# Micol De Simoni

*Curriculum Vitae*

## Personal Information

**Fiscal code:** DSMMCL92D69H501S  **Date of birth:** 29/04/1992
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**Nationality:** Italian  **Linkedin:** linkedin.com/in/micol-de-simoni-481a6311a

## Education

2017–Present  **PhD in Accelerator Physics**.
"Sapienza", University of Rome.
Title of thesis: "Development of tools for quality control on therapeutic Carbon beams with a fast MC code (FRED)"
Supervisor: Professor Vincenzo Patera

2015–2017  **Master's degree of Particles Physics**.
"Sapienza", University of Rome.
*110 cum laude/110*
Title of thesis: "Characterisation of an innovative detector for on-line dose monitoring during treatment with particles therapy"
Supervisors: Professor Riccardo Faccini. Co-supervisor: Professor Alessio Sarti
Curriculum focuses in Experimental Particle Physics and Medical Physics

2011–2014  **Bachelor degree in Physics**.
"Sapienza", University of Rome.
*97/110*
Title of thesis: "The cyclotron for the production of PET tracers"
Supervisor: Professor Riccardo Faccini

## Teaching Activities

2018–2020  **Lectures and workshop assistant**, *Course of Physics I (Classical Mechanics and Thermodynamics)*, for Mechanical Engineer students held by Professor M. Rossi and Professor A. Sarti.
*SBAI Department, "Sapienza", University of Rome*

2018  **Co-supervisor of a Bachelor Student**.
*Physics Departments, "Sapienza", University of Rome*

2014–2016  **Physics lab assistant**, *Thermodynamic, mechanic and electronic laboratory, Laboratori Bruno Pontecorvo*.
*Physics Department, "Sapienza", University of Rome*

## Research Performances

**h index:** 3 with 24 publications, plus 2 in press, in refereed international journals for a total of 26 citations (database: http://www.scopus.com)

**Presentations:** 9 presentations at national and international conferences (5 Oral Presentations and 4 Poster Presentations)

**Review:** 1 review in a refereed international journal (Scientific Reports)

## Attended Conferences

**Nov. 2020, Oral Presentation** — **IEEE Nuclear Science Symposium and Medical Imaging Conference - Online**, "In vivo verification of carbon ion therapy treatments at CNAO by means of charged fragments detection".

**Nov. 2020, Poster Presentation** — **IEEE Nuclear Science Symposium and Medical Imaging Conference - Online**, "Study Fragmentation model of carbon ion for Treatment Planning System with a fast MC code (FRED)".

**Nov. 2020, Poster Presentation** — **IEEE Nuclear Science Symposium and Medical Imaging Conference - Online**, "Study of secondary neutron production in PT treatments using MONDO, an innovative ultra-fast neutrons tracker".

**Sept. 2019, Oral Presentation** — **International Conference on Medical Accelerators and Particle Therapy - Seville (Spain)**, "A data-driven nuclear fragmentation model for a fast Monte-Carlo code, FRED, in Particle Therapy with Carbon beams".

**Sept. 2019, Poster Presentation** — **International Conference on Medical Accelerators and Particle Therapy - Seville (Spain)**, "Spectrum and flux measurements of secondary ultra-fast neutrons produced in Particle Therapy treatments using the innovative MONDO tracker".

**Jun. 2019, Oral Presentation** — **10th Young Researcher Meeting - Rome (Italy)**, "FRED: a fast Monte Carlo code on GPU for quality control in Particle Therapy".

**Jan. 2019, Oral Presentation** — **57th International Winter Meeting on Nuclear Physics - Bormio (Italy)**, "The Dose Profiler tracker: an online Particle Therapy monitor".

**Sept. 2018, Oral Presentation** — **Società italiana per le ricerche sulle radiazioni - Roma (Italy)**, "In-room characterization, using an anthropomorphic phantom, of a novel detector for on-line dose monitoring in light ions cancer therapy" ).

**Sept. 2018, Poster Presentation** — **Società italiana per le ricerche sulle radiazioni - Roma (Italy)**, "Applications in Particle Therapy of FRED, a fast Monte Carlo code on GPUs for energy deposition of proton beams in matter".

