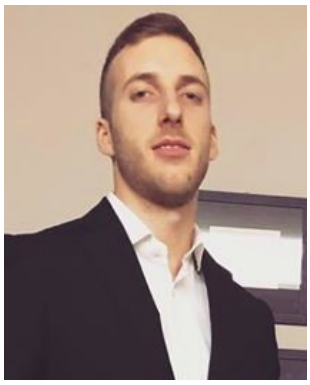
Gianluca Bianco



Personal Data

Born 23/07/1995, Bologna (BO), Italy

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Social profiles

Websites HSF

Summary

Current position **PhD student** at University of Bologna and INFN - Bologna section, **teaching tutor** at University of Bologna and **member** of the CERN ATLAS experiment.

Career goal I am a PhD student in particle physics and my main scientific interests are related to elementary particle physics and in particular to top-quark studies. I mostly prefer to work with data analysis and data science tools, together with computer programming algorithms, in order to extract physics results from data. I am also fascinated by computer science and in particular by quantum computing.

Fields of interest **Particle physics**, **top quark physics**, Standard-Model physics, Beyond-the-Standard-Model physics, **technical detector upgrades**, data science, computer science, quantum computing and cosmology.

Publications › I am author of **3** publications, which are: **1** proceeding, **1** paper and **1** unofficial paper.

Oral contributions › I presented **6** oral contributions at public events, which are: **4** talks and **2** poster.

Education

11/2021 - Now **PhD in Elementary Particle Physics** (english) *EQF Level 8*

Alma Mater Studiorum - Università di Bologna, Bologna, Italy

- *Supervisors*: Prof. Maximiliano Sioli, Dr. Marino Romano and Dr. Alessia Bruni.
- *Topics*: particle and computational physics, machine learning and computing.

10/2018 - 12/2020 **Master's Degree in Nuclear and Subnuclear Physics** (english) *EQF Level 7*

110/110 cum laude

Alma Mater Studiorum - Università di Bologna, Bologna, Italy

- *Thesis*: "Study of the quantum interference between singly and doubly resonant top-quark production in proton-proton collisions at the LHC with the ATLAS detector".
- *Supervisors*: Prof. Maximiliano Sioli and Dr. Marino Romano.
- *Topics*: particle and nuclear physics, machine learning, computing.

10/2015 - 07/2018 **Bachelor's Degree in Physics** (italian) *EQF Level 6*

99/110

Alma Mater Studiorum - Università di Bologna, Bologna, Italy

- *Thesis*: "Il confinamento magnetico del plasma termonucleare".
- *Supervisor*: Prof. Michele Dragoni.
- *Topics*: classical, quantum, plasma and nuclear physics, computing and mathematics.

09/2009 - 07/2015 **Scientific High School Diploma** *EQF Level 4*

Liceo Scientifico Statale Enrico Fermi, Bologna, Italy

Professional Experiences

Research

11/2021 - Now
Full-time

Doctoral Researcher at the CERN ATLAS experiment

INFN (Istituto Nazionale di Fisica Nucleare), Bologna, Italy

- *Research topics*: top-quark physics and technical detector upgrades.
- *Responsibilities*: data analysis with Bayesian inference and unfolding techniques and software development.
- *Software kills*: `Python` (`pyROOT`, `NumPy`, `Pandas`, `Matplotlib`), `C++`, Bash, LaTeX, `XML`, `Git`, `HTCondor`, HEP software, SSH, Jira, Excell.

07/2021 - 10/2021
4 Mos · Full-time

Postgraduate Researcher at the CERN ATLAS experiment

INFN (Istituto Nazionale di Fisica Nucleare), Bologna, Italy

- *Research topic*: top-quark physics.
- *Responsibilities*: data analysis with Bayesian inference and unfolding techniques and software development.
- *S&C main skills*: `Python`, `C++`, Bash, LaTeX, `XML`, `Git`, `HTCondor`, (py)`ROOT`, HEP software, SSH, Jira, Excell.

04/2020 - 12/2020
9 Mos · Internship

Master's Degree Trainee at the CERN ATLAS experiment

INFN (Istituto Nazionale di Fisica Nucleare), Bologna, Italy

- *Research topic*: top-quark physics.
- *Responsibilities*: data analysis with Bayesian inference and unfolding techniques.
- *S&C main skills*: `Python`, `C++`, Bash, LaTeX, `XML`, `Git`, `HTCondor`, (py)`ROOT`, HEP software, SSH, Jira, Excell.

