T 17: Gamma Astronomy 1

Time: Monday 16:15–18:20 Location: T-H30

Group Report T 17.1 Mon 16:15 T-H30

Status and First Results of the CTA Large-Sized Telescope — •Martin Will for the CTA-Collaboration — Max-Planck-Institut für Physik, München

The prototype of the Large-Sized Telescope (LST), intended to become part of the Northern site of the Cherenkov Telescope Array (CTA) in the Canarian island of La Palma, is currently finishing its commissioning phase and started taking engineering data runs. With its reflective surface of 23 meter diameter, the LSTs are optimized to detect gamma-rays in the energy range between 20 and 200 GeV. In this presentation, some preliminary physics results, the performance of the prototype, and the plans to construct more LSTs as part of CTA will be shown.

T 17.2 Mon 16:35 T-H30

Muons as a tool for background rejection in Imaging Atmospheric Cherenkov Telescope arrays — •Laura Olivera-Nieto[1], Alison Mitchell[2,3], Konrad Bernlöhr[1], and Jim Hinton[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]Department of Physics, ETH Zurich, Zurich, Switzerland — [3]Erlangen Centre for Astroparticle Physics, Erlangen, Germany

The presence of muons in air-showers initiated by cosmic ray protons and nuclei is well established as a powerful tool to separate such showers from those initiated by gamma rays. However, so far this approach has been fully exploited only for ground level particle detecting arrays. We explore the feasibility of using Cherenkov light from muons as a background rejection tool for imaging atmospheric Cherenkov telescope arrays at the highest energies. We adopt an analytical model of the Cherenkov light from individual muons to allow rapid simulation of a large number of showers in a hybrid mode. This allows us to explore the very high background rejection power regime at acceptable cost in terms of computing time. We show that for very large ($\gtrsim$20 m mirror diameter) telescopes, efficient identification of muon light can potentially lead to background rejection levels up to 10^{-5} whilst retaining high efficiency for gamma rays. While many challenges remain in the effective exploitation of the muon Cherenkov light in the data analysis for imaging Cherenkov telescope arrays, our study indicates that for arrays containing at least one large telescope, this is a very worthwhile endeavor.

T 17.3 Mon 16:50 T-H30

Adjusting Monte Carlo Simulations for the Cherenkov Telescope Array's Large-Sized Telescope Prototype — •Lukas Nickel and Maximilian Nöthe for the CTA LST Project — Astroparticle Physics, WG Elsässer, TU Dortmund University, Germany

The lowest energy range of the Cherenkov Telescope Array, which is going to be the next-generation very-high energy ($\geq 20\,\mathrm{GeV}$) gamma-ray observatory, will be covered by the Large-Sized Telescopes (LSTs). The prototype of the LST was inaugurated in October 2018 on the Canary Island of La Palma and has since performed observations of bright gamma-ray sources as part of the commissioning process.

One area that needs special care for any analysis regards potential differences between Monte Carlo simulations and observed data. In this talk current approaches to adjust existing simulations for different observational conditions will be presented.

T 17.4 Mon 17:05 T-H30

Data Volume Reduction for the Cherenkov Telescope Array's Large-Sized Telescope Prototype — •Jonas Hackfeld for the CTA-Collaboration — Institute for theoretical physics IV, Ruhr-University Bochum, Germany

The prototype of the Large-Sized Telescope (LST) of the Cherenkov Telescope Array (CTA), which is going to be the next-generation very-high energy ($>20\,\mathrm{GeV}$) gamma-ray observatory, was inaugurated in October 2018 and has already observed several bright gamma-ray sources during its commissioning phase. For the next years, in addition to 3 more LSTs, several Medium-Sized Telescopes (MST) are planned, which together will equip the northern site of the CTA Observatory. Due to the locally limited data transfer rates and the technical and economic effort to store data quantities of $\sim 100\,\mathrm{PByte/year}$ permanently over a planned duration of $\sim 30\,\mathrm{years}$, a volume reduction for low level data is inevitable. In addition to lossless compression methods for volume reduction, there are lossy methods such as pixel selection. In this process, the pixels with signal are isolated from the night-sky background ones, so that the physics results are impacted as minimally as possible during subsequent event reconstruction. In this talk, pixel selection algorithms and their impact on higher level data analysis will be presented.

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T 17.5 Mon 17:20 T-H30

Background Estimation: Towards an Analysis of MAGIC Data Using Gammapy — •Simone Mender and Lena Linhoff for the MAGIC-Collaboration — Astroparticle Physics WG Elsässer, TU Dortmund University, Germany

The Python package Gammapy is mainly developed for the high-level analysis of gamma-ray data of the future Cherenkov Telescope Array. As it can also be used to analyze data from existing imaging air Cherenkov telescopes, it is reasonable to perform the high-level analysis of MAGIC data with Gammapy and compare the results with existing analyses. Gammapy requires event-based data combined with the corresponding instrument response functions. In order to process these so-called DL3 data for MAGIC, the new database-based framework AutoMAGIC is developed. With AutoMAGIC it is possible to create DL3 data in an automated and reproducible way.

