

Weekly report

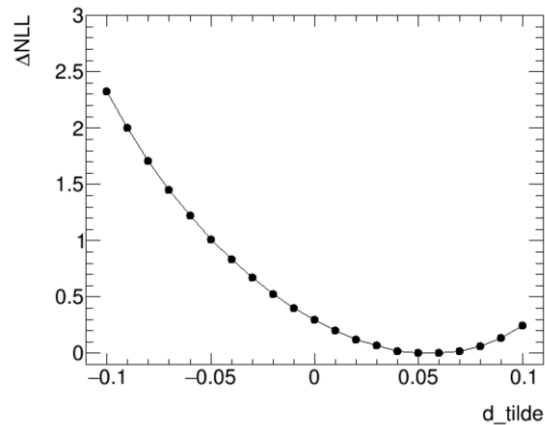
FANGYI GUO

VBF Higgs CP

Previous:

minimum value shift in NLL curve.

Background modelling

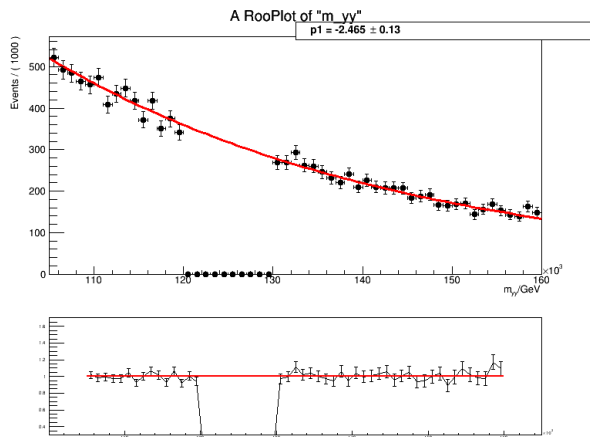


Next step:

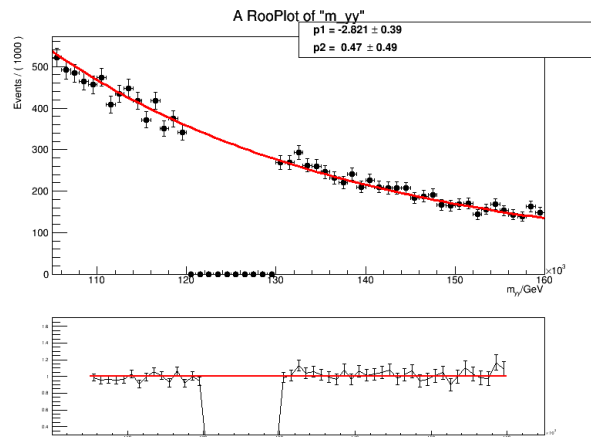
- Check bkg model.
- Keep considering $DSCB(m_{yy}) \times \text{HistPdf}(oo)$. DSCB ignored the di-peak structure in OO distribution.

