Status of MSD subsystem

L. Servoli

Hardware: Sensor and VA140

→ **Sensor:** procurement procedure concluded. One week ago issued the formal purchase order.

Estimated time of arrival of sensors: within half ~~september.~~
january.

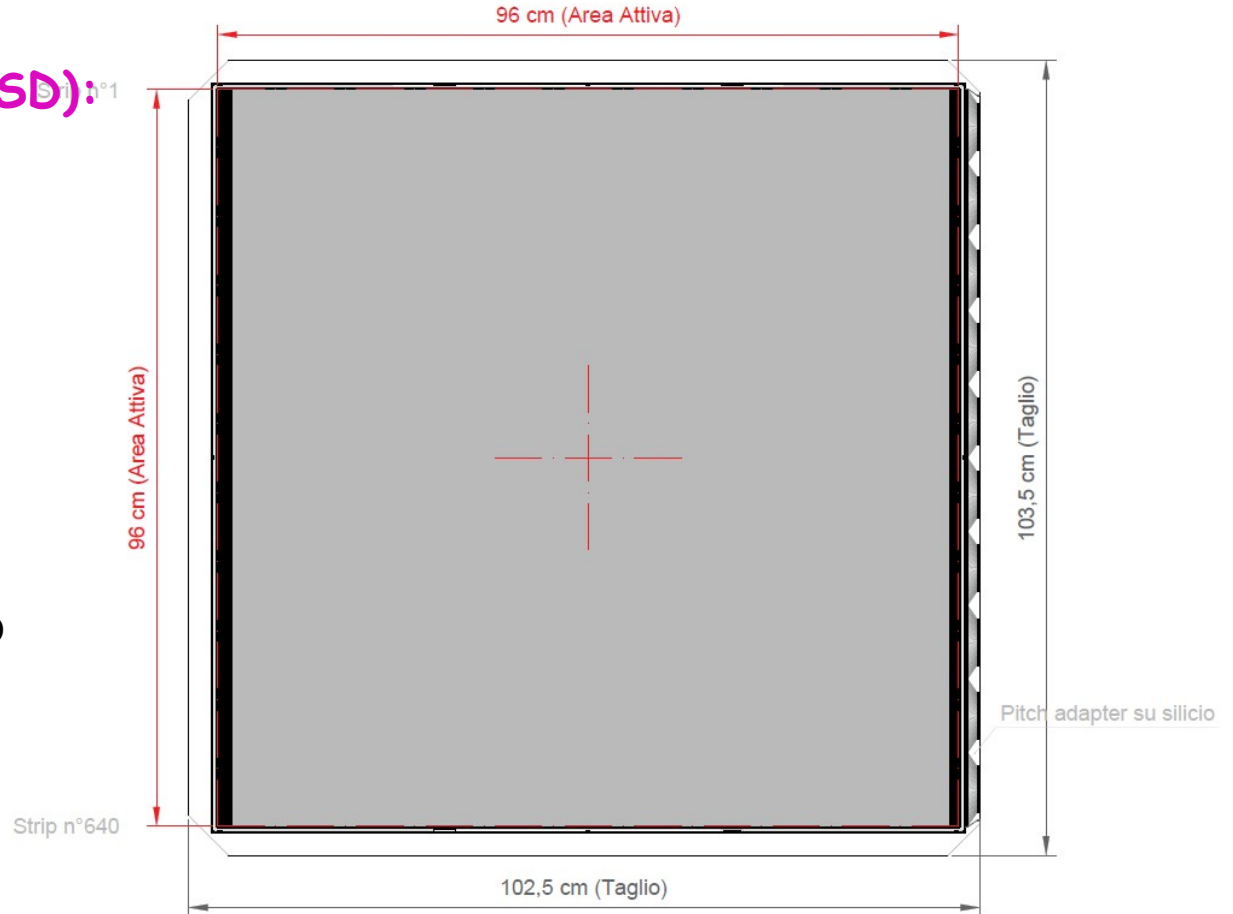→ **Readout Chip (VA140):** order procedure (210 k€, HERD, POX FOOT) issued.

Estimated time of arrival of chips: ~~before august.~~
end of the year.

~ 10 chips have been already been borrowed from a german group.

Hardware: Sensor

Single-sided silicon detector (SSSD):

→ 150 μm thickness.

→ 96x96 mm² active area.

→ strip pitch: 50 μm ;

→ readout pitch: 150 μm ;
   (two floating strip among two
     readout strips);

→ pitch adapter on silicon;

→ 5 more mm passive material to
   help mechanical handling;

→ 10 x 64 strips readout = 640
   channels x each sensor.

96 cm (Area Attiva)

Strip n°1

96 cm (Area Attiva)

103,5 cm (Taglio)

Pitch adapter su silicio

Strip n°640

102,5 cm (Taglio)

Hardware: Hybrid and ADC

→ **Hybrid board:** Tuesday issued the formal purchase order.

Estimated time of arrival of hybrids: within end january/mid february.

→ **ADC daughter board:** Ordered within same hybrid board order procedure.

Estimated time of arrival of ADC daughter board: within january.

