ROOT basics tutorial

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- 1. Login to your system (Docker ROOT container or LIP remote machine):
 - A. <u>For participants using Docker</u>, follow instructions (available for linux, window, mac) in: <u>root docker image</u>:
 - I. docker run -e DISPLAY=\$DISPLAY -v /tmp/.X11-unix:/tmp/.X11-unix -v ~:/userhome --rm -it --user \$(id -u) rootproject/root root
 - B. For participant using LIP machines,
 - I. ssh -XY user@pauli.a.acnca.pt
 - II. module load gcc63/root/6.24.06
 - C. Download the data file for this exercise (zjet.root) and save it in this directory.
- 2. Now we can start the tutorial:
 - A. Open ROOT and load the data file: *root zjet.root*
 - B. Check the content of the file: .ls
 - C. Print the content of the tree TData: $TData \rightarrow Print()$.
 - I. Check the number of branches and the names of the variables in each branch.
 - D. Check the number of entries in the tree: $TData \rightarrow GetEntries()$
 - E. Draw the px variable: $TData \rightarrow Draw("px")$
 - F. Take a look at the different variables that exist in the tree and draw a couple of them. Try to understand their shape.
 - G. Draw the mass of the particles. Which particles can you identify from this plot?
 - H. Quit ROOT by typing: .q
- 3. Download and save the <u>RootTutorial1.cc</u> macro to your working directory. Open it with your favorite editor.
 - A. You can execute it in the terminal by typing: *root RootTutorial1.cc*.
 - I. Your task is to modify the macro in order to accomplish the following (you might need to rely on <u>ROOT's reference guide</u> and google "(something you need) root cern"):
 - 1. Draw px, py and pz.
 - 2. Draw a 2D histogram of py versus px.

- 3. Draw the mass of the particles with id=0.
- 4. Set the title of the histogram, change the line color, rebin it and scale it to unit area.
- 5. Fit the histogram with a Gaussian function and print the results.
- II. Download and save the macros <u>RootTutorial2.cc</u> to the same directory as in the previous exercise. It shows you how to loop over the events of a TTree and fill a histogram.
 - 1. Create a TCanvas and divide it in two pads side by side. Use the method *Divide(2)*.
 - 2. In the left pad draw the mass of the particles with id=10. What objects are responsible for this mass peak?
 - 3. In the right pad draw the mass of the Z boson (id=0).
 - 4. Fit the mass peak of the Z boson with a Gaussian function (as you did in the previous exercise) and the mass of the jet with an exponential function.