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Search for Gluinos in Events with Two Same-Sign Leptons, Jets, and Missing Transverse Momentum with the ATLAS Detector in pp Collisions at $\sqrt{s} = 7$ TeV

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A search is presented for gluinos decaying via the supersymmetric partner of the top quark using events with two same-sign leptons, jets, and missing transverse momentum. The analysis is performed with 2.05 fb^{-1} of integrated luminosity from pp collisions at $\sqrt{s} = 7$ TeV collected by the ATLAS detector at the LHC. No excess beyond the standard model expectation is observed, and exclusion limits are derived for simplified models where the gluino decays via the supersymmetric partner of the top quark and in the minimal supergravity and constrained minimal supersymmetric standard model framework. In those scenarios, gluino masses below 550 GeV are excluded at 95% C.L. within the parameter space considered, significantly extending the coverage with respect to existing limits. Depending on the model parameters, gluino masses up to 750 GeV can also be excluded at 95% C.L.

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Supersymmetry (SUSY) [1–7] is a theory beyond the standard model (SM) which predicts new bosonic partners for the existing fermions and fermionic partners for the known bosons. In the framework of a generic R-parity conserving minimal supersymmetric extension of the SM, SUSY particles are produced in pairs [8,9] and the lightest supersymmetric particle is stable, providing a possible candidate for dark matter.

In SUSY models, the gluino is a strongly interacting Majorana fermion. Pair-produced gluinos therefore have an equal probability to produce a pair of leptons that have the same charge [same-sign (SS)] and the opposite charge from their decays. The supersymmetric partner of the top quark (top squark) has two mass eigenstates with $\tilde{t}_1$ being the lightest. Top quarks and $\tilde{t}_1$ squarks can be produced in the decay of the gluino via $\tilde{g}\,\tilde{g} \to t\bar{t}\tilde{t}_1\tilde{t}_1^*$, $tt\tilde{t}_1^*\tilde{t}_1^*$, $\bar{t}\,\bar{t}\,\tilde{t}_1\tilde{t}_1$ [10–14]. The $\tilde{t}_1$ squark can further decay to the lightest chargino ($\tilde{\chi}_1^{\pm}$) or lightest neutralino ($\tilde{\chi}_1^0$) via $\tilde{t}_1 \to b\tilde{\chi}_1^{\pm}$ or $\tilde{t}_1 \to t\tilde{\chi}_1^0$ producing isolated leptons in the semileptonic top-quark decay or in the leptonic $\tilde{\chi}_1^{\pm}$ decay and enriching the signal events with two or more leptons, jets, and missing transverse momentum ($E_{\mathrm{T}}^{\mathrm{miss}}$) from the undetected neutralinos. This analysis considers events with a pair of isolated SS leptons, multiple high-p_{T} jets, and large $E_{\mathrm{T}}^{\mathrm{miss}}$. The requirement of SS leptons in the event suppresses the contribution from SM processes and thus enhances the potential signal significance even for final state topologies with relatively soft jet kinematics. This Letter presents the first search for gluino-mediated top squark production using the SS signature, although other searches with SS leptons have been performed [15–18]. The analysis presented here complements the results of the ATLAS search based on a single lepton plus b jets [19], enhancing the sensitivity in the experimentally difficult region near the kinematic limit for the production of two top quarks and a neutralino and for the region with low top squark masses.

ATLAS is a general-purpose detector [20] at the LHC. This search uses pp collision data recorded from March to August 2011 at a center-of-mass energy of 7 TeV. The data set corresponds to a total integrated luminosity of $2.05 \pm 0.08\ \mathrm{fb}^{-1}$ [21,22] after the application of data quality requirements. Events are selected by using single lepton and dilepton triggers that have constant efficiency as a function of lepton p_{T} above the offline p_{T} cuts used in the analysis.

Jets are reconstructed from three-dimensional calorimeter energy clusters by using the anti-k_t jet algorithm [23,24] with a radius parameter of 0.4. The measured jet energy is corrected for inhomogeneities in, and for the noncompensating nature of, the calorimeter by using p_{T}- and η-dependent correction factors [25]. Only jet candidates with $p_{\mathrm{T}} > 20$ GeV within $|\eta| < 2.8$ are retained. Events with any jet that fails the jet quality criteria designed to remove noise and noncollision backgrounds [25] are rejected.

Electron candidates are required to have $p_{\mathrm{T}} > 20$ GeV, $|\eta| < 2.47$ and satisfy the "tight" selection criteria defined in Ref. [26]. They are also required to be isolated: The scalar sum of p_{T} of tracks within a cone in the $\eta - \phi$ plane of radius $\Delta R = 0.2$ around the candidate excluding its own track, $\Sigma_{p_{\mathrm{T}}}$, must be less than 10% of the electron p_{T}. Muon candidates are required to have $p_{\mathrm{T}} > 20$ GeV, $|\eta| < 2.4$ and are identified by matching an extrapolated inner detector track and one or more track segments in the muon spectrometer [27]. They must have longitudinal and

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transverse impact parameters within 1 and 0.2 mm of the primary vertex [28], respectively, and $\Sigma_{p_T} < 1.8$ GeV.