We keep the option of directly connecting ADC board to Hybrid board or having flat cables to connect within 1-2 m from Hybrid board to have more flexibility for mechanical/electronic noise problems.
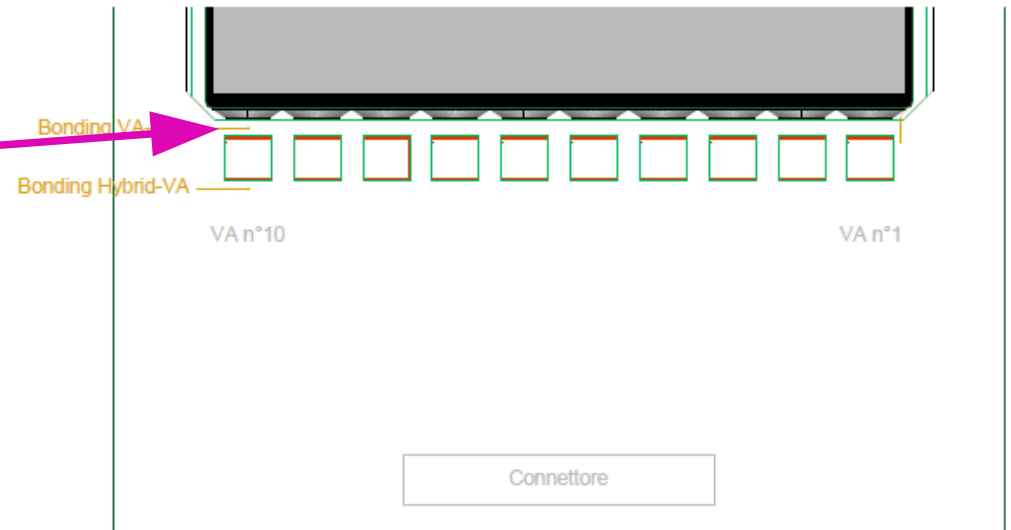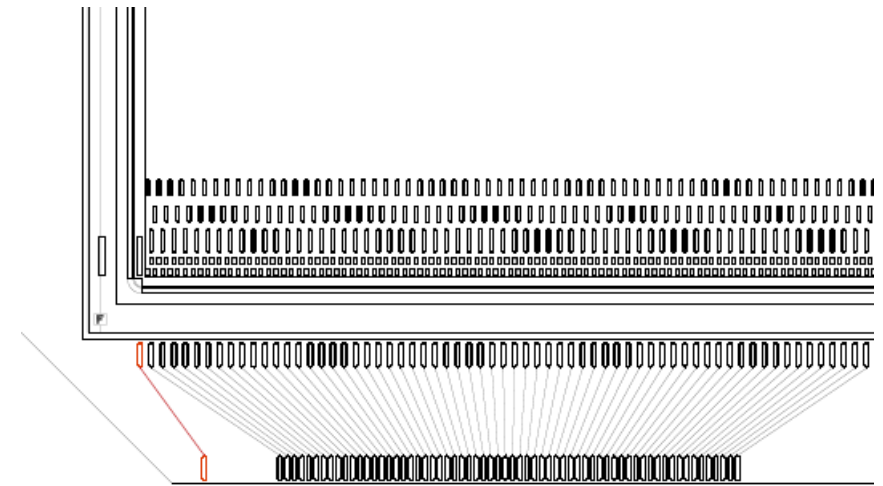
Hardware: Hybrid

