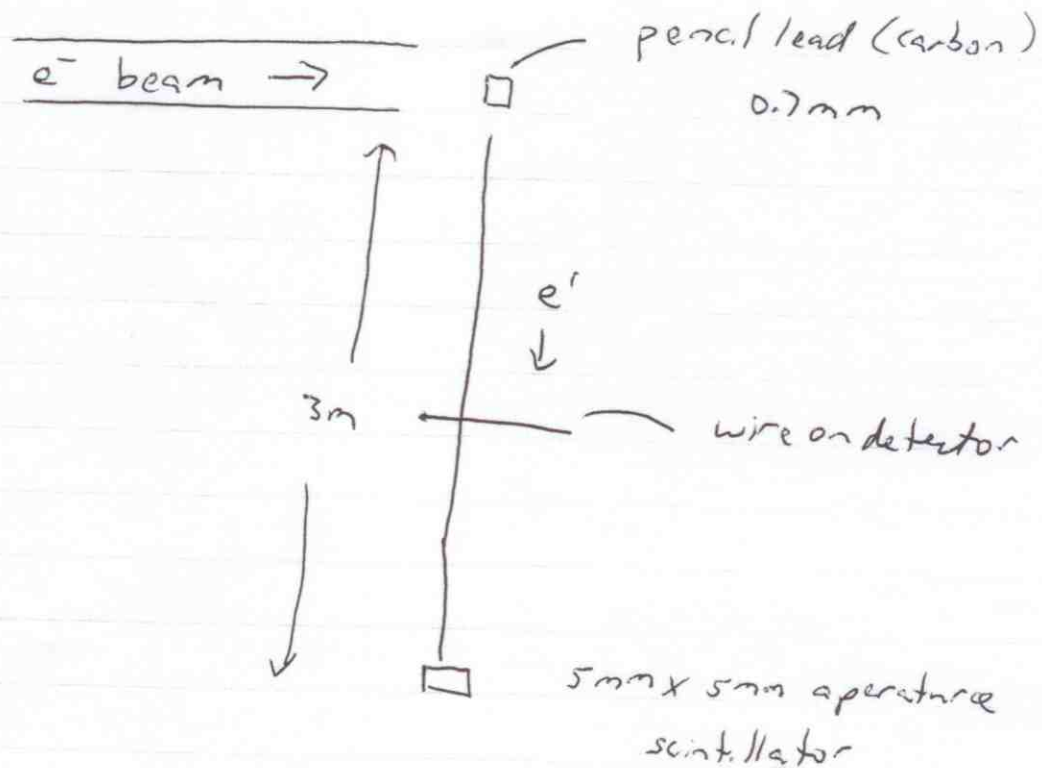


6/14/07

A Detector Test Facility Utilizing Elastic Electron Scattering

Geometry:



Target thickness:

$$\rho_c = 2.3 \text{ g/cm}^3$$

$$\text{atoms/cm}^2 = 2.3 \text{ g/cm}^3 \times \frac{6 \times 10^{23} \text{ atoms}}{12 \text{ g}} \times 7 \times 10^{-2} \text{ cm}$$

$$= 8 \times 10^{21} \text{ atoms/cm}^2$$

Solid angle:

$$\Delta\Omega = 4\pi \frac{(5 \times 10^{-3} \text{ m})^2}{4\pi (3 \text{ m})^2}$$

$$= 2.8 \times 10^{-6} \text{ sr}$$

$$\left. \frac{d\sigma}{d\Omega} \right|_{\text{mott}} (E = 25 \text{ MeV}, \theta = 90^\circ) = 16.6 \mu\text{b/sr}$$

(from /utils/mott.f)

$$E' = 24.94 \text{ MeV} \quad \vec{\beta} = 35.3 \text{ MeV}/c$$

Prob electron from beam hits scintillator

$$\text{Prob} = 16 \times 10^{-6} \times \frac{10^{-24} \text{ cm}^2}{\text{sr}} \times 2.8 \times 10^{-6} \text{ sr} \times \frac{10^{22} \text{ atoms}}{\text{cm}^2}$$

$$= 4.5 \times 10^{-13}$$

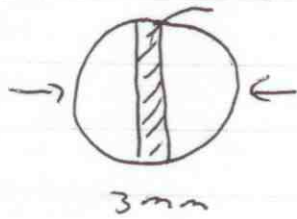
Let's say $2 \mu\text{C/pulse}$ (44 MeV Short Pulse Accelerator)

$$2 \times 10^{-6} \text{ C} \times \frac{1 \text{ e}^-}{1.6 \times 10^{-19} \text{ C}} = 10^{13} \text{ e}^-/\text{pulse}$$

"Miss factor"

- Beam is bigger than target

c target, 0.7mm



$$\text{miss factor} = \frac{3\text{mm} \times 0.7\text{mm}}{\pi (1.5\text{mm})^2}$$

$$= 0.3$$

$$\text{Rate} = \frac{100\text{ pulses}}{\text{sec}} \times \frac{10^{13} \text{ e}^-}{\text{pulse}} \times 0.3 \times 4.5 \times 10^{-13}$$

$$\text{Rate} = 135 \text{ Hz}$$