

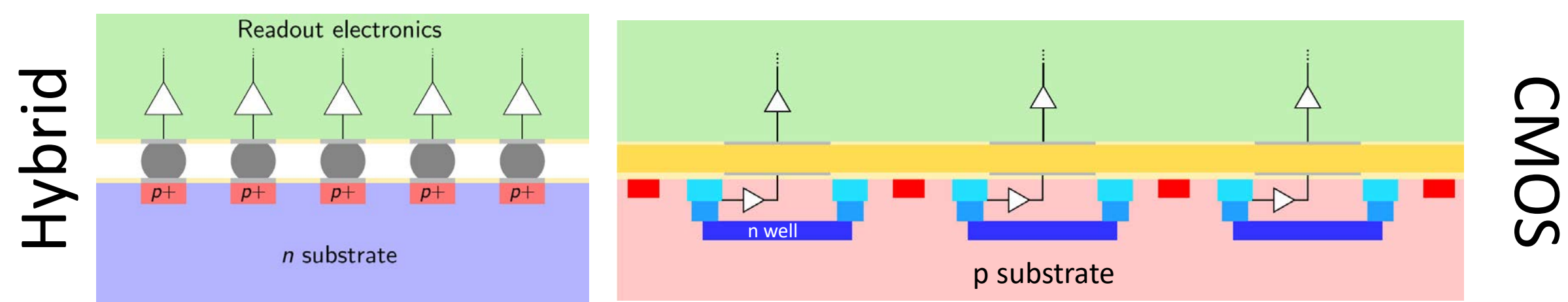
Characterization of HV-CMOS detectors in BCD8 technology and of a controlled hybridization technique

A. Andreazza⁵, A. Castoldi⁶, V. Ceriale², G. Chiodini³, M. Citterio⁵, M. Dalla⁷, G. Darbo², G. Gariano², A. Gaudiello², C. Guazzoni⁶,
V. Liberali⁵, S. Passadore⁵, F. Ragusa⁵, A. Rovani², E. Ruscino², C. Sbarra¹, A. Sidoti¹, H. Shrimali⁴, A. Stabile⁵, E. Zaffaroni⁵

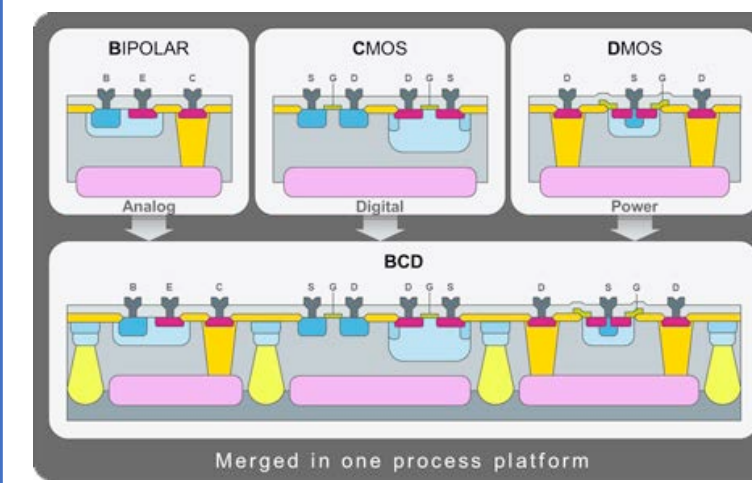
¹INFN Sezione di Bologna ²INFN Sezione di Genova ³INFN Sezione di Lecce ⁴Indian Institute of Technology Mandi
⁵Università di Milano and INFN Sezione di Milano ⁶Politecnico di Milano and INFN Sezione di Milano
⁷Università di Bologna e INFN sezione di Bologna

