Simulation a Muon detector for the ALICE 3 experiment

Content

The quark-gluon plasma, QGP, is a state of matter with an energy density such that it exceeds the temperature of the Sun's core by approximately one hundred thousand times. The QGP is the primary object of study for the ALICE (A Large Ion Collider Experiment) experiment at the LHC (Large Hadron Collider). The experiment will be upgraded to operate during the High-Luminosity LHC phase. The name of this update is ALICE 3. One of the detectors that will be part of ALICE 3 is the MID (Muon Identifier), which will have the capacity to identify the trajectory of low transverse momentum dimuons produced in heavy-ion collisions for $|\eta| \approx 0$. It is planned that the MID will be formed by an array of plastic scintillators and wavelength-shifting optical fibers coupled to silicon photomultipliers (SiPM).

The thesis project consists of simulating the interaction between particles that are produced by a heavy-ion collisions and the arrangement of bars and SiPMs using the Geant4 software. The interactions will be between the particles and a uniform magnetic field, a steel absorber and the plastic scintillators. Inside the bars, photons are generated and subsequently detected by the SiPM. Afterward, we analyze information about the number of detected photons, the time of flight, the deposited energy, the position of detection in the scintillators, etc. The main results are the particle detection efficiency for different plastic configurations and using different primary particles. The efficiency will be analyzed as a function of the particles momentum, the type of incident particle (muons, kaons, protons, and pions) and the hit definition in the scintillators array in terms of deposited energy, the number of scintillation photons produced and detected. Additionally, we expect to simulate the particle fluxes expected under the High-Luminosity LHC conditions at the MID level.

Summary

Simulation of a muon detector (MID) for the experiment ALICE 3 in the LHC. The detector is based on plastic scintillators with Silicon photomultipliers (SiPM's) readout.

Primary author(s) : Mr. FERNANDEZ LUNA, Carlos (Benemerita Universidad Autonoma de Puebla)

Co-author(s) : RODRÍGUEZ CAHUANTZI, Mario (Facultad de Ciencias Físico Matemáticas, BUAP)

Presenter(s): Mr. FERNANDEZ LUNA, Carlos (Benemerita Universidad Autonoma de Puebla)