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NLO-NNLL higgsino-like C1C1 cross sections

The following cross sections are for higgsino-like chargino-chargino pair production. They have been calculated for $\sqrt{s} = 13$ TeV at NLO-NNLL using Resummino 2.0.1 from B. Fuks et al. The Monte Carlo PDF set with 100 replicas PDF4LHC15_mc is used, which is a statistical combination of CT14, MMHT14 and NNPDF3.0, all using $\alpha_s(m_Z^2) = 0.118$. The use of this combination of PDF sets is recommended for searches for new Physics by the PDF4LHC Working Group. See <https://arxiv.org/abs/1510.03865> for more details.

The cross sections are computed for degenerate charginos and neutralinos. The mass is denoted as $m_{\tilde{\chi}}$. The following sentence describes all the assumptions in the cross section calculations and is suitable to be included in the description of the interpretation of your results:

The production cross sections are computed at NLO plus next-to-next-to-leading-log (NNLL) precision in a limit of mass-degenerate higgsino $\tilde{\chi}_{2\pm}$, $\tilde{\chi}_{1\pm}$, and $\tilde{\chi}_{10}$ with all the other sparticles assumed to be heavy and decoupled.

When using these cross sections, some references have to be cited. They can be found below in bibtex format. The references can also be downloaded from this Twiki, see attachments at the bottom.

Show References Hide References

Resummino:

```
@article{Debove:2010kf,
  author      = "Debove, Jonathan and Fuks, Benjamin and Klasen, Michael",
  title       = "{Threshold resummation for gaugino pair production at hadron colliders}",
  journal     = "Nucl. Phys. B",
  volume      = "842",
  year       = "2011",
  pages       = "51-85",
  doi        = "10.1016/j.nuclphysb.2010.08.016",
  eprint      = "1005.2909",
  archivePrefix = "arXiv",
  primaryClass = "hep-ph",
  reportNumber = "IPHC-PHENO-10-02, LPSC-10-050",
  SLACcitation = "%%CITATION = ARXIV:1005.2909;%%"
}
@article{Fuks:2012qx,
  author      = "Fuks, Benjamin and Klasen, Michael and Lamprea, David R. and Rothering, Marcel",
  title       = "{Gaugino production in proton-proton collisions at a center-of-mass energy of 8 TeV}",
  journal     = "JHEP",
  volume      = "10",
  pages       = "081",
  doi        = "10.1007/JHEP10(2012)081",
  year       = "2012",
  eprint      = "1207.2159",
  archivePrefix = "arXiv",
  primaryClass = "hep-ph",
  reportNumber = "IPHC-PHENO-12-07, MS-TP-12-05",
  SLACcitation = "%%CITATION = ARXIV:1207.2159;%%",
}
@article{Fuks:2013vua,
  author      = "Fuks, Benjamin and Klasen, Michael and Lamprea, David R. and Rothering, Marcel",
  title       = "{Precision predictions for electroweak superpartner production at hadron colliders with {\sc Resummino}}",
  journal     = "Eur. Phys. J. C",
```

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```
volume      = "73",
pages       = "2480",
doi         = "10.1140/epjc/s10052-013-2480-0",
year        = "2013",
eprint      = "1304.0790",
archivePrefix = "arXiv",
primaryClass = "hep-ph",
reportNumber = "CERN-PH-TH-2013-064, IPHC-PHENO-13-02, MS-TP-13-06",
SLACcitation = "%CITATION = ARXIV:1304.0790;%"
}
@article{Fiaschi:2018hgm,
  author      = "Fiaschi, Juri and Klasen, Michael",
  title       = "{Neutralino-chargino pair production at NLO+NLL with
    resummation-improved parton density functions for LHC Run
    II}",
  journal     = "Phys. Rev. D",
  volume      = "98",
  year        = "2018",
  number      = "5",
  pages       = "055014",
  doi         = "10.1103/PhysRevD.98.055014",
  eprint      = "1805.11322",
  archivePrefix = "arXiv",
  primaryClass = "hep-ph",
  reportNumber = "MS-TP-18-19",
  SLACcitation = "%CITATION = ARXIV:1805.11322;%"
}
```

LHAPDF:

```
@article{Buckley:2014ana,
  author      = "Buckley, Andy and Ferrando, James and Lloyd, Stephen and
    Nordström, Karl and Page, Ben and Rüfenacht, Martin and
    Schönherr, Marek and Watt, Graeme",
  title       = "{LHAPDF6: parton density access in the LHC precision
    era}",
  journal     = "Eur. Phys. J.",
  volume      = "C75",
  year        = "2015",
  number      = "132",
  pages       = "132",
  doi         = "10.1140/epjc/s10052-015-3318-8",
  eprint      = "1412.7420",
  archivePrefix = "arXiv",
  primaryClass = "hep-ph",
  reportNumber = "GLAS-PPE-2014-05, MCNET-14-29, IPPP-14-111, DCPT-14-222",
  SLACcitation = "%CITATION = ARXIV:1412.7420;%"
}
```

PDF4LHC:

```
@article{Butterworth:2015oua,
  author      = "Butterworth, Jon and others",
  title       = "{PDF4LHC recommendations for LHC Run II}",
  journal     = "J. Phys.",
  volume      = "G43",
  year        = "2016",
  number      = "023001",
  pages       = "023001",
  doi         = "10.1088/0954-3899/43/2/023001",
  eprint      = "1510.03865",
  archivePrefix = "arXiv",
  primaryClass = "hep-ph",
  reportNumber = "OUTP-15-17P, SMU-HEP-15-12, TIF-UNIMI-2015-14,
    LCTS-2015-27, CERN-PH-TH-2015-249",
  SLACcitation = "%CITATION = ARXIV:1510.03865;%"
}
@article{Carrazza:2015hva,
```

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```
author      = "Carrazza, Stefano and Latorre, José I. and Rojo, Juan
              and Watt, Graeme",
title       = "{A compression algorithm for the combination of PDF
              sets}",
journal     = "Eur. Phys. J.",
volume      = "C75",
year        = "2015",
pages       = "474",
doi         = "10.1140/epjc/s10052-015-3703-3",
eprint      = "1504.06469",
archivePrefix = "arXiv",
primaryClass = "hep-ph",
reportNumber = "TIF-UNIMI-2015-2, OUTP-15-01P, IPPP-15-22, DCPT-15-44",
SLACcitation = "%CITATION = ARXIV:1504.06469;%"
}
@article{Watt:2012tq,
  author      = "Watt, G. and Thorne, R. S.",
  title       = "{Study of Monte Carlo approach to experimental
              uncertainty propagation with MSTW 2008 PDFs}",
  journal     = "JHEP",
  volume      = "08",
  year        = "2012",
  pages       = "052",
  doi         = "10.1007/JHEP08(2012)052",
  eprint      = "1205.4024",
  archivePrefix = "arXiv",
  primaryClass = "hep-ph",
  reportNumber = "CERN-PH-TH-2012-132, LCTS-2012-11",
  SLACcitation = "%CITATION = ARXIV:1205.4024;%"
}
```

CT14:

```
@article{Dulat:2015mca,
  author      = "Dulat, Sayipjamal and Hou, Tie-Jiun and Gao, Jun and
              Guzzi, Marco and Huston, Joey and Nadolsky, Pavel and
              Pumplin, Jon and Schmidt, Carl and Stump, Daniel and Yuan,
              C. P.",
  title       = "{New parton distribution functions from a global analysis
              of quantum chromodynamics}",
  journal     = "Phys. Rev.",
  volume      = "D93",
  year        = "2016",
  number      = "3",
  pages       = "033006",
  doi         = "10.1103/PhysRevD.93.033006",
  eprint      = "1506.07443",
  archivePrefix = "arXiv",
  primaryClass = "hep-ph",
  SLACcitation = "%CITATION = ARXIV:1506.07443;%"
}
```

MMHT14:

```
@article{Harland-Lang:2014zoa,
  author      = "Harland-Lang, L. A. and Martin, A. D. and Motylinski, P.
              and Thorne, R. S.",
  title       = "{Parton distributions in the LHC era: MMHT 2014 PDFs}",
  journal     = "Eur. Phys. J.",
  volume      = "C75",
  year        = "2015",
  number      = "5",
  pages       = "204",
  doi         = "10.1140/epjc/s10052-015-3397-6",
  eprint      = "1412.3989",
  archivePrefix = "arXiv",
```

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primaryClass = "hep-ph",
reportNumber = "LCTS-2014-47, IPPP-14-97, DCPT-14-194",
SLACcitation = "%CITATION = ARXIV:1412.3989;%"
}

```

NNPDF:

```

@article{Ball:2014uwa,
  author = "Ball, Richard D. and others",
  title = "{Parton distributions for the LHC Run II}",
  collaboration = "NNPDF",
  journal = "JHEP",
  volume = "04",
  year = "2015",
  pages = "040",
  doi = "10.1007/JHEP04(2015)040",
  eprint = "1410.8849",
  archivePrefix = "arXiv",
  primaryClass = "hep-ph",
  reportNumber = "EDINBURGH-2014-15, IFUM-1034-FT, CERN-PH-TH-2013-253,
  OUTP-14-11P, CAVENDISH-HEP-14-11",
  SLACcitation = "%CITATION = ARXIV:1410.8849;%"
}

```

To calculate these cross sections, this repository [can be used](#). The SLHA files can be found there as well: [wino.in](#) and [hino.in](#).

Should cross section information be needed for a mass that is not tabulated below, one can obtain it by using the ROOT macros provided under:

```
/afs/cern.ch/user/a/amete/public/EWKGauginoCrossSections_13TeV
```

For this specific grid one needs to do:

```
root -l 'get_gaugino.C("C1C1", "hino", mass)'
```

where mass is the mass of the sparticle in GeV. The result of the interpolation can be seen here.

NLO+NNLL Higgsino cross sections for $\tilde{\chi}_1^+ \tilde{\chi}_1^-$ production at $\sqrt{s} = 13$ TeV

m [GeV]	[fb]	uncertainty [fb]
50	61880	89.45
75	8436.9	10.15
100	2973.1	3.391
125	1355.4	1.483
150	712.25	0.7639
175	410.78	0.4352
200	253.18	0.2615
225	164.04	0.1657
250	110.54	0.1113

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275	76.867	0.07588
300	54.85	0.0532
325	39.993	0.0382
350	29.696	0.0271
375	22.403	0.0202
400	17.133	0.01528
425	13.26	0.0117
450	10.372	0.009071
475	8.1906	0.007203
500	6.5214	0.005683
525	5.2315	0.00452
550	4.2258	0.003622
575	3.4346	0.002921
600	2.8065	0.002337
625	2.3057	0.001907
650	1.9034	0.001564
675	1.5781	0.001289
700	1.3135	0.001066
725	1.0978	0.0008876
750	0.92095	0.0007411
775	0.77465	0.00062
800	0.65346	0.0005202
825	0.55303	0.0004393
850	0.46894	0.0003714
875	0.39873	0.0003144
900	0.3398	0.0002667
925	0.29015	0.0002267
950	0.24827	0.0001944
975	0.21287	0.000166
1000	0.18286	0.0001422
1025	0.15735	0.0001221
1050	0.13563	0.0001052
1075	0.11709	9.101e-05
1100	0.10122	7.902e-05
1125	0.087646	6.971e-05

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1150	0.075979	6.129e-05
1175	0.065941	5.462e-05
1200	0.057351	5.01e-05
1225	0.049951	4.788e-05
1250	0.0436	4.927e-05
1275	0.03757	2.88e-05
1300	0.032757	2.491e-05
1325	0.028596	2.197e-05
1350	0.025001	2.017e-05
1375	0.021882	1.861e-05
1400	0.019147	1.758e-05
1425	0.016794	1.699e-05
1450	0.014666	1.079e-05
1475	0.012895	1.742e-05
1500	0.011344	2.125e-05
1525	0.010896	9.379e-05
1550	0.0086871	6.305e-06
1575	0.0076313	5.522e-06
1600	0.0067436	1.384e-05
1625	0.0058978	4.336e-06
1650	0.0051908	3.887e-06
1675	0.004646	1.215e-05
1700	0.0040559	8.335e-06
1725	0.0035357	2.625e-06
1750	0.0031157	2.302e-06
1775	0.0027481	1.99e-06
1800	0.0024793	3.479e-06
1825	0.0021358	1.54e-06
1850	0.0018835	1.357e-06
1875	0.0019066	6.354e-05
1900	0.0027037	0.0001622
1925	0.0012891	1.05e-06
1950	0.0012244	3.419e-05
1975	0.0010037	7.98e-07
2000	0.00089022	6.516e-07

-- BasilSchneider - 2018-11-14

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