Measure of the IV CV characteristics of sensors before dicing

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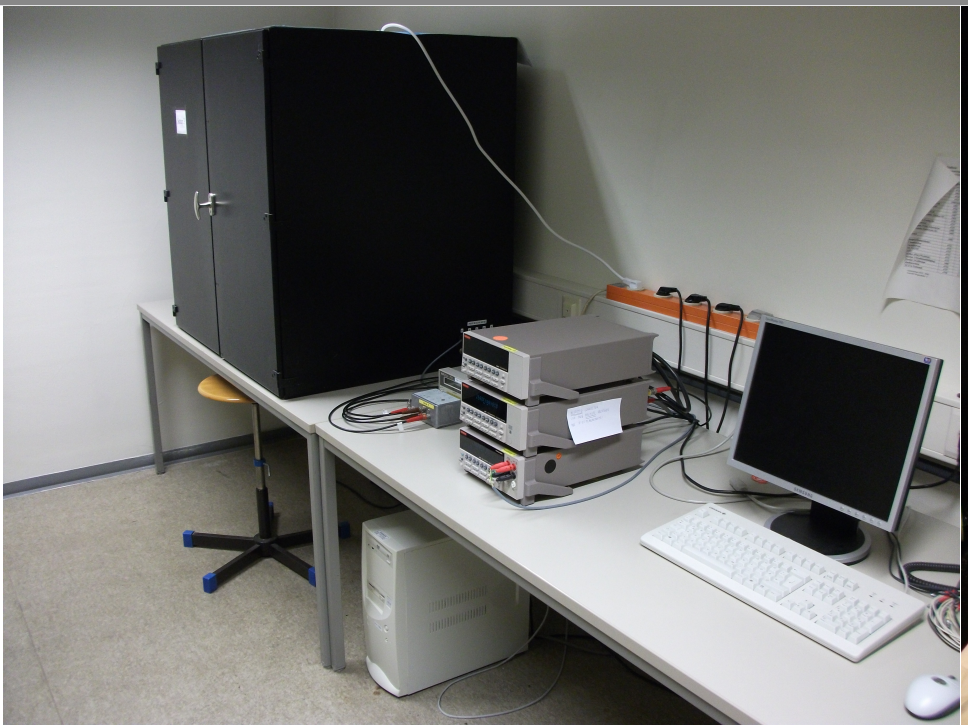
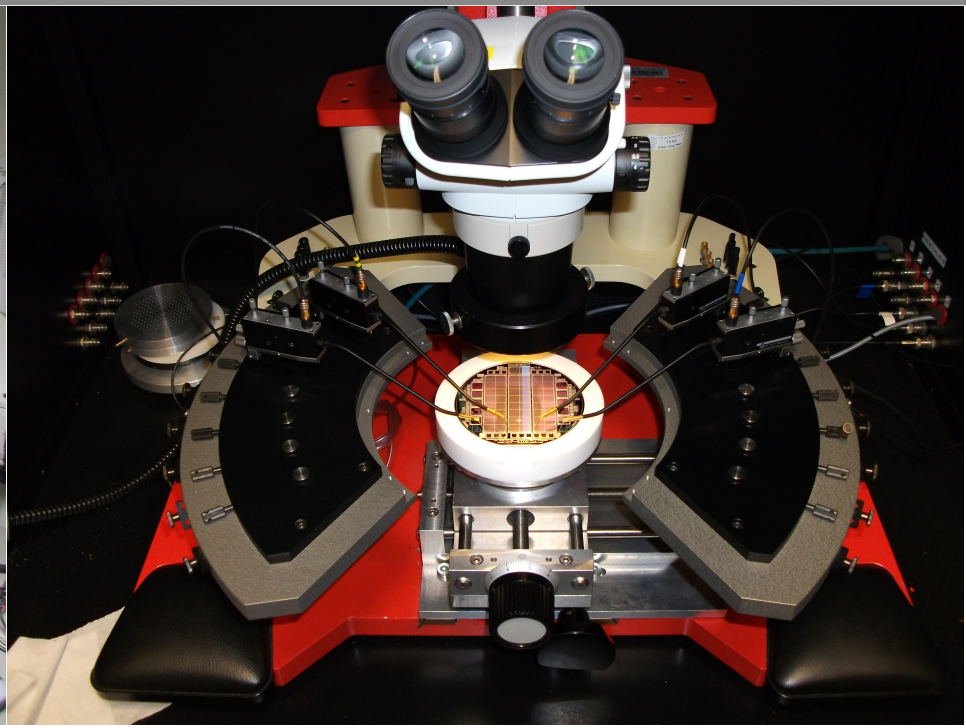
Setup I

