# A readout system for microstrip silicon sensors (ALIBAVA)

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# OUTLINE

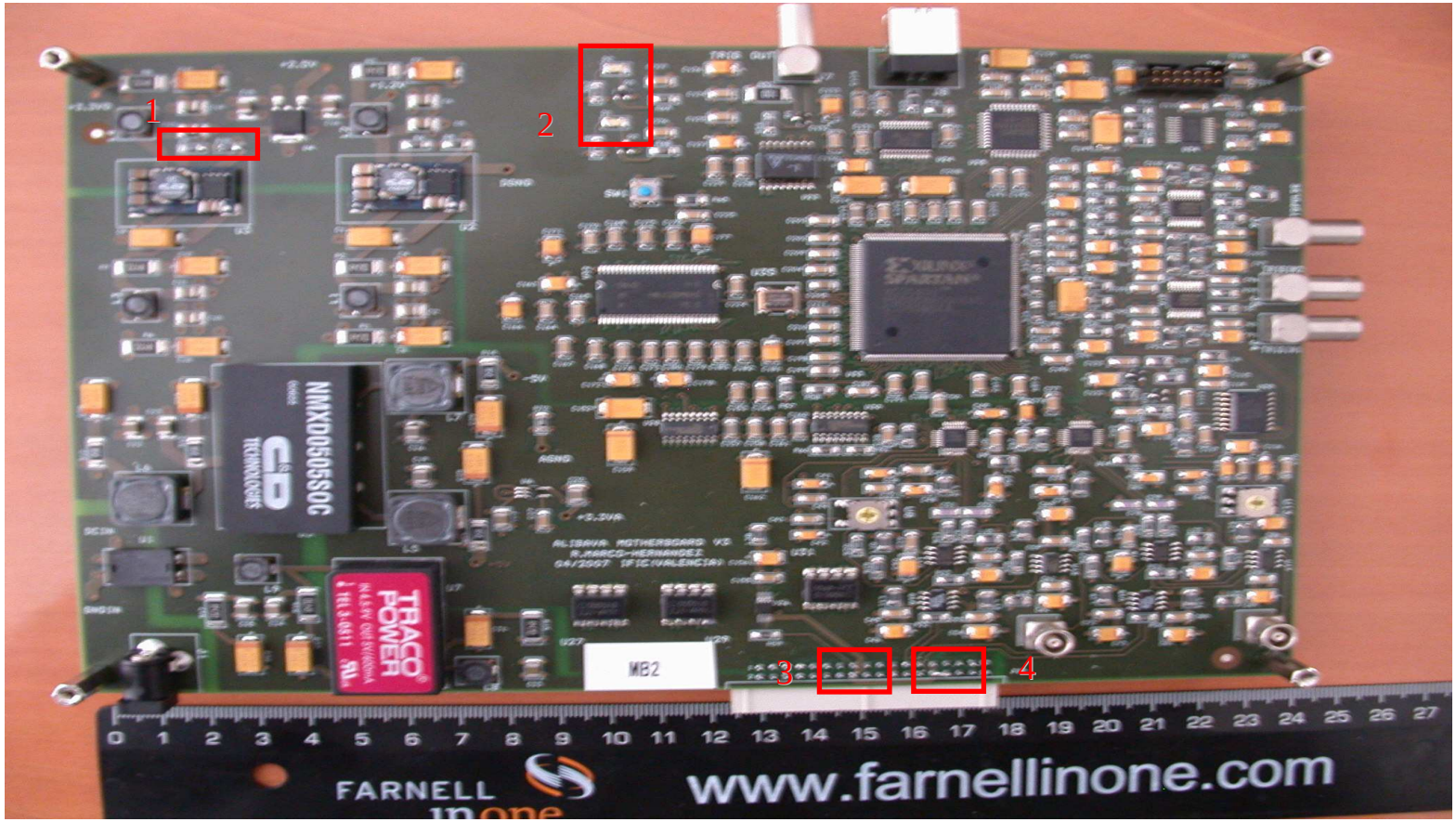
- RS Acquisition bug.
- External TDC operation.
- New motherboard PCB checking.
- Beetle configuration upgrade.
- Pedestals acquisition upgrade.
- Laser setup test.
- Conclusion and future work.

# RS ACQUISITION BUG/EXTERNAL TDC OPERATION

- Up to now the system used to get hang-up waiting for a new event (trigger in pulse) after a variable number of events.
- This problem was detected just in the RS states.
- The bug has been fixed for the internal TDC and the external TDC by improving the synchronization between the Trigger Input Block and the TDC Block (at FPGA hardware and firmware level).
- External TDC works correctly in the new motherboard PCB.
- This TDC will be used instead of the internal TDC for RS acquisition.
- The internal TDC will be used for the synchronization of various ALIBAVAS for a testbeam.

