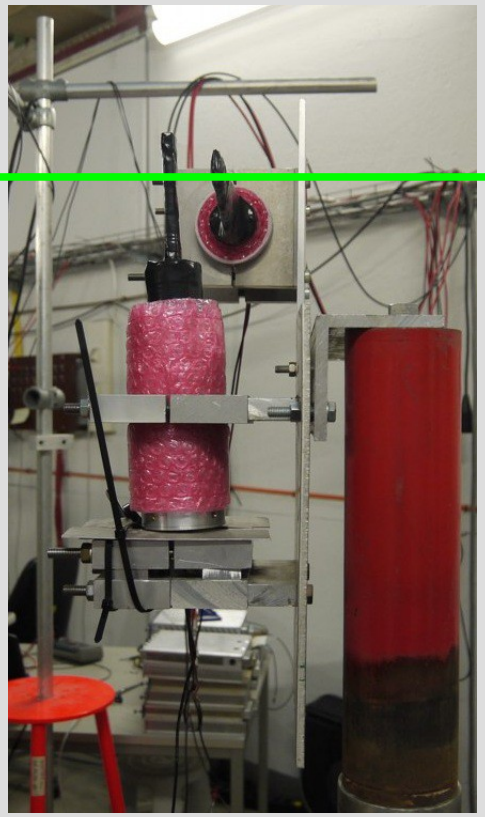
When we apply voltage to LEDs, channels of this area have strange ADC distributions.

