Report on my research at KEK

Oguz Alp Duran

Who am I?

Oguz Alp Duran (オーズ・アルプ・ドゥラン) IPA: /oːz/

23 Years old

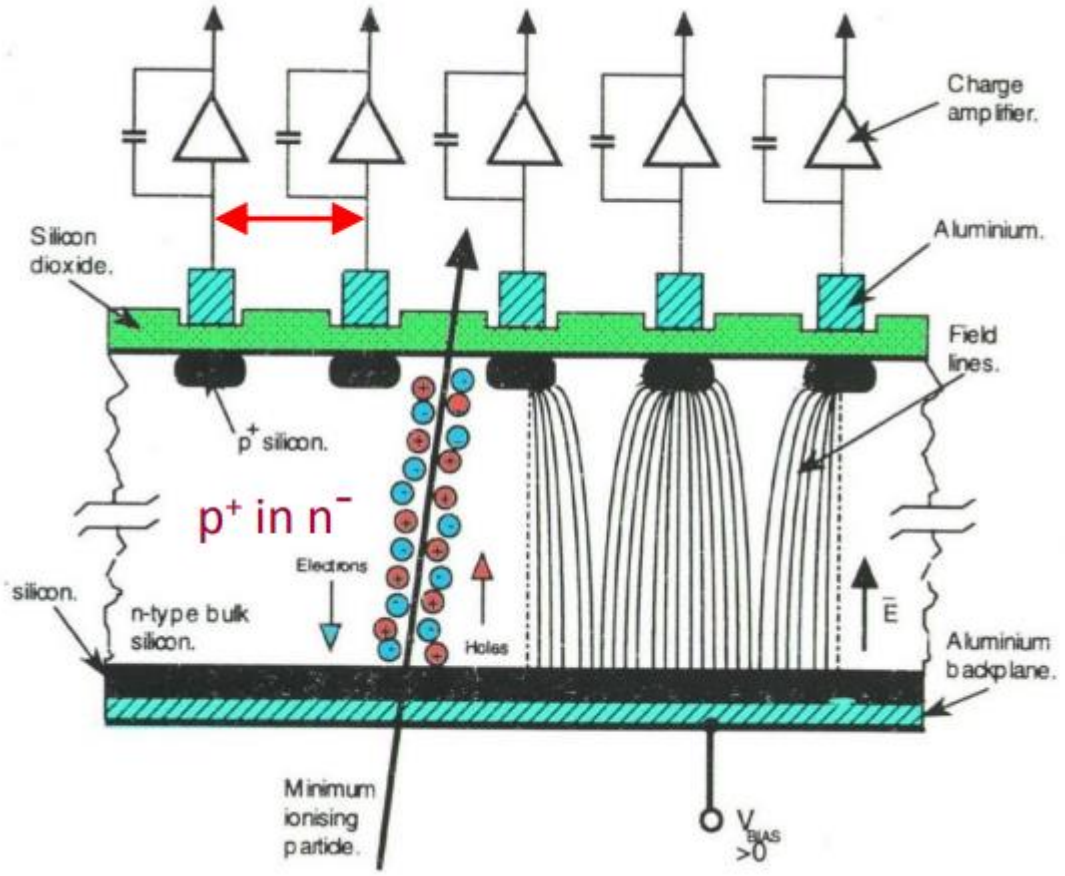
Turkish, but studies in Germany at

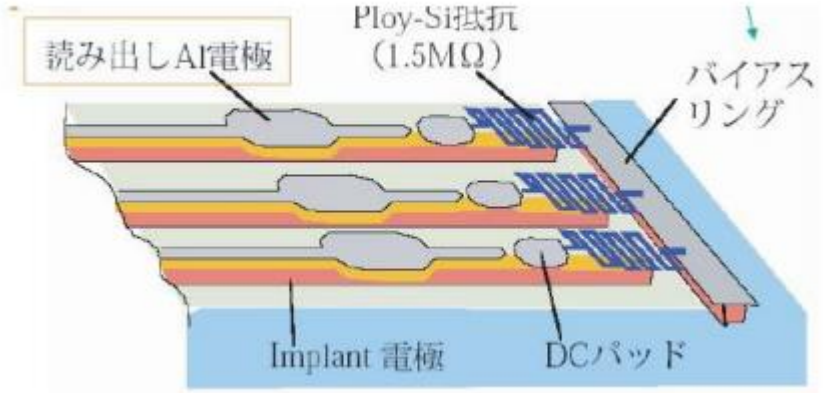
TECHNISCHE UNIVERSITÄT MÜNCHEN

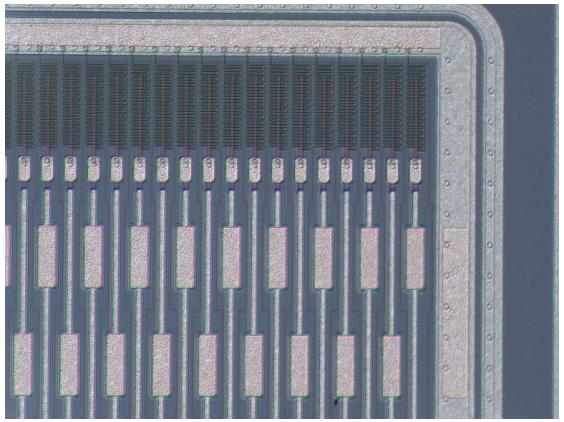
Finished Electonics BSc. → Go on to MSc.

