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Reconstructing long-lived particles with the ILD detector

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Future e^+e^- colliders, thanks to their clean environment and triggerless operation, offer a unique opportunity to search for long-lived particles (LLPs) at sub-TeV energies. Considered in this contribution are promissing prospects for LLP searches offered by the International Large Detector (ILD), with a Time Projection Chamber (TPC) as the core of its tracking systems, providing almost continuous tracking. The ILD has been developed as a detector concept for the ILC, however, studies directed towards understanding of ILD performance at other collider concepts are ongoing.

Based on the full detector simulation, we study the possibility of reconstructing decays of both light and heavy LLPs at the ILD. For the heavy, $\mathcal{O}$(100 GeV) LLPs, we consider a challenging scenario with small mass splitting between LLP and the dark matter candidate, resulting in only a very soft displaced track pair in the final state, not pointing to the interaction point. We account for the soft beam-induced background (from measurable e^+e^- pairs and $\gamma\gamma \rightarrow$ hadrons processes), expected to give the dominant background contribution due to a very high cross section, and show the possible means of its reduction. As the opposite extreme scenario we consider the production of light, $\mathcal{O}$(1 GeV) pseudo\-scalar LLP, which decays to two highly boosted and almost colinear displaced tracks.

We also present the corresponding results for an alternative ILD design, where the TPC is replaced by a silicon tracker modified from the Compact Linear Collider detector (CLICdet) design.

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