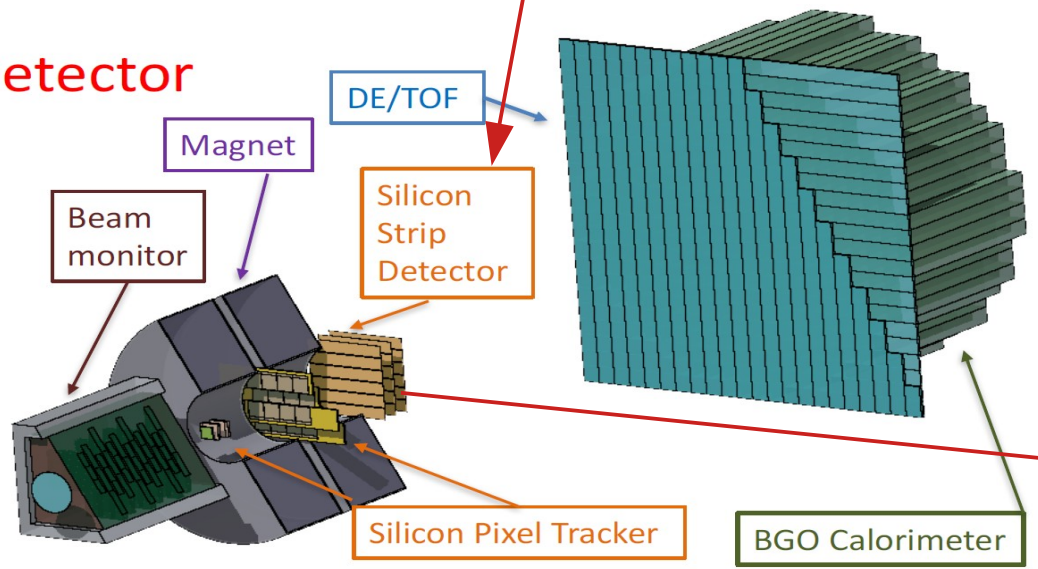
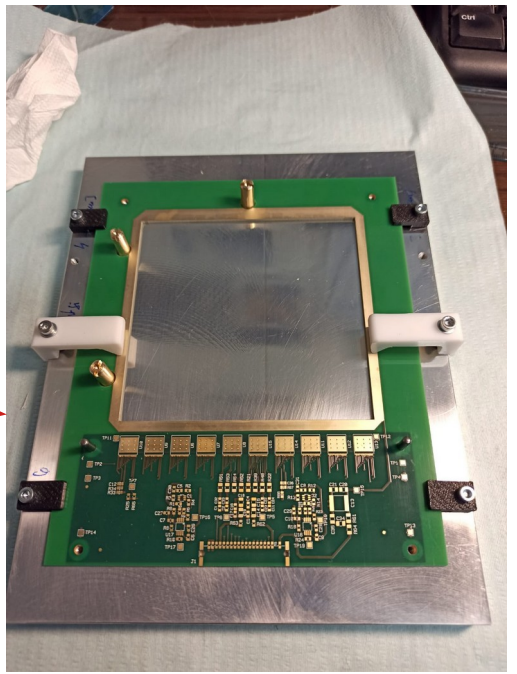
L. Servoli, G. Ambrosi,
K. Kanxheri, G. Silvestre,
M. Movileanu-Ionica,
M. Caprai, P. Placidi,
E. Fiandrini, B. Alpat,
M. Italiani (3.3 FTE)