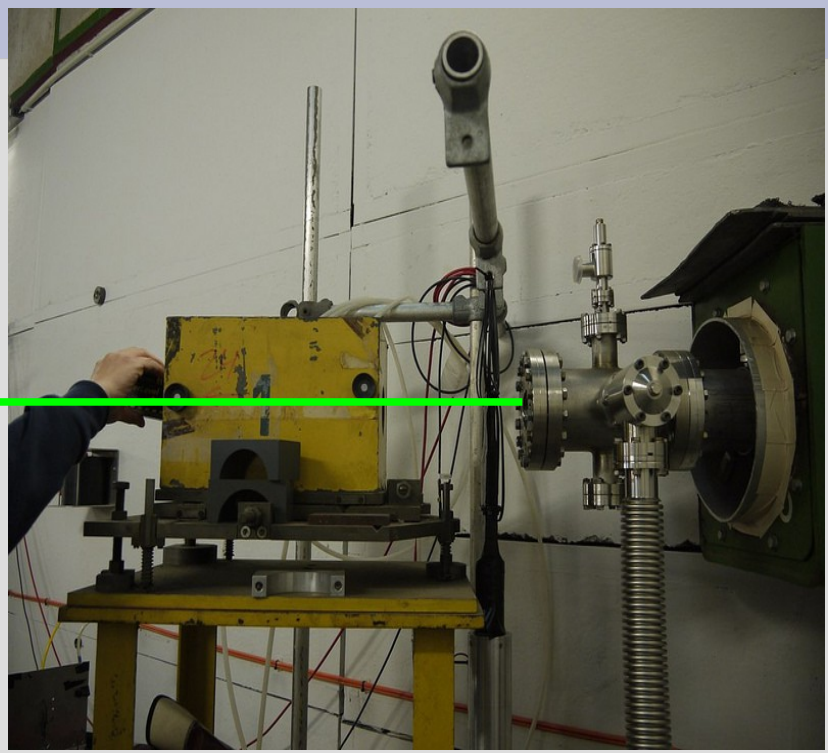
Test Beam
in DESY test beam line 24

EBU



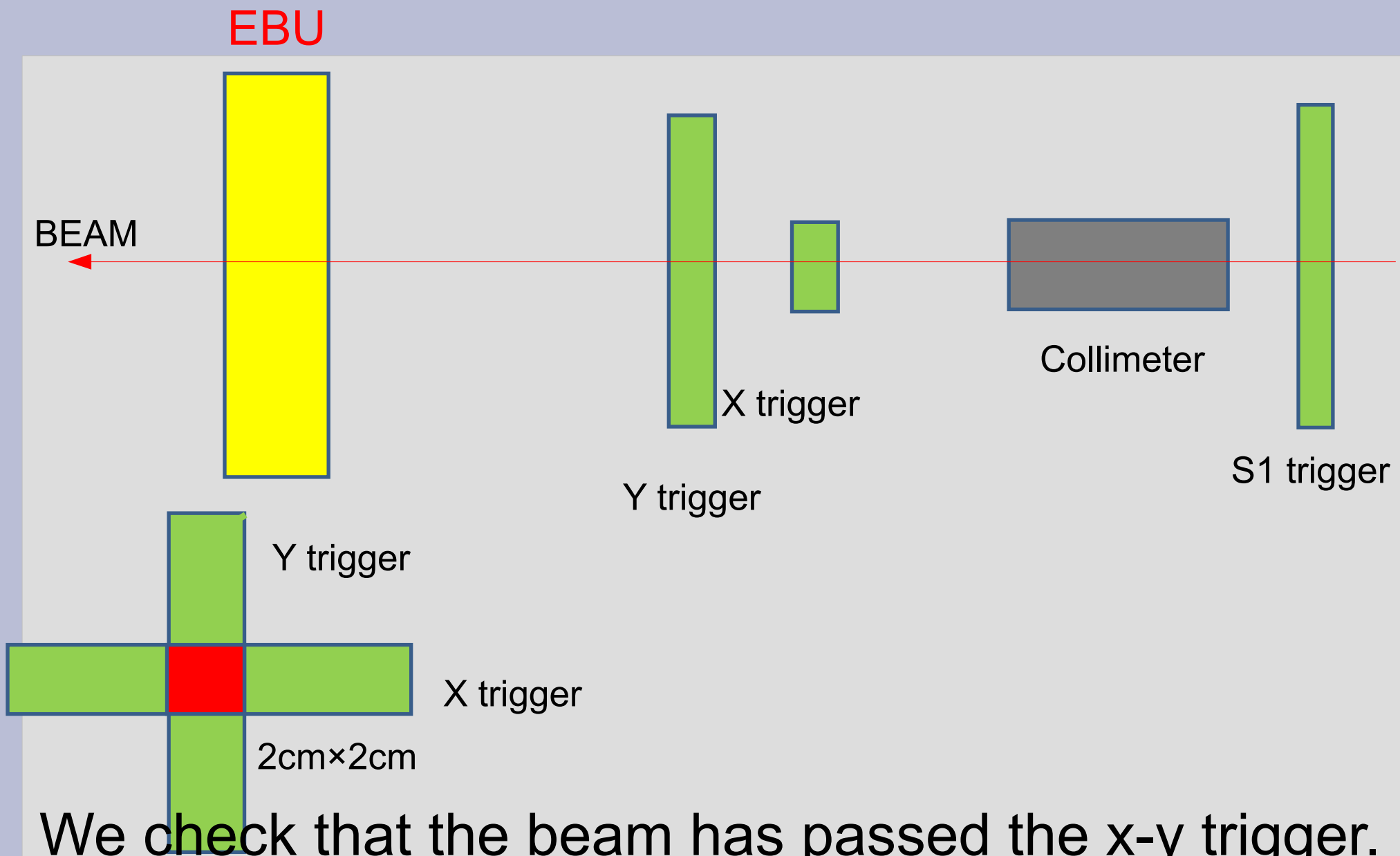
