

Practical 1 – Option J

Measuring the strong interaction coupling constant

For this activity you need to visit the CERN website ‘Hands on CERN’ at <http://hands-on-cern.physto.se/>. Select the language in which you will work (English or Swedish). Then, from the left-hand list of links, choose Z-exercise 2 (which is under the heading ‘Particle Collisions’).

What to do

This is not an easy activity and it takes time. The idea is to go to the library of decays involving the Z boson and identify decays into a quark/antiquark pair. The quark and antiquark in the pair move away from each other, eventually forming two jets of particles (mainly mesons). If, however, the quark (or antiquark) emits a gluon, the gluon will also form a jet and so there will be a total of three jets. The coupling constant can be calculated by knowing the number of 2 and 3 jet events, N_2 , N_3 , respectively:

$$\alpha_s = 0.2 \times \frac{N_3}{N_2}$$

The numbers, N_2 , N_3 , must be determined by analysis of Z decay events available from the collision library on this site.

This activity gives some of the flavor of experimental particle physics work, but it is time consuming.