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## D6.3 Interlinks to European radiation protection platforms and health and digitisation programmes

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## Abbreviations

BT	Breakthrough
IR	Ionising radiation
RP	Radiation Protection

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## 1. Foreword

The overall vision of the strategic research agenda (SRA) and the roadmap is to provide guidance to European policymakers, funders, as well as the scientific and clinical communities regarding research needs and priorities, infrastructure development, as well as education and training actions related to medical applications of ionising radiation (IR).

The proposed actions are prioritised with regard to their impact on patients' life expectancy and/or quality of life, on radiation protection as an integral part of quality and safety measures, and on healthcare systems as well as their feasibility, providing time frames and cost estimations. The roadmap builds on the challenges and research needs identified in the EURAMED rocc-n-roll Strategic Research Agenda and also takes into account the European funding landscape for health and digital innovation, as well as actions that are or shall in the future be carried out within the scope of the SAMIRA Strategic Plan, with the aim to drive progress in personalised medicine using medical applications of ionizing radiation in Europe.

In the roadmap, 8 breakthroughs (BTs) were identified, and the challenges and corresponding research needs were assigned to these breakthroughs as follows:

- **Breakthrough 1** - Improve / develop diagnosis – innovation and development for better screening, early detection, and diagnosis
- **Breakthrough 2** - Improve / develop therapies - innovation and development for better therapies, theranostics and interventional procedures
- **Breakthrough 3** - Patient radiation protection - Improved understanding of adverse effect and patient dosimetry
- **Breakthrough 4** - Patient relations (incl. dialogue and communications; data handling; ethics)
- **Breakthrough 5** - Strategic positioning of applications of ionising radiation in medicine
- **Breakthrough 6** - Implementation, sustainability, accessibility, and organisation of IR-based medicine
- **Breakthrough 7** - Quality, safety, and legislation for medical application of IR in Europe
- **Breakthrough 8** - Career attractiveness and radioprotection for workers

The roadmap defines these breakthroughs as those research and technological developments that have the potential to facilitate the greatest improvement on patient-tailored health care. To achieve these improvements and foster and strengthen European leadership in health care, sufficient funding is crucial. **As the resources needed are obviously high, it must be elaborated for which Directorate-General (DG) (e.g. DG ENER, DG SANTE, DG CONNECT, DG RTD) the BTs are of interest and relevance, and which related funding streams would be appropriate means for funding related projects.** A European component of the funding is important to guarantee broad acceptance of the research and a Europe-wide implementation of the methods into clinical practice. Such a European component of funding is also necessary to allow all potential innovations to be evaluated and followed upon across Europe independent of regional or national funding options. It can be suggested to explore co-funding schemes (e.g. European-national or public-private partnerships) and that European funding should be used at a first stage to concentrate on some major possible developments or potential role model funding.

While single projects may focus on a single or several steps to reach the BT, overall, it needs to be ensured that the entire chain is funded to guarantee the optimal benefit for the patient and the European healthcare system.

There is a **clear need to pave the way for a future fully integrated and coordinated European funding capacity** to warrant EU leadership in medical application of IR and related RP. To this end, an interlink strategy is required to identify which themes of the EURAMED rocc-n-roll SRA

and which BT topics are not only implementable via radiation protection research programmes but also relevant for other European funding streams.

### Funding Programmes of Interest

The EURATOM call NFRP-2019-2020-13 - Research roadmap for medical applications of ionising radiation - asked to identify synergies between relevant clusters of the Horizon Europe Framework Programme for Research and Innovation and the Euratom Research and Training Programme 2021-2025. The EURAMED rocc-n-roll project has therefore developed this interlink document to evaluate for which DGs topics of the SRA and roadmap are of particular interest and provide recommendations which funding programmes could and should implement R&D&I in medical applications of IR in medicine.

The EURAMED rocc-n-roll SRA, roadmap and the present interlinking document are intended to be instruments that will guide stakeholders to selectively fund the most effective medical developments using IR and related RP. It aims to be a source of information for policy makers and funding bodies and related initiatives and partnerships, to national funding bodies in member states.

