First Measurements on 3D Strips Detectors Irradiated at 10^{16}-10^{17} n/cm^2

Virginia Greco - IMB-CNM, Barcelona (Spain)

Marta Baselga, Celeste Fleta, Manuel Lozano,
Giulio Pellegrini, David Quirion

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Centro Nacional de Microelectrónica CSIC

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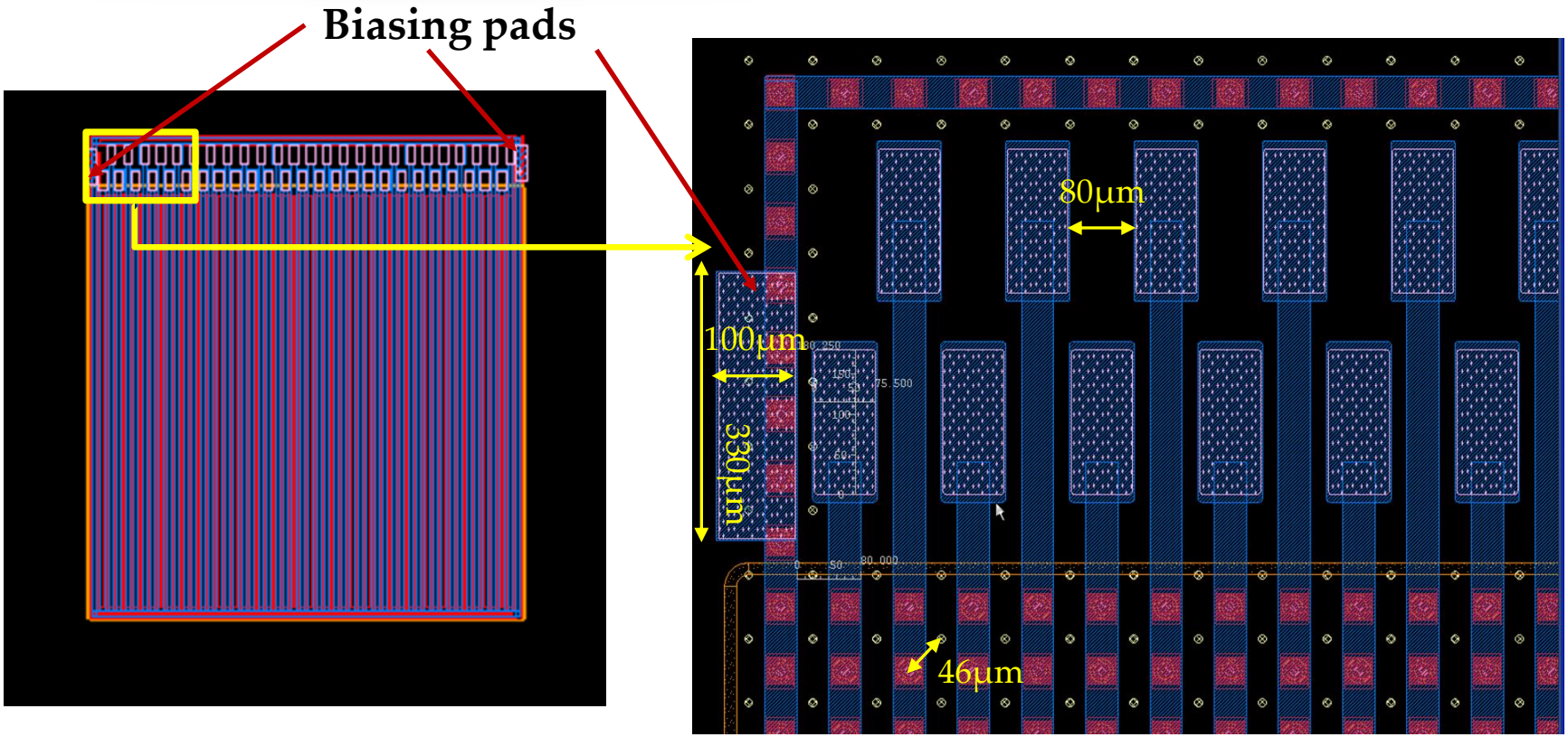
Geometry of the 3D Strip Detectors



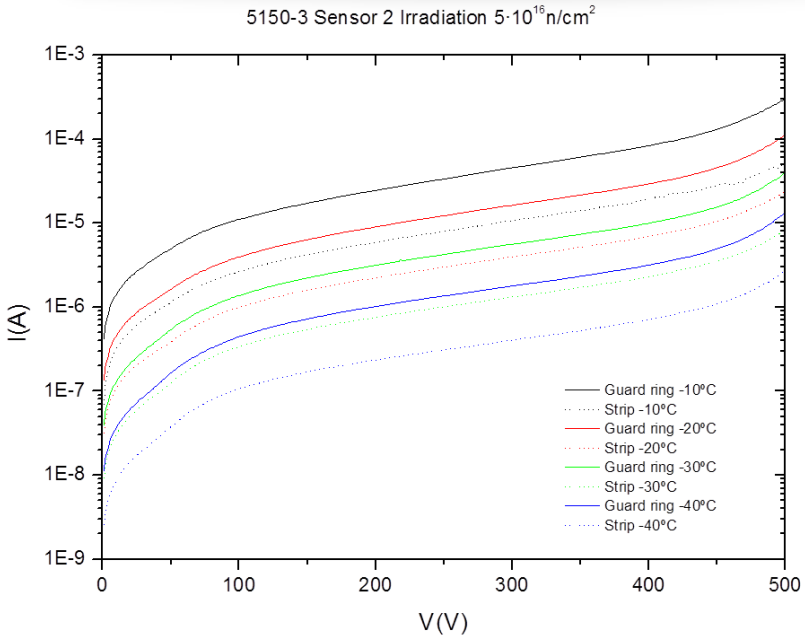
- 50 channels, 80µm strip pitch
- 280 µm of thickness
- 180x75 µm passivation openings for wire bonding

- p-type and n-type 3D detectors from different runs were irradiated at various fluences in Ljubljana.

