

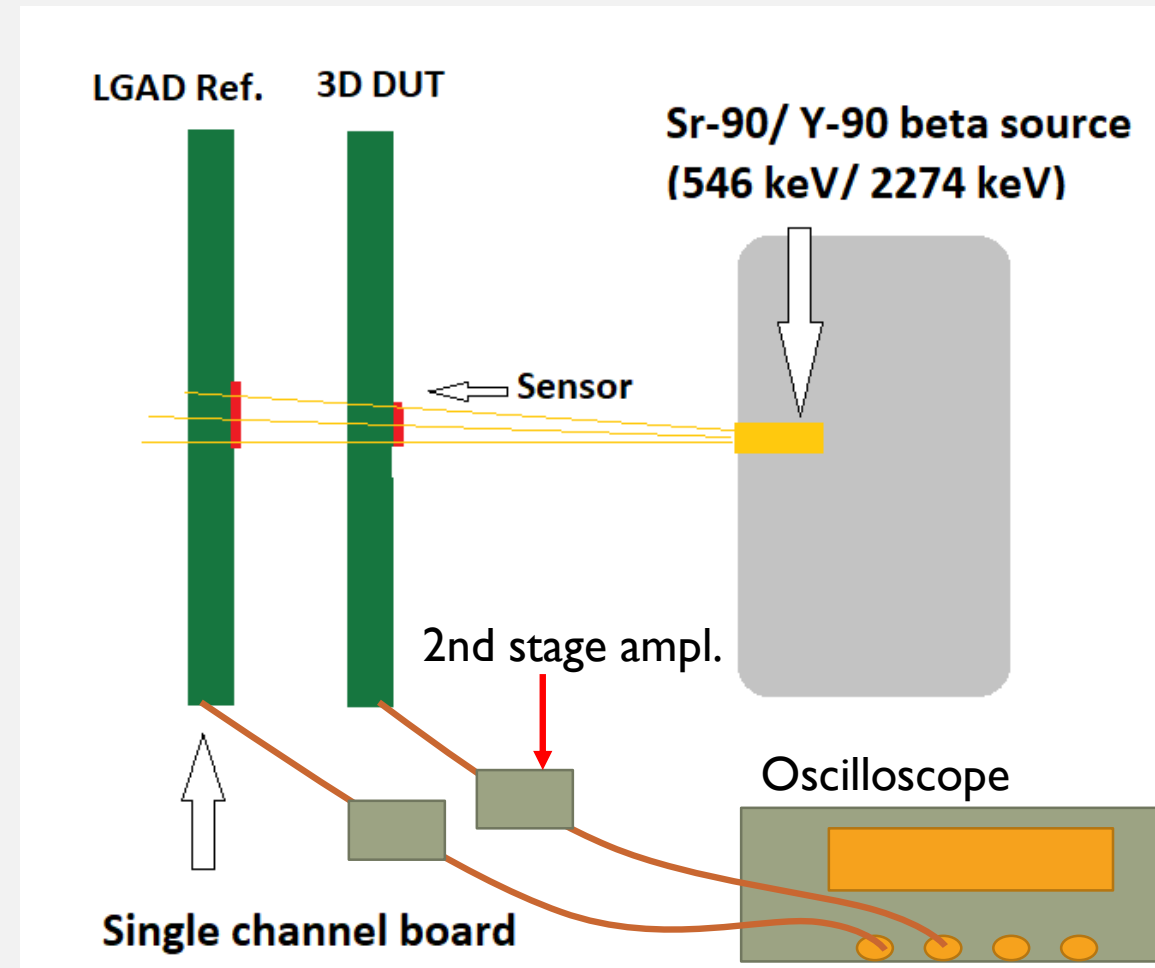
3D-TIMING

RD-50 group meeting

17/06

SET UP

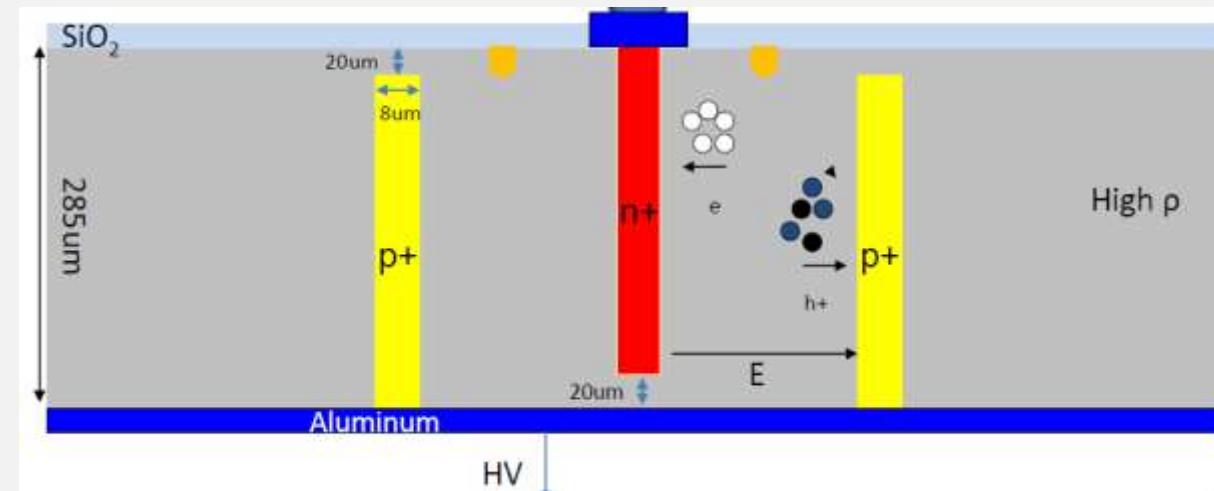
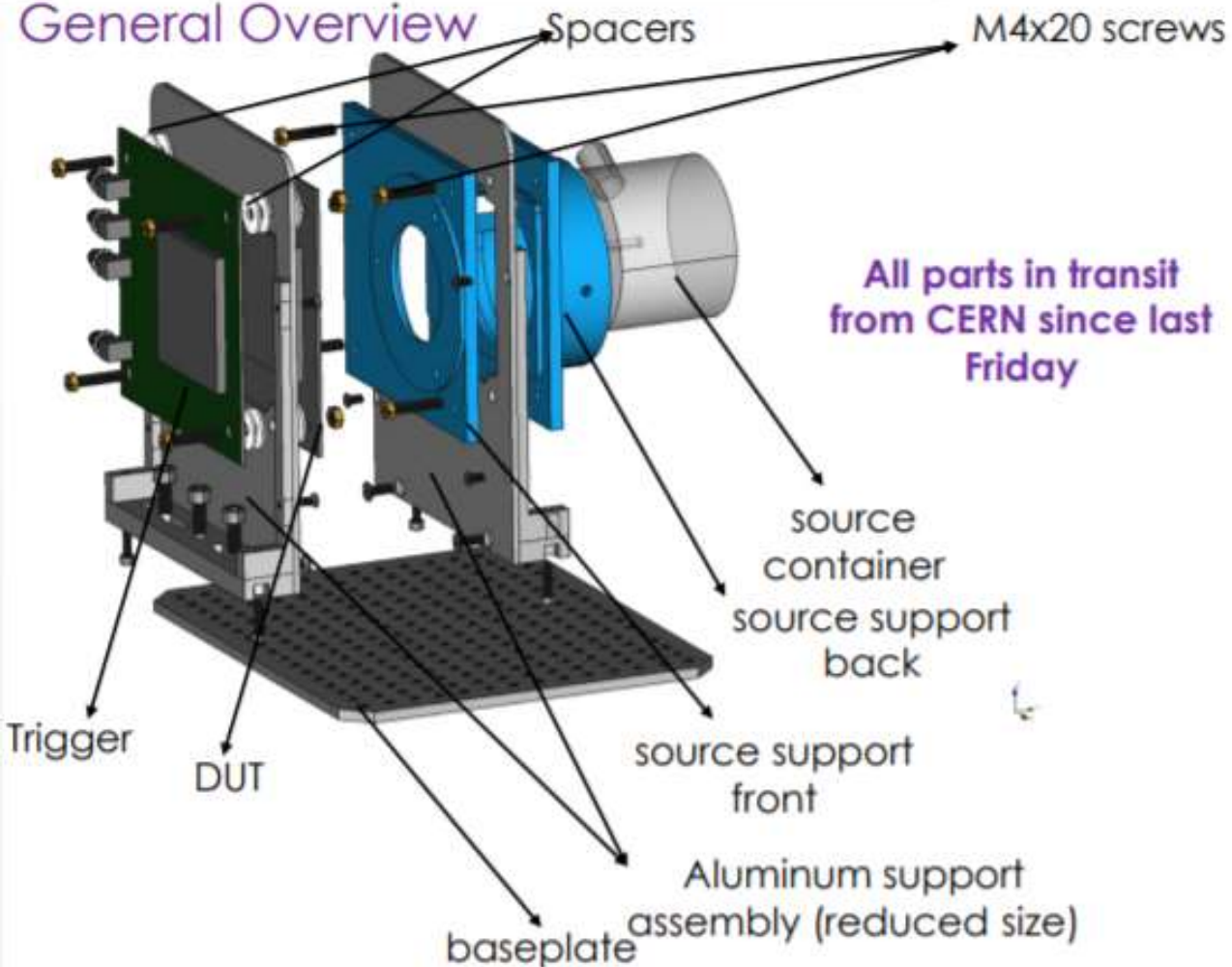
- Setup consists of a Sr-90/Y-90 beta source (3.7MBq), aligned to the 3D and LGAD (reference) sensors
- At first the 3D was mounted on a UCSC 4-channel board but the noise was pretty high → No signal
- Right now both sensors are mounted on a UCSC single-channel board
- 2nd stage external amplifiers (Mini-Circuits TB-409-52+) are used in both sensors
- Signal is acquired by a 6.3GHz (Bandwidth) / 16Gsamples/sec oscilloscope
- The whole measurements process is controlled via LabView software : **TiCAS - Timing Control Automation Software** ([link](#)) - Developed by: Vagelis Gkougkousis
- During Scanning the scope collects coincident events with given threshold for each channel (-10mV for 3D DUT and -15mV for LGAD reference)



