

Photosensors meeting Gain automation

M.Á. García-Peris, J.L Rocabado, M. Querol, A. Cervera

IFIC-VALENCIA

SiPM characterization needs to be automatized

DUNE SiPM mass production will involve ~300000 SiPMs.

Characterizing 5% of them means characterizing ~15000 SiPMs.

With the current methods, taking into account all the labs, this would take **years** → **we need to speed up the process.**

Bologna group is already working on a facility to automatize the IV measurement. However, the remaining measurements (**gain**, correlated noise) are not automatized yet –and they are the most time-consuming!

Based on the experience gained on the NEXT experiment, we are proposing to develop a facility that could automatically measure the gain of several SiPM faster than we do now.

Mass gain characterization at NEXT

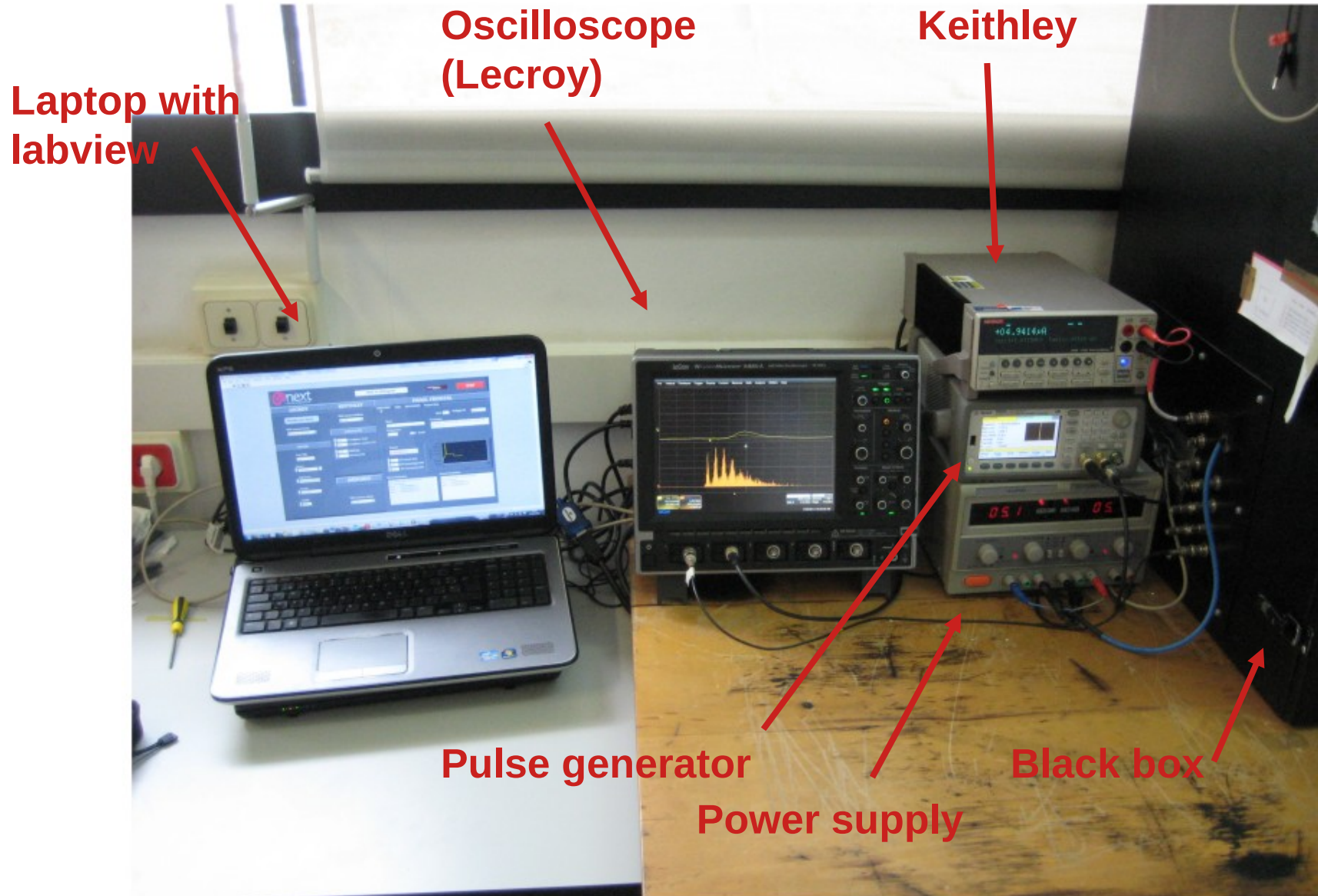
The NEXT experiment is neutrinoless a double-beta decay experiment lead by our group. It is a Electroluminescence TPC, which uses tracking planes formed by ~2000 SiPM.

