Extraction of the Muon Signals Recorded with the Surface Detector of the Pierre Auger Observatory Using Recurrent Neural Networks

Executive Summary

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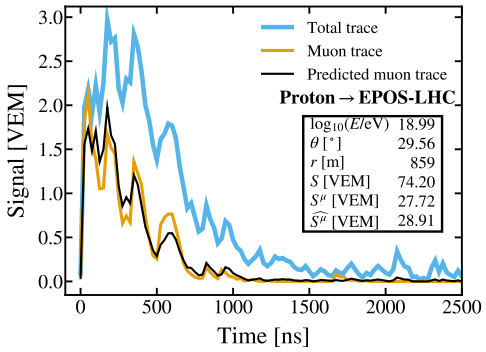
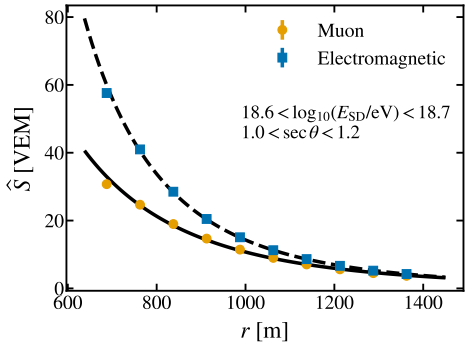
What is this contribution about?

The baseline design of The Pierre Auger Observatory does not allow to separate, for each event, the signal coming from muons from the electromagnetic signal, coming from electrons, positrons and photons.

Why is it relevant/interesting?

The muon signal depends on the composition of the primary cosmic ray, so knowledge about the muon signal can give us hints about the composition. In addition, hadronic models can be tested and search for other particles such as photons can be performed with knowledge about the muon component.





What has been done?

A Neural Network based on a Recurrent Neural Network has been trained on the temporal signals to predict the muon component (left plot, simulations only).

What is the result?

The predictions have a good resolution of 10-20% of the total signal depending on the energy and zenith angle of the primary cosmic ray. When applied to data, the predicted lateral distributions for the muonic and electromagnetic components follow the functional form obtained by the AGASA collaboration (right plot).