Strip sensor prototype tests

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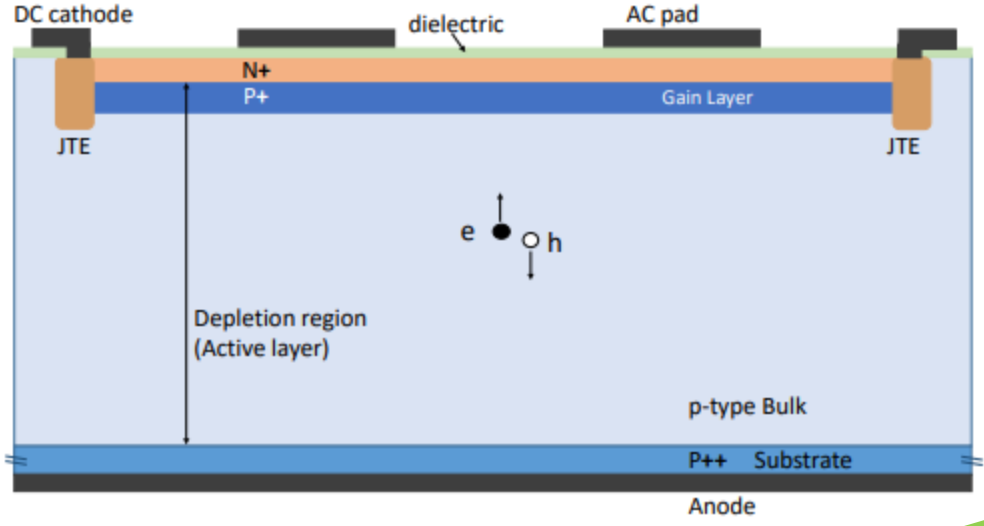
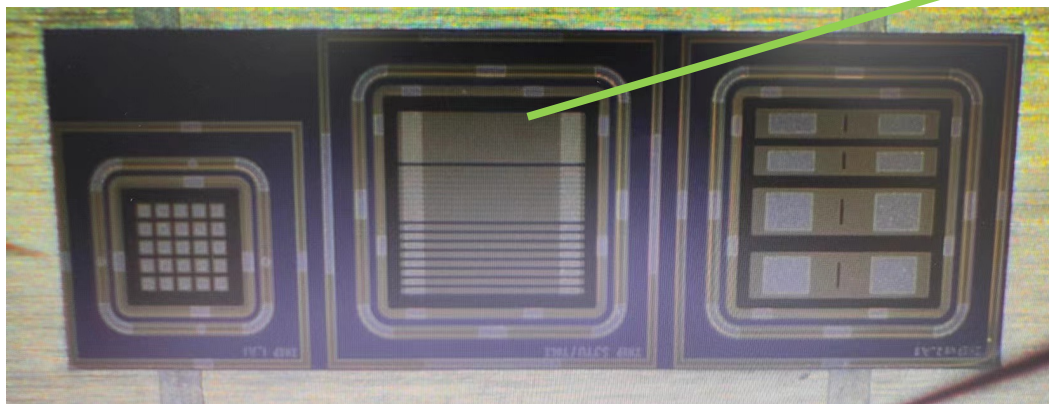
