Ian Postuma

Curriculum Vitae

Birth year 1988

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Current Positions

2022 – present **Technologist**, *INFN*, Pavia, Italy.

Past Professional experience

2021 – 2022 **Postdoctoral researcher**, *INFN*, Pavia, Italy.

INFN grant n° 23031/2021: *"Set-up of a Treatment Planning System for BNCT using novel computational strategies"*.

2019 – 2021 **Grant giovani ricercatori**, *PI*, INFN-Pavia, Italy.

PI of the project *"an Innovative Toolkit to Simulate neuTron cApture theRapy irradiaTion and doSimetry"* (IT_STARTS). The project aims at addressing two aspects of Boron Neutron Capture Threapy (BNCT) treatment planning. The first is the need of a complete and usable tool, able to transform medical images of patients into a computational model, allowing irradiation positioning, dose calculation and analysis. The second is the need of implementing more robust and validated algorithms for in-patient mixed-field dose calculation. To this aim, computational work as well as *in-vitro* experimental activities are performed.

2018 – 2019 **Postdoctoral researcher**, *INFN*, Pavia, Italy.

INFN grant n° 19571/2017: *"Neutron beam tailoring and computational dosimetry for BNCT using accelerators"*.

2016 – 2018 **Postdoctoral researcher**, *INFN*, Pavia, Italy.

INFN grant n° 17738/2015: *"Development of an infrastructure for BNCT (Boron Neutron Capture Therapy) based on a proton accelerator: from the development of the neutron beam to the treatment planning of patients."*

2012 **Programmer**, *Cerved Group S.P.A*, Milano, Italy.

I was responsible for developing a web interface to query databases and monitor the activity of data analysts. During this experience I managed to become a proficient user of MySQL, PHP, CSS and HTML.

Participation in funded projects

2022 − 2025 **PNRR-ANTHEM**, *INFN*, Pilot 4.9 - BNCT @ Caserta.

Realisation of a Boron Neutron Capture Therapy (BNCT) facility in Caserta. I coordinate the activities of WP 4 and 5, on the development of the Beam Shaping Assembly and the Treatment Planning System for BNCT.

2022 − 2025 **INFN-*next*AIM**, *INFN*, WP4 convener.

the challenges of next Artificial Intelligence in Medicine are the management of limited data-sets and explainability of the AI solutions. My role in WP4 is to coordinate and manage the production of documentation for data and software repository and to organise training seminars and workshops.

2021 − present **Aggiornamenti**, *INFN*, Local PI, Pavia.

Organisation of seminars for high school teachers on relevant INFN research topics, in the frame of the CC3M activities.

2019 − 2022 **ENTER_BNCT**, *INFN*, Participant.

I designed the BSA and participated in its construction at the mechanical workshop of Pavia INFN. I was responsible of the irradiation run at the CN of LNL. I personally developed and optimised a neutron autoradiography technique, capable of overlaying tracks from the neutron capture reaction on ^{10}B and cells.

2018 − present **NEPTUNE**, *INFN*, Participant, Pavia.

I was in charge for the preparation of samples for boron concentration measurements during the irradiation runs at CNAO and LNS, of measuring boron concentration and of optimising the technique to point out low boron concentration values in tissue samples for comparison with NMR measurements in Rome.

2019 − 2021 **IT-STARTS**, *INFN*, Principal Investigator, 100k€ grant.

an Innovative Toolkit to Simulate neuTron cApture theRapy irradiaTion and doSimetry.

2020 − 2021 **INFN-AIM**, *INFN*, Participant.

Artificial Intelligence in Medicine.

2019 − 2021 **NEPTUNE**, *INFN*, Participant.

Nuclear process-driven Enhancement of Proton Therapy UNravEled.

2017 − 2019 **BEAT_PRO**, *INFN*, Participant.

BEAm Tailoring and ProceduRes Optimization for clinical BNCT.

2016 − 2018 **NEU_BEAT**, *Progetto Grande Rilevanza Italia-Cina MAECI_MOST*, Participant.

NEUtron BEAms for cancer Treatment Project Italy-China. Executive Program of Scientific and Technological Collaboration.