→ **10 VA140 chips (91 μm pitch among channels)**

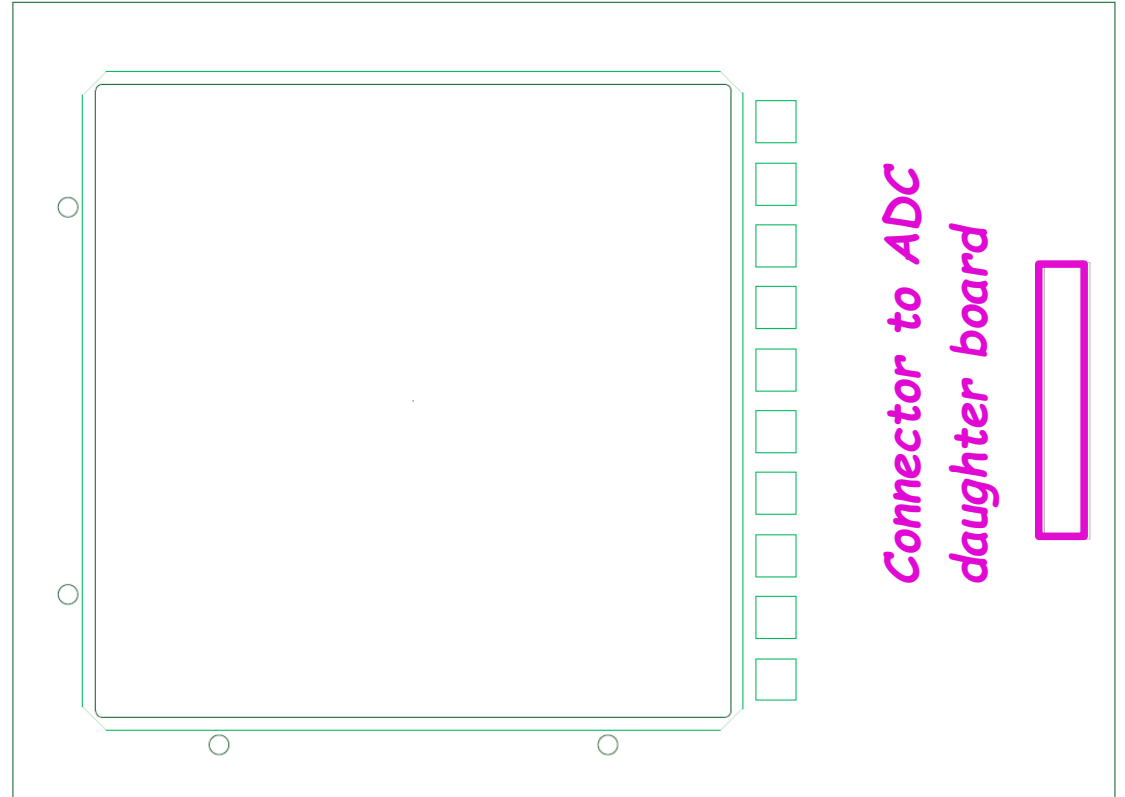**Pitch adapter on Silicon**

Hybrid PCB as support for sensor

Only one bonding:

VA-Si

Bonding VA-
Bonding Hybrid-VA

VA n°10   VA n°1
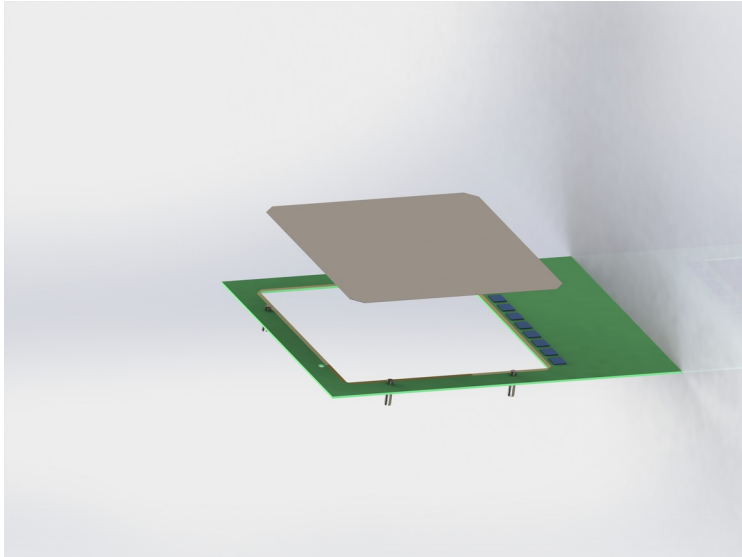
Connettore

FOOT Collaboration Meeting – 4/6 december – Roma
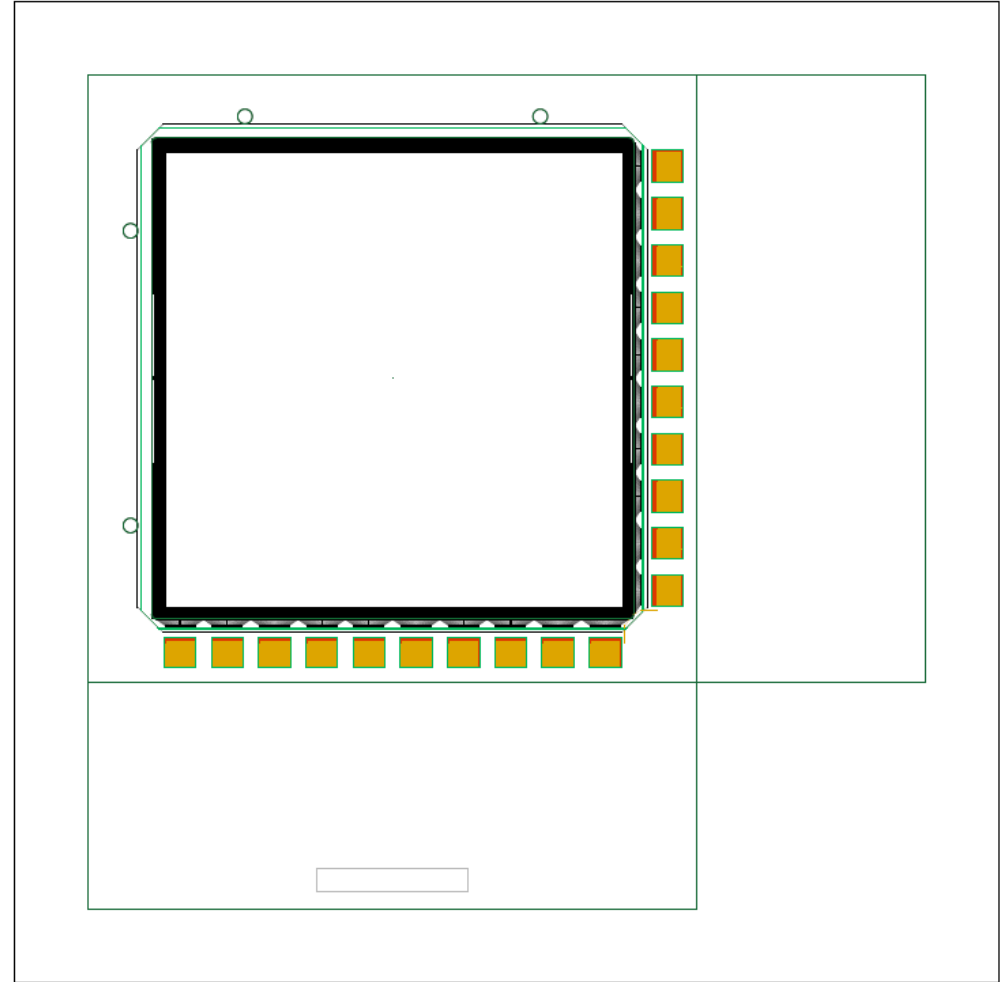
Hardware: Support structure