HVR-CMOS sensors

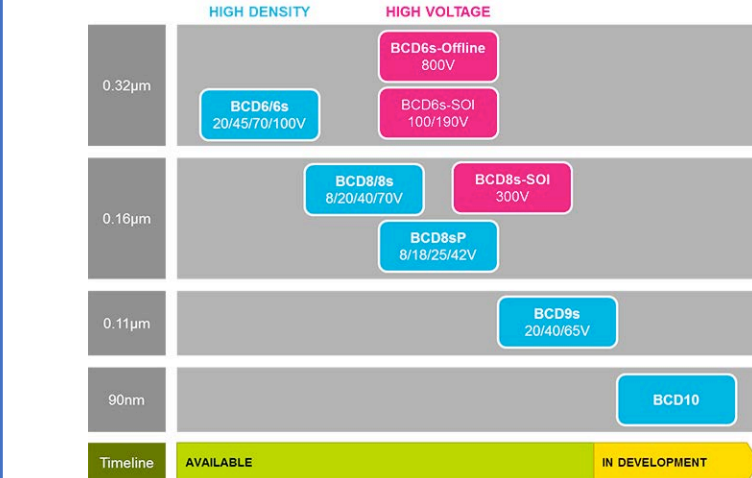
HV CMOS sensors features high voltage and low voltage electronics on the same chip. CMOS circuitry (preamplifier, comparator...) is separated from the HV substrate with an N well. They can be capacitively coupled to the FE chip, instead of being bump bonded.



