



# SEEIIST - modern and advanced infrastructure for innovative cancer tumour therapy and research

## ABOUT SEEIIST

The South East European International Institute for Sustainable Technologies (SEEIIST) aims at building in the area of South-East Europe a modern and advanced infrastructure for innovative cancer research and tumour therapy which will be using beams of particles such as protons, carbon, helium and others. For this challenge, it counts on cutting-edge technologies, such as the ones developed at CERN<sup>1</sup>, GSI<sup>2</sup> and other hi-tech research laboratories.

SEEIIST received initial funding from the European Commission for the design studies of the facility and from IAEA<sup>3</sup> for capacity building. It is further supported by many important actors promoting real international cooperation in the SEE region. After the first conceptual design, a team of experts continues developing the technical details of the facility.

### The site decision has not been taken yet.

The decision will be taken by the Steering Committee of the project based on agreed upon criteria and procedures. After careful considerations and evaluations, the site selection will be completed by the end of 2024. SEEIIST will be a distributed facility so that all its member states can benefit contributing to supporting hubs dedicated to specific functions e.g. digital data storage, green energy production, etc.

SEEIIST aims at becoming a regional centre of excellence based on state-of-art sustainable technology, which will assure high competitiveness in Europe. It will promote regional collaboration in science and technology and the active participation of the SEE industries.

In particular, the project will become an attraction point for education and training for young scientists, researchers, engineers, technicians, medical doctors, biologists, biomedicine engineers and others who will contribute to the improvement of the whole region in terms of medical innovations, scientific achievements, technological advances, industrial empowerment and economic benefits.

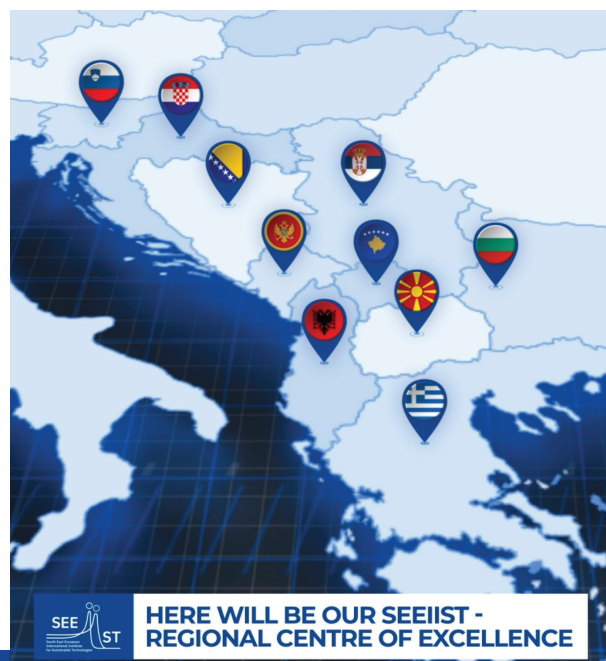
**Ten partners in South East Europe - Albania, Bosnia & Herzegovina, Bulgaria, Croatia, Greece, Kosovo<sup>4</sup>, Montenegro, North Macedonia, Serbia and Slovenia – are joining forces to set-up a large scale research infrastructure: SEEIIST**

<sup>1</sup> European Organization for Nuclear Research

<sup>2</sup> Helmholtzzentrum für Schwerionenforschung in Darmstadt (GSI)

<sup>3</sup> International Atomic Energy Agency (IAEA)

<sup>4</sup> This designation is without prejudice to positions on status, and is in line with UNSC 1244 and the ICJ Opinion on the Kosovo Declaration of Independence.