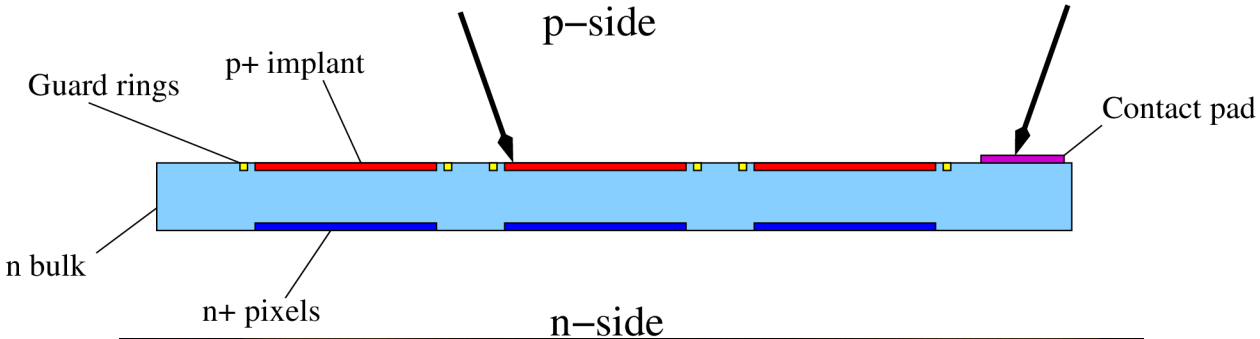




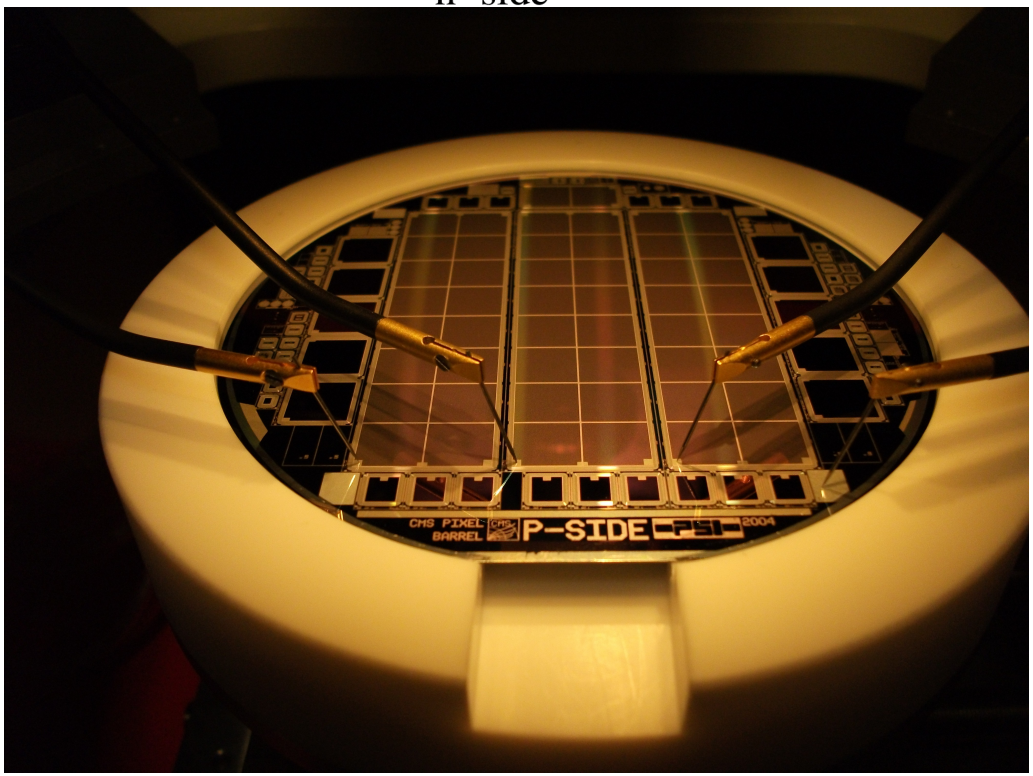
- Ammeter (kei6487)
- Voltage supply (kei6487)
- LCR-meter (hp4263a)
- Temperature monitor (kei2700 + pt100)
- DAQ computer

