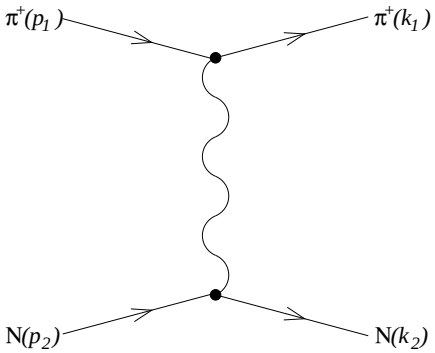
Physics 565 - Fall 2010, Assignment #5, Due March 10th

1. Show that the flux factor,

$$F = 4\sqrt{(p_1 \cdot p_2)^2 - m_1^2 m_2^2} \tag{1}$$

can be expressed as $F = 4p_1^* \sqrt{s}$ in the center-of-mass frame and as $F = 4m_2 p_1^{\rm lab}$ in the lab frame.

2. Calculate the differential cross section, $d\sigma/dy$ for elastic scattering of pions from a target composed of spin-0 nuclei of mass M. That is, evaluate the invariant amplitude corresponding to the Feynman diagram:

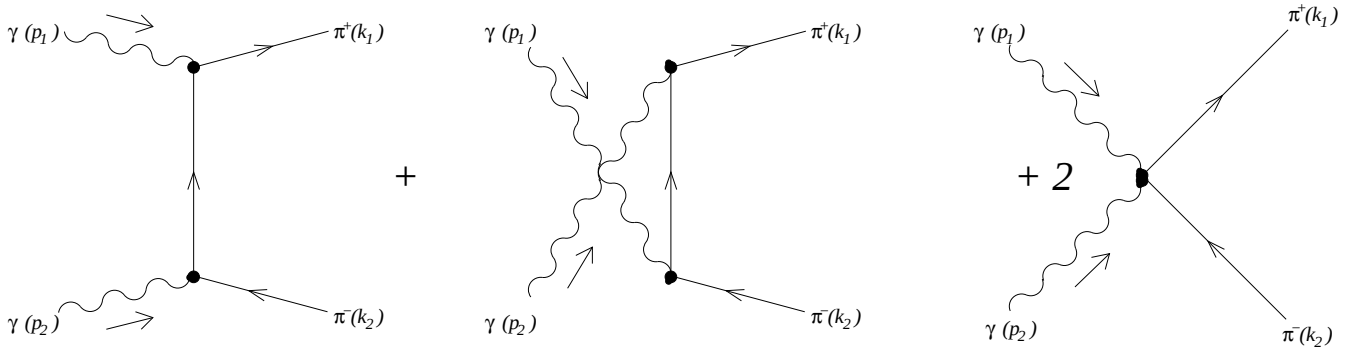


and calculate the differential cross section,

$$\frac{d\sigma}{dy} = -2EM\frac{d\sigma}{dt} \tag{2}$$

where $y = (E - E')/E$ is the fractional energy loss of the scattered pion.

3. Calculate the differential and total cross section for pion production in photon-photon collisions by evaluating the invariant amplitude corresponding to the Feynman diagrams:



That is, calculate the differential cross section for observing a π^+ scattered into an element of solid angle $d\Omega$ in the center-of-mass frame of the colliding photons. Assume that the photon beams are unpolarized.