

SciTil prototype test

Marius Chirita

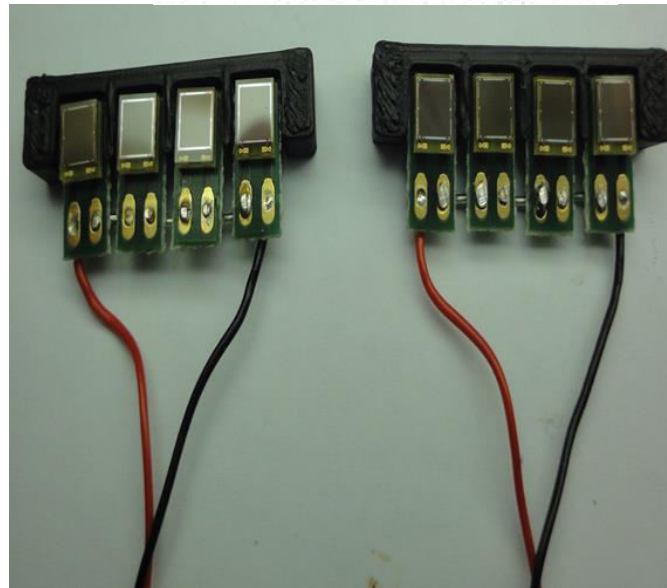
Panda TOF Meeting
Bochum, 01.03.2016

L.Gruber, A.Gamal, D.Steinschaden, K.Suzuki, J.Marton, J.Zmeskal

Outline

- Reminder
- Current prototype -> SiPM serial connection
-> preamplifier
- Experimental setup
- First results
- Outlook

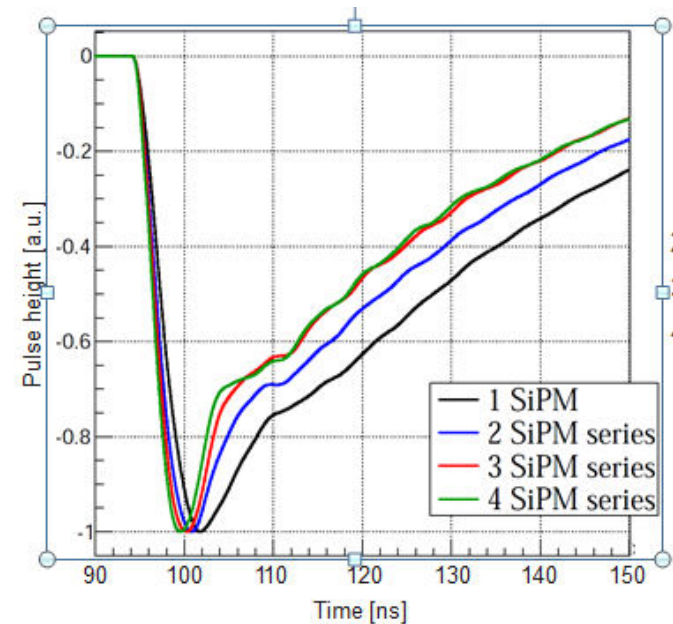
Ketek PM3350



Serial connection of SiPMs (Ketek PM3350):

- + Automatic adjustment of over-voltage
- + Signal becomes narrower
- + Fast rise time
- + Better time resolution
- Higher bias voltage
- Reduced pulse height (but photon counting capability remains)

