SiW ECAL - Test Beam (DESY – July 2012)

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On behalf of the SiW ECAL team

CALICE Calorimeter for ILC

LABORATOIRE DE L'ACCÉLÉRATEUR LINÉAIRE

AGENCE NATIONALE DE LA RECHERCHE ANR

Setup

- wafer 9x9 cm^2, 324 pixels 5x5 mm^2
- 6 FEV8 (4 SKIROCs per FEV)
  - 4 SKIROCs x 64 channels = 256 channels

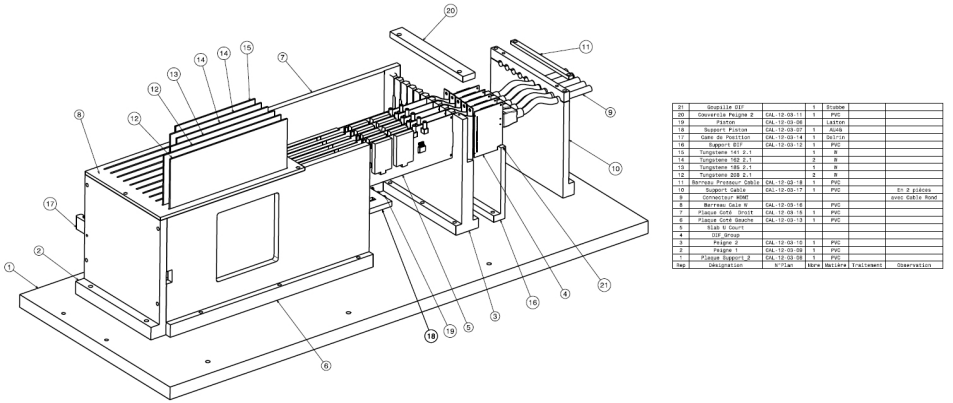
    (2 channels with 2 pixels and 22 channels with 4 pixels)

Total = 1536 channels

PreAmplifiers of noisy channels are switched off

total active channels = 1278

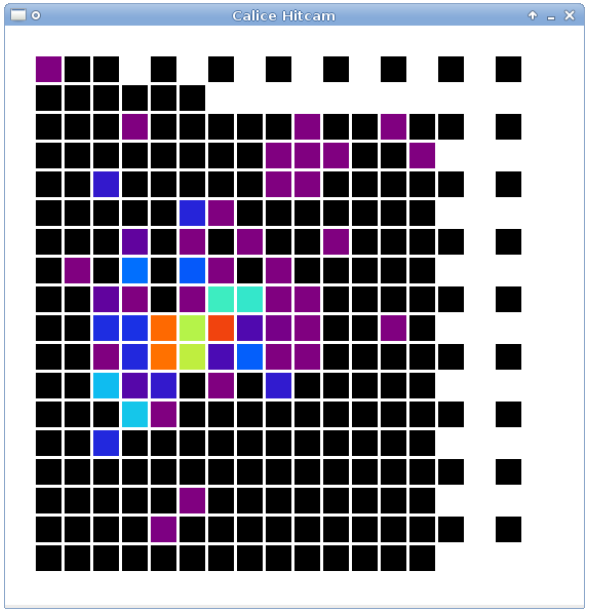
  - Internal trigger only
  - New CCC (see André's talk)
- PVC structure with position for tungsten plates (2.1 mm)

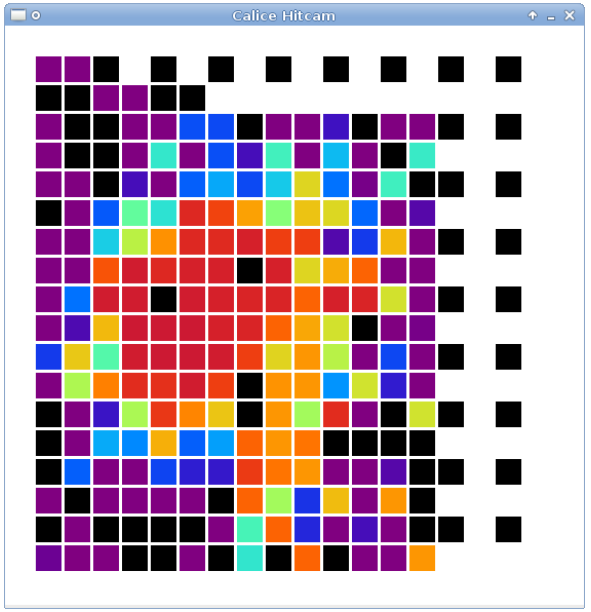


See Mickael, Stéphane and Didier talks

DAQ (see Rémi and Frédéric talks)

