PIANOFORTE
EUROPEAN PARTNERSHIP FOR RADIATION PROTECTION RESEARCH

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PIANOFORTE Partnership

European Partnership for Radiation Protection Research

Horizon-Euratom – 101061037

D6.4 – Information on projects selected for funding - call 1

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Reviewer(s): Members of the Executive Board

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Table of Contents

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1. First call for research projects

1.1 Call documents and research topics

Three research topics with the highest priority were approved during online General Assembly meeting held online on Tuesday 17th January 2023:

Topic 1 - Developing a knowledge base for a better understanding of the disease pathogenesis of ionising radiation-induced cancer to improve human health risk assessment.

Topic 2 - Individualised diagnostic and therapeutic procedures for optimisation of benefit/risk ratios.

Topic 3 - Development of risk assessment and risk management approaches and technological capabilities to cope with scenarios arising from threats due to war or armed conflict situations or natural disasters taking into consideration social, ethical and legal issues.

1.2 Important dates

The first open call for proposals has been launched on Monday 24th April 2023. The original deadline for submissions has been extended due to a delay of the system's opening. The revised deadline for submissions was 26th July, 2023 (15:00 CEST). The first call for research projects has been accomplished during PIANOFORTE General Assembly on Tuesday 5th December 2023 (Budapest, Hungary), where the results of the first call have been presented and selected research projects approved for funding.

1.3 Dissemination of information about the Call

Administrative, legal and financial conditions of Pianoforte Open Call 2023 were presented during Call Infoday organized online on 10th May 2023. Video replay of the webinar was posted on YouTube channel (https://lnkd.in/ejsND8eK) and presentations from the online meeting (General information (PDF), Legal, administrative and financial information (PDF)) were available on the PIANOFORTE website together with "Frequently Asked Questions". Information about the Call has been disseminated also by means of social media (LinkedIn and X network).

1.4 Call evaluation procedure

Call evaluation procedure is summarized in Figure 1. Project coordinators submitted full proposals before call deadline – 26th July 2023. There were 24 proposals submitted. First, all projects were checked for their eligibility. Afterwards, evaluation by the independent international Review Panel took place.

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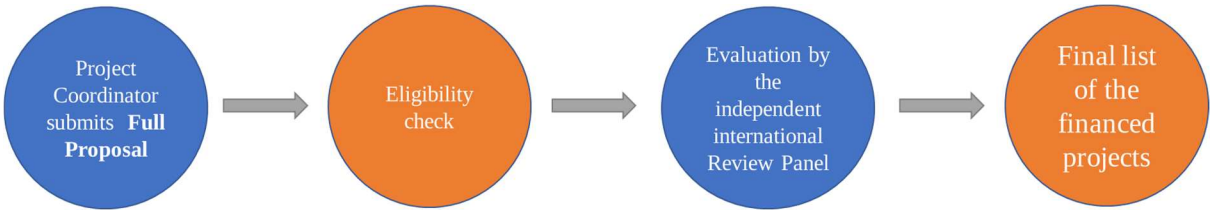

Figure 1: Schema of the call evaluation procedure.

1.5 Evaluation criteria

Evaluation criteria were the same for all submitted project proposals with equal weight of each criterion:

- **Excellence (threshold 3/5)**

Clarity and pertinence of the project's objectives, and the extent to which the proposed work is ambitious, and goes beyond the state of the art.
Soundness of the proposed methodology, including the underlying concepts, models, assumptions, inter-disciplinary approaches, appropriate consideration of the gender dimension in research and innovation content, and the quality of open science practices, including sharing and management of research outputs and engagement of citizens, civil society and end-users where appropriate.

- **Impact (threshold 3/5)**

Credibility of the pathways to achieve the expected outcomes and impacts specified in the work program, and the likely scale and significance of the contributions from the project.
Suitability and quality of the measures to maximize expected outcomes and impacts, as set out in the dissemination and exploitation plan, including communication activities.

- **Quality and efficiency of the implementation (threshold 3/5)**

Quality and effectiveness of the work plan, assessment of risks, and appropriateness of the effort assigned to work packages, and the resources overall.
Capacity and role of each participant, and the extent to which the consortium as a whole brings together the necessary expertise.

Reviewers were asked to evaluate submitted proposals by the whole numbers and halves according to the following evaluation scores:

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Score	Grade	Definition
0	The proposal fails to address the criterion or cannot be assessed due to missing or incomplete information (unless the result of an 'obvious clerical error').	
1	Poor	The criterion is inadequately addressed, or there are serious inherent weaknesses.
2	Fair	The proposal broadly addresses the criterion, but there are significant weaknesses.
3	Good	The proposal addresses the criterion well, but with a number of shortcomings.
4	Very good	The proposal addresses the criterion very well, but with a small number of shortcomings.
5	Excellent	The proposal successfully addresses all relevant aspects of the criterion. Any shortcomings are minor.

