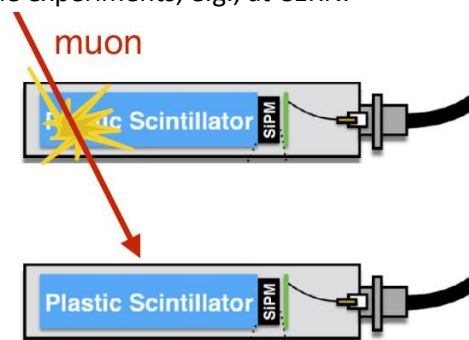
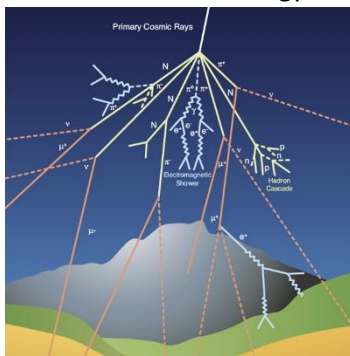


Design and construction of a cosmic ray muon detector

Project type	SFG
Language	English
Supervisor	Mehran Dehpour
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Laboratory	Group for cooperation with CERN (KFNT)
Keywords	Cosmic Rays; Muons; Scintillator; SiPM; Arduino
Workload	1 semester

Space is full of high-energy particles called cosmic rays. When they hit Earth's atmosphere, they create new particles called muons. These muons are all around us and can pass through walls and buildings. The goal of this project is to build a functional detector to study these muons. You will use a plastic scintillator (a material that glows when a particle hits it) and a modern light sensor called a SiPM. You will also use an Arduino to count the particles and save the data. We will measure how many muons arrive from different directions and see how the numbers change behind different materials. Then, we will compare our results with physics simulations. This setup will also give us a strong foundation for future upgrades, such as measuring the muon lifetime. This project is a perfect way to learn the actual technology used in large-scale experiments, e.g., at CERN.



Project Aim

The aim is to build a working muon detector and use it to study cosmic rays. You will measure the number of muons, compare your data with simulations, and prepare the system for future muon lifetime measurements.

What you will learn

- Physics: How particles like muons travel and interact with matter.
- Electronics: How to build simple circuits and use modern light sensors (SiPM).
- Programming & Analysis: How to use an Arduino to collect data, and how to check results.

Key milestones

- Learning: Reading about cosmic rays and how particle detectors work.
- Building: Connecting the scintillator, the SiPM sensor, and the Arduino.
- Testing: Making sure the detector is working correctly and counting muons.
- Data & Simulation: Collecting measurements and comparing them with physics simulations.
- Future Work: Discussing and preparing the next steps to measure the muon lifetime.

Reference

- S.N. Axani, K. Frankiewicz and J.M. Conrad, The CosmicWatch Desktop Muon Detector: a self-contained, pocket sized particle detector, [JINST 13 \(2018\) P03019](#) [[1801.03029](#)].