#	Run	Strip length	Type	Fluence
1	5150-3 S2	5mm	p-type	$5 \cdot 10^{16}$ n/cm^2
2	5150-3 S4	5mm	p-type	$8 \cdot 10^{16}$ n/cm^2
3	4223-8	10mm	p-type	10^{17} n/cm^2
4	4223-2	10mm	p-type	10^{17} n/cm^2
5	4222-2	10mm	n-type	10^{17} n/cm^2

- All detectors were **annealed** for 8 minutes at 80°C.
- Measurements with probe station:
  - → I–V curves at different temperatures
  - → C–V curves at T = - 40°C

I-V Curves (10^{16} n/cm^2)



p-type
Size: 5mm
Fluence : $5 \cdot 10^{16}$ n/cm^2

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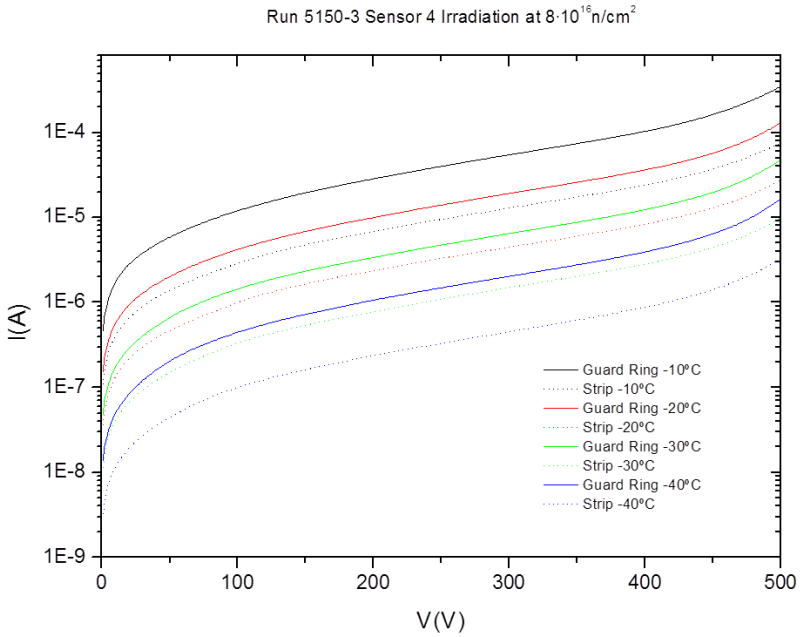
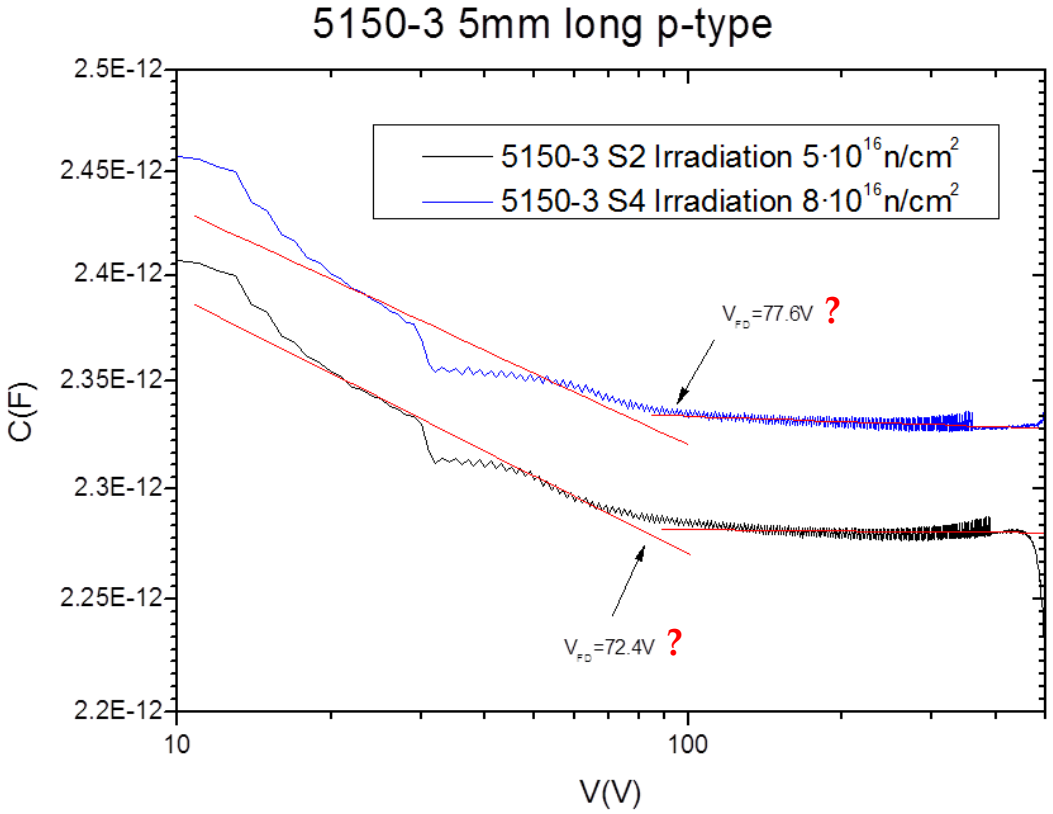
Size: 5mm
Fluence : $8 \cdot 10^{16}$ n/cm^2



