

# Transverse momentum spectra

This is the analysis used in `examples/exp13.optns` (proton-proton scattering).

```
!-----
!           Define analysis
!-----

write "Our first histogram"      !the "write" writes literally to the output file

beginanalysis
  histogram
    pt      !variable name (x-axis)      (The pt variable refers to "transverse momentum")
    numptl !what is counted (yaxis)      (The numptl variable refers to "number of particles")
    12      !normalisation (see below)
    0       !xmin (range for
    20      !xmax  x variable)
    100     !number of bins
  trigger iptl A+B+1 inf !do not consider spectators
                                !(the iptl variable refers to the particle index in the particle list)
  trigger rap -1 1      !rapidity range (The rap variable refers to "rapidity")
  set hisfac 0.5        !overall normalization factor
  idcode 120 idcode -120 !define particle species (see EPOS id codes) (+-120 are pions)
  noweak              !no weak decays
endanalysis

!-----
!           Write out final results to output file
!-----

histoweight          !provides event weight
writearray 3         !provides histogram table (x,y,y-error)
```

The command `write` defines the histogram title (here: **Our first histogram**). It does not matter if this is put before or after the analysis part.

## Defining analysis

The commands between `beginanalysis` and `endanalysis` define our analysis.

We first define the *xvariable* as `pt` (transverse momentum) and *yvariable* as `numptl` (number of particles). The following four numbers define: the normalisation code (`12` means that we perform a normalisation by dividing by the number of events and by the bin width), the transverse momentum range (from `0` to `20`), the number of bins (`100`).

The first trigger concerns the special variable `iptl`, which is the index of the particle in the particle list. The trigger limits "A+B+1" and "inf" are special values, which allows to not consider the places with projectile and target spectators. The second trigger restricts particle counting to the rapidity range [-1, 1].

A normalisation factor of 0.5 is used, with help of `hisfac`.

The `idcode` commands define the particles of interest. Please refer to `src/KWt/idt.dt` to get EPOS identifier values. In this example, we only focus on charged pions ( $\pi^+$ ,  $\pi^-$ ).

Finally, we do not consider weak decays (`noweak`).

## Output

The command `histoweight` prints the `histoweight` value, in this case the number of triggered events. The command `writearray 3` creates a 3-column table with X, Y and Y-error values. The analysis results are written in the file `$(HTO)z-exp13.histo`.

We get 100 bins with rapidity values in the range [0, 20] with a total of 200 events. One can then build and display the plot.