Since the SiPM are not used just to “count” but to do the tracking, all of them needed to be gain-characterized.

For such task, M. Querol developed a facility to automatically measure the gain of all the SiPM (in groups of 64) at 5 different OV. **It took only 2 weeks to characterize the 2000 SiPMs.**

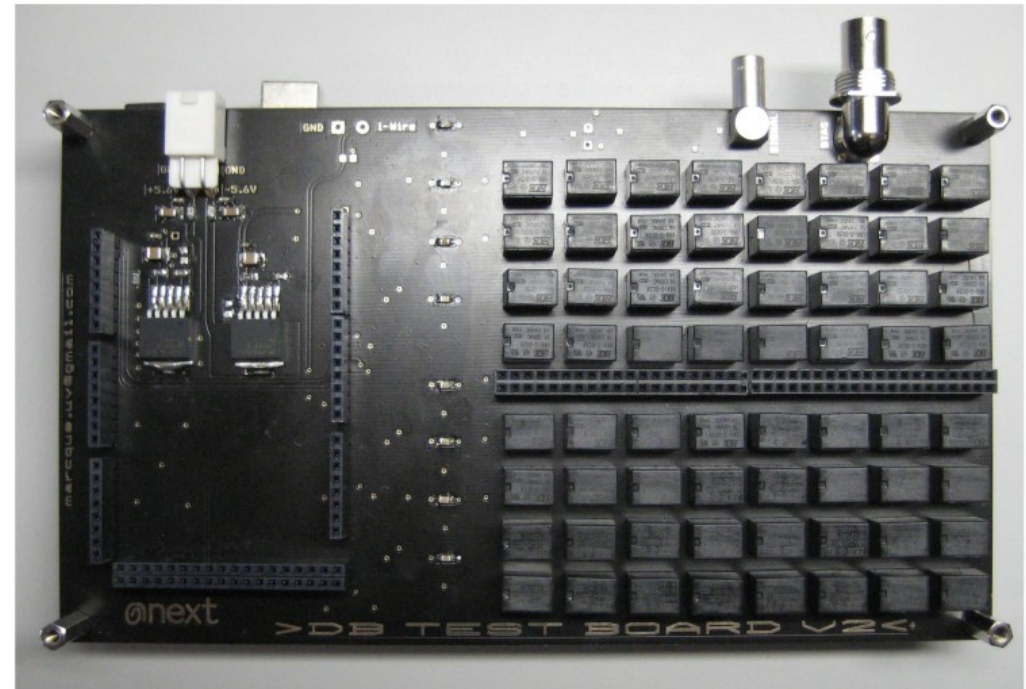
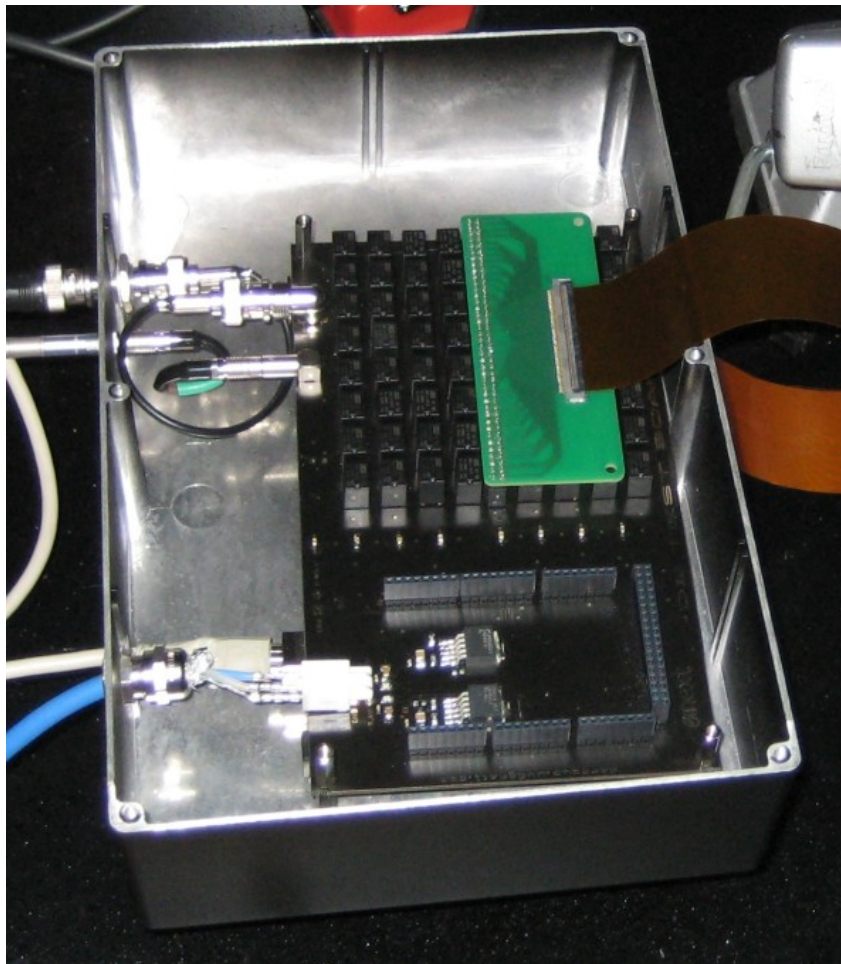
Although conditions of the our characterization is different (NEXT does not work at cryogenic temperatures), we think **this facility could be adapted to our needs.**

