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Hadron Production in Photon-Photon Processes at the ILC and BSM signatures with small mass differences

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In supersymmetric extensions of the Standard Model,higgsino-like charginos and neutralinos are preferred to have masses of the order of the elecktroweak scale by naturalness arguments. Light higgsinos are also well motivated from a top-down perspective. Such light $\tilde{\chi}^{\pm}1$,$\tilde{\chi}01$ and $\tilde{\chi}02$ states can be almost mass degenerate. In this talk the analysis of two benchmark points which exhibits mass difference of O [GeV] in the higgsino sector is presented. Due to their mass degeneracy it is very difficult to observe the decay of such higgsinos at hadron colliders. ILC being an e+e− collider has the prospect of providing very clean physics environment to observe or exclude such scenarios. However, in addition to the desired e+e− $\longrightarrow \tilde{\chi}+\tilde{\chi}-$ processes, parasitic collisions of real and virtual photons radiated off the e+e− beams occur at the rates depending on the center of mass energy (250 GeV - 1 TeV) and other beam parameters. For instance, at a centre of mass energy 500 GeV the expectation value is about 1.05 γγ events per bunch crossing. In the given higgsino scenarios, visible decay products have low transverse momenta due to their small mass differences. This so called γγ overlay has a very similar topology to our signal event which makes the removal of overlay very challenging. The standard methods to remove γγ background e.g kt algorithm method remains inadequate. This talk presents a proposed solution namely a newly developed track grouping algorithm which is based on the concept of displaced vertices. The algorithm identifies and clusters the tracks from the same origin. The performance of the algorithm is studied through purity checks of clustered tracks and is presented in this talk. We also discuss the scope and the application of this algorithm on the low ΔM higssino analysis.

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