→ **Hybrid PCB as support for sensor.**

→ **Border wide enough for glueing inactive sensor border.**
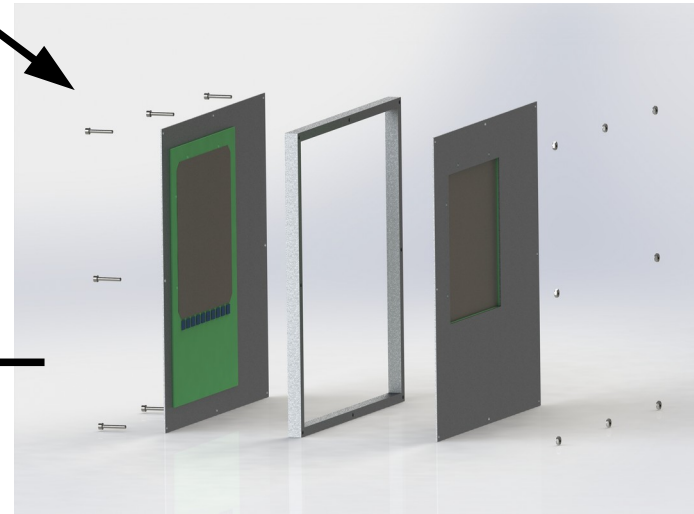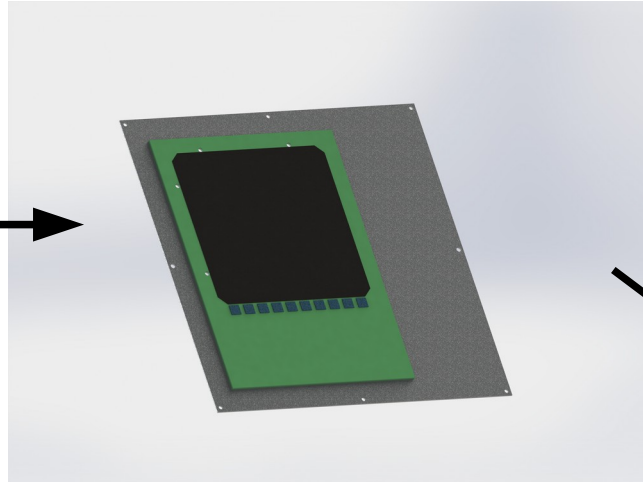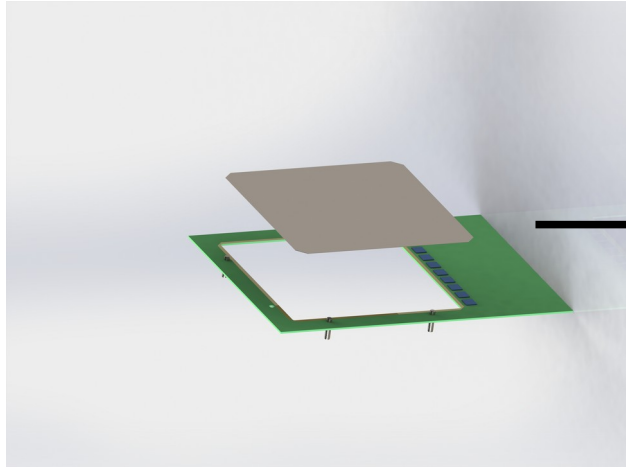

Connector to ADC daughter board
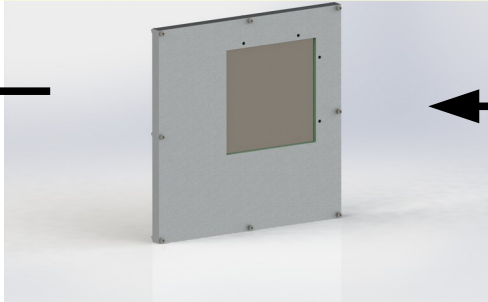
Hardware: x-y plane

→ **Perpendicular planes.**

→ No biadhesive kapton. Defining a mechanical fixing between the two support structures.

