# Section b: Curriculum vitae and Track Record

# PERSONAL DETAILS

Family name, First name: ROUSSEAU Marc Researcher unique identifier(s) : <u>https://orcid.org/0000-0001-8711-8383</u> URL for web site:<u>https://www.researchgate.net/profile/Marc-Rousseau</u>

## • • Education and key qualifications

- 01/04/2015 Habilitation à diriger des recherches (HDR), French academic degree needed to supervise PhD students. HDR thesis: « Precis on the improvement of treatment plans, contribution of nuclear physics from GANIL to PRECy », University of Strasbourg (Unistra), France.
- 08/12/2000 PhD at Unistra under the supervision of D C. Beck. PhD title: « Study of the fusion in the 28Si+28Si and 28Si+12C reactions: investigation of deformation effects in 56Ni and 40Ca compound nuclei. »
- 1997 Master in Subatomic Physics and Astroparticles, University of Strasbourg, France.

# • • Current position

01/09/2023 Professor (permanent position) at the University of Caen (Unicaen) in the Joint Research Unit (JRU) 6534 « Laboratoire de Physique Corpusculaire » (LPC), France. LPC expertise: nuclear physics, application of nuclear sciences, particle physics, astroparticles and neutrinos.

### • • Previous position(s)

 2002-2023 Lecturer at Unistra and researcher in the JRU 7178 "Hubert Curien Pluridisciplinary Institute" (IPHC) supervised by (French) National Research Council (CNRS) and Unistra.
2000-2002 Postdoctoral position at the Surrey University, United Kingdom, commissioning of the

Vamos spectrometer for the laboratory «Large Heavy Ion National Accelerator» (GANIL) based in Caen.

• • Teaching activities

Since 2023	Teaching at the Physics Faculty of Unicaen at Bachelor and Master level
	(192 hours/ year).
From 2002 to 2023	Teaching at the Physics and Engineering Faculty of Unistra at Bachelor and
	Master level (192 hours/ year).
From 2020 to 2023	Head of first year Bachelor « Science for Health - Physics course », Unistra
Since 2010	15 Master's interns supervised on metrology and dosimetry of a preclinical irradiation platform, effects of proton beams on living organisms.

# **RESEARCH ACHIEVEMENTS AND PEER RECOGNITION**

Following my recruitment, I worked in the field of nuclear physics around the coulombic barrier, and more specifically on the themes of molecular resonances radiative capture and cluster states in light nuclei. My research work has focused on instrumentation for fundamental nuclear physics through the development of radioactive beamlines as part of the construction of the Spiral2 infrastructure at the JRU "Large Heavy Ion National Accelerator" (GANIL) based in Caen and the development of a high-energy gamma-calorimeter to meet the experimental needs of my scientific problem, the PARIS multidetector.

Since 2009 my scientific research has gradually turned to the societal applications of nuclear physics in the health domain. Indeed, the expertise I had acquired in the detection of charged particles and the study of reaction mechanisms enabled me to get involved in more finely-tuned hadrontherapy research.

In this highly multidisciplinary field, my research activities began with the measurement of the interaction cross-sections of carbon beams with different targets (H, C, O...), which can be used to enhance clinical treatment planning software. My work in this field has subsequently extended to instrumental development linked to dose control (INCa QUAPIVI grant), proton tomography (INCa ProtonCT grant) and, in recent years, the development of irradiation protocols for radiobiology.

Google scholar metrics: h-index 32, 3105 citations

• • Research achievements (most relevant publications)

1. **1-**Publications in connection with the development of an experimental radiobiology platform (PRECy project), where I defined the specifications, took part in instrumental developments and experimentally validated the specifications:

- Beam Chopper and RF Kicker Systems for the TR24 Cyclotron Injection Line, M. Pellicioli, J. Schuler, C. Ruescas, C. Haas, U. Goerlach, and M. Rousseau, JAIS-313, (2023)

- Control system of the CYRCé beamlines, C. Maazouzi, T. Adam, E. Bouquerel, M. Pellicioli, J. Schuler, M. Rousseau, E. Traykov and P. Graehling, JINST, P0503117, (2022)

- Design and commissioning of the first two CYRCé extension beamlines, E.Bouquerel, E.Traykov, C.Maazouzi, M.Rousseau, M.Pellicioli, T.Adam, P.Graehling, C.Mathieu, G.Heitz, M.Krauth, D.Oster, T.Foehrenbacher, C.Ruescas, J.Schuler, U.Goerlach, C.Haas, Nucl. Instrum. Methods Phys. Res., A1024, 166034 (2022)

- Transverse beam emittance studies of the CYRCé TR24 cyclotron, E. Bouquerel, E. Traykov, K.P. Nesteruk, S. Braccini, T.S. Carzaniga, C. Mathieu, M. Pellicioli, M. Rousseau, C. Ruescas, J. Schule, S. Vichi, Nucl. Instrum. Methods Phys. Res., A931, 151 (2019)

1. **2-**Publication on dosimetric validation of the first irradiation line developed at IPHC (prototype for PRECy project). Supervision and direction of the work of J. Constanzo (postdoctoral student):

