

New FE card prototype for MWPC upgrade

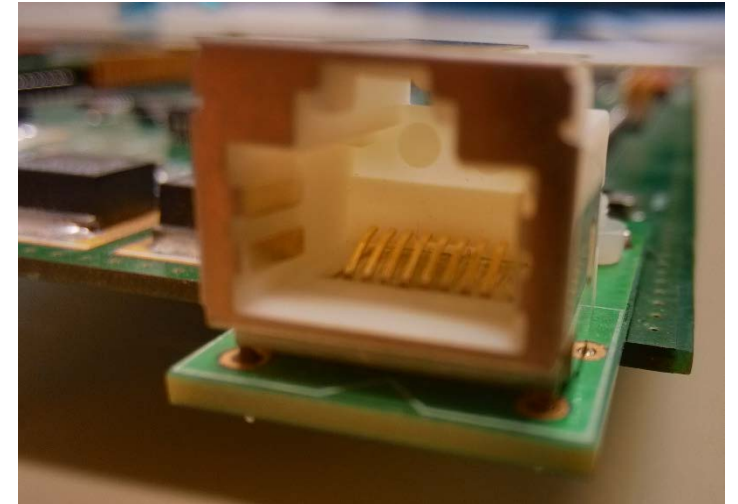
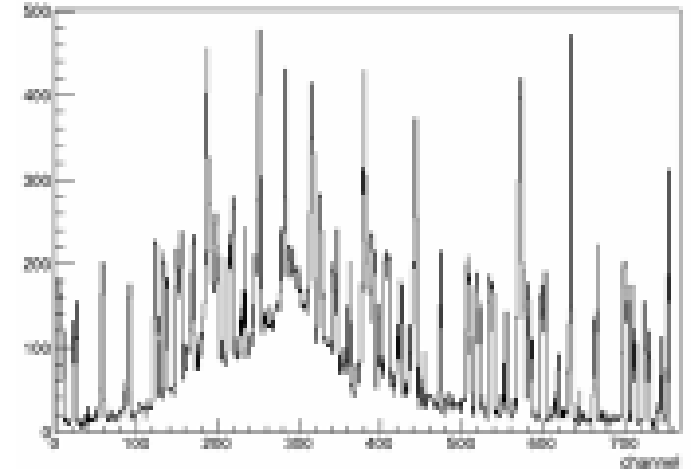
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Main issues of the MWPCs that we would like to fix

- The dead time of the experiment is limited by the 4mks delay between consecutive triggers imposed by the MWPC FE noise.
- During the 2017 RUN we had issues with the RJ45 connector at a rate close to 1 disconnection every 2 weeks



➤ To try to address those issues are evaluating a possible new FE.

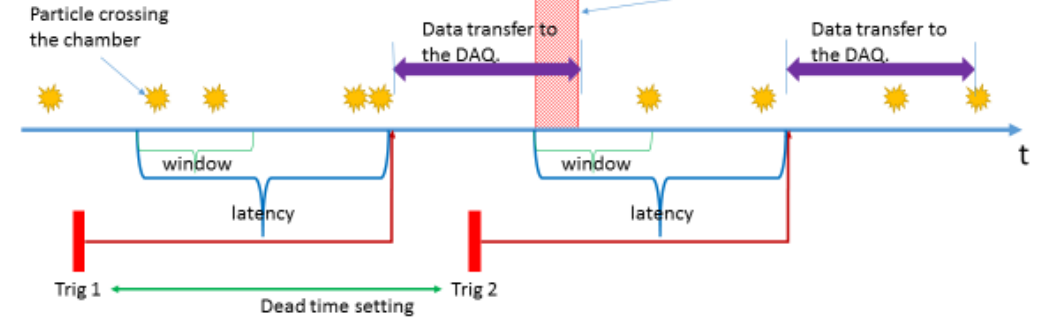
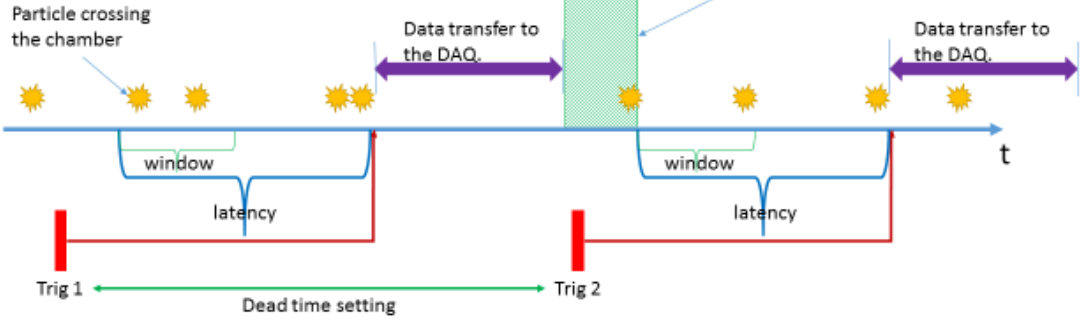
Noise problem of consecutive triggers

GOOD SITUATION.

