Curriculum Vitae

Carlo Mancini Terracciano

June 9, 2025

Part I - General Information

Full Name	Carlo Mancini Terracciano
Citizenship	Italian
E-mail	carlo.mancini-terracciano@uniroma1.it
Spoken Languages	Italian (mother tongue), English (excellent knowledge), French (basic knowledge)

Part II - Education

Type	Date	Institution	Notes
PhD	January, 27 2015	"Roma Tre"	Thesis title: "Analysis and interpretation of Carbon ion fragmentation in the Bragg peak energy range". Supervisors: Prof. Filippo Ceradini, Dr. Alfredo Ferrari. Ph.D. student at Bern University (Jan. 2011-Jan. 2012) and at "Roma Tre" (Jan. 2012-Jan. 2015).
Master's Degree (Laurea Specialistica) in Particle Physics (DM 509/99 - Ordin. 2007 classe 20/S)	December, 20 2010	Sapienza	Final Mark: 110 cum laude / 110 Thesis title: *"Study of the correlated noise in an array of bolmeteric detectors"*. Supervisors: Prof. Fernando Ferroni, Dr. Marco Vignati.
Internship	July - September 2008	SLAC (Stanford)	Study of the exotic charmonioum state Y(4260) decay in $\psi(2s)\pi^+\pi^-$ within the BaBar collaboration. Mentor: Dr. Gianluigi Cibinetto.
Bachelor Degree (Laurea) in Physics (DM 509/99 - Ordin. 2002 classe 25)	October, 3 2007	Sapienza	Final mark: 106/110. Thesis title *"Study of the signal produced in a bolometric detector by a neutrinoless double beta decay"*. Supervisor: Prof. Riccardo Faccini.

Part III - Appointments

III.A - Academic Appointments

Starting date	Ending date	Institution	Position
October 2022	to date	Sapienza Physics Dep.	Assistant Professor (RTDB)
March 2020	September 2022	Sapienza Physics Dep.	Research Fellow (RTDA)
March 2019	February 2020	Sapienza Physics Dep.	Postdoc (Assegno di ricerca, Phys. Dep. grant for young researcher's projects)
March 2017	February 2019	INFN, Sec. of Rome	Postdoc (INFN CSN5 grant for young researcher's projects)
February 2015	February 2017	Sapienza Physics Dep.	Postdoc (Assegno di ricerca)
April 2015	May 2015	CERN	COAS (Cooperation Associate scientist)
July 2012	January 2015	CERN	Research Fellow (within the Marie Skłodowska-Curie ITN "ENTERVISION" MSCA Grant Agreement: 264552)

Part IV - Teaching Experiences

Year	Institution	Lecture/Course
since 2022/23	Sapienza	**Teacher of the course "Laboratory of Computational Physics"** at the degree course in Physics.
since 2019/20	Sapienza	**Teacher of the course "Physics I"** at the degree course in Primary Education Sciences (Scienze della Formazione Primaria).
2022 - 2025	Sapienza	Supervisor of two Ph.D. students: Lorenzo Arsini and Francesca Nicolanti. Both got the degree "cum laude".
8th - 13th Jun. 2025	Porto Conte, Sassari	Lecturer and member of the scientific committee at the "XXII Seminar on software for Nuclear, Subnuclear, and Applied Physics".
9th - 15th Jun. 2024	Porto Conte, Sassari	Lecturer and member of the scientific committee at the "XXI Seminar on software for Nuclear, Subnuclear, and Applied Physics".
4th - 9th Jun. 2023	Porto Conte, Sassari	Lecturer and member of the scientific committee at the "XX Seminar on software for Nuclear, Subnuclear, and Applied Physics".
5th - 12th Jun. 2022	Porto Conte, Sassari	Lecturer at the "IXX Seminar on software for Nuclear, Subnuclear, and Applied Physics".
Oct. 2022	INFN sec. of Perugia	Teacher of the "Advanced Python course for scientific purposes".
Nov. 2019	INFN sec. of Perugia	Teacher of the "Python Introductory Course with emphasis on data-science problems".
2018/19 - 2019/20	Roma Tre	Teacher of the course "Introduction to Monte Carlo methods" for the Ph.D School in Physics.
2018/2019	Sapienza	Teaching assistant in the "Applied Physics" for the Physics course.
Jun. - Jul. 2019	INFN sec. of Firenze	Lecturer in the "Geant4 INFN course: from beginner to advanced".
26th - 30th Nov. 2018	TIFPA Trento	Lecturer in the "VI International Geant4 School".
24th Jun. - 14th Jul. 2018	Univ. of Windhoek (Namibia)	Lecturer of the "Introduction to Geant4" course during the "Fifth African School of Fundamental Physics and its Applications".

