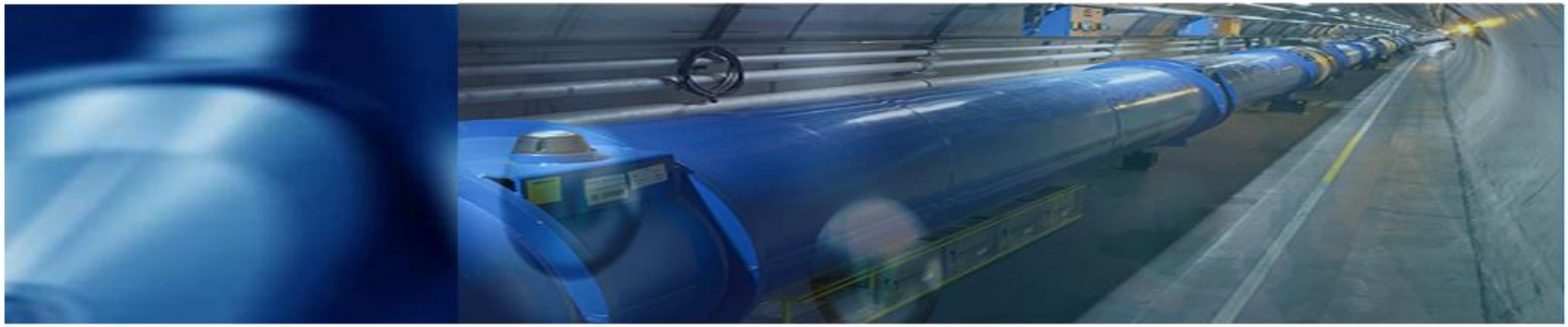
IT Accelerator Engineering Center ITAEC

Pedestal Analysis



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1. What is Pedestal

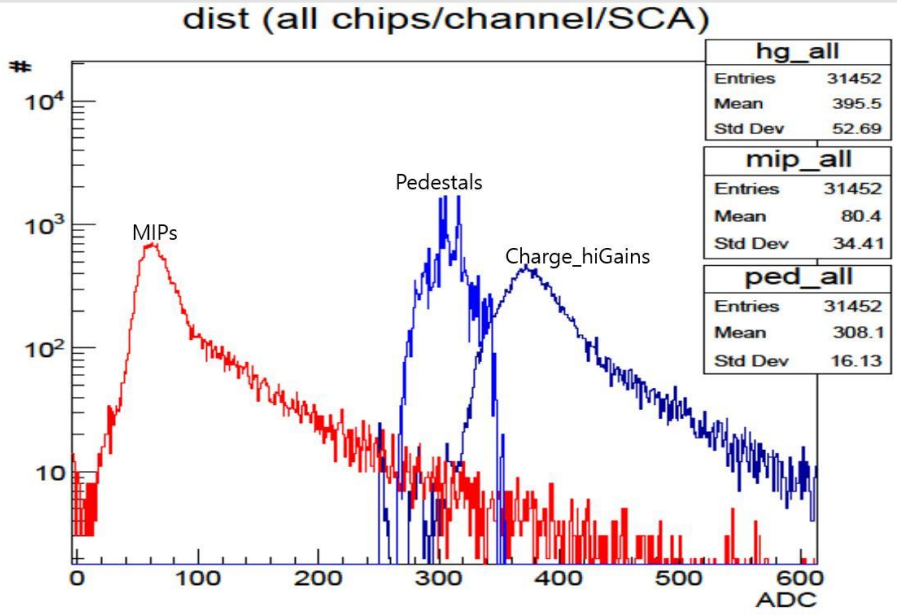

Fig.2 Spectra of MIPs, pedestals and Charge_hiGains of all chips of slab2 (3GeV positron beam was irradiated for 1800s at the center of the detector)

- **Each channel only tags data as a hit if the charge is over the threshold value.**
- **The charges below the threshold value are tagged as pedestals and they are stored only when one of the charges in SCAs is over threshold value.**
- **Each channel has internal noises from system of the chip like power suppliers and those noises were the sources of pedestals**
- **When the real input signals from Minimum Ionizing Particles (MIPs) enter the channels, internal noises tend to mount on the real input signals, shifting zeros of hit_charge (making a bias)**
- **The biases from electronic noises are called pedestals and we can get desired signals(MIPs) by subtracting pedestals from stored signals(Charge_hiGains)**

