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KERN- EN STRALINGSFYSICA

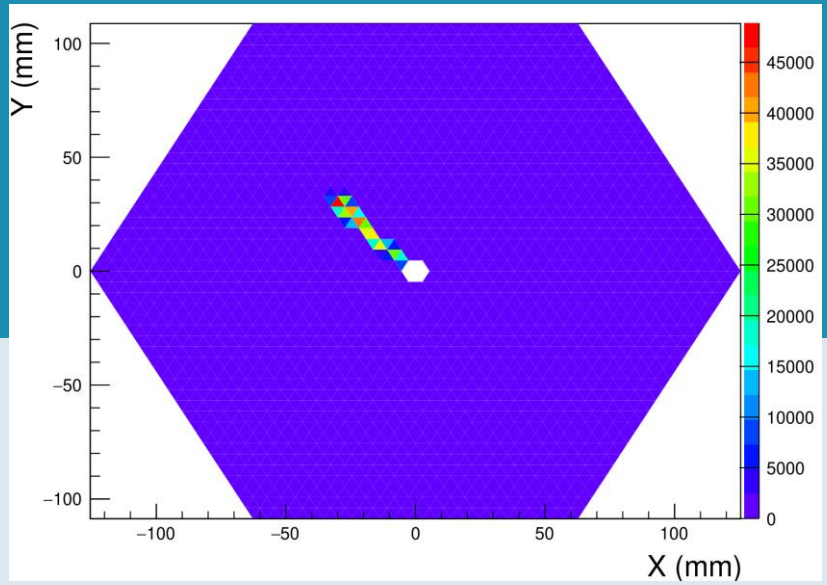
SpecMAT

erc

European Research Council

Status of SpecMAT:

first recorded events and characterisation of the detector



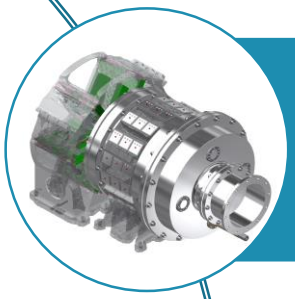
[an event recorded with SpecMAT TPC in April 2020]

Oleksii Poleshchuk

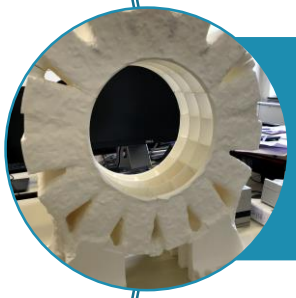
ISS workshop

20 July 2020

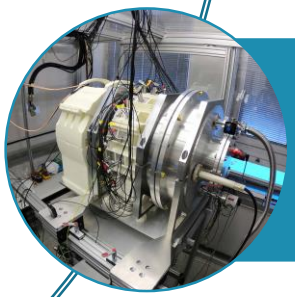
Outline



The SpecMAT active target



Characterisation of the scintillation array



Characterisation of SpecMAT

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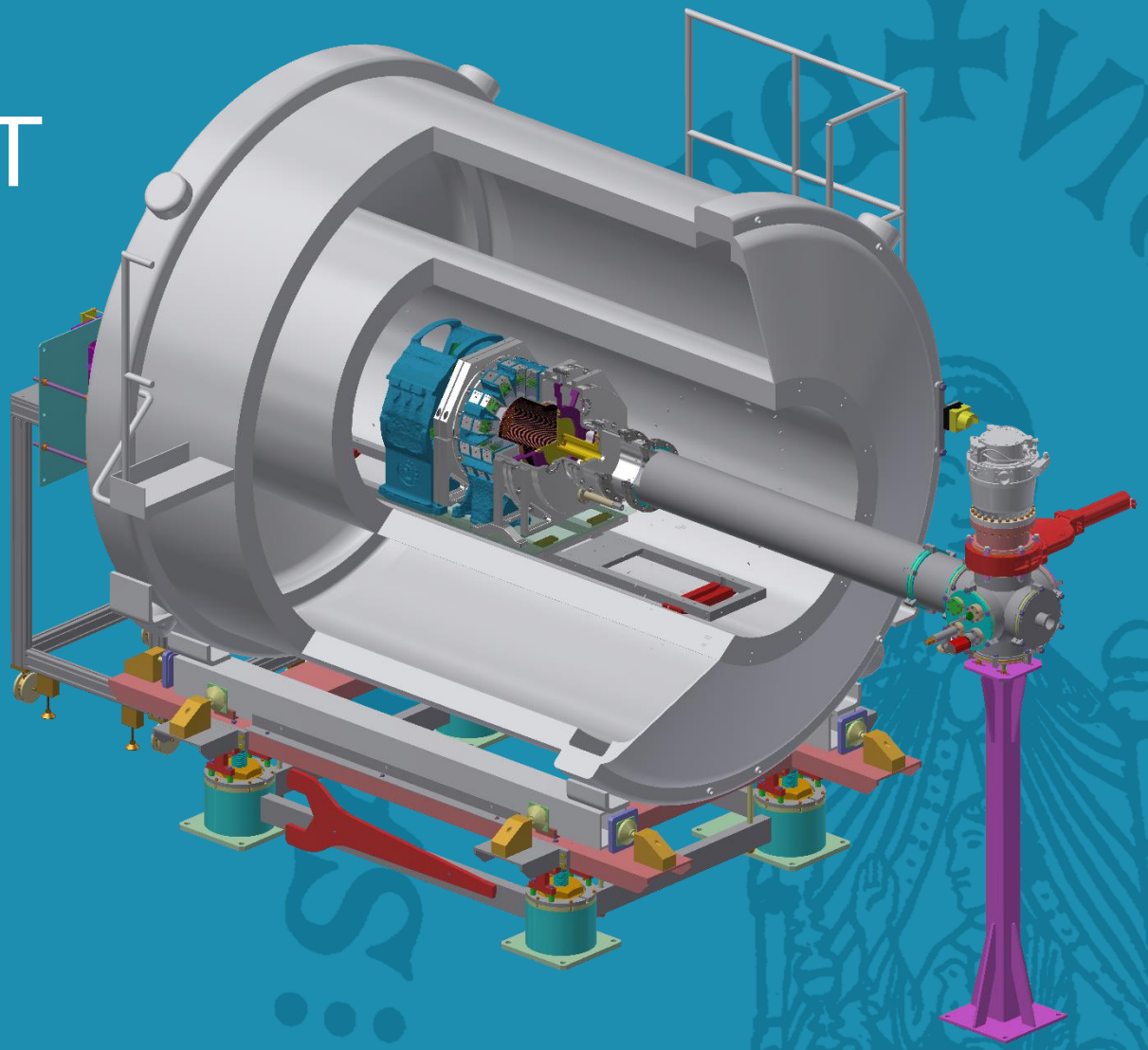
The SpecMAT active target

