Federico Morodei

WORK EXPERIENCE

CERN

City: Geneva | **Country:** Switzerland

[03/2025 – 02/2026] **Project Associate at CERN**

The main responsibility covered as a Project Associate (PJAS) at CERN is the coordination of the hardware tests carried out in several CERN facilities to validate the RPC trigger and readout electronics for the Phase 2 upgrade of the ATLAS detector. I prepared a test station employing both legacy and new RPC detectors and all the software infrastructure that will be used to validate the new RPC chambers during production. This activity is carried out in parallel with the finalization of the development of the firmwares of the RPC Barrel Sector Logic board and the Data Collector and Transmitter (DCT) board. I am also the contact person for the Detector Control System (DCS) of the RPC barrel Sector Logic board and as such I am responsible for the development of the DCS and DAQ infrastructure of the DCT and Sector Logic systems.

I also play an active role in a data analysis with the aim of measuring the low-mass di-muon Drell-Yan cross-section.

Moreover, I participate in the Run 3 ATLAS detector operations by covering several shifts at the Muon Spectrometer desk.

University of Rome "La Sapienza", Department of Physics

City: Rome | **Country:** Italy

[02/2024 – 01/2026] **Physics researcher ("Assegnista di ricerca")**

The main research topic is the development and testing of the Level-0 Muon barrel trigger and readout system of the ATLAS detector for the High-Luminosity LHC upgrade. I continue working on the activities started with the PhD thesis research (completion of the DCT and SL FPGA firmwares) but with more responsibilities on the hardware tests of the board prototypes. I am also studying the feasibility of adopting alternative algorithms for the Level-0 muon barrel trigger to be implemented in the SL FPGA firmware. The performance and FPGA resource demand of a pattern-matching and a Machine Learning algorithms are under evaluation.

Part of the research activity has also been dedicated to the completion of the analyses on Drell-Yan di-tau cross-section measurement and leptoquark searches started during the PhD.

University of Rome "La Sapienza", Department of Physics

City: Rome | **Country:** Italy

[11/2020 – 01/2024] **PhD Student**

The research activity for the PhD thesis has been carried out within the ATLAS experiment at CERN and can be divided into two main topics, one dealing with data analysis and the other one with detector upgrade.

The first aspect of the research activity consisted in a Standard Model precision measurement and the interpretation of the results according to new physics theoretical models. The goal of the measurement was the unfolded differential cross-section of the Drell-Yan process with two tau leptons in the final state with respect to their visible invariant mass. The measurement results have been used to set exclusion limits in the parameter space of the simplified U1 leptoquark model. Great part of my research activity

was dedicated to analysis selection definition and optimization, trigger studies, uncertainty evaluation and result interpretation. I have given a very important contribution also to the development and application of a new data driven technique, the Universal Fake Factor method, to estimate the background from jets and light-leptons misreconstructed as tau leptons.

The other aspect of the research activity was about the development and testing of the new Resistive Plate Chamber (RPC) trigger and readout system of the ATLAS detector for the upgrade in preparation to the High-Luminosity LHC (HL-LHC). On this topic, I have been one of the main developers of the FPGA firmware for the new electronic boards that will be installed during the HL-LHC upgrade, the on-detector Data Collector and Transmitter (DCT) and the off-detector barrel Sector Logic (SL) board. I was in charge of the design and implementation of the firmwares and the software simulations to evaluate their performance. I have also executed several hardware tests with Evaluation boards and the SL and DCT prototypes.

Master student

City: Rome | **Country:** Italy

[02/2020 – 10/2020] **University of Rome "La Sapienza", Department of Physics**

Activity of data analysis on a search for long-lived particles predicted by some extensions of the Standard Model and application of innovative Deep Learning techniques to particle physics. In particular, different types of Deep Neural Networks (convolutional and graph NN) have been studied and optimized for an application in lepton jet reconstruction with the ATLAS detector. The activity was carried on within the ATLAS Roma1 group for the Master Degree thesis in Particle and Astroparticle Physics.