C-V Curves (10^{16} n/cm^2)

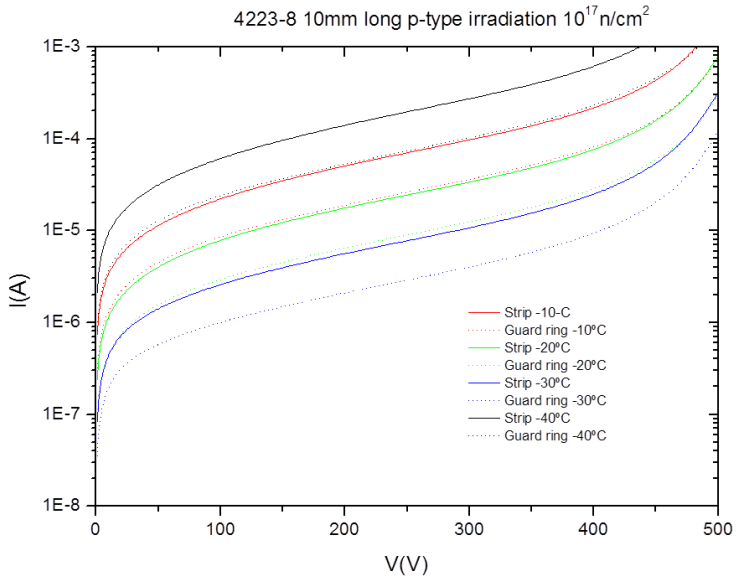


p-type
Size: 5mm
Fluence : $8 \cdot 10^{16}$ n/cm^2

p-type
Size: 5mm
Fluence : $5 \cdot 10^{16}$ n/cm^2

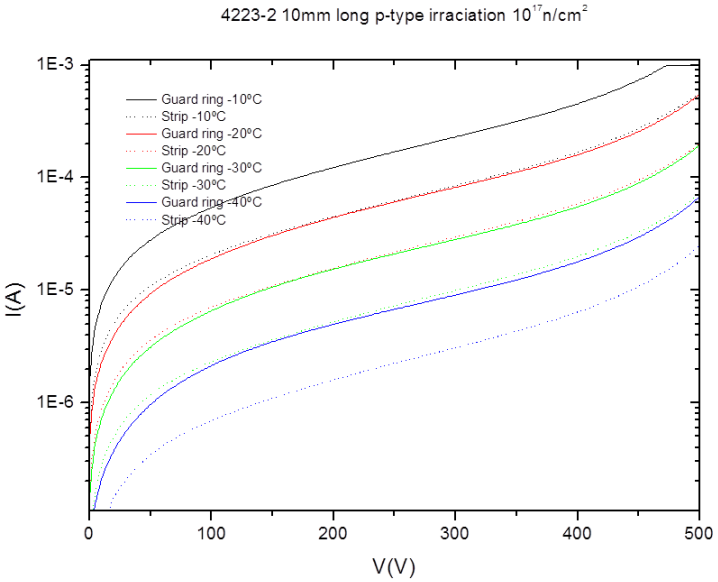
T = - 40° C
f = 10 kHz

I-V Curves (10^{17} n/cm^2)

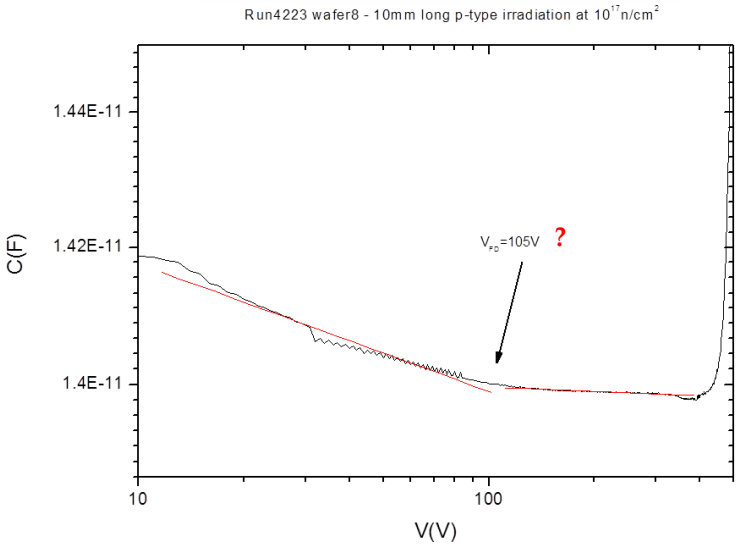


p-type
Size: **10**mm
Fluence : 10^{17} n/cm^2

p-type
Size: **10**mm
Fluence : 10^{17} n/cm^2



C-V Curves (10^{17} n/cm^2)