2016 − 2018 **CHNet_TANDEM**, *INFN*, Participant.

Tecniche Analitiche Non Distruttive per lâĂŹarchEoMetria.

2012 – 2015 **Nettuno**, *INFN*, Participant.

NEuTron capTUre therapy of thoracic tumors with New fOrmulations.

2012 – 2013 **FIRB futuro in ricerca**, Participant.

Neutron capture therapy a new prospective for the treatment of osteosarcoma.

Positions in international organisations

2020 – present **Communication Task Force**, *isnct*, Web manager.

The International Society for Neutron Capture Therapy (ISNCT) Communication Task Force (CTF) is a group of young ISNCT members with the mission of promoting the BNCT culture thorugh ISNCT outreach, creating and maintaing a communication system inside and putside the Society. I currently maintain and manage the website and SEO configuration.

Education

2012 – 2016 **Ph.D. in Physics**, *University of Pavia*, Pavia, Italy.

Final Dissertation: "*Clinical application of accelerator-based Boron Neutron Capture Therapy: optimization of procedures, tailoring of a neutron beam and evaluation of its dosimetric performance.*" Supervisor: Prof. S. Bortolussi.

2009 – 2012 **M.Sc. in Physics**, *University of Pavia*, Pavia, Italy, (109/110).

Final Dissertation: "*A neutron autoradiography method to measure ^{10}B in biological samples applied to BNCT of osteosarcoma*". Supervisor: Prof. S. Bortolussi.

2006 – 2009 **B.Sc. in Physics**, *University of Pavia*, Pavia, Italy, (105/110).

Final Dissertation: "*The state of the art of solar panels.*" Supervisor: Prof. Vittorio Bellani.

1999 – 2006 **European Baccalaureate**, *European School*, Bergen, The Netherlands.

ISCED 3B.

International Schools

2019 **Introduzione alle tecniche di gestione progetti (BM Basic)**, *Metodologia AGILE*, Pavia, Italy.

2017 **Entrepreneurship for Physicists: an Introduction**, *Prof. Davide Iannuzzi*, Pavia, Italy.

2014 **Neutron Detectors and Related Applications**, *Riva del Garda*, Italy.

2013 **Geant4**, *Alghero*, Italy.

10th Seminar on Software for Nuclear, Subnuclear and Applied Physics

2013 **PHITS**, *Paris*, France.

Stage

2010 **University of Pavia**, *Pavia*, Italy.

I worked for a physics project applied to cultural heritages aiming to evaluate the com- position of ancient glass. My activity was to measure relevant physical parameters with different techniques: NMR, Raman and light absorption analysis. The coordinator of the project was Prof. Pietro Galinetto.

Research work

Radiation Physics

Experimental Set-up and calibration of **passive nuclear track detectors** (i.e., CR39 and Lexan) for ^{10}B concentration measurements in liquid or biological samples. Implementation of an automated image acquisition system combining a microscope and a motorised xy-stage, allowing macroscopic spacial distribution evaluation of ^{10}B uptake in cell samples, on an are of ≈ 1 cm^2. Joining a mosaic of microscopic images with an area of $\approx 3 \times 10^{-3}$ cm^2.

Neutron irradiation experiments, set-up and data acquisition at:
- nuclear reactors of LENA (Pavia) and ILL (Grenoble);
- CN proton accelerator facility of INFN-LNL (Legnaro National Laboratories).

Classified radiation worker, according to italian legislation "*categoria di esposizione B*"

Computational Monte Carlo nuclear physics particle transport simulation with **MCNP, PHITS and Geant4**. Neutron beam design, for BNCT and Prompt Gamma Neutron Activation Analysis applied to cultural heritage studies. Implementation of a **CPU cluster** based on HTCondor to distribute computationally intensive MC simulation tasks.

Artificial Intelligence

Detection Machine Learning object recognition in images using **TensorFlow**. Implementation of a **deep neural network** capable of detecting and counting tracks for boron concentration measurements in liquid, cell and tissue samples. Set-up of a **linux based computational environment** for deep learning, based on a NVIDIA RTX 2070, for multiple users and with a dedicated data storage partition.

