Maximally possible Xsections for $ggF \to H_{heavy} \to (H_{125} \to bb) + (H_{singlet} \to bb)$ in the NMSSM

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The process $ggF \to H_{heavy} \to (H_{125} \to bb) + (H_{singlet} \to bb)$
is one of the promising channels to look for an extended Higgs sector
in the NMSSM

How large can this cross section be, for
various masses of $H_{heavy} \equiv H_3 \simeq H_{MSSM}$ and $H_{singlet}$?

$\to$ Scan the parameter space using NMSSMTools, using a dedicated
Monte Carlo routine, consistent with

- SM Higgs Mass + couplings (kappas) within present bounds,

- LHC searches for BSM Higgses,

- B-Physics,

- constraints from dark matter direct detection experiments.

(The NMSSM contains a neutral stable LSP which must not violate these
constraints even if its relic density is below the observed one, in which case an
additional hidden sector has to be assumed.)

ggF -> H_3 -> H_{SM} + $H_{singlet}$ -> bb + bb
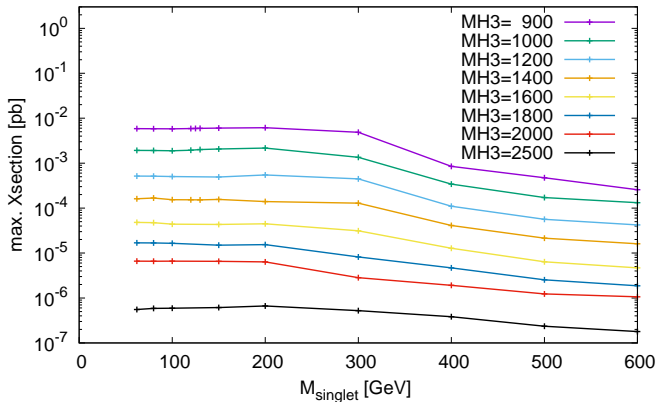
Rough estimate of possible sensitivities:
$\mathcal{O}(10^{-3})$ pb, increase to $\mathcal{O}(10^{-4}) - \mathcal{O}(10^{-5})$ pb for larger masses

$\rightarrow$ Discoveries are possible (but not guaranteed!)

Comments:

- $M_{Hs} > 62$ GeV since otherwise the parameter space is strongly constraint by limits on $H_{125} \to H_s + H_s$ leading to significantly smaller allowed Xsections.
- Otherwise: max. Xsection nearly independent from M_{Hs} (also for $M_{Hs} \sim 125$ GeV; interference effects show up only if $M_{H_{125}} - M_{Hs} \sim \Gamma_{H_{125}} \sim 4$ MeV)
- Decreasing Xsection for $M_{Hs} > 250$ GeV where $Hs \to H_{125} + H_{125}$ becomes possible reducing the $BR(Hs \to bb)$
- Further decrease of the Xsection for $M_{Hs} > 350$ GeV where $Hs \to toptop$ becomes possible reducing the $BR(Hs \to bb)$
- Prospects: Continue towards lighter values of $M_{H_{heavy}} < 900$ GeV, repeat the exercise for other channels

Good Luck!