p-type
Size: **10**mm
Fluence : 10^{17} n/cm^2

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Size: **10**mm
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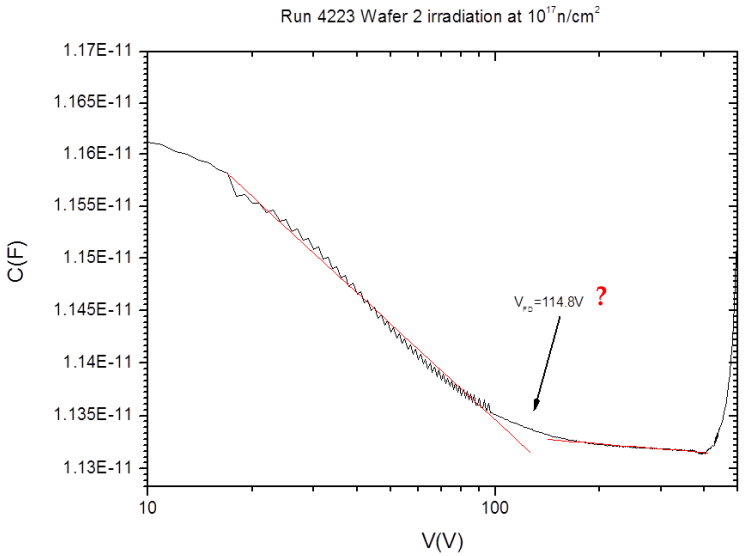
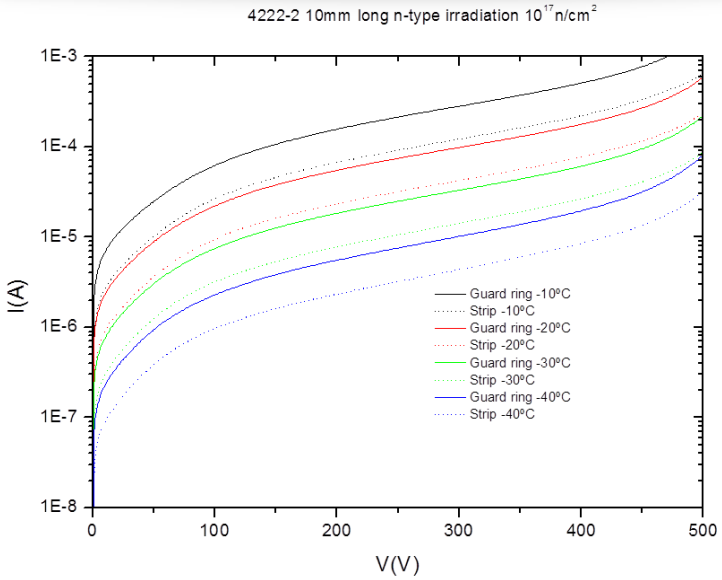
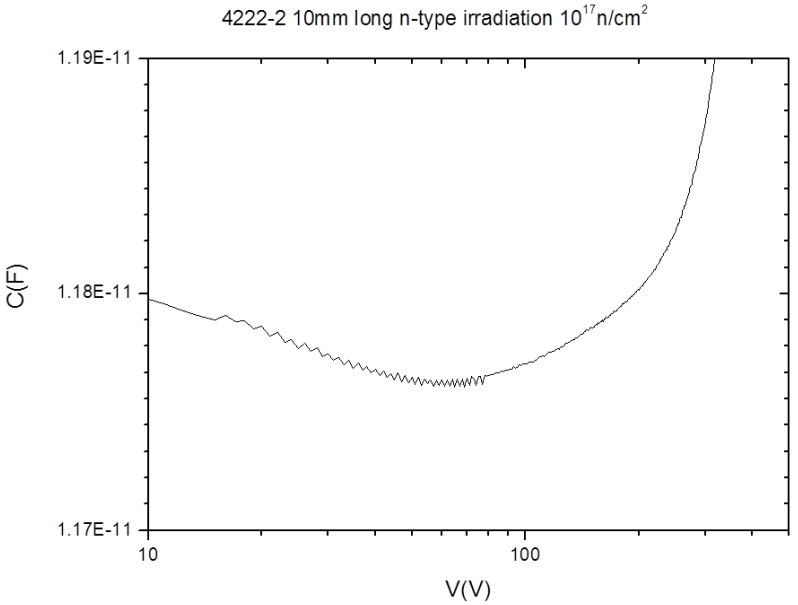


T = - 40° C
f = 10 kHz

I-V & C-V Curves (10^{17} n/cm^2 -n-type)



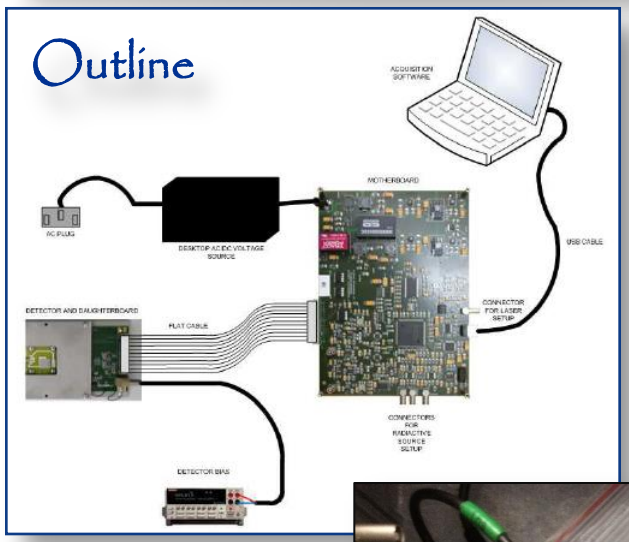
n-type
Size: **10**mm
Fluence : 10^{17} n/cm^2

