Cosmic Muon Test Setup (TTU)
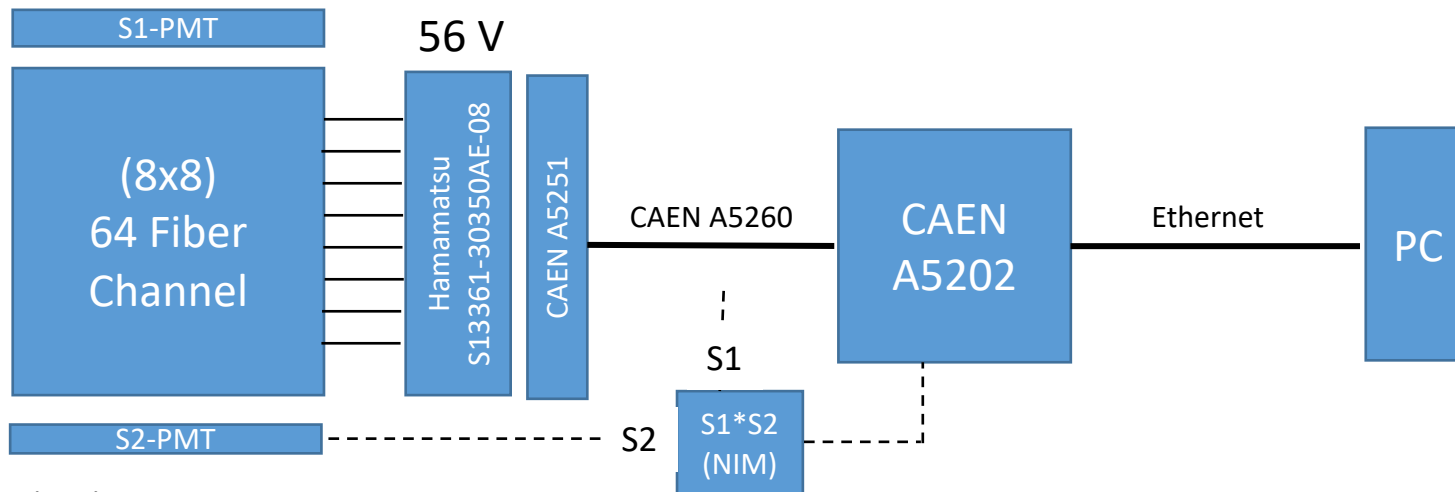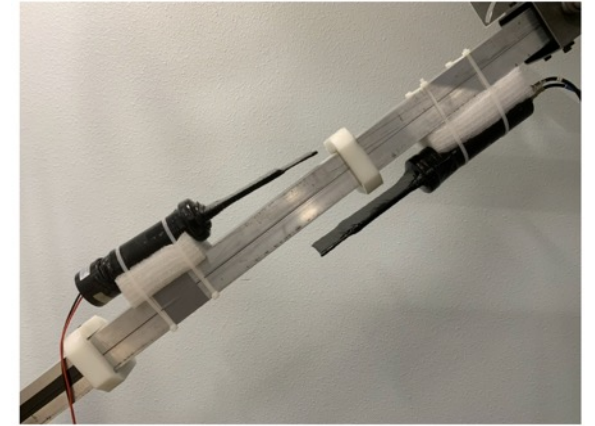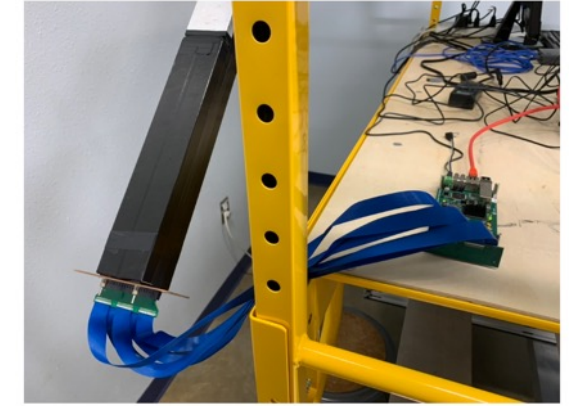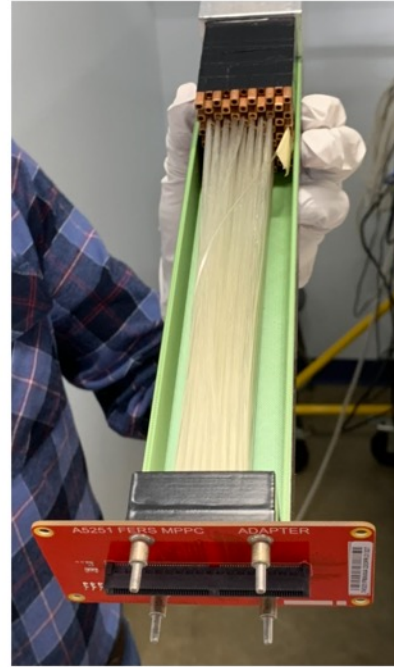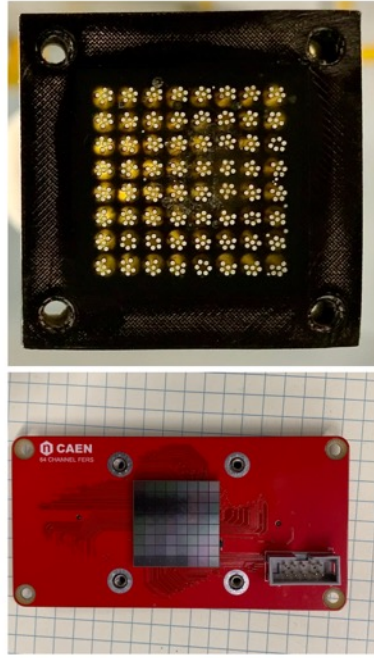
Triggers:
(1) External: S1*S2
(2) Internal: TOP(OR32) * BOT(OR32)