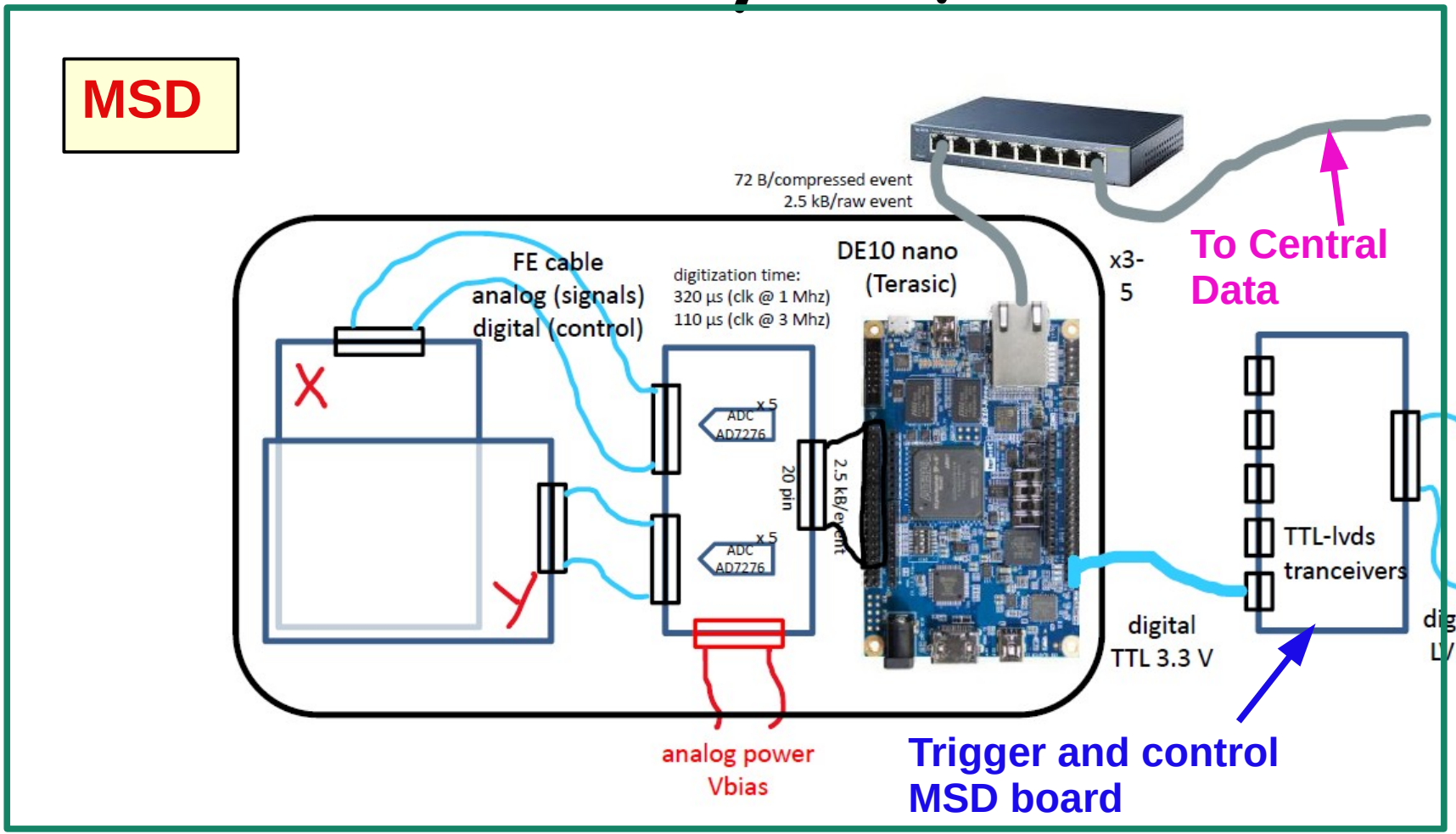
Status of MSD subsystem

FOOT Detector





Hardware: Hybrid, ADC and DAQ



Procurement: Sensor + DAQ chain

→ Sensors: arrived.

→ Readout Chip (VA1140): Arrived.

→ Some dummy sensor with metallization obtained in february for mechanical tests and jigs development.

→ Hybrid for chip bonding: arrived

→ ADC board: order placed; first design approved;
to be processed beginning of September; final board ready by end October