The calculation of E_T^{miss} [29] is based on the vectorial sum of the p_T of the reconstructed jets (with $p_T > 20$ GeV and $|\eta| < 4.5$), leptons, and the calorimeter energy clusters not belonging to reconstructed objects.

During part of the data-taking period, a localized electronics failure in the electromagnetic calorimeter created a dead region ($\Delta\eta \times \Delta\phi \simeq 1.4 \times 0.2$). For jets in this region, a correction to their energy is made by using the energy depositions in the neighboring cells and is propagated to E_T^{miss}. If this correction projected onto the direction of the E_T^{miss} is larger than 10 GeV or 10% of the E_T^{miss}, the event is discarded [30]. Events with reconstructed electrons in the calorimeter dead region are also rejected.

Events in which the two highest-p_T leptons ($\ell = e, \mu$) have the same charge and with at least four jets with $p_T > 50$ GeV are selected. In addition, two signal regions are considered: SR1, which requires $E_T^{miss} > 150$ GeV, and SR2, which in addition requires $m_T > 100$ GeV, where m_T is the transverse mass of the E_T^{miss} and the highest-p_T lepton defined as $m_T^2 = 2p_T^{\ell}E_T^{miss}\{1 - \cos[\Delta\phi(\ell, E_T^{miss})]\}$. This final m_T cut helps reduce the $t\bar{t}$ background. The signal regions are optimized based on several models where SS dileptons are produced in gluino decays. In signals such as the MSUGRA-CMSSM (minimal supergravity or constrained minimal supersymmetric standard model) [31,32], the directions of the lepton and $\tilde{\chi}_1^0$ are strongly correlated, as they originate from the decay of a common parent particle (usually $\tilde{\chi}_1^{\pm}$ or the next-to-lightest neutralino $\tilde{\chi}_2^0$). This leads to a softer m_T spectrum than that found in gluino-mediated top squark signal models, where the lepton and the $\tilde{\chi}_1^0$ originate from different parent particles and are thus uncorrelated.

Simulated Monte Carlo (MC) event samples are used to aid in the description of the background and to model the SUSY signal. Top-quark pair and single-top production are simulated with MC@NLO [33], fixing the top-quark mass at 172.5 GeV and using the next-to-leading-order (NLO) parton density function (PDF) set CTEQ6.6 [34]. Samples of W + jets and Z + jets with both light- and heavy-flavor jets are generated with ALPGEN [35] and PDF set CTEQ6L1 [36]. The fragmentation and hadronization for the ALPGEN and MC@NLO samples are performed with HERWIG [37], using JIMMY [38] for the underlying event. Samples of $t\bar{t}Z$, $t\bar{t}W$, and $t\bar{t}WW$ (referred to as $t\bar{t} + X$) are generated with MADGRAPH [39] interfaced to PYTHIA [40]. The total LO cross section for these samples is 0.39 pb and is normalized to NLO by using a K factor of 1.3 [41]. Diboson samples are generated with HERWIG for $W^{\pm}W^{\mp}$, WZ, and ZZ processes and with MADGRAPH for $W^{\pm}W^{\pm}qq$ processes. The total NLO cross section for the diboson background is 71 pb [42,43]. SUSY signal processes are simulated for various models by using HERWIG++ [37] v2.4.2. The SUSY sample yields are normalized to the results of NLO calculations, as obtained by using PROSPINO [44] v2.1. The CTEQ6.6M [45] parameterization of the PDFs is used. The tunings of the MC parameters of Ref. [46] are used in the production of the MC samples, which are processed through a detector simulation [47] based on GEANT4 [48]. Effects of multiple proton-proton interactions per bunch crossing are included in the simulation.

The SM backgrounds are evaluated by using a combination of MC simulation and data-driven techniques. SM processes that generate events containing jets which are misidentified as leptons or where a lepton from a b- or c-hadron decay is selected are collectively referred to as "fake-lepton" background. It generally consists of semileptonic $t\bar{t}$, single-top, W + jets, and strong light- and heavy-flavor jet production. The contribution from the fake-lepton background is estimated from data with a method similar to that described in Refs. [49,50] by loosening the lepton identification and isolation criteria. For electrons the "medium" criteria are used instead of the "tight" criteria [26], and for both electrons and muons the isolation criterion is relaxed. The method counts the number of observed events containing loose-loose, loose-tight, tight-loose, and tight-tight lepton pairs. The probability of loose real leptons passing the tight selection criteria is obtained by using a $Z \to \ell^+\ell^-$ sample. The probability of loose fake leptons to pass the tight selection criteria is determined as a function of the lepton p_T by using multijet control samples obtained by requiring two SS leptons and low E_T^{miss}. By using these probabilities, relations are obtained for the observed event counts in the signal regions as functions of the numbers of events containing fake-fake, fake-real, real-fake, and real-real lepton pairs. These can be solved simultaneously to estimate the number of background events [49,50]. The results of the estimations have been validated with data in control regions obtained by reversing the E_T^{miss} or jet multiplicity cuts used in the signal regions.