Cosmic Muon Events

$\delta T = T(i) - T(mean)$

toa_deltaT_corrected

toa_deltaT_corrected
Entries   5661

$\sigma = 1.2$ ns

Internal trigger
(200 cm active)

blue: raw
bred: corrected
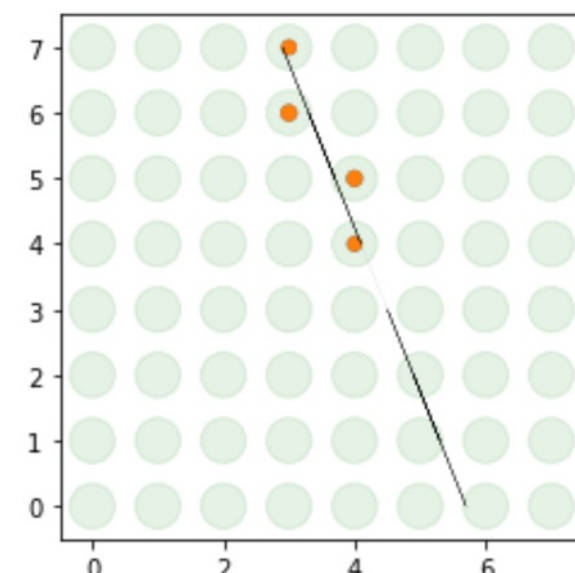
toa_deltaT_corrected

toa_deltaT_corrected
Entries   80

$\sigma = 1.0$ ns

External trigger
(4 cm active)

