Search for the Standard Model Higgs Boson in the $H \to WW^{(*)} \to l\nu l\nu$ decay mode for the ATLAS Experiment

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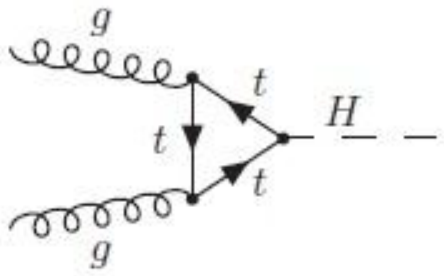
$H \to WW \to l\nu l\nu$ group

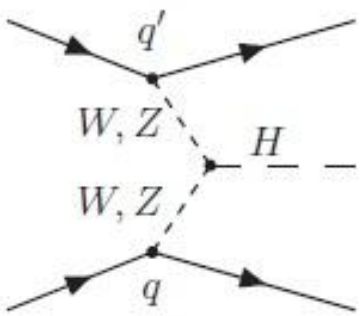
- ATLAS Collaboration
- University of Toronto, Canada group
- Advisor: Prof. Richard Teuscher

Introduction —Higgs production modes

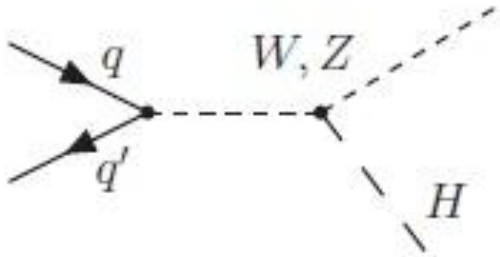
ggF —gluon gluon fusion



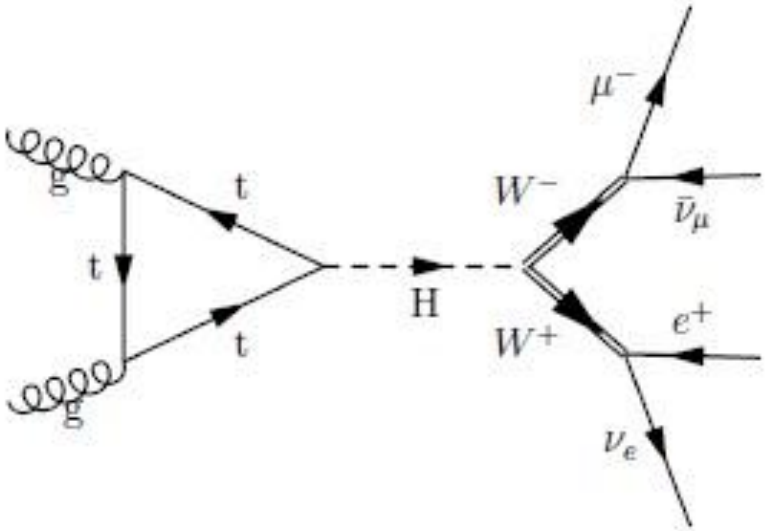
VBF —vector boson fusion



WH/ZH — Higgs-strahlung



$H \to WW \to l\nu l\nu$ decay mode



- Higgs boson decays into two W bosons, which in turn decay into a lepton and a neutrino
- Signature:
  - Two oppositely charged leptons
  - Large missing transverse energy, E_T^{miss}, due to the two neutrinos
- Cannot reconstruct mass! Understanding E_T^{miss} is crucial

Strategy —Cut-based Analysis

Study the kinematic and topological properties of the signal and of the main background processes (those that lead to two leptons in their final state) with MC simulations

- Pre-selection cuts
  - QCD predictions
  - Kinematic cuts
  - Topological cuts
- Jet cuts
- Mass cuts

