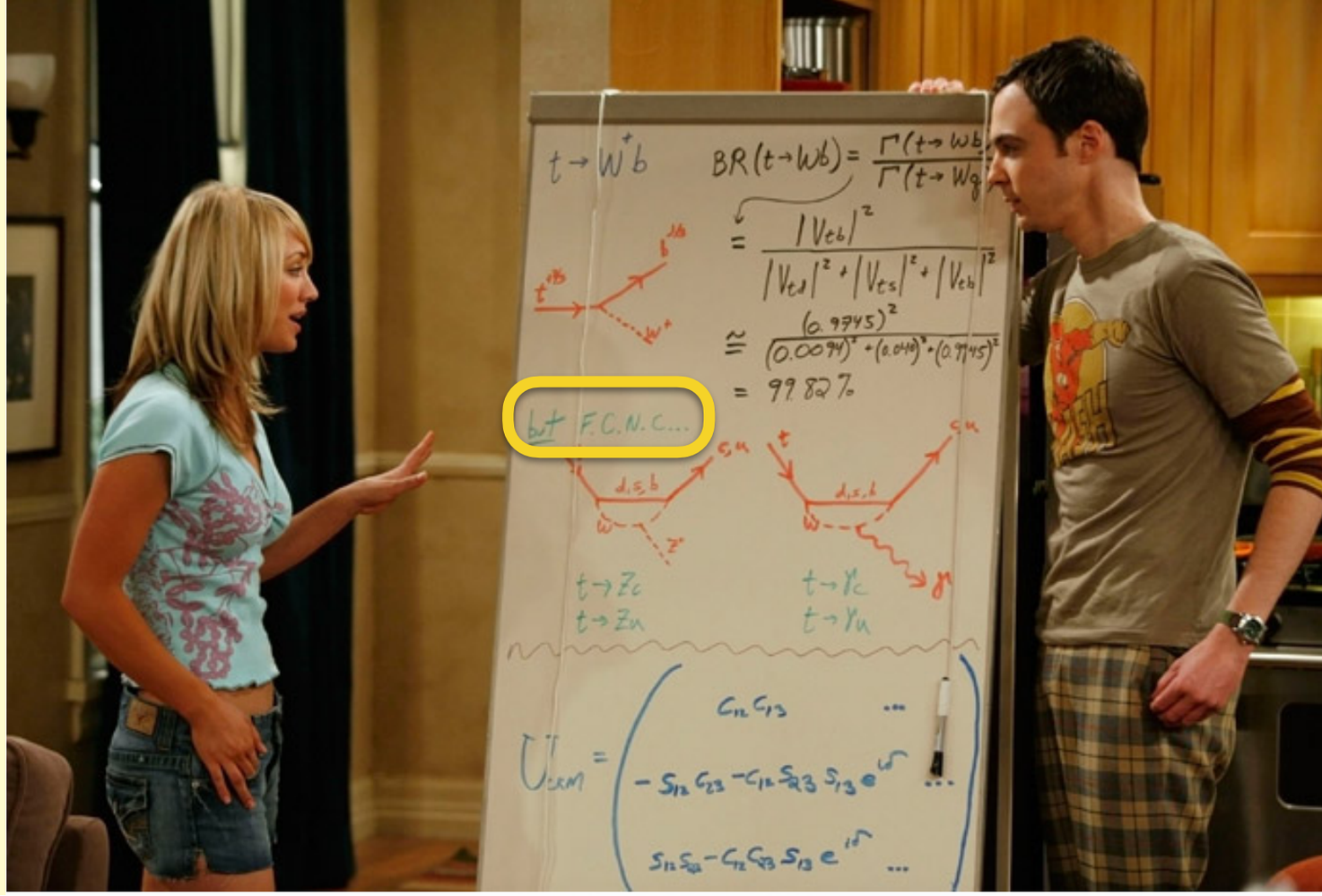
Prospects for Top-Higgs FCNC at HL-LHC (CMS view)



Kirill Skovpen (VUB Brussel)

