BSM benchmark request from the off-shell subgroup

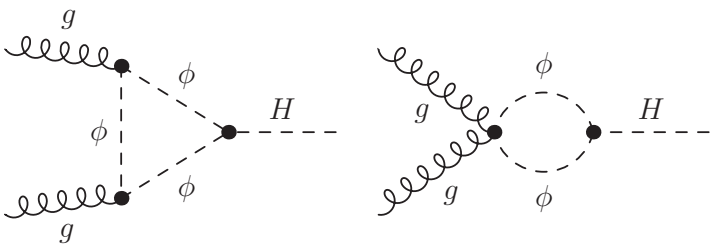
Request

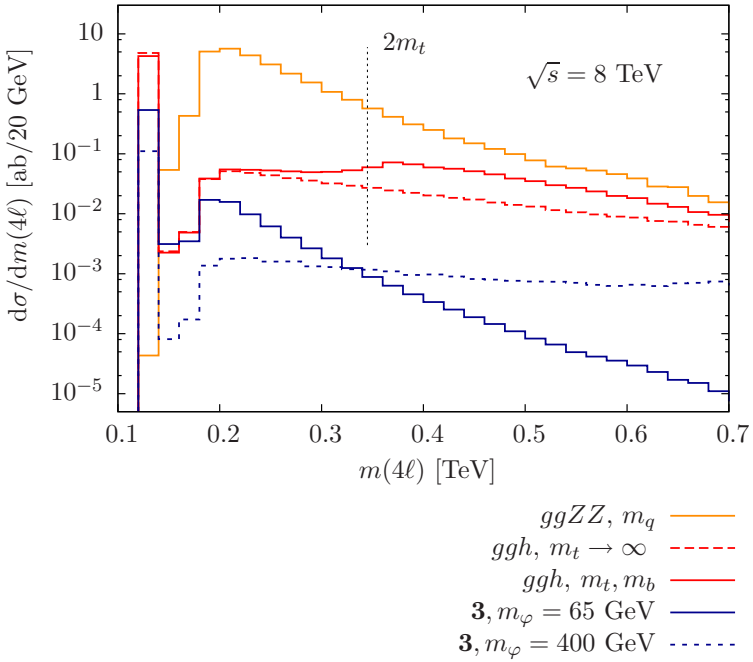
- non-excluded benchmark points for 1-Higgs-Singlet model (as defined in YR3, Section 13.3)
- non-excluded benchmark points for MSSM, general 2HDM, . . .

for the study of

- off-shell tail of the 125 GeV Higgs boson
- Higgs-background interference effects
- model dependence of on-peak/off-peak Higgs width constraints
- model dependence of Higgs mass peak shift in $gg \to H \to \gamma\gamma$