TOA counts (0.5 ns)
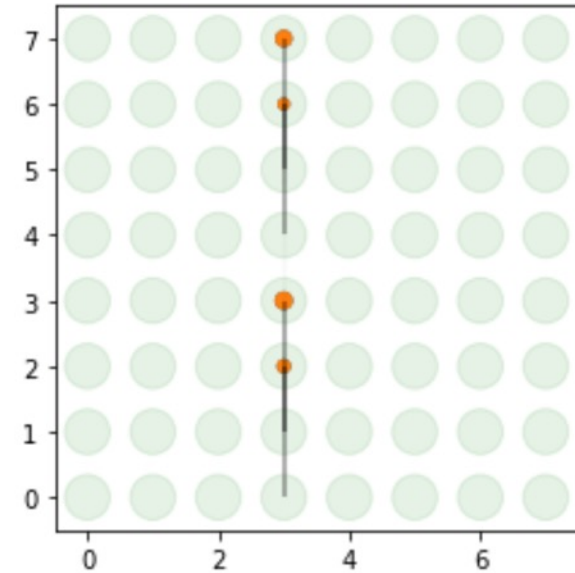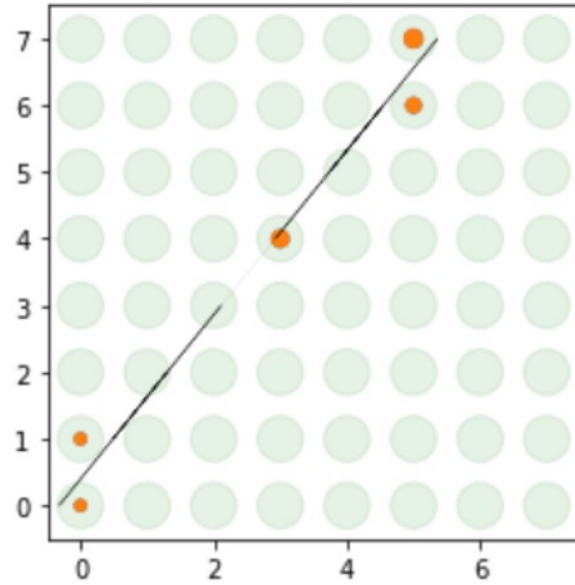
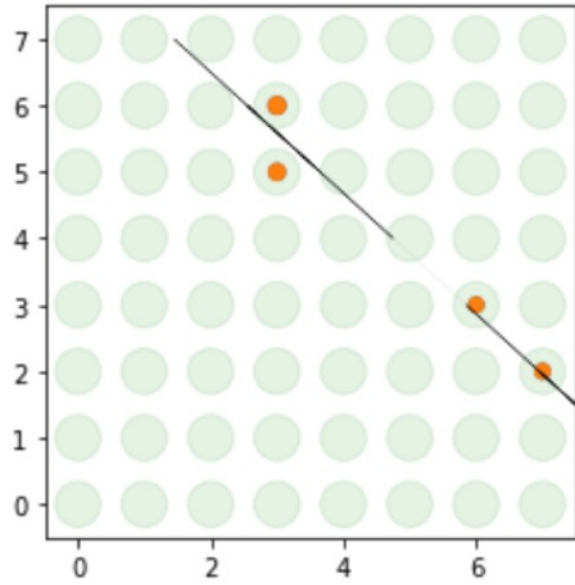