Elena Pompa Pacchi

Curriculum Vitae

Academic employment

July 2024 – Now
Postdoctoral Research Associate, *The University of Oklahoma*, CERN, Geneva.
- Postodoctoral position with the University of Oklahoma, fully based at CERN;
- Convener of the LUP sub-group;
- Long Lived Particle and unconventional searches, (ID) operations for the ATLAS detector, Combined Performance work (jet calibration);
- PhD students supervision.

Education

Nov. 2020 – May. 2024
PhD in Physics, *Sapienza University*, Rome.
- PhD (with scholarship) in collaboration with the ATLAS experiment at CERN under the supervision of Prof. Stefano Giagu and Dr. Valerio Ippolito;
- My research was focused on Dark Sector searches at the ATLAS experiment;
- I contributed actively to the upgrade of the muon trigger system for the High-Luminosity phase of the LHC;
- I chose *Deep Learning Methods in Physics* and *Probability and Measure Uncertainty* as PhD exams and I passed them with 30/30;
- I defended my PhD thesis on the 30/05/2024 achieving the highest grade.

Mar. 2023 – Mar. 2024
Doctoral Student at CERN, *CERN*, Geneva.
- I was selected for a one-year Doctoral Student position at CERN (with scholarship), where I carried out my PhD project.

Sep. 2017 – March 2020
MSc in Physics, *Sapienza University*, Rome, *110 with honors/110*.
- MSc thesis titled "Constraining the Dark Sector with Monojet signature at the LHC", with the ATLAS experiment and under the supervision of Prof. Stefano Giagu (internal) and Dr. Cristiano Sebastiani (external);
- Theoretical curriculum focused on Quantum Field Theory and High Energy Physics with insights of General Relativity;
- Within the *Physics Laboratory II* exam I characterised a dual-readout calorimeter with the DREAM (Dual REAdout Method) experiment, aimed at distinguishing between Cherenkov and scintillation light produced by cosmic rays traversing a BGO crystal.

Sep. 2014 – Sep. 2017
BSc in Physics, *Sapienza University*, Rome, *110/110*.
- BSc thesis in Experimental Particle Physics titled "Dark Matter direct search with double-phase TPC detectors" under the supervision of Prof. Stefano Giagu;
- General Physics curriculum, where I chose *Applied Physics* and *Fluid Dynamics applied to Astrophysics* as free BSc exams.

Sep. 2009 – July 2014
Liceo Classico, *Liceo Classico Torquato Tasso*, Rome, 90/100.

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Research Activity

October 2025 - now
Main developer, *Dense Neural Network Monte-Carlo to Monte-Carlo jet calibration*.
Developing a MC-to-MC unconventional jet calibration such that the reconstructed jet energy resulting from hadronic activity is as close as possible at the generator level one. The jet collection considered is the one used by LLP analyses, relying only on calorimeter information, as the exploitation of standard tracking causes losses in efficiency for displaced signatures. A ML-based calibration method is applied, where a DNN is trained to find the correction factor such that the reconstructed jet energy matches the true one, exploiting different jet features.

March 2026 - July 2026
Expert reviewer, *Z' search in dilepton final states in partial Run-3 and full Run-2 in ATLAS*.
Expert review of analysis looking for high mass spin 1 di-electron and di-muon resonances in the ATLAS full Run-2 and partial Run-3 2022-2024 dataset. This resulted in the publication *arXiv:2607.28334*

October 2025 - now
Sub-group convener, *Long-Lived and Unconventional Physics (LUP), Exotics*.
Sub-group convener for the LUP sub-group within the Exotics group. Organizing and streaming O(25) analyses and O(400) analyzers, holding weekly meetings with regular reports from teams. Streamlining internal review process with Editorial Boards, Expert reviews etc. Revising talks and slides for conferences where sub-group material is shown.

May 2025 - now
Detector Expert, *Semi-Conductor Tracker*.
Expert on call for the ATLAS Inner Detector, in particular for the Semi-Conductor Tracker.