NEXT gain facility



NEXT gain facility

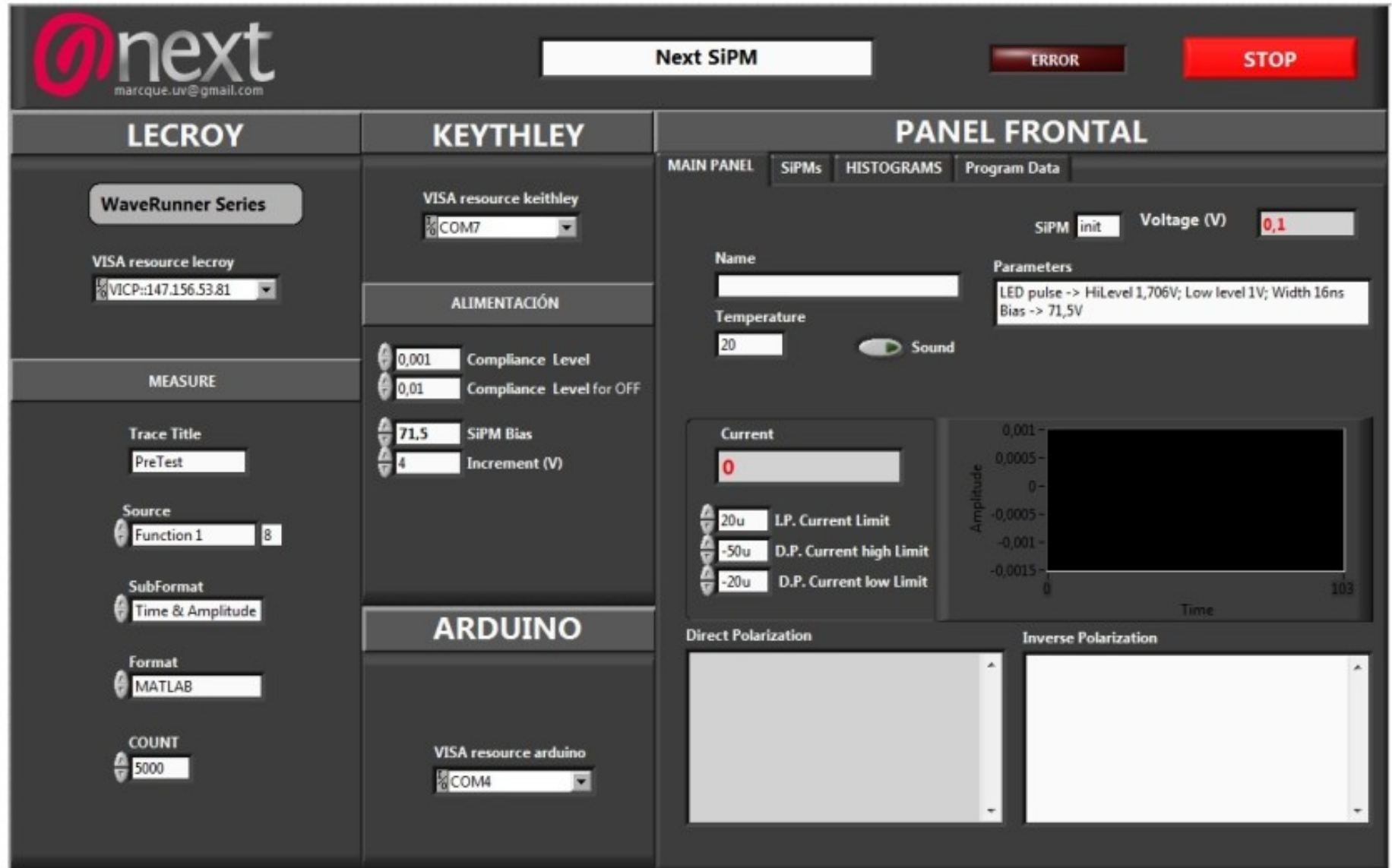
The commutation between SiPMs was made with relays.