VBF Higgs CP

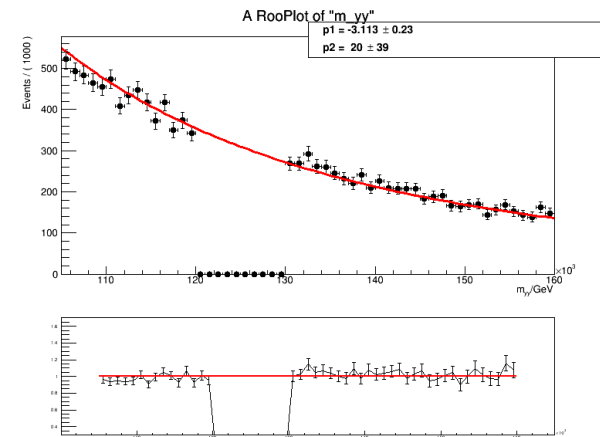
Background modelling



Exponential
Chi2/ndf=0.71



2nd Exponential
polynomial
Chi2/ndf=0.80



2nd order dijet
Chi2/ndf=0.78

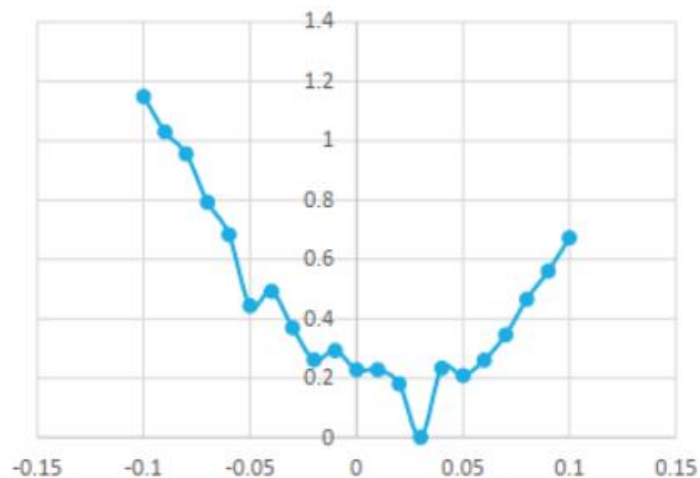
```
double chi2 = xframe->chiSquare("pdf","data",0);
```

VBF HCP

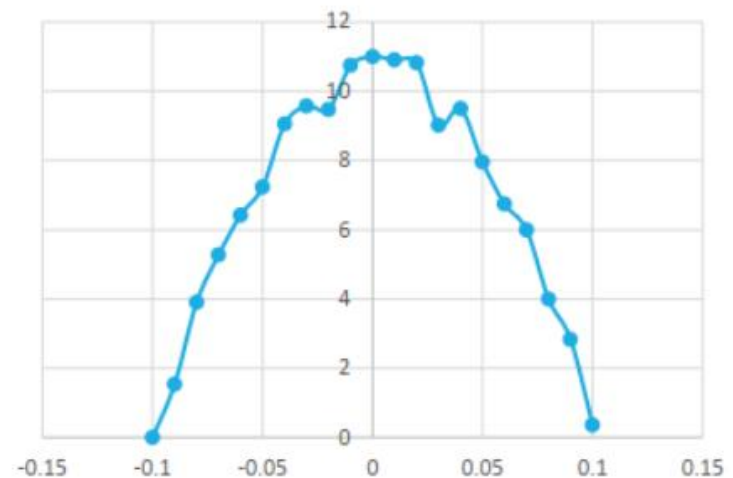
Check1: DoubleSideCB might not describe OO distribution well, so use a RooHistPdf to describe OO and DSCB to describe $m_{\gamma\gamma}$.

$$PDF_{total} = \sum N_i \times f_i(m_{\gamma\gamma}) \times h_i(OO).$$

DNLL calculated by hand-write code

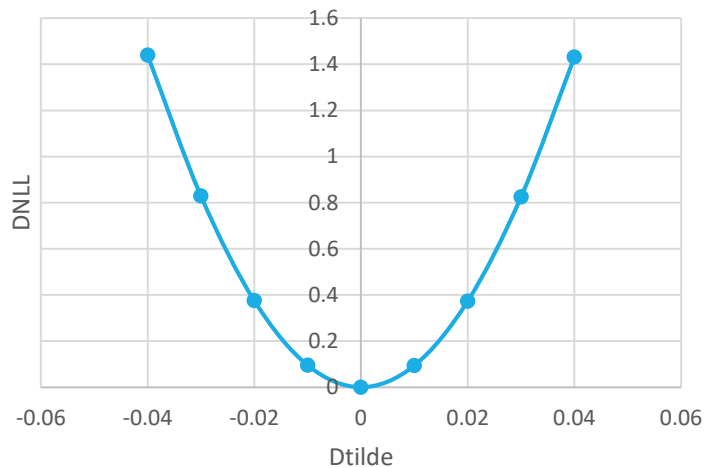


DNLL calculated by RooStat(createNLL)

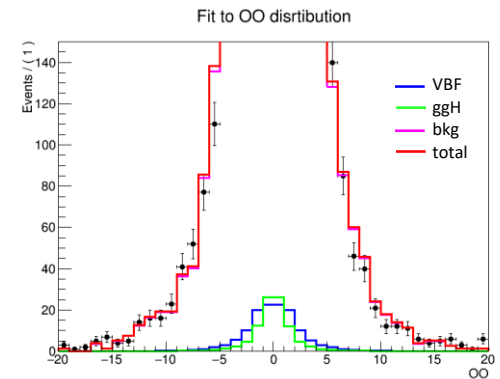
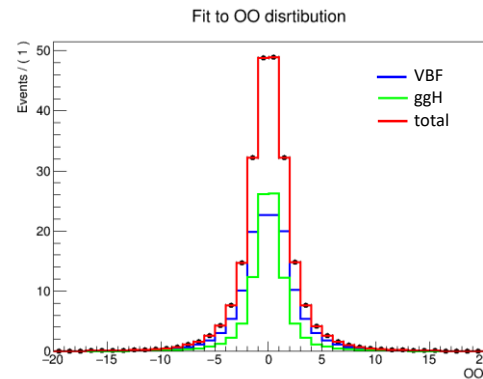


