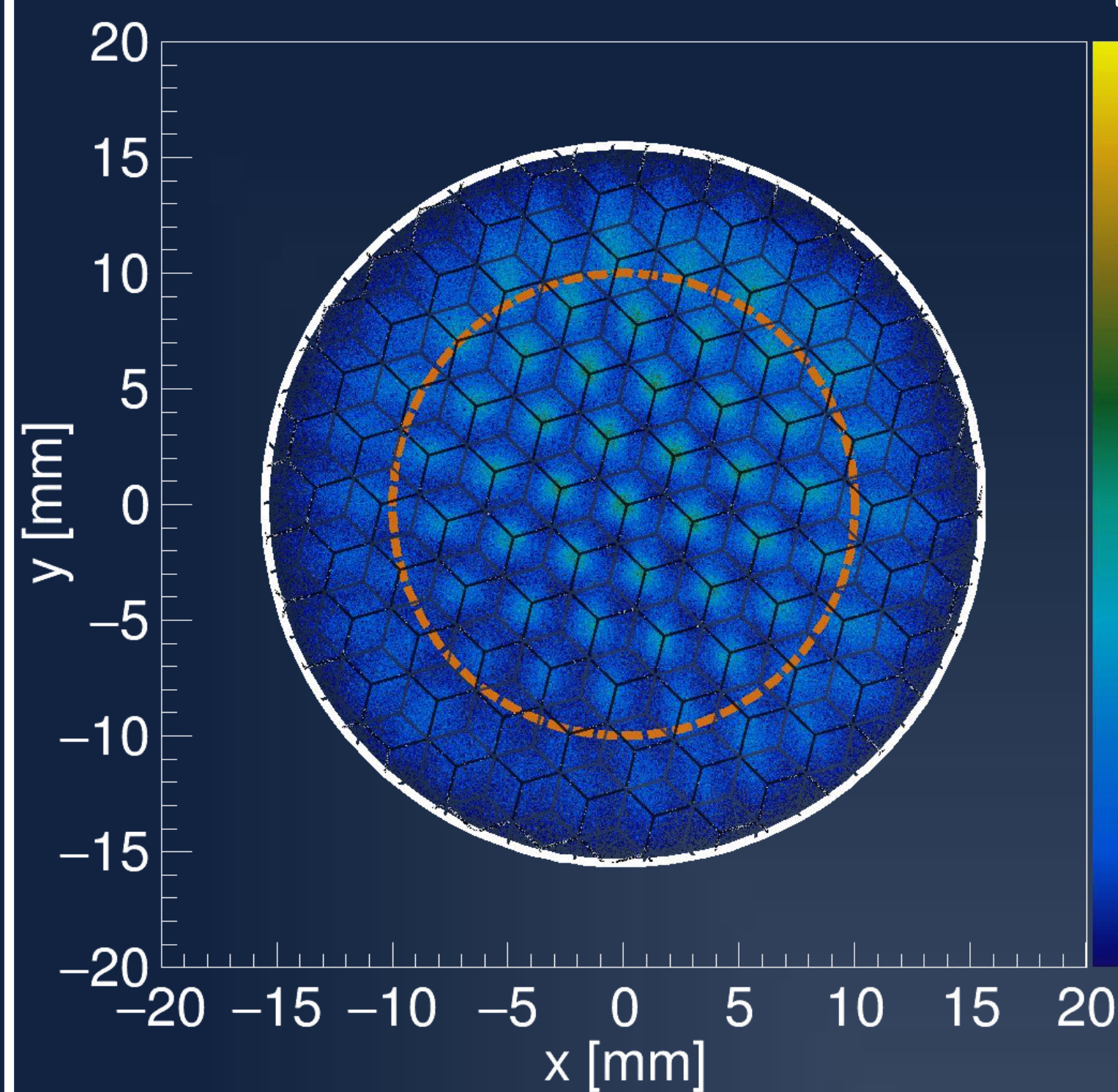
