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# SiW ECAL - Test Beam (DESY – July 2012)

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On behalf of the SiW ECAL team

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

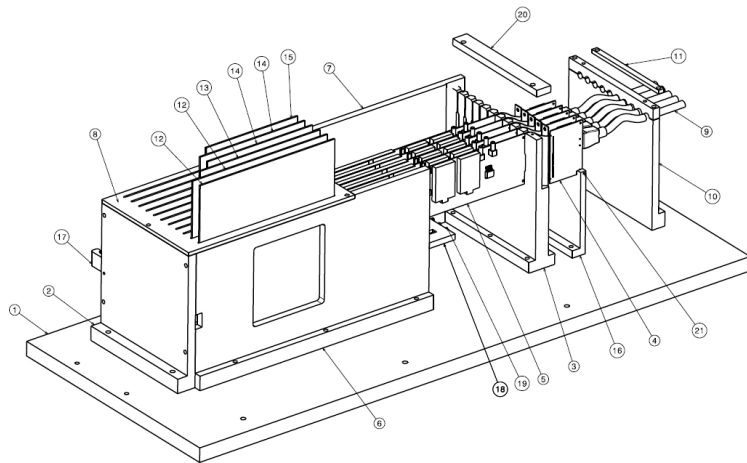
Special thanks to the electronic and DAQ experts:  
**Stéphane Callier, Rémi Cornat and Frédéric Magniette**

# Setup

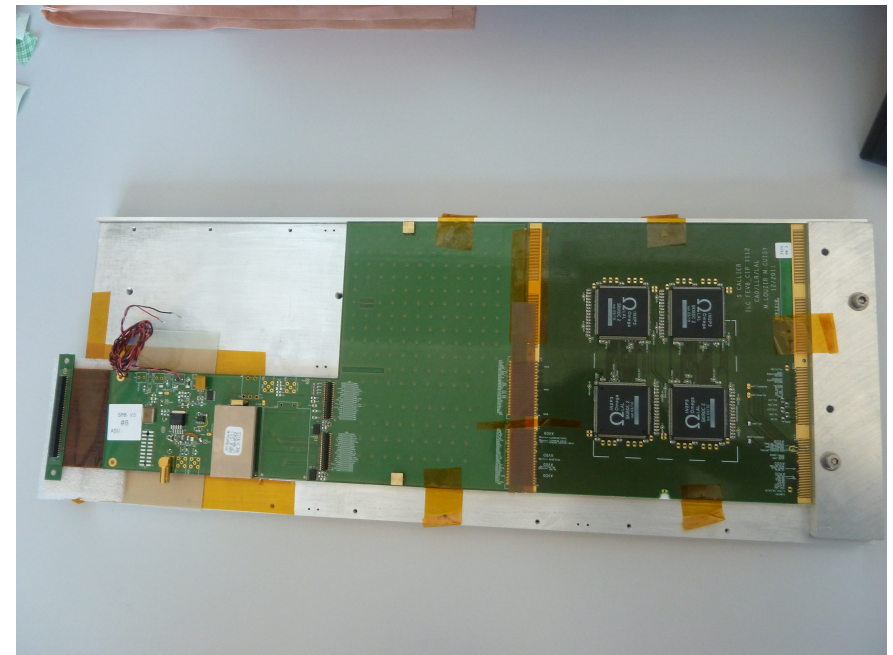
- wafer 9x9 cm<sup>2</sup>, 324 pixels 5x5 mm<sup>2</sup>
- 6 FEV8 (4 SKIROCs per FEV)
  - 4 SKIROCs x 64 channels = 256 channels  
(2 channels with 2 pixels and 22 channels with 4 pixels)

**Total = 1536 channels**

- PVC structure with position for tungsten plates (2.1 mm)

