Relazione su Tesi di Katherin Shtejer Diaz da Laura Perini

This thesis studies the Muon Multiplicity Distribution MMD in cosmic rays using the ALICE detector. The effective live time was slightly more than 30 days; similar studies were previously performed by some LEP detectors.

Chapter 2 summarizes the properties of cosmic rays and presents the features of the shower development at different stages, as well as a brief description of the measurement methods.
Results of cosmic-ray studies performed by previous experiments based on high-energy physics detectors, are shown in chapter 3.
In chapter 4, a general description of the ALICE experiment is presented, specifically of the detector subsystems used to study cosmic ray physics.
Chapter 5 describes the methods used for reconstructing the events and the track selection criteria.
The Monte Carlo simulations to reproduce the experimental results are described in chapter 6 including the selection of the event generator and models for the extensive air showers, together with the strategy to assure and assess the accuracy and efficiency of the simulations.
In chapter 7, the data sample analysed is presented. The analysis of the MMD from data and simulations is discussed, as well as the measurements and interpretation of the frequency of HMM events. The systematic and statistical uncertainties are described.
The discussion of the final results and the comparison between data and model predictions are discussed in chapter 8.

The MMD seems well explained in the range of low – intermediate multiplicities, using simulated cosmic showers produced by light component (proton) and heavy component (iron).
In this range of multiplicity the primary cosmic rays turns out to have a mixed composition with an average mass that increases with energy, and the result is in agreement with most of the experiments working in this range. The analysis also concludes that only events produced by primary with energies above 10^{16} eV give rise to events with $N\mu > 100$, and that these events should be produced by heavy primary. However the low statistics in this energy region (only 5 events) prevents firm conclusions to be reached.

The thesis is well written and organized and shows a high level of competence. The results are interesting and original.