Probe Station Test

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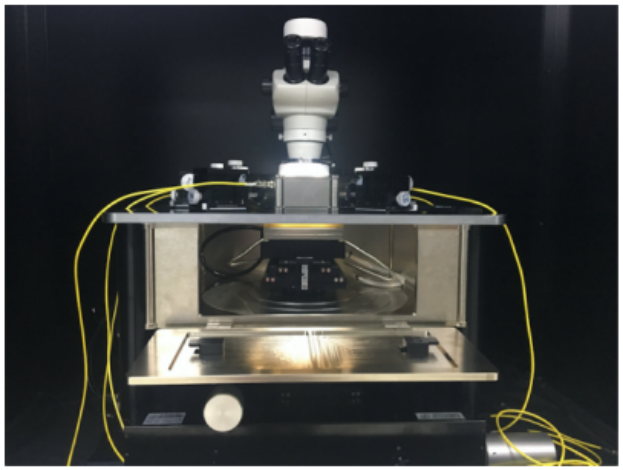
Overview

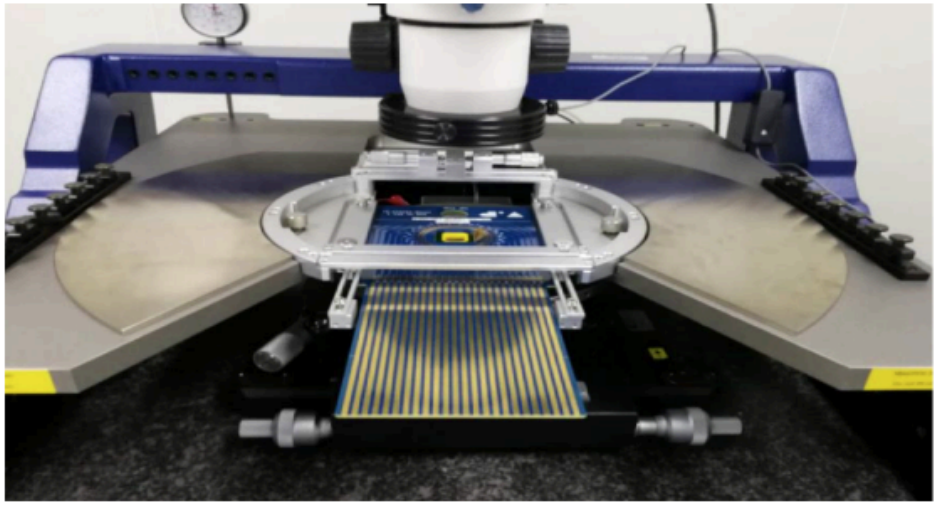
- General task: Perform I-V and C-V measurements to study the electrical characters of the sensors:
  - breakdown voltage, leakage current, full depletion voltage, doping profile…

