



nEXO

Assembly and characterization of a large area SiPM in Liquid Xenon Time Projection Chamber (LXe TPC)

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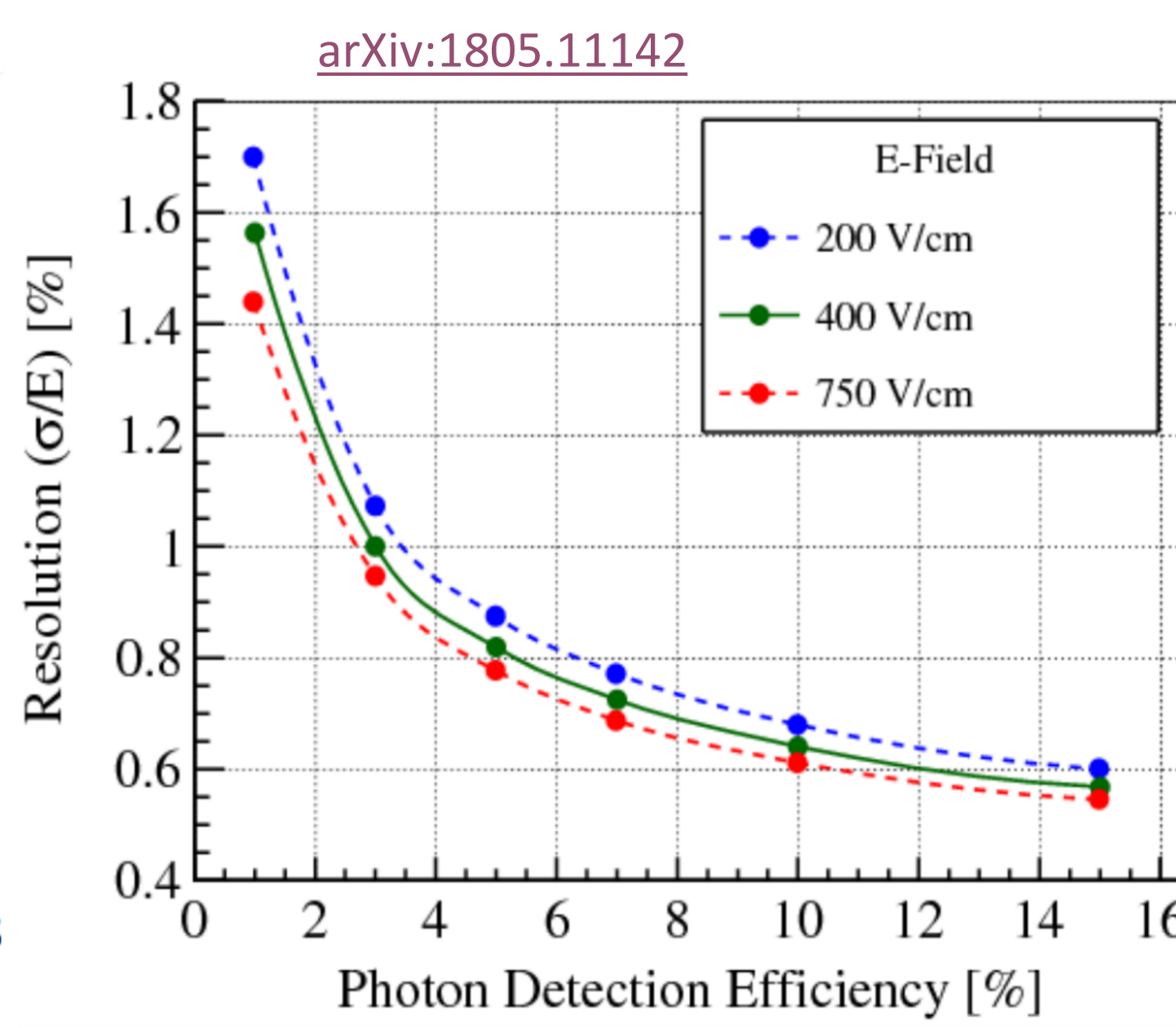
