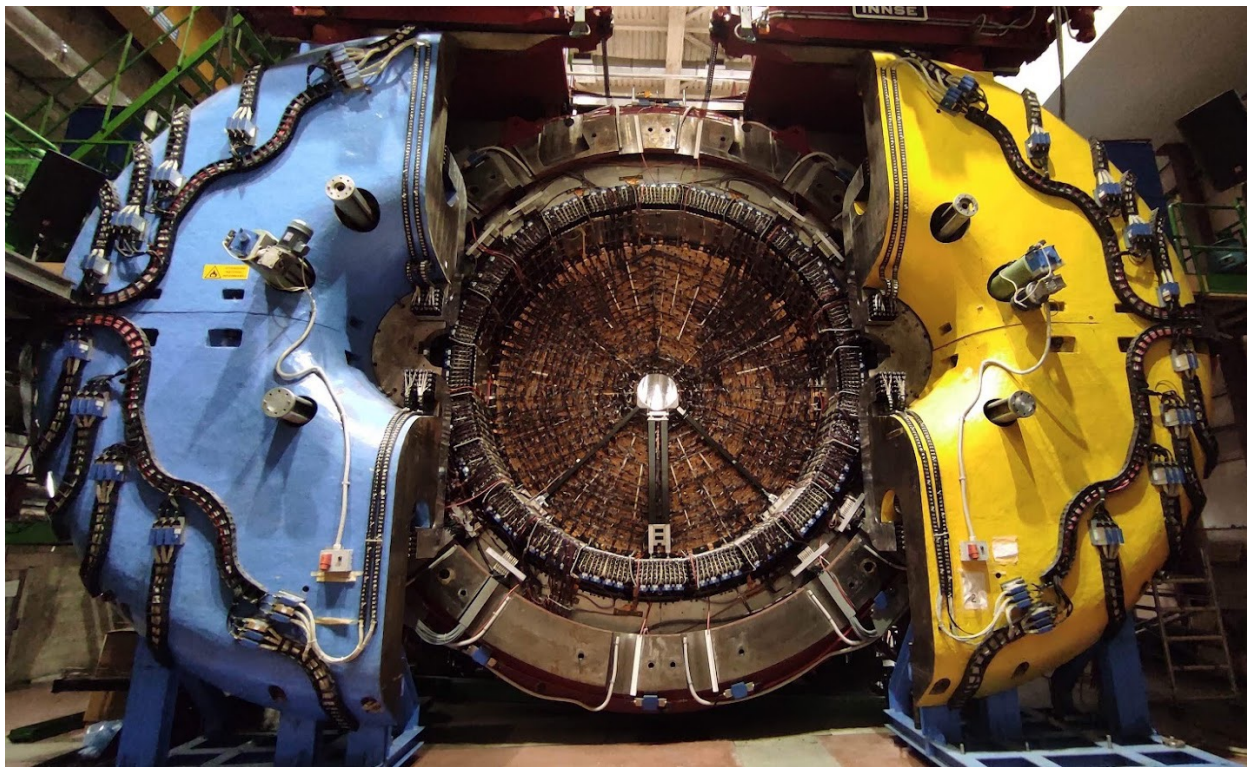# First preliminary results of the picoTDC test with PMTs

