

The SEEIST Project

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

History and Vision

SEEIIST:

- *South East European International Institute for Sustainable Technologies*
- **Initiative launched in 2017 as Science for Peace project**
- 10 participating countries
- Focus on ion beam therapy related research
- **Closing gap in European Research Landscape**
- **Making SEE region attractive for researchers**
- **Capacity building for SEE and EU wide**
- Enlarging excellence of Hadron Therapy Network in Europe (MedAustron, CNAO, HIT Heidelberg)



Participating Countries:

- Republic of Slovenia
- Republic of Croatia
- Bosnia and Herzegovina
- Montenegro
- Republic of Albania
- Republic of Serbia
- Kosovo*
- Republic of Bulgaria
- Republic of North Macedonia
- Hellenic Republic

* 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.

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SEEIIST Research Infrastructure:

Main scientific Instrument:

- Synchrotron based Ion Beam Accelerator

Research Fields:

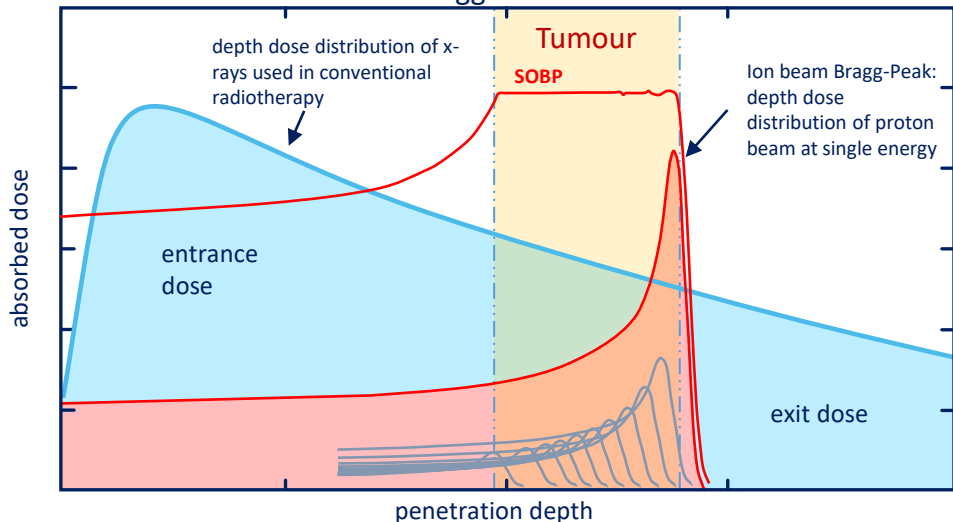
- Non-clinical Research
- Clinical Research, incl. Treatment

Distributed RI:

- Main Facility
- Technology Hubs
- Research Hubs
- Clinical Hubs

The Rational for an Ion Beam Therapy Research Institute

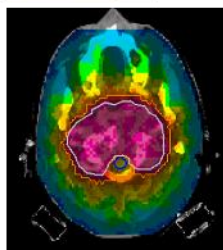
Inverse Dose Profile - The Bragg Peak



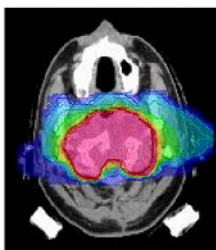
Medical Benefit

- substantial lower dose to healthy tissue and organs at risk
- at least equal cure rates
- more efficient for radio-resistant tumours
- lower side effects
- higher quality of life
- for some tumours the only treatment option
- for many patients the only option for re-irradiation after conventional radiotherapy

9-field IMRT



2-field particle



Courtesy of U Weber, GSI



Situation in Europe

- Population in Europe: 746,4 Mio
- Population SEE Region: 44,3 Mio
- IBT Centers Europe: 34 (20 p⁺; 4 p⁺ and C¹²)
- IBT Patients Europe: total: ca. 150.000
SEE: ca. 10.500
but only 34 centers with 10.600 p in 2021



Rational

- Make Ion Beam Therapy is available for patients in SEE
- Accelerator based RI: seed for a wide range of science
- Close lack of human capacities and knowledge on fields in SEE

