

# Table of Contents

<b>NLO-NNLL wino-like N2C1 cross sections.....</b>	<b>1</b>
NLO+NNLL Wino cross sections for combined $02 +1$ and $02 -1$ production at $\sqrt{s} = 14$ TeV.....	4
NLO+NNLL Wino cross sections for $02 +1$ production at $\sqrt{s} = 14$ TeV.....	7
NLO+NNLL Wino cross sections for $02 -1$ production at $\sqrt{s} = 14$ TeV.....	9

# NLO-NNLL wino-like N2C1 cross sections

The following cross sections are for wino-like chargino-neutralino pair production (sum of  $\sigma_{\tilde{\chi}_1^0 \tilde{\chi}_2^0}$  and  $\sigma_{\tilde{\chi}_1^\pm \tilde{\chi}_2^\mp}$ , and also for each subprocess individually). They have been calculated for  $\sqrt{s} = 14$  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 wino  $\tilde{\chi}_{2,3}$  and  $\tilde{\chi}_{1,2}$ , 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",
```

## SUSYNLONLLCrossSections14TeVWinoN2C1 < LHCPHysics < TWiki

```
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,
```

## SUSYNLONLLCrossSections14TeVWinoN2C1 < LHCPHysics < TWiki

```

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",

```

## SUSYNLONLLCrossSections14TeVWinoN2C1 < LHCPHysics < TWiki

