Status of MSD subsystem

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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.

→ **Readout Chip (VA140):** order procedure (210 k€, HERD, POX FOOT) on track.
Hopefully within june Giunta will approve formally procedure.

Estimated time of arrival of chips: before august.

Hardware: Sensor

→ Sensor type choice →
Standard single-sided.

Single-sided silicon detector (SSSD):
→ 150 μm thickness.
→ 96x93 mm^2 active area.
→ strip pitch: to be precisely defined together with Hamamatsu for maximizing surface coverage maintaining same strip number.

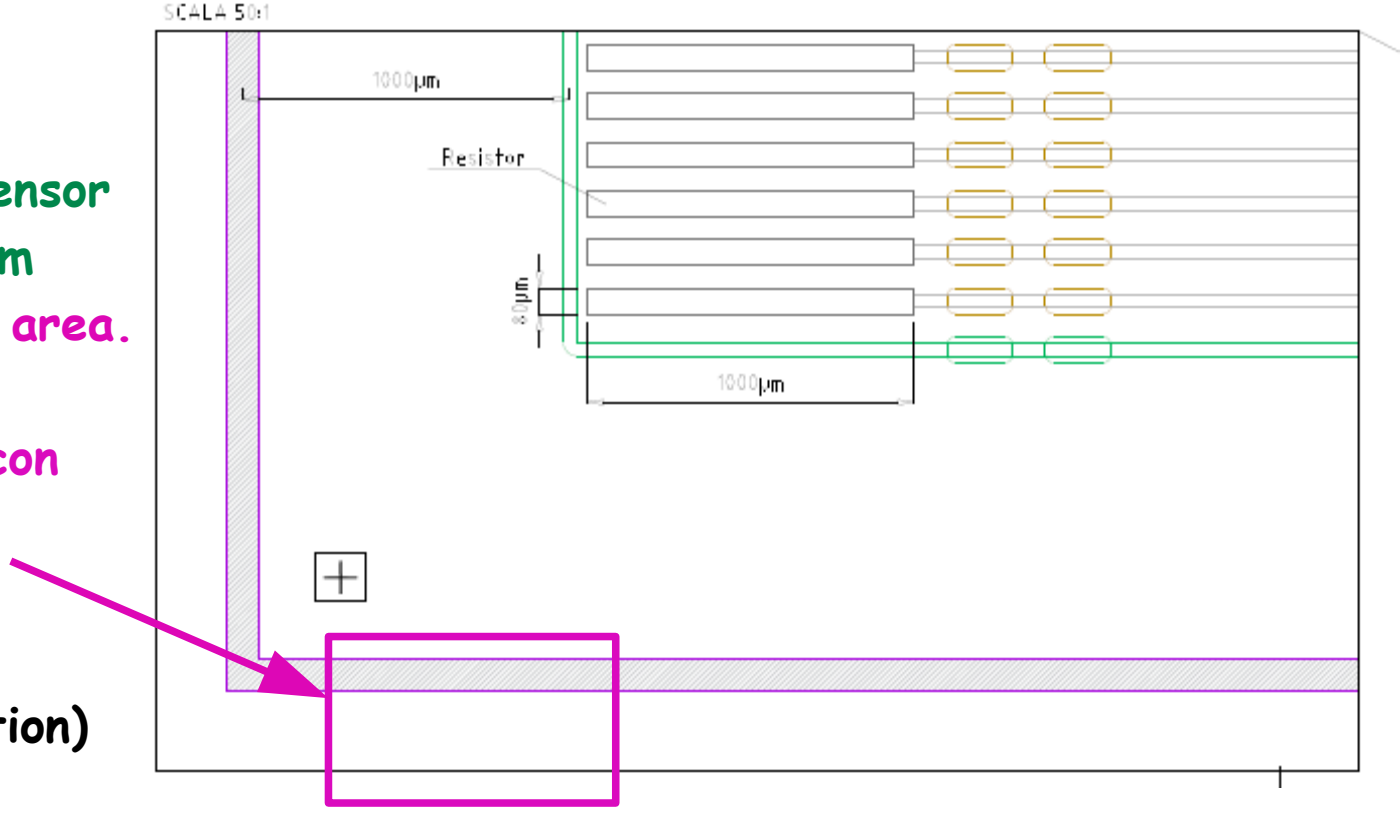
Hardware:Sensor

→ Single Strip Resistors implemented directly on sensor active area → loss of 3 mm

→ small asymmetry in active area.