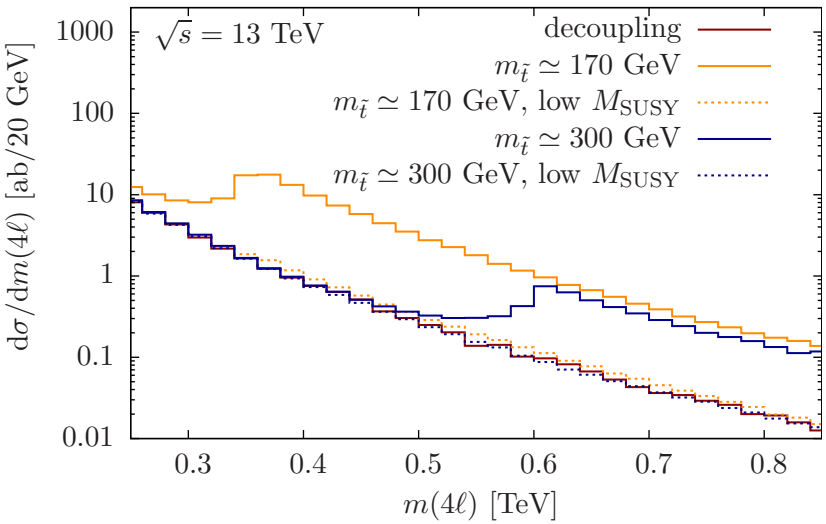
Beyond the Standard Model

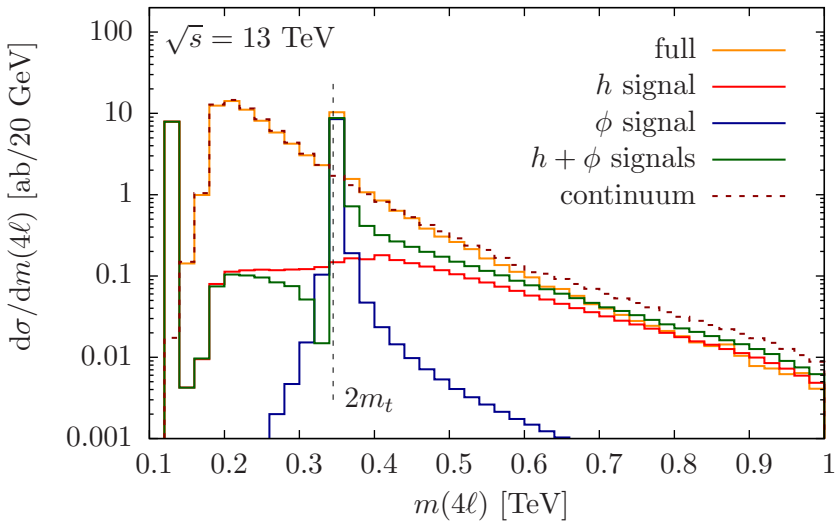




C. Englert, M. Spannowsky (2014)

BSM benchmark scenario studies



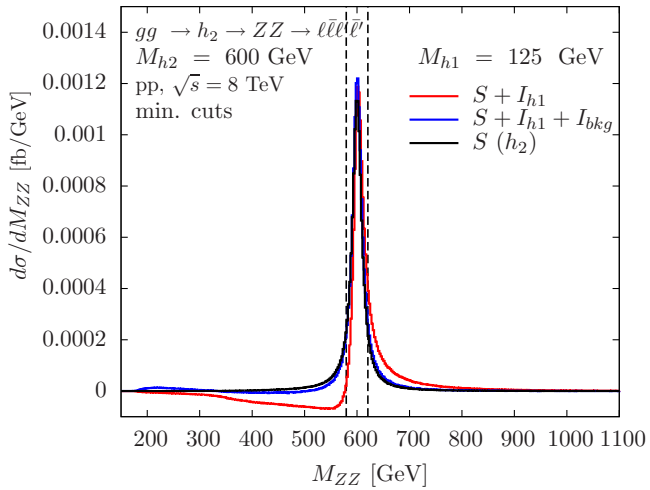


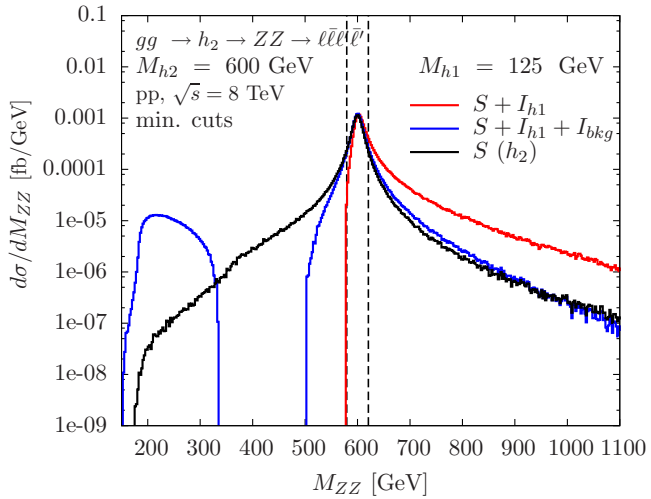
left: MSSM, right: portal-extended SM model

C. Englert, Y. Soreq, M. Spannowsky (2014)

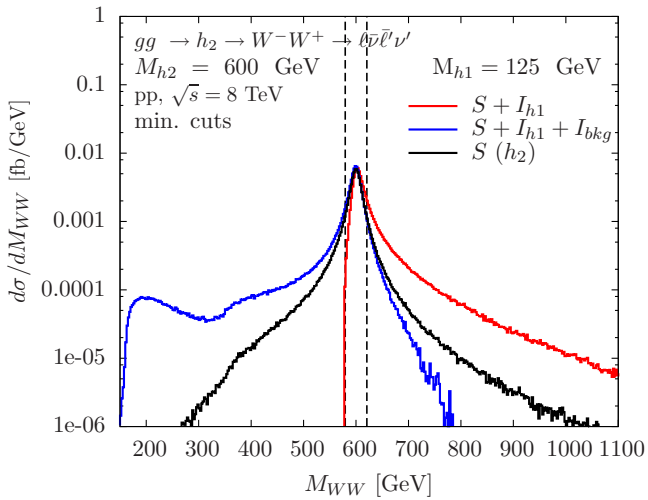
also: C. Englert, I. Low, M. Spannowsky (2015)