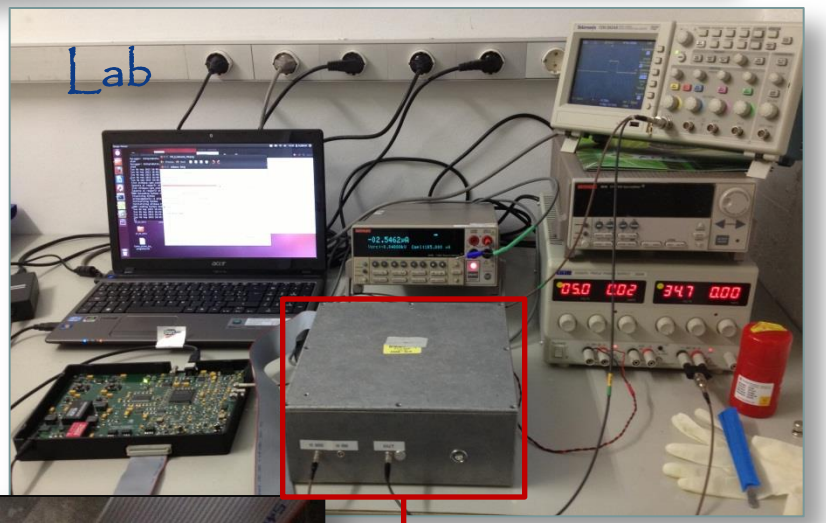


T = - 40° C
f = 10 kHz

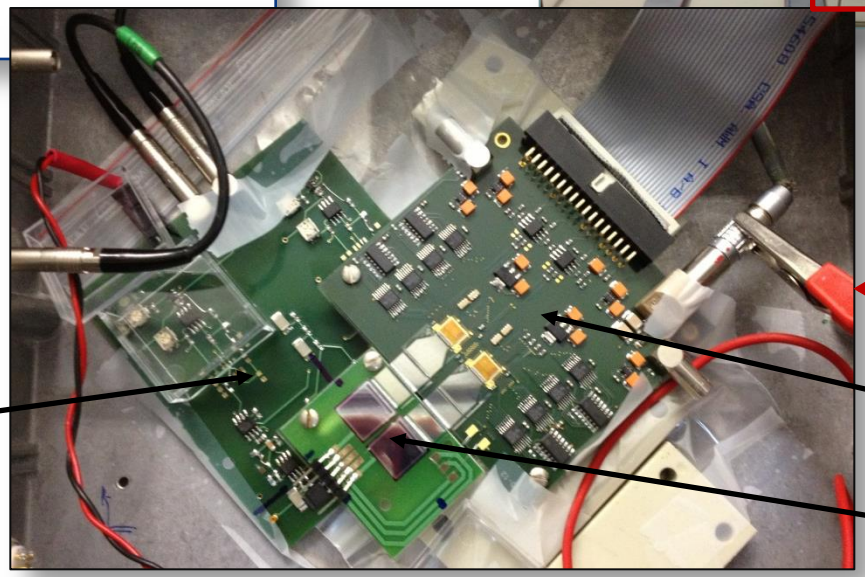
Characterization with the ALIBAVA Readout System

The ALIBAVA Setup





Al ibava systems



Inside the box

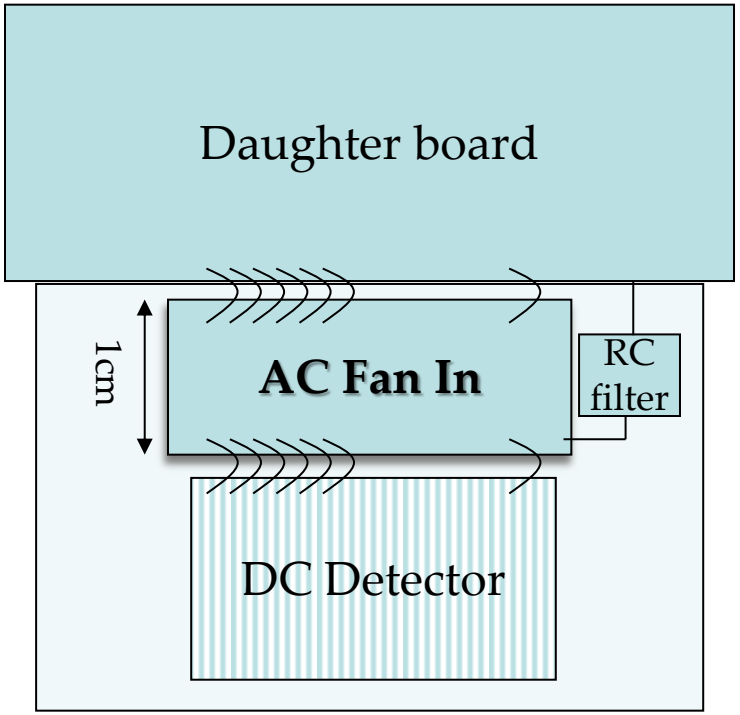
Trigger Board (diode)

