Physics 499

Homework Assignment 5
Chi-Square Analysis

Due Friday June 7th

Problem : Analysis of Z_0 resonance
Reference : CERN-EP-2000-148 OPAL PR 328 30 Novenber 2000

a) Write a computer program that will find the best fit to the following electron-positron cross section data at the Z_0 resonance:

C.M. Energy (GeV)	σ(nb)
88.251	4.669 ± 0.110
89.251	8.501 ± 0.130
90.249	18.899 ± 0.281
91.244	30.445 ± 0.130
92.235	21.400 ± 0.271
93.238	12.434 ± 0.180
94.235	7.947 ± 0.130

Try and fit the data with a Lorenzian function for the peak plus a constant background:

$$\sigma = \sigma_{max} \frac{(\Gamma/2)^2}{(E - E_0)^2 + (\Gamma/2)^2} + B \tag{1}$$

There are 4 constants to be determined from the fit. The Lorentzian has 3 parameters: peak height σ_{max}, peak center E_0, and the peak width Γ. The background has one parameter, B.

Your program should print out the values of the 4 parameters that minimize the χ^2 function from lecture, as well as the value of χ^2 for this minimum situation.

b) If you write the program in ROOT, in addition you can plot the data and the fit. Plotting the data (if done correctly) can compensate for mistakes in your code.

You should turn in (e-mail) two files: your computer code that will run in either gcc or ROOT, and a file discussing your results. For the discussion file, you can use straight text (*.txt) or latex. No *.doc files. Be sure your name is somewhere in each file you e-mail to me.