The Rational for an Ion Beam Therapy Research Institute

SEEIIST
Targets and Values:

- bring IBT to the region
- establish a major European research institute in SEE
- counteract the brain drain
- retract researchers to their home countries
- give young scientists a perspective
- develop a research eco-system in SEE

→ Follow the spirit
 “Science for Peace”

SEEIIST
Economic Net Present Value

- European Investment Bank and University of Milan analysed cost benefit ratio for CNAO, that is comparable to SEEIIST

→ Benefit-Cost Ratio of 4.5

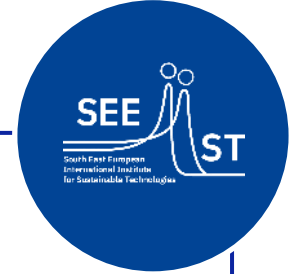
→ ENPV of 1.5 billion Euro

→ Similar socio-economic leverage effects can be assumed for SEEIIST and for the participating countries hosting hubs.

SEEIIST
Project Perspectives – Spinoffs

- beam characteristics suitable for a wide range of research in radiobiology, radiopharmaceuticals, material sciences and space sciences
- SEEIIST know how as incubator for further developments like an synchrotron light source or compact, cost optimized machines and technologies and their commercialization
- Business spinoffs: radiopharmaceuticals, detector technology, material characterization and development, artificial intelligence and big data computing in medicine, green engineering, etc.

Basic Concept for the Future Institute



SEEIIST *research* – European Research Infrastructure Consortium (ERIC)

- Responsible for establishment and operation of the SEEIIST infrastructure
- Owner of the SEEIIST facility
- Responsible for non-clinical research programme
- Legal manufacturer of the Treatment Accelerator
- Service provider for clinical and non-clinical users

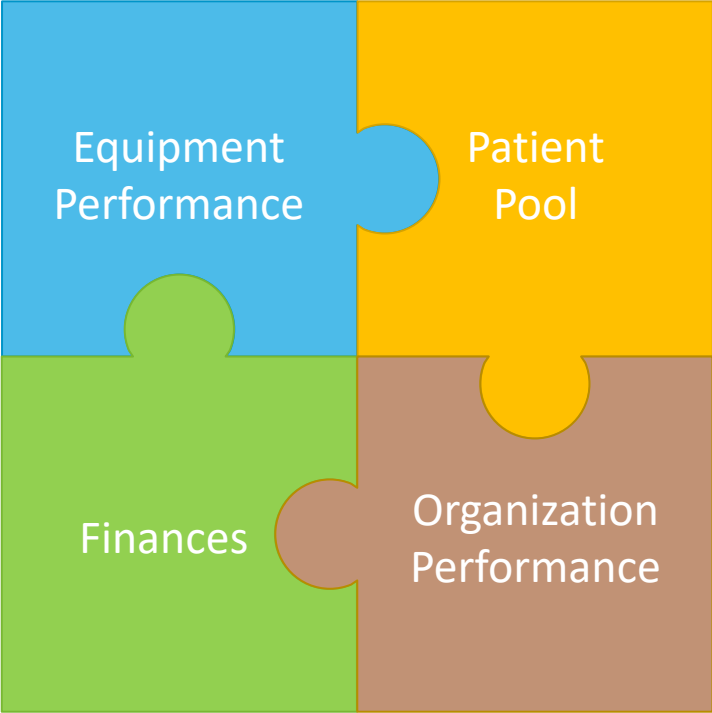
SEEIIST *clinics (research and clinical trials)*

- Separate legal entity
- User of the SEEIIST infrastructure
- Permit holder for clinical trials and treatment
- Legal responsibility for clinical trials and treatment
- Takes financial risks for clinical operation

SEEIIST *external research users*

- Researchers from Europe and SEE region
- Executing own research programmes
- Collaboration and proposal based
- Considering excellence and capacity building
- Potential industrial users

