

Lucas Flores

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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× 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 softw.) enabled dedicated computing clusters to process big data sets.
- Developed C++/Python framework with [ROOT](#) (stat. analysis framework) libraries 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.

AUG. 2015 – MAY 2016 **Teaching Assistant** *University of Pennsylvania, Philadelphia, PA*

Responsible for laying out the purpose of each lab and grading bi-weekly homework assignments for physics lecture component of 40+ undergraduate students.

- Lead lab sections in both classical mechanics and electromagnetism.
- Guided students to complete each lab with a good understanding of the experimental techniques and physics principles as well as how the lab connected to the lecture component.

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*

SELECTED PUBLICATIONS & PROJECTS

- 2021 **PhD Thesis:** “Identifying Electrons and Searching for Electroweak R-Parity Violating Supersymmetry at ATLAS” [lucasflores.com/thesis] [repository.upenn.edu/dissertations/AAI28722112/]
- 2021 **Paper:** Search for trilepton resonances from chargino and neutralino pair production in $\sqrt{s} = 13$ TeV pp collisions with the ATLAS detector [[PhysRevD.103.112003](#)]
- 2019 **Paper:** ATLAS electron and photon reconstruction and energy calibration with 2015-2017 data [[2019 JINST 14 P12006](#) (Section: 6 Electron Identification)]
- 2017 **Project:** “*cryptoino*” [PennApps XV Hackathon] – Lightweight symmetric key exchange via Tree Parity Machine neural nets. Targeted small insecure Internet of Things devices. Semi-final qualifier. blog post: lucasflores.com/blogfolio/cryptoino/
- 2016 **Project:** “*eyeHUD*” [PennApps XIV Hackathon] – Smart eye-tracking transparent window ‘heads-up’ display. Third place overall and Best Public Safety or Video Processing App (presented by Axon). blog post: lucasflores.com/blogfolio/eyeHUD/