dRICH Prototype Beam Test: Overview and First Results

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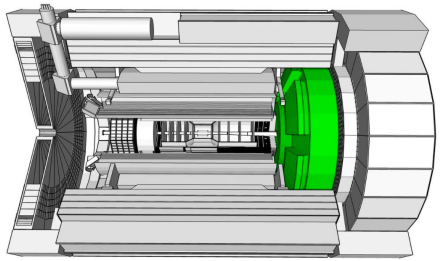
The dual-radiator (dRICH) for forward PID at ePIC

Particle ID

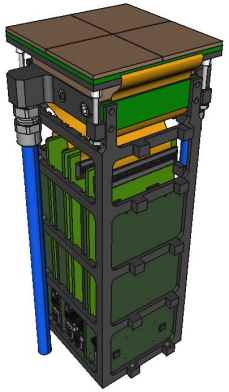
dRICH
p ~3-50 GeV/c
η ~1.5-3.5
e-ID up to 15GeV/c

Broad momentum coverage thanks to dual refractive index:
gas ~ 1.0008
aerogel ~ 1.02



Photosensors:

- 3x3mm^2 pixels
- 0.5m^2 per sector
- SiPM chosen
- photodetectors are placed on a spherical shell



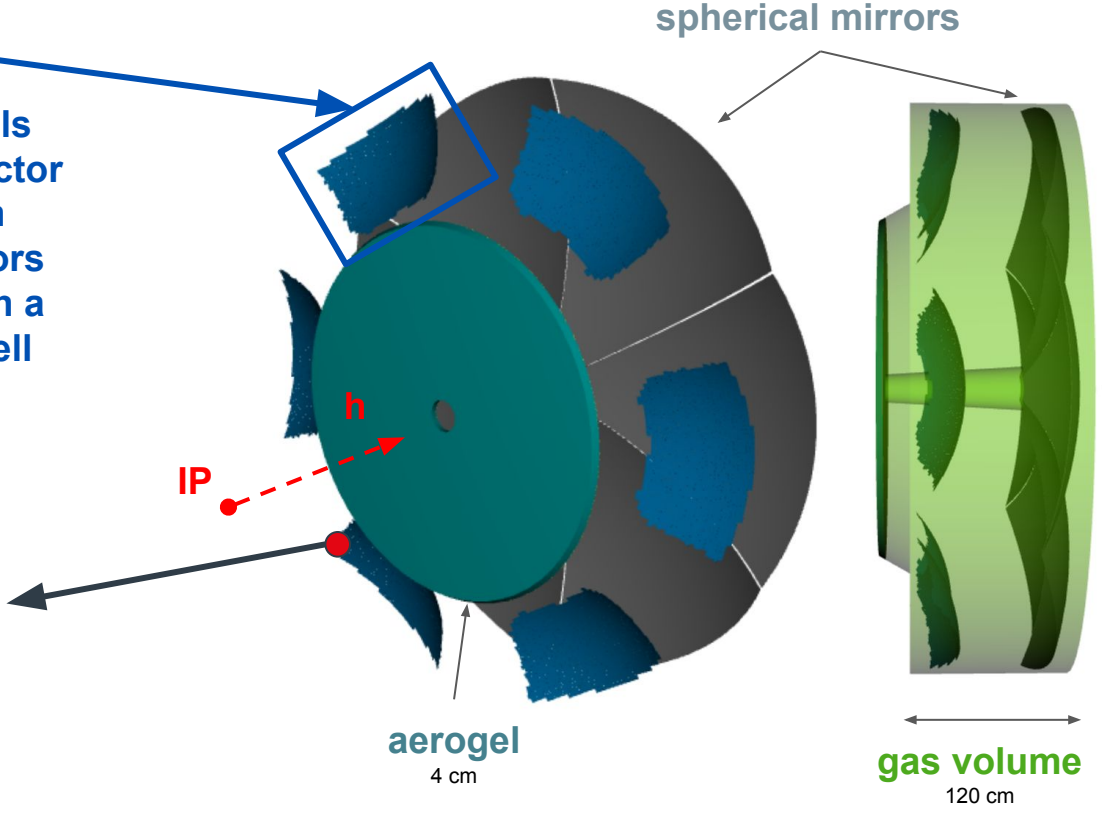
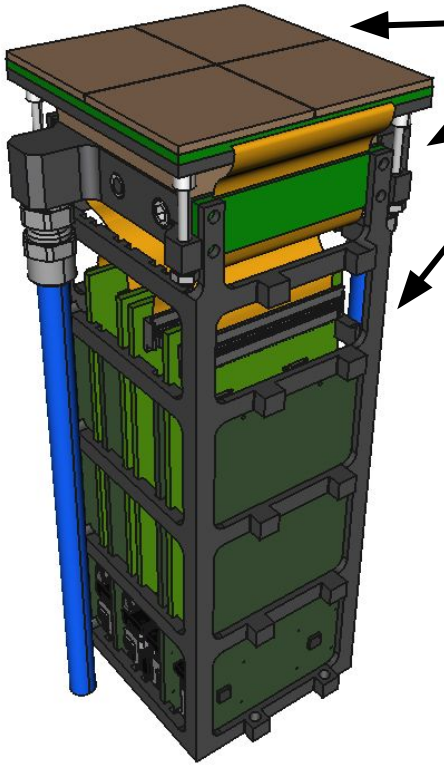


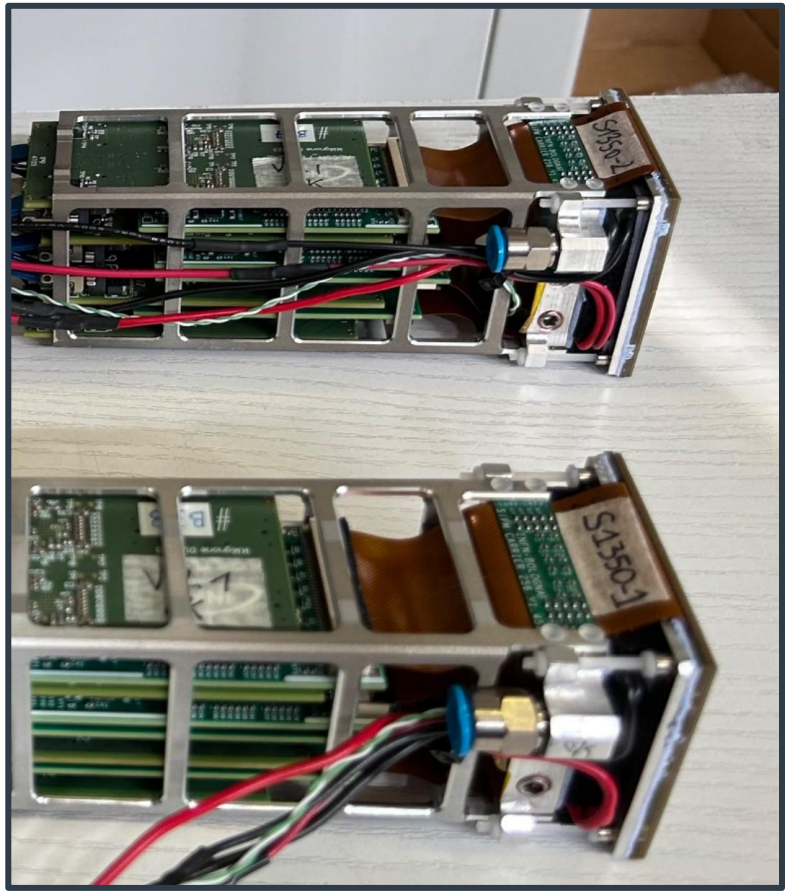
Photo Detection Unit (PDU)



4x matrices of 8x8 SiPMs
3x3 mm^2, total 256 channels

cooling stack down to -40°C

Front-end electronics featuring
the ALCOR ASIC chip



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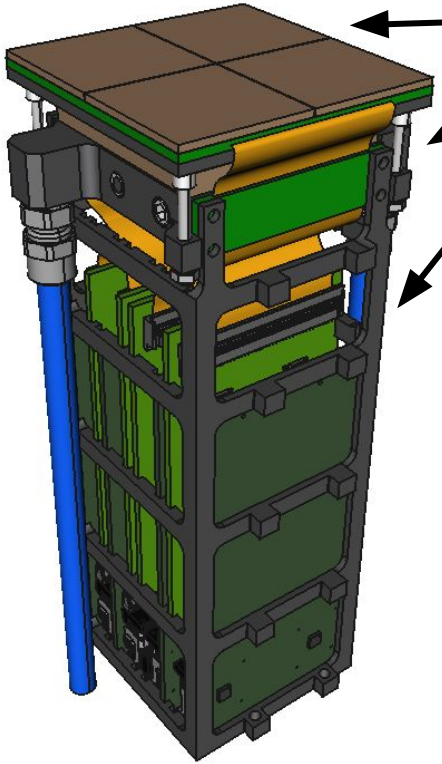

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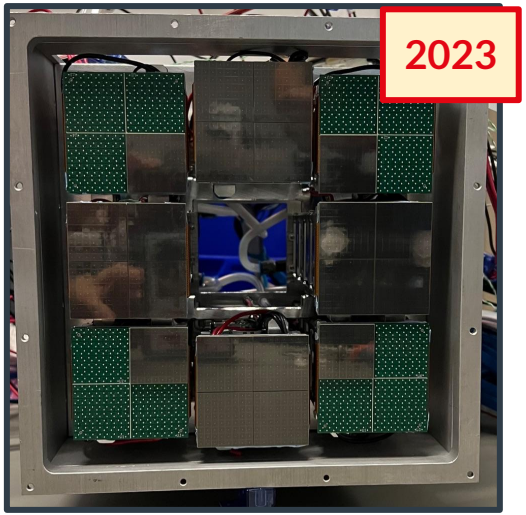

