Call: HORIZON-WIDERA-2021-ACCESS-03
(Twinning call)

Topic: HORIZON-WIDERA-2021-ACCESS-03

Type of action: HORIZON-CSA

Title of proposal: Capacity building on novel radionuclide production methods for cancer treatment
Proposal number: SEP-210811258
Proposal acronym: STRONGER4CANCER

List of Participants

Participant No. *	Participant organisation name	Country
1 (Coordinator)	Aristotle University of Thessaloniki –**AUTH**	Greece
2	National Centre for Scientific Research "Demokritos" –**NCSRD**	Greece
3	Papageorgiou General Hospital –**Papageorgiou Hospital**	Greece
4	Technopolis Thessaloniki - **TECHNOPOLIS**	Greece
5	Università degli Studi di Milano - **UMIL**	Italy
6	National Institute of Nuclear Physics **INFN**	Italy
7	European Organization for Nuclear Research –**CERN**	Switzerland
8	GSI HelmholtzzentrumfürSchwerionenforschung–**GSI**	Germany

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ABSTRACT

To be completed by Giovanni et al.

This project proposal addresses one of the missions of the Horizon Europe programme, namely an increased effectiveness in diagnosis and treatment of **human** cancer. More specifically it focuses on radionuclide production for cancer diagnosis and therapy, by heavy particle accelerators. It accomplishes this goal by building upon the existing capacity of public institutions in Greece, i.e. the Aristotle University of Thessaloniki (AUTH) and Demokritos of Athens (NCSR); and by connecting them to leading research centers in Europe (CERN, INFN-Italy and GSI-Germany) which are highly involved in these disciplines and realized frontier facilities of this kind. University of Milan-UMIL (Italy) adds up competence in radionuclide production and purification.

Many institutions in Greece are involved in experimental nuclear physics (NP) with international connections; however, there is a lag on the specific capacity to develop efficient radiopharmaceuticals for diagnosis and treatment of cancer based on heavy particle accelerators. Networking, capacity building, R&D in translational research covering the production of selected radionuclides (RN) for Nuclear Medicine (NM) by accelerators are the focus of STRONGER4CANCER.

The project programme will connect AUTH with best administrative practices in the partner institutions, it will sustain the network through exchange of personnel, nurture the career development of the younger generation, take care of technology and knowledge transfer, provide adequate dissemination and coordinate education and training in these fields. Exploratory research projects on advanced radionuclides for NM and on the related experimental methods will be investigated.

The wider goal of STRONGER4CANCER is to provide the Greek partners a well-focused research line and related tools and competences, promote long-term welfare and health benefits, while fostering regional integration and convergence with the EU research area and its priority missions.

CALL Requirements:

Excellence

Excellence – aspects to be taken into account.

1. −Clarity and pertinence of the project's objectives
2. −Quality of the proposed coordination and/or support measures including soundness of methodology.

The following aspects will be taken into account only to the extent that the proposed work is within the scope of the work programme topic.

1.1 Objectives [e.g. 2 pages]

• Briefly describe the objectives of your proposed work. **Why are they pertinent to the work programme topic? Are they measurable and verifiable? Are they realistically achievable?**

1.2 Coordination and/or support measures and methodology *[e.g. 6 pages]*

• Describe and explain the coordination and/or support measures and the overall methodology, including the concepts, models and assumptions that underpin your work. **Explain how this will enable you to deliver your project's objectives. Refer to any challenges you may have identified in the chosen methodology and how you intend to overcome them**. *[e.g. 4.5 pages]*

1. *This section should be presented as a narrative. The detailed tasks and work packages are described below under 'Implementation'.*
2. *Where relevant, include how the project methodology **complies with the 'do no significant harm'** principle as per Article 17 of Regulation (EU) No 2020/852 on the establishment of a framework to facilitate **sustainable investment (i.e. the so-called 'EU Taxonomy Regulation')**. This means that the methodology is designed in a way it **is not significantly harming any of the six environmental objectives of the EU Taxonomy Regulation**.*

• Describe how appropriate **open science practices** are implemented as an integral part of the proposed methodology. Show how the choice of practices and their implementation are adapted to the nature of your work, in a way that will increase the chances of the project delivering on its objectives *[e.g. **1 page**, **including research data management**]*. If you believe that none of these practices are appropriate for your project, please provide a justification here.

1. ***Open science is an approach based on open cooperative work and systematic sharing of knowledge and tools as early and widely as possible in the process**. Open science practices include early and open sharing of research (for example through preregistration, registered reports, pre-prints, or crowd-sourcing); research output management; measures to ensure reproducibility of research outputs; providing open access to research outputs (such as publications, data, software, models, algorithms, and workflows); participation in open peer-review; and involving all relevant knowledge actors including citizens, civil society and end users in the co-creation of R&I agendas and contents (such as citizen science).*
2. ***Please note that this question does not refer to outreach actions that may be planned as part of communication, dissemination and exploitation activities. These aspects should instead be described below under 'Impact'.***

• Research **data management and management of other research outputs:** Applicants generating/collecting data and/or other research outputs (except for publications) during the project must provide maximum 1/2 page on how the data/research outputs will be managed in line with the FAIR principles (Findable, Accessible, Interoperable, Reusable).

1. *For guidance on open science practices and research data management, please refer to the relevant section of the HE Programme Guide on the Funding & Tenders Portal.*

1. EXCELLENCE

1.1 OBJECTIVES

Each institute to complement, where necessary

Input from Giovanni

Cancer is a major public health and economic issue, and its burden is set to spiral. With over 19 million new cases worldwide in 2020, 29 million cases are expected by 2040 due to the growth and aging of the population. For this reason, the fight against cancer is a priority for our society and has been recognised as one of the main mission areas in the scientific strategy of the EC. This issue is particularly sensitive in the South East Europe area where cancer rates and mortality are significantly higher than in Western European countries. In Greece for example, cancer mortality-to-incidence ratio is **NNN about NNN** higher than European average[1].

The development of advanced techniques for cancer therapy is therefore an urgent item, in need of wide public support in the region. Radiopharmaceuticals are fundamental tools to both diagnose and treat a number of oncologic diseases. In this very context, a regional production of radiopharmaceuticals is a key point, as their production at far sites severely limits their efficiency for patients while increasing their cost because the nuclear decay starts immediately after production. Greece urgently need to bridge this scientific and technological gap and to add such novel tools to the existing equipments of Nuclear Medicine in the fight against cancer thus providing the population with enhanced possibilities for early diagnosis and efficient treatment.

To bridge this gap, the education of a new generation of scientists and engineers is mandatory. The range of disciplines, which are at the basis of the realization of innovative and efficient radiopharmaceuticals, is very broad. It involves competence in particle accelerators to generate and give the needed energy to the projectiles impinging the nuclear targets, nuclear physics and nuclear engineering to produce radionuclides at a sufficient rate and quality for medical applications, radiochemistry to provide purification by separating the nuclear species of interest from unwanted contaminants. Eventually, the work of radiobiologists and Nuclear Medicine (NM) doctors allow to prepare the biomolecules which will drive the correct radioactivity dose to the targeting cells, i.e. where the tumour needs to be either diagnosed, or cured, or both.

The objective of this project proposal is, therefore, ambitious; but the goal has been precisely (accurately) setup so that it is achievable, with limited risk and a very high expected impact.

The very first choice that the proposers made was indeed to limit the quest of novel radionuclides to those for which tests in radiobiology and NM are already at an advanced stage of development. This means that there are already proven recipes for transforming the selected radionuclides into radiopharmaceuticals. This will, one day, shorten the pathway from the outcomes of this project to their clinical implementation; moreover, it will limit the range of science fields, as well as highly technological devices and methods that the project and its contributors shall have to concentrate on, limiting them to accelerators, targets and radiochemical purification. The set of science and technological methods for production of these selected pure radionuclides is indeed the final goal of this capacity building action, and we rely on standardized methodologies, which are hence not included herein, to transform them into medical tools.

In this project proposal, the coordinator is Aristoteles University of Thessaloniki, leading a small cluster of Greek institutions which will pair with long-tradition western European laboratories. The Greek partners span over a number of specializations at the AUTH (nuclear physics, computational physics, chemistry) complemented by the experience on accelerators of the NCSR, and making the connection to the health providers via the Papageorgiou Hospital and industry via Technopolis. The twinning partners are: CERN (Geneva, Switzerland), GSI (Darmstadt, Germany) INFN (Legnaro Padova, Italy) and University of Milano (Milan, Italy). They are characterized by an acknowledged acquired capacity in the field, have built modern medium- and large-scale facilities for R&D on the production of radionuclides for nuclear medicine and their expertise span all topics covered by the present project proposal.

We propose, therefore, to launch a strong coordinated action that will federate the above mentioned more advanced scientific institutions across Europe with AUTH and other Greek centers. This will attract a broad interest from

both students and researchers into novel and cutting-edge technologies spanning across different faculties, from accelerator science and technology to nuclear physics and radiochemistry, with a clear deliverable for radiobiology and nuclear medicine. This effort holds a strong potential for future developments and for engaging the local industry, which the Greek institutions will try to involve in the course of the project to better face the expected further development, i.e. the design of a compact machine for radioisotope production in the northern Greece. A sentence about "health providers" via Papageorgiou Hospital.

In this context, the overarching objective of the project "**STRONGER4CANCER**" is to build scientific and technical capacity to develop efficient radiopharmaceuticals for diagnosis and treatment of cancer based on heavy particle accelerators, beyond providing training in applied physics needed eventually for research on cancer treatment with radiopharmaceuticals, boosting at the same time interest its connection to industry on one side and increased competence in fundamental scientific research on the other. A sentence about "health providers" via Papageorgiou Hospital.

Papageorgiou Hospital:

- provide users requirements (what they need to better serve patients)
- immediate use of the deliverables (for more efficient diagnosis and novel ways of treating cancer)
- early engagement and training medical communities: information about upcoming advanced techniques for cancer therapy, plus more convenient, easier, faster, diversified diagnosis at demand (having a RN production center closer opens the possibility to use short-lived RN also).

[1]Ristova MM, Gershan V, Schopper H, Amaldi U, Dosanjh M. Cancer patients in the countries of SEE (the Balkans) region and prospective of the Particle Therapy Center-SEEIIST. Advances in Radiation Oncology. 2021 Aug 9:100772.

The main pillars to achieve these goals will be:

- (Workpackage 3) an active network among the participating institutes, with thematic workshops covering all scientific and technological aspects of the proposed activities and actively involving both academy key players and students; while most of the workshop will take place in the country of the leading institution, some will be hosted at CERN, INFN, University of Milan or GSI, with the main purpose of establishing a link towards the specific advanced activities which are being carried out in those sites;
- (Workpackage 4) an intense education and training activity, in support of AUTh and other Greek institutions, targeting university students in particular (at all levels, from undergraduate, to master, to PhD students) including summer schools but also targeted specialised course and seminars; emphasis will be given to training on administration (in particular through links to the EU offices in the collaborating partner laboratories), with the purpose of improving the ability of the Greek colleagues to apply for EU funds, in future calls, with creativity and competence; even secondary school classes (at the last years of their education path) will be addressed, with the purpose of making even the younger generation aware of the healthcare issues, the opportunities made available by the most advanced technological tools and carrier development opportunities in emerging fields, where often there is luck of specialised personnel;
- (Workpackage 5) frontier research activity on the methods to produce the most advanced radionuclides for nuclear medicine, through the involvement of undergraduate, masters and PhD students in the activities which are being carried out at CERN, INFN, University of Milan and GSI; this activity will span across the whole portfolio of scientific and technological tools, from accelerators for beam generation and its energy increase, to nuclear science related to beam interactions in the targets, to radiochemistry to obtain the desired pure radionuclide, to radioprotection and safety which are essential ingredients which must be considered since the early stage of any design of a facility of this kind.

Appropriate room will be dedicated to communication of the project contents and deliverables (Workpackage 2), addressing the project stakeholders (in the biology and medical sector), the authorities, the general public.

In particular, awareness in the advantages/drawbacks ratio of nuclear technologies, when addressing health problems and improving the quality of life of the population, is an essential aspect which we intend to face, in the most transparent and scientific way, with an attitude of mutual listening and of overcoming potential prejudices in highly constructive and open way. This is an issue that CERN, INFN and GSI had to face in the past and are continuing to address even when the radioisotope facilities are in full operation. We rate this aspect as crucial to the success of this kind of projects.

To achieve its goals, STRONGER4CANCER will engage the Greek (and the broader SEE) scientific community by offering them open access to workshops, summer schools, seminars, scientific soft-skills, technology transfer competences, and an e-learning platform.

All research and teaching outputs in form of textbooks or journal publications will be made available via open access, and all data produced within the project will be openly accessible. All research and teaching activities within STRONGER4CANCER are EU taxonomy aligned, since the scientific and education activity *is contributing* to "**pollution prevention**" one of the six environmental objectives.

Furthermore, the STRONGER4CANCER programme is coordinated with and complementary to the SEEIIST initiative and to the HITRI+ European project. STRONGER4CANCER will be highly beneficial for SEEIIST because, in one of the possible scenarios, the SEEIST linac injector is meant to serve the double purpose of delivering high-current ion beam to the hadron-therapy synchrotron and to serve a target station for radioisotope production at the same time. The double scope of the linac is, on the other hand, an explicit deliverable of the HITRI+ project. Therefore, despite the very different scopes and range of objectives of all these initiatives, there is clear room for synergies, which are being explored during this proposal preparation already, to be implemented if this project proposal is approved. In particular, joint meetings and workshops among these projects will allow to leverage on the topics that they have in common and the contributions that would derive from a larger scientific community.

In conclusion, the wider overall objective of STRONGER4CANCER is to provide the Greek partners with a solid and sustainable culture, a well-focused research line and related tools and competences, promote long-term welfare and health benefits, while fostering regional integration and convergence with the EU research area and its priority missions.

The overall evaluation of the actions of STRONGER4CANCER will be measured using multiple performance indicators. The specific objectives for this collaborative initiative are given in the table below.

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Objectives	Performance indicators	Relation to the WPs
Create a new research field at **AUTh**: Applied and Accelerator Physics for radionuclide production in medical applications.	Number of trained staff members, of undergraduate students, master and PhD students, number of publications on the specialised topics, participation in scientific meetings and conferences, number of expert visits.	WP2, WP3, and WP5
Educate and train researchers in the field of Applied and Accelerator Physics for radionuclide production in medical applications	Number of attended summer schools, workshops, training courses, virtual trainings, invited seminars, internships, staff exchanges.	WP2-WP5
Expand the scientific reach of AUTH research in Applied and Accelerator Physics for radionuclide production in medical applications	Number of publications in peer-reviewed scientific journals, proceedings and reports, number of presentations in scientific meetings, invited seminars, staff-exchanges	WP2, WP4, and WP5
Create a long-lasting collaboration between **AUTH, UMIL**, **INFN**, **CERN**, **GSI** and health care communities in Greece and bridging to industry.	Further collaborations between partners of **STRONGER4CANCER**, number of publications involving multiple partners, joint activities, joint publications, joint proposals, staff exchanges	all WPs
Enhance **Greek** researchers' ability to contribute to specialized advanced research topics and be competitive in Europe	AUTH participation in more scientific EU consortia	WP2-WP5
Enhancement of complementary and knowledge & technology transfer skills of the Greek academic staff	Number of participants in specialized soft-skills enhancement seminars, number of dissemination activities, number of EU projects applications	WP1, WP2, WP6

Promote and establish the connection of academia and industry to help the **digital transition**	Number of students internship in digital technologies industries, number of collaboration agreements with businesses	WP3-WP5
*Position **AUTh and Greece** as an active contributor to the SEEIIST initiative*	Collaboration agreements with SEEIIST and its partners, statements by the SEEIIST SC	WP2, WP4, WP5
Promote research on the use of radioisotopes for cancer treatment and diagnostics in order to decrease avoidable mortality	Number of publications in peer-reviewed scientific journals, number of citations and communications in scientific meetings, attract more students in the scientific field	WP4, WP5

1.1.1 Relation to the work programme

Each institute to complement, where necessary

Networking and capacity-building objectives in *Applied and Medical physics* Nuclear Medicine will be attained through a detailed work programme consisting of **workshops, summer schools, periodic staff exchange, scientific visits, e-learning, and e-dissemination**. It will create the foundation of a national research dynamic for the academic and medical communities, increasing the scientific outputs in *applied and medical physics* and promoting new collaborations at national, regional, and international levels.

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H2020- WIDERA-2021-ACCESS-03-01	STRONGER4CANCER
???? 03-01 or just 03????? Improved excellence capacity and resources in Widening country (Greece) enabling to close the still apparent research and innovation gap within Europe	**AUTH and Greek partners** will pair up with **UMIL Academic Institute and INFN, CERN, GSI** Leading European Research Institutions. This will allow **AUTH and Greek partners** to enhance strategic networking activities, improve the quality and impact of the national and accelerator-based radionuclide production in medical applications at the research level, and boost the scientific community's impact through publications arising from participation in European networks. A new research field in accelerator technologies and their applications will be added at **AUTH**,
Enhanced strategic networking activities between the research institutions of the Widening country and at least two internationally leading counterparts at EU level	The **STRONGER4CANCER** strategy will be implemented through an action plan which includes a range of diverse activities: staff and students scientific exchanges, expert visits at **AUTH**, summer schools, workshops, annual meetings, e-learning. **STRONG4CANCER** will build on the success of ongoing networking and integration activities (e.g. IFAST, HITRI+). This network will be enhanced and strengthened by more extensive student training and collaborative work on research topics.
Raised reputation, research profile and attractiveness of the coordinating institution from the Widening country and the research profile of its staff	High quality scientific publications from **AUTH** are in theoretical and experimental nuclear physics, in elementary particle physics, in nuclear physics applications, in radiochemistry.... The Network of excellence in Applied and Accelerator Physics for radionuclide production in medical applications will add a new scientific field that will raise the reputation, research profile, and attractiveness of **AUTH**.
Strengthened research management capacities and administrative skills of the staff working in institutions from the Widening country	The execution of **STRONGER4CANCER** will be supported by the international partners with wide experience in project management and execution, in particular for EU Projects. A member of AUTH MT will spend 6 months at **CERN** to acquire skills and to be exposed to best practices at the **CERN** EU office. A trainee will join the Knowledge and Technology group of partners' institutes. **GSI** is part of the **STRONGER4CANCER** project MT.

Improved creativity supported by development of new approaches in R&I collaboration, increased mobility (inwards and outwards) of qualified scientists	**STRONGER4CANCER** will provide expertise in a new research activity, with opportunities for AUTH/Greece to become a regional leader in novel accelerator technologies for innovative radionuclide production. Connections between academia and industry will, moreover, support national digital transition in medical research and economic recovery of the region.

1.2 COORDINATION AND/OR SUPPORT MEASURES AND METHODOLOGY

EXPLAIN HOW THIS WILL ENABLE YOU TO DELIVER YOUR PROJECT'S OBJECTIVES. REFER TO ANY CHALLENGES YOU MAY HAVE IDENTIFIED IN THE CHOSEN METHODOLOGY AND HOW YOU INTEND TO OVERCOME THEM.

1. *it **is not significantly harming any of the six environmental objectives of the EU Taxonomy Regulation**.*

OPEN SCIENCE, 1 PAGE, INCLUDING RESEARCH DATA MANAGEMENT

1.2.1 STRONGER4CANCER **Network Overview**

Each institute to complement, where necessary

Through **STRONGER4CANCER**, **AUTH** (Greece) will pair up with NNNN Leading European Research Institutions, UMIL **Leading EU Digital technology Companies**, and NNNN national hospital.

THE GREEK COLLEAGUES TO REVISE, COMPLETE AND FINALISE THIS PARAGRAPH

This network will allow **AUTH** to enhance strategic networking activities, improve the quality and impact of the national research level on Applied and Accelerator Physics for radioisotope production in medical applications, and boost the scientific community's impact through publications arising from participation in research and technology networks. The **STRONGER4CANCER** long-term goal is to increase translational and technological know-how and research output in *experimental physics and medical physics* in Greece. The **STRONGER4CANCER** European network is represented in Figure 1.

AUTH to FINALISE

AUTH (https://www.auth.gr/en/) is the largest Greek university. It includes a total of 10 faculties, consisting of 40 departments and 1 one-part faculty. There are 60 Clinics (Medicine, Dentistry, Veterinary Medicine), 319 institutionalized Laboratories and 23 Study Centers. The Central Library of the Aristotle University of Thessaloniki, one of the largest in the Balkans, together with the 43 regional libraries of the Departments and Schools, constitute the library system of the Aristotle University of Thessaloniki. At AUTH there are 42 undergraduate programs and 92 postgraduate programs in individual departments, but also inter-departmental, inter-university and international. There are also 23 collaborations with foreign institutions for the elaboration of doctoral dissertations, Greek and foreign doctoral candidates under co-supervision. Today, there are 88,283 **students,** of which 77,198 **attend undergraduate programmes** and 6,588 **postgraduate programmes**. Also, 3,952 **are PhD candidates.** The **Teaching and Research Staff** (DEP) amounts to **1,682** people, the **Laboratory Teaching Staff** (EDIP) to **311** people and the **Special Teaching Staff** to **104**. The training project is assisted by another **144** members of the **Special Technical Laboratory Staff** (E.T.E.P.), while the administration employs **278 M Permanent Employees** and **256** with a relationship of **Private Law of Indefinite Time** (IDAK). The Physics Department (https://www.physics.auth.gr/) is one of the most active and internationally recognized scientific institutions in Greece. It offers first-, second-, and third-cycle study programs covering a range of advanced courses in theoretical, experimental, and medical physics. It is actively collaborating with the main Hospitals of Thessaloniki, which is instrumental for the high quality of the training of students in the last-cycle study programs in medical physics.