→ Trigger distribution board: order placed; to be ready by end October

→ DAQ De10-nano boards: arrived

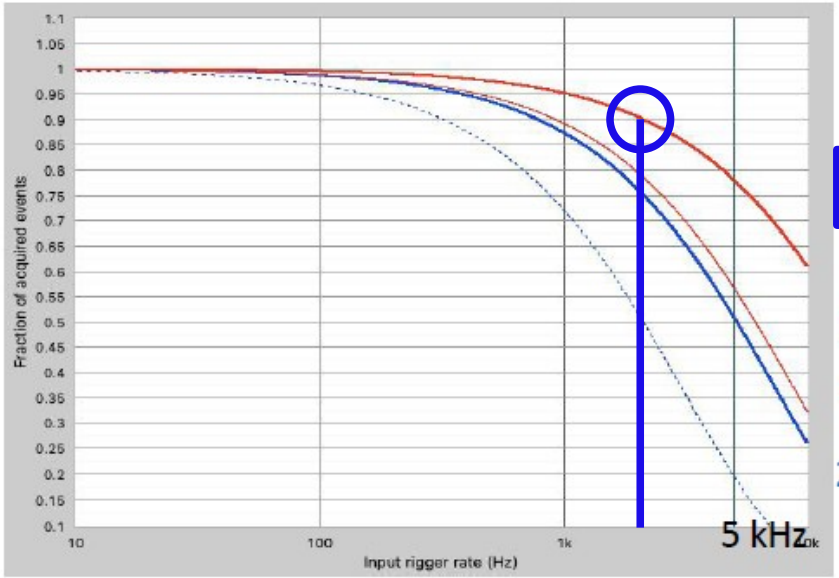
→ bias: CAEN A7585DU (SiPM power supply chip); to be acquired (end September)

DAQ chain: new ADC board

We have modified the layout to gain some more margin in acquisition rate.

Old ADC board: 1 ADC to read out 5 VA1140 chips.

Now we have 1 ADC to readout 5 VA1140 chips.
→ ~2 kHz @ 90%



5 ADC @ 3 Mhz, T = 50 µs

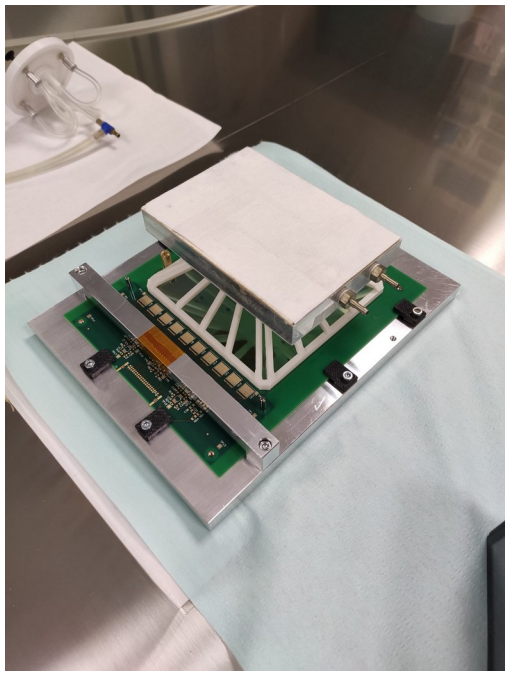
2 ADC @ 3 MHz, T = 114 µs

5 ADC @ 1 MHz, T = 135 µs

2 ADC @ 1 MHz, T = 327 µs

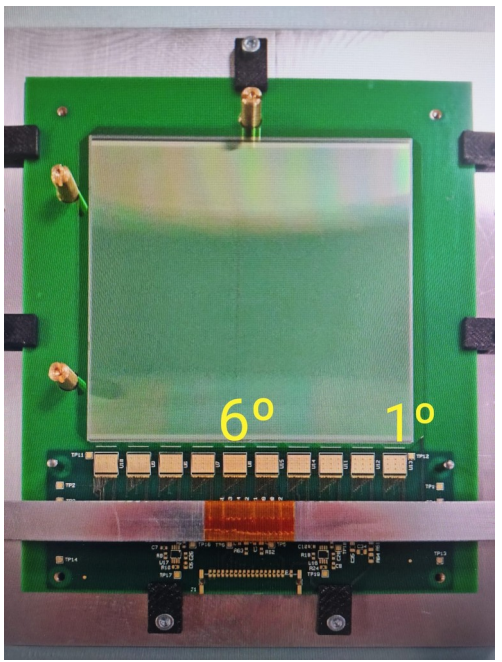
Module Construction

First mechanical assembly test with dummy modules to develop procedure (begin july - begin august):



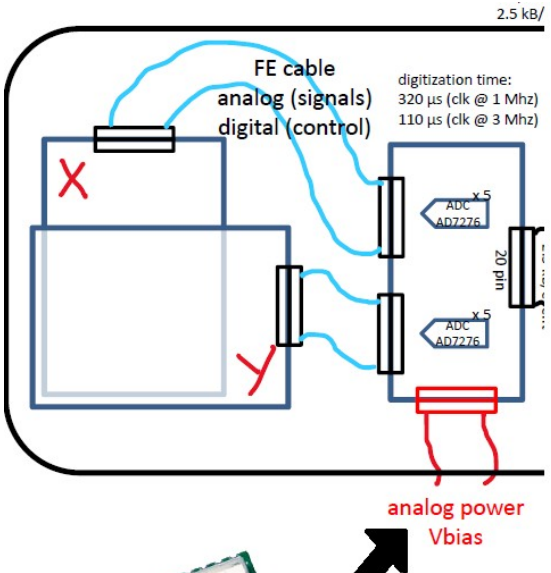
First electrical module (good 150 μm thick Hamamatsu sensor + new hybrid + 2 VA1140 chips to test electrical functionality.