1.6 Call results

From the submitted 24 project proposals, there were 10 not recommended for funding. The other 14 projects (Topic 1 – 2 projects, Topic 2 – 8 projects, Topic 3 – 4 projects) were ranked according to their overall scores. Nine projects with the best evaluation scores fitted into Call 1 total budget of 13 MEUR and were proposed to PIANOFORTE General Assembly to be selected for funding. The first call for research projects has been successfully accomplished and 9 research projects were approved by PIANOFORTE General Assembly on Tuesday 5th December 2023 in Budapest, Hungary.

The overall representation of EU countries in submitted proposals is shown in Figure 2. It is obvious that the countries are also widely represented in the funded projects (Figure 3). In total, 197 entities (Beneficiaries, Affiliated entities, etc.) was involved in 24 submitted projects and 86 entities participate in 9 funded projects. Two of nine project coordinators are women (22 %).

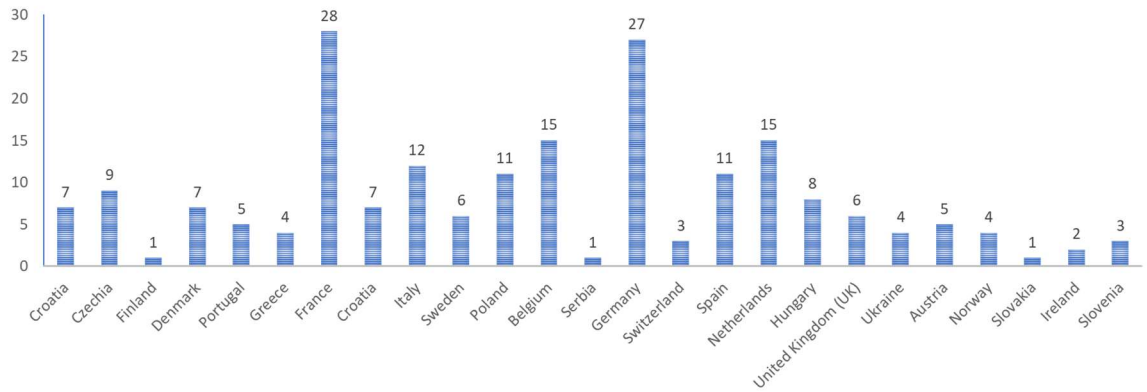

Figure 2: Country distribution in submitted proposals.

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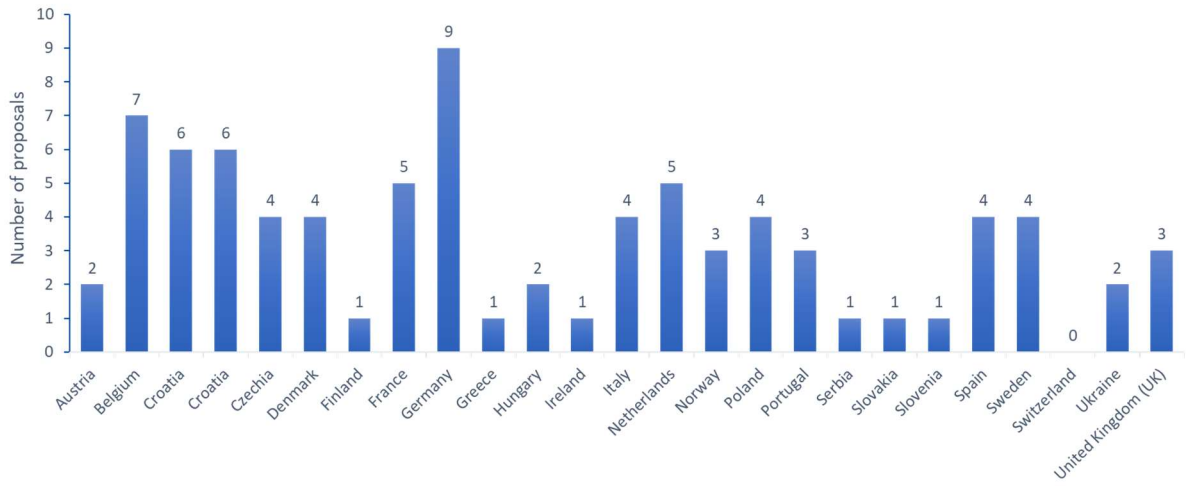

Figure 3: Country distribution in funded proposals.

2. Selected research projects

The 9 projects approved for funding are:
Topic 1 - Developing a knowledge base for a better understanding of the disease pathogenesis of ionising radiation-induced cancer to improve human health risk assessment

- DISCOVER - Dissecting radIation effectS into the Cerebellum micrOenVironmEnt driving tumour pRomotion.

