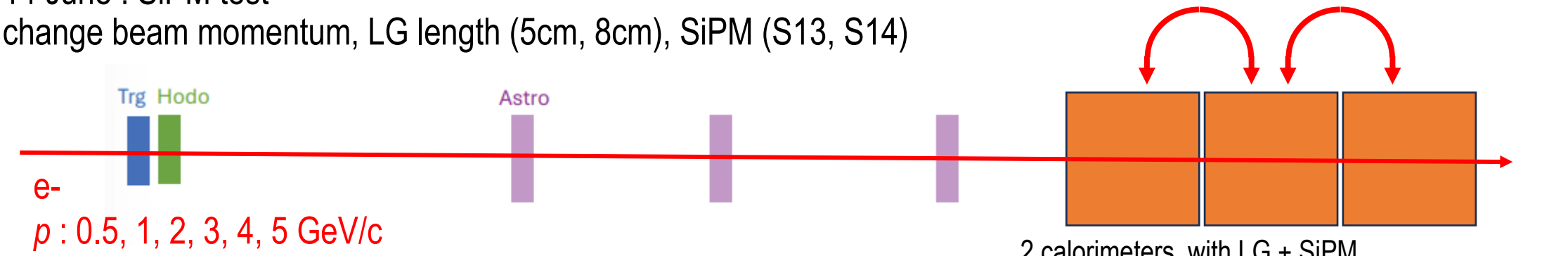
BIC DAQ LED test
KEK beam test

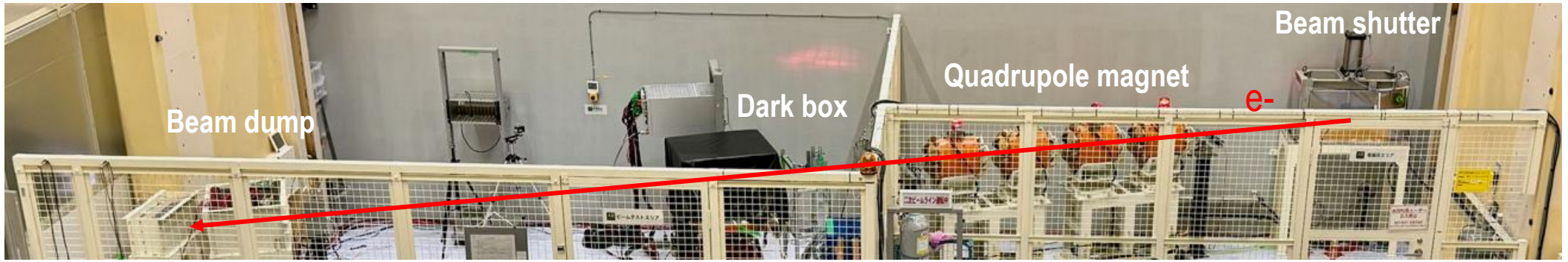
Bo Gyeong SEO, Jun Seop SHIN, Shin Hyung KIM

Department of Physics, Kyungpook National University

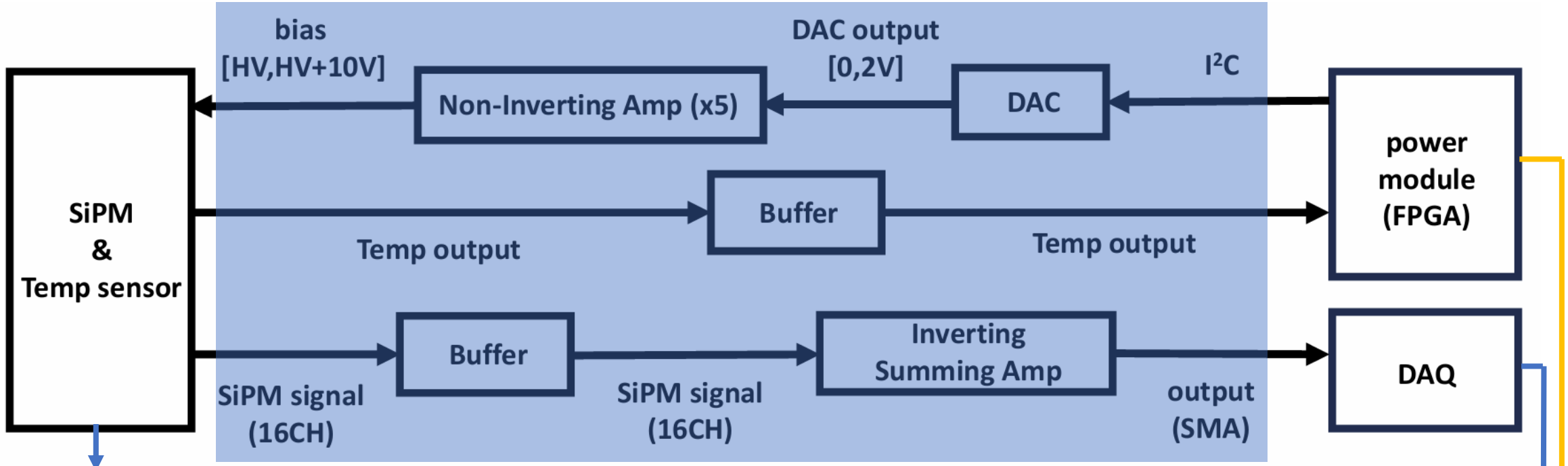
KEK PF-AR beam time

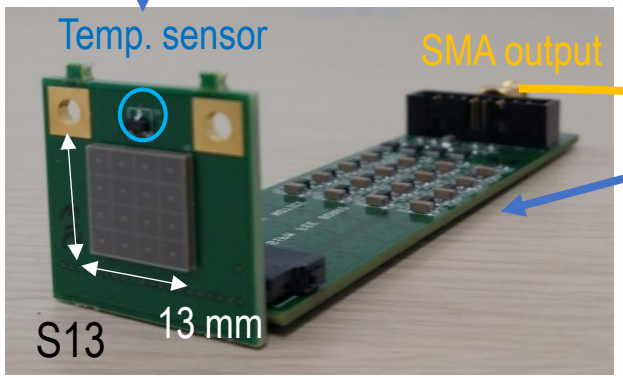
- KEK beam test : 11 June – 17 June
- Main goal : Astropix multi hit & Integrated DAQ test
- 14 June : SiPM test
  change beam momentum, LG length (5cm, 8cm), SiPM (S13, S14)