HL/HE-LHC WG1 Meeting / Top physics

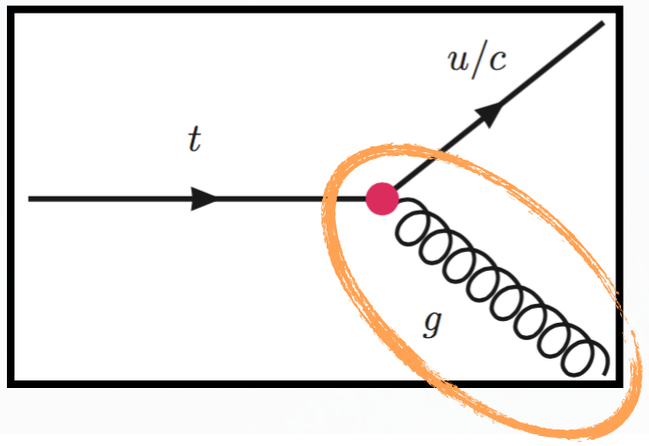
February 28, 2018

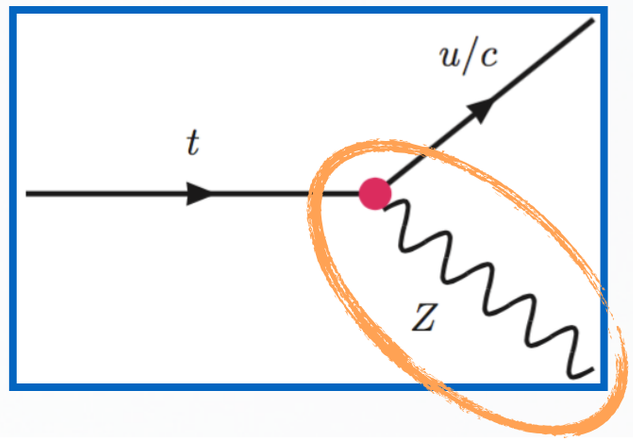
Research Foundation Flanders
Opening new horizons

VRIJE UNIVERSITEIT BRUSSEL

FCNC with top quarks

Top + gluon





Top + Z

$$\mathcal{L} = \sum_{q=u,c} [\sqrt{2} g_s \frac{\kappa_{gqt}}{\Lambda} \bar{t} \sigma^{\mu\nu} T_a (f_{Gq}^L P_L + f_{Gq}^R P_R) q G_{\mu\nu}^a +$$

$$+ \frac{g}{\sqrt{2} c_W} \frac{\kappa_{zqt}}{\Lambda} \bar{t} \sigma^{\mu\nu} (f_{Zq}^L P_L + f_{Zq}^R P_R) q Z_{\mu\nu} + \frac{g}{4 c_W} \zeta_{zqt} \bar{t} \gamma^{\mu} (f_{Zq}^L P_L + f_{Zq}^R P_R) q Z_{\mu} -$$

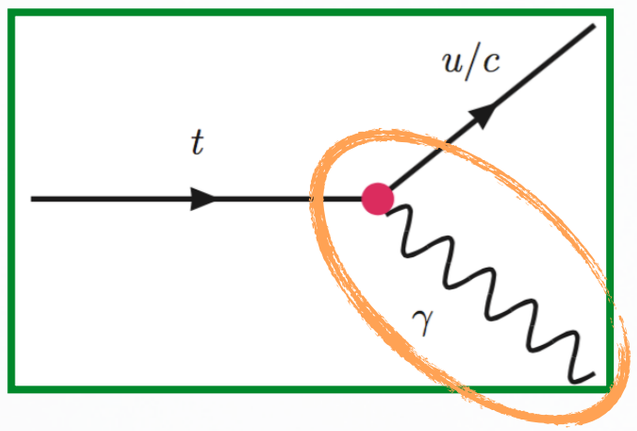
$$- e \frac{\kappa_{\gamma qt}}{\Lambda} \bar{t} \sigma^{\mu\nu} (f_{\gamma q}^L P_L + f_{\gamma q}^R P_R) q A_{\mu\nu} +$$