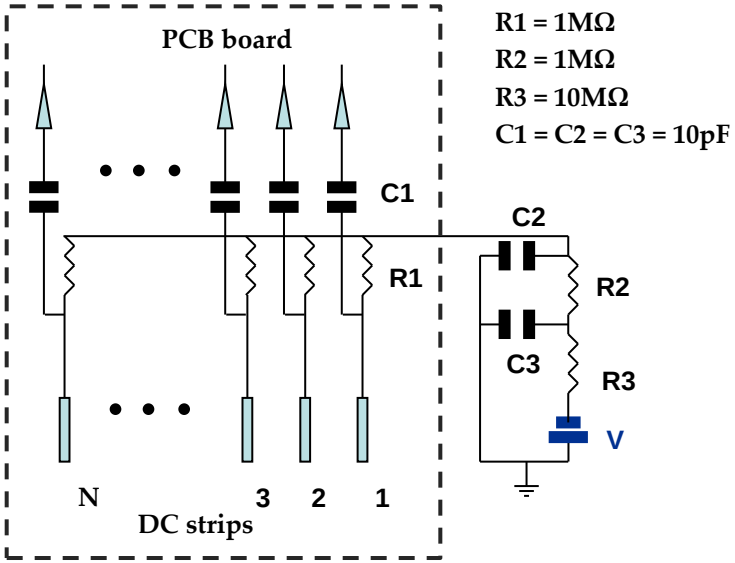
Daughterboard (Beetle chip)

3D Pixel Sensors (230 μm thick)

AC Pitch Adaptors

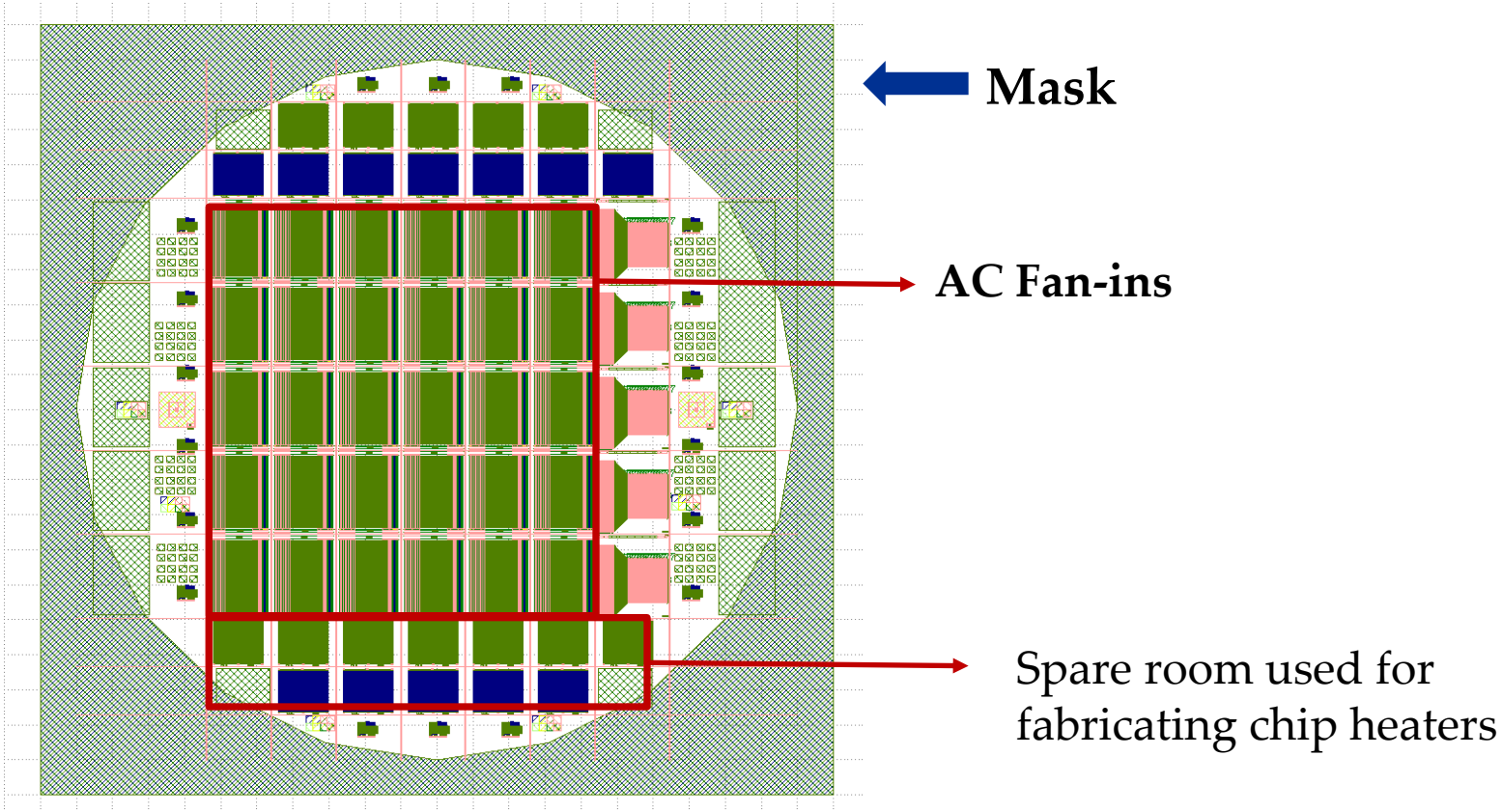
- In order to perform measurements on the 3D irradiated detectors (strips and pixels) we need AC pitch adaptors.





- Fabrication run of AC pitch adaptors in progress.