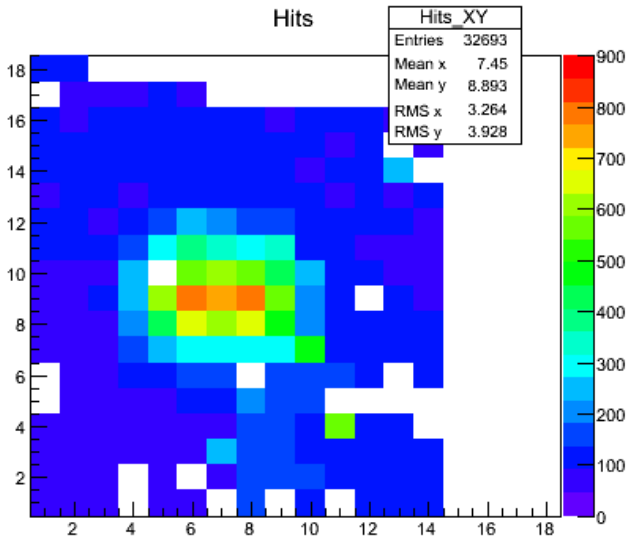
- Up to 6 layers together
- Clean procedure to run an acquisition
  - no crash in one week of data taking
  - few corrupted events
- Remote access for all devices (CCC, LDA, DIF, power supplies, HV...)
  - no access to the beam test area (except to add or remove tungsten plates)
- Online beam monitor
- Python scripts to loop over parameters (calibrations)
- External software needed to create slow control files by hand for each layer