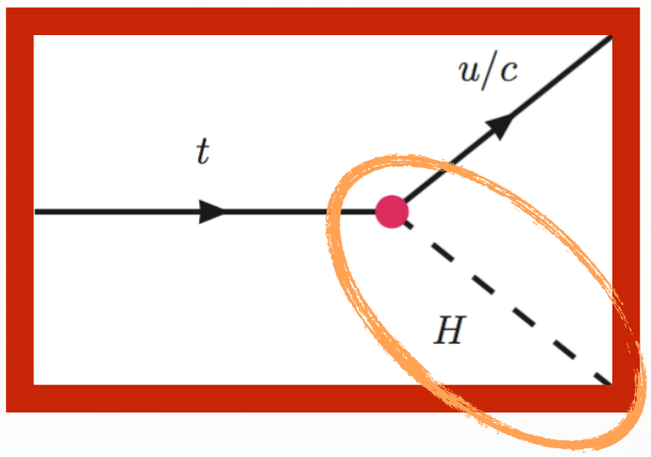
$$+ \frac{g}{\sqrt{2}} \bar{t} \kappa_{Hqt} (f_{Hq}^L P_L + f_{Hq}^R P_R) q H \Big] + h.c.$$

u ← c ← t

d ← s ← b

Top + gamma





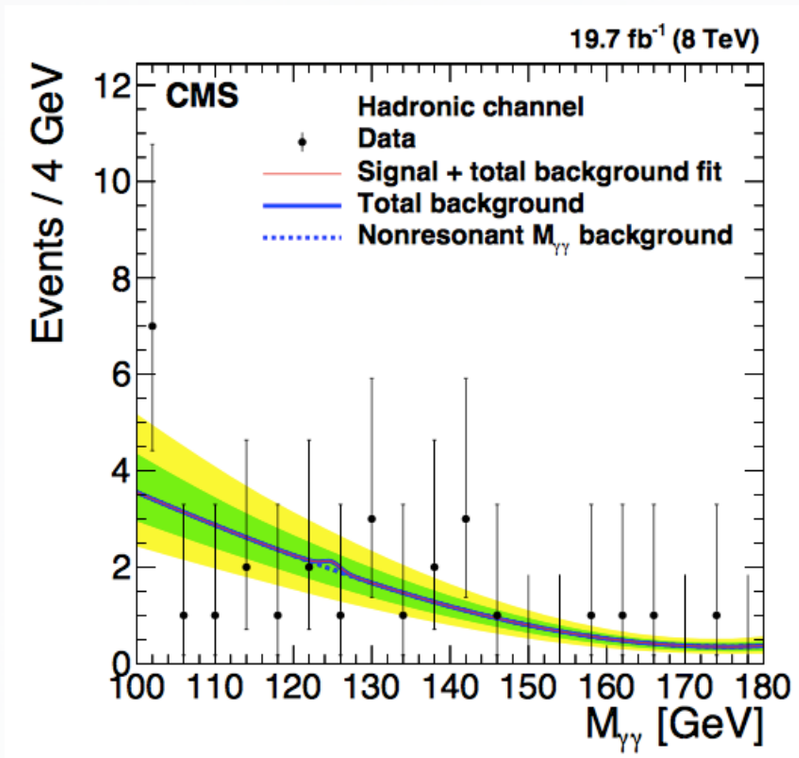
Top + Higgs

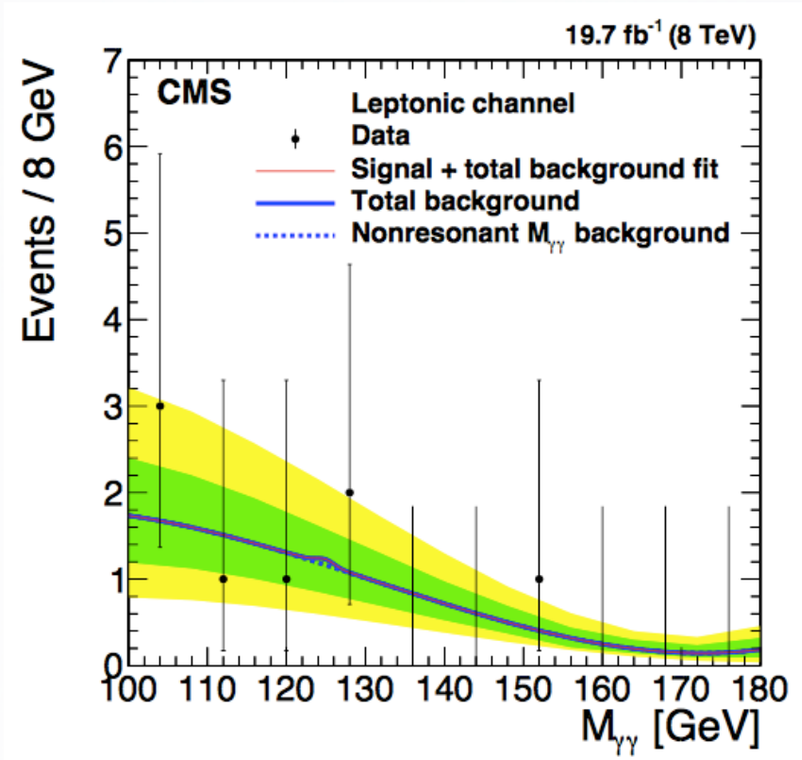