Oct 2024 - March 2025
Expert reviewer, *Early Run-3 search for high mass Displaced vertices and displaced muons*.
Expert review of analysis looking for displaced vertices and displaced muons in the ATLAS Run-3 2022-2024 dataset. This resulted in the publication *PLB-D-26-00533*

Oct 2024 - March 2025
Expert reviewer, *Run-2 displaced Heavy Neutral Leptons search at ATLAS*.
Expert review of analysis looking for displaced Heavy Neutral Leptons in the ATLAS Run-2 dataset. This resulted in the publication *JHEP07(2025)196*

July 2024 - now
Analysis contact, *Run-3 Higgs to displaced vertices and jets search at ATLAS*.
Analysis contact for a search looking for SM extensions including long-lived (pseudo)-scalars, produced via BSM decays of the Higgs boson through the Higgs portal and decaying hadronically into a pair of b-quarks. Coordinating an analysis team with 20 members, of which 5 are PhD students, in different universities and time-zones. This search exploits for the first time the gluon-gluon fusion (ggF) Higgs boson production mechanism, using a newly developed trigger targeting an ISR jet and up to two displaced jets, and the Vector Boson Fusion (VBF) production mechanism, targeting a VBF topology in the so-called VBF delayed stream. This search will exploit the Large Radius Tracking, to target displaced tracks, and a displaced jet tagger, identifying BSM displaced jets.

March 2023 - now
Detector shifter, *Inner Detector and Muon Desk shifter*.

March 2021 - October 2025 **Main analyser**, *Run-2 Prompt Lepton-Jet searches at ATLAS*.
Responsible for the analysis of the *muonic channel* of the search for events where two *lepton-jets*, collimated pairs of light leptons, are reconstructed. I designed and optimised the analysis strategy with the usage of tailor-made discriminant variables, the background evaluation, fully data-driven and based on the bump-hunting technique. The result of this search is interpreted in the context of dark sector model searches with promptly-decaying neutral particles. In this context, I have supervised a master student working on the *mixed channel*, where a lepton-jet built with muons and one built with electrons are found. The result of this search have been published on *EPJC-24-07-135*.

March 2021 - May 2024 **Firmware developer**, *Development and testing of the FPGA monitoring and initialization procedure for the L0 muon-trigger upgrade for HL-LHC*.
Taking part in the upgrade for the barrel muon trigger which will comprise testing the interfaces with detectors, central trigger, MDT-TP (Monitored Drift Tube-Trigger Processor) and DAQ (Data AcQuistion), as well as running the whole system with simulated hits. I developed of a communication protocol between a MPSoC (Multi-Processor System on Chip) and a FPGA (Field Programmable Gate Array), that has been successfully tested on an FPGA evaluation board available at Sapienza laboratories. This work, that granted me ATLAS authorship rights, has been tested succesfully at CERN, where a Virtex Ultrascale+ and a Zynq Ultrascale+ were available.

June 2020 - Oct 2021 **Analyser**, *Run-2 displaced Dark Photon at ATLAS*.
Performed truth studies of kinematic distributions for signal and developed the life-time reweighting algorithm to extrapolate signal strength limits to mean lives of the dark photons different from the generated ones in the MC simulations.

June 2019 - June 2021 **Main analyser**, *Dark Sector searches with the monojet signatures at ATLAS*.
Gave the leading contribution to the reinterpretation of the search for final events with at least one energetic jet and missing transverse momentum in the context of dark sector models with long-lived non-charged particles. The resulting constraints extend those from dedicated searches at large proper lifetimes and have been documented in ATL-PHYS-PUB-2021-020.

Schools, workshops and trainings

11th of Feb to 1st of May 2026 — **Leading in ATLAS program**, *CERN, Geneva*, Switzerland.
Selected for three months program to improve leadership skills, with weekly meetings with colleague, bi-weekly meeting with the mentor and the full cohort, three day-long meetings to kick-off and end the program.

1st to 5th of July 2024 — **14th Long Lived Particles workshop**, *Tokyo*, Japan.
Fourteenth LLP Community workshop with discussions about searching for long-lived particles at the LHC and beyond.

7th to 10th of May 2024 — **SM @ LHC**, *Rome*, Italy.
Conference about most recent LHC results in terms of SM precision measurements.

6th to 19th of September 2023 — **European School of High Energy Physics**, *Greena*, Denmark.
School organised by the CERN collaboration aimed at students at the end of their PhD. The school is comprised of 33 lectures about High Energy Physics topics, mostly from a theory perspective.

19th to 23th of June 2023 — **13th Long Lived Particles workshop**, *CERN*, Geneve.
Thirteenth LLP Community workshop with discussions about searching for long-lived particles at the LHC and beyond.

13th to 27th of June 2022 — **ISOTDAQ School**, *INFN Catania, Catania University*, Catania.
The International School of Trigger and Data AcQuisition provided an overview of the basic instruments and methodologies used in High Energy Physics, emphasizing the main building blocks as well as the different choices and architectures at different levels of complexity. The school envisaged both theoretical and practical lectures, with laboratory hands-on sessions.

