Swiss CTA Day 2020

Report of Contributions

https://indico.cern.ch/e/SwissCTA2020

Contribution ID: **1** Type: **not specified**

Welcome: the role of the University of Geneva in CTA

Tuesday, 24 November 2020 09:40 (15 minutes)

Presenter: Prof. GALLIOT, Brigitte (ViceRector UNIGE)

Session Classification: Introduction to the CTA Project and the Swiss Landscape

Contribution ID: **3** Type: **not specified**

Scope of the Meeting

Tuesday, 24 November 2020 09:15 (5 minutes)

Presenter: Prof. MONTARULI, Teresa (Universite de Geneve (CH))

Session Classification: Introduction to the CTA Project and the Swiss Landscape

Contribution ID: **4** Type: **not specified**

CTA key science projects

Tuesday, 24 November 2020 10:35 (25 minutes)

Spokesperson of CTAC

Presenter: Prof. HOFMANN, Werner (Max Planck Institut für Kernphysik)

Session Classification: Introduction to the CTA Project and the Swiss Landscape

Contribution ID: **5** Type: **not specified**

Status of the Cherenkov Telescope Array Observatory (CTAO)

Tuesday, 24 November 2020 10:10 (25 minutes)

CTAO Managing Director

Presenter: Prof. FERRINI, Federico (INFN Sezione di Pisa (INFN))

Session Classification: Introduction to the CTA Project and the Swiss Landscape

Contribution ID: **6** Type: **not specified**

The CTA Large Size Telescope project (LST)

Tuesday, 24 November 2020 11:20 (25 minutes)

Spokesperson of LST

Presenter: Prof. TESHIMA, Masahiro (Max-Planck-Institute for Physics)

Session Classification: CTA in Switzerland

Contribution ID: **7** Type: **not specified**

SERI remarks

Tuesday, 24 November 2020 09:55 (15 minutes)

Presenter: Dr REYMOND, Kevin

Session Classification: Introduction to the CTA Project and the Swiss Landscape

Contribution ID: **8** Type: **not specified**

Multi-messenger Astrophysics with CTA

Tuesday, 24 November 2020 15:55 (20 minutes)

Presenter: Dr SAVCHENKO, Volodymyr (University of Geneva)

Session Classification: CTA Science - The extragalactic space

Contribution ID: **9** Type: **not specified**

Fundamental Physics and Dark Matter searches with CTA

Tuesday, 24 November 2020 14:00 (30 minutes)

Primary author: Dr BOYARSKY, Alexey (EPFL)

Co-author: Prof. NERONOV, Andrii (APC and University of Geneva)

Presenters: Dr BOYARSKY, Alexey (EPFL); Prof. NERONOV, Andrii (APC and University of Geneva)

Session Classification: CTA Science - The Galaxy

Contribution ID: **10** Type: **not specified**

Cosmic Rays & Positrons

Tuesday, 24 November 2020 14:55 (20 minutes)

Presenter: Prof. WU, Xin (University of Geneva)

Session Classification: CTA Science - The Galaxy

Contribution ID: **11** Type: **not specified**

LHAASO and possible synergy with CTA

Contribution ID: **12** Type: **not specified**

Galactic Sources

Tuesday, 24 November 2020 14:30 (25 minutes)

Primary author: Dr ALISON, Mitchell (University of Zurich)

Co-author: BALBO, Matteo (Université de Genève)

Presenters: BALBO, Matteo (Université de Genève); Dr ALISON, Mitchell (University of Zurich)

Session Classification: CTA Science - The Galaxy

Contribution ID: **13** Type: **not specified**

Stellar intensity Interferometry with CTA

Tuesday, 24 November 2020 16:35 (20 minutes)

Presenter: Prof. SAHA, Prasenjit (Universität Zürich)

Session Classification: CTA Science - The extragalactic space

Contribution ID: **14** Type: **not specified**

Computing needs

Session Classification: CTA Science - The extragalactic space

Contribution ID: **15** Type: **not specified**

Technology Development within CTA

Session Classification: CTA Science - The extragalactic space

Contribution ID: **16** Type: **not specified**

Inheritance of gamma-ray astronomy in Switzerland

Tuesday, 24 November 2020 11:45 (20 minutes)

Presenter: Prof. BILAND, Adrian (Eidgenossische Technische Hochschule Zurich/ETH (ETH))

Session Classification: CTA in Switzerland

Contribution ID: **17** Type: **not specified**

Relativistic Jets with CTA

Tuesday, 24 November 2020 16:15 (20 minutes)

Presenter: Dr TRAMACERE, Andrea (University of Geneva)

Session Classification: CTA Science - The extragalactic space

Contribution ID: **18** Type: **not specified**

The expansion of the Universe and what do we learn from CTA

Tuesday, 24 November 2020 15:35 (20 minutes)