Search for top-H FCNC in ttbar

H→γγ

JHEP 02 (2017) 079

20 fb^{-1}, 8 TeV





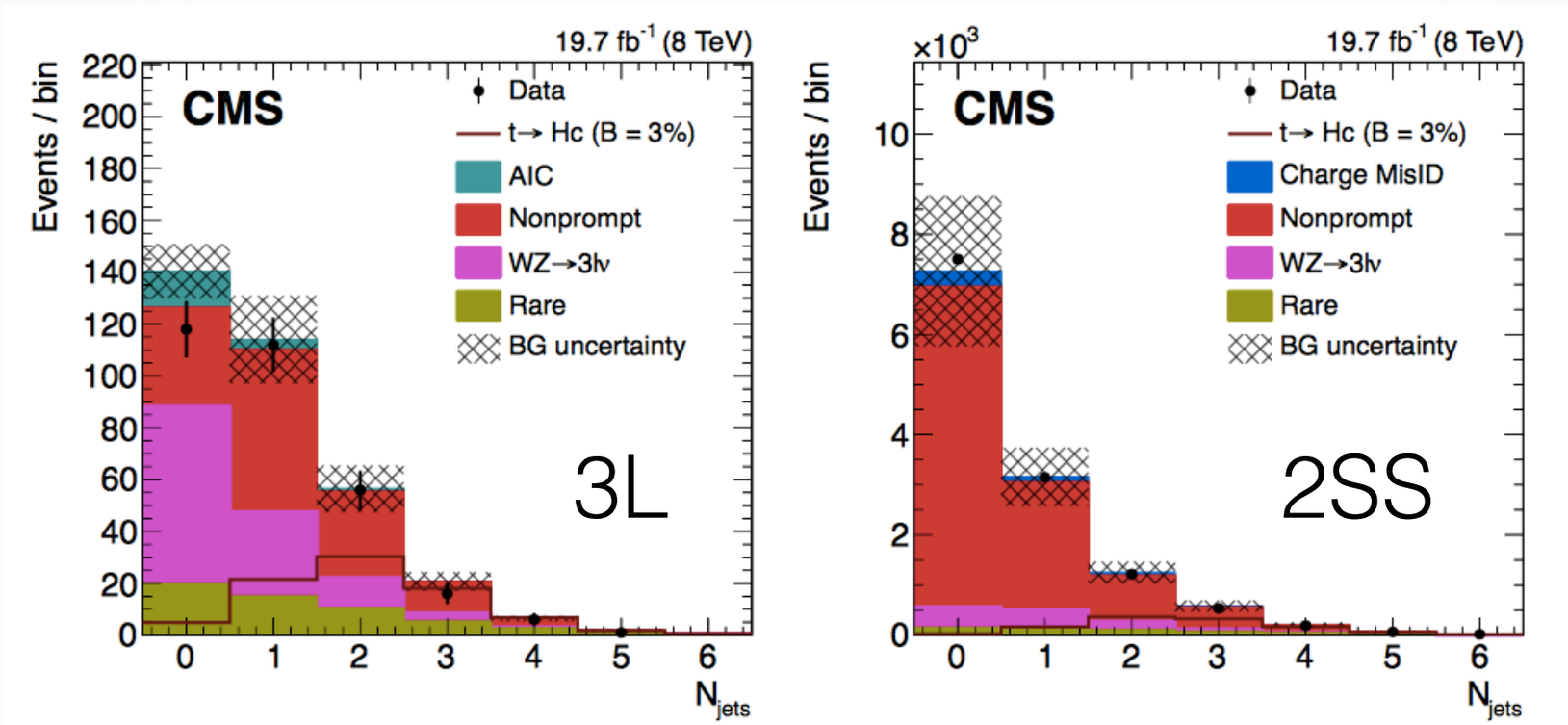
- **Beaten by ATLAS with 13 TeV data (arXiv:1707.01404)**
- ***Fully statistics*** limited
- Include single top for FCNC signal production ?