X-Y Scintillator
2cm×2cm





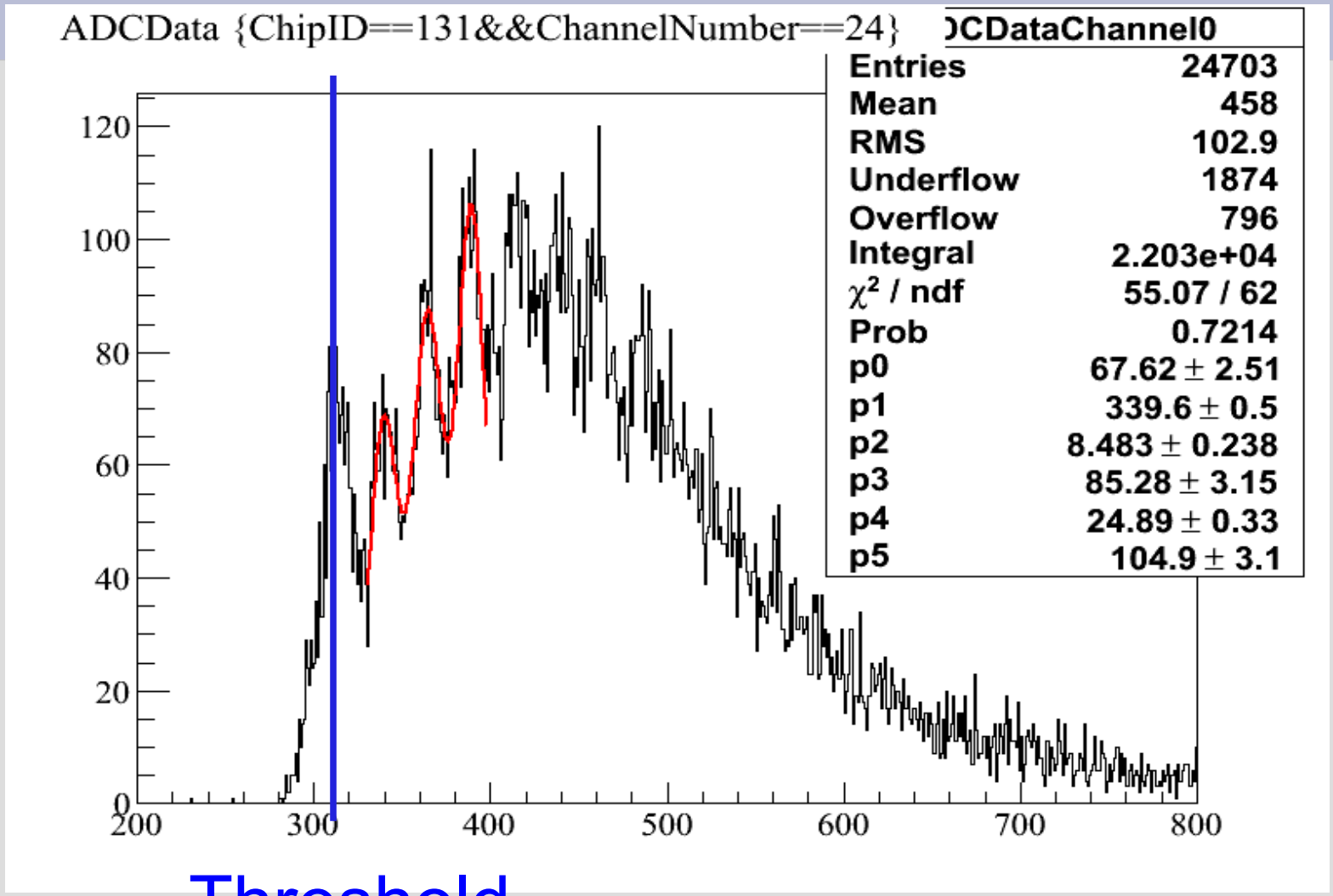
Collimator
It extracts a beam.

