

Personal Information

Education

- 2019–Present **PhD in "Accelerator Physics"**.
"Sapienza", University of Rome.
Supervisor: Vincenzo Patera
- 2017–2019 **Master's degree course in Particle and Astroparticle Physics**.
"Sapienza", University of Rome.
110 with honors /110
Title of thesis: "Time of flight measurements at the FOOT experiment: detector characterization and preliminary results"
Supervisors: Professor Riccardo Faccini. Co-supervisor: Professor Alessio Sarti
Curriculum focuses in Experimental Particle Physics and Medical Physics.
- 2014–2017 **Bachelor degree in Physics**.
"Sapienza", University of Rome.
109/110
Title of thesis: "Comparison between conventional radiotherapy and hadrontherapy" ("Confronto tra radioterapia convenzionale e adroterapia")
Supervisor: Professor Riccardo Faccini.
- 2009–2014 **Liceo Classico Statale Ennio Quirino Visconti** .
Rome, Italy.
77/100
During the third year I was selected from the physics professor of my class to participate on an extracurricular project "Time in its many versions". Working in a group with other students, We deepened the concept of time in physics and then We attended a public conference at the end of the year.

Teaching Activities

- 2019-2020 **Lectures assistant**, *Course of Physics (Classical Meachanics, Termodynamics and Electromagnetism)*, for Computer Engineering students held by Professor M. Germano and A. Belardini.
Engineering Departments, "Sapienza", Univeristy of Rome
- 2019-2020 **Lectures assistant**, *Course of Physics (Classical Meachanics, Termodynamics and Electromagnetism)*, for Menagement Engineering students held by Professor M. Ortolani.
Engineering Departments, "Sapienza", Univeristy of Rome

Attended Conferences and Meeting

- [a] **FOOT experiment (FragmentatiON Of Target)**, Poster Presentation, 10th Young Researcher Meeting, 18th-21st June 2019, Rome, Italy.
- [b] **Margarita: GSI operation and developments**, Oral Presentation, VI FOOT Collaboration Meeting at CNAO (Centro Nazionale di Adroterapia Oncologica), 5th-7th June 2019, Pisa, Italy.

Attended School

13th Jan.- **JUAS, Joint Universities Accelerator School**, Archamps, France.

14th Feb. 2020 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 undergo an exam to verify the acquired competences. I passed it with 15.10/20
<https://www.esi-archamps.eu/Thematic-Schools/Discover-JUAS/JUAS-2020>

Scholarships

Nov. 2018 – **INFN competition for undergraduated students for scientific activities at LNF aimed to the master's degree**, Competition notice n. 19871 (2018).

Apr. 2019 I decided to present my application for admission in the field of nuclear physics with the FOOT (FragmentatiOn Of Target) experiment
INFN-Laboratori Nazionali di Frascati.
Funding: 2000€

Research Activity

During the second year of my Master's degree course I worked with Professor R. Pani in the Nuclear imaging context. Our study aimed to obtain the best spectrometric features using a monolithic scintillation crystal (CRY19). To enhance the pulse height uniformity and energy resolution response, we chose a total white painted crystal. The pulse height, the energy resolution and the position linearity were analyzed as a function of scanning position on the crystal. In particular we studied the position linearity with respect to the depth of interaction that affects the spatial resolution response. The results have been submitted to a referred journal [1].

During the same year we developed a gamma tracker prototype that is a small and handy object that can identify the direction of a radioactive source. It consists in several scintillation detectors with cylindrical symmetry (40 mm height and 25 mm large) coupled with a position sensitive matrix of SiPM. A LYSO external crystal surrounds an internal one acting as active collimator that shield the central detector ($LaBr_3 : Ce$ or GAGG), such a device can provide information about the radioactive source position. We first investigated spectrometric characteristics of the prototype detecting elements, irradiating the crystals with collimated ^{133}Ba and ^{57}Co sources and then we explored the properties of whole detecting system (scintillating crystals + SiPM matrix). The results have been submitted to a referred journal [2].

During my Master Thesis, my activity has been focused on the FOOT (*FragmentatiOn Of Target*) collaboration experiment, aiming to significantly improve the precision on the proton Relative Biological Effectiveness (RBE) measurements for particle therapy applications. The FOOT experiment has been conceived in order to perform a set of measurements of nuclear cross sections which will be used to develop a new generation of biologically oriented Treatment Planning Systems (TPS) for proton and heavy ion therapy. I had the chance to present the FOOT experiment to a young researcher international conference (Rome, Italy)[a]. My work consists on the analysis of the data taken in 2018 with ^{12}C and 2019 with ^{16}O at Centro Nazionale di Adroterapia Oncologica (Pavia, Italy) and at GSI (Darmstadt, Germany) laboratory respectively, and on the Time Of Flight (TOF) detectors optimization. My contribution is mainly related to the implementation of the algorithms needed to obtain the best configuration to study the performance of the TOF start detector. The code is now implemented into the software developed for the FOOT experiment as standard reconstruction code of the experiment.

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 electron beams with a fast MC code, called FRED (Fast paRticle thErapy Dose evaluator). I am currently implementing the algorithms needed to account for what concern the electron interactions in matter. Electrons transport will be included in FRED by implementing electron stopping power and multiple Coulomb scattering. FRED results will be then cross-checked and benchmarked against FLUKA and GEANT4 simulations step-by-step. Starting from an electron primary beam, secondary photons will be generated by implementing the Bremsstrahlung emission. Photons transport within the matter will be then modeled, including photoelectric effect, Compton scattering and pair production. Parallel to this project I am working on the development (both hardware and software) of a low intensity beam monitor for the CNAO experimental room.

Working

- 2016-2017 **Collaboration scholarship for student at the Library**, of the *Physics Departement at "Sapienza" Università di Roma*.
- 2017-2018 **Collaboration scholarship for student at the Library**, of the *SBAI (Scienze di Base e Applicate all'Ingegneria) Departement at "Sapienza" Università di Roma*.

During these two years I have dealt with:

- interaction with user;
- organization of printed materials;
- assistance to computer services.

Publications

- [1] Pellegrini R. et al, *DOI dependence on imaging position and resolution response of a monolithic scintillator with optimal light output*, Submitted as IEEE NSS-MIC Conference Record (2019).
- [2] Pellegrini R. et al, *Novel gamma tracker for rapid radiation direction detection for UAV drone use*, Submitted as IEEE NSS-MIC Conference Record (2019).

Computer skills

Good knowledge of programming in C and C++;

Good familiarity with ROOT, Gnuplot and Origin scientific softwares for data analysis;

Languages

Italian Mother tongue

English Proficient in reading, writing and speaking.

F.to Gaia Franciosini