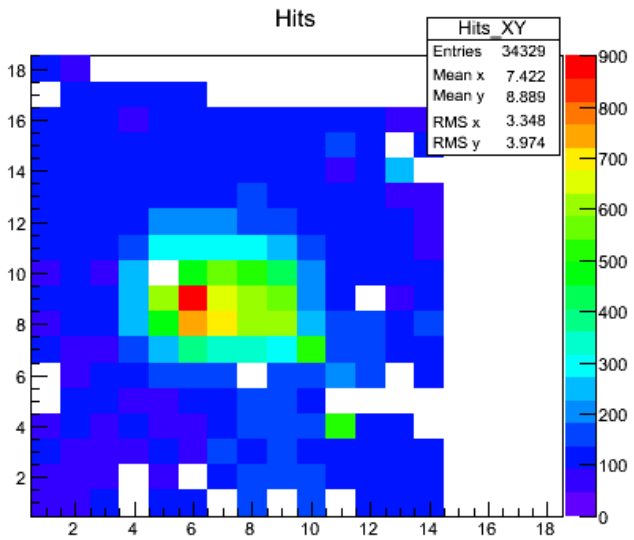


Beam spot

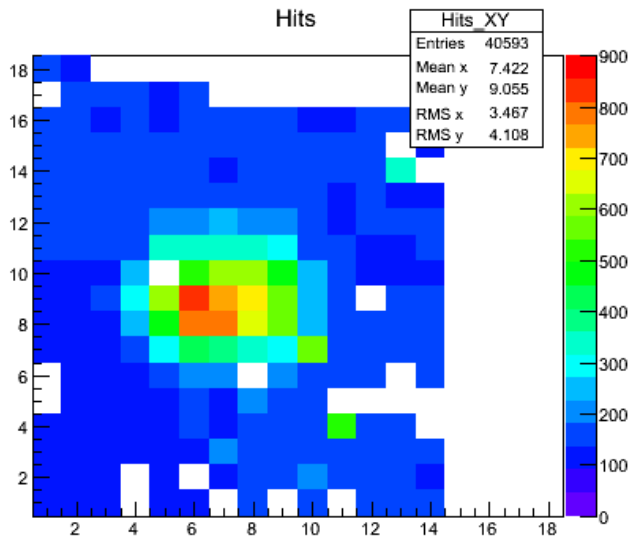
Layer 1

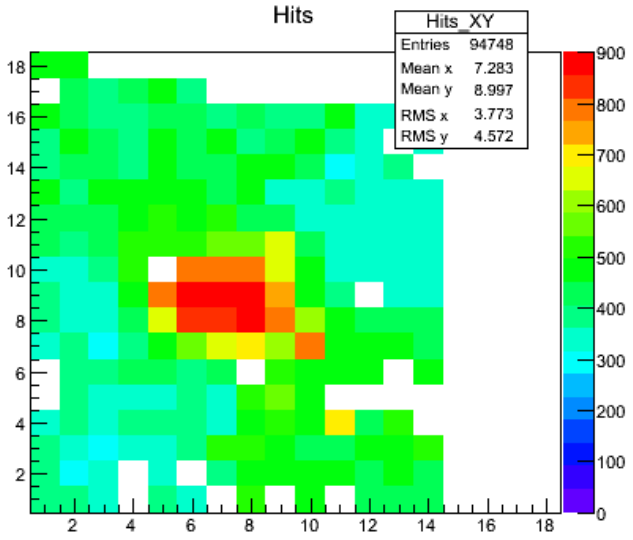


Layer 2

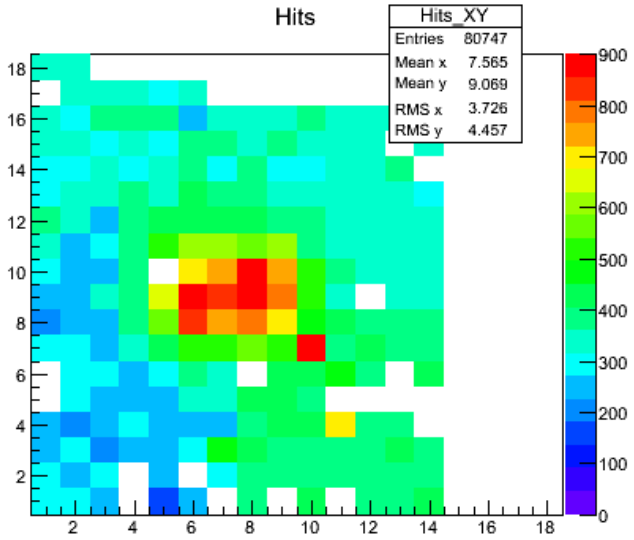


Layer 3

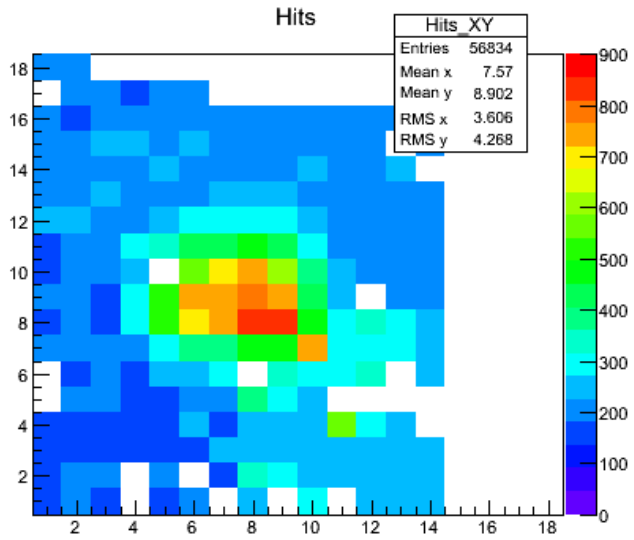




Layer 4



Layer 5



Layer 6

Goals of the test beam (from Roman's talk)

- Main goal: Determine signal over noise ratio of the detector
(Remember: R&D target is 10:1)

- Operate first layers of the technological prototype

- Establishment of calibration procedure for a larger number of cells

- Homogeneity of response (x,y scan of detector)

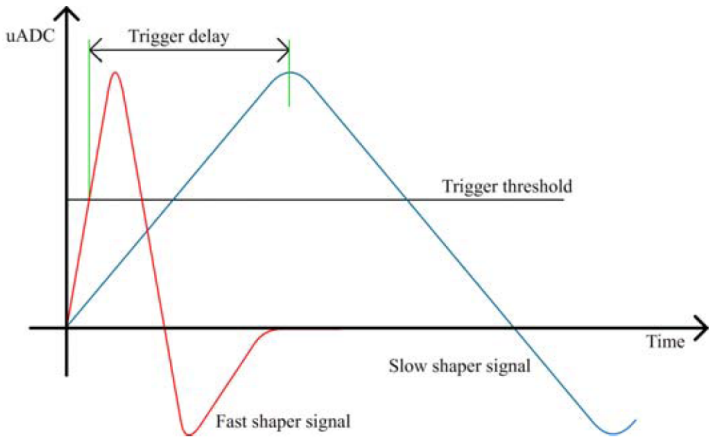
- Small physics program (Electrons between 1-6 GeV, three configurations)

