Weekly report

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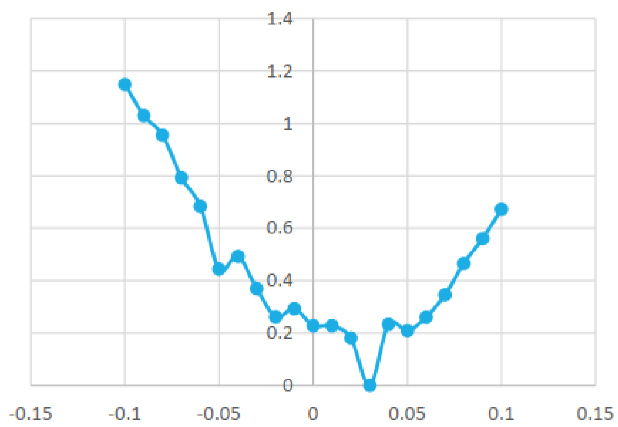
VBF Higgs CP

Previous: very strange performance of NLL curve

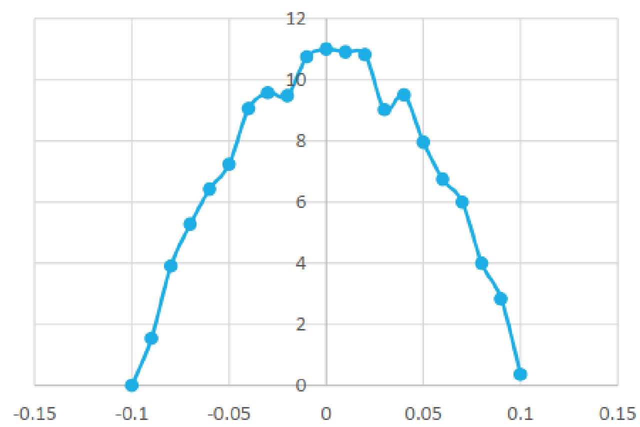
Check1: DoubleSideCB might not describe OO distribution well, so use a RooHistPdf to describe OO and DSCB to describe m_yy.

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

DNLL calculated by hand-write code

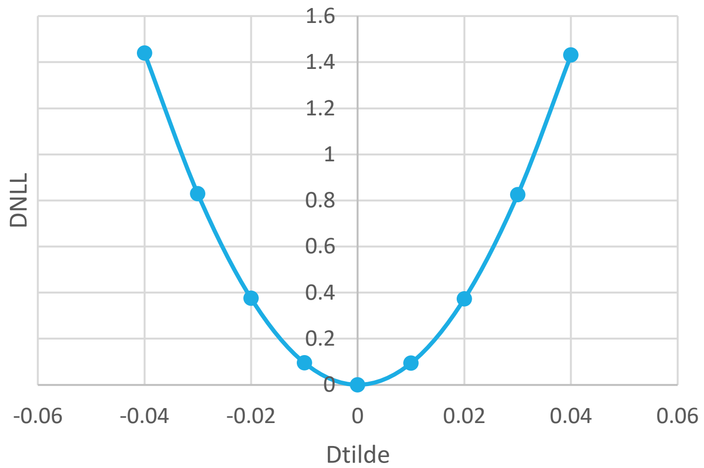


DNLL calculated by RooStat(createNLL)