EDUCATION AND TRAINING

[11/2020 – 01/2024] **PhD**

University of Rome "La Sapienza", Department of Physics

City: Rome | **Country:** Italy | | **Thesis:** Particle Physics; thesis title: "A search for third-generation leptoquarks in the non-resonant production with the ATLAS experiment and development of the Level-0 muon trigger for the High Luminosity LHC

[09/2018 – 10/2020] **Master degree**

University of Rome "La Sapienza", Department of Physics

City: Rome | **Country:** Italy | | **Final grade:** 110/110 cum laude | **Thesis:** New Generalization methods in Deep Neural Networks for displaced jet tagging with the ATLAS experiment at the LHC

[09/2015 – 09/2018] **Bachelor degree**

University of Rome "La Sapienza", Department of Physics

City: Rome | **Country:** Italy | | **Final grade:** 110/110 cum laude | **Thesis:** The Transition Radiation Detector of the AMS-02 experiment

CONFERENCES AND SEMINARS

[07/07/2025 – 11/07/2025] **European Physical Society Conference on High Energy Physics (EPS-HEP 2025)**
Marseille, France

Participated with a poster title "*Estimation of backgrounds from jets misidentified as tau-leptons using the Universal Fake Factor method with the ATLAS detector*".

[30/09/2024 – 04/10/2024] **Topical Workshop on Electronics for Particle Physics (TWEPP 2024)** Glasgow, UK

Participated with a poster titled "*Low-latency hardware trigger for muons in the barrel region of the ATLAS experiment at the high-luminosity LHC*".

[16/09/2024 – 18/09/2024] **XVII ATLAS Italia workshop** Rome, Italy

[07/05/2024 – 10/05/2024] **Standard Model at the LHC (SM@LHC 2024)** Rome, Italy

Participated with a talk titled "*Constraining the leptoquark pair-production cross-section using tau leptons with the ATLAS detector*".

[18/09/2023 – 20/09/2023] **XVI ATLAS Italia workshop** Rimini, Italy

Participated with a talk titled "*Status of L0 Muon TDAQ for the Phase-II Upgrade*".

[12/04/2023 – 14/04/2023] **Incontri di Fisica delle Alte Energie (IFAE 2023)** Catania, Italy

Participated with a poster titled "*Development of the firmware of the barrel Sector Logic board of the ATLAS Muon Spectrometer for the High-Luminosity LHC*".

[19/09/2022 – 23/09/2022] **Topical Workshop on Electronics for Particle Physics (TWEPP 2022)** Bergen, Norway

Participated with a poster titled *"Status of the Level-0 ATLAS Barrel Muon Trigger for High-Luminosity LHC"*.

[27/06/2022 – 29/06/2022] **XV ATLAS Italia Workshop** Pisa, Italy

[16/10/2021 – 23/10/2021] **IEEE NSS/MIC 2021**

Participated with a poster titled "*The ATLAS Muon Trigger System for the High Luminosity LHC: upgraded data readout and transmission electronics for the Resistive Plate Chambers".*

[13/09/2021 – 17/09/2021] **107° National Congress of the Società Italiana di Fisica**

Participated with a talk titled "*Test of the DCT board prototypes for the Phase-II Upgrade of the Muon Spectrometer of the ATLAS experiment at the LHC".*

[14/09/2020 – 18/09/2020] **106° National Congress of the Società Italiana di Fisica**

Participated with a talk titled "*Methods of artificial intelligence for jet identification with the ATLAS experiment at the LHC*".

PUBLICATIONS

Publications with the ATLAS Collaboration

ATLAS Active Author since February 2022. Author of 331 published papers with the ATLAS Collaboration. H-index: 53.

[2025] **Low-latency hardware trigger for muons in the barrel region of the ATLAS experiment for the High-Luminosity LHC**

Reference: M. Bauce et al., Journal of Instrumentation, Volume 20, 2025 JINST 20 C03048

doi: 10.1088/1748-0221/20/03/C03048

[2024] **Development of the Barrel Sector Logic firmware of the ATLAS Muon Spectrometer for the High-Luminosity LHC**

Reference: F. Morodei, Nuovo Cim.C 47 (2024) 3, 128

doi: 10.1393/ncc/i2024-24128-6

[2024] **A search for third-generation leptoquarks in the non-resonant production with the ATLAS experiment and development of the Level-0 muon trigger for the High Luminosity LHC**

