GENERAL:

TO READ THE DESCRIPTION OF THE CALL AND TEMPLATES. GREEN AND DIGITAL TRANSITION.

Cover:

I) Uncheck the colours and add the same slash between the acronyms
II) Acronym for PAP-HOSP, TECH-THESS or TECH
III) AUTH everywhere capital
IV) To establish the names of the institutes --→ According to cover page
V) HITRIplus or HITRI+

Abstract:

I) Why to specify human cancer?
II) Is it necessary to write a country addressed by the call

1.1 Objectives, find the numbers from paper of MImoza.

1.1 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).
- 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;
- taxonomy aligned, since the scientific and education activity *is contributing* to "**pollution prevention**" one of the six environmental objectives.
    - *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**.*
- . 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.
- TO MENTION ARIES REGARDING COMPACT LINEAR ACCELERATOR PRODUCTION.

- **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.*
  QUESTION*: ARE WE GOING TO USE PATIENT DATA?? AND ARE WE GOING TO PUBLISH PATIENT DATA? HOW DOES IT RELATE WITH THE MENTION OF PRECLINICAL AND CLINICAL STUDIES?*

- **TO DISCUSS**: "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.

  5. ***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).*
  6. ***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).

  7. *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.* "

And in 2.2:

"*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]. The **STRONGER4CANCER** partners will endeavour **to publish any results as swiftly as possible** in conference proceedings and/or scientific journals. The Journals more related to our 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

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~~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.***

The radionuclide production and radiochemistry community has a long tradition to publish the results of the research in specialized journals and to organize various conferences on a worldwide basis to allow comparison and debate on the most up-to-date techniques and results between the various researchers, with the peer-reviewed publication of the proceedings and the related papers in the specialized journals.

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.*

"

- To discuss how to mention the EU leading partners or the Western European partners? How to mention all the participants collectively.

SECTION 3:

- TO Giovanni: update on WP5
- URGENT: WHAT IS TRAINING AND WHAT RESEARCH???

-"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. In particular, the selection of an appropriate radionuclide depending on a number of criteria and parameters, affecting usefulness and feasibility. The first is directly related to the radiological performance of the ionising radiation in relation to tissue and its morphology, with a major distinction between the effects of alpha and beta-particles; usefulness is also directly related to the proper choice of RN half-life. The second depends also on convenience and safety aspects in the preparation and the handling of the RN's.
- 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]. Parallel the research activity at UMIL carried out at IBAK70 ARRONAX Cyclotron that can deliver protons, deuterons beam at variable energies and alpha beams, allowing to demonstrate the differences and the advantages using beams different by protons ones as for the highest yields and radionuclidic purity as for waste problems.
- The nuclear cross section measurements for medical radionuclide production, how to properly set the experiments parameters (irradiation run: beam intensity and time, targetsry 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, OLINDA/EXM for internal dose calculation.-
- 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.
- The simulation of the cross sections for the nuclear reactions involved by dedicated computers codes like EMPIRE, TALYSENDL, FLUKA
- The setup of suitable radiochemical separations of the radionuclide of interest by the targets, carried out in no carrier added form to produce the radionuclide with the highest specific activity that can be achieved.
- Point out the quality control program for the experimental determination of the radionuclidic, radiochemical, chemical purities in order to reach the highest specific activity (i.e. radioactivity / mass of isotopic carrier). Furthermore, in order to allow the use of these labelled compounds on living organisms, it is necessary to guarantee their biological compatibility, that means physiological pH, sterility, physiological values of both ionic conductivity and osmotic strength and all these parameters must be verifiedy as a function of the time, as in vitro as in vivo, due to the decay of the radionuclides involved. This is also reflected in the expiration time of the radiopharmaceutical into the official Pharmacopea regulation.
- *Details on the radiochemical procedures … etc.*

WP5 Safety
(place for Dimitri's and lucia's text) ~~*here*~~
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:

1. generating competencies -in radiological protection and safety, particularly in view of challenges in medical applications with radionuclides - e.g. nuclear medicine, production of radioisotopes;
2. fostering the understanding, research and development of related technologies, including new ones;
3. 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);
4. 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;
5. increasing the capabilities and abilities to ensure appropriate levels of protection of individuals and the environment;
6. increasing the awareness of the importance of international cooperation and an interdisciplinary approach in the research and implementation of radiological protection science and technology "

- To discuss:
- **TABLE 3.1C: LIST OF DELIVERABLES IN THE END**

Deliverable (nº)	Deliverable name	WP (nº)	Short name of lead participant	Type	Dissemination level	Delivery date Months
D 1.1	Sustainability plan	WP 1	**AUTH**	R	PU	M3 4
D 1.2	Data Protection Officer appointed	WP 1	**AUTH**	R	PU	M2
D 2.1	Networking scientific exchange plan	WP 2	**AUTH**	R	PU	M2
D 2.2	Report on networking achievements	WP 2	**AUTH**	R	PU	M3 4
D 2.3	Seminar on the impact of scientific exchanges	WP 2	**AUTH**	R	PU	M3 5

