Tools for physics analysis using ATLAS Open Data. A BDT in H->ZZ

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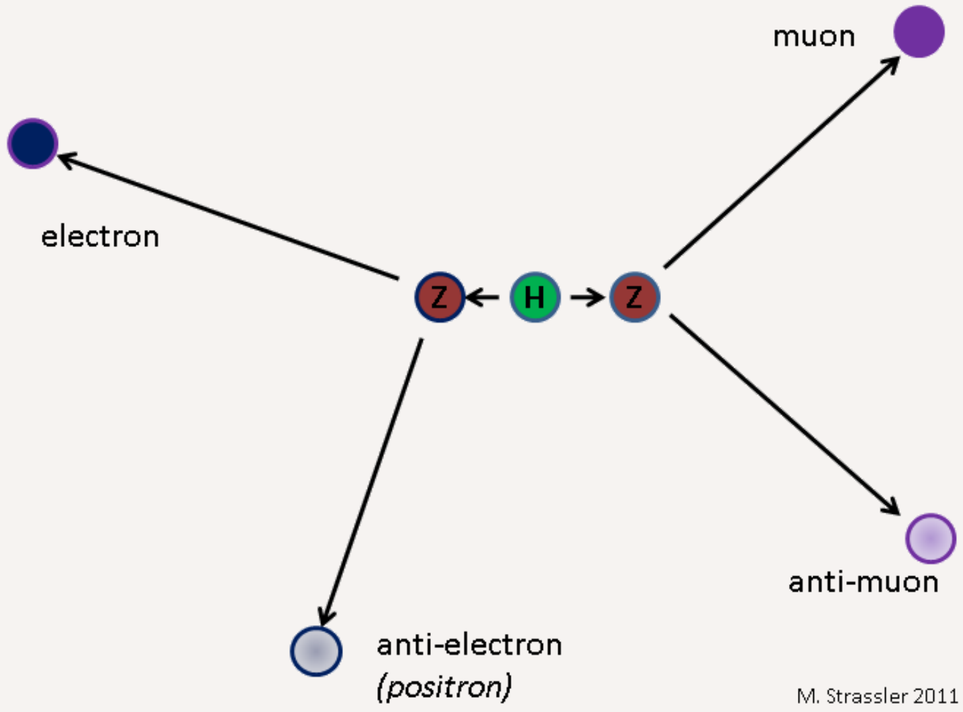
UNIVERSIDAD NACIONAL DE COLOMBIA

6th ComHEP

December 1st 2021

ATLAS EXPERIMENT



INTRODUCTION

H->ZZ Decay

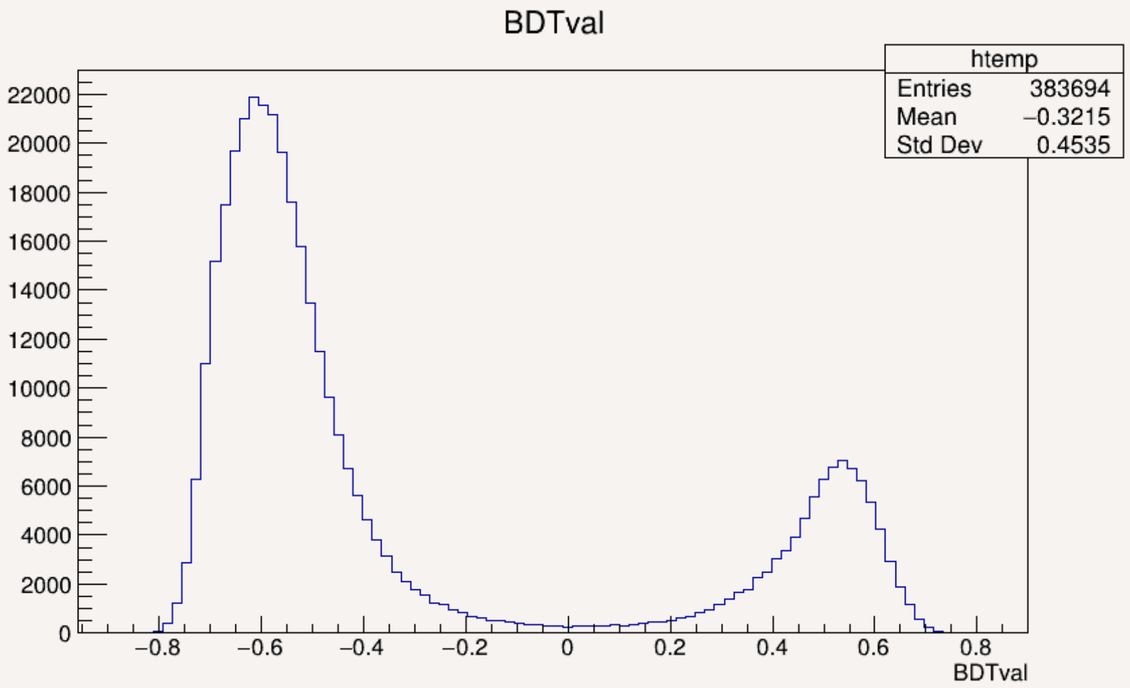
* The goal is to increase the signal H->ZZ->llll.
* This leads to a four-lepton invariant mass peak.
* Reducing the amount of background from ZZ->llll, ttbar and Z.
* In the samples used, the process ZZ composes arround 99% of total background.