Reference: F. Morodei, CERN-THESIS-2024-057, URN/HDL: 11573/1710206

[2024] **ATLAS Level-0 Muon Barrel Trigger system status and integration tests for Phase-II**

Reference: M. Bauce et al., Nuclear Instruments and Methods in Physics Research Section A (2024), 1069

doi: 10.1016/j.nima.2024.169843

[2023] **Status of the Level-0 ATLAS barrel muon trigger for High-Luminosity LHC**

Reference: F. Morodei, Journal of Instrumentation, Volume 18, 2023 JINST 18 C02047

doi: 10.1088/1748-0221/18/02/C02047

[2022] **An FPGA Based Sub-Nanosecond Hit Time Measurement Board for the Muon Spectrometer of the ATLAS Experiment at HL-LHC**

Reference: M. Corradi et al., 2022 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)

doi: 10.1109/NSS/MIC44845.2022.10398962

[2021] **Upgraded Data Readout and Transmission Electronics for the Resistive Plate Chambers of the ATLAS Muon Trigger System for the High Luminosity LHC**

Reference: M. Corradi et al., 2021 IEEE Nuclear Science Symposium and Medical Imaging Conference (NSS/MIC)

doi: 10.1109/NSS/MIC44867.2021.9875551.

LANGUAGE SKILLS

Mother tongue(s): Italian

Other language(s):

English

LISTENING C1 **READING** C1 **WRITING** C1

SPOKEN PRODUCTION C1 **SPOKEN INTERACTION** C1

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

OUTREACH

[01/04/2025 – Current] **CERN guided tours**

I am an official CERN guide trained for the following CERN visiting points: ATLAS Visitor Centre, Antiproton Decelerator, Synchrocyclotron, Data Centre Visitor Point, SM18, CERN Control Centre, Science Gateway exhibitions. I guided several tours at the ATLAS Visitor Centre and Synchrocyclotron for high-schools and the general public.

[11/02/2025] **International Masterclass on Particle Physics**

Event organised by INFN Sezione di Roma.

[24/02/2022] **International Masterclass on Particle Physics**

Event organised by INFN Sezione di Roma.

GRANTS AND SCHOLARSHIPS

[01/2026] **Contratto di Ricerca (CDR)**

Winner of the tender CDR 52 DD. 218/2025 prot.n. 4040 of 10/10/25 announced by University of Rome La Sapienza for the assignment of one Contratto di Ricerca on the topic "Search for production of Higgs boson couples in the bbtautau final state with the ATLAS Run3 data and development of trigger algorithm for the HL-LHC".

[12/2024] **Project Associate position at CERN**

Winner of the tender 2540 of 21 October 2024 announced by the Istituto Nazionale di Fisica Nucleare for the position of Project Associate (PJAS) at CERN for the duration of one year.

[12/2023] **Assegno di ricerca di Categoria B – Tipologia I**

Winner of the tender N. 190/2023 (Prot. 2098 of 22-06-2023) announced by the University of Rome "La Sapienza" for the assignment of a research grant ("*Assegno di ricerca di Categoria B – Tipologia I*") for a project titled "Development of innovative methods of real-time event selection for applications in elementary particle physics".

[09/2021] **Tutoring assignment**

Winner of the tender N. 10/2021 for tutoring assignment ex legge N.170/2003 for PhD students (2021-1147-1439-179439), announced by the University of Rome "La Sapienza".

[09/2020] **Scholarship for PhD courses**

Winner with scholarship of the tender for the admission to the PhD courses in Physics for the Academic Year 2020/2021 (XXXVI cycle) announced by the University of Rome "La Sapienza" (DR n. 1638/2020 – Prot. N. 46031 del 30/06/2020).

[03/2020] **Scholarship for "Attività di formazione scientifica" for university students**

Winner of the tender 21364 of 6 August 2019 announced by the Istituto Nazionale di Fisica Nucleare, for a scholarship on activities of scientific education for university students ("*Attività di formazione scientifica*").

TEACHING

[09/2021 – 02/2022] **Tutoring activity**

Tutoring activity for the course "Laboratorio di Fisica Computazionale I" at the Department of Physics of the University of Rome La Sapienza in the Academic Year 2021-2022.

Ai fini della pubblicazione

Roma, 07/10/2025