

**Radiation protection –practical 2**

**Experiment No.1**

**Dead-Time Corrections for the Geiger Counter.**

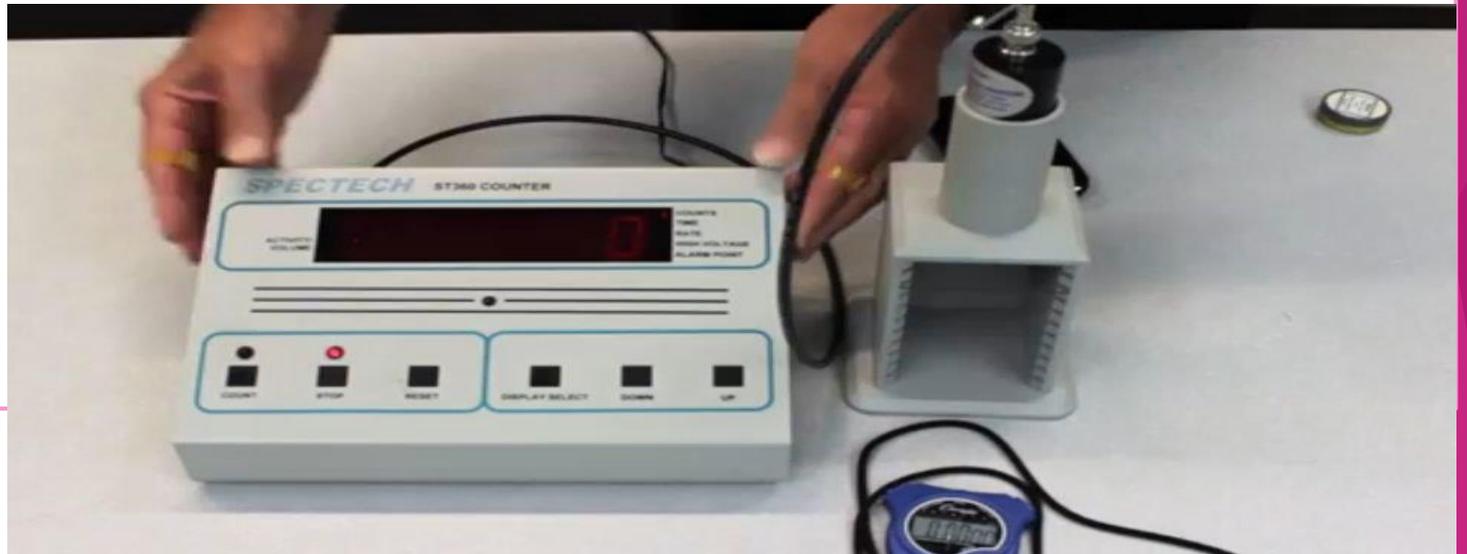
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## 1.1 The objective of this experiment

- ▶ **1- Calculate the dead time ( $T_R$ ) of the Geiger Counter.**
- ▶ **2 - Calculate the corrected or actual count rate of the Geiger detector.**

## 1.2 Equipment :

- 1) **Geiger counter**
- 2) **Radiation source (such as a radioactive sample or a radioactive material).**
- 3) **Power supply**



## 1.3 Theory :

**When ionization radiation enters the GM tube through the window and loses its energy by creating electron-ion pairs, the electrons that are produced in the resulting avalanche are accelerated to the anode and collected in a short period of time. The positive ions, however, are more massive and make their way slowly to the cylindrical cathode. If their average transient time is  $T$ , the GM tube is busy, so to speak, during  $T$ . If another ionizing particle enters the GM tube during  $T$ , it will not be counted. This time ( $T$ ) is called the dead time (or resolving time) of the GM tube is the period of time after each detected event during which the counter is unable to detect another event**

▶ The existence of this dead time causes:

- 1) **The count rate we read from the counter to be less than the actual number of particles** that interact with the gas and walls of the tube in a particular time interval. To find this the corrected count rate or the actual count rate
- 2) **It can affect the accuracy of the measurements** if the counting rate is high, the dead time can cause the counter to miss some events, leading to an underestimation of the true count rate.

▶ This effect can be corrected using mathematical techniques

$$\text{▶ } T_R = \frac{R_1 + R_2 - R_T}{2R_1R_2} \dots\dots\dots(1)$$

Where:  $T_R$  is dead time

$R_1$ : The count of source 1

$R_2$ : The count of source 2

$R_T$ : The count of source 1,2(Total)

$$\text{▶ } \acute{R} = \frac{R_X}{1 - R_X T_R} \dots\dots\dots(2)$$

$\acute{R}$  : Is actual count rate

## 1.4 Procedure:

- ▶ 1-Connect the plugs of the electric mains .
- ▶ 2-Set the timer to 1 min and the voltage to the operating voltage you found in experiment (1)
- ▶ 3-Put the 1st source in front of the GM tube and count .
- ▶ 4-Convert the resulting count rate from count/300 s to count/min and record it as count rate (R1)
- ▶ 5-Put the 1st source in front of the GM tube and count.
- ▶ 6-Convert the resulting count rate from count/300 s to count/min and record it as count rate(R2)

- ▶ 7- Put the 2<sup>nd</sup> source with the 1<sup>st</sup> source in the same shelf (without changing anything) and count
- ▶ 8- Repeat step no.6 and record it as count rate
- ▶ 9- Calculate the dead time ( $T$ ) of GM detector in minutes and microseconds
- ▶ 10- Calculate the true counting rate ( $R$ ) of the actual particles that