→ with this solution the substitution of one sensor in case of problems would be easier. Also less passive material in the beam line.
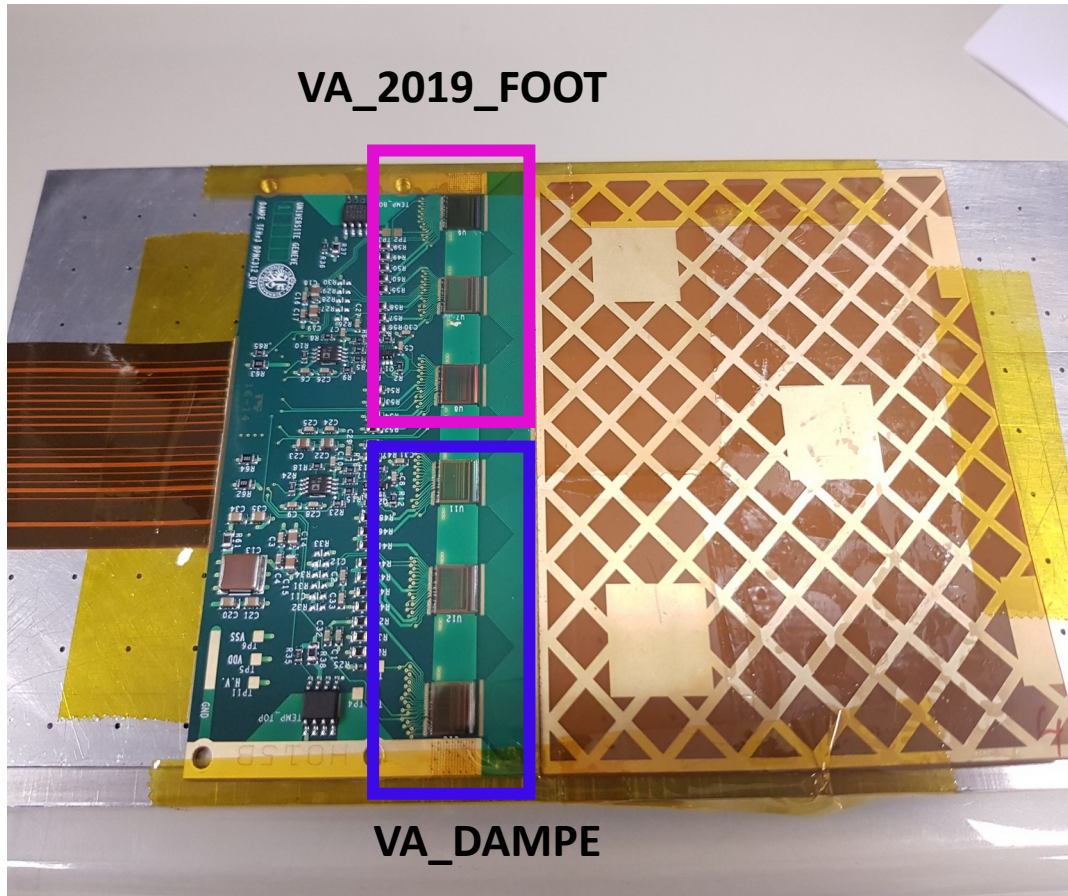
Hardware: Support structure

Light shielding by back of sensors

MSD

→ **Pitch adapter on PCB**

Waiting for new hybrids: test

Used old 6 chip hybrid board to glue 3 new VA140 + 3 old VA140 chip.
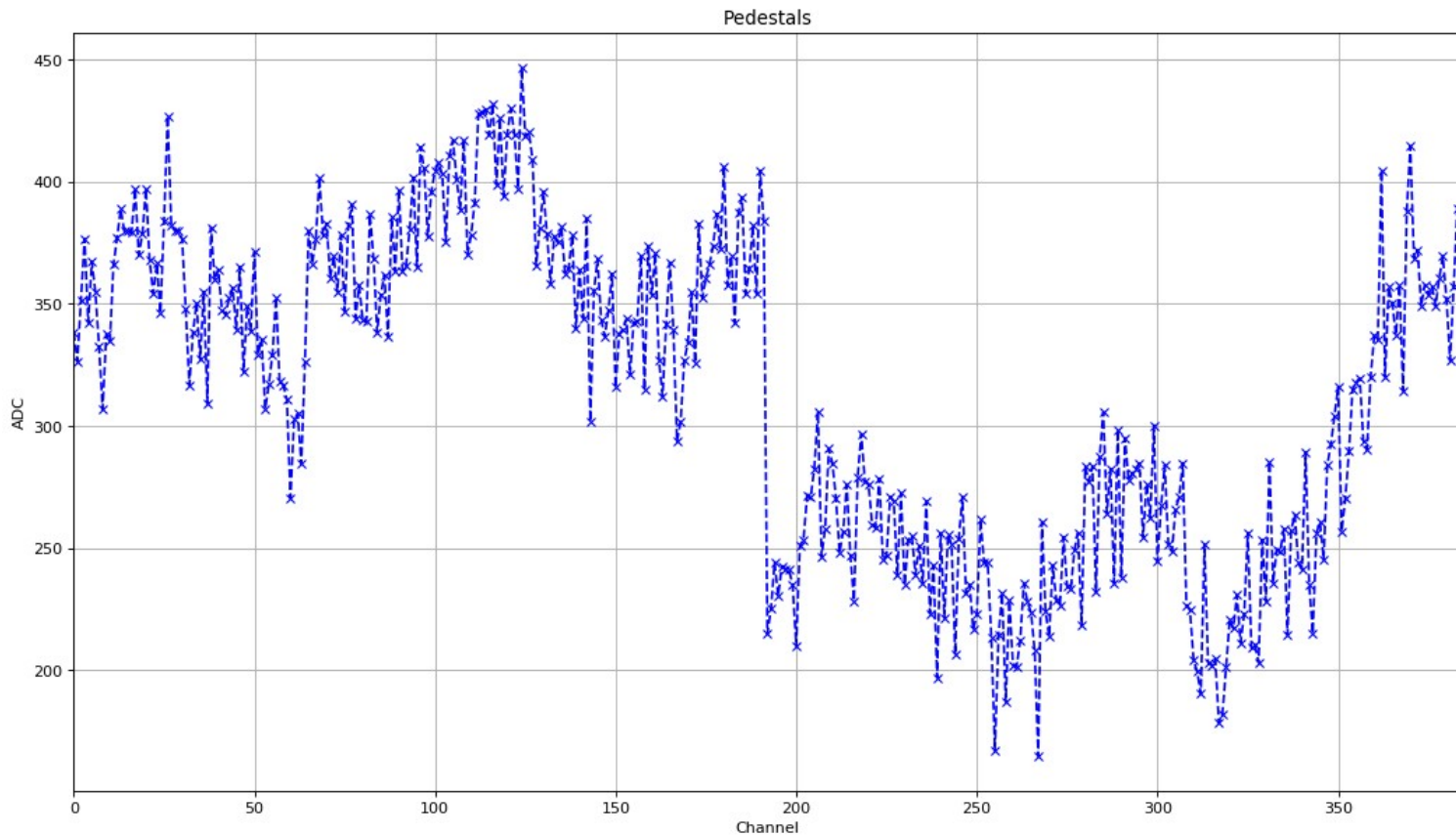

