

Steps towards LGAD simulation and production

WP 7, task 7.2 & 7.5

Deliverables e Milestones

D7.3 (M18):

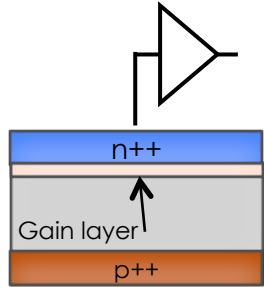
LGAD simulation (results of LGAD simulation with choice of doping profile and position of the gain layer for pads and pixelated detectors. Identification of optimal dopant as alternative to boron for best radiation resistance. Choice of design between electron initiated or hole initiated avalanche)

D7.8 (M46):

LGAD characterization (characterization for the LGAD detectors in terms of charge collection and time resolution with different methods. Technological recommendation for the future productions)

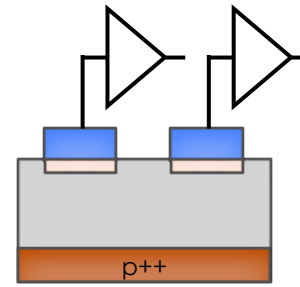
LGAD sensors: gain and pixelation

Works well in pad detectors, does not work in pixelated read-out



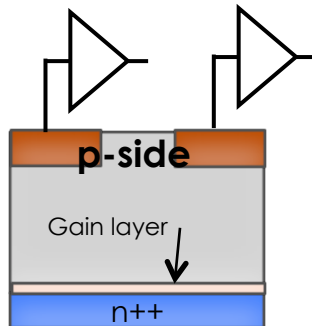
Works well

(needs noise optimization)

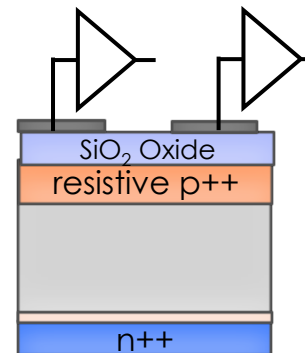


Does not work

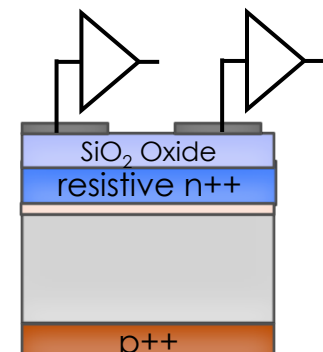
Current ideas under study:



**p-in-p, Ohmic side
segmentation**

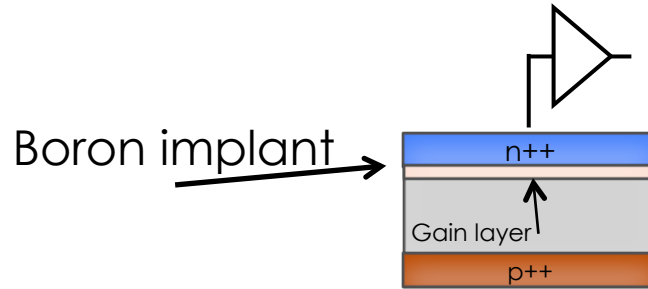


**AC segmentation via
resistive n++/p++ layer**



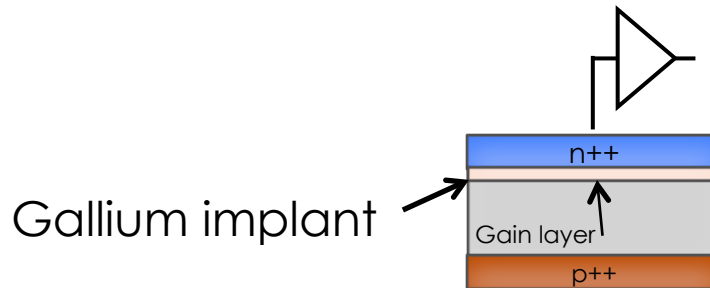
LGAD sensors: radiation hardness

Boron disappearance reduces the gain



Not radiation hard

Current ideas under study:

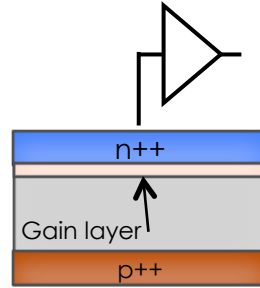


**Use gallium instead of Boron for
the gain layer**

LGAD sensors: Timing and low material budget applications

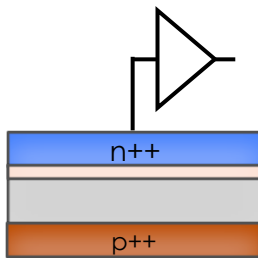
Up to now, only 300 micron thick sensors

300 micron sensors

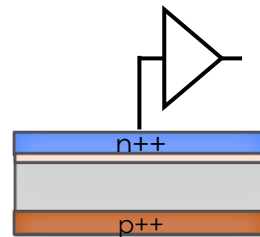


Too thick

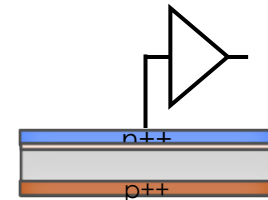
Current ideas under study:



FZ 200 micron



Epi 100 micron



Epi 50 micron

LGAD Simulation: D7.3, in eighteen months (M18)

- 1) **Tune the low gain avalanche mechanism:** optimization of the doping profile of the n+- and p- implantations to minimize noise.
- 2) **Gain in highly segmented sensors:** Investigation of the best configuration (n-in-p, p-in-p, etc.) to allow for reliable gain in highly segmented sensors.
- 3) **Radiation damage effects:** study of charge multiplication layer, to overcome the observed gain drop after irradiation.
- 4) **Development of thin LGAD detectors:** design the best sensors for timing and low material budget applications.

LGAD Simulation: D7.3, in eighteen months (M18)

The different design evolutions have already started, both at FBK and CNM. Currently these designs are progressing independently.

A delicate aspect:

FBK and CNM will develop different solutions to these problems. In this WP we should foster and respect this diversity, while obtaining the results we seek.

LGAD Testing: D7.8, in 48 months (M48)

It's a long way down the road.

Many institutions are already in position to test sensors, so this item is not on the critical path