Fundação para a Ciência e a Tecnologia

Evaluation Research Unit 2023/2024

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Part 1: Identification of the R&D Unit, Management Institutions, Laboratory Intensity, and Participating Institutions

01. IDENTIFICATION OF THE R&D Unit

1.0 ID number
4349

1.1 R&D Unit name
Center for Nuclear Sciences and Technologies

1.2 R&D Unit acronym
C2TN

1.3 R&D Coordinator
António Cândido Lampreia Pereira Gonçalves

1.4 Main scientific areas of activity

Exact and Natural Sciences - Earth and environmental sciences
Exact and Natural Sciences - Physics
Exact and Natural Sciences - Chemistry
Medical and Health Sciences - Basic medicine

1.5 Keywords

Nuclear Sciences and Technology
Ionizing Radiation
Advanced Materials
Radiopharmaceutical Sciences
Radiation Protection and Safety
Environment and Cultural Heritage

1.6 R&D Unit address and contacts

- Postal Address:
  C2TN, DECN, IST, Univ. Lisboa., Campus Tecnológico e Nuclear, Estrada Nacional 10, km 139.7
  2695 - 066 Bobadela-LRS
- Telephone Number:219946183
- E-mail address:sec.c2tn@ctn.tecnico.ulisboa.pt

1.7 R&D Unit home page URL
https://c2tn.tecnico.ulisboa.pt/

02. Evaluation Panel to which the R&D Unit submits the application

2.1 Evaluation Panel to which the R&D Unit submits the application

NATURAL SCIENCES - Earth and Environmental Sciences and Technologies

2.2 Multidisciplinary evaluation

Yes

Evaluation panel
EXACT SCIENCES - Physics
EXACT SCIENCES - Chemistry

2.3 Location for the Evaluation Panel visit to the R&D Unit

- Campus Tecnológico e Nuclear, Estrada Nacional 10, km 139.7
  2695 - 066 Bobadela-LRS

03. Laboratory Intensity

3.1 Laboratory intensity

Laboratory intensity	Intensity description
High [f=1,2]	R&D unit with equipments and/or laboratories, or that participates in campaigns and/or field activities, that have significant operating and maintenance costs, in relation to the base funding of R&D unit.

C2TN houses a large set of laboratorial infrastructures and equipment, many of them unique at national level, entailing high operating and maintenance costs. Given their number, only the major and more complex are listed below.

Nuclear Sciences and Technology include: Scanning Nuclear Microprobe, with Ion Beam Analysis (IBA) techniques in-vacuum/open-air (elemental distribution maps at ?m and composition/elemental depth profiles) to study a wide type of materials; X-ray Advanced High Resolution Energy Dispersive Spectrometry Research and Metrology Laboratory, including Holistic measurements of X-ray and backscattered Particle Spectra (Total-IBA), for materials characterization including low mass and/or nanoparticle samples and advanced fundamental studies. Experimental setups at CERN/ISOLDE supported by C2TN: on-line Emission Channeling for lattice location of dopants/impurities in crystals with sub-angstrom precision to probe short-lived isotopes; Perturbed Angular Correlations to probe hyperfine interactions studying atomic scale electrical and magnetic properties.
Ionizing Radiation has: Ionizing Radiation Facility equipped with a Co-60 irradiator and a linear electron accelerator with electron/photon beams. Effects of ionizing radiation are evaluated at Laboratory of Technological Assays in Clean Rooms (ISO 5 - ISO7) for ionizing radiation applications using microbiology (include a virology negative pressure room), molecular biology, chemistry, biochemistry interdisciplinarity. It is the only national laboratory able to determine the sterilization dose for industry.
Radiation Protection holds laboratories for: Environmental and Radioecology (several HPGE and

Laboratory intensity	Intensity description

liquid scintillation detectors), Radioactive Waste Management, Radiobiology and Dosimetry (light/fluorescence microscopy, phantoms MOSFET detector and Metrology of Ionizing Radiation). Environment and Cultural Heritage has laboratories for: Isotopic Hydrology, ICP-MS, Radiocarbon Dating, X-ray Fluorescence Spectrometry, Air Quality and Climate Action Observatory, Absolute Luminescence Dating of geoarchaeological materials and Dosimetry by thermoluminescence, Gamma Spectrometry with Sample Changer Gamma Analyst, DRX/SEM-EDS, Porosimetry with a Quantachrom instrument for pore/micropore volume and surface area studies by various methods; laboratories for samples treatment with high maintenance costs, comprising, e.g., ovens, centrifuges, electric mills, high precision balances, etc.
Radiopharmaceutical Sciences include laboratories for: Radiosynthesis, inorganic/organic chemistry with equipment for solution thermodynamic studies and solid-phase peptide synthesis; biochemical studies, molecular biology, cell culture and animal housing facilities. Biological evaluation of radioactive compounds is achieved in dedicated cell and animal studies laboratories that comprise a micro-PET/SPECT/CT animal imaging equipment.
Advanced Materials holds: Low Temperature and High Magnetic Field Laboratory for physical characterization measurements at low temperatures with several magnetometers, electric transport and magnetotransport characterization, and the Mössbauer spectroscopy facility, to study natural and synthetic materials (this laboratory is supported by a He liquefier that supplies the cryogenic equipment, and some outside); High-temperature Synthesis and Crystal Growth Laboratory, with arc/induction melting Hot-press, Splat Cooling/Melt Spinning, Electrospinning (micra/submicra fibers production), able to handle most elements, comprising U and Th; Electrochemical Laboratory, for synthesis and crystal growth; Molecular Materials Laboratory with FTIR, TGA and DSC to study irradiated macromolecular materials.

All the above-described infrastructures and equipment have average annual maintenance and operating costs higher than 500 k€. Research also includes campaigns and field activities, mainly within Environmental and Cultural Heritage domain, incurring annual costs of ~50 k€.

04. Involved institutions

4.1 Main Management Institution

Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)

4.2 Other(s) Management Institution(s)

4.3 Partnership agreements with other Management Institution(s)

4.4 Participating Institution(s)

4.5 Partnership agreements with Participant Institution(s)

Instituto Politécnico do Porto (IPP)
Instituto Politécnico de Setúbal (IPSetúbal)

Part 2: Description of the R&D Unit, main contributions of the team of integrated researchers, External Advisory Board and funding in 2018-2023

05. Description of the main contributions of the team of Integrated Researchers in the current application

5.1 General description of the R&D Unit

C2TN is the national reference unit and a major international player in applications of nuclear sciences and technologies and ionizing radiation. Guided by its motto, "Radiation for Science and Society", it upholds a commitment to scientific excellence while actively addressing societal challenges.
C2TN´s objectives in 2018-2023 were:
i) PURSUIT OF SCIENTIFIC AND TECHNICAL EXCELLENCE: using its expertise in domains of long-standing interest, and applying it to fields new to C2TN, such as space and defense, and increasing internationalization through participation in international projects (EURATOM, 8 H2020, 6 Horizon Europe, 2 Interreg, 1 EEA Grants, 20 IAEA), R&D networks (9 Cost Actions, 14 bilateral cooperations), 8 platforms and 6 CERN experiments.
ii) OUTREACH AND DISSEMINATION: engaging with society via an Outreach team to promote science and its societal relevance by organizing scientific visits, leveraging social media platforms, promoting living-lab initiatives, adopting a citizen science approach, participating in key national/international events, publishing in high-quality journals (55% Q1), organizing seminars, conferences, training schools and other events.
iii) ENSURING FUNDING SUSTAINABILITY: diversifying funding sources and opportunities, resulting in ~8.3M€ income used to mitigate job insecurity of young PhD researchers (17 contracts, 73 grants), maintain unique equipment/infrastructures, and renew or acquire scientific equipment. Collaboration with the Pre-Award office of IST-ID was instrumental in identifying funding opportunities and facilitating networking.
Activities reinforced and consolidated C2TN as a multidisciplinary hub of excellence, engaged in R&D, services and advanced training using nuclear and related techniques in 3 Thematic Lines (TLs):
a) EARTH SYSTEMS, RADIOACTIVITY AND CULTURAL HERITAGE: pollutant sources were identified in air, water and soil for environmental and natural resources management and protection; mitigation processes for environmental (bio)hazards were developed using ionizing radiation, including wastewater treatment and valorization; processes for sustainable agroindustry were explored; low carbon and circular economy approaches were promoted; cultural heritage leverage and safeguard strategies were studied;
b) RADIOPHARMACEUTICAL SCIENCES AND HEALTH PHYSICS: better management of cancer with effective and personalized diagnosis and treatments was pursued by the design and pre-clinical evaluation of radioactive tools, and the quantification of risks related to low doses and prolonged exposure to radiation. Quality and safety standards in radiation protection were improved via the assessment of doses and risks due to radiation exposure of patients and doctors.
c) ADVANCED MATERIALS: enhancing the understanding of the relation between structure/composition/processing and physical properties by studying molecular, macromolecular and inorganic materials led to the development of materials for energy conversion, sensors, electronic devices, and biomedical applications.
During COVID pandemic, C2TN was an example of proactive engagement with societal concerns, mobilizing a task force of researchers to reinforce the national testing capacity. C2TN also collaborated with industry to develop a long-acting disinfectant solution (submitted patent).
All activities were made by 5(6) Research Groups: 1) Nuclear Engineering and Techniques, 2) Radiation, Elements and Isotopes, 3) Radiation Protection and Safety, 4) Radiopharmaceutical Sciences, 5) Solid State, and 6) f-element Chemistry (left in 2019); contributing to the mentioned TLs.
Monthly meetings of the Coordination Committee, led by C2TN President, with Group and TLs coordinators, served as crucial forums to monitor, discuss and evaluate the progress of the Unit's project, and ensure an efficient management and the attainment of objectives. C2TN proactively promoted gender balance and strengthened young researchers' involvement.

5.2 Identification and brief description of up to 5 contributions that the R&D Unit considers to be the most important during 2018-2023 period, from Integrated PhD holder Researchers registered in the

current application, independently of the R&D Unit having previously existed or not

C2TN´s expertise and unique facilities have resulted in relevant achievements to the advancement of knowledge and benefit of society. Below are the 5 selected contributions.

TACKLING GLOBAL ENVIRONMENTAL STRESSORS: EFFECTIVE MITIGATION STRATEGIES

C2TN has taken a leading role in spearheading research initiatives in collaboration with authorities, industries, companies, NGOs, and scientific partners aiming at the improvement and protection of air, soil, and water quality. These collaborative efforts led to: 1) the assessment of levels of radioactivity and chemical and microbiological pollutants based on advanced analytical techniques; 2) the evaluation of environment and health risks combining measuring and modeling approaches; 3) the development of methods for source apportionment to identify the impact of anthropogenic sources; 4) the clarification of transfer mechanisms among environmental compartments at contrasting worldwide regions; 5) the proposal of methodologies for air, soil, water and waste treatment (some using ionizing radiation); 6) the creation of tools for pollution managing and mitigation and 7) the promotion of circular and low carbon economy.

Strategies for assessing exposure to air pollutants in indoor and outdoor environments were developed within 6 European (EU) projects. Networks of mobile low-cost air quality sensors and concepts like big data analytics and the internet of things facilitated the provision of health-optimized routing services to the population, representing an advancement towards the smart city concept.

New approaches were developed for the identification of NO3 sources, supported by the International Atomic Energy Agency and Aveiro municipality, allowing the assessment, protection and sustainability of water resources.

The PANORAMA EU project contributed to PhD training and advancing knowledge in the field of Rare Earth Elements (REE) contamination, focusing on REE anthropogenic sources, bioavailability, uptake and accumulation in living organisms in old mine environments.

EEA Grants PAB-living lab and EU ECF4CLIM initiatives promoted measures addressing climate change, such as establishing living labs in schools and urban parks to showcase strategies for decarbonization.

ADDRESSING CHRONOLOGICAL, TECHNOLOGICAL AND PROVENANCE CHALLENGES IN CULTURAL HERITAGE

C2TN's interdisciplinary collaboration, integrating archaeological, historical, scientific, and technological partners (e.g. monuments, museums, companies) tackled the complex challenges of chronology and provenance of cultural heritage. With a focus on advanced extensive data collection, compositional characterization, dating techniques, and robust interpretation frameworks, our efforts aimed at reconstructing timelines of ancient contexts and objects. C2TN state-of-the-art methodologies and unique infrastructures, including nuclear microprobe analytical techniques, radiocarbon and luminescence dating, enhanced the accuracy of technological and chronological investigations, contributing to the understanding of objects, ideas and people mobility across different periods.

The study of metal production and trade in SW Iberia revealed evidence of local and long-distance copper trade with Iberia regions during the 3rd millennium BC, in addition to advancements in manufacturing complexity and arsenical copper use during the 2nd millennium BC. The Phoenician technological influence from 9th/8th century BC onwards and a Roman food/textile commerce with North Africa provided valuable insights on the Mediterranean influences in the evolution of Iberian communities.

Innovative protocols produced reliable luminescence ages in calcite-rich materials, as well as enabled the identification of prehistoric "firesetting" through the detection of residual heated rock from mining exploration. The complex chronological framework of archaeological sites, by TL-OSL, as a Roman military camp (Lomba do Mouro, Portugal) or Menga (Spain, UNESCO World Heritage) were also defined.

The characterization of lithic artefacts, by using non-destructive techniques (PGAA, PIXE), increased the knowledge on the regional role and extra-regional relationship of prehistoric sites (Perdigões and Vila Nova de São Pedro, National Monuments) (IPERION HS/H2020).

CANCER THERANOSTICS AND MEDICAL RADIATION PROTECTION FOR PERSONALIZED MEDICINE

C2TN has addressed several challenges in the field of cancer theranostics towards a personalized

medicine approach, involving ionizing radiation delivered by photon or particle external beams and medical radionuclides. Innovative approaches combining experimental in vitro and in vivo studies with computational insights using state-of-the-art Monte Carlo (MC) simulation programs were pursued.

For targeted radionuclide therapy (TRT) of disseminated cancer, the promising Auger emitter 161Tb was explored for prostate cancer, in comparison with 111In, in a setting of improved subcellular targeting. The results corroborated its potential for Auger electron radiopharmaceutical therapy, which is expected to have similar efficacy as alpha therapy for oncological small disease, with estimated lower risks of normal tissue toxicity. In a supramolecular approach, metallacages were explored to transport imaging radionuclides across the blood brain barrier. This versatile strategy opens new avenues for the delivery of therapeutic radionuclides to brain tumors. Importantly, we have further expanded the biological assessment of radiotheranostic compounds to advanced 3D cultures of cancer that can better mimic the complexity of in vivo tumors, and improve the clinical translatability of the preclinical studies being pursued at C2TN.

On the path to improve current radiation therapies and taking into account radiological protection, a relevant C2TN´s contribution was the optimization of clinical dosimetry, both in TRT and external radiotherapy, based on MC simulations and measurements in clinical settings, in collaboration with Portuguese hospitals. Thus, MC simulations were used to determine absorbed doses, considering data from patients treated with 177Lu. Employing pediatric computational phantoms, absorbed dose studies were conducted with i) novel therapeutic radionuclides and ii) out-of-field doses in radiotherapy. Furthermore, we have assessed radiation doses on the foetus, using anthropomorphic computational and physical phantoms for women undergoing mammograms during the first trimester of pregnancy.

ADVANCED MATERIALS FOR SUSTAINABILITY

C2TN pioneering research, using cutting-edge synthesis, processing, and characterization techniques, tackled sustainability challenges by developing materials for green energy, quantum technologies, and healthcare. At the forefront of these advances was the investigation of the fundamental properties of materials, particularly those exhibiting unconventional electrical and magnetic behaviors, which leads to a better understanding of the interplay between structure, composition, processing, microstructure, and physical properties. Such knowledge has enabled the development of new thermoelectric materials based on tetrahedrites for efficient, low-cost and environmentally friendly conversion of heat into electricity. Leveraging its expertise in developing molecular materials, known for their remarkable tunability in achieving specific properties, C2TN has led the exploration of new materials with potential applications in emerging fields like spintronics or memory devices, including transition metals and f-elements single molecule magnets, spin crossover complexes or molecular spin ladders. Relevant contributions were made in the healthcare field through the functionalization of biocompatible and biodegradable macromolecular materials using radiation technologies for biomedical applications, with advantage over conventional technologies. The developed methods enable reactions at room temperature, absence of harmful initiators or solvents, ensure deep penetration through bulk materials, and allow for preparation and sterilization in a single step.

All these studies were possible due to specialized preparation techniques such as radiation processing and high temperatures. Unique characterization techniques involving low temperatures, high magnetic fields or ion beams provided crucial insights into the material properties.

NUCLEAR TECHNIQUES FOR CUTTING-EDGE RESEARCH

C2TN has a series of specialized nuclear characterization techniques and expertise. Good examples of cutting-edge research that highlight such capability are: i) Photon lights a path towards a nuclear clock: observation of radiative decay of 229Th nuclear clock isomer - C2TN's Materials Characterization with Nuclear Radioactive Techniques infrastructure utilizing radioactive ion beams at ISOLDE-CERN yielded significant results: (a) pioneered nuclear hyperfine studies using Perturbed Angular Correlations online via "PAC-SLI" setup focusing on nuclear moments of Sn isotopes; (b) conducted Emission Channeling & Photoluminescence techniques with Ge and Pb isotopes, and continued investigation on 229Th implanted CaF2, vital for solid-state nuclear clocks. This work enabled the external excitation of the VUV low-energy nuclear state in 229Th-doped samples. With its exceptionally low excitation energy, 229Th is a leading candidate for next-generation optical clocks, offering precise tests for fundamental physics. ii) Fe speciation by

Mössbauer Spectroscopy: an enlightening nuclear technique able to characterize Fe in advanced materials - C2TN is globally renowned as a leading expert in iron speciation using Mössbauer Spectroscopy. Its experimental setup allows data collection from 1.5 to 297 K, making it suitable for characterizing a wide array of materials. Notable instances include studies on the characterization of the environment, oxidation states, and spin of iron in a 2D crystalline functionalized monolayer of coordination polymers.

5.3 Main publications in 2018-2023 by Integrated PhD holder Researchers registered in the application

Reference	URL
1 - Kraemer, S., Moens, J., Athanasakis-Kaklamanakis, M. et al. Observation of the radiative decay of the 229Th nuclear clock isomer. Nature, 617, 706-710 (2023). FI: 64.8	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
2 - Castells-Gil, J., Padial, N.M., Martí-Gastaldo, C. et al. Heterometallic Titanium-Organic Frameworks as Dual-Metal Catalysts for Synergistic Non-buffered Hydrolysis of Nerve Agent Simulants. Chem, 6, 3118-3131 (2020). FI:25.8	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
3- López-Cabrelles, J., Mañas-Valero, S., Coronado, E. et al. Isoreticular two-dimensional magnetic coordination polymers prepared through pre-synthetic ligand functionalization. Nature Chemistry, 10, 1001-1007 (2018). FI: 21.8	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
4 - J. Madureira, M. I. Dias, J. Pinela, R. C. Calhelha, L. Barros, C. Santos-Buelga, F. M.A. Margaça, I. C.F.R.Ferreira, S. Cabo Verde. The use of gamma radiation for extractability improvement of bioactive compounds in olive oil wastes. Science of the Total Environment, 2020, 727:138706. FI: 9.8	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
5 - Almeida, S.M., Manousakas, M., Diapouli, E., Kertesz, Z., Samek, L., Hristova, E., Šega, K., Alvarez, R.P., Belis, C.A., Eleftheriadis, K., The IAEA European Region Study GROUP, 2020. Ambient particulate matter source apportionment using receptor modelling in European and Central Asia urban areas. Environ. Pollut. 266, 115199. FI=8.9	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
6 - I. Paiva, R. Marques, M. Santos, M. Reis, M.I. Prudêncio, J.C. Waerenborgh, M.I. Dias, D. Russo, G. Cardoso, B.J.C. Vieira, E. Carvalho, C. Rosa, D. Lobarinhas, C. Diamantino, R. Pinto (2019). Naturally Occurring Radioactive Material and risk assessment of tailings of polymetallic and Ra/U mines from legacy sites.Chemosphere 223, 171-179.FI=8.8	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
7 - El Mountassir O.; Bahir M.;Ouazar D.; Chehbouni A; Carreira P.M. (2022) - Temporal and spatial assessment of groundwater contamination with nitrate using nitrate pollution index (NPI), groundwater pollution index (GPI) and GIS (case study: Essaouira basin, Morocco).Environmental	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...

Reference	URL
Science and Pollution Research, 29(12),17132-17149. FI=5.8	
8 - Santos JF, Braz MT, Raposinho P, Cleeren F, Cassells I, Leekens S, Cawthorne C, Mendes F, Fernandes C, Paulo A* (2023) "Synthesis and Preclinical Evaluation of PSMA-Targeted 111In-Radioconjugates Containing a Mitochondria-Tropic Triphenylphosphonium Carrier" Mol Pharm Mol. Pharmaceutics 2024, 21, 1, 216-233 Publ. Date:Nov. 22, 2023. FI=4.9	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
9 - Woods, B., Silva, R.D.M., Schmidt, C., Wragg, D., Cavaco, M., Neves,V., Ferreira, V.F.C., Gano, L., Morais, T.S., Mendes, F*., Correia, J.D.G*., & Casini, A*. (2021). Bioconjugate Supramolecular Pd2+ Metallacages Penetrate the Blood Brain Barrier In Vitro and In Vivo. Bioconjugate Chemistry, 32(7), 1399-1408. FI=4.7	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
10 - Cravo Sá, A., Barateiro, A., Bednarz, B.P., Almeida, P., Vaz, P., Madaleno, T. (2022). Comparison of 3DCRT and IMRT out-of-field doses in pediatric patients using Monte Carlo simulations with treatment planning system calculations and measurements. Front. Oncol. 12:879167. FI=4.7	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
11 - J. T. Coutinho, M. Perfetti, J. J. Baldoví, M. A. Antunes, P. P. Hallmen, H. Bamberger, I. Crassee, M. Orlita, M. Almeida, J. van Slageren, L. C. J. Pereira, Chem. Eur. J. 2019, 25, 1758. FI=4.3	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
12 - Di Maria, S.; Vedantham, S.; Vaz, P. (2022) Breast dosimetry in alternative X-ray-based imaging modalities used in current clinical practices. European Journal of Radiology 155: 110509. FI=3.3	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
13 - Sanjuán, L. G. Medialdea, A., Nieto, V.B., Athanassas, C., Pike, A., Standish, C. D., Dias, M. I., Rodrigues, A. L., Toledo, J. L. C., Wheatley, D. W., Peña, M. C. 2023 Birth of a Giant. A Multi-Method Approach to The Genesis of Menga, A World Heritage Megalith. Quaternary Research, 1-20. WOS:000839971800001. FI=2.3	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
14 - Pinto, C.I.G, Bucar, S., Alves, V., Fonseca, F., Abrunhosa, A., da Silva, C.L., Guerreiro J.F., & Mendes, F*. (2020). Copper-64 chloride exhibits therapeutic potential in three-dimensional cellular models of prostate cancer. Frontiers in Molecular Biosciences, 7, 609172. FI=5.2	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...
15 - Gomes S.S., Valerio P., Freitas V.T., Fabião C., Soares, A.M., Araújo M.F. (2023) An insight from the sea: provenance studies on Roman lead artefacts from the Arade River, Portimão (Portugal). Archaeological and Anthropological Sciences, 15, 171. FI=2.2	http://projects.ctn.tecnico.ulisboa.pt/C2TN_FCT...

5.4 Description of other relevant activities carried out in 2018-2023 by integrated PhD holder researchers registered in the application

VIBRANT AND ENGAGING INTERNATIONAL COLLABORATION

C2TN is a dynamic center of reference in applications of nuclear sciences and technologies and ionizing radiation, renowned for its strong international collaborations and esteemed reputation within its fields of expertise. C2TN global impact is evident through its participation in numerous international joint research projects, resulting in publications in high-impact journals, demonstrating the unit's significant influence and reputation worldwide, including authors from 72 different countries. It is actively involved in over 30 international networks and platforms, indicating its high level of international engagement and recognition. Moreover, C2TN's advanced infrastructure and expertise have drawn a substantial number of international visitors, who come to conduct experiments and explore potential collaborations. Such as Prof. Jeffrey Snyder (Northwestern Univ. USA) and Takao Mori (National Institute for Materials Science, Japan), world-leading experts on thermoelectrics, and Prof. Angela Casini (Technical Univ. of Munich, Germany), renowned scientist in the field of bioinorganic chemistry. C2TN researchers are also engaged in many exchange projects, involving scientific missions to several international universities and research centers.

PROACTIVITY IN SEEKING CO-FINANCING

In the period 2018-2023, C2TN successfully started 90 projects (>11 M€). Central to this success has been C2TN commitment to internationalization and the strategic diversification of funding sources. Leveraging its vast international network, C2TN has been adept at securing projects from numerous programs, including European Commission Horizon Europe (6), H2020 (8), LIFE (1), Interreg (2), and COST (9) projects, as well 1 EEA grant and 20 IAEA projects. While C2TN´s engagement with various international funding programs has been crucial in advancing its research, it is worth noting the significant role played by the Portuguese Foundation for Science and Technology (FCT). FCT has funded 18 projects, facilitated 14 bilateral cooperations, and provided contracts and essential PhD fellowships for young researchers within the C2TN team.

ADVANCED AND PROFESSIONAL TRAINING

C2TN prioritizes advanced training through partnerships with national and international institutions. A notable example is its collaboration with the IAEA in the environment field and the use of radiation technologies to improve resource efficiency. Through this partnership, C2TN supports training initiatives to enhance the skills and knowledge of professionals involved in monitoring and assessment areas. C2TN also organized 6 schools for training on its areas of expertise. Additionally, C2TN researchers play a key role on TECNICO+, an advanced and professional post-graduate school in technology, engineering, science, and architecture, particularly in the radiological protection and security areas. Thus, C2TN ensures that its research findings and best practices reach beyond academia, benefiting professionals and stakeholders across various sectors.

SCIENTIFIC TRAINING OF STUDENTS

C2TN recognizes the crucial role of scientific training of students in nurturing the next generation of researchers. Despite being primarily devoted to research, most C2TN members belong to the Department of Engineering and Nuclear Sciences (DECN), and were involved in the creation and teaching of 1 doctoral and 3 master programs. From 2018 to 2023, C2TN´s researchers mentored and supervised over 100 PhD and MSc students, and numerous undergraduate students. A hallmark of C2TN is the multidisciplinary expertise of team members, allowing them to supervise students from diverse backgrounds and disciplines, like Environmental Engineering (18), Chemistry (18), Radiological Protection and Safety (14), Physics (13), Materials Engineering (6), Biomedical Engineering (5), Pharmaceutical Engineering (4), Applied Microbiology (3) and Earth Sciences (2), in collaboration with national and international scientists. Around 75% of the PhD students were co-supervised with external partners, 30% from other countries. C2TN took part in 2 Marie Sklodowska-Curie Innovative Training Networks, involving 4 PhD students in earth sciences, advanced materials and radiopharmaceutical sciences, contributing to highly skilled doctoral training, talent development, and research advancement. C2TN's international student appeal is evident from the significant number choosing our labs for internships and scientific missions.

ORGANIZATION OF CONFERENCES, COLLOQUIA AND SEMINARS

C2TN actively organizes conferences to promote knowledge exchange and collaboration within the scientific community. Between 2018 and 2023, despite Covid pandemia, C2TN hosted 12 international conferences, serving as platforms for researchers, academics, and industrials to explore the latest advancements in the environment (1), materials (5), health (3), cultural heritage (1)

and radioprotection (2) fields. Moreover, the research unit launched the C2TN Academy, a dynamic space aimed at enhancing knowledge, skills, and strategic dialogue within our scientific community. Through various initiatives, C2TN Academy has proven instrumental in fostering professional growth, attracting new talent, and advancing our research unit strategic vision. C2TN Academy hosted 26 seminars, workshops, courses, summer schools, round table discussions and dissemination events, each contributing to an ecosystem of learning, collaboration, and strategic foresight.

TRANSFER OF KNOWLEDGE AND TECHNOLOGY AND ACTIONS OF SPECIAL RELEVANCE TO SOCIETY

C2TN researchers have unparalleled expertise in radiological protection and radiation safety, contributing significantly to societal welfare. The research unit is committed to addressing urgent societal needs through a multifaceted approach involving fundamental and applied research, advanced services, training and knowledge transfer initiatives. C2TN activities span radiosterilization, dosimetry, radiobiology, environmental radioactivity, radioecology, radioactive waste management, ionizing radiation metrology, and emergency management of radiological and nuclear incidents. In addition, relevant contributions were made in the field of cultural heritage, involving national and international museums, national heritage and Unesco heritage. C2TN also collaborated with regional water authorities, municipalities and stakeholders, and offers advice to state regulatory agencies. Thus, C2TN´s expertise goes beyond research, offering advanced services and training for the benefit of the state, the national health system, companies, and industries, contributing to enhancing safety standards and minimizing risks.

PROMOTION OF SCIENTIFIC AND TECHNOLOGICAL CULTURE AND CITIZEN SCIENCE

C2TN actively fosters scientific and technological culture through its participation in various fairs and events, including esteemed European Research Night. Moreover, C2TN ensures broad dissemination of its research by involving researchers in radio programs like '90 Seconds of Science' and publications in newspapers, while also participating in engaging dissemination events such as the highly successful initiative 'Explain As If I Was a Child', endorsed by IST, which draws in hundreds of participants. Citizen Science is a cornerstone of C2TN research initiatives, playing a key role in several European projects like LIFE Index-Air, 3SQAIR, ECF4CLIM, and InChildHealth, international results dissemination within Cultural Heritage classified sites communities, alongside numerous national works collaborations with municipalities, like Loures, Seixal, and Ponte de Sôr. In the past five years, C2TN has actively engaged over 30,000 citizens, including 20,000 students from more than 40 educational institutions. The active participation of the population in these scientific projects opened opportunities for non-scientific communication of environment and health issues, and cultural heritage preservation, increased literacy, changed individual behaviors and promoted societal pressure to implement actions that may mitigate damages, pollution and its harmful effects.

PLANS FOR GENDER EQUALITY AND INCLUSIVENESS

C2TN promotes gender mainstreaming in research, reflected in a balanced gender representation throughout its scientific community and governance structure: 57% of the integrated members are female, women coordinated 50% of Research Groups and 50% of Thematic Strands. Gender balance was actively achieved in the recruitment of PhD researchers and PhD candidates. Training on tackling unconscious bias and on gender equality have been implemented in alignment with the IST-ID gender equality plan, fostering an inclusive environment at C2TN.

POLICY OF PRIVACY CONCERNING DATA MANAGEMENT AND PROCESSING

C2TN practices Open Science principles while protecting Intellectual Property Rights (IPR) to enable its exploitation by researchers. Data and results with commercial potential adhere to IST's IPR policy, supported by the IST Technology Transfer Office. The aim was to maximize the public availability of data, while protecting the interests of researchers. C2TN projects have a research data management plan following the FAIR (Findability, Accessibility, Interoperability, and Reuse of digital assets) principles. Whenever feasible, data is stored in a straightforward, readable format, and the software (4 tools developed between 2018-2022) is written in widely-used languages and extensively documented. C2TN aim and mission, as well as public events, are available on the public website (https://c2tn.tecnico.ulisboa.pt). Both the data and website are maintained to enable continued access. C2TN adheres to Open Access (OA) standards, providing unrestricted access to its scientific output without financial, legal or technical barriers (~30% publications Gold OA). Journals are chosen based on subject relevance, prestige and visibility (55% Q1).

5.5 Explain to what extent the proposed activity plan for the period between 2018-2023 was fulfilled, indicating and justifying any deviations from this plan

The majority of the tasks outlined in the activity plan for 2018-2023 were successfully completed, despite the challenges faced during COVID pandemic. Missions, field activities, conferences, and visits that could not be carried out as planned were either conducted virtually or postponed for following years. Pandemic also affected advanced training of young researchers, decreasing expected PhD theses from > 8 to 6.4/year.
Actions were focused on the 3 main pillars outlined in the Activity Plan: i) SCIENTIFIC AND TECHNICAL EXCELLENCE, ii) OUTREACH AND DISSEMINATION, and iii) FUNDING SUSTAINABILITY.
RESEARCH kept its commitment to EXCELLENCE, relying on the TLs - Earth Systems, Radioactivity and Cultural Heritage (ESRCH), Radiopharmaceutical Sciences and Health Physics (RSHP) and Advanced Materials (AM), the key role for such achievements. Collaboration among researchers from Research Groups through TLs was evidenced by the expressive number of co-authored articles (144 out of 706).
ESRCH studies advanced as planned, achieving milestones in various areas including air quality improvement, reduction of carbon footprint, industrial wastewater treatment/valorization, environmental protection, natural resources management, and environmental hazards decontamination. Also nuclear and related techniques were used to characterize cultural heritage. Efforts also extended into sustainable agroindustry and food security by ionizing radiation.
In RSHP, as planned, new radiopharmaceutical tools were designed and assessed to enhance cancer and disease management, focusing on personalized medicine diagnostics and treatments. Computational studies were conducted on micro- and nanodosimetry in radiotherapy. As outlined, research on dosimetry of ionizing radiation in medical applications was undertaken, integrating clinical data and Monte Carlo simulations with voxel phantoms.
In AM, new nanostructured and multifunctional materials, strongly correlated electronic and topological systems, novel intermetallics, macromolecular and hybrid materials were studied, without significant deviations from the intended activities, with results on energy, biomedical and other applications.
C2TN consolidated its internationalization activities and participation in international infrastructures, as per the plan.
Due to the reduction in Pluriannual funding, we faced limitations in hiring permanent research career positions and the proposed PhD scholarships. However, C2TN dedicated more than 50% of its Pluriannual funding for human resources. This funding reduction also limited the acquisition of proposed equipment, but in addition, XRD, SEM/EDS was co-acquired with DECN and Loures Campus, and a pre-clinical microSPECT/PET/CT, unique in Portugal, was received as donation.
OUTREACH AND DISSEMINATION activities increased. A renewed image, logo and website to enhance accessibility for stakeholders and the public. Engagements included internships, workshops and events related to C2TN's activities, and organized visits, summer schools and conferences (some online). The "Social C2TN" initiative, aiming to strengthen relationships among members, was acknowledged as a Best Practice by ObservIST.
C2TN led/participated in many national/international projects, enhancing FUNDING SUSTAINABILITY. Examples are EU projects, as InChildHealth or RADOV, Iperion projects, and MSCI Training Networks, as MEDICIS-Promed or PANORAMA. We join FCT projects, COST Actions and bilateral collaborations. C2TN researchers integrated CERN and IAEA projects, pulling expertise in fields like ionizing radiation, nuclear microanalysis, environmental isotopes, hybrid materials, radioprotection, radionuclide therapy and cultural heritage.
During pandemic C2TN researchers carried out SARS-CoV-2 virus inactivation, enhancing national testing capacity, collaborated with industry to develop a long-acting Nano Spray disinfectant, and disseminated reliable information on the topic.