2017	CNAO, Pavia	Lecturer in the Summer School organised by the CERN Marie Skłlodowska-Curie ITN "MEDICIS-Promed"
2016	iThemba Laboratories, Cape Town (South Africa)	Teacher of the "Monte Carlo Radiation Transport and FLUKA" course
2015 and 2016	Sapienza	Teaching assistant in the "Scientific Programming" for the Physics course.
2013	CERN	Co-supervisor of a summer student internship at CERN about the development with CUDA of an efficient pseudo-random number generation algorithm for FLUKA.
2011	University of Bern (Switzerland)	Teaching assistant in the Physics II for Chemistry, Pharmacy, Philosophy, Mathematics and Informatics.and in the Laboratory of modern Physics for physicists.

Part V - Society memberships, Awards, Honours and Coordination roles

Year	Title
11/11/2020	**Qualified** (Abilitazione Scientifica Nazionale) as Associate Professor (II Fascia) for Applied Physics (S.C. 02/D1 Quinto Quadrimestre).
2017 - 2019	National **PI** and coordinator of the INFN research project (sigla) "**GeNIALE**".
2018	**Creator** and **PI** of the research project **"ANIMA"** (Accelerate the computation of a Nuclear Interaction model for Medical Applications, Proposal Number: 840121) submitted as a Marie Skłlodowska-Curie Individual Fellowship (Call: H2020-MSCA-IF-2018). ANIMA got the **Seal of Excellence**.
since 2017	Member of the Geant4 collaboration.
2016	**Qualified** as a III level researcher at the INFN public selection n.: 18221/2016.
2012	**Marie Skłlodowska-Curie Fellowship** within the "ITN ENTERVISION" (MSCA Grant agreement: 264552).
2012 - 2016	Member of the FLUKA collaboration.
2012	**Responsible** for the "Work Package 2" (activities and scientific direction) of the popular science event "RESPECT (FP7-316436)" granted to the non-profit organisation "Frascati Scienza" (www.frascatiscienza.it) by the European Commission within the "European Researchers' Night" project[a].
2011 - 2016	**President** and founder of the "Rome Young Minds Section" of the European Physics Society.
since 2010	**President** and founder of the non-profit organisation "Accatagliato", recognised by the Region of Lazio as NGO. The association is devoted to Science popularisation and it is an official partner of Frascati Scienza for the organisation of the European Researchers' Night in Rome since 2011. Moreover, the association is publisher of the popular science magazine "Accastampato"(www.accastampato.it).

Part VI - Funding Information

Year	Role	Title	Program	Grant value

2021 - on going	PI	Development of ionization models in Geant4-DNA to simulate cosmic rays effects on ion-molecules reaction in the atmosphere	PON "Ricerca e Innovazione" 2014-2020, Asse IV "Istruzione e ricerca per il recupero" con riferimento all'Azione IV.5 "Dottorati su tematiche green". DM 1061/2021	approx. € 45 000
2021 - on going	I	WIDMApp	INFN	€ 50 000
2020 - on going	PI	ADeLE (Advancing Deep Learning in medical applications through Explainability)	Sapienza research project (medium)	€ 13 000
2020 - on going	I	MUCCA (Multi-disciplinary Use Cases for Convergent new Approaches to AI explainability)	CHIST-ERA IV – Call 2019	€ 200 000
2019 - 2020	PI	Emulation of the BLOB nuclear interaction model with Deep Learning	Sapienza Physics Dep. grant for young researchers.	approx. € 30 000
2019 - on going	I	NEPTUNE (Nuclear process-driven Enhancement of Proton Therapy. UNravEled)	INFN call CNS 5	€ 14 000
2017 - 2019	PI	'**GeNIALE**" (Geant Nuclear Interaction At Low Energy)	INFN CSN5 grant for young researchers.	approx. € 90 000
2017	PI	Computing resources for GeNIALE (Grant n.: CRM:0740173)	Microsoft "Azure Research Award"	$ 20 000
2017 - 2018	I	CHIR2	INFN	€ 40 000
2015 - 2016	I	CHIRONE	INFN	€ 30 000