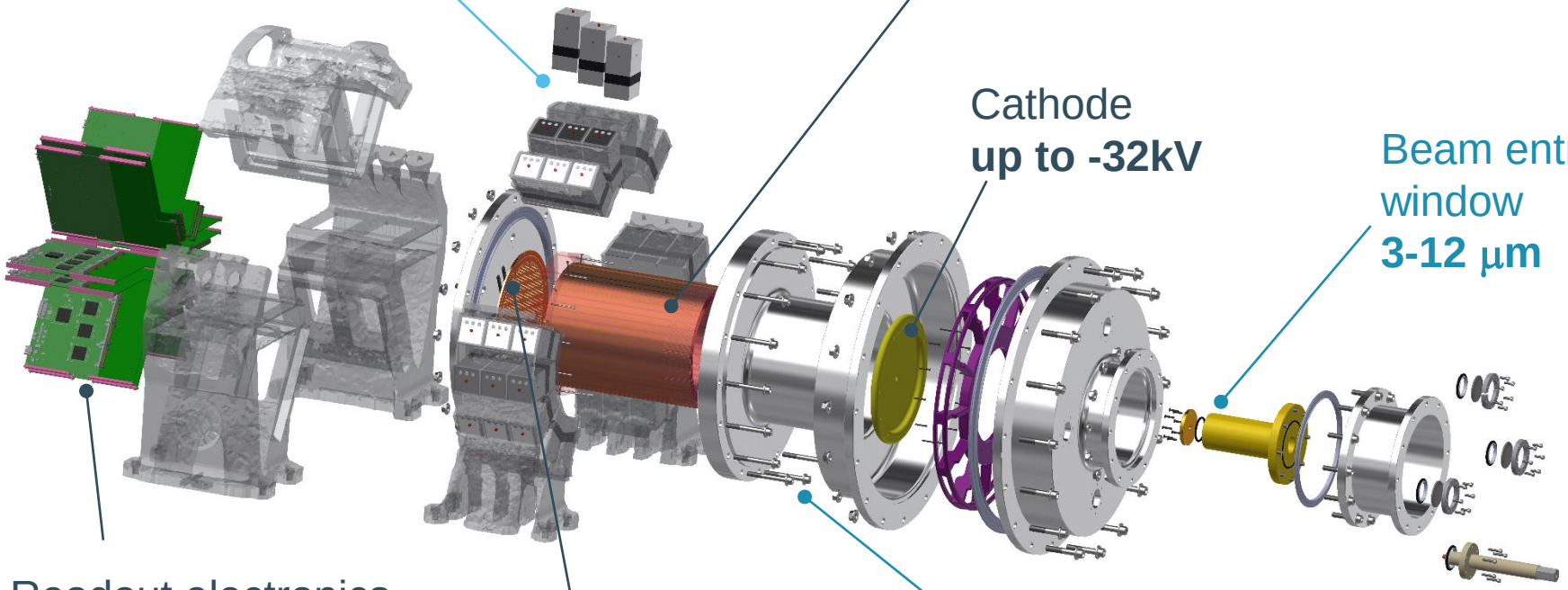


45 $CeBr_3$
48×48×48mm
scintillation
detectors

Field cage
homogeneous
electric field ~2%

Cathode
up to -32kV

Beam entrance
window
3-12 μm



Readout electronics
1-100MS/s 12bit
3072+256 channels

MICROMEGAS detector
2916 channels

Gas chamber
up to 1 atm
min wall thickness 3mm

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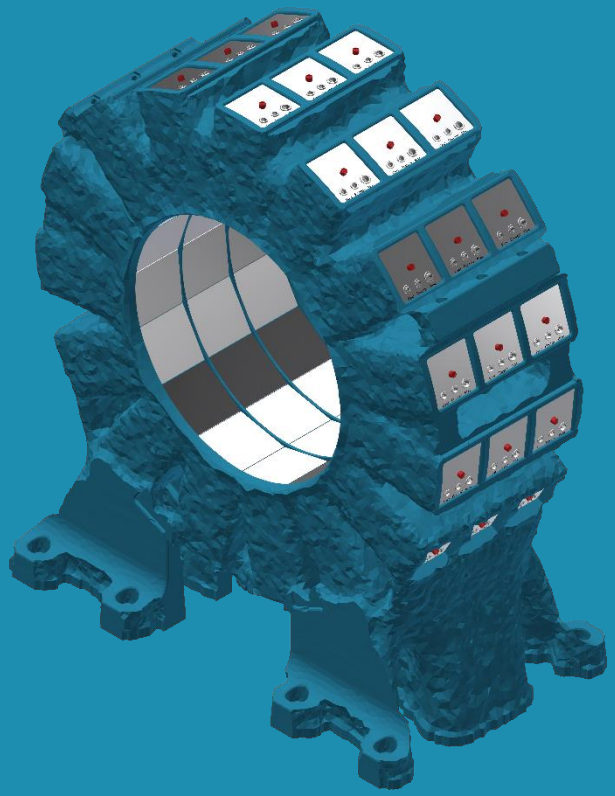
The $CeBr_3$ scintillation array



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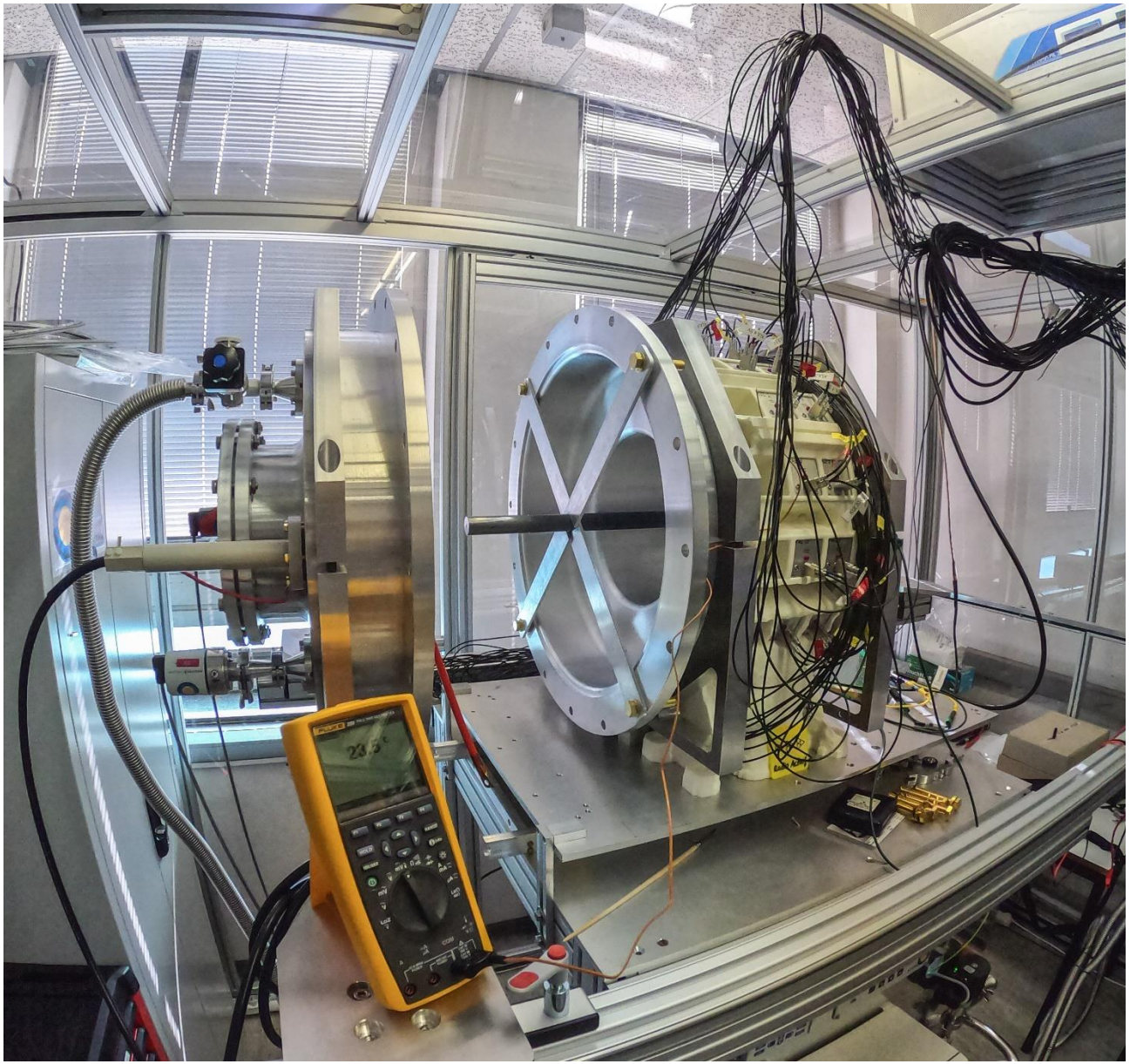
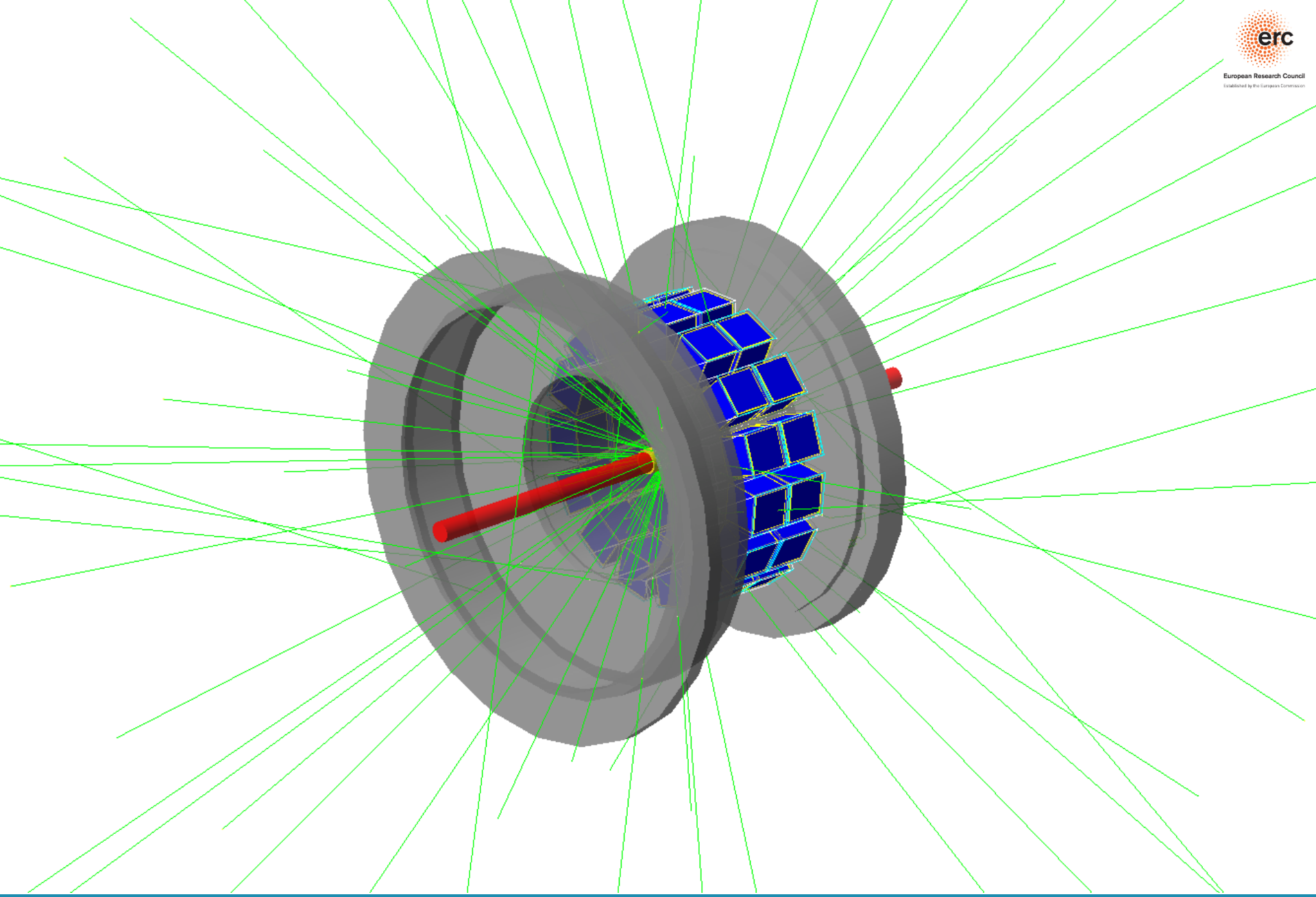
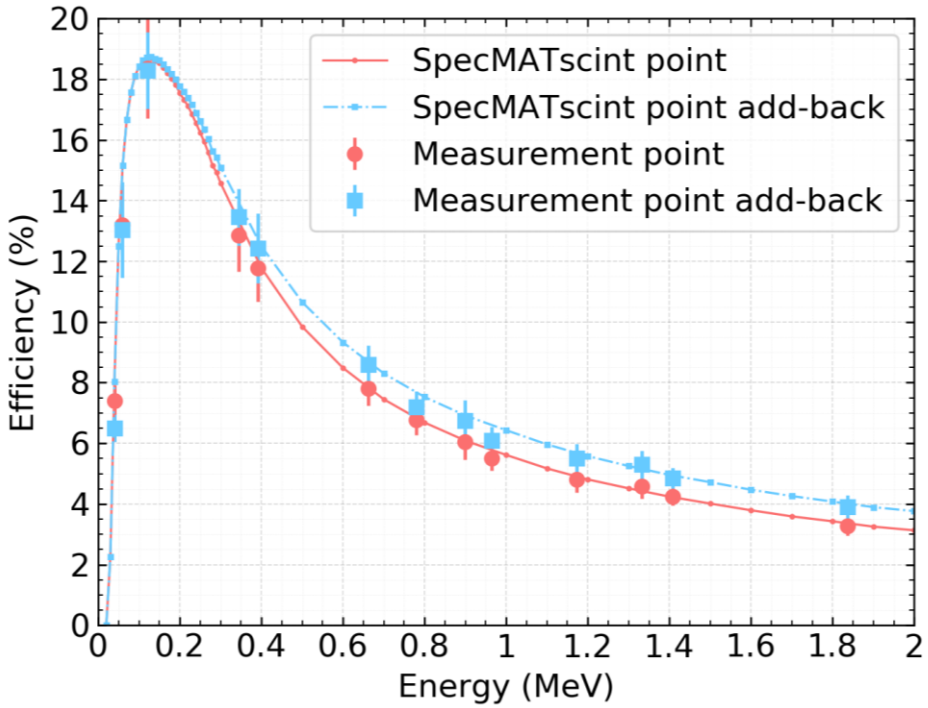
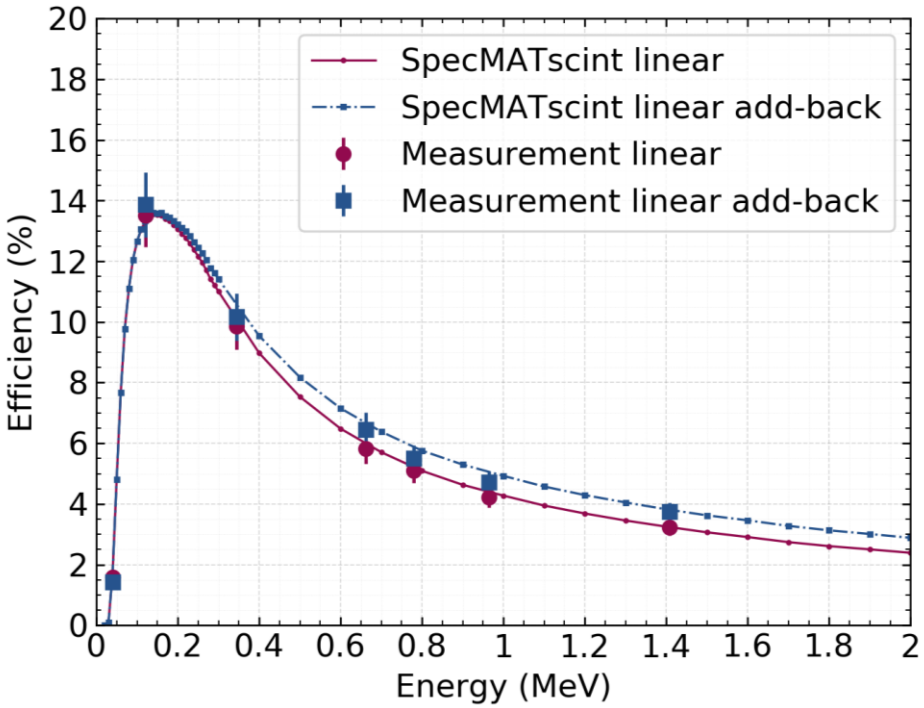