06. Reports and composition of the External Advisory Board

6.1 Reports of the External Advisory Board in 2018-2023

R&D Unit	File
Centro de Ciências e Tecnologias Nucleares	Advisory Board Report-EC.pdf
Centro de Ciências e Tecnologias Nucleares	Advisory Board Report-AD.pdf
Centro de Ciências e Tecnologias Nucleares	Advisory Board Report-ZK.pdf

6.2 Composition of the current External Advisory Board

R&D Unit	Member Name	Institution	Country
Centro de Ciências e Tecnologias Nucleares	Professor Adriano Duatti	University of Ferrara	Italy
Centro de Ciências e Tecnologias Nucleares	Professor Zsolt Kasztovszky	Centre for Energy Research	Hungary
Centro de Ciências e Tecnologias Nucleares	Professor Eugenio Coronado	Universidad de Valencia	Spain

07. Funding during 2018-2023

7.1 Annual funding in 2018-2023

FUNDING SOURCES (TOTAL FUNDING)	2018	2019	2020	2021	2022	2023	TOTAL (K€)
Fundação para a Ciência e a Tecnologia, I.P. - FCT	1.490	1.606	1.796	1.705	1.331	865	8.793
R&D Unit Pluriannual funding (base and programatic)	308	583	366	468	367	338	2.430
R&D Project funding	795	323	872	713	766	398	3.867
Funding for contracts of researchers with PhD (1)	12	450	408	438	146	65	1.519
Scholarship funding for PhD, PostDoc or other fellowships (2)	375	250	150	86	52	64	977
Other funding	0	0	0	0	0	0	0
Other national sources	78	63	83	43	243	103	613
Funding received from Participant or Management Institutions	0	0	0	0	0	0	0
Public sources (3)	18	1	0	0	2	19	40
Companies, industry and other private sources based in Portugal (3)	21	42	59	33	57	47	259
Any other funding source (3)	39	20	24	10	184	37	314
International sources	108	157	298	465	578	403	2.009
European Commission (3)	3	67	298	67	488	75	998
Companies, industry and other private sources not based in Portugal (3)	0	0	0	0	22	0	22
Other funding sources (3)	105	90	0	398	68	328	989
Total (K€)	1.676	1.826	2.177	2.213	2.152	1.371	11.415

(1) Payed through an institution or directly to researchers with PhD integrated in the R&D Unit

(2) Payed directly to fellows, researchers or students integrated in the R&D Unit

(3) Grants, projects, fellowships, prizes received, etc

08. Integrated PhD holder Researchers, PhD Students and Total Research Contracts in 2018-2023

8.1 Integrated PhD holder researchers, PhD students and total research contracts in each year in the period 2018-2023

Researchers and students	2018	2019	2020	2021	2022	2023
No. of integrated PhD researchers	74	75	76	75	64	59
No. of PhD students supervised by PhD integrated members of the R&D Unit (ongoing)	25	28	34	34	31	35
No. of PhD students supervised by PhD integrated members of the R&D Unit (concluded)	12	7	4	4	5	4
No. of contracts with national public or private entities	2	5	1	1	1	3
No. of contracts with international bodies	4	2	4	3	3	4

8.2 Measures implemented in the development of scientific careers

C2TN was highly active in supporting and developing the scientific careers of its members in their different stages, taking into consideration the regulations and guidelines of IST and IST-ID, as briefly described below.

FELLOWSHIPS AND CONTRACTS
C2TN´s Plurianual funding reduction disabled permanent research positions, but enabled the funding of contracts and/or grants to train and identify talent, ensuring their stability until they could obtain/apply to permanent tenure career positions, namely at IST ecosystem. During this period, C2TN dedicated more than 50% of its Pluriannual funding for human resources, totaling 73 grants (24 early career researchers and 49 students) and 17 contracts.
The aim of these efforts was to offer comprehensive on-the-job training to competitive individuals across various dimensions of career development within C2TN's areas of expertise, namely, on nuclear techniques, instruments and methods as well as on other state of the art techniques and laboratories, with a focus on knowledge transfer. Moreover, non-permanent PhD holders were actively encouraged to participate and manage projects, organize dissemination events, and supervise students. Because of these initiatives, both young and senior non-permanent C2TN researchers experienced improvements in their CVs in terms of skills, know-how, knowledge and ability for R&D work, thus increasing their chances of success in securing a permanent career position. Notably, 8 of such non-permanent C2TN members secured permanent positions through open and highly competitive recruitment processes at IST and >10 obtained employment contracts at prominent national, multinational or international companies and institutions, such as IAEA.

COACHING AND MENTORING
All early career researchers with 3rd party agreement with IST participated in the 3-year IST Program Shaping the Future, which promotes their integration and adaptation, through a Mentoring Program and a set of initiatives aiming at accelerating the development of their careers in the dimensions of scientific and academic leadership and the development of competences in scientific and pedagogical areas. The program also supports these new collaborators through a start-up funding system. For early career researchers with an IST-ID contract in C2TN, the Research Unit provided a mentoring program, as well as a start up fund of 3k€.

CAREER DEVELOPMENT INITIATIVES
C2TN prioritized the enhancement of C2TN career development throughout their careers by

providing financial support for mobility, facilitating scientific visits, collaborative work, or training at any of the numerous R&D institutions within its extensive national and international collaboration network. In addition, C2TN Academy served as a pivotal tool for enhancing the skills of both non-permanent and permanent members. It organized periodic seminars, workshops, courses and round-table discussion, all of which contributed significantly to talent development. Moreover, C2TN provided support and assistance in the preparation of applications for R&D projects, studentships, scientific employment stimulus, and similar, offered by various funding agencies. Finally, C2TN researchers were incentivized to enhance their CVs by pursuing the habilitation process, with four researchers successfully completing it.

All of this clearly demonstrates the significant and successful efforts made by C2TN to foster the development and consolidation of scientific careers for its researchers during the 2018-2023 period.

Part 3: Research team with links to CVs and ORCID registry

09. Lists of researchers in the current application

9.1 List of Integrated PhD holder Researchers in the R&D Unit

Name	Nuclear CV	Dedication %	ORCID iD
António Cândido Lampreia Pereira Gonçalves **(Coordinator)** 4D1A-2834-70FA	✓	100	0000-0003-2640-3038

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador coordenador
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Narrative CV

- Scientific and professional profile and career:António Gonçalves (AG) graduated in Chemical Engineering in (1985) from Instituto Superior Técnico (IST), being hired as a Research Fellow at ICEN-LNETI. He passed to Research Intern in 1988 and became Research Assistant in 1991. In 1992, he began his PhD in Chemistry, on the "Study of Intermetallic Compounds of the UFe12-xMx Type", which included a period at JRC-Karlsruhe, Germany. He successfully defended his dissertation in 1996 at IST, subsequently assuming the position of Auxiliary Researcher at Instituto Tecnológico e Nuclear. In 2006, AG was promoted to Principal Researcher. He attained his Aggregation in Chemistry from IST in 2013 and in 2017 he became Coordinator Researcher of the Department of Nuclear Sciences and Engineering (DECN) at IST. Throughout his career, he participated in many internships, in countries such as USA, Japan, Germany or France, to promote training or research activities.
  His research primarily focused on the Solid State field, investigating inorganic compounds with unconventional electronic and magnetic behaviors, such as intermetallics, pnictides or

Name	Nuclear CV	Dedication %	ORCID iD

chalcogenides, including those involving U and Th. His work aim to advance the understanding of the relationships among structure, microstructure, composition, and properties.
He proposed numerous research projects in response to national and international competitive calls (e.g., FCT, ANI, EU), being the coordinator of 16 projects, securing a total funding of ~750 k€, and playing a role in 16 other national and international projects.
AG held various leadership positions, including Vice-President of C2TN (2015-2016), member of the IST Scientific Council (2017), and coordinator of the IST Nanotechnology and Materials Platform (2017-2021). Since 2021, he has been serving as President of C2TN. Furthermore, he is responsible for the Chemical and Radiopharmaceutical Sciences scientific area within DECN, and Secretary of the European Thermoelectric Society.

- Contributions to science and society:
    1. Contributions to the generation of new ideas, tools, methodologies or knowledge:During the initial years, AG's research was centered on the purification of metallurgical silicon by acid leaching. Following these preliminary studies, he shifted his focus to the Solid State field, studying new high-Tc (oxide) superconductors. Throughout his PhD, he expanded his investigations to include other inorganic systems, aiming to contribute to a better understanding of the relationship between structure, microstructure, composition and properties of materials with unconventional electronic and magnetic behaviours. Taking advantage of the unique synthesis and characterization facilities at C2TN, these research activities include phase diagram studies, the design of new compounds, exploratory synthesis, preparation and growth of single crystals, the research of fundamental properties of these materials and exploration of potential applications. For that, he has installed (and is responsible for) the High Temperature Synthesis and Crystal Growth Laboratory, which has all capabilities to prepare materials and grow single crystals of inorganic compounds by high-temperature methods and is licensed to handle U and Th.
    AG regularly collaborates with various national and international higher education and research institutions, focusing on the synthesis and characterization of inorganic compounds and materials. He has organized or co-organized several national (6) and international (12) conferences and scientific meetings. AG has authored/co-authored over 250 articles published in international peer-reviewed scientific journals or book chapters. Additionally, he is the inventor/co-inventor of 3 patents, and has participated in over 400 oral and poster presentations at national and international conferences (30 invited orals). Highlighted below are examples of his significant contributions.

    A)High Tc superconductors
    The work on superconductors started just after the discovery of high-Tc superconductivity, by the study of the transport properties of Y1-xPrxBa2Cu3O7-?. In this oxide, the substitution of the tetravalent Pr for the trivalent Y increases the band filling, with the Tc being progressively decreasing with increasing x. This work had a large impact, as it comproved for the first time that these oxides have relatively narrow bands and that the electronic correlations dominate their properties. The investigations in this field continue by the study of BiSrCaCuO superconductors obtained by alternative methods, like glass crystallization or LFZ technique.

    B)Actinide and lanthanide intermetallic compounds
    In his PhD, AG start studying intermetallic compounds, first from the UFe12-xMx family and after from ternary systems with f-elements and Fe. This work included the investigation of ternary phase diagrams, identification of new ternary alloys or compounds, their preparation as single phase and/or single crystals, and the structural, magnetic and electrical transport properties characterization. UFe4Al8 is a quite remarkable case, as this compound shows a giant magnetoresistance anomaly associated to a new magnetisation process in which the magnetization remains blocked

perpendicularly to the applied magnetic field. Was in this context that was developed the Extended Miedema Model to predict the formation enthalpies of intermetallic phases with more than two elements, being the first time that the Miedema model was expanded to higher-order compounds. The impact of the model was first small, but after some years the interest from it strongly increased due to its simplicity and easy use. This model was used to predict the existence of several ternary intermetallic phases, which were investigated. UFe2Zn20 was one them, with electrical and thermal transport measurements showing that it was a novel moderately-enhanced heavy-fermion system. The study of intermetallics (including materials as silicides or carbides) continued through the years until now, with several phases showing unconventional electronic and magnetic behaviours (e.g. complex magnetism, superconductivity) being discovered.

C)Thermoelectric materials and devices
The exploration of thermoelectric materials started by investigating selected antimonides. However, their Seebeck coefficient was frequently small and the thermoelectric figure of merit (zT) low. This lead to a deep search of alternative systems, tellurides being the most promising. As the low thermal conductivity is a fundamental issue to get good thermoelectrics, was for the first time proposed the investigation of Te-based conducting glasses as new potential thermoelectric materials. This opened a new worldwide research line, and a maximum zT~0.2 was already obtained in those glasses. The studies continue on other chalcogenides, particularly on sulphides, which are more environment friendly and less expensive, issues critical for applications. The recent focus was on tetrahedrites, which were optimized and tested for the preparation of thermoelectric devices.

2. Contributions to the training and career development of researchers and/or research teams:AG skills in the preparation and characterization of advanced materials allowed him to have a vital role in the training, teaching and career development of many researchers and research teams. He was the Principal Investigator of numerous FCT, ICCTI, IDEA, and EU projects, the two last ones being PT2020 "New topological insulating materials and superconductors", and M-ERA.Net "THERMOSS: Sustainable Thermoelectric Modules based on Non-toxic Silicides and Sulphides for Recovery of Waste Heat to Power Generation". In all projects, he was responsible for management and leadership of teams, including the contract and training of a dozen young researchers (3 PostDocs and 9 masters or master students). But his activities in this field were not restricted to those under project leadership, AG was actively engaged in the supervision or co-supervision of other early stage researchers like PosDocs (3), PhD students (8, 5 finished, 3 running), master students (13, 11 finished, 2 running), graduation students (18), summer internship students (8) and dozens of others in the frame of curricular units or stage programmes (40). He is frequently invited to give lessons and seminars in national and international schools (organized 1), and graduation, master and PhD courses. AG is responsible for the obligatory curricular unit "Functional Materials" of the master on Materials Engineering of IST since 2021. Examples of success of his contribution to training and career development of researchers are the two former PhD students, Marta Dias, a permanent member of IPFN (https://www.cienciavitae.pt/0E13-5F70-9D8A), and Margarida Henriques, head of group at FZU (https://www.fzu.cz/en/people/margarida-isabel-sousa-henriques-phd).
Within C2TN activities, AG constantly encourages team members, in particular young researchers, to coordinate and participate in projects and networks (he himself was or is part of 3 COST Actions management committees), and submit grants proposals and internships.
3. Contributions to the scientific community:AG has made significant contributions to the scientific community, serving as editor for three renowned international scientific journals (PeerJ Materials Science, PeerJ Inorganic Chemistry, Materials, IF>3) and as a topical advisory member for another (Nanomaterials, IF>5). He was also reviewer of over 25

Name	Nuclear CV	Dedication %	ORCID iD

research journals, completed 116 verified peer reviews, and received two top reviewer awards. Additionally, AG has evaluated scientific projects submitted to various EU and national funding institutions, including the "Agence Nationale de la Recherche" (France), "National Science Centre" (Poland), and "The Austrian Science Fund" (Austria). He also serves on the external Scientific Advisory Committee of the "Materials Growth and Measurement Laboratory," a significant Czech research infrastructure.

Moreover, AG has played key roles in organizing over five national and 30 international meetings and events, including conferences such as "Actinides," "European Conference on Thermoelectrics," and "International Conference on Solid Compounds of Transition Elements," as well as two international training courses. He has also participated in the evaluation of eight national and five international Aggregation and PhD theses.

In his role as President of C2TN, AG has been a strong advocate for equal opportunities, diversity, mobility, and gender equality among researchers, as evidenced by the Executive Committee, which consists of 66% female members.

4. Contributions to society:AG has been actively engaged, either as researcher or as president of C2TN, in promoting the society involvement in scientific and technological activities and in knowledge transfer to the public. Some projects leaded by him already involved private companies but others were focused in such technological transfer (e.g., PAC-ATD). In this sense, C2TN belongs, and AG routinely participates in their meetings, to associations like the AED cluster (the Portuguese cluster for Aeronautics, Space and Defence, which includes more than 100 members, mostly private companies, but also research centres and universities), disseminating C2TN activities and the last scientific and technological discoveries in its areas of competence. Moreover, he was also the responsible for the outreach of national and international projects (e.g., MEDICIS.Promed), making presentations at high-schools and university classes to divulgate the scientific and technological actions in such projects and in C2TN.
AG activities also involved scientific dissemination towards the public in general through divulgation articles in national society journals with great impact (e.g., Revista Portuguesa de Química, which has a very large distribution to basic and high-school chemistry professors) and to the Portuguese press. Furthermore, he participated and promoted the participation of C2TN young members to large dissemination events, like the European Researchers Night or the Ciência Viva annual meeting.

- Scientific production and/or selected activities:A)Oxidation Studies of Cu12Sb3.9Bi0.1S10Se3 Tetrahedrite (DOI: 10.1007/s11664-018-6141-9)
It was the first of a series of works made on tetrahedrites with the objective of explore their aptitude for applications, reporting studies of oxidation in air at working temperatures made on these thermoelectric materials. It was observed that they oxidize if submitted to temperatures >230ºC in air for long periods, leading to investigations of protective coatings and diffusion barriers. This study resulted from a collaboration between Portuguese and French researchers, with AG taking the leading role, proposing and designing the experiments, analysing the results and taking the conclusions.

  B)Analysis of thermoelectric generator incorporating n-magnesium silicide and p-tetrahedrite materials (DOI: 10.1016/j.enconman.2021.114003)
  Here, another work for the development of novel, cheap/sustainable, thermoelectric devices was reported. A full multiphysics model was used to optimize the geometry of an n-p thermoelectric pair using n-Mg silicide and p-tetrahedrite materials and assess its performance. AG took the role of plan the working strategy and supply the experimental data to develop the models. This investigation was executed by Portuguese and Cypriot researchers, within an ERA.NET project.

  C)Thermoelectric Properties of Ni and Se Co-Doped Tetrahedrite (DOI: 10.3390/ma16030898)

Name	Nuclear CV	Dedication %	ORCID iD

Many studies on tetrahedrites were focused on the optimization of thermoelectric properties by substituting one element, but works reporting substitutions with more are scarce. Here, the effects of simultaneous substitution with Ni and Se in the thermoelectric properties of tetrahedrite are explored. A maximum zT=0.3 at 300 K was obtained for Cu11.5Ni0.5Sb4S12.5Se0.5, which is the highest for these materials at room temperature. AG idealized the work and oriented the PhD student that executed it, which had the help of American colleagues.

D)Investigation of UTe3-based materials
This work was recently proposed by AG and is being executed by Portuguese, French, German, Polish and Czech colleagues. UTe2 is an intermetallic with unique, unconventional, superconducting behaviour. UTe3 is a Van der Walls semiconducting compound, which has structural similarities with UTe2. It is proposed to investigate intermediate compositions and intercalated materials, to check their effects in the physical properties and better understand the unusual behaviour. The studies are now under way.

Ana Belchior
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Ana Cristina Fidalgo Palma Fernandes
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Ana Luísa Rodrigues
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Name	Nuclear CV	Dedication %	ORCID iD

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Ana Maria Morais Cravo de Sá
281E-62F9-4138
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Politécnico do Porto (IPP)
- Linking modality:Contrato de trabalho sem termo (sem regime de «tenure»)
- Professional category:Docente Politécnico - Professor adjunto
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Ana Rita de Paulo Proença Melo
4E11-C1D1-0226
75 0000-0001-9332-2399

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho sem termo (sem regime de «tenure»)
- Professional category:Investigador - Outra
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Ana Sofia Cavalheiro Gama
2C1A-2100-63BC
100 0000-0002-9689-7435

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Andreas Kling
5919-4BC4-08DD
80 0000-0002-5597-502X

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes

Name	Nuclear CV	Dedication %	ORCID iD

- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

ÂNGELO RAFAEL GRANADEIRO COSTA 50 0000-0002-9318-2418
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Investigador - Outra
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

António Manuel Monge Soares 100 0000-0001-7112-0849
1516-A662-E4DB

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Aposentado com vínculo
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Higher education professors with an exclusive or full-time employment contract and other researchers, except those covered by the 0.2 category. - weighting factor = 0.50

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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador coordenador
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Narrative CV

- Scientific and professional profile and career:António Paulo (AP) obtained a degree in Chemical Engineering (IST, 1985) and a PhD in Chemistry (IST, 1998). He began his scientific activity at the Institute of Nuclear Sciences and Engineering (ICEN) of the National Institute of Engineering, Technology and Innovation (INETI) in 1985, as a research fellow. Since then, his academic and scientific career has been developed in the area of Radiopharmaceutical

Name	Nuclear CV	Dedication %	ORCID iD

Chemistry. In this field, he had an internship in 1991 at the Institut fur Heisse Chemie, Karlsruhe-Germany, under the supervision of Prof. Basil Kanellakopulos, and a postdoctoral stay in 2005 at the University of Zurich, under the supervision of Prof. Roger Alberto.

Currently, AP is Coordinator Researcher at the Department of Nuclear Sciences and Engineering (DECN) and Center for Nuclear Sciences and Technologies (C2TN) from IST. He joined the Executive Committee of DECN as a member during the period 2015-2018. At C2TN, he was coordinator of the Radiopharmaceutical Sciences Group (GCR) (2015-2021) and responsible for the Thematic Line "Radiopharmaceutical Sciences and Radiological Protection" (2016-2021). He has been member of the Scientific Council of the Institute of Nuclear Sciences Applied to Health (ICNAS) of the University of Coimbra (2011-2012) and is the IST representative on the Management Committee of the CERN's MEDICIS Project (since 2017).

AP managed to obtain significant funding in national and international competitive calls. He was coordinator of 10 projects financed by FCT (4 of them started in the last 5 years), with global funding of ca. 1 M€. He participates or participated as a team member in 18 other projects funded by FCT, ANI, industrial partners and the European Commission. On a regular basis, AP has been involved in national and international evaluation panels of PhD grants and scientific projects, as well as on reviewer activities for a variety of international journals from his field of research.

- Contributions to science and society:
    1. Contributions to the generation of new ideas, tools, methodologies or knowledge:His research activity essentially involves the study of new radioactive molecules of interest for molecular imaging and molecular radiotherapy applications in nuclear medicine. This is an area with relevance for the diagnosis and/or treatment of oncological, cardiovascular or neurodegenerative diseases and with high potential to promote the development of so-called molecular and precision medicine. Currently, his main scientific interests focus on the development of radioactive compounds (molecular or nanometric) with relevance for cancer theranostics, based essentially on peptide molecules and radiometals of interest for diagnosis and/or therapy, namely Auger electron emitting radiometals. In his area of specialization, António Paulo is the author of 138 manuscripts (45 of them in the last 5 years) in international peer-reviewed journals, 6 book chapters and is the inventor/co-inventor of 3 international patents. Due to his expertise in Radiopharmaceutical Sciences, AP delivered several invited oral presentations in national and international conferences, was involved in the organization of different national and international scientific meetings and participated as an expert in technical meetings launched by private and institutional entities, namely the Department of Nuclear Sciences and Applications from the IAEA.

       In this multidisciplinary field, the research activity carried out by AP relies on skills and knowledge in radiopharmaceutical chemistry, inorganic and organometallic chemistry, radiochemistry and nanochemistry. Some examples of significant contributions are highlighted below:

       1)99mTc(I) Complexes with Poly(mercaptoimidazolylborates) for Brain Receptor Imaging Design of technetium complexes containing coordinated hydrides, a type of chemical bond unprecedented in radiopharmaceutical chemistry. The designed compounds can cross the blood-brain barrier (BBB), and were used in the development of radiopharmaceuticals to visualize brain receptors involved in different psychiatric disorders and neurodegenerative diseases (e.g. serotonergic receptors of the 5-HT1A subtype) with promising results. The results justified to proceed with their IP protection (EP Application 2005077977) and led to the publication of two papers in JACS (10.1021/ja002652t; 10.1021/ja0644226).

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2)Bifunctional Pyrazolyl-diamine Type Ligands for Radiolabeling of Biomolecules
Design of pyrazolyl-diamine derivatives as bifunctional ligands for the development of target-specific 99mTc or 186/188Re radiopharmaceuticals (Application EP1529537A1). Under the scope of projects coordinated by AP or by other researchers from the RSG of C2TN/IST, the versatility of these ligands allowed their successful use in the labeling of a wide range of clinically relevant biomolecules. This included biologically active peptides (e.g. RGD analogues, bombesin and melanocortins), enzyme inhibitors and substrates (e.g. arginine and quinazoline derivatives), and other biomolecules, such as estradiol derivatives, delocalized triphenylphosphonium cations, benzamide derivatives, bisphosphonates and mannose derivatives. These studies led to biological results with relevance for different clinical applications and, in some cases, with translational potential.

3) Radioactive Probes for the Study of Cardiac Perfusion and Multidrug Resistance (MDR)
Introduction of a new family of Re(I)/99mTc(I) complexes stabilized by tris(pyrazolyl)methane ligands with interest for the design of radiopharmaceuticals for myocardial perfusion studies. One of these complexes (99mTc-TMEOP) revealed more favorable characteristics than the myocardial perfusion agents currently in clinical use (99mTc-Sestamibi and 99mTc-tetrofosmin); clinical trials with 99mTc-TMEOP were planned by the multinational company Mallinckrodt LLC that financed the study and patented the product (Grant US-9023315-B2). 99mTc-TMEOP is located in the mitochondria of tumor cells and is a substrate of Pgp, and is also a promising molecular probe for studying MDR by SPECT imaging.

4) Multifunctional Gold Nanoparticles for Cancer Theranostics
Design of multifunctional gold nanoparticles (AuNPs) under the framework of the projects "Multifunctional nanoseeds for chemoradiotherapy of glioblastoma" (PTDC/MED-QUI/29649/2017) and "In-beam Time-of-Flight (TOF) Positron Emission Tomography (PET) for Proton Radiation Therapy" (LISBOA-01-0247-FEDER-045904)/Programa UT Austin Portugal). The versatility of the designed AuNPs allowed their functionalization with biologically active peptides (e.g., bombesin or substance P analogues) directed to receptors overexpressed in human tumors (e.g., prostate cancer or glioblastoma) and macrocyclic ligands for coordination of (radio)metals with interest for theranostic applications (e.g., Gd for magnetic resonance imaging, 67Ga for SPECT imaging and 177Lu for molecular radiotherapy).

2. Contributions to the training and career development of researchers and/or research teams:AP's knowledge and skills in Radiopharmaceutical Sciences allowed him to assume a prominent role in training and teaching activities related to this area: i) coordination of several practical Radiopharmacy courses for nuclear medicine doctors or nuclear medicine technicians; ii) supervision or co-supervision of different master's (11) and doctoral (7 completed+4 ongoing) students. His former PhD fellows have a successful career being hired by academic institutions, private companies and research centers (e.g., Raquel Garcia, https://www.uevora.pt/en/people?id=31265; Alice D'Onofrio, http://www.nukmed.insel.ch/de/ueber-uns/unser-team/forschungsteam-wissenschafliche-mitarbeitende).

AP is/was the PI of IST teams integrating the following European projects: 1) Marie-Curie Action "MEDICIS-Promed" (2015-2019); 3) A-CINCH (Augmented Cooperation in Education and Training in Nuclear and Radiochemistry) (2020-2023); 2) PRISMAP - The European medical radionuclides programme (2021-2024); 4) ENEN2plus (Building European Nuclear Competence through Continuous Advanced and Structured Education and Training Actions) (2022-2026). Under the scope of these European projects, he

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coordinated three one-week Summer Schools within the topic "Development and Pre-clinical Evaluation of Radiopharmaceuticals", in June 2018 (MEDICIS-Promed), July 2023 (A-CINCH) and September 2023 (PRISMAP). In total, these Summer Schools involved more than 50 international participants who attended several lessons given by national and international experts, internationally recognized in the field of Radiopharmaceutical Sciences. In the coming years, the participation in two of these projects still ongoing will allow a more intense networking with other European teams interested in applications of nuclear chemistry and radiochemistry, offering opportunities to find new partners and funding for scientific and training projects, particularly in the field of Radiopharmaceuticals and Nuclear Medicine Applications.

3. Contributions to the scientific community:AP has integrated the jury of several MSc and doctoral thesis in different national and European universities, being involved in national and international evaluation panels of calls of PhD grants and scientific projects, namely for the FCT and other European and international science foundations (e.g., Austria, Chile, France or Poland). He has also participated as an expert/consultant in different meetings related with Radiopharmaceutical Sciences, such as the IAEA meetings "Technical Meeting on The Preclinical Testing of Radiopharmaceuticals" (2021) and "Technical Meeting on Auger Electron Emitters for Radiopharmaceutical Developments" (2022).

   Reviewer in a variety of international journals from his field of research and participation in the organization of scientific events and editorial work, as summarized below:

   1) PRISMAP project meeting (CTN, 2023); workshop "Preclinical small animal in vivo imaging" organized by IST and IMM with the sponsorship of MILabs (CTN, 2017); "Nuclear Molecular Imaging" organized by IST with IAEA support (CTN, 2016); final meeting of the WG2 of COST Action CM1105 (CTN, 2015)).

   2) Associate Editor of the journal "Inorganic and Nano-metal Chemistry" (Taylor & Francis) (since 2020) and editor of various special issues ("New Advances in Radiopharmaceutical Sciences: Chemistry and Applications", Molecules, 2021/2022; "Targeted Drug Delivery", Materials, 2019/2020; "Metal Complexes for Imaging and Therapy" Inorganics, 2018).
4. Contributions to society:AP regularly participated in scientific dissemination activities towards the general public and secondary school and university students who frequently visited the C2TN/IST facilities. During these guided tours, he had the opportunity to provide an overview of his scientific activity and its societal impact. As part of this scientific dissemination effort, his work was published and/or highlighted in Portuguese newspapers with national circulation, as well as in scientific and project-dedicated sites, as exemplified below.

   1- Responsible for the deliverable dealing with the implementation of the PRISMAP "Information Portal" (https://www.prismap.eu/radionuclides/information-portal/), December 2023.
   2 - Promotion of the AugerTher project, QUÍMICA, Vol. 45, No. 163, 253, 2021.
   3 - Scientific divulgation paper "Radiofluorinated Carbohydrates for Nuclear Imaging", QUÍMICA, N.o 132, 41-46, 2014.
   4 - Scientific divulgation paper "Molecular imaging agents for detection of ß-amyloid plaques in Alzheimer's disease", Saúde & Tecnologia, 10, 5-9, 2013.
   5 - Article from "Chemical Sciences" highlighting his work on radiopharmaceuticals for cardiac perfusion studies: "New technetium complex has been made for accurate heart imaging - Complex matters of the heart", Chem. Sci., 6, C9-C16, 2009.
   6 - Interview published in Diário de Notícias ("A vehicle on the way to the mysteries of the brain") to promote the FCT project POCTI/QUI/42939/2001) (January, 2003).

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- Scientific production and/or selected activities:1) New TEM1 targeting recombinant antibodies for radioimmunotherapy (10.1016/j.ejpb.2020.11.015).
  This study resulted from a collaboration between the RSG from C2TN/IST, the Department of Nuclear Medicine and Molecular Imaging of the University Hospital of Lausanne and the Ludwig Institute for Cancer Research of Lausanne, within the scope of Marie-Curie Action "Medicis-Promed". The study identified the 1C1m-Fc antibody as a promising candidate for the development of new radioimmunoconjugates targeting TEM1 for cancer theranostics applications. AP outlined the strategies for the labeling of antibody fragments with 125I, through direct or indirect radioiodination methods, and designed their pre-clinical evaluation in cellular and animal models.

  2) Clickable Radiocomplexes for Pretargeting Approaches (10.3389/fmed.2021.647379).
  The work was developed within the scope of a bilateral project Portugal/Poland. The main objective was to explore "clickable" radioactive metal complexes for in vivo "pre-targeting" strategies based on bioorthogonal "click" chemistry. Radioactive (111In, 177Lu and 90Y) metal complexes with DOTA-type ligands functionalized with tetrazine derivatives were successfully synthesized and evaluated in vitro and in vivo. Biodistribution studies in healthy mice showed that the complexes have favorable biological behavior in terms of blood elimination and excretion rate to be further explored within pretargeting strategies. AP conceived the original idea for the project and coordinated the chemical and radiochemical studies carried out at C2TN/IST.

  3) Radioconjugates for Auger Electron Radiopharmaceutical Therapy (AE-RPT) in Cancer (10.2967/jnumed.122.265039)
  This work resulted from an international collaboration between experts that gathered at an IAEA Technical Meeting in Vienna in September 2022. AP contribution was mainly focused on radiolabeling chemistry aspects taking advantage of his involvement in the design of AE-emitting radioconjugates for cancer theranostics (10.1021/acs.molpharma-ceut.3c00787). For this purpose, he is currently studying radiocomplexes targeting radiosensitive organelles, such as the nucleus or mitochondria, using less common AE-emitting radioactive metals (e.g., 161Tb or 169Er), within the scope of the FCT project "Organelle-targeted Radiocomplexes for Auger Therapy of Cancer" (PTDC/MED-QUI/1554/2020) and the European project PRISMAP (Nº 101008571), in collaboration with Belgian teams from KU-Leuven and SCK-CEN.

