

Constraints on non-Standard Model vector boson interactions in an effective field theory using differential cross section of the production of two jets associate with two leptonically decayed Z bosons at $\sqrt{s} = 13$ TeV with the ATLAS detector

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ABSTRACT: Abstract...

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1 Introduction

Since the discovery of last particle predicted by the Standard Model of particle physics (SM)[1], the Higgs boson, in 2012[2], the nature of its interactions with other particles has been carefully investigated in order to seek any deviation from the prediction of the SM. The Vector Boson Scattering (VBS) process[3], a important pure electroweak process in the Large Hardron Collider (LHC)[4], enables us to probe the nature of Higgs boson interactions with vector bosons and to constrain Beyond the Standard Model (BSM) hypothesis altering the nature of the Higgs boson and/or vector bosons which may provide alternative Electroweak Symmetry Breaking (EWSB) mechanism[5] and additional source of CP violation[6].

In the LHC, VBS events are produced by a pair of vector bosons radiated from the colliding partons scattered to another pair of vector bosons subsequently. At the ATLAS detector-level, the signature of VBS events are two jets from the initial partons associate with the decay products of two vector boson, we denote such events

$VVjj$. The evidence of electroweak production of $W^\pm W^\pm jj$ ($EW W^\pm W^\pm jj$) was first observed during the first run of LHC with the ATLAS detector[7], and the observation of this very process has been confirmed by the CMS[8] collaboration during the second run of LHC in 2018[9], while the observation of $EW ZZjj$ channel has been reported in 2019[10]. In spite the endeavour has been put on the VBS process, the model-independent measurement of the differential cross section have not been made so far.

With a total of 139 fb^{-1} proton proton collision data at $\sqrt{s} = 13\text{ TeV}$ accumulated in the ATLAS detector[11] during the second run of the LHC, a great opportunity to scrutinise the SM at much higher accuracy has been provided. In this report, the fiducial differential cross section of $ZZjj$ process measured at $\sqrt{s} = 13\text{ TeV}$ using the whole run II data is reported and the results has been used to constrain a BSM effective field theory[12] which provides alternative Higgs boson interactions, vector boson interactions and additional source of CP violation in the electroweak sector.

2 Recap

36/fb unfolded results for $dpjj$ distributions

3 Differential $ZZjj$ cross section measurements

3.1 Theory

i.e. contributing processes ($EW ZZjj$, strong $ZZjj$, what the backgrounds processes are)

3.2 Chosen Observables

3.3 simulations

3.4 Event selection

3.5 Unfolding

3.6 Results

4 Reinterpretation in an effective field theory

4.1 EFT theory

4.2 Truth-level event generation

4.3 Limit setting procedure

4.4 Results

5 Future works

(you miss many systematics in each part of the results, so give some thought about what you would do if given another 6months on this research).

6 Conclusions

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