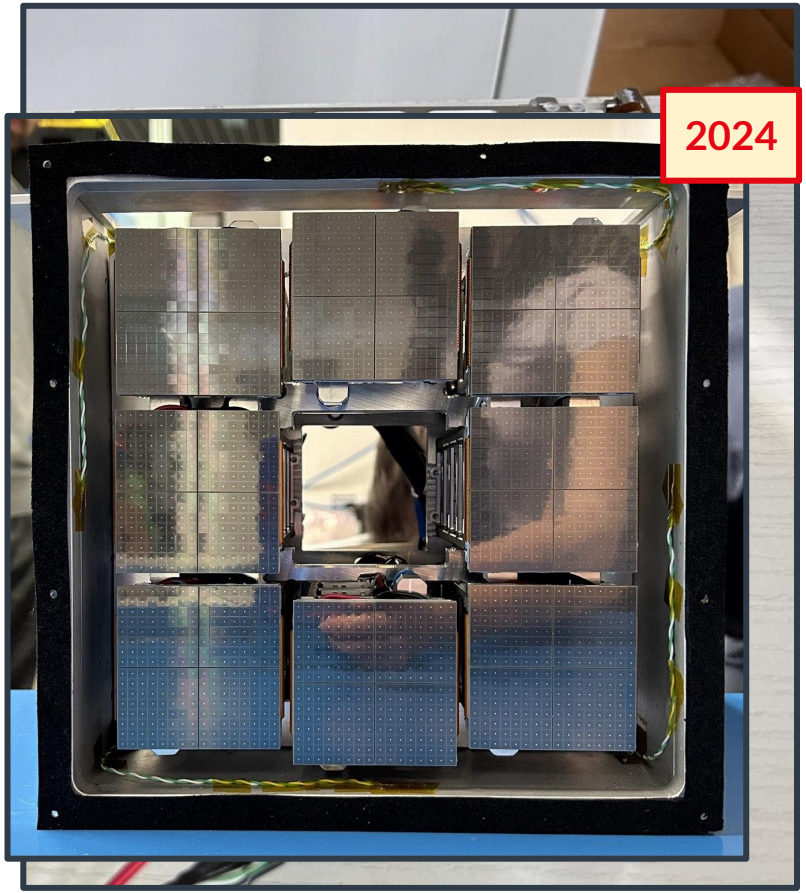

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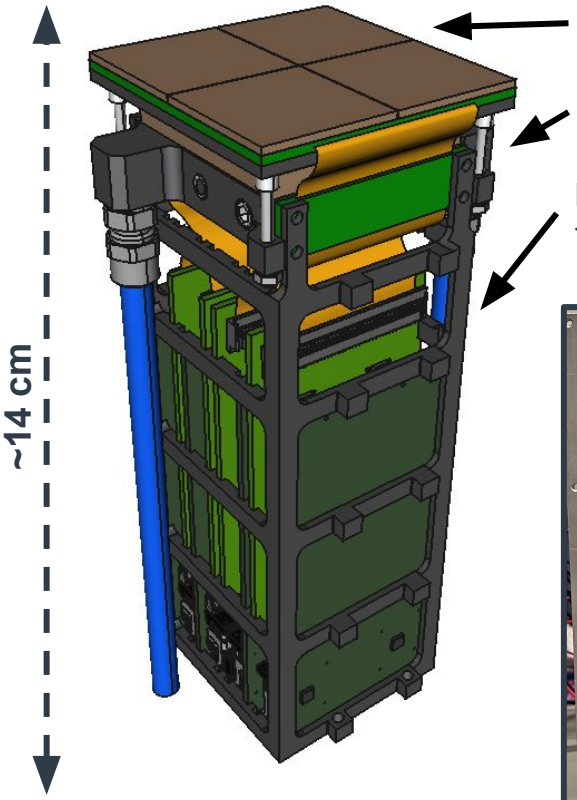

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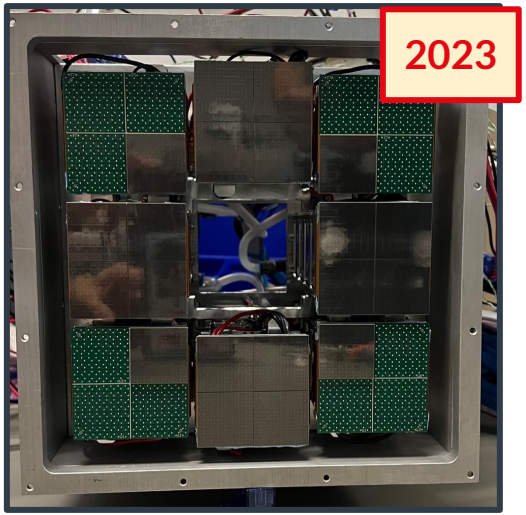
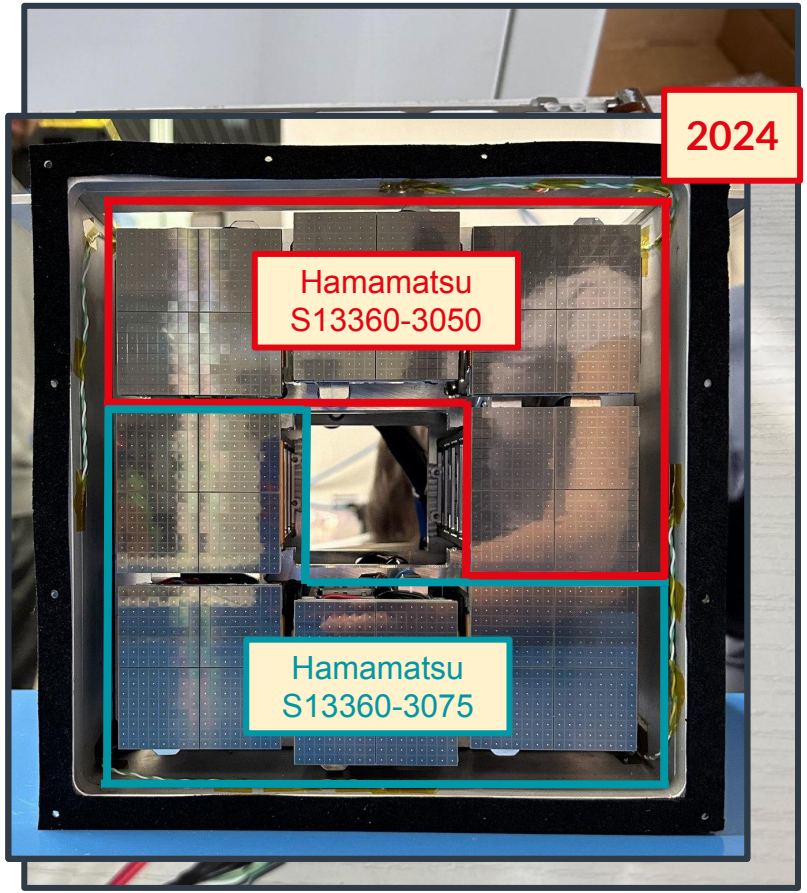
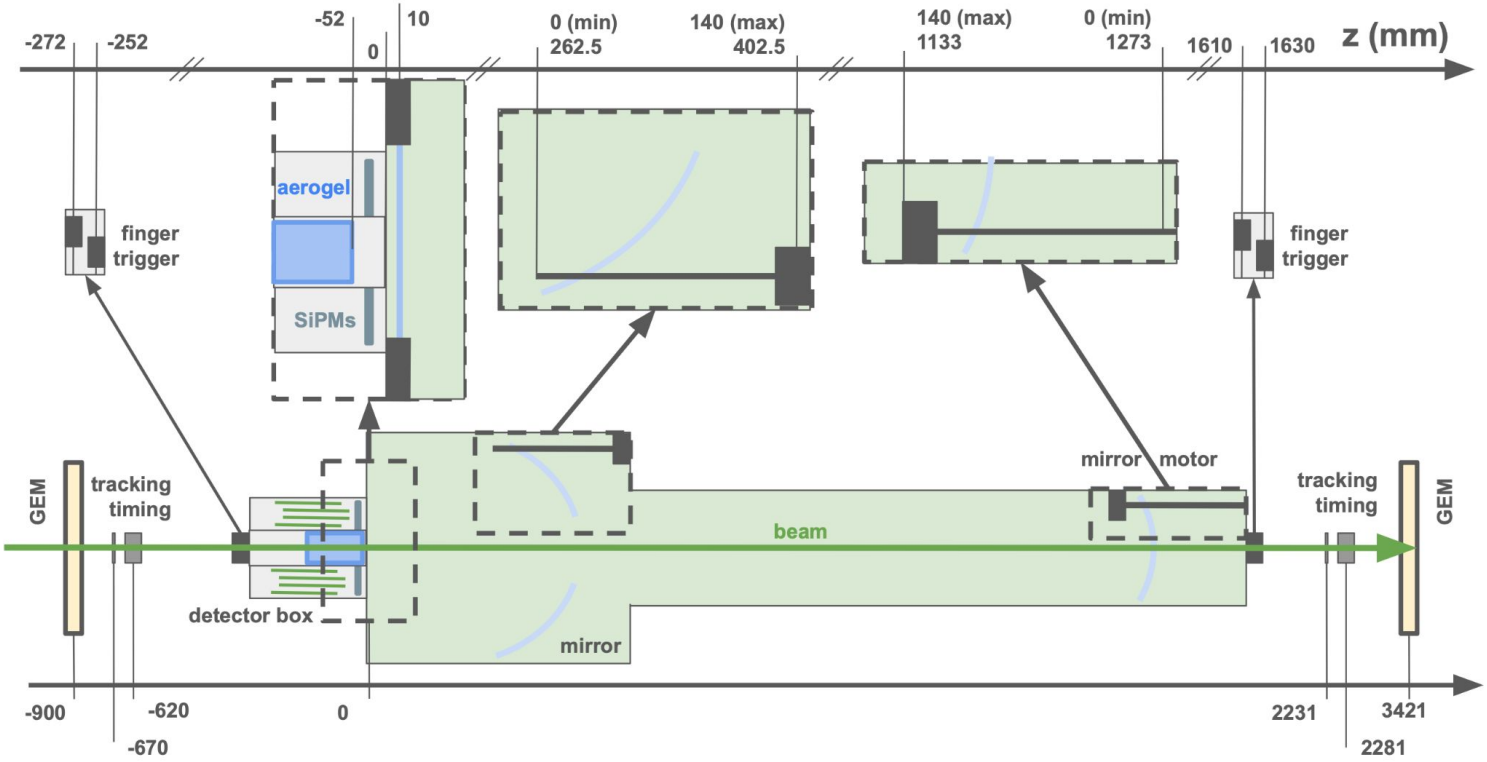