VA_2019_FOOT

VA_DAMPE

Test for differences in electrical behavior under same conditions.
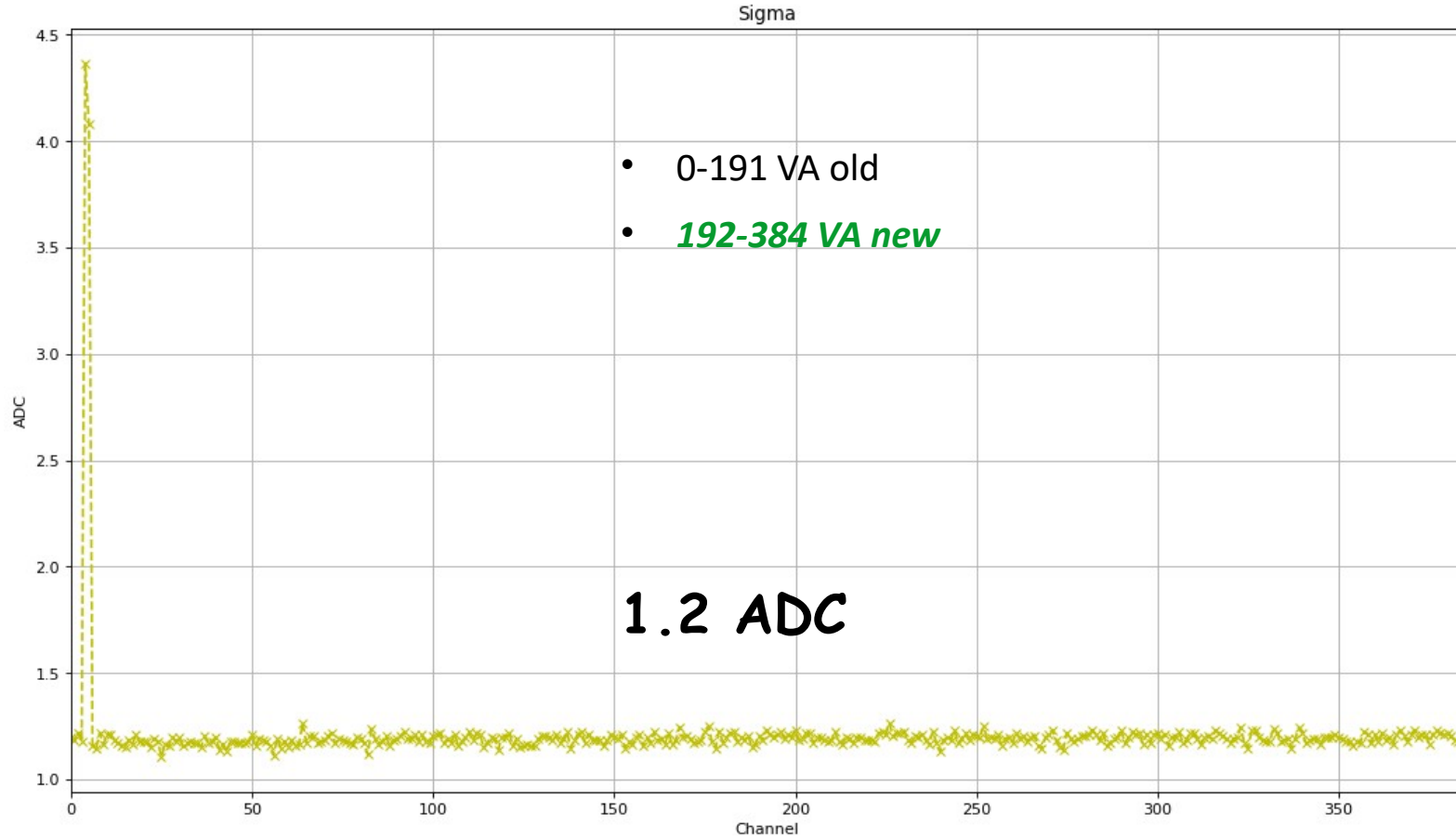
For readout used old DAMPE readout box (one hybrid only)