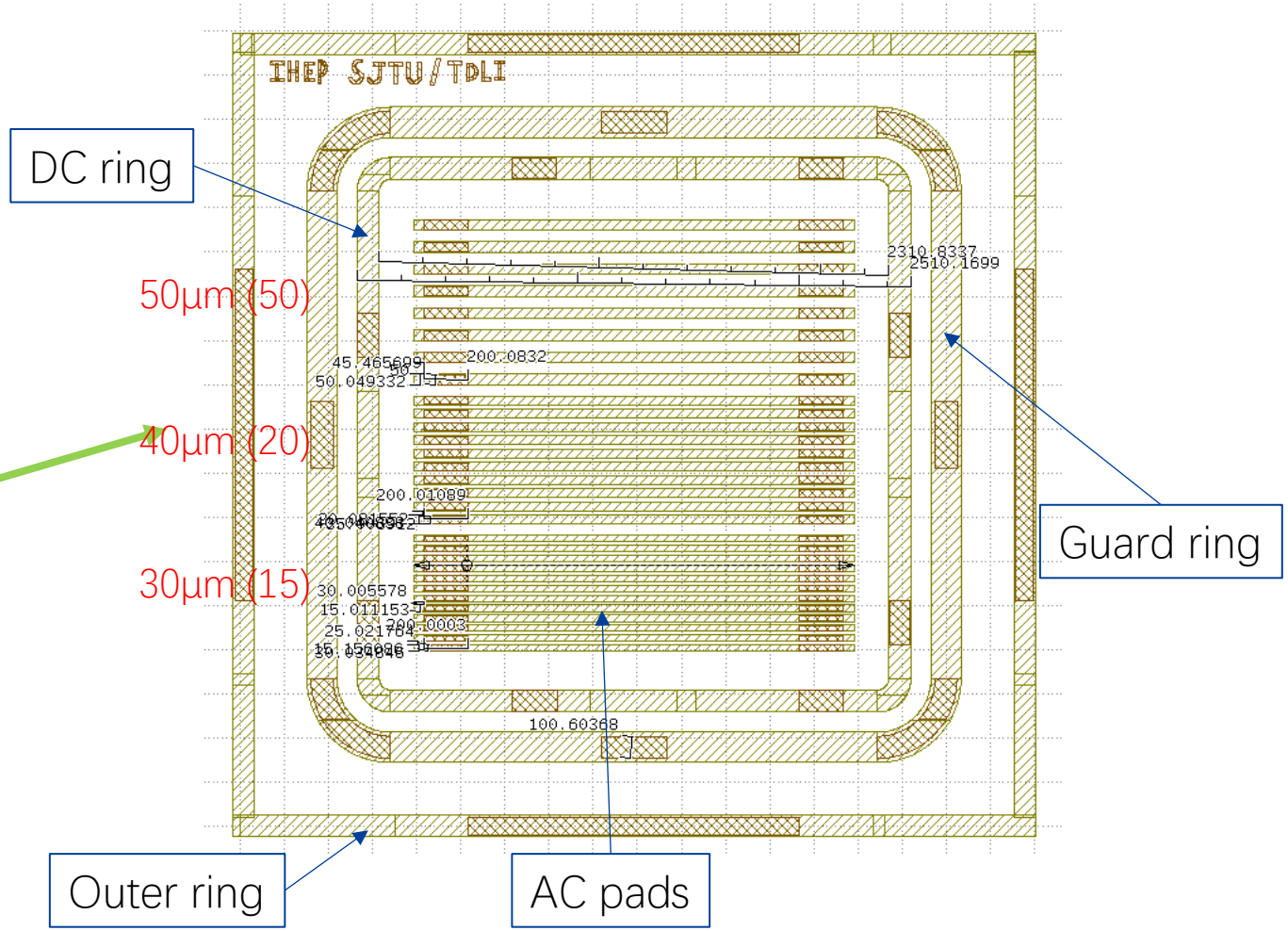
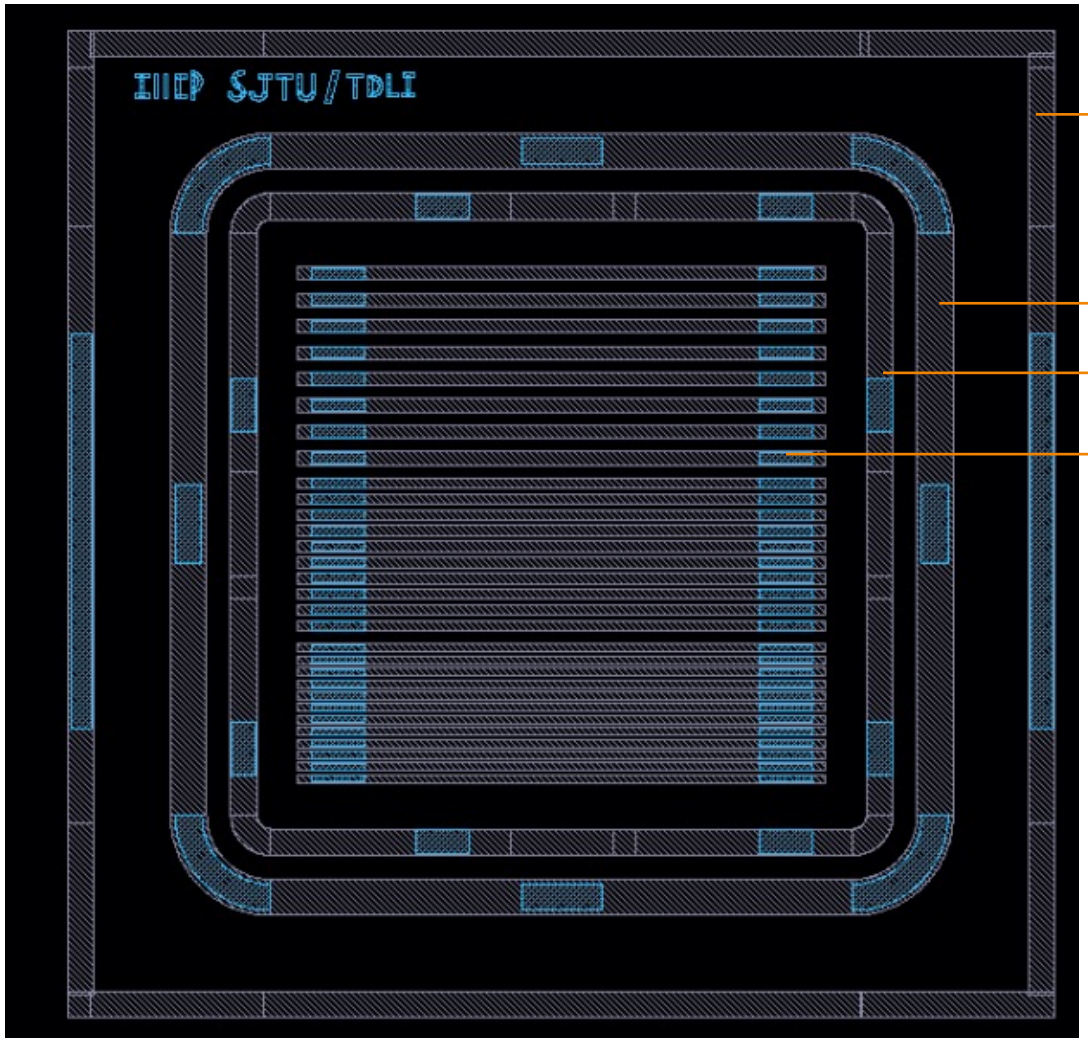
Sensor structure