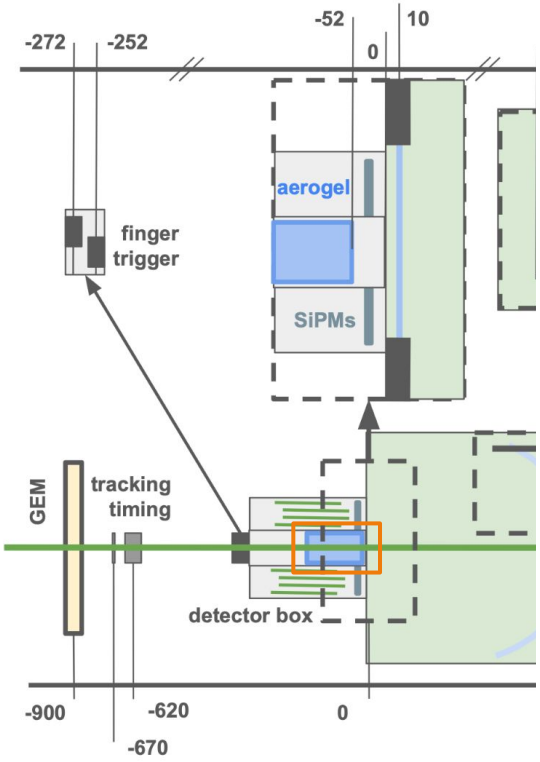


Experimental set-up



Experimental set-up

Aerogel studies

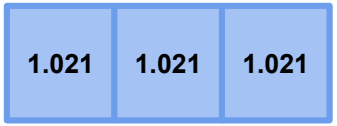


nominal

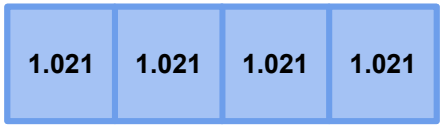
background

single

triple



quadrupole



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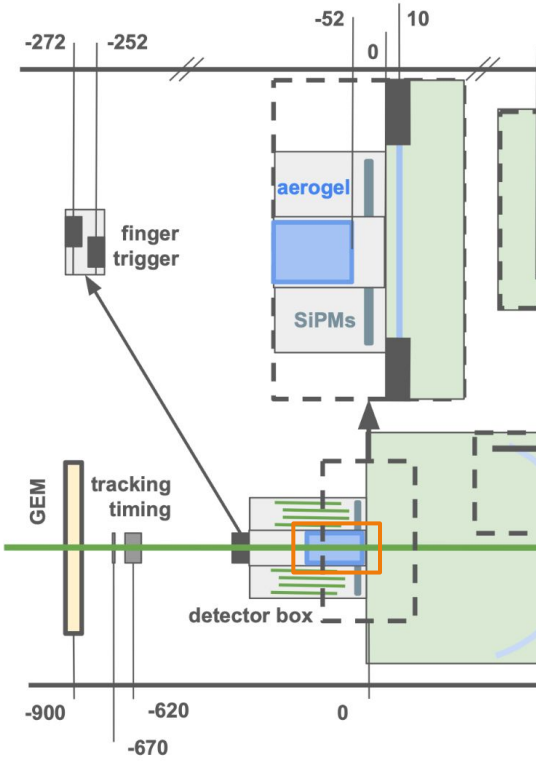

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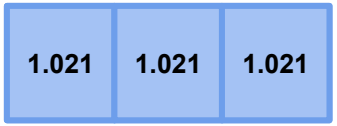

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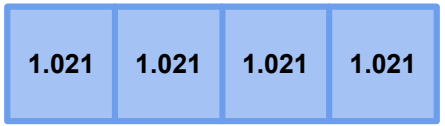
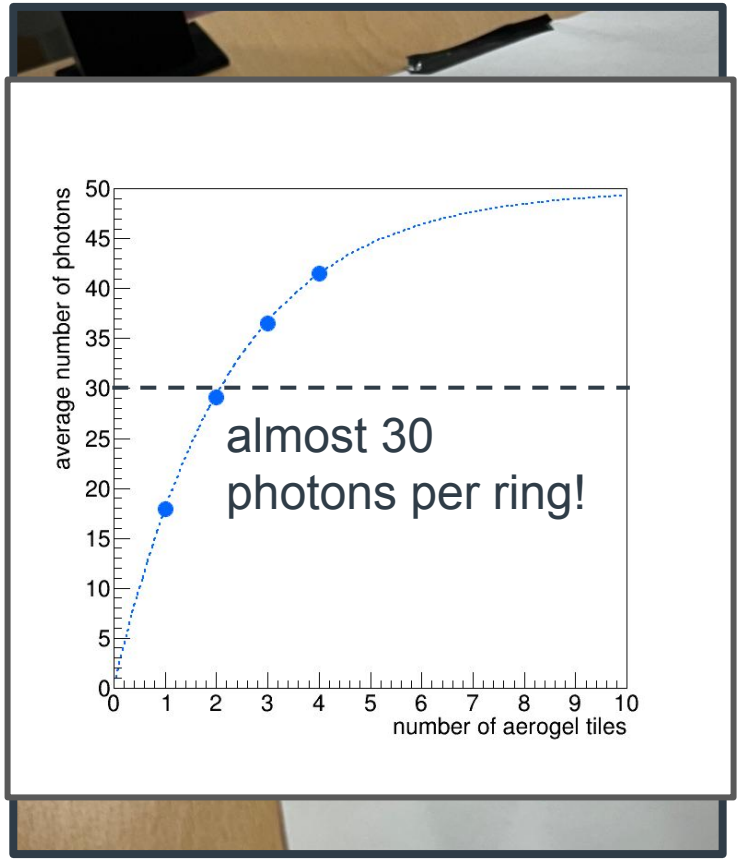
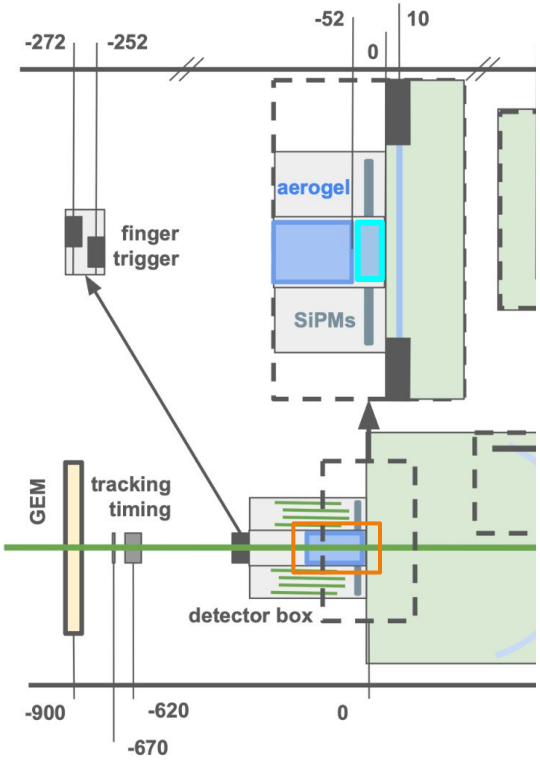
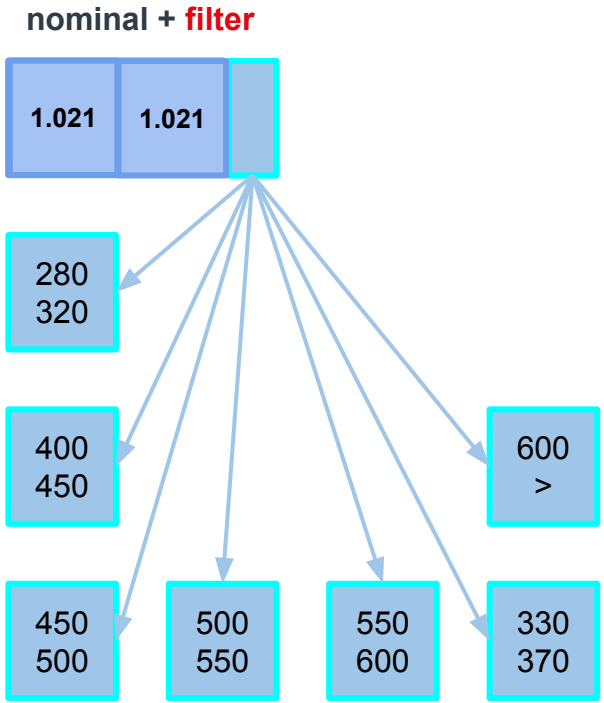
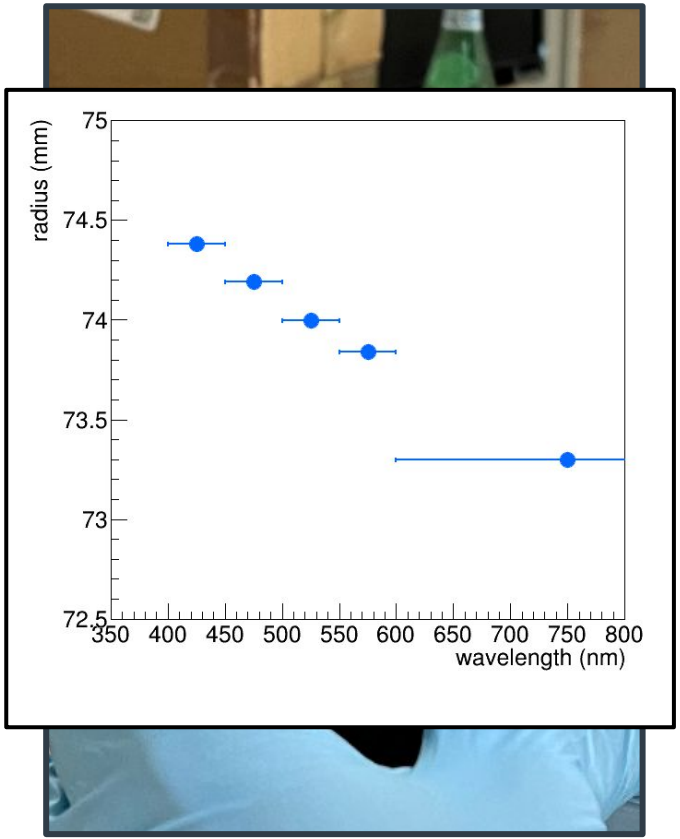




Experimental set-up: aerogel







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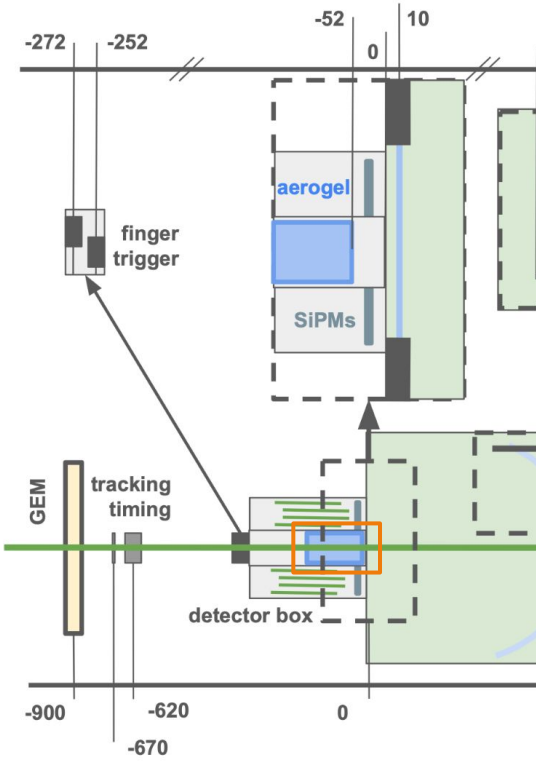


