

PROBLEM 3

$$f_0 = 402.5 \text{ MHz}$$



$$\Delta\phi = 2\pi f_0 \Delta t$$

↳ Calculate velocity

$$\beta = \frac{v}{c} = \frac{\Delta z}{\Delta t c} \Rightarrow \beta = \frac{2\pi f_0}{c} \frac{1}{\left(\frac{\Delta\phi}{\Delta z}\right)^{-1}}$$

↳ Quantity calculated from fit in problem3.ipynb.

$$\gamma = \frac{1}{\sqrt{1-\beta^2}} \Rightarrow E_{\text{kin}} = (\gamma - 1) m_p c^2$$

↓ Plugging in numbers

$$\frac{\Delta\phi}{\Delta z} = 6629.4543... \left[\frac{\text{deg}}{\text{m}} \right]$$

$$f_0 = 402.5 \text{ MHz}$$

c : speed of light
 m_p : proton mass



$$E_{\text{kin}} = 2.504 \text{ MeV}$$