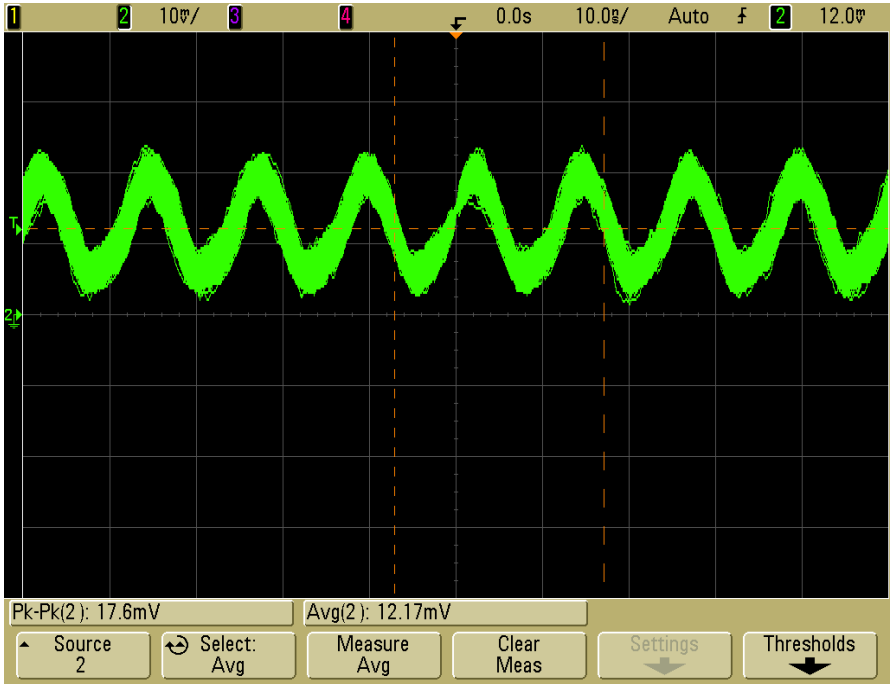
# NEW MOTHERBOARD PCB

- Some minimal rework needed for correct operation of this PCB.
  - Change two resistors on 3.3 VD DC/DC (1).
  - Change position of the LEDs for direct polarization (2).
  - Correct isolation of two IDC connector pins (3).
  - Soldering DB ground and analogue MB ground to minimize the noise (4).

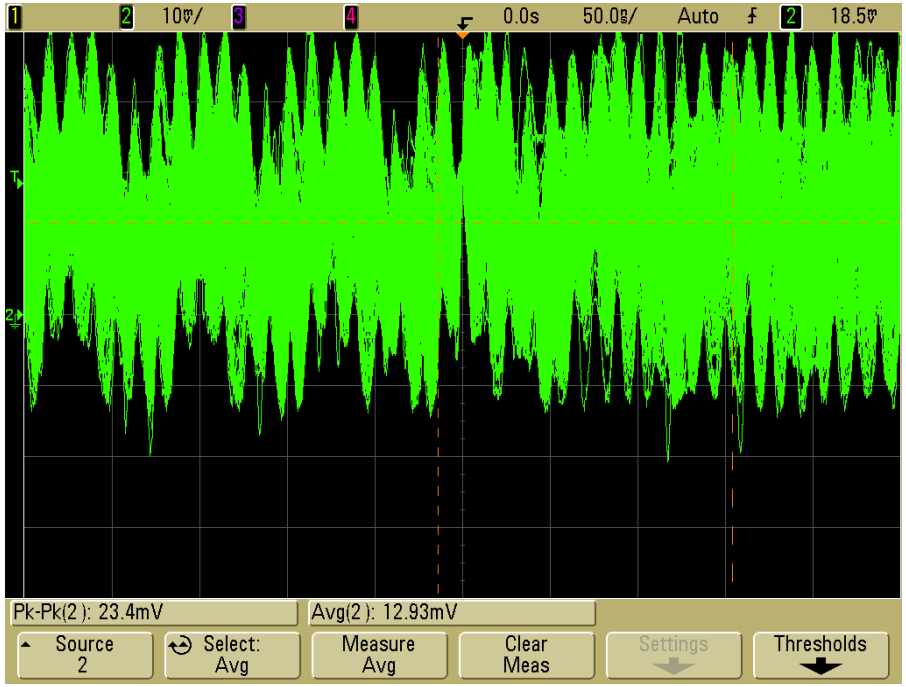


# NEW MOTHERBOARD PCB

- The ground connection improves significantly the noise level in the analogue Beetle output signals at “scope” level.
- The noise measured with the software is low in both cases but it is also improved.



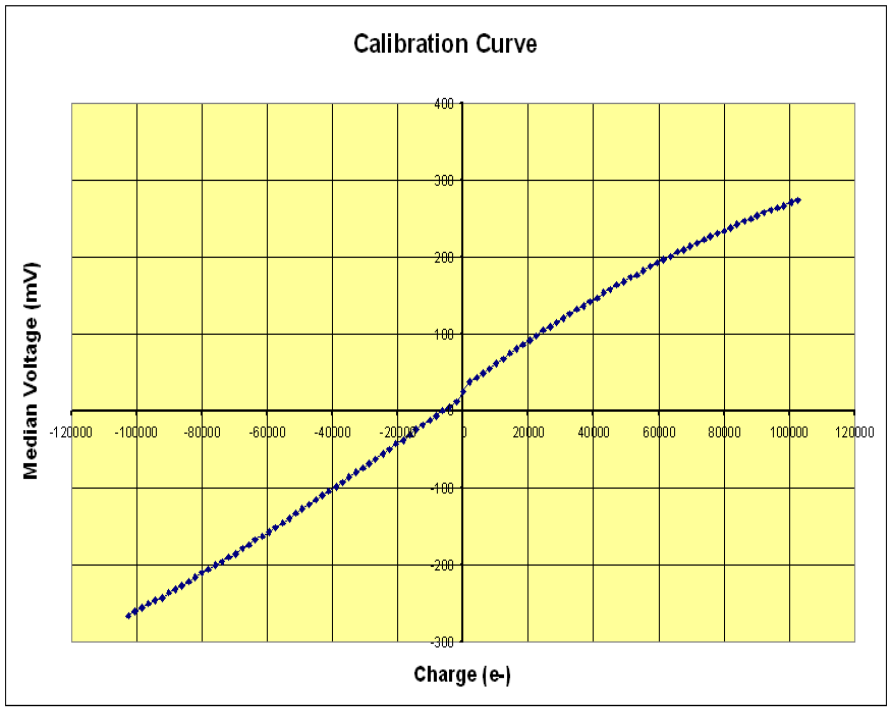

Beetle0 analogue signal with grounds connected in the IDC connector.



