ALLAN MACHADO PAYERAS, PhD

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Web page: allanpayeras.github.io   *Portfolio:* allanpayeras.github.io/portfolio/

Technical Skills

- Data analysis frameworks: Numpy, Pandas, Scipy, Matplotlib, ROOT (Cern).
- Machine learning frameworks: Scikit-learn, TensorFlow, LangChain.
- Computational tools: Python, C++, Linux, shell script, git, LaTex.
- Theoretical background: statistics, probability, calculus, linear algebra, mathematical modeling, physics.
- Languages: Portuguese (native), English (fluent), French (basic), German (basic).

I am interested in learning new computational and mathematical tools relevant to achieve the goals of projects I am involved with as well as effectively communicating my findings to stakeholders.

Professional Experience

University of Campinas, Brazil   *August 2018 - December 2023*
Ph.D. Candidate

- Developed a data pipeline with bash scripts and C++ in a high performance computing environment (in Linux) to generate simulated data regarding the detection of high-energy cosmic rays with the AugerPrime Observatory.
- Developed a nonlinear regression model using Python to predict signals due to muons within the AugerPrime detectors. The model exhibits a bias below 5%, validated with Monte Carlo simulations.
- Using Python libraries (Numpy, Pandas, Scipy), the potential of the aforementioned model to identify light and heavy species of cosmic rays was demonstrated, quantified by merit factors above 1. This experimental resolution in composition is the primary aim of the upgrade of the Pierre Auger Observatory, which will facilitate future scientific insights into the astrophysical nature of high-energy cosmic rays.
- These findings were documented in technical notes of the Auger Collaboration and presented in international meetings for leading experts in the field of cosmic rays.

Karlsruhe Institute of Technology, Germany   *November 2021 - November 2022*
Ph.D. Intern

- Implemented algorithms in C++ to calibrate and process signals of AugerPrime detectors which were included in the official framework of the Auger Collaboration (hosted in GitLab). These implementations rendered the framework compatible with data of the upgraded detectors of the Observatory.
- Created an ETL pipeline with C++ and Python to combine calibration and monitoring data of AugerPrime detectors from different sources aiming at assessing the performance of the implemented calibration algorithm, which was verified as successful in more than 99.5% of the time.
- Developed a maximum likelihood method in Python which demonstrated that the nonlinearity and bias between the signals of the upgraded and former stations is below 3%, verifying the stability of the new detectors.
- Applying statistical analyses, showed that reconstruction of cosmic ray events using data of the AugerPrime Observatory exhibits less than 5% bias in energy estimation with respect to the pre-upgrade configuration of the detectors. This finding ensures compatibility and a seamless transition between the two operation phases of the Pierre Auger Observatory.

University of Campinas, Brazil   *March 2016 - August 2018*
Masters student

- Using a small-area photomultiplier tube and a cross-calibration procedure in C++, the occurrence of saturation in the AugerPrime detectors was reduced to less than 0.1%. This result enhances the quality of data collected, ultimately leading to more accurate estimations of the properties of detected high-energy cosmic rays.

Royal Holloway University of London, UK   *June 2014 - September 2014*
Research Intern

- Developed a linear regression model in C++ (ROOT) to correlate the invariant mass of the top quark to the corresponding decay particles as measured by the ATLAS detector in the Large Hadron Collider (CERN, Switzerland). This study was relevant for the inference of intrinsic properties of fundamental particles.

List of academic publications can be found on my Google Scholar profile: Allan Machado Payeras.

Education

University of Campinas, Institute of Physics Gleb Wataghin   São Paulo, Brazil
Ph.D. in Physics   December 2023

- Full scholarship from the São Paulo Research Foundation.
- Research internship at Karlsruhe Institute of Technology (Germany) funded by the São Paulo Research Foundation.

University of Campinas, Institute of Physics Gleb Wataghin   São Paulo, Brazil
Masters in Physics   October 2018

- Full scholarship from the Federal Agency for Support and Evaluation of Graduate Education (Brazil).

Federal University of Paraná   Paraná, Brazil
Bachelor in Physics   April 2016

- Study abroad experience at *Royal Holloway University of London* (United Kingdom) from September 2013 to September 2014. Funded by the Brazilian program Science without Borders.

I currently possess an employment authorization document (EAD) from the USCIS to legally work in the USA.