D 3.1	Curriculum for PhD programme in physics	WP 3	**UL**	R	PU	M33
D 3.2	Report ~~on hands-on module and~~ summer schools	WP 3	**UL, GSI**	R	PU	M34
D 3.3	Report on expert visits and their impact on new curricula	WP 3	**UL**	R	PU	M32
D 3.4	Report on students educational training and theses	WP 3	**UL**	R	PU	M35
D 3.5	Report on ~~"CosylabAcademy"~~ training.	WP 3	**CSL**	R	PU	M32
D 3.6	Report on laboratory courses establishment	WP 3	**I-TECH**	R	PU	M24
D 3.7	Report on student internships at industrial partner **I-TECH**	WP 3	**TECH nopolis**	R	PU	M33
D 4.1	Report on medical-physicist gained experience and training sessions	WP 4	**Papageorgiou**	R	PU	M33
D 4.2	Report on the R&D workshop (1st and 2nd)	WP 4	**Legnaro**	R	PU	M26
D 5.1	~~Model for mixed ion beams~~	WP 5	**DKFZ**	R	PU	M12
D 5.2	~~Model for combined FLASH and mixed ion beams~~	WP 5	**DKFZ**	R	PU	M24
D 5.3	~~Preliminary design of an EBIS ion source for injection in an ion therapy synchrotron~~	WP 5	**DKFZ**	R	PU	M12
D 5.4	~~Optimisation of beam parameters and comparison of results for ion source prototypes~~	WP 5	**DKFZ**	R	PU	M30
D 5.5	R&D workshop report	WP 5	**DKFZ**	R	PU	M19
D 5.6	Report on research activities and student theses	WP 5	**DKFZ**	R	PU	M34
D 6.1	Dissemination, exploitation, and communication plan	WP 6	**AUTH**	R	PU	M6
D 6.2	Project website, logo, and social media set up	WP 6	**AUTH**	R	PU	M3
D 6.3	Report on the impact of dissemination, exploitation, and communication activities	WP 6	**AUTH**	R	PU	M35
D 6.4	Final report on MasterClasses	WP 6	**GSI**	R	PU	M34

- To discuss:
- **TABLE 3.1D: LIST OF MILESTONESIN THE END**

Milestone (nº)	Milestone name	WP (nº)	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

- To discuss:

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"***
2. ***MENTION OTHER RISKS.***

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

Description of risk (indicate level of (i) likelihood, and (ii) severity: Low/Medium/High)	WPs	Proposed risk-mitigation measures
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	WP3	*The project team will seek and provide support at the local "political" level (Thessaloniki Canton and state*

LH: Low, SV: Medium		*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

- **EVERYONE SHOULD COMPLETE:**

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

TO FLAVIA:

- What is LERU, founding member, only Italian university, good or bad?
- towards theranostics as well as for radio-nano-medicine and radiotracers for environmental applications. **HIGHLIGHT IN GENERAL THE ENVIRONMENTAL PROFIT OF THE PROPOSAL.**

To Giovanni:

- 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.
  HIGHLIGHT THE BENEFIT FOR ALL EU
- Section Impact, 2.1 "which can be safely built in the vicinity of a hospital." TO SPELL IT IN THE START. FIRST TIME BEING MENTIONED IN THE TEXT.
- "Second, the possibility to widen the present research activities on radionuclides and radiopharmaceuticals carried out at UNIMI and ~~the~~ INFN-LNL in a clinical environment, taking into account the regulatory and quality control aspects in Greece, …" To discuss with Giovanni.
  QUESTION: Should we discuss clinical or preclinical studies? If so, does it make sense to discuss the facilities of the hospital? Etc. Trouble of using animal etc.

For the Greek colleagues:

THE GREEK COLLEAGUES TO REVISE, COMPLETE AND FINALISE

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

THE GREEK COLLEAGUES TO REVISE, COMPLETE AND FINALISE

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.

Section 1.2, please read and complete accordingly

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

- **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 **Error! Reference source not found.**.

- **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.

URGENT: AUTH TO FINALIZE SWOT ANALYSIS

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**.*

TO BE COMPLETED BY THE GREEK COLLEAGUES

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.

- **TO BE COMPLETED BY GREEK COLLEAGUES**

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.*

- YF & AM input

PAP-HOS 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

To change figure 1, STRONGER4CANCER map

To start the acronym list

To search UNIMI and replace with UMIL

To merge from IFAST & ION2APP in section 2.2.

FOR CERN:

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.

++ CERN EQUIPMENT FOR PART A