

Discussion on the masterclass content

YIOTA FOKA (GSI)

ON BEHALF OF THE MASTERCLASS CORE TEAM



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HITRIplus Schools

In order to facilitate sustainability and spreading to the max the acquired knowledge all HITRIplus schools foresee

“Train the Trainer” sessions: train tutors that could perform back at their home institutes the **Particle Therapy MasterClasses** that are one-day events addressing high-school students.

HITRIplus schools:

<https://www.hitriplus.eu/event-calendar/>

- 17-22 May 2021 <https://indico.cern.ch/event/1019104/>
- 4-8 July 2022 <https://indico.cern.ch/event/1160802/>
- 3-7 July in 2023. <https://indico.cern.ch/event/1248018/>

HITRIplus YouTube channel:

<https://www.youtube.com/@hitriplus9177/about>

<https://indico.cern.ch/event/1019104/>

Heavy Ion Therapy MasterClass School | 17-22 May 2021 Online Course

The program is intended for the students of the following disciplines: Medical Physics, Physics, Radiotherapy, Radiology, Biomedical Engineering and Imaging and Radiotherapy Techniques and early stage researchers.

In collaboration with

TOPICS

- Particle Therapy
- Radiation Protection
- Treatment Planning
- Imaging
- Radiology
- Physics
- Imaging & Radiotherapy
- Biomedical Engineering

SCOPE

Focus on Heavy Ion Therapy Treatment Planning, Radiology, Imaging, Biomedical Engineering, and early stage researchers.

PROGRAMME COMMITTEE

- V. PATA (COUSAR, CH)
- J. BOEK (MZF)
- A. MANNES (ACTHUCZEP)
- A. GÖTTSCHEW (RWTH AACHEN)
- M. WERNER (CERN)
- A. SPOFF (CERN)
- D. BARNES (LIFE SCIENCES)
- D. WILLY (MZF)
- D. BURTON (LIFE SCIENCES)
- M. SCHNEIDER (MZF)
- M. WERNER (MZF)
- R. SCHNEIDER (MZF)

SCIENTIFIC ASSISTANTS

SIGN UP NOW TO THE FIRST HEAVY ION THERAPY COURSE!

Registration link: <https://indico.cern.ch/event/1019104/>

Registration deadline: 15 May 2021

HITRI

Heavy Ion Therapy – 1st online course

Masterclass

@Sarajevo-Online

2021/05/17

18:00

Join the event

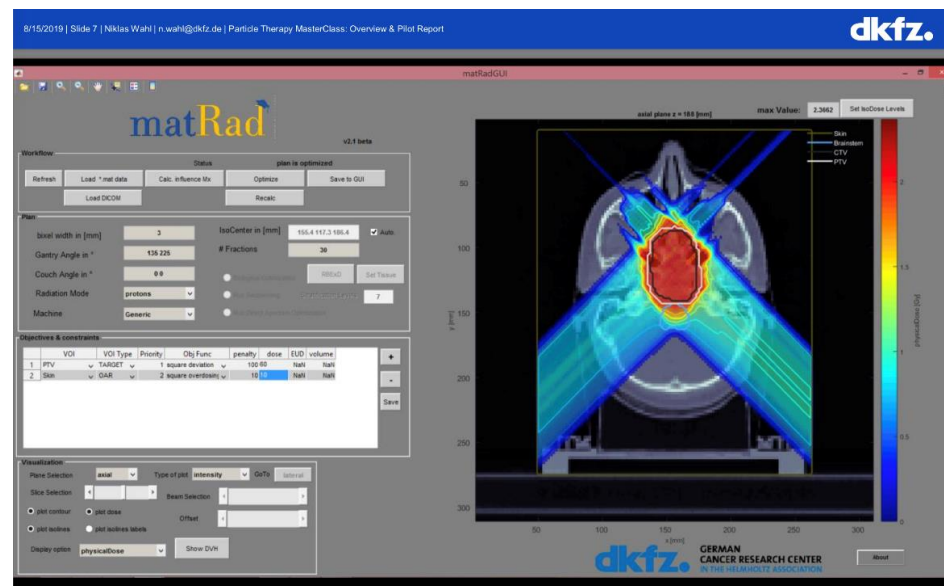
Add to Calendar

Heavy Ion Therapy Masterclass School in HITRIplus “Education and Training” addressing university students, starting from basics assuming no specialisation, and up to early stage researchers and even professionals



Hands-on Treatment Planning

Hands-on: based on professional open source treatment planning toolkit matRad, developed by Heidelberg DKFZ for research and training www.matrad.org



Please submit the results of the hands-on by email to: nicholas.sammuto@um.edu.mt by 10 July 2023.

For any issues related to the Train the Trainers Hands-on Session please contact: yiota.foka@cern.ch and/or n.wahl@dkfz-heidelberg.de

