Experiment 1

Adwait Naravane - 19MS151

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1 Introduction

To study the Geiger Muller Characteristic curve using a γ-source.

1. Obtain the operational characteristic curve for at least 30-50 readings of voltage.
2. Study the Gaussian distribution curve of decay counts.

2 Theory

Study of Nuclear reactions deals with length scales as small as $10^{-15}m$, which include products and trajectories of these products, therefore we use detectors to amplify these interactions to get an accurate picture of these reactions and the products.
The Geiger Counter is a Gas filled detector used for detection of all kinds of radiations i.e. alpha, beta Gamma radiations. It consists of a pair of electrodes surrounded by Helium or Argon gas. When radiation from source enters the tube, it ionises the gas molecules. The ions (and electrons) are attracted to the electrodes and an electric current is produced. And we get a count everytime the radiation ionises the gas.
For proper use, the voltage across the electrodes must be appropriate, for low voltages, no counts are recorded as the electric field is too weak to record a pulse. The count suddenly shoots up at the starting potential of the tube, and then plateaus off. If the voltage is too high, we'll get near continuous discharge and damage the tube.

3 Observations and Figures

3.1 Part A

Data for Part A was collected for 54 voltage points with them being denser near the jump. The distance between the Cesium-137 Source and the Detector was kept at 12.3 *cm*.
The figure for the same is also presented.

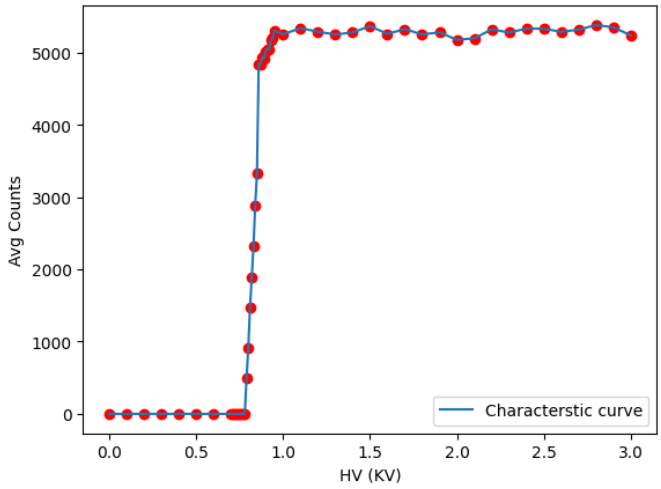

Figure 1: Characteristic curve

HV (KV)	Run1	Run2	Avg	HV (KV)	Run1	Run2	Avg
0.00	0	0	0.0	0.90	5020	5017	5018.5
0.10	0	0	0.0	0.91	5084	5021	5052.5
0.20	0	0	0.0	0.92	5046	5038	5042.0
0.30	0	0	0.0	0.93	5286	5044	5165.0
0.40	0	0	0.0	0.94	5269	5131	5200.0
0.50	0	0	0.0	0.95	5321	5287	5304.0
0.60	0	0	0.0	1.00	5200	5308	5254.0
0.70	0	0	0.0	1.10	5332	5344	5338.0
0.71	0	0	0.0	1.20	5218	5362	5290.0
0.72	0	0	0.0	1.30	5308	5193	5250.5
0.73	0	0	0.0	1.40	5210	5349	5279.5
0.74	0	0	0.0	1.50	5437	5295	5366.0
0.75	0	0	0.0	1.60	5244	5277	5260.5
0.76	0	0	0.0	1.70	5296	5353	5324.5
0.77	0	0	0.0	1.80	5314	5192	5253.0
0.78	0	0	0.0	1.90	5297	5263	5280.0
0.79	482	494	488.0	2.00	5230	5126	5178.0
0.80	939	876	907.5	2.10	5219	5175	5197.0
0.81	1460	1472	1466.0	2.20	5377	5268	5322.5
0.82	1892	1881	1886.5	2.30	5280	5278	5279.0
0.83	2327	2321	2324.0	2.40	5354	5311	5332.5
0.84	2956	2815	2885.5	2.50	5332	5331	5331.5
0.85	3314	3333	3323.5	2.60	5265	5312	5288.5
0.86	4874	4809	4841.5	2.70	5428	5207	5317.5
0.87	4838	4838	4838.0	2.80	5401	5364	5382.5
0.88	4853	5027	4940.0	2.90	5448	5253	5350.5
0.89	4993	4846	4919.5	3.00	5367	5112	5239.5

3.2 Part B

For Part B, the data and the figure have been presented. The distance was kept at 12.3 cm and the Voltage at 1.2 kV.

$$F(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-(x-\mu)^2/2\sigma^2}$$

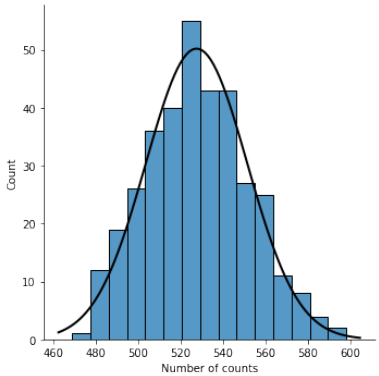

Figure 2: $\mu = 527.54, \sigma = 23.83$

Counts	Frequency	Counts	Frequency	Counts	Frequency
538	12	551	4	485	2
513	11	527	4	575	2
509	10	498	4	490	2
525	9	505	4	573	2
524	9	492	4	500	2
517	9	493	4	564	2
530	8	516	4	503	2
534	7	552	3	478	2
540	7	549	3	494	1
522	7	507	3	491	1
521	6	506	3	497	1
528	6	556	3	469	1
536	6	559	3	487	1
537	6	504	3	484	1
523	6	501	3	483	1
541	6	499	3	482	1
539	6	545	3	481	1
529	5	544	3	480	1
514	5	550	3	585	1
547	5	515	3	598	1
502	5	496	3	590	1
557	5	495	3	558	1
554	5	489	3	584	1
508	5	488	3	580	1
542	4	519	3	579	1
510	4	486	3	577	1
562	4	526	3	574	1
535	4	543	4 2	572	1
533	4	548	2	571	1
532	4	518	2	568	1
531	4	520	2	567	1
560	4	565	2	566	1
555	4	553	2	561	1
511	4	570	2	512	1

4 Conclusion

Characteristic curve obtained matches the theory, and the Geiger region was within 350-1000 V.
We can conclude that the Gamma radiation emission energy forms a normal distribution.