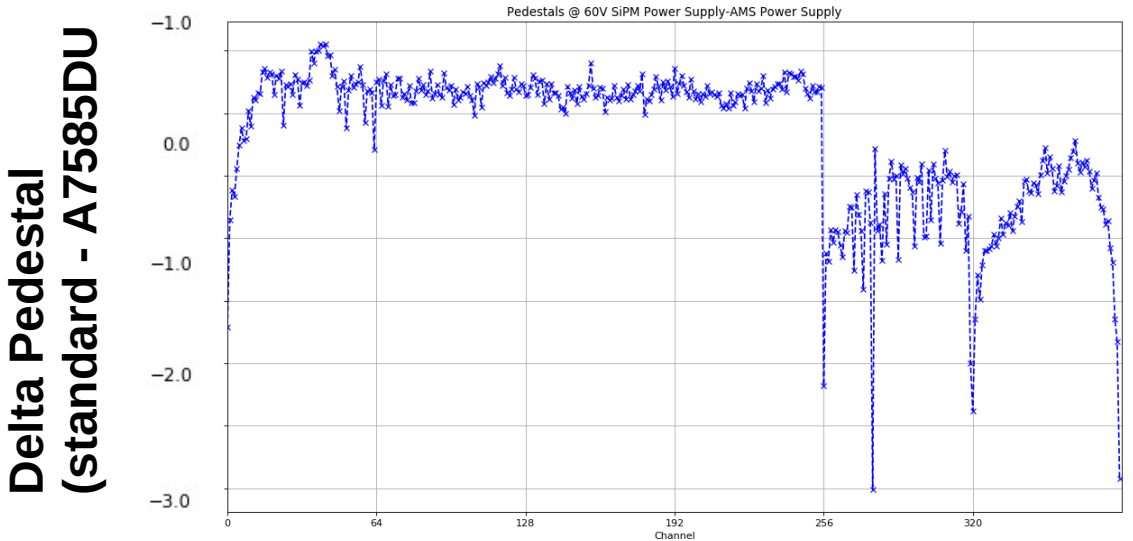
(today VA1140 glueing and bonding)



Next week: start tests also with lab sources. Using old DAQ chain from DAMPE experiment (only 2 ADC on the ADC board)