- Teflon chuck
- 4 needles (3 sensors + 1 bulk)

Setup II



n−side

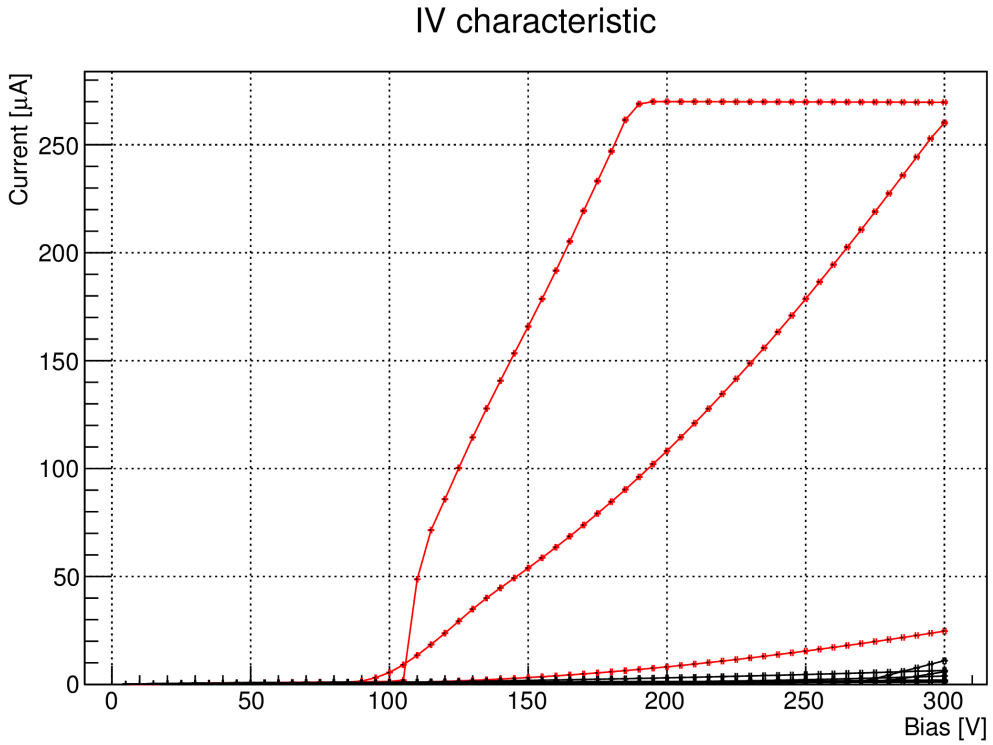


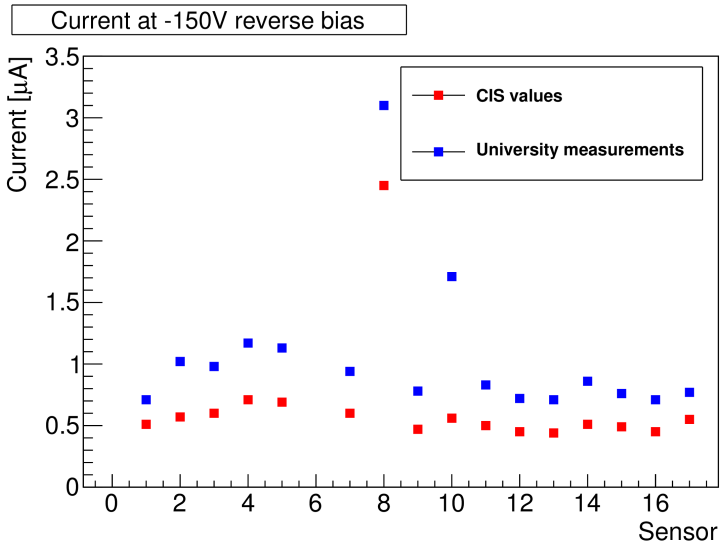