SET UP & 3D DEVICE

Mechanics

General Overview

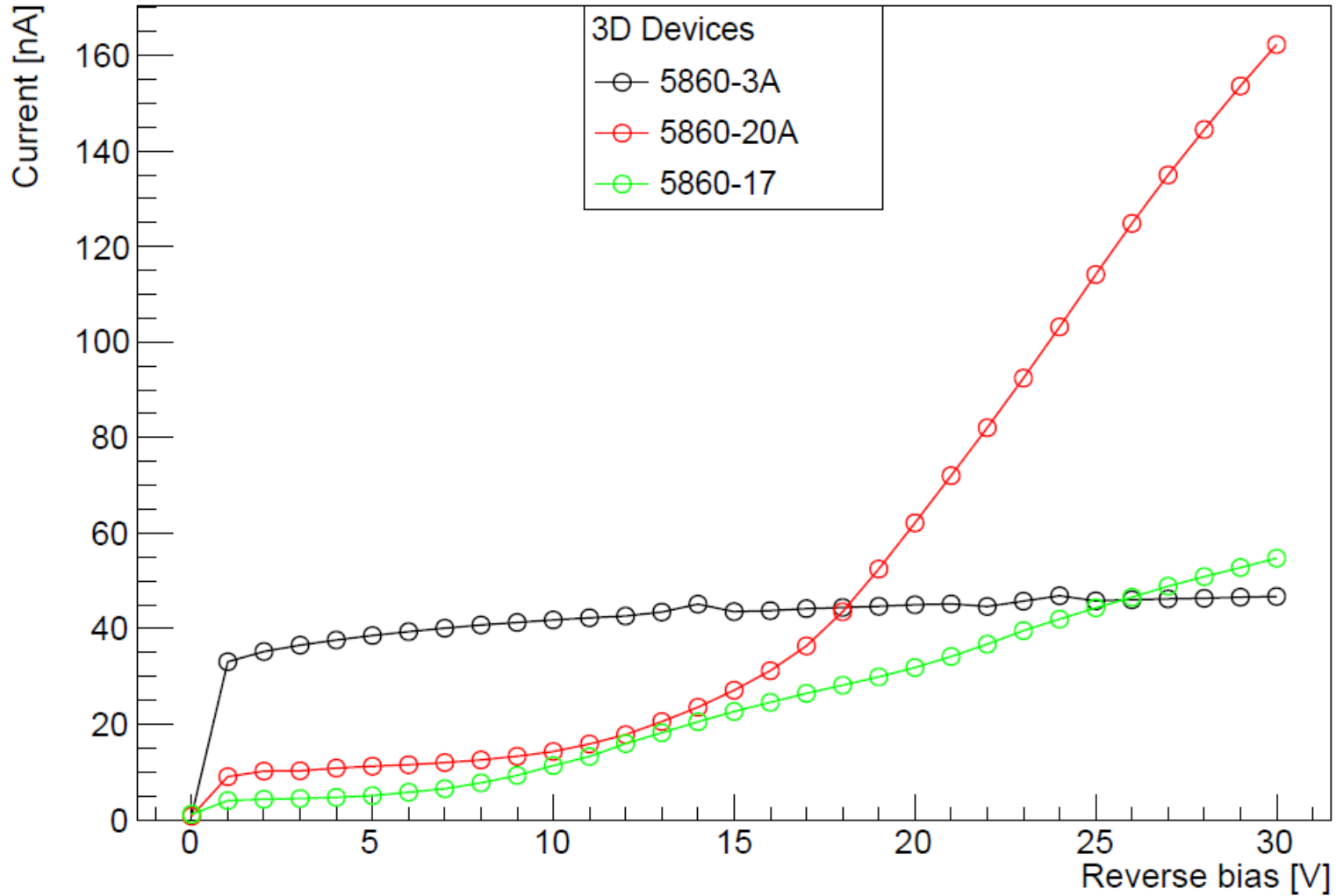