nominal

1.021	1.021

higher ref index

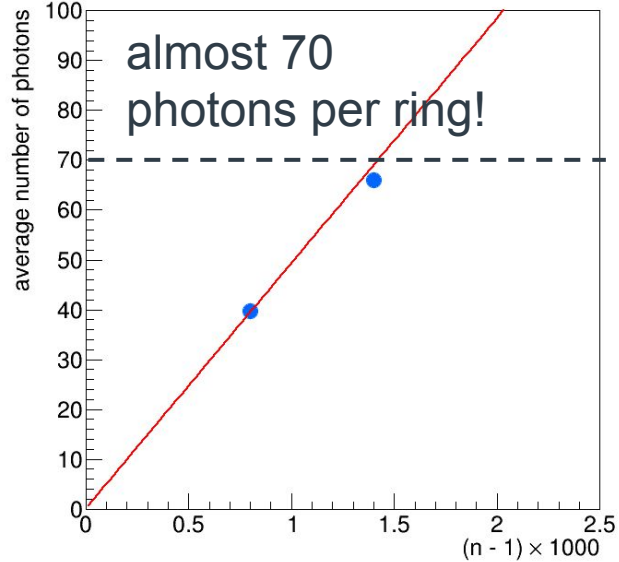
1.026	1.026

nominal

C_2F_6
1.0008

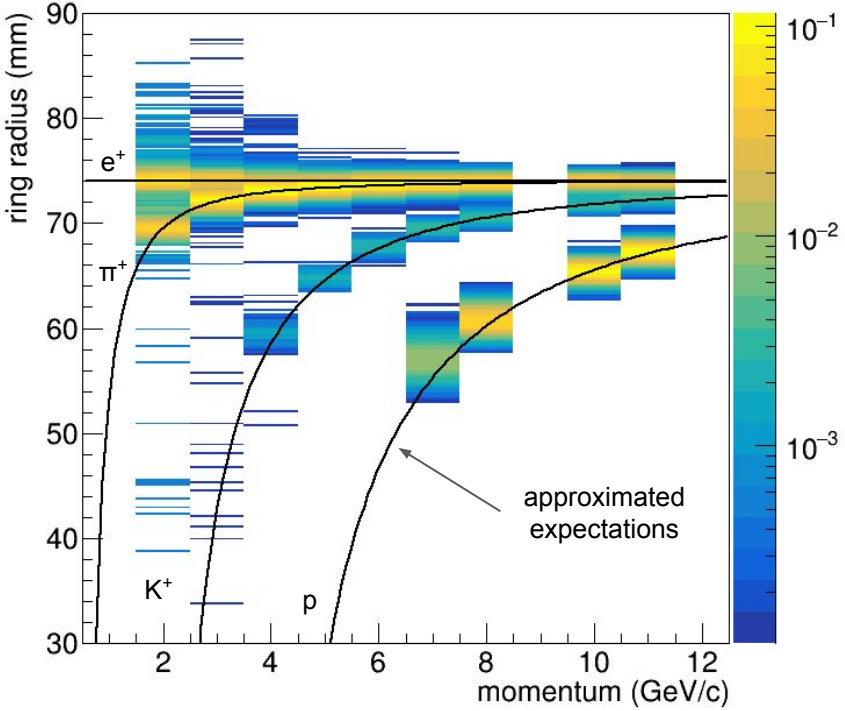
higher ref index

C_4F_{10}
1.0014

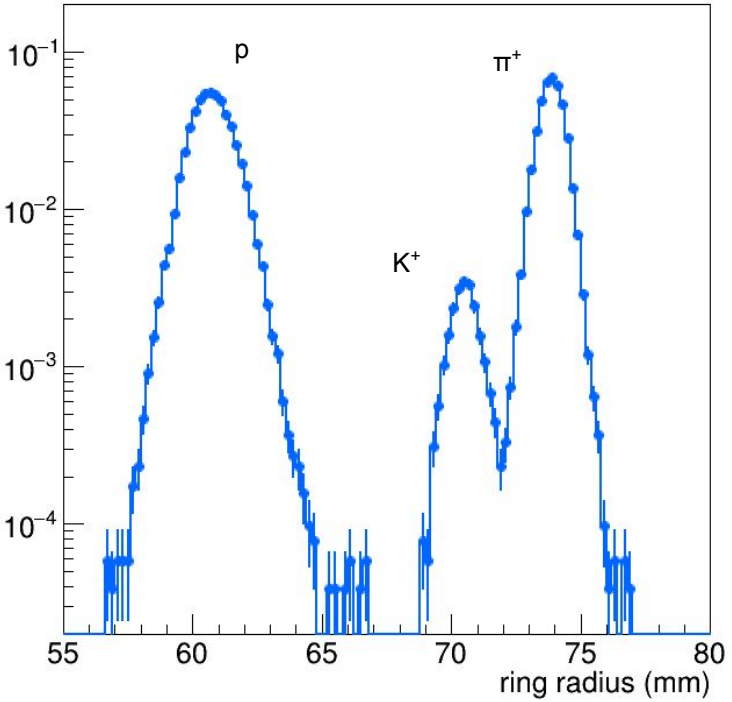


Momentum scan

reconstructed radii vs. beam momentum

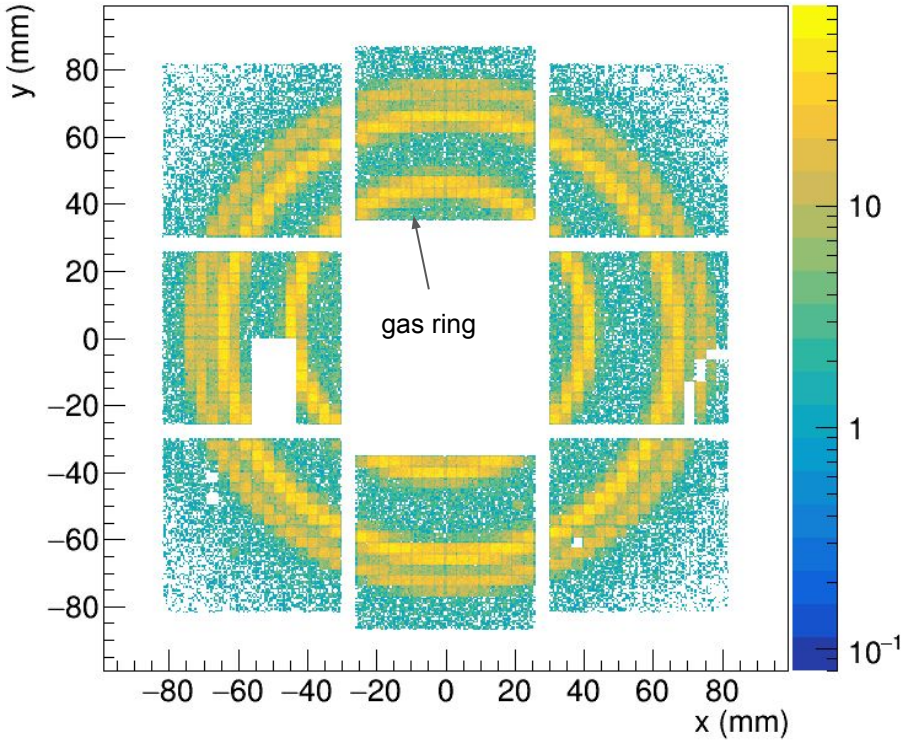


reconstructed radii at 8 GeV/c beam momentum



PID w/ Gas & Aerogel

10 GeV/c positive beam with no selection applied



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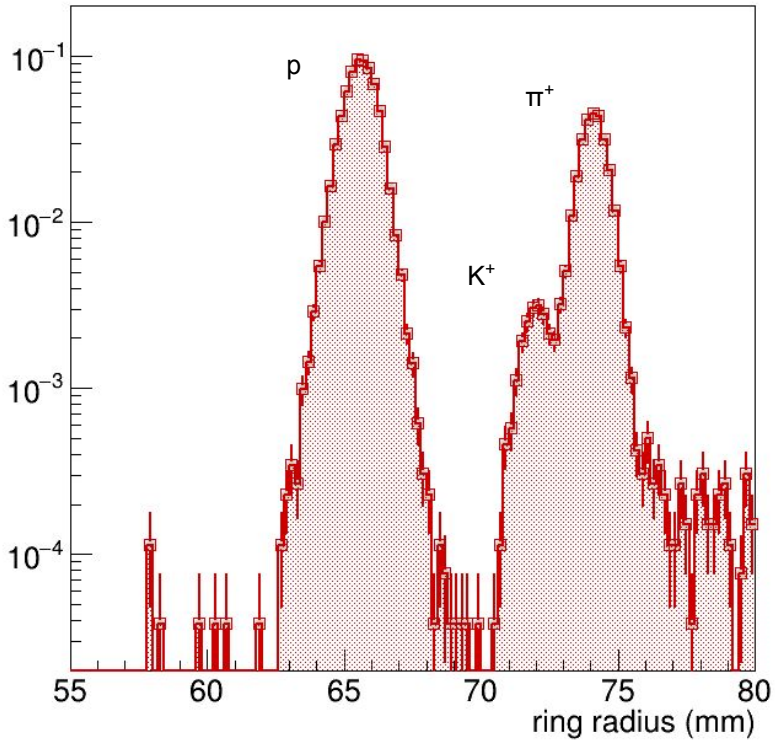

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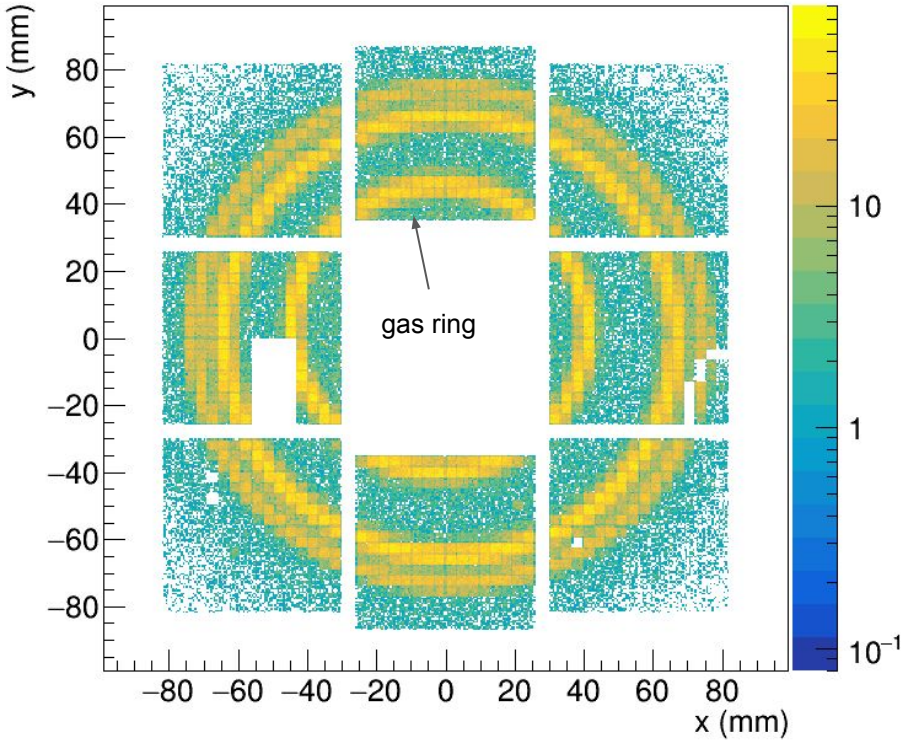

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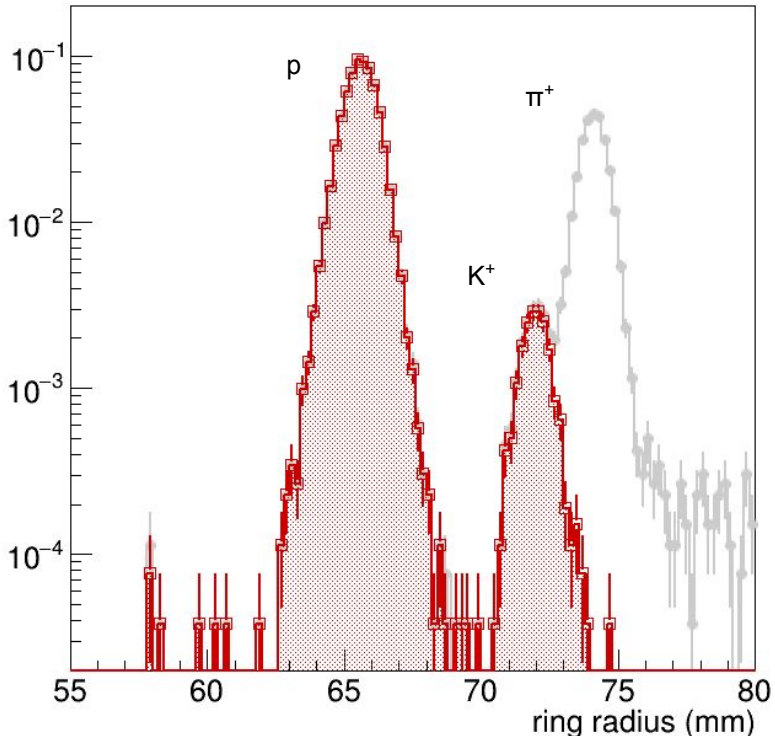

Conclusions

The beam tests of October 2023 and May/June 2024 were very successful.