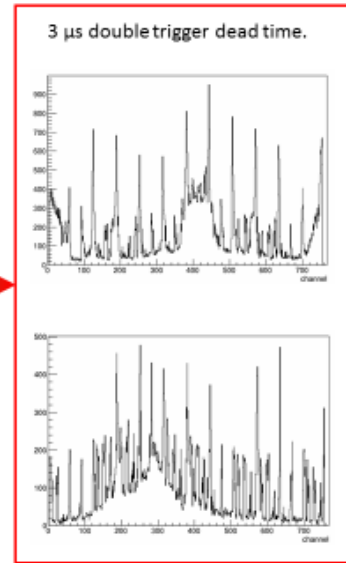
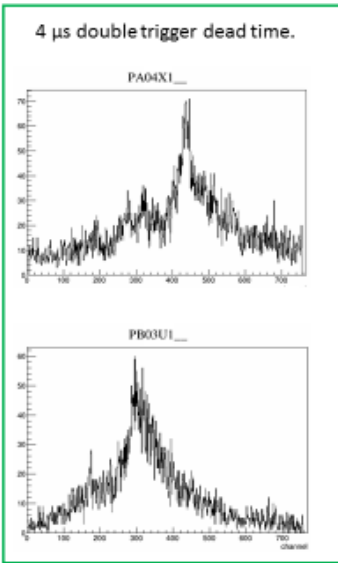
There is no overlap and as a consequence no noise induction into the data.

BAD SITUATION.

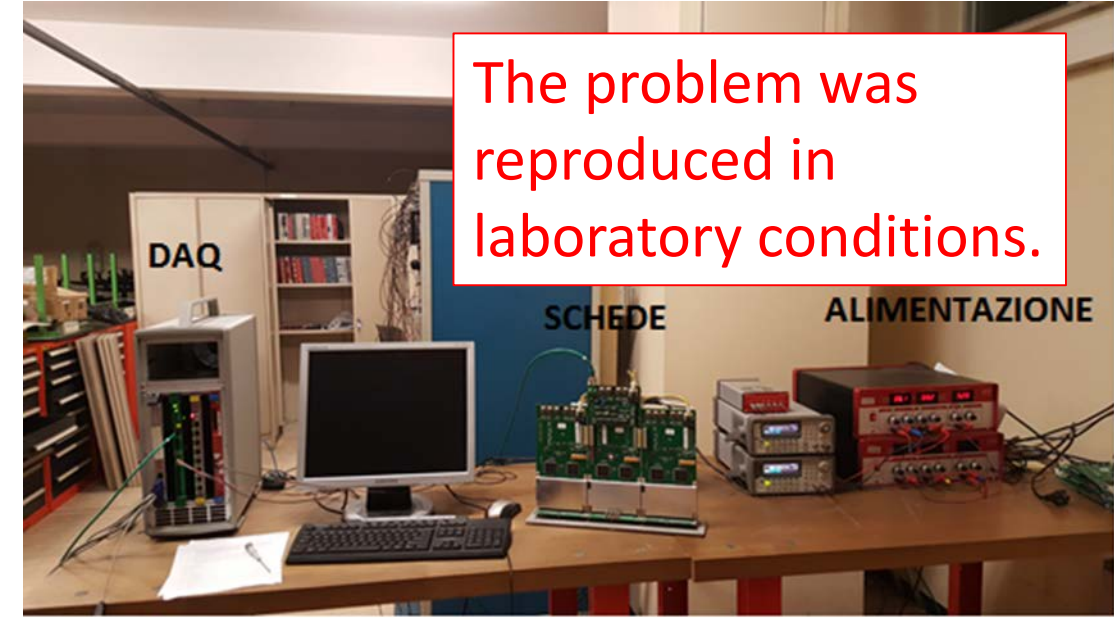
There is an overlap and as a consequence noise is induced into the data.