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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Bruno José Cardoso Vieira A912-C62A-901C		100	0000-0002-6536-9875

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)

Name	Nuclear CV	Dedication %	ORCID iD

- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

BRUNO LUÍS JESUS PINTO DE OLIVEIRA — 100 — 0000-0002-7687-4746
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

CARLA ALEXANDRA GAMELAS ALBUQUERQUE PINTO REIS — 30 — 0000-0002-7656-1053
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Politécnico de Setúbal (IPSetúbal)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Docente Politécnico - Professor coordenador
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Célia Fernandes — 100 — 0000-0002-2119-8293
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Elisa Vaz Morgado de Palma — 100 — 0000-0002-8877-6633
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto

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- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Elsa Maria Simões Branco Lopes
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Fernanda Maria Amaro Margaça
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Fernanda Marujo Marques (Waerenborgh)
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Filipa Fernandes Mendes
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal

Name	Nuclear CV	Dedication %	ORCID iD

- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Isabel Cordeiro Santos — 100 — 0000-0001-8350-480X
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Joana Filipa de Paiva dos Santos Madureira — 100 — 0000-0001-6546-797X
1418-9602-C932
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto
- Professional category:Investigador júnior
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Joana Múrias Gomes Lage — 100 — 0000-0002-0189-5438
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto
- Professional category:Investigador júnior
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

João Carlos Bentes Waerenborgh — 100 — 0000-0001-6171-4099
0F1E-08F4-D8A0
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Aposentado com vínculo
- Professional category:Investigador principal
- Retiree?No

Name	Nuclear CV	Dedication %	ORCID iD
João Domingos Galamba Correia EC11-F3E9-78A2	✓	100	0000-0002-7847-4906

- Weighting factor:Higher education professors with an exclusive or full-time employment contract and other researchers, except those covered by the 0.2 category. - weighting factor = 0.50

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador coordenador
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Narrative CV

- Scientific and professional profile and career:I hold a degree in Pharmaceutical Sciences from the Faculty of Pharmacy, University of Lisbon (UL), Portugal (1991), and I pursued my Ph.D. in Inorganic Chemistry with Prof. W. A. Herrmann at the Technical University of Munich (TUM), Germany (1997). Next year, I joined the former Instituto Tecnológico e Nuclear (ITN), Portugal, where I was a postdoctoral fellow. Between 2000 and 2006 I worked as Invited Assistant Researcher and, since 2006, I was appointed Associate Researcher. Since January 2024, I am Coordinator Researcher in Instituto Superior Técnico (IST), UL. Currently, I lead the Radiopharmaceutical Sciences Group of Centro de Ciências e Tecnologias Nucleares (C2TN), a research unit of IST dedicated to Nuclear Sciences and applications of Ionizing Radiation. Since January 2022, I am Deputy-Director of the Radioesterilization Unit of IST. I am also member of the management board of the Campus Tecnológico e Nuclear (CTN-IST) and of the executive committee of the Department of Engineering and Nuclear Sciences (DECN-IST). I am member of the Medicines Evaluation Committee of INFARMED IP (National Authority of Medicines and Health Products) as external quality assessor, especially in the area of radiopharmaceuticals. I am also recognized as external Quality expert of the European Medicines Agency (EMA). Since December 2017, I am a quality observer member, representing INFARMED, in the Radiopharmaceutical Drafting of the Committee for Medicinal Products for Human Use of the EMA.
  In conclusion, a coherent line is observed throughout my professional and scientific career, which culminated in the current multidisciplinary activities in the field of molecular imaging and systemic targeted radiotherapy. Brought together the training in pharmaceutical sciences; the knowledge acquired in inorganic chemistry during my PhD at the TUM, Germany; and my work at the former ITN, now C2TN/DECN-IST, were key for my expertise in pharmaceutical radiochemistry.
- Contributions to science and society:
  1. Contributions to the generation of new ideas, tools, methodologies or knowledge:Oxidation catalysts display a relevant role in large scale production of small molecules for food and pharmaceutical industry, and address relevant topics in "green chemistry". Within this scope, I would like to highlight the work developed during my PhD, which aimed at the development of rhenium-based oxidation catalysts for the selective oxidation of aromatic compounds. Amongst various molecules, vitamin K3, essential for blood clotting and bone health, emerged as the one with the highest commercial value, and several patents were granted (DE4419799A1, US5616734A and US5710292A, co-inventor). Profiting from my background in Pharmaceutical Sciences and Inorganic chemistry, I was awarded a postdoctoral fellowship in the group of Prof. I. Santos at ITN, which, before being merged with IST-UL in 2012, was a National

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Laboratory for R&D in the field of Nuclear Sciences, including in "Radioisotopes and Radiation on Health Sciences". The task I was assigned was to develop novel chelating ligands for stabilizing rhenium and technetium complexes aimed at the design of novel agents for diagnostic imaging and/or targeted-specific radionuclide therapy. Apart from several publications in peer-reviewed journals (1998 - 2009), the importance and applicability of the work was recognized by a pharmaceutical company (Mallinckrodt Inc.), which patented the bifunctional pyrazolyl-based ligands (US20060198785A1) for using in radiopharmaceuticals. Aiming to design target-specific radioactive tools for diagnostic and/or radionuclide therapy, I extended my scientific interests to the design of radiometallated compounds containing "targeting" units of various nature to reach molecular targets, such as enzymes, amino acid transporters or membrane receptors associated to specific pathologies. Indeed, one of my preoccupations, which proved crucial for my scientific independence, is the exploration of less studied targets in pharmaceutical radiochemistry. As a result, I was/am PI of 4 projects successfully approved and funded after highly competitive calls by the main Portuguese funding agency (Fundação para a Ciência e a Tecnologia - FCT). I would like to highlight two of those projects, "A molecular and nano approach to target the RANK-TRAF6 interface for bone metastases treatment" (PTDC/QUI-OUT/3854/2021, 2022 - 2024, https://sciproj.ptcris.pt/173460PRJ) and "Targeting the transporters of cationic amino acids for cancer radiotheranostics: experimental and computational chemistry approach" (PTDC/QUI-NUC/30147/2017, 2018 - 2021). Whereas the former encompasses the first systematic study that explores novel bone-seeking, RANK/TRAF6-targeted peptides or nanoplatforms aiming to locally treat bone metastasis; the latter aimed at the development of new radioactive molecules for cancer Theranostics that recognize cationic amino acid transporters overexpressed in cancer cells. Such projects engage multidisciplinary teams of experts belonging to academic institutions of excellence, which are all committed to contributing towards innovative therapeutic strategies to improve survival and the quality of life of cancer patients. Together, we intend to contribute to Goal 3, Quality Health - Ensure healthy lives and promote well-being for all at all ages, of the UN 2030 agenda for sustainable development.
I am also team member of 14 FCT-funded research grants, where pharmaceutical radiochemistry plays a decisive role. I was responsible for conceiving and implementing the most adequate strategies to radiolabel new molecules, mainly peptides and antibody fragments, and assess their biological properties in appropriate cell lines and animal models. I would like to highlight the fruitful collaboration with Prof. Frederico Aires da Silva, from the Faculty of Veterinary Medicine, UL, whose main activity relies on the development and biological evaluation of antibody fragments for several applications, including neutralization of COVID-19 (PTDC/CVT-CVT/0149/2021, 2022 - 2024, https://www.fmv.ulisboa.pt/uploads/2022/04/6262933b1e4fe.pdf), design of antibody-drug conjugates (PTDC/BTM-SAL/32085/2017, 2018 - 2022) and brain targeting/drug delivery across the Blood Brain Barrier (BBB) (PTDC/BBB-BIO/0508/2014, 2016 - 2019). Within my research network, I also collaborate with the group of Prof. Miguel Castanho from Instituto de Medicina Molecular (iMM), Faculty of medicine, UL, which apart from recent published articles in high impact journals (e.g. 10.1128/JVI.01200-21, 10.3390/pharmaceutics13101598 and 10.1021/acsinfecdis.9b00507), resulted in a recently submitted common patent (M. A. R. B. Castanho et al., Methods for Identifying Blood Brain Barrier Peptide Shuttles), where I am a co-inventor. The use of radiolabeled peptides was crucial to establishing the proposed method for identification of the best peptide vectors to transport drugs and radionuclides across the BBB aiming to treat central nervous system-related diseases.

2. Contributions to the training and career development of researchers and/or research teams:I am engaged in the training of young scientists, either through the (co)supervision of Master (3 ongoing and 16 finished) and PhD students (7 ongoing and 6 finished) or through hiring of grantees or young researchers to research projects. The

Name	Nuclear CV	Dedication %	ORCID iD

quality of the PhD students was recognized by world renowned academic institutions such as the case of Harvard University and University College London, having welcomed Dr. Bruno Oliveira and Dr. Maurício Silva as post-doctoral fellows, respectively. The former, after a period at the University of Cambridge, is a researcher at iMM, UL. Dr. Morais was also a researcher at the School of Biomedical Engineering and Imaging Sciences, KCL, St. Thomas' Hospital, London, and is currently a researcher at the Institute of Experimental and Clinical Research, Université Catholique de Louvain, following a period at the University of Wroclaw as Assistant Professor
I was responsible for the installation of an automatic microwave-assisted solid-phase peptide synthesizer, pioneer in Portugal at the time (2009), and also contributed to the implementation of the Portuguese bioimaging network, where I was responsible for the installation of the first national preclinical micro-PET/SPECT/CT imaging scanner. Both equipments were key for the establishment of new research lines and training of young researchers. I was/am involved in several European networks, including bilateral projects, COST Actions (6), and European Commission-funded projects (e.g. https://www.prismap.eu/). In this way was possible to strengthen scientific ties with European colleagues through student exchange, participation in meetings, and organization and lecturing in several "Summer Schools". Such contacts allowed long-lasting scientific relationships with several scientists, such as the case of Prof. Angela Casini and Prof. Fritz Kuehn (TUM, DE) that resulted in the publication of joint articles in high impact journals as well as in the (co)advisoring of PhD students.

3. Contributions to the scientific community:Regular reviewer for prestigious international chemistry journals (e.g. Bioconjugate Chemistry, PLOS ONE, Chemistry - A European Journal or Dalton Transactions) and co-editor of special issues (e.g. Frontiers in Radionuclide Imaging and Therapy: A chemical journey from naturally radioactive elements to targeted theranostic agents, Dalton Transactions 2017, 41, RSC; Guest Editors: A. Casini, J. D. G. Correia and C. Orvig). Participation in national and international examination committees (Master and PhD Theses).
Co-organizer of the 18th Iberian Peptide Meeting (EPI2023), 2023, Sesimbra, Portugal.
Scientific committee of the 17th Iberian Peptide Meeting (EPI2020), 2020, Madrid, Spain.
I participated in the so named GENI Commission (General Engineering Course at IST), appointed by the Scientific Council and the Pedagogical Council of our School (IST). The course, which aims to attract international students to IST, was recently accredited by the Agency for Assessment and Accreditation of Higher Education, Portugal, to start in the next academic year (2024/2025).
I was visiting lecturer at the University of Groningen and visiting professor at the Technical University of Munich (2017 and 2022) under an August-Wilhelm Scheer Visiting Professorship and TUM Global Visiting Professor Program. I also participated as guest lecturer in different doctoral programmes and MSc courses of different Schools at UL (e.g. Oncobiology and Pharmaceutical and Therapeutic Chemistry).
4. Contributions to society:I am member of the Medicines Evaluation Committee of INFARMED IP as external quality expert - assessment of radiopharmaceuticals and other contrast agents. I am also recognized as external Quality expert by the European Medicines Agency (EMA). Since December 2017 I am a quality observer member, representing INFARMED, in the Radiopharmaceutical Drafting of the Committee for Medicinal Products for Human Use of the European Medicines Agency.
Currently, I am the Representant of the Portuguese Society of Chemistry in IUPAC - Division II - Inorganic Chemistry Division. I am also involved in and fully support various outreach activities aimed at involving local populations in current research challenges faced by scientists to address societal challenges such as health, demographic change and wellbeing. Within the framework of the "Doors Open Days", or by demand, I guide tours to groups of students, general public and journalists interested in Science.
My Group also participates actively in the "Ciência Viva" Project organized by the FCT, where high school students undertake short-term internships at our laboratories. The

Name	Nuclear CV	Dedication %	ORCID iD

interaction between our research Unit and the neighbour city council of Loures resulted in the organization of the so named "Science weeks" for general public.
I was also actively involved in transfer of knowledge to private pharmaceutical/biotech companies (e.g. Hovione, 2016; Technophage, 2015 - 2016; Mallinckrodt - Tyco Healthcare 2003 - 2006).

- Scientific production and/or selected activities:One of my scientific concerns is the exploration of less studied targets in pharmaceutical radiochemistry as discussed below.

  - Amino acid (aa) transporters: targeting cationic aa transporters with radiometallated aa for cancer theranostics is the main topic of the PhD student Rúben Silva. In vitro and in vivo studies suggest that Tc(I)-99m-labeled His or Trp recognize aa transporters. This work stems from a recent publication (Dalton Trans. 2017, 46, 14537, DOI: 10.1039/C7DT01146F, corresponding author), inside cover, and from a FCT-funded project (PTDC/QUI-NUC/30147/2017, 2018-2022).

  - Target brain: aimed at imaging and/or treating brain diseases, I am exploring supramolecular agents as radiotheranostic drugs. We have shown for the first time that [99mTcO4]- labeled "supramolecular metal cages" vectorized with peptide shuttles cross the BBB in mice. This study was designed in collaboration with Prof. Casini (TUM), and the results were published (Bioconjugate Chem. 2021, 32, 1399, DOI: 10.1021/acs.bioconjchem.0c00659, corresponding author).
  - Intracellular protein-protein interaction RANK-TRAF6: I am the PI of the FCT-funded project "A molecular and nano approach to target the RANK-TRAF6 interface for bone metastases treatment", (https://sciproj.ptcris.pt/173460PRJ), which aims at the use of the osteotropic properties of bisphosphonates to deliver radionuclides and/or drugs to bone metastases. Preliminary results were published in a MSc thesis (Kyle Gonçalves, Faculdade de Ciências, UL, 2023).

  - Less Exploited G Protein-Coupled Receptors (GPCRs) as targets for Molecular Imaging and Theranostics: there is still potential to increase the number of new specific ligands as discussed in a review article (Molecules 2019, 24(1), 49, 10.3390/molecules24010049, corresponding author). I participated as team member in a FCT-funded project, whose main goal was the development of computational approaches applied to GPCRs (PTDC/QUI-OUT/32243/2017, 2018 - 2021).

  I am also involved in the design of multifunctional cytotoxic Pt and Ru complexes for cancer theranostics, decorated with the RGD sequence or FGFR-targeting peptides to target integrin avß3(+) or FGFR(+) cancer cell lines, respectively (DOI: 10.1002/ejic.201700072, DOI: 10.1039/D0DT00955E and www.arrows2cancer.com/funded projects). I am engaged in the design and biological evaluation of new cytotoxic multifunctional Au(I) complexes as well (DOI: 10.1021/acs.jmedchem.1c01021 and DOI: 10.1039/d3dt03052k).

João Guilherme Martins Correia 061F-EF2B-6B39	100	0000-0002-8848-0824

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Name	Nuclear CV	Dedication %	ORCID iD
João Henrique Garcia Alves 6A11-F508-8A6B		80	0000-0001-7221-871X

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Jose Antunes 8C18-5E48-B5CA		50	0000-0002-2572-3681

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Aposentado com vínculo
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Higher education professors with an exclusive or full-time employment contract and other researchers, except those covered by the 0.2 category. - weighting factor = 0.50

José Joaquim Gonçalves Marques 9119-0740-AF52		80	0000-0002-3724-5664

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador coordenador
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Laura Cristina de Jesus Pereira 5317-7110-E52E	✓	100	0000-0002-8818-0039

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Narrative CV

Name	Nuclear CV	Dedication %	ORCID iD

- Scientific and professional profile and career:I am principal researcher in Instituto Superior Técnico (IST) since 2015, graduated in Technological Chemistry, 1989, MSc in Physics and Chemistry of Materials, 1993 and PhD (summa cum laude) in Inorganic Chemistry, 1998, by the Faculty of Sciences of the University of Lisbon. My expertise research field is Exact Sciences - Chemical Sciences within Solid State Chemistry and Chemical Physics main areas. My work is focused on the correlation between crystal structure and the magnetic properties of new advanced materials, smart metal oxide-based nanostructures, multifunctional molecular-based compounds, and intermetallic compounds with 3d and f-elements. Head of the Solid State group and member of the Coordinating Committee of the Nuclear Sciences and Technologies Centre, C2TN since 2021. Member of the Executive Committee and the Scientific Pedagogical Committee of the Nuclear Sciences and Engineering Department (DECN) since 2023. Representative of the European Institute of Molecular Magnetism (EIMM) at IST/Lisbon University since 2022. Member of the Portuguese Physics Society. Member of the Editorial Board and guest editor of Magnetochemistry Journal. I teach at Instituto Superior Técnico the UCs "Electrical and Magnetic Properties of Materials" for the PhD in Chemistry at the Chemical Engineering Dept. (since 2016), "Functional Materials" and "Materials for Electronics and Optoelectronics" (since 2021), both for the MSc of Materials Engineering. To date, I have authored 170 papers in international peer review journals, and 4 book chapters. More than 2750 citations, h-index 28, Ciência ID: 5317-7110-E52E. PI of 3 and co-member of other 19 national research projects. To date I supervised 4 PhD and 3 MSc thesis to completion and currently more 4 PhD and 2 MSc. Responsible for the installation, operation and maintenance of the Magnetic Characterization Facility of the Low Temperature and High Magnetic Fields Laboratory (LTHMFL).
- Contributions to science and society:
    1. Contributions to the generation of new ideas, tools, methodologies or knowledge:Despite my background in chemistry, my research activities in addition to synthesis and crystalline engineering of new magnetic molecular materials, intermetallics and nanostructured oxides, were also extended to magnetic characterization techniques, allowing me to focus on magneto-structure correlation. I was directly involved in the remodelling of the cryogenic building and the installation of a new facility in this building, the Low Temperature and High Magnetic Fields Laboratory (LTHMFL), unique in Portugal, integrated into the Mapping of the European Research Infrastructure Landscape, and the successful application for funding in the FCT Infrastructures Roadmap (2017-2023). This facility benefits not only our group but also a large external community and stakeholders through an extensive network of research collaborations and services. In 2010, I was part of the team responsible for installing the He Liquefier Linde L70, supervising the installation work and new procedures. I also had a direct role in funding through the FCT's reequipment projects of the 3 magnetometers which I installed and operate, MagLab2000 (1999), SQUID (2007), VSM (2019) allowing suitable and accurate DC and AC measurements in a wide range of temperatures, 0.3 to 360 K, magnetic fields up to 14T, and frequencies from 10Hz to 20kHz.
    In my group a challenging research topic is molecular magnetism in the framework of the EIMM, resulting from the MAGMANet NoE. The first European Conference on Molecular Magnetism, ECMM2006, was organised by our group under the scope of this NoE. We study multifunctional switchable magnetic materials and single component molecular metals with transition metals, as well as single molecule magnets (SMM), with slow magnetic relaxation based not only in transition metals and lanthanides but also uranium complexes, due to the peculiar properties of the 5f electron shell. These materials have a potential use in high-density information storage, quantum computing and spin-based electronics. The skills acquired since my PhD together with my expertise in magnetic characterisation techniques at low temperatures enabled the creation of new research routes and methodologies by designing different systems based on lanthanides and uranium. I established my research team and supervised 3 postdoctoral fellows and 2 PhD students. The contribution to other 2 PhD from abroad under the scope of scientific

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collaborations also played an important role in the advance of this area, not only within my group but also at a European level in the framework of the EIMM. So far 21 refereed papers were published and a considerably number of national and international conference oral presentations, including invited talks and a PhD with "suma cum laude" award.
Multifunctional materials exhibiting spin transitions are also strong candidates for the preparation of materials with technological applications, such as memory devices, batteries, and data processing units. In these compounds, metal spin states can be reversibly switched through the application of external stimuli, such as temperature, pressure, magnetic field, or light irradiation. The supervision of a PhD student allowed to understand the structural modifications that can modulate the SCO transition sharpness and give rise to different transition processes, smooth or sharp, with hysteresis, or two-step spin transition, rare in Fe(III) compounds. After a PhD supervision the coordination of this work continues with several publications and conferences participations. The subject was approved for funding in a FCT IC&DT in 2017.
The families of intermetallic compounds containing f elements as strongly correlated electronic systems and their magnetic behaviour still represent one of the Solid State group major areas of study, given their fundamental scientific and technological interest. In my PhD thesis, I studied an extensive family of compounds especially with uranium. The success of a new design for obtaining large single crystals based on a new mineralization process allowed to determine not only the crystal structure but also to characterize magnetically, both by magnetization and neutron scattering a significant number of compounds of this family and allowed other foreign PhD students to use these new synthetic methods and/or my samples for their work. I was PI of two national approved FCT projects and outputs such as published papers, supervision of MSc and PhD, participation, and organization of international conferences, such as 29JdA1999, 37JdA2007, 48JdA2018, and SCTE 2012.
Recently I have started the study of superparamagnetic iron oxide nanoparticles that can be used as smart nanoplatforms for drug delivery, therapy, and imaging. I was already able to gather a team involving researchers from several institutions with background in a wide range of scientific research fields and supervised 2 completed MSc, and 1 MSc and 1 PhD (Prototera), whose work just started.

2. Contributions to the training and career development of researchers and/or research teams:Throughout my career, I have always tried to guide me or my team by creating synergies and establishing national and international collaborations and projects, writing papers, grant applications and conference presentations (myself or students and researchers). To date I mentored 1 aux. researcher, 4 post-docs, 4 PhD and 3 MSc to completion and currently more 4 PhD and 2 MSc. Part of these PhDs belong to the doctoral FCT program ChemMat in which I'm member. This program was coordinated by the previous group leader involving 3 institutions, IST, FCTUP, FCUC. At present I'm coordinating a new PhD program in Nuclear Sciences and Engineering of IST already accepted by the Senate from University of Lisbon and waiting A3Es accreditation. I'm also representing IST at EIMM, the European institute for research and training and world leading reference in Molecular Magnetism. Furthermore, I have trained more than 25 PhD students and post-docs as well as many fellows, through various research projects, whose work involved magnetic studies of their compounds. I also teach cryogenic techniques and the application of magnetic fields. The outputs of this training are expressed both in PhD theses and papers. I also participated in several PhD and MSc juries and teaching activities at IST (Chemistry PhD program and MSc of Materials Eng.). Many research projects have been submitted and I encourage my team to do the same. An important contribution to support young scientists was my role as coordinator of the Short Training Scientific Mission and the Training Schools and Workshops of COST Action 15128 (2016-2020). As member of the core team of the Portuguese Magnetism Association, I contribute to gather all scientific community working on

Name	Nuclear CV	Dedication %	ORCID iD

magnetism, especially young researchers, creating synergies with other national and international networks and to promote the scientific work under this field. In this context I chaired the school of metrology in magnetism in February 2024.

3. Contributions to the scientific community:I have authored more than 170 papers in peer review journals. Under the scope of different collaborations, Cost actions research projects and bilaterial agreements, I have attended many national and international meetings and conferences, some as invited. I'm referee of papers in peer review journals and research projects, organized scientific events, and performed short term research visits and knowledge transfer. I was member/president of organization committees of several national and international workshops and conferences, participated in PhD and MSc juries and jury selection of fellows. I coordinated WP Develop Citizen's awareness in Science and the Gender Action Plan, of the MAGMANET NoE, and the Short Training Scientific Mission plus the Training Schools and Workshops of COST Action 15128. I'm representing IST at EIMM. I'm member of the core team of Portuguese Magnetism Association, operating under the Portuguese Physics Society, of which I'm a member. I supervised 4 PhD, 2 of them with "suma cum laude" award and 3 MSc and currently supervise 4 PhD and 2 MSc. To promote synergies with the scientific community, my students are applying for mobility and attending scientific events. At LTHMFL I operate and develop several facilities which are available to the external scientific community on a collaboration basis. I use C2TN's tools (web and media) to highlight my ongoing results. I teach as collaborator at the IST PhD Chemistry program and MSc Materials Engineering.
4. Contributions to society:As a researcher I've always been aware of the need to promote and disseminate the development and innovation activities and services that the institution provides to society. As a group leader I encourage this commitment to my team, including students, to promote an effective involvement of our community through the institutional initiatives, and to showcase our results on the C2TN website and social media to increase visibility. Within the framework of the "open day" organized by CTN and the former ITN (before 2012), visits to our facilities to the public are performed where a general overview of our research is given, showing also practical experiments, and bringing into discussion the social impact of our work. We regularly host other universities and secondary schools and organize pedagogical training sessions and oral presentations in schools.
   As delegate member for the Communication, Image, and Marketing Area of IST I'm acting as a link between our department and C2TN to manage the institutional image and ensure its promotion and communication with the outside world. Several outreach activities are being developed and I'm contributing not only as organizer, but also as a participant at the IST open day, "Noite Europeia dos Investigadores", brochure writing and design, film productions, website contents (photos, short videos, text). Moreover, I'm also in contact with academic, scientific, and business stakeholders interested in our research fields and facilities.

- Scientific production and/or selected activities:As activity I select the equipment upgrade of the LTHMFL within the FCT Infrastructure Program and the submission of the expression of interest for the RNIE 22-27. This facility integrated into the MERIL-Database benefits not only our group but also a large external community through an extensive network of research collaborations.
  As scientific productions, I highlight my role of conceptualization, methodology, validation, formal analysis, resources, writing, editing, and PhD supervision within 3 main topics:
  -Single molecule magnets have been increasing their relevance due to the presence of magnetic bistability generated by an energy barrier for magnetisation reversal giving them a memory effect and making them the most promising materials for magnetic data storage and computing systems above cryogenic temperatures. My expertise in this field made possible to rationalise a study of the electronic structure and its relation to the magnetic properties by comparing several families of compounds, with d- (10.1039/d2qi00601d;

Name	Nuclear CV	Dedication %	ORCID iD

10.1039/D2CC03511A), 4f- (10.1039/c8dt03672a) and 5f- (10.1002/chem.201805090) based elements and to understand the factors that govern the slow relaxation, such as the coordination environment and magnetic anisotropy. This work made in collaboration with renowned collaborators has been considered of prime relevance in the field of molecular magnetism.
Spincrossover (SCO) materials show a chemical and physical versatility based on their controlled response to different external stimuli making them good candidates for spintronic devices. By a comprehensive structural and magnetic characterization of a series of Fe(III) complexes the nature of intra- and inter-molecular interactions that enable or disable the SCO transition was identified. 10.1039/d3ce00954h.
Superparamagnetic iron oxide nanoparticles can be used as smart nanoplatforms for drug delivery, therapy, and imaging. The great advantage of such magnetic systems is to acquire real-time information on the delivery and the effects of therapeutic agents when guided by a magnetic field to target sites in the human body and hyperthermia therapies. New approaches in the preparation of such nanoplatforms and cores with enhanced magnetic properties have been designed. In vitro tests showed excellent multi-stimuli response and anti-bacterial activity with potential applications in bone diseases. 10.3390/nano9070943; 10.1016/j.matdes.2018.01.017; 10.1016/j.ijpharm.2020.120097.

Name	Nuclear CV	Dedication %	ORCID iD
Luís Manuel Cerqueira Lopes Alves	FD19-D61D-3A7E	80	0000-0001-5369-5019

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Name	Nuclear CV	Dedication %	ORCID iD
Luis Miguel Mota Ferreira	1611-A0AF-DE8C	100	0000-0002-0352-5721

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Name	Nuclear CV	Dedication %	ORCID iD
Maria de Fátima Duarte de Araújo	1811-C86A-A8B8	100	0000-0001-9192-9461

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No

Name	Nuclear CV	Dedication %	ORCID iD

- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Maria Dulce Jesus Pombo Belo — 100 — 0000-0001-8480-963X
8E1D-A03B-83AA
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Maria Isabel Flausino de Paiva — 90 — 0000-0002-1861-4735
A510-08C7-D724
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Maria Isabel Garrido Prudêncio — 50 — 0000-0003-2311-1806
3B15-0FEC-3787
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Aposentado com vínculo
- Professional category:Investigador coordenador
- Retiree?No
- Weighting factor:Higher education professors with an exclusive or full-time employment contract and other researchers, except those covered by the 0.2 category. - weighting factor = 0.50

Maria Isabel Marques Dias — ✓ — 75 — 0000-0002-7033-0502
FD10-AA30-29E6
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador coordenador
- Retiree?No

Name	Nuclear CV	Dedication %	ORCID iD

- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Narrative CV

- Scientific and professional profile and career:Isabel Dias (ID) has obtained the degree in Geography at Universidade de Lisboa (UL) in 1990, She completed the MSc in Applied Geology at UL in 1993, the PhD in Applied Geology at UL in 1998, and got the academic title Agregado in Georesources at Instituto Superior Técnico (IST), UL in 2014. She specializes in Mineralogy, Geochemistry and Technological properties of Clays, in view to industrial use. In 1999 ID had an FTC Post-doc grant and in 2002 a Junior Researcher position at Instituto Tecnológico e Nuclear. Here she developed skills in the application of nuclear methods in geosciences, environment, NORM, archaeometry. She has coordinated/member of national and international projects in Earth Sciences, Environment, Cultural Heritage and Waste from Electrical and Electronic Equipment treatment, recovery and recycling, highlighting the interdisciplinarity. She has been Expert and member of several national and international evaluation panels and editorial boards. She has established numerous national and international collaborations and has participated in supervision of master and doctoral students in national (Aveiro, Algarve, Lisboa) and international universities (Seville, La Coruña, Bordeus, Sheffield). She has participated in the organization/scientific committees of national and international conferences. She belongs to national and international associations and has been President of the Society of Iberian Archaeometry Applied to Cultural Heritage. ID is now Senior Researcher of the Department of Nuclear Sciences and Engineering, IST. She has high impact management activities at the University: since 2020 Vice-president of the IST, Vice-president of IST-ID-Associação do Instituto Superior Técnico para a Investigação e Desenvolvimento; member of board of ADIST-Associação Para o Desenvolvimento do IST; 2015-2019 member of Conselho de Escola of IST; 2014-2019 member of Board for Loures Campus Management, CTN, IST; since 2015 research group coordinator.
- Contributions to science and society:
    1. Contributions to the generation of new ideas, tools, methodologies or knowledge:ID has fostered international and national partnerships in earth sciences, cultural heritage, environmental radioactivity, and emerging ecotoxicity fields. These collaborations have encouraged team members to assume increased responsibilities.
    ID research has been carried out in the frame of multidisciplinary and intersectoral teams resulting in 4 books, 20 book chapters, 144 articles in international journals, 31 articles in conference proceedings, 140 oral conference presentations, 40 invited talks, 143 posters, and several contributions to museums exhibitions.
    Research contributions and societal impact are outlined across the following domains:
    A.Nuclear methods and geochemical fingerprints in archaeometric studies
    The former NAA Laboratory has been a significant contributor to the analysis of cultural materials. ID has made substantial advancements in this scientific area, including methodological innovations, positioning IST at the forefront of archaeometry. While sample activation can no longer be conducted at the CTN, IST ID has established international partnerships to continue this work, and gamma spectrometry measurements persist in existing campus laboratories. International recognition of IST's work in this field is evident through invitations to publish in a special volume of Archaeometry journal "Fifty Years of Neutron Activation Analysis in Archaeology", organizing prestigious conferences such as the 7th European Meeting on Ancient Ceramics, the 11th Iberian Congress of Archaeometry, and the 42nd International Symposium on Archaeometry, and the election as president of the Iberian Society of Archaeometry.
    B.Luminescence dosimetry & geochemistry applied to cultural heritage and paleoenvironmental interpretations
    Scientific impact encompasses the expanded utilization of luminescence dosimetry, NAA, and XRD not only for authenticating and dating historical/geo-archaeological

Name	Nuclear CV	Dedication %	ORCID iD

objects and contexts but also for innovative applications in studying stratigraphic accumulation dynamics to address paleoenvironmental issues. Another notable scientific advance involves developing novel methodologies to evaluate the feasibility of absolute dating of rock paintings. ID's work in this field includes establishing chronological frameworks for significant sites such as the UNESCO World Heritage Site of Menga (Antequera, Spain) and the National Monument Perdigões site (southern Portugal).
A new research direction combines nuclear methods and luminescence to investigate the genesis and development of calcretes and the sedimentary dynamics of archaeological pits, thereby delineating different deposition rates. Additionally, a new tool and methodology have been devised for luminescence dating of highly carbonated archaeological contexts, surpassing the limitations posed by existing low-radioactive elements.
C.Non-destructive nuclear methods applied to cultural heritage
The use of non-destructive methodologies, where no samples are taken, is very appropriate in Cultural Heritage studies, maintaining the object's integrity. Prompt-gamma activation analysis and neutron tomography stand out as NATs used, together with PIXE in the frame of international Projects with international collaboration (Budapest Neutron Center), studying for the first time National Museums collections.
D.Rare Earth Elements (REE) geochemistry of clays and other geological materials in uraniferous contexts and natural radioactivity assessment
ID has provided new insights into the behavior of REE, especially their mobilization and/or precipitation during supergenetic processes. These findings, along with the utilization of clays materials, serve as indicators of paleoenvironments. Nuclear methods for chemical characterization, coupled with XRD mineralogical analysis and in-situ environmental dosimetry measurements, have enhanced the understanding of geological resources and environmental issues, particularly in old uranium mining contexts.
E.Innovative and environmentally friendly strategies for the recovery of REE and other critical metals (CM) from secondary natural sources and electrical and electronic waste (WEEE)
REE are vital in various industrial applications. Despite their relative abundance, they are termed "rare" due to the challenges associated with their extraction. The European Commission has initiated funding programs aimed at securing a stable supply of REE for Europe. ID contributed to European projects such as ENVIREE and COST Action "ReCreew." These projects focused on exploring secondary sources of REE, including materials from mining activities (such as radioactive waste) and from WEEE. ID played a key role in establishing a European network for innovative CM recovery to support European industries, mitigating environmental risks and human health impacts. Additionally, ID conducted evaluations and characterizations of available materials, assessing the health risks associated with their recovery, particularly from WEEE.

2. Contributions to the training and career development of researchers and/or research teams:As ETN group coordinator, ID fosters collaboration among researchers within and outside the organization, facilitating networking, joint projects, and partnerships. Assistance in securing research funding is provided, offering guidance on applications and connecting researchers with opportunities. Early researchers receive training and access to high-quality resources, including support for accessing external infrastructure. Leadership roles and scientific autonomy are promoted, with professional development plans established for career growth. Flexible working arrangements are encouraged, ensuring work-life balance in line with IST-ID rules.
   Junior researchers are fully integrated and encouraged to actively participate in projects, where ID has participated (75 in total: 26 international-10 EC, 6 IAEA and 49 National-12 FCT), or coordinated (3 EC, 7 FCT, 24 IPA, 3 EDIA, 35 services), resulting 3M€ funding for the institution. These facilitated research activities, equipment renewal, consumables acquisition, and recruitment and training of promising young researchers.

Name	Nuclear CV	Dedication %	ORCID iD

ID is committed to mentorship, supervising various students and interns, including post-doctoral, PhD, MSc, and undergraduate students. Her guided students have impactful roles within research units, academia, and private companies, reflecting the excellence of the work environment. Furthermore, ID has significantly contributed to the development of academic programs, including coordinating the Master Program in Science and Technology for Cultural Heritage and participating in various other programs such as the Marie-Curie PhD program, minors, and non-graduate courses. ID has also shared her expertise through teaching in numerous degree, master's, and doctoral programs, post-graduations, and training courses across several institutions. She has been in charge of the Luminescence Dating Laboratory, and other laboratory facilities management. Her leadership extends to institutional governance.

3. Contributions to the scientific community:ID contributed to the scientific community through her editorial roles: Editorial Board of 2 International journals, 2 international monographic series and 1 national magazine, 15 organizing committees of national and international (11) conferences, 12 international Scientific committees. ID refereed 220 papers of international conference proceedings and 150 articles in journals (43 international, 35 indexed in WOS, Scopus and SJR), being awarded with the Certificate of Outstanding Contribution in Reviewing (Elsevier).
   Giving her expertise, she is actively engaged in evaluation processes as panel member in EC Project Evaluation, H2020 IPERION, FCT (BD, BPE and BPD); juries of national/international PhD and MSc thesis and of public competitions.
   ID also encouraging team members to take on more research autonomy, facilitating mobility, access to foreign research cultures, fostering academic experiences enrichment for aspiring scholars.
   ID commitment to dissemination of research culture is expressed in several outreach activities. The ITN-IPA Protocol had significant impact on the scientific community, strengthening archaeometry in Portugal and at an international level never attained before. Within the Univ. Lisbon, ID promote an event in the European Year of Cultural Heritage, entailed the various schools of the UL in the field, and given its success, the decision was alternately hosted by schools of UL, belonging to the Coordinating Committee for further events.
4. Contributions to society:ID promotes societal engagement and knowledge transfer by prioritizing collaboration with companies' partners and authorities, integrating community outreach initiatives and educational programs to further engage with society and transfer knowledge effectively. ID connects with stakeholders promoting actions to publicise the scientific practices she specialises in, with particular emphasis in Cultural Heritage field, with a view to raise awareness of the importance of knowledge and characterisation of cultural heritage, for better definition of conservation and safeguarding strategies. Actions are carried out in museums, town halls, secondary schools, television programmes (Programa 2010, RTP2) and newspapers. She has also taken part in the Ciência Viva. ID has also coordinated 35 services/contracts with public and private entities. Services liaising with the scientific and technical community in different public and private institutions, reinforcing the importance of publicising and disseminating scientific knowledge, namely its social and economic impact, aiming contributing to the subjective well-being of the population, and good practices available to individuals, institutions, companies, or government bodies. Services provided to society in the field of authenticity testing are usually divulged to the public, i.e. public exhibition at Lisbon City Hall - "Alma Africana Exhibition" and Exhibition "À luz de Einstein. 1905-2005", F. Calouste Gulbenkian.