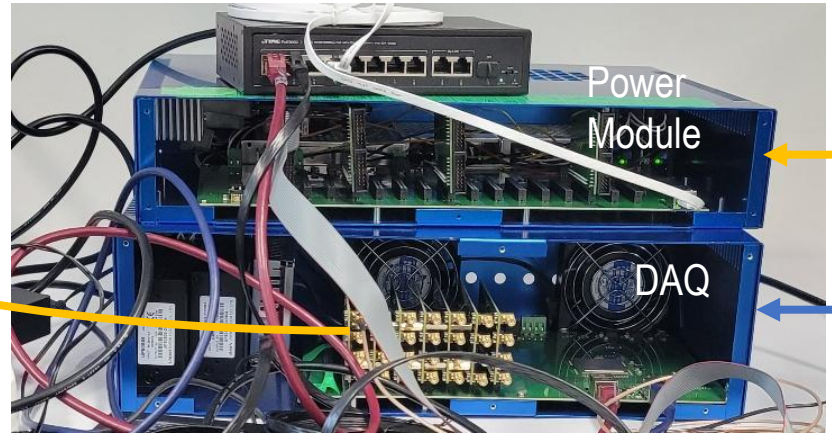


Circuit setup





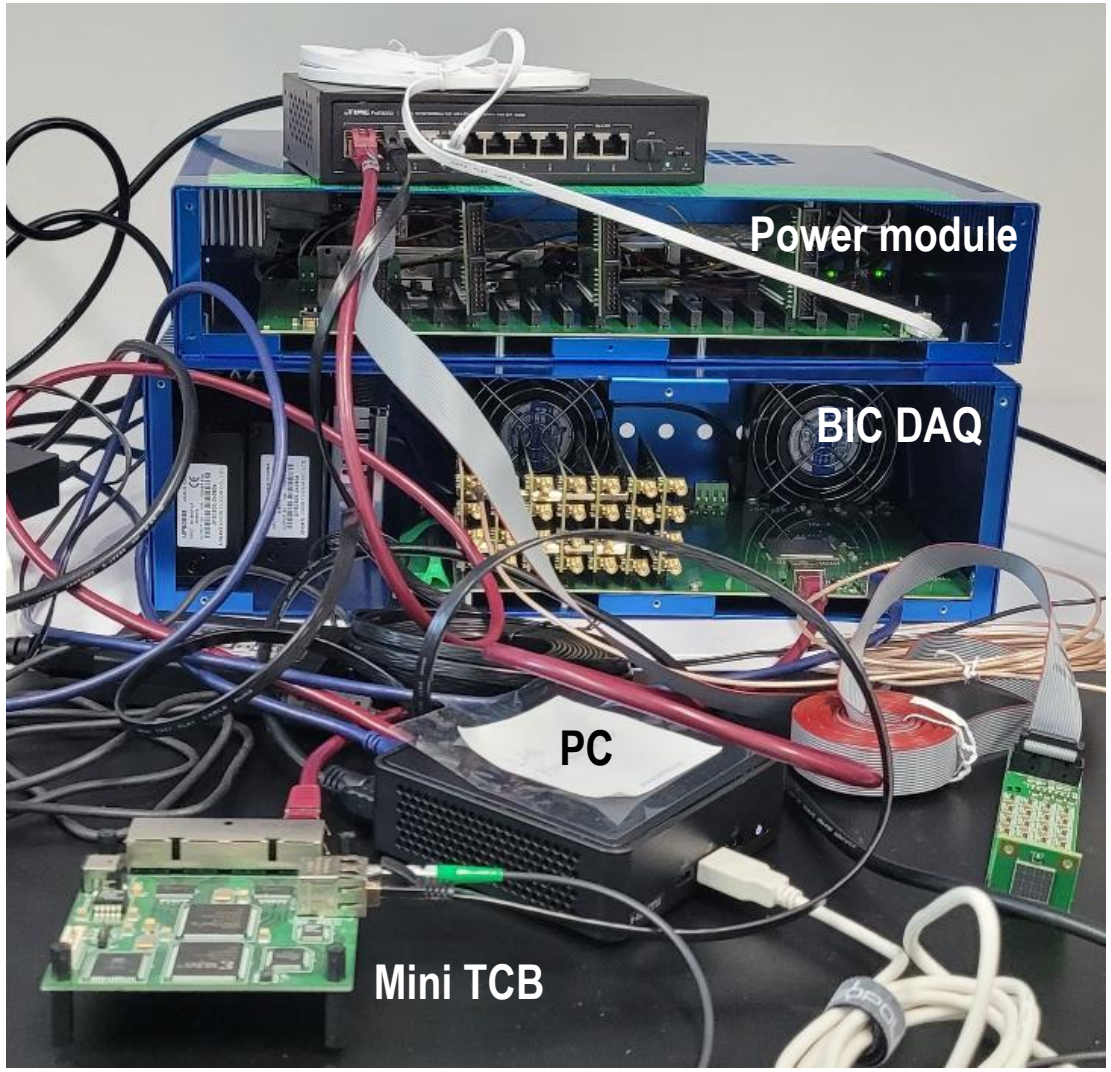
FEE board

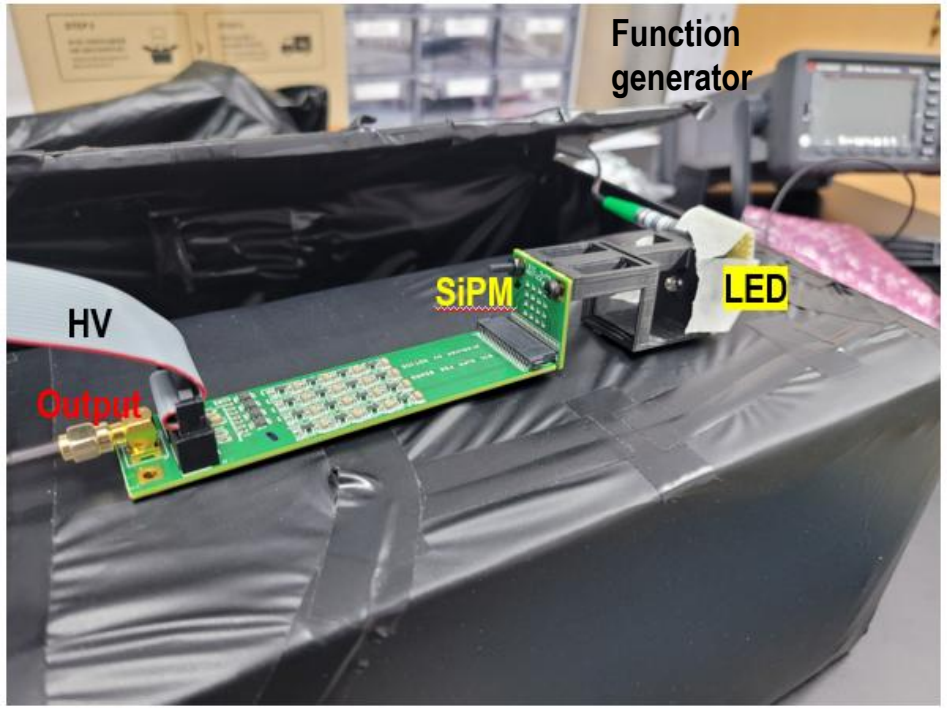


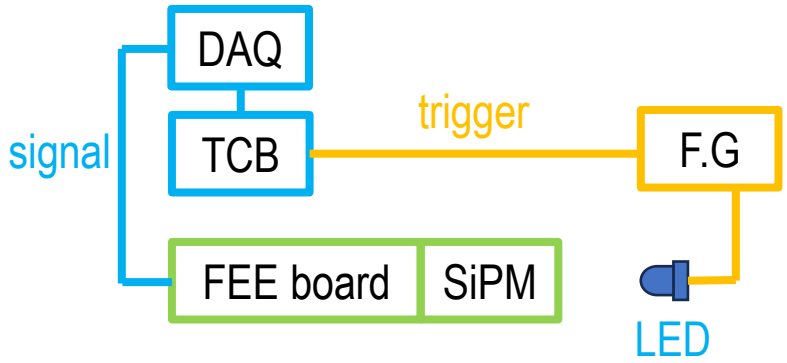
SiPM : consists of 16 ch

FEE board : **amplifying** and **summing 16 SiPM signals**
distribute different bias voltage to each SiPM ch
temperature readout