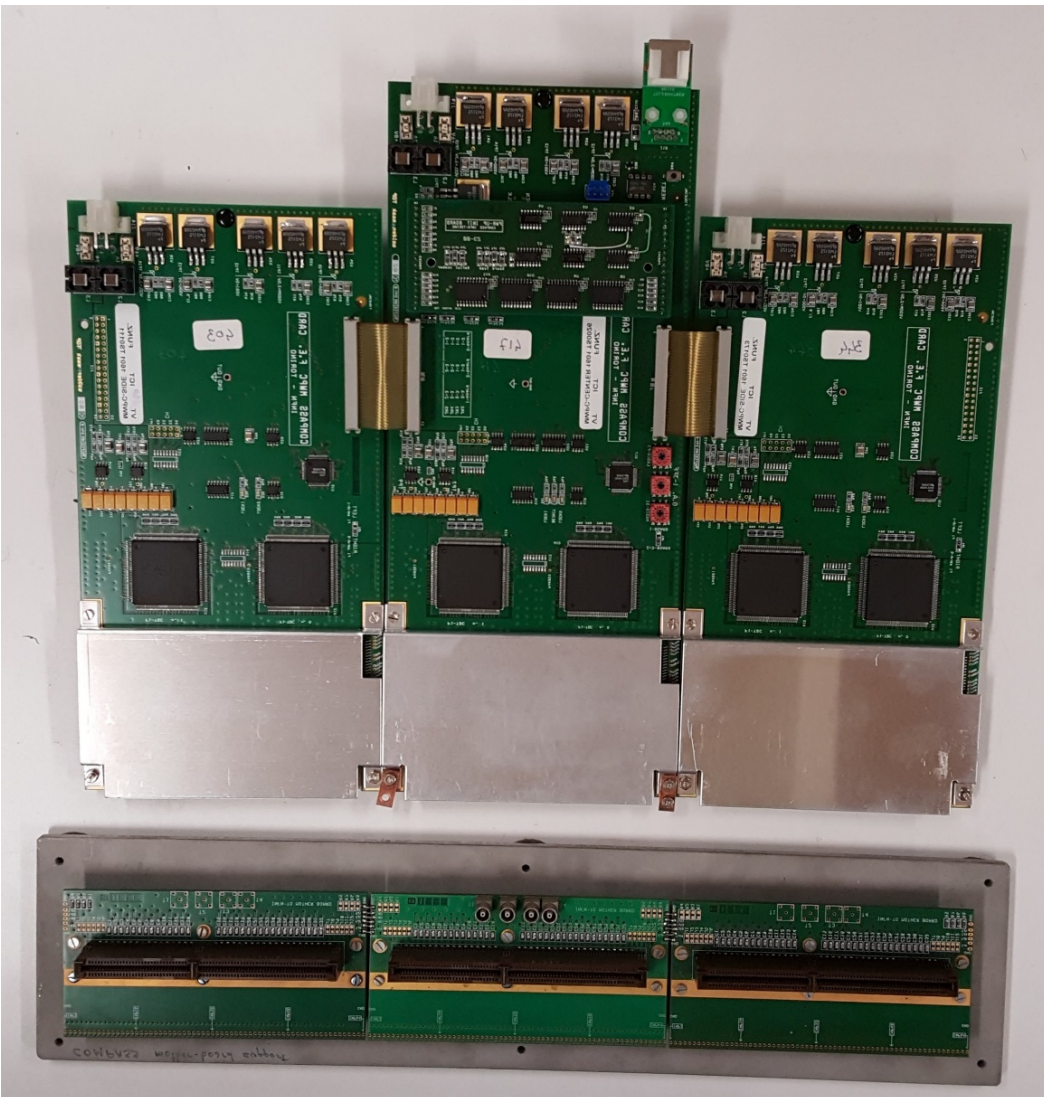
Dead time problem seen in the data.



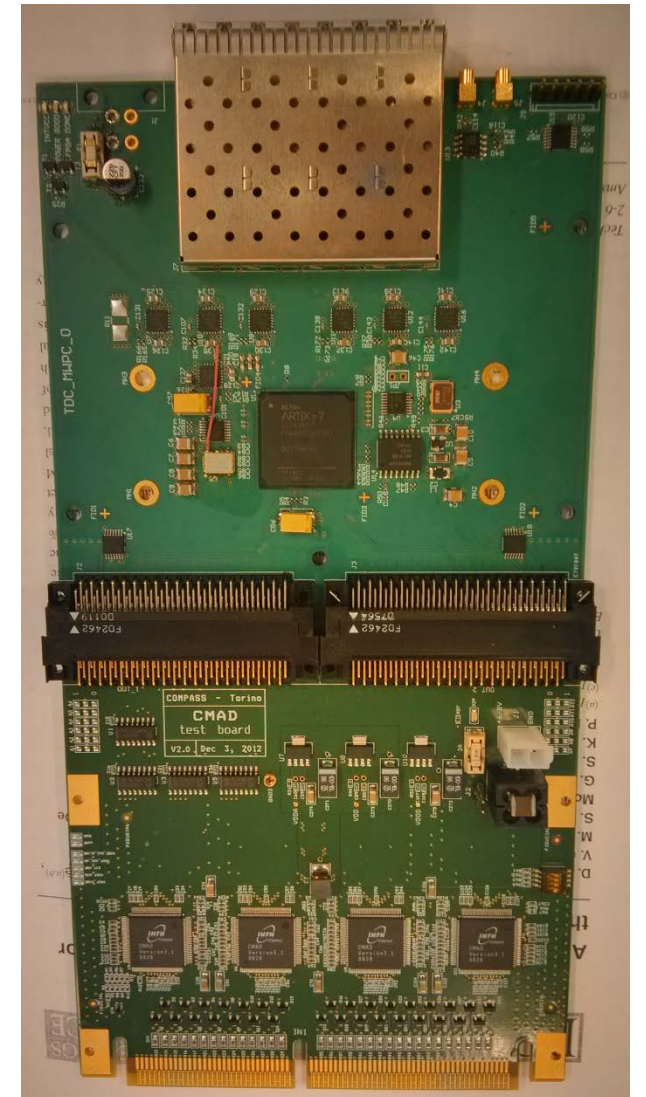
- We can see that the noise induced in case of dead time shorter than 4 μs is quite high.
- As we want to run with a smaller double trigger dead time in the future we need to reproduce the issue in the lab to investigate it in detail.



