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# Performance of the 433 m surface array of the Pierre Auger Observatory

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The Pierre Auger Observatory, located in western Argentina, is the world's largest cosmic ray observatory. While it was originally built to study the cosmic-ray flux above $10^{18.5}$ eV, several enhancements have reduced this energy threshold, thus extending significantly the Observatory's scientific capabilities significantly. One such enhancement, part of the AMIGA original proposal, is a dense surface array composed of a triangular grid of 19 water-Cherenkov detectors separated by 433 meters (SD-433) to explore the energies down to $\sim 10^{16}$ eV. Currently, we are developing two research lines. Firstly, we will measure the energy spectrum in a region where previous experiments have shown evidence of the second knee. Secondly, we will search for UHE photons to study the PeV sources residing in the Galactic center.

In this work, we present the performance of the SD-433 derived from simulations. We show that the SD-433 reaches full efficiency near $4 \times 10^{16}$ eV for hadronic primaries with $\theta < 35^{\circ}$, and we assess the accuracy of the event geometry reconstruction.

We also present the event set observed over seven years of operation and use them to parametrize the lateral distribution function of particles hitting the ground in terms of the zenith angle and shower size.

Our studies indicate that with the SD-433, Auger will be able to extend the scientific output of the surface detector down to $10^{16}$ eV.

## Keywords

Surface detector, Pierre Auger Observatory, SD-433, efficiency, resolution, event reconstruction

## Collaboration

Auger

## other Collaboration

## Subcategory

Experimental Methods & Instrumentation

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