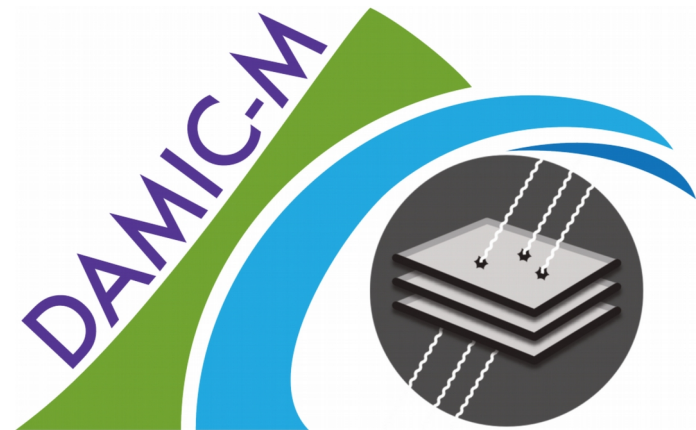


Characterization of readout electronics for the DAMIC-M upgrade

PAPADOPOULOS Georgios

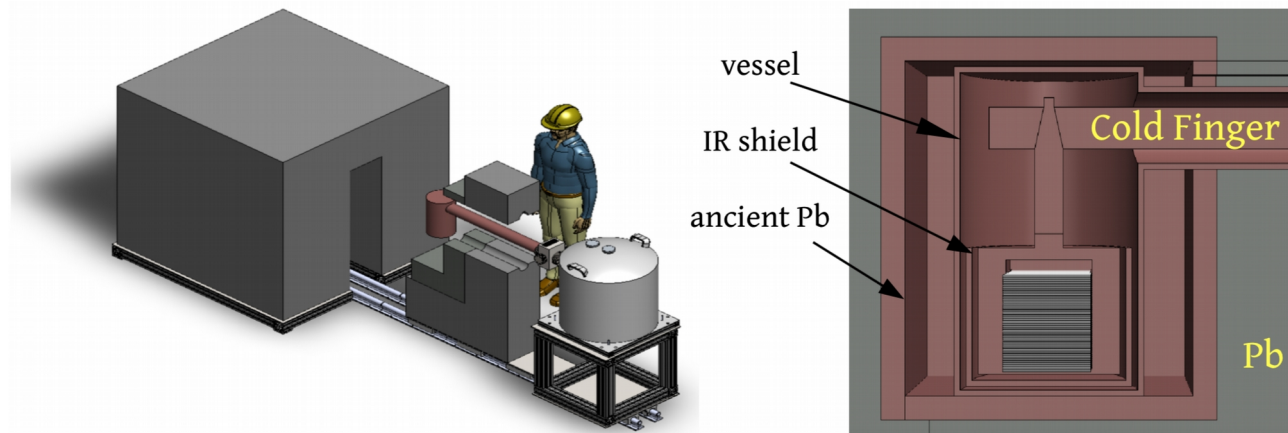
LETESSIER-SELVON Antoine



**SORBONNE
UNIVERSITÉ**

About DAMIC-M

- The Dark Matter In CCD @ Modane experiment aims to detect nuclear recoils and electrons induced by light Dark Matter particle (<10 GeV) in Charge Coupled Devices.
- Novel techniques in fabrication allow the production of the most massive CCDs ever made, 6k x 6k pixels large with a thickness of 1 mm of ultra-pure Si. The goal of DAMIC-M is to achieve a total active mass of 1 kg.

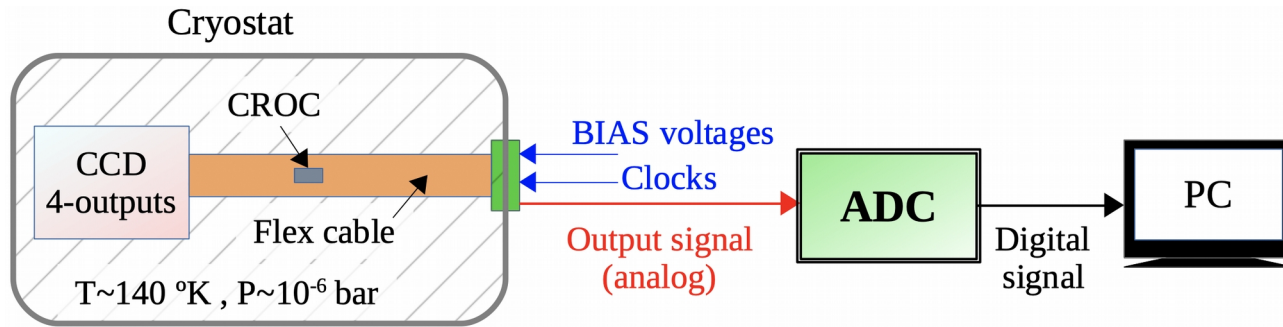


DAMIC-M at Laboratoire Souterrain de Modane

About DAMIC-M

- The Dark Matter In CCD @ Modane experiment aims to detect nuclear recoils and electrons induced by light Dark Matter particle (<10 GeV) in Charge Coupled Devices.
- Novel techniques in fabrication allow the production of the most massive CCDs ever made, 6k x 6k pixels large with a thickness of 1 mm of ultra-pure Si. The goal of DAMIC-M is to achieve a total active mass of 1 kg.
- A threshold of a few eV will be possible due to the Skipper readout with a pixel charge resolution of $O(0.1 e^-)$.
- Proper electronics are necessary to support the readout speed and resolution.

Experimental setup

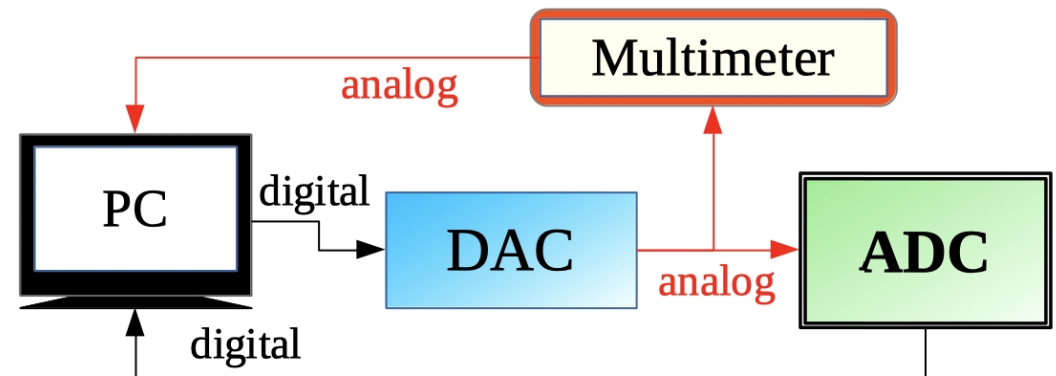


CCD setup overview

The readout signal of the CCD passes through CROC chip and at last is converted into a final digital code by the ADC.

The ADC limits the resolution and the readout time.

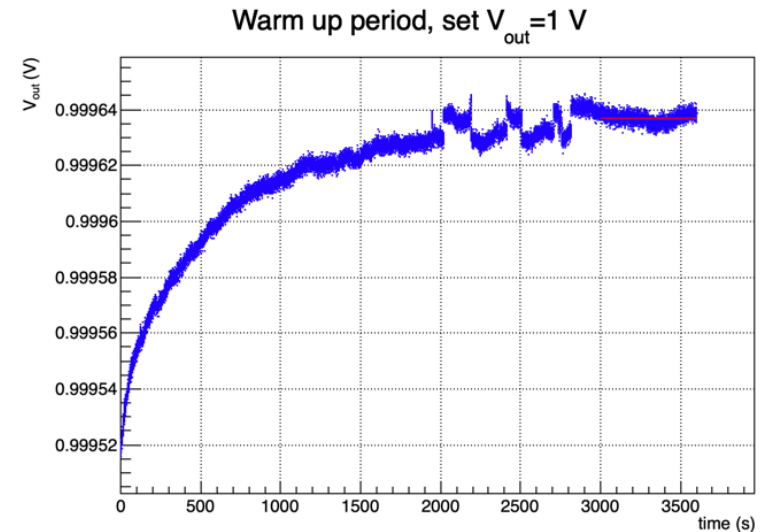
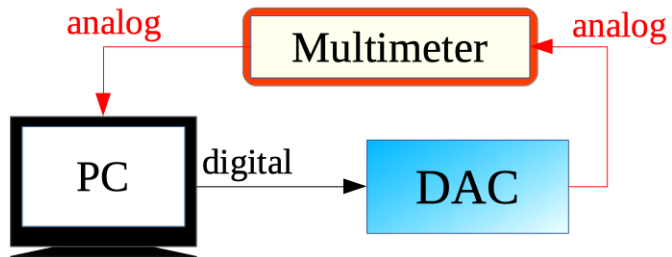
- In order to evaluate an ADC, one needs a very precise, low noise signal source
 - 20-bit DAC AD5791



ADC evaluation setup

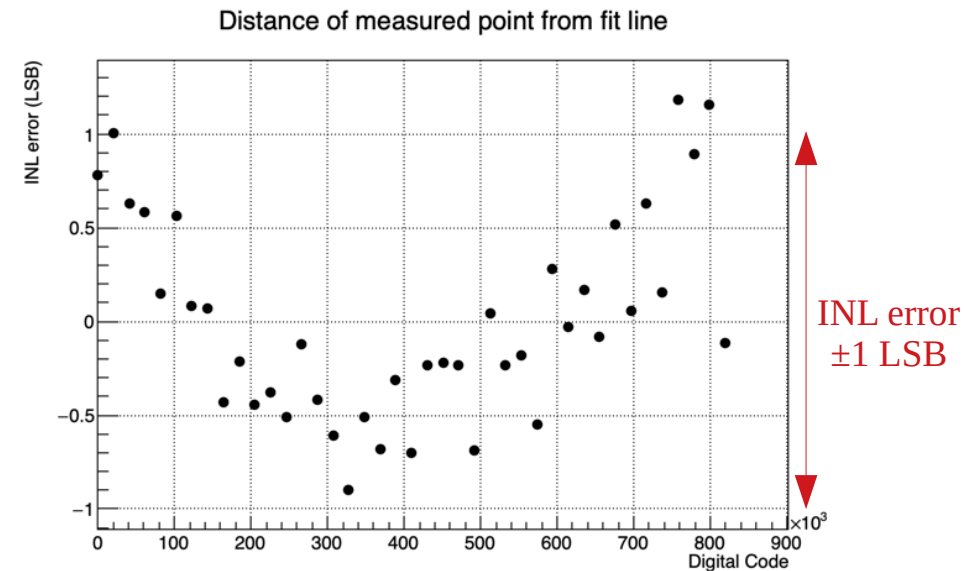
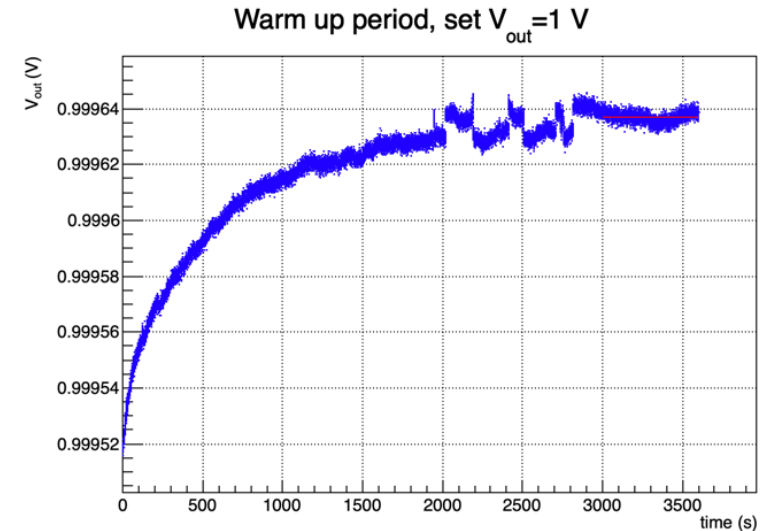
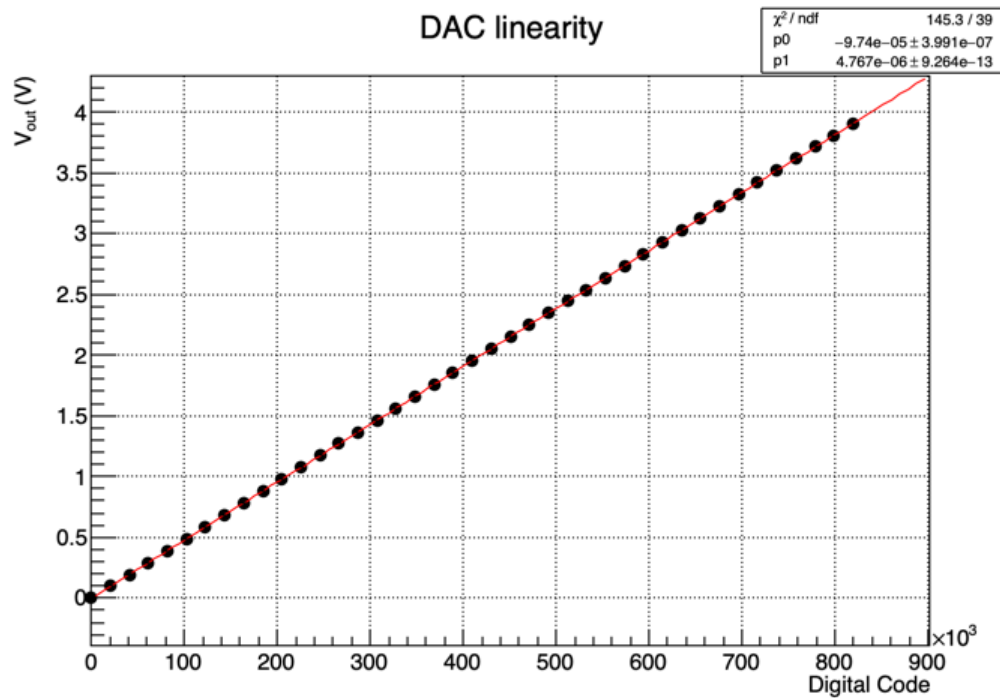
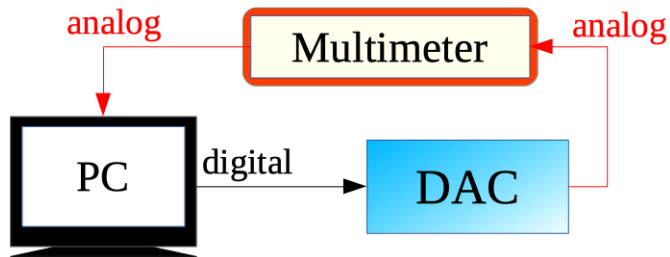
Characterization of AD5791 20-bit

- A high resolution multimeter was used for the evaluation of the DAC



Characterization of AD5791 20-bit

- A high resolution multimeter was used for the evaluation of the DAC



Next steps

- Characterization of a 4 ADC board with DC and AC signals
 - LTC2387-18 18-bit 15MS/s
- Characterization of CROC (**CCD ReadOut Chip**)
 - amplify and process the video signal coming from the CCDs in order to optimize the signal to noise ratio before digitization.
 - Will operate under $\sim 10^{-6}$ mbar pressure and ~ 140 K temperature

