SIMULATION STUDIES OF THE INFORMATION CONTENT OF MUON ARRIVAL TIME OBSERVATIONS OF HIGH ENERGY EXTENSIVE AIR SHOWERS

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On basis of detailed Monte Carlo simulations of high energy Extensive Air Showers, using the EAS simulation code CORSIKA, the information potential of muon arrival time studies has been explored. Muon arrival time distributions and EAS time profiles have been analysed up to 320 m distances from the EAS centre for proton, oxygen and iron induced showers. Special attention is focussed to the model dependence and mass discriminating features, scrutinized for three energies ranges, (1.-1.78)$\cdot 10^{15}$ eV, (1.-1.78)$\cdot 10^{16}$ eV and (1.78-3.16)$\cdot 10^{16}$ eV. Non-parametric statistical inference methods have been applied in the analysis of multidimensional distributions and of the correlations of the EAS time parameters with different other EAS observables. Local muon arrival times referring to the first registered muon indicate a good mass separation when correlated with the local muon density and the shower age, especially at larger distances from the shower core. Global muon arrival times, which refer to the arrival of the shower core and represent also the curvature of the EAS disk, exhibit a slightly improved mass separation quality.