HITRI plus
Heavy Ion Therapy Research Integration

Heavy Ion Therapy MasterClass School
17-21 May 2021

YIOTA FOKA (GSI)

FOR THE ORGANISERS

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

HITRIplus Project

Organised in the Framework of the HITRIplus EU-funded project

Large consortium where also all existing European heavy-ion therapy centres participate, plus CERN and GSI research centres, and the future SEEIIST research infrastructure, among many others.

Heavy Ion Therapy Masterclass School included in "Education and Training" Work Package addressing university students and up to early stage researchers and practitioners

First event of HITRIplus Project

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Heavy Ion Therapy Masterclass School

Executive Summary

Uploaded in indico a summary report/article: https://indico.cern.ch/event/840212/page/18001-articles

- Accelerating News
- GSI News
- ENLIGHT
- CERN Courier

Very well received, had a big impact, but also a big challenge

Despite the online mode, and huge numbers, it run smoothly and was quite interactive

but required big efforts and a well-trained, enthusiastic team of friends

Some comments of participants:

- It's approach, regarding the content but also its format was "holistic, multi-disciplinary, original"
- Speakers, top experts in their fields, started from basic principles, so beginners and participants from different fields could follow, and then progressed to deeper details, not taking shortcuts.
- It gave the opportunity to have an overview of heavy-ion therapy but also included cutting-edge developments.

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Heavy Ion Therapy Masterclass School

Format of School

"Original" Format: commented, liked by participants

- Long lectures in the morning
- Hands-on in the afternoon
- Students' presentations in the presence of experts
- Virtual visits to existing therapy centres guided by the local 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

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Heavy Ion Therapy Masterclass School

Location and Time

Why Sarajevo
Why this year

Ongoing collaboration with the University of Sarajevo,
supported by private sponsor Eddy Offermann through his foundation
“The three physicists”

Organise it already before the end of this semester to support all students finishing this year and provide them with some directions and options for their future studies

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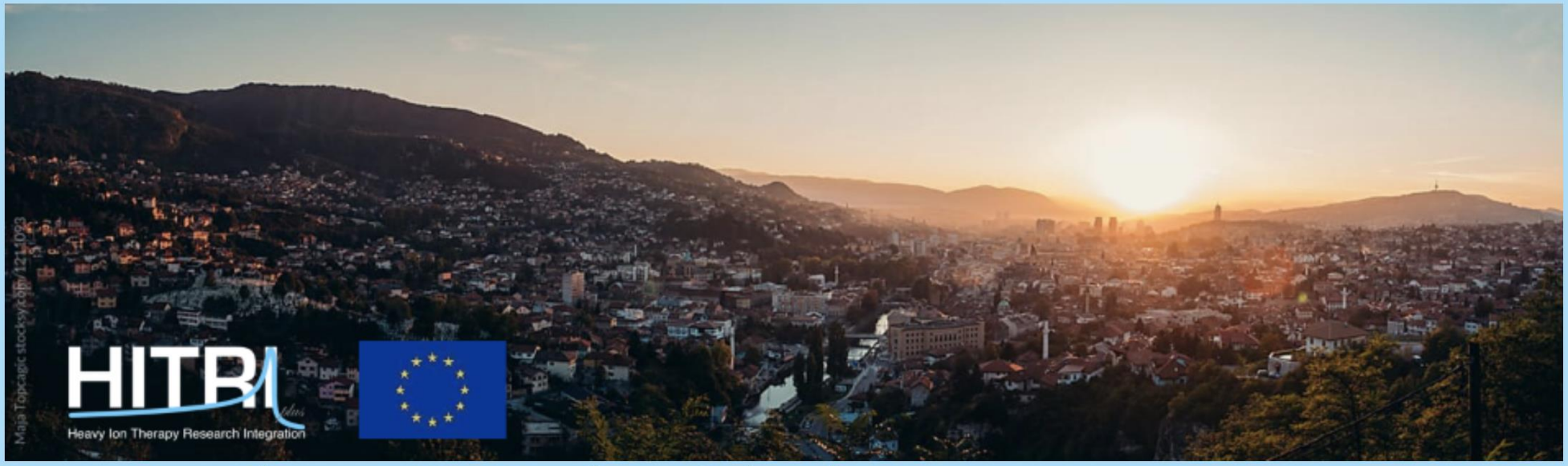