Pitch = $55\mu\text{m}$
Thickness = $285\mu\text{m}$

I-V GRAPH

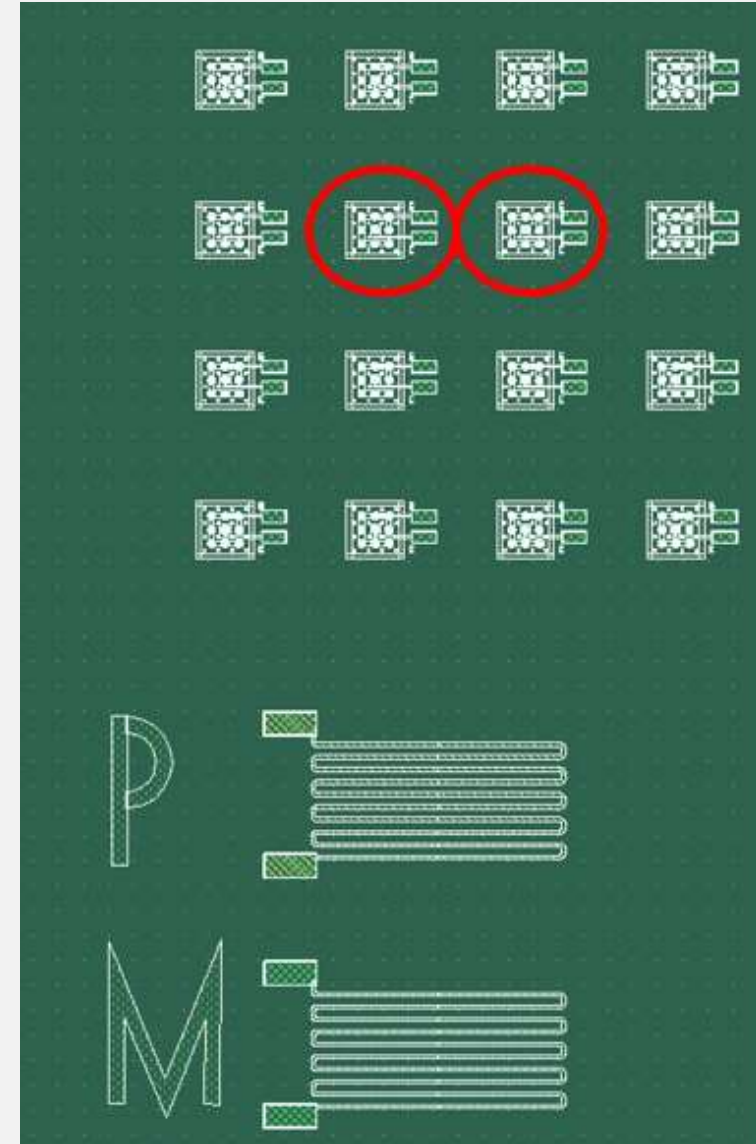
