工 作 总 结

2022.08-12

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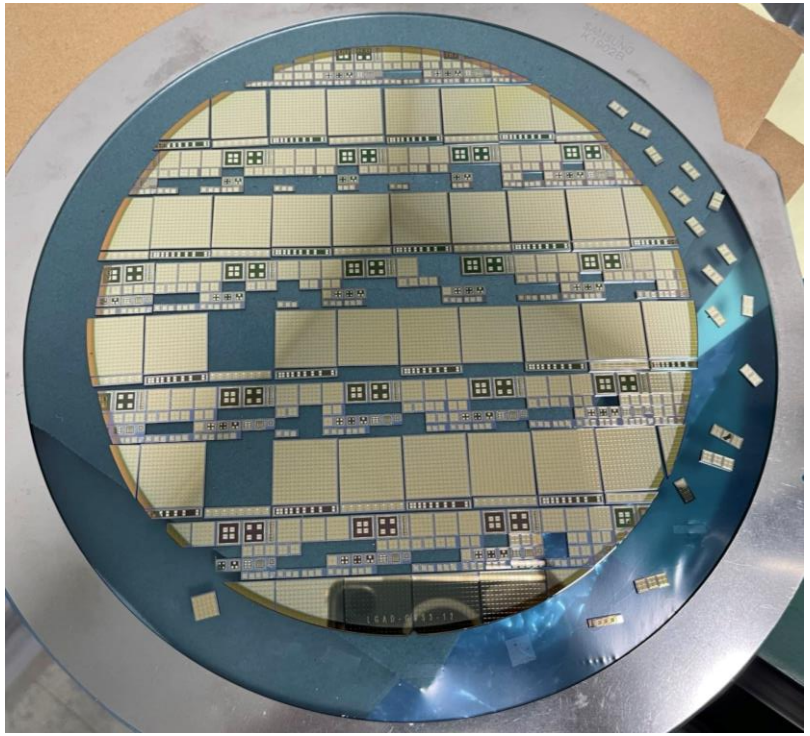
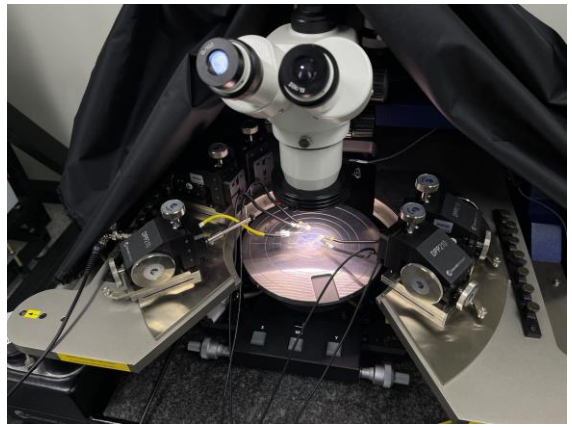
导师：梁志均
2023.1

