

Properties of new type MRPC with $C_2F_4H_2$ 100%

2020 KoALICE WorkShop

GWNU

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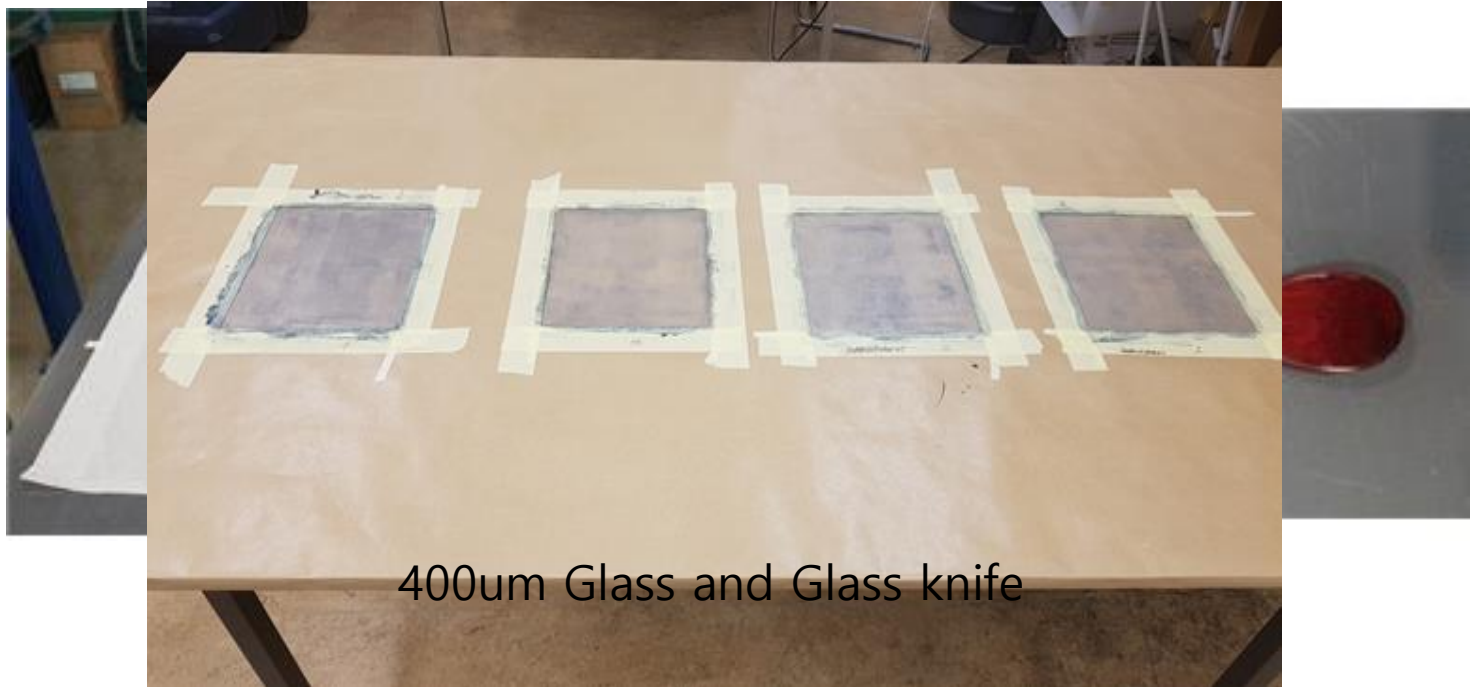
Contents

- Chamber Building
(double stack total 8 gaps with PCB)
- How to measure without NINO
(perform with Oscilloscope)
- Result
(Gas shielding, Efficiency)

Material

- Glass(400um)
- PCB(1.6mm, 0.8mm)
- Mylar(175um) for insulation
- Fishing line(250um) with screw
- Kepton tape for insulation
- Gas Tube to make flush gas evenly into the chamber

Glass(Resistive Plate)



400um Glass and Glass knife

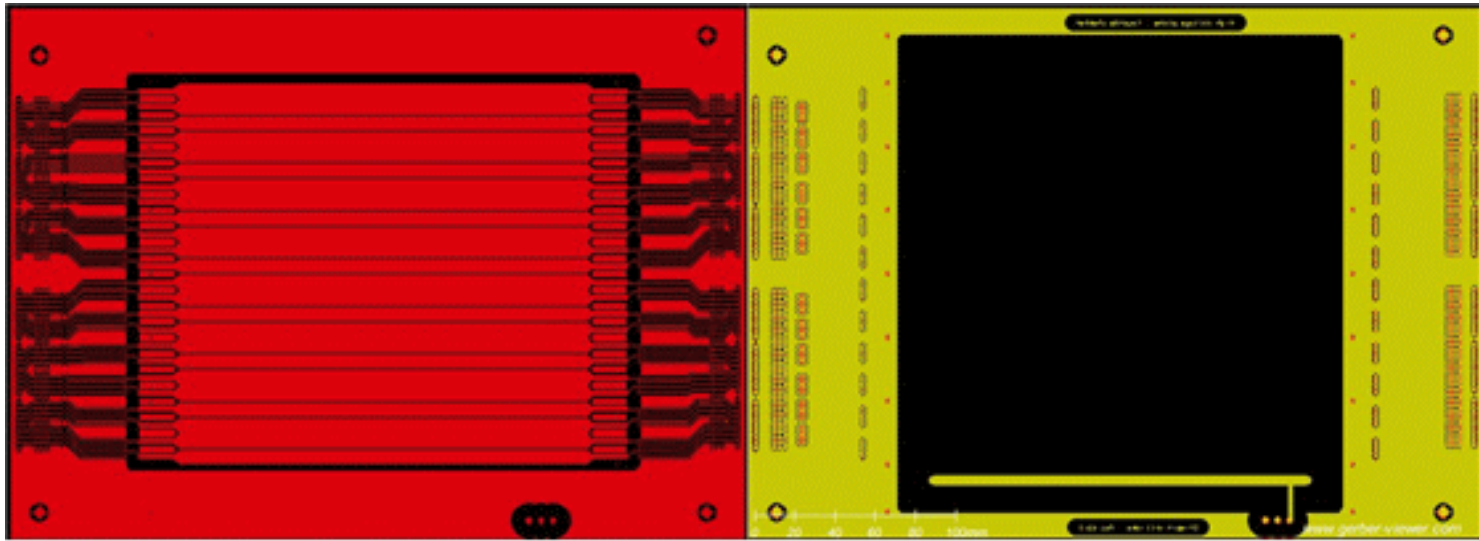
Resistance of Outer Glass = $1M\Omega/\blacksquare \sim 100M\Omega/\blacksquare$

