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Constraining models of hadronic showers using proton-Oxygen collisions at the LHC with proton/neutron tagging

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Cosmic rays (CRs) span a wide range of energies, where the ultra-high-energy CRs are studied through the extended air showers produced when CRs collide with the upper atmosphere on earth. The determination of their mass and energy depends upon the measured and simulated maxima air-shower profiles. These are modeled using hadronic Monte Carlo (MC) simulations. However, the measurements of diffractive signatures in proton-ion collisions substantially differ from the prediction of MC simulations. A short run of proton-oxygen (pO) collisions is planned at the Large Hadron Collider (LHC) at CERN in 2024 to improve the modeling of CR interactions and reduce the model uncertainties of proton-air cross-sections. While the inelastic cross-section will be measured directly, an array of very forward proton and neutron detectors introduced by the ATLAS and CMS experiments can provide a unique opportunity to study elastic and diffractive interactions in pO collisions at the center of mass energies above TeV. In my talk, I will present the possible impact of proton and neutron tagging on the measurement of the elastic and diffractive components and discuss the perspectives of measuring decay products of oxygen ions after dissociation during the preceding oxygen – oxygen run at the LHC using the array of very forward detectors.

Submitted on behalf of a Collaboration?

No

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