In a first task we should estimate the average decay length of K+ using data (100’000 measurements of decay lengths, (dli)) of an already conducted experiment (see figure 1), where also a beam of particles with a fixed momentum of 75 GeV/c was used. However, the beam consisted only of 16% of K+. The remaining 84% consisted of π+ (with a known average decay length of βγcτπ = 4.188 km = adlπ+).

Figure 1 (Histogram)

To estimate the average decay length of K+ (adlK+) we used the method of maximum likelihood with the following equation, which was subsequently maximized:

(1.1)

The equation is constructed by two exponential distributions, weighted with the corresponding probability that a particle belongs to this distribution (with this parameters). Implementing this resulted in a maximum likelihood for an average decay length of K+ of (562 ± 10) m (see figure 2).

The error on was calculated by

(1.2)

Figure 2

From this can be calculated by

, (1.3)

where and with , , and .

This resulted in a maximum likelihood for at (1.235 ± 0.022) \* 10-8 s. Compared to the literature value of (1.2380±0.0020) \* 10-8 s this results seems reasonable.