- Dosimetry and characterization of a 25-MeV proton beam line for preclinical radiobiology research, Julie Constanzo, Marie Vanstalle, Christian Finck, David Brasse, Marc Rousseau, Medical Physics, 46, 2356 (2019)

1. **3-**Publication on the irradiation protocol development of the first irradiation line developed at IPHC (prototype for PRECy project). Definition of specification, analysis and interpretation of results:

- Analytical dose modeling for preclinical proton irradiation of millimetric targets, Marie Vanstalle, Julie Constanzo, Yusuf Karakaya, Christian Finck, Marc Rousseau, David Brasse, Medical Physics, 45, 470 (2018)

**1. 4**-Publications on work carried out with PRECy infrastructure and carried out by teams of biologists and clinicians. Development of experimental protocols, performing irradiations, participation in interpretation of results:

- Revealing the effect of X-ray or proton brain irradiation on systemic inflammation and leukocyte subpopulation. interplay in rodents, TN Pham, J Coupey, M Rousseau, J Thariat, S Valable, Journal of Leukocyte Biology, qiae156 (2024)

-Early effects of different brain radiotherapy modalities on circulating leucocyte subpopulations in rodents, T. Pham, J. Coupey, J. Toutain, S.M. Candéias, G. Simonin, M. Rousseau, O. Touzani, J. Thariat, S. Valable, International Journal of Radiation Biology, 100:5, 744-755 (2024)

- Impact of proton therapy on antitumor immune response, Céline Mirjolet, Anaïs Nicol, Emeric Limagne, Carole Mura, Corentin Richard, Véronique Morgand, Marc Rousseau, Romain Boidot, François Ghiringhelli, Georges Noel, Hélène Burckel, Scientific Reports, 11, (2021)

- Comparison of the [18F]-FDG and [18F]-FLT PET Tracers in the Evaluation of the Preclinical Proton Therapy Response in Hepatocellular Carcinoma, David Brasse, , Hélène Burckel, Patrice Marchand, Marc Rousseau, Ali Ouadi, Marie Vanstalle, Christian Finck, Patrice Laquerrière, Fréderic Boisson, Molecular Imaging and Biology, 62 (2021)

- Radiosensitizing Pancreatic Cancer with PARP Inhibitor and Gemcitabine: An In Vivo and a Whole-Transcriptome Analysis after Proton or Photon Irradiation, Waisse Waissi, Anaïs Nicol, Matthieu Jung, Marc Rousseau, Delphine Jarnet, Georges Noel, Hélène Burckel, Cancers, 13, 527 (2021)

The publications listed above clearly demonstrate my evolution from an instrumental nuclear physicist specializing in the manipulation and transport of ion beams to the field of biology and more particularly the study of the effects of radiation combined or not with other treatments. This evolution allows me today to have the expertise necessary for the development of dosimetric irradiation protocols, to have a perfect knowledge of the physical processes of interaction of radiation with living organisms, to understand the needs and questions of biologists in order to respond to them as best as possible and to propose new avenues of research by developing innovative physical protocols.

#### • • Main collaborations and projects

As mentioned above, the first part of my career was dedicated to the spiral2 project through radioactive beamlines and a gamma-calorimeter development. During this period, I was an active member of the international SPIRAL2 collaboration and of the "Spiral2 France" committee where I took part in drafting the white paper defining the scientific priorities of this new international infrastructure (https://www.ganil-spiral2.eu/). Moreover, I was the scientific leader of the ANR grant PROVA (600 k€, 12 FTE) linked to the calorimeter developments.

From 2009, when my scientific career shifted towards healthcare applications, to 2016, I took part in a number of different projects.

- Protom (Proton Beam computed tomography applied to treatment planning protontherapy): INCa (national cancer institute) grant 60 k€, collaboration: IPHC (Strasbourg), CREATIS (Lyon), IP2I (Lyon), LPC (Caen)

- QAPIVI (Quality assurance for carbon therapy by proton interaction vertex imaging): INCa grant 200 k€, collaboration: IPHC (Strasbourg), IP2I (Lyon)

Since 2016, I have been collaborating more specifically with different teams of biologists (Epigenetic regulation and memory team IBMP Strasbourg, ISTCT team Cyceron Caen, INRae Clermont, LPC Clermont) and oncologists (ICANS cancer center Strasbourg, CGFL cancer center Dijon, Baclesse cancer center Caen, NCT Heidelberg) on the biological response of cells (tumour and healthy cells), to different dose delivery methods (photon/proton comparisons, conventional irradiations, fractionation, flash irradiation, combination of irradiation with targeted chemotherapies or immune system activation) to be able to use biological dosimetry rather than physical dosimetry in the future.