The prototype under test

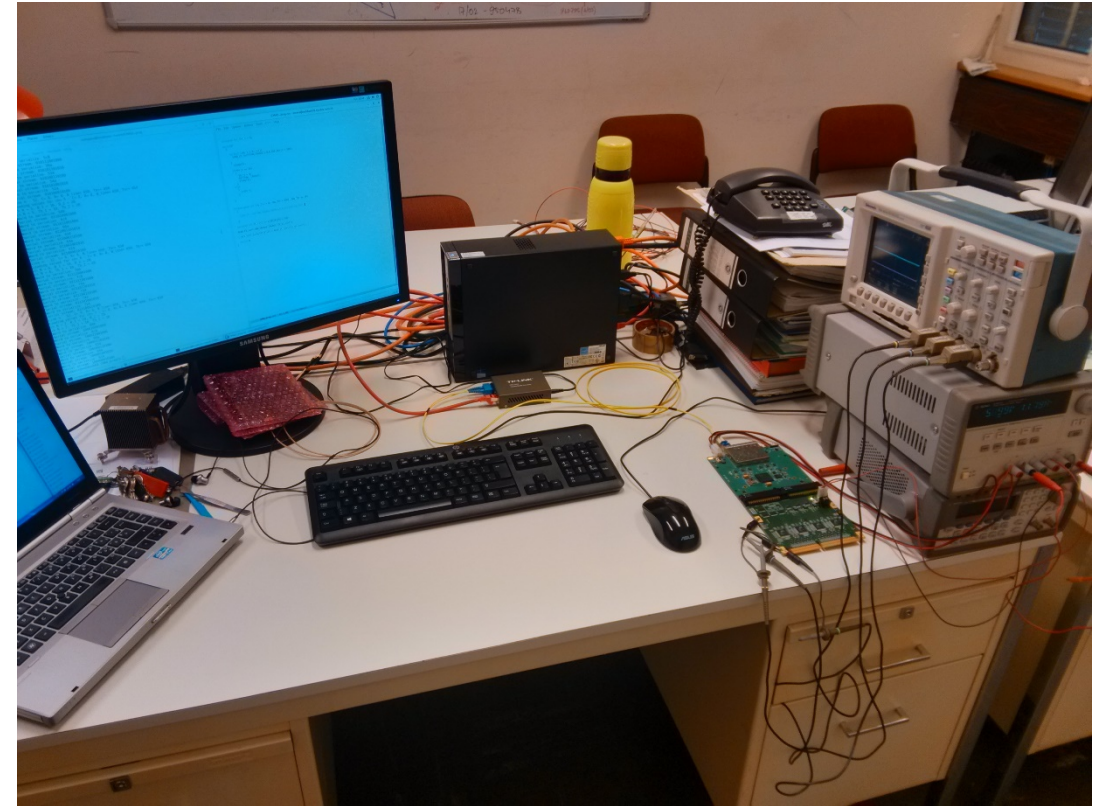


- FPGA based TDC by Igor
- Single card configuration
- Optical readout
- Separate digital and analog parts



Planning of the test on beam of the prototype

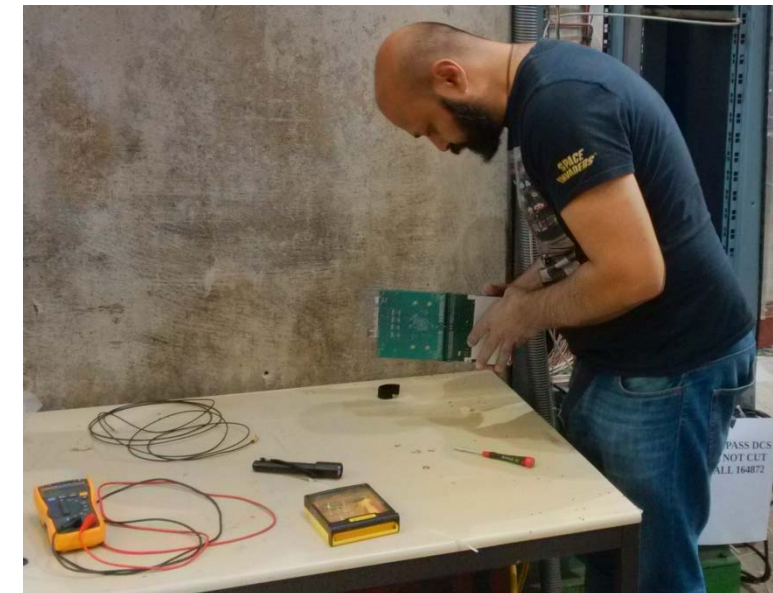
- 19.10.17 – Install the testing equipment and start the
- 20-21.10.17 – Calibration of the card using Ethernet DAQ
- 22.10.17 – Installation in the area and test the readout through DAQ
- 23.10.17 - Taking some data to evaluate the efficiency and the timing



