

# CMS & ATLAS $H(125)$ Fermion Decays Results (including $t\bar{t}H$ )

Andrew Chisholm

Birmingham U.



Anne-Catherine Le Bihan

IPHC, IN2P3, UHA Mulhouse

Andrei Gritsan

Johns Hopkins U.

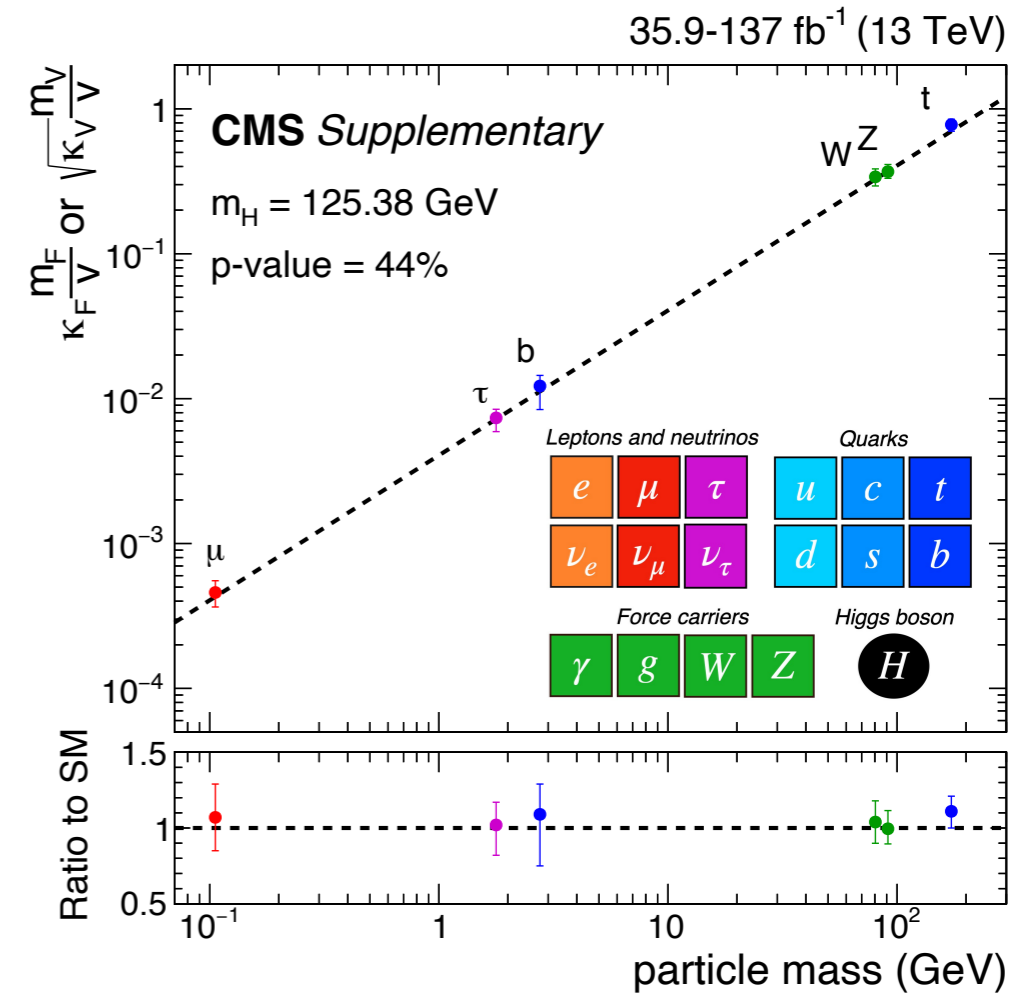
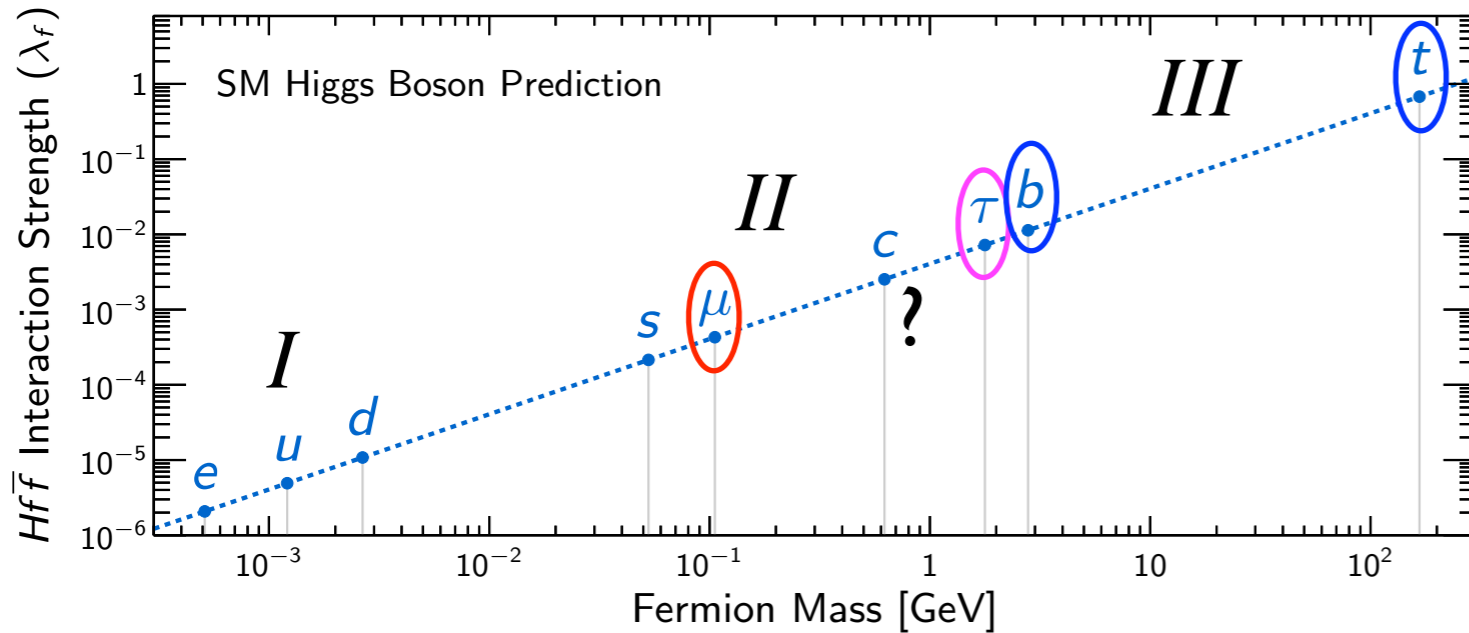