Additional 5 mm inactive silicon area outisde guard ring:
width: 103 mm

(better glueing and manipulation)

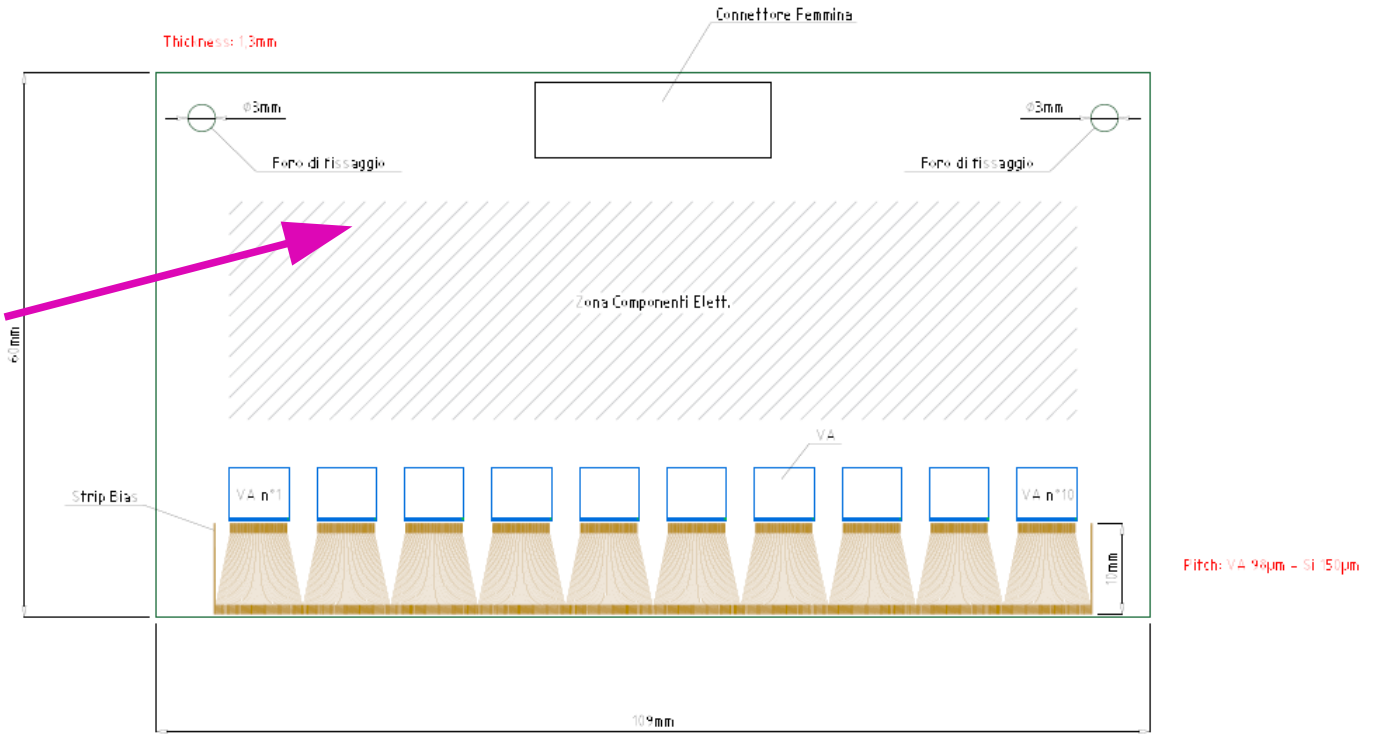


Hardware: Hybrid

→ 10 VA140 chips (91 μm pitch among channels)

