

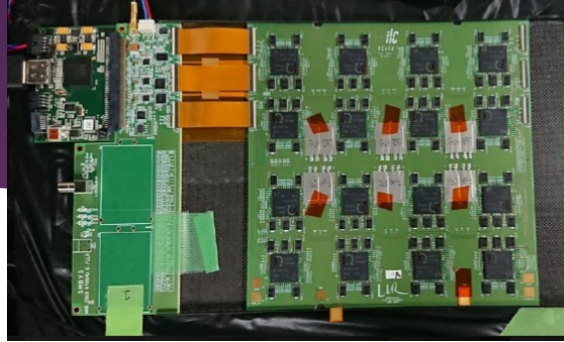
ILD Detector Meeting - Test beam Analysis

SHUSAKU TSUMURA

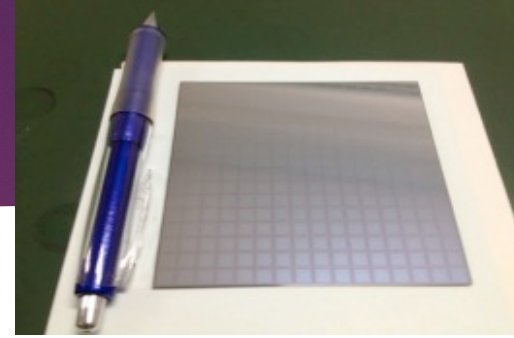
FEV boards and readout system



FEV10-12



FEV13



Si Pad Sensor

Readout system



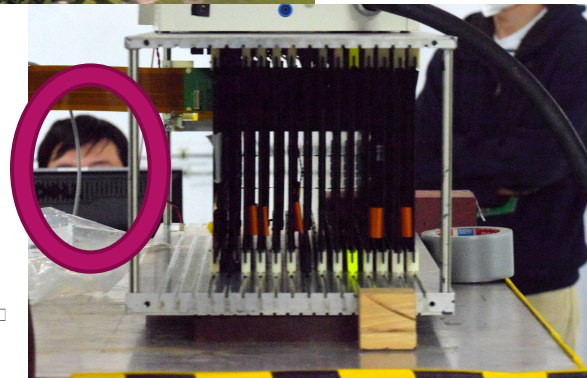
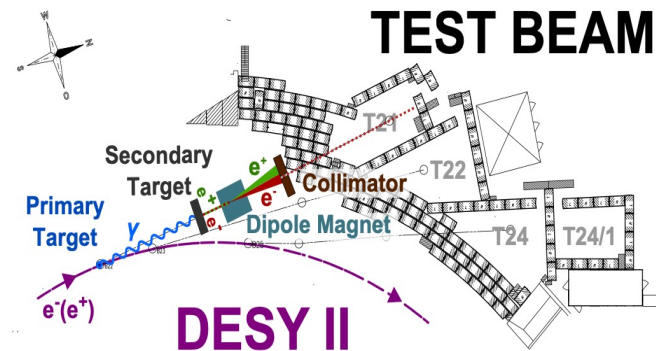
In the detection layer, the sensor part and the preamplifier must be close and the whole must be compact.
SL board

- FEV board
- ▶ Application-specific integrated circuits (ASICs) are mounted on a printed circuit board, on which a silicon pad sensor is bonded with a conductive adhesive to act as a sensor.
Channel : 64 channels * 16 chips
- ▶ SL board
Interface card for connecting the FEV board to the readout circuit
- Readout system
- ▶ Consists of CORE-MOTHER and CORE-Daughter to achieve a compact readout circuit

German Electron Synchrotron (DESY)/DESY II

3

- ▶ Germany/Hamburg
High Energy Accelerator and High Energy Physics Laboratory
- ▶ DESY II :
1-6 GeV electron beam is available by accelerating the beam from LINAC with PIA
- ▶ Using beamline T-22
- ▶ Beamline period:
11/1-7 MIP measurements without W-absorber
11/8-14 Performance evaluation with W-absorber inserted -> I joined the beam test from the second week and did the setup etc.