-> for High Voltage

Strip type Readout PCB

Three kinds of PCB

1. ANODE(contain NINO connector part)
2. CATHODE(different strip line)
3. EMPTY(same as CATHODE but not-printed only drill)



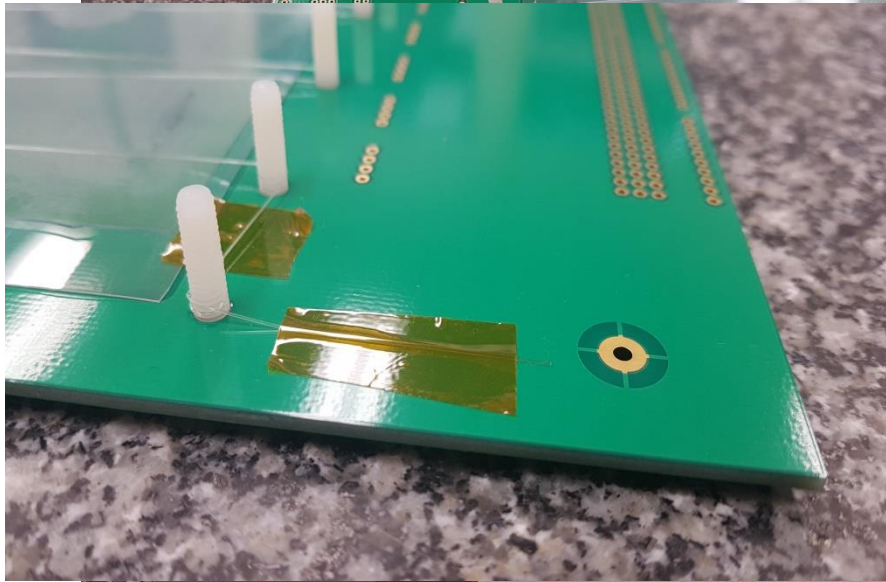
Open masked area ↑

Strip line



Strip line of Cathode is shifted

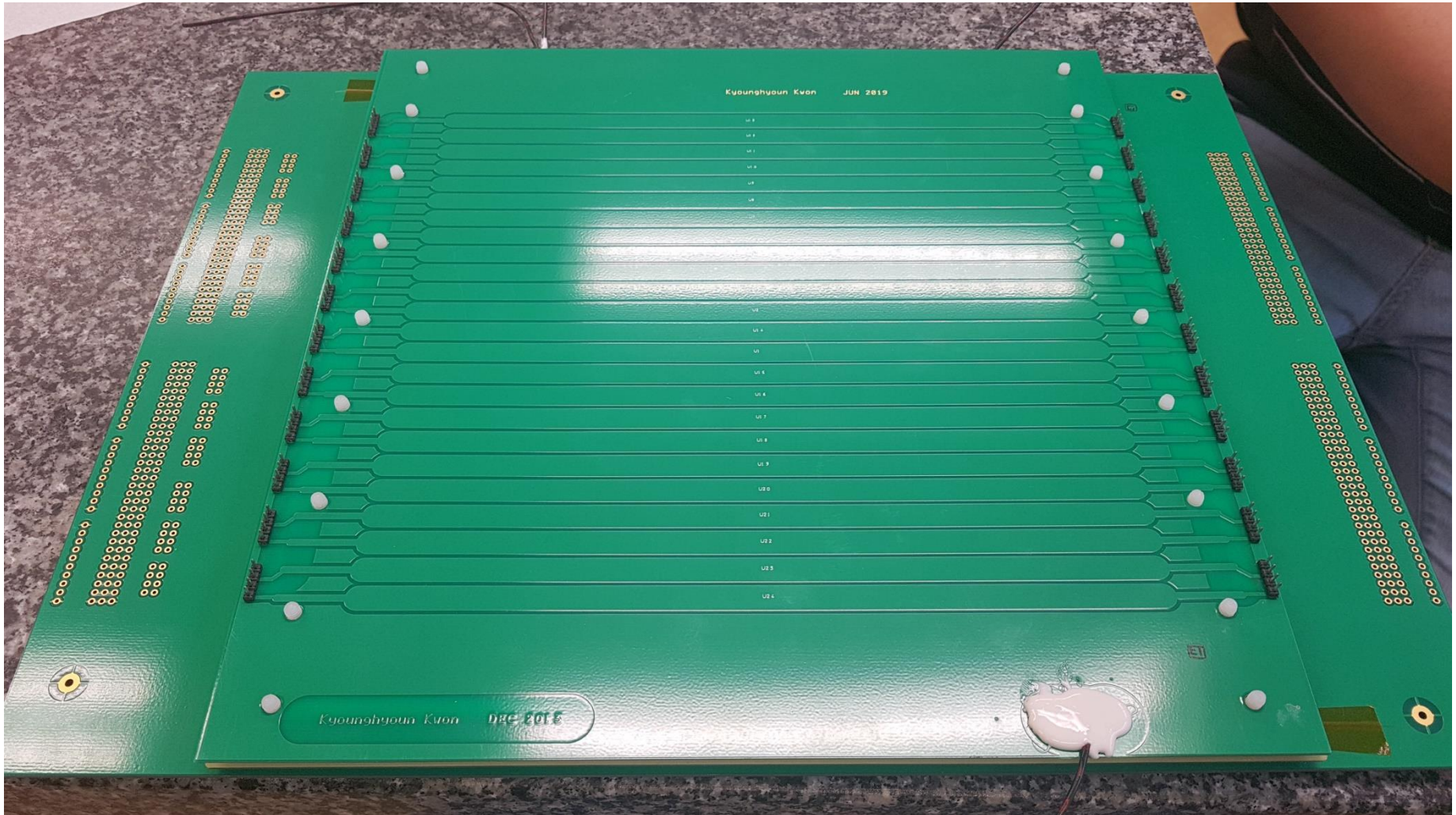
Building



Put the Outer Glass and to Connect painted surface with the HV line
Attach the Mylar to both ends of the glass with a yellow tape