Presenter: Prof. KNEIB, Jean-Paul (EPFL)

Session Classification: CTA Science - The extragalactic space

Contribution ID: **19** Type: **not specified**

Discussion

Session Classification: CTA in Switzerland

Contribution ID: **20** Type: **not specified**

Coffee and Croissants

Session Classification: Introduction to the CTA Project and the Swiss Landscape

Contribution ID: **21** Type: **not specified**

Swiss Contributions to CTA

Tuesday, 24 November 2020 12:05 (20 minutes)

Presenter: Prof. MONTARULI, Teresa (Universite de Geneve (CH))

Session Classification: CTA in Switzerland

Contribution ID: **22** Type: **not specified**

Why CTA matters and its computing challenges

Tuesday, 24 November 2020 12:45 (20 minutes)

Presenter: WALTER, Roland (University of Geneva)

Session Classification: CTA in Switzerland

Contribution ID: **23** Type: **not specified**

Technology expertise for CTA in Switzerland

Tuesday, 24 November 2020 12:25 (20 minutes)

Presenter: Prof. CHARBON, Edoardo (EPFL)

Session Classification: CTA in Switzerland

Contribution ID: **24** Type: **not specified**

Wrap up and Discussion

Tuesday, 24 November 2020 16:55 (20 minutes)

Session Classification: CTA Science - The extragalactic space

Contribution ID: **28** Type: **not specified**

POLAR-2 The first Large Scale Gamma-Ray Polarimeter

The mechanisms responsible for the prompt emission of Gamma-Ray Bursts (GRBs) remain poorly understood despite a
wealth of measurements performed over the last 5 decades. After detailed measurements of the photon direction, time
and energy, recent years have seen the first measurements of the polarization of the prompt emission by two dedicated
polarimeters, POLAR and GAP. The typical low levels of polarization observed by POLAR and the temporal evolution of
the polarization angle observed by both instruments indicates that time resolved studies are required to constrain
theoretical emission models. Additionally a larger sample of GRB polarization measurements is required to answer the
remaining open questions on gamma-ray emission in GRBs. The POLAR-2 instrument aims to provide such
measurements by having an effective area one order of magnitude larger than that of POLAR. The detector, proposed by
an international collaboration, was recently selected to be launched in 2024. It will then be placed on the China Space
Station and operate for at least 2 years. By improving the design of POLAR and scaling up the instrument, an increase in
effective area of one order of magnitude compared to POLAR can be achieved. Using the improved design, which includes
the replacement of photomultiplier tubes with silicon photomultipliers, as well as other technological upgrades, the
instrument is foreseen to perform detailed polarization measurements of 50 GRBs per year. The instrument design will
be discussed in detail together with the scientific potential expected from the mission.

Primary authors: Dr PRODUIT, Nicolas (Universite de Geneve (CH)); KOLE, Merlin Reynaard (Universite de Geneve (CH))

Presenters: Dr PRODUIT, Nicolas (Universite de Geneve (CH)); KOLE, Merlin Reynaard (Universite de Geneve (CH))

Session Classification: Poster Lunch

Contribution ID: **29** Type: **not specified**

Search for dark matter annihilation in the dwarf irregular galaxy WLM with H.E.S.S.

Tuesday, 24 November 2020 13:16 (3 minutes)

We search for an indirect signal of dark matter through high-energy γ rays from the Wolf-Lundmark-Melotte (WLM) dwarf irregular galaxy. The pair annihilation of dark matter particles would produce Standard Model particles in the final state such as γ rays, which might be detected by ground-based Cherenkov telescopes. Dwarf irregular galaxies represent promising targets as they are dark matter dominated objects with well measured kinematics and small uncertainties on their dark matter distribution profiles. In 2018, the H.E.S.S. five-telescope array observed the dwarf irregular galaxy WLM for 18 hours. These observations are the very first ones made by an imaging atmospheric Cherenkov telescope for this subclass of dwarf galaxy. As we do not observe any significant signal excess in the direction of WLM, we interpret the result in terms of constraints on the velocity-weighted cross section for dark matter pair annihilation $\langle\sigma v\rangle$ as a function of the darkmatter particle mass for various continuum channels as well as the prompt emission γγ. For the τ+τ− channel the limits reach a value of $\langle\sigma v\rangle = 4\times10-22$ cm3 s−1 for a dark matter particle mass of 1 TeV. For the prompt γγ channel, the upper limit reaches a value of $\langle\sigma v\rangle = 5\times10-24$ cm3 s−1 for a mass of 370 GeV. These limits represent an improvement of up to a factor 200 with respect to previous results for the dwarf irregular galaxies for TeV dark matter search.