Heavy Higgs-background interference in 1-Higgs-Singlet-Model

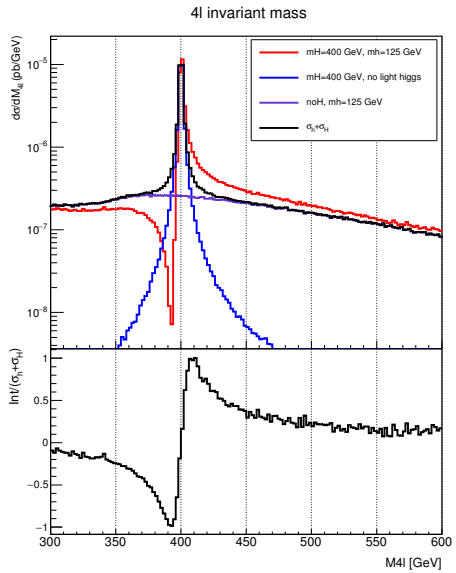


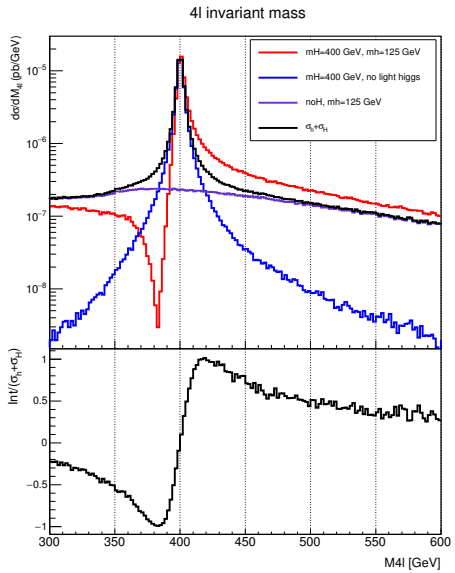


NK, C. O'Brien



NK, C. O'Brien

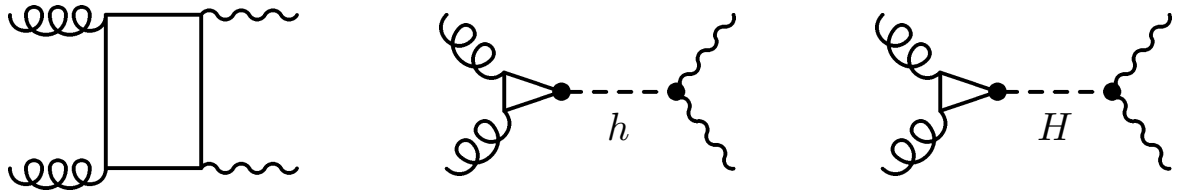




E. Maina

Loophole: additional light scalar in the s-channel

[H.E. Logan, 1412.7577]



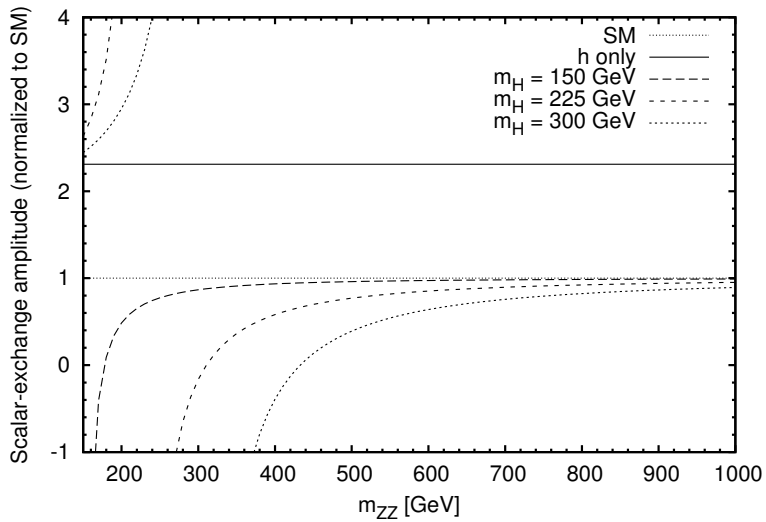
SM: h cancels growth $\propto E/v$ of $t\bar{t} \to ZZ$ amplitude.

Modified h couplings: cancellation imperfect; growth of amplitude with E provides LHC sensitivity at high m_{ZZ}!

