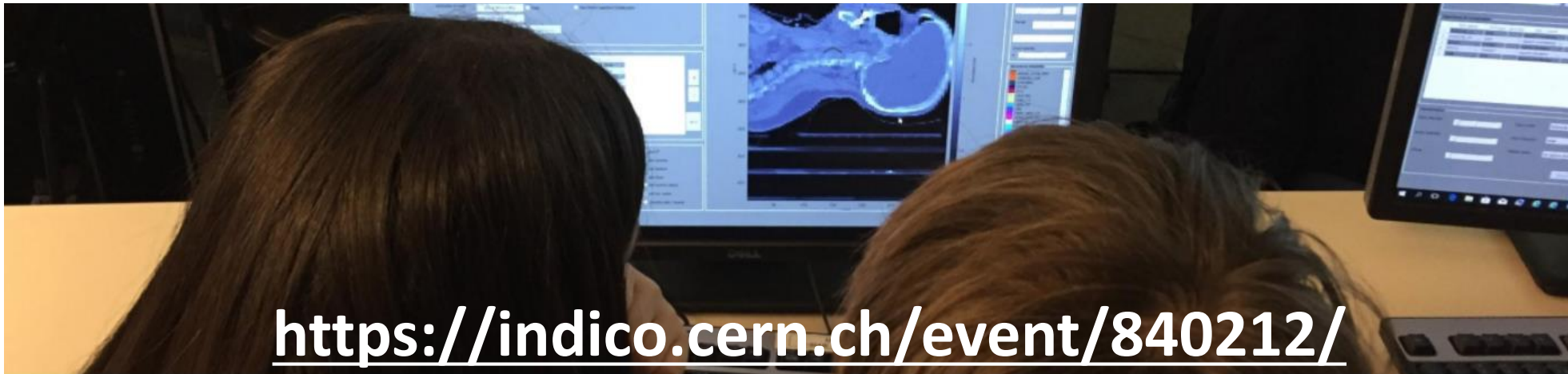


Particle Therapy MasterClass



INTERNATIONAL MASTERCLASSES

Yiota Foka (GSI/CERN)

on behalf of

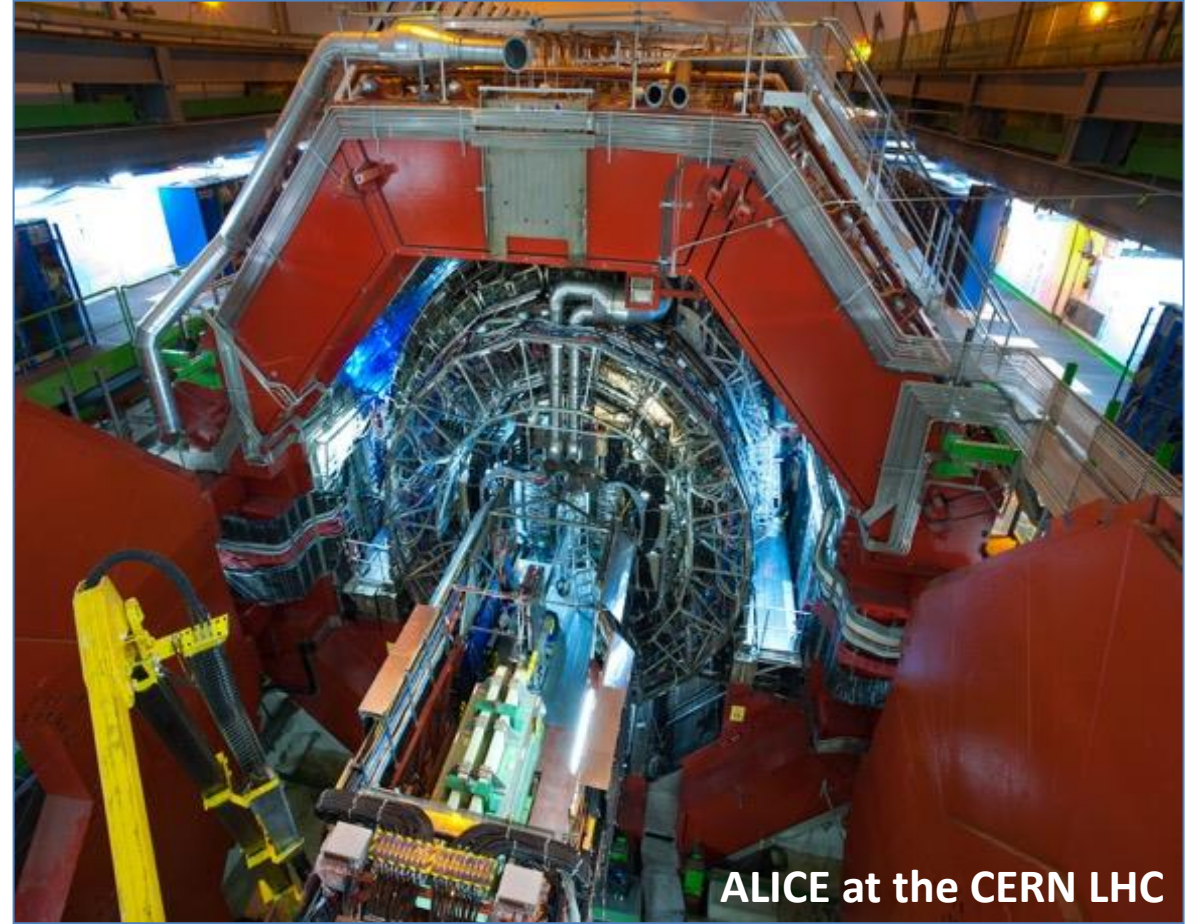
IPPOG and IMC Steering Group

From Particle Physics to Particle Therapy

From heavy-ion research to heavy-ion therapy



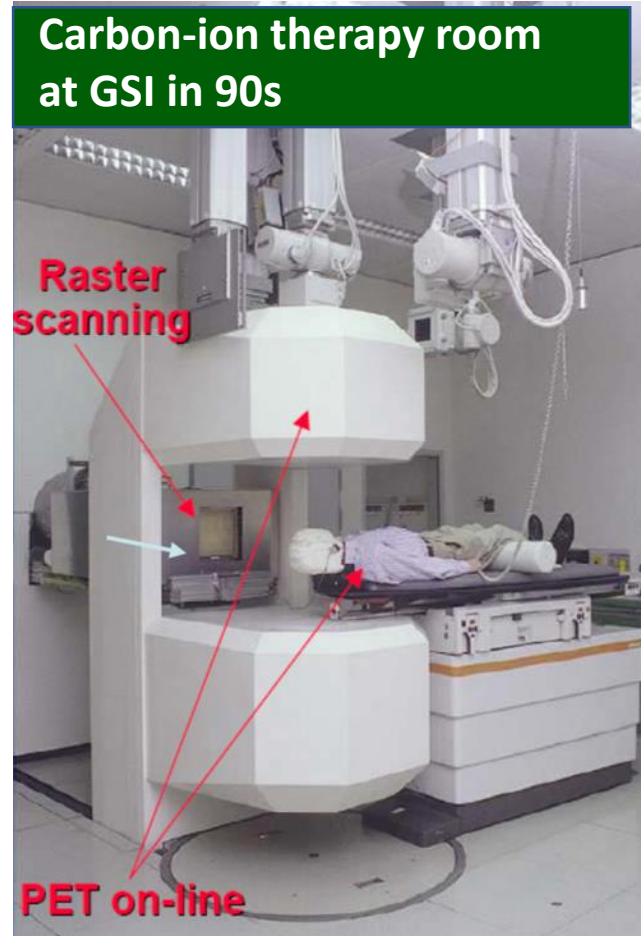
Control Room of ALICE at CERN



ALICE at the CERN LHC

Heavy-ion physicist, involved with medical applications of heavy-ions for cancer therapy

Heavy-ion research and heavy-ion therapy at GSI



Pioneered heavy-ion (carbon) therapy for cancer tumours in Europe (90s)

Implemented in the HIT Heidelberg Ion Treatment centre and later in Marburg

Mission and mandate of research institutes: fundamental research

Developed technologies and acquired knowledge find applications for society

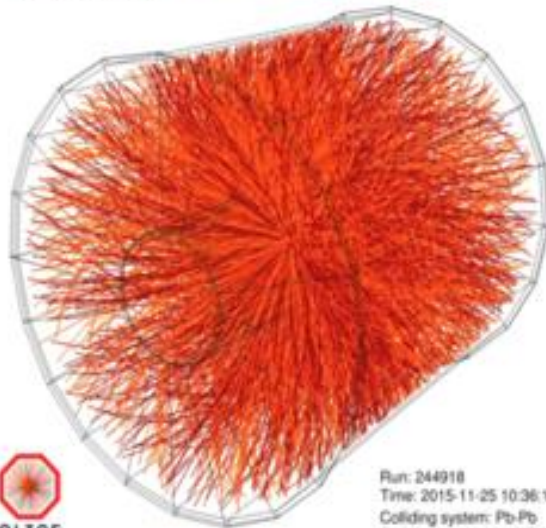
Heavy-ion research and heavy-ion therapy

Pb-Pb at 5.5 TeV
pp at 14 TeV

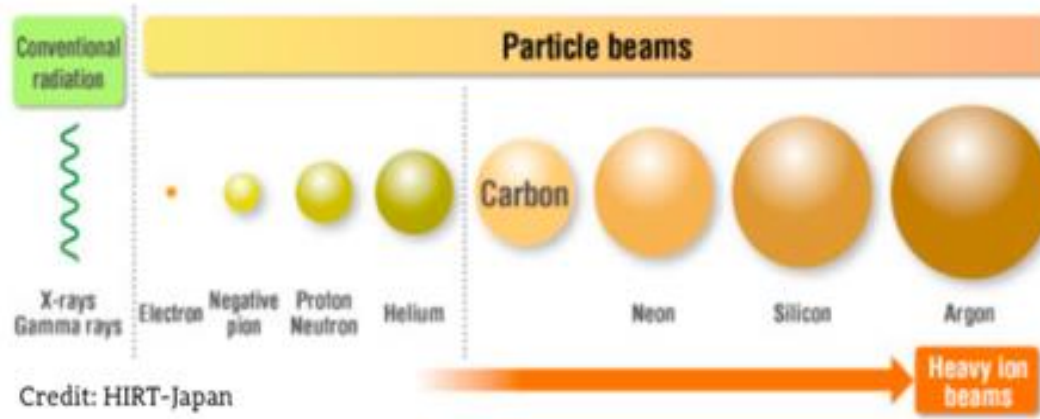
fundamental science
QGP studies



Credit: CERN



Run: 244918
Time: 2015-11-25 10:36:18
Colliding system: Pb-Pb
Collision energy: 5.02 TeV



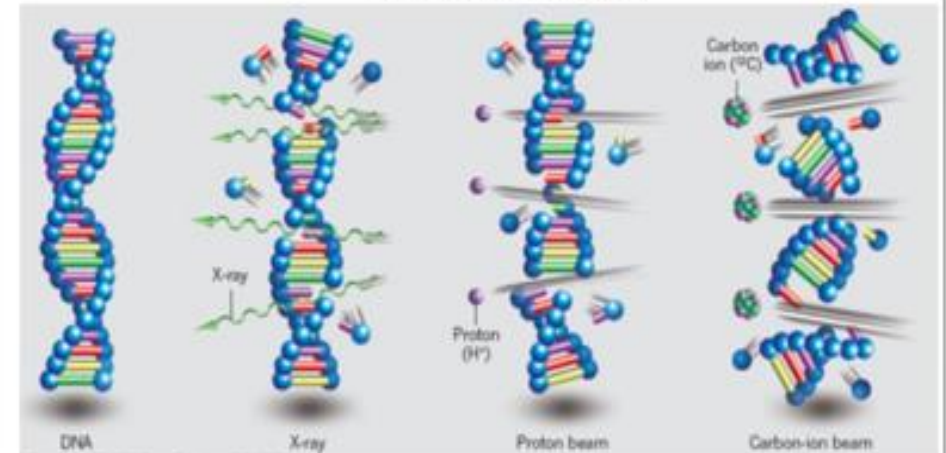
Credit: HIRT-Japan

88-430 MeV/u carbon
50-221 MeV/u protons

applied science
medicine



Credit: HIT Heidelberg



Credit: T. Nomiva, NIRS Japan

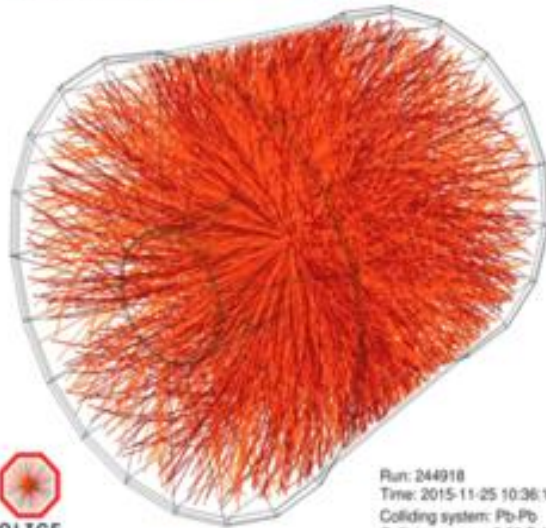
Heavy-ion research and heavy-ion therapy

Pb-Pb at 5.5 TeV
pp at 14 TeV

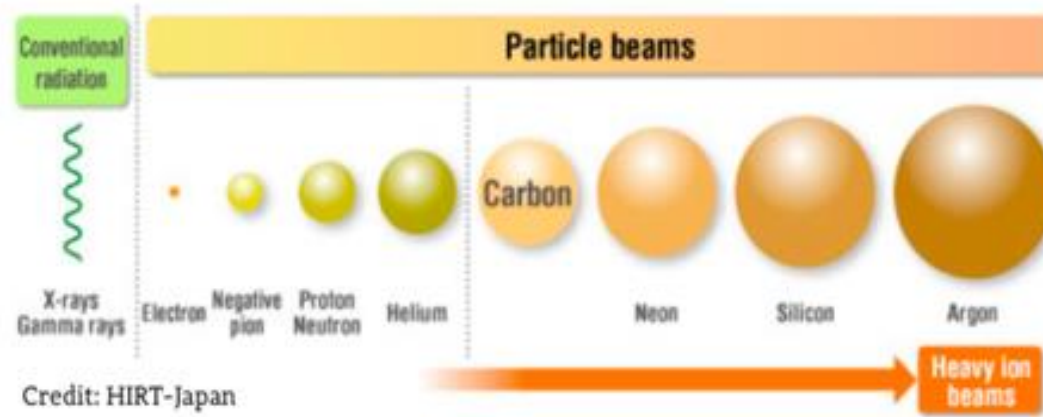
fundamental science
QGP studies



Credit: CERN



Run: 244918
Time: 2015-11-25 10:36:18
Colliding system: Pb-Pb
Collision energy: 5.02 TeV



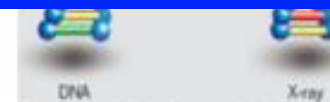
88-430 MeV/u carbon
50-221 MeV/u protons

applied science
medicine

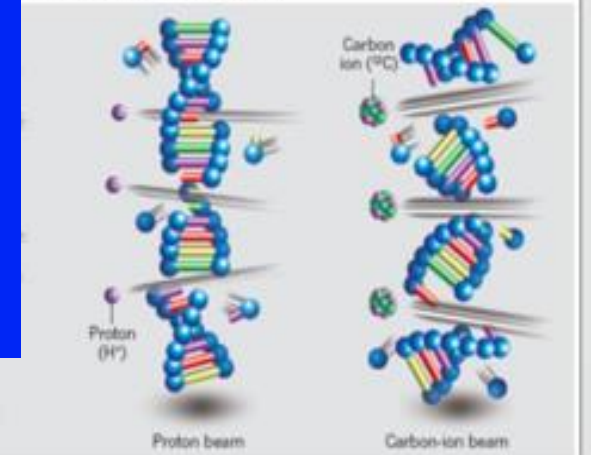


Credit: HIT Heidelberg

atom	nucleus	nucleon
10^{-10} m	10^{-14} m	10^{-15} m
$M \approx \sum m_i$	$M \approx \sum m_i$	$M \gg m_i$



Credit: T. Nomiya, NIRS Japan



What are the International MasterClasses

and

What is the Particle Therapy MasterClass

International MasterClasses

Motivate the next generations of scientists !

**The “International Masterclasses” IMC project
is an educational/outreach activity that brings the excitement
of cutting-edge high-energy physics research into the classroom !!**

Classes by masters, experts



Today’s masters



Become scientist for a day !



Students are given the opportunity to analyze real data the same way that scientists do.

New PTMC:

- what physics has to do with medicine
- how we go from Particle Physics to Particle Therapy: impact of physics research on medicine advancements
- *different new career opportunities*, various possibilities that physics and STEM studies may open up for interesting jobs

IMC typical Reach and Statistics

Motivate the next generations of scientists !



60 countries
255 institutes
15 000 students

IMC dates :
11 Feb – Before Easter



Brings scientific methods and real data to schools!