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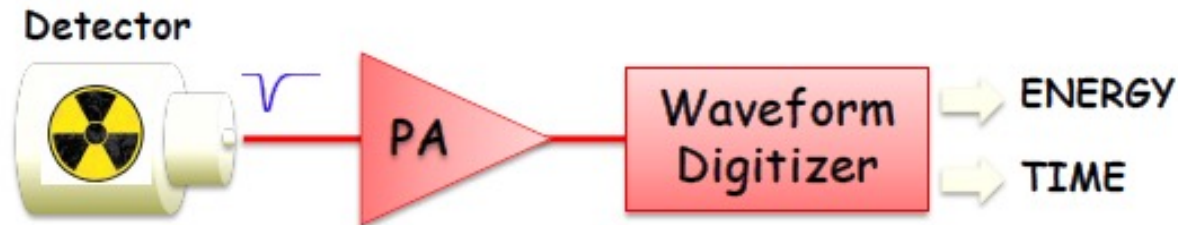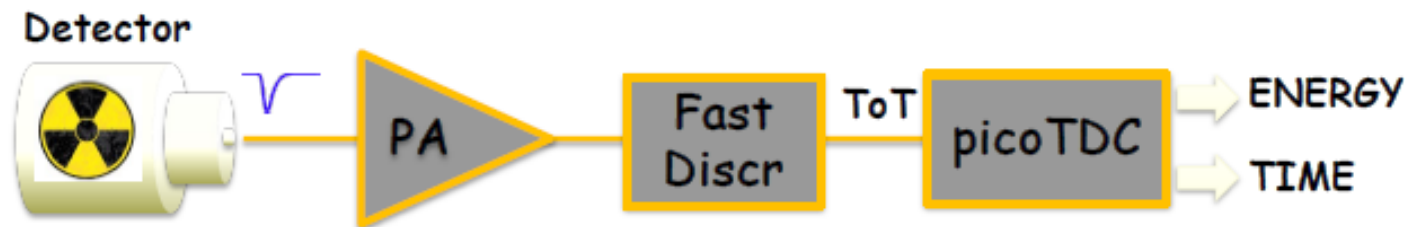CAEN, Viareggio, Italy

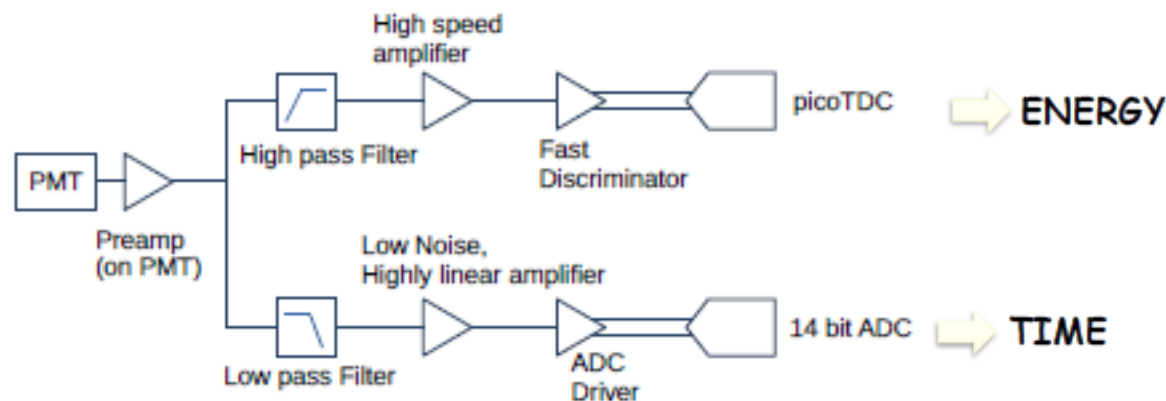SAND ECAL WG Meeting – 18th March 2024

Choice of FEE for SAND/ECAL

Three possible read-out schemes:

Highest Flexibility => Fsampl ~ 1 GS/s =>High Cost or Fsampl ~ 125-250 MS/s + signal shaper

Less Flexibility => energy by ToT with 2 or more thresholds not to worsen energy resol. Time walk correction needed

less Flexibility
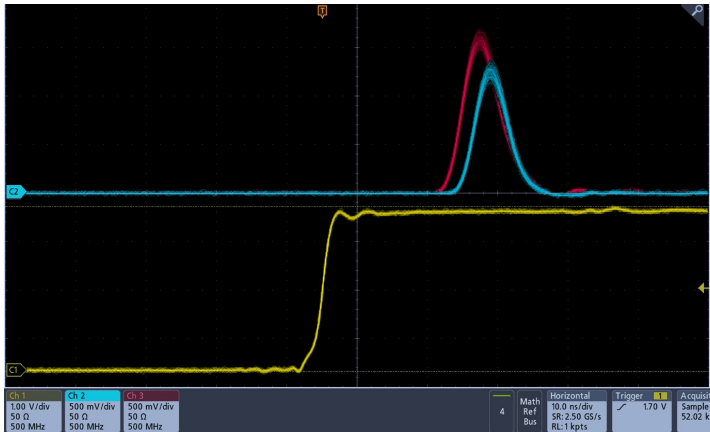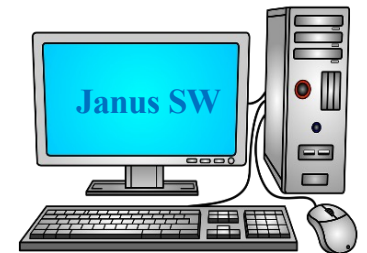
Pico TDC test

Test setup:

1.