Operational voltage @ 29V



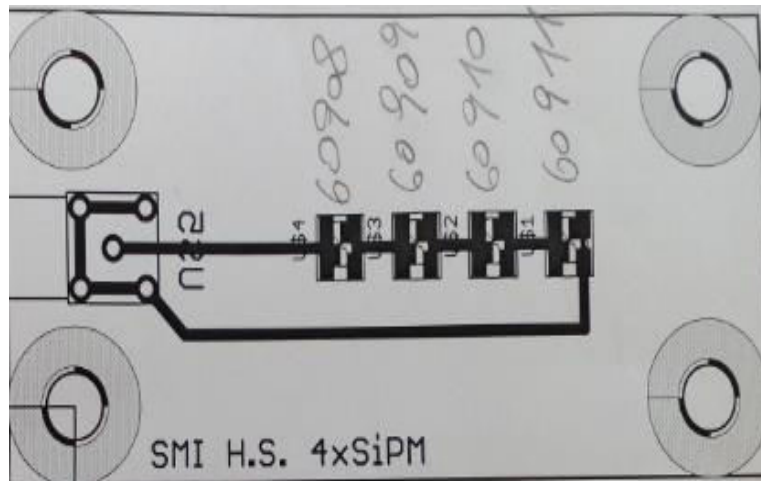
L. Gruber

PANDA TOF meeting - 01.12.2015

Current prototype

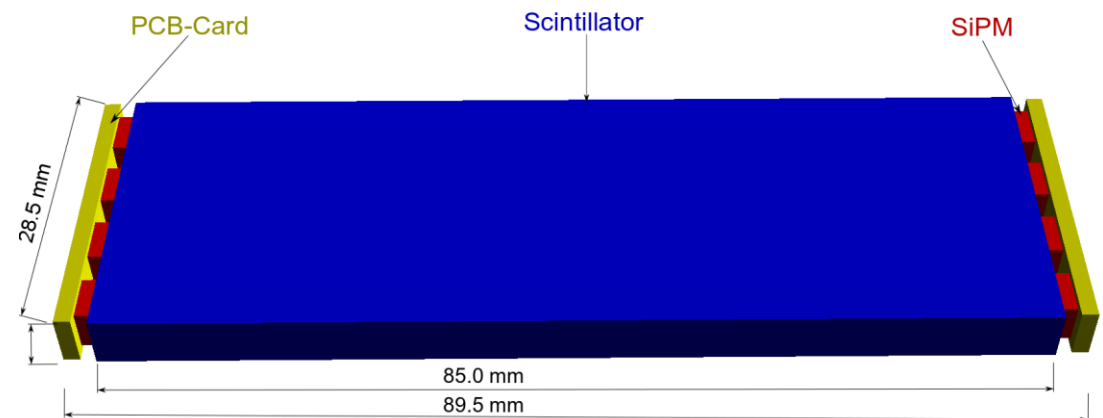
- improve time resolution
- decrease number of channels
- sustain position resolution