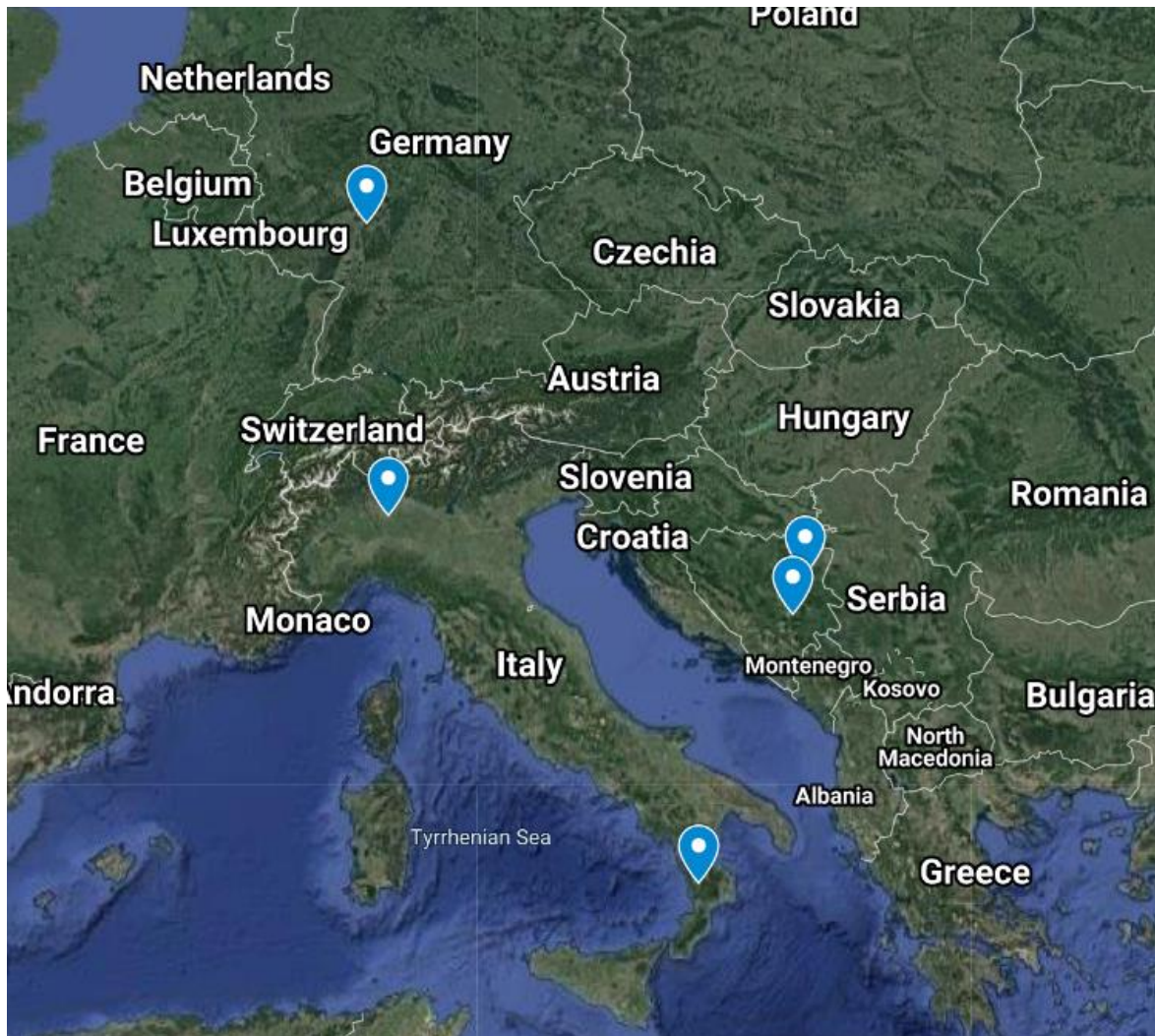
Coordination QuarkNet / TU Dresden

- 51 institutes (48)
- 54 LHC Masterclasses (50)
 - 22 ATLAS (19)
 - 32 CMS (31)
- 12 MINERvA Masterclasses

- 188 institutes (177)
- 266 LHC Masterclasses (257)
 - 30 ATLAS W (35)
 - 101 ATLAS Z (104)
 - 64 CMS (58)
 - 41 LHCb (39)
 - 27 ALICE SP (18)
 - 3 ALICE R_AA (3)

Flagship project of IPPOG, the International Particle Physics Outreach Group

IMC typical daily and weekly schedule



14.03. - 19.03.2022

	Mon, Mar 14	Tue, Mar 15	Wed, Mar 16	Thu, Mar 17	Fri, Mar 18	Sat, Mar 19
topic		VC 1: ATLAS Z	VC 1: ATLAS Z	VC 1: ATLAS Z	VC 1: ATLAS Z	VC 1: ATLAS W
moderators		Guglielmo	Denis	Anke	Ana P.	André
moderators		Matt	Ennio	Eleanor	Hassnae	Joshua
moderators		Niamh	Jennifer	Matt	Joshua	Muhammad Alhr.
		Grenoble	Genova	Zaragoza	Ankara, METU	Porto
		Bologna	Wuppertal	Lublin	Louisiana Tech	São Tomé e Príncipe
		Prague CU	Rzeszow	Opava	Granada	Dresden
		Amsterdam	Faro	Dortmund	Olomouc	Funchal
			Maynooth	Grenoble		



International MasterClasses <https://physicsmasterclasses.org/>

[Home](#)

[Information for
High School Students](#)

[Information for
Teachers and Educators](#)

[Information for
Institutes and Physicists](#)

Schedule

[Intl. Day of Women
and Girls in Science](#)

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Hands on Particle Physics Masterclasses SCHEDULE 2021

At the end of each Masterclass day a videoconference between the institutes and with moderators at CERN, at Fermilab, TRIUMF, KEK, or GSI is established. The schedules for 2021 will be created early in 2021.



© CERN



© Fermilab



Adapted online on zoom

Every year, during the months of February-April school-children (15-19 year old) are invited **at/by** an institute of their area.

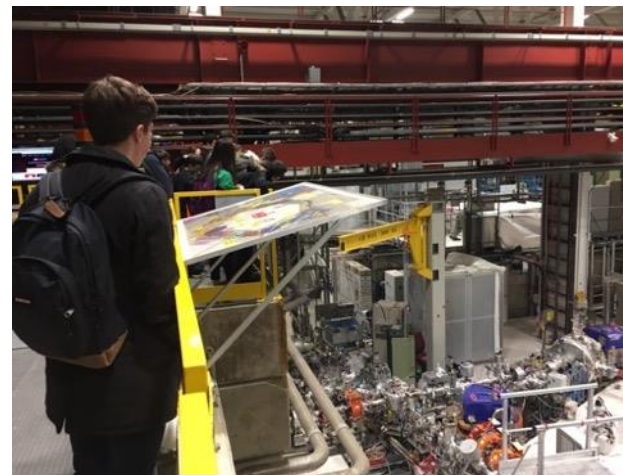
LOCAL TIME: ACTIVITY

8:30 - 9:00	Registration and Welcome
9:00 - 10:00	Introductory lectures
10:30 - 11:30	Visit of a lab or experiment
12:00 - 13:00	Lunch
13:00 - 15:00	Hands-on session
15:00 - 16:00	Discuss results locally
16:00 - 17:00	Common Video Conference

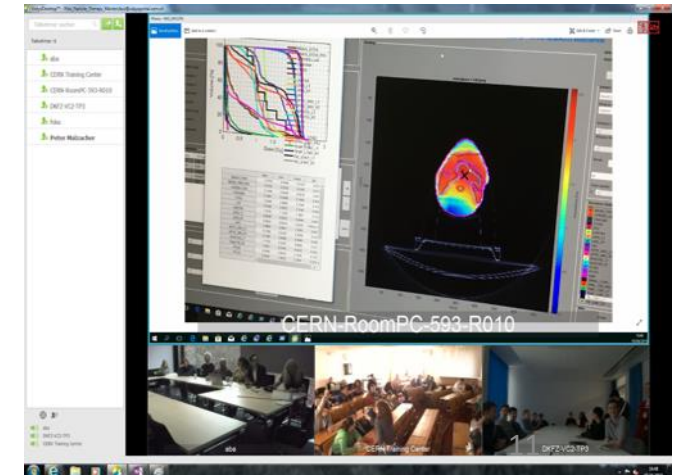
Local: Morning Presentations Local: Afternoon Hands-on



Local: Morning Visits



Common: Afternoon at 16:00 Video-Conference



PTMC: Typical MasterClass Day Agenda

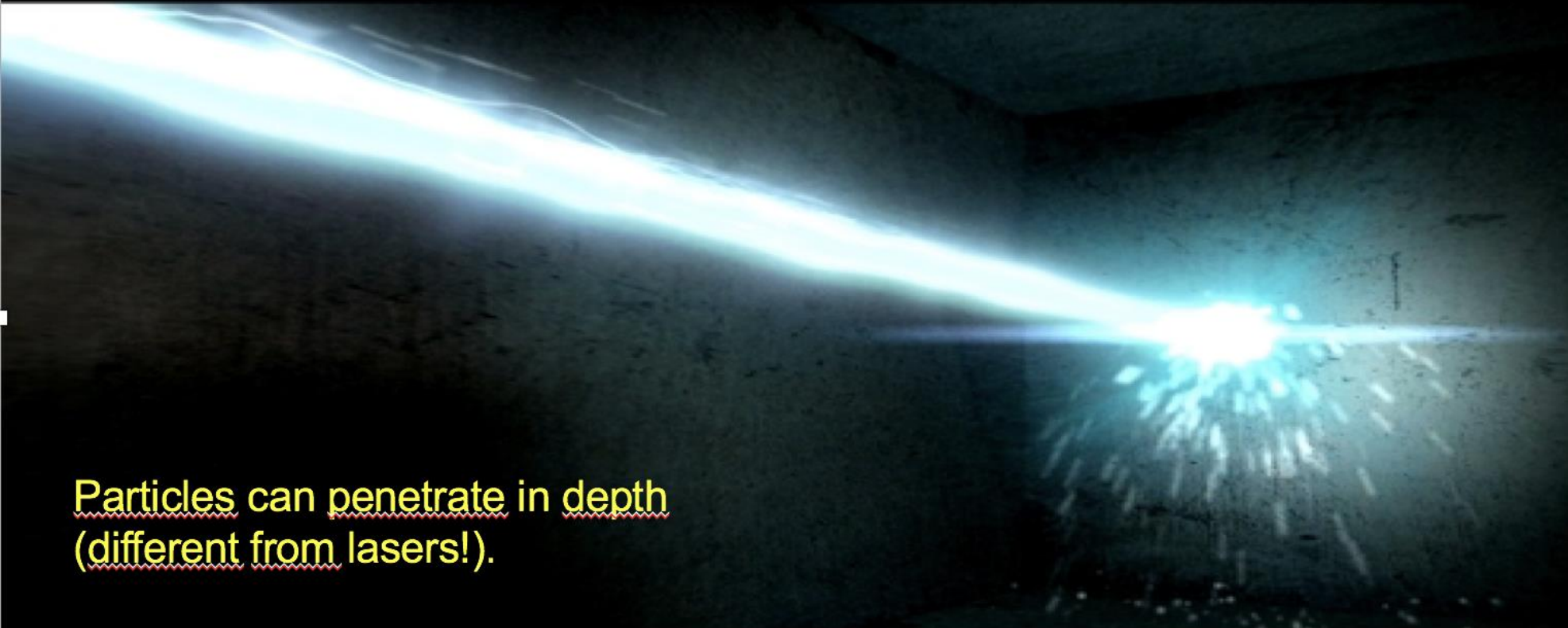
Start with videos on hadron therapy procedures in a virtual hadron therapy center while participants arrive (or join the zoom session)



<https://indico.cern.ch/event/840212/>

See presentation by :
Joao Seco (DKFZ)

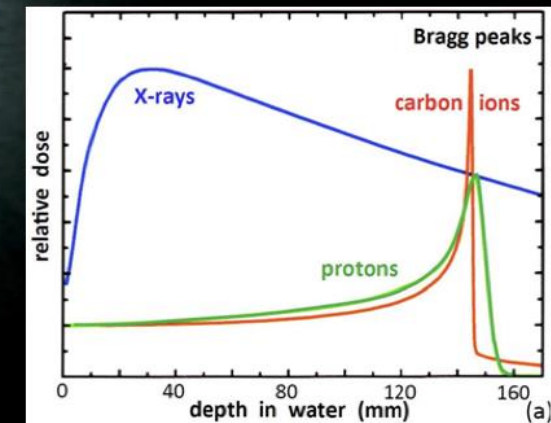
A «beam» of accelerated particles is like a small “knife” penetrating into the matter



Particles can penetrate in depth
(different from lasers!).

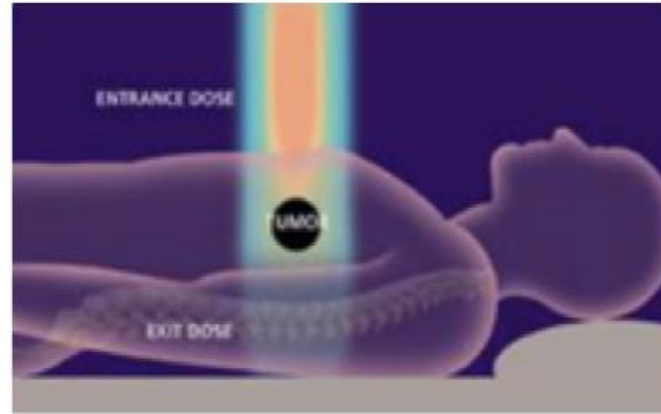
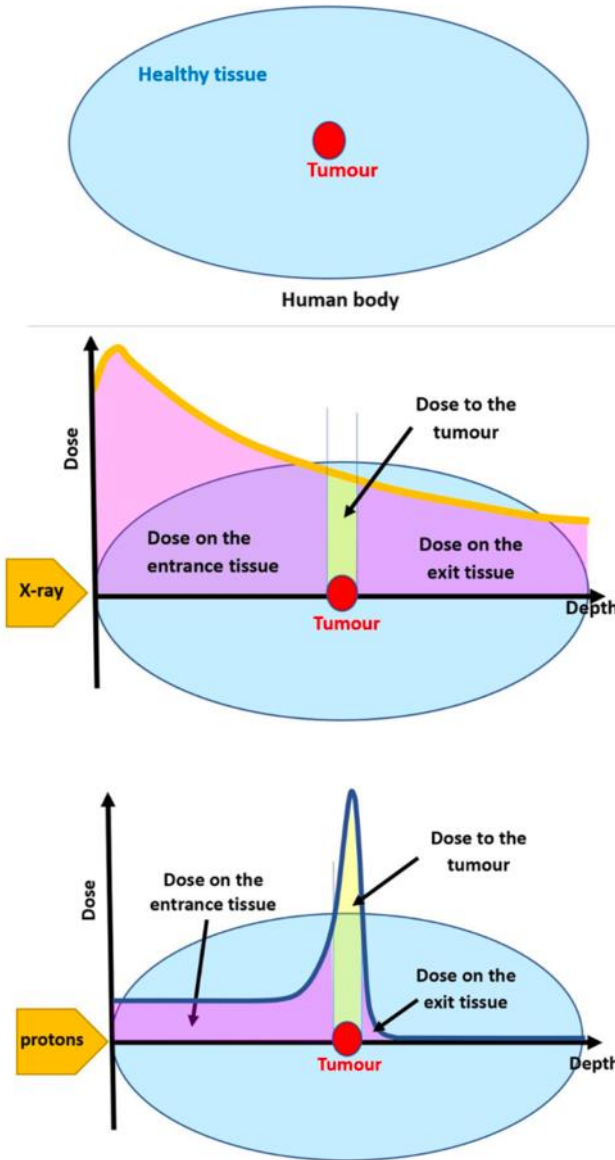
Particle beams are used in medical and industrial applications,
e.g. to cure cancer, delivering their energy at a well-defined depth inside the body (Bragg peak)

A particle beam can deliver energy to a very precisely defined area, interacting with the electrons and with the nucleus.