2. Pedestal Analysis in MIP scan

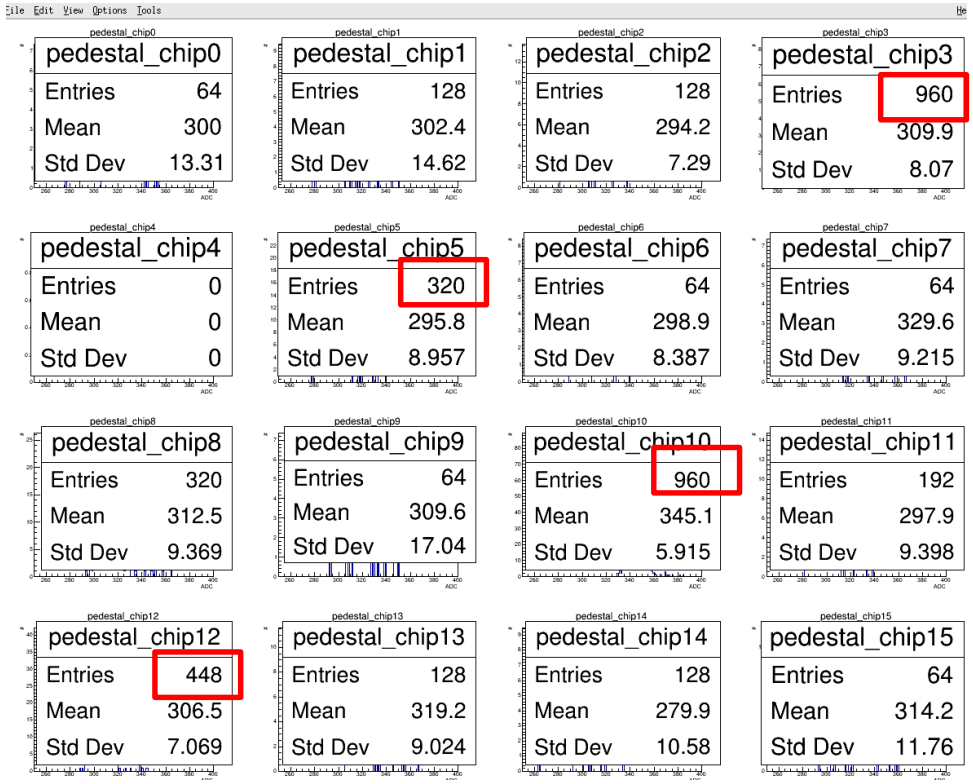

Fig.7 Pedestal values of slab2 at grid 41 MIP scan

- **The Pedestal result of the MIP scanning on grid 41.**
- **The chip 3,5,10 and12 showed significantly higher triggering frequencies than other chips.**
- **=>The pedestals only stored when there is a beam => generated pedestals were concentrated on beam area**
- **The chip 3 and 10 are fully triggered as one chip has 960 SCAs (64channels x 15SCAs)**
- **That is why the surrounding chips of them (chip 1, 2, 8 and 11) were triggered to acquire extra signals from centers.**
- **The chip 5 and 12 were not frequently triggered as chip 3 and 10 even if they were the irradiated chips.**
- **However, Chip 5 and 12 were not fully triggered, explaining the silence of pedestals in neighbor chips.**