Primary author: ARMAND, Celine (LAPTh)

Co-authors: POIREAU, Vincent (Laboratoire d'Annecy-le-Vieux de Physique des Particules (LAPP)); MOULIN, Emmanuel (CEA Saclay); RINCHIUSO, Lucia (CEA Saclay)

Presenters: ARMAND, Celine (LAPTh); POIREAU, Vincent (Laboratoire d'Annecy-le-Vieux de Physique des Particules (LAPP)); MOULIN, Emmanuel (CEA Saclay); RINCHIUSO, Lucia (CEA Saclay)

Session Classification: Poster Lunch

Contribution ID: **30** Type: **not specified**

Twelve-hour spikes from the Crab Pevatron

In September 2010 the Crab nebula astonished the scientific community displaying 3 γ-ray spikes above few hundreds MeV. Despite this variability had been already predicted in 1998, it has been the very first time that was observed.
We have been the first to publish a paper analysing the INTEGRAL (20-500\,keV) and FERMI (0.1-300\,GeV) data. They were collected almost simultaneously to better understand the origin of this phenomenon. We divided the available data into three different sets (pre-flare, flare, post-flare) and performed timing and spectral analyses. We separated the γ-ray luminosity associated to the pulsar from the contribution of the surrounding nebula. In the hard X-ray domain, no significant variations in the pulse profile and spectral characteristics were detected. Conversely, we identified three separate enhancements in the γ-ray flux lasting for about 12 hours, matching to the synchrotron cooling time scale of electrons at an energy larger than 10^{15} eV. This might be the clear sign of the highest electron energy ever measured in a cosmic accelerator. We also confirmed that the γ-ray flare is not pulsed. The timing and spectral analysis have indicated that the γ-ray flare is due to synchrotron emission from a very compact Pevatron located in the region of interaction between the pulsar wind and the surrounding nebula. The flux enhancement, confined below $\sim$1\,GeV, can be modelled by a power-law with a high energy exponential cut-off, where either the cut-off energy or the model normalization increased by a factor of ~ 5 relative to the pre-flare emission. The spectral properties of the flare has been interpreted in the framework of a relativistically moving emitter and/or a harder emitting electron population.
Since that event, many more random flares have been detected from the Crab nebula, roughly once per year. Despite being challenging, the observation of this source in the very low energy range of CTA could provide constraints in the emission regions and test the different models invoked to accelerate particles in the nebula at such energies. The same electron population could also interact with the less energetic photons (e.g. cosmic microwave background, near- and far-infrared, photon background fields, synchrotron emission) via inverse-Compton process, providing another γ-ray source of variability at much higher energies. Unfortunately, such radiation seems to be hardly detectable by CTA, because overwhelmed by the large nebula luminosity, except in the case of soft particle spectra ($\Gamma_e > 2.5$) and strong magnetic fields ($\sim$mG), which would allow re-acceleration of particles.

Primary authors: BALBO, Matteo (Université de Genève); WALTER, Roland (University of Geneva); FERRIGNO, Carlo (University of Geneva); BORDAS, Pol (Max-Planc-Institut fur Kernphysik)

Presenters: BALBO, Matteo (Université de Genève); WALTER, Roland (University of Geneva); FERRIGNO, Carlo (University of Geneva); BORDAS, Pol (Max-Planc-Institut fur Kernphysik)

Session Classification: Poster Lunch

Contribution ID: **31** Type: **not specified**

HESS J1632-478: an energetic relic

HESS J1632-478 is an extended and unidentified TeV source in the Galactic plane.
In order to identify the source of the very high energy emission and to constrain its spectral energy distribution, we used a deep observation of the field obtained with XMM-Newton together with data from Molonglo, Spitzer and Fermi to detect counterparts at other wavelengths. The flux density emitted by HESS J1632-478 peaks at very high energies and is more than 20 times weaker at all other wavelengths probed. The source spectrum features two large prominent bumps with the synchrotron emission peaking in the ultraviolet and the external inverse Compton emission peaking in the TeV.
HESS J1632-478 is an energetic pulsar wind nebula with an age of the order of 10^4 year.
Its bolometric (mostly GeV-TeV) luminosity reaches 10% of the current pulsar spin down power.
The synchrotron nebula has a size of $\sim$1 pc and contains an unresolved point like X-ray source, probably the pulsar with its wind termination shock.
As of today, we only know about one hundred of Galactic sources emitting in the TeV band. A large part of them still do not show a firm association and are thus classified as unidentified. Different simulations have shown that CTA, with its better angular resolution and deeper sensitivity, will significantly enrich the current scarce TeV source population, detecting up to 400 new Galactic sources during its Galactic Plane Survey (GPS). With such a larger statistics, is not even excluded that a new sub-class of sources could be detected among supernova remnants, pulsar or pulsar wind nebulae. Let the future surprise us.