Test Beam Setup



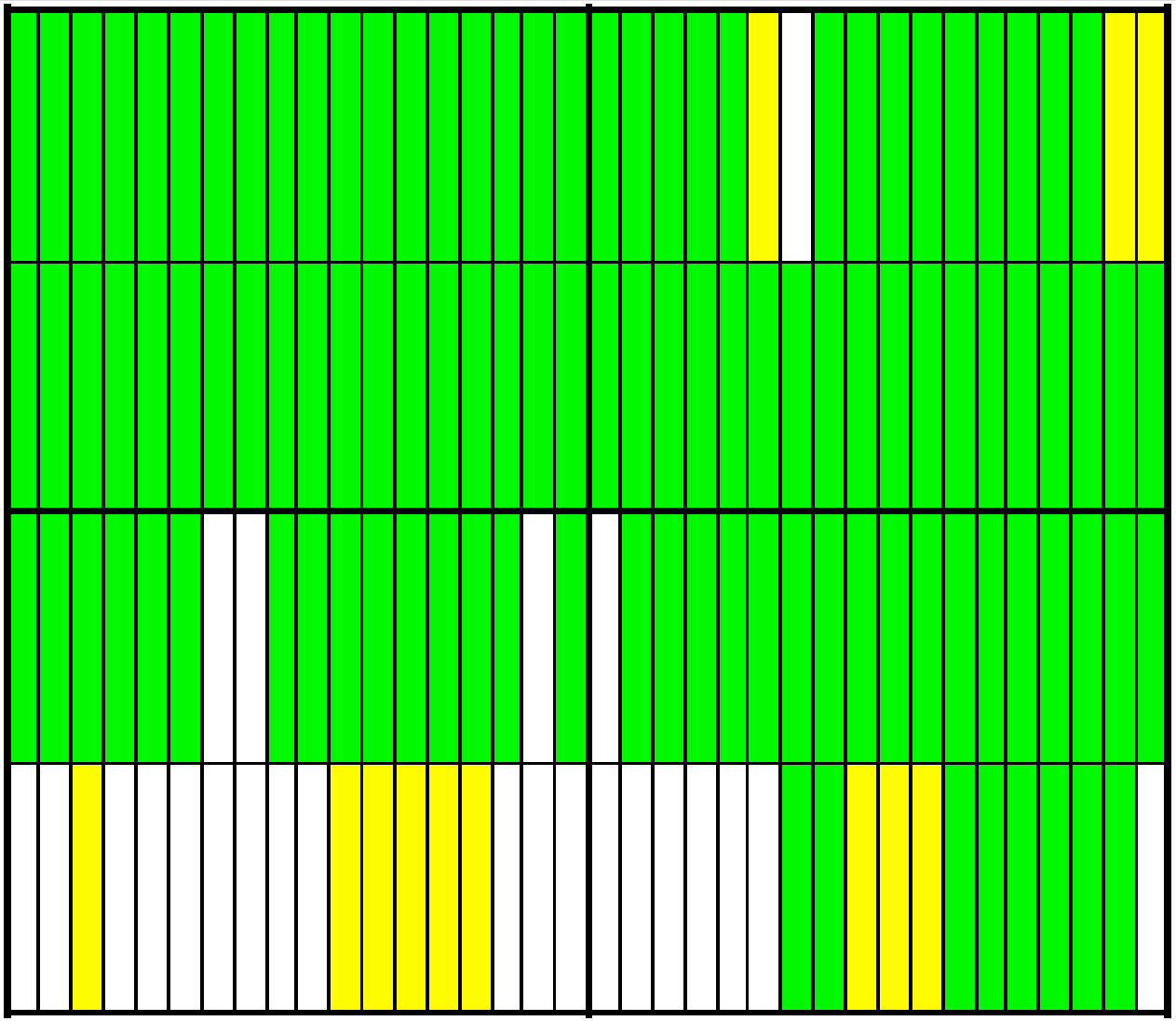
We check that the beam has passed the x-y trigger.

