

Measurement of Higgs' Z boson associated production & decay into b -quark pair

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Introduction

What are we looking for?

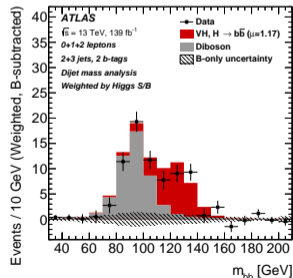
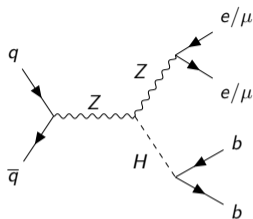
- H produced associated with a Z boson (ZH mode)
- H decays into pair of b quarks

Why $H \rightarrow b\bar{b}$?

- has largest branching fraction
 \Rightarrow measure H 's dominant decay
- direct study of Higgs-quark coupling

Why ZH ?

- most sensitive to $H \rightarrow b\bar{b}$ ∴
 - relatively less background
 - effective lepton trigger
- can probe high transverse momentum (p_T) regime
 \Rightarrow sensitive to BSM physics



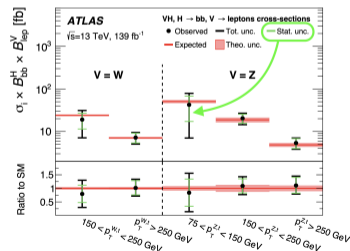
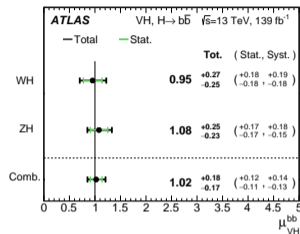
Introduction

Last round of analysis:

- Xsec consistent with SM
- Total uncertainties range from 30% to 80%!
- Stat. unc. (green bars in plots) contributes the most

This time:

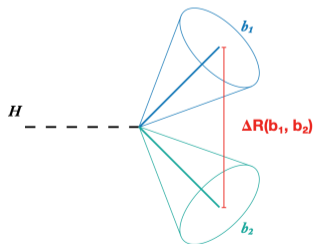
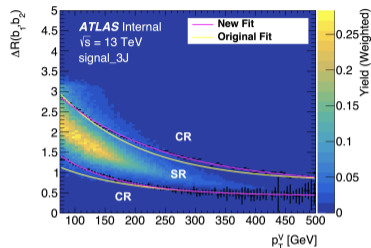
- Harmonise/optimize analysis regions
- Streamline workflow
⇒ What's missed & what's redundant?
- New b -tagger
- Combine $H \rightarrow b\bar{b}$ & $H \rightarrow c\bar{c}$ analysis
(2nd gen. quark!)



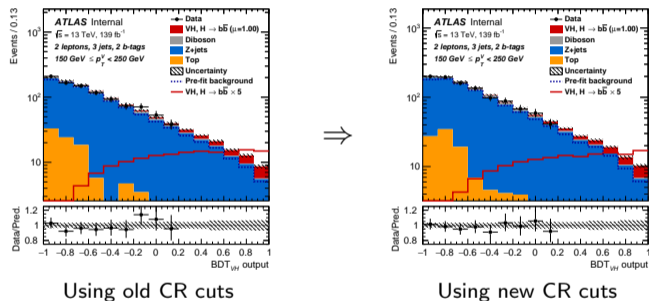
My study includes:

- 1 Electroweak correction on diboson
- 2 Effect of jet multiplicity on likelihood fit
- 3 Impact of CRs on MVA training
- 4 Redefining control regions (CRs)

- CRs are places with little signal
- Signal region (SR) is between two cuts, above & below are CRs
- Old CR cuts (yellow lines) were derived in WH channel & applied to ZH , convenient but not optimised
- Using the desired yield I derived the new cuts (magenta lines)



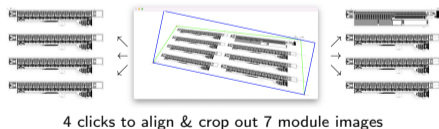
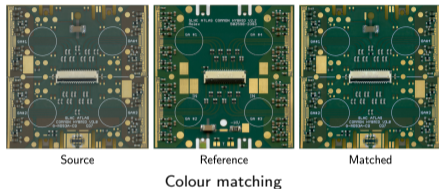
Some distribution after likelihood fit:



- New CR cuts give better data/MC agreement & slightly higher significance

ATLAS qualification task

- Adam Ruby made an automated visual inspection tool for ATLAS detector modules
- Module design keeps updating
⇒ need to calibrate parameters
- Module photos taken manually
⇒ need alignment tool
- I developed softwares for colour matching, alignment & cropping
- Only 1/4 images require human attention with our tools
- Qualified last month!



- Analysis group aims to publish the first $VH(bb/cc)$ paper in 2023
- Would work on different aspects of this analysis for a bigger picture
- Expect to submit my thesis in 2024

Thank you!