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Search for New Physics with Top Tagging and Missing Transverse Momentum

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This analysis is a generic search for new physics targeting final states with one or more top quarks. It is motivated by models of R-parity conserving Supersymmetry (SUSY) that assume the existence of additional elementary particles not included in the Standard Model (SM). In the simplest case, there is one supersymmetric partner-particle for each Standard Model SM particle. The existence of these additional particles has many interesting consequences: Most strikingly, they can provide excellent candidates for Dark Matter, the substance that constitutes about 25% of our universe and for which there is no candidate particle in the SM. Moreover, the presence of supersymmetric partner particles in virtual loops can cancel the otherwise large corrections occurring in the renormalisation of e.g. the Higgs-boson mass. As a consequence, the theory becomes less dependent on the exact values of its parameters (becomes more natural) - a feature typically thought desirable. Also, the presence of supersymmetric particles in virtual loops leads to common gauge-coupling strengths when extrapolated to higher scales, which hints to some underlying, unified theory. However, so far, SUSY particles have not been observed, and hence, they must have higher masses than the known SM particles. SUSY particles could be directly produced in the proton-proton collisions at the LHC if they have masses in the TeV range. In many SUSY models the super partners of the quarks and gluons (called squarks and gluinos), are pair produced and can occur with particularly large cross sections compared to other SUSY-production channels. The squarks and gluinos will predominantly decay into coloured SM particles and pairs of stable LSPs (Lightest Supersymmetric Particles). In realistic models, the LSPs are electrically neutral and only weakly interacting such as neutrinos.

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