Forum on New International Research Facilities for South East Europe

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Jan 25-26, 2018
ICTP, Trieste, Italy
International Institute for Sustainable Technologies
WAAS Initiative for New International Research Institute in SEE
The World Academy of Art & Science is a network established by its founders to address global challenges confronting humanity.

Report by M.Barone

Proposal for Large-Scale Research Facilities in South East Europe

Dr. Sanja Damjanovic

Minister of Science of Montenegro

Forum on New International Research Facilities for South East Europe,
ICTP Trieste, January 25-26, 2018

Joint South-East European International Institute for Sustainable Technologies (SEEIIST) in the spirit of 'Science for Peace'

Initiative proposed by Prof. Herwig Schopper, former Director General of CERN

positive reception by a number of organizations and institutions

The main objectives of the Project

- To promote collaboration between science, technology and industry, but also to provide platforms for the development of the education of young scientists and engineers based on knowledge and technology transfer from European laboratories like CERN and others
- To mitigate tensions between countries in the region
- To form a research nucleus in the region of South-East Europe by bringing people from different countries to work together – not only scientists and engineers, but also industry and administration

The combination of all these tasks would imply another case of the 'CERN model'

The goals can only be achieved with a Large Scale Facility based on the latest technologies to enable 'first class research' and thereby strongly revert brain drain and assure high competitiveness

Importance of the Project for the Region

- The project would be unique in the whole region
- Real international cooperation, bringing people together in the spirit of 'Science for Peace' could contribute to
  - ❖ develop the economic situation
  - ❖ improve the standard of living
  - ❖ reduce unemployment (in particular for young people)
  - ❖ revert brain drain
  - ❖ aim at excellence throughout

  this would imply a certain 'industrialization' of the region based on sustainable technologies

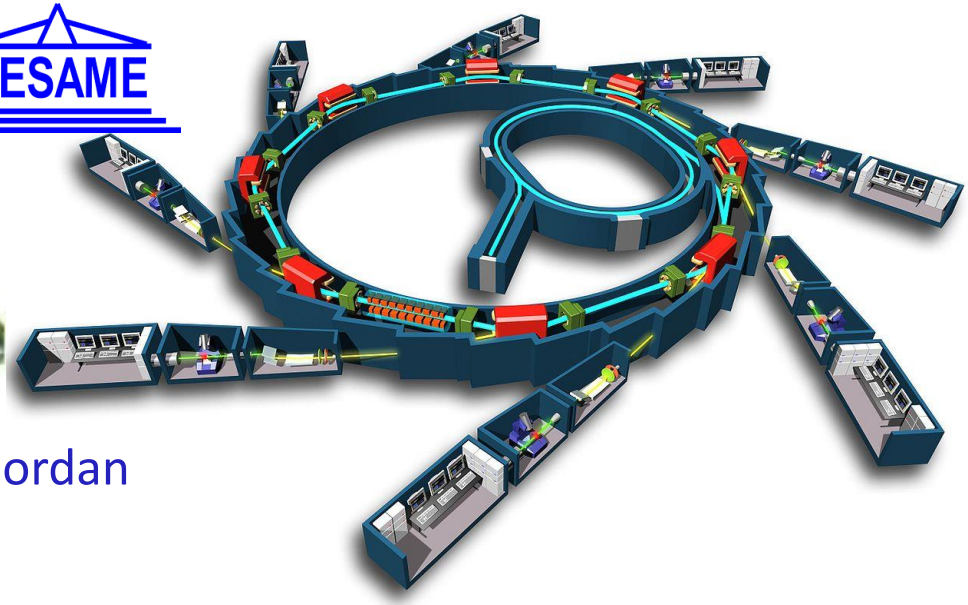
These type of projects represent 'knowledge-based economy'

Summary of the main mission of the SEE Project

- Science for Peace
- Scientific Excellence
- International Collaboration
- Sustainable development of society
- Education
- Technology Transfer and Innovation

SESAME: 'Synchrotron Light for Experimental Science and Applications in the Middle East'

SESAME



Jordan

The success of such an initiative is being demonstrated by the SESAME project:

built in Jordan, unifies nine member states of different political systems and religions in the Middle East: Bahrain, Cyprus, Egypt, Israel, Iran, Jordan, Pakistan, Palestinian Authority, Turkey; has achieved all of them to peacefully work together

The first President of Council of SESAME: Prof. Herwig Schopper

The first preparatory steps during 2017 towards the realization of a SEE Project

2016	2017							
November	March	April	May	June	July	August	September	October

WAAS meeting, Dubrovnik, proposal H. Schopper for a joint SEE International Institute

Official support by the Government of Montenegro

Visit of all Science/Corresp. Ministers of the region

Initiative presented to the EC, incl. Commissioner C. Moedas

First joint discussion, Budva

Initiative presented to the IAEA, incl. DG Y. Amano

Ministerial meeting at CERN – Signature of Declaration of Intent

Political steps

2017							2018		
Jun	July	August	Septemb.	October	November	Decemb.	January	February	March

Two international committees of experts for each of the two project options formed

Editori committees work on Concept Studies

Editor committee meeting at CERN

Editor committee meeting in Podgorica

Editor committee meeting at CERN

Scientific Forum ICTP, Trieste

Executive Summary of the results prepared

Scientific steps

Candidate Members for the South-East European International Institute for Sustainable Technologies