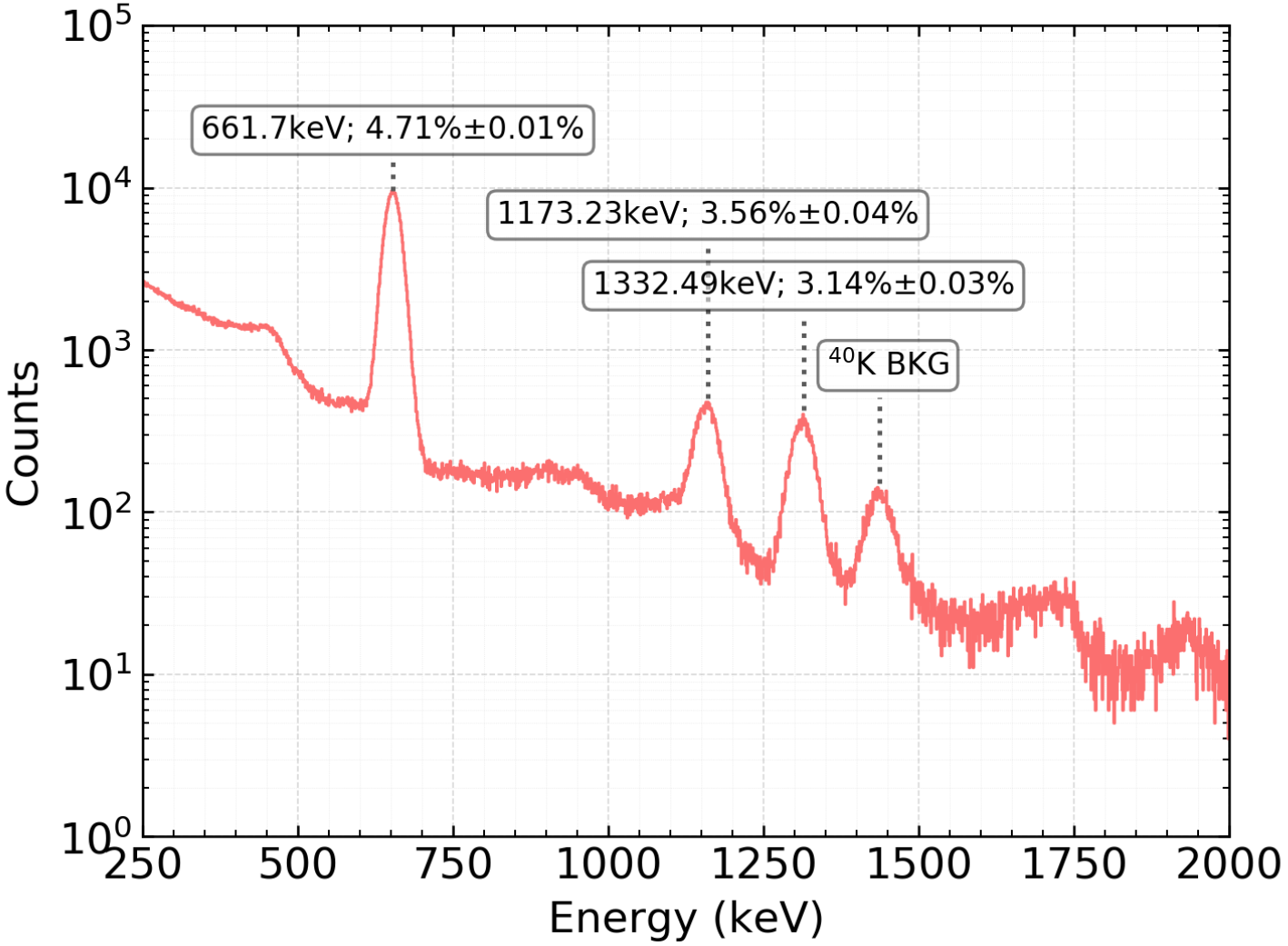


Efficiency with 30 detectors





Cumulative spectrum



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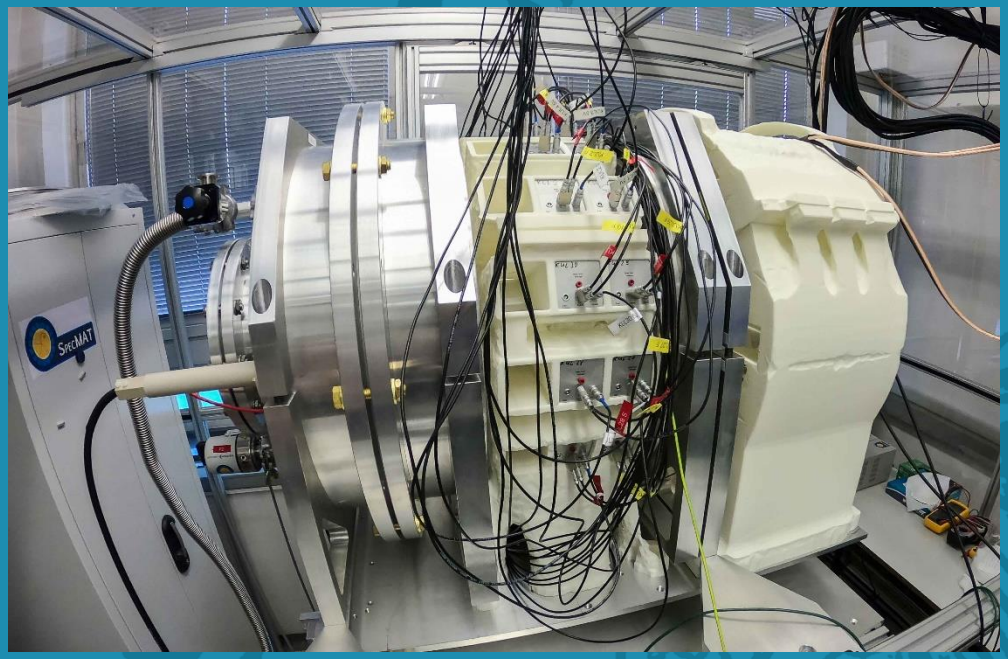
