Stau coannihilation parameter fits

Essence of the talk:
Split spectrum pMSSM now possible to fit
Have started fits

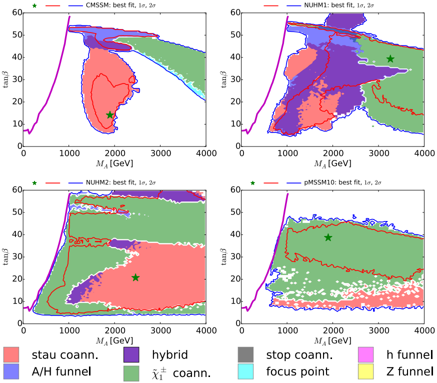
10.5.2017

Motivation

➤ Stau coannihilation is one of the preferred mechanisms to explain dark matter in SUSY (pink areas)

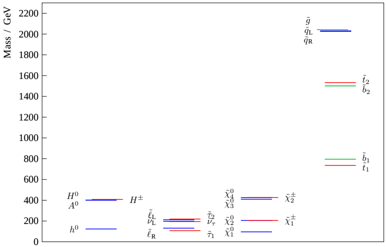
CMSSM NUHM1

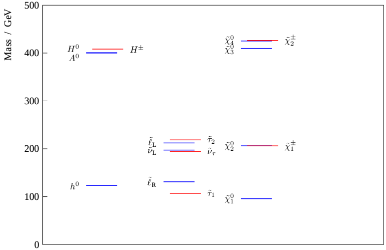
NUHM2 pMSSM



Mastercode arXiv:1508.01173v1

Stau coannihilation fits: STC8 scenario

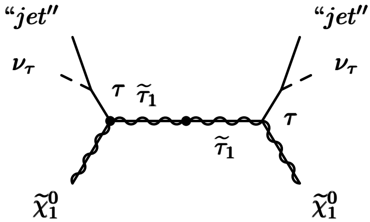


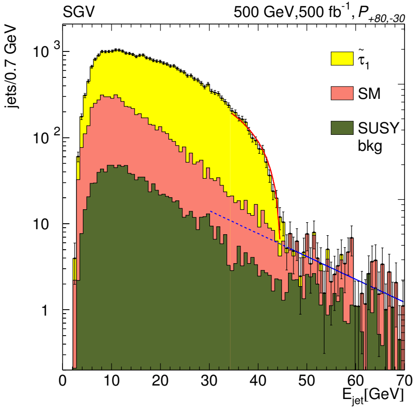


- Many particles accessible at $\sqrt{s} = 500$ GeV: important are $\widetilde{\chi}^0_1, \widetilde{\chi}^0_2, \widetilde{\chi}^\pm_1, \widetilde{\tau}_1, \widetilde{e}_R, \widetilde{\mu}_R$
- Stau-LSP mass difference 11 GeV (originally)
- Mass precisions $\sim 0.1\%$ after 2×500 fb^{-1}
- Analysis paper arXiv:1508.04383, relic density study arXiv:1602.08439

500GeV measurements: example $\widetilde{\tau}_1$ endpoint

- $\widetilde{\tau}_1 \to \widetilde{\chi}_1^0 \tau$ endpoint $\Longrightarrow$ $\Delta m_{\widetilde{\tau}_1} = 0.15\%$ (160 MeV)





[arXiv:1508.04383v1]

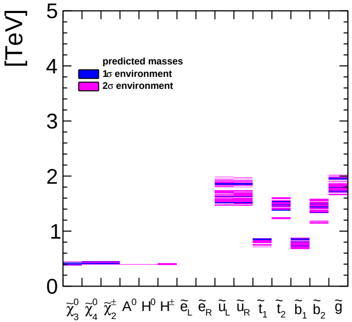
500GeV measurements

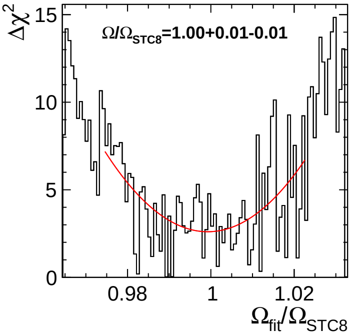
- Can discover all sleptons, sneutrinos, $\widetilde{\chi}_1^0, \widetilde{\chi}_2^0$ and $\widetilde{\chi}_1^\pm$
- Precisions on masses after 500 fb^{-1} for both $\mathcal{P}(\pm 0.8, \mp 0.3)$:

analysis [1508.04383v1]	$m_{\widetilde{\chi}_1^0}$	0.15%	$m_{\widetilde{\chi}_2^0}$	0.5%
	$m_{\widetilde{\tau}_1}$	0.16%	$m_{\widetilde{\tau}_2}$	2.5%
	$m_{\widetilde{e}_R}$	0.17%	$m_{\widetilde{\mu}_R}$	0.4%
estimate	$m_{\widetilde{e}_L}$	1%	$m_{\widetilde{\mu}_L}$	1%
	$m_{\widetilde{\nu}_e,\widetilde{\nu}_\mu,\widetilde{\nu}_\tau}$	1%	$m_{\widetilde{\chi}_1^\pm}$	1%

First preliminary fits to original STC8 scenario

- Fit 13 independent parameters[1] with Fittino
- Observables: slepton, sneutrino, $\tilde{\chi}_1^0, \tilde{\chi}_2^0, \tilde{\chi}_1^\pm$ masses, Higgs
- Masses of unobserved sparticles and dark matter relic density are predicted





[1] $M_1, M_2, \mu, \tan\beta$, universal LH slepton mass, universal RH slepton mass, universal squark mass except third generation masses, m_A, $A_{t=b=\tau}$, M_3

Notes and plans

- A closer look at SUSY parameter χ^2 distributions shows that a longer fit is needed especially if reduce number of observables
- Predictions gets weaker if reduce number of observables and separate 1st and 2nd generation slepton parameters from 3rd generation slepton parameters
- Will make a modified scenario to evade current LHC heavy Higgs and other exclusion limits