

PERSONAL INFORMATION Maria Carnesale**EDUCATION AND WORK EXPERIENCE**March 2022 - March 2023 **CERN associate as Doctoral Student**

CERN

Development of ML algorithms for particle reconstruction and pattern recognition and implementation on FPGA architectures for ATLAS High Level Trigger

November 2019 - September 2023 **PhD**

Università degli studi di Roma La Sapienza

Supervisor Prof. Cesare Bini, Dr. Stefano Rosati

Thesis Title Studies of the Higgs boson properties with the $H \rightarrow WW$ channel and optimization of muon tracking algorithms with the ATLAS experimentSeptember 2017- October 2019 **Physics Master Degree**

Università degli studi di Roma La Sapienza

Supervisor Prof. Cesare Bini, Dr. Stefano Rosati

Curriculum Particle and Astroparticle Physics

Thesis Title Study of muons reconstruction with the New Small Wheel detectors for the upgrade of the Atlas experiment

Grade 110/110 cum laude

September 2017 **Physics Bachelor Degree**

Università degli studi di Roma La Sapienza

Supervisor Prof. Francesco Sciortino

Thesis Title La funzione d'onda dell' H_2^+ : calcoli esatti (H_2^+ wave function: analytical solution)

Grade 110/110 cum laude

July 2014 **Secondary School Diploma**

Liceo Scientifico Statale "Bruno Touschek"

Grade 100/100

AWARDS2021 **Grant for tutoring activities**

Grant awarded according to academic merit by the "Facoltà di Scienze Matematiche, Fisiche e Naturali" (Faculty of Mathematical, Physical and Natural Sciences) of Sapienza University for tutoring activities for courses and lectures.

2020 **Sapienza "Laureato Eccellente" Award**

"Excellent Graduate" award given by "Roma Sapienza Foundation" for the Master Degree in Physics.

January-July 2019 **INFN scholarships for scientific training activities for university students**

Scholarship of 6 months awarded by the National Institute for Nuclear Physics to the 5 best students of the Particle and Astroparticle curriculum in Physics Master Degree at La Sapienza University of Rome.

https://jobs.dsi.infn.it/dettagli_job.php?id=2263

2016-2018 **Grant for Collaboration in the Physics Department**

Grant awarded according to academic merit by the Physics Department of Sapienza University to the students, to collaborate in different Department activities. I was assigned to be the Physics Department library.

2014-2017 and 2018-2019 **University Path of Excellence**

Admission to University Path of Excellence in academic year 2014/2015, successfully completed in 2017. It included also an additional course focused on gaseous particle detectors.

RESEARCH ACTIVITY

Study of the Higgs to WW decay in the same flavor channel

Strongly involved in the HWW analysis with the full LHC Run2 data collected by ATLAS. In particular I worked on the same flavor channel of the analysis, where the 2 Ws, coming from the Higgs decay, decay leptonically in 2 same flavor charged leptons. I have developed a multivariate analyses to reject the dominant Drell-Yan background with respect to the signal and implemented the fit of the ggF and VBF signal strengths.

New Small Wheel calibration, reconstruction and performance studies

I worked at the development of the calibration algorithm for the New Small Wheel software in the ATLAS software framework Athena. I was also involved in the development of the New Small Wheel software for the single points and tracks reconstruction algorithms, working on the optimization of these algorithms.

Development of machine learning algorithms for single points and muon tracks reconstruction

Development of new algorithms to be implemented in the ATLAS software framework (Athena) for the reconstruction of single points in the New Small Wheel and for pattern finding algorithms. For the single point reconstruction I implemented a deep neural network able to exploit all the information collected by the New Small Wheels' detectors, while for the Pattern Finding I developed a recurrent neural network able to understand the sequential structure of the input data and to identify muon tracks.

Study of FPGA algorithms implementation for ATLAS High Level Trigger

I worked on the implementation of machine learning algorithms for muon reconstruction in FPGA architectures to be used by the ATLAS trigger system for the High Level Trigger during Run4, using the Vitis AI development environment provided by Xilinx.

