1 Benchmarks

In Table 1 we present our two benchmark points, taken from Ref. [1]. The first 6 parameters completely specify the model at the high scale M and allow to reproduce the low-energy spectrum using the expressions for NMSSM soft terms given in the above paper, together with the SM input as specified in the accompanying SLHA files that contain all information.

The main features of these spectra are:

- Lightest CP even Higgs at ≈ 93 GeV
- SM-like Higgs is next-to-lightest CP even state and strongly mixed
- (essentially massless) gravitino LSP
- Singlino-like NLSP that is stable (P5) or decays to LSP+b-jets at displaced vertex (P2)
- Stau NNLSP with smuon/selectron co-NNLSPs that decays to NLSP+tau/leptons (P2) or bino-like NNLSP that decays to NLSP+b-jets (P5)

	P2	P5
$\tilde{m}$	$8.7 \cdot 10^2$	$9.3 \cdot 10^2$
M	$2.8 \cdot 10^6$	$3.4 \cdot 10^{14}$
$\lambda(M)$	$9.6 \cdot 10^{-3}$	$6.9 \cdot 10^{-3}$
$\xi_T(M)$	$2.0 \cdot 10^{-2}$	$2.2 \cdot 10^{-2}$
$\xi_D(M)$	$1.5 \cdot 10^{-2}$	$2.1 \cdot 10^{-2}$
$\kappa(M)$	$5.4 \cdot 10^{-4}$	$2.9 \cdot 10^{-4}$
$\tan\beta$	28	21
m_{h_1}	93	94
m_{h_2}	123.4	125.0
m_{a_1}	26	32
$m_{\tilde{N}_1}$	102	104
$m_{\tilde{N}_2}$	377	379
$m_{\tilde{e}_1}$	358	676
$m_{\tilde{\tau}_1}$	333	637
$m_{\tilde{g}}$	1.98	2.06
$m_{\tilde{u}_R}$	2.06	2.07
$m_{\tilde{t}_1}$	1.87	1.63
$c\tau_{\tilde{N}_1}$	0.34	$6.0 \cdot 10^{15}$
$\sigma^{13\text{TeV}}_{\tilde{q}\tilde{q}}$	2.99	2.63
$\sigma^{13\text{TeV}}_{\tilde{q}\tilde{g}}$	3.30	2.48
$\sigma^{13\text{TeV}}_{\text{strong}}$	7.28	5.95
$\sigma^{8\text{TeV}}_{\text{strong}}$	0.07	0.05
$\sigma^{13\text{TeV}}_{\text{EW}}$	12	5.6
$\sigma^{8\text{TeV}}_{\text{EW}}$	2.1	0.7

Table 1: List of benchmark points. All masses are in GeV except colored sparticle masses in TeV, the neutralino decay length $c\tau_{\tilde{N}_1}$ in m and cross-sections in fb.

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2 Motivation

These two Benchmark points are motivated by the simplest model that allows to successfully combine Minimal Gauge Mediation (MGM) and the Z_3-invariant NMSSM. This model (proposed by Delgado, Giudice and Slavich in Ref. [2]) is just the usual MGM superpotential with 2 pairs of messengers and a single additional term that couples the singlet to the messengers.

This model has 5 free parameters (the messenger scale M, the overall scale of SUSY breaking terms $\tilde{m}$, the NMSSM couplings λ, κ and the new singlet messenger coupling ξ), from which 2 are removed by obtaining the correct Z-boson mass and the correct Higgs mass (up to the usual theoretical uncertainty of around 3 GeV).

The most interesting region of this 3-dimensional parameter space is clearly the one with superpartners in the reach of LHC14. In contrast to MGM in the MSSM (which needs gluino heavier than 3 TeV to accommodate the Higgs mass), in this model one can profit from a large singlet-Higgs mixing to increase the tree-level SM-like Higgs mass. Maximizing this mixing effect determines two more parameters (corresponding to the mass of the lightest CP even Higgs and the mixing angle), and allows for colored sparticles in the reach of LHC14.

Therefore this scenario is very predictive, and most features of the low-energy spectrum are fixed. The LSP is a practically massless Gravitino, the NLSP is singlino with a mass of around 100 GeV. The lightest CP even scalar has a mass around 93 GeV, the lightest pseudoscalar at around 30 GeV. Higgs-singlet mixing is very large, with a mixing angle of around $\cos\theta \approx 0.88$, which leads to reduced SM-like Higgs couplings.

Essentially the only free parameter is the messenger scale M that directly controls the gravitino couplings and through RG effects the nature of the NNLSP and the effective scale of superpartners. For low values (P2) the singlino decays to gravitino inside the detector and the NNSLP is stau with slepton co-NNLSPs. For large values (P5) the singlino is practically stable, the NNLSP is bino, and for the same gluino mass a larger Higgs mass can be achieved due to larger RG-induced A-terms.

3 Prospects at LHC14

In the two benchmark points first generation squarks and gluino are of the order of 2 TeV, which leads to a strong production cross section of the order of several fb. This implies a sizable number of colored sparticle events at LHC14 already in 2015, which might be searched for using the particular features in this scenario. In P2 one has additional taus or leptons in all endpoints of SUSY decay chains, and the final decay to LSP can occur at a displaced vertex. In P5 instead there are additional b-jets in all events.

References

[1] B. Allanach, M. Badziak, C. Hugonie and R. Ziegler, "Light Sparticles from a Light Singlet in Gauge Mediation," arXiv:1502.05836 [hep-ph].

[2] A. Delgado, G. F. Giudice and P. Slavich, "Dynamical mu term in gauge mediation," Phys. Lett. B **653** (2007) 424 [arXiv:0706.3873 [hep-ph]].