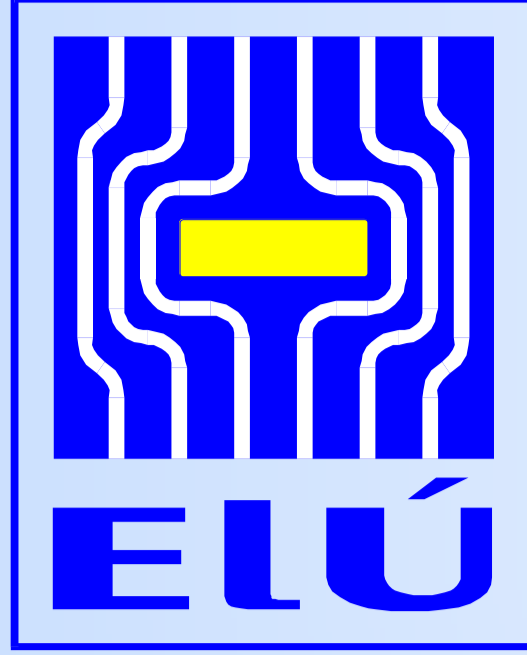


Imaging and spectrometric performance of SiC Timepix3 radiation camera

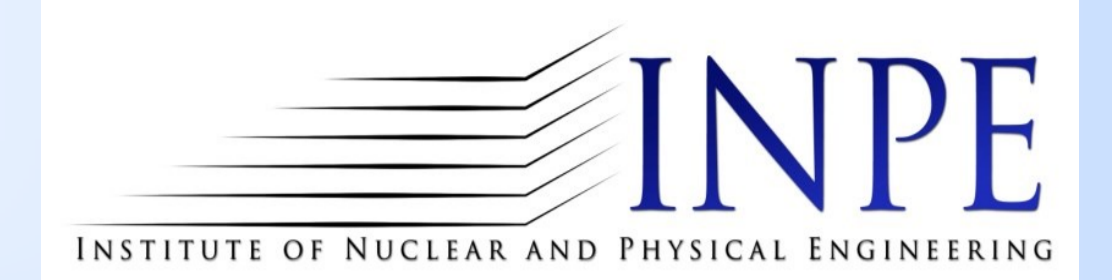


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INTRODUCTION

Detectors based on 4H-SiC (Silicon Carbide) are very perspective due to:

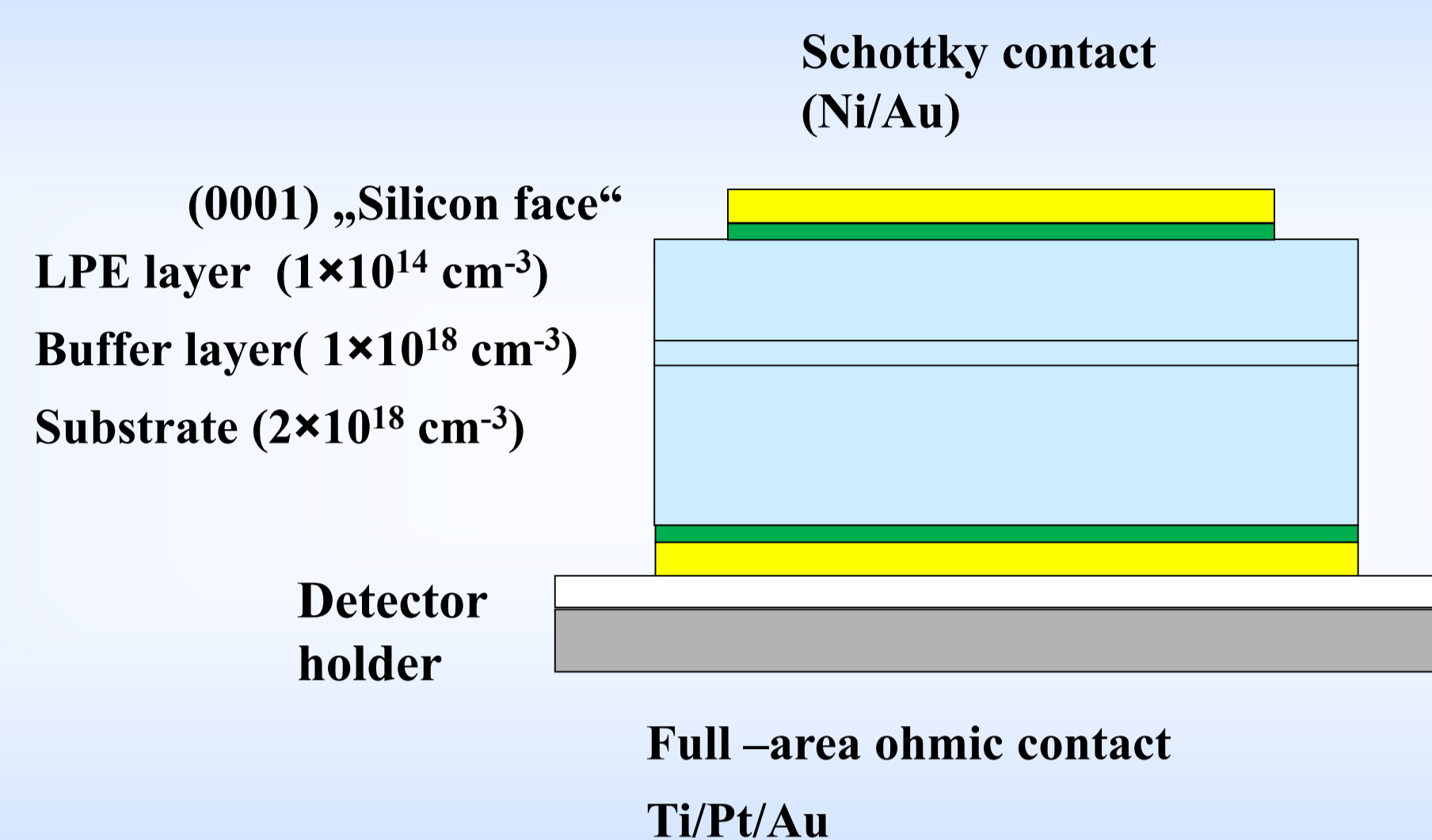
- high breakdown voltage (4×10^6 V/cm)
- electron mobility of about $900 \text{ cm}^2 \text{ V}^{-1} \text{ s}^{-1}$
- high electron saturation drift velocity ($2 \times 10^7 \text{ cm s}^{-1}$)
- band gap energy of 3.26 eV
- operation at increased temperature up to 500 °C
- good radiation hardness

