Nuclear reaction rate

Reaction rate (**thick target**): $R\left[s^{-1}\right] = \phi_p\left[s^{-1}\right] - \phi\left[s^{-1}\right] = \phi_p\left[s^{-1}\right] - \phi_p\left[s^{-1}\right] \cdot e^{-N_t\left[cm^{-2}\right]\sigma\left[cm^2\right]}$

$$\phi\left[s^{-1}\right] = \phi_p\left[s^{-1}\right] \cdot e^{-\frac{x\left[g/cm^2\right] \cdot 6.02 \cdot 10^{23} \sigma\left[cm^2\right]}{A[g]}}$$

Reaction rate (**thin target**): $R\left[s^{-1}\right] \cong \phi_p\left[s^{-1}\right] \cdot N_t\left[cm^{-2}\right] \cdot \sigma\left[cm^2\right]$

$$R\left[s^{-1}\right] \cong \phi_p\left[s^{-1}\right] \cdot \frac{x\left[g/cm^2\right] \cdot 6.02 \cdot 10^{23}}{A[g]} \cdot \sigma\left[cm^2\right]$$

Example: $^{238}U\ \left[1 \cdot 10^9\ s^{-1}\right] on\ \ ^{208}Pb\ \ x = 1.3\left[g/cm^2\right] \rightarrow {}^{132}Sn\ (\sigma = 15.4[mb])$

Reaction rate: 57941[s^{-1}] transmission (SIS/FRS)=70%, transmission (FRS) 1.9%

$1 - e^{-y} \cong y \qquad for\ \ y = 0.02$