

Detector developments with Guy: a nano-ammeter for the ALICE TPC Upgrade

Dr. Sergio Vergara Limon, FCE-BUAP

Dra. Ma. Aurora D. Vargas Treviño, FCE-BUAP

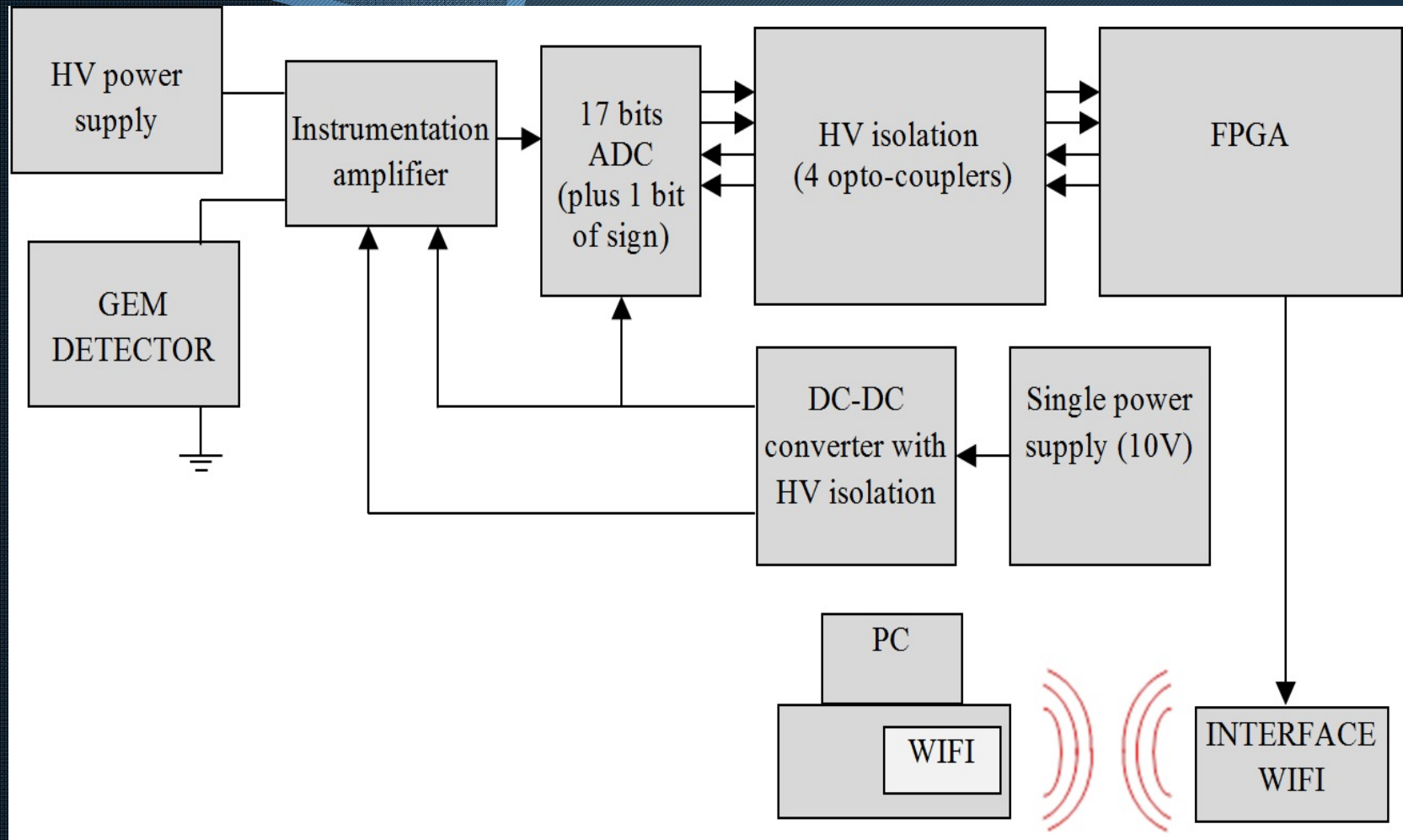
Dr. Guy Paic, ICN-UNAM

MC Rabi Soto Camacho, FCC-BUAP

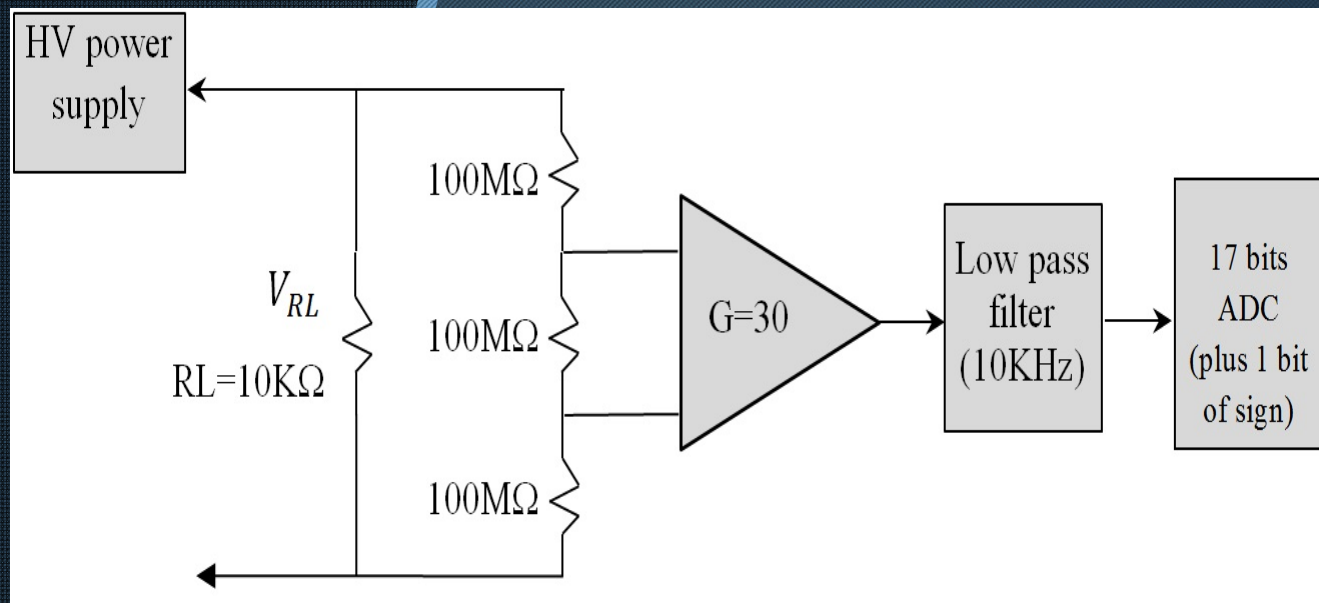
MC Ricardo de Gante, FCE-BUAP

MC Enrique Patiño, ICN-UNAM

Current monitor, block diagram



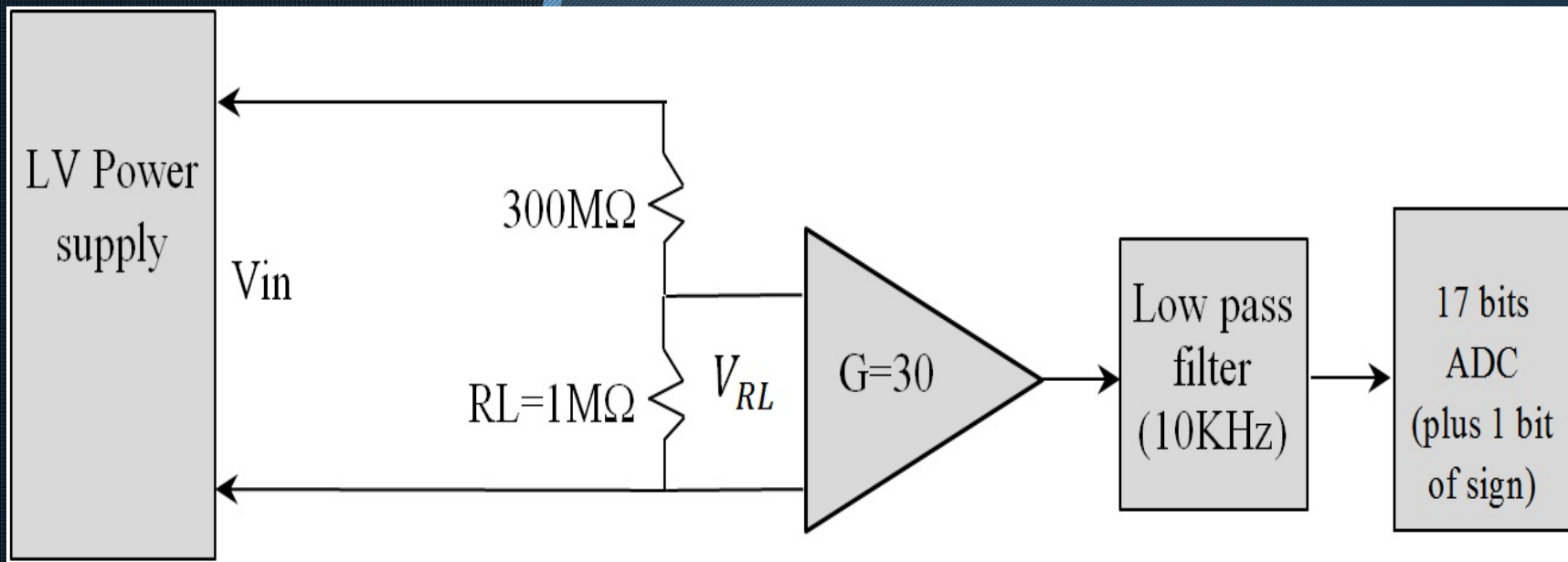
Pico-ampere circuit



Current range as function of the resistance load (RL)