Put mylar on the PCB and insert the screw

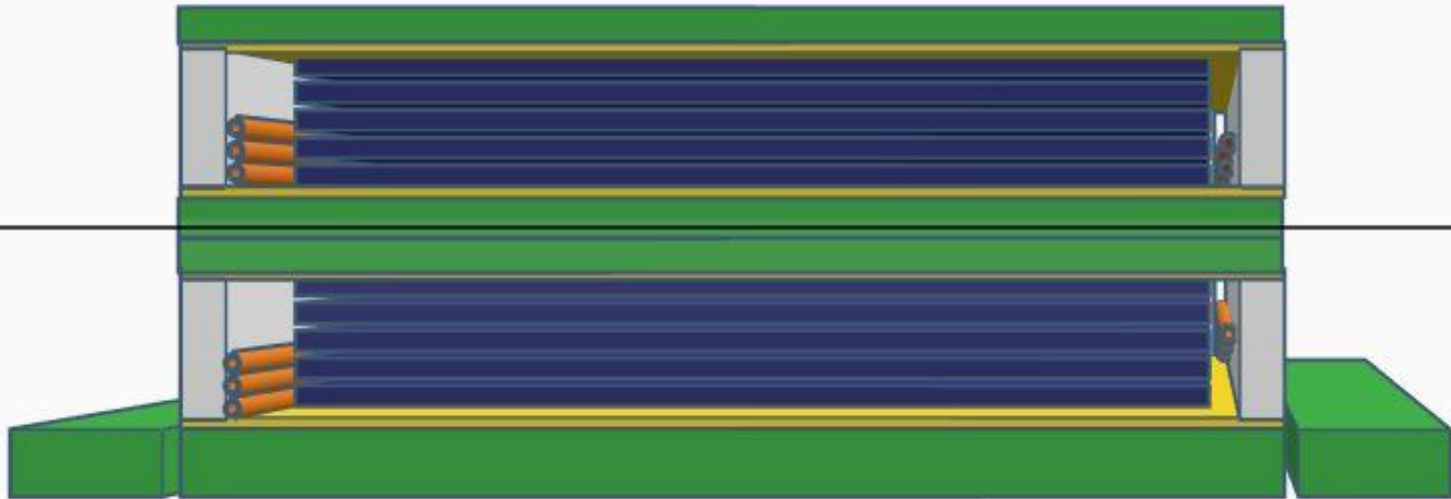
Completed Gap



Gas tube connected with Gas connector



3D model



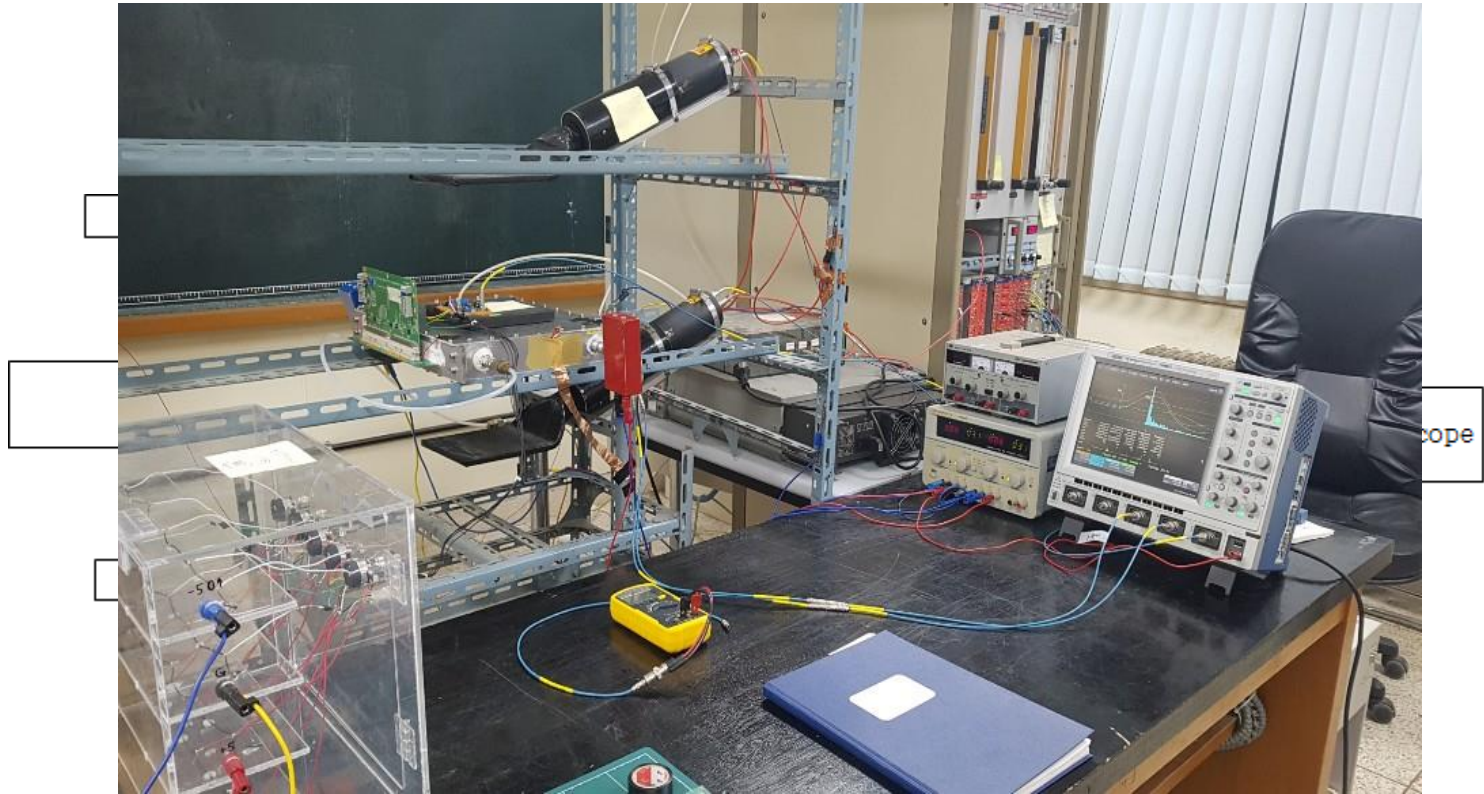
Orange color = gas tube inside of the chamber

-> flush the gas into the chamber