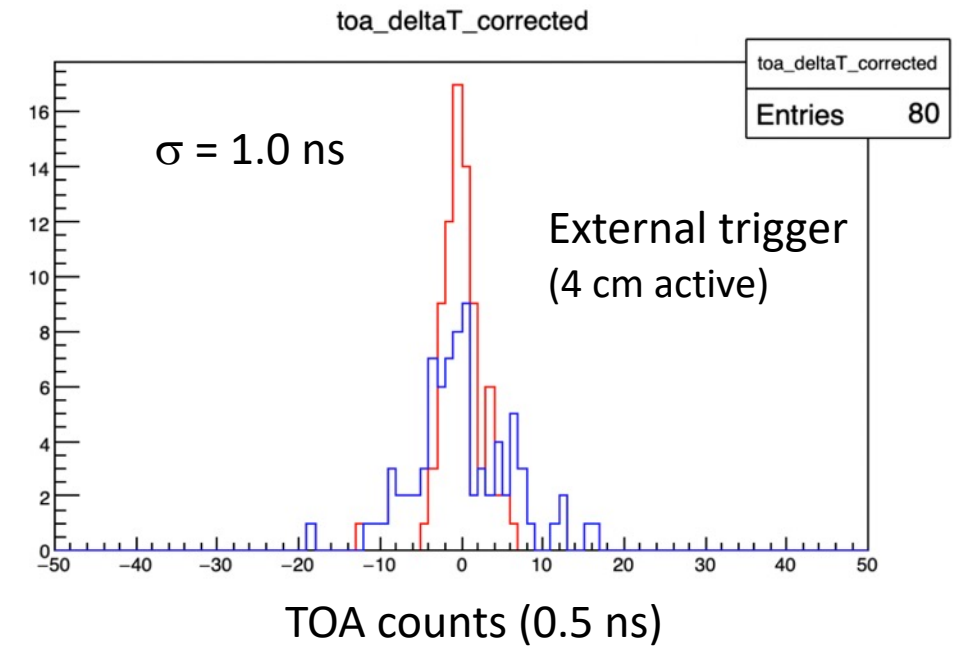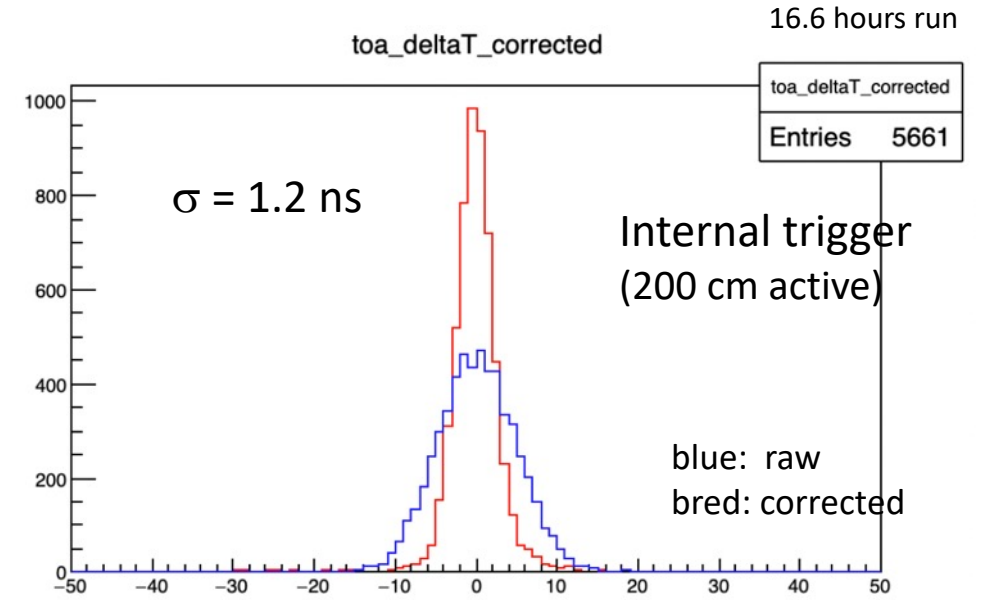# TOA correction with TOT