RL	Current range	Current LSB (pA)
10Kohms	0-100 μ A	763
100Kohms	0-10 μ A	76
1Mohm	0-1 μ A	7.6

Pico-amperimeter circuit used for the Characterization

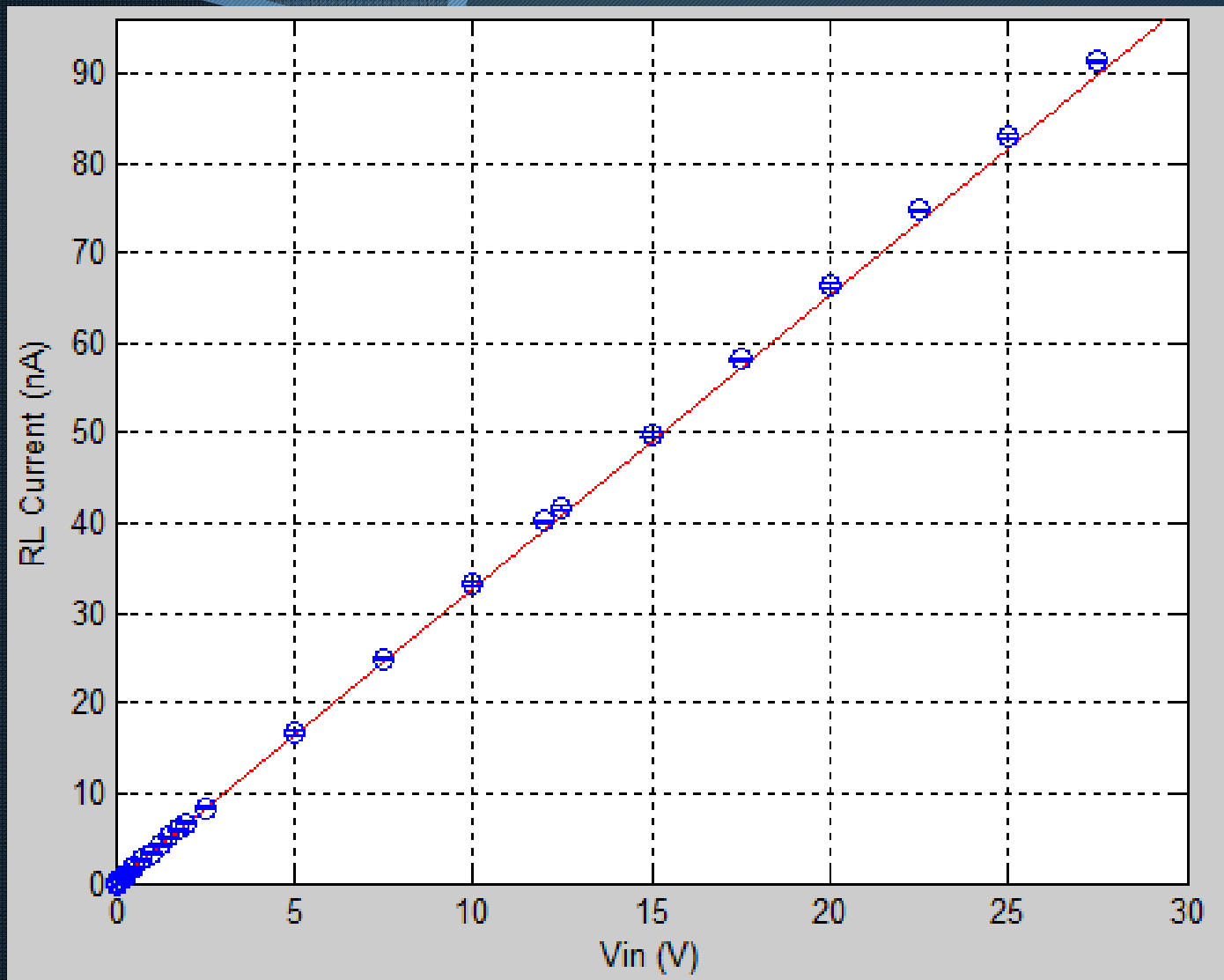


Current monitor board

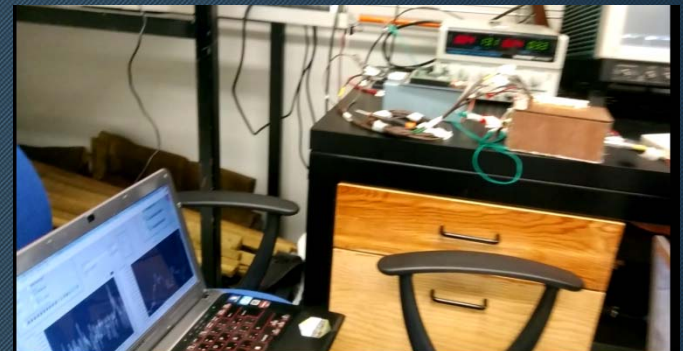
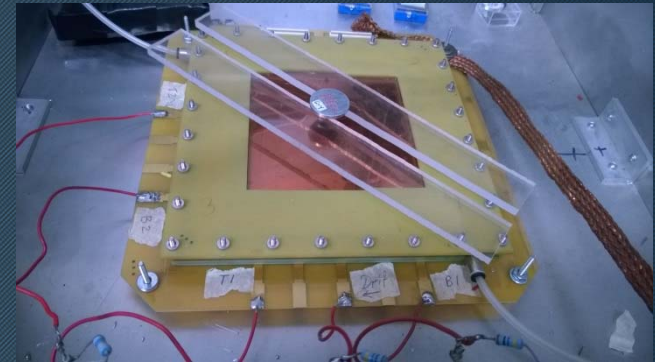
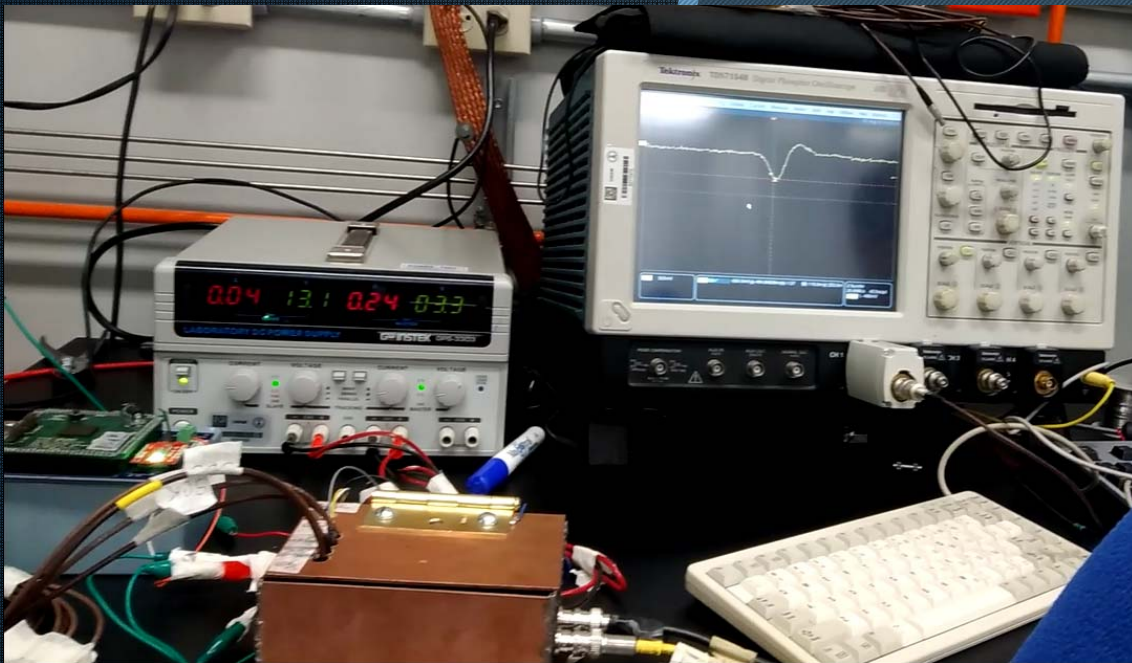


