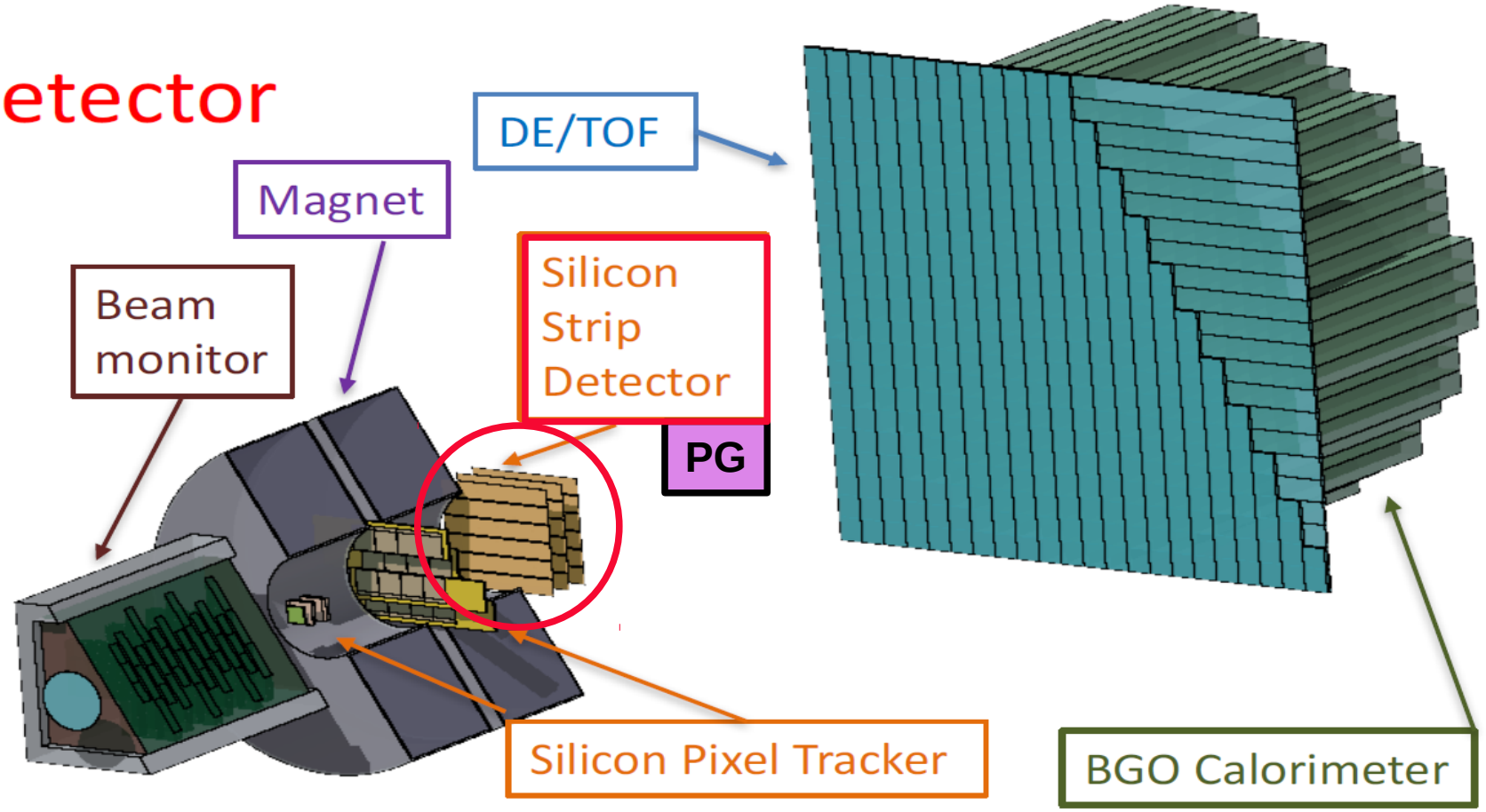
Status of MSD subsystem

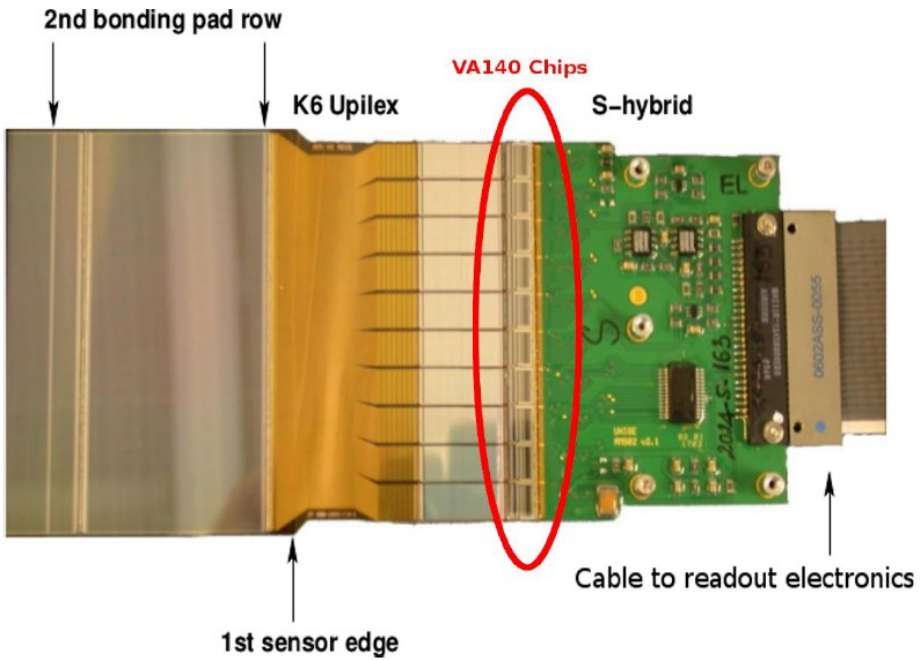