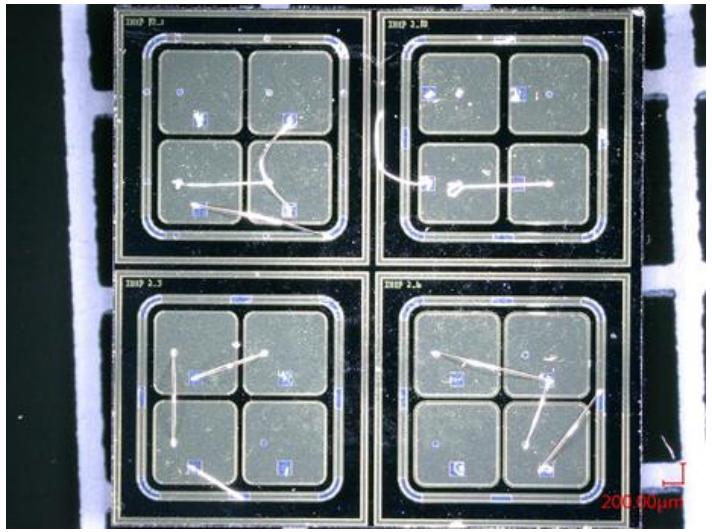
Test of LGAD Sensor after TID

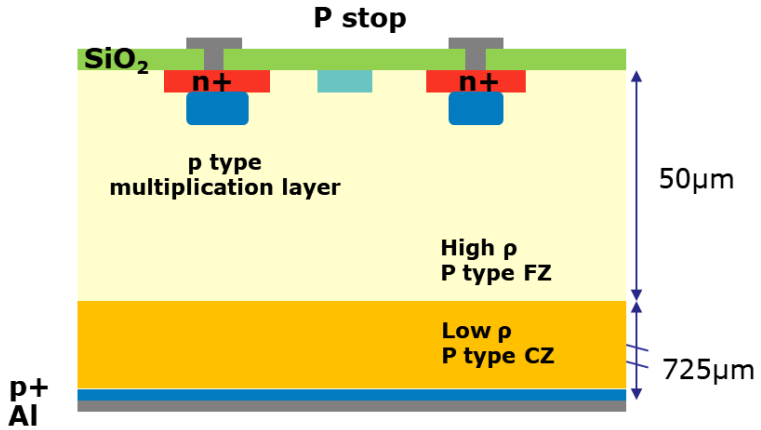
Spatial and Timing reconstruction of AC-LGAD

IHEP-IME LGAD Sensor **with shallow carbon** (wafer 12)



