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LHC SUSY Cross Section Working Group

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- Mailing list: [lhc-susy-cross-section-wg@cernNOSPAMch](mailto:lhc-susy-cross-section-wg@cern.ch), [archive](#).
- The cross-section values from these TWiki pages are available in JSON format in this public git repository on [github](#). (So far it only contains the 13 TeV cross sections.)

SUSY Cross Sections for 13, 14, 33 and 100 TeV pp Collisions

Abstract

We summarise the status of the cross section predictions for various supersymmetric processes in pp collisions at $\sqrt{s}=13, 14, 33$ and 100 TeV. This document is based on the agreement between the ATLAS and CMS collaborations, as well as with the LPCC SUSY cross section working group. Calculations including the resummation of soft gluon emission at the next-to-leading logarithmic accuracy are used whenever available. In all other cases we rely on the next-to-leading order in the strong coupling constant. These cross sections and their uncertainties are provided for various scale and PDF choices.

Documentation

Colored Sector

- NLO + NLL Tool for 13, 14, 33 and 100 TeV cross sections.
- Squark and gluino production cross sections in pp collisions at $\sqrt{s} = 13, 14, 33$ and 100 TeV, C. Borschensky, M. Kramer, A. Kulesza, M. Mangano, S. Padhi, T. Plehn, X. Portell, [arXiv:1407.5066](#), published in *Eur.Phys.J. C74* (2014) 12.
- NNLO_approx + NNLL Tool for 13 TeV cross sections, uses PDF4LHC15_MC PDF sets
- NNLL-fast: predictions for coloured supersymmetric particle production at the LHC with threshold and Coulomb resummation, Wim Beenakker, Christoph Borschensky, Michael Krämer, Anna Kulesza, Eric Laenen, [arXiv:1607.07741](#), published in *JHEP* 1612 (2016) 133.
- The full list of references can be found [here](#).

Electroweak Sector

NLO+NLL threshold resummed results from Resummino.

For slepton production:

- G. Bozzi, B. Fuks, and M. Klasen, *Nucl. Phys. B* 777, 157 (2007)
- B. Fuks, M. Klasen, D. R. Lamprea, and M. Rothering, *Eur. Phys. J. C* 73, 2480 (2013)
- B. Fuks, M. Klasen, D. R. Lamprea and M. Rothering, *JHEP* 01 (2014) 168
- J. Fiaschi and M. Klasen, *JHEP* 03 (2018) 094
- W. Beenakker et al., *Phys. Rev. Lett.* 83 (1999) 3780, Erratum: *Phys. Rev. Lett.* 100 (2008) 029901

For gaugino production:

- J. Debove, B. Fuks, and M. Klasen, *Nucl. Phys. B* 842, 51 (2011)
- B. Fuks, M. Klasen, D. R. Lamprea, and M. Rothering, *JHEP* 10 (2012) 081
- B. Fuks, M. Klasen, D. R. Lamprea, and M. Rothering, *Eur. Phys. J. C* 73, 2480 (2013)

- J. Fiaschi and M. Klasen, Phys. Rev. D 98 (2018) 055014
- W. Beenakker et al., Phys. Rev. Lett. 83 (1999) 3780, Erratum: Phys. Rev. Lett. 100 (2008) 029901

(The last reference to the paper by W. Beenakker et al. is the reference for the original NLO results.)