Selection criteria

Based on filtered 4 lepton samples, collected by ATLAS detector at 13 TeV during 2016.

Selection is performed, integrated with a multivariate analysis.

- Single electron and single muon trigger satisfied.
- Exactly four good leptons with pt > 25 GeV.
- Selecting Higgs candidates from the two SFOS lepton pairs.



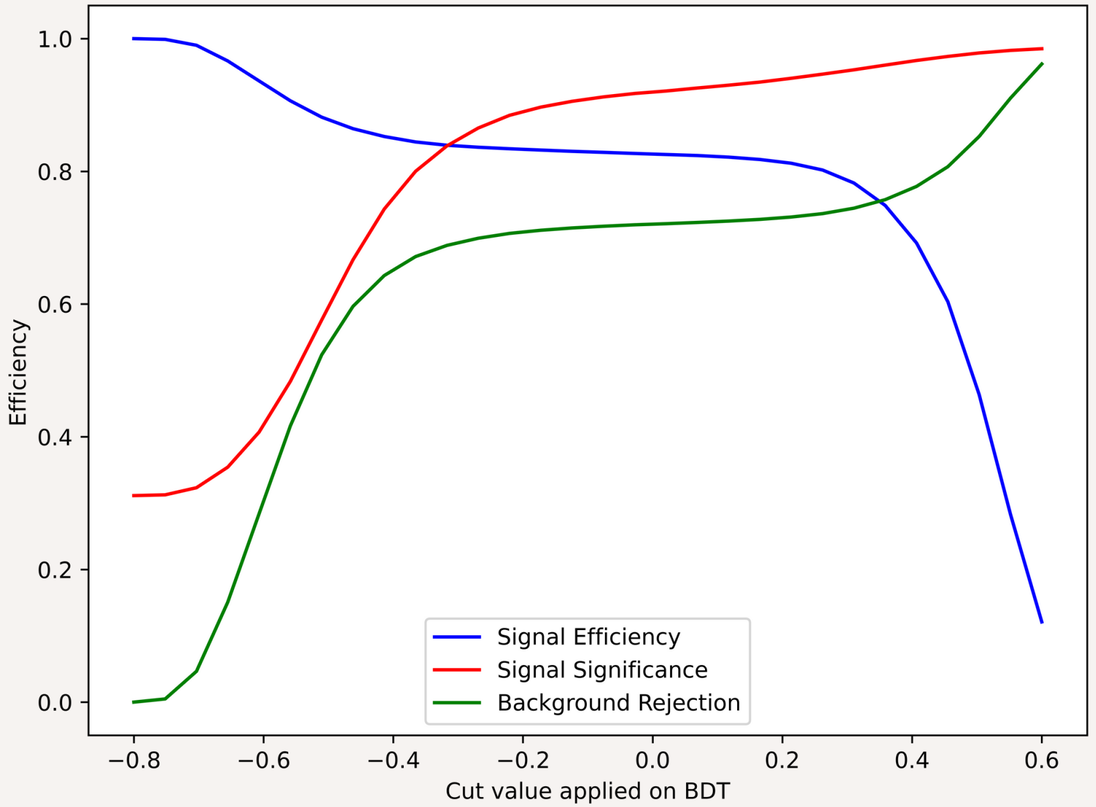
BDT Classification

Training of BDT was made using a fraction of simulated samples, of known background and signal.