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# $H(125)$ Fermion Couplings / Decays

$$L_Y = \frac{m_f}{v} H(\kappa_f \tilde{f} \tilde{f} + \tilde{\kappa}_f \tilde{f} i \gamma_5 f)$$

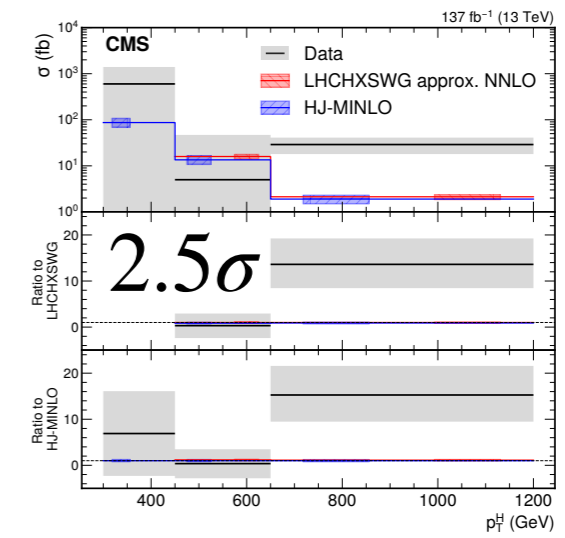
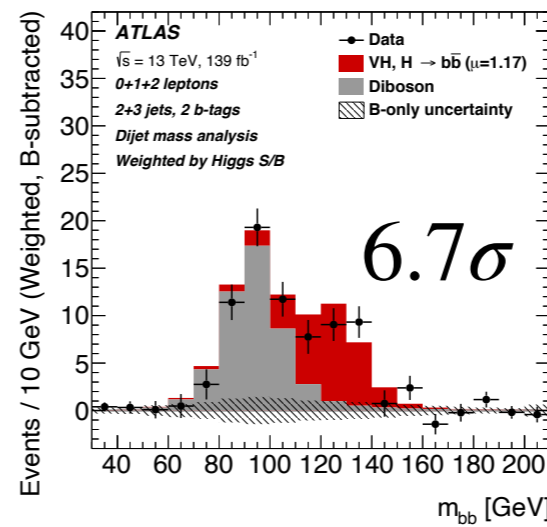


- How precise are the  $H\mu\mu, H\tau\tau, Hbb, Htt$  ?
- Can we reach lighter quarks, electrons?
- CP violation?
- New techniques, learn between ATLAS and CMS, theory?