The length of the gas tube was varied

-> gas flush into the chamber evenly

Trigger Setting

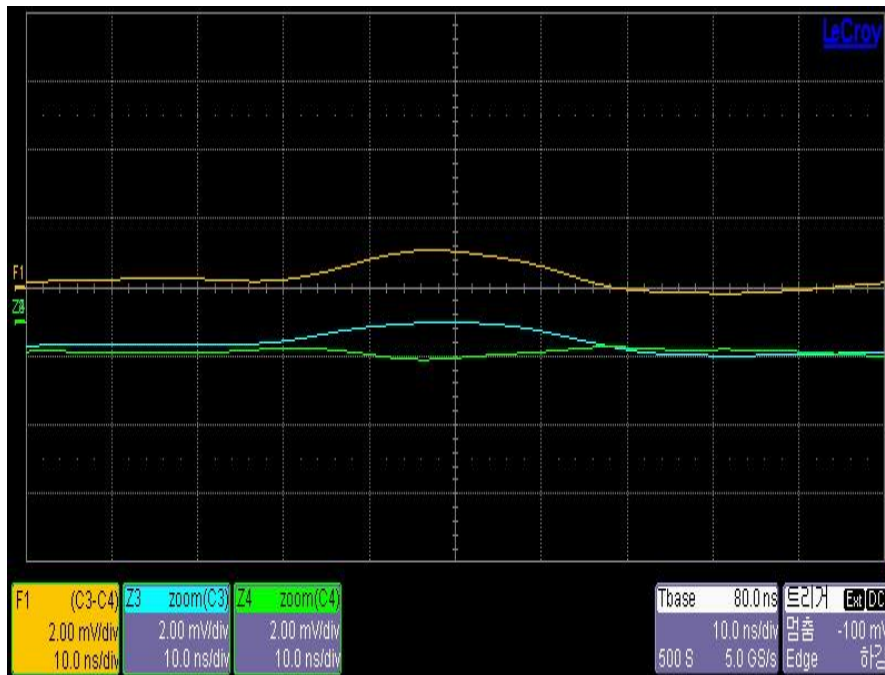


a fit noise of the data with a form

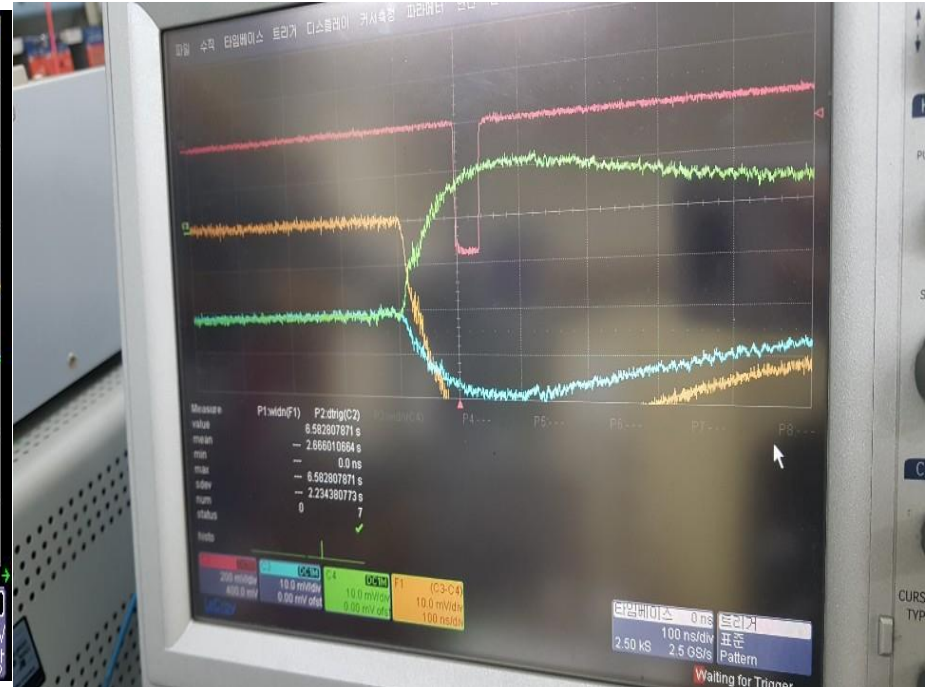
Trigger signal = (PM1 & PM2) & (Si-PM + 40ns) -> Oscilloscope