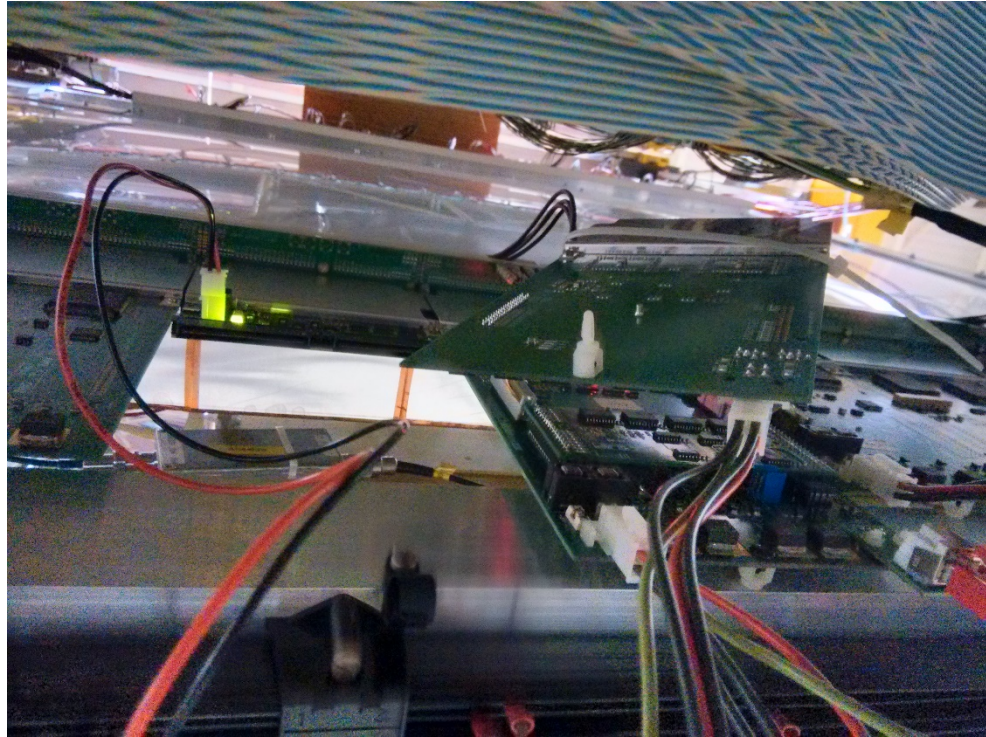
Optimistic planning...

The reality...

- 19.10.17 – Install the testing equipment and start the Firmware testing
- ~~➤ 20-21.10.17 – Calibration of the card using Ethernet DAQ~~
- ~~➤ 22.10.17 – Installation in the area and test the readout through DAQ~~
- **21-22.10.17 Evening** – Testing the Firmware on the table and in the COMPASS DAQ
- **23.10.17** – Installation in the area. And hope for some data.



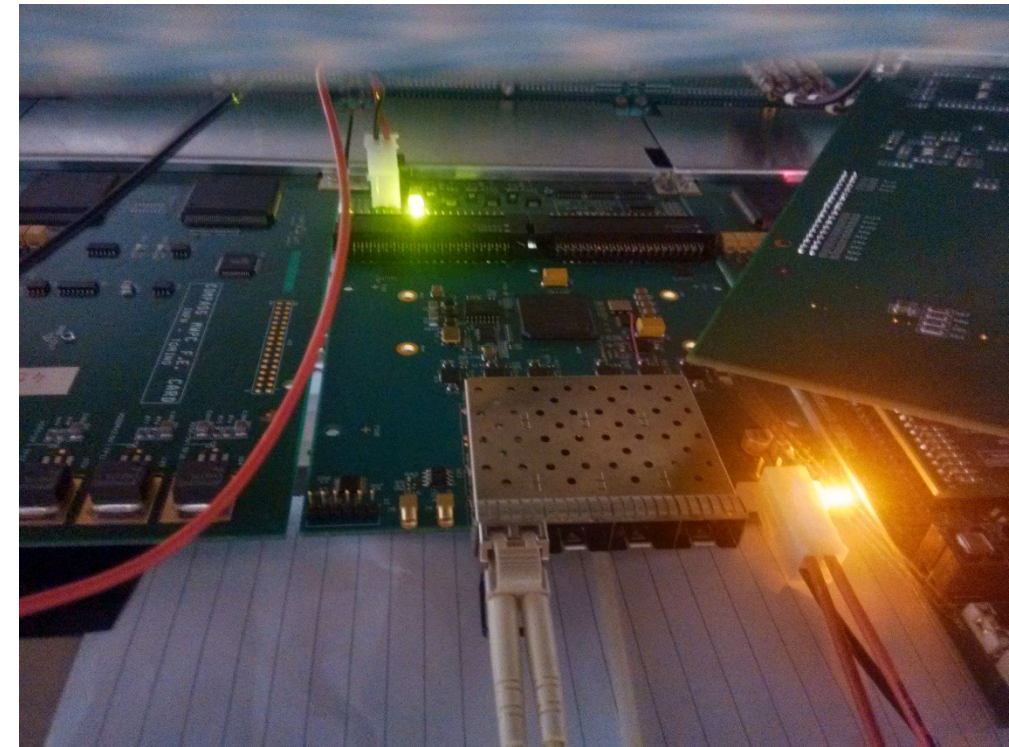
Installation method



- Bend one card from a working triplet to allow it to remain operational.