We are moving forward in the detector, sensors and light characterisation for a deeper understanding of the detector prototype.

A LOT of data has been taken, if you wish to help there is plenty of room to join the data analysis task force

Thank you!
Any questions?

nicola.rubini@bo.infn.it

Back-up

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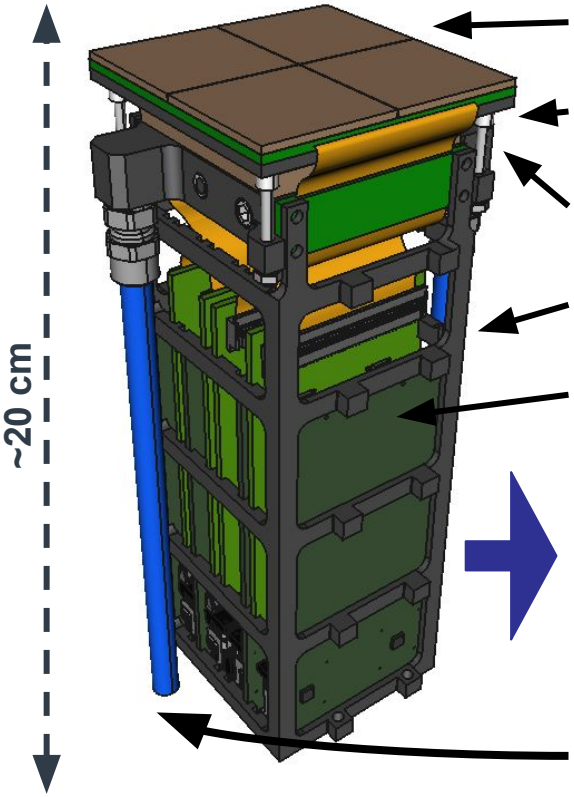


4x matrices of 8x8 SiPMs
3x3 mm^2, total 256 channels

2 peltier cells for subzero operating temperatures

Temperature sensors both under the sensors and on the peltiers

light-weight aluminium structure

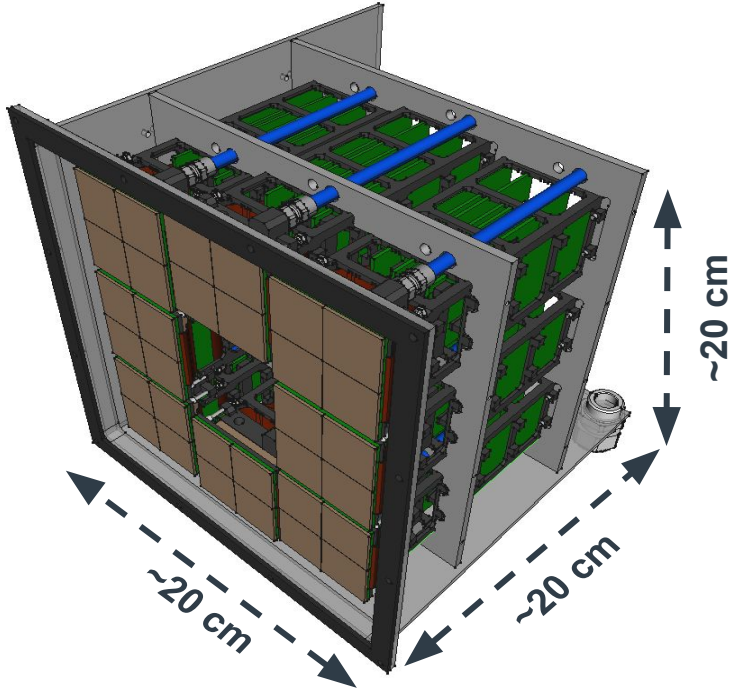
Front-end electronics featuring the ALCOR ASIC chip

Externally provided:
High voltage bias for sensors, low voltage power supply for electronics, T sensors piloting and read-out

liquid heat exchange for temperature control of hot-face of peltiers

Prototype

Compact solution for a ~18 cm^2 of active area, reading 2048 channels



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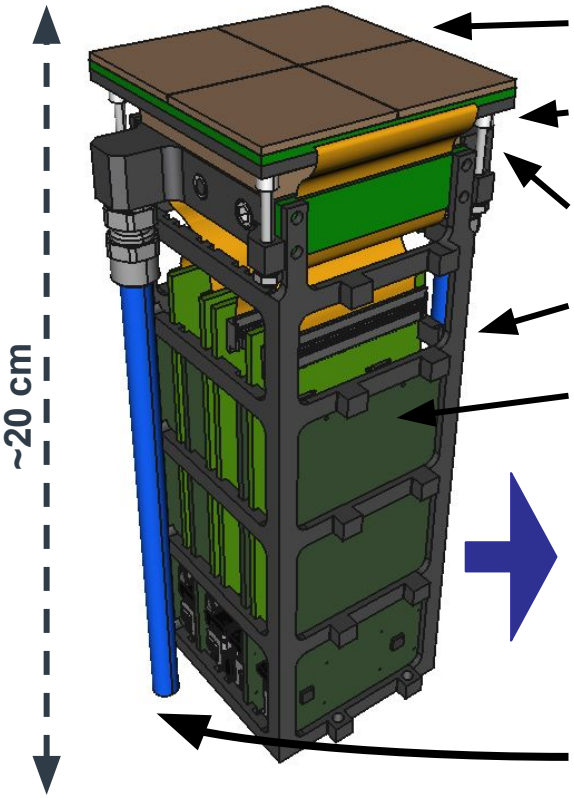

4x matrices of 8x8 SiPMs
3x3 mm^2, total 256 channels

2 peltier cells for subzero operating temperatures

Temperature sensors both under the sensors and on the peltiers

light-weight aluminium structure

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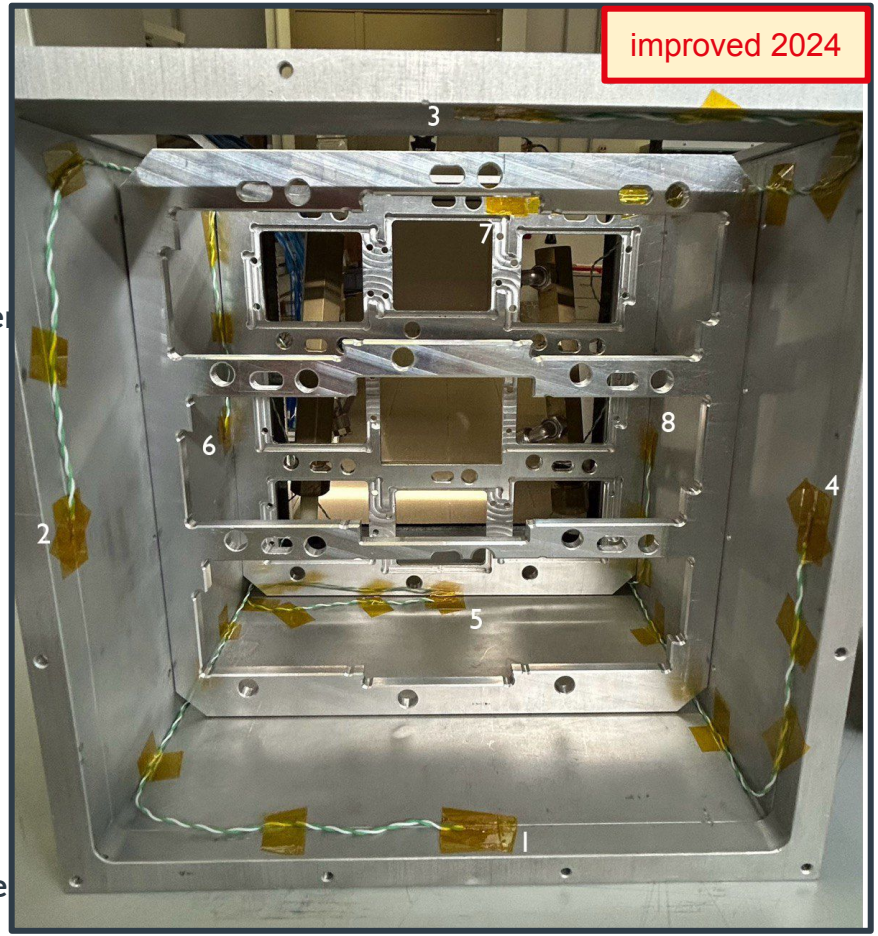

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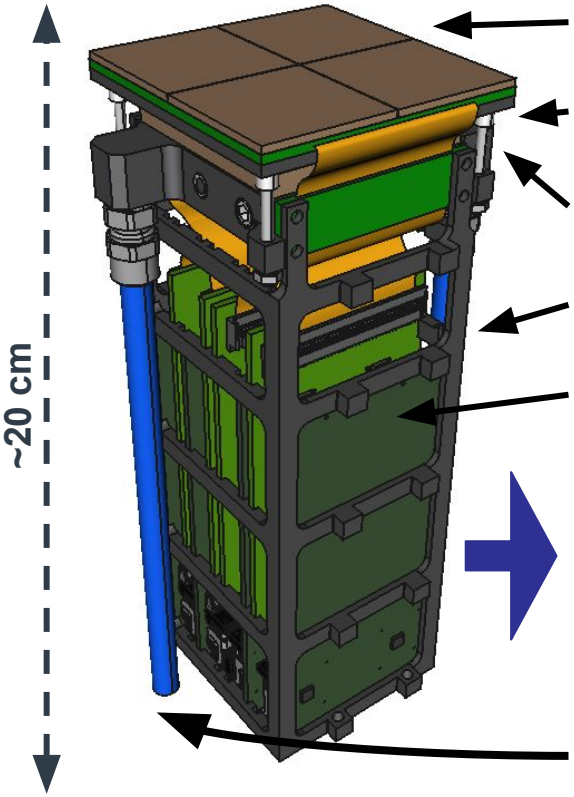