Differential signal(sample)

$$F1 = C3 - C4 : (+ \text{ signal}) - (- \text{ signal})$$



50Ω Coupling in 10ns scale



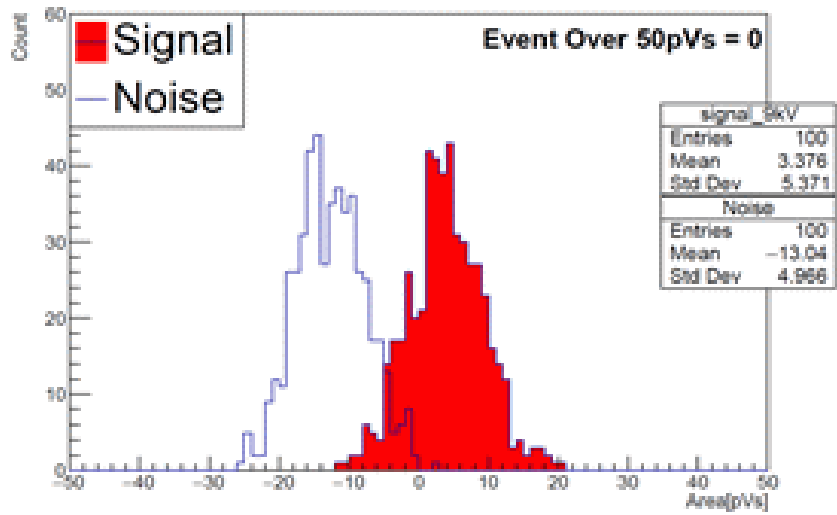
1MΩ Coupling in 100ns scale

Parameter Setting

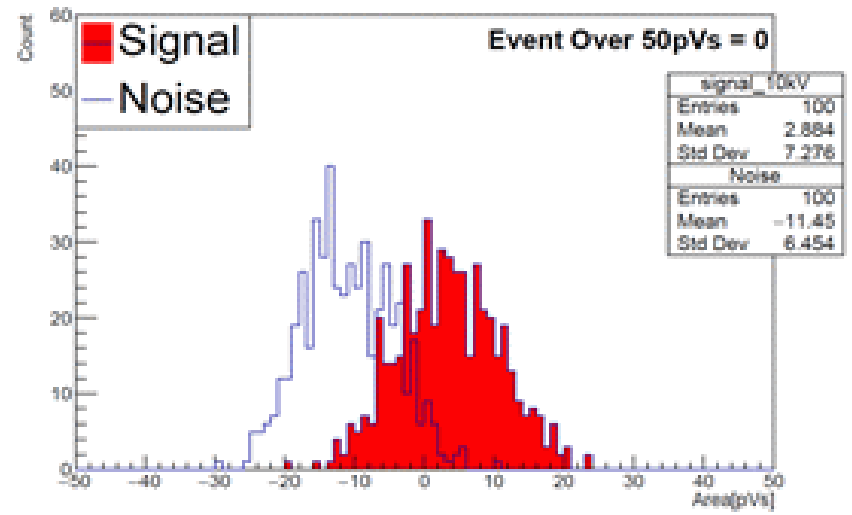
- $P1 = \text{Area of F1} \rightarrow P1 \geq 0 \text{ pVs}$
- $P3 = \text{time value of Maximum voltage of C3}$, $P4 = \text{time value of Maximum voltage of F1} \rightarrow P3 - 5\text{ns} \leq P4 \leq P3 + 5\text{ns}$
- $P5 = \text{peak to peak of F1} \rightarrow P5 \geq 100\mu\text{V}$
- Save area of F1 in Histogram