Sensor structure



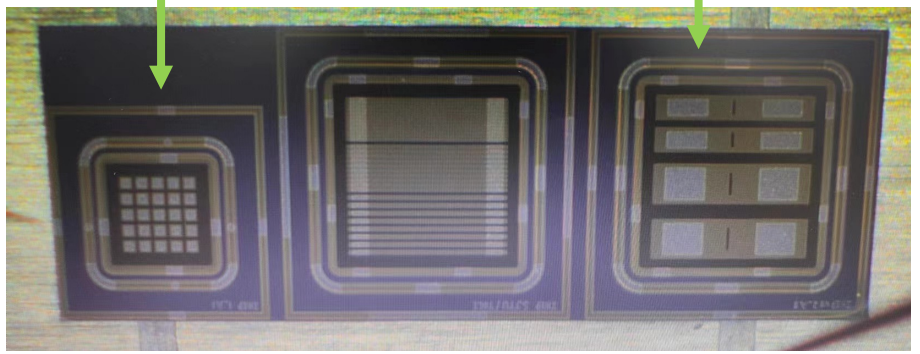
Outer ring: substrate potential. Apply negative HV on the background through trunk.

Guard ring: for protection. 0V.

DC ring: $\boldsymbol{I_{DC}} = \sum \boldsymbol{I_{pad}}$. 0 V.

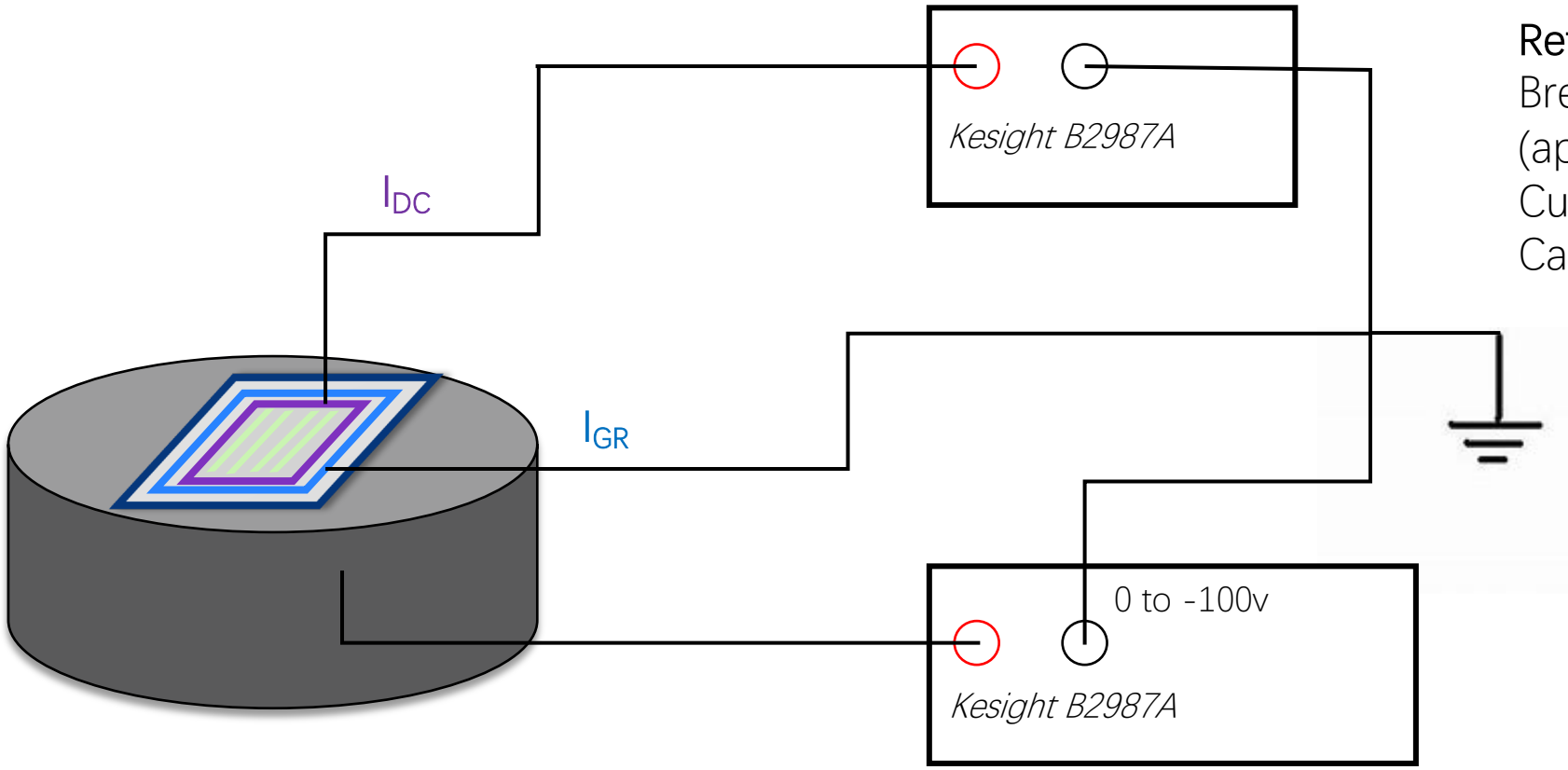
Strips (pads): extract signal. 0 V.

