

### Experiment – 3

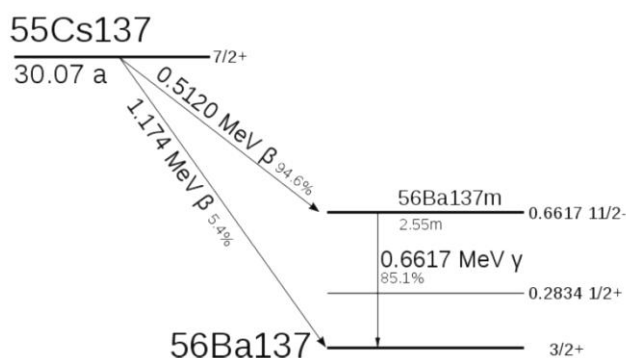
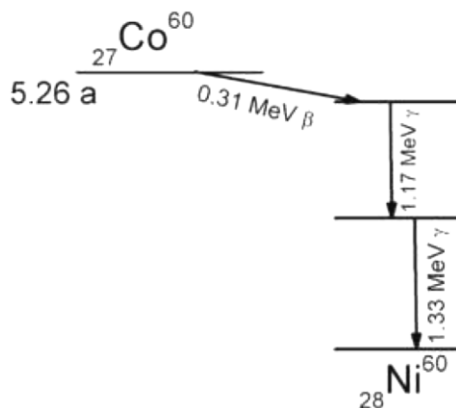
**Objective :** Study of gamma energy spectrum using a scintillation counter with Single Channel Analyzer (SCA).

**Sources :**  $\gamma$ -ray source =  $\text{Co}^{60}$  (two peak) or  $\text{Cs}^{137}$  (one peak)

#### Scope of Expt :

- Set the PMT voltage (750) and gain (5.0X). Observe the amplifier pulse on the Oscilloscope.
- Set the window voltage so that you have enough no. of points in the spectrum and the peak.
- Vary baseline in convenient steps. Note the counts as a function of baseline for a given window.
- Take a plot of the spectrum by using Origin or excel.
- Determine the resolution of the peak.
- Sketch pulse shapes for preamp output, amplifier output and SCA output.

**Theory :** Write necessary theory for  $\gamma$ -ray interaction with matter. Decay of  $\gamma$ -ray sources like  $\text{Co}^{60}$ ,  $\text{Cs}^{137}$ , About scintillation detector, Photo-multiplier tube etc..