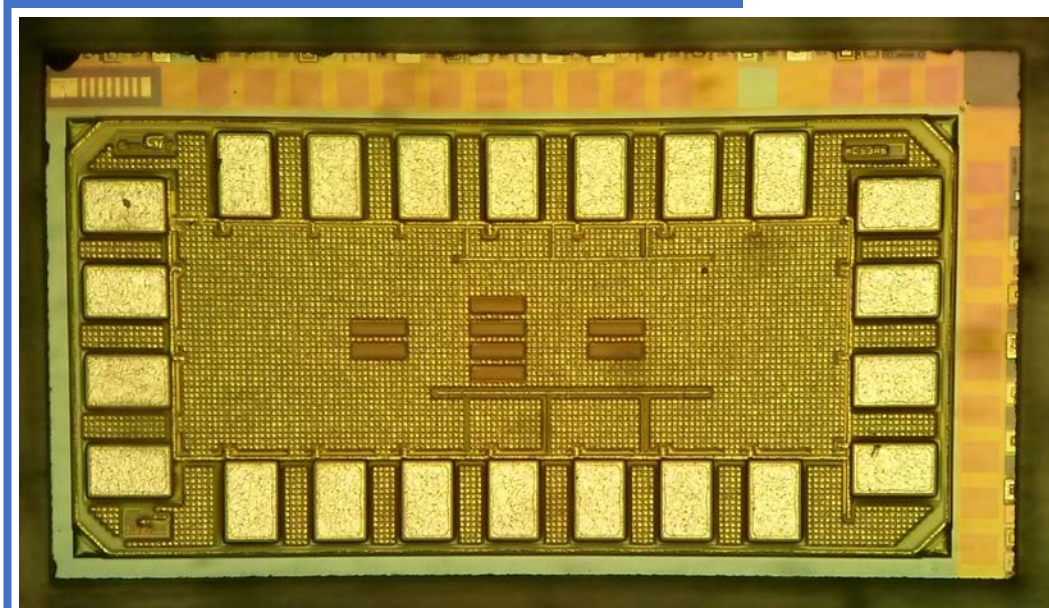
BCD8 technology



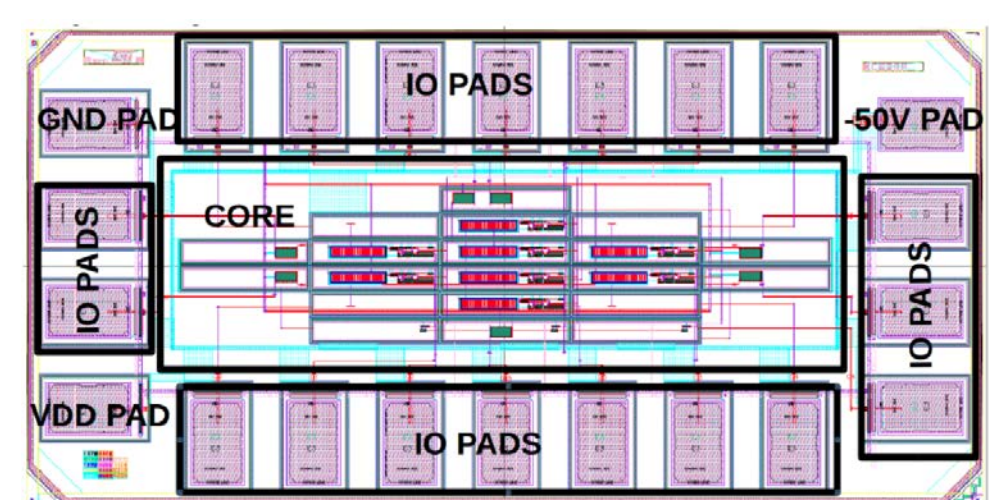
Epitaxial process developed by STM, which combines different devices on the same chip (bipolar, CMOS, DMOS). Also features long term availability, being a major product line for automotive products. It is possible to obtain thick depletion layers (30 μm).