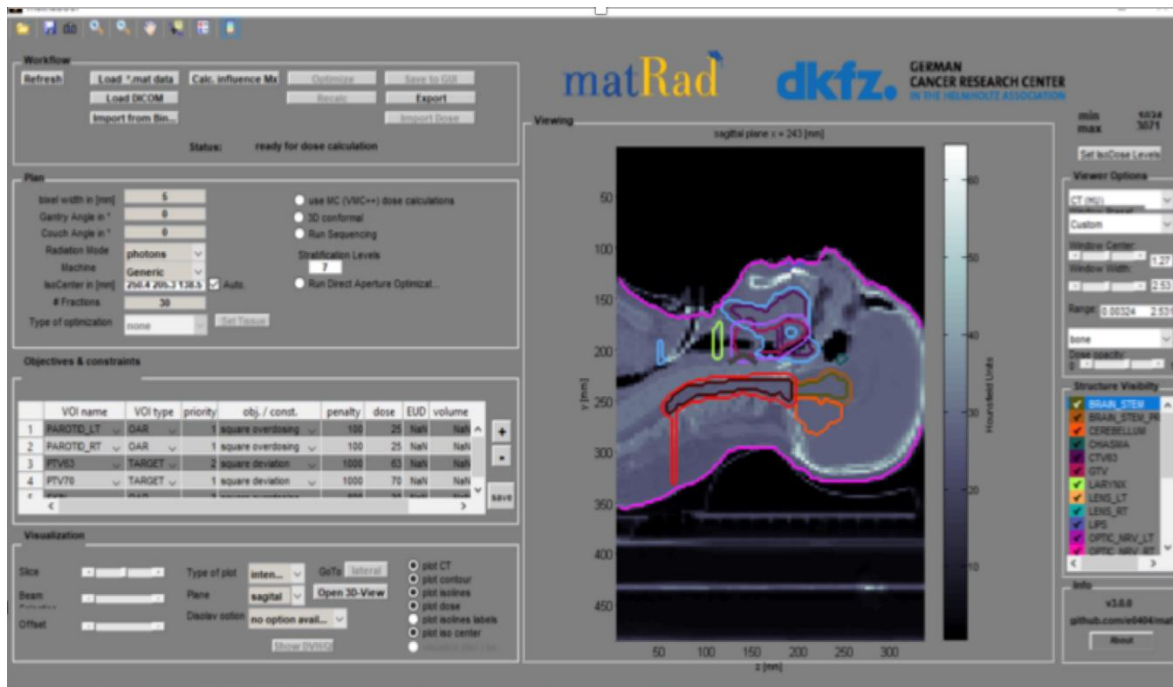
Particle Therapy MasterClasses PTMC

Treatment Planning

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

Virtual Therapy Centre

Treatment Planning and all it entails to deliver the beam to the target



multidisciplinary facets of heavy- ion therapy

aim: give the full image what happens from the beginning to the end

New PTMC and Treatment Planning

matRad open source Treatment Planning toolkit: DKFZ German Cancer Research Centre

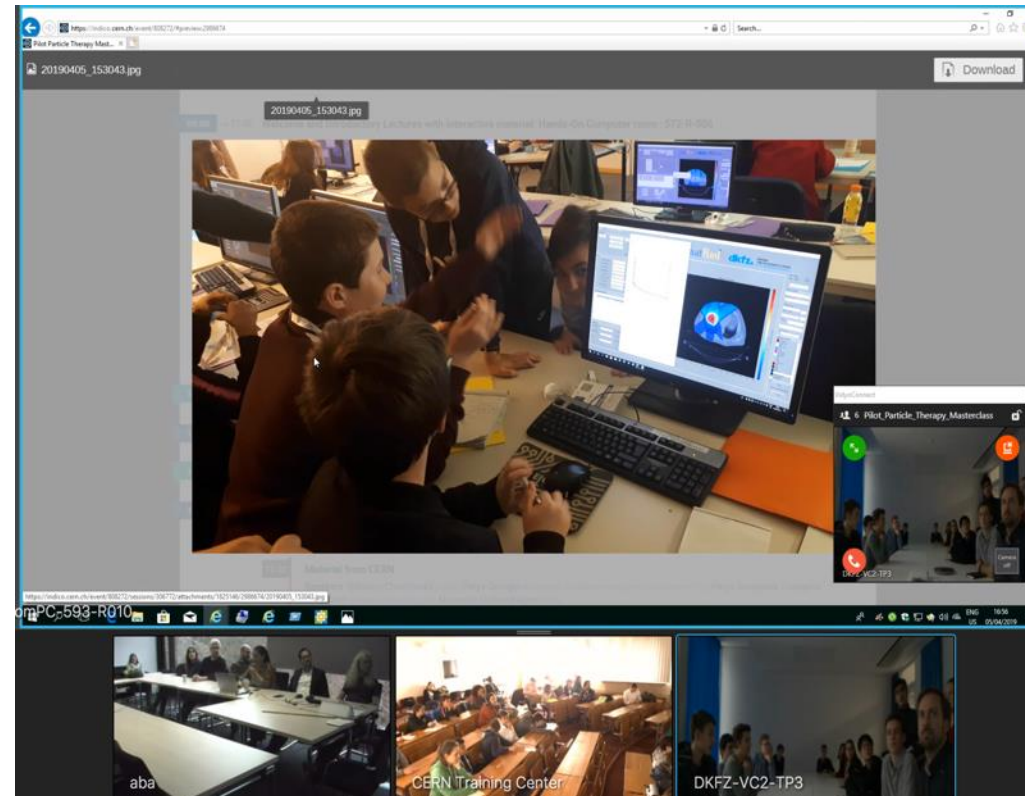
First Local Test: GSI Feb 2019



CERN Open days



International Pilot: CERN, GSI, DKFZ April 2019



First tests positive feedback:

“motivation to contribute to the fight against cancer”

- IMC Steering Group Approval: GSI May 2019
- web pages: Sarajevo Uni students Aug 2019 at CERN

PTMC: Typical MasterClass Day Agenda

Scientists for a day !!