Background events from charge misidentification (dominated by electrons which have undergone hard bremsstrahlung with subsequent photon conversion) are estimated by using a partially data-driven technique [16]. The probability of charge misidentification is calculated from MC simulations and corrected by consideration of the number of events in the data with SS electron pairs and invariant mass within 15 GeV of the Z-boson mass. This probability is applied to $t\bar{t}$ MC events producing $e^{\pm}\ell^{\mp}$ pairs to evaluate the number of SS events from incorrect charge assignment in each signal region. The probability of misidentifying the charge of a muon and the contributions in the signal regions from charge misidentification of Z/γ^* + jets and other SM backgrounds are negligible.

Contributions from other SM background sources (diboson and $t\bar{t} + X$) are evaluated by using the MC samples described above. In these processes, real SS lepton pairs are produced, and their contribution to the signal regions can be described with MC simulations. In particular, the contribution from the experimentally unmeasured $t\bar{t}+X$ processes has been studied by using several MC generators. The background from cosmic rays is evaluated with data by using the method in Ref. [16], and its contribution is negligible in the signal regions.

Systematic uncertainties are estimated in the signal regions for the background and the SUSY signal processes. The primary sources of systematic uncertainties in the background are the jet energy scale calibration (35%), the jet energy resolution (10%), uncertainties on lepton and jet reconstruction and identification (5%), and MC modeling and theoretical cross section uncertainties (40%–70%). In particular, the theoretical uncertainties on the cross section of the $t\bar{t}+X$ processes are found to be between 35% and 55% by varying factorization and renormalization scales and 25% due to PDF uncertainties. In addition, a 50% uncertainty is assigned on the K factor used to obtain the NLO cross section [41]. In the fake-lepton background estimation, systematic uncertainties are assigned to the probabilities for loose fake leptons to pass the tight selection. This accounts for potentially different compositions of the signal and control regions. These uncertainties vary in the 10%–80% range depending on the lepton p_T and are evaluated by using data samples with jets of different energies. The absolute uncertainty for each background source is given in Table I. Systematic uncertainties on the signal expectations are evaluated through variations of the factorization and renormalization scales between half and twice their default values and by including the uncertainty on α_s and on the PDF provided by CTEQ6. Uncertainties are calculated for individual SUSY processes. The total uncertainty varies in the 20%–40% range for the considered MC signals. Any correlations of the systematic uncertainties in signals and background are taken into account.

Figure 1 shows the distribution of the number of jets with $p_T > 50$ GeV for events with 2 SS leptons and the E_T^{miss} distribution for events with 2 SS leptons and at least four jets with $p_T > 50$ GeV. The contributions from all the SM backgrounds are shown together with their total statistical and systematic uncertainties. For illustration, the distribution for a signal obtained with the decay $\tilde{g} \to t\bar{t}\tilde{\chi}_1^0$ in $\tilde{g}\tilde{g}$ pair-produced events with $m_{\tilde{g}} = 650$ GeV and $m_{\tilde{\chi}_1^0} = 150$ GeV is also shown. The data are in agreement with the SM background expectation, and once four jets of $p_T > 50$ GeV are required no event is observed with $E_T^{miss} > 150$ GeV.

Table I shows the number of expected events in the signal regions for each background source together with the observed number of events. The expectation from the SM is estimated to be less than one event for each signal region with no events observed in the data. Limits at 95% confidence level (C.L.) are derived on the visible cross section $\sigma_{vis} = \sigma \times \epsilon \times A$, where σ is the total production cross section for any new signal producing SS dileptons, A is the acceptance defined by the fraction of events passing

TABLE I. Number of expected SM background events together with the number of observed events in the data. The errors are a combination of the uncertainties due to MC statistics, statistical uncertainties in control regions, and systematic uncertainties. Observed and expected upper limits at 95% confidence level on $\sigma_{vis} = \sigma \times \epsilon \times A$, together with the $\pm 1\sigma$ errors on the expected limits, are also shown.