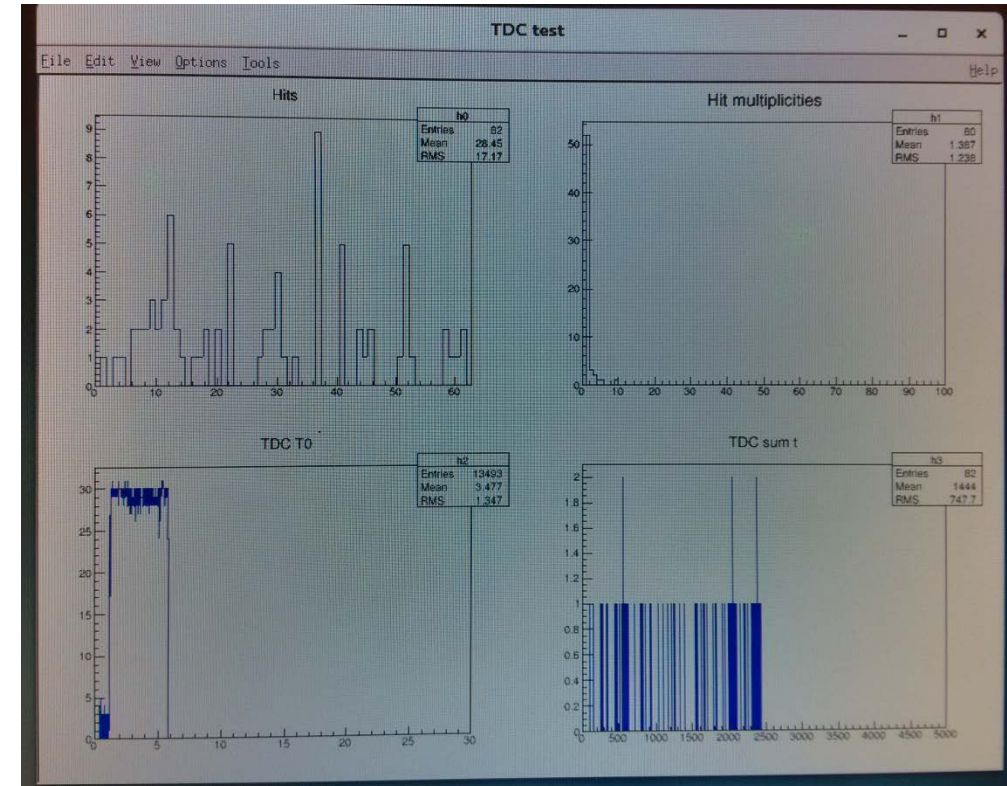


- Install the prototype on the chamber between the standard cards.



Data taking

- The installation was done around 01:00 of 23.10.17.
- We had immediately a problem with the triplets around the new card. It was found to be usual problem with the connection.
- Around 2:00 we stopped the attempts to make all the triplets work and started data tacking.
 - **THE CARD BEHAVED WRONGLY....**
- Around 04:00 a badly but somehow working configuration was found and left in acquisition until the end or 2017 RUN.



