Alpha Particle Lab

1) $R_1 = 10\ k\Omega$ ± 5%

$R_2 = 82\ k\Omega$ ± 5%

$C_F = 1\ pF$ ± 5% (assumed)

$$G_2 = \frac{R_2}{R_1 C_F} = \frac{82k}{(10k)(1p)} = (8.2 \pm 0.7)\times 10^{12}\ V/C \quad (F^{-1})$$

2) $G_1 = 0.0264 \pm 0.001$ electrons/eV or C/J

$E_\alpha = 5.486\ MeV = 8.7896 \times 10^{-13}\ J$

$V_{pp} = G_1 \cdot G_2 \cdot E_\alpha = 1.90 \pm 0.16\ V$

3) Estimated typical pulse $\approx$ 352.46 mV

Data Used   All voltages ± 3 mV

Amp - 479.9 mV

=> 10% - 48.0 mV

=> 90% - 431.9 mV

10% to 90% rise time - $2.69 \pm 0.10\ \mu s$

=> 37% - 177.6 mV

100% to 37% decay time - $74.11 \pm 0.10\ \mu s$

times measured have appropriate magnitudes

4)

Peak	Peak heights [mV] (± 3 mV)
1	485
2	531
3	476
4	496
5	509
6	518
7	435
8	394
9	365
10	611

5) $0.8\ \mu Ci = 2.96 \times 10^4$ decays/s

Measured over 120s period - cutoff at 800 bins => 56 mV

Estimated total counts $= (2.96\times10^4$ decays/s$)(120s)$

$= 3.552 \times 10^6$ decays

Measured total counts = 351083 counts

This count is likely off because the ^{241}Am radiates in every direction and the sensor only detects around 10% of the decayed particles

6) Stopping power at 5 MeV = S = 1000 MeV cm^2/g

Mylar density = 1.4 g/cm^3

Air density = 1.2×10^{-3} g/cm^3

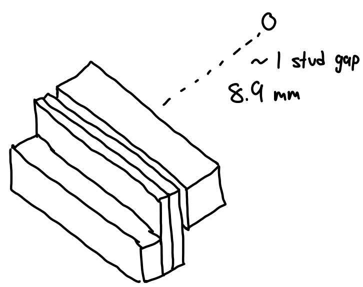
For Mylar $0 = 5\,MeV - 1000\,MeV\,cm^2/g \cdot 1.2 \times 10^{-3}\,g/cm^3\,\Delta d$

$\Delta d = 4.2\ cm$

For Mylar $0 = 5\,MeV - 1000\,MeV\,cm^2/g \cdot 1.4\,g/cm^3\,\Delta d$

$\Delta d = 3.6 \times 10^{-3}\ cm$

7) We will measure the energy with different numbers of Mylar sheets (2.5 μm) between the ^{241}Am and detector. The air cannot be considered negligable due to the gap needing to be large enough to fit the Mylar sheets.



Distance between ^{241}Am and detector - 8.9 mm

$0 = 5\,MeV - 1000\,MeV\,cm^2/g \cdot \left(1.2 \times 10^{-3}\,g/cm^3\,(0.89) + 1.4\,g/cm^3\,\Delta d\right)$

$\Delta d = 2.8 \times 10^{-3}\ cm$

$\frac{\Delta d}{2.5\mu m} = 11.2$

∴ We can use ~11 sheets of Mylar

all Multichannel Analyser settings are the same as part 5