Study of the potential of MATHUSLA as cosmic ray detector

Executive Summary

Arturo Fernández Téllez* for the MATHUSLA COLLABORATION
*Benemérita Universidad Autónoma de Puebla, México

What is this contribution about?

MATHUSLA is an experimental proposal for the High Luminosity-LHC data taking period at CERN to search for long-lived particles. Because of it dimensions and tracking capabilities (scintillator and RPC layers), this detector can operate as a cosmic ray observatory at PeV energies.

Why is it relevant/interesting?

With an extra RPC layer, MATHUSLA could become a new kind of instrument to

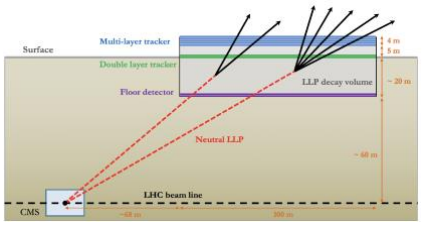
- Study the spatial and temporal structure of extensive air showers,
- Test the predictions of hadronic interaction models, muon bundles,
- Perform research on some open issues of the physics of PeV cosmic rays.

What has been done?

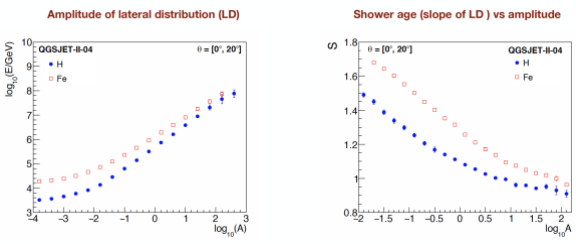
More detailed MC EAS shower analysis in under way. We are preparing a Technical Design Report, to be presented at the CERN's LHCC for approval.

What is the result?

With MATHUSLA we can reconstruct the EAS core position, arrival direction, front plane structure, sensitivity to EAS primary compositions for both, vertical (0^0-20^0) and inclined showers (70^0-80^0). with CMS + MATHUSLA experimental data, we can provide a detailed studies on muon bundles.



MATHUSLA Detector Concept



Charged density Lateral Distribution function parameters: A (Amplitude of the shower), s (Shower age)