Particle Interactions with matter

The purpose of a particle physics detector is to measurement the 4-momenta of all particles produced in a collision and to identify the particle types.

Particles primarily interact with the matter of the detector via electric force, as it is long range (remember that solids are mostly empty space). The strong force will also play a role, but we will ignore this for now and come back to it when we discuss calorimetry. The type of interaction, however, varies with the energy of the particle. We can sometimes think of the electric force as being composed of photons. Higher energy particles can emit higher energy photons. The wave length of the photon, as we discussed earlier, is related to the photons energy. The interactions of those photons with bulk matter will be different if this wave length is short compared to the spacing of the atoms or long compared to this spacing.

## Interactions of charged particles with matter

## Interactions of gamma rays with matter

Here we call them “gamma rays” instead of photons because we are going to discuss only those photons of interest to particle physics: ones with energies above a kev or so.