Republic of Albania

Bosnia and Herzegovina

Republic of Bulgaria

Republic of Croatia

Hellenic Republic

Kosovo*

FYR of Macedonia

Montenegro

Republic of Serbia

Republic of Slovenia

Signed a Declaration of Intent

Agreed 'ad referendum'

Observer

* This designation is without prejudice to positions on status and is in line with UNSC 1244/1999 and the ICJ option on the Kosovo Declaration of Independence

Culmination of the political development so far: Declaration of Intent signed at CERN on October 25, 2017

Signed by eight parties:
Albania, Bosnian and Herzegovina, Bulgaria, Kosovo*, The FYR of Macedonia, Montenegro, Serbia and Slovenia.
Croatia agreed 'ad referendum',
Greece is presently an observer

SEE Initiative now transformed into a Project with regional character

Further result:
Intergovernmental Steering Committee formed for the further steps

SEE Ministers of Science/Corresponding Ministers or their representatives at CERN

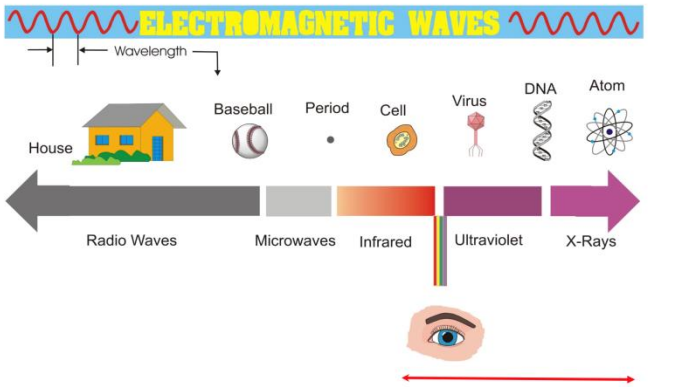
How the common central facility would look like?

Proposed are two complementary options, both based on most advanced technologies

Option I: 4th Generation Synchrotron Light Source with a new technique used for the first time in Lund, Sweden

Science community of South-East Europe would be unified, more than 1000 Users, a broad spectrum of research and applications reaching from biology up to industrial aspects

Option I: Applications of Synchrotron Light



Synchrotron Radiation Light

Synchrotron Radiation Light

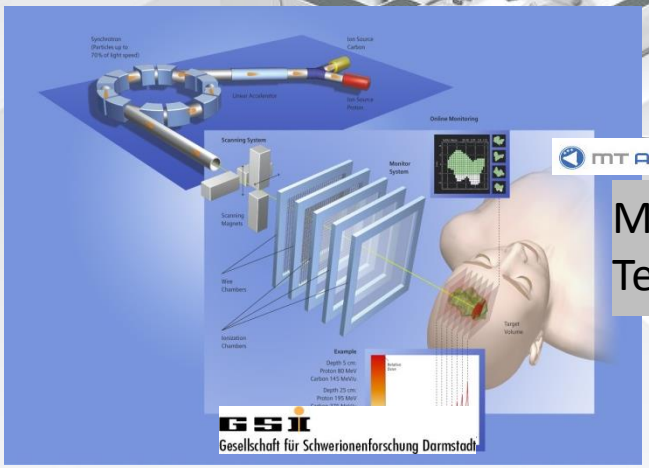
- **Life Sciences**
  - Drug design
  - Imaging
  - Therapy
- **Material Science**
  - New materials
  - Energy
- **Environmental Science**
  - Air, soil and water pollution analyses
- **Cultural Heritage**
  - Non-destructive analyses

Examples of possible research domains which are relevant for the region

Option II: Facility for Tumour Therapy and Biomedical Research with protons and heavier ions

About 400 patients per year to be treated as needed for a population of 20M. In parallel, 50% of the beam time dedicated to biomedical research. About 1000 researchers, including a major number from outside the SEE region. Unique.