Contouring Development and training of a **UNET** like neural network, able to read **CT images** and output a mask of the region of interests such as lungs and ground glass opacifications in lungs caused by Covid19. To train neural networks of this size I used a **GPU cluster** (based on NVIDIA V100 GPUs) managed through a Slurm job scheduler.

Radiobiology

Experimental Work with **cell cultures** for pre-clinical BNCT and PBCT. Administration of borated formulation and preparation of samples for ^{10}B uptake measurements. Irradiation of cell culture with photons, neutrons and protons. Set-up of a **new *in-vitro* model with cultivated epidermis** (Episkin model) for BNCT dose effect measurements. Evaluation of BNCT irradiations by analysis of histological sections, MTT and BrdU. Preliminary boron measurements in 3D printed cell cultures. These research works are made in close collaboration with the Laboratory of Experimental Surgery of University of Pavia. Set-up of a technique for **boron imaging at sub-cellular level** by cultivating cells adherent to the CR39 nuclear track-detector.

Computational Monte Carlo mixed-field dose calculation for *in-vitro* and *in-vivo* models. Study and use of radiobiology models to convert absorbed dose into **photon-equivalent units** (Calculation with RBE, CBE and photon iso-effective models). This part of the work is the basis of the possibility to compare and possibly to sum BNCT and other forms of radiotherapy. **BNCT treatment planning simulation** of realistic clinical cases, using dedicated softwares (NCTPLan, MultiCell, NeuboronPlan, DVHTool, BNCTAr). This part of the work is performed in close **collaboration with** the Argentinan BNCT computational dosimetry group (CNEA, Buenos Aires).

Research products

Research Products (Scopus)
- **43 Publications** in peer reviewed International Journals, 4 Proceedings of National and International Congresses.
- **h-index 10**
- **334 citations**
- **10 oral presentations and 5 posters** in national and international congresses,
- **5 invited** talks-seminars-conferences

Reviewer Scientific Reports, Radiation Oncology and Applied Radiation and Isotopes.

Technology Transfer and 3rd Mission

Work in **TT projects** such as third-party beneficiary contracts (INFN contract with Bayer for in-vitro tests of borated componds)

Work in development of technologies with possible industrial application (development and test of **new materials** for neutron moderation)

2019 – present **Lecturer for Aggiornamenti**: teaching for secondary school professors in physics

2016 – present	Participation in the organization and activities of **European Researchers Night**, for science communication and outreach
2020	Shooting and post-processing of the **video for the advertisement of the B.Sc. physics curricula at the university of Pavia** (https://youtu.be/Dllmvk9QPrE).
2016	**Lecturer "Incontri del martedì"** at the physics department of the University of Pavia.

Teaching Experience

2022 – present	**Adjunct Professor**, *Physics - University of Pavia*, Italy.
	course title: "Artificial Intelligence for experimental and applied physics."
2022 – present	**Adjunct Professor**, *Artificial Intelligence for Science and Technology - University of Milano Bicocca*, Milano, Italy.
	course title: "Physical Sensors and Systems for Biomedical Imaging"
2021	**Lecturer**, *Nanjing University of Aeronautics and Astronautics* , Nanjing, China.
	Lectures on the coupling of Python to Monte Carlo particle transport tool-kits such as PHITS and MCNP, for the evaluation of dose in treatment planning simulations.
2014 – 2021	**Lecturer**, *University of Pavia*, Pavia, Italy.
	Lecturer for 1st year B.Sc. Physics students for the course "Physics Computational methods". The main topics of the course are: Unix, bash script, C++, ROOT and LaTeX. I am responsile for the LaTeX classes and for the C++ hands-on laboratory, and recently I organized a few Python introductory lectures.
2014 – 2021	**Lecturer**, *University of Pavia*, Pavia, Italy.
	Lecturer for 1st and 2nd year M.Sc. Physics students for the course "Monte Carlo simulation in medical physics". The main topics of the course are MCNP (a widely used monte carlo particle transport code) and radiobiology. I organize an introductory course on PHITS (a monte carlo particle transport code) where i give both theory lessons and hands-on labs.
2012 – 2020	**Lecturer**, *University of Pavia*, Pavia, Italy.
	Lecturer for 1st year B.Sc. Biology and Biotechnology students for the course "Elementary Physics". I teach them the laboratory class, by performing experiments with: microscopes, electric circuits and classical mechanics.
2018	**Lecturer**, *University of Pavia*, Pavia, Italy.
	Lecturer for 1st year B.Sc. Engineering students for the course "Elementary Physics". I show and solve exercises during class on: mechanics, dynamics, energy conservation and thermodynamics

