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Systematic analysis of the properties of low energy cosmic ray extensive air showers

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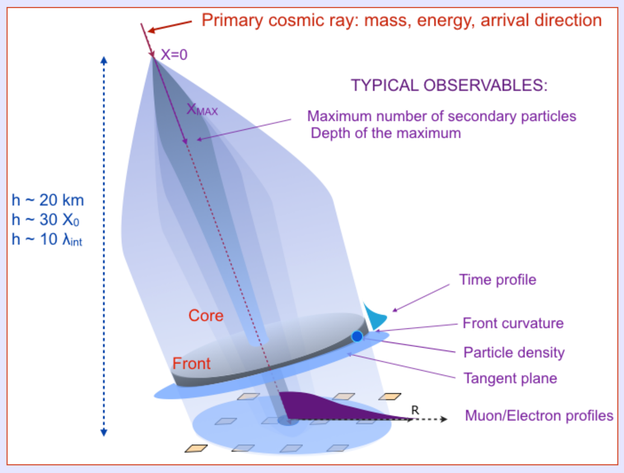
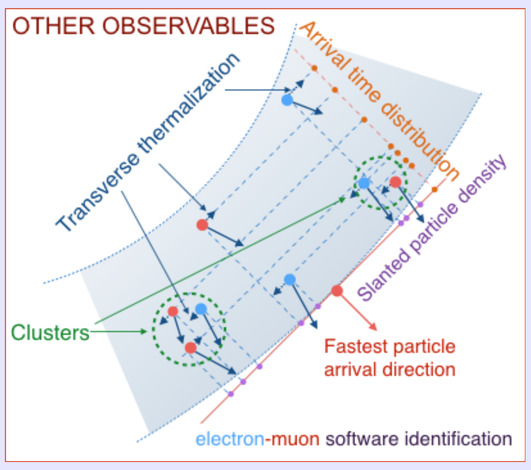
Introduction: Primary cosmic rays are completely defined by their Mass (M), Energy (E_0) and Arrival Direction (**n**). High energy cosmic rays are very scarce and can be only measured indirectly using large detector arrays at the Earth's surface. A systematic analysis of the properties of the air showers produced by cosmic rays in the energy range of (0.1 TeV, 1000 TeV) using simulated events has been started at different locations of the world. The main goal is to reach a better understanding of the properties of air showers and to explore new signatures that could be tested in the future with high performance tracking detectors.