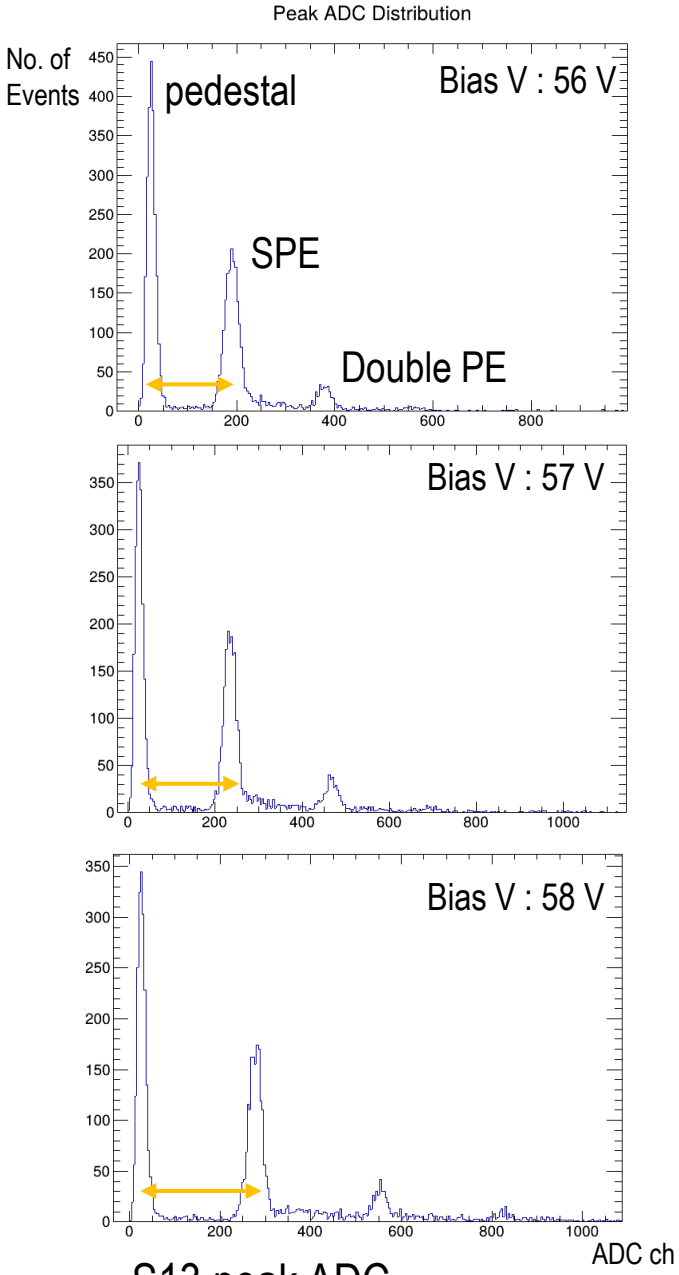
LED calibration setup at KNU



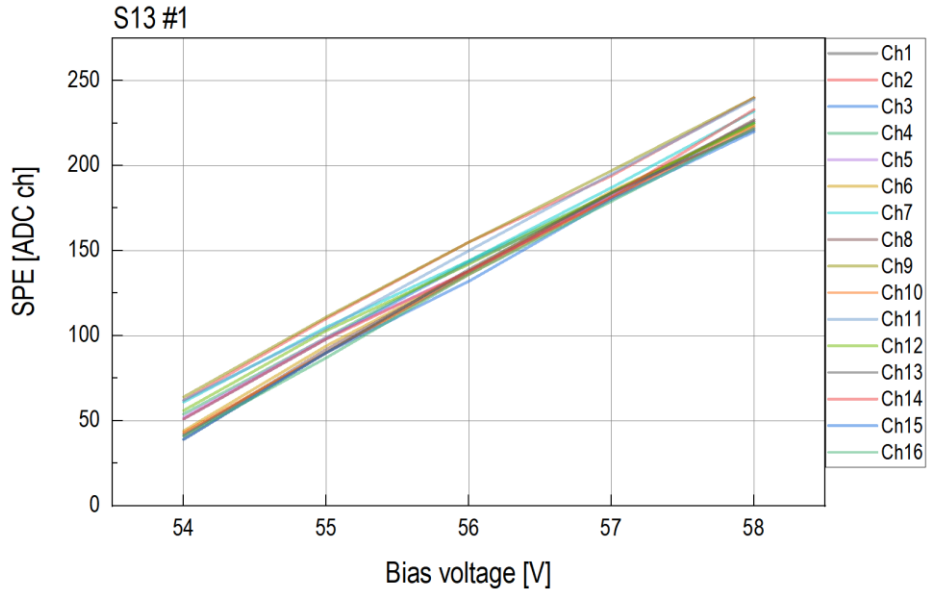




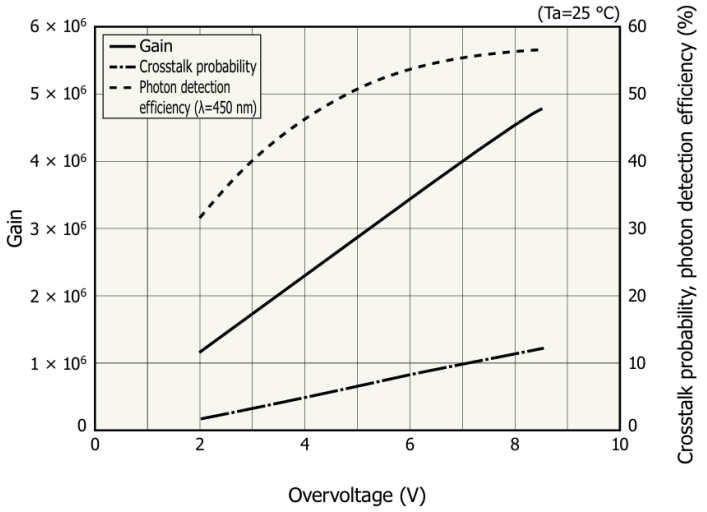