Figure 1. Overview of STRONGER4CANCER network

YF & AM input

PAPHOS Papageorgiou Hospital (https://www.papageorgiou-hospital.gr) provides medical services to adult and paediatric patients, including radiotherapy and nuclear medicine. It is closely linked to the research and educational activities of **AUTH**, mainly the

Medical School, but also the Faculty of Science. It is considered as one of the most active and internationally recognized scientific institution in the country. All medical physics activities are organized through the Department of Radiation Protection and Medical Physics.

TECH-THESS..... ARIS TO COMPLETE FROM WEB

DEMOKRITOS COLLEAGUES TO FINALISE.....

The Università degli Studi di Milano, UMIL (www.unimi.it) is among the most important Italian universities for investments in research infrastructures and human capital. It is a founding member of LERU and is the only Italian university to be part of it. The research activity carried out by the Departments includes all three major areas: Life Science, Social Sciences and Humanities, and Physical Sciences and Engineering, according to the classification of the European Research Council (ERC). It is organized also with the presence of Coordinated Research Centres (CRC) (https://work.unimi.it/servizi_ricerca/centri/118529.htm) that coordinate activities within a specific topic, including interdisciplinary. There is also a very large activity of the Technology Transfer Department (https://www.unimi.it/it/ugov/ou-structure/direzione-inTecnologia-e-valificazione-delle-conoscenze). At UMIL there are 77 undergraduate programmess, 64 Master, 33 PhD Schools, 75 postgraduate programmes and more than 65 Specialization Schools in individual departments but also inter-departmental, inter-university and international. See the file added in Annex XXXX

The contribution by UMIL will be to provide target courses and contribute to training a new generation of physicists in AUTH in experimental physics with a particular attention in the radioactivity field and radionuclides production applied to medicine.

The **European Organization for Nuclear Research, CERN** (www.cern.ch) is one of the world's largest and most respected international centres for scientific research in fundamental and applied physics. It is home to the Large Hadron Collider (LHC), the world's largest and most powerful particle accelerator. Many discoveries at **CERN** have led to Nobel prizes in physics. **CERN** is a pioneer in the application of accelerators to cancer therapy and holds a research line on technologies for new **Ion Therapy** accelerators. **CERN**'s contribution to **STRONGER4CANCER** consortium will be to train a new generation of physicists (in GREECE) in applied physics and share its best administrative practices.

The **GSI Helmholtz Centre for Heavy Ion Research** (www.gsi.de) is one of the European centres of excellence for ion beam research, having developed and applied many of ion beam technologies to cancer therapy. **GSI** was the first centre in Europe to treat cancer patients with ion beams in 1997 jointly with the Heidelberg University Hospital and the **DKFZ**. Since **GSI** has extensive expertise in both medical accelerator technology and ion beam therapy, the main contribution of **GSI** to **STRONGER4CANCER** will be to coordinate the teaching and training of GREEK students at the collaborating research institutions to guarantee a uniform and standardized level of education for all GREEK students.

GB to shorten it

The National Institute for Nuclear Physics (INFN) is the Italian research agency dedicated to fundamental reserach, under the supervision of the Ministry of University and Research (MUR). This requires the use of cutting-edge technology and instruments, which is developed by the INFN, at its own laboratories, and in collaboration with industries. INFN participates in the construction and use, of powerful accelerators at CERN and its research programmes. Today the INFN employs some 5,000 scientists whose work is recognised internationally for their contribution to various European laboratories and numerous research centres worldwide. The current project proposal is enriched by the collaboration of the INFN Department Laboratori Nazionali di Legnaro (LNL, Legnaro, Padova, Italy), one of the four national laboratories of INFN. The operation of electrostatic and linear accelerators, since 1961, and the experimental instrumentation make LNL a center of international class research in the field of low energy nuclear physics. In 2016, a new 70 MeV proton cyclotron was installed and tested. It represents the heart of the SPES infrastructure, currently being completed, aimed at a novel class of experiments with radioactive beams and at the development of medical radionuclides. The LNL accelerator group made important contributions to IFMIF (Japan) and ESS (Sweden) projects, with the design and construction of the very challenging RFQ and DTL structures, respectively. The proton cyclotron will be used for fundamental science, but also for R&D in innovative radionuclides for nuclear medicine, in strong connection with the local medical community and universities.

1.2.2 Strategy, Coordination and Support Actions (CSA)

THE GREEK COLLEAGUES TO REVISE, COMPLETE AND FINALISE THIS PARAGRAPH

EACH INSTITUTE TO REVISE AND COMPLEMENT

The **STRONGER4CANCER** long-term goal is to enhance **AUTH** (and Greek) researchers' ability to contribute to state-of-the-art research and become competitive in Europe in the field of novel RN production for nuclear medicine employing advanced accelerators, and to create a new research *field in applied physics with a focus on medical physics and in particular on cancer diagnosis and therapy*. **AUTH** will coordinate **STRONGER4CANCER**, being responsible for the implementation of its activities that will lead towards these goals. To do so, **AUTH** has defined short-term and long-term strategic goals schematically presented in Figure 2:

- The **short-term strategy** focuses on the investment in capacity building *in applied and medical physics* to allow the development of *an initial programme of fundamental and applied research*. This effort will be based on the organisation of workshops, summer schools, e-seminars, scientific exchange, scientific soft-skills trainings, development of technology transfer competences, and by providing an e-learning platform

The **long-term strategy** will focus on *translational research in applied and accelerator physics* for radionuclide production in medical applications, to develop the backbone of a research and teaching environment needed to develop a robust university curriculum.

STRONGER4CANCER will develop novel MSc and PhD courses needed in AUTH. ***The development of curricula for MSc and PhD programmes in AUTH will allow the standardization of the training of applied physics needed to work in applied areas such as experimental physics, medical physics, and high-tech companies*.** The development of curricula for **standard MSc and PhD programmes** will require the cooperation of all European partners and capacity building within Greece. A long-term vision is needed which combines national expertise, present in Greece, with international expertise provided by the partner research institutions and support by the partner companies that also provide specialized training programmes and internships on modern technologies. The overall strategy of the **STRONGER4CANCER** is highlighted in the following diagram, where the short-term and long-term goals are indicated and how they contribute to improving know-how and expertise in *applied physics in AUTH*.**UPDATE FIGURES with the same concept**

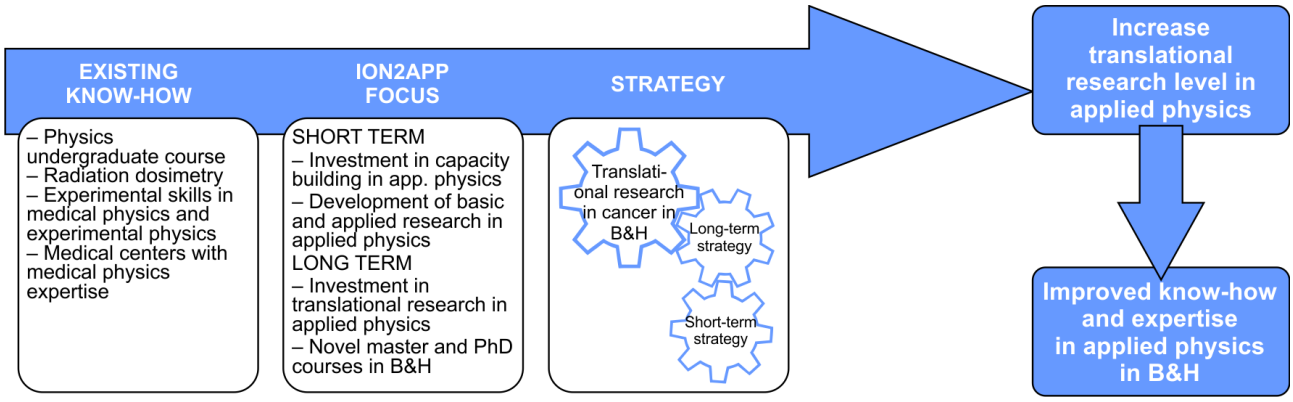


Figure 2. Short- and long-term scientific strategy definition process at AUTH

The European partners will contribute to the strategic goals of the project with a diversified coordination and support actions, globally embracing all the main pillars of this capacity building initiative.

INFN-LNL, with expertise in accelerators, target design, medical radionuclides and safety, will provide lectures, dissemination actions and high-level contributions to ad-hoc workshops in all these disciplines, that will regard both fellow researchers at AUTH and the associated Greek institutions, and students at various level of their careers. It will involve Greek students and their tutors in design work, physical and engineering studies, making use – whenever possible – of the instrumentation that they have on their site and of the experimental methods that they mastered. Special emphasis will be given, towards the project completion, to delivering to the Greek colleagues the technological and management tools which are indispensable for preparing a future facility, in Thessaloniki, with a sufficient degree of overall proficiency and in an autonomous fashion.

Also, UMIL, that has carried out since seventies the study of the optimization production of non-conventional radionuclide in no carrier added form with High Specific Activity, will contribute in the training and dissemination

of the items, procedure, experimental approach, instrumentation of the Greek new generations to achieve the necessary skills in this subject.

SWOT ANALYSIS:TO BE COMPLETED FROM AUTHA SWOT analysis of the *current situation of applied physics in GREECE*is given in Table 1.

Table 1. ***SWOT Analysis of the current situation of applied physics on ion beam research and medical physics education and research at University of Sarajevo (S-Strength, W-Weaknesses, O-Opportunities, T-Threats.***

Strengths	Weaknesses	Opportunities	Threats
Internal Factors		External Factors	
~~Private funding for ion-source laboratory and group leader position to allow ion beam R&D~~	~~Lack of competence to operate hardware. Weak inter-departments support for ion beam research~~	~~Further development of this instrumentation creates a local facility for production of isotopes for medical applications~~	~~The state approval is required for new ion source laboratory.~~
High qualification and competence of Greek partners' staff	Weak expertise in accelerator physics for radioisotope production for cancer therapy	International cooperation will establish best practices and improve training for professors, researchers and students in GREECE	The workload at university and research institutes is increased due to retirement of staff.
Effort, dedication commitment of Greek partners' staff	Lack of training and qualification framework	Fast scientific and technological evolution	The workload at university and research institutes is increased due to retirement of staff.
High professional recognition of Greek staff	Lack of training and qualification framework	Collaboration with more advanced partners will complement the initial high professional standard with novel competences	
High expertise in experimental physics and very good laboratory conditions to allow hands-on training			
Strengthening the physics department with a medical physics dedicated programme	Lack of experimental laboratory conditions for training and education in medical physics	Create a standard medical physics training programme for the Balkan countries	Poor cooperation between University and Hospital can delay or weaken trainings
The novel education and research **STRONGER4CANCER** programme will attract more undergraduate students	Inadequate laboratory facilities for experimental training	Temporary training at collaborating institutes. ~~Training students for positions in industry~~	Highly trained students from **STRONGER4CANCER** may prefer to leave the Balkans due to lack of job opportunities there.
~~Establish incubator hub for industrial start-ups~~	University rules make collaboration with industry difficult.	Create a sustainable regional network of industrial partners.	Political decisions that constrain establishing private enterprises.
Master and PhD programme in experimental nuclear physics and computational physics	University cumbersome administrative procedures slow down progress	Create a larger scientific network with collaborating non-Greek partners which may last after the project completion	Current GREEKlabour laws make time-limited contracts jobs (like PhD) in academia difficult.

*The SWOT analysis shows inadequate laboratories for research and teaching, which hamper education and research. There are also poor inter-department collaborations and lack of experienced physicists to handle complex research equipment. The **STRONGER4CANCER**main focus is to develop both a teaching and research programme at **AUTH**.*

Benefits for AUTH: The AUTH has been involved in the preparation of the proposal guaranteeing its alignment with the institutional strategy as well as the individual research interests of the involved group leaders. As such, AUTH envisions that the STRONGER4CANCER network, that will be established through this project, will live well beyond the project terminus. The STRONGER4CANCER consortium gathers an outstanding scientific community in the field of experimental physics and medical physics. The complementary skills and competences of the staff of each beneficiary will contribute decisively to leverage research excellence and technology capacity at AUTH and generally in Greece. Additionally, the AUTH will benefit from STRONGER4CANCER project since new scientific collaborations will be established by the participating researchers with their peers in Greece and within Europe. Very positive impact is also expected from the experience and know-how exchange between the students and postdoc community between NOT FINISHED SENTENCE ??

Input from Demokretos CHECK THE CALL

Benefits for CERN: There are several reasons for the involvement of **CERN** in the **STRONGER4CANCER** project. **CERN** has launched in 2018 its NIMMS (Next Ion Medical Machine Study) initiative to develop novel accelerator technology aiming at improved access to ion therapy. Students supported by **STRONGER4CANCER** will work jointly with researchers from **CERN** to develop novel ion beam technology for use in the Balkans and especially within the SEEIIST project (initiated in 2017), which has signed in 2020 a collaboration agreement with **CERN**. **CERN** will benefit from the influx of young scientists that will contribute to the NIMMS and SEEIST projects. In addition, **CERN** will be heavily involved in the training of the future physicist working on novel medical accelerators, contributing to education in applied physics to the future generation of scientists.

Benefits for GSI: The motivation behind the involvement of **GSI** in the **STRONGER4CANCER** project is twofold. **GSI** has extensive know-how and expertise in both accelerator technology and ion beam therapy and is therefore ideally suited to train the new generation of scientists, applied physicists and medical physicists. **GSI** will benefit from the influx of many young physics students from Greece and the broader South East European area that will receive training in applied physics and can contribute to the **GSI/FAIR** projects. In addition, **GSI** is heavily involved in the project HITRI+ (Heavy Ion Therapy Research Integration) Integrating Activity for Starting Communities of the Horizon 2020 Framework Programme that started in 2021. **STRONGER4CANCER** will prepare trained students from the SEE that can then better benefit from specialized HITRI+ courses that provide education in biophysics and medical research on cancer treatment.

Benefits for UMIL: The motivation for the involvement of UNIMI in this project, in particular for the LASA Laboratory of Physics Department, is related to the tradition of research activity that is being carried out since the seventies. This tradition is focused on the study of the optimization of the production of radionuclides with unconventional ways, for applications in medicine such as diagnosis and metabolic radiotherapy, towards theranostics as well as for radio-nano-medicine and radiotracers for environmental applications. In this framework, the production of more than 70 radionuclides produced in no-carrier-added form with very high specific activity has been set up by the research group related to this Laboratory, as testimonial by the many research projects in which it is involved since 1980 together with the publications. Hence, based on this background UMIL can be a good deputy to convey all the knowledge in this field to young generations, in order to provide them with the appropriate training both in the field of nuclear physics and radiochemistry, applied to radionuclide production; as well as to create new figures that can be employed in the research and industry like in hospital fields. Thus, UNIMI can receive Master's and PhD students to be trained in this field and has a good opportunity to be inserted in the framework of this research network of collaborations.

Benefits for INFN: INFN would benefit from the outcome of the project for the main following reasons. The INFN-LNL "Unit on radioisotope production for medical applications and applied physics" and the experts in radioprotection and safety would take advantage from an expansion of their research activities by the addition of a fraction of the time of a post-doc and by the work of PhD and masters students. The scheme of a real infrastructure for R&D activities on established and emerging radioisotopes production– focused on accelerator, target, safety and main associated systems –, at a level between the conceptual and technical design, will pair up a similar effort by INFN-LNL on a possible similar facility to be realised in close connection with the University of Padova: the contribution of Greek students and fellow researchers to this aim will be beneficial, speeding up this investigation for both INFN and AUTH.

Impact

Impact – aspects to be taken into account.

1. −Credibility of the pathways to achieve the expected outcomes and impacts specified in the work programme, and the likely scale and significance of the contributions due to the project.
2. −Suitability and quality of the measures to maximise expected outcomes and impacts, as set out in the dissemination and exploitation plan, including communication activities.

The results of your project should make a contribution to the expected outcomes set out for the work programme topic over the medium term, and to the wider expected impacts set out in the 'destination' over the longer term. In this section you should show how your project could contribute to the outcomes and impacts described in the work programme, the likely scale and significance of this contribution, and the measures to maximise these impacts.

2.1 Project's pathways towards impact *[e.g. 4 pages]*

1. Provide **narrative** explaining how the project's results are expected to make a difference in terms of impact, beyond the immediate scope and duration of the project. The narrative should include the components below, tailored to your project.

a. (a) Describe the unique contribution your project results would make towards (1) the **outcomes** specified in this topic, and (2) the **wider impacts**, in the longer term, specified in the respective destinations in the work programme.

1. *Be specific, referring to the effects of your project, and not R&I in general in this field.*
2. *State the target groups that would benefit. Even if target groups are mentioned in general terms in the work programme, you should be specific here, breaking target groups into particular interest groups or segments of society relevant to this project.*
3. *The outcomes and impacts of your project may be:*

1. Scientific, e.g. **contributing to specific scientific advances**, across and within disciplines, creating new knowledge, reinforcing scientific equipment and instruments, computing systems (i.e. research infrastructures);
2. **Economic/technological, e.g. bringing new products, services**, business processes to the market, increasing efficiency, decreasing costs, increasing profits, contributing to standards' setting, etc.
3. **Societal ,** e.g. decreasing CO_2 *emissions,* ***decreasing avoidable mortality****, improving policies and decision making, raising consumer awareness.*

Only include such outcomes and impacts where your project would make a significant and direct contribution. Avoid describing very tenuous links to wider impacts. ***However, include any potential negative environmental outcome or impact of the project. Where relevant, explain how the potential harm can be managed.***

a. (b) Describe any requirements and potential barriers - arising from factors beyond the scope and duration of the project - that may determine whether the desired outcomes and impacts are achieved. These may include, for example, other R&I work within and beyond Horizon Europe; regulatory environment; targeted markets; user behaviour. Indicate if these factors might evolve over time. Describe any mitigating measures you propose, within or beyond your project, that could be needed should your assumptions prove to be wrong, or to address identified barriers.

1. *Note that this does not include the critical risks inherent to the management of the project itself , which should be described below under 'Implementation'.*

a. (c) Give an indication of the scale and significance of the project's contribution to the expected outcomes and impacts, should the project be successful. Provide quantified estimates where possible and meaningful.

1. *'Scale' refers to how widespread the outcomes and impacts are likely to be. For example, in terms of the size of the target group, or the proportion of that group, that should benefit over time;'Significance' refers to the*

importance, or value, of those benefits. For example, number of additional healthy life years; efficiency savings in energy supply.

1. *Explain your baselines, benchmarks and assumptions used for those estimates. Wherever possible, quantify your estimation of the effects that you expect from your project. Explain assumptions that you make, referring for example to any relevant studies or statistics. Where appropriate, try to use only one methodology for calculating your estimates: not different methodologies for each partner, region or country (the extrapolation should preferably be prepared by one partner).*
2. *Your estimate must relate to this project only - the effect of other initiatives should not be taken into account.*

2.2 Measures to maximise impact - Dissemination, exploitation and communication [e.g. 5 pages, including section 2.3]

1. Describe the planned measures to maximise the impact of your project by providing a first version of your 'plan for the dissemination and exploitation including communication activities'. Describe the dissemination, exploitation and communication measures that are planned, and the target group(s) addressed (e.g. scientific community, end users, financial actors, public at large).

1. *Please remember that this plan is an admissibility condition, unless the work programme topic explicitly states otherwise. In case your proposal is selected for funding, a more detailed 'plan for dissemination and exploitation including communication activities' will need to be provided as a mandatory project deliverable within 6 months after signature date. This plan shall be periodically updated in alignment with the project's progress.*
2. *Communication measures should promote the project throughout the full lifespan of the project. The aim is to inform and reach out to society and show the activities performed, and the use and the benefits the project will have for citizens. Activities must be strategically planned, with clear objectives, start at the outset and continue through the lifetime of the project. The description of the communication activities **needs to state the main messages** as well as the tools and channels that will be used to reach out to each of the chosen target groups.*
3. *All measures should be proportionate to the scale of the project, and should contain concrete actions to be implemented both **during and after the end of the project**, e.g. standardisation activities. Your plan should give due consideration to the possible follow-up of your project, once it is finished. In the justification, **explain why each measure chosen is best suited to reach the target group addressed.** Where relevant, and for innovation actions, in particular, describe the measures for a plausible path to commercialise the innovations.*
4. *If exploitation is expected primarily in non-associated third countries, justify by explaining how that exploitation is still in the Union's interest.*
5. *Describe possible **feedback to policy measures generated by the project** that will contribute to designing, monitoring, reviewing and rectifying (if necessary) existing policy and programmatic measures or shaping and supporting the implementation of new policy initiatives and decisions.*

1. Outline your strategy for the management of intellectual property, foreseen protection measures, , such as patents, design rights, copyrights, trade secrets, etc., and how these would be used to support exploitation.