PMTs's signal
LED Driver with fixed
ampllitude

Step Attenuator

DT5203+A5256

Janus SW


- PMT WA5656
- PMT WA8792
- Start on Ch0 with trigger from LED Driver. Stop on Ch1 and Ch2 (dual threshold) with variable amplitude.
- **Sweep**: acquire **ToT** and ΔT at different amplitudes (from 0 to 52 dB)
- Fit points and build **ToT-Walk** and **ToT-Ampl** curves
- Use curves to correct Walk from ToT (replace CFD)
- Use curves to get Amplitude from ToT (make ADC from TDC)

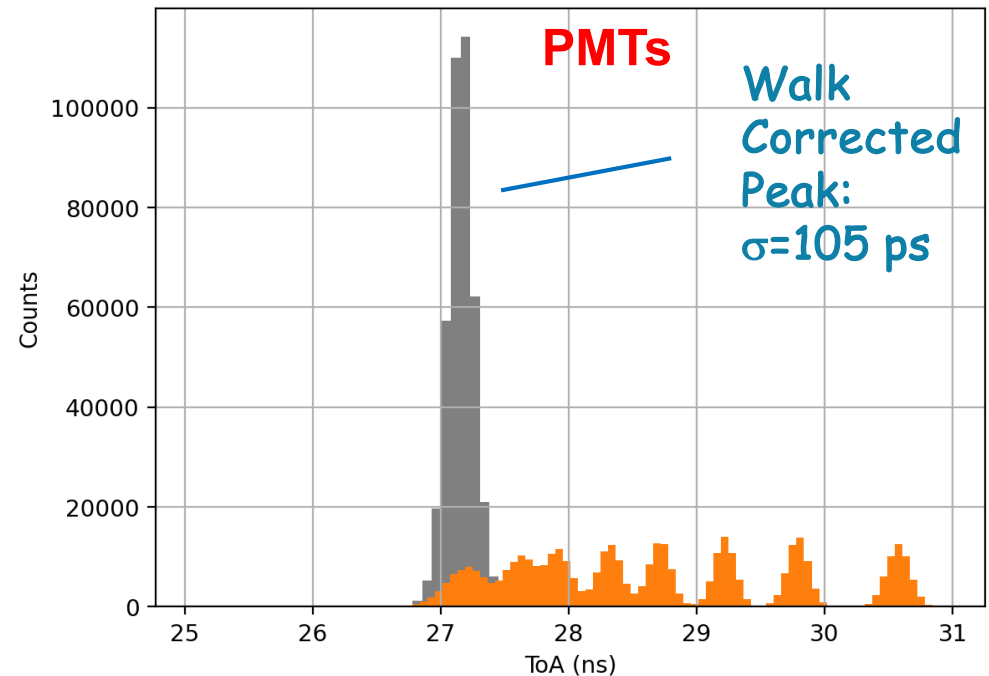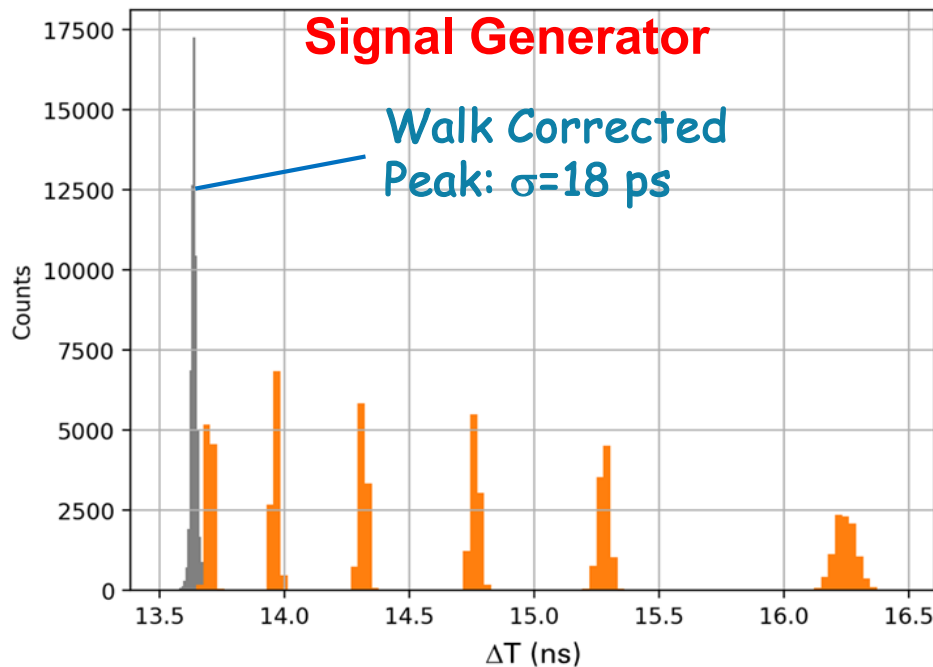# Pico TDC test
Calibration Curve:
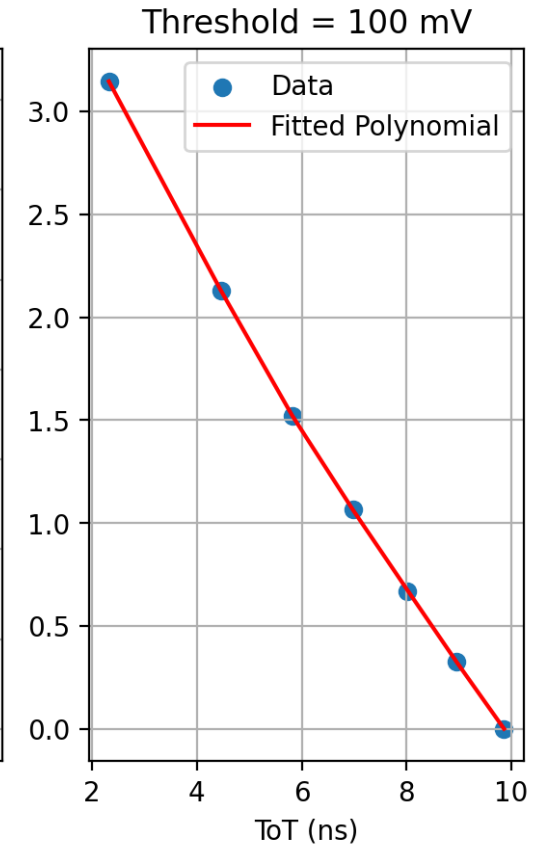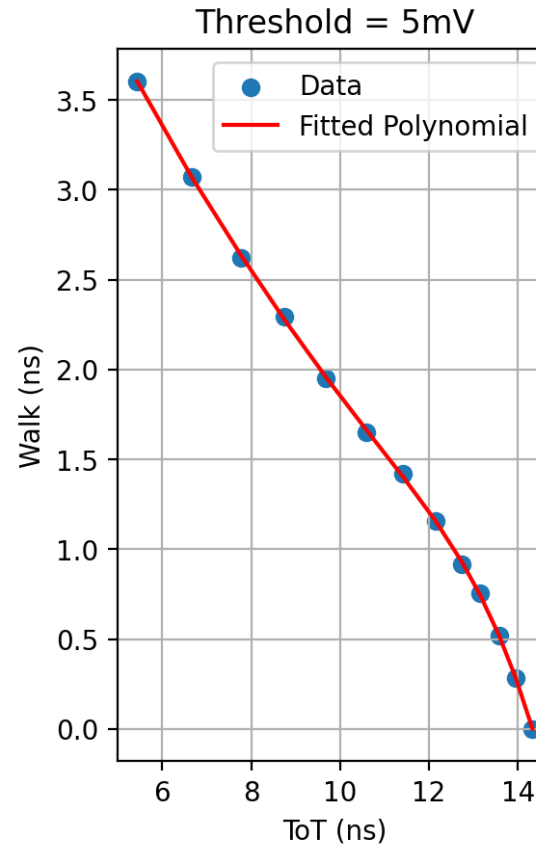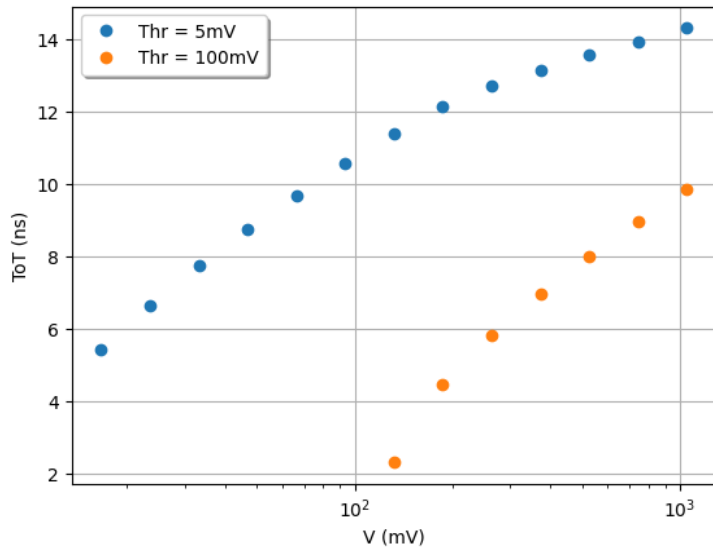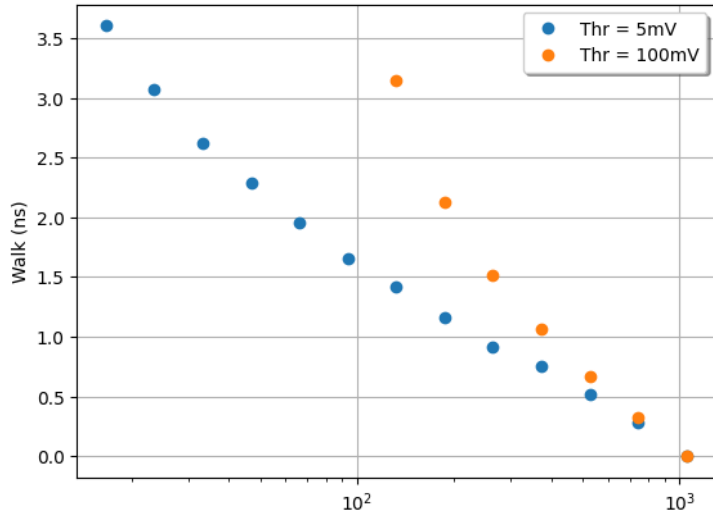
Pico TDC test