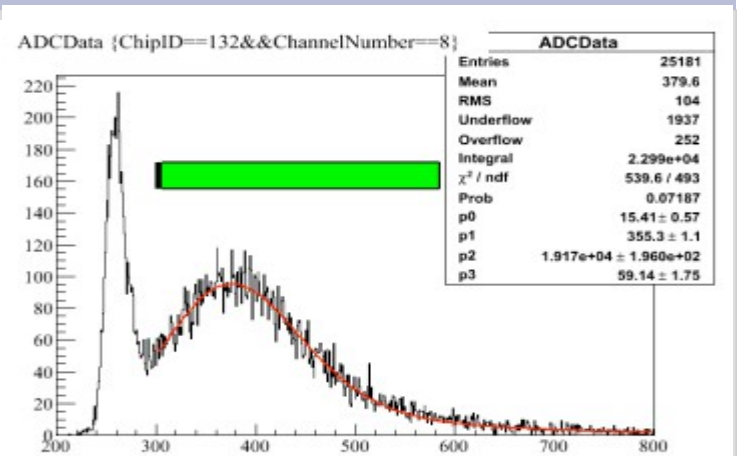
One MIP signal

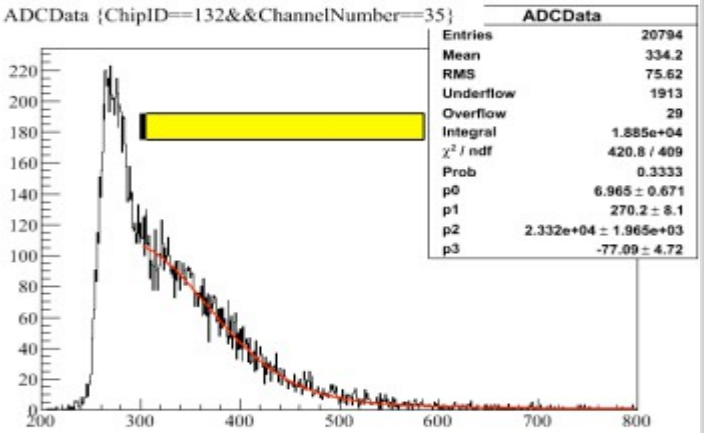


This signal shows that one particle passed the scintillator.