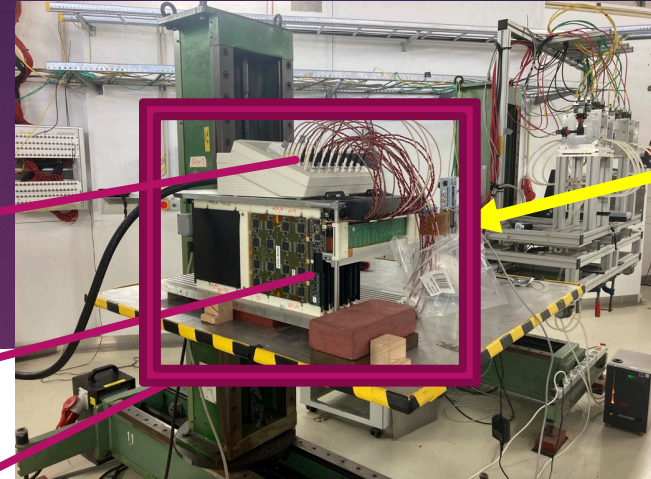
2022/3/9

Beam test setup

High Voltage/ Low Voltage distributor

FEV board

ECAL prototype

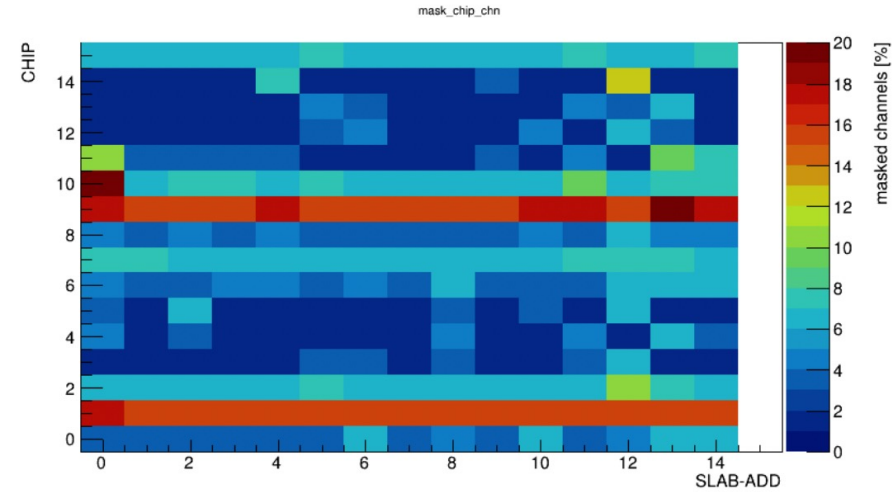


Electron beam

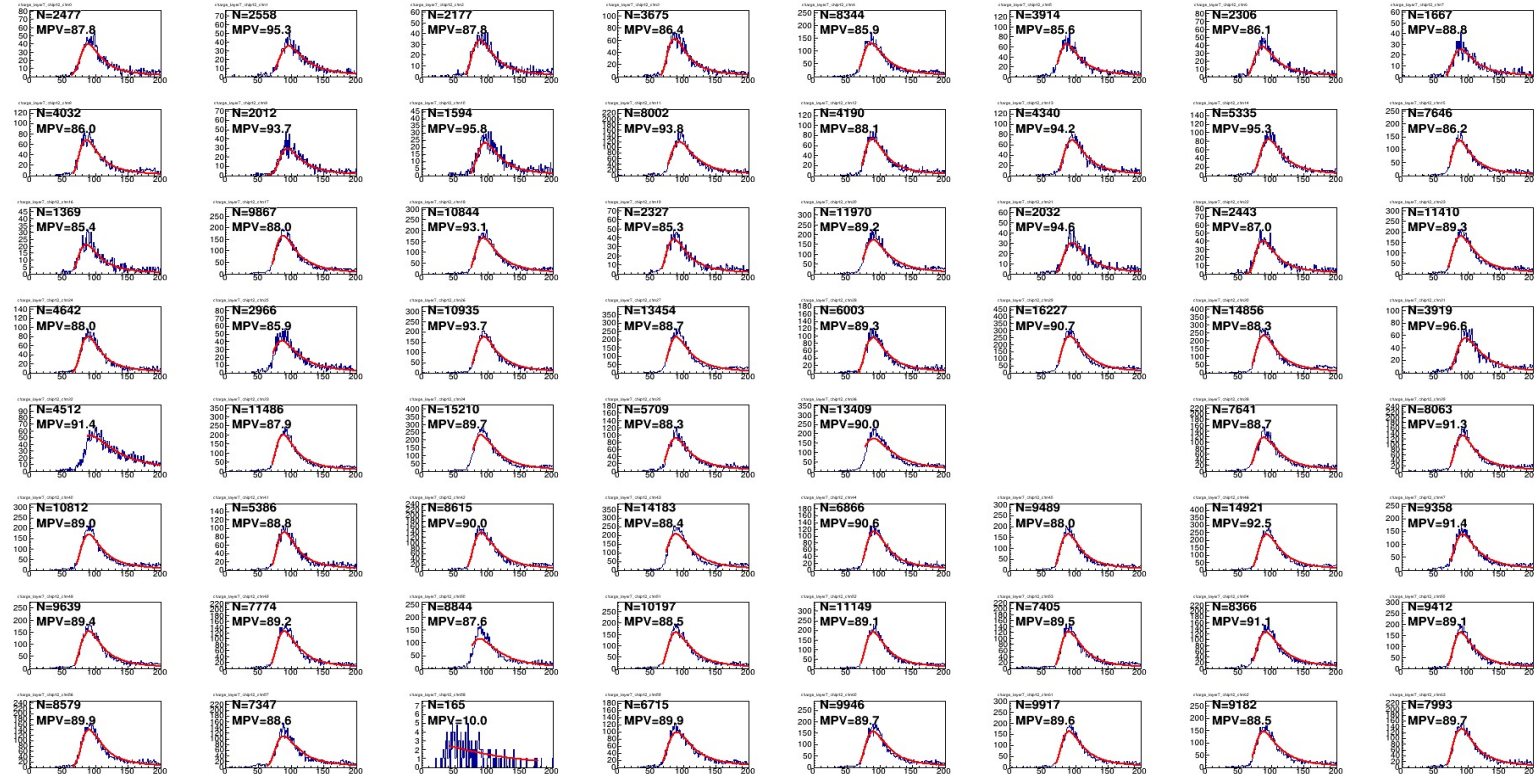
- ▶ Electron beam to a SiW electromagnetic calorimeter made up of 15 layers of FEV boards
-> largest number of layers ever for a technical prototype
- ▶ The position of the measuring instrument can be changed by means of a movable stage
- ▶ The measurements were carried out at different beam energies and incident angles.

