



復旦大學

R&D Status of muon detector

XIAOLONG WANG

FOR MUON DET R&D GROUP

FUDAN UNIVERSITY

REF TDR MEETING, 19/3/2024

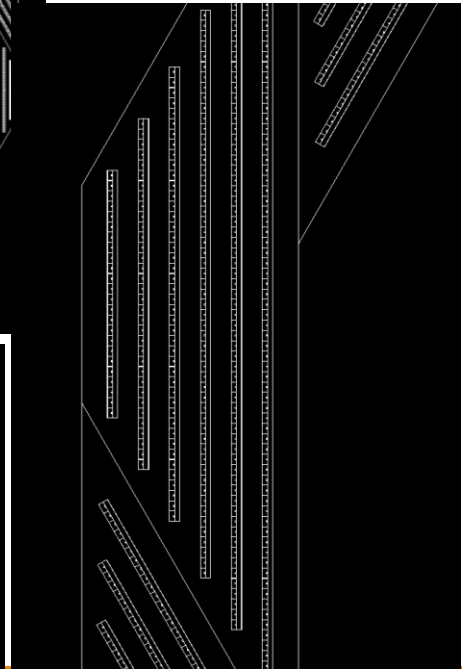
Comparison between scint. and RPC

	Scintillator scheme	RPC scheme
Spatial resolution	$\leq 1.2 \text{ cm}$	1 cm
Time resolution	$< 1.5 \text{ ns}$	$1 - 2 \text{ ns}$
Muon efficiency	$> 95\%/\text{channel}$	95%
Long term rate limit	$> 25 \text{ kHz}/\text{cm}^2$	$100 \text{ Hz}/\text{cm}^2$
Peak luminosity	$6 \times 10^{35} \text{ cm}^{-2} \text{ s}^{-1}$ (Belle II design)	$\sim 2 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$
Cost w/out BEE	$\sim 5600 \text{ ¥}/\text{cm}^2$ (estimation)	$\sim 5600 \text{ ¥}/\text{cm}^2$ (Dayabay)
Massive production	Much simple (experience at VT)	3 years for Belle RPC
Maintenance	LV system	Gas cost per year, HV system
...

Geant4 simulation of barrel structure

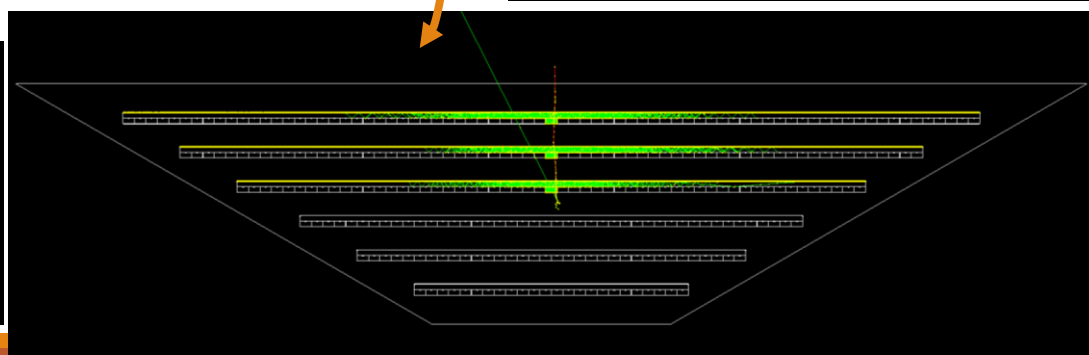
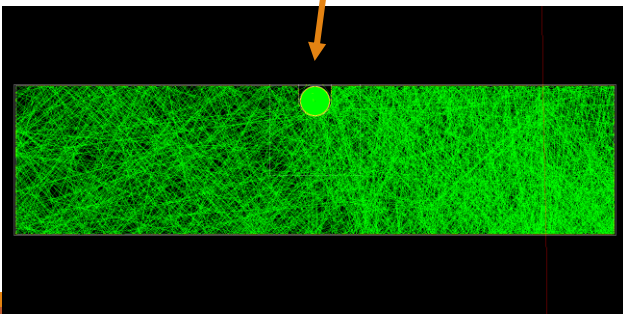
by Zibing Bai (NKU)

- Spiral geometry with 12 sectors.
- Six superlayers with common 4m length and different widths, covered by 0.5mm Al support structure and 0.5mm for gas gap.
- Simulation of single channel with scintillator strip, WLS fibre, and SiPM.
- Total Length: 71040m.
- Simulation of 500 MeV/c muon hits.
- Going to simulate the Endcaps, and implement it in CEPCSW.



