

ROMA TRE UNIVERSITY

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The Modeling of Scintillation Detectors with Geant4

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Abstract

In particle physics, using Monte Carlo simulation is widespread nowadays, and it allows for reproducing the interactions between radiation and matter with a high level of precision. Not only is this instrument used for designing the new generation of detectors, but it has also become a vital aspect of an experiment.

This thesis will describe both the designing phase and how a Geant4 simulation is carried out. The work concerns a specific scintillation detector, namely a detector capable of emitting a light signal at the passage of a charged particle (in the specific case, cosmic muons). In the simulation, all the main processes that contribute to the operating of the detector have been reproduced, i.e., generation, propagation, and photomultiplication of the light signal. The results produced have been discussed and compared with the theory, and, when possible, with the experimental data of the Laboratory of Nuclear and Subnuclear Physics.

This work has provided a more in-depth understanding of the functioning of scintillation detectors and allowed for learning some up-to-date simulation methods used in particle physics.