Topic 2 - Individualised diagnostic and therapeutic procedures for optimisation of benefit/risk ratios

- SONORA - Towards safe, optimized and personalized radiology and radiotherapy procedures for pregnant patients.
- LutADose - Personalized dosimetry to improve the clinical outcome of prostate cancer patients treated with 177Lu/225Ac-PSMA targeted therapies.
- VERIFIED - In vivo patient-specific real-time dosimetry for adaptive radiotherapy.
- IMAGEOMICS - Optimizing Benefit/Risk Ratio in Breast Cancer Diagnosis and Radiotherapy: Identifying Molecular, Cellular and Imaging Signatures of Breast Cancer Heterogeneity to Improve Personalized Therapeutic Strategies for Synergistic Treatment Combinations.
- IMMPRINT - Integrated molecular Imaging for Personalized Biomarker-based Breast Cancer Characterization and Treatment.

Topic 3 - Development of risk assessment and risk management approaches and technological capabilities to cope with scenarios arising from threats due to war or armed conflict situations or natural disasters taking into consideration social, ethical and legal issues

- RRADEW - Resilience to RADiological Events in Wartime.
- CITISTRA - Citizen measurements as complementary radiation monitoring strategy

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in threats due to armed conflict or natural disasters.

- PREDICT - ImPRovements in atmospheric dispErsion moDellIng and protective action strategies in case of nuclear detonations.

2.1 DISCOVER - Dissecting radIation effectS into the Cerebellum microenvironment driving tumour pRomotion

Project coordinator: ENEA, Italy – Simonetta Pazzaglia
simonetta.pazzaglia@enea.it

Project partners (3):

- Italian National Agency for New Technologies (ENEA), Energy and Sustainable Economic Development , Roma, Italy
- Federal Office for Radiation Protection, Oberschleissheim, Germany
- National Public Health Centre, Budapest, Hungary

Abstract:

Radiation carcinogenesis has classically been attributed to unrepaired or misrepaired DNA damage. By now, there is increasing recognition that radiation can induce changes within the microenvironment and cause epigenetic modifications, which can also contribute to the development of cancer, challenging the conventional target theory in radiobiology. However, the interplay between DNA damage, microenvironmental changes, and epigenetic modifications in radiation-induced carcinogenesis is complex and not yet fully understood.

DISCOVER will study the impact of radiation-induced changes in the microenvironment and the influence of related cell communication processes on carcinogenesis. The project will exploit a robust model of radiation-induced carcinogenesis, the Ptch1+/- mice, exhibiting a genetic predisposition for development of medulloblastoma (MB), a cerebellar tumour. Irradiation of these mice, even at low dose, increases MB incidence. The project aims to understand how different cerebellar populations, such as granule cell precursors, the MB cell of origin, and astrocytes, microglia and endothelium, representing microenvironmental components, respond to moderate (2 Gy) and low (0.1 Gy) radiation doses and contribute to tumour formation. Model systems of different complexity including (i) Ptch1+/- mice, (ii) ex-vivo cerebellum slices and (iii) in vitro cerebellar cell cultures, will be used to evaluate the effect of the microenvironment in transmitting radiation signals driving carcinogenesis. We will conduct a comprehensive analysis of various types of data, including morphology, function, tumourigenesis and omics data. We will also investigate secretome, as well as extracellular vesicles from exposed tissue and their specific bioactive cargo for their role in mediating radiation tumourigenesis. An integrated analysis of DISCOVER animal data and publicly available human brain cancer data aims to identify patterns/signatures for MB development.

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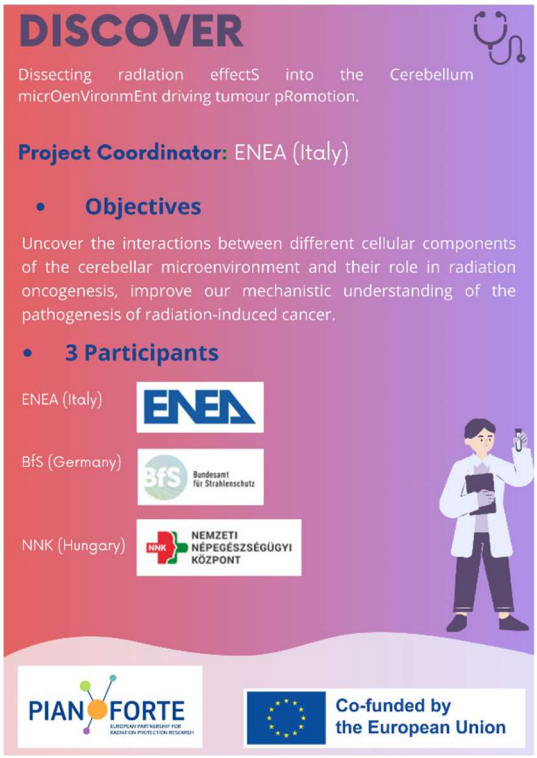

Figure 4: DISCOVER project presentation at social media.