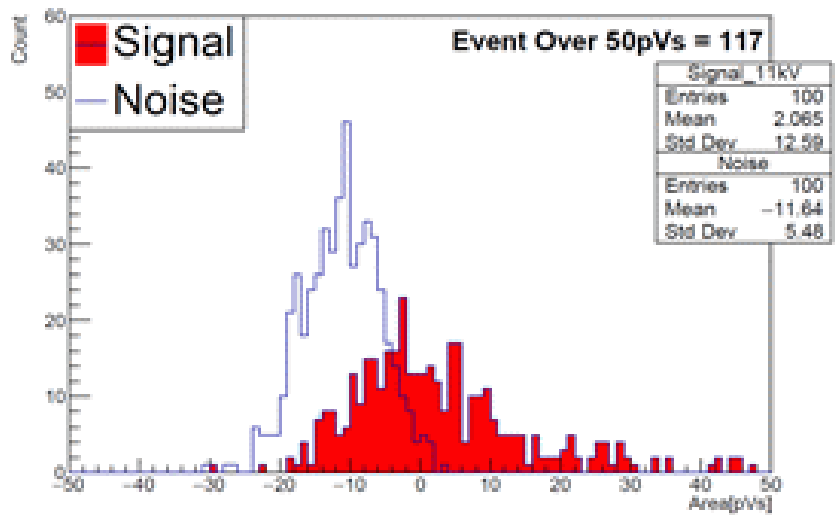
signal_9kV



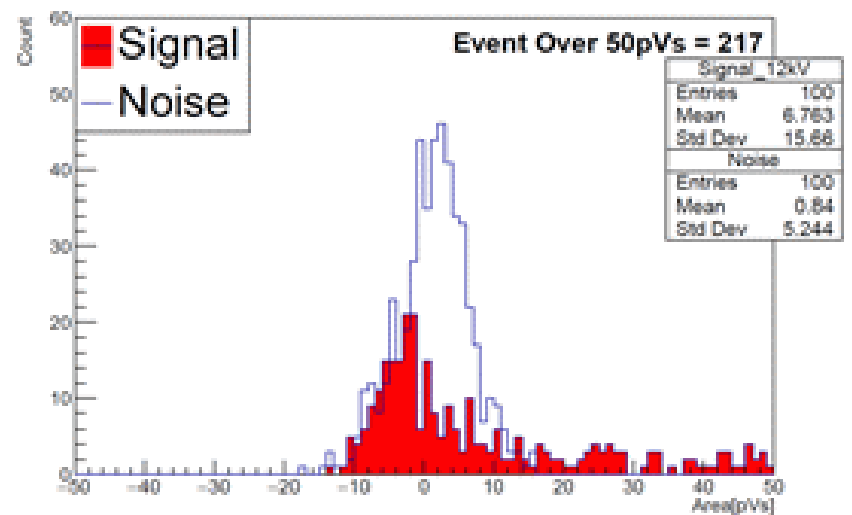
signal_10kV



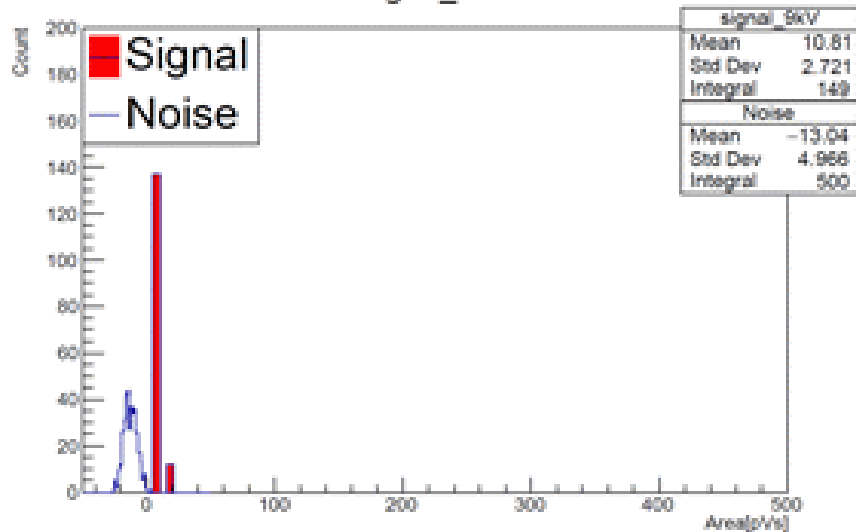
Signal_11kV



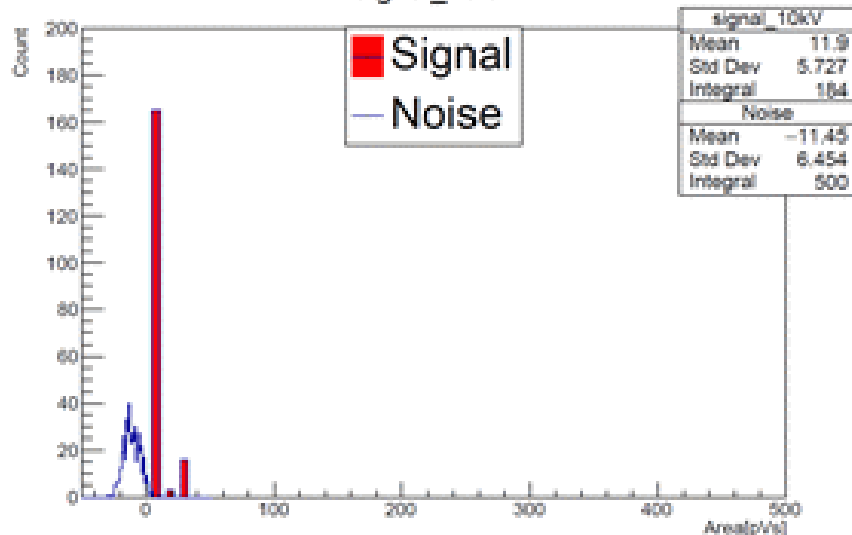
Signal_12kV



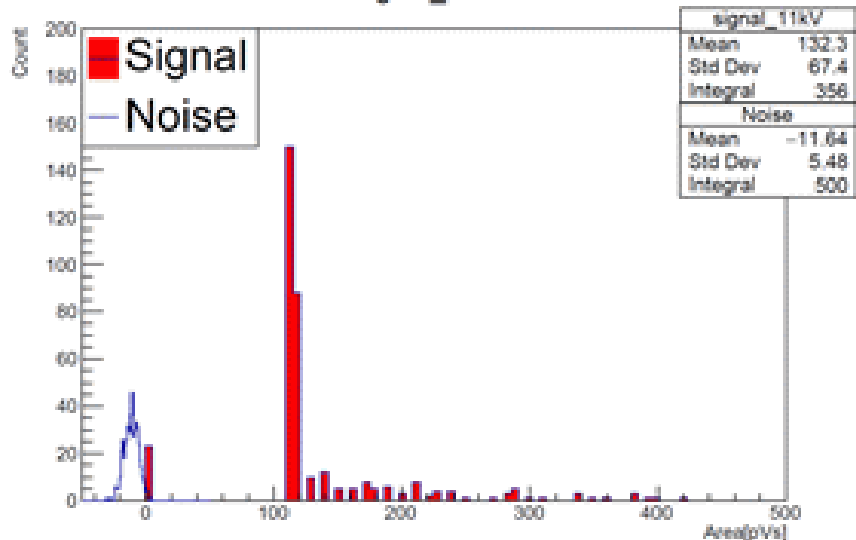
signal_9kV



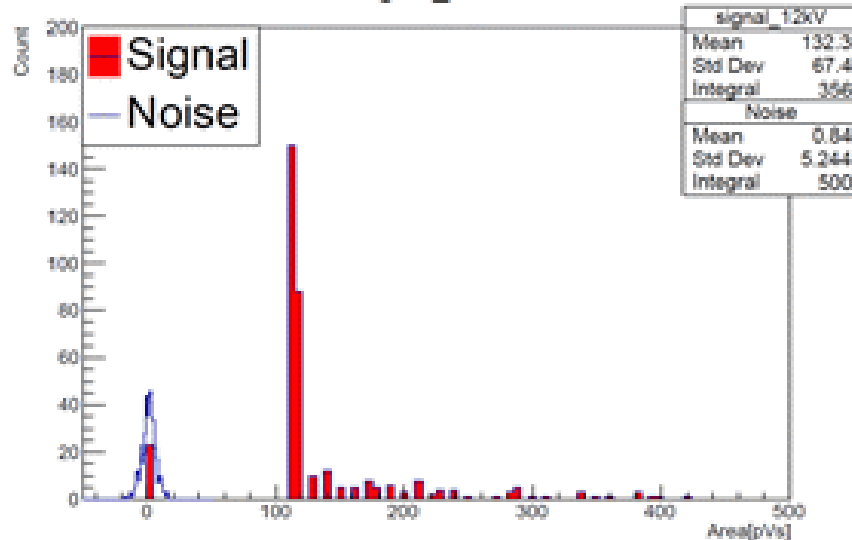
signal_10kV



signal_11kV



