

Lucas Flores

Corona, California ◦ (951) 545-3382 ◦ lucasmacrorieflores@gmail.com

SKILLS

	<i>(Proficient)</i>	<i>(Good)</i>	<i>(Basic)</i>
LANGUAGES:	C/C++, Python, Bash	HTML, CSS	YAML, JavaScript, SQL
SOFTWARE/TOOLS:	Linux/Unix, git, CI, ROOT, \LaTeX	pandas, Docker	matplotlib, scipy, numpy
OTHER:	Hypothesis testing, statistics, machine learning, regression analysis, scraping, Web design, Arduino microcontrollers		

EXPERIENCE

JULY 2015 – DEC. 2021 **Research Assistant** ***University of Pennsylvania,*** ***Philadelphia, PA***
 CERN, ***Geneva, Switzerland***

Responsible for designing and implementing control and validation regions in a particle physics analysis using $7\times$ the data as the previous most analogous analysis iteration. Developed a framework for the preservation, re-usability, and reinterpretation of this analysis using git, Continuous Integration (CI), Docker images, and workflows. Gave weekly reports to audiences of varying expertise within the ATLAS collaboration.

- Investigated petabytes of proton-proton collision data (≈ 13.9 million billion collisions) produced by the Large Hadron Collider (LHC) with the ATLAS detector in a search for theorized subatomic particles, furthering our knowledge of fundamental physics.
- Utilized the Worldwide LHC Computing Grid, a powerful distributed computing resource, and HTCondor (distributed parallelization software) enabled dedicated computing clusters to process big data sets.
- Developed C++/Python framework to clean, analyze, transform, and visualize data.
- Engineered new features to optimize selections for control, validation, and signal regions.
- Set exclusion limits at a 95% confidence level (exclude for $p < 0.05$) for the existence of new fundamental particles via a profile likelihood ratio fit.
- Presented results to the broader physics community at two international conferences.

Served as a software expert for the “electron-photon” performance group, a major working group within the ATLAS collaboration tasked with measuring the properties of electrons/photons that emerge from the proton collisions. Responsible for maintaining and developing the electron identification analysis framework (Python/C++). Responsible for re-optimization of a data-driven multivariate likelihood based electron identification algorithm, the *electron likelihood*, used in nearly all analyses on ATLAS (over 5000 members).

- Transitioned the electron likelihood from a being trained on a hybrid of simulated and real data to a fully real data driven algorithm.
- Re-optimized the electron likelihood by utilizing all newly available *high-energy* data that was collected.
- Investigated new metric for tuning the algorithm to retain desired signal and background rates for different detector environments, i.e. the detector can see anywhere from 1 to 80 “simultaneous” collisions.
- Validated the electron likelihood after a major upgrade of software that produces its lower level inputs (i.e. an “electron reconstruction” object that gets fed into the electron identification).
- Ported framework from RootCore (deprecated physicist built package build manager) to CMake and migrated framework from longstanding version control software SVN, to gitlab.
- Mentored new framework users/developers. Hands on help and served as expert contact.

PROJECTS

- 2022 **“PermaLost”** – Predictive permafrost loss tool for potential vulnerability to the rot/decay of “soft” artifacts in Greenland due to climate change induced warming. Utilizes data provided by the European Space Agency’s (ESA) Climate Change Initiative (CCI) Permafrost project. Built with pandas, geopandas, matplotlib, scikit-learn, and skforecast. Identifying list of localities with greatest rate in permafrost reduction.
- 2017 **“cryptoino”** [PennApps XV Hackathon] – Lightweight symmetric key exchange via Tree Parity Machine (TPM) neural nets. Targeted small insecure Internet of Things devices. Semi-final qualifier. Contributed to arduino/C# code development and sole creator of the TPM synchronization visualization. blog post: lucasflores.com/blogfolio/cryptoino/
- 2016 **“eyeHUD”** [PennApps XIV Hackathon] – Smart eye-tracking transparent window ‘heads-up’ display. Responsible for developing the calibration/training method for transform factors for the 3 different ‘pixel’ spaces (2 webcams and LCD). **Third place overall** and *“Best Public Safety or Video Processing App”*. blog post: lucasflores.com/blogfolio/eyeHUD/

EDUCATION

AUG. 2015 – DEC. 2021 **PhD/MS** – Particle Physics *University of Pennsylvania, Philadelphia, PA*
 SEPT. 2010 – JUNE 2015 **BS** – Physics & Applied Math. *UC Riverside, Riverside, CA*