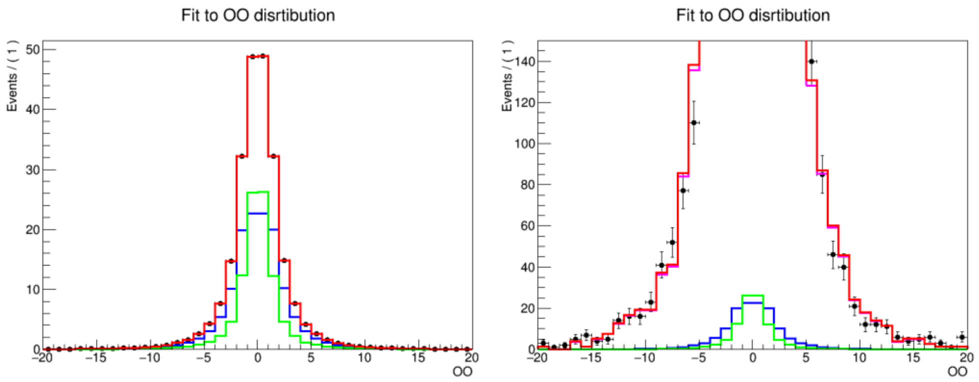


VBF Higgs CP

Check1: 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

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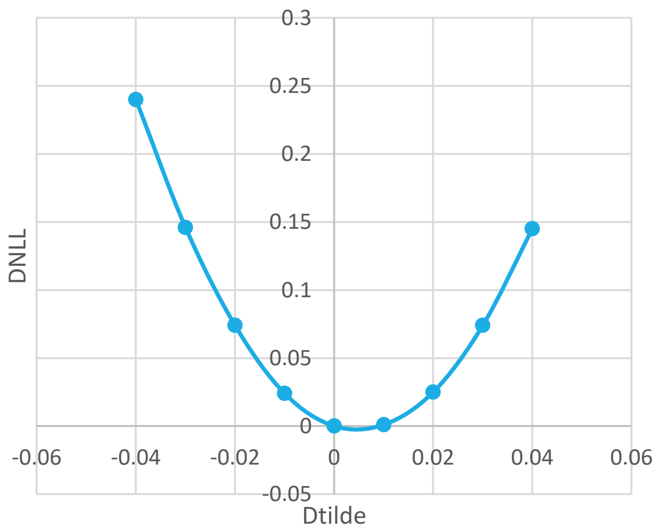
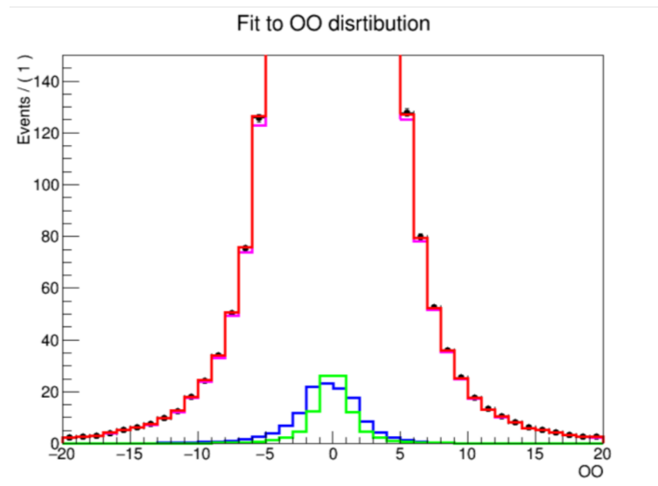
Increase background statistics.

Use same bkg sample in extracting histPDF and NLL.



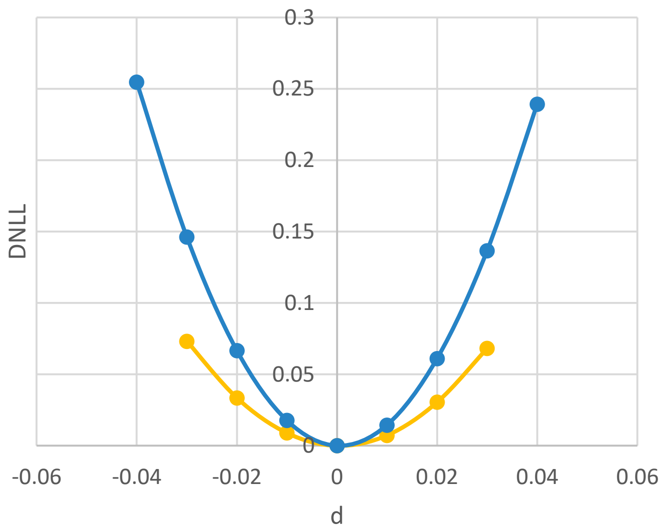


Hist pdf is more sensitive than functional pdf.
Minimum shift still exist, but better than total 2D fit.

VBF Higgs CP

Check2: Fit OO shape in signal region $m_{\gamma\gamma} \in [120{,}130]GeV$, 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 my SR:

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

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.