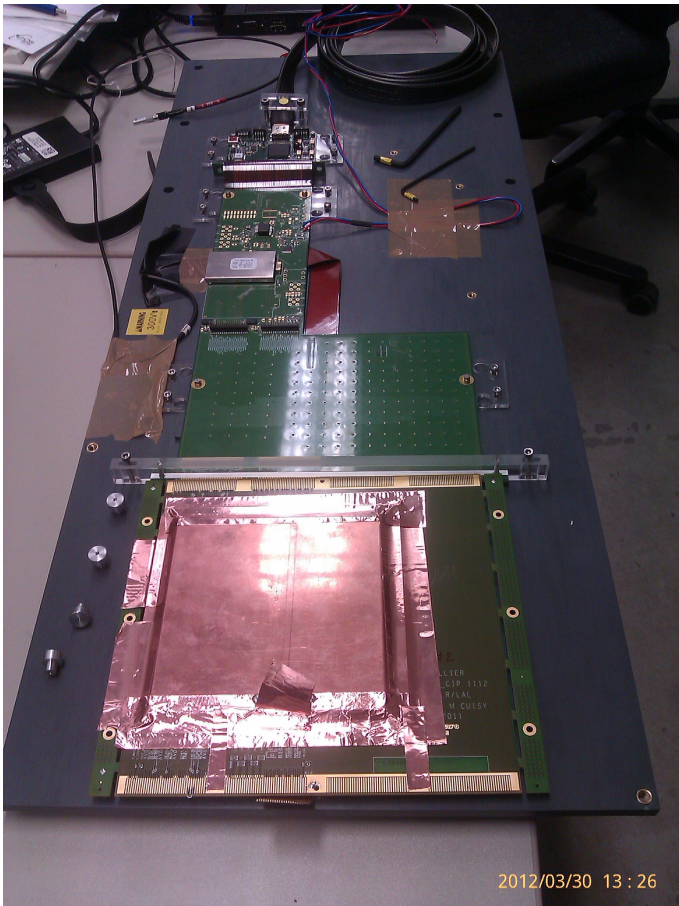


|     |                         |              |   |           |  |  |
|-----|-------------------------|--------------|---|-----------|--|--|
| 21  | Supporter BIP           | CAL-12-03-13 | 1 | Supporter |  |  |
| 22  | Conversion Feuille 2    | CAL-12-03-13 | 1 | Feuille   |  |  |
| 23  | Plaque                  | CAL-12-03-08 | 1 | Plaque    |  |  |
| 24  | Support Plaque          | CAL-12-03-07 | 1 | Support   |  |  |
| 25  | Cable de connexion      | CAL-12-03-14 | 1 | Cable     |  |  |
| 26  | Support Feuille         | CAL-12-03-13 | 1 | Support   |  |  |
| 27  | Tungstène 141 2.1       |              | 1 | M         |  |  |
| 28  | Tungstène 188 2.1       |              | 2 | M         |  |  |
| 29  | Tungstène 188 2.1       |              | 1 | M         |  |  |
| 30  | Tungstène 188 2.1       |              | 2 | M         |  |  |
| 31  | Barreau Protocole Cable | CAL-12-03-18 | 1 | Feuille   |  |  |
| 32  | Support Cable           | CAL-12-03-17 | 1 | Feuille   |  |  |
| 33  | Connecteur BIP          |              |   |           |  |  |
| 34  | Barreau Cable M         | CAL-12-03-12 | 1 | Feuille   |  |  |
| 35  | Plaque Carte Shield     | CAL-12-03-13 | 1 | Feuille   |  |  |
| 36  | Plaque Carte Shield     | CAL-12-03-13 | 1 | Feuille   |  |  |
| 37  | Plaque Carte Shield     |              |   |           |  |  |
| 38  | Plaque Carte Shield     |              |   |           |  |  |
| 39  | Plaque Carte Shield     |              |   |           |  |  |
| 40  | Plaque Carte Shield     |              |   |           |  |  |
| 41  | Plaque Carte Shield     |              |   |           |  |  |
| 42  | Plaque Carte Shield     |              |   |           |  |  |
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| 44  | Plaque Carte Shield     |              |   |           |  |  |
| 45  | Plaque Carte Shield     |              |   |           |  |  |
| 46  | Plaque Carte Shield     |              |   |           |  |  |
| 47  | Plaque Carte Shield     |              |   |           |  |  |
| 48  | Plaque Carte Shield     |              |   |           |  |  |
| 49  | Plaque Carte Shield     |              |   |           |  |  |
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| 51  | Plaque Carte Shield     |              |   |           |  |  |
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| 53  | Plaque Carte Shield     |              |   |           |  |  |
| 54  | Plaque Carte Shield     |              |   |           |  |  |
| 55  | Plaque Carte Shield     |              |   |           |  |  |
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| 75  | Plaque Carte Shield     |              |   |           |  |  |
| 76  | Plaque Carte Shield     |              |   |           |  |  |
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| 80  | Plaque Carte Shield     |              |   |           |  |  |
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| 92  | Plaque Carte Shield     |              |   |           |  |  |
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| 94  | Plaque Carte Shield     |              |   |           |  |  |
| 95  | Plaque Carte Shield     |              |   |           |  |  |
| 96  | Plaque Carte Shield     |              |   |           |  |  |
| 97  | Plaque Carte Shield     |              |   |           |  |  |
| 98  | Plaque Carte Shield     |              |   |           |  |  |
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| 100 | Plaque Carte Shield     |              |   |           |  |  |