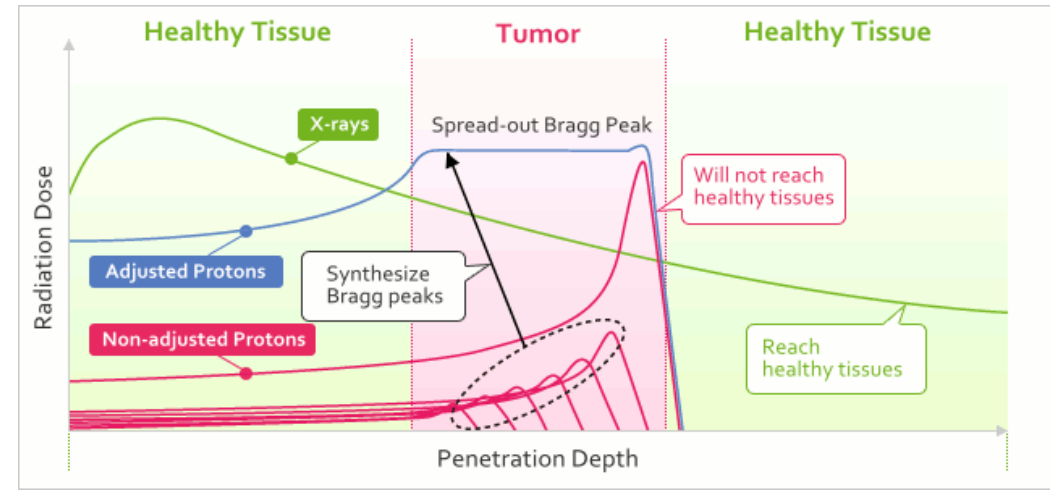
Particle properties and cancer therapy

Advantages of hadron therapy with protons or carbon ions

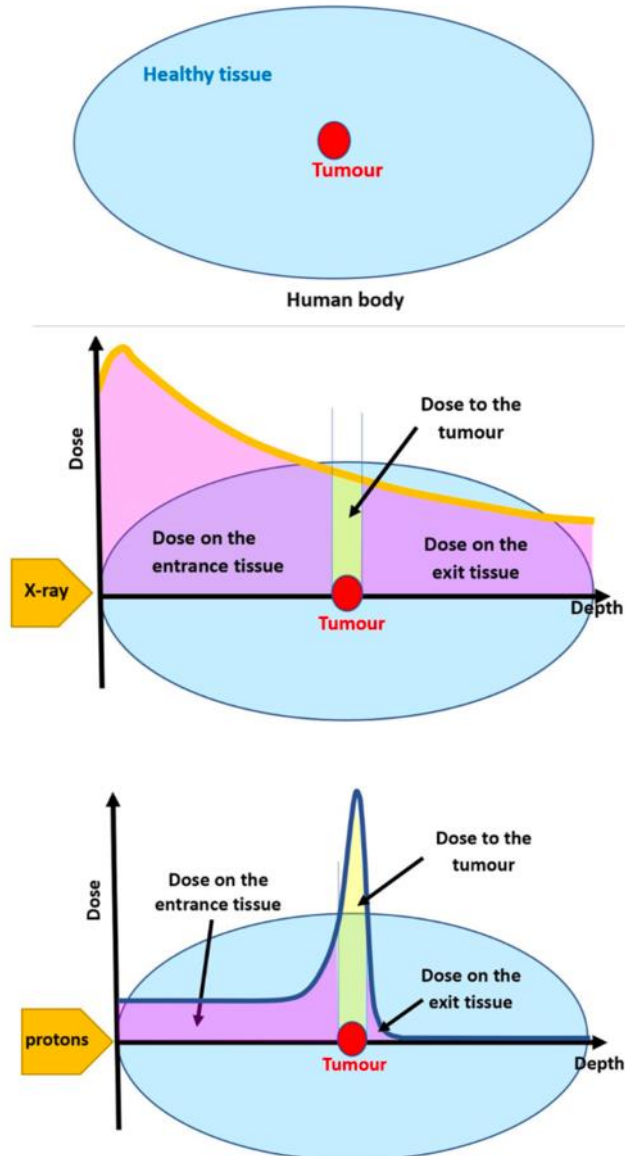


Different from X-rays or electrons, protons (and ions) deposit their energy at a given depth inside the tissues, **minimising dose to the organs close to the tumour, sparing nearby organs.**

Spread-out Bragg peak

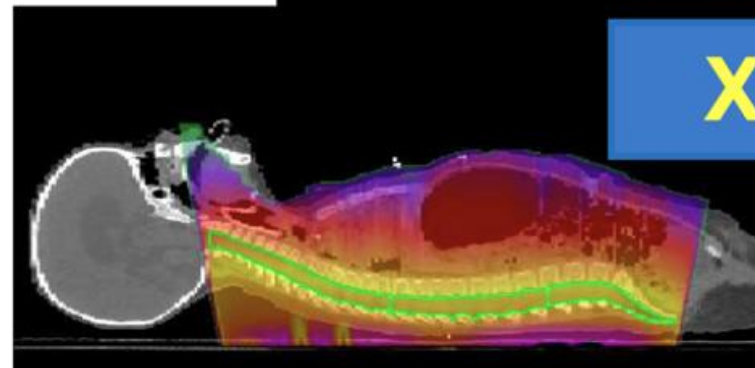
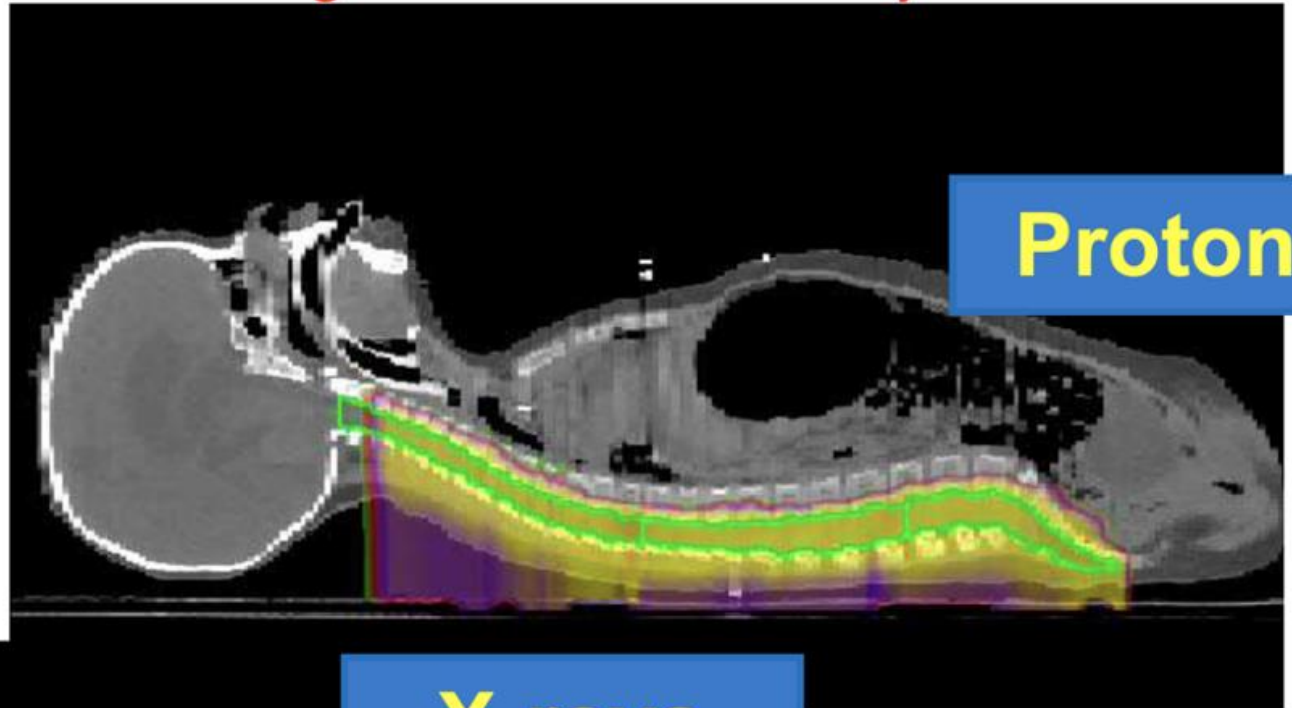


Particle properties and cancer therapy

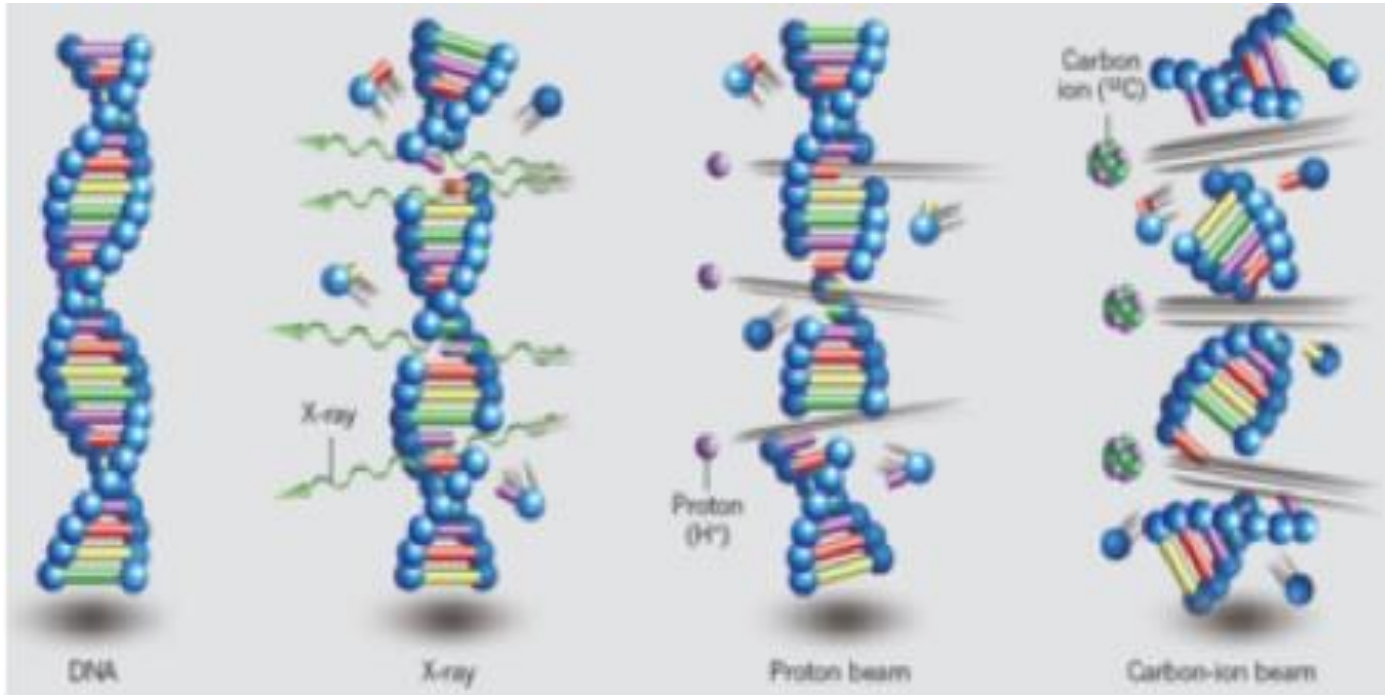


Pediatric patients elective for protons

Less dose to healthy tissues
to reduce long term risks of secondary tumours



A particle beam can break the DNA and kill a cell

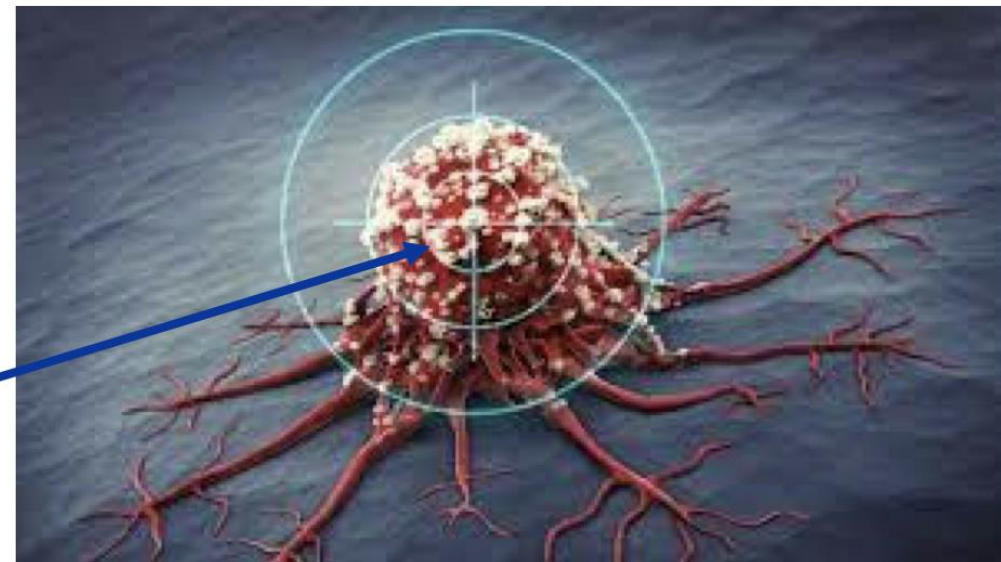


Advantages of particle therapy with: protons or carbon ions

**And if the cell has the cancer?
Killed !**

See presentation by :
Joao Seco (DKFZ)

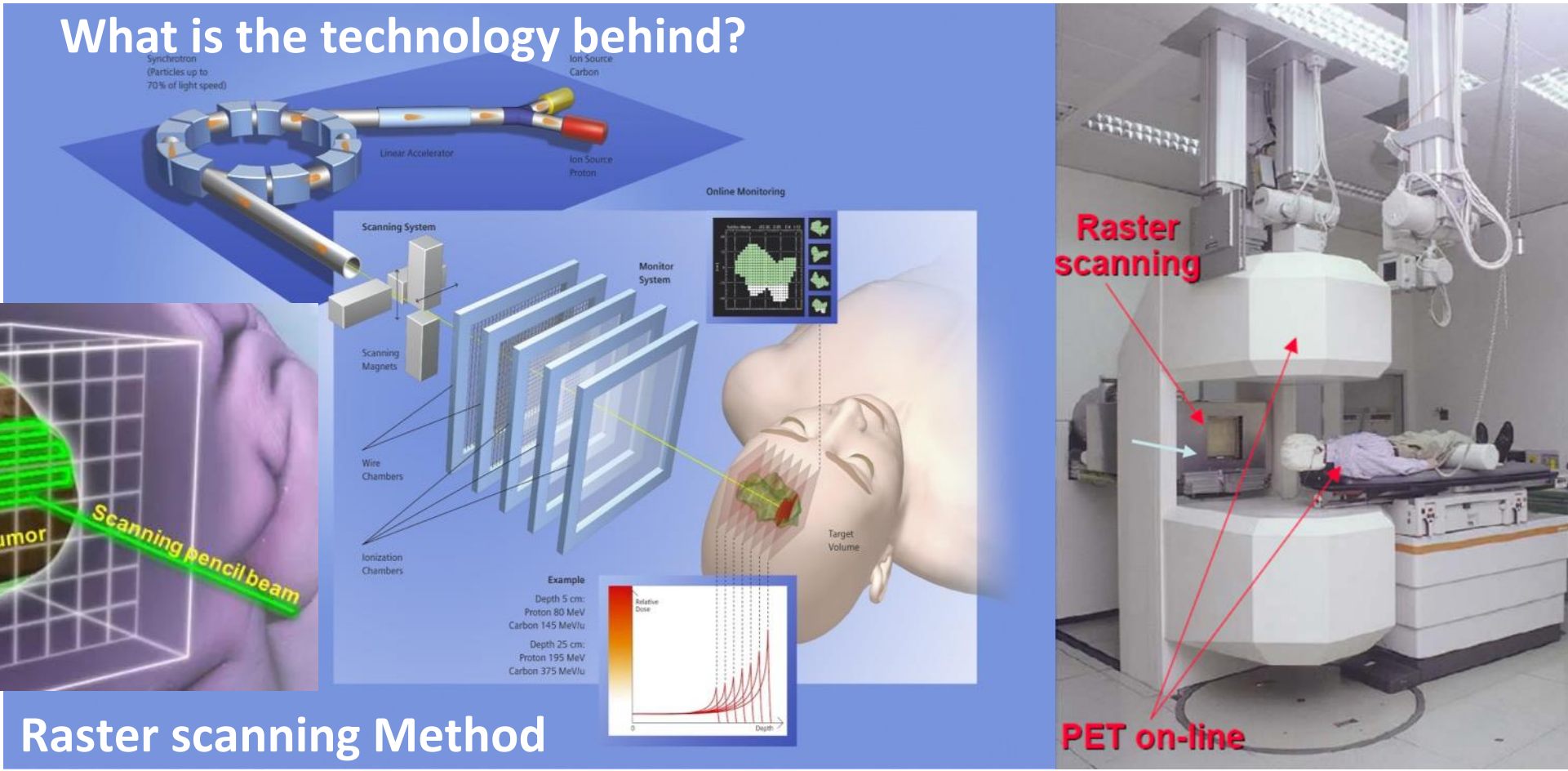
proton



In addition to ballistic effects carbon-ions induce different radio-biological effects/damage. Therefore, they are more effective, and the only solution for some rare types of cancer tumours

Heavy-ions for cancer therapy: from GSI to HIT

What is the technology behind?



Raster scanning Method

Haberer et al., NIM A , 1993

scanning of focussed ion beams in fast dipole magnets
 active variation of the energy, focus and intensity in the accelerator and beam lines

Raster Scanning and PET on-line: importance of in-therapy imaging

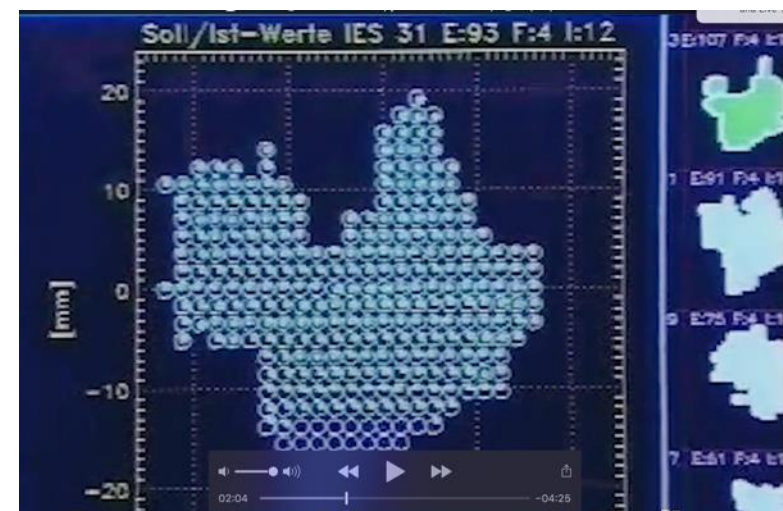
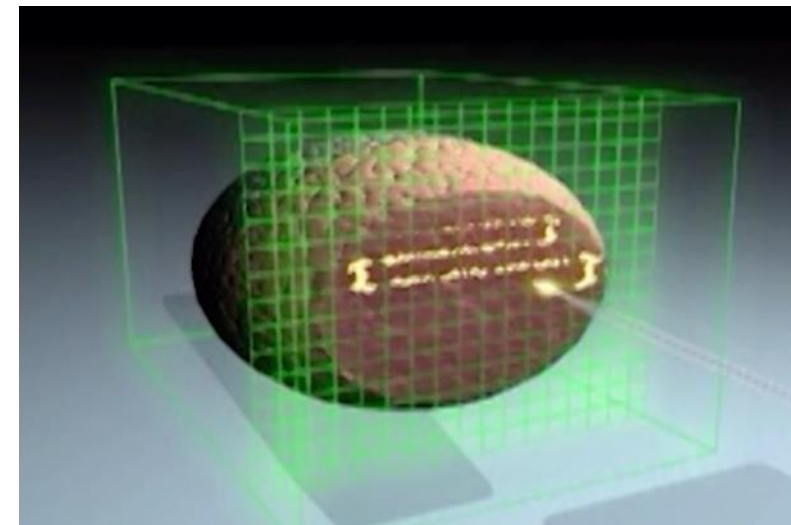
Medical accelerators requirements and parameters

Accelerator Requirements for Scanning

Example: beam parameters Heidelberg Ion Therapy (HIT)

Parameter	
ions	protons and carbon (3 ion sources); pre-clinical: helium, research: oxygen (from carbon source)
intensity	$2 \times 10^6/s$ to $8 \times 10^7/s$ for carbon $8 \times 10^7/s$ to $4 \times 10^8/s$ for protons 10 steps ; maximum extraction time 5 s Increase needed ~ 5x (FLASH not understood today)
energy	88-430 MeV/u for carbon 50-221 MeV/u for protons 255 steps , 1-1.5 mm spacing, 2-30 cm range in water
focus	3.5-13 mm FWHM 11-33 mm FWHM 4 steps

→ a total of $3 \times 10 \times 255 \times 40 = 30600$ settings per treatment room!








