# An implementation of python and C++ on physics analysis using data from ATLAS Open Data

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# ATLAS Open Data Website

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## The ATLAS Open Data 13 TeV docs

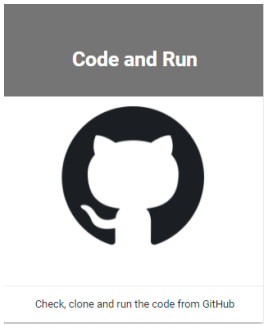
# Analysis Framework and Jupyter Notebooks

**Analysis Framework**

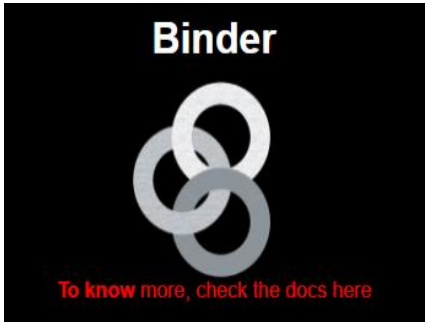
- These frameworks are mostly written in c++ and interfaced with ROOT, python and RDataFrame.

**Notebooks collection - opendata**

- There are some programs mostly implemented in python.
- Allows us to make analysis data directly in a web browser.



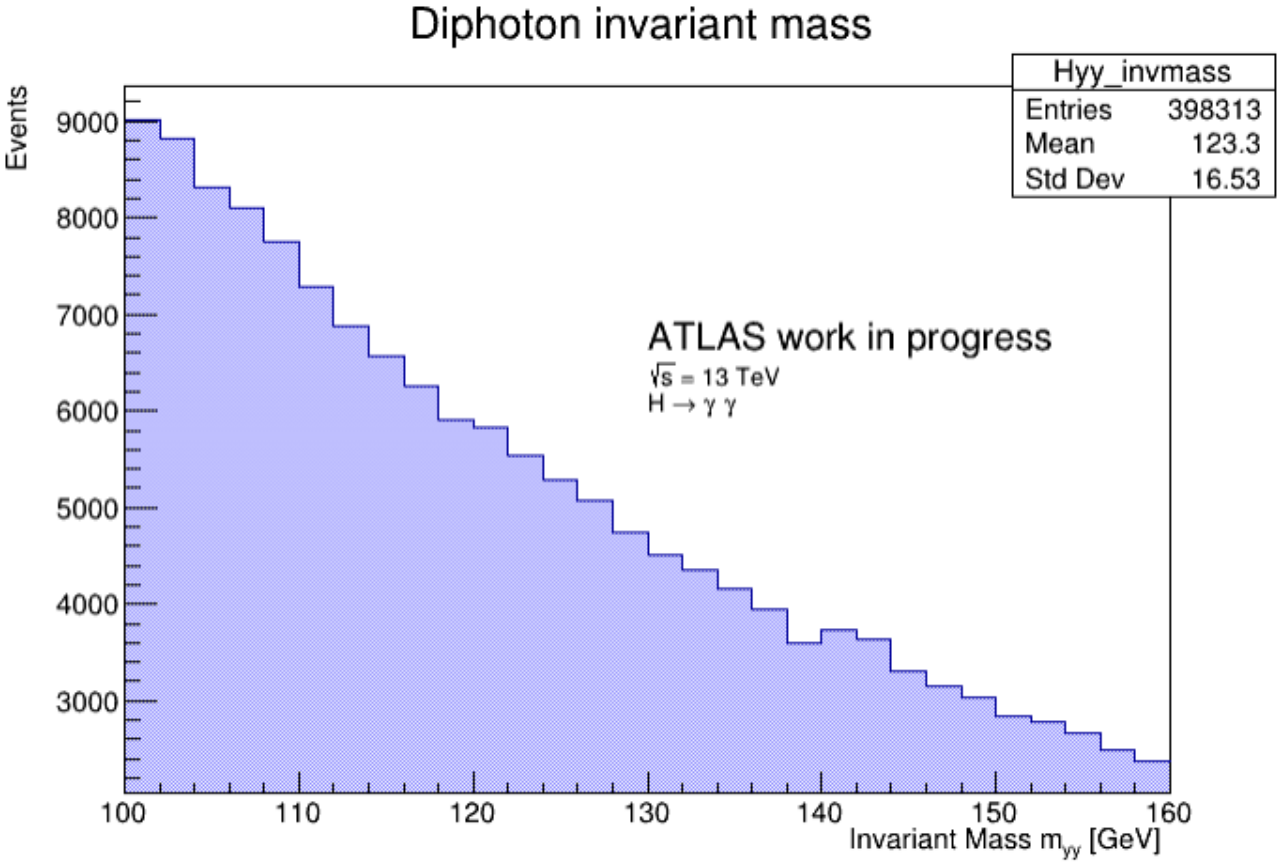