Thesis supervision

2023	**M.Sc. Co-Supervisor**, *Mattia Ragni*, University of Pavia, Italy.
	Developement of machine learning tool for guiding a smart interface optimisation of efficient perovskite solar cells (110/110)

2023 **M.Sc. Supervisor**, *Santa Gabriella Bonaccorsi*, University of Pavia, Italy.

A Geant4 toolkit to simulate X-rays tubes for radiobiological experiments. (110/110)

2023 **M.Sc. Co-Supervisor**, *Matilde Avesani*, University of Pavia, Italy.

Experimental and computational neutron beam characterization at the CN facility of the INFN National Laboratory of Legnaro (110/110 *cum Laude*)

2022 **M.Sc. Supervisor**, *Francesco Morosato*, University of Pavia, Italy.

Deep neural networks per la segmentazione automatica di CT di tumori testa-collo: studio preliminare per la personalizzazione del Piano di Trattamento per la BNCT (110/110 *cum Laude*)

2021 **M.Sc. Supervisor**, *Barbara Marcaccio*, University of Pavia, Italy.

From radiobiological experiments to treatment planning in patients: a BNCT dosimetry study. (110/110)

2021 **M.Sc. Supervisor**, *Belinda Calanni*, University of Pavia, Italy.

Withing the INFN IT-STARTS project, the student will perform treatment planning simulations for BNCT. (101/110)

2020 **M.Sc. Co-supervisor**, *Claretta Guidi*, University of Pavia, Italy.

"Irradiation of reconstructed human skin cultivated in vitro: computational dosimetry and preliminary radiobiological evaluations for BNCT studies". (110/110 *cum Laude*)

2018 **M.Sc. Co-supervisor**, *Andrea Spiga*, University of Pavia, Italy.

"Progettazione di una facility multifunzionale che utilizza un fascio termico di neutroni estratto dal TRIGA Mark II situato al LENA". (96/110)

2017 **M.Sc. Co-supervisor**, *Chiara Magni*, University of Pavia, Italy.

"Neutron activation and dosimetry studies for the design of an accelerator-based BNCT clinical facility at CNAO". (110/110 *cum Laude*)

International Experience

Research Abroad

2019 – 2020 **CNEA**, *Buenos Aires*, Argentina.

Host: Dr Sara J. Gonzalez, Group of Computational Dosimetry and Treatment Planning. In the framework IT-STARTS, I have spent a cumulative period of 3 months at CNEA. There I learned to apply Isoeffective dosimetry models for the clinical dose evaluation in a mixed radiation field.

2019 **ILL**, *Grenoble*, France.

Host: Prof. Ignacio Porras. I was invited to assist the team of Prof. Porras for their BNCT related radiobiological experiments. In particular, in that occasion I've calibrated the system to measure boron concentration in cell samples with neutron autoradiography.

2018 – 2019 **NUAA**, *Nanjing*, China.

Hosts: Prof. Y.-H. Liu and Prof. X. Tang. During a cumulative period of 2 months, I've participated in the research activities related to the development of a BNCT clinically performing neutron beam, from a 5 MeV proton accelerator generating neutrons on a Be target.

International Exchanges

2021 **University of Pavia**, *Pavia*, Italy.

Invited: Miss. Inmaculada Torres Torres, M.Sc student at the University of Granada, Spain. Together with the student, we have completed the evaluation of a BNCT treatment of liver metastases in colon cancer.