Search for top-H FCNC in ttbar

H→WW/(ττ)

JHEP 02 (2017) 079

20 fb^{-1}, 8 TeV



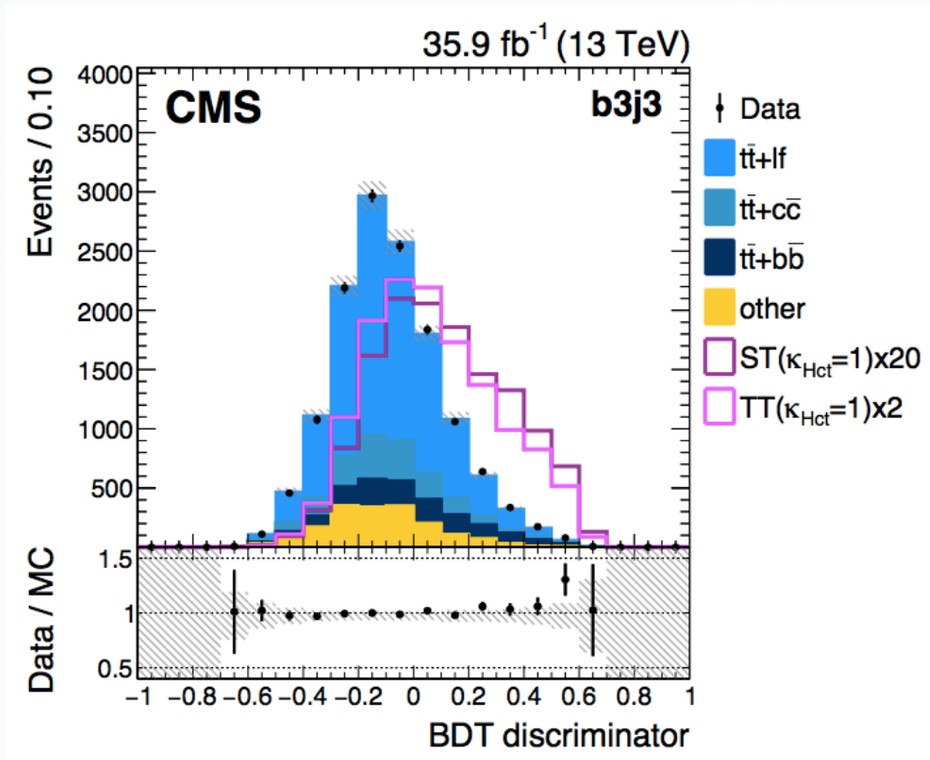
- **Beaten by ATLAS at 8 TeV (JHEP 12 (2015) 061)**
- ***Statistics*** (3L) and ***systematics*** (2SS) limited
- Include single top for FCNC signal production ?

