

# Tutorial ROOT 2

Laboratório de Instrumentação e Física experimental de Partículas

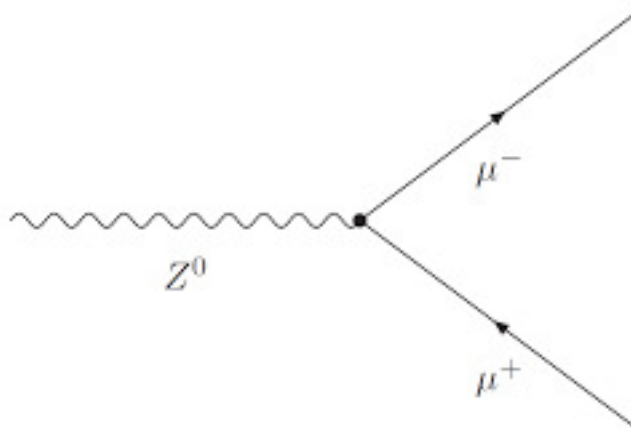
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## Introduction

The purpose of this tutorial is to write a ROOT macro that receives a ROOT file with all the particles of an event and returns another ROOT file with only the Z that will be reconstructed. In the end you can compare the mass spectrum of the Z obtained here with the spectrum you obtained in the previous tutorials.

## One step at a time

- Create a new file (with whatever name you want) with a function (à la C++ with the same name as the file).
- Declare the file object that we are going use to access our input file ROOTFILENAME.
- Declare the tree object as in previous tutorials.
- Declare a histogram object ( [href https://root.cern.ch/doc/master/classTH1D.html](https://root.cern.ch/doc/master/classTH1D.html) ref), with the limits, number of bins, and title you think best for the Z mass.
- Declare the variables that we will use to access the particles of each event, saved in the tree (as in the SKELATONNAME skeleton).
- Link these variables to the tree with the SetBranchAddress function (as in the skeleton).
- Loop the tree with a for loop, for example (to get the number of entries in the tree:  $t \rightarrow GetEntries()$  and to get the values of entry i loaded on the linked variables make  $t \rightarrow GetEntry(i)$ ).
- Loop the particles in the event.
- The Z in this MC data was forced to decay for two muons:



- You must therefore find the muons in the particle list. Tip: The ids of the different particles used can be found here: [particle codes](#).
- When you find the muons, you must add up the different components of the moment and the energy.

- Por fim devem preencher o histograma que criaram com a massa invariante:

$$m = \sqrt{E^2 - \sum_i p_i^2} \quad (1)$$

- Verify that the spectrum makes sense. Do you have events in which the Z has a mass very different than expected? Why is that, if it is the case? Can we deal with them and remove them?
- When you are satisfied and happy with your plot (certainly the most beautiful of the whole room) you should now save the events that pass your selection in a new tree, in a new file, say the four vector (momentum plus energy) the mass and an id that makes sense to you. The idea is to pass your reconstructed file to the macros you developed in previous tutorials and check if you get the same mass plot.
- To do this is should declare a file, more or less in the same place where you had declared the input one and the same for the tree.
- You must declare new output variables (i.e. px\_o, etc.) and link them to the new tree with the Branch function (ref).
- Every time an event passes you should fill the output variables with the values you want to save and then use  $t \rightarrow Fill()$ , in order to save them to your output tree.