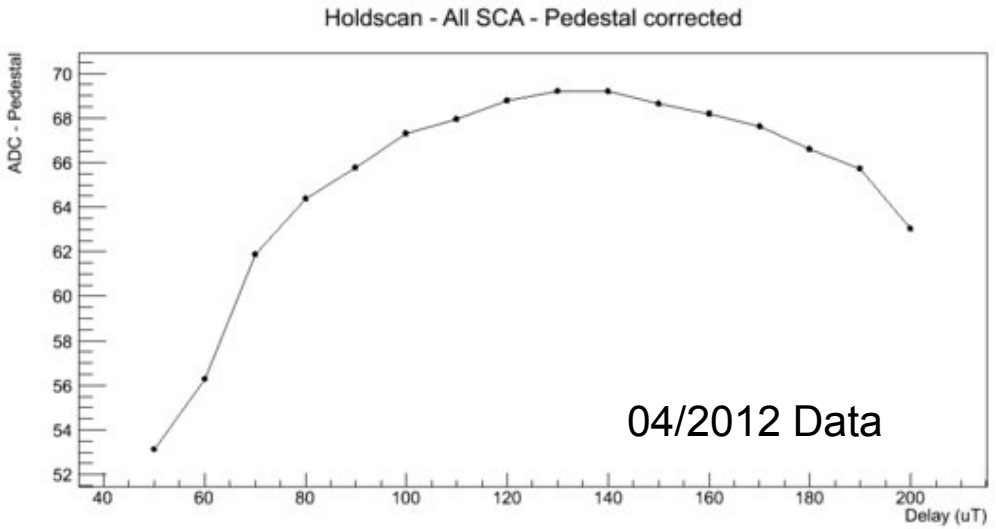
SC settings

- Trigger threshold calibration

  see Jeremy's talk

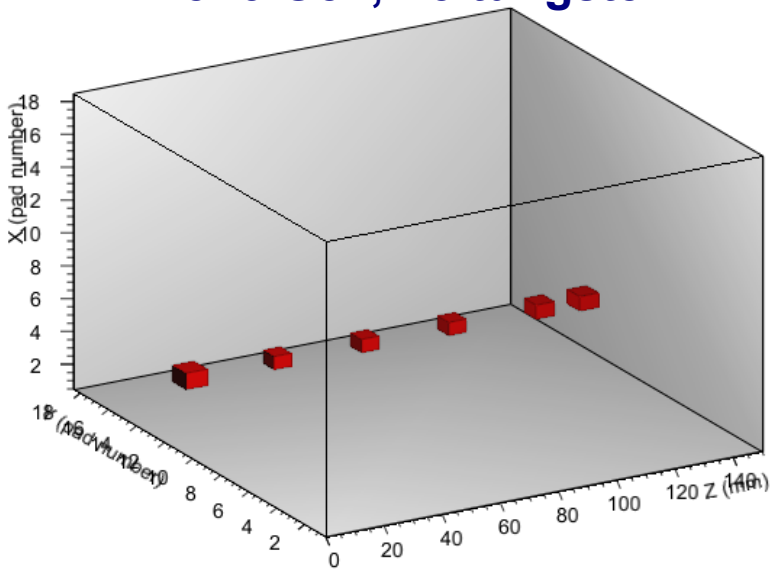
- Trigger delay calibration



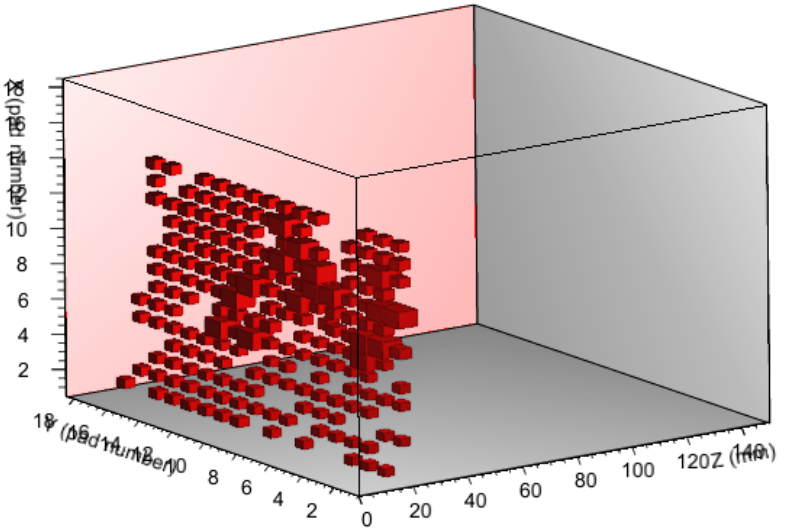


Some events