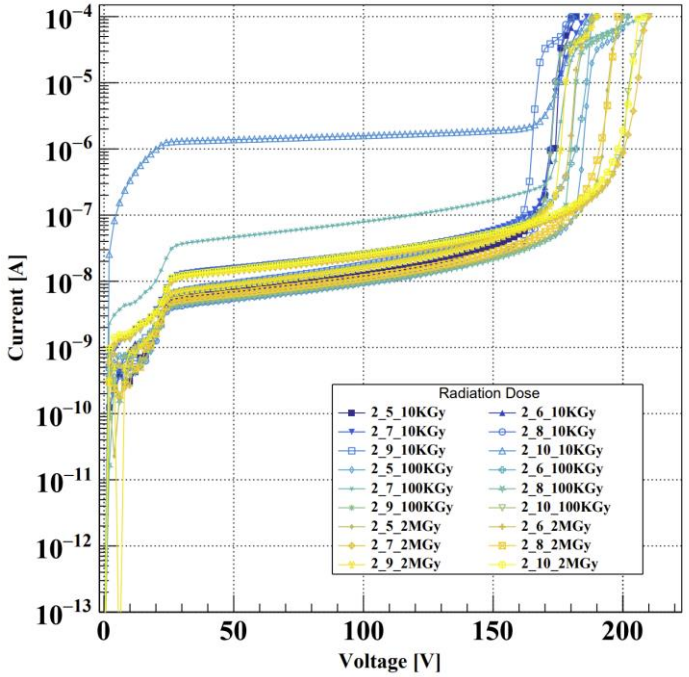


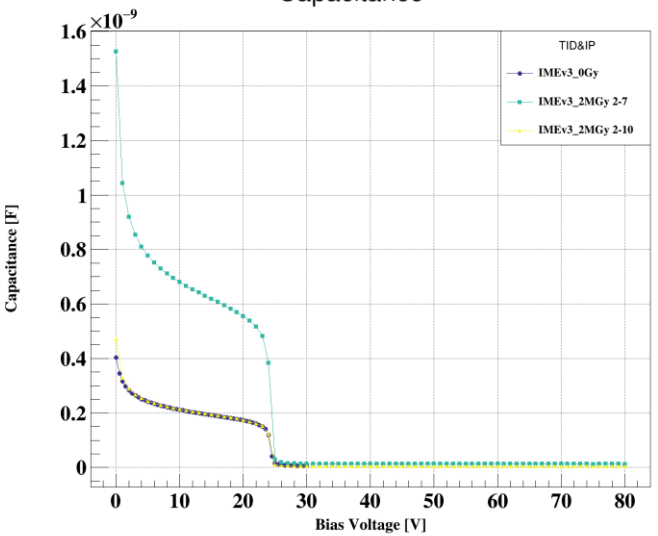




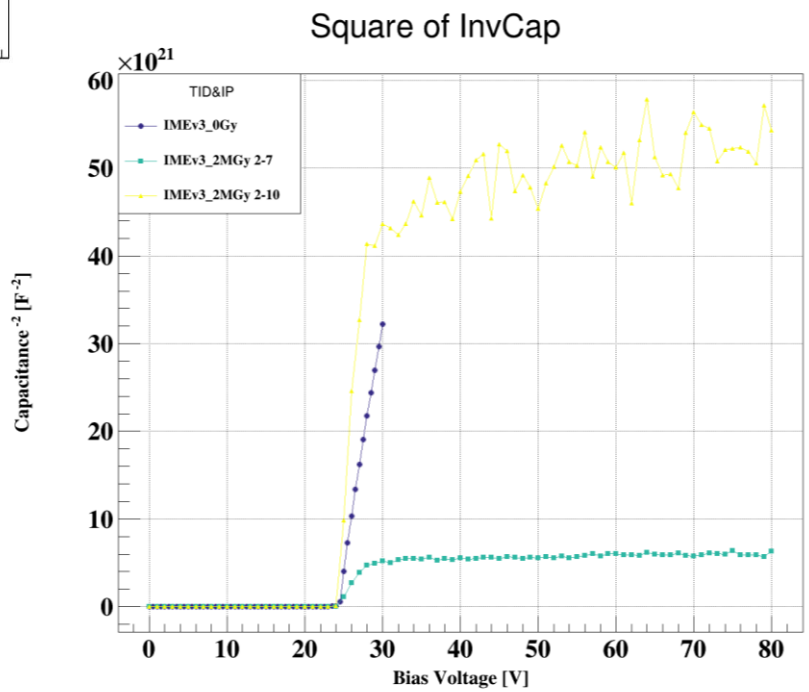
- IHEP-IME V3 LGAD
- Shallow carbon
- ATLAS Upgrade
- Optimize the design of LGAD
- Requirement:
  - Inter-pad Isolation
  - C<4.5pF
  - R>$10^9\Omega$
  - 2.5×10^{15}neq/cm2