HIT Heidelberg



Med. Director: Prof. J. Debus
Tech. Director: Prof. T. Haberer

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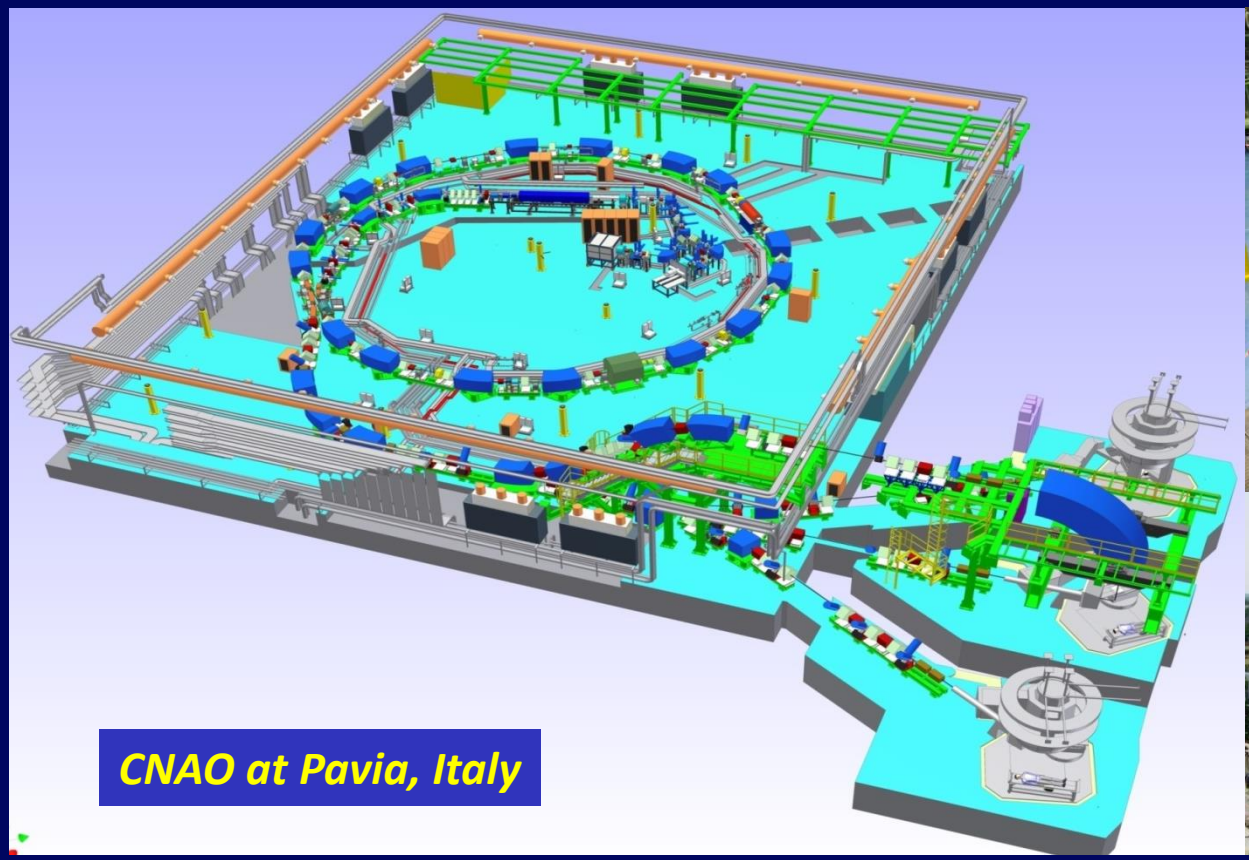
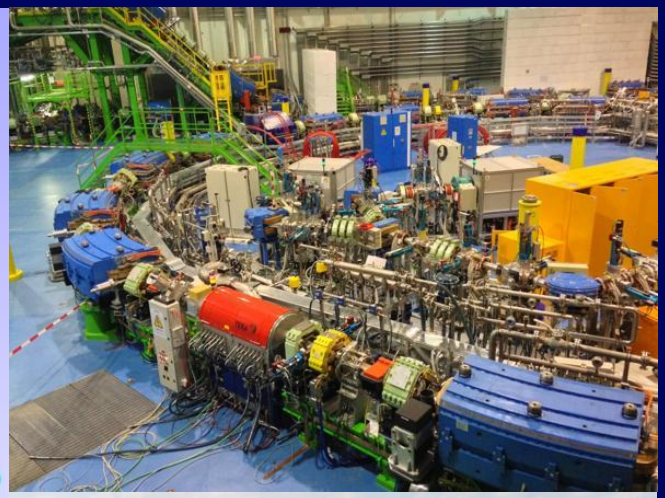


CNAO at Pavia, Italy



Spiritus Rector Prof. Ugo Amaldi, President of TERA, Director of CNAO Dr. Sandro Rossi

Members of the Editor Committee for Option I – 4th Generation Synchrotron Light Source

Dr Amor Nadji, Director of Sources and Accelerator Division of SOLEIL, France

Chairman

Dr Dieter Einfeld, former Technical Director of SESAME and ALBA

Dr. Pedro Fernandez-Tavarez, Machine-Director of MAX IV Lund, Sweden

Prof. Riccardo Bartolini, University Oxford and Diamond, UK

Dr. Trevor Rayment, University of Birmingham, UK

Dr. Christoph Quitmann, Director of MAX IV, Sweden

Members of the Editor Committee for Option II – Facility for Tumour Therapy and Biomedical Research with *p* and heavier ions

Dr Sandro Rossi, Director of CNAO in Pavia, Italy

Chairman

Prof. Ugo Amaldi, President of TERA, Novara, Italy

Prof. Manjit Dosanjh, Staff at CERN

Prof. Philippe Lambin, Head of Radiation Oncology, University of Maastricht, Maastricht, Netherlands

Dr. Michael Scholz, Scientific Head of Biophysics Departm. GSI, Darmstadt, D

Prof. Brita Singers Sorensen, Depar. of Clinical Medicine, Denmark

Prof. Dr. Jacques Balosso, CHU Grenoble Alpes, FR

Status of the scientific developments
Concept Studies created by the Editor Committees

Executive Summary of the Concept Studies prepared for the Forum

Main elements of a Business Plan:

- technical parameters of the facilities
- time schedule
- investment costs
- operation costs

The next political and scientific-technical steps

- Develop Steering Committee to a leadership role in all future science-policy steps: ‘Council’ (first meeting scheduled in Sofia on January 30)
- Prepare proposals for funding requests
- Form an Executive (future Directors)
- Start training programs for young people in 2018
  - for technical operation crew
  - for future Users community
- Concept Design Report (CDR)
- Decision on options and Selection of sites

Sources of funding

Politically widely accepted that the SEE region needs economic help and further stabilization. Europe needs SEE, and SEE needs Europe. Hence main investment from EU programs (EU members and Non-members)