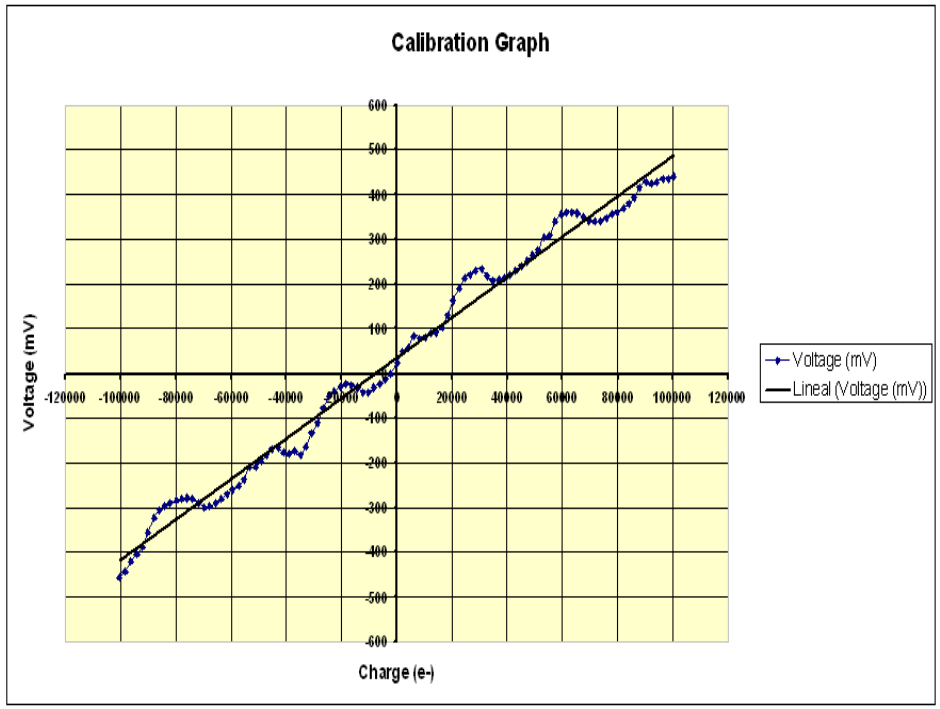

Beetle0 analogue signal with grounds not connected in the IDC connector.

# NEW MOTHERBOARD PCB

- The calibration curve waves observed with the motherboard prototype are not present in the new motherboard calibration curve: more reliable hardware and sample point improved.
- The curve are smoother but the gain is lower (why?): the gain could be doubled at hardware level if required (maybe with RS setup).



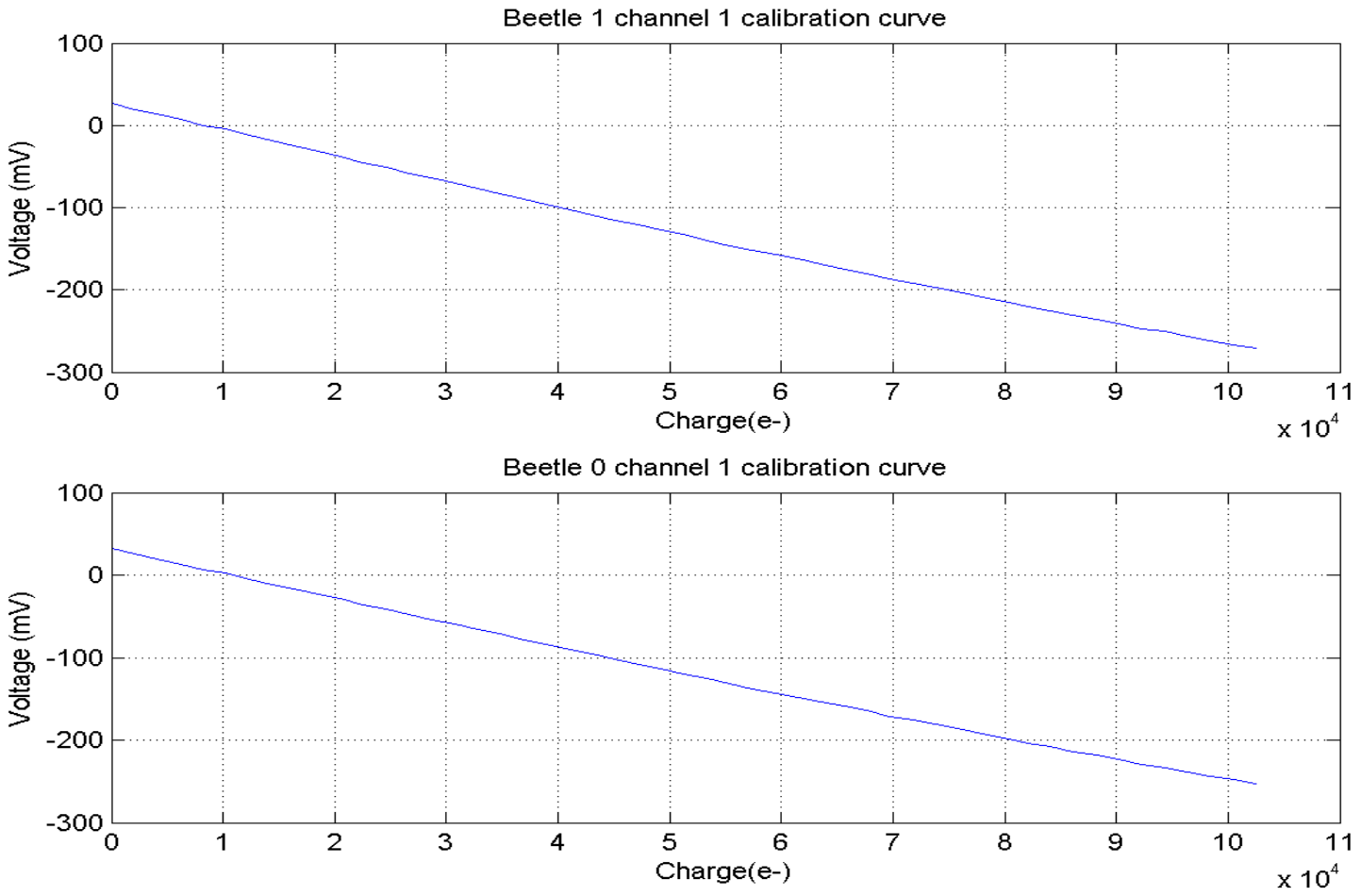

Calibration curve for Beetle1 obtained with the new motherboard.




