

dRICH Interaction Tagger Development Status

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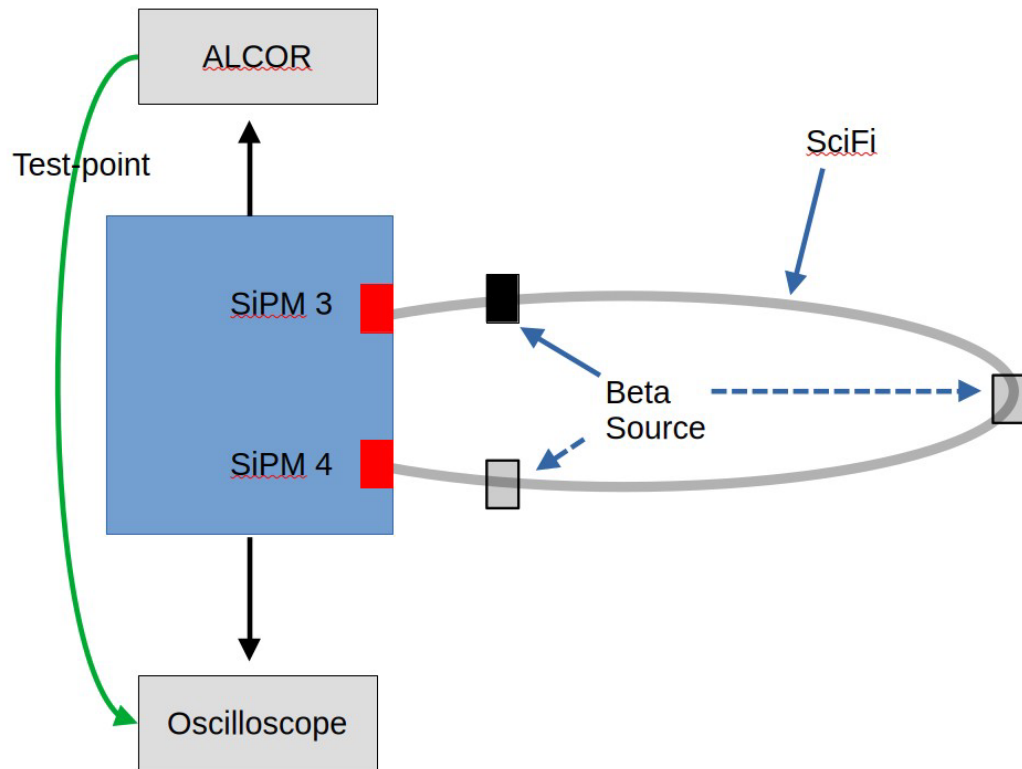
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Overview

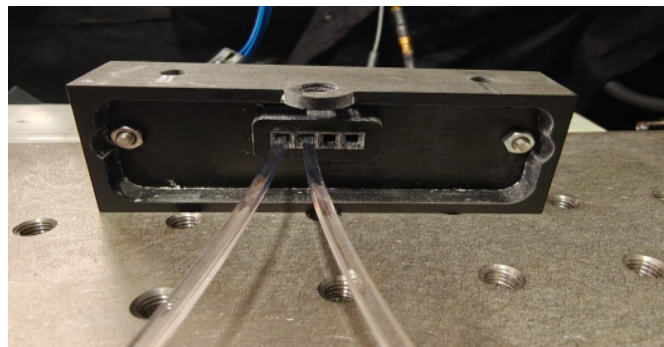
- dRICH Interaction Tagger (dIT)
 - Tag charged particles above energy threshold
 - Trigger dRICH data acquisition for possible relevant physics
 - Reduce background acquisition rate
- Design
 - 2 layers of scintillating fiber (SciFi) coupled to SiPMs
 - Charged particles produce light inside the fibers
 - SiPM converts light into electrical signal
 - ALCOR measures signal crossing time and slew

Measurements

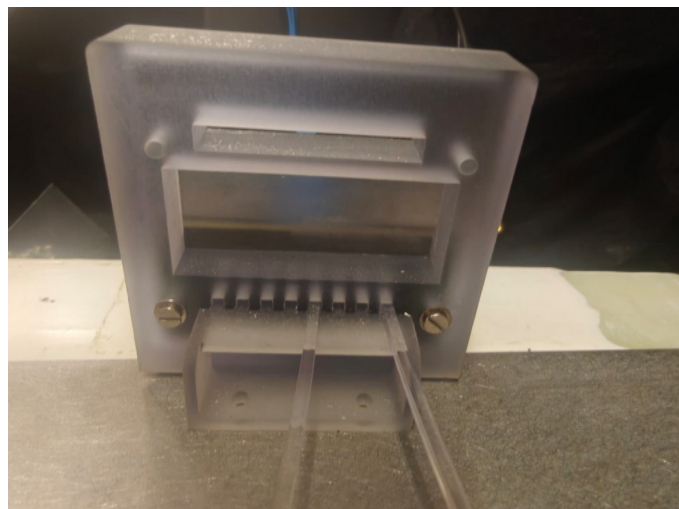
- dIT needs to record timestamp of particle interaction
 - Need precise timing
- Setup:
 - SciFi coupled to two SiPM with radio source along SciFi
- Measurement:
 - Record time difference between two SiPMs