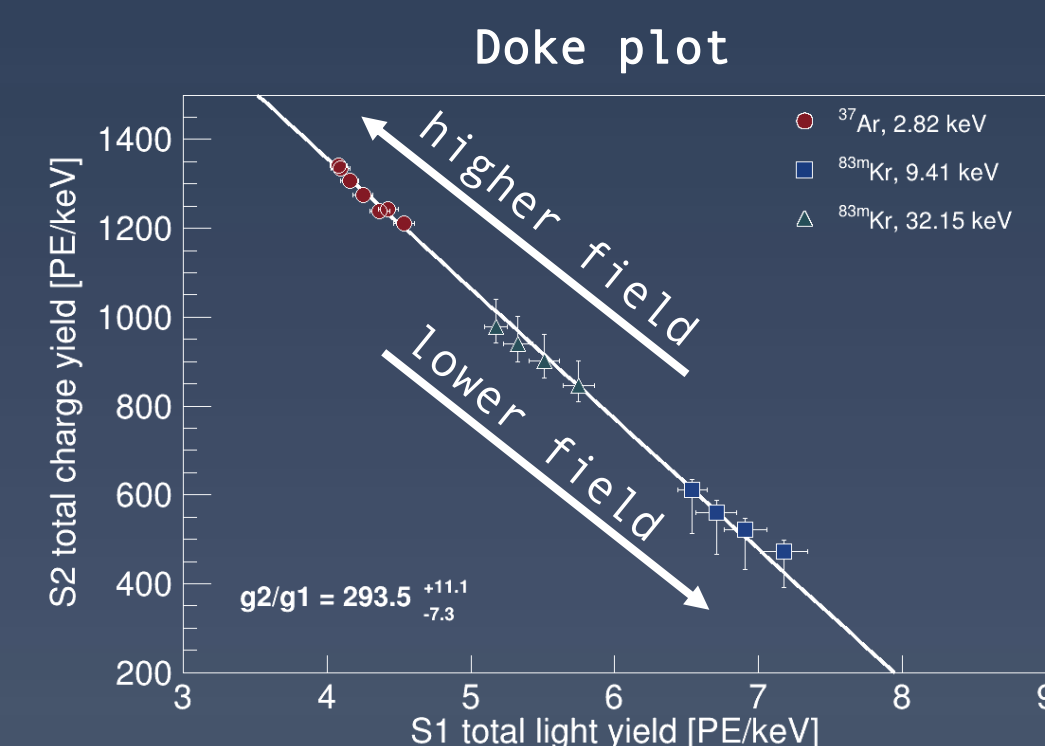