- Scientific production and/or selected activities:NON-DESTRUCTIVE NUCLEAR METHODS APPLIED TO CULTURAL HERITAGE
  https://doi.org/10.1007/s12520-016-0457-2
  Non-destructive compositional information avoiding sampling is crucial in singular and rare cultural heritage objects. ID developed at the Budapest Neutron Center a combination of X-ray

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and neutron-based non-invasive analysis applied for the first-time to prehistoric stone idols and vessels, contributing to mobility interaction in Prehistory of Southern Iberia.
LUMINESCENCE DATING: THE CONSTRUCTION DATE OF MENGA DOLMEN, ANTEQUERA WORLD HERITAGE SITE (MÁLAGA, SPAIN)
https://doi.org/10.1017/qua.2022.33
The scientific study of Neolithic monuments is often hindered by understanding their temporality. ID developed interdisciplinary research, being her contributions Luminescence and geochemistry. Successful results establish for the first time Menga's construction date, introducing new possibilities for its interpretation, both in terms of local and supralocal social and cultural processes.
NEW INSIGHTS ON THE GENESIS & DEVELOPMENT OF CALCRETES BY USING LUMINESCENCE DOSIMETRY & GEOCHEMISTRY
http://dx.doi.org/10.1007/s10967-019-06591-w
In the frame of this new line of research, ID carried out fieldwork, laboratory work and discussion, combining geochemistry, mineralogy and luminescence dosimetry. For the first time, the genesis of Alentejo calcretes was attributed to both abiotic and biogenic processes, in a paleoenvironmental trend towards aridification.
AN ALTERNATIVE SOURCE FOR CRITICAL MATERIALS, INCLUDING RARE EARTH ELEMENTS, IN WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT: RECOVERY MANAGEMENT BY ASSESSING POTENTIAL DAMAGE TO HUMAN HEALTH
https://doi.org/10.1007/s11356-017-0390-7
In a Cost Action concerning informal PCB recycling and exposure routes, ID contributes to develop a methodological approach to assess potential health damage more effectively and prioritize strategies for future management.
GEOCHEMICAL AND MINERALOGICAL CHARACTERIZATION OF URANIUM MINING WASTES: LANTHANIDES AND ACTINIDES IN THE SOIL-WATER SYSTEM IN A VIEW TO ENVIRONMENTAL MANAGEMENT
http://dx.doi.org/10.3390/geosciences13060168
This activity underscores the environmental significance of investigating the dynamics of REEs and associated elements in mining-impacted areas. ID supervised a PhD, made fieldwork, laboratory activities and results discussion, that highlight the influence of mine tailings in surrounding environment, influenced by weathering process and climate.

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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Maria Paula Cordeiro Crespo Cabral Campello 851B-6306-49AB		100	0000-0003-2017-3358

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»

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- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Maria Raquel Nunes Pereira Crespo
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Docente Universitário - Professor auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Maria-Cristina das Neves Oliveira
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Mário João Capucho dos Reis
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Miguel Adrião Mateus dos Reis
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No

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- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

MIGUEL FELIZARDO
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Nuno Pessoa Barradas
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador coordenador
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Narrative CV

- Scientific and professional profile and career:My career has been centred on the applications and development of nuclear analytical techniques. During my MSc and PhD I applied Perturbed Angular Correlations and Rutherford backscattering to the analysis of magnetic materials. During Postdocs in Germany and England I continued to use Ion Beam Analysis for materials analysis.

  In 1999 I joined the Portuguese Research Reactor (RR), then in the State Laboratory Instituto Tecnológico e Nuclear, which was integrated in 2012 in Instituto Superior Técnico. First, I was responsible for reactor calculations, later becoming the reactor's Deputy Facility Manager and then Facility Manager, reporting to the Reactor Director. I continued in parallel to work on IBA in collaboration with the institute's accelerator laboratory and international groups.

  I started managing research grants in 2000. In 2007 I became member of the Institute's Scientific Council management. I was C2TN's first vice-President in 2015, later becoming President. I was also member of the Scientific-Pedagogical Council of the also newly created academic Department, of the IST Board of Research Units, and of the Coordinating Committee of the IST Loures Hub.

  I joined the IAEA in 2017 as a RR Specialist, leaving in February 2024. In this period I kept membership of C2TN as collaborator. I was a scientific and technical manager and coordinator, formulating, developing, organizing and implementing the IAEA activities on utilization of RR and accelerator based neutron sources. I developed and managed projects with over 50 countries in all continents. I was the coordinator of the IAEA cross-cutting team

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on RRs and the Focal Point for RR Technical Cooperation projects. The IAEA is not a research institution, nevertheless I published 58 papers referenced in Web of Science and 15 IAEA technical books.

In short, I am a nuclear applications research scientist with extensive experience in project management at national and international level.

- Contributions to science and society:
  1. Contributions to the generation of new ideas, tools, methodologies or knowledge:I am a world leader in analysis, simulation and advanced model development in ion beam analysis (IBA), and its application to the analysis of materials. This translates into numerous invited lectures at the most important dedicated international conferences, in the authorship of two chapters in the 2nd ed of the Handbook of Modern Ion Beam Materials Analysis, and in over three hundred papers.

     My research focuses on the development and application of IBA techniques, in several aspects:
     - Development of advanced theoretical and analytical models to describe as faithfully as possible the interaction between the analysing beam and sample, and their implementation in data analysis codes to allow accurate analysis of complex samples.
     - Experimental determination of the needed physical parameters, i.e. stopping powers and scattering cross sections. I developed a new method for this.
     - Development of advanced data analysis methods for IBA, using simulated annealing and Bayes inference, allowing for the simultaneous and automatic analysis of an unlimited number of spectra collected from a given sample, leading to solutions that integrate in a self-consistent way all the information present in the various data and techniques.
     - Development of artificial neural networks with multiple hidden layers for IBA in 2000, which is one of the earliest applications of ANNs for quantitative analysis of any type of data in any field, as opposed to the classification problems for which ANNs were then used.
     - Development, together with other experts and under the auspices of the IAEA, of a new ion beam analysis data format that can support any IBA technique, and can be used by any code.
     - IBA analysis of many materials and systems of technological interest: complex nanolayered magnetic systems; thermophotovoltaic cells; SiGe-based heterojunctions; semiconductors, including based on InN and GaN; fusion materials; oxynitride films for diverse applications, including photocatalysts, multifunctional nanocomposite films, bioelectrodes; and others.

     To carry out this work, I solved the hardest outstanding problems in analytical simulation of broadbeam IBA data (i.e. not including Monte Carlo, channelling and ubeam techniques). These include: simultaneous and self-consistent analysis of RBS, ERDA, PIXE, PIGE, nuclear reaction analysis and SIMS data collected from the same sample, with any beam (1H and 4He for PIXE) (no other code can do all this); calculation of realistic uncertainties in final results taking all sources of uncertainty into account (no other code can as yet do this); effect of roughness and quantum dots on the data; calculation of double scattering effects including at grazing angle geometry; influence of multiple scattering in the RBS yield; accurate simulation in the presence of sharp resonances in the scattering cross section; accurate calculation of pileup effects including triple pile-up; calculation of the low energy yield in RBS; and routine calculation of pulse height defect corrections.

     Why is this important? All together, these developments:
     - Allowed for higher accuracy in data analysis, and to provide accurate quantification of

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associated uncertainties.
- Allowed for the retrieval of information, for instance on 2D structure, that is present in the data but with previously available methods could not be retrieved. That is, the same techniques, the same data, now provide extended information on the samples.
- Turned what was previously very hard, such as elastic backscattering, differential PIXE or the self-consistent analysis of RBS and PIXE data collected simultaneously (even with a 4He beam), into a trivial task.
- Allowed for fast analysis of large data sets. For instance, a one week experimental campaign of JET samples for fusion typically leads to 800 to 1000 spectra; these can now be analysed in one day, as opposed to several months. In general, this revolutionized the application of IBA to large-scale problems previously intractable with IBA.

Impact: IBA has become more powerful due to my work. My code has been used, by me, other IST staff, and many users abroad, to analyse tens of thousands of spectra from diverse types of samples and applications for many research groups worldwide. The new data format is now used by the main IBA codes, which can hence easily exchange data among themselves.

I received the awards:
- Stimulus to Excellence, FCT, 2005.
- Ranked since 2017 in the category Applied Physics, Stanford University "science-wide author databases of standardized citation indicators" of top 2% scientists.
- International Atomic Energy Agency: Merit Award for outstanding performance, 2023; Director General's Recognition Award for Exceptional Service, 2020 (on the coordinated IAEA-wide response to COVID-19 pandemic) and 2023 (on the IAEA Support and Assistance Mission to Ukraine); Immediate recognition award for outstanding performance for release of e-learning courses, 2019.

2. Contributions to the training and career development of researchers and/or research teams:I taught "Radioquímica: Fundamentos e Técnicas" of the MSc in Biomedic Inorganic Chemistry of the University of Lisbon between 2004/05 and 2009/10. I was member of the direction of the Training Centre of the former State Laboratory ITN between 2004 and 2012. I supervised 12 BSc, MSc, PhD and Postdoc students. I conveived and implemented numerous training courses, including the yearly retraining courses for operators of the Portuguese Research Reactor.

   I lectured at several international schools and workshops for career-entry researchers, including 4 ICTP workshops in Trieste, Italy, and several others in Spain, Portugal and Czech Republic.
   I was PI of 10 research projects funded by Portugal, the IAEA and the EU; and participated in another 35. I was Portugal's representative in the Mediterranean Research Reactor Network.

   As President of C2TN (2015-2027), I was responsible for the planning, implementation, monitoring and managing human and financial resources; to define outputs and clarify roles and responsibilities of the team elements in the prosecution of C2TN's Programme; and to lead and participate in research projects. For instance: I introduced a Regulation for Performance Assessment of renewable-term personnel; I defined the role of Objective Manager (OM) for each project of C2TN's Thematic Strands, for which I appointed junior scientists.

   At the IAEA, I organized numerous capacity building actions, including fellowships and scientific visits for people from developing countries; I (co-)organized and lectured in 28 training workshops; I was (co-)responsible for 17 e-learning courses available to the

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public. I was (co-)responsible for conceiving and managing 4 Coordinated Research Projects, each involving over 10 research institutions from the whole world. I planned, evaluated and implemented over 50 regional and national Technical Cooperation projects.

3. Contributions to the scientific community:I was reviewer for several international evaluation processes, including for South Africa National Research Foundation, Czech National Foundation, FONDECYT (Chile), Agency for Science and Higher Education (Croatia) and Research Council for Natural Sciences and Engineering of the Academy of Finland.
   Member of the Int. Comm. of the Int. Conf. Ion Beam Analysis since 2013.

   (Co-)Organizer, (Co-)Chairman, Scientific Advisory Board, Local Organizing Committee, Program Committee, Meeting Organizer of over 25 conferences and meetings (excluding IAEA). (Co-)organizer of over 60 IAEA meetings.

   Member of the Advisory Editorial Board of Nuclear Inst. Meth. Phy. Res. B, 2014-2019.

   I have 194 Verified Peer Reviews in WoS and received 5 top reviewer awards from Publons, and have several top referee mentions from different journals.

   I created a new IAEA service, the Integrated Research Reactor Utilization Review, which is a peer review mission to assist countries in improving the utilization of their research reactors. I conducted 8 such missions in developing and developed countries, including at the MIT, thus helping scientific communities worldwide.

   I adopted gender mainstreaming measures in all my activities at the IAEA, such as giving preference to selection of women and giving high profile roles to women in meetings. I ensured geographical balance with participants from all the world including a majority from developing countries.
4. Contributions to society:I conducted numerous visits to the Portuguese Research Reactor, including high school pupils, general public, local political leaders and professional bodies. This contributes to better understanding of the contribution of nuclear science and technology to society.

   I was PI of the project "Scientific Culture in the Group of Schools Gil Vicente", comprising 1 Kindergarten, 7 basic schools and 1 high school, financed by Ciência Viva (2013/2014), which brought equipment, experimental and practical activities.

   I was responsible for the translation into Portuguese of the site Understanding Science of the University of California at Berkeley. I adapted the teacher resources to the Portuguese and Brazilian school systems. The site is a non-commercial educational website, for teaching and learning about the nature and process of science. Its immediate goals are to (1) improve teacher understanding of the nature of the scientific enterprise, (2) provide resources and strategies that encourage and enable teachers to reinforce the nature of science throughout their science teaching, and (3) provide a clear and informative reference for students and the general public that accurately portrays what science is and how science really works.

   I had many other outreach activities, including talks for high school teachers, pupils and general public; several TV and radio appearances on science; several science fairs; an interactive model of the Portuguese Research Reactor; and others.

- Scientific production and/or selected activities:1. Neutron Scattering with Low and Medium Flux Neutron Sources, IAEA-TECDOC-1961, ISBN 978-92-0-116721-7, IAEA, Vienna (2021) I conceived, managed and implemented the project and meetings leading to this publication,

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which is an authoritative reference on the application of neutron scattering at low and medium flux neutron sources, promoting R&D programmes worldwide.

2. Benchmarks of Fuel Burnup and Material Activation Computational Tools against Experimental Data for Research Reactors, IAEA-TECDOC-1992, ISBN 978-92-0-101322-4, IAEA, Vienna (2022)
This reports the results of an IAEA Coordinated Research Project that involved 11 countries and which I implemented. I coordinated the drafting of the publication. In particular the activation benchmarks can be useful to decommissioning planning of the Portuguese Research Reactor.

3. Addressing forensic science challenges with nuclear analytical techniques - A review, A. Simon, N. Pessoa Barradas, C. Jeynes, F.S. Romolo, Forensic Science International, In Press, 10.1016/j.forsciint.2023.111767
I co-coordinated and participated in drafting the paper, part of Special Issue of FSI Nuclear Technologies for Forensic Science, co-edited by me. The paper illustrates the wide availability of Nuclear Analytical Techniques worldwide, opening up opportunities for their increased use in routine forensic casework.

4. Artificial neural networks for NAA: proof of concept on data analysed with k0-based software, N. Pessoa Barradas, N. Farjallah, A. Vieira, M. Blaauw, Journal of Radioanalytical and Nuclear Chemistry 332 (2023) 3421-3429. 10.1007/s10967-022-08568-8
I coordinated, wrote software and drafted the paper. The paper shows that ANNs work very well in quantitative analysis of NAA data, and is intended to encourage labs worldwide to adopt this method, leading to high efficiency gains and decreased reporting times.

5. International Atomic Energy Agency inter-comparison of Particle Induced Gamma-ray Emission codes for bulk samples, N. Pessoa Barradas, J. Cruz, M. Fonseca, A.P. de Jesus, A. Lagoyannis, V. Manteigas, M. Mayer, K. Preketes-Sigalas, P. Dimitriou, Nucl. Instrum. Methods B 468 (2020) 37-47. 10.1016/j.nimb.2020.02.019
I defined methodology, wrote software, and drafted the paper. It was concluded that all participating codes are fit for the purpose of analyzing PIGE data for bulk samples, which validated one of the crucial elements of the technique.

Octávia Gabriela da Silva Viegas Nené Monteiro Gil B61C-8B26-2D4B	✓	80	0000-0002-0366-8124

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Narrative CV

- Scientific and professional profile and career:Begin working in the area of Radiological Protection (RP) and Safety, on the study of the deleterious effects induced by exposure to ionizing radiation, development of a stable temperature irradiator model for blood samples. An experimental micromethod was developed for the analysis of lipoperoxidation by spectrofluorimetry.

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Study of radioinduced injury in patients with thyroid carcinoma treated with 131I.
Participation in international and national R&D projects in multidisciplinary areas linked to RP: RENEB, PREPARE, CONFIDENCE, UPCAST, CAThyMARA, BioQuaRT, MinUrar, PIANOFORTE as team member, leader of WP, and Portuguese leader of project.
Participation in the Projects: "Scientific Mission in Kosovo and Bosnia-Herzegovina to assess radioactive contamination and radiological risk resulting from the use of depleted uranium munitions" as cytogenetic analyses leader, and "MinUrar: Uranium Mines and their waste: effects on the health of the population" as coordinator for the IST cytogenetic area.
Head of cytogenetic research area regarding the Portuguese population dose response curves elaboration, related to chromosomal aberration and micronucleus assays, to apply in case of an incident, large-scale radiological or nuclear accident.
Implementation of ?-H2AX assay in blood, and micronucleus assay in jugal mucosa cells to be used in radiation protection.
RP and Radiobiology research work with European institutes dedicated to new biomarkers and dose estimation. Participation in intercomparisons and proficiency tests, using human blood samples.
Participation in the elaboration of the Master in Radiological Protection and Safety (MPSR) proposal of IST, member of the Scientific Commission and of the Self-Assessment Committee.
Teaches in the IST department DECN, responsible for the MPSR curricular unit "Biological Effects of Radiation".
Radiological Protection and Safety Group coordinator since 2021.

- Contributions to science and society:
  1. Contributions to the generation of new ideas, tools, methodologies or knowledge:Considering the RP importance to general public, and to patients submitted to radiation therapy and diagnosis, the study of the health effects induced by exposure to ionizing radiation (IR), is very important. Studies performed in cancer patients submitted to treatment with radioactive substances allow us to know the real effects induced directly by the dose provided.
     Also, at international level, there is an increasing concern, in terms of RP, regarding radiological and/or nuclear emergency situations resulting from accidents (Chernobyl and Fukushima) or terrorist attacks. Following unpredicted radiation exposures, quick dose determination is essential to prioritize potential patients that require immediate medical care.
     Biological dosimetry plays an important role in the case of an accidents involving exposure to IR, either when it is the only way to estimate the dose or when it is used to complement physical dosimetry, being an added value in terms of RP for the population potentially exposed.
     Revision of the methods established and emerging physical and biological methods concerning biodosimetry and retrospective dosimetry. Know the exposure dose is important in RP, and based on these values, make appropriate clinical decisions (doi:10.1093/rpd/ncq499). Elaboration of the article part related to cytogenetic techniques for retrospective dosimetry, review of the all article.
     Establishment of dose response curves for Portuguese population: dicentric chromosomes (dic), considered the "gold standard", and the induction of micronuclei (MN) in peripheral blood. The existence of these curves (doi: 10.1016/j.mrgentox.2013.09.012; doi: 10.1016/j.mrgentox.2012.09.009) allows C2TN to do the dose assessment of exposed individuals (doi.org/10.1016/j.radphyschem.2020.108683). Responsible for the research team, outline of experiments. Preparation and scoring of all MN slides, validation of all recorded chromosomal aberrations. Interpretation and discussion of results, preparation of the articles and review.
     Quick assessment of the dose is important. Implementation of the gamma-H2AX foci assay allow to estimate radiation doses (early effects of radiation) in a timely and effectively manner. Implementation and optimization of the assay, intercomparison

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exercise, review of the article (doi:10. 1093 / rpd/ncu259).
The number of individuals exposed to IR and/or contaminated by ingestion or inhalation of radionuclides can vary between a few and hundreds of thousands of individuals. Any lab for itself has no capacity to answer. Knowing the real response capacity in case of accidents is important (doi. 10.1093/rpd/ncs157; doi.org/10.1016/j.radmeas.2019.03.004).
The projects CAThyMARA, PREPARE, CONFIDENCE were related to Radiological and Nuclear Emergencies Response. CAThyMARA study strategies for monitoring measuring and evaluating thyroid doses due to the incorporation of the I-131 in children and adults (doi: 10.1016/j.radm eas.2019.02.008; doi.org/10.1016/j.radmeas.2019.03.004). WP2 leader "Review of existing plans and means", WP 2 presenter in meetings and at OPERRA 3rd Periodic & Final Meeting. PREPARE deals with the need to consider radioactive contamination of food and other consumer goods. Food safety problems associated with the management of contaminated food for human and animal consumption and the management of other contaminated consumer goods (doi.org/10.1051/radiopro/2016038). Co-responsible for the organization of 2 panels in WP3 for the "Managing complexity in nuclear accidental situations - Experts interacting with experts and society".
In the sequence of PREPARE, CONFIDENCE aims to fill gaps focusing on the initial and transition phase of an emergency, taking also into account long-term decisions. Work in WP4 "Transition to long-term recovery, involving stakeholders in decision-making processes" and WP5 "Social, ethical and communication aspects of uncertainty management" (doi:org/10.1051/radiopro/2020023; doi:org/10.1051/radiopro/2020023).
Cancer is one of the main causes of morbidity and mortality worldwide, being thyroid cancer (TC) etiology associated with IR exposure. In terms of RP it is important to identify patients who will not respond to the treatment. Studies were performed in blood of TC patients treated with 131I concerning the DNA damage and its persistence through chromosomal aberrations (CA) and MN assays. We also studied genes involved in DNA repair homologous recombination, non-homologous end-joining, and mismatch repair polymorphisms in order to define a biomarker profile allowing for a more personalized treatment (doi.org/10.1093/mutage/15.1.69; doi. 10.1002/ijc.10768; doi.org/10.3390/genes10080586; doi:10.3892/or_00000958; doi:10.1089/thy.2009.0099; doi:10.3390/genes11091083). Personal contribution in sample collection, chosen methodology, set up of experimental work, compilation, interpretation and discussion of results, preparation, edition and review of articles.

2. Contributions to the training and career development of researchers and/or research teams:In the DECN of IST is responsible for the curricular unit "Biological effects of Radiation" of the Master in Radiological Protection and Safety. Awarded twice with the" Diploma of Excellence in Teaching from IST".
Ionizing radiation (IR) has applications in various sectors such as Health, Industry, Environment, Research, Services, Security and Energy, in which RP aspects cannot be neglected. Students who attend this master's degree are directed to areas of work either at the medical or industrial level.
Also participate in Masters and Postgraduate Courses in other Universities given seminar related to the effects induced when we are exposed to IR. Also teaches in "Specialization Course in Radiological Protection and Safety" level II and III, and in training courses for workers involved with radioactive and radiation sources (medical area, industry, and environment).
Orientation of students (some of them integrated in projects) in areas related to RP and nuclear safety, radiobiology (CA and MN in blood of cancer patients, MN in buccal mucosa cells), retrospective and biological dosimetry (dose response curves, evaluation of exposure doses), radiological or nuclear emergencies (preparedness and response to radiological and nuclear emergencies, stakeholder's engagement). Implementation of new assay in the context of a master's thesis correlated to the genetic damage induced

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by exposure to ionizing radiation using the micronucleus assay in cells of the buccal mucosa, through a non-invasive method. Assay very useful to assess children exposure. Some of the trainees went to PhD programs and one is working in the National Regulatory Authority (APA).
Collaboration with NOVA Medical School/FCM.
Participation in international networks such as: EURADOS, RENEB, NERIS and MELODI.
Submission of projects to FCT and participation in international projects in order to networking and generate conditions to further research activities.

3. Contributions to the scientific community:Reviewer of the following international journals: Radiation and Environmental Biophysics; International Journal of Radiation Biology; PLOS ONE; European Journal of Radiology; Ecotoxicology and Environmental Safety.
Reviewer of abstracts submitted to national and international conferences such as: LOWDOSE-PT 2015; IRB 2015; PRS 2017; EPRBioDose 2018; ICDA- 3 2019 and ERPW2022.
Involved in the scientific and organizing committees of several conferences, workshops, webinars and scientific meetings at national and international level.
Activities of scientific divulgation through organization of webinars related to RP.
Seminars to university students related to the topic biological effects of radiation, biological dosimetry, thyroid cancer at the Chemistry Department of Nova School of Science and Technology, at IST and Faculty of Pharmacy UL.
As a member of the network RENEB "Running the European Network of Biological and Retrospective Physical Dosimetry" have participated in prospective studies related to the development of new biomarkers and new assays, to provide faster responses in the event of an emergency situation involving a large number of victims who need to be categorized to initiate medical treatment. Participation in the preparation of international reports and publications of scientific and technical nature, including recommendations for good practices, response strategies in case of an accident, etc.
Participation in PhD and MSc juries.
4. Contributions to society:Organization of conferences and meetings to disseminate scientific results to the community:
Participation and organization of meetings related to the societal impact of RP during COVID open to the general public: "Radiological Protection in Health in Times of Covid: the Principle of Justification" and "Optimization of procedures and occupational exposure in times of COVID".
Participation in the Iberian Workshop - Nuclear Energy and Civil Protection which took place in the district of Portalegre in Portugal.
Organization of a national panel on uncertainties related to transition from a nuclear emergency to long-term rehabilitation involving stakeholders in the decision-making process, Castelo Branco district.
Participation in the infoday on the topic of Radiological Protection and Dosimetry: what research is being carried out in Portugal". EURATOM National Infoday Work Program 2016-2017.
Participation in the Civil Society program (TV RTP2 program) on the theme "Dangers of radiation around us".
Participation in the round table "Radon and Human Health". Radon Journeys in Guarda. Portugal.
Participation in training courses in the area of radiological protection and biological effects of ionizing radiation, given in a business environment (training courses for companies and entities).
Participation in MinUrar project, requested by the National Assembly of the Republic: possible repercussions of uranium mines and their waste on the environment and the health of the populations.

Name	Nuclear CV	Dedication %	ORCID iD

- Scientific production and/or selected activities:The threat of large-scale radiological or nuclear scenarios or a malicious act requires exercises and intercomparisons to improve preparedness and response. In any of these cases is necessary screening efficiently and quickly a huge quantity of individuals of civil society. Those exposed to high doses require urgent medical care.
  Participation in international intercomparison and proficiency tests, including intercomparisons of biomarkers for radiation exposure to evaluate dose exposure is important.
  Field exercises simulating real-life exposure scenarios through the use of anthropomorphic phantoms positioned in different geometries allow considering additional uncertainties to the evaluation of doses (doi.org/10.1080/09553002.2021.1941380; doi.org/10.1667/RADE-22-00201.1; doi: 10.1667/ RADE-22-00202.1; doi.org/10.1016/j.radphyschem.2020.108683). The participation in these studies allow us to provide a more reliable answer for categorizing members of society who have been accidentally exposed and to provide a more accurate information for medical doctors. Sample treatment, microscope scoring, dose calculation, categorization of victims, review of the manuscripts.
  A key priority for RP research is to improve health risk estimation for exposures to low doses and low- dose rate, always bearing in mind the possibility of stochastic effects and the deleterious effects that can arise over time (life-long health effects). Micronuclei formation in the oral mucosa exfoliated cells is a non-invasive procedure that can provide an idea of the damage caused by low dose of IR induced by orthopantomography (widely used due to the easiness to be performed mainly in children, and in adults). Conceptualization, design the methodology, validation of proceedings, writing of the original draft.
  Participation in an exploratory study looking at BRCA1 variants of unknown significance (VUS) trying to differentiate between pathogenic from benign variants. For that purpose, two women carrying BRCA1 mutation VUS (NM_007294.3:c.1067A>G) were studied for DNA damage after genotoxic challenge by IR or doxorubicin, using functional assays CA, CBMN, comet, ? H2AX, caspase and TUNEL assays, comparing with two non-mutated women. The results suggested that this BRCA1 VUS is likely benign since they didn't show deleterious chromosomal rearrangements. (doi: 10.3892/mmr.2023.13023). Designed the methodology, performed experiments, validated the proceedings, review final manuscript.

Name	Nuclear CV	Dedication %	ORCID iD
Paula Dolores Galhofas Raposinho 9E1A-8B6A-9C11		100	0000-0002-9542-1427

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Name	Nuclear CV	Dedication %	ORCID iD
Paula Maria Mimo Carreira Paquete F412-D093-110B	✓	90	0000-0002-2178-7848

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No

Name	Nuclear CV	Dedication %	ORCID iD

- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Narrative CV

- Scientific and professional profile and career:After graduation in Geology by the Faculdade de Ciências, Universidade de Lisboa, I was granted with a fellowship by ICEN-INETI (now C2TN/IST) to work on isotope hydrology projects until July 1988.

  During this period, under the supervision of Professor Peixoto Cabral, I was responsible for the field campaigns and stable isotope analyses of water collected under the IAEA Isotope Hydrology Project (IAEA - POR/8/004 - Origin of salinization in Algarve costal aquifers). From July 1988 to March 1992, I joined the research group of Prof. Peixoto Cabral - Chemistry Department of ICEN-INETI. Under his supervision, the research work dedicated to "Degradation of Coastal Aquifers - Origin of Groundwater Salinization in the Algarve Basin" was the basis of the "MSc Thesis" that allowed to obtain the "Young Researcher" position within ICEN-INETI.

  In 1994, I was granted a PhD scholarship by JNICT and joined the IAEA-Isotope Hydrology Section as an intern, under the supervision of Professor Roberto Gonfiantini and after Professor K. Rozanski. The research work at the IAEA Vienna led to the presentation of my PhD thesis "Palaeowaters of Aveiro", presented at the University of Aveiro - Department of Geosciences in 1999. After the PhD, I was appointed as an Auxiliary Researcher within ITN (now IST/CTN), where I continued to work on national and international research projects in the field of water resources sustainability, using nuclear methods.

  Since 2010, I have been appointed as an expert of the IAEA - Isotope Hydrology Section, lecturing in the Isotope Hydrology Training Courses organized by the IAEA-IHS in cooperation with the host countries.
  Since 2014, I have been head of the Environmental Light Isotope Laboratory (C2TN/IST).

  Following an international call for a research position, I was appointed as principal investigator in 2020, my current position.
  Since April 2022 I am Group Leader of the Research Thematic Area Focus on Environmental Issues of C2TN, Research Centre.
- Contributions to science and society:
  1. Contributions to the generation of new ideas, tools, methodologies or knowledge:The solid background in isotope hydrology has led to my appointment as an expert of the IAEA - Isotope Hydrology Section, to teaching in training courses on isotope hydrology organized by the IAEA-IHS in collaboration with host countries, and to my integration and active participation in several national and international projects, and to active collaboration with the Portuguese Regional Water Authorities. This is reflected in numerous invited lectures, seminars at universities, in international meetings, in the authorship of 22 book chapters and in over 96 papers in peer-reviewed journals. This academic expertise has also led me to be responsible for two curricular disciplines, "Geoquímica Isotópica" and "Reconstrução Ambiental e Geocronologia" of the MSc in Science and Technology for the Cultural Heritage.

     Among these research projects, the study of groundwater salinization origin in Portugal and other coastal countries (Cape Verde, Morocco; Tunisia) led me as a reference in this type of water resources degradation issues. In the framework of the IAEA Regional Project RER 7013 - Evaluating Groundwater Resources and Groundwater-Surface Water Interactions in the Context of Adaptation to Climate Change, I was selected to lead the Coastal Aquifers Group, composed of representatives from Georgia, Russia, Bulgaria, Turkey, Montenegro, Cyprus, Malta and Albania.

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The above-mentioned research topic proved to be crucial for a good sustainable use of water resources, especially under the scenario of climate change. The use of the isotopic composition of water to identify the origin of salinization/degradation is one of the most important issues in groundwater sustainability. These methods are proving to be a unique and crucial approach in identifying the origin of salinization in coastal aquifer systems, where the mineralization of these systems may be associated with marine intrusion, dissolution of evaporative minerals, dissolution of marine aerosol or mixing with brines, where all mechanisms result in similar hydrogeochemical facies.

Part of my work has been devoted to the dating of groundwater systems using 3H and 14C as dating tools. The age of the water is reflected in the amount of replacement/recharge of the groundwater, with determination of flow velocity and direction, definition of recharge areas, mixing between different water units for example.

My knowledge of isotope hydrology has led to an invitation from the IAEA-IHS to participate as a guest lecturer in various IAEA training courses since 2010. I have lectured at several international training courses and workshops for early career researchers in Portugal, Ethiopia, Thailand, Albania, Angola, Brazil, Morocco, and Ghana. I have also been responsible for training at C2TN campus, 15 research fellows of different nationalities (Paraguay 1; Portugal 1; Morocco 4; Egypt 2; Syria 1; Angola 4 and Kuwait 2) in isotope geochemistry.

Co-editor of the Special Issue on "Mineral and Thermal Water Studies", invited by Springer - Sustainable Management of Water Resources, December 2019. In 2022 I was invited to be the Guest Editor of the WATER Special Issue "The Use of Environmental Isotopes in Hydrogeology".

The papers Carreira et al, 2014, 2018 (doi.org/10.1016/j.ap geochem.2013.12.012 and doi.org/10.1007/s10040-018-1815-1) continue to be a reference in the identification of salt sources in groundwater systems using water isotopic composition. In this work on coastal areas, freshwater stored in coastal aquifers is at risk of contamination by seawater due to the proximity of the freshwater/saltwater interface to the land; due to overexploitation of water reserves (anthropogenic action) leading to saline intrusion mechanisms. The existence of natural processes, such as the dissolution of evaporite minerals, which is common in sedimentary basins, causes the deterioration of water reserves. The use of isotopic composition to identify the origin of salinization is a unique and crucial approach to identify the origin of salinization when groundwater mineralization can be associated with: marine intrusion; dissolution of evaporite minerals; dissolution of marine aerosol or mixing with brines, where all mechanisms give similar hydrogeochemical facies to the water. Carreira et al. 2010 (doi: 10.1007/s11269-009-9489-z) also discusses the problems of dating groundwater using 14C, and this work is often used to support dating in problematic areas. Collaboration with the Moroccan team has provided highlights on groundwater quality and mean residence time of groundwater systems in the Essaouira basin, with numerous publications on this topic.

2. Contributions to the training and career development of researchers and/or research teams:Although my teaching activities within the DECN/IST (Departamento de Engenharia e Tecnologias Nucleares) are relatively small, since 2020 I teach "Radioquímica" in the MSc in Radiation Protection and Safety, of the IST-University of Lisbon. Since 2022, I am also responsible for two of the curricular disciplines "Geoquímica Isotópica" and "Reconstrução Ambiental e Geocronologia" of the MSc in Science and Technology for the Cultural Heritage.

   Since 2000, I regularly collaborate with the MSc of the Faculty of Sciences (University of

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Lisbon) and with the MSc of the IST - Departamento de Minas, through seminars focusing on the application of nuclear isotope hydrology methods in the characterisation of water resources; and, in the characterisation and dating of geothermal systems. I have been a member of 19 doctoral and master's examination boards in several Portuguese universities. I have supervised/co-supervised 4 PhD, 8 MSc and 4 BSc students and 2 post-doctoral students. Regarding the postdoctoral students, both are currently working as professors at the Faculty of Science, University of Lisbon (Maria do Rosário Carvalho) and Salah OUHAMDOUCH is currently with a faculty position at the Mohammed VI Polytechnic University of Benguerir, Morocco. In collaboration with the IAEA-IHS, since 2000 I have been responsible for the training in isotope hydrology of 15 young researchers of different nationalities.

I have lectured at several international training courses and workshops for early career researchers in Portugal, Ethiopia, Thailand, Albania, Angola, Brazil, Morocco, Ghana.

Of the 34 research projects I have participated in, I have been PI in 12 (5 active). These research projects were/are funded by Portugal through the Portuguese Foundation for Science, by the IAEA and the by EU.

The research activities and expertise in water quality degradation of coastal aquifers led to my selection as representative of the Coastal Aquifers Group in the IAEA project RER7013.

3. Contributions to the scientific community:I have been invited by the IHS-IAEA to be an evaluator for the following IAEA projects
- RAF7013 02 - "Enhancing The Use Of Isotope Hydrology In Planning, Management And Development Of Water Resources (AFRA)", 2014;
- ANG7003 01 (National Project) - Enhancing the Use of Isotope Hydrology in Planning, Management and Development of Water Resources and Establishment of an Isotope Hydrology Laboratory, 2016
- RLA7018 14 "Improving Knowledge Of Groundwater Resources To Contribute To Their Protection, Integrated Management And Governance" (ARCAL CXXXV), 2017.

Member of the International Association of Hydrogeologists since 2001; member of the IAH Commission on Mineral and Thermal Waters, also member of the Portuguese Water Resources Association - Groundwater Committee. Also I am a member of the Geochemistry Group of the Geological Society of Portugal, and Member of the Centre for Science and Education in Territory, Groundwater and Geothermal Resources at Geopark Estrela (NCET-RHSG).

