3. Experiments with the use of ST360 Counting System-Geiger-Mueller Detector

3.1. Finding the Operating Plateau of Geiger Mueller Detector

The aim of this experiment is to obtain the operational plateau of the Geiger Mueller detector and determine its operating voltage to use during the experiments when this detector is used.

In figure 1, the graph of voltage versus count may be seen. The area between N_1 and N_2 on this graph corresponds to the operating voltages of V_1 and V_2 and this area is called as plateau in Geiger Mueller detectors.

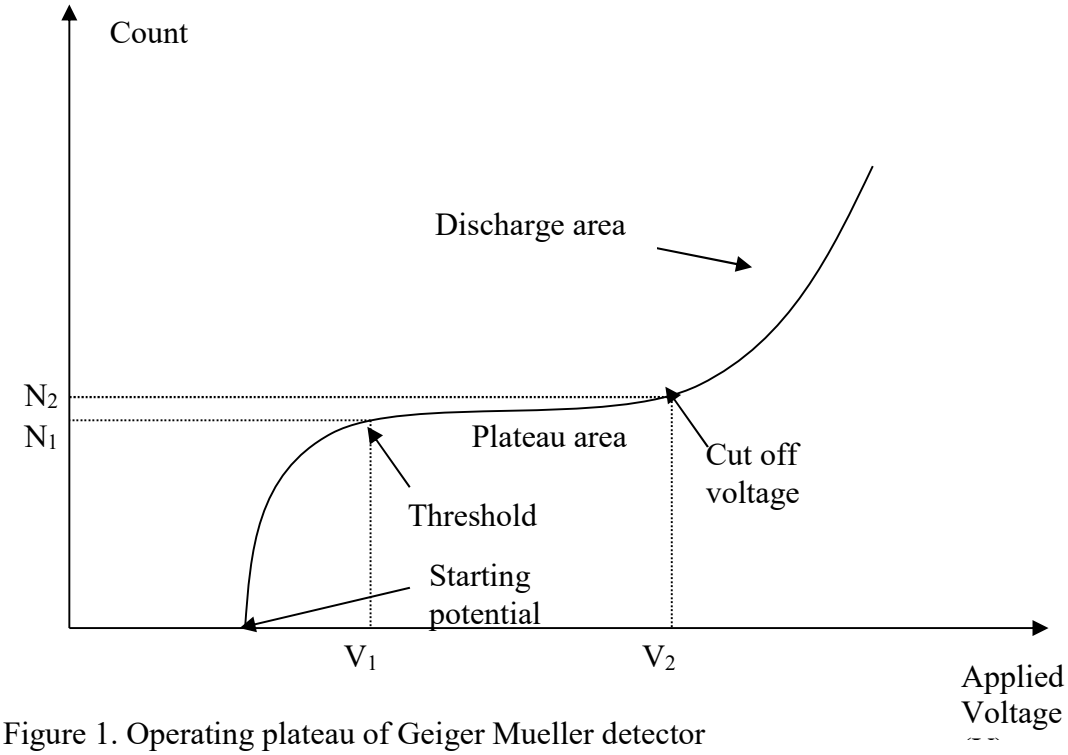

Figure 1. Operating plateau of Geiger Mueller detector

PROCEDURE

1. Set the detector set-up.
2. Place the ^{137}Cs source on a shelf close to the detector.
3. Adjust 30 seconds on ST360 counting system and acquire set up in steps of 20 V increase. Fill Table 1 with these values.

WARNING: Do not exceed the value of 900V on the detector.

Table 1

Voltage (V)	Count	Voltage (V)	Count

640		780	
660		800	
680		820	
700		840	
720		860	
740		880	
760		900	

EVALUATION

1. Plot the voltage-count graph with the values of Table 1.
2. Determine the operating voltage of Geiger Mueller tube with the use of the slope of the curve by the following equation. (Slope value should be less than 10%)

$$\text{Slope}=\left(\frac{N_2-N_1}{N_1}\right)x\left(\frac{100}{V_2-V_1}\right)\%$$

3. Chose an operating voltage from the 50%-70% of the plateau.

3.2. Correction of the dead time of the system

In this experiment it is aimed that to find the dead time of a Geiger Mueller tube.

On a system with a Geiger Mueller derector, it is a must to make dead time correction with high count rates (more than 5000 counts). In this experiment two source method will be used to measure the dead time of the detector.

PROCEDURE

1. Set the experiment set up.
2. Adjust following settings on the ST360 counting system.
   - Time : 60 s
   - Voltage : The value which is determined in the previous experiment.
3. Place the ^{90}Sr and ^{204}Tl sources together on a close shelf in front of the detector and acquire a count for 60 seconds (R_{12}).
4. Without changing the geometry take one of the sources and acquire a count for 60 seconds (R_1) .
5. Place back the source that to take in Step 4 and remove the other source and acquire the count for 60 seconds (R_2) .
6. Repeat the steps 3-5 for two more times. Fill Table 2 and calculate the mean count.

Table 2

Experiment	**R_1**	**R_2**	**R_{12}**
1			
2			
3			
Mean			

EVALUATION

1. Calculate the dead time with the following equation.

$$T_R = \frac{R_1 + R_2 - R_{12}}{2 \times R_1 \times R_2} \text{ minute/count}$$

2. Calculate the corrected count rates with the use of the following equation. (This equation is valid only for the count rates more than 500 count/minute.

$$R = \frac{R_{observed}}{1-(R_{observed} \times T_R)} \text{ minute/count}$$

Create 5 more experiments with more than 5000 count rate and correct your results with the equation above. Fill the Table 3 with these values.

Table3

Experiment	**$R_{observed}$**	**R**
1		
2		
3		
4		
5		