(x,y) position reconstruction with gate and anode meshes

### POSITION RECONSTRUCTION



- (x,y) position from S2 in top array => Resolution ~1.5 mm
- Center-of-gravity algorithm
- Electron focusing to the knots of the gate mesh during drift

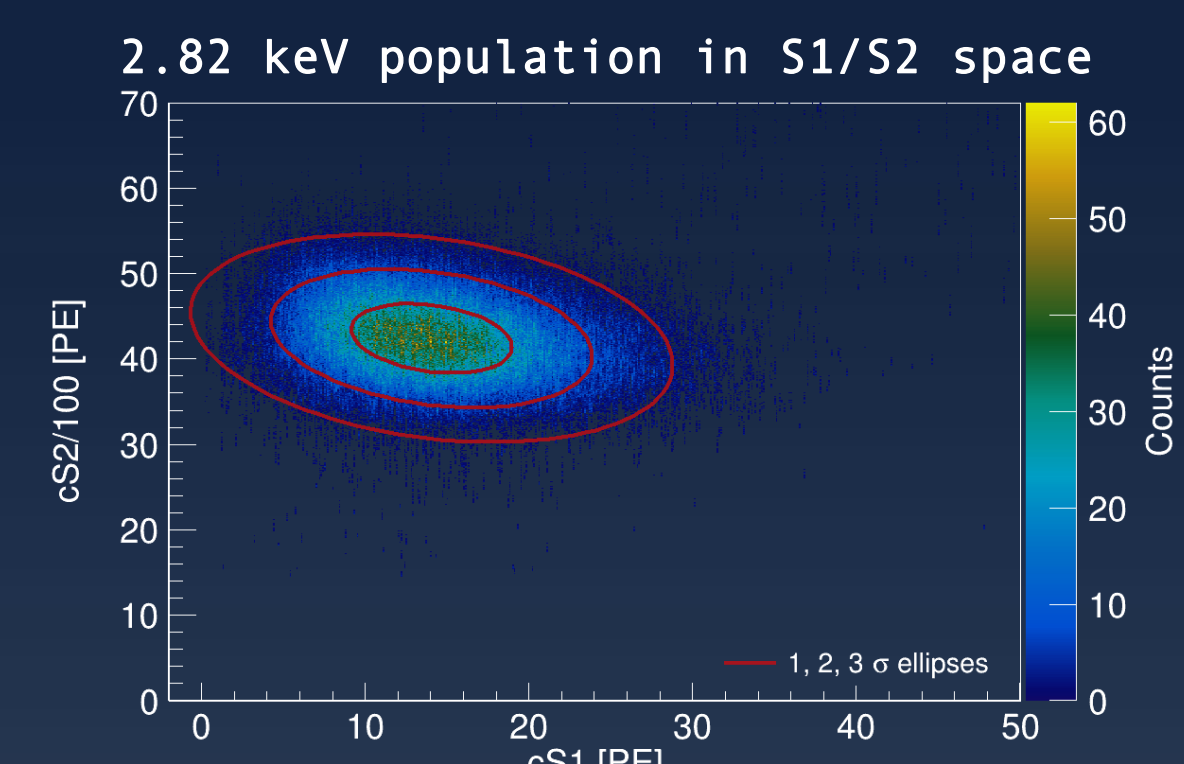


### DETECTOR RESPONSE PARAMETERS

- Combined energy scale:  