	SR1	SR2
$t\bar{t}+X$	0.37 ± 0.26	0.21 ± 0.16
Diboson	0.05 ± 0.02	0.02 ± 0.01
Fake-lepton	0.34 ± 0.20	<0.17
Charge mis-ID	0.08 ± 0.01	0.039 ± 0.007
Total SM	0.84 ± 0.33	0.27 ± 0.24
Observed	0	0
σ_{vis}^{obs} [fb]	<1.6	<1.5
σ_{vis}^{exp} [fb]	$<1.7^{+0.5}_{-0.1}$	$<1.6^{+0.2}_{-0.1}$

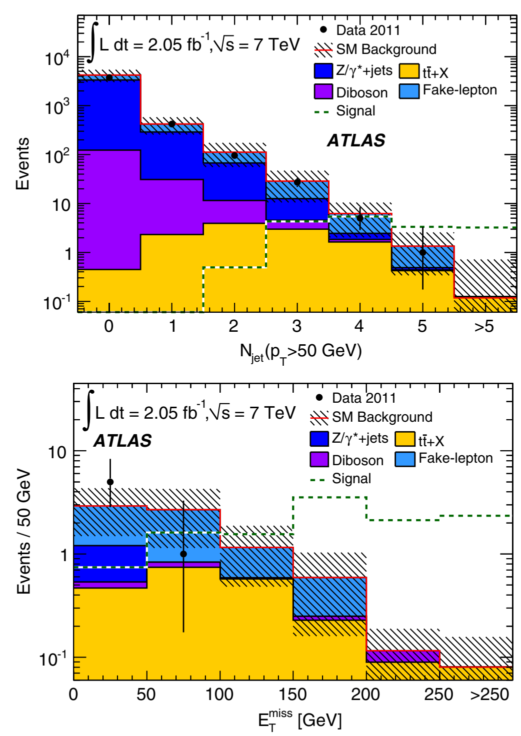

FIG. 1 (color online). Number of jets with $p_T > 50$ GeV for events with 2 SS leptons (top) and the E_T^{miss} distribution for events with 2 SS leptons and at least 4 jets with $p_T > 50$ GeV (bottom). Errors on data points are statistical, while the error band on the SM background represents the total uncertainty. The component labeled "Fake-lepton" is evaluated by using data as described in the text. The component labeled "$Z/\gamma^* +$ jets" is estimated from MC simulations. No estimation of the charge mis-ID is included in the distribution. The component labeled "Signal" corresponds to a signal obtained with the decay $\tilde{g} \to t\bar{t}\tilde{\chi}_1^0$ via off mass-shell $\tilde{t}$ ($m_{\tilde{t}} = 1.2$ TeV) in $\tilde{g}\tilde{g}$ pair-produced events with $m_{\tilde{g}} = 650$ GeV and $m_{\tilde{\chi}_1^0} = 150$ GeV.

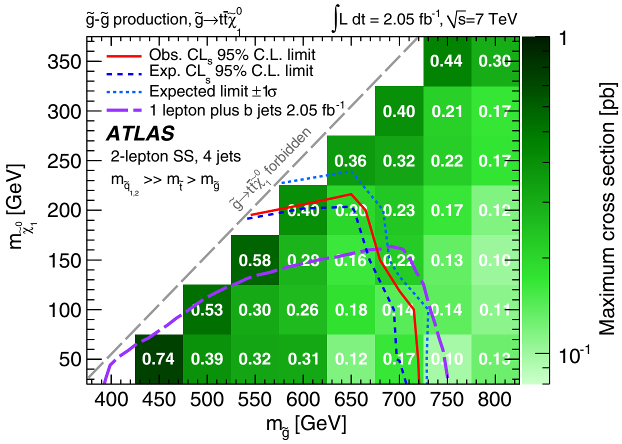

FIG. 2 (color online). Expected and observed 95% C.L. exclusion limits in the $\tilde{g} \to t\bar{t}\tilde{\chi}_1^0$ (via off mass-shell $\tilde{t}$, $m_{\tilde{t}} = 1.2$ TeV) simplified model as a function of the gluino and neutralino masses, together with existing limits [19]. The -1σ limit lies outside the range of the figure. The production cross section upper limits at 95% C.L. are also shown.

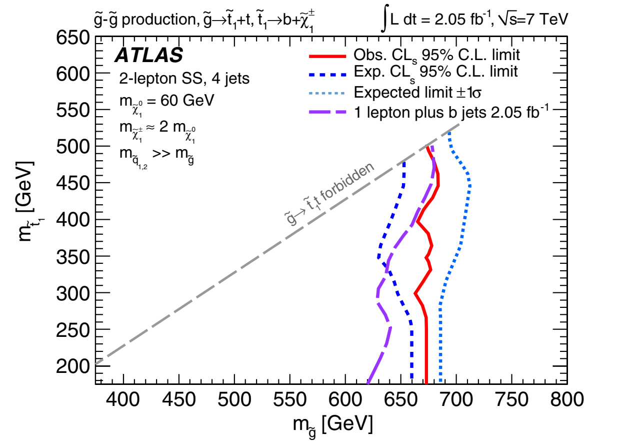

FIG. 3 (color online). Expected and observed 95% C.L. exclusion limits in the $\tilde{g} \to \tilde{t}_1 t$ with $\tilde{t}_1 \to b\tilde{\chi}_1^{\pm}$ model as a function of the gluino and top squark masses assuming that $m_{\tilde{\chi}_1^{\pm}} \approx 2m_{\tilde{\chi}_1^0}$. The -1σ band lies outside the range of the figure.

geometric and kinematic cuts at particle level, and ϵ is the detector reconstruction, identification, and trigger efficiency. For the signal shown in Fig. 1, the acceptance and efficiency are 1.5% and 55%, respectively. Limits are set by using the CL_s prescription, as described in Ref. [51]. The results are given in Table I.

