# Fit function

* By coding equation 1,,

and plotting against the energy range 0-10 GeV, using the given values of the parameters, the **probability distribution** is obtained to be

Chart, histogram

Description automatically generated

* Also, we know from the given data the **simulated unoscillatory data** can be plotted to be: Chart, histogram

  Description automatically generated
* Therefore, the product of the upper two dist is the **theoretical oscillatory data dist**. Plotting along with the **given experimental data** we have: Chart, histogram

  Description automatically generated
* It can be seen that the gap at first is accounted, but the tail still deviates for some unknown reasons.

# Likelihood function

* By coding the NLL function

Text

Description automatically generated with medium confidence

for the given data, then taking u = as the only parameter, with m and L set as the previous given values, the NLL plot against to give

Chart, histogram

Description automatically generated

* The next step is to find the minimum and error of the minimum.
* For the minimum, the parabola minimization method is used and the **position of the minimum** is obtained and plotted to be 0.7853558966563745Chart, histogram

  Description automatically generated
* Then, to find the **error (standard deviation)**, the values corresponding to NLL\_min + 0.5 is obtained and plotted. Their difference is the standard deviation according to the instruction. Chart

  Description automatically generated
* Now we have the **estimated value** of



Note that I used

* Using the other method, estimating the error from curvature, where
  + The curvature is estimated using numerical calculus with h = 1e-4 (eqn 5.13 in note)
  + The error is estimated to be 0.07114480580876315

# 4. two dimensional minimization

## 4.1 The univariate method