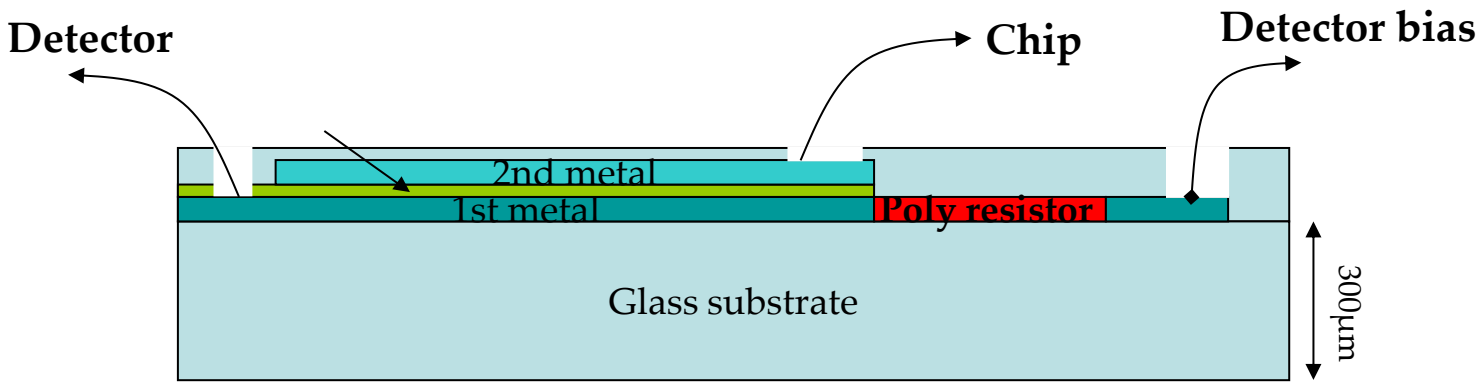
  → Expected for the end of July



AC Pitch Layout

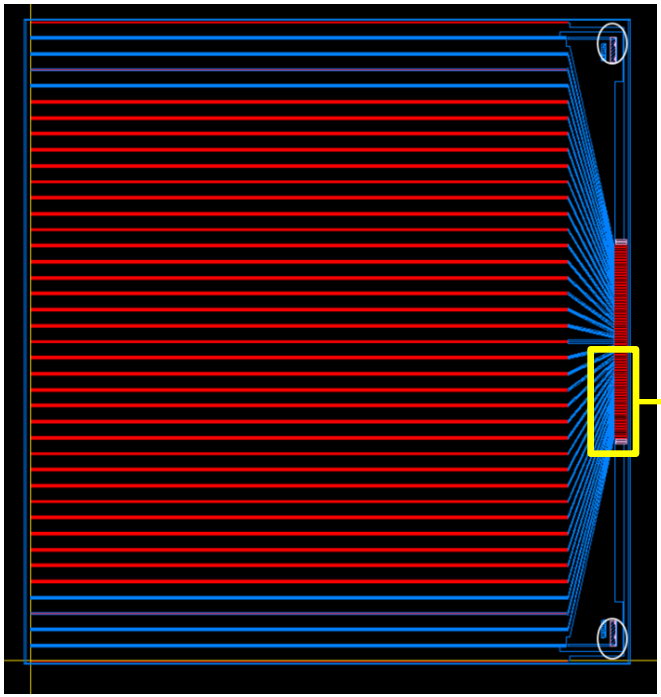
$$C = \varepsilon_0 \varepsilon_{SiO_2} \frac{S}{d_{ox}}$$

Oxide/Nitride/Oxide thickness (for the capacitor)	200	nm
Resistance of polySi	1	MΩ
Capacitance Area	50 x 4500	μm²
Capacitance	40	pF

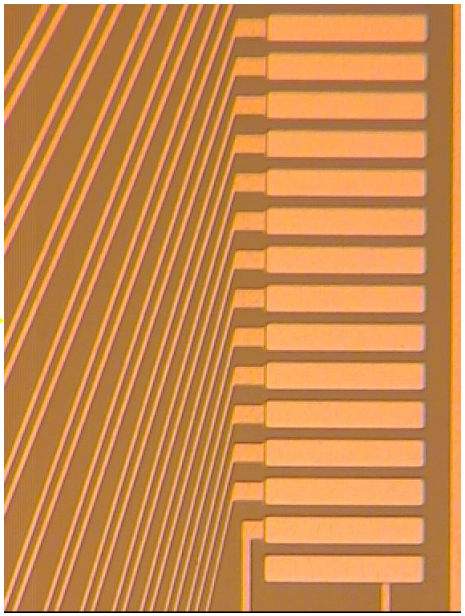


Routing for Pixels

- Routing FE-I4 Atlas Pixels to read with Beetle chip (ALIBAVA system)



DC coupled pads, pitch 80 μm



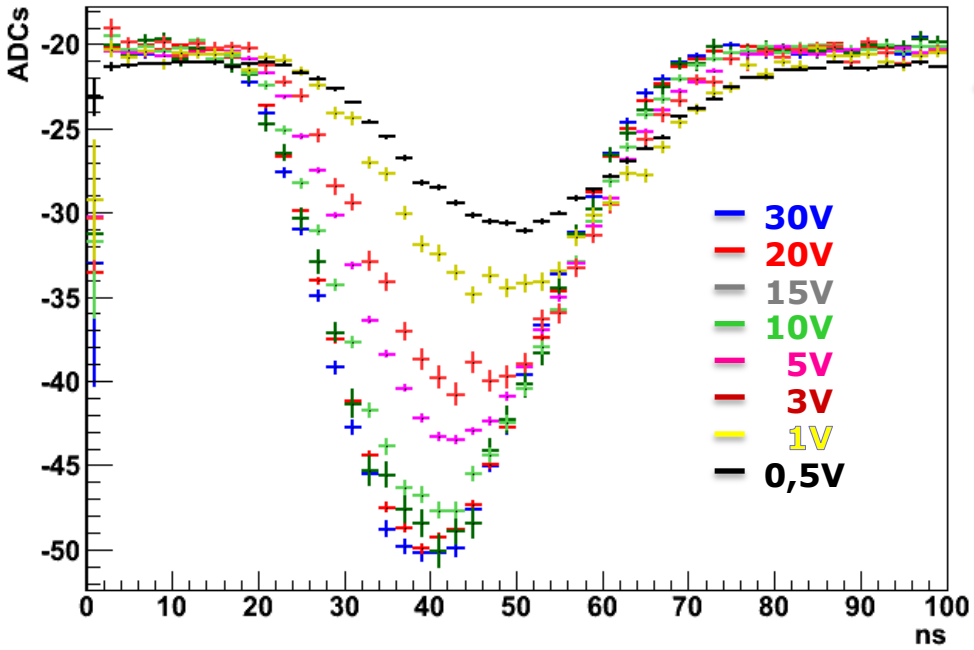
Preliminary Measurements on Non-Irradiated 3D FE-I4 Pixel Detectors