Summary of the “on-line” test

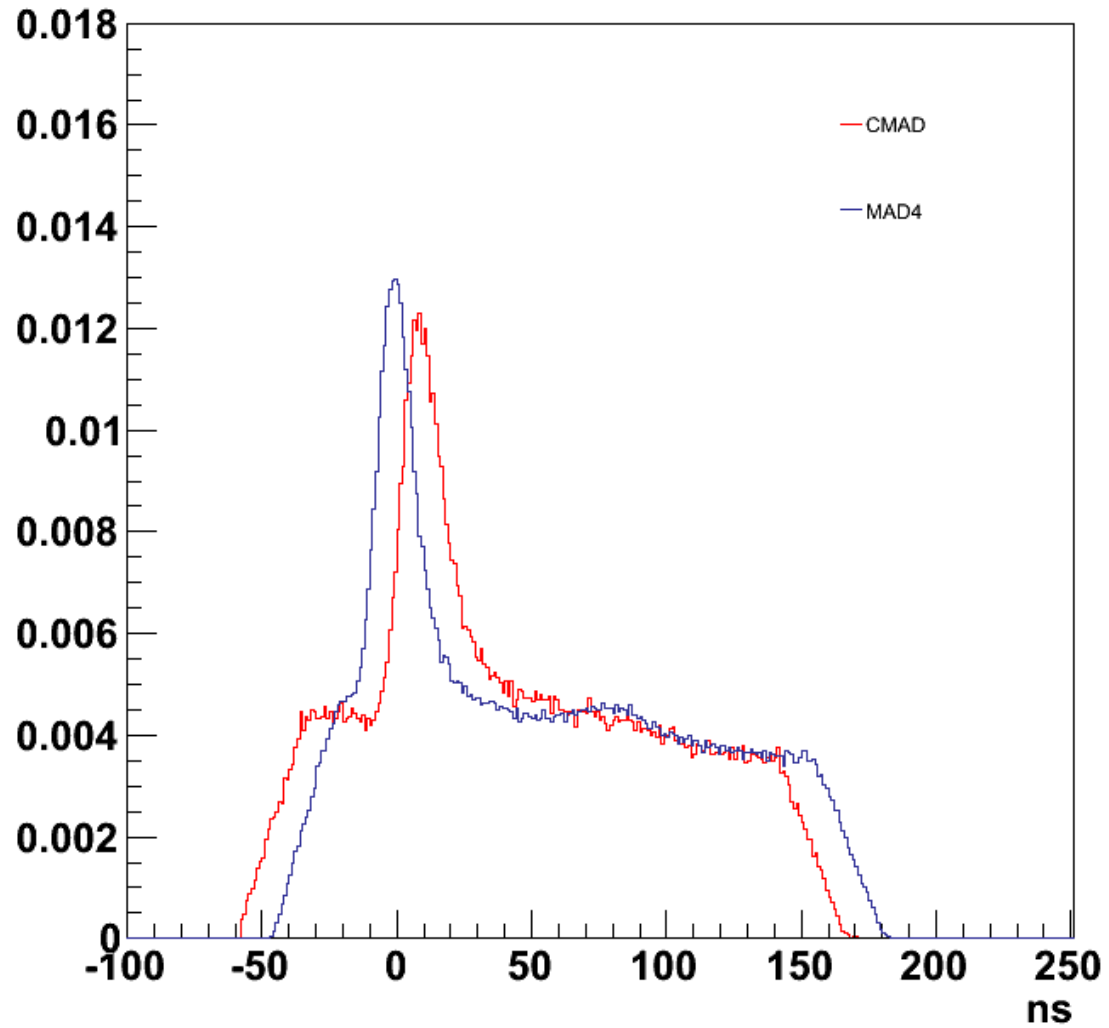
- The TDC to analog FE integration worked ok.
- The DAQ integration of the FE was done.
- No problems were found in the data flux to the DAQ and in the monitoring software.
- No noise issue were observed on the old FEs with the new card on the chamber
 - The normal operation failed due to a mistake in the FE programming software.
- The data will be analyzed in off-line to check what can be extracted.

Plans

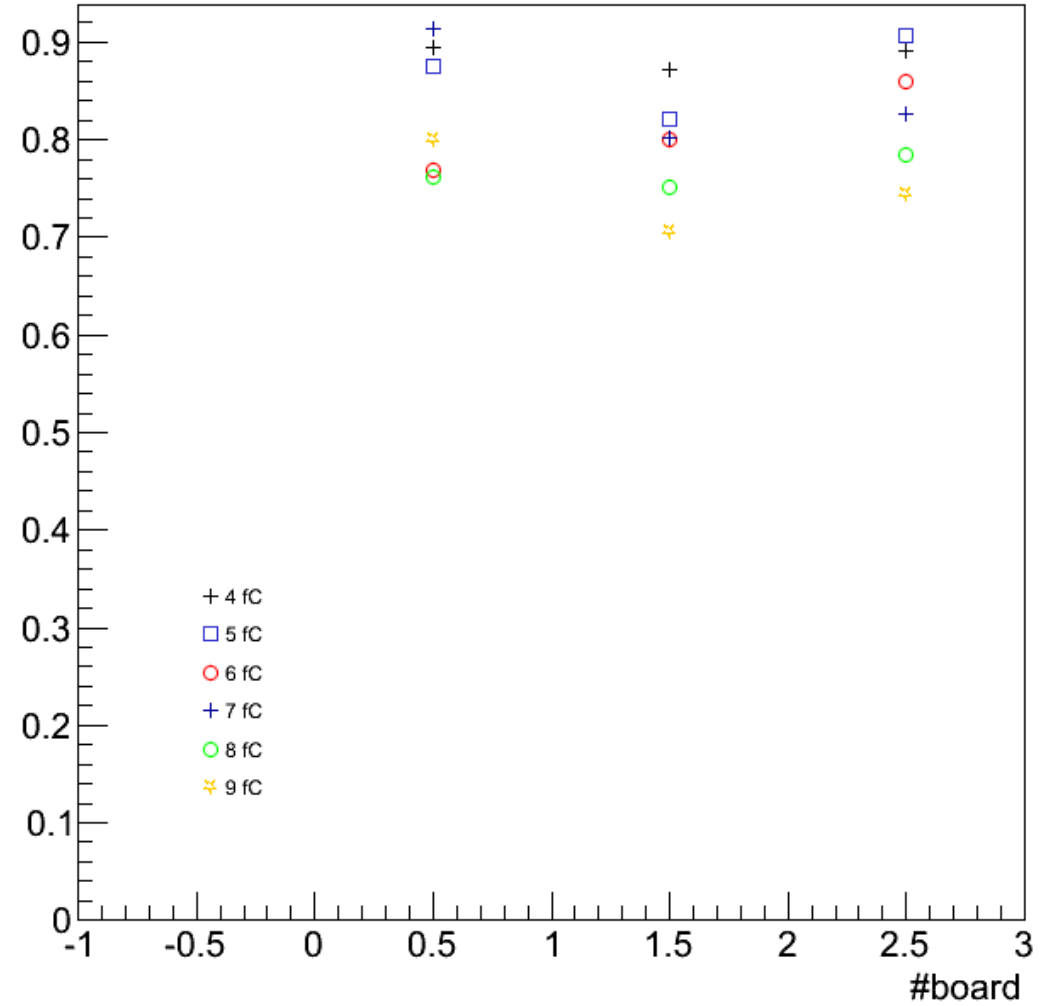
- We would like to make the laboratory test to cross-check that calibration and noise situation in laboratory and then on the chamber during the winter.
- We are confident in the analog FE operation due to the results of the test that were performed in 2012. No efficiency/noise problems were observed then.
- We will need to check in laboratory the issue of the noise induced by the readout with “dead time < 4mks”.
- We are willing to equip one or two chambers in 2018 with the new Fes in case laboratory tests are successful.
 - This solution is back compatible with the old FEs.
 - This should resolve the RJ45 connection issue.