Masking/MIP SCAN

- ▶ Noisy channels are masked.
- ▶ The MIP spectrum of the electron beam was measured using only the Si detection layer without the W absorption layer.
- ▶ Beam Energy : 3GeV
Horizontal axis : ADC
- ▶ MIP spectrum:85~95



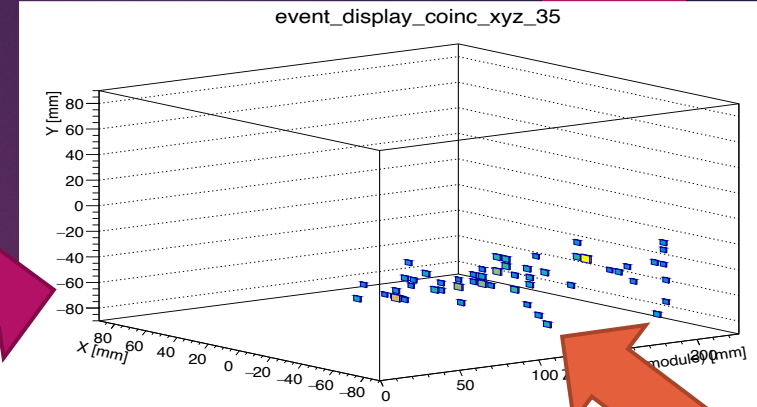
Masked Channel



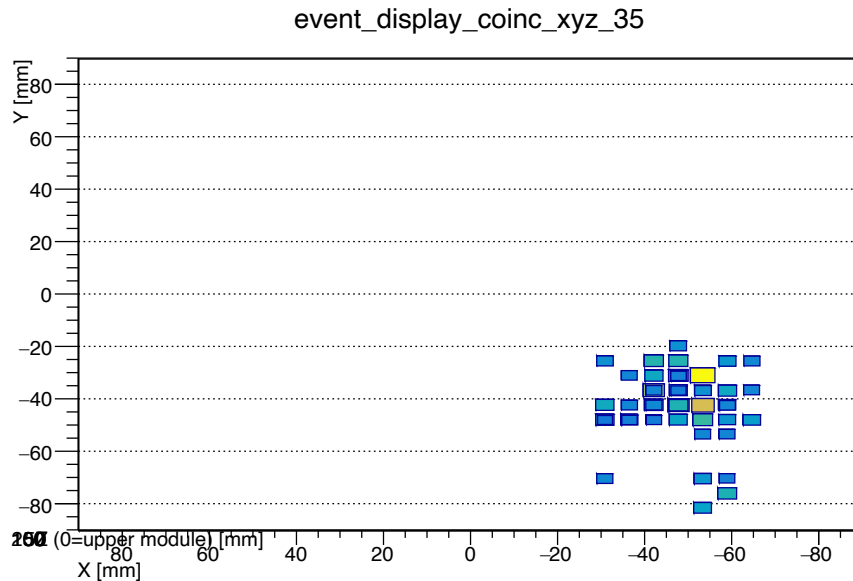
MIP scan
(one layer)

Observation of electromagnetic showers

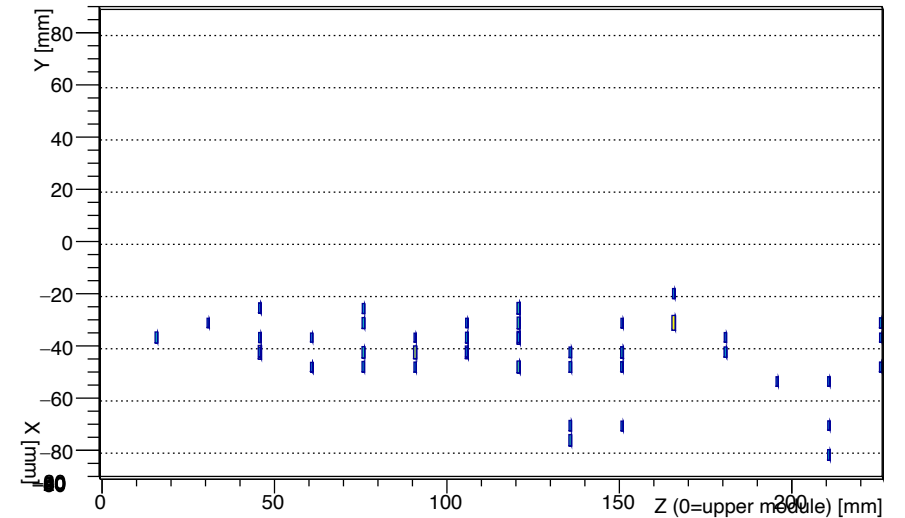
- ▶ Extract one event and display it in 3D
- ▶ Electromagnetic showers have been observed in all 15 layers.
- ▶ Thickness of W layers: 2.1 mm each → About $10X_0$ at all
- ▶ Horizontal spread : 40mm
Height spread : 60mm