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## Attended School

**14 Oct. - 31 Dic. 2020)** **Scuola MRI Prof. Girolamo Garreffa - Metodi e Tecniche di Risonanza Magnetica**, Online.

The course, organized by the Sicilian School of Radiation Protection "S. Masculine", aims both to provide basic knowledge on the physical principles of magnetic resonance imaging and the instrumentation used to acquire MR images and to show the applications in the clinical setting also through the use of advanced MR techniques. In addition, recent applications of artificial intelligence in the field of MRI are presented.
https://sites.google.com/community.unipa.it/scuolamri2020

**15 Sept. - 1 Oct. 2019** **The ESA-FAIR Space Radiation School**, Darmstadt, Germany.

The ESA-FAIR Radiation Summer School has been established to train students in basic heavy ion biophysics for both terrestrial and space applications. It contributes to research and development in the field of biomedical and biophysical applications of heavy ions in Europe and it highlights ESA's commitment to stimulate the pursuit of education in the Science, Technology, Engineering and Mathematics (STEM) disciplines as well as to foster interest and generate expertise relevant to Human Spaceflight activities.
https://www.gsi.de/work/forschung/biophysik/esa_summer_school.htm

**7 Jan.-8 Feb. 2018** **JUAS, Joint Universities Accelerator School**, Archamps, France.

Taught by leading European particle accelerators specialists, JUAS delivers a regularly updated, academically accredited training program in partnership with CERN and a cluster of 16 European universities. At the end of the school participants have to undergone an exam to verify the acquired competences.
I passed it with 13.70/20.
http://www.esi-archamps.eu/Thematic-Schools/Discover-JUAS

**17-22 July, 2016** **HASCO Summer School**, University of Göttingen, Germany.

The main objectives of the hadron collider physics school were introductory topics in elementary particle physics, in particular in hadron collider physics as relevant for research at the Large Hadron Collider (LHC).
http://hasco.uni-goettingen.de    https://youtu.be/VZAtX29uoiw

## Funded Projects

**As Principal Investigator:**

**2018-2019** ***"Avvio alla ricerca" ("Young researcher financing")*** , "Low intensity ion monitoring: new developments in particle therapy.".
*"Sapienza", University of Rome*
Funding: 1000€

**As a Member:**

**2019-2021** ***"Grant INFN CSN5"***, "PAPRICA" - The PAir PRoduction Imaging ChAmber.
Funding: 75k€

## Research Activity

During my Master Thesis, my activity was focused on the development of a new detector, the Dose Profiler, a tracker detector capable of monitoring online Particle Therapy treatments in combination with a PET detector to be operated within the INSIDE (*Innovative Solution for monitoring in Hadrontherapy*) project. I have assembled and characterized the detector and I have tested it using the Proton and Carbon ion beams available at CNAO (*Centro Nazionale di Adroterapia*

*Oncologica*) measuring the secondary radiation produced by the interactions PMMA targets and on an anthropomorphic phantom in a treatment room with clinical-like conditions. I have been part of the first clinical trial of the INSIDE detectors at CNAO. The obtained results have been published in peer-reviewed journals [9][16][25][26] and I had the opportunity to present them in the context of an international conference. Furthermore, I gained experience in dealing with the problems related to the clinical context.

During my Ph.D I decided to continue my research activity in the *Applied Radiation Physics Group* (ARPG) focusing my contribution to the development of tools for quality control of therapeutic Carbon beams with a fast MC code, called **FRED** (*Fast paRticle thErapy Dose evaluator*) [1]. I implemented the algorithms needed to account for the detailed nuclear model describing the interactions of the $^{12}$C ions with the matter. This is a crucial step towards the implementation of complete modeling of the interactions between the beam and the patient body. As the beam fragmentation process is related to the dose release outside the tumor region its description is of paramount importance and has been accurately modeled. I had the opportunity to present the state of the art of the implementation of FRED software in international conferences.

