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Detection of primary photons in high energy cosmic rays using Cherenkov imaging and surface detectors

\lettrine[nindent=0em,lines=3]{G}iven that two important experiments to study γ rays, \textit{\textbf{\ac{LHAASO}}} and \textit{\textbf{\ac{CTA}}}, are currently in planning phase, we analyzed some simulations made by \textit{\textbf{\ac{CORSIKA}}} to compare \textit{\textbf{\ac{EAS}}} induced by protons to \ac{EAS} induced by γ. We choosed two primary particles energies $E \sim$
$unit[150]GeV$ and $E \sim$
$unit[1]TeV$ and we plotted secondary particles distributions at observation level; by plots we observe that secondary particles of γ rays showers are arranged on surfaces centered in \ac{EAS} core smaller than particles of proton showers. Later we showed that in proton showers we have more secondaries $\mu^{\pm}$ than in γ rays showers. Mostly, by calculating particles density in circular crowns centered in the \ac{EAS} core, we showed that, increasing distance from core, density decreasing of secondary particles produced by γ rays showers is faster than secondary particles produced by proton showers. Lastly, arbitrarily choosing 3 distances from the core
$unit[10]m$,
$unit[100]m$ and
$unit[600]m$ it was calculated secondaries particles density, showing that for fixed distances, increasing primary particles energy, secondary particles density increases too. Obtained results are important because they allow us to test teories at the basis of \ac{LHAASO} and \ac{CTA} realization, that is thanks to algorithms based on differences between lateral developments of showers in atmosphere, lateral distribution at observation level about charged and neutral particles around shower core, number of $\mu^{\pm}$, it will be possible to discern γ rays showers from proton showers ($\frac{protonacEAS}{\gamma \quad acEAS} \sim 100$) to acquire events and to reject adronic background. Finally, comparing experimental data to obtained mean values of studied physical quantities in function of primary particles energies, it will be possible to estimate the latter.

\section*{acronyms}
\begin{acronym}[WYSIWYM]
\acro{CORSIKA}[CORSIKA]{Cosmic Ray SImulations for KAscade}
\acro{CTA}[CTA]{\v{C}erenkov Telescope Array}
\acro{EAS}[EAS]{Extensive Air Shower}
\acro{LHAASO}[LHAASO]{Large High Altitude Air Shower Observatory}

\end{acronym}

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