The European funding programs suitable for supporting research lines identified by EURAMED rocc-n-roll are listed below:

- HORIZON EUROPE (2021-2027)<sup>1</sup>, in particular Pillar 2 and the “Health” cluster and the “Digital, Industry” cluster
- The EU4Health Programme<sup>2</sup>
- The DIGITAL EUROPE Programme<sup>3</sup>
- The EURATOM research and training program (2021-2025)
- The Innovative Health Initiative<sup>4</sup>

**The HORIZON EUROPE framework program 2021-2027 and specifically its “health” cluster** contains several calls potentially suitable to bolster the development of a new, safe, and optimised use of IR in medicine as described in chapter 1 both for imaging and therapeutic applications and partially 2 regarding the safe use, even if the announced work program for 2023 does not contain any specific calls in this area. The main breakthroughs within the roadmap for which research identified could be funded for are for sure breakthroughs 1, 2 and 5 as well as partly breakthroughs 3 and 4.

**The “Digital, Industry and Space” cluster within the HORIZON EUROPE programme** was also identified as a potential funding opportunity. Its focus on innovations, which also includes the market for healthcare and medicine, could foster the inclusion of topics identified by EURAMED rocc-n-roll. This would especially be relevant for projects related to chapter 3 of the EURAMED rocc-n-roll SRA, but partly also some of the topics of chapter 1. Regarding the roadmap, this means that research could be funded contributing mainly to breakthroughs 6 and 7 as well as partly 1, 2 and 4.

A dedicated topic relevant to both funding schemes is the development, assessment, evaluation and implementation of screening tools and programs.

<sup>1</sup> [https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2023-2024/wp-12-missions\\_horizon-2023-2024\\_en.pdf](https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2023-2024/wp-12-missions_horizon-2023-2024_en.pdf)

<sup>2</sup> [https://health.ec.europa.eu/funding/key-documents\\_en?f%5B0%5D=topic\\_topic%3A194](https://health.ec.europa.eu/funding/key-documents_en?f%5B0%5D=topic_topic%3A194)

<sup>3</sup> <https://digital-strategy.ec.europa.eu/en/activities/work-programmes-digital>

<sup>4</sup> <https://www.ihl.europa.eu/apply-funding/future-opportunities>

Also relevant is the **Mission on Cancer**, which supports the implementation of the Europe's Beating Cancer Plan. The mission aims to improve the lives of more than 3 million people by 2030. The mission deals with 4 areas: Understanding of cancer, Prevention and early detection, Diagnosis and treatment, and Quality of life for patients and their families. All areas have strong connections with the research topics identified within the EURAMED rocc-n-roll project:

- Understanding of cancer is mentioned in breakthrough 3 and especially in the SRA in chapter 2 on the biological effects of IR,
- Prevention and early detection are strongly connected to screening programs for which corresponding research is named various times in chapter 1 of the SRA and in breakthrough 1 of the roadmap,
- Diagnosis and treatment are discussed in the roadmap within breakthroughs 1, 2, 3, 4 and 5 mainly as well as in the SRA in chapter 1,
- and Quality of life for patients and their families is addressed within breakthrough 1 and 2, 3, 4 and 5 as well as mainly 7 and 8. This can be found in corresponding topics of the SRA in all three chapters.

The work programme of the mission is particularly implemented under the Horizon Europe programme.

At the time, when this document has been prepared, the number of open HORIZON EUROPE calls within the Health Cluster, Digital, Industry and Space cluster and the Mission on Cancer suitable for a safe and novel or optimised use of ionising radiation in medicine and radiation protection is limited, when focussing on call text explicitly focussing on IR topics or RP topics. There are relevant call texts related to optimised diagnosis or treatment and prevention of cancer, nevertheless. The programmes remain highly relevant and is an instrument of major importance for the implementation of calls for research topics identified by the EURAMED rocc-n-roll SRA and roadmap.

The **Innovative Health Initiative** (IHI) is a public-private partnership programme launched by the European Commission as part of the Horizon Europe research and innovation framework. The IHI aims to support and accelerate the development of innovative healthcare solutions to address the current and future health challenges in Europe. It brings together various stakeholders, including the European Commission, industry, academia, healthcare providers, and patient organisations, to collaborate and invest in cutting-edge research and innovation. From the perspective of EURAMED rocc-n-roll, the IHI programme would be of interest for the development of new technologies and corresponding systems for imaging (like e.g. new CTs, molecular imaging technologies etc) and or therapeutic (like e.g. FLASH or targeted radionuclide therapy) applications.