<https://indico.cern.ch/event/840212/>


 Instruction in Albanian

 Instructions in Bosnian

 Instructions in French

 Instructions in Greek

 Instructions in Lithuanian

 Instructions in N.Macedonian

 Instructions in Spanish

**Material in different languages
including animations and demos**

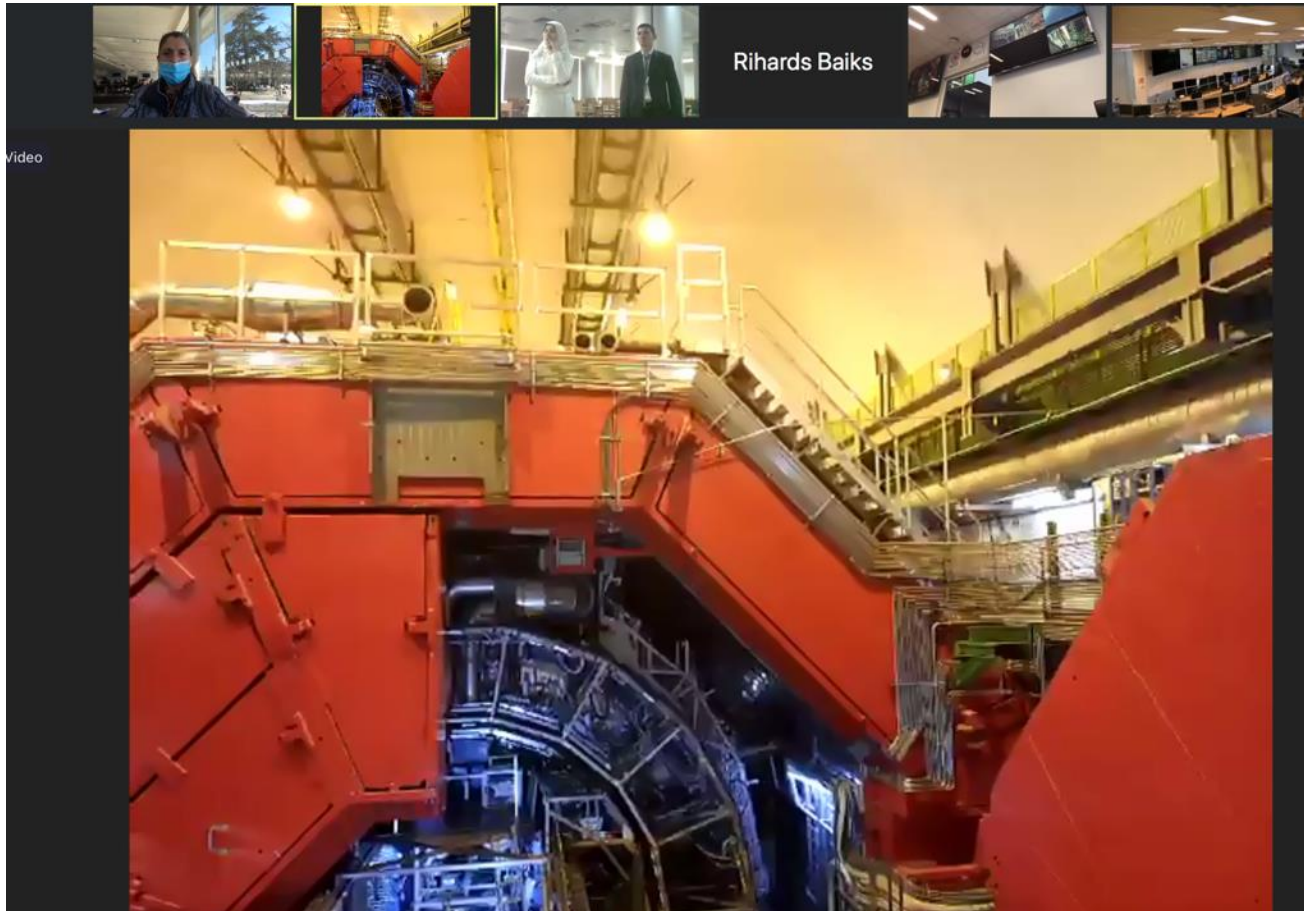
“PTMC in a kit”
in different languages
with introduction by DKFZ
including recordings

https://drive.google.com/drive/folders/1L94yhos6L7k3FQIMzD9QI7kpk_c_ABD7



**See presentation by :
Amit Ben Antony (DKFZ)**

Real-time virtual visits at the end of the morning lectures to ALICE heavy-ion experiment



16:00

Virtual Visit

Particle accelerator: <https://youtu.be/DtOsEPwtSkQ>

Tumor therapy: <https://youtu.be/2KUzT7YZzTA>

HIT: https://youtu.be/Fw9H_hceNIA

FAIR: <https://youtu.be/N48YCJli1lo>

3 Years in 3 Min FAIR: <https://youtu.be/x0RTwqaRock>

Biological modeling: <https://youtu.be/azVNWptPA40>

As an alternative to a visit to a local lab or experiment, videos can be used (see the link below)

Animations Link:

<https://indico.cern.ch/event/840212/page/18000-animations>

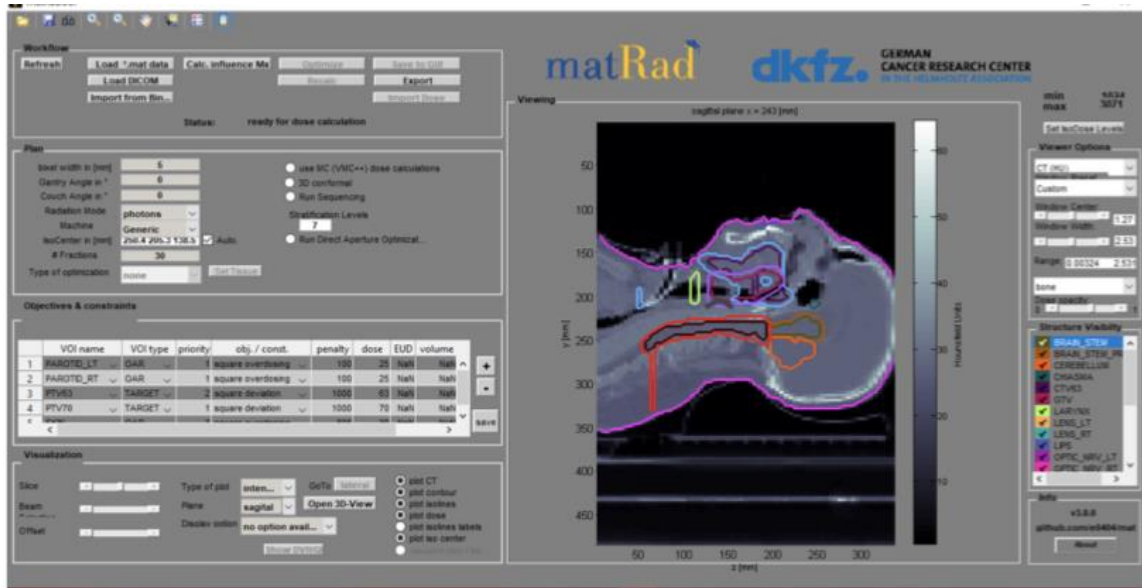
Alternatively, use of provided videos
in the PTMC web pages

PTMC hands-on Treatment Planning

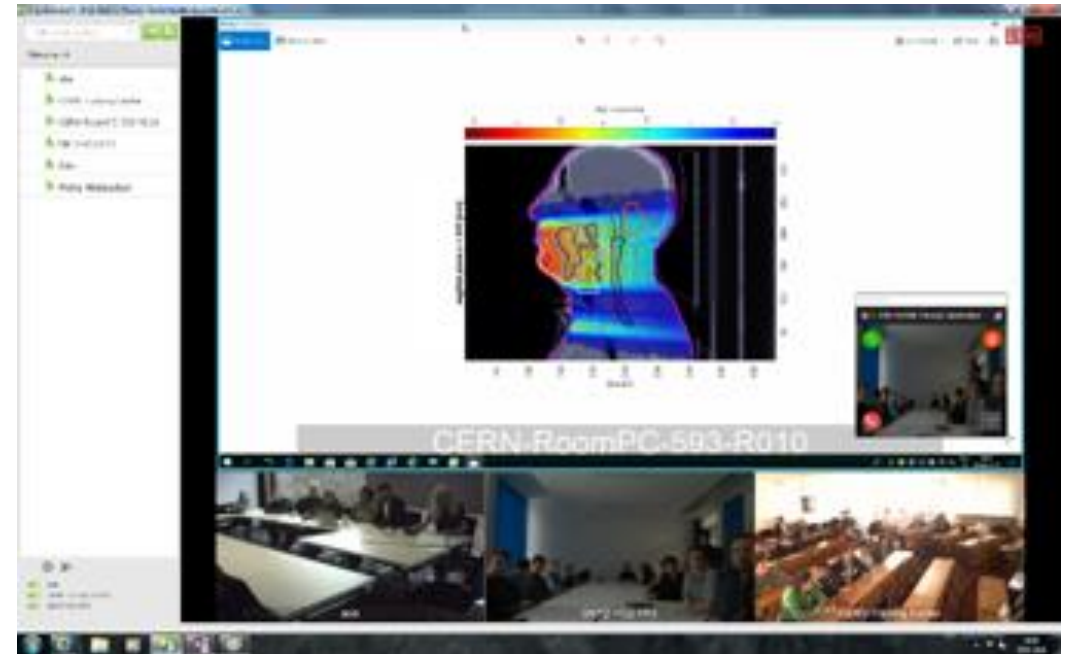
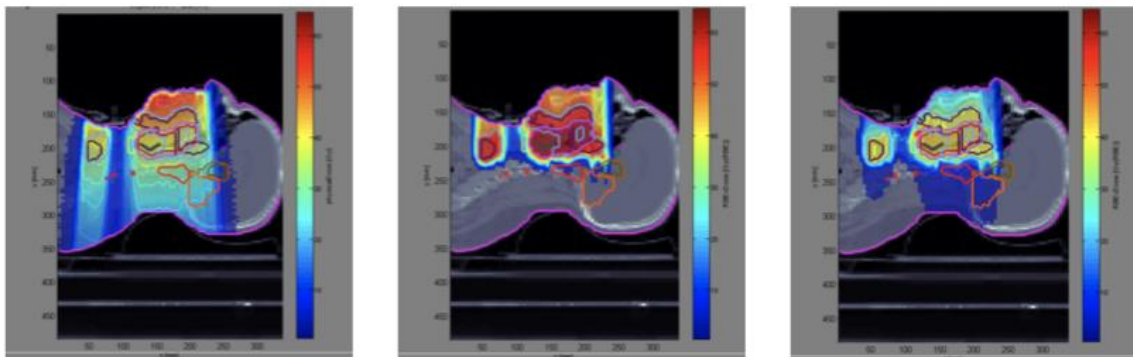
Based on professional open source treatment planning: **matRad** developed by DKFZ, Heidelberg www.matrad.org

See presentation by
Amit Ben Antony (DKFZ)
and hands-on

Dose prescription
using photons, protons and carbon ions

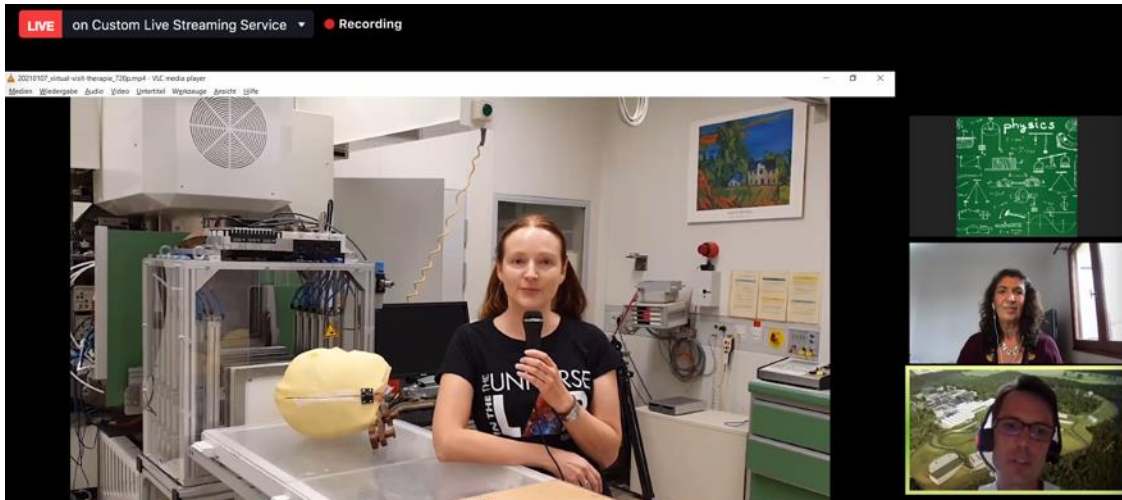


Demo⁴ of the matRad software kit for Treatment Planning .



Simplified version for PTMC

Virtual visits during video-conferencing to GSI research institute and CNAO therapy center