WLS fibre, $\phi = 2.0\text{mm!}$

Muon hit

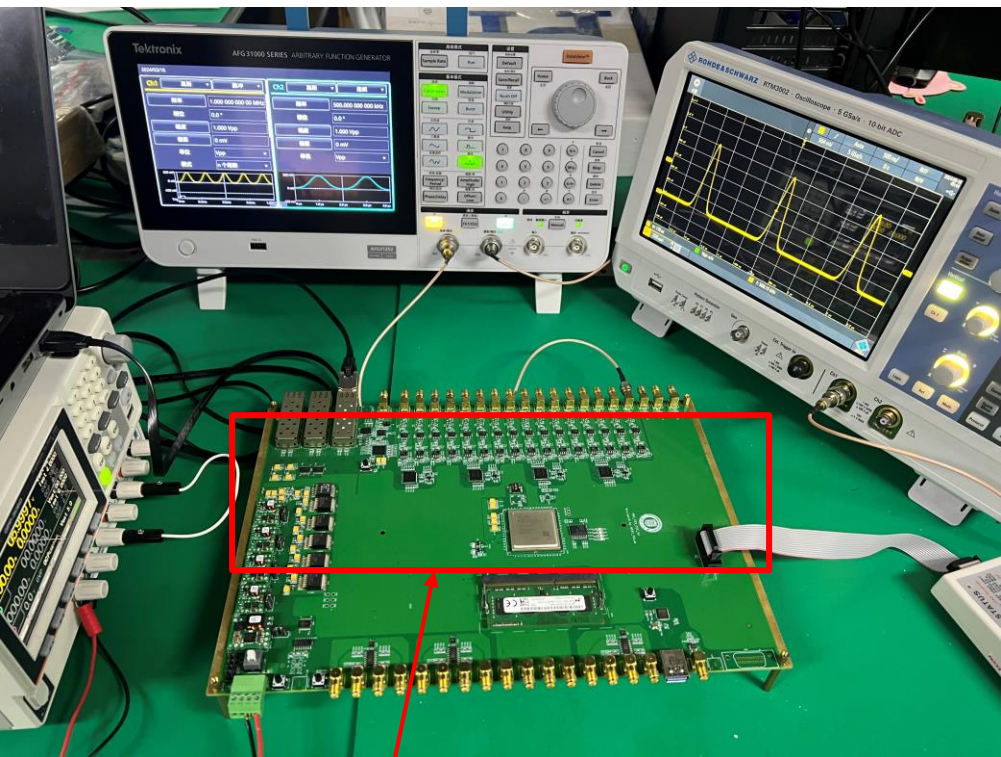


Test with the ADC board at USST

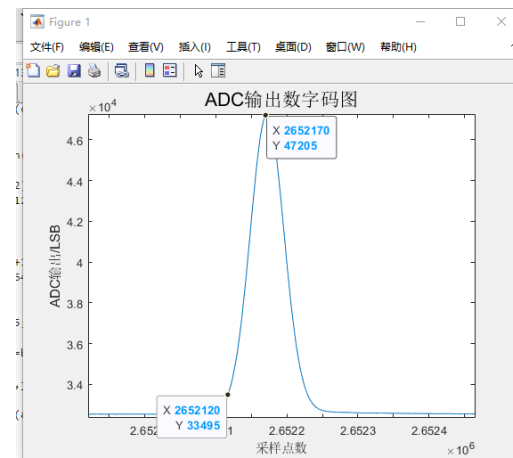
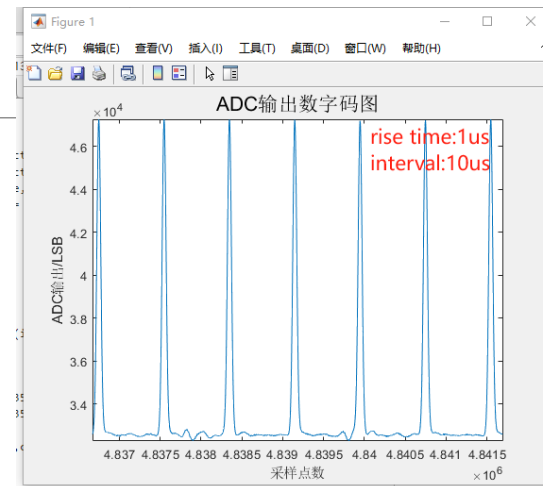
By Jianjun Wang

Test on 40MSPS. Suggested to try 100 MSPS.

ADS5263



Major Parameters	
Sample Rate(MSPS)	10-100
Resolution (Bits)	16
Number of input channels	4
SNR(dB)	85.5