IV characteristic I

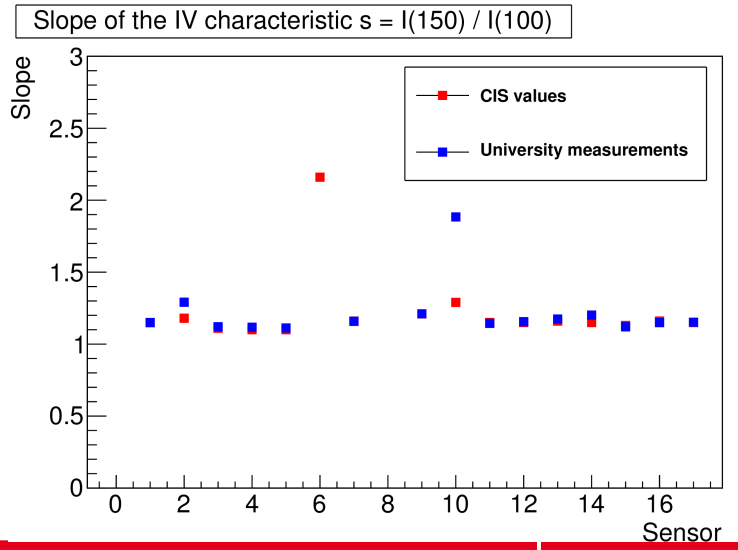
Good sensors (Tilman, Grindelwald 2012):
- I(150) < 2 µA
- I(150) / I(100) < 2