Hamamatsu S13360-3050PE

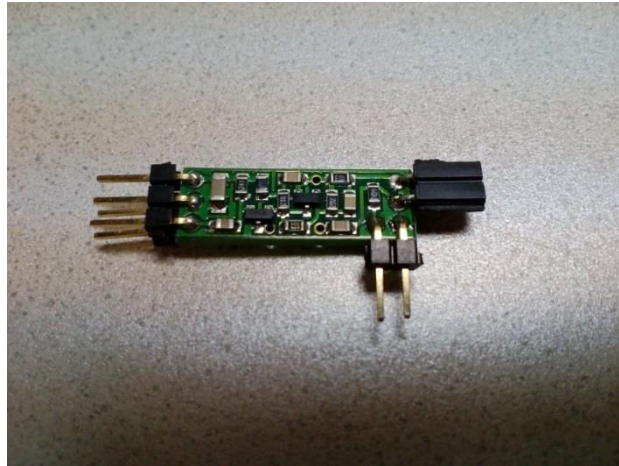


$V_{op}: 55.07 \text{ V}, V_{op} = V_{br} + 3\text{V}$

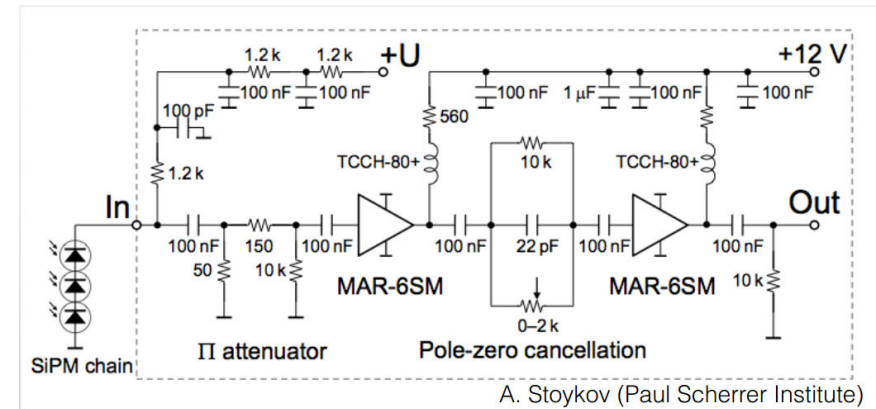
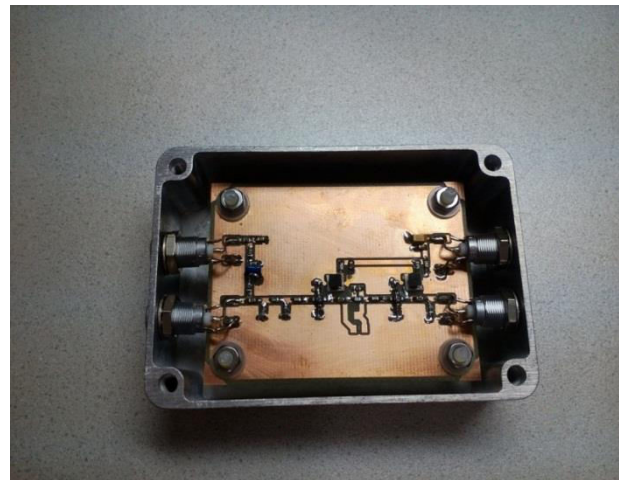
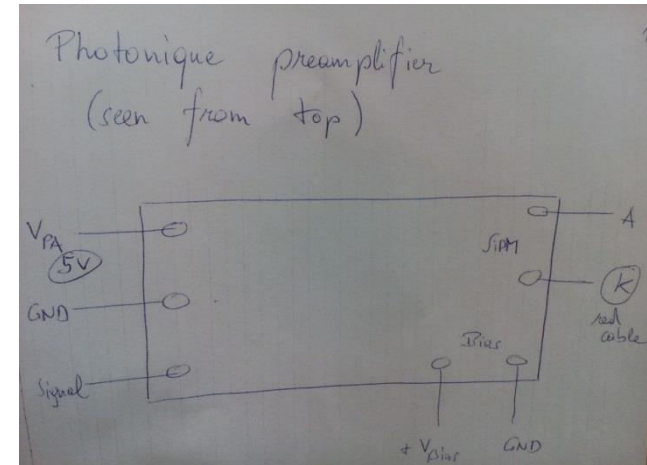
$I: 0.095 \text{ }\mu\text{A}$



Preamplifier boards

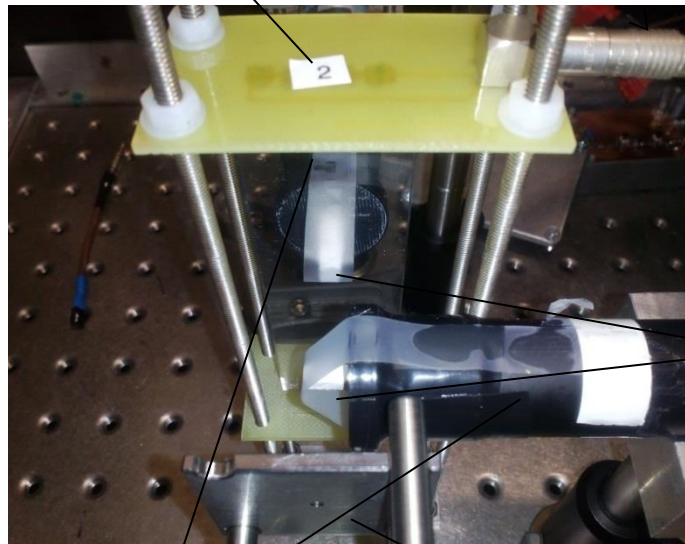


till now



“Development of High Precision Timing Counter Based on Plastic Scintillator with SiPM Readout” Paolo W. Cattaneo et al