The **DIGITAL EUROPE** programme provides strategic funding supporting projects in five key areas including artificial intelligence (AI) and ensures wide use of digital technologies through Digital Innovation Hubs, including the European Health Data Space. The EUCAIM project (EUropean Federation for CANcer IMages) funded under the call DIGITAL-2022-CLOUD-AI-02-CANCER-IMAGE is of great interest for specific EURAMED rocc-n-roll R&D&I lines as outlined in breakthrough 6 and partly 1 of the roadmap and corresponding to such research topics mentioned in chapter 1 and 3 of the SRA. The project aims to design and deploy a pan-European digital federated infrastructure facilitating access to standardised cancer images and related patient data for basic and clinical research. This project was based on the AI4HI position paper

2022<sup>5</sup>. The main objective of AI for Health Imaging Network (AI4HI)<sup>6</sup> was identified as deploying a pan-European digital infrastructure facilitating access to cancer images and related patient data. **It aims linking and exploring fragmented EU databases of cancer images, with solid governance and model for data ingestion and exploitation by public and private organisations.** This project aims at building on the progress achieved in the AI4HI projects regarding system architecture, reference APIs, metadata, data structure and quality, legal requirements, repositories. 5 projects were already funded in the last years by the EC: the CHAIMELEON project, the EUCanImage project, the INCISIVE project, the Primage project and the ProCancer-I project.

- **The EU-funded CHAIMELEON project** (Accelerating the lab to market transition of AI tools for cancer management) aims to establish an EU-wide repository for health-related imaging data as an open source for AI experimentation in cancer management.
- The goal of **the EU-funded EuCanImage project** (A European Cancer Image Platform Linked to Biological and Health Data for Next- Generation Artificial Intelligence and Precision Medicine in Oncology) builds a secure, large-scale European cancer imaging platform with capabilities that will advance the application of AI in oncology.
- The **EU-funded INCISIVE project** (A multimodal AI-based toolbox and an interoperable health imaging repository for the empowerment of imaging analysis related to the diagnosis, prediction, and follow-up of cancer) aims to develop a toolbox for enhancing the accuracy, specificity, and sensitivity of existing cancer imaging methods. The idea is to generate a pan-European repository of medical images that can be used for ML-based training for various types of cancer assisting the accurate prediction of tumour spread, evolution and relapse, as well as stratifying patients.
- The **EU-funded PRIMAGE project** (PRedictive In-silico Multiscale Analytics to support cancer personalized diaGnosis and prognosis, Empowered by imaging biomarkers) develops a cloud-based platform for personalised diagnosis of paediatric cancers to further promote the development of in silico tools for a more personalised clinical management of cancer.
- The **EU-funded ProCancer-I project** (An AI Platform integrating imaging data and models, supporting precision care through prostate cancer's continuum) developed advanced AI models to address unmet clinical needs: diagnosis, metastases detection and prediction of response to treatment.

The above-mentioned projects are linked to various of the breakthroughs defined in the EURAMED rocc-n-roll roadmap such as BT1, BT2 and BT6. Future projects could broaden such approaches and should also relate to BT5 and BT7 at least.

**The EU4Health Programme (2021-2027)** is supposed to bring added value to patient care and the health care systems and to complement the policies of the Member States to pursue four general areas of intervention including: (i) improve and foster health (including: Health promotion and disease prevention, in particular cancer), (ii) Protect people, (iii) Access to medicinal products, medical devices and crisis-relevant products, (iv) Strengthen health systems. In this last area of intervention, the EU4Health Program supports (i) Reinforcing health data, digital tools and services, digital transformation of healthcare, (ii) Enhancing access to healthcare, (iii) Developing

<sup>5</sup> Marti-Bonmati, L., Koh, DM., Riklund, K. et al. Considerations for artificial intelligence clinical impact in oncologic imaging: an AI4HI position paper. *Insights Imaging* 13, 89 (2022). <https://doi.org/10.1186/s13244-022-01220-9>

<sup>6</sup> *Considerations for AI clinical impact in oncologic imaging: an AI4HI position paper. Luis Marti-Bonmati et al. 2022.*

and implementing EU health legislation and evidence-based decision making and (iv) Integrated work among national health systems. Most of the EURAMED rocc-n-roll BTs like BTs 1, 2, 3, 4, 5, 6 and 7 could in parts fit with these objectives.

