

Update on Crystal ECAL

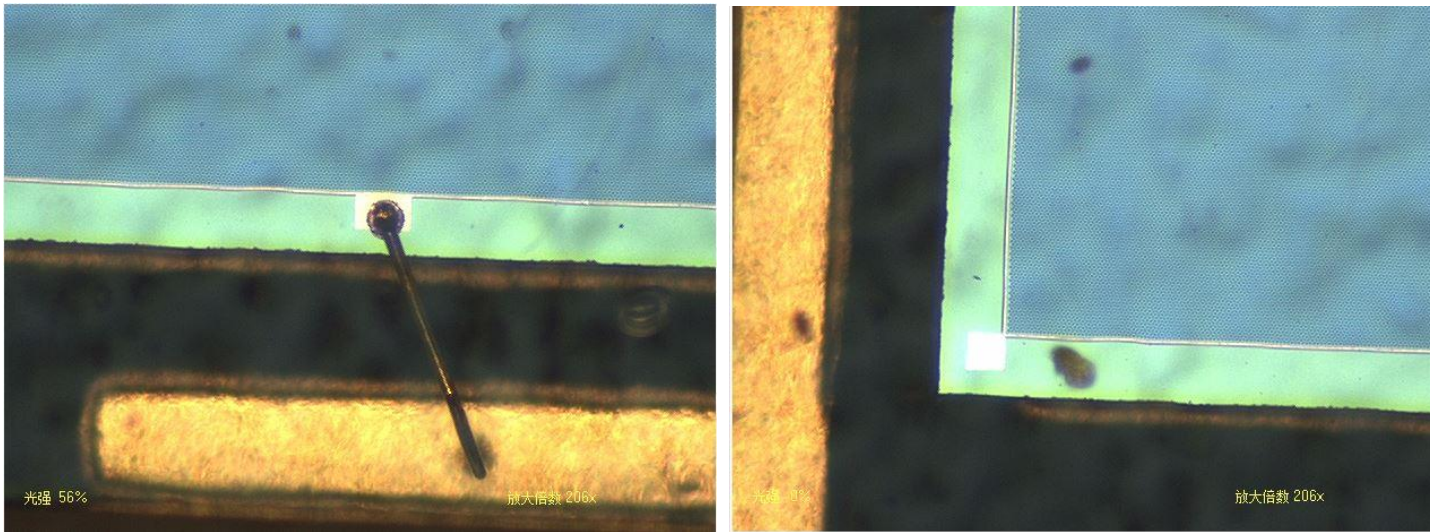
Baohua Qi

July 13, 2022

CEPC Scintillator Calorimeter Meeting

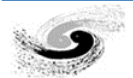
Motivation

- SiPM: NDL EQR06 series, 6 μm pixel, 3 \times 3 mm²
 - Response check with NDL SiPM candidate



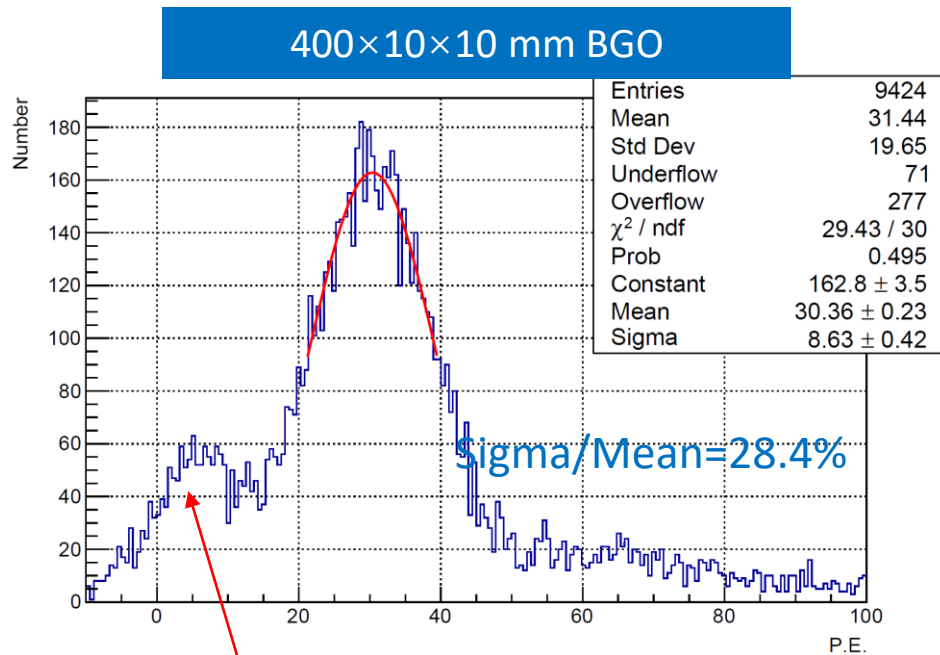
Type	EQR06 11-3030D-S
Effective Pitch	6 μm
Element Number	1 \times 1
Active Area	3.0 \times 3.0 mm ²
Micro-cell Number	244720
Typical Breakdown Voltage (V_B)	24.5 V
Temperature Coefficient for V_B	23 mV / $^{\circ}\text{C}$
Recommended Operation Voltage	$V_B + 8$ V
Peak PDE @420nm	30 %
Gain	8.0×10^4
Dark Count Rate (DCR)	276 kHz / mm ²
Terminal Capacitance	5.1 pF / mm ²