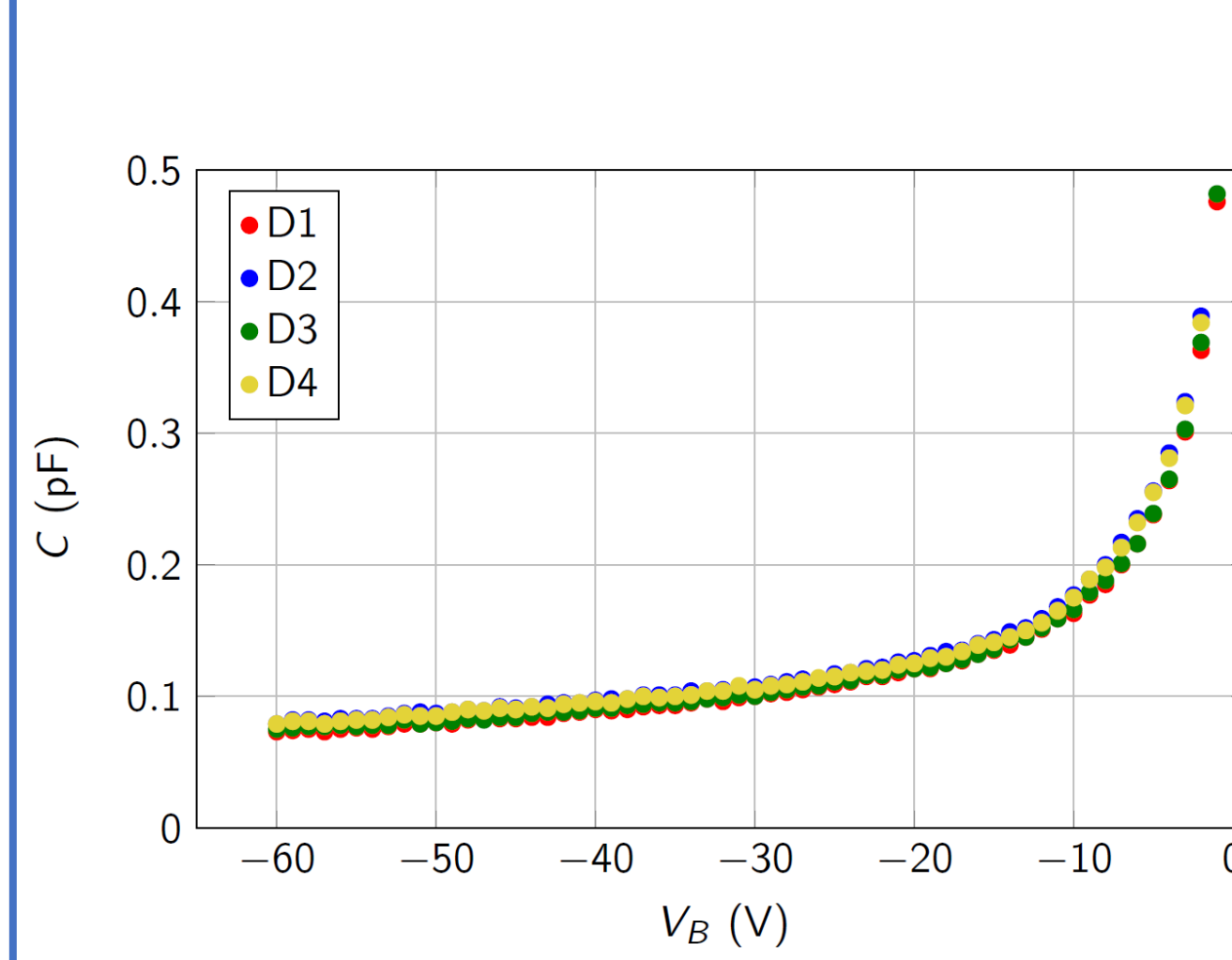
KC53A chip



The KC53A demo chip is realised in BCD8 and contains 4 passive pixels and 8 active pixels (with amplifier). The pixel dimensions are $50 \times 250 \mu\text{m}^2$ and the substrate resistivity is $125 \Omega \cdot \text{cm}$. Passive pixels have been characterized.