Fig. 8.1: Simplified block diagram of the A5202/DT5202 FERS-5200 unit.

HG/LG Pulse Height Analysis

TOA/TOT

FAST SHAPER
100 ns/tick
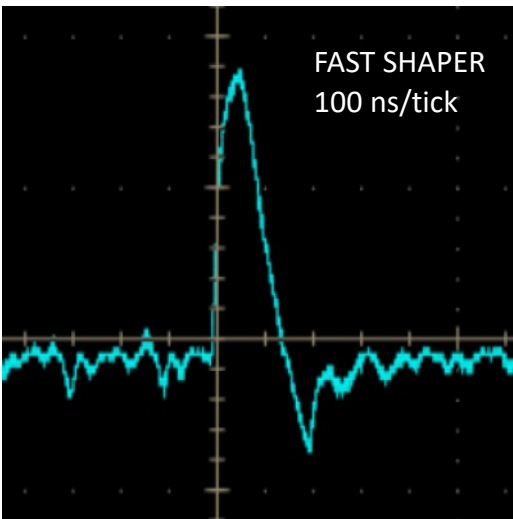
$$TOA(corr) = TOA(raw) - 0.30\ TOT - 10.0$$

3 pe   4 pe   5 pe

TOT
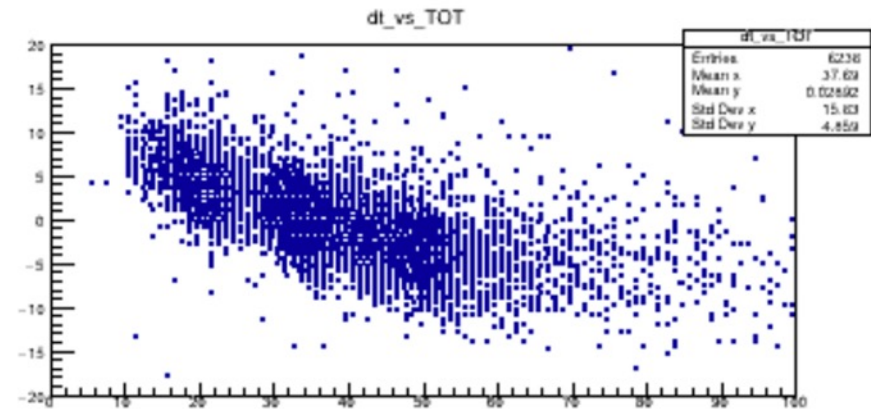
Trigger Timing

The timing of external trigger is fixed.

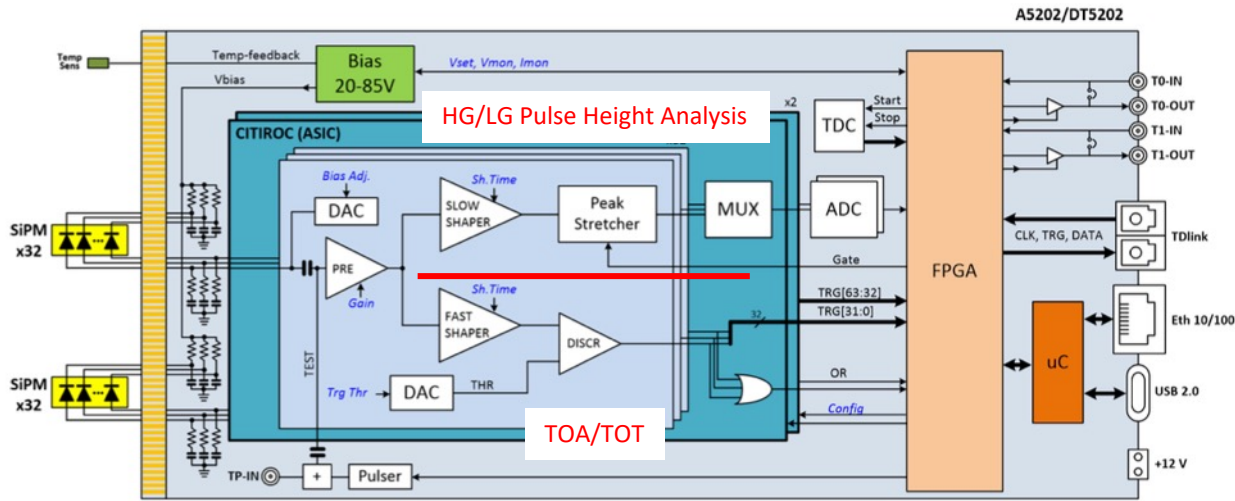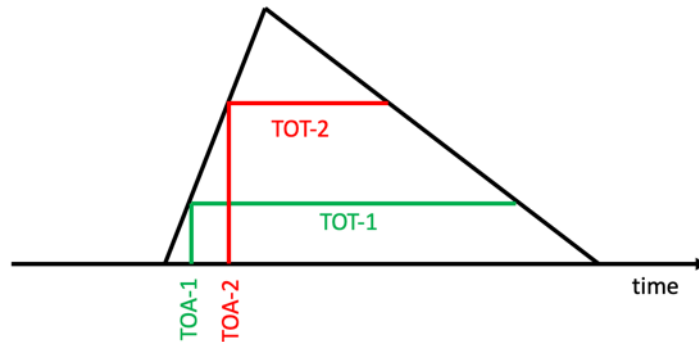The timing of internal trigger varies event by event.