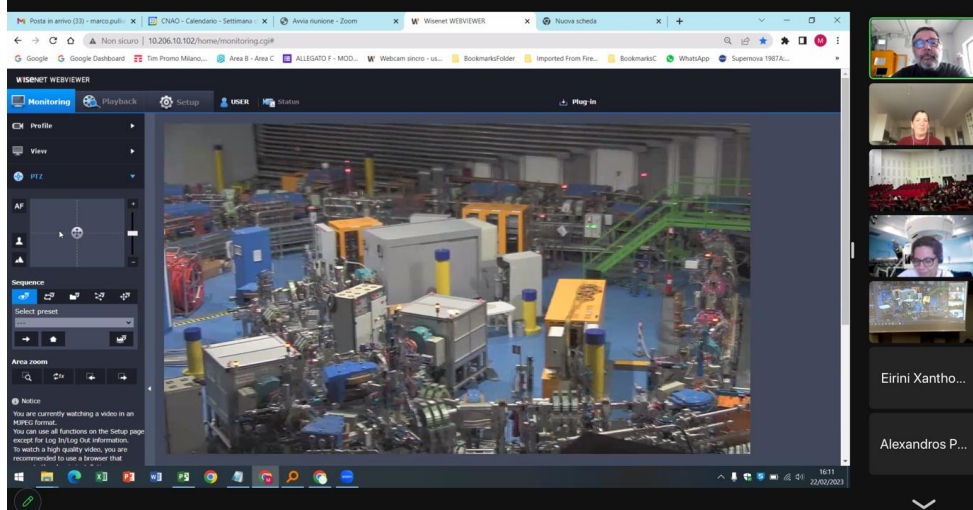
GSI moderator

CNAO moderator



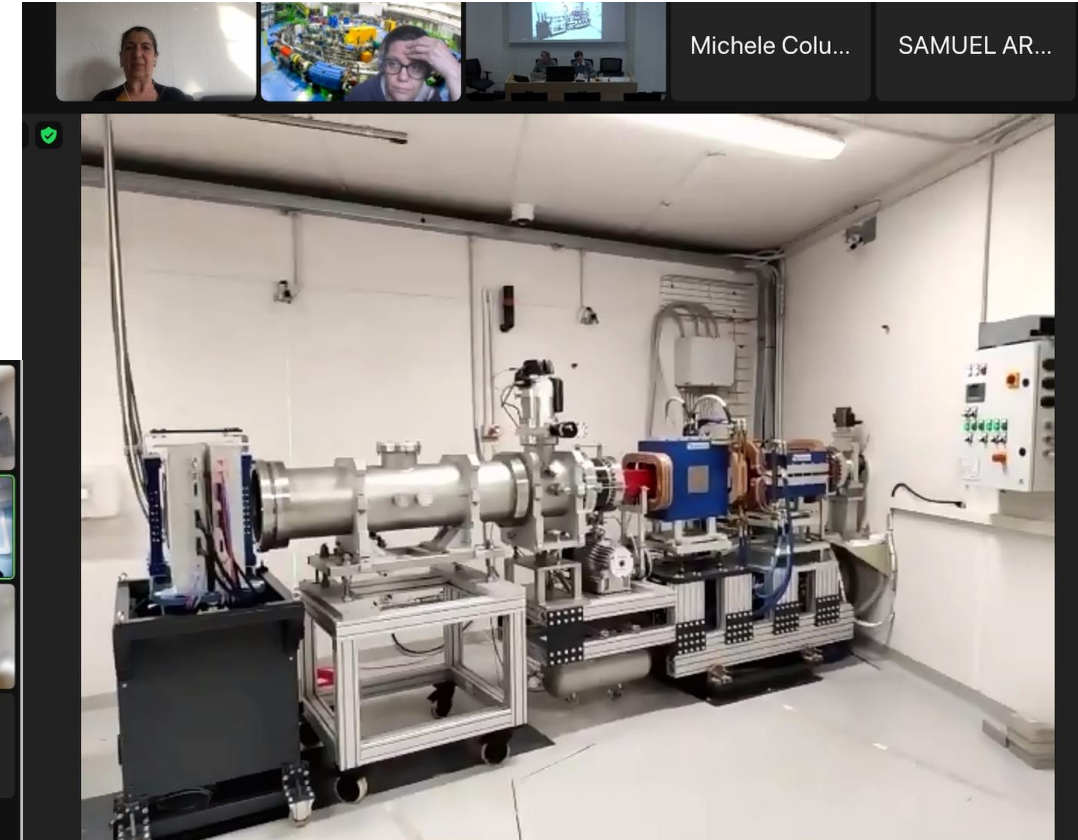
PTMC Coommon Video-Conference

see the CNAO accelerators via webcam

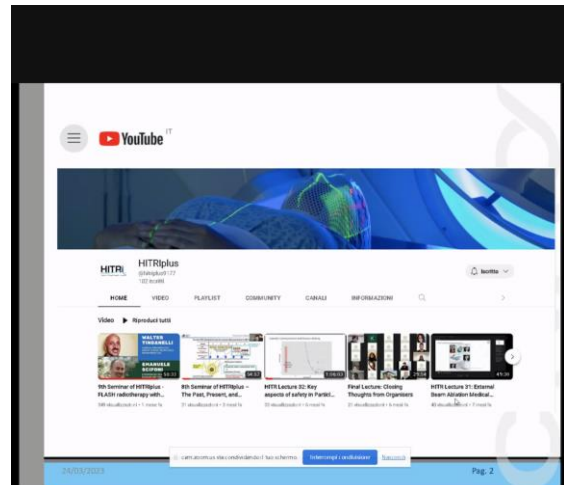
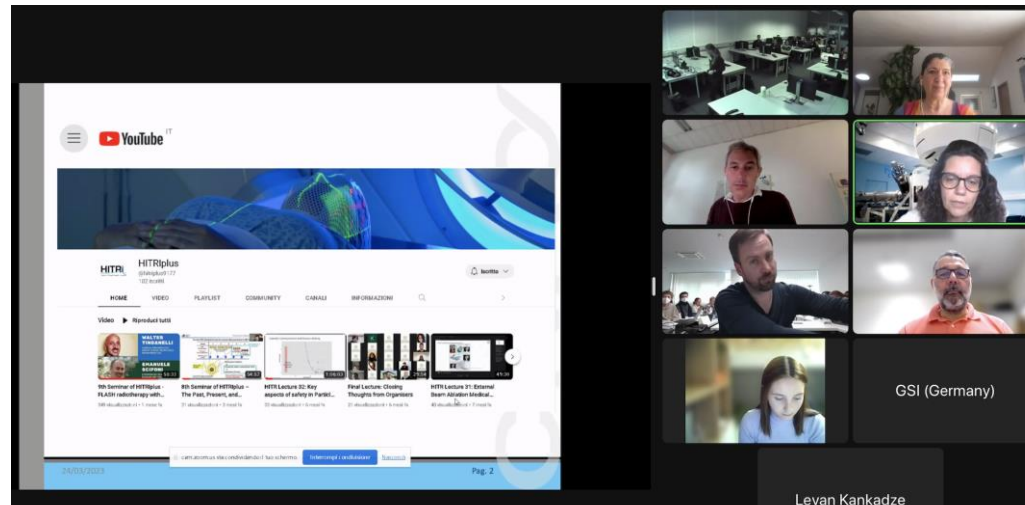


Virtual real-time visits during video-conferencing to CNAO therapy center

visit the CNAO experimental room



learn how to find PT educational material and opportunities provided by HITRIplus EU-funded project

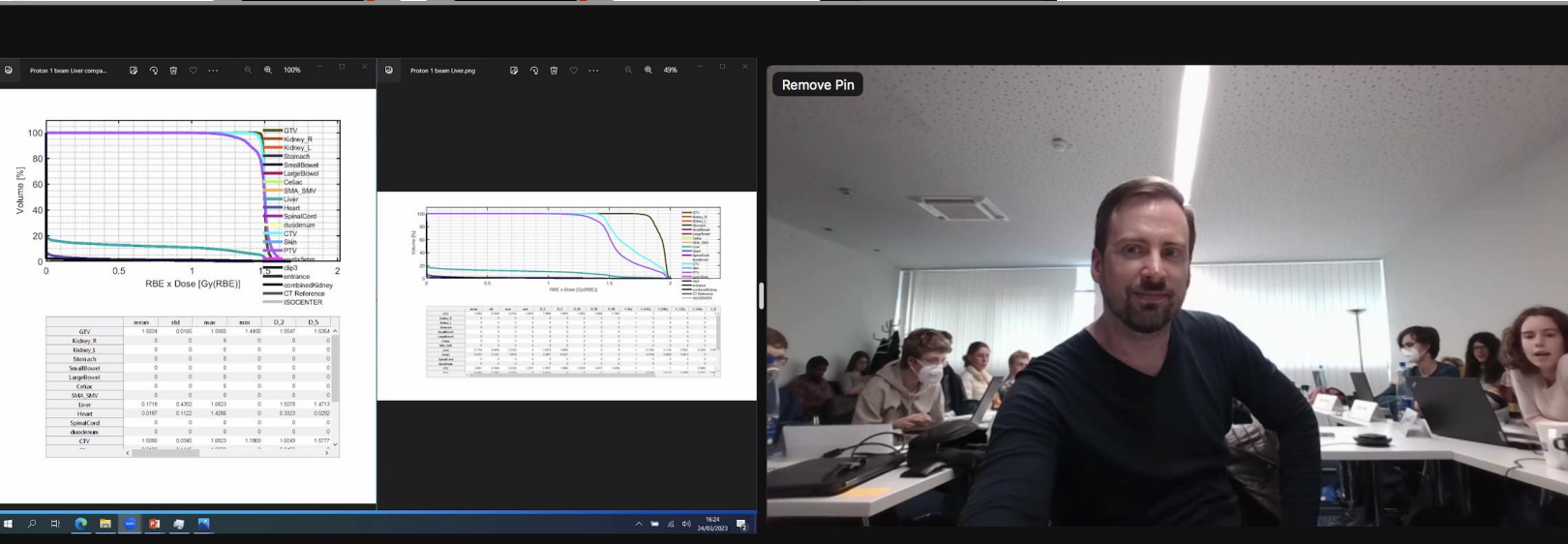
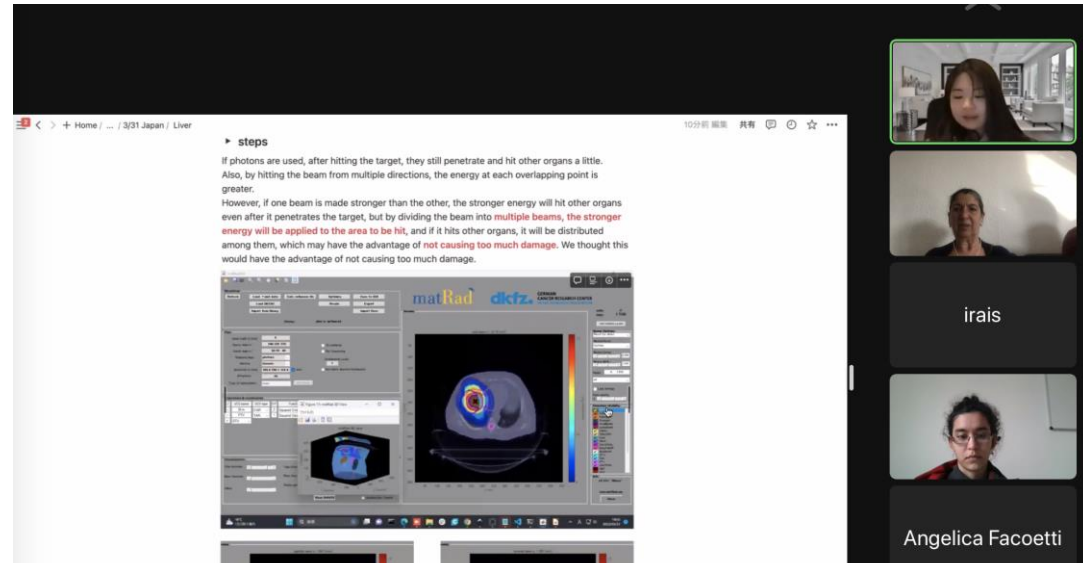


Highlight benefit of collaborations discussing results among partners around the world

Show how big collaborations work:
remote communications routinely
**On 31 March 2023: 10 institutes:
from Japan, Mexico, Europe....**

Highlight the benefit of collaboration:
big projects do not come from one person
nor one institute, one country....

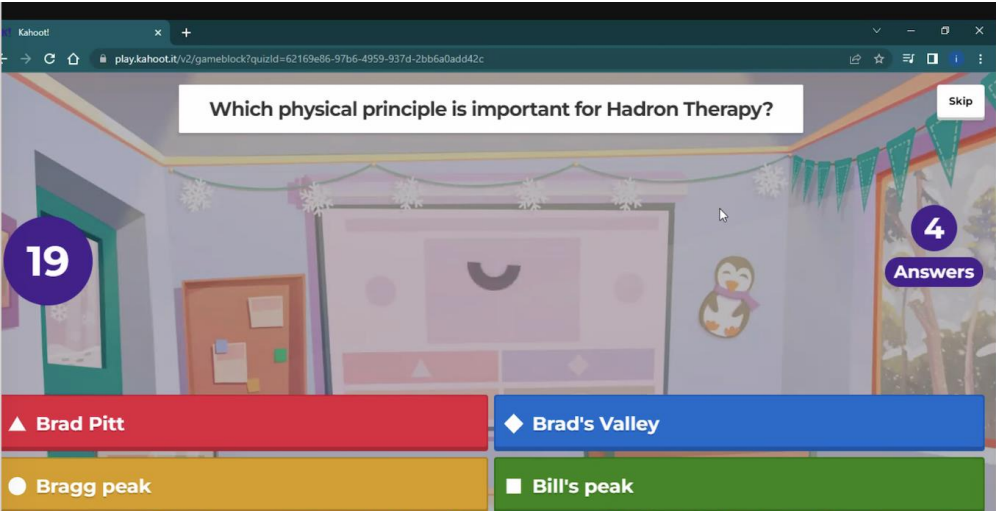
Comments on results by DKFZ experts
Good, "out-of-the-box" creative results



PTMC quiz: a fun way to finish

What we have learnt

Gentle competition: who is the winner !?



Which physical principle is important for Hadron Therapy?

19

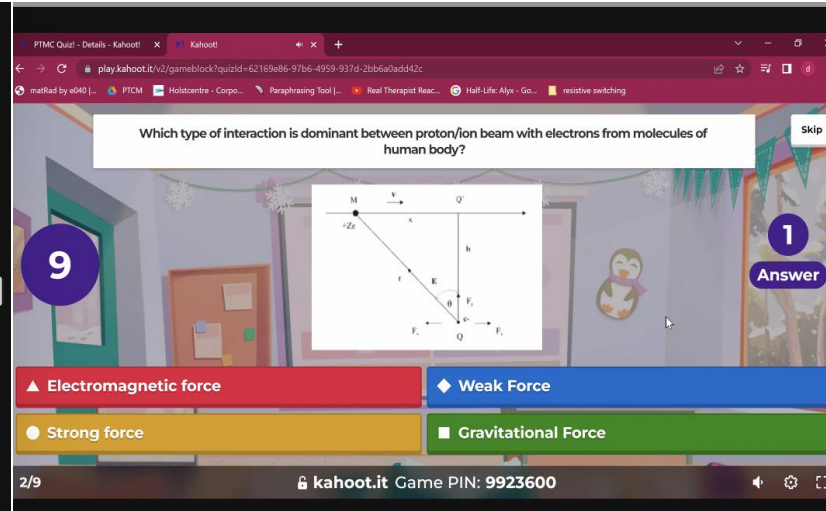
4 Answers

Brad Pitt

Brad's Valley

Bragg peak

Bill's peak



Which type of interaction is dominant between proton/ion beam with electrons from molecules of human body?

9

1 Answer

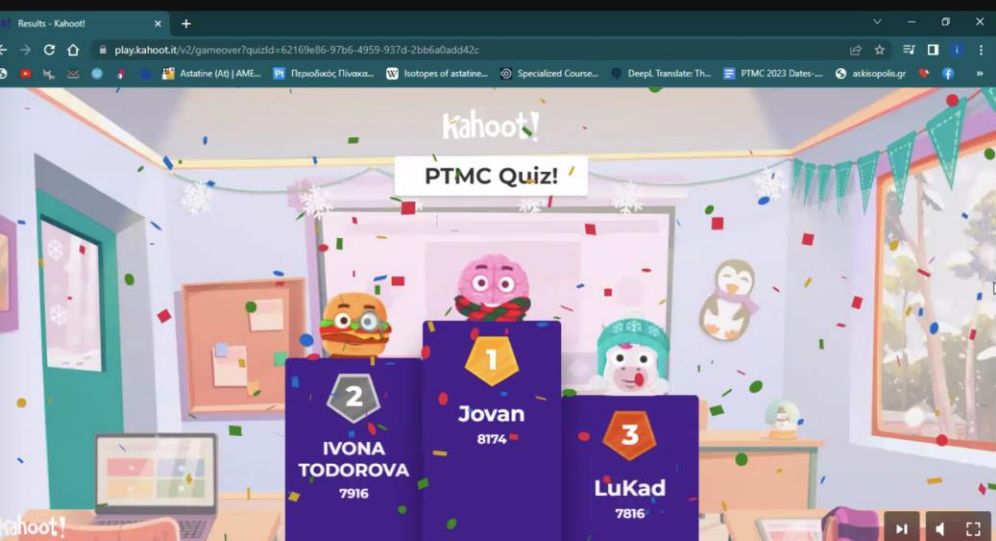
Electromagnetic force

Weak Force

Strong force

Gravitational Force

2/9 kahoot.it Game PIN: 9923600



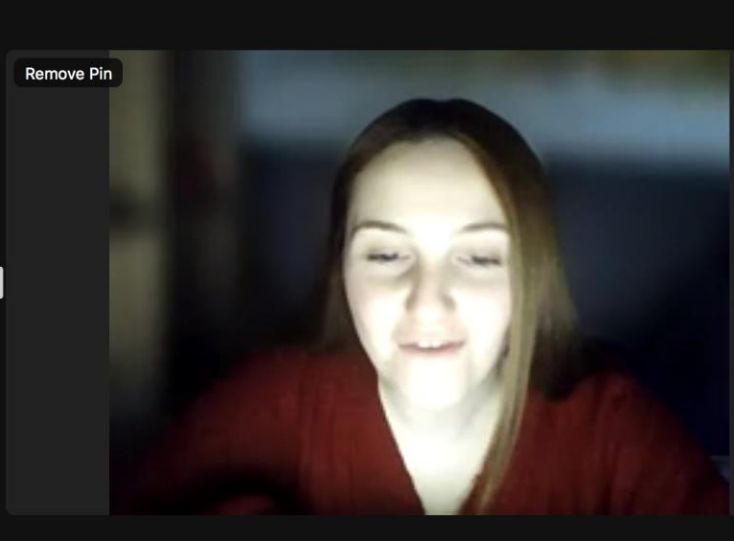
Results - Kahoot!

PTMC Quiz!