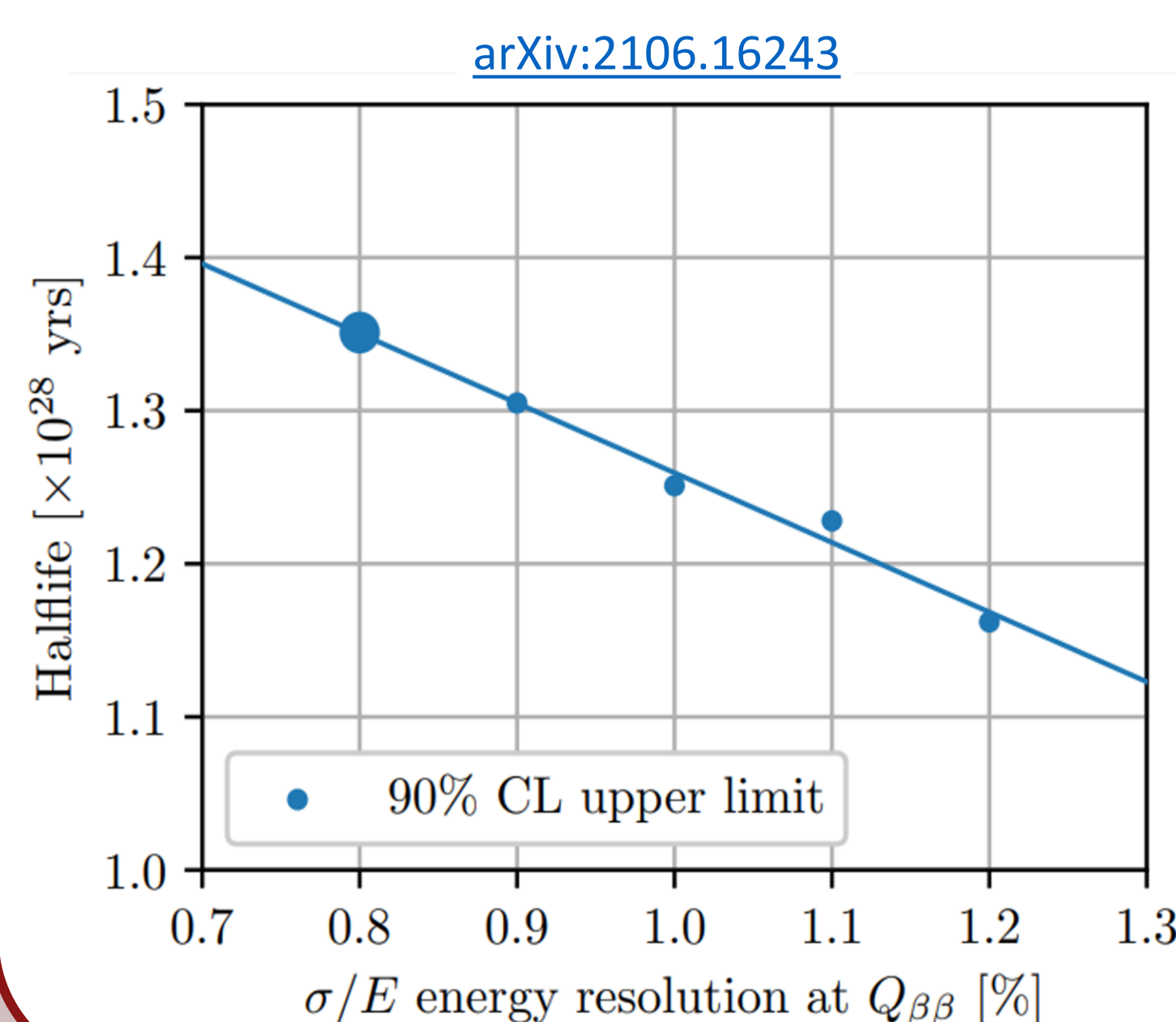
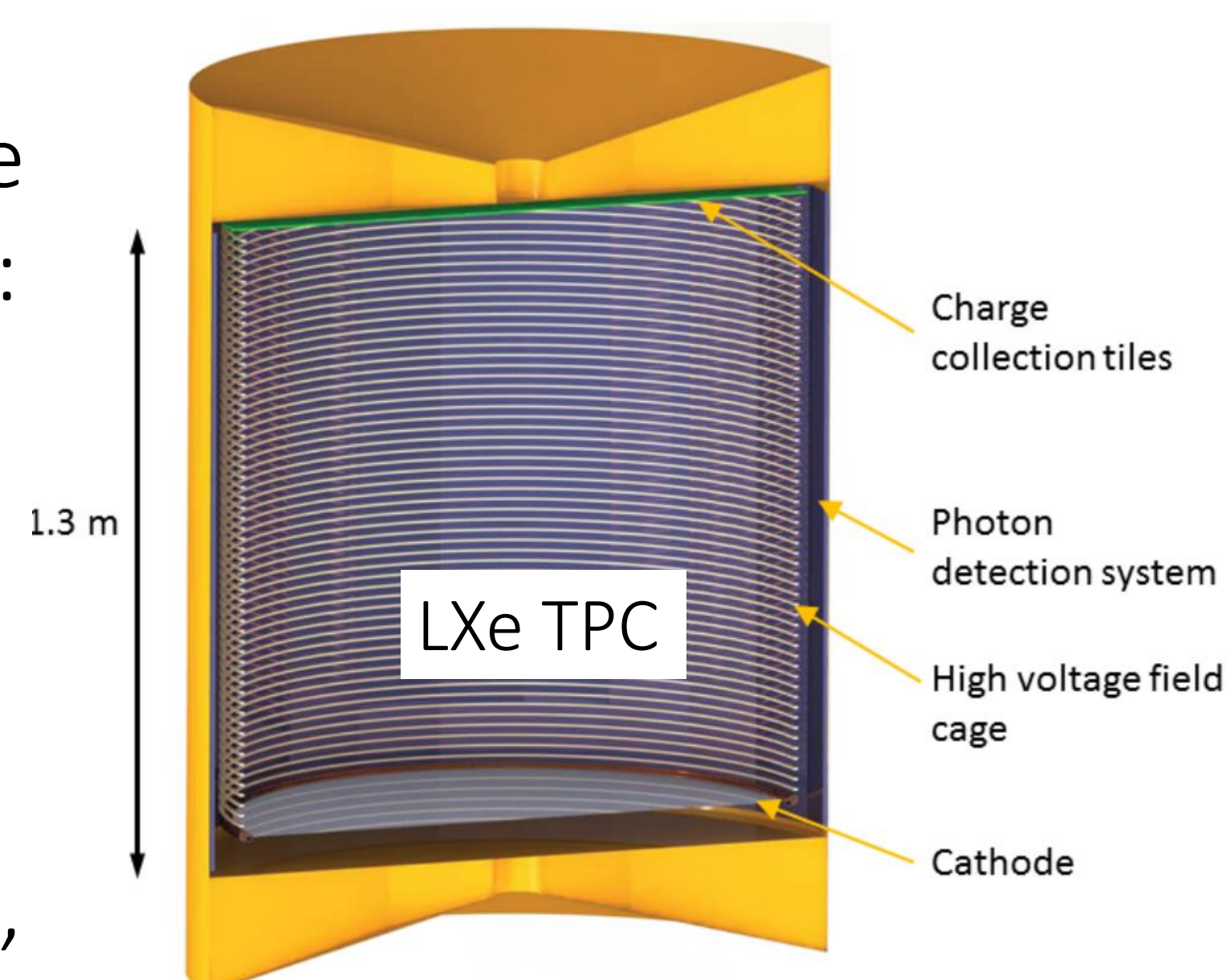
The nEXO experiment