3. Pedestal Analysis with W layer

Stability Test with Constantly Energized Beams

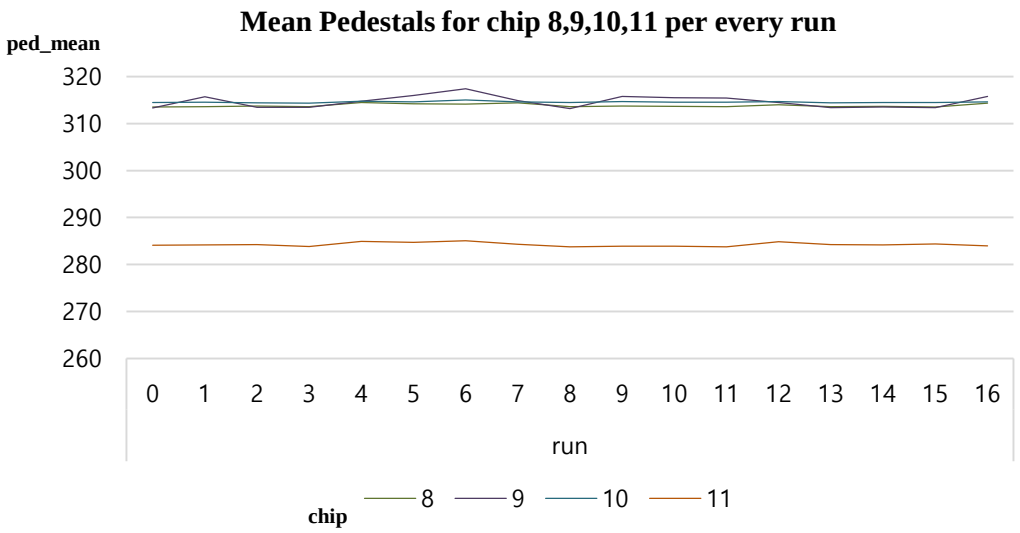

Fig.8 Reliability test with constant Energy (5.8GeV, chip 8,9,10 and 11 of slab2)

- only chip 8,9,10 and 11 were considered as those chips were targeted (other chips were rarely triggered) and fully triggered.
- The pedestal of chip 8 changed 0.02% on average during 17 beam exposures, 0.05% for chip 9, 0.002% for chip10 and 0.003% for chip11.
- The pedestals of all targeted chips were varied less than 0.1%, which is extremely low rate of change.
- Therefore, the SiW-ECAL prototype showed highly stable pedestals without breaking even the repeated 5.8 GeV high energy positron beam was injected.

3. Pedestal Analysis with W layer

Stability Test with varying Energies of the Beams

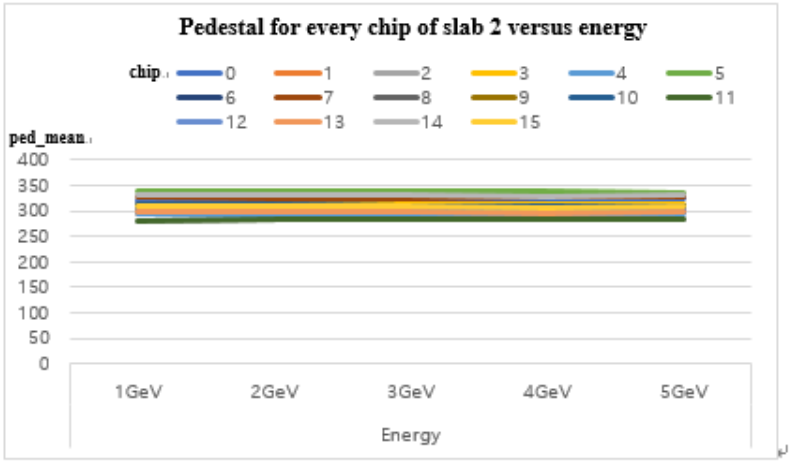

Fig.9 Reliability test with different energies (1 GeV to 5 GeV positron beam)

Table1. Results of energy variation test

Chip	AverageRate of change [%]	Ped_Mean
0	0.20	321.7
1	0.24	297.18
2	0.03	283.62
3	0.02	312.96
4	0.21	293.98
5	0.04	340.12
6	0.07	305.04
7	0.12	327.18
8	0.01	313.14
9	0.22	308.98
10	0.02	314.46
11	0.05	282.64
12	0.01	306.92
13	0.02	297.7
14	0.11	331.1
15	0.07	308.96
avg	0.09	309.105

- Every chip showed pedestals because of electromagnetic shower
- all chip showed almost straight lines of pedestals
- Slab2 of grid 24

- **Table.1** shows the numerical result that each chip showed less than **0.3%** of average variation of pedestals. It was **0.09%** on average.