Above parameters are measured at their recommended operation voltage and 20 $^{\circ}\text{C}$.

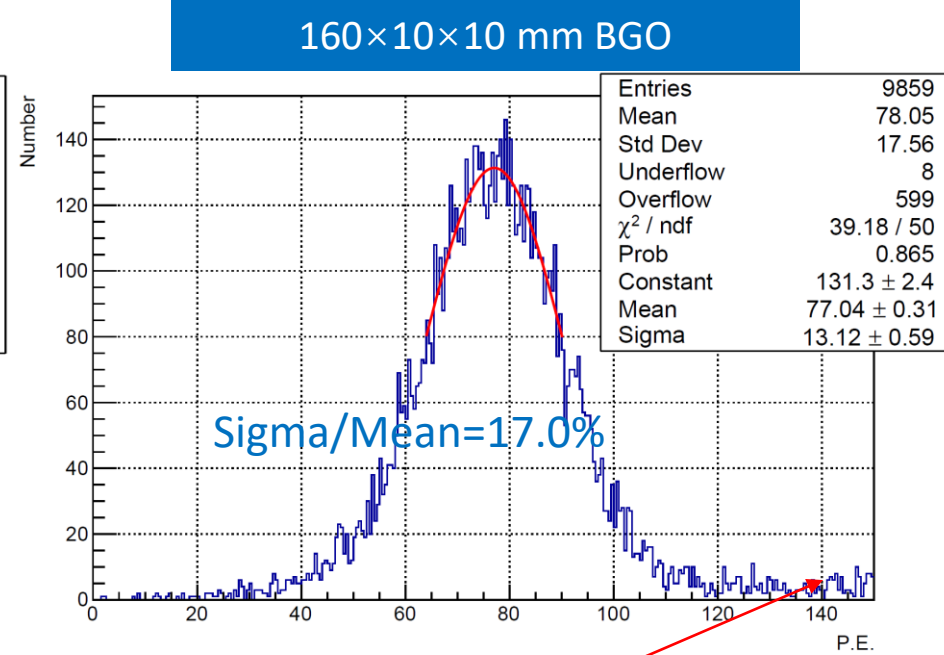


^{137}Cs radioactive source test

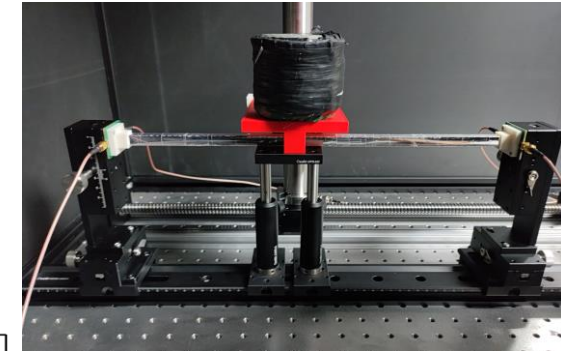
- Comparison of different length of crystal bar
 - Mean value of detected photons: $30 \rightarrow 77$ (400mm \rightarrow 160mm crystal)
 - The attenuation effect is stronger than expected



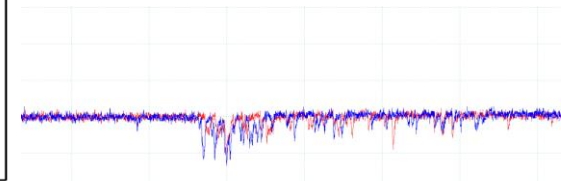
- Contamination of thermal noise
- Trigger threshold is lower