L. Servoli

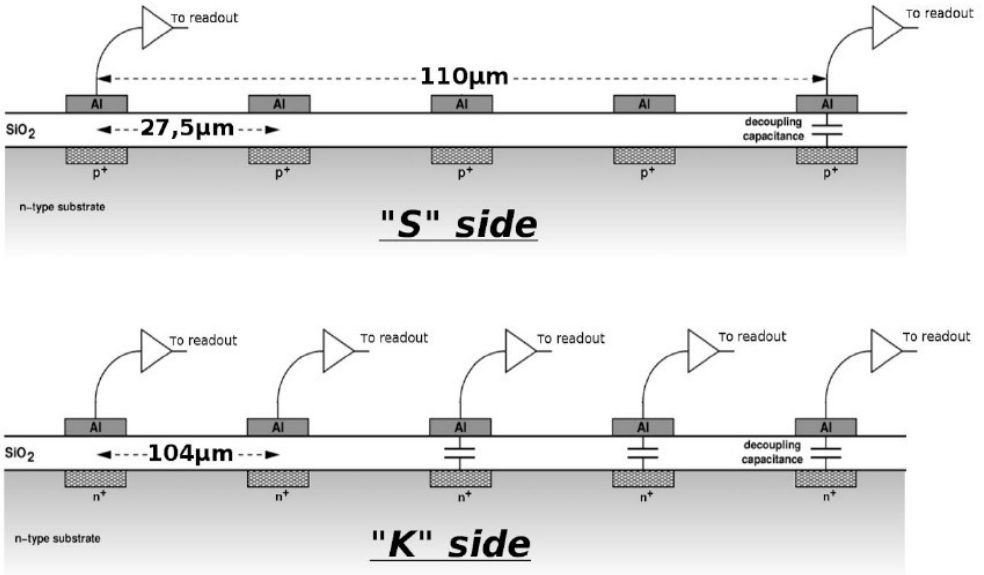
FOOT Meeting con referee – 28 agosto – Roma