EUR 150 - 200 million required per project guaranteeing competitivity in Europe

Support for the Training Program

- Establishment of an International Training Committee mandatory to help to organize the training program

- IAEA had an important role for the Training Program to help the success of the SESAME Project

  Similar support from the IAEA to the SEE Project expected both from Department of Technical Cooperation and Department of Nuclear Sciences and Applications

- EU programs like Marie Curie actions through RISE and others

- ICTP – support for training also expected

Acknowledgments

Organizers and sponsors of the FORUM:

Ministry of Science of Montenegro

ICTP, Trieste

Organizing Committee: Herwig Schopper (Chairman), Fernano Ferroni, Christoph Quitmann, Nicholas Sammut, Hans J. Specht and Ruediger Voss

Co-sponsors of the FORUM

UNESCO

IAEA

EPS

FIT

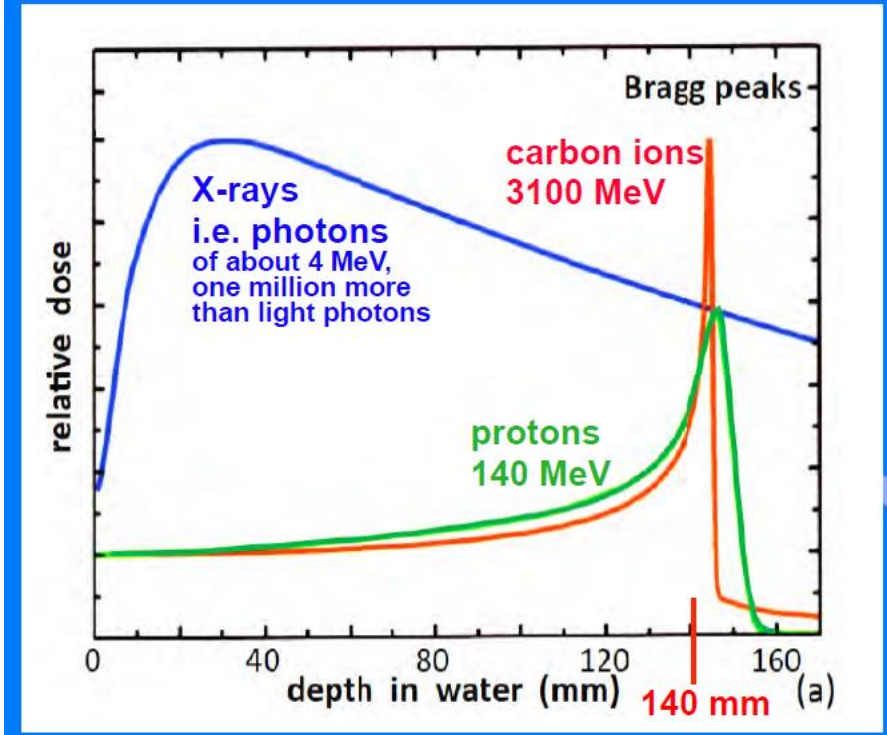
Follow-up

-In a meeting held in Sofia at the end of March a Panel of Experts to decide which project to select, was formed and in May the decision in favor of the Hadrotheraphy has been taken.

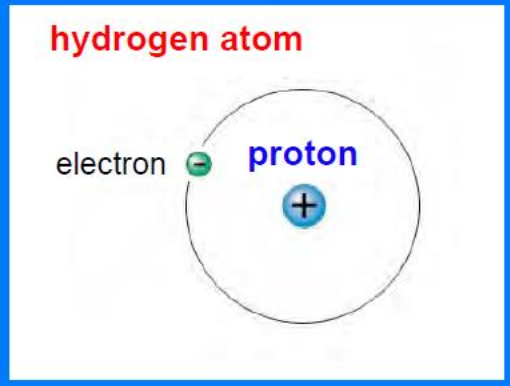
-In the next two years a Conceptual Design Report which will be followed by a Technical Design Report will be produce .Fellowships and dedicated contracts financed by EU and IAEA will be available.

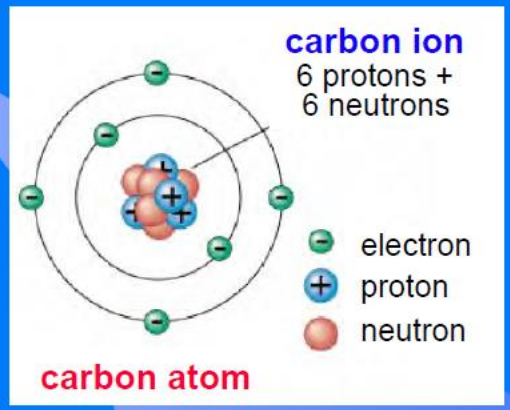
-The final destination decision will be also taken.