My Project at IPNS 

Microstrip



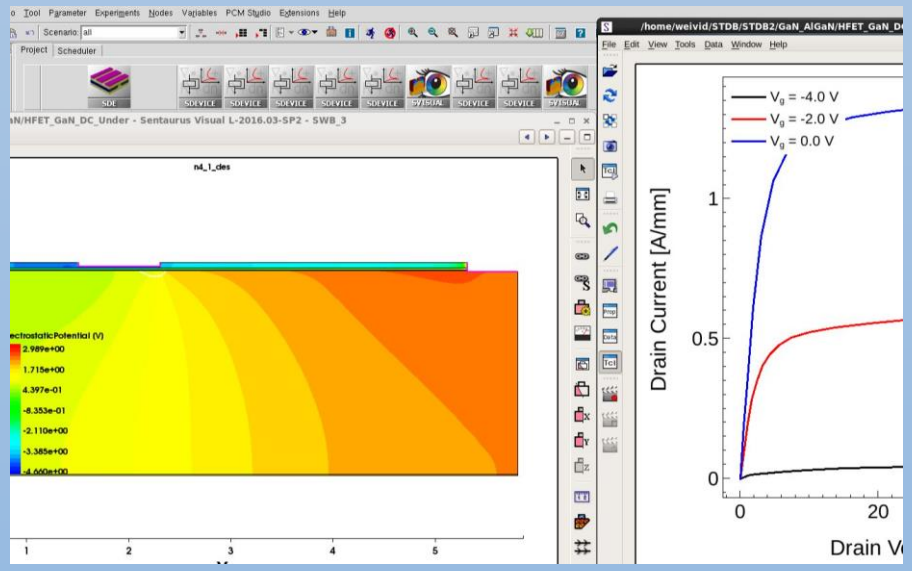




Task Definition

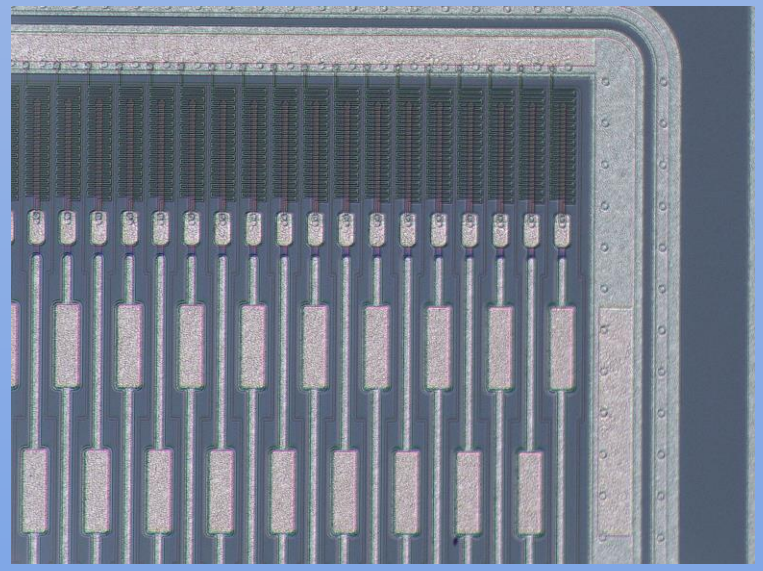
SIMULATION

Simulative search for understanding strip behavior



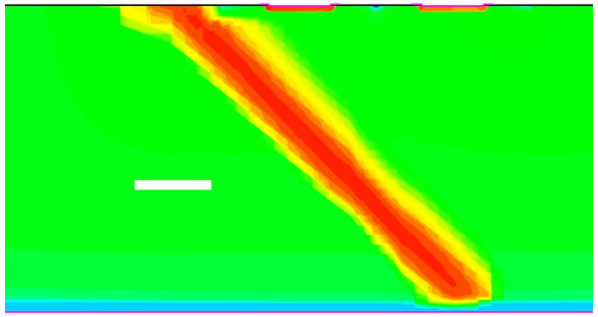
HANDS-ON

Testing, characterizing the ATLAS-BABY ITK STRIP

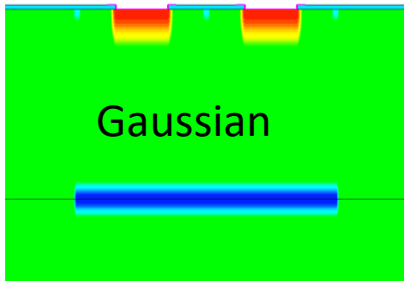


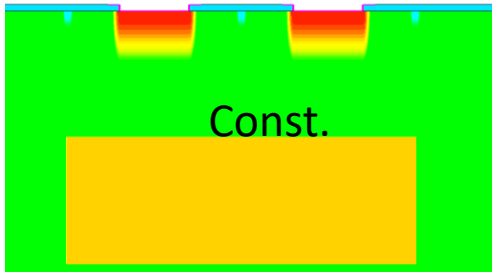
Simulation Tasks

- Minimum Ionizing Particle (MIP) effect on strip
  - Angle, Incidence and Timing Studies
  - Manufacturing effects
    (Epitaxial, Spin-on-dopant, Implant)

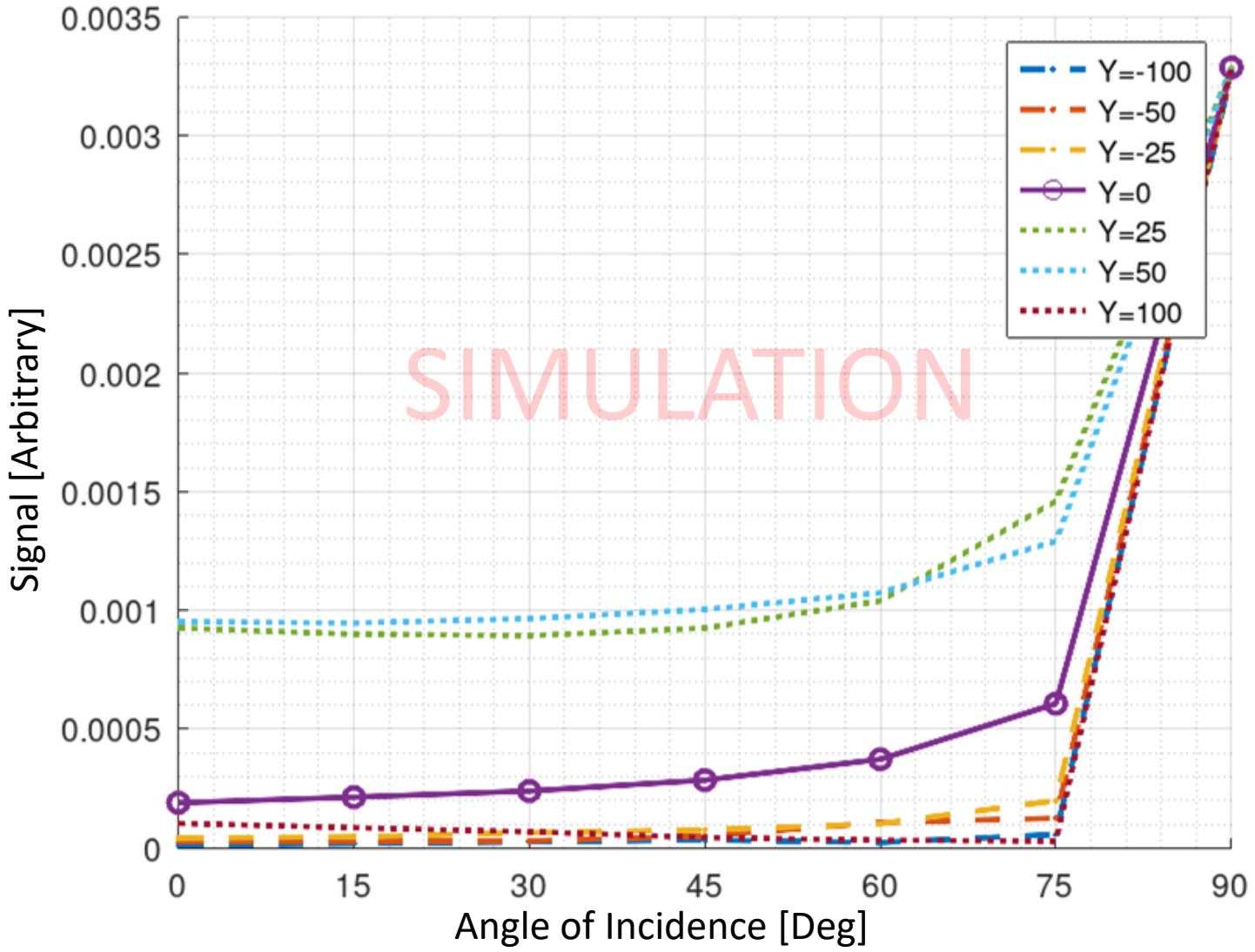


- Effect of a gain layer





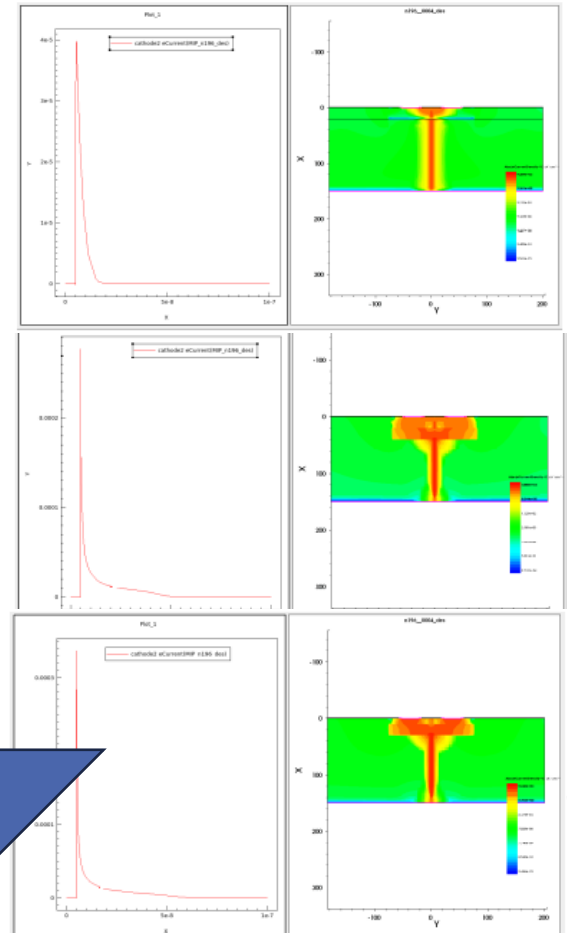
Results of the Simulation → Angle and Position