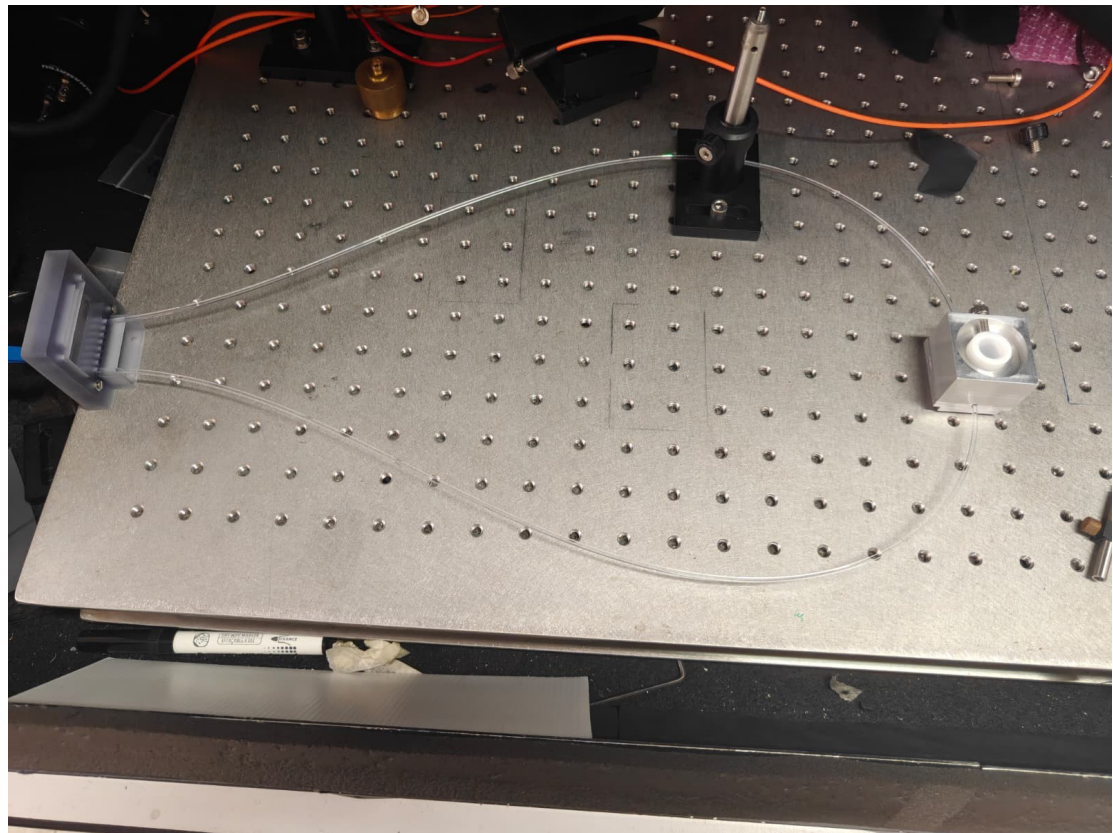
4 SiPM PCB



8 SiPM PCB

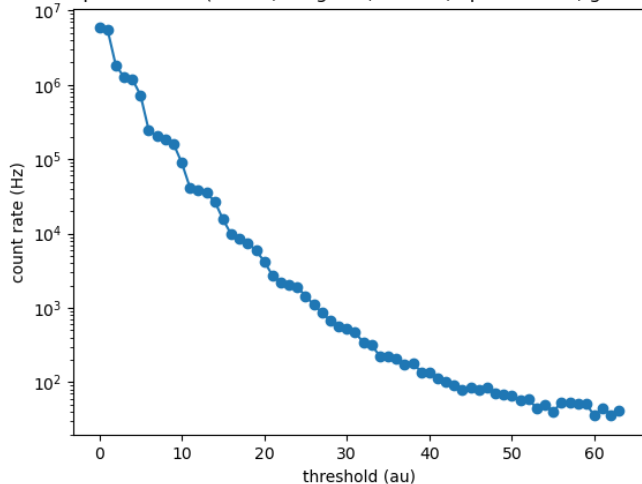


Measurements

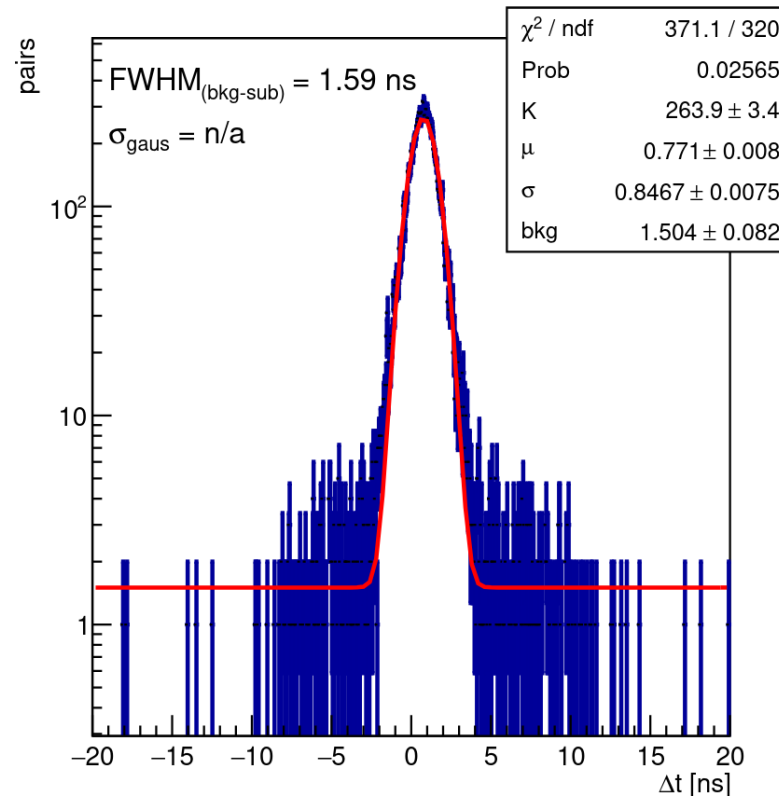


- Two main kinds of measurements
 - Threshold scan
 - Coincidence timing distribution

05-196 chip-2 chan-19 (vth=1, range=3, off1=2, opmode=12, gain1=0, gair

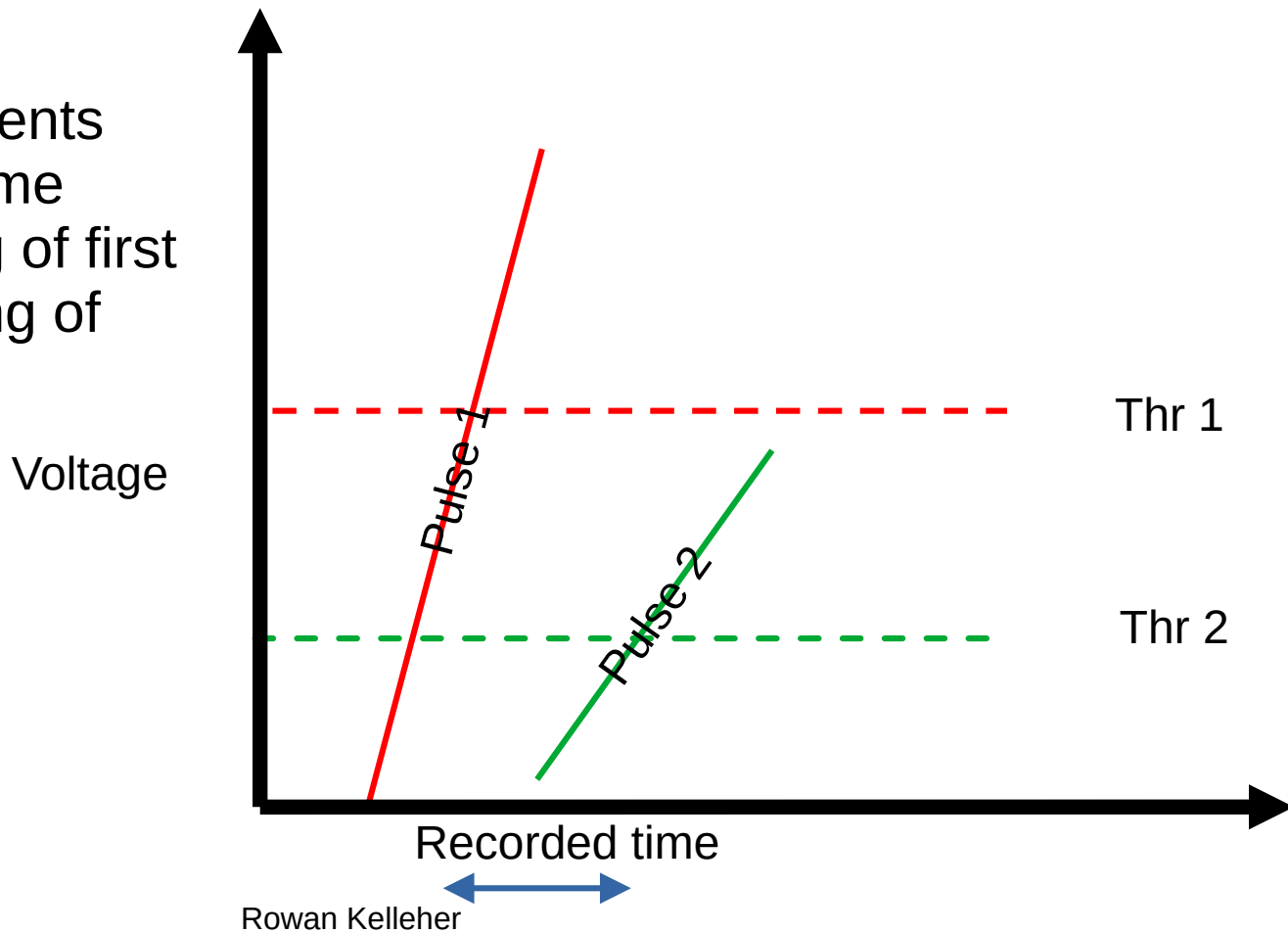


ch 17 vs 19 (coinc window 20 ns)



