

Extracting variables from SpinQuest Data

When performing analysis using data obtained from experiment or Monte Carlo, you need to extract information from the data file and organize it into a plot that represent physical phenomena. For SpinQuest the data from the detector and from MC is compressed within a root file. This root file contains a Tree with several branches to organize the data to save memory. A Tree is similar to a spread sheet with rows and columns. Every tree has branches(The column) and every branch has leaves(The row/data element). The elements inside a tree can be printed out, viewed using TBrowser, or stored into variables. More information on trees can be found: <https://root.cern.ch/root/html/doc/guides/users-guide/Trees.html> and for python uproot can be used to a similar effect: <https://pypi.org/project/uproot/>

If you open a root file produce by our Monte Carlo, Fun4Sim, you will see that there are several branches such as "pid", "elementID", "detectorID". These branches hold several data points for every event generated by the MC and can be sent into arrays to be used in plots/ equations. Branches **gpx**, **gpy**, **gpz** are the truth(theoretical) values of the momentum in x, y, and z in the lab frame. The branches labeled **rec_px**, **rec_py**, and **rec_pz** are the reconstructed momenta in x, y, and z, but in the reference frame of the dimuon. This frame is known as the **collins soper** frame and is described below. These values can be expressed in the form of a histogram, graphical representation of the distribution of numerical data. It consists of a series of adjacent rectangles, or bins, each representing a range of values, with the area of each rectangle proportional to the frequency of data points within that range, the counts. For C++ information of histograms using root can be found here: <https://root.cern.ch/root/html/doc/guides/users-guide/Histograms.html> and for python information of using matplotlib for histograms can be found here: https://matplotlib.org/stable/plot_types/stats/hist_plot.html#sphx-glr-plot-types-stats-hist-plot-py. The point of a histogram is to visualize the distribution of data and identify patterns, trends, and outliers within the dataset.

Reference Frames

Physics Equations

Examples

Fun4Sim