The icon of "hadron therapy" (also "particle therapy")

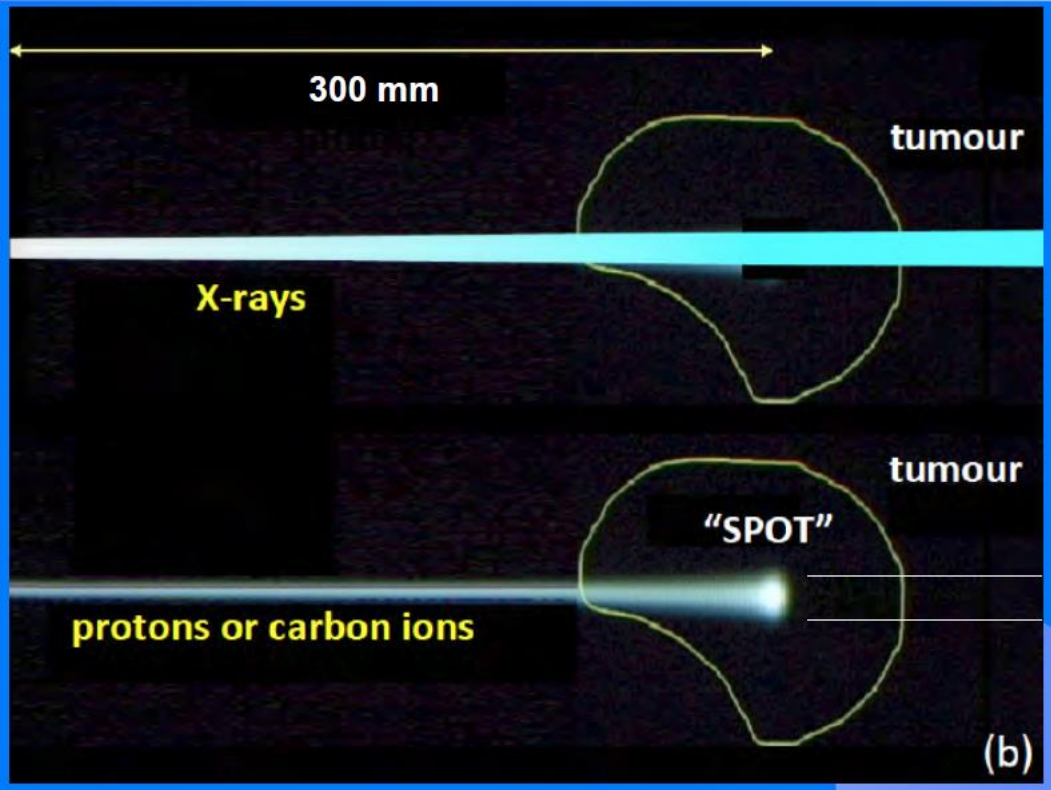


"dose" = energy deposited per milligram of tissue





X rays have two disadvantages:
1. the deposited dose is poorly distributed
2. about 5% of tumours are "radioresistant" to X rays and protons



Clinical Program

Table 2.1 *Proton therapy and ion therapy indications of the highest priority.*

Type of tumour eligible with highest priority for proton therapy	**Type of tumour eligible with highest priority for ion therapy (carbon)**
Adult unresectable or relapsing meningioma Other rare adult central nervous system tumours Child central nervous system tumours Any other child solid tumours	Adenoid cystic carcinomas of salivary glands, including head & neck and thorax, sinus adenocarcinomas. Mucinous melanomas of head and neck. Chordomas and chondrosarcomas of skull base and spine. Soft tissues sarcomas of low and medium grade, unresectable or partially unresectable without threatening metastasis. Non small cell lung carcinomas, of small and medium size (N0,M0) unsuitable for surgery. Pelvic local relapses of adenocarcinomas, M0 and previously irradiated by X-rays. Hepatocarcinomas unique and of large size.
Total: about 80 cases/year for 10 million inhabitants	**Total: about 200 cases/year for 10 million inhabitants**

Table 2.2 *Investments in M€ and man-years for construction and commissioning (in 5 years) of the layout (a) of Figure 2.4.*