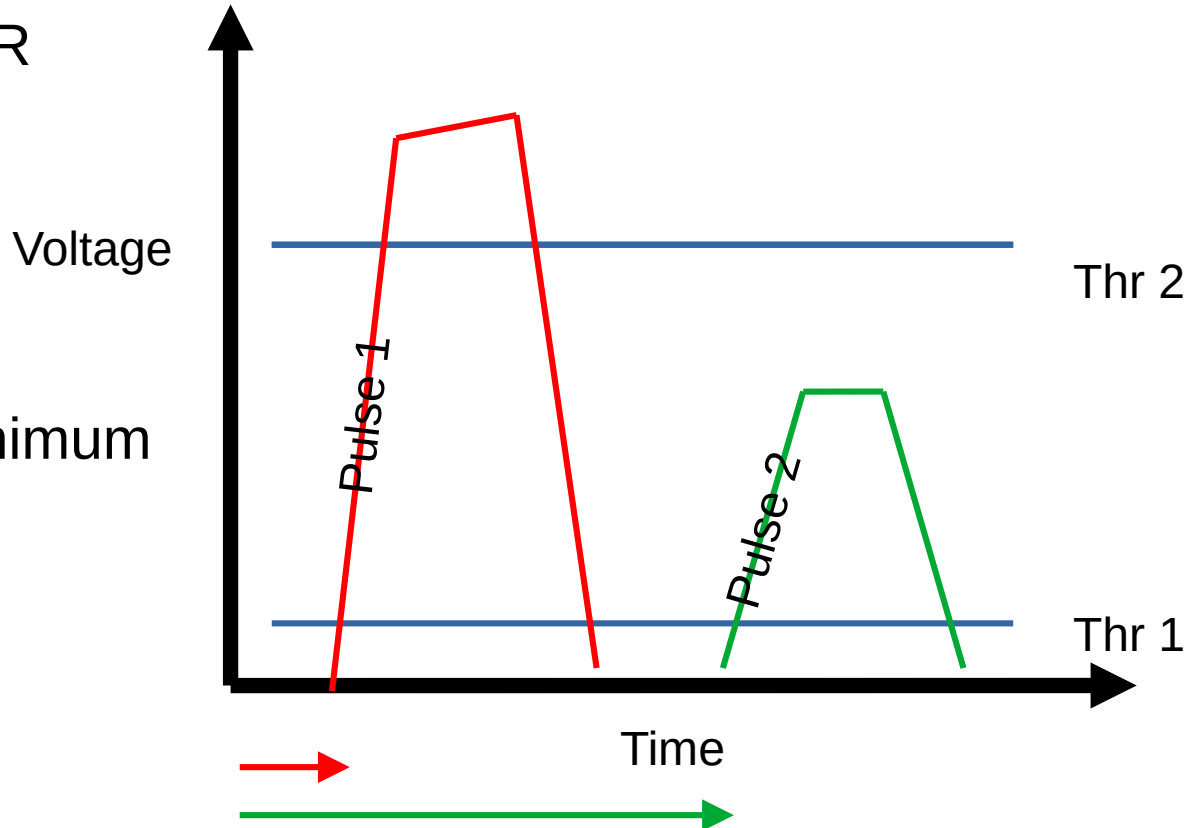
Measurements

- Oscilloscope Measurements
 - Record difference in time between 50% crossing of first SiPM and 50% crossing of second SiPM



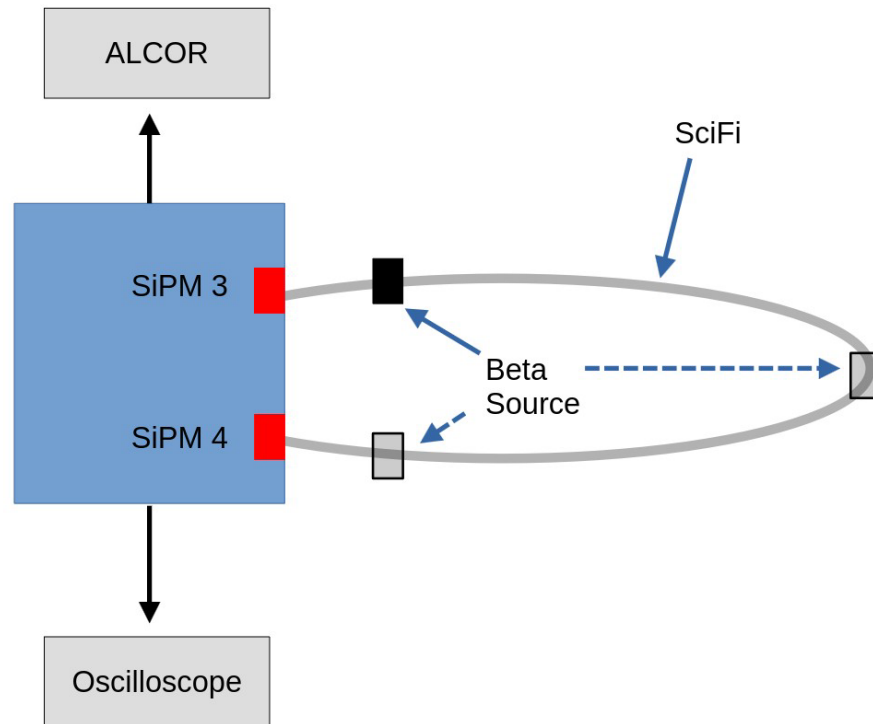
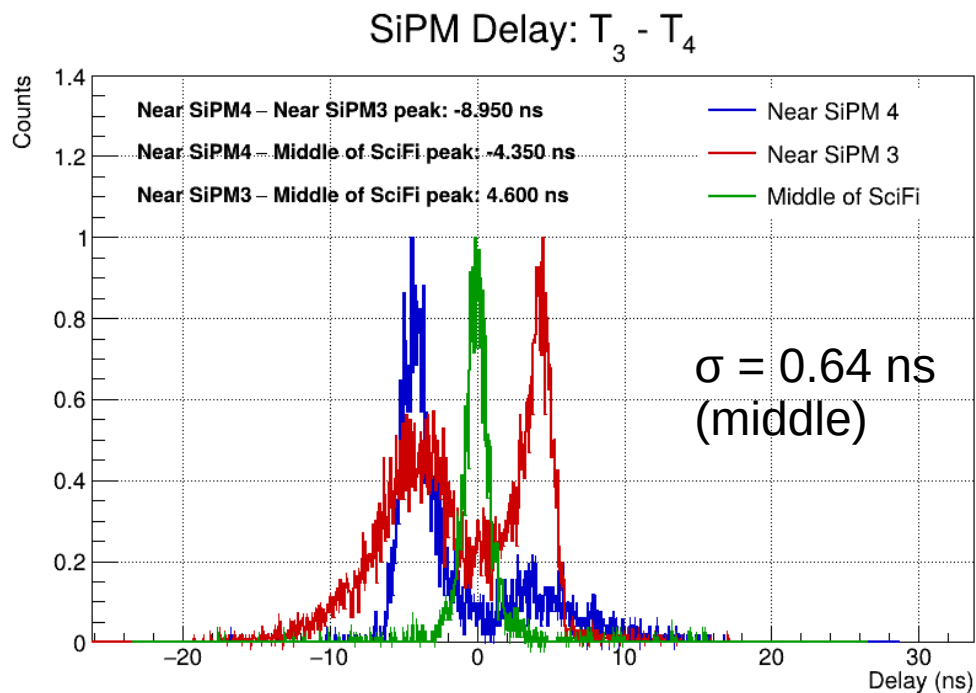
Measurements

- Simple measurement: ALCOR
 - Slew-rate mode
- First threshold:
 - Record timestamp
- Second threshold:
 - Select for events with a minimum amplitude
 - Limits noise