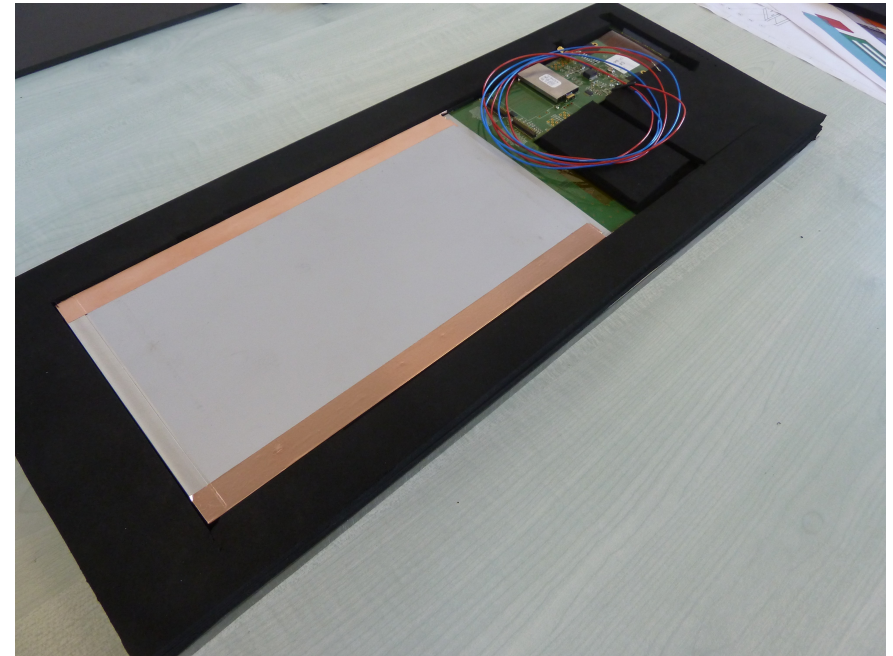


# Improvements since April 2012

Test beam - April 2012



Test beam - July 2012



Epoxy U-structure  
Alu cover  
Wedges...

Improvement of the layer

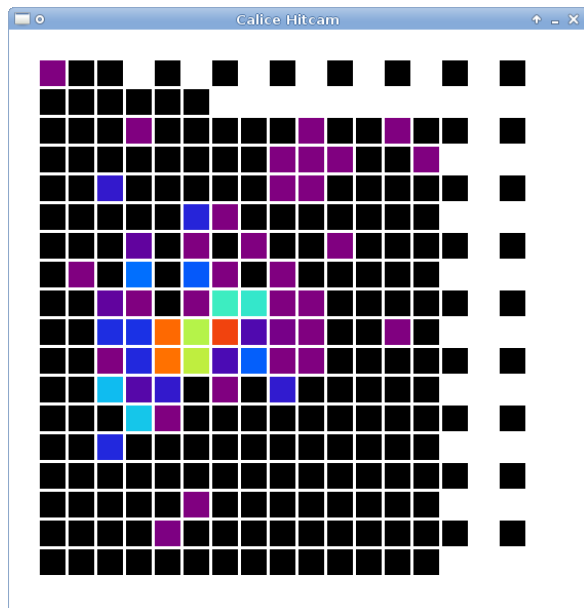


Noise reduction  
Easier handling

# Improvements since April 2012

## DAQ:

- 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



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

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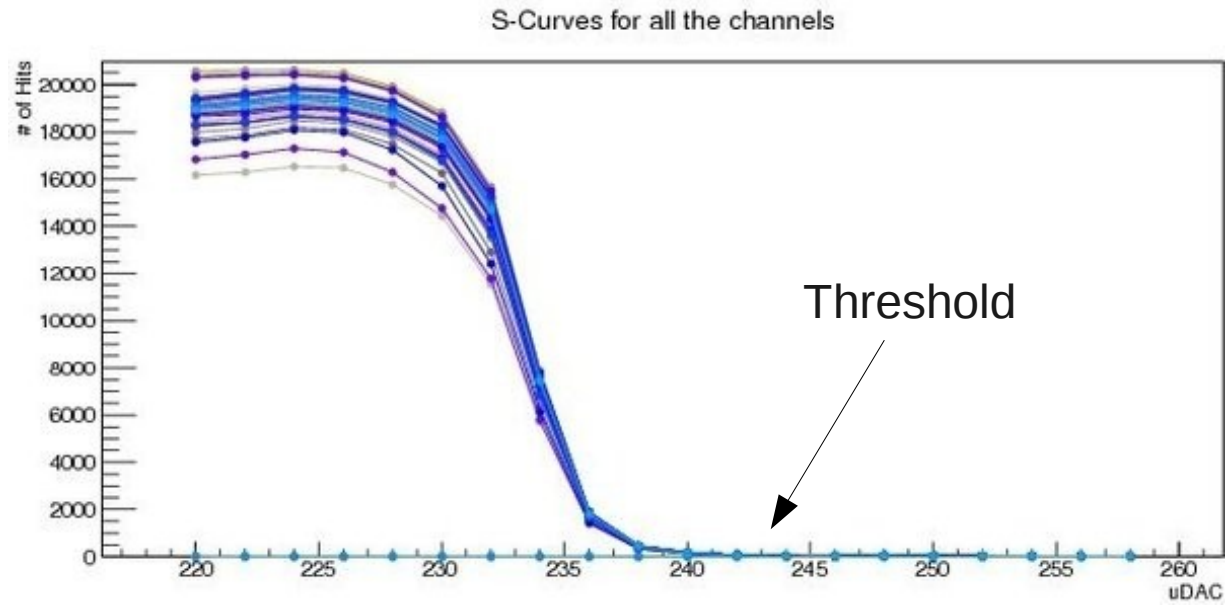
- **Main goal: Determine signal over noise ratio of the detector**