- 5 tonnes $\sim 90\%$ enriched ^{136}Xe TPC aiming to fully explore the neutrino Majorana mass in the inverted ordering
- Projected sensitivity to neutrinoless double beta decay after 10 years exposure (90% CL) $> 10^{28}\text{y}$

Three main observables are crucial to reach such result:

- Energy resolution
- Topology
- Event location

The resolution depends, among other parameters, on light collection efficiency.



Current Setup at Stanford

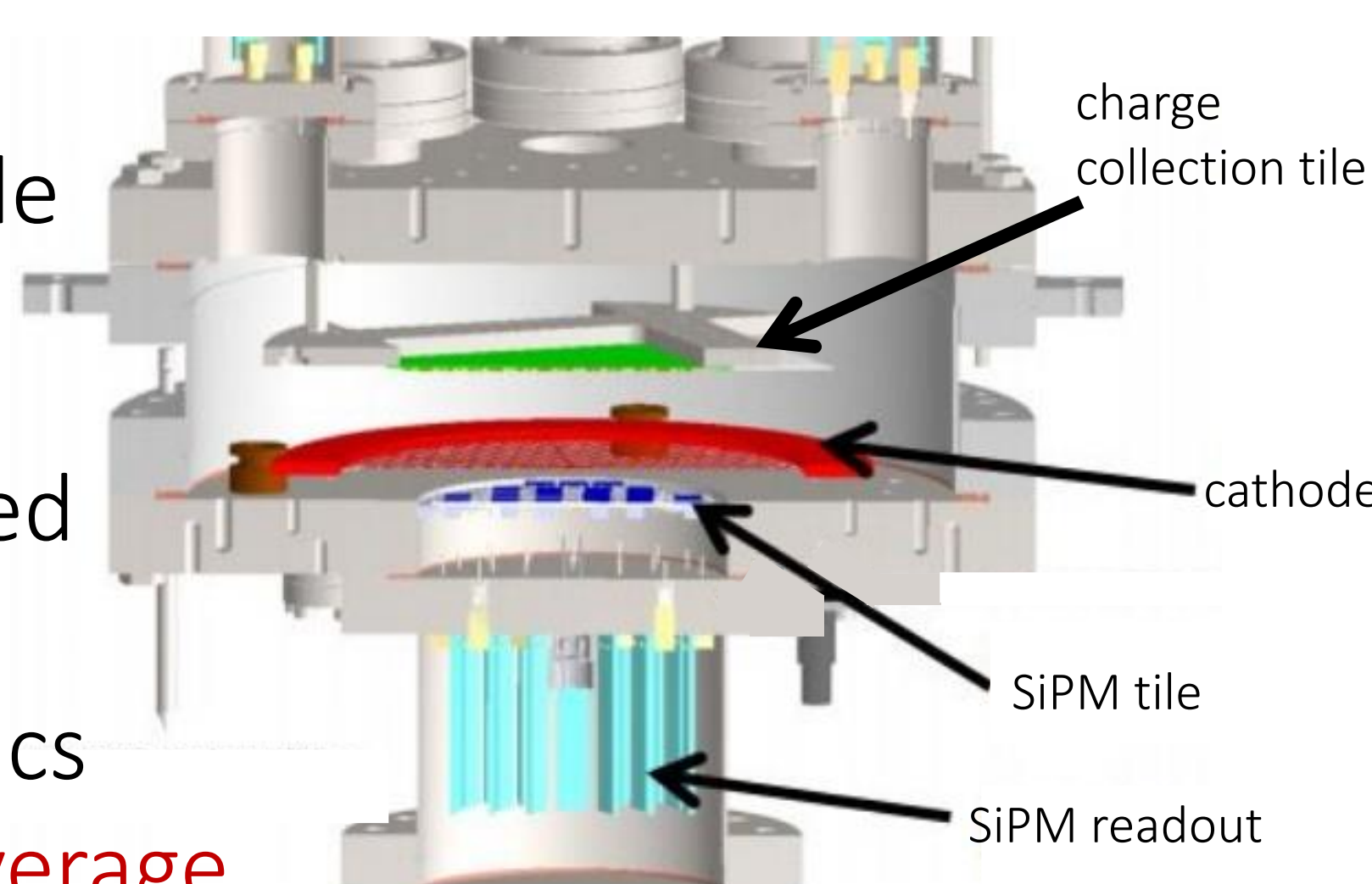
Mainly developed to characterize the charge tile