**HERE WILL BE OUR SEEIIST - REGIONAL CENTRE OF EXCELLENCE**

## MISSION, GOALS AND BENEFITS

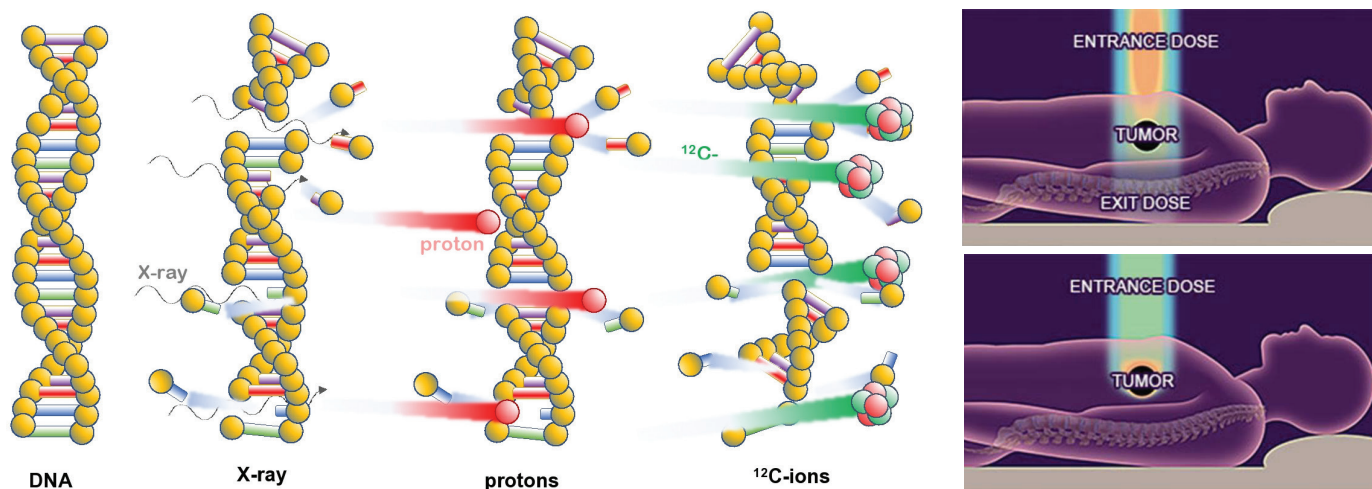
The SEEIIST mission is to promote collaboration among south-east and west European institutions aiming at research excellence on advanced cancer treatment for the benefit of their citizens as well as of patients around the world.

SEEIIST is committed to foster collaboration among all relevant stakeholders such as hospitals, universities, research institutes, industry and policymakers, enabling rapid translation of research to the optimal treatment of cancer patients and to implement the first of a kind SEE research infrastructure, with beam-time dedicated to both, to multidisciplinary research and patient treatment.

*Among the SEEIIST goals there are:*



The damage caused on the DNA by protons and C-ions is much larger compared to high energy photons (x-rays) used in conventional radio-therapy, as it is schematically shown in the left hand-side figure. The right-hand-side figure shows, at the lower part, the superiority of protons that leave most of their energy at the target where they stop, contrary to photons that leave most of their energy before the target and they still penetrate healthy tissues after the target.



## BUILDING A FACILITY FOR CANCER THERAPY AND BIOMEDICAL RESEARCH

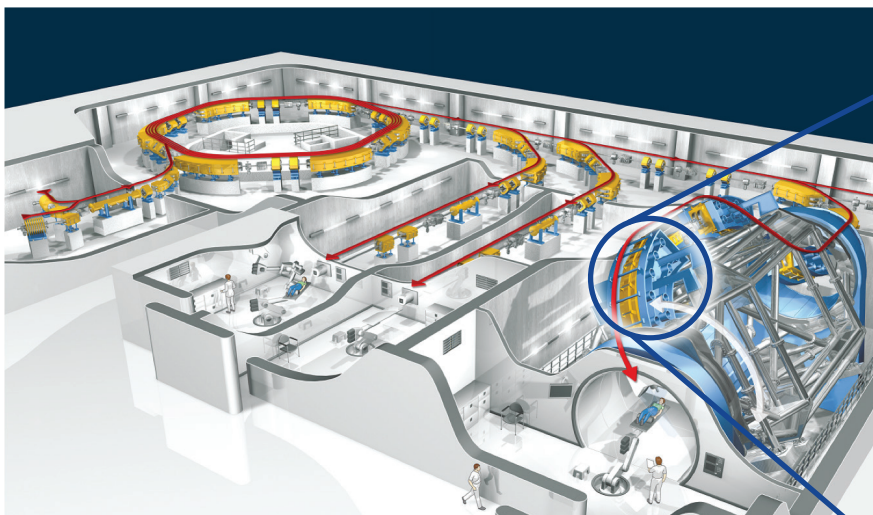
The SEEIIST Project tackles the following main research areas:

- 1. Radiobiology** – Pre-clinical radiobiology is an essential tool to support new therapy solutions
- 2. Medical physics** – Ultra-fast dose delivery methods will extend ion therapy to the special group of tumours in moving organs
- 3. Nuclear medicine and Radioisotope production** – Many isotopes for medical applications (diagnostics and cancer treatment) can be produced by the novel Injector-Linac (Linear Accelerator)
- 4. Material science** – Innovative material research using high-energy ions (radiation hardness, space microelectronics, nano- tubes)

Approximately 400 patients per year will be treated. In parallel, at least 50% of the beam time will be dedicated to biomedical research with multi-ion sources beyond presently used proton and carbon-ions, making the SEEIIST project unique in the world. SEEIIST will host about 1000 researchers, including a large number from outside the SEE region.



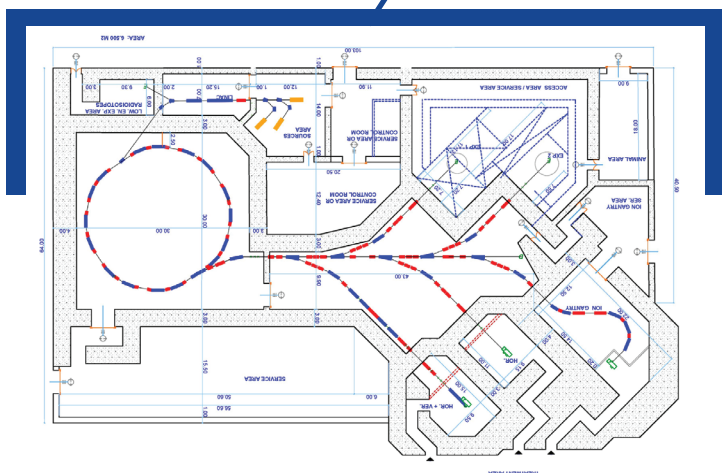
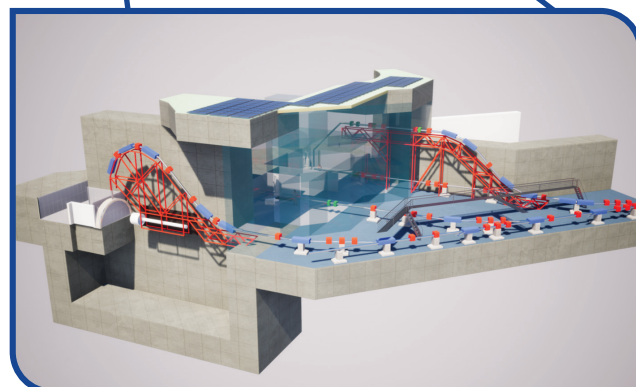
## CURRENT TECHNOLOGICAL ACHIEVEMENT - INNOVATIVE ASPECTS OF THE SEEIIST FACILITY



The HIT ion therapy centre in Heidelberg Germany has been treating patients since 2009. It is the only one among the European ion therapy centres to operate a gantry which is 19 m long, and about 15 m in diameter. The total weight is 600 tons. Current studies show that the weight of the SEEIIST gantry could be reduced by about a factor ten.

SEEIIST will host fundamental and clinical research for cancer treatment utilising protons and heavier ions with beam intensities beyond the ones that are currently used in the existing ion therapy centres.

The SEEIIST design is inspired by the successful solutions developed for the four European therapy centres HIT/MIT, CNAO and MedAustron.





SEEIIST will implement and enhance all positive features of the existing European ion therapy centres aiming at a more compact facility but making it even more effective, safe, patient and environmental friendly, with improved methods for recycling and promoting carbon-clean technologies.

Some of its main features are:

- New accelerator design with outstanding beam intensity, 20 times higher than that of the present European centres.
- Improved flexible dose delivery system allowing frontier research and advanced treatment methods.
- Novel treatment possibilities, such as FLASH therapy, with 100-1000 times larger dose rates than that of standard treatments.
- Improved synchrotron injector to make possible, in parallel, the production of radioisotopes for imaging and the treatment of metastatic tumours.
- Flexibility in serving the needs of broad experimental research which needs in-vivo irradiation, covering a range of emerging treatment modalities, and providing different ion species, from protons and helium to argon.
- New rotating gantry design with advanced superconducting technology and significant reduction in size (by almost a factor 10 in weight compared to the HIT one).

For more information please consult the SEEIIST web site: <https://seeiist.eu>



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008548