SiPM board attached to EJ-232 scintillator

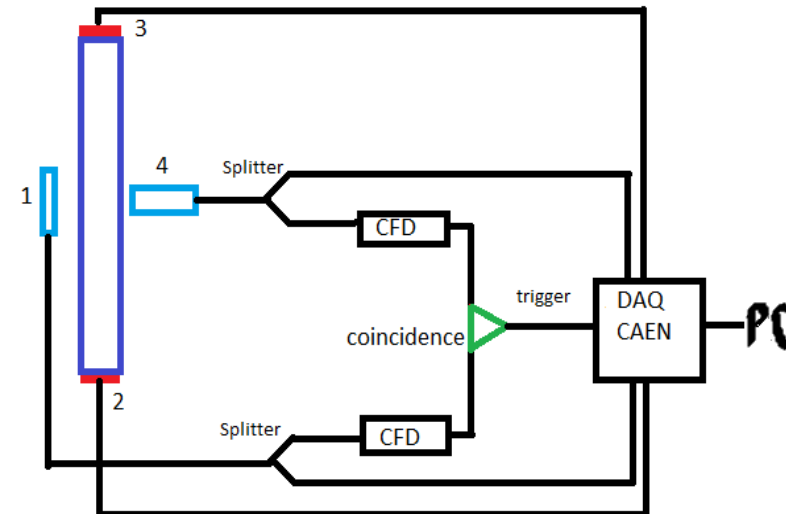


- 1... PMT1
- 2... SciTil unten
- 3... SciTil oben
- 4... PMT2

▶ ... Quad four-fold logic unit