External Trigger

toa_mean_corrected	
Entries	16
Mean	78.34
Std Dev	1.699

Mean   -60.8 ns
Std Dev   0.9 ns

TOA counts

-75   -50   -25 ns

Muon Signal w.r.t. the external trigger

Internal Trigger

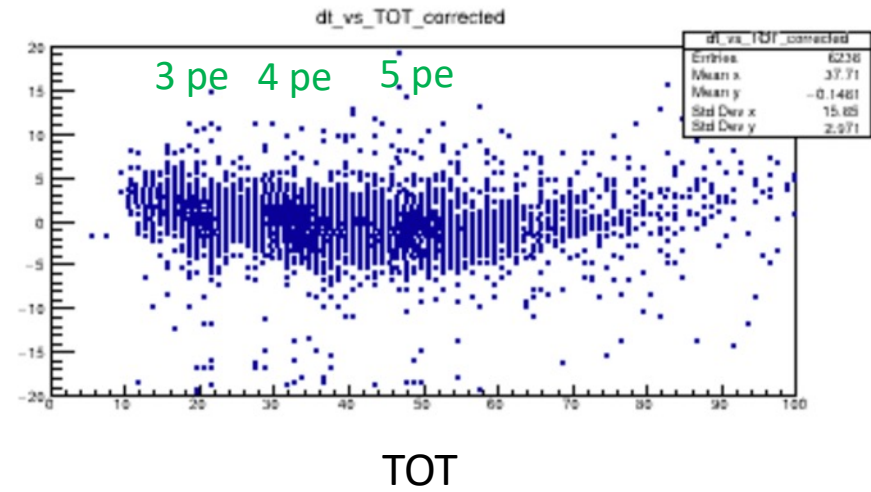| toa_mean_corrected	
Entries	1317
Mean	145.1
Std Dev	6.455