SEEIIST - Project: Key Factors for Success

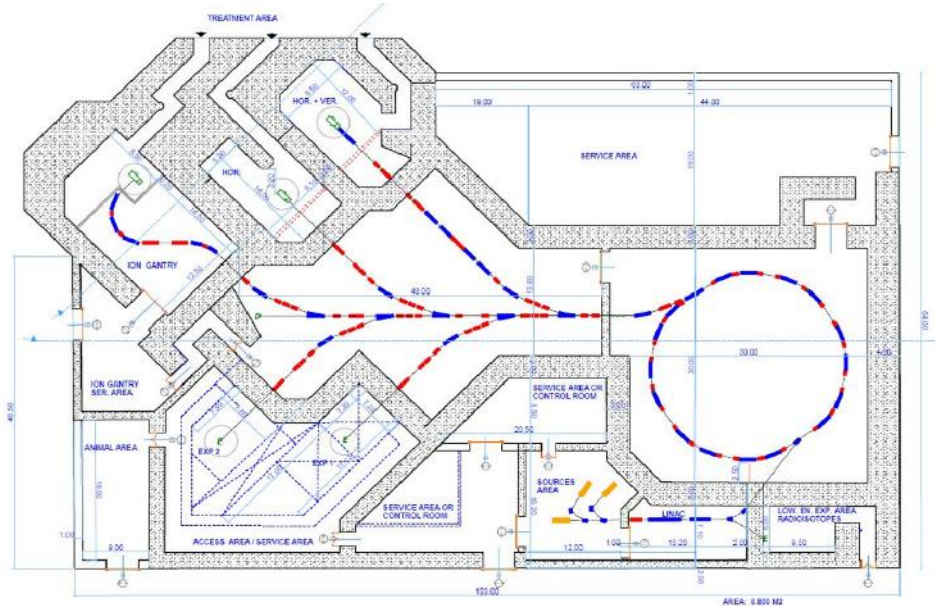


Key Factor: Equipment Performance (see HITRIplus WP7)



Particle Beam Therapy equipment is required to

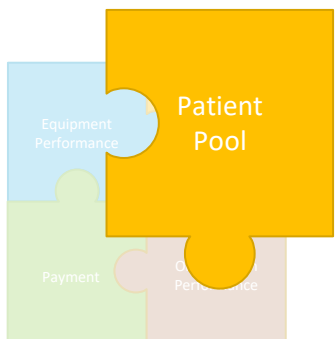
- have high performance in sense of **patient throughput** and **parallel research**
- be professionally integrated with auxiliary equipment and IT systems
- **provide state-of-the-art PBT incl. image guided PBT**



→ Accelerator:

- Synchrotron based, providing ion beams from helium up to neon with energy up to 450 MeV/u (carbon ions)
- ions per spill up to $2 * 10^{10}$ (**20 times higher** than provided by existing treatment machines)
- in **fast extraction mode**, up to 1000 times larger dose rates **capable for FLASH therapy**
- fast cycling mode for **parallel clinical and non-clinical use: switching times in the order of 1 second**
- dedicated **isotope production** beam line
- 3 medical beamlines
- 2 expandable research beamlines

Key Factor: Patient Pool



Potential Number of Patients (indication based)

- Indications for treatment with photon therapy include a number of approximately 20.000 for every ten million populations per year, including 12% (2.400) of proton therapy*.

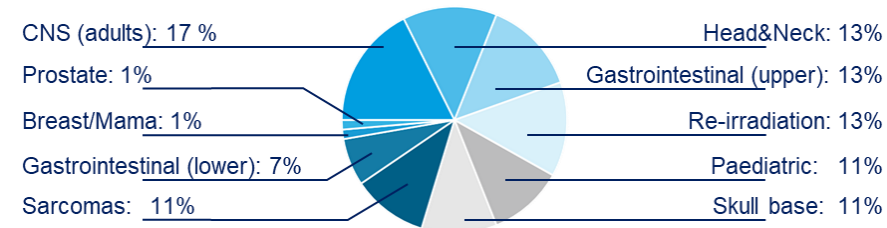
→ Europe: 179.000 PBT Patients per year
 → SEE: 10.560 PBT Patients per year

- Reality Check: Europe in 2021 – 10.600 only !!

- **Realistic achievable numbers:**

→ MedAustron expects realistically 750+ patients/a
 → PBT cases per 10 million of population – in total 835
 → scaled to SEE: ca. 3700 patients/a

→ achievable via SEEIST clinical hubs !!