CMAD card in 2012

PA05X1_time



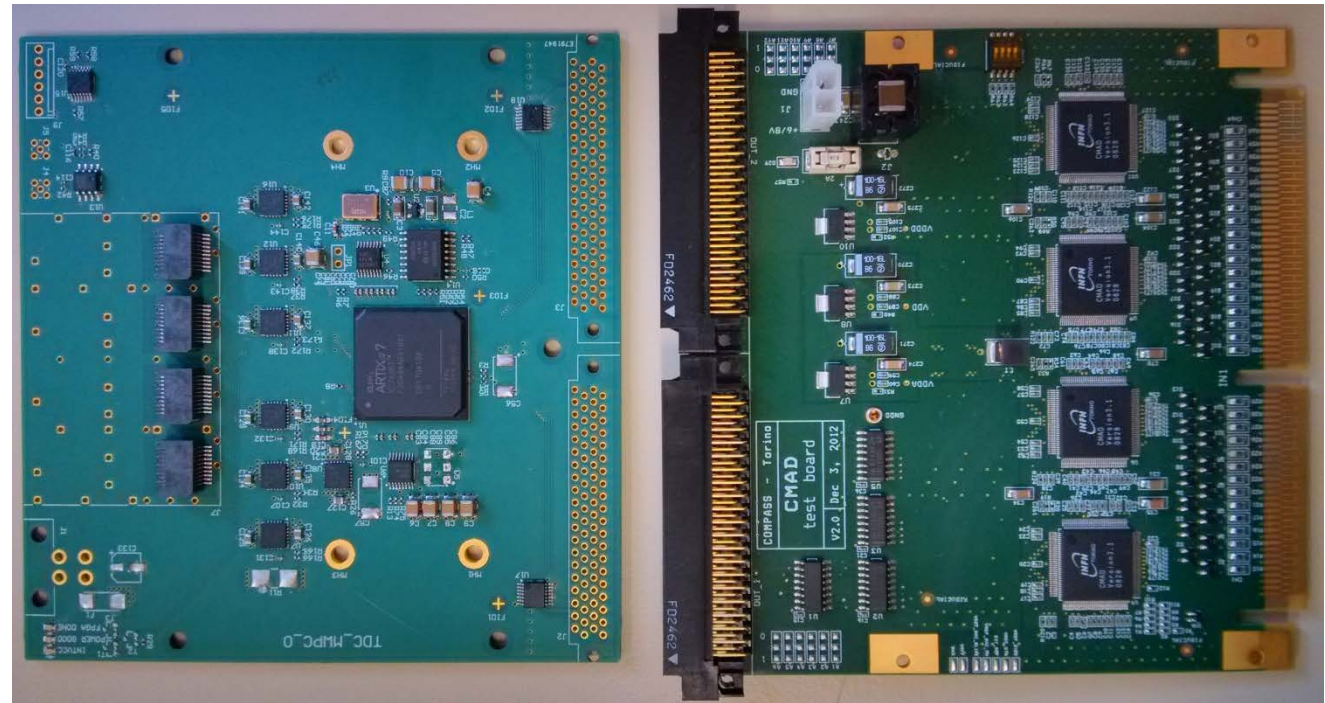
Eff CMAD



Ongoing work on the studies of a possible upgrade of the MWPC FEs

The main reason for the COMPASS time lose due to the MWPCs during the running are:

- The problem with the connectors that require short access to the area to fix the problem.
 - Problem of self excitation of the FEs in case of short death time between triggers.
- To address this issues we are now involved in an R&D of a new FE based on a new TDC.
 - This FE would decouple the analog and digital parts and would be readout by an optical fiber.
 - The planned steps for the moment:
 - Qualify the cards in laboratory conditions during the winter shutdown.
 - To equip part of one chamber for the last week of running with the new FE prototypes.



07/11/2017 In case of success we could think of equipping one chamber with new FE for the 2017 RUN.