2020 **University of Pavia**, *Pavia*, Italy.

Invited: Mr. Zhao Sheng, B.Sc student at the NUAA University, Nanjing, China. Together with the student, we evaluated the dosimetric performances of MCNP and PHITS for clinical BNCT treatment simulations.

2019 **INFN**, *Pavia*, Italy.

Invited: Dr. Agustina Portu, researcher at CNEA, Buenos Aires, Argentina. Dr. Portu was invited to further develop the neutron autoradiography technique capable of co-localising alpha and lithium tracks (from the neutron capture reaction on ^{10}B) with cells.

2019 **INFN**, *Pavia*, Italy.

Invited: Dr. Maria Pedrosa, PhD student at ILL, Grenoble, France. Dr. Pedrosa came to Pavia to perform boron concentration measurements on cell samples.

2018 **University of Pavia**, *Pavia*, Italy.

Invited: Mr. Diyun Shu, M.Sc student at the NUAA University, Nanjing, China. During his final year as a M.Sc student of the NUAA university, Mr Shu came to Pavia and assisted in the development of the cell-tracks co-localising neutron autoradiography technique.

Awards

November 2020 **Premio miglior presentazione orale**, *XIX congresso nazionale SIRR*.

per il lavoro: "Modello di cute sana cresciuto in-vitro per valutare il danno da radiazione"

June 2014 **Fairchild Award**, *16th International Congress on Neutron Capture Therapy*, Helsinki, Finland.

For making significant contribution to the development of Neutron Capture Therapy, with the abstract: "Geant4 study of BNCT mixed field energy deposit in an approximated healthy tissue geometry"

Roles in scientific organisations

2020 – present **Communication Task Force**, *ISNCT*.

ISNCT.net website manager of the International Society for Neutron Capture Therapy.

2019	**10th YBNCT meeting**, *Helsinki*, Finland, Chairman.
2018	**18th ICNCT**, *Taipei*, Taiwan, Chairman.
2017	**9th YBNCT meeting**, *Kyoto*, Japan, Chairman.
2015	**Congress organizer**, *University of Pavia*, Pavia, Italy.
	The 8th young BNCT researchers meeting was held in Pavia. I contributed by developing and managin the event website, and I was part of the organizing committee. Therefore, I helped managing the: scientific program, accommodations and social events.
2014	**Congress Website Manager**, *University of Pavia*, Pavia, Italy.
	Developed and managed the website for "XVI convegno SIRR" and "AQFT 2014"

Personal skills

public speaking	Strong communication skills acquired in oral presentation at congresses, seminars and teaching activities. Ability to communicate to non-technical public through outreach activities. Great care in preparation of audio/video materials and presentations.
work in group	Capacity to work in groups characterized by a high level of multidisciplinarity: BNCT requires the collaboration of different areas of science such as physics, biology, chemistry, engineering, medicine. Ability to work with colleagues in other fileds than physics, especially with biologists, learning new methods and languages, with the goal of a truly interdisciplinary research work.
Leadership	Strong ability in organizing work, managing people, guiding young collaborators. Project management, tasks assignment, delegation, time and budget management are skills which have been improved in the work as Principal Investigator of the INFN grant IT_STARTS. Strong interest in strategic and managerial aspects of the research work. Ability to write proposals and to start new scientific projects.
Intercultural skills	Numerous and strong collaboration with foreign colleagues, based on scientific work and human connection, also sustained by a natural predisposition in learning languages. Ability to form networks and to mix with different cultures, due to interest and capacity to work in very different environments (China, Argentina, Europe)

Coding languages

Advanced	Python, C++ and bash.

Languages

Bilingual	Italian and English
Fluent	Dutch and Spanish

International conferences communications

2023 **Invited seminar**, *INSIGHTS*, Pisa, Italy.

Oral: "Computational dosimetry in BNCT: the ANTHEM project"

2023 **Invited seminar**, *Hadrontherapy: status and perspectives*, CNAO, Pavia, Italy.

Oral: "Treatment Planning for BNCT"

2023 **Invited seminar**, *SIF*, Salerno, Italy.