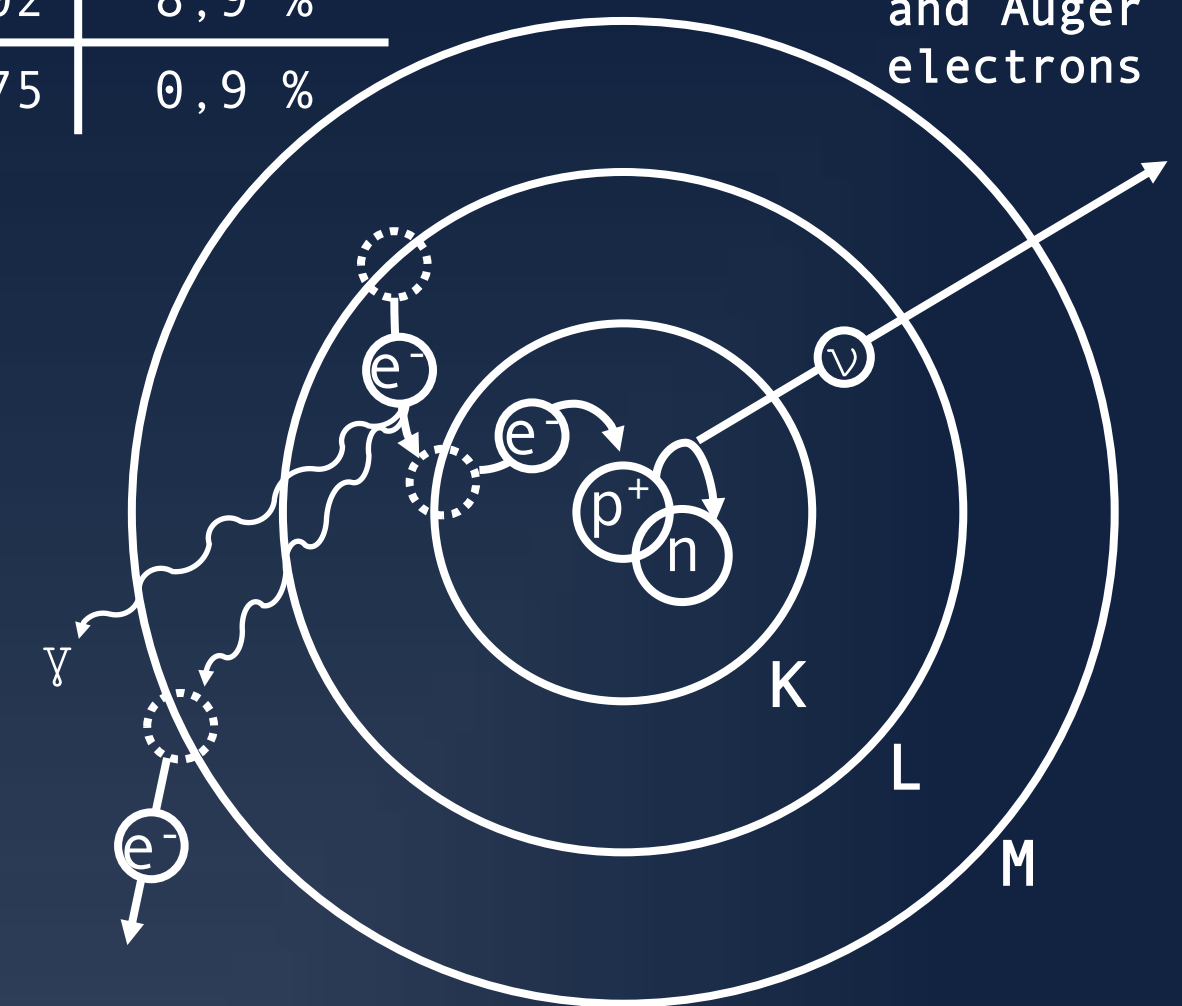
$$E = (N_\gamma + N_{e^-})W = \left(\frac{S1}{g1} + \frac{S2}{g2}\right)W$$
- $W = 13.7 \text{ eV}$  -> new value measured with single electron background (TBP)

