Status report of the TOF-Wall

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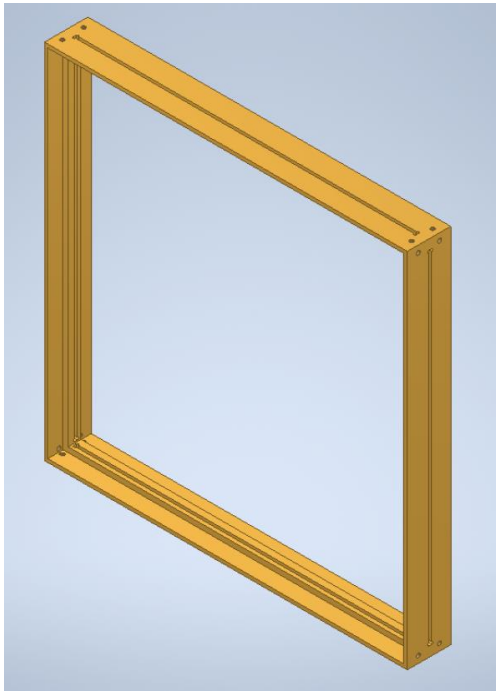
VIII FOOT Collaboration Meeting

10-12 June 2020

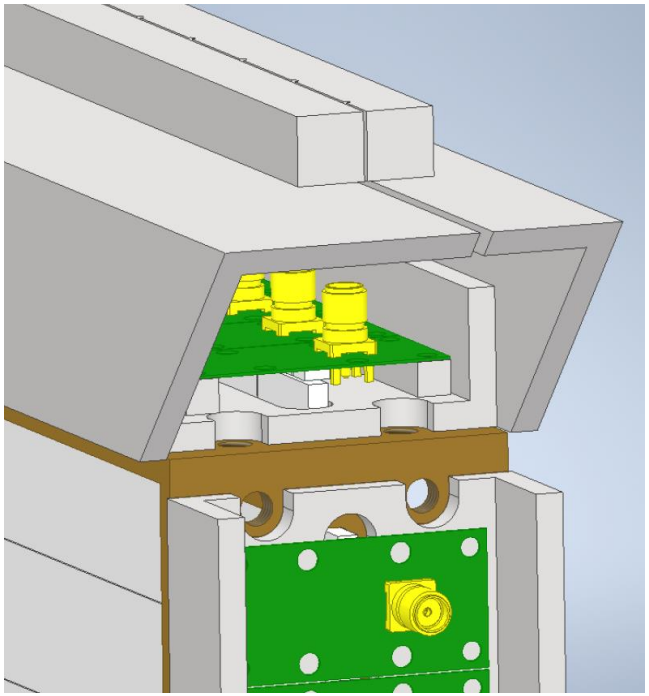
Status of the detector (1)

We are currently designing a new mechanical frame for the detector

Monolithic Frame to ease the replacement of SiPMs in case of malfunctioning

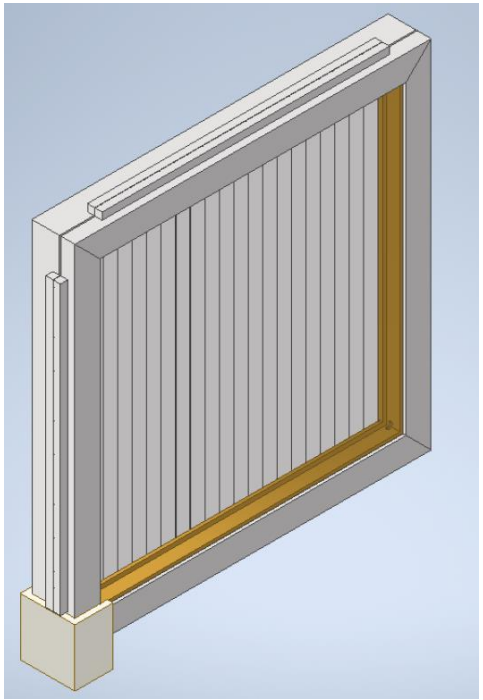


Frame for light tightness included in the system, to ensure more uniform results among data takings



