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Top Secrets: Long-Lived ALPs in Top Production

We investigate the discovery potential for long-lived particles produced in association with a top-antitop quark pair at the (High-Luminosity) LHC. Compared to inclusive searches for a displaced vertex, top-associated signals offer new trigger options and an extra handle to suppress background. We design a search strategy for a displaced di-muon vertex in the tracking detectors, in association with a reconstructed top-antitop pair. For axion-like particles with masses above the di-muon threshold, we find that the (High-Luminosity) LHC can probe effective top-quark couplings as small as $|c_{tt}|/f_a = 0.03$ (0.002)/TeV and proper decay lengths as long as $40(800)$ m, assuming a cross section of 1 fb, with data corresponding to an integrated luminosity of 150 fb^{-1} (3 ab^{-1}). Our predictions suggest that searches for top-associated displaced di-muons will explore new terrain in the current sensitivity gap between searches for prompt di-muons and missing energy. For this poster session we present a summary of the analysis, including signal and background kinematics, the event selection, and predictions for LHC Run 2 and High-Luminosity LHC.

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