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Cristian Pena

# Searches for Long-lived Particles and Other Challenging Exotic Signatures in CMS, HL-LHC and Beyond

## Abstract

Compelling models beyond the standard model predict new particles with long lifetimes. These long-lived particles (LLPs) decay significantly displaced from their initial production vertex giving rise to interesting signatures. Dedicated data streams and innovative usage of the CMS detector subsystems have been exploited to significantly boost the sensitivity of such searches at CMS. We present a comprehensive picture of this landscape with an emphasis on recent results obtained using data recorded by the CMS experiment during Run-II and III of the LHC, the exciting prospects for LLPs with the extensive detector upgrades to be deployed for the high-luminosity LHC and the daring and innovative detector designs in the envisioned future machines beyond the HL-LHC.