Size: 6.1cm x 10 cm

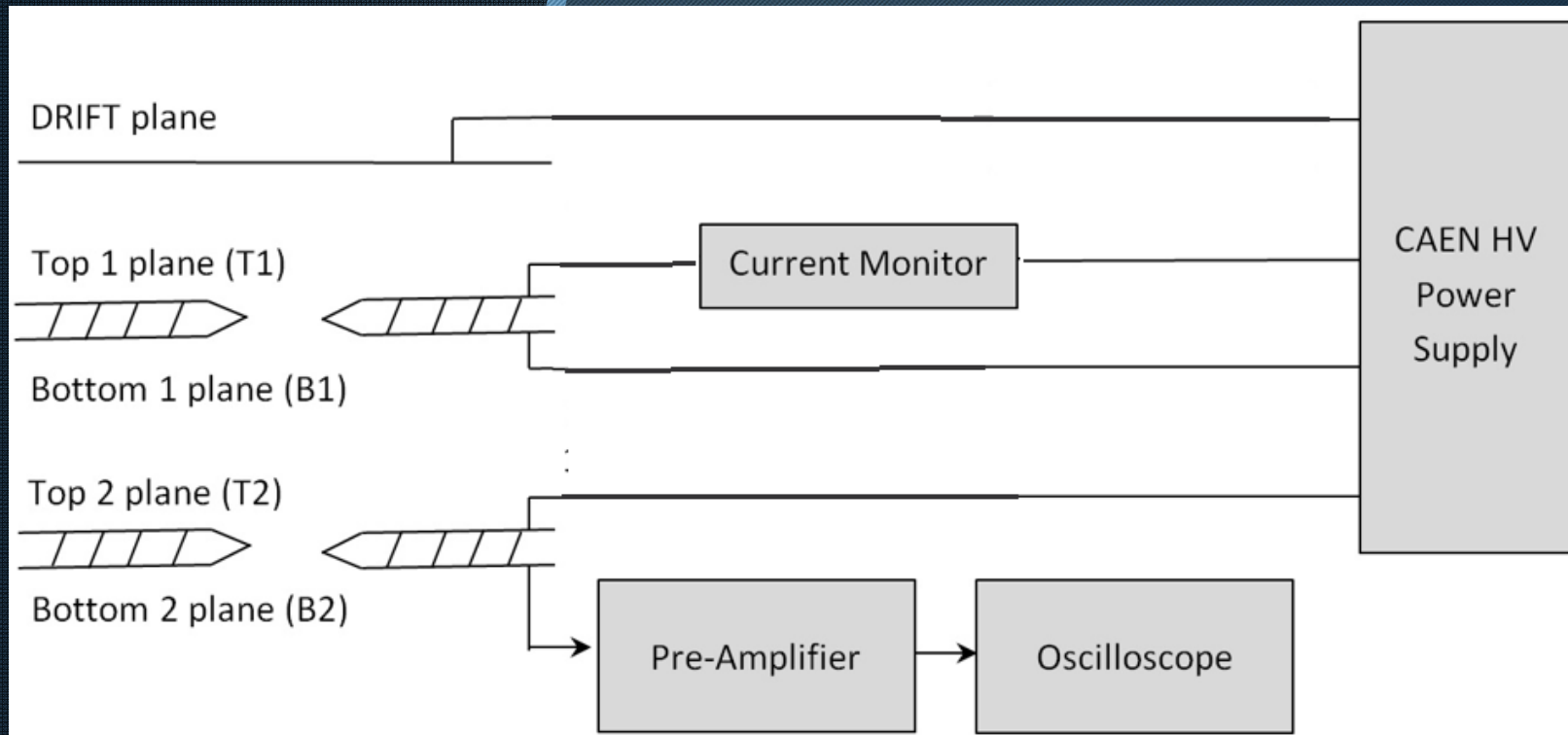
Characterization results



Current monitor experimental setup

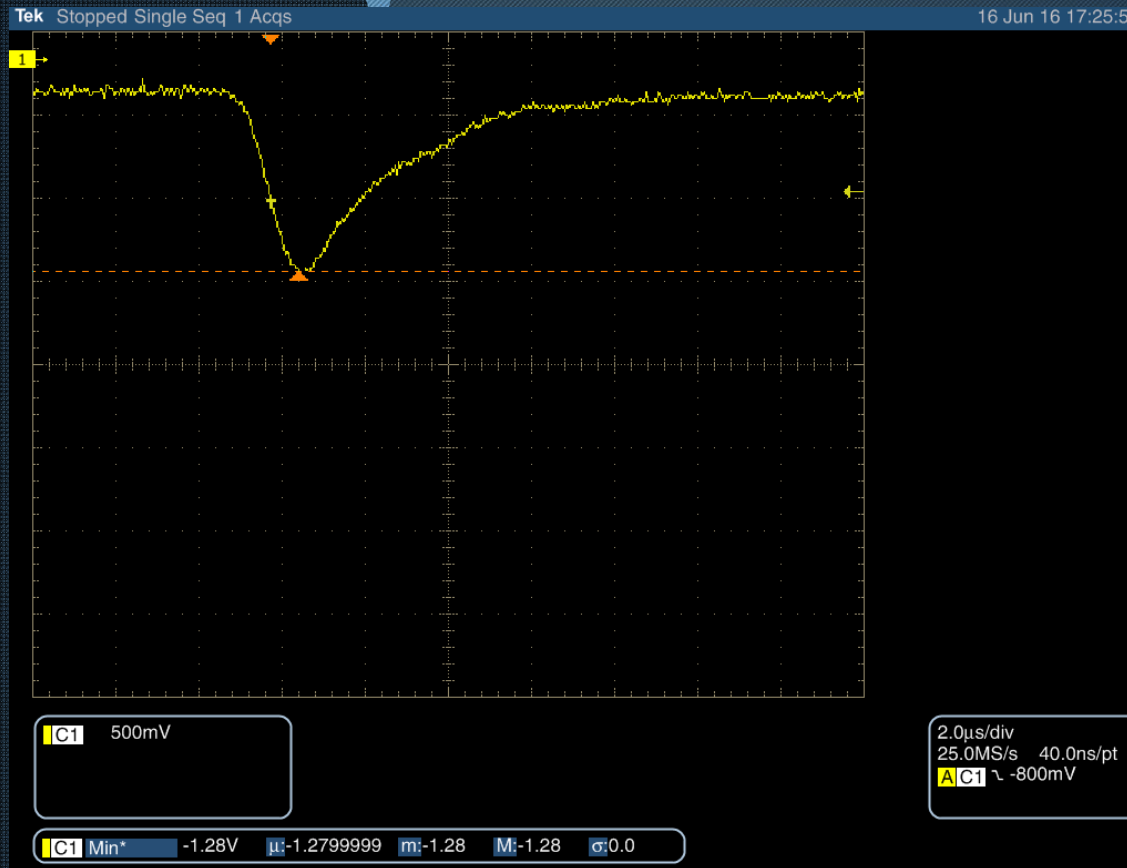


Current monitor connected to the TOP1 plane in the GEM



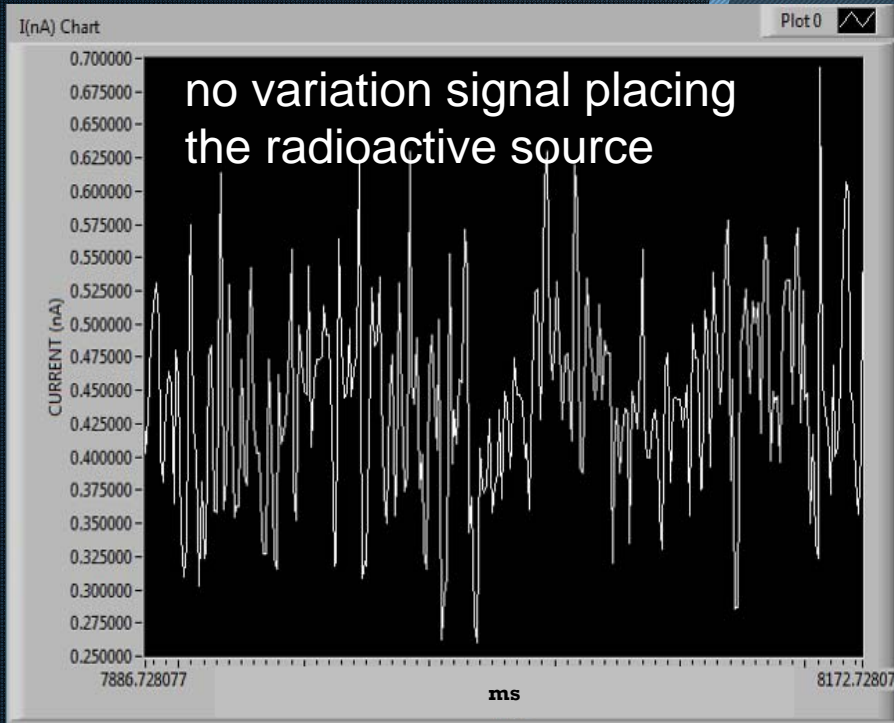
GEM's output signal without RC,
with Monitor current.