VBF Higgs CP

Use VBF+ggH sample to test NLL function



NLL curve for
VBF+ggH sample

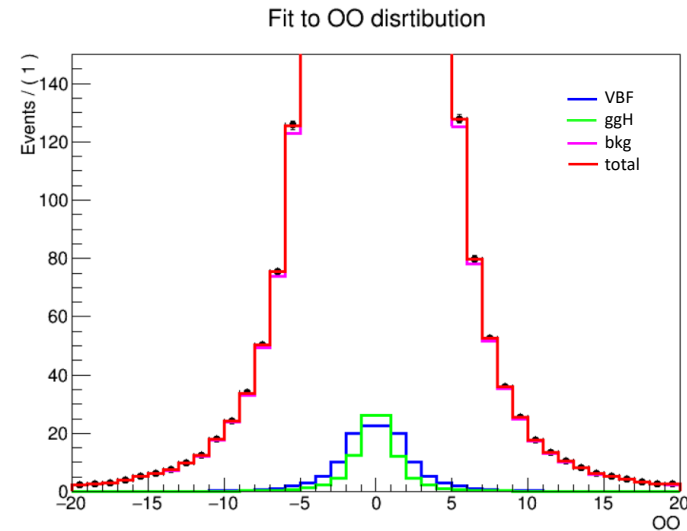
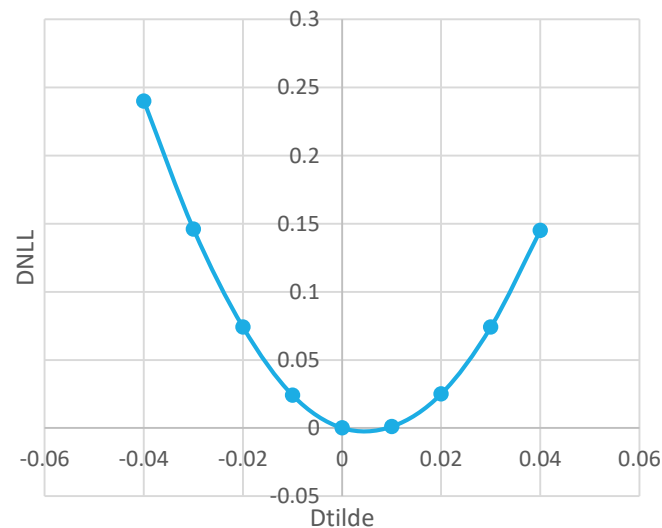


OO distribution for VBF+ggH(left) and
VBF+ggH+bkg(right, zoomed) sample

VBF Higgs CP

Increase background statistics.

Use same bkg sample in extracting histPDF and NLL.



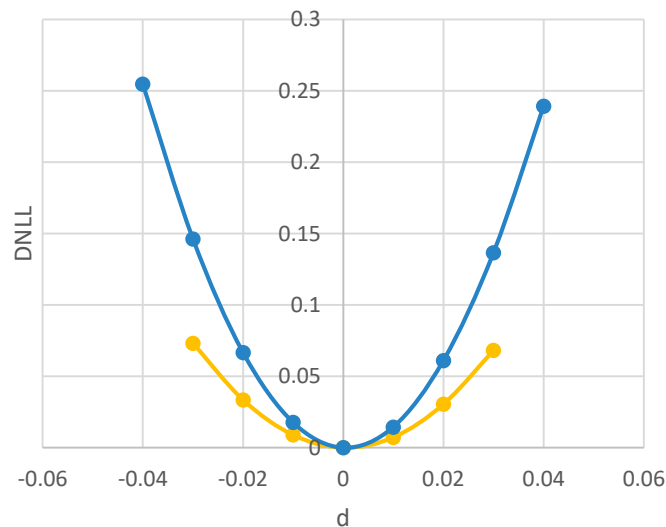
Hist pdf is more sensitive than functional pdf.