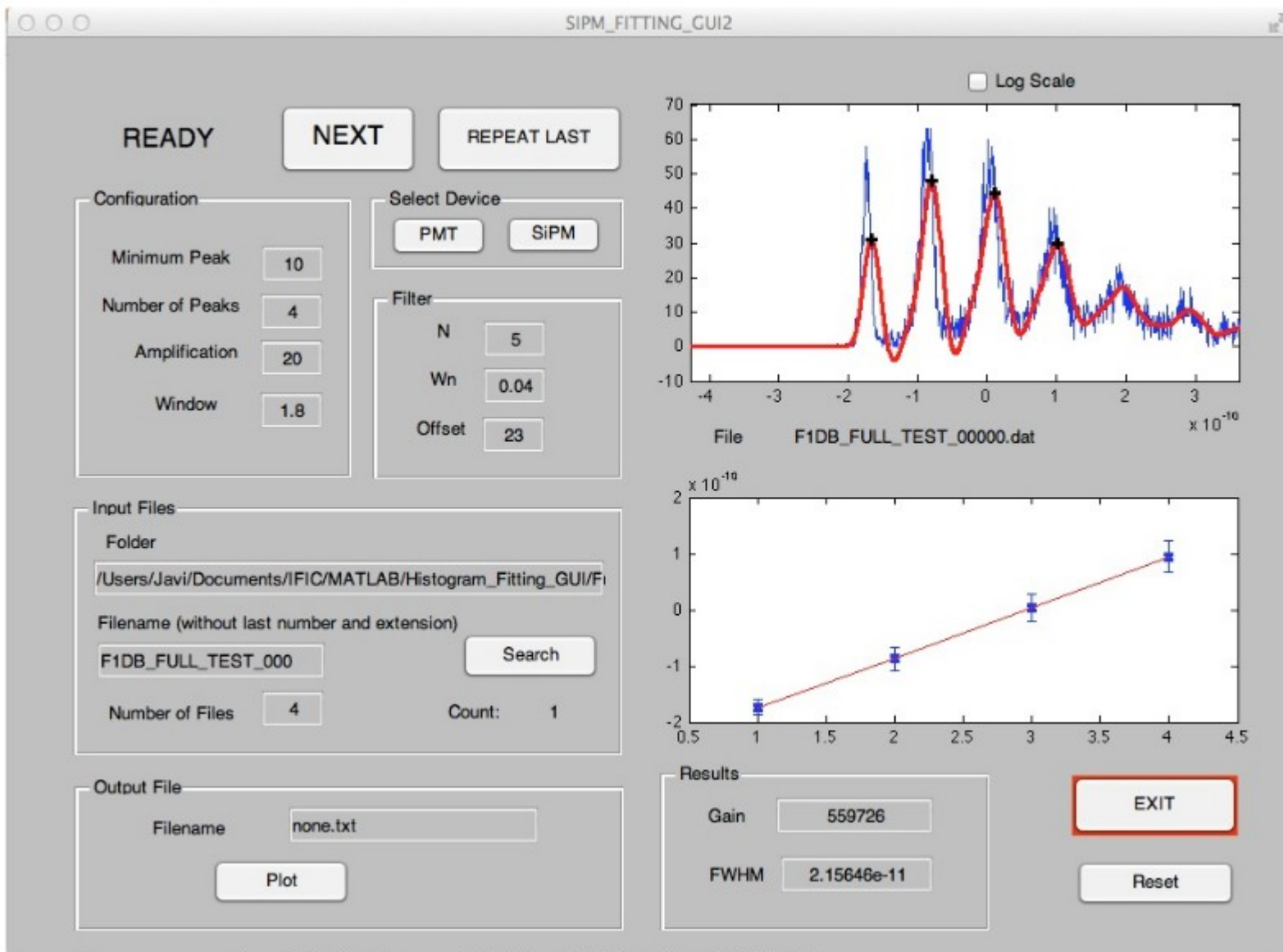
Relays were used because they added no noise to the measurements.