To carry out this work, I proposed in 2015, the development of an Experimental Radiobiology Platform at CYRCé (PRECy project), that got funded by the CPER 2015-2020 (French Grant of €1 million). The aim of this project was to develop a beamline for radiobiology studies at the CYRCé research facility. This infrastructure, dedicated to preclinical research on nuclear imaging, is equipped with a cyclotron accelerating protons to an energy of 25 MeV for isotope production. I spearheaded this project and the team set up in the laboratory (8 FTEs). The PRECY project included, on the one hand the construction of an irradiation room and biology laboratories (cell culture and molecular biology), and the development of a set of beam lines for in vitro and in vivo irradiation. This project provided a link between the various different research activities I had developed over the course of my career, since it combined beam line development and instrumentation, the development of detection and measurement systems and the improvement of treatment schemes. The infrastructure and equipment were handed over in December 2019. Since then, the facility has continued to evolve in order to improve dose delivery and meet new user requirements. In addition, I have been working to define and develop new irradiation and metrology protocols, which are essential to the smooth running of experiments at this platform, whether for radiobiology activities or the validation of dosimetry tools.

Today, all these developments are an integral part of the CYRCé platform, for which I was scientific coordinator up to September 2023. In 2022, almost 500 hours of beam time were delivered on this irradiation line, and some fifteen scientific teams (national and international) benefited from this work.

In order to better understand my colleagues in biology and/or oncology, and to meet their needs as effectively as possible, over the last few years I have begun a major acculturation process towards these disciplines. It is for these reasons that I have been a member of the French Society of Radiation Biology (SFBR, formerly SIRLaF) since 2015. This work, coupled with the development of the platform and irradiation protocols, has enabled me to develop a range of collaborations on the following research themes:

- Exploring the trade-offs between telomere lengthening and cellular costs as a vital component of healthy life histories in seasonal mammals. ANR grant 692 k€ collaboration: IPHC (Strasbourg), LIENSs (La Rochelle), LPC (Caen)

- Study of plant epigenome dynamics in response to oxidative stress. MITI-CNRS (Mission for Transversal and Interdisciplinary Initiatives) grant  $36 \text{ k} \in +3$  years PhD, collaboration: IPHC (Strasbourg), IBMP(Strasbourg)

- In vivo study of the inflammatory response in the treatment of glyoblastoma. Ligue contre le cancer (league against cancer) grant 100 k€, collaboration IPHC (Strasbourg), ICANS cancer center (Strasbourg) CGFL cancer center Dijon

- Exploring exotic mechanisms of cancer resistance (hibernation). MITI-CNRS grant 20 k€ + 3 years PhD, collaboration: IPHC (Strasbourg), INRae (Clermont), LPC (Clermont)

- Combining proton irradiation and oncolytic viruses against cancer. ANR grant 290 k€,

collaboration: IPHC (Strasbourg), NCT (Heidelberg)

Since 2015, I'm a member of the French Society of Radiation Biology.

# • • Scientific events organisation

- 2023 "ResPlaNdIr Days", Strasbourg (France), March 21-22
- 2019 "ResPlaNdIr Days", Dijon (France), March 18-19
- 2015 Member of the scientific committee of the 12th International Colloquium on Fundamental and Applied Radiobiology in Obernai (France), November 8-12
- 2014 "Workshop network of national irradiation platforms for radiobiology" at IPHC, November
- 2011 "PARIS detector collaboration meeting" at IPHC, January

### • • Scientific responsibilities

- Since 2022 Scientific coordinator for the CNRS of WP5 "infrastructure" in the European PianoForte project co-financed by the European Union's EURATOM program and the governments of the participating countries and coordinated by Institute for Radiation Protection and Nuclear Safety (IRSN).
- Since 2018 Head of the ResPlaNdIr network steering committee (Réseau des Plateformes Nationales d'Irradiation pour la dosimétrie, l'instrumentation et la radiobiologie).
- 2015-2017 then 2022-2023: Scientific Coordinator CYRCé platform
- 2007-2011 Scientific coordinator for CNRS of associated international laboratory (LIA) FJ-NSP "French-Japanese Associated Laboratory for Nuclear Structure Problems" agreed by CNRS, CEA, JRU GANIL and RIKEN Nishina Center for Accelerator-Based Science
- 2002-2015 Technical coordination of the Spiral2 project at IPHC, a structuring project for CNRS.

### **ADDITIONAL INFORMATION**

### • • Supervision of PhD students and postdoctoral researchers

Since 2011: 6 PhD supervisions and co-supervisions

Since 2021: 2 Post-doctorate supervisions and co-supervisions

#### • • Managerial and institutional activities

Head of the Hadrontherapy team at IPHC. 2020-2023 2019-2024 Member of the scientific Council of CNRS' National institute of nuclear and particle physics (IN2P3). Tasks: Assessing the relevance of the Institute's scientific directions. Internal member of the IPHC Scientific Advisory Board. Tasks: Assessing the relevance of 2018-2023 the laboratory scientific directions. 2015-2017 Creation, then Head of the Radiobiology Hadrontherapy and Molecular Imaging Department (approximately 30 permanent members). 2011-2015 Head of the Subatomic Research Department (approximately 250 permanent members). Deputy Director of the IPHC appointed by the CNRS (approximately 400 permanent 2011-2015 members). 2008-2011 Selection committee member of the CNRS for researcher permanent position Head of the "Accelerator Instrumentation" team at IPHC. 2006-2015