# Target down type: $H \rightarrow b\bar{b}, \tau^+\tau^-, \mu^+\mu^-$

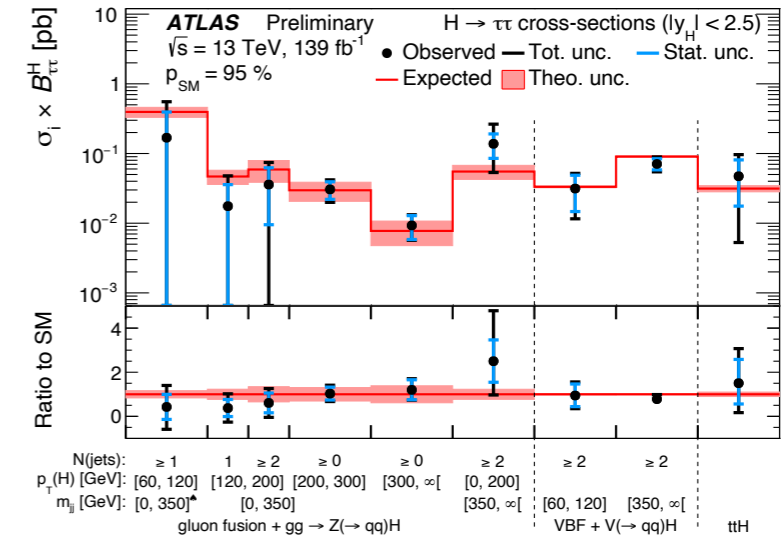
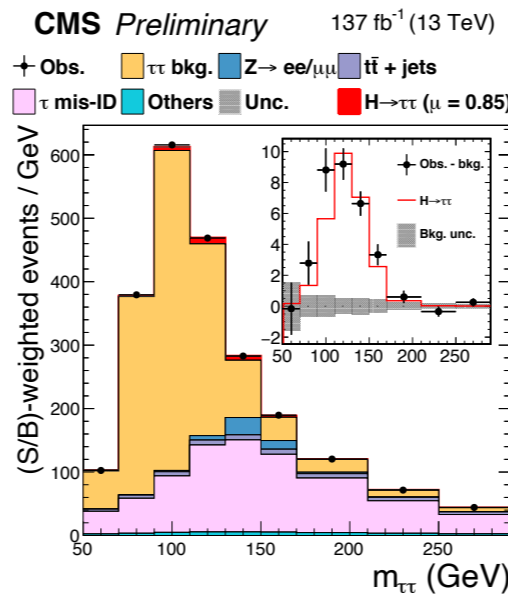
- $Hbb$ : associated production, boosted

STXS, differential  $p_T$   
(boosted on ATLAS?)



- $H\tau\tau$ : associated,  $p_T$

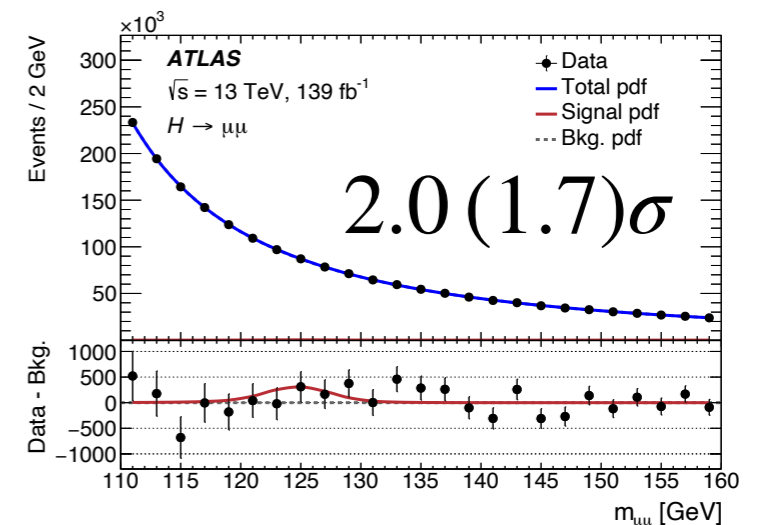
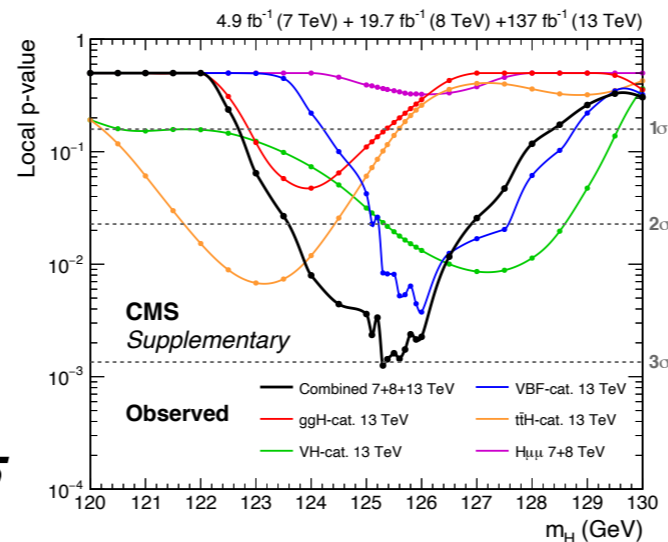
STXS  
(signif. of VBF on CMS?)