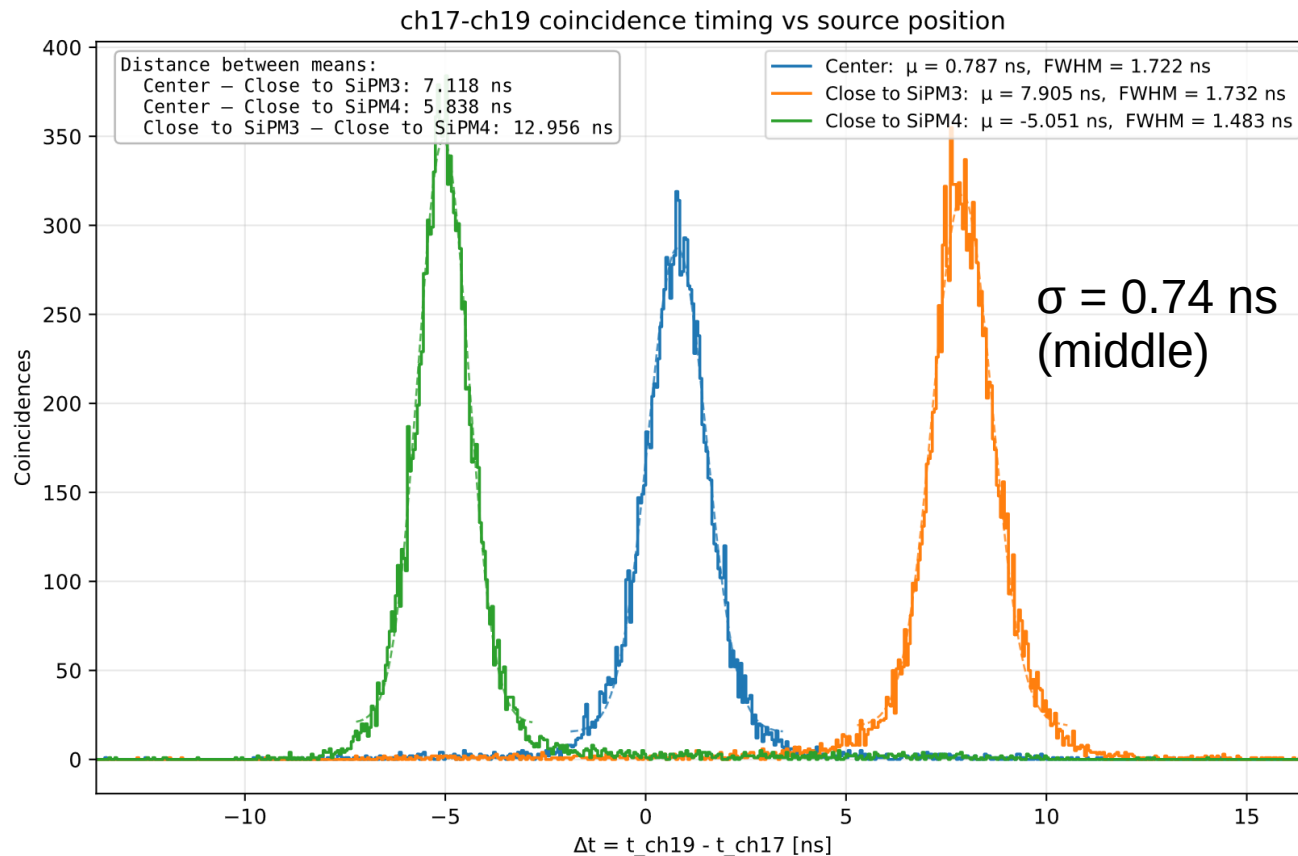


Measurements

- Simple measurement:
- 4 SiPM PCB
- Oscilloscope

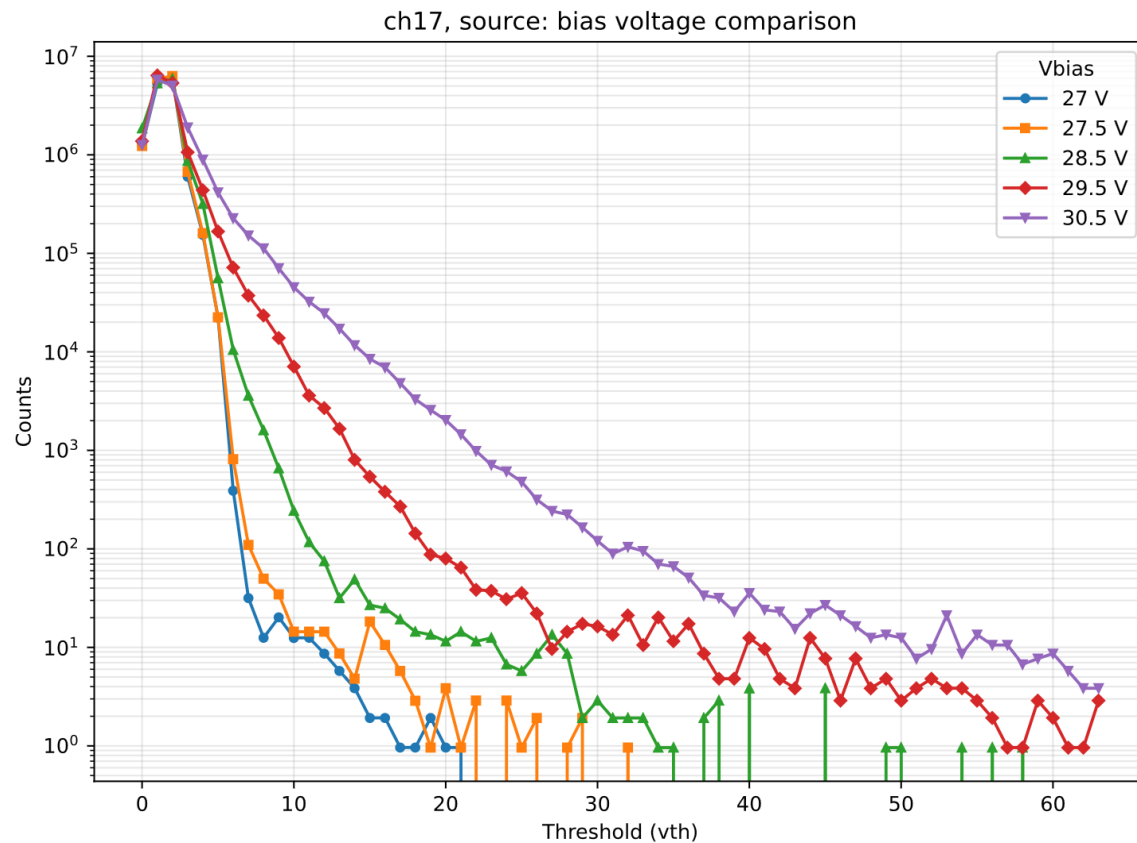


- ALCOR:
 - 4 SiPM board
- Expectation
 - SciFi = 115cm long
 - Source 10cm from SiPM
 - Refractive index = 1.49
 - $dt = 4.7\text{ns}$

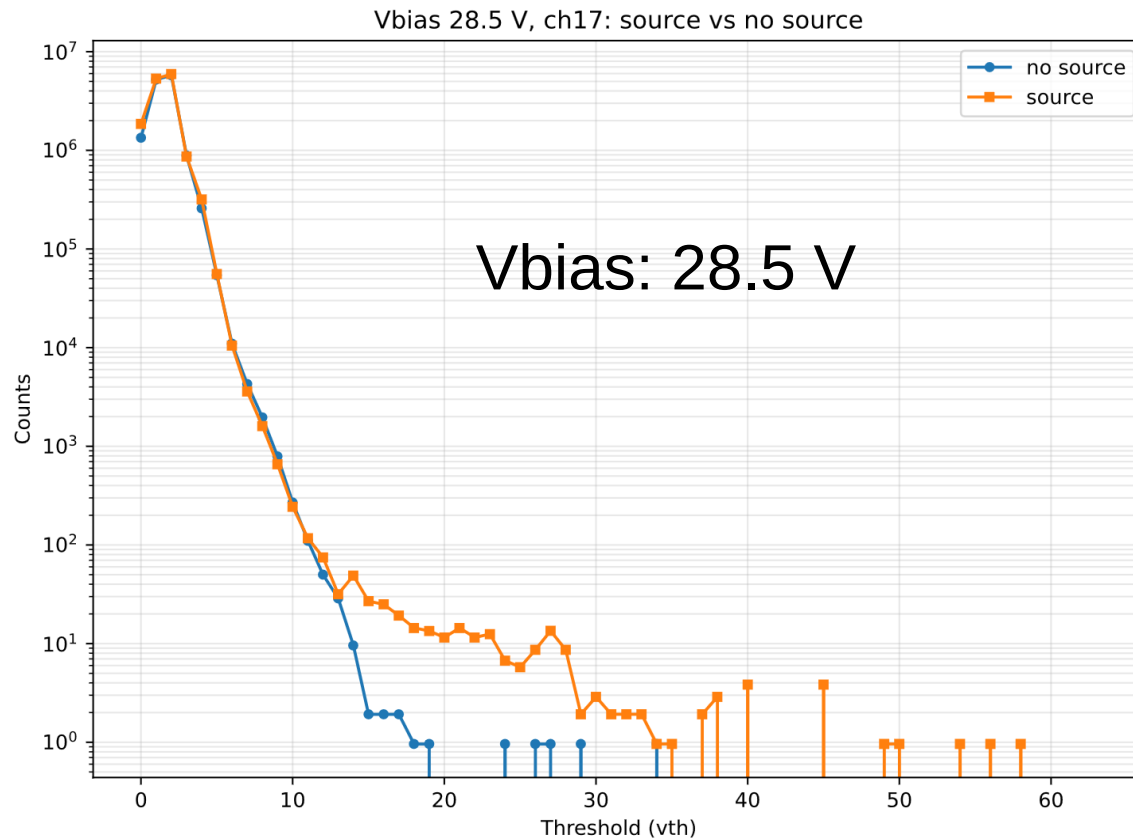


- Goal: improve timing resolution
- What can we vary?
 - Bias voltage
 - First/Second threshold
 - Radio. Source