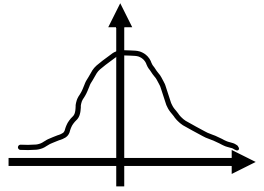
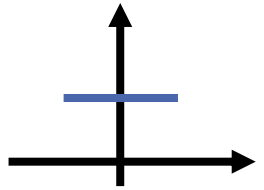
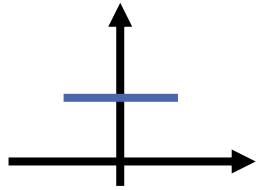


Gain Layer? Yeah!

Peak Signal when no Gain Layer = 0.00019A → 0 dB(rel)

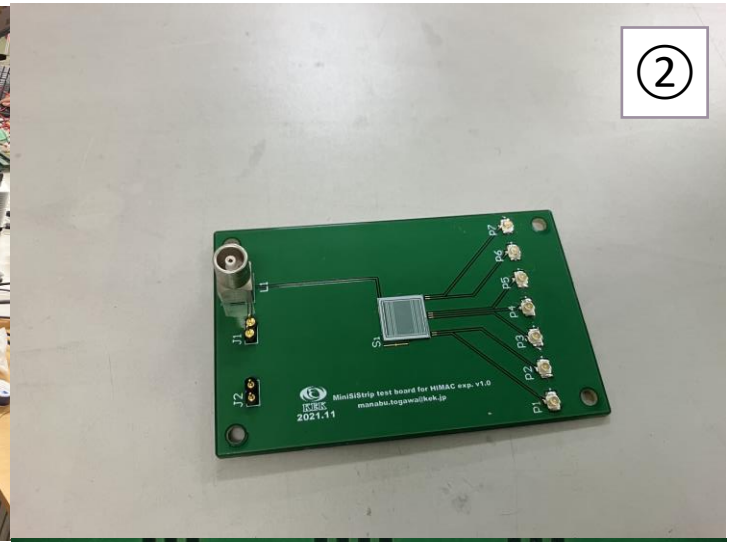
More Gain → More Signal

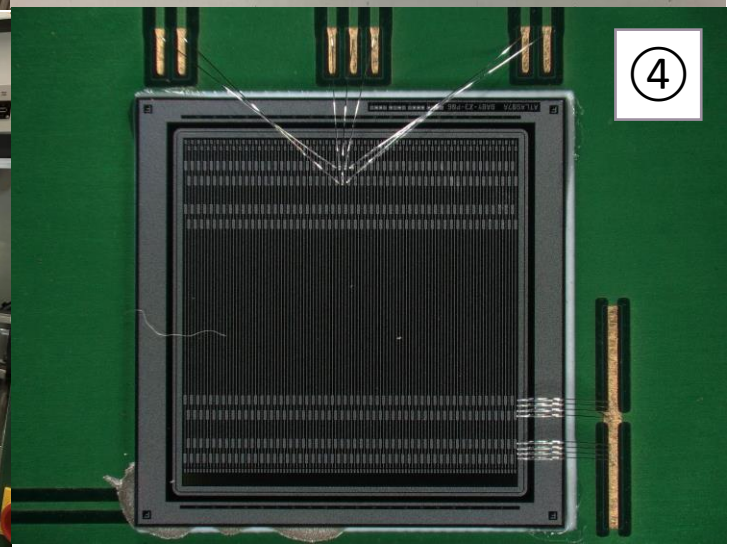


Type of Layer	Type of Doping Profile	
Spin-on-dopant + Epitaxial	Gaussian	
Peak Signal: 1.62dB (rel) NG		
Implant	Constant	
Peak Signal: 1.64dB (rel) NG		
Implant	Constant	
Peak Signal **2.5dB** (rel) OK		

Practical Tests and Tasks

BabyITK Commissioning





No 1.