**The EURATOM research and training program (2021-2025)** is a complementary funding program to HORIZON EUROPE which covers nuclear research and innovation. The EURATOM program is a part of the EU's efforts to further develop technological leadership and promote excellence in nuclear research and innovation, including radiation protection. The EURATOM program will expand research into non-power applications of ionising radiation e.g. links with the Horizon Europe Health activities and Europe's beating cancer. It will also develop synergies with other areas (e.g. artificial intelligence and robotics). Radiation protection research has led to improvements in medical technologies (e.g. diagnosis and treatment) from which many citizens benefit. The envisaged research is supposed to lead to further improvements in radiology, nuclear medicine, radiation oncology and in interventional radiology. Within EURAMED rocc-n-roll, EURATOM is of particular importance for funding of the aspects related to chapter 2 of the SRA as well as in parts of chapter 3. This is mirrored by BTs 3 and 4 as well as 6, 7 and 8 of the roadmap.

Co-funded by EURATOM, the **European Partnership for Radiation Protection Research (PIANOFORTE)**, offers some opportunities for the promotion of R&D&I for a safe and optimised use of IR in medicine. The partnership aims to enhance the protection of the public, workers, patients, and the environment from ionizing radiation exposure in environmental, occupational, and medical settings. The partnership's research activities are co-financed by the European Union's EURATOM program and the governments of the participating countries. Within its framework, PIANOFORTE will contribute to the implementation of significant European policies, such as the Europe's Beating Cancer Plan (ECBP), the green pact for growth, and the roadmap for reducing industrial and natural risks. From the perspective of EURAMED rocc-n-roll, PIANOFORTE calls are of relevance for research in all research areas identified in chapter 2 of the SRA. In addition, especially aspects related to infrastructures and research on big data are of importance in the context of PIANOFORTE funding. This is related to subchapters within chapter 3 of the SRA. Those aspects are reflected in breakthroughs 6 and 7 but are partly also relevant in breakthroughs 1, 2, 3 and 8.

On **policy level**, the ECBP and the SAMIRA action plan are of particular interest for the EURAMED rocc-n-roll R&D&I lines. The ECBP is an EU policy priority that drives part of the topics in the above listed funding programmes. The Mission on Cancer has been included in HORIZON EUROPE - Pillar 2. The SAMIRA action plan is the EU's first comprehensive plan for action to support a safe, high quality and reliable use of radiological and nuclear technology in healthcare. The Strategic Agenda for Medical Ionising Radiation Applications (SAMIRA) is the energy sector's contribution to Europe's Beating Cancer Plan, and a response to the EU Council's conclusion from 24 May 2019 on non-power nuclear and radiological technologies and applications. The action plan defines EU actions in 3 priority areas: securing the supply of medical radioisotopes, improving radiation quality and safety in medicine, and facilitating innovation and the technological development of medical ionising radiation applications.

### The Interlink Document

Following an analysis of the Horizon Europe Framework Programme for Research and Innovation with a view to identify synergies with the Euratom Research and Training Programme 2021-2025 it became evident that interlinks exist between health-related research and RP-related research. These two areas could cross-fertilise each other and be more synergistic in the future. Interlinks between the Health, the digital, industry and space cluster, the EU4Health programme, IHI, and the Digital Europe programme are also identified as valuable to carry out EURAMED rocc-n-roll R&D&I lines.

This document intends to clearly position the EURAMED rocc-n-roll R&D&I lines among the different European funding programmes as well as potential national funding schemes and public private partnerships and aims to call for the organisation of more efficient interlinks between them. Moreover, the interlinking document proposes recommendations to the EC to facilitate the decisions which funding schemes would be suitable to integrate future R&D&I aspects to create synergies and to avoid duplication.