Present status of MIP measurement

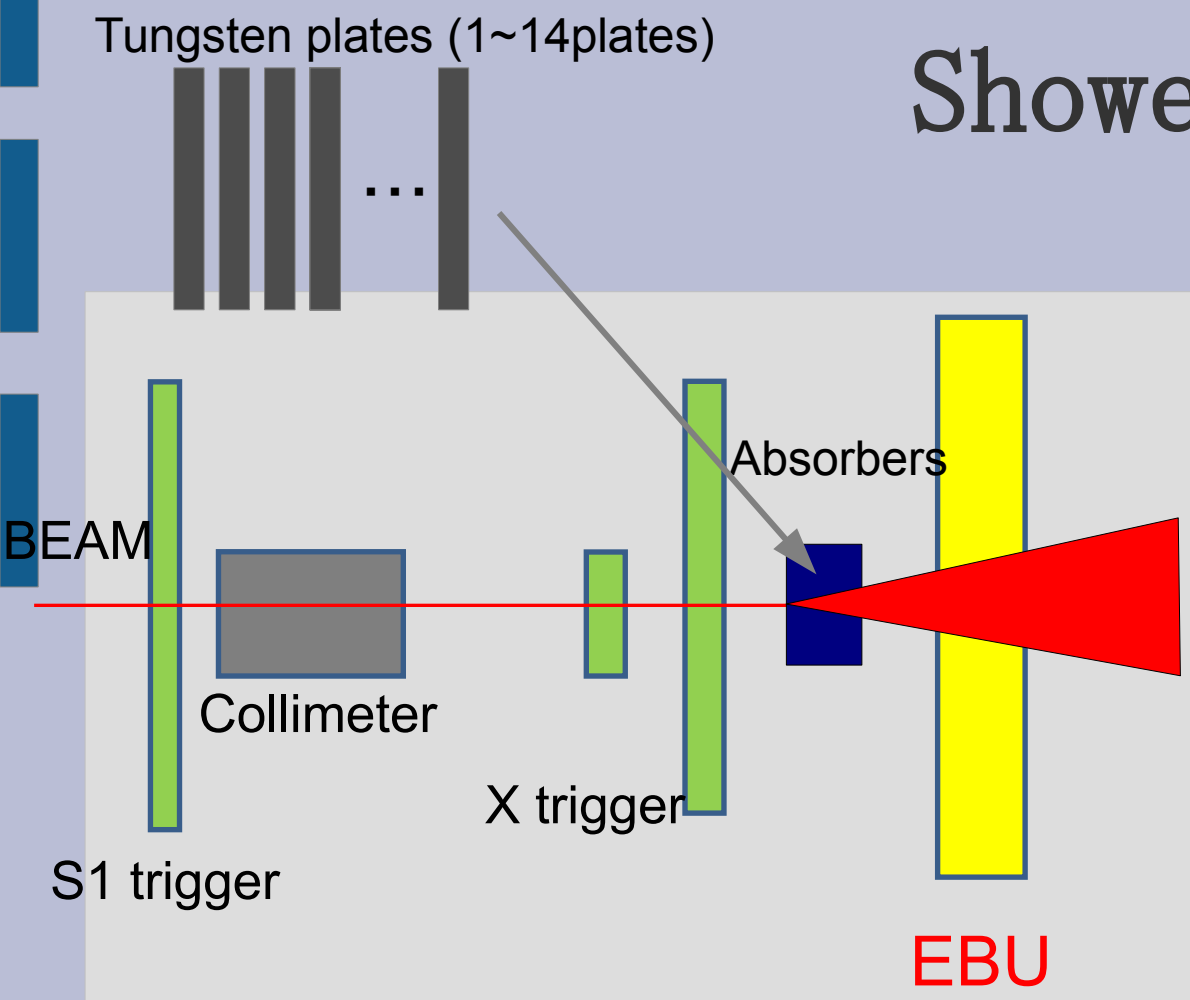






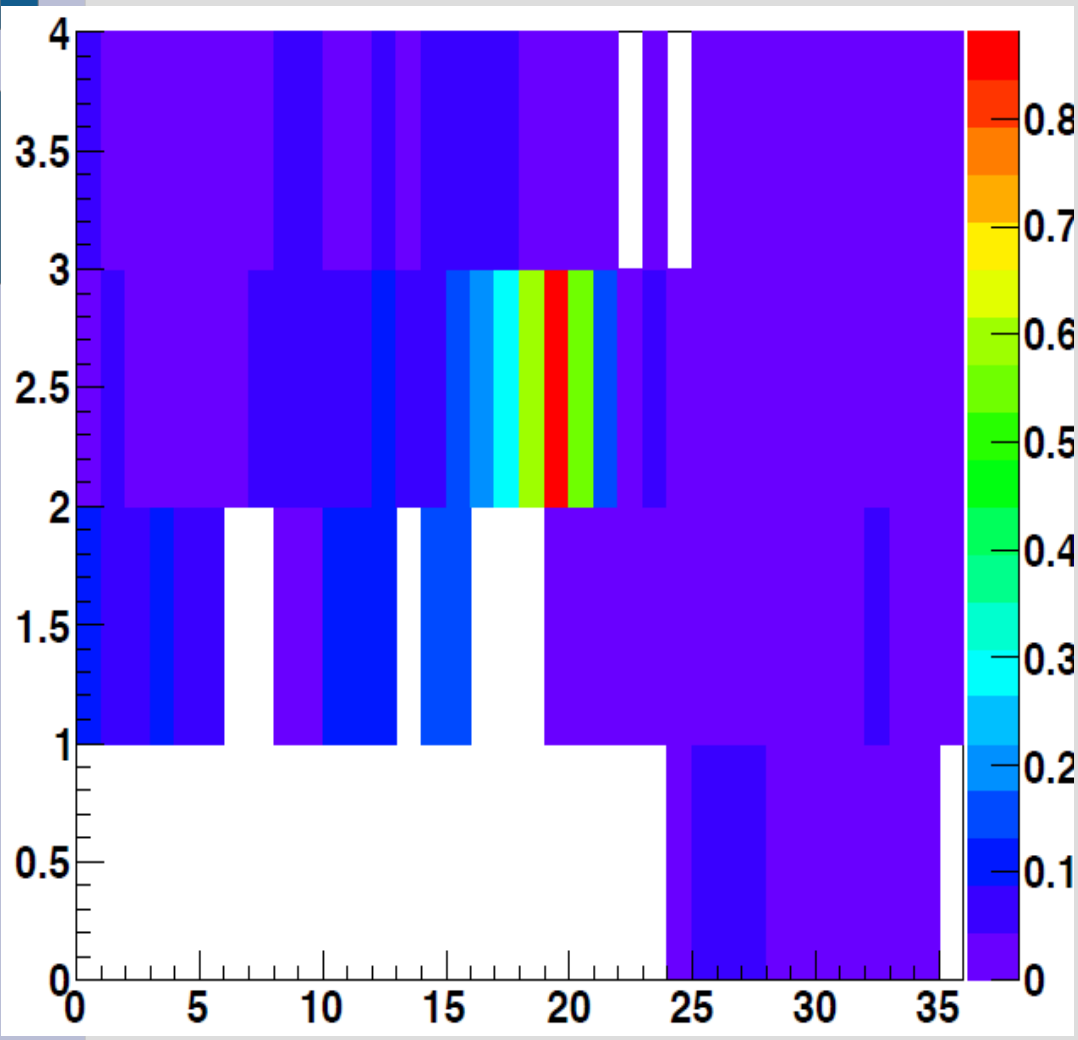
: no signal or large noise