Mean   -27.5 ns
Std Dev   3.2 ns

TOA counts

-50 ns   -25 ns   0 ns
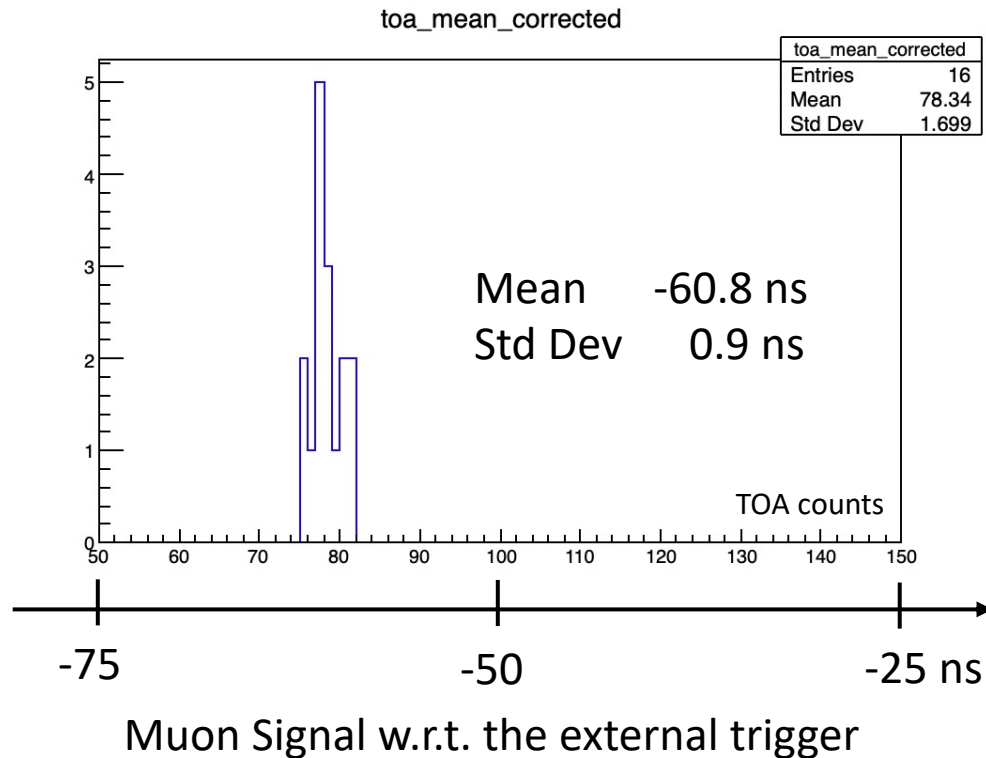
Muon Signal w.r.t. the internal trigger
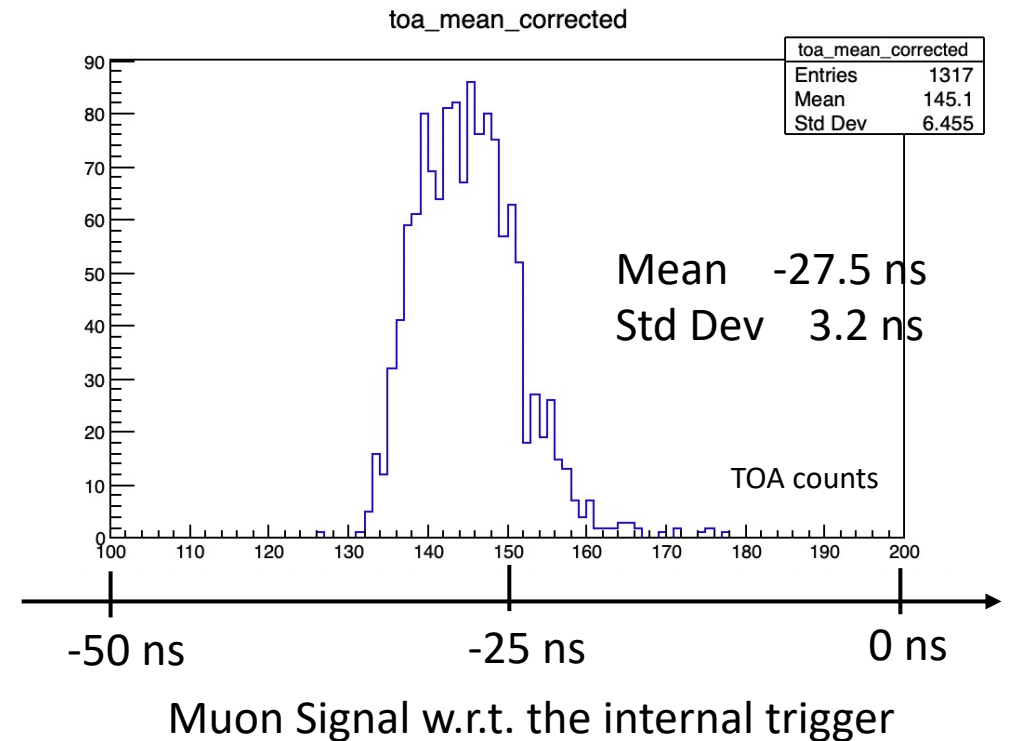
Longitudinal Segmentation with Timing