### ARGON CALIBRATION

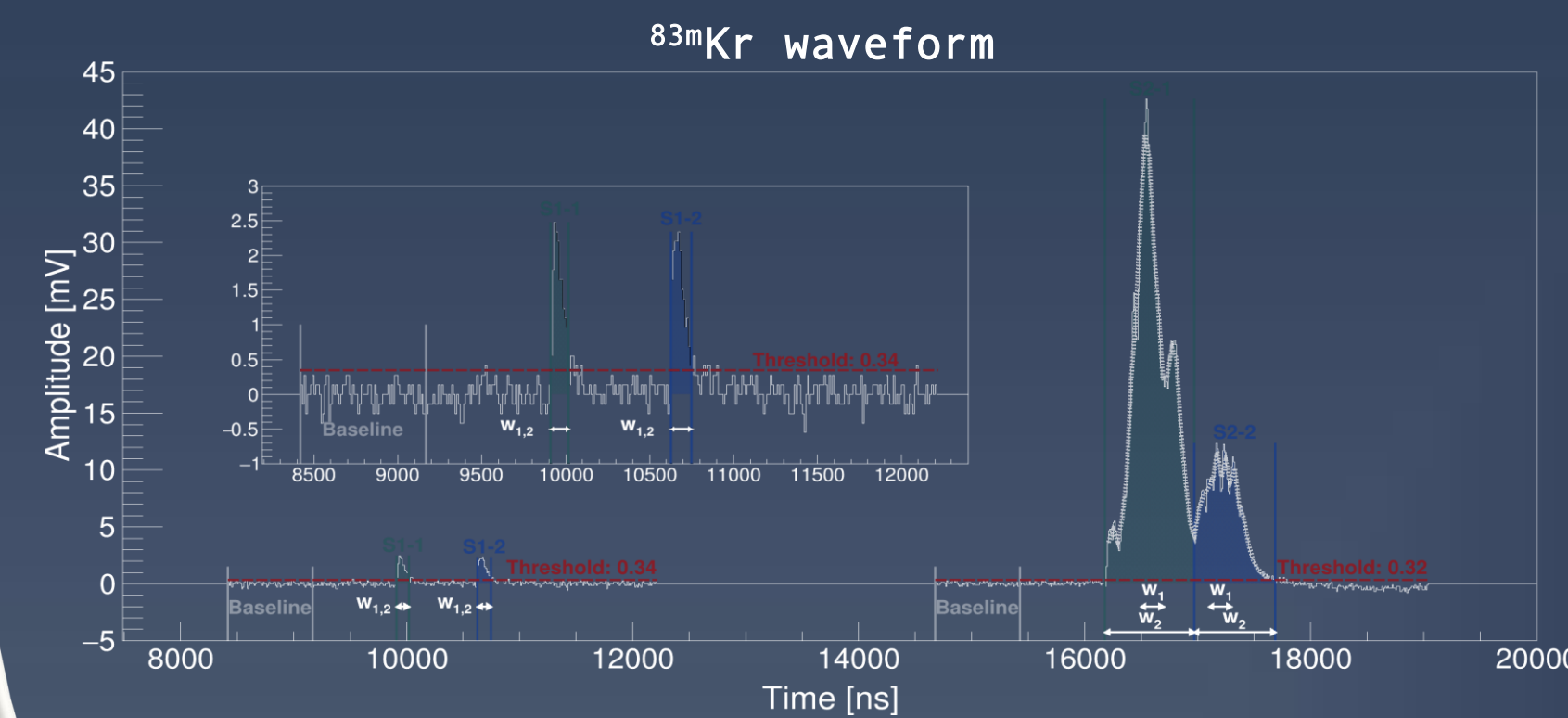


- Low-energy ER-calibrations with internal sources

Decay mode	Energy release [keV]	Branching ratio	<sup>37</sup> Ar T <sub>1/2</sub> = 35.01 d
K-shell	2.8224	90.2 %	Electron capture with X-rays and Auger electrons
L-shell	0.2702	8.9 %	
M-shell	0.0175	0.9 %	



### KRYPTON CALIBRATION

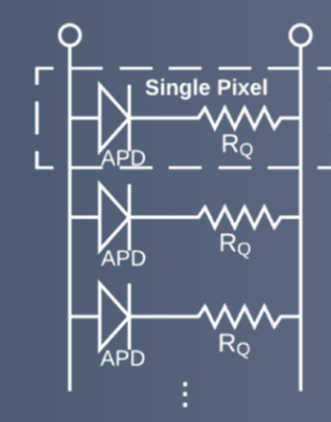
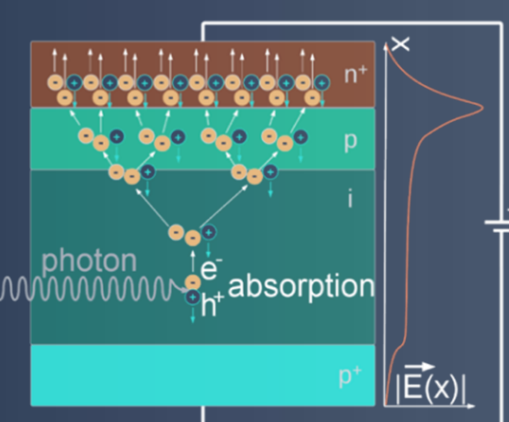


