RWTH AACHEN UNIVERSITY

Setup for top quark analysis exercise

Andrey Pozdnyakov

January 26, 2021

Overview

- The datasets
- The code
  - The Analyzer
  - The Plotter
  - How to run it

Datasets

- ROOT files are located in **files** directory
  - Each file contains a ROOT tree called **events**
- The file called **data.root** is real CMS data
  - Other files are MC simulation of various processes

filename	type	#events	x-section
`data.root`	data	469384	
`ttbar.root`	sim. $t\bar{t}$ signal	36941	165 pb
`wjets.root`	sim. W plus jets background	109737	31300 pb
`dy.root`	sim. Drell-Yan background	77729	15800 pb
`ww.root`	sim. WW background	4580	43 pb
`wz.root`	sim. WZ background	3367	18 pb
`zz.root`	sim. ZZ background	2421	6 pb
`single_top.root`	sim. single top background	5684	85 pb
`qcd.root`	sim. QCD multijet backgr.	142	10^8 pb

Analyzer

- Analysis code consists of **MyAnalysis**.C and .h files
  - This is the main code to be edited in the exercise
  - A loop over events and an event selection (aka “cuts”) are implemented in .C
  - Histograms are declared in .h and initialized in .C
    - Then these histograms are filled in event loop
    - You need to do the same for new histograms you want to create
  - Classes are used for particles: MyMuon, MyJet, etc.
    - They are inherited from TlorentzVector ROOT class, which simplifies certain calculations (Pt, sum of two particles, dR, etc)
    - Supposed to help write easier code for physics

Plotting

- **Plotter**.C and .h
  - Scripts to make nice plots out of histograms produced in analysis step
  - You do not need to change this code. It will automatically pick up new histograms you create, following the example of existing ones

Running

- Script: **example**.C
  - It runs the analysis over each input file
  - Then it runs plotting script to display produced histograms
  - You do not need to modify it
- The script is compiled with **make**
  - Executable example.**x** is produced.
  - This is what we run
  - Must re-compile every time you change the code

What to do?

1. Run the cells in the tutorial
    a) Does it all work for you?
2. Read full manual in **TutorialDocu.pdf** file (uploaded to Jupyter)
3. Investigate the root files
    a) Open events tree and look which variables are present
    b) Make a few histograms
4. Go back to the tutorial code and **study** MyAnalysis.C file
    a) Do you understand where the **loop** over events is done
    b) Do you understand how event **selection** is applied
    c) Do you understand how the two **histograms** in the example are filled
5. Now create your own histogram of some new variable
6. If no problems with the above – you are ready to do the tasks of the exercise
    a) If you have problems – ask questions!

Hints and tricks

- Use **counters** to count events after each selection to keep track of your cuts
- Printout useful information with **cout** statements
- Think of **physics**:
  - Say, you want to plot a variable. How would you ***expect*** it to look like. This could be different depending on the process. Does you plot agree with the expectation?