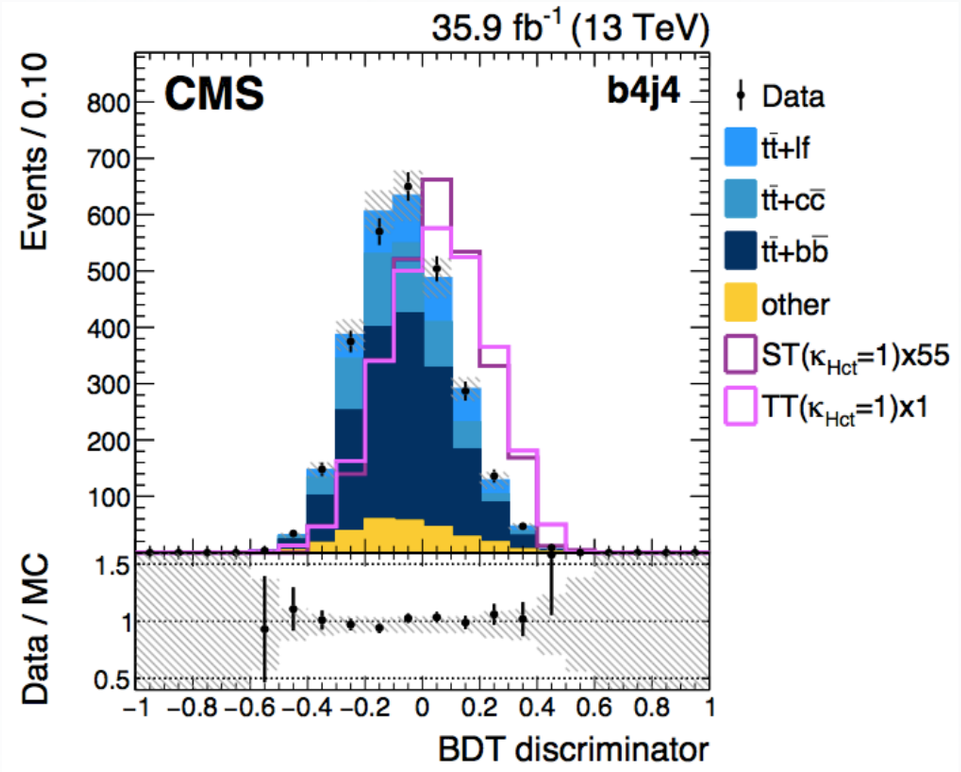
Search for top-H FCNC in ttbar and single top

H→bb

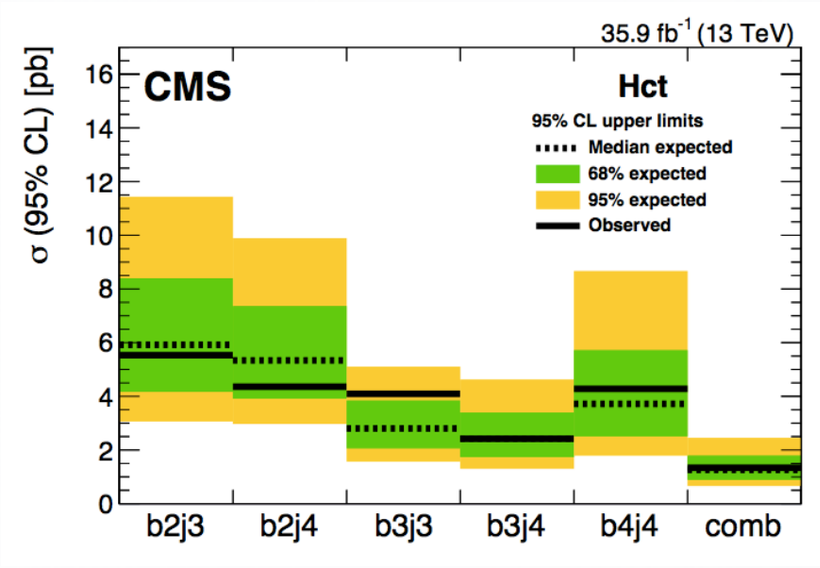
arXiv:1712.02399

36 fb-1, 13 TeV





- **Best limits in this channel from CMS, but beaten by ATLAS with H→γγ at 13 TeV**
- ***Systematics*** limited



