Valentina Vecchio, PhD
Researcher & Data Scientist

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👤 PROFILE

I am an experienced and established scientific researcher with a passion for discovering and making sense of statistical patterns within huge data sets.

I am proficient in the latest analysis techinques, including classical Machine Learning and more modern Deep Learning algorithms. I am a strong communicator, able to convey complex concepts both to peer scientists and
to laymen.

I am a highly influential player in the ATLAS collaboration at CERN, not only for my intellectual contributions to several high-profile analyses related to properties of the Higgs Boson, but also for my role as a global group leader of several research teams.

💼 PROFESSIONAL EXPERIENCE

University of Manchester, Research Associate
11/2019 – present | Manchester, UK
My main research activity is aimed to understand the building blocks of the universe. My work within the ATLAS Collaboration at CERN includes:
- Development of data analyses for the study of the Higgs boson properties (high background environment).
- Implementation of bleeding-edge machine learning techniques for the identification of bottom-quark (flavour tagging).
- Leadership of research teams, steering the group activities and acting as a facilitator resolving conflicting objectives of different stakeholders and collaborating institutions.
- Mentorship of several PhD/MSc Students.
- Leadership of a UK-based effort to showcase the potential of Muon Colliders.

CERN, Associate Fellow
07/2018 – 06/2019 | Geneva, Switzerland
Carried my research within the ATLAS collaboration focussing on data analysis techniques to extract particle's properties with highest precision.

Fermilab National Laboratory, Summer Intern
07/2015 – 09/2015 | Batavia, Illinois (USA)
Contributed to the analysis for the measurement of the W-asymmetry production with the CDF experiment. 🔗

🧠 SKILLS

Skill	Level
Data Analysis & Machine Learning	● ● ● ● ●
Leadership & Mentorship	● ● ● ● ●
Data processing & visualisation	● ● ● ● ●
Communication	● ● ● ● ●
Statistical Inference	● ● ● ● ●
Mathematical Thinking	● ● ● ● ●
Machine Learning & Deep Learning	● ● ● ● ○
Git | CI/CD | MkDocs	● ● ● ● ●
Python | C++ | Bash | LaTeX	● ● ● ● ○
Numpy | Pandas | Polars	● ● ● ○ ○
Scikit-learn | PyTorch | XGBoost	● ● ● ● ○

🎤 TALKS & WORKSHOPS

Complete List 🔗

🏅 AWARDS

Breakthrough Prize in Fundamental Physics 🔗
2025

⚛ LEADERSHIP AND RESEARCH

10/2024 – present

Lead Convener of international Flavour Tagging programme
I currently lead a group of 200 researchers and PhD students across multiple institutions around the world to advance the field of flavour tagging.

Under my leadership the team:
- Revolutionised the paradigm of jet flavour tagging, having developed, deployed and calibrated the first ever transformer-based tagger, with a four-fold improvement in performance. 🔗
- Developed methods to gain a better understanding of the transformer neural network. 🔗

My duties include:
- Provide strategic guidance to the group to meet the collaboration's broader goal of driving innovative research and discovery.
- Liaise between senior stakeholders and team members to translate strategic priorities into achievable deliverables and define measurable benchmarks to assess analytical effectiveness.
- Lead the articulation and communication of compelling narratives to explain our scientific findings both to the wider research community, to funding stakeholders and to the public.

03/2021 – present

Lead Higgs Boson analyst
I led the team that designed the first ever measurement of the Higgs boson coupling to one top-quark using the ATLAS detector.

My contributions are:
- Leading analyser, guiding the group in defining the analysis strategy employing BDTs for mitigation of the background contribution and both data-driven and MC-simulated studies of the background composition.
- Editor of a paper shortly to be published documenting the results.
- Developer of a Python tool for the generation of a statistical inference model to harmonise the fitting strategy across the different channels of the analysis.

10/2022 – 09/2024

Convener of Flavour Tagging Calibration sub-group
- Led the first ever measurement ✐ of the performance of a transformer-based tagger, estimating from data a background subject to extremely high rejections (~1.8k). ✐
- Identified and fixed a weak step in the deployment of recommendations to the collaboration.
  - Developed a standalone Python plotting tool to cross-check consistency between calibration results in the deployment format, accelerating its validation process significantly (~weeks).

03/2021 – 02/2023

Liaison lead for ATLAS in the UK
- Point of contact and liaison for all researchers in UK institutions working on top-quark physics as part of the ATLAS experiment.
- Organised annual workshops ✐ at which researchers could meet up, present their work, exchange ideas and establish new collaborations.

10/2020 – 09/2022

Convener of Flavour Tagging 'X->bb' sub-group
- Led the team that developed the first ever data-driven method for the calibration of a neural network tagger for the identification of highly energetic Higgs Boson objects, setting the standard in the sector. ✐
- Conducted validation studies on the tagger, to understand its performance on Monte Carlo (MC) simulated events
- Designed a novel data-driven method for the measurement of tagger performance. I developed a C++ code-base that allows the full chain of calibration to run with less steps and in less time. I pioneered the development of a simple Boosted Decision Tree ✐ algorithm to increase the purity of a very challenging calibration data-set.

🎓 EDUCATION

PhD in Physics, Università degli Studi Roma Tre
10/2016 – 10/2019 | Rome/Geneva, Italy/Switzerland
- Designed a novel analysis for the statistical inference of the top-bottom quark coupling - achieving the highest single-measurement precision. ✐
- Improved and fastened the C++ software used to measure in data the performance of a Neural Network jet flavour tagger. ✐

Masters in Physics [110/110 Cum Laude], Università degli Studi Roma Tre
10/2014 – 09/2016 | Rome, Italy
Wrote a BDT algorithm for the reconstruction of background events in the analysis that lead to the first ever observation of the associated production of the Higgs boson to two top-quarks

Bachelor in Physics [110/110 Cum Laude],
Università degli Studi Roma Tre
10/2011 – 09/2014 | Rome, Italy

🚀 INTERESTS

- Fantasy Premier League ✐
- Film Photography ✐

🌐 LANGUAGES

Italian
English
Spanish
French