Hardware: new VA140 pedestals

- 0-191 VA old

- 192-384 VA new

- Different baseline between old and new VA groups due to different ADCs (each ADC readout 3 chips)


Pedestals

Hardware: new VA140 noise

- 0-191 VA old
- *192-384 VA new*

1.2 ADC

Firmware: readout 10 VA hybrid

- Given schedule with all pieces in our hands in november 2019 **(sigh)** we **modified existing DAMPE DAQ** system in order to be able to test the first 10 VA140 hybrid independently from FOOT DAQ development *(with some help from a Geneva University engineer).*

- **First test of the two readout Firmware** using the same sensor (DAMPE sensor with hybrid with 6 VA).

- Different baselines between first and second groups of 3 VA140 due to different ADCs.

- Everything compatible with variation between two consecutive readouts.

Pedestals Difference
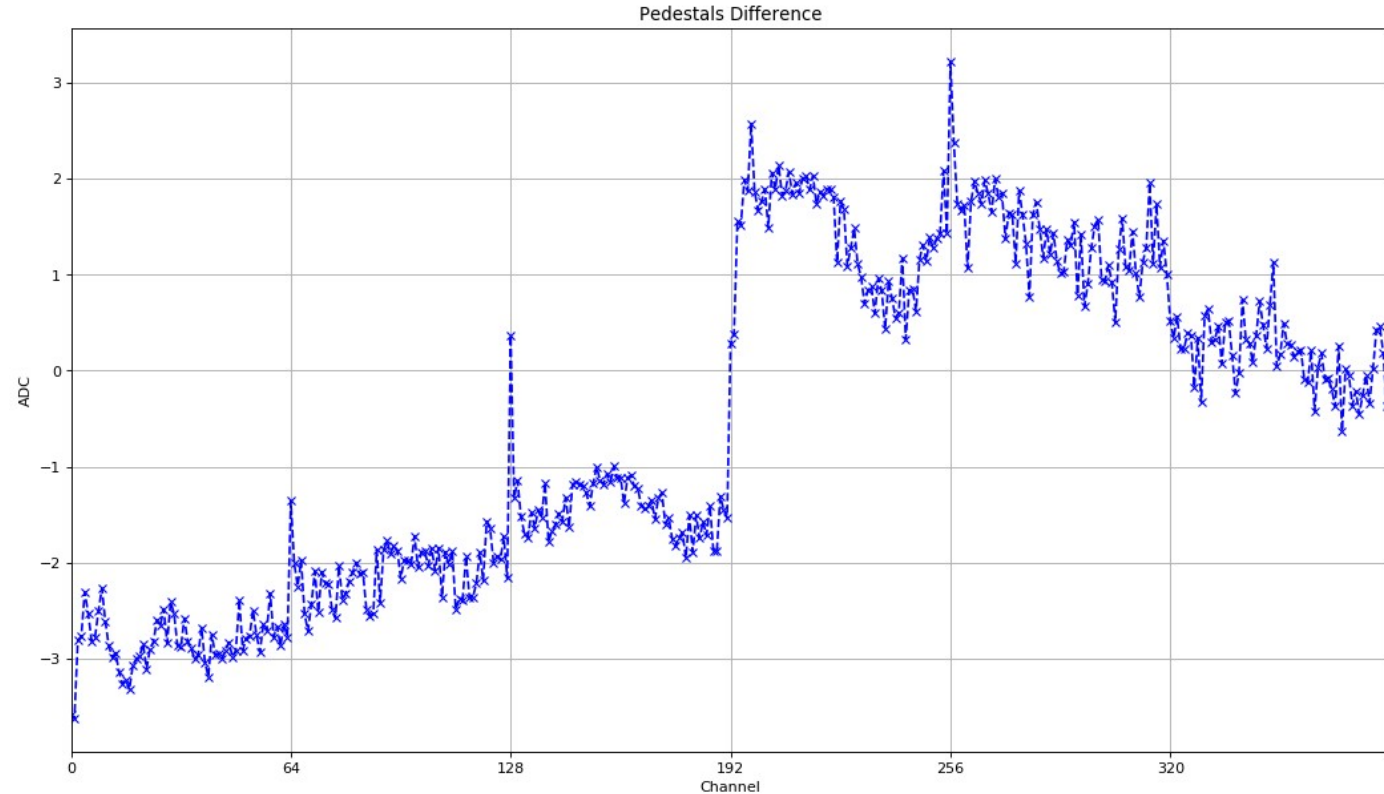
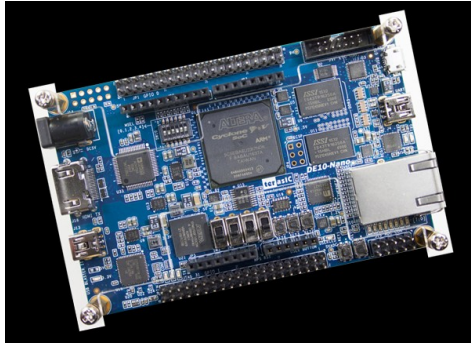# Firmware: readout 10 VA hybrid
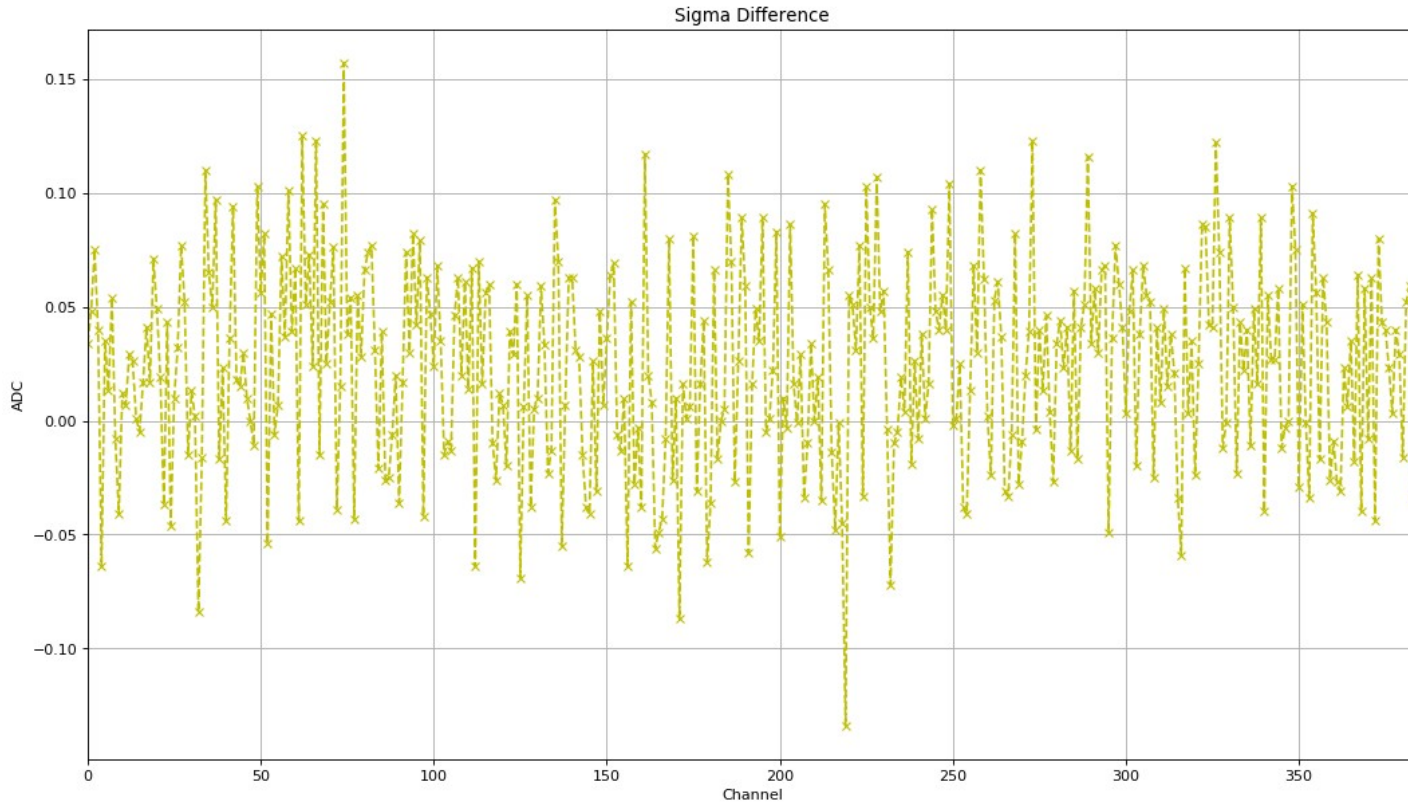
We have a solution to test new hybrids as soon as we have them.