event_display_coinc_xyz_35

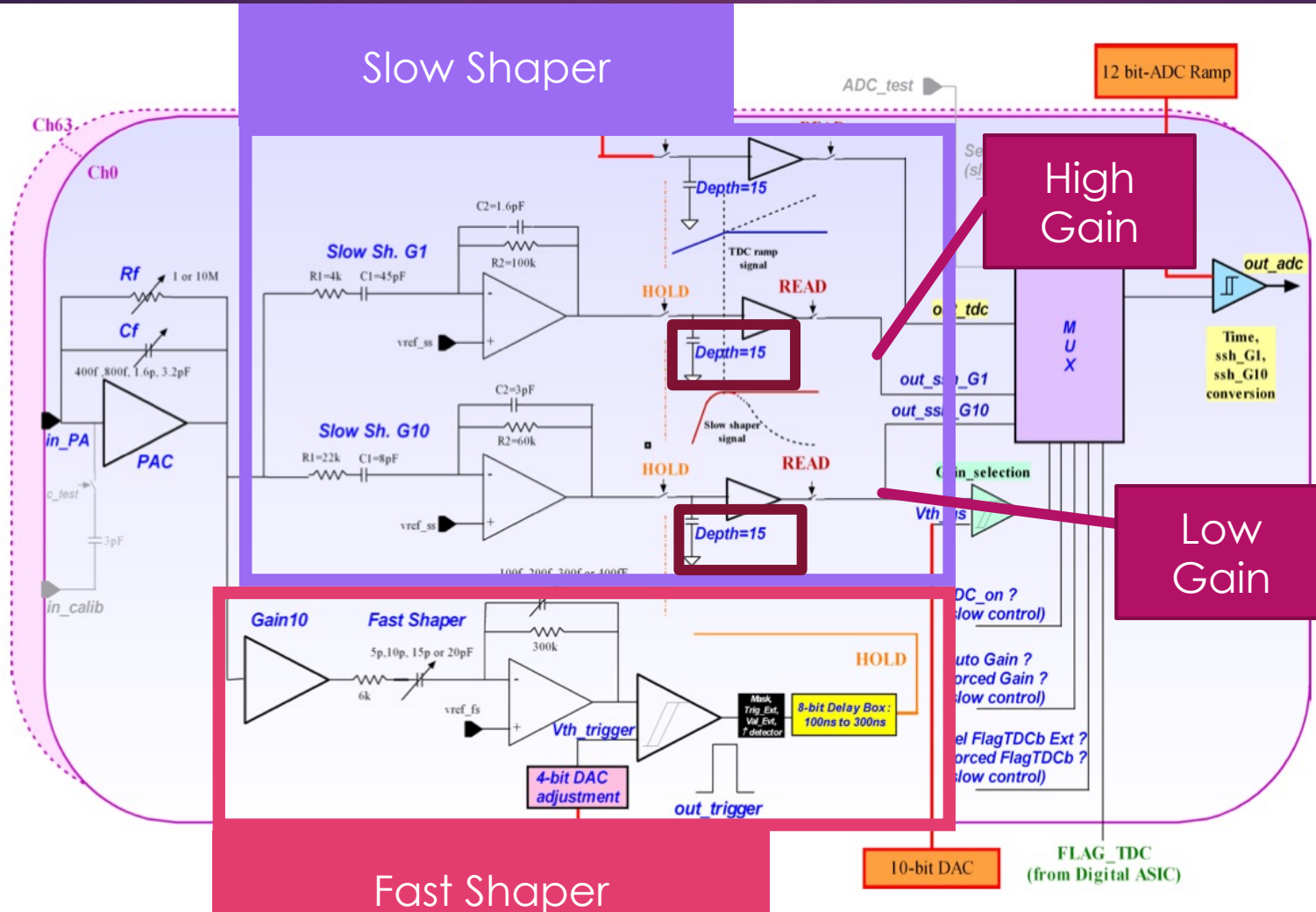


The plot as seen from



The plot as seen from

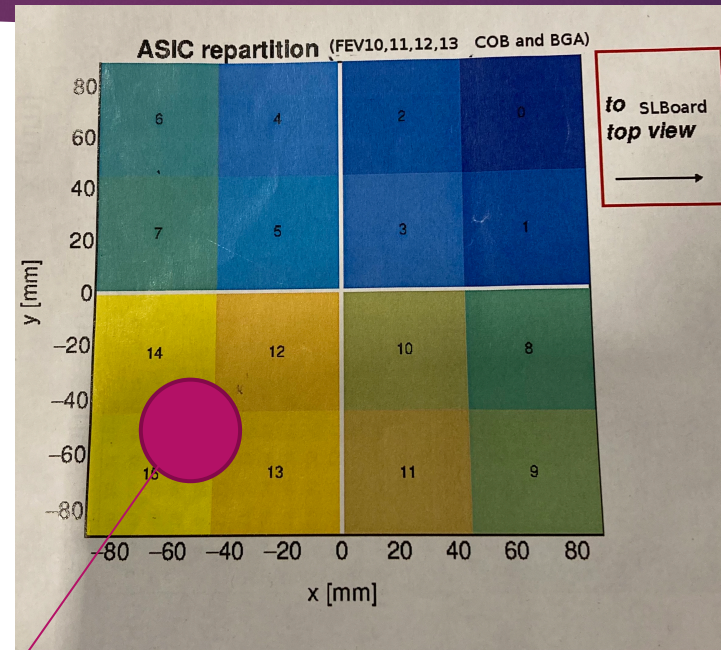
SKIROC2A



High Gain/Low Gain
should be ~10

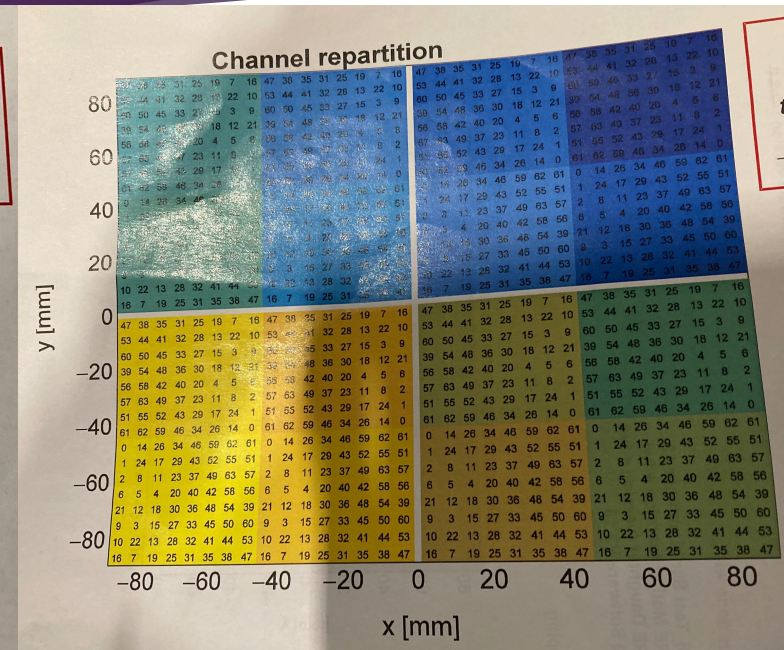
Analysis

- ▶ Data : 3GeV_W_run_050168
→ Electric showers were observed