2.2 SONORA - Towards safe, optimized and personalized radiology and radiotherapy procedures for pregnant patients

Project coordinator: MEFOS, Croatia – Hrvoje Brkic
hbrkic@mefos.hr

Project partners (20):

- Faculty of Dental Medicine and Health Osijek, Osijek, Croatia
- Faculty of Medicine in Osijek (MEFOS), Osijek, Croatia
- Nuclear Physics Institute of the CAS (NPI), Prague, Czech Republic
- University of Helsinki (STUK), Helsinki, Finland
- Aarhus University, Dept. of Clin. Medicine (DCPT), Aarhus, Denmark
- Instituto Superior Técnico (IST), Bobadela, Italy
- National Radiation Protection Institution (SURO), Prague,
- Greek Atomic Energy Commission (EEAE), Agia Paraskevi, Athens
- Institute for radiation protection and nuclear safety (IRSN), Fontenay-aux-Roses, France
- Dubrava University Hospital (DUH), Zagreb, Croatia
- Ruder Boškovic Institute (IRB), Zagreb, Croatia
- Veneto Institute of Oncology (VIO), Padova, Italy
- Skandion Clinic (SKANDION), Uppsala, Sweden
- Polytechnic Institute of Lisbon (IPL), Lisbon, Portugal

- Institute of Nuclear Physics, Polish Academy of Sciences (IFJ), Krakow, Poland
- Institute for Medical Research and Occupational Health (IMROH), Zagreb, Croatia
- Belgian Nuclear Research Centre (SCK-CEN), Mol, Belgium
- University of Kragujevac, Faculty of Science (UKG), Kragujevac, Serbia
- Glowny Instytut Gornictwa (GIG), Katowice, Poland
- National Institute of Health (ISS), Rome, Italy

Abstract:

A number of pregnant patients are undergoing diagnostic and therapeutic radiological procedures placing the unborn child at an increased risk due to the use of ionising radiation. The lacking knowledge and patients' anxiety can lead to unnecessary termination of pregnancy. EU BSS requires that when the pregnant patient undergoes medical exposure, special attention should be given to the justification and optimization of the procedure, considering both, the expectant individual and the unborn child. This research proposal focuses on improving the accuracy of fetal doses estimation in diagnostic and interventional radiology (DIR) and radiotherapy (RT) to optimize process and improve benefit/risk communication with the patient. In DIR, a variety of methods and software are used for fetal dose estimation in clinical practice. However, there is a lack of harmonization, resulting in large differences in fetal dose estimation for the same cases. In RT, the treatment planning systems do not allow for accurate assessment of dose to the fetus. This project aims at:

- developing physical phantoms of different pregnancy stages,
- developing a library of personalized computational phantoms using available CT or MR images of pregnant patients and a method to select appropriate phantom using clinical parameters,
- investigating fetal doses and dosimetry methods for different DIR procedures, RT techniques and patient anatomies using the physical and personalize computational phantoms developed in the project. The investigation includes the doses from imaging in RT process,
- identifying the factors that affect the fetal dose estimations by methods used in clinical practice in DIR and give further guidance on the limitations of each method to decrease variability of dose estimation and enable further personalization and optimisation of the procedure considering fetal dose,
- developing and testing a clinical tool for estimating the fetal doses in proton RT according to the individual pregnant patient's anatomy and clinical plan parameters.

The project will result in a good practice guide to perform fetal dose estimation in pregnant or potentially pregnant patients undergoing radiology or radiotherapy procedures. Fetal dose and associated risk data will be considered and debated for their ethical aspects to increase the quality of risk-benefit communication with the patient.

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Figure 5: SONORA project presentation at social media.

2.3 LutADose - Personalized dosimetry to improve the clinical outcome of prostate cancer patients treated with 177Lu/225Ac-PSMA targeted therapies

Project coordinator: KU Leuven, Belgium – Michel Koole
michel.koole@kuleuven.be

Project partners (8):

- KU Leuven, Leuven, Belgium
- LMU Hospital, Munich, Germany
- Belgian Nuclear Research Centre (SCK CEN), Mol, Belgium
- Institut National de la Sante et de la Recherche Medicale (INSERM), Brest, France
- Erasmus Medical Centre, Rotterdam, Netherlands
- Rijksinstituut voor Volksgezondheid en Milieu (RIVM), Bilthoven, Netherlands
- Commissariat a l´Energie Atomique et aux Energies Alternatives (CEA), Paris, France
- Bundesamt fuer Strahlenschutz (BfS), Salzgitter, Germany

Abstract:
Prostate cancer is the second most frequent malignancy worldwide with metastatic castration-resistant prostate cancer (mCRPC) being very difficult to treat. A possible treatment of mCRPC is PSMA (prostate-specific membrane antigen) radioligand therapy (PRLT) to deliver a targeted high dose of ionizing radiation directly to tumour cells. However, current treatment schemes for ^{177}Lu(Beta)-PRLT use fixed therapeutic schemes, resulting in a conservative tendency to undertreat patients and