- $H\mu\mu$ : associated, inclusive

(CMS vs. ATLAS?)

3.0 (2.5) sigma



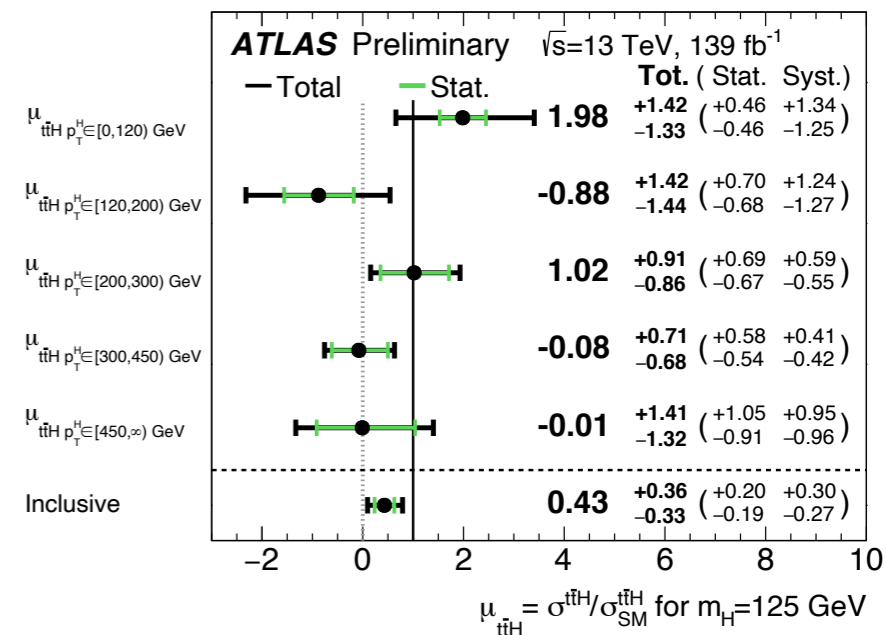
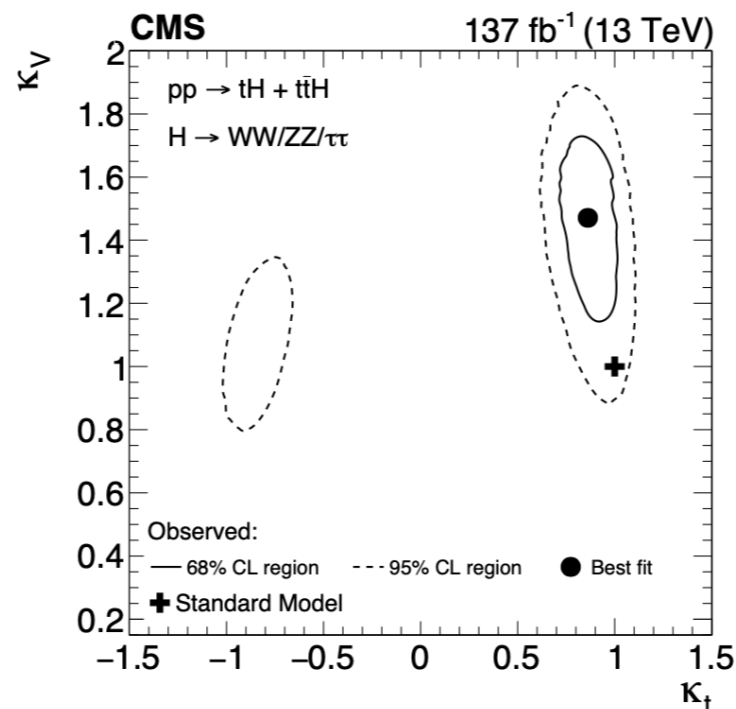
# Target up type: $t \rightarrow tH, H \rightarrow c\bar{c}$