I have been (co-)organizer, (co-)chairperson, organizing committee and scientific committee of 15 conferences and meetings.

I have published as (co-)author 22 book chapters and 96 peer-reviewed reviews.

I received the award for best paper on Theme 6 - Hydrology, Hydrogeology, Hydrochemistry; AJG Conference 2018; and the award for best reviewer Theme 6 - Hydrology, Hydrogeology, Hydrochemistry, CAJG - 2018.

4. Contributions to society:I have participated in and led numerous visits to C2TN's Environmental Light Isotope Laboratory as part of university and secondary school visits to the campus. I also regularly take part in workshops aimed at a non-scientific audience to explain the importance of protecting and managing water resources using nuclear methods approach.

In all the research projects I am involved in, the interaction of the research team with the

Name	Nuclear CV	Dedication %	ORCID iD

regional water authorities and stakeholders is always a mandatory collaboration. The collaboration with the stakeholders related to water bottling and spas facilities has, since the early stage of my career, provided the output of different conceptual circulation models of different aquifer systems all over Portugal (Chaves; Pedras Salgadas; Melgaço; S.Pedro do Sul; Cabeço de Vide, Moura for example) and used to identify the protection boundaries / recharge areas of these systems. As a result of the collaboration with stakeholders and municipalities, several research papers have been published.

Likewise, a strong collaboration with the Portuguese Environment Agency (APA) has made it possible to access and study some problematic regions dealing with water degradation issues (Algarve Basin). I used the isotopic composition of the Algarve groundwater in the identification of the origin of salinization is the coastal aquifers and, the results obtained were given to APA-Algarve and, are used as a tool for water management in this region.

- Scientific production and/or selected activities:1. Tracing salinization processes in coastal aquifers using an isotopic and geochemical approach: comparative studies in western Morocco and southwest Portugal. P.M. Carreira; M. Bahir; S. Ouhamdouch; P. Galego Fernandes; D. Nunes. Hydrogeology Journal, (2018). 26 (8). 2595-2615 doi.org/10.1007/s10040-018-1815-1
  - A comparison between two coastal aquifer systems, using a similar approach in both regions (isotopes and chemical content) to identify the main causes of water degradation. Collaboration between C2TN and Mohammed VI Polytechnic University of Benguerir, Morocco

  2. Radiocarbon dating and stable isotopes content in the assessment of groundwater recharge at Santiago Island, Republic of Cape Verde. P.M. Carreira; A. Lobo de Pina; A. Mota Gomes; J.M. Marques; F. Monteiro Santos. Water (2022) 14 (15): 2339. doi.org/10.3390/w14152339
  - Environmental isotopes were used to identify the main source of salts dissolved in groundwater systems; radiocarbon content allowed the identification of ancient waters and recharge under different climatic conditions. Collaborative study between the University of Lisbon and the University of Cape Verde.

  3. Linking serpentinization, hyperalkaline mineral waters and abiotic methane production in continental peridotites: an integrated hydrogeological - biogeochemical model from the Cabeço de Vide CH4-rich aquifer (Portugal). J.M.M. Marques;G. Etiope; M.O. Neves; P.M. Carreira; C. Rocha; S.D. Vance; L. Christensen; A.Z. Miller; S. Suzuki. Applied Geochemistry (2018), 96, 287-301. doi.org/10.1016/j.apgeochem.2018.07.011
  - The chemical and isotopic composition of Cabeço de Vide mineral water has been used as an analogue for the first life on Earth and compared with possible life on Mars. A team from the University of Lisbon, the National Institute of Geophysics and Volcanology (Rome - Italy) and the Jet Propulsion Laboratory (NASA).

  4. Evidence for groundwater salinity origin based on hydrogeochemical and isotopic (2H, 18O, 37Cl, 3H, 13C, 14C) approaches: Sousse, Eastern Tunisia. F. Nefzaoui; M.F. Ben Hamouda; P.M. Carreira; J.M. Marques; H.G.M. Eggenkamp. WATER (2023) 15, 1242. doi.org/10.3390/w15061242
  - Chemical and isotopic composition has been used to identify the origin of salinisation in the Sousse region. Studies carried out in collaboration between C2TN, University of Lisbon and CNSTN Sidi Thabet, Tunisia.

Pedro Manuel da Cunha Catalão Pires dos Santos 9A13-2304-3D69		100	0000-0002-3363-0098

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes

Name	Nuclear CV	Dedication %	ORCID iD

- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho a termo certo
- Professional category:Investigador - Outra
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Pedro Valério
9512-7C72-C7AC
100 0000-0002-3726-6975

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Pedro Vaz
001C-AED3-9A77
75 0000-0002-7186-2359

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador coordenador
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Rita Lourenço Paiva de Melo
ED1A-5FE8-8E69
80 0000-0003-1056-1007

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Rosa Maria Salgueiro Marques
8712-07AE-51F0
90 0000-0001-6239-5456

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)

Name	Nuclear CV	Dedication %	ORCID iD

- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Salvatore Di Maria
9716-892F-5E5E — 100 — 0000-0002-0511-6665

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto
- Professional category:Investigador júnior
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Sandra Cabo Verde
0D16-5620-7AEA — ✓ — 100 — 0000-0002-6615-5289

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Narrative CV

- Scientific and professional profile and career:Sandra Cabo Verde (SCV) graduated in 1998 in Applied Chemistry/Biotechnology (FCT-UNL). In 1999, she entered the former Instituto Tecnológico e Nuclear for a two years Post-Graduation Course in Radiation Protection and Safety, and continued there as a PhD student. In 2004, she performed an internship at Clinical Microbiology Department of Uppsala University, Sweden. SCV completed her PhD in Microbiology at Universidade de Lisboa in 2007. She initiated the post-doc research in Environmental Virology, in 2007, at the Faculty of Pharmacy from Universidade do Porto, profiting from an internationalization period, in 2008, at the Gastroenteritis and Respiratory Viruses Laboratory, Centers for Disease Control and Prevention (CDC; Atlanta, USA).
SCV manage, since 2013, the Laboratory of Technological Assays in Clean Rooms (LETAL) of Centro de Ciências e Tecnologias Nucleares (C2TN) of Instituto Superior Técnico (IST). She was Assistant Professor of Bioengineering Department (IST), from 2014-2016, and since 2019 is Auxiliary Researcher of Department of Nuclear Sciences and Engineering (DECN) and C2TN. SCV is national member of the technical committee ISO/TC 198-Sterilization of Health Care Products, since 2020. Recently (2024), she joined as a member of the Executive Committees of C2TN and DECN, and as a vice-president of the scientific council of IST-ID.
Her R&D work has been contributing for ionizing radiation applications to guarantee the safety and efficacy of Radiation Technologies to foster public health and environmental sustainability (e.g. sterilization, food irradiation, wastewater treatment). These activities are in the scope of funded projects (10 PI; 16 team) and specialized services (Sterilization Dose; IAQ microbiological parameters) engaging funding of 1 M€. Often, SCV is involved on reviewer

Name	Nuclear CV	Dedication %	ORCID iD

activities for several international journals, and recently was recruited for the evaluation panel of Pathfinder Open - Horizon call for research projects.

- Contributions to science and society:
    1. Contributions to the generation of new ideas, tools, methodologies or knowledge:Sandra Cabo Verde research activities focus on the development of ionizing radiation technologies. She investigates, in detail, the effects of gamma radiation and electron beam on food products (e.g. cherry tomatoes, mushrooms, raspberries, strawberries, lettuce, dry milk, oregano) to contribute for the optimization of food processing by irradiation that guarantees the safety and quality of food. Furthermore, the entailed studies have indicated that the treatment by ionizing radiation is able to preserve or improve the bioactivity of food products [A], suggesting irradiation as a potential food functionalization tool. Extending the shelf-life, while improving the food safety and quality, will have a positive impact on both the industry and consumers - less food waste plus healthier food for all. The consolidated knowledge on food irradiation prompt SCV to the development of new applications of ionizing radiation, a clean and eco-friendly (no chemicals) technology with the potential to be used to improve the extraction of bioactive compounds. These studies are within the scope of a Portugal-Tunisia Bilateral Project, and International Atomic Energy Agency (IAEA) Coordinated Research Projects (CRP) contributing for collaborative international research. Following this research trend, work is being supervised by SCV to characterize the phytochemicals profile of olive [B] and grape pomace wastes from Portuguese industries to assess the impact of ionizing radiation on these compounds selecting the optimal radiation dose to improve their extractability. In this context, agro-industrial residues, which can have a negative impact on the environment, can represent a natural source for bioactive compounds and their recovery can contribute to the availability of natural compounds with biological activity (e.g. antimicrobial, antitumoral, antioxidants, antidiabetics properties), as well as to environmental sustainability and circular economy. A proof of this concept is currently being assessed, as EU Euratom project partner, where new product prototypes - antimicrobial/antioxidant hydrogel wound dressings and peptide-grafted active food packaging film - are being developed that incorporate protein-derived peptides from egg membrane (industrial residue) and egg white produced by high energy e-beam.
    In recent years, viral infection has become extremely common in humans worldwide. Epidemiological evidence suggests that a wide variety of pathogenic viruses may be transmitted to humans by water and foods via the fecal-oral route in the midst of infected individuals. Human enteric viruses are always found in municipal sewage wastes and, after discharge, may find their way into drinking and recreational waters. Human adenovirus (HAdV) and hepatitis A virus (HAV) are prevalent enteric virus in waters worldwide due to their environmental stability, which leads to public health concerns. Mitigation strategies are therefore required, being this the drive for other SCV research activity concerning the use of ionizing radiation as an alternative method to ensure the treatment of wastewater and to reduce the wastewater-linked contamination of fresh food products. This PI research (funded by FCT exploratory, IAEA CRP, IST start up fund projects) evaluate the inactivation efficiency of enteric virus (e.g. norovirus, adenovirus, hepatitis A) by physical methods (ionizing and UV irradiation, temperature) through the exploitation of mechanisms of the virucidal action [C]. The output is to generate knowledge to serve as a guide to the scientific community and policy makers on enteric virus and their control to achieve public and environmental health protection. Innovative advances were also supervised by SCV regarding the development of a methodology for the construction and production of Virus-Like Particles (VLP) containing on the surface a fragment of an anti-HER2 antibody, which can be used as targeted therapeutic delivery system for HER2 overexpressing cancers [D]. Virus-like particles arise as promising nanoplatforms that have a stable structure and are functionally versatile, which makes them ideal for a variety of scientific developments in the medicine area, such as vaccines and as delivery vehicles for therapeutic and/or imaging agents.

Name	Nuclear CV	Dedication %	ORCID iD

The Indoor Air Quality (IAQ) is other collaborative thematic included in SCV activities, focusing mainly in the characterization of air microbiota of several types of settings, such as health-care facilities [E], academic, dwelling and transports. This knowledge is essential since air is a microbial vehicle of transmission that has impact on products microbiota, which can affect the efficiency of decontamination, disinfection and sterilization processes. These activities embrace the participation in EU research projects and services to community.

2. Contributions to the training and career development of researchers and/or research teams:Sandra Cabo Verde specific background and knowledge in Radiomicrobiology, Biotechnology and Ionizing Radiation Technologies supported her interdisciplinarity in teaching and training activities. SCV promotes the career development of all cycles of higher education by scientific supervision of (i) 32 undergraduated students (including Erasmus +); (ii) 24 graduated students (16 MSc students, 2 ongoing; 6 BI fellowships; 2 MSc curricular students) (iii) 7 PhD students (3 ongoing). Additionally, SCV contributes for the development of the research activities of 4 post-doctoral researchers under the scope of different grants and projects.
   S. Cabo Verde trains frequently in courses/workshops related to Ionizing Radiation Applications for health care and pharmaceutics professionals, food industrials and academics, contributing for the awareness of ionizing radiation technologies in different societal sectors.
   SCV is national representative, since 2011, in IAEA funded research projects (6 PI, 5 member) of food irradiation, sterilization and biohazard control by ionizing radiation, being part and contributing for international collaborative research teams. She is/was IST leader or member of teams of research projects from diverse funding authorities, such as EU HORIZON (1 PI, 1 member), POR2020 (2 member), FCT (2 PI, 5 member), National Strategic Reference Framework (Quadro de Referência Estratégico Nacional - QREN; 1 member), National Defense Ministry (2 member), European Agricultural Fund for Rural Development - ProDer (1 PI); contributing, in this way, for the ionizing radiation technologies consolidation and transference of knowledge between researchers and stakeholders.
3. Contributions to the scientific community:Sandra Cabo Verde is currently Guest Editor of two special issues of the MDPI journal Applied Science "Application of Radiation in Wastewater Treatment" and "Air Quality in Indoor Environments". SCV was also editor of a book "Food Irradiation Technologies: Concepts, Applications and Outcomes" of Royal Society of Chemistry representing an update of ionizing radiation application as a food treatment process.
   SCV has integrated the jury of several MSc and PhD thesis mainly in national universities, and was recently recruited for the evaluation panel of Pathfinder Open - Horizon call for research projects. She also participated as an expert in IAEA Technical Meetings such as "Recent Achievement on the Removal of Biohazardous Pollutants by Radiation" (2019), "Radiation Technologies for Degradation of Contaminants of Emerging Concern" (2016), "Deployment of Clean (Green) Radiation Technology for Environmental Remediation" (2014); and organized one IAEA Technical Meeting "Removal of Biohazardous Pollutants" (2019) and two IAEA Training courses on "Microbiological Aspects of Sterilization Validation Process" (2013) and "Radiation Technology for Cultural Heritage Preservation" (2012).
   She is a frequent reviewer (144) of international journals in areas such as Radiation, Food Sciences and Air Quality.
   SCV hosts the international mobility of female researchers, including from Arabic countries, promoting the research culture and gender equality.
4. Contributions to society:SCV manages LETAL, a multidisciplinary laboratory that features cascade-controlled areas including BSL-2 rooms. This laboratorial infrastructure indents to suppress the needs of the industrial sector and academia regarding the radiation processes and clean rooms, transferring the knowledge outside. These SCV

Name	Nuclear CV	Dedication %	ORCID iD

activities included technical support on:
- Assessment of gamma radiation sterilization dose of health care products (Portus Pharma; Animal Blood Bank; Hovione; IBILI; Lusomedicamenta; Edol; Minho University; Ineye Pharma; Plastic Progress; Aran; Gepack; Ceramed; Medmat Innovation).
- Potency and bioburden determination (Iberfar, Delta and Jaba Laboratories).
- IAQ microbiological parameters (Stechcomply; TradeLabor; ATM; HomeEnergy; AventisPharma; Estefânia Hospital).

During Covid-19 pandemic, her virology background was used to serve the community by implementing and performing at IST, the Covid-19 testing for some nursing homes and IST community. Also, SCV joined Bioceramed in the development of a long-lasting disinfectant solution through antiviral screening (patent application, 2021).
SCV is a national member of the technical committee ISO/TC 198 Sterilization of Health Care Products, encouraging the harmonization of sterilization guidelines.
SCV participated in several dissemination activities of ionizing radiation applications towards the general public, secondary schools and university students; namely Tecnico Day, European Research Night, and municipal fairs.

- Scientific production and/or selected activities:A) Effect of Ionizing Radiation and Refrigeration on the Antioxidants of Strawberries. doi:10.1007/S11947-020-02490-1
Collaboration IST & ISBST, Tunisia
This work provided a deep understanding of the use of ionizing radiation (first for e-beam) for strawberries processing, considering the shelf-life extension with the add benefit of bioactivity improvement. Corresponding author, supervision of S. Barkaoui PhD thesis.
B) Effect of Olive Pomace Extract Application and Packaging Material on the Preservation of Fresh-Cut Royal Gala Apples. doi:10.3390/foods12091926
Collaboration IST, IPB, ISA & USAL, Spain
First study to use an extract of olive pomace, an agroindustrial residue, as additive for fresh-cut fruits to enhance their quality. Represents a strategy to improve the availability of effective natural food additives, to promote the sustainability of the olive oil industry and the circular economy, while reducing the environmental impact. Corresponding author, supervision of J. Madureira PhD thesis.
C) Inactivation mechanisms of human adenovirus by e-beam irradiation in water environments. doi:10.1007/s00253-022-11958-3
Collaboration IST & FCUL
First study on the inactivation of human adenovirus (HAdV) in water environments by electron beam radiation, detailing the effects on infectivity, integrity of the genome and capsid proteins. Contribution for the knowledge on the kinetics and mechanisms of HAdV inactivation by physical disinfection methods that could be used to optimize the wastewater treatment. Corresponding author, supervision of J. Roque MSc thesis.
D) Integrated in Silico and Experimental Approach towards the Design of a Novel Recombinant Protein Containing an Anti-HER2 scFv. doi:10.3390/ijms22073547
Collaboration IST, FFUL & CNC
A multidisciplinary integrated in silico and experimental strategy for the construction of a recombinant protein which can be used in HER2+-targeted therapy paves the way towards the production of other therapeutic proteins in a more cost-effective way. Supervision of R. Melo post-doc and J. Santos MSc thesis.
E) Bacterial Contamination in Health Care Centers: Differences Between Urban and Rural Settings. doi.org:10.3390/atmos12040450
Collaboration IST & ESTeSL
First study to characterize the airborne microbiota of Primary Health Care Centers in Portugal. Data emphasized the importance of a routine bacterial contamination assessment to reduce patients and healthcare workers exposure risk. Supervision of A. Monteiro PhD

Sandra Marisa Baptista Rabaça Rodrigues B112-E462-3FBE		100	0000-0002-5324-8013

Name	Nuclear CV	Dedication %	ORCID iD

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Susana Alves de Sousa e Silva Gomes — 100 — 0000-0002-8622-2119
6411-E6CA-9F0B

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto
- Professional category:Investigador júnior
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Susana Marta Lopes Almeida — ✓ — 90 — 0000-0002-8506-6679
F317-DDD1-DB81

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Narrative CV

- Scientific and professional profile and career:Marta Almeida (MA) has obtained the degree in Environmental Engineering at Universidade Nova de Lisboa in 1998, completed the PhD in Environmental Sciences at Universidade de Aveiro in 2004 and got the academic title Agregado in Environmental Engineering at Instituto Superior Técnico (IST) in 2023.
  After the PhD, MA moved to Instituto de Soldadura e Qualidade (ISQ) where she was responsible for 31 consultancy projects for national and international industries. The contacts and experience obtained in ISQ proved to be determinant in her current research, which became much centered on the environmental challenges of our society.
  In 2008 MA decided to follow her passion for research and teaching and have returned to ITN (meanwhile integrated at IST). From 2008 to 2017 she was Assistant Researcher within the scope of the Ciência 2007 and Investigador FCT programs, two highly competitive programs financed by FCT. In July 2017 she took a permanent position as Assistant Researcher in the Department of Nuclear Sciences and Engineering (DECN) of IST and in 2021 she was promoted to Principal Researcher.

Name	Nuclear CV	Dedication %	ORCID iD

In 2011, MA became responsible for the design and development of research programs, scientific activities, facilities management, team coordination and students supervision of ObservAR - Air Quality and Climate Change Observatory. MA has participated in 34 research projects, as Principal Researcher in 2 European and 5 National projects and as IST coordinator in 17. MA also coordinates and teaches the "Air Quality Management and Climate Change" course of the Master in Environmental Engineering.
MA was Vice-President of the Center for Nuclear Sciences and Technologies (C2TN), member of the Executive Commission of DECN, Member of the Management Committee of Campus Tecnológico e Nuclear and Member of the Scientific Commission of the Master in Environmental Engineering. Presently, MA is Vice-President of IST for the management of Loures Campus.

- Contributions to science and society:
  1. Contributions to the generation of new ideas, tools, methodologies or knowledge:MA have dedicated her research to the integration of complementary analytical techniques and modelling tools, in order to assess the human exposure to air pollutants (AP) and to provide solid scientific information to support decision makers, industries, companies, authorities and citizens. MA's research activities have been carried out by a multidisciplinary and inter sectorial team and resulted in 4 books, 3 book chapters, 160 articles in international journals, 1 international patent and 2 awards attributed by the European Union (EU). MA was in the World's Top 2% Scientists list developed by Stanford University in 2021 and was recognized by Ciência Viva in the book "Woman in Science 2019".
     NUCLEAR ANALYTICAL TECHNIQUES: OPTIMIZATION AND QUALITY CONTROL
     MA has applied NATs to the environmental field, namely to the elemental analysis of atmospheric particles (PM), biomonitors, soils and food. She worked on quality control, automation and optimization of sample collection and preparation, and improvement of the detection limits.
     The work developed showed that NATs are very useful to the elemental characterization of PM, identification of emission sources, evaluation of the workers exposure in industrial environments and health impact assessment.
     CHARACTERIZATION OF PM FOR SOURCE APPORTIONMENT
     MA has studied PM and the application of source apportionment (SA) methodologies, which comprehend modelling techniques used to relate the emissions from pollution sources to the concentrations of such pollutants in the ambient air. She has applied SA techniques to determine the causes of pollution levels exceeding legislation thresholds, support the design of air quality plans, assess the effectiveness of remediation measures and quantify transboundary pollution.
     MA coordinated a SA work developed in urban areas from16 countries. This was the first study focusing on the PM levels, chemical composition and sources from a considerable number of locations in Eastern Europe and Central Asia and provided important information for policy design in the environment, energy, transport, industry and health sectors.
     INDOOR AIR QUALITY
     MA started working on Indoor Air Quality because data available for risk assessment of indoor air pollution was scarce and often insufficient. She has studied the chemical properties of AP, identified signatures of indoor sources and developed approaches to assess the toxicity of indoor AP sources. Within the scope of the projects XPOSURE, 3SQAIR, Hospital SUDOE 4.0 and InChildHealth, she characterized air quality in schools, elderly care centres, gyms, hospitals and transports and showed that the exposure to AP is higher indoors, which is highly relevant for policy making, since the European legislation is mainly oriented to outdoor air pollution.
     During COVID pandemics, MA has focused on the role of buildings in the infectious disease transmission and in exploring how building systems may play a role in mitigating this transmission.

Name	Nuclear CV	Dedication %	ORCID iD

ASSESSMENT OF THE POPULATION EXPOSURE TO AIR POLLUTANTS
MA has coordinated the European project LIFE Index-Air, which developed a Management Tool, which provided policy makers with the means to assess citizens' exposure to AP and related health effects, as well as evaluate the effectiveness of mitigation measures.
ExpoLIS project showed that implementing wireless networks of low-cost sensors increase the coverage area of monitoring systems, especially if deployed on mobile platforms. The implementation of the ExpoLIS system in Lisbon demonstrated its applicability to support urban planning policies, transport companies and citizens by generating massive air pollution data and providing a health-optimal routing service.
EFFECTS OF AIR QUALITY ON HUMAN HEALTH
MA calculated the deposited dose and retention of PM in the respiratory tract and estimated health risk indexes caused by their inhalation. Responding to a WHO's priority, MA has studied the health risk associated with electronic cigarettes and heated tobacco.
In the field of occupational exposure, the project "Exhaled Breath Condensate (EBC): a non-evasive tool for the assessment of exposure to pollutants?" showed several important features of EBC, such as its ability to assess different levels of exposure, the minor influence of confounders, the non-invasive characteristics, and the analytically undemanding processes.
INTEGRATION OF AIR QUALITY AND CLIMATE CHANGE IN URBAN SYSTEMS
Many health-harmful AP also damage the climate, therefore their reduction conducts to substantial gains in public health and contributes for mitigating and adapting to climate change. The EU projects Hospital Sudoe 4.0, ClimACT and Remedio gathered research partners, companies, authorities and NGOs to develop educational, decision support and financial tools to support air quality and climate change governance in Europe and to identify specific actions for hospitals, schools and cities that aim to reduce their carbon fingerprint.

2. Contributions to the training and career development of researchers and/or research teams:Since 2011, MA has served as the head of the ObservAR team, overseeing its operations and activities. MA has participated in 34 research projects, holding roles such as Principal Researcher in 2 European projects and 5 National projects, and serving as IST coordinator in 17. Her adept management has resulted in securing 4.8M€ in funding for her institution, facilitating the advancement of research objectives and enabling the acquisition of essential resources, including equipment, consumables, and services, while also fostering the recruitment of promising young scientists.
MA's dedication to mentorship is evident through her supervision of 8 post-doctoral studies, 8 doctoral dissertations, 25 master's theses, 20 internships, and 6 long-term scientific visits. Presently, she is supervising 7 doctoral and 3 master's students, with a commendable track record of guiding doctoral students to impactful roles within research units, academia, private industry, and non-governmental organizations, thus affirming the excellence of the educational environment fostered by her team.
MA has contributed significantly to the development of academic programs, including the Doctoral Program in Nuclear Sciences and Technologies at DECN, the Erasmus Mundus Master Program in Engineering for Environmental Sustainability and International Cooperation, and the "Air Quality Management and Climate Change" course within the IST Master in Environmental Engineering. Additionally, she has imparted her expertise through teaching roles in various master's and bachelor's degree programs, as well as post-graduations and training courses.
MA has played pivotal roles in organizing 4 international training courses and 2 summer schools, and participating in the organizing and/or scientific committees of 16 international scientific events. Her leadership extends to institutional governance. Currently, MA holds the position of Vice-President of IST, overseeing the management of Loures Campus.

Name	Nuclear CV	Dedication %	ORCID iD

3. Contributions to the scientific community:MA has contributed to the scientific community through her editorial roles, serving as an editor for 4 research journals and providing insights as a reviewer for over 20 international publications. She has actively engaged in evaluation processes, lending her expertise as a panel member for Fundação para a Ciência e Tecnologia and over 10 renowned international funding institutions, including the European Union, Swiss National Science Foundation, and Academy of Finland, thereby shaping research agendas and fostering scientific excellence on a global scale. MA has played instrumental roles in organizing 4 international training courses and 2 summer schools, while also serving on the organizing and/or scientific committees of 16 international scientific events. Her dedication to enhancing the research culture extends to her role in leading outreach activities at C2TN, where she leads the C2TN academy, facilitating seminars, workshops, round tables, and courses to promote knowledge dissemination and collaboration within the scientific community.
   MA is committed to promoting researcher mobility, facilitating exchanges by sending her students to research institutions abroad, welcoming researchers into her own laboratory, and championing initiatives such as the Erasmus Mundus Master Program in Engineering for Environmental Sustainability and International Cooperation, thereby fostering cross-cultural collaboration and enriching academic experiences for aspiring scholars.
4. Contributions to society:MA's dedication to promoting societal engagement and knowledge transfer is evident through her collaborative efforts with industrial partners and authorities, demonstrating a proactive approach to addressing real-world challenges.
   By collaborating with industry stakeholders, MA contributes to the development of methodologies aimed at enhancing air quality. Her involvement in EU RFCS projects such as ERAMAC, NOx and ASEMIS has yielded invaluable insights into steelworks emissions and their impact on environment. These endeavors have facilitated the targeted implementation of cost-effective abatement measures, crucial for improving local air quality and fostering sustainability in European steelmaking. MA's leadership in the project PMFugitive, conducted in partnership with SAPEC Parques Industriais, exemplifies her commitment to study fugitive emissions in harbors, addressing both environmental and operational concerns.
   Recognizing the importance of citizen engagement, MA has championed initiatives such as Citizen Science within projects like H2020 ECF4CLIM, Interreg Sudoe ClimACT (which she coordinated), AtuAr, and PAB Living-LAB. These projects, developed in collaboration with municipalities, empower citizens to actively participate in monitoring and addressing air quality issues. By engaging the public in scientific endeavors, MA fosters a sense of ownership and responsibility, encouraging collective action to mitigate air pollution and promote environmental stewardship.

- Scientific production and/or selected activities:AMBIENT PARTICULATE MATTER SOURCE APPORTIONMENT USING RECEPTOR MODELLING IN EUROPEAN AND CENTRAL ASIA URBAN AREAS https://doi.org/10.1016/j.envpol.2020.115199
  For some cities this was the first time that quantitative information on pollution source contributions to PM has been performed. Results showed that all cities exceeded the WHO guidelines and indicated that biomass burning, traffic and industry are important contributors to air quality degradation. MA coordinated the SA work.

  SOURCE APPORTIONMENT OF CHILDREN DAILY EXPOSURE TO PARTICULATE MATTER https://doi.org/10.1016/j.scitotenv.2022.155349
  This study, developed within LIFE Index-Air, improved the understanding of the sources affecting the indoor and outdoor environments and how these sources contribute to the overall exposure. The results from this paper were highly relevant for policy making, since the European legislation is mainly oriented to outdoor air pollution. MA was PI of the project.

Name	Nuclear CV	Dedication %	ORCID iD

EXPOSURE TO AIR POLLUTANTS IN GROUND TRANSPORT MICROENVIRONMENTS. IN: HANDBOOK OF INDOOR AIR QUALITY
This book chapter, developed within ExpoLIS, identified the factors affecting the exposure in transport micro-environments and showed that exposures incurred during commuting can contribute substantially to daily exposure and be associated with adverse health effects in healthy persons and susceptible groups of people. MA was PI of the project.

AIR QUALITY MAPPING AND VISUALISATION: AN AFFORDABLE SOLUTION BASED ON A VEHICLE-MOUNTED SENSOR NETWORK https://doi.org/10.1016/j.jclepro.2021.128194
This paper describes a prototype of the ExpoLIS system that was developed to inform citizens regarding the air quality of their surroundings and how to cope with it (e.g., choosing commuting routes according to a health model) and to gather dense spatiotemporal air quality data to support the work of environmental experts. MA was PI of the project.

A METHODOLOGY TO EMPOWER CITIZENS TOWARDS A LOW-CARBON ECONOMY. THE POTENTIAL OF SCHOOLS AND SUSTAINABILITY INDICATORS https://doi.org/10.1016/j.jenvman.2021.112043
This paper resulted from the collaboration between research institutions, companies, NGOs and local authorities. This work presents the ClimACT methodology that was developed to measure and promote sustainability in schools. The methodology involves a school sustainability index based on a multi-criteria environmental assessment through measurable key performance indicators. MA was PI of ClimACT.

Tiago Alexandre Ferreira Paes de Faria F813-D1AB-C75D		100	0000-0001-8586-2176

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho a termo certo
- Professional category:Investigador auxiliar convidado
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

tomoko morlat 3416-C779-B990		100	0000-0001-8607-8930

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto
- Professional category:Investigador júnior
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Ulrich Wahl CC19-3A72-A95D		100	0000-0001-7398-2904

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)

Name	Nuclear CV	Dedication %	ORCID iD

- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador principal
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Vânia Martins
E311-1FBD-EFB4 100 0000-0003-2465-5880

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho a termo incerto
- Professional category:Investigador júnior
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

Victoria Corregidor Berdasco
1F18-E638-17DE 100 0000-0001-8323-0634

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No
- Weighting factor:Researchers with an exclusive or full-time employment contract. - weighting factor = 1.00

9.2 List of Collaborating Researchers of the R&D Unit

Name	Dedication %	ORCID iD
Ana Monteiro 7919-B75B-9CC7	30	0000-0003-2879-9291

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Politécnico de Lisboa (IPL)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Docente Politécnico - Professor adjunto
- Retiree?No

André da Costa Miranda
3111-0179-44B3 70 0000-0001-5240-3678

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No

Name	Dedication %	ORCID iD

- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

André Henriques da Silva
8214-9DD3-171E
100 -
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

António José Canaria Amaro
9512-E577-616A
100 -
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Outras categorias, não equiparáveis às anteriores, não exigindo habilitação superior
- Retiree?No

Beatriz Guerreiro Morgadinho
A81C-AEF1-ED7F
100 -
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Carlinhos Jeovanny Fernandes dos Reis Cabral
4415-2D56-15CC
100 -
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Carolina Lebre Branco
9219-8256-452F
100 -
Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-

Name	Dedication %	ORCID iD

- Retiree?No

Debut Vincent
DE11-527F-4E58 30 0000-0003-2011-0656

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Politécnico de Castelo Branco (IPCB)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Docente Politécnico - Professor adjunto
- Retiree?No

Dina Maria Mendes Nunes André
A613-6336-4350 100 0000-0002-5360-1606

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Técnico superior
- Retiree?No

Duarte Moço
0910-253E-949B 100 0000-0001-7665-9096

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Dulce Russo
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Assistente técnico
- Retiree?No

Elisabete Lopes Correia
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Name	Dedication %	ORCID iD

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Assistente técnico
- Retiree?No

Eva Mafalda de Sousa Andrade
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Técnico superior
- Retiree?No

Filipe Soares
7016-77F0-40B2 15 0000-0003-3914-6026

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Helena Maria Jorge Monteiro Marcos
F111-6DC1-E9F9 100 -

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Outras categorias, não equiparáveis às anteriores, não exigindo habilitação superior
- Retiree?No

Joana Bravo Catela Pinto dos Santos
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Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Técnico superior
- Retiree?No

Name	Dedication %	ORCID iD
Joana Coutinho 7615-714E-044C	50	0000-0002-1571-6904

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Name	Dedication %	ORCID iD
Joana Rodrigues dos Santos 9D1D-1B94-9FF5	30	0000-0002-8923-5820

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Politécnico de Coimbra (IPC)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Docente Politécnico - Professor coordenador
- Retiree?No

Name	Dedication %	ORCID iD
João Paulo Arriegas Estevão Correia Leal 1419-C6F8-14D8	10	0000-0003-1235-0107

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Investigador principal
- Retiree?No

Name	Dedication %	ORCID iD
Joaquim Carrasqueiro Marçalo de Almeida BA19-1A63-A9CB	10	0000-0001-7580-057X

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Investigador principal
- Retiree?No

Name	Dedication %	ORCID iD
Joaquim Miguel Badalo Branco B015-A5F2-E012	10	0000-0002-1220-2676

Name	Dedication %	ORCID iD

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Investigador auxiliar
- Retiree?No

JOSÉ ALBERTO GIL CORISCO
1D10-0CE4-6BA2 — 70 — 0000-0003-0959-9382

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Investigador auxiliar
- Retiree?No

José Manuel da Cunha Oliveira Figueira Carretas
C412-9695-B91B — 10 — 0000-0003-1361-0265

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Investigador auxiliar
- Retiree?No

Leonel Gil da Silva Nogueira
D119-3929-117F — 100 — -

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Técnico superior
- Retiree?No

Margarida Caldeira
DA1F-FA7E-DCBA — 50 — -

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Técnico superior
- Retiree?No

Name	Dedication %	ORCID iD
Maria Helena Freitas Casimiro 2B14-0217-DEBB	20	0000-0003-0893-0686

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Maria Manuela Lopes Correia 5C10-E1E3-2110	100	-

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Assistente técnico
- Retiree?No

Marta de Campos Baptista Guimarães Santos 0C1C-1964-AA95	50	https://orcid.org/0000-0002-8755-9442

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Técnico superior
- Retiree?No

Patrícia Alexandra Dias Silva Russo 751A-6FBA-8BAF	50	-

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Assistente técnico
- Retiree?No

Paula Cristina Vicente Teixeira Chaves 5115-9409-1228	20	0000-0002-0456-903X

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Name	Dedication %	ORCID iD
Pedro de Almeida Silva 0715-DD04-9C98	100	0000-0003-4670-8605

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Name	Dedication %	ORCID iD
Telma Silva Marques 9717-5CFD-D84D	50	0000-0002-0526-8415

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Name	Dedication %	ORCID iD
Yuriy ROMANETS 6D1A-3911-7A87	50	0000-0002-4337-8519

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Instituto Superior Técnico (IST/ULisboa)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado (sem regime de «tenure»)
- Professional category:Técnico superior
- Retiree?No

9.3 List of PhD students supervised by integrated PhD holder researchers in the R&D Unit

Name	Dedication %	ORCID iD
Afonso Xavier de Matos Lamelas F01F-76CF-C6FF	40	0000-0002-1668-6399

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:-
- Degree granting institutions:
  Universidade de Aveiro
- Title of the thesis:Reliable group-IV color centers in diamond
- Main advisor integrated in the R&D unit:Ulrich Wahl
- Start Date:2022/10/01
- End Date:2026/09/30

Name	Dedication %	ORCID iD

- External collaborations:O Dr Ulrich Wahl é co-orientador da tese de doutoramento. A tese é orientada pelo Professor Vítor Amaral, da Universidade de Aveiro, Aveiro, Portugal, e co-orientada também pelo Professor Lino Pereira, da Universidade KU Leuven, Leuven, Bélgia. Engloba ainda uma colaboração com o CERN, Genebra, Suíça, e com o Professor Adam Gali do
  Wigner Research Centre for Physics, Budapeste, Hungria.