To trigger the DAQ we used a coincidence of the two PMT signals

BC408



Hamamatsu-PMT:R1450

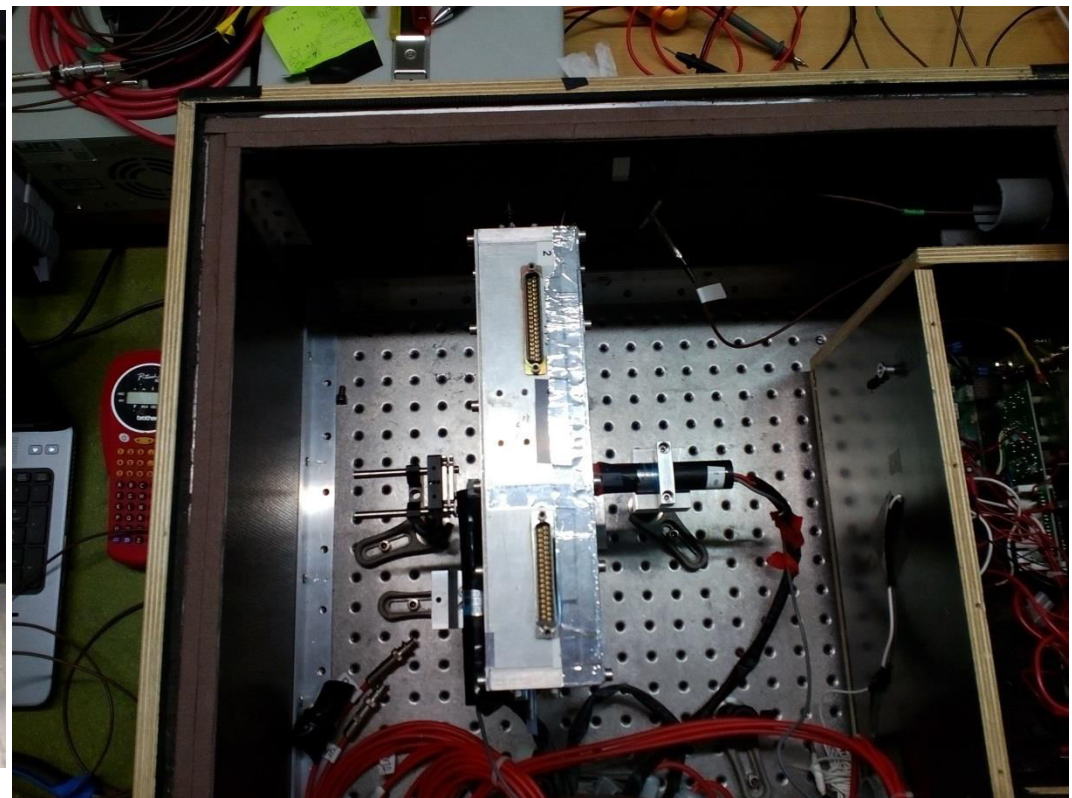
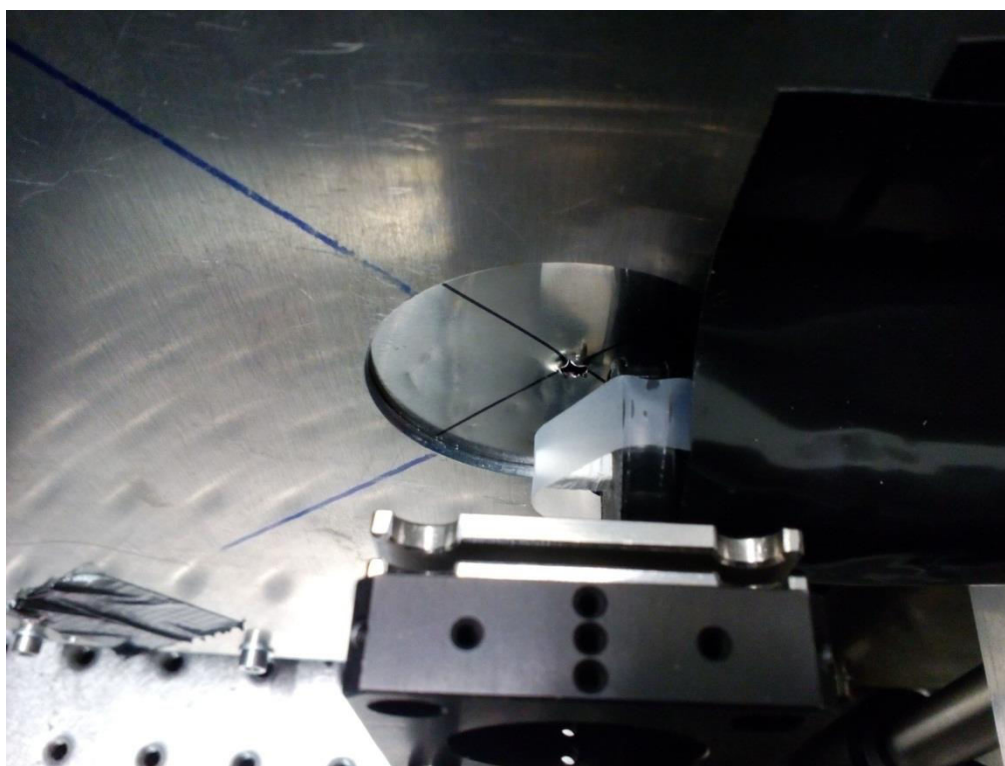
1...(3x3+15)mm

