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Search for third-generation squarks at LHC Run 2 with the ATLAS detector

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Summary. — Despite the fact that no experimental evidence of Supersimmetry (SUSY) came from LHC Run I, this theory remains one of the most promising and motivated Standard Model extensions. Thanks to the increased Run II LHC centre-of-mass energy (13 TeV), the sensitivity to a possible discovery of 3rd-generation squarks is higher that reached in Run I. New results for the search of these particles in ATLAS, obtained using 3.2 fb^{-1} proton-proton collision data collected in 2015 at LHC, will be reported.

1. – Introduction

Supersymmetry (SUSY) [1] is one of the most studied framework to extend the Standard Model (SM). Starting from its minimal formulation, Minimal Supersymmetric Standard Model (MSSM), a large variety of models assumes the conservation of multiplicative quantum number $R-$parity([1]) and that the neutralino $\tilde{\chi}_1^0$ is the Lightest Supersymmetric Particle (LSP). As a consequence, at LHC SUSY particles are expected to be produced in pairs in events characterized by large missing transverse momentum, E_T^{miss}.

2. – Third-generation squark

Thanks to the increased Run II LHC centre-of-mass energy (13 TeV), the sensitivity to a possible discovery of 3rd-generation squarks is higher than that reached in Run I ($\sqrt{s} = 7$ and 8 TeV). For this reason, it was possible to explore the possibility of discovery of $\tilde{t}_1$ or $\tilde{b}_1$ with the 3.2 fb^{-1} data collected by the ATLAS detector during

([1]) $R-$parity is defined as $R = (-1)^{3(B-L)+2S}$ with B, baryon number, and L, lepton number.

TABLE I. – *3rd-generation squarks models together with their signatures. For the* $\tilde{b}_1 \to t\tilde{\chi}_1^{\pm}$ *analysis it was assumed that* $m(\tilde{\chi}_1^{\pm}) = m(\tilde{\chi}_1^0) + 100\ GeV$. *Instead for* $\tilde{t}_1 \to b\tilde{\chi}_1^{\pm}$ *it was considered* $m(\tilde{t}_1) = m(\tilde{\chi}_1^{\pm}) - 10\ GeV$ *or* $m(\tilde{\chi}_1^{\pm}) = 2 \times m(\tilde{\chi}_1^0)$.

Signal Model	Final states
$\tilde{b}_1 \to b\tilde{\chi}_1^0$	2 b-jet, large E_T^{miss}
$\tilde{b}_1 \to t\tilde{\chi}_1^{\pm} \to tW^{\pm}\tilde{\chi}_1^0$	2 same-sign or at least 3 leptons, at least 1 b-jet, at least 4 jet with high P_T, large E_T^{miss}
$\tilde{t}_1 \to t\tilde{t}\tilde{\chi}_1^0$	1 lepton, at least 1 b-jet, at least 4 jets, large E_T^{miss}
$\tilde{t}_1 \to b\tilde{\chi}_1^{\pm} \to bW^{\pm}\tilde{\chi}_1^0$	2 opposite-sign leptons, large E_T^{miss}

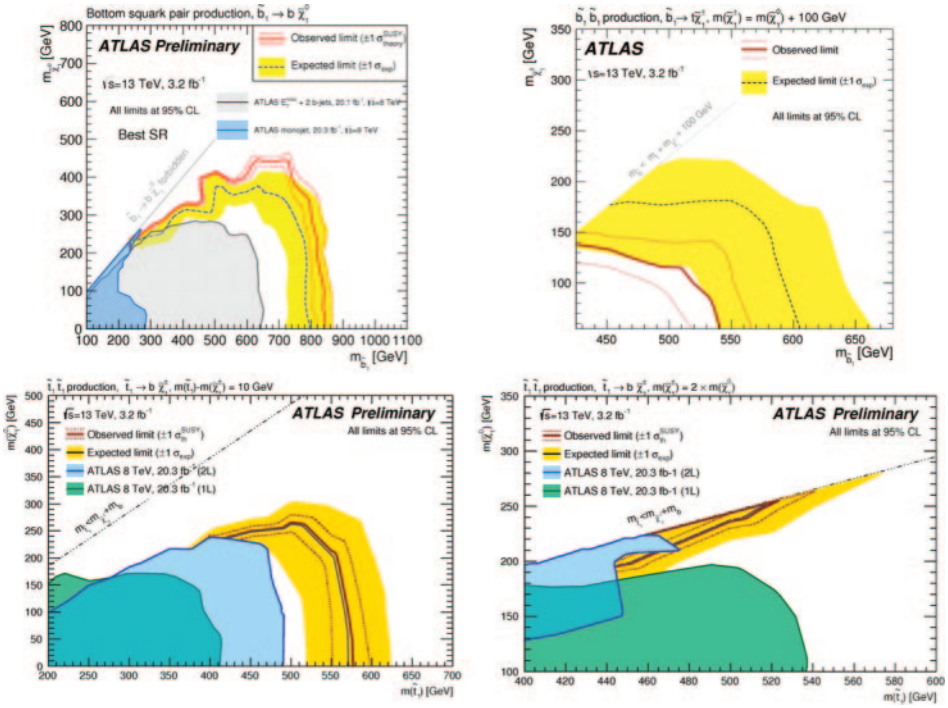

Fig. 1. – Exclusion limits from $\tilde{b}_1 \to b\tilde{\chi}_1^0$ (top-left) [2], $\tilde{b}_1 \to t\tilde{\chi}_1^{\pm}$ (top-right) [3] and $\tilde{t}_1 \to b\tilde{\chi}_1^{\pm}$ (bottom) [4] analyses.

2015. The decays considered are shown in table I together with the relative final state signatures.

With exception of the $\tilde{t}_1 \to t\tilde{\chi}_1^0$ analysis [5], where a small excess has been observed([2]) in one of the signal region corresponding to 2.3σ, no significant excess has been observed and therefore limits on the SUSY particles masses have been set at 95% CL. In fig. 1 the exclusion limits are shown together with the Run I results when available.

([2]) 12 events were observed, against the expected 5.50 ± 0.72.

REFERENCES

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