

Laura Pereira Sanchez

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 LinkedIn |  Github |  CERN Gitlab |  Publication List |  Google Scholar

Geneva, Switzerland

ABOUT ME

PhD in Physics with 6+ years of experience analyzing Big Data from CERN, with expertise in AI, data science, statistics, and software development. Driven to apply my skills to projects that deliver meaningful impact to society.

TECHICAL SKILLS

- **Programming Languages:** Python, C++, ROOT, Bash/UNIX
- **Machine Learning & Deep Learning Frameworks:** Pytorch, Tensorflow, JAX, Keras, XGBoost, TMVA
- **Gen AI architectures:** Generative Adversarial Network (GAN), Variational Autoencoder (VAE), Normalising Flows, Large Language Models (LLM)
- **AI architectures for classification:** Transformers, Deep Neural Network (DNN), Convolutional Neural Network (CNN), Boosted Decision Tree (BDT)
- **Data Processing and Visualization:** Pandas, Matplotlib, Seaborn, Numpy etc.
- **Cloud Technologies:** Research clouds at CERN (HTCondor), SLAC (SLURM).
- **DevOps & Version Control:** Gitlab, Github, VSCode, JIRA, CI/CD Pipelines, Unit Testing
- **Database Systems:** Non-SQL (Mongo DB), SQL
- **Statistics:** Hypothesis Testing, Log-likelihoods, Uncertainty Modeling

EXPERIENCE


- **Stanford University & SLAC National Laboratory (US)** Oct 2023 -
Postdoctoral Research Fellow - ATLAS Collaboration (CERN) Menlo Park, CA, USA & Geneva, Switzerland

Role Overview: **Development of AI algorithms, data engineering and database management**

- **Project 1: AI algorithms to identify key signatures in particle physics collisions**
Tools: JAX, PyTorch, Tensorflow
 - * Developed and benchmarked AI algorithms, utilizing transformers, graph neural networks, deep neural networks, boosted decision trees and generative models such as normalizing flows.
 - * Applied state-of-the-art auto-differentiable programming techniques to train physics-aware neural networks.
 - * Prepared and optimized datasets for machine learning model training.
- **Project 2: Building a state of the art silicon tracking detector**
Tools: MongoDB database, Docker
 - * Documented loading and integration stages at the experiments MongoDB, specifying component requirements and test parameters for accurate data entry.
 - * Coordinated with cross-functional teams to align database functions with project needs, enhancing accessibility and workflow integration.
 - * Acted as primary contact for coordination between sites and detector subsystems.
 - * Set up the software required for testing during integration using *Docker* containers.

- **Stockholm University** September 2018 - August 2023
Doctoral Researcher - ATLAS Collaboration (CERN) Stockholm, Sweden

Role Overview: **Data analysis: Software development, data visualization and statistical interpretations**

- **Project 3: Coordinated analysis of LHC data to search for unknown particles**
Tools: python, hypothesis testing, Git, XGBoost, Keras 
 - * Led a 4-year LHC data analysis project with a team of 15 to search for new particles.
 - * Designed and implemented a parametrized neural network strategy, achieving 30% higher detection rates.
 - * Built a flexible framework for training neural networks and boosted decision trees on imbalanced datasets, widely adopted across analyses.

- * Oversaw project stages, including meetings, documentation, sample requests, and approvals.
 - * Performed statistical analysis and guided the preparation of the final journal paper [J.1].
 - * Wrote and presented outreach materials, including a briefing and video script, to publicize the publication.
 - * Applied experience with imbalanced datasets to long-range 3D object detection for autonomous driving [C.2.]
- **Project 4: AI Algorithm Calibration for Simulation-to-Data Shifts**
Tools: *Python, C++, Bash, ROOT, Git*
 - * Calibrated AI algorithms to correct for simulation-to-data domain shifts over 4 years, adapting to new data and algorithms.
 - * Published a comprehensive statistical analysis of the calibration process in a peer-reviewed journal [J.5].
 - * Automated the calibration workflow with Git pipelines, Bash scripts, and batch processing, reducing required analysis time by over 70%.




SOFT SKILLS

- **Leadership:** Served a project owner in a team of 15 physicist in a novel data analysis project during 4 years, from its start until its publication.
- **Coordination:** Liaison between different international and interdisciplinary teams for 2 different projects
- **Supervision:** Supervised master and PhD students from different universities.
- **Team work** Collaborated in different international and interdisciplinary teams of between 4 and 40 people, resulting in more than 10 scientific publications and two hardware implementations.
- **Languages:** Native Spanish and Catalan, Proficient English (C2), Beginner German (B1) and French (A2).
- **Communication:** Presented research to experts (meetings, conferences and journals) and public (outreach events).