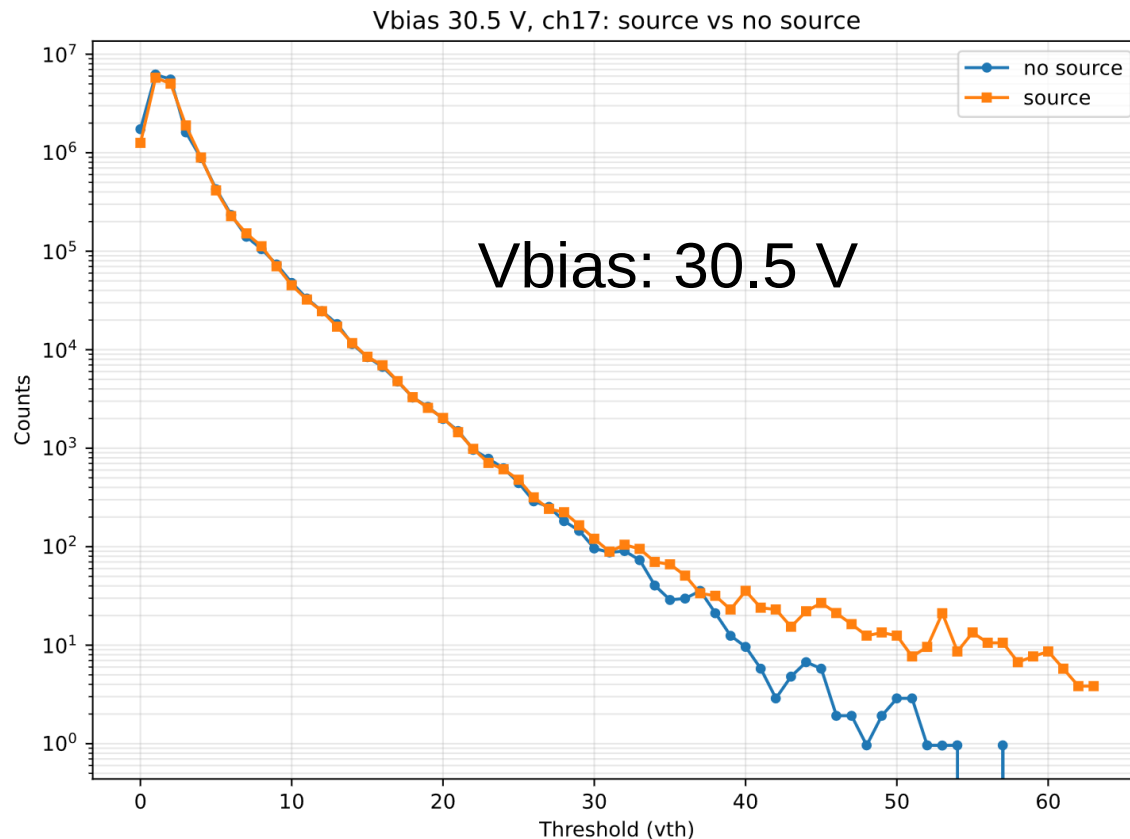
Note: all using 4-SiPM PCB



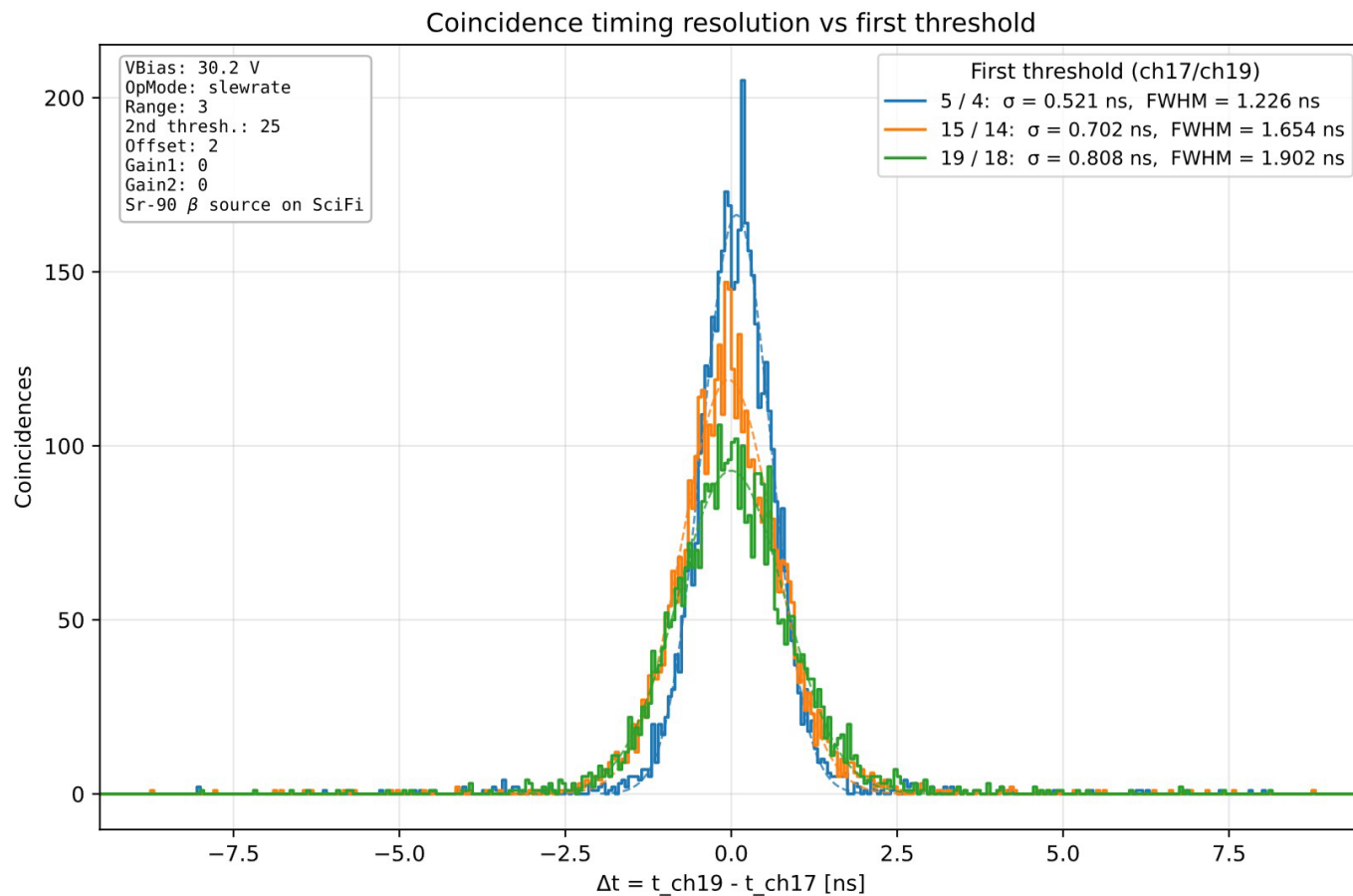
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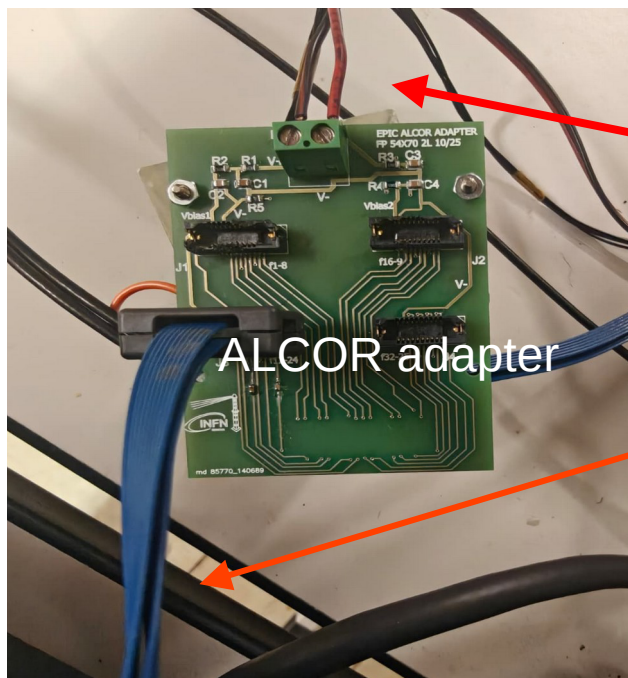