# Run 2 notebooks collection folder

- There are 3 folders which contain the analysis of data**.**
- These programs have different levels of complexity. An introductory level with fundamental tools are found in cpp and python folders.
- In the uproot folder, we can find an alternative to run the codes instead of ROOT, such as Uproot, Pandas, Numpy, Matplotlib, etc. These folder contains codes of a moderate and high levels of complexity.

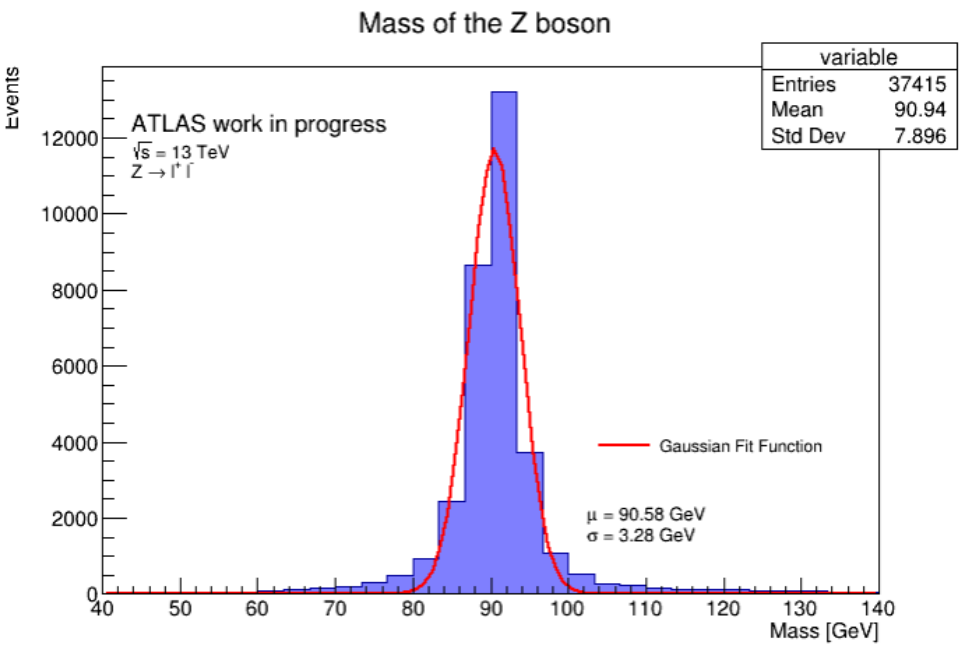
# Root Tools in Jupyter notebooks implemented in c++

- The aim of these folders (cpp and python folders) is introduce to students who are interested in learn basic ROOT tools for analysis of data in experimental particle physics (TChain, TFile, TH1F, TMath, TLorentzVector, etc).