Country	Population	No. of Linacs (ca.)	No. Persons per Linac	PBT-patients 2019	scaled to SEE
Switzerland	8.544.527	71	120.345	376	1951
France	66.993.000	504	132.923	1126	745
Italy	60.262.701	452	133.325	950	699
Germany	83.019.213	590	140.711	2301	1229
Sweden	10.230.185	64	159.847	260	1127
<i>IAEA recommendation</i>			180.000		
Austria	8.858.775	49	180.791	274	1371
Czech Rep.	10.637.794	53	200.713	1151	4796
SEE	44.326.571	164	270.185	-	average: 1702

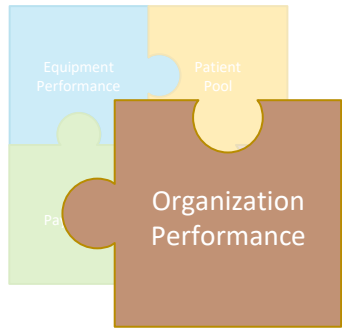
* Nunes Marcos d'Ávila. Protontherapy versus carbon ion therapy: advantages, disadvantages and similarities. Cham et al.: Springer, 2015.



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Key Factor: Organizational Performance

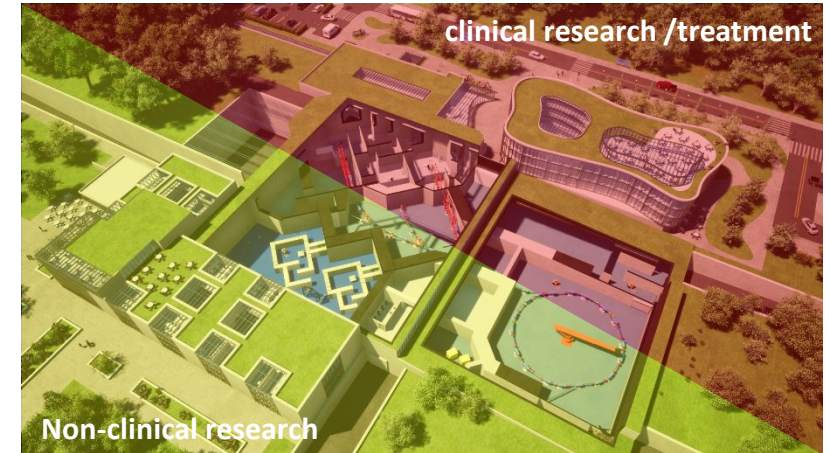


Influencing aspects:

- **Clinical concept and clinical protocols**
 - Impact on indication mix, number of fractions per patient and consequently the total number of patients
- **Research concept**
 - Impact on user and experiment management
 - Impact on funding and costs
- **Quasi-parallel Research and Clinical operation**
 - Impact on beam time management
 - Impact on reimbursement, funding and costs
- **Workflow performance**
 - Impact on machine idle time (should be as low as possible !!)

→ to be tackled by:

- Workflow and organizational optimization
- Training
- Appropriate planning
- Optimized facility and appropriate accelerator design



Building:

- 120 x 100 (11650) m² footprint size of the facility
- 3400 m² office space
- 2650 m² lab space
- 5000 m² social and communication facilities

Key Factor: Coverage of Operational Costs



Funding of Research

- Adequate calculation of costs per hour of beam time
- Competitive research programme addressing European needs for EU funding
- Regional educational and research programme for SEEIST member funding

