University of the Andes - CEVALE2VE
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Overview: Optimization proposal to computational analysis of the Higgs boson in the decay channel $H \rightarrow ZZ^* \rightarrow 4l$ at $\sqrt{s} = 13$ TeV using ATLAS Open Data

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About me...

Oscar Alejandro,
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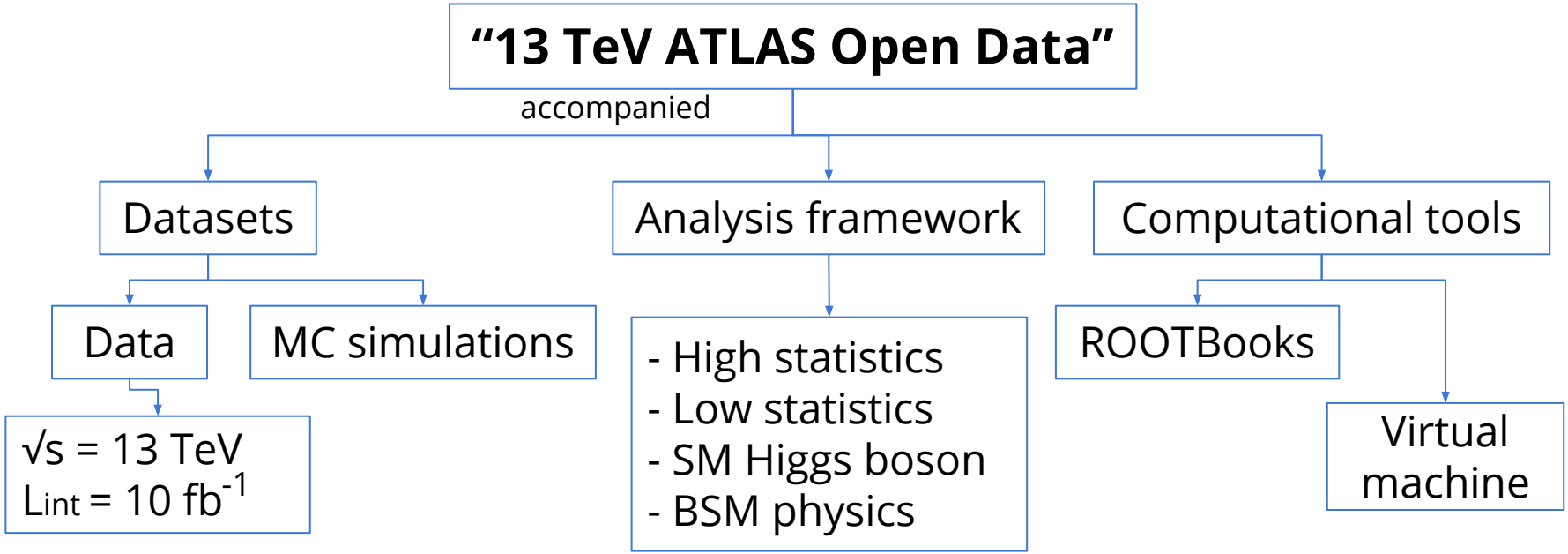

Online documentation:

Figure 1: The 13 TeV ATLAS Open Data, hosted on the CERN and ATLAS Open Data online portals [1].

Four-lepton final state

The case of SM Higgs boson production in the H→ZZ*→4l decay channel

- The so-called “golden channel” of the Higgs boson.
- 0.0124% branching fraction into final states with electrons or muons.
- Small background contamination.

