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Stau searches at future e+e- colliders

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The direct pair-production of the tau-lepton superpartner, stau, is one of the most interesting channels to search for SUSY. First of all the stau is with high probability the lightest of the scalar leptons. Secondly the signature of stau pair production signal events is one of the most difficult ones, yielding the 'worst' and thus most general scenario for the searches.
The most model-independent limits on the stau mass comes from the LEP experiments. They exclude a stau with mass below 26.3 GeV for any mixing and any difference between stau and neutralino masses larger than the tau mass.
The LHC exclusion reach extends to higher masses for large mass differences, but under strong model assumptions.
Future electron-positron colliders are ideally suited for stau searches: they will feature increased luminosity and centre-of-mass energy, and improved accelerator, detector and analysis technologies with respect to previous electron-positron colliders. With respect to hadron colliders, they will profit from a cleaner environment, from the initial state being known, and from trigger-less operation of the detectors.

In this contribution, the prospects for discovering stau-pair production at future e+e- Higgs factories and the resulting detector requirements will be discussed.
For detector-level simulations, the study takes the ILD detector concept and ILC parameters at 500 GeV as example. It includes all SM backgrounds, as well as beam induced backgrounds, as overlay-on-physics and - for the first time - overlay-only events, and considers the worst-case scenario for the stau-mixing. It shows that with the chosen accelerator and detector conditions, SUSY *will* be discovered if the NLSP mass is up to just a few GeV below the kinematic limit of the collider.

Based on these results, expectations for other center-of-mass energies, luminosities, beam polarisations, beam background and detector conditions will derived. Among the detector performance criteria,in particular the role of the hermeticity of the detector, of the tracking acceptance and of the ability to operate trigger-less will be discussed and put into perspective of the experimental environment expected at different Higgs factories.

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