Status of the detector (2)

The frame must be pluggable to the motion system



We already received the linear stages for the detector scan

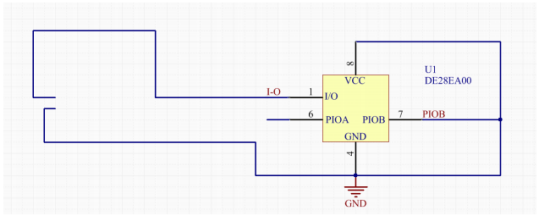
Electrical parts (motors and controllers) will be delivered soon

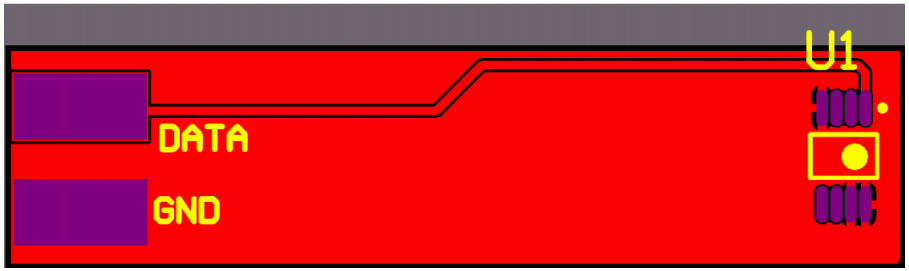
We expect a dead space between the bars of about 250 – 300 um. Pitch of 20.25 – 20.30 mm.
In the previous version it was about 200 um, but a black foil will be added to avoid light sharing.

Status of the detector (3)

The WaveDAQ for the read-out of the whole TOF system is available (split between Pisa and Roma)

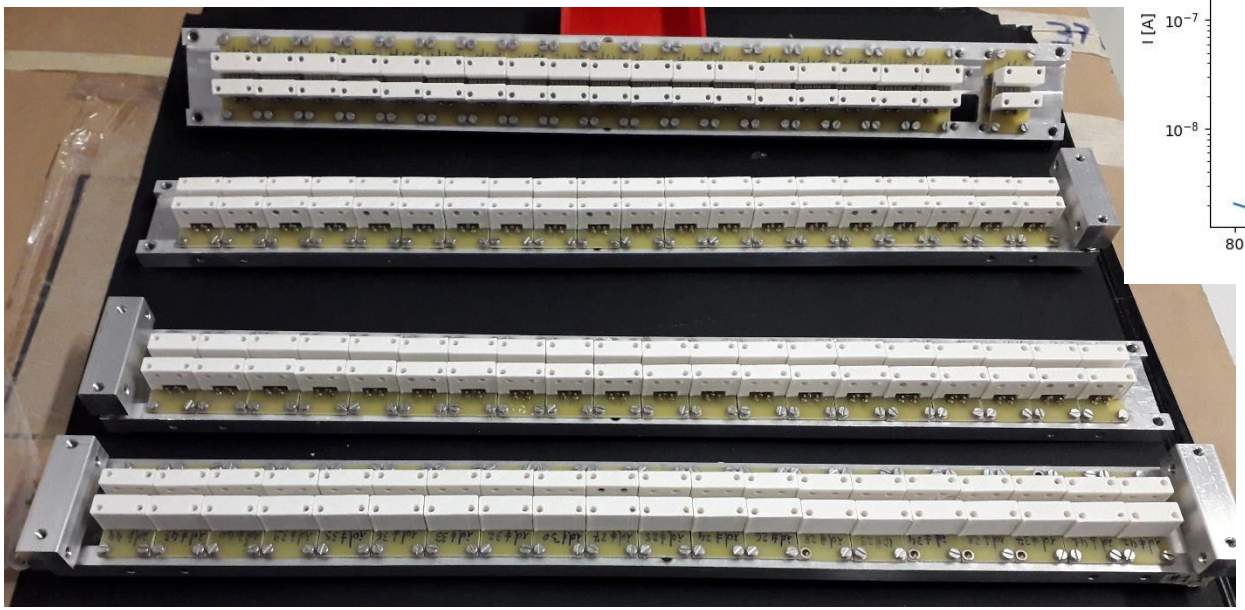
We are working on the set-up of few boards for temperature monitoring hosting the DS28EA00 chip. The sensor will be managed directly by the WaveDAQ system without additional hardware. We expect between 4 and 9 sensors on the TOF-Wall.