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sacrificing efficacy for safety. As a result, complete response is still uncommon with about 30% of patients not responding to treatment. Meanwhile, ^{225}Ac(Alpha)-PRLT has emerged as adjuvant therapy to improve efficacy and overcome the potential radio resistance to ^{177}Lu-PRLT. However, ^{225}Ac-PRLT can induce significant side effects such as salivary radiotoxicity, which has led patients to request treatment discontinuation. These side effects should be addressed before ^{225}Ac-PRLT can be considered for earlier lines of treatment and not only for compassionate use. Therefore, the aim of LutADose is to increase the clinical applicability of tumour and organ dosimetry during ^{177}Lu/^{225}Ac-PRLT to allow individualized treatment schemes and move away from a 'one fits all' approach. This includes improved quantitative ^{177}Lu/^{225}Ac-SPECT imaging during therapy to better estimate the pharmacokinetics (PK) of ^{177}Lu/^{225}Ac-PSMA ligands in tumours and organs at risk (OAR). For patients receiving ^{225}Ac-PRLT as adjuvant therapy to 177Lu-PRLT, we will use ^{177}Lu-PSMA PK information from the final ^{177}Lu-PRLT cycle to better predict the absorbed dose of the subsequent ^{225}Ac-PRLT cycle. In addition, we will revisit the relative biological effectiveness (RBE) of ^{225}Ac-PRLT vs ^{177}Lu-PRLT for the salivary glands to better predict differences in radiotoxic effects between ^{225}Ac-PRLT and ^{177}Lu-PRLT. Meanwhile, small scale dosimetry will be considered for ^{225}Ac-PRLT to better estimate the absorbed dose to OAR. Finally, we will evaluate the impact of the recoil daughter effect (RDE) for ^{225}Ac-PRLT and the potential renal toxicity caused by redistribution of free ^{213}Bi. As a result, we will increase the clinical applicability of image guided dosimetry during ^{177}Lu/^{225}Ac-PRLT such that therapeutic doses can be tailored for each patient individually to achieve a better risk–benefit balance and improved efficacy.

Figure 6: LutADose project presentation at social media.

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2.4 VERIFIED - In vivo patient-specific real-time dosimetry for adaptive radiotherapy

Project coordinator: SCK CEN, Belgium – Luana de Freitas Nascimento
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Project partners (8):

- Belgian Nuclear Research Centre, SCK CEN, Mol, Belgium
- Maastricht University, UM, Maastricht, Netherlands
- University of Antwerp, inViLab, Antwerp, Belgium
- Gasthuiszusters Antwerpen University Hospital, GZA, Wilrijk, Belgium
- University of Antwerp, MIPRO, Wilrijk, Belgium
- National Institute for Public Health and the Environment, Bilthoven, Netherlands
- Institute for Medical Research and Occupational Health, Zagreb, Croatia
- University Hospital Centre Zagreb KBC, Zagreb, Croatia

Abstract:

Errors in radiotherapy can have significant consequences for patients and generate concerns in public opinion due to misconceptions surrounding ionizing radiation. To enhance its safety, the implementation of in vivo dosimetry is crucial. The VERIFIED project aims to advance individualized therapeutic procedures by utilizing patient-specific information, real-time dose, and deep learning techniques in adaptive radiotherapy (ART). The primary objective of the project is to develop dynamic end-to-end methods that closely simulate real patient treatments. Our project encompasses several key objectives. First, it involves the development and characterization of appropriate phantoms featuring movable and deformable inserts, specifically targeting lung and brain tumours for ART. Additionally, we focus on investigating individualized patient-specific real-time dosimetry in cases of non-small-cell lung cancer using Volumetric Modulated Arc Therapy (ART-VMAT). This approach enables accurate and timely monitoring of radiation doses. development of a realtime dose prediction protocol for non-small-cell lung and bladder tumours ART-VMAT. This protocol combines data obtained from the developed dynamic phantoms and the patient-specific real-time dosimetry system. Deep learning algorithms are employed to enhance the accuracy of dose prediction. Furthermore, an image-based system is being implemented to monitor the patient's head surface during in adaptive hypofractionated Gamma Knife radiosurgery (hfGKRS) for brain tumours, ensuring precise treatment delivery. Additionally, we will analyse the data obtained from the patient's head surface monitoring system, incorporating deep learning-based algorithms to generate a protocol for patient selection in hfGKRS. The proposed protocols integrate state-of-the-art deep learning methods with patient specific real-time dosimetry in ART-VMAT and real-time position imaging in hfGKRS, effectively addressing several unmet needs in adaptive radiotherapy. These protocols encompass adaptability assessment, dosimetric verification, imaging validation, plan evaluation metrics, and treatment efficiency. By leveraging the power of real-time dosimetry, imaging, and deep learning, treatment efficacy can be enhanced while minimizing toxicity and radiation-induced side effects, ultimately resulting in improved patient outcomes in radiotherapy.

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Figure 7: VERIFIED project presentation at social media.