Basic operational Costs and Maintenance

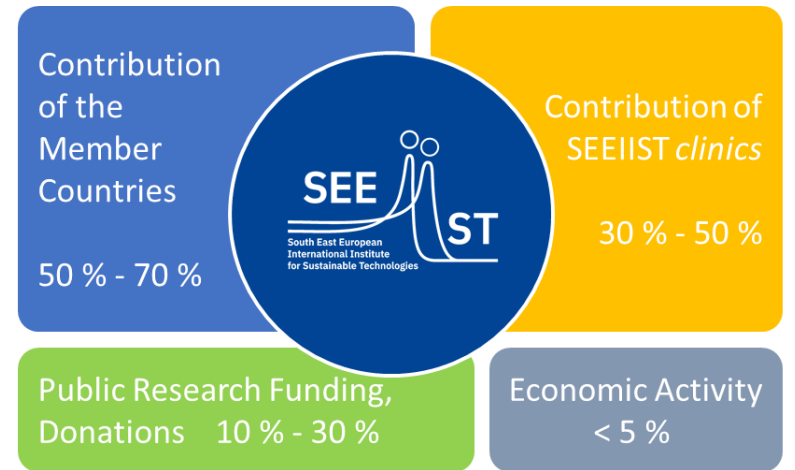
- Sustainable financing concept by SEEIST members

Reimbursement of Clinical Research and Treatment

- Adequate contracts with health care insurances are mandatory
- Reimbursement per patient should be calculated to cover costs for the worst case of patient numbers (patient pool and performance)
- National factors are to be considered

Collaboration with Industrial partners

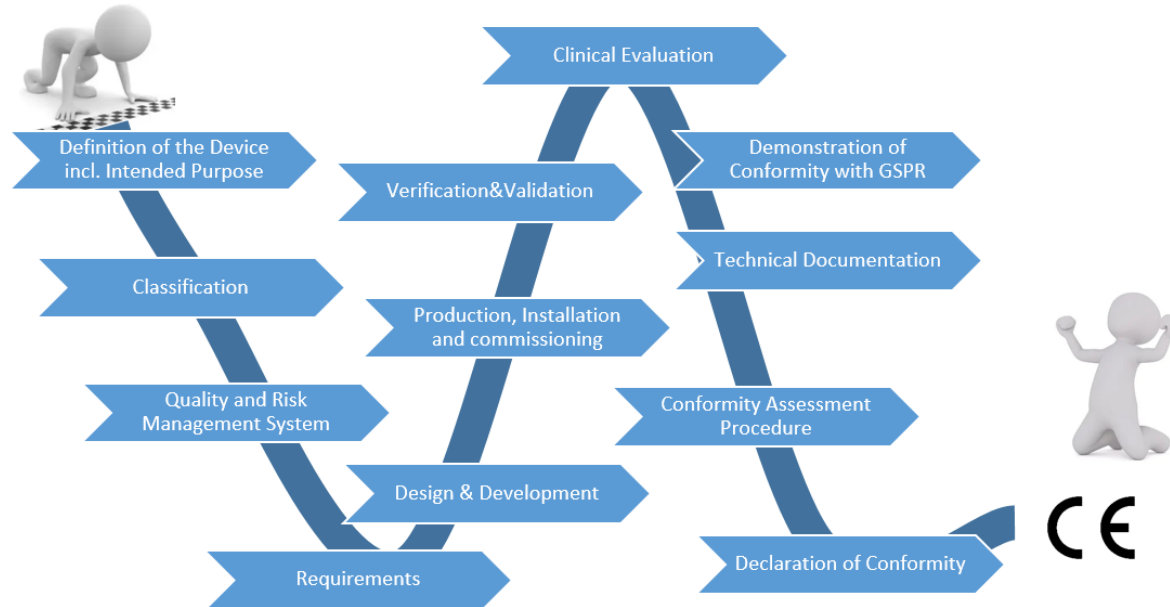
- Competitive costs and reimbursement scheme