So far, the MAGIC DL3 data does not include background models, which are needed for the creation of skymaps. In this talk, the dependence of the background on parameters like the azimuth and zenith angle of the pointing position will be presented. Using the exclusion region method, background models are built from DL3 data. Using these background models, the first preliminary skymaps of MAGIC data created with Gammapy will be shown.

T 17.6 Mon 17:35 T-H30

Automatized Analysis of MAGIC Sum-Trigger-II Data — •Jan Lukas Schubert and Lena Linhoff for the MAGIC-Collaboration — Astroparticle Physics WG Elsässer, TU Dortmund University, Germany

The MAGIC telescopes are a stereoscopic system of Imaging Air Cherenkov Telescopes. They are used for the detection of gamma rays in the GeV to TeV range. With the Sum-Trigger-II, low-energy data with a threshold as low as 25 GeV can be recorded. This data requires a dedicated analysis adapted to the low energies. Since the analysis structure is complex, it is reasonable to automatize the analysis in order to save time for an analyzer and to deliver entirely reproducible results. The automatization of the analysis of Sum-Trigger-II data was implemented in the autoMAGIC project which aims to automatize the entire MAGIC analysis chain.

For testing the performance, currently an analysis of the Crab pulsar is performed based on the autoMAGIC output and compared to previous analyses.

In the future, the automatization of the analysis of Sum-Trigger-II data could be used for further optimizations of the low-energy analysis as well as for comparisons of low-energy data from MAGIC and the CTA-LST1.

T 17.7 Mon 17:50 T-H30

Characterization of the performance of the MAGIC LIDAR — •Felix Schmuckermaier for the MAGIC-Collaboration — Max-Planck-Institut für Physik — TU München

The Major Atmospheric Gamma-ray Imaging Cherenkov (MAGIC) telescopes are a system of two Imaging Atmospheric Cherenkov Telescopes (IACTs). IACTs make calorimetric use of the Earth's atmosphere, which allows them to reach large effective areas, but also makes them strongly dependent on the quality of the atmosphere at the time of the observations. Suboptimal conditions can then lead to a wrong reconstruction of the gamma-ray data. In order to mitigate this problem, the MPP group built and has been operating a single wavelength elastic LIDAR (LIght Detection And Ranging) system to perform real time ranged-resolved measurements of the atmospheric transmission. This information is then used to quantify the quality of the telescope data, as well as to correct the data taken under suboptimal atmospheric conditions. In this talk, I will present the first detailed characterization of the correction capabilities of the LIDAR system. The results describe the impact of the LIDAR corrections for a variety of atmospheric and observational conditions, and therefore contribute to a better understanding of the telescope's performance and related systematic uncertainties.

T 17.8 Mon 18:05 T-H30

Combined analysis pipeline for joint observations with MAGIC and CTA LST-1 — •Giorgio Pirola[1], Yoshiki Ohtani[2], Alessio Berti[1], Davide Depaoli[3], Federico Di Pierro[3], David Green[1], Lea Heckmann[1], Moritz Hütten[1], Ruben López-Coto[4], Abelardo Moralejo[5], Daniel Morcuende[6], Marcel Strzys[2], Yusuke Suda[7], Ievgen Vovk[2], and Martin Will[1] for the CTA-Collaboration — [1]Max Planck Institute for Physics, München, Germany — [2]ICRR, the University of Tokyo, Japan — [3]INFN Sezione di Torino, Italy — [4]INFN Sezione di Padova, Italy — [5]IFAE, Barcelona, Spain — [6]Universidad Complutense de Madrid, Spain — [7]Hiroshima University, Japan

The performance achievable with Imaging Atmospheric Cherenkov Technique is remarkably improved by using multiple telescopes. Currently, in La Palma (Canary Islands), there are three operative Cherenkov telescopes: the two MAGIC telescopes and the prototype Large-Sized Telescope (LST-1), intended for the future northern site of the Cherenkov Telescope Array (CTA), the next generation Very-High Energy gamma-ray observatory. The data acquired during nights of simultaneous observation of the same target have been used to develop and test an algorithm for the offline search of coincident events. Recently, this algorithm was implemented for the development of the combined analysis pipeline: an analysis chain meant to perform the 3-telescope event reconstruction. The talk aims to present the current status of the pipeline and to give an insight into the possible results achievable with the 3-telescope system.