Cross sections for various subprocesses - 13 TeV

Colored Sector

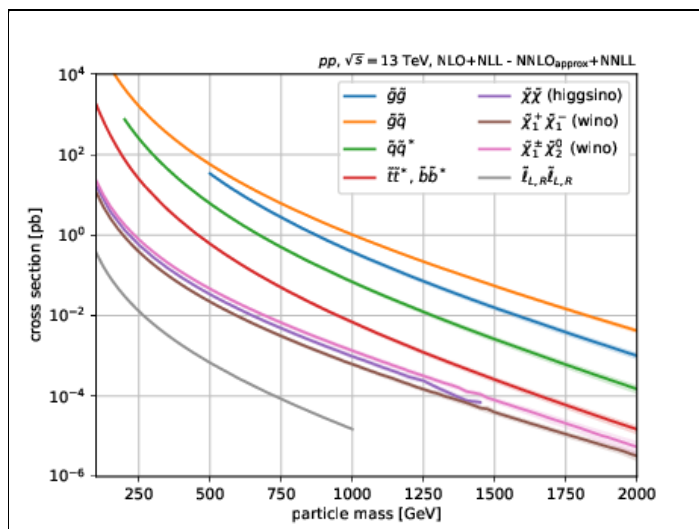
- Simplified topologies - gluino-gluino cross sections with squarks decoupled
- Simplified topologies - squark-antisquark cross sections with gluinos (and stops) decoupled
- Simplified topologies - stop and sbottom cross sections with squarks and gluinos decoupled
- Simplified topologies - gluino-squark cross sections with the rest of the spectrum decoupled (equal mass of squark and gluino)
- Simplified topologies - gluino-squark model with the rest of the spectrum decoupled, cross sections for gluino-gluino, squark-antisquark, squark-squark and squark-gluino processes

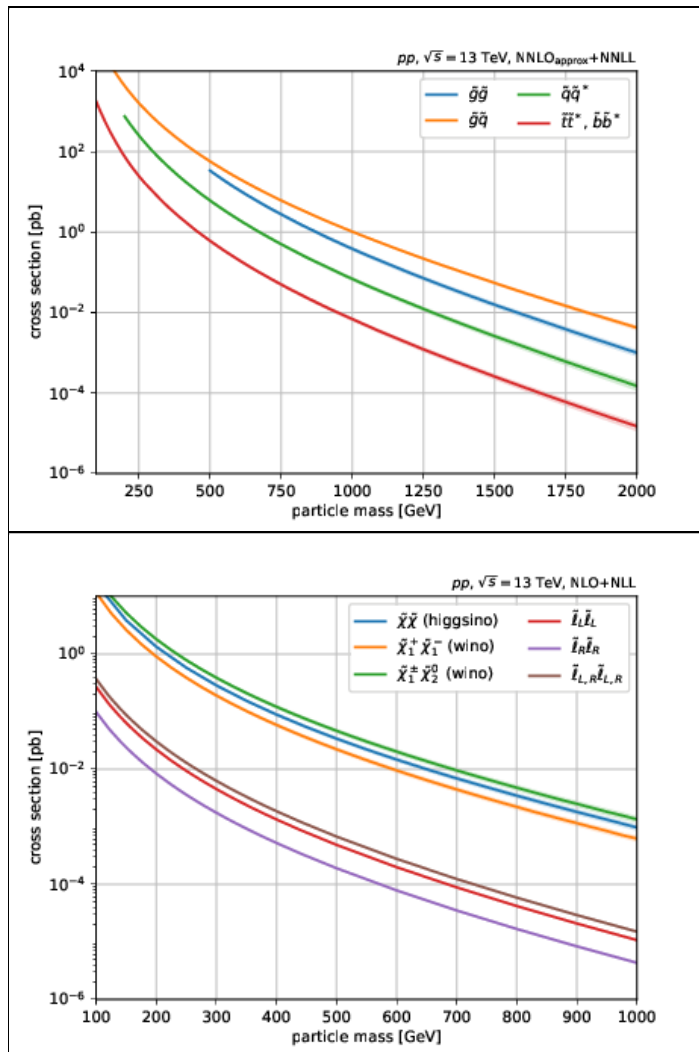
Electroweak Sector

- Simplified topologies - NLO-NLL wino-like chargino-neutralino (N2C1) cross sections
- Simplified topologies - NLO-NLL wino-like chargino-chargino (C1C1) cross sections
- Simplified topologies - NLO-NLL higgsino-like cross sections (fully degenerate triplet)
 - ◆ Simplified topologies - NLO-NLL higgsino-like neutralino-neutralino (N2N1) cross sections
 - ◆ Simplified topologies - NLO-NLL higgsino-like chargino-neutralino (N2C1) cross sections
 - ◆ Simplified topologies - NLO-NLL higgsino-like chargino-chargino (C1C1) cross sections
- Simplified topologies - NLO-NLL higgsino-like cross sections (non-fully-degenerate case)
- Simplified topologies - NLO-NLL slepton-pair cross sections

Cross-section plots

The following plots show the cross-section values from the TWiki pages above:





The code to make these plots can be found on [github](#).