Some other design from IHEP



Response test: I-V

By Jialin

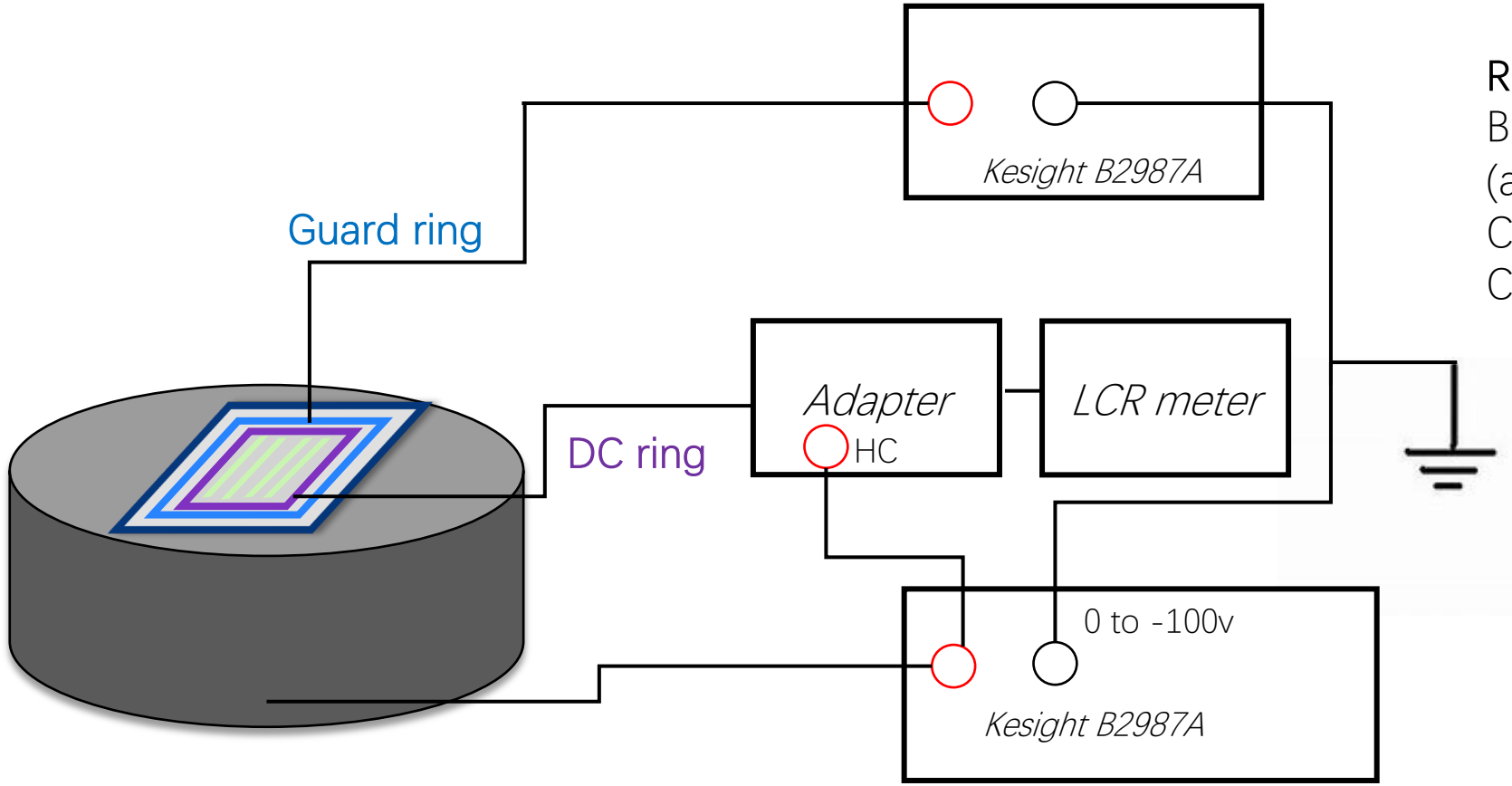


Set of I-V measurement

Reference value:
Breakdown voltage: ~180 V (apply 160~170)
Current: 9~10 nA
Capacitance: 40~50

