The EOSC-Synergy cloud services implementation for the Latin American Giant Observatory (LAGO)

Executive Summary PoS(395 ICRC2021)261

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Brief The development and successful deployment of a **Docker**-based **cloud** implementation of the **LAGO-ARTI** framework within the European Open Scientific Cloud **EOSC-Synergy** project.

Tool **LAGO-ARTI** is an own designed framework including CORSIKA, MAGCOS, GDAS and GEANT4 and own codes to determine in a very precise way, the **signals** originated by Extensive Air Showers (EAS) expected **at any detector** of any type**,** in any particular site **around the World,** and under **realistic atmospheric and geomagnetic time-evolving conditions**.

Relevance Now we are able to run **synthetic data production and analysis** of **EAS development** (CORSIKA) and **detector response** (GEANT4) in an autonomous and unsupervised manner by deploying **virtual clusters** and **Dockers** at any **High Performance Computer** cloud-based facility, like **EOSC**.

Work Using this new **Docker-based** framework for the **cloud**, the **expected flux** of secondaries was calculated at **each LAGO site** for 1 (standard) to 7 days (high altitude or latitude site) in **realistic atmospheric and geomagnetic** conditions. These data are used to determine optimal detector geometry, calibration parameters, etc.
Additionally, we have calculated the **flux of secondaries at the TeV** scale for **1 year** at selected sites around the **World**, as these are of interest for **muography studies** and **background signals at underground laboratories.**

Results After **>150,000 processor-hours** we have a library based on **10^11 primary simulations** containing the directional flux of **high-energy secondaries (E_s>800 GeV)** at several, and the **complete flux of secondaries** at **LAGO and other sites** of interest. **Docker files will be released** during the production phase of the EOSC-Synergy **in 2022**.

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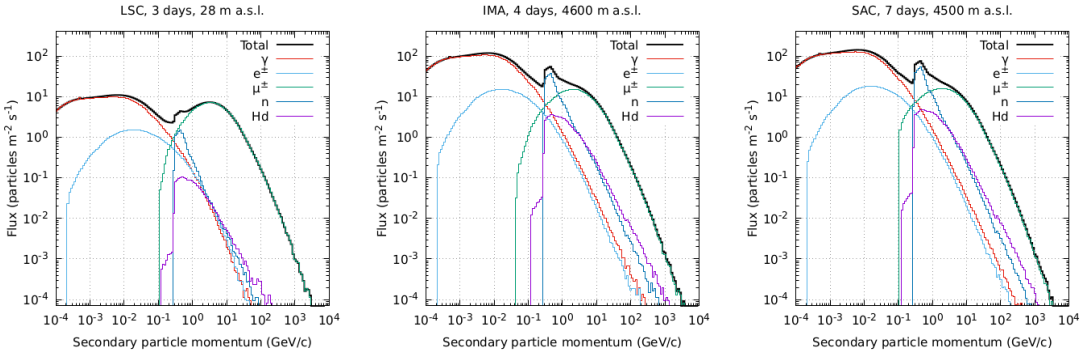

Figure 1. The expected flux of secondaries at three different LAGO sites: LSC (La Serena, Chile, 28 m a.s.l., left), IMA (Imata, Perú, 4600 m a.s.l., centre) and SAC (San Antonio de los Cobres, Argentina, 4500 m a.s.l., right). Atmospheric absorption is clearly visible in this comparative. These spectra correspond to the integrated and averaged flux of all secondary particles at detector level for 3 days at LSC, 4 days at IMA and 7 days at SAC.

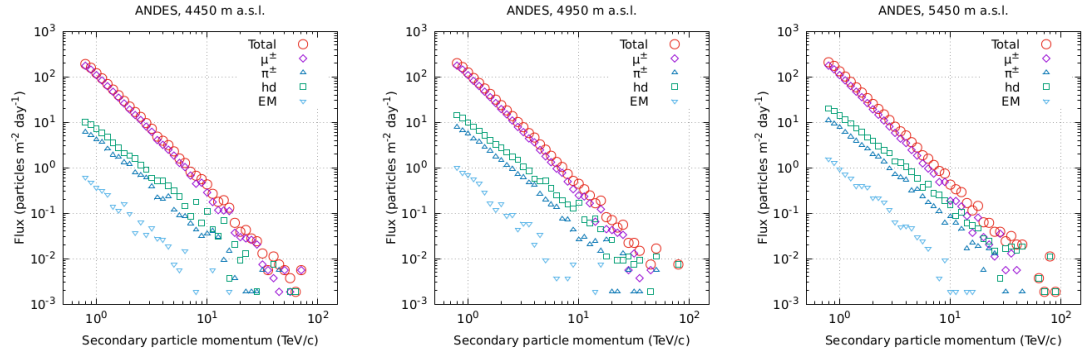

Figure 2. One-year averaged flux of the high-energy (HE) of secondary particles expected at three different altitudes of the mountain above the ANDES underground laboratory: near the tunnel entrance (4450 m a.s.l.); at mid-altitude (4950 m a.s.l.) and at the summit (5450 m a.s.l.). The HE flux of charged pions should also be considered. These studies are of most interest for underground laboratories, and muography applications.