12/2019 - 05/2020
6 Mos · Internship

Tandem Project Trainee at the CERN ATLAS experiment

iTHEPHY (Innovative Team-Teaching for Physics), Bologna, Italy

- *Research topic*: Higgs-boson physics.
- *Responsibilities*: data science with classical machine learning techniques.
- *S&C main skills*: `Python`, LaTeX, `pytest`, `Git`, (py)`ROOT`, `Keras`, `SciKit-Learn`, `Pandas`.

Teaching

02/2021 - Now
Contract

Teaching Tutor

Alma Mater Studiorum - Università di Bologna, Bologna, Italy

- *Courses*:
  - 1x "Programmazione per la Fisica (A-L) [Mod. 2]" (24 hrs) at Bachelor of Physics.
  - 1x "Fenomeni Termici" (12 hrs) at Bachelor of Physics.
  - 2x "Lab. di Elettromagnetismo e Ottica [Mod. 3]" (36 hrs) at Bachelor of Physics.
  - 1x "Lab. di Meccanica e Termodinamica [Mod. 4]" (12 hrs) at Bachelor of Physics.
  - 1x "Fisica Generale T" (30 hrs) at Building Engineering.
- *Responsibilities*: oral and written exams assistance, in-class exercises, `C++` / `ROOT` training sessions assistance, laboratory assistance.
- *S&C main skills*: `C++`, `ROOT`.

03/2021 - Now
Pro bono

Mentor

HSF (HEP Software Foundation), Online

- *Courses*:
  - 1x "HEP C++ Course and Hands-on Training" (5 hrs).
- *Responsibilities*: `C++` training sessions assistance.
- *S&C main skills*: `C++`, `GNU make`.

Outreach

03/2022
1 mos · Pro bono

Outreach Tutor
INFN (Istituto Nazionale di Fisica Nucleare), Bologna, Italy
- *Activities*:
  - 1x "International Masterclass and Hands-on on particle physics" (2 hrs).
- *Responsibilities*: preparation of teaching experiments and social research.
- *S&C main skills*: `HYPATHIA` software.

01/2021 - 06/2021
6 mos · Contract

Outreach Tutor
Alma Mater Studiorum - Università di Bologna, Bologna, Italy
- *Activities*:
  - 1x "Officina-Laboratorio" (20 hrs) at Physics [cod. 95970].
- *Responsibilities*: preparation of teaching experiments and social research.
- *S&C main skills*: Excell.

02/2021 - 05/2021
4 Mos · Pro bono

Active Member of the CERN ATLAS experiment data and tools outreach group
CERN (The European Organization of Nuclear Research), Online
- *Responsibilities*: testing and preparation of the Jupyter Notebook examples and tutorials.
- *S&C main skills*: `Python`, `C++`, `Git`, (py)`ROOT`.

Research Activities

Particle Physics Analyses

04/2020 - Now
Top-quark physics

Study of the quantum interference between singly and doubly resonant top-quark production in proton-proton collisions at the LHC with the ATLAS detector
- *Description*: measurement of the $WbWb$ single- and double- differential cross-sections in the $e\mu$ dilepton channel in pp collisions, using the full ATLAS Run-2 dataset ($\sqrt{s} = 13$ TeV and $L = 139\,\text{fb}^{-1}$). Particular focus is dedicated to the study of the quantum interference properties of singly- and doubly-resonant top-quark production processes in the $WbWb$ phase-space.

12/2019 - 05/2020
Higgs-boson physics

Study of the Higgs boson Yukawa coupling to τ leptons with the ATLAS detector
- *Description*: study of the Higgs boson Yukawa coupling to τ leptons using the 2012 ATLAS Run-2 dataset ($\sqrt{s} = 8$ TeV and $L = 20.3\,\text{fb}^{-1}$). Particular focus is dedicated to the usage of machine learning classification algorithms to classify the Higgs decay channel $H \to \tau\tau$ as signal with respect to the other background processes.

Particle Detectors Analyses

11/2021 - Now
Offline analysis

Development of tools to analyze the data describing the RPC detector status recorded by the DCS
- *Description*: development of tools which evaluate the impact of RPC detector defects on RPC data quality that will be used for offline performance studies of the RPC detector itself. In particular: study of the HV and I_{gap} channels mapping and gas system monitoring.

Social and Humanistic Research

01/2021 - 06/2021
Gender study

Study of the gender gaps at DIFA department at University of Bologna
- *Description*: investigation of the presence of biases in the choice of the student's supervisors, related to the gender of both students and supervisors themselves, using data of PhD students of DIFA department at the University of Bologna from years 2010-2020.