The results obtained in SR2 are interpreted in a simplified model where gluinos are produced only in pairs, the top squark ($m_{\tilde{t}} = 1.2$ TeV) is heavier than the gluino, and only the gluino three-body decay $\tilde{g} \to t\bar{t}\tilde{\chi}_1^0$ via an off-shell top squark is allowed. Figure 2 shows the limit in the gluino-neutralino mass plane. For a gluino mass of 650 GeV, neutralino masses below 215 GeV are excluded at 95% C.L. For a neutralino mass of 100 GeV, gluino masses below 715 GeV are similarly excluded. The -1σ uncertainty limit on the expected limit lies outside the range of the figure as a consequence of the low number of expected signal events and a total signal uncertainty that reaches close to 50%. The results can be generalized in terms of production cross section upper limits at 95% C.L. for $\tilde{g}\,\tilde{g}$ pair production processes with the produced particles decaying into $t\bar{t}\tilde{\chi}_1^0$ final states, as also shown in Fig. 2.

The results in SR2 are also interpreted by considering gluino pair production followed by the $\tilde{g} \to \tilde{t}_1 t$ decay. Only top squark decays via $\tilde{t}_1 \to b\tilde{\chi}_1^{\pm}$ are considered with $m_{\tilde{\chi}_1^{\pm}} \approx 2m_{\tilde{\chi}_1^0}$ and $m_{\tilde{\chi}_1^0} = 60$ GeV. Figure 3 shows the exclusion limit as a function of gluino and top squark masses, where gluino masses below 660 GeV are excluded at 95% C.L. for top squark masses below 460 GeV.

The results in SR1 are interpreted within the MSUGRA-CMSSM framework in terms of limits on the universal scalar and gaugino mass parameters m_0 and $m_{1/2}$, as shown in Fig. 4. These are presented for fixed values of the universal trilinear coupling parameter $A_0 = 0$, ratio of the vacuum expectation values of the two Higgs doublets $\tan\beta = 10$, and Higgs mixing parameter $\mu > 0$. In this model, values of $m_{1/2}$ below 300 GeV are excluded at 95% C.L. for m_0 values below 750 GeV, and $m_{1/2}$ values below 180 GeV are excluded over the entire m_0 region considered. These are equivalent to the exclusion of gluino masses below ~550 GeV independent of the squark mass (and gluino masses below ~750 GeV for squark masses below 1 TeV).

In summary, a search for SUSY with two SS leptons, jets, and missing transverse momentum has been performed by using 2.05 fb^{-1} of ATLAS data. With no events observed in the signal regions, limits have been derived in the context of models where top quarks are produced in gluino decays and MSUGRA-CMSSM scenarios. In all these signal models, gluino masses below ~550 GeV are

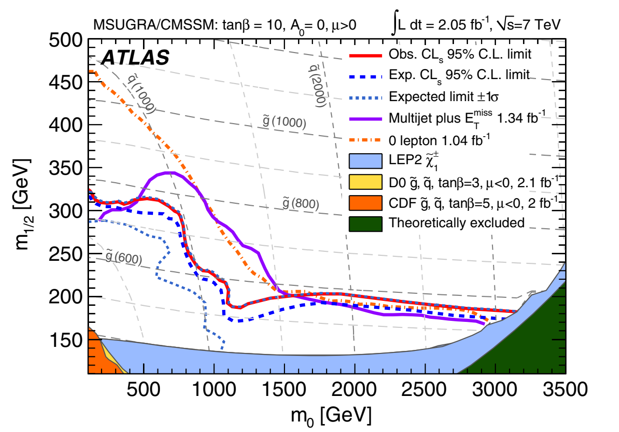

FIG. 4 (color online). Expected and observed 95% C.L. exclusion limits in the MSUGRA-CMSSM (m_0, $m_{1/2}$) plane for $\tan\beta = 10$, $A_0 = 0$, and $\mu > 0$, compared to existing limits [52–56].

excluded at 95% C.L. within the parameter space considered, and gluino masses up to ~750 GeV are excluded at 95% C.L., depending on the model parameters. The results of this analysis are complementary to and extend the current exclusion limits on the gluino mass beyond those from other ATLAS searches [19,52].

