Alessandro Ambler

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Professional Summary

PhD physicist with 8+ years of experience in high-performance data analysis, real-time signal processing, and collaborative scientific software development at CERN's ATLAS experiment at the Large Hadron Collider. Skilled in C++, Python, and machine learning, with a strong track record in algorithm design, modeling, and system validation. Experience working in international, interdisciplinary teams and delivering reliable, scalable solutions for complex technical challenges.

Technical Skills

- **Programming:** C++ (Expert), Python (Excellent), MATLAB (Proficient)
- **Tools & Technologies:** Git, ROOT, Keras, TensorFlow, Bash, LaTeX
- **Data Analysis:** large datasets, data-driven background estimates, statistical modeling, signal extraction, physics simulation
- **Signal Processing:** Optimal filters, Weiner Filters, Convolutional Neural Networks (CNNs), Machine Learning (ML)
- **Languages:** English (Native), French (Native), Italian (Proficient)

Education

Ph.D., Physics — McGill University
Advisor : Brigitte Vachon — 2018–2024

- Thesis: "First observation of the simultaneous production of a W boson and two photons in proton-proton collisions"
- Focus: data analysis, data-driven background estimates, physics simulation, statistical modeling

M.Sc., Physics — McGill University
Advisor : Brigitte Vachon — 2016–2018

- Thesis: "Performance and optimization of analog and digital filtering algorithms for the Phase-II upgrade of the Hadronic End-Cap Calorimeter"
- Focus : developing and evaluating filtering algorithms for real-time signal reconstruction, simulating detector electronics

B.Sc., Physics — Université de Montréal
Advisor : Viktor Zacek — 2012–2015

- Thesis: "Caractérisation de la réaction $^{51}\mathrm{V(p,n)}^{51}\mathrm{Cr}$"
- Focus : producing and measuring a nuclear reaction using a particle acceleration for the calibration of a dark matter detector

Professional Experience

Research & Development – ATLAS Experiment (CERN / McGill University) — 2016–2024
Research Assistant for an international experimental particle physics experiment

- Collaborative physics data analysis
  - Data-driven estimates of important background processes
  - Statistical signal strength extraction and limit setting from multi-terabyte datasets
  - Modeling and simulation of physics processes
- Designed and implemented signal processing algorithms for signal extraction in noisy background
  - Advanced filtering techniques
  - Development of Machine Learning (ML) techniques using Convolutional Neural Networks (CNNs)
- Collaborated on software development

    - Data analysis code used for first observation of a rare physics process
    - Accurate electronics simulation for performance-critical detector upgrades for state-of-the-art ATLAS upgrades
  - Monitored real-time detector performance during data-taking campaigns
    - Coordinated issue resolution with international teams of experts
  - Ensured stability and performance of daily software releases through systematic validation and testing
    - Contributed to CI/CD pipelines in large-scale scientific software environments

Teaching Assistant – McGill University Physics Courses 2016–2022
Instructed laboratories, gave tutorials, and occasionally full lectures

- Assisted in teaching introductory electromagnetism, electronics, signal processing, and experimental methods
- Developed lab exercises and supported students in understanding technical material

Instrumentation & Data Acquisition – PICO Dark Matter Experiment (SNOLAB / UdeM)
Research and Development Intern Summer 2015

- Operated and calibrated nuclear and dark matter detection systems (including high-purity germanium detectors)
- Managed beamline operations using a particle accelerator for data acquisition

Publications

[1] ATLAS Collabration, "Observation of $W\gamma\gamma$ triboson production in proton-proton collisions at $\sqrt{s}$=13 TeV with the ATLAS detector", *Physics Letters B*, vol. 848, p. 138 400, 2024, ISSN: 0370-2693.

[2] ATLAS Collabration, "ATLAS Liquid Argon Calorimeter Phase-II Upgrade: Technical Design Report", CERN, Geneva, Tech. Rep., Sep. 2017.

- As a contributing member of the ATLAS collaboration, I have been an active author on all publications from May 2018.
  - Currently, I appear as an author on a total of 611 publications. Here is a link to my inspire.

Selected Public Presentations

- First Observation of the Production of a W Boson and Two Photons, WNPPC Conference. Bromont 2024
- Triboson measurements at ATLAS and CMS, LHCP Conference (invited) Belgrade 2023
- Development of the ATLAS Liquid Argon Calorimeter Readout Electronics, ANIMMA Conference (invited) Prague 2021
- W$\gamma\gamma$ Production in Proton-Proton Collisions, WNPPC Conference TRIUMF 2021
- Optimization studies for the ATLAS Calorimeter upgraded readout electronics, WNPPC Conference Mont-Tremblant 2018

Selected Achievements

- Breakthrough Prize in Fundamental Physics International, 2025
  Awarded to the ATLAS collaboration of which I was an active member
- Yablonovitch Research Prize for Ph.D. Thesis McGill, 2024
  Awarded by the Faculty of Science for the best research accomplishment in experimental physics
- NSERC Postgraduate Scholarship-Doctoral (PGS D) National, 2019-2021
- 4 separate travel awards for research and conferences abroad McGill, 2016-2019
- Mention d'excellence de la doyenne de la Faculté des arts et des sciences UdeM, 2015
- Bourses d'études, bourses de perfectionnement, prix UdeM, 2015
- Programme de bourses pour de courts séjours à l'étranger (PBCSE) Provincial, 2014

Outreach

- Volunteer Instructor at the McGill Particle Physics Masterclass 2016, 2017, 2019 & 2021
  Gave lecture high-school and cegep on particle detection and guided them through a physics analysis using real data.
- Volunteer Animator at the CERN Open Days Summer 2019
  Animated an activity and learning booth for visitors of all ages