1 Jovan 8174

2 IVONA TODOROVA 7916

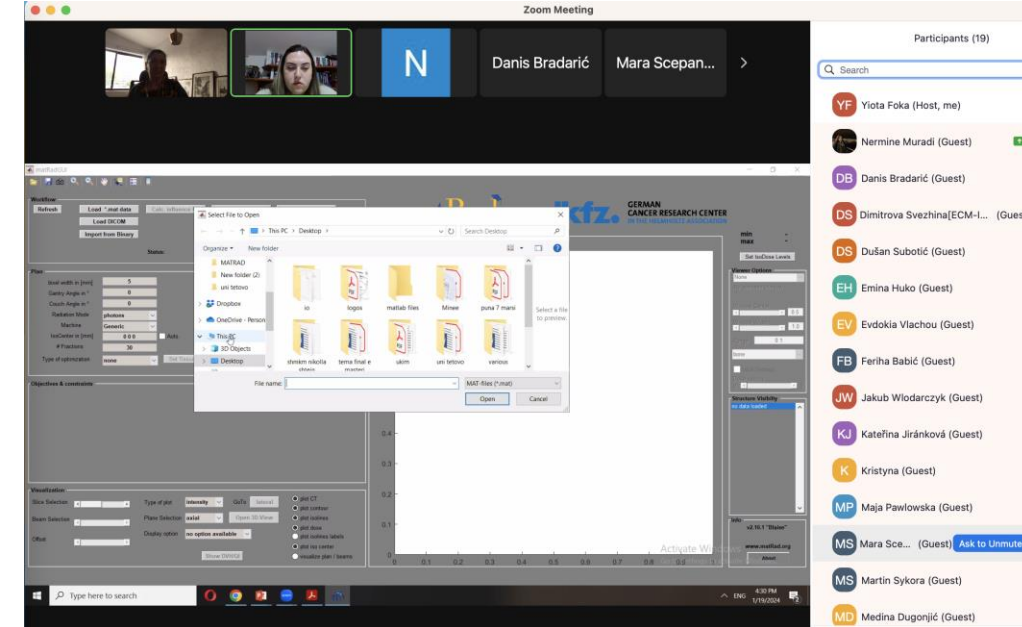
3 LuKad 7816



PTMC session example agenda

Particle Therapy Masterclass Training 26th February	
Friday 26 Feb 2021, 13:00 → 15:40 Europe/Zurich	
UNSA	
Description PTMC Training for colleagues.	
13:00 → 13:05	Welcome https://indico.cern.ch/event/1011063/ Welcome and aim of the PTMC training day, set the stage. For a visual impression a virtual Particle Therapy centre is in the link below. A good summary connecting physics and particle therapy can be found on the animation link. Convener: Yiota Foka (GSI - Helmholtzzentrum für Schwerionenforschung GmbH (DE)) YF-PTMC-TRAINING... YF-PTMC-TRAINING...
13:05 → 13:20	PTMC Indico Webpage Example PTMC Example
13:20 → 13:25	Animations Animations
13:25 → 13:30	Theoretical Material for Tutors Dosanjh-Physics_to... MasterClass_theory... Radiotherapy.pdf
13:30 → 13:50	Hands-on-Session Material for Tutors ALDERSON.mat BOXPHANTOM.mat HEAD_AND_NECK... LIVER.mat MatRad GitHub PROSTATE.mat PTMC Hands-on Se... PTMCPres..._Englis... Recording MatRad... TG119.mat Workflow_English.pdf
13:50 → 13:55	PTMC Webpage PTMC in a kit PTMC Webpage
13:55 → 14:15	MatRad Installation Material MatRad Installation ... README_Installatio... README_Installatio...
14:15 → 14:25	Videoconferencing material Moderators-DS.doc Particle therapy ma... Particle therapy ma... Particle therapy ma... Particle therapy ma... quiz-PTMC-2020-DS... quiz-PTMC-2020-DS... Video conferencing ...

matRad tutorials and workflow recordings



Installation instructions are sent in advance

Ongoing work for browser-based version by DKFZ colleagues

Importance of training teachers

Example of UNSA/Sarajevo:

- in-person at university
- in-person at schools
- common lectures online

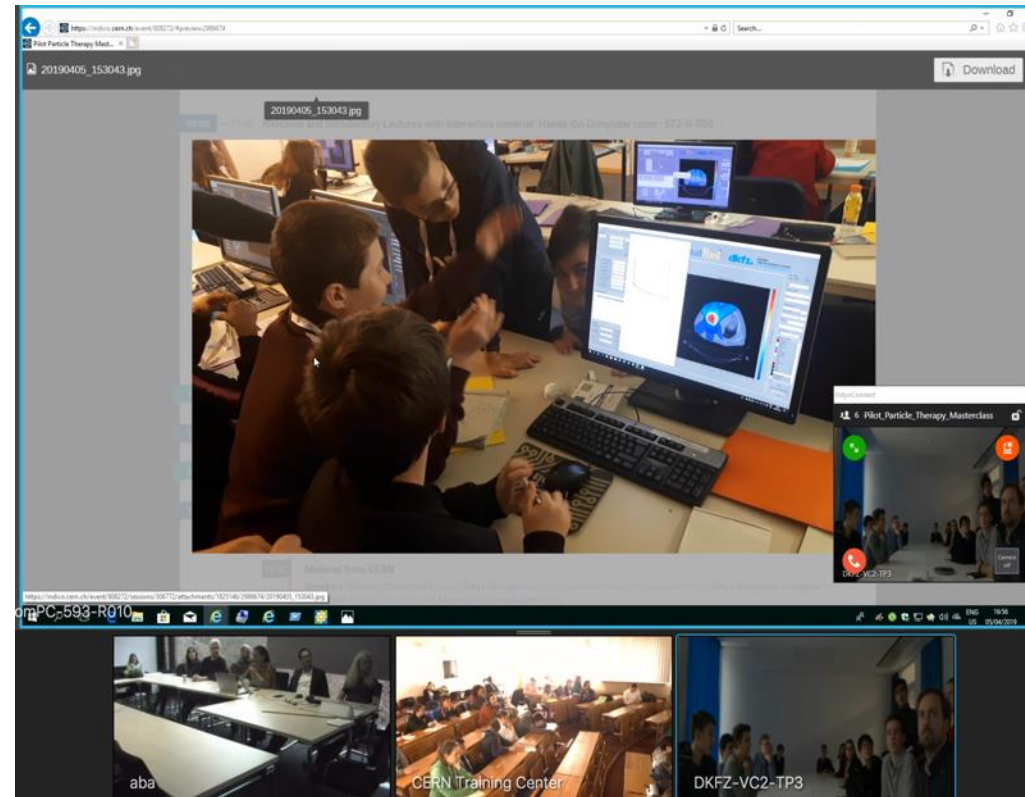
First Local Test: GSI Feb 2019



Web page: UNSA students at CERN, Aug 2019



International Pilot: CERN, GSI, DKFZ April 2019



- First local test: GSI Feb 2019
- First International Pilot: CERN, GSI, DKFZ Heidelberg, Apr 2019
- **IMC Steering Group Approval: GSI May 2019**
- Web pages: UNSA Sarajevo Uni students Aug 2019 at CERN
- CERN Open days: UNSA Sarajevo Uni students Sep 2019

PTMC Important Links

- Information about the PTMC, in a different languages, can be found through the PTMC web page and the “PTMC in a kit” Google Drive links:

PTMC web page: <https://indico.cern.ch/event/840212/overview>

Google Drive: https://drive.google.com/drive/folders/1jRnLf49N_yRoOGg8V8vwq3DIpnetWdF0?usp=sharing

- Material for the matRad installation can be found through the word document in the link below, together with a video describing the procedure:

Installation: <https://drive.google.com/file/d/1vT9tQ9ft1C7AwUSbU18pftC9H-ep4BPC/view>

Video: https://drive.google.com/file/d/1BdkjN63StX-1kFEqR_FgTgj_pgZ2-PhL/view?usp=sharing

- Additional instructions for the use of matRad are provided through the workflow, which is available in many languages through the PTMC web page
A video describing the workflow of different cases is provided via the google drive:

Workflow: <https://indico.cern.ch/event/840212/page/17991-workflow>

Video: https://drive.google.com/file/d/1jyCzJFfS7I_-0e45ZEcyb4fnXTaRJmpK/view?usp=sharing

- Units and terminology of matRad can be found here:

Link: <https://indico.cern.ch/event/840212/page/18006-definitions>

Took it a step further !

A week school inspired by the PTMC format

**Advanced material for uni students
and up to professionals**

**The level can be adjusted
by the level of lectures
and details of matRad cases**

Full week schools

in the framework of HITRIplus EU-funded project

3-7 July 2023 :specialized clinical course
UPCOMING: 18-21 oct 2024 in Thessaloniki



Heavy Ion Therapy Masterclass School **1050 participants**
17-22 May 2021
Sarajevo-Online
Europe/Sarajevo timezone
<https://indico.cern.ch/e/HeavylonTherapyMasterClass>

- Home
- Organizers and Sponsors
- Objectives and Scientific Programme
- Poster School
- Poster Social Events


Cancer is a central health problem for our society. Heavy ion beams irradiate cancerous tissue whilst sparing healthy tissue around it hence making the treatment any other irradiation treatment.

Due to this the European Union, through its H2020 research and innovation programme Heavy Ion Therapy Research Integration (HITRIplus) project which includes the training and training in heavy ion therapy.

Including: train-the-trainer matRad sessions

Visible impacts:
Tutors motivated to chose/follow these paths
Using matRad for their research



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



Specialized Course on Clinical Aspects of Heavy Ion Therapy Research
600 participants
3-7 Jul 2023
Online
Europe/Zurich timezone
<https://indico.cern.ch/event/1248018/>

- Home
- Organizers
- Objectives and Scientific Programme
- School Poster

Most cancer radiation treatment worldwide is delivered with high-energy X-rays, despite their physical and biological limitations. However, particle therapy using protons and heavy ions has many advantages over conventional X-Ray radiotherapy. Heavy ion beams radiate tumors by focusing on cancerous tissue whilst sparing healthy tissue around it, making the treatment more effective than any other irradiation treatment.

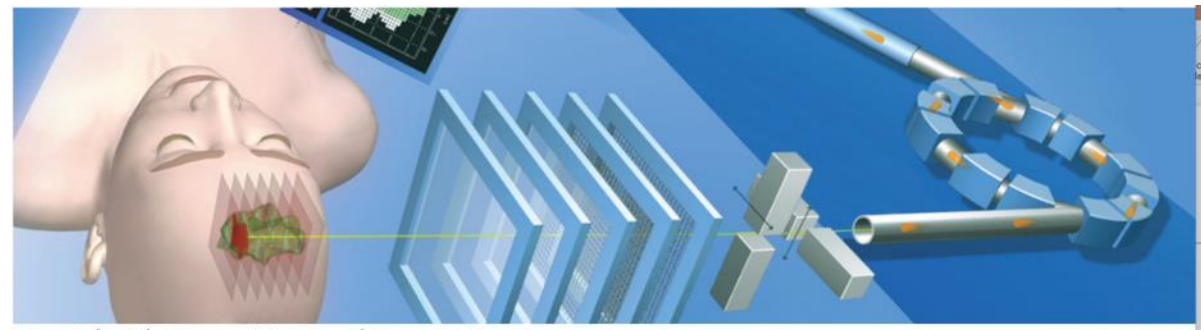


Heavy Ion Therapy Masterclass School

<https://indico.cern.ch/e/HeavyIonTherapyMasterClass>

Full week course

The HITM school is aimed at university students, and up to early stage researchers.



Particle Therapy Masterclass

<https://indico.cern.ch/event/840212/>

One day activity

The Particle Therapy MasterClass, is aimed at high-school students (16-18)



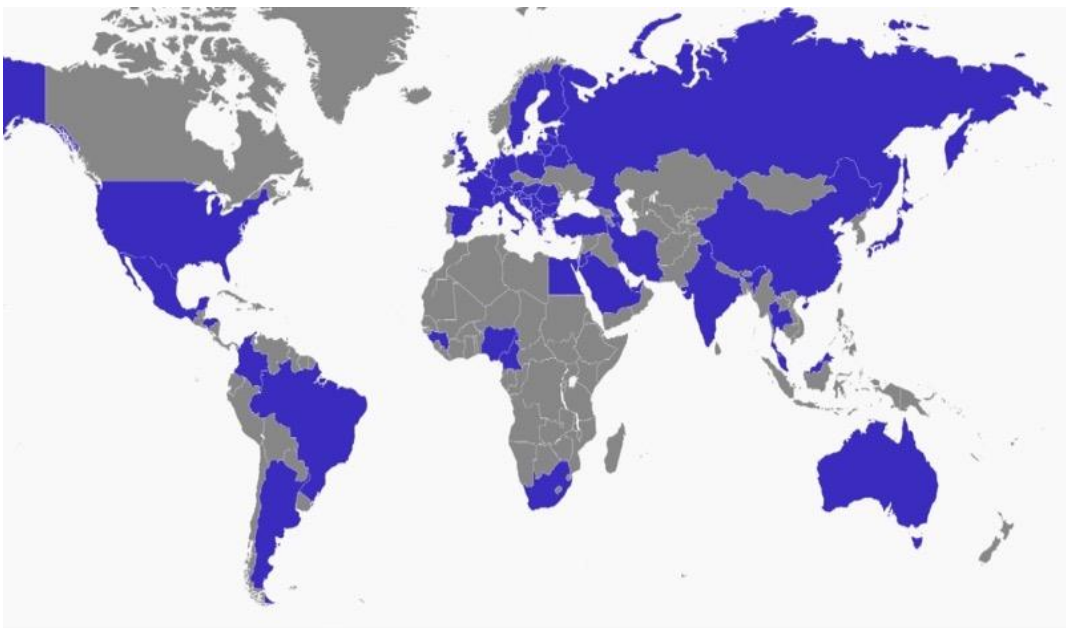
Different options studying physics, for example accelerator physics, medical physics, bio-physics... that can provide interesting career paths in upcoming fields where there is lack of specialised personnel

World-wide reach motivating next generation of scientists

HITRIplus full week heavy-ion therapy masterclass school



Heavy Ion Therapy Masterclass School



International MasterClasses one day activity



Power of Networks !

Participants of online PTMC in IMC2021

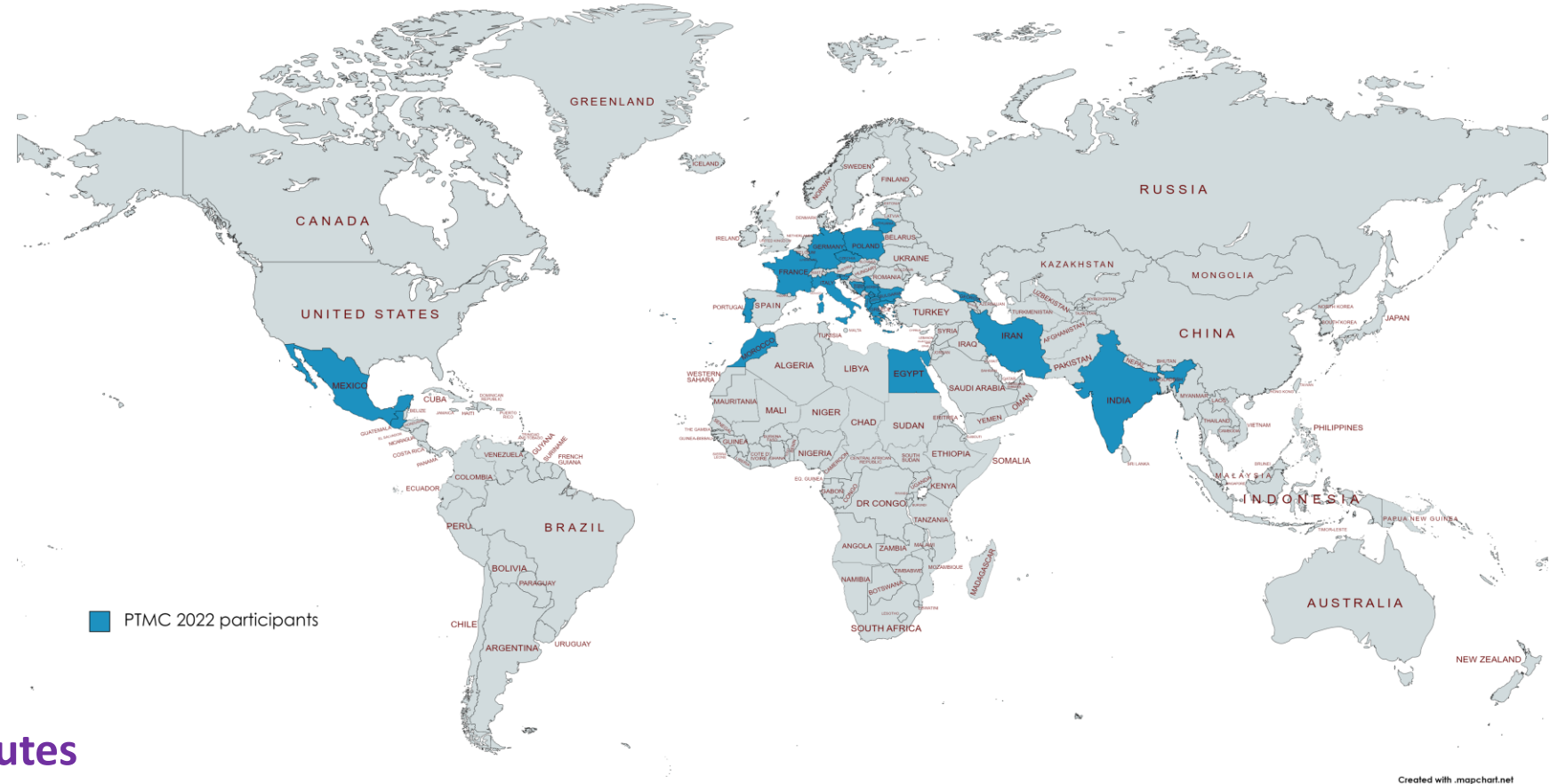
[PTMC: https://indico.cern.ch/event/840212/](https://indico.cern.ch/event/840212/)



PTMC2021 online:
6 sessions, 1500 students
from 20 countries and 37 institutes

Participants of online PTMC in IMC2022

[PTMC: https://indico.cern.ch/event/840212/](https://indico.cern.ch/event/840212/)



**PTMC2022 online/hybrid:
6 sessions, 1500 students
from 22 countries and 37 institutes**

web pages with agendas of every institute with material
in different languages, publicly available for future events