Adapted online/zoom due to covid

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

2-5 institutes per day performing the same programme

LOCAL TIME:

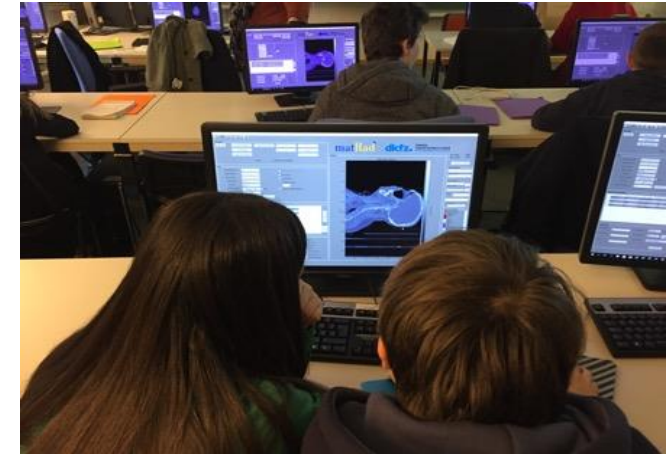
ACTIVITY

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

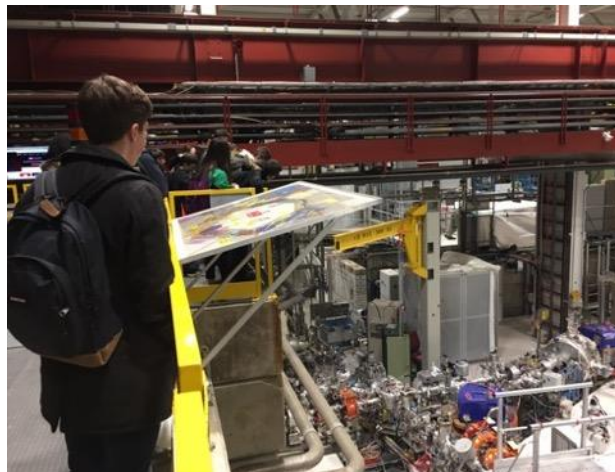
Local: Morning Presentations



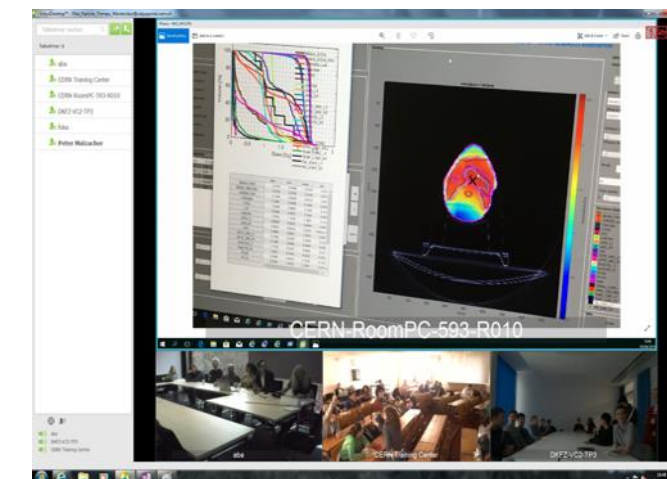
Local: Afternoon Hands-on



Local: Morning Visits



Common: Afternoon at 16:00 Video-Conference



09:30 → 09:45 **Welcome**

[Particle Physics Mas...](#) [Particle Therapy Ma...](#) [PTMC-8march2022_...](#)

09:45 → 10:30 **Introduction to Particle Therapy**

Speaker: Aafke Kraan (INFN, Pisa)

[INFN](#) [INFN website](#) [MasterClass_Particl...](#) [Proton therapy 3 min...](#)

10:30 → 11:00 **Video Visit to CNAO**

[Virtual tour CNAO w...](#) [Youtube Video Visit t...](#)

11:00 → 11:30

Coffee break

11:30 → 12:00 **Particle Therapy at CNAO**

Speaker: Marco Pullia (CNAO)

12:00 → 12:30 **Particle Therapy treatment planning**

Speaker: Aafke Kraan (INFN, Pisa)

[MasterClass_Treatm...](#)

12:30 → 13:30

Lunch Break

13:30 → 14:59 **Hands-on session**

[HandsOn_FirstExerci...](#) [HandsOn_SecondEx...](#) [Handson_ThirdExerc...](#)

15:00 → 16:00 **Discussion of results locally**

16:00 → 17:00 **Video Conference**

Indico page of Video Conference: <https://indico.cern.ch/event/1122748/>

Check List

- Contact school/teachers (during week days) or announce via proper channels and social media (on Saturday)
- Organise room (and lunch) at the institute or zoom
- Lectures in the morning
- Connect to virtual visits to existing therapy centres guided by their experts
- Hands-on in the afternoon
- Prepare students' presentations and discussions of their results locally
- Connect to common video-conference
- Finish with Quiz

PTMC Quiz!

