Contribution ID: **37** Type: **Poster**

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

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%————————————————————————————————-
% PACKAGES AND OTHER DOCUMENT CONFIGURATIONS
%————————————————————————————————-

\documentclass[twoside,twocolumn]{article}

\usepackage{blindtext} % Package to generate dummy text throughout this template
\usepackage[]{units}
\usepackage{graphicx}
\usepackage{acronym}
\usepackage[sc]{mathpazo} % Use the Palatino font
\usepackage[T1]{fontenc} % Use 8-bit encoding that has 256 glyphs
\linespread{1.05} % Line spacing - Palatino needs more space between lines
\usepackage{microtype} % Slightly tweak font spacing for aesthetics

\usepackage[english]{babel} % Language hyphenation and typographical rules

\usepackage[hmarginratio=1:1,top=32mm,columnsep=20pt]{geometry} % Document margins
\usepackage[hang, small,labelfont=bf,up,textfont=it,up]{caption} % Custom captions under/above floats in tables or figures
\usepackage{booktabs} % Horizontal rules in tables

\usepackage{lettrine} % The lettrine is the first enlarged letter at the beginning of the text

\usepackage{enumitem} % Customized lists
\setlist[itemize]{noitemsep} % Make itemize lists more compact

\usepackage{abstract} % Allows abstract customization
\renewcommand{\abstractnamefont}{\normalfont\bfseries} % Set the "Abstract" text to bold
\renewcommand{\abstracttextfont}{\normalfont\small\itshape} % Set the abstract itself to small italic text

\usepackage{titlesec} % Allows customization of titles
\renewcommand\thesection{\Roman{section}} % Roman numerals for the sections
\renewcommand\thesubsection{\roman{subsection}} % roman numerals for subsections
\titleformat{\section}[block]{\large\scshape\centering}{\thesection.}{1em}{} % Change the look of the section titles
\titleformat{\subsection}[block]{\large}{\thesubsection.}{1em}{} % Change the look of the section titles

\usepackage{fancyhdr} % Headers and footers
\pagestyle{fancy} % All pages have headers and footers
\fancyhead{} % Blank out the default header
\fancyfoot{} % Blank out the default footer
\fancyhead[C]{Detection of primary photons in high energy cosmic rays using \v{C}erenkov imaging and surface detectors} % Custom header text
\fancyfoot[RO,LE]{\thepage} % Custom footer text

\usepackage{titling} % Customizing the title section

\usepackage{hyperref} % For hyperlinks in the PDF
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%———————————————————————————-
% TITLE SECTION
%———————————————————————————-

\setlength{\droptitle}{-4\baselineskip} % Move the title up

\pretitle{\begin{center}\Huge\bfseries} % Article title formatting
\posttitle{\end{center}} % Article title closing formatting
\title{Detection of primary photons in high energy cosmic rays using \v{C}erenkov imaging and surface detectors} % Article title
\author{%
\textsc{Fausto Casaburo}%\thanks{A thank you or further information} \\[1ex] % Your name
\normalsize \\University of Rome “La Sapienza” \\ % Your institution
\normalsize \href{mailto:fausto198701@yahoo.it}{fausto198701@yahoo.it} % Your email address
%\and % Uncomment if 2 authors are required, duplicate these 4 lines if more
%\textsc{Jane Smith}\thanks{Corresponding author} \\[1ex] % Second author's name
%\normalsize University of Utah \\ % Second author's institution
%\normalsize \href{mailto:jane@smith.com}{jane@smith.com} % Second author's email address
}
%\date{} % Leave empty to omit a date
\renewcommand{\maketitlehookd}{%
%\begin{abstract}
%\noindent
%\end{abstract}
}

%———————————————————————————-

\begin{document}

% Print the title
\maketitle

%———————————————————————————-
% ARTICLE CONTENTS
%———————————————————————————-

\section{Abstract}

\lettrine[nindent=0em,lines=3]{G}iven that two important experiments to study $\gamma$ 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 $\gamma$. We choosed two primary particles energies $E \sim$
$unit[150]GeV$ and $E \sim$
$unit[1]TeV$, there were plotted secondary particles distributions at observation level; by plots we can see that secondary particles of $\gamma$ 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 $\gamma$ 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 $\gamma$ 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 $\gamma$ 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.

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% ACRONIMI
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\section*{acronyms}
\begin{acronym}[WYSIWYM]
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\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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\end{document}
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