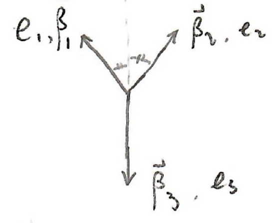
15.15 (a) The pions start from zero velocity. Using the result of Prob. 15.4(a)

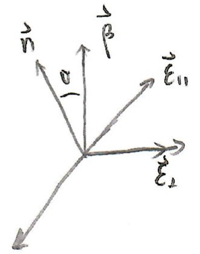


$$\vec{E} = \left(\frac{e_1 \vec{\beta}_1}{1-\vec{n}\cdot\vec{\beta}_1} + \frac{e_2 \vec{\beta}_2}{1-\vec{n}\cdot\vec{\beta}_2} + \frac{e_3 \vec{\beta}_3}{1-\vec{n}\cdot\vec{\beta}_3} \right) e^{-i\omega\vec{n}\cdot\vec{r}(0)/c}$$

$$\sim \left(e_1\vec{\beta}_1 + e_2\vec{\beta}_2 + e_3\vec{\beta}_3 \right) e^{-i\omega\vec{n}\cdot\vec{r}(0)/c} ,$$

for non-relativistic particles. Also notice that $e_1 = e_2 = -e_3 = e$, and $\vec{\beta}_1 + \vec{\beta}_2 = -\vec{\beta}_3$ due to momentum conservation, we can write $\vec{E}$ as

$$\vec{E} = -2e\vec{\beta}_- e^{-i\omega\vec{n}\cdot\vec{r}(0)/c}$$



where $c\vec{\beta}_-$ is the velocity of the π^- pion. Then,

$$\frac{d^2I}{d\omega d\Omega} = \frac{1}{4\pi^2 c} \sum_\lambda \left| \vec{\varepsilon}_\lambda^{\,*}\cdot\vec{E} \right|^2 = \frac{1}{4\pi^2 c} \left| \vec{\varepsilon}_{\parallel}^{\,*}\cdot\vec{E} \right|^2$$

$$= \frac{e^2}{\pi^2 c} \beta_-^2 \sin^2\theta$$

For non-relativistic pion, its kinetic energy is

$$T_- = \frac{1}{2} m_\pi v^2 = \frac{1}{2} m_\pi c^2 \beta_-^2 ,$$

or $$\beta_-^2 = \frac{2T_-}{m_\pi c^2} .$$

Then,
$$\frac{d^2I}{d\omega d\Omega} = \frac{2e^2}{\pi^2 c} \frac{T_-}{m_\pi c^2} \sin^2\theta .$$