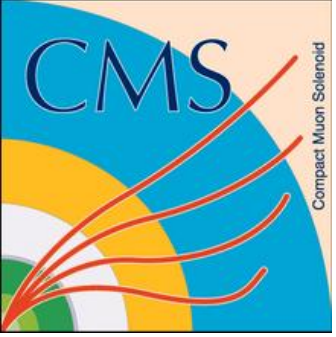

VBF Higgs to WW Interference Study by using Madgraph5

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2013.12.19

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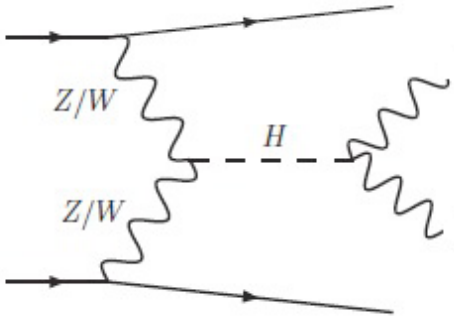
Motivation and Introduction

Motivation

- For heavy higgs, the interference effect is significant
- gg>H>WW interference done before: Qiang Li et al.
- VBF Higgs > ZZ interference using MG and Phantom: Jian Wang
- VBF WW lnujj interference: Sandro Ballestrero et.al. Detailed study, fitting to mass and ratio plot
- Here we use ONLY Madgraph with dynamic scale
- We study signal H>WW, W decay not considered, however we believe decaying would not change too much interference (MadSpin could be used for decay if necessary)

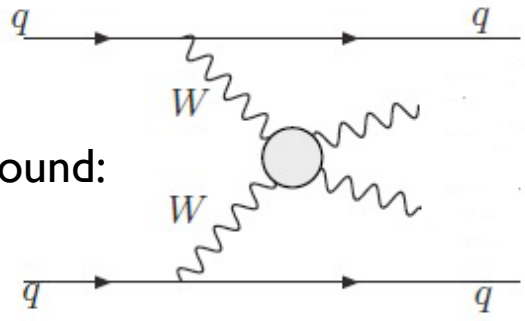
Introduction

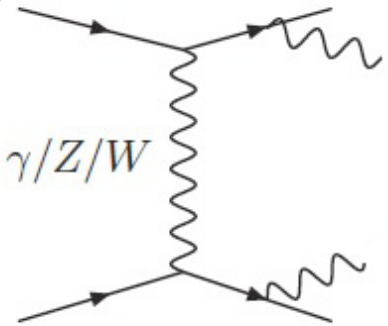
Signal:

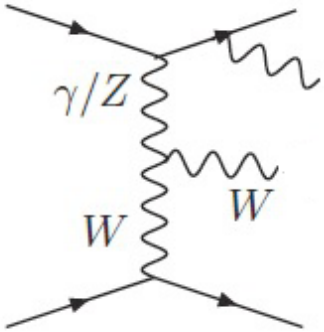


Interference

Background:



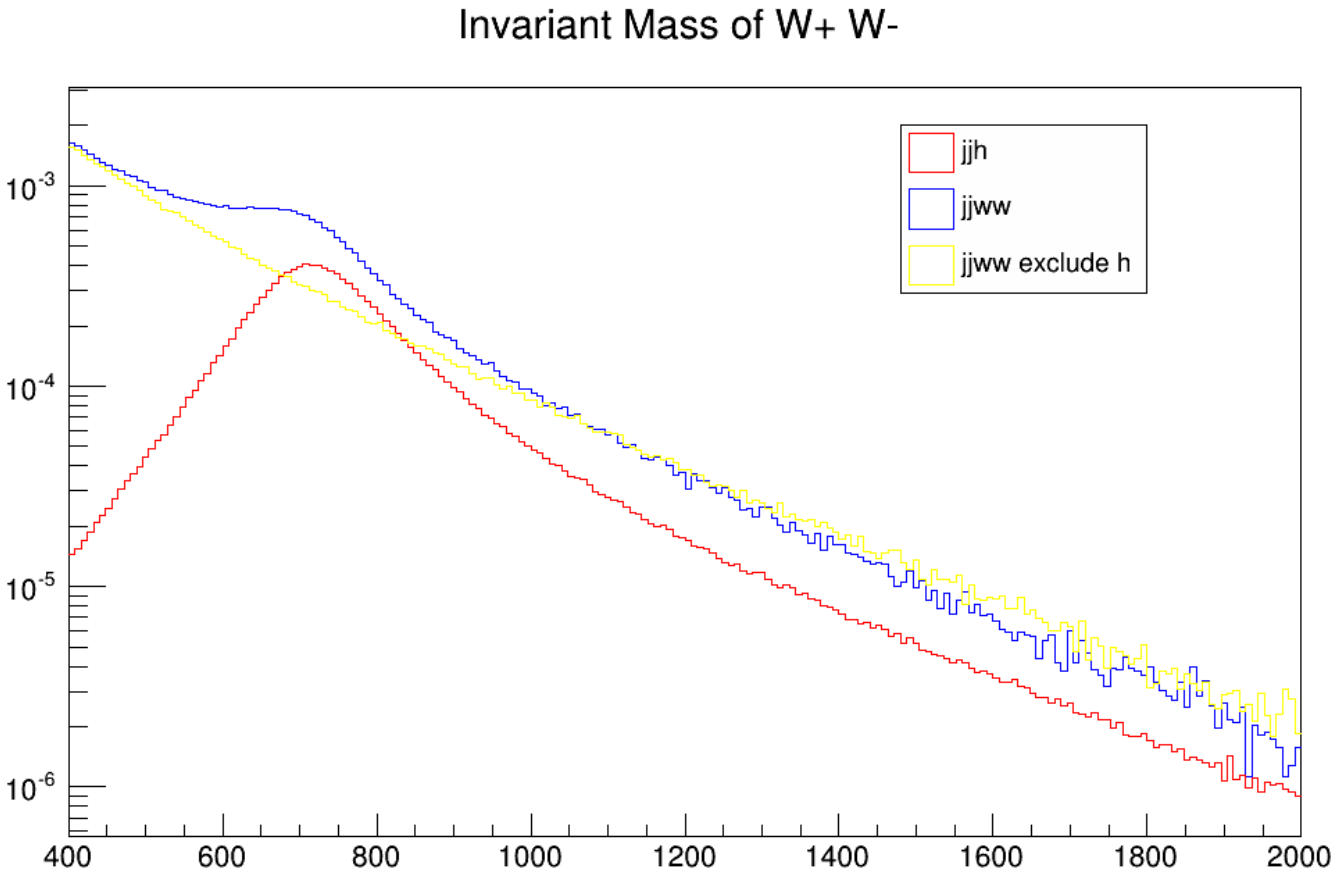




- Use MG to generate both LO signal and background process
- Signal: p p > j j h, h> W+ W-
- Signal+Background+Interference: p p > j j W+ W-
- Background (without higgs): p p > j j W+ W- /h
- We use the no Higgs scenario regardless of the unitarity violation.