Extended Higgs sector: Require $\kappa_t^h \kappa_Z^h + \kappa_t^H \kappa_Z^H = 1$ for unitarity of $t\bar{t} \to ZZ$ (automatic in renormalizable models): $\kappa_t^h \kappa_Z^h = 1 + \Delta > 1, \quad \kappa_t^H \kappa_Z^H = -\Delta$

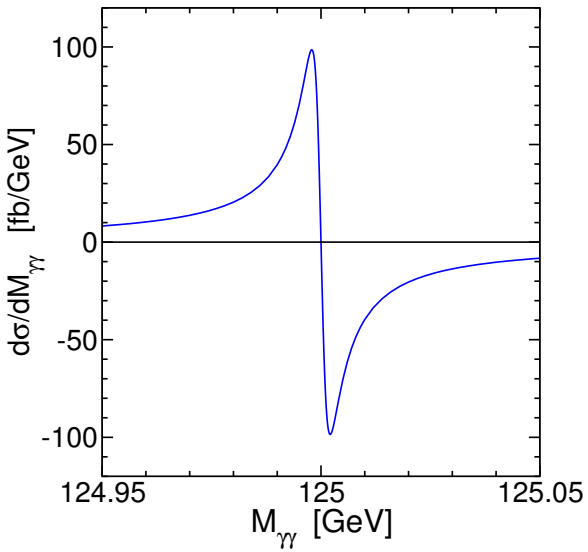
Amplitude relative to SM:

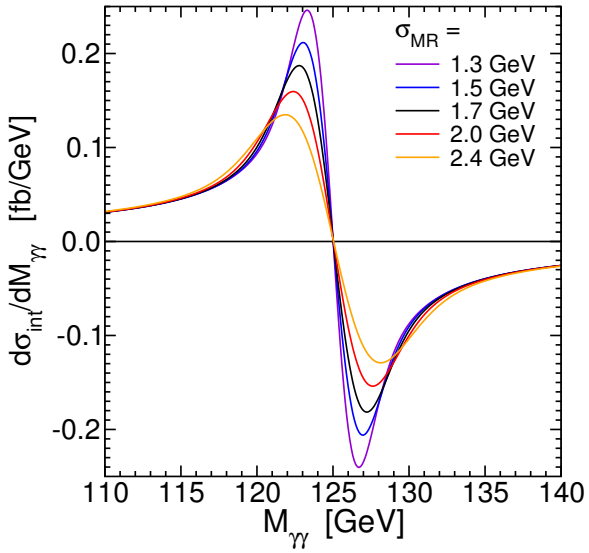
$$\begin{aligned} \frac{\mathcal{M}_h + \mathcal{M}_H}{\mathcal{M}_{h_{\rm SM}}} &= (1+\Delta) - \Delta \frac{p^2 - m_h^2}{p^2 - m_H^2} \\ &\simeq 1 - \Delta \frac{(m_H^2 - m_h^2)}{p^2} \\ &\to 1 \text{ for } p^2 \gg m_{h,H}^2 \end{aligned}$$

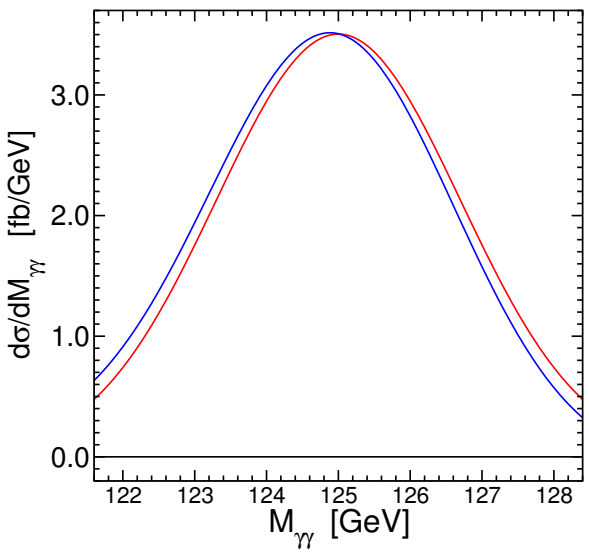


Presence of H at low mass (well below 350 GeV) causes $gg \to ZZ$ cross section to be SM-like at high m_{ZZ}, even if $\kappa_t^h \kappa_Z^h$ is strongly non-SM-like.

BSM dependence of $H \to \gamma\gamma$ mass peak shift?







Higgs resonance - BSM continuum interference effects?

new feature: BSM EW light degrees of freedom active in loop-induced $H \to \gamma\gamma$ decay?