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[1] P. Ramond, Phys. Rev. D **3**, 2415 (1971).
[2] Y. Golfand and E. Likhtman, JETP Lett. **13**, 323 (1971).
[3] A. Neveu and J. H. Schwarz, Nucl. Phys. **B31**, 86 (1971).
[4] A. Neveu and J. H. Schwarz, Phys. Rev. D **4**, 1109 (1971).
[5] D. Volkov and V. Akulov, Phys. Lett. **46B**, 109 (1973).
[6] J. Wess and B. Zumino, Phys. Lett. **49B**, 52 (1974).
[7] J. Wess and B. Zumino, Nucl. Phys. **B70**, 39 (1974).
[8] P. Fayet, Phys. Lett. **69B**, 489 (1977).
[9] G. R. Farrar and P. Fayet, Phys. Lett. **76B**, 575 (1978).
[10] W. Beenakker, R. Hopker, T. Plehn, and P. Zerwas, Z. Phys. C **75**, 349 (1997).
[11] J. Hisano, K. Kawagoe, and M. M. Nojiri, Phys. Rev. D **68**, 035007 (2003).
[12] C. Balázs, M. Carena, and C. E. M. Wagner, Phys. Rev. D **70**, 015007 (2004).
[13] M. Mühlleitner, A. Djouadi, and Y. Mambrini, Comput. Phys. Commun. **168**, 46 (2005).
[14] S. Kraml and A. R. Raklev, Phys. Rev. D **73**, 075002 (2006).
[15] ATLAS Collaboration, Eur. Phys. J. C **71**, 1682 (2011).
[16] ATLAS Collaboration, Phys. Lett. B **709**, 137 (2012).
[17] ATLAS Collaboration, J. High Energy Phys. 04 (2012) 069.
[18] A. Abulencia *et al.* (CDF Collaboration), Phys. Rev. Lett. **98**, 221803 (2007).
[19] ATLAS Collaboration, arXiv:1203.6193.
[20] ATLAS Collaboration, JINST **3**, S08003 (2008).
[21] ATLAS Collaboration, Eur. Phys. J. C **71**, 1630 (2011).
[22] ATLAS Collaboration, Report No. ATLAS-CONF-2011-116, 2011.
[23] M. Cacciari, G. P. Salam, and G. Soyez, J. High Energy Phys. 04 (2008) 063.
[24] M. Cacciari and G. Salam, Phys. Lett. B **641**, 57 (2006).
[25] ATLAS Collaboration, arXiv:1112.6426.
[26] ATLAS Collaboration, Eur. Phys. J. C **72**, 1909 (2012).
[27] ATLAS Collaboration, Report No. ATLAS-CONF-2011-063, 2011.
[28] ATLAS Collaboration, Report No. ATLAS-CONF-2010-069, 2010.
[29] ATLAS Collaboration, Eur. Phys. J. C **72**, 1844 (2012).
[30] ATLAS Collaboration, Phys. Rev. D **85**, 012006 (2012).
[31] A. H. Chamseddine, R. L. Arnowitt, and P. Nath, Phys. Rev. Lett. **49**, 970 (1982); R. Barbieri, S. Ferrara, and C. A. Savoy, Phys. Lett. **119B**, 343 (1982); L. E. Ibanez, Phys. Lett. **118B**, 73 (1982); L. J. Hall, J. D. Lykken, and S. Weinberg, Phys. Rev. D **27**, 2359 (1983); N. Ohta, Prog. Theor. Phys. **70**, 542 (1983).
[32] G. Kane, C. Kolda, L. Roszkowski, and J. Wells, Phys. Rev. D **49**, 6173 (1994).
[33] S. Frixione and B. Webber, arXiv:hep-ph/0601192.
[34] P. Nadolsky, H.-L. Lai, Q.-H. Cao, J. Huston, J. Pumplin, D. Stump, W.-K. Tung, and C.-P. Yuan, Phys. Rev. D **78**, 013004 (2008).
[35] M. Mangano, F. Piccinini, A. D. Polosa, M. Moretti, and R. Pittau, J. High Energy Phys. 07 (2003) 001.
[36] J. Pumplin, D. R. Stump, J. Huston, H.-L. Lai, P. Nadolsky, and W.-K. Tung, J. High Energy Phys. 07 (2002) 012.
[37] G. Corcella, I. G. Knowles, G. Marchesini, S. Moretti, K. Odagiri, P. Richardson, M. H. Seymour, and B. R. Webber, J. High Energy Phys. 01 (2001) 010.
[38] J. Butterworth, J. R. Forshaw, and M. Seymour, Z. Phys. C **72**, 637 (1996).
[39] J. Alwall, M. Herquet, F. Maltoni, O. Mattelaer, and T. Stelzer, J. High Energy Phys. 06 (2011) 128.
[40] T. Sjöstrand, S. Mrenna, and P. Skands, J. High Energy Phys. 05 (2006) 026.
[41] A. Lazopoulos, T. McElmurry, K. Melnikov, and F. Petriello, Phys. Lett. B **666**, 62 (2008); F. Petriello (private communication).
[42] J. M. Campbell and R. K. Ellis, Phys. Rev. D **60**, 113006 (1999).
[43] J. Campbell, R. Ellis, and C. Williams, J. High Energy Phys. 07 (2011) 018.