Shower

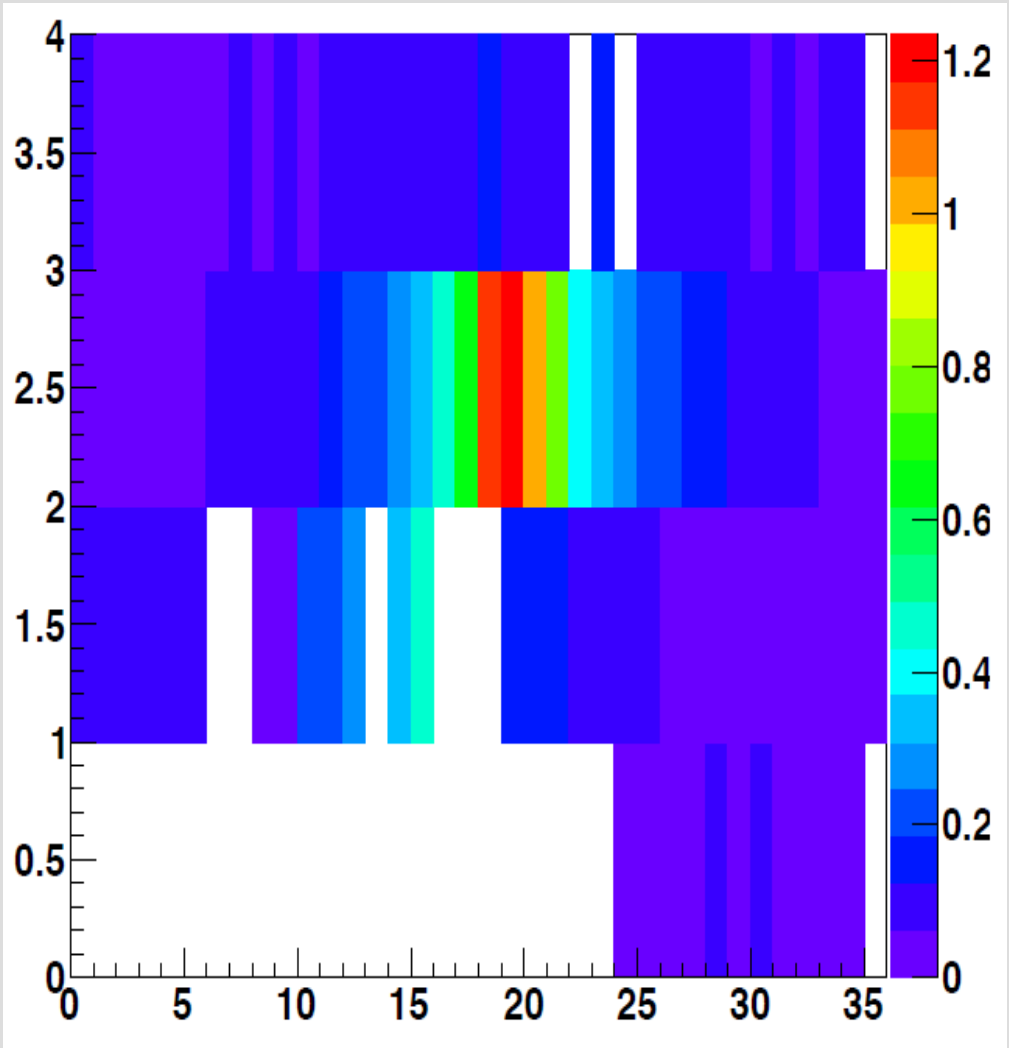


A spread of a shower is measured changing the number of plates of absorber in front of EBU.

