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In this report senior investigator Prof. Milind V. Purohit describes research done with data from the ATLAS experiment at CERN. Other USC personnel who participated in this project during the period of this grant were a graduate student, Anton Kravchenko.

At the start of the grant period we were writing a paper on the performance of the CSC detector, one on searches for SUSY using a new modern "big data" technique and one on a search for supersymmetry (SUSY) using the "zero leptons razor" (0LRaz) technique. Purohit was also promoting publication of the first observation of bremmstrahlung from muons at high energies in detectors.

Here we will mention the 0lRaz paper which has been submitted for publication. [1]. The Razor variable set is designed to group together visible final-state particles associated with heavy produced sparticles, and in doing so contains information about the mass scale of those sparticles. The events are selected using a combination of E_T^{Miss} triggers which are fully efficient for the event selections considered in this search. The new 0-lepton Razor (0LRaz) analysis selects events with at least two high-p_T jets and E_T^{Miss}. The baseline object selection and event cleaning, as well as the choice of MC generators for SM background processes and the approach for calculating systematic uncertainties exactly follow those of the 0L search [2]. Two signal regions are identified by optimizing criteria on the Razor variables. One signal region, SR_{loose}, targets models with small mass splittings which typically have softer visible objects, while the other signal region, SR_{tight}, is designed to target models with high squark masses which typically contain harder visible objects.

The prediction of the W/Z+jets background processes by the ATLAS simulation prior to the fit is found to be overestimated in the phase space of interest and is consequently decreased by the fit. This is consistent with the behaviour observed in previous publications probing a similar phase space [2]. In all new signal regions presented in our analysis the number of events observed is consistent with the post-fit SM expectations. Assuming R-parity conservation, the limit on the gluino mass exceeds 1150 GeV at 95% confidence level, for an LSP mass smaller than 100 GeV.

References

[1] "Summary of the searches for squarks and gluinos using $\sqrt{s} = 8$ TeV pp collisions with the ATLAS experiment at the LHC", by the ATLAS collaboration. arXiv:1507.05525v1, submitted to JHEP.

[2] "Search for squarks and gluinos with the ATLAS detector in final states with jets and missing transverse momentum using $\sqrt{s} = 8$ TeV proton–proton collision data", by the ATLAS collaboration. arXiv:1405.7875, JHEP09 (2014) 176.