

T 106: Gamma Astronomy III

Time: Friday 9:00–10:15

Location: KS 00.005

T 106.1 Fri 9:00 KS 00.005

Unsupervised Machine Learning for Muon Ring Classification in Imaging Atmospheric Cherenkov Telescopes— •GIOVANNI COZZOLONGO¹, ALISON MITCHELL¹, and SAMUEL SPENCER² — ¹ECAP, FAU Erlangen-Nürnberg — ²CTAO SMC, Zeuthen, Germany

Muons from extensive air showers create ring-like patterns in Imaging Atmospheric Cherenkov Telescopes (IACTs). These ring images encode valuable information about muon properties such as energy and direction, making them important for studying the physics of muons in air showers. However, automated identification of muon events remains challenging, particularly for partial rings and mixed events containing both muon rings and air shower components. We present an unsupervised deep learning approach to classify muon events in H.E.S.S. CT5 data using clustering techniques to automatically separate events into categories like complete muon rings, partial rings, mixed events, and standard air showers. This represents one of the first deep learning applications to the analysis of muons in IACT data, offering significant advantages over manual classification and analytical methods that focus primarily on identifying complete rings.

T 106.2 Fri 9:15 KS 00.005

Exploring goodness of fit methods to improve gamma-hadron separation for the CTA Observatory— •JAYENDRA PUNDARIKAKSHA KAVIPURAPU^{1,2}, GEORG SCHWEFER^{1,2}, and JAMES ANTHONY HINTON¹ — ¹Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117, Heidelberg, Germany — ²Fakultät für Physik und Astronomie, Universität Heidelberg, Im Neuenheimer Feld 226, 69120, Heidelberg, Germany

Background rejection of hadrons is one of the limiting factors for the performance of IACTs. Unfortunately, hadron showers look similar in telescope cameras, even if they produce broader images. A promising approach to differentiate between them is to implement goodness-of-fit measures based on the per-pixel charge probability distribution. In this talk, we explore these goodness-of-fit metrics exploiting the differences between the reconstructed and predicted charges. We do this using methods from likelihood-free inference and simulations of the Cherenkov Telescope Array Observatory, allowing us to create classification criteria to differentiate shower observations

T 106.3 Fri 9:30 KS 00.005

Analysis of Condition Monitoring Data for the Large Sized Telescope

— •LUCA DAVIDE DI BELLA and TRISTAN GRADETZKE — TU Dortmund University

The Cherenkov Telescope Array Observatory (CTAO) is the next generation high energy gamma ray observatory. It reaches higher sensitivities than current instruments, between several GeV to hundreds of TeV by facilitating different types of telescopes in the array, which differ mainly in their size. The LST-1 is the first prototype of a Large Sized Telescope of the array, sensitive to the lower energies. It is cur-

rently finishing commissioning at the CTAO-North array site, located at the Roque de los Muchachos Observatory (ORM) on La Palma.

As Imaging Air Cherenkov Telescope (IACT) measurement time is limited by dark hours, maintenance is essential to ensure smooth operation and maximize the uptime. In order to find problems in structural dynamics of the telescope, condition monitoring and predictive maintenance can be performed using sensors placed across the structure. In the years since start of operations, different kinds of sensors have been installed, including linear displacement sensors, vibration sensors and so-called load pins. Methods of data acquisition and a preliminary analysis of recent data from these sensors is presented.

T 106.4 Fri 9:45 KS 00.005

Characterization of ANTARES Photomultiplier Tubes for Sustainable Reuse in SWGO

— •SAUJANYA DUBALE, ALISON MITCHELL, and OLEG KALEKIN — Erlangen Centre for Astroparticle Physics, Friedrich Alexander Universität Erlangen-Nürnberg, Nikolaus-Fiebiger-Str. 2, 91058 Erlangen, Germany

Modern astroparticle physics experiments face growing pressure to balance scientific performance with cost and sustainability. In this contribution, we explore the possibility of reusing photomultiplier tubes (PMTs) that were previously operated in the ANTARES neutrino telescope for use in the future Southern Wide-field Gamma-ray Observatory (SWGO). A dedicated laboratory setup has been constructed to study the long-term operability and general performance behaviour of these PMTs after extended use deep in the Mediterranean sea, including their quantum efficiency. The aim is to evaluate whether these PMTs remain suitable for use in next-generation Water Cherenkov Detectors. By investigating reuse as a viable option, this work addresses both economic and environmental considerations and supports more sustainable detector development strategies.

T 106.5 Fri 10:00 KS 00.005

Probing Energy-dependent Morphology in the Pulsar Wind Nebula HESS J1303-631

— •MAXIMILIAN BOHLE, ALISON MITCHELL, and KATHARINA EGG — Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen Centre for Astroparticle Physics, Nikolaus-Fiebiger-Str. 2, 91058 Erlangen, Germany

Pulsar Wind Nebulae (PWN) exhibit complex morphologies that are often known to be energy-dependent. These morphological variations across energy bands can provide useful insights into the underlying physical mechanisms. In this work, detailed morphological studies of the very-high-energy gamma-ray source HESS J1303-631 are presented, using H.E.S.S. data analysed with the open source software gammapy. Previous studies based on more limited data found the source to be significantly energy-dependent. This energy-dependent nature is probed in more detail by analysing over 20 years of data for several energy ranges and therefore quantifying its morphological energy-dependency. HESS J1303-631 is found to be consistently elongated and highly extended, yet the results suggest that HESS J1303-631 exhibits a weaker energy dependence than previously reported.