3. Pedestal Analysis with W layer

Stability Test with varying Energies of the Beams

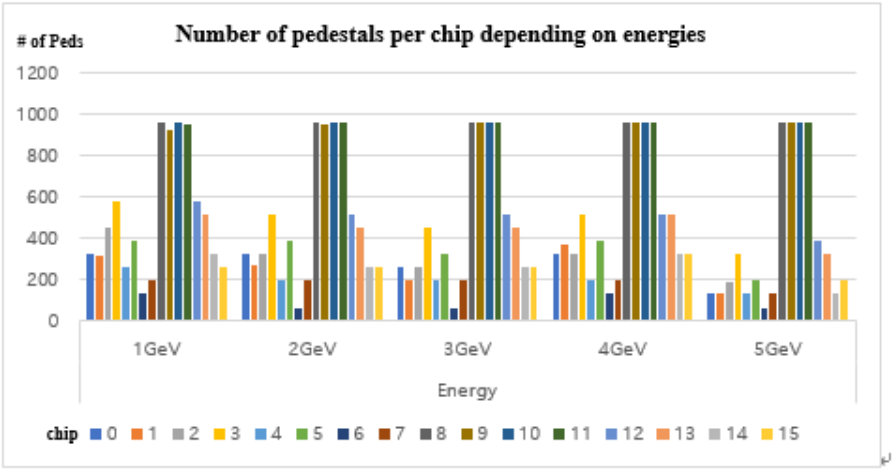

Fig.10 The number of pedestals per chip of slab 2 depending on energies

- As we can see in **Fig.10**, the number of triggers (pedestals) were concentrated into chip 8,9,10 and 11.
- As the beam energy gets higher, the numbers of triggers of chip 8,9,10 and 11 tend to increase and the other ones decrease.
- The higher the beam energy, the higher the momentum of each charged particles, the lower events of electromagnetic shower, the less scattering happens in detector.

4. Pedestal Analysis with 1T Magnet

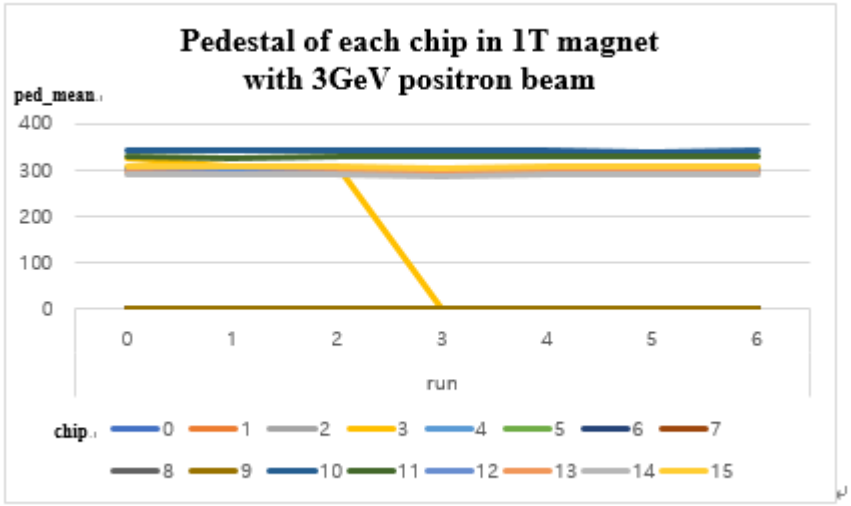

Fig.13 magnet dependency test result

- As **Fig.13** shows Chip 0,1,2,4,5,6,7 and 9 didn't respond during entire beam injection.
- Chip 3 was triggered during run 0,1 and 2 but stopped responding.
- The other chips showed stable pedestals with **0.0038%** variation.
- Therefore, most of chips were **independent on** strong magnet

5. Future Plan

- Wrote a paper which has exactly same content of this presentation
- Planning to participate the conference, "International Symposium on Sensor Science" (9.27-9.29, Barcelona, Spain)
- or submit the paper to JKPS(The Journal of the Korean Physical Society) which is the Korean SCI journal.
- Welcome to another suggestion

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Thank You

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