

Homework 21.05.2021

- A) Download the code `Scan_cross_section_vs_sqrt_s.C`. The code contains the scanned data of σ_{tot} vs \sqrt{s} from pp collisions as shown in the lecture. Write a “brute force” minimization to perform a χ^2 fit to the data with the function given in the lecture: $\sigma_{\text{tot}} = Xs^\epsilon + Ys^{\epsilon'}$. The function with fixed parameters “ ϵ ” and “ ϵ' ” is already given in the code.
- B) Perform a standard ROOT fit independent from the brute force method. An example is given in your ROOT/tutorials/fit/fithist.C.
- C) You will soon realize that the given parameter of ϵ is not optimal and both fit methods don't converge perfectly. Modify ϵ to get a better fit. Do that either manually or by adding ϵ as a fit parameter to any of the two methods.
- D) In many cases data from papers and books isn't directly available to you. A way to get the data is to scan it. For this, one can use the easy-to-use program “xyscan”. xyscan software, available for Mac, Linux and Windows: <https://rhig.physics.yale.edu/~ullrich/software/xyscan/>. Install the software, scan the data on the right hand side figure (two graphs).
- E) Fit the data with the function shown in the figure. Use a method of your choice for fitting, e.g. brute force, ROOT fit.

Hint A: “Brute force” minimization: Step through the parameters “X” and “Y” from the function in a certain range with some step size. For every step calculate the χ^2 . Store always the best parameters with the smallest χ^2 . For simplicity you can also ignore the error σ in that case.

$$\chi^2 = \frac{1}{N} \sum_1^N \frac{|y_i - f(x_i)|^2}{\sigma_i^2}$$