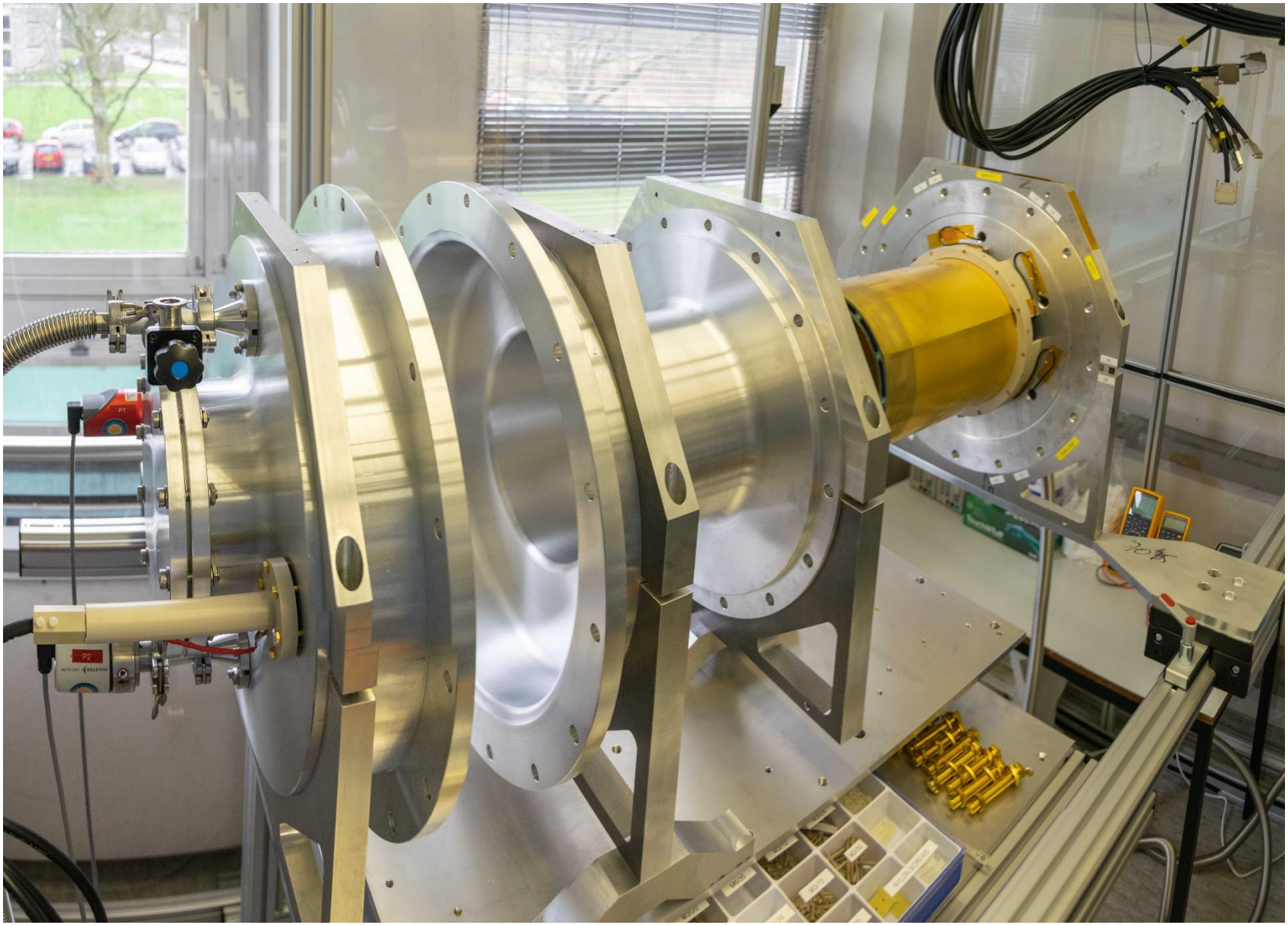
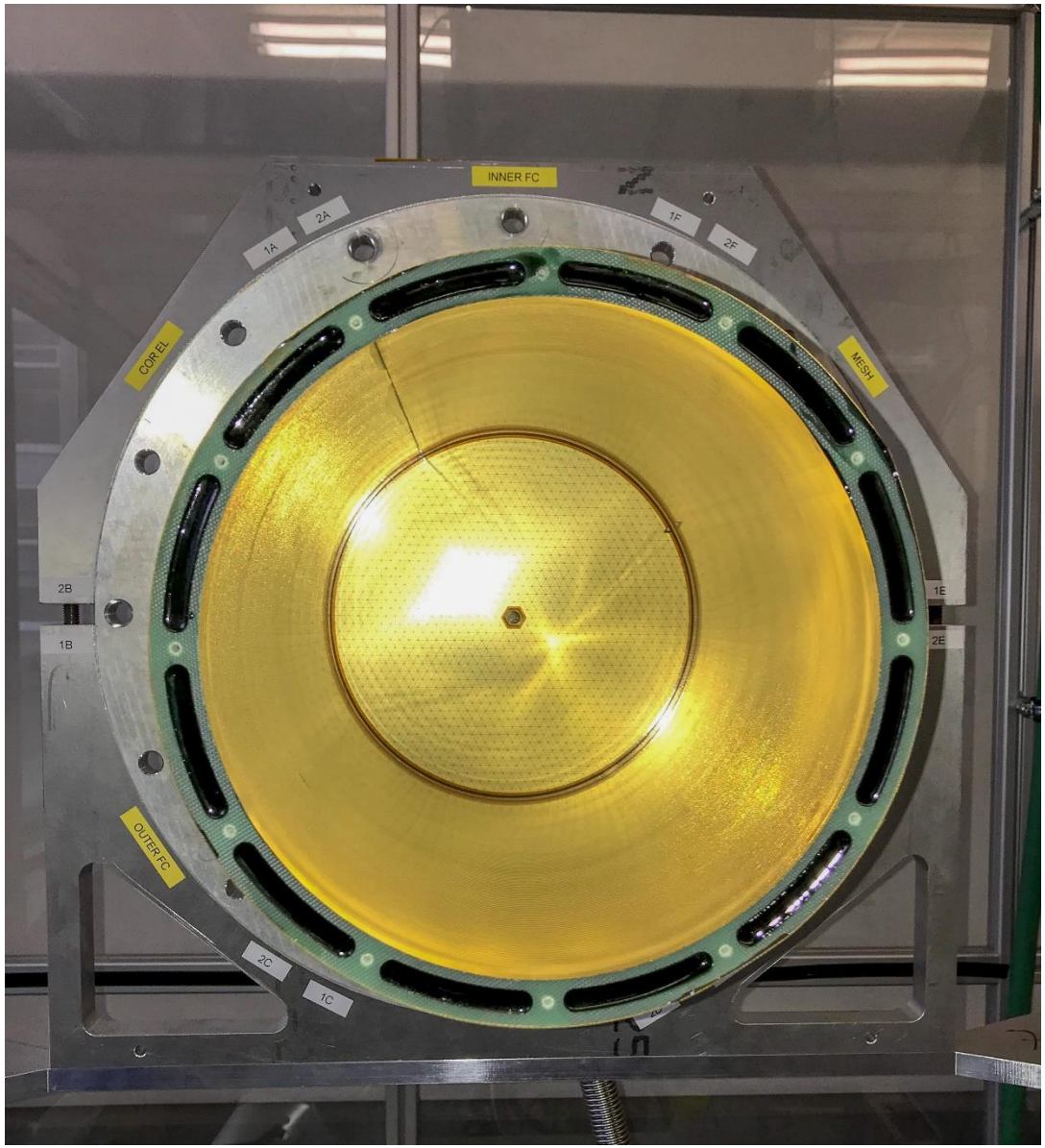
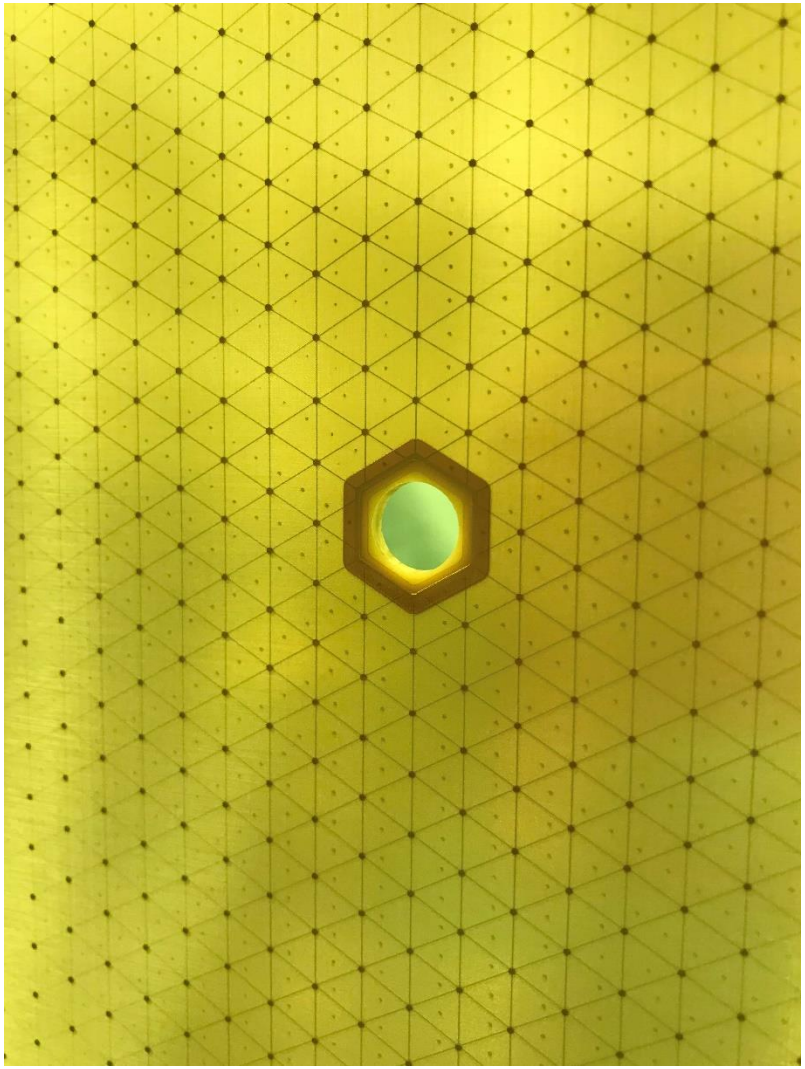
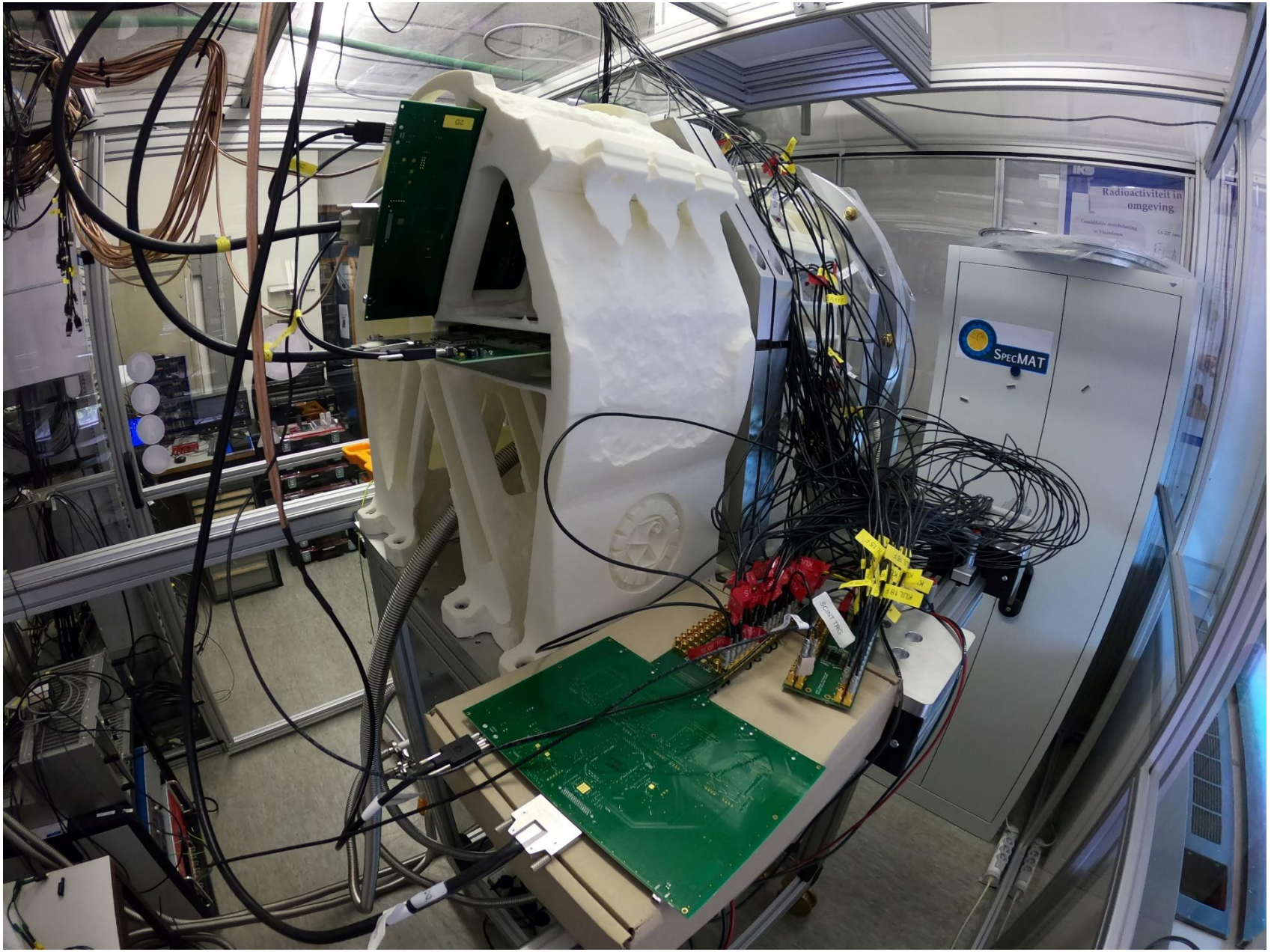
TPC data and its correlation with gamma-rays