1. *If your project is selected, you will need an appropriate consortium agreement to manage (amongst other things) the ownership and access to key knowledge (IPR, research data etc.). Where relevant, these will allow you, collectively and individually, to pursue market opportunities arising from the project.*
2. *If your project is selected, you must indicate the owner(s) of the results (results ownership list) in the final periodic report.*

2.3 Summary

Provide a summary of this section by presenting in the canvas below the key elements of your project impact pathway and of the measures to maximise its impact.

KEY ELEMENT OF THE IMPACT SECTION

What are the specific needs that triggered this project?

Example 1
Most airports use process flow-oriented models based on static mathematical values limiting the optimal management of passenger flow and hampering the accurate use of the available resources to the actual demand of passengers.

Example 2
Electronic components need to get smaller and lighter to match the expectations of the end-users. At the same time there is a problem of sourcing of raw materials that has an environmental impact.

OUR PROJECT
Radioisotopes are produced at specialized centers and then transported to the place of use (which most often is far; example Athens/Thessaloniki). This causes loss of useful radioactivitiy (as the deay of the product starts immediately). It also imposes the use of RN with long enough half-lives.
As stated in literature, research related to specific alpha emitter for targeted alpha therapy (At) is hampered by the non-availability of appropriate accelerators for its production (close to the research centres).

What dissemination, exploitation and communication measures will you apply to the results?

Example 1
Exploitation: Patenting the algorithmic model.

Dissemination towards the scientific community and airports: Scientific publication with the results of the large-scale demonstration.

Communication towards citizens: An event in a shopping mall to show how the outcomes of the action are relevant to our everyday lives.

Example 2

Exploitation of the new product: Patenting the new product; Licencing to major electronic companies.

Dissemination towards the scientific community and industry: Participating at conferences; Developing a platform of material compositions for industry; Participation at EC project portfolios to disseminate the results as part of a group and maximise the visibility vis-à-vis companies.

OUR PROJECT:

Exploitation: Patenting the accelerator design and RN production protocols.
Licencing to RN production private company in Thessaloniki/Athens.

Dissemination towards the scientific community and hospitals: Scientific publication with the results and specific information events for medical communities through the partner hospital.

Dissemination towards the scientific community and industry: Participating at conferences; Developing a platform of material for industry; Industry targeting events and information to Ministry "Innovation, Development" (through Technopolis). Contact to private company (and cooperation through students "internships"?)
Participation at EC project portfolios to disseminate the results as part of a group and maximise the visibility vis-à-vis companies ??.WHAT DOES THIS MEAN?

Communication towards citizens: A public event and special stand during the International Fair of Thessaloniki to show how the outcomes of the action are relevant to health care of citizens life and how early diagnosis supports avoidable mortality from cancer.

What do you expect to generate by the end of the project?

Example 1

Successful large-scale demonstrator:
Successful large-scale demonstrator: Trial with 3 airports of an advanced forecasting system for proactive airport passenger flow management.

Algorithmic model:

Novel algorithmic model for proactive airport passenger flow management.

Example 2
Publication of a **scientific discovery on transparent electronics.**

New product: More sustainable electronic circuits.

Three PhD students trained.

Accelerator designs
RN production protocols
Scientific Publications open access
Three PhD students trained
Curricula of specialized advanced Masters courses

Who will use or further up-take the results of the project? Who will benefit from the results of the project?

Example 1
9 European airports:
Schiphol, Brussels airport, etc.

The European Union aviation safety agency.
The EU RN production centers, EU industry, EU hospitals and diagnostic centers

Air passengers (indirect).
End users: All citizens that need imagining diagnostics, All (cancer) patients

Example 2
End-users: consumers of electronic devices.

Major electronic companies:
Samsung, Apple, etc.

Scientific community (field of transparent electronics).

Scientific research community focusing on

novel RN research

What change do you expect to see after successful dissemination and exploitation of project results to the target group(s)?

Example 1

Up-take by airports: 9 European airports adopt the advanced forecasting system demonstrated during the project.

Up-take by RN production companies
Up-take by accelerators production companies
Up-take by research institutes

Stimulated students in related fields: increase of enrolled students, continuation of related studies and carrier paths

International collaborations in the related subjects with participation of greek institutes and scientists

Expansion of such methods/techniques/research/education to South East Europe

Example 2

High use of the scientific discovery published (measured with the relative rate of citation index of project publications).

High use of publications (measured with the relative rate of citation index of project publications).

A **major electronic company** (Samsung or Apple) **exploits/uses the new product** in their manufacturing.

A major accelerator company adapts their designs for RN production

What are the expected wider scientific, economic

and societal effects of the project contributing to the expected impacts outlined in the respective destination in the work programme?

Example 1
Scientific: New breakthrough scientific discovery on passenger forecast modelling.

Economic: Increased airport efficiency
Size: 15% increase of maximum passenger capacity in European airports, leading to a 28% reduction in infrastructure expansion costs.

Example 2
Scientific: New breakthrough scientific discovery on transparent electronics.

Economic/Technological: A new market for touch enabled electronic devices.
A new market for new RN with short half-lives
A new market for novel accelerator designs

Societal: Lower climate impact of electronics manufacturing (including through material sourcing and waste management).

Societal: more efficient, early cancer diagnosis.
Additional cancer therapy methods based on targeted alpha therapy

2. IMPACT

2.1 PROJECT'S PATHWAYS TOWARDS IMPACT

TO COMPLEMENT BASED ON EU REGULATIONS/GUIDELINES BY EVERYONE (ABOVE)

ALEXANDRA notes

Staff members will expand their knowledge and get expertise in a new research field
Staff members will be trained by experts in accelerator physics and radioisotope production
AUTH networking activities with EU leading institutes will be increased
AUTH and AUTH staff joint activities with EU leading institutes will be increased
AUTH will gain by the training of its members in CERN EU office and KT office
AUTH applications in EU calls will be increased
AUTH completive applications in EU calls will be increased
AUTH publications if a new research field will be increased
AUTH will attract more reputation by participating in a novel research activity
AUTH staff will gain by visits at EU leading institutes
AUTH staff and students will gain by expert visits at AUTH
AUTH will add novel curses in MSc programs, becoming more attractive and more....
AUTH will attract more students
AUTH will gain by the funding of PhD students through the STRONGER4CANCER
funding and training of undergraduate and master students in leading institutions abroad

(CREATION – Portugal – Section Impact – 2.1 Expected impacts pages 20-23)
Cancer remains a key public health concern and a burden on the EU.

SEEIST shall be established, so Greece should be well prepared in the field in order to support future needs and demands for supporting SEEIST actions.

STRONG4CANCER will combine AUTH scientific strength with the UMIL, INFN, CERN, GSI expertise to create a new research group in the applied and accelerator application in radionuclide production for medical applications. Through this network AUTH aims at strengthening and improving translational research capacity of the Greek scientific community in cancer diagnosis and therapy. The dynamic and intensive research framework is focused on promoting capacity building and the exchange of know-how in research excellence and cutting-edge technologies to tackle current and future challenges in radionuclide production for cancer therapy.

To be corrected by
Scientific and Translational Research Capacity
The scientific and technological topics of the activity which will be carried out in this project (through networking, training, dissemination, research) will cover several disciplines: accelerator science and technology for beam production; nuclear physics for study the experimental excitation functions and the thick target yield for the optimization production conditions for radionuclide purity, the engineering in the development of efficient beam targets; radiochemistry for the purification of the desired nuclear species; radioprotection and nuclear safety for the realisation of facilities which **can be safely built in the vicinity of a hospital**.

All these aspects are intrinsically translational, in that they will eventually translate in an enhanced capacity of AUTH and Greek institutions to develop a complete facility for radionuclide production with high specific activity. However, even each of them, taken separately, has its own positive impact for most of the involved institutions.
Impact on accelerator design
Compact accelerators for isotope production: the market of accelerators for production of imaging radioisotope (PET scanning etc.) is estimated at 165M€/year, rapidly growing. An important trend in this field is the evolution towards compact accelerators that are directly installed at hospitals, avoiding the transport of isotopes over long distances from the production center. The **internal RF ion source** for cyclotrons developed in Task 1.2.3 is a crucial component of compact cyclotrons that will give to the two involved companies access to a critical technology for the next generation of compact cyclotrons.
On the other hand, compact linacs are extremely reliable machines and, differently from cyclotrons, their

accelerating structure is self-shielding thus requiring smaller concerns when it is necessary to provide maintenance. This translates potentially in their higher overall availability versus compact cyclotrons. This topic has never been treated in detail, considering advantages and drawbacks of the two solutions in a systematic approach.
Therefore, a thorough comparison of the two solutions is one of the scientific scopes of the proposed activity. Due to its novelty, it will translate into a clear step forward for both the main collaborating partners (INFN and CERN in primis), which will obtain new information from the outcome of this analysis, and for AUTH and the Greek partners, which will have a clear pathway to realise the most cost-effective and efficient solution as a potential future facility in northern Greece for the production of radiopharmaceuticals.

Impact on radionuclide production methods and related purification

(Gaia, Flavia, …)

Nuclear cross section measurements and radiochemical processing for medical radionuclides production, mainly based on the use of proton, deuteron and alpha beams delivered by a cyclotron, is the ground of the INFN and UMIL expertise. Both institutions will benefit by the current project, first by exploiting the capacity of the high-intensity tunable alpha beam provided by the linac under investigation, that will surely enlarge the current European possibilities in medical radionuclides production. Second, the possibility to widen the present research activities on radionuclides and radiopharmaceuticals carried out at the INFN-LNL in a clinical environment, taking into account the regulatory and quality control aspects in Greece, potentially including in the production cycle the targetry technologies developed at the INFN-LNL and the radiochemical processing studied at UMIL. Third, the possibility to build a strong collaboration with the Greek institutions, in view of future preclinical and clinical studies carried out in Greece with radionuclides (and possibly radiopharmaceuticals) produced and developed at the INFN-LNL, in collaboration with UMIL.

Impact on radioprotection and safety studies.
Educational activity and training in the field of safety and radiation protection will result into a high level trained people able to evaluate in a right manner for proper site characterization, human and environmental exposure and impact assessments, safety assessments and evaluation of remediation options (in terms of technical performance, associated exposure reduction and social impact) which constitute the basis for decision making especially when particle accelerators are involved and radioactive materials have to be handled.

STRONGER4CANCER will create three major pathways towards impact in GREECE and in the South East European region beyond the immediate scope and duration of the project.

- **Pathway 1:** Development of a strong and independent research and teaching programme at **AUTH**, based on the three translational pillars characteristic of this project programme: (a) accelerators, (b) optimization pruduction of non-conventional radionuclides, targets and radiochemistry, (c) nuclear safety
- **Pathway 2:** Lay the grounds for an integrated design of a radionuclide production centre, to be located close to a hospital in northern Greece, by identifying the major items to be investigated and by preparing the first integration and management methods for its exploitation
- **Pathway 3:** Establishment of long-term academic relationships with leading European centres in the production of radionuclides and, in general, the application of ions to cancer therapy.

Giovanni: let's firs agree on the above short descriptions, and then we can develop them further

Pathway 1: The development of a strong and independent research and teaching programme in **AUTH** will have a long-term impact in science, technological innovation and society health care within GREECE. Pathway 1 will allow for the training of a new generation of experts and researchers in the field of Applied and Medical Physics, who will contribute to the scientific production of **AUTH** and to the increased application of radiation medical equipment to cancer therapy and diagnostics, yielding a major impact in healthcare of cancer patients in Greek society. Carefully planned activities within the **STRONGER4CANCER** project, such as workshops, hands-on trainings, expert visits, summer schools, etc., will strengthen the scientific research and teaching capacities of the Department of Physics at **AUTH**. In addition, its scientific output and consequently the one of the Faculty of Science and **AUTH** would be significantly increased, contributing to the strengthening of its position and reputation. It is expected that implementing **STRONGER4CANCER** will increase all scientific performance indicators, including the number of publications and citations in ion, particle, and medical physics. At least eight publications are expected in the first three years of **STRONGER4CANCER** and at least 15 publications in the five years after completion of **STRONGER4CANCER**.

The target groups of pathway 1 are the scientists and university professors in GREECE that will be able to perform cutting-edge research. In addition, another target group are **the physics students** that will receive training and education in applied physics.

The major requirements for developing a long-term research and teaching programme at **AUTH** is the need for training in the new field of radionuclide production with ion accelerators Potential barriers to the success of pathway 1 are the poor university practices in **management and administration** of public infrastructures and university personnel. Mitigation measures that can reduce the impact of poor management and administration at **AUTH**, would be to send the best students abroad to receive extended training at leading Europe research centres. In addition, local management and administration policies should be improved to guarantee success at acquiring European funding.

All ion beam research in GREECE, short- and long-term, will depend on the successful development of a strong and independent research and teaching programme at **AUTH**. The success of pathway 1 will yield a major impact in the long-term to GREECE scientific, technological and health care components.

Pathway 2: The development of a strong and independent research and teaching programme requires a strong investment in laboratory infrastructure in GREECE. Pathway 2 will create conditions to allow both science and technology development to occur in GREECE with a new state-of-the-art ion source laboratory. The establishment of the **new ion source laboratory at AUTH, will allow for the long-term development of top-class scientific output** and contribution to international projects like the SEEIIST.

One of the biggest problems in the WB countries is the continuous population decline caused mainly by the migration of young people to developed countries due to lack of adequate conditions such as advanced infrastructures necessary for proper education and career advancement. Consequently, the number of students enrolled in GREECE universities has steadily decreased over the past decade. With the establishment of a modern laboratory for ion physics in GREECE, financed through a donor's foundation, and the expansion of **AUTH**'s research capacities within the **STRONGER4CANCER**, we expect that the decline in the number of enrolled students will be slowed down, especially at the Faculty of Science. We predict that the number of students enrolled at the Physics department will increase by 50% in the five years following the closure of the **STRONGER4CANCER**. In addition, the novel laboratory will allow for the teaching of graduate physics students attending the master of PhD programme. Laboratory infrastructure at GREECE will have major long-term impact

in everything from science to technology to education and to medical healthcare. The major requirement for the creation of a modern ion source laboratory, is the international hiring of a group leader with expertise and know-how to drive the new laboratory. Potential barriers to the creation of the new ion source laboratory are the lack of management and administration expertise and experience in managing large modern laboratories needed for both research and teaching. The new ion source laboratory will have a major impact in both education and research at **AUTH**, affecting all levels of teaching and research of young physicists and experts. In addition, the new laboratory will have a major impact in training the medical physicists of the future that will primarily work in healthcare, providing therapy or diagnostics to cancer patients.

YF NOTE: most of the items below are valid: to cross check with Greek colleagues and AI

Pathway 3: Pathway 3 fosters the establishment of a long-term **"twinning" collaboration** between partners in Greece (a university, **AUTH,** a research center NSNN, a health-care provider Papageorgiou Hospital and industry through Technopolis) on the one hand, and a set of top-class European research centres in the fields of fundamental and applied physics and of nuclear medicine and cancer research on the other hand. This collaboration is intended to establish durable personal and scientific connections that will last well beyond **STRONGER4CANCER**. The establishment of a long-term academic relationship with leading European centres in nuclear medicine, ion beam research and development is vital to allow **AUTH** to think beyond the 3 years of funding provided by the European Union. Pathway 3 offers a long-term solution to scientific and technological development at **AUTH** with immediate impact in medical accelerator research and development and its application to nuclear medicine and cancer care. All activities proposed in the **STRONGER4CANCER** have been designed to stimulate the integration of **AUTH** researchers and its partners, including medical staff and industry, within networks of excellence inside Europe and to increase the international visibility of **AUTH** and Greek partner institutions. Short and long-term visits of staff from **AUTH** and Greek collaborating institutes at partner institutes, expert visits from western european partner institutions to **AUTH**, workshops, on-site training, and contact with outstanding international research institutes will be a powerful stimulus to increase the number of applications for international grants and participate in various European scientific networks. Greece is a founding member of the European Organization for Nuclear Research (**CERN**), signed by AUTH Prof Empirikos in 1954 and since then, Greek institutions contribute to fundamental research at CERN. Several agreements have been signed with the aim to contribute to capacity building and industry involvement; most recently an effort was made to focus on the field of accelerator physics and its applications. The **STRONGER4CANCER** activities will allow **AUTH** and Greek partners to gain necessary expertise and hence enable them to actively contribute to the planning and implementation of future cancer therapy facilities such as the one planned within the SEEIIST initiative. An increase in the number of applications for international grants is expected. In addition, a 30% increase in the number of scientific staff exchanges and expert visits is expected as well as to the participation to scientific meetings and conferences.

2.2 MEASURES TO MAXIMISE IMPACT - DISSEMINATION, EXPLOITATION AND COMMUNICATION

It is completed by Yiota

The **STRONGER4CANCER** dissemination, exploitation and communication (DEC) activities will be coordinated by the dedicated WP2. The aim of all **STRONGER4CANCER** partners is to maximise the project's impact among the scientific community and public. All Tasks take this aim into consideration. The Communication Officer, also playing the role of Diversity Officer, will oversee such activities with the support of the MT, and present the draft DEC plan at the kick-off meeting. This evolving document will be evaluated and updated and is a concrete deliverable (D N.N). It will put particular emphasis on diversity and gender aspects. DEC material will be available in English, in order to maximize impact, and/or Greek language when necessary. The resulting collaboration of the Greek partners with renowned European experts, along with the young generation, will be a sustainable, empowered network, strongly linking research centres, universities, health providers and industry; it is the declared aim of all **STRONGER4CANCER** partners to establish long term collaborations expanding the reach of **STRONGER4CANCER**. With the aim to support such networks and ultimate objective to strengthen the position of Europe including the SSE area, the **STRONGER4CANCER** draft DEC plan is outlined below.

STRONGER4CANCER Draft plan for dissemination, exploitation communication of project results

The**STRONGER4CANCER** dissemination plan aims at addressing the widest possible spectrum of communities among and beyond its members in a time span that will go beyond the project duration; the main objective is to reach all stakeholders, researchers, undergraduate/graduate students and to-be Medical Physicists, patients, physicians, Medical Physics experts, the general public giving special attention to high-school students and female population. The **STRONGER4CANCER** dissemination strategy dwells on the open science efforts, with the objective to allow great visibility and fast access to the research results and raw data of the published material as outlined below:

2.2.1 Dissemination and exploitation of scientific results

***Scientific communities*:** the **STRONGER4CANCER** results will be disseminated to the scientific communities through: (1) presentations of the project's results at scientific meetings by its members; (2) scientific publications in international peer-reviewed journals (3) open access platforms, e-learning platform, and its webpage.

***Organisation, conferences organizers, journal editors*:** several **STRONGER4CANCER** members are reviewers or advisors to national and international agencies and organizations or editorial boards. This is a reflection of their scientific capacity and broad recognition, providing opportunities to reach highest scientific levels and broader communities.

University students: dissemination to the Greek students' community will be supported by the expert visits, special seminars (also online), schools and workshops, and the recorded material that will be posted at the e-learning platform, which can also be used by students in all partner institutes and beyond. Opportunities for direct contact to students' communities will increase impacts. **STRONGER4CANCER** will also foster internships for master's students to partner institutes. ++++ students social media and other communication web sites etc

***Medical/clinical communities*:** among the **STRONGER4CANCER** partners, the Papageorgiou Hospital in Thessaloniki is in good position to reach the Medical Physics and Clinical communities, which will be directly exposed to **STRONGER4CANCER** activities that include workshops and summer-schools open to medical communities. The e-learning platform will allow them to have access to training content without being time-bonded.

Knowledge management and protection

The principles for dissemination, access and use of **STRONGER4CANCER** results will fully comply with the Rules for Participation and Dissemination in Horizon Europe[1]. Its partners will endeavour **to publish any results as swiftly as possible** in conference proceedings and/or scientific journals.

The Consortium Agreement will define the procedures for publication, which will take into account the potential for commercial exploitation and/or the need for protection of Intellectual Property Rights (IPR) of the concerned results, with due consideration of the IP practices of all participants. The IPR policy will guarantee that all information shared between beneficiaries will remain confidential allowing protecting the novelty of all results and inventions.