- ▶ Low gain and high gain are subtracted the mean of pedestal value for each column. Pedestal Selection: ADC > 30
- ▶ Plot High Gain vs Low Gain on 2D histograms.



Chip positions

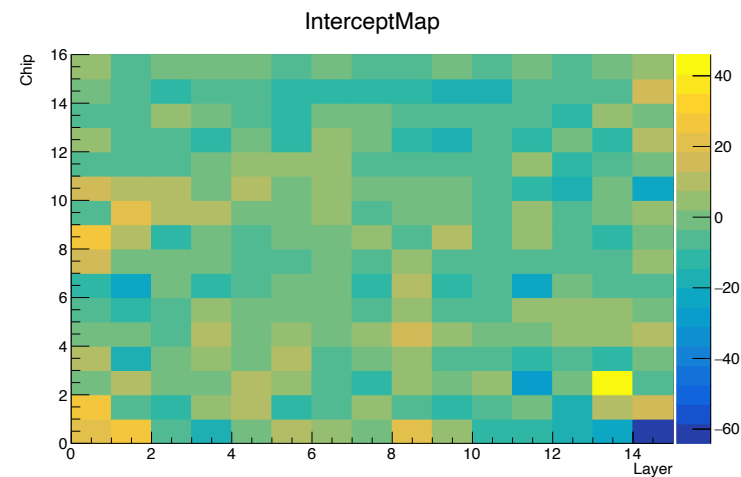
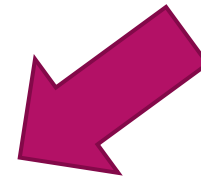
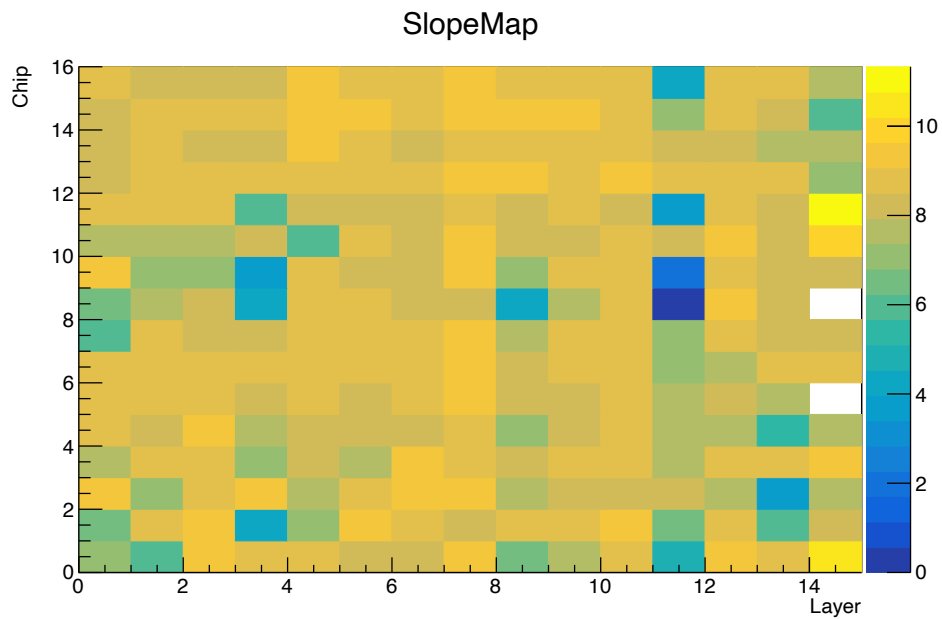
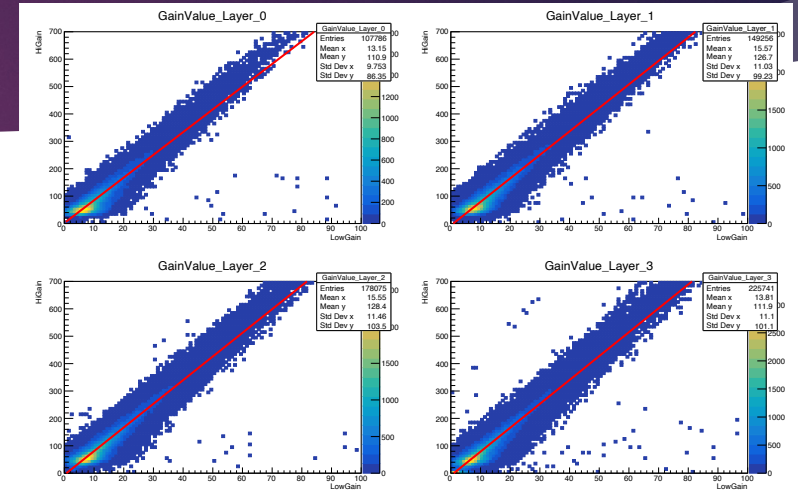
Beam Position