The system commutation was controlled by arduino.

NEXT gain facility: LabView



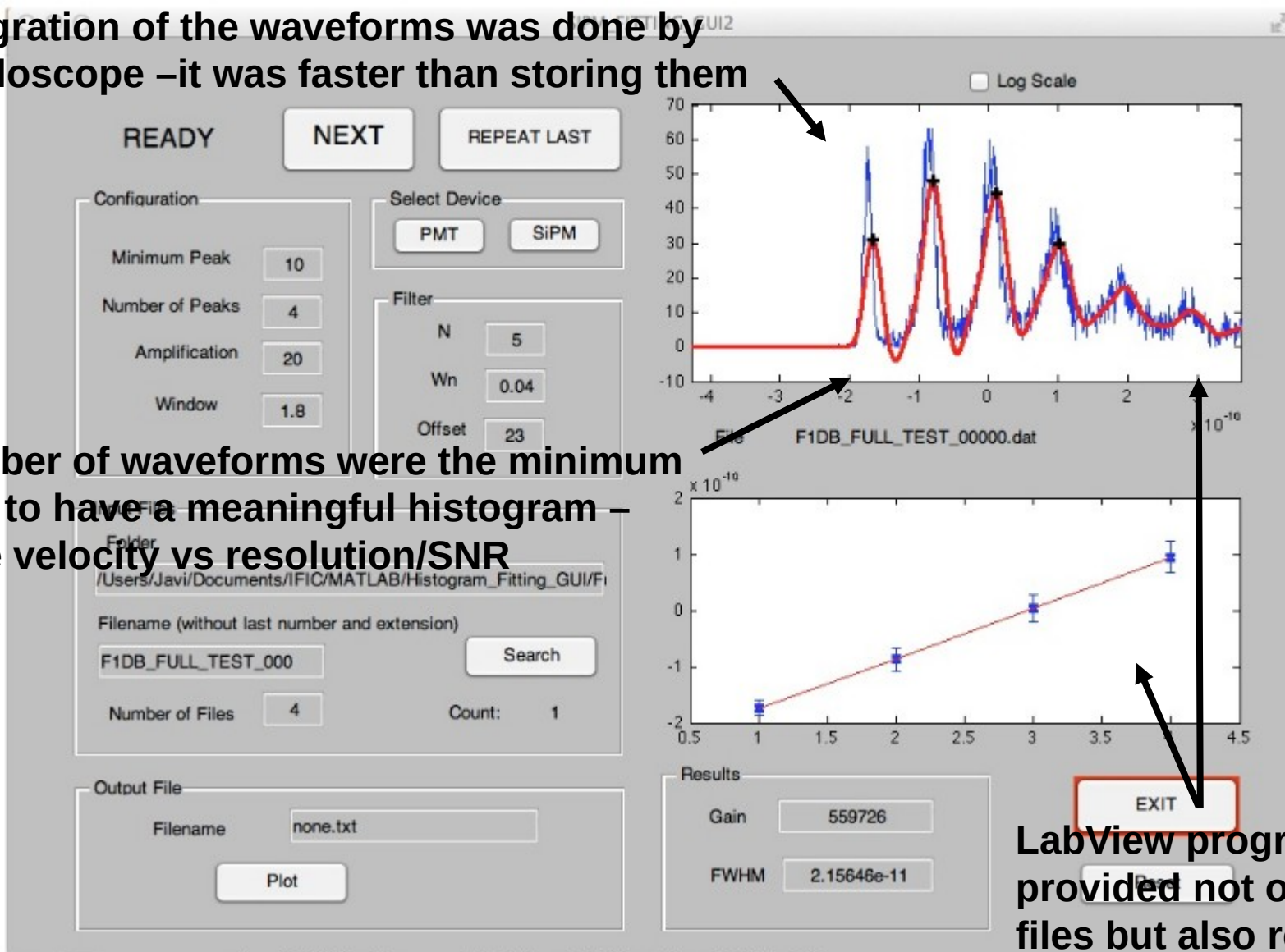
NEXT gain facility: LabView



NEXT gain facility: LabView

The integration of the waveforms was