Homework #5

- How much energy is lost on average via transition radiation by a 20 GeV charged pion if in the same detector a 20 GeV electron loses on average 200 keV? And if it is a 20 GeV proton?

- What is the mean free path of 2 MeV and 2 GeV photon in Lead and in Silicon? How thick material is needed to absorb 99.9% of the photons? Use information from the Particle Data Book.

- Calculate the energy absorbed via Compton-scattering as a function of the scattering angle. What will be the energy of a 511 keV photon after it scattered by 90 degree or by 180 degree?

- At which distance shall we place the STOP counter of a 50 ps time resolution time-of-flight detector if we intend to separate 2 GeV/c momentum pions, kaons and protons?

- In the CMS detector there is about 0.35 - 2 radiation length material before the electromagnetic calorimeter depending on the pseudorapidity. How does it affect our ability to reconstruct precisely high energy photons created in the decay of the Higgs boson?