MIP count of showers

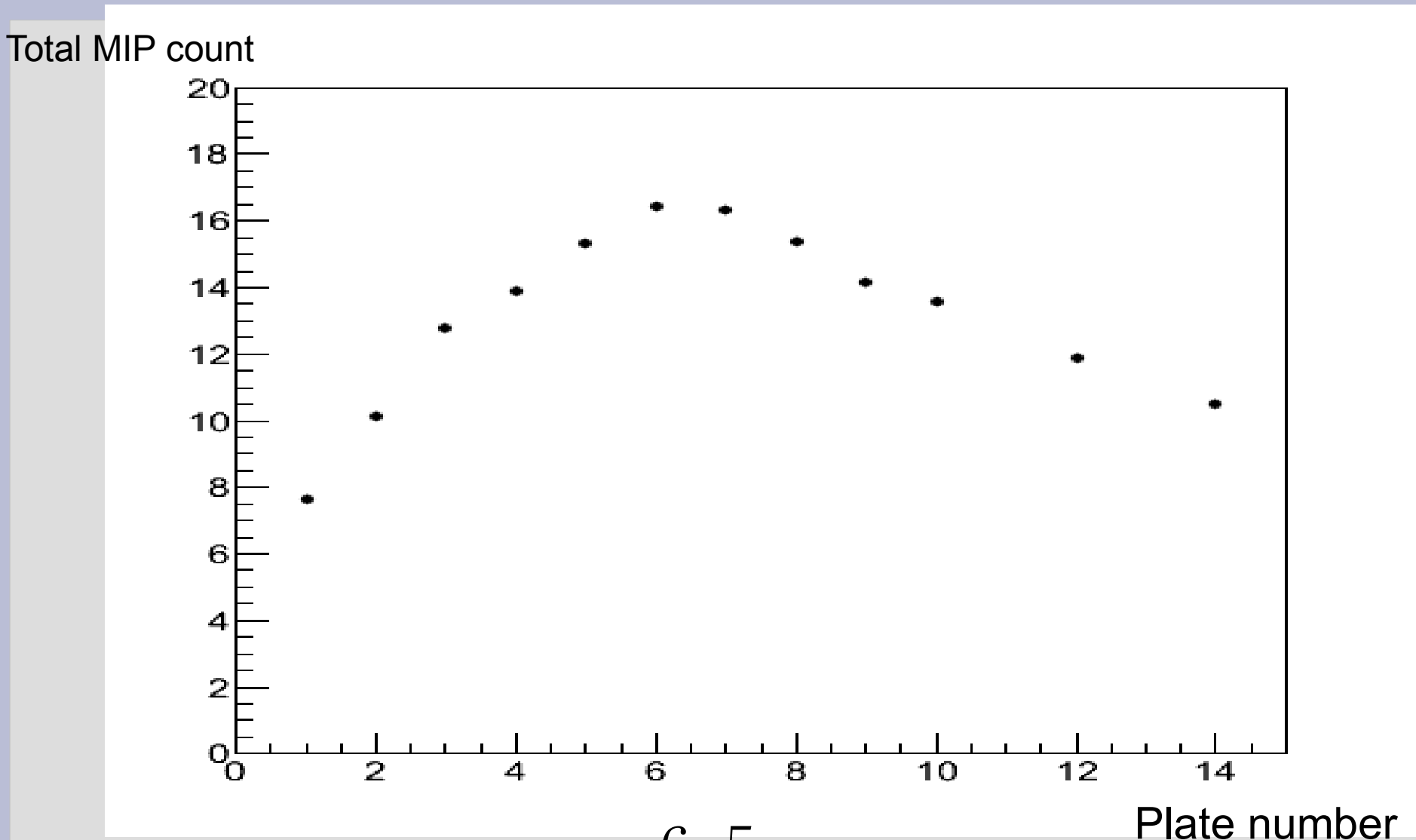


3GeV e-/ 1 absorber



3GeV e-/ 7 absorbers

Change of Total MIP counts by the number of tungsten plates



Summary

- We carried out the commissioning of Technological Prototype using e-beam.

- Number of MIP separable channels is 108 in all 144channels. (75%)
- 17% channels have no signal.
- 8% channels are not MIP separable.

- Number of δ Measurement possible channels is 64.(44%)
- 19%channels dont equip LED.
- Photon peaks of 20%channels are not separable,or have no signal.
- When we apply voltage to LEDs,channels of this area have strange ADC distributions.

- We could observe the shower.

Future plans

- Since a Threshold cannot be set up according to channel, required Threshold is set by changing Gain of PreAmprifier instead.
- The cause of channel have no signal is explored.