Channel positions

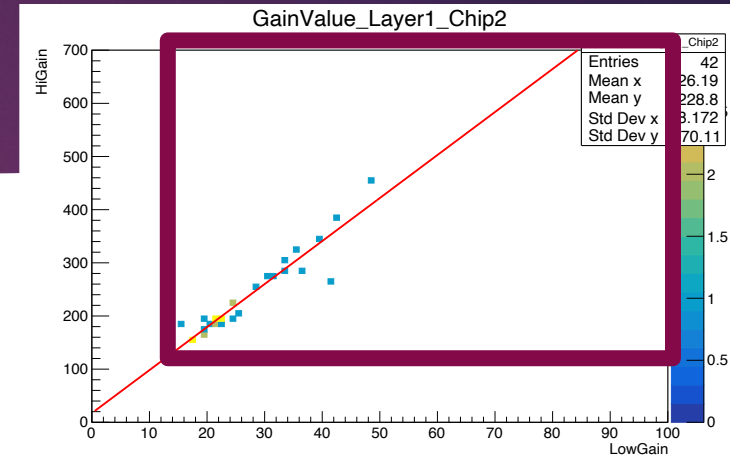
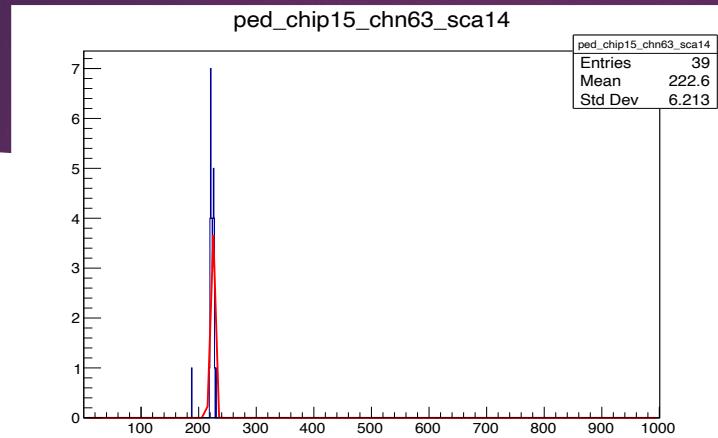
The slope and the intercept of fitting line