2.5 IMAGEOMICS - Optimizing Benefit/Risk Ratio in Breast Cancer Diagnosis and Radiotherapy: Identifying Molecular, Cellular and Imaging Signatures of Breast Cancer Heterogeneity to Improve Personalized Therapeutic Strategies for Synergistic Treatment Combinations

Project coordinator: NNGYK, Hungary - Géza Sáfrány
safrany.geza@nnk.gov.hu

Project partners (7):

- National Public Health Center (NNK), Budapest, Hungary
- European Alliance for Medical Radiation Protection Research (EURAMED), Wien, Austria
- Otto von Guericke University (OvGU), Magdeburg, Germany
- Centro de Investigaciones Energeticas, Medioambientales y Tecnologicas (CIEMAT), Madrid, Spain
- Barcelona Institute for Global Health (ISGlobal), Barcelona, Spain
- Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA), Rome, Italy
- University of Pavia (UNIPV), Pavia, Italy

Abstract:
A major objective of PIANOFORTE is to innovate in ionising radiation based medical diagnostic and

therapeutic applications combating cancer to improve patient health and safety. Combating cancer is in the focus of other EU initiatives as well, such as the Samira action plan, Europe's Beating Cancer Plan and Horizon Europe Mission on Cancer. IMAGEOMICS adheres to these initiatives by proposing new imaging modality to improve cancer diagnosis and solutions to increase the benefit of cancer patients from radiotherapy.

The main aims of IMAGEOMICS are to improve benefit/risk ratio of breast cancer (BC) patients by identifying patients with a predicted favorable response to combined radiotherapy (RT) and immunotherapy and to develop new imaging modality with increased diagnostic potential and reduced ionizing radiation exposure. These aims will be realized through the following specific objectives: a) investigate how RT influences immunogenic heterogeneity of BC cells of different molecular subtypes using in vitro and in vivo approaches; b) test the applicability of nanoparticles for X ray fluorescence computed tomography (XFCT) to be used for the detection of BC heterogeneity; c) to identify local and systemic signatures that predict patient benefit from combined RT and immunotherapy and test their clinical applicability; d) to integrate data retrieved from experimental models and human studies with epidemiological data to build up a protocol for optimal patient stratification. High-throughput techniques such as immunopeptidome analysis and spatial multiomics analysis coupled with single cell imaging will be used. The innovative aspects of the project rely on providing an integrative analysis based on in vitro (3D bioprints, organ-on-a-chip systems), in vivo and human studies on markers reflecting interactions between BC RT and immunotherapy as well as investigating the applicability of molecularly targeted nanoparticles to be used in XFCT, opening the possibility for further developments in their theranostic application. The successful completion of IMAGEOMICS tasks is guaranteed by its multidisciplinary team, involving radiation physicists, radiation oncologists, radiation and molecular biologists, as well as epidemiologists, all strongly committed to advance radiation protection research for the benefit of the public and patients.

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Figure 8: IMAGEOMICS project presentation at social media.

2.6 IMMPRINT - Integrated Molecular iMaging for PeRsonalized bIomarker-based breast cancer characterizatioN and Treatment

Project coordinator: OVGU, Germany - Christoph Hoeschen
christoph.hoeschen@ovgu.de

Project partners (6):

- Otto-von-Guericke-University, Magdeburg, Germany
- Heinrich Heine University Düsseldorf (HHU), Düsseldorf, Germany
- National Public Health Center (NNK), Budapest, Hungary
- Jožef Stefan Institute (JSI), Ljubljana, Slovenia
- Agencia Estatal Consejo Superior de Investigaciones Científicas (CSIC), Paterna, Spain
- European Alliance for Medical Radiation Protection Research (EURAMED), Wien, Austria

Abstract:

Molecular medical imaging plays a crucial role in modern medical diagnosis, enabling early and personalized therapy for various diseases, especially cancer. However, existing in vivo medical imaging methods have limitations for molecular imaging in humans, such as low sensitivity to molecular processes, limited spatial and temporal resolution, or high exposure to ionizing radiation. To address these challenges, IMMPRINT aims to develop a proof-of-principle demonstrator for in vivo 3D imaging, utilizing X-ray dark-field imaging (DFI) and X-ray fluorescence computed tomography (XFCT) as a novel hybrid tool for personalised tumour profiling, with a specific focus on breast cancer (BC) disease. DFI

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will aid the identification of suspicious tumour lesion sites at micrometer scales, followed by a detailed high spatial resolution molecular assessment at the local tumour level using XFCT. As a result of this approach, exposure to body-wide high ionizing radiation doses, as seen in nuclear medical imaging methods, can be confined to regions of interest, thus promoting patient safety. The DF-XFCT will rely on various pillars of innovative technology development, from novel detectors to integrated in vivo, in vitro bio-diagnostics. X-ray fluorescence is emitted when nanoparticles are excited by X-rays. Within IMMPRINT, distinct signatures of intra- and inter-tumour heterogeneity in BC will be identified, which are suitable for detection by specifically designed and targeted nanoparticles. The IMMPRINT system for hybrid DF-XFCT imaging will include standard clinical X-ray sources and will benefit from innovative detectors, enabling concurrent detection of DFI and XFCT, aimed at high spatial and energy resolution. The unequally distributed data, which includes timing and energy information, requires the development of new methods to extract 3D imaging information from this data, providing insights into the functional, molecular, and anatomical properties of BC disease. The IMMPRINT imaging system will allow new approaches for better medical diagnosis and also new biomedical research. It will demonstrate the technical feasibility on the lab scale and potentially form the basis for the commercial development of a system. The consortium unites expertise from all fields mentioned above and is using nationally and internationally funded large-scale infrastructures.