Current monitor connected to the TOP1 plane in the GEM

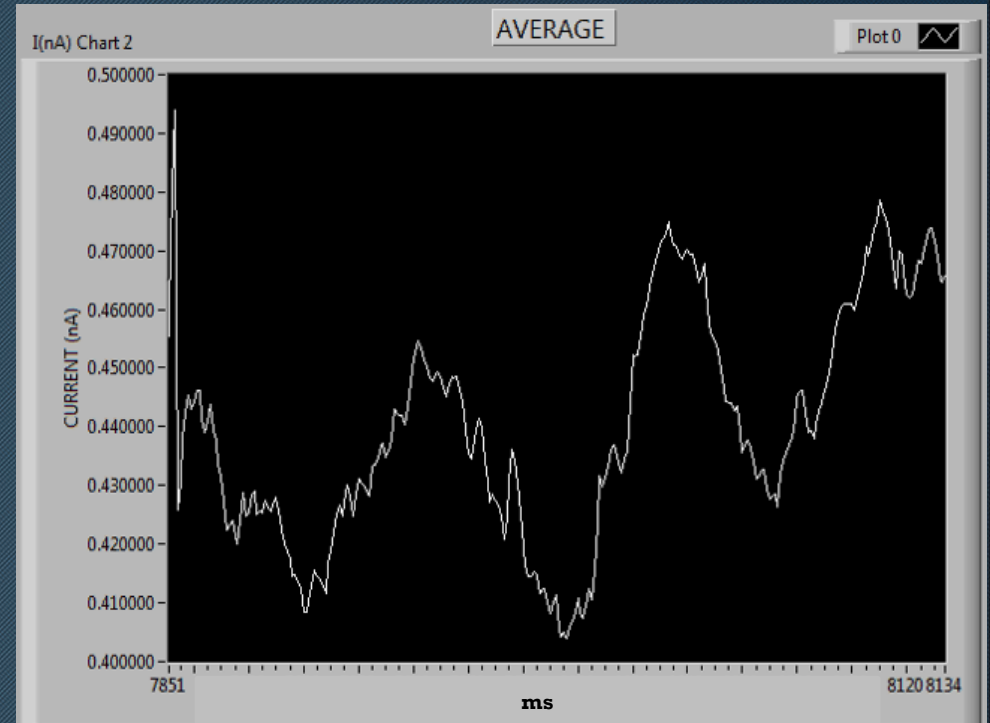


GEM's output signal without RC, with Monitor current.

Current monitor connected to the TOP1 plane in the GEM

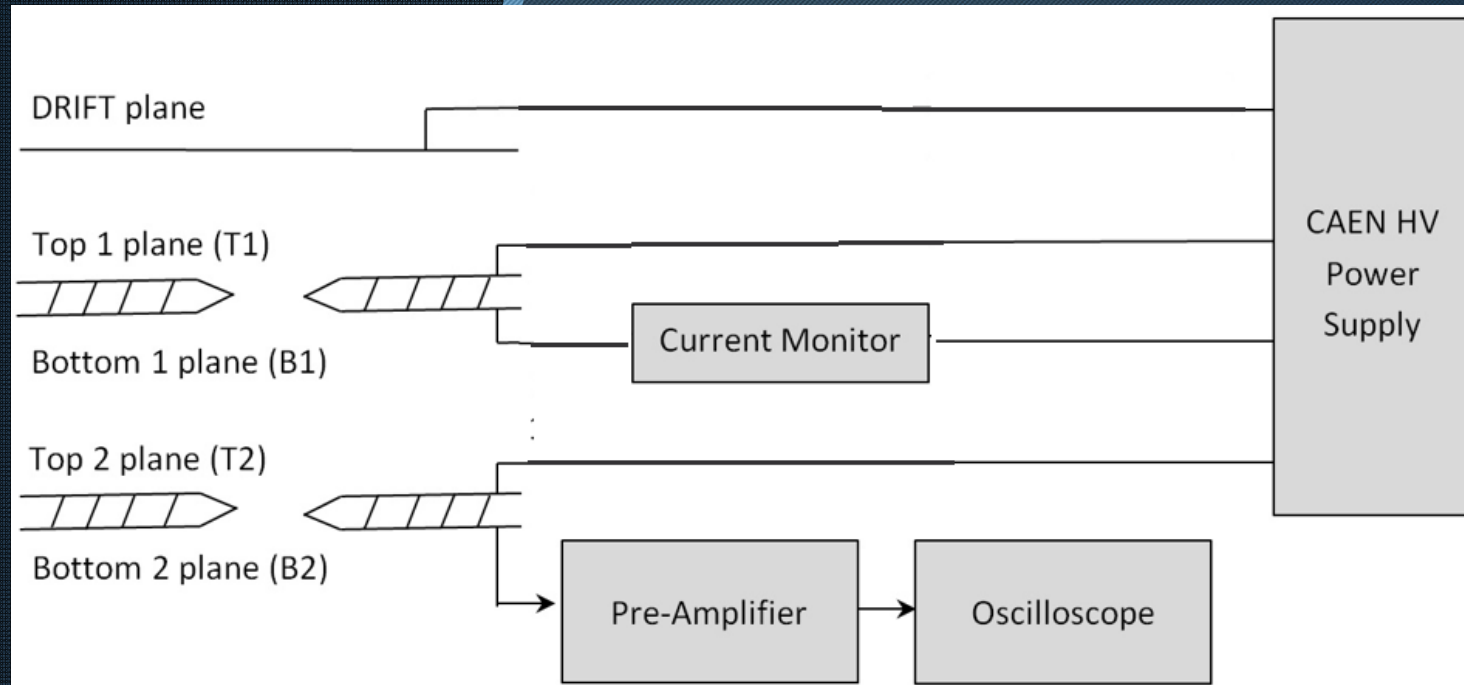


TOP1 plane, current without RC circuit, with the GEM working normally. Sampling 1Ksps.



TOP1 plane, current without RC circuit, with the GEM working normally. This view shows a 40 samples average.

Current monitor connected to the BOTTOM1 plane in the GEM



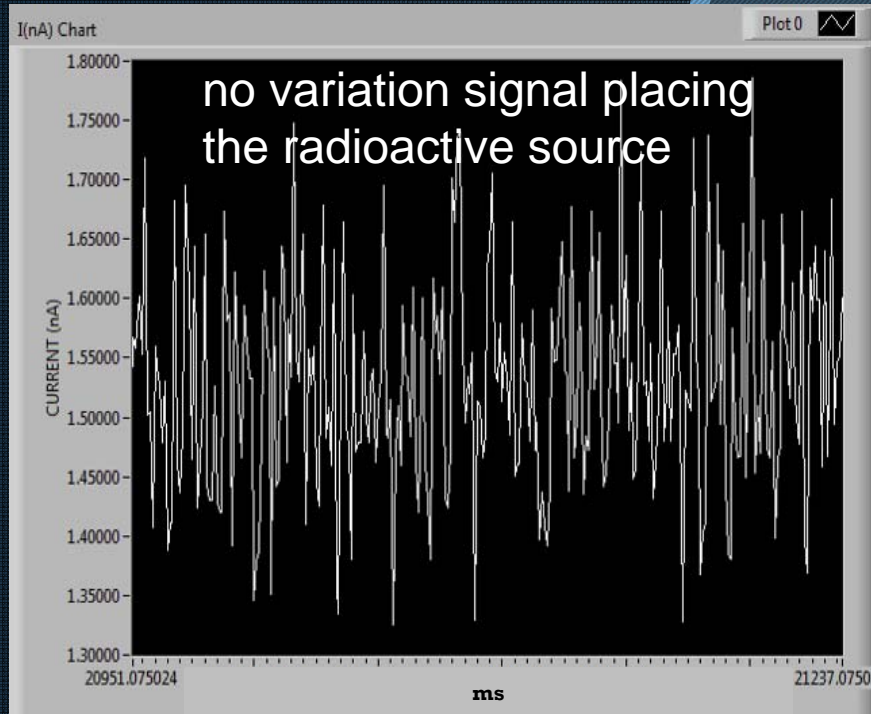
GEM's output signal without RC,
with Monitor current.