Open access to results*: STRONGER4CANCER**is expected to produce a diverse array of publications and particular attention will be dedicated to the principle of open access, in accordance with the Horizon Europe requirements. It will make use of both Open Access standards ("**Gold**" and "**Green**"), ensuring that readers are granted access to its scientific output without financial, legal or technical barriers:*

- ***Gold standard**, preferred for peer-reviewed publications directly submitted to open-access journals. Publications are expected to be submitted to journals commonly used both, for applied and medical physics results.*

- ***Green standard**: The "Green" standard will take the form of self-archiving in the ZENODO open repository (**www.zenodo.org**) which is integrated and used also by OpenAIRE (**www.openaire.eu**) to provide a common platform for Open Access results across various scientific fields.*

The accelerator community has a long tradition of publishing results in Physical Review Letters and Physical Review Accelerators and Beams but also to conference proceedings. **STRONGER4CANCER** will use JACOW, the Joint Accelerator Conferences Website (***www.jacow.org***), an international collaboration that publishes the proceedings of international accelerator conferences, whereby all conferences agree to the policies and requirements for Open Access publication. Other Journals related to the project's specific activity are:

a) Journal of Radioanalytical and Nuclear Chemistry - JRNC
b) Applied Radiation and Isotopes - ARI
c) Nuclear Medicine and Biology
d) Nuclear Instruments and Method B - NIM B
e) Health Physics and or Radiation Protection Dosimetry

New possibility for Open Access publishing: ***Open Research Europe*** *provides all Horizon 2020 and Horizon Europe beneficiaries and their researchers with a new, easy, high quality peer-reviewed venue to publish their results in open access, at no cost to them, and in full compliance with EU open access policies. The platform uses a*

model of immediate publication, followed by transparent, invited, and open peer review, with inclusion of all supporting data.

Open access to raw data and publications*: all joint-peer-reviewed publications will be accessible through the ZENODO open-access repository following the open access models and the open access vision will be extended to scientific data management. The* ***STRONGER4CANCER*** *researchers will be encouraged to follow the same policy and share the primary data together with the publication of results.*

Patient data*: in the case that patient data might be used, this will be from appropriate public repositories anonymized as means to protect patient privacy.* ***STRONGER4CANCER*** *will not publish any patient data.*

Dissemination of results to industry partners: interaction with industry partners is essential, both, for students' carrier development, and for swift dissemination of the results and technologies developed within the project. Industry through Technopolis will participate actively in information events, schools and workshops. Knowledge and Technology Transfer of any innovation that may occur within **STRONGER4CANCER** will be handled according to the policies outlined in the Consortium Agreement and with the support of experts from its partner institutions.

***Patients and general public*:** dissemination targeting patients and the general public will be performed through the webpage, newsletters, social media and a dedicated YouTube channel, as well as active dissemination within the Papageorgiou Hospital and making use of its newsletters and usual information channels, as well as appropriate online material.

INDUSTRY: something similar related to Technopolis and its networks, ministry of innovation etc

***High school children*:** all **ION2AAP** participants are conscious of the importance of motivating the younger school students to follow STEM related studies. MasterClasses tailored specifically for high-school students will be performed every year within the framework of the IPPOG International MasterClasses, involving university students properly trained as tutors. Special events will be organised for the International Women's Day in STEM on February 11th and International Women's Day on March 8th.

***Diversity/Gender aspects*:** contacts to Diversity officers of all **STRONGER4CANCER** partners will be established and their web pages will be linked to its web page. A special session during the kick-off and yearly project meetings will be dedicated to Diversity aspects with the aim of establishing a dedicated Forum. All west-european partners, and **CERN** in particular, will provide advice/guidance and existing material on procedures, strategies and activities/events.

Communication

The STRONGER4CANCER communication plan will involve both internal and external communication activities. Internal communication activities aim at contributing to the successful implementation of the project's work plan by establishing the appropriate pathways for sharing information, building team spirit and efficient supporting management. External communication activities will guarantee that communication with the public at large is performed in an efficient and adequate way. The foreseen communication activities/material for the public include media/press releases, social media posts and targeted activities/material for schoolchildren and students. The draft plan of communication measures to achieve the set objectives is outlined below:

Project meetings: the three **STRONGER4CANCER** annual project meetings will provide direct communication with its contributors gathering, in-person, the maximum possible number of its members, the MT, SC, AB, IM, CO. The SC members, as nominated representatives of their institutions, will communicate any relevant information and liaise with the AB for independent advice. The aim of these meetings is to facilitate the SC in monitoring the project implementation that is ultimately responsible to evaluate, discuss and agree on major alterations to the project plan. DEC plans, the sustainability plan, proposals/evaluations for scientific staff and students exchanges will be presented, discussed and approved by the SC. Regular communication with all stakeholders will be guaranteed by the MT which will also organize informal meetings with the WP leaders every 3-months and whenever needed. Communication with the EC is the task of the Coordinator who is ultimately responsible for ensuring smooth implementation.

Workshops and summer schools: primarily for **STRONGER4CANCER** members, they will enhance communication of the project's results among partners but they will also be open to the regional, national and international scientific community. Their aim is to also involve experts from medical applications and Medical Physics and Clinical communities, thus enhancing exchange of information among different communities that

usually do not interact.+++ Create e-groups with the participants to get informed about future events, news etc.

Summer Schools is the right tool to give students the opportunity to have a full immersion in the items related to the project, having the possibility to be in contact with international expert, sharing the experiences and confronting and discussing among peers and with the teachers.++ mention career opportunities, similar to the event of HITM school

E-learning and Webinars: The e-learning platform will promote the dissemination beyond the **STRONGER4CANCER** network. Each expert visit will result in a video on the visit subject, uploaded in the platform. Videos will be recorded in English, and, if necessary, proper subtitles Greece will be added for larger accessibility. The platform will require on-line registration that will be used as an indicator of general interest. webinars are also planned, in Greece language, targeting general public. The material will be also uploaded in the dedicated YouTube channel. (SCIENTIFIC) SEMINARS FRO STUDENTS

Media/Press release and newsletters*:* Online newsletters will provide information on the **STRONGER4CANCER** developments, and flyers/posters will be produced prior to major events, in English and Greek.

Website and social media: *The Website will be the main source of dissemination and communication information and will be in English (and/or Greek, when necessary). It will link to the e-learning platform and other information channels. It will be used as the primary interface with the scientific community (national and international) and will be routinely updated with information about the ongoing and future project activities/events.* ***STRONGER4CANCER*** *reports and documents will be made public through the website. Social media presence will be ensured through the generation of social media (LinkedIn, Facebook, Twitter, Instagram) and YouTube accounts of the project.*++ promote career opportunities to the e-groups, participants, mail lists.

Informal social interactions and public events: In the occasion of external experts visits at **AUTH**, informal social interactions will be organized involving discussions among researchers and students. Public events and presentations will further enhance the **STRONGER4CANCER** reach.

Audience	Information needs	Drivers	Channels/Platforms	Outcome
Project participants	Project information; updates on work plan implementation (events, results), outreachmaterials	Community spirit; careerdevelopment	Website, mailing lists, online platforms,project meetings, workshops	Engagement withprojectresults; sense of pride ; efficient implementation
Accelerator &wider scientific community	Main advancements in accelerator science; opportunities to collaborate ; Best practices in researchprojects managing, Main achievements,	Scientific excellence; peer recognition; funding ;Active involvement by partner institutes	Newsletter *Accelerating News;* beneficiaries' and projects' channels; communityevents ; Website, Publications, Newsletters, Exchange programmes, commonevents, workshops	Identifyingcommon challenges, knowledge sharing, closer collaborationssuccessful state support actions
Undergraduate students	Best practices in scientific research, Carrier opportunities,Main advancements	Peer recognition; careerdevelopment ; Creating	Social media, audio-visualmaterial, public events, presentations,	Attract talent; support nextgeneration of researchers ; Understanding

	in acceleratorand nuclearscience; careeropportunities	future scientific leaders Greece	website	impact of STEM in society, supporting fundamental research
EuropeanIndustry	Academic publications, potentialknowledge-transferopportunities,Information exchange betweenacademia and industry	Innovation; job creation; collaboration ;Researchcreatingindustrial entrepreneurship	Academia MeetsIndustryevents; beneficiaries' channels ;Common events/projects Newsletters, website	Knowledge and technologytransfer, joint R&D ;efficient knowledgetransferCreation of on-campus industrialincubators
Funding agencies&decision-makers	Summary of results; project impact; policyrecommendationsImpact of STEM education on Greekeconomicdevelopment	Scientific excellence; economic and societal impactSuccess of EU supported programmes	Website, newsletter *Accelerating News*, marketing material (e.g. brochure) ;Public presentations; Information events Briefings, newsletters	Support to projectcommunity; demonstration of return of investment in acceleratorDemonstrate return of STEM investment to society; evolution/standardization of policiesS&T ;
Public	Societal impact of accelerator technologies	Curiosity, societal impact	Social media, including the beneficiaries' channels; public talks	Support for fundamentalresearch
Patients	Available treatment alternatives; Future possibilities/development	Promotingadvancedtherapy methods to reducemortality	Brochure, TV, social media, Targetedevents, website	Possibility for betterquality of life, support research

2.3 SUMMARY

THE GREEK COLLEAGUES TO REVISE AND COMPLEMENT WHERE NECESSARY

What are the specific needs that triggered this project?	What dissemination, exploitation and communication measures will you apply to the results?	What do you expect to generate by the end of the project?

The number of students enrolled at Greece universities . are interested to continue their studies for a MSc and/or PhD programme and to get knowledge to a state of the art topic, to be satisfied with themselves and useful in their community	**Exploitation**: Patenting any scientific or technological development on ion beams for medical applications. **Dissemination towards the scientific community and industrial partners**: Scientific publication with the results will be made available via open-access. In addition, dissemination towards industrial partners, albeit to be protected by agreements protecting the intellectual property of te involved parties, to allow commercializing any know-how developed within the project. **Communication towards students, scientific community and citizens**: Online communications will be focused towards students to advertise the new master and PhD programme In addition, communication in university newsletters of scientific achievements to attract students. Online events to provide information on ion beam radiotherapy and its use in cancer therapy.	Advanced lesson in Master and PhD teaching programme in radioaisotope production by accelerators. High expertise in Applied and Accelerator Physics for radionuclide production in medical applications Medical Physics research programme on ion beams for radiotherapy of cancer and in direct cooperation medical hospitals Greece. Creation of trained individuals with expertise in security and safety culture in radiological applications and decision-making also in conditions of uncertainty and emergencies, with attention to science and values, such as societal and ethical values, justification and optimisation, and the involvement of stakeholders Technical and management tool to let AUTh to proceed autonomously on the pathway towards the creation of a frontier regional center for the production of both conventional and innovative radionuclides, to be translated in radiopharmaceuticals for people welfare.

Who will use or further up-take the results of the project? Who will benefit from the results of the project?	What change do you expect to see after successful dissemination and exploitation of project results to the target group(s)?	What are the expected wider scientific, economic and societal effects of the project contributing to the expected impacts outlined in the respective destination in the work programme?
Professors and researchers in **AUTH** and Greece. Students and researchers in Greece will benefit most from the outputs of the project. Novel research and teaching manuals will be made available during the project.	A significant up-take in research output from AUTh An increase in the number of students at **AUTH** preferring to do physics master and PhD degrees.	**Scientific**: AUTh will start scientific studies of leading-edge radioisotopes for nuclear medicine **Technological**: Innovative aspects in the production methods and in the instrumentation for the generation of novel radionuclides will be integrated into overall innovative and frontier machines **Societal**: the investment in research and development radionuclide production for medical applications will benefit cancer patients receiving this treatment.

SUMMARY OF STRONGER4CANCER DISSEMINATION, EXPLOITATION AND COMMUNICATION

Target Group	Information Content	Drivers	Methods	Expected Outcome
Project participant	Project information; work plan updates;	Community spirit; career	Website, mailing lists, online	Engagement with project results; efficient

s	implementation (events, results) outreach materials	development	platforms, project meetings, workshops	implementation
MSc/PhD School students	Basic knowledge/information; Best practices in scientific research, Carrier opportunities,	Peer recognition; career development, Creating future scientific in leaders Greece	Website, social media, schools, workshops, MasterClasses, education/research internships at partner institutes/industry	Attract Greek talent towards science
General Public	General information on radionuclide production by accelerators, societal impacts, implications	Creating future supporters of scientific research in Greece	Social media, audio-visual material, public events, presentations, website	Understanding impact of STEM in society, supporting fundamental research
Patients	Available treatment alternatives Future possibilities/development	Promoting advanced therapy methods to reduce mortality	Brochure, TV, social media, Targeted events, website	Possibility for better quality of life, support research
Scientific community	Best practices in research projects managing, Main achievements, Collaboration opportunities	Active involvement by partner institutes	Website, Publications, Newsletters, Exchange programmes, common events, workshops	Identify common challenges, future projects, knowledge sharing, efficient collaborations successful state support actions
Media	Notable results / events	Advertise STEM education	Website, YouTube, newsletters, clips, social media channels	Improve visibility of STEM impact, reach policy makers
Industry	Information exchange between academia and industry	Research creating industrial entrepreneurship	Common events/projects Newsletters, website	Efficient knowledge transfer Creation of on-campus industrial incubators
Policy makers	Impact of STEM education on Greek economic development	Success of EU supported programmes	Public presentations; Information events Briefings, newsletters	Demonstrate return of STEM investment to society; evolution/standardization of policies

[1]Regulation (EU) 2021/695 of the European Parliament and of the Council of 28 April 2021 establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination, and repealing Regulations (EU) No 1290/2013 and (EU)No 1291/2013"

a. 3. Quality and efficiency of the implementation

Quality and efficiency of the implementation – aspects to be taken into account

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

3.1 Work plan and resources *[e.g. 10 pages – including tables]*

Please provide the following:

1. brief presentation of the overall structure of the work plan;
2. **timing of the different work packages and their components (Gantt chart or similar);**
3. graphical presentation of the components **showing how they inter-relate (Pert chart or similar)**
4. detailed work description, i.e.:
   - o a list of work packages (table 3.1a);
   - o a description of each work package (table 3.1b);
   - o a list of deliverables (table 3.1c);

Give full details. Base your account on the logical structure of the project and the stages in which it is to be carried out.The number of work packages should be proportionate to the scale and complexity of the project.
You should give enough detail in each work package to justify the proposed resources to be allocated and also quantified information so that progress can be monitored, including by the Commission
Resources assigned to work packages should be in line with their objectives and deliverables. You are advised to include a distinct work package on 'project management', and to give due visibility in the work plan to ***'data management'*** *'dissemination and exploitation' and 'communication activities', either with distinct tasks or distinct work packages.*
You will be required to update the 'plan for the dissemination and exploitation of results including communication activities', and a ***'data management plan'****, (****this does not apply to topics where a plan was not required****.) This should include a record of activities related to dissemination and exploitation that have been undertaken and those still planned.*
Please make sure the information in this section matches the costs as stated in the budget table in section 3 of the application forms, and the number of person months, shown in the detailed work package descriptions.

a list of milestones (table 3.1d);

a list of critical risks, relating to project implementation, that the stated project's objectives may not be achieved. Detail any risk mitigation measures. You will be able to update the list of critical risks and mitigation measures as the project progresses (table 3.1e);

a table showing number of person months required (table 3.1f);

a table showing description and justification of subcontracting costs for each participant (table 3.1g)

a table showing justifications for 'purchase costs' (table 3.1h) for participants where those costs exceed 15% of the personnel costs (according to the budget table in proposal part A);

if applicable, a table showing justifications for 'other costs categories' (table 3.1i).

if applicable, a table showing in-kind contributions from third parties (table 3.1j)

3.2 Capacity of participants and consortium as a whole *[e.g. 3 pages]*

The individual members of the consortium are described in a separate section under Part A. There is no need to repeat that information here.

Describe the consortium. How does it match the project's objectives, and bring together the necessary disciplinary and inter-disciplinary knowledge. Show how this includes expertise in social sciences and humanities, open science practices, and gender aspects of R&I, as appropriate. Include in the description affiliated entities and associated partners, if any.

Show how the partners will have access to critical infrastructure needed to carry out the project activities.

Describe how the members complement one another (and cover the value chain, where appropriate)

In what way does each of them contribute to the project? Show that each has a valid role, and adequate resources in the project to fulfil that role.

If applicable, describe the industrial/commercial involvement in the project to ensure exploitation of the results and explain why this is consistent with and will help to achieve the specific measures which are proposed for exploitation of the results of the project (see section 2.2).

Other countries and international organisations: If one or more of the participants requesting EU funding is based in a country or is an international organisation that is not automatically eligible for such funding (entities from Member States of the EU, from Associated Countries and from one of the countries in the exhaustive list included in the Work Programme General Annexes B are automatically eligible for EU funding), explain why the participation of the entity in question is essential to successfully carry out the project

3. QUALITY AND EFFICIENCY OF THE IMPLEMENTATION

3.1 WORK PLAN AND RESOURCES

3.1.1 Overall structure of the work plan

All institutes to complement where necessary

The **STRONGER4CANCER** work plan describes the roadmap for**AUTH** and its Greek partners to increase technology capacity, improve research quality and scientific output by establishing sustainable networks with the western-european partner institutes. It is divided in *five* work packages (WP), *shown in* **Error! Reference source not found.**, *together with their inter-relation.*

WP1 is dedicated to project management. The description of the management structure and decision-making procedures is described in Section 3.2. The Management Team (MT) will ensure proper implementation of the work plan and will be responsible for all administrative and financial issues. The Project Coordinator (PC) will be ultimately responsible for ensuring the timely submission of all deliverables/reports and communication to the EC Project Officer. Three project meetings will be organized during the project lifetime: a kick-off, an interim and a final project meeting. Each one will be attended by the maximum possible number of the **STRONGER4CANCER** members, the Steering Committee (SC), and the Advisory Board (AB). *Work plans and procedures will be presented and approved by the SC.* A strategy for the network sustainability will be developed after the interim project meeting and updated after the final assessment. Proper follow-up of the work plan will be facilitated by online meetings of the WP Leaders and SC every three months.

To support the MT, ***an administrative manager will be hired*** and trained with the aim to ***to support the AUTH School of Physics).*** Appropriate **training on soft skills** is foreseen, including management and administration related to EU project, **primarily at the CERN EU office**, which will also provide advice for the **STRONGER4CANCER** project, if needed. **Training on knowledge and innovation management** is planned in coordination with partner institutions. WP1 oversees the flow of information and activities of common interest for all WPs. The SC will appoint appropriate officers and a Data Protection Officer (DPO). All project activities will comply with the General Data Protection Regulation 2016/679 (GDPR).

WP2 focuses on proper dissemination, exploitation, and communication of all STRONGER4CANCER project activities and results with contributions from all partners. In particular, knowledge and innovation management will profit of the experience of the western-european partners in the field. Dissemination of scientific results will implement open access principles. The project website will be the gateway channelling information for scientific communities and general public. MasterClasses addressing high-school students will be held to motivate them towards STEM studies. The CO in coordination with the IM will guarantee the widest possible impact of the planned activities and obtained results; **the efficiency of the implemented dissemination, exploitation, and communication measures will be monitored to maximise impacts.**

WP1 and WP2 close coordination will support the overall project and guarantee the objectives achievement.

WP3 aims at establishing a network *between the Greek (AUTh, DEM, PAP, TECH)* and its western-european **partners** (CERN, GSI, INFN, UMIL), through scientific staff exchanges (in and out), leading to a more efficient support of the planned *educational, training (WP4) and research (WP5) activities.* These are complemented by workshops and dedicated events such as “Academia meets Industry” or common events with medical communities representing the “end users”.

A detailed plan of the networking activities will be prepared *by WP3* and approved by the SC. The plan for staff exchanges in the first six months of the project and the template for expression of interest will be established during the kick-off meeting. Feedback after each scientific exchange will be considered for updating the networking plans and the schedule for the next phase will be agreed upon at the interim project meeting.

WP4 is dedicated to capacity-building. Based on the partners’expertise a series of activities within WP4 is foreseen for education and training including best practices related to **knowledge/technology transfer, administrative and project management skills or other soft skills**.*As no academic institute Greece currently offers a*

PhD programme in physics focused on radionuclide production by accelerators, **the aim is to develop a detailed curriculum of such PhD studies in cooperation with partner institutes.** The PhD courses *will be held in English*, to enable student participation *from the South East European region*. The ultimate goal of WP4 is to develop curricula for modernised advanced modules, at MSc and PhD levels, in specialised fast-developing fields of applied physics (**experimental physics and its applications to medicine in particular, focusing on particle accelerators and instrumentation, medical accelerators, medical physics**). To achieve this a comprehensive set of training and education activities are planned.

Training modules of a *series of physics experiments at the advanced second-cycle level will be held at **AUTH*** and will **support the development of related curricula for AUTh**. Furthermore, a summer school will be held *at **AUTH*** focusing on *accelerator and detector instrumentation, experimental particle physics applications for accelerators (e.g., controls) or medical applications (e.g., treatment planning). Another summer school will be organized at **AUTH**, on medical accelerators and medical physics. The school will include hands-on training on treatment planning, based on specialised software developed by **DKFZ**. The summer schools are open to all students from national and international higher education institutions, with priority to the ones from Greece region. **Training by the industry partner Technopolis complements** the WP3 educational activities with a specialised remote online course and establishing a laboratory course on instrumentation at **AUTH**.*

Experts from western-european partner institutes will be invited at **AUTH** to present their work and give lectures, dedicated courses, specialised tutorials, and training, including instrumentation, to enhance the competencies of the participants in experimental physics and advanced technology (scientific instrumentation).