Primary authors: BALBO, Matteo (Université de Genève); Dr SAOUTER, Pierre; WALTER, Roland (University of Geneva); PAVAN, Lucia (University of Geneva); TRAMACERE, Andrea (Université de Genève); POHL, Martin (Universite de Geneve (CH)); Dr ZURITA-HERAS, Juan-Antonio

Presenters: BALBO, Matteo (Université de Genève); Dr SAOUTER, Pierre; WALTER, Roland (University of Geneva); PAVAN, Lucia (University of Geneva); TRAMACERE, Andrea (Université de Genève); POHL, Martin (Universite de Geneve (CH)); Dr ZURITA-HERAS, Juan-Antonio

Session Classification: Poster Lunch

Contribution ID: **33** Type: **not specified**

Fermi acceleration along the orbit of η Carinae

The η Carinae binary system is the first γ-ray binary ever observed which does not contain a compact object. It can be considered as a natural laboratory to study particle acceleration and γ-ray emission. Indeed the dense wind of the primary star shocks against the fast light wind coming from the companion star, creating the conditions to accelerate particles up to relativistic energies via Fermi mechanism. These relativistic particles subsequently dissipate energy as non-thermal radiation. Fermi-LAT and H.E.S.S. detections of η Carinae confirm such hypotheses.
Hydrodynamic simulations provide a convincing match to the observations if a few percent of the wind mechanical energy dissipated in the shock goes into particle acceleration. The intrinsic π^0 decay spectrum is a complex convolution of the maximum energy, luminosity, particle drift and obscuration. Accelerated particles cool down mainly via inverse-Compton, synchrotron radiation, and proton-proton collisions. High-energy γ-rays interact also with the field of anisotropic UV photons emitted by both luminous stars, creating $e^{\pm}$ pairs and strongly modifying the observed spectrum. Quick variations of the optical depth are expected along the orbit, due to changes in shape, position, and gas density of the shocked region. Various CTA simulations confirm that flux variability down to few days timescale could be detected above 30 GeV. These variations could disentangle the intrinsic particle spectral cut off from that related to γ-γ opacity and determine the flux of relativistic protons and positrons injected in the interstellar medium, the geometry of the colliding wind region and the magnetic field configuration, as well as the geometrical orientation of the binary system. CTA will also enlighten the nature of the high-energy component, the mechanisms and the percentage of kinetic energy channelled into particle acceleration.

Primary authors: BALBO, Matteo (Université de Genève); WALTER, Roland (University of Geneva)

Presenters: BALBO, Matteo (Université de Genève); WALTER, Roland (University of Geneva)

Session Classification: Poster Lunch

Contribution ID: **34** Type: **not specified**

CTA at the Départment de Physique Nucléaire et Corpusculaire

Tuesday, 24 November 2020 09:20 (10 minutes)

Presenter: Prof. SANCHEZ, Federico (Universite de Geneve (CH))

Session Classification: Introduction to the CTA Project and the Swiss Landscape

Contribution ID: **35** Type: **not specified**

CTA at Départment d'Astronomie

Tuesday, 24 November 2020 09:30 (10 minutes)

Presenter: Prof. PALTANI, Stéphane (Université de Genève)

Session Classification: Introduction to the CTA Project and the Swiss Landscape

Contribution ID: **37** Type: **not specified**

The Single Mirror Small-Sized Telescope project

Tuesday, 24 November 2020 13:10 (3 minutes)

In this work we present the status of the Single Mirror Small-Sized Telescope project: its design, previous observation campaigns, simulation results and future.

Primary authors: HELLER, Matthieu (Universite de Geneve (CH)); NAGAI, Andrii (Universite de Geneve (CH)); ALISPACH, Cyril Martin (Universite de Geneve (CH)); DELLA VOLPE, Domenico (Universitè de Genève); LYARD, Etienne (University of Geneva); BALBO, Matteo (Université de Genève); WALTER, Roland (University of Geneva); MONTARULI, Teresa (Universite de Geneve (CH)); Dr SLIUSAR, Vitalii (University of Geneva)

Presenters: HELLER, Matthieu (Universite de Geneve (CH)); NAGAI, Andrii (Universite de Geneve (CH)); ALISPACH, Cyril Martin (Universite de Geneve (CH)); DELLA VOLPE, Domenico (Universitè de Genève); LYARD, Etienne (University of Geneva); BALBO, Matteo (Université de Genève); WALTER, Roland (University of Geneva); MONTARULI, Teresa (Universite de Geneve (CH)); Dr SLIUSAR, Vitalii (University of Geneva)

Session Classification: Poster Lunch

Contribution ID: **38** Type: **not specified**

A Mini-Imaging Air Cherenkov Telescope

Tuesday, 24 November 2020 13:44 (3 minutes)

In this work we present the design and realization of a mini-telescope based on the optical module of the SST-1M project. The result of the observation campaign in the St Luc Observatory will also be presented.