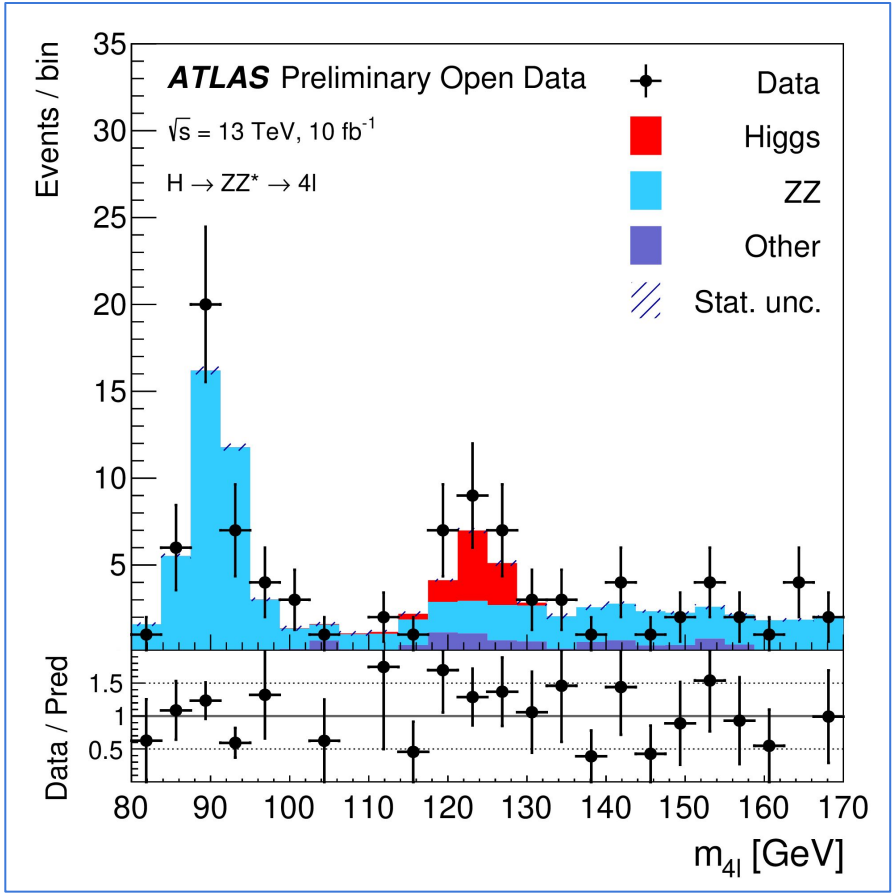

Figure 2: The four-lepton invariant mass m_{4l} distribution in selected events are shown. [2]

Research objectives

Overall objective

Propose an optimization to the computational analysis of the Higgs boson in the decay channel $H \rightarrow ZZ^* \rightarrow 4l$ at $\sqrt{s}=13$ TeV using ATLAS Open Data in Jupyter Notebook with ROOT C++ kernel.

Specific objectives

- Reproduce the computational analysis of the Higgs boson in the decay channel $H \rightarrow ZZ^* \rightarrow 4l$ at $\sqrt{s}=13$ TeV of ATLAS Open Data in Jupyter Notebook with ROOT C++ kernel.
- Discuss the results obtained in Jupyter Notebook with ROOT C++ kernel with the computational analysis of the Higgs boson from ATLAS Open Data in the decay channel $H \rightarrow ZZ^* \rightarrow 4l$ at $\sqrt{s}=13$ TeV.
- Optimize the computational analysis of the Higgs boson in the decay channel $H \rightarrow ZZ^* \rightarrow 4l$ at $\sqrt{s}=13$ TeV based on the discussion of results.

Scope

In accordance with: ATLAS Open Data's overall goal for the published dataset and tools [2].

Via: The “Jupyter Notebooks” software tool.

With: “ROOT C++” analysis framework.

The proposed research will contribute to the reproduction of the software tool and will also propose an optimization to "C++ framework for the 13 TeV ATLAS Open Data analysis" [3], for the example of the Higgs boson in the decay channel H→ZZ*→4l in Jupyter Notebooks with ROOT C++ kernel.

References

[1] ATLAS Collaboration, “ATLAS Open Data 13 TeV Documentation,” ATLAS Experiment, [Online]. Available: http://opendata.atlas.cern/release/2020/documentation/index.html. [Accessed 13 October 2020].

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[3] ATLAS Outreach data and tools, “C++ framework for the 13 TeV ATLAS Open Data analysis,” atlas-outreach-data-tools, 28 April 2020. [Online]. Available: https://github.com/atlas-outreach-data-tools/atlas-outreach-cpp-framework-13tev. [Accessed 13 October 2020].

References

[4] ATLAS Collaboration, “Exploring the Higgs boson “discovery channels",” ATLAS Experiment, 12 July 2019. [Online]. Available: https://atlas.cern/updates/physics-briefing/exploring-higgs-discovery-channels. [Accessed 13 October 2020].

[5] J. M. Perkel, “Why Jupyter is data scientists’ computational notebook of choice,” Springer Nature Limited, 30 October 2018. [Online]. Available: https://www.nature.com/articles/d41586-018-07196-1. [Accessed 13 October 2020].

[6] “About ROOT,” ROOT Team, [Online]. Available: https://root.cern/about/. [Accessed 13 October 2020].