Measurements on Non-Irradiated 3D Pixels

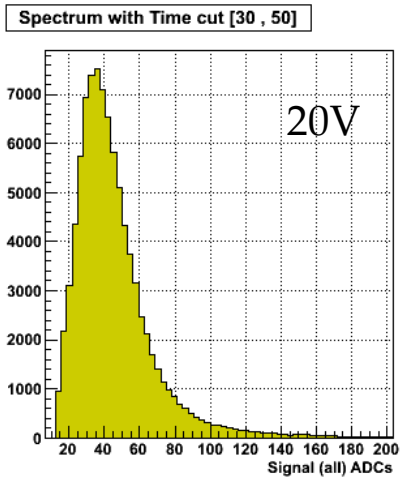
(in collaboration with IFIC)

- β-source: Sr-90 → MIPs; External trigger

Pulse reconstructed with the ALIBAVA System

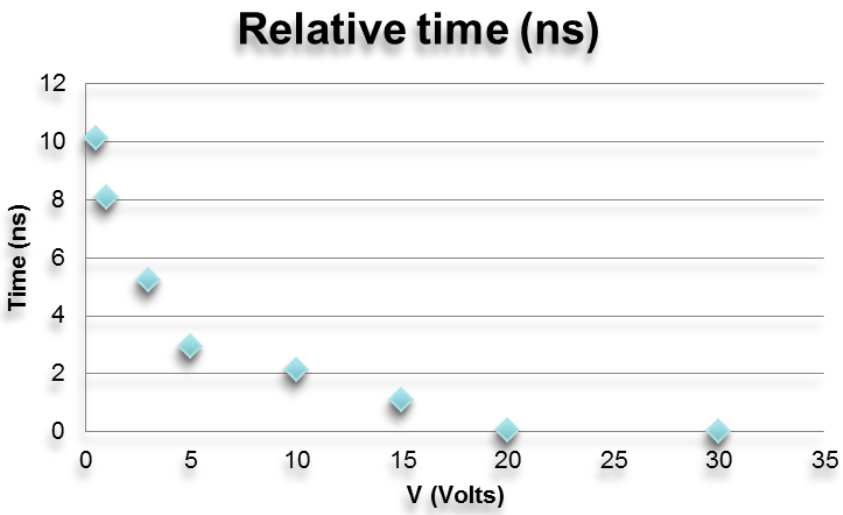


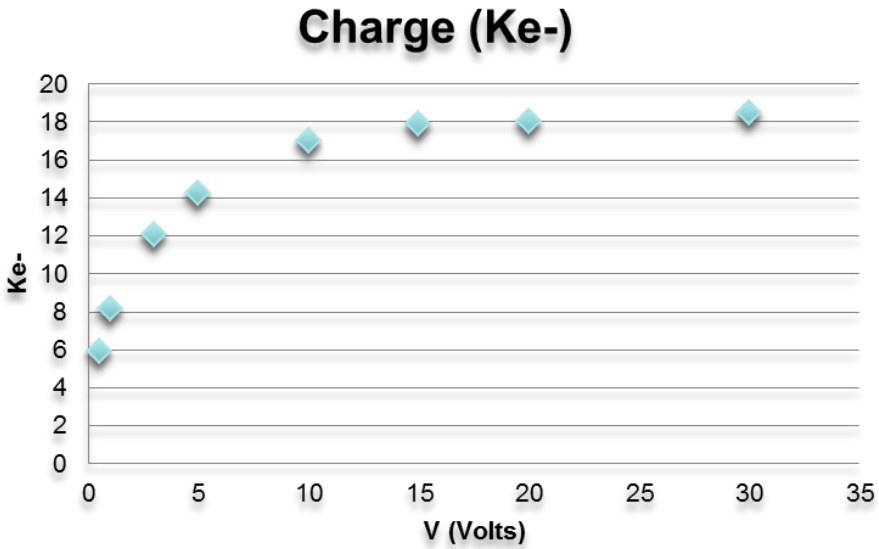
S/N >5



- The rise time of the signal is given by the Beetle chip.
  The relative peak position is due to the variation of the collection velocity with the applied voltage.

Collection Relative Time and Charge Collected as a function of the detector power supply





Conclusions & Future work

- A primary electrical characterization of irradiated 3D **strips** sensors has been performed.
- The ALIBAVA readout system has been used to characterize **non**-irradiated 3D FE-I4 **pixel** sensors.

- We foresee to finish by the end of June the fabrication process of the AC pitch adaptors;

- Once the AC adaptors are ready, we will proceed by characterizing irradiated 3D strips and pixel sensors with the ALIBAVA system:

  - charge collection studies with MIPs;
  - annealing studies;
  - laser measurements.