Alexandra Raquel Lourenço Nunes
9F1C-FE40-26CD — 100 — -

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Climate Change and Sustainable Development Policies
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Assessing the Impact of Road Transport on Microplastic Pollution in an Urban Environment - The case of Lisbon city
- Main advisor integrated in the R&D unit:Vânia Martins
- Start Date:2023/07/17
- End Date:2026/02/28
- External collaborations:-

Beatriz Aguiar Moreiras Vicente dos Santos
9B1D-EE25-0824 — 100 — 0000-0001-8134-243X

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Programa de Doutoramento em Engenharia de Materiais
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Thermoelectric Technologies for Small Satellites
- Main advisor integrated in the R&D unit:António Cândido Lampreia Pereira Gonçalves
- Start Date:2022/02/11
- End Date:2026/02/11
- External collaborations:Colaboração com a Agência Aeroespacial Alemã (DLR) no contexto da tese de doutoramento, onde parte dos trabalhos são desenvolvidos na referida instituição. Colaboração com a Joint Research Center (JRC) no âmbito de uma proposta de colaboração entre laboratórios europeus. Concurso: ACTUSLAB-FMR, Proposta: StarUC.

Carolina Gonçalves Correia
161D-E247-7280 — 100 — 0000-0002-5904-2104

Name	Dedication %	ORCID iD

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Programa Doutoral em Engenharia do Ambiente
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Assessment of the commuters' daily exposure to traffic related air pollutants
- Main advisor integrated in the R&D unit:Susana Marta Lopes Almeida
- Start Date:2021/01/01
- End Date:2025/01/01
- External collaborations:-

Carolina Vicente Reis
2A1A-7256-5CA3 100 0000-0002-4054-5297

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Engenharia do Ambiente
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:How promoting circular economy influences the health impacts of air pollution?
- Main advisor integrated in the R&D unit:Susana Marta Lopes Almeida
- Start Date:2023/06/01
- End Date:2027/06/01
- External collaborations:-

Catarina Dorisa Azevedo da Silva
1410-40C7-D284 100 0000-0002-2201-6500

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Engenharia Biomédica
- Degree granting institutions:

Name	Dedication %	ORCID iD

Instituto Superior Técnico

- Title of the thesis:Subcellular Targeted Radiopharmaceuticals to Unravel the Potential of Auger-Electron Cancer Therapy
- Main advisor integrated in the R&D unit:António Paulo
- Start Date:2023/09/01
- End Date:2027/08/31
- External collaborations:-

Catarina Isabel Guilherme Pinto
A814-DB44-F3C6 — 100 — 0000-0002-4195-5810

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Engenharia Biomédica
- Degree granting institutions:

Instituto Superior Técnico

- Title of the thesis:Biological evaluation of copper-64 chloride as a promising tool for cancer theranostics
- Main advisor integrated in the R&D unit:Filipa Fernandes Mendes
- Start Date:2021/05/02
- End Date:2025/04/30
- External collaborations:-

Cátia Filipa Gouveia Rosa
5C10-BAAC-7FD8 — 100 — -

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Engenharia Biomédica
- Degree granting institutions:

Instituto Superior Técnico

- Title of the thesis:Radiation and targeted therapy combined approach in metastatic breast and prostate cancers - computational and biological evaluation
- Main advisor integrated in the R&D unit:Rita Lourenço Paiva de Melo
- Start Date:2023/11/01
- End Date:2027/10/31
- External collaborations:Division of Biomedical Physics in Radiation Oncology group from the German Cancer Research Center (DKFZ), under the supervision of Prof. João Seco.

Cristiana Magalhães Correia Rodrigues
8E1C-AEE2-F1BD — 50 — 0000-0002-1059-9091

Name	Dedication %	ORCID iD

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Engenharia Biomédica e Biofísica
- Degree granting institutions:
  Faculdade de Ciências da Universidade de Lisboa
- Title of the thesis:Development of Microdosimetric Detectors for Radiobiology in Hadron Therapy Facilities
- Main advisor integrated in the R&D unit:António Cândido Lampreia Pereira Gonçalves
- Start Date:2022/04/07
- End Date:2026/04/06
- External collaborations:Trabalho realizado em colaboração com o grupo de Dosimetria do Laboratório de Instrumentação e Física Experimental de Partículas (LIP) sob a orientação do Dr. João Gentil Saraiva

Cynthia Lorena Obregón Castro 1315-0104-5C4B	100	0000-0002-6716-4945

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Georrecursos
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:A comprehensive approach to evaluate the distribution, speciation, and behavior of rare earth elements in several compartments of acid mine drainage environments under remediation processes
- Main advisor integrated in the R&D unit:Rosa Maria Salgueiro Marques
- Start Date:2020/10/15
- End Date:2024/03/30
- External collaborations:-

Daniel Alves Barcelos B512-69D6-C778	50	https://orcid.org/0000-0002-7549-4792

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Name	Dedication %	ORCID iD
Diogo Miguel Gonçalves Engrácia 5111-58CA-1AB8	60	0000-0001-5979-1810

PhD info

- Doctoral program:ChemMat
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Flexible magnetic SiO2/TiO2 based-glasses by sol-gel for sensing applications
- Main advisor integrated in the R&D unit:Laura Cristina de Jesus Pereira
- Start Date:2019/10/01
- End Date:2024/05/01
- External collaborations:Orientado por professora Clara Gonçalves do Instituto Superior Técnico da Universidade de Lisboa

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Engenharia Biomédica
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Exploring Advanced 3D Models of Breast and Lung Cancer for Evaluation of Proton and FLASH Radiotherapy
- Main advisor integrated in the R&D unit:Filipa Fernandes Mendes
- Start Date:2024/02/02
- End Date:2028/02/02
- External collaborations:Division of Biomedical Physics in Radiation Oncology group from the German Cancer Research Center (DKFZ), under the supervision of Prof. João Seco.

Gonçalo André Gonçalves Brás Lopes FD1F-8F04-A276	100	0000-0002-2723-5083

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:ChemMat
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Self-Assembled Molecular Conducting Bilayers
- Main advisor integrated in the R&D unit:Sandra Marisa Baptista Rabaça Rodrigues
- Start Date:2020/02/10

Name	Dedication %	ORCID iD

- End Date:2024/04/30
- External collaborations:-

Gonçalo Ruivo Lopes da Fonseca 100 0000-0001-6211-7560
4516-61DD-D5CB

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Física
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Física e Matemática de Transições Internas em Sistemas Atómicos Imersos
- Main advisor integrated in the R&D unit:Miguel Adrião Mateus dos Reis
- Start Date:2021/09/13
- End Date:2025/08/31
- External collaborations:-

Inês Filipa Morais da Costa 100 0000-0003-4928-4668
211A-318D-1084

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:ChemMat - Química
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Heterometallic Coordination Polymers and Clusters for Magnetically-driven Applications
- Main advisor integrated in the R&D unit:Laura Cristina de Jesus Pereira
- Start Date:2019/09/02
- End Date:2024/03/15
- External collaborations:-

Janice da Conceição Lopes 100 0000-0002-2670-516X
2D14-6CC8-4FEC

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

Name	Dedication %	ORCID iD

PhD info

- Doctoral program:Programa Doutoral em Biotecnologia e Biociências
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Avaliação da extractabilidade por radiação ionizante de compostos bioativos do bagaço de uva: caraterização, avaliação da bioactividade e valorização agroindustrial.
- Main advisor integrated in the R&D unit:Sandra Cabo Verde
- Start Date:2023/10/01
- End Date:2027/10/01
- External collaborations:-

Joana Filipa da Silva Santos
7B19-3EB2-39D9 50 0000-0001-9138-561X

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Biotecnologia e Biociências
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:EGFR/SHP2-targeted nanomedicines for colorectal cancer theranostics
- Main advisor integrated in the R&D unit:Célia Fernandes
- Start Date:2023/11/01
- End Date:2027/10/31
- External collaborations:Doutoramento realizado em conjunto com o Instituto de Medicina Molecular da Faculdade de Medicina da Universidade de Lisboa

João Miguel Franco Machado
CE14-F7CF-936B 30 0000-0003-3741-2386

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Quimica
- Degree granting institutions:
  Faculdade de Ciências da Universidade de Lisboa
- Title of the thesis:Novos conjugados ruténio-péptido para a terapia seletiva do cancro da mama metastático
- Main advisor integrated in the R&D unit:João Domingos Galamba Correia
- Start Date:2018/10/01
- End Date:2024/03/31

Name	Dedication %	ORCID iD

- External collaborations:-

Jorge Cebola Borbinha
AF1E-800C-85D0

100 0000-0003-1014-908X

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Doutoramento em Engenharia Física Tecnológica
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Improving Dosimetric Effectiveness in Personalized Targeted Radionuclide Therapy Considering Tumor Phenotypes
- Main advisor integrated in the R&D unit:Salvatore Di Maria
- Start Date:2019/03/07
- End Date:2024/07/31
- External collaborations:A data de fim é planeada e indicativa. A tese encontra-se a ser realizada em colaboração com a Fundação Champlamaud. Um co-orientador da tese é o Dr. Paulo Ferreira, especialista em Física Médica na Fundação Champalimaud.

Juliana Gonçalves Araújo
BC13-7EE5-F269

50 0000-0001-5132-3158

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Química
- Degree granting institutions:
  Faculdade de Ciências e Tecnologia da Universidade de Coimbra
- Title of the thesis:New Biomaterials Based in Metal Organic Frameworks (BioMOFs) for Cancer Photodiagnostic and Cancer Magnetic Hyperthermia Therapy
- Main advisor integrated in the R&D unit:Laura Cristina de Jesus Pereira
- Start Date:2019/09/01
- End Date:2024/07/31
- External collaborations:-

Ketlyn Oliveira
2E14-1B7A-D2F0

100 0000-0003-3785-7625

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-

Name	Dedication %	ORCID iD

- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Engenharia do Ambiente
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Socio-economic inequalities in children exposure to air pollutants
- Main advisor integrated in the R&D unit:Susana Marta Lopes Almeida
- Start Date:2023/09/01
- End Date:2027/09/01
- External collaborations:-

Luís Miguel Cabeça Marques 50 0000-0003-1965-2044
3B1E-E96B-1A50

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?Yes
- Institution:Força Aérea Portuguesa (FAP)
- Linking modality:Contrato de trabalho em funções públicas por tempo indeterminado em regime de «tenure»
- Professional category:Oficial Superior
- Retiree?No

PhD info

- Doctoral program:Engenharia Física Tecnológica
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Development of a Radiation Detection System Coupled to an Unmanned Aerial Vehicle for Security and Defence Applications
- Main advisor integrated in the R&D unit:Pedro Vaz
- Start Date:2018/09/14
- End Date:2024/11/06
- External collaborations:-

Rafael Cartaxo Travassos 100 -
E211-5C9E-8EB9

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Engenharia Biomédica
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Chemo-radiotherapy versus standard radiotherapy in breast cancer - a computational and biological perspective
- Main advisor integrated in the R&D unit:Rita Lourenço Paiva de Melo

Name	Dedication %	ORCID iD

- Start Date:2024/02/01
- End Date:2028/02/01
- External collaborations:Division of Biomedical Physics in Radiation Oncology group from the German Cancer Research Center (DKFZ), under the supervision of Prof. João Seco.

Raquel Filipa Lourenço Pimenta 6119-0773-C4E8	100	-

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Engenharia do Ambiente
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:CHILDREN'S EXPOSURE TO PARTICLES AND EMERGING AIR POLLUTANTS: DEVELOPMENT OF A NEW STRATEGY TO PROMOTE KNOWLEDGE, AWARENESS AND BEHAVIORAL CHANGE
- Main advisor integrated in the R&D unit:Susana Marta Lopes Almeida
- Start Date:2023/09/01
- End Date:2027/08/31
- External collaborations:Orientadores externos:
  - Evangelia Diapouli (National Center for Scientific Research "DEMOKRITOS" ? Dept.: Institute of Nuclear & Radiological Sciences & Technology, Energy & Safety);
  - Katrin Vorkamp (Aarhus University ? Dept.: Department of Environmental Science).

Rita Isabel Lucas Pires 2910-02D3-B1A2	50	-

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Ciências dos Alimentos
- Degree granting institutions:
  Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa
- Title of the thesis:Selenium enrichment of Chlorella sp. biomass through culture media optimization and radiation technologies
- Main advisor integrated in the R&D unit:Luis Miguel Mota Ferreira
- Start Date:2023/01/01
- End Date:2027/01/01
- External collaborations:LAQV Requimte e Allmicroalgae Natural Products S.A

Rodrigo Coelho	100	0000-0002-8353-538X

Name	Dedication %	ORCID iD

7315-2C44-212C

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Programa Doutoral em Engenharia de Materiais (DeMat)
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Tetrahedrite Nanocomposites for High Performance Thermoelectrics
- Main advisor integrated in the R&D unit:António Cândido Lampreia Pereira Gonçalves
- Start Date:2020/09/01
- End Date:2024/09/01
- External collaborations:Este trabalho conta com a colaboração de estudantes e Investigadores pertencentes ás seguintes universidades:

  Universidade do Minho
  Universidade de Aveiro
  Universidade do Chipre
  Universidade de Navarra

Rúben Silva — 100 — 0000-0003-3665-9571
561A-878D-536F

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Química
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Targeting of cationic amino acid transporters with radiometallated amino acids for cancer theranostics
- Main advisor integrated in the R&D unit:João Domingos Galamba Correia
- Start Date:2020/10/01
- End Date:2024/09/30
- External collaborations:-

SERGIO LUIS MENDEZ HOYOS — 100 — 0000-0003-4145-9566
2810-E388-2431

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-

Name	Dedication %	ORCID iD

- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Doutoramento em Engenharía do Ambiente
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Projeto HypnosAIR - Compreendendo o impacto da qualidade do ar sobre a qualidade do sono, considerando um abordagem integrado de exposição humana
- Main advisor integrated in the R&D unit:Susana Marta Lopes Almeida
- Start Date:2022/02/08
- End Date:2026/02/08
- External collaborations:Supervisão científica do Orientador Nuno Henrique Varela Canha e das co-orientadoras Susana Marta Lopes Almeida e Joana Lograd Figueiredo Belo da Costa.

Sofia Alexandra de Albuquerque Martins A61E-FC2A-FF82	100	0000-0003-0575-2650

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Programa Doutoral em Biotecnologia e Biociências
- Degree granting institutions:
  Instituto Superior Técnico
- Title of the thesis:Targeting the RANK-TRAF6 Interface for Bone Metastases Theranostics
- Main advisor integrated in the R&D unit:João Domingos Galamba Correia
- Start Date:2023/04/01
- End Date:2027/04/01
- External collaborations:Instituto de Medicina Molecular João Lobo Antunes

Vital Cruvinel Ferreira Filho 4918-DC25-43DF	100	-

Participation in the R&D Unit

- Has contract or link with a Portuguese institution?No
- Institution:-
- Linking modality:-
- Professional category:-
- Retiree?No

PhD info

- Doctoral program:Engenharia de Materiais
- Degree granting institutions:
  Universidade de Lisboa (UL)
- Title of the thesis:Magnetic Nanoplatforms for Biomedical Applications Using High Energy Gamma Rays and Proton Radiation
- Main advisor integrated in the R&D unit:Laura Cristina de Jesus Pereira

Name	Dedication %	ORCID iD

- Start Date:2024/02/01
- End Date:2027/12/31
- External collaborations:Center for Molecular Biophysics, CNRS - Orleans (Doutora Sara Lacerda)

Part 4: Activity Plan for 2025-2029

10. Summary of the Activity Plan for 2025-2029

10.1 Summary in Portuguese for publication

O C2TN é uma unidade de investigação reconhecida nacional e internacionalmente pelo desenvolvimento e aplicação de tecnologias nucleares e radiação ionizante nas áreas do ambiente, património cultural, saúde e materiais avançados. Realiza atividades científicas de excelência, serviços especializados e formação avançada, em 5 grupos de investigação, interligados em 3 linhas temáticas (LT) na resposta a desafios societais:
SISTEMAS DA TERRA, RADIOATIVIDADE E PATRIMÓNIO CULTURAL: investiga a gestão sustentável e a proteção dos recursos naturais (ar, água, solos) e do património cultural, abordando a ação climática, as cidades sustentáveis e as ciências da terra.
CIÊNCIAS RADIOFARMACÊUTICAS E PROTEÇÃO RADIOLÓGICA: aborda a teranóstica e a medicina personalizada, a proteção radiológica e dosimetria, com o objetivo de reduzir o impacto negativo de doenças, especialmente o cancro, através da deteção e tratamento precoces.
MATERIAIS AVANÇADOS: estuda as propriedades dos materiais para melhorar as suas aplicações em conversão de energia, sensores, eletrónica e biomateriais, impulsionando assim o desenvolvimento sustentável.
O C2TN pretende reforçar a sua INTERNACIONALIZAÇÃO, expandindo as suas redes de colaboração (>30) e fontes de financiamento. PARCERIAS estratégicas serão promovidas através de colaborações com outras unidades de investigação, laboratórios associados, indústria e autoridades nacionais. Um exemplo é a colaboração com a Agência Portuguesa do Ambiente na área da proteção radiológica e metrologia.
A FORMAÇÃO AVANÇADA será uma prioridade, com o ensino de estudantes em todos os ciclos e a divulgação das tecnologias nucleares e radiação ionizante. A MENTORIA E FORMAÇÃO CIENTÍFICA de jovens investigadores terá como base os Programas do IST, com a atribuição de tutores, subsídios para projetos exploratórios, e promoção anual de projetos internos. O C2TN co-financiará a contratação de 4 investigadores através do programa FCT Tenure+ Técnico, e abrirá posições para 5 contratos de investigadores em início de carreira, reforçando a equipa e promovendo o DESENVOLVIMENTO DE CARREIRAS.
O C2TN alargará a sua atividade na ORGANIZAÇÃO DE EVENTOS CIENTÍFICOS, nomeadamente seminários, workshops, cursos, escolas de verão e mesas-redondas, incluindo uma conferência anual do C2TN e seminários das LT. Será criada uma equipa de DIVULGAÇÃO que irá colaborar com o gabinete de comunicação do IST, e recorrer a vários meios de disseminação, tais como o site renovado do C2TN, as redes sociais e eventos públicos.
A TRANSFERÊNCIA DE CONHECIMENTO E TECNOLOGIA à sociedade (autoridades, indústrias e museus) será efetuada através de serviços especializados nas áreas do ambiente, proteção e segurança radiológica, metrologia, património cultural e agroindústria sustentável.
O C2TN tem como prioridade a igualdade de género, respeito pelos animais e ambiente, aplica princípios de "open science" e usa responsavelmente as tecnologias de IA.

10.2 Summary in English for publicity purposes

C2TN's is a key player in nuclear sciences and technologies and ionizing radiation applied to environment, cultural heritage, health and advanced materials. It is dedicated to scientific excellence, carrying out cutting-edge research, high-level services, and advanced training. C2TN is organized in 5 research groups (RG) cross-linked in 3 multidisciplinary thematic lines (TL) to develop advanced RD&I and apply the knowledge to address critical global challenges.
EARTH SYSTEMS, RADIOACTIVITY, AND CULTURAL HERITAGE advances on the sustainable management and protection of natural resources (air, water, soils) and cultural heritage, addressing climate action, sustainable cities and earth sciences.
RADIOPHARMACEUTICAL SCIENCES AND HEALTH PHYSICS tackles theranostics and personalized medicine, medical radiation protection and dosimetry aiming to reduce the negative impact of diseases, particularly cancer, through early diagnosis and treatment.
ADVANCED MATERIALS deepen our understanding of materials properties and drive sustainable development by improving their properties for applications, like energy conversion, sensors, electronics, and biomaterials.
C2TN intends to reinforce INTERNATIONALIZATION by expanding its networks (>30) and funding sources. PARTNERSHIPS will be fostered through close collaborations with other research units, associated laboratories, industry and national authorities, such as the pivotal connection of some C2TN researchers with the Portuguese Environmental Agency in radiological protection and metrology.
We will persist in ADVANCED TRAINING by teaching students and creating awareness on nuclear technologies and ionizing radiation. COACHING, MENTORING AND SCIENTIFIC TRAINING of young researchers will be followed by IST Programs, assigning a tutoring/advisory committee, providing a startup grant for exploratory projects, and promoting annual internal project calls. C2TN will co-finance the hiring of 4 researchers through the FCT Tenure+ Técnico, and launch calls for 5 contracts for early career researchers to reinforce its team and promote CAREER DEVELOPMENT.
C2TN will maximize the ORGANIZATION OF SCIENTIFIC EVENTS, expanding initiatives like seminars, workshops, courses, summer schools and round tables, including an annual C2TN conference and TL workshops. We will assign an OUTREACH team in close collaboration with the IST Science Communication office, using various channels, as the refreshed C2TN website, social media and public events.
C2TN will continue the TRANSFER OF KNOWLEDGE AND TECHNOLOGY by offering specialized services to society, including authorities and institutions, industries and museums, namely on environment, radiological protection and safety, metrology, cultural heritage and sustainable agroindustry.
We will prioritize gender equality actions, the respect for animals and environment, while applying principles of open science, and responsible use of AI technologies.

10.3 Summary in English for assessment

C2TN's is a key player in nuclear sciences and technologies and ionizing radiation applied to environment, cultural heritage, health and advanced materials. It is dedicated to scientific excellence and actively tackles societal challenges, carrying out cutting-edge research, high-level services, and advanced training. C2TN is organized in 5 research groups (RG) interlinked in 3 thematic lines (TL) to advance in RD&I and applies the knowledge to address critical global challenges.

EARTH SYSTEMS, RADIOACTIVITY, AND CULTURAL HERITAGE advances on the sustainable management and protection of natural resources (air, water, soils), tracing and reduction of the adverse effects of anthropogenic and natural sources on environment, human health and climate change, and cultural heritage characterization and protection. It addresses pressing societal challenges such as climate action, sustainable cities and earth sciences.
RADIOPHARMACEUTICAL SCIENCES AND HEALTH PHYSICS focus on the application of ionizing radiation in different aspects of human health, tackling two major topics: theranostics and personalized medicine, medical radiation protection and dosimetry. It is devoted to the societal challenge good health and well-being, and intends, in the long term, to reduce the negative impact of diseases, particularly cancer, through early diagnosis and treatment.
ADVANCED MATERIALS aims to deepen our understanding of materials properties, especially the correlations between structure/microstructure/composition/processing and physical properties, and to drive sustainable development through materials with improved properties for applications, like sensors, electronics, energy conversion and biomaterials. It tackles societal challenges like

affordable and clean energy for all, and responsible production and consumption.
C2TN will boost INTERNATIONALIZATION by expanding its networks (>30) and funding sources through assigning a science manager in liaising with the IST-ID Pre-award Office, to increase the number of international projects; as well as by promoting researchers' participation in international activities by covering fees for relevant networks; and will continue ongoing operation of ISOLDE and n-TOF infrastructures at CERN.
Using the C2TN researcher's expertise, we persist in ADVANCED TRAINING by teaching MSc/PhD students, and creating opportunities of contact between young researchers and students. Actual knowledge will be given to students through problem-based learning methods within research activities and leveraging C2TN's partners. C2TN researchers will continue offering advanced courses through Técnico+, contributing to the country's economy and creating awareness on nuclear technologies and ionizing radiation.
We will follow young researchers by COACHING, MENTORING AND SCIENTIFIC TRAINING using the IST Programs, to smooth their integration and support research. C2TN will assign a mentor to assist each researcher with career management, funding search and student recruitment strategies. A startup grant of 5k€ to bolster exploratory projects will be provided, and it will be promoted annual internal project calls, funding 3 projects of 15k€ each.
C2TN will co-finance the hiring of 4 researchers through the FCT Tenure+ Técnico, to reinforce its research team and bear in PROSPECT FOR CAREER DEVELOPMENT. C2TN will launch calls for 5 contracts for early career researchers (1/RG) and 9 PhD fellowships (3/TL), also contributing for student's career development, by sharing its facilities, knowledge and connections.
All these will contribute for a CAREER DEVELOPMENT AND RECOGNITION for all C2TN members.
PARTNERSHIPS will be fostered by enhanced collaborations with other national and international research units, industry and national authorities, which will generate impactful outcomes. An example is the connection with the Portuguese Environmental Agency in radiological protection and metrology, where C2TN researchers play a pivotal role. Moreover, C2TN is negotiating its integration into LaPMET, an excellent Associated Laboratory that joins CeFEMA, IFIMUP and CF-M-UP. Entering LaPMET will increase research activities, enhance C2TN visibility and boost the hiring of researchers.
C2TN Academy will maximize the ORGANIZATION OF SCIENTIFIC EVENTS, expanding and improving initiatives like seminars, workshops, courses, summer schools and round tables. IST Loures Campus will host an annual C2TN conference, supplemented by annual thematic line workshops that will turn into an international conference every 3 years. These activities will cultivate professional growth among C2TN members, attract new talent, and create an innovation and collaboration environment.
C2TN offers specialized support to society, including authorities and institutions, industries and museums, being strongly involved in the TRANSFER OF KNOWLEDGE AND TECHNOLOGY. With focus on environment, radiological protection and safety, metrology, cultural heritage and sustainable agroindustry, C2TN will closely collaborate with stakeholders for innovative solutions and expert guidance.
We will promote OUTREACH through a team that will closely collaborate with the IST Science Communication office. In addition to communications and publications, outreach efforts will extend through various channels, as the new C2TN website, social networks, media and public events.
C2TN will continue to integrate CITIZEN SCIENCE into its strategy, aiming not only to broaden the scope of scientific inquiry but also to cultivate greater community engagement. C2TN secured approval of 3 European Projects, aiming to address pressing issues in the realms of air quality and climate change.
A fundamental pillar for C2TN is ETHICS, by prioritizing respect for humans, animals, environment, cultural heritage, while also supporting gender equality, inclusion, data privacy and safety protocols, principles of open science, and responsible deployment of AI technologies.

11. Description of the Activity Plan for 2025-2029

11.1 Objectives and strategy of the R&D Unit for 2025-2029

C2TN's objectives are aligned with its strategy to be a key player in nuclear sciences and technologies and ionizing radiation applied to environment, cultural heritage, health and advanced materials. Our primary societal impact lies in the environmental realm, spanning air, soil, water, and (radioactive)waste management, cultural heritage preservation, as well as radiological protection. C2TN goals are to carry out cutting-edge research, high-level services, and advanced training, with relevant impact in society, addressing 6 strategic vectors:

EXCELLENCE IN RD&I

ADVANCEMENT AND APPLICATION OF KNOWLEDGE: Scientific activities will use advanced technology and infrastructures based on nuclear techniques and ionizing radiation, such as ISOLDE, Mössbauer spectroscopy and ion beam analysis methods, to drive scientific advances and provide training, through 3 thematic lines (TL) that will address critical global challenges:

EARTH SYSTEMS, RADIOACTIVITY, AND CULTURAL HERITAGE: C2TN will focus on advancing knowledge to understand and manage the complex dynamics of air, soil, and water pollution, addressing pressing societal challenges such as climate change. Central to our efforts is the identification and characterization of emergent pollutants like microplastics, ultra-fine particles, black carbon, heavy metals, rare earth elements, and naturally occurring radioactive materials. This will rely on state-of-the-art sampling and analytical techniques, including unmanned ground and aerial vehicles, online monitoring methods and sensor networks. C2TN will use advanced models and machine learning techniques to decipher the mechanisms and sources of pollutants and greenhouse gases. By doing so, we will contribute to anticipate future scenarios and identify cost-effective measures to mitigate pollution and climate change. We will also focus on cultural heritage (CH) characterization and absolute dating in a view to its preservation. Non-invasive and environmentally friendly nuclear and ionizing radiation techniques will be used for CH preservation.

RADIOPHARMACEUTICAL SCIENCES AND HEALTH PHYSICS: C2TN will explore applications of radionuclides and ionizing radiation to human health focusing on diagnostic and therapy in precision medicine and radiation protection and dosimetry, addressing unmet needs in the clinical setting. We will pursue innovative solutions to develop target-specific radiopharmaceuticals for nuclear imaging and therapy, while focusing on clinical dosimetry for both radionuclide therapy and external radiotherapy. We will undertake a multidisciplinary approach at the interfaces of (radio)chemistry, (radio)biology and radiation (bio)physics. We will explore new theranostics agents, investigate novel radiochemical strategies and targeting vectors, and increase the translational relevance of pre-clinical studies with advanced cellular models and imaging approaches. In medical physics and radiation protection, we'll merge Monte Carlo simulations, anthropomorphic phantoms, clinical measurements, and radiobiology techniques to ensure precise dosimetry in medical procedures involving ionizing radiation. Our focus will be on approved and investigational radionuclide therapies, and external radiotherapy, in collaboration with hospitals. Furthermore, we will explore innovative directions in proton therapy.

ADVANCED MATERIALS: C2TN will expand research in new molecular materials with unique electrical and magnetic properties and extend traditional molecular building blocks to applications in organic batteries and sensors. We will advance on intermetallics by studying U-based strongly correlated and topological systems for quantum systems, and eco-friendly thermoelectric materials for clean energy generation. Using irradiation, electrochemical and high-temperature methods we will develop and alter materials for cutting-edge applications, such as energy, quantum technology, biomedical, environmental, CH, space, defense, natural resource valorization and circular economy initiatives. Nuclear and related techniques will be applied to characterize the novel materials. Unconventional methods and artificial intelligence for predictive modeling and pattern recognition will also be used.

INTERNATIONALIZATION: C2TN will amplify internationalization efforts by leveraging its >30 networks and platforms and diversifying the funding sources. For that, we will assign a science manager in liaising with the IST-ID Pre-award office to further increase success rates in international projects; promote researchers' participation in international networks relevant for the planned activities and ongoing operation of the experimental infrastructures ISOLDE and n-TOF at CERN.

2. CAREER DEVELOPMENT AND RECOGNITION
ADVANCED TRAINING: C2TN researchers are co-responsible for 3 MSc programs, Medical Physics, Radiological Protection and Safety, and Cultural Heritage and Sciences, and a doctoral program in Nuclear Sciences and Technologies. The MSc/PhD student supervision will create opportunities for a close contact between researchers and students. By integrating students into research activities, they will receive knowledge through problem-based learning methods and have the chance to collaborate with C2TN's partners. We will continue delivering advanced courses through Técnico+, providing training on nuclear technologies and ionizing radiation.

COACHING, MENTORING AND SCIENTIFIC TRAINING: young researchers will benefit from "Shaping the Future", "Digital+" and "Start Up Funds" IST programs to smooth integration and support research/sabbaticals, with a tutoring/advisory committee being assigned for guidance. Each researcher will have a mentor to directly assist career management, funding search and student recruitment strategies. C2TN will further provide startup grants of 5k€ to bolster exploratory projects or facilitate sabbaticals. Annually, C2TN will promote 3 internal project applications of 15k€ each.

PROSPECT FOR CAREER DEVELOPMENT: C2TN will reinforce its research team by co-financing the hiring of 4 researchers through the FCT Tenure+ Técnico, which optimizes the FCT Tenure program. Furthermore, it will hire a science manager and will launch calls for 5 contracts for early career researchers (1/RG) and 9 PhD fellowships (3/TL). C2TN will also contribute to the career development of students, who will benefit from its facilities, knowledge and multi-sector connections. By investing in career at various stages, C2TN not only ensures its own vitality, but also contributes to the broader landscape of scientific discovery.

3. PARTNERSHIPS AND NETWORKING
PARTNERSHIPS: C2TN is negotiating its integration into LaPMET, an Associated Laboratory rated as excellent by FCT that joins CeFEMA, IFIMUP and CF-M-UP (>200 researchers), that will foster the excellence of research activities, enhance C2TN visibility and boost the hiring of researchers. The organization of workshops, co-supervision of students and joint projects is already happening.

NETWORKING: C2TN participates in international >30 partnerships/networks, but others with research units, industry and national authorities are planned, which will be essential to generate impactful outcomes. A relevant example is the involvement with the Portuguese Environmental Agency, particularly in the fields of radiological protection and metrology, where some C2TN researchers play a pivotal role.

ORGANIZATION OF SCIENTIFIC EVENTS: C2TN will maximize the use of C2TN Academy, taking advantage of the existing structure to expand and improve initiatives, such as seminars, workshops, courses, summer schools, and round tables. CTN will host an annual C2TN conference, complemented by annual TL workshops that will be converted into an international conference every 3 years. These activities will cultivate professional growth among C2TN members, attract new talent, and create an innovation and collaboration environment.

4. TRANSFER OF KNOWLEDGE AND TECHNOLOGY
C2TN serves as a dynamic hub, offering specialized support to society, including authorities and institutions, industries, and museums. With focus on environment, earth sciences, cultural heritage, radiological protection and safety, metrology, and medical applications of radionuclides and ionizing radiation, C2TN will collaborate closely with stakeholders to develop innovative solutions and provide expert guidance. The science manager will interact with IST's TT Office, supporting the technology transfer along the whole value chain.

5. PROMOTION OF SCIENTIFIC AND TECHNOLOGICAL CULTURE
OUTREACH: the science manager and an outreach team, with one representative from each

research group, will collaborate closely with the IST Science Communication office. In addition to scientific communications and publications, outreach efforts will encompass science fairs, open days, and participation in various channels, such as the new C2TN website (https://c2tn.tecnico.ulisboa.pt), social networks, and media.

CITIZEN SCIENCE: C2TN is committed to continue to integrate citizen science into its strategy, aiming not only to broaden the scope of scientific inquiry but also to cultivate greater community engagement. C2TN secured approval of 3 European Projects, where the methodology will be applied to address pressing issues in the realms of air quality and climate change.

6. ETHICS
C2TN prioritizes respect for humans, animals, environment, cultural heritage, together with gender equality, inclusion, data privacy and safety protocols, principles of open science, and responsible deployment of AI technologies. Training on tackling unconscious bias and on gender equality to promote an inclusive environment will be given to C2TN leadership, including its direction and RGs and TLs coordinators.