done by the oscilloscope –it was faster than storing them

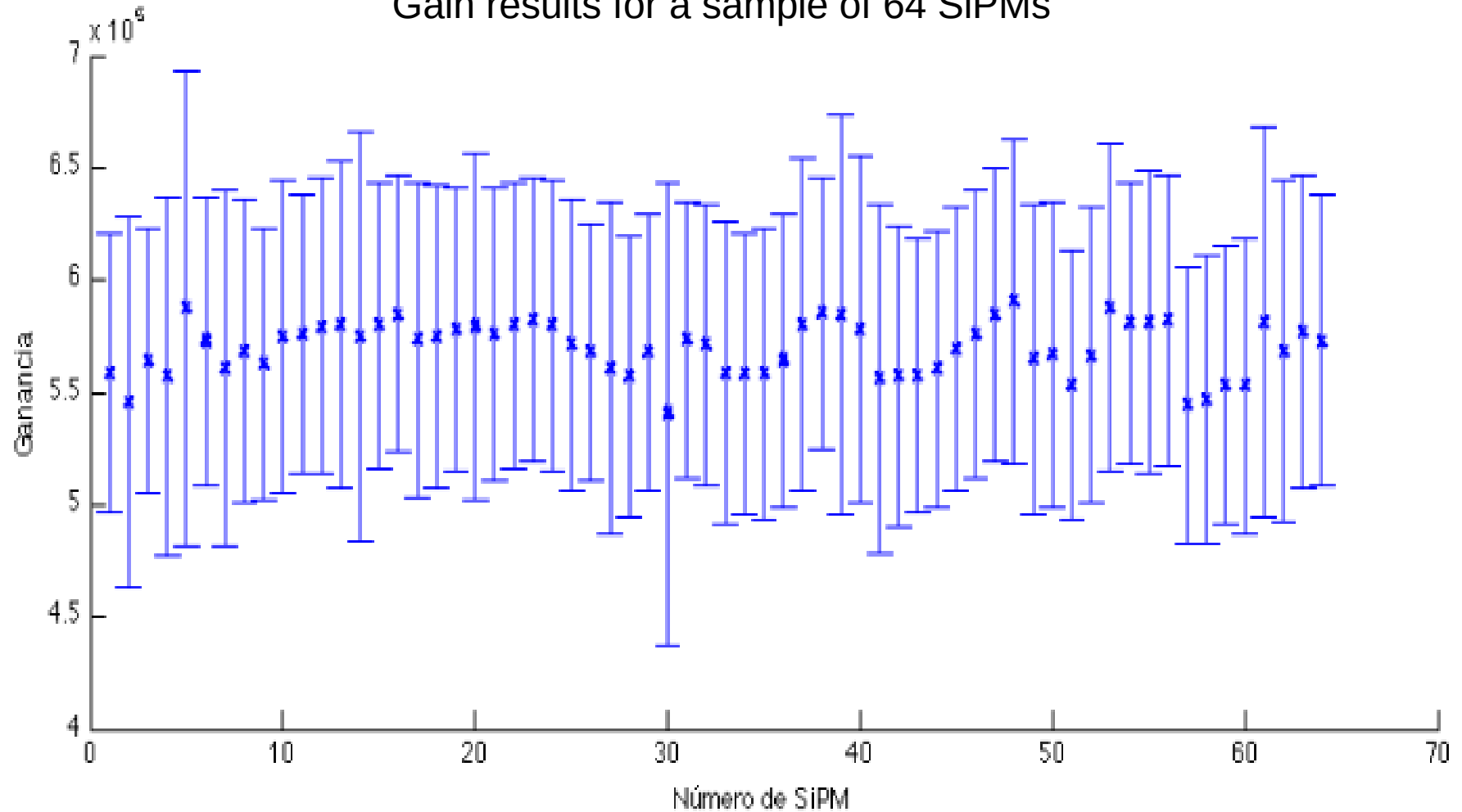
The number of waveforms were the minimum required to have a meaningful histogram – prioritize velocity vs resolution/SNR



LabView programme provided not only data files but also results directly

NEXT gain facility

Gain results for a sample of 64 SiPMs



Adaptation to DUNE

Adapting NEXT facility to DUNE needs should not be difficult –we ‘just’ need to immerse the system in LN2.

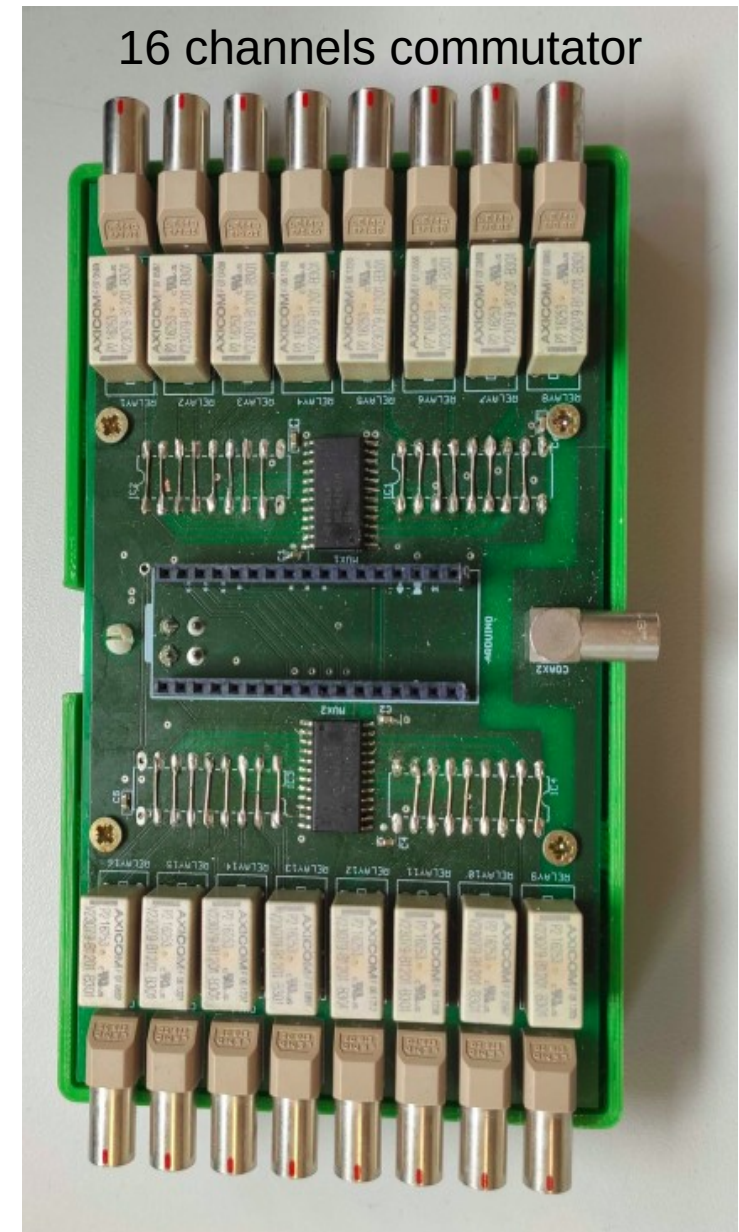
We have already started the development of a demonstrator of the facility which will work with 16 SiPMs. This would give us some insight about the time needed for the measurements.

Since we don’t start from scratch, it could be possible to have the demonstrator ready in ~2 months.

Once the demonstrator has been proven, we just need to increase the number of SiPMs.

The system could be extended to perform correlated noise measurements.

Since the timescale is ~months, we think that this facility could also be used for protoDUNE phase 2 mass production.



Adaptation to DUNE

Before we spend months working on this, we would like to know your thoughts about this facility. Do you think it could be useful for our purposes? Is it worth to fully develop it?