Calibration curve for Beetle1 obtained with the motherboard prototype.

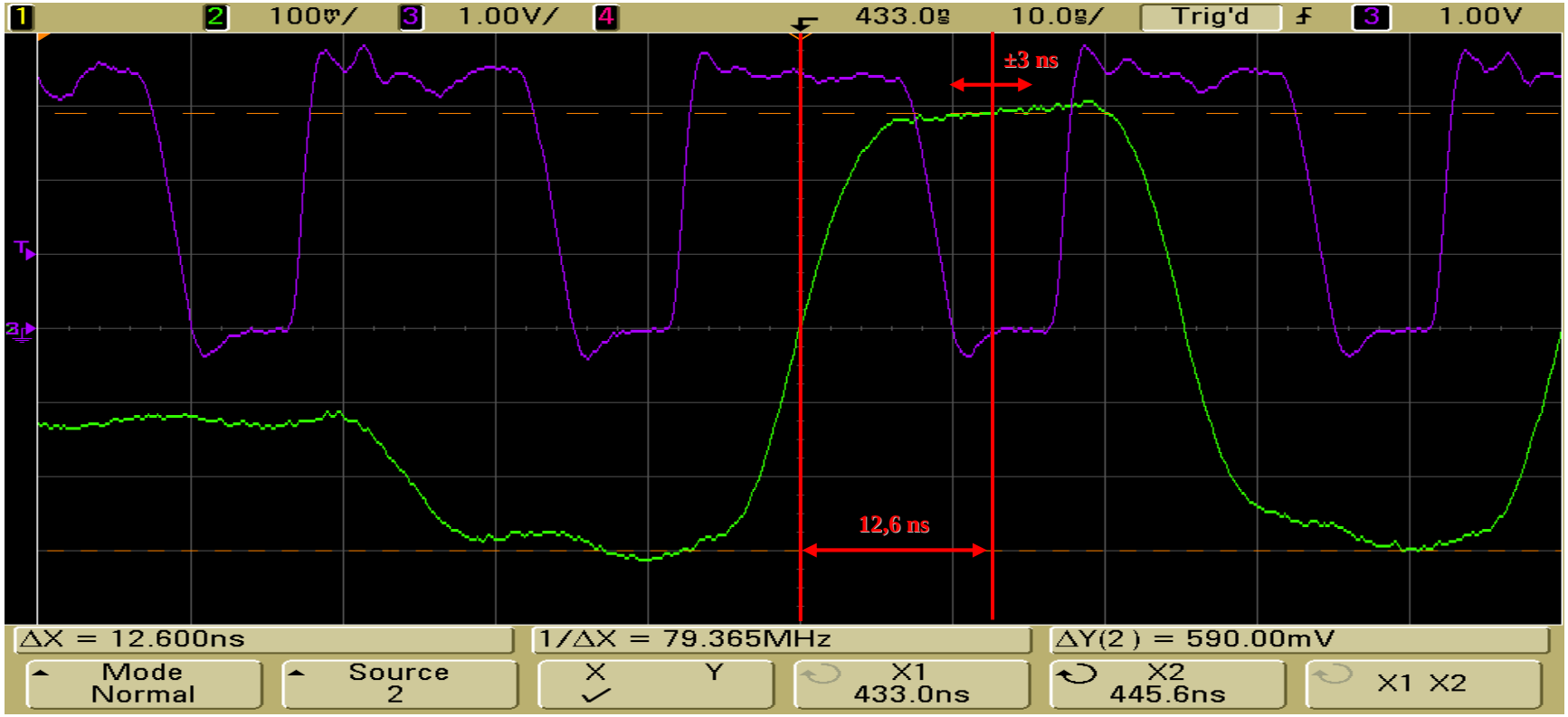
# NEW MOTHERBOARD PCB

- Calibration curves for individual channels of Beetle 0 and Beetle 1.



# NEW MOTHERBOARD PCB

- The ADC sampling point of the Beetle chips analogue signal has been optimized in order to obtain the best results in the calibration curves (the smoothest curve as shown before).
- The ADC control at FPGA level has been upgraded to achieve the optimum sampling point: the resolution of this point is about ±3 ns.



