Analyses in simple LHC bound

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This note summarizes analyses available on the Mathematica package `simple_LHC_bound`, which collects LHC results with $\sqrt{s} > 13\,\text{TeV}$ related to non-colored SUSY particles. Preliminary results are not included. For references and a citation guideline, see `readme.md` files included in respective analyses.

Throughout this note, $l = (e, \mu, \tau)$ and $\ell = (e, \mu)$. Tau-leptons $\tau^{\pm}$ are labelled by its decay product: τ_{h} means those decaying hadronically and are observed as tau jets, while τ_{ℓ} means it decays as $\tau^{\pm} \to \ell^{\pm}\nu\nu$. SFOS denotes an e^+e^- or $\mu^+\mu^-$ pair, standing for "same-flavor opposite sign." The missing transverse momentum is denoted by $p_{\text{T}}^{\text{miss}}$.

Colored SUSY particles and heavy Higgs bosons are assumed to be decoupled unless otherwise noted. In addition to $\tilde{\chi}_i^0$ and $\tilde{\chi}_j^{\pm}$ ($i = 1, 2, 3, 4$ and $j = 1, 2$), which denote the i-th lightest neutralino and the j-th lightest chargino, respectively, we use $\tilde{B}$, $\tilde{W}^0$, and $\tilde{H}^0$ to describe particles that are assumed to be mostly bino-like, wino-like, or Higgsino-like, respectively, and similary $\tilde{W}^{\pm}$ and $\tilde{H}^{\pm}$. Note that $\tilde{H}^0$ is made of two Majorana fermions, i.e., $\tilde{H}_{\text{u}}^0$ and $\tilde{H}_{\text{d}}^0$ with a Dirac-type mass term, and neutralino pair-production $pp \to \tilde{\chi}_i^0\tilde{\chi}_j^0$ for Higgsino-like neutralinos happens only for $i \neq j$.

Visit `https://github.com/misho104/simple_lhc_bound` for further information, updates, and reporting issues.

1 Standard neutralino–chargino (NC) searches

1909.09226/A NC/HW.

1912.08479/A NC/ZW (degenerate N2-N1 $\sim m_{\mathrm{EW}}$).

2012.08600/C NC/ZW by $2\ell^{Z\text{-like}}$ + jet(s) + $p_{\mathrm{T}}^{\mathrm{miss}}$ signature.

2108.07586/A NC/ZW and NC/HW.

2 Standard chargino-pair (CC) searches

- CC/WW for $\tilde{\chi}^+\tilde{\chi}^- \to W^+W^- p_{\mathrm{T}}^{\mathrm{miss}}$.
- CC/slep for $\tilde{\chi}^+\tilde{\chi}^-$ into $(\tilde{\ell}_{\mathrm{L}}, \tilde{\nu}) \times (\tilde{\ell}_{\mathrm{L}}, \tilde{\nu})$, which anyway results in $2\ell^{\mathrm{SFOS}}$ signature.

1908.08215/A $\tilde{\chi}^+\tilde{\chi}^-$ to $2\ell^{\mathrm{SFOS}} + p_{\mathrm{T}}^{\mathrm{miss}}$. Both of CC/WW and CC/slep.

2108.07586/A CC/WW.

3 Standard slepton-pair (LL) searches

1908.08215/A Standard $2\ell^{\mathrm{SFOS}} + p_{\mathrm{T}}^{\mathrm{miss}}$.

1911.12606/A Degenerate slepton search.

2012.08600/C Standard $2\ell^{\mathrm{SFOS}} + p_{\mathrm{T}}^{\mathrm{miss}}$.

4 Standard stau-pair (TaTa) searches

1911.06660/A Standard $2\tau_{\mathrm{h}} + p_{\mathrm{T}}^{\mathrm{miss}}$.

5 Inclusive chargino/neutralino searches

1911.12606/A Degenerate scenarios with $2\ell^{\text{maybe soft}} + 1j + p_{\mathrm{T}}^{\mathrm{miss}}$.

- NC/ZW from wino-like $\tilde{\chi}_1^\pm\tilde{\chi}_2^0$ and bino-like $\tilde{\chi}_1^0$, degenerate ($\tilde{\chi}_1^\pm = \tilde{\chi}_2^0 \gtrsim \tilde{\chi}_1^0$); effect of the sign sign($\tilde{\chi}_2^0\tilde{\chi}_1^0$) is taken into account. VBF production is also discussed.
- NC/ZW from pure-Higgsino $\tilde{\chi}_1^\pm\tilde{\chi}_1^0\tilde{\chi}_2^0$, degenerate ($\tilde{\chi}_2^0 \gtrsim \tilde{\chi}_1^0$ and $\tilde{\chi}_1^\pm = (\tilde{\chi}_2^0 + \tilde{\chi}_1^0)/2$). VBF production is also discussed.

2108.07586/A Productions of all chargino/neutralino combinations.

- Wino-like $\tilde{\chi}_1^\pm\tilde{\chi}_2^0$ with bino-like $\tilde{\chi}_1^0$ and decoupled sleptons; CC/WW plus NC/(H|Z)W are all considered.
- Higgsino-like $\tilde{\chi}_1^\pm\tilde{\chi}_2^0\tilde{\chi}_3^0$ with bino-like $\tilde{\chi}_1^0$ and decoupled sleptons; CC/WW, N2C/(H|Z)W, N3C/(H|Z)W, and NN/(H|Z)(H|Z) are all considered.

6 Long-lived chargino searches

2004.05153/C Standard centimeter-track searches for quasi-LSP $\tilde{W}^{\pm}$ and $\tilde{H}^{\pm}$.

2201.02472/A Standard centimeter-track searches for quasi-LSP $\tilde{W}^{\pm}$ and $\tilde{H}^{\pm}$.