The WP4 will further benefit the national community targeting health-care providers*through a workshop and hands-on training, **enhancing medical physics capacities** especially in particle therapy. Clinically qualified medical physicists (CQMPs) will be trained, on-the-job, at the **DKFZ** specialised institute who will then ensure knowledge transfer to the local community upon their return through specialised training sessions. A workshop targeting the national and regional medical community will be organized to share the **STRONGER4CANCER** scientific developments. Inviting international experts, it will review the current status of HT and increase awareness of HT for medical professionals.*

WP5 is dedicated to developing exploratory research projectsto further enhance research capacity and boost education and training to a higher level, (between, ***CERN***, ***GSI, INFN, UMIL*** *and the Greek partners)*, which would potentially have a broader impact *for Greece*. The exploratory research projects will be along two lines: *(a) a translational research project developing multiple-ion beam sources to allow FLASH delivery of mixed ions and (b) a Technological research project developing and testing novel and radioactive ion beam sources for ion beam therapy.*

An R&D workshop targeting the national and regional scientific community will share the scientific developments. The first R&D workshop will include *reviewing the current possibilities of radioisotope production by accelerators and the second one will include the scientific achievements and progress of the project* .

The Table 3 presents the deliverables and milestones that will report on the **STRONGER4CANCER** achievements in the lifetime of the project and which are detailed in the following sections.

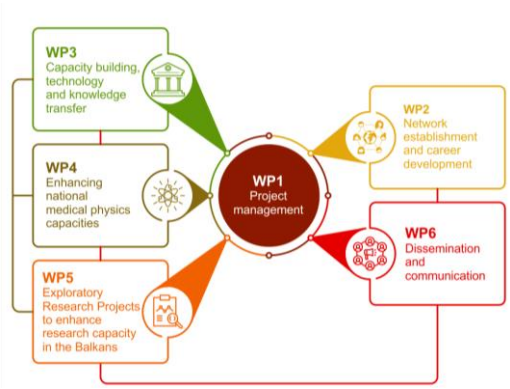


Figure 3. Graphical representation of how WPs are interconnected

Table 2. Time distribution of deliverables and milestones of each WP, To be completed by Yiota and Aris

		Year 1												Year 2												Year 3											
		Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4		
Task		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	WP1: Project management																																				
1.1	Definition of management and communication procedures			M																																	
1.2	Project meetings				M															M																M	
1.3	Sustainability strategy of ION2APP network																			M														D			
1.4	Enhancing complementary skills						M																											D			
1.5	Data Protection and Safety		D																																		
	WP2: Network establishment and career development																																				
2.1	Networking scientific exchanges planning	M	D																																		
2.2	Evaluation of the implementation of the networking activities												M						M	M					M				M						D	D	
	WP3: Capacity building, knowledge and technology transfer																																				
3.1	Curriculum development																											M						D			
3.2	Physics laboratory hands-on module										M																								D		
3.3	Summer school in experimental particle physics, artificial intelligence																									M	M								D		
3.4	Summer school in medical accelerators and medical physics																															M	M	D			
3.5	Expert visits and support																															D					
3.6	Enhancing student skills in experimental and medical physics											M												M											D		
3.7	Online industrial training																															D					
3.8	Setup of laboratory courses based on Red Pitaya instruments																									D											
3.9	Specialised hands-on internships on instrumentation of beam-diagnostics and RF-control systems																																	D			
	WP4: Enhancement of medical physics capacities																																				
4.1	Enhancing skills on medical physics									M		M										M			M					M		M	D				
4.2	Workshop in hadron therapy																						M				D										
	WP5: Exploratory research projects to enhance research capacity to the Balkans																																				
5.1	Translational Research Project												D												D										D		
5.2	Technological Research Project												D																	D					D		
5.3	Research & Development (R&D) Workshop																			D																	
	WP6: Dissemination, exploitation and communication																																				
6.1	Dissemination and communication plan						D						M										M														
6.2	Setting up and maintenance of the ION2APP project website			D																																	
6.3	Media, press and public interaction			D																																	
6.4	E-learning and YouTube channel			D								M																									
6.5	MasterClass														M												M						M	D		
6.6	Dissemination and exploitation of scientific results																																			D	

Tables for section 3.1

TABLE 3.1A: LIST OF WORK PACKAGES TO COMPLEMENT BY AI, YF AND AM IN THE END

WP No	Work Package Title	Lead Participant No	Lead Participant Short Name	Person-Months	Start Month	End month
WP1		1			M1	M36
WP2		1			M1	M36
WP3		4			M1	M36
WP4		2			M1	M36
WP5		6			M1	M36
WP6		1			M1	M36

			Total =			

FROM YIOTA

WP1 Management (AUTH, CERN, GSI, DEM, INFN)

Objectives

Task 1.1: Project Management, **coordination** M1-M36

- Management of the project, monitoring of overall scientific and technical progress.
- Organisation of project's meetings
- Contractual and financial follow-up of the project and use of resources.
- Ensure effective and transparent cross-coordination of the work between WPs

Task 1.2: Internal Communication M1-M36

- Develop and maintain the internal communication plan and tools.

Task 1.3: Data Protection and SafetyM1-M36

- Ensure compliance with "ethics requirements".

Task 1.4: Network Sustainability PlanM1-M36

- Definition of a sustainability strategy.

Task 1.5. Relations with the other Innovation Pilots M1-M36

- Set up a Coordination Group and liaise with other relevant EU projects.

Description of work

Task 1.1: Project Management, **coordination** (AUTH, GSI, DEM, CERN)

This Task comprises all management and coordination activities carried out by the Project Management Team, within the overall managerial structure of the project described in
Section 3.2 (organisation structure).
These include the (a) coordination and continuous monitoring of the programme of work;

Cross-coordination and flow of information

(b) overall cross-coordination and information flow between the project's WPs, in particular on subjects that are relevant for different WPs;

Organisation of meetings

(c) theorganisation of theinternal project meetings related to the technical work including the Project Management Team meetings (once per month), Steering Committee meetings (every three months); the Annual Meetings,Advisory Board meetings (together with the Annual meetings) and the Mid-term Review. Agendas and meeting minutes will be drawn up for all meetings.

Communication with EU

The Task also comprises the regular communication with the European Commission on administrative and technical aspects of the project,

Admin/Finance follow-up

the administrative, financial and contractual follow-up of the project, according to the EC Grant Agreement and its annexes. This work covers the preparation of the periodic and final activity reports and the reviewing of the Deliverable and Milestone reports.
The financial follow-up consists of distribution and payments of the EU funding, resource utilisation control, internal cost reporting and collection, review and submission of the Certificates on the Financial Statements by the beneficiaries.

Deputies

The Project Coordination is provided by AUTh. The Project Coordinator is supported by two Deputies with experience of H2020 projects, one from GSI and the other from DEM.

EU Office: Administrative

An administrative manager from AUTh will be trained at the EU office of CERN (and other partners) to support the project, seek advice on financial and administrative matters, while enhancing project management and

administrative skills (READ THE CALL AND COPY)

Task 1.2: Internal Communication (GSI, AUTH, CERN)
This Task will focus on the coordination and consistent implementation of communication tools and activities between the project partners. This will be organised with an internal communication plan (GSI, D1.4). **A common archive repository, real-time communication tools and online workspace for documents (i.e. organisation of agendas, minutes and action lists, etc.) will be provided. In general, this task will** provide appropriate Information Technology (IT) tools in order to ensure the effective management of the project supported by the experience of CERN.*(SharePoint, INDICO)*

Task 1.3: Data Protection and Safety (AUTh, CERN, GSI)
This task will ensure that all project activities will comply with the "ethics requirements" (a) the Steering Committeewill appoint a Data Protection Officer who will ensure compliance with GDPR (D1.2) (b) AUTh will demonstrate that health and safety procedures conforming to relevant legislations are followed and safety measures will be implemented as appropriate (D1.3) supported by the CERN experience.

Task 1.5 Relations with the other relevant EU-funded projects (LNL, CERN, AUTh,)
The project proposal participants are fully aware that PRISMAP, a EU-funded medical isotope programme, has been recently approved. PRISMAP addresses the production of high purity isotopes by mass separation and by direct activation by federating a consortium of the key European intense neutron sources, isotope mass separation facilities and high-power accelerators and cyclotrons, with leading biomedical research institutes and hospitals active in the translation of the emerging radionuclides into medical diagnosis and treatment. This very large broad scope consortium is a natural reference for all activities in the field of medical radioisotopes in the next few years. This proposal will pay the utmost attention in following this up, by establishing links through dedicated workforces. A strong interface to PRISMAP will help "STRONGER4CANCER" to better focus its objective of building a modern scientific and technological capacity at AUTH in the field of medical radionuclides, with INFN, UMIL, CERN and GSI as the very first references, and with the whole community - making outstanding steps forward in this route of cancer treatment in Europe - just afterwards.

WP2 Dissemination, Exploitation, Communication (AUTH, UMIL, CERN, GSI, DEM, TECHNOPOLIS, PAPAGEORGIOU)

Objectives

Task 2.1: WP2Management and coordination M1-M36

- Management of WP2 tasks, monitoring of activities, readiness of tools and content, milestones and deliverables, production of documentation.
- **Dissemination, Exploitation and Communication plan**

Preparation of the overall Dissemination, Exploitation and Communication plan

Task 2.2: Dissemination, Communication and outreach platforms/tools M1-M36

- Provide dissemination,communication, and outreach tools, required to address the project's goals and implement the Dissemination and Communication plan.

(ZENODO, webpage, e-learning platform, social media)

Task 2.3: Media, press and public interaction M1-M36
Task 2.4 e-learning platform and YouTube channel M6-M36
Task 2.5 MasterClassM6-M34

Task 2.1 WP2Management and coordination (AUTh, GSI, CERN**)**
This task will focus on the overall Management of WP2 tasks, monitoring of activities, readiness of tools and content, production of documentation, and project's milestones and deliverables.
Communication Strategy
The draft communication plan will be prepared by the Communication Officer with the support of the Project Management Team (D2.1) and will be subject to approval by the Steering Committee. It will evolve based on yearly evaluation of the dissemination and communication activities and their impact, with the support of the **Impact Manager,** leading to a final report (D2.1).
Dissemination and Exploitation (KT trainee)
The project's partners will strive to promote knowledge dissemination and publish novel scientific results in open access journals. Novel ideas will be exploited and patented for further development under patent. Workshops and seminars will present project's results, handling properly intellectual property rights of involved participants.
HERE: trainee from AUTh at KT of partners READ CALL and COPY.
Knowledge and innovation management best practices will be transferred to the coordinating institute via training of AUTH members at the KT offices of partners**.**
The dissemination and exploitation plan will be presented at the kick-off meeting and approved by the Steering Committee (MS2.1). Following evaluations and updates a final report will summarize the Dissemination Exploitation and Communication activities and their impacts (D2.2) with the support of the **Impact Manager and Communication Officer**.

Task 2.2: Dissemination, Communication and outreach platforms/tools (AUTh, CERN, GSI)
Platforms (IT expert)
The website, incorporating the project logo and graphical identity, will be created and link relevant platforms for internal and external communication, within the first quarter, with the support of an IT expert (D2.3). It will be the primary interface with the scientific communities (within the project and beyond) and the general public. It will be updated with information on ongoing and future activities, published documents and social media material.

Task 2.3: Media, press and public interaction (AUTh, DEM, TECH)
(Communication officer)
Social media presence will be ensured through social media (LinkedIn, Facebook, Twitter, and Instagram) accounts (MS2.2). Students' social media and associations will be used to announce the projects activities and new opportunities. Informal activities/interaction will be organized with the participation of students and visiting

scientists. Online newsletters and media/press releases will be issued every year in English and/or Greek as necessary.

Task 2.4: e-learning platform and YouTube channel (AUTh)
An e-learning platform and YouTube channel will be set up (D2.3) to make available the recorded material of seminars and/or courses for the benefit of extended students' communities or time-bound members (e.g. of medical communities). Short video-clips for public will be uploaded to the e-learning platform and a dedicated YouTube channel.

Task 2.5: MasterClasses (GSI, AUTh, DEMOKRITOS, CERN, UMIL)
MasterClasses will be organised every year, with the participation of the projects partner institutes, targeting, primarily, high-school students, with the aim to raise interest for fundamental sciences and its applications in medicine and to motivate them towards STEM studies. They will be organised in the framework of the IPPOG International MasterClasses (LINK); but also, locally, or for special events e.g. International Women's Days. They will also be held for university students University; thus, also training future tutors for the high-school sessions, also ensuring sustainability. A final report will summarize the MasterClass activities and their impact (D2.4).

D2.1: Communication strategy and plan **(Communication officer)** Task2.1, M6, M1-M36
Report on the project communication strategy and plans
MS2.1 Dissemination and Exploitation plan **(KT trainee: scientific)** Task2.1, M6, M1-M36
Preparation of the overall Dissemination and Exploitation plan
D2.2 Final reporton the impact of dissemination, exploitation, and communication activities **(Impact Manager and Communication Officer)** Task2.1, M35, M1-M36
Report on impact: how many new students in the new group, how many students at CERN/LNL, how many publications, new international collaborations….
D2.3 website and communication platforms/tools set up **(IT expert: technical)** Task2.2 and Task 2.4, M3, M1-M36
Preparation of website, ZENODO (for publications), SharePoint (internal), INDICO (meetings), e-learning platform, YouTubbe channel
MS2.2 LinkedIn, Facebook, Twitter, and Instagram accounts set up Task2.3, M3, M1-M36
D2.4 Report of MasterClasses Task2.5, M34, M6-M34

WP3 Networking Activities (AUTh, GSI,CERN,TECHNOPOLIS, PAPAGEORGIOU, DEM, INFN)

Work Package Leader: YF GSI

Task 3.1 Establish the network
Task 3.2 Plan and evaluate staff scientific exchanges (final report)
- from AUTh to others
- from others to AUTh (for courses, seminars….)

Task 3.3 Plan and evaluate students' internships from AUTh to others (final report)
- undergrads/Masters at CERN, Legnaro, Milano
- PhDs at CERN, Legnaro, Milano

Task 3.4 Workshops (final report)
- At Start of project to define research topics
- At end of 2nd year to assess status, present results

Task 3.5 Academia meets Industry events (final report)
- One day events Technopolis, AUTh et al

Task 3.6 Dissemination at the medical world events (final report)
- One day events: Papageorgiou, AUTh et al

Task 3.7 Sustainability of network after end of project (sustainability plan)
HERE OR WP1?

- *Engage the network of ….*in **knowledge-sharing**
- *….developing a synergistic communication strategy***with industry and hospital** .

Facilitate knowledge transfer between the laboratories and industrial companies working in the respective 'hi-tech' areas.

Task 1.4: Network Sustainability Strategy (AUTh, GSI, DEM, CERN, ALL) **HERE or WP3?**
A strategy for the network sustainability will be developed and discussed between the Steering Committee and Advisory Board, based on the evaluation of the project activities and reports. A sustainability plan will be developed after the interim evaluation and updated after the final assessment (D1.1) which will involve forecasting the evolution of impact indicators (five years after the project's end), coordinated by the Impact Manager. It will be subject to approval by the Steering Committee. It is supported by the motivation of Greek colleagues in the partner institutes (GSI, CERN, LNL) to support the Greek participating institutes in continuing the established collaborations. *Also, by the students who will be trained in the partner institutes and will transmit their know-how back at the Greek institutes (questionable if they will want to go back and if there will be any positions for them going back (maybe to say about new and hopefully successful EU calls??). KEEP RELATIONS BETWEEN AUTH/GREECE and their future employment even if in WE institutes*

WP4 Training Activities (UMIL, AUTH, CERN, GSI, INFN, DEM)

Work Package Leader: Flavia Groppi (Uni Milano), and/or Lagogiannis Dimokritos
Task 4.1: Oversee curricula for AUTh
Task 4.2: Lectures/courses at AUTh
Task 4.3: Schools

- HITM-similar by YFetal in Thessaloniki

Task 4.4 Hands-on training of undergrads and Masters at CERN (reports on theses)
Task 4.5 Hands-on training of undergrads and Masters at Legnaro (reports on theses)
Task 4.6 Admin Training (EU and/or KT) at CERN (report)
Task 4.7 Admin Training (EU and/or KT) at Legnaro (report)
Task 4.8 Soft skills training at AUTh (report)
Carrier development, CV, scientific writing, presentations etc
Task 4.9 e-learning material, recording

Task 4.8 Enhancing administrative/complementary skills (SHOULD GO TO THE WP4: TRAINING)
The aim of this task is to establish a small EU project office at AUTh, by hiring an administrative manager.
A dedicated person from AUTh (administrative manager)
will be trained at the **CERN EU Office****and the LNL EU Office**
This on-the-job training will ensure knowledge transfer of skills related to EC project management/administration. The trained administrative manager should(a) train others back at AUTh with dedicated seminars/tutorials (b) investigate possibilities for other EU calls (c) prepare proposals for other calls (if available before the end of the project).

WP5 Exploratory Research Projects (INFN, CERN, GSI, AUTH)

Budget :from research

Total budget: 450 000 E (30% of total)

315 000 E at AUTh

135 000 E at "others"

Work Package Leader: Legnaro

Giovanni general comment: we should probably organise these topics by subject and not by Institute.
Topics:
(1) accelerators (INFN, CERN, AUTh, others);
(2) production and purification (INFN, UMIL, AUTh,…);
(3) safety (INFN, AUTh, others).
The sharing of specific responsibilities on tasks is less important, I believe, we shall find a balance.

Task 5.1 Coordination and Dissemination (of WP5)

Coordinate the collaboration between AUTh, CERN, Legnaro

In coordination with WP-Networking organize the scientific exchanges of

- PhDs from AUTh at CERN/Legnaro
- Scientists from CERN to Legnaroetc

Oversee and coordinate the research work of (PhDs) from AUTh with CERN, Legnaro groups

Coordinate with WP-Networking organization of workshops

(a) at start up of the project to define research topics and open questions

(b) at end of 2nd year of the project to present research status and results

Oversee the delivery of reports, theses, conferences presentations, scientific publications

Overall report of scientific achievements (theses produced)

Task 5.2 Research Topic Legnaro related to accelerators/radioisotopes/radioprotection

(Task Leader Giovanni)

Input by Gaia

Task 5.2 is dedicated to developing exploratory research projects to further enhance research capacity and boost education and training to a higher level in the field of accelerators and medical radionuclides production.
As preliminary fundamental step, it is foreseen the training through seminars and lessons on:

- the use of radionuclides in nuclear medicine, including the characteristics of a radiopharmaceutical, how the imaging PET/SPECT imaging techniques works, the peculiarities of radionuclides for diagnosis and therapy and the use of theranostic radionuclides, which are the criteria to select the radionuclides for medical applications
- the research activities carried out at the INFN-LNL on this topic, considering the 70 MeV proton cyclotron and the possibility to use this tunable beam for the radionuclide production via the direct activation method, LARAMED project [ref Laramed], and with the ISOL technique, ISOLpharm project [ref ISOL].
- The nuclear cross section measurements for medical radionuclide production, how to properly set the experiments parameters (irradiation run: beam intensity and time, targetry characteristics: homogeneity and purity, γ-spectrometry acquisition and decay characteristics, data analysis including the correction for eventual γ-rays interferences); further details can be given on the useful tools for data analysis, such as the SRIM software [ref SRIM] for stopping power calculations, ISOTOPIA [ref ISOTOPIA] for radionuclide yield calculations and activation estimations
- Details on the analysis of a spectra acquired with a HPGe detector for nuclear cross section measurements (particularly for students in physics interested in this topic) and how to calculate the Radionuclidic Purity (RNP) of the desired radionuclide
- *Details on the radiochemical procedures … etc.*

WP5 Safety
(place for Dimitri's and lucia's text)

The aim is to create a multi-element programme of education and training in the field of radiological protection starting from the early stage in planning to install a particle accelerator for radioisotope production up to the

operation including management of produced radioactive materials of any type. The programme will be focusing on:

2. generating competencies in radiological protection and safety, particularly in view of challenges in medical applications with radionuclides - e.g. nuclear medicine, production of radioisotopes;
3. fostering the understanding, research and development of related technologies, including new ones;
4. promoting research and implementation of radiological protection, with direct engagement of several stakeholders (a stakeholder Forum will be set up to provide expert input; the Forum may include e.g. regulators, experts from human sciences, representatives of international organisations, coordinators of relevant international collaborative projects);
5. promoting the implementation of approaches to security and safety culture in radiological applications and decision-making in normal conditions, uncertainty and emergencies, with attention to science and values, such as societal and ethical values, justification and optimisation, and the involvement of stakeholders;
6. increasing the capabilities and abilities to ensure appropriate levels of protection of individuals and the environment;
7. increasing the awareness of the importance of international cooperation and an interdisciplinary approach in the research and implementation of radiological protection science and technology

Task 5.3 Research Topic Milano related to radioisotopes (Task Leader Flavia)
Task 5.4 Research topic CERN related to accelerators (Task Leader Maurizio)
Task 5.5 Research topic CERN related to
Task 5.6 *?? Research topic Dimokritos related to comparisons (Task Leader Lagogiannis)*
Would Dimokritos count as "Coordinator" or "Others"

- *Is not the coordinating institute but is not a leading institute either?*

WP1: Project Management (WP Leader: Aleksandra AUTh)
WP2: Communication (WP Leader: Aleksandra AUTh)
Flavia Milano Task Leader
WP3: Network Activities (WP Leader: YF GSI)
oversee/plan scientific exchanges from AUTh OUT and from OUT to AUTh
outcomes/reports
oversee/plan students internships
oversee mentorship/outcome students reports, theses, final presentations/seminars
WP4: Education/Training (WP Leader: Flavia, MILANO)
andLagogiannis DEMOKRITOS, AUTh Task Leader
curricula definitions
courses at AUTh
schools
training on administration, soft skills
e-learning
WP5: Exploratory Research Project (WP Leader: LEGNARO)

TABLE 3.1B: WORK PACKAGE DESCRIPTION **All institutes to complement where necessary**

WP	WP1			Lead beneficiary					
WP Title									
Participant number	1	2	3	4	5	6	7	8	9
Short name of participant									
Person months per participant:									
Start month	M1			**End month**		M36			

OBJECTIVES

WP1 aims to ensure the timely implementation of the proposed activities and proper communication among the project partners and with the EC. All administrative and financial procedures shall be decided by the MT and SC ensuring conformity with EC rules and procedures. Training on complementary skills will ensure an efficient project management. All project activities will comply with General Data Protection Regulation 2016/679 (GDPR).

