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Exploring the lifetime and cosmic frontier with the proposed MATHUSLA experiment

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The proposed MATHUSLA experiment (MAssive Timing Hodoscope for Ultra-Stable neutraL pArticles) could open a new avenue for discovery of Physics Beyond the Standard Model at the LHC. The large-volume detector will be placed above the CMS experiment with O(100) m of rock separation from the LHC interaction point. It is instrumented with a tracking system to observe long-lived particle decays inside its empty volume. The experiment is composed of a modular array of detectors covering together (100×100) m^2 $\times$ 25 m high. It is planned in time for the high luminosity LHC runs. With a large detection area and good granularity tracking system, MATHUSLA is also an efficient cosmic-ray Extensive Air Shower (EAS) detector. With good timing, spatial and angular resolution, the several tracking layers allow precise cosmic-ray measurements up to the PeV scale that compliment other experiments.
We will describe the detector concept and layout, the status of the project, the on-going cosmic ray studies, as well as the future plans. We will focus on the current R&D on 2.5 m long extruded plastic scintillator bars readout by wavelength shifting fibers connected to Silicon Photomultipliers (SiPM) located at each end of the bar. We will discuss the studies made on possible fiber layout, dopant concentration, as well as report on the timing resolution measurements obtained using Saint Gobain and Kuraray fibers. We will also describe the tests made on the Hamamatsu and Broadcom SiPM, a possible SiPM cooling system using chillers, as well as highlight the structure of the trigger and data acquisition. Moreover, we will discuss the proposal of adding a 10^4 m^2 layer of RPCs with both digital and analogue readout to improve significantly cosmic ray studies in the 100 TeV – 100 PeV energy range with a focus on large zenith angle EAS.

In-person or Virtual?

In-person

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