

Exercises, part 1

Tuesday 2003-10-21 - Friday 2003-10-24 15:30 (secr. IIIA)

1. collider design

3 points

The Υ particle was discovered 1977 by L. Ledermann et al. in a fixed target proton-nucleon experiment, with a proton energy of **400 GeV**.

- What was the center of mass energy in the proton-nucleon system ?
- Design a **pp** collider reaching the same center of mass energy: if superconducting dipole magnets are used, how big will the ring radius be (at least) ?

2. rapidity

3 points

To measure distances between to particles from a collider experiment the measure R was introduced:

$$R^2 = (\Delta\phi)^2 + (\Delta y)^2 \quad [or \quad R^2 = (\Delta\phi)^2 + (\Delta\eta)^2]$$

where rapidity y and pseudorapidity η are given by

$$y = \text{const} \ln \frac{E + p_L}{E - p_L} \quad \text{and} \quad \eta = -2 \text{const} \ln \tan \theta/2$$

Why was **const** chosen to be $= 1/2$?

3. Pythia

4 points

- Install a recent version of the CERN analysis package 'root' (root.cern.ch) on your linux-PC or gain access to a linux-computer where this package is installed.
Try out: demos.C in subdirectory 'tutorials'.
- Make sure that directory 'libs' includes the pythia library 'libPythia6.so'. Run the tutorial 'pythiaExample.C' to generate a few events with the Pythia event generator (www.thep.lu.se/~torbjorn/Pythia.html).
- Determine the total inclusive W production cross section for the Tevatron and for the LHC.