15th to 20th of May 2022 — **INFN School of Statistics**, *INFN Napoli, Federico II University*, Paestum.
International school aimed at providing an overview of statistical methods and tools used in particle, astro-particle and nuclear Physics.

6th to 8th of Sep. 2021 — **Shedding light on X17**, *INFN, Sapienza University*, Centro Ricerche Enrico Fermi, Rome.
Workshop on evidence found by the ATOMKI collaboration for the hypothetical X17 particle. Theoretical interpretations of its possible discovery as well as present and future experiments aimed at confirming the result or at providing experimental evidence for its interpretation as a dark photon were discussed.

17th to 21st of Sep. 2018 — **Pisa School on Future Colliders**, *Pisa University*, Pisa.
International school focused on the most relevant design issues for future high-energy lepton and hadron colliders, with attention to the physics programs that can be addressed at the different machines.

Awards and Scholarships

Grant — **Sapienza grant for young researchers**, *2023*.
I was given the maximum available funding (4000€) grant for my research project.

Award — **SIF Best Communication**, *SIF 2022*, Parallel talk.
The parallel talk I gave at the SIF 2022 was selected among the best communications of the congress.

Award — **SIF Best Communication**, *SIF 2021*, Parallel talk.
The parallel talk I gave at the SIF 2021 was selected among the best communications of the congress.

Award **RECAST challenge award**, *ATLAS*, Analysis prize.
The analysis *Dark Sector searches with the monojet signatures at ATLAS* was awarded by the ATLAS collaboration for the outstanding relevance of the interpretation results of the mono-jet analysis in dark sectors predicting long-lived particles. Followed by the publication via an ATLAS public note (ATL-PHYS-PUB-2021-020).

Award **ARAP award for special involvement in LAB2GO project**, *LAB2GO 2018*.
My additional effort in addressing the needs of underprivileged high schools was rewarded by the ARAP (Associazione Romana per le AstroParticelle) association.

Scholarship **LAB2GO student-collaboration scholarship**.
Jan. 2022 – Oct. 2022
In collaboration with Sapienza University of Rome and the INFN (Istituto Nazionale di Fisica Nucleare), in the framework of the PCTO (Percorsi per le Competenze Trasversali e l'Orientamento), I was chosen for a project aimed at spreading in Secondary Schools the usage of laboratory experiments as a way of teaching Physics. I worked with a group of twenty high school students in two Rome high schools.

Scholarship **BibUp student-collaboration scholarship**.
Nov. 2018 – June 2019
In collaboration with Sapienza University of Rome and the SBN (Sistema Bibliotecario Nazionale), in the framework of the Alternanza Scuola Lavoro, I was selected for a project aimed at enhancing the bibliographic heritage of Secondary Schools by coordinating students that had joined the project. I worked with a group of a dozen high school students in two Rome high schools.

Scholarship **LAB2GO student-collaboration scholarship**.
Nov. 2017 – June 2018
In collaboration with Sapienza University of Rome and the INFN (Istituto Nazionale di Fisica Nucleare), in the framework of the Alternanza Scuola Lavoro, I was chosen for a project aimed at spreading in Secondary Schools the usage of laboratory experiments as a way of teaching Physics. I worked with a group of twenty high school students in four Lazio high schools.

Publications

As an ATLAS author (since the 31st of March 2022) I co-signed 402 peer-reviewed papers.

Since I was an ATLAS author, I directly contributed to the following publications.

- *Search for light neutral particles decaying promptly into collimated pairs of electrons or muons in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector*, arXiv:2407.09168, published on arXiv on July 14th, 2024 and on EPJC on February 10th, 2025 (Eur.Phys.J.C 85 (2025) 3, 335).

I directly contributed to the following publications, although I was not yet an ATLAS author.

- *Constraining the dark sector with the monojet signature in the ATLAS experiment*, ATL-PHYS-PUB-2021-020, published on June 9, 2021
- *Search for light long-lived neutral particles that decay to collimated pairs of leptons or light hadrons in pp at $\sqrt{s} = 13$ TeV with the ATLAS detector*, arXiv:2206.12181, JHEP06(2023)153, (July 2022), published by Journal of High-Energy Physics

Peer-reviewed conference proceedings.