- $t\bar{t}H, tqH, tWH$ :

$\gamma\gamma, bb, \text{multileptons}$

$p_T$

(ATLAS vs. CMS?)

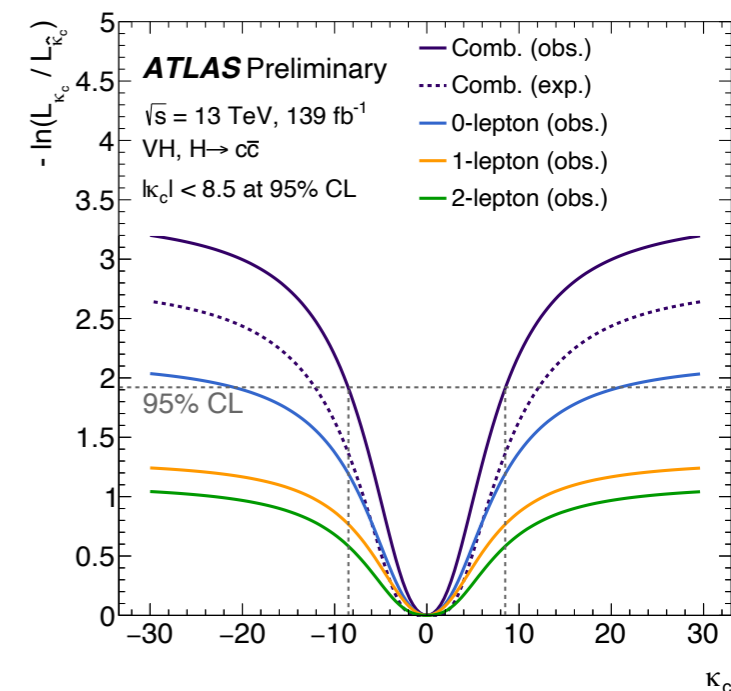
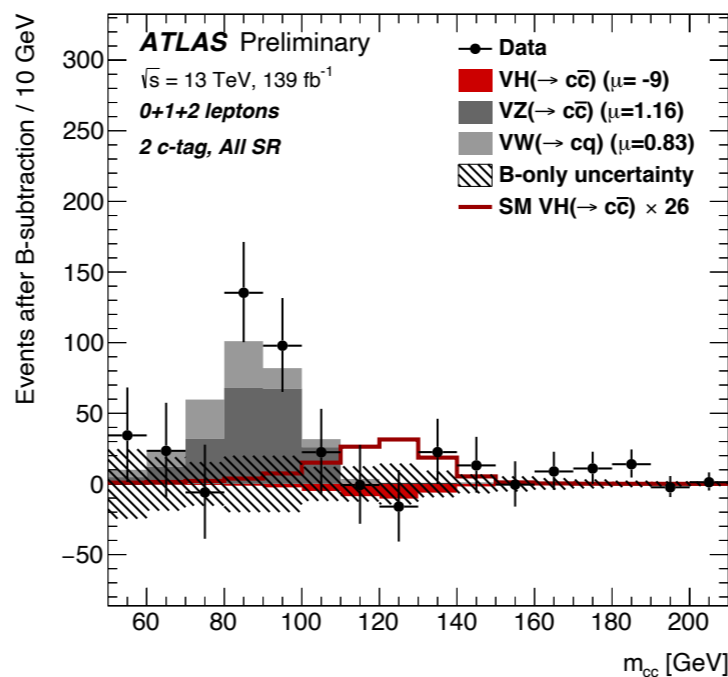


- $Hcc$ :  $c$ -tagging, associated production

expected:

ATLAS:  $\mu < 31^{+12}_{-8}$  at  $139 \text{ fb}^{-1}$

(CMS:  $\mu < 49^{+24}_{-15}$  at  $36 \text{ fb}^{-1}$ )