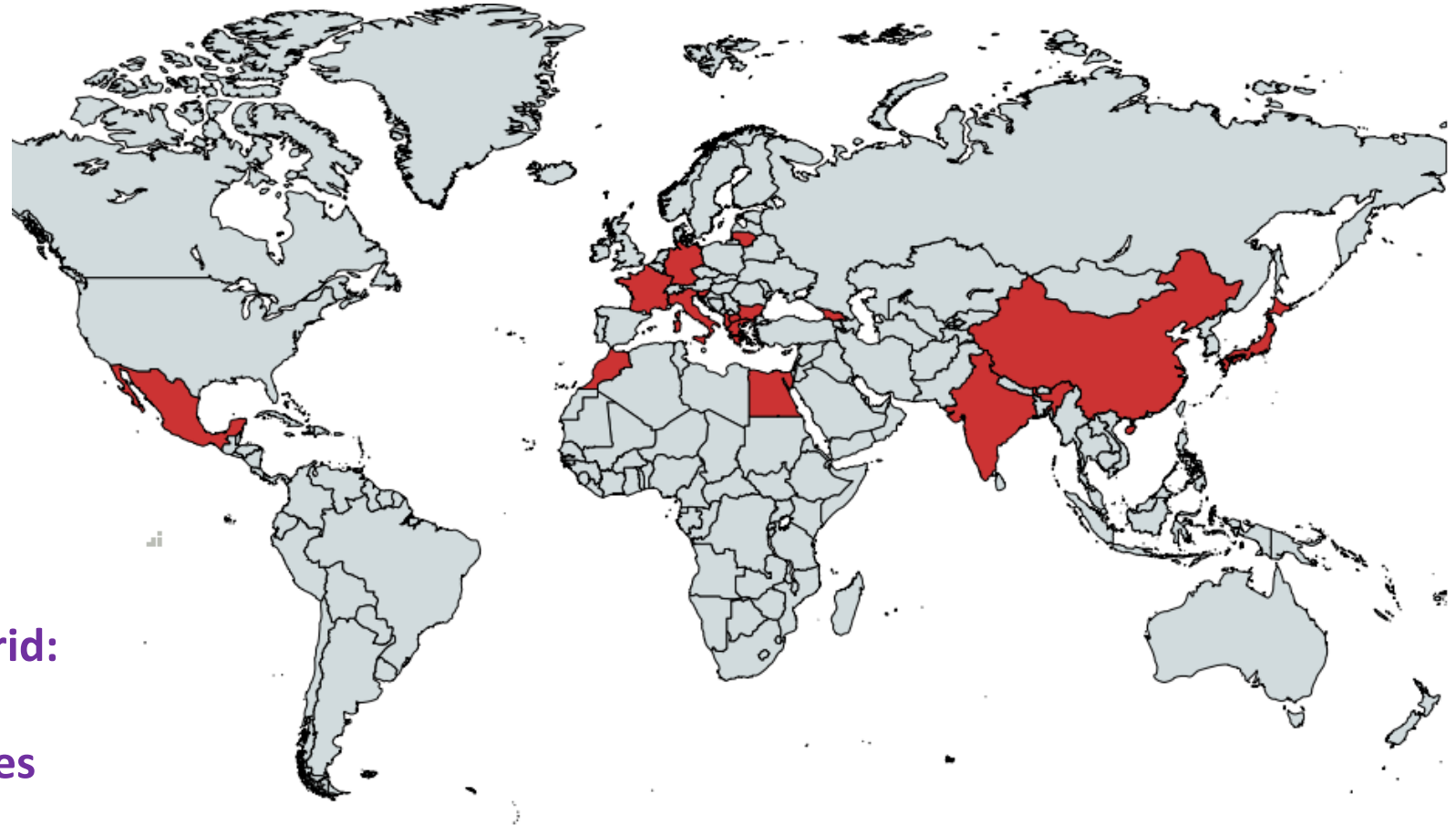
Interest of students, motivation of tutors (voluntary work), potential impact

Participants of PTMC in IMC2023

PTMC: <https://indico.cern.ch/event/840212/>

From Japan to Latinoamerica

**Contacted by Mayo Clinic
in Florida, US
(getting a carbon-ion facility)**



**PTMC2023 in person/online/hybrid:
9 sessions
from 22 countries and 38 institutes**

**web pages with agendas of every institute with material
in different languages, publicly available for future events**

Interest of students, motivation of tutors (voluntary work), potential impact

Participants of PTMC in IMC2024

More than 1500 students participated from 22 countries and 47 institutes during 8 sessions

Including 11 Feb and 8 March women days

Czech republic, Prague, Proton Therapy centre AND Charles UNI

Mexico Puebla

Mexico Hermosillo Uni of Sonora

Mexico, Mexico city, UNAM

Algeria

Poland

Greece

India

Montenegro

Ukraine

Italy Uni Piemonte Orientale

Italy Bologna

Italy Pavia Uni AND INFN

Italy Torino

Italy Cosenza. Uni AND INFN

Italy Milano UNIMI AND INFN

CERN

Slovenia

Lithuania Vilnius, Uni AND Cancer institute

Lithuania Kaunas Health uni AND Uni of Technology

Germany DKFZ

Georgia

France

Slovenia Uni Ljubljana

N. Macedonia Uni Tetovo

Morocco

Bulgaria Varna Astronomical observatory AND Uni

Bulgaria Sofia Uni

Spain Uni AND Hospital

Portugal Uni Lisbon

BiH Sarajevo AND Tuzla

Some institutes had 2 sessions
due to high demand.

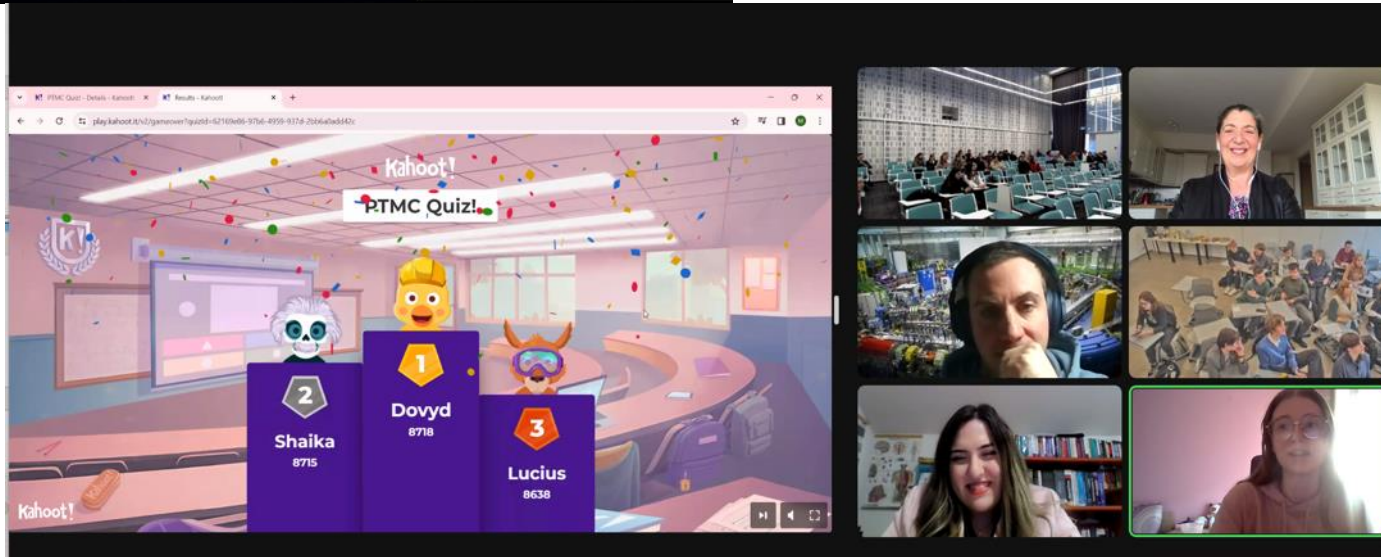
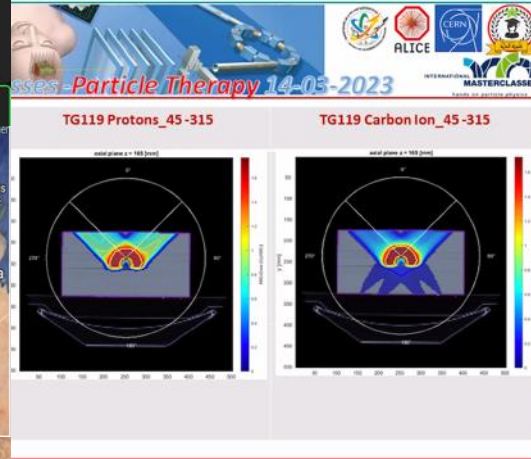
Online and hybrid sessions too.

At least 8 of the core team
tutors follow MSc or PhD in
related field.

PTMC supporting female in STEM



Encouraging female participation and providing role models



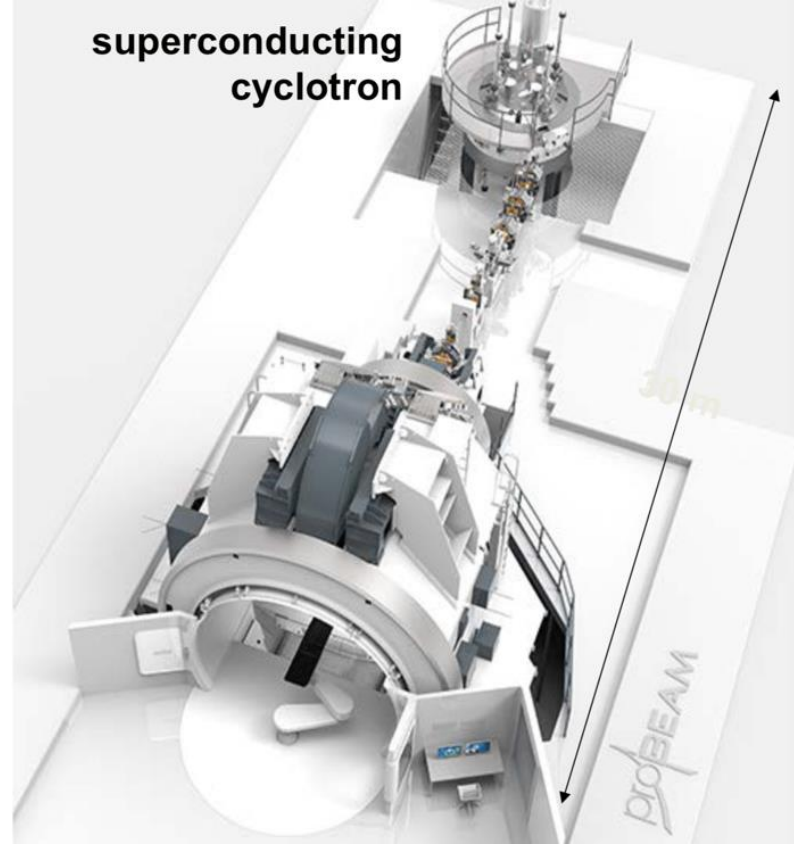
Current Status and Future Perspectives

Particle Therapy Facilities Current Status and Future Perspectives

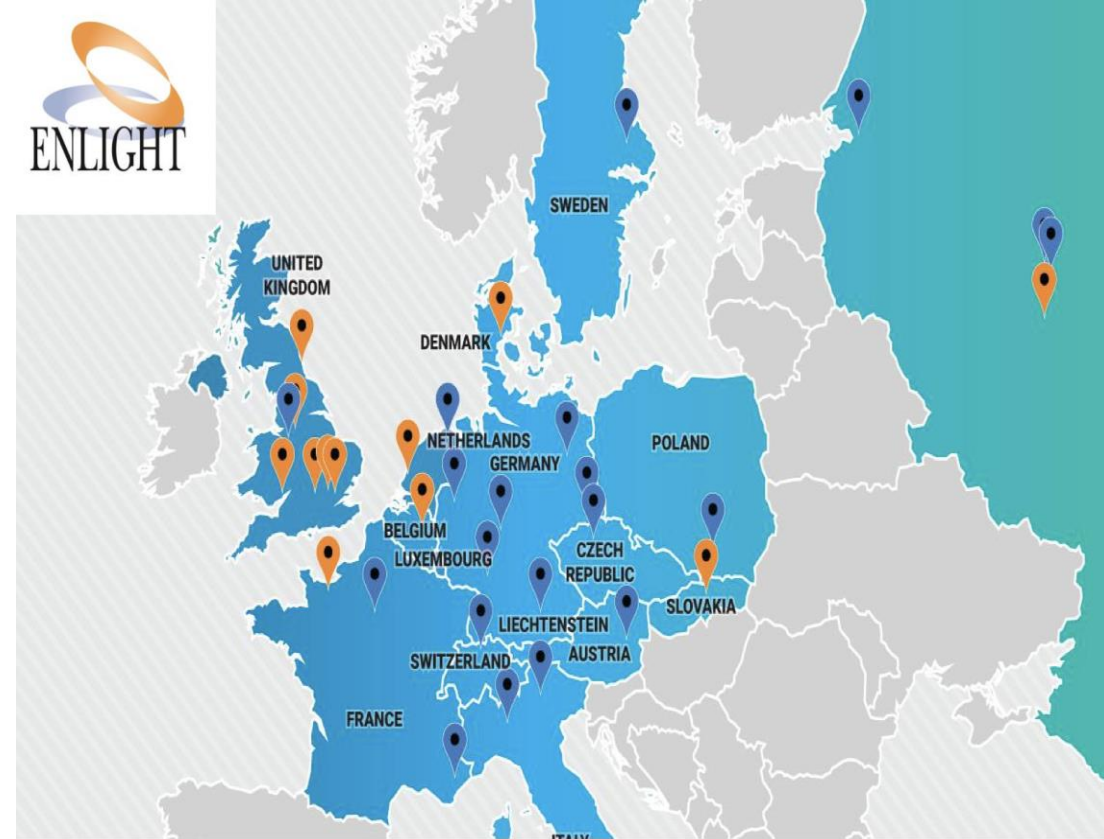
Conventional x-ray
Radiotherapy



Particle/Hadron Therapy with protons



Hadron Therapy centers in Europe (2018)



Accelerators for health

Four carbon-ion cancer therapy centers in Europe

MedAustron, Austria



CNAO, Italy



HIT, Germany



MIT, Germany



Different accelerators for different particles

Ions deliver more energy to the tissues but **need more energy to enter the body** → higher energy accelerator, **factor 2.8** in diameter with respect to protons

Required energy for full-body penetration: 230 MeV protons, 450 MeV/u C-ions.

Conventional x-ray Radiotherapy



Linac, X-rays

~50 m²
~5 M€



protons

courtesy IBA



Cyclotron, protons

~500 m²
~40 M€

CNAO, Italy



HIT, Germany



Synchrotron, heavy ions

~5,000 m²
~200 M€

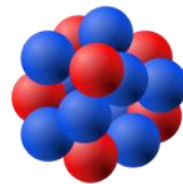
Better results come at a price



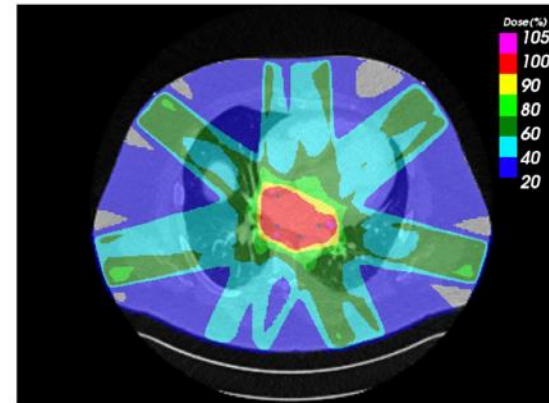
Photon (X-ray)
no mass



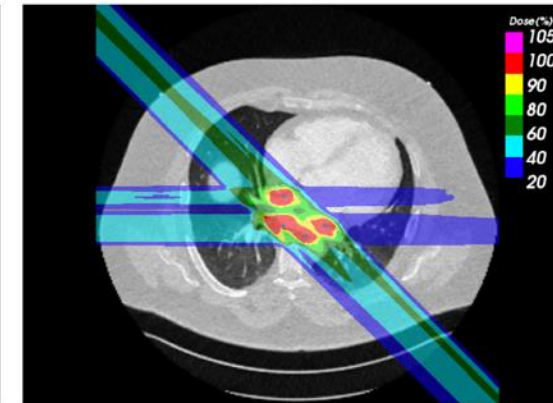
Proton
mass: 1 m₀



Carbon ion
mass: 12 m₀



Photons



Carbon

Towards the future

I.FAST EU-funded project: Innovation in Accelerator Science and Technology



IFAST

Innovation Fostering in Accelerator Science and Technology

Particle accelerators deliver huge amounts of energy into tiny volumes of matter at subatomic scale, allowing particle physicists to penetrate into the heart of matter. These activities spark a wealth of applications from fundamental science to applied science, medicine and industry.

IFAST aims to enable Europe to develop and enhance leadership in particular accelerators technologies for science and society.

"The particle accelerator community is entering the age of open innovation"

IFAST will boost innovation in and from the particle accelerator-based Research Infrastructures by developing innovative technologies common to different particle accelerator facilities; and by defining strategic roadmaps for future technological developments.

- 9 thematic areas for R&D
- 48 beneficiaries from 15 countries
- 16 industrial partners

Development of novel components:
e.g. magnets....

I.FAST EU-funded project: Strong Training and Outreach components



Sustainability & Societal Applications

Despite their wide range of applications and high level of maturity and success, particle accelerators face a potentially challenging transition into the future. I.FAST will work to identify and develop new sustainable accelerator technologies capable of reaching the performance required by particle physicists at an acceptable impact on society; and to favour the transfer of key technologies, developed over the last decades, to particle accelerators used for applied science (photon and neutron sources) and for societal applications (medicine, industry, environment).

An Innovation Ecosystem with Industry

IFAST brings together a wider and more diversified Consortium, involving 16 industrial partners, with the goal of establishing a broad Open Innovation ecosystem around accelerator-based Research Infrastructures, and provide accelerator science with the tools to face its next challenges. The project will provide European industry with a portfolio of advanced accelerator technologies, thus contributing to the construction and upgrade of the next generation of accelerator-based Research Infrastructures, the creation of jobs, and ultimately long-term growth.

- Innovation**
An internal innovation fund contributes to
- Training**
A special traineeship programme allows early-career
- Outreach**
A challenge-based innovation programme enables students

Capacity building in relevant sciences:
e.g. accelerators physics

Towards the future

Consortium

The consortium consists of 2 major European heavy ion physics laboratories, 4 European ion therapy centres, 8 world-class research institutions, 5 leading universities, 3 innovative SME's (two of which from SEE region). Their combined knowledge and background, grounded in experience of running four state-of-the-art treatment facilities and committed user communities, constitutes the core of this proposal.

