PERSONAL INFORMATION

Alessio Sarti

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OVERVIEW

Current Position: Associate Professor – FIS01 / 02 – A1

ASN for PO gained both in FIS01 02/A1 and FIS07 02/D1

Scientific Profile: Member of the Applied Radiation Physics Group of Rome since 2011. Since early 2018 Associated Professor in "Università di Roma - Sapienza". The main research activities, started in 2010 as a researcher of "Sapienza" with a research assignment from INFN, are related to the application of High Energy Physics Techniques to Particle Therapy, to study both the interaction of the beam particles with the patient, and the related fragmentation of the target and projectile particles, to exploit new ways to deploy an 'on-line' monitor of PT treatments and to address the challenge posed by recent FLASH therapy observation. The beam fragmentation studies have been performed within the FIRST (2009 - 2016) and FOOT (ongoing) collaborations and are dedicated to the carbon and proton beam induced fragmentation. As a parallel activity, since 2011 and within the INSIDE and RDH collaborations, the study of the production of secondary particles in the beam interactions with different targets have been carried out. Since 2019 started an activity related also to the planning of particle therapy treatments using electron beams both in the field of deep seated tumors and IOeRT applications. Finally, starting from 2021, **A. Sarti has been appointed as PI of the INFN – FRIDA project** (a CSN5 call funded with ~ 1M€ budget and 100 participants from all over Italy and international network)**. Since Nov 2023 is vice-director of the Scuola di Specializzazione in Fisica Medica of the Sapienza Università di Roma.**

Bibliometric Indicators (scopus source):

 # Publications (15 y) 844;
 # Citations (15 y) 41500;
H index 99 (15 y);
H Index (5 y) 44

WORK EXPERIENCE

2018 – Current

Associate Professor, "Sapienza" University of Rome, Rome, Italy.

Vice-director of "Scuola di Specializzazione in Fisica Medica", "Sapienza" University of Rome, Rome, Italy.

Co-founder of the DARTS s.r.l Sapienza Startup [https://dartsroma.com/] & member of the board of directors of the startup.

Main duties/responsibilities: Master thesis supervisor, Doctorate thesis supervisor, PI of an INFN CSN5 Call (FRIDA, 1 M€), collaborator of FOOT – INFN experiment, coordinator of the Sapienza unit in the Sapienza – SIT joint effort to develop a TPS for IOeRT standard and FLASH applications, Member of the Doctorate scientific board in the Accelerator Doctorate of Sapienza University, Member of the Specialisation School scientific board in the School of Specialisation in Medical Physics of the Sapienza University. Since 2023,

member of the board of directors of a Sapienza Startup (DARTS s.r.l.) that provides services related to the fast and precise calculus of interactions of ionizing radiation with matter.

Sector: Particle Physics applied to Medicine. In particular, external beam radio therapy with photons, protons, carbon ions and electrons. Member of SAFEST research group for the development and implementation of VHEE delivered both in conventional and FLASH mode in Sapienza.

2010-2018

Researcher (permanent position), "Sapienza" University of Rome, Rome, Italy.

Main duties/responsibilities: Master thesis supervisor, Doctorate thesis supervisor, Software coordinator of the FOOT – INFN experiment, Coordinator of the Sapienza Unit of the INSIDE and INSIDE2 projects of the INFN for the implementation of an on-line monitor device capable of measuring the secondary radiation produced in PT treatments at CNAO both with p and 12C projectiles. Member of the FIRST collaboration, in which I had the physics analysis coordination duty. Member of the LHCb collaboration, in charge for the study of the extremely rare decay of the Bs meson in two muons.

Sector: Particle Physics applied to Medicine and High energy physics. The first sector was mainly pursued in applications of HEP techniques to particle therapy with ions and protons (both from the planning and the monitoring point of views) while the second one was related to the study of leptonic B decays.

2004 – 2010

Temporary position as Research at Sapienza (2004-2005) and INFN - LNF (2005-2010)

Main duties/responsibilities: Starting from my post-doc position in Sapienza and afterwards as a temporary research in the Laboratori Nazionali di Frascati of the INFN, I have studied the B meson decays at the LHCb experiment at CERN. I was responsible for the construction, test and installation of the Muon System at the CERN facility.

Sector: High energy physics, LHCb experiment at the LHC. I have taken part in the construction of the muon system apparatus, its installation at CERN and its operation until the very start of the LHC activities in 2010.

EDUCATION AND TRAINING

2000-2004

PhD in Physics, marked as "excellent (ottimo)".
University of Ferrara, Ferrara, ITALY
Study of B meson semileptonic decays @ BaBar experiment (SLAC, Stanford)..

1996-2000

Degree in Physics, 110/110
"Sapienza" University of Roma, Roma, ITALY
Study of B meson decays @ BaBar experiment (SLAC, Stanford).