Rank	Name	Score
1	Aa77	6675 / 7 out of 7
2	Michele Colucc	6667 / 7 out of 7
3	Stella	6577 / 7 out of 7

Participants: Damir Skrijelj, Yiota Foka, Fehima



Particle Therapy MasterClass

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

UTC timezone

- Home
- Aim
- Organizers
- Schedule
 - PTMC Registration 2022
 - PTMC Agenda 2022
 - PTMC Schedule 2022
 - PTMC 2022 Statistics
- Material**

Material

Here you can find useful presentations and animations on Particle therapy:

[PTMC in a kit](#) (*all the necessary material for the PTMC in a usb-kit*)

[Demo](#)

[Presentations](#)

[Animations](#)

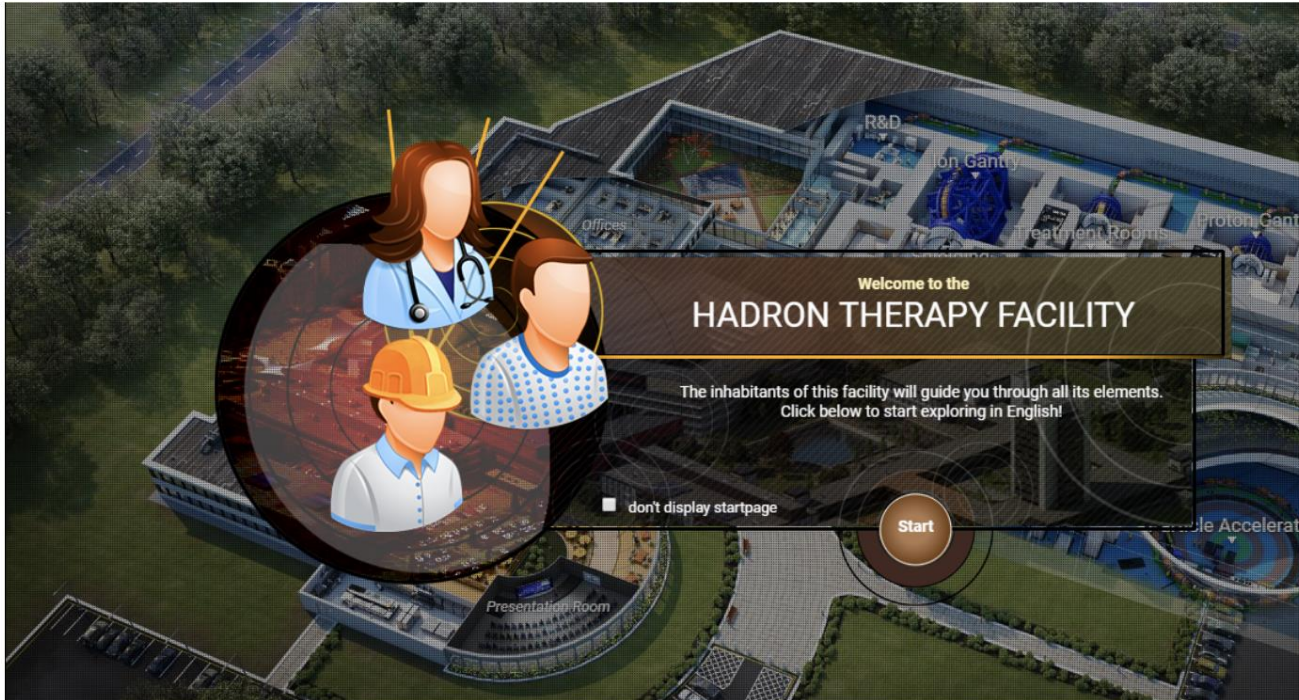
[Posters](#)

- [Instructions in Lithuanian](#)
- [Instructions in N.Macedonian](#)
- [Instructions in Spanish](#)
- [1_ParticleTherapy.pptx](#)
- [2_WhatIsMatrad-AM.pptx](#)
- [3_Installation-AM.pptx](#)
- [4.1_Introduction to simulations-AM.pptx](#)
- [4.2_Liver-AM.pptx](#)
- [4.3_Head 'n' Neck-AM.pptx](#)
- [4.4_Conclusions-AM.pptx](#)
- [Installation_MatRad.mp4](#)
- [Introduction to MatRad_PTMC - AM](#)
- [PTMC.mp4](#)
- [README_Installation_matRad.docx](#)

Therapy Centres

	ENLIGHT Animations, Courtesy of ENLIGHT
	CNAO Video, Courtesy of CNAO
	HIT Video, Courtesy of HIT
	MedAustron Video, Courtesy of MedAustron MedAustron Behind the Scenes, Courtesy of MedAustron

ENLIGHT Interactive Hadron Facility



Participation to Conferences

Presentations and Tutorials to Conferences:

1) CERN/Fermilab school 2021, home page

- International Masterclasses (IMC) session, timetable
- recording of the presentation/slides by Yiota Foka
- recording of the tutorial/material by Aristeidis Mamaras
- presentation

2) APS home page

- International Masterclasses (IMC) session
- Presentation

3) EPS home page

- International Masterclasses (IMC) session
- Presentation
- Proceedings

4) vConf 2021 home page

- International Masterclasses (IMC) session
- Presentation
- Proceedings



Heavy Ion Therapy Masterclass school format

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

HITM school format: inspired by PTMC

Pedagogical elements facilitating learning

- Lectures in the morning
- Hands-on in the afternoon
- Students' presentations and discussions of their results with experts
- Virtual visits to existing therapy centres guided by their experts, supported by web-cam or videos
- Every day started with videos while participants were connecting to give them a visual impression and help them relate what they would listen
- Every day ended with social events, to provide opportunities for networking and entertainment
- Last day dedicated to "future developments" just before the "Careers Fair" in the evening

Highlight:

Hands-on sessions, "do it yourself" guided by experts, with real data and professional tools and methods