Cross sections for various subprocesses - 14 TeV

- Simplified topologies - gluino-gluino cross sections with squarks decoupled
- Simplified topologies - squark-antisquark cross section with gluinos (and stops) decoupled
- Simplified topologies - stop and sbottom cross sections with squarks and gluinos decoupled
- Simplified topologies - NLO-NLL wino-like chargino-neutralino (N2C1) cross sections
- Simplified topologies - NLO-NLL higgsino-like chargino-neutralino (N2C1) cross sections
- Simplified topologies - gluino-squark cross sections with the rest of the spectrum decoupled

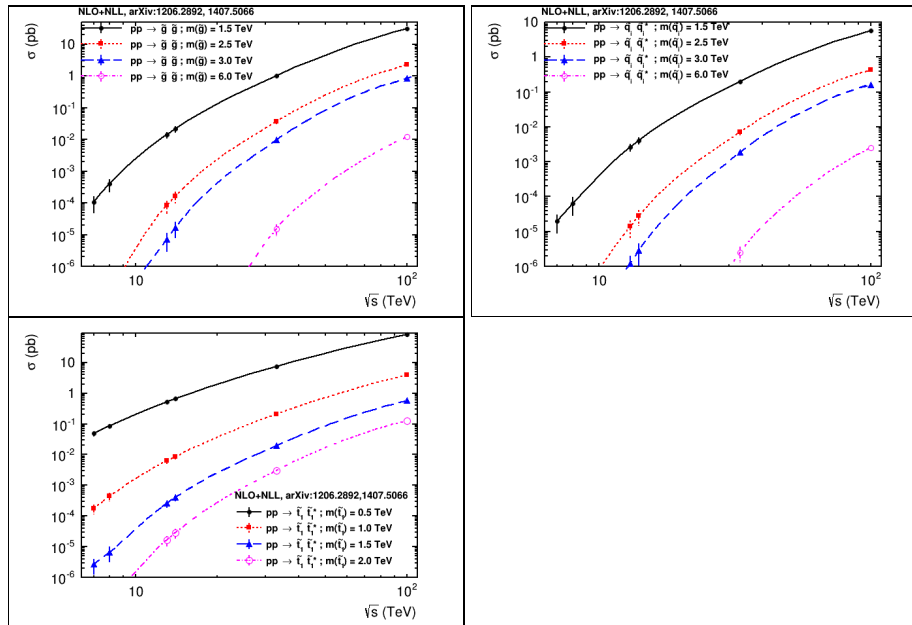
Cross sections for various subprocesses - 33 TeV

- Simplified topologies - gluino-gluino cross sections with squarks decoupled
- Simplified topologies - squark-antisquark cross sections with gluinos (and stops) decoupled
- Simplified topologies - stop and sbottom cross sections with squarks and gluinos decoupled

Cross sections for various subprocesses - 100 TeV

- Simplified topologies - gluino-gluino cross sections with squarks decoupled
- Simplified topologies - squark-antisquark cross sections with gluinos (and stops) decoupled
- Simplified topologies - stop and sbottom cross sections with squarks and gluinos decoupled

Overview (Strong Production Only)



Reference: Squark and gluino production cross sections in pp collisions at $\sqrt{s} = 13, 14, 33$ and 100 TeV, C. Borschensky, M. Kramer, A. Kulesza, M. Mangano, S. Padhi, T. Plehn, X. Portell, arXiv:1407.5066, Published in *Eur.Phys.J. C74* (2014) 12

SUSY Cross Sections for 7 TeV pp Collisions

Abstract

We summarise the status of the cross section predictions for various supersymmetric processes in pp collisions at $\sqrt{s}=7$ TeV. This document is based on the agreement between the ATLAS and CMS collaborations, as well as with the LPCC SUSY cross section working group. Calculations including the resummation of soft gluon emission at the next-to-leading logarithmic accuracy are used whenever available. In all other cases we rely on the next-to-leading order in the strong coupling constant. These cross sections and their uncertainties are provided for various scale and PDF choices.

