Search for supersymmetry in events with large missing transverse momentum and two leptons in proton-proton collisions at 7 TeV with the ATLAS detector

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Abstract

In 2010, the Large Hadron Collider (LHC) at CERN opened up a new regime for probing physics beyond the Standard Model. The search for various manifestations of Supersymmetry is one of the main tasks of the LHC experiments. First searches for the production of SuperSymmetric (SUSY) particles yielding large missing transverse momentum and two isolated leptons in the final state are presented. The full data sample collected in 2010 by the ATLAS experiment in LHC proton-proton collisions at a center-of-mass energy of 7 TeV, corresponding to an integrated luminosity of 35 pb⁻¹, has been analyzed.

The ATLAS detector

pp collisions at ATLAS in 2010
45 pb⁻¹ recorded, 35 pb⁻¹ usable for physics analysis

Lepton identification:
- Electrons: EM calorimetry in liquid Ar, transition radiation tracker to provide e/π separation;
- Muons: precision muon tracking with Monitored Drift Tubes, matching with Inner Detector.

2 leptons + MET

OS Signal region: MET > 150 GeV
SS Signal region: MET > 100 GeV

Search of excess of Same-Flavour Opposite Sign (SFOS) over Different Flavour Opposite Sign (DFOS):

\[ S = \frac{N(e^+e^-)}{N(\mu^+\mu^-)} \]

- \( \beta \) = ratio of electron to muon (efficiency * acceptance) = 0.69 ± 0.03
- \( \tau \) = trigger efficiency for offline reconstructed electrons (98.5 ± 1.1%) and muons (93.7±1.5%)

Conclusion

No excess of events is observed in searches for events with 2 isolated leptons (electrons and muons) and large missing transverse energy with respect to SM predictions. Depending on model assumptions, squark masses between 450 and 690 GeV are excluded. With a flavour subtraction analysis, the 95% confidence lower limit on the squark mass is 503 GeV for compressed spectrum models, and 558 GeV for light neutralino models.