IPPOG and spin-offs from nuclear physics

Yiota Foka (GSI/CERN)

28th IPPOG meeting

25-27 November 2024, CERN

Motivation

Adding “nuclear” in the title

of ICHEP presentation

IPPOG and spin-offs
from particle and nuclear physics

Yiota Foka (GSI/CERN)

on behalf of

IPPOG*

IMC Steering Group

WG Outreach of Applications for Society

*IPPOG International Particle Physics Outreach Group
IPPOG Author-List: https://cds.cern.ch/record/2903278

IPPOG activities on benefits for society

Contacts:
yiota.foka@cern.ch

International Particle Physics Outreach Group

Tangible examples of connecting fundamental research and everyday life

Working Group

Outreach of Application for Society

https://ippog.org/for-ippogers/outreach-application-society

Contacts:
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barbora.gulejova@cern.ch

This working group focuses on collecting and making available engaging stories about concrete examples of successful applications for the benefit of society from (particle) physics and related sciences. Out of a wide range of working documents and even more ideas, the stories available so far are:

- Unraveling Cosmic Mysteries: The collaboration between International Space Station and CERN
- Superconductivity – quantum mechanics at work
- Medipix detectors, from colour X-ray imaging to education
- Muography - Invisible particles help to reveal invisible structures
- Searching for hidden cavities inside the Sun pyramid in Mexico
- Einstein's Relativity in Action – the GPS Navigation System knows it
- Positron Emission Tomography: Can crystals used in particle detectors save lives?
- Accelerators to reduce pollution of maritime traffic

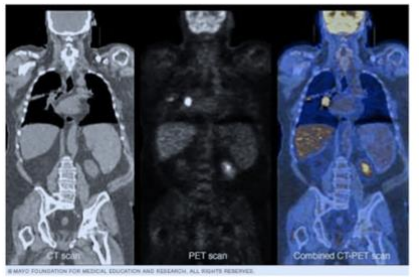
Resently compiled, outcome of Hackathons

Focus on medical applications

- PTMC
- 25% of stories

Particle interactions with matter
in the real-world QCD matter at low energies

PET

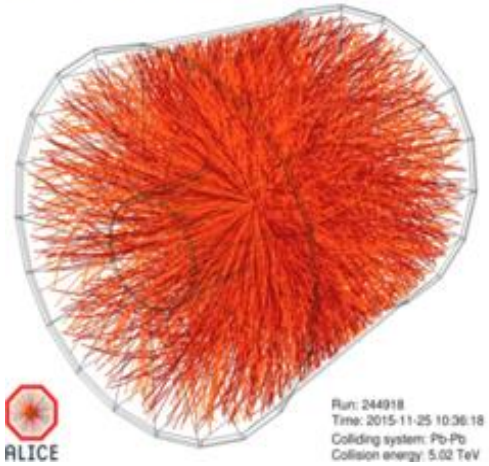


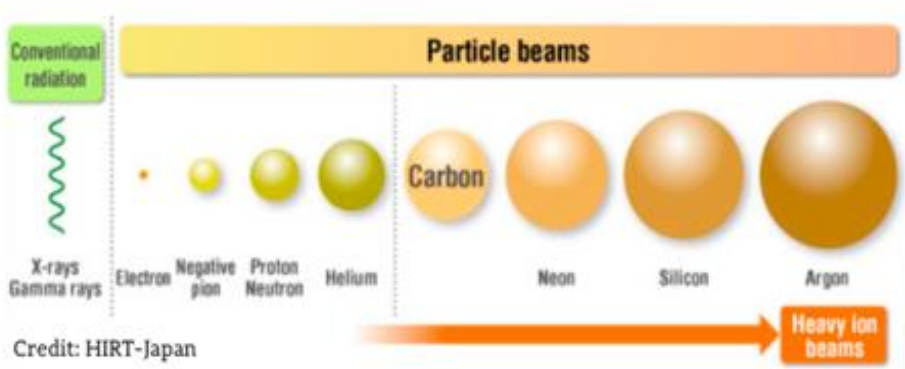
MEDIPIX

Heavy-ion research and heavy-ion therapy

Pb-Pb at 5.5 TeV
pp at 14 TeV
fundamental science
QGP studies

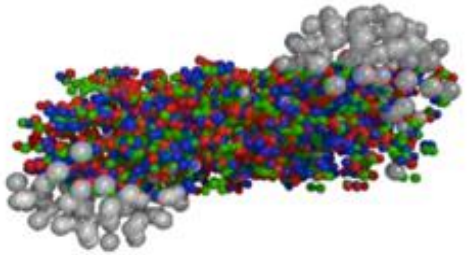
Credit: CERN





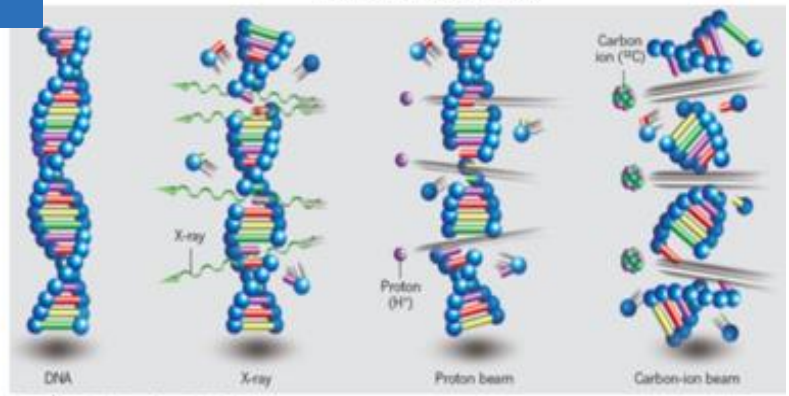
Credit: HIRT-Japan

What Physics has to do with Medicine?



88-430 MeV/u carbon
50-221 MeV/u protons
applied science
medicine

Credit: HIT Heidelberg



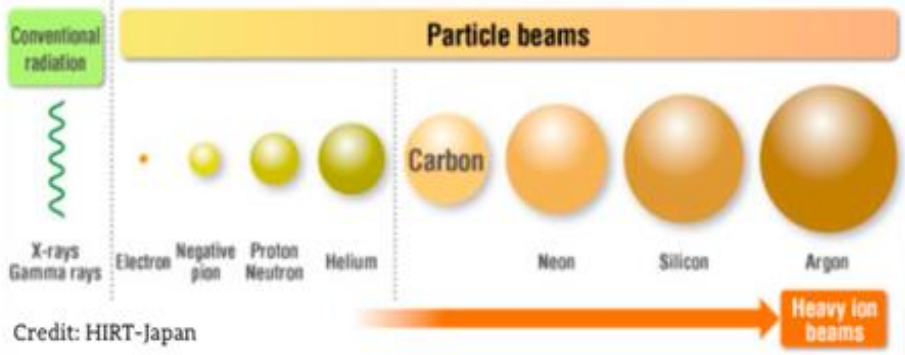
Credit: T. Nomiya, NIRS Japan

An example of applications of fundamental research for the benefit of society

Heavy-ion research and heavy-ion therapy

Pb-Pb at 5.5 TeV
pp at 14 TeV
fundamental science
QGP studies


Credit: CERN



88-430 MeV/u carbon
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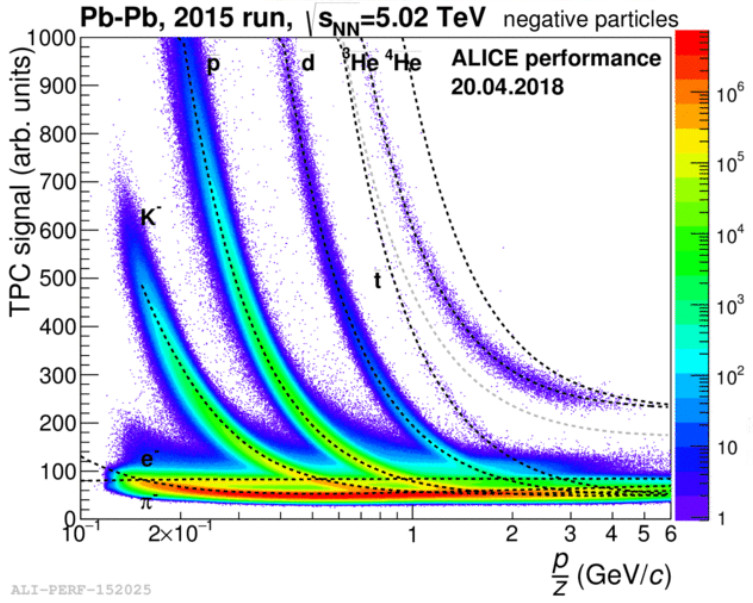
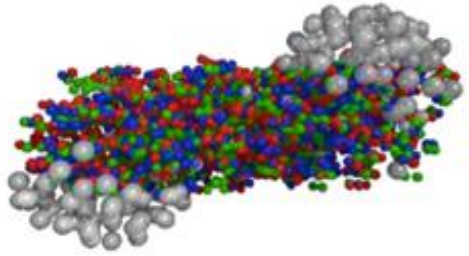
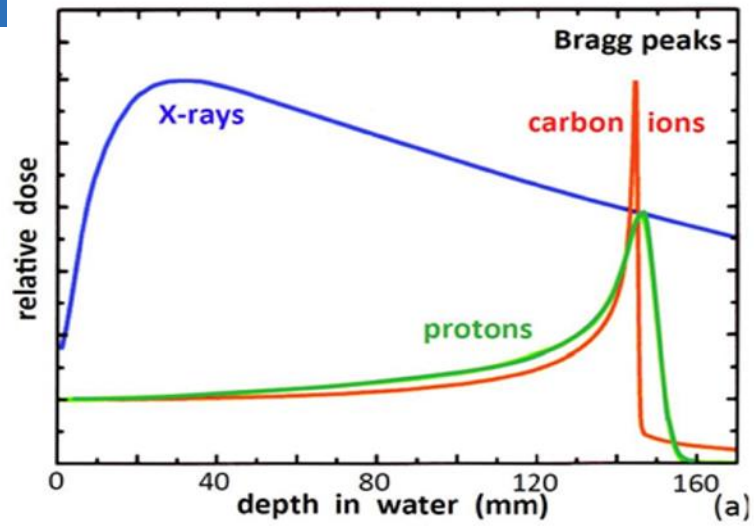
What Physics has to do with Medicine?



From Bethe Bloch ionization for PID



fundamental properties
of particles
and their interaction with matter
in the service of society



to Bragg peak for cancer therapy

International Particle Physics Outreach Group

What are the benefits for society?

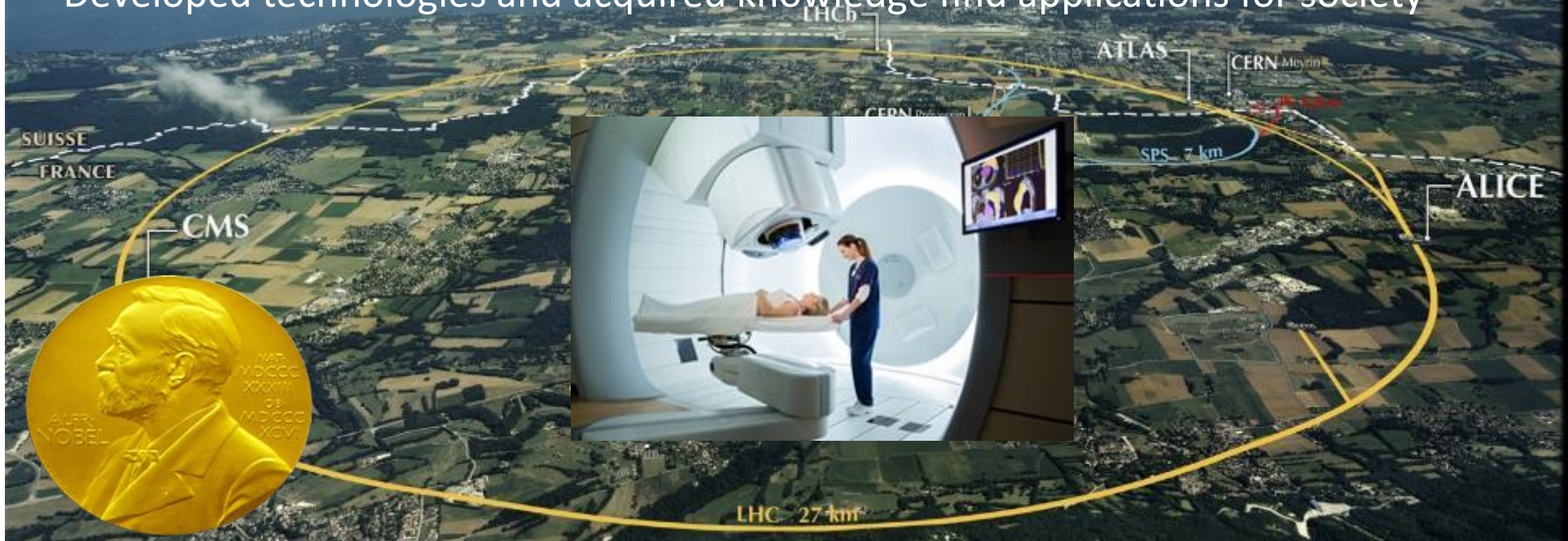
The developed accelerator technology is used for cancer research and therapy

Innovative technologies developed for future CERN projects find already applications in medicine

From Fundamental Physics Research….