Pitch adapter on PCB

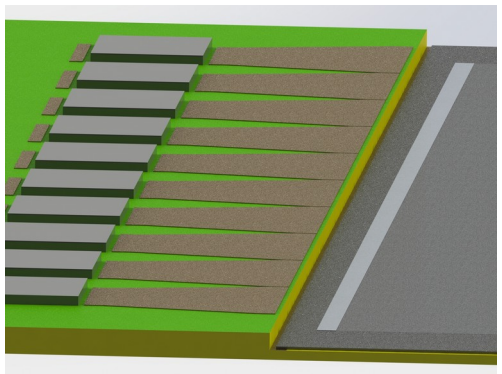
(two bonding, one of which VA-PCB and the other PCB-silicon)

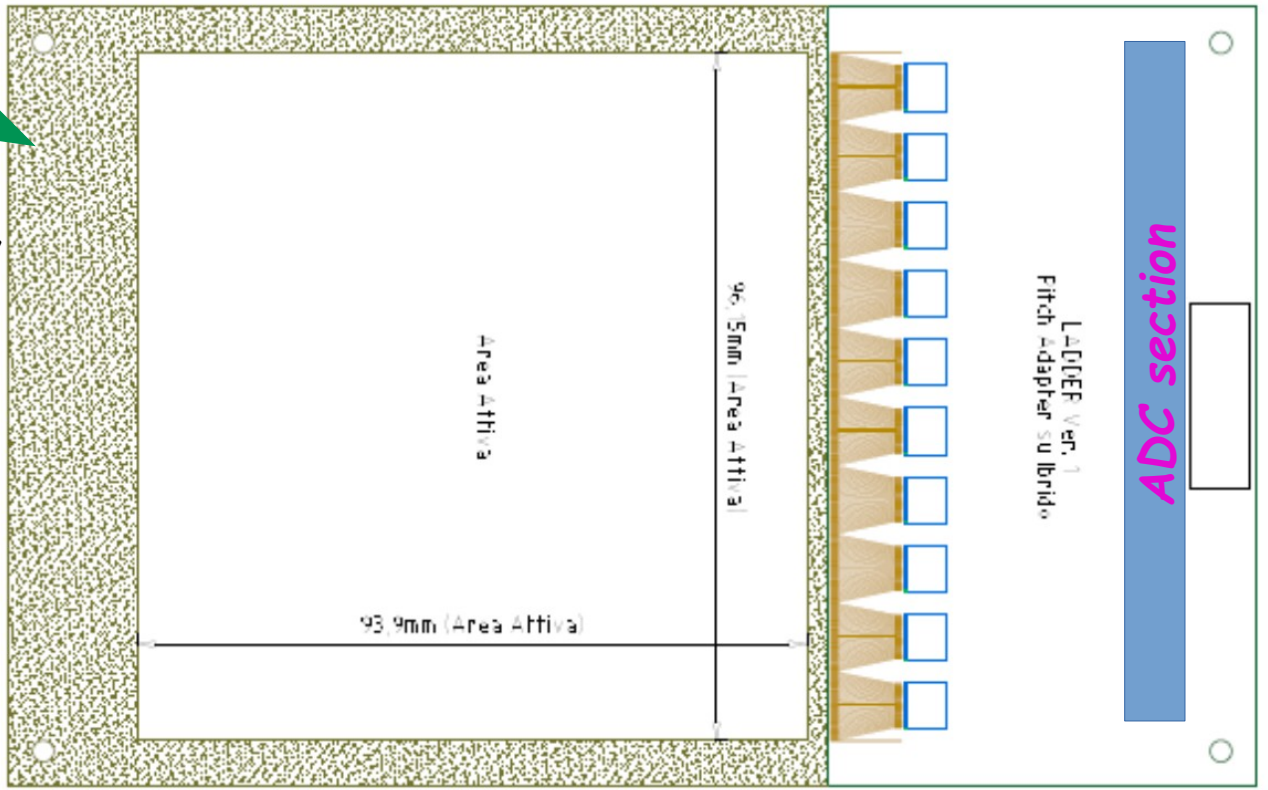


Hardware: Support structure

→ Carbon fiber support or PCB.