Within the ARPG group, I contributed also to the FOOT (*FragmentatiOn Of Target*) collaboration [2][5][14][20][24], aiming to significantly improve the precision on the proton Relative Biological Effectiveness (RBE) measurements for particle therapy applications. I also contributed to and on a project in which radioguided surgery can be performed through a novel probe exploiting the detection of $\beta$ radiation[6][7][8][15][18][22]. Moreover, using the knowledge acquired with the Dose Profiler, I participated in the development of the MONDO [11][16][17][19][23] detector, a fiber tracker optimized for the detection of secondary neutrons produced during Particle Therapy treatments.

## Publications

**[1]** De Simoni M. et al. "FRED: A fast Monte Carlo code on GPU for quality control in Particle Therapy". In: *Journal of Physics: Conference Series* 1548 (2020), p. 012020. DOI: 10.1088/1742-6596/1548/1/012020

**[2]** Dong Y. et al. "The Drift Chamber detector of the FOOT experiment: Performance analysis and external calibration". In:*Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 986 (2020), DOI: 10.1016/j.nima.2020.164756

**[3]** Mattei I. et al. "Charged particles and neutron trackers: Applications to particle therapy". In: *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 954 (2020), DOI: 10.1016/j.nima.2018.09.064

**[4]** Mattei I. et al. "Measurement of 12C Fragmentation Cross Sections on C, O, and H in the Energy Range of Interest for Particle Therapy Applications". In: *IEEE Transactions on Radiation and Plasma Medical Sciences* 4, pp 269-282 (2020), DOI: 10.1109/TRPMS.2020.2972197

**[5]** Traini G. et al. "Performance of the ToF detectors in the foot experiment". In: *Nuovo Cimento della Societa Italiana di Fisica C* 43 (2020), DOI: 10.1393/ncc/i2020-20016-5

**[6]** Morganti S. et al. "Tumor-non-tumor discrimination by a $\beta^-$ detector for Radio Guided Surgery on ex-vivo neuroendocrine tumors samples", In: *Physica Medica* 72 (2020), pp. 96-102, DOI: 10.1016/j.ejmp.2020.03.021

**[7]** Collamati F. et al. "Radioguided surgery with $\beta^-$ radiation in pancreatic Neuroendocrine Tumors:

a feasibility study". In:*Scientific Reports* 10 (2020), p. 4015. DOI:10.1038/s41598-020-61075-2

**[8]** Collamati F. et al. "A DROP-IN beta probe for robot-assisted $^{68}Ga$-PSMA radioguided surgery: first ex vivo technology evaluation using prostate cancer specimens". In: *EJNMMI Research* 10,92 (2020). DOI: https://doi.org/10.1186/s13550-020-00682-6

**[9]** Traini G. et al. "Review and performance of the Dose Profiler, a particle therapy treatments online monitor". In: *Physica Medica* 65 (2019). pp. 84-93. DOI:10.1016/j.ejmp.2019.07.010

**[10]** Rucinski A. et al. "Secondary radiation measurements for particle therapy applications: Charged secondaries produced by 16O ion beams in a PMMA target at large angles". In: *Physica Medica* 64 (2019). pp. 45-53. DOI: 10.1016/j.ejmp.2019.06.001

**[11]** Gioscio E. et al. "Development of a novel neutron tracker for the characterisation of secondary neutrons emitted in Particle Therapy". In: *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 958 (2019). pp. 162862. DOI: 10.1016/j.nima.2019.162862

**[12]** Manuzzato E. et al. "A $16 \times 18$ Digital-SiPM Array with Distributed Trigger Generator for Low SNR Particle Tracking". In: *ESSCIRC 2019 - IEEE 45th European Solid State Circuits Conference* (2019). pp. 75-78. DOI:10.1109/ESSCIRC.2019.8902571

**[13]** Montesi M. C. et al. "Ion charge separation with new generation of nuclear emulsion films". In: *Open Physics* 17 (2019). pp. 233-240. DOI: 10.1515/phys-2019-0024

**[14]** Morrocchi M. et al. "Development and characterization of a $\Delta$E-TOF detector prototype for the FOOT experiment". In: *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 916 (2019).pp. 116-124. DOI: 10.1016/j.nima.2018.09.086

**[15]** Collamati F. et al. "Characterisation of a $\beta$ detector on positron emitters for medical applications", In: *Physica Medica* 67 (2019). pp. 85-90, DOI: 10.1016/j.ejmp.2019.10.025