Single Photoelectron (SPE) gain graph



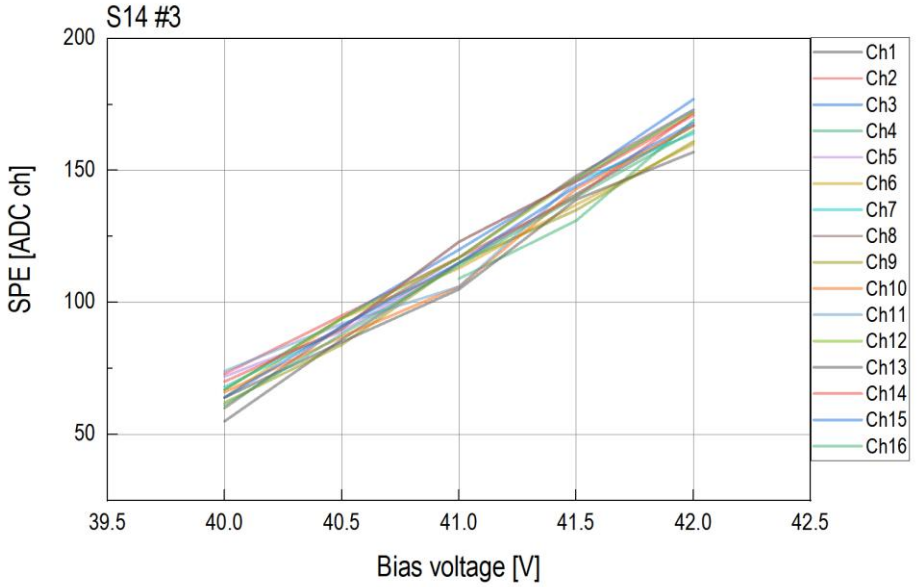
S13 peak ADC



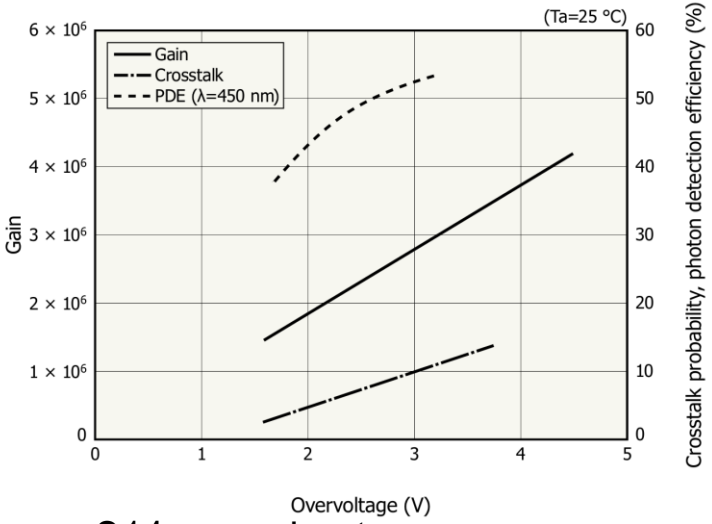
S13 gain curve (V_{BR} : 53 V)