- What can we vary?
 - Bias voltage
 - **First**/Second threshold
 - Radio. source



Measurements

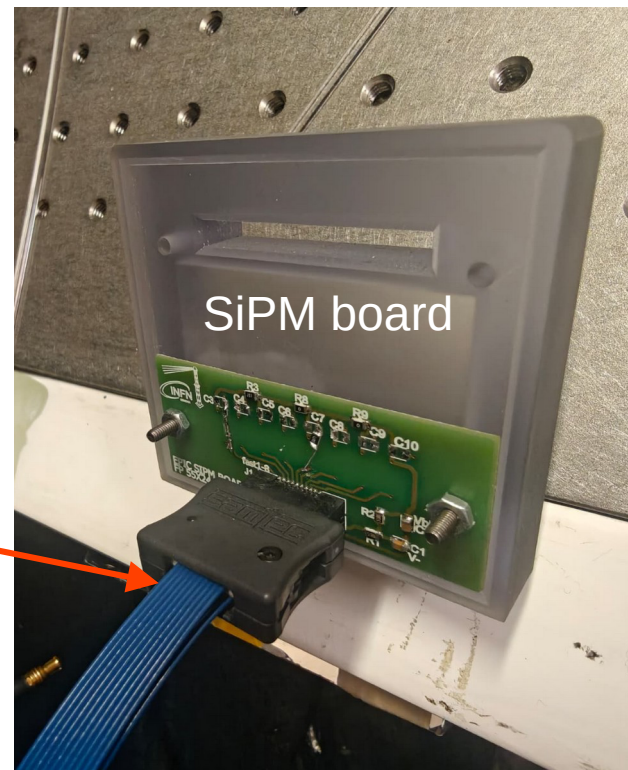
- Swap to 8 SiPM board
 - Connect to ALCOR via Samtec cable
 - Adapter to scope available
 - ALCOR Testpoint available



Bias Voltage

ALCOR adapter

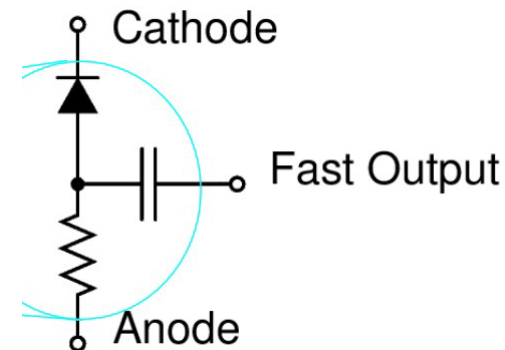
Samtec cable



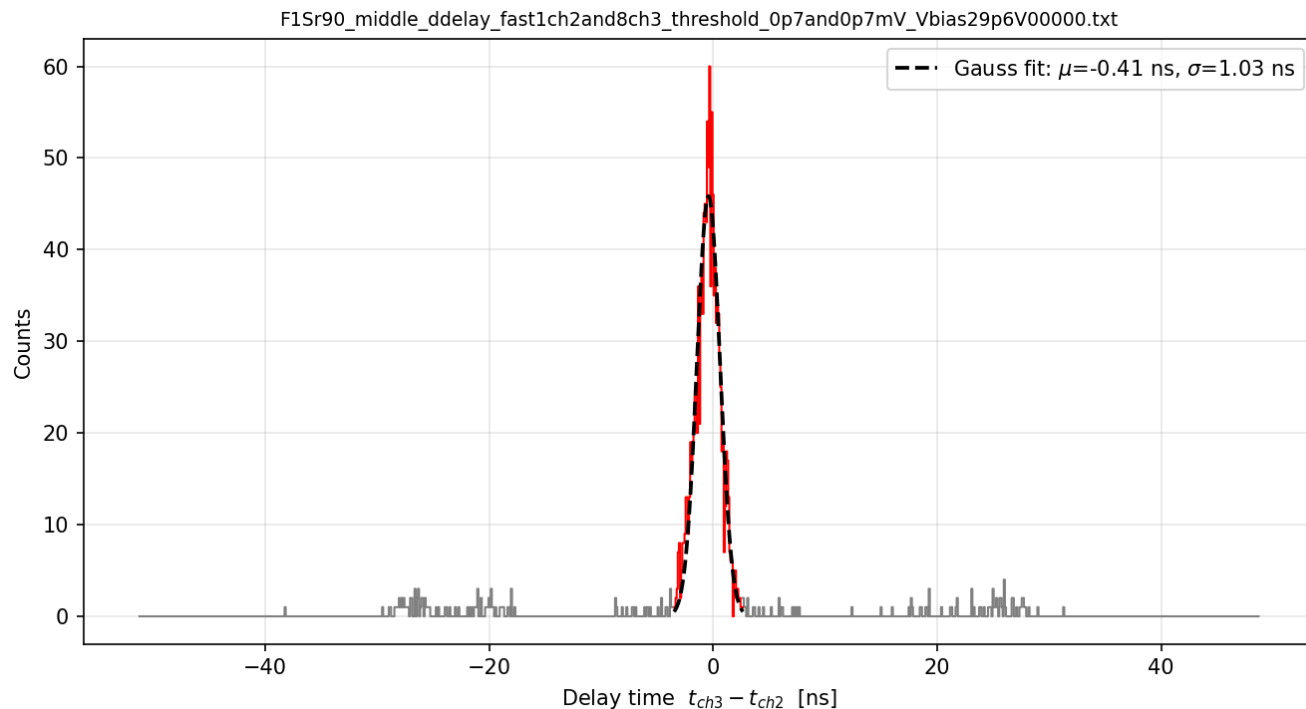
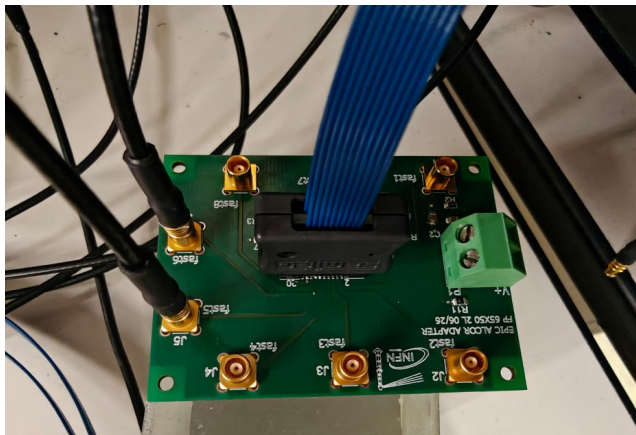
SiPM board

Measurements: Oscilloscope

- Using positive signal from SiPM fast output
 - Signal sent via Samtec cable directly to ALCOR input
- SiPM fast output is AC-coupled
 - Can send directly to ALCOR
 - We are testing using an additional decoupling capacitor
- Fast output has 70 pF capacitance
 - Anode-Cathode has 1800 pF



- 8 SiPM PCB
- Sr-90 source coincidence measurement with scope: (signal not amplified)
- Resolution worse than 4 SiPM PCB result
 - $\sigma = 0.64$ ns (slide 8)



