Absorption of muon radiation by concrete

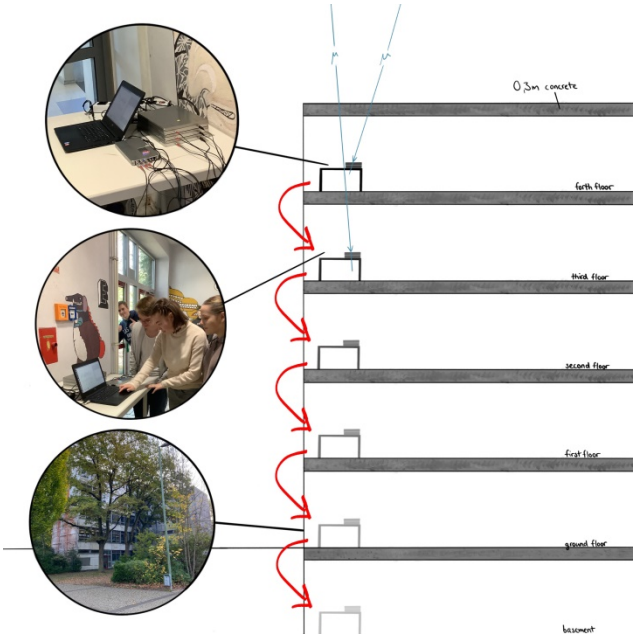
Kopernikus-Gymnasium Duisburg-Walsum, Germany
Advanced physics course (Q1)

Abstract

This experiment should determine the absorption of muon radiation passing increasingly thick layers of concrete as well as the half-value thickness.

Experimental planning and implementation

The measurements took place in the A building of our school and on each floor a ten-minute measurement was performed. To determine the muon rate, we used the CosMO experiment which includes three detectors, one data selector card and a computer. One of our detectors was defect which is why we only used two. The muon rate was measured in a double coincident. The threshold voltage in Channel II was 300mV and on Channel III 250mV.

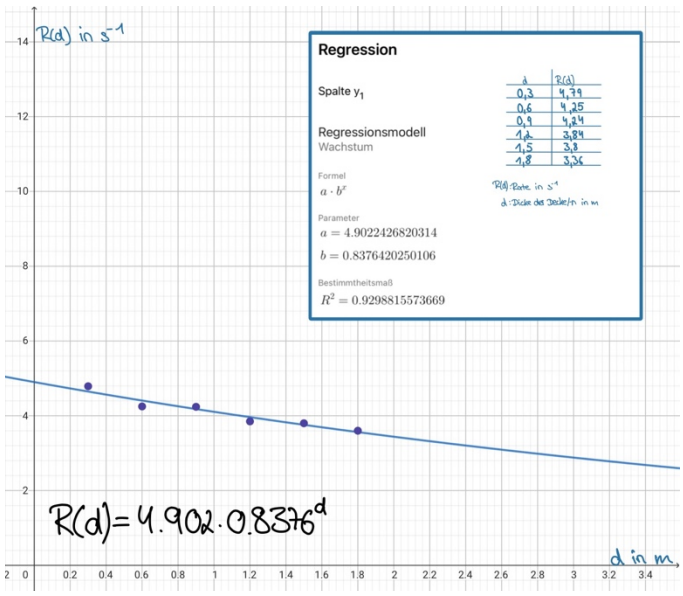


Data and evaluation

1) Graphical representation of the data with GeoGebra with an exponential function.
2) To determine the absorption coefficient, the above equation was converted into an e-function:

$$R(d) = 4.9022s^{-1} \cdot e^{-0.1772 \cdot \frac{1}{m} \cdot d}$$
$$\rightarrow \mu = 0.1772 \cdot \frac{1}{m}$$

Therefore $d_{1/2} = \frac{\ln(2)}{\mu}$ with 3.91m is the half-value thickness.



Discussion

On the positive side, we can observe an exponential decrease of muon radiation with increasing concrete thickness.
Factors that might have had a negative effect on the experiment:

- Small distance between the detectors
- Two instead of three detectors
- Short measuring time
- Inaccurate measurement of the concrete thicknes