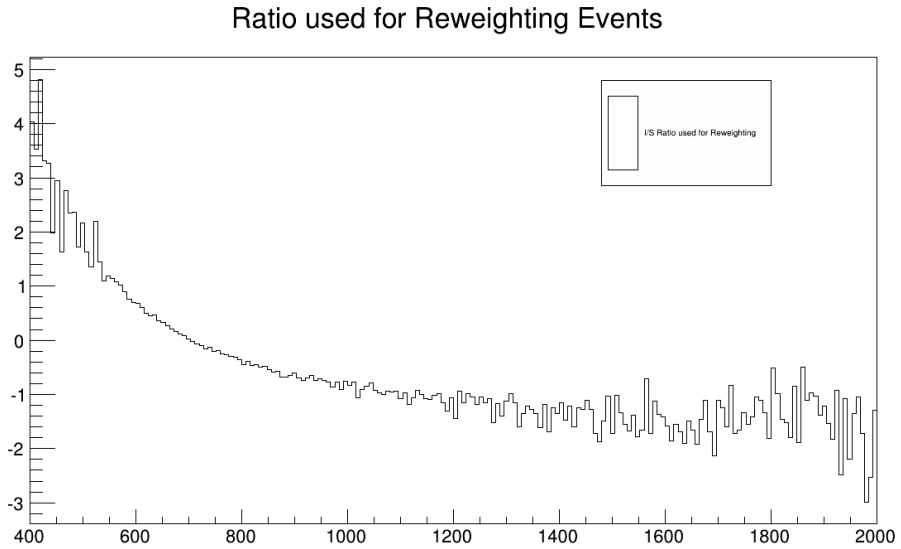
VBF Interference ratio

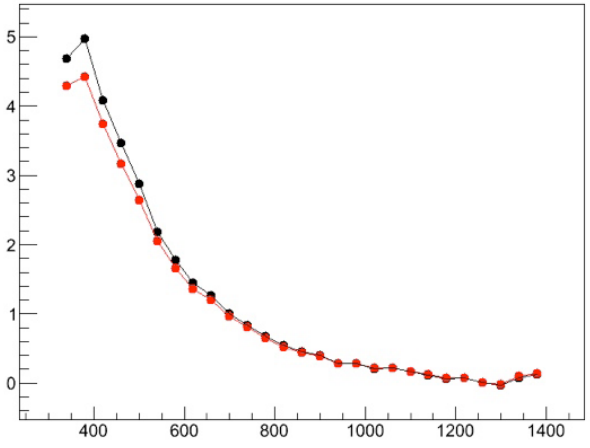
The MWW distribution



Higgs mass 700GeV, decay width 199GeV

The ratio plot

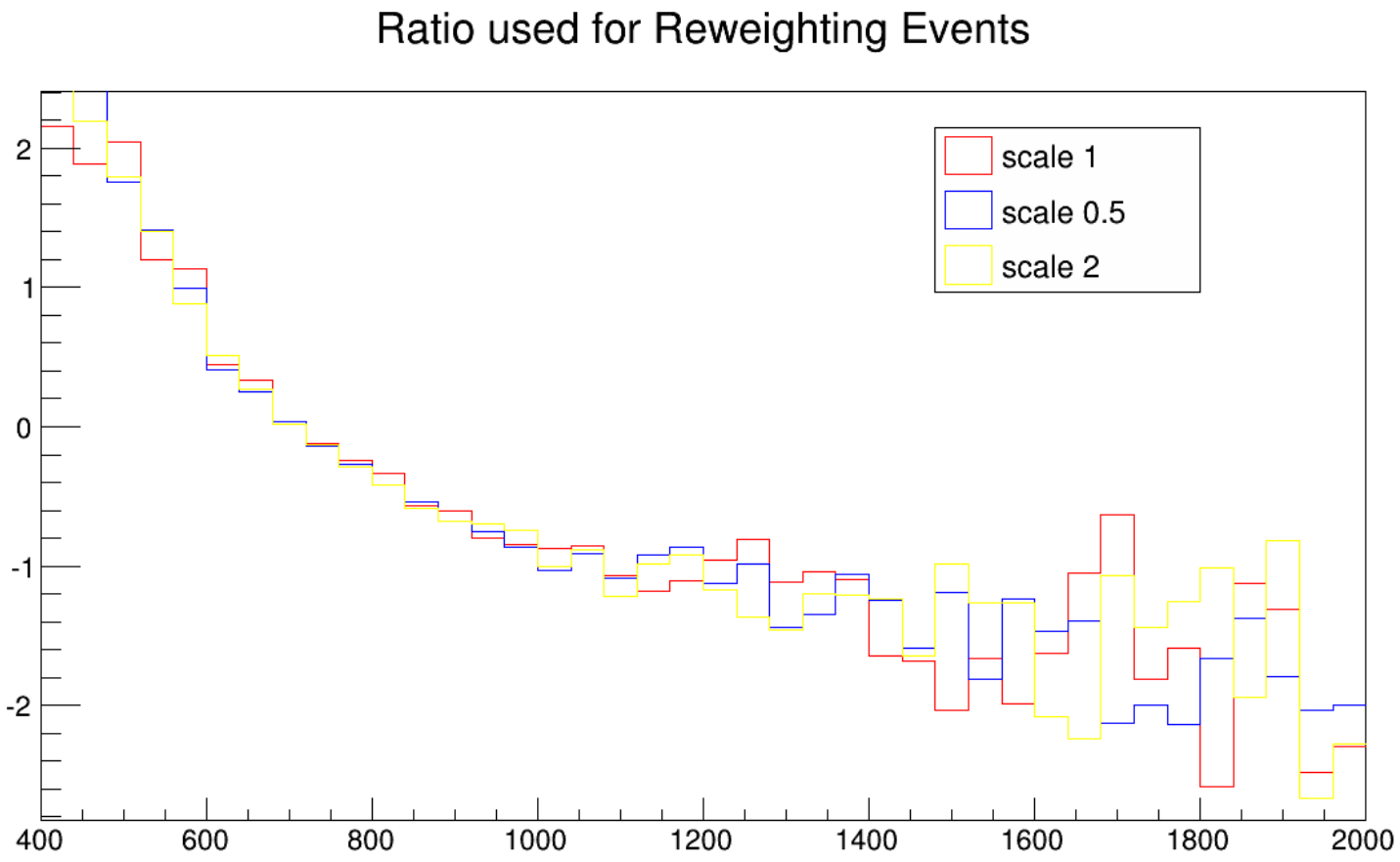




$$R = \frac{SBI(m_{ww}) - B(m_{ww}) - S(m_{ww})}{S(m_{ww})} = \frac{I}{S}$$

The right plot is taken from Jian Wang's work. The ratio is 1+R for two different bkg.: 125GeV higgs and No higgs scenario

Ratio in different dynamic scale



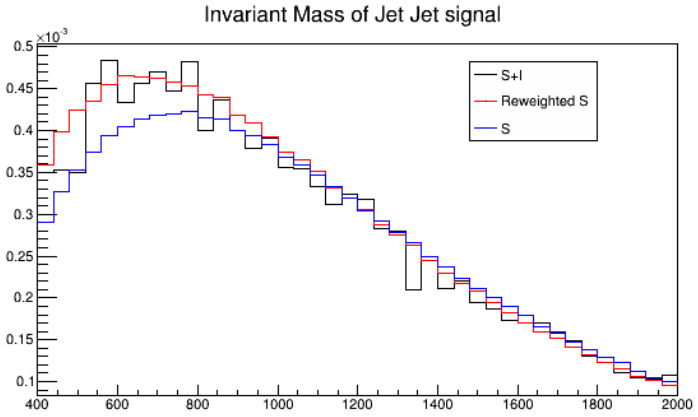
The ratio seems stable when changing the scale