- *Status and perspective of Dark Sector searches at ATLAS and CMS*, *PoS WIFAI2023 (2024) 009*, DOI: 10.22323/1.457.0009, published on March 12, 2024
- *Dark Sector searches in final states with prompt neutral particles with the ATLAS detector*, *Nuovo Cim.C 46 (2023) 100*, DOI: 10.1393/ncc/i2023-23100-4, published on July 27, 2023
- *Searches for BSM physics using challenging and long-lived signatures with the ATLAS detector*, *ATL-PHYS-PROC-2023-029*, url:`https://cds.cern.ch/record/2863958`, published on July 4, 2023
- *Dark sector searches with the mono-jet signature at the ATLAS detector at the LHC*, *Nuovo Cim.C 45 (2022) 5, 126*, DOI: 10.1393/ncc/i2022-22126-4, published on June 30, 2022
- *Constraining the Dark Sector with the Mono-jet signature with the ATLAS detector at the LHC*, *LHC, PoS, LHCP2021*, DOI: https://doi.org/10.22323/1.397.0254, published on November 17, 2021

As independent author, I contributed to the following papers.

- *Early Career Researcher Input to the European Strategy for Particle Physics Update: White Paper*, published on arXiv on February 25, 2025, arXiv:2503.19862. This paper was submitted as input to the European Strategy for Particle Physics of 2025.

Talks, posters and conference organizations

29th June-3rd of July 2026 — **16th Long Lived Particles workshop**, *Cambridge, England*, Sixteenth LLP Community workshop with discussions about searching for long-lived particles at the LHC and beyond..
Organizing committee

19th-21st of Oct. 2025 — **LHC BSM WG General meeting**, *CERN, Geneva, Switzerland*, Gaps in experimental coverage and new signatures for long-lived particles in ATLAS, CMS and LHCb.
Invited talk

8th-11th of Nov. 2023 — **WIFAI 2023**, *Rome, Italy*, Status and perspective of Dark Sector searches at ATLAS and CMS.
Invited plenary talk

27th-31st of Mar. 2023 — **DIS 2023**, *Michigan State University, East Lansing*, Searches for BSM physics using challenging and long-lived signatures with the ATLAS detector.
Talk in parallel session

12th to 16th of Sep. 2022 — **SIF 2022**, *Milano University, Milano*, Dark Sector searches in final states with prompt neutral particles with the ATLAS detector.
Talk in parallel session

13th to 17th of Sep. 2021 — **SIF 2021**, *Virtual*, Constraining the Dark Sector with the Mono-jet signature with the ATLAS detector at the LHC.
Talk in parallel session

7th to 12th of June 2021 — **LHCP2021**, *Virtual*, Constraining the Dark Sector with the Mono-jet signature with the ATLAS detector at the LHC.
Poster session

ATLAS relevant internal talks and posters

26th - 30th of October 2026 **ATLAS Exotics + HMBS workshop**, *Clermont Ferrand, France*, Annual Exotics + HMBS workshop. Part of the organizing committee as well as discussion leader for LHC BSM WG session related with LLPs..
Organizing committee and discussion leader

14th - 18th July 2025 **ATLAS Exotics + HMBS workshop**, *Edinburgh*, Scotland.
Talk about unconventional data streams in ATLAS

7th - 11th of September 2026 **Hadronic Calibration Workshop**, *Dortmund, Germany*, Monte-Carlo to Monte-Carlo calibration..
Session chair focusing on ML-based calibrations

14th - 18th July 2025 **ATLAS Exotics + HMBS workshop**, *Edinburgh*, Scotland.
Talk about unconventional data streams in ATLAS

21st - 25th October 2024 **ATLAS Exotics Workshop**, *Bologna*, Italy, Long Lived Particles session foreseeing vector, (pseudo-)scalar and fermionic portal.
Session chair

26th of June 2024 **Paper Approval Meeting**, Meeting for paper approval of the Prompt lepton-jets search using the ATLAS Run-2 dataset.
Paper Approval Meeting Talk

20th of Sep. 2023 **ATLAS Italia Workshop**, *Rimini, Italy*, Prompt lepton-jets at Run-2.
Talk

27th of Sep. 2022 **EXOTICS Workshop**, *Nikhef University, Amsterdam*, Prompt lepton-jets at Run-2.
Poster session

27th of Sep. 2021 **ATLAS Young**, Dark sector searches in final states with long-lived or prompt neutral particles.
Talk

20th of May 2021 **Mono-jet reinterpretation analysis closure presentation**, *Exotics Group Meeting*.
Analysis closure talk

13th of May 2021 **Uncovered signatures + Run 3 opportunities workshop**, *JDM+LPX+strong+CDM*, Constraining the Dark Sector with the Mono-jet signature.
Talk