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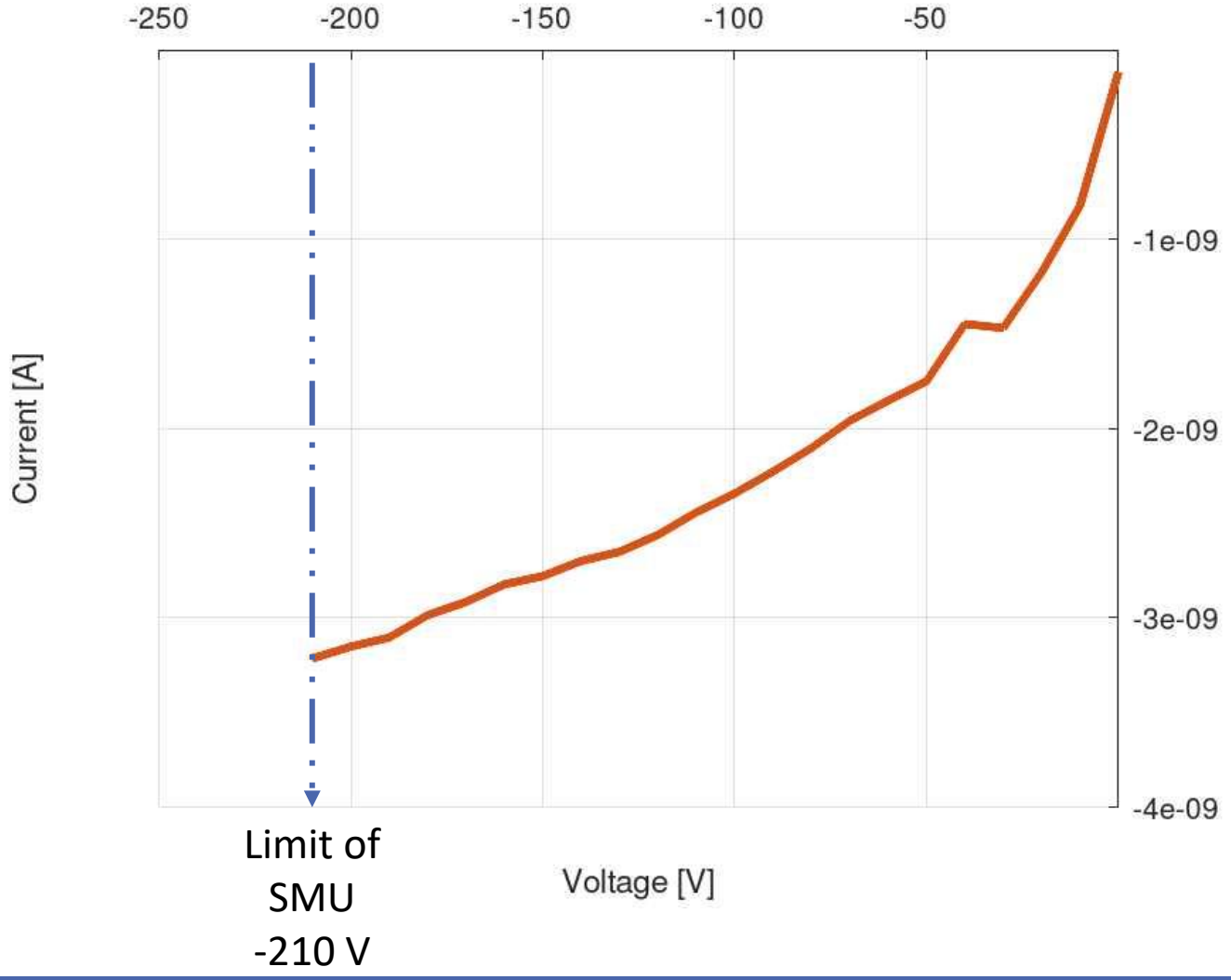
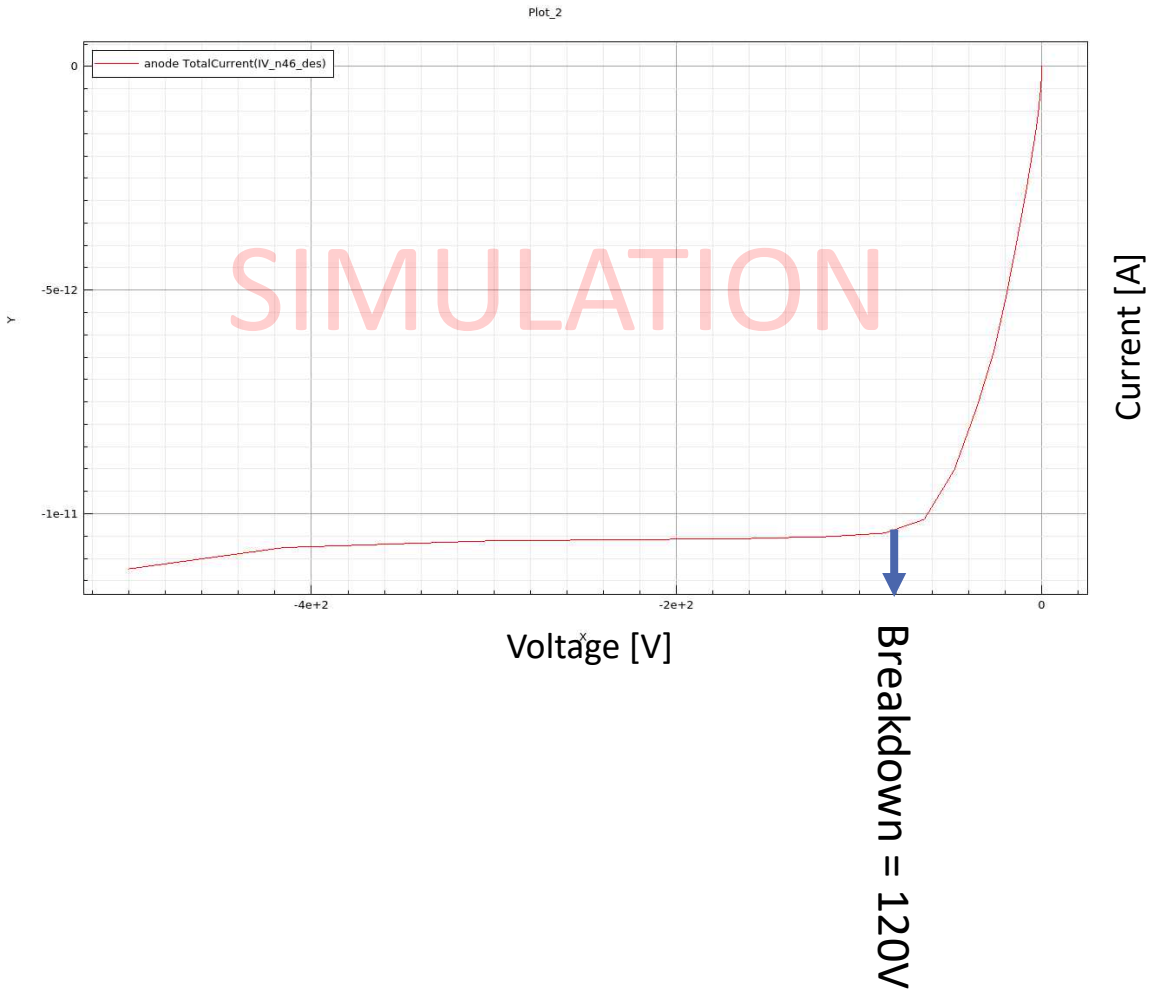
<u>Prepare the PCB:</u>
①Place components (connector, passive)
②Ready up conductive epoxy for the back side contact
③Glue the chip onto the PCBWire bond via the bonder at FUJI b4
④Wire Bonded and Glued Sensor

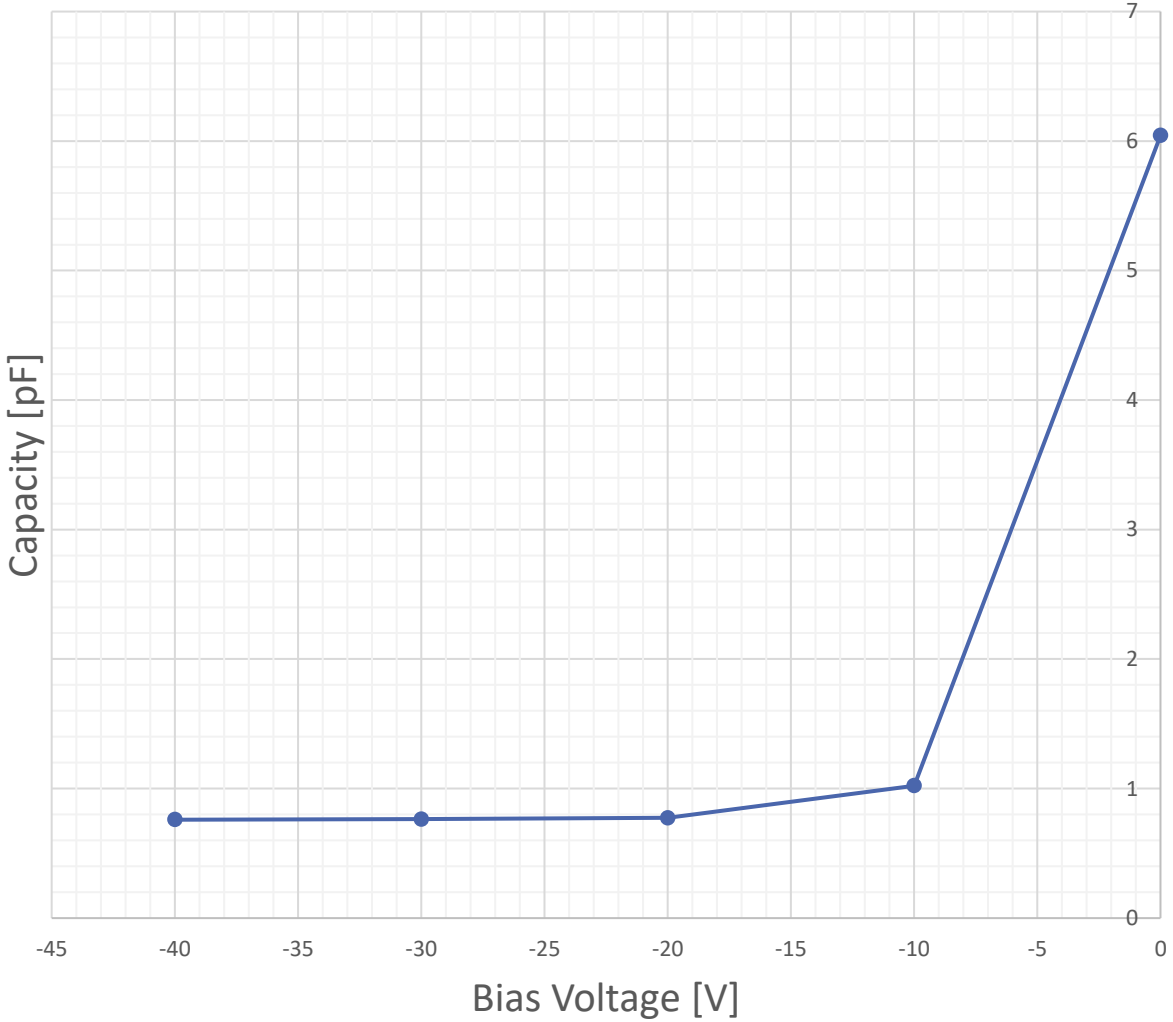
Do above for all 3 boards.