Minimum shift still exist, but better than total 2D fit.

VBF Higgs CP

Check2: Fit OO shape in signal region $m_{\gamma\gamma} \in [120, 130] \text{ GeV}$, to increase VBF significance. Abandon $m_{\gamma\gamma}$ shape.

- Fit sample: MC for VBF and ggH, Asimov data for bkg.
- Extract NLL exclude OO range $[-3, 3]$ (remove peak region)



Define SR:

- $m_{\gamma\gamma} \in [120, 130] \text{ GeV}$
- $OO \in [-20, -3] \cup [3, 20]$

— extract NLL in $[-20, 20]$

— extract NLL exclude $[-3, 3]$

NLL curve for fit OO in SR.

Problem: NLL value is negative?

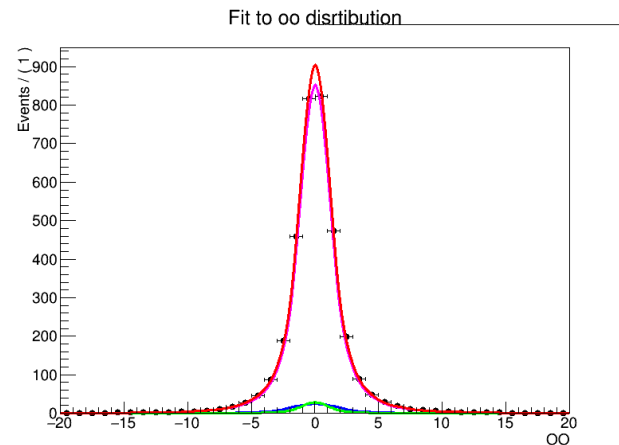
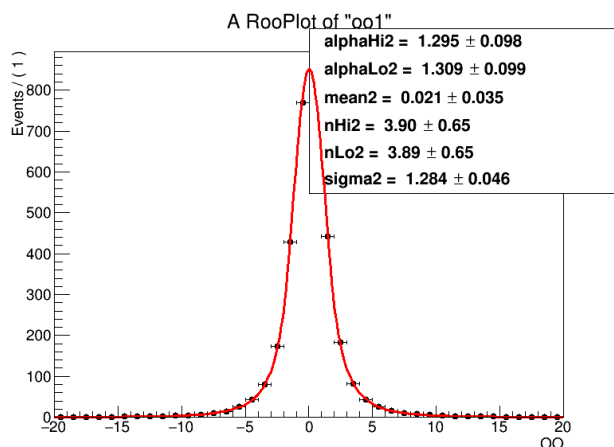
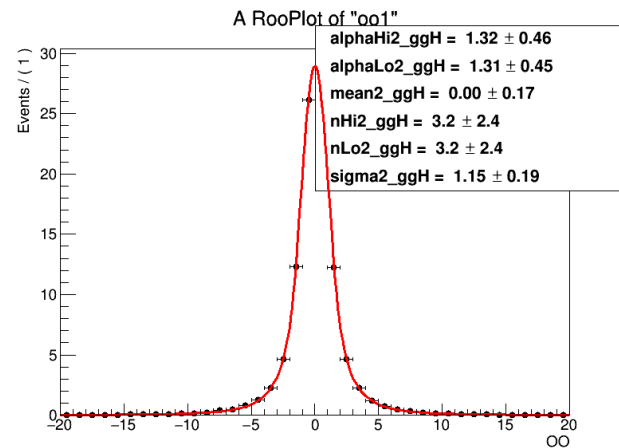
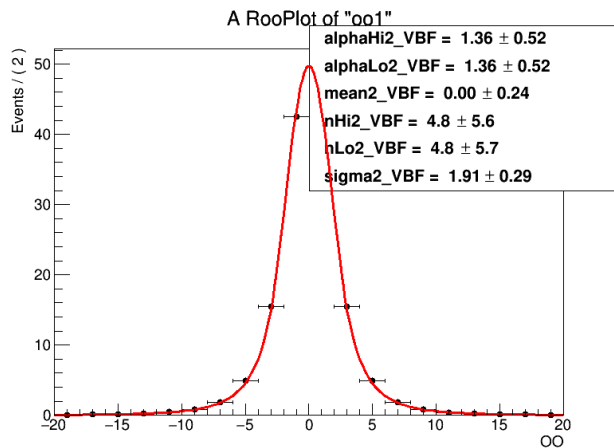
VBF Higgs CP