4...(5x5+15)mm

DAQ...CAEN Waveform Digitizer V1742

Sr90 source

Experimental setup

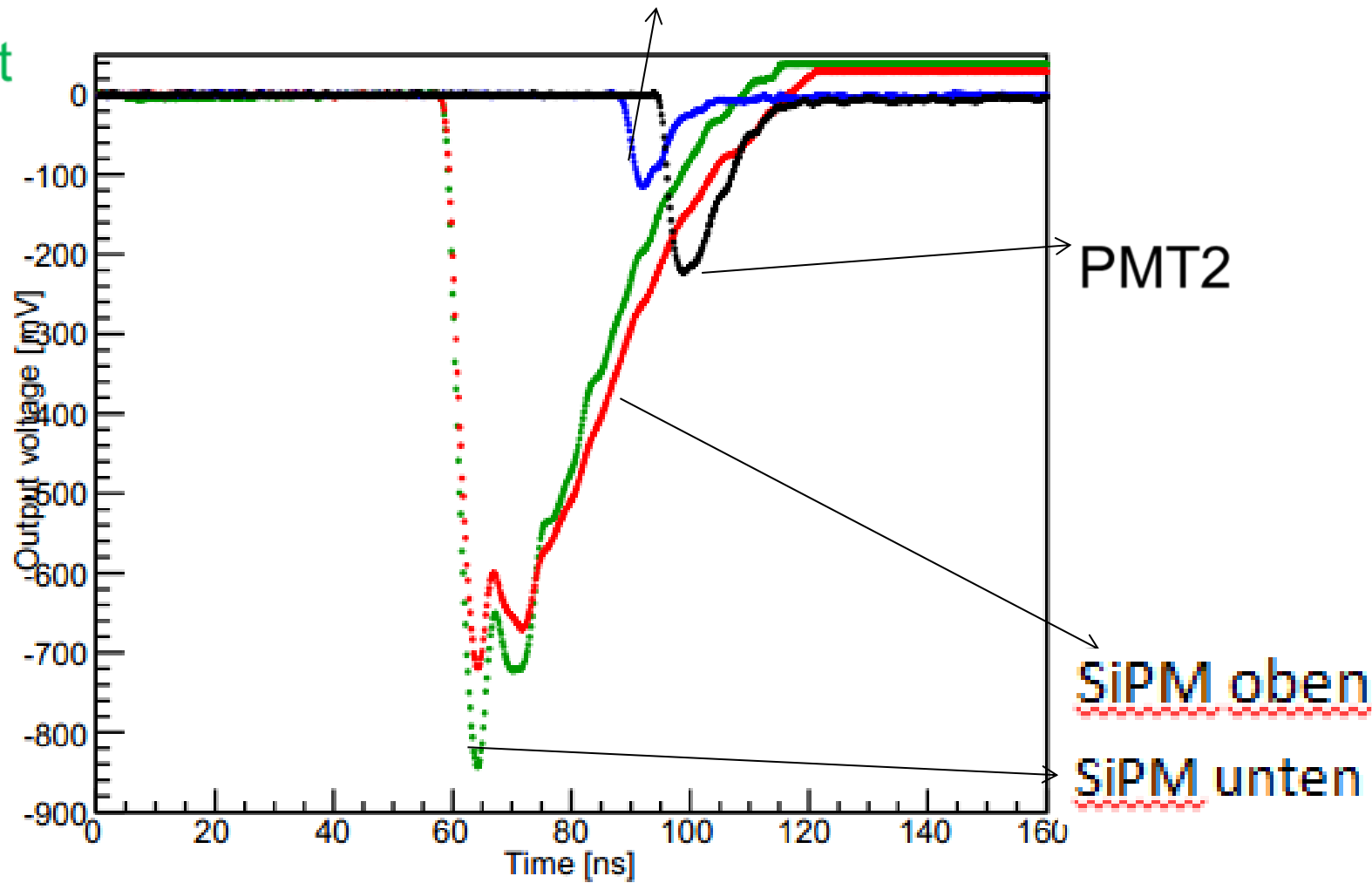


Signals PMT1

Typical pulseheight

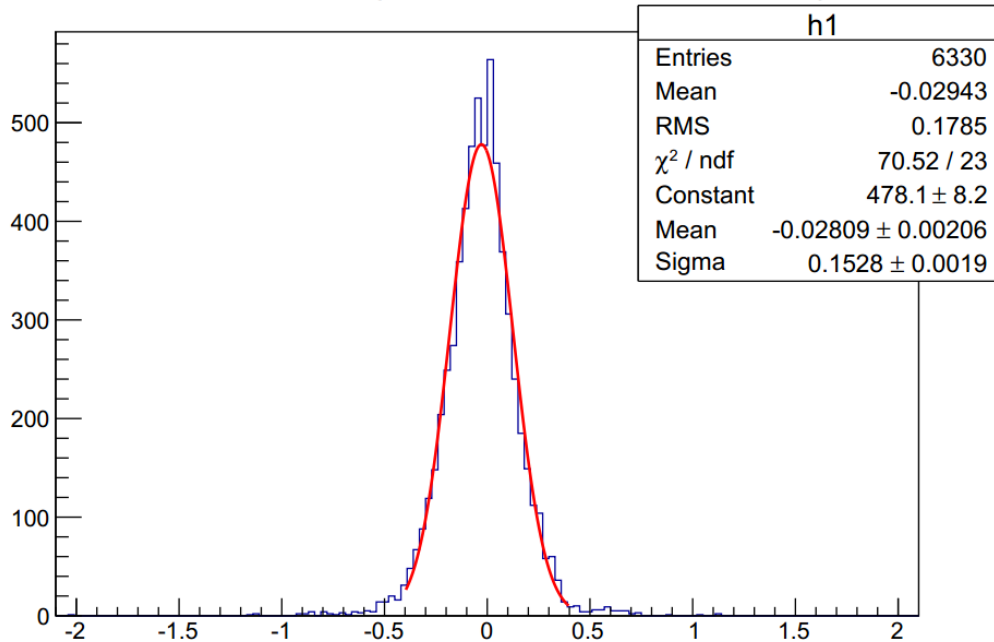
850 mv

~ 350 photons

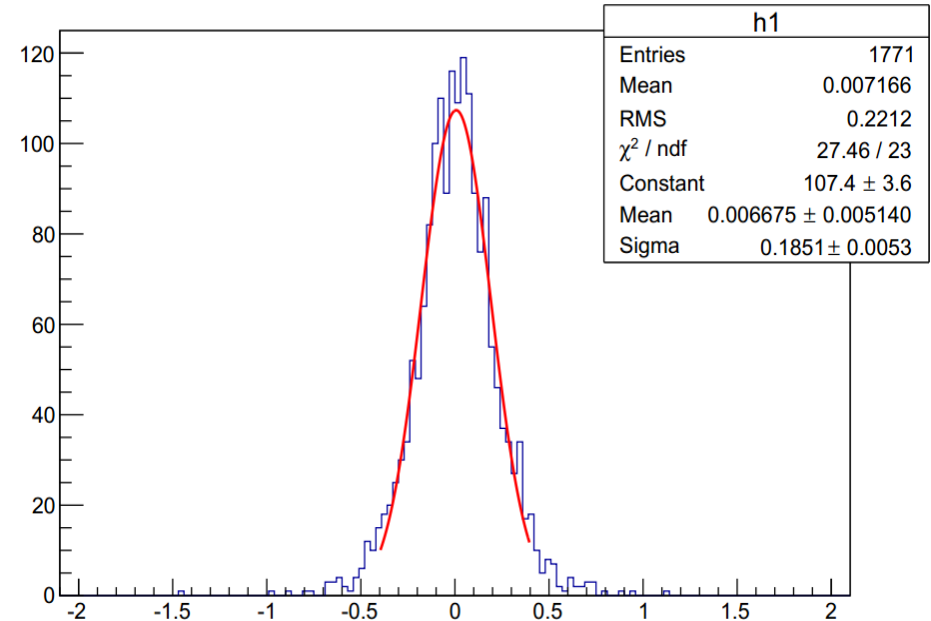


First results on time resolution

TDC01-TDC02 {TDC01!==-999&&TDC02!==-999}



TDC01-TDC02 {TDC01!==-999&&TDC02!==-999}



$V_{op}=222V$, $V_{op}=V_{br}+ 3.5V/\text{per SiPM}$