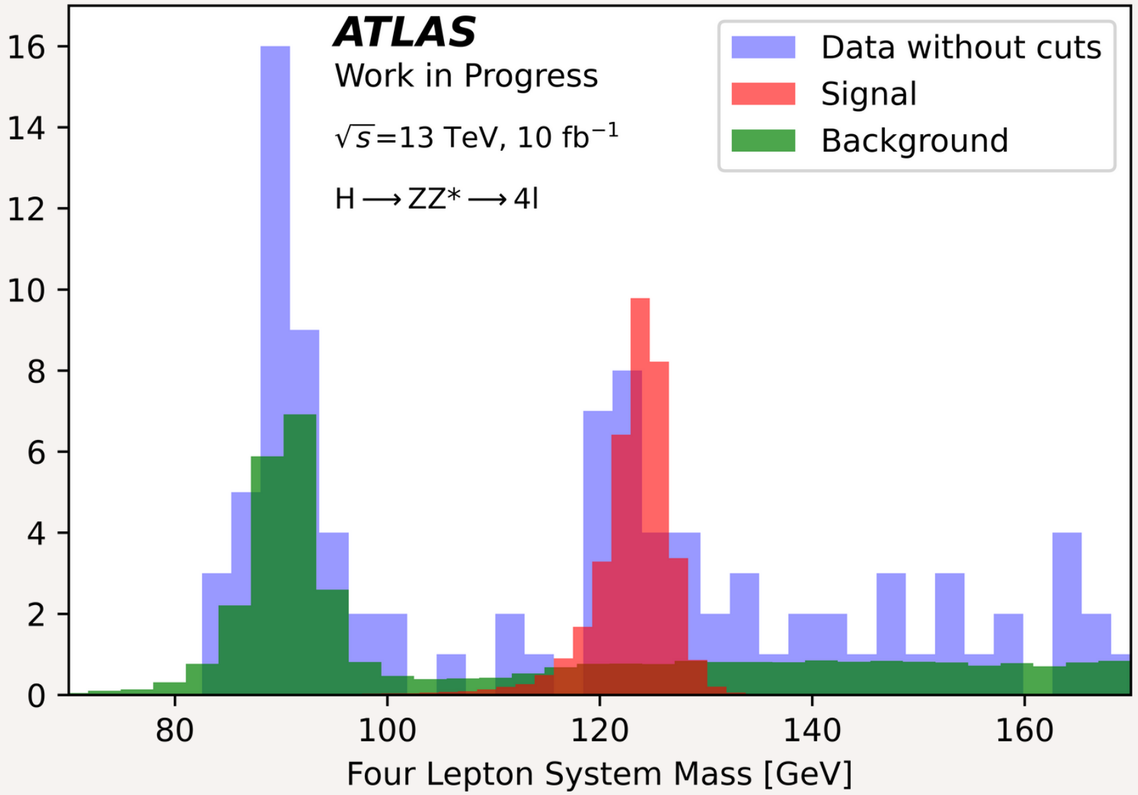
For this analysis, we studied the behavior of the mass, transverse momentum and energy of the final four lepton system, and the invariant mass of the two Z bosons.

Efficiency

The discrimination fo BDT over the signal and background samples, allows cuts on the output to maximise signal efficiency while keeping a high background rejection.



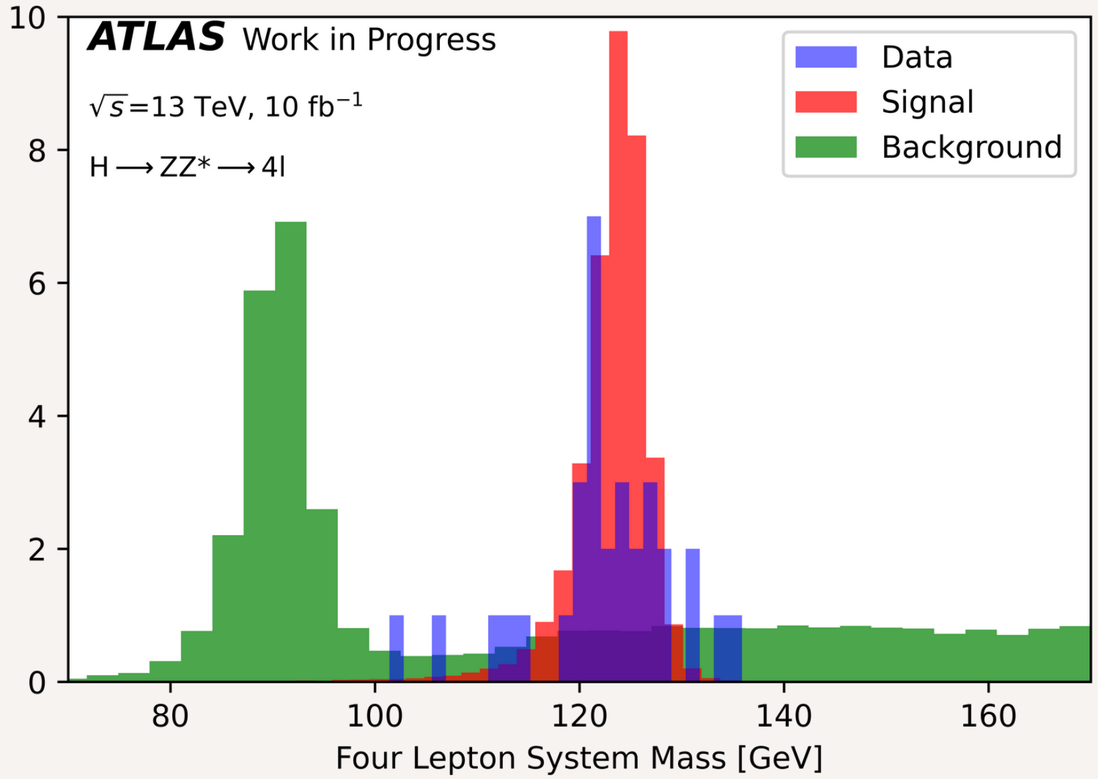
Application



For the mass of the Four Lepton System, signal has the expected peak at 125 GeV.

As expected, before any BDT cut, Data is distributed in the whole range.

Application



After applying BDT criteria over data samples, just the signal information is conserved, removing a considerable part of background.

Conclusions

Since available Atlas Open Data were used in this analysis, final data samples have a small size.

Hence the resolution and statistics of some final results could be low.

Even so, the general output from the experimental data agrees with expected values.

Thanks