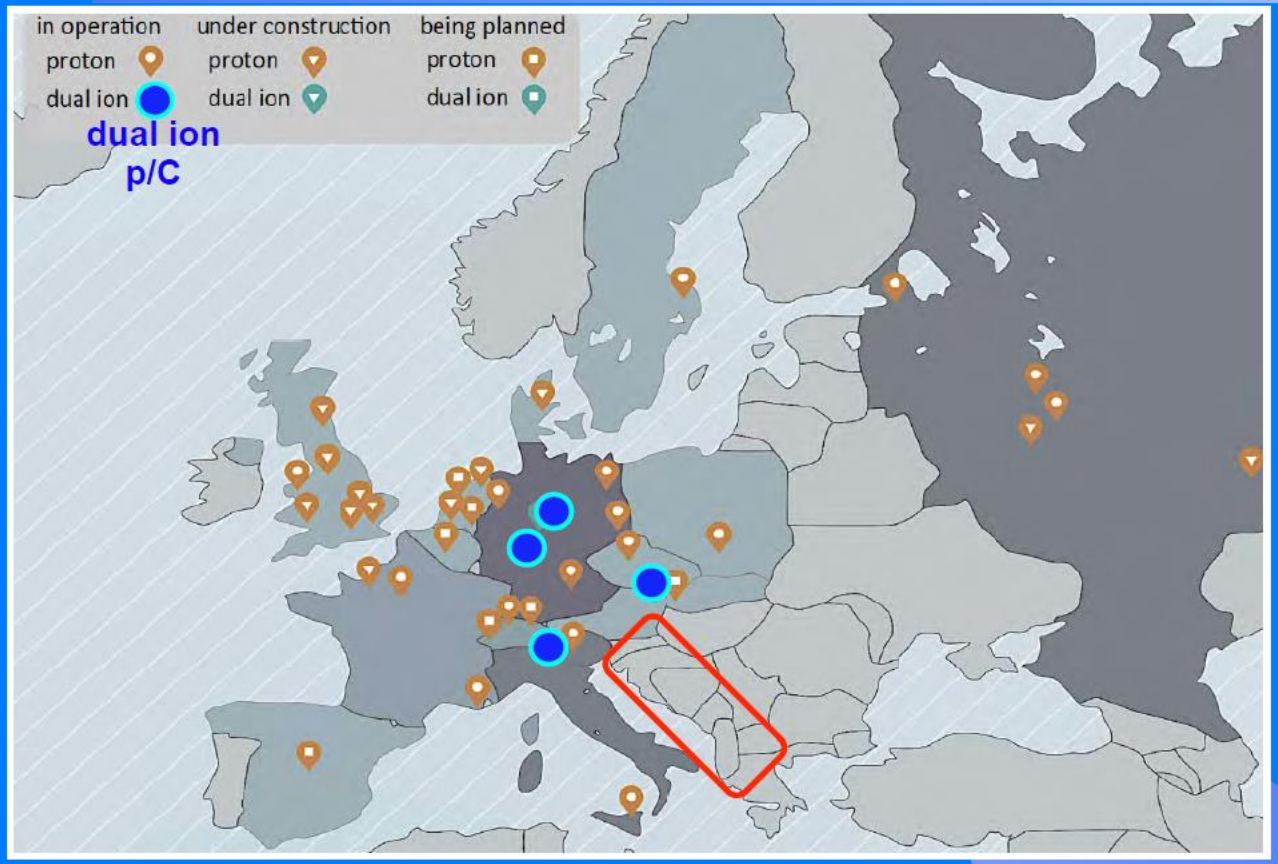
Items	Investments in M€	Man-years during construction and commissioning
Accelerator and beams Oriented Technologies (AOTs)	54	258
Patient and radiobiology Oriented Technologies (POTs)	22	142
European cost of the personnel (numbers of the last column)(*)	44	
Buildings and shielding	45	
Total	**165**	**400**

Table 2.4 *Personnel and operation costs per year.*

Item	Yearly investment
Personnel for Accelerator and beams Oriented Technologies (AOTs)	41 persons
Personnel for Patient and radiobiology Oriented Technologies (POTs) (*)	40 persons
Maintenance of hardware and software, spares	5.7 M€
Power at 100 €/MWh	1.2 M€
Personnel (81 people)	3.5 M€
Total	**10.4 M€**
Income due to the treatment of 250 patients/year	- 5.0 M€
Net Sum	**5.4 M€**

(*) It includes radiation oncologists, anaesthesiologists, bioengineers, medical physicists etc.

European centres of hadron therapy



Hadron therapy facility - benefits for the region

L. Litov
Sofia University

Meeting on Science, Technology and Medicine for Sustainable Development of Southeastern Europe, January 16, 2018, Belgrade, Serbia

New TESLA Project: Science, Technology and Medicine for Sustainable Development of Southeastern Europe

N. Nešković
Vinča Institute of Nuclear Sciences, Belgrade, Serbia

In January 2008, TESLA was divided into three parts – the low energy, medium energy, and high energy parts. The low energy part, called FAMA, was commissioned in May 1998. In June 2010, the upgrading of FAMA, based on the clearing debt of Russia to Serbia, began. The upgraded FAMA will comprise a multiply charged heavy ion source and a positive or negative light ion source with two channels for modification of materials, and a small cyclotron complex delivering protons of energies between 1 and 3 MeV with two channels for analysis of materials. The commissioning of these machines and experimental channels should be completed in September 2018. It must be emphasized that this depends solely on the Ministry of Education, Science and Technological Development and the Ministry of Finance of Serbia. If they urgently adopt a positive approach toward the Vinča Institute, the use of the upgraded FAMA will commence in October 2018.

The additional upgrading of FAMA will include the construction of a channel for surface physics and a channel for transmission studies, and the upgrading of the two channels for analysis of materials.