FOOT Detector



Test in Trento 2017

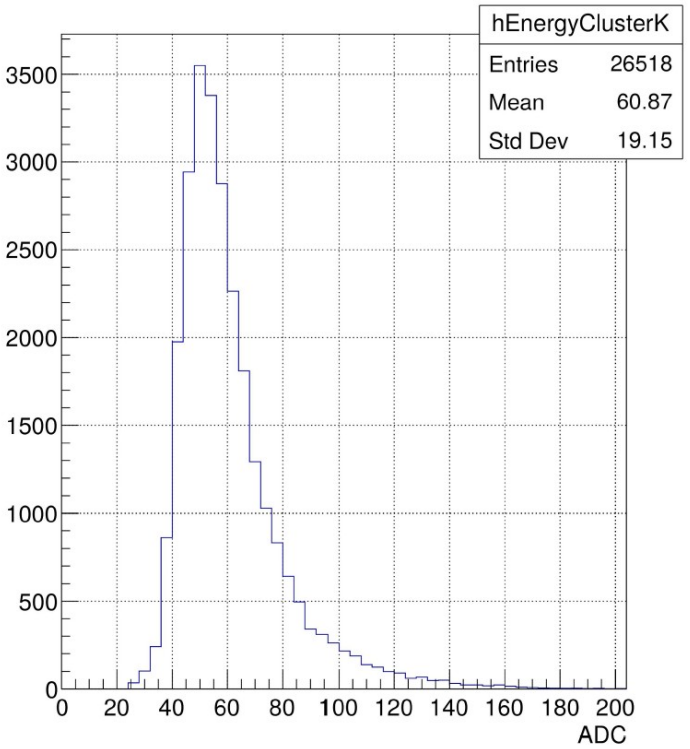




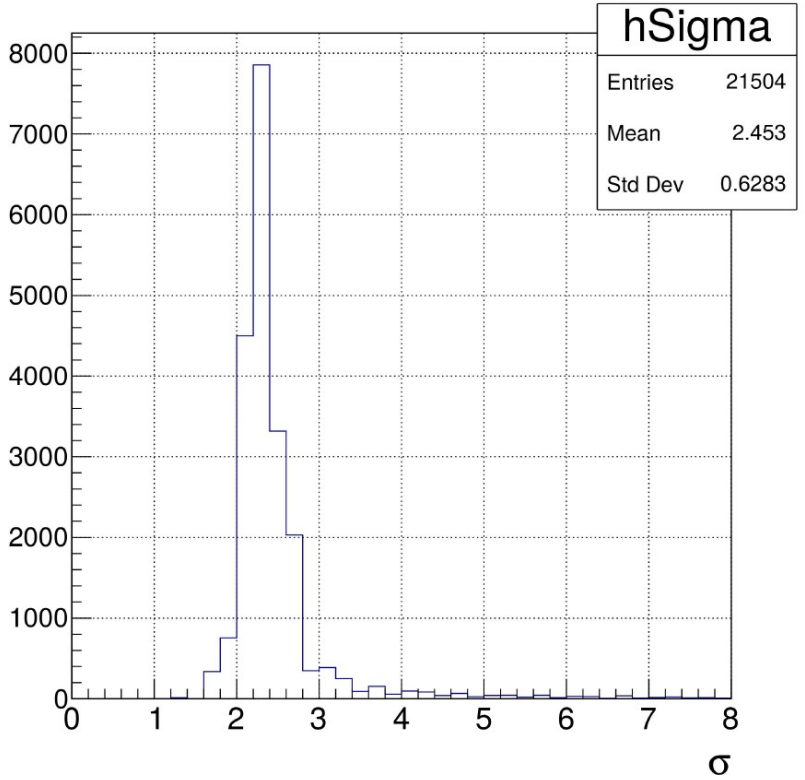
Double sisded but S-side used only for event selection

All other results fron K-side analysis

Test in Trento 2017



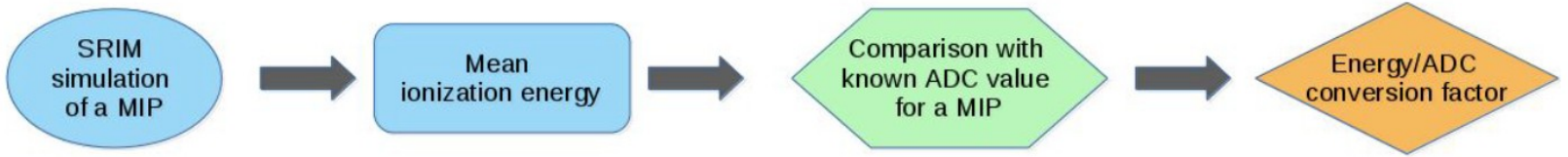
Cluster signal: Landau with values as expected after calibration factor applied



