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# Projected Performance of an Upgraded CMS Detector at the LHC and HL-LHC: Contribution to the Snowmass Process

[Link to the document in CDS](#) [Link to the document in arXiv](#)

# Section 5: Discovery Potential: Super symmetry

This section presents 5 discovery sensitivity projections of the several SUSY searches by CMS to the 14 TeV 300 fb<sup>-1</sup> scenario. These projections are performed by scaling the luminosity and taking into account the change of cross section with higher energy accordingly. The projections are made based on 8 TeV Monte Carlo samples and without optimizing the selections for searches at higher energies and higher luminosities. In Scenario A the signal and background yields, and the uncertainty on the background, are scaled by the ratio of the luminosities (20 fb<sup>-1</sup> for 8 TeV and 300 fb<sup>-1</sup> for 14 TeV) and by the ratio of the cross sections for signal and background. More details can be found in the paper.

Figure	Links	Description
	pdf, png	Next-to-leading order cross sections for gluino-pair production, stop-pair (sbottom-sbottom) production, and chargino-neutralino production versus the mass of the pairproduced SUSY particles. The chargino-neutralino production cross section is presented for common $m(\chi_{1^{+}}) = m(\chi_{1^{0}})$ masses.
	pdf, png	(top) The simplified model topology for gluino production, where the gluinos decay to two top quarks and an LSP each, and (bottom) the projected 5 discovery reaches for this model.
	pdf, png	This projection is based on the search in events with a single lepton, multiple jets, and b-tags: CMS-PAS-SUS-13-007 [ CDS ].
	pdf, png	The simplified model topology for gluino production, where the gluinos decay to two bottom quarks and an LSP each (top), and the projected 5 discovery reaches for this model (bottom).
		This projection is based on the search in events with multiple jets, large missing transverse energy, and b tags: CMS-SUS-12-024 [ CDS ].

	<p>pdf, png</p>	
	<p>pdf, png</p>	<p>The simplified model topology direct stop production, where the stops decay to a top quark and an LSP each (top), and the projected 5-sigma discovery reaches for this model (bottom).</p>
	<p>pdf, png</p>	<p>This projection is based on the search in the single lepton final state: CMS-SUS-13-011 [ CDS ].</p>
	<p>pdf, png</p>	<p>The simplified model topology for direct sbottom production, where the sbottoms decay to a top quark and a chargino each, and the chargino decays to a W boson and a LSP (top), and the projected 5-sigma discovery reaches for this model (bottom).</p>
	<p>pdf, png</p>	<p>This projection is based on the search in events with same-sign dileptons and jets: CMS-PAS-SUS-13-013 [ CDS ].</p>
	<p>pdf, png</p>	<p>The simplified model topology for direct <math>\chi_1^{+-} \chi_1^0</math> production decaying to the <math>WZ+E_T^{miss}</math> final state (top), and the projected 5-sigma discovery projections for this model (bottom).</p>
		<p>This projection is based on the search in a 3-lepton final state: CMS-PAS-SUS-13-006 [ CDS ].</p>

<p>CMS Preliminary  <math>pp \rightarrow \tilde{\chi}_2^0 \tilde{\chi}_1^\pm</math>  <math>\tilde{\chi}_2^0 \rightarrow Z \tilde{\chi}_1^0</math>  <math>\tilde{\chi}_1^\pm \rightarrow W \tilde{\chi}_1^0</math>          Based on SUS-13-006          Estimated 5<math>\sigma</math> discovery reach</p>	<p>pdf, png</p>	
<p>Diagram showing production of <math>\tilde{\chi}_2^0</math> and <math>\tilde{\chi}_1^\pm</math> from <math>P_1</math> and <math>P_2</math>. <math>\tilde{\chi}_2^0</math> decays to <math>H</math> and <math>\tilde{\chi}_1^0</math>. <math>\tilde{\chi}_1^\pm</math> decays to <math>\tilde{\chi}_1^0</math> and <math>W^\pm</math>.</p>	<p>pdf, png</p>	<p>The simplified model topology for direct <math>\tilde{\chi}_1^{+-} \tilde{\chi}_2^0</math> production decaying to the <math>WH+E_T^{miss}</math> final state (top), and the projected 5<math>\sigma</math> discovery projections for this model (bottom).</p>
<p>CMS Preliminary  <math>pp \rightarrow \tilde{\chi}_2^0 \tilde{\chi}_1^\pm \rightarrow (W \tilde{\chi}_1^0)(H \tilde{\chi}_1^\pm)</math>          1-lepton channel          Based on SUS-13-017          Estimated 5<math>\sigma</math> discovery reach</p>	<p>pdf, png</p>	<p>This projection is based on the search with a final state with 1 bb and missing transverse energy:          CMS- PAS- SUS- 13- 017 [ CDS ].</p>

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