

Resonant $WZ \rightarrow \ell\nu\ell'\ell'$ search at $\sqrt{s} = 13 \text{ TeV}$

Salah-eddine Dahbi^a,

^aMohammed V university in Rabat, Morocco

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Université Mohammed V
Faculté des Sciences
Rabat



Introduction

- A resonant search for WZ production in the fully leptonic final states is performed, using LHC p-p collision at $s = \sqrt{13} \text{ TeV}$ with 36.1 fb^{-1} integrated luminosity of data collected by the ATLAS experiment during 2015 and 2016 period.
- Two mode of WZ production are considered in this analysis : quark-anti-quark ($q\bar{q}$) fusion and vector-boson fusion (VBF).
- Results for $q\bar{q}$ category are interpreted in the context of the phenomenological Heavy Vector Triplet $pp \rightarrow W' \rightarrow WZ$ benchmark Model A (Model B) with coupling constant $g_V = 1$ ($g_V = 3$).
- For the VBF category, the interpretation is performed using HVT with $g_V = 1$, the coupling parameter $c_H = 1$ and the all other coupling parameters of the heavy triplet were set to 0 to maximize the VBF contribution. In addition, the Georgi-Machacek (GM) Model used to predict the charged higgs H_5^\pm sector ($pp \rightarrow H_5 \rightarrow WZ$) in this category.

Data, Background and signal samples

Final Good run list used in 2015-2016 data-taking by ATLAS detector :

- data15_13TeV.periodAllYear_DetStatus-v79_All_Good_25ns
- data16_13TeV.periodAllYear_DetStatus-v88_All_Good_25ns

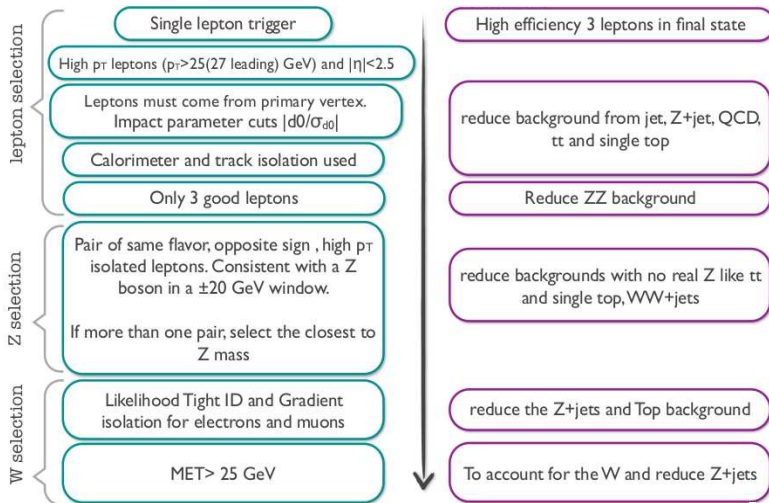
Background Monte-Carlo samples used in this analysis :

- WZ (QCD Sherpa 2.2.2, EWK Sherpa 2.1).
- ZZ (Powheg (qq) and Sherpa (gg)).
- ttbarV (V=Z,W) (MadGraphPythia).
- tZ (MadGraphPythia).
- VVV (V=Z,W) (Sherpa).
- Z+jets (Sherpa 2.2.1).
- Top (Single top, ttbar) (PowhegPythia).
- $Z\gamma$ (Sherpa)

Signal samples :

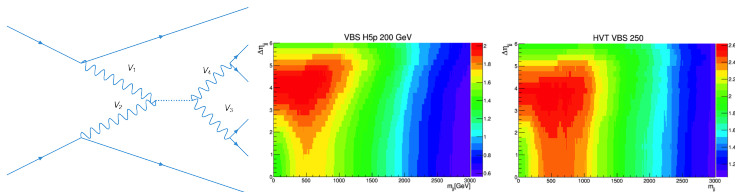
- Heavy Vector Triplet (HVT), (MADGRAPH) with resonances mass point between 0.25 to 3 TeV for $q\bar{q}$.
- Georgi-Machacek (200 to 900 GeV) and HVT (250 GeV to 2 TeV) for VBF (MADGRAPH).

Event selection (CutFlow)



VBF category

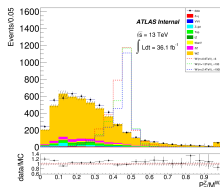
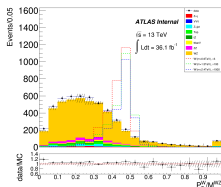
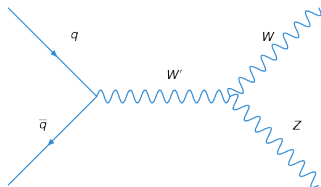
- Requiring at least two jets with $p_T > 30 \text{ GeV}$ passing B-tagging criteria at 0.1758 MV2c10 working point.
- Cuts on $m_{jj} > 500 \text{ GeV}$ and $\Delta\eta_{jj} > 3.5$ produce a clear separation between VBF signal region and backgrounds .



VBF Signal Region	
WZ	82.8 ± 9.1
Fakes	15.0 ± 3.9
tZ + VVV	5.5 ± 2.4
t \bar{t} V	5.0 ± 2.3
ZZ	4.4 ± 2.1
Total Background	112.6 ± 1.0
Data	114

$q\bar{q}$ category

- All events that do not satisfy the VBF criteria will fall in $q\bar{q}$ category.
- Cuts on $p_T^Z / WZ_{\text{Mass}} > 0.35$ and $p_T^W / WZ_{\text{Mass}} > 0.35$ are applied, which allow a clear separation between signal region and the WZ SM background.



$q\bar{q}$ SR

WZ	533 ± 23
Fakes	64.3 ± 8.1
$t\bar{t}V$	29.4 ± 5.5
ZZ	18.9 ± 4.4
$tZ + VVV$	9.3 ± 3.1
Total Background	654.65 ± 2.62
Observed	650