Spatial resolution measurements for AC-coupled LGAD sensor

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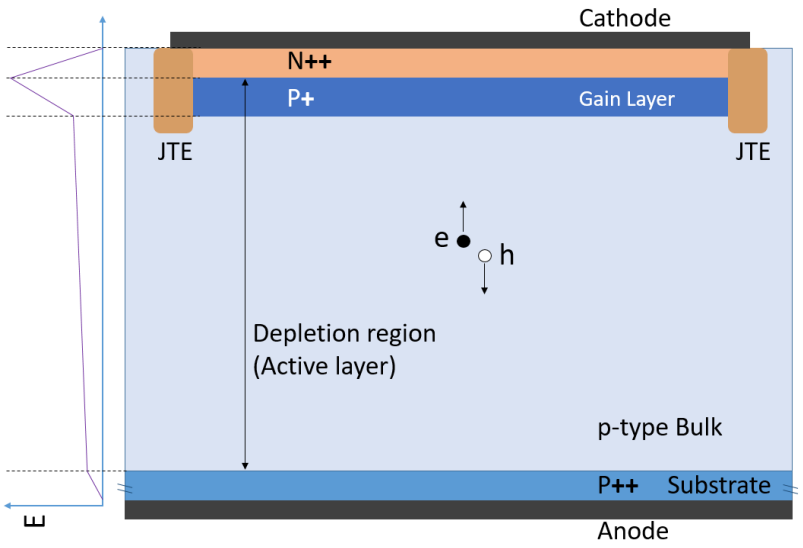
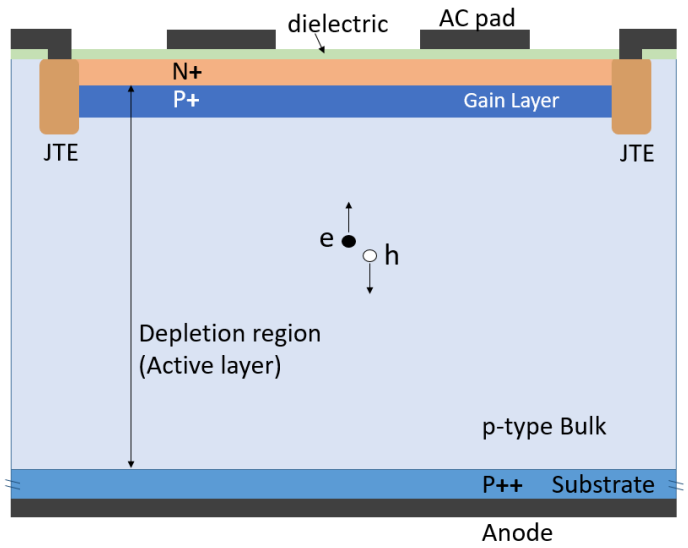
1. Introduction of AC-LGAD

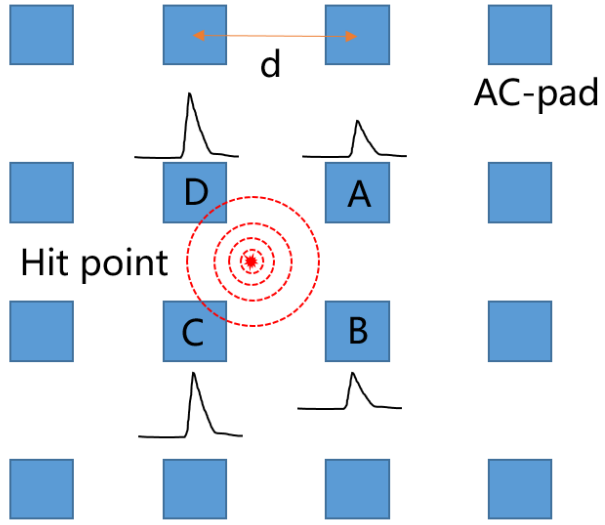


LGAD (Low-Gain Avalanche Diode)

- The read-out pad is connected to N++ layer
- Time resolution ~ 30ps

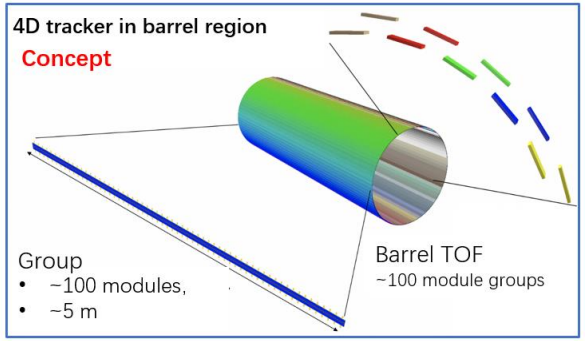


AC-LGAD (AC-coupled LGAD)



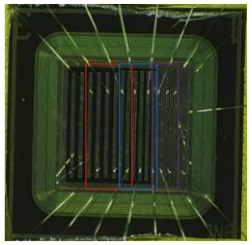
AC-pad arrays

- AC-pads separated from the N+ layer by a thin dielectric (SiO_2)
- Large area, **100% fill factor**
- Time resolution ~ 30ps
- Position resolution: 10-50 μm
- **4D detector：position + time**
- AC-LGAD can be used as a 4D tracker for CEPC



2. AC-LGAD sensors development by IHEP

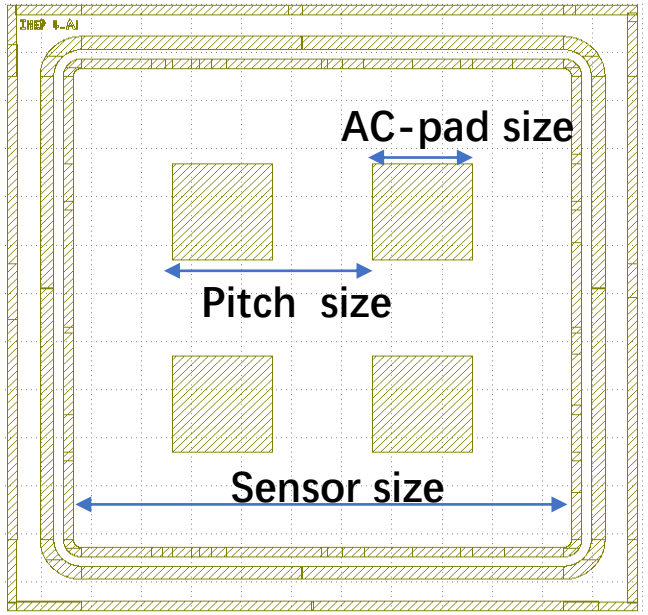
FBK 

BNL 

IHEP designed a larger pitch AC-LGAD

IHEP AC-LGAD
- large area
- **large pitch 2000 μm**
- low readout density

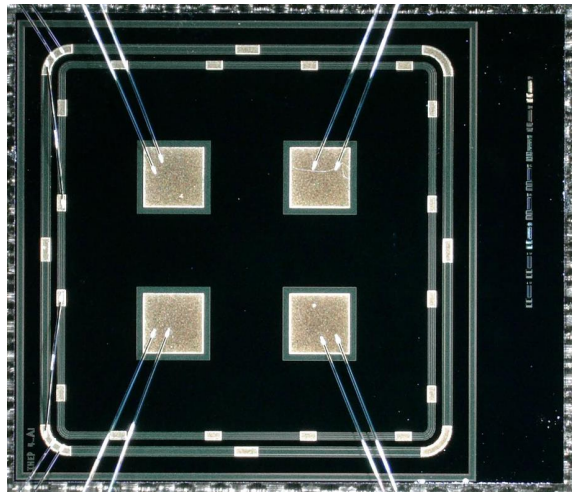
According to the current report, AC-LGAD is a small-size pitch, 50~500 μm, such as FBK / BNL AC-LGAD
https://indico.cern.ch/event/861104/contributions/4503072/attachments/2306673/3924214/H.%20Sadrozinski.pdf



IHEP AC-LGAD

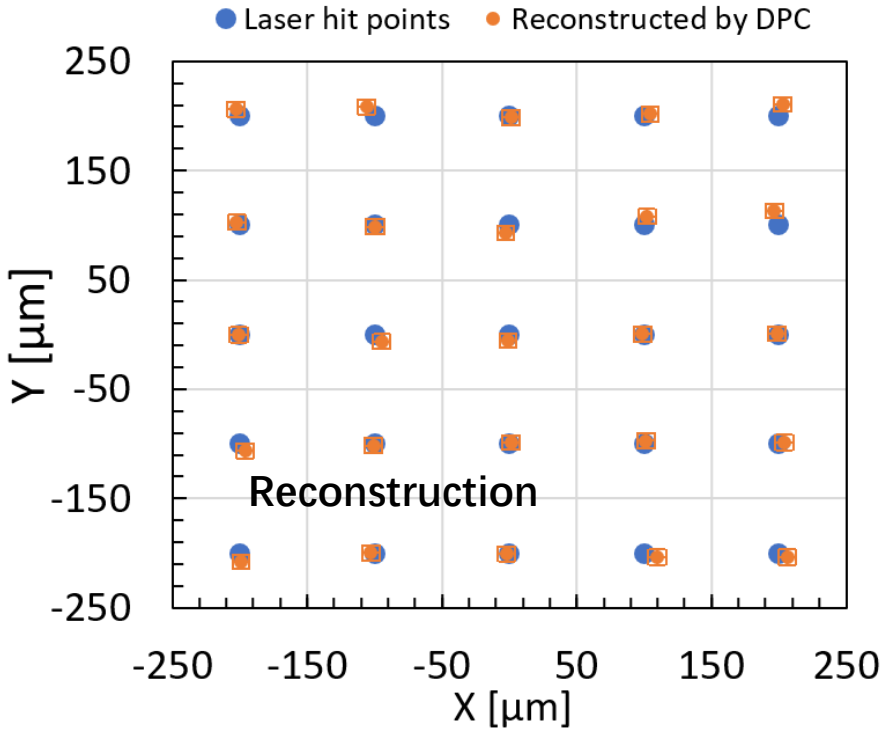
Sensor	N+ dose [unit]	AC-pad size [μm]	Picth size [μm]
W7Q1	10.0	1000	2000
W5Q1	5.0	1000	2000
W5Q2	1.0	1000	2000
W5Q3	0.5	1000	2000
W5Q4	0.2	1000	2000

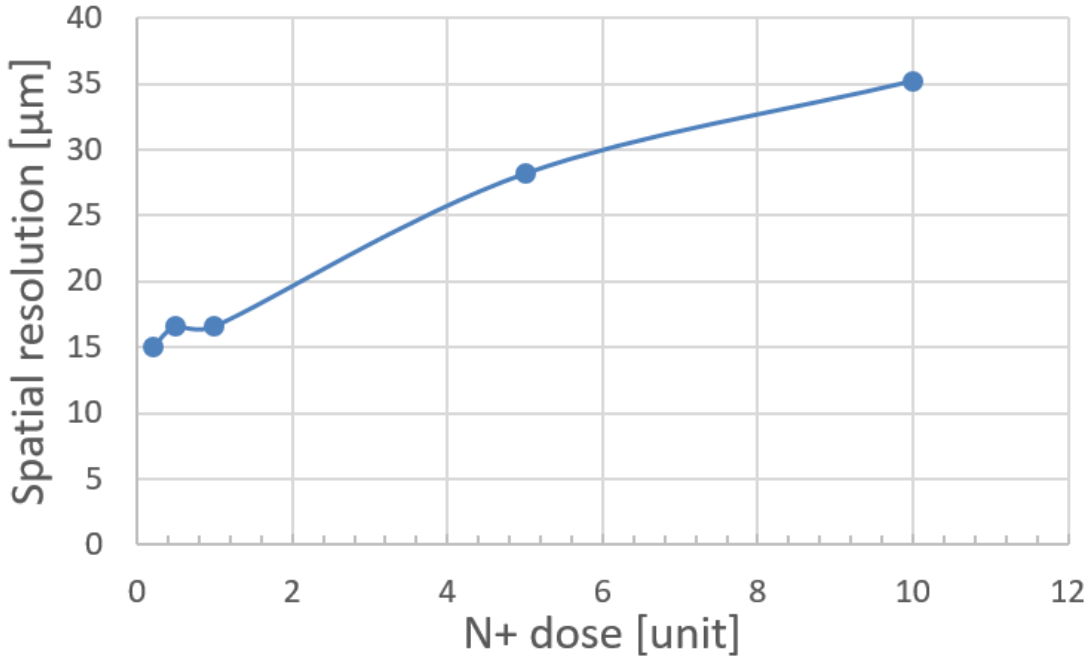
Main parameters Different N+ dose



IHEP AC-LGAD

3. Spatial resolution





Spatial resolution

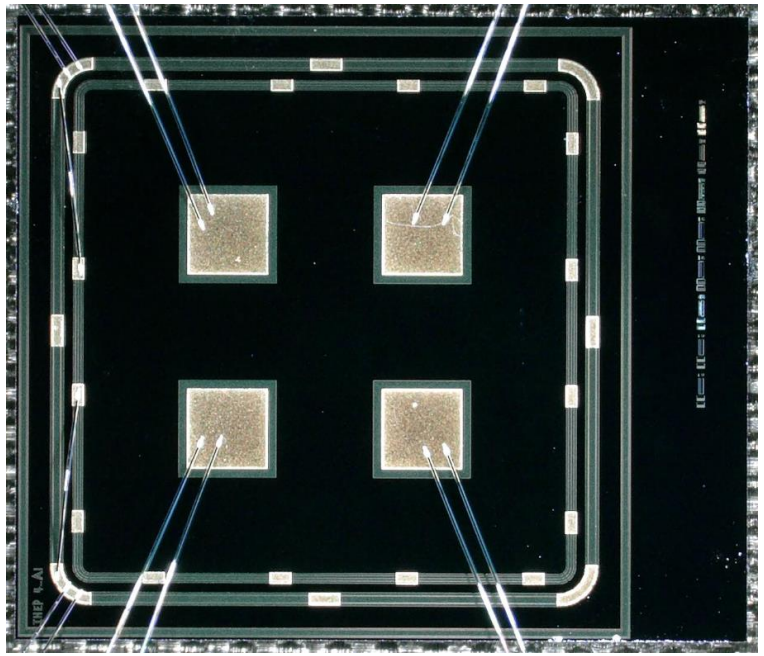
- N+ dose 10 unit→0.2 unit, the spatial resolution from 28 to 15 μm.
- Lower N + dose has higher resistivity, better spatial resolution.

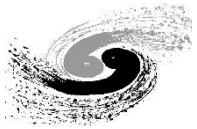
The details are in Zhijun's talk

26/11/2021 AC-LGAD based 4D tracking detector R & D for the future lepton collider

4. Summary

- AC-LGAD is a new 4D tracker (position + time)
- IHEP designed a **large-area AC-LGAD** and studied the **effect of N+ dose**
- Lower N + dose has a better **spatial resolution**, and the best is **15μm**.





Thanks