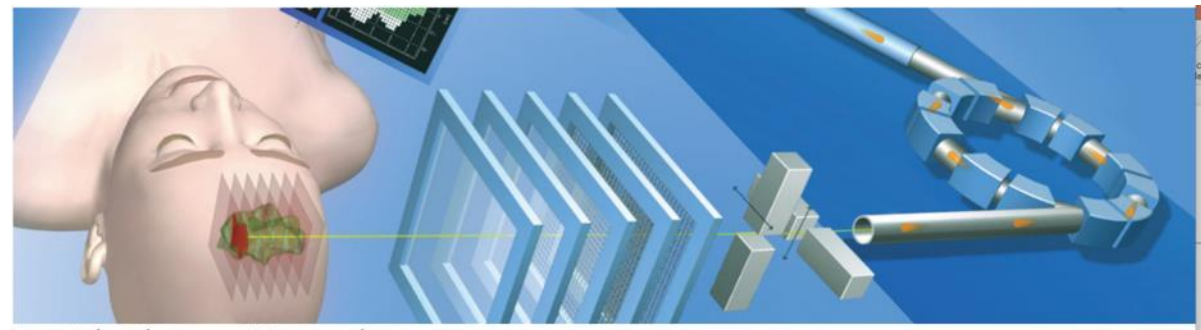


Heavy Ion Therapy Masterclass School

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

Full week course

The HITM school is aimed at university students, 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)



Interesting career paths in emerging fields where often there is lack of specialised personnel

Information about upcoming modern techniques for cancer tumour therapy and new research avenues, where clearly the development of technology and the expertise of research laboratories is crucial.

Virtual visits and video-conferences

Virtual visits during video-conference: GSI research institute, CNAO, MedAustron therapy centers

A screenshot of a Zoom video conference. The main window shows a woman in a black t-shirt with 'UNIVERSE' on it speaking into a microphone in a laboratory setting. A yellow balloon is on the table in front of her. The background features scientific equipment and a 'physics' board. A 'Participants (63)' window is visible at the bottom. A subtitle at the bottom reads: "ed è sufficiente perché esse effettuino i primi giri all'interno del sincrotrone che ha un diametro di 25 metri ed una circonferenza*di 80 metri."

GSI moderators CNAO moderator medAustron moder.

A collage of video conference windows. Top row: Christian Graeff (GSI moderator) with a headset in front of a GSI facility aerial view; Marco Pullia (CNAO moderator) in a laboratory; a medAustron moderator. Middle row: U. Amaldi (HI therapy pioneer) in a large video conference grid. Bottom row: A large video of a particle accelerator facility with the text "it is the heart of the cancer" and a WTV logo; a man in a suit speaking in a laboratory with "OMIS" in the background; and a woman in a video conference window.

Participants of online PTMC in IMC2022

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



PTMC2022 online:
more than 1500 students participated
from 22 countries and 37 institutes during 6 sessions

online and in-person participation

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

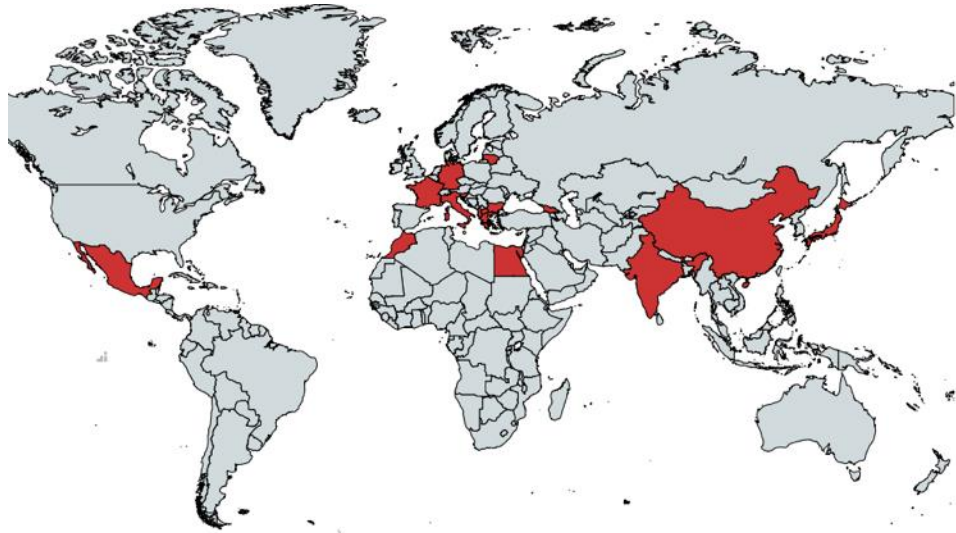
Training sessions planned and upon request

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

Participants of PTMC 2023

PTMC 2023:

9 days, 37 institutes, 20 countries
In person, hybrid, online modes



Contacted by Mayo Clinic Florida
PTMC found on web searching for related material



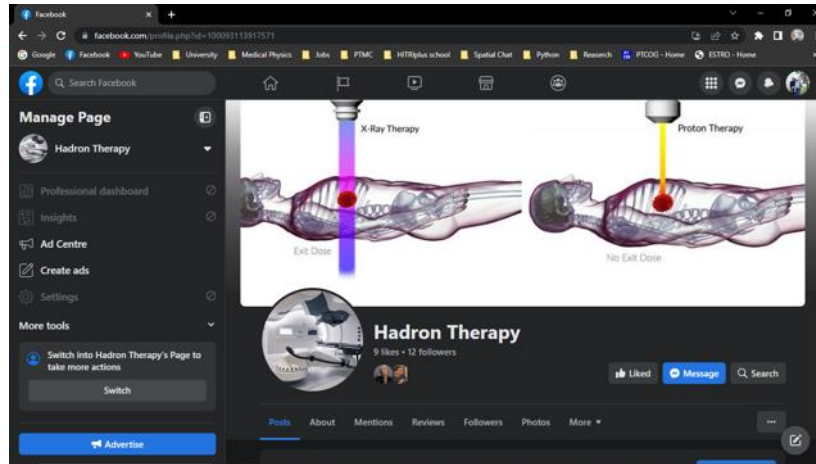
Important Impacts

Tutors:

motivated to search for in depth relevant info, enhancing related knowledge, follow relevant studies, career paths

