

# MATTEO BARBETTI

Ph.D. student in Smart Computing

Department of Physics and Astronomy, University of Florence

Room 183, Via Sansone 1, 50019 Sesto Fiorentino (FI), Italy

✉ [matteo.barbetti@unifi.it](mailto:matteo.barbetti@unifi.it) | 🌐 <https://mbarbetti.github.io>

## 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*”

**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 &amp; University of Florence

May 2019

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



## OPEN SOURCE SOFTWARE

---

### lb-pidsim-train

PYTHON

Scripts and logics to train PID models for the Ultra-Fast Simulation of the LHCb experiment



### OptunAPI

PYTHON

API to distribute hyperparameters optimization through HTTP requests



### lymphoma-classification

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 the  $B_c^+$  decays into charmonia and three light hadrons*, [arXiv:2111.03001](#)
- [2] LHCb Collaboration, R. Aaij *et al.*, *Tests of lepton universality using  $B^0 \rightarrow K_S^0 \ell^+ \ell^-$  and  $B^+ \rightarrow K^{*+} \ell^+ \ell^-$  decays*, [arXiv:2110.09501](#)
- [3] LHCb Collaboration, R. Aaij *et al.*, *Search for massive long-lived particles decaying semileptonically at  $\sqrt{s} = 13$  TeV*, [arXiv:2110.07293](#)
- [4] LHCb Collaboration, R. Aaij *et al.*, *Observation of two new excited  $\Xi_b^0$  states decaying to  $\Lambda_b^0 K^- \pi^+$* , [arXiv:2110.04497](#)
- [5] LHCb Collaboration, R. Aaij *et al.*, *Simultaneous determination of CKM angle  $\gamma$  and charm mixing parameters*, [arXiv:2110.02350](#)
- [6] LHCb Collaboration, R. Aaij *et al.*, *Study of Z bosons produced in association with charm in the forward region*, [arXiv:2109.08084](#)
- [7] 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](#)
- [8] LHCb Collaboration, R. Aaij *et al.*, *Search for the doubly charmed baryon  $\Xi_{cc}^+$  in the  $\Xi_c^+ \pi^- \pi^+$  final state*, [arXiv:2109.07292](#)
- [9] LHCb Collaboration, R. Aaij *et al.*, *Observation of the suppressed  $\Lambda_b^0 \rightarrow D p K^-$  decay with  $D \rightarrow K^+ \pi^-$  and measurement of its CP asymmetry*, [arXiv:2109.02621](#)
- [10] LHCb Collaboration, R. Aaij *et al.*, *Measurement of the lifetimes of promptly produced  $\Omega_c^0$  and  $\Xi_c^0$  baryons*, [arXiv:2109.01334](#)
- [11] LHCb Collaboration, R. Aaij *et al.*, *Measurement of the W boson mass*, [arXiv:2109.01113](#)
- [12] LHCb Collaboration, R. Aaij *et al.*, *Study of the doubly charmed tetraquark  $T_{cc}^+$* , [arXiv:2109.01056](#)
- [13] LHCb Collaboration, R. Aaij *et al.*, *Observation of an exotic narrow doubly charmed tetraquark*, [arXiv:2109.01038](#)

- [14] LHCb Collaboration, R. Aaij *et al.*, *Updated search for  $B_c^+$  decays to two charm mesons*, [arXiv:2109.00488](#)
- [15] LHCb Collaboration, R. Aaij *et al.*, *Measurement of  $J/\psi$  production cross-sections in pp collisions at  $\sqrt{s} = 5$  TeV*, [arXiv:2109.00220](#)
- [16] 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 Bonghi* 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 Bonghi* 2020 – 2021
- B005476: Physics I – *TA for Oscar Adriani* 2020 – 2021
- B015860: Physics Laboratory I – *Lab Tutor and TA for Massimo Bonghi* 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 &amp; 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 &amp; 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*