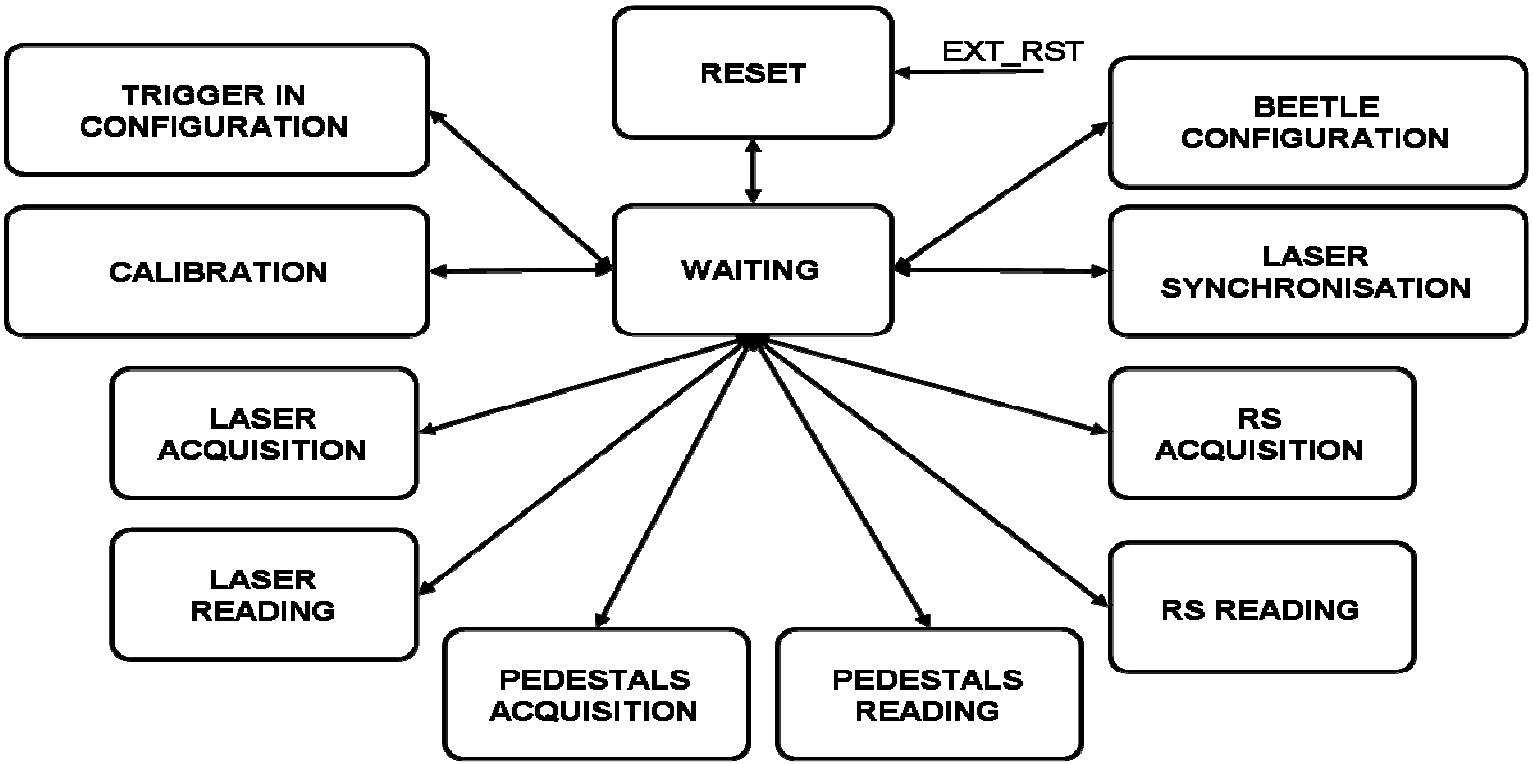

Beetle 1 analoge signal (purple) in a calibration and ADC0 sampling clock signal of 40 MHz (purple).

# BEETLE CONFIGURATION UPGRADE

- The Beetle Configuration block in the FPGA has been upgraded.
- Up to now the system configured the Beetle chips registers by just writing these registers using I2C protocol.
- In the upgraded version (I2C protocol as well):
  - First: writing of the specified register of the Beetle chips (MB => DB).
  - Second: reading of the same register preiously written (DB => MB).
  - Third: checking that the data written is the same that the data read.
- The system works as expected with this upgrade.