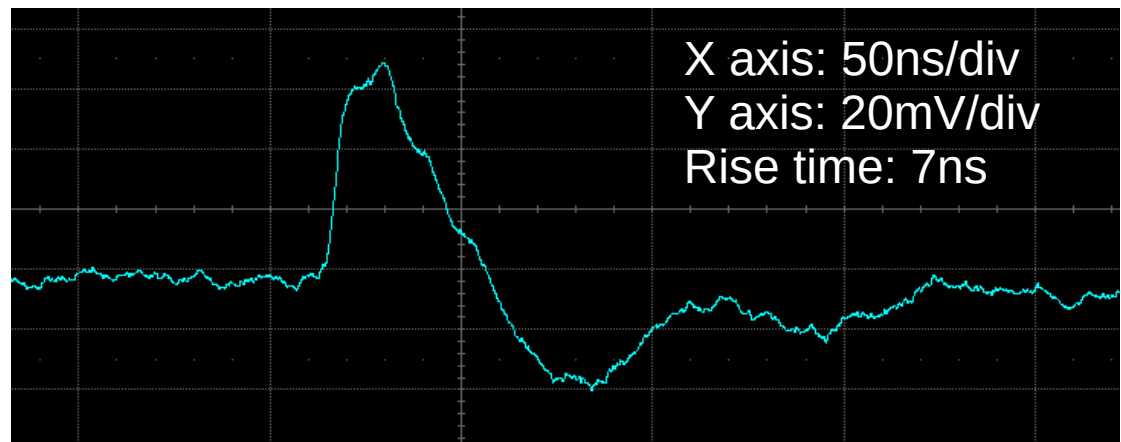
Ongoing Work: ALCOR

- 8 SiPM PCB
 - Understanding amplified ALCOR signal
 - Polarity = 1



Fast output directly to Oscilloscope
(no ALCOR), DC 50 Ω coupling

July 22, 2026



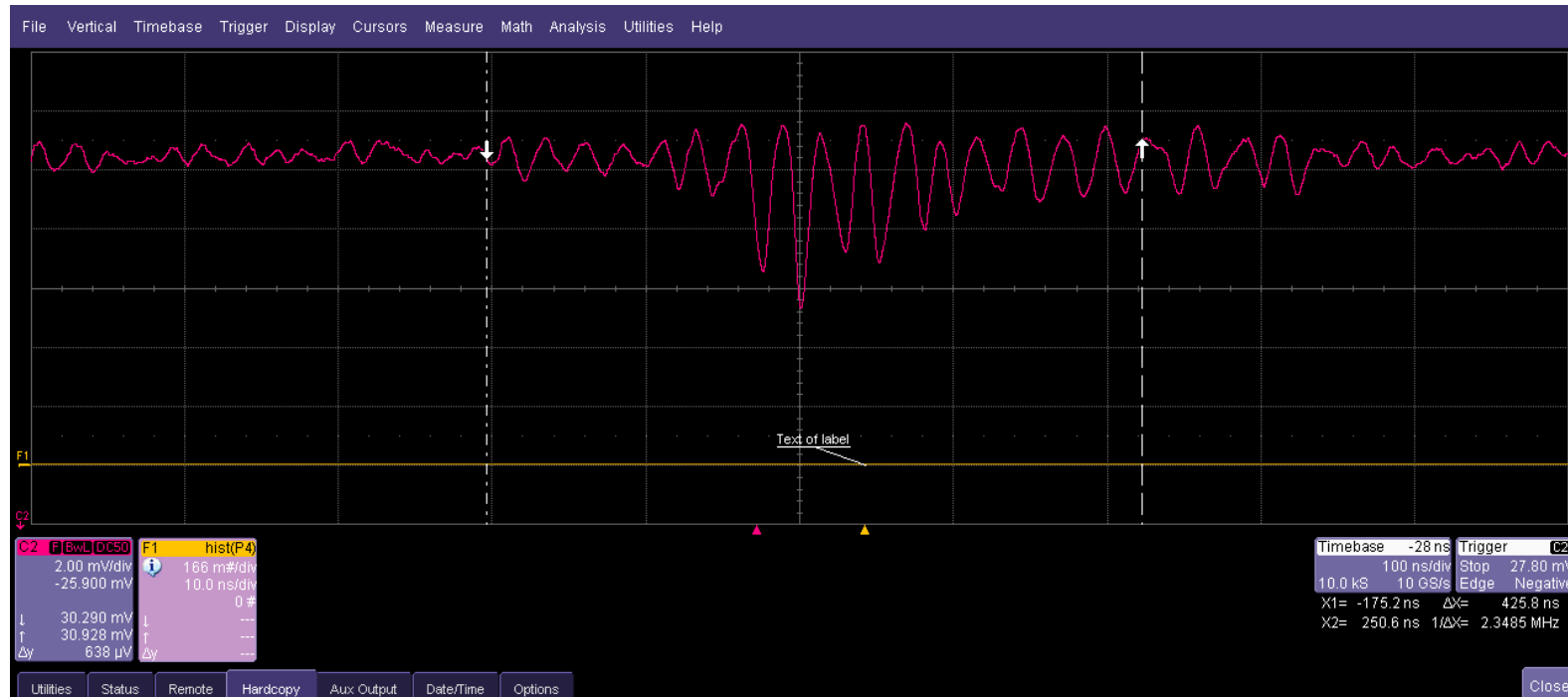
Fast output, **ALCOR** testpoint
AC 1 M Ω coupling

Rowan Kelleher

17

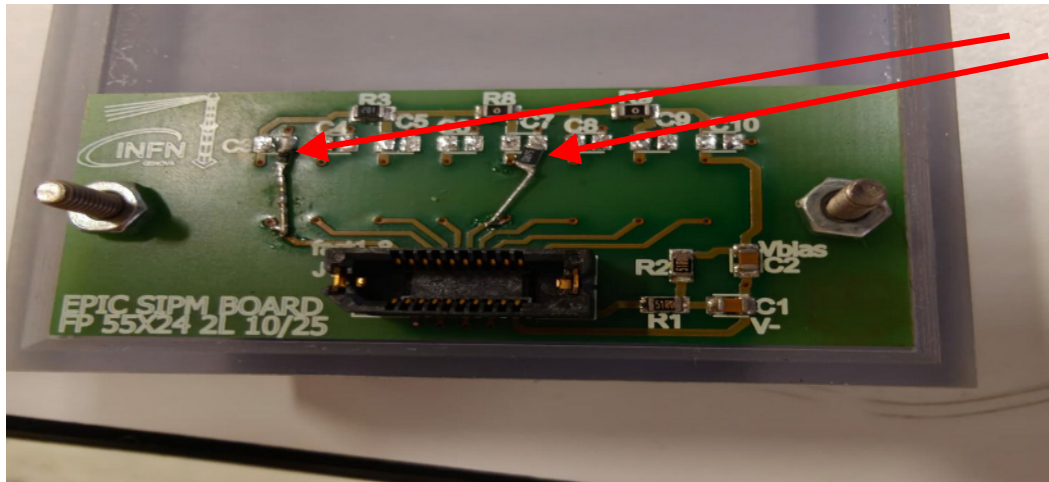
Ongoing Work

- New board with 8 SiPM
 - Getting lots of noise from Samtec cable
 - ALCOR test point (No bias voltage supplied)

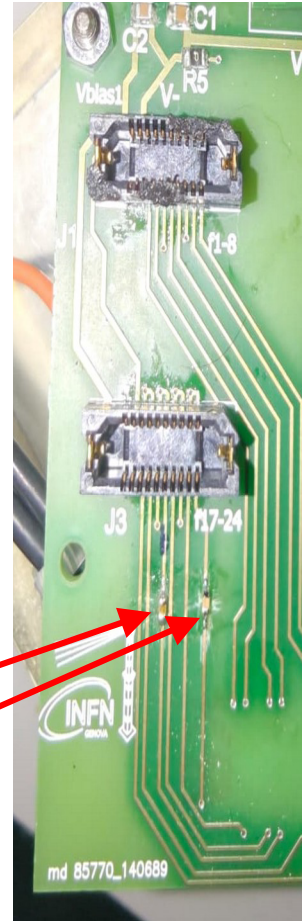


Ongoing Work

- Updating the 8 SiPM PCB + adapter
 - Working with INFN Genova electronics group to improve signal
 - Adding resistors to reduce cross talk + noise
 - Adding capacitors to decouple DC from ALCOR