Heavy Ion Therapy Masterclass School

17-22 May 2021
Sarajevo-Online
Europe/Sarajevo timezone

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

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

Participant List

798 participants

Registration Form

965+100
from Egypt
via a single
connections

Number of participants: 965

- 36 lecturers
- 222 young researchers
- 234 PhD students
- 197 Master students
- 276 Undergraduate sudents

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Heavy Ion Therapy Masterclass School

Opening Session

Uni of Benha, Egypt: Integrate the school into the Uni curriculum, presence of rector

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Heavy Ion Therapy Masterclass School

Opening Session

First day: only speakers on zoom and webcasting (any number of participants, but no communication)

Heavy Ion Therapy Masterclass School

Connection Instructions

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

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Contact

hitm.adm@cern.ch

webcasting with support of CERN IT:
https://webcast.web.cern.ch/event/i1024183

Webcast link

Participants should join the webcast through the link: https://webcast.web.cern.ch/event/i1024183

Participant that will join hands-on and students afternoon sessions, they will be provided a zoom link also through webcast.

Shared document to submit questions

Participants can ask experts questions through this shared document:

https://docs.google.com/document/d/1QXEi7wai8QtvNlWEcr1mcy7GgTuqGfUfY4nCADrc2v0/edit

Evaluation form

Please use the evaluation form to give us your opinion, comments about the school:

https://docs.google.com/forms/d/1rF1A5U7rBTTSPjQ42Zb_Q9Fj7oG3cE6Q8ZdZYvIf_yg/edit

Social Events:

SIGNup Social Events Mon: ENLIGHT Networking

https://forms.gle/4P2Db1LS5YG5fNEw9

every day zoom links and updates

For better interaction use of the
- **shared doc to insert questions**
- **Zoom chat**
- **evaluation form**
- **polls**

Recordings available in the timetable for the ones at different time zones

Info on certificate of attendance via the web page and special email.

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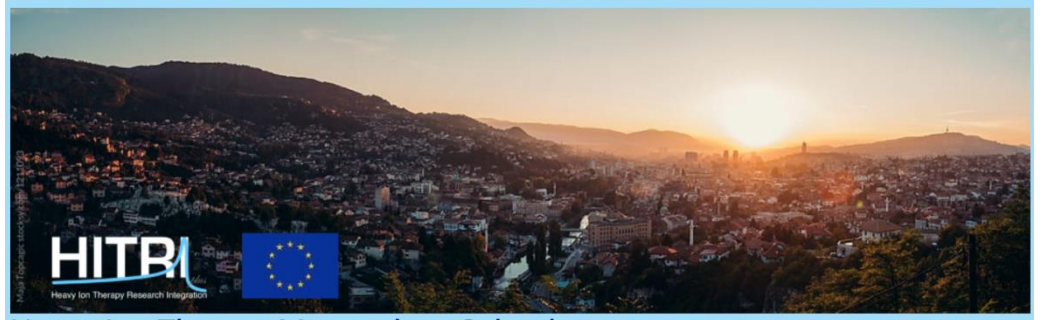
HITRI Heavy Ion Therapy Research Integration