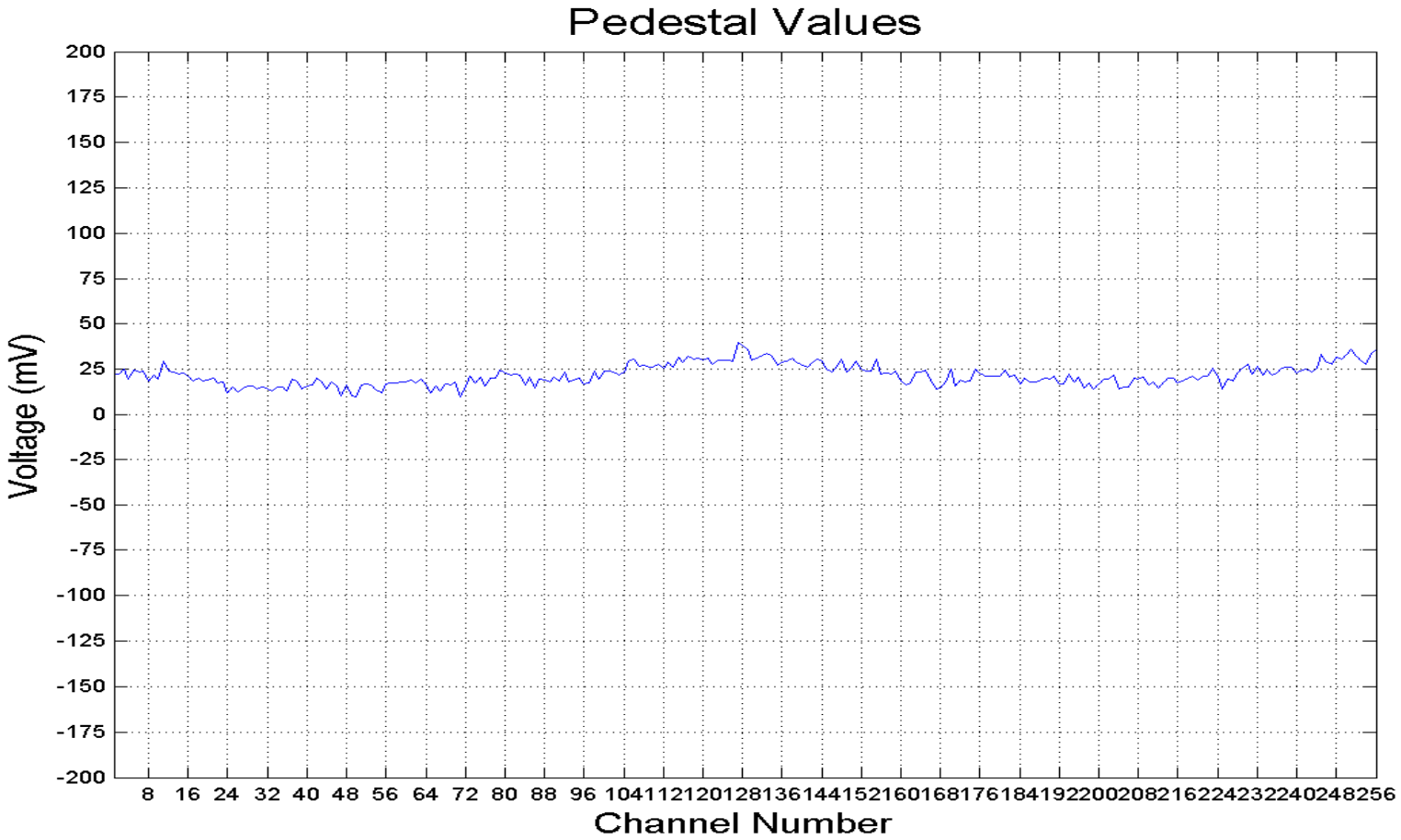
# PEDESTALS ACQUISITION UPGRADE

- The FPGA logic and the embedded processor firmware have been upgraded in order to acquire the pedestals.
- Two new states have been added to achieve this: Pedestals Acquisition and Pedestals Reading.
- These states have a similar behaviour that the Laser or RS states.
- This new states have been tested with a Matlab emulator of the custom software and the system works as expected.



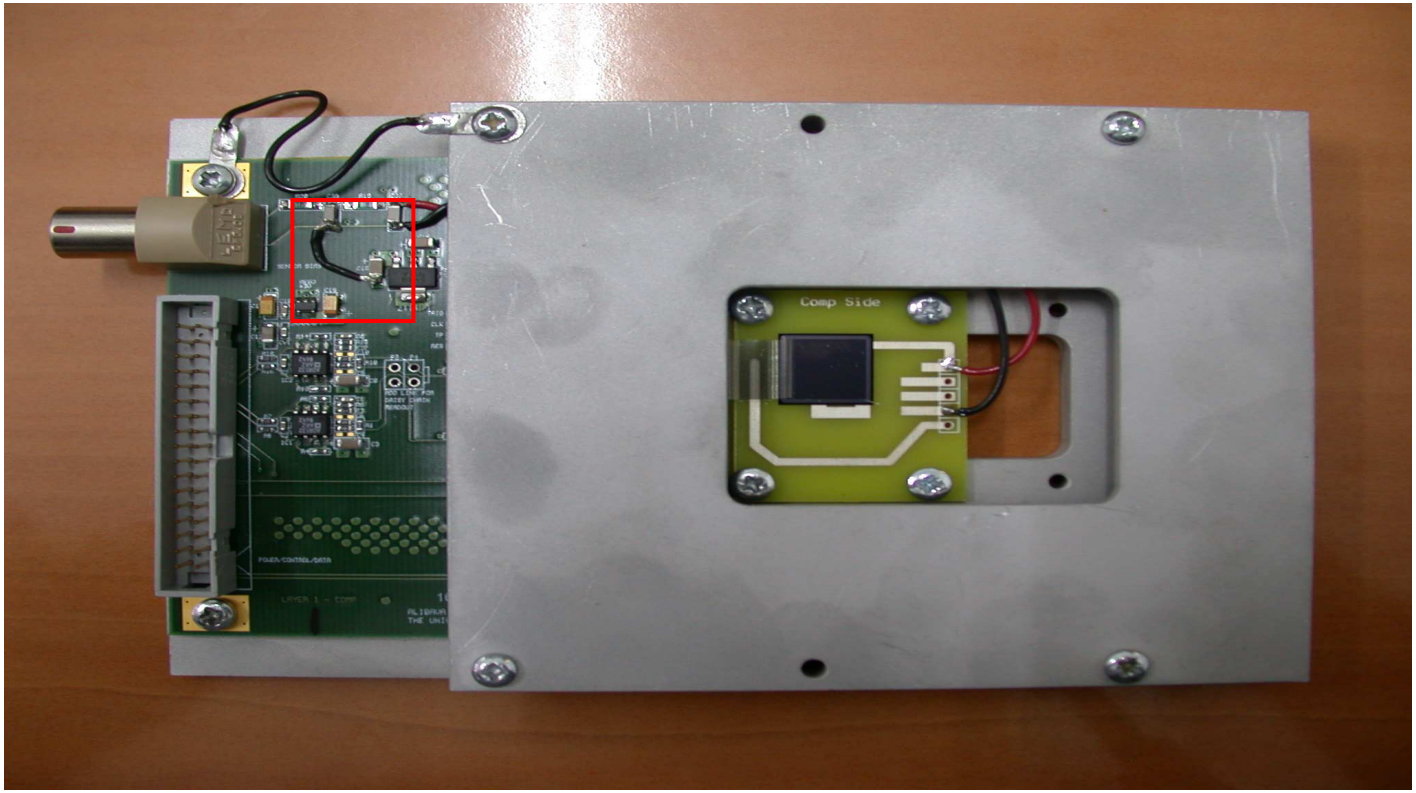
# PEDESTALS ACQUISITION UPGRADE

- Pedestals acquired with a Matlab emulator of the custom software.
- Average of 5000 events.