Probe station
with cold chuck



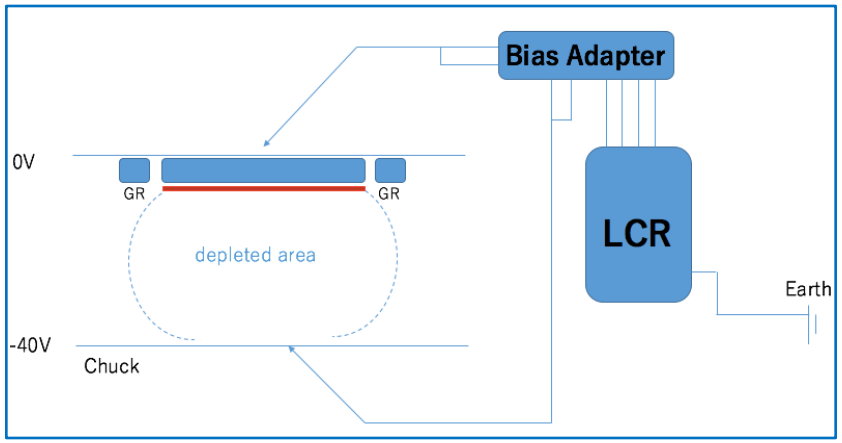
testing irradiated sensors

Probe station
with probe card

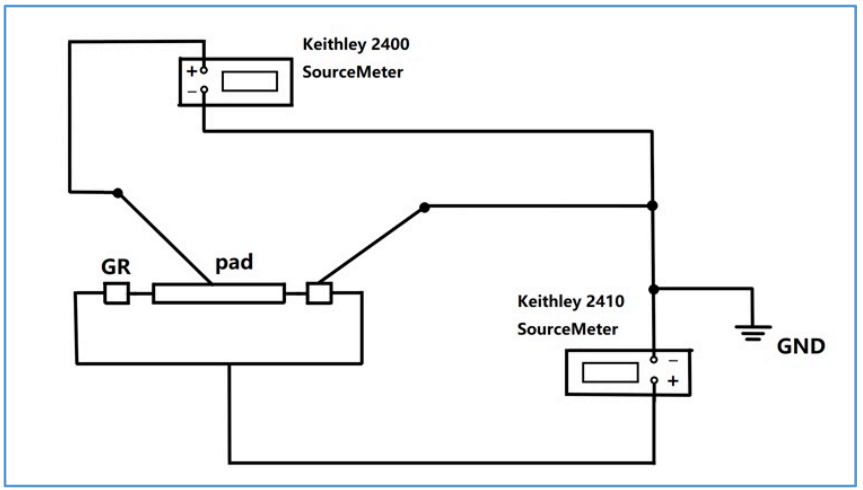


Test setups

C-V setup



I-V setup

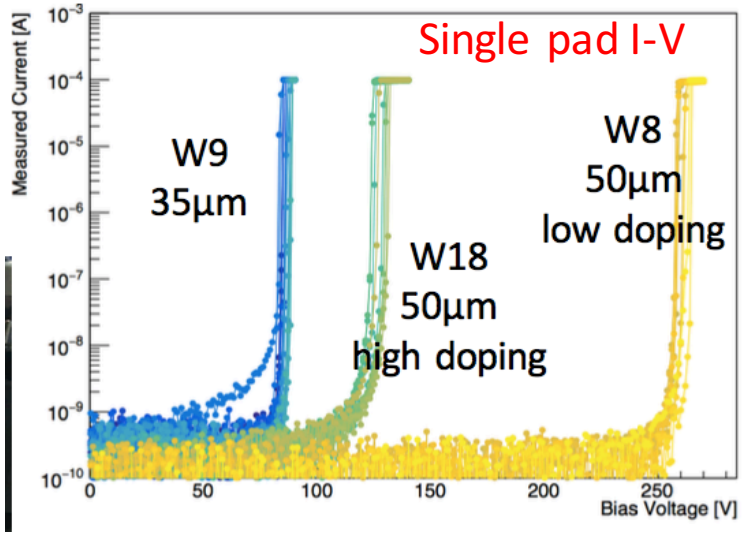


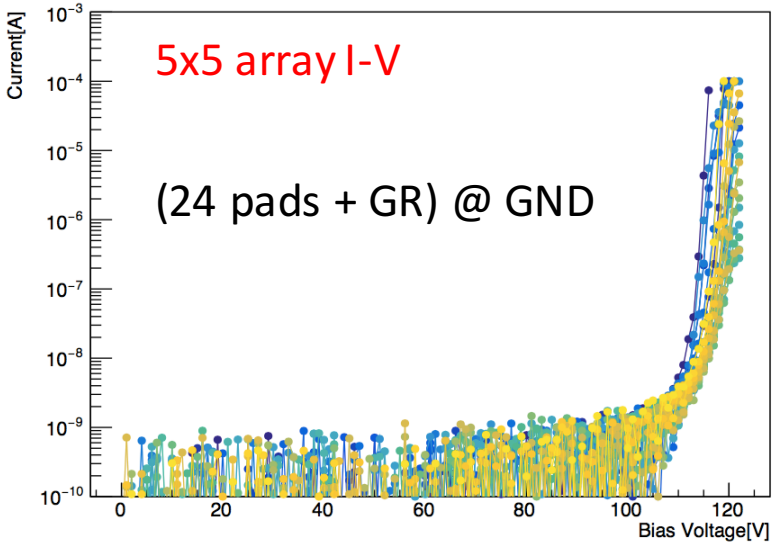
Scripts for DAQ: https://github.com/hgtd/sensor-test