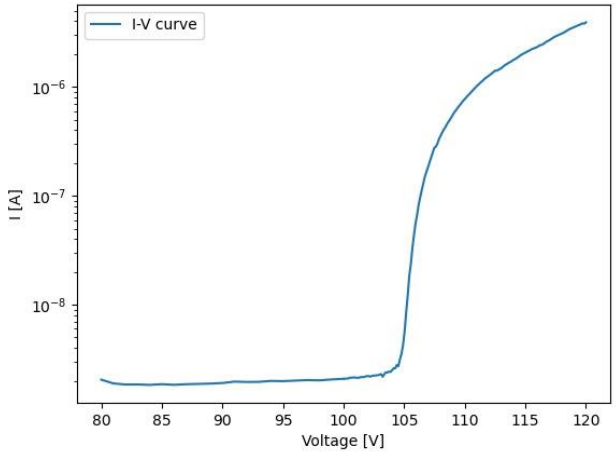




Status of the detector (4)

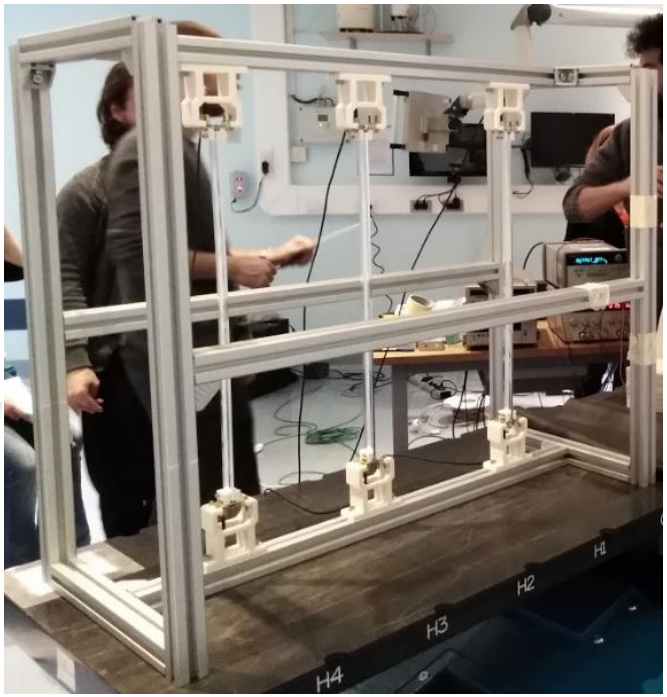
The detector has been disassembled and tests are being performed on each SiPM board to check for possible damages.