## 2. Methodology

Based on the EURAMED rocc-n-roll R&D&I lines as identified in the SRA (D6.1) and on the Breakthroughs as identified in the roadmap (D6.2), the applicability of the BTs to the different policy areas, related Directorate-Generals, and funding frameworks was analysed.

After consolidating the analysis, three concrete examples of the EURAMED rocc-n-roll R&D&I lines were selected as examples (the following examples have been chosen: developing “Imaging based screening programmes using AI”, “patient dosimetry for new therapeutic applications” or “benefit/risk balance for combined treatment”) to illustrate which funding schemes would be possible to integrate future rocc-n-roll R&D&I lines and create setup synergies and avoid duplication.

The work in Task 6.3 is largely based on the results of WPs 2 and 3. To evaluate the findings and analyse the potential for synergies, a panel of experts from among the consortium and the Advisory Board was set up:

First Name	Last Name	Organisation
Marc	Benderitter	IRSN
Jonas	Teuwen	NKI
Nathalie	Impens	SCK CEN
Christoph	Hoeschen	OvGU
Guy	Frija	UP
Katrine	Riklund	UmU
Ursula	Nestle	UKLFR
Kristoff	Muylle	VUB
Klaus	Bacher	UGent
Erik	Briers	Advisory Board

Table 1. Composition of the Taks 6.3 panel

The view of all panel members was collected and a consensus regarding the D6.3 was reached during the final consortium meeting.

## 3. Overview of interlinks between EURAMED rocc-n-roll priorities with policy areas and related funding programmes

To identify suitable funding schemes for the EURAMED rocc-n-roll BTs, the BTs were analysed with regard to their level of interest for the different EC DGs and their related policy areas. The DGs of relevance include DG Energy (ENER), DG Health and Food Safety (SANTE), DG Communications Networks, Content and Technology (DG CONNECT), and DG Research and Innovation (RTD).

The following table shows the level of potential policy interest for the 8 BTs between DG ENER, DG SANTE, DG CONNECT and DG RTD:



DG ENER      DG SANTE      DG CONNECT      DG RTD

**Patient related BTs**

<b>BT1 – improve/develop diagnosis</b>				
<i>Decision-making</i>				
<i>Technical developments including AI based methods</i>				
<i>Screening</i>				
<i>Molecular imaging methods</i>				
<i>Quantitative imaging and radiomics</i>				

<b>BT2 – Improve/develop therapies</b>				
<i>Radiation oncology</i>				
<i>Theranostics</i>				
<i>Interventional procedures</i>				

<b>BT3 – Patient radiation protection and benefit-risk ratio</b>				
<i>Radiation biology</i>				
<i>Patient dosimetry</i>				

<b>BT4 – Patient relations</b>				
<i>Individual benefit-risk balance assessment</i>				
<i>Involvement of patients in research</i>				
<i>Shifting the communication landscape</i>				
<i>Ethical data management</i>				

**Generic BTs**

<b>BT5 – Strategic positioning of applications of IR in medicine</b>				
<i>Comparison of benefit-risk of radiation-based and other medicine</i>				
<i>Synergies between radiation-based and other techniques</i>				
<i>Investigating economical aspects and securing funding of R&amp;D</i>				

<b>BT6 – Implementation, sustainability, and organisation of IR-based medicine</b>				
<i>Translation and organisation</i>				
<i>Research for sustainable supply including radionuclides</i>				
<i>Access to data, biobanks and equipment for research and patient care</i>				
<i>Harmonisation of data and protocols</i>				

<b>BT7 – Quality, safety, and legislation in Europe</b>				
<i>Quality determination</i>				
<i>Q&amp;S for diagnosis and therapy</i>				
<i>Clinical quality and safety audits</i>				
<i>Improve the safety culture</i>				



<i>Harmonisation of EU legislation for medical care, RP, medical devices, manufacturing, and marketing authorization</i>				
<b>BT8 – Career attractiveness and radioprotection for workers</b>				
<i>Career attractiveness in medical applications or IR and corresponding radiation protection</i>				
<i>Radiation protection for workers</i>				

	<i>High potential interest</i>
	<i>Medium potential interest</i>
	<i>Low potential interest</i>

The corresponding funding programmes in terms of related policy priorities would be as follows:

- DG ENER: EURATOM
- DG SANTE: Horizon Europe Health Cluster, EU4Health, IHI
- DG CONNECT: Horizon Europe Digital, Industry and Space Cluster, DIGITAL EUROPE
- DG RTD (including the European Health and Digital Executive Agency (HaDEA)): Development and implementation of Horizon Europe programmes

### 3.2 Examples of interlinks and needs for coordinated EU actions

The first two breakthroughs are the most directly related to patient-tailored improvement of healthcare. As these breakthroughs allow the greatest improvement on patient-centred healthcare, sufficient funding is crucial to foster and strengthen European leadership in individual patient care.

