CERN

Response of the straw detector to ionizing radiation and calibration

~~Measurement of cosmic radiation by straw detector~~

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Main objectives

Examine detector response to different types of radiation

Investigate the effect of changed straw detector parameters, namely operating voltage and pressure on signal amplitude.

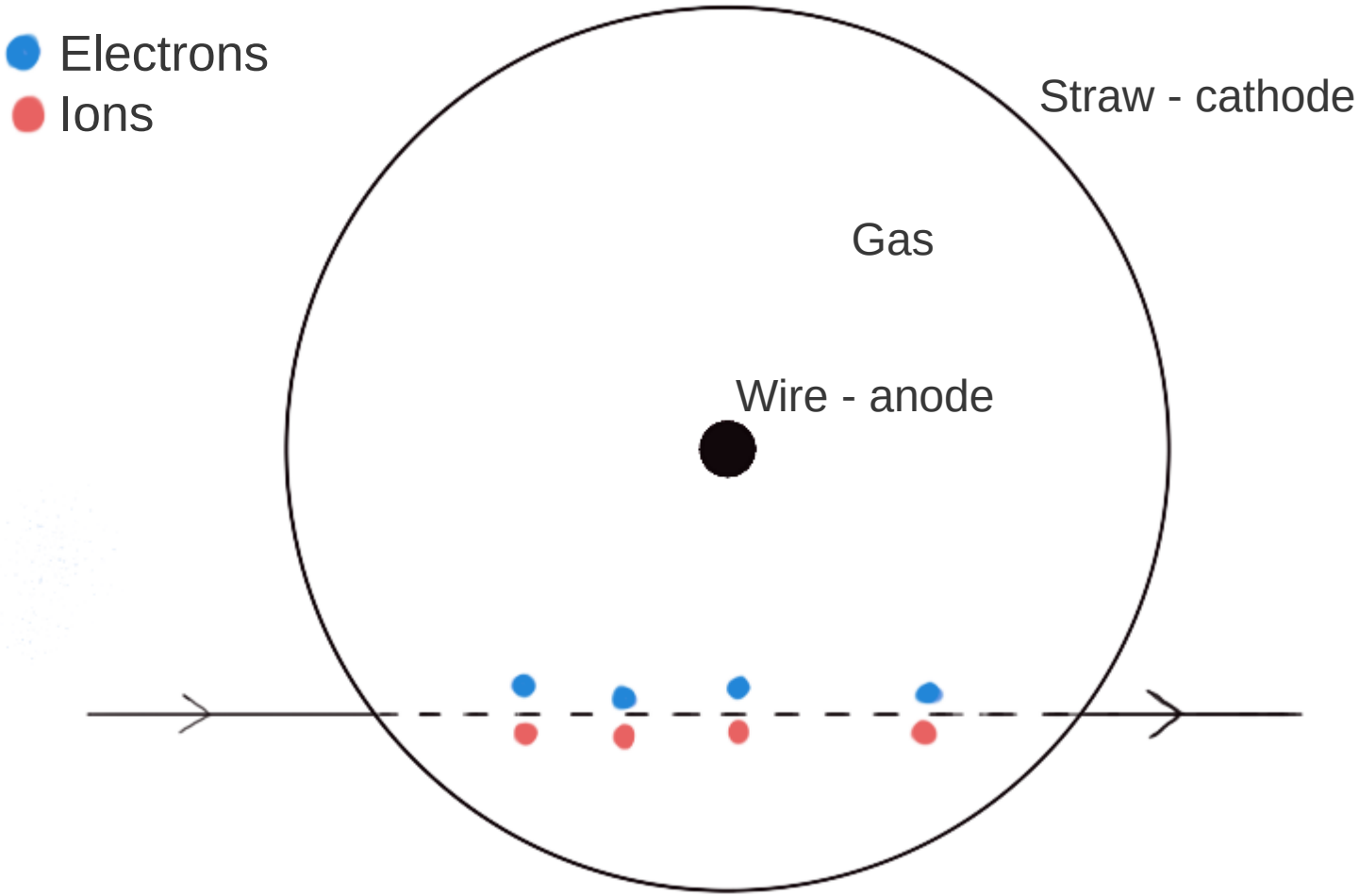
Simulate effects of changed parameters on time resolution

Contents

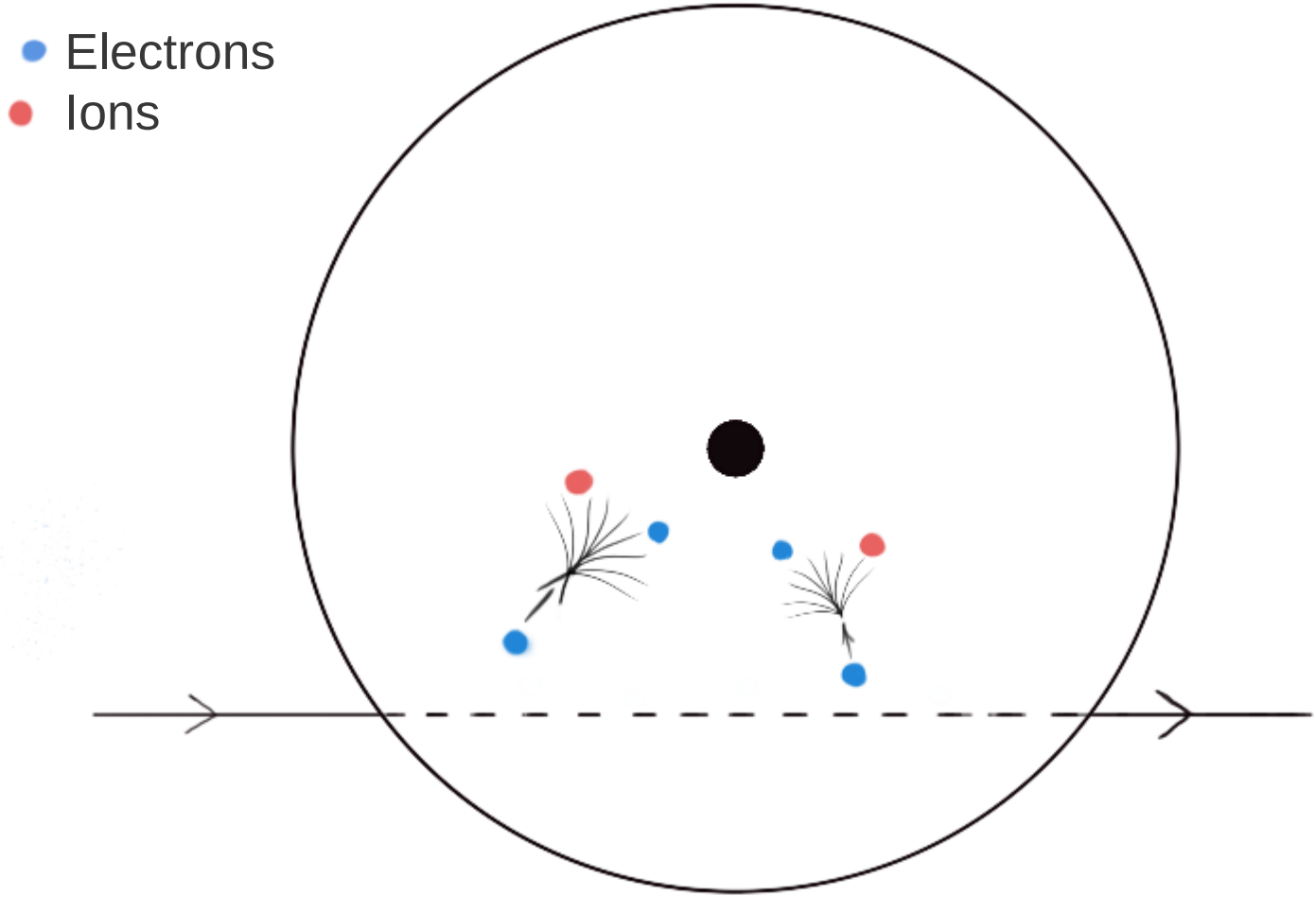
- Straw detectors
- Radiation sources
- Experimental apparatus
- Experimental results
- Garfield simulation