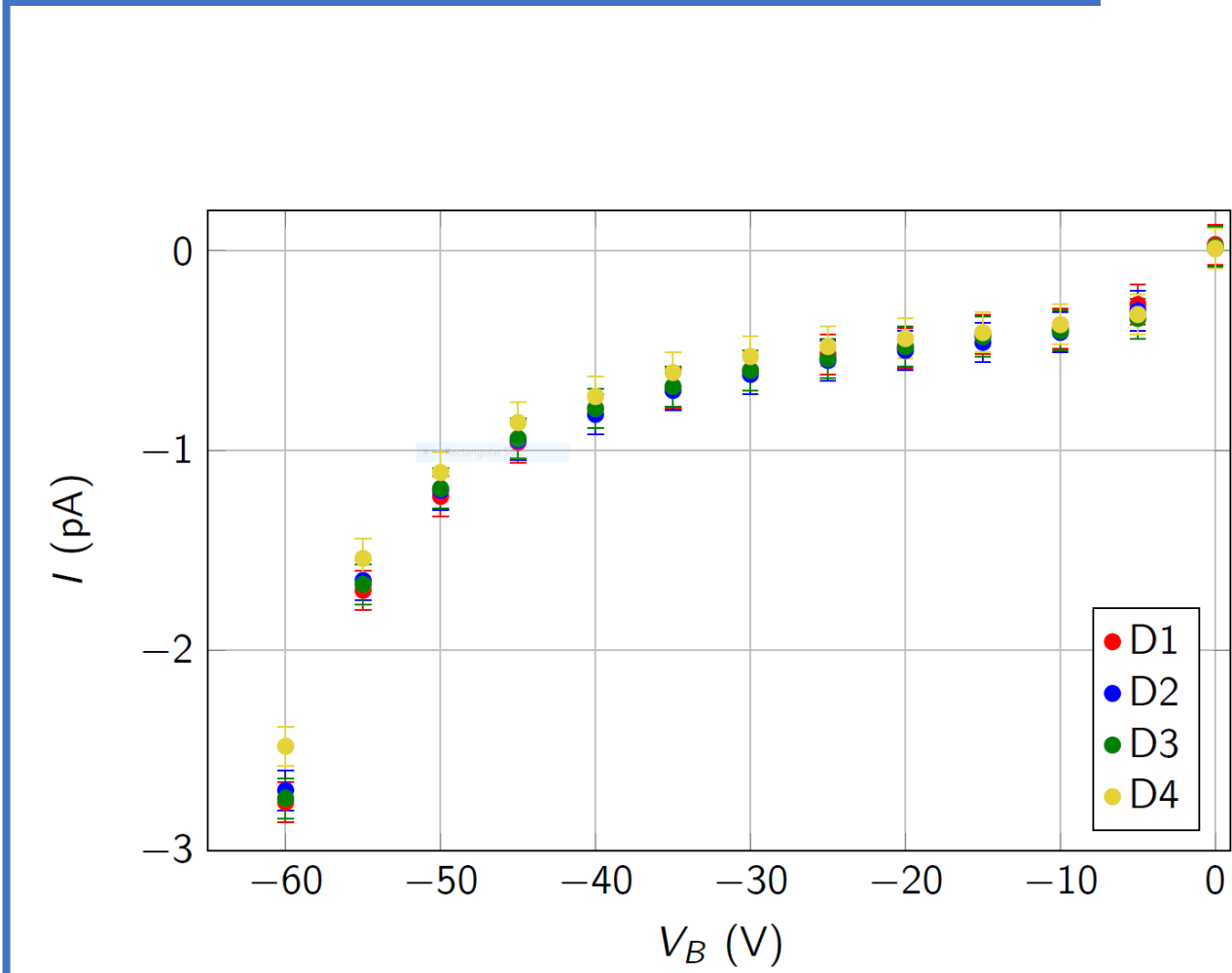


CV measurements



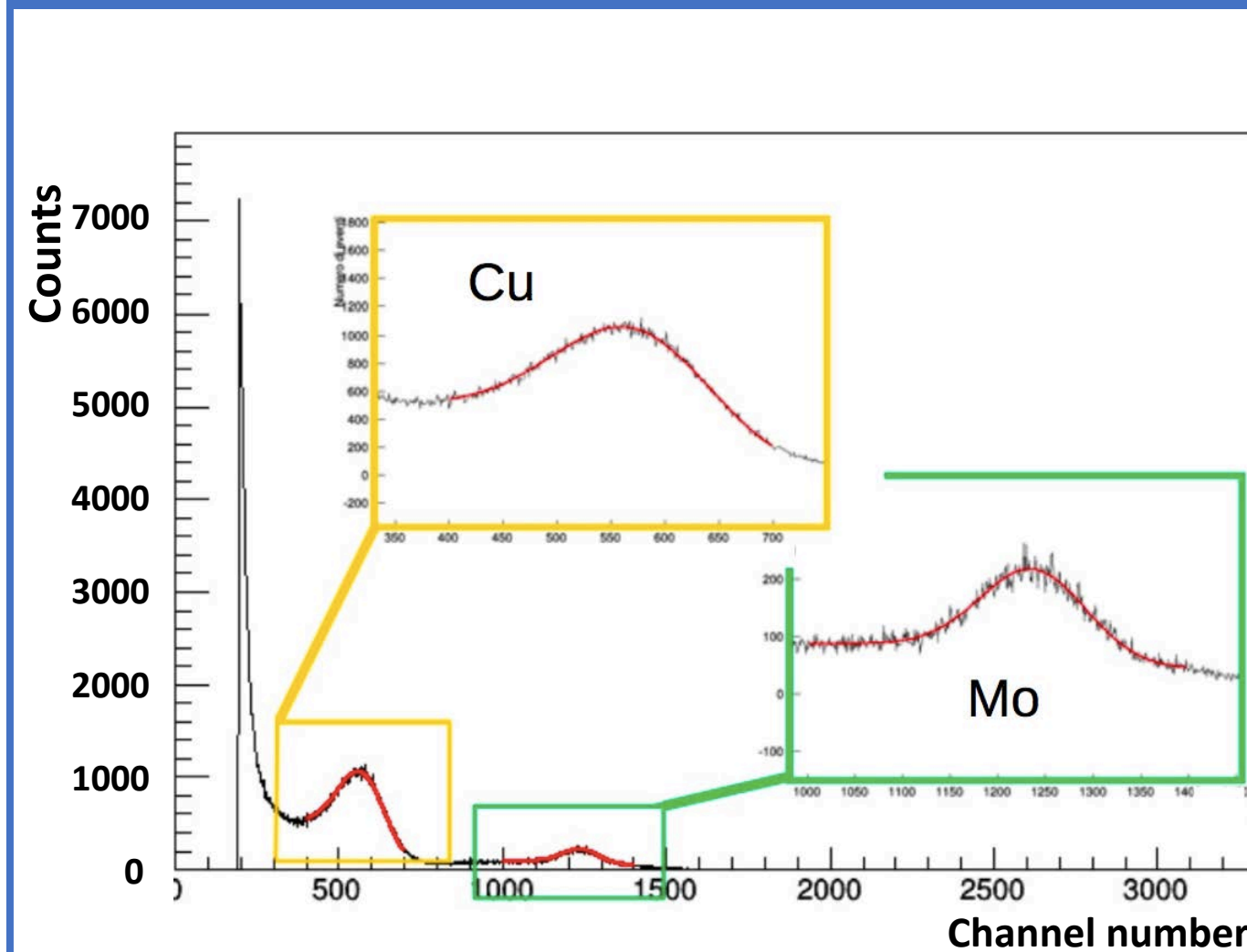
CV measurements have been performed with a probe station and HP 4280A CV meter. They exhibit a capacitance of 0.8 pF per pixel at -50 V bias.

