



Exercises on Statistical Methods

Tools we shall use

- Primary the example scripts are written in python
- In addition, numpy, ROOT and Matplotlib, jupyter-notebook

Problem 1

- Goal - Muon lifetime measurement simulation
 - Example of unbinned fit
- Task 1 - Write a function to generate exponential random numbers → time measurements in real experiments
- Task 2 - Fit the exponential random numbers generated in task 1 and get the value of $\langle \tau \rangle$
- Task 3 -
 - Step 1 and 2 corresponds to 1 measurement of the lifetime. Now repeat the same for many experiments → ~ 100, 1000..
 - Plot the distribution of the $\langle \tau \rangle$
- Task 4 - Match the standard deviation of the $\langle \tau \rangle$ with the expected (σ/\sqrt{n}) from CLT

Problem 2

- Goal - Do a binned fitting using the method of maximum likelihood
- 1. Generate a binned exponential data
- 2. Fit the data using maximum likelihood
- 3. Check goodness of fit using chi-square
- 4. Repeat the exercise 1000 times and see the distribution of chi-squared.