Top FCNC searches must go on

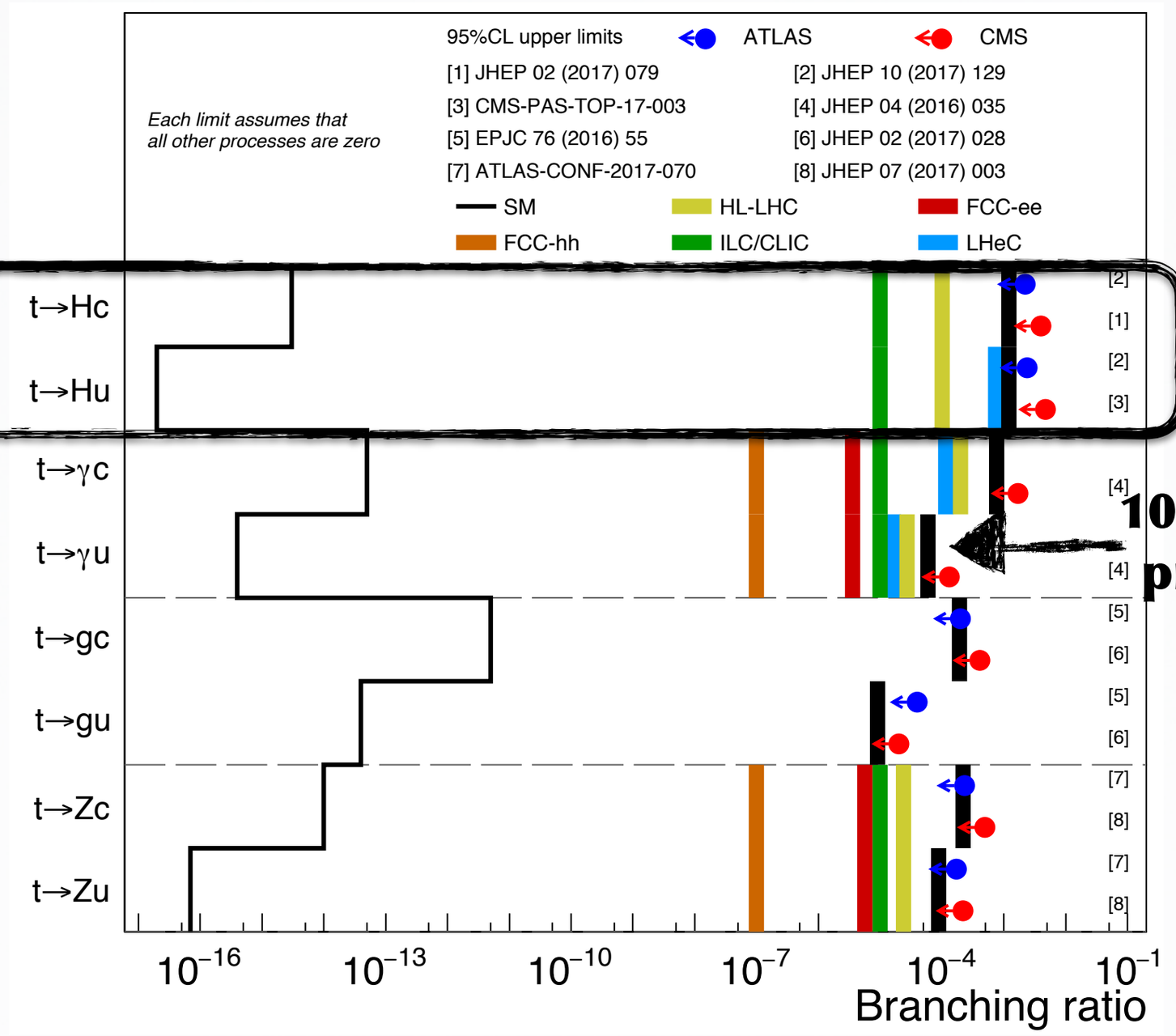
Limited by:

Stat/Syst

Syst/Stat

Syst

Stat



Conclusion

- Need to study all Higgs decay channels to get the best limits on top-Higgs FCNC
- Good coverage of all channels at CMS at 8 TeV
- Several analyses are in progress at 13 TeV
- Statistically (H→γγ, H→multilepton) and systematically (H→bb) limited analyses

- Different approaches to signal event generation are used at ATLAS (TopFCNC, NLO) and CMS (MadGraph, LO)
- Single top+V/H FCNC is only studied by CMS
- A common ATLAS-CMS FCNC discussion group would ease to use a consistent set of generator tools and analysis strategies