Radiation protection –practical 2
Experiment No.1
Dead-Time Corrections for the Geiger Counter.

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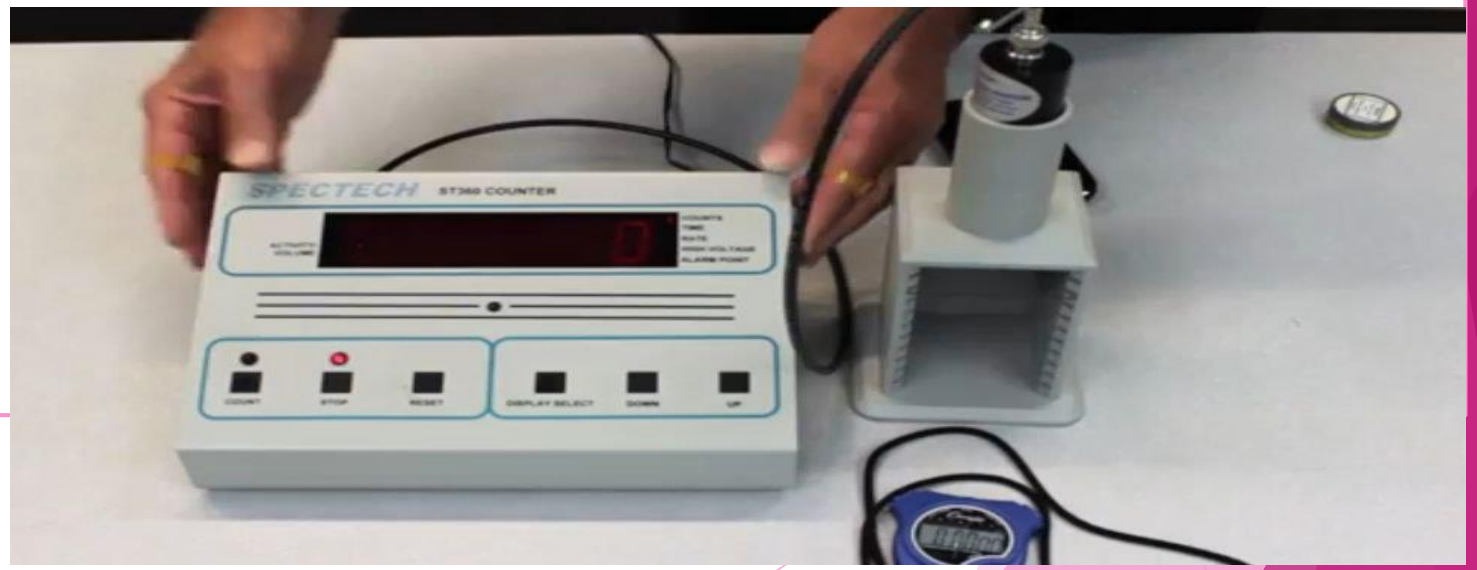
1.1 The objective of this experiment

- **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
- $T_R = \frac{R_1+R_2-R_T}{2R_1R_2}$ .....(1)

Where: T_R is dead time

R_1: The count of source1

R_2:The count of source 2

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

- $\acute{R} = \frac{R_X}{1-R_XT_R}$ .....(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 nd source with the 1st 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