High-school students: interested to follow STEM studies, medical applications

Extra Contributions to Facebook



Hadron Therapy FB Page:

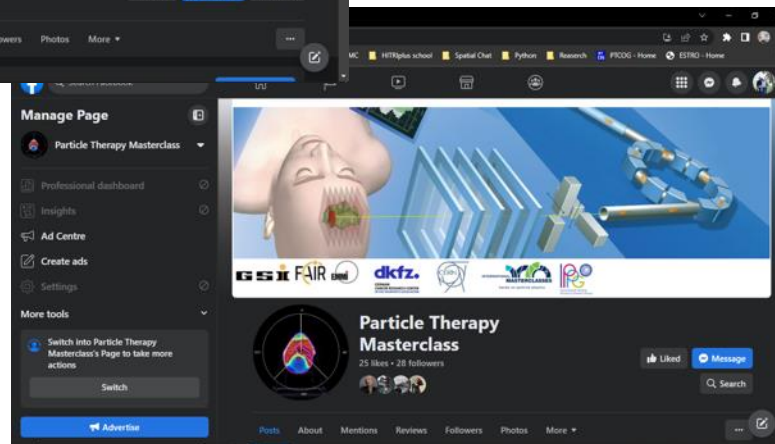
<https://www.facebook.com/profile.php?id=100093113917571>

3rd HITRIplus School FB Page:

<https://www.facebook.com/profile.php?id=100090779213801>

Particle Therapy MasterClass FB Page:

<https://www.facebook.com/profile.php?id=100090138523461>

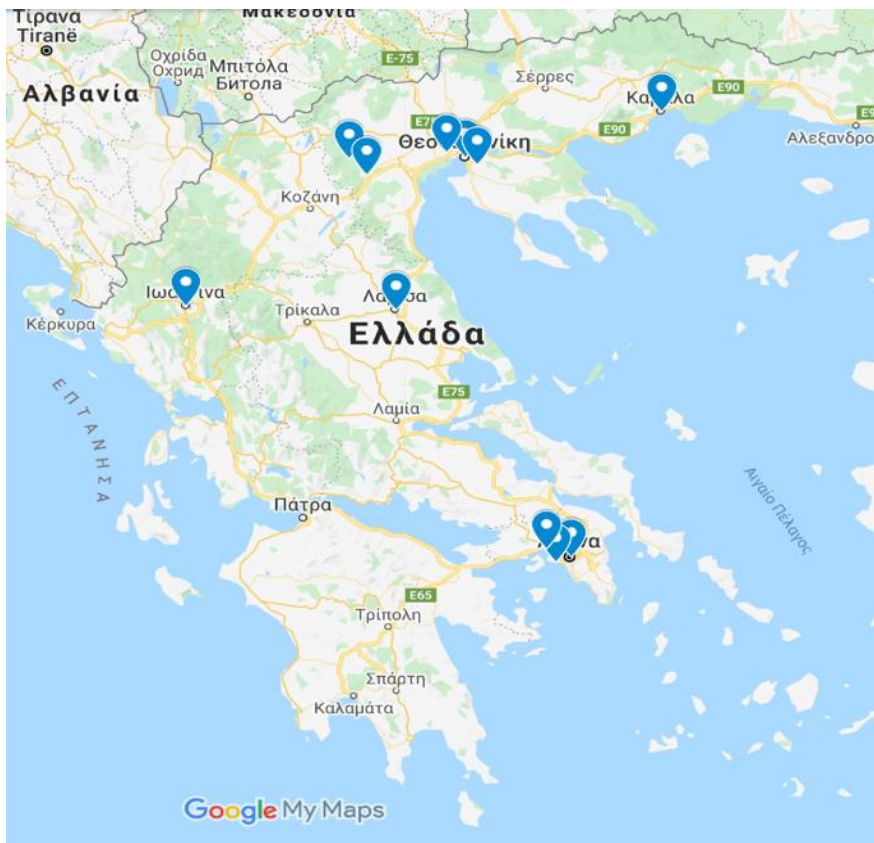


PTMC in Greece

PTMC2021 online: through Library of Veroia

Total of 366 live views

from at least 20 major regions of Greece



PTMC2023 online: 240 participants and in-person 40 students

AUTH uni, Dimokritos research centre, Papageorgiou Hospital, Technopolis.

