You need to measure elastic scattering angular distribution $^7Li+^{12}C$ at E_{lab}=100 MeV.

Define the experimental condition for this measurement :

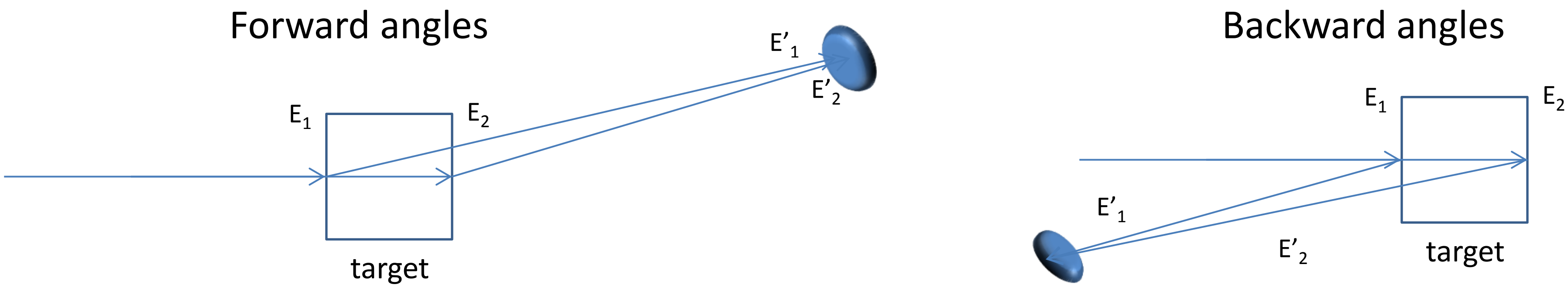
1) Verify if a target thickness of 200 μgr/cm^2 is ok for discriminating elastic from inelastic scattering measurement up to 150^0.
2) Si-Detector thicknesses (verify if a 15 μm ΔE detector is ok for your purposes)
3) Angular resolution (target angular straggling, beam emittance)

Knowing that:

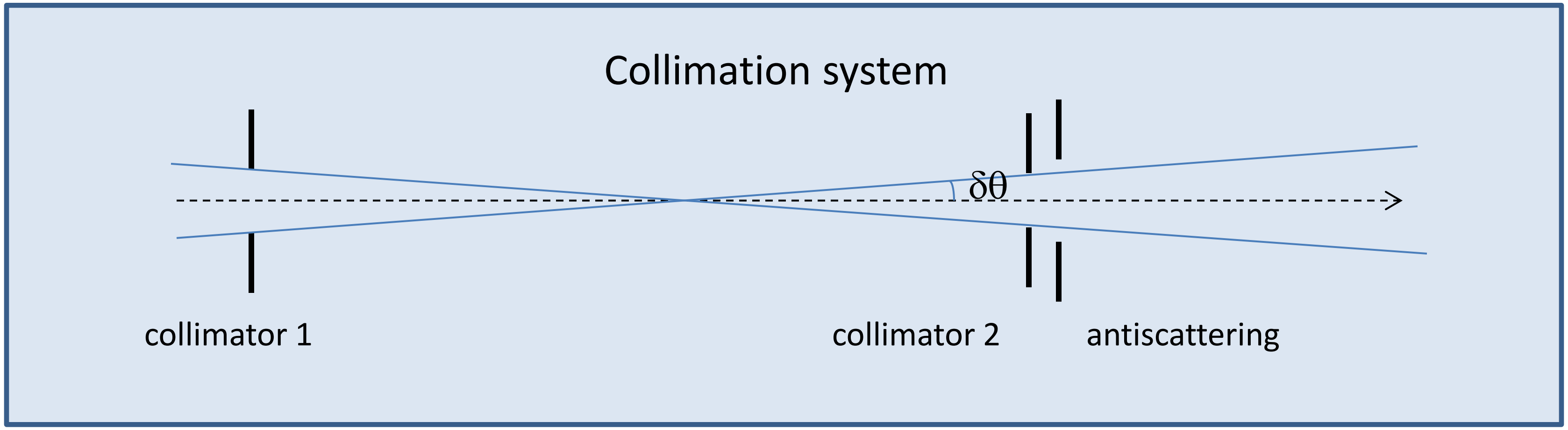
1) You need to separate elastic scattering from the inelastic excitation of ^7Li (E_x=0.48 MeV)
2) You need to identify ^7Li using a ΔE-E technique (choose ΔE thickness). Detection threshold 0.5 MeV.
3) Your beam transverse emittance is $\Delta\phi\Delta\theta=1/\beta$ πmm.mrad ($\gamma=1$) and the beam spot size is 3mm.
4) You have to design a collimation system to limit your angular resolution at forward angles to 0.2^0 knowing that the distance between the collimators is 1 m.
5) You want to measure at very large angles θ H$=150^0$.