Brief summary: Methods for extracting NLL

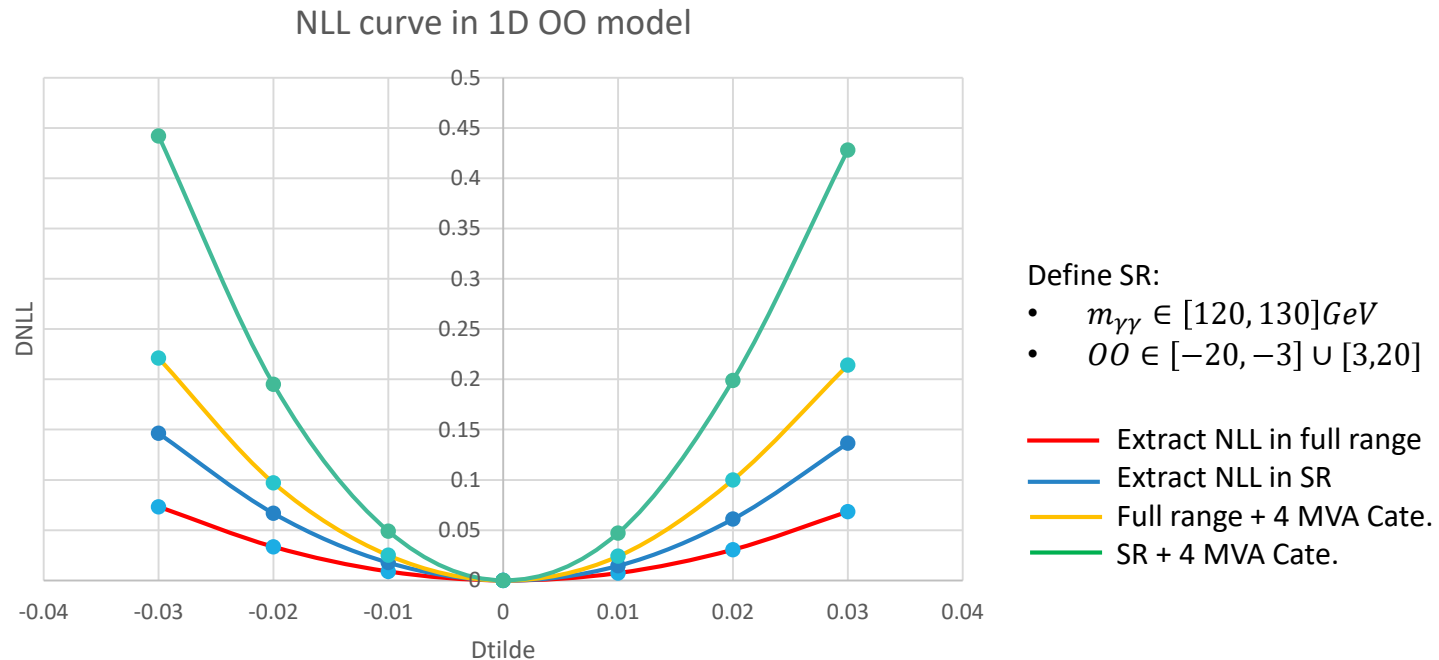
- 2D functional model: $PDF_{total} = \sum N_i \times f_i(m_{\gamma\gamma}) \times g_i(OO)$.
Problem: minimum value shift in NLL curve
- 2D histpdf model: $PDF_{total} = hist(m_{\gamma\gamma}, OO)$
Pro: can include possible correlation between $m_{\gamma\gamma}$ and OO
Con: hard to code and debug. Maybe not necessary.
- 2D functional*hist model: $PDF_{total} = \sum N_i \times f_i(m_{\gamma\gamma}) \times h_i(OO)$.
Pro: can describe OO shape better, and consider di-peak structure.
Con: very sensitive to dataset. Still have minimum value shift.
- **1D OO model in SR**
Pro: High VBF significance. No have shift problem.
Con: lose some sensitivity.
- 1D $m_{\gamma\gamma}$ model in several OO bins
Pro: mature tools for analysis
Con: worst performance in these several methods.

backup

OO distribution for SL7



MVA result for OO fit



H→ $\tau\tau$ expected result(36fb):

- $[-0.035, 0.033]$ @ 68% CL.
- $[-0.21, 0.15]$ @ 95% CL.