DESCRIPTION OF WORK

WPleader: Alexandra Ioannidou (AUTH)

Task 1.1. Definition of management and communication procedures (Leader: administrative manager, **AUTH)**

The MT, headed by the PC, Alexandra Ioannidou (**AUTH**), is supported by the administrative manager (AM) and finance officer (FO) and is responsible for all administrative and financial issues of **STRONGER4CANCER**. The PC is ultimately responsible for ensuring the timely submission of all deliverables and reports and communication with the EC. The PC will be assisted by a Deputy (YiotaFoka, **GSI**). The MT will oversee all communication and guarantee proper flow of information among all partners, supported by a CO and IM. The MT will propose, and the SC will approve the nomination of the AM, FO, CO, IM that will support the MT. The MT will organize follow-up meetings with the WP leaders every three months and whenever needed. **AUTH** members will lead three WPs, namely: WP1, WP2, and WP6, while WP3, WP4, and WP5 will be led by **UL**, **KCUS**, and **DKFZ**, respectively. The administrative and financial management procedures and dissemination, exploitation and communication plans will be presented, discussed, and agreed upon during the kick-off meeting.

Three project meetings will be organized during the project lifetime: kick-off, interim, and final project meetings. Each meeting will gather all **STRONGER4CANCER** members, the SC, the AB, and guest experts as needed. The SC will monitor the project implementation and evaluate, discuss, and agree on significant alterations to the project plan or allocated budget. The PC will present these alterations to the Project Officer (EC). The role of the AB, composed of independent world-leading experts in accelerator physics and charged particle therapy: PrimožPelicon and Stefan Both, is to provide independent guidance and expert opinions to the SC at each project meeting. **CERN**/**GSI** and **DKFZ** will support MT as needed.

Task 1.3. Sustainability strategy of STRONGER4CANCER network (Leader: Amra Banda, **AUTH)**

A strategy for sustainability of the **STRONGER4CANCER** network will be developed and discussed between the MT, SC, WP Leaders and AB, based on the evaluation of activities and project meeting reports. A sustainability plan will be developed after the interim evaluation and updated after the final assessment (D 1.1) and will involve forecasting the evolution of impact indicators (five years after the project ends), coordinated by IM. Itis complemented by commitment for support via a private foundation, which also guarantees continuation of the network activities. The proposed strategies for maintaining the established network will be discussed and subject to approval by the SC.

Task 1.4. Enhancing complementary skills (Leader: Maja Arslanagić-Kalajdžić**, AUTH)**

The aim of this task is to establish a small EU project office at **AUTH** by hiring an administrative manager (AM) who will be trained at the **CERN** EU office. This on-the-job training will ensure knowledge transfer on skills related to EC project management/administration. After this training, in coordination with the CO, the AM should train others back at **AUTH** with dedicated seminars/tutorials on topics enhancing soft skills such as career development, CV and scientific writing, presentations of scientific results, knowledge/innovation management, dissemination and communication and other related topics. In addition, before the end of the project, at least one proposal submission on EU project calls will be accomplished.

Task 1.5. Data Protection and Safety (Leader: YiotaFoka, **GSI)**

The SC will appoint a Data Protection Officer who will ensure that all-project activities comply with GDPR (D 1.2). The Data Protection and Security plan will be prepared, with the AM support, presented and approved by the SC.

DELIVERABLES

D 1.1Sustainability plan (Task 1.3, M34)
D 1.2 Data Protection Officer appointed (Task 1.5, M2)

WP	WP2			Lead beneficiary					
WP Title									
Participant number	1	2	3	4	5	6	7	8	9
Short name of participant									
Person months per participant:									
Start month	M1			**End month**		M36			

OBJECTIVES

WP2 aims to establish a network and lasting connections among Greek Institutions***AUTH, KCUS, UCHM*** and EU partners through common interests and activities in the field of radionuclide production by accelerators. The network activities will start with scientific exchanges (in and out) to support **AUTH** with building expertise in the field of ion and accelerator physics and their application in medical physics. The network activities and acquired know-how by Greek partners will support setting up a new curicula at the **AUTH** Department of Physics based on the new knowledge on the field. The established collaborations will improve the research quality and raise the research output of Greek partners. The network framework will be defined at the kick-off meeting. A detailed implementation plan will be drawn and revised during project meetings, including the scientific exchanges, meetings, and joint projects.

DESCRIPTION OF WORK

WPleader: (AUTH)

Task 2.1. Networking scientific exchanges planning (Leader:AUTH)

To establish a research network between **Greek** and EU partner institutions, scientific exchanges will be carried out during the project implementation. These visits aim to improve specific skills in the accelerator applications in medical physics of Greek partners staff. Staff members from various departments of Greek partner institutes, with related research interests, are going to participate in these exchanges. Experts visits from the EU partner institutes will support scientific activities at **AUTH**. Every visit will be planned, prepared, and approved by the SC.The plan for scientific exchanges in the first six months of the project, and the template for expression of interest will be discussed and agreed upon during the kick-off meeting (D 2.1).

Task 2.2.Evaluationoftheimplementationofthenetworkingactivities (Leader:AUTH)

During the kick-off meeting, a survey template for the evaluation of the scientific exchanges will be discussed and agreed upon. After each scientific exchange, the involved staff will provide feedback which will be considered in the following staff exchange activities. After the end of all exchange activities a report will be produced containing an analysis of all achieved improvements (D2.2). All scientists who participated in the scientific exchanges will present their results in a dedicated seminar (D2.3).

DELIVERABLES

D 2.1 Networking scientificexchangeplan (Task 2.1, M2)
D2.2 Report on networkingachievements (Task 2.2, M34)
D 2.3 Presentation on the impact of scientific exchanges (Task 2.2, M35)

WP	WP3			Lead beneficiary					
WP title	Capacity building, technology and knowledge transfer								
Participant number	1	2	3	4	5	6	7	8	9
Short name of participant									
Person months per participant:									
Start month	M1			**End month**		M36			

OBJECTIVES

The WP3 goal is to raise the scientific excellence of the Greek research communities. A number of synergetic

actions are envisaged (a) to establish new modernized curricula on accelerator technologies and applications in medical physics and cancer therapy and raise the quality and quantity of the research output of the **AUTH** and Greek partners; (b) to support the Greek partners, first making up for lacking expertise, and then, building up expertise locally; (c) to increase attractiveness for continuation of physics or STEM studies among undergraduate students, especially female. WP3 will offer opportunities for learning from world scientific experts, and education/training opportunities at the leading EU partner institutes organizing number of education and training activities for all three cycle students and teaching and research assistants as needed. Each year, *up to four undergraduate or graduate students* from Greece will be offered an opportunity for training at **CERN**, **INFN**, and **UMIL** and/or will be involved in the research projects of WP5. The knowledge acquired through these activities will reflect in their respective theses. Online training and mentoring will be offered by the industrial partners **CSL** and **I-TECH** through the remote learning "Cosylab Academy" and a laboratory course will be established at **AUTH** including the "Red Pitaya" instrumentation component. To enhance networking possibilities, the WP3 summer schools will be open to applicants from around the world, with the ones from Greece in priority. The organizers of all WP3 activities will seek opportunities to enhance diversity and will encourage individuals from under-represented communities to participate. Lectures recordings will be posted on the **STRONGER4CANCER** webpage.

DESCRIPTION OF WORK

WPleader:

Task 3.1. Curriculum development(Leader: PrimožZiherl, **UL)**

Currently, *no university Greece* offers advanced study programmeswith focus on accelerator physics and its medical applications. A task force of international experts and local groups will develop curricula for second- and third-cycle study programmes (D 3.1). The courses will be held in *English enabling participation of international* students. The second-cycle programme will serve as a starting point, focusing on experimental and medical physics. *These activities will also promote closer collaboration of **KCUS** and **AUTH*** in upgrading the existing second-cycle studies in medical physics, and the development of a sustainable programme for third-cycle studies.

Task 3.2.*Physics laboratory hands-on module* IS IT NEEDED ??(Leader:PrimožZiherl, **UL)**

This training module, of 3 weeks/15 workdays, *to be held in M9 at **UL,*** will include a series of physics experiments at the advanced first- and second-cycle level. The aim is to increase the participants' competences in experimental physics and scientific instrumentation. Selected experiments will focus primarily on topics relevant for accelerators, particle detectors, and related devices. The participants will carry out the experiments, analyse the data and discuss the results with the instructors. The hands-on laboratory classes will be complemented by lectures in selected topics. The training will be tailored to the needs of the AUTh students. A report will summarize the outcomes (D 3.2).

Task 3.3.Summer school in experimental particle physics, artificial intelligence (Leader:)

This summer school, of 1 week/5 workdays, will be organized in *M24 at **AUTH or Demokritos*** and will focus on accelerator and detector instrumentation in experimental particle physics and *applications of artificial intelligence in physics with emphasis on medical applications.Lecturers will include faculty members from AUTH, experts from **CERN**, **GSI, INFN** and **UMIL**, and a few guests from non-**STRONGER4CANCER** institutes*. The first week will cover physics topics in a whiteboard-style fashion, and include seminars in selected topics. The second week will consist of lectures and *practical computational problem-solving sessions in machine learning in physics, e.g., for the identification of tumours and appropriate irradiation configuration in medical physics. It will be complemented by a two-day workshop including practical work, training and exhibition in **CSL**, in the accelerator and HT domain, summarized in a report (D 3.2).*

Task 3.4.Summer school in medical accelerators and medical physics (Leader:YiotaFoka, **GSI)**

This school, to be organized at **AUTh** in M34, will cover selected topics *in medical physics*. It will also include hands-on training on FLUKA *on treatment planning based on the "matRad" open-source software toolkit developed by **DKFZ**,* and the participants will be expected to deliver and discuss their *treatment plans* as a practical exercise. The lectures will be given by faculty members *from **Demokritos and**, **AUTH**, and experts from **UMIL**, **CERN**, **GSI** and **INFN*** as well as by some non-**STRONGER4CANCER**-affiliated researchers. A report will summarize the outcomes (D 3.2).

Task 3.5.Expert visits and support (Leader: AUTH)

An average of 12 expert visits to the Greek institutions is expected to take place. Experts from EU partner institutionswill be invited to present their work and to give targeted lectures with the aim to assist and train students and personnel and provide online support whenever needed. *The goal is also to facilitate the establishment and operation of the Ion-Source Laboratory at **AUTH**.* The plan for expert visits in Greecewill be drawn by WP2, as the plan for staff visits from Greece to EU partners, and will be evaluated, updated, and approved by the SC. The achievements will be reported at the Final Meeting, and a report on the expert visits and their impact will be written (D 3.3).

Task 3.6. Enhancing student skills in experimental and medical physics (Leader: AUTH)

Up to 3 students per year will get the opportunity to be trained at the EU leading partner institutes. Students will be selected by a selection committee, composed by the WP and tasks leaders and representatives of the hosting institutes, and will be approved by the SC. A report on their progress and their theses will be written (D 3.4).

Task 3.7. Online industrial training (Leader:J

*Up to 4 students per year will participate at the Cosylab Academy remote training. It is a training programme which lasts for about three weeks (part time, and at a distance). Every candidate is advised by a mentor who will review, provide feedback, and help during the Academy. **CSL** runs various technology-based academies. In the second stage, students work on ongoing **CSL** projects. Students will be selected by **CSL**, **AUTH** and WP/Tasks leaders and approved by the SC. A report on their progress will be written (D 3.5).*

Task 3.8. Setup of laboratory courses based on Red Pitaya instruments (Leader:)

*Laboratory courses will be established at **AUTH**, introducing new curricula, projects or experiments based on the teaching material for Red Pitaya reconfigurable instruments. The students will work on projects using these instruments, analyse the data and discuss the results with **AUTH**faculty. **I-TECH** will provide technical support, advice on the choice of projects, and assistance in evaluating reports. The first classes will be defined together with **AUTH** faculty to identify the missing curricula at **AUTH** and adapt the training to increase students' competences in scientific instrumentation. The projects will focus on accelerators, particle detectors etc. After the first implementation of the course, a survey will be carried out, and the following courses will be fine-tuned accordingly. A report including the courses curricula will summarize the outcomes (D 3.6).*

Task 3.9. Specialised hands-on internships on instrumentation of beam-diagnostics and RF-control systems (Leader:

*Up to two a student per year, selected among those who will have successfully accomplished Task 3.8, will be hosted by **I-TECH** for 6 months. They will carry out specialized practical work in the field of particle accelerator and data acquisition electronics in line with their interests and the company's R&D activities, which will be part of their MS theses.Each student will be supervised by a technical mentor from the appropriate group at **I-TECH**. The internship will have an introductory part: a seminar on the relevant instrument(s), a lecture on applications in Beam Diagnostics or RF Control, and an introduction to the MSc thesis project. An **I-TECH** mentor will oversee the hands-on training and assist **AUTH** faculty in reviewing each MSc thesis. The candidates proposed by a selection committee involving **I-TECH** representatives will be approved by the SC. A report including the courses curricula will summarize the outcomes (D 3.7).*

DELIVERABLES

D 3.1 Curriculum for PhD programme in physics (Task 3.1, M33)
D 3.2 Report on hands-on module and summer schools (Task 3.2,Task 3.3,Task 3.4, M34)
D 3.3 Report on expert visits and their impact on new curricula (Task 3.5, M32)
D 3.4 Report on students' educational training and theses (Task 3.6, M35)
D 3.5 Report on "Cosylab Academy" training (Task 3.7, M32)
D 3.6 Report on laboratory courses establishment(Task 3.8, M24)
D 3.7 Report on student internships at industrial partner **I-TECH** (Task 3.9, M33)

WP	WP4			**Lead beneficiary**					
WP Title									
Participant number	1	2	3	4	5	6	7	8	9
Short name of participant									
Person months per participant:									
Start month	M1			**End month**		M36			

OBJECTIVES

WP4 aims to expand the benefits of **STRONGER4CANCER** project to enhance scientific excellence of the professional medical physics communities Greece by offering on-the-job training focused on hadron therapy. A workshop targeting the national and regional medical community will be organized to share the **STRONGER4CANCER** scientific developments.

DESCRIPTION OF WORK

WPleader: Adnan Beganović (KCUS) SUPRESS IT AND INCLUDE IT IN WP3

Task 4.1. Enhancing skills on medical physics (Leader:)

*There is a need to train professionals, clinically qualified medical physicists (CQMPs) working in healthcare, in order to create a group of professionals with advanced skills in the clinical centres **UCHM** and **KCUS**. The availability of trained CQMPs is a critical precondition for implementation of a successful radiotherapy programme. For that, hands-on training is required, which will be provided for three CQMPs/oncologist by the leading **DKFZ** partner. After two-month training, the CQMPs/oncologists will transfer the acquired skills and knowledge to their peers, from local and regional communities, through reports and presentations (D 4.1).*

Task 4.2. Workshop in hadron therapy (Leader:

*A workshop on advanced HT aiming at bringing up to speed national and regional communities is going to be organised at **KCUS** with the participation of external lecturers. It will review the current status of HT and increase awareness for medical professionals, including CQMP, radiation oncologists, radiation therapists, and electrical engineers. The first three days, it will focus on HT technical aspects, the last two on HT clinical aspects. The tentative participant number is up to 25. The workshop report will be posted on the **STRONGER4CANCER** website (D 4.3).*

DELIVERABLES

D 4.1 Report on medical-physicist gained experience and training sessions (Task 4.1, M33)
D 4.2 Report on the workshop on medical physics in HT (Task 4.2, M26)

WP	WP5			**Lead beneficiary**					
WP Title									
Participant number	1	2	3	4	5	6	7	8	9
Short name of participant									
Person months per participant:									
Start month	M1			**End month**		M36			

OBJECTIVES

WP5 aims to develop exploratory research projects between ***CERN , GSI, INFN, UMIL*** *and the Greek university/centres **AUTH**, **Demokritos**,*. The exploratory research projects will be along two lines:

1. *Translational research project developing multiple-ion beam sources to allow FLASH delivery of mixed ions (**DKFZ**).*
2. *Technological research project developing and testing of novel and radioactive ion beam sources for ion beam therapy (**CERN**).*

One R&D workshop targeting the national and regional scientific community will be organized to share the **STRONGER4CANCER** scientific developments *and to provide material for Master and PhD theses of Greek students involved*.

DESCRIPTION OF WORK

WPleader:To be checked by INFN, CERN, UMIL

Task 5.1. Comparison of cyclotrons and compact linacs for efficient production of medical radionuclides GB

~~In this task, **DKFZ** proposes to develop range guided radiation ion-therapy (RGRIT) to reduce toxicity in ion therapy, by in-vivo monitoring of the delivered dose to a moving tumour. The RGRIT is achieved by delivering two ions simultaneously, such as carbon and helium ions. The heavier ion (i.e., carbon) will treat the cancer, while the lighter ion (helium) provides information of the effective range at which treatment occurred. Mixed ion therapy provides a powerful tool to treat moving tumours such as those in the lung and liver. In order to reduce radiation toxicity effects of the treatment, mixed ion therapy will be investigated with FLASH radiotherapy. FLASH is the delivery of radiation dose at dose rates several orders of magnitude higher than what is currently used in conventional clinical radiotherapy and has the potential to revolutionize the future of cancer treatment. FLASH radiotherapy has been shown to reduce toxicity in healthy surrounding tissues. In the present exploratory project, we investigate how to adapt FLASH in combination with mix ion beams. The final report on achieved students' progress and theses in WP5 will be presented at the final meeting (D 5.1, D 5.2).~~

Task 5.2. Production and radiochemical purification FG, GP

~~In this task **CERN** proposes: a) to design an innovative ion source of the EBIS (electron beam ion source) type for fully stripped helium and carbon ions, including controls, to be used as injector for a cancer therapy and research facility to be built in SEE, and b) to perform beam measurements on a test EBIS source available at **CERN** and on a~~

~~commercial helium source of the ECRIS (electron cyclotron resonance ion source) type, presently being ordered, with the goal of optimising beam parameters at extraction and of comparing EBIS and ECRIS designs for future use in the frame of future projects in the SEE region(D 5.3, D 5.4).~~

~~The ion source is intended to be commissioned at **CERN** with participation of **AUTH** personnel and students, and to be finally installed at **AUTH** to become the core element of the Ion Physics Laboratory. Purchasing of the ion source is done through **CERN**, funded by a private Foundation. The final report on achieved students' progress and theses in WP5 will be presented at the final meeting (D 5.6).~~

Task 5.3. Safety aspects in compact facilities for medical radionuclide production DZ, LS

~~One R&D workshop (end of 2nd year) will be organized following the interim meeting. The R&D workshop aims to create an event in which the scientific community will present recent research results and open problems. This will include reports on the progress achieved in Tasks 5.1 and Task 5.2 as well as future directions and prospects. In that respect radioisotope production will be included as a special topic. The list of problems to be solved will be given to the SC for approval. Participation in the R&D workshop will be open to the international community. This will be followed by a three-days dedicated training focusing on the technical aspects of production, quality control, and synthesis of radiopharmaceuticals aimed at national and regional medical physicists, chemists, pharmacists, and electrical engineers, still open to all interested participants from the international community. The tentative number of participants is 15, with three expert lecturers. As a result of this workshop a report on the work developed will be performed and posted on the **STRONGER4CANCER** website (D 5.5).~~

DELIVERABLES

D 5.1 Model for mixed ion beams (Task 5.1, M12)
D 5.2 Model for combined FLASH and mixed ion beams (Task 5.1, M24)
D 5.3 Preliminary design of an EBIS ion source for injection in an ion therapy synchrotron (Task 5.2, M12)
D 5.4 Optimisation of beam parameters and comparison of results for ion source prototypes (Task 5.2, M30)
D 5.5 R&D workshop report (Task 5.3, M19)
D 5.6 Report on research activities and student theses (Task 5.1, Task 5.2, M34)

WP	WP6			**Lead beneficiary**					
WP Title									
Participant number	1	2	3	4	5	6	7	8	9
Short name of participant									
Person months per participant:									
Start month	M1			**End month**		M36			

OBJECTIVES

WP6 is responsible for guaranteeing proper dissemination, exploitation, and communication of all **NNNN**results and activities, providing open access of **NNNN** results to the scientific and non-scientific communities. Aiming at the most efficient implementation of these objectives, a yearly evaluation will be conducted in relation to their expected impact and the dissemination, exploitation and communication plans will be adapted accordingly, supported by the CO and IM, as well as personnel trained in partners' institutes. WP6 also aims to enhance such skills at **AUTh** and Greekpartners institutes in a close collaboration among all partners. WP6 also aims to increase the popularity of pursuing science among high-school students, especially females, by enabling them to participate *to the **CERN** and **GSI**MasterClass (ALICE and PTMC).*

DESCRIPTION OF WORK

WPleader:AzraGazibegović-Busuladžić (AUTH)

Task 6.1. Dissemination and communication plan (Leader: AzraGazibegović-Busuladžić**, AUTH)**
The initial draft for dissemination and communication activities will be written by the MT with the support of the CO (D 6.1). It will be subject to approval by the SC. These plans will evolve based on yearly evaluation of the dissemination, and communication activities and their impact leading to a final report (D 6.3).