Part VII -   Research Activities

Low energy models development and applications

I had been the **PI** of the research project GeNIALE, aimed at improving the Geant4 performances in simulating nuclear reactions below 100 MeV/n. GeNIALE has been financed by INFN for two years and by the Physics Department of Sapienza for another year. I benchmarked the models already available in Geant4 (this work has been included in the official benchmark system of the Geant4 collaboration [10]) and I interfaced a dedicated model called BLOB (Boltzmann-Langevin One Body) with Geant4, optimising its free parameters to simulate ^{12}C fragmentation and designed and developed a coalescence model in between BLOB and the Geant4 de-excitation phase [12]. I am now working, and supervising a Ph.D. student on the topic, on the possibility of emulating BLOB with a Graph Deep Learning (DL) algorithm [6]. We will also participate in a specific action of the INFN NSC4 to develop hybrid models using DL. For this research project, I settled collaborations with M. Colonna, P. Cirrone and L. Pandola from Laboratori Nazionali del Sud (INFN), P. Napolitani from Institut de Physique Nucléaire of Orsay (France), B. Caccia from Istituto Superiore di Sanità (Italy), and M. Asai, A. Dotti and D. Wright from SLAC (California, US).

I worked at CERN in the FLUKA development team. I worked on the ^{12}C fragmentation after an interaction of few tens of MeV/n. In particular, I contributed in the implementation of α particle emission in the pre-equilibrium phase. I had been the responsible of the analysis and the MC simulation of an experiment carried out at the iThemba Laboratories (Cape Town, SA) that measured the ^{12}C fragmentation in the interaction with fixed targets at 33 MeV/n.

Finally, I proposed a project to develop electromagnetic interaction models in Geant4-DNA to simulate cosmic rays interaction with molecules of interest for chemical reactions in atmosphere.

This project has been granted with a Ph.D. scholarship and I am supervising the candidate. For this project I settled a collaboration with A. Cartoni and M. Satta (Sapienza Chemistry Department) and S. Incerti (Bordeaux University).

Medical applications of Nuclear Physics

Within the Applied Radiation Physics Group (ARPG) collaboration, I participated in the development of an intra-operative probe for radio-guided surgery with $\beta-$ radiation (CHIRONE and CHIR2 INFN projects). I was the responsible for the Monte Carlo (MC) simulation. I participated in the evaluation of the CMOS technology to develop the radio-guided surgery detector and in the possibility of developing a multi-channel detector with a single para-therphenyl crystal [15]. I am now involved in the WIDMApp project, a multi-channel radiation detector and data processing system for in vivo patient measurement and collection of radiopharmaceutical biokinetic data aimed at monitoring the dose to sensitive organs in patients treated with Molecular Radiotherapy. I am the responsible of the MC simulation and the analysis. We recently published a study that shows the feasibility of such approach [8].

Medical Physics applications of Artificial Intelligence

I am exploring the possibility of using Deep Learning generative models to emulate the BLOB, in order to have the BLOB accuracy in a Geant4 simulation without its computation overhead. Preliminary results are encouraging [9]. I am also studying the possibility of using this approach to emulate the energy deposition of an electron beam to develop a treatment planning optimisation algorithm for FLASH radiotherapy based on Deep Learning. I am also supervising a Ph.D. student on that topic. I am participating in the MUCCA (Multi-disciplinary Use Cases for Convergent new Approaches to AI explainability) project, aimed at developing and testing methodologies that allow to interpret the predictions of the Artificial Intelligence (AI) algorithms in terms of transparency, interpretability, and explainability. On the same topic I proposed and lead the ADeLE (Advancing Deep Learning in medical applications through Explainability) project, granted by Sapienza. I applied AI algorithms to analyse medical data, in particular to classify patient with rectal cancer on the basis of their response to chemio-radio therapy [13]. Finally, I proposed a project, and started a collaboration with B. Caccia (Istituto Superiore di Sanità), to improve lung ultrasound for interstitial pneumonia diagnosis.