→ Border wide enough for glueing inactive sensor border, partially with conductive glue to assure easy biasing of the back plane of the sensor.





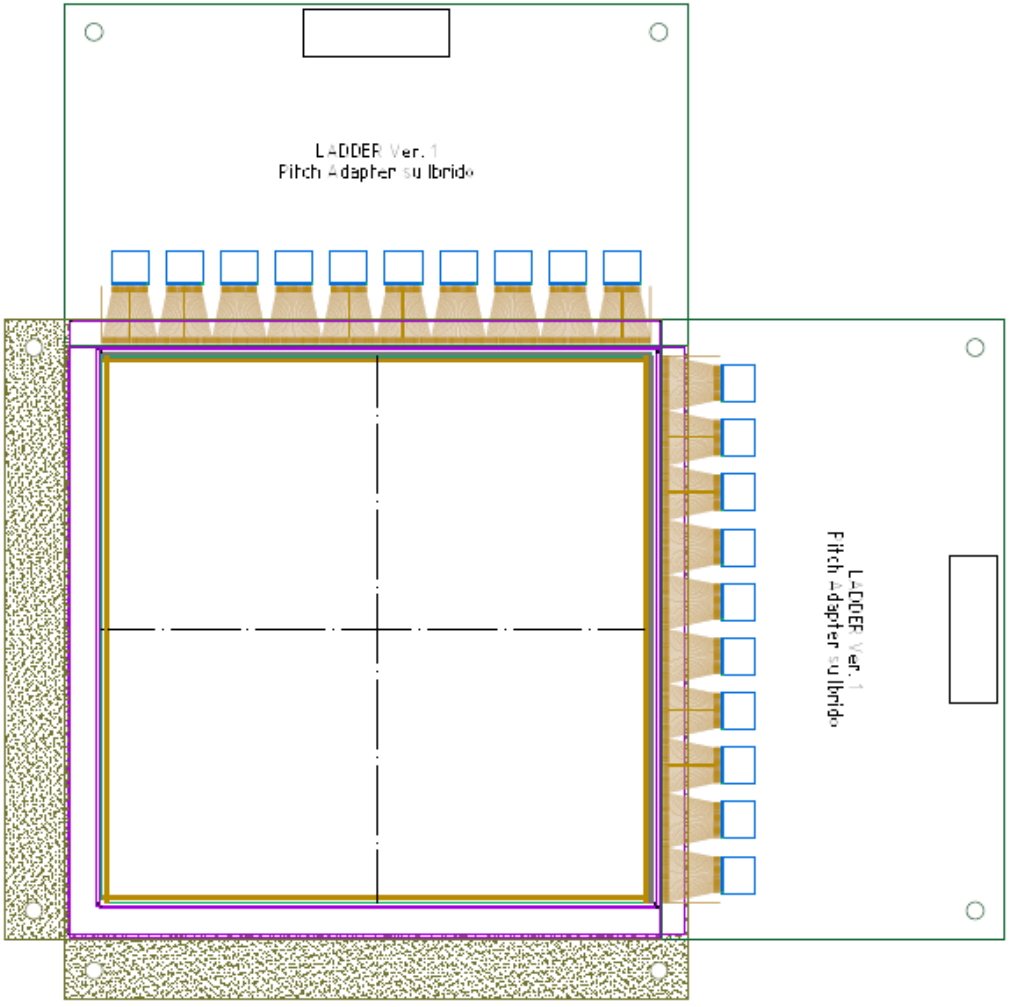
→ Pitch adapter on PCB

Hardware: x-y plane

→ **Perpendicular planes.**

→ No biadhesive kapton up to now. Trying to define a mechanical fixing between the two support structures (precision pins ~ 100 μm uncertainty)

