Nuclear reaction rate

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

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

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

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

Example: \[ ^{238} U \left[ 1.10^9 \ s^{-1} \right] \text{on} \ ^{208} Pb \ \ x = 1.3 \left[ g/cm^2 \right] \rightarrow ^{132} Sn \ (\sigma = 15.4[mb]) \]

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

\[ 1 - e^{-3} \approx y \quad \text{for} \quad y = 0.02 \]