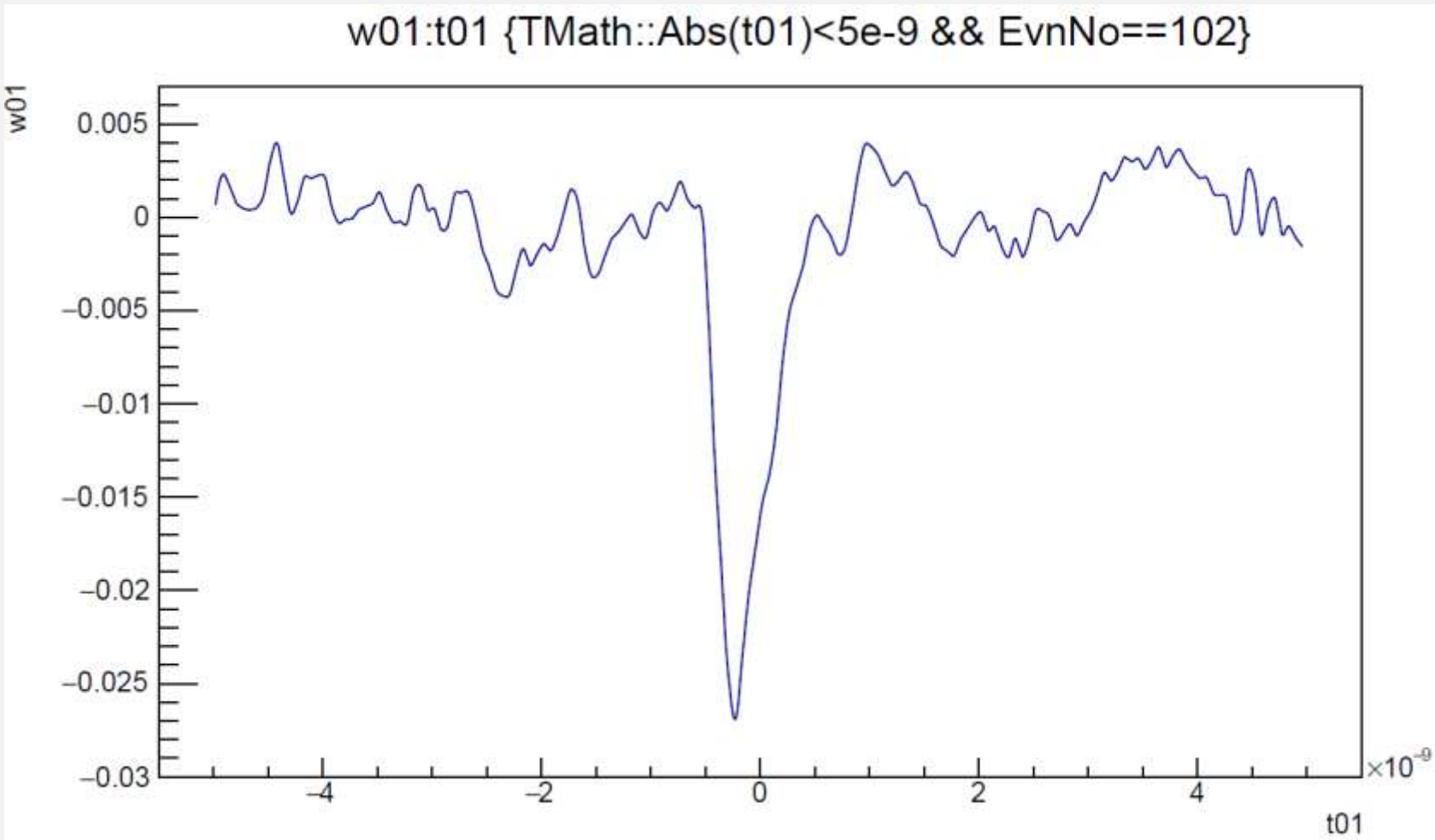
5860-20A device is being studied right now