<sup>83</sup>Rb  
T<sub>1/2</sub> = 86.2 d

571.1 keV	62 %
562.0 keV	30 %
41.6 keV	26 %
9.4 keV	74 %
T <sub>1/2</sub> = 156.8 ns	6 %
<sup>83</sup> Kr stable	0 keV

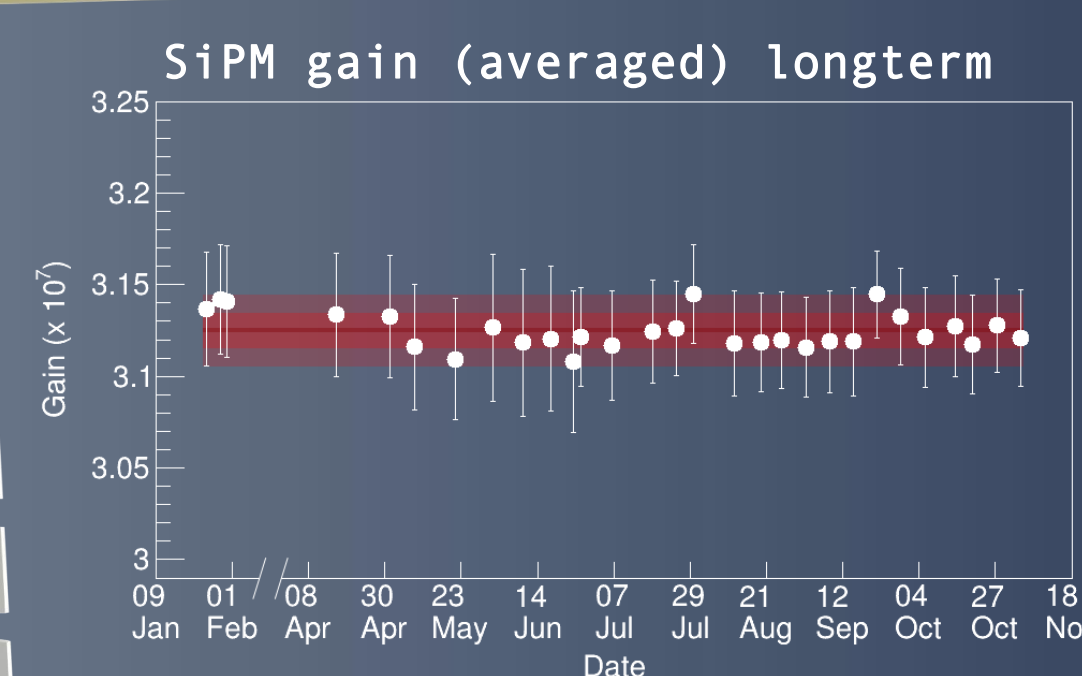
### SILICON PHOTOMULTIPLIERS

- Parallel Single-Photon Avalanche diodes with quenching resistors
- Reversely biased in Geiger mode



### SIPM PERFORMANCE

- + Radiopurity
- + Longterm stability
- + Position resolution
- + Slim form factor
- + Low operation voltage
- + Good SPE resolution
- Dark Count Rate



