

MATTEO BARBETTI

Ph.D. student in Smart Computing

Department of Physics and Astronomy, University of Florence

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INTERESTS

deep-learning, adversarial-learning, generative-models, optimization-studies,
high-energy-physics, particle-simulation, detector-simulation, ultrafast-simulation

EDUCATION

University of Florence

Firenze, Italy

🎓 PH.D. IN SMART COMPUTING

Nov 2020 – present

Topic: *Smart Computing Techniques applied to Medical Physics, Nuclear Physics and Particle Physics*

Advisors: Lucio Anderlini, Denis Derkach, Michael Williams

University of Florence

Firenze, Italy

🎓 M.SC. IN PARTICLE PHYSICS

Sep 2017 – Jun 2020

Thesis: *“Techniques for parametric simulation with deep neural networks and implementation for the LHCb experiment at CERN and its future upgrades”*

Thesis Advisors: Lucio Anderlini, Piergiulio Lenzi

Graduation Score: 110/110 *cum laude*

University of Florence

Firenze, Italy

🎓 B.SC. IN PHYSICS AND ASTROPHYSICS

Sep 2013 – Sep 2017

Thesis: *“Study of the charmonium resonances in $B^+ \rightarrow p\bar{p}K^+$ and $B^+ \rightarrow p\bar{p}\gamma K^+$ decays with the LHCb experiment at CERN”*

Thesis Advisor: Lucio Anderlini, Giuseppe Latino

Graduation Score: 110/110

EXPERIENCE

University of Florence

Firenze, Italy

GRADUATE RESEARCHER (LHCb Florence Group)

Nov 2020 – present

🔖 *Research focused on development and deployment of Ultra-Fast Simulation for LHCb, generative models optimization and parallel computing for intense hyperparameter studies.*

Advisor: Lucio Anderlini

INFN-Firenze

Firenze, Italy

STUDENT RESEARCHER

Feb 2020 – Apr 2020

🔖 *Traineeship focused on application of machine learning techniques to High Energy Physics.*

Tutors: Gabriele Pasquali, Lucio Anderlini

CERN

Geneva, Switzerland

RESEARCH INTERN (LHCb Experiment)

Sep 2019 – Dec 2019

🔖 *Research in generative models to parameterise the LHCb particle identification system.*

Host: Giovanni Passaleva

University of Florence

Firenze, Italy

STUDENT RESEARCHER (LHCb Florence Group)

Jun 2019 – Jun 2020

📖 *Research aimed to build (non)parametric models for the LHCb detector and to develop a new simulation framework for High Energy Physics applications.*

Mentors: Lucio Anderlini, Giacomo Graziani

CERN

Geneva, Switzerland

STUDENT RESEARCHER (LHCb Experiment)

Jul 2017

📖 *Research in statistical methods for data analysis in High Energy Physics.*

Host: Giovanni Passaleva

University of Florence

Firenze, Italy

STUDENT RESEARCHER (LHCb Florence Group)

May 2017 – Sep 2017

📖 *Research aimed to study charmonium resonances decaying into purely hadronic final states as reconstructed by the LHCb experiment.*

Mentors: Lucio Anderlini, Giacomo Graziani

HONORS & AWARDS**Ph.D. Scholarship in Smart Computing**, INFN

2020 – 2023

📖 *Scholarship to carry out machine learning research for Physics applications*

Scholarship for research activity, INFN

2019

📖 *National grant to pass three months at CERN for research activity*

Scholarship for thesis abroad, University of Florence

2017

📖 *Local grant to pass ten days at CERN for bachelor thesis*

CONFERENCES, WORKSHOPS & SCHOOLS**107° Congresso Nazionale della SIF**

online

Italian Physical Society (SIF)

Sep 2021

Presentation: “*Simulating the LHCb detector with GANs*” (restricted access)

**8th Thematic CERN School of Computing**

online

CERN School of Computing

Jun 2021

Theme: *Scientific Software for Heterogeneous Architectures*

**Workshop della Commissione Calcolo e Reti dell'INFN**

online

INFN Computing and Network Service

May 2021

Presentation: “*Simulating the LHCb detector with GANs*”

**1st CloudBank EU Workshop**

online

CERN IT and IPT Departments

Apr 2021

Presentation: “*LHCb deployment in AWS*” (restricted access)

**2nd Summer School in Physical Sensing and Processing**

online

University of Bologna

Jul 2020

Theme: *Sensing devices, DAQ systems and data processing strategies*

**Artificial Intelligence in Health and Well-Being**

Firenze, Italy

IFAC-CNR & University of Florence

May 2019

Theme: *Artificial Intelligence applications to health and well-being*



OPEN SOURCE SOFTWARE

lb-pidsim-train

PYTHON

Training pipeline for the parameterization of the LHCb PID system



OptunAPI

PYTHON

API to distribute hyperparameters optimization through HTTP requests



LNHunter

JUPYTER NOTEBOOK, PYTHON

Bulky mediastinal lymphoma classification with machine learning techniques



lab3-numpyntro

JUPYTER NOTEBOOK

Introduction to NumPy for Physics Laboratory III students of the University of Florence