INNER FC
1A
2A
1F
2F
COR EL
MESH
2B
1B
1E
2E
OUTER FC
2C
1C




Radioactiviteit in
omgeving
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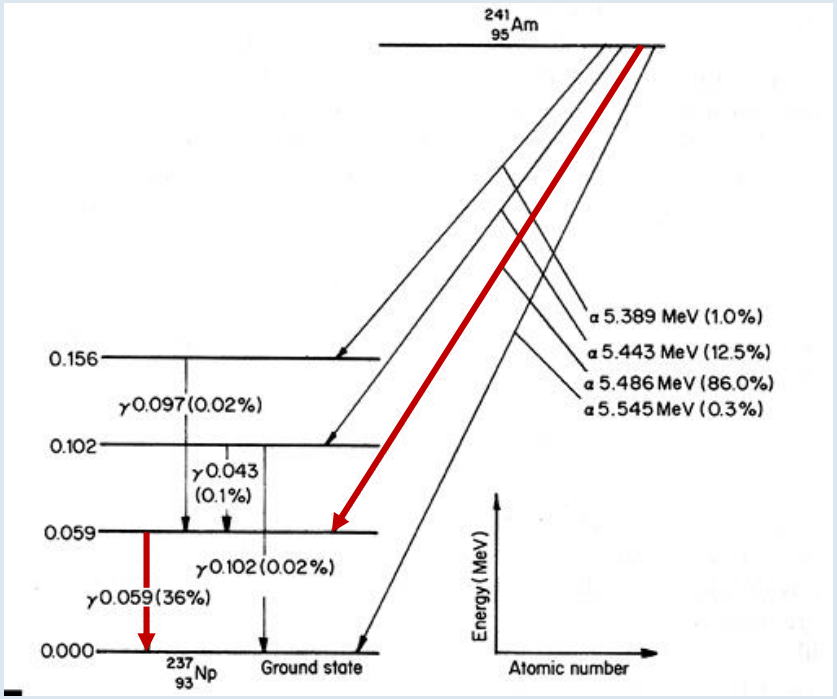
Calibration with a 3-alpha source in $Ar(95\%)CF_4(5\%)$ @ 400mbar



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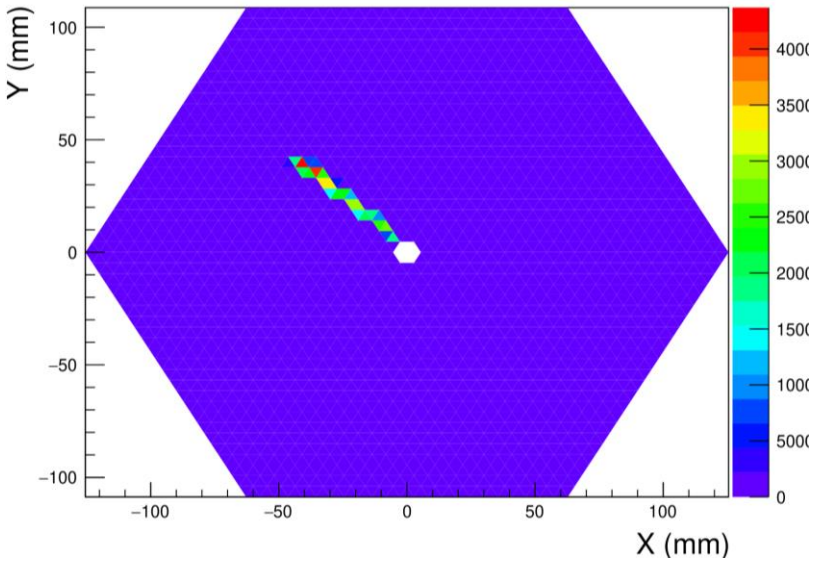
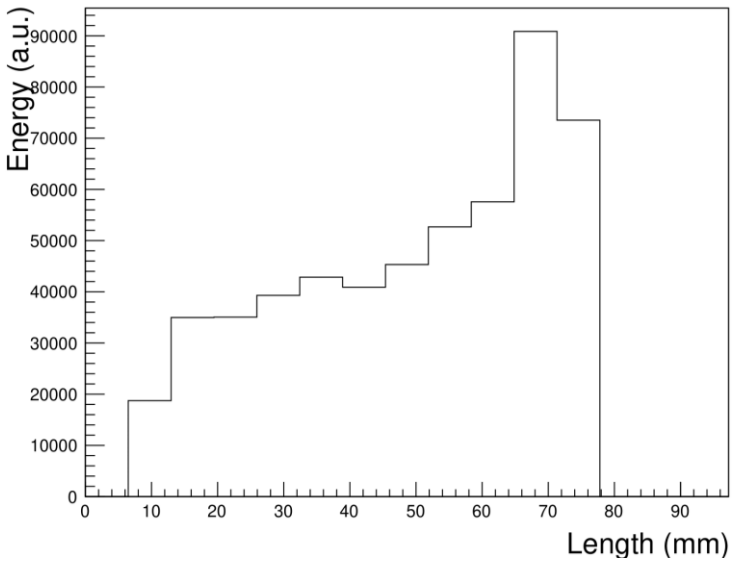
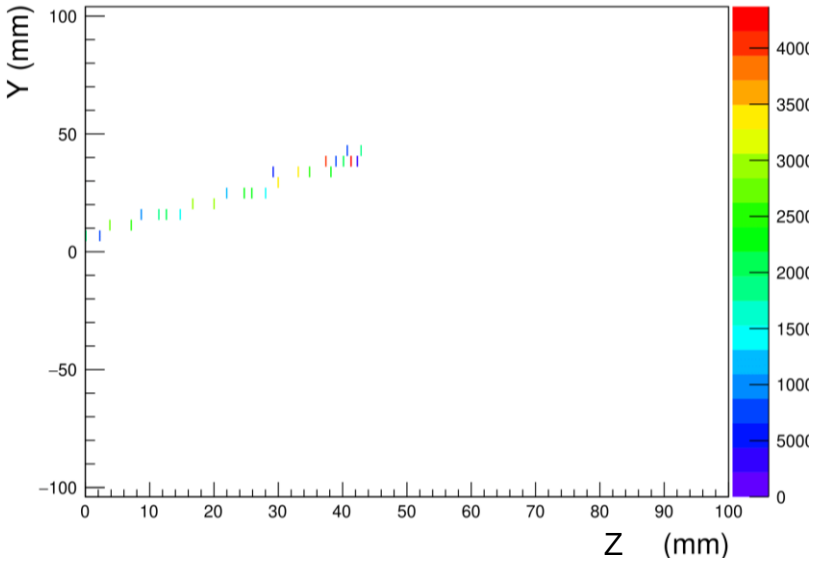
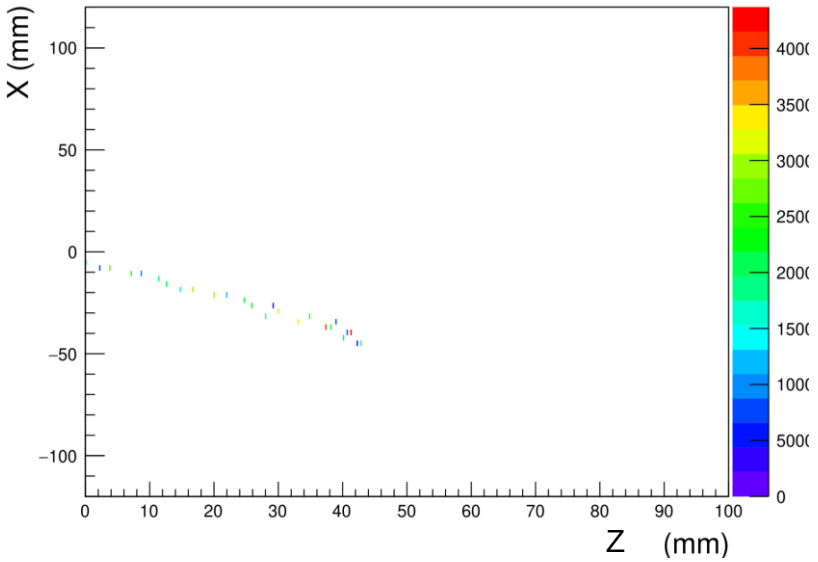
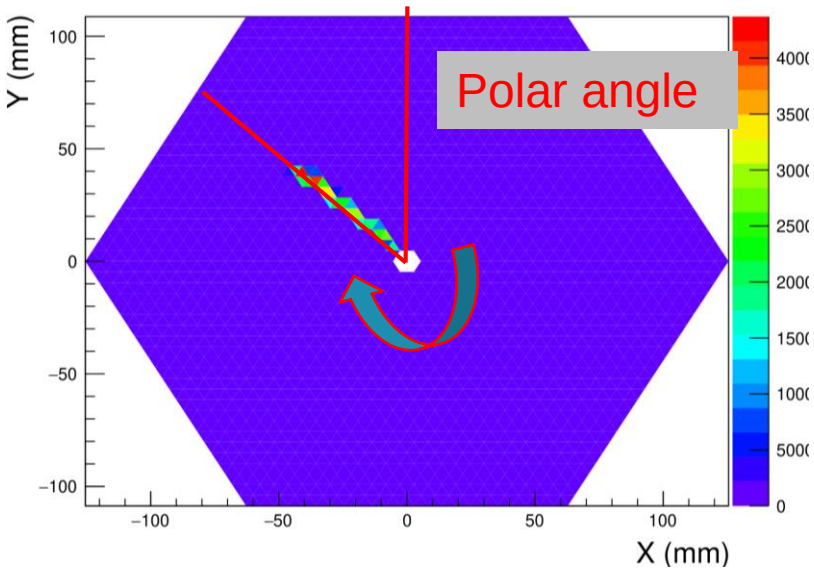
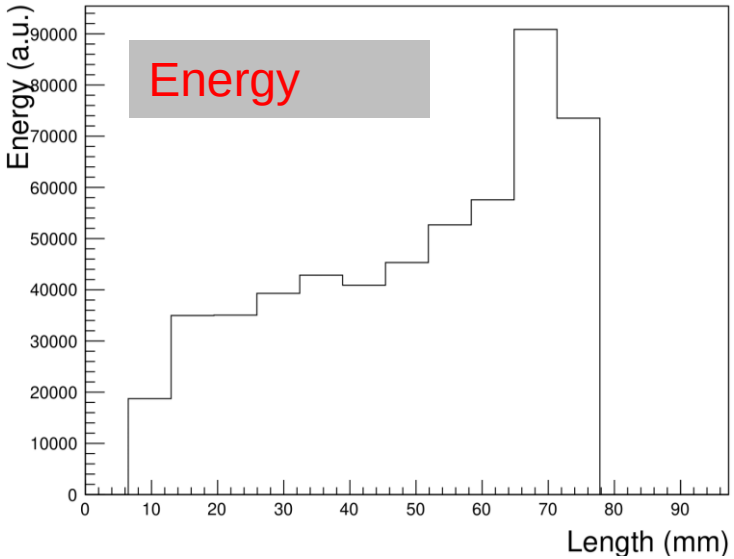

Y (mm)
X (mm)

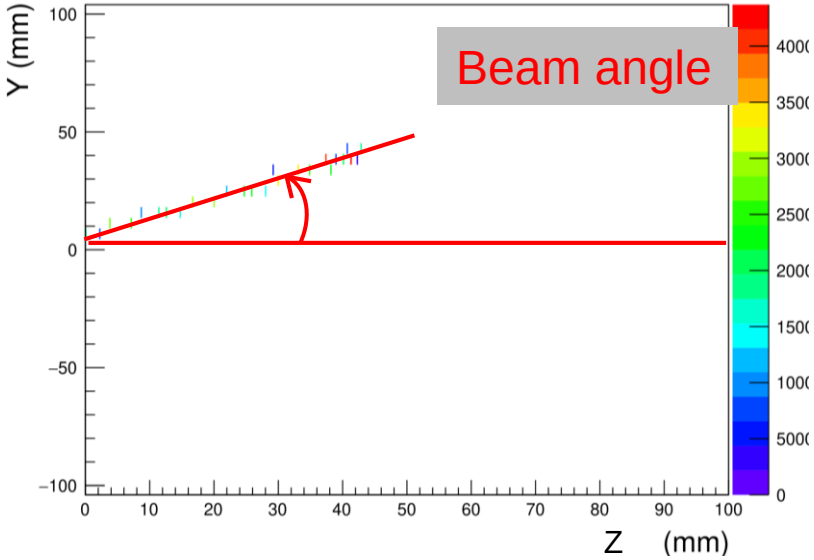

Energy (a.u.)
Length (mm)

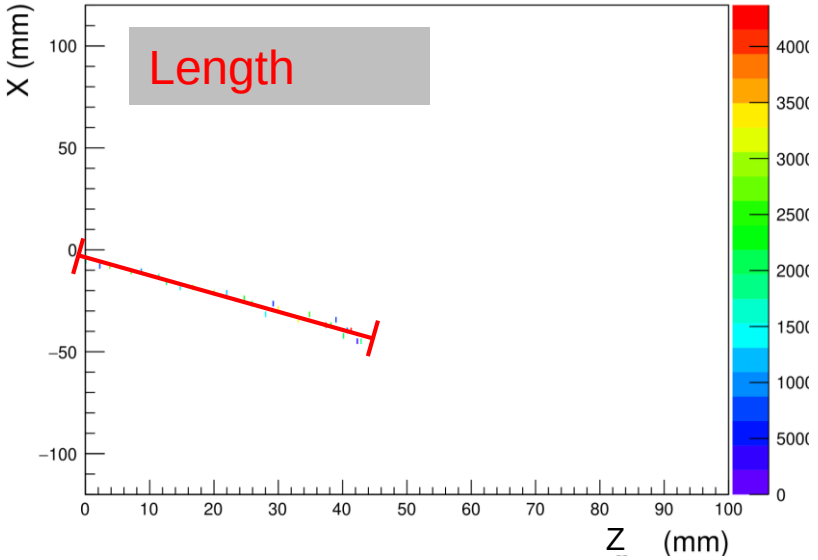

Y (mm)
Z (mm)


X (mm)
Z (mm)

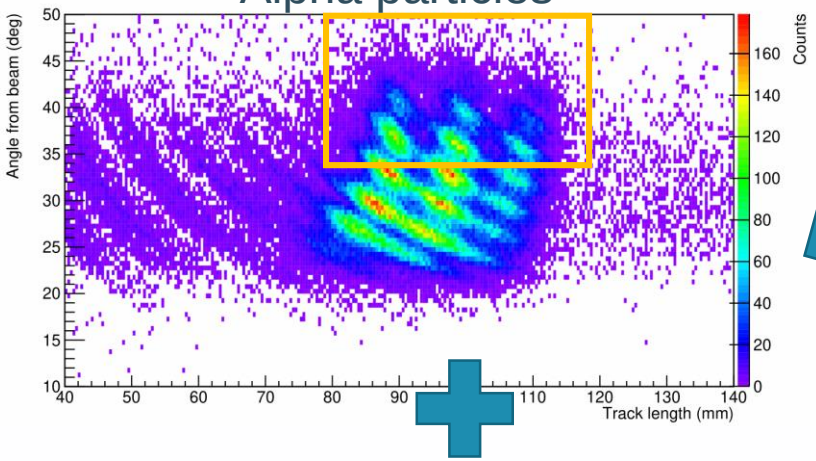

Polar angle
Y (mm)
X (mm)

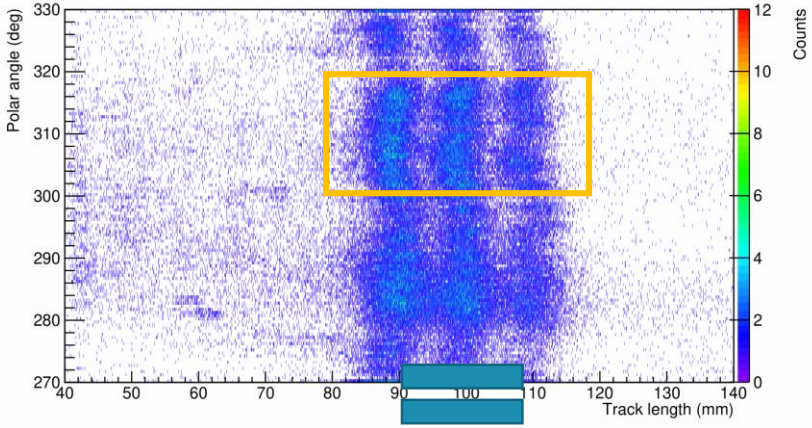

Energy
Energy (a.u.)
Length (mm)


Beam angle
Y (mm)
Z (mm)

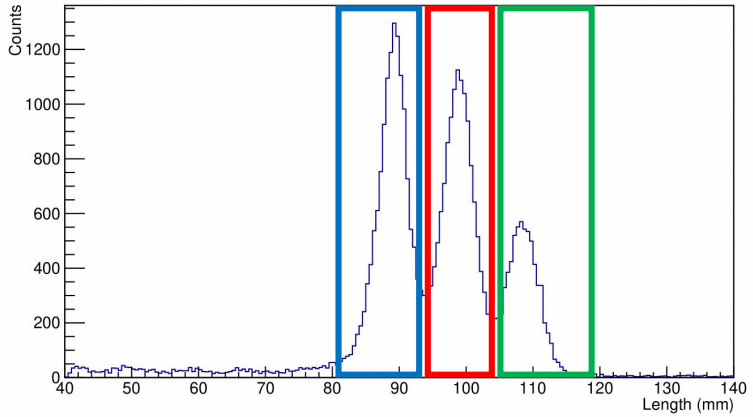

Length
X (mm)
Z (mm)