DETECTOR MATERIAL

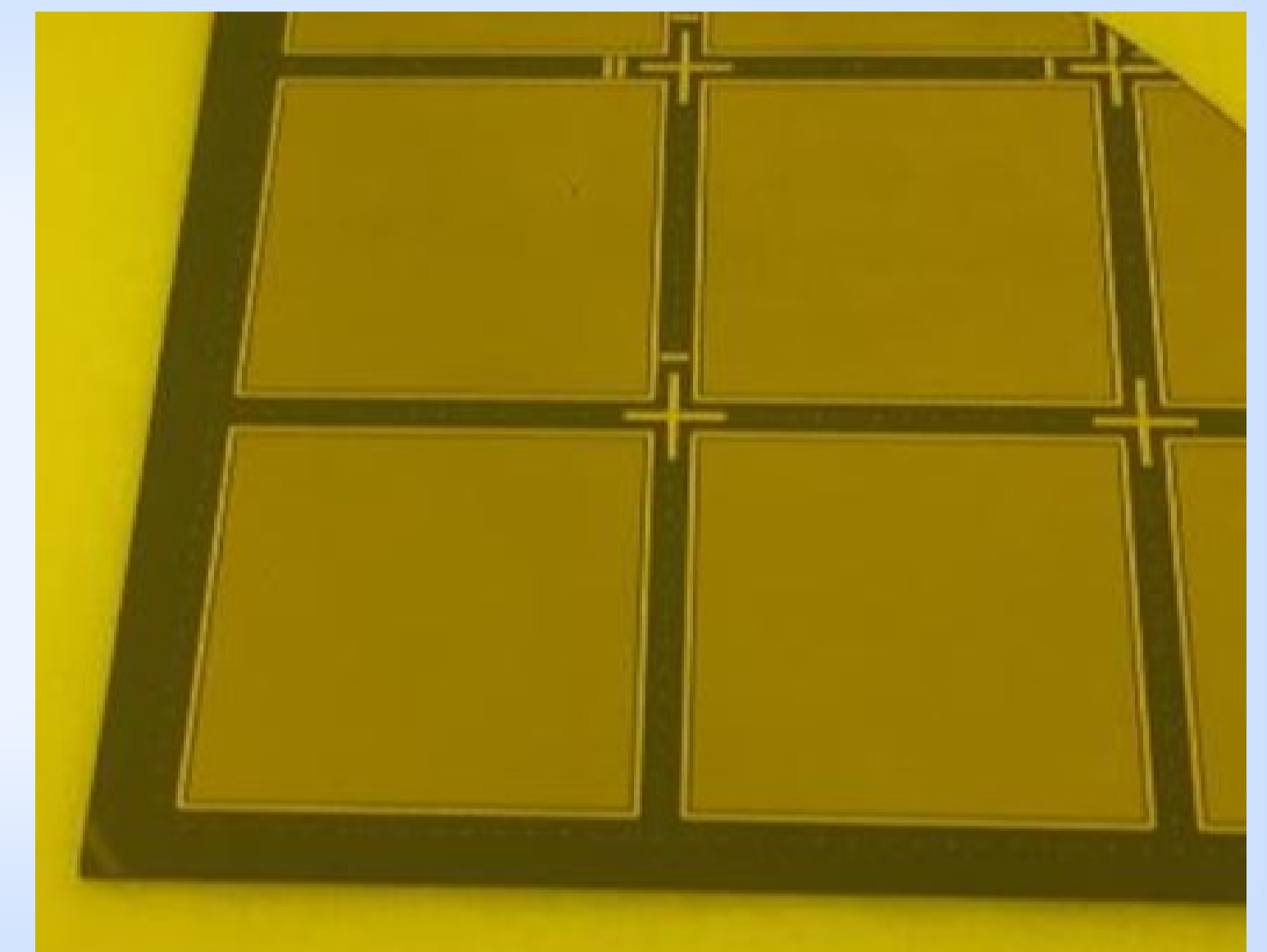
Base material parameters:

- 80 μm thick nitrogen-doped 4H-SiC layer grown by LPE
- Doping concentrations about $7 \times 10^{13} \text{ cm}^{-3}$ and $3 \times 10^{14} \text{ cm}^{-3}$
- 4H-SiC n^{++} substrate (350 μm thick)
- 0.5 μm buffer layer n^+ -SiC with concentration $1 \times 10^{18} \text{ cm}^{-3}$

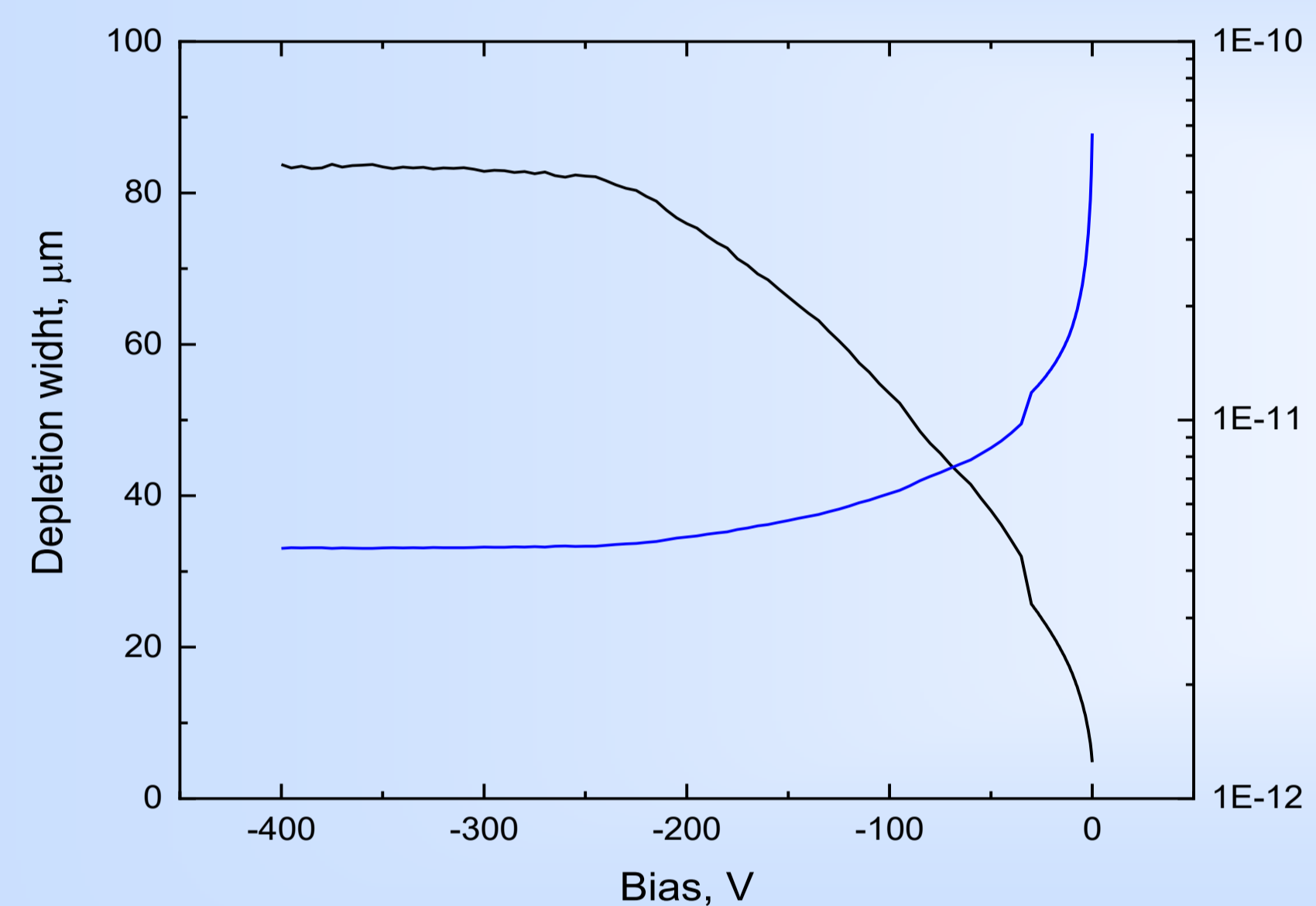
CROSS-SECTION OF DETECTOR



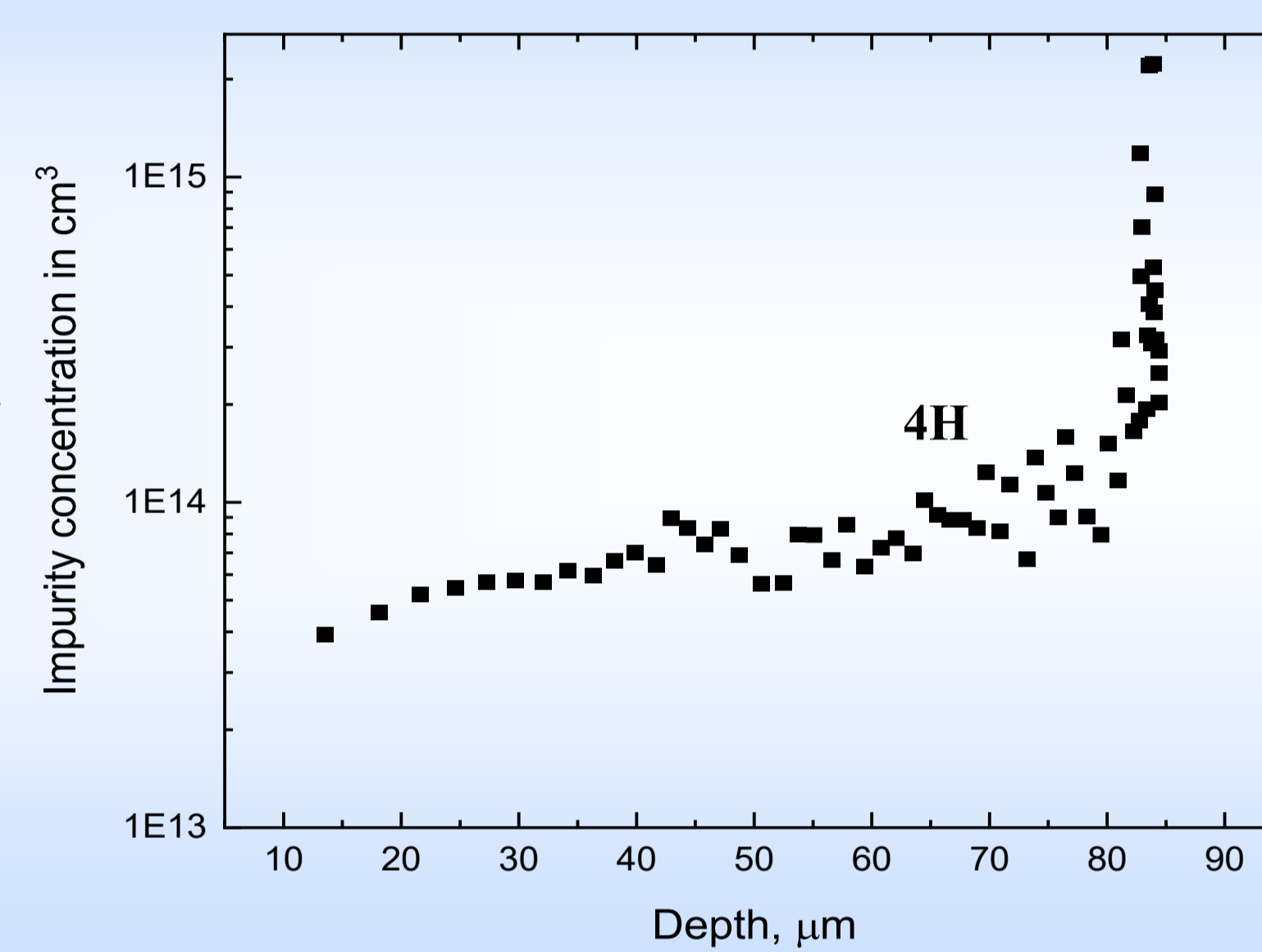
PHOTOGRAPH OF PIXEL DETECTOR



CAPACITANCE-VOLTAGE MEASUREMENTS DEPLETION THICKNESS