Remember: R&D target is 10:1

- 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

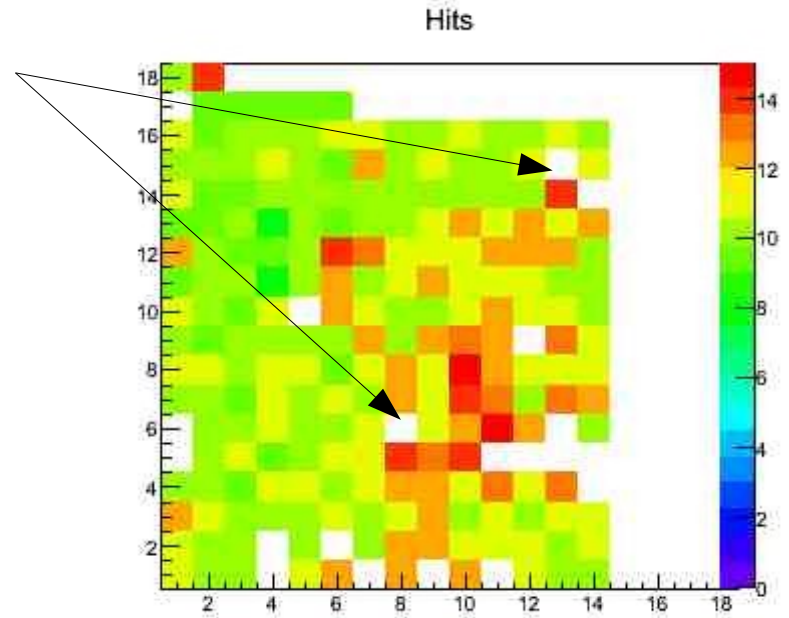


# Trigger threshold calibration



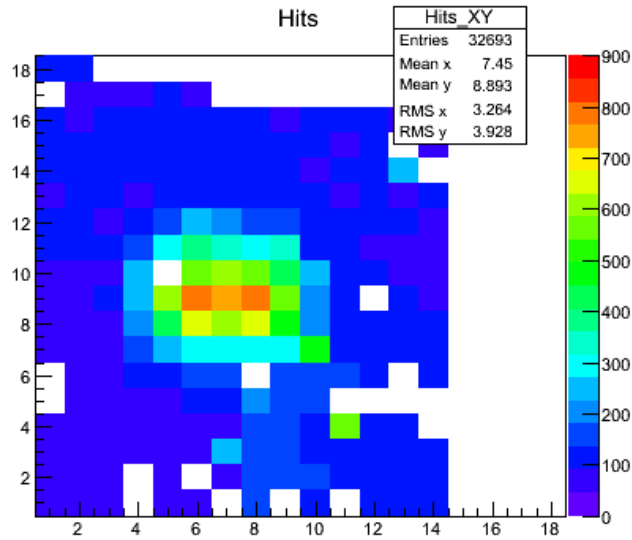
Range of the channel by channel threshold adjustment is too small:

- One threshold by ASIC
- PreAmplifiers of noisy channels are switched off  
total active channels = 1278