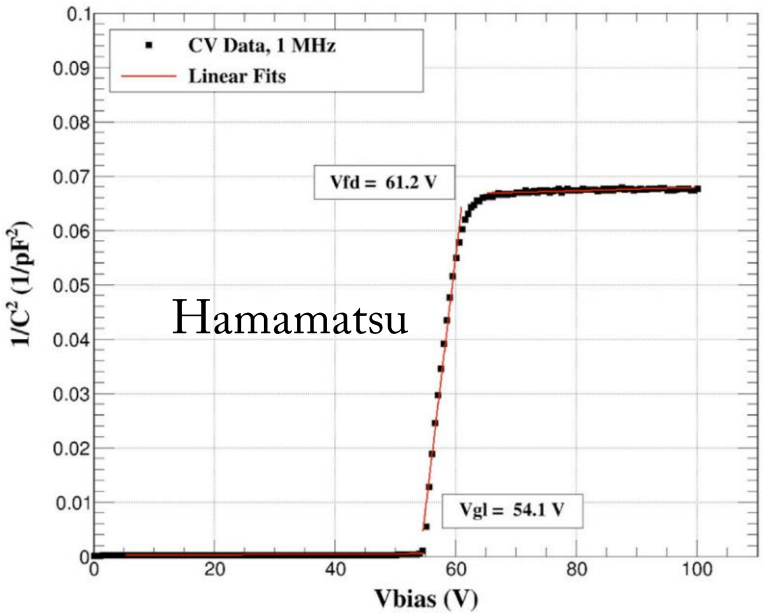
I-V C-V Interpad Resistance





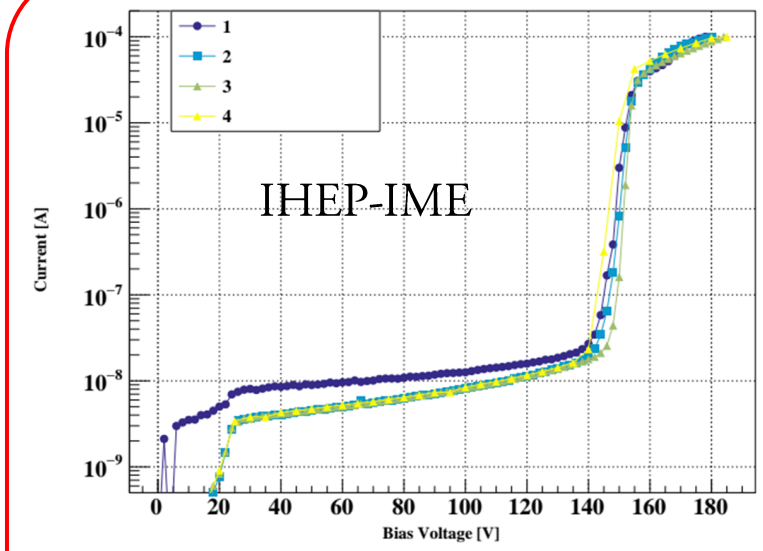
- Breakdown voltage(BV): increase 60V-70V
- The leakage currents of pad4 increase slightly(~5μA) with the increase of the TID dose, within the requirement of ATLAS HGTD
- Capacitance <4pF varies while depletion voltages remain
- Vgl Vid characteristics same as Hamamatsu

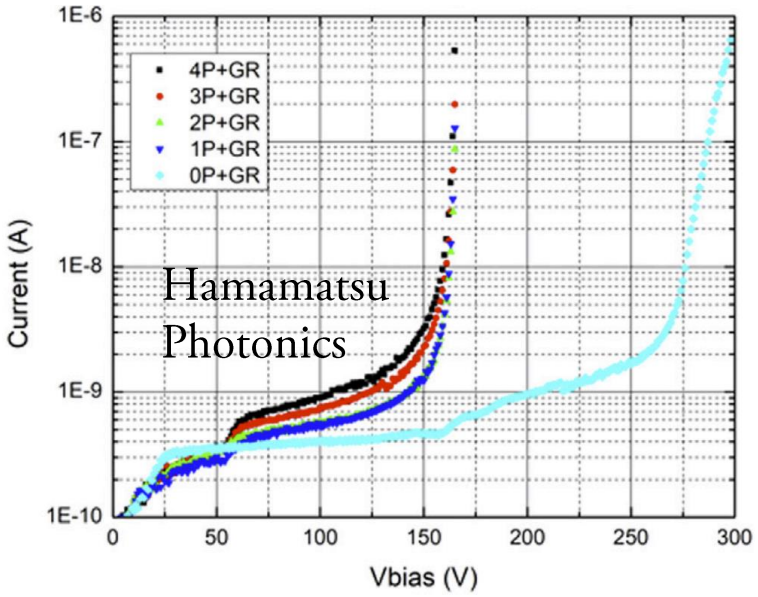




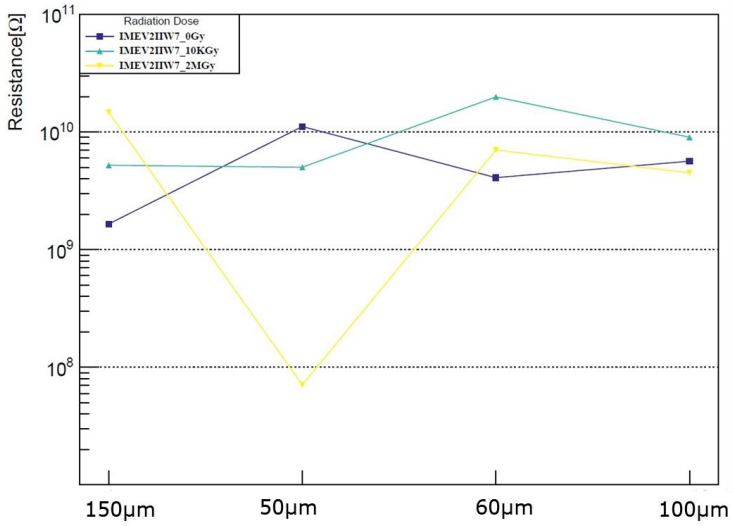
Hamamatsu:
doi: 10.3389/fphy.2022.838463