Figure 9: IMMPRINT project presentation at social media.

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2.7 RRADEW - Resilience to RADiological Events in Wartime

Project coordinator: CEPN, France – Pascal Croüail
pascal.crouail@cepn.asso.fr

Project partners (17):

- Nuclear Protection Evaluation Centre (CEPN), Fontenay-aux-Roses, France
- Belgian Nuclear Research Centre (SCK CEN), Brussels, Belgium
- Karlsruhe Institute of Technology (KIT), Eggenstein-Leopoldshafen, Germany
- Institute for Radiological Protection and Nuclear Safety (IRSN), Fontenay-aux-Roses, France
- Norwegian University of Life Sciences (NMBU), Aas, Norway
- Institute for Safety Problems of Nuclear Power Plants of National Academy of Sciences (ISPNPP), Chornobyl, Ukraine
- National Research Center for Radiation Medicine, National Academy of Medical Sciences (NRCRM), Kyiv, Ukraine
- Lund University (LU), Malmö, Sweden
- United Kingdom Health Security Agency (UKHSA), Didcot, UK
- University of South Bohemia in Ceské Budejovice (USB), České Budějovice, Czech Republic
- Centre for Energy, Environmental and Technological Research (CIEMAT), Madrid, Spain
- Portuguese Environment Agency (APA), Amadora, Portugal
- University of Antwerp (UA), Antwerp, Belgium
- French National Fire Officers Academy (ENSOSP), Aix-en-Provence, France
- National Radiation Protection Institute (SURO), Praha, Czech Republic
- Swedish Radiation Safety Authority - Stralsakerhetsmyndigheten (SSM), Stockholm, Sweden
- Helmholtz-Zentrum Dresden-Rossendorf EV (HZDR), Dresden, Germany

Abstract:

The overall objective of RRADEW (“Resilience to RADiological Events in Wartime”) is to enhance nuclear emergency preparedness, response, and recovery (EPR&R) systems by developing methodological and technological approaches to strengthen resilience in the context of war or armed conflict disasters. Despite extensive research on planning and response for radiological and nuclear emergencies, existing studies and guidelines have not yet considered the context of armed conflict situations, which present unique challenges that can compromise the safety and well-being of both affected populations and responders. To meet this objective, RRADEW, brings together 14 institutions, including two from Ukraine, with a broad expertise in EPR&R, covering technical, social, ethical, legal, and regulatory aspects. Supported by extensive stakeholder engagement, and bringing expertise from other areas of disaster research, RRADEW will address emergency management as a system of closely linked social, organisational, and technical elements. RRADEW research adopts a scenario approach that allows key actors to envision, anticipate and solve problems that can arise during disasters. This recognizes that contingency planning is an important part of EPR&R and follows the United Nation's Sendai Framework on Disaster Risk Reduction definition of resilience as the “ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner”. In the context of nuclear

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emergency preparedness, this requires a critical reflection on how an armed conflict situation may impact the feasibility and adequacy of current planning, response and recovery strategies. RRADEW will assess and prioritize plausible scenarios for the deployment of hostilities at nuclear facilities and consider their possible radiological consequences. The resilience of the emergency management system will be analysed through case studies, the development and application of a resilience analysis platform, and assessment of legal, ethical, and social issues. The final output of the project will be guidance and recommendations for improving radiological protection and strengthening resilience in situations of armed conflict, as well as education and training materials for better preparation of stakeholders.

Figure 10: RRADEW project presentation at social media.

2.8 CITISTRA - Citizen measurements as complementary radiation monitoring strategy in threats due to armed conflict or natural disasters

Project coordinator: SURO, Czech Republic – Jan Helebrant
jan.helebrant@suro.cz

Project partner (4):

- National Radiation Protection Institute (SURO), Prague, Czech Republic
- Henryk Niewodniczanski Institute of Nuclear Physics, Polish Academy of Sciences (IFJ PAN), Krakow, Poland
- Slovak Medical University in Bratislava, Bratislava, Slovakia

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- Glowny Instytut Gornictwa (GIG), Katowice, Poland

Abstract:

The current geopolitical situation in Europe raises the issue of whether risk management procedures and technological solutions are up-to-date to handle scenarios arising from threats due to war or armed conflicts. The conflict in Ukraine leads to serious concerns about the safety and security of nuclear facilities in the region. In the event of military action or sabotage targeting these facilities, there is a risk of releasing radioactive materials, leading to a potential radiation emergency with consequences for public health and the environment in close proximity and at least to public concern in more distant territories. There is even a threat of using nuclear weapons. In these scenarios, the functioning of official monitoring networks can be perturbed due to network failure, communication failure, blackout or through sabotage activities. Citizen radiation measurements can complement official monitoring systems and provide fast local radiation data. The project aims to analyze the feasibility and procedures of employment of citizen measurements with regard to different national legal frames, social and cultural habits using experimental study in three countries – Czech Republic, Slovak Republic and Poland. The project addresses challenges in using citizen radiation measurements: - quality, accuracy, and reliability of the data collected and analyzed by citizens, - ethical, legal, and social implications of sharing and using radiation data in different countries, - adequate training, support, and feedback to citizens involved in radiation measurement activities, - preconditions of the sustainability of a system built on measurements by volunteers. The developed radiation detector CzechRad will be distributed among selected citizen groups together with simple software. Training will be provided on taking measurements, data processing and interpreting. Practical guides for training and measurements in different emergency scenarios will be designed and tested. In addition to the living environment, the self-measurements of thyroid glands, food, feed and personal items of daily use etc. will be considered. The public attitude to citizen measurements will be monitored using sociological surveys. The effect of the self-measurement availability on a public sense of security and fear about ionizing radiation shall be determined.

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Figure 11: CITISTRA project presentation at social media.

2.9 PREDICT - ImPRovements in atmospheric dispErsion moDellIng and protective action strategies in case of nuclear detonations.

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Project partners (13):

- Federal Office for Radiation Protection (BfS), Salzgitter, Germany
- Danish Emergency Management Agency (DEMA), governmental agency under Ministry of Defence (MoD), Birkerød, Denmark
- Technical University of Denmark (DTU), Roskilde, Denmark
- Norwegian Radiation and Nuclear Safety Authority (DSA), Oslo, Norway
- Environmental Protection Agency (EPA), Wexford, Ireland
- Helmholtz-Zentrum Dresden-Rossendorf EV (HZDR), Dresden, Germany
- Karlsruhe Institute of Technology (KIT), Eggenstein-Leopoldshafen, Germany
- Norwegian University of Life Sciences (NMBU), Aas, Norway
- PDC-ARGOS ApS, Brøndby, Denmark
- National Institute for Public Health and the Environment (RIVM), Bilthoven, Netherlands
- Swedish Radiation Safety Authority (SSM), Stockholm, Sweden
- Department of Health (UKHSA), Didcot, UK
- Met Office (UKMO), Exeter, UK

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Abstract:

The present risk assessment and risk management knowledge of civilian emergency planning organisations concerning radiological consequences of nuclear fallout is still limited. This project aims at filling in significant gaps and improving upon current radiological assessment and decision-aiding technological capabilities. Since the invasion of Ukraine by Russia, there has been ongoing concern over the threatened use of tactical nuclear weapons. In such an event, radiation protection of the public should focus on the fallout zone, where urgent protective actions could significantly help reduce health impacts. Several European countries have already undertaken assessments of the radiological impacts of nuclear detonations and this project will build on that work, further extending technical capabilities. PREDICT aims to enable the major internationally used decision support systems JRODOS and ARGOS and other nationally used atmospheric dispersion and transport codes and follow-on foodchain models to simulate and predict consequences due to the fallout of a nuclear detonation in Europe or worldwide. A key aspect will be the description of the blast cloud which is complex due to its height, the large number of radionuclides (most short-lived) and variety of particle sizes produced. Using a range of source terms and weather conditions, results from different Partner assessment models will be compared and the uncertainties better understood. Recommendations will be made to improve dose modelling and computing run times. Existing advice on responding to nuclear power plant accidents will be adapted, and public protection strategies will be reviewed and improved ways of communicating these to the public will be developed. A key outcome will be harmonising the technical means of decision-making following a nuclear detonation event at the European level as well as considering social, ethical and communication aspects. There will be pro-active engagement with decision-makers and other stakeholders to ensure that the information arising from the assessment models will apply a holistic understanding of the event consequences enabling them to better understand the risks and thereby improving the protection of the public from harm.

Co-funded by the European Union

Figure 12: PREDICT project presentation at social media.

3. Research projects start

The most of research projects start on 1st February 2024, projects SONORA and VERIFIED on 1st March 2024 and project IMMPRINT on 1st April 2024. Representatives of Pianoforte WPs prepared for all projects a questionnaire in order to gather information on expected results and their dissemination, planned education and training efforts, data management and infrastructure use by each project. Available Pianoforte tools and resources will be provided to research teams in order to maximize the scientific impact.

4. Conclusions

The first call for research projects was prepared in collaboration of all PIANOFORTE workpackages: research topics formulation and prioritisation, preparation of Call documents (Call text, Guidelines for applicants, Auxiliary proposal template, Auxiliary financial excel sheet), online Infoday for applicants, etc.

The evaluation procedure of submitted proposals was leaded by WP7 independently of Pianoforte coordinator and beneficiaries. The first call for research projects has been successfully accomplished and 9 research projects were approved by PIANOFORTE General Assembly on Tuesday 5th December 2023 in Budapest, Hungary. Deliverable 6.4 summarizes details of the selected projects.