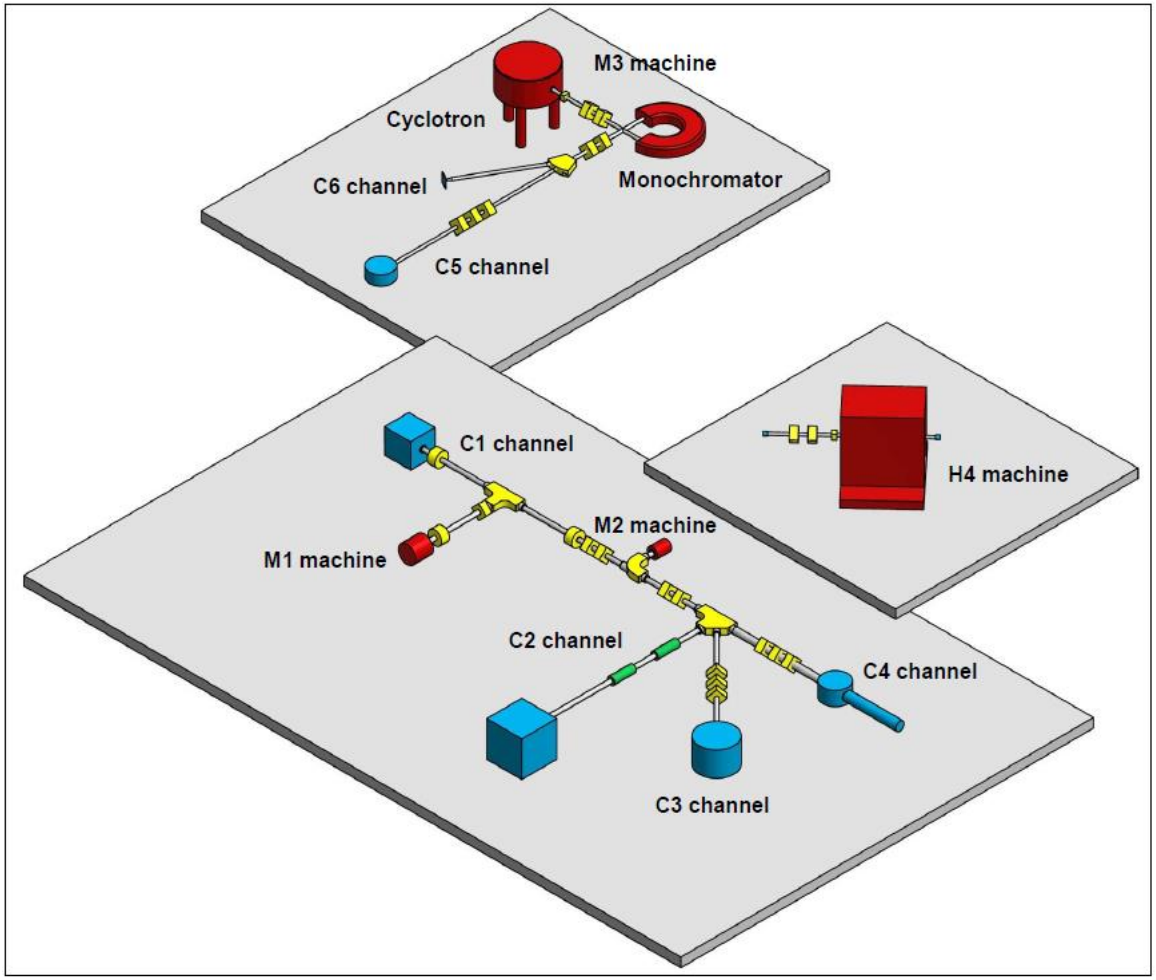


Figure 4. Schemes of FAMA and the cyclotron of the H4 Facility.

Figure 1. M1 machine

Figure 2. M3 machine.

The medium energy part of TESLA, called the H4 Facility, should be used for production of cyclotron radiopharmaceuticals. Its main part will be a cyclotron delivering protons of energy about 18 MeV.

The high energy part of TESLA, called the VINCY Facility, comprises a medium-size cyclotron delivering protons of energies between 30 and 75 MeV and currents up to about 100 μA, and five experimental channels, to be used for research and development in physics, chemistry and biology, and for production of cyclotron radiopharmaceuticals and proton therapy of eye tumors.