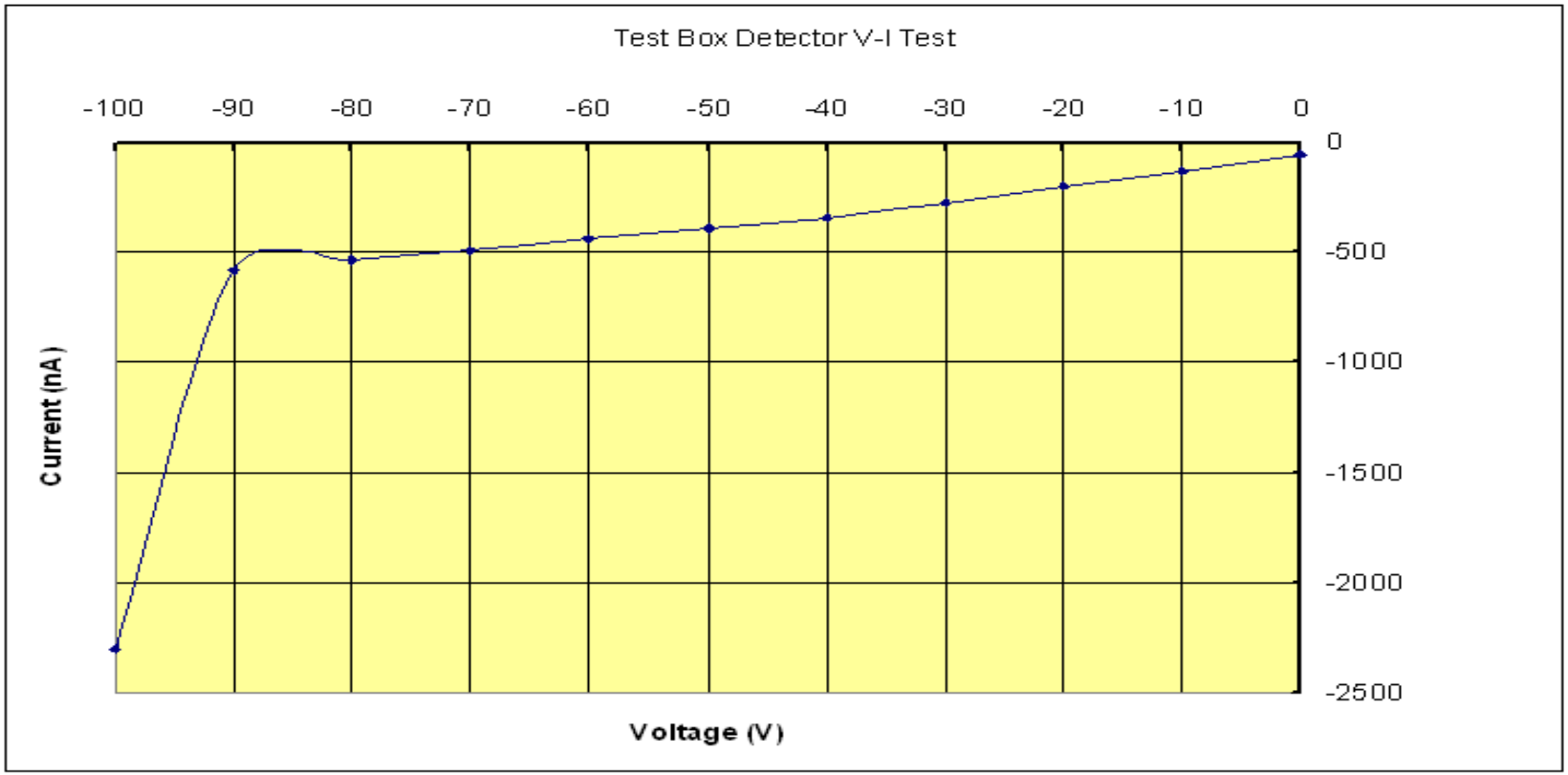
# LASER SETUP TEST

- It was observed a common mode noise in the analogue output signal of the Beetle connected to the detector.
- This problem have been solved succesfully by connecting the detector power supply return with the Beetle chips ground (isolated originally).
- This connection has been carried out by soldering a wire.



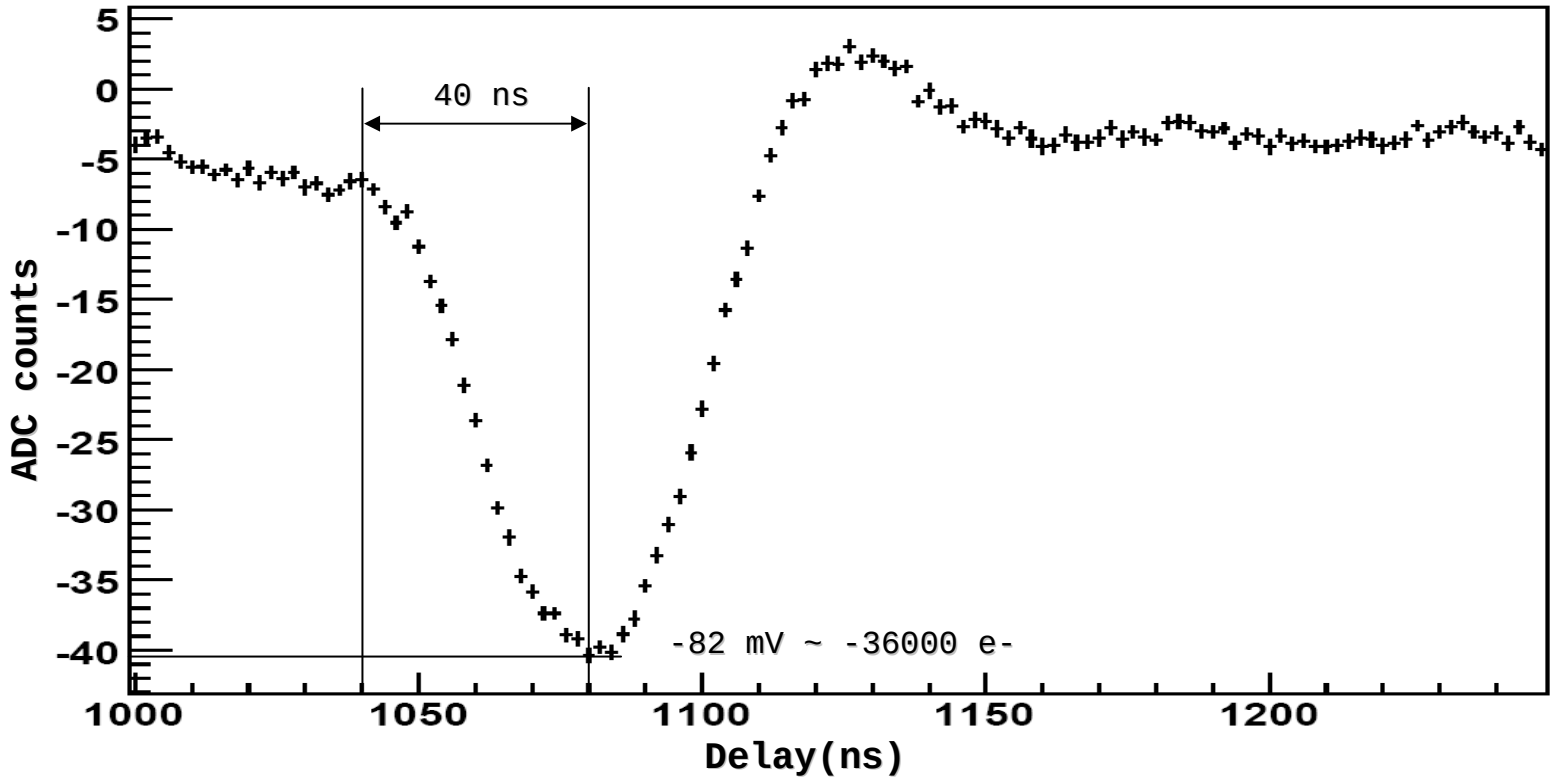
# LASER SETUP TEST

- The detector was checked in order to observe if it was active or not.
- A I-V curve of the detector was done in order to measure the noise current and the depletion voltage.



# LASER SETUP TEST

- A laser scan and a laser acquisition were carried out.
- The system worked as expected and the pulse shape of the Beetle 0 was measured with the system.




Laser scan figure. Detector type: standard technology (not MCZ ) and non-irradiated. Vdet = -70 V.

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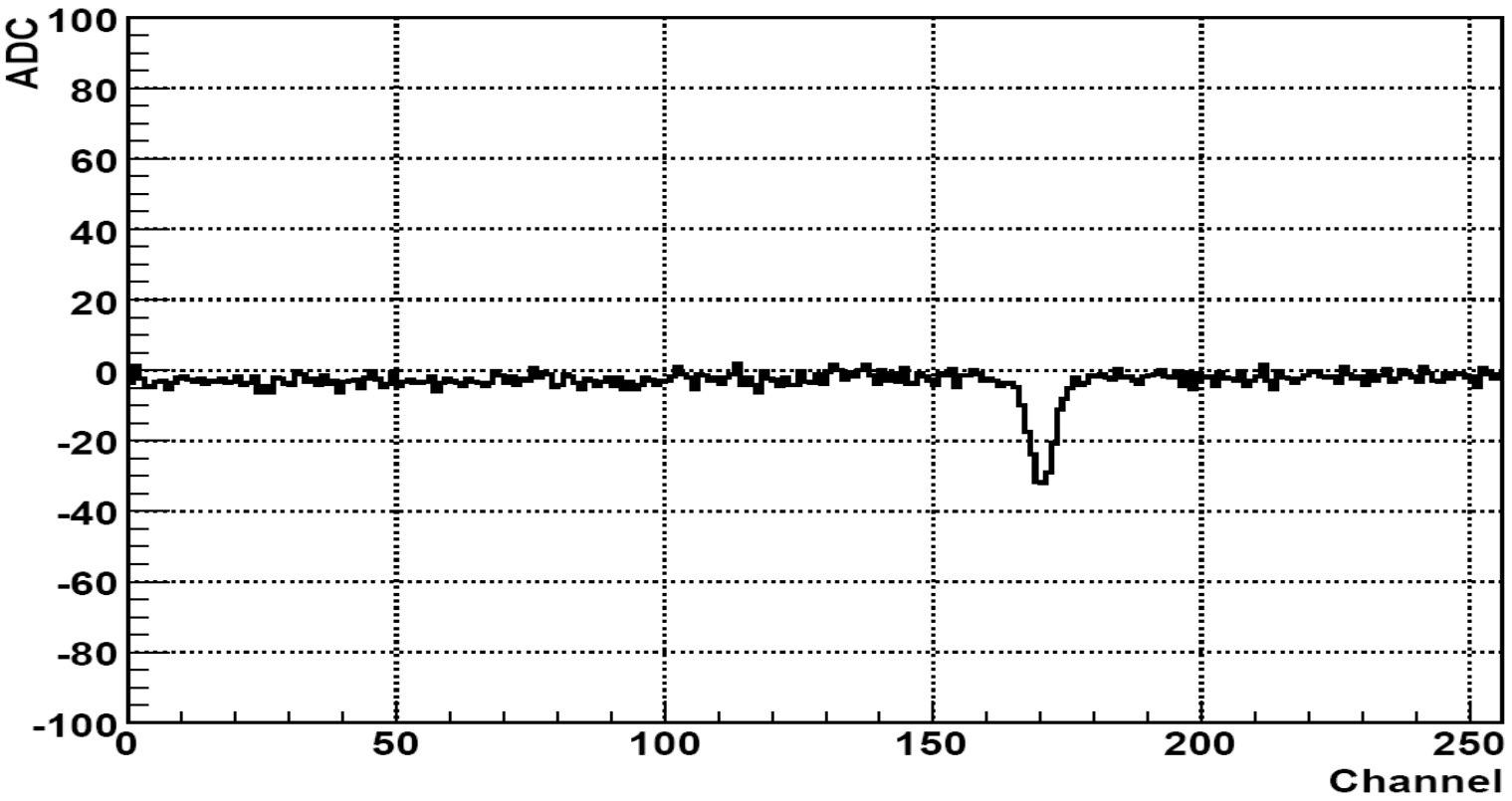


Laser acquisition figure. Detector type: standard technology (not MCZ ) and non-irradiated. Vdet = -70 V.

# CONCLUSIONS & FUTURE WORK

- Currently, we have the ALIBAVA system finished and almost fully tested.
- We have to carry out RS setup testing since laser setup testing has been succesful.
- The gain of the analogue signal will be doubled if required (from RS setup testing).
- The custom software will be upgraded for pedestals acquisition and for a Windows version release.
- Submission of a publication to TNS of IEEE.
- Barcelona meeting (14-18th of April): ???
- ALIBAVA upgrade for a testbeam.

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