Search for physics beyond the standard model in events with tau-leptons in the presence of multijets and large momentum imbalance in pp collisions at sqrt(s) = 7 TeV

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A search for physics beyond the standard model is performed with hadronically decaying tau-leptons, highly energetic jets and large momentum imbalance in the final state. The data sample corresponds to an integrated luminosity of 4.98 fb\(^{-1}\) of pp collisions at sqrt(s) = 7 TeV collected with the CMS detector at the LHC. The number of observed events is consistent with predictions for standard model processes. In the absence of any evidence of supersymmetry, lower limits on the mass of the gluino have been set.

**SUSY Dark Matter at the LHC**

- Supersymmetrized Standard Model between Fermions and Bosons with unification of gauge couplings
- Supersymmetry models, the lightest neutralino in the LSP which escapes the detector
- Cosmologically a natural dark matter CDM candidate
- stau-neutralino co-annihilation processes sensitive to the amount of dark matter relic density observed by the Wilkinson Microwave Anisotropy Probe (WMAP)
- SUSY signature at the LHC is involved with high multiplicity of energetic jets because squark and gluino pairs are dominant at the pp collisions,
- a large momentum imbalance in the detector (from LSP CDM candidate)
- and the Taus in the stau-neutralino coannihilation region

**Tau Reconstruction and Identification**

- A jet reconstructed by Particle Flow (PF) algorithm is used for Hadron-Plus-Stripes (HPS) algorithm to find the decay modes
- Reconstruction of the decay modes: 1 prong, 1 prong + e\(_{\tau}\), 3 prongs
- Muon ID efficiency 72.8%, tau ID efficiency 64.1% measured for the analysis

**Sensitivity in SUSY models**

- Supergravity models (mSUGRA/CMSSM)
- Simplified Model Scenarios (SMS)
- Gauge Mediated Supersymmetry Breaking Models (GMSB)

**Comparison : data and backgrounds**

**Summary**

- SUSY (R-parity conserved) search results with up to ~5fb of data, observed no significant excess.
- SM background estimations done with data driven methods.
- Setting the 95% exclusion limits on the constrained MSSM models, SUSY Simplified model, and GMSB.
- Limits on Gluino mass reach to ~5 TeV with the 2011 data of pp@\(\sqrt{s} = 7\) TeV