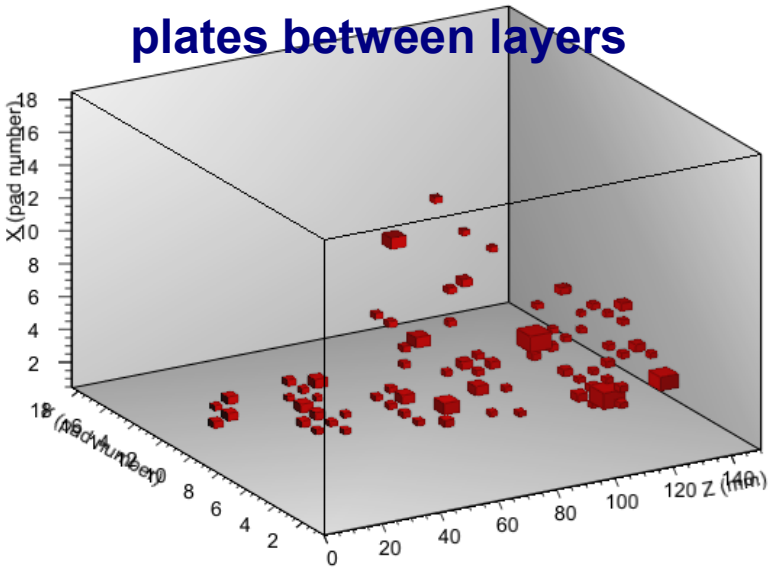
e- 3 GeV, no tungsten



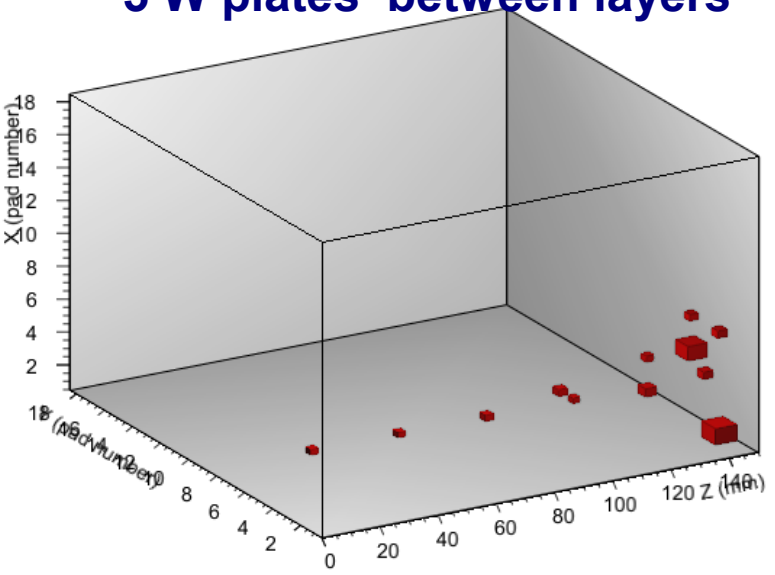
Plane event: a lot of hits in 1 layer



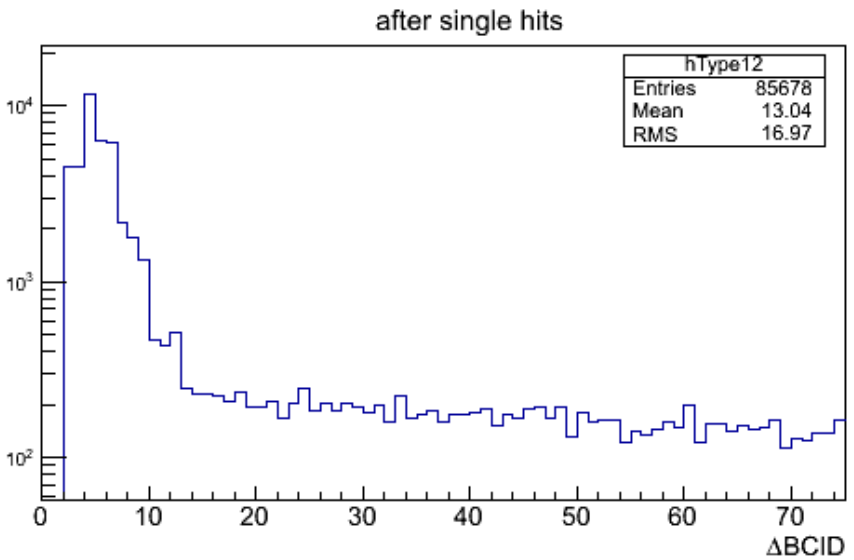
e- 3 GeV
3X0 in front of the detector + 5 W plates between layers

