2003-10-24

Exercises, part 3

Thursday 2003-10-30 - Thursday 2003-11-06 16:00

1. Elastic cross section

4 points

Study the elastic p p cross section at LHC energy using Pythia.

a) How big is the total cross section ?

b) What is the fraction of events for which the scattering angle $\boldsymbol{\theta}$ exceeds **0.1 mrad** ?

What can you conclude ?

2. Rapidity distribution

6 points

Plot the rapidity (not pseudorapidity !) distribution (for charged particles)

$$\frac{\mathbf{1}}{\boldsymbol{\sigma_{tot}}} \cdot \frac{\mathbf{d}\boldsymbol{\sigma}_{\mathbf{ch}}}{\mathbf{dy}}$$

a) for the SPS

b) for the LHC

Do these results agree with your expectations ?

Note: Make sure that you normalize to the **total** (= elastic + inelastic) cross section (how big is it ?).
Don't forget to switch on all relevant processes.

Example for histogramming inside root:

```
//_____________________________________________________________________
//
//  pythia_E.C    2003-10-29   T.Hebbeker
//
//
//  example: how to plot energy distribution of particles
//_____________________________________________________________________
//
#ifndef __CINT__
#include "TPythia6.h"
#include <cstdlib>
using namespace std;
#endif

// This funtion just loads the needed libraries if we're executing from
// an interactive session.
void loadLibraries()
{
#ifdef __CINT__
  // Load the Event Generator abstraction library, Pythia 6
  // library, and the Pythia 6 interface library.
  gSystem->Load("libEG");
  gSystem->Load("$ROOTSYS/lib/libPythia6"); //change to your setup
  gSystem->Load("$ROOTSYS/lib/libEGPythia6");
#endif
}

float e;
int ks, kf;

// This is the main part
//
void pythia_E()
{

  // Load needed libraries
  loadLibraries();

  // Create an instance of the Pythia event generator ...
  TPythia6* eg = new TPythia6;

  // ... and initialise it to run p+p at 10000 GeV in CMS
  eg->Initialize("cms", "p", "p", 14000.);

  // (re)creating histogram file
  TFile* file = new TFile("pythia_E.root", "recreate");
  // booking histogram
```

```
  TH1F* energy = new TH1F("energy", "energy distr. pi+ ",100,0.,100.);

  // Now we make some events
  for (Int_t i = 0; i < 1000; i++)
  {
    // Make an event.
    eg->GenerateEvent();

    // Print the first event
    if(i==0) eg->Pylist(1);

    // loop over all particles in the event
    for (Int_t part=1; part<=eg->GetN(); part++)
    {
      // select only final state particles
      if (ks = eg->GetK(part,1) == 1)
      {
        // flavor code (pi+ = 211)
        if(kf = eg->GetK(part,2) == 211)
        {
          // energy
          e = eg->GetP(part,4);
          // fill histogram
          energy->Fill(e,1.);
        }
      }
    }
  }

  // print statistics
  eg->Pystat(1);

  // open graphics window
  c1 = new TCanvas("pythia_E"," ",800,600);

  // plot energy distribution - histogram
  energy->Draw();

  // save histogram file
  energy->Write();
}
```