Current monitor connected to the BOTTOM1 plane in the GEM

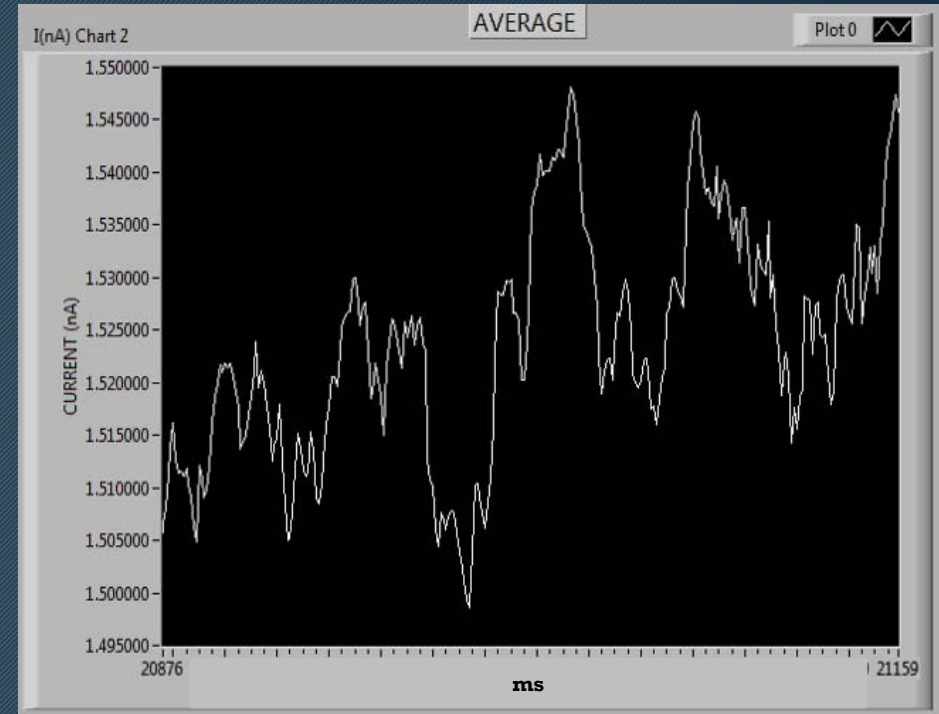


GEM's output signal without RC, with Monitor current.

Current monitor connected to the BOTTOM1 plane in the GEM

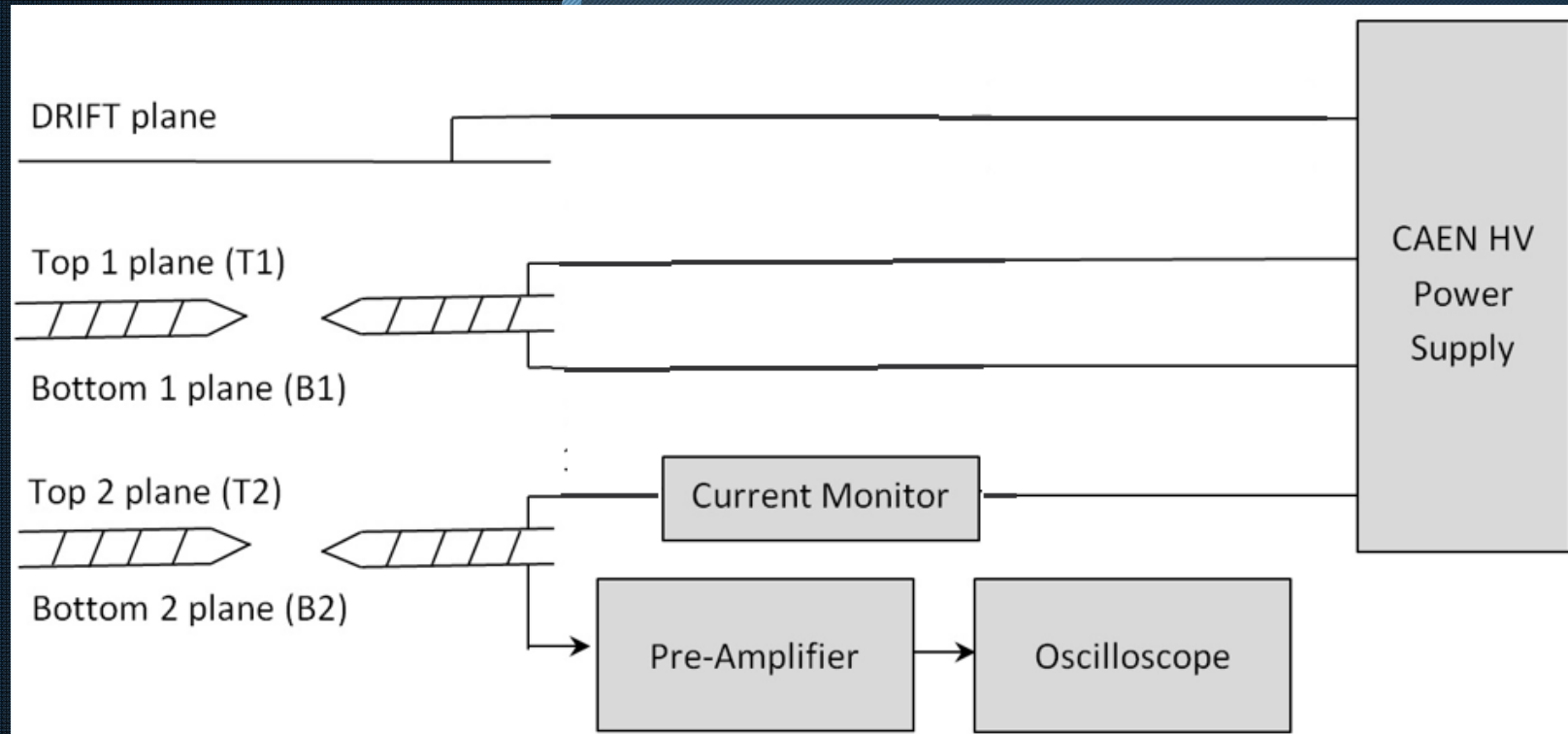


BOTTOM1 plane, current without RC circuit, with the GEM working normally. Sampling 1Ksps.



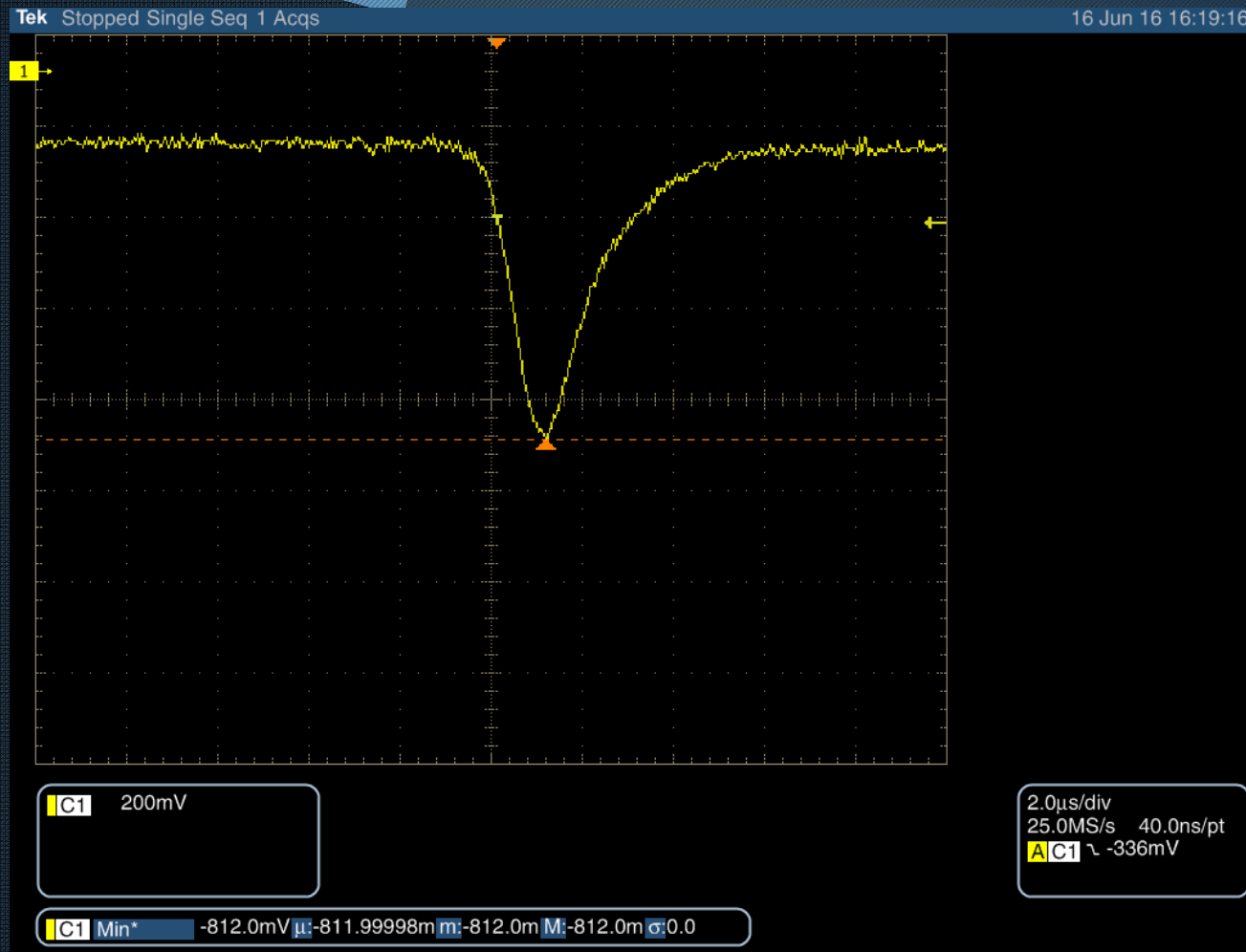
BOTTOM1 plane, current without RC circuit, with the GEM working normally. This view shows a 40 samples average.