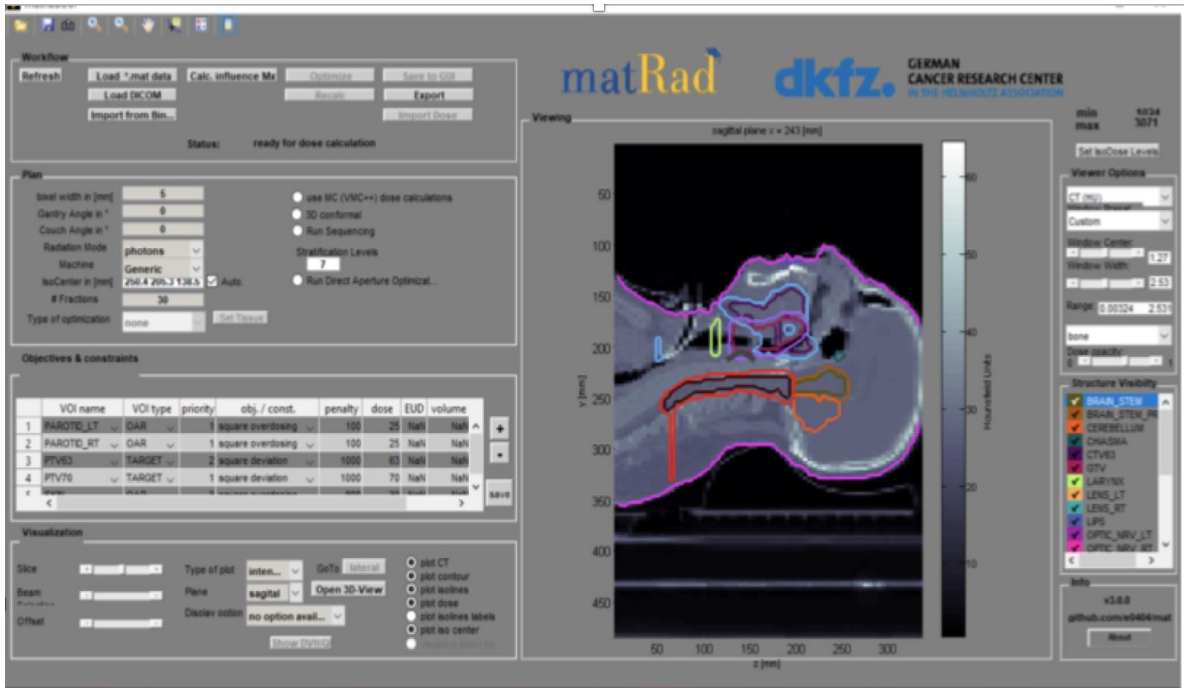
Treatment Planning



Heavy Ion Therapy Masterclass School

Virtual Therapy Centre

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



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Heavy Ion Therapy Masterclass School

School Lectures

Timetable: https://indico.cern.ch/event/1024183/

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Timetable Heavy Ion Therapy MasterClass School 17 May 2021

17 May 2021, 08:23 → 22 May 2021, 19:00 Europe/Zurich

Webcast

There is a live webcast for this event — Watch

Main Topics:

- Heavy ion therapy
- Treatment planning
- Medical accelerators and accelerator physics including:
  - Ion sources
  - Beam optics
  - Beam delivery systems
  - Controls
- Linear accelerators for isotope production
- Radiation protection and safety
- Imaging for particle therapy and diagnostics
- Biophysics
- Machine learning applications for particle therapy
- European heavy ion therapy centres:
  - Current activities
  - Future upgrades

Manjit and Mimoza

Maurizio, Mariusz, Giovanni, Elena, Rebecca

multidisciplinary facets of heavy- ion therapy
many different interesting career paths in many different fields
where there is lack of specialised personnel

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Heavy Ion Therapy Masterclass School

Timetable: https://indico.cern.ch/event/1024183/

Friday afternoon Sessions: Future Plans

dedicated to future projects
and upgrades
based on the current experiences of existing
heavy-ion therapy centres
and needs for further research

"next generation of specialised scientists
in heavy-ion therapy" needed
to build and run the "next generation facilities"

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School Lectures

Experiences of existing heavy ion therapy and research infrastructures, Future Plans, Upgrades

Input from HIT, MIT, MedAustron, CNAO, GSI, CERN, SEEIIST

13:15 **Clinical experience on benefits of heavy-ion therapy**
Speaker: Ester Orlandi (CNAO)