S13 spec sheet

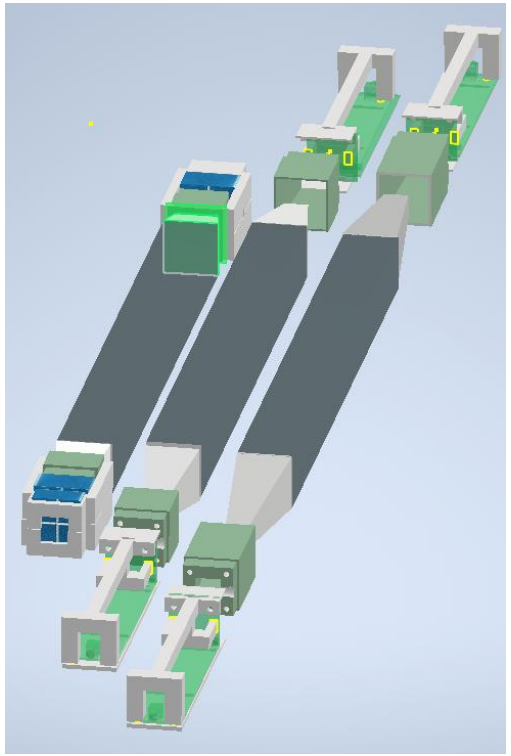


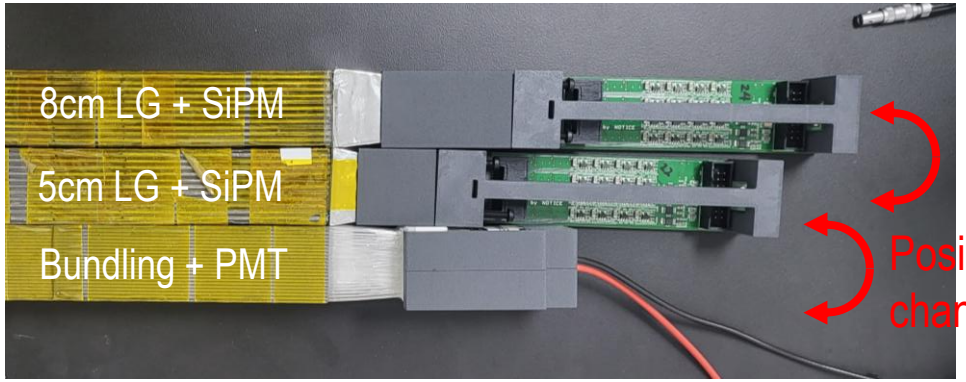
S14 gain curve (V_{BR} : 38 V)



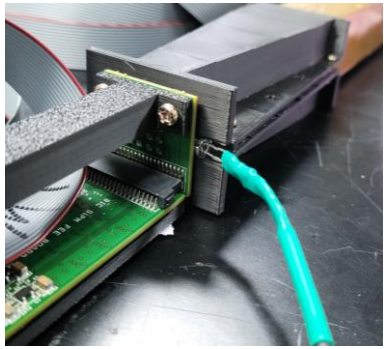
S14 spec sheet

KEK PF-AR beam test





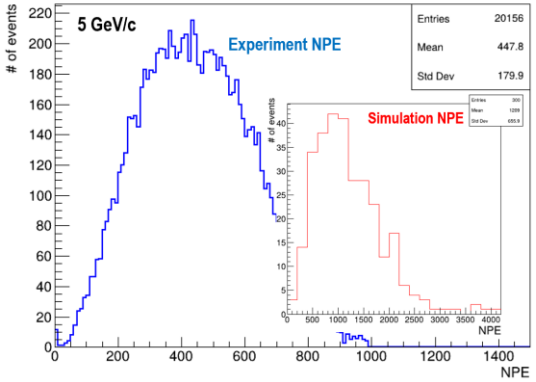
Bundling + PMT



LG + SiPM

Edep simulation (by C.H.LEE)

	0.12 %	0.44 %	1.02 %
4GeV/c	3.79 %	15.7 7 %	22.0 1 %
	0.11 %	0.45 %	1.02 %



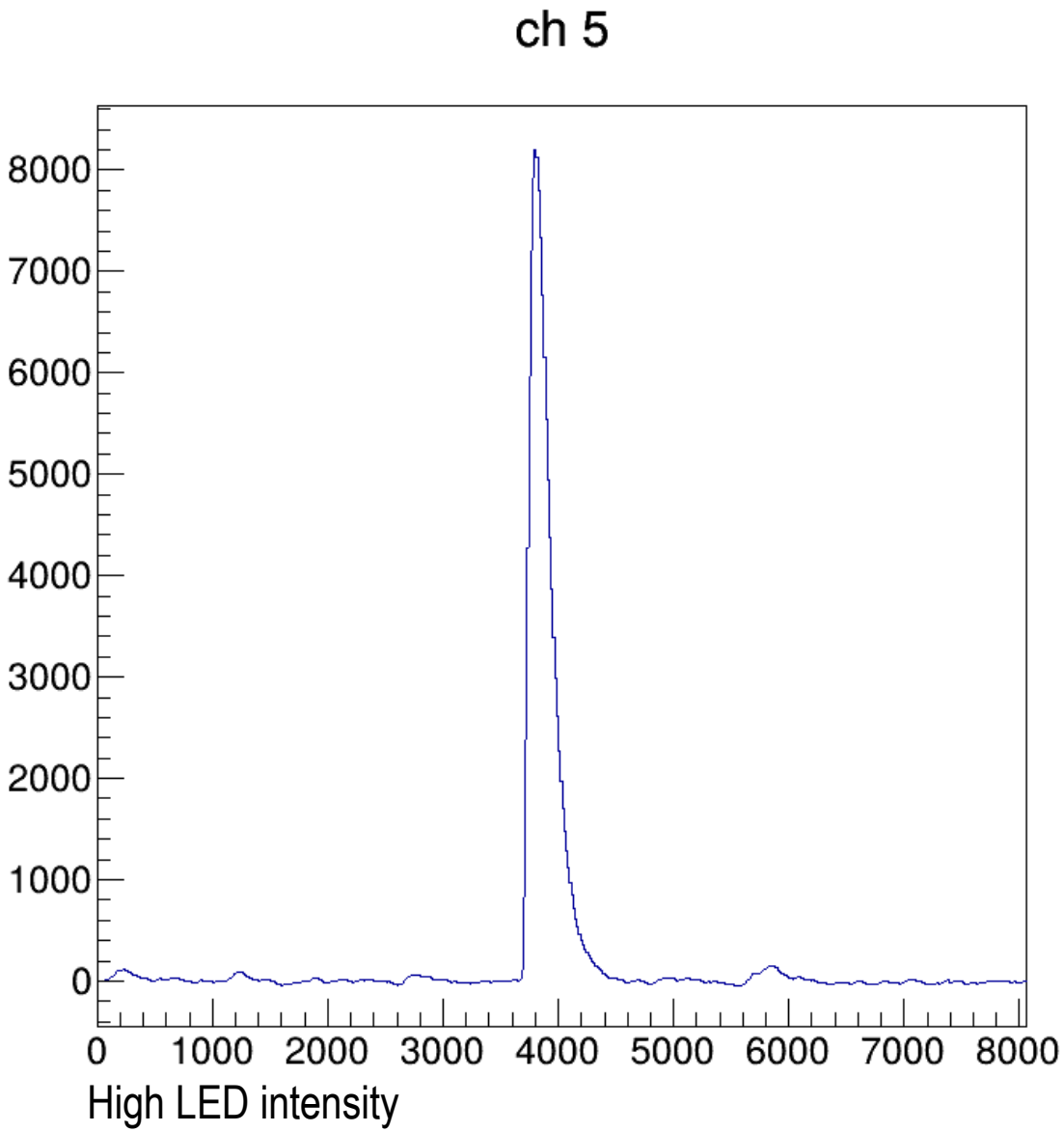
Readout
3 sampling calorimeter
LG : 5cm, 8cm
SiPM: S14, S13
Different composition (LG length, Photon detector) for each beam test