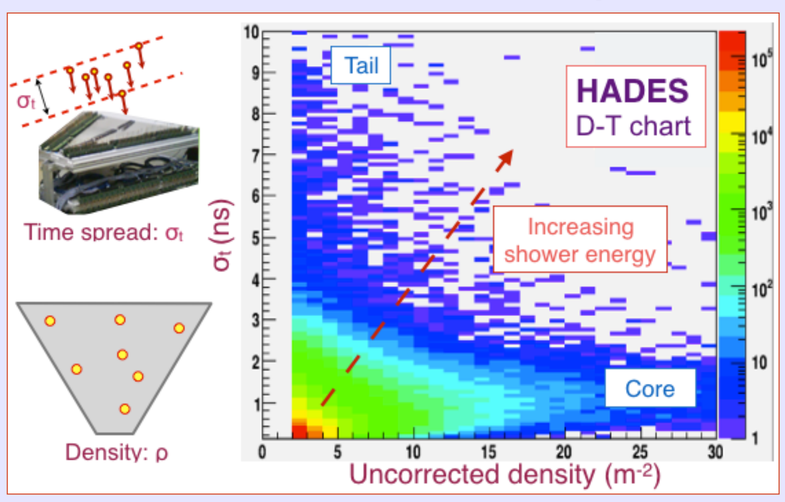
Extensive Air Shower Properties

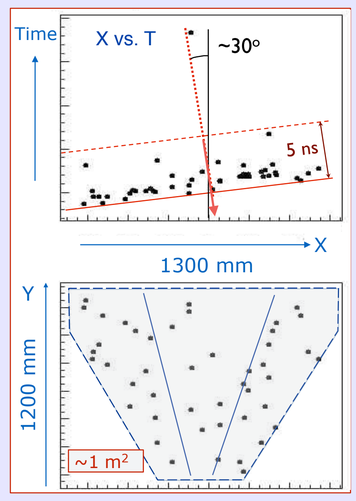




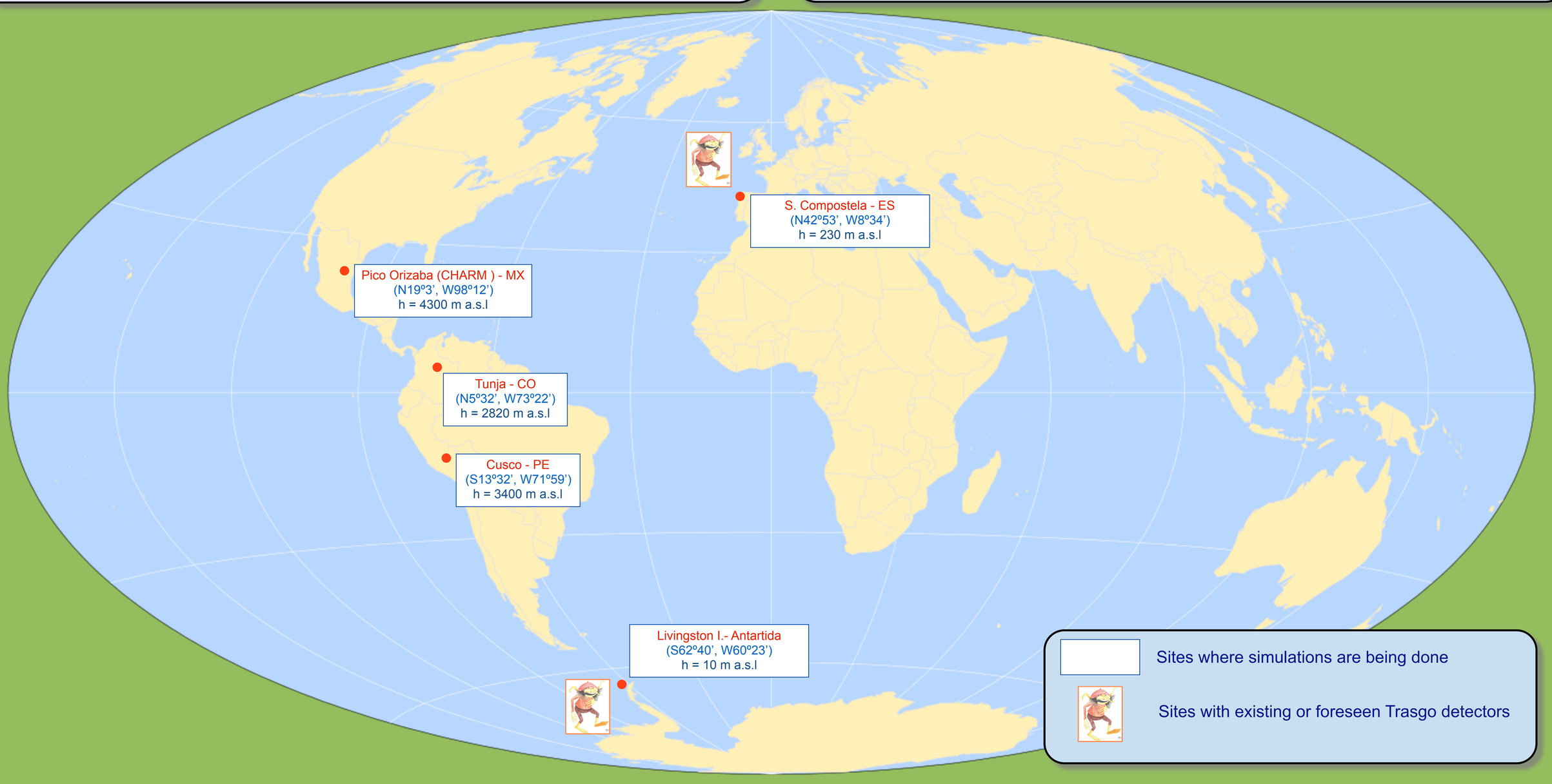
High energy cosmic rays properties are usually estimated indirectly using several variables measured with big arrays of detectors at the Earth's surface. Other few observables accesible with new high performance tracking detectors could provide new signatures of interest for their more reliable identification.