PERSONAL SKILLS

Organisational / managerial skills

- I have co-founded in 2011 the ARPG group that, in the next 10 years or more, I have contributed to lead. In particular, at the SBAI department, the activities have been carried out by a group of 10-20 people (researchers, master thesis students, researchers from other institutions, ..), that I have coordinated in the context of several projects (INSIDE, FOOT, FIRST, MONDO, PAPRICA,…).
- I have coordinated the work also of researchers from other countries, producing lead edge results in the field, overcoming the difficulties met and helping people to work and produce reliable results even in stressful conditions.
- I am now the PI of an INFN CSN5 call funded for 3 years with ~ 1 M€ and with 100 participants for all over Italy, mainly in Trento, Milano, Torino, Pisa, Roma and Catania. In the past I have lead the Sapienza group that built and installed the Dose Profiler @ CNAO and was used to perform the first online monitoring of a carbon ion treatment ever. I have also acted as Software Coordinator of the FOOT collaboration with15 members from all over Italy and also some researchers from Strasbourg.
- I have co-founded the DARTS s.r.l. Sapienza Startup. DARTS srl is a company with registered office in Rome operating in the landscape of particle physics and ionizing radiation applications respectively in the fields of medicine and industry.

ADDITIONAL INFORMATION

Most relevant publications (16) in the last 10 Years

1. *G. Franciosini, …* ***A. Sarti*** IOeRT conventional and FLASH treatment planning system implementation exploiting fast GPU Monte Carlo. The case of breast cancer. (2024) PHYSICA MEDICA, vol. 121, p. 1-9, ISSN: 1120-1797 DOI: 10.1016/j.ejmp.2024.103346
2. *G. Franciosini, …..* ***A.Sarti****, … A. Schiavi,* GPU-accelerated Monte Carlo simulation of electron and photon interactions for radiotherapy applications, (2023) Physics in Medicine and Biology, Volume 68, Issue 421 Article number 04400101
3. A. Muscato, … ***A. Sarti*** Treatment planning of intracranial lesions with VHEE: comparing conventional and FLASH irradiation potential with state-of-the-art photon and proton radiotherapy.
4. *M. De Simoni, …* ***A. Sarti****, … A. Schiavi* A Data-Driven Fragmentation Model for Carbon Therapy GPU-Accelerated Monte-Carlo Dose Recalculation (2022) Frontiers in Oncology, 12, art. no. 780784, DOI: 10.3389/fonc.2022.780784
5. *A. C. Kraan, …* ***A. Sarti****, .. M. G. Bisogni* Localization of anatomical changes in patients during proton therapy with in-beam PET monitoring: A voxel-based morphometry approach exploiting Monte Carlo simulations (2022) Medical Physics, 49 (1), pp. 23-40. Cited 1 time. DOI: 10.1002/mp.15336
6. ***A. Sarti****,*.. Deep Seated Tumour Treatments With Electrons of High Energy Delivered at FLASH Rates: The Example of Prostate Cancer (2021) Frontiers in Oncology, 11, art. no. 777852, . Cited 1 time. DOI: 10.3389/fonc.2021.777852
7. *Franciosini G., …* ***A. Sarti****, … G. Battistoni*, Preliminary study on the correlation between accelerated current and dose in water for an electron-based LINAC (2024) Frontiers in Physics Volume 12 Article 1249393 DOI: 10.3389/fphy.2024.1249393
8. *M. Toppi, …* ***A. Sarti*** Monitoring Carbon Ion Beams Transverse Position Detecting Charged Secondary Fragments: Results From Patient Treatment Performed at CNAO (2021) Frontiers in Oncology, 11, art. no. 601784, . Cited 2 times. DOI: 10.3389/fonc.2021.601784
9. *M. Toppi, …* ***A. Sarti*** ,… *I. Mattei* PAPRICA: The Pair Production Imaging Chamber—Proof of Principl (2021) Frontiers in Physics, 9, art. no. 568139, . DOI: 10.3389/fphy.2021.568139
10. *M. Fischetti, …* ***A. Sarti,*** Inter-fractional monitoring of 12 C ions treatments: results from a clinical trial at the CNAO facility (2020) Nature Scientific Reports, 10 (1), art. no. 20735, . Cited 9 times. DOI: 10.1038/s41598-020-77843-z
11. *M. Toppi, ..* ***A. Sarti****, … M. Marafini* The MONDO Tracker: Characterisation and

Study of Secondary Ultrafast Neutrons Production in Carbon Ion Radiotherapy (2020) Frontiers in Physics, 8, art. no. 567990 DOI: 10.3389/fphy.2020.567990

12. *G. Traini, …* ***A. Sarti*** Review and performance of the Dose Profiler, a particle therapy treatments online monitor (2019) Physica Medica, 65, pp. 84-93. Cited 14 times. DOI: 10.1016/j.ejmp.2019.07.010
13. *A. Rucinski, …* ***A. Sarti****, ….V. Patera* Secondary radiation measurements for particle therapy applications: charged particles produced by ^{4}He and ^{12}C ion beams in a PMMA target at large angle (2018) Phys. Med. Biol. **63** 055018 DOI: 10.1088/1361-6560/aaa36a
14. *M. Marafini, …* ***A. Sarti*** MONDO: a neutron tracker for particle therapy secondary emission characterisation (2017) *Phys. Med. Biol.* **62** 3299 DOI: 10.1088/1361-6560/aa623a
15. *M. Toppi, … ,* ***A. Sarti*** Measurement of fragmentation cross sections of 12C ions on a thin gold target with the FIRST apparatus Phys. Rev. C **93**, 064601 (2016) DOI: 10.1103/PhysRevC.93.064601
16. *F. Collamati …* ***A. Sarti****, .. R. Faccini* Time Evolution of DOTATOC Uptake in Neuroendocrine Tumors in View of a Possible Application of Radioguided Surgery with β^- Decay Journal of Nuclear Medicine October 2015, 56 (10) 1501-1506; DOI: 10.2967/jnumed.115.160481