Part VIII -   Summary of Scientific Achievements

Total Documents	63 (SCOPUS).
Total Citations	1'036 (SCOPUS).
Hirsch (H) index	18 (SCOPUS).

Selected Publications

Selected in the last 7 years. The ⋆ means I am the corresponding author for that paper and the † that I am the last author.

[1] P. Arce et al. "Results of a Geant4 benchmarking study for bio-medical applications, performed with the G4-Med system". In: *Medical Physics* (2025). DOI: 10.1002/mp.17678.

[2] † F. Nicolanti et al. "Reconstruction of time-activity curves in molecular radiotherapy using a Bayesian unfolding". In: *Physica Medica* 135 (2025), p. 104980. DOI: 10.1016/j.ejmp.2025.104980.

[3] † F. Nicolanti et al. "Geant4-DNA development for atmospheric applications: N2, O2 and CO2 models implementation". In: *Physica Medica* 128 (2024). DOI: 10.1016/j.ejmp.2024.104838.

[4] † L. Arsini et al. "Fast and precise dose estimation for very high energy electron radiotherapy with graph neural networks". In: *Frontiers in Physics* 12 (2024). DOI: 10.3389/fphy.2024.1443306.

[5] † F. Nicolanti et al. "Calculation of electron interaction models in N2 and O2". In: *Physica Medica* 114 (2023). DOI: 10.1016/j.ejmp.2023.102661.

[6] † L. Arsini et al. "Nearest Neighbours Graph Variational AutoEncoder". In: *Algorithms* 16.143 (2023), pp. 1 –17. DOI: 10.3390/a16030143.

[7] C. Mancini-Terracciano et al. "Experimental validation of an innovative approach in biokinetics study for personalised dosimetry of molecular radiation therapy treatments". In: *Physics in Medicine and Biology* 68.19 (2023). DOI: 10.1088/1361-6560/acf910.

[8] ⋆ S. Morganti et al. "Technical note: A wearable radiation measurement system for collection of patient-specific time-activity data in radiopharmaceutical therapy: system design and Monte Carlo simulation results". In: *Medical Physics* 48.12 (2021), pp. 8117–8126. DOI: 10.1002/mp.15311.

[9] ⋆† A. Ciardiello et al. "Preliminary results in using Deep Learning to emulate BLOB, a nuclear interaction model". In: *Physica Medica* 73 (2020), pp. 65–72. DOI: 10.1016/j.ejmp.2020.04.005.

[10] P. Arce et al. "Report on G4-Med, a Geant4 benchmarking system for medical physics applications developed by the Geant4 Medical Simulation Benchmarking Group". In: *Medical Physics* 48 (2020), pp. 19–56. DOI: 10.1002/mp.14226.

[11] ⋆ F. Collamati et al. "Radioguided surgery with $\beta-$ radiation in pancreatic Neuroendocrine Tumors: a feasibility study." In: *Scientific Reports* 10 (1 2020), pp. 1–10. DOI: 10.1038/s41598-020-61075-2.

[12] ⋆ C. Mancini-Terracciano et al. "Preliminary results coupling "Stochastic Mean Field" and "Boltzmann-Langevin One Body" models with Geant4". In: *Physica Medica* 67 (2019), pp. 116 –122. DOI: 10.1016/j.ejmp.2019.10.026.

[13] R. Ferrari, C. Mancini-Terracciano, et al. "MR-based artificial intelligence model to assess response to therapy in locally advanced rectal cancer". In: *European Journal of Radiology* 118 (2019), pp. 1–9. DOI: 10.1016/j.ejrad.2019.06.013.

[14] ⋆ F. Collamati et al. "Radioguided surgery with β radiation: a novel application with Ga68". In: *Scientific Reports* 8.1 (Oct. 2018), pp. 1–9. DOI: 10.1038/s41598-018-34626-x.

[15] ⋆ S. Morganti et al. "Position sensitive β- detector based on p-terphenyl scintillator for medical applications". In: *Journal of Instrumentation* 13.07 (P07001 July 2018), pp. 1–20. DOI: 10.1088/1748-0221/13/07/P07001.