```

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("C1N2", "wino", mass)'
```

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

## NLO+NNLL Wino cross sections for combined $\tilde{g} \tilde{g} \rightarrow \tilde{W}_2^0 \tilde{W}_1^+$ and $\tilde{g} \tilde{g} \rightarrow \tilde{W}_2^0 \tilde{W}_1^-$ production at $\sqrt{s} = 14$ TeV

m [GeV]	[fb]	uncertainty [fb]
50	453090	760.5
75	69749	90.84
100	24309.5	27.98
125	10974.5	12.103
150	5725.8	6.093
175	3294.6	3.435
200	2031.81	2.0739
225	1319.9	1.331
250	892.7	0.8858

SUSYNLONNLLCrossSections14TeVWinoN2C1 < LHCPysics < TWiki

275	623.41	0.6156
300	447.26	0.43
325	327.92	0.31013
350	244.972	0.2281
375	185.904	0.16564
400	143.079	0.12602
425	111.464	0.09718
450	87.768	0.07577
475	69.776	0.06023
500	55.939	0.04812
525	45.19	0.03857
550	36.756	0.03113
575	30.0768	0.025265
600	24.7639	0.02068
625	20.4906	0.016792
650	17.0326	0.013883
675	14.2147	0.011518
700	11.9149	0.009608
725	10.0242	0.008047
750	8.4605	0.00676
775	7.1765	0.005728
800	6.0852	0.004838
825	5.1941	0.004145
850	4.4386	0.0035694
875	3.79698	0.0030128
900	3.25738	0.0025928
925	2.80039	0.002226
950	2.4121	0.0019155
975	2.08109	0.0016502
1000	1.79822	0.0014249
1025	1.5566	0.0012384
1050	1.34957	0.0010736
1075	1.17175	0.0009336
1100	1.01872	0.0008141
1125	0.88698	0.0007125

SUSYNLONNLLCrossSections14TeVWinoN2C1 < LHCPysics < TWiki

1150	0.77344	0.0006269
1175	0.67497	0.0005536
1200	0.5897	0.00049
1225	0.51582	0.00043881
1250	0.45158	0.00039293
1275	0.395717	0.00035548
1300	0.34718	0.00032653
1325	0.305019	0.0003057
1350	0.268228	0.00029375
1375	0.236144	0.00028886
1400	0.202895	0.00016403
1425	0.17831	0.00014511
1450	0.156786	0.00012702
1475	0.138006	0.00012301
1500	0.121491	0.00011202
1525	0.107005	0.00010199
1550	0.09434	7.423e-05
1575	0.083125	6.545e-05
1600	0.073196	7.183e-05
1625	0.064537	6.44e-05
1650	0.058294	0.00022857
1675	0.050192	5.159e-05
1700	0.044326	3.5817e-05
1725	0.0401429	0.00022072
1750	0.0345182	2.8006e-05
1775	0.0303266	2.6969e-05
1800	0.0275796	6.642e-05
1825	0.0239712	4.836e-05
1850	0.0208988	1.7758e-05
1875	0.0184593	1.5672e-05
1900	0.0162996	1.3899e-05
1925	0.0144256	1.2028e-05
1950	0.0127432	1.7476e-05
1975	0.0112465	9.45e-06
2000	0.0099278	8.386e-06

**NLO+NNLL Wino cross sections for  $\tilde{\chi}_2^0 \tilde{\chi}_1^+$  production at  $\sqrt{s} = 14$  TeV**

<b>m</b> <b>[GeV]</b>	<b>[fb]</b>	<b>uncertainty</b> <b>[fb]</b>
50	2.6427e+05	452.2
75	41727	55.66
100	14810	17.53
125	6789.7	7.747
150	3591.1	3.95
175	2091.8	2.261
200	1304.4	1.371
225	856.05	0.8925
250	584.45	0.5954
275	411.7	0.4198
300	297.83	0.2915
325	220.05	0.2118
350	165.59	0.1568
375	126.53	0.115
400	98.02	0.088
425	76.835	0.06824
450	60.857	0.0535
475	48.655	0.04291
500	39.215	0.03427
525	31.842	0.0276
550	26.026	0.02238
575	21.395	0.01825
600	17.696	0.015
625	14.705	0.01225
650	12.273	0.01017
675	10.281	0.008474
700	8.6495	0.007096
725	7.3028	0.005965
750	6.184	0.005029
775	5.2658	0.004279
800	4.476	0.003628



SUSYNLONNLLCrossSections14TeVWinoN2C1 < LHCPysics < TWiki

825	3.8352	0.003119
850	3.2877	0.002692
875	2.8194	0.002283
900	2.425	0.001971
925	2.09	0.001698
950	1.8045	0.001466
975	1.5603	0.001267
1000	1.351	0.001095
1025	1.1718	0.000956
1050	1.0179	0.0008313
1075	0.88542	0.0007252
1100	0.77114	0.0006346
1125	0.67258	0.0005575
1150	0.58751	0.0004929
1175	0.51349	0.0004364
1200	0.4493	0.0003883
1225	0.3936	0.0003505
1250	0.34506	0.0003161
1275	0.30278	0.0002885
1300	0.26602	0.000268
1325	0.23407	0.0002544
1350	0.20614	0.0002486
1375	0.18175	0.0002489
1400	0.15513	0.0001296
1425	0.13637	0.0001144
1450	0.11995	0.0001004
1475	0.10557	9.529e-05
1500	0.092944	8.594e-05
1525	0.081861	7.733e-05
1550	0.072259	5.906e-05
1575	0.063667	5.212e-05
1600	0.055952	5.298e-05
1625	0.049305	4.679e-05
1650	0.043921	6.767e-05
1675	0.038305	3.731e-05

1700	0.033898	2.861e-05
1725	0.030287	5.982e-05
1750	0.026365	2.239e-05
1775	0.023154	2.1e-05
1800	0.021065	4.219e-05
1825	0.018307	3.143e-05
1850	0.015904	1.412e-05
1875	0.014031	1.248e-05
1900	0.012374	1.106e-05
1925	0.01094	9.628e-06
1950	0.0095714	9.223e-06
1975	0.0085024	7.57e-06
2000	0.0074931	6.717e-06

**NLO+NNLL Wino cross sections for  $\tilde{\chi}_2^0 \tilde{\chi}_1^-$  production at  $\sqrt{s} = 14$  TeV**

<b>m</b> <b>[GeV]</b>	<b>[fb]</b>	<b>uncertainty</b> <b>[fb]</b>
50	1.8882e+05	308.3
75	28022	35.18
100	9499.5	10.45
125	4184.8	4.356
150	2134.7	2.143
175	1202.8	1.174
200	727.41	0.7029
225	463.85	0.4385
250	308.25	0.2904
275	211.71	0.1958
300	149.43	0.1385
325	107.87	0.09833
350	79.382	0.0713
375	59.374	0.05064
400	45.059	0.03802
425	34.629	0.02894
450	26.911	0.02227

SUSYNLONNLLCrossSections14TeVWinoN2C1 < LHCPysics < TWiki

475	21.121	0.01732
500	16.724	0.01385
525	13.348	0.01097
550	10.73	0.00875
575	8.6818	0.007015
600	7.0679	0.00568
625	5.7856	0.004542
650	4.7596	0.003713
675	3.9337	0.003044
700	3.2654	0.002512
725	2.7214	0.002082
750	2.2765	0.001731
775	1.9107	0.001449
800	1.6092	0.00121
825	1.3589	0.001026
850	1.1509	0.0008774
875	0.97758	0.0007298
900	0.83238	0.0006218
925	0.71039	0.000528
950	0.6076	0.0004495
975	0.52079	0.0003832
1000	0.44722	0.0003299
1025	0.3848	0.0002824
1050	0.33167	0.0002423
1075	0.28633	0.0002084
1100	0.24758	0.0001795
1125	0.2144	0.000155
1150	0.18593	0.000134
1175	0.16148	0.0001172
1200	0.1404	0.0001017
1225	0.12222	8.831e-05
1250	0.10652	7.683e-05
1275	0.092937	6.698e-05
1300	0.08116	5.853e-05
1325	0.070949	5.13e-05

SUSYNLONNLLCrossSections14TeVWinoN2C1 < LHCPhysics < TWiki

1350	0.062088	4.515e-05
1375	0.054394	3.996e-05
1400	0.047765	3.443e-05
1425	0.04194	3.071e-05
1450	0.036836	2.662e-05
1475	0.032436	2.772e-05
1500	0.028547	2.608e-05
1525	0.025144	2.466e-05
1550	0.022081	1.517e-05
1575	0.019458	1.333e-05
1600	0.017244	1.885e-05
1625	0.015232	1.761e-05
1650	0.014373	0.0001609
1675	0.011887	1.428e-05
1700	0.010428	7.207e-06
1725	0.0098559	0.0001609
1750	0.0081532	5.616e-06
1775	0.0071726	5.969e-06
1800	0.0065146	2.423e-05
1825	0.0056642	1.693e-05
1850	0.0049948	3.638e-06
1875	0.0044283	3.192e-06
1900	0.0039256	2.839e-06
1925	0.0034856	2.4e-06
1950	0.0031718	8.253e-06
1975	0.0027441	1.88e-06
2000	0.0024347	1.669e-06

-- BasilSchneider - 2018-11-14

---

This topic: LHCPhysics > SUSYNLONNLLCrossSections14TeVWinoN2C1

Topic revision: r3 - 2019-01-23 - BasilSchneider



Copyright &© 2008-2021 by the contributing authors. All material on this collaboration platform is the property of the contributing authors.

or Ideas, requests, problems regarding TWiki? use Discourse or Send feedback