Projects/Grants

2022-2025
PI of FRIDA (INFN CSN5 call)
FLASH Radiotherapy with high Dose-rate particle beAms **Funding:** 1 M€

2013-2022
WP responsible for INSIDE, INSIDE2
INnovative Solutions for In-beam DosimEtry in Hadrontherapy **Funding** 1M€ (PRIN,: INFN funds)

2013-2014
"Calibration of a new dose monitoring technique for hadrontherapy**"**,
Università di Roma "La Sapienza" **Funding**: 36k€

Patents

"Beta radiation probe for the intra-operative identification of tumour residuals" : European patent (Patent number EP2951612: INTRAOPERATIVE DETECTION OF TUMOR RESIDUES USING BETA- RADIATION AND CORRESPONDING PROBES) and USA patent (Patent number US20150359499)

Conferences

Oral Communications

- December 2021, Online, "A FEASIBILITY STUDY OF IORT-FLASH USING A GPU-BASED FAST MONTE CARLO" presented at FRPT conference.
- May 2018, Cincinnaty, USA. "In-room characterisation, using an anthropomorphic phantom, of a novel monitor exploiting secondary charged particles emission in light ion PT treatments" presented at **PTCOG 2018 conference**.
- February 2016, Ginevra, Switzerland. "Study of the radiation produced by therapeutic He, C and O ion beams impinging on a PMMA target" presented at **ICTR-PHE 2016 conference**.
- May 2015, Osaka, Japan. "Particle yields measurements, produced by the HIT facility therapeutical beams on a PMMA phantom, and their particle therapy dose monitor applications" presented at **Space Radiation and Heavy Ions in Therapy Simposium 2015**.
- November 2014, Pavia, Italy. "A novel monitoring technique for online dose profiling in particle therapy treatments" presented at the XVI Convegno SIRR.

According to law 679/2016 of the Regulation of the European Parliament of 27th April 2016, I hereby express my consent to process and use my data provided in this CV

Rome, 17/07/2024
Signature

MOST RELEVANT SCIENTIFIC RESULTS OVER THE LAST 10 YEARS

After graduating in physics in “Sapienza” I had the opportunity to train, as a researcher, in the most exciting laboratories and physics research centres of the world. Starting at the Stanford Linear Accelerator Center (SLAC, Stanford) in the BaBar experiment collaboration, and continuing at the CERN (Geneva) and Laboratori Nazionali di Frascati – INFN (Frascati) research laboratories in the LHCb experiment collaboration I had the unique chance to gain an invaluable experience in all the difference experimental aspects of the High Energy Physics field working with some of the worldwide most renowned scientist and stimulating research environments. I also improved my outreach expertise, contributing to the QUASAR INFN-LNF project (for school age kids) and the other initiatives targeting high school teachers and students.
Since 2009 I had differentiated the scope of my research, in order to pursue the application of the HEP techniques to the medical field and to address one of the most fundamental questions remained open in the SM (the CP violation breaking mechanism). I identified in the measurement of the ultra rare B(s)0 → μ+μ− decay my preferred way to experimentally **test possible New Physics extensions of the SM**. In the meantime I started (participated / organized / lead) a set of experimental measurements aiming for **a radical reduction of the experimental uncertainty** on the interactions of the beam particles used for charged particle therapy applications with matter (and hence, patient tissues).

I am a Member of the Applied Radiation Physics Group of Rome since 2011. Since early I am an 2018 Associated Professor in “Università di Roma - Sapienza”. The main research activities started in 2010 as a researcher of “Sapienza” with a research assignment from INFN, are related to the application of High Energy Physics Techniques to Particle Therapy, to study both the interaction of the beam particles with the patient, and the related fragmentation of the target and projectile particles, to exploit new ways to deploy an ‘on-line’ monitor of PT treatments and to address the challenge posed by recent FLASH therapy observation. The beam fragmentation studies have been performed within the FIRST and FOOT collaborations and are dedicated to the carbon and proton beam induced fragmentation. Since 2011 and within the INSIDE and RDH collaborations, I studied of the production of secondary particles in the beam interactions with different targets. Since 2019 started an activity related also to the planning of particle therapy treatments using electron beams both in the field of deep seated tumors and IOeRT applications. Finally, starting from 2021, **I have been appointed as PI of the INFN – FRIDA project (a CSN5 call funded with ~ 1M€ budget and 100 participants from all over Italy and international network). Since Nov 2023 I am the vice-director of the Scuola di Specializzazione in Fisica Medica of the Sapienza Università di Roma**