- Contamination of cosmic-ray events



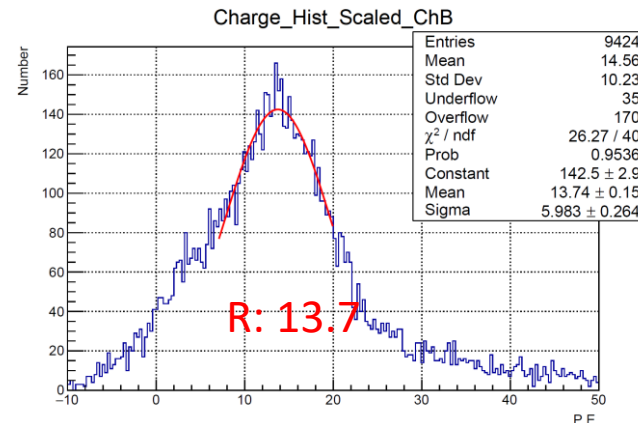
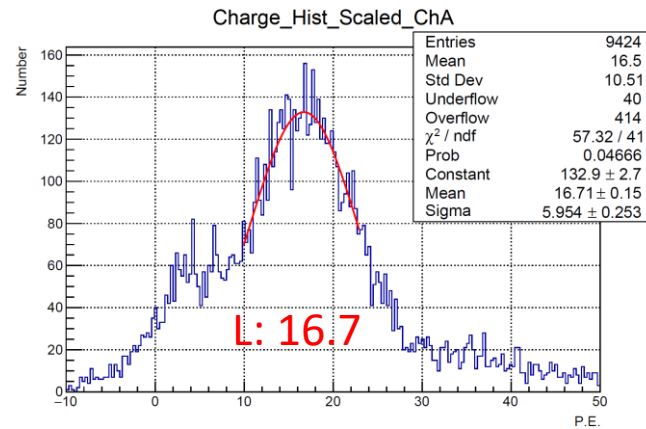
- Difficulty on trigger threshold setup
- Contamination of thermal noise and cosmic-ray events
- Energy spectrum of ^{137}Cs is not clear enough



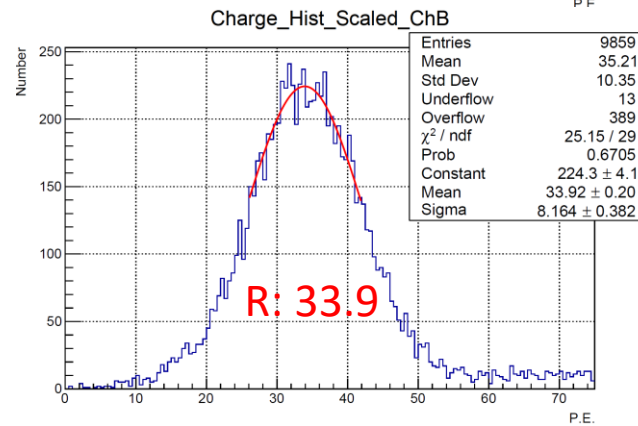
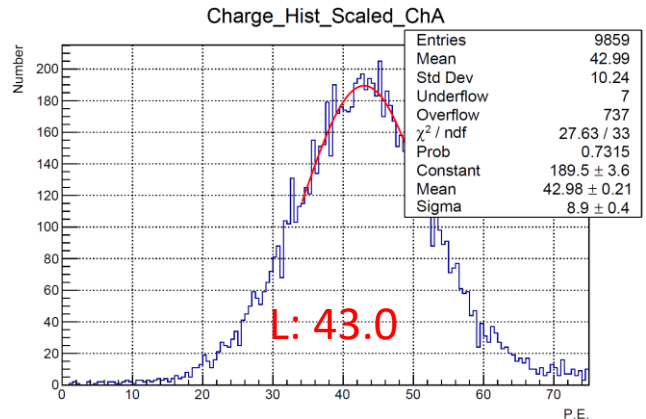
^{137}Cs radioactive source test