Software Development Activities

Working Projects

03/2022 - Now — Framework
`DCSAnalysisTools` (private to ATLAS)
- *Description*: Python framework used to analyze ATLAS RPC DCS data.

09/2022 - Now — Website
`DCSWebPages` (private to ATLAS)
- *Description*: Python `DJango` repository to share results with DCS team.

Personal Projects

11/2021 - Now — Library
`osmanip`
- *Description*: `C++` library for output stream manipulation using ANSI escape sequences.

07/2022 - Now — Library
`ptc::print`
- *Description*: a `C++` single-header library for custom printing to the output

12/2021 - Now — Script
`root-framework-installer`
- *Description*: automatic `ROOT` framework installer for any platform.

03/2022 - Now — App
`IGStatTools` (work-in-progress)
- *Description*: a `Python` app to retrieve general statistics about an Instagram profile using the Instaloader API.

09/2022 — Data Science
`the-sonar-project`
- *Description*: Application of machine learning to classify the Sonar data.

Awards and Fellowships

Awards

08/2021 **3rd place at "Annamaria Cartacci" award** for the best 2020 particle physics MSc thesis
Università degli Studi di Firenze

Fellowships

07/2021 **Postgraduate fellowship** for scientific training activities [call 23083]
INFN (Istituto Nazionale di Fisica Nucleare) - Bologna section

07/2021 **PhD fellowship** of INFN in Physics
Alma Mater Studiorum - Università di Bologna

07/2021 **PhD fellowship** of INFN in Data Science and Computation (refused)
Alma Mater Studiorum - Università di Bologna

Oral Contributions

Talks

10/2022 **Development of tools to analyze the data describing the RPC detector status recorded by the DCS**
Muon Week at CERN, Geneva, Switzerland.

09/2022 **Study of the quantum interference between singly and doubly resonant top-quark production in $WbWb$ phase-space with the ATLAS detector**
108° *Congresso Nazionale SIF*, Milan, Italy

09/2021 **Study of quantum interference between singly and doubly resonant top-quark production**
ATLAS Italia Young Workshop, Online

06/2020 **Classification in particle physics using machine learning**
International School on High Energy Physics - ISHEP 2020, Online

Posters

10/2022 **Study of the quantum interference between singly and doubly resonant top-quark production in the $WbWb$ phase-space with the ATLAS detector**
13th INFN School on Efficient Scientific Computing - ESC22 , Bertinoro, Italy

07/2021 **Study of the quantum interference between singly and doubly resonant top-quark production in proton-proton collisions at the LHC with the ATLAS detector**
The 1st INFN School on Underground Physics - SOUP 20|21, Online

Training Activities

Schools

10/2022 **13th INFN School on Efficient Scientific Computing - ESC22** (35 hrs)
05/2022 **INFN School of Statistics 2022** (24 hrs)
07/2021 **The 1st INFN School on Underground Physics - SOUP 20|21** (44 hrs)
10/2020 **Inverted CERN School of Computing - iCSC 2020** (16 hrs)
07/2020 **Physical Sensing and Processing Summer School 2020** (29 hrs)
06/2020 **International School on High Energy Physics - ISHEP 2020** (36 hrs)
07/2019 **Hadron Collider Summer School - HASCO 2019** (36 hrs)

Courses

12/2021 **Software Carpentry Workshop** (20 hours)
11/2021 **ATLAS Software Development Tutorial** (21 hours)
07/2021 **ATLAS Analysis Software Tutorial** (24 hours)
02/2021 **Fundamentals of Particle Accelerator Technology** (26 hours)
03/2021 **Standard Template Library And DSA Interview Questions** (3 hours)
02/2021 **Learning GIT with GitHub and GitLab** (5 hours)
01/2021 **Linux Basics: The Command Line Interface** (20 hours)
12/2020 **Cosmic Rays, Dark Matter, and the Mysteries of the Universe** (16 hours)
10/2020 **The Hardware of a Quantum Computer** (42 hours)
10/2020 **HEP C++ Course and Hands-on Training** (22 hours)
09/2020 **Machine Learning with Python: A Practical Introduction** (25 hours)

Certifications

04/2021 **English Language IELTS Academic 6.0 (B2)**
07/2020 **Linkedin Skill Assessments:** `C++`, `Python`
02/2018 **QCER English Language Assestment B2**

Languages

Mother tongue Italian

English

Overall	**B2 / C1**	***Very good / Excellent***
Speaking	C1	*Proficient*
Listening	B2	*Independent*
Reading	C1	*Proficient*
Writing	B2	*Independent*

Spanish

Overall	**A2**	***Limited***
Speaking	A2	*Basic*
Listening	B1	*Independent*
Reading	A2	*Basic*
Writing	A1	*Basic*

Skills

Software Development Languages

Programming	C++ (11/14/17), C, Python (2 & 3), LabVIEW.
Scripting	Bash, PowerShell.
Markup	LaTeX (w/ Overleaf), XML, Markdown.
Building	GNU make.