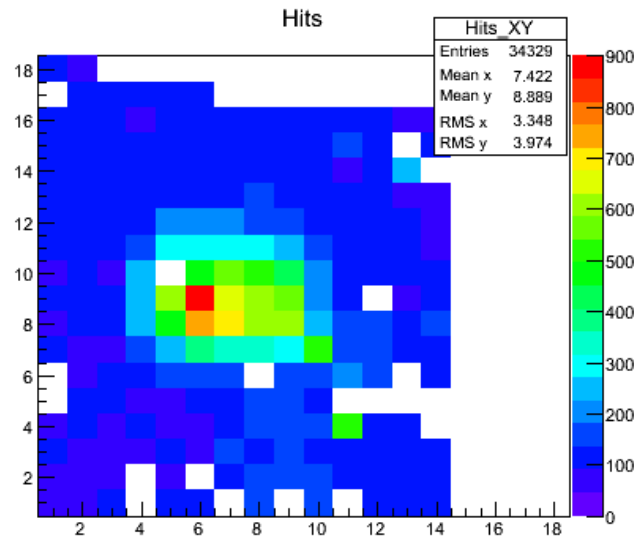


# Beam spot

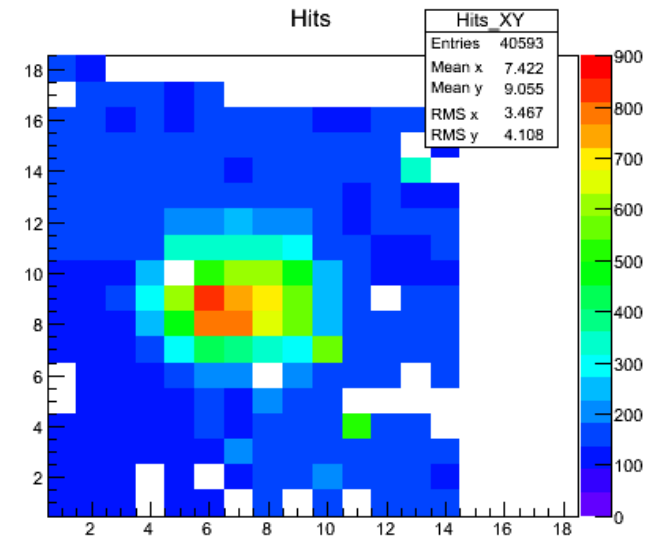
Layer 1



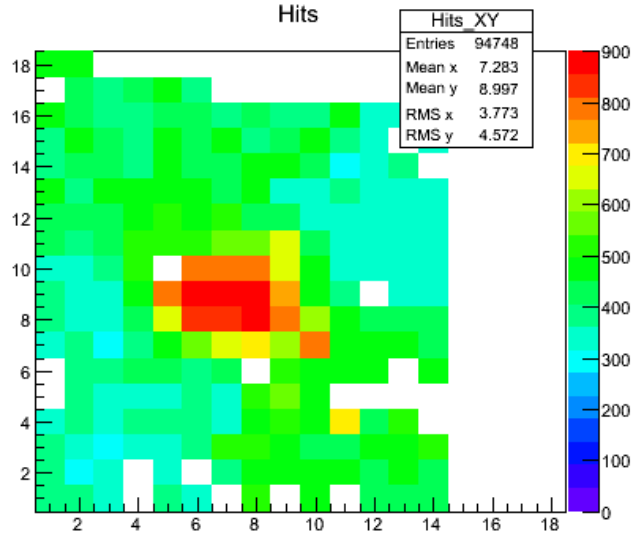
Layer 2



Layer 3

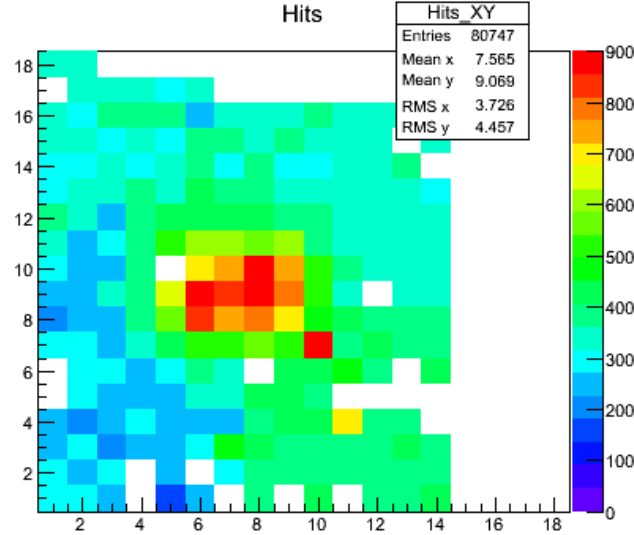