Task 6.2. Setting up and maintenance of the STRONGER4CANCER project website (Leader: Moustakidis Charalampos, **AUTH)**
A website and logo will be created and linked to relevant sources of information, within the first quarter, with the support of an IT expert (D 6.2). It will be the primary interface with the public and scientific communities and updated with information on ongoing and future activities, published documents and social media material.

Task 6.3. Media, press and public interaction (**Leader:** EminaHadžić, **AUTH**)
Online newsletters and media/press releases will be issued every year *in English and Greek*. Social media presence will be ensured through LinkedIn, Facebook, Twitter, and Instagram accounts (D 6.2). Informal activities with participation of visiting scientists, and students will be organised discussing **STRONGER4CANCER** activities. Students' social media and associations will be used to facilitate flow of information on **STRONGER4CANCER** and new opportunities.

Task 6.4. E-learning and YouTube channel (**Leader:** Sabina Žero, **AUTH**)
The e-learning platform aims to promote dissemination of knowledge and advances *in ion and accelerator physics and charged particle therapy*. Each expert visit will result in a short video for public and a recording of the scientific presentation to be uploaded to the platform. This material will be *in English, with Greek subtitles* (D 6.2).

Task 6.5. MasterClass (**Leader:** YiotaFoka, **GSI**)
MasterClasswill be organized every year, targeting primarily high-school students, with the aim to motivate them towards STEM studies. *The ALICE and PTMC, developed by **CERN/GSI***, are used to raise interest for fundamental science and its applications for treatment of cancer tumours. They will be organized in the framework of the International MasterClasses; but also, locally, or special events e.g. for the International Women's Days. At least one PTMC,will be held for the Medical School students. This way, university participants will also be trained as potential tutors for high schools PTMCs. A report will summarize the outcomes (D 6.4).

Task 6.6. Dissemination and exploitation of scientific results (**Leader:** Joao Seco, **DKFZ**)
Task Contributors: CERN, **GSI**, INFN, UMIL, **AUTH**, **Demokritos, Papgeorgiou, Technopolis**

STRONGER4CANCER partners will strive to promote knowledge dissemination and publish novel scientific results in open access journals. Novel ideas will be exploited and patented for further development under patent. Workshops and seminars will present**NNNN**research results, handling intellectual property rights of involved participants.The dissemination and exploitation plan will be presented in the kick-off meeting and approved by the SC.

DELIVERABLES

D 6.1 Dissemination, exploitation, and communication plan (Task 6.1, M6)
D 6.2 **STRONGER4CANCER** website, logo, and social media (Task 6.2, Task 6.3,Task 6.4, M3)
D 6.3 Report on the impact of dissemination, exploitation, and communication activities (Task 6.6, M35)
D 6.4 Final report on MasterClasses (Task 6.5, M34)

TABLE 3.1C: LIST OF DELIVERABLES IN THE END

Deliverable (n°)	Deliverable name	WP (n°)	Short name of lead participant	Type	Dissemination level	Delivery date Months
D 1.1	Sustainability plan	WP1	**AUTH**	R	PU	M34
D 1.2	Data Protection Officer appointed	WP1	**AUTH**	R	PU	M2
D 2.1	Networking scientific exchange plan	WP2	**AUTH**	R	PU	M2
D 2.2	Report on networking achievements	WP2	**AUTH**	R	PU	M34
D 2.3	Seminar on the impact of scientific exchanges	WP2	**AUTH**	R	PU	M35
D 3.1	Curriculum for PhD programme in physics	WP3	**UL**	R	PU	M33
D 3.2	Report ~~on hands-on module and~~ summer schools	WP3	**UL, GSI**	R	PU	M34
D 3.3	Report on expert visits and their impact on new curricula	WP3	**UL**	R	PU	M32
D 3.4	Report on students educational training and theses	WP3	**UL**	R	PU	M35
D 3.5	Report on ~~"CosylabAcademy"~~ training.	WP3	**CSL**	R	PU	M32
D 3.6	Report on laboratory courses establishment	WP3	**I-TECH**	R	PU	M24
D 3.7	Report on student internships at industrial partner **I-TECH**	WP3	**TECHnopolis**	R	PU	M33
D 4.1	Report on medical-physicist gained experience and training sessions	WP4	**Papageorgiou**	R	PU	M33
D 4.2	Report on the R&D workshop (1st and 2nd)	WP4	**Legnaro**	R	PU	M26
D 5.1	~~Model for mixed ion beams~~	WP5	**DKFZ**	R	PU	M12
D 5.2	~~Model for combined FLASH and mixed ion beams~~	WP5	**DKFZ**	R	PU	M24
D 5.3	~~Preliminary design of an EBIS ion source for injection in an~~	WP5	**DKFZ**	R	PU	M12

	~~ion therapy synchrotron~~					
D 5.4	~~Optimisation of beam parameters and comparison of results for ion source prototypes~~	WP5	**DKFZ**	R	PU	M30
D 5.5	R&D workshop report	WP5	**DKFZ**	R	PU	M19
D 5.6	Report on research activities and student theses	WP5	**DKFZ**	R	PU	M34
D 6.1	Dissemination, exploitation, and communication plan	WP6	**AUTH**	R	PU	M6
D 6.2	Project website, logo, and social media set up	WP6	**AUTH**	R	PU	M3
D 6.3	Report on the impact of dissemination, exploitation, and communication activities	WP6	**AUTH**	R	PU	M35
D 6.4	Final report on MasterClasses	WP6	**GSI**	R	PU	M34

TABLE 3.1D: LIST OF MILESTONESIN THE END

Mile stone (n°)	Milestone name	WP (n°)	Due date (month)	Means of verification
MS1	Template for scientific exchanges	2.1	1	Website post
MS2	Communication Officer appointed	1.1	3	Website post
MS3	Impact Manager appointed	1.1	3	Website post
MS4	Administrative manager appointed	1.1	3	Website post Employer's contract
MS5	Kick-off meeting report	1.2	4	Published report
MS6	EU office setup at **AUTH** (enhancing complement. skills)	1.4	6	~~Employer's contract~~
MS7	~~On-the-job training for medical physicists~~	4.1	9	Published report
MS8	Report on physics laboratory hands-on module	3.2	10	Published report
MS9	~~Training session by the trained medical physicists~~	4.1	11	Website post
MS10	Progress report on student educational projects	3.6	11	Published report
MS11	E-learning platform and YouTube channel setup	6.4	11	Posted material
MS12	Evaluation of networking scientific exchange plan	2.2	12	Published report
MS13	Dissemination, exploitation, communication evaluation	6.1	12	Published report
MS14	MasterClass performed (1st year)	6.5	14	MasterClass website
MS15	Evaluation of networking scientific exchange plan	2.2	18	Published report
MS16	Interim meeting report (is this a standard document?)	1.2	19	Published report
MS17	Interim report on impact of expert/networking visits	2.2	19	Published report
MS18	Sustainability plan proposal at interim meeting	1.3	19	Published report
MS19	~~On-the-job training for medical physicists~~	4.1	21	Published report
MS20	Dissemination, exploitation, communication evaluation	6.1	22	Published report
MS21	Progress report on students' educational projects	3.6	23	Published report
MS22	~~Workshop on medical physics in hadron therapy~~	4.2	23	Workshop website
MS23	Evaluation of networking scientific exchange plan	2.2	24	Published report
MS24	~~Training session by the trained medical physicists~~	4.1	24	Published report
MS25	1st Summer school recordings published on website	3.3	26	Website upload
MS26	Report on physics summer school	3.3	25	Published report
MS27	MasterClass performed (2nd year)	6.5	26	MasterClass website
MS28	Proposal for subjects for MSc curricula	3.1	27	Published report
MS29	Evaluation of networking scientific exchange plan	2.2	28	Published report
MS30	~~On-the-job training for medical physicists~~	4.1	30	Published report
MS31	~~Training session by the trained medical physicists~~	4.1	32	Website post
MS32	2nd Summer school recordings published on website	3.4	32	Website upload
MS33	Report on physics summer school	3.4	33	Published report
MS34	MasterClass performed (3rd year)	6.5	33	MasterClass website
MS35	Search for EU calls and preparation, if available	1.4	35	Published report
MS36	Final meeting report	1.2	35	Published report

TABLE 3.1E: CRITICAL RISKS FOR IMPLEMENTATION
EACH INSTITUTE TO CHECK AND COMPLEMENT

Description of risk (indicate level of (i) likelihood, and (ii)	WPs	Proposed risk-mitigation measures

severity: Low/Medium/High)		
Lack of adequate staff in the participating institutes LH: Low, SV: Medium	All	Possible staff problems will be addressed collectively by the partners, and solutions worked out considering shifting activities to other contributors or redistribution of work among partners.
Delays in deliverables LH: Low, SV: High	All	Most of the deliverables are based on personnel effort and their timing does not depend on external factors. Some technical deliverables in WP5 can be delayed in case of technical (hardware) problems or de-scoped or replaced with equivalent activities in case the problems cannot be solved in the duration of the project. A system will be implemented to spot delays early. Mitigating actions will be discussed with partners to keep the project on time. Partners in WPs will appoint project personnel on time to solve problems.
Administrative Manager not hired during project *LH: Medium, SV: High*	WP1	*Existing **AUTH** staff will be engaged to cover the administrative tasks of WP1*
Consortium disruption (partners not engaged or stepping out) LH: Low, SV: High	WP1	All partners have experience and proven track records in large collaborative projects and are motivated to reach the project objectives. A strong Project Coordination will be put in place to keep interest and motivation. Partners not adhering to common interests will be excluded, and their Tasks will be redistributed among the partners.
Difficulties in the establishment of the staff visits plan LH: Low, SV: Medium	WP2	Each staff visit will be discussed and agreed upon in advance, possibly with a flexible time window, also providing a backup solution whenever possible.
Project meets external administrative restrictions LH: Low, SV: Medium	WP3	*The project team will seek and provide support at the local "political" level (Thessaloniki Canton and state level) through formal agreements such as the agreement between **AUTH** and **CERN.***
COVID-19 or COVID-like pandemic prevents gatherings LH: High, SV: Low	WP1, WP3-WP6	The events (meetings, schools, workshops, public presentations) will be organized online. Experience with the Heavy Ion Therapy MasterClass School organized, in May 2021, online, by partners of this project, very successfully, will facilitate to find solutions.
E-learning platform not ready LH: Low, SV: Low	WP 6	In case the platform does not run on time, all e-learning material will be made available to the public through the YouTube channel

TABLE 3.1F: SUMMARY OF STAFF EFFORT

	WP1	WP2	WP3	WP4	WP5	WP6	Total Person-Months per Participant
1 /							
2 /							
3 /							
4 /							
5 / CERN							
6 /							
7 / GSI							
8 /							
9 /							
Total Person Months							

TABLE 3.1G: 'SUBCONTRACTING COSTS' ITEMS

No subcontracting will occur in **STRONGER4CANCER**.

TABLE 3.1H: 'PURCHASE COSTS' ITEMS (TRAVEL AND SUBSISTENCE, EQUIPMENT AND OTHER GOODS, WORKS AND SERVICES)

TABLE 3.1I: 'OTHER COSTS CATEGORIES' ITEMS (E.G. INTERNALLY INVOICED GOODS AND SERVICES)

No internally invoiced goods and services costs will occur in **STRONGER4CANCER**.

TABLE 3.1J: 'IN-KIND CONTRIBUTIONS' PROVIDED BY THIRD PARTIES

No In-kind contribution costs will occur in **STRONGER4CANCER**.

3.2 CAPACITY OF PARTICIPANTS AND CONSORTIUM AS A WHOLE GIOVANNI

All institutes to complement where necessary

The individual members of the consortium are described in a separate section under Part A. There is no need to repeat that information here.

Describe the consortium. How does it match the project's objectives, and bring together the necessary disciplinary and inter-disciplinary knowledge. Show how this includes expertise in social sciences and humanities, open science practices, and gender aspects of R&I, as appropriate. Include in the description affiliated entities and associated partners, if any.

Show how the partners will have access to critical infrastructure needed to carry out the project activities.

Describe how the members complement one another (and cover the value chain, where appropriate) In what way does each of them contribute to the project? Show that each has a valid role, and adequate resources in the project to fulfil that role.

If applicable, describe the industrial/commercial involvement in the project to ensure exploitation of the results and explain why this is consistent with and will help to achieve the specific measures which are proposed for exploitation of the results of the project (see section 2.2).

Other countries and international organisations: If one or more of the participants requesting EU funding is based in a country or is an international organisation that is not automatically eligible for such funding (entities from Member States of the EU, from Associated Countries and from one of the countries in the exhaustive list included in the Work Programme General Annexes B are automatically eligible for EU funding), explain why the participation of the entity in question is essential to successfully carry out the project

The consortium brings together **AUTH** with nnnnnnnnn. The strengths of this consortium are divided in three main areas: (1) know-how in the development and testing of experimental physics technology *for ion beams*, (2) know-how *in cancer research and patient treatment with the use of ion beams* and (3) know-how in education and training of young scientists in experimental physics and medical physics:

1. Know-how in the development and testing of experimental physics technology *for ion beams:***CERN** and **GSI** are institutions that have strong experience in the development and testing of *novel ion beam technology* applied to both fundamental and translational research. ***GSI*** *was the first centre in Europe to perform the translation of ion beam technology to the treatment of cancer patients in 1997. Cancer patients from University Hospital in Heidelberg were treated at* ***GSI*** *in 1997 with the help of* ***DKFZ****, which prepared the treatment plan and performed all dosimetry checks needed for the treatment*. Critical infrastructure will be available at both institutions to allow training and research in the field of experimental physics.
2. Know-how in cancer research and patient treatment *with the use of ion beams*: ***DKFZ*** *and* ***GSI*** *institutions have a strong background in cancer research, radiation physics, system biology and imaging methods. For 2018, nine scientists from the* ***DKFZ*** *ranked in the top 1% of the world's highly cited researchers for their field (bit.ly/DKFZTop).* ***GSI*** *still performs research in the room where the first carbon ion therapy was applied in Europe, while developing its future accelerator facility, FAIR, and strengthens its biophysics department*. Critical infrastructure will be available at both institutions to allow training and research in the field of medical physics.
3. Know-how in education and training of young scientists in applied physics with specialization in experimental and medical physics: All European institutions (**CERN**, **GSI**, **DKFZ** and **UL**) have a strong background in applied science in medical physics, providing advanced training to physics students at both the MSc and PhD levels. The major long-term vision of the present twinning is to develop curricula for MSc and PhD programmes within **AUTh** with the help of the European co-partners within the **NNNNNN** project.
4. The alignment of the institutional vision and mission between all partners:***AUTH*** *has a strategic role Greece in basic and applied research, training, scientific and technological activity spreading actions in a variety of areas. The* ***STRONGER4CANCER*** *mission is to provide the needed support to* ***AUTH*** *to allow capacity building Greece in applied physics in the areas of experimental and medical physics.* The long-term vision is to develop curricula for Master and PhD programmes that can be used to train the new generation *of physicists needed for B&H.* All partners are aligned with this vision and are complementary in their know-how and expertise provided to the **NNNNN**.

- The alignment and complementarity of the educational and scientific research interests: **AUTH** will work closely with all partners (within Greece and external) to promote, train, disseminate knowledge and publish novel scientific results in *experimental and medical physics* in open access journals. Novel ideas will be exploited

and patented to allow their further development, under patent protection. **AUTH** will establish teaching and training programmes to improve *basic knowledge in experimental and medical physics* It will also send researchers to the West-European centres to allow further development and learning of these scientists and teachers. Expert visits from the West-European partners to **AUTH** will permit specialised *(and hands-on)* training of many scientists and technicians in Greece.

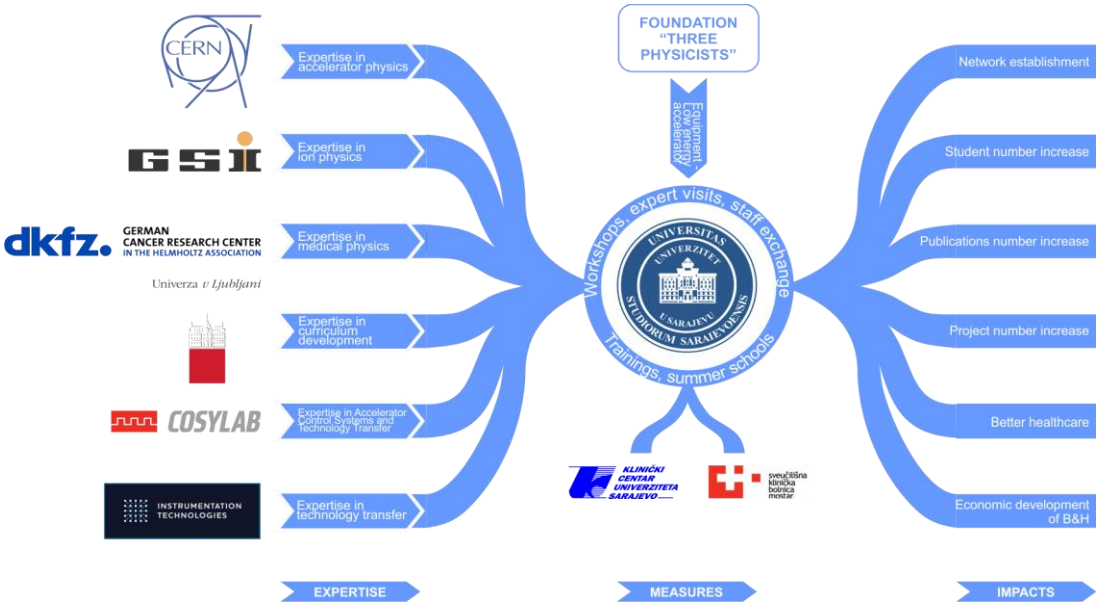


Figure 4. Schematic layout of the STRONGER4CANCER Twinning participant institutes UPDATE

3.2.1 STRONGER4CANCER organizational structure and decision making

All institutes to complement where necessary

The STRONGER4CANCER management structure is based on the partners' experience and best practices aiming, however, at a simplified but efficient decision-making process.

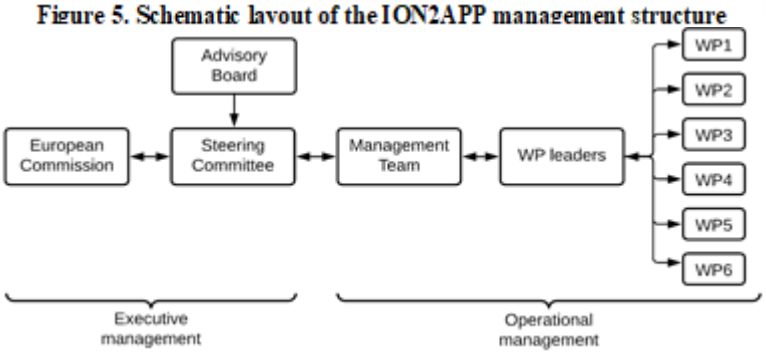
Figure 5 shows a schematic layout of the STRONGER4CANCER management structure. Its main components are the (a) Steering Committee (SC) (b) Management Team (MT) (c) Advisory Board (AB). The coordinating institute, AUTH, is paired for this Twinning project, with West-European leading partners with extensive experience in the coordination of EU projects that will assist actively participating in the organisational structure and decision-making processes.