- ▶ Fitting of LG and HG histograms
→ Slope / Intercept for each chip

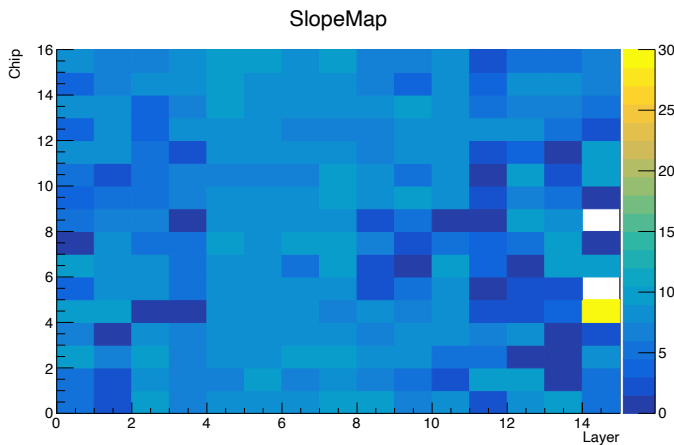


Slopes at some chips are near 5

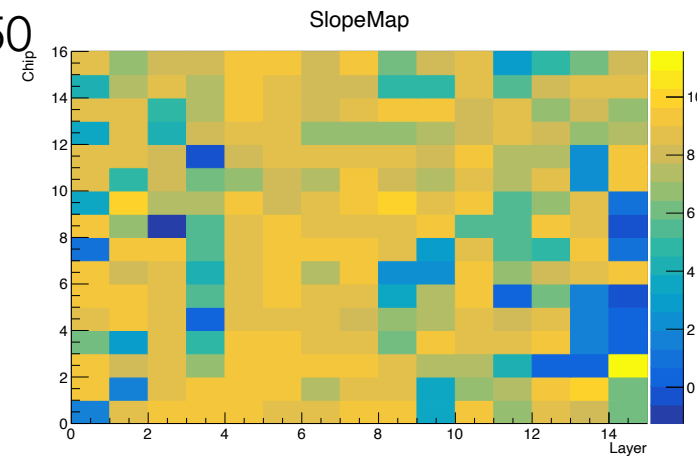
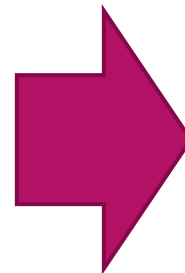
Results



- ▶ Pedestal data are fitted by gaussian
- ▶ Results :

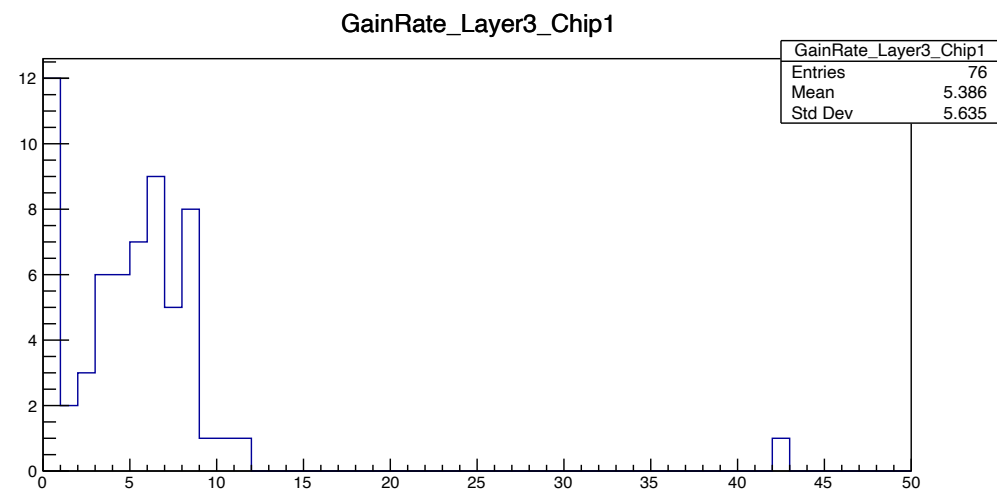
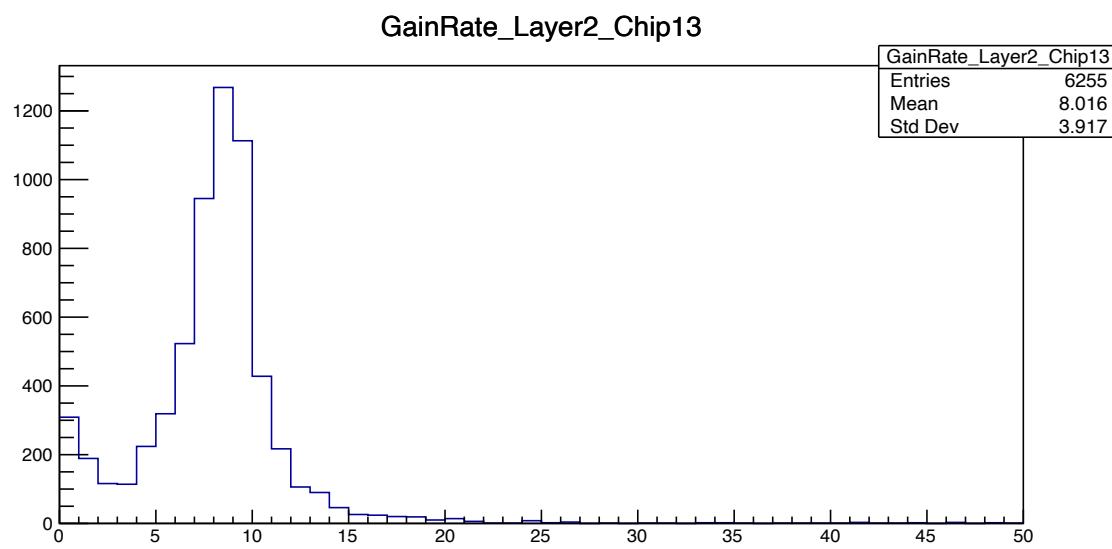


