➡ J. C. Arteaga-Velazquez, “**A report by the WHISP* working group on the combined analysis of muon data at cosmic-ray energies above 1 PeV**”, *PoS ICRC2023 (2023) 466*

* Working group on Hadronic Interactions and Shower Physics

“*A meta-analysis of global data on muon densities in EAS induced by cosmic rays at high energies has revealed that in the ultra-high energy regime of primary energies there are **several** experiments that show a muon excess with regard to the p/Fe MC simulations based on post-LHC and pre-LHC hadronic interaction models. […]*”

➡ J. Albrecht *et al.*, **The Muon Puzzle in cosmic-ray induced air showers and its connection to the Large Hadron Collider**, *Astrophys Space Sci 367, 27 (2022)*.

“*Since the study of soft hadronic interactions was not driving their design, most LHC experiments focus their instrumentation on the mid-rapidity region where new heavy particles such as the Higgs are best observed, while the air shower development is strongly dominated by particles produced in the forward region. The relevant phase-space starts at pseudo-rapidity $\eta \gtrsim 2$. […]*”

★ Menzione speciale: **The LHCf detector at the CERN Large Hadron Collider** (2008 *JINST* 3 S08006) con i suoi molti risultati

➡ A. Aab *et al.* (Pierre Auger Collaboration), **Measurement of the Fluctuations in the Number of Muons in Extensive Air Showers with the Pierre Auger Observatory**, *Phys. Rev. Lett. 126, 152002 (2021)*

"*At the same time, the fluctuations of the muon signal measured by Auger are consistent with the MC predictions, indicating that the muon deficit might originate from the accumulation of small deviations from the model predictions during the development of a shower, rather than be caused by a strong deviation in the first interaction. […]*”