

Search for Extra Scalars Produced in Association with Muon Pairs at the ILC

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In many models with extended Higgs sectors, e.g. Two Higgs Doublet Model, Next-to-Minimal Supersymmetric Standard Model and Randall Sundrum model, there exists an extra scalar S , and the coupling of SZZ can be very small, as expected from the likeness of the 125 GeV Higgs boson measured at the LHC to the SM Higgs boson. Searches for additional scalars at LEP and LHC are usually dependent on the model details, such as decay channels. Thus, it is necessary to have a more general analysis with model-independent assumptions. Furthermore, an extra scalar with suppressed couplings to the Z boson, even when its mass is smaller than 125 GeV, would have still escaped detection at LEP due to its limited luminosity. With a factor of 1000 higher luminosity and polarized beams, the International Linear Collider (ILC) is expected to have substantial discovery potential for such states. In this work, we perform a search for an extra scalar boson produced in association with Z boson at the ILC with a center-of-mass energy of 250 GeV and 500 GeV, using the full Geant4-based simulation of the ILD detector concept. In order to be as model-independent as possible, the analysis is performed using the recoil technique, in particular with the Z boson decaying into a pair of muons. As a preliminary result, exclusion cross-section limits are given in terms of a scale factor k with respect to the Standard Model Higgs-strahlung process cross section. These results, covering all possible searching regions of the extra scalar at the 250 GeV ILC and 500 GeV ILC, can be interpreted independently of the decay modes of the S .

Presenter: WANG, yan (desy)

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