4th of May 2021 **SUSY/Exotics/HDBS Recast Challenge**, Recasting mono-jet for long-lived particle scenarios.
Talk

Outreach and Other Activities

9th to 11th of Sep. 2024 **Guide for CERN prize trip organised for best sub-nuclear physics undergraduates students from INFN Rome-1 section**, *CERN*.
Workshop organised by the University of Roma La Sapienza and directed to its best undergraduate students in the course of Nuclear and Sub-nuclear Physics. I did three guided tours, to the Cern Control Center (CCC), SynchroCyclotron (SC), to the ATLAS Visitor Center (AVC) and to the Antimatter Decelerator (AD).

19th to 23rd of Aug. 2024 **Liverpool @ CERN Particle Physics School**, *CERN*.
Workshop organised by the University of Liverpool and directed to UK High School students. This school is an introduction to Particle Physics, covering the main areas of interest in the field. I gave a lecture about BSM Physics and then did three guided tours, to the CCC, SC and to AD.

May 2023 – now **CERN guide**, *CERN*.
I am a certified CERN guide of many CERN premises (CERN Control Center, ATLAS Vistor Center, Antimatter Decelerator, SynchroCyclotron, ATLAS underground cavern, CERN Data Center, CMS underground cavern)

February 2023 – now **INFN@Young Seminars Committee**, *INFN Rome 1*.
I am part of the organization committee of the INFN@Young seminars of the Rome 1 section of the INFN. This project is directed to early carreer researchers and its aim is to promote collaboration within young physicits of the department.

June 2021 – now **Sapienza PhD Seminars Committee**, *Sapienza Physics Department*.
I am part of the organization committee of the PhD seminars of the Sapienza Physics Department. This project envisages bi-weekly events held by PhD students and are directed both to PhD and Master students. Aims of this project are developing both soft and hard skills in an informal environment, enriching students' Physics background and creating a stronger sense of community among students. Special events have been organized too, with international speakers with various expertise.

Sep. 2021 – now **Gender Balance Working Group**, *Sapienza Physics Department*.
Along with other PhD students, I founded a group whose aim is to support the work on gender balance in the Sapienza Physics Department. The goal of the working group is to improve the gender balance of the department, by discussing challenges and proposing changes (for example via topical workshops), according to the collected statistics (e.g. through surveys sent to students and young researchers).

10th of Feb. 2023 **International Day of Women and Girls in Science (IDWGS)**, *Sapienza Physics Department*, `https://agenda.infn.it/event/34038`.
I took part to a workshop that has been organised by the Rome 1 group of ATLAS and CMS in the IDWGS. The event was directed to high school students that identify themselves as women and its aim was the promotion of Physics among young girls. My contribution was via a talk that I prepared and presented in collaboration with two other PhD students.

15th of March to 3rd of April 2022 **Art & Science Across Italy**, *INFN Rome*, Palazzo delle Esposizioni, Rome.
I took part in the final event of the Art & Science Across Italy, a project aimed at promoting scientific culture to high schools students using art as communicative mean. The final event was an exhibition at Palazzo delle Esposizioni in Rome with creations made by students.

24th of Feb. 2022 **International Masterclass on Particle Physics**, *Sapienza Physics Department*.
Tutor for the 24th of Feb. 2022 International Masterclass event on High Energy Physics directed to high school students.

11th of Feb. 2022 **International Day of Women and Girls in Science**, *Sapienza Physics Department*.
I took part in an event aimed at promoting science among young women in high schools.

8th to 10th of Nov. 2012 **IMUN (Iberian Model United Nations)**, *Lisbon, Portugal*.
I was chosen to take part in a simulation of the Council United Nations' Economic and Social Council deliberations.

28th of Oct. to 5th of Nov. 2010 **Festival del Cinema di Roma - Alice Nella Città**, *Rome, Italy*.
I was selected by the association "Alice nella Città" among 500 candidates to be part of the Young Jury for the Festival del Cinema di Roma, 2010 edition.

Languages

Italian	Native speaker	
English	C1	*CAE (Cambridge Advanced English) certificate obtained in 2014.*
French	A2	

Computer skills

Hardware design	VHDL, Xylinx Vivado, LabView
Programming Scripting	C, C++, Python, BASH
Data Analysis Visualization	ROOT, matplotbib, grafana, numpy
Machine Learning	tensorflow, keras, pytorch
Word Processing	LaTeX, Microsoft Word, Apple pages