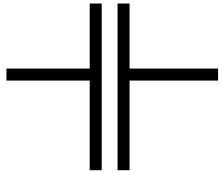
I-V character of the Detector



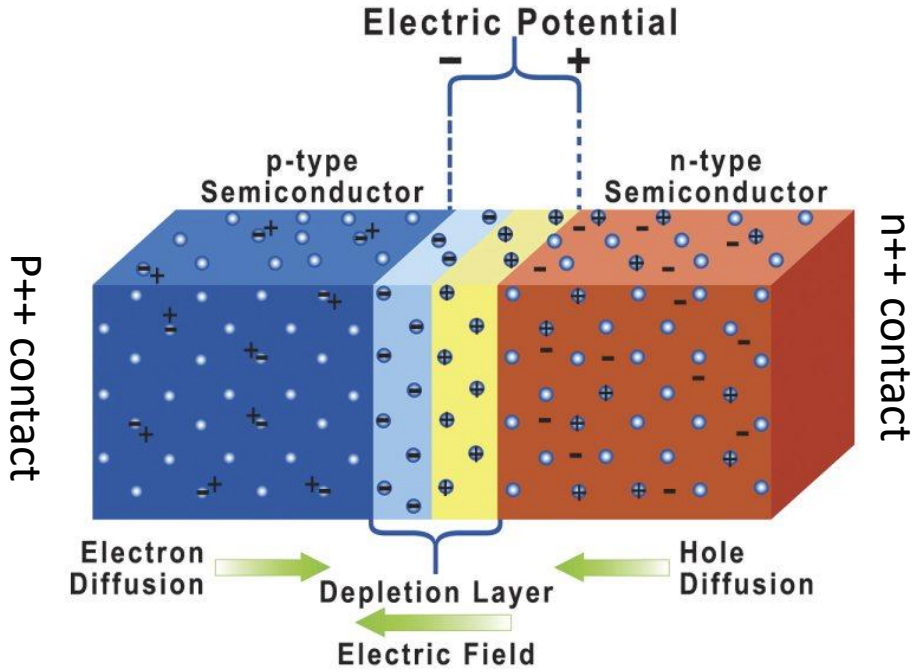


C-V character of the Detector

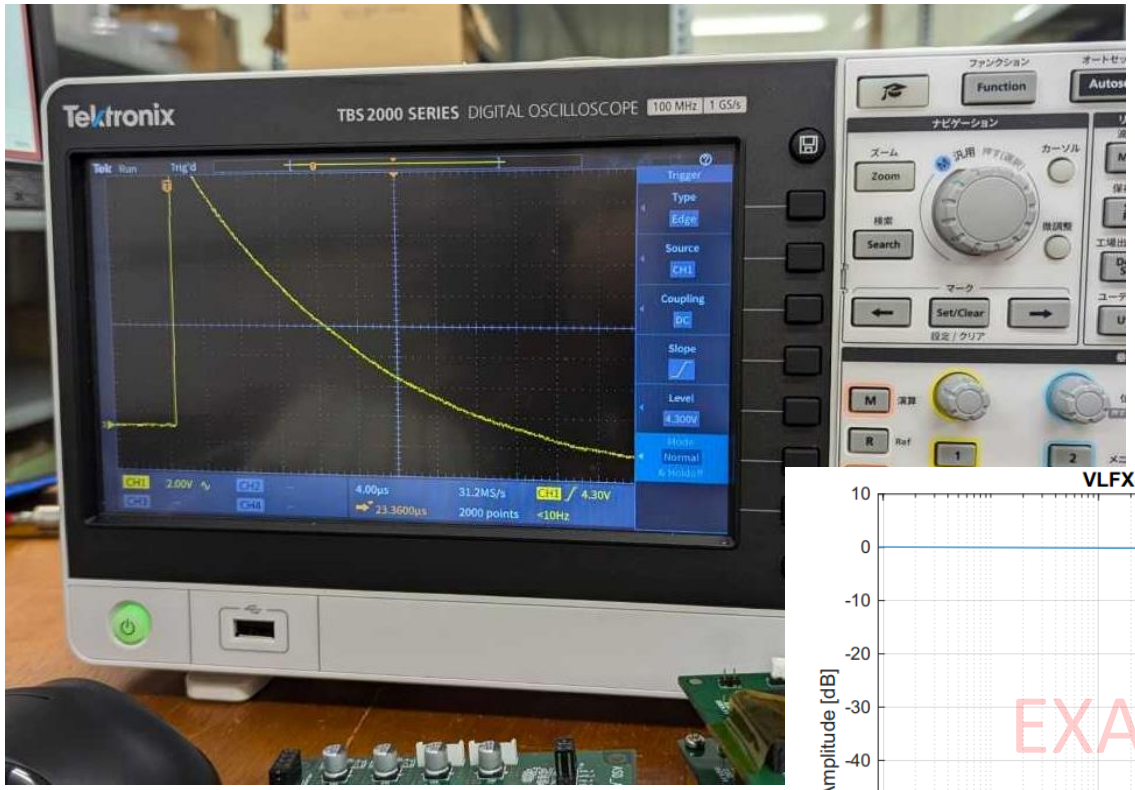


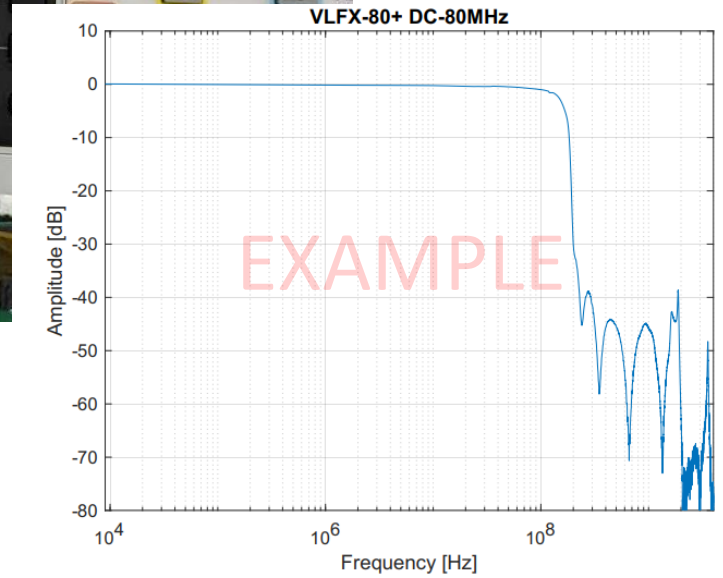


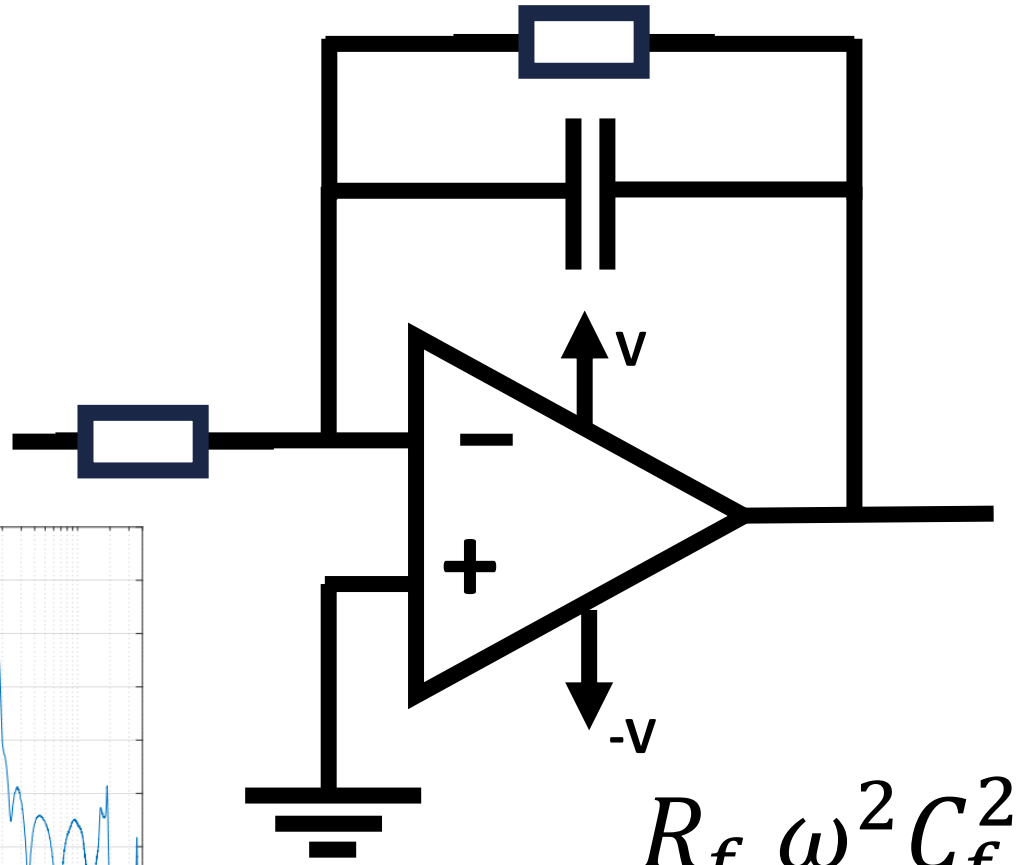
$$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$



Measurement







