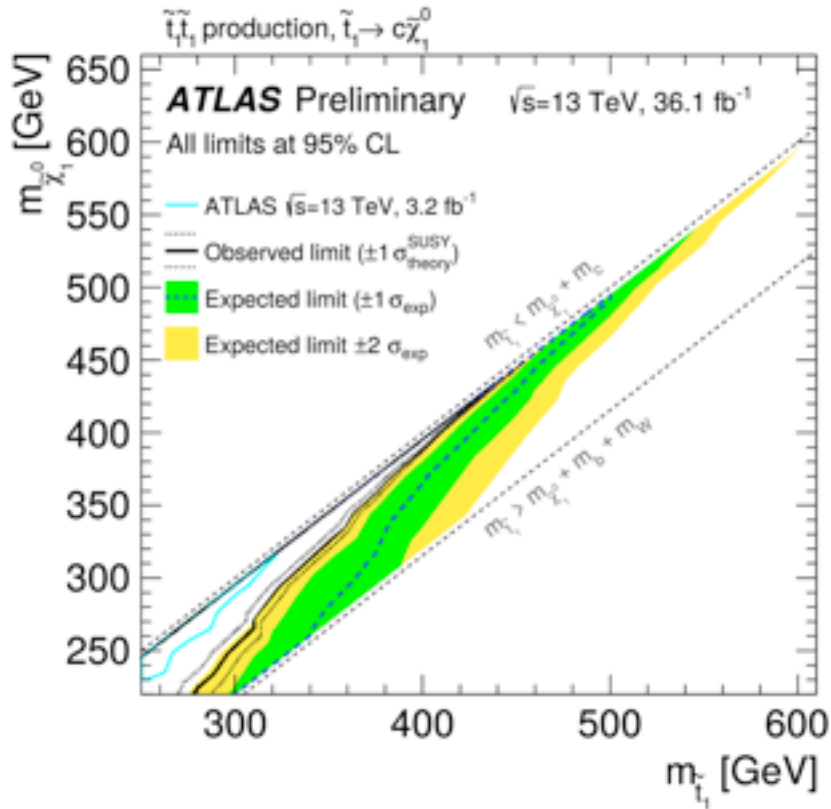# Current activities involving the MSSM-Neutral subgroup
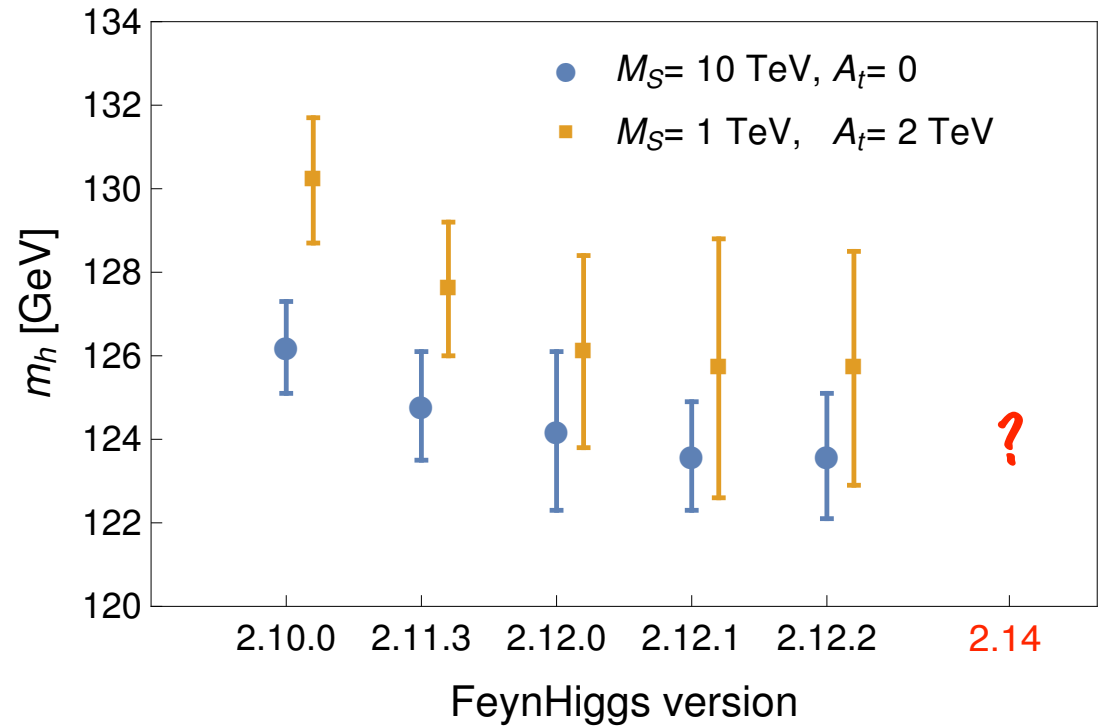
- Refresh the "classic" benchmark scenarios with TeV-scale SUSY

- Refresh the heavy-SUSY / light-THDM scenario

- Obtain MSSM-Higgs p_T distributions by reweighting THDM ones

The benchmark scenarios need refreshing

Direct searches eat the
MSSM parameter space:

Theory predictions have evolved:

(e.g., both kill the "light-stop" scenario?)

MSSM Higgs Boson Searches at the LHC:
Benchmark Scenarios for Run 2

Elina Fuchs[a], Sven Heinemeyer[b,c,d], Stefan Liebler[e,f], Shruti Patel[e],

Pietro Slavich[g,h], Tim Stefaniak[e,i], Carlos E.M. Wagner[j,k,l], Georg Weiglein[e]

- **basic scenario:** TeV-scale SUSY, large X_t (so $m_h \approx 125$ GeV), Δ_b effects

- **light-stau scenario:** contributions to $h \to$ gaga, plus $H/A \to$ staus, $H/A \to$ EW-inos

- **light-chi scenario:** contributions to $h \to$ gaga plus $H/A \to$ EW-inos
  (bounds on EW-ino masses?)

- **alignment scenario:** h SM-like even at low m_A, for moderate tanβ
  (but how low can we go?)

- **H125 scenario:** the heaviest scalar H is the SM-like one
  (vacuum stability? bounds from charged-Higgs searches?)

- **CPV scenario:** H and A mix, large interference effects in $H/A \to$ tautau

Heavy-SUSY / Light-THDM

- The "resummed" calculation used for the "low-tb-high" scenario was inadequate (no light THDM)

- The alternative "hMSSM" approach involves hidden assumptions and its results cannot be mapped everywhere to an underlying MSSM scenario

- We aim at defining a proper "low-$\tan\beta$" MSSM scenario via an EFT calculation where the low-energy theory is a THDM

- Two public codes now available (MhEFT by Wagner & Lee, FlexibleSUSY) plus FeynHiggs coming "soon"

- A preliminary version of FeynHiggs 2.14 seems to agree with MhEFT

- We are prodding the authors but not (so far) taking an active role

Reweighting Higgs p_T

- In THDM: top, bottom and interference contributions to Higgs pT distributions are computed at different scales and reweighted by effective Yukawa couplings

- Approximate results for the MSSM: further reweighting with Δ_b effects (neglect direct squark contributions)

- Stefan and Andrew know more about this...