Three examples were selected to illustrate the need to pave the way for future coordinated funding between various European funding schemes and various national funding as well as private public partnerships.

#### Example 1: BT1 –Imaging based screening programmes using AI

In the context of BT1 fall advancements in screening that enable optimisation and broad and quality-assured implementation of existing diagnostic imaging, which may lay the basis for European leadership in fighting against cancer including the goal to improve lives of 3 million cancer patients by 2030. Screening might also help for the fight against certain neurovascular, cardiovascular, rare diseases and other diseases. Relevant research topics under screening include the evaluation of the benefit-risk ratios, epidemiological evaluation, dose assessment and optimisation, as well as optimisation of imaging in terms of efficiency, accuracy, and safety.

As epidemiological investigations are needed for determine potential benefits as well as potential risks and this maybe in connection with certain biological and life-style confounders, large cohort studies seem to be necessary. These should be done therefore funded on a public European level. The risks related studies could be implemented through the EURATOM programme while the benefit related and (biological) cofounder related studies could be addressed through the health cluster or the cancer mission.

More detailed biological basic research could be done through various types of funding schemes including European or national funding.

The dose assessment is certainly most strongly linked to the EURATOM programme but can also be covered partly by national funding or within the EURAMET (European metrology network) programme.

Optimisation of the imaging procedures for screening regarding efficiency, accuracy and safety can be covered again mainly by European funded projects starting with projects in the health cluster and to a small amount in the EURATOM programme. The (safe) implementation could be realised at least in some parts through the EU4Health programme. All these projects could be supported by national co-funding or nationally funded projects. If the optimisation leads to new imaging approaches which could best be realised in new systems funding through the IHI private public partnership seems to be most appropriate.

Similar approaches hold for development of software and especially AI-based methods for computer-aided image evaluation for screening purposes. These topics could, besides the health cluster and the cancer mission, also be addressed e.g. within the DIGITAL EUROPE programme. In addition, aspects regarding the safe and quality-assured use of such methods could be covered in either the EURAMET funding regimes or within the EURATOM programme.

### **Example 2: BT3 – Patient dosimetry for new therapeutic applications**

BT3 addresses, among other topics, the advancement of currently available applications for patient dosimetry. The approaches can refer to novel developments like camera-based and software-based dose assessment. The development of methods for assessing relevant dosimetric parameters in the context of new technological developments such as e.g. FLASH therapy is a relevant component for determining and understanding the related effects and to guarantee a safe and quality assured application of such therapies. This means that there is a variety of approaches and corresponding projects that needs to be covered ranging from dosimetric approaches for spatially and timely resolved dosimetry for basic research on mechanisms and, later on, for quality assurance in patients, new technological developments for dose calculations including camera-based and software-based dose assessment. Funding for the related projects would fit into various funding regimes depending on the purpose of the developments: Within the EURATOM programme and especially as part of the PIANOFORTE partnership research on implementable patient dosimetry systems could be funded. EURAMET projects could deal with dosimetric developments for accurate multidimensional dose determination for basic research and later on patient dosimetry and quality assurance. The further development into potential products for clinical quality assessment and assurance could be dealt with in IHI funded projects. This later stage could also be covered through national corresponding funds in similar funding schemes.

### **Example 3: BT5 – Benefit/risk balance for combined treatment**

Another very interesting research line is related to BT5: A big step forward towards more efficient but also safer treatment of , in particular, cancer diseases seems to be the suitable use of combined therapy approaches with IR and other therapies e.g. immunotherapies or classical chemotherapies. The effects of both the radiation therapy as well as the medicinal therapy as well as the ways of interaction has to be understood in detail to make the best use of it for the best possible and cost-effective therapy for the individual patient with as little side effects as possible.