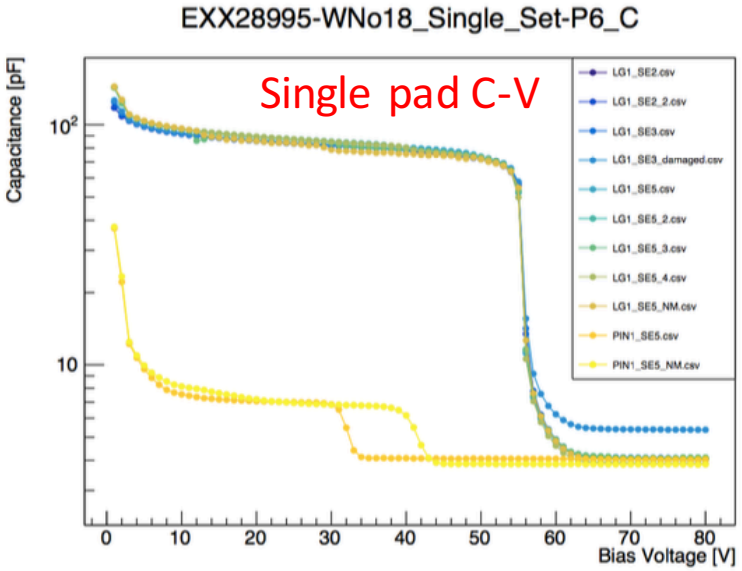
- For I-V scan
  - Keithley 2410 source meter is used.
  - Launch the scan with
    > python3 scanIV.py
- For C-V scan
  - Keithley 2410 source meter and Keysight E4980 LCR meter are used.
  - Launch the scan with
    > python3 scanCV.py

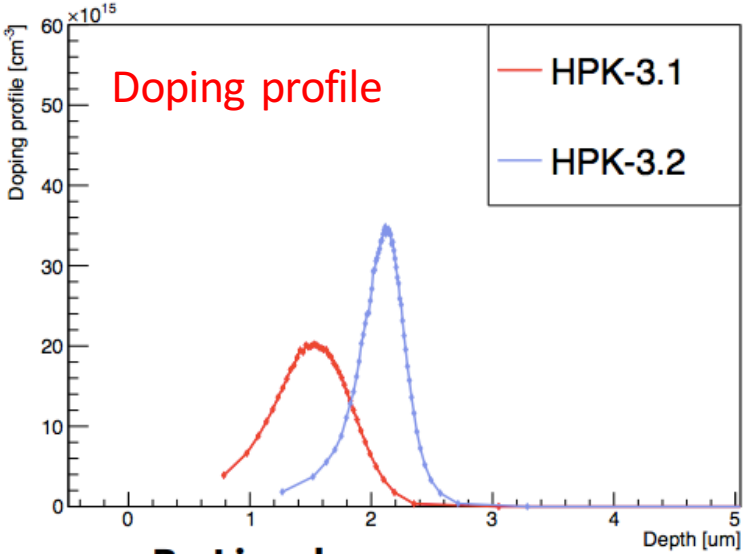
macros	
Kei2400CControl.py	source meter control
KeyE4980AControl.py	LCR meter control
README.md	
plot.C	
scanCV.py	perform C-V scan
scanIV.py	perform I-V scan

Characterize the HPK sensors (unirradiated)



