

Weekly report

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VBF Higgs CP

Hgam report last week: <https://indico.cern.ch/event/843513/>

Feedback from group:

- Use side-band to check background PDFs.
- Introduce MVA categories.
- Check shape correlation of $m_{\gamma\gamma}$ and OO in 3 templates.
- Check if HAWK could calculate SM matrix element correctly.
- 1 remaining problem: event weight.

MVA in Higgs CP test

VBF categories:

- 4 Run2 MVA categories for VBF:

p_T^{Hjj} high-tight, p_T^{Hjj} high-loose, p_T^{Hjj} low-tight, p_T^{Hjj} low-loose

- Combined results of 4 categories:

$$NLL_{comb} = \sum_{4\ cat.} NLL, \text{ and } \Delta NLL_{comb} = NLL_{comb} - NLL_{comb}^{min}$$

Cut-based result:

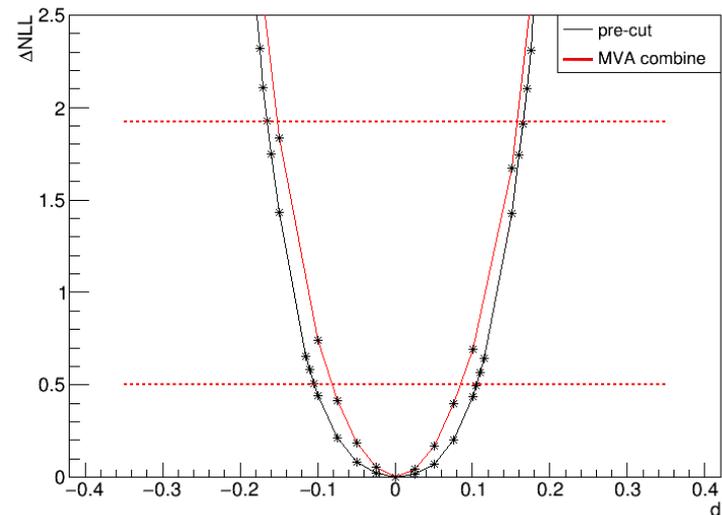
1σ exclusion for outside $[-0.105, 0.105]$

2σ exclusion for outside $[-0.165, 0.165]$

MVA result:

1σ for $\sim[-0.08, 0.08]$

2σ for $\sim[-0.15, 0.16]$



VBF Higgs CP test

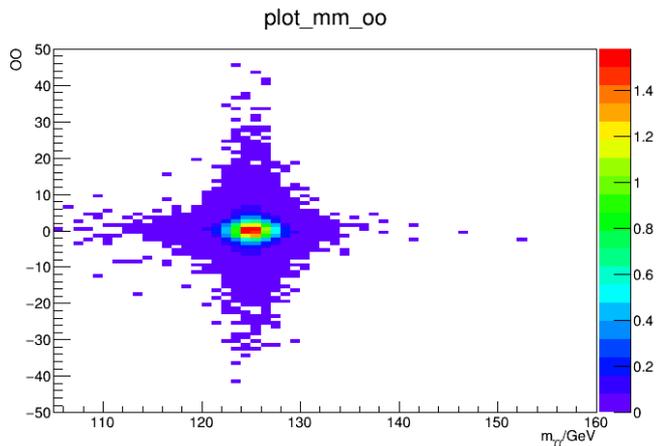
Remaining problem:

- Weight calculation: ~20% events could not have correct event weight from HAWK, and ~2% events have very large weight number.
 - HAWK includes $qg \rightarrow qq\bar{q}H$ process, which could have 3 quarks in final state.
 - The PDGID stored in TruthEvent::PDGID and (TruthParticle::status()==21)->PDGID is not the same.
 - But when I change the code, it doesn't change too much.

Next step:

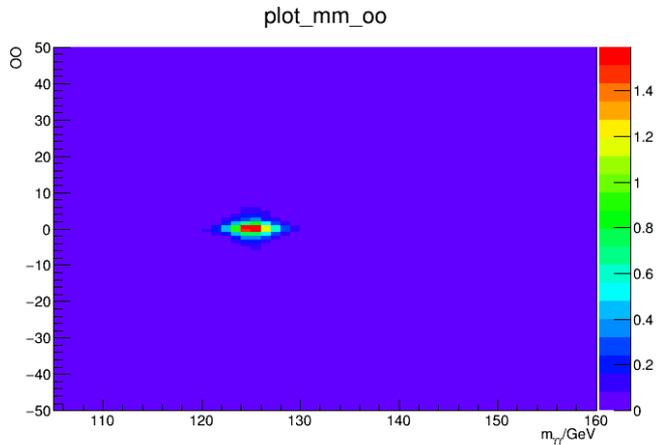
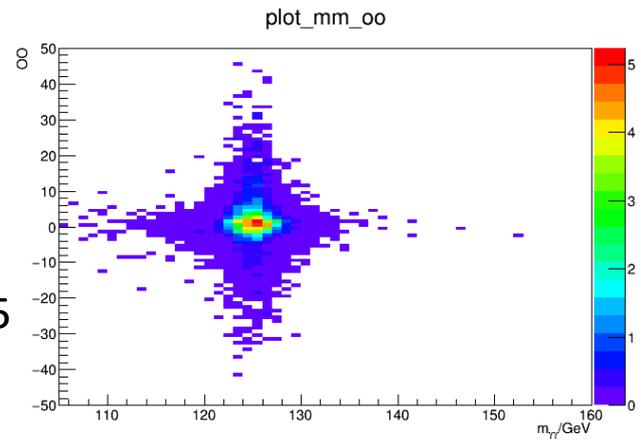
- Check HAWK package for event weight and validation.
- Introduce some sys. Error.
- Check side-band background model.

VBF Higgs CP test



VBF
SM

VBF
 $d=0.35$



ggF
SM

bkg
SM

