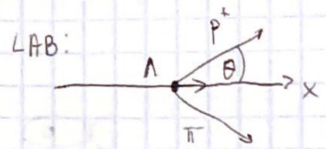
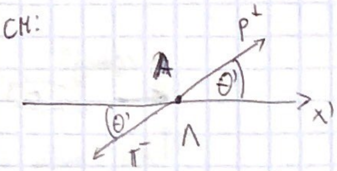
4.

LAB:



CM:



$p_p' = -p_\pi'$ $\quad p_0' = p_k' = 0$

$E_0 = m_\Lambda c^2$

$E_0 = E_k = \sqrt{m_p^2 c^4 + p_p'^2 c^2} + \sqrt{m_\pi^2 c^4 + p_p'^2 c^2}$

chcemy p_p'

$$m_\Lambda c^2 = \sqrt{m_p^2 c^4 + p_p'^2 c^2} + \sqrt{m_\pi^2 c^4 + p_p'^2 c^2}$$

$$m_\Lambda^2 c^4 = m_p^2 c^4 + p_p'^2 c^2 + m_\pi^2 c^4 + p_p'^2 c^2 + 2\sqrt{(m_p^2 c^4 + p_p'^2 c^2)(m_\pi^2 c^4 + p_p'^2 c^2)}$$

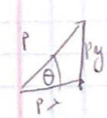
$$\left[c^4 (m_\Lambda^2 - m_p^2 - m_\pi^2) - 2 p_p'^2 c^2\right]^2 = 4 m_p^2 m_\pi^2 c^8 + 4 m_p^2 c^6 p_p'^2 + 4 m_\pi^2 c^6 p_p'^2 + 4 c^4 p_p'^4$$

$$c^8 (m_\Lambda^4 + m_p^4 + m_\pi^4 - 2 m_\Lambda^2 m_p^2 - 2 m_\Lambda^2 m_\pi^2 - 2 m_p^2 m_\pi^2) = 4 p_p'^2 c^6 m_\Lambda$$

$$(m_\Lambda^2 + m_p^2 - m_\pi^2)^2 - 4 m_\Lambda^2 m_p^2$$

$$p_p'^2 = c^2 \frac{(m_\Lambda^2 + m_p^2 - m_\pi^2)^2 - 4 m_\Lambda^2 m_p^2}{4 m_\Lambda}$$

$$p_p' = \frac{c}{2} \sqrt{\frac{(m_\Lambda^2 + m_p^2 - m_\pi^2)^2 - 4 m_\Lambda^2 m_p^2}{m_\Lambda}}$$



$p'_x = \cos\theta' p_p'$ $\quad p_y' = \sin\theta' p_p' = p_y$

$$p_x = \gamma \left(p'_x + \frac{E_p'}{c^2} v\right) = \gamma \left(\cos\theta' p_p' + \frac{E_p'}{c} \beta\right)$$

$$\mathrm{tg}\,\theta = \frac{p_y}{p_x} = \frac{\sin\theta' p_p'}{\gamma\left(\cos\theta' p_p' + \frac{E_p'}{c}\beta\right)} = \frac{\sin\theta' p_p' c}{\gamma(\cos\theta' c p_p' + E_p' \beta)}$$

gdzie $\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$ $\quad \beta = \frac{v}{c}$ $\quad E_p' = \sqrt{m_p^2 c^4 + p_p'^2 c^2}$

p_p' wyżej