PRELIMINARY

Walk Correction and comparison with the signal generator data

- Acquired pulses at different amplitudes over a 50 dB dynamic range
- The walk causes ~2 ns spread on ΔT: separate peaks appear on the histogram.
- deltaT corrected by ToT using a 5th order polynomial fit of the **ToT-Walk** points)

Signal Generator

Walk Corrected Peak: σ=18 ps

PMTs

Walk Corrected Peak: σ=105 ps

- Corrected ΔT histogram presents one single peak:
- **18 ps RMS for the data from the signal generator**
- **105 ps RMS for the data from the PMTs**

Pico TDC test
Test setup:
2.

- PMT WA5656
- PMT WA8792
- Signal splitted:
- i. Pico TDC
- ii. Digitizer
- Resolution comparison
- TDC: Start on Ch0 with trigger from LED Driver. Stop on Ch1 and Ch2 (dual threshold) with variable amplitude.
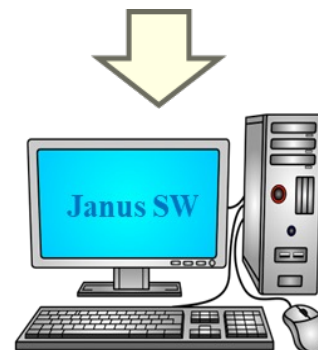- Digitizer: autotriggering on the Ch0.

PMTs's signal

Step Attenuator

DT5203+A5256

Digitizer

Janus SW

Compas SW

Pico TDC test

Conclusions

- The time resolution with the signal generator is 18 ps RMS, while for the PMTs signal is 105 ps on a 50 dB dynamic range

- Work in progress and more tests undergoing for the amplitude resolution evaluation.

- New ideas e.g. use of a fast shaper, worth to be tested.