On the need for unbiasing azimuthal asymmetry in signals measured by surface detector arrays

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What is this contribution about?

We studied **azimuthal asymmetry, caused by a combination of geometrical and attenuation effects,** in the signal measured by ground detectors, in the case of an array of water-Cherenkov detectors, examplified by the surface detector of the Pierre Auger Observatory.

Why is it relevant/interesting?

The azimuthal asymmetry in signals introduces a **shift in the position of the core** into the *upstream* direction and **worsens its resolution.**
In fine, the bias in the core position could impact the reconstruction of the **arrival direction and of the energy of the cosmic ray.**

What has been done?

The amplitude of the asymmetry has been **modelled using simulations** performed with EPOS-LHC and QGSJet-II.04 and for proton and iron primaries.

A detailed study of the contribution of the electromagnetic and muonic components in the amplitude of the asymmetry has been performed.

What is the result?

Azimuthal asymmetry of the muonic component is **negative at large distances.**

The developed model **suppresses the observed mean bias and improves the resolution of the core position by ~20 m**.
However the application of the correction **does not impact the angular resolution or the uncertainties in the shower-size**.