NPE comparison (sim. & exp.) was done for 8 cm LG & PMT with e- beam

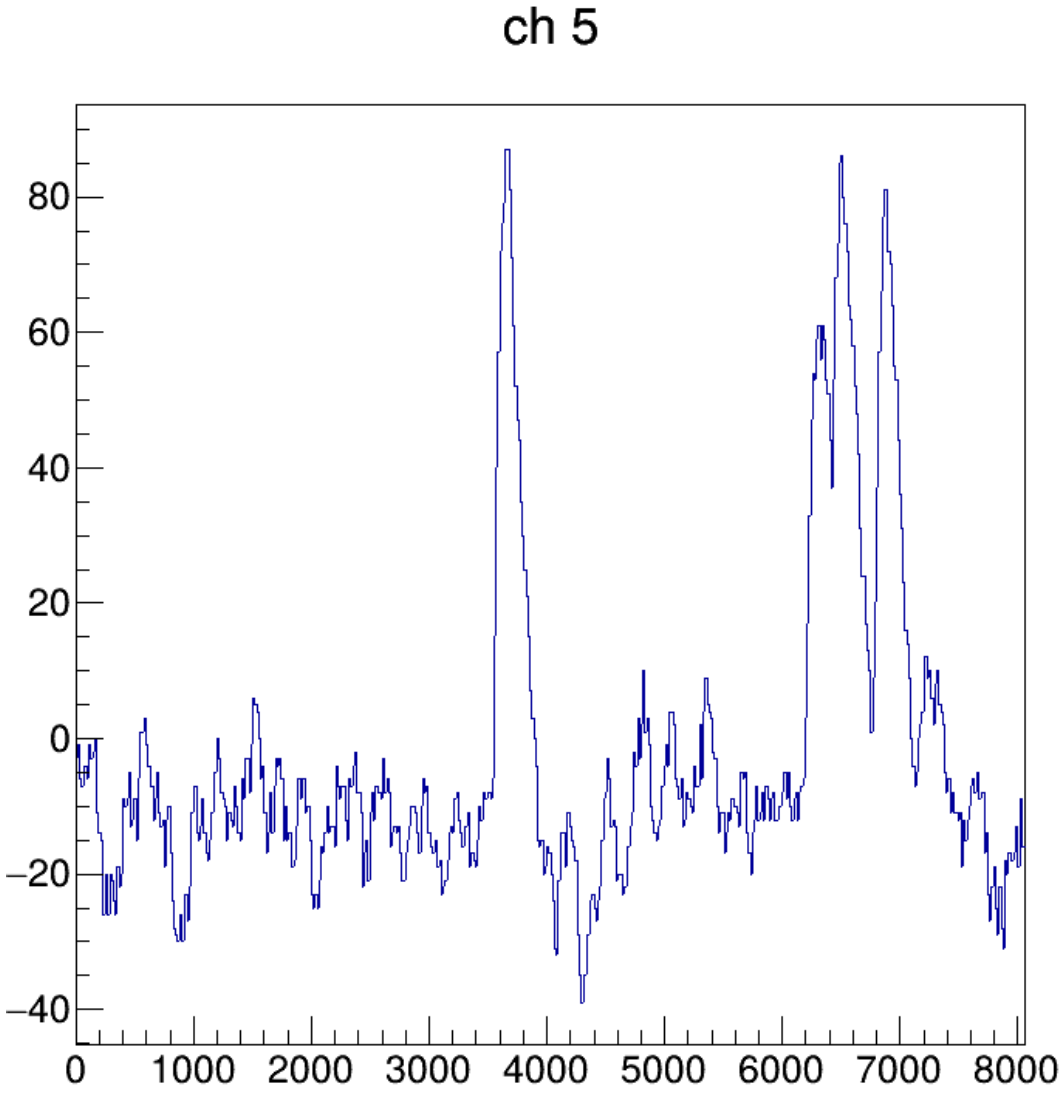
NPE comparison for **LG + SiPM** will be done