Primary authors: HELLER, Matthieu (Universite de Geneve (CH)); NERONOV, Andrii (Universite de Geneve (CH)); NJOH EKOUME, Theodore (Universite de Geneve (CH)); DELLA VOLPE, Domenico (Universitè de Genève); MONTARULI, Teresa (Universite de Geneve (CH))

Presenters: HELLER, Matthieu (Universite de Geneve (CH)); NERONOV, Andrii (Universite de Geneve (CH)); NJOH EKOUME, Theodore (Universite de Geneve (CH)); DELLA VOLPE, Domenico (Universitè de Genève); MONTARULI, Teresa (Universite de Geneve (CH))

Session Classification: Poster Lunch

Contribution ID: **39** Type: **not specified**

Neural Networks for the Gamma/Hadron Separation of the Cherenkov Telescope Array

Tuesday, 24 November 2020 13:26 (3 minutes)

The Cherenkov Telescope Array (CTA) will be the largest ground-based gamma-ray observatory. CTA will detect the signature of gamma rays and cosmic
rays hadrons and electrons interacting with the Earth's atmosphere. Making the best possible use of this facility requires to be able to separate events
generated by gamma rays from the particle-induced background. Deep neural networks produced encouraging results, but so far there has been no
evaluation of their performance for gamma/hadron separation with respect to well established approaches. In this paper we compare convolutional neural
networks and a standard analysis technique, namely boosted decision trees. We compare the performance of the two techniques as applied to simulated
observation data. We then looked at the Receiver Operating Characteristics (ROC) curves produced by the two approaches and discuss the similarities
and differences between both.

Primary author: LYARD, Etienne (University of Geneva)

Co-authors: PRODUIT, Nicolas (Universite de Geneve (CH)); WALTER, Roland (University of Geneva); SLIUSAR, Vitalii (University of Geneva)

Presenters: LYARD, Etienne (University of Geneva); PRODUIT, Nicolas (Universite de Geneve (CH)); WALTER, Roland (University of Geneva); SLIUSAR, Vitalii (University of Geneva)

Session Classification: Poster Lunch

Contribution ID: **40** Type: **not specified**

GAMAS - A Generic and Multipurpose Archive System

There exist many distributed storage systems that are mature and reliable, for instance DIRAC, iRods and OneData. These systems lack compliance with the Open Archival Information Systems (OAIS) standard and require data centres that run them to accommodate for their specific needs. We introduce GAMAS, a novel distributed OAIS. GAMAS is a lightweight python package that can be interfaced with any storage via a plugin system. It is modular and can be used stand-alone or in conjunction with pre-existing distributed storage systems. It ensures data integrity and provides high-level data management based on experiments metadata.

Primary author: LYARD, Etienne (University of Geneva)

Co-authors: WALTER, Roland (University of Geneva); SLIUSAR, Vitalii (University of Geneva); NEISE, Dominik (ETHZ - ETH Zurich); BILAND, Adrian (ETH Zurich); FERNANDEZ FERNANDEZ, Pablo (ETH Zurich (CH))

Presenters: LYARD, Etienne (University of Geneva); WALTER, Roland (University of Geneva); SLIUSAR, Vitalii (University of Geneva); NEISE, Dominik (ETHZ - ETH Zurich); BILAND, Adrian (ETH Zurich); FERNANDEZ FERNANDEZ, Pablo (ETH Zurich (CH))

Session Classification: Poster Lunch

Contribution ID: **41** Type: **not specified**

CTA Array Control And Data Acquisition activities at UNIGE

The Cherenkov Telescope Array (CTA) will operate several types of telescopes and cameras. The individual camera trigger rates will vary much –from 0.6 to 15kHz –while the content of the raw data will be heterogeneous. Raw data streams of up to 24Gbps per telescope must be handled efficiently, from the camera front-ends down to the on-site repository and real-time analysis.

