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Search for supersymmetry in hadronic final states using M_{T2} in pp collisions at $\sqrt{s} = 7$ TeV

The CMS collaboration

Abstract: A search for supersymmetry or other new physics resulting in similar final states is presented using a data sample of 4.73 fb^{-1} of pp collisions collected at $\sqrt{s} = 7$ TeV with the CMS detector at the LHC. Fully hadronic final states are selected based on the variable M_{T2}, an extension of the transverse mass in events with two invisible particles. Two complementary studies are performed. The first targets the region of parameter space with medium to high squark and gluino masses, in which the signal can be separated from the standard model backgrounds by a tight requirement on M_{T2}. The second is optimized to be sensitive to events with a light gluino and heavy squarks. In this case, the M_{T2} requirement is relaxed, but a higher jet multiplicity and at least one b-tagged jet are required. No significant excess of events over the standard model expectations is observed. Exclusion limits are derived for the parameter space of the constrained minimal supersymmetric extension of the standard model, as well as on a variety of simplified model spectra.

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gluinos, in which the $E_{\mathrm{T}}^{\mathrm{miss}}$ tends to be smaller. Therefore, the restriction on M_{T2} is relaxed. The effect of the loosened M_{T2} is compensated by requiring at least one b-tagged jet and a larger jet multiplicity, to suppress the QCD multijet background. For both analyses, the standard model backgrounds, arising from QCD multijet, electroweak, and top-quark production processes, are obtained from data control samples and simulation. No excess beyond the standard model expectations is found. Exclusion limits are established in the CMSSM parameter space, as well as for some simplified model spectra. Conservatively, using the minus one standard deviation (-1σ) theory uncertainty values, absolute mass limits in the CMSSM scenario for $\tan\beta = 10$ are found to be $m(\tilde{\mathrm{q}}) > 1110\,\mathrm{GeV}$ and $m(\tilde{\mathrm{g}}) > 800\,\mathrm{GeV}$, and $m(\tilde{\mathrm{q}}) = m(\tilde{\mathrm{g}}) > 1180\,\mathrm{GeV}$ assuming equal squark and gluino masses.

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