

# Weekly report

---

FANGYI GUO

A solid blue horizontal bar at the bottom of the page.

# VBF Higgs CP

Theory comparison between VBF Higgs and ttH Higgs

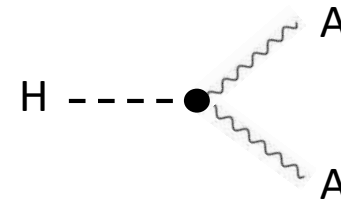
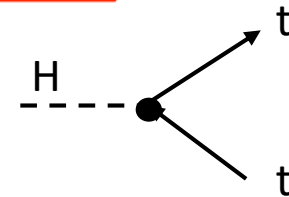
- Lagrangian:
- The Lagrangian for t-H interaction including CP mixing is

$$\mathcal{L}_t = -\frac{m}{\nu} \kappa_t (\cos(\alpha) \bar{t}t + i \sin(\alpha) \bar{t} \gamma_5 t) H, \quad \kappa_t > 0, \quad \alpha \in [-\pi, \pi]$$

SM corresponds to  $\alpha = 0$ ,  $\kappa_t = 1$ , full CP odd is  $\alpha = 90^\circ$

$$\mathcal{L}_{\text{eff}} = \mathcal{L}_{\text{SM}} + \frac{f_{BB}}{\Lambda^2} \mathcal{O}_{\bar{B}B} + \frac{f_{WW}}{\Lambda^2} \mathcal{O}_{\bar{W}W} + \frac{f_B}{\Lambda^2} \mathcal{O}_{\bar{B}}$$

$$= \mathcal{L}_{\text{SM}} + \tilde{g}_{HAA} H \tilde{A}_{\mu\nu} A^{\mu\nu} + \tilde{g}_{HAZ} H \tilde{A}_{\mu\nu} Z^{\mu\nu} + \tilde{g}_{HZZ} H \tilde{Z}_{\mu\nu} Z^{\mu\nu} + \tilde{g}_{HWW} H \tilde{W}_{\mu\nu}^+ W^{-\mu\nu}.$$

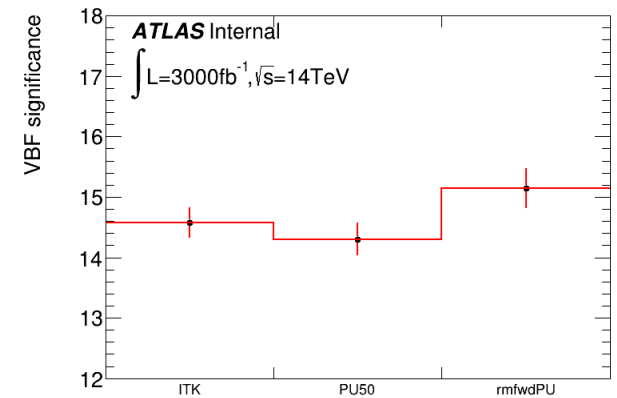


# Upgrade HGTD

## Previous

- 3 scenario: ITK(default), PU50, rmfwdPU.

Scenario	$\sigma_{VBF}$	Improvement
ITK	$14.58 \pm 0.25$	0
PU50	$14.30 \pm 0.27$	-1.92%
rmfwdPU	$15.15 \pm 0.33$	3.91%



Update: increase training sample in traditional BDT, decide the category simultaneously.

ITK	PU50	rmfwdPU
14.39	14.58	15.15