Supplementary

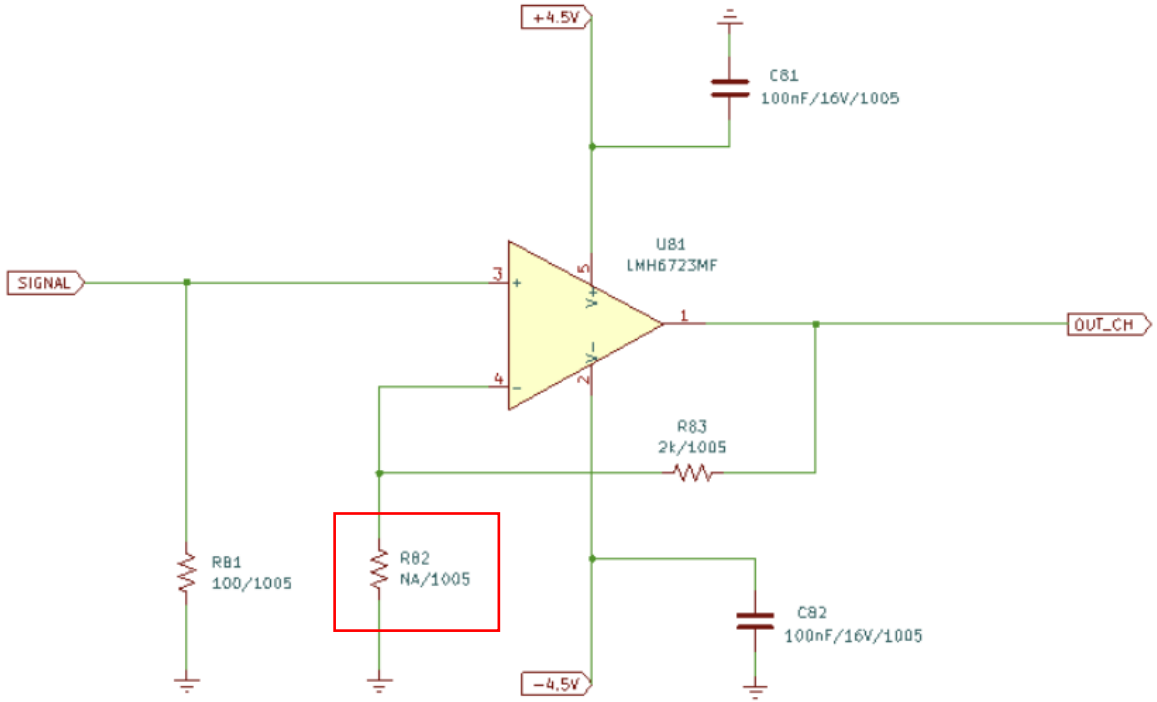
SNR



High LED intensity

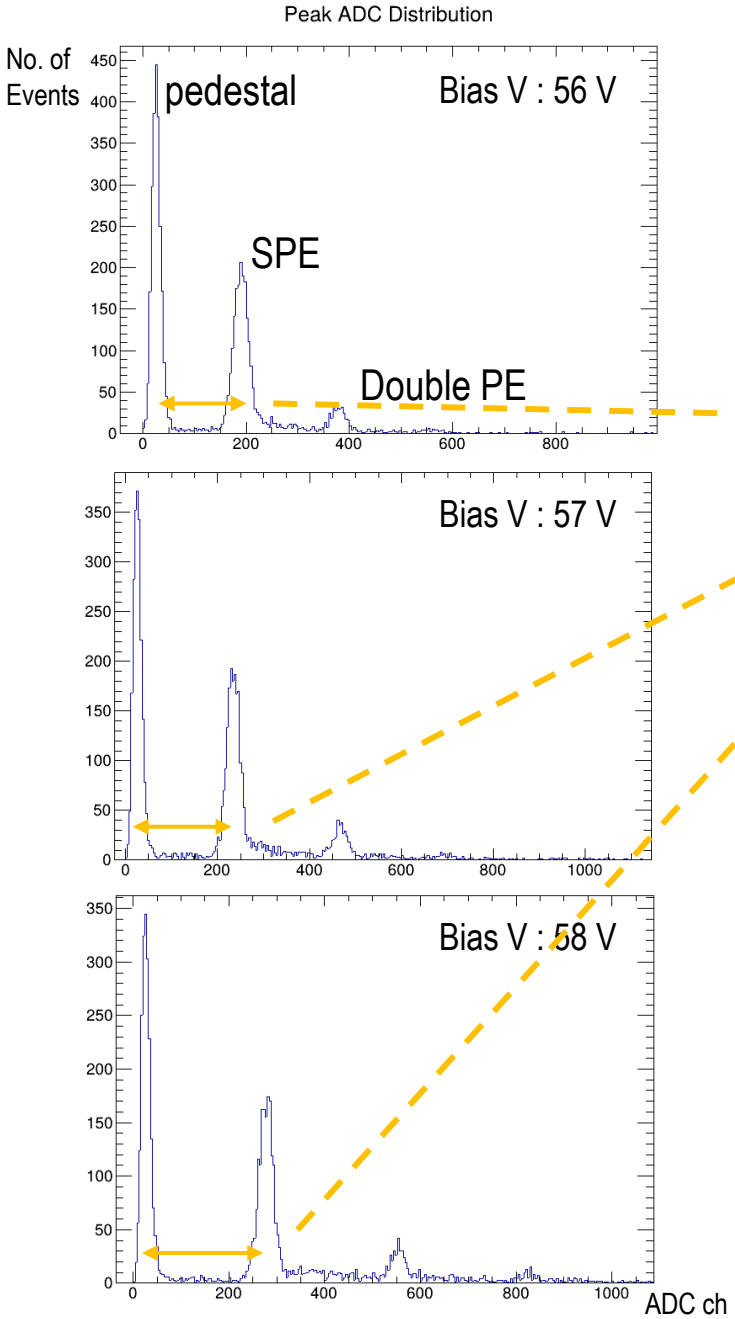


Low LED intensity (Dark current)