TALK/POSTERS AT CONFERENCES, SEMINARS

7-11/11/2023 **CHEP 2023**

"Fast inference on FPGA for the ATLAS Muon Trigger"

<https://www.jlab.org/conference/CHEP2023>

7-11/11/2022 **Higgs 2022**

"Measurements and interpretations of Simplified Template Cross Sections and differential and fiducial cross sections in Higgs boson decays to two W bosons with the ATLAS detector"

<https://indico.cern.ch/event/1086716/>

16-20/05/2022 **LHCP 2022**

"The ATLAS New Small Wheel Simulation and Reconstruction Software and Detector Performance Studies"

<https://indico.cern.ch/event/1109611/>

2019- 2022 **105^o/106^o/107^o/108^o congresso SIF**

Talk in a parallel session

- "Neural network techniques for charged particles reconstruction in ATLAS New Small Wheels"
- "Study of the HWW same flavour channel with the ATLAS detector"
- "Study of calibration and performances of the New Small Wheels of the ATLAS experiment"
- "Muon reconstruction in the ATLAS experiment with the New Small Wheel"

ATLAS INTERNAL TALKS

17/11/2022 **ATLAS Upgrade Week**

"FPGA AI accelerators for HLT Muon"

21/09/2022 **ATLAS Week, ECS session**

"First look at early Run-3 data with the New Small Wheels"

29/09/2021 **ATLAS Italia Young**

"New Small Wheel reconstruction and performance"

21/09/2021 **ATLAS TDAQ Week**

"Tests on FPGA accelerators of ML algs for the muon HLT"

22/10/2020 **Muon Software & Performance (Muon Week)**

"New Small Wheel calibration and performance"

SCHOOLS AND WORKSHOPS

30 Nov -13 Dec 2022 **2021 CERN European School of High-Energy Physics**

Attended the 2021 CERN European School of High-Energy Physics, with focus on Field Theory, Standard Model, practical statistics, physics Beyond the Standard Model, outlook for experimental HEP. <https://indico.cern.ch/event/940219/page/20598-home>

15-20 May 2022 **INFN School of Statistics 2022**

Attended the school held in Paestum, Italy, and organized by INFN and university Federico II. The topics focused on probability theory, statistical methods, multivariate techniques, including artificial neural networks. <https://agenda.infn.it/event/28039/>

1-3 Nov + 10 Nov 2021 **PHYSTAT-Systematics 2021**

Remote workshop focused on uncertainties in data analyses in Particle Physics. <https://espace.cern.ch/phystat>.

29 Aug - 3 sept 2021

Advanced VBSCan Training School 2021

Attended the school held in Milan, Italy, and organized by Milano-Bicocca University. The topics focused on current research in the electroweak symmetry breaking domain: polarised vector boson scattering, connection between effective field theory and complete models, and use of anomaly detection in the search for deviations from the SM.

5 Jul - 9 Jul 2021

PyHEP 2021 virtual Workshop

Attended the online workshop supported by the HEP Software Foundation, focused on the usage of Python in the HEP community.

PUBLICATIONS

Qualified as ATLAS author since November 2020

papers: 225, citations: 3927, hindex: 35

OUTREACH ACTIVITY

05/2020-03/2022

Tutor for the INFN-CERN project "Art&Science"

Involved in the INFN-CERN project "Art&Science across Italy", outreach project for High schools.

OTHER EXPERIENCES

10/2021 - 03/2022

Tutoring activities for university math lectures

Tutoring activities for university students. My main activity consists in giving lessons on math subjects and helping students solving exercises.

2016-2018

Librarian in the Physics Department

I worked at service desk for Physics department library.

PERSONAL SKILLS

Mother tongue Italian

Other languages

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	C1	C1	C1	C1	C1

Levels: A1 and A2: Basic user – B1 and B2: Independent user – C1 and C2: Proficient user
[Common European Framework of Reference for Languages](http://www.cedefop.europa.eu/en/etd/12345)

Computer skills

- Good knowledge of ATLAS event reconstruction framework and analysis code -
- In-depth knowledge of ROOT framework
- In-depth knowledge of C++,C, good knowledge of R, shell(BASH) scripting and Perl scripting
- In-depth knowledge of python and neural network development tools (Keras, Tensorflow)
- Advanced knowledge in Open Office, Linux, Microsoft Windows and Latex.

F.to Maria Carnesale