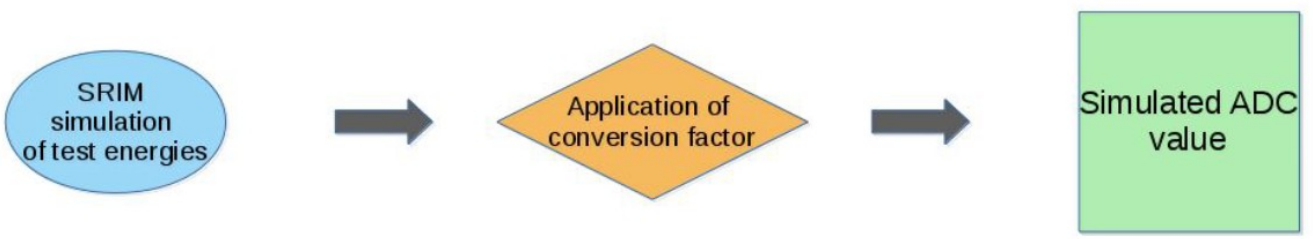
Cluster width: limited number of strips → with 150 μm we expect the same width or less.

Sensor Simulation

Step 1



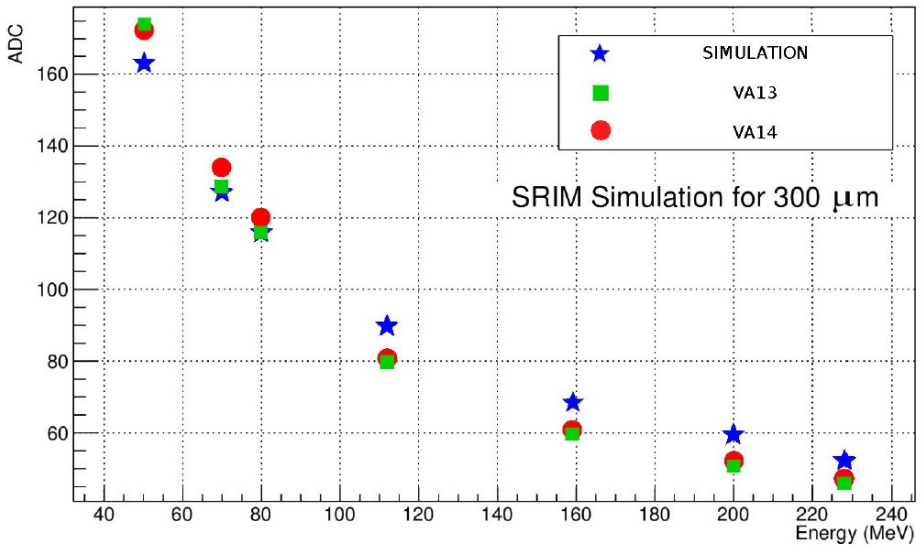
Step 2



Step 1: find the Energy / ADC conversion factor for sensor under test (300 μm thickness)

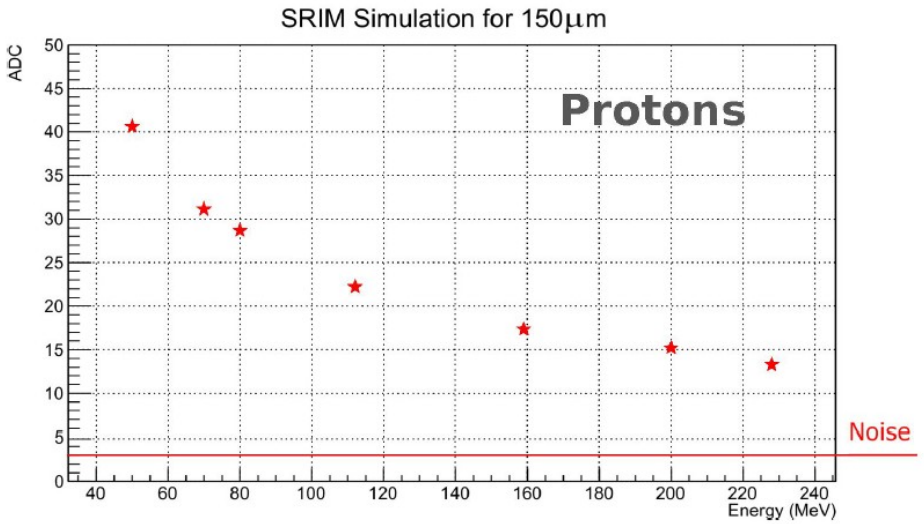
Step 2: simulate sensor with 150 μm thickness with same readout and different beams (protons and carbon ions) at different energies.