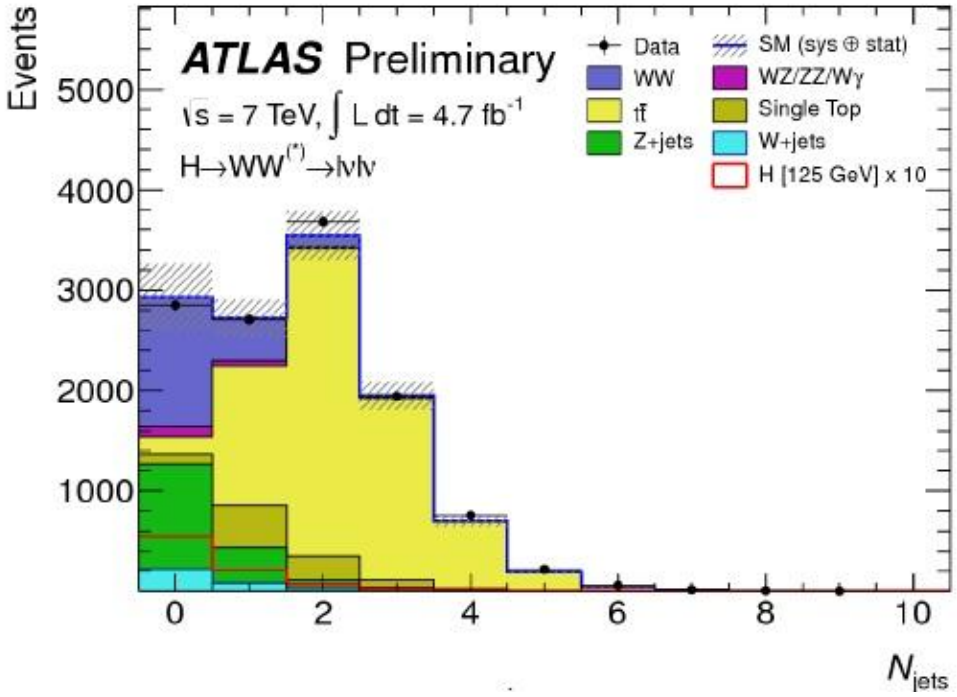
➢ Use Control Regions to study backgrounds individually.

Main Backgrounds

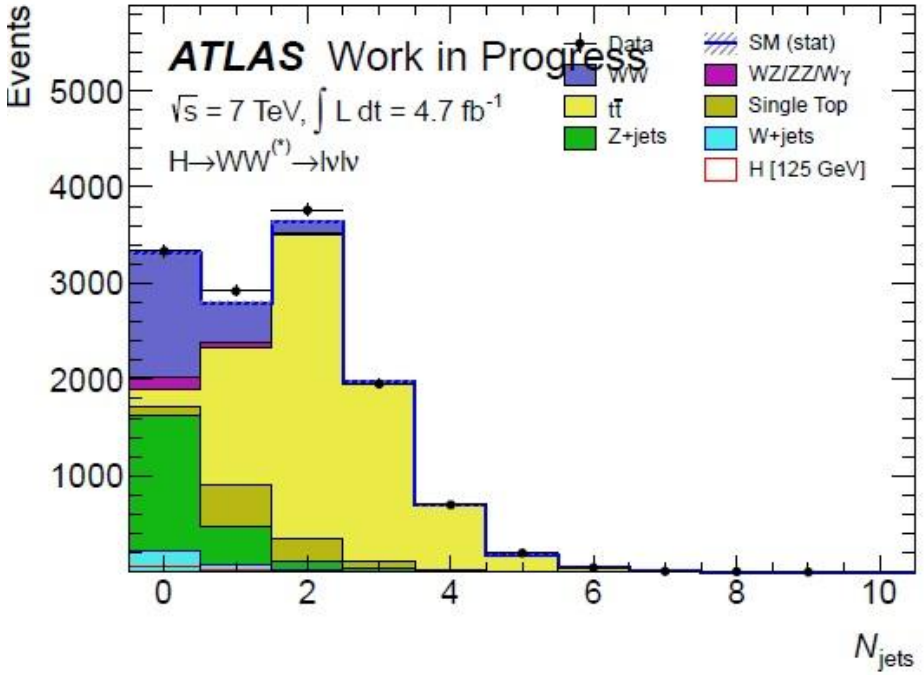
- WW continuum
- W + jets
- W/γ^* + jets
- $t\bar{t}$
- Single t
- More: $WW, ZZ, W/\gamma$

Analysis for 2011 data and MC

So far, I have been trying to reproduce the results obtained with the 2011 data and MC. Example:



Published results



Trying to reproduce them

Next…

- Study the backgrounds individually
- Start with the 2012 MC data
- Yesterday the unblinding of the 2012 data was approved for the H-WW group
- Task: - Optimize the jet-Pt cuts
  - Study/try to reduce the Drell-Yan process background

Switzerland fun!