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



Hardware: sensors' light shielding

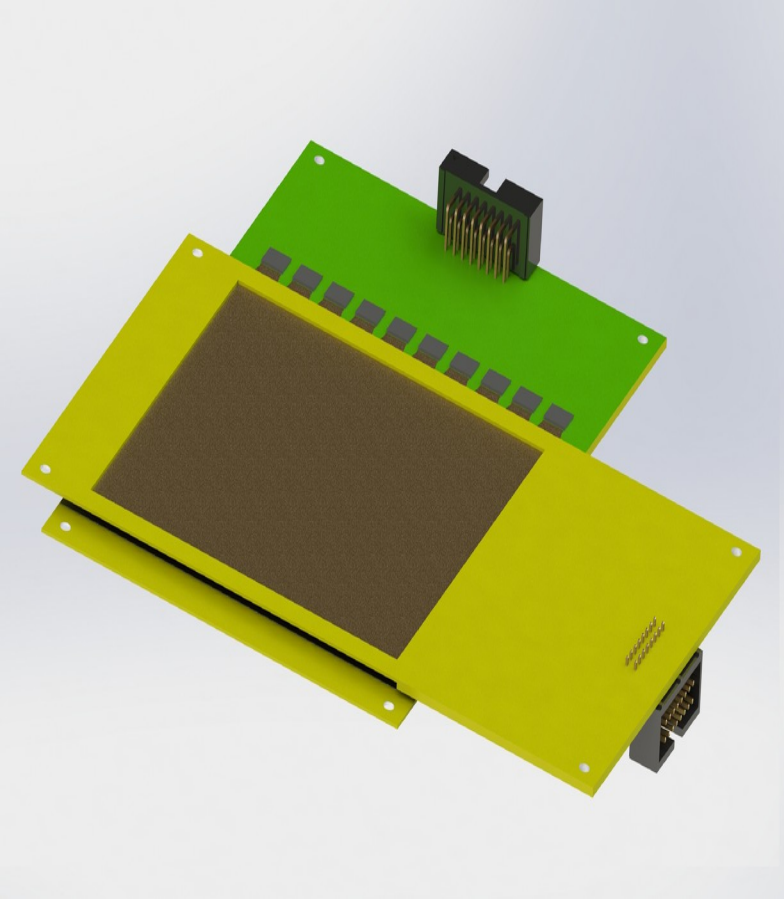
Traditional solution: enclose all MSD in a light tight box.

→ put more material on the beam line and have a more complicated mechanical setup.

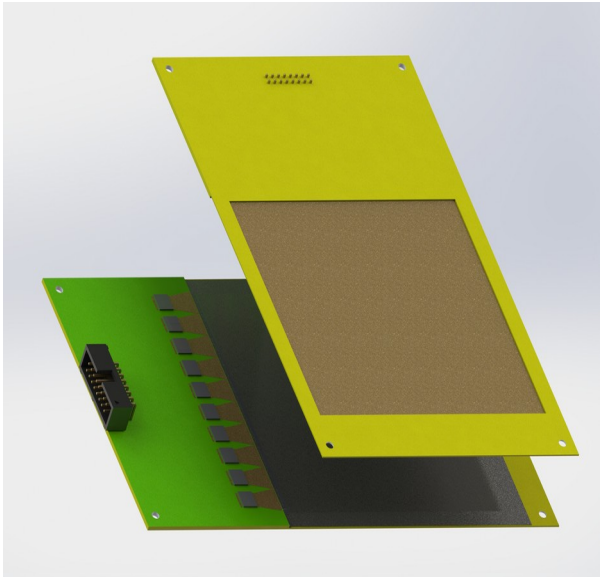
Innovation….. (still under study)

