

# Cross-calibrating the energy scales of cosmic-ray experiments using a portable radio array

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Different experiments use different techniques to detect and reconstruct cosmic-ray events, yielding different energy scales. Having a method to compare the energy scales of different experiments with minimal uncertainty is necessary in order to make meaningful comparisons of their spectra and composition measurements, which are used to create global models of cosmic-ray sources, acceleration and propagation. Comparing energy scales has proven to be difficult, given that uncertainties on energy measurements depend on the location, technique and equipment used. In this contribution we introduce a new radio-based technique which will be used to build a universal cosmic-ray energy scale. Radio detection provides a measure of the radiation energy in air showers, which scales quadratically with the electromagnetic energy. Once the local magnetic field strength is taken into account, radiation energy can be directly compared at different locations. A portable array of antennas will be built and deployed at various experiments, measuring radiation energy in conjunction with the host experiment's traditional air shower measurements. The energy measured at each location can then be directly compared via the contemporaneous radiation energy measurements. Using radiation energy to compare the energy scales eliminates uncertainties due to measurements being made at different locations, and using the same array at each site eliminates the uncertainties associated with the equipment and calibration. This will allow for a cross-calibration of the energy scales of different experiments with minimal uncertainty. Here we present the technique and report on the status of a prototype array that began taking data in January 2021.

## Keywords

energy scale; cross-calibration; radiation energy

## Collaboration

LOFAR

## other Collaboration

## Subcategory

Future projects

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