Hits



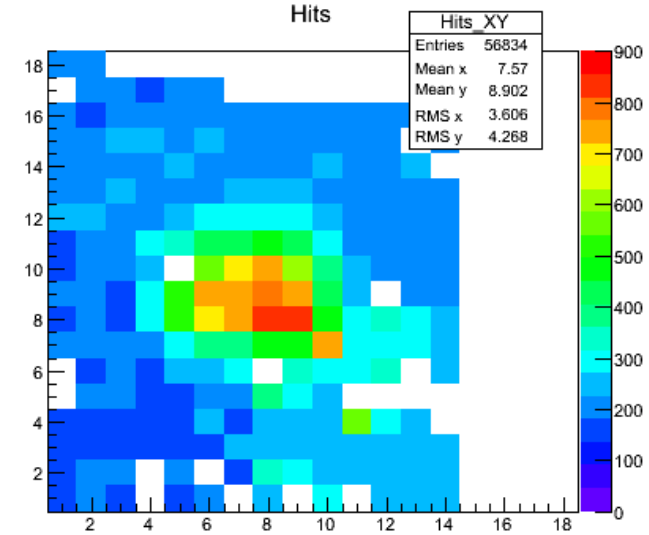
Layer 4

Hits



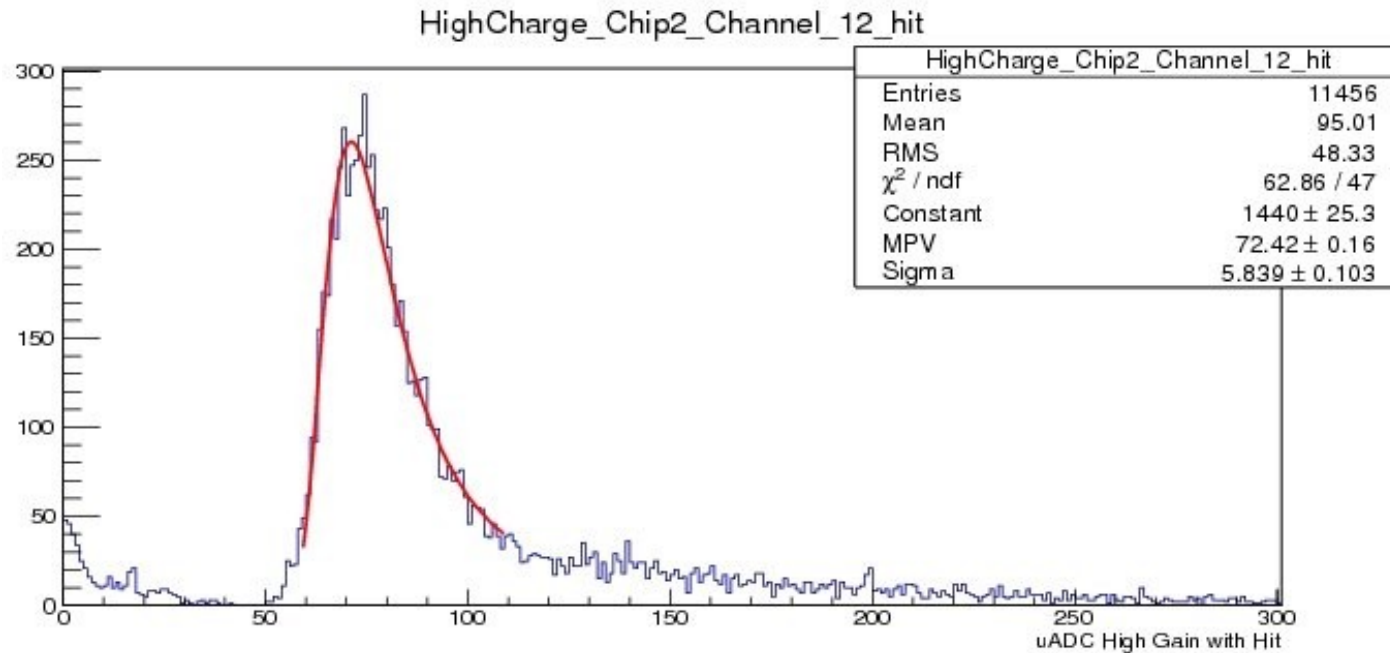
Layer 5

Hits

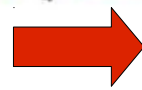
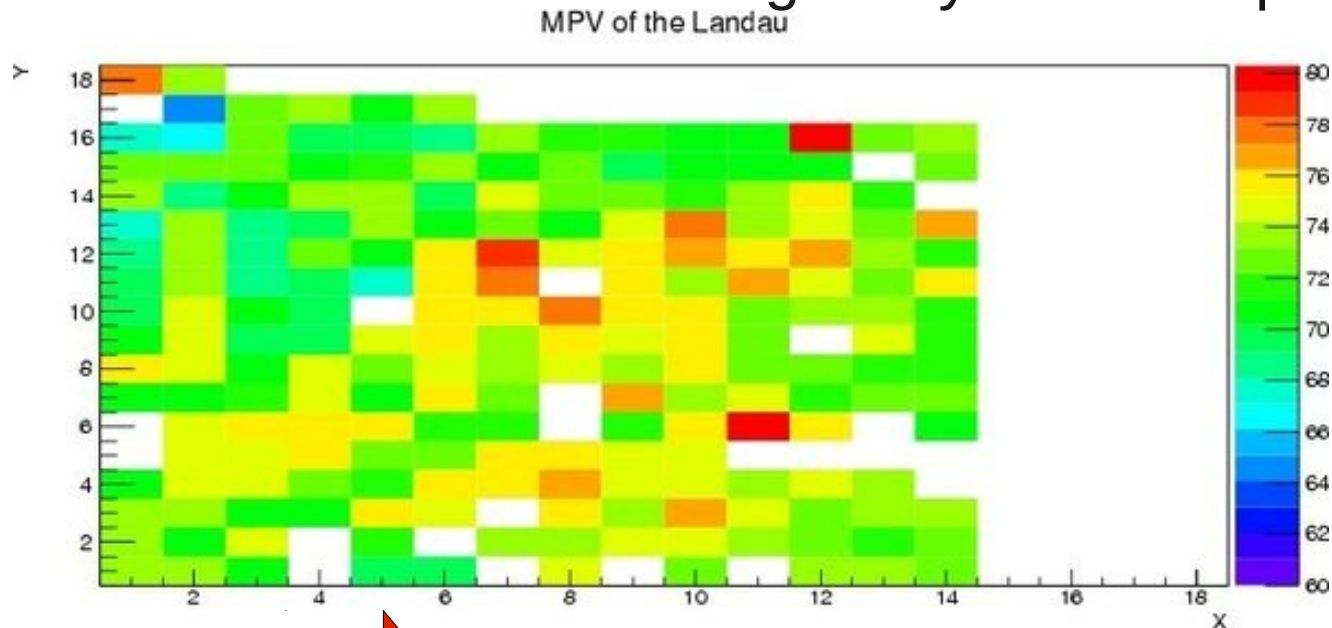


