WG3 NMSSM Subgroup: ideas for the future

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on behalf of

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Summary of YR4 contribution

- ▶ Presentation of tools for the NMSSM
- ▶ Summary of NMSSM-specific signatures
- ▶ Collection of benchmark points

Tools

- We discuss the tools available to study the NMSSM.
- We give for each spectrum generator the most relevant information
  - What models are supported?
  - What is the method and accuracy of the Higgs mass calculation?
  - What is about the calculation of decays?
  - What other calculations are performed by the tool?
- We give details about the calculation of cross sections in the NMSSM
  - Implementation of higher-order corrections in public tools
  - Discussion of the uncertainties

Signatures

We categorise NMSSM-specific signatures as follows:

1. Direct H_{125} production and decays
2. Direct light H_S/A_S production and decays
3. Direct H/A production and decays
4. Higgs bosons in squark/gluino/chargino/neutralino decays, singlino-like LSP
5. Displaced vertices

A few general comments for each category are given, and for most scenarios benchmark points are proposed.

Benchmark Points

- We summarise nine benchmark scenarios already published elsewhere
- All points are updated for YR4
  - . . . to use proposed SM parameters
  - . . . to use spectrum generator with highest available precision
- Main features as well as most important masses, cross sections and branching ratios are presented in YR4

- Distinguishing the NMSSM from other models
- Pinning down the NMSSM properties
- Singlet/Singlino phenomenology
- Benchmark scenarios

Distinguishing the NMSSM from other models

▶ Identify signatures that allow us to distinguish the NMSSM from other NMSSM-like models, e.g. the SM extended by a complex singlet

broken CxSM vs NMSSM: $m_\varphi < m_{h_{125}}$

[Costa, Mühlleitner,Sampaio, Santos,1512.05355]
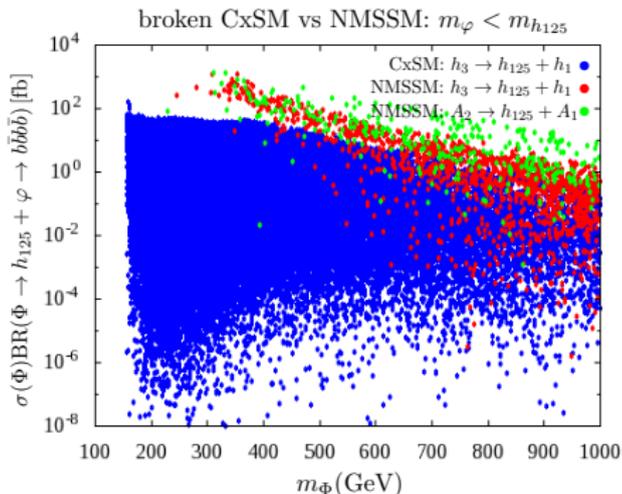
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- ▶ To what extend can coupling measurements allow us to distinguish the NMSSM from other BSM Higgs sectors, in case not all NMSSM Higgs bosons are discovered?
- ▶ How can one distinguish the Z_3 invariant NMSSM from the general one
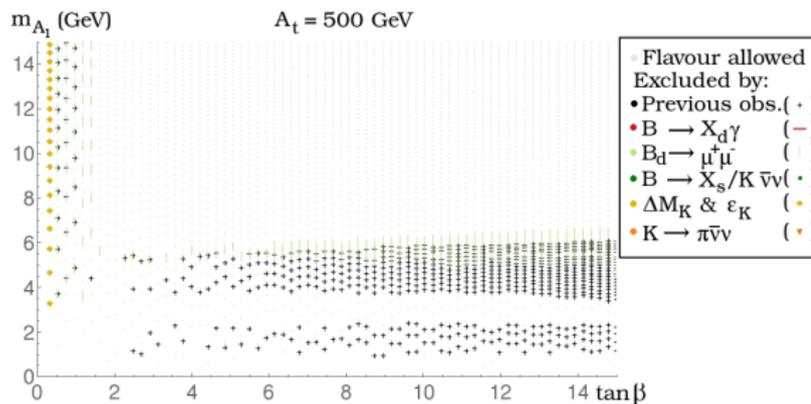
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▶ Flavour violation in the NMSSM

[Domingo,1512.02091]

Pinning down the NMSSM properties

- ▶ Higgs-to-Higgs decays: what do we learn in the presence/absence of signals?
- ▶ NMSSM Higgs bosons in sparticle decay cascades: what do we learn in the presence/absence of signals?
- ▶ Flavour violation in the NMSSM
- ▶ Dark matter in the NMSSM, complementarity with searches at the LHC.

Singlet/Singlino phenomenology

- Production of singlets in association with b-quarks

Singlet/Singlino phenomenology

- ▶ Production of singlets in association with b-quarks
- ▶ light singlino/"missing missing" E_T in sparticle decay cascades: re-interpretation of limits/signals
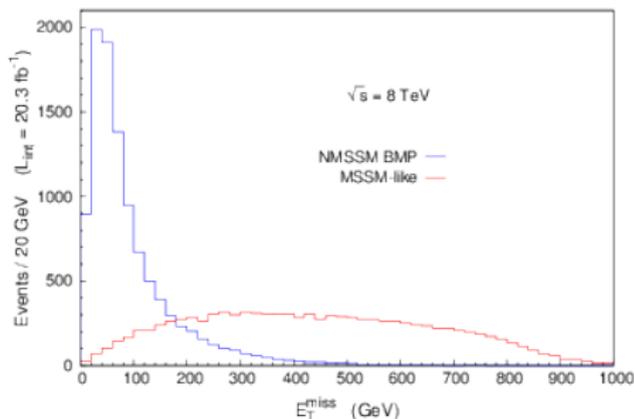
[Ellwanger, Teixeira, 1406.7221]

Benchmark scenarios

- ▶ Defining parameter planes rather than single benchmark points as for the MSSM
- ▶ What are specific signatures in the CP-violating NMSSM, taking account experimental constraints (like EDMs, vacuum stability)?