The HADES precedent

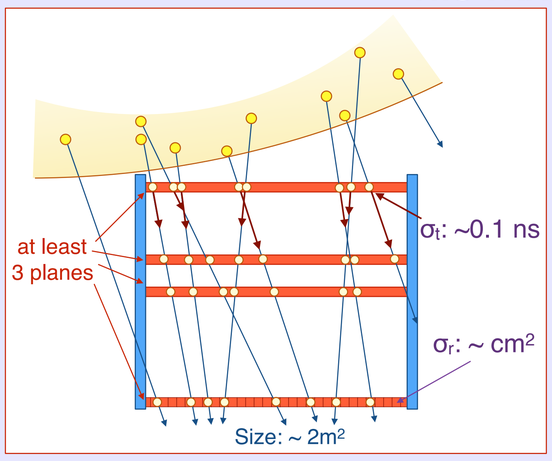


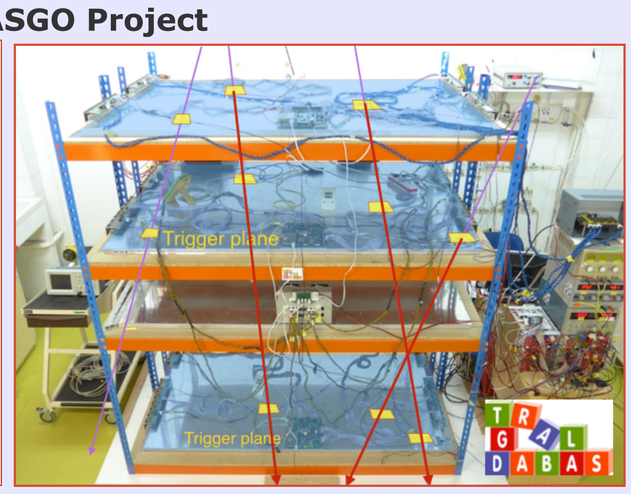


The analysis of cosmic rays at the HADES experiment [1], at GSI (Darmstadt, GE) show that a high performance tracking detector may provide an estimate of both the energy of the primary cosmic ray and the arrival direction of the front of the shower.



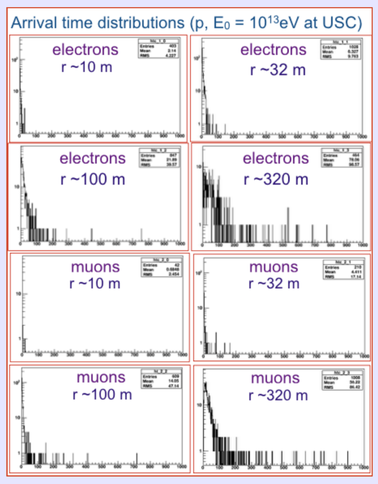
The TRASGO Project

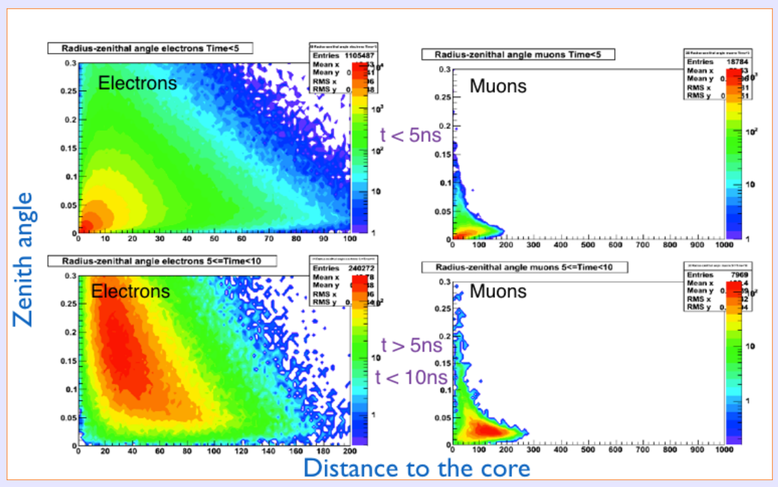




The TRASGO project [2] aims to develop affordable high performance tracking detectors able to provide accurate information of several variables of the air showers and their correlations. A first trasgo detector, TRAGALDABAS [3,4], is already operative at the Univ. of S. de Compostela. A multidisciplinary and international team is developing the main reconstruction and analysis tools.

Simulation programme





Simulations of showers induced by H, He, C and Fe nuclei in the range of energies (0.1TeV,1000TeV) are being done at different locations in the World using the Corsika code [5]. Radial density, both arrival time and lateral distributions and other observables an their correlations will be analyzed both for secondary muons and electrons

Summary & Conclusions

A systematic programe has started, as a collaboration between researchers of several research institutions, for analyzing the main features of the air showers of secondary cosmic rays at different regions of the World, with different altitudes and threshold rigidities. A second step of the initiative will be to compare the results of the MonteCarlo generations with the direct measurement done with high performance detectors. The main expected consequences of our work would be the improvement of both air shower identification signatures and MonteCarlo generator codes.

Bibliography

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