Hardware: Power Supply

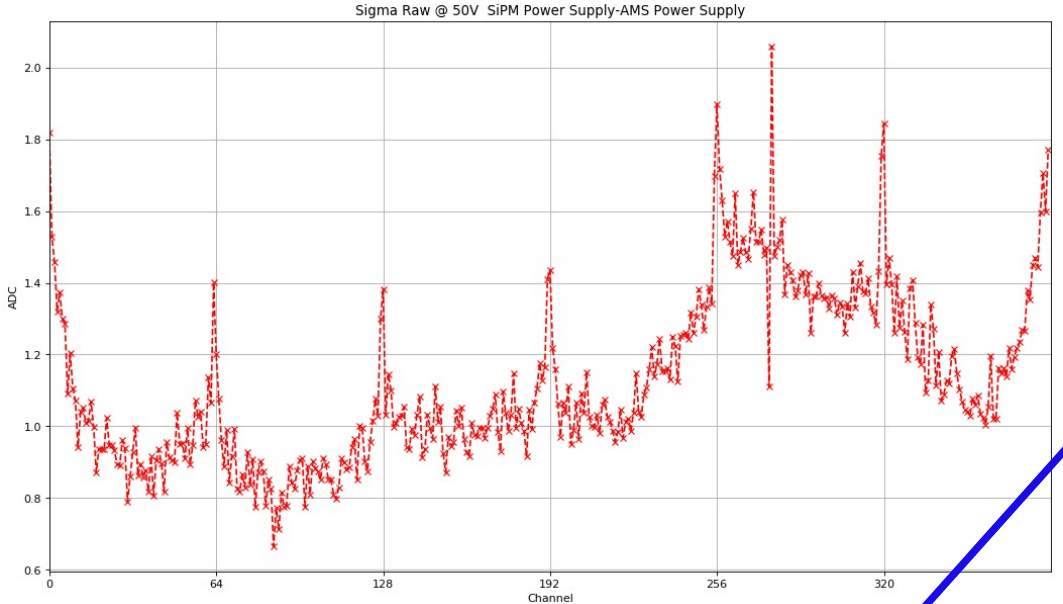




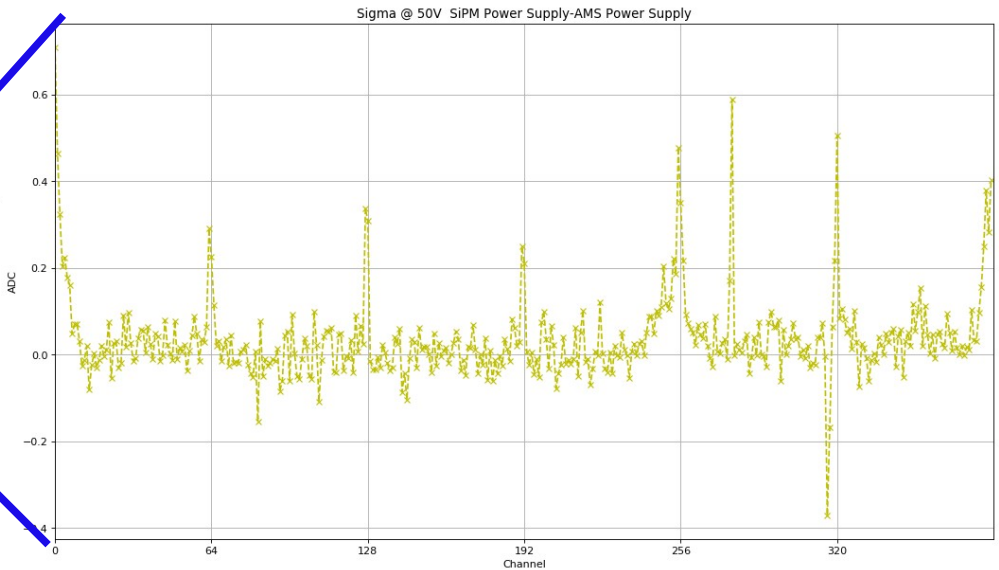
We are testing CAEN power supply A7585DU (SiPM)

→ 20÷85 V (10 mA) output range
→ Resolution: 10 mV and 60 nA
→ USB powered.

Hardware: Power Supply



Raw Noise: difference within 2 ADC



Strip Noise: difference < 1 ADC

CAEN A7585DU has been chosen

Up to 16 CAEN chips could be controlled in daisy chain

Hardware: Mechanical support structure

We are working to have a one-piece MSD system including:

→ Support for x-y planes (3 to 5 possible) (sensors + hybrids);
→ Support for ADC boards;
→ Support for trigger and Control board;
→ Support for Ethernet switch;
→ Support for sensor Analog Bias power supply.

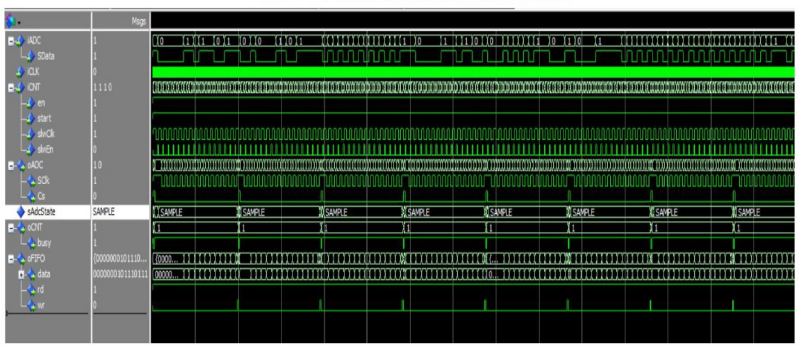
In principle only: 1 ethernet cable, 1 flat cable (digital LVDS), 1 power cable will get out from MSD subsystem.

Coordination with general mechanical FOOT system starts in September.