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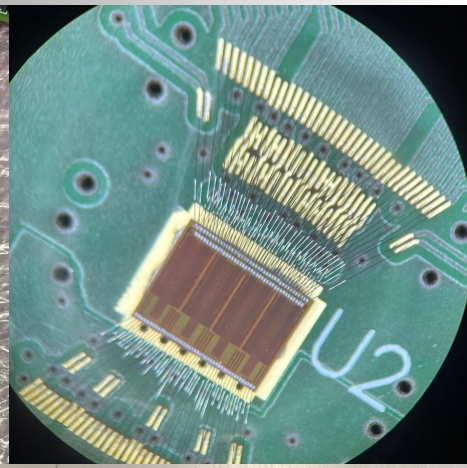
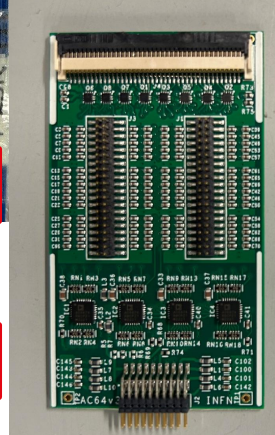


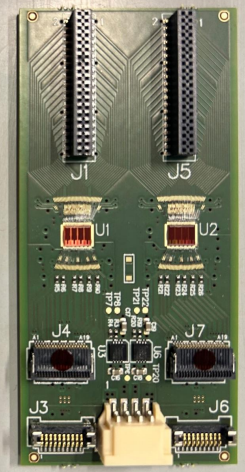
improved 2024

we installed ALCOR v2.1

studied in 2023

thresholds





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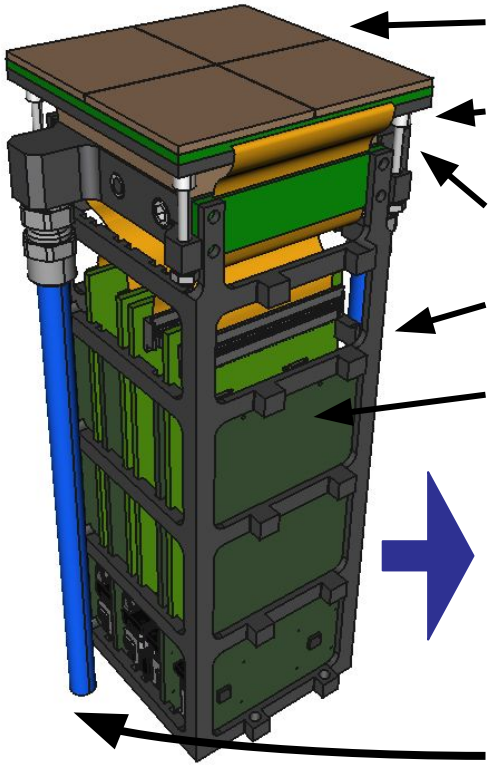

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2 peltier cells for subzero operating temperatures

Temperature sensors both under the sensors and on the peltiers

light-weight aluminium structure

Front-end electronics featuring the ALCOR ASIC chip

Externally provided: **High voltage bias** for sensors, low voltage power supply for electronics, T sensors piloting and read-out

studied in 2023

liquid heat exchange for temperature control of hot-face of peltiers

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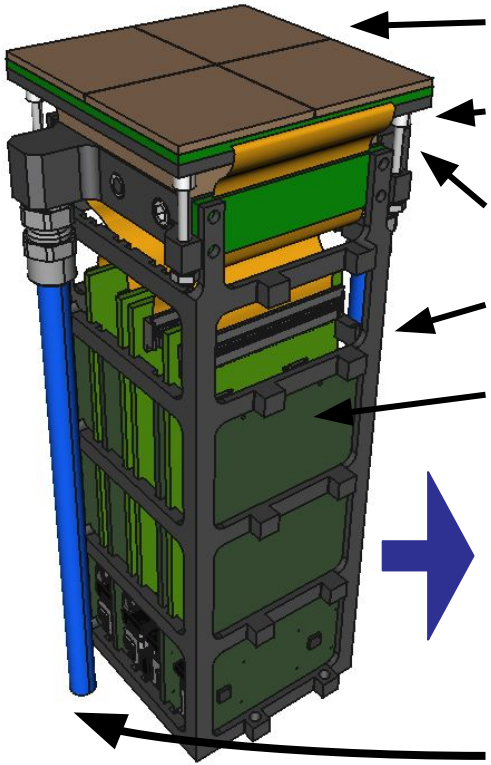

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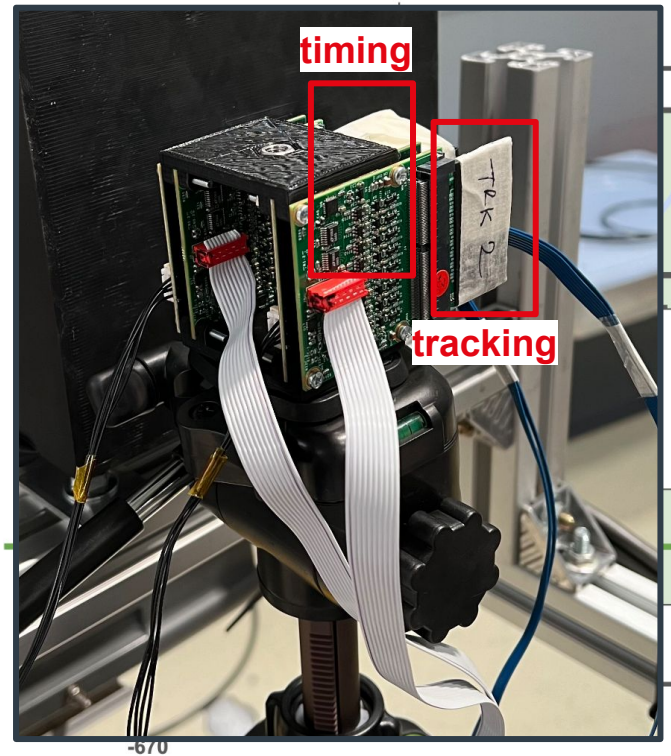
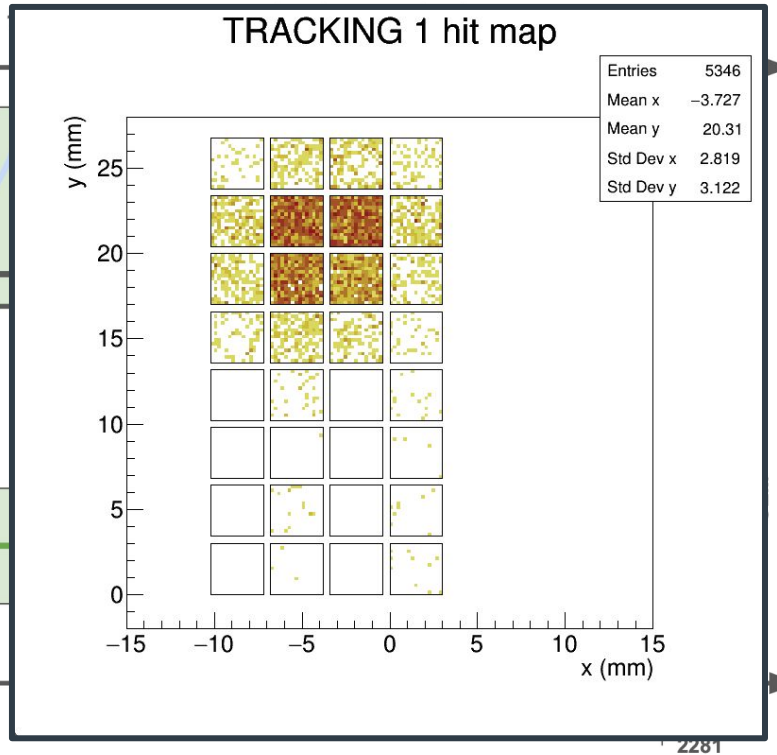
improving 2024