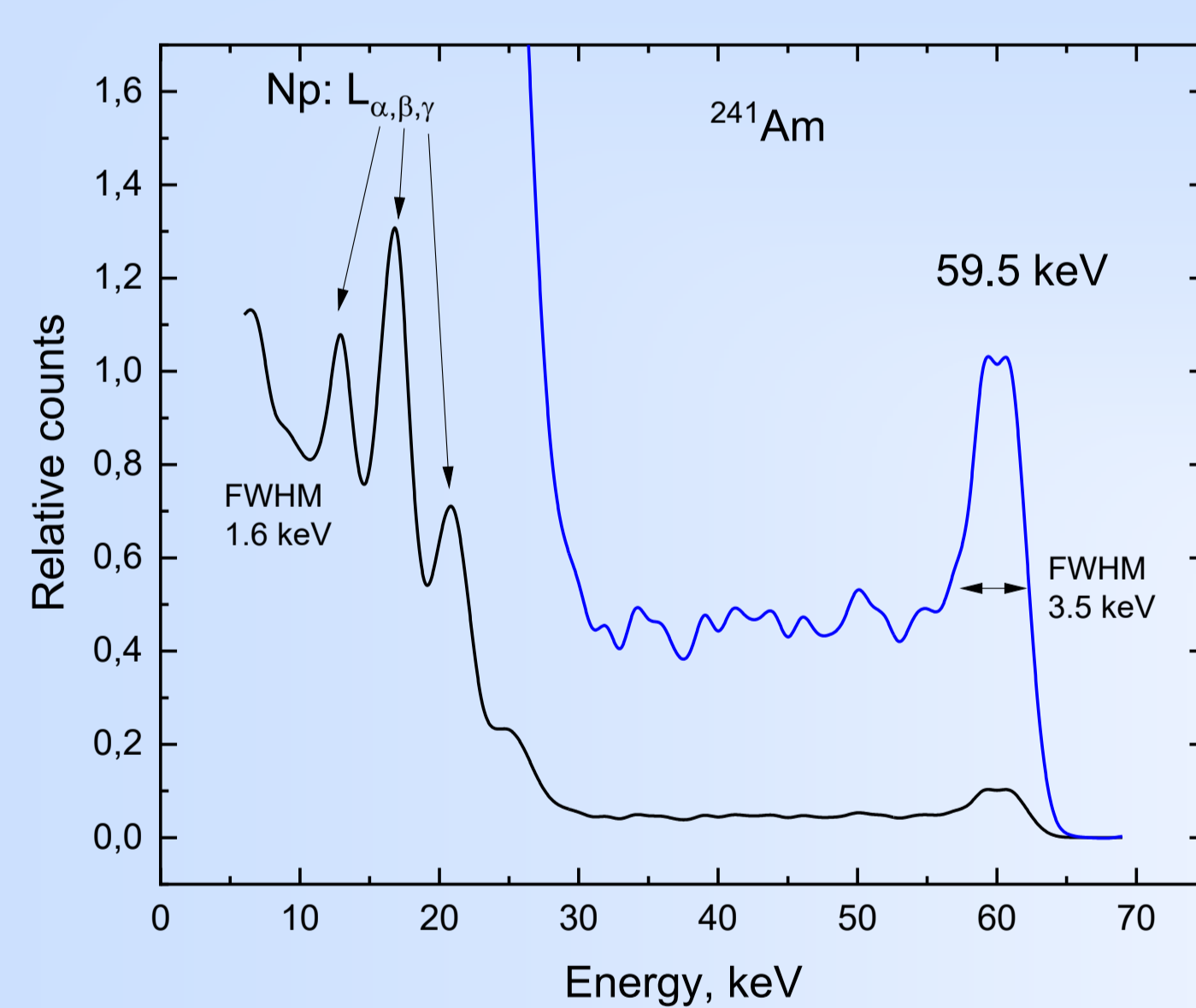
CONCENTRATION PROFILE



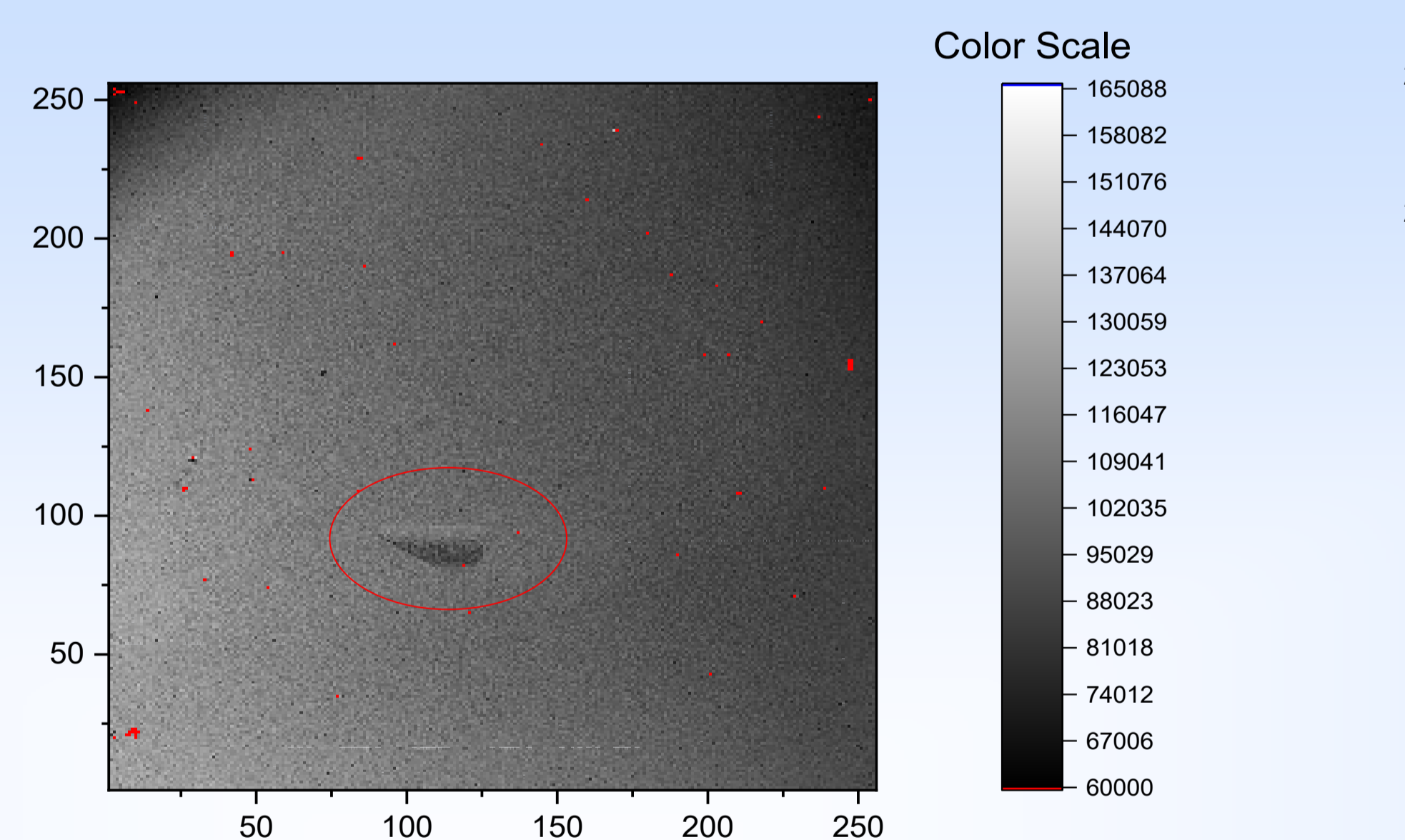
TIMEPIX3 DETECTOR IMAGE



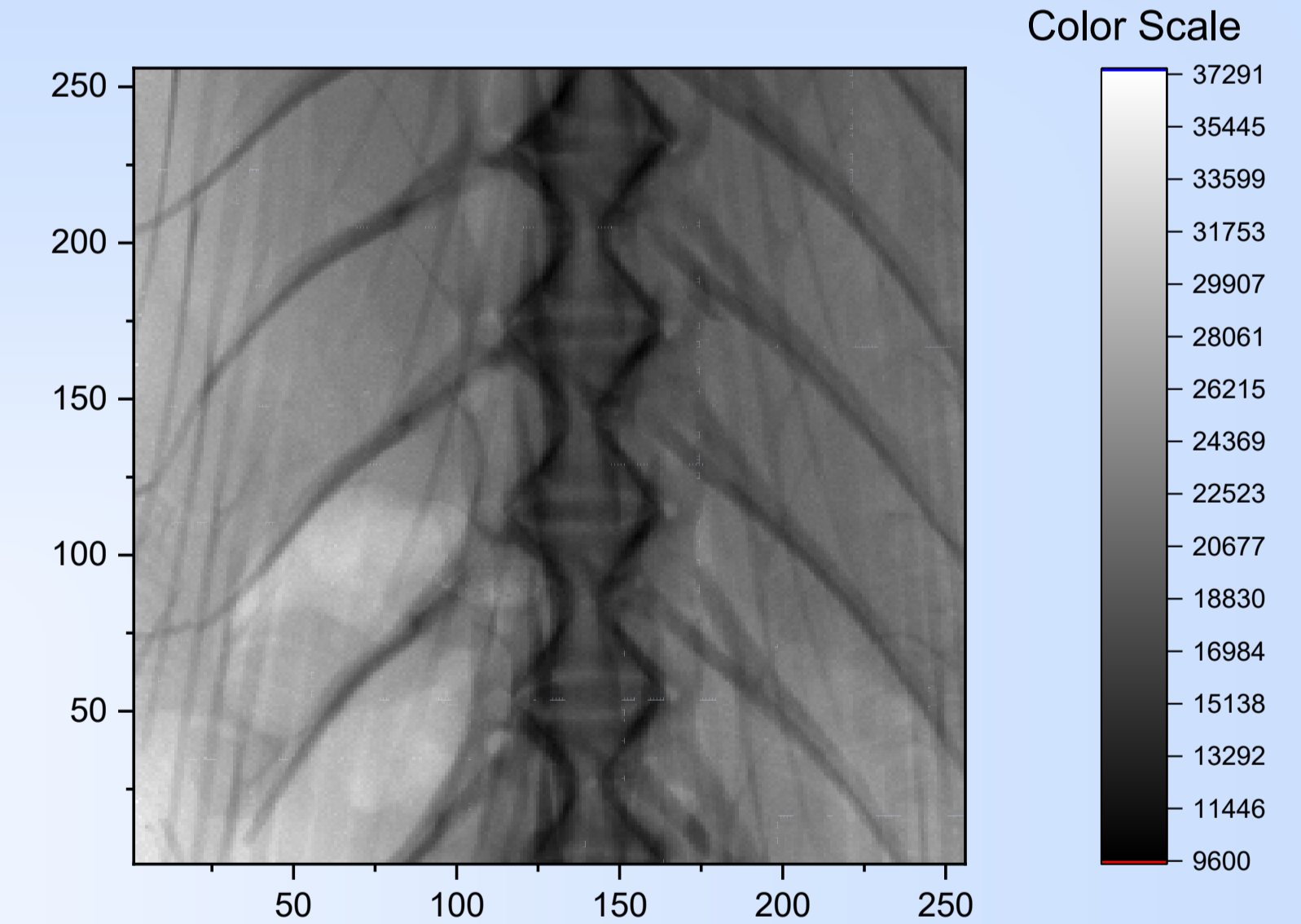
THRESHOLD SCAN



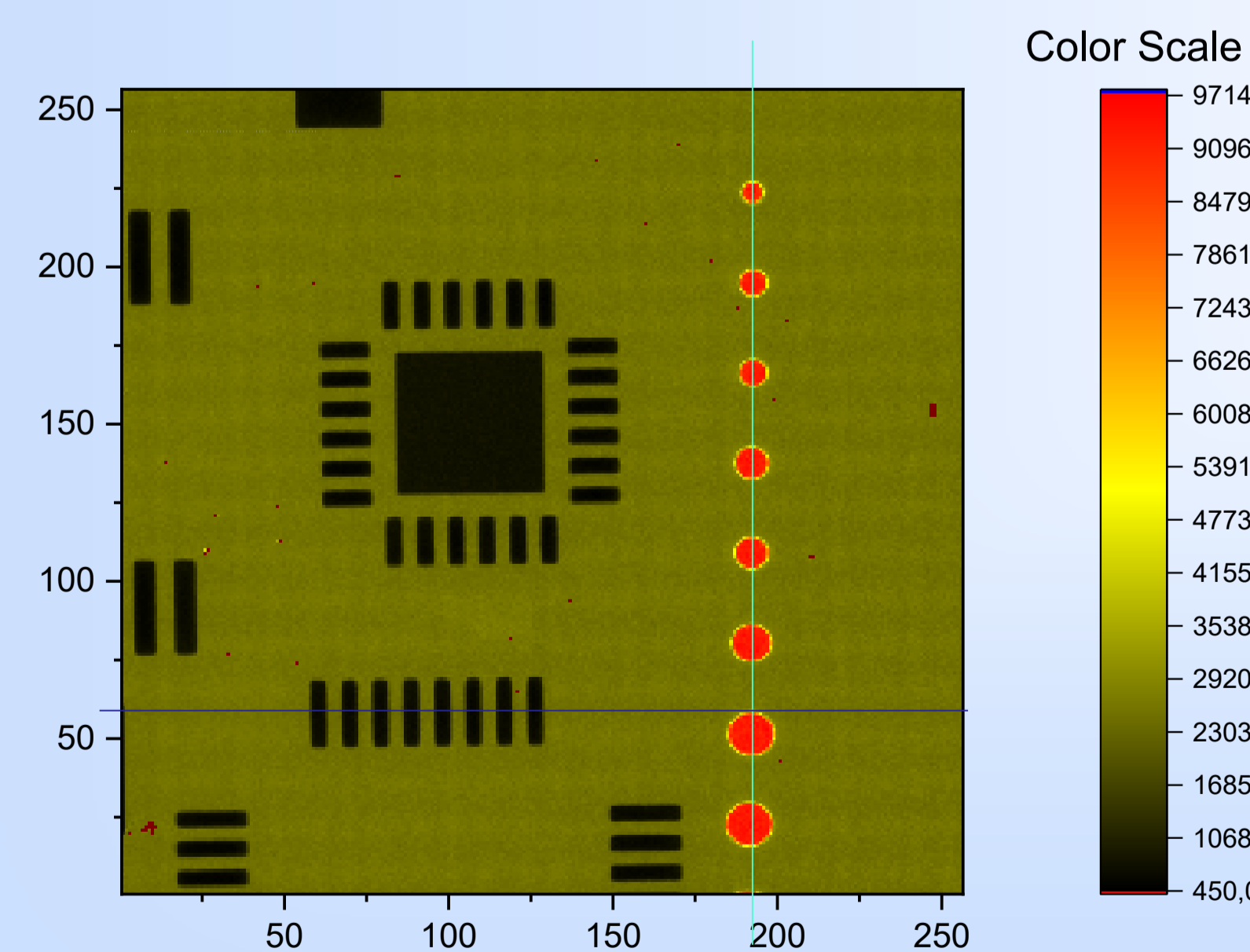