[arXiv:1710.05109]

Light readout features:

- 24 $1\times 1\text{cm}^2$ SiPMs ganged into 12 channels
- Cold frontend electronics

Need for a larger light coverage to better study energy resolution



Large Area SiPM Array Upgrade

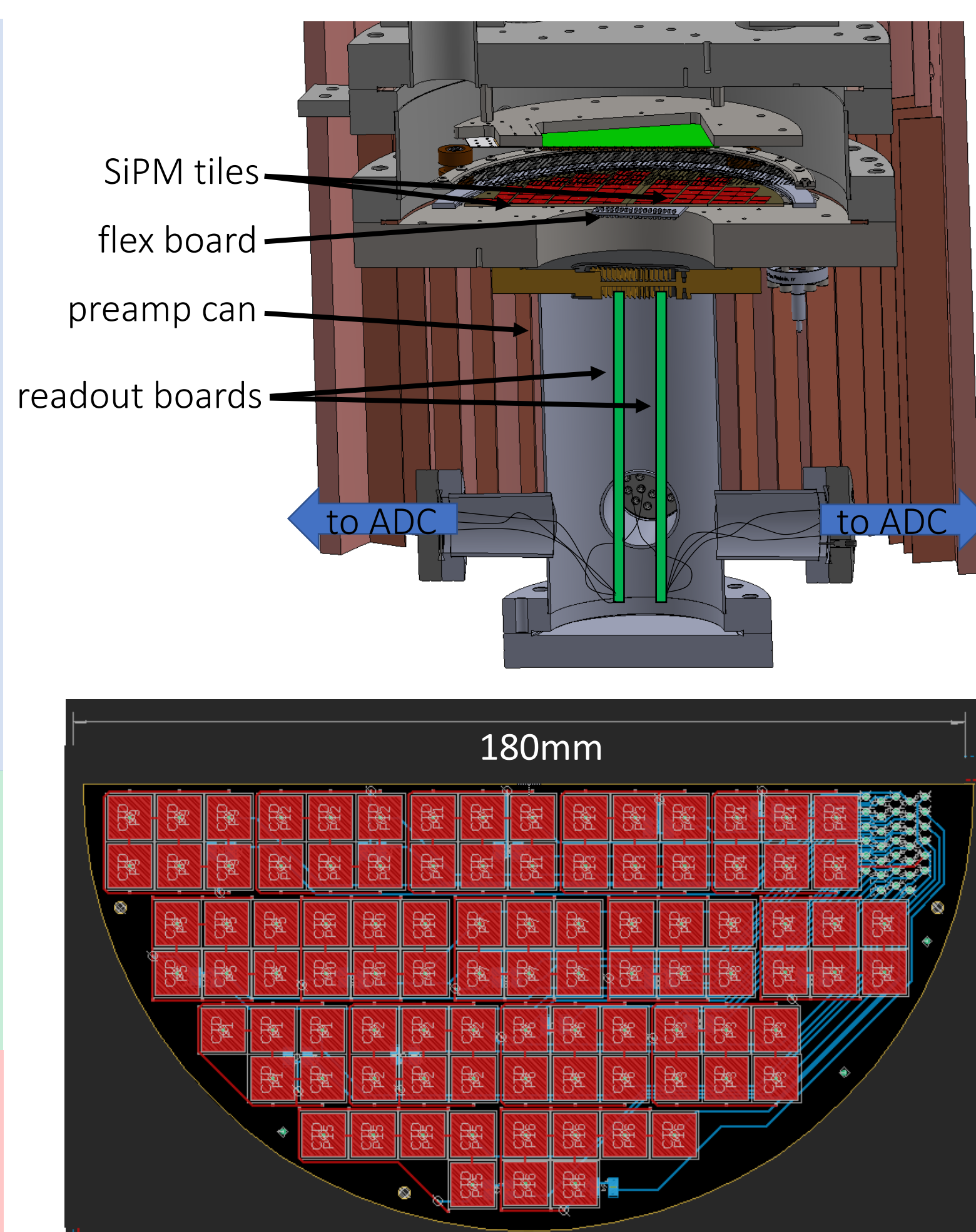
8 fold increase in light-sensitive area:

- SiPMs epoxied and wirebonded on two ceramic tiles
- 32 channels (gang of 6 SiPMs/ch)
- Signal carried out from the cell via Kapton flex boards

Signal is amplified with 2 readout boards (16 channels each)

Digitized with a 16bit ADC (125MS/s sampling rate)

Room

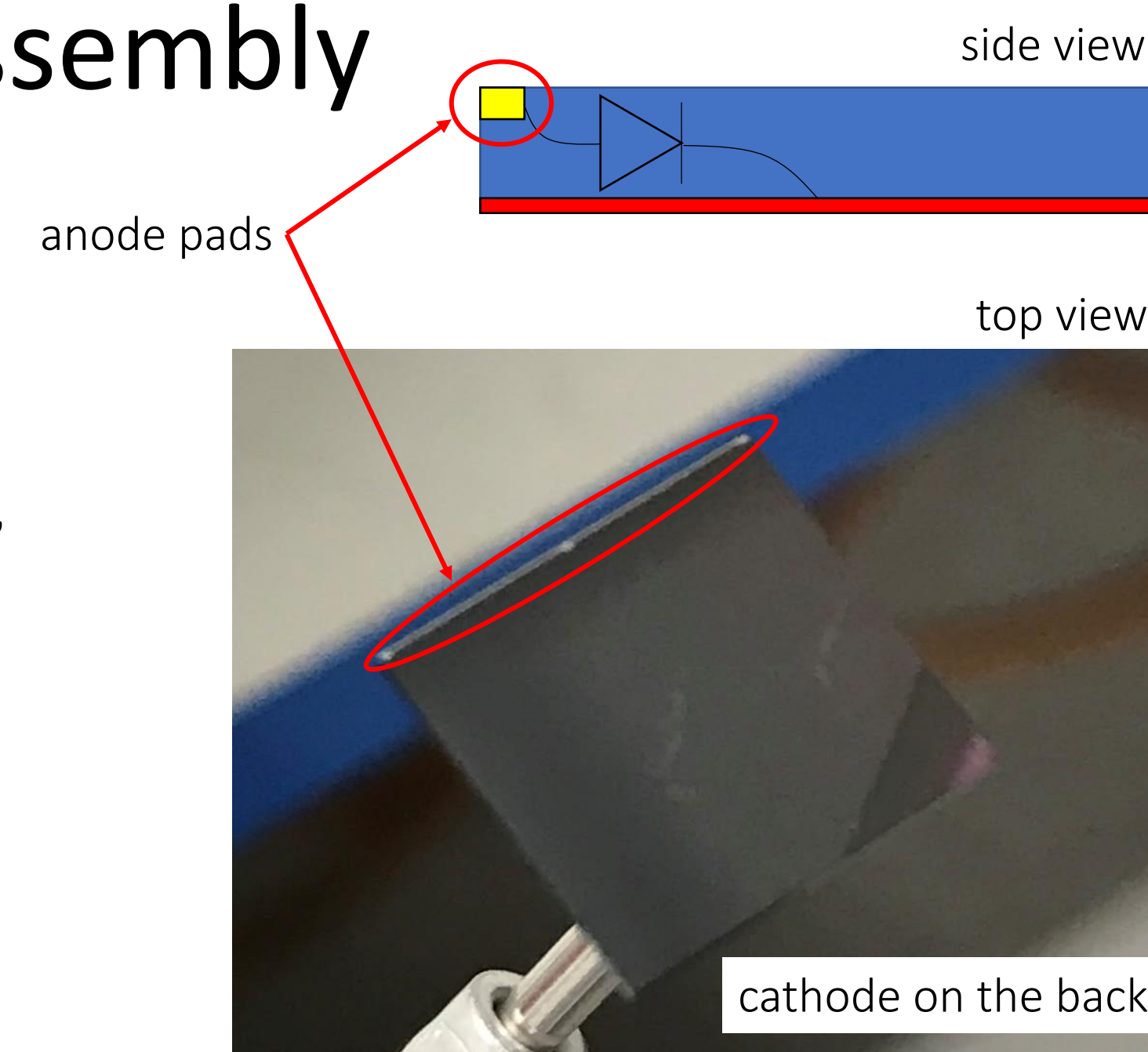


The Assembly

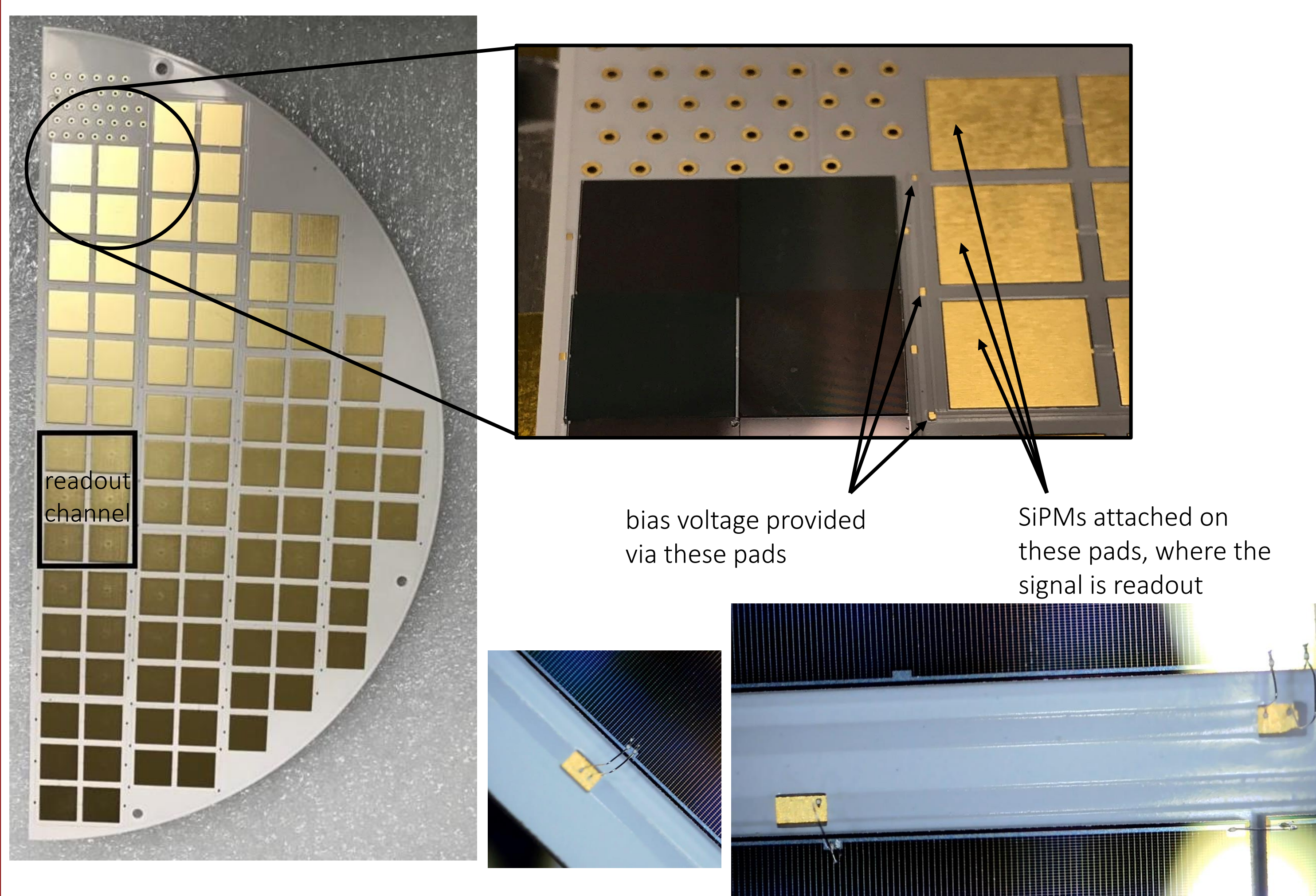
SiPM