Response test: C-V

By Jialin



Set of C-V measurement

Reference value:
Breakdown voltage: ~180 V
(apply 160~170)
Current: 9~10 nA
Capacitance: 40~50

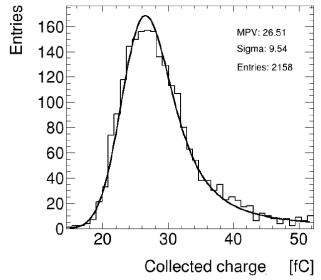
Charge collection

From chihao

Will need the same set of equipment as time resolution.

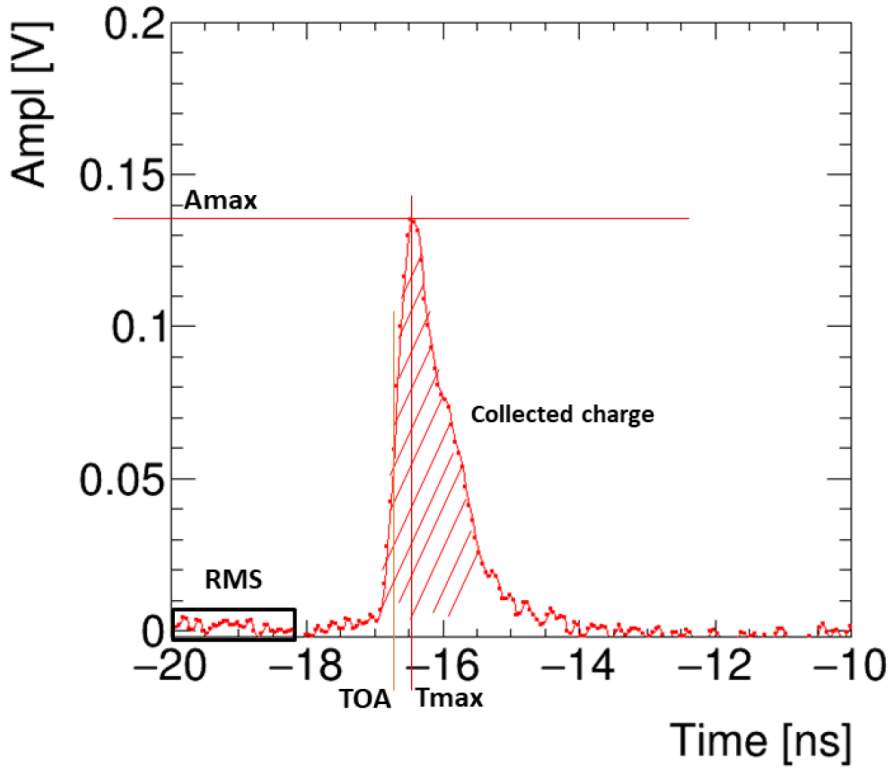
- HV monitor:
- leakage current, bias monitor, bias setting
- Oscilloscope monitor:
- waveform features, count rate, bias scanning, waveforms recording