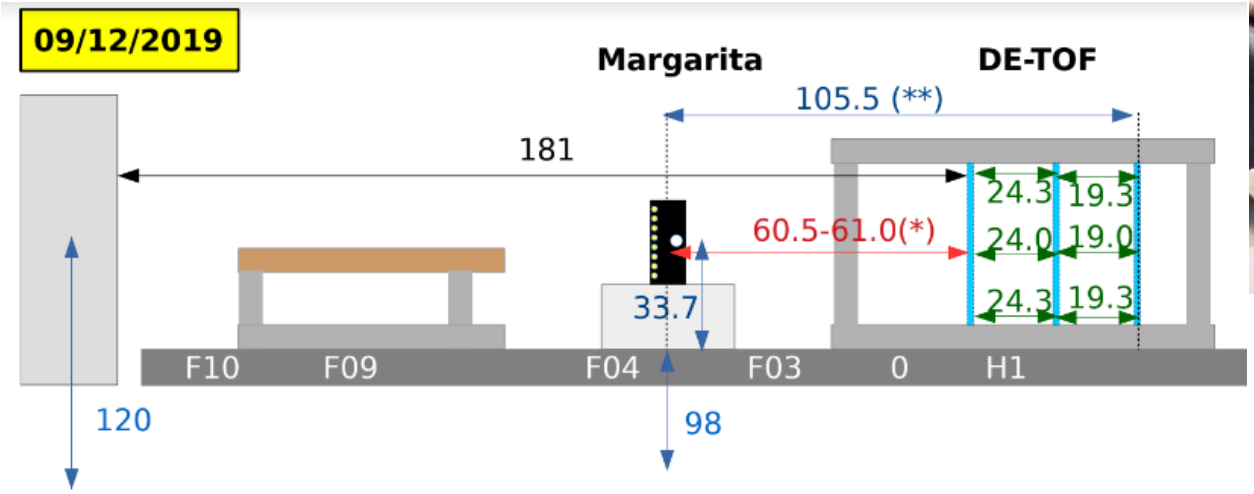




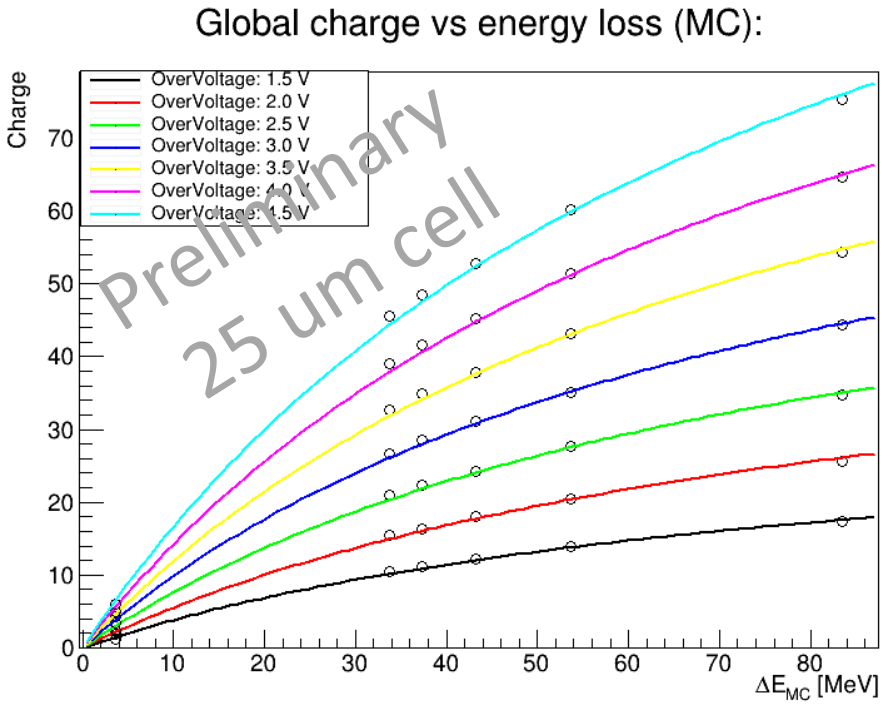
December 2019 - Data

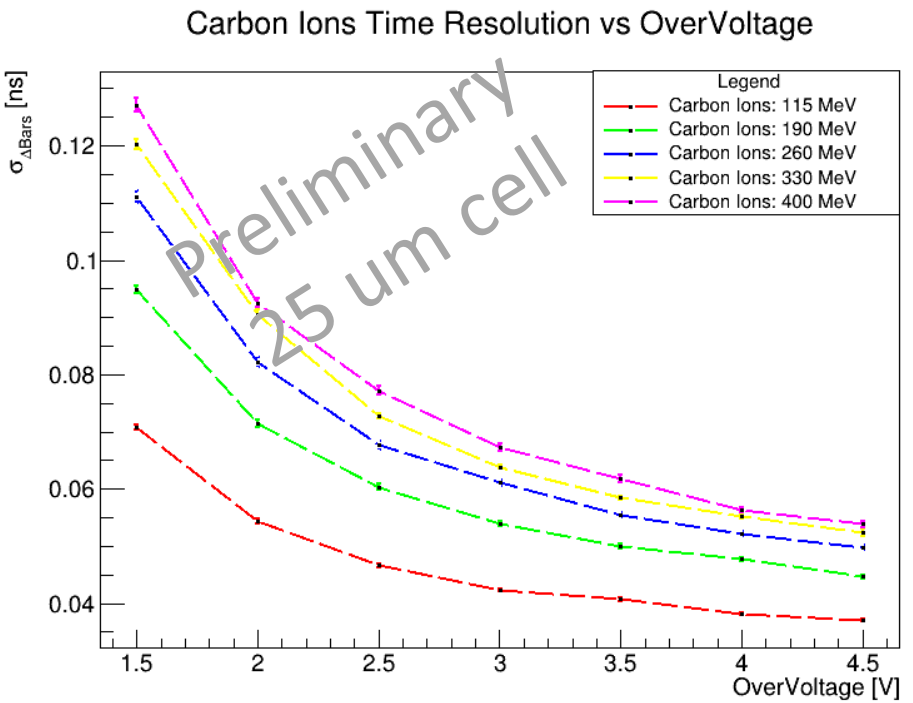
Test using 3 bars to investigate the energy and timing resolution as a function of the overvoltage. One of the three bars was equipped with 50 um cell SiPMs.





December 2019 - Data





December 2019 - Data

We investigated over-voltages below the working point of the detector, mainly to check:

- If the energy resolution could benefit of a lower cross-talk probability
- The difference in resolution between 50 um cells and 25 um cells
- If the saturation coefficient changes with the overvoltage (i.e., with PDE and crosstalk)

→ A higher overvoltage could give saturation problems with oxygen ions.

