Introduction

The aim of this simulation is to determine an optimal experimental setup for detecting the decay of charged kaons (*K*+) into a charged and a neutral pion (*\_*+ and *\_*0).

Figure 1: Experimental setup

As shown in figure 1 the initial beam of *K*+ is measured in detecor 1 and the resulting pions are observed by detector 2. The second detector is a circular disc with a radius of 2 meters. Depending on

* the location of the decay on the z-axis and
* on the decay angle (in the K+ rest frame)

the pions will possibly not travel through the pion detector. Thus, the closer the second detector to the first one the bigger the probability that the pions are detected. However, if the detector is too close to the first one it may happen, that the kaons decay after the detector and will therefore not be detected. Given these two constraints there will be an optimal distance between the first and the second detector which should be computed with the following simulation.

In a first part of this project the average decay length (the location on the z-axis) of a K+ is estimated based on a dataset consisting of decay lengths of kaons and pions. Subsequently we can simulate the location of the decay using a Monte-Carlo simulation for an exponential distribution. Further, some in the K+ rest frame isotropically (with even probability) distributed decay angles are generated and boosted into the laboratory frame. Finally, the percentage of decayed kaons that are detected (the acceptance of the downstream detector) can be determined.

The whole simulation is conducted twice, once assuming that the particle beam is parallel to the z-axis and once including a Gaussian distributed deviation from the z-axis of the particle beam.