we tried to swap water with siliconic fluid

Experimental set-up

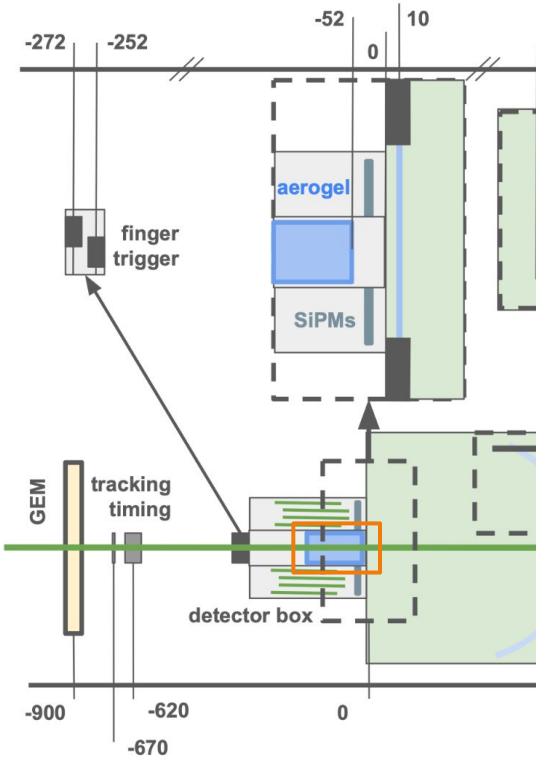




NEW

we installed a new timing and tracking system based on SiPM w/ ALCOR readout

Experimental set-up: aerogel



standard

.021 .021

background

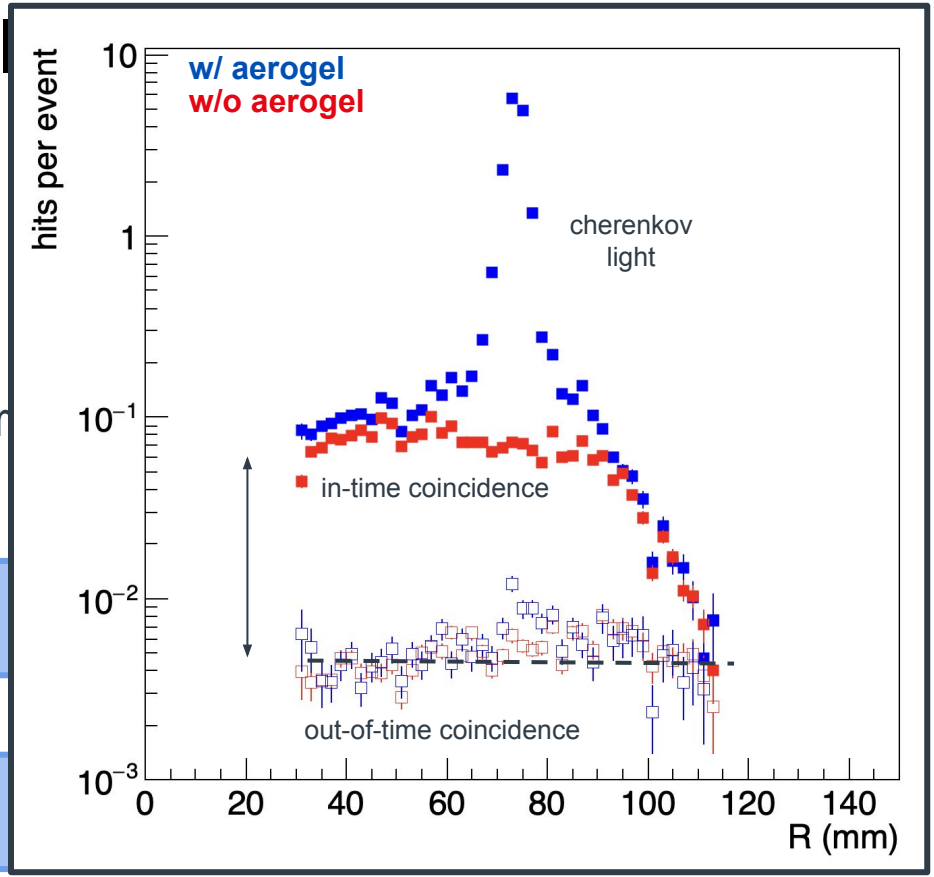
X backgr

single **triple**

.021 .021

quadrupole

.021 .021 .021



Experimental set-up: aerogel

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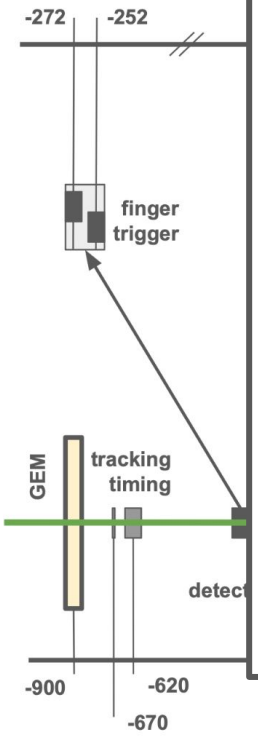

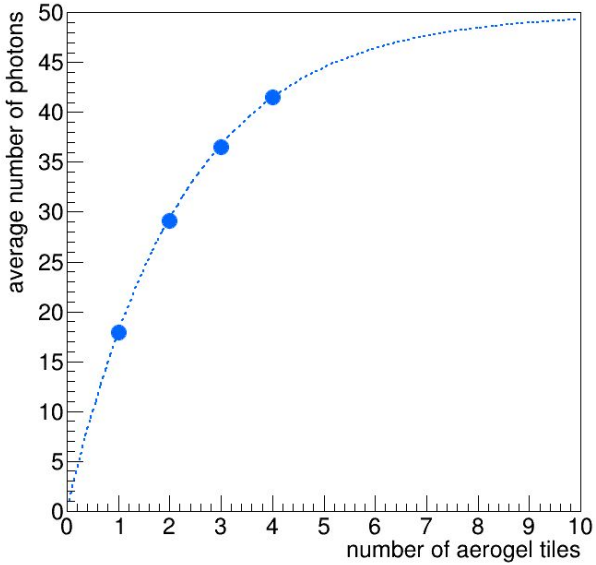

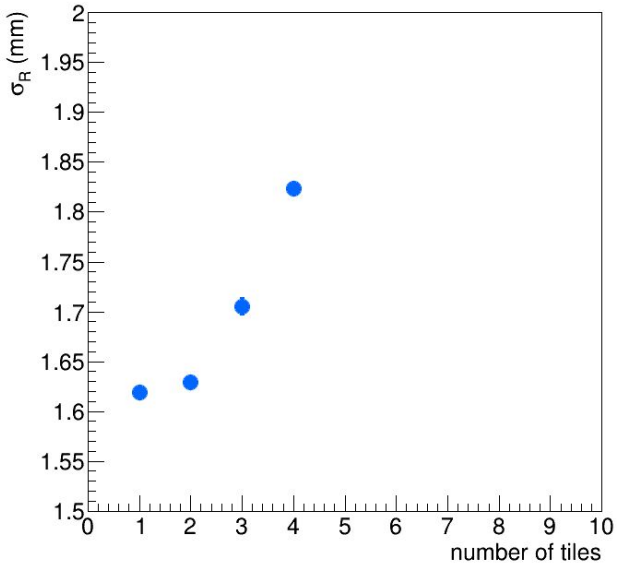

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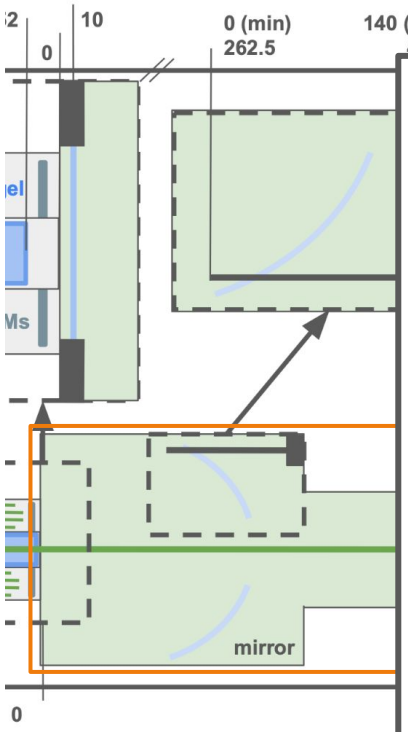
umber

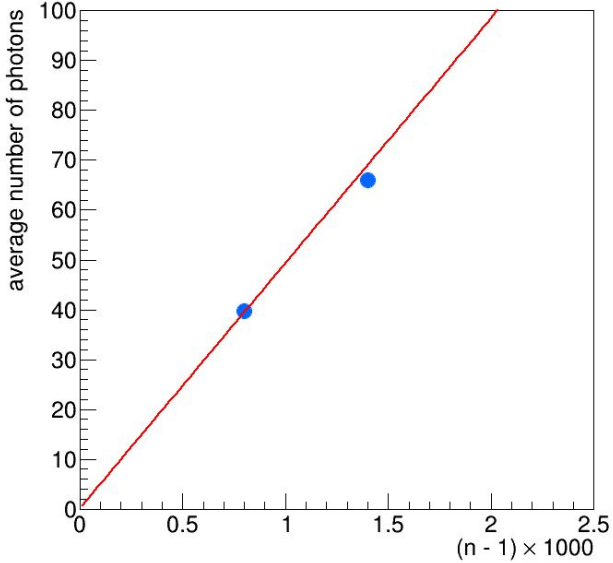
.021	.021	.021	.021

Experimental set-up

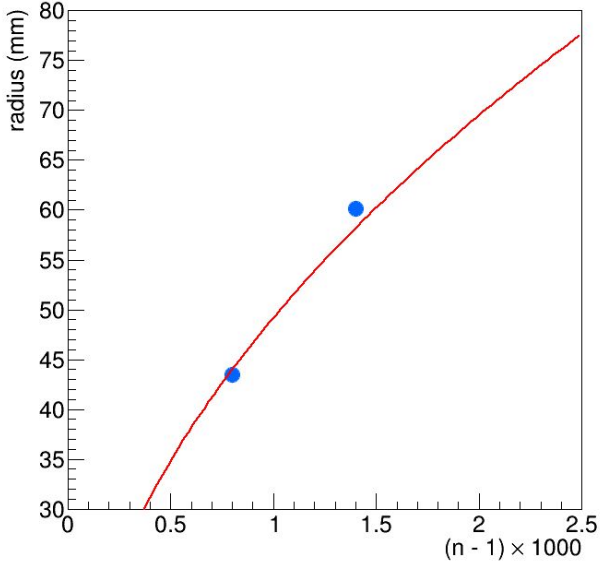
NEW



standard

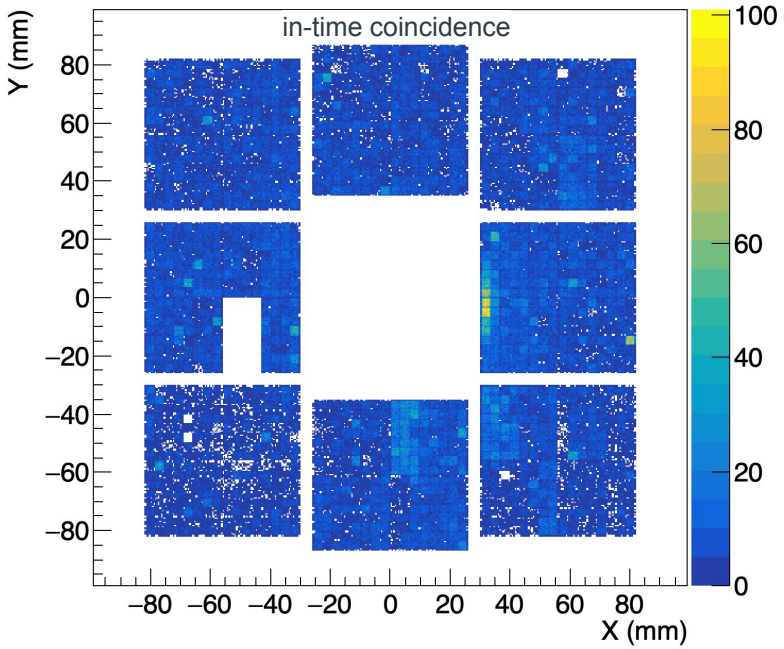


We worked on the gas

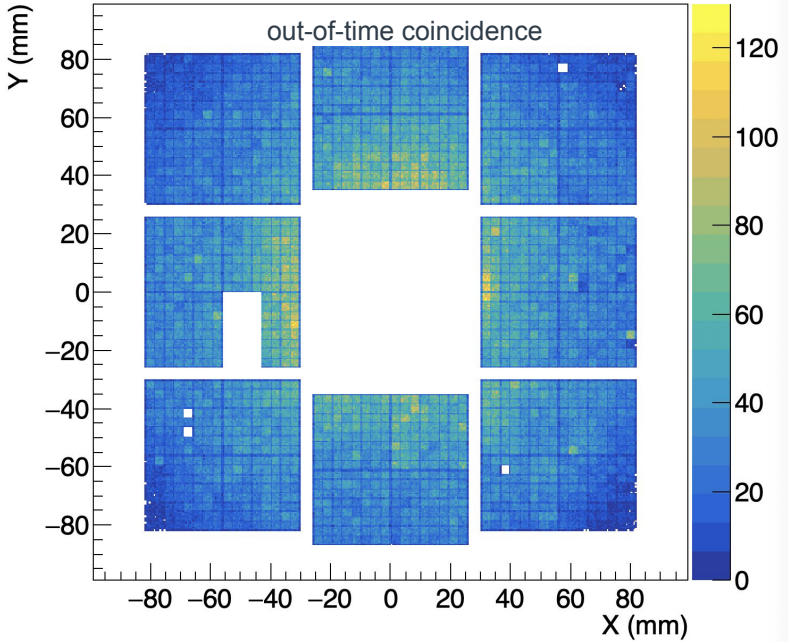


Background investigation

First contribution: DCR (No aerogel)

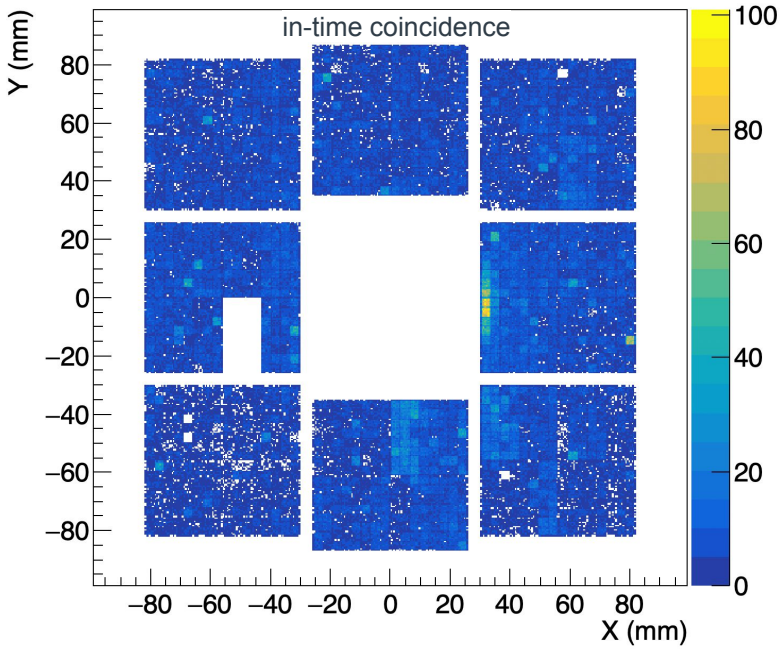


subtracted to

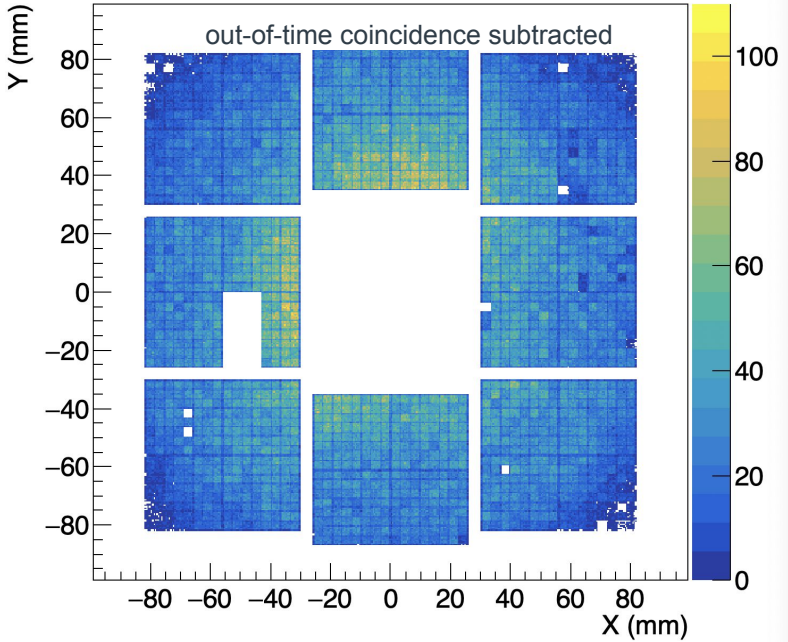


Background investigation

First contribution: DCR (No aerogel)



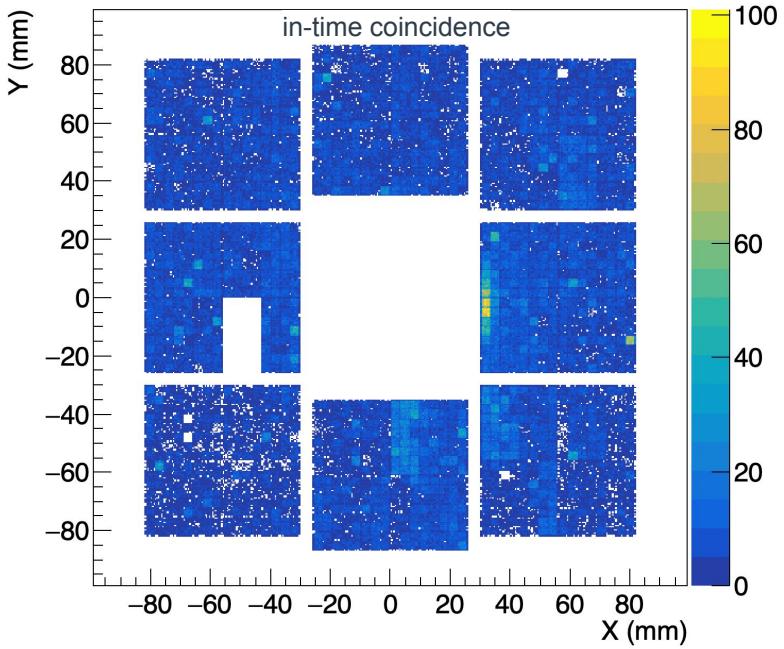
comes out as



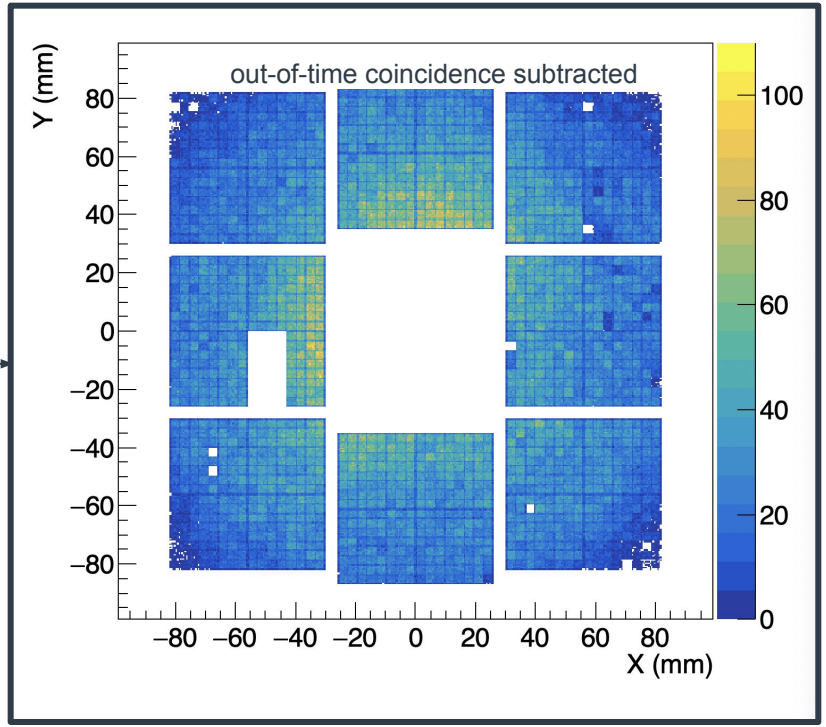
Background investigation

Second contribution: halo (unknown origin)

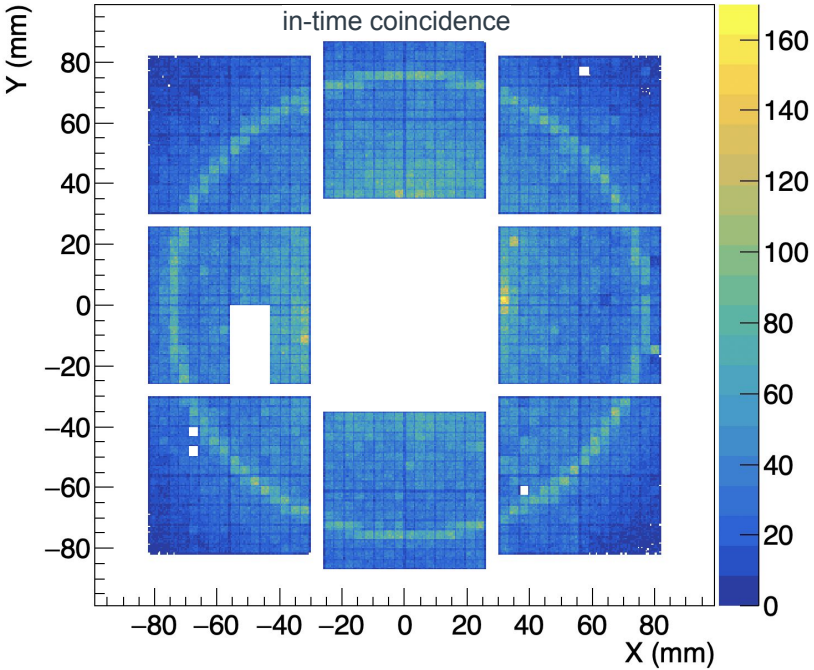
This can be used as a template to subtract in aerogel runs

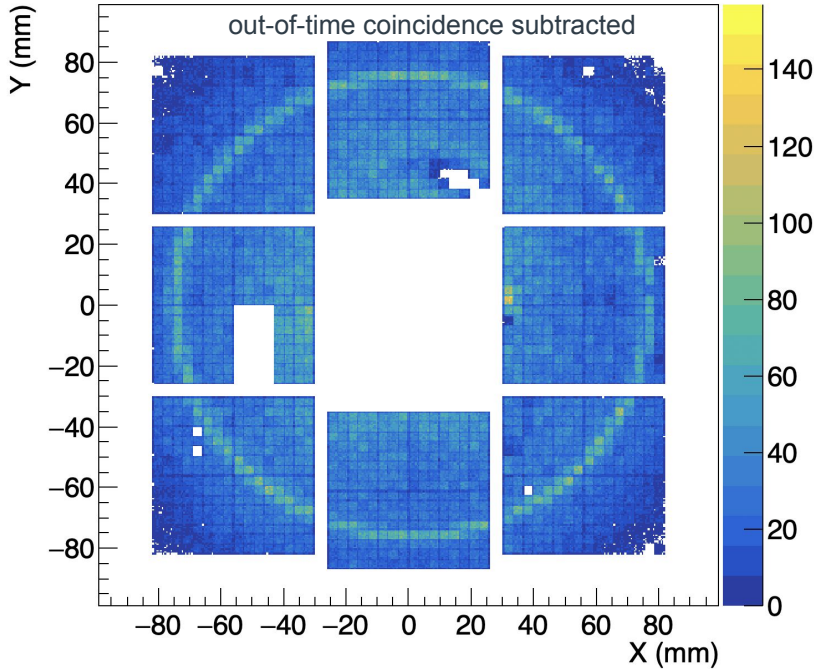


comes out as



Background investigation





Background investigation