**[16]** De Simoni M. et al. "In-room test results at CNAO of an innovative PT treatments online monitor (Dose Profiler)". In: *IL NUOVO CIMENTO 41 C* 209 (2018). DOI: 10.1393/ncc/i2018-18209-2

**[17]** Fischetti M. et al. "Characterisation of the secondary-neutron production in particle therapy treatments with the MONDO tracking detector". In: *IL NUOVO CIMENTO 41 C* 206 (2018). DOI: 10.1393/ncc/i2018-18206-5

**[18]** Collamati F. et al. "Radioguided surgery with $\beta$ radiation: a novel application with Ga$^{68}$". In. *Scientific Report* 8 (2018). p. 16171. DOI:10.1038/s41598-018-34626-x

**[19]** Giacometti V. et al. "Characterisation of the MONDO detector response to neutrons by means of a FLUKA Monte Carlo simulation". In: *Radiation Measurements* 119 (2018). pp. 144-149. DOI: 10.1016/j.radmeas.2018.10.006

**[20]** Valle S. M. et al. "The FOOT (FragmentatiOn Of Target) experiment". In: *IL NUOVO CIMENTO 41 C* 41 (2018). p. 169. DOI: 10.1393/ncc/i2018-18169-5

**[21]** Mattei I. et al. "Scintillating fiber devices for particle therapy applications". In: *IEEE Transactions on Nuclear Science* 65 (2018). pp. 2054-2060. DOI: 10.1109/TNS.2018.2843179

**[22]** Morganti S. et al. "Position sensitive $\beta^-$ Detector based on p-terphenyl scintillator for medical applications". In: *Journal of Instrumentation* 13 (2018). p. 07001. DOI: 10.1088/1748-0221/13/07/P07001

**[23]** Mirabelli R. et al. "In-room performance evaluation of a novel online charged secondary particles monitor of light ions PT treatments". In: *2018 IEEE Nuclear Science Symposium and Medical Imaging Conference Proceedings (NSS/MIC)* (2018). pp. 1-3. DOI: 10.1109/NSS-MIC.2018.8824552

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**[24]** Andrey A. et al. "The foot fragmentation of target experiment"In: *Proceedings of the 15th International Conference on Nuclear Reaction Mechanisms, NRM 2018* (2018), pp. 305-311.

**[25]** Toppi M. et al. "Monitoring carbon ion beams transverse position detecting charged secondary fragments: results from patient treatment performed at CNAO". In: *Frontiers in Oncology* IN PRESS.

**[26]** Fischetti M. et al. "Inter-fractional monitoring of $^{12}$C ions treatments: results from a clinical trial at the CNAO facility". In: *Scientific Report, Nature* IN PRESS.

## Outreach

5 Feb. 2019    **Training Course Event for FameLab2019**, *Organized by Museo Storico della Fisica e Centro Studi e Ricerche E. Fermi*, Rome.

2017-2019    **High School lab Tutor**, *(160 hours) LAB2GO project with La Sapienza and INFN (Istituto nazionale di Fisica nucleare)*, Physics department, *"Sapienza", University of Rome*, Liceo Russel (Rome) and ISISS Teodosio Rossi (Priverno).
https://www.roma1.infn.it/LAB2GO/

29 Jan.-4 Feb. 2015    **Scientific Animator**, *INFN (Istituto Nazionale Fisica Nucleare), Piazza di Spagna, Rome*, Event "MEET LHC".
http://home.infn.it/it/comunicati-stampa/comunicati-stampa-2015/977-lhc-a-piazza-di-spagna

2014-2015    **Sperimental School of Scientific Communication**, *Organized by "Libreria Assaggi", "accatagliato", "MaddMaths!"*, Rome.
Course of 45 hours

## Languages

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| Italian | **Mother tongue** | |
| English | **Proficient (B2)** | *TOEFL iBT and First Certificate in English FCB (Cambridge ESOL Examinations)* |
| French | **Intermediate (B1)** | *Diplôme d'Études en Langue Française DELF (Ministére de l'Education nationale française)* |
| Neo Greek | **Basic User (A2)** | *Private lessons* |

Roma, 18/11/2020