SOLUTION FOR HOMEWORK ASSIGNMENT NO. 05

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Exercise 5.1

a) We are asked to find the position α for a given distance $\beta = 30$. To do this we maximize a likelihood function based on the probability $p(x;\alpha,\beta)$ which is given as

$$p(x;\alpha,\beta) = \prod_{i=1}^{n} \tag{1}$$

Exercise 5.2

After importing the dataset we plotted it to confirm that we indeed have a gaussian distribution

$$p(x;\mu,\sigma) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}. \tag{2}$$

The negative loglikelihood function then looks like

$$\begin{aligned} l(\mu,\sigma;x) &= \ln\left(\prod_{i=1}^{n} p(x_i;\mu,\sigma)\right) \\ &= \sum_{i=1}^{n}\left(-\ln\left(\sigma\sqrt{2\pi}\right) - \frac{(x-\mu)^2}{2\sigma^2}\right) \\ &= -\sum_{i=1}^{n}\left(\ln\left(\sigma\sqrt{2\pi}\right) + \frac{(x-\mu)^2}{2\sigma^2}\right) \end{aligned}$$

The resulting plot is illustrated in figure 1. The output by the fit is given in tabke 1.

Figure 1: Distribution of data points given in the file 'data_05.h'. The distribution of points seem to follow a gaussian distribution.

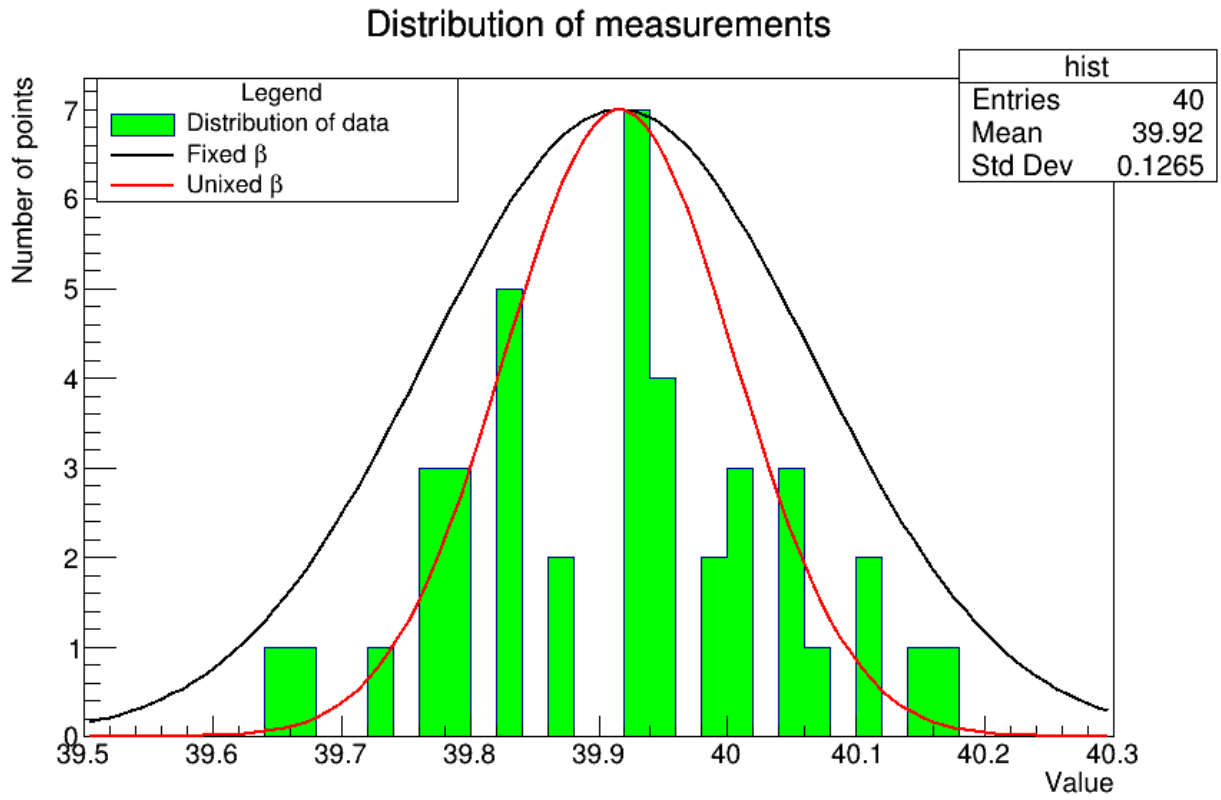

Table 1: Summary of all fitted parameters.

Parameter	**Value**	
	fixed σ	**unfixed** σ
μ	39.916	39.916
σ	0.15	0.089