[44] W. Beenakker, M. Kramer, T. Plehn, M. Spira, and P. Zerwas, Nucl. Phys. **B515**, 3 (1998).
[45] D. Stump, J. Huston, J. Pumplin, W.-K. Tung, H.-L. Lai, S. Kuhlmann, and J. F. Owens, J. High Energy Phys. 10 (2003) 046.
[46] ATLAS Collaboration, Reports No. ATL-PHYS-PUB-2010-014 and No. ATLAS-CONF-2010-031, 2010.
[47] ATLAS Collaboration, Eur. Phys. J. C **70**, 823 (2010).
[48] S. Agostinelli *et al.*, Nucl. Instrum. Methods Phys. Res., Sect. A **506**, 250 (2003).
[49] ATLAS Collaboration, Eur. Phys. J. C **71**, 1577 (2011).
[50] ATLAS Collaboration, Phys. Lett. B **707**, 459 (2012).
[51] A. L. Read, J. Phys. G **28**, 2693 (2002).
[52] ATLAS Collaboration, J. High Energy Phys. 11 (2011) 099.
[53] T. Aaltonen *et al.* (CDF Collaboration), Phys. Rev. Lett. **102**, 121801 (2009).
[54] V. M. Abazov *et al.* (D0 Collaboration), Phys. Lett. B **660**, 449 (2008).
[55] V. M. Abazov *et al.* (D0 Collaboration), Phys. Lett. B **693**, 95 (2010).
[56] LEP SUSY Working Group (ALEPH, DELPHI, L3, and OPAL Collaborations), Notes No. LEPSUSYWG/01-03.1 and No. 04-02.1, http://lepsusy.web.cern.ch/lepsusy/Welcome.html.

