

Study of the potential of MATHUSLA as a cosmic ray detector

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MATHUSLA is a proposal to build a hodoscope of large dimensions at ground level, close to the interaction point of the CMS detector at CERN, to search for displaced vertices from the decay of neutral long-lived particles (LLP) during the High Luminosity LHC runs in an environment with low background. LLPs are predicted by different models, which try to solve open problems in fundamental particle physics. The idea behind MATHUSLA is to monitor a large volume of air (100 m x 100 m x 25 m) with a series of layers of tracking detectors to look for displayed vertices produced by the LLPs. MATHUSLA design considers 9 m x 9 m units of extruded scintillators bars (4.6 m x 4.5 cm x 2 cm) in each detector plane, which will provide spatial and timing information of impinging charged particles. Due to its configuration, MATHUSLA could be also sensitive to air showers induced by cosmic rays. However, it would be limited as an air shower detector due to hit saturation. To enhance the capabilities of MATHUSLA to the detection of extensive air showers above 100 TeV, it was proposed to add an extra layer of RPCs. We present the results of a MC study to analyze the sensitivity of MATHUSLA to cosmic ray detection. We will show that MATHUSLA could offer different advantages for cosmic ray research: it could provide unique spatial and temporal measurements of an EAS for studies of the energy spectrum, composition and arrival distribution of cosmic rays, as well as for tests of hadronic interaction models. In addition, it offers potential tracking capabilities particularly for inclined events.

Keywords

“LLP”, “secondary cosmic rays”, “CERN”, “MATHUSLA”

Collaboration

other (fill field below)

other Collaboration

MATHUSLA

Subcategory

Future projects

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