signal_12kV



Result

- Gas shielding

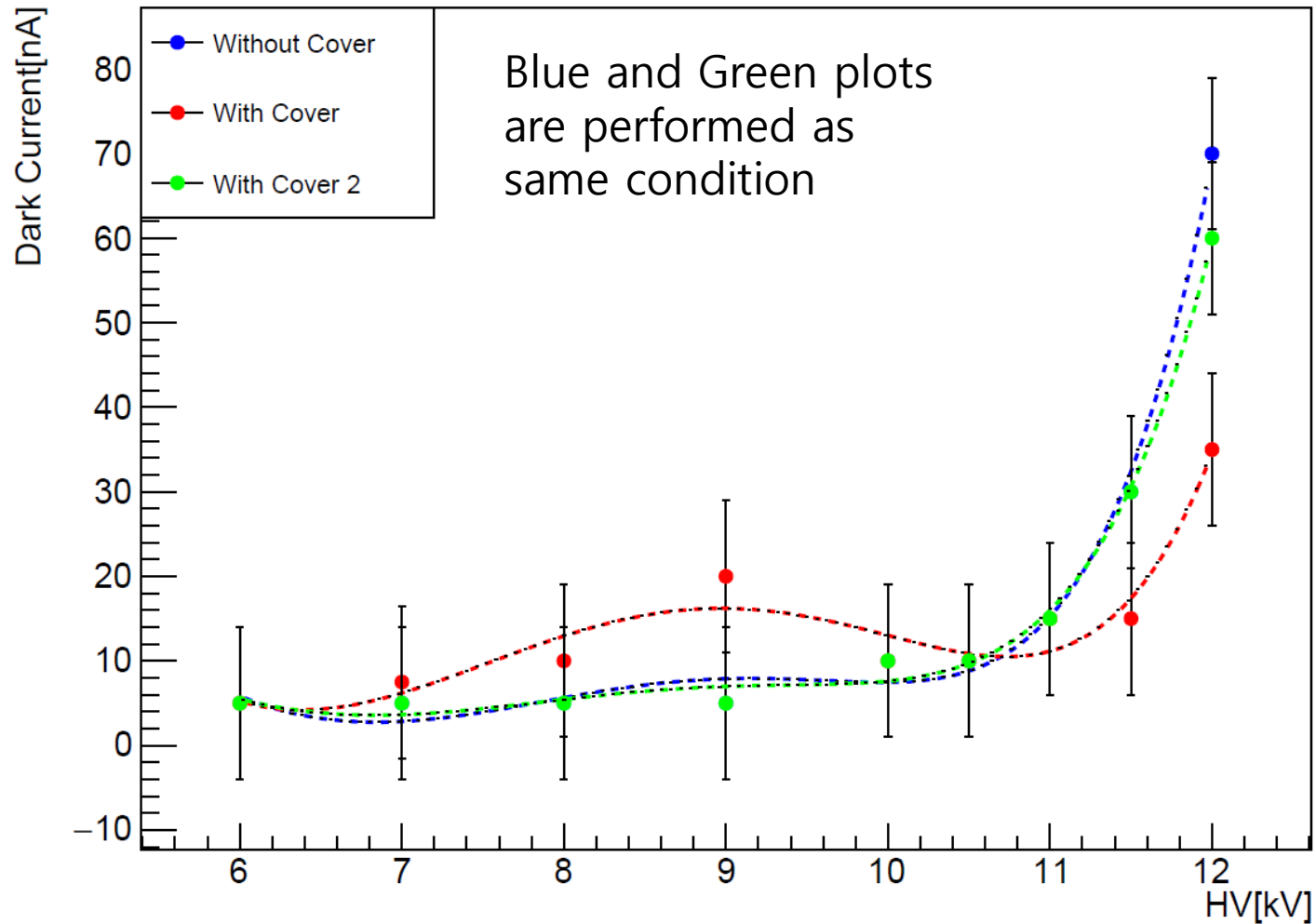
Dark Current compare

- Efficiency

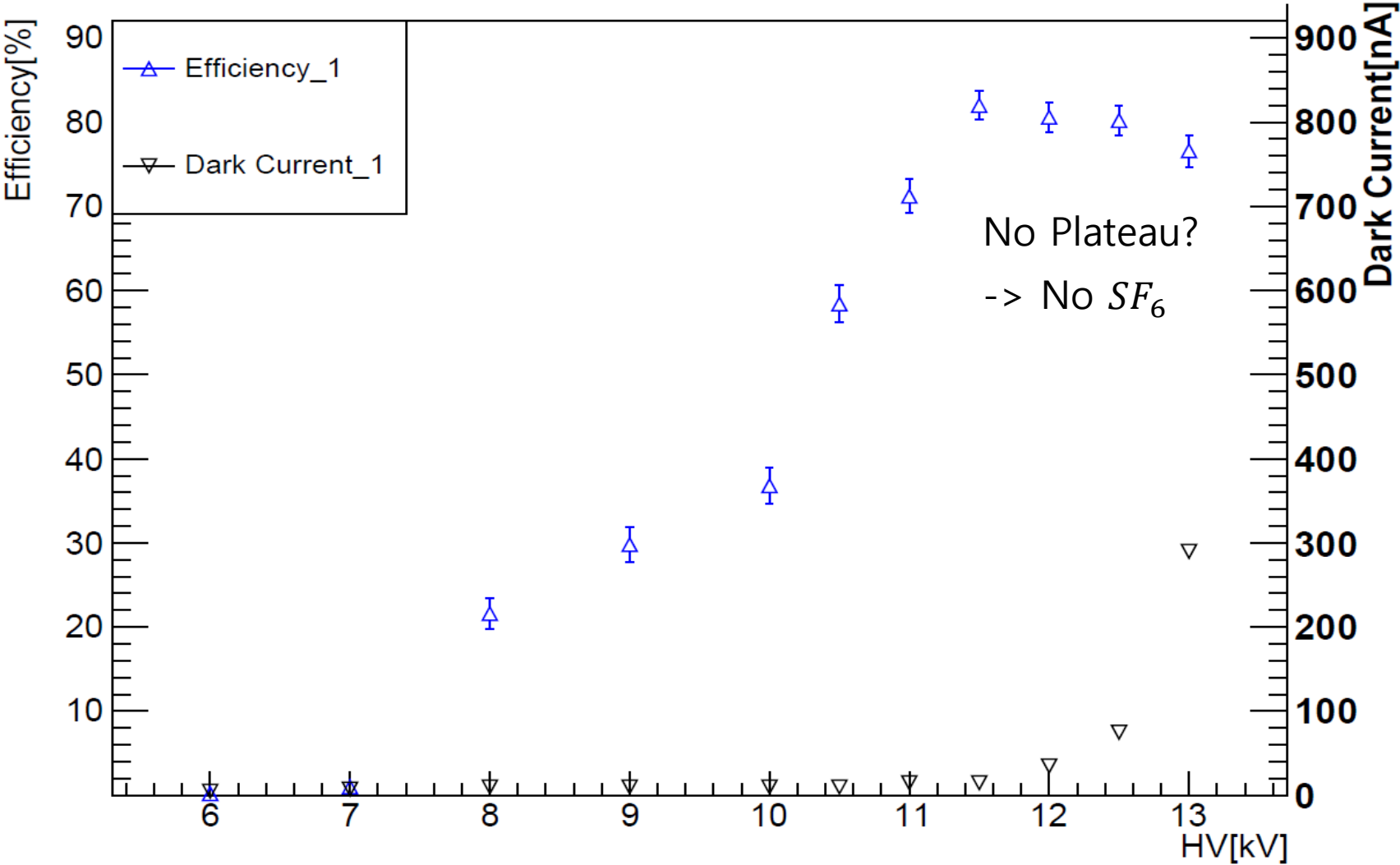
With Dark Current

Gas shielding

Dark Current



Efficiency



Future Plans

- Trigger Setting

With more than two different MRPC

- Performance test with NINO-ASIC using Standard Gas-mixture ($C_2F_4H_2$ 98%, SF_6 2%)

Time and position resolution

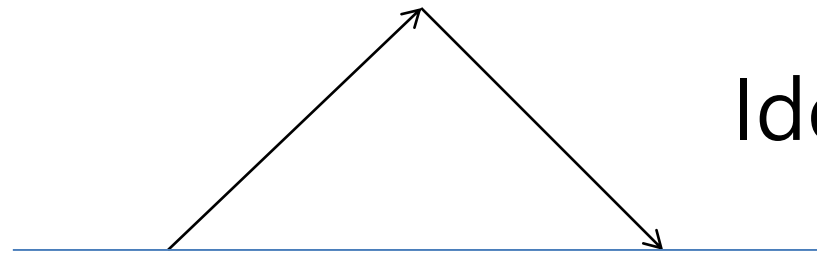
Efficiency

- Ecological Gas-mixture test



$$V = IR = \frac{\Delta Q}{\Delta t} R \rightarrow \Delta Q = \frac{V}{R} \Delta t$$

$$\frac{1}{2} \times 100 \mu V \times 30 ns \div 50 \text{ Ohm} = 30 fC$$



Ideal case

NINO threshold : $10 fC \sim 100 fC$