EDUCATION

- **PhD in Physics** September 2018 - May 2023
Stockholm University Stockholm, Sweden
 - Thesis title: [The Beauty in Broken Symmetries: b-jet identification and searches for Supersymmetry, Dark Matter and multi-Higgs production with the ATLAS experiment](#)
- **Master in Particle Physics, Astrophysics and Cosmology** September 2017 - July 2018
Universitat Autònoma de Barcelona Barcelona, Spain
- **Bachelor in Physics** September 2013 - July 2017
Universitat Autònoma de Barcelona Barcelona, Spain

HONORS AND AWARDS

- **Postdoctoral Fellow at Stanford University** May 2023
Knut and Alice Wallenberg Foundation - KAW 2022.0358 
 - My research proposal "Measuring the shape of the Higgs potential in ATLAS" was funded for up to 4 years.
- **Travel Grants** 2023 / 2021
Kinanders, Lydia and Emil, Foundation / Kobbs, Gustaf and Ellen, Scholarship Foundation 
 - Two independent grants to present research at cutting edge international conferences.
- **69th Lindau Nobel Laureate Meeting in Physics** 2019
Ragnar Söderberg Foundation 
 - Selected to spend one week discussing with Nobel Laureates and other young scientists about Physics.

CERTIFICATIONS

- **IBM:** [Generative AI and LLMs: Architecture and Data Preparation](#) 2025
- **IBM:** [SQL: A Practical Introduction for Querying Databases](#) 2024
- **DeepLearning.AI:** [Deep Learning Specialization \(4/5\)](#) 2021
- **CERN, HSF and SIDIS:** HEP C++ course 2020
- **University of Michigan:** Proficiency in English 2014

- [S.1] ATLAS Collaboration. (2025). **Transforming Jet Flavour Tagging in ATLAS**. To be submitted to *Nature Communications*. Currently in the last stages of internal review.
- [C.1] A. Khoche, Q. Zhang, L.Pereira Sanchez et al. (2025). **SSF: Sparse Long-Range Scene Flow for Autonomous Driving**. Accepted to *International Conference on Robotics and Automation (ICRA) 2025*. arxiv.2501.17821.
- [J.1] ATLAS Collaboration. (2024). **Search for a resonance decaying into a scalar particle and a Higgs boson in the final state with two bottom quarks and two photons in proton-proton collisions at a center of mass energy of 13 TeV with the ATLAS detector**. Published in *Journal of High Energy Physics* 11 (2024) 047. DOI: 10.1007/JHEP11(2024)047
- [J.2] ATLAS Collaboration.(2024). **Combination of searches for Higgs boson pair production in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector**. Published in *Phys. Rev. Lett.* 133, 101801. DOI: 10.1103/PhysRevLett.133.101801
- [J.3] ATLAS Collaboration.(2024). **Studies of new Higgs boson interactions through nonresonant HH production in the $b\bar{b}\gamma\gamma$ final state in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector**. Published in *Journal of High Energy Physics* 01, 066. DOI: 10.1007/JHEP01(2024)066
- [J.4] R. Gröber, L. Pereira Sanchez et al (2024). **Effective Field Theory descriptions of Higgs boson pair production**. In *SciPost Phys. Comm. Rep.* 2. DOI: 10.21468/SciPostPhysCommRep.2
- [C.2] A. Khoche, L.Pereira Sanchez et al. (2024). **Towards Long-Range 3D Object Detection for Autonomous Vehicles**. Presented at the *Intelligent Vehicle Symposium (IV) 2024*. arXiv.2310.04800.
- [J.5] ATLAS Collaboration (2023). **Calibration of the light-flavour jet mistagging efficiency of the b-tagging algorithms with Z+jets events using 139 fb⁻¹ of ATLAS proton-proton collision data at $\sqrt{s} = 13$ TeV**. In *Eur. Phys. J. C*, 83(8), 728. DOI: 10.1140/epjc/s10052-023-11736-z
- [J.6] ATLAS Collaboration (2022). **Search for Higgs Boson Pair Production in the Two Bottom Quarks Plus Two Photons Final State in pp Collisions at $\sqrt{s} = 13$ TeV with the ATLAS Detector**. Published in *Phys. Rev. D* 106, 052001. DOI: 10.1103/PhysRevD.106.052001
- [J.7] ATLAS Collaboration (2021). **Search for New Phenomena with Top Quark Pairs in Final States with One Lepton, Jets, and Missing Transverse Momentum in pp Collisions at $\sqrt{s} = 13$ TeV with the ATLAS Detector**. *Journal of High Energy Physics* 04, 174. DOI: 10.1007/JHEP04(2021)174

Summary information

I have a total of 400 publications in peer-reviewed journals as part of the ATLAS Collaboration, with a total of 20,079 citations (8,435 excluding self-citations). My h_{HEP} index is 77 (46 excluding self-citations). In this section a list of selected scientific publications, which I find most relevant.

Database used for citations

INSPIRE High-Energy Physics Literature Database (<http://inspirehep.net/>)
Data extracted 2025-03-02