- Uniformity of signals from both ends of crystal

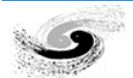
400 mm



160 mm



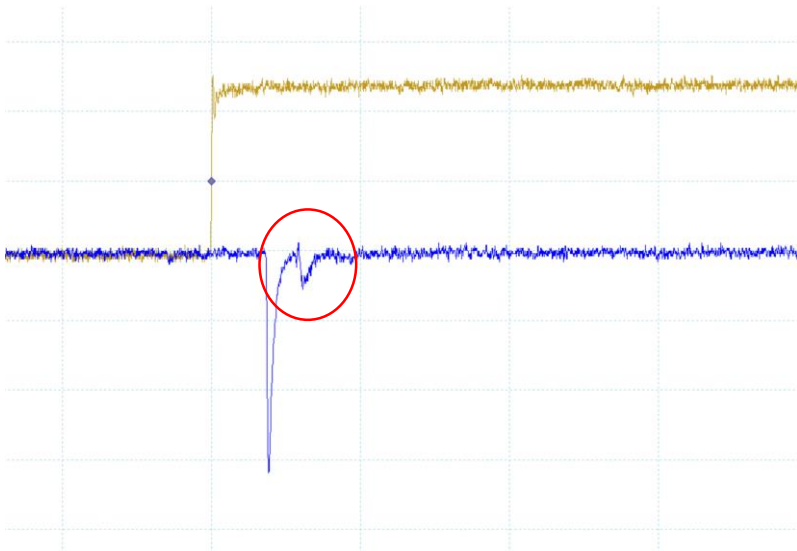
- Response non-uniformity of the 2 ends still exists
 - Main cause: crystal surface treatment difference
 - Still need further tests



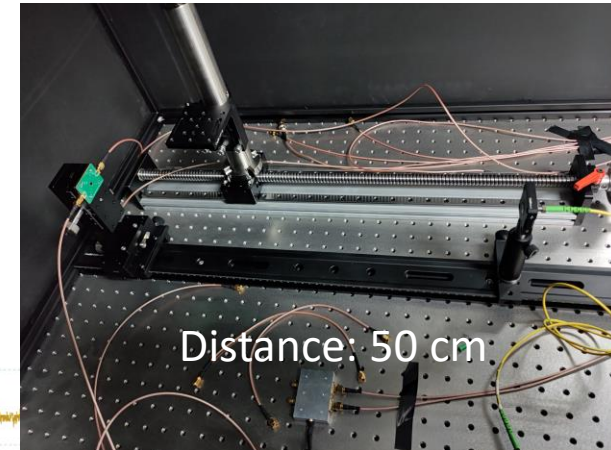
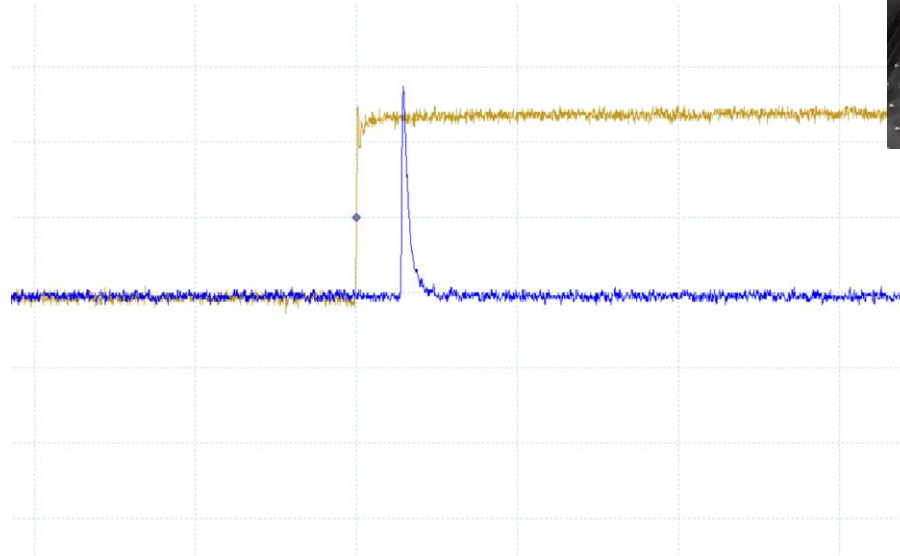
Laser test: dynamic range

- Laser test of NDL EQR06 SiPM (preliminary result)