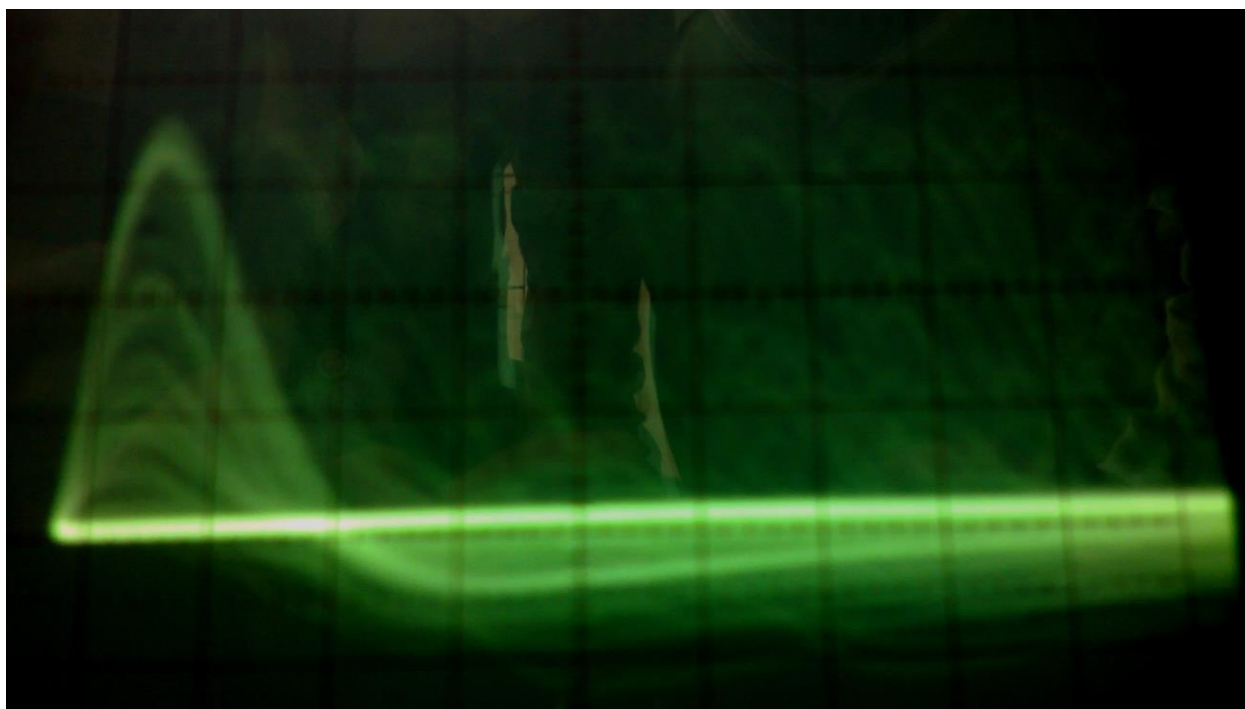


**Window :** 10 Rotation pot = 0 ~ 2 Volts

**Baseline :** 10 Rotation pot = 0 ~ 10 Volts

#### Experimental Procedure :

Connect the output of the amplifier to the oscilloscope and look at the signal pattern. Then adjust the gain so that no pulse gets cut off and noted down the peak voltage of the most bright line, which should correspond to the photopeak.



[ Amplifier output as displayed in CRO ]

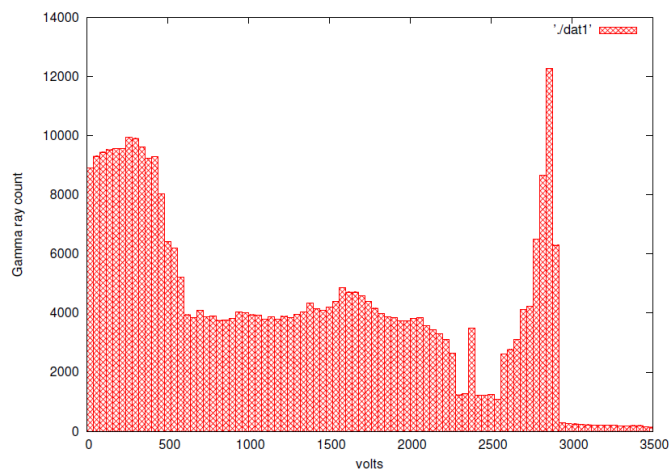
Keep the window fixed at **20 mV** and varied the baseline in **steps of 40mV** from 20mV to 3500mV. Each reading should be taken for 30 sec and two (2) readings to be averaged for each baseline.

**Table :**

baseline(mV)	count	baseline(mV)	count	baseline(mV)	count
20	8923.25	260	9961.25	500	6417.25
60	9309	300	9910.5	540	6197.25
100	9446.75	340	9613	580	5226
140	9528.25	380	9237	620	3943.25
180	9567	420	9299.5	660	3838.25
220	9575	460	8045	700	4082.25

740	3871.5	1700	4597	2660	3108
780	3897	1740	4392	2700	4123.5
820	3751.5	1780	4161	2740	4233.5
860	3755	1820	3994.5	2780	6507
900	3829.5	1860	3864	2820	8662.5
940	4030	1900	3839	2860	12267.5
980	4024	1940	3748.5	2900	6299
1020	3944	1980	3728.5	2940	282.5
1060	3921.5	2020	3816.5	2980	271
1100	3798.5	2060	3838	3020	250
1140	3875	2100	3570.5	3060	236.5
1180	3795.5	2140	3429	3100	220.5
1220	3890.5	2180	3303.5	3140	217
1260	3856.5	2220	3101	3180	213.5
1300	3949	2260	2635.5	3220	212
1340	4050.5	2300	1236	3260	212
1380	4336	2340	1263.5	3300	181.5
1420	4142	2380	3482	3340	180.5
1460	4091.5	2420	1213	3380	193
1500	4200	2460	1231.5	3420	194.5
1540	4386	2500	1239	3460	158
1580	4858.5	2540	1096	3500	138.5
1620	4711	2580	2623		
1660	4709.5	2620	2765		

**Graph :**



$\gamma$  spectrum for  $^{137}_{55}\text{Cs}$

**Conclusion :** Write your conclusion on the above observations.