Cross sections for various subprocesses

Important notice: ATLAS and CMS used the same CMSSM $\tan\beta$ grid but the program performing the Renormalisation Group Equations is different (ATLAS is using ISAJET whereas CMS is using SOFTSUSY). These different programs lead to differences in mass at the 7 TeV scale. In particular, for the same starting m_0 and $m_{1/2}$ combination, the sparticle masses used in ATLAS are usually slightly higher than the ones used in CMS case. This effect has two effects which partially cancel each other: on the one hand, CMS cross sections are higher than those of ATLAS but, on the other hand, ATLAS scenarios tend to have slightly harder jet p_T spectrum, leading to a slightly higher acceptance in most of the analyses. The SUSY Working Groups of the two collaborations agreed to use the same generator for analyses using 8 TeV centre-of-mass energy.

- The ATLAS cross sections for CMSSM $\tan\beta = 10$ can be found here
- The CMS cross sections using CMSSM $\tan\beta = 10$ can be found here or text file
- The CMS cross sections using CMSSM $\tan\beta = 40$ can be found here
- Simplified topologies - gluino gluino cross section with squarks decoupled
 - ◆ gluino gluino cross section with squarks decoupled, 5 GeV bins or text file
- Simplified topologies - squark anti-squark cross section with gluinos (and stops) decoupled

- ◆ squark anti-squark cross section with gluinos (and stops) decoupled, 5 GeV bins or text file
- Simplified topologies - stop/sbottom pair production with rest of the sparticles decoupled or text file

Documentation

- NLO + NLL Tool [↗](#) for 7 TeV cross sections.
- Supersymmetry production cross sections in pp collisions at $\sqrt{s} = 7 \text{ TeV}$ [↗](#), M. Kramer, A. Kulesza, R. Leeuw, M. Mangano, S. Padhi, T. Plehn, X. Portell, arXiv:1206.2892, June 2012.

SUSY Cross Sections for 8 TeV pp Collisions

Abstract

We summarise the status of the cross section predictions for various supersymmetric processes in pp collisions at $\sqrt{s}=8 \text{ TeV}$. This document is based on the agreement between the ATLAS and CMS collaborations, as well as with the LPCC SUSY cross section working group. Calculations including the resummation of soft gluon emission at the next-to-leading logarithmic accuracy are used whenever available. In all other cases we rely on the next-to-leading order in the strong coupling constant. These cross sections and their uncertainties are provided for various scale and PDF choices.

Documentation

- NLO + NLL Tool [↗](#) for 8 TeV cross sections.
- Supersymmetry production cross sections in pp collisions at $\sqrt{s} = 7 \text{ TeV}$ [↗](#), M. Kramer, A. Kulesza, R. Leeuw, M. Mangano, S. Padhi, T. Plehn, X. Portell, arXiv:1206.2892, June 2012

Cross sections for various subprocesses

- Simplified topologies - gluino gluino cross section with squarks decoupled
- Simplified topologies - squark anti-squark cross section with gluinos (and stops) decoupled
- Simplified topologies - stop/sbottom cross section with squarks and gluinos decoupled
- Simplified topologies - chargino pair cross section as used by CMS for HCP
- Simplified topologies - slepton pair cross section as used by CMS for HCP
- Higgsino Model - Higgsino cross section as used by CMS for HCP

The cross sections for the associated production of mass degenerate chargino1 and neutralino2 calculated by ATLAS and by CMS differ due to the non-zero higgsino component assumed in the ATLAS model.

- Simplified topologies - chargino neutralino cross section as used by CMS for HCP
- Simplified topologies - chargino neutralino cross section as used by ATLAS for HCP
- SUSY electroweak production cross sections - NLO-NLL electroweak SUSY production cross sections

This topic: LHCPysics > SUSYCrossSections

Topic revision: r46 - 2021-05-10 - AlexanderMann



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