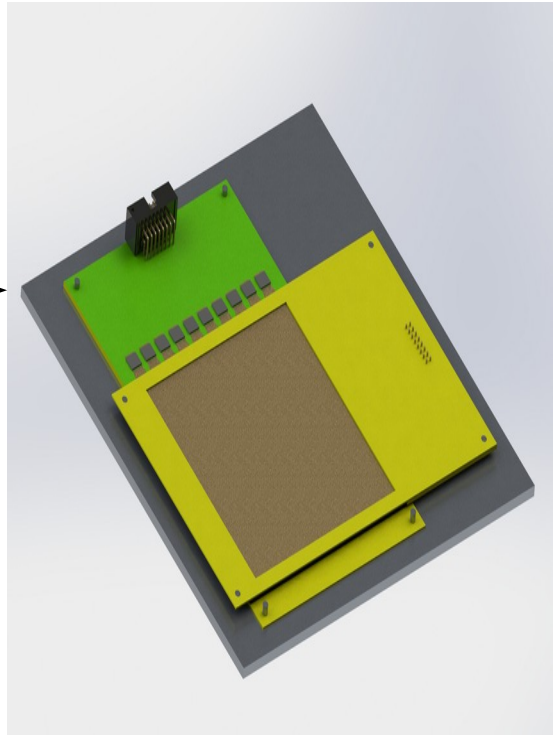
→ front planes face-to-face to seal from light using them.

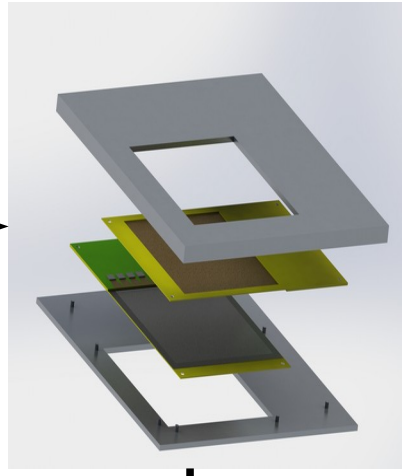
We will start some tests beginning of next year using existing DAMPE sensors.