I-V C-V Interpad Resistance

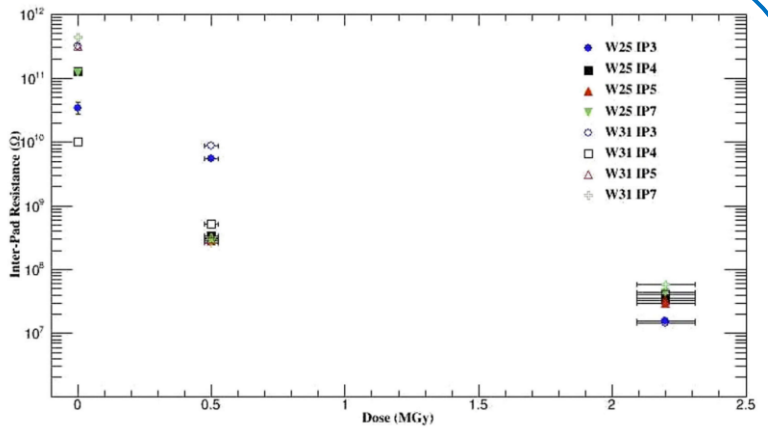




ΔBV<5V, BOTH



IHEP-IME



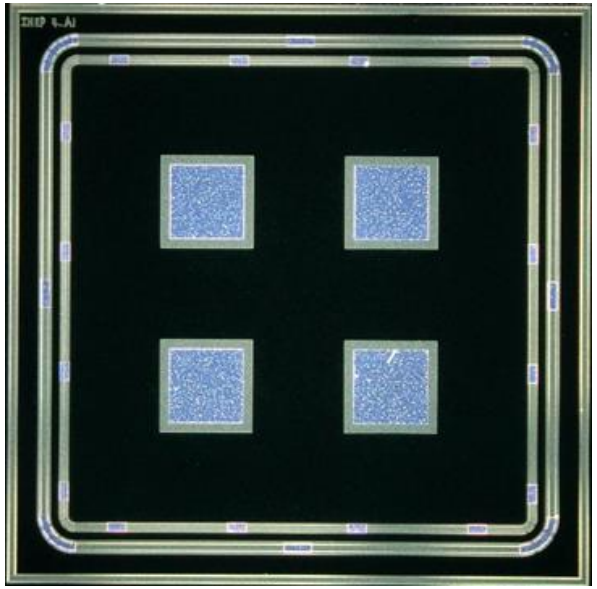
Hamamatsu Photonics
doi: 10.3389/fphy.2022.838463

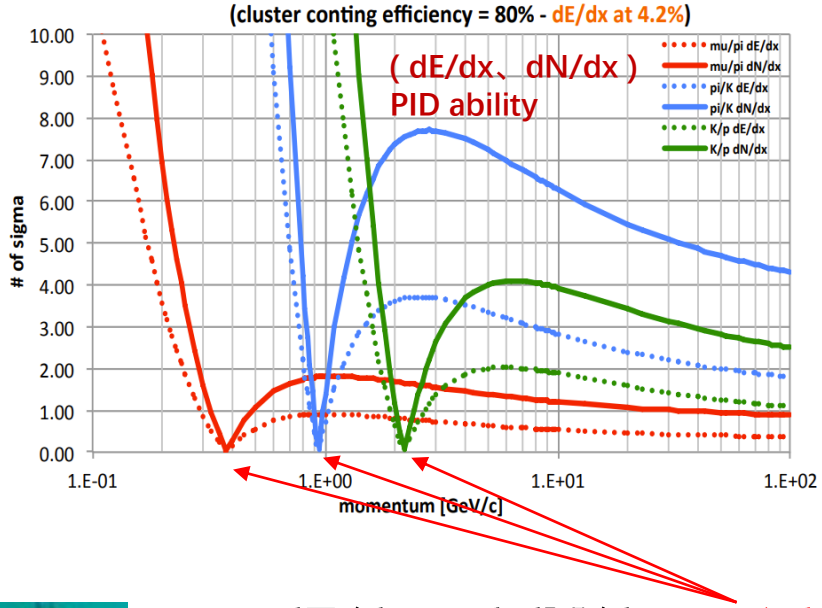
$10^{10}\,\Omega \rightarrow 10^{10}\,\Omega \rightarrow 10^{10}\,\Omega$ $10^{11}\,\Omega \rightarrow 10^{9}\,\Omega \rightarrow 10^{7}\,\Omega$