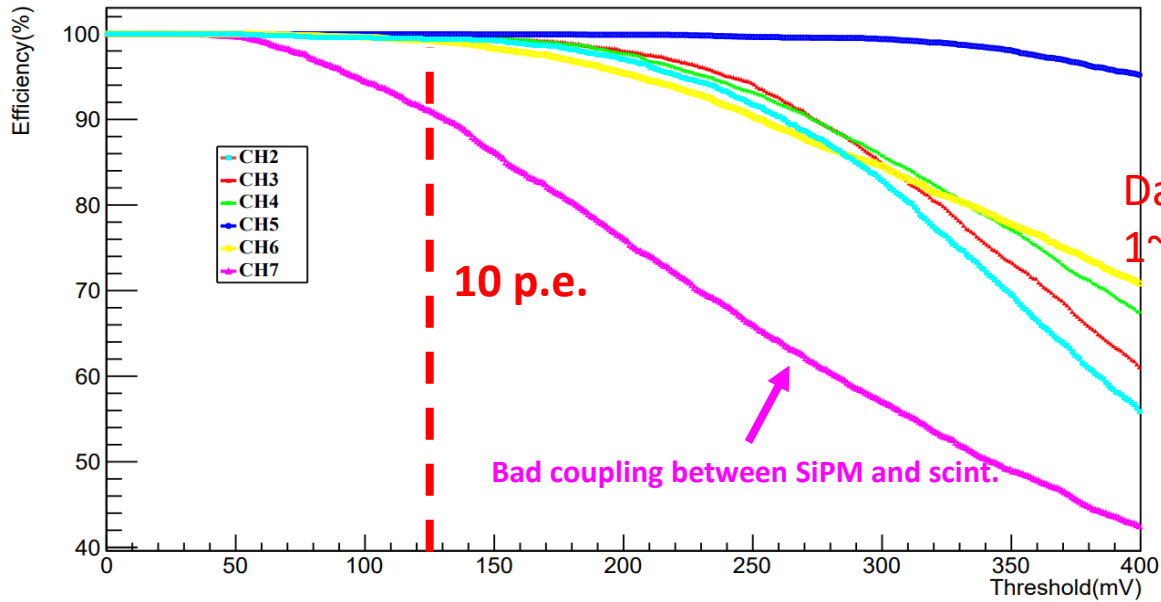
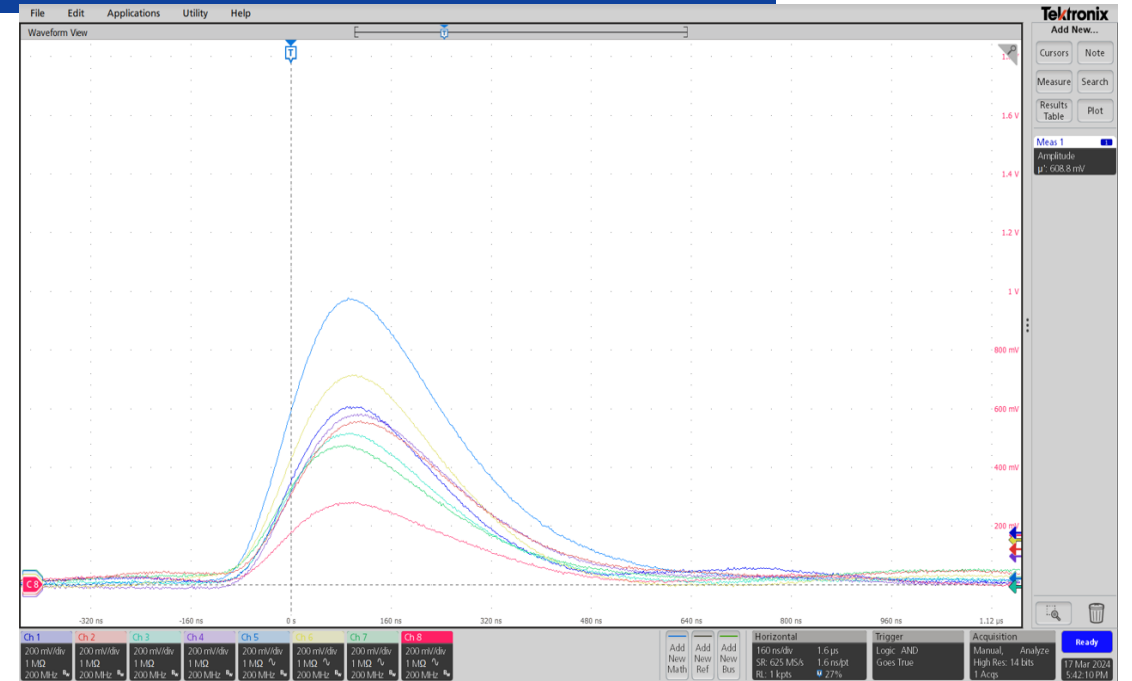
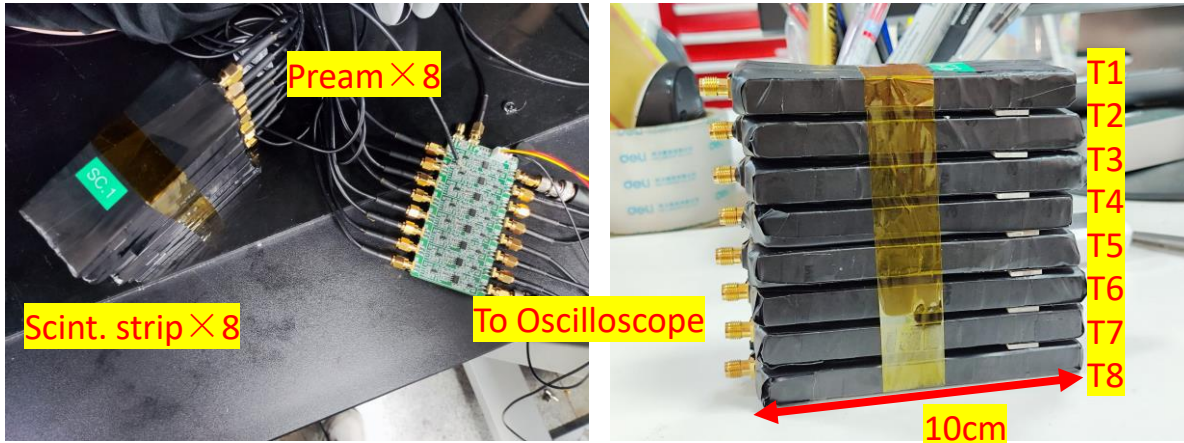
4 × 4 ADC channels

Dual pulses: $\tau_{rise} = 1\mu s$,
 $\tau_{delay} = 1.2\mu s$

Single pulse

CR test on scintillator channels

By Xiyang Wang



Dark counting:
1~3 p.e.