I-V (3D single cell devices)



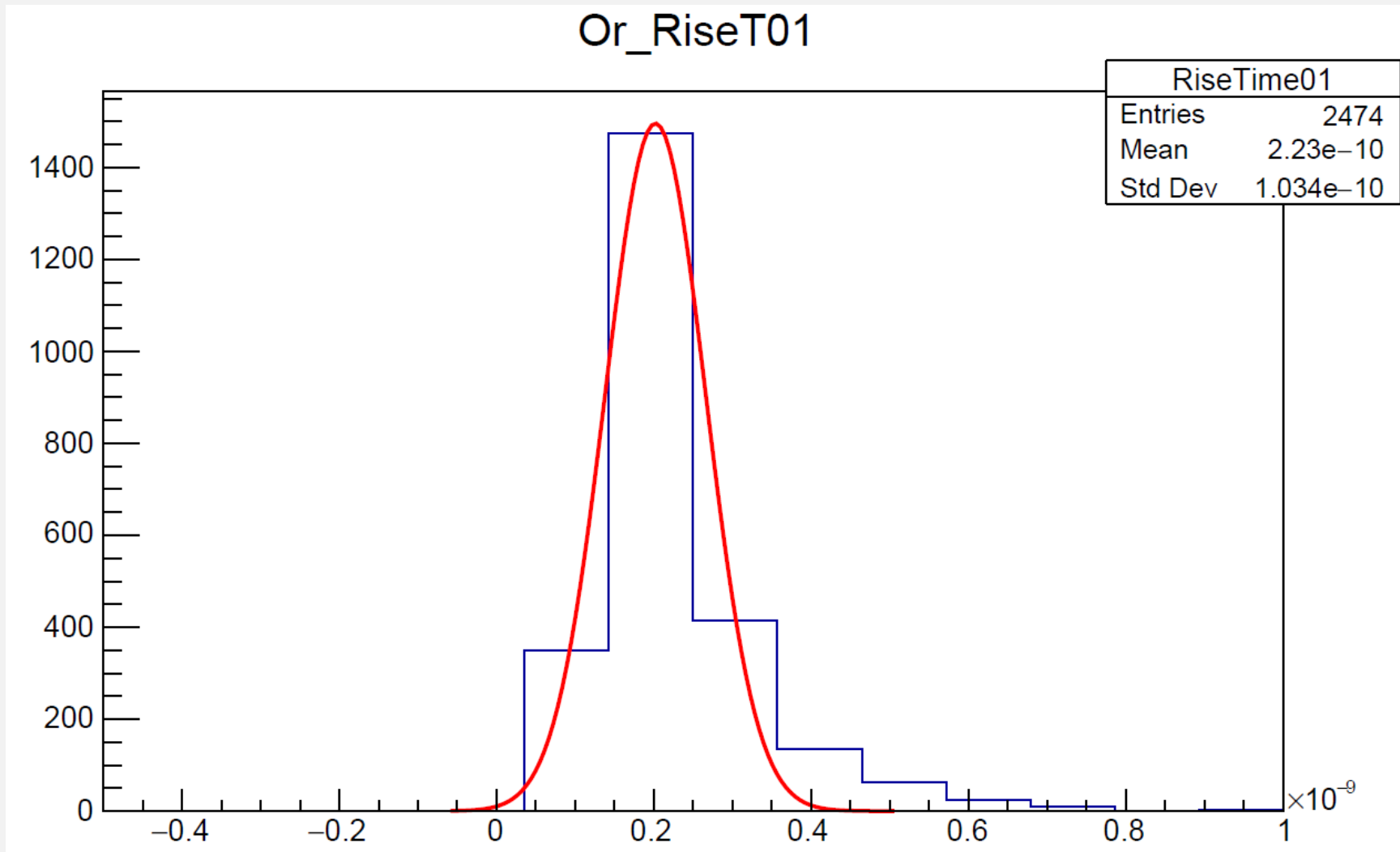
NEW RESULTS-BAD STATISTICS

- Finally getting a clear signal from a 3D sensor as the single-channel board reduced the noise
- Small “active” surface ($2 \times 55 \times 55 \mu m^2$) leads to low coincident events rate (avg. 0.33 evnt /min)



RISE TIME

- The software that is being used for analysis : LGADUtils (<https://gitlab.cern.ch/egkougko/lgadutils>) – Developed By Vagelis Gkougkousis
- First (low amount of) data give us a rise time of $0.22 \pm 0.09 \text{ ns}$
- Knowing that our 2nd stage amplifiers are “low pass filters” at 2 GHz, we need to check if this result is **true**



RISE TIME CALCULATION



**Adobe Acrobat
Document**

TIMING RESOLUTION

- A loop calculates the time differences for all possible combinations of CFDTime values between the two channels (two sensors)
- A total of 361 (19x19) histograms are created and filled
- **i.e** : for 5000 events the first histogram will take 5000 values of " $CFDTime01 - CFDTime02$ " at 5% of max. volt. The second one \rightarrow 5000 values of " $CFDTime01$ (at 5%) $- CFDTime02$ (at 10%)" and so on..
- Guassian distribution is fitted to all histograms
- The sigmas of those distributions are the σ_{tot} of the following formula for timing resolution calculation
$$\sigma_{tot}^2 = \sigma_{DUT}^2 + \sigma_{ref}^2$$
- σ_{ref} is a known (from previous experiments in specific conditions) timing resolution of the LGAD sensor used as a reference
- Last data gave us a time resolution of **56.017 ps** for our 3D sensor, biasing it at **15 V, room temperature** (the σ_{ref} value came from measurements in lower temperature, because we are missing some calibration data at the moment. Corrections will come soon).