Straw detectors

Primary ionization



Secondary ionization



Signal generation

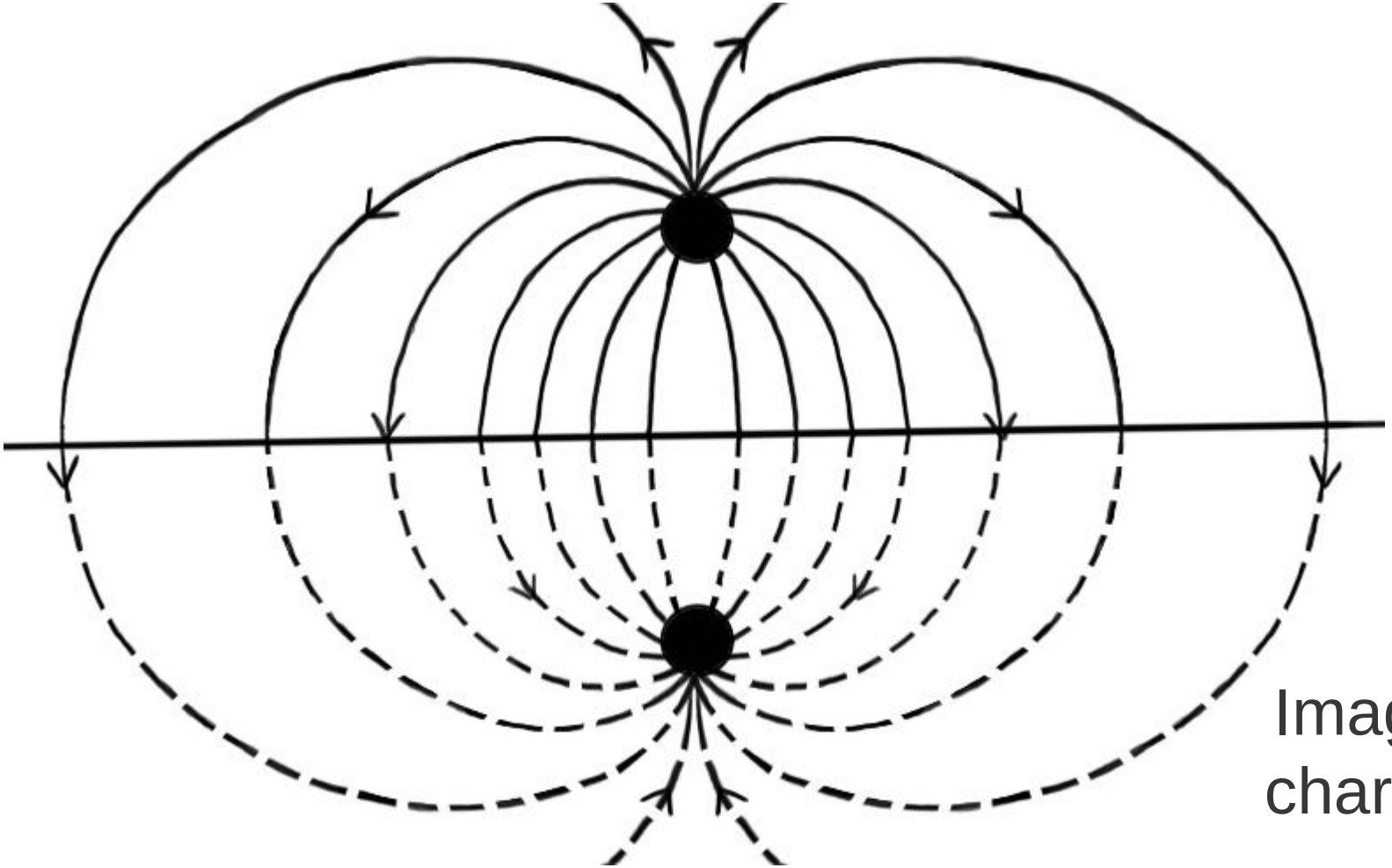
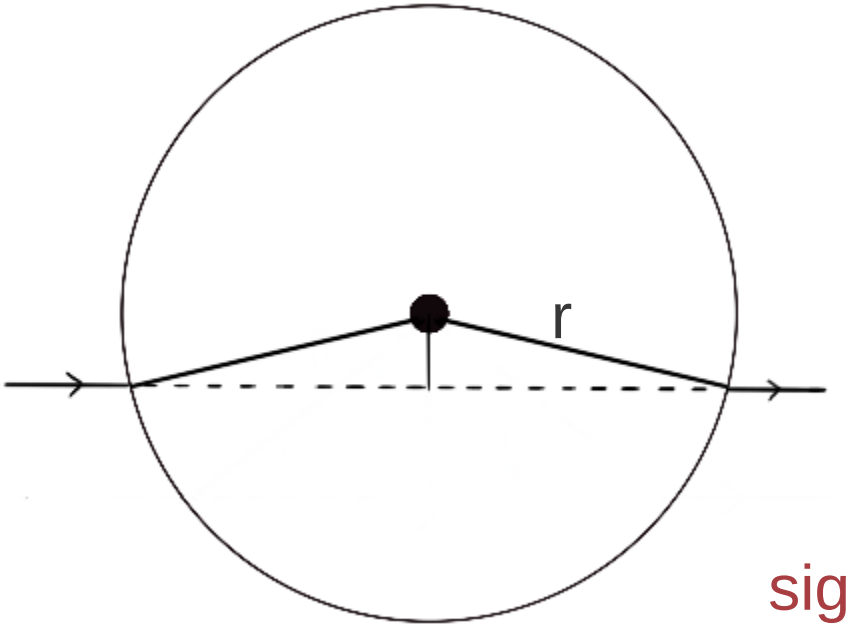
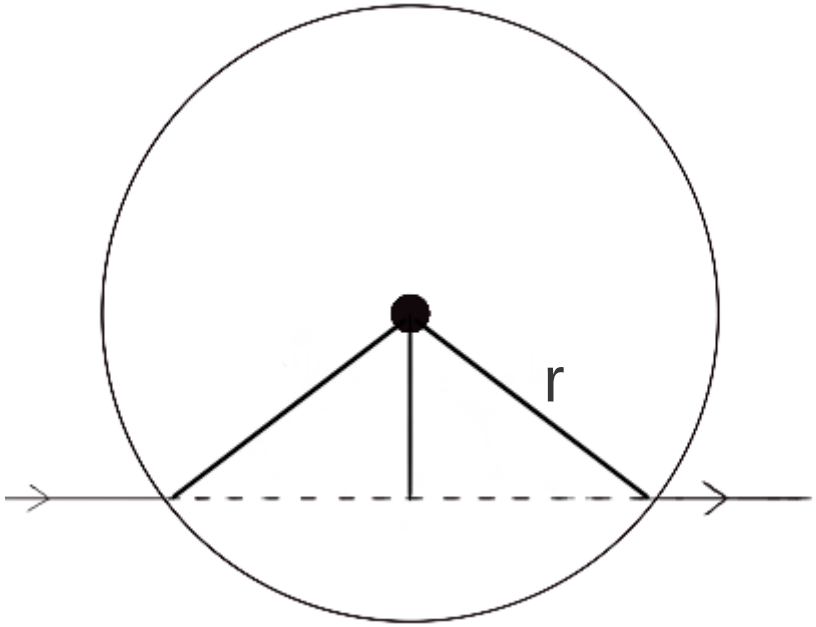
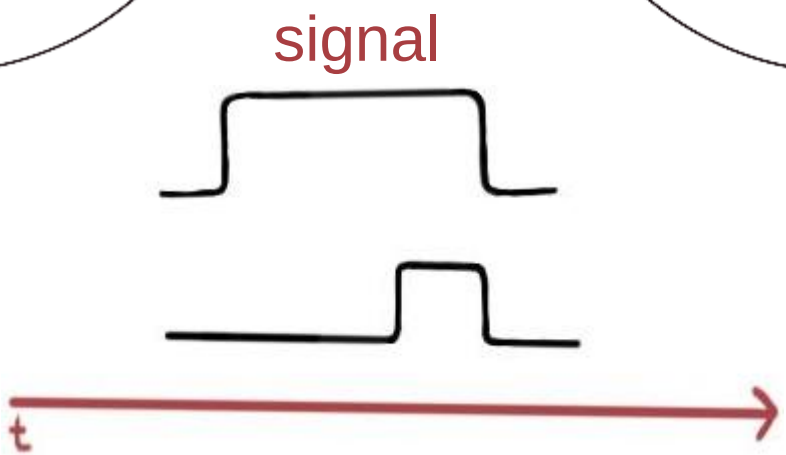


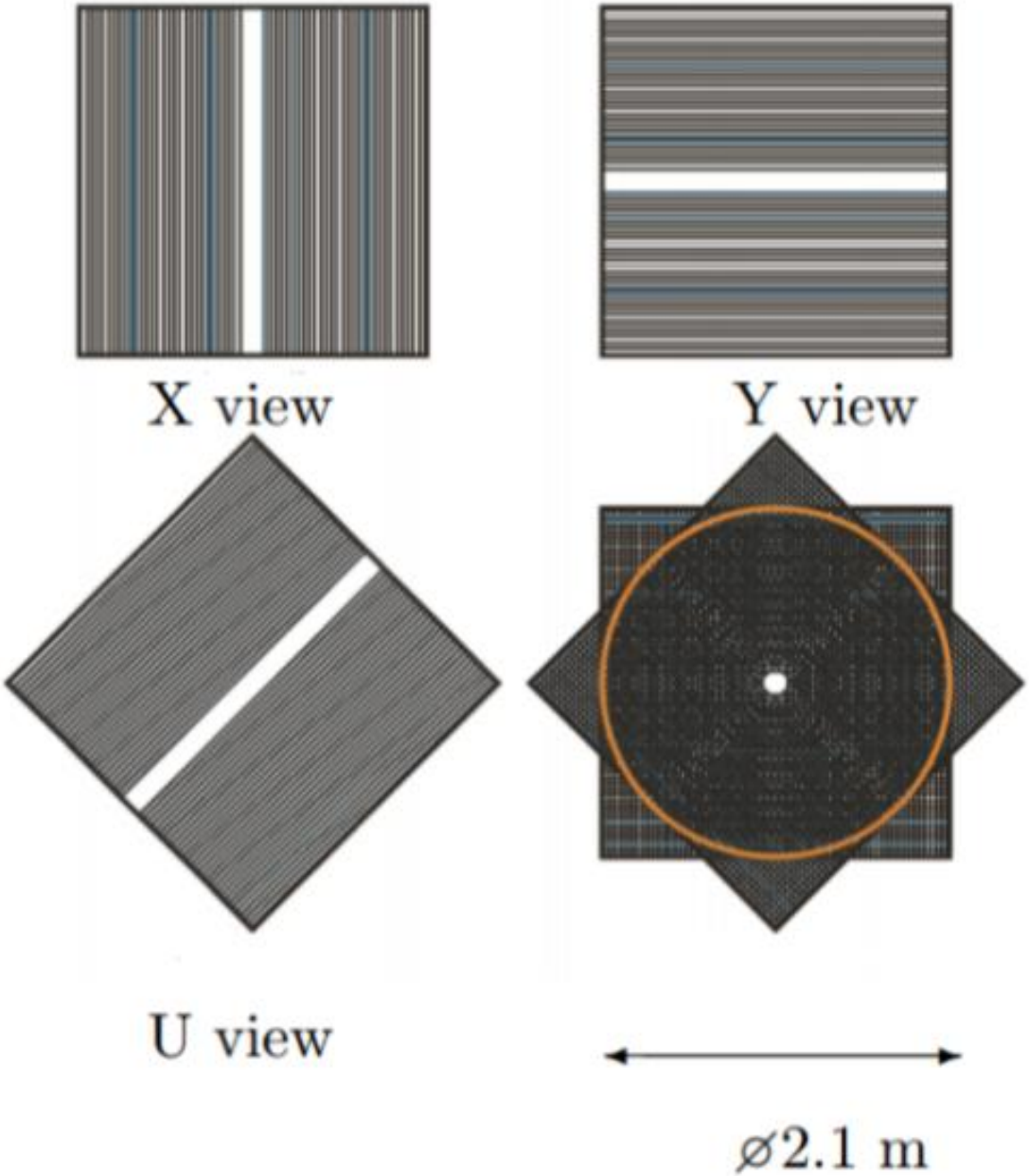
Image charge

Extra resolution



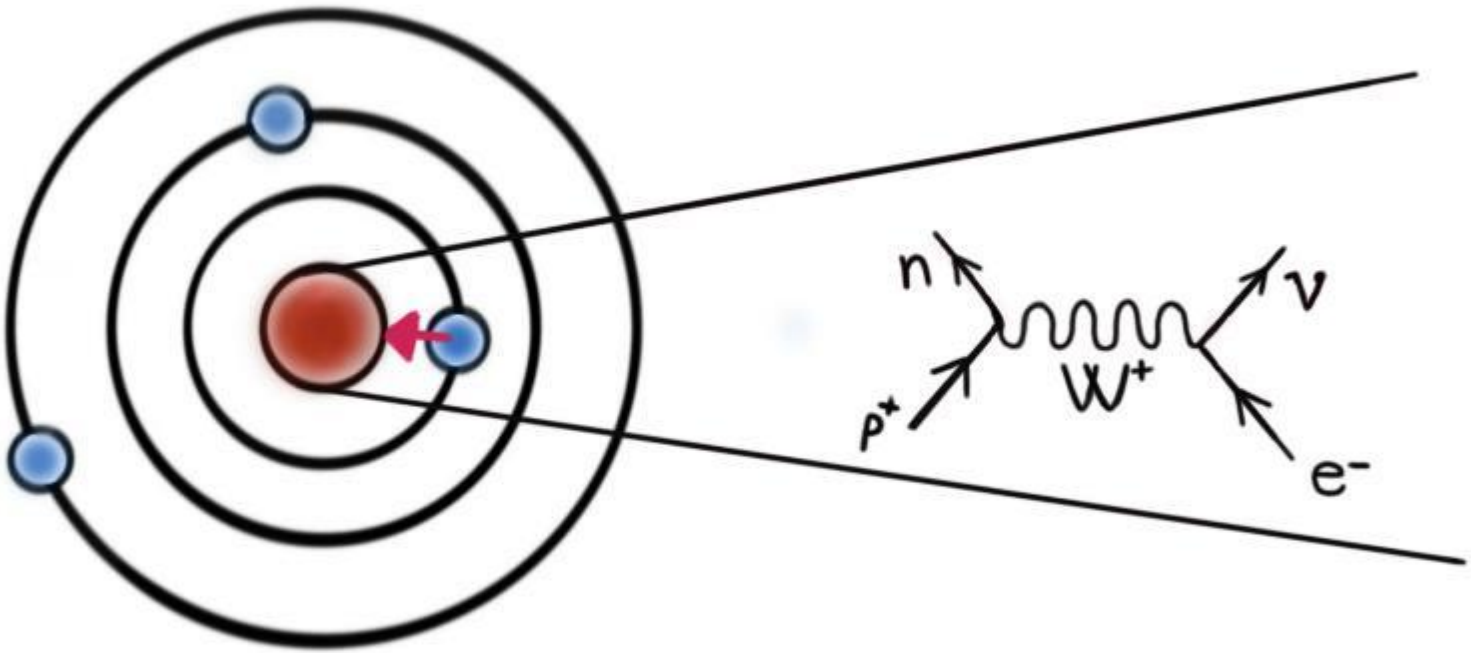




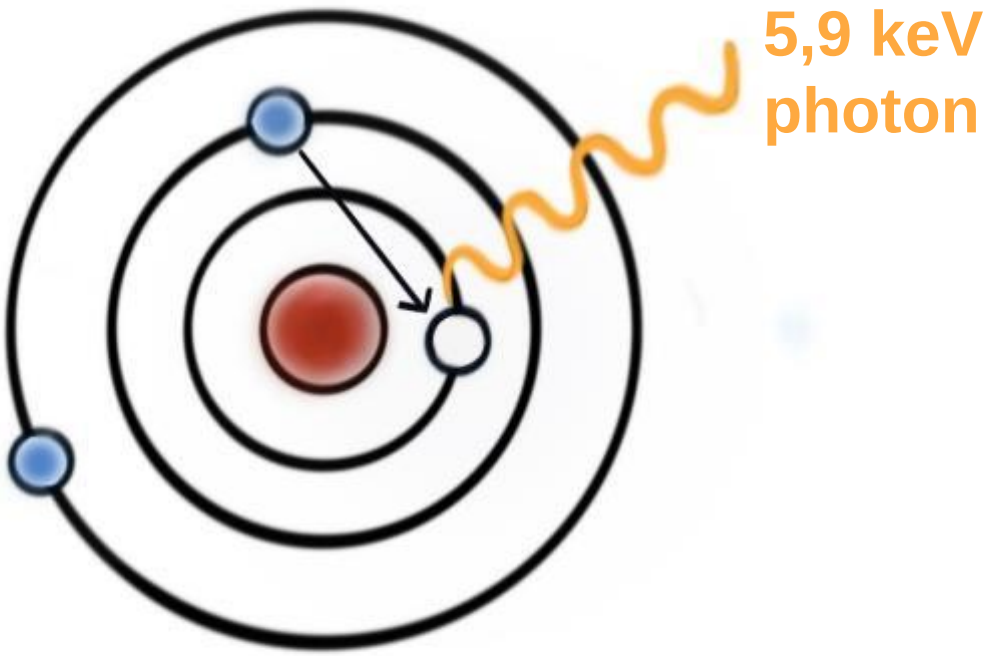

X view
Y view
U view
⌀2.1 m

Radiation sources

^{55}Fe Electron capture decay



^{55}Fe Electron capture decay

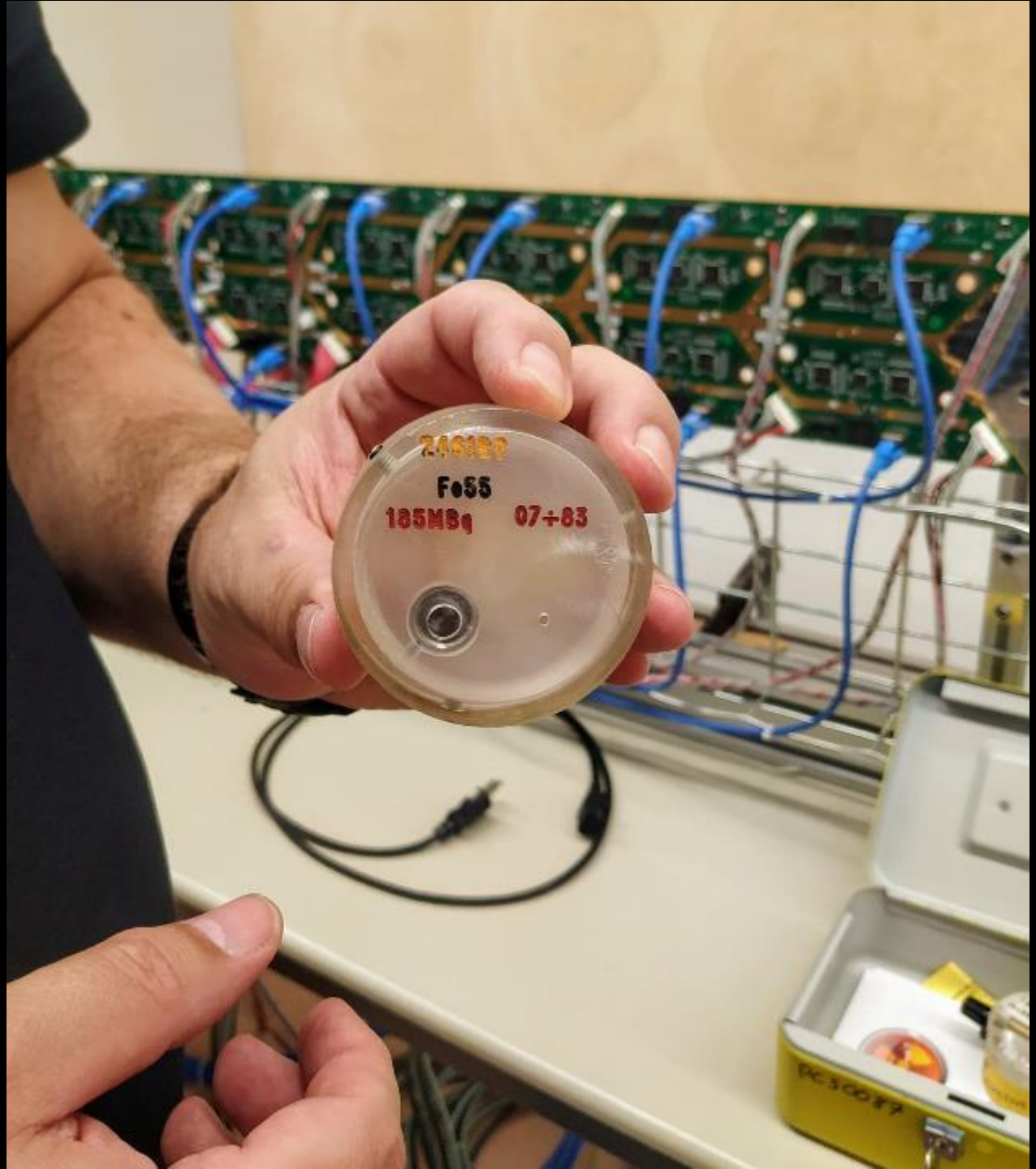


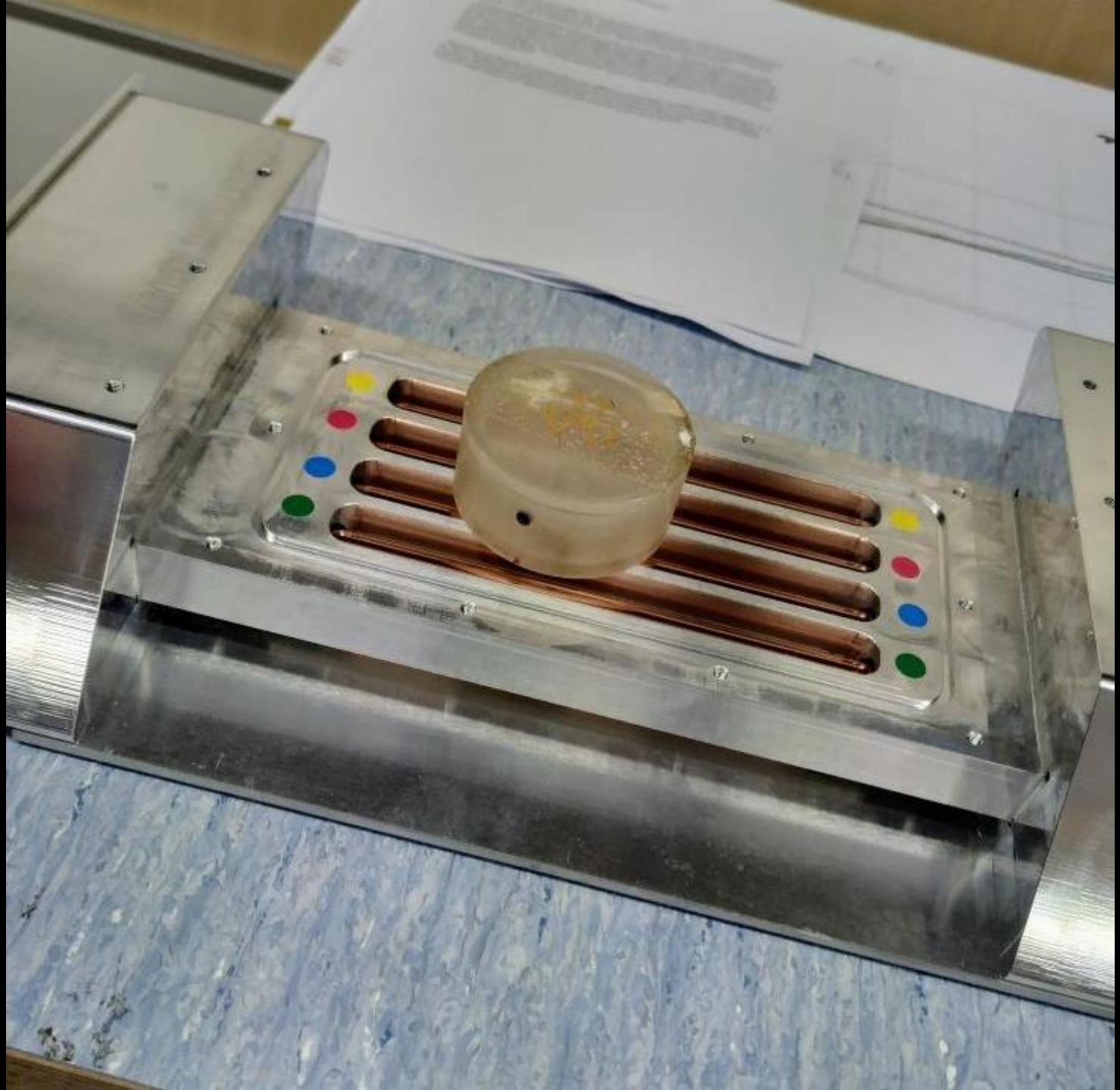
- Absorbed all at once
- Consistent amount of energy
- Consistent detector signal

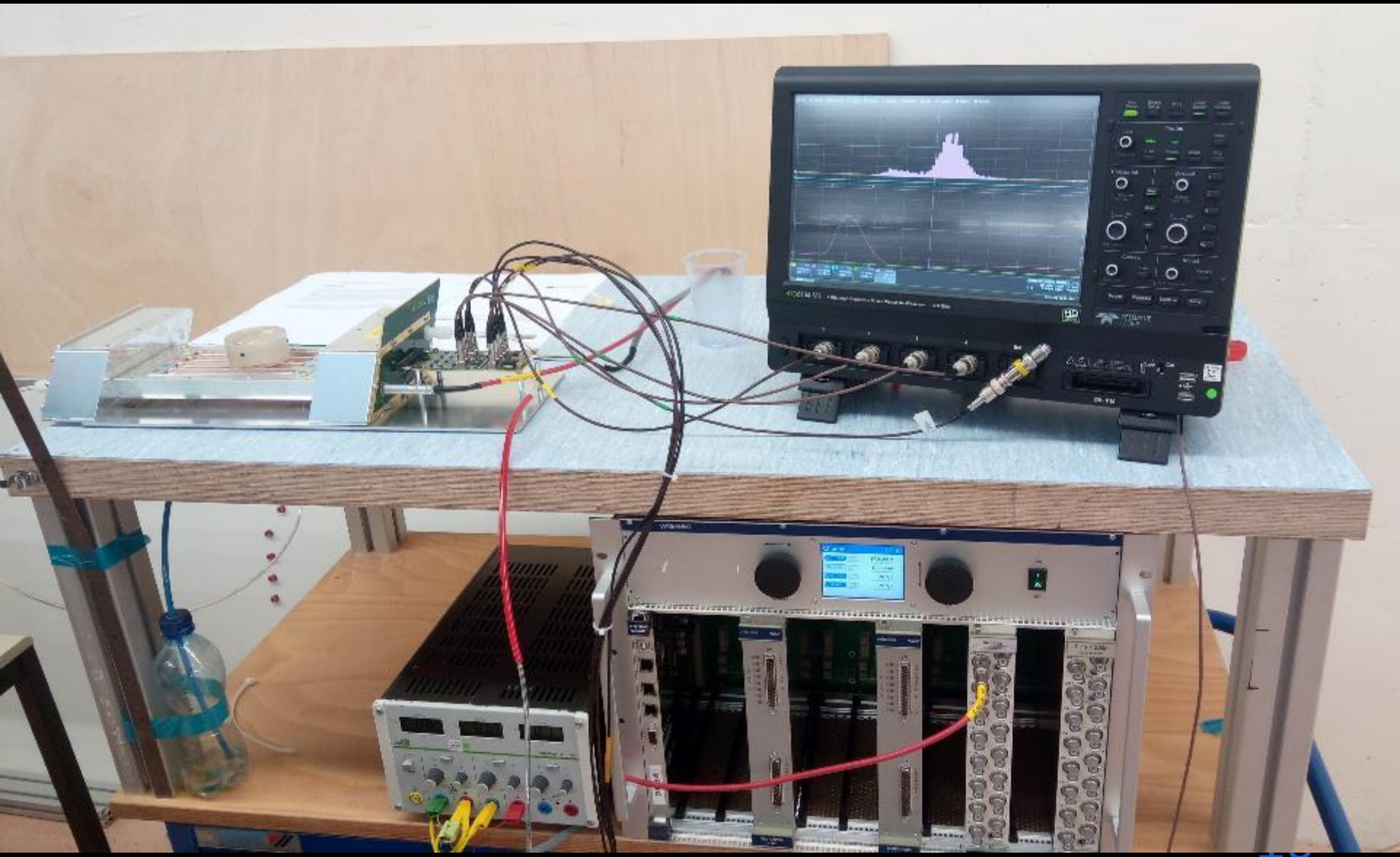
Other radiation sources

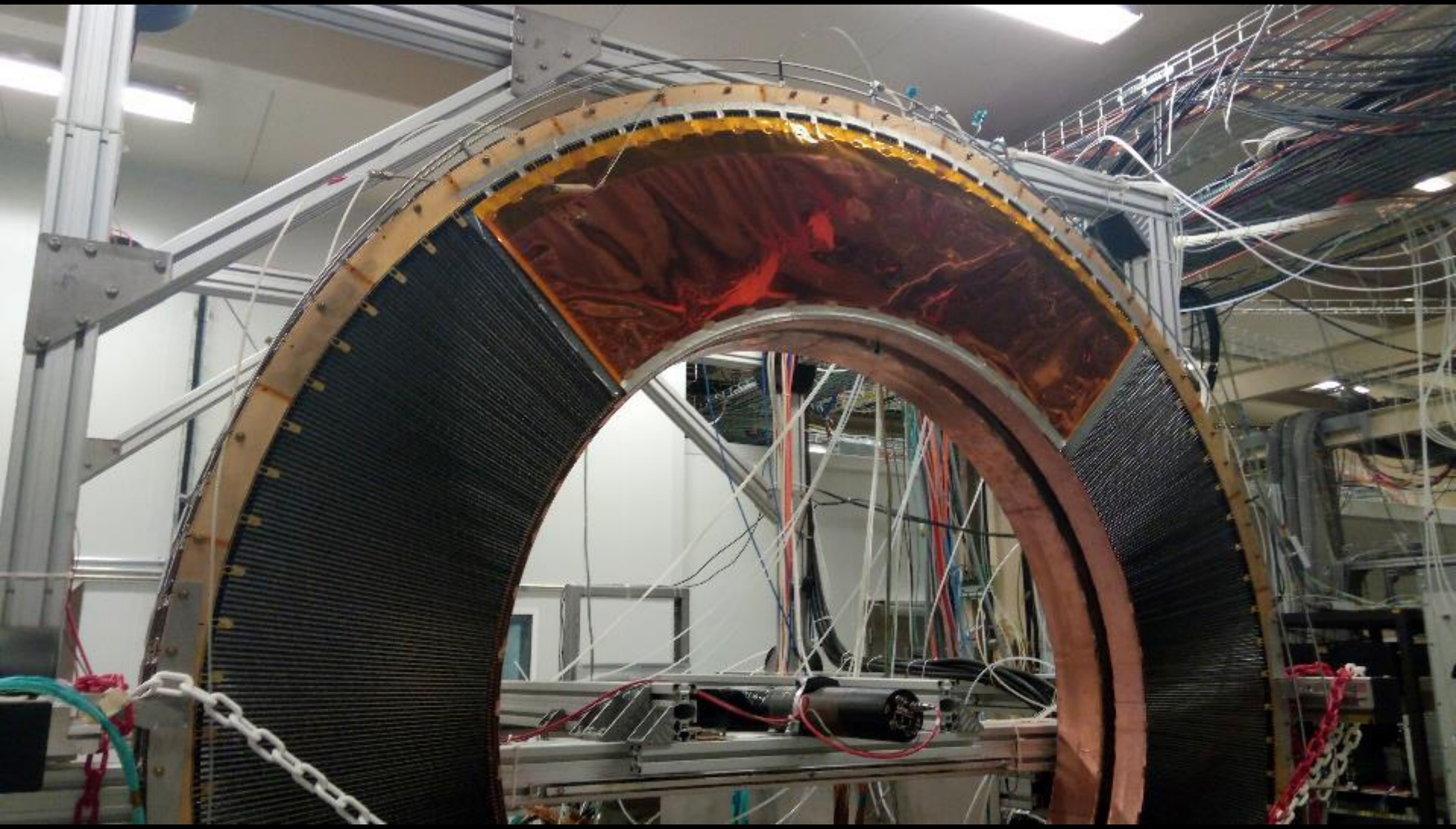
- $^{90}\mathrm{Sr}$ 546keV electron
- $^{241}\mathrm{Am}$ photons, neutrons, α-particles, clusters, fission products
- Background radiation

Experimental aparatus


FeS5
185MBq
07÷83

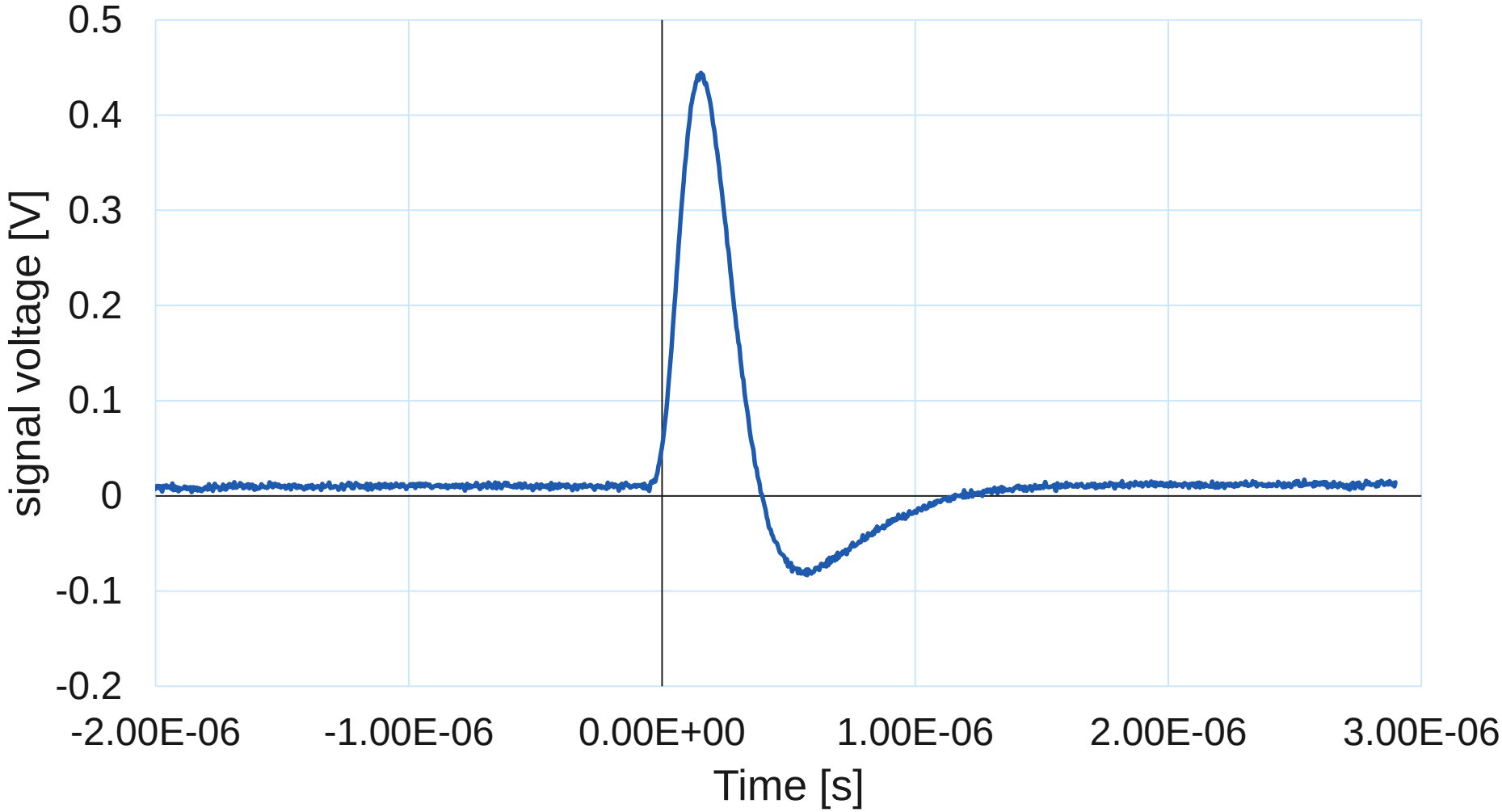




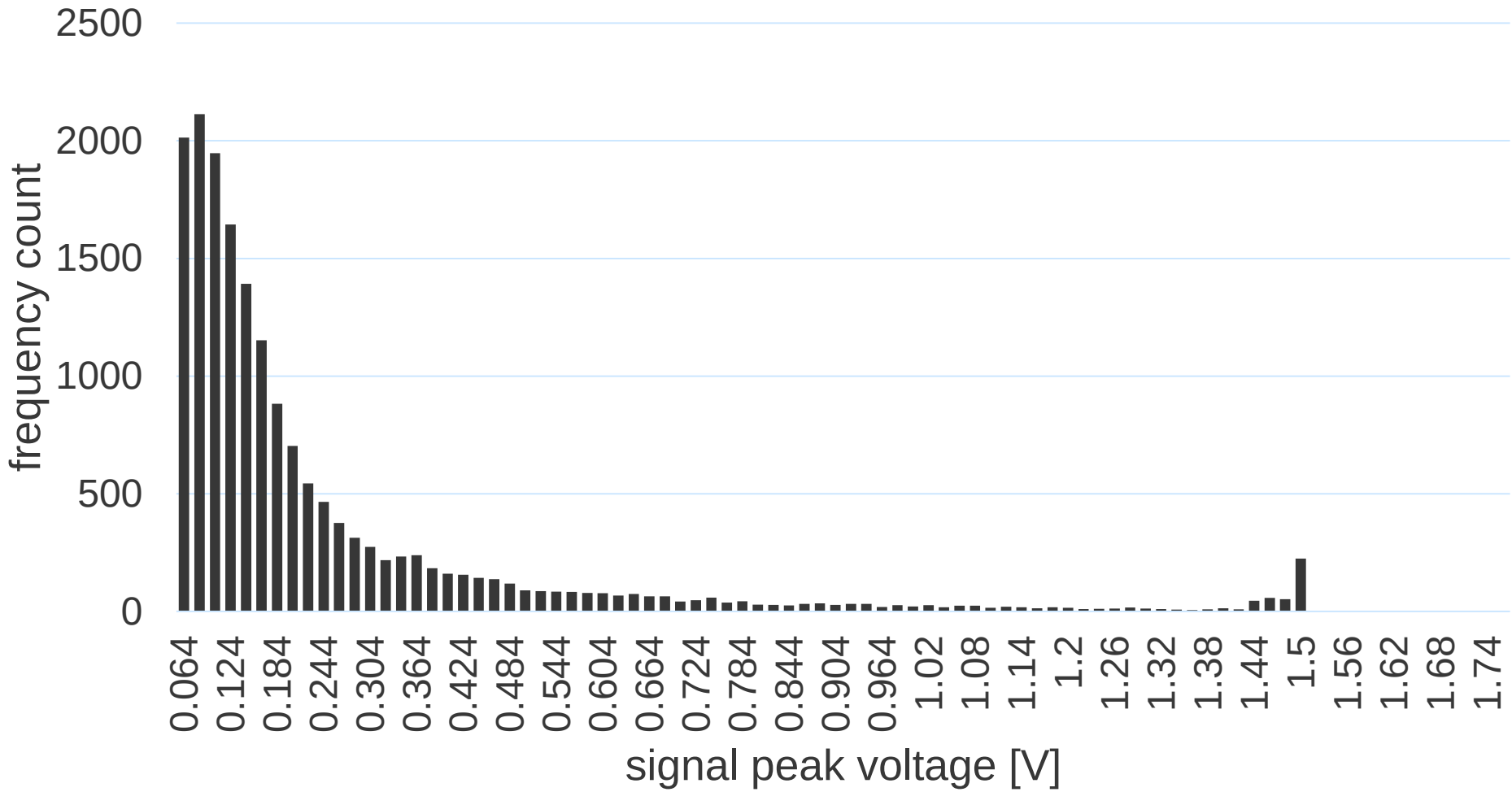


Experimental results

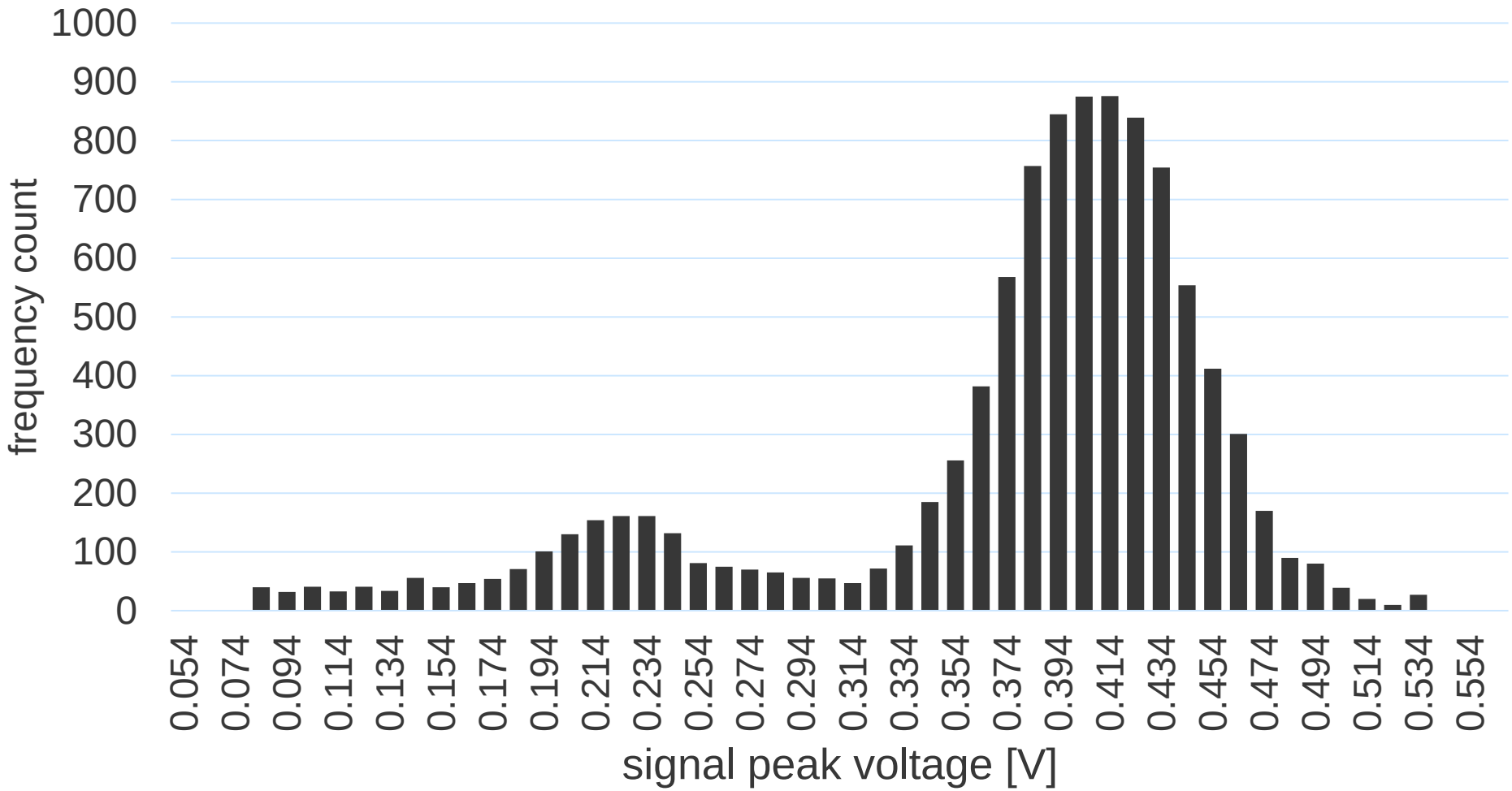
Typical signal (after electronic processing)



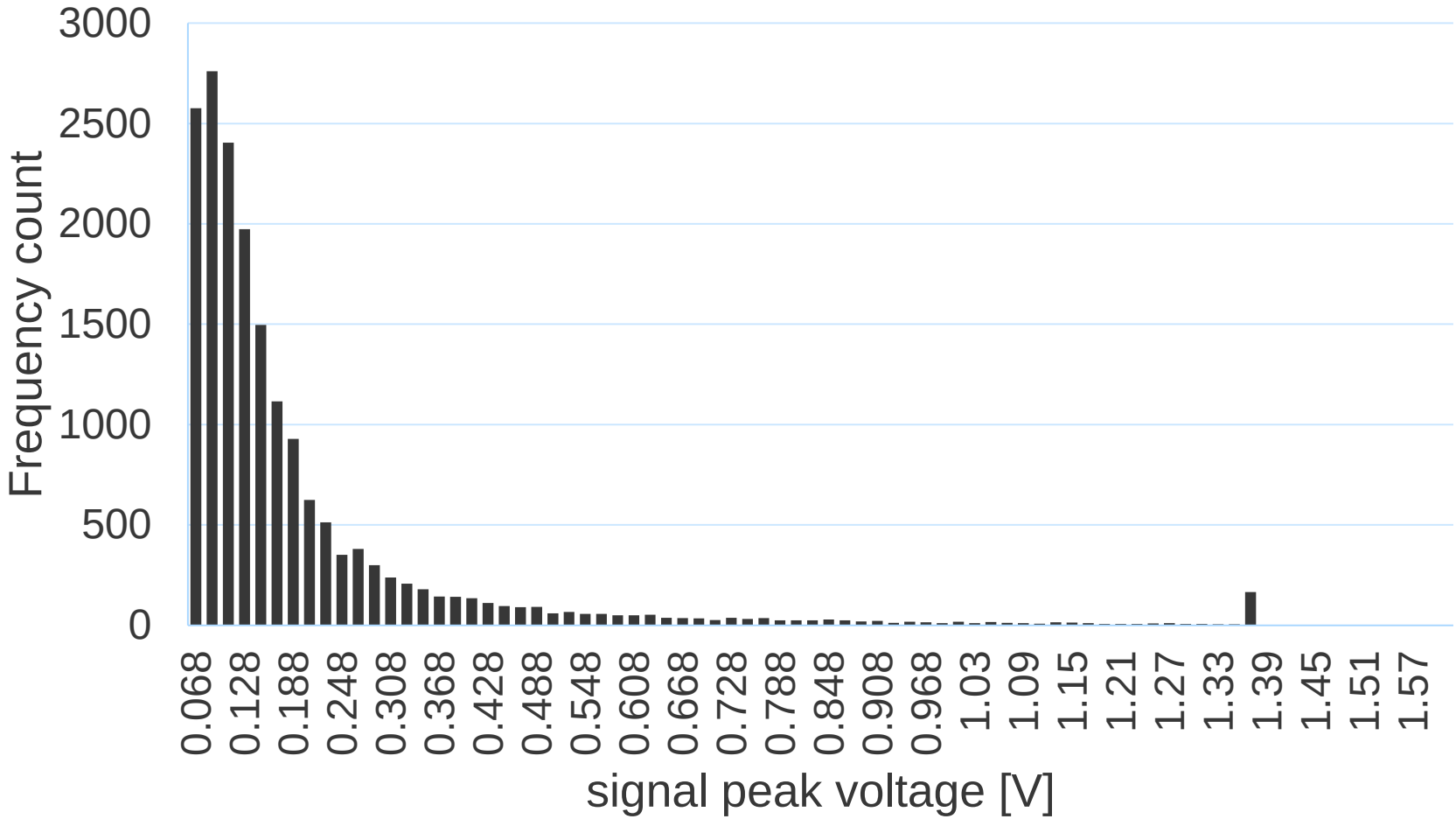
Background radiation



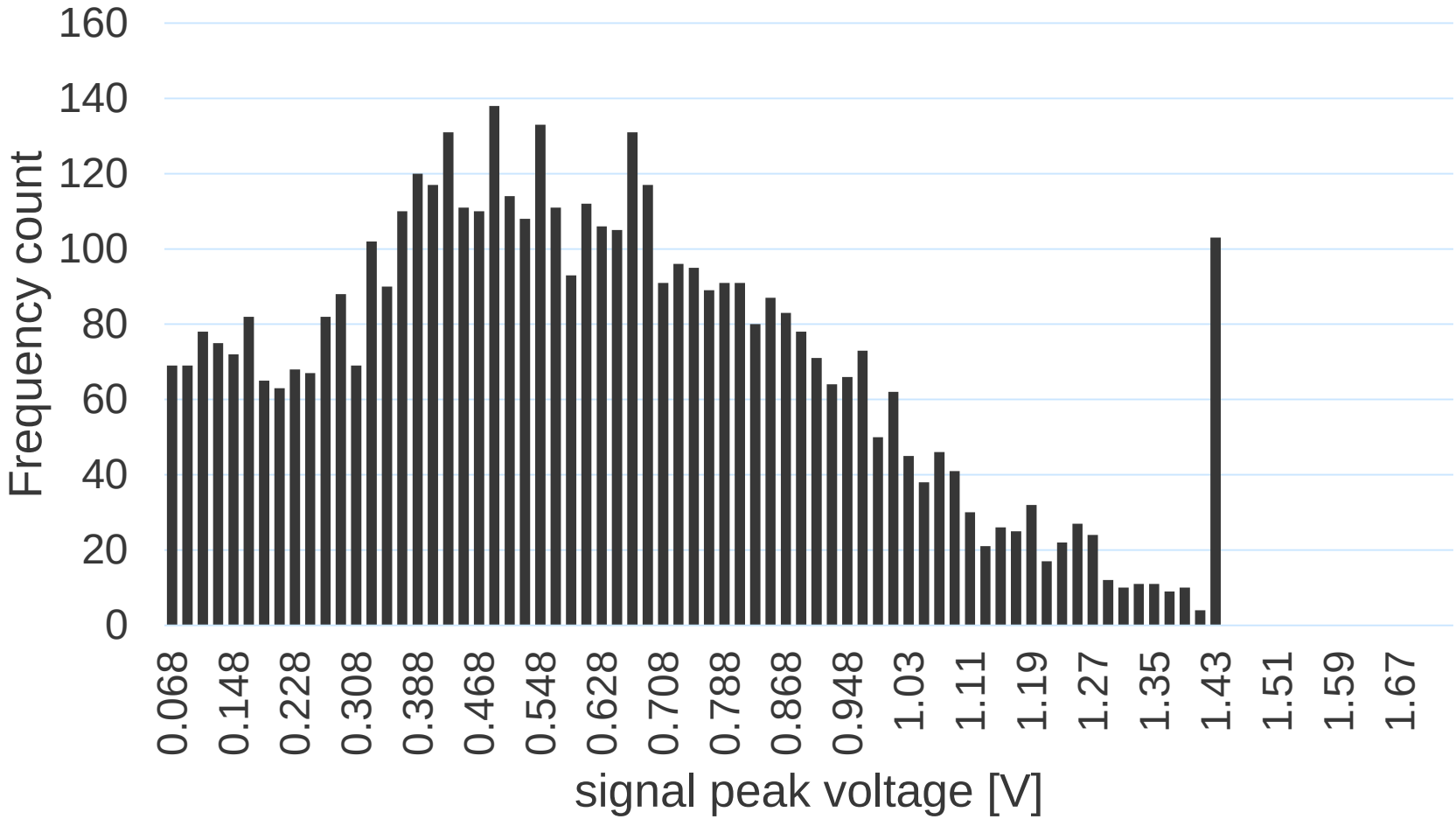
^{55}Fe radiation

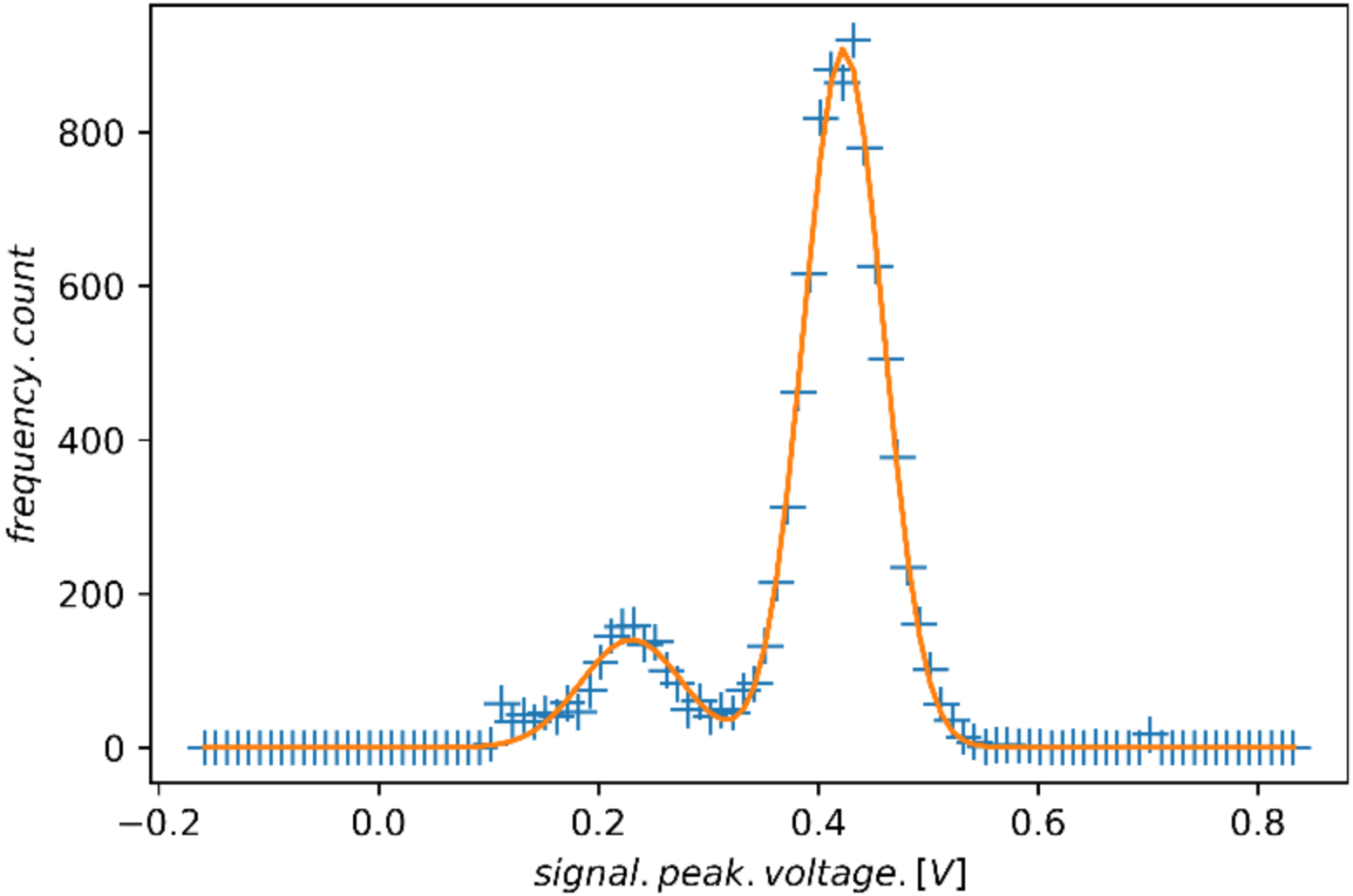


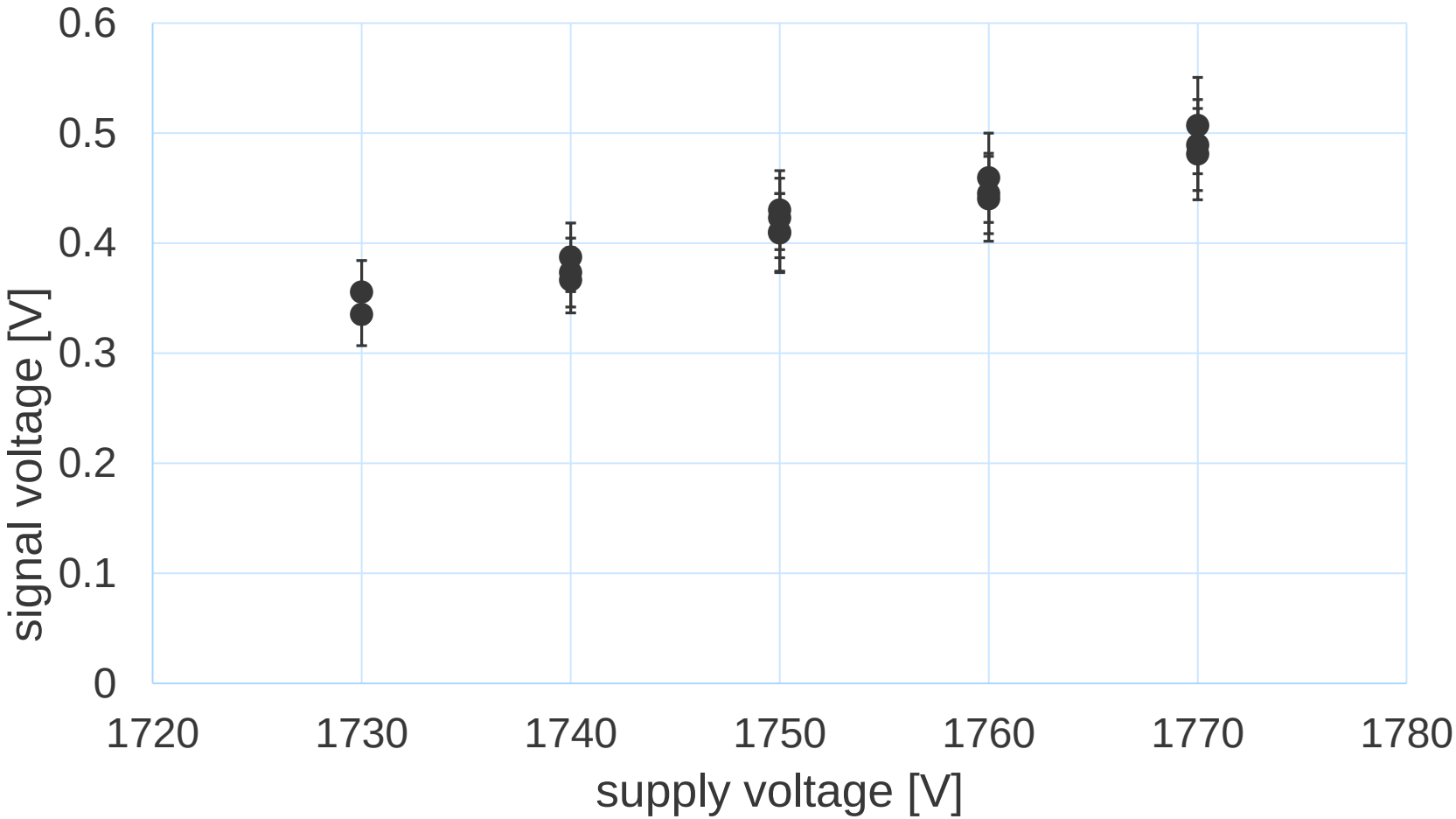
^{90}Sr radiation

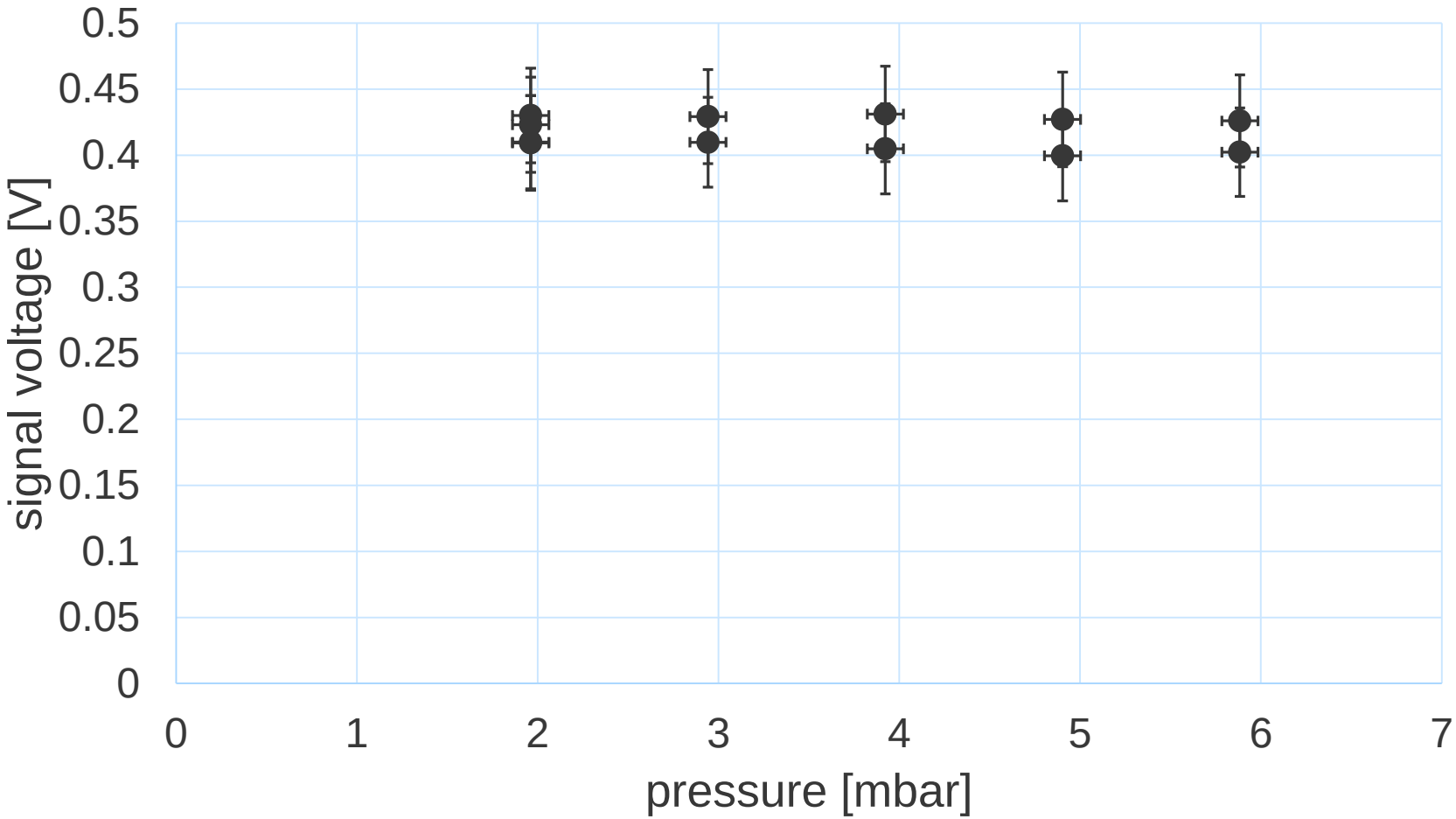


^{241}Am radiation

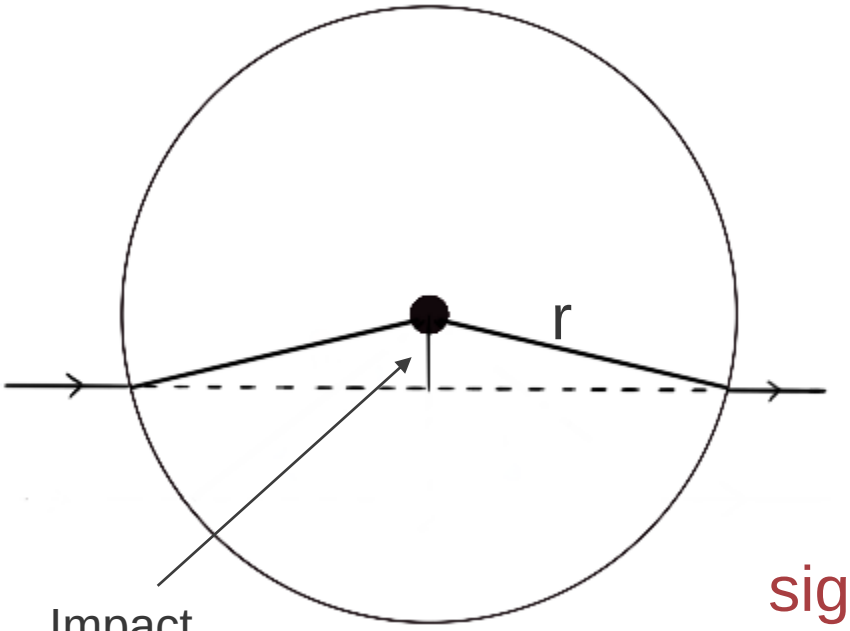


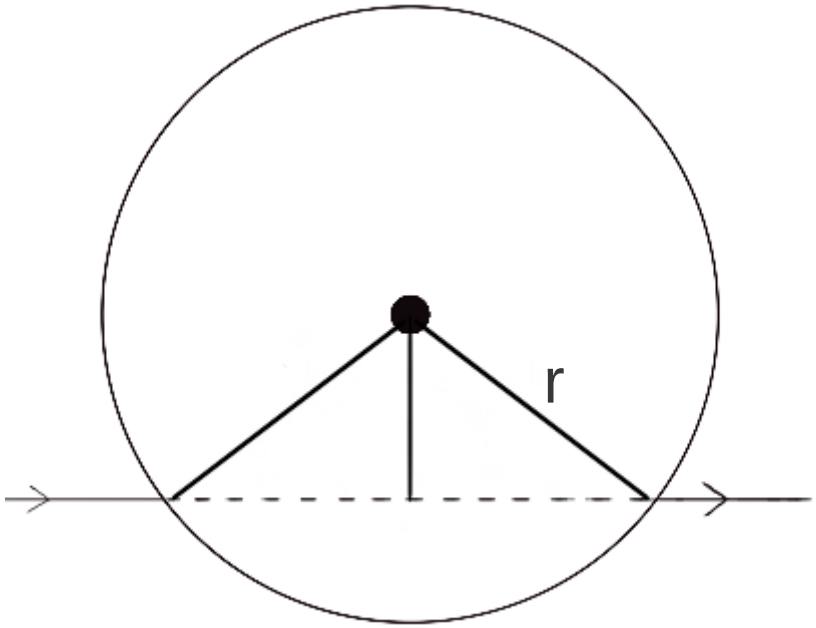

800
600
400
200
0
frequency. count
−0.2
0.0
0.2
0.4
0.6
0.8
signal. peak. voltage. [V]


0.6
0.5
0.4
0.3
0.2
0.1
0
signal voltage [V]
1720
1730
1740
1750
1760
1770
1780
supply voltage [V]


0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
signal voltage [V]
0
1
2
3
4
5
6
7
pressure [mbar]

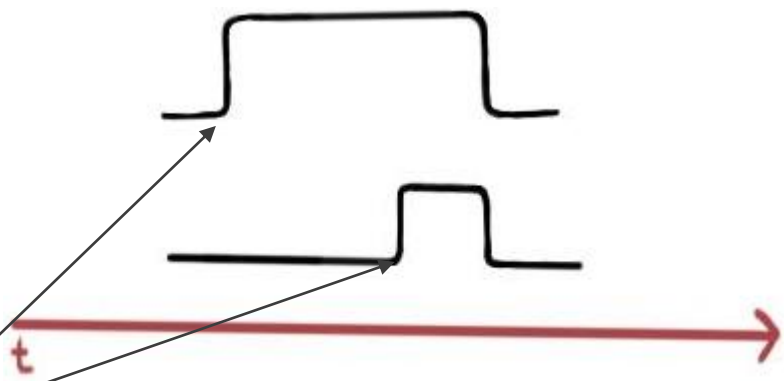
Garfield simulation





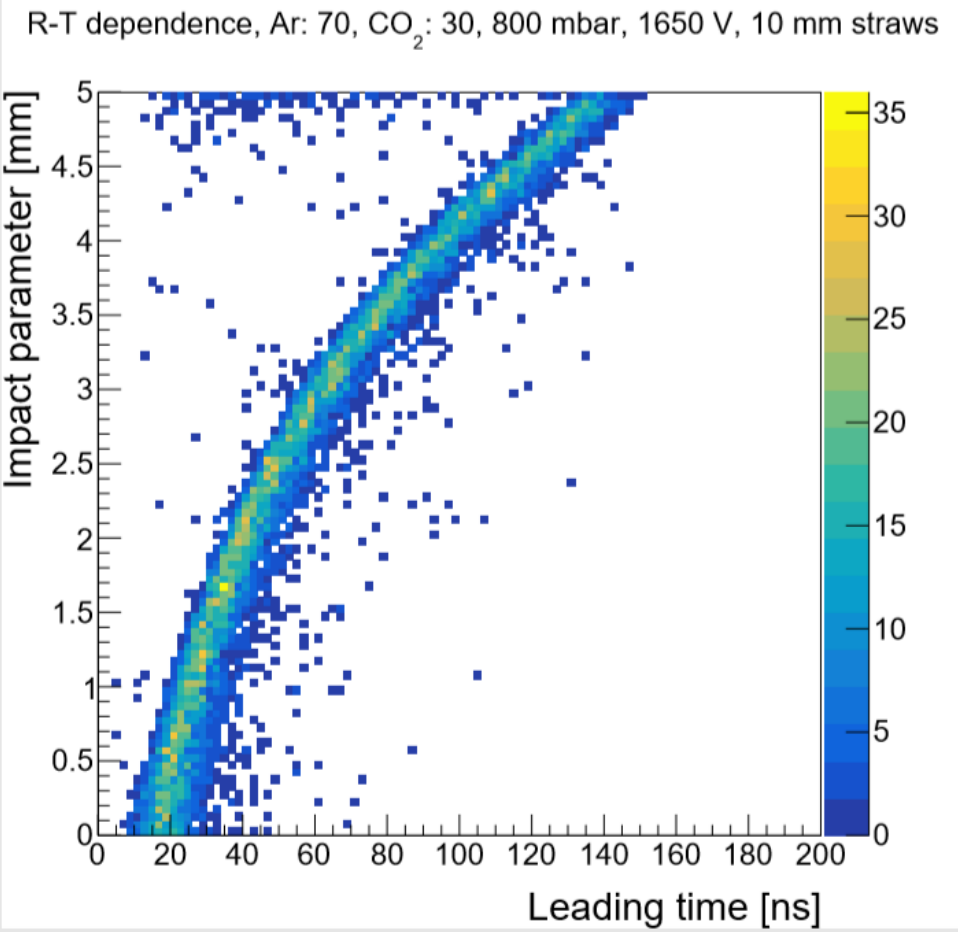
Impact parameter

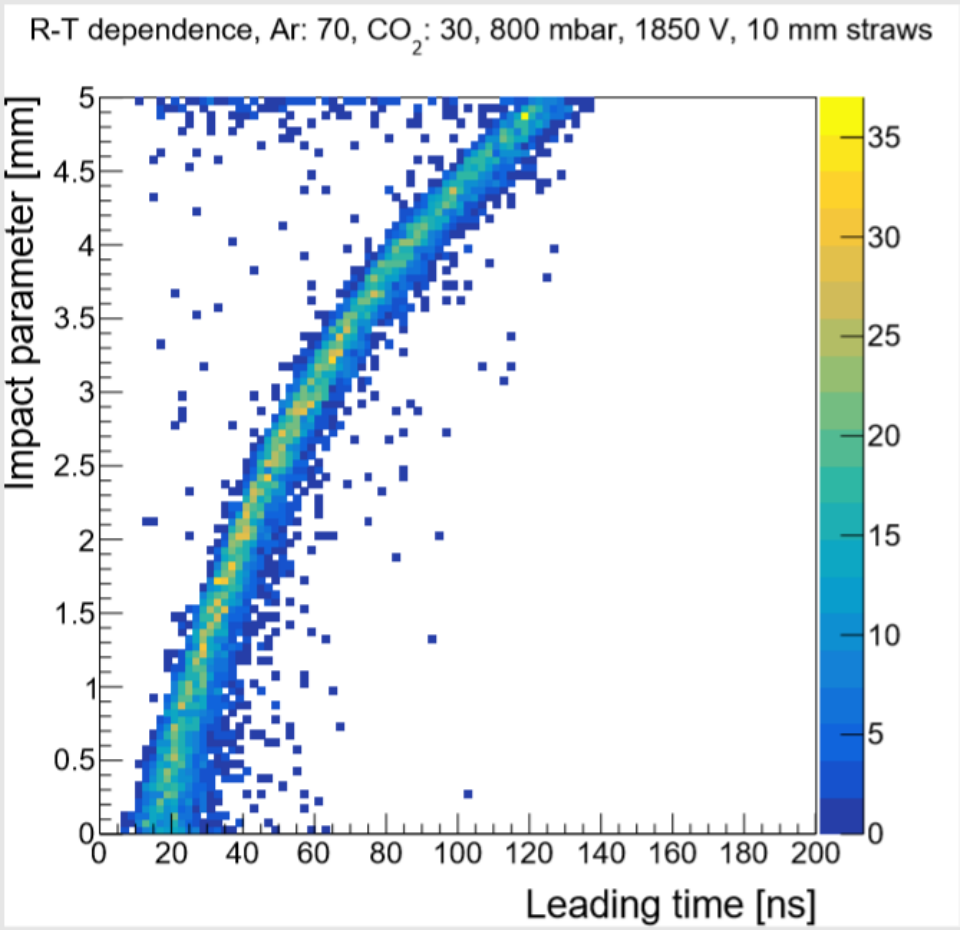
signal



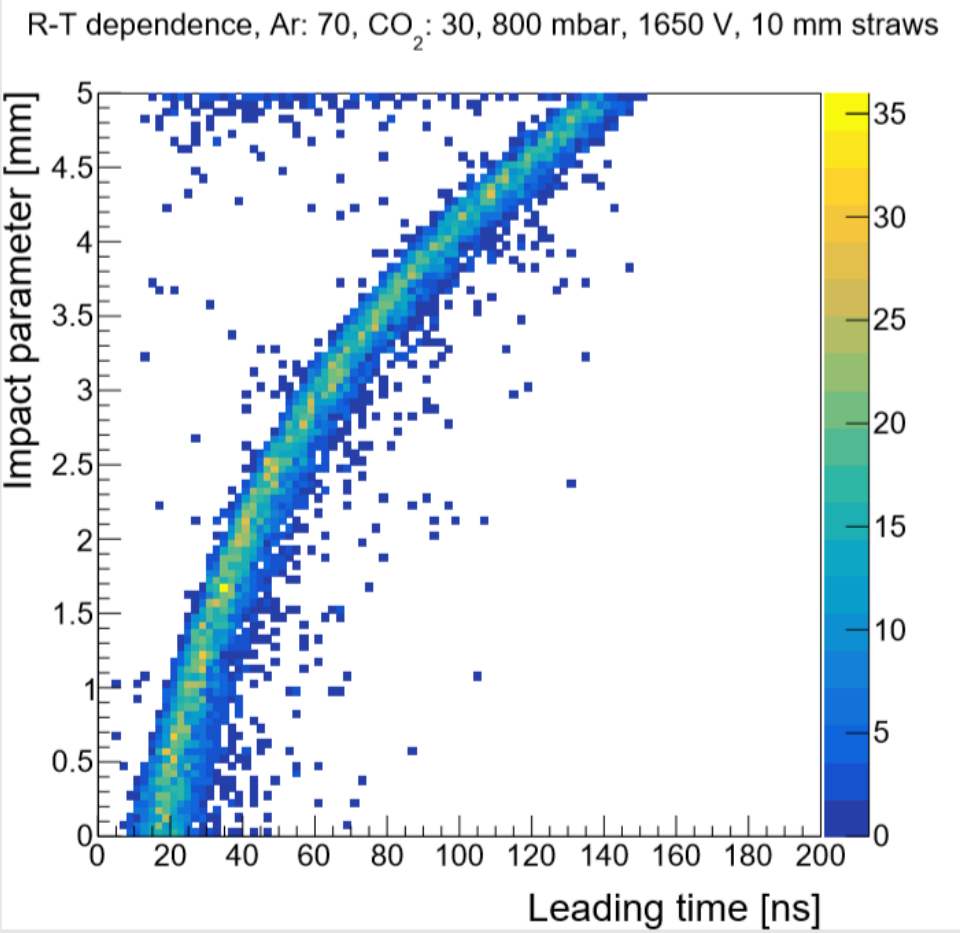
Leading time

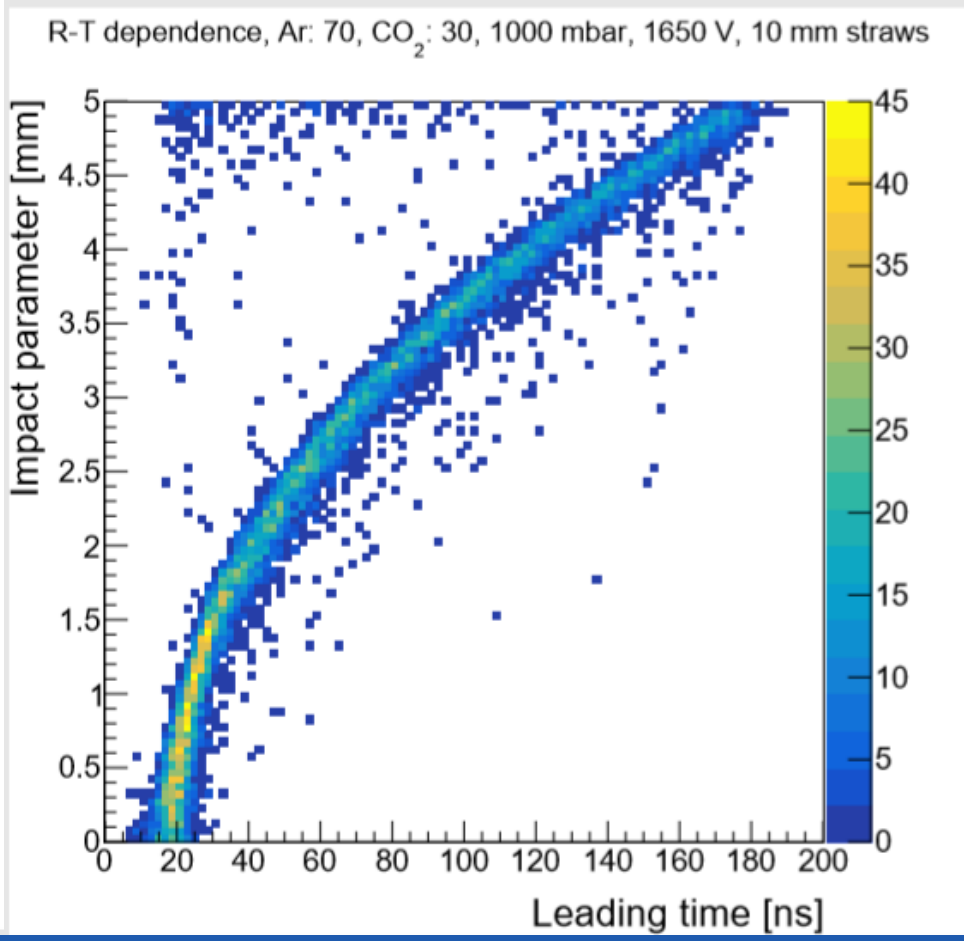
Different supply voltage





Different pressure





References

Uhliarik, A. (2019). *Optimization of STRAW spectrometer parameters for the NA62 experiment* (bachelor thesis).

Híveš, Z. (2019). *Time resolution studies of the STRAW detector at the NA62 experiment* (bachelor thesis).

Photo source

https://cds.cern.ch/record/1454654?ln=sk

https://drive.google.com/file/d/1PbhPPaNLzsyDU3Bb1vaXGHe8K70RuMC6/view?usp=sharing