T 35: Gamma astronomy I

Time: Tuesday 17:00–18:30 Location: H-HS XVII

T 35.1 Tue 17:00 H-HS XVII

Event classification in Compton-Pair telescopes using Convolutional Networks — •Jan Peter Lommler and Uwe Oberlack — Johannes Gutenberg-Universität Mainz

Low to medium energy gamma rays are shielded by the Earth's atmosphere and can only be measured from space (or near-space environment). Imaging is based on the dominant interaction processes of photons with matter in this energy range, Compton scattering at lower and pair creation at higher energies. Among the biggest challenges are the low signal to background ratio in the low-energy range and high event rates even in a moderate environment like equatorial Low Earth Orbits. An efficient event tagging reduces signal losses by preventing type-mismatching applications of reconstruction algorithms (e.g. performing a Compton reconstruction on a pair event) and signal pollution (distinguishing events originating from background sources). We explore the feasibility of Deep Convolutional Neural Nets in the context of event classification for Compton-pair telescopes on the example of the e-ASTROGAM design proposal.

T 35.2 Tue 17:15 H-HS XVII

Stereo Reconstruction for the early days of CTA — •Lukas Nickel, Richard Wiemann, and Maximilian Nöthe for the CTA-Collaboration — TU Dortmund

The Cherenkov Telescope Array(CTA) aims to increase sensitivity for gamma-ray astronomy compared to the currently operating experiments H.E.S.S, MAGIC and VERITAS while operating as an open observatory. Low-level analysis will be performed with the framework 'ctapipe' that is currently in active development.

The two arrays are planned to consist of 19 (La Palma) and 99 (Chile) telescopes. With these huge numbers of telescopes geometric reconstruction methods for the source position become far superior over traditional disp-based methods.

However, these methods require a certain amount of telescopes to perform well and it is going to take several years to build the complete array. This contribution aims to show that the disp-based approach using the 'aict-tools' works for mono CTA-analysis and the resulting stereoskopic results outperform the geometric approach for low multiplicity events.

T 35.3 Tue 17:30 H-HS XVII

Novel Methods for Particle Energy Reconstruction with the MAGIC Experiment — •Lukas Lütke-Lengerich, Simone Mender, and Dominik Baack for the MAGIC-Collaboration — TU Dortmund, Germany

The MAGIC telescopes, two Imaging Air Cherenkov Telescopes at La Palma, are sensitive in the energy regime from the GeV to the TeV range and are extremely capable instruments for studying gamma*ray sources in the Universe. With a ratio of photons to hadrons up to 1:10000 for the detected showers, it is crucial to understand the properties of all the particles for an improved background rejection and diverse scientific studies. In this talk, two novel methods for the energy regression are presented and compared, applicable to improve the characterization of all species of primary particles. While the first method uses look-up tables to estimate the particles* energy, the second approach is based on a random forest algorithm.

T 35.4 Tue 17:45 H-HS XVII

Analysis of Coincident MAGIC - FACT Events — •Noah Biederbeck and Maximilian Nöthe for the FACT-Collaboration — Experimentelle Physik Vb, Technische Universität Dortmund, Otto-Hahn-Str. 4a, 44227 Dortmund

MAGIC is a system of two 17m-diameter Imaging Air Cherenkov telescopes at the Roque de los Muchachos observatory on La Palma, operating as stereo system since 2009. FACT, a 4m telescope, is operating in close vicinity since October 2011.

The two projects regularly observe the same sources at the same time. Although there is no common hardware trigger, it is possible to identify events recorded by both experiments. These coincident events get processed by the respective standard analyses to compare image features and reconstructed event properties.

This three-telescope system of unlike siblings is similar to the situation with the upcoming Cherenkov Telescope Array (CTA), where also telescopes of very different sizes will operate together. CTApipe, the low-level analysis framework currently under development for CTA, is used to do a stereoscopic three-telescope reconstruction of the origin of the particles.

T 35.5 Tue 18:00 H-HS XVII

Colibri - The Coincidence library for real-time inquiry — •Patrick Reichherzer[1,2,3], Anke Yusafzai[1,2,3], Fabian Schüssler[3], Julia Tjus[1,2], and Lenka Tomankova[4] — [1]Ruhr-University Bochum, Theoretical Physics IV — [2]Ruhr Astroparticle and Plasma Physics (RAPP) Center — [3]Irfu,CEA Paris-Saclay — [4]ECAP, Friedrich-Alexander-Universität Erlangen-Nürnberg

Colibri can support the interpretation of astronomical data. The sensitivity of the next generation high-energy gamma-ray observatory, the Cherenkov Telescope Array (CTA), will surpass current instruments by about an order of magnitude. It will thus provide unique opportunities for the study of transient phenomena at high energies.

Flares of known stable astronomical sources and transient sources can occur on different timescales. The discovery potential of both serendipitous observations and multi-messenger and multi-wavelength follow-up observations could be maximized with a tool which allows for quickly acquiring an overview over both stable sources and transient events in the relevant phase space. We here present Colibri, a prototype for such a tool. It is based on notices forwarded by NASAs Gamma-ray Coordinates Network (GCN) and various catalogues of known sources, and yields a graphical representation with a summary of the relevant data to allow for the fast identification of changes in observed sky regions, and for analyses of those.

In this contribution, the key features of the graphical interface are presented. Details about the used data resources are explained. Current and possible future implementations of Colibri will be discussed.

T 35.6 Tue 18:15 H-HS XVII

Evaluation of Unfolding Methods On IACT Data with irreducible Background — •Lars Poppe and Maximilian Nöthe — Technische Universität Dortmund Exp. Physik 5, Otto-Hahn-Str. 4a, 44227 Dortmund

Especially in astroparticle physics, quantities of interest like the energy spectra of cosmic gamma-ray sources are not directly observable due to the measurement process. The reconstruction of the relevant quantity is called unfolding. In the case of IACT data (Imaging Atmospheric Cherenkov Telescope), Cherenkov light which is produced by high-energy gamma particles is observed along with a background from charged cosmic rays, which cannot be fully removed. The methodical investigation of the unfolding of these energy spectra is part of this work. Different unfolding methods are evaluated and compared on the basis of Monte-Carlo simulations. In particular, the influence of irreducible background on the unfolded spectra and on the unfolding procedures is investigated. In addition, methods for the estimation of uncertainties are presented.