Gamma Spectroscopy Notes

Detector gets 6 sig figs

Nuclear excitation states rely on strong force

Nucleus from α or β decay can be excited allowing γ decay.

α decay relies on tunneling; α particles are very stable

Visible light $\rightarrow$ 1.3 [eV] Lifetime of a free n is 15 minutes

Neutrons are slightly heavier than protons; this is what causes decay

"Channel" refers to bin # in the software

Samples have been here 7 years - short $t_{1/2}$ lives wouldn't stick around

Both single gamma-ray emitters

Relatively inexpensive

Acquire > Start

File > Save As (*.CNF) to Desktop

On desktop, Cnf2txt.exe or cnf2txtall.bat

Start > Gamma Acquisition & Analysis

Can open *.txt in Excel using delimiting

A channel, C, is counts, rest is trash

$$\lambda_c = \frac{h}{m_e c} \qquad \Delta\lambda = \lambda' - \lambda_0 = \lambda_c(1-\cos\theta)$$

$$E = \frac{hc}{\lambda_c} = \frac{hc^2 m_e}{h} = 511\ [\text{keV}]$$

So, for e^+/e^- pair production 1.022 [MeV] from γ

$C = mE + b$ (m: slope (not mass!); C: Channel; E: Energy)

$$\boxed{E = \frac{C-b}{m}}$$

$$\sigma_E^2 = \sigma_C^2 \frac{1}{m^2} + \sigma_b^2 \frac{1}{m^2} + \sigma_m^2 \frac{(C-b)^2}{m^4}$$