Radiation Dose: 0Gy→10KGy→2MGy

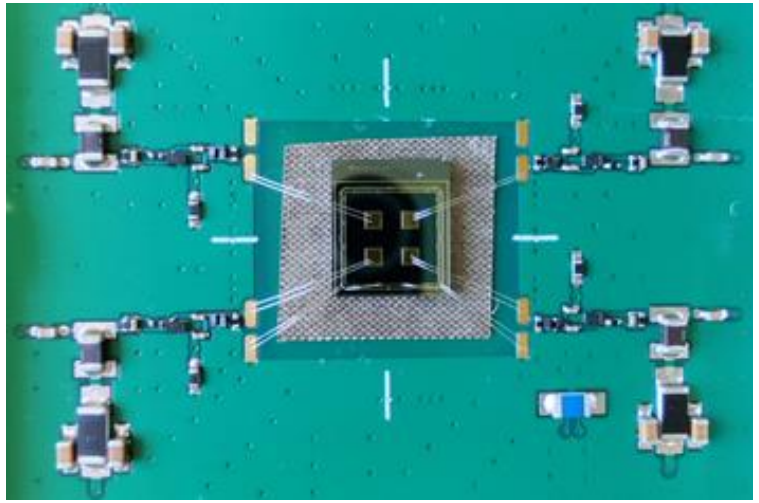
- R increase by 1 order with shallow carbon
- $R \approx 10^{10}\,\Omega$ after 2 MGy irradiation, better than Hamamatsu
- Break Voltage maintains, same as Hamamatsu
- No significant pattern observed, further study needing

Quad pad AC LGAD spatial and timing resolution





- ✓ AC-LGAD for TOF on CEPC
- ✓ 4D Tracker Spatial and timing at same time
- ✓ 6000μm × 6000μm Largest Area Reported
- ✓ 4(Multi)-channel readout

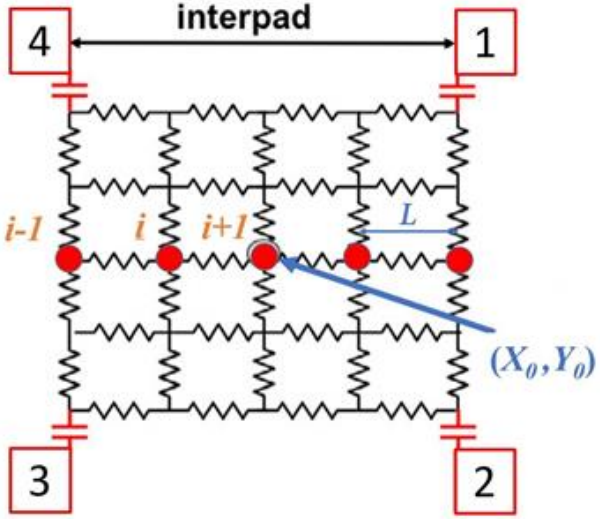


- dE/dx and dN/dx invalid area
- PID improvement by TOF
- Others:

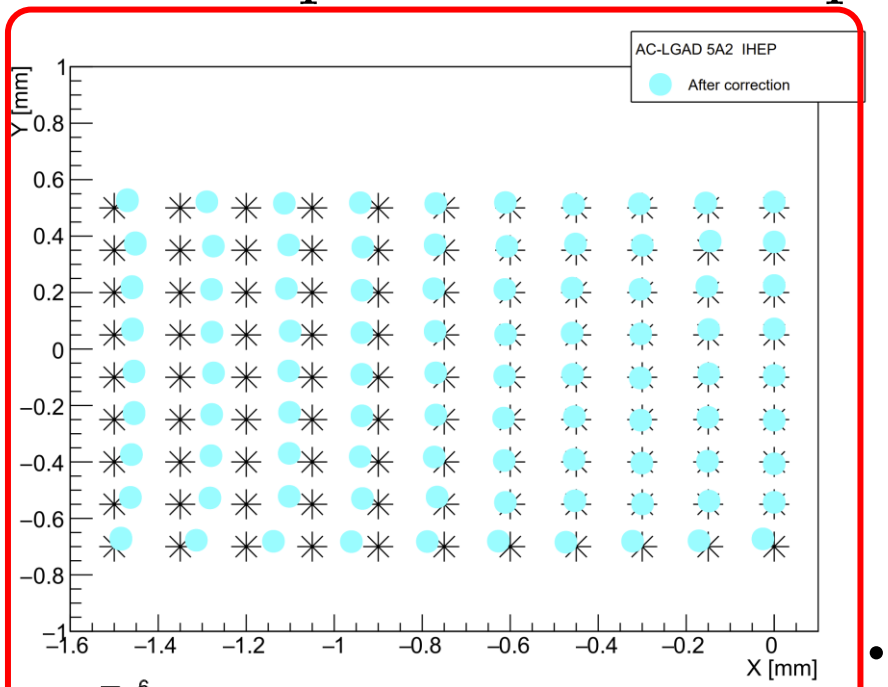
  Telescope

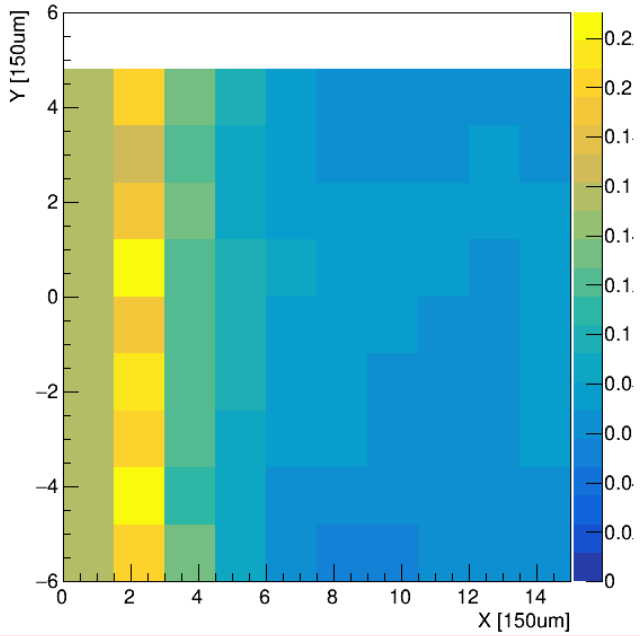
  Beam quality monitoring

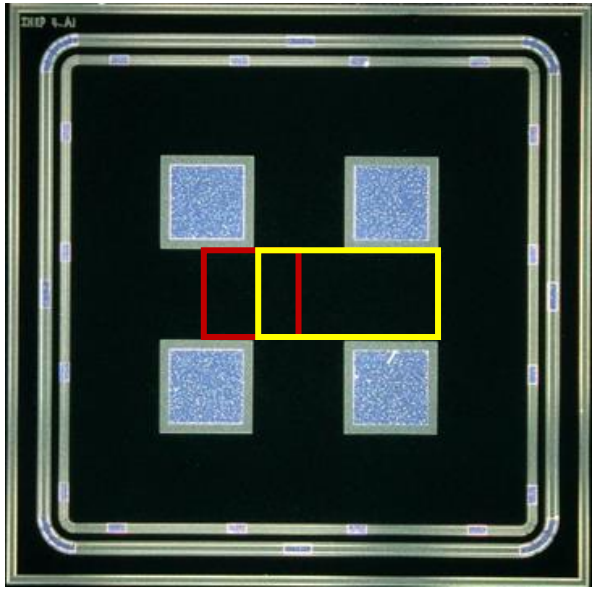
  proton CT oncological therapy



Quad pad AC LGAD spatial and timing resolution



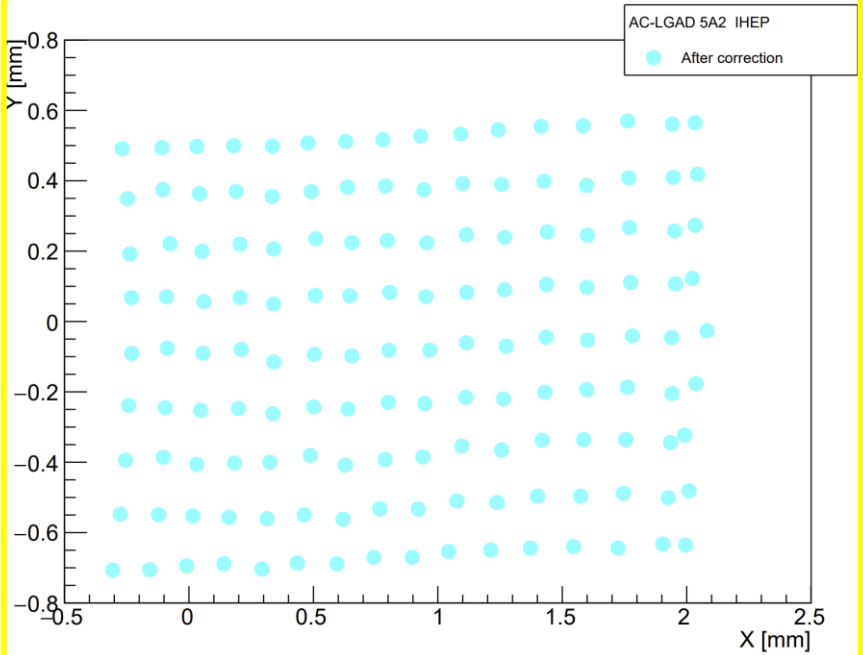


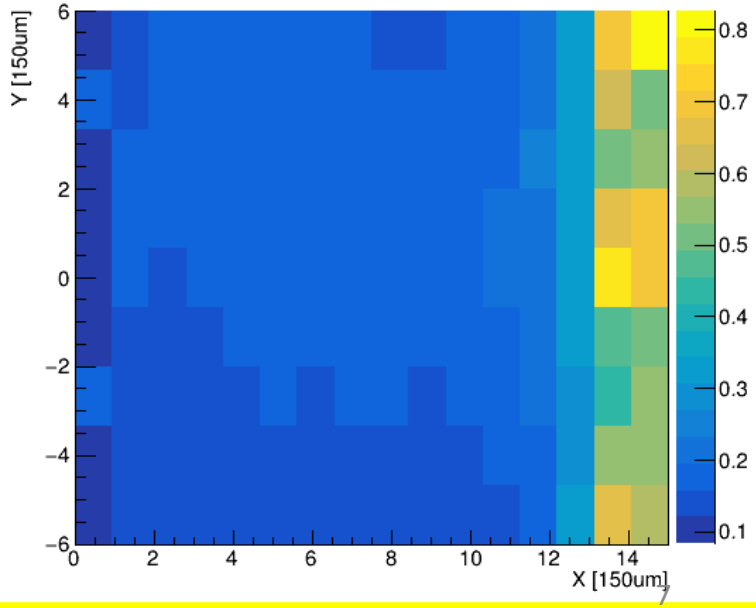


- Antisymmetric hitting test
- 40μm(red) and 80μm(yellow)