Discover



HITRIplus aims

Main aims:

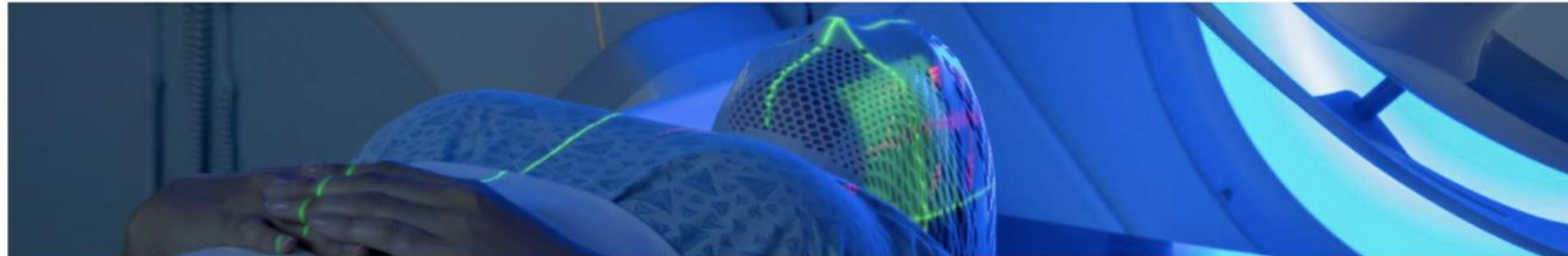
- (a) transnational access,
- (b) new developments for the future SEEIST facility and upgrades of the existing ones
- (a) networking, training and education (capacity building)**

HITRIplus EU-funded project

Large consortium of research infrastructures including CERN and GSI, plus universities, industry, all four existing European heavy-ion therapy centres, and the future research infrastructure SEEIST (South-East Europe International Institute for Sustainable Technologies)

Leaflets available

Capacity Building



HITRIplus
@hitriplus9177
102 iscritti

🔔 Iscritto ▾

HOME

VIDEO

PLAYLIST

COMMUNITY

CANALI

INFORMAZIONI

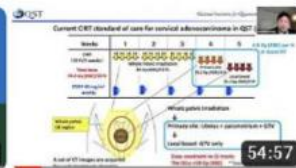


Video ▶ Riproduci tutti



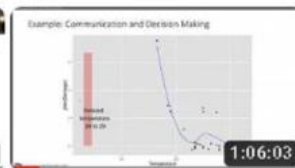
**9th Seminar of HITRIplus -
FLASH radiotherapy with...**

349 visualizzazioni • 1 mese fa



**8th Seminar of HITRIplus –
The Past, Present, and...**

31 visualizzazioni • 3 mesi fa



**HITR Lecture 32: Key
aspects of safety in Partic...**

33 visualizzazioni • 6 mesi fa



**Final Lecture: Closing
Thoughts from Organisers**

21 visualizzazioni • 6 mesi fa



**HITR Lecture 31: External
Beam Ablation Medical...**

40 visualizzazioni • 7 mesi fa

HITRIplus Open Access: Transnational Access TNA

The **Clinical Access** gives the opportunity to clinicians/medical physicists/technicians referring patients to the hadrontherapy facilities to personally follow patient's treatment and follow up.

The **Research Access** will attract universities, research centres, and hospitals, which will connect all the groups to perform research activities with carbon ion beams. Industrial partners are also encouraged to take part in the research programme, to be involved in the development of new clinical procedures and new medical devices.

TNA: Clinical

HITRIplus provides **funding** of travel and accommodation costs **for oncologists, radiotherapists and medical physicists, to visit the 4 EU centres** to:

- **Submit a clinical case for C-ion treatment**
- **Compare treatment plans (photons, C-ions, protons)**
- **Discussion of C-ion eligibility criteria**
- **Experience the workflow in hadrontherapy**

TNA: <https://www.hitriplus.eu/transnational-access-what-is-ta/>

FORMS for TNA Access

CLINICAL: <https://www.hitriplus.eu/transnational-access-ca/>

RESEARCH: <https://www.hitriplus.eu/transnational-access-ra/>

CLINICAL RESEARCH ACCESS

REFER PATIENTS TO THESE FACILITIES AND PERSONALLY PARTICIPATE TO CLINICAL RESEARCH.
IMPROVE YOUR KNOWLEDGE ON HEAVY ION THERAPY

CNAO, HIT, Marburg, MedAustron will be glad to welcome physicians, oncologists, radiotherapists and medical physicists willing to perform clinical research:

- discussing the eligibilities
- comparing treatment plans
- taking part in research clinical trials

THE BEST OF CLINICAL RESEARCH ON:

- Chordoma & chondrosarcoma base/spine
- Meningiomas
- Brain tumors (trunk)
- ACC Salivary Glands
- Orbit tumors including eye melanoma
- Sinonasal carcinoma
- Soft Tissue & bone Sarcoma (every sites)
- Recurrent tumors (retreatment)
- Immunological disorders

CLINICAL RESEARCH IN HADRONTHERAPY AT NO COST FOR SCIENTIFIC PROGRESS AGAINST CANCER:

- Choose the treatment facility
- Stay at the centre with a group of 2-3 clinical researchers for up to one week
- Reimbursement for travel and accommodation

SCAN AND APPLY

RESEARCH ACCESS

SHARE RESEARCHERS HIGH LEVEL KNOWLEDGE AND BE INVOLVED IN PRECLINICAL RESEARCH AND NEW CHALLENGES

CNAO, GSI, HIT will be glad to welcome members of universities, research centres, and hospitals for carrying out research activities with heavy ion beams.

SUBMIT YOUR PROPOSAL FOR A NEXT LEVEL RESEARCH PROJECT ON:

- radiation biology for heavy ions radiotherapy
- medical physics of heavy ions
- nuclear physics applied to particle therapy
- new model systems for pre-clinical experiments with heavy ions

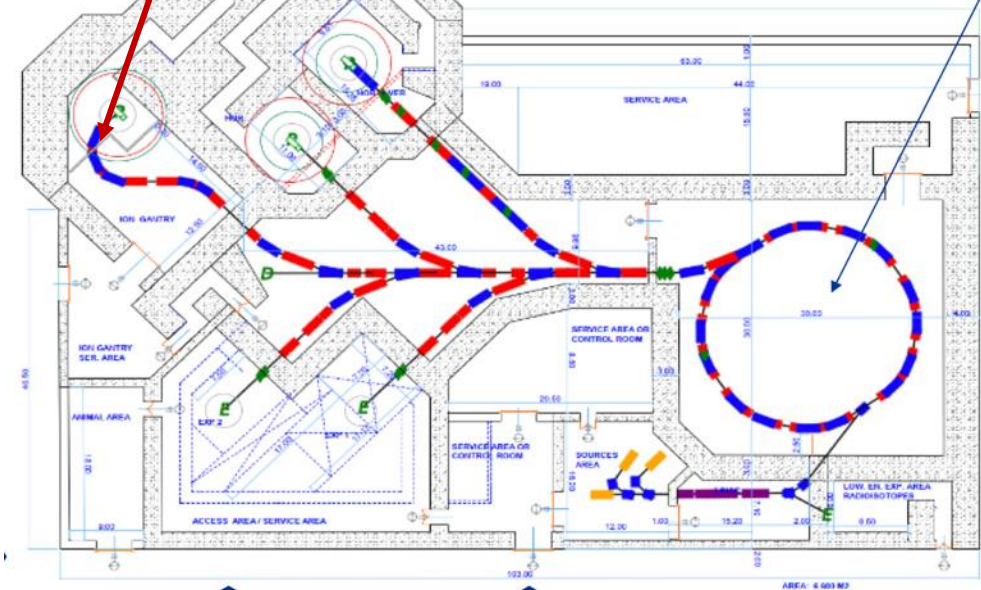
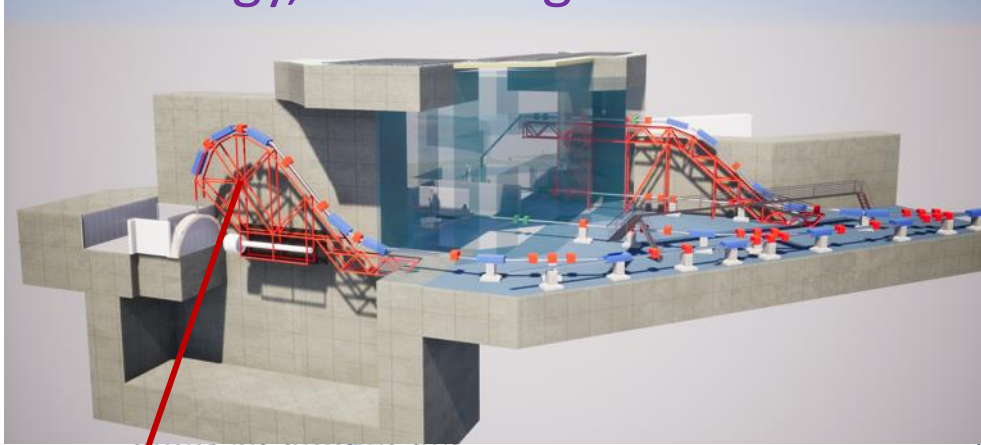
ION BEAMS AT NO COST:

- Choose the research facility and plan your experiments with the experts
- Reimbursement for travel and accommodation

SCAN AND APPLY

Next generation facility for cancer tumour therapy and research with heavy-ion beams

Technology, Knowledge Transfer and Capacity Building

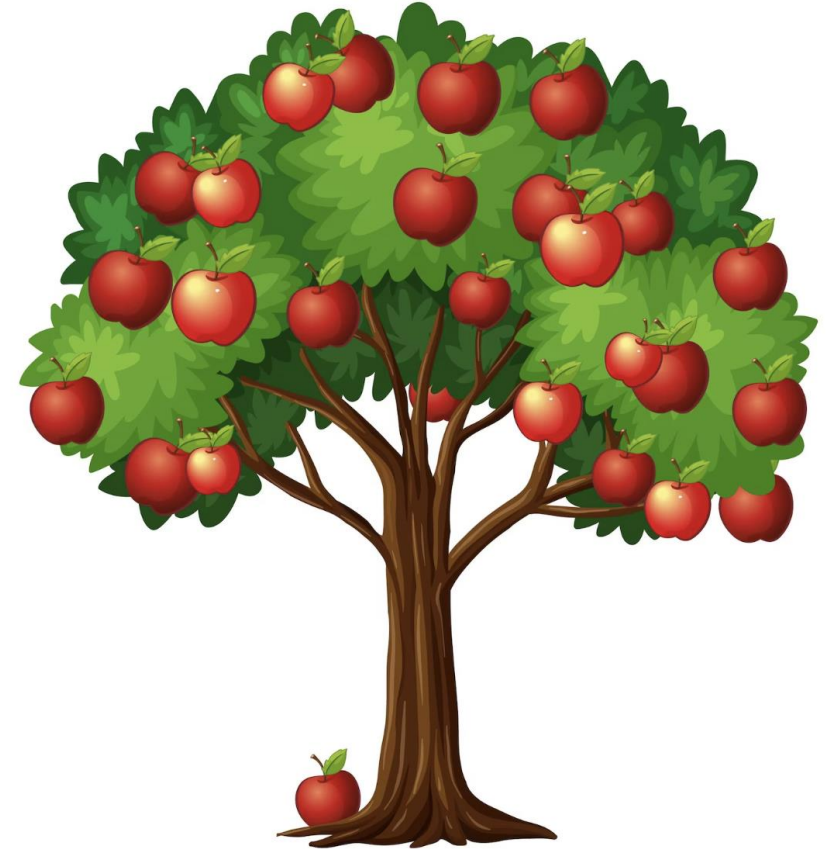


Proposal for a facility in South East Europe: SEEIST

Main Message: need for fundamental research

To get the fruit you need the tree with its roots, trunk, branches....

- **Attract school-children to STEM at early stages: decide future studies/career**
- **Cultivate confidence through the hands-on (I can do it!) and “demystify the difficulty” of physics, math....**
NOTE: a Master thesis survey/study has shown that students do learn!
- **Support female students (i.e. 11 Feb, 8 March sessions) handle prejudices (i.e. M:**
- **Create groups of Uni assistants/tutors that learn better in order to teach**
- **Demonstrate a return to society from investment in fundamental research**
- **Enhance awareness of broader public**
extended reach to family, friends, personal environment
- **Prepare future generations aware of importance of fundamental research and it**
 - favourable politicians,
 - evidence-based decision-making society



Demonstrate a return to society from investment in fundamental research

Direct application of fundamental research for society, medicine, citizens health

From participants to collaborators

Attendees of IMC were attracted by Science, Technology, Engineering and Math careers.

It was definitely our case



It is inspiring to young students.

This could mean more professionals in STEM topics

Noteworthy fact:

now we collaborate in UNAM with our IMC tutor Antonio Ortiz Velasquez

First PTMC in Mexico 2 march 2020:
brings hope and motivation



Acknowledgements PTMC

matRad Developers

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GSI

LoC: Yiota Foka

GSI Biophysics:

Christian Graeff, Radek Pleskac

GSI ALICE, EMMI :

Ralf Averbeck, Malzacher, Peter

GSI IT :

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Osdoba, Sascha

Sponsors : Edmond Offermann



CERN (staff and users)

CERN: tutors

Loc Org: Nikolaos Charitonidis

Alexander Gerbershagen

Evangelia Dimovasili

Elena Benedetto

CERN/ARIES: Maurizio Vretenar, Valerie Brunner

CERN/ENLIGHT: Manjit Dosanjh Petya Georgieva

CERN/KT: Manuela Cirilli Anais Rassat Rita Ferreira

Giovanni Porcellana

CERN: Visits Service Erwan Harrouch Francois Butin

CERN: Training Centre: Eric Bonnefoy M-L LECOQ

Uni Sarajevo: web pages

Amila Avdic

Amra Ibrahimovic

Mirsad Tunja

Damir Skrijelj

Online mode, web pages, training

Aris Mamaras (AUTH), Damir Skrijelj (UNSA), Elpida Theodoridou et al (AUTH)

Nermine Muradi (Uni of Tetovo)

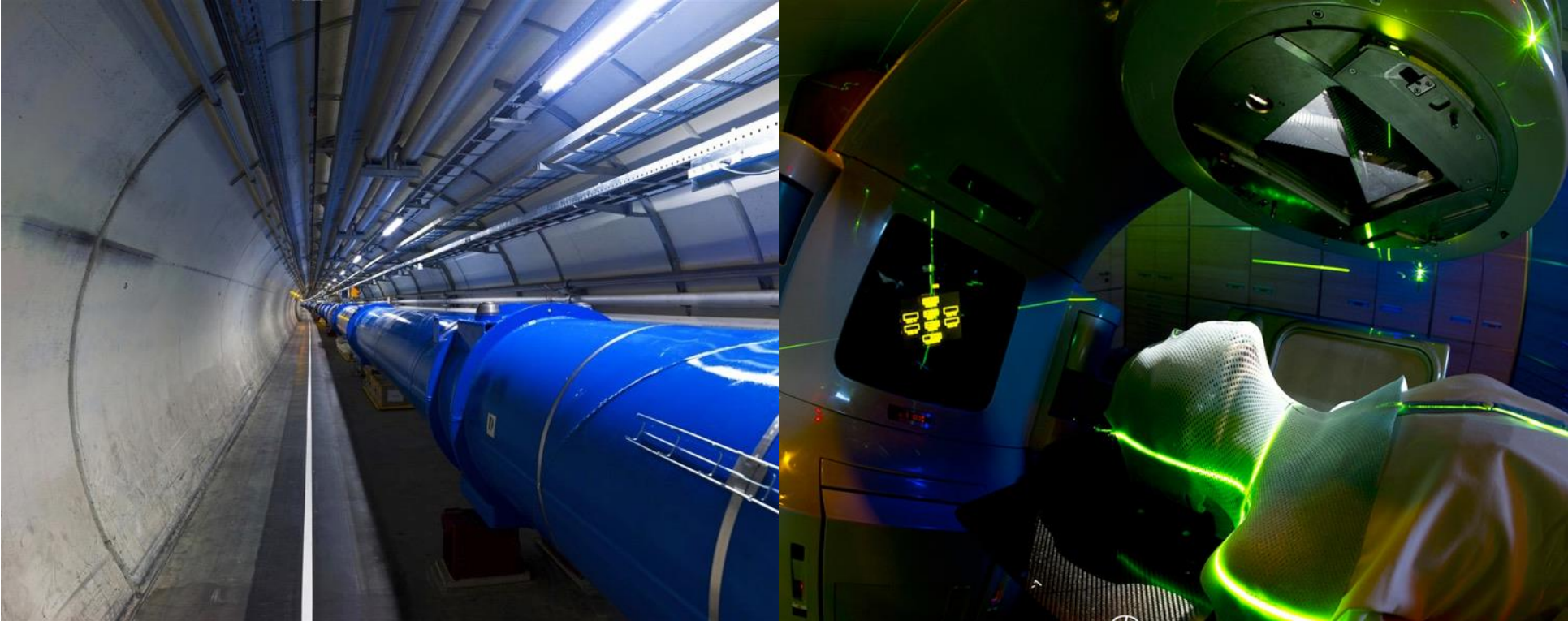
General Coordination :

p.foka@gsi.de yiota.foka@cern.ch

BACKUP

Towards the future Accelerators for health

From fundamental research...



.....to medical applications

Accelerator and Society

Over 30'000 particle accelerators are in operation world-wide.

Only ~1% are used for fundamental research.

Medicine is the largest application with more than 1/3 of all accelerators.

Research		6%
	<u>Particle Physics</u>	0,5%
	<u>Nuclear Physics, solid state, materials</u>	0,2 - 0,9%
	<u>Biology</u>	5%
Medical Applications		35%
	<u>Diagnostics/treatment with X-ray or electrons</u>	33%
	Radio-isotope production	2%
	<u>Proton or ion treatment</u>	0,1%
Industrial Applications		<60%
	Ion implantation	34%
	<u>Cutting and welding with electron beams</u>	16%
	<u>Polymerization</u>	7%
	<u>Neutron testing</u>	3.5%
	<u>Non destructive testing</u>	2,3%