$$\frac{R_f\,\omega^2 C_f^2}{R_f + j\omega C_f}$$

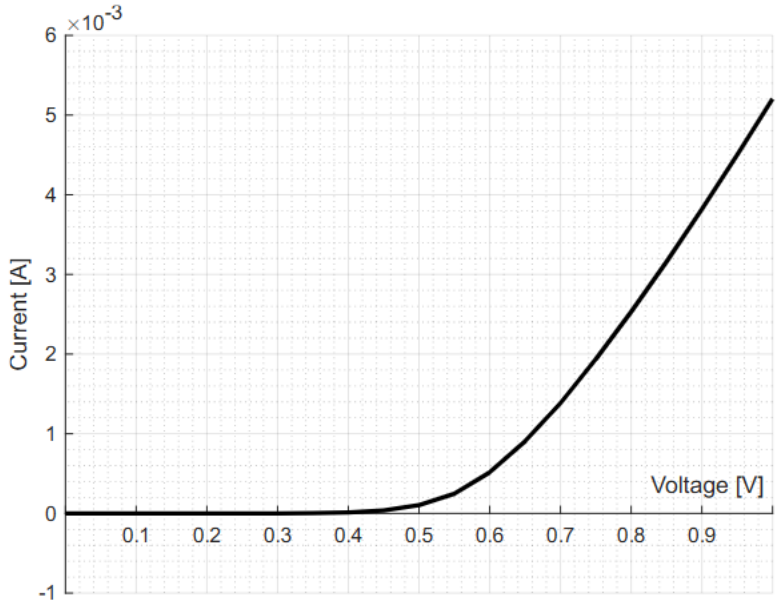
Part of your future, part of your life.

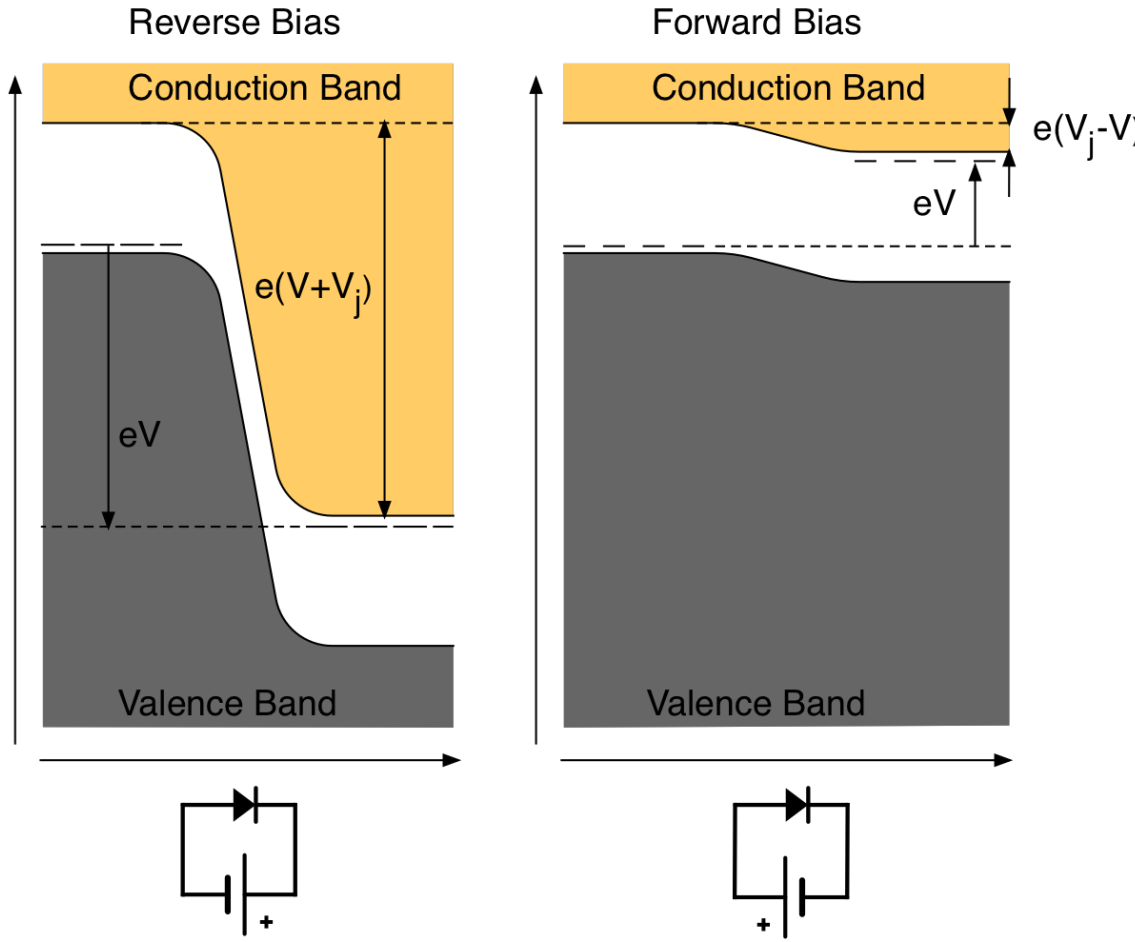
Extra Slides

Diodes to Microstrips

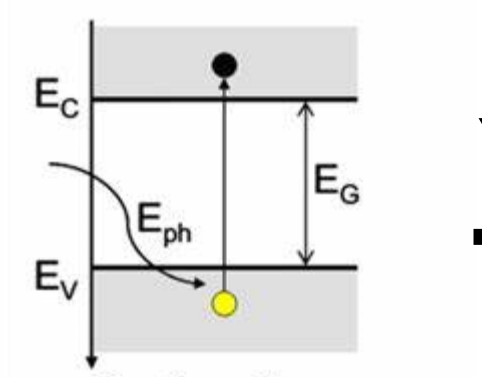
The Hows of a PN Diode

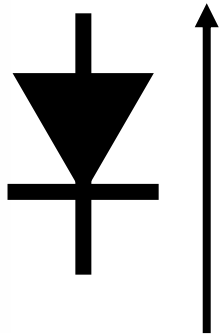
$$I_D = I_S \left(\exp\left(\frac{V_D}{n\,V_R}\right)\text{-}1\right)$$