IV measurements



IV measurements have been performed with a probe station and Keithley 6517 electrometer. They exhibit a leakage current of 1.2 pA per pixel at -50 V bias.

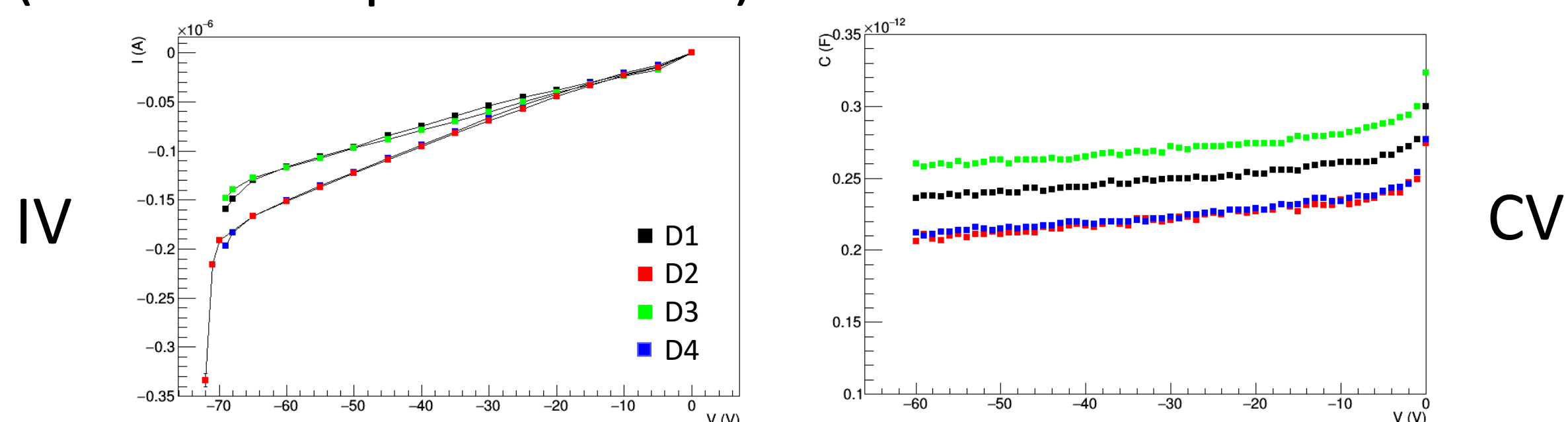
Radioactive sources and X-rays



Various spectra have been acquired with an external chain. The Cu peak corresponds to the energy deposition of a MIP. Resolution: $1.0 \pm 0.2 \text{ keV}$, ENC = $290 \pm 50 \text{ e}$

Radiation hardness

Irradiation at LNS Catania with a 62 MeV proton beam (57 Mrad). The sensors exhibit an increase of leakage current and a decrease of the junction capacitance (due to acceptor removal).



Hybridization

Creation of 5 μm thick pillars to keep a uniform distance between the chips. The goal is to reach less than 10% variations in the glue thickness. This process will be tested with a capacitor array to measure uniformity on a surface of $2 \times 2 \text{ cm}^2$.

Basic process

Spin SU-8 photoresist
Pattern pillars by mask



Glue deposition



Align & pressure

