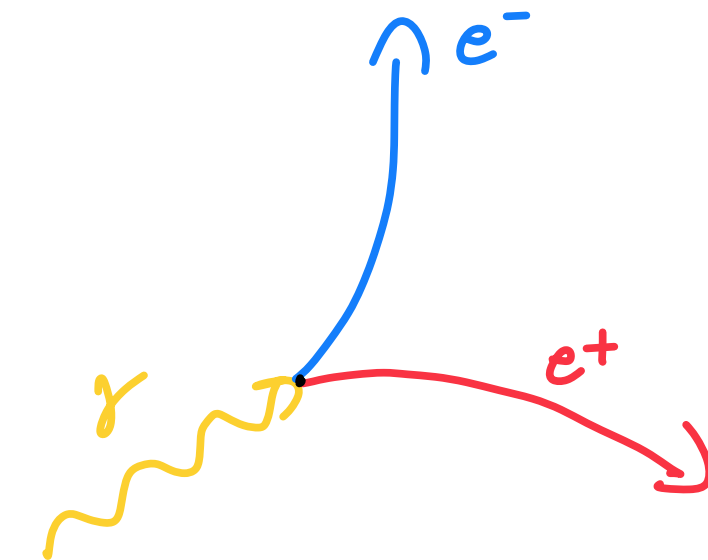


Homework 09.06.2021

A) Photons make in material a conversion into an electron-positron pair:

$$\gamma \rightarrow e^+e^-$$

Given an average number of electrons and positrons measured per event of 9 and an electron/positron reconstruction efficiency of $\varepsilon_{\text{eff}} = 0.7$ and an acceptance of $\varepsilon_{\text{acc}} = 0.8$, how many photons do we reconstruct on average per event? Assume that all electron/positron are only from gamma conversions. How many photons were originally produced per event on average?



B) Assume now that 20 gammas are produced per event. All of them are from π^0 decays:

$$\pi^0 \rightarrow \gamma\gamma \rightarrow e^+e^- + e^+e^-$$

With the efficiencies and acceptance from A), what is the measured integrated signal to background ratio? Hint: one doesn't know which photons need to be combined for the π^0 .

$$\Sigma = \frac{S}{\sqrt{S+B}} \quad \text{Significance}$$

C) Given a signal-to-background ratio S/B of 0.001 at a certain di-lepton M_{ee} bin and a production rate of 0.1 per event for this bin. Assume the background determination has no error, how many events are needed to get a significant signal (significance ≥ 3)?