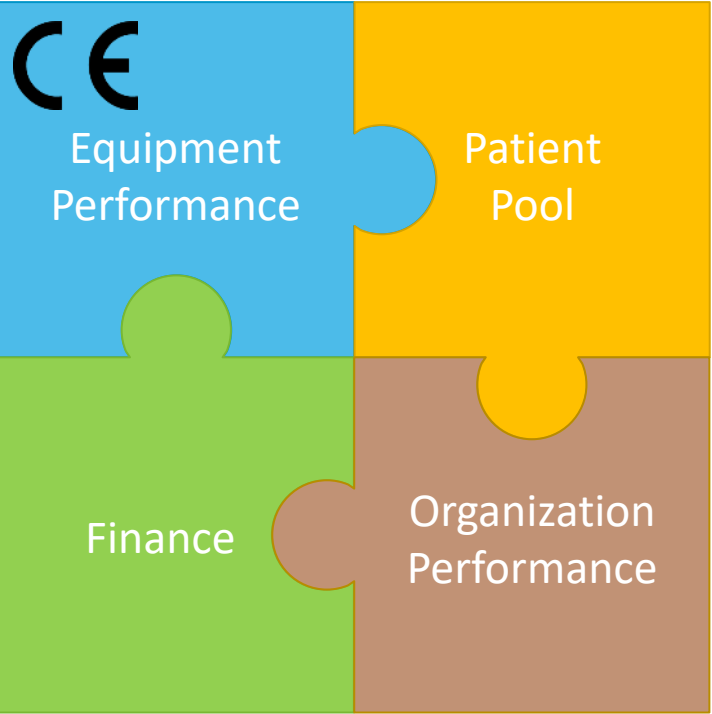
Accelerator - “Licence” for Treatment

Europe: Application of MDR

The way to the CE - mark : → The way of success: application of standards and guidelines



SEEIST - Project: Work Plan



International Collaborations

1. CERN
 - Established 11.2020
 - Content: accelerator design, HITRIplus and NIMMS activities
2. CNAO
 - Established 07.2022
 - 2 IAEA follows to work at CNAO
3. ICTP
 - Established 03.2023
 - 1 project: Hadron Therapy School for professionals in medical physics (Trieste, 04/2024)
4. School of Medicine Aristotle University of Thessaloniki
 - Established 12.2023
 - 1 project: Workshop/Training course (Thessaloniki, 10/2024)
5. Tera-Care
 - Established 01.2024
 - 1 project: Collaboration in HITRIplus, accelerator design



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CERN

AMENDMENT No.1
TO
ADDENDUM No.1 (KN 4964)
TO
FRAMEWORK COLLABORATION AGREEMENT

BETWEEN: THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (CERN), an Intergovernmental Organization having its seat at Geneva.

AND: THE ASSOCIATION FOR THE SUPPORT OF THE SOUTH EAST EUROPEAN INTERNATIONAL INSTITUTE FOR SUSTAINABLE TECHNOLOGIES (SEEIIST) established in Rue des Bains 7, Geneva 1205, Switzerland. www.seeiist.org, email: office@seeiist.eu, and which has as its legal representative the CEO Dr. P. Grübling.

HEREINAFTER COLLECTIVELY REFERRED TO AS THE "PARTIES"

CONSIDERING THAT

On 21 November 2020, the Parties agreed to amend the Framework Collaboration Agreement and Addendum No. 1 (KN 4964) to include the following:

AGREE TO AMEND

The duration set forth in the Addendum No. 1 shall continue on the same terms and conditions as set forth in the Addendum No. 1.

All other provisions of the Framework Collaboration Agreement and Addendum No. 1 shall remain in full force and effect.

This Amendment shall be subject to the provisions of the Framework Collaboration Agreement and Addendum No. 1.

Now, therefore, the Parties have reached the following understanding:

CNAO

AGREEMENT

ICTP

MEMORANDUM OF UNDERSTANDING BETWEEN

The Abdus Salam International Centre for Theoretical Physics (ICTP) a category I United Nations Educational, Scientific and Cultural Organization (UNESCO) institute, operating under the tripartite agreement between the Italian Government, the International Atomic Energy Agency (IAEA) and UNESCO, with its registered office in Trieste, Strada Costiera, 11-34151, ITALY, Italian Fiscal Code 8003373028 has as its legal representative Director Prof. A. Dubbeddar,

AND

The Association for the Support of the South East European International Institute for Sustainable Technologies (SEEIIST) established in Rue des Bains 7, Geneva 1205, Switzerland, www.seeiist.org, email: office@seeiist.eu, and which has as its legal representative the CEO Dr. P. Grübling.