Primary author: LYARD, Etienne (University of Geneva)

Co-authors: NEISE, Dominik (ETHZ - ETH Zurich); WALTER, Roland (University of Geneva)

Presenters: LYARD, Etienne (University of Geneva); NEISE, Dominik (ETHZ - ETH Zurich); WALTER, Roland (University of Geneva)

Session Classification: Poster Lunch

Contribution ID: **42** Type: **not specified**

The CTA Multi-messenger and multi-wavelength program

Tuesday, 24 November 2020 13:19 (3 minutes)

The Cherenkov Telescope Array (CTA) will allow observations in the >10 GeV range with unprecedented photon statistics and sensitivity to investigate the yet-unexplored physics of short-time-scale transient events. The CTA Transient program includes follow-up observations of a wide range of multi-wavelength and multi-messenger alerts, ranging from Galactic compact object binary systems to extragalactic events such as GRBs. In recent years, the proven connection between gravitational waves and short GRBs as well as the detection of VHE signal associated to GRB and the possible neutrino-blazar association on TXS 0506+056 has shown the importance of coordinated follow-up observations triggered by these different cosmic signals. In the next years, CTA will play a major role in this type of observations by taking advantage of its fast slewing (for LSTs), large effective area and good sensitivity, opening new opportunities for time-domain astrophysics in an energy range not affected by selective absorption processes typical of other wavelengths.

Primary authors: CAROSI, Alessandro (Universite de Geneve (CH)); LONGO, Francesco (Univ. + INFN)

Presenters: CAROSI, Alessandro (Universite de Geneve (CH)); LONGO, Francesco (Univ. + INFN)

Session Classification: Poster Lunch

Contribution ID: **43** Type: **not specified**

Transient Handler for the LST-1 prototype

Tuesday, 24 November 2020 13:22 (3 minutes)

In 2019, the first firm detection of a very high energy (VHE, E>100 GeV) emission component from Gamma-ray Bursts (GRBs) has definitely opened a new observational window for the study of those enigmatic transient events.These discoveries did not arrive unexpectedly but they represent the result of a 20-years-long-lasting hunt by the major Cherenkov telescope collaborations. Furthermore, the recently discovered high-energy neutrinos and gravitational waves from astrophysical sources have opened the era of the so-called multi-messenger astrophysics. The proven connection between gravitational waves and short GRBs has shown the importance of coordinated follow-up observations triggered by different cosmic signals. However, the unpredictable nature of the transient sky makes it difficult for the large ground-based IACTs to point and start follow-up of these sources rapidly enough to catch their early emission phase(s). The instrument response to external triggers (GRB and multi-messenger transients) relies on a dedicated transient handler. In this contribution , I will report about the first implementation of transient handler within the LST-1 framework.

Primary author: CAROSI, Alessandro (Universite de Geneve (CH))

Presenter: CAROSI, Alessandro (Universite de Geneve (CH))

Session Classification: Poster Lunch

Contribution ID: **44** Type: **not specified**

An alternative way to monitor telescope pointing: application to LST-1

Tuesday, 24 November 2020 13:35 (3 minutes)

The first prototype of the Large Size Telescopes (LST) proposed for the forthcoming Cherenkov Telescope Array (CTA) has recently started to operate in La Palma and is finalizing its commissioning period. The large structure of LST-1 (24 m diameter mirror) imposes a strict control of the telescope bending and deformations that could affect the pointing accuracy and its overall performances. According to CTA specifications, LST pointing accuracy should be better than 14 arcseconds. To achieve this, the LST-1 pointing accuracy is monitored by means of dedicated devices, for example a starguider camera and a Camera Displacement Monitor. In this work, we propose an alternative approach by using the stars that are naturally present in the field of view during observations. By cleaning from the Cherenkov showers the events registered by the camera, it is possible to obtain a picture of the sky at the pointed direction. The reconstructed positions of the stars in the field of view can be compared to their nominal expected position, providing a direct measurement of the mispointing of the telescope.

Primary authors: Dr FOFFANO, Luca (Universite de Geneve (CH)); CAROSI, Alessandro (Universite de Geneve (CH))

Co-authors: MONTARULI, Teresa (Universite de Geneve (CH)); HELLER, Matthieu (Universite de Geneve (CH)); DELLA VOLPE, Domenico (Universitè de Genève)

Presenters: Dr FOFFANO, Luca (Universite de Geneve (CH)); CAROSI, Alessandro (Universite de Geneve (CH))

Session Classification: Poster Lunch

Contribution ID: **45** Type: **not specified**

IACT image reconstruction using a spatio-temporal likelihood for LST

Tuesday, 24 November 2020 13:38 (3 minutes)

Imaging Atmospheric Cherenkov Telescopes (IACTs) collect the Cherenkov light emitted in Extensive Air Showers (EASs) from highly energetic particles in the atmosphere. One of the main challenges of IACT based astronomy is to discriminate between images from very high energy photons and other particles, mainly protons, and to identify the energy and direction of the primary photons. Here, an innovative method using the maximization of a likelihood function describing the spatial and temporal distributions of the signal in the camera is presented. It allows propagating the calibration parameters in the extraction of the image parameters. These parameters are used to estimate the gammaness of the event, the energy, and the arrival direction of the photon.