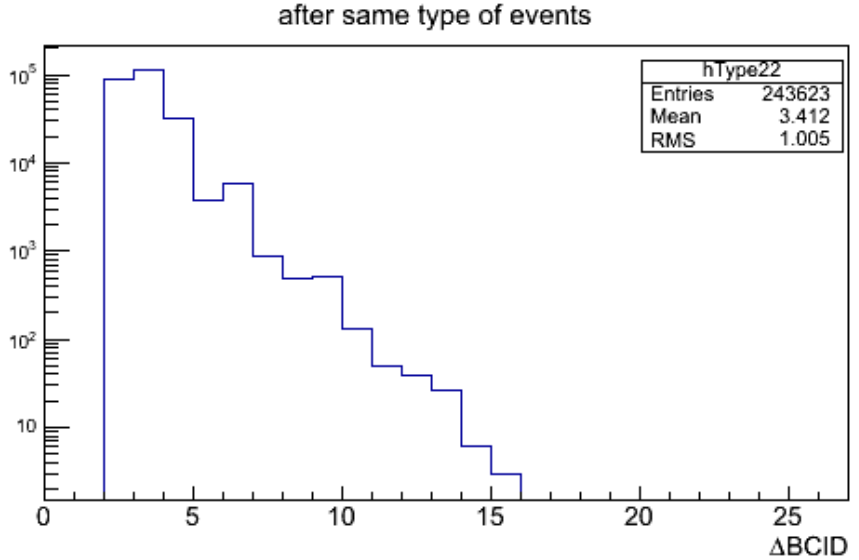


e- 1 GeV
5 W plates between layers

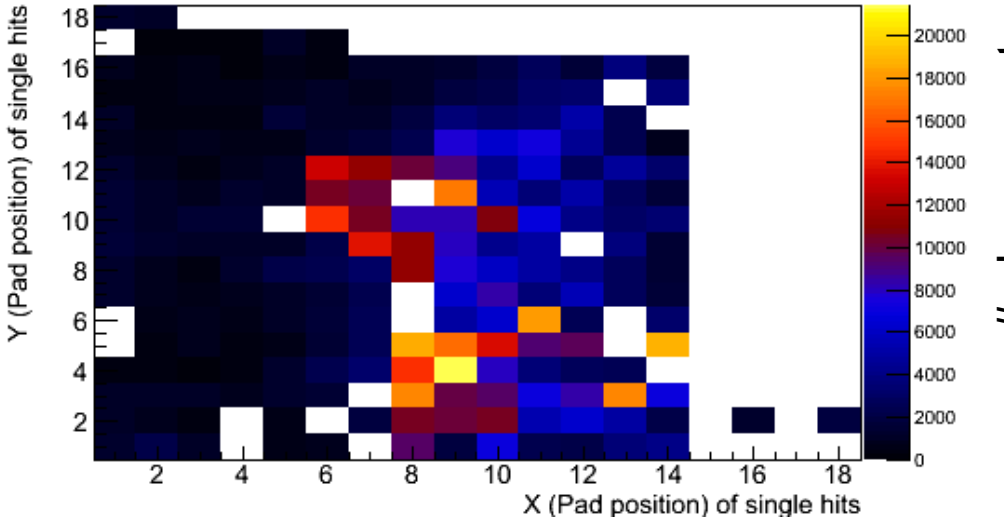


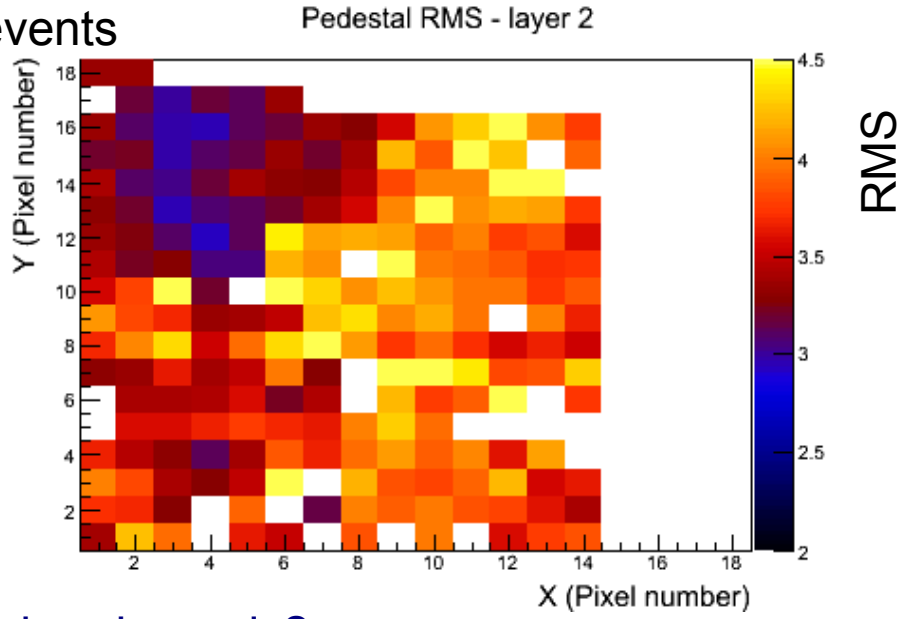
Plane events





~10% of plane events

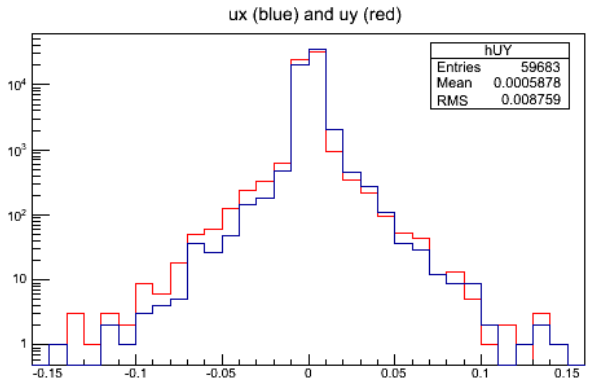




Is it just a map of noisy channels?
Is some channels induced plane events?

Need further investigations!

MIP reconstruction - Beam studies

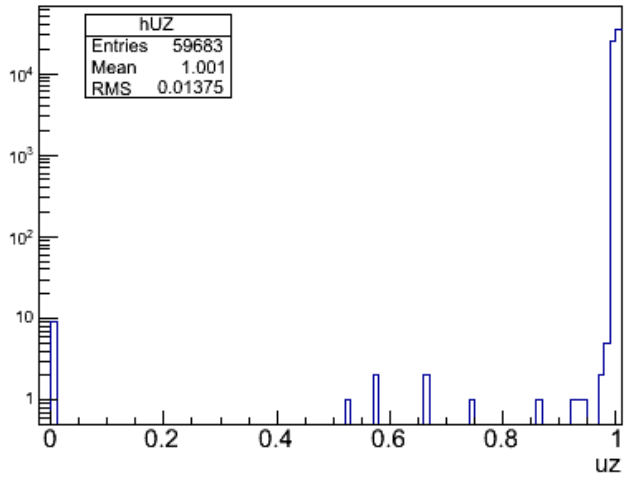


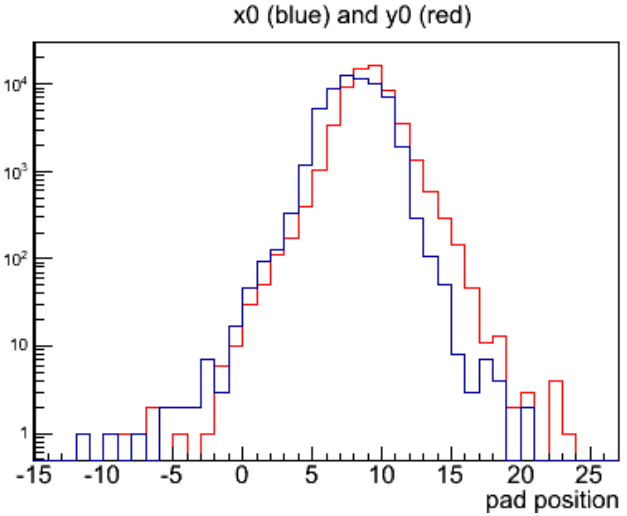
Fit function:

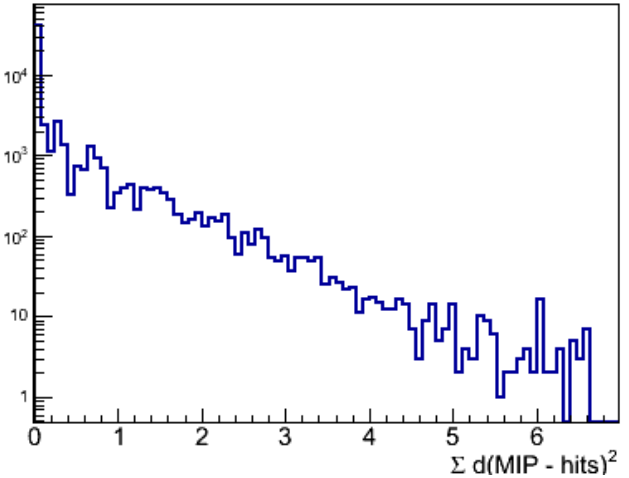
$x = x_0 + k.u_x$

$y = y_0 + k.u_y$

$z = k.u_z$

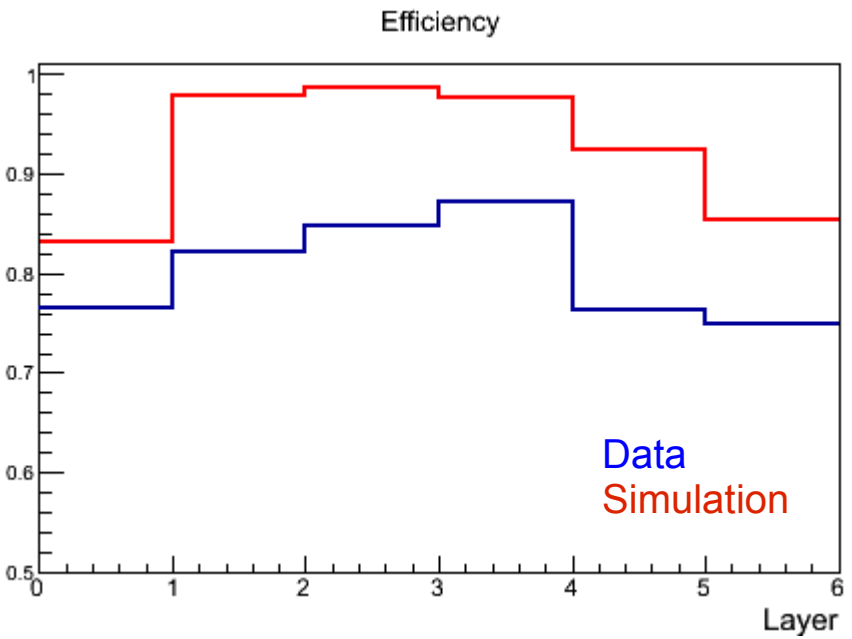


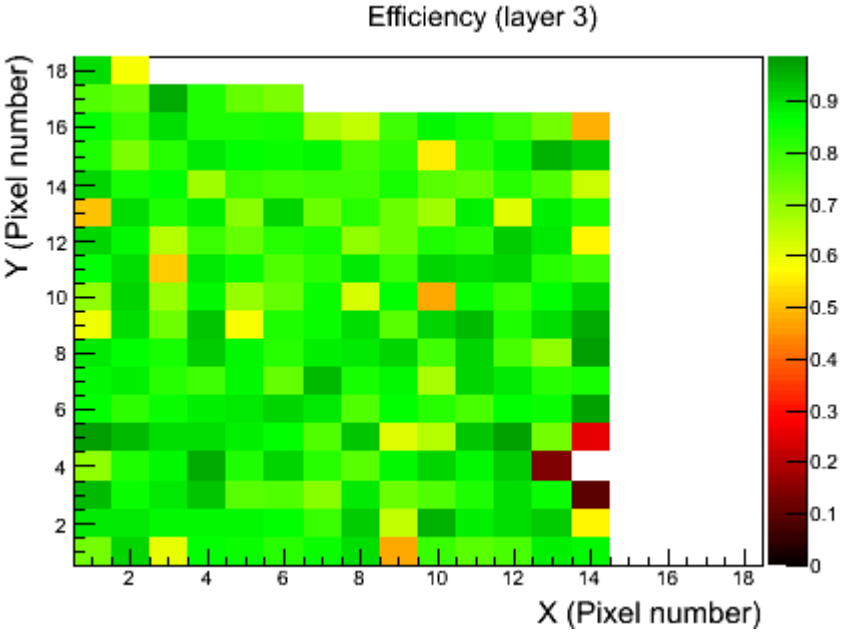




Input for the beam parameters in the simulation

Detection efficiency

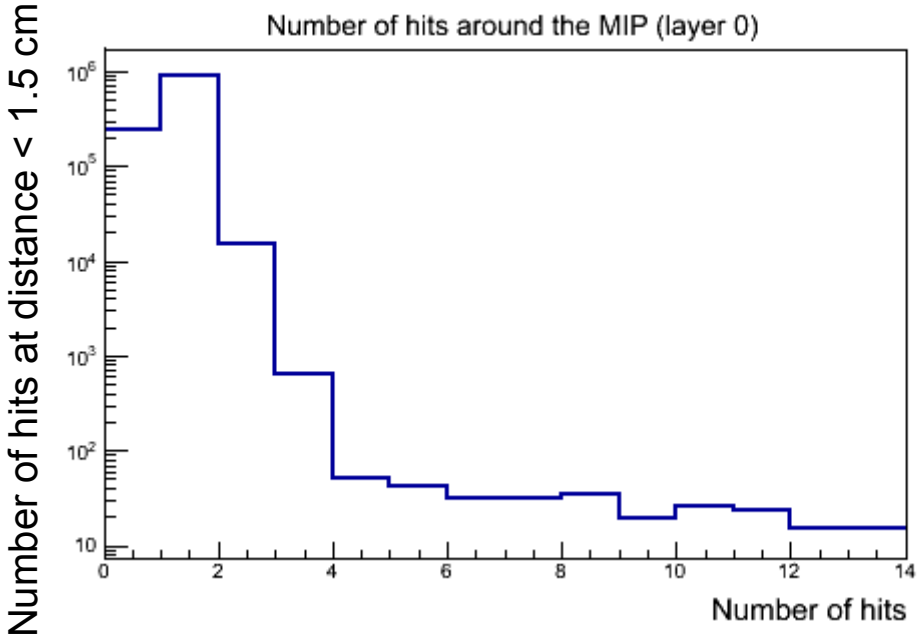


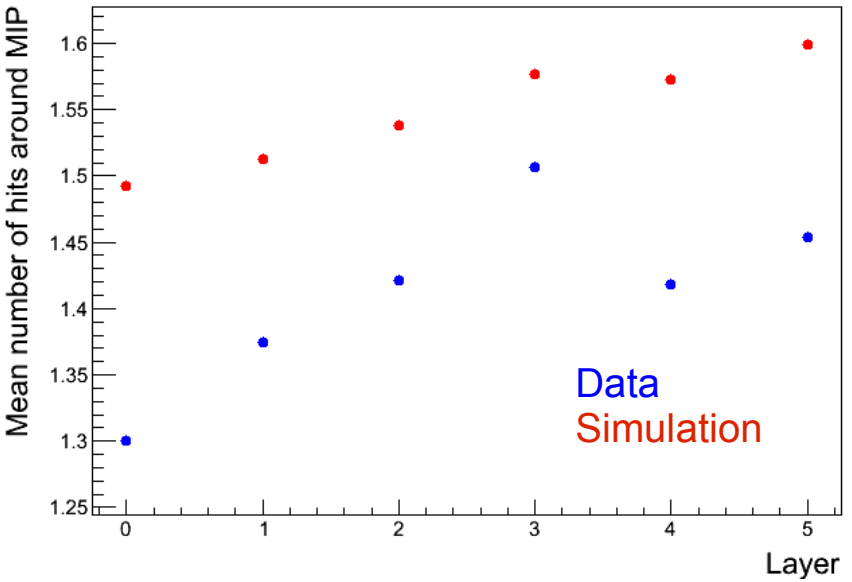


- Low efficiency close to switched off channels
  But some isolated low efficiency channels (to be investigated)
- Efficiency depends on the beam parameters (angle)
  Need real beam parameters in simulation
- Some effects not yet in the simulation (noise, trigger...)

On going analysis!

Number of hits around MIP





- Some effects not yet in the simulation (noise, trigger...)
- Check correlation between the number of hits around MIP and the trigger threshold