Average hadron shower longitudinal profile

shower profile (z)

shower profile (time)
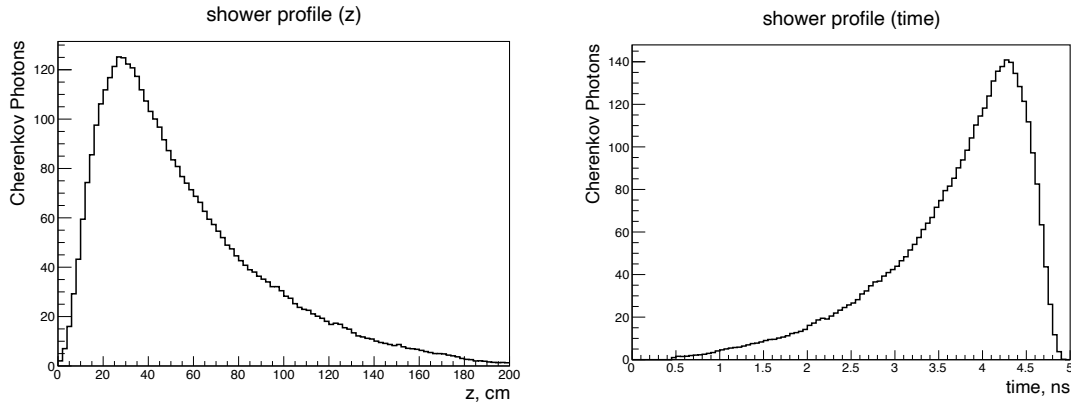
4 example events

signal in
1.2 x 1.2 cm tower

0.05 ns   0.20 ns   1.0 ns per bin
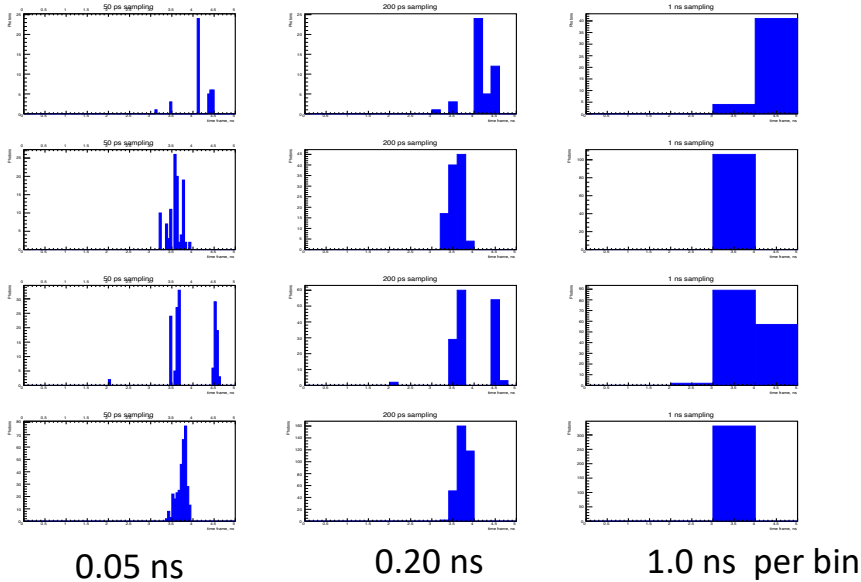
R&D of fast multi-hits SiPM and readout

SiPMs in hands:

64ch array: Hamamatsu S13361-30350AE-08
64ch array: Onsemi ArrayJ-60035-64p-PCN

16ch array: SensL ArrayC-30035-16P-PCB

Signle ch: SensL MicroFC-SMA-30020-GEVB (*a)
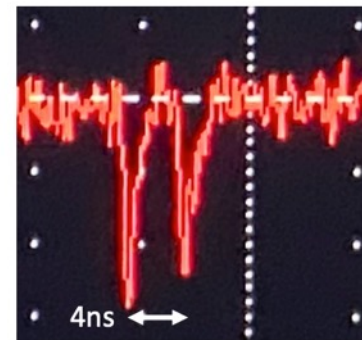Signle ch: SensL MicroFC-SMA-10010-GEVB (*b)

Fast output:
(*a) Rise time   0.6 ns, Pulse width (FWHM) 1.5 ns
(*b) Rise time   0.3 ns, Pulse width (FWHM) 0.6 ns

2 photons signal (4 ns apart)

4ns

Cathode   Fast Output

Anode

(2.5 Gs/s on scope)