- indirect constraints from  $p_T^H$  — comparable  $\kappa_c$

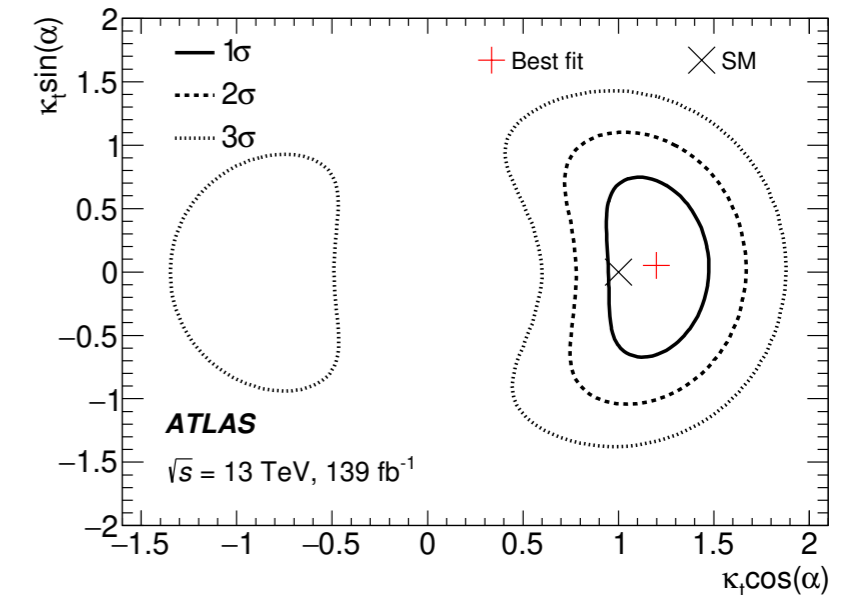
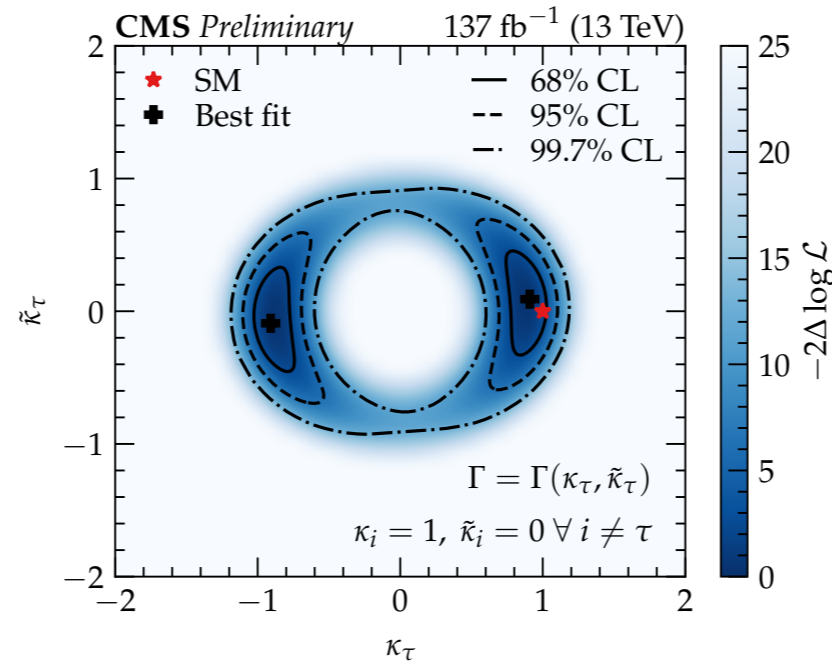
# CP violation in fermion $H(125)$ couplings

- First steps on CP in  $Htt, H\tau\tau$  :

similar  $Htt$  on CMS / ATLAS

(CP in  $H\tau\tau$  on ATLAS?)

(HL-LHC ATLAS  
 $\pm 18^\circ \rightarrow \pm 33^\circ$   
 CMS now  $\pm 23^\circ$ )



- Other studies (indirect):

- $\kappa_t$  and  $\tilde{\kappa}_t$  from  $t\bar{t}$  and  $t\bar{t}t\bar{t}$
- $\kappa_t$  and  $\tilde{\kappa}_t$  from  $gg \rightarrow H$ , loops...
- $\kappa_c$  from  $p_T^H$
- light quarks from  $H \rightarrow Z\rho, \dots$