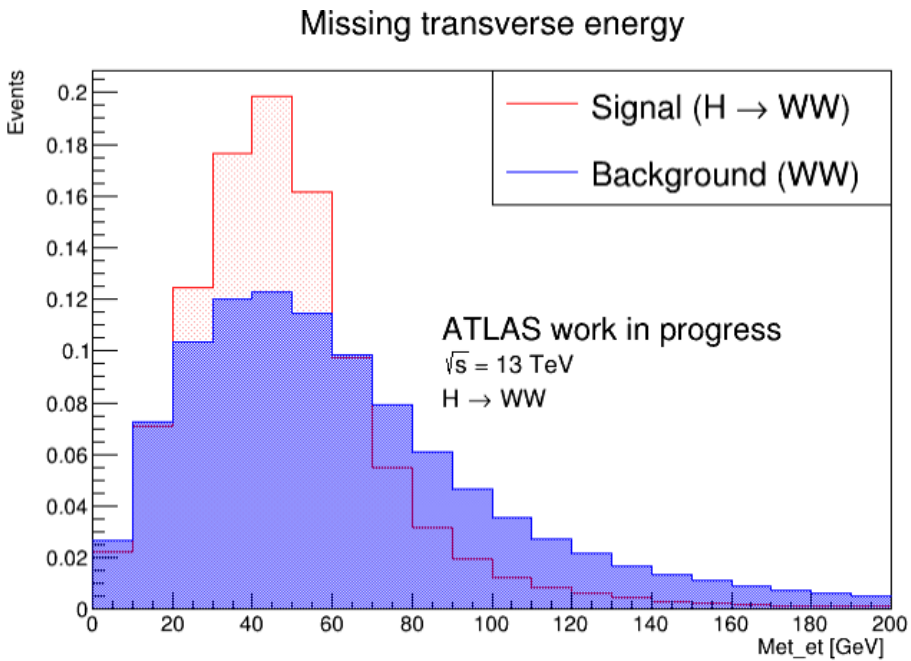


# Root Tools in jupyter-notebooks implemented in c++

## Reconstruction of invariant mass of Z boson decaying to 2 leptons



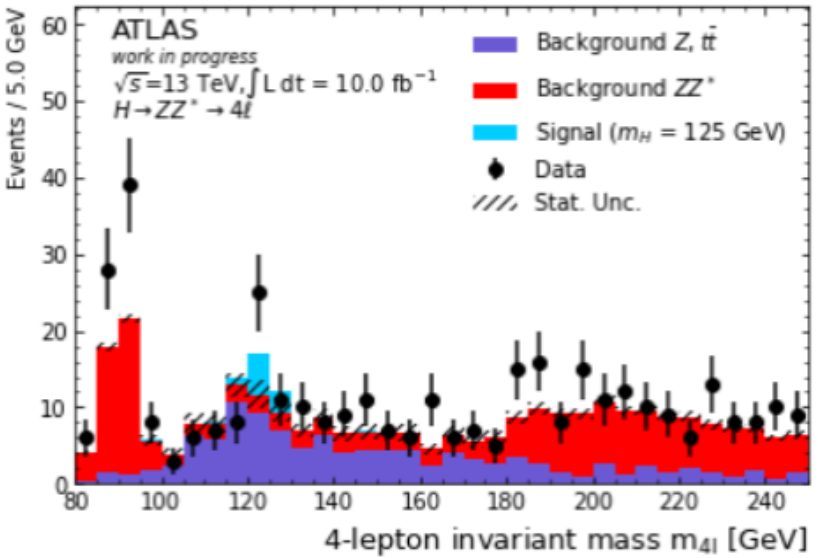

## Comparison between production of 2 W bosons from Higgs and other processes



# Uproot: Use of Pandas to Store Data as Dataframe

**Alternative tools for ROOT**

- Uproot: It allows us to read files .root.
- Pandas: lets us store data as dataframe, it is a format widely used in python.
- Numpy: provides numerical calculations, such as trigonometric functions, histograms, etc.
- Matplotlib: common tool for making plots, figures, images, visualizations.
- The plot shows a comparison between different backgrounds in ZZ production and the signal H->ZZ. Some cuts were applied to increase the ratio of signal to background and some others were left to students to improve the results.



# Thanks!