Oral: "Verso la clinica della terapia per cattura neutronica sul ^{10}B"

2023 **Congresso nazionale AIFM**, Firenze, Italy.

Fiera del fai da te: "The LungQuant system: a software tool for the quantification of pulmonary involvement in COVID-19"

2023 **Workshop AIFM**, Trento, Italy.

Oral: "Terapia per Cattura Neutronica sul Boro: le porte si aprono alla pratica clinica"

2022 **Invited seminar**, *University of Palermo - physics department*, Palermo, Italy.

Oral: "The use of artificial intelligence in Boron Neutron Capture Therapy dosimetry evaluations"

2022 **Invited seminar**, *Wired Health*, Milano, Italy.

Oral: "Neutroni per curare: verso una realtÃă clinica"

2022 **Invited seminar**, *International School on Advanced Imaging Techniques*, Pavia, Italy.

Oral: "Applications of Machine Learning and AI"

2021 **19th ICNCT**, *Granada*, Spain.

oral : "BNCT Neutron Beams should be evaluated by Combining Physical, Radiobiological, and Dosimetric Figures of Merit. "

2020 **19th convegno SIRR**, Italy.

oral : "Modello di cute sana cresciuta in-vitro per valutare il danno da radiazione"

2019 **Invited Seminar**, *Training School: NMR relaxometry data analysis, theory and software*, Pavia, Italy.

"Introduction to Python basics for use with relaxometry data including teaching session with a case study"

2019 **10th YBNCT meeting**, *Helsinki*, Finland.

Poster : "Beam shaping assembly optimization by maximizing the uncomplicated tumor control probability on a cylindrical phantom.".
Poster: "Evaluation of the therapeutic consequences of patient movement during BNCT treatment for the INFN RFQ epithermal neutron beam.".

2019 **Invited Seminar**, *CNEA*, Buenos Aires, Argentina.

"Beam shaping assembly design for clinical BNCT in Pavia and *in-vitro* experimental studies"

2018 **18th ICNCT**, *Taipei*, Taiwan.

oral : "Use of Episkin^{TM} to evaluate BNCT radiation damage to healthy tissue";

oral : "Intra cellular boron distribution evaluation by neutron autoradiography".

2018 **Invited Seminar**, *NUAA*, Nanjing, China.

"Boron Neutron Capture Therapy research from boron measurements to clinical neutron beam evaluations"

2018 **Invited Seminar**, *BIPLE*, Pavia, Italy.

"Introduzione alla simulazione in ambito sanitario"

2017 **9th YBNCT meeting**, *Kyoto*, Japan.

oral : "Neutron beam tailoring for clinical BNCT:from physical parameters optimization to dose distribution evaluations in patient and in treatment room".

2017 **MCMA**, *Naples*, Italy.

poster : "Monte Carlo optimization of a neutron beam from 5 MeV ^{9}Be(p,n)^{9}B reaction for clinical BNCT".

2016 **17th ICNCT**, *Columbia*, Missouri, USA.

oral : "Feasibility and efficacy of a Boron Neutron Capture Therapy for diffused lung tumor: the Pavia university experience on the animal model";

poster : "Tailoring of an epithermal neutron beam for the RFQ-based facility of INFN".

2016 **5th UCANS**, *INFN*, Padova, Italy.

oral : "BNCT neutron beam from accelerator"

2015 **8th YBNCT meeting**, *University of Pavia*, Pavia, Italy.

oral : "Neutron Beam Shaping Assembly from an accelerator source for clinical BNCT"

2014 **16th convegno SIRR**, *University of Pavia*, Pavia, Italy.

poster : "Geant4 study of BNCT mixed field energy deposit in an approximated healthy tissue geometry"

2014 **16th ICNCT**, *Helsinki*, Finland.

oral : "Geant4 study of BNCT mixed field energy deposit in an approximated healthy tissue geometry"

2013 **7th YBNCT meeting**, *University of Granada*, Granada, Spain.

oral : "An improved neutron autoradiography set-up for 10B concentration measurements in biological samples"

Pavia, March 11, 2025