11.2 Organization of the R&D Unit for 2025-2029
ORGANIZATION

C2TN researchers hold unique scientific, technological and engineering competence and skills both in Portugal and, in some topical areas, in international scientific arenas. They operate and make available to different scientific communities, laboratories, equipment and infrastructures, some of them exclusive in Portugal.
The R&D activities of C2TN are organized in 5 Research Groups (RGs) that converge into 3 multidisciplinary Thematic Lines (TLs). TLs address the main societal challenges and promote synergies amongst RGs. The RGs ensure effective resource management, while TLs are central hubs to coordinate and prioritize research efforts for the sake of efficiency and the successful accomplishment of the scientific goals.

The 5 RGs and their main goals are briefly presented below:

NUCLEAR ENGINEERING AND TECHNIQUES develops and uses nuclear and related techniques for air quality, earth sciences, geo/bio-environment, cultural heritage, advanced materials and ionizing radiation metrology. The group also operates an experimental infrastructure at ISOLDE-CERN that uses short-lived isotopes and the only existing luminescence dating laboratory in Portugal.
RADIATION, ELEMENTS AND ISOTOPES applies ionizing radiation and nuclear techniques to perform elemental, isotopic, trace element and tritium determinations, radiocarbon dating and analysis of microbiological and chemical radiation effects in water and bio/hazards management, archaeometric studies and materials processing.
RADIOLOGICAL PROTECTION AND SAFETY addresses dosimetry and radiobiology, environmental radioactivity and radioecology, radioactive waste management, emergency preparedness and management of radiological and nuclear accidents, defence and security applications for radiological protection and radiation safety.
RADIOPHARMACEUTICAL SCIENCES explores the application of ionizing radiation to human health, namely the design and development of innovative molecules and nanoparticles containing radionuclides for molecular imaging, targeted radionuclide therapy and cancer theranostics.
SOLID STATE develops functional and nanostructured materials with potential applications in emerging scientific and technological research areas, such as sensors, electronics and optoelectronics, new alternative energy sources, environment, and nuclear technologies.

The 3 TLs, aligned with C2TN's mission, are summarized below:

EARTH SYSTEMS, RADIOACTIVITY AND CULTURAL HERITAGE: is focused on the sustainable management and protection of natural resources (air, water, and soils), tracing and reduction of the adverse effects of anthropogenic and natural sources on environment, human health and climate

change, and cultural heritage characterization and protection. It addresses pressing societal challenges such as climate action, sustainable cities and earth sciences.
RADIOPHARMACEUTICAL SCIENCES AND HEALTH PHYSICS: is focused on the application of ionizing radiation in different aspects of human health, tackling two major research topics - theranostics and personalized medicine, medical radiation protection and dosimetry. This integrative program is devoted to health and life sciences and intends, in the long term, to reduce the negative impact of diseases, particularly cancer, through early diagnosis and treatment.
ADVANCED MATERIALS: aims to deepen our understanding of materials properties, especially the correlations between structure/microstructure/composition/processing and physical properties, and to drive sustainable development through materials with improved properties for applications, like sensors, electronics, energy conversion and biomaterials. It tackles urgent societal challenges such as affordable and clean energy for all, and responsible production and consumption.

MANAGEMENT STRUCTURE
The management structure of the C2TN was designed to ensure efficient operation and strategic development of the research unit. It is a clear and effective management framework that aligns with the objectives and regulations of the C2TN.

The management is assured by 3 main bodies:

- Scientific Council (SC): includes all PhD holders of C2TN, who gather in Plenary Sessions at least twice annually. The latter elects the President, proposes the creation or discontinuation of RGs and TLs, approves new members' admissions, endorses activity plans, budgets, and reports. The Coordinating Commission of the SC, which includes the Executive Commission (EC), coordinators of the RGs and of TLs, meets at least once a month to decide on scientific, administrative and financial issues, ensuring the coordination and alignment of activities.
- President (P) of C2TN: proposed by the SC (after election) and nominated officially by the President of IST, is the official representative of C2TN.
- Executive Commission (EC): composed of three members, namely the P, the Vice-president, and a third member which are both proposed by the P and approved by SC. The EC implements decisions of the SC, manages human and material resources, prepares and presents the annual plan, budget, and activities report, and ensures compliance with regulations and financial management standards.

C2TN prioritizes a strong monitoring process within its management structure. This involves annual analyses of Key Performance Indicators (considering publications, projects, students, patents, awards and outreach activities) to ensure the efficiency and effectiveness of research efforts. C2TN publishes a bi-annual report that compiles researchers' outputs and highlights R&D achievements, promoting transparency and dissemination of research outcomes. An External Advisory Board, consisting of 3 internationally recognized experts, assists C2TN and advises on the different scientific and organizational aspects of the research unit.

An Outreach team shares and promotes the research unit's activities. A dedicated science manager will be hired to collaborate with the IST Pre-Award Office and to enhance C2TN participation in international projects, informing about funding opportunities, programs, calls, and deadlines, and assisting in proposal preparation.

12. Proposed Research Groups

Reference	Name	Principal Investigator
RG-4349-401045	Nuclear Engineering and Techniques (NET)	Maria Isabel Marques Dias

Reference	Name	Principal Investigator
RG-4349-402148	Radiation, Elements & Isotopes Group (REIG)	Fernanda Maria Amaro Margaça
RG-4349-402149	Radiological Protection and Safety Group (RPSG)	Octávia Gabriela da Silva Viegas Nené Monteiro Gil
RG-4349-402150	Radiopharmaceutical Sciences Group (RSG)	João Domingos Galamba Correia
RG-4349-402151	Solid State Group (SSG)	Laura Cristina de Jesus Pereira

(RG-4349-401045) Nuclear Engineering and Techniques (NET)

12.1. IDENTIFICATION OF THE RESEARCH GROUP

12.1.1 ID number of Research Group
RG-4349-401045

12.1.2 Research Group name in Portuguese
Engenharia e Técnicas Nucleares

12.1.3 Research Group name in English
Nuclear Engineering and Techniques (NET)

12.1.4 Keyword(s)

Nuclear techniques development and applications
Air quality assessment and decision support
Geochemistry and mineral resources
Science and Technology for Cultural Heritage

12.1.5 The Research Group existed in 2018-2023?
Yes

12.1.6 Identification and summary description of up to 3 contributions that the R&D Unit considers most relevant during 2018-2023 by researchers from the Research Group included in the application

1. Integrating air pollution, climate change and health in urban systems
NET has played a pivotal role in developing tools to support air quality and climate change governance in the EU. Activities ranged from assessing children's daily exposure to fine particles and creating an air quality management tool (LIFE Index-Air) to evaluating exposure in indoor environments such as schools (EU Horizon InChildHealth; Interreg Sudoe 3SqAir), hospitals (Interreg Hospital Sudoe 4.0), and bedrooms (FCT HypnosAir). NET has innovated strategies for assessing commuting exposure using mobile sensor networks, big data analytics, and IoT (FCT Expolis). Concurrently, NET has actively participated in implementing measures to address climate change. Projects like the H2020 ECF4CLIM have adopted a citizen science approach to engage scholars and foster behavior change, while the PAB_LivingLab (EEA Grants) has set up a living lab in an urban park to demonstrate effective strategies for decarbonization and climate change mitigation.

2. Assessing environmental impacts for remediation strategies in old uranium and polymetallic mines
Groundbreaking research of NET in the field of earth surface geochemistry, namely the expertise in geochemistry of rare earth elements (REE) and associated elements in old uranium and polymetallic

mines, aid sustainable sites management. Projects like EU's Horizon 2020 Marie Sklodowska-Curie (Panorama) shows the NET role in training and mentoring the next generation of geochemists. The assessment of contamination in mines surroundings by studying geochemical interactions, hydrological processes, and sedimentation dynamics showed (i) the influence of the distribution and transport of elements, particularly REE, Uranium (U), and Manganese among mineral phases (i.e. clay minerals, Fe-Mn (oxy)hydroxides, and U minerals) and (ii) the need of a comprehensive risk appraisal to evaluate impacts, prior and after implementing passive remediation systems to mitigate acid mine drainage effects.

3. High resolution energy dispersive spectrometry (HiREDS), a new tool for X-ray emission work Replacing standard Si(Li) detectors by X-ray microcalorimeter spectrometers (XMS) to collect energy disperse emission X-ray spectra, HiREDS provides high resolution spectra over wide energy windows (1 to 20 keV). NET, following the pioneer installation of the HiREDS-PIXE system with resolving powers from 100 (15 eV @ 1.5 keV) up to 500 (25 eV @ 12.5 keV), developed dedicated specific software for off-line optimized spectra generation and spectra fitting and demonstrated HiREDS capacity to provide elemental speciation in a priori unknown composition samples. Presently the facility is being upgraded to best in class under HORIZON2020 AHEAD2020 adding PIXE induced XRF, an X-ray lens and a 3rd generation metallic magnetic calorimeter XMS, increasing capacities, solid angle, resolving power and count rate.

12.2. Researchers of the Research Group

12.2.1 List of Integrated PhD holder Researchers in the R&D Unit from the Research Group

Name	Principal Investigator
Maria Isabel Marques Dias	✓
Ana Cristina Fidalgo Palma Fernandes	
Ana Luísa Rodrigues	
Andreas Kling	
ÂNGELO RAFAEL GRANADEIRO COSTA	
Augusto M Dias de Oliveira	
CARLA ALEXANDRA GAMELAS ALBUQUERQUE PINTO REIS	
Joana Múrias Gomes Lage	
João Guilherme Martins Correia	
João Henrique Garcia Alves	
Jose Antunes	
José Joaquim Gonçalves Marques	
Maria Isabel Garrido Prudêncio	

Name	Principal Investigator
Maria Raquel Nunes Pereira Crespo	
Miguel Adrião Mateus dos Reis	
MIGUEL FELIZARDO	
Nuno Pessoa Barradas	
Rosa Maria Salgueiro Marques	
Susana Marta Lopes Almeida	
Tiago Alexandre Ferreira Paes de Faria	
tomoko morlat	
Ulrich Wahl	
Vânia Martins	

12.2.2 List of Collaborating Researchers from the R&D Unit who constitute the Research Group

Name
Debut Vincent
Dulce Russo
Joana Bravo Catela Pinto dos Santos
Joana Coutinho
Paula Cristina Vicente Teixeira Chaves

12.2.3 List of PhD students supervised by Integrated PhD holder Researchers in the R&D unit

Name
Afonso Xavier de Matos Lamelas
Alexandra Raquel Lourenço Nunes
Carolina Gonçalves Correia
Carolina Vicente Reis
Cynthia Lorena Obregón Castro

Name

Gonçalo Ruivo Lopes da Fonseca

Ketlyn Oliveira

Raquel Filipa Lourenço Pimenta

SERGIO LUIS MENDEZ HOYOS

12.3. Description of the main contributions of the Research Group in 2025-2029

12.3.1 General description of the Research Group

NET is the C2TN's group with a foremost role in nuclear physics, engineering, environment, development and application of nuclear techniques in the 3 scientific thematic lines.

NET:
i) develops and uses nuclear techniques such as ion beam analysis, radioactive beams, PGAA, NAA, gamma spectroscopy, and nuclear-related techniques such as X-ray diffraction and luminescence dating
ii) develops research on vibratory modeling, acoustic behavior, neutron transport simulation, radiobiology, dosimetry, software development mainly for IBA
iii) develops instruments and instrumental speciation methods
iv) operates a unique experimental setup at ISOLDE-CERN to use short-lived isotopes for emission channeling and perturbed angular correlations and utilizes other international facilities.
Additionally:
v) the work conducted by NET members at the Ionising Radiation Metrology Laboratory (LMRI) is pivotal within the Laboratory for Radiation Protection and Safety at IST. LMRI holds recognition as a Designated Institute for ionizing radiation by the Portuguese National Metrology Institute
vi) the team preparing the decommissioning of the Portuguese Research Reactor is integrated in NET.

NET leads and/or participates in national and international projects. It contributes to various scientific domains, including:
i) development and analysis of advanced materials
ii) earth sciences, geo/bio-environmental studies, and cultural heritage
iii) research on low activity samples of long-lived isotopes
iv) air quality assessment and tools for its management, including transition to a low carbon economy and climate change.

Our research aims to benefit society by:
i) impacting in UN SDG including 3, 4, 11, 13, 14, 15
ii) fostering collaboration with stakeholders in industry, public and private entities, hospitals, schools, museums, and municipalities
iii) commitment to education and training and participation in several PhD and MSc programs
iv) contributing to policymaking initiatives.

(RG-4349-402148) Radiation, Elements & Isotopes Group (REIG)

12.1. IDENTIFICATION OF THE RESEARCH GROUP

12.1.1 ID number of Research Group
RG-4349-402148

12.1.2 Research Group name in Portuguese
Grupo de Radiações, Elementos e Isótopos (GREI)

12.1.3 Research Group name in English
Radiation, Elements & Isotopes Group (REIG)

12.1.4 Keyword(s)

Ionizing Radiation Technologies
Environmental Geochemistry
Archaeometry
Materials Processing

12.1.5 The Research Group existed in 2018-2023?
Yes

12.1.6 Identification and summary description of up to 3 contributions that the R&D Unit considers most relevant during 2018-2023 by researchers from the Research Group included in the application

1. Extractability enhancement of bioactive compounds from agroindustrial wastes by ionizing radiation
Agroindustrial wastes, like olive pomace, detrimental to the environment, can be a source of natural compounds, as they contain several bioactives with relevant health benefits. Studies were performed with olive pomace, a waste from olive oil industry that contains a variety of bioactives, such as hydroxytyrosol, tyrosol, and oleuropein. Ionizing radiation applied as a pretreatment to olive pomace, enhanced by 144% the extractability of its bioactive compounds. The extracts from irradiated olive pomace, showed antioxidant activity as well as other bioactivities such as antimicrobial, antiproliferative, and antidiabetic properties. Thus, ionizing radiation was highlighted as a technology to valorize agroindustrial wastes, contributing for the availability of natural compounds with health benefits and potential applications in food, cosmetic and pharmaceutical industries, so promoting the circular economy for an environmentally sustainable development.

2. Multi isotope approach for water resources protection
Hydrological studies performed in freshwater systems in semi-arid regions (Cape Verde, Morocco, Tunisia, S-Portugal) showed that recharge rates are strongly influenced by anthropogenic pollution: overexploitation in coastal areas, agricultural practices, industrial activities and urbanization. Chemical and isotopic analytical methodologies contributed to the characterisation and identification of water pollutants origin. Results showed that: in most cases, active seawater intrusion is responsible for freshwater degradation; groundwater dating (3H & 14C) identified salt legacies responsible for salinization increase; and ancient recharge under different climatic regimes (palaeoclimatic fingerprint). All these studies aimed at proper management and protection of water resources, a major global concern (SDG 6): to ensure access to and sustainable management of water and sanitation for all.

3. Ion beam analytical techniques
The nuclear microprobe showed its importance in materials characterization providing information on small sample details (internal beam setup) and on delicate or large samples as are most of CH artefacts (external beam setup).
Highlights include: the analysis of historical glass fragments (important for proposing the existence of non-documented quality medieval Portuguese glass production centers); examination of the composition and degradation of cellulose materials and iron gall inks (crucial for the conservation of ancient manuscripts); characterization of advanced devices or materials such as CIGS solar cells (defects found - fabrication improvement needed), or GaN microwires and Ga2O3 micro flakes as radiation sensors. The impact of the work with manuscripts is further magnified through its integration into international research initiatives aiming to mitigate radiation induced alterations (EURO-LABS, IAEA-Secure).

12.2. Researchers of the Research Group

12.2.1 List of Integrated PhD holder Researchers in the R&D Unit from the Research Group

Name	Principal Investigator
Fernanda Maria Amaro Margaça	✓
António Manuel Monge Soares	
Joana Filipa de Paiva dos Santos Madureira	
Luís Manuel Cerqueira Lopes Alves	
Luis Miguel Mota Ferreira	
Maria de Fátima Duarte de Araújo	
Paula Maria Mimo Carreira Paquete	
Pedro Manuel da Cunha Catalão Pires dos Santos	
Pedro Valério	
Sandra Cabo Verde	
Susana Alves de Sousa e Silva Gomes	
Victoria Corregidor Berdasco	

12.2.2 List of Collaborating Researchers from the R&D Unit who constitute the Research Group

Name
Ana Monteiro
António José Canaria Amaro

Name
Dina Maria Mendes Nunes André
Filipe Soares
Helena Maria Jorge Monteiro Marcos
João Paulo Arriegas Estevão Correia Leal
Joaquim Carrasqueiro Marçalo de Almeida
José Manuel da Cunha Oliveira Figueira Carretas
Maria Helena Freitas Casimiro
Maria Manuela Lopes Correia

12.2.3 List of PhD students supervised by Integrated PhD holder Researchers in the R&D unit

Name
Janice da Conceição Lopes
Rita Isabel Lucas Pires

12.3. Description of the main contributions of the Research Group in 2025-2029

12.3.1 General description of the Research Group

GREI is an interdisciplinary group contributing to the body of knowledge related to the 3 TLs. It combines a high expertise in ionizing radiation technologies and nuclear analytical techniques dedicated to: water resources management; search of pollutant sources, treatment and extractability of bioactives from industrial wastes; provenance and technological developments of cultural materials and processing of macromolecular materials for environment, health and cultural heritage.

Activities will focus on:
i) Ionizing radiation applications
Mitigate emerging (bio)hazards in wastewater, valorize agroindustrial/biomass wastes, decontaminate/sterilize healthcare products and plastic recycling; Process novel polymer-based materials for health and environmental remediation; Evaluate critical ionizing radiation side effects on cellulose-based CH materials. Outcomes will significantly promote public health, advance environmental sustainability and foster circular economy practices.

ii) Environment
Identification of nitrate sources in water systems (affecting surface and groundwater quality and drinking quantity), pollution legacy (e.g. agriculture, manure, municipal wastewater) and evaluation of groundwater overexploitation impact will benefit from the on-going installation of a multi-isotope tracer methodology. The assessment of trace metal pollution in polar regions will be linked to climate change and human impact.

iii) Archaeometry
Characterization and chronological framework of CH artefacts (e.g. metals, glasses, manuscripts). Studies of ancient metals (mines artefacts, metallurgical remains and mines) and medieval glasses to investigate raw materials provenance, production techniques and trade networks. Investigation of ancient manuscripts: to acknowledge inks used and causes of degradation. Apart from increase knowledge on ancient technologies, studies will significantly enrich Museological sets.

(RG-4349-402149) Radiological Protection and Safety Group (RPSG)

12.1. IDENTIFICATION OF THE RESEARCH GROUP

12.1.1 ID number of Research Group
RG-4349-402149

12.1.2 Research Group name in Portuguese
Grupo de Proteção e Segurança Radiológica (GPSR)

12.1.3 Research Group name in English
Radiological Protection and Safety Group (RPSG)

12.1.4 Keyword(s)
Radiation Protection
Dosimetry
Radiobiology
Environmental Radioactivity

12.1.5 The Research Group existed in 2018-2023?
Yes

12.1.6 Identification and summary description of up to 3 contributions that the R&D Unit considers most relevant during 2018-2023 by researchers from the Research Group included in the application
The group's activities were developed in 2 main components: Health (encompassing medical Radiation Protection and Dosimetry, Medical Physics and radiobiology, contributing to personalized and precision Medicine) and Environment (exposure to natural sources of radiation like radon and NORM). The following three contributions were pursued:

1. Dosimetry in standard and novel radiotherapy techniques, including:
In radiotherapy with X-ray photon beams: measurements in clinical settings combined with Monte Carlo (MC) simulations using voxel phantoms, and out-of-field doses assessment with particular interest in pediatric patients;
In proton radiotherapy: studies about the influence of the computational algorithm used in the calculation of ionization cluster size distributions and associated nanodosimetric parameters from proton track structures, in proton treatment plans;
In the field of Targeted Radionuclide Therapy (TRT): calculations of absorbed dose using MC simulations considering clinical patient's data treated with 177Lu. Using pediatric computational phantoms, we performed dosimetry studies with novel radionuclides such as 161Tb that could have a role in clinical therapy;
Studies devoted to the quantification of the biological effects, including the use of radiosensitizers, alpha particles and Auger electrons.

2. X-ray imaging, including:

In mammography and Computed Tomography (CT), activities related to image quality and absorbed dose optimization studies;
Studies (computational and physical phantoms) devoted to the assessment of radiation doses at the foetus level, considering women performing mammography examinations in the first three months pregnant period.

3. Exposure to radon and NORM
The development of robotics applied to the conception of Unmanned Terrestrial and Aerial Vehicles (UTVs, UAVs) designed for environmental monitoring purposes, has outdated much of the need for piloted ionizing radiation (IR) monitoring. The high range made possible by these technologies enables radiological and dosimetric mapping of areas affected by radioactive contamination of artificial origin or by enhanced natural radioactivity derived from NORM industries (projects ROBOSAMPLER and FRIENDS).
Regarding exposure to radon, research activities undertaken in the framework of the RadoNorm project focus on the development of new measurement techniques and protocols to reduce uncertainties in radon measurements. This aims to identify typologies of workplaces were radon concentration behavior is significantly different from that in dwellings and set up workplace type specific measurement protocols for realistic assessment of the exposure of the workers. Other goal is to assess the contribution of local geology versus other sources of radon exposure in dwellings by improving the modelling of radon transport from soils to indoor air.

12.2. Researchers of the Research Group

12.2.1 List of Integrated PhD holder Researchers in the R&D Unit from the Research Group

Name	Principal Investigator
Octávia Gabriela da Silva Viegas Nené Monteiro Gil	✓
Ana Belchior	
Ana Maria Morais Cravo de Sá	
Maria Isabel Flausino de Paiva	
Mário João Capucho dos Reis	
Pedro Vaz	
Salvatore Di Maria	

12.2.2 List of Collaborating Researchers from the R&D Unit who constitute the Research Group

Name
Eva Mafalda de Sousa Andrade
Joana Rodrigues dos Santos
JOSÉ ALBERTO GIL CORISCO

Name

Margarida Caldeira

Marta de Campos Baptista Guimarães Santos

Telma Silva Marques

Yuriy ROMANETS

12.2.3 List of PhD students supervised by Integrated PhD holder Researchers in the R&D unit

Name

Jorge Cebola Borbinha

Luís Miguel Cabeça Marques

12.3. Description of the main contributions of the Research Group in 2025-2029

12.3.1 General description of the Research Group

RPSG is a unique research group in Portugal, with knowledge, skills and competence in multiple strands of radiation protection (RP), such as radioactive waste, environmental radioactivity, radioecology, dosimetry, radiobiology and metrology.
Its strategy encompasses pursuing and expanding the group´s skills articulated around:

i) Internationalization, through participation in the activities of EU research platforms: MELODI, EURADOS, RENEB, NERIS, ALLIANCE, IGD-TP

ii) Fostering collaboration, at the inter- and national level, towards precision and personalized medicine;

iii) Participation in the Europe´s beating cancer plan (SAMIRA initiative and EU4Health);

iv) Coordinating efforts, executing IST´s unique role as Programme Manager for Radiation Protection in Portugal, formally recognized by the FCT, in the framework of the PIANOFORTE EU Partnership and national consortia (PROT@RAD).

RPSG will undertake activities associated to RP in medicine and environment. Specifically by:

i) Optimize and improve medical/clinical dosimetry protocols in theranostics by using computational micro and nanodosimetry;

ii) Study image-guided radiation therapy with cone beam CT;

iii) Develop novel compact gas-based nanodosimeter detectors for proton therapy;

iv) Assess the radiobiological risk of patients undergoing therapy;

v) Development of new measurement protocols to reduce uncertainties in indoor radon

measurements in underground workplaces, where radon concentration behave differently;

vi) Conception and development of Unmanned Terrestrial and Aerial Vehicles designed for environmental monitoring purposes, enabling radiological and dosimetric mapping of areas affected by radioactive contamination from enhanced natural radioactivity derived from NORM industries.

(RG-4349-402150) Radiopharmaceutical Sciences Group (RSG)

12.1. IDENTIFICATION OF THE RESEARCH GROUP

12.1.1 ID number of Research Group
RG-4349-402150

12.1.2 Research Group name in Portuguese
Grupo de Ciências Radiofarmacêuticas (GCR)

12.1.3 Research Group name in English
Radiopharmaceutical Sciences Group (RSG)

12.1.4 Keyword(s)
Cancer Theranostics
Molecular Imaging
Radiopharmaceuticals
Targeted Radionuclide Therapy

12.1.5 The Research Group existed in 2018-2023?
Yes

12.1.6 Identification and summary description of up to 3 contributions that the R&D Unit considers most relevant during 2018-2023 by researchers from the Research Group included in the application

1. Structural Biology and Computational Biophysics applied to Radiopharmaceutical Sciences
An interdisciplinary approach is crucial for identifying and validating disease targets, and designing diagnostic or therapeutics agents with enhanced specificity and pharmacokinetics, including theranostic agents. Computational methods like molecular docking and molecular dynamics simulations play a pivotal role. The RSG established a new research line using computational biophysics to identify novel targets and design molecules for cancer theranostics. These tools were applied to deepen our understanding of trastuzumab's mechanism in blocking HER2 dimerization but have also facilitated the development of a novel strategy employing allosteric ligands to modulate HER2 activity. Additionally, our investigation into single point mutations in antibodies revealed their significant influence on antibody structure and binding affinity, particularly highlighted through the study of the microenvironment surrounding a new antibody targeting TEM1.

2. Click Chemistry for In Vivo Imaging Approaches
Pre-targeting approaches based on the inverse electron demand Diels-Alder reaction and the in vivo click reaction between tetrazine (Tz) and trans-cyclooctene (TCO) were explored to improve diagnostic and therapeutic properties of two biomolecules. Firstly, a carbonylacrylic reagent was used for the site-specific incorporation of TCO onto the anti-HER2 antibody Thiomab, which was then coupled with a fluorescent or 111In-labelled Tz. Studies performed in breast cancer cell models confirmed target specificity and in vivo studies showed a high and specific accumulation in HER2+ tumor xenografts. The same strategy was applied to a potent GRPr peptide antagonist functionalized with TCO and conjugated to 111In- or 90Y-labelled Tz derivatives. The radioconjugate with the highest uptake was selected after in vitro studies in a prostate cancer model. Further in vivo studies, based on Cherenkov Luminescence Imaging, confirmed good tumour uptake and tumour to

background ratio.

3. 64CuCl2 as a simple tool for prostate cancer theranostics
Multiple copper isotopes are explored for cancer imaging and therapy. Studies using the simpler ionic form of the medically relevant copper radioisotope, 64Cu, were conducted using 2D cell culture and different prostate cancer (PCa) cell lines. PCa cells were found to exhibit increased 64CuCl2 uptake, which resulted in higher early DNA damage and genomic instability. In addition, PCa cells have a higher sensitivity to 64CuCl2 than healthy cells. These encouraging results were corroborated in preclinical models with improved predictive value, i.e. advanced in vitro 3D cellular models of prostate cancer, being observed that 64CuCl2 significantly reduces the growth, viability and reproductive ability of spheroids from both castration-resistant and hormone-naïve prostate cancer. These results pinpoint the high potential of 64CuCl2 as a theranostic agent.

12.2. Researchers of the Research Group

12.2.1 List of Integrated PhD holder Researchers in the R&D Unit from the Research Group

Name	Principal Investigator
João Domingos Galamba Correia	✓
Ana Sofia Cavalheiro Gama	
António Paulo	
BRUNO LUÍS JESUS PINTO DE OLIVEIRA	
Célia Fernandes	
Elisa Vaz Morgado de Palma	
Fernanda Marujo Marques (Waerenborgh)	
Filipa Fernandes Mendes	
Maria Lurdes Barrela Patricio Gano	
Maria Paula Cordeiro Crespo Cabral Campello	
Maria-Cristina das Neves Oliveira	
Paula Dolores Galhofas Raposinho	
Rita Lourenço Paiva de Melo	

12.2.2 List of Collaborating Researchers from the R&D Unit who constitute the Research Group

Name
Elisabete Lopes Correia

12.2.3 List of PhD students supervised by Integrated PhD holder Researchers in the R&D unit

Name
Catarina Dorisa Azevedo da Silva
Catarina Isabel Guilherme Pinto
Cátia Filipa Gouveia Rosa
Diogo Miguel Gonçalves Engrácia
Joana Filipa da Silva Santos
João Miguel Franco Machado
Rafael Cartaxo Travassos
Rúben Silva
Sofia Alexandra de Albuquerque Martins

12.3. Description of the main contributions of the Research Group in 2025-2029

12.3.1 General description of the Research Group

Nuclear molecular Imaging modalities allow the detection and quantification of molecular targets, leading to the visualization of functional and metabolic alterations and disease diagnosis. In this way, it is possible to stratify patients, namely for targeted radionuclide therapy that can specifically eradicate target cells while sparing healthy tissues. In this context of precision medicine, the research activities of the RSG address unexplored issues in nuclear molecular imaging and targeted therapy.
Towards this goal, the group aims at exploring the application of ionizing radiation to human health, more specifically based on the design and development of innovative molecules and nanoparticles containing medical radionuclides, useful as target-specific radiopharmaceuticals for molecular imaging, targeted radionuclide therapy and cancer theranostics. These activities are undertaken by a multidisciplinary team with expertise in chemistry, radiochemistry and biology supported by a set of facilities for:

i) chemical synthesis (including solid phase peptide synthesis);
ii) radiosynthesis;
iii) biochemical and cellular studies;
iv) animal studies and preclinical imaging.

The integrated program for target-specific radiopharmaceuticals will focus on cancer and infectious diseases (e.g. triple negative breast cancer or bacterial infections) that are increasingly impacting human health; it will put emphasis on less explored targets supported by computational biophysics approaches (e.g. protein-protein interactions); it will explore new emerging radionuclides (e.g. Auger-emitters as 161Tb and 165Er, and alpha-emitters as 225Ac and 211At) within the framework of European networks; it will use alternative targeting vectors (e.g. antibody fragments or miniproteins), novel bioconjugation and radiolabeling approaches; and potentiate the clinical translatability of

preclinical studies using advanced cellular models, such as spheroids and tumoroids, and imaging approaches.

(RG-4349-402151) Solid State Group (SSG)

12.1. IDENTIFICATION OF THE RESEARCH GROUP

12.1.1 ID number of Research Group
RG-4349-402151

12.1.2 Research Group name in Portuguese
Grupo do Estado Sólido (GES)

12.1.3 Research Group name in English
Solid State Group (SSG)

12.1.4 Keyword(s)
Multifunctional and nanostructured Materials
Electrical and magnetic properties
Low temperature and high magnetic field techniques

12.1.5 The Research Group existed in 2018-2023?
Yes

12.1.6 Identification and summary description of up to 3 contributions that the R&D Unit considers most relevant during 2018-2023 by researchers from the Research Group included in the application
1. Iron speciation
Bond breaking in metal-organic frameworks tunes the properties of these porous materials obtaining pore environments in structures that are inaccessible by other techniques. The essential contribution of Mössbauer spectroscopy showed that in Fe-Zn Zeolitic Imidazolate frameworks obtained through clip-off chemistry, Fe is present as tetracoordinated Fe2+ occupying the Zn2+ sites of the sodalite structure. During hydrolysis a first oxidation step of the Fe2+ ion occurs, with the generated Fe3+ being part of the sodalite structure. As the material is further oxidized, this unstable Fe3+ species forms nanosized superparamagnetic oxides that remain in the pores generated by the removal of the Fe2+ centers. The two processes, metal−ligand bond cleavage and oxidation of the iron centers, are combined in the global process of mesopore formation.

2. New Thermoelectric materials
Thermoelectric (TE) materials directly convert thermal into electrical energy and vice versa. TE devices are reliable, maintenance-free, silent, scalable and flexible. With approximately 60% of energy lost as waste heat, TEs are seen as a promising green energy source. However, commercial systems rely on expensive and toxic materials, and their efficiency is low, limiting widespread use. At C2TN, new low-cost and non-toxic tetrahedrite-based TE materials have been developed and optimized to address these limitations, achieving the highest reported room temperature power factor in this family. Through an international M-ERA.Net project, key constraints for building a TE device using tetrahedrites and Mg silicides were identified. Simulations revealed contact resistance as the most critical factor impacting power output, and a small TE device that incorporates the knowledge acquired is being developed.

3. Molecular Materials
The search for Molecular Materials with unconventional electrical and magnetic properties has led to relevant results. This includes the study of [Au(dspdt)2] (dspdt = 2,3-dihydro-5,6-selenophenediolate), a rare case of a conductive compound based only on a single neutral molecule

where an alternative electrical conduction mechanism explains its high electrical conductivity. Concerning molecular magnetism, the possibility of storing magnetic information in a single molecule offers potential applications in nanodevices for molecular spintronics and as spin qubits. Remarkable achievements have been attained with the study of molecules with 3d- or f-elements providing insights into the correlations between the structure, related with different steric effects of the ligands, and the magnetic and electronic properties of the metal ion.

12.2. Researchers of the Research Group

12.2.1 List of Integrated PhD holder Researchers in the R&D Unit from the Research Group

Name	Principal Investigator
Laura Cristina de Jesus Pereira	✓
António Cândido Lampreia Pereira Gonçalves	
Bruno José Cardoso Vieira	
Elsa Maria Simões Branco Lopes	
Isabel Cordeiro Santos	
João Carlos Bentes Waerenborgh	
Maria Dulce Jesus Pombo Belo	
Sandra Marisa Baptista Rabaça Rodrigues	
Ana Rita de Paulo Proença Melo	

12.2.2 List of Collaborating Researchers from the R&D Unit who constitute the Research Group

Name
André da Costa Miranda
André Henriques da Silva
Beatriz Guerreiro Morgadinho
Carlinhos Jeovanny Fernandes dos Reis Cabral
Carolina Lebre Branco
Duarte Moço
Joaquim Miguel Badalo Branco
Leonel Gil da Silva Nogueira

Name
Pedro de Almeida Silva

12.2.3 List of PhD students supervised by Integrated PhD holder Researchers in the R&D unit

Name
Beatriz Aguiar Moreiras Vicente dos Santos
Cristiana Magalhães Correia Rodrigues
Daniel Alves Barcelos
Gonçalo André Gonçalves Brás Lopes
Inês Filipa Morais da Costa
Juliana Gonçalves Araújo
Rodrigo Coelho
Vital Cruvinel Ferreira Filho

12.3. Description of the main contributions of the Research Group in 2025-2029

12.3.1 General description of the Research Group

SSG mainly contributes to the Advanced Materials TL. Focuses on new materials with unconventional electrical and magnetic properties, tackling cutting-edge topics in materials science essential to develop sensors, electronic devices, energy conversion and biomedical applications. It combines expertise in synthetic chemistry, materials preparation and processing with skills in compositional, structural, microstructural and physical characterisation techniques, which include high temperature synthesis, crystal growth, and physical characterization techniques under extreme conditions of temperature and magnetic fields, placing it at the forefront nationally and internationally.