Primary authors: ALISPACH, Cyril Martin (Universite de Geneve (CH)); EMERY, Gabriel (Universite de Geneve (CH))

Presenters: ALISPACH, Cyril Martin (Universite de Geneve (CH)); EMERY, Gabriel (Universite de Geneve (CH))

Session Classification: Poster Lunch

Contribution ID: **46** Type: **not specified**

Multi-messenger searches of neutrino sources driven by gamma-ray observations

Tuesday, 24 November 2020 13:13 (3 minutes)

After more than 100 years since their discovery, cosmic rays (CRs) are still one of the most intriguing open questions in astrophysics. Intrinsic difficulties are unavoidable when trying to identify the sites of production and acceleration of these charged particles due to the magnetic deflections they undergo when travelling across galactic and extragalactic distances. However, in the era of multimessenger astrophysics, hints of a cosmic accelerator might come from the detection of high-energy γ rays and/or neutrinos that are expected to be produced by the interactions of CRs with the ambient matter and radiation in the vicinity of a potential source. IceCube, the largest neutrino telescope ever built, provided some years ago the most emblematic and fruitful example of synergy between γ-rays and astrophysical neutrinos in the identification of a potential source of CRs. A high-energy neutrino alert detected from a restricted region of the sky, compatible with the location of the known blazar TXS 0506+056, triggered a follow-up of several γ-ray experiments that observed an enriched activity from the same location and coincident with the neutrino event. Additionally, an analysis of the data at the same location but prior to the alert time revealed a prominent neutrino flare in 2014/2015. Recently, IceCube has also presented an evidence at 3.3σ-level of a time-integrated neutrino excess from four sources in a catalog of astrophysical objects selected on the basis of γ-ray observations. Such an excess is due to the Seyfert galaxy NGC 1068 (also reported as the most significant northern spot in a time-integrated all-sky search), the aforementioned blazar TXS 0506+056 and the BL Lacs PKS 1424+240 and GB6 J1542+6129. A subsequent time-dependent investigation of the same catalog confirmed the neutrino excess and provided interesting results at the location of M87, the most significant time-dependent source of the catalog and a well known emitter of ultra-relativistic jets of particles, recently popular also for the first picture of the black hole at its center. Gamma-ray experiments are expected to provide attractive insights in the following years: in particular, with a sensitivity that is 10 times better than any existing gamma-ray instrument and reaching energies up to 300 TeV, the Cherenkov Telescope Array project and its multi-messenger program might unveil new potential neutrino sources and help to reveal the origin of ultra high-energy cosmic rays.

Primary author: LUCARELLI, Francesco (Universite de Geneve (CH))

Co-author: MONTARULI, Teresa

Presenters: LUCARELLI, Francesco (Universite de Geneve (CH)); MONTARULI, Teresa

Session Classification: Poster Lunch

Contribution ID: **47** Type: **not specified**

LST-1 telescope performance and preliminary data analysis

Tuesday, 24 November 2020 13:29 (3 minutes)

Large Size Telescope (LST) is the biggest from three main telescope types of CTA. Both CTA sites shall be equipped with four LSTs, located in the middle of each array. Having the largest reflector of 23 m diameter, the LSTs will lower the energy threshold of the whole observatory down to about 20 GeV and will be crucial for the CTA sensitivity from that energy up to about 200 GeV. As the first telescope for CTA, a fully equipped LST-1 was installed and inaugurated at the CTA-N site in October 2018.

We present a performance estimation of the LST-1 prototype located at La Palma together with a preliminary analysis of the data from the first and second Crab observation campaigns conducted during the author's stay at Institut de Fisica d'Altes Energies (IFAE) of Universitat Autònoma de Barcelona in the cooperation with members of the LST Consortium.

Primary author: JURYSEK, Jakub (Institute of Physics, ASCR)

Presenter: JURYSEK, Jakub (Institute of Physics, ASCR)

Session Classification: Poster Lunch

Contribution ID: **48** Type: **not specified**

Trigger rate studies with LST-1 prototype

Tuesday, 24 November 2020 13:32 (3 minutes)

In-depth analysis and comparison of simulated and observed trigger rates provides a good verification on the correctness of the telescope simulation. Presented method uses the full simulation of cosmic rays induced showers with the large size telescope prototype (LST-1) which is installed at the Roque de los Muchachos Observatory, La Palma, Spain. It compliments the results obtained with the analysis of detected muons. Good agreement achieved through entire range of scanned trigger threshold points.

