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Stau searches at the ILC

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The colour neutral sector is the one most relevant for the suggestions SUSY presents to the problems of the the SM - the hierarchy problem, naturalness, dark matter, the muon g-2 enigma. This sector is both for theoretical reasons, and from the results of global fits, expected to be light. But, unfortunately, it is also the sector for which current energy frontier colliders, viz. the LHC, is less well adapted.

In contrast, any future high energy electron-positron collider offers an excellent facility for SUSY searches in general, and for searches in the colour neutral sector in particular.

Among the particles in this part of the SUSY spectrum, the superpartner of the tau-lepton, the stau, plays an important role. The stau is likely to be the lightest of the sfermions, so to be the first SUSY particle that could be observed. As a benchmark for the power of SUSY searches, the stau is the prime candidate, as it can for good reasons be regarded as the worst and thus most general scenario for the searches: If one can find the stau, then any alternative next-to-lightest SUSY particle (NLSP) will also be findable.

In this contribution, a detailed study of the direct stau pair-production at the International Linear Collider (ILC) has been performed, showing the capability of this collider for determining stau exclusion/discovery limits in a model-independent way.

The studies were done using the full detector simulation and reconstruction procedures of the International Large Detector concept (ILD) at the ILC. The simulation included all SM backgrounds, as well as the beam induced ones. A detailed study of the effect of beam induced backgrounds, as overlay-on-physics and - for the first time - overlay-only events, in the stau limits was performed. The analysis of the worst mixing for stau searches at the ILC conditions is also included.

We have thus carefully evaluated all possible complications, both theoretically and experimentally, and are confident that this analysis indeed confirms the statement that at a linear e+e- collider, SUSY *will* be discovered if the NLSP mass is up to just a few GeV below the kinematic limit of the collider.

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