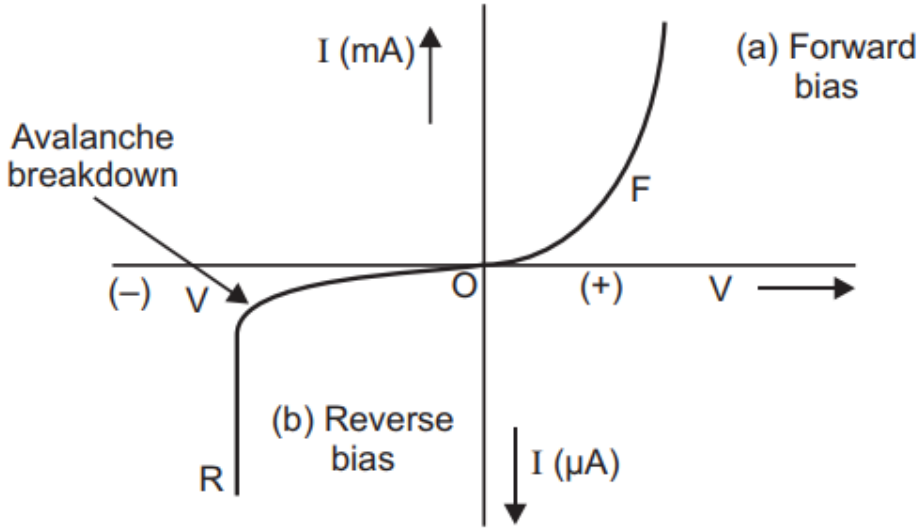


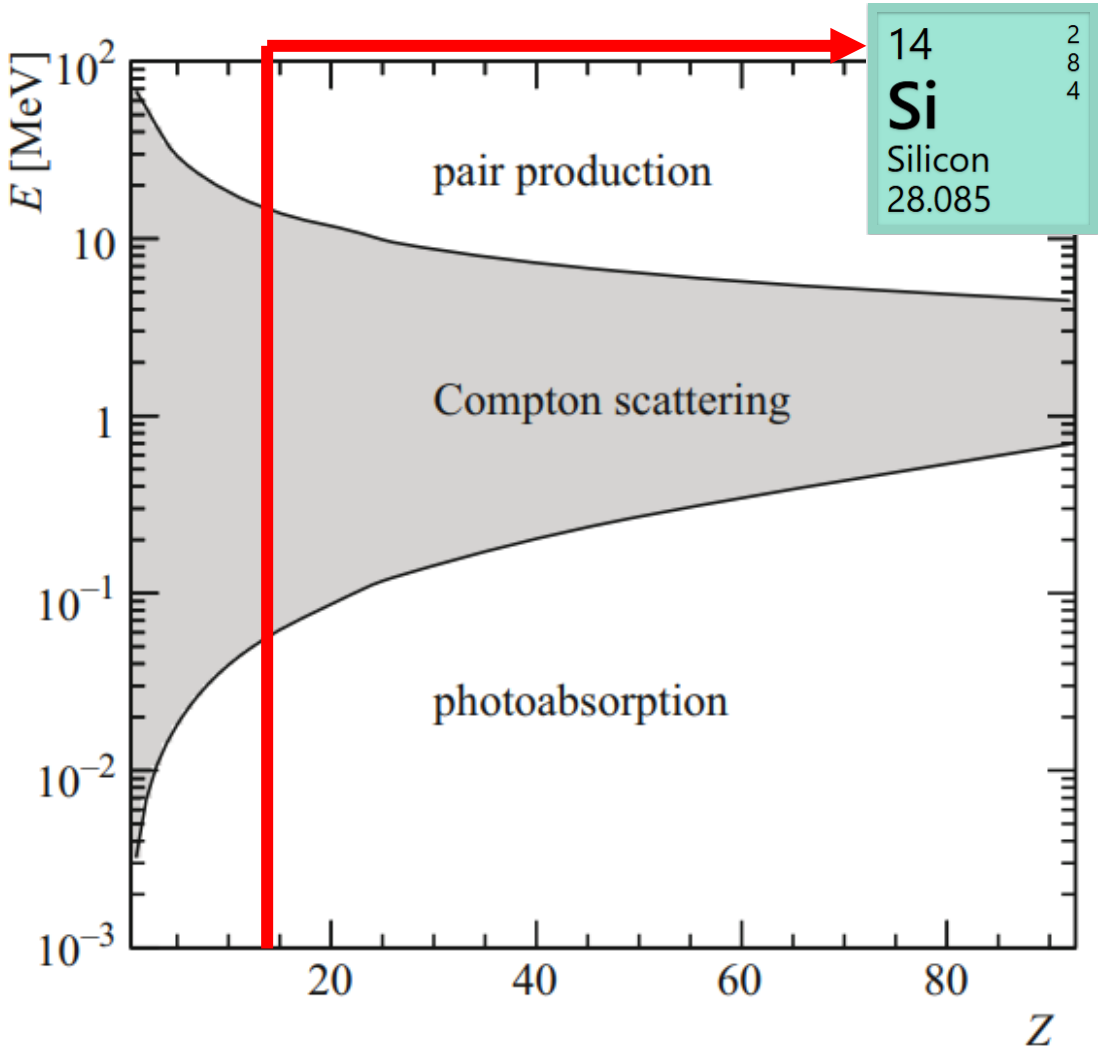
Silicone as a Detector





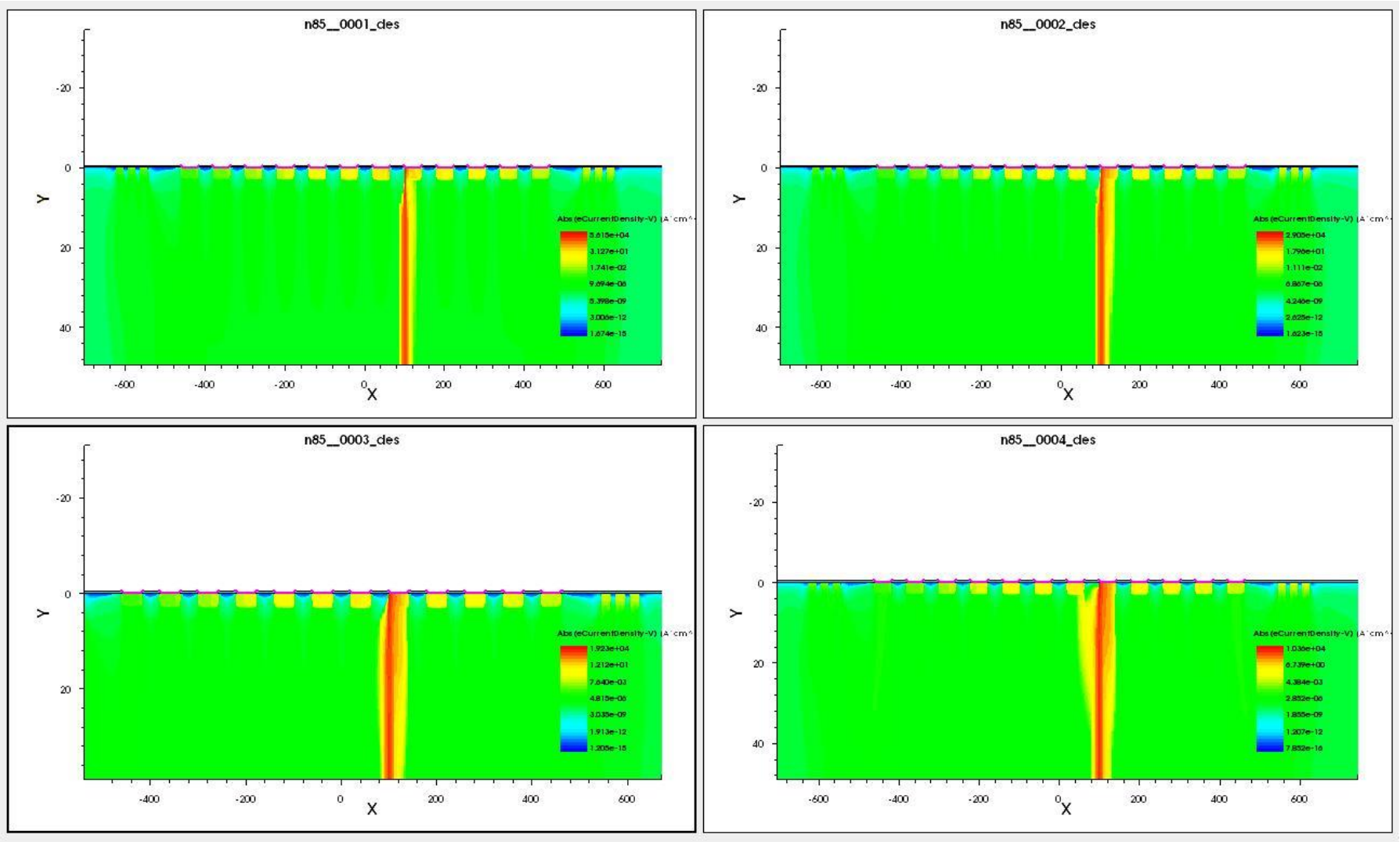
E field > Thermalisation





Particle Physics Reference Library Volume 2: Detectors for Particles and Radiation, Springer

Simulating the Baby ITK



What to look out for:

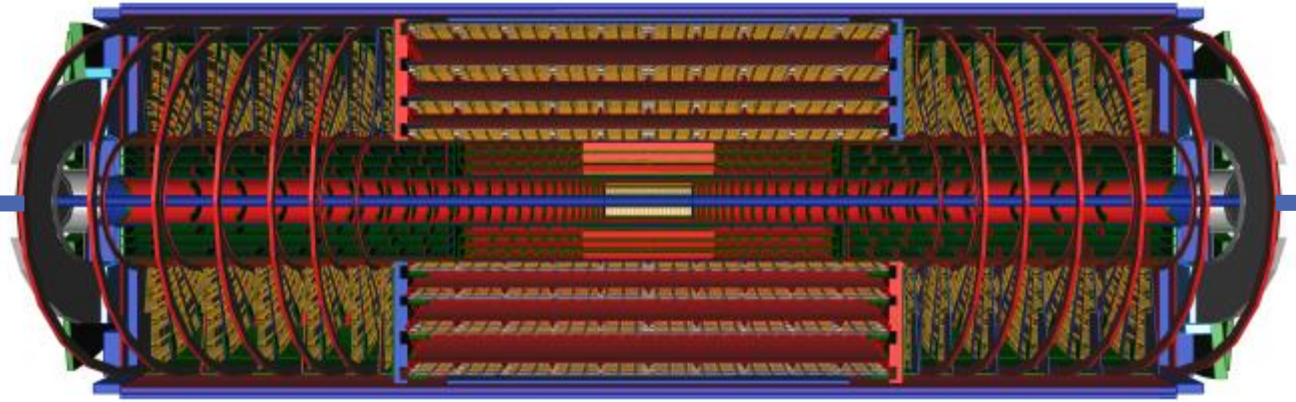
+ Correct number of Ground Rings

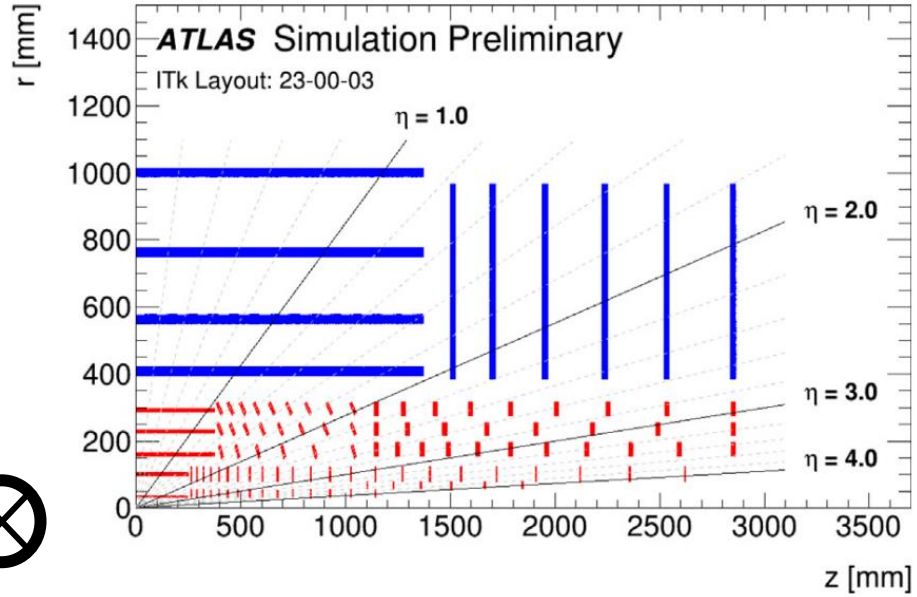
+ Correct number of stripes
→ Increased simulation time 20x

+ Charge Transport!

→ Signal shape matches!
→ Signal Time does NOT

ITk





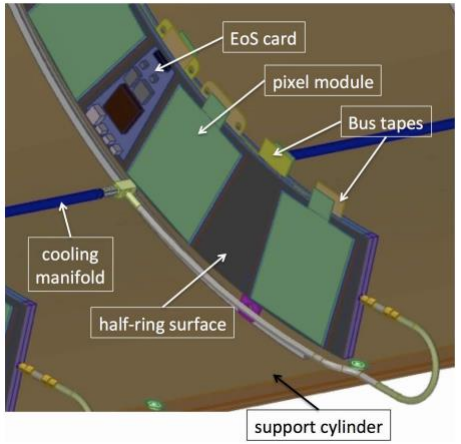


Fig. 1. Schematic view of the ITk layout. The figure shows only one quadrant. Only active detector elements are shown, in red for the pixel detector and in blue for the strip detector [3].

Getting Voltage-Current Character

```
#!/usr/bin/env bash

echo -e ":OUTP OFF" >> /dev/ttyUSB0

echo -e "*RST"  >> /dev/ttyUSB0

sleep 0.005
echo -e ":SOUR:FUNC:MODE VOLT"  >> /dev/ttyUSB0
echo -e ":SENS:CURR:PROT:LEV 1.0e-3" >> /dev/ttyUSB0
echo -e ":SENS:CURR:RANGE:AUTO 1"  >> /dev/ttyUSB0
echo -e ":OUTP ON" >> /dev/ttyUSB0

touch data


for i in $(seq -200 10 150);
do
    echo -e ":SOUR:VOLT "$i >> /dev/ttyUSB0
    sleep 0.5
    echo -e ":READ?" >> /dev/ttyUSB0
    sleep 0.5

done
echo -e ":OUTP OFF" >> /dev/ttyUSB0
```

No 2.

2024/Jul/25

IV scan using a Source Meter with a bash script to retrieve data.