Data Acquisition

We are working with TERASIC DE10 nano evaluation board as interface between front-end VA140 readout chip and general FOOT DAQ.

Currently working on the interface between new hybrid and TERASIC.

Hopefully a first functional working version for this part by end of january.

Next 2020 Test beams

→ **We need to test on beam the first x-y prototype plane as quickly as possible on Proton and/or Carbon Beam (Trento/CNAO).**
Test some final detectors (sensor + readout chip + DAQ) on proton/carbon beam at various energies to extract detector parameters.

→ We need to test the full MSD (three planes + external reference) to measure tracking capability and Multiple scattering issues. (proton beam somewhere)

→ If possible also to start understanding how fragmentation behaves in the MSD and how to tag it.

Waiting for new hybrids: tests

- Bond hybrid with 3 new VA140 chips and 3 old VA140 chips to a DAMPE sensor.

  (today or tomorrow)

- Test in lab with sources and in test beam next week in Trento to validate new VA140 batch performance.

Papers, Conferences & notes:

→ **Started a study on MSD cluster reconstruction to optimize parameters (Gianluigi). It should became at least a technical note.
It will be complemented by the data taken (hopefully) next week.**

→ **Proceedings of the 2019 IFAE poster submitted last week (Gianluigi).**

→ **Abstract for AccApp 2020 (IAEA + ANS @ Vienna) conference submitted (LS).**

→ **Beam monitor calibration with MSD paper in progress (see Yun).**

Wafer and sensor: