

Zero effect is the effect when one can register impulses with a Geiger-Müller-counter, even when no radioactive substance is present near it.

The atmosphere of the earth is full of a stream of energetic particles entering it from space. This primary radiation produces a secondary radiation in the upper layers of air through nuclear processes, which manages to reach the surface of earth even after being weakened by successive layers of air.

The zero effect is produced by this cosmic radiation along with a terrestrial radiation. This terrestrial radiation is caused by the radioactive elements like Uranium, Thorium with its by-products, as well as Potassium, which are present in the earth's crust in different concentrations. The radioactive Radon-isotope caused by the decay of Uranium and Thorium can penetrate through to the earth's surface and can accumulate in high concentrations in deep underground sections (rooms). In this experiment the natural radiation is registered as statistically varying zero

effect or as zero rate. The mean value of the zero rate depends on the place and is about 20 Impulses/60s. As the actual zero rate is about 100 times more, but the registering ability of the Geiger-Müller-counter tube is just about 1% of the total registered  $\gamma$ -radiation. One can get an idea about the radioactive load on the human body, when one applies the zero rate of the counter tube surface – about  $0.6 \text{ cm}^2$  multiplied by a factor of 100, on the estimated surface area of the human body.

## Equipment

Support clamp for small case	02043.10	1
Clamp on holder	02164.00	1
Support rod, stainless steel	02030.00	1
Counter tube holder on fix. magnet	09201.00	1
Counter tube Type B	09005.00	1
Geiger-Müller-Counter	13606.99	1
Demo-Board for Physics with stand	02150.00	1

Fig. 1: Experimental setup



**Setup and procedure**

See Fig.1

- Fix the counter tube in the counter tube holder, connect it with the counter and remove the protective cap.
- Select a measurement time of 60 s and determine the zero rate 5 times; Enter the values in Table 1.

**Results**

Table 1

Running no.	$Z$
	Imp/60 s
1	17
2	15
3	22
4	19
5	20

**Evaluation**

The counter tube registers impulses, even when there is no radioactive source near it; this impulse rate is called the zero rate  $Z_0$ .

The measured value of the zero rate varies around a mean value  $Z_0$ . Its value is  $Z_0 = 18.6 \text{ Imp/60 s}$ .

This value must be taken into consideration when doing experiments with radioactive substances.