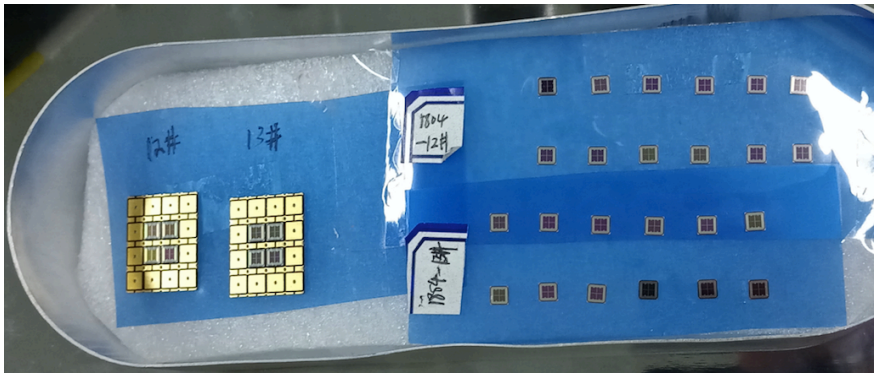


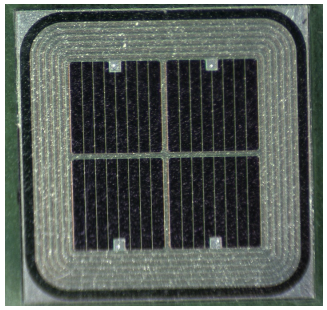


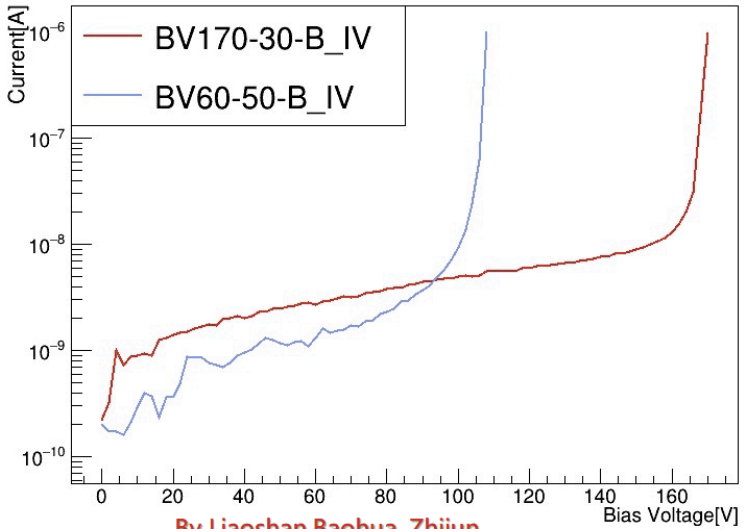


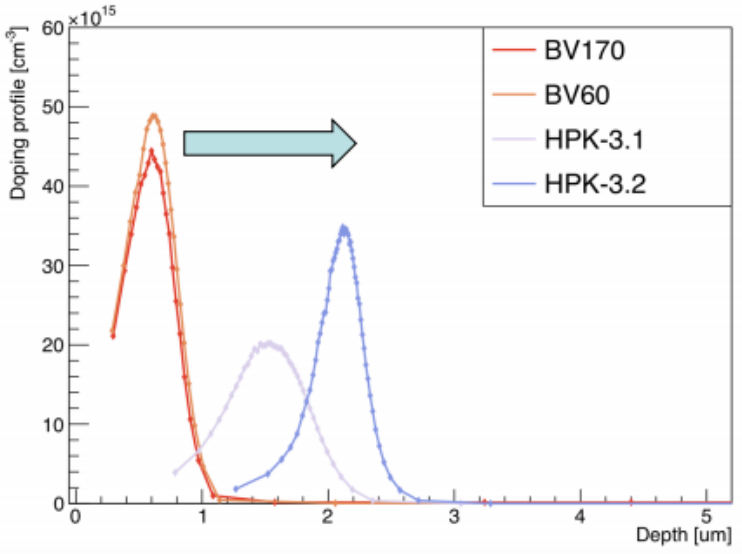
Characterize the NDL sensors (unirradiated)

- First batch of NDL sensors fabricated and tested.
- Two types:
  - BV170-30
  - BV60-50