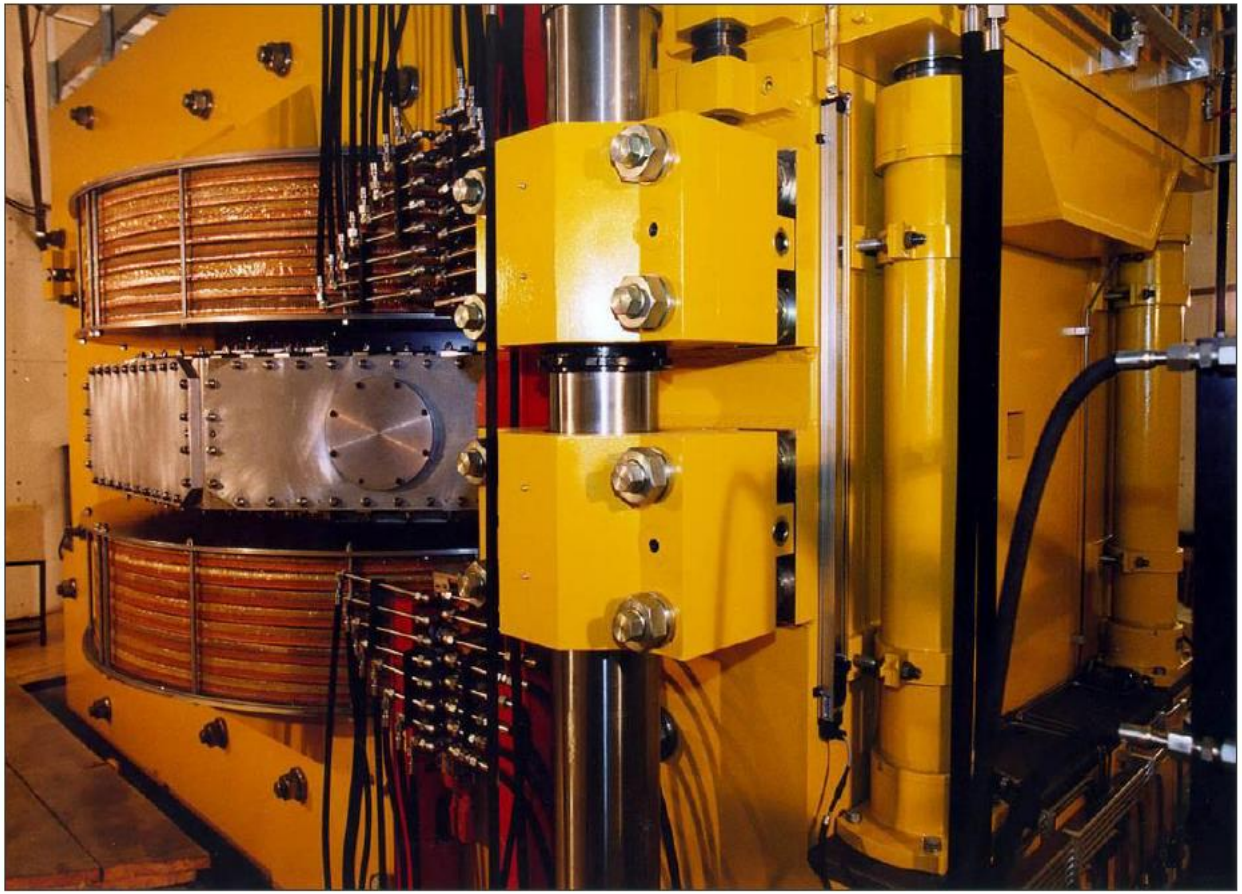


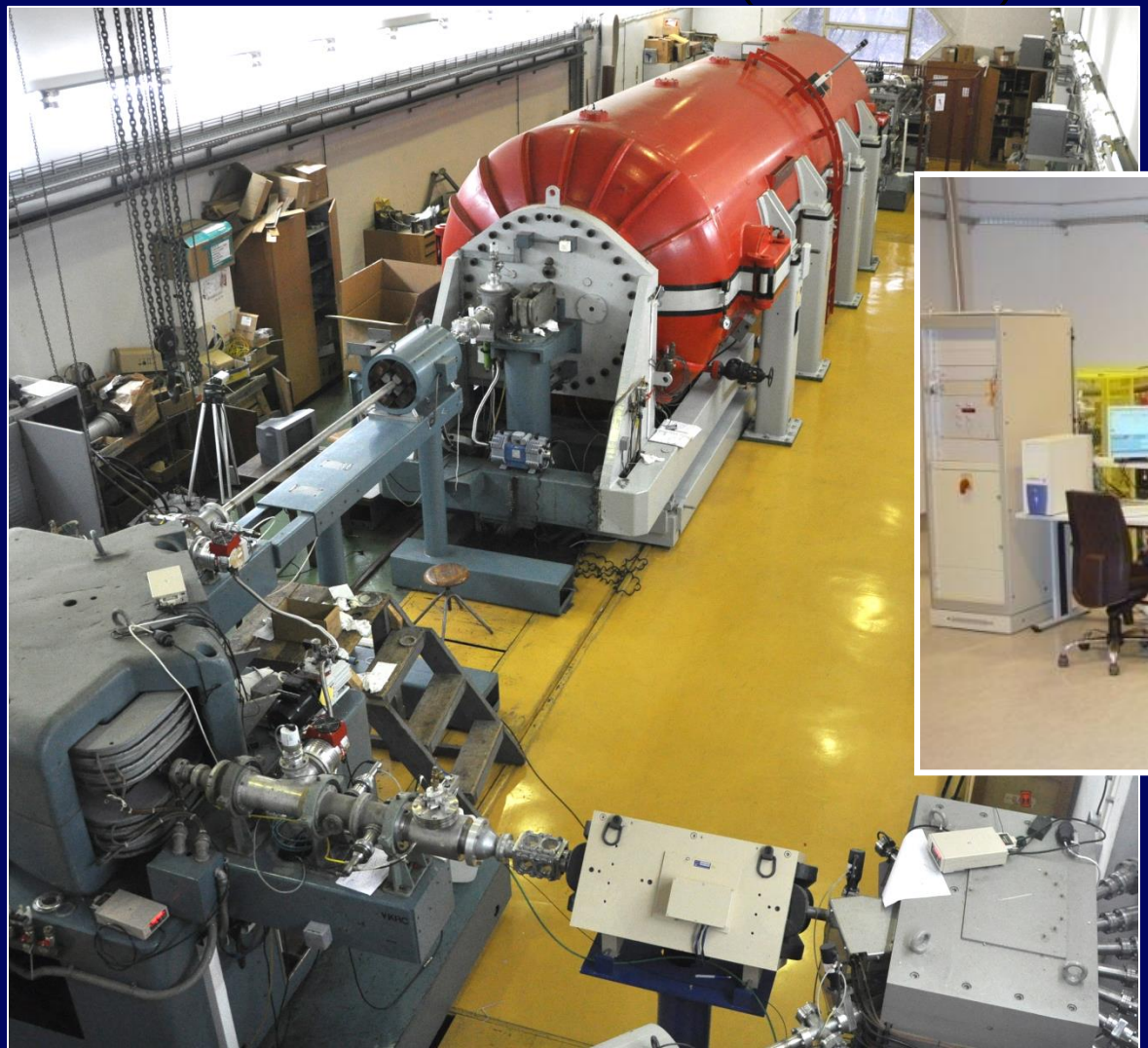
Figure 3. Magnetic structure of the cyclotron within the VINCY Facility.

Thank you!

RBI Accelerator – access to facility

Milko Jakšić, Ruđer Bošković Institute, Zagreb, Croatia

6.0 MV Tandem Van de Graaff (1962/1987)



1.0 MV Tandetron (2005)

RBI Accelerator facility - layout