G. Aad,[47] B. Abbott,[109] J. Abdallah,[11] S. Abdel Khalek,[113] A. A. Abdelalim,[48] A. Abdesselam,[116] O. Abdinov,[10] B. Abi,[110] M. Abolins,[86] O. S. AbouZeid,[156] H. Abramowicz,[151] H. Abreu,[113] E. Acerbi,[87a,87b] B. S. Acharya,[162a,162b] L. Adamczyk,[37] D. L. Adams,[24] T. N. Addy,[55] J. Adelman,[173] M. Aderholz,[97] S. Adomeit,[96] P. Adragna,[73] T. Adye,[127] S. Aefsky,[22] J. A. Aguilar-Saavedra,[122b,b] M. Aharrouche,[79] S. P. Ahlen,[21] F. Ahles,[47] A. Ahmad,[146] M. Ahsan,[40] G. Aielli,[131a,131b] T. Akdogan,[18a] T. P. A. Åkesson,[77] G. Akimoto,[153] A. V. Akimov,[92] A. Akiyama,[65] M. S. Alam,[1] M. A. Alam,[74] J. Albert,[167] S. Albrand,[54] M. Aleksa,[29] I. N. Aleksandrov,[63] F. Alessandria,[87a] C. Alexa,[25a] G. Alexander,[151] G. Alexandre,[48] T. Alexopoulos,[9] M. Alhroob,[20] M. Aliev,[15] G. Alimonti,[87a] J. Alison,[118] M. Aliyev,[10] B. M. M. Allbrooke,[17] P. P. Allport,[71] S. E. Allwood-Spiers,[52] J. Almond,[80] A. Aloisio,[100a,100b] R. Alon,[169] A. Alonso,[77] B. Alvarez Gonzalez,[86] M. G. Alviggi,[100a,100b] K. Amako,[64] P. Amaral,[29] C. Amelung,[22] V. V. Ammosov,[126] A. Amorim,[122a,c] G. Amorós,[165] N. Amram,[151] C. Anastopoulos,[29] L. S. Ancu,[16] N. Andari,[113] T. Andeen,[34] C. F. Anders,[20] G. Anders,[57a] K. J. Anderson,[30] A. Andreazza,[87a,87b] V. Andrei,[57a] M-L. Andrieux,[54] X. S. Anduaga,[68] A. Angerami,[34] F. Anghinolfi,[29] A. Anisenkov,[105] N. Anjos,[122a] A. Annovi,[46] A. Antonaki,[8] M. Antonelli,[46] A. Antonov,[94] J. Antos,[142b] F. Anulli,[130a] S. Aoun,[81] L. Aperio Bella,[4] R. Apolle,[116,d] G. Arabidze,[86] I. Aracena,[141] Y. Arai,[64] A. T. H. Arce,[44] S. Arfaoui,[146] J-F. Arguin,[14] E. Arik,[18a,a] M. Arik,[18a] A. J. Armbruster,[85] O. Arnaez,[79] V. Arnal,[78] C. Arnault,[113] A. Artamonov,[93] G. Artoni,[130a,130b] D. Arutinov,[20] S. Asai,[153] R. Asfandiyarov,[170] S. Ask,[27] B. Åsman,[144a,144b] L. Asquith,[5] K. Assamagan,[24] A. Astbury,[167] A. Astvatsatourov,[51] B. Aubert,[4] E. Auge,[113] K. Augsten,[125] M. Aurousseau,[143a] G. Avolio,[161] R. Avramidou,[9] D. Axen,[166] C. Ay,[53] G. Azuelos,[91,e] Y. Azuma,[153] M. A. Baak,[29] G. Baccaglioni,[87a] C. Bacci,[132a,132b] A. M. Bach,[14] H. Bachacou,[134] K. Bachas,[29] M. Backes,[48] M. Backhaus,[20] E. Badescu,[25a] P. Bagnaia,[130a,130b] S. Bahinipati,[2] Y. Bai,[32a] D. C. Bailey,[156] T. Bain,[156] J. T. Baines,[127] O. K. Baker,[173] M. D. Baker,[24] S. Baker,[75] E. Banas,[38] P. Banerjee,[91] Sw. Banerjee,[170] D. Banfi,[29] A. Bangert,[148] V. Bansal,[167] H. S. Bansil,[17] L. Barak,[169] S. P. Baranov,[92] A. Barashkou,[63] A. Barbaro Galtieri,[14] T. Barber,[47] E. L. Barberio,[84] D. Barberis,[49a,49b] M. Barbero,[20] D. Y. Bardin,[63] T. Barillari,[97] M. Barisonzi,[172] T. Barklow,[141] N. Barlow,[27] B. M. Barnett,[127] R. M. Barnett,[14] A. Baroncelli,[132a] G. Barone,[48] A. J. Barr,[116] F. Barreiro,[78] J. Barreiro Guimarães da Costa,[56] P. Barrillon,[113] R. Bartoldus,[141] A. E. Barton,[69] V. Bartsch,[147] R. L. Bates,[52] L. Batkova,[142a] J. R. Batley,[27] A. Battaglia,[16] M. Battistin,[29] F. Bauer,[134] H. S. Bawa,[141,f] S. Beale,[96] T. Beau,[76] P. H. Beauchemin,[159] R. Beccherle,[49a] P. Bechtle,[20] H. P. Beck,[16] S. Becker,[96] M. Beckingham,[136] K. H. Becks,[172] A. J. Beddall,[18c] A. Beddall,[18c] S. Bedikian,[173] V. A. Bednyakov,[63] C. P. Bee,[81] M. Begel,[24] S. Behar Harpaz,[150] P. K. Behera,[61] M. Beimforde,[97] C. Belanger-Champagne,[83] P. J. Bell,[48] W. H. Bell,[48] G. Bella,[151] L. Bellagamba,[19a] F. Bellina,[29] M. Bellomo,[29] A. Belloni,[56] O. Beloborodova,[105,g] K. Belotskiy,[94] O. Beltramello,[29] O. Benary,[151] D. Benchekroun,[133a] M. Bendel,[79] N. Benekos,[163] Y. Benhammou,[151] E. Benhar Noccioli,[48] J. A. Benitez Garcia,[157b] D. P. Benjamin,[44] M. Benoit,[113] J. R. Bensinger,[22] K. Benslama,[128] S. Bentvelsen,[103] D. Berge,[29] E. Bergeaas Kuutmann,[41] N. Berger,[4] F. Berghaus,[167] E. Berglund,[103] J. Beringer,[14] P. Bernat,[75] R. Bernhard,[47] C. Bernius,[24] T. Berry,[74] C. Bertella,[81] A. Bertin,[19a,19b] F. Bertinelli,[29] F. Bertolucci,[120a,120b] M. I. Besana,[87a,87b] N. Besson,[134] S. Bethke,[97] W. Bhimji,[45] R. M. Bianchi,[29] M. Bianco,[70a,70b] O. Biebel,[96] S. P. Bieniek,[75] K. Bierwagen,[53] J. Biesiada,[14] M. Biglietti,[132a] H. Bilokon,[46] M. Bindi,[19a,19b] S. Binet,[113] A. Bingul,[18c] C. Bini,[130a,130b] C. Biscarat,[175] U. Bitenc,[47] K. M. Black,[21] R. E. Blair,[5] J.-B. Blanchard,[134] G. Blanchot,[29] T. Blazek,[142a] C. Blocker,[22] J. Blocki,[38] A. Blondel,[48] W. Blum,[79] U. Blumenschein,[53] G. J. Bobbink,[103] V. B. Bobrovnikov,[105] S. S. Bocchetta,[77] A. Bocci,[44] C. R. Boddy,[116] M. Boehler,[41] J. Boek,[172] N. Boelaert,[35]

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