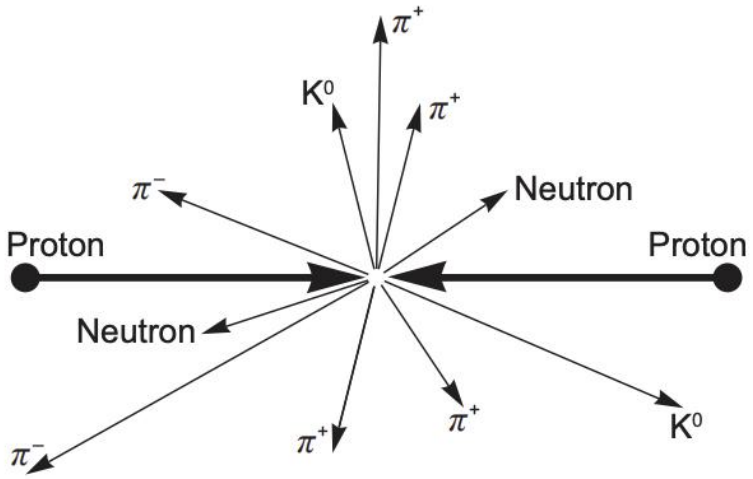
Question 14 **(14 marks)**



Two protons, travelling at 0.9500 c in opposite directions relative to an observer in the laboratory, collide. A possible outcome of the collision is depicted in the diagram above. The two protons are annihilated and two neutrons, six π mesons and two K mesons are produced.

(a) Calculate the momentum of either proton in the laboratory's frame of reference. (3 marks)

Answer: _____ kg m s^{-1}

(b) Determine the total momentum of the two protons as measured in the laboratory frame of reference. (1 mark)

Answer: _____ kg m s^{-1}

(c) Calculate the momentum of one proton in the other proton's frame of reference. Give your answer to **four** significant figures. (6 marks)

Answer: _____ kg m s^{-1}

(d) Calculate the total energy of the particles produced in the collision, as measured by the observer in the laboratory. Give your answer to **three** significant figures. (4 marks)