LowGain > 15
HiGain > 150



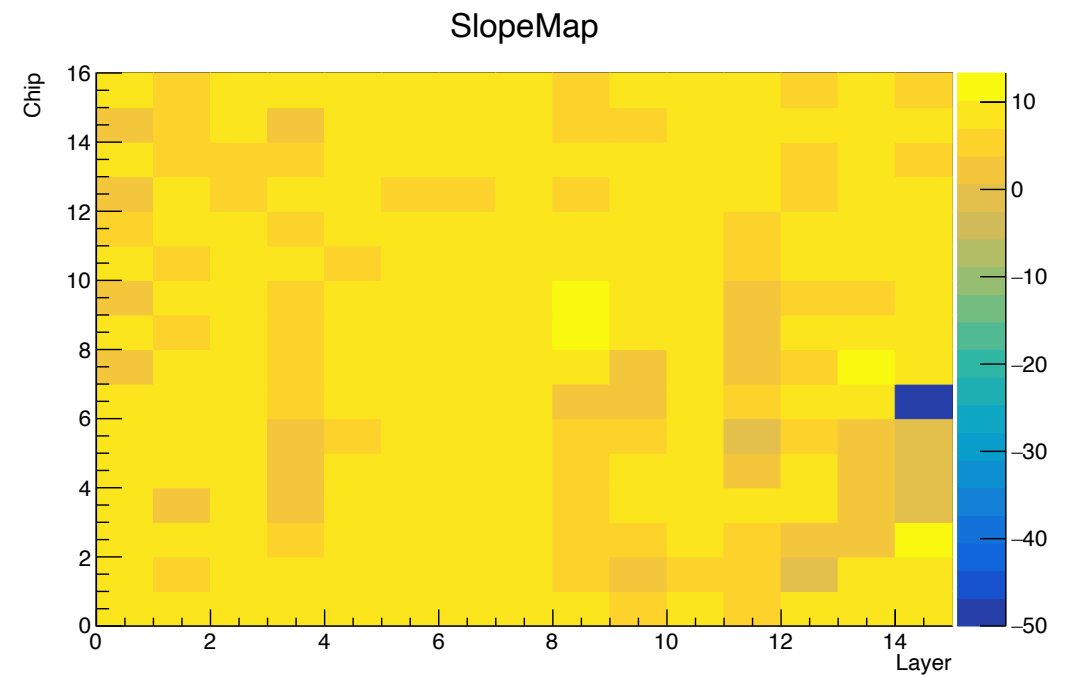
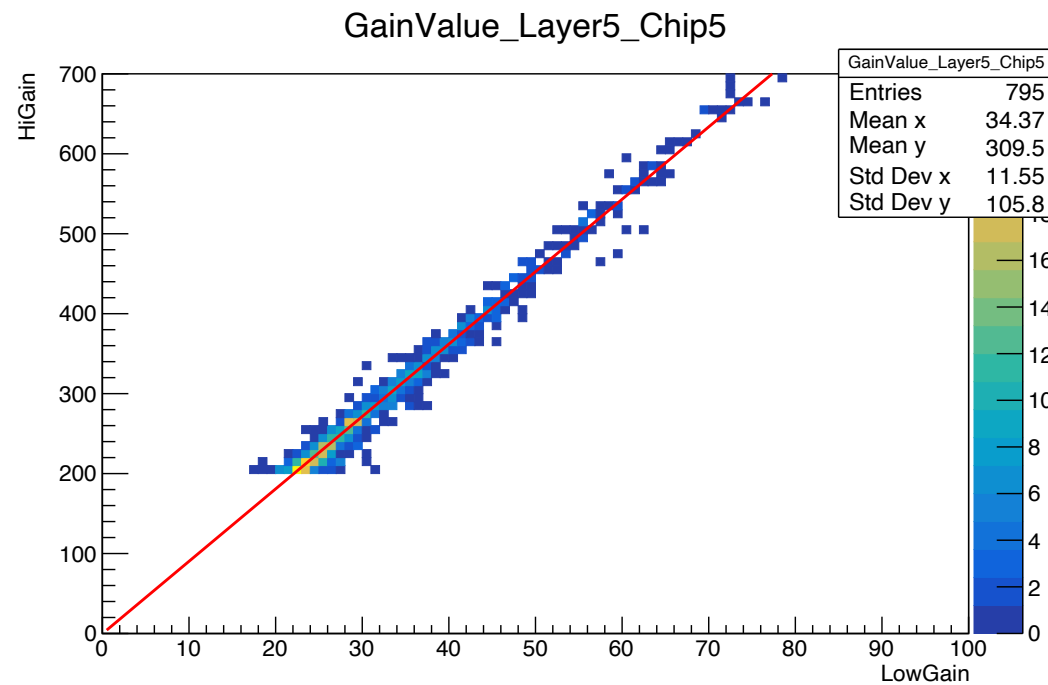
Results

► Hi Gain / Low Gain Rate



Preliminantly Results

► Hi Gain > 200



Summary and Plan

- ▶ Summary :
 - ▶ Beam test was conducted at DESY and we observed the electromagnetic shower.
 - ▶ A comparison of the Hi gain and low gain values obtained using the test beam was carried out.
 - ▶ As a result of fitting, some plots of ratio of hi gain to low gain are smaller than the ideal value of 10.
 - I'll try to improve more
- ▶ Plan : The next beam test will be conducted at DESY again this month.
 - Update of FEV boards etc.