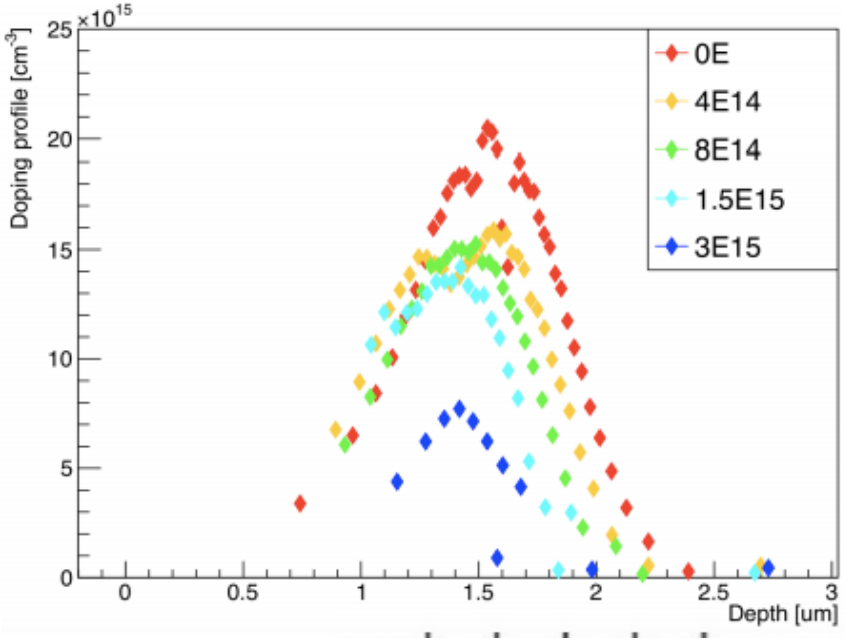


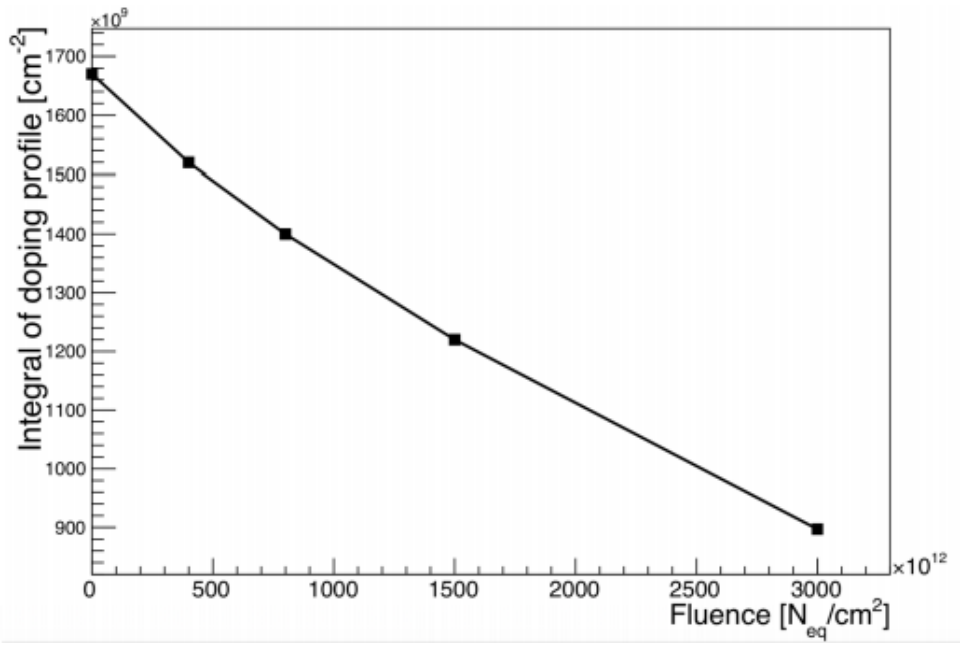


- Try deeper p doping in next submission.

Characterize HPK sensors (neutron irradiated)

- Observe the acceptor removal effect from C-V measurements after irradiation.





Ongoing and planned tasks

- Supporting other tests. Depends on what is needed from these tasks, and perform I-V and C-V measurement for:
  - X-ray irradiation
  - proton irradiation
  - wire bonding
  - sensor design
  - …
- Upgrade cooling system for low temperature irradiation tests..
  - Require -30C.
  - Require an upgrade of the cooling system

Temperature debugging at the probe station in the sensor test:

Target temperature: -30℃ for irradiation sensors test

- Liquid nitrogen cooling (this can reach -30 ℃)
  - Liquid nitrogen tank is too small. It can only be used 1-2 times.
  - Unstable, I tried twice this week, and did not reach -30℃, only can reach 0. The main reason is the lack of liquid nitrogen.
- Water cooling
  - Stable, may take longer to cool down
  - Our laboratory water cooler can only reach -20℃
  - Solution: Buy a new water cooler which can reach -40℃

Device	Price
RH40-12A	28425 RMB
RH40-25A	37125 RMB

Water cooler

BACKUP

Sensor list

		layout	available (no UBM + UBM)	tested
HPK	unirradiated	single	6 + 25 sets	6 + 0 sets
		2x2	2 + 8	0
		5x5	6 + 23	3 + 3
		15x15	4 + 23	0
	neutron irradiated	single	9	9
		5x5	5	0

		layout	available	tested
CNM	unirradiated	single	10	10
		2x2	2	0
		5x5	a few	0
NDL	unirradiated	2x2	37 x BV60	2
			87 x BV170	1