Current monitor connected to the TOP2 plane in the GEM



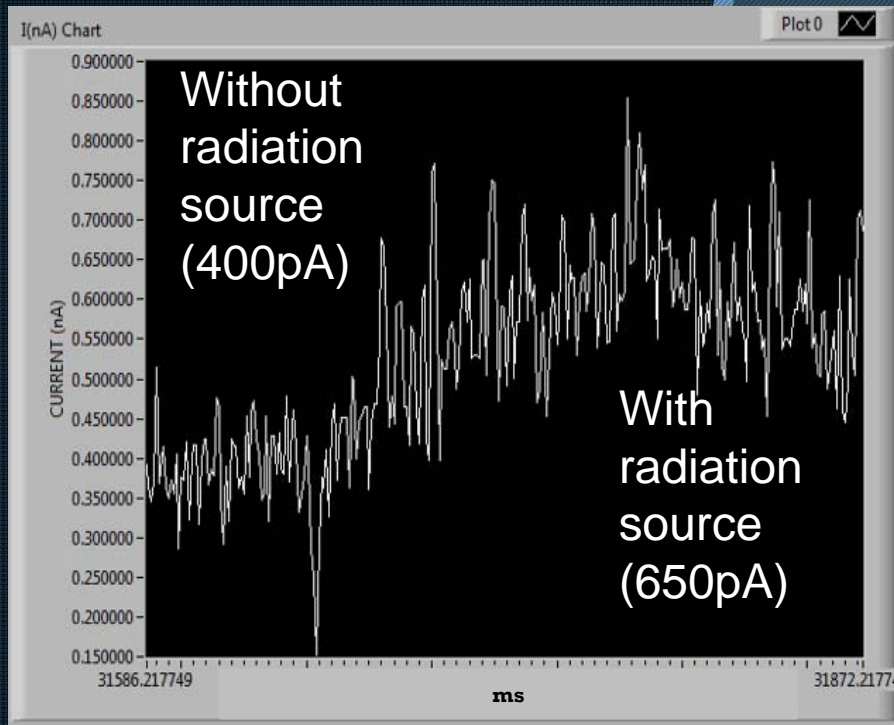
GEM's output signal without RC,
with Monitor current.

Current monitor connected to the TOP2 plane in the GEM

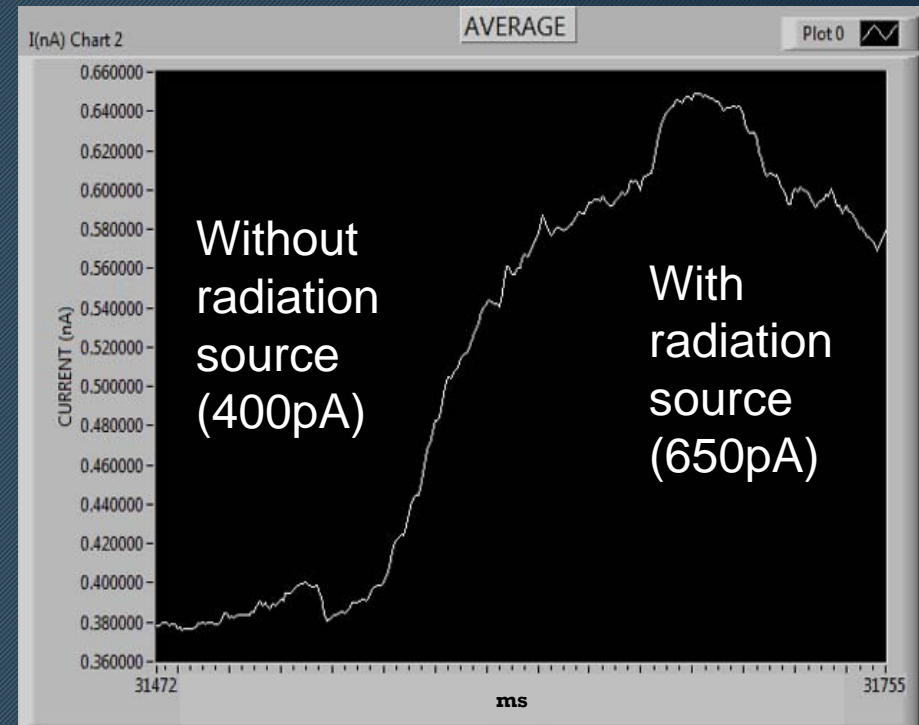


GEM's output signal without RC, with Monitor current.

Current monitor connected to the TOP2 plane in the GEM



TOP2 plane, current without RC circuit, with the GEM working normally. Sampling 1Ksps.



TOP2 plane, current without RC circuit, with the GEM working normally. This view shows a 40 samples average.

