Search for long-lived axion-like particles in top production

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December 8, 2023

Abstract

We investigate the discovery potential for long-lived axion-like 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. The search strategy includes axion-like particle decays to a displaced di-muon vertex which further contributes to the suppression of prompt background. 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 $|c_{tt}|/f_a = 0.03(0.002)/\text{TeV}$ and proper decay lengths as long as 20(300) 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.

In this talk I will present the results of our phenomenology study, and the first results of the CMS analysis searching for this same signature.