Layer 6

# Energy calibration



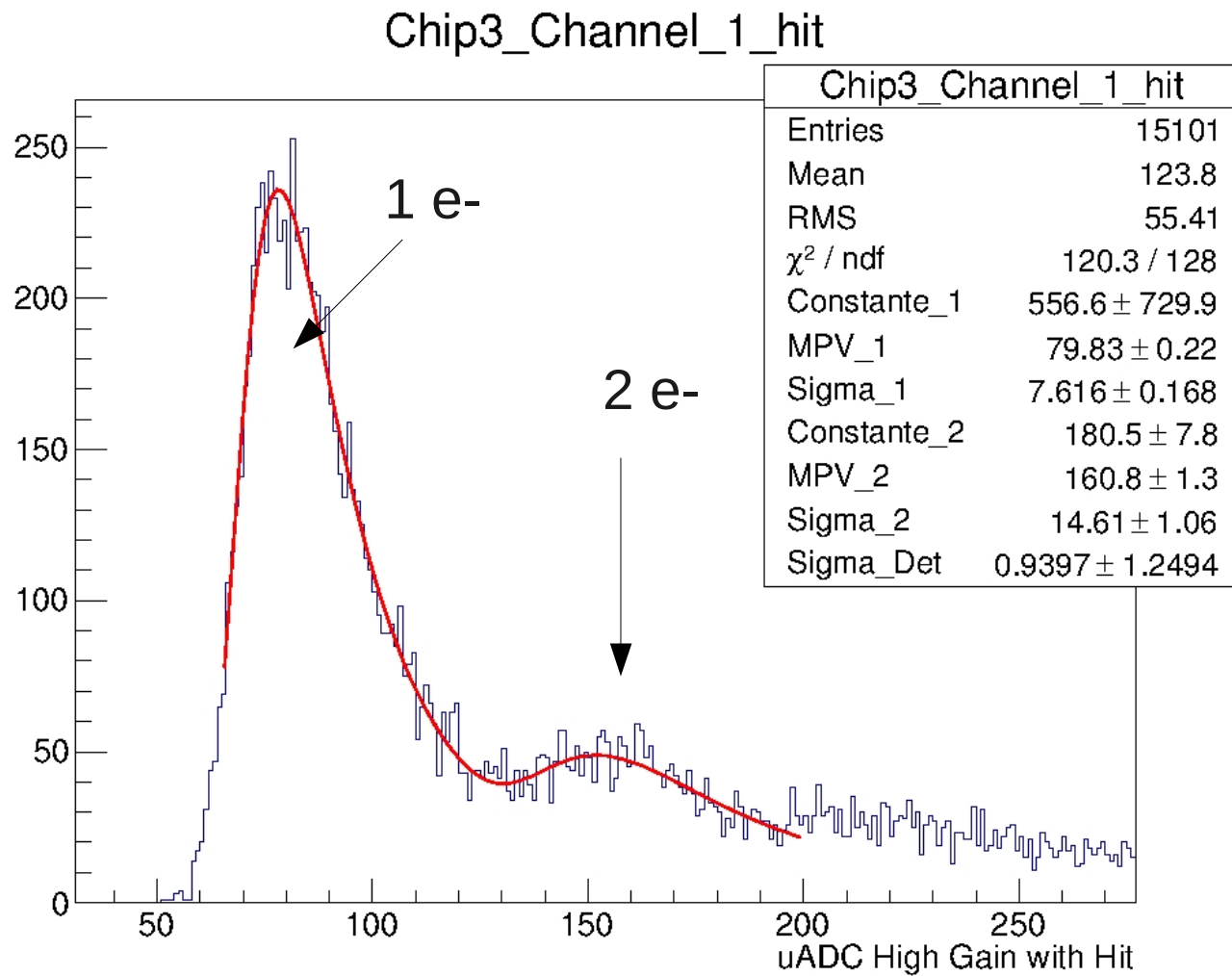
XY Scan to check the homogeneity of the response