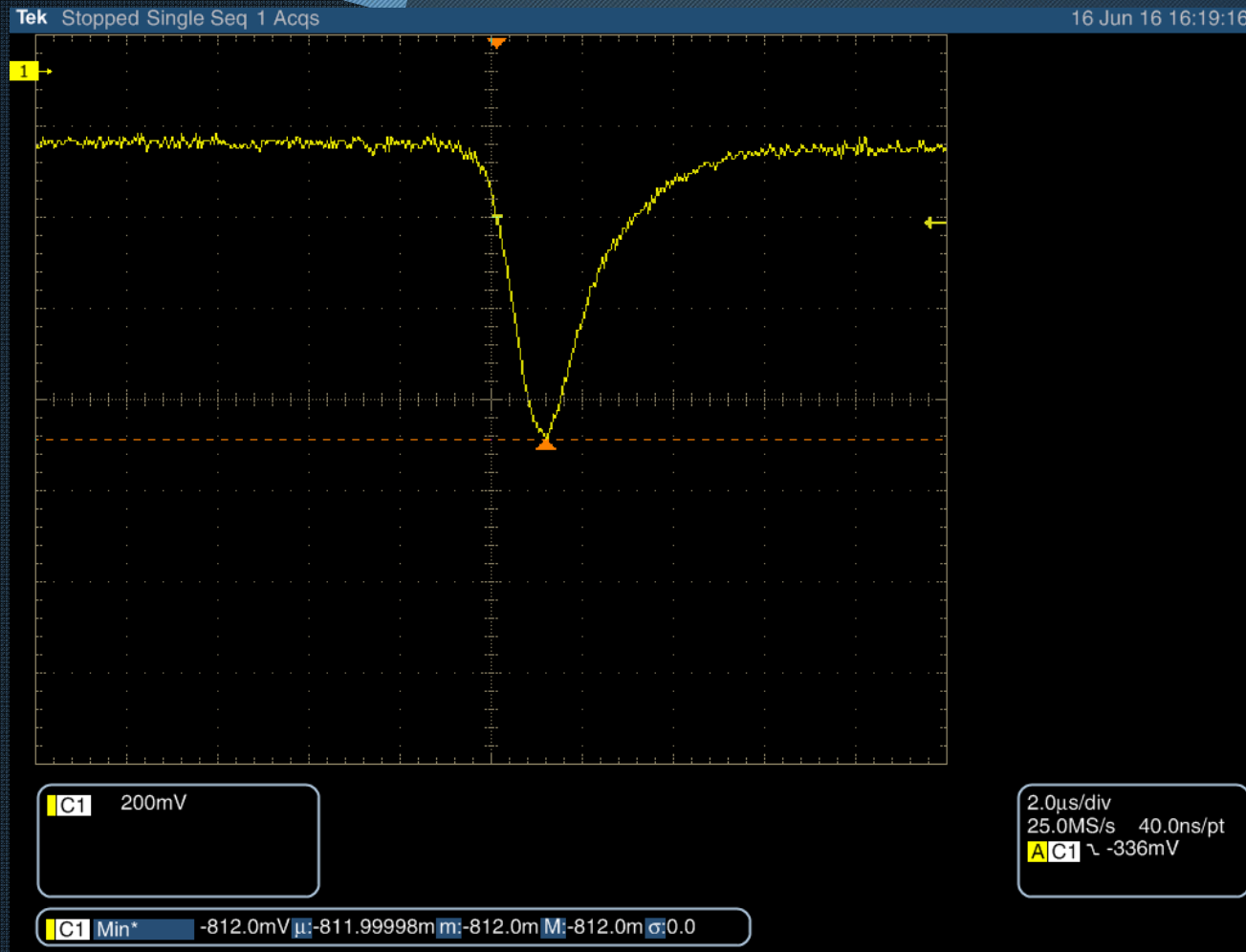
Results

- Top 1, no variation in the current level with radiation source.
- Bottom 1, no variation in its current level with radiation source.

Top 2, there is a variation in the current level with radiation source.

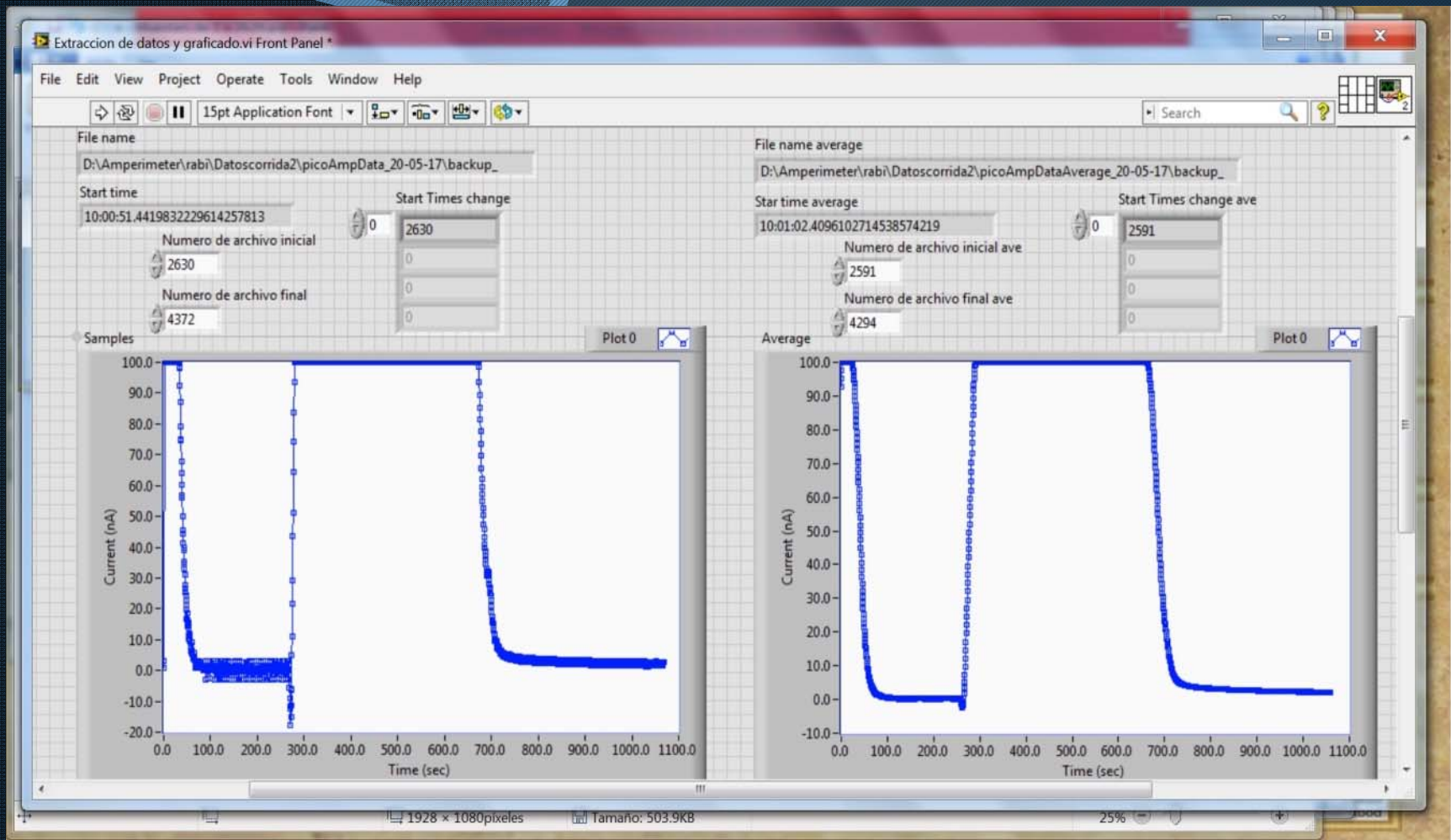
- 400pA without radiation source .
- 650pA offset with radiation source
- Noise level about +/- 75pA.
- 17 bits ADC plus 1 bit of sign.

Current monitor connected to the TOP2 plane in the GEM



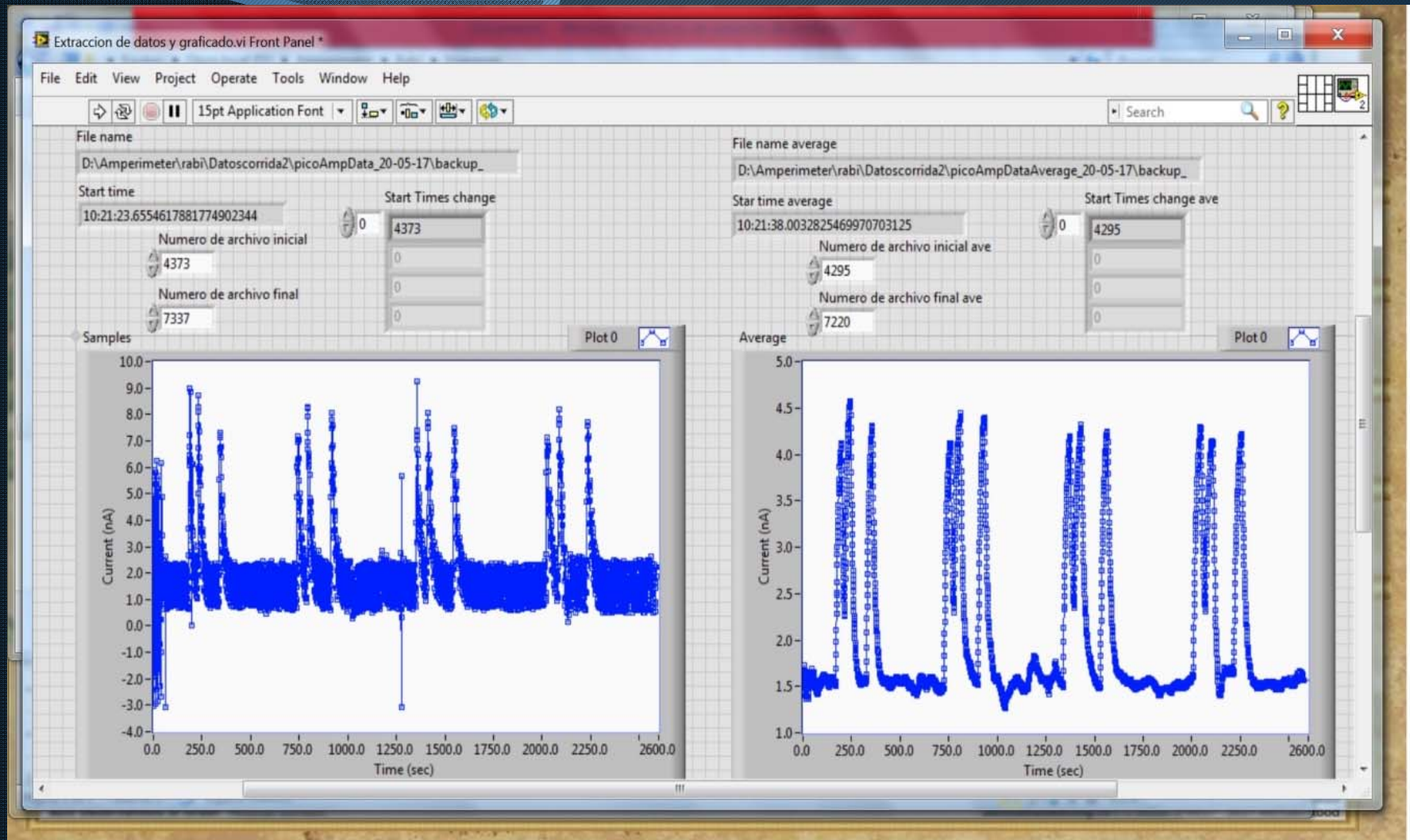
GEM's output signal without RC, with Monitor current.

