

# Long-lived particle searches with the ILD experiment

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Future  $e^+e^-$  colliders provide a unique opportunity for long-lived particle (LLP) searches. This study focusses on LLP searches using the International Large Detector (ILD), a detector concept for a future Higgs factory. The signature considered is a displaced vertex inside the ILD's Time Projection Chamber. We study challenging scenarios involving small mass splittings between heavy LLP and dark matter, resulting in soft displaced tracks. As an opposite case, we explore light pseudo-scalar LLPs decaying to boosted, nearly collinear tracks. Backgrounds from beam-induced processes and physical events are considered. Various tracking system designs and their impact on LLP reconstruction are discussed. Assuming a single displaced vertex signature, model-independent limits on signal production cross-section are presented for a range of LLP lifetimes, masses, and mass splittings. The limits can be used for constraining specific models, with more complex displaced vertex signatures.

## Alternate track

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