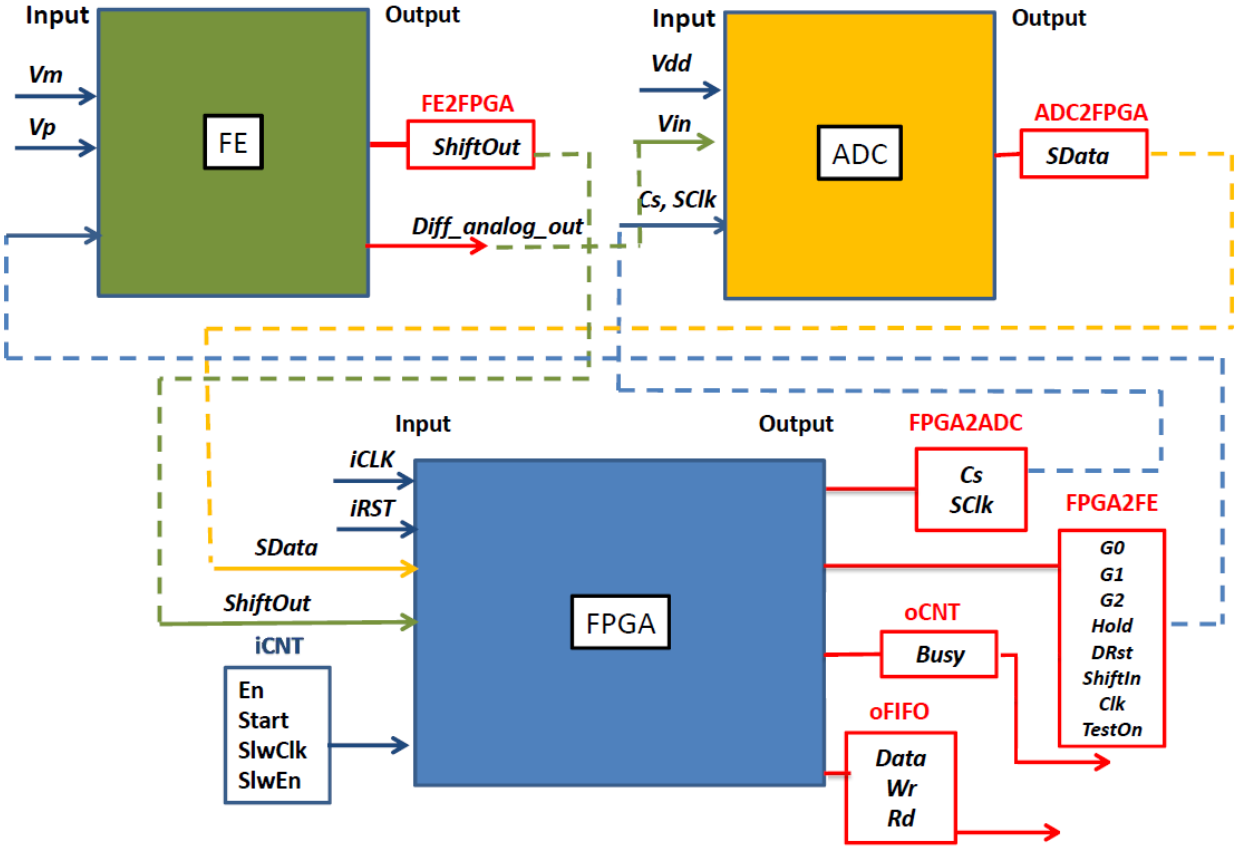
DAQ Firmware

→ Development of DAQ system based on De10-nano Board. Waiting for hardware components of DAQ chain, we simulate them to develop the final firmware. At this stage simulations are running.

ADC - FPGA INTERFACE SIMULATION



FE - ADC - FPGA INTERFACE



Workplan for construction, commissioning and data taking

→ We should finish the 3 x-y plane production before the end of the year to be tested extensively at CNAO in december.

→ There could be some limited follow-up next year if we found problems at the CNAO test beam, to modify ADC board and/or mechanical setup.

→ MSD DAQ full chain: functionality test during entire November

→ DAQ should continue to be fully integrated in general DAQ (beginning of November); then commissioning for the next few months.

→ DAQ 2021: development for online zero suppression, fine tuning and related commissioning.

→ 2021: Dedicated test beam for defining the detector response to ion and to define the eta-function for spatial resolution.