Fit with the convolution of landau and gauss



$Q = MPV(L * G) = 26.51\ fC$

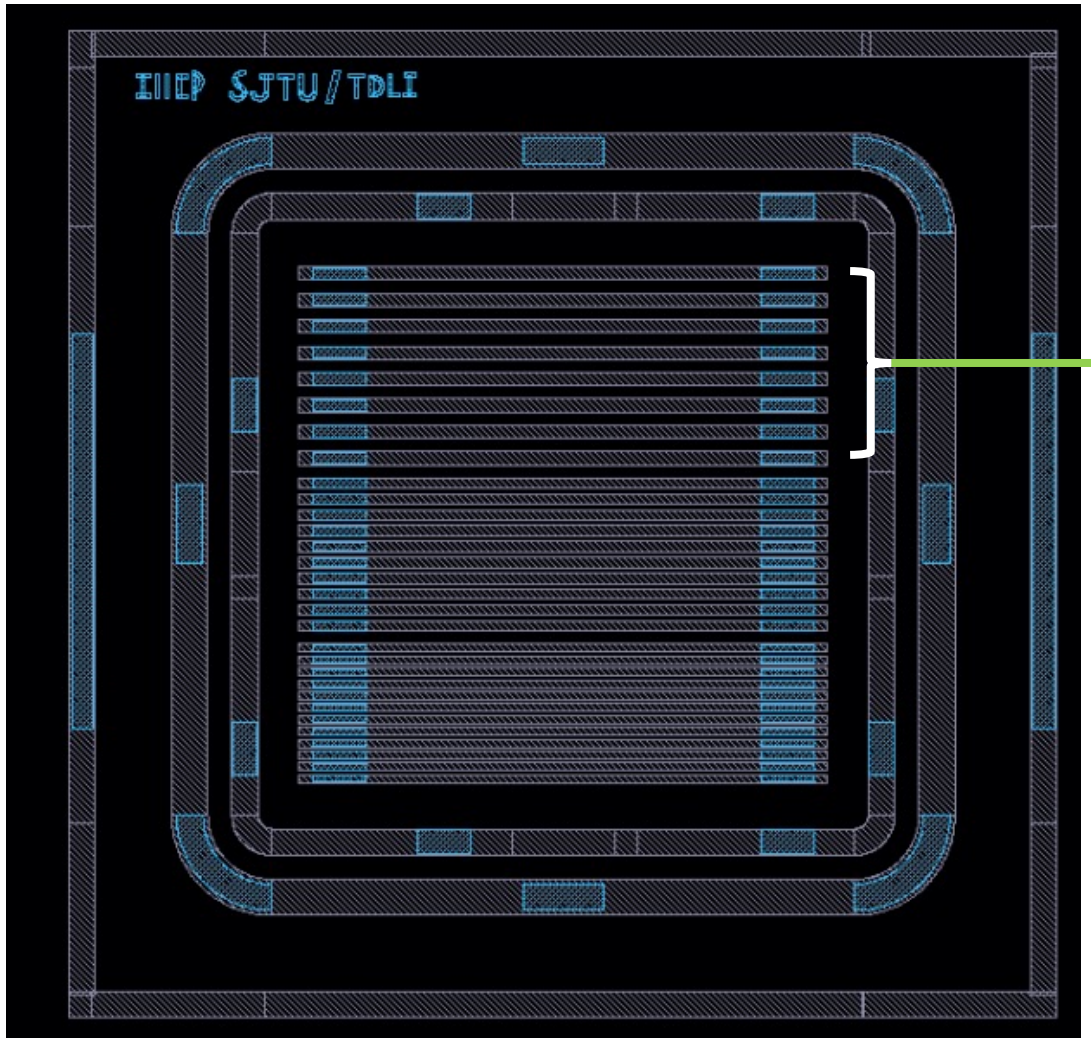
Waveform analysis



- **Amax**: the maximum amplitude
- **Tmax**: time at the maximum amplitude
- **RMS**: RMS of the head part of the waveform (before the peak)
- **SNR:** Amax/RMS
- **TOA**: time when the amplitude of the signal crosses 0.5*Amax (interpolated with the two points nearest to the 0.5*Amax)
- **Collected charge**: the pulse integral times the calibration constant ($0.2131 \frac{fC}{mV*ns}$)

Position resolution

By Jialin



- Inject particle targeting different position of the strips/gaps.
  (signal might be missing @ strips?)
- Extract signal from both side.

- Check among three different combinations.