Current monitor connected to the TPC GEM



Run of 18 minutes.

Current monitor connected to the TPC GEM



Run of 72 minutes.

Results

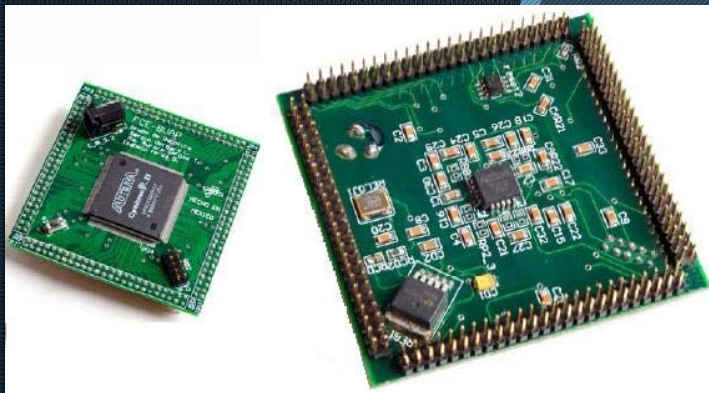
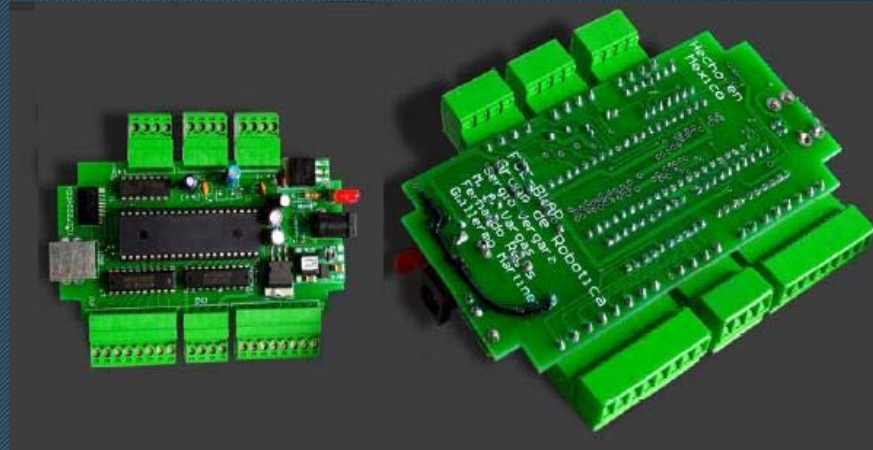
- The TPC GEM presented a offset current of 1.5nA , while the ICN GEM presented 400pA .
- There is a second current monitor developed by some group from Germany.
- The collaboration will decide which current monitor would be used in the TPC.

Implications of the Collaboration with Guy Paic

- The developments of the electronic systems have generated 10 patent applications, 5 patents have been granted and 5 are in process.
- A workshop for surface and BGA devices mounting.
- All this knowledge has been applied to develop medical instruments, robots, CNC machines, etc.

Implications of the Collaboration with Guy Paic

USB DAQ card



FPGA
cards

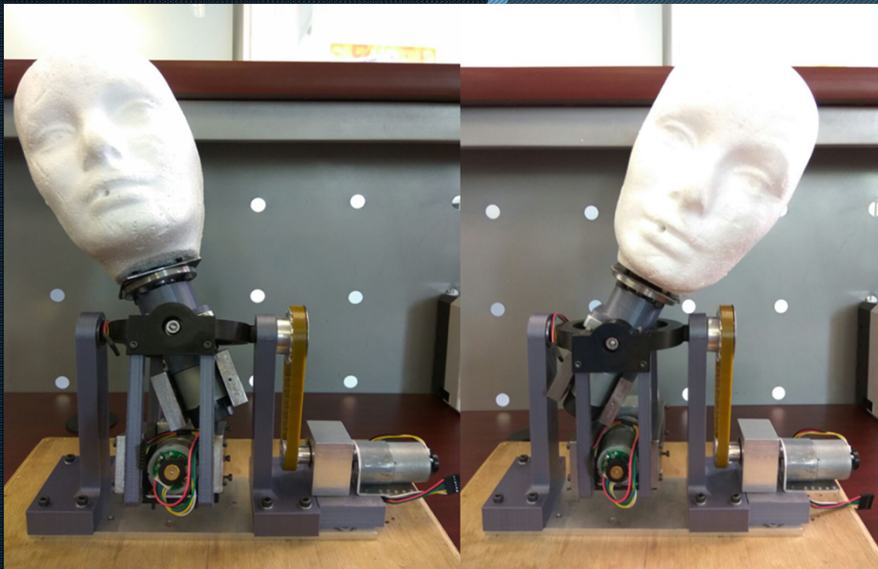


Implications of the Collaboration with Guy Paic



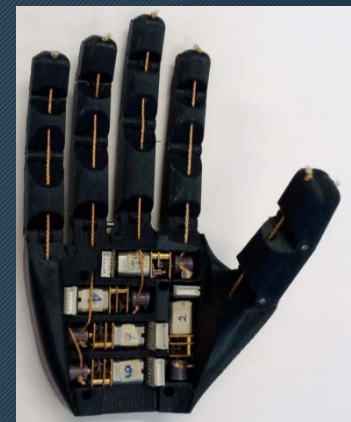
Robotic head

Electronic chair

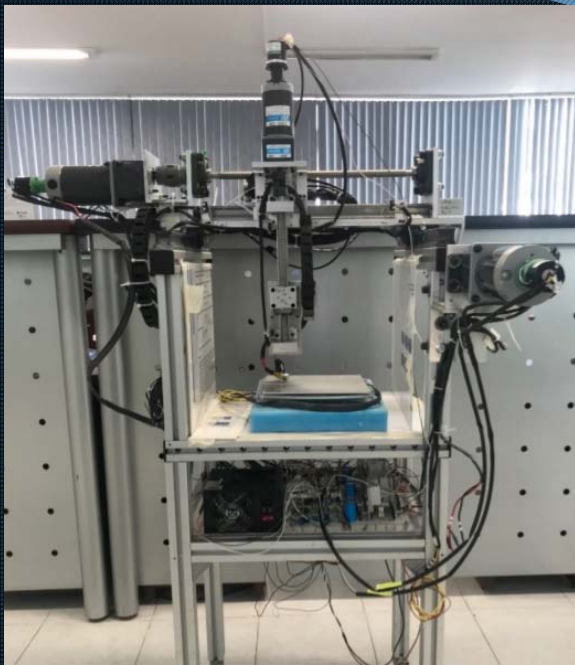


Robotic neck

Robotic hand



Implications of the Collaboration with Guy Paic

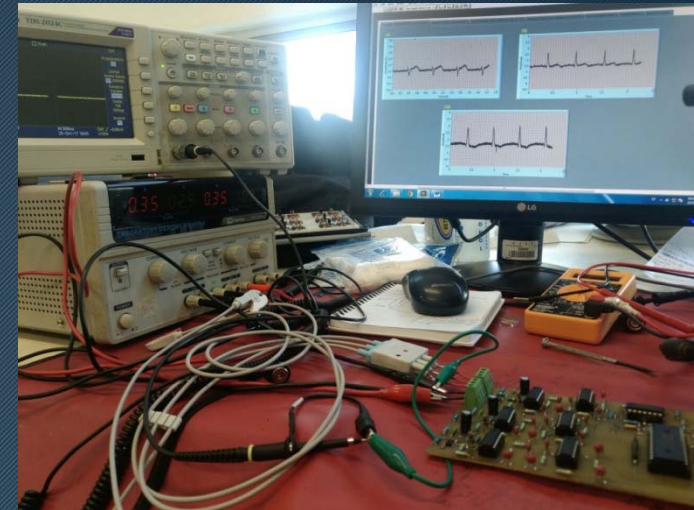


CNC machine

Control card with WiFi connectivity



Electrocardiograph



Electrocardiograph sensors

THANKS