EXTENSIVE AIR SHOWERS SIMULATIONS: APPLICATIONS TO GEOPHYSICS AND ASTROPARTICLE PHYSICS

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Abstract

Secondary particles produced during the interaction of cosmic rays with the atmosphere are the major source of background radiation at ground level. Huge efforts have been directed to reproduce the expected flux at any site around the World by taking into account all the factors that could affect the arrival of primaries at Earth and the secondary particle flux.

Aiming for increasing the precision of the flux calculations we developed ARTI, a computational framework that allows us to calculate the expected particle flux at any place in the World including real-time atmospheric, geomagnetic and being capable to reproduce the expected signals in different detector models. Even more, with ARTI we are also able to calculate the expected signals produced by the occurrence of transient astrophysical phenomena, such as the observed modulation during Forbush decreases, Gamma-Ray Bursts, or Solar Particle events. As these calculations require a vast amount of computational resources, several approaches were adopted, such as the recent development of OneDataSim, an application to run ARTI at high-performance computing and cloud-based environments.

In this contribution, we show some of the main applications of the ARTI framework, such as the design of new astroparticle detectors, the characterization of new LAGO sites for space weather or gamma transients observations, the precise calculation of radiation exposure at flight levels, or the expected muon flux at underground laboratories and geophysical applications of muography.

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