The basic research on the biology will most probably have to be funded in a collaborative approach between the EURATOM programme and the Health cluster. As it can be expected that such research would be pretty demanding, to achieve useful results, a co-funding in a public partnership using national resources also seems suitable. As medicinal treatment and corresponding development of new drugs will be involved, such research needs to be driven in projects using private public partnerships like in the IHI programme. For such developments, it might also be feasible to use funding in dedicated partnerships within the Health cluster. Implementation can be then driven by EU4Health-funded projects again. These should again be

combined with projects within the EURATOM programme to address the need for high-quality standards especially with respect to the application of IR in the context of such combined therapies.

## 4. Conclusions

- The EURAMED rocc-n-roll project **paves the way for future interconnected and coordinated action on European, national, regional level for coordinated public and private research funding for a secure and optimized medical application of ionizing radiation taking a clear patient-centric approach.**
- The EURAMED rocc-n-roll strategic research agenda (D6.1) and roadmap (D6.2) and Interlink document (D6.3) are co-constructed vision of the R&D&I needs for a secure and optimized use of ionising radiation in medicine. They integrate ideas and concepts of the SAMIRA initiative as well as many stakeholders in the field including scientific and medical associations dealing with the use of ionising radiation in medicine and the MEENAS research platforms and relevant projects. Regulator's need and expectation relevant to medical radiation protection were taken into account. To ensure the inclusion of a broad health perspective of application of ionising radiation and radiation protection in the project, an in-depth analysis of the EC health and Euratom programs was conducted (D3.5). Disease areas most relevant in terms of diagnostic and therapeutic approaches based on ionising radiation and potential radiation protection issues were investigated. Impact of digitalisation in healthcare on medical applications and related radiation protection, opportunities, challenges and caveats of AI applications and advances in electronic patient records in medical applications and related radiation protection were analysed. Question on how ethics and data protection issues related to medical applications and radiation protection research were addressed. Although, analysis of the research needs for innovation in radiation based high-quality healthcare across Europe and foster interactions between industry and academia research as well as clinical practitioners to reach such high-quality healthcare in a sustainable manner were examined. A patient centric investigation was adopted throughout this analysis process. **A consensus was reached regarding the research needs and gaps as well as their implementation in 8 breakthroughs that may substantially impact medical applications of ionising radiation from the perspective of patient's life expectancy and/or quality of life, radiation protection and health care systems.**
- The EURAMED rocc-n-roll SRA, roadmap and Interlink document are intended to be an instrument that will guide stakeholders to selectively fund the most effective medical developments using IR and related radiation protection. It aims to be a source of information for funding bodies of the EURATOM, including the PIANOFORTE Partnership, Horizon Europe, in particular as regards its "Health" and "Digital, Industry and Space" clusters, EU4HEALTH and Digital Europe programmes as well as the IHI partnership.
- In this document, for each of the 8 BTs identified by EURAMED rocc-n-roll, links to policy areas and DGs with a potentially high interest in driving research and innovation in the area were identified. The R&D&I topics identified in the EURAMED rocc-n-roll SRA, and the breakthroughs developed in the Roadmap clearly call for an overall funding approach that makes use of the synergies of all relevant funding instruments available in the EU. The topics listed by EURAMED rocc-n-roll are of relevance to several EU programmes. This has been clearly illustrated through a couple of examples. Research and innovation within the field of medical applications of ionising radiation and related RP is for large parts a clear fit to the EURATOM programme, in other aspects it is in the same way linked to the Health and Digital clusters of Horizon Europe and more recent programmes such as EU4Health and Digital Europe as well as dedicated partnerships are of interest. Making use of the synergies between these programmes would be of benefit to the European

research landscape and enable cross-fertilisation between the EU's funding programmes and ensure optimised use of European funds for the ultimate benefit of Europe's patients. It also has been shown that there is a strong need for national funding structures and public private partnerships for funding of certain aspects of the identified R&D&I topics.

- The work carried out by the EURAMED rocc-n-roll project to **define EC priorities for secure and optimised medical application of ionising radiation considering the patient perspective** should be capitalized on to achieve this goal.