Time difference resolution $\sigma_{diff} \sim 152 \text{ ps}$

Estimated tile time resolution $\sigma_{tile} \sim 76 \text{ ps @ } 222V$

$V_{op}=230V$, $V_{op}=V_{br}+ 5.5V/\text{per SiPM}$

Time difference resolution $\sigma_{diff} \sim 185 \text{ ps}$

Estimated tile time resolution $\sigma_{tile} \sim 92.5 \text{ ps @ } 230V$

Outlook

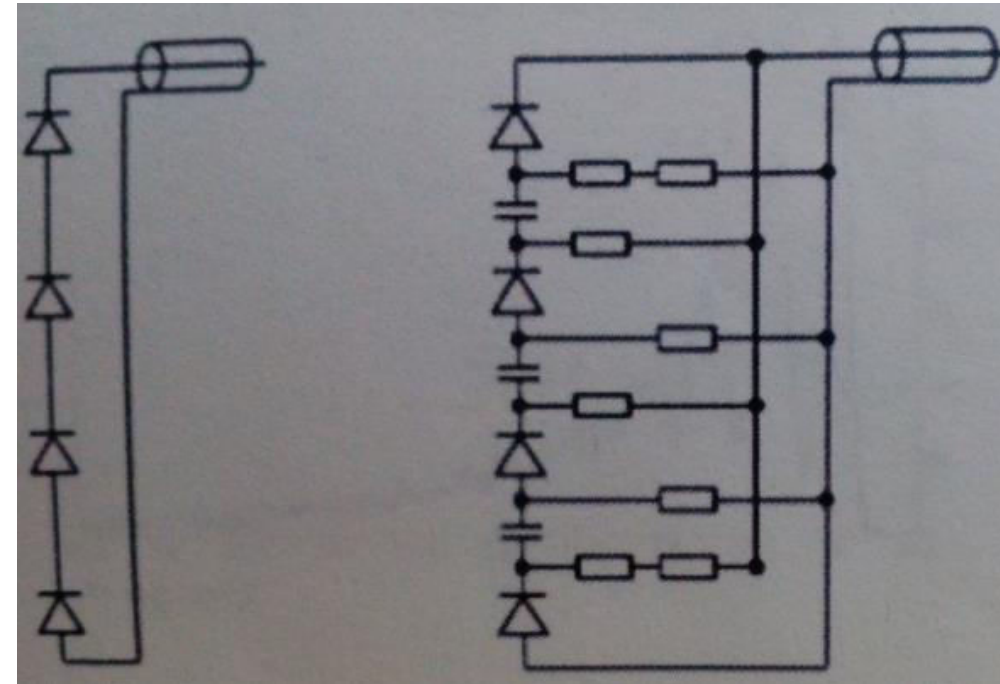
- preamplifier
- Position resolution
- Wrappings (Tyvek, ESR)
- Compare SiPM (Hamamatsu, Ketek)
- Test with TOF-PET chip
- Hybrid connection

Outlook

simple

hybrid connection

	Simple	Hybrid
Bias	280V (×4 segmented) ☹️	70V (common) 😊
Gain uniformity	Automatic gain equalization 😊	Required ☹️
Potential diff. bw/ adjacent segments	~70V ☹️	0V 😊
External circuit	No 😊	Required ☹️



W. Ootani on behalf of MEG collaboration

“Performance of UV Sensitive MPPC for Liquid Xenon Detector in MEG Experiment”, Daisuke Kaneko