Frameworks and Libraries

Data analysis	ROOT, Pandas, Matplotlib, NumPy, Distfit.
ROOT extensions	RooFit, RooStat, RooUnfold, PyROOT, uproot.
Machine learning	Keras, SciKit-Learn.
Graphics	tkinter.
Testing	pytest, doctest (C++, Python).
Debugging	Valgrind, Cppcheck, GDB.
Parallelization	HTCondor, STL multiprocessing and threading.
Modeling	Geant4.
HEP software	TTbarUnfold, pyTTbarDiffXs13TeV, HYPATIA.
Other API's	clang-format, Instaloader, Boost.org, Google Benchmark.

Computing Tools

Operating systems	Linux (Ubuntu CentOS, WSL), Windows (XP, Vista, 7, 10), iOS.
Version control	Git (w/ GitHub, GitLab).
IDE	VS Code, Jupyter Notebook, Spyder, Emacs.
Bug tracking	Jira, Trello.
Network protocols	SSH.
Audio editing	FL Studio, Audacity.
Productivity	MS / Libre Office Word, Excell and Power Point.
Other tools	Matternmost, Stack Overflow.

Scientific Knowledge

Data analysis	Bayesian inference, unfolding methods, Monte Carlo simulations, statistics, modeling.
Machine learning	Deep learning, pattern recognition, data mining.
Prog. paradigms	Functional, object oriented, scripting, multiprocessing, multithreading.
Scientific computing	Computational physics, quantum computing.
Physics fields	Classical, quantum, particle, nuclear and plasma physics, special and general relativity.
Hardware	Data acquisition and processing, analogical and digital electronics.
Soft skills	Leadership, teamwork, adaptability, problem solving, creativity, analytical skills, time management.
Other skills	Research, advanced mathematics, science communication, outreach and education.

Organizations Membership

01/2021 - Now **Alma Mater Studiorum - Università di Bologna**
- *Current position* (11/2021 - Now): PhD student.
- *Current position* (01/2021 - Now): teaching tutor.

05/2020 - Now **ATLAS Experiment at CERN**
- *Current position* (05/2020 - Now): member of the ATLAS top-quark analysis team.
- Previously (02/2021 - 05/2021): member of the ATLAS outreach group.

04/2020 - Now **INFN (Istituto Nazionale di Fisica Nucleare) - Bologna section**
- *Current position* (07/2021 - Now): associate member.
- Previously (04/2020 - 04/2021): master student.

03/2021 - Now **HSF (HEP Software Foundation)**
- *Current position* (03/2021 - Now): mentor.

Other Details

Extra Information

Hobbies Calisthenics, fitness, walking, music, cinema, tv series, travelling, extraterrestrial science and computing. You can find my personal projects, which I develope in my free time, at my GitHub page.

Availabilities I am available to move on the national and international territory for short periods (weeks or a few months). I have a B driving license.

Declarations and Authorizations

Declarations Declaration in lieu of notoriety (art. 47 D.P.R. 28/12/2000 n. 445): aware of the penalties, in the case of false statements and false documents, as per art. 76 of Presidential Decree n. 445/2000 of 28/12/2000, I declare that the information provided in this curriculum vitae, including the information about the professional activity performed, is true.

Authorizations I hereby authorize the processing of the personal data contained in this CV in compliance with the European Regulation (UE) 2016/679.

Relevant Publications

Proceedings

[1] G. Bianco. "**A method for the study of the quantum interference between singly and doubly resonant top-quark production in proton-proton collisions at the LHC with the ATLAS detector**." In: *Nuovo Cimento C*. Vol. 45. 1. 2022.

Papers

[1] S. Malik et al. "**Software Training in HEP**." In: *Computing and Software for Big Science* 5.22 (2021). arXiv: 2103.00659 [hep-ex].

Unofficial papers

[1] G. Bianco et al. "**Tandem Project Report: Classification in particle physics using machine learning**." 2020.

Other publications

Full list of my publications can be found here.

Bologna, October 17, 2022