Supply limit I = 250 µA

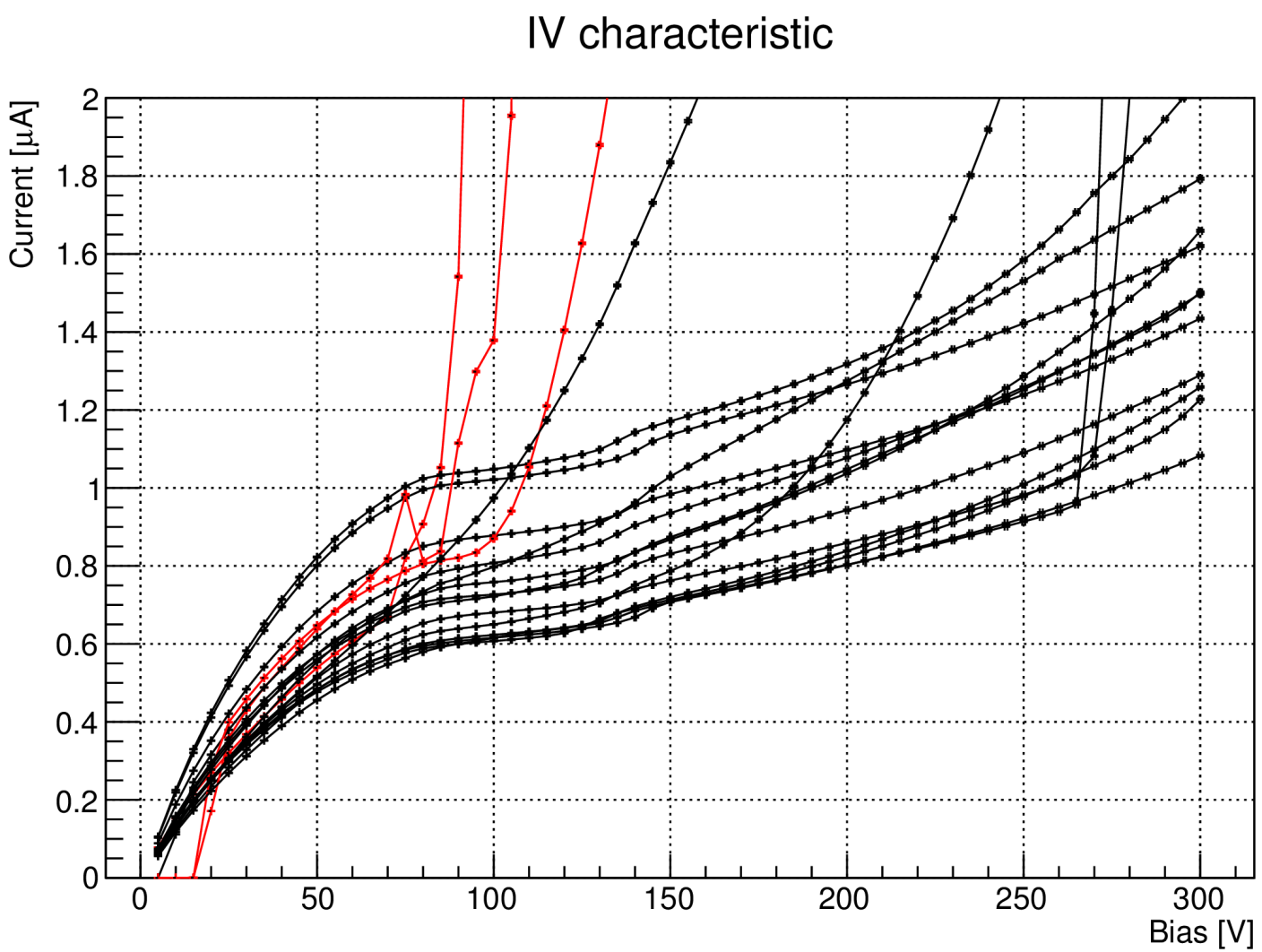
Higher temperature than CIS





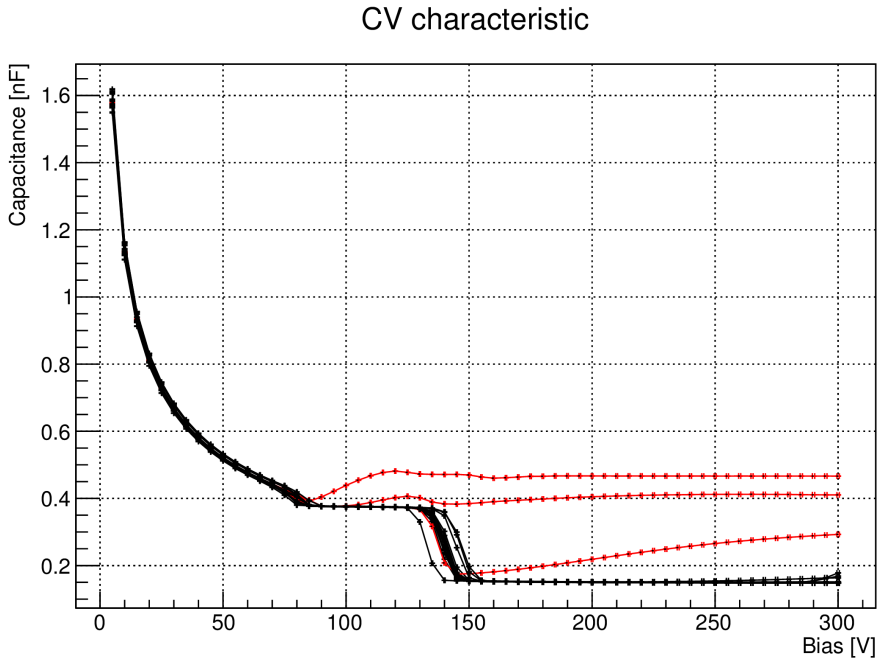


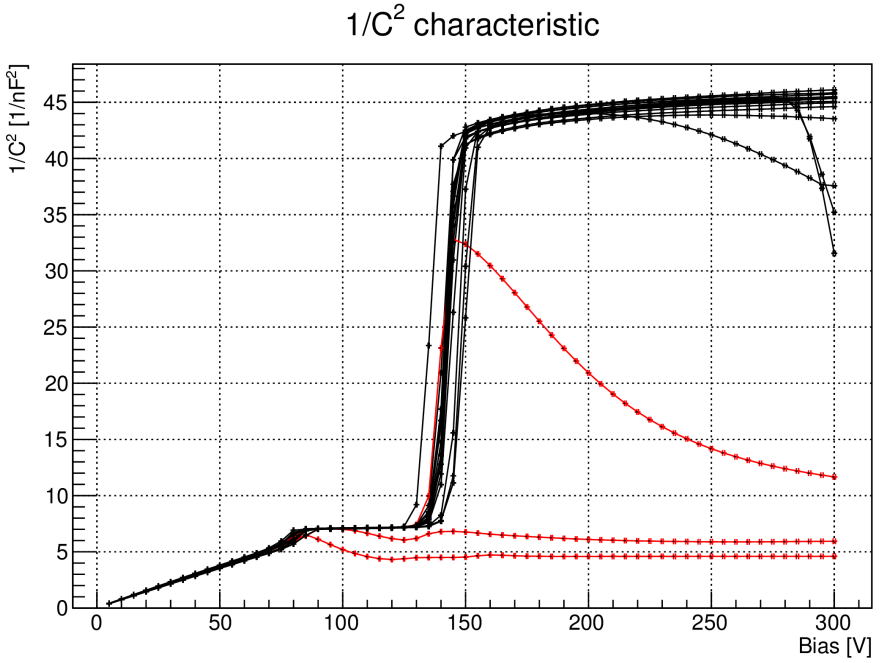