On going analysis!

Summary

Successful beam test

- Significant improvements of the DAQ: excellent stability, UI
- Good behavior of the wafers and the electronic (to be check with analysis)

- Analysis in progress:
  - Study of showers
  - Crosstalk, plane events.....
  - Energy calibration + Homogeneity of response
  - Determine signal over noise ratio of the detector

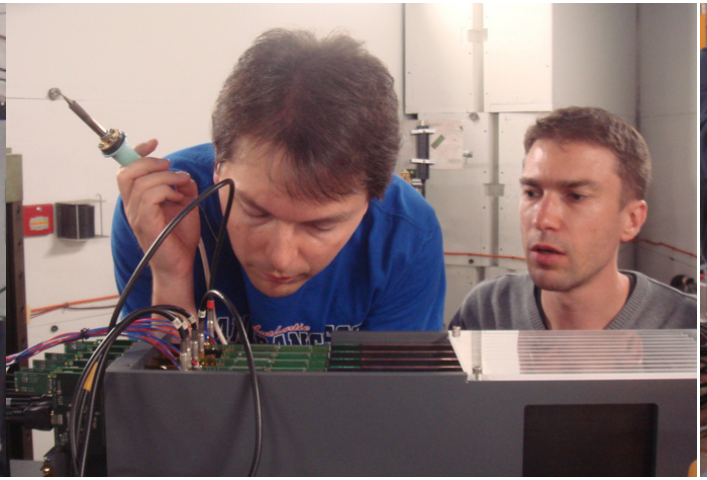
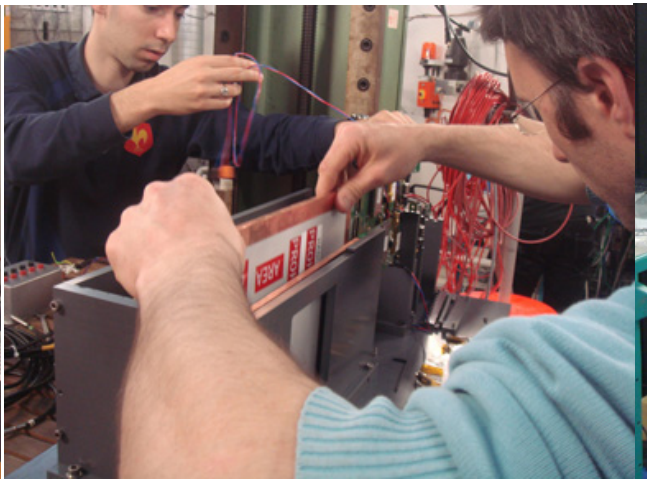
} See Jeremy's talk

- R&D prospects: see the Rémi's talk

Thanks

Special thanks to our experts:

Frédéric, Mickael, Patrick, Rémi and Stéphane


And to everyone who took part in the prepration of the test beam and the data taking:

- Kyushu University, Tokyo University, Nippon Dental University
- LLR, LAL+OMEGA, LPNHE
- SKKU
- Mainz University