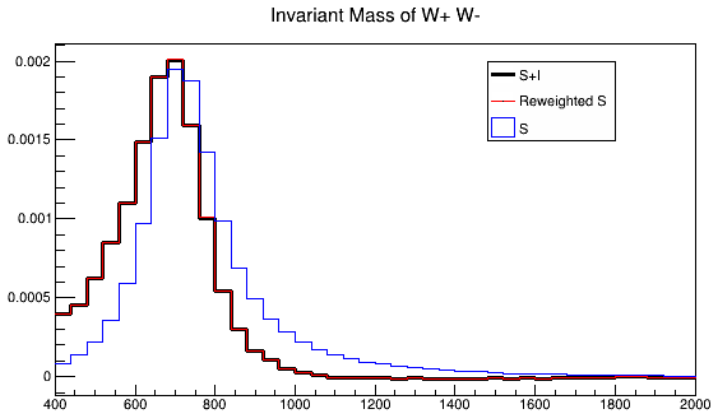
Reweight VBF signal

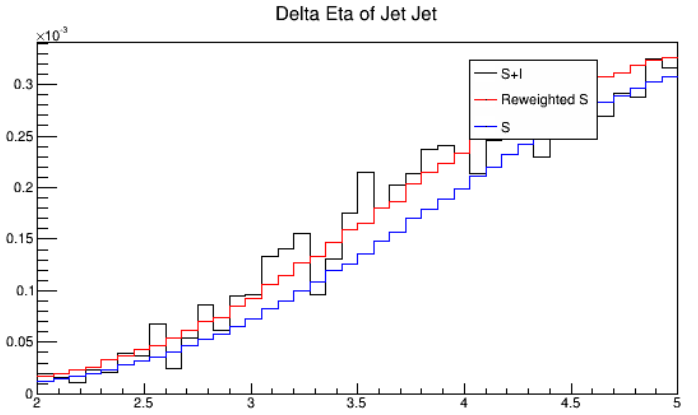
To reweight distribution

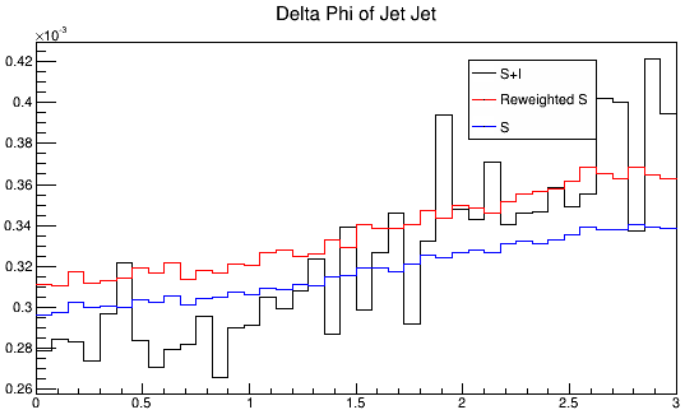
- In each signal EVENT, using mWW to find the correct ratio of this event
- Use this ratio to reweight when filling the histogram
- Set the event weight to (1+ratio)
- The distribution could be m_{jj}, $\Delta\eta_{jj}$ and $\Delta\varphi_{jj}$

Reweighted Distribution



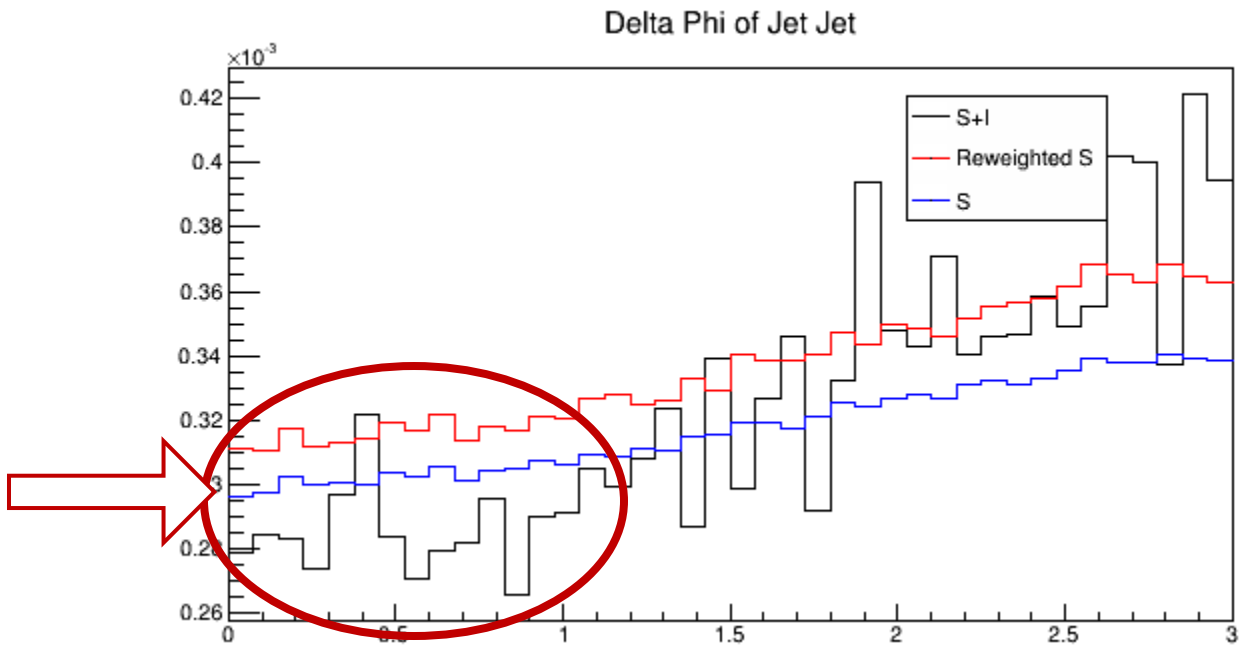






The Delta Phi plot seems not so good at low tail

$\Delta\varphi_{jj}$ plot



Considering $\Delta\varphi_{jj}$ is important to suppress the gluon fusion bkg..
Maybe should use 2 dimension reweighting?

Summary

Summary

- The Sig. and Bkg. Interference for VBF higgs is studied by using Madgraph
- We get the interference ratio I/S to reweight the signal
- The dynamic scale doesn't have significant effect on the ratio
- The result seems good except the $\Delta\varphi_{jj}$ plot
- Need to estimate the reweighting uncertainty. However we are thinking for the I/S. The scale and the PDF uncertainty may be canceled out

Backup

Gen-level Selection

- 8TeV
- PTj > 30, |etaj|<5,drjj>0.5
- deltaEtaj >2, mjj>200