

# 1. Experiments with the use of ST7 Counting System and Anthracene Crystal

## 1.1. Finding the Operating Voltage Range of Anthracene Crystal

The aim of this experiment is to find the operating voltage range of an Anthracene crystal detector and determine the optimal operating voltage for the further experiments.

It is necessary to work with maximum stability on detector voltage during the radioactivity measurement experiments. In this way it is expected the count rates from the detector will not be affected significantly by the possible small fluctuations if the suitable operating voltage plato is obtained for detector operation.

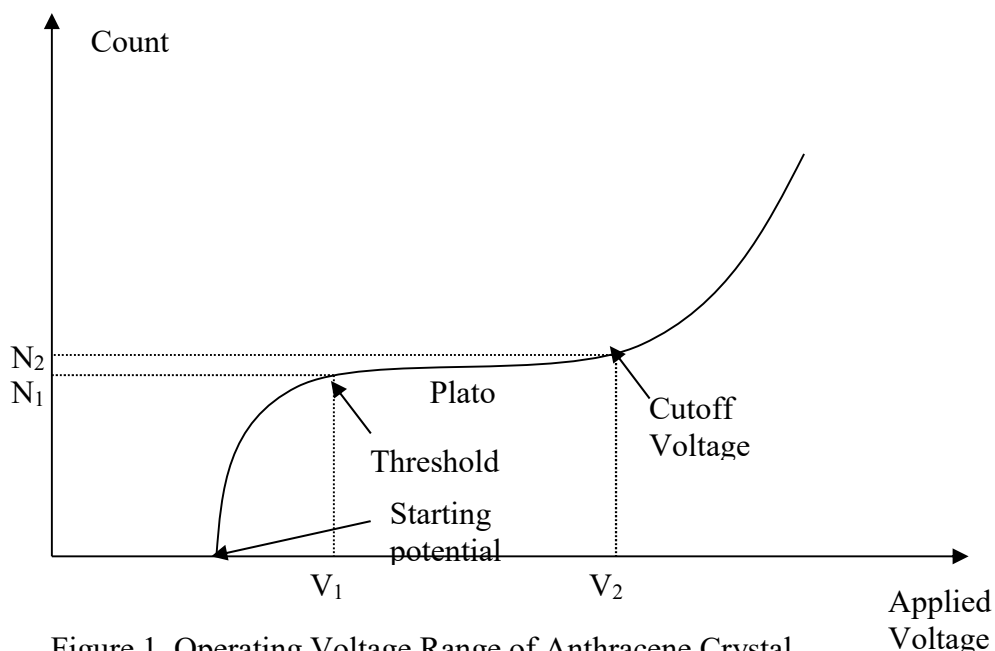


Figure 1. Operating Voltage Range of Anthracene Crystal

## METHOD

1. Set up the experiment geometry.
2. Adjust the following settings on ST7 counting system.
  - Count type : Integral
  - Window :0
  - Threshold :0,5
  - Count :500000
  - Time :10 s

**Note:** On ST7 counting system, when adjusting window and threshold settings the potentiometer's one cycle corresponds to 250 mV.

3. Place  $^{204}\text{Tl}$  source the second shelf of the detector.
4. Increasing the voltage in 20 V steps and fill the Table 1. (Do not exceed the written values.)

**Note:** The voltage range is 0-2000 V for ST7 counting system. Every cycle on the potentiometer corresponds to 200 V. For instance, in order to set 400 V, potentiometer should be set to 2.0.

**Warning: The operating voltage of Anthracene crystal shall not exceed 1350 V.**

Table 1

Voltage (V)	Count	Voltage (V)	Count	Voltage (V)	Count
400		680		960	
420		700		980	
440		720		1000	
460		740		1020	
480		760		1040	
500		780		1060	
520		800		1080	
540		820		1100	
560		840		1120	
580		860		1140	
600		880		1160	
620		900		1180	
640		920		1200	
660		940			

## EVALUATION

1. Plot the count-voltage graph by using the measure values to be filled in Table 1.
2. Use the second plateau to determine the operating voltage. First plateau is made by electronic noise. Find the slope of the plateau by using the following equation. (The positive slope on the plateau curve should be less than 10%).

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

3. Determine the operating voltage. (Select a value from the 50%-70% of the plateau)

**Note: the operating voltage of Anthracene crystal is between 750-1350 V.**

### 1.2. Counting different particles

The aim of this study is to compare the counts obtained by Anthracene crystal with alpha, beta and gamma sources.

## METHOD

1. Set up the experiment geometry.
2. Adjust the following settings on ST7 counting system.
  - Count type : Integral
  - Window :0
  - Threshold :0,5
  - Count :500000
  - Time :30 s
  - High Voltage: : Set the value which is found in the first experiment.
  - Sources :<sup>241</sup>Am (alpha), <sup>204</sup>Tl (beta), <sup>60</sup>Co (gamma).
3. Acquire the required counts in the given order to Table 2 and fill Table 2. Place every source on the circle where its name is written.

Table 2

	Source	Count	Net Count
1	Background		
2	$\alpha$		
3	$\alpha$ + 1 sheet of paper (8 mg/cm <sup>2</sup> )		
4	$\alpha$ + 2 sheets of paper (16 mg/cm <sup>2</sup> )		
5	$\alpha$ + $\beta$ + 2 sheets of paper		
6	$\beta$ + Al (27 mg/cm <sup>2</sup> )		
7	$\beta$ + 2 Al		
8	$\alpha$ + $\beta$ + Al (27 mg/cm <sup>2</sup> )		
9	$\alpha$ + $\beta$ + $\gamma$		
10	$\alpha$ + $\beta$ + $\gamma$ + Al(27 mg/cm <sup>2</sup> )		
11	$\alpha$ + $\beta$ + $\gamma$ + 2 Al		
12	$\alpha$ + $\beta$ + $\gamma$ + 3 Al		

## EVALUATION

Find the net count by subtracting the background from the count. Interpret the results.