Resistors



Capacitors

Summary

- Successfully measured timing resolution with ALCOR (4 SiPM PCB)
 - Agrees with Oscilloscope measurement
 - ~1 ns timing resolution
- 8 SiPM PCB connecting to ALCOR via Samtec cable
 - Work in progress
 - Improving PCB and adapter to get usable signal

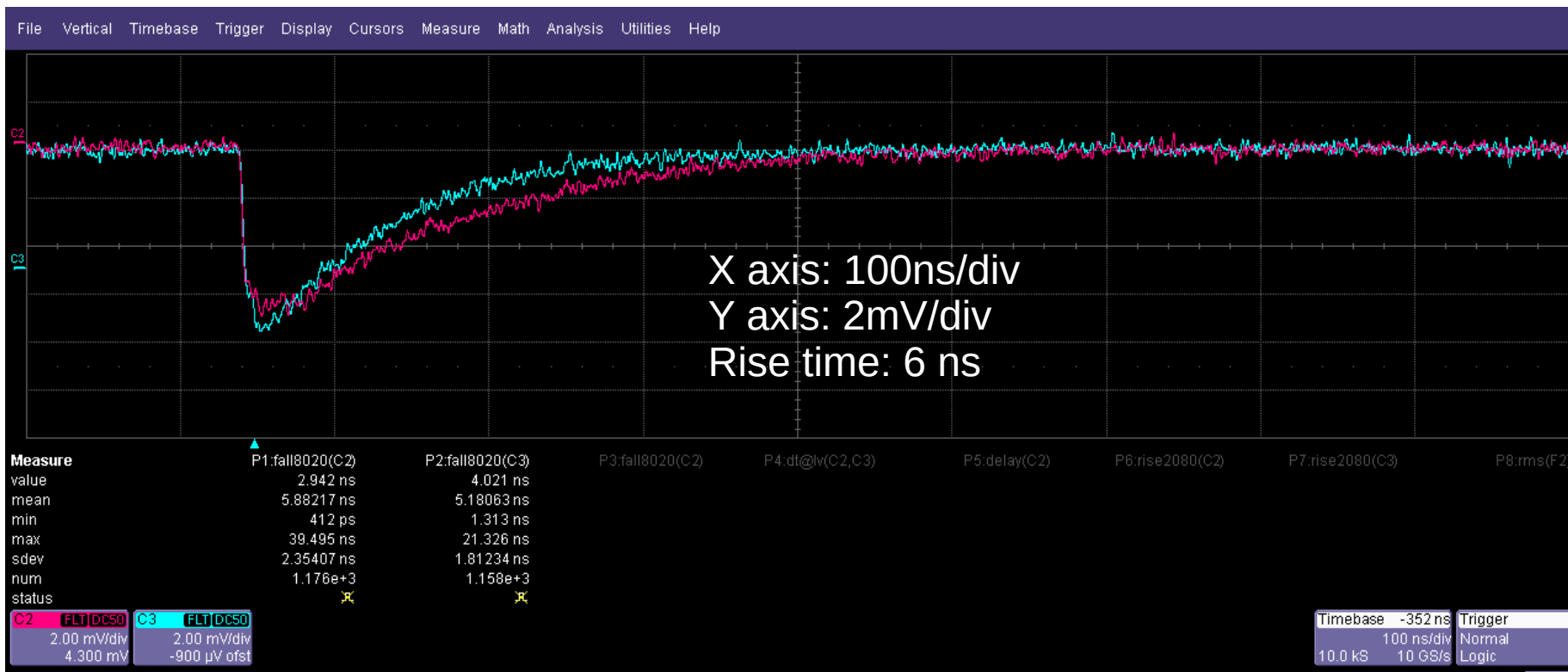


Backup



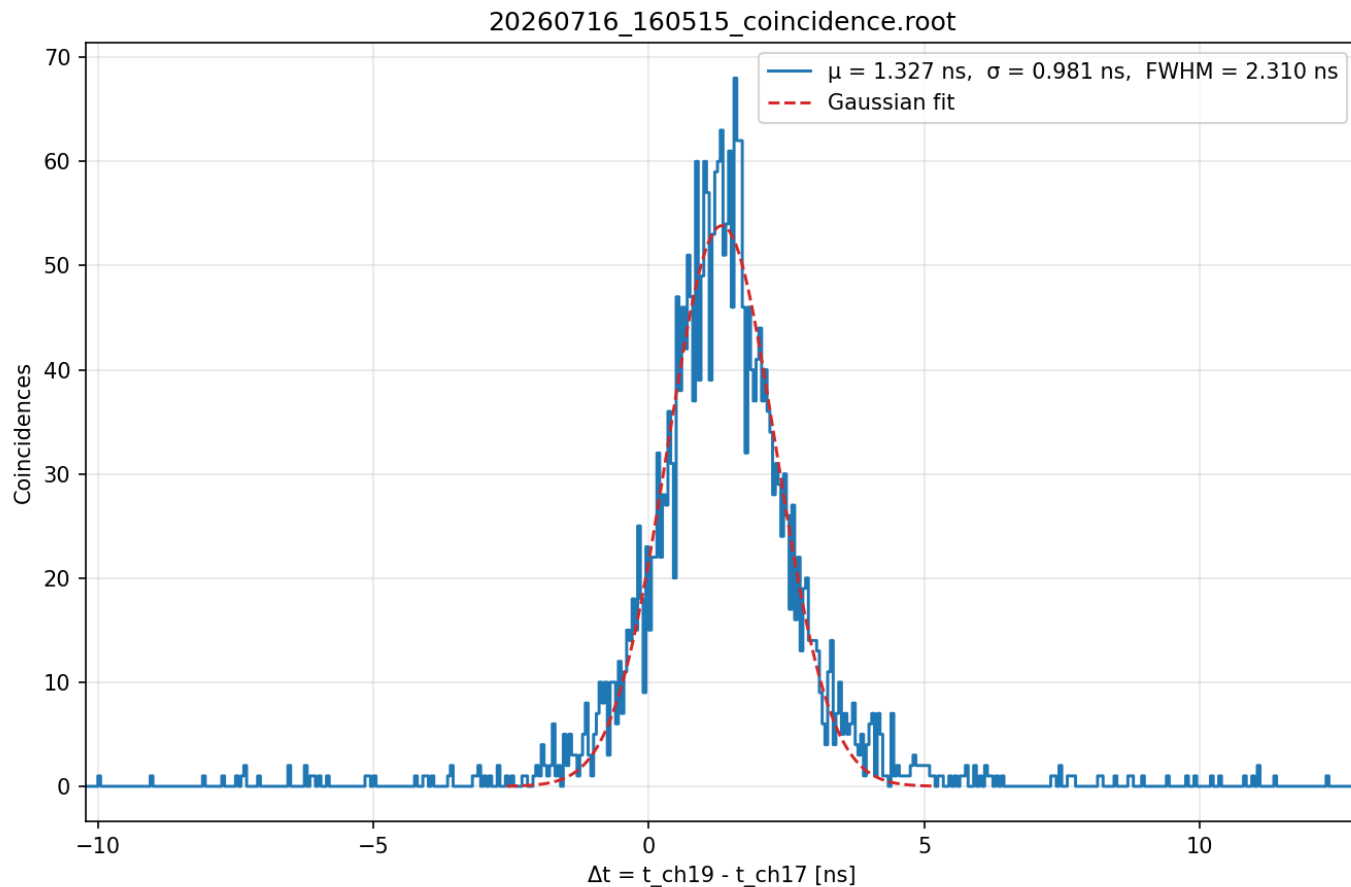
Cathode Output

- 4 SiPM PCB directly to oscilloscope (DC 50 Ω)



Cathode Output

- 4 SiPM PCB
- Cathode output:
 - $\sigma = 0.981$ ns
- Fast output: (slide 13)
 - $\sigma = 0.521$ ns





ALCOR Configurations



- For all plots:
 - Gain 1 & Gain 2: 0
 - PCR2 Offset, PCR3 Offset 1 & Offset 2: 0