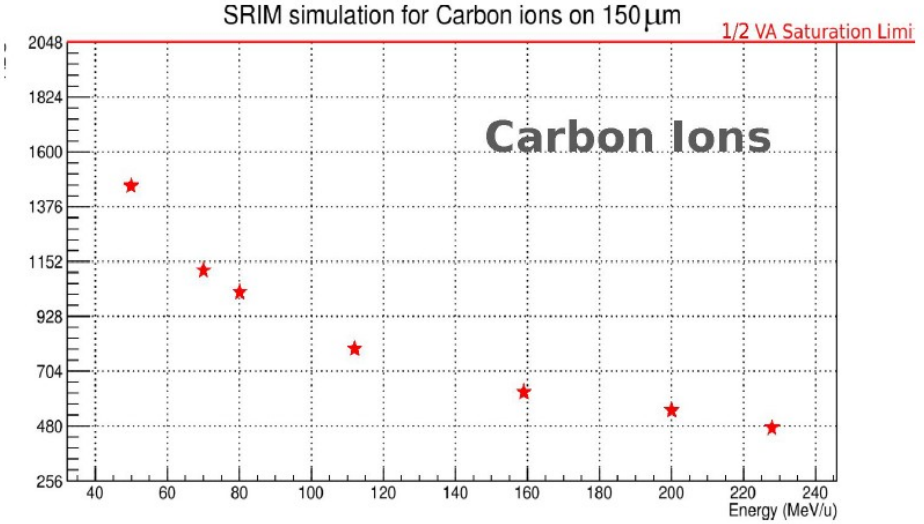
Results



Validation of simulation with experimental data taken at various proton energies. Agreement within 10%.

Results





Simulation for 150 μm thickness. Protons (lower red line is noise limit) and Carbon ions (upper red line is 50% chip dynamic range).

Sensors

→ Sensor type choice single-sided (SSD)

currently available from Hamamatsu, 150 μm thickness, 95x95 mm^2

Solution: two planes glued together (30 μm biadhesive kapton) with perpendicular coordinates. 300 μm for each measuring plane → 900 μm for three x-y layers.

→ already existing;
→ no saturation of readout channels (see poster at FDFP 2018);
→ easier assembly of readout chip;
→ more silicon → better dE/dx measurement

Estimated Cost: 65 k€ (could be splitted between 2019 and 2020)

Readout chip

→ Readout Chip : VA140 (Ideas)

Initial estimate 15 k€ for buying 50 pieces. But minimum number 100 pieces → 30 k€ needed unless other partners join.

Chips tested last year in Trento and LNS with 300 μm thick double sided silicon detectors. Verified that we have no saturation even for low energy ions. (see poster at FDFP2018, G. Silvestre et al., now submitted to Nucl. Inst. Meth. A).

We learned that Ideas has changed his price list :(

Now they want to charge the restarting of the production line, means: 200 k€ + VAT for 500 pieces.

Readout chip

How to tackle this new situation…

1) Finding partners: we have found multiproject scheme to approximate Ideas requests:

→ Exp. POX (ASI): 30 k€ financed for 2019 to obtain VA140 chips.

→ Exp. HERD (CSN2): 70 k€ to be discussed next 10-15 september;

→ Exp. GAMMAMEV (CSN2): 30 k€ to be discussed next 10-15 september;

→ Exp. FOOT (CSN3): 70 k€ to be discussed next 17-22 september, when CSN2 decisions already known (we should obtain 200 chips).

If all is confirmed we start discussing with Ideas to obtain a discount (no VAT).

Readout chip

→ Readout Chip : VA140 (Ideas) Why other solutions are difficult to find?

We started thinking about possible alternatives.
Not easy given the requirements in dynamic range (± 200 pF) and channel pitch (100-120 micrometers).

We try to investigate the referee suggested NUMEN solution in the coming weeks.

However we would need to verify with experimental data that this solution is suitable for our case.

It means to obtain several chips, to bond them to a sensor, to do a carbon and proton test beam and analyse the results. Several months at best.