PUBLICATIONS

Papers reported in reverse chronological order

Preprints & Working Papers

- [1] LHCb Collaboration, R. Aaij *et al.*, *Study of Z bosons produced in association with charm in the forward region*, [arXiv:2109.08084](#)
- [2] LHCb Collaboration, R. Aaij *et al.*, *Measurement of $\chi_{c1}(3872)$ production in proton-proton collisions at $\sqrt{s} = 8$ and 13 TeV*, [arXiv:2109.07360](#)
- [3] LHCb Collaboration, R. Aaij *et al.*, *Search for the doubly charmed baryon Ξ_{cc}^+ in the $\Xi_c^+ \pi^- \pi^+$ final state*, [arXiv:2109.07292](#)
- [4] LHCb Collaboration, R. Aaij *et al.*, *Observation of the suppressed $\Lambda_b^0 \rightarrow DpK^-$ decay with $D \rightarrow K^+ \pi^-$ and measurement of its CP asymmetry*, [arXiv:2109.02621](#)
- [5] LHCb Collaboration, R. Aaij *et al.*, *Measurement of the lifetimes of promptly produced Ω_c^0 and Ξ_c^0 baryons*, [arXiv:2109.01334](#)
- [6] LHCb Collaboration, R. Aaij *et al.*, *Measurement of the W boson mass*, [arXiv:2109.01113](#)
- [7] LHCb Collaboration, R. Aaij *et al.*, *Study of the doubly charmed tetraquark T_{cc}^+* , [arXiv:2109.01056](#)
- [8] LHCb Collaboration, R. Aaij *et al.*, *Observation of an exotic narrow doubly charmed tetraquark*, [arXiv:2109.01038](#)
- [9] LHCb Collaboration, R. Aaij *et al.*, *Updated search for B_c^+ decays to two charm mesons*, [arXiv:2109.00488](#)
- [10] LHCb Collaboration, R. Aaij *et al.*, *Measurement of J/ψ production cross-sections in pp collisions at $\sqrt{s} = 5$ TeV*, [arXiv:2109.00220](#)
- [11] LHCb Collaboration, R. Aaij *et al.*, *Angular analysis of the rare decay $B_s^0 \rightarrow \phi \mu^+ \mu^-$* , [arXiv:2107.13428](#)

TEACHING & TUTORING

B.Sc. in Physics and Astrophysics, University of Florence

- B015862: Physics Laboratory III – *Lab Tutor and Head TA for Vitaliano Ciulli* 2021 – 2022
- B015860: Physics Laboratory I – *Lab Tutor and TA for Massimo Bongì* 2021 – 2022
- B015862: Physics Laboratory III – *Lab Tutor and Head TA for Vitaliano Ciulli* 2020 – 2021
- B015861: Physics Laboratory II – *Lab Tutor for Andrea Stefanini* 2020 – 2021
- B015860: Physics Laboratory I – *Lab Tutor and TA for Massimo Bongì* 2020 – 2021
- B005476: Physics I – *TA for Oscar Adriani* 2020 – 2021
- B015860: Physics Laboratory I – *Lab Tutor and TA for Massimo Bongì* 2019 – 2020
- B005476: Physics I – *TA for Oscar Adriani* 2019 – 2020

B.Sc. in Mathematics, University of Florence

- B016237: Physics II – *Lab Tutor and TA for Piergiulio Lenzi* 2020 – 2021

B.Sc. in Biological Sciences, University of Florence

- B019238: Physics Laboratory for Biology – *Lab Tutor and TA for Francesca Intonti* 2019 – 2020
- B019238: Physics Laboratory for Biology – *Lab Tutor and TA for Francesca Intonti* 2018 – 2019
- B019231: Physics – *TA for Diederik Sybolt Wiersma* 2018 – 2019

OUTREACH & DISSEMINATION

Science book “Invenzioni”

Sassi Junior & INFN

Preparation of a paragraph dedicated to Artificial Intelligence

Jun 2021



Live interview “Fisica del Clima” with Daniele Visioni

AISF & Cornell University

Organization of an interview about Climate Physics

online

Mar 2021



Live interview “Women in Science” with Anna Gregorio

AISF & University of Trieste

Organization of an interview on the occasion of Women in Science International Day

online

Feb 2021



Live interview “COVID19” with Eugenio Valdano

AISF & INSERM

Organization of an interview about statistical models for COVID-19 pandemic

online

Apr 2020



Outreach event “Tra clima e cocktail”

AISF, Italian Climate Network, CNR & University of Florence

Organization of an event aimed to raise awareness about climate change problem

Firenze, Italy

May 2019



Outreach event “Viaggio al Polo”

AISF, Caffè-Scienza, INFN & University of Florence

Organization of an event about intelligence according to various scientific domains

Firenze, Italy

May 2019



Outreach event “Luminoscienza”

AISF, LENS, University of Florence, INRIM & Caffè-Scienza

Organization of three scientific evenings on the occasion of International Day of Light

Firenze, Italy

May 2018



Seminar “The new particles of LHCb” by Lucio Anderlini

AISF & LHCb Florence Group

Organization of a seminar to discuss latest LHCb discoveries

Firenze, Italy

Oct 2017



Blog post “Quei ragazzacci di via Panisperna”

Fisici Senza Palestra

Writing of a post about Via Panisperna boys

online

Jan 2017

**LEADERSHIP & COMMUNITY SERVICES**

National Institute for Nuclear Physics (INFN)

- PhD Student Member
- Master Student Member



Nov 2020 – present

Sep 2019 – Jun 2020

LHCb Collaboration

- PhD Student Author
- PhD Student Member
- Master Student Member
- Bachelor Student Member



May 2021 – present

Nov 2020 – present

Sep 2019 – Jun 2020

Jul 2017 – Sep 2017

Italian Association of Physics Students (AISF)

- Deputy-President
- Secretary
- President of the Florence Local Committee
- Editorial Board Member of “Sistemi di Riferimento”
- Deputy-President of the Florence Local Committee



Oct 2020 – present

Oct 2019 – present

Nov 2018 – May 2019

May 2018 – present

Dec 2017 – Nov 2018

COMPUTER SKILLS

GitHub <https://github.com/mbarbetti>
Languages Python, C/C++, TeX
OS Windows, Mac OS, Linux

LANGUAGES

Italian *Native*
English *Advanced*
Spanish *Intermediate*