Steering Committee YF and AM At the executive level, the Steering Committee is the ultimate decision-making body, advised by the independent experts of the Advisory Board. The SC is composed by (a) one nominated representative from each beneficiary, with one vote each: *Maurizio Vretenar (CERN), YiotaFoka (GSI), Giovanni Bisofi (LNL), Flavia Groppi (UNIM)….NNNNN NOT SURE IF NEEDED TO GIVE NAMES HERE*
and complemented, with no voting rights, by (b) the Work Package (WP) Leaders, if different from the beneficiary representatives and (c) the Management Team. The types of decisions and the corresponding voting procedure and rules will be described in the Consortium Agreement.
The SC is chaired by the Project Coordinator (PC), and will meet formally, in-person, during the annual project meetings. The SC oversees and reviews the work progress, milestones and deliverables, consolidates the reports received from the WP Coordinators and discusses technical and scientific matters. It is responsible to access the project advancements and any risks or challenges, the achieved impacts and efficiency of dissemination and communication plans, potential innovation, and current trends. To ensure close monitoring of the project implementation and regularly evaluate progress, the SC will meet, in addition, online, every three months. Based on the resulting assessments, supported by the Impact Manager and Communication Officer, the SC is also responsible to create mitigation plans and propose alterations to the project plan, or allocated budget, admission of new beneficiaries to the project, that must be communicated to EC and agreed upon before implementation. The SC is also responsible for the approval of the networking activities, including the scientific exchanges and education and training activities plans, as well as the selection of candidates *(staff, teaching and research assistants, students, other personnel)*, as prepared and proposed by the selection committees.

Advisory Board: FG and GP The SC is advised by the AB that will formally meet during the annual project meetings. The AB will provide guidance and independent expert opinion contributing to the successful implementation of the STRONGER4CANCER objectives. The AB is composed by world-leading experts in their field: *PrimožPelicon and Stefan Both.*

1. *Primož Pelicon (Institute Jožef Stefan, Slovenia, primoz.pelicon@ijs.si) is engaged in the development of research methods and the applications of high energy ion beams. He co-authored 139 papers listed in the WOS. During his career, he was active in the research of materials and fusion. Lately, he is intensively engaged in the development and applications of high energy focused ion beams in biology and medicine.*
2. *Stefan Both (University Medical Centre Groningen, the Netherlands, s.both@umcg.nl) is a long-standing expert in clinical physics in the field of radiotherapy, with vast experience in proton therapy. Having started his career in nuclear medicine, he soon switched to radiotherapy. In 1999 Both moved to the United States, where he developed his talents as a physicist in the Faculty of Medicine in the Ivy League University of Pennsylvania (Penn). He not only focused on treatment programmes within radiotherapy, but also spent years conducting academic research into technical innovations and the introduction of proton therapy.*

Figure 5. Schematic layout of the ION2APP management structure



*Management Team:*At the operational level, the Management Team is responsible to ensure day-to-day smooth operation, efficient communication, and flow of information with all partners, and the timely submission of all deliverables, milestones and annual project reports. The MT is chaired by the Project Coordinator.
The MT oversees all matters of common interest among the beneficiaries and WPs: it is composed by an Administrative Manager (AM) and a Finance Officer (FO), responsible for all administrative and financial matters; the Impact Manager, Communication/Diversity Officer (CO), Data Protection Officer (DPO), who will oversee internal and external communication to guarantee proper flow of information, dissemination and exploitation, data protection and security matters as well as activities aiming at enhancing soft and project management skills. The PC and MT are supported by experts in the beneficiary institutes (CERN, GSI, LNL), that will complement with their expertise; they will seek advice, as needed, in particular from the EU and Knowledge Transfer offices. The administrative and financial management procedures, as well as the dissemination, exploitation, communication and data protection plans will be presented and agreed upon during the STRONGER4CANCER kick-off meeting. The MT is also responsible for the preparation of the sustainability strategy between SC, WP Leaders and AB; which will be discussed during the interim project meeting and updated for the final one.
The MT will meet (online) once per month and will organize the STRONGER4CANCER annual project meetings, gathering its members and expert guests as needed. The annual meetings will be in person and include in-person meetings of the SC, WP Leaders, and AB. In addition, the MT will organize online meetings with the SC members and WP Leaders (every 3 months) or ad-hoc meetings as required according to the needs of the project. The aim of these regular meetings is to follow up the evolution of the project, identify possible obstacles/risks and discuss mitigation solutions.

Project Coordinator and Deputies: The Project Coordinator is responsible for the technical management and overall coordination of project's activities, regular follow-up of the progress in all WPs, and monitors the deadlines, achievements and quality of the deliverables and milestones, as well as the organisation of project reviews when needed. The PC is ultimately responsible to liaise with the European Commission and communicate progress or changes of the project on all scientific or technical aspects. The PC chairs and organises the Steering Committee meetings, and will be in charge of the preparation of the technical and management sections of the Periodic Reports and the Final Report. The PC leads the WP1.
The designated Scientific Coordinator is Prof. Alexandra Ioannidou (AUTH). The PC is assisted by *two Deputy Project* Coordinators, Yiota Foka (GSI/CERN) who will ensure the liaison with the EU leading partners, in particular CERN, GSI, and their relevant services *and MMMMMM from Demokritos who will also complement the role of*

scientific project coordinator.

Work Package Leaders

The STRONGER4CANCER WP and Task Leaders are a balanced mix from Greece with the leading institutes complementing competences. N1 women WP Leaders and N2 women Task Leaders

The WP Leaders lead and coordinate the activities in the framework of their own WP. They have the responsibility for ensuring the effective cooperation between their WP participants, for monitoring the progress of the tasks, and for reviewing the Milestone and Deliverable reports that are prepared by the Task Leaders within the respective WPs. They prepare internal or other reports concerning their WP, as requested by the MT. They will make the results of the work available to the project collaborators and are in charge of providing the relevant dissemination and communication materials. They coordinate the review of all publications that will result from the work in their WP.

Decision-making mechanisms: Before the start of the project the participants will formally conclude a Consortium Agreement that sets forth the terms and conditions pursuant to which they agree to function and cooperate in the performance of their respective tasks in the project. The Consortium Agreement will specify the responsibilities of the Coordinating Institution and the terms of reference of the Steering Committee, including the relevant decision-making mechanisms and voting procedures.

From Yiota:

ACTIVITIES

Monthly Project Management Team meetings
Quarterly Steering Committee meetings
Annual Project meetings with Advisory Board

M(-N) Project Management Team meetings to prepare
Grant Agreement, signatures etc
Tools, web pages etc for kick-off meeting

M1 Steering Committee meeting to prepare for the Kick-off
present/prepare internal/external communication plans/tools

M2 Kick-off meeting: Thessaloniki IN PERSON
School-1AUTh:
Seminar AUTh
MasterClass Thessaloniki

M3 PMT
seminar

M4 Steering Committee meeting to prepare for the Combined meeting
present/approve plans for network exchanges/internships
internal/external communication plans/tools
seminar

M5 PMT
seminar

M6 Combined ANNUAL meeting: Milano/Legnaro (visit lab/machine) IN PERSON 5 days
1st R&D workshop
current status, trends, define topics of research
Open Steering Committee meeting
present/approve plans for network exchanges/internships
Data Protection and Safety
Advisory Board
Draft Plan:
travel Mon morning, start Mon after lunch workshop,
Tue morning workshop
Tue after lunch travel to Legnaro, visit, presentations about lab/accelerator etc
Tue evening, travel back to Milano (after dinner)
Consider plus one extra day, if many topics/speakers
Wed morning Steering Committee, Advisory Board
Lunch, Departure
MasterClass
Seminar

M7 PMT
seminar

M8 PMT
seminar

M9 Steering Committee meeting
Academia meets industry event: Thessaloniki

M10 PMT
seminar

M11 PMT
seminar

M12 Steering Committee meeting online

By M12 2 x 1 week courses by UMIL at Thessaloniki

M13 PMT

seminar

M14 PMT

seminar

M15 Steering Committee meeting

Academia meets Medicine event: Thessaloniki

M16 PMT

seminar

M17 PMT

seminar

M18 Mid-term Review: Athens IN PERSON 5 days

School-2 Athens

Steering Committee meeting

Advisory Board

Seminar

MasterClasses

M19 PMT

seminar

M20 PMT

seminar

M21 Steering Committee meeting

Seminar

M22 PMT

seminar

M23 PMT

seminar

M24 Steering Committee meeting

By M24 2 x 1 week courses by UMIL at Thessaloniki

M25 PMT

seminar

M26 PMT

seminar

M27 Steering Committee meeting

seminar

M30 Steering Committee meeting IN PERSON 5 days

2nd R&D workshop: Legnaro

MasterClasses Milano and/or Legnaro

M31 PMT

seminar

M32 PMT

seminar

M33 Steering Committee meeting

M34 PMT

seminar

M35 End-of-Project Conference: Thessaloniki IN PERSON 5 days

Steering Committee meeting

Advisory Board

MasterClasses

By M35 2 x 1 week courses by UMIL at Thessaloniki

M36 END

COURSES AT THESSALONIKI: From OUT / IN(full cost on traveler: OUT)

MILANO

FLAVIA: 3 x 2 weeks

LEGNARO

ACCELERATORSGIOVANNI: 3 x 1 week
RadioProtectionDIMITRIS: 3 x 1 week
RI GAIA: 3 x 1 week

CERN

ACCELERATORS MAURIZIO: 3 x 1 week
FLUKA VLACHOUDIS: 3 x 1 week

DEMOKRITOS

ACCELERATORS TasosLagogiannis: 3 x 1 week
RI Aris : 3 x 1 week

SCIENTIFIC EXCHANGES OUT: From IN / OUT(full cost on traveler: IN)

From AUTh / OUT

Noli: to MILANO/LEGARO how many months
Moustakidis: to CERN (FLUKA=Vlachoudis) how many times x how many months
Samaras: to Legnaro (Zafeiropoulos)
Alexandra: to Legnaro/Milano (Flavia, months)

From DEMOKRITOS / OUT

Lagogiannis: to Legnaro
Aris: to Legnaro (to Zafiropoulos)

From Technopolis

3y x 3 days to CERN 3 x 1150 E = 3450
CERN Ticket: 400 E
CERN accommodation: 150 E
CERN per dim: 150 E

From Papageorgiou

3y x 3 days to ITALY 3 x 1050 = 3150
ITALY ticket: 300 E
ITALY accommodation: 150 E
ITALY per dim: 150 E

CONFERENCES

1for every beneficiary per 3 years
Cost per conference: 1800 E
PhDs on their results

STUDENTS

3 PhDs: TOTAL COST 315 000 E at AUTh Budget (including 25%)
affiliated to AUTh and visiting/supervised by partners
PhDs = 26 250 E per year (not more than 2185 per month)

TOTAL CERN STUDENTS COSTS: 100 000 + 25 000 = 125 000 CHF
20 months x 4 173 CHF max (visitors, including 1 trainee (at 1500CHF): at CERN Budget
6 months x 4 173 CHF (COAS) for EU Office: at CERN Budget
(1 x 6 EU office COAS , 1 x 6 KT trainee, 3 x 6 masters/visitors)
Masters: 18 months x 4 173 CHF

TOTAL LEGNARO: 4 pax x 6 m x 1100 E = 26 400 E (+25% 6 600) = 33 000 E
Masters: 24 months x 1 100 E

TOTAL UMIL:2 pax x 6 m x 1100 E = 13 200 E (+25% 3250)= 16 450 E
Masters :12 months x 1 100 E

HIRING at AUTh:

Administrator: part time
Communication officer: quarter of time

COSTS FOR ACTIVITIES

SCHOOL at AUTh TOTAL 30 000 E

(10 000 E to AUTh, 10000 TECHNOPOLIS, 10000 PAPAGEORGIOU)

SCHOOL STUDENTS = 17 000 E for students

TOTAL Students: 50
AUTh Students: 30 x 150 = 4500
Ticket: 0
GREECE Students: 10 x 500 = 5000
Ticket: 30 E bus, 100 E airplane (50 E average)
EU students: 10 x 750 = 7500
Tickets: 300 E
CATERING (2 coffee + 1 lunch + 1 dinner = 30 E) x 5 = 150 E
Local Transport: 2 E per day per student x 5 = 10 E

ACCOMMODATION: 60 E per day per student in single room x 5 = 300 E

BUDGET AUTh = LOCAL = 150
BUDGET GREECE = LOCAL + ACCOMMODATION + TICKET = 150 + 300 + 50 E = 500 E
BUDGET EU: = LOCAL + ACCOMMODATIO+ TICKET = 150 + 300 + 300 E = 750 E

SCHOOL SPEAKERS : 10 total = 5850 E for speakers

Non-project speakers: 3 per school x 1500 E = 4500 E
ACCOMMODATION: 100 E x 5 = 500 E
TICKET: 400 E
Perdiem: 90 E x 5 = 450 E
Catering = 30 x 5 days = 150 E
Project speakers: paid by their institute 7 per school x 150 E = 1050
Catering: 2 coffee + lunch + dinner = 30 E x 5 d = 150 E

For ALL Speakers:
Extra Dinner: 30 E x 10 = 300

ALL PARTICIPANTS: excursion: 60 E x 70 = 4200 E

Students + speakers + organisers x 60 E = 50 + 10 + 10 x 60 = 4200 E

WORKSHOP/Meeting at AUTh 1 week x 40 participants = 10000

FOR PROJECT PARTICIPANTS: 250 E
Catering: 30 E x 5 = 150 E
Excursion: 70 E
Dinner: 30 E
Non-project speakers: 3 per workshop x 1500 E = 4500 E
ACCOMMODATION: 100 E x 5 = 500 E
TICKET: 400 E
Perdiem: 90 E x 5 = 450 E
Catering = 30 x 5 days = 150 E

AUDIT at AUTh

3 y x 2 d x ???

FOR TECHNOPOLIS AND PAPAGEORGIOU

FOR TECHNOPOLIS: 10 000 E school + 5000 E end-of-project meeting
FOR PAPAGEORGIOU: 10 000 E school + 5000 E kick-off meeting
ONE DAY EVENT = 1500 E x 3 = 4500 E
TRIPS OUT/IN YF : 2 per year (2060 per year) x 3 y = 6180 E
TRIPS IN/OUT = 3450 for 3 years
TOTAL: 30 000 E
Plus 25% (7375) = 35 000 E

COMMENT TO IFAST – we should mention the IFAST activities on accelerator design

GIOVANNI: THE WHOLE TEXT BELOW WAS AN INITIAL PROPOSAL FRO THE DESCRIPTION OF THE ACTIVITY. LET'S PUT IT SOMEWHERE ELSE FOR THE MOMENT. THE TEXT IN EXCELLENCE SHOULD BE THE GOOD ONE. MAYBE LATER WE FIND BITS AND PIECES HERE WHICH MIGHT BE USEFUL

Inserted by Giovanni to be completed by Alexandra et al.

The present project proposal addresses one of the main missions of the Horizon Europe programme, which is the more and more effective diagnosis and treatment of human cancer. The goal it aims to accomplishing is to build upon the existing capacity and expertise of a public Institution in a country addressed by the call (Greece), i.e. the Aristoteles University of Thessaloniki. While Greece can count on a Nuclear Physics center built around a particle accelerator, the national Centre for Scientific Research Demoktritos, already well involved in experimental science with the major European Centres, the rest of the country lags behind in this field. As to the specific aspect of building up the capacity needed to construct infrastructures for cancer diagnosis and treatment based on heavy particle beams in particular, the following is noted: the country is in urgent need of filling up the cultural and infrastructural gap with western Europe; only one manufacturer of radioisotopes (RI) for medical isotopes is reported at present in Greece, a private one offering much higher prices than e.g. in Italy or elsewhere (as the natural outcome of a monopoly situation); Aristoteles University of Thessaloniki possesses the background conditions for which this development can built up in an ordered way and efficient times, through the fundamental support of this project, if approved.

(Space for describing the initial capacities at AUTh)

Input from Alexandra

Aristotle University of Thessaloniki (AUTH) has a strong Nuclear Physics and Nuclear Medicine group, but without any specific knoweledge on the field of RI production and medical accelerators. The members of Nuclear Physics & Elementary Particle Physics Division, both theoriticians and experimentalists, have a strong knoweledge background that will allow then to adupt any new specific scientific topic and to support the students of the School of Physics at all three study levels. At the School of Physics all undregraduate students are enrolled at compulsory courses of Nuclear Physics & Elementary Particle Physics and Nuclear Physics Lab. There are also elective courses on the specialization on Nuclear & Elementary particle physics, where arround 25 percent of the undergraduate students are ususally attend.

The proposers of this project unanimously concur that the best investment, towards building long-term capacity in the field of diagnosing and curing cancer with the fundamental tool of particle accelerators and their whole associated equipment in Greece, is to provide a high level educational environment to master and PhD students and their AUTh professors. The project will involve a new generation of future scientists (nuclear physicists, medical physicists, radiochemists, radiobiologists), eventually all serving Nuclear Medicine as the ultimate "customer". This will be done through lectures, workshops and – above all – experimental science, all done at the state-of-the-art level available in Europe nowadays.

It is reasonable to expect that the first public infrastructures for RI production, following the boost provided also by this project, may well be the realization in Greece of those tools which are already routinely used in present-day medical practice. This will be dictated both by the urgent need of such infrastructures in the country, and by the need of acquiring a progressive experience through this intermediate, quicker and not too ambitious goal. A small cyclotron for 18F production, as the one which has been recently purchased by the Demokritos centre, is indeed an excellent opportunity for this initial step.
However, to bridge the gap of knowledge, challenges and opportunities with western Europe, Greece urgently needs a generation of young researchers able to quickly master all the diverse scientific and technological fields that this application of Nuclear Science requires.
The most important expertise are: Nuclear Physics to master the very production of RIs through the interaction of beams with targets; particle accelerators producing and accelerating the beams onto appropriate targets (mainly cyclotrons and linacs, with their ion sources, beam transport and instrumentation, electronic control etc.); radiochemistry, as the process of purification of RIs from the co-produced contaminants is of paramount

importance; radiobiology, to build up the macromolecules able to drive the RIs, in the human body, precisely to those locations where cancer has to be diagnosed or treated.
The present project aims at boosting the capacity of AUTh, over its present and non-negligible background, in the majority of the above-mentioned disciplines.

The research part of the project, which will act as a "catalyst" of the broader educational programme, will hence focus on research and innovation activities, at major European labs and centres, on a selected number of RIs – for cancer diagnosis, therapy or "theranostics" – which already are at an advanced stage of development in radiopharmacy or even in Nuclear Medicine testing phase and for which the most competitive production routes will be analysed and assessed.
Vector beams of protons, deuterons and alpha particle will be considered, up to an energy of around 10 MeV/u or more.
The capabilities of compact cyclotrons and compact linacs will be analysed. RIs investigated at larger cyclotrons will also play a central role in the research activity, at least as a tool to broaden the landscape of opportunities offered by this broad-band-discipline at its state-of-the-art level.
Besides assessing the technologies at the basis of the above-described infrastructures, special emphasis shall be given – in the educational activity, in training and workshops – to the aspect of nuclear safety and radioprotection. This is also based on firm initial capacities at AUTh (see above) and on the large experience acquired at larger centers in the last decade or more (GSI, CERN, INFN-LNL). One of the purposes of the research activity in this project will hence be the investigation of the required radiation shieldings and of the methods to minimise the risk of radiation exposure of workers to radiation, on the appropriate control system. The eventual goal of this part will be an assessment of the advantage/risk ratios of the various considered options.

Familiarity with latest scientific models and related computational tools shall be a fundamental brick of this learning process (to be expanded, on RI production, on shielding, on accelerators,…).

As an overall consequence of this two-stage process, a novel generation of RI scientists in Greece shall be made then able to familiarise with the most promising RI-based cancer medical tools, while benchmarking ideas and methods with the more traditional ones, which will find their way more easily and quickly – in a first phase - towards patients in need at the local hospital. (to be written better, sorry…)
Awareness of the benefit that Nuclear Science can do to Nuclear Medicine and to public health, eventually, shall be one of the main goals of the dissemination programme associated to this project. Indeed, following the experience that the more advanced European centres already went through, the societal acceptance of the nuclear tools as tools for the welfare of many, with the advantages overwhelmingly exceeding the risks, is a fundamental project accompanying process (YF more on this).
The ultimate goal, on which to build the very sustainability of this ambitious but eventually accessible plan, can be to provide the Thessaloniki hospital – on a longer time span – of a modern diagnosis and treatment chain of cancer diagnosis and treatment tools based on particle accelerators, offering a variety of RIs which may address a large variety of human tumors, accessibly and effectively. The construction of such facilities in the proximity of an existing hospital will make this diagnostic and therapeutic tool at least as advanced as at other leading centers Europewide.
A proposed ingredient of this project is to transfer to AUTh also the capacity of planning and managing the project for this kind of infrastructures, which has obviously been acquired by the more advanced western European centers which have already built them. In view of the project sustainability, a workpackage of the project will be devoted to transferring – on an initial and prototypical basis- some best project management tools and practices, within the subset of tools of particle accelerators, their targets, and the associated safety requirements.