- 30ps (red) and ~100ps (yellow)
- Linear model considered invalid

  new model desired
- Paper finished arXiv:2212.03754

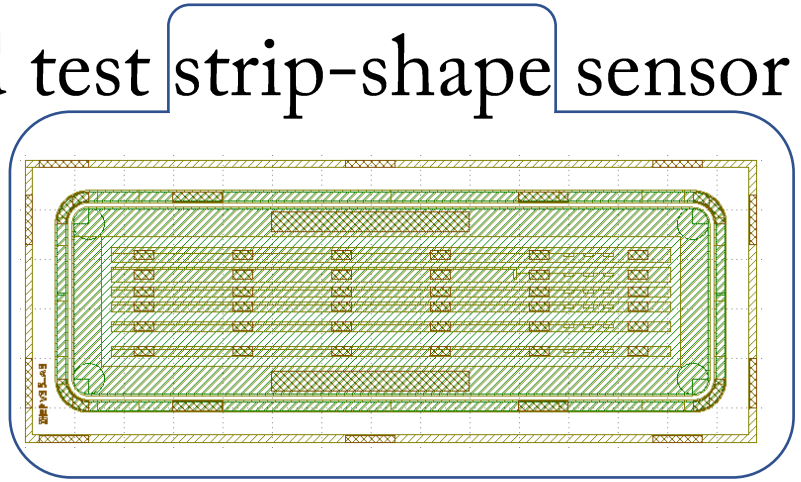
  To submit to IEEE TNS





OUTLOOK

- TID and reconstruction, 2 paper writings & reports
- Analysis of radiation effect after synchrotron radiation
- Improve resolution and test strip-shape sensor



Thank You

Weiyi Sun
2023.1