IV characteristic II



Change in slope around 80V and 140V

CV characteristic

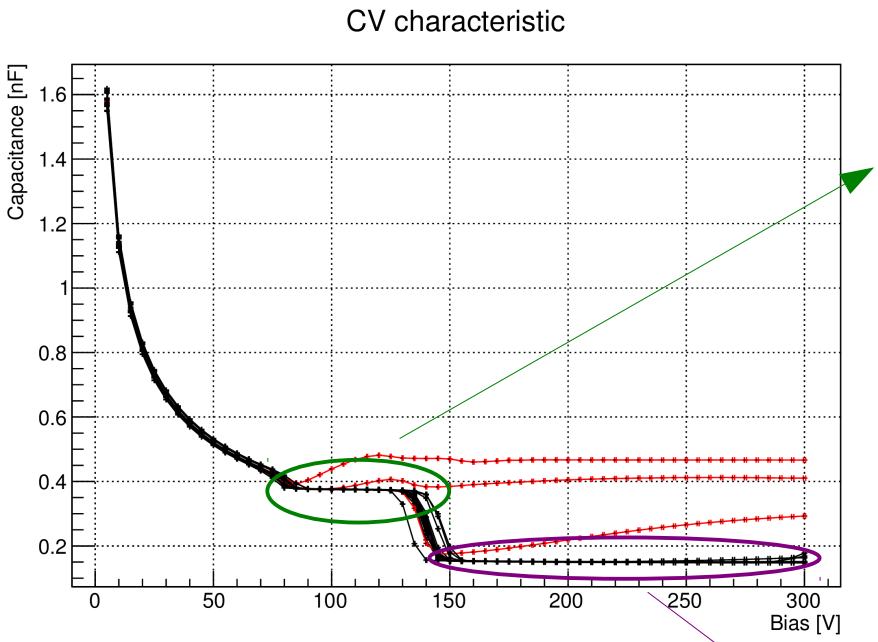


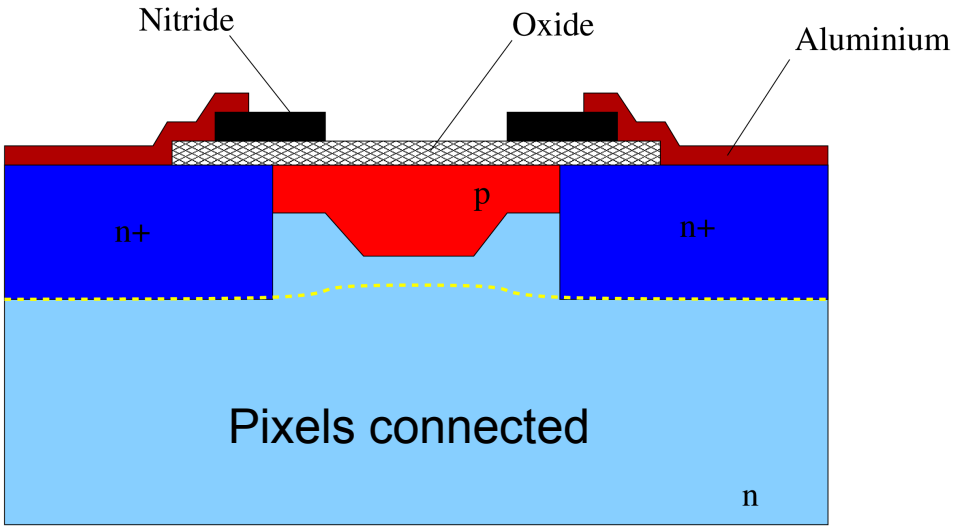


