Exercises, part 11

Thursday 2004-01-15 - Thursday 2004-01-22

1. CDF paper on B_d^0 oscillation $\hfill$ 10 points

Please, read the paper
F. Abe et al. (CDF collaboration), 'Measurement of the $B_d^0\,\overline{B_d^0}$ Oscillation Frequency Using Di-muon Data in $p\bar{p}$ Collisions at $\sqrt{s} = 1.8\,\text{TeV}$', Phys. Rev. D60 051101 (1999).

i) Please answer the following questions / perform the following tasks:

a) Estimate the relative fractions of B_d^0, B_s^0, $B^\pm$ and Λ_b production (at the Tevatron).

b) Which assumptions/approximations have been made with respect to the formula on page 4 ?

c) How can a primary (negative) b quark yield a (positive) μ^+ ? List three possibilities.

d) Explain - with the help of an example - the correlation between d and ϕ. Illustrate for one hypothetical event how the $d - \phi$ plot looks like.

e) Take figure 2 and perform a crude fit 'by eye and pencil' of the expected oscillation curve to the CDF data: which value of Δm_d do you get ?

f) Take figure 2 and draw by hand the expected B_s^0 (!) oscillation curve if $x_s = 25$.

g) If it is not possible to measure the time evolution, and if only the total number of same-sign and opposite-sign dimuon pairs is measured - can this tell us something about B_d^0 oscillations ? What can you derive from the CDF event numbers given on page 5 ?

h) Which other tagging possibilities (beyond dileptons and beyond this paper!) exist ?

ii) Ask yourself two questions related to the paper!