### THE PROJECT

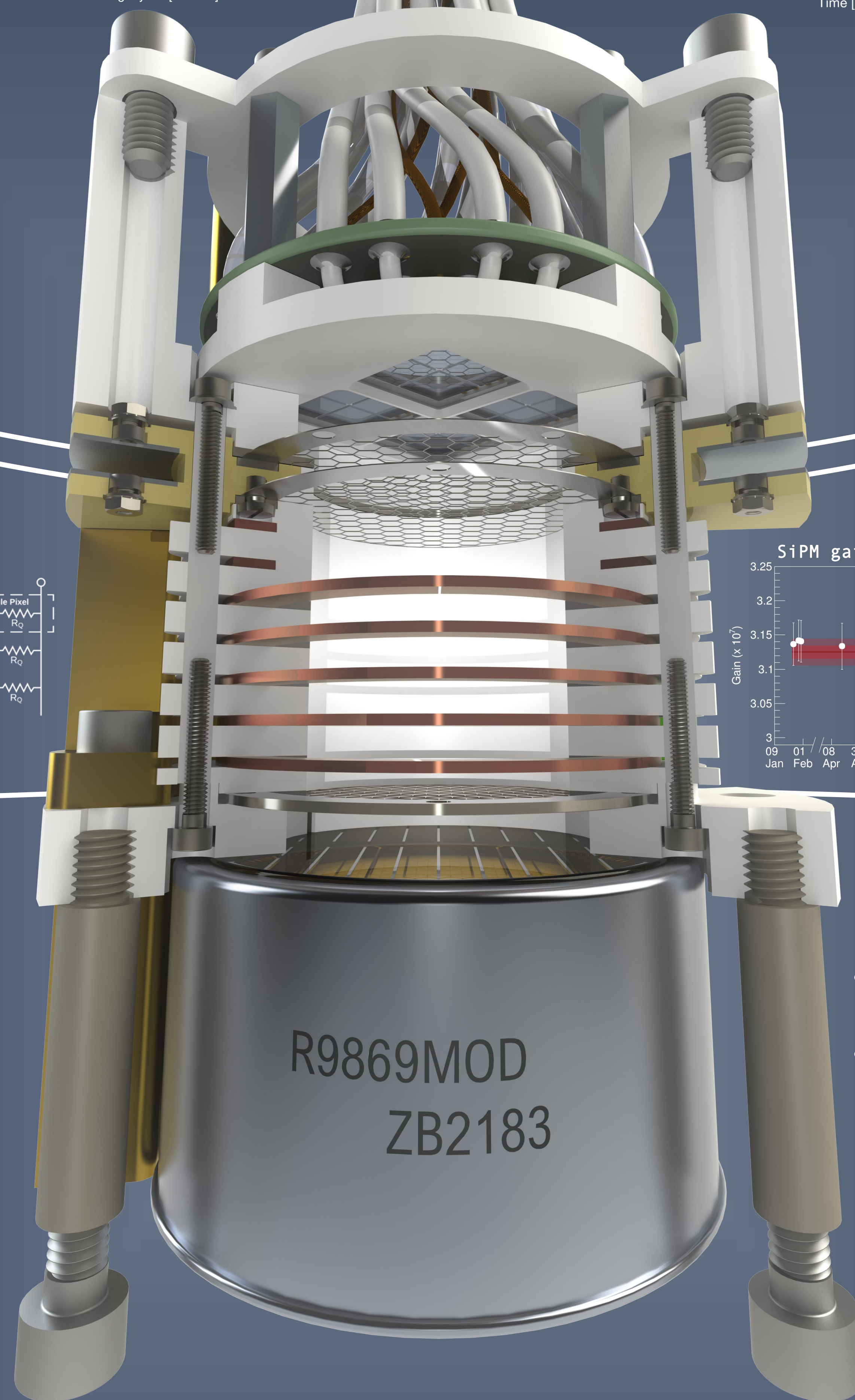
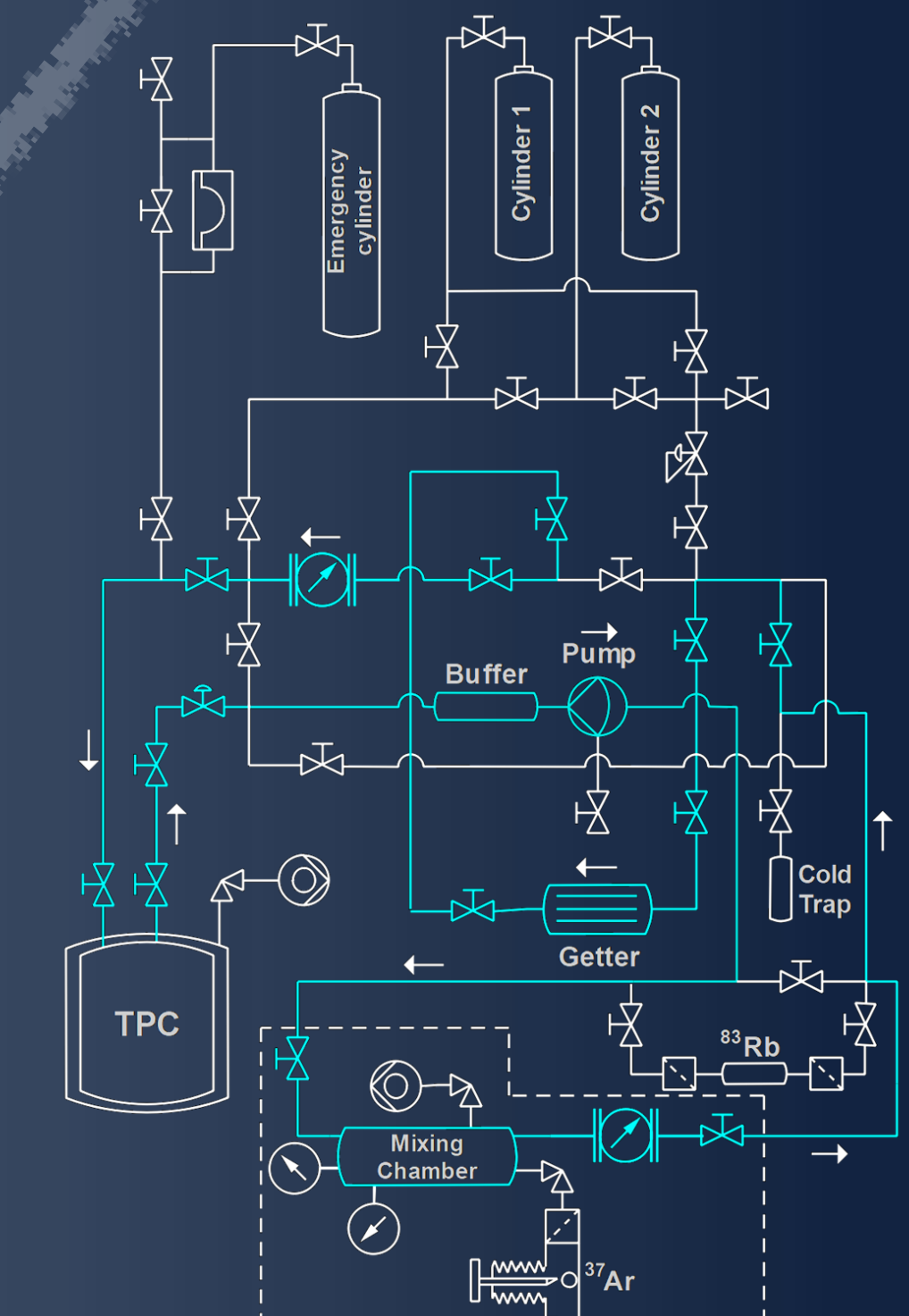
- Xenoscope, ERC advanced grant
- R&D towards the ultimate dark matter observatory DARWIN

### THE SETUP

- LOCATION: Zurich, above ground
- DETECTOR: Dual-phase xenon Time Projection Chamber (TPC)
- SIZE (h x d): (31 x 31) mm<sup>2</sup>
- DRIFT FIELD: up to over 1 kV/cm (10 kV/cm extraction field)
- ENERGY THRESHOLD: < 0.27 keV (S2 only)
- BOTTOM PHOTODIODE: 2-inch Hamamatsu R9869 PMT

### THE UPGRADE

- TOP PHOTODIODES: 2x2 Hamamatsu S13371 VUV-4 MPPCs (12 x 12) mm<sup>2</sup>
- GAS SYSTEM: <sup>37</sup>Ar calibration setup



# XURICH II: FIRST DUAL-PHASE XENON TPC WITH SiPMs

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