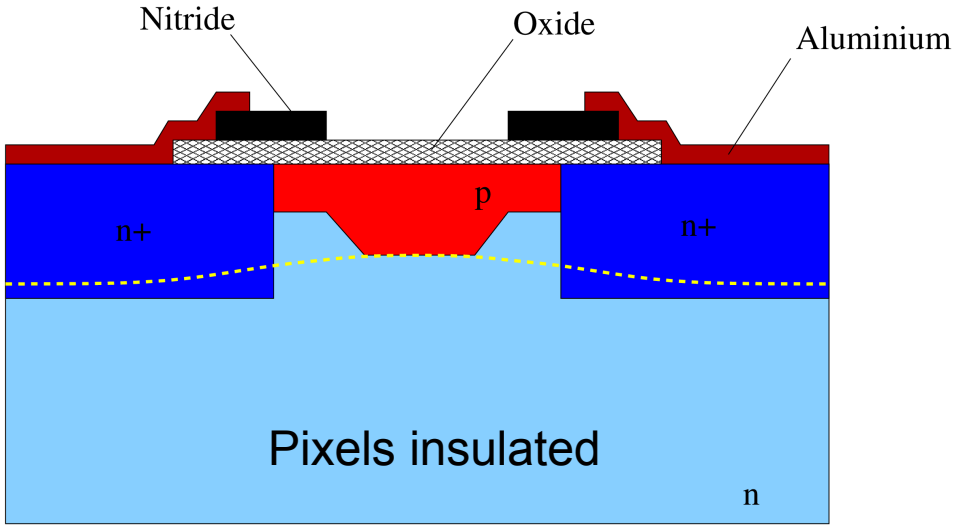
Depletion voltage around 80V → Agrees with CIS data

Second plateau for V > 140V → Where does it come from?