Use LISE++

Remember that:



Normalised beam emittance $\Delta\phi\Delta\theta=\varepsilon/\beta\gamma=1\ \pi$ mm.mrad

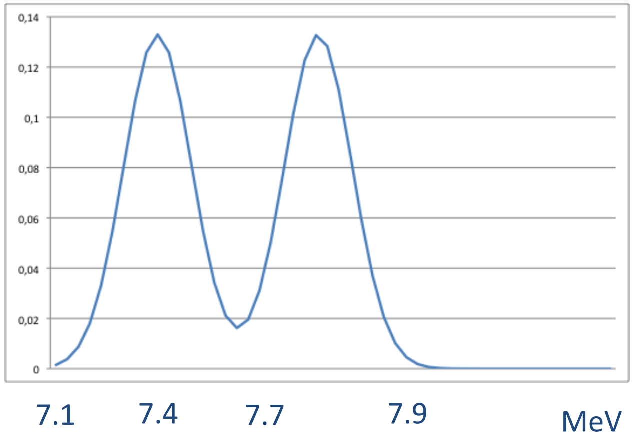


At forward angles the ^{7}Li beam energy is around 100 MeV → need to choose a ΔE detector thickness where the energy deposited by the ^{7}Li is sufficiently above the detection threshold.

For ΔE=15 μm E_{loss}(^{7}Li 100MeV) ≈900 keV
E_{loss}(^{7}Li 8 MeV from kinematics) ≈5.7 MeV $E_{residual}$=2.3 MeV

Target thickness 200 μgr/cm^2 E_{loss} in target at 150^0 to be evaluated if you energy resolution is an issue.

Condition 1: no beam energy loss E given by kinematics → E_{7Li}=7.91 MeV
Condition 2: E_{loss} of the beam in the whole target → kinematics→ E_{loss} of particle in the target thickness t/cos($\pi-\theta$)= 0.250 MeV



Beam emittance:

$\varepsilon = 1/\beta\gamma\ \pi$ mm.mrad

$$\beta = \sqrt{\frac{2E}{m}} = \sqrt{\frac{2 \times 100\,MeV}{7 \times 931\,MeV}} = 0.175$$

$$\varepsilon = \frac{1}{0.175} = 5.71\pi mm.mrad$$

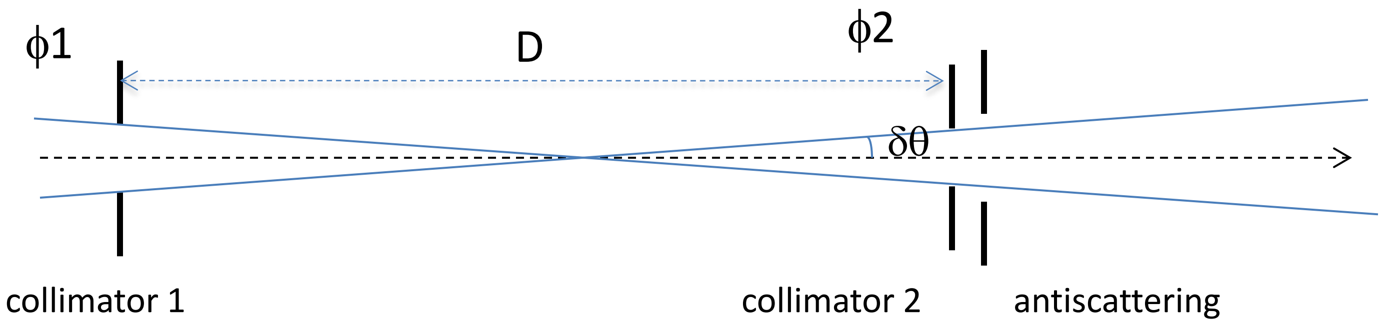
$$\Delta\phi\Delta\theta = 5.71\pi mm.mrad$$

$$\Delta\theta = \frac{5.71\pi}{3} mrad = 5.97 mrad = 0.34^{0}$$

$$\delta\theta = \sqrt{\delta\theta^2_{beam} + \delta\theta^2_{straggling}}$$

Target angular straggling at forward angles $\delta\theta$H0.05^0 FWHM

Target angular straggling at $\theta=150^0$ $\delta\theta$H0.6^0 FWHM



φ1= diameter of collimator 1
φ2= diameter of collimator 2
D= distance between the two collimators= 1000 mm
$\delta\theta = 0.2^0$

$$\frac{1}{2}(\phi_1 + \phi_2) = D \sin\delta\theta = 3.5mm$$

If you want a beam spot of 3 mm → φ2=3, φ1=4