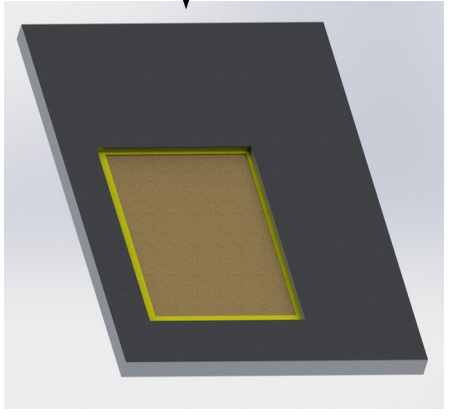


Hardware: face-to-face solution





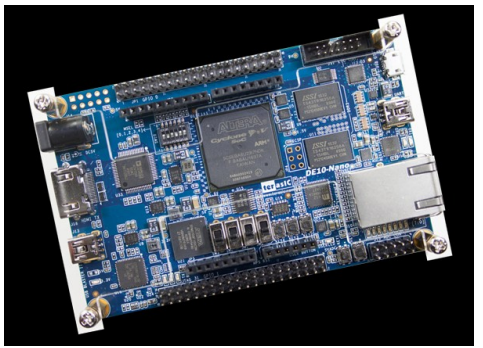




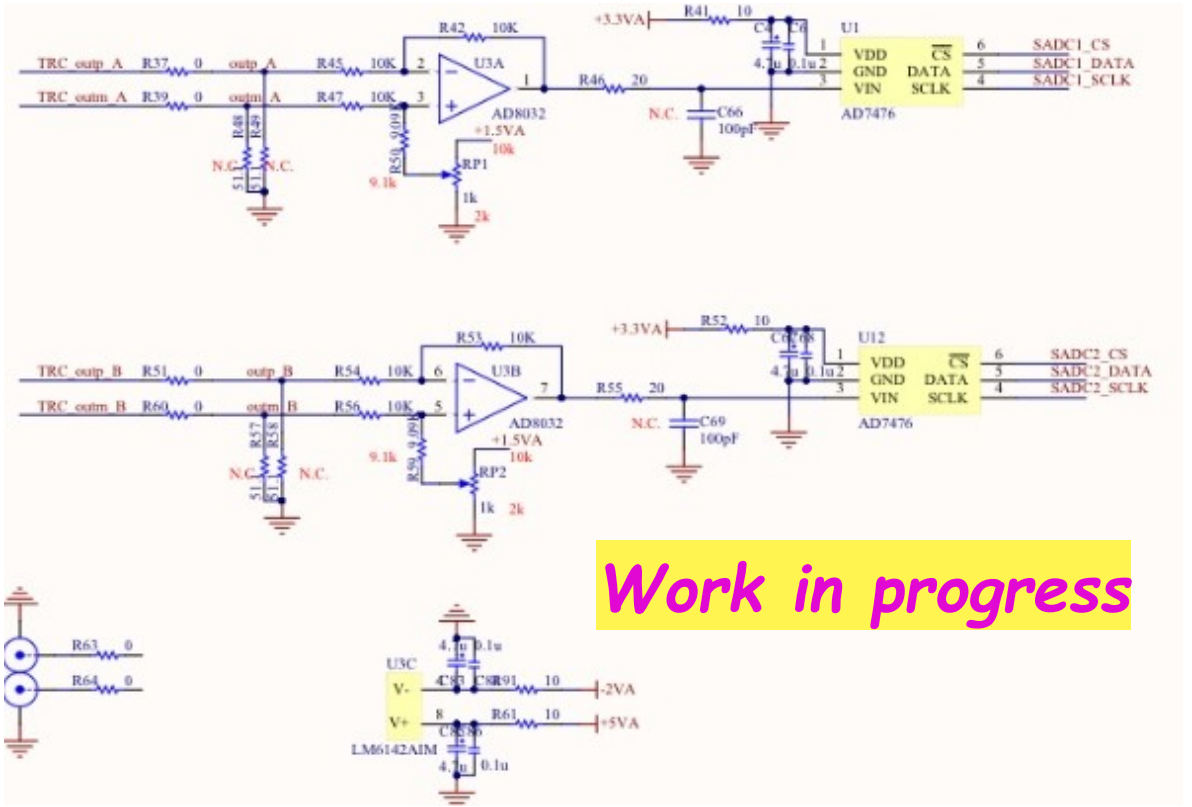
Each x-y plane sealed from light using sensors' backplane (metallized)

Data Acquisition

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



We have designed a custom board to convert from analog to digital VA140 signal.



FOOT Collaboration Meeting – 5/7 june – Pavia

Past 2019 Test beams

→ CNAO (february 2019): carbon beam

Test of 300 and 150 μm thick sensors with VA140 readout chip. Same goal of december 2018 Trento test with protons.

→ Trento with Beam Monitor (march 2019). Goals:

A) Primary: to furnish a telescope to Beam Monitor to calibrate that device.

B) Secondary: to study 150 μm thick sensor (Micron UK) with VA140 readout chip for cluster size, saturation, bias charge collection and cluster size dependence.

Test Done…. Analysis in progress. Part in common with BM has higher priority.

Next 2019 Test beams

→ **Asked for a beam period in Trento autumn 2019.**
Test some final detectors (sensor + readout chip + DAQ) on proton beam at various energies to extract detector parameters.

→ **Test at CNAO alone or with the full FOOT with carbon ions with final detectors, if possible in 2019, at latest before spring 2020.**

→ **test with assembled MSD as soon as possible to measure offsets, rotation, spatial resolution before final mounting on experiment (to be defined where and With which beams: Trento, LNF..)**

Papers & notes:

→ Poster at FDFP2018 : Full Collaboration paper. Accepted, corrected proofs.
Evaluation of double-sided silicon microstrip sensor for the FOOT experiment.
https://doi.org/10.1016/j.nima.2018.10.190

→ LGAD paper: Technical paper concerning LGAD performances on ion beams.
Most likely submitted before end of summer)
(in progress, on hold due to other analysis higher priorities)

→ Started a study on MSD cluster reconstruction to optimize parameters (Gianluigi). It should became at least a technical note.