However it would be interesting to investigate also higher voltages to improve time resolution, trying to correct somehow the saturated waveform

Next steps: detector set-up

- New mechanical set-up will be ready by September
- New calibration of the detector is needed, no clue on the date
- We will start collecting cosmic data for an initial debug

Next steps: detector tests

- We planned a test with a scintillator bar coupled to PMTs to investigate in detail the scintillator saturation.
  → Postponed, but all equipment is already available for the test

- Test on SiPMs with pulsed light to investigate linearity and gain uniformity on a board (on few samples, before assembly)

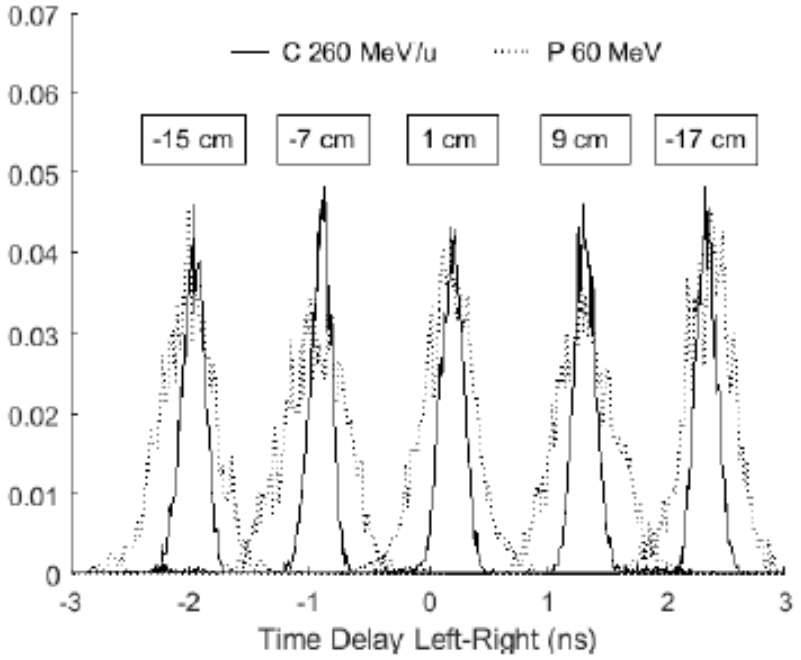
- Analyze the detector stability using the data collected at CNAO and GSI

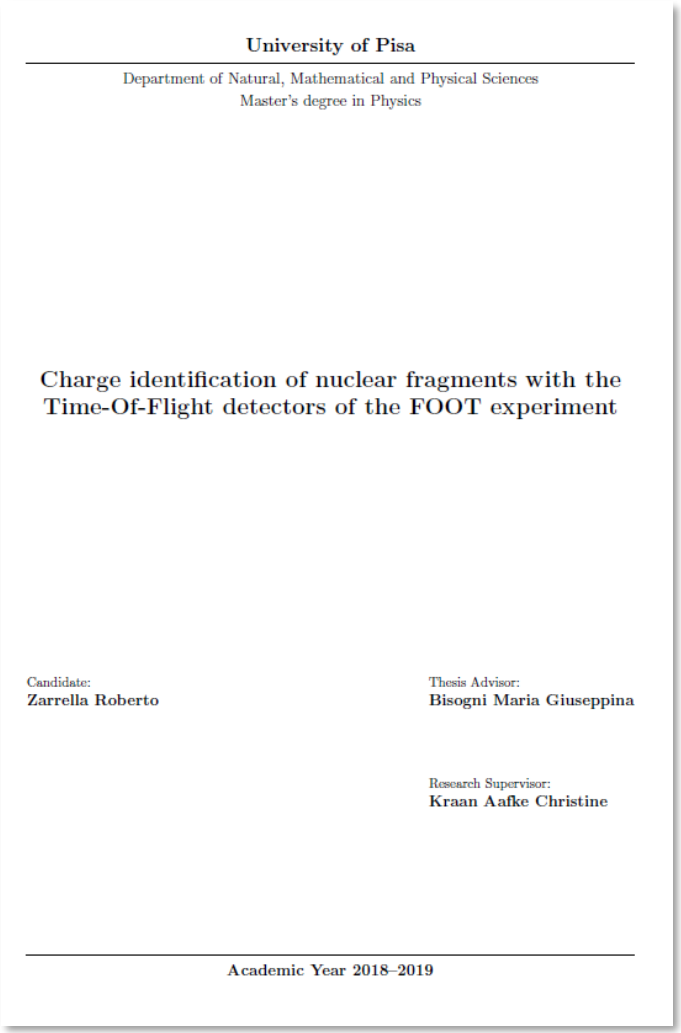
Next steps: calibration

- A full 400-points calibration should be performed (CNAO?)

- Participate to the HIT data taking to investigate the energy calibration with a larger set of ions.

Also, the possibility of different gains in the two layers to optimize the performance with protons should be investigated





University of Pisa

Department of Natural, Mathematical and Physical Sciences
Master's degree in Physics

Charge identification of nuclear fragments with the Time-Of-Flight detectors of the FOOT experiment

Candidate:
Zarrella Roberto

Thesis Advisor:
Bisogni Maria Giuseppina

Research Supervisor:
Kraan Aafke Christine

Academic Year 2018–2019

Roberto graduated on the 06/04/2020 !

… another MsC student, Marco Montefiori, in currently working on the TOF-Wall detector