Publicity: Library of Veroia extended networks and national press



International Particle Therapy MasterClass online in Greece

4 March 2023
AUTH
Europe/Zurich timezone

Enter your search term

Overview
PTMC 2023
Registration
Participant List

ΟΙ ΠΡΩΙΝΕΣ ΟΜΙΛΙΕΣ ΘΑ ΠΡΑΓΜΑΤΟΠΟΙΗΘΟΥΝ ΜΕΣΑ ΑΠΟ ΤΟ ΚΑΝΑΛΙ ΤΗΣ ΚΕΝΤΡΙΚΗΣ ΒΙΒΛΙΟΘΗΚΗΣ ΒΕΡΟΙΑΣ ΣΤΟ YOUTUBE

LINK: <https://www.youtube.com/user/libveria>

- Press Release published in **nation-wide media**
- Post on Facebook resonated with **3,600** people
- Announcement viewed **941** times on website

Aims and expectations

- **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. MSc/PhD in Mexico)**
- **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 its applications:**
 - favourable politicians,
 - evidence-based decision-making society

World-wide reach motivating next generation of scientists

International MasterClasses one day activity; material can be used in different ways, for different occasions



The screenshot shows the homepage of the International MasterClasses website. At the top left is the IPPOG logo (International Particle Physics Outreach Group). The main header features the 'INTERNATIONAL MASTERCLASSES' logo with the tagline 'hands on particle physics'. Below this, a section titled 'International Masterclasses' highlights the '18th International Masterclasses 2022'. A grid of images shows various particle physics experiments: ATLAS, ALICE, CMS, LHCb, BELLE II, MINERvA, Particle Therapy, and Other Physics Masterclasses. A sidebar on the left contains a navigation menu with links to 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, My Country, Physics, In the Media, Published Papers, Archive, Contributors, and Contact Us. A social media link for '@physicsIMC' is at the bottom left.



This screenshot shows a different part of the website, featuring a world map. The map is color-coded, with green indicating countries where MasterClasses have been held or are planned. Labeled countries include Canada, USA, Mexico, Colombia, Ecuador, Peru, Chile, Argentina, Venezuela, Brazil, Uruguay, Sao Tomé and Príncipe, South Africa, Morocco, Egypt, Qatar, Iran, Georgia, India, China, Philippines, Japan, Russia, and New Zealand. A scale bar indicates 5000 km. Above the map, the text reads 'Hands on Particle Physics Masterclasses SCHEDULE 2021'. The URL 'https://physicsmasterclasses.org/' is visible at the top right.

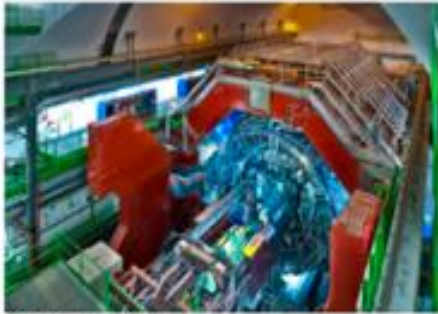
Flagship project of IPPOG, the International Particle Physics Outreach Group

Feedback: example from Serbia, almost 50% of IMC participants enrolled at UNI

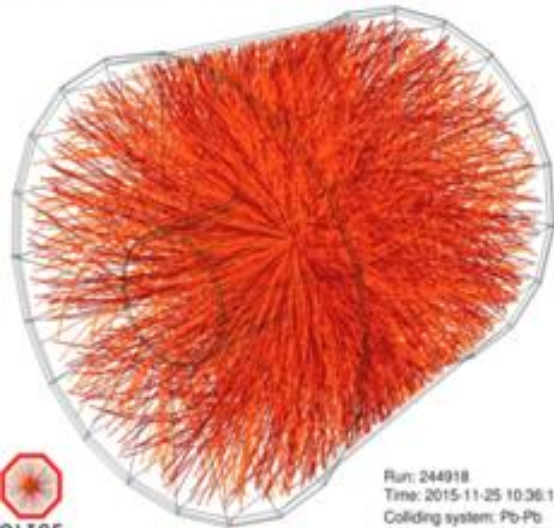
Heavy-ion research and heavy-ion therapy

Pb-Pb at 5.5 TeV
pp at 14 TeV

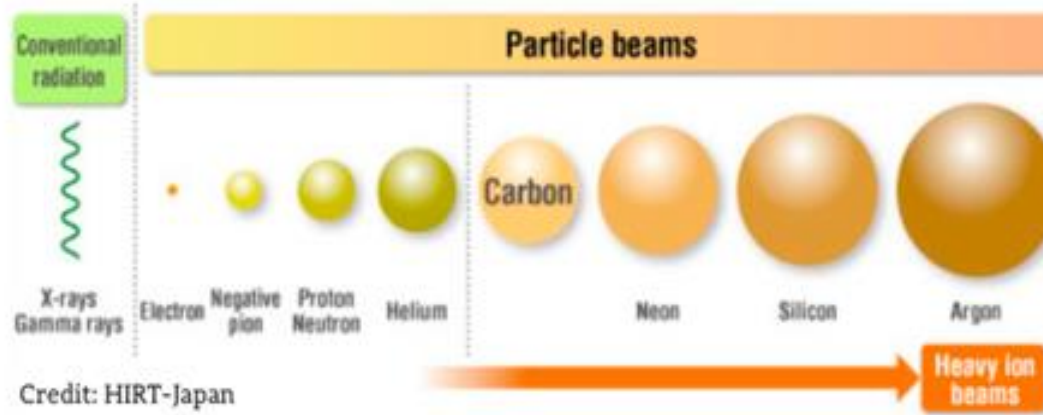
fundamental science
QGP studies



Credit: CERN



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



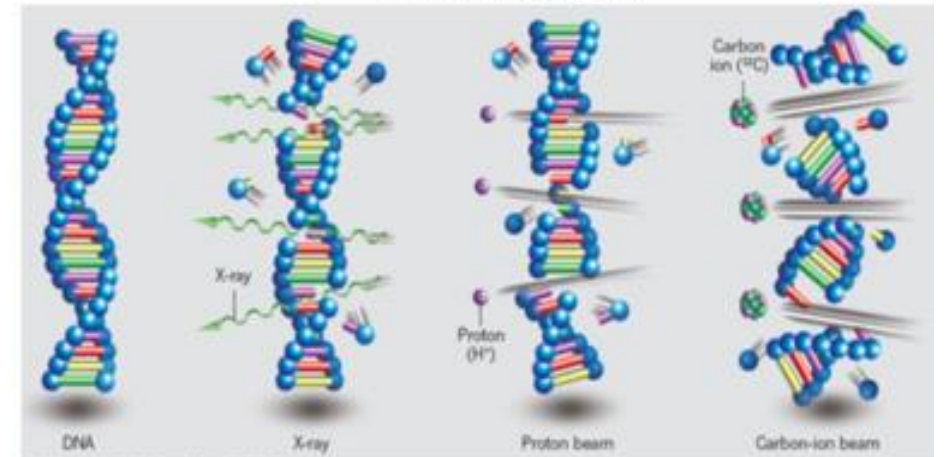
Credit: HIRT-Japan

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

applied science
medicine



Credit: HIT Heidelberg



Credit: T. Nomiva, NIRS Japan

Acknowledgements PTMC 2019 pilot

matRad Developers

Wahl, Niklas
Bangert, Mark
Hans-Peter Wieser

DKFZ Heidelberg

LoC: Wahl, Niklas

Katrin Platzer, Malte Ellerbrock
Noa Homolka Amit Ben Antony Bennan

GSI

LoC: Yiota Foka

GSI Biophysics:
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GSI ALICE, EMMI :
Ralf Averbeck, Malzacher, Peter
GSI IT :
Thorsten Kollegger, Behnert, Katharina
Osdoba, Sascha

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

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Acknowledgements PTMC

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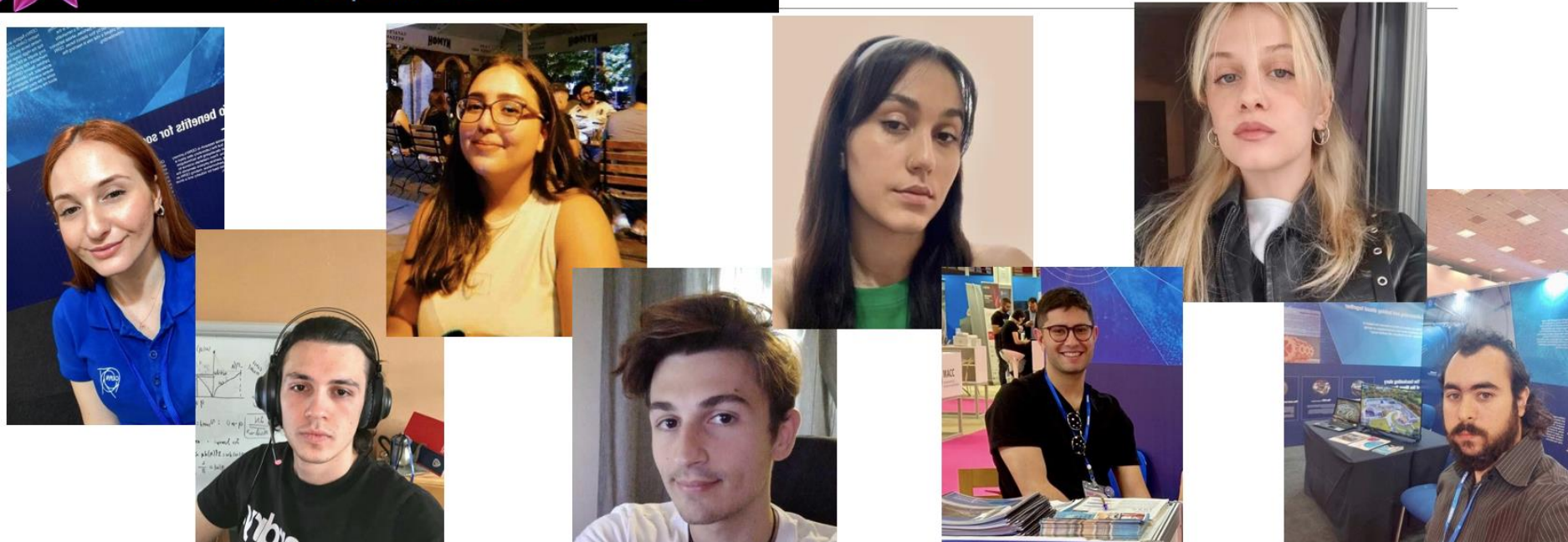
Sponsors :



CERN (staff and users)



Thanks to the Assistants Team



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An aerial architectural rendering of a modern building complex. The building features multiple levels with green roofs and large glass facades. A central courtyard area is visible, containing a blue pool or courtyard with a red structure. The surrounding area includes trees, a road with cars, and a bus. The text is overlaid in the center of the image.

Support preparation of
next generation experts
for next generation facilities
for research and therapy
of cancer tumours with ions



Thank you for your attention !

"This material was prepared and presented within the HITRIplus **Specialised Course on Heavy Ion Therapy Research**, and it is intended for personal educational purposes to help students; people interested in using any of the material for any other purposes (such as other lectures, courses etc.) are requested to please contact the authors (Yiota Foka yiota.foka@cern.ch).