Research will focus on its areas of expertise:

i) Molecular Materials: Research will continue on new materials with unusual electrical and magnetic properties. Keeping a commitment to fundamental research, efforts will aim tobe made translate these materials into practical applicationsto use these materials in a practical application, such using as tetrathiofulvalene derivatives in organic batteries, transition metal bisdithiolate complexes in therapeutic applications and spin crossover compounds as sensors and switches.

ii) Intermetallics (including with Th and U): Emphasis will be on efficient, cost-effective, and eco-friendly thermoelectric materials (Mg2Si, MgAgSb, Cu12SbS13) and devices, as well as on U-based strongly correlated electronic systems (UFeGe, UTe3) and novel topological systems.

iii) Exploratory Studies: New hybrid organic-inorganic, nanostructured and multifunctional materials prepared by electrochemical, irradiation or high-temperature methods will be studied, including magnetic and electrical properties characterizations at low temperatures and high magnetic fields.

Research aims to contribute to solving global challenges, particularly impacting UN SDGs 4, 7, 9 and EU priorities "Green Deal", "Fit for the digital age" and "Economy that works for people".

13. Thematic Lines

The minimum number of confirmed integrated researchers in order to fill thematic lines information is 100 and you have only 64.

14. Ethical issues

14.1 Ethical issues

C2TN researchers are aware of the scientific relevance and social impact of ethical issues related with: i) The use of Human cells/tissues; ii) Protection of personal data; iii) Research with animals; iv) Environment & Health and Safety; v) Cultural Heritage sampling vi) Artificial Intelligence (AI) and vii) Data Management. These activities are essential to achieve the main goals of this proposal, and all studies will comply with national/EU legislation and will previously get ethical/legal approvals by competent committees and the corresponding National Authorities. Researchers will disclose conflicts of interest and uphold recognized standards of research integrity and address the following ethical considerations:
HUMAN CELLS/TISSUES: The research program envisages the use, analysis and storage of immortalized human cell lines commercially available. Most of these cell lines were already purchased and belong to the C2TN cell collection. However, the acquisition of other cell lines can be considered throughout the research work. Other human biological samples will be used to study the biological effects of ionizing radiation exposure. Those samples will be collected under collaborative projects with national/international institutions after approval at the local Ethical Commitees.
PROTECTION OF PERSONAL DATA: Protection of personal data is paramount in C2TN projects involving human participation and data collection. Participation is voluntary, and participants can withdraw at any time. They must be informed about the research's purpose, their data protection rights, and the risks and benefits, giving informed consent. Studies will comply with legislation and respect privacy and confidentiality rights, with personal data known only to the research team. When collecting clinical data from children to assess radiation exposure effects and secondary cancer risks, parental information and consent will be obtained.
ANIMALS: Animal studies using commercially available mice/rats are essential to achieve some project goals. Animals offer valuable insights in the in vivo behavior of new compounds, particularly for molecular imaging/targeted radionuclide therapeutics. While alternative model systems like computational or biophysics models and cell lines provide insights, they do not offer a comprehensive preclinical characterization to assess clinical potential. Animal experimentation will only be pursued when no alternatives exist. Initially, all compounds undergo evaluation by in vitro techniques, as biophysics models and cell lines (preferably in 3D). Only the most promising compounds proceed to in vivo studies. The animal facilities and team members responsible for experimentation adhere to principles of laboratory animal science concerning care, protection, and welfare. They are accredited by National Authorities in compliance with national (DL 113/2013) and EU (Directive 63/2010/EU) legislation. All animal experimentation projects undergo prior approval. Researchers involved in animal experimentation apply the Three Rs Concept (3Rs) for animal welfare and experiment quality, ensuring maximal information with minimal animal use. Wherever feasible, alternative methods as 3D cell models will be employed to replace/reduce the number of animals. Procedures and anesthesia methods are refined to minimize animal pain or suffering and enhance their well-being. Careful experimental design and statistical analysis further contribute to the responsible use of animals.
ENVIRONMENT & HEALTH AND SAFETY: The project involves handling chemical substances,

radioactive compounds, and biological samples. Laboratory facilities have the proper radiological protection authorisation by the National Authority for radioactive products manipulation and storage with an appointed radiation protection officer. Researchers/technicians possess extensive expertise in these procedures. Proper waste management protocols are established for chemicals, radiochemicals, and biological samples. Students handling chemicals and radioisotopes will receive appropriate training and supervision from experienced staff. We adhere to the ALARA principle (as low as reasonably achievable) for activities involving ionizing radiation. Before handling radionuclides, all students must complete a mandatory radiological safety course.
CULTURAL HERITAGE: to conduct sampling of cultural heritage in a responsible and respectful manner the ethical issues includes: i) informed consent from relevant stakeholders (museum curators, conservators, or CH authorities) if sampling involves the removal/alteration of any part of the artifact, ensuring that sampling methods are carefully planned to avoid damage; ii) respect for Cultural Sensitivities and traditions; iii) respect for Ownership and Custodianship - get permission before sampling any artifacts and transparency about their sampling procedures and methodologies, providing clear explanations of the purpose and potential impact of the sampling activity and adhere to established guidelines and standards of museums; iv) data sharing and access - transparency about intentions for data use, ensuring that any data obtained from sampling are shared responsibly and in accordance with ethical guidelines, respecting any restrictions on access or dissemination imposed by CH institutions; v) long-term Impact - consider the implications of sampling on the artifact, documenting sampling procedures and findings comprehensively to facilitate future research and conservation efforts.
ARTIFICIAL INTELLIGENCE: The integration of AI in C2TN activities will ensure responsible and transparent deployment without compromising ethical standards. The Ethical Office at IST will provide necessary support whenever required.
DATA MANAGEMENT: Data preparation and sharing will adhere to the FAIR principles, ensuring that data is Findable, Accessible, Interoperable and Reusable for the advancement of science and innovation.

15. Aspects of the Activity Plan that involve requesting Programmatic Funding

15.1 Funding for Multi-annual plan for hiring researchers in 2025-2029

	2025	2026	2027	2028	2029	Total
Required ammount	97000	99000	101000	206000	210000	713000

C2TN is committed to the development and consolidation of researchers careers. In the 2025-2029 period it plans to co-finance 4 Auxiliary Researchers through an inter-institutional partnership established with the Department of Nuclear Sciences and Engineering (DECN) of IST. The FCT-Tenure program will be used, taking advantage of the FCT-Tenure Plus Técnico program of IST, which was built to boost financing of permanent careers in IST' ecosystem. Gender equality and inclusion will be always taken into consideration in the jury composition and recruitment process. Open and highly competitive hiring procedures will be conducted, with public announcements in web platforms and other channels.
The most urgent hiring needs were identified through collaborative efforts between C2TN and DECN, aligning with the strategies of both entities. Based on this identification, C2TN will provide financial co-support for the hiring of researchers in the following scientific areas:
i) Earth and Environmental Sciences, focusing on air quality management, monitoring, impacts, and measures.
ii) Environmental Biotechnology, with an emphasis on ionizing radiation and nuclear technologies for health and environmental sciences.
iii) Chemical Sciences, with a focus on radiopharmaceutical chemistry.
iv) Chemical Sciences, focusing on solid-state chemistry.
Moreover, a Science Manager will be hired by C2TN, with a 5 year contract, liaising with the IST-ID Pre-award office and helping to identify and process applications, with the objective of increasing the

success rates in impactful international projects.
The hired researchers will benefit from the Técnico Capacity Building Hub program, including the "Shaping the Future", "Digital+" and "Start Up Funds" initiatives, to smooth their integration and support their research/sabbaticals. "Shaping the Future" is a 3-year onboarding process, including a 3-day workshop, which welcomes new hires and ensures they are engaged with the school and research unit by sharing the culture, values, and practices. The "Digital+" program supports the modernization of technological/digital skills. The "Start Up Funds" program provides initial endowment to all faculty during the tenure-track period, supporting research, activity setup, and sabbatical leaves.
C2TN is aligned with the IST-ID Research Career Rules, complementing the IST Rules, by a tutoring/advisory committee, constituted by experienced senior researchers, assigned for guidance. Each Assistant Researcher will have a mentor during their tenure-track period to directly assist with career management, including recruitment and supervision of PhD and master's students, teaching practices, research and funding search strategies and other mentoring components. The mentor will be a researcher from any scientific area or department of IST, with tenure and an extensive experience, which can be considered a role model.
C2TN will provide to the new hires access to its laboratorial infrastructures, facilities and networks, and will give them office space and an additional support to the existing programs, providing a startup grant of 5k€ to bolster exploratory projects or facilitate sabbaticals. Moreover, C2TN will promote annual internal project applications, supporting 3 projects per year, with a funding allocation of 15k€ each.
The newly hired Auxiliary Researchers are expected to actively contribute to C2TN by developing innovative and impactful research, applying to national and international project calls to secure competitive funding, and dynamically training students in their areas of expertise.

15.2 Funding for early career researchers

	2025	2026	2027	2028	2029	Total
Required ammount	52000	313000	319000	325000	56000	1065000

As a part of C2TN's strong commitment to create and maintain scientific employment and aligned with its strategy, 5 contracts for early stage researchers will be initiated in the 2023-2029 period, with one contract per Research Group, aimed at enhancing group capabilities. The contracts will have a duration of up to three years and will be intended exclusively for the initial career stages of researchers who have completed their PhD within three years before the contract. The objective is not only the initial development of the researcher's career, but also to boost exploratory research in the research groups, promoting their development and the investigation on cutting-edge topics.
All conditions existing in IST's ecosystem, including initiatives addressing work-life balance, like support with parenting responsibilities by providing day-care facilities for children at Alameda campus, will be provided to early stage researchers. In addition, other resources to carry out their research will be available, including open access to C2TN's laboratorial infrastructures, facilities and networks, and an office space. C2TN will also provide a startup grant of 5k€ to reinforce exploratory projects.
Early stage researchers will be encouraged to compete for C2TN's internal projects, launched annually and with a value of €15, to promote exploratory ideas, to supervise master and/or doctoral projects and will be involved in international visits and networking events, such as COST meetings, organization of workshops, like the annual TLs workshops, with a view to promote their research independence, leadership potential and proactive fundraising. The C2TN Academy will continue to serve as a pivotal tool for improving the skills of researchers, including early stage researchers, by providing them with training in subjects like grant writing or ethics in science. Similarly to Auxiliary Researchers to be hired, a tutoring/advisory committee will be also appointed to guide early stage researchers and a mentor will be assigned. An external panel of three members, including recognized foreign researchers, will periodically conduct assessment for career progression, in agreement with the IST´ ecosystem rules.
The necessity of this funding is crucial to kickstart research careers, especially the critical role in providing early-career researchers with the financial support needed to pursue their innovative ideas and advance their research trajectories. These will contribute to conduct cutting-edge research, publish their findings, and establish themselves as independent researchers in their respective fields. Additionally, funding for early career researchers enables C2TN to attract and retain top talent,

fostering a vibrant research community and contributing to scientific innovation and discovery. By investing in the next generation of researchers, this funding not only drives progress in the various C2TN scientific lines of research but also lays the foundation for future breakthroughs and advancements.
To justify the proposed fixed-term contracts of up to three years for starting careers of PhD holders, we highlight several key points:
Career Development: These contracts provide early-career researchers with a structured pathway to develop their skills, gain experience, and establish themselves in their respective fields.
Research Independence: By offering fixed-term contracts, C2TN empower PhD holders to pursue their research interests and projects independently, laying the foundation for future academic and scientific contributions.
Flexibility: Fixed-term contracts offer flexibility for both researchers and institutions, allowing for adjustments in research focus, career goals, and organizational needs over time.
Talent Retention: Contribution for further stable employment opportunities for early-career researchers encouraging talent retention, fostering a dynamic and diverse research community.
Competitive Advantage: C2TN demonstrates commitment to supporting early-career researchers and attracting top talent, enhancing their competitiveness in the academic and research landscape.
Overall, fixed-term contracts of up to three years serve as a vital mechanism for nurturing the next generation of researchers, promoting innovation, and driving progress in various fields.

15.3 Strategy and funding for internationalization activities and promotion of European Formal R&D networks in 2025-2029

	2025	2026	2027	2028	2029	Total
Required ammount	20000	20000	20000	20000	20000	100000

Internationalization activities and network promotion are crucial aspects of C2TN strategy, which is engaged in over 30 international networks, platforms, associations, and infrastructures. This participation drives cross-sector collaborations and research projects, increases visibility, and enhances capabilities, resulting in cutting-edge research in environmental, radiopharmaceutical sciences and health physics, advanced materials, and cultural heritage. However, participation in these networks and platforms usually requires annual fees.
Under the Horizon 2020 EURATOM Programme and beyond, research activities are steered by the EU´s Research Networks and Platforms (RPs), which define Strategic Research Agendas (SRA). C2TN participation in these RPs enhances new research activities, particularly in the areas of environment, and radiopharmaceutical sciences and health physics. Below are listed some of those RPs.
- ALLIANCE (European Radioecology Alliance) - research on radioecology issues and environmental exposures.
- NERIS (Preparedness for Nuclear and Radiological Emergency Response and Recovery) - research on nuclear and radiological emergency response and preparedness issues.
- EuradScience (EuradScience) - research on radioactive waste management from cradle to grave within EURAD EJP.
- MELODI (Multidisciplinary European Low Dose Initiative) - research on low dose and protracted exposures to ionizing radiation.
- EURADOS (European Radiation Dosimetry Group) - research on dosimetry issues.
- RENEB (Running the European Network of Biological dosimetry and physical retrospective dosimetry) - research on biological and retrospective dosimetry.
- SHARE (Social sciences and Humanities in ionising radiation Research) - research on society interaction with ionizing radiation applications.

Radiopharmaceutical Sciences and Health Physics activities are also boosted by C2TN participation in the Euro-BioImaging (EuBI) platform. C2TN aims to become a node of this ESFRI, accessing biological and biomedical imaging technologies in Europe, imaging data repositories and analysis tools, and training opportunities in imaging. C2TN participation in MEDICIS, a CERN facility dedicated to R&D in life sciences and medical applications, to produce innovative high-purity radioisotopes for pre-clinical and early-phase clinical studies, is part of its strategy for the Health field. At C2TN, pre-clinical tests are carried out on radioisotopes produced at MEDICIS, particularly for cancer research.

C2TN's involvement in networks and infrastructures also strongly boosts the area of Advanced Materials.
A Portuguese team, led by C2TN researchers, is responsible for developing and operating a unique cutting-edge infrastructure at ISOLDE/CERN, with various spectrometers and detection systems, conducting experiments and measurements relevant to different materials. Moreover, a Portuguese team participates in the activities of the Time of Flight (TOF) spectrometer at CERN, a premier facility worldwide to perform neutron cross-section measurements of relevance for Nuclear Astrophysics and Nuclear Technology.
C2TN researchers are also funding members of the EIMM (European Institute of Molecular Magnetism), a European leading reference association for research and training in the area of magnetism in molecular materials.
The C2TN participation in IPERION H2020, a unique European research infrastructure for restoration and conservation of Cultural Heritage, deeply improves C2TN capacity in the Cultural Heritage field. It allows access to i) archives in European museums or conservation institutes, ii) advanced mobile analytical instrumentations for in-situ non-invasive measurements, and iii) integrated platforms where large scale facilities are coupled with medium scale installations.
A large number of C2TN researchers are involved in IAEA activities such as Coordinated Research Projects (CRP), participating in technical meetings and workshops, acting as experts, etc. Additional own funding to that provided by the IAEA is often required.
The requested funding will facilitate the establishment and upkeep of international networks, fostering academic exchanges, collaborative projects, and knowledge sharing initiatives. It would also support participation in international conferences, workshops, and events, aiding in the dissemination of research findings and boosting the institution's global visibility and reputation. Moreover, investing in internationalization efforts would promote cultural exchange, diversity, and cross-cultural understanding, enriching the academic experience for students and researchers. In summary, funding for internationalization initiatives is vital for positioning C2TN as a leading player in the global academic/research arena and for fostering innovation, excellence, and sustainable development through international collaboration.

15.4 Plan and funding for specific infrastructure and equipment in 2025-2029

	2025	2026	2027	2028	2029	Total
Required ammount	200000	650000	350000	0	0	1200000

C2TN, as a high-intensity laboratory research unit, requires equipment replacement due to aging and reloading operations for certain nuclear techniques relying on radioactive sources. Moreover, to expand impact and enhance capabilities, new equipment is needed. Below is a detailed funding request.

EDXRF spectrometer (ca. 100 k€)
C2TN has extensive expertise in utilizing this methodology. However, the old system (1990), broke down and could not be replaced. This equipment complements the existing methods (ICP-MS, PIXE, SEM-EDS), allowing the determination of composition of a wide range of materials and sample matrices. It is a versatile, fast, cheap and non-invasive method for multi-elemental analysis and its acquisition will allow to pursue/improve research in Environment, Earth Sciences and Cultural Heritage. The acquisition will be financed (20%) by other projects.

Ionizing radiation Hub (ca. 200 k€)
The C2TN Ionizing Radiations Facility (IRIS) has an experimental gamma irradiator (PRECISA22), broadly applied to the development of products and processes in material, environmental and health fields. PRECISA22 has radioactive 60Co gamma sources, which have now a very low activity, needing an urgent reload.

Liquid Scintillation Counter (ca. 150 k€)
C2TN has extensive experience in 14C and 3H dating methods in a variety of fields, ranging from archaeological investigations to characterisation and protection of water resources. The former LSC was acquired more than 20 years ago. Although operational, it is increasingly difficult to repair due to a shortage of parts and lack of guarantees from representatives. This LSC supports the Radiocarbon

Dating Laboratory and the Tritium Dating Laboratory for Water Resources, both unique in Portugal.

Facility for radiobiology /pre-clinical biological evaluation (400 k€)
To enhance research activities, we plan to upgrade our experimental platforms for advanced studies in radiobiology. This will aid in understanding the biological effects of external ionizing radiation and evaluating the diagnostic and therapeutic potential of radioactive compounds. The upgrade includes acquiring: 1) a cell and small animal X-ray irradiation equipment, 2) a surface plasmon resonance system for analysis of biomolecular interactions of novel target specific agents, 3) a flow cytometer and a live cell imaging equipment for quantitative live cell analysis including 3D and 4) an autoradiography device for detection of tissue-cellular distribution of radioprobes. Furthermore, an upgrade of the existing micro-PET/SPECT-CT imaging equipment with a new SPECT detector is requested to enable the acquisition of SPECT images with superior resolution. This upgraded facility will boost the translational potential of our research, enabling more detailed mechanistic studies across various biological scales and models, including 3D and preclinical imaging.

Neutron Generators for analytical purposes (200k€)
Neutron generators are used as alternatives to research reactors to obtain neutrons. With the Portuguese Research Reactor shutdown, C2TN lost the capability to perform in-house neutron radiography and activation analysis that were applied to cultural heritage and environmental studies. It is envisaged to acquire a neutron generator using DD reactions for neutrons with ~2E8 n/s intensity. While lower than previously available with the reactor, it will enable gamma neutron activation analysis and neutron imaging of small objects, as complement to other techniques. A neutron generator is also excellent for training students in a variety of topics, ranging from ion sources to nuclear electronics. Neutron generators also provide a test ground to prepare experiments at larger facilities. The equipment costs cover a DD tube and the control electronics.

Low Temperature SNSPD Facility (100k€)
Quantum technologies hold promise for revolutionizing fields such as computing and communication. In quantum key distribution setups, the transmission speed of encoded photons depends on factors like laser pulse frequency and the receiver's detection module. Traditional single-photon avalanche diodes (SPADs) have limitations, such as low detection efficiency (~20%) and high dead times. However, superconducting nanowire single-photon detectors (SNSPDs) can offer significant improvements at low temperatures, with efficiencies up to 90% and reduced dead times/dark counts. Cryostat-based cooling enables SNSPDs to achieve such performance. This facility will upgrade our low-temperature capabilities and address novel materials technologies, complementing the infrastructures of LapMET. This not only supports the expansion of our research activities but also aligns with our strategic vision of embracing new technologies.

15.5 Plan and funding for R&D Unit internal call for project applications of the R&D Unit

	2025	2026	2027	2028	2029	Total
Required ammount	45000	45000	45000	45000	45000	225000

Within the scope of the strategic vector on "TALENT ATTRACTION, DEVELOPMENT AND RECOGNITION", C2TN plans to launch internal calls for open project applications, inviting proposals from early-stage researchers (with 2-7 years of experience post-PhD). Annually, three projects will be supported, typically one per Thematic Line (TL), with a funding allocation of 15 k€ each, totaling 15 projects over the five years. Calls will be made internally in the first semester of each year.
The initiative aims to partially fund original exploratory projects based on new ideas, including high-risk challenges, and to promote the career development of its early stage researchers. This sponsorship will enhance their preparedness and competitiveness for future applications. Projects will cover the scientific areas of the 3 TLs, with a total of 5 projects in each TL.
An internal commission comprising the coordinators of the Research Groups and TLs will evaluate and select projects based on Excellence (60%), Impact (40%), and Quality and efficiency of the implementation (40%). The projects will be allocated to the coordinators of the related TL and Research Groups. Each coordinator will evaluate the projects using the specified criteria, and the score for each award criterion will be determined by the median of the coordinators scores.

Quantification and Justification of Funding:
Research Excellence: Internal calls aim to promote research excellence and innovation within C2TN. By providing funding support to early stage researchers, the research unit can catalyze high-impact projects that address key scientific challenges and advance knowledge.
Capacity Building: Funding from internal calls enables early stage researchers to develop skills, expand networks, and enhance competitiveness for external funding opportunities. This investment in capacity building strengthens the research capabilities of C2TN and contributes to its long-term sustainability.
Alignment with Objectives: The funding allocated through internal calls supports projects aligned with the objectives of C2TN TLs, strategic priorities, and broader mission, maximizing its impact and relevance.
Leveraging External Funding: Successful outcomes from projects funded through internal calls enhance C2TN track record and reputation, increasing competitiveness for external funding sources and amplifying impact.
Overall, this funding is essential to drive research excellence, capacity development and strategic alignment within C2TN. By attracting and developing talent, the research unit gains reputation, increases its leverage potential, amplifies the impact of internal investments and promotes a virtuous cycle of research excellence and resource mobilization. By supporting innovative research projects led by its researchers, the unit can advance its mission, achieve its goals and contribute to scientific progress and social impact.

15.6 Plan and funding for advanced training programs of the R&D Unit

	2025	2026	2027	2028	2029	Total
Required ammount	54000	110000	169000	172000	117000	622000

Nine PhD grants, in total, will be launched in 3 calls in each of the 3 Thematic Lines (TLs) fields: i) environment and cultural heritage, ii) radiopharmaceutical sciences and health physics, and iii) advanced materials. The calls will follow the IST rules on the "Application Process for PhD Scholarships", with two possible periods for open the calls, June 1 to July 15, and November 15 to January 15. This scheduling allows recruited students to smoothly participate in the academic part of PhD programs, such as Chemistry, Physics, Environmental Engineering, Mechanical Engineering, Materials Engineering, Biotechnology and Biosciences and Biomedical Engineering.
Additionally, a new doctoral program in "Nuclear Sciences and Engineering" of the Department of Nuclear Sciences and Engineering of IST, expected to start in 2025/2026, will increase the number of PhD students at C2TN. The vast majority of C2TN members belong to this department and potentially all will be involved in the doctoral program, either as responsible for courses or as supervisor. Nuclear Sciences and Engineering, owing to their multidisciplinary and cross-cutting nature, stand at the forefront of technology, making a distinctive contribution to applications and fundamental knowledge in various fields, including environment, health, industry, space exploration, materials, and cultural heritage, among others. This doctoral program aims to provide students with the necessary skills in nuclear sciences and technologies needed to develop new tools, including those that address the big societal challenges, while simultaneously advancing knowledge in areas of recognized social, economic, industrial and environmental importance. It targets individuals interested in pursuing an academic and/or scientific career in this area, or alternatively, a professional path that brings added value to perform tasks of advanced complexity in national and international entities, companies across various sectors, healthcare establishments, museums, and other organizations. The students will be deeply involved in the research activities of C2TN, profiting from its laboratories, equipment and infrastructures. A key feature of this PhD program will be close interaction with C2TN researchers, especially early-stage researchers, which will provide a smooth knowledge transfer to students, while also enhancing the early-stage researchers skills.
C2TN members will continue to participate/propose in Doctoral Networks, such as Marie Sklodowska-Curie Actions, promoting doctoral education, supporting reference research and contributing for a resilient, flexible and creative human resource base.
The selection of PhD students will be made considering the experience of the candidate in the scientific field of the TL, the CV, and a motivation letter, as well as gender equality. Reference letters and an interview can also be considered if needed. The evaluation will be made by a panel of a minimum of 3 C2TN members, which will evaluate applications in accordance with the previously defined evaluation criteria. All panel members commit to respecting a set of responsibilities essential

to the evaluation process, such as the duties of impartiality, declaring any potential situations of conflict of interest and confidentiality. For each application, the panel will produce a final evaluation form in which the arguments that led to the classifications assigned to each of the criteria are presented in a clear, coherent and consistent manner. The results of the assessment will be communicated via email to the email address used by the candidate to send the application.
The PhD research projects of the 9 PhD students will be in the fields of the 3 TL, being fully aligned with C2TN strategy and contributing to answer societal impactful challenges in environmental sustainability, good health/well being and materials innovation. They will allow to cover the different subjects of the 3 TLs:
ESRCH: Water Resources protection; air quality management; cultural heritage preservation
RSHP: radioactive tools for cancer theranostics; biological effects of radiation; dosimetry for medical physics
AM: molecular materials; intermetallics materials; materials interaction with radiation.
The recruitment of these students will also allow the identification and development of talent, for future recruitment to permanent positions and/or to fulfill the needs of the labor market, that will create innovation, knowledge and ideas for economic and social benefit.

16. Funding planned for 2025-2029 for evaluation purposes

16.1 Expected funding of the R&D Unit for 2025-2029

FUNDING SOURCES (TOTAL FUNDING)	2025	2026	2027	2028	2029	TOTAL (K€)
Fundação para a Ciência e a Tecnologia, I.P. - FCT	1.237	1.246	1.256	1.266	1.276	6.281
Project funding expected to be received	750	750	750	750	750	3.750
Expected funding for contracts of researchers with PhD (1)	312	318	324	330	337	1.621
Expected funding for PhD, PostDoc or other fellowships (2)	175	178	182	186	189	910
Audit certificates	0	0	0	0	0	0
Other funding	0	0	0	0	0	0
Other national sources	110	115	120	125	130	600
Funding expected to be received from Participant or Management Institutions	0	0	0	0	0	0
Public sources (3)	10	10	10	10	10	50
Companies, industry and other private sources based in Portugal (3)	50	55	60	65	70	300
Any other funding source (3)	50	50	50	50	50	250
International sources	500	526	536	546	556	2.664
European Commission (3)	250	263	268	273	278	1.332
Companies, industry and other private sources not based in Portugal (3)	0	0	0	0	0	0
Other fundingsources (3)	250	263	268	273	278	1.332
Total (K€)	1.847	1.887	1.912	1.937	1.962	9.545

(1) Payed through an institution or directly to researchers with PhD integrated in the R&D Unit

(2) Payed directly to fellows, researchers or students integrated in the R&D Unit

(3) Grants, projects, fellowships, prizes received, etc.

16.2 Expenditure budget of the R&D Unit at the Main Management Institution

Associação do Instituto Superior Técnico para a Investigação e o Desenvolvimento (IST-ID)

Expense Budget items	2025	2026	2027	2028	2029	TOTAL (K€)
Human Resources	487	496	506	516	526	2.531
Contracts of researchers with PhD	312	318	324	330	337	1.621
PhD, PostDoc or other fellowships	175	178	182	186	189	910
Contracts of technical or secretarial staff	0	0	0	0	0	0
Missions	45	45	45	45	65	245
Visiting researchers or consultants	25	15	25	0	26	91
Patents registration and maintenance	4	4	4	4	4	20
Service or product procurement and acquisition	448	455	454	463	476	2.296
Equipment	225	250	250	250	200	1.175
Adaptation of facilities and buildings	150	150	150	175	175	800
Audit certificates	0	0	0	0	0	0
Other expenses	463	472	478	484	490	2.387
Total (K€)	1.847	1.887	1.912	1.937	1.962	9.545

16.3 Expenditure budget of the R&D Unit in other Management Institutions (if any)

16.4 Estimate of the percentage distribution by types of expenditure to be ensured with Base Funding for 2025-2029 that will be obtained following the evaluation

Expense Budget items	%
Human Resources	10 %
Contracts of researchers with PhD	0 %
PhD, PostDoc or other fellowships	0 %
Contracts of technical or secretarial staff	10 %
Missions	9 %
Visiting researchers or consultants	1 %
Patents registration and maintenance	0 %
Service or product procurement and acquisition	35 %
Equipment	12 %
Adaptation of facilities and buildings	8 %
Audit certificates	0 %
Other expenses	25 %
Total	100 %

17. Budget justification for 2025-2029

17.1 Justification of the total proposed budget

C2TN's research activities require a considerable budget to achieve the main goals proposed for 2025-2029 and to maintain the large set of laboratorial infrastructures and equipment. Expenses will be shared with funds obtained from other national and international projects (e.g. FCT, EU), contracts and services. Nevertheless, an important part of the budget will be required to implement

the new research projects, startup grants for young researchers and advanced training of PhD students and PostDocs.

SERVICES OR PRODUCT PROCUREMENT AND ACQUISITION is crucial for enabling the R&D unit to achieve its objectives, advance its strategy, and maintain its competitiveness in the field for several reasons: i) Access to Specialized Services allows C2TN to access expertise and resources that are not available internally, like INAA and PGAA. This enables the unit to enhance its research capabilities and pursue innovative projects. ii) Acquisition of Cutting-edge Technologies allows researchers to explore new methodologies, conduct experiments more efficiently, and generate high-quality data; iii) Collaborative Opportunities facilitating collaboration with external partners; iv) Quality Assurance: Procuring high-quality products or services ensures the reliability and reproducibility of research outcomes. v) Compliance and Standards enables adherence to specific standards or regulations enhancing the credibility of research outcomes; vi) Efficiency and Cost-effectiveness: While internal development of certain resources may be feasible, it can be time-consuming and costly, allowing the R&D unit to allocate resources more strategically. In addition to accomplish the objectives and strategy to the R&D unit a substantial budget is required to support the acquisition of chemical and biological reagents, analytical solvents, laboratory consumables, electronic components, gases, acquisition of commercially available radionuclides and radioactive sources and cell lines and animals for experimentation. Due to the high laboratory intensity level of C2TN with high maintenance and operating costs, part of the budget will be used for the acquisition of services to repair/maintain infrastructures and equipment. Payment of open-access journals' fees will also be covered.

OTHER EXPENSES: an average overhead rate of 25% was assumed.

MISSIONS: The budget allocated to this item will be used to support travel/living expenses of researchers to disseminate the main scientific achievements obtained within the scope of the present proposal in national and international conferences, workshops and symposia. Field-work activities particularly for sampling campaigns in earth sciences, environment and cultural heritage studies also comprise budget for missions. Mission budget will also support training courses and outreach actions, promoting the dissemination of the scientific activities and skills of C2TN's researchers and internationalization of the R&D unit activities. Participation of C2TN researchers in national and international meetings in the framework of research platforms and networks to discuss future scientific projects and consortia is also foreseen.

ADAPTATION OF FACILITIES AND BUILDINGS: The budget allocated to this item will be used to carry out works and adaptation in the existing facilities and laboratories to house the new research activities and new equipment, taking in consideration health and environmental safety and also radiation protection measures.

VISITING RESEARCHERS AND CONSULTANTS: the budget allocated to this item is intended to pay travel/ living expenses regarding 2 visits of the External Advisory Board. Expenses related with visits of experts or consultants in the scope of annual C2TN international conferences and C2TN Academy activities are also planned and will be paid through this item.

PATENTS REGISTRATION AND MAINTENANCE: Costs regarding patent registration will be also covered.

17.2 Justification of the Human Resources component in total proposed budget

Human resources' renewal is an essential requirement to accomplish the proposed R&D Unit objectives. C2TN has a large set of specialized scientific equipment, laboratories and infrastructures, some of them unique in Portugal, that are used to undertake most of the research activities in a wide variety of applications, from environment, earth sciences and cultural heritage to healthcare and radiation protection. Since many of these multidisciplinary facilities and infrastructures are complex, their proper operating and maintenance need a wide range of expertise and dedicated staff. Therefore, our plan for 2025-2029 involves, apart from the human resources already requested and justified in the Programmatic Funding, three fixed-term contracts for highly qualified technical staff holding a PhD to support the operation of specific equipment and infrastructures. The objective is to

launch 1 contract under the scope of each thematic line:

Earth Systems, Radioactivity and Cultural Heritage - a position for a technician with Geology degree or related and knowledge and skills in the area of Nuclear Geosciences will be opened. The main activities will be focused on environmental radioactivity, geochemistry and radioactive waste management.

Radiopharmaceutical Sciences and Health Physics - a position for a technician to support operating the microSPECT/PET/CT will be opened. We seek for a physicist, biomedical engineer or related degree with willingness to learn and carry out preclinical small rodent imaging studies for various disease models and drug discovery using preclinical SPECT/PET/CT scanners.

Advanced Materials - a position for a technician with a Chemistry degree or related, with expertise in Chemistry and Physics of Materials, will be created. He/she will be dedicated to materials' structural characterization by using magnetic and electrical properties and cryogenics techniques, low temperature techniques, high magnetic fields and Mössbauer spectroscopy.

17.3 Justification of the Equipment component in total proposed budget

Modernizing equipment within C2TN is crucial for achieving our primary objectives over the next five years and beyond. This investment is integral to enhancing our technological capabilities and conducting research aligned with our strategic vision. Depending on the available funds sourced from various avenues such as projects, contracts, and services, we plan to procure medium or small-scale equipment in addition to larger items requested through Programmatic Funding.

Therefore, alongside potential replacements or upgrades for smaller equipment, the following acquisitions are planned: i) MicroDose, equipment for accurate measurements of low-level natural radioactivity in small samples of Cultural Heritage (40 k€); ii) Piezoelectric ultrasonic cleaner - single grain disc cleaner for luminescence dating (0,5 k€); iii) Powder diffraction sample holder for the XRD equipment enabling expands the analytical capabilities and the characterization of a wider range of materials and samples (1k€); iv) Dehumidifier for the luminescence dating laboratory improving laboratory sampling treatment conditions (0,3 k€); v) Anesthesia system for preclinical imaging studies (~15k€); vi) Cell counter (~14k€); vii) Gel imaging system (~20 k€); viii) Equipment for contact angle measurements and drop shape analysis for characterization of the weattability of solid surfaces and determination of the surface energy of solids (~30 k€); ix) Zeta potential analyser for materials application. The analysis depends on several properties including adhesion between solids (as well as cells), adsorption and chemical reactions of ions/molecules, surfactants, polymers (~30 k€); x) CHNS elemental analyser (~30 k€).

18. Composition of the future External Advisory Board

18.1 Composition of the future External Advisory Board

Name	Institution	Country
Professor Zsolt Kasztovszky	Centre for Energy Research	Hungary
Professor Eugenio Coronado	Universidad de Valencia	Spain
Professor Renata Mikołajczak	National Centre for Nuclear Research	Poland

Declaration of commitment of the R&D Unit

☑ 2024-04-17 07:11 By António Cândido Lampreia Pereira Gonçalves

Declaration of commitment of the Main Management Institution

☑ 2024-04-17 12:29 By Maria Isabel Marques Dias