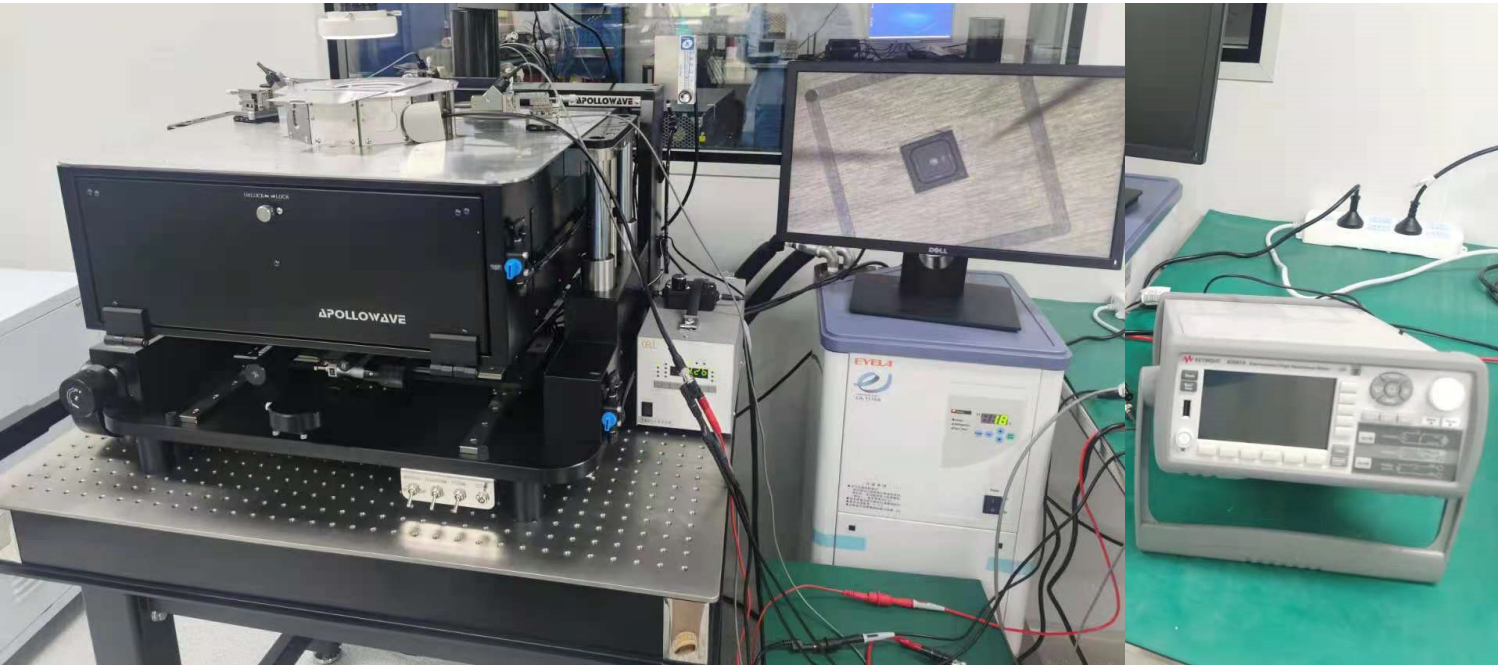
Conclusion

- Restore the operation of the tracker lab (test with old known sensor).
- Carry out the I-V, C-V test
  - Check with the reference numbers provided by IHEP
  - Provide feedback
- Further study: charge collection, position measurement
  - Borrow monitors
  - Need precise particle source (pulsed laser, ~nA), perhaps USTC or IHEP
  - Optimize among the different width combination of strip/gap

Thanks !

Testing system

Temperature: 20C°



Set of testing system

The sensor under microscope

Testing procedure

1. Checkout the circuit.
2. Put the silicon wafer into probe station.
3. Prick the silicon wafer with probes(one for GR, one for sensor). Be cautious!!!
4. Turn off the light.
5. Add negative bias voltage and record the current.

Facility	Price	Arrived time
keithley皮安表6482	¥52380	End of July
keithley高压源表4270	¥82,400	Arrived
Agilent LCR表E4980A	¥145000	This week
适配器	¥6500	