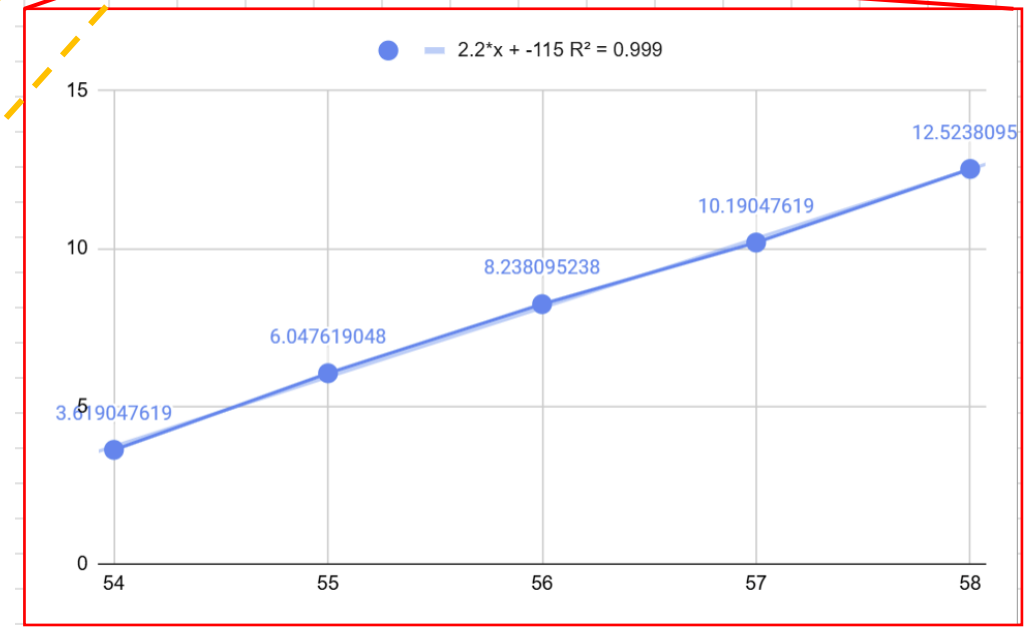


Op Amp circuit in the FEE board
NA : buffer
100 Ω : x 21 Op Amp

Single Photoelectron (SPE) gain graph

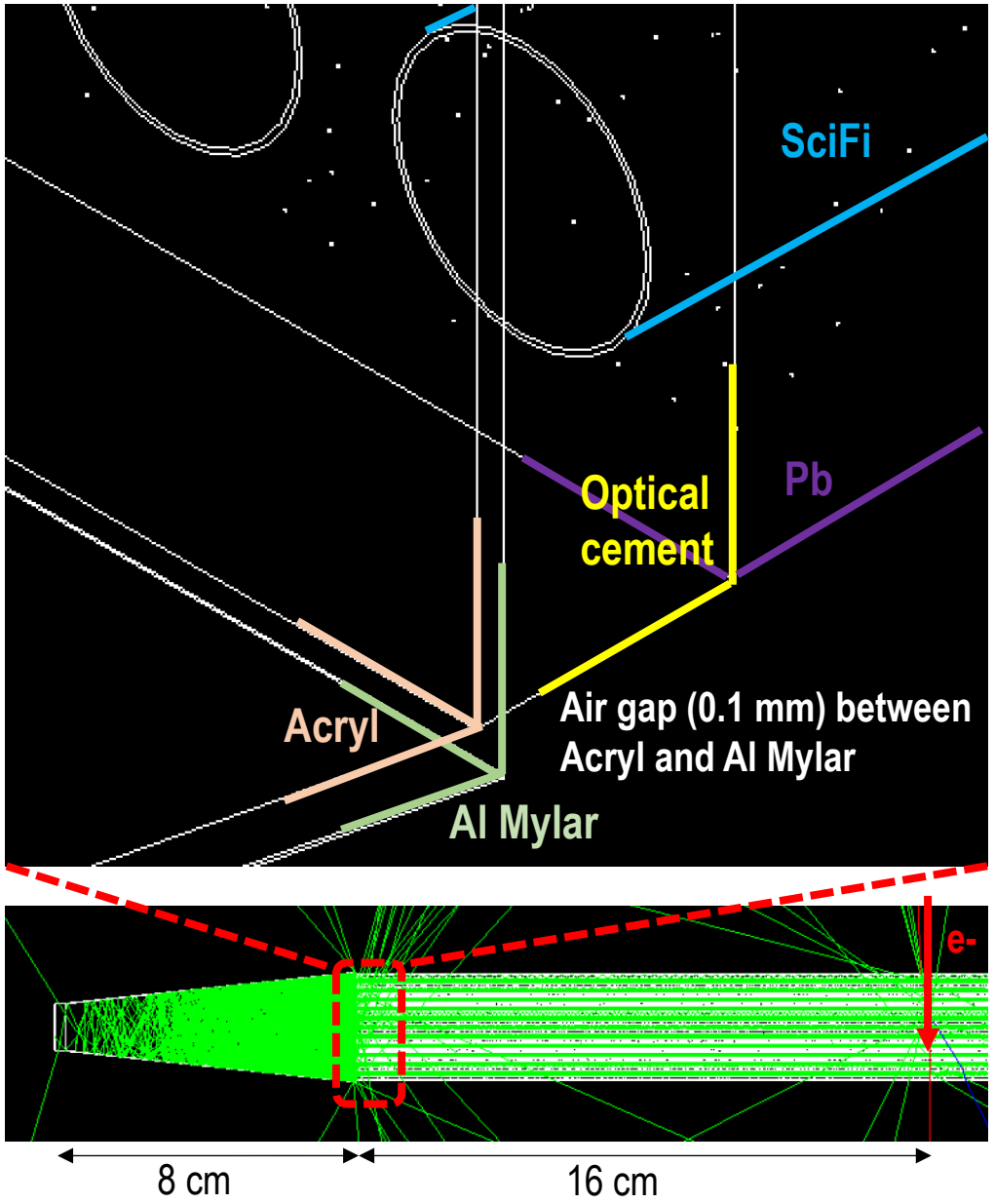


	common		48										
HV/Ch	1	2	3	4	5	6	7	8	9	10	11	12	13
48													
49													
50													
51													
52													
53													
54	68	76	83	84	84	84	83	73	85	78	82	86	73
55	110	127	126	127	132	129	127	120	132	125	129	127	121
56	1[illegible]8	173	170	174	176	168	173	160	174	170	172	174	168
57	182	214	218	213	220	218	218	209	223	214	226	221	206
58	-	263	258	257	258	257	261	246	261	252	262	265	249
1	51.602	51.816	51.904	51.456	51.442	51.696	51.643	51.690	51.658	51.923	51.834	51.627	51.923



Plot **gain graph (linear fitting)** for each SiPM ch

Experimental & Simulation NPE comparison



Geant4 sim. event display

NPE comparison between Geant4 simulation and experimental results will be done

NPE mean

GeV/c	Estimated NPE mean								
	8 cm LG (SiPM)			5 cm LG (SiPM)			Bundling (PMT)		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
1	520	1300	1200	640	1600	1500	-		
2	680	2200	2400				-		
3	760	2800	3800	1060	4000	5200	-		
4	810	3400	4600				-		
5	900	4000	6000	1200	5000	7600	-		

Estimated NPE with Geant4 Simulation
mean NPE per e- *p* : **min 520, max 7600**
NPE per event : **min 40, max 20000**

Gain graph will be used to adjust bias V efficiently during beam time