OPEN BEAM ILLUMINATION



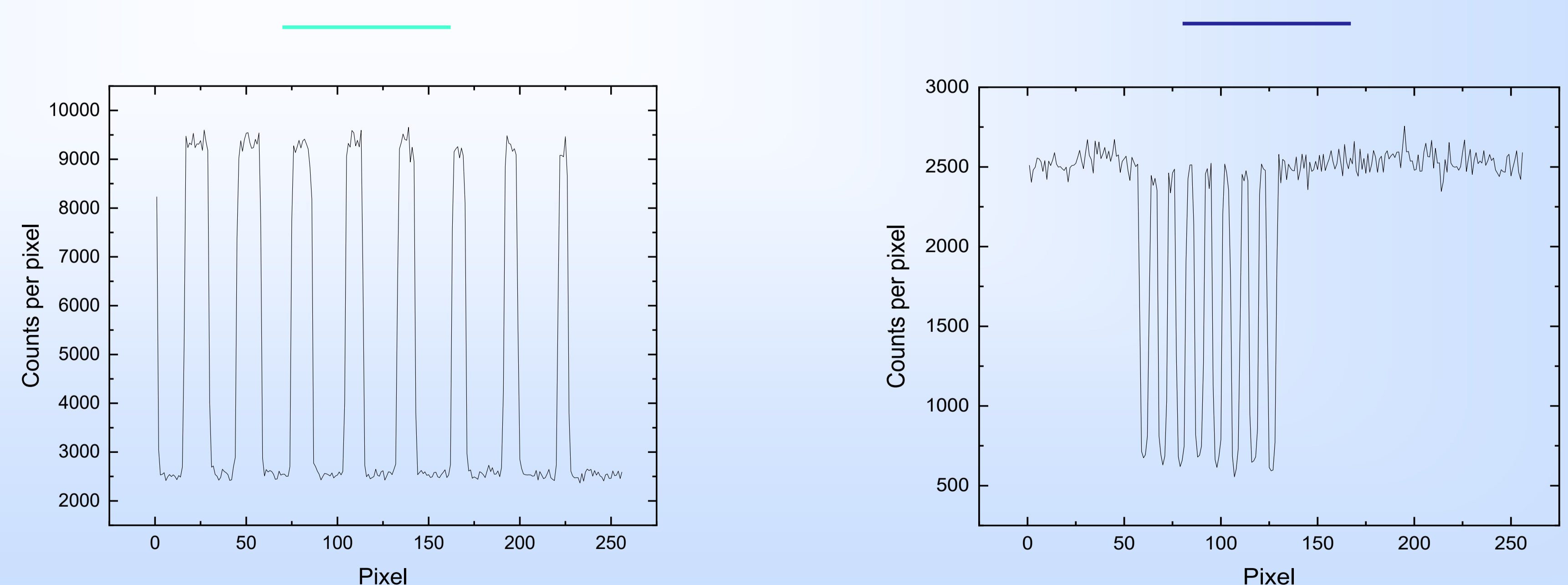
X-RAY IMAGE OF FISH



TESTING OBJECT



LINE PROFILES



SUMMARY AND CONCLUSIONS

- We fabricated semiconductor detectors based on 4H-SiC epitaxial layer.
- Active layer consists of 4H-SiC LPE with thickness up to 80 μm .
- The lowest doping concentration is below $7 \times 10^{13} \text{ cm}^{-3}$.
- Detectors can obtain high energy resolution comparable to silicon detectors.
- We fabricated pixelated structures based on high-quality 4H-SiC epitaxial layer.
- Structures were bump-bonded to Timepix3 readout chips.
- The SiC Timepix3 detector shows high resolution comparable to silicon sensor.
- X-ray images show excellent quality and stable operation during long time.