AUTH School of Medicine

SEEIIST

MEMORANDUM OF UNDERSTANDING

FA-2023-01

between

the School of Medicine of the Aristotle University of Thessaloniki ("AUTH School of Medicine")

and

The Association for the Support of the South East European International Institute for Sustainable Technologies ("SEEIIST")

Concerning

Clinical Concepts for a Particle Therapy and of the Development of a Particle Therapy and Application in the South East Europe in particular

Tera-Care

FRAMEWORK COLLABORATION AGREEMENT

FA-2024-01

between

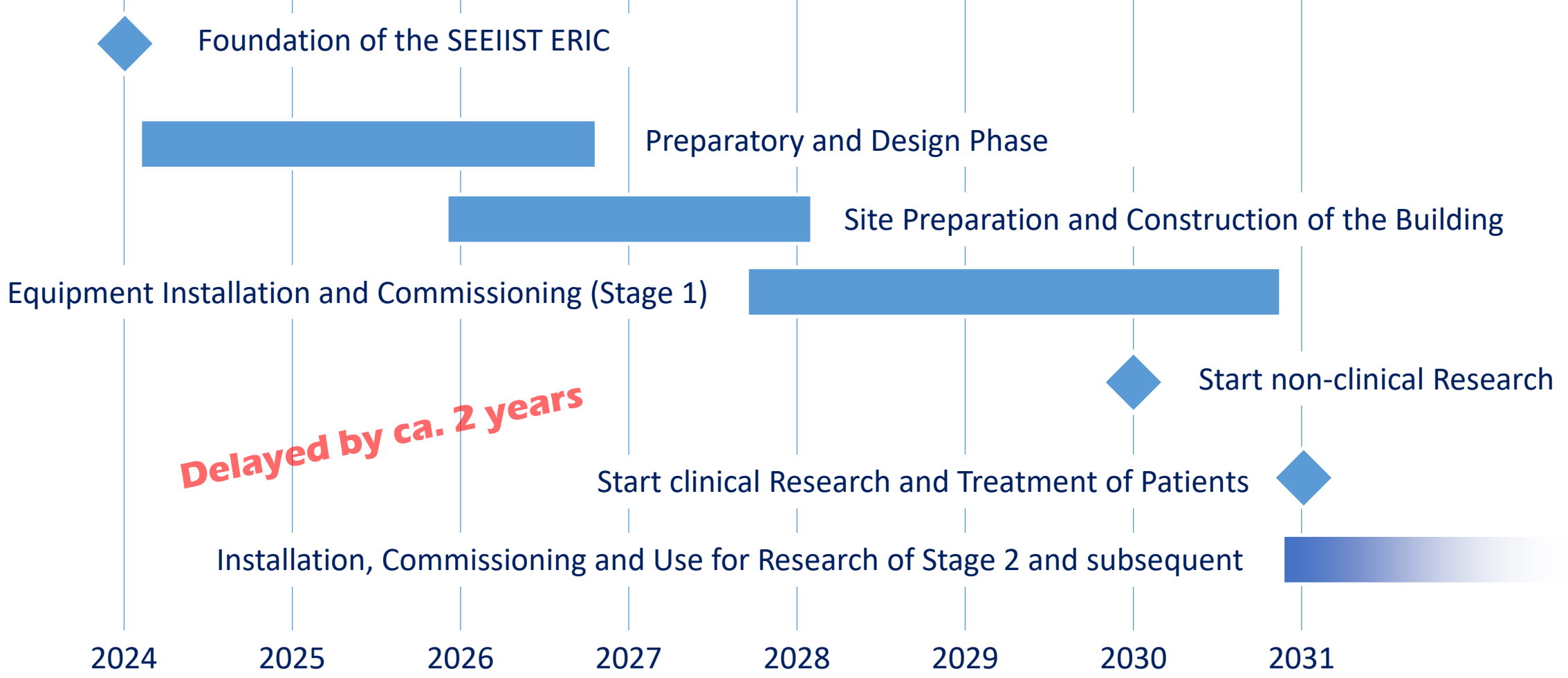
Fondation Tera-Care ("Tera-Care")

and

The Association for the Support of the South East European International Institute for Sustainable Technologies ("SEEIIST")

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SEEIST: Time Line





Thank you for your attention.

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Stay tuned ...



www.seeiist.eu



<https://www.facebook.com/SEEIIST/>



<https://ch.linkedin.com/company/seeiist>



Architectural design by Kaprinis Architects



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