Possible explanation I







Problem:
difference in depth of n+ implants and p-spray

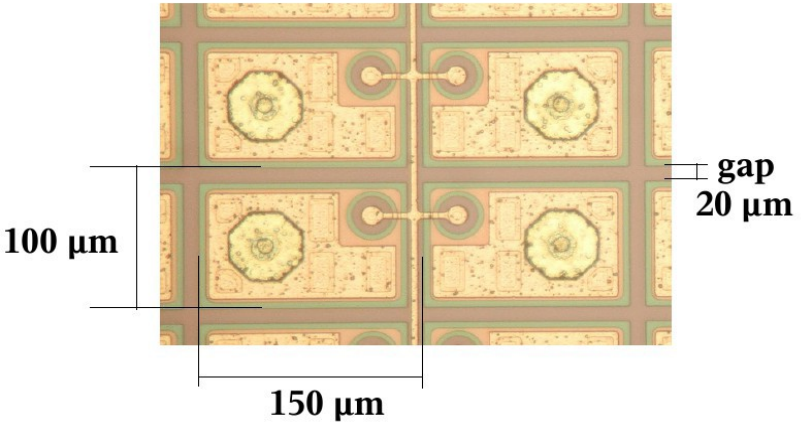
Possible explanation II

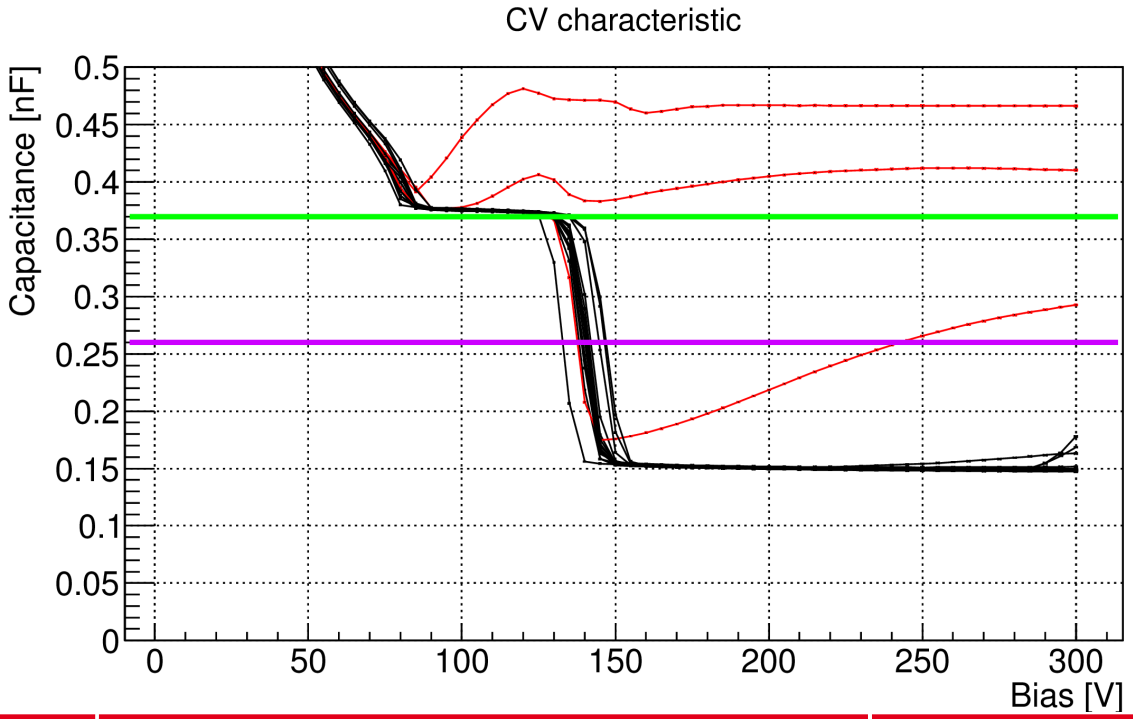
Parallel plates capacitor:

$$C = \varepsilon\,\varepsilon_0 \frac{A}{d} \qquad \varepsilon_0 = 8.85 \cdot 10^{-12}\, F/m$$

$$A = A_{pix} \cdot N_{pix} \qquad \varepsilon_{Si} = 11.9$$

$$N_{pix} = 52 \cdot 80 \cdot 16 = 66560$$





Pixels connected:
n side forms a continuous plate

$$A_{pix} = 150 \cdot 100\,\mu\, m^2$$

$$C_{con} = 0.37\, nF$$

Pixels insulated:
p-spray region does not contribute

$$A_{pix} = 130 \cdot 80\,\mu\, m^2$$

$$C_{ins} = 0.26\, nF$$

Conclusions

- Measured IV and CV characteristics of the sensors up to 300V bias
- 3 defective sensors
- Results in agreement with CIS
- 2 plateaus found in the CV characteristic
- Formulated one hypothesis about the presence of 2 plateaus in the CV (not completely satisfactory)

Further investigations:
- Different needle placement
- Simulations of the CV ?
- Measure of single ROC sensors