Alpha particles

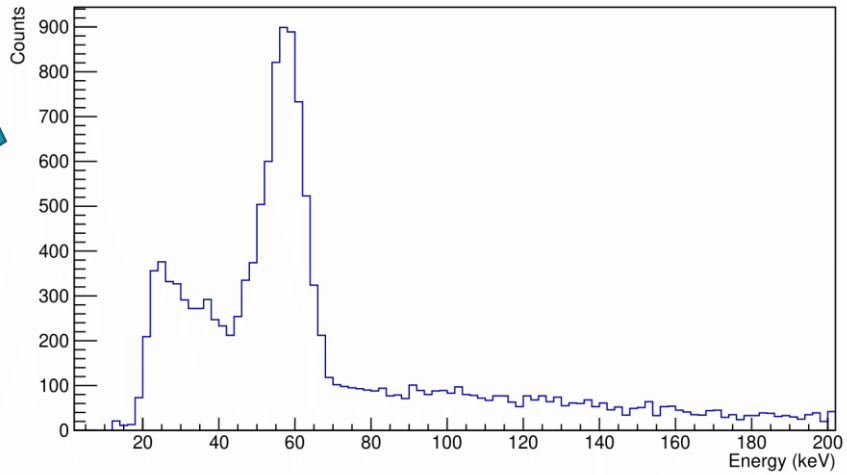


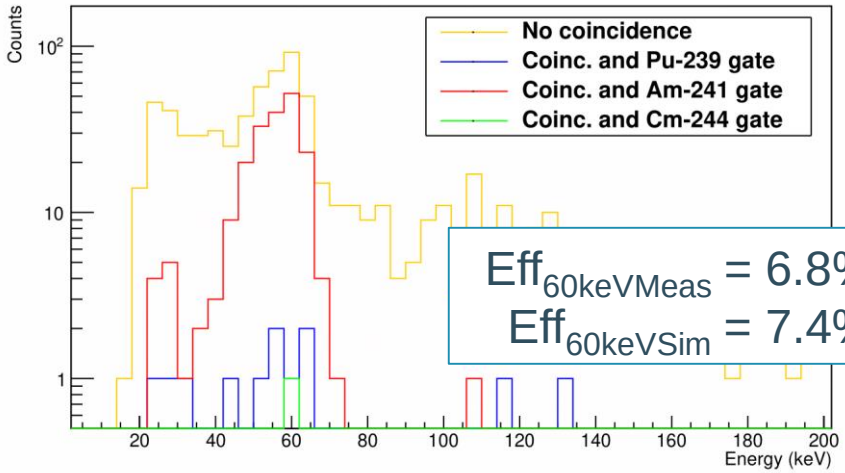


Pu-239 Am-241 Cm-244



Gamma-rays

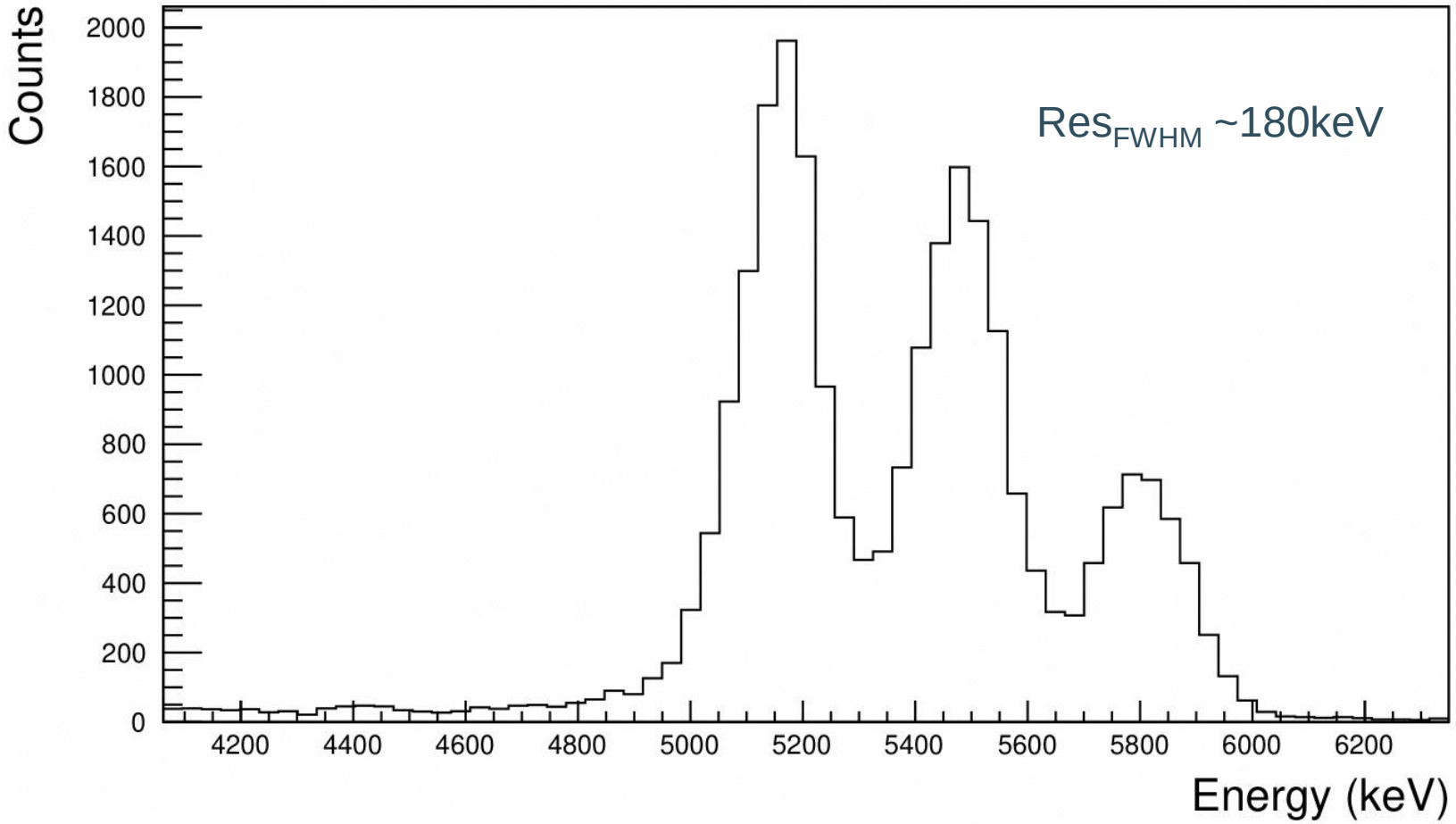




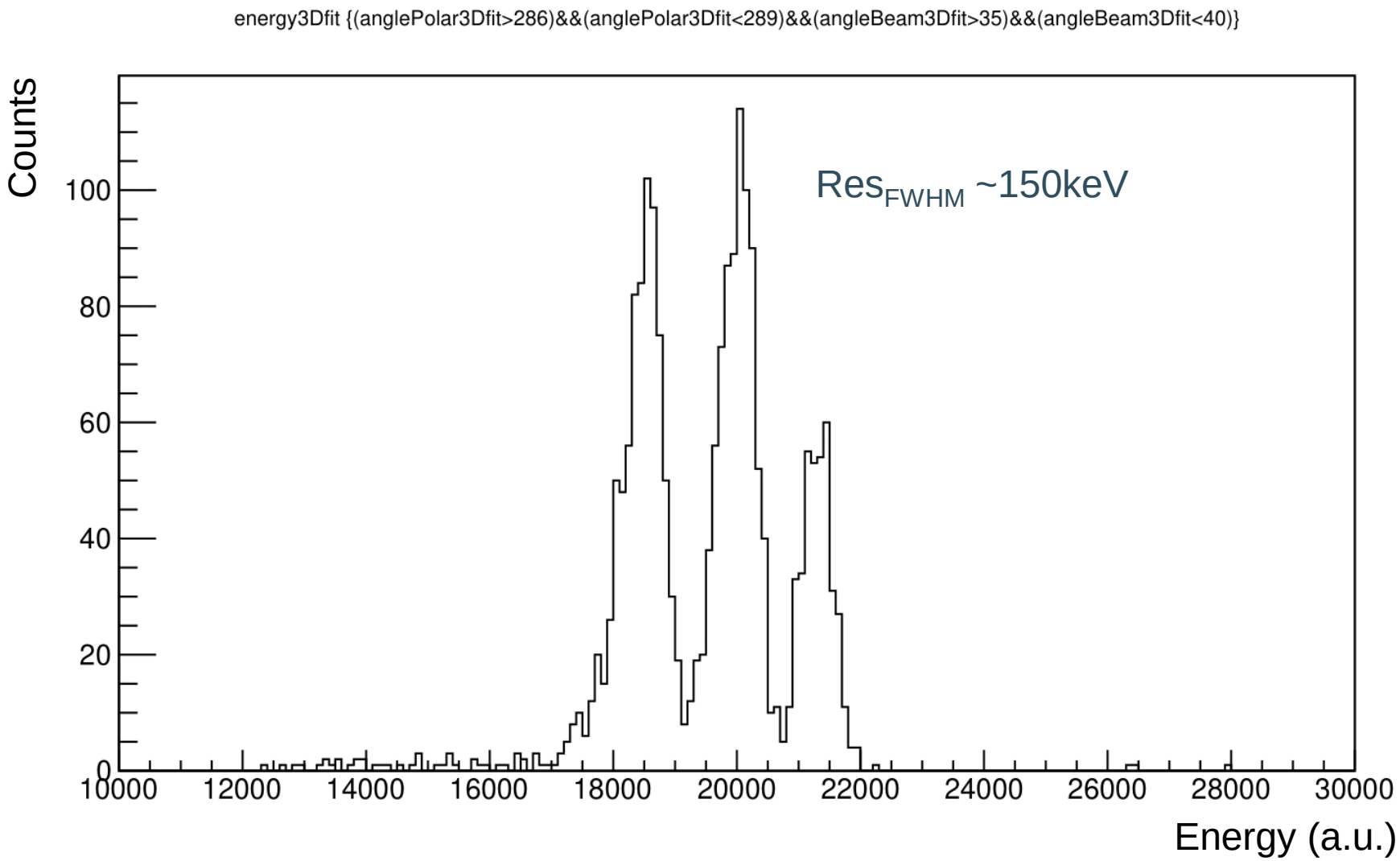
$Eff_{60keVMeas} = 6.8\%$

$Eff_{60keVSim} = 7.4\%$

CalibSpectrum



Another data set …



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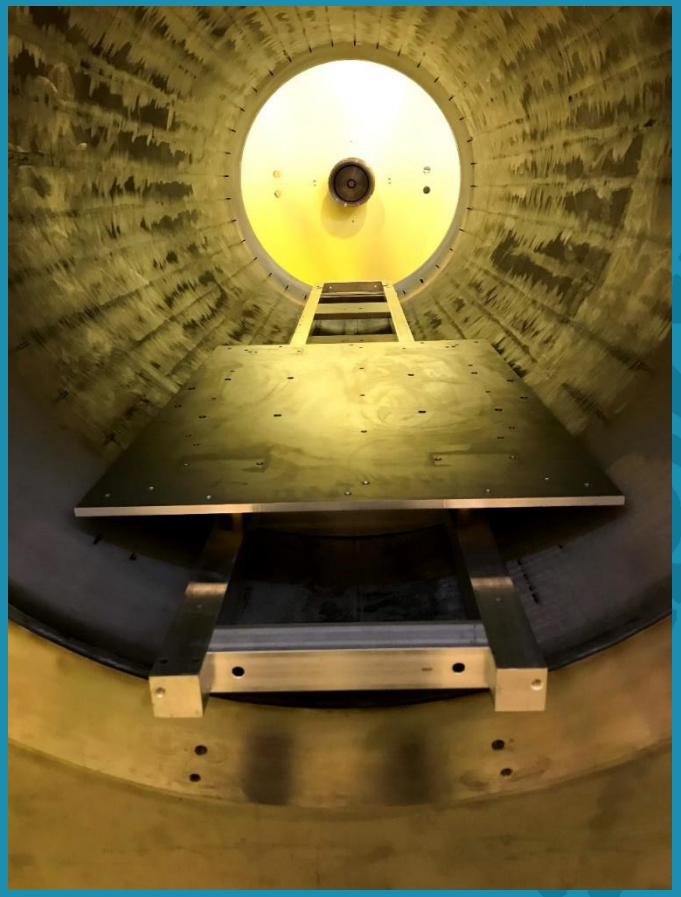
SpecMAT rail system in ISS



Summary

✓The SpecMAT active target was assembled.

- ✓With some parts successfully tested in ISS.
- ✗ Some of the arrived parts (MICROMEGAS + supl. electronics) has low production quality → require repair.

✓The scintillation array was characterised.

✓The TPC was characterised.

✓A working set of simulations.

Thank you for your attention!