13:30 **MedAustron experience with heavy ion therapy**
Speaker: Piero Fossati (MedAustron)

13:40 **Particle therapy approach exploring the synergies between carbon ion and immune response**
Speaker: Slavisa Tubin (MedAustron)

13:50 **From pioneering heavy ion therapy at GSI to the HIT and MIT hospitals**
Speaker: Christian Graeff (GSI)

14:10 **From fundamental research to medical applications**
Speaker: Manuela Cirilli (CERN)

14:30 **CNAO Accelerator complex and upgrade plans**
Speaker: Marco Pullia (CNAO)

14:45 **Accelerator complex for next generation heavy ion therapy and research facilities**
Speaker: Mariusz Sapinski (SEEIIST)

Heavy Ion Therapy Masterclass School

School Format

Timetable: https://indico.cern.ch/event/1024183/

Afternoon Sessions: "Interactive Experiences"

- Hands-on sessions, "do it yourself" guided by experts, with real data and professional tools and methods
- Presentations by students of hands-on results or projects
- Discussions with experts from different Labs
- Visits of Labs

Hands-on results presented everyday by students of Benha Uni, Egypt and some other volunteers

14:00 → 16:00 **Hands-On Treatment Planning Basics**

Conveners: Hans-Peter Wieser (LMU Munich) , Niklas Wahl (Deutsches Krebsforschungsz

Agenda

16:00 → 16:15 **Complete the evaluation form**

Evaluation Form

16:15 → 16:30 **Coffee Break**

16:30 → 18:00 **Interaction with Experts, Students Presentations, Virtual Visits**

Virtual Visit to therapy centers or labs; discussion of results with experts from therapy center

Conveners: Yiota Foka (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE)) , Arist Graeff (GSI) , Marco Pullia (CNAO) , Angelica Facoetti (CNAO)

Agenda

18:00 → 19:00 **SOCIAL EVENT: Language & Culture Cafe**

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Heavy Ion Therapy Masterclass School

School Format

Interaction with Experts, Students Presentations, Virtual Visits

Virtual Tour to therapy centers or labs; discussion of results with experts from therapy centers/research lab

Conveners: Angelica Facoetti (CNAO) , Aristeidis Mamaras (Aristotle University of Thessaloniki (GR)) , Foka (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Video Visit to CNAO

16:30	**Connection to GSI, Video/Visit**	**Speaker**: Christian Graeff (GSI)
16:40	**Connection to CNAO, Video/Visit**	**Speaker**: Marco Pullia (CNAO)
17:00	**Connection to CNAO, Video/Visit** ¶	**Speaker**: Angelica Facoetti (CNAO)
17:20	**Simulations of Low Energy Beam Transport**	**Speaker**: Benjamin Dedic (University of Sarajevo (BA))
17:30	**Hands-on TP Results and Radiation Therapy for Cancer Treatment**	**Speaker**: Maja Kuzmanovic
17:35	**Hands-on TP Results and Cancer Data Platform**	**Speaker**: Andrijana Gjoreska (Ss. Cyril and Methodius University)
17:40	**Q&A with experts**	**Speakers**: Marko Pullia (CNAO) , Christian Graeff (GSI) , Angelica Facoetti (CNAO)

Timetable: https://indico.cern.ch/event/1024183/

Hands-on results and students presentations

Participants could drop results of hands-on session:
https://docs.google.com/document/d/1K5wGM9sZJNQauvaS6P5jfm30mUNzPPdChCFQ0o7KDKM/edit
to discuss them during the students session with the experts
But also as requirement to obtain "certificate of attendance"

Some student's presentations were scheduled already:
mostly master's and/or CERN summer students supported by private sponsor wishing to strengthen this kind of research and support young researchers in this field

Masters: Aris, Damir, Denjamin, Fehima
Sum Stud: Maja, Adrjana, Stipe….

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