Dedicated production of VUV sensitive SiPM by FBK ($1\times 1\text{cm}^2$, $375\mu\text{m}$ thick)

Devices in each channel have been gain-matched based on their breakdown voltage

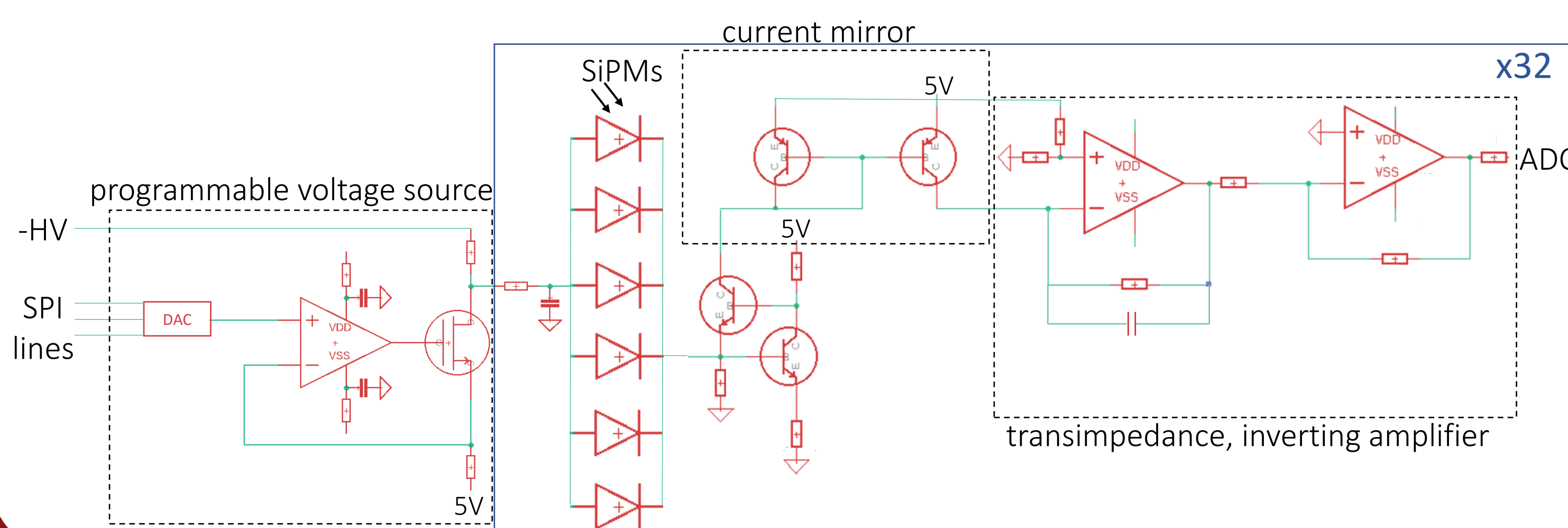


Ceramic Tile



Frontend Readout

- programmable voltage to each channel (SiPMs input)
- 4x8 channels DACs daisy chained (SPI controlled) controlling the different biases -> only 4 wires controlling the 32 biases
- frontend amplifier for the signal (SiPMs output)
- components modularly tested at LXe temperature



First Test in LXe

Full end-to-end test carried out in LXe

- ^{137}Cs source outside the cryostat
- V_{bias} swept from 27.4V to 32.5V
- OR threshold trigger on all 16 channels
- $6\mu\text{s}$ acquisition window