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Session Classification: Poster Lunch

Contribution ID: **49** Type: **not specified**

Long-term multi-wavelength analysis Mrk 421 variability

Tuesday, 24 November 2020 13:41 (3 minutes)

We are using the longest and densest unbiased observing campaign obtained at TeV and GeV energies during 5.5 years with the FACT telescope and the Fermi LAT detector together with contemporaneous multi-wavelength observations to characterize the variability of the source and constrain the underlying physical mechanisms. We study and correlate light curves obtained by ten different instruments and found two significant results. The TeV and X-ray light curves are very well correlated with a \textbf{lag $<$ 0.6 day}. The GeV light curve accurately leads the variations observed at long wavelengths and in particular in the radio band by 43 days with a broad response.

Primary authors: Dr SLIUSAR, Vitalii (University of Geneva); WALTER, Roland (University of Geneva); BALBO, Matteo (Université de Genève); FACT COLLABORATION

Presenter: Dr SLIUSAR, Vitalii (University of Geneva)

Session Classification: Poster Lunch

Contribution ID: **50** Type: **not specified**

Long-term multi-band photometric monitoring of Mrk 501

We present a long-term multi-wavelength observation campaign of the bright blazar Mrk 501, performed between December 2012 and April 2018, from the radio to the TeV. These data are used to study the emission mechanisms in the jet. We examined the variability and the correlations of the light curves obtained by eight different instruments across the electromagnetic spectrum. Individual TeV and X-rays flares were identified. A response profile function was found which when convolved with the GeV light curve resembles the radio variability. The source was found to be variable on different timescales over broad energy ranges. We found three significant results. Simultaneous TeV and X-rays variations with close to zero lag indicates that the emission process is consistent with leptonic scenario, where TeV photons are produced through inverse Compton mechanism. The characteristic time interval between the TeV flares hints that Lense-Thirring precession of the accretion disk may drive the variability in X-rays and TeV. A lack of GeV and radio correlation prior to MJD 56800 and a good correlation afterwards indicates that the source probably experienced a transition which results in GeV and radio becoming apparently more dependent.

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Presenter: Dr SLIUSAR, Vitalii (University of Geneva)

Session Classification: Poster Lunch

Contribution ID: **51** Type: **not specified**

Towards a polarization prediction for LISA via intensity interferometry

Tuesday, 24 November 2020 13:47 (3 minutes)

Compact Galactic binary systems with orbital periods of a few hours are expected to be detected in gravitational waves (GW) by LISA or a similar mission. At present, these so-called verification binaries provide predictions for GW frequency and amplitude. A full polarisation prediction would provide a new method to calibrate LISA and other GW observatories, but requires resolving the orientation of the binary on the sky, which is not currently possible. We suggest a method to determine the elusive binary orientation and hence predict the GW polarisation, using km-scale optical intensity interferometry. The most promising candidate is CD–30◦ 11223, consisting of a hot helium subdwarf with ⊠⊠ = 12 and a much fainter white dwarf companion, in a nearly edge-on orbit with period 70.5 min. We estimate that the brighter star is tidally stretched by 6%. Resolving the tidal stretching would provide the binary orientation. The resolution needed is far beyond any current instrument, but not beyond current technology. We consider scenarios where an array of telescopes with km- scale baselines and/or the Very Large Telescope (VLT) and Extremely Large Telescope (ELT) are equipped with recently-developed kilo-pixel sub-ns single-photon counters and used for intensity interferometry. We estimate that a team-up of the VLT and ELT could measure the orientation to ±1◦ at 2⊠ confidence in 24 hours of observation.

Primary authors: Mrs BAUMGARTNER, Sandra; Mr BERNARDINI, Mauro; Mr CUISSA, Jose R. Canivete; Mr DE LAROUSSILHE, Hugues; Mrs MITCHELL, Alison M. W.; Mr NEUENSCHWANDER, Benno; Mr SAHA, Prasenjit; Mr SCHAEFFER, Timothee; Mr SOYUER, Deniz; Mr ZWICK, Lorenz

Presenter: Mr NEUENSCHWANDER, Benno

Session Classification: Poster Lunch

Contribution ID: **52** Type: **not specified**

TCU: high-level control software of LST

The Large-Sized Telescope (LST) is one of the three main types of telescopes populating the CTA Southern and Northern sites. There will be four LST on each site. Each LST telescope has a 23-meters parabolic segmented mirror and is sensitive to γ-rays from 20 to 150 GeV. Telescope Control Unit (TCU) is a high level control software of LST-1 telescope, which consists of Telescope Manager, Structure and Camera. TCU connects to all telescope subsystems, including camera, drive, active mirror control, etc, and implements their control logic based on the procedures developed by the teams.

Primary authors: Dr SLIUSAR, Vitalii (University of Geneva); TCU TEAM; CTA COLLABORATION

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Session Classification: Poster Lunch