



Federico Morodei

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Nationality: Italian

WORK EXPERIENCE

[Feb 2024 – Current]

Physics researcher ("Assegnista di ricerca")

University of Rome "La Sapienza", Department of Physics

City: Rome | **Country:** Italy

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 is also dedicated to the completion of the analyses on Drell-Yan di-tau cross-section measurement and leptoquark searches started during the PhD.

[Nov 2020 – Jan 2024]

PhD Student

University of Rome "La Sapienza", Department of Physics

City: Rome | **Country:** Italy

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.

[Feb 2020 – Oct 2020]

University of Rome "La Sapienza", Department of Physics

Master student

City: Rome | **Country:** Italy

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

[Nov 2020 – Jan 2024]	PhD <i>University of Rome “La Sapienza”, Department of Physics</i> 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
[Sep 2018 – Oct 2020]	Master degree <i>University of Rome “La Sapienza”, Department of Physics</i> 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
[Sep 2015 – Sep 2018]	Bachelor degree <i>University of Rome “La Sapienza”, Department of Physics</i> City: Rome Country: Italy Final grade: 110/110 cum laude Thesis: The Transition Radiation Detector of the AMS-02 experiment

CONFERENCES AND SEMINARS

[30 Sep 2024 – 4 Oct 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 Sep 2024 – 18 Sep 2024]	XVII ATLAS Italia workshop Rome, Italy
[7 May 2024 – 10 May 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 Sep 2023 – 20 Sep 2023]	XVI ATLAS Italia workshop Rimini, Italy Participated with a talk titled “Status of L0 Muon TDAQ for the Phase-II Upgrade”.
[12 Apr 2023 – 14 Apr 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 Sep 2022 – 23 Sep 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 Jun 2022 – 29 Jun 2022] **XV ATLAS Italia Workshop** Pisa, Italy

[16 Oct 2021 – 23 Oct 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 Sep 2021 – 17 Sep 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 Sep 2020 – 18 Sep 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"*.

OUTREACH

[24 Feb 2022] **International Masterclass on Particle Physics**

Event organised by INFN Sezione di Roma.

PUBLICATIONS

Publications with the ATLAS Collaboration

ATLAS Active Author since February 2022. Author of 267 papers with the ATLAS Collaboration.

[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.

GRANTS AND SCHOLARSHIPS

[Dec 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".

[Sep 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".

[Sep 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).

[Mar 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

[Sep 2021 – Feb 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.

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

Autorizzo il trattamento dei miei dati personali ai sensi del Dlgs 196 del 30 giugno 2003 e dell'art. 13 GDPR (Regolamento UE 2016/679) al fine della pubblicazione

Roma, 9 Nov 2024