Calibration of the 6 layers

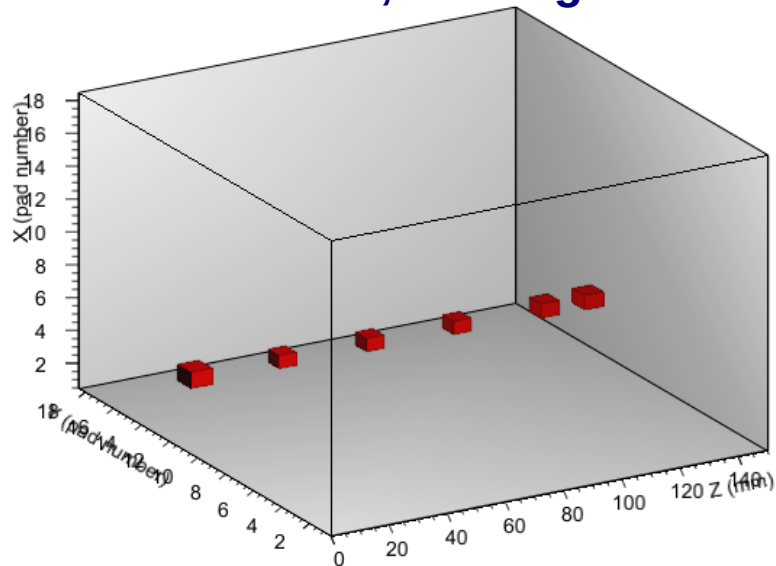


# MIP peaks

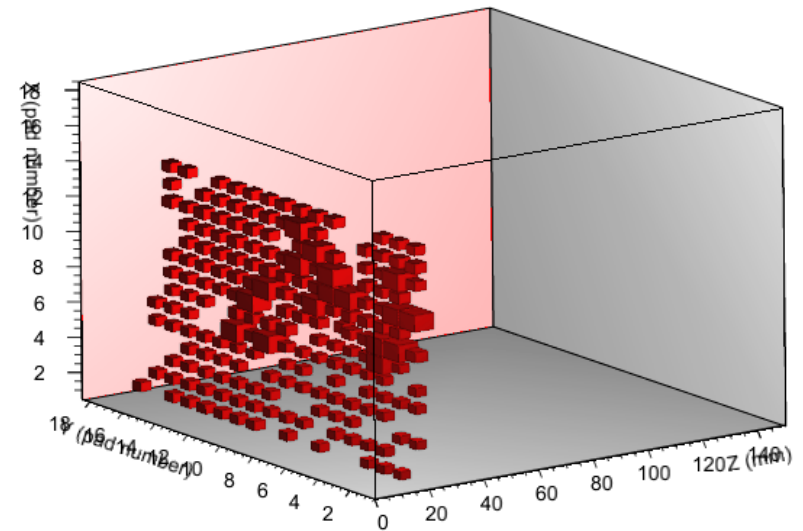


# Some events

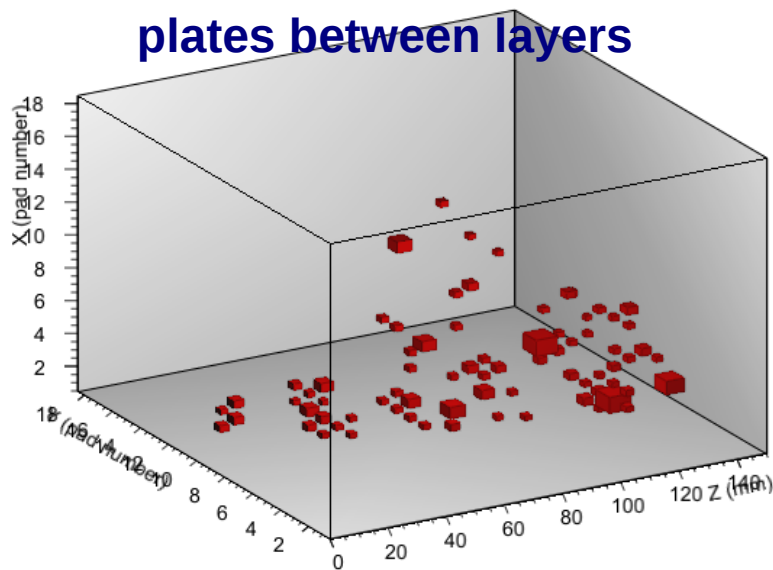
**e- 3 GeV, no tungsten**



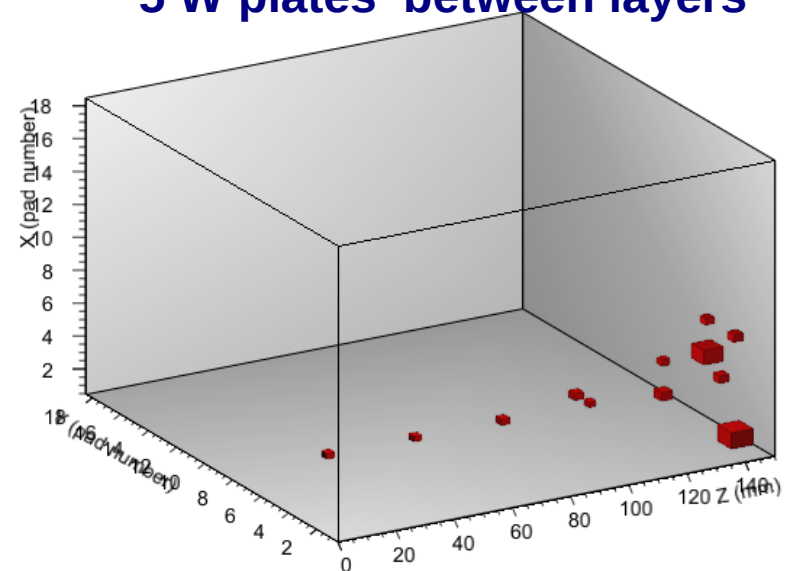
**Event with a lot of hits in 1 layer**



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



**e- 1 GeV  
5 W plates between layers**



# Summary

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## 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:
  - Determine signal over noise ratio of the detector  
 **$S/N = \sim 10-20$  in function of the gain (min to max)**
  - Energy calibration + Homogeneity of response
  - Study of showers
  - Crosstalk, events with a lot of hits.....

Next test beam in november?:

- Improvement of the channel by channel threshold ajustement (SKIROC)
- Power pulsing tests
- Test with magnetic field