Talks in international conferences

- *Preliminary results in using Deep Learning to emulate BLOB, a nuclear interaction model.* Talk at the IEEE Nuclear Science Symposium and Medical Imaging Conference, 28 October - 2 November 2019, Manchester (United Kingdom)

- *Interfacing a nuclear interaction model (BLOB) with Geant4.* Talk at the ICCR-MCMA Conference, 17-21 June 2019, Montreal (Canada)

- *Preliminary results in using Deep Learning to emulate BLOB, a nuclear interaction mode.* Talk at the ICCR-MCMA Conference, 17-21 June 2019, Montreal (Canada)

- *The interface of BLOB with Geant4.* Invited talk at the ENSAR2 workshop, 24-26 April 2019, CIEMAT Madrid (Spain)

- *Preliminary results coupling SMF and BLOB with Geant4* Third Geant4 International User Conference. 29-31 October 2018, Bordeaux (France).
- *Radio-guided surgery with $\beta-$ radiation: test on ex-vivo specimens.* Talk at SIRR-2018, 10-13 September 2018, Rome (Italy).
- *Preliminary results coupling SMF and BLOB with Geant4* First Biennial African Conference on Fundamental Physics and Applications. 28 June - 4 July 2018, Windhoek (Namibia).
- *Validation of Geant4 nuclear reaction models for hadrontherapy and preliminary results with SMF and BLOB* IUPESM 2018 World Congress on Medical Physics and Biomedical Engineering. 3-8 June 2018, Prague (Czech Republic).
- *Multivariate analysis of MR texture parameters for rectal cancer patient staging* IUPESM 2018 World Congress on Medical Physics and Biomedical Engineering. 3-8 June 2018, Prague (Czech Republic).
- *Radio-guided surgery with beta- radiation: test on ex-vivo specimens* IUPESM 2018 World Congress on Medical Physics and Biomedical Engineering. 3-8 June 2018, Prague (Czech Republic).
- *Monte Carlo study of beta-particle radio-guided surgery feasibility with a variety of radionuclides* IUPESM 2018 World Congress on Medical Physics and Biomedical Engineering. 3-8 June 2018, Prague (Czech Republic).
- *Validation of Geant4 nuclear reaction models for hadrontherapy and preliminary results with SMF and BLOB* International Conference on Monte Carlo Techniques for Medical Applications (MCMA2017). October 2017, Università degli Studi di Napoli (Italy).
- *Quasi-elastic break-up of ^{12}C in ^{8}Be and ^{4}He at an incident energy of 33 MeV/n.* 14th International Conference on Nuclear Reaction Mechanisms. 15-19 June 2015, Varenna (Italy).
- *Development of techniques to speed up the simulation of PET and SPECT for hadrontherapy monitoring.* ICTR-PHE (International Conference on Translational Research in Radio-Oncology and Physics for Health in Europe). 15-19 February 2014, Geneva (Switzerland).
- *Study of the correlated noise in a bolometric detector array.* 96° Congress of the Italian Physics Society. 20-24 September 2010, Bologna (Italy).

Invited seminars

- *Deep Learning and Monte Carlo simulations, opportunities and challenges.* TECH-FPA PhD Retreat 2025, LNGS L'Aquila (Italy).
- *Nuclear fragmentation models, interfacing BLOB with Geant4 and adapting it for applications.* "FOOT" (FragmentatiOn Of Target) Collaboration Meeting. 10th December 2023
- *Machine learning for medical applications of Physics.* AI-at-SLAC seminar. 16th January 2019, SLAC, Menlo Park (CA, US).
- *Artificial intelligence in MR image analysis.* Artificial Intelligence in Medicine. 3rd December 2018, Sapienza, Physics Dep., Rome (Italy)
- *The GeNIALE project.* 5th April 2017, Sapienza, Physics Dep., Rome (Italy)
- *MaRIANNe (MAgnetic Resonance Image Analysis with Neural NEtworks).* 2nd February 2017, Roma Tre, Physics Dep., Rome (Italy)

Ai sensi degli art. 46 e 47 del D.P.R. 445/2000 il sottoscritto Carlo Mancini Terracciano, consapevole della responsabilità penale prevista dall'art. 76 del D.P.R. 445/200 per le ipotesi di falsità in atti e dichiarazioni mendaci ivi indicate dichiara che le informazioni sopra riportate sono veritiere.

Roma, June 9, 2025

Carlo Mancini Terracciano