Signal with preamplifier



Signal without preamplifier

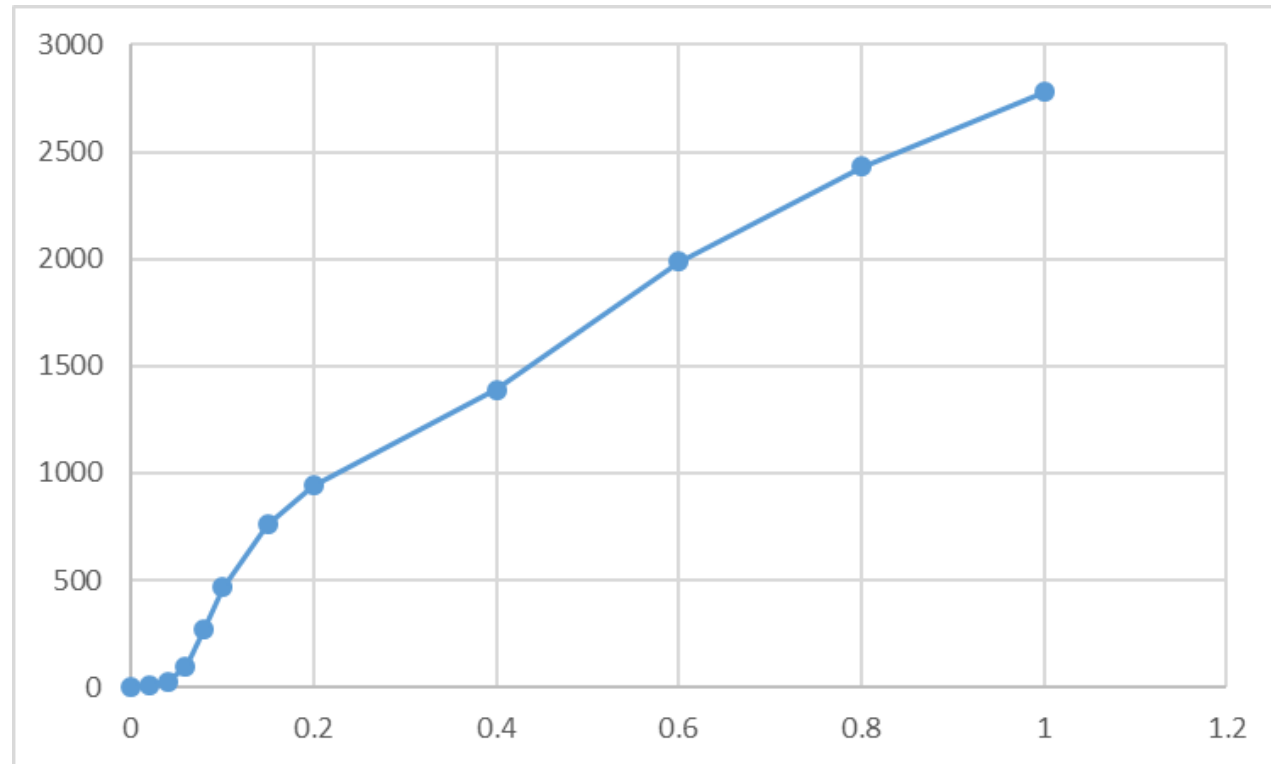


- Preamplifier will saturate at 1.6 V
- The test conducted without preamplifier

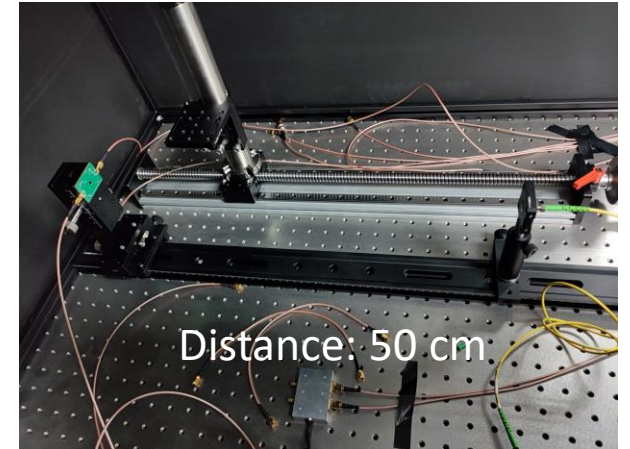
Laser test: dynamic range

- Laser test of NDL EQR06 SiPM (preliminary result)

Response



Laser intensity (1 - tune value)



- Laser intensity need to be calibrated
- The distance seems too far