…..to Medical Applications

Mission and mandate of research institutes: fundamental research
Developed technologies and acquired knowledge find applications for society



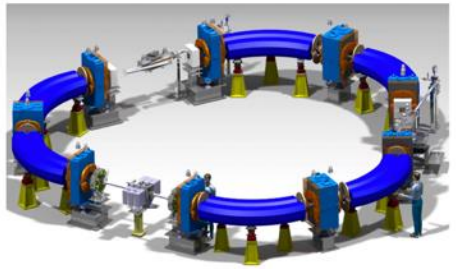
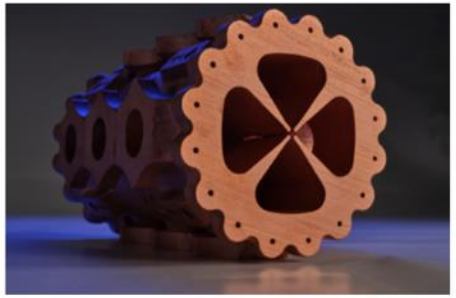
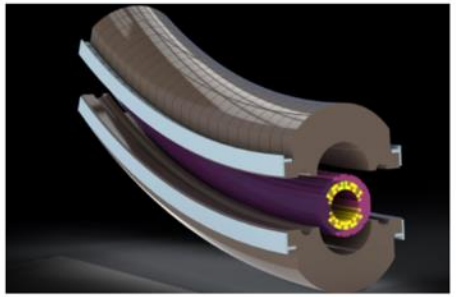
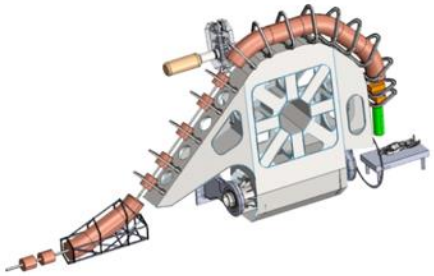
Accelerators for Health

Next Ion Medical Machine Study Group Developments

nimms

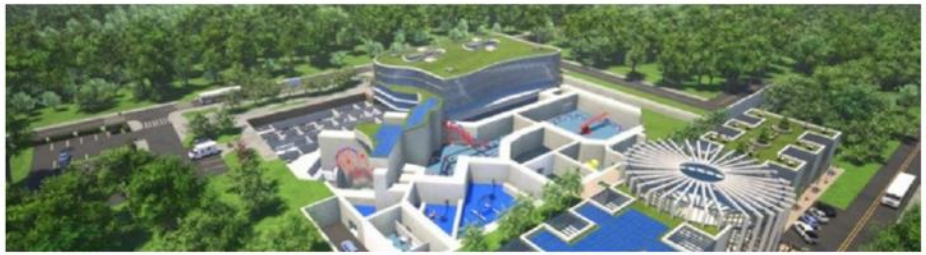
HOME ABOUT TECHNOLOGICAL R&D INITIATIVES TRAINING PUBLICATIONS NEWS

Our Technological R&D

Synchrotron Accelerators	Linear Accelerators	Superconducting Magnets	Superconducting Gantries
HeLICS (Helium Synchrotron), Carbon Synchrotron, and Superconducting Carbon Synchrotron	Innovative LINAC technologies for treatment and radioisotope production	Design and prototyping of novel, compact curved magnets	360° beam delivery with EuroSig & GaToroid

Our Supported Initiatives

APTCB	SEEIIST
Advanced Particle Therapy Center for the Baltics	South East European International Institute for Sustainable Technologies

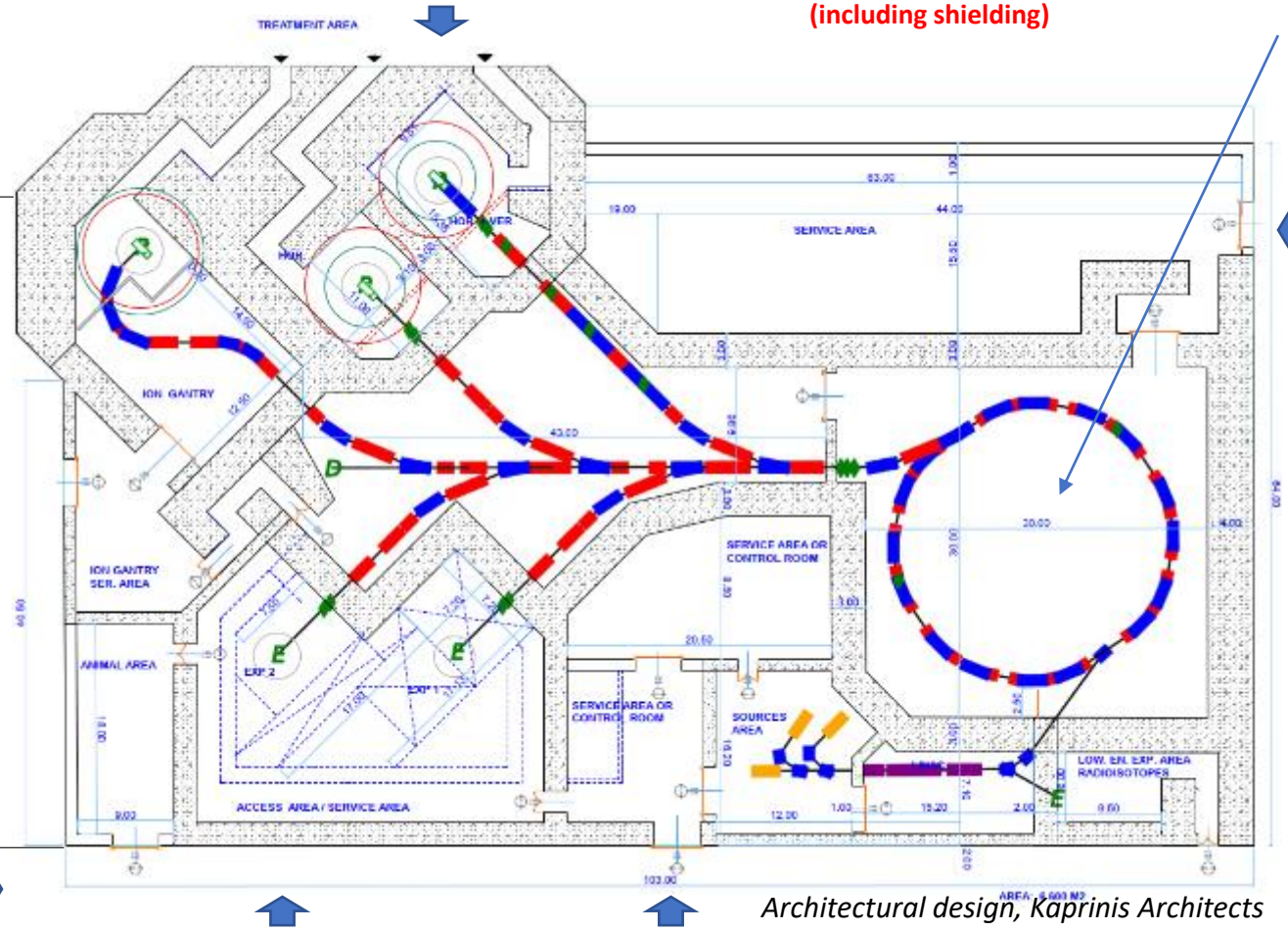
NIMMS supported designs:
1. SEEIIST C-ion therapy and research facility

Design to be presented in a CERN Yellow Report in preparation

Access for therapy

Total 5,400 m^2
(including shielding)

The synchrotron can be replaced by an SC version if R&D successful



Equipment room and access to synchrotron

Area for future expansion

Target for isotope production

Access for animal testing

Architectural design, Kaprinis Architects

Reconfigurable experimental room

Access to experimental room and linac

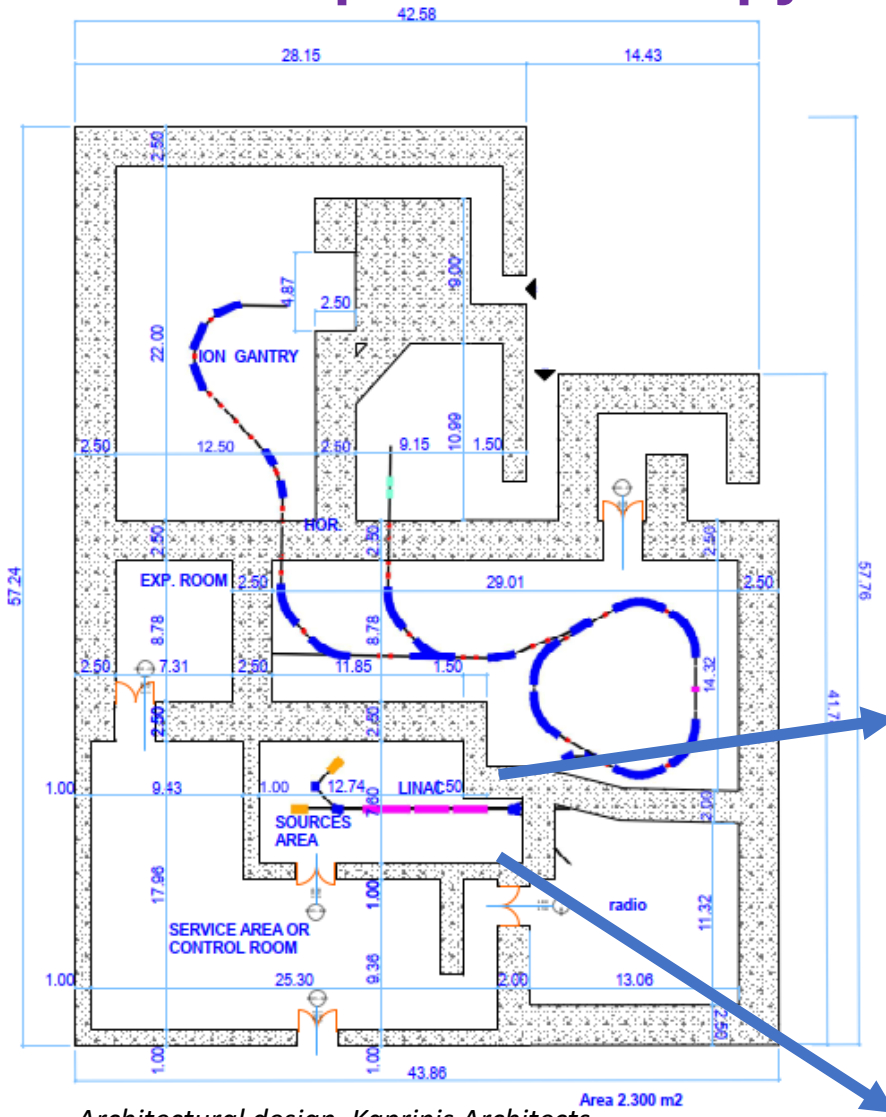
complete modern facility for research and therapy with ions up to Oxygen

NIMMS supported designs:
2. Compact research and therapy facility with p and He beams

CERN Baltic Group

Draft concept paper
Advanced Particle Therapy Center for the Baltic States

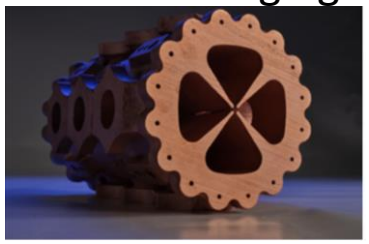
Advanced particle therapy facility for the Baltic states

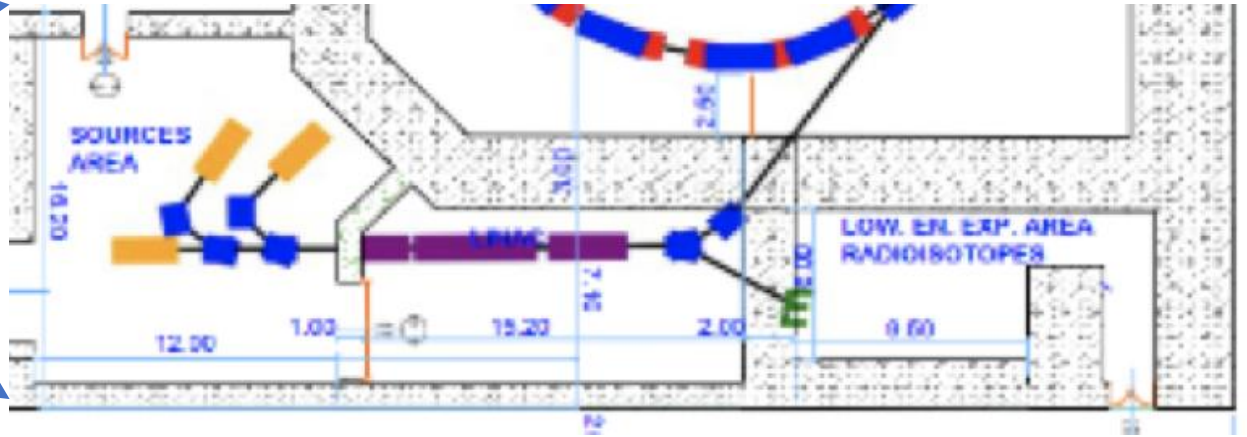


Architectural design, Kaprinis Architects

Both facility layouts include RI production:
- in the same facility
- production close to where it will be used

IPAC22: Vretenar, M., Mamaras, A., Bisoffi, G., Foka, P. (2022). "Production of radioisotopes for cancer imaging and treatment with compact linear accelerators."





NIMMS supported designs:

Success !

IFIGENEIA: Excellence Hub, Widening Era

Innovative Facility for Isotope GENeration with Efficient Ion Accelerator

IFIGENEIA: Innovative Facility for Isotope GENeration with Efficient Ion Accelerator

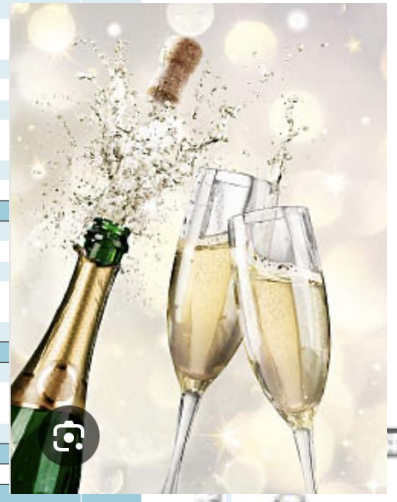
HORIZON-WIDERA-2023-ACCESS-07-01, CSA — **Excellence Hubs**

#@APP-FORM-HECSA@#

List of participants

#*	Organisation Name	Country	Type
	Greek Hub		
1	**ARISTOTELIO PANEPISTIMIO THESSALONIKIS (AUTH)**	**EL**	**UNI**
2	REGION OF CENTRAL MACEDONIA (RCM)		
3	BIOKOSMOS MEDICAL SCIENTIFIC EQUIPMENT COMMERCIAL INDUSTRY SOCIETE ANONYME (BIOKOSMOS)		
4	Archaeological Museum of Thessaloniki (AMTH)		
5	ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS (CERTH)		
6	GENIKO NOSOKOMEIO PAPAGEORGIOU (GNP)		
7	MANAGEMENT AND ADMINISTRATION AUTHORITY OF TECHNOPOLIS THESSALONIKIS SA (TPOLIS)		
8	NATIONAL CENTER FOR SCIENTIFIC RESEARCH "DEMOKRITOS" (NCSRD)		
9	ALEXOPOULOS SPYRIDON TOU IOANNOU (AMOLDS)		
	Slovenian Hub		
10	University of Ljubljana (UL)		
11	INSTITUT JOZEF STEFAN (IJS)		
12	COSYLAB LABORATORIJ ZA KONTROLNE SISTEME DD (COSYLAB)		
13	SLOVENSKO INOVACIJSKO STICISCEEVROPSKO GOSPODARSKO INTERESNOZDRUZENJE (SIH)		
14	Slovenian Academy of Engineering (IAS)		
	Cyprus Hub		
15	RTD TALOS LIMITED (TALOS)		
16	UNIVERSITY OF CYPRUS (UCY)		
17	PAGKYPRIOS SYNDESMOS KARKINOPATHON KAI FILON 1986 (PASYKAF)		
18	ORGANISMOS KRATIKON YPIRESION YGEIAS (SHSO)		
	Mentoring partners		
19	UNIVERZITET U SARAJEVU (UNSA)		
	Horizontal Partners		
20	GSI HELMHOLTZZENTRUM FUR SCHWERIONENFORSCHUNG GMBH (GSI)	**DE**	NGO
21	DEUTSCHES KREBSFORSCHUNGSZENTRUM HEIDELBERG (DKFZ)	**DE**	RTO
22	ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE (CERN)	**CH**	RTO
	Supporting Partners with Letter of Intent		
1	MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATION	**SI**	PUB
2	South East European International Institute for Sustainable Technologies - SEEIIST	**CH**	NGO
3	Web2Learn	**EL**	SME
4	Verlab Research Institute for Biomedical Engineering, Medical Devices and AI	**BiH**	RTO
5	UNIVERSITETI I TETOVES	**NM**	UNI
6	CNE TECHNOLOGY CENTER	**CY**	SME
7	University of Kragujevac Faculty od Science	**SRB**	UNI
8	Chamber of Commerce and Industry of Slovenia	**SI**	NGO
9	State Regulatory Agency for Radiation and Nuclear Safety	**BiH**	PUB
10	ZDRUŽENJE EUROPA DONNA SLOVENIJA	**SI**	NPO
11	Hellenic Cancer Federation (ELLOK)	**EL**	NGO
12	Test Infrastructures and Accelerator Research Area (TIARA) Consortium	**EU**	-

Both facility layouts include RI production:
- in the same facility
- production close to where it will be used



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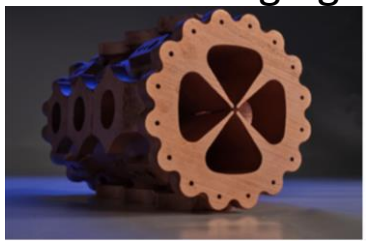


Particle Therapy MasterClasses

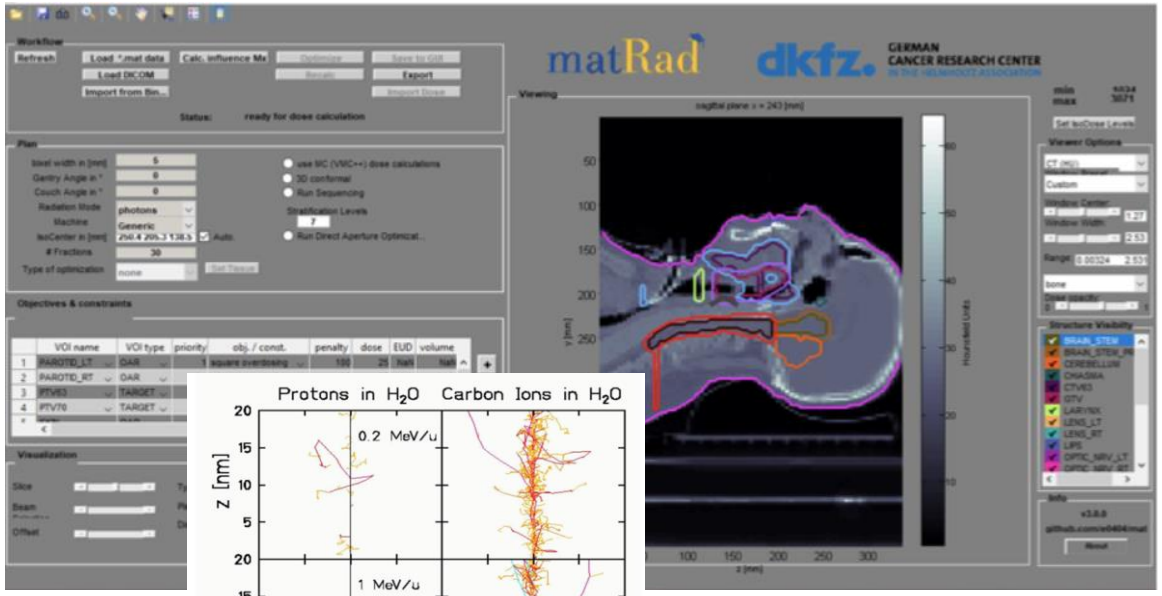
as tool for capacity building

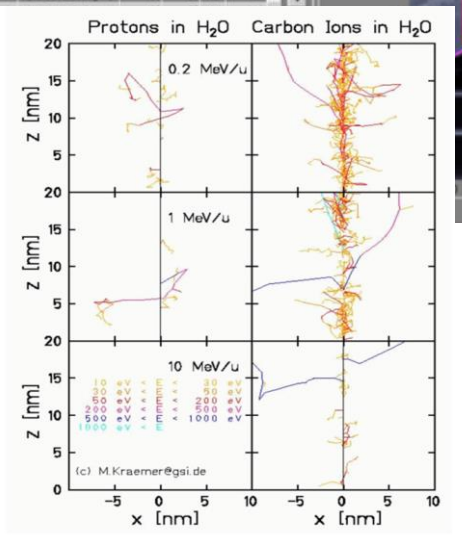
in a Work Package dedicated to mentorship

Particle Therapy Multidisciplinary Field

A broad multi-disciplinary field:

the accuracy of ion beams has to be matched by properly locating the target





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

Lectures adapted to the expertise of institutes

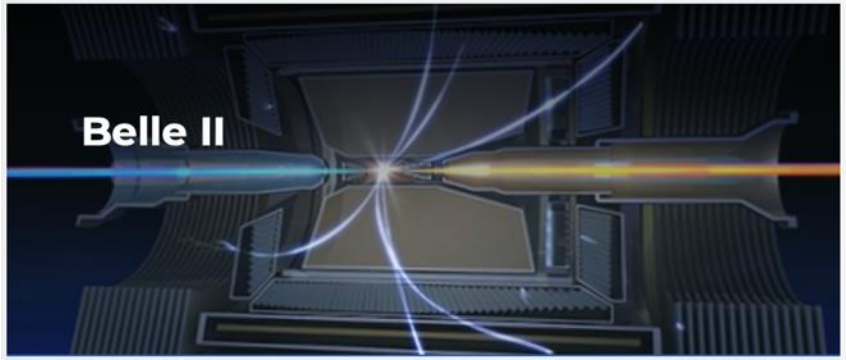
INCLUSIVITY MATTERS !

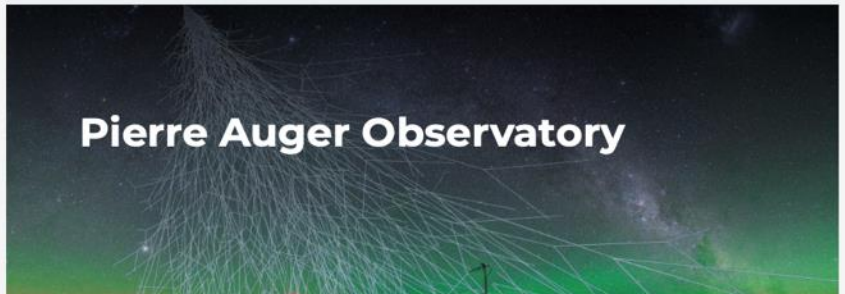
International Particle Physics Outreach Group

About Resources Activit

International Masterclasses

INCLUSIVITY MATTERS !





INTERNATIONAL MASTERCLASSES

hands on particle physics

Feedb

Participants Response

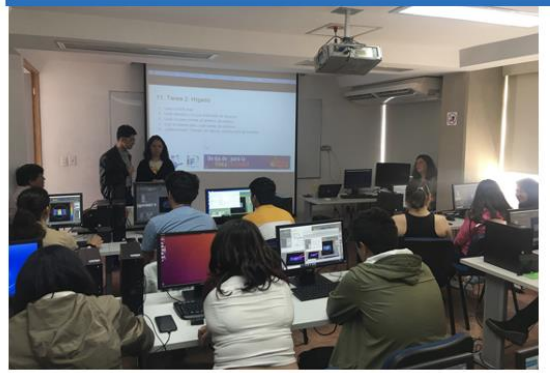
Studying Physics: possibility to do something

“applied” and “useful to society”

We could not imagine what physics has to do with medicine,
that research institutes such as CERN can contribute to medical applications



“In the morning we could not imagine that we would perform treatment planning by ourselves in the afternoon”

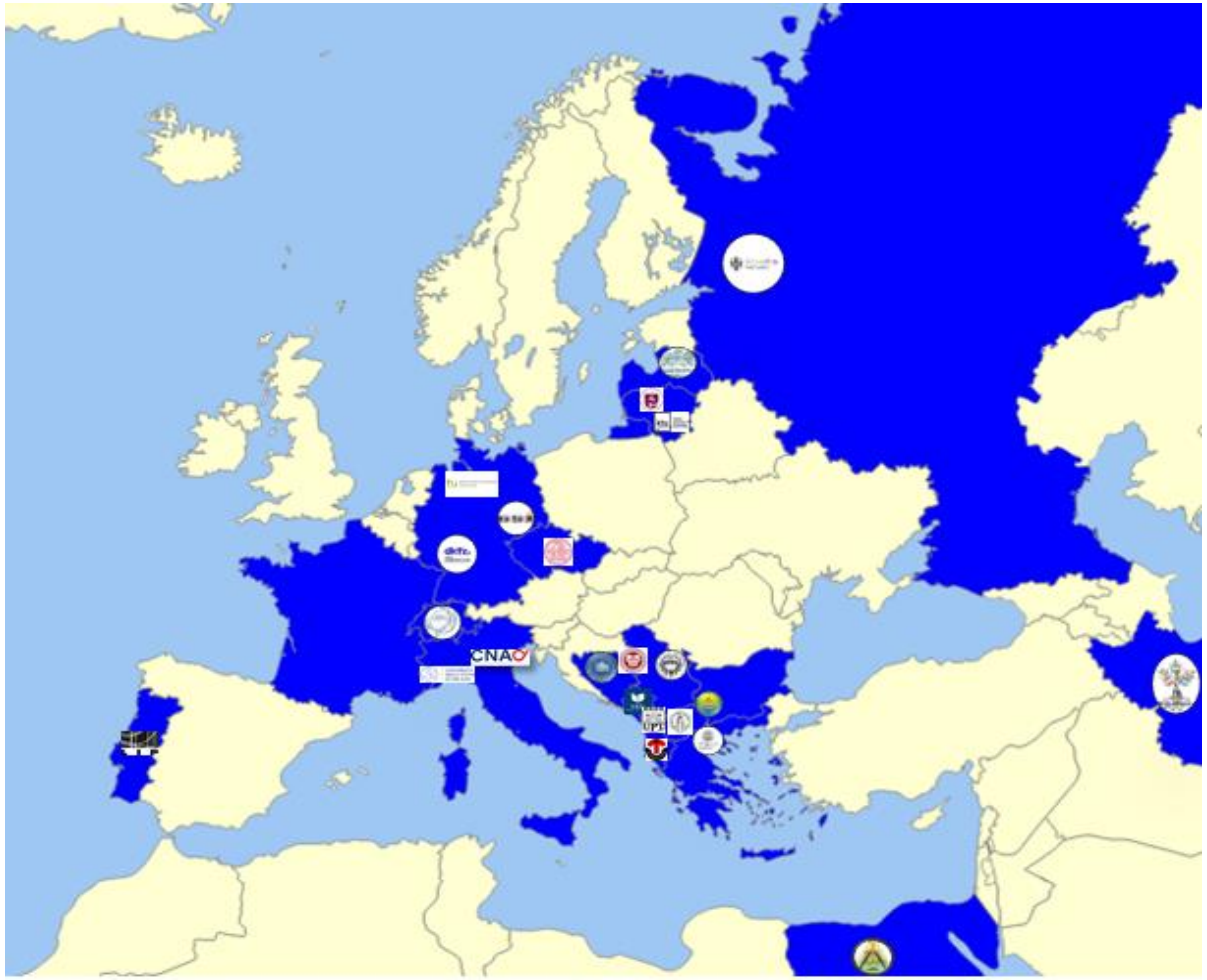


First PTMC in IMC2020

Mexico 2nd March 2020, then online due to covid

Participants of online PTMC in IMC2021

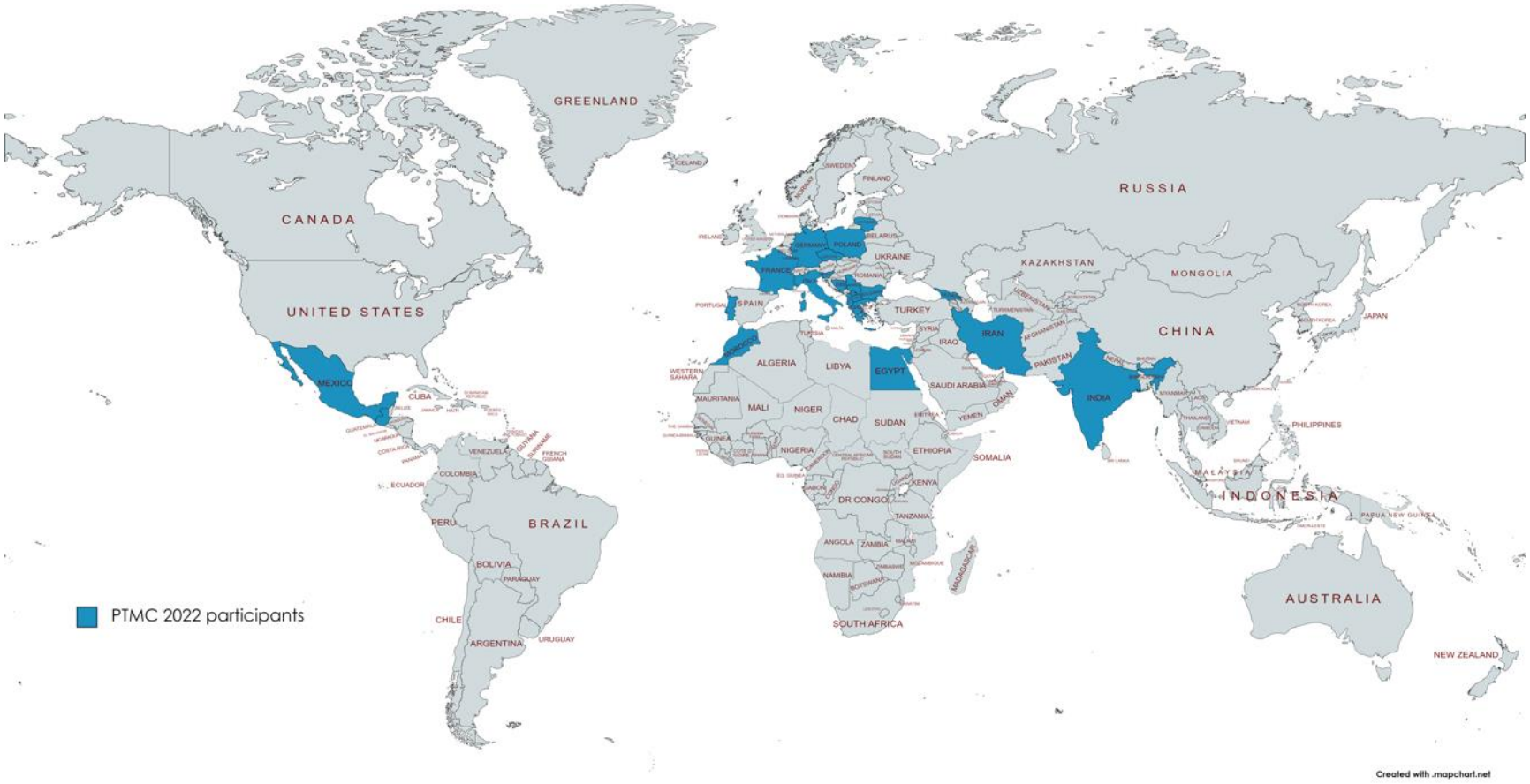
https://indico.cern.ch/e/PTMC



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

Participants of online PTMC in IMC2022

https://indico.cern.ch/e/PTMC



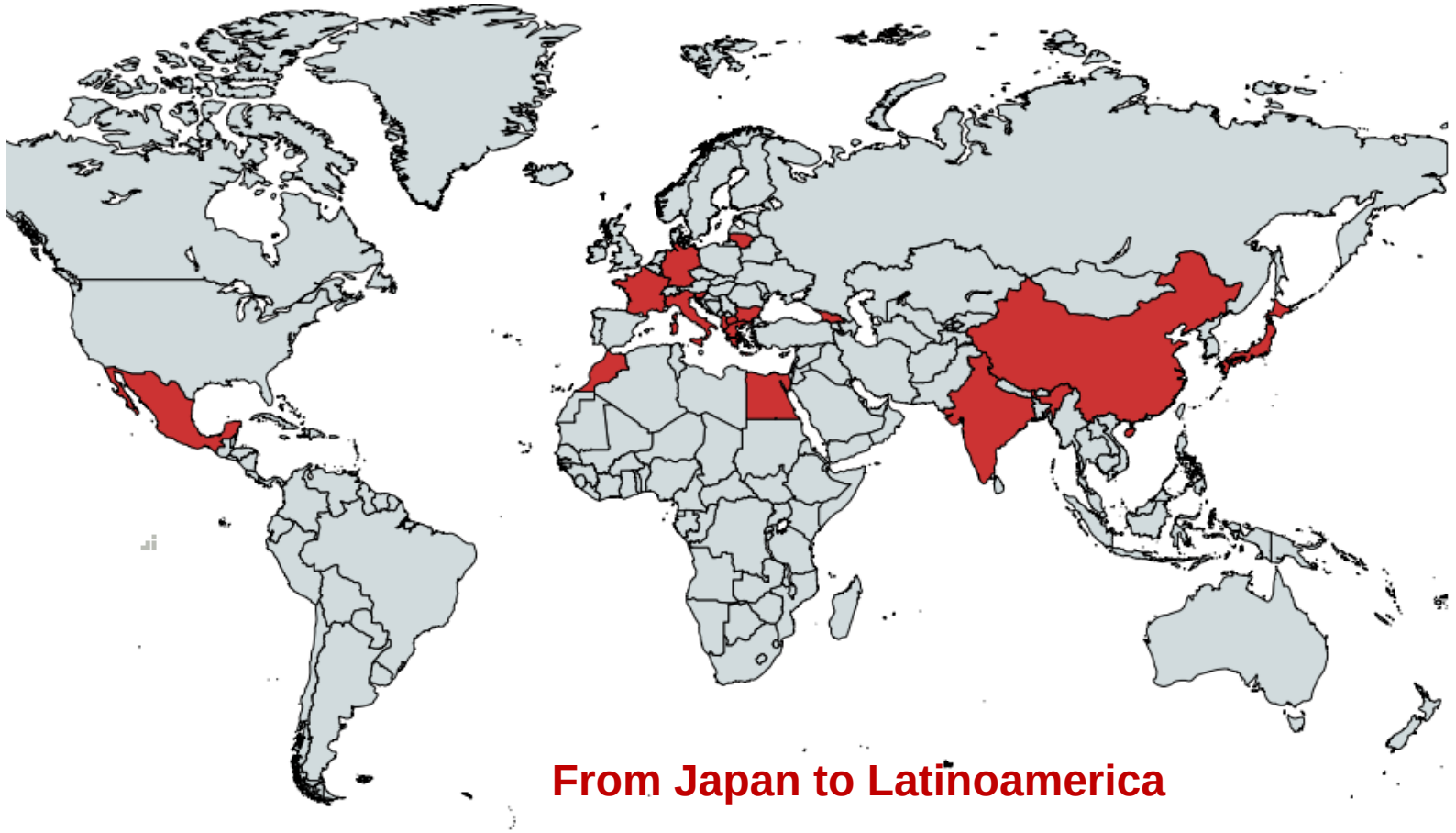
PTMC2022 online/hybrid:
6 sessions, 1500 students
from 22 countries and 37 institutes

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 hybrid PTMC in IMC2023

https://indico.cern.ch/e/PTMC



From Japan to Latinoamerica

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

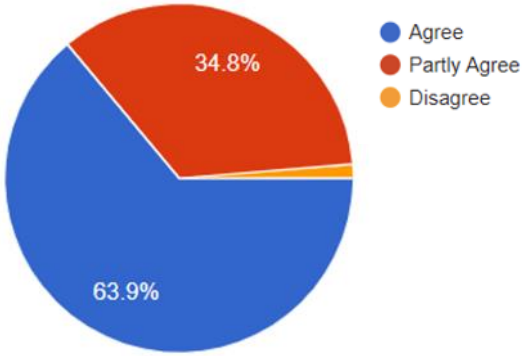
web pages with agendas of every institute with material
in different languages, publicly available for future events

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

Participants of hybrid PTMC in IMC2024

https://indico.cern.ch/e/PTMC

Statistics of 22 out of 47 institutes:
Total: 1567
428 female, 430 male
17 in person, 5 hybrid



Italy Uni Piemonte Orientale
Italy Bologna
Italy Pavia Uni AND INFN
Italy Torino
Italy Cosenza. Uni AND INFN
Italy Milano UNIMI AND INFN

PTMC2024 in person/online/hybrid:
8 sessions, more than 1500 students
from 22 countries and 47 institutes

Some institutes had 2 sessions in-person and online

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

International Particle Physics Outreach Group

INTERNATIONAL MASTERCLASSES
hands on particle physics

Took it a step further !

A full week MasterClass school

inspired by the PTMC format

within the HITRIplus EU funded project

Advanced material
for uni students and up to professionals

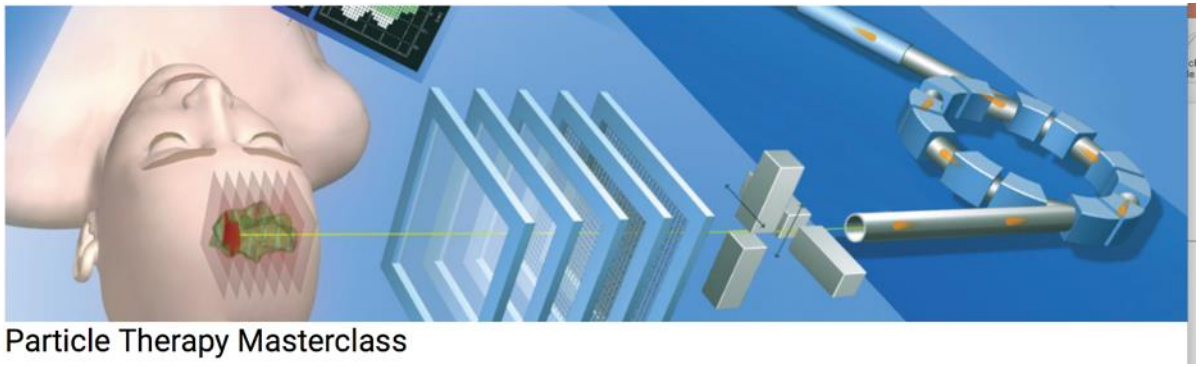
https://indico.cern.ch/e/HeavyIonTherapyMasterClass

HITRIplus
Heavy Ion Therapy Research Integration

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

Heavy Ion Therapy Masterclass School

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



Particle Therapy Masterclass

https://indico.cern.ch/e/PTMC

Full week course

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

One day activity

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

Future tutors

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**

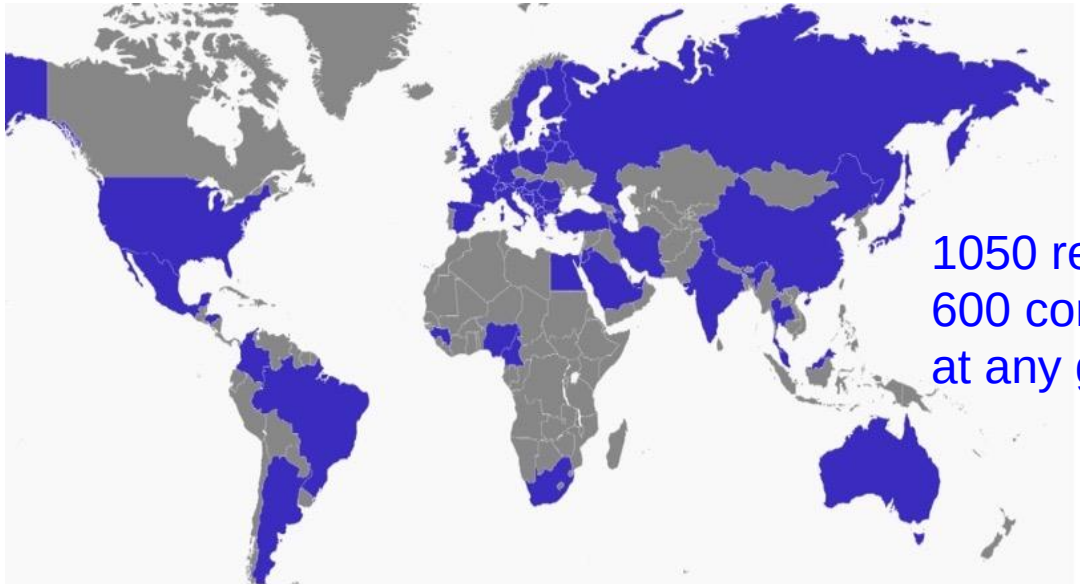
Information about upcoming modern techniques for cancer tumour therapy and new research avenues, where clearly **the development of technology and the expertise of research laboratories is crucial**

HITRI
Heavy Ion Therapy Research Integration

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

World-wide reach motivating next generation of scientists

HITRIplus full week heavy-ion therapy masterclass school



1050 registrants,
600 connections
at any given time

International MasterClasses one day activity

Power of Networks !

HITRI
Heavy Ion Therapy Research Integration

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

Train the Trainer

HITRIplus
Heavy Ion Therapy Research Integration
www.hitriplus.eu

SEE ST
South East European International Institute for Sustainable Technologies

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

Commissione Europea

HADRON THERAPY SYMPOSIUM

STATUS AND PERSPECTIVES, PLANS FOR NEXT GENERATION FACILITIES

18 - 21 October 2024
Thessaloniki

International and Local Organising Committee:

Yiota Foka (GSI/SEEIIST) chair
Peter Gruebling (SEEIIST)
Sandro Rossi (CNAO)
Nicholas Sammut (Uni. Malta)
Maurizio Vretenar (CERN)
Panagiotis Bamidis (AUTH/AHEPA) co-chair
Emmanouil Papanastasiou (AUTH/AHEPA)
Maria Bigaki (Papageorgiou/IAEA) co-chair
Antonio Capizzello: (AHEPA)
Stefanos Triaridis (AUTH/AHEPA)
Kosmas Badiabas (Papageorgiou)
Maria Topalidou (Papageorgiou)

Scientific Committee:

Piero Fossati (MedAustron)
Marco Durante (GSI)
Fabian Eberle (MIT)
Angelica Facoetti (CNAO)
Yiota Foka (GSI/SEEIIST)
Semmi Harrabi (HIT)
Ester Orlandi (CNAO)
Joao Seco (DKFZ)
Maurizio Vretenar (CERN)

Treatment Planning MasterClass 21 October 2024

Monday 21 Oct 2024, 08:00 → 19:30 Europe/Zurich
Venue Aristotle University Research Dissemination Center (KEDEA)
Yiota Foka (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Description Webcast Link: https://webcast.cern.ch/view/wyxgrrnoendlmwbp/1431627

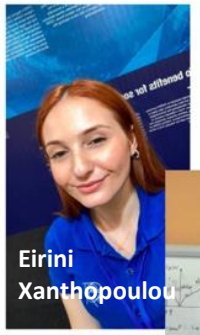
Scientific Assistants: Elpida Theodoridou (Uni Malta/DKFZ) chair, Nermine Muradi (Uni Tetova) chair, Alexandros Puckett Anastasiou (Uni Patra), Athanasios Athanasiou (AUTh), Christina Litou (AUTh), Dafni Giannakeri (AUTh), Effrosyni Chatzivasiloglou (AUTh), George Ntinas (AUTh), Maria Eleni Bozika (AUTh), Maria Vagianni (AUTh), Emina Huko (UNSA), Feriha Babic (UNSA), Naida Ustavdic (UNSA), Medina Dugonjic (UNSA), Danis Bradaric (UNSA).

HITRIplus
Heavy Ion Therapy Research Integration

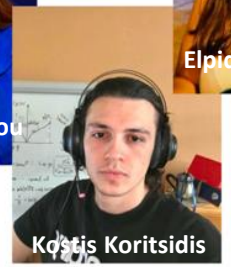
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101008548

PTMC and HITRIplus school assistants

Greece

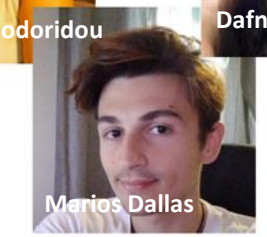


At AUTH

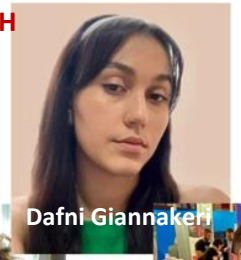


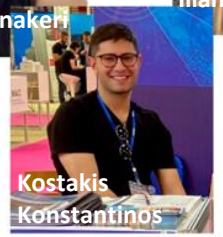
At DKFZ

At AUTH

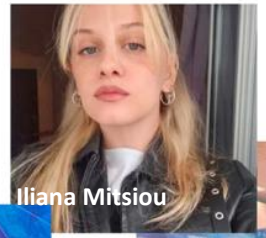


At DKFZ



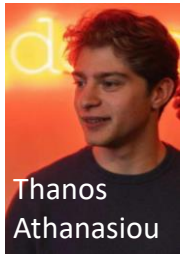


At DKFZ



At GSI

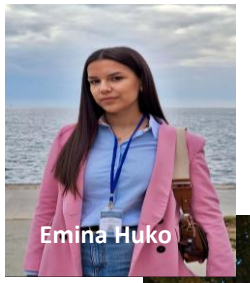
At PATRAS

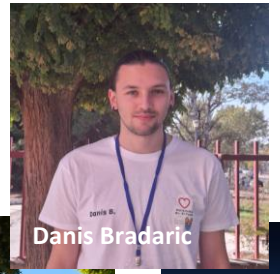


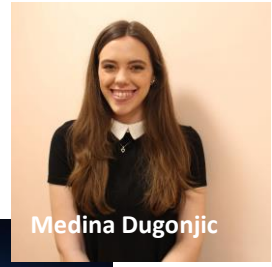
Tetova

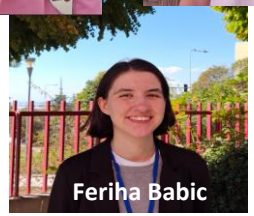
At CERN

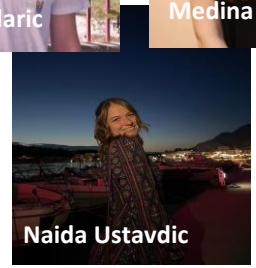
Sarajevo









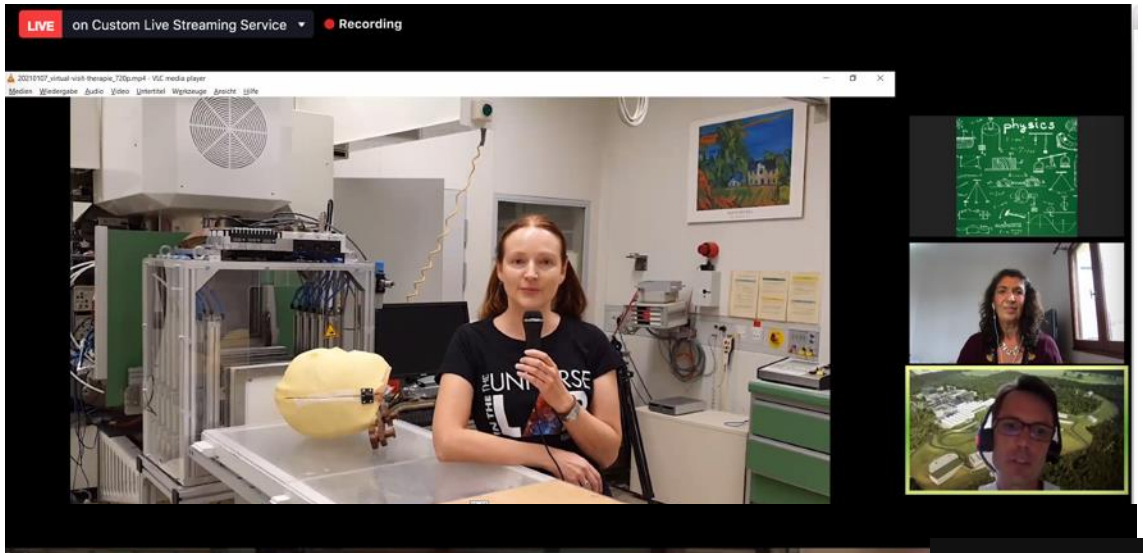


HITRIplus
Heavy Ion Therapy Research Integration

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

Virtual visits and video-conferences

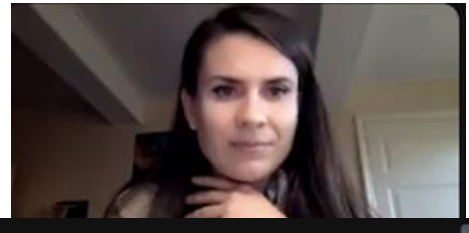
Virtual visits during video-conference: GSI research institute, CNAO, MedAustron therapy centers



GSI moderators

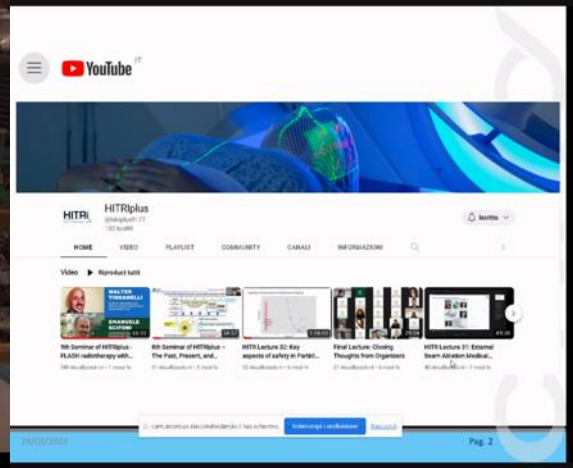
CNAO moderator

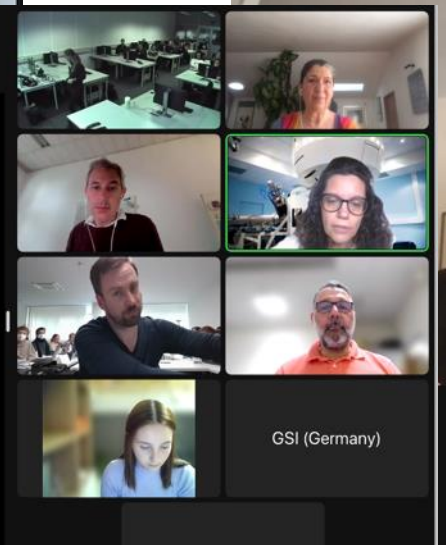
medAustron moder.



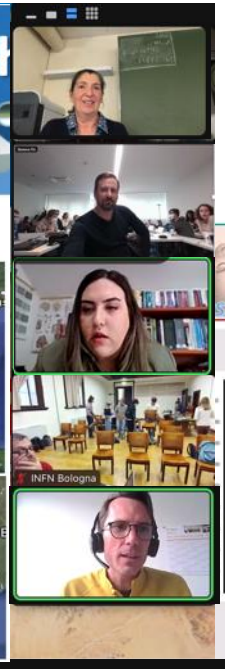
U. Amaldi: HI therapy pioneer

HITRIplus EU-funded project



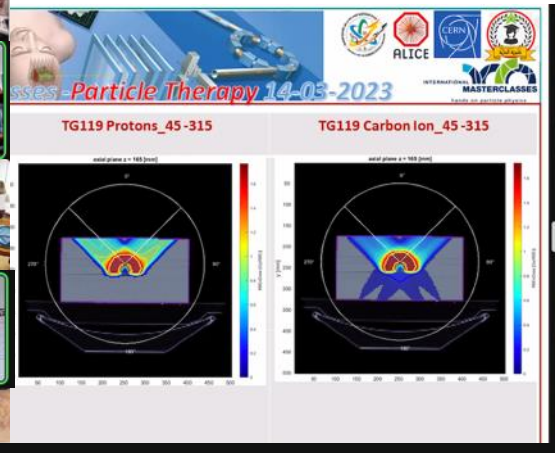


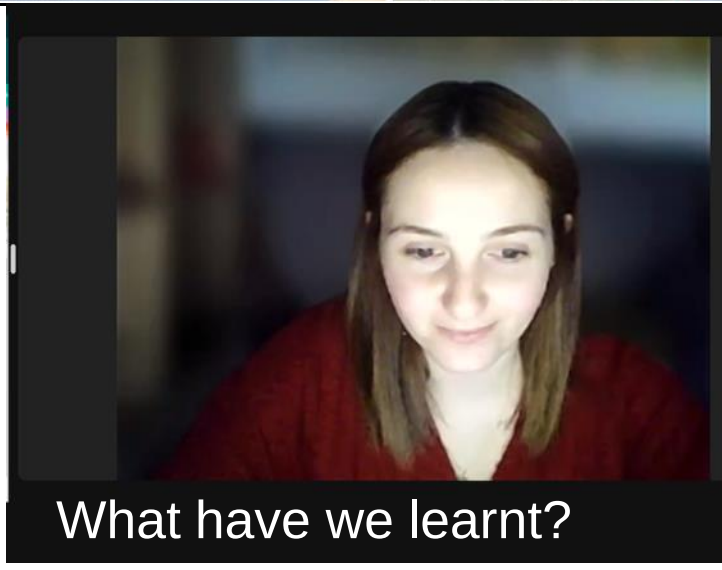
PTMC supporting females in STEM



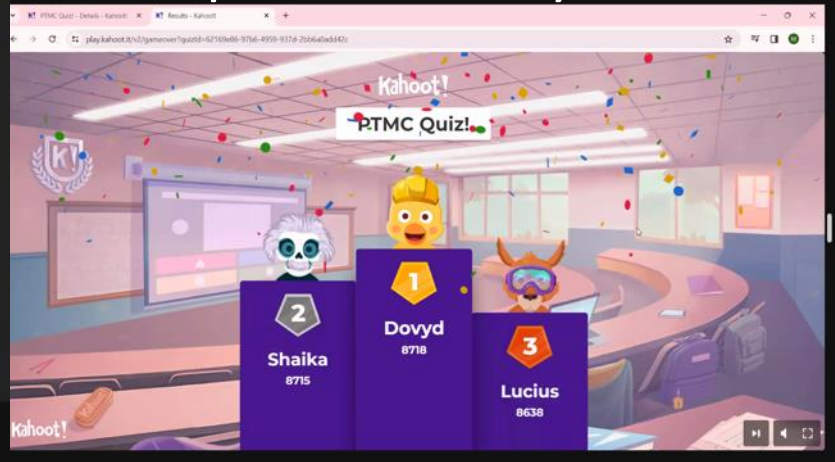
11 Feb and 8 March sessions encouraging female participation and providing role models

El Houria Algeria





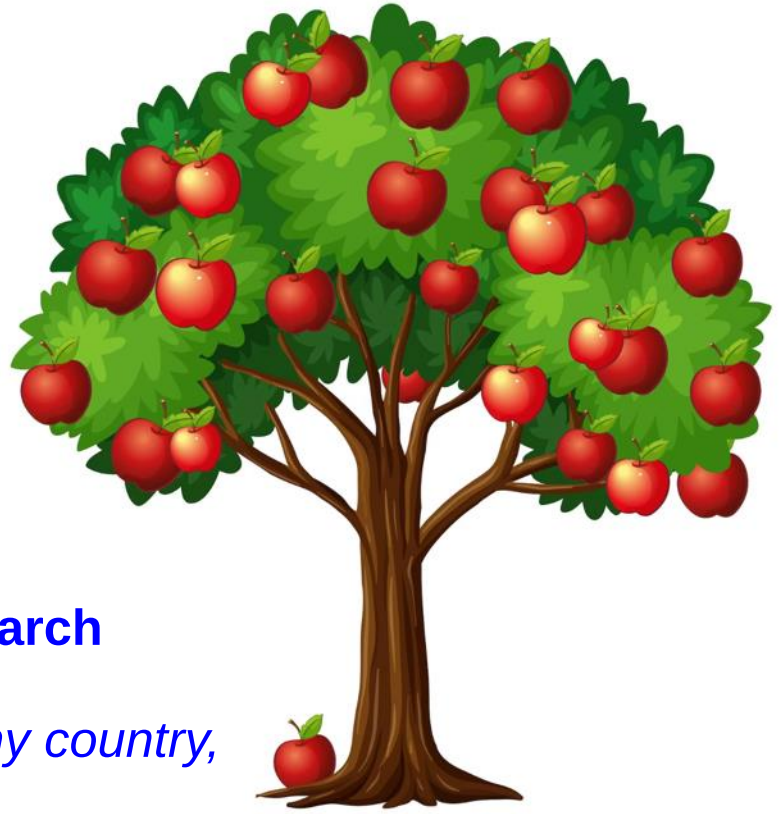
PTMC quiz: a fun way to finish



Main Message: need for fundamental research

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

- **Attract high-school students to STEM**
- **Cultivate confidence through the hands-on**
- **Support female participation**
- **Create groups of Uni assistants that learn better in order to teach**
- **Enhance public awareness on benefits from fundamental research**
- **Prepare future generations aware of importance of fundamental research**



a science educated future generation is crucial for shaping the future of any country, based on rational scientific thinking and decision-making processes

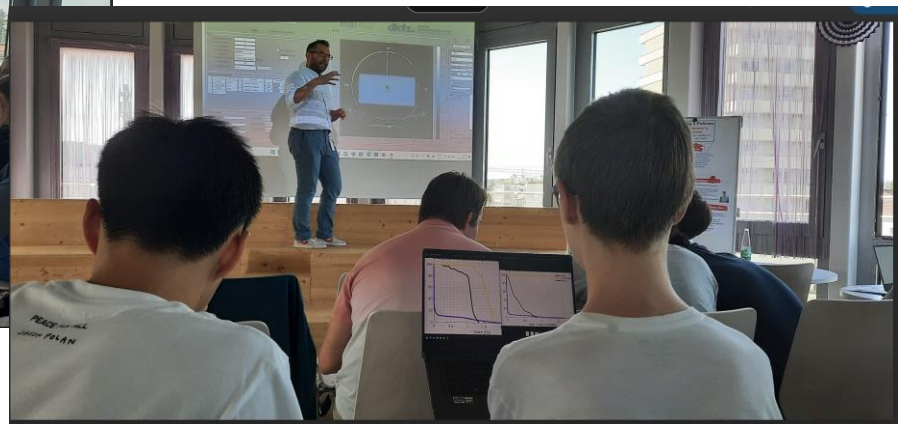
Demonstrate a return to society from investment in fundamental research

Our reward: the enthusiasm and appreciation of the students

Summary of Activities

1. PTMC in Zurich and EPFL: PTMC and new material for school curricula
2. ICHEP Prague: PTMC and stories on applications for society
3. CONF Australia : Plenary plus MasterClass plus other activities
4. ANP Thessaloniki : Plenary
5. Hadron Therapy Symposium: 2 days lectures, 1 day PTMC hands-on
6. CERN 70th including LIT LHC Interactive Tunnel, with particle therapy
7. Greek Physics Association 13-14 December, PTMC MasterClass

PTMC and new materials for school curricula



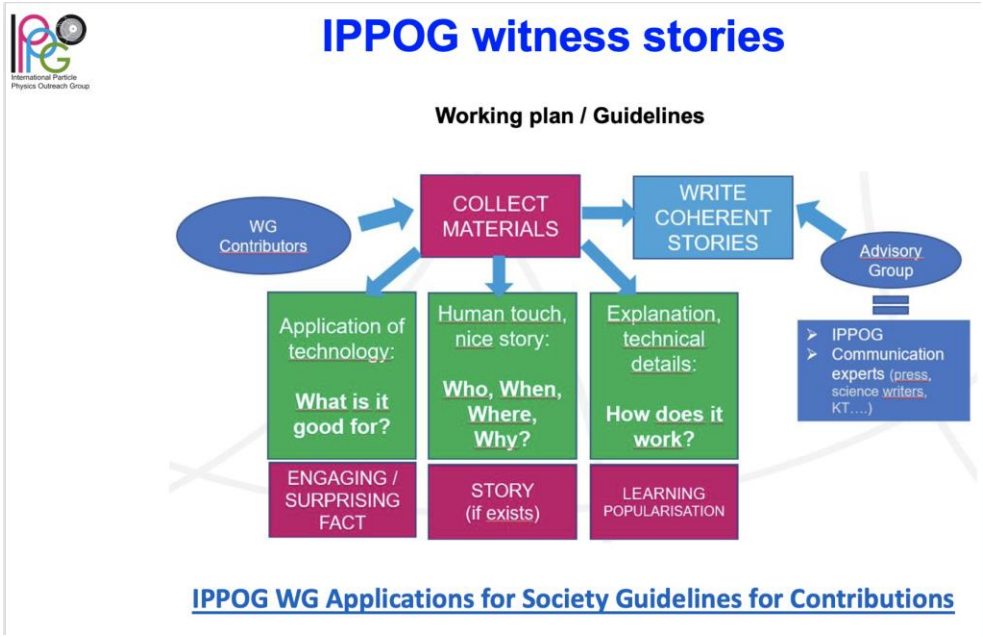
Swiss schools curricula: invited to participate to projects exploring the possibilities to enhance the schools curricula by creating digital tools for STEM teachers in Switzerland and abroad **see attached presentation for details**

PTMC presented by Luca Gandolfi

Swiss pilot and proof of concept: YF and Luca Garolfi

- PTMC at International School, Zurich, 19 june 2024
- SEFI 2024 Workshop EPFL Lausanne, 2-5 sep 2024:
  PTMC contribution **“Inspiring next STEM generation by Innovation”**

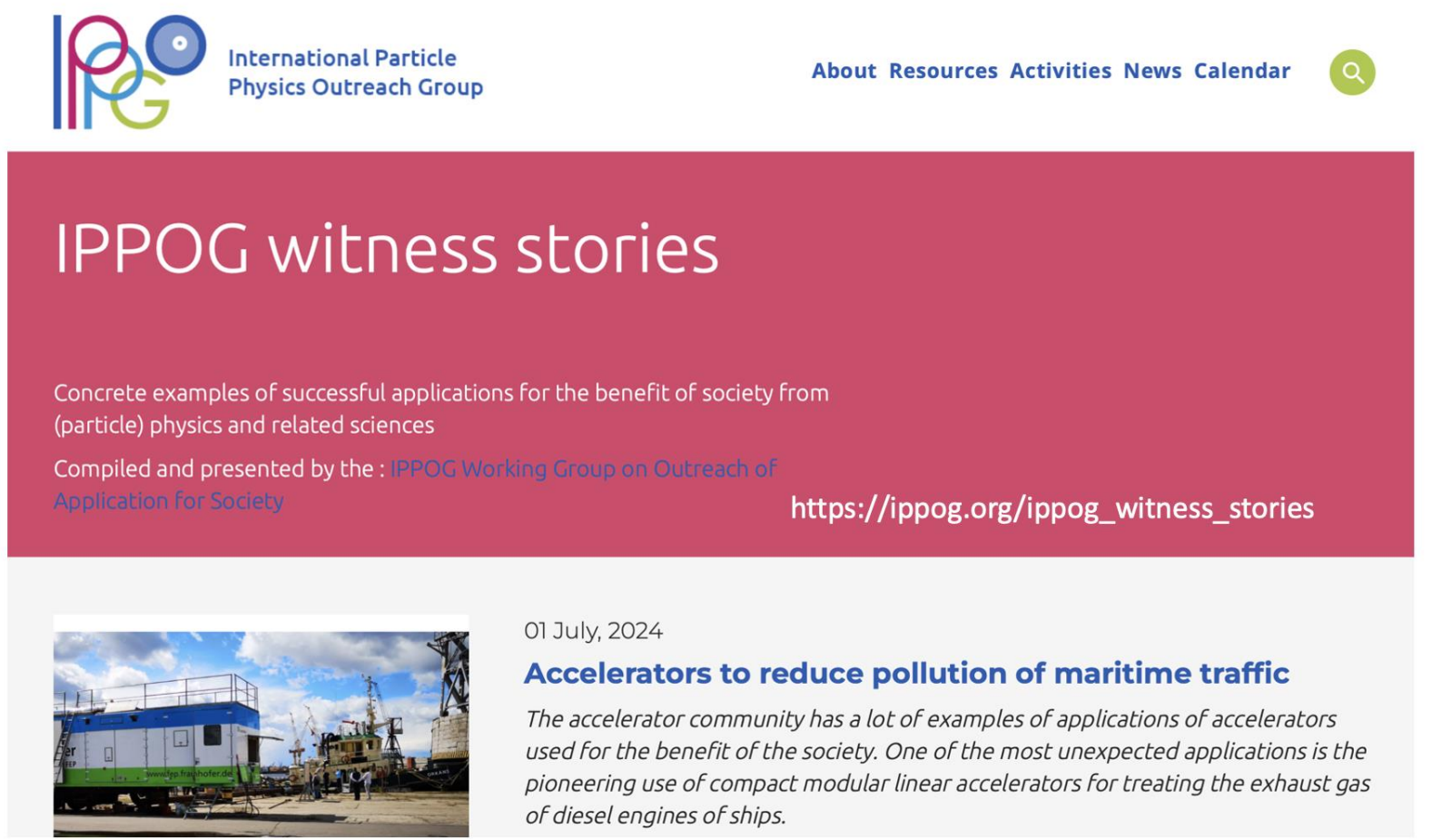
PTMC and stories on applications for society



From plans to reality !

Dedicated web page

Collection of stories



Participation to outreach activities in Australia in a nutshell

Tuesday 20 august 2024, Cairns

10:00 Plenary presentation on PTMC and WG “Outreach of Applications for Society” (similar to the one in ICHEP)
11:00 ALICE MC
Conference web page: https://confinement24.org.au
Timetable: https://indico.cern.ch/event/1293041/timetable/#20240818

Saturday 17 august 2024, Townsville

Outreach Workshops in Townsville focusing on Dark Matter by IPPOG Australian representative Jackie Bondel as part of full day event organized by a college for the region’s schools

Wednesday 14 august 2024, Melbourne

Outreach Workshops in Melbourne by IPPOG Australian representative Jackie Bondel and colleagues as part of a half day event of “science week” organized by university
https://us21.campaign-archive.com/?e=__test_email__&u=47467255c3c5953fcc07ccd51&id=cd8c870d04
Youtube: https://www.youtube.com/watch?v=2ByOfkXZGaM

ALICE Masterclass

Tuesday 20 august 2024, Cairns

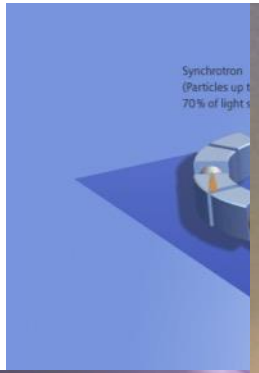
Attended by about 65 high-school students from 5 schools accompanied by their teachers

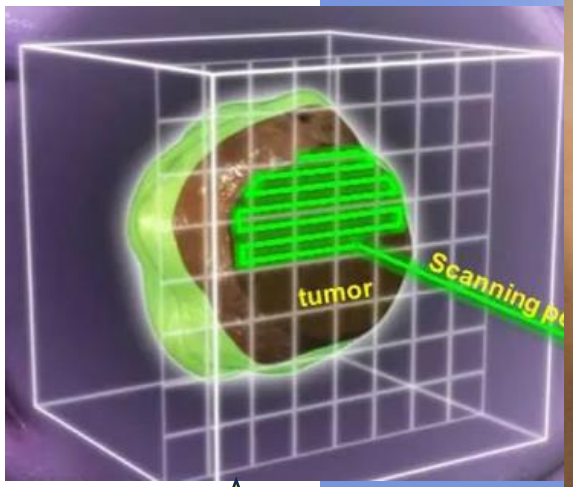
Presented by: Jon-Ivar Skullerud jonivar@thphys.nuim.ie from Maynooth, Wioleta Rzesa wioleta.rzesa@cern.ch from WUT

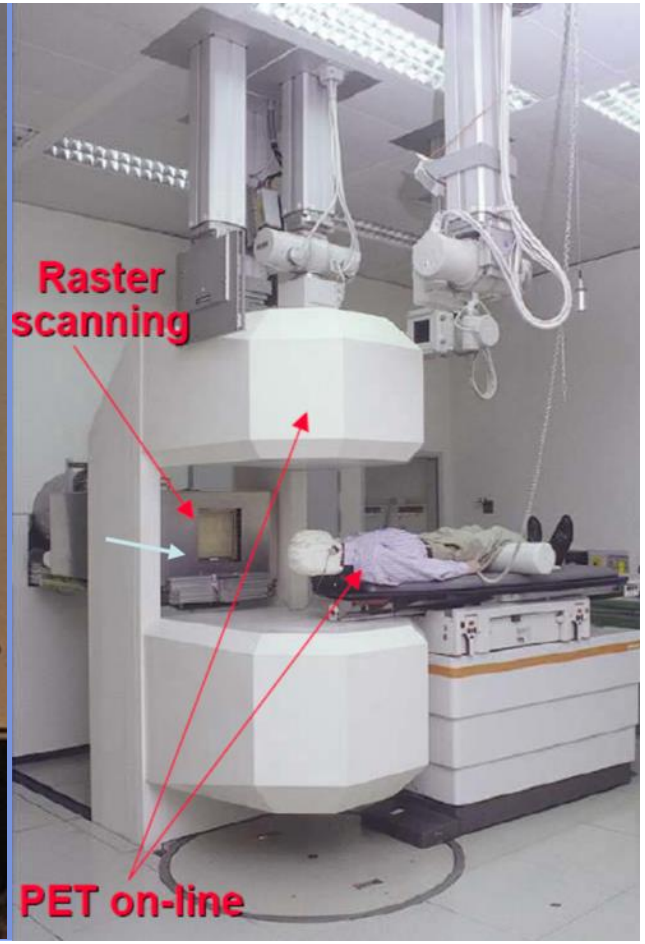
Assisted by 6 “local” PhD students and Francesca Ercolessi from Bologna

Group Photos in: https://cernbox.cern.ch/index.php/s/2We9DoacU4qd8UK

ANP Applied Nuclear Physics in Thessaloniki







Raster sc

Haberer et al., NIM A , 1993

EPS Awards

relying on scanning of focussed ion beams in fast dipole magnets

active variation of the energy, focus and intensity in the accelerator and beam lines

Hadron Therapy Symposium Thessaloniki

Workshop: 392 indico + 23 on-site registrants, 130 in person
MastrClass: 60 in person + 50 online
World experts and
sizeable local paricipation
Many young participants

Hadron Therapy Symposium Thessaloniki

CERN 70th at Thessaloniki International Fair TIF

CERN 70th at TIF

Attract childern:
protons for resrearch
and cancer therapy

International Particle Physics Outreach Group

CERN 70th at TIF

Technology development for research and cancer therapy

International Particle Physics Outreach Group

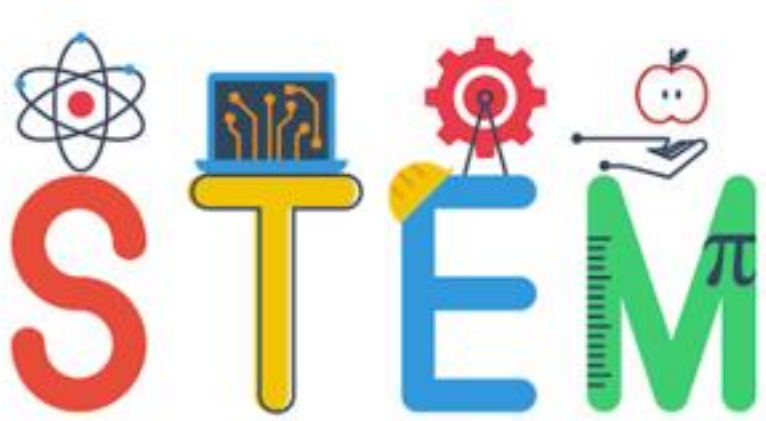
CERN 70th at TIF

CERN 70th at TIF

End of event party and 70th anniversary cake

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 tutors

.

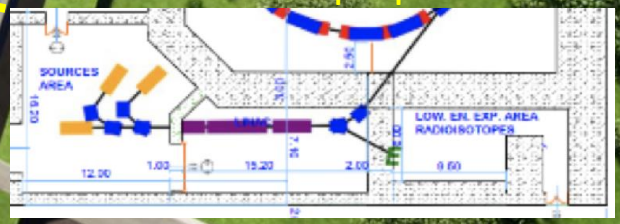
BACKUP

Proposal for a facility in South East Europe: SEEIIST

50% research and 50% therapy with multiple ions

CERN Yellow Report in publication process

Optimisation of linac injector for radio-isotope production



Architectural design, Kaprinis Architects

PTMC Important Links

https://indico.cern.ch/e/PTMC

- 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

Acknowledgements PTMC

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:
Christian Graeff, Radek Pleskac
GSI ALICE, EMMI :
Ralf Averbeck, Malzacher, Peter
GSI IT :
Thorsten Kollegger, Behnert, Katharina
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

Participants of hybrid 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 Vilnious, 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

https://indico.cern.ch/e/PTMC

- 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/1L94yhos6L7k3FQlMzD9Ql7kpk_c_ABD7

Training sessions: 4-5 per year

Importance of training teachers: Sofia, Madrid, and Sarajevo

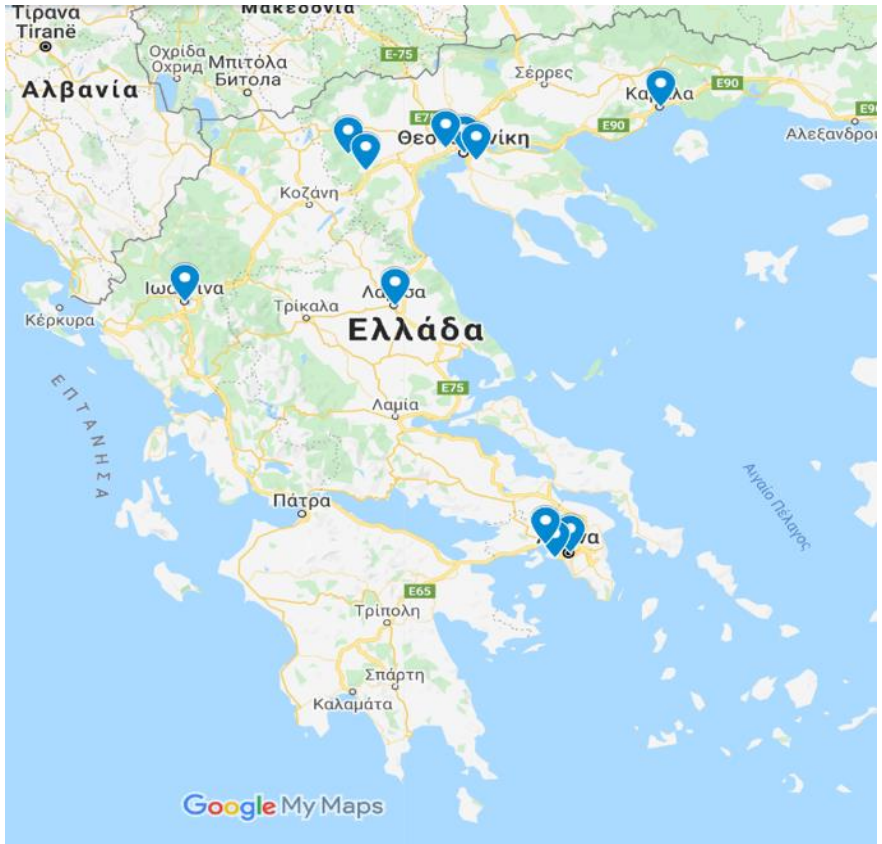
Example of UNSA/Sarajevo:

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

PTMC in Greece

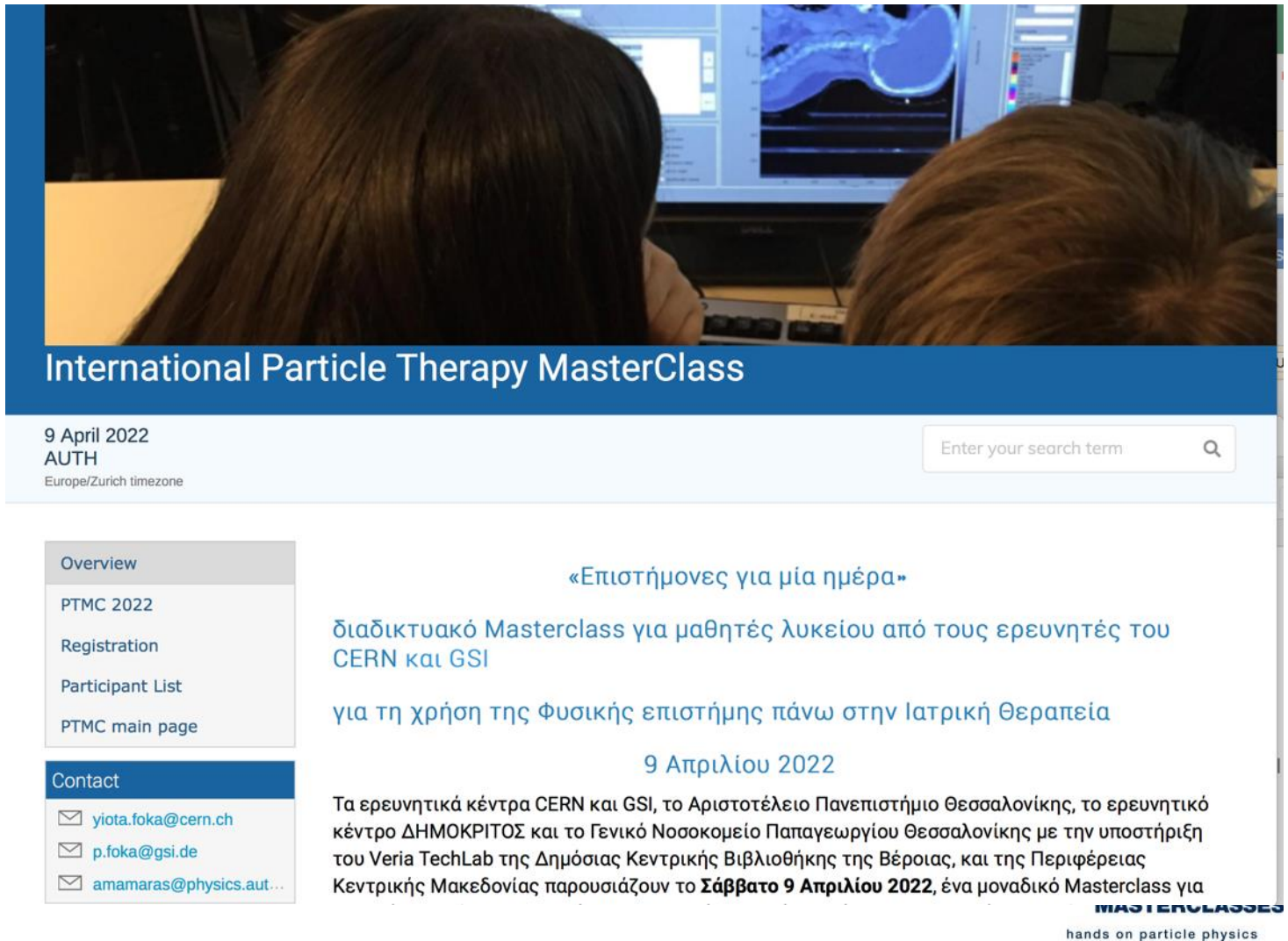
PTMC2021 online: through Library of Veroia

Total of 366 live views
from at least 20 major regions of Greece



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

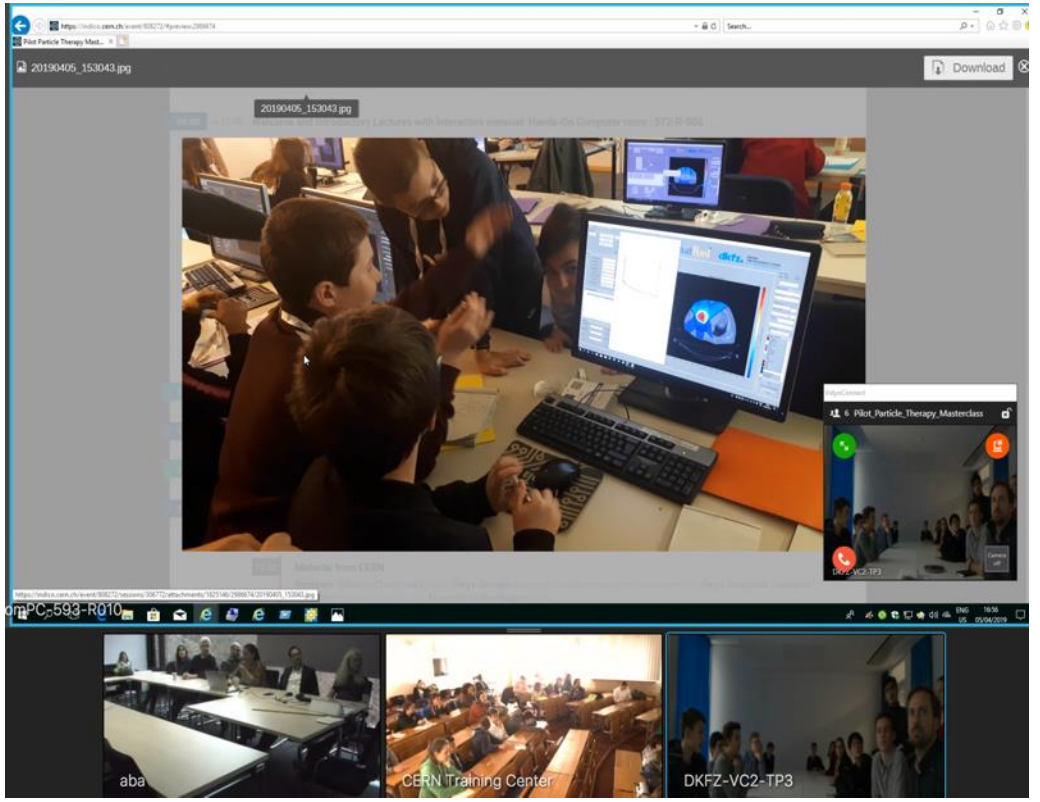
PTMC2022 online: more than 150 participants, PTMC2024: 275 participants
AUTH uni, Dimokritos research centre, Papageorgiou Hospital, Technopolis.
Publicity: Library of Veroia extended networks and national press



PTMC and matRad Treatment Planning

First Local Test: GSI Feb 2019

International Pilot: CERN, GSI, DKFZ April 2019



Web page: UNSA students CERN Open Days, Aug 2019

IMC Steering Group Approval: GSI May 2019

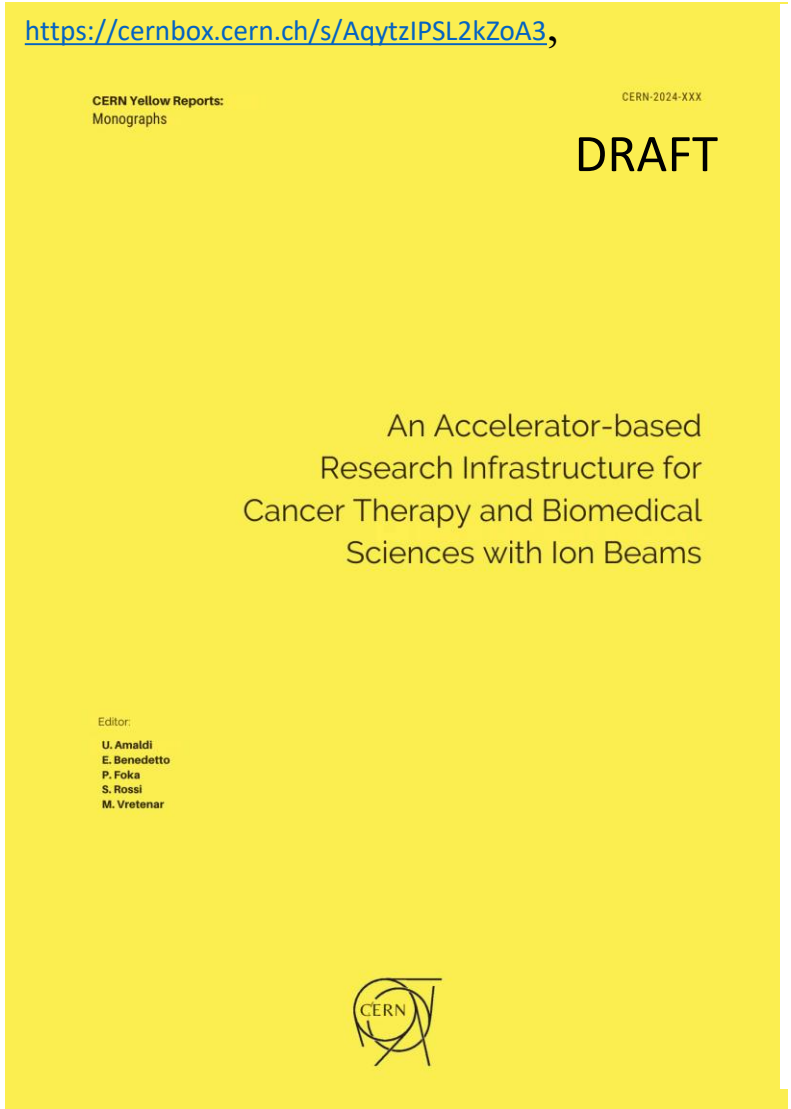
We could not imagine
what physics has to do with medicine,
that research institutes such as CERN
can contribute to medical applications

Publications as CERN Yellow Reports

(1) Proposal for a multi-ion accelerator based facility
(2) Conceptual (pre-TRD) design report
CERN Yellow Reports by Ugo Amaldi and international collaborators

https://e-publishing.cern.ch/index.php/CYRM/issue/view/88

https://cernbox.cern.ch/s/AqytzIPSL2kZoA3,



SCIENTIFIC CASE
A project of the
South-East European International Institute for Sustainable Technologies—SEEIIST

U. Amaldi
TERA Foundation, Novara, Italy
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E. Benedetto
TERA Foundation, Novara, Italy, and CERN, Geneva, Switzerland
G. Bisoffi
INFN, Legnaro, Italy, and CERN, Geneva, Switzerland
J. Burgar
Slovenian Engineering Academy, Slovenia
S. Damjanovic
SEEIIST
M. Durante
GSI, Darmstadt, Germany
M. Dosanih
CERN, Geneva, Switzerland
P. Foka
GSI, Darmstadt, Germany
P. Georgieva
SEEIIST
Th. Haberer
HIT, Heidelberg, Germany
L. Litov
SEEIIST
S. Rossi
CNAO Foundation, Pavia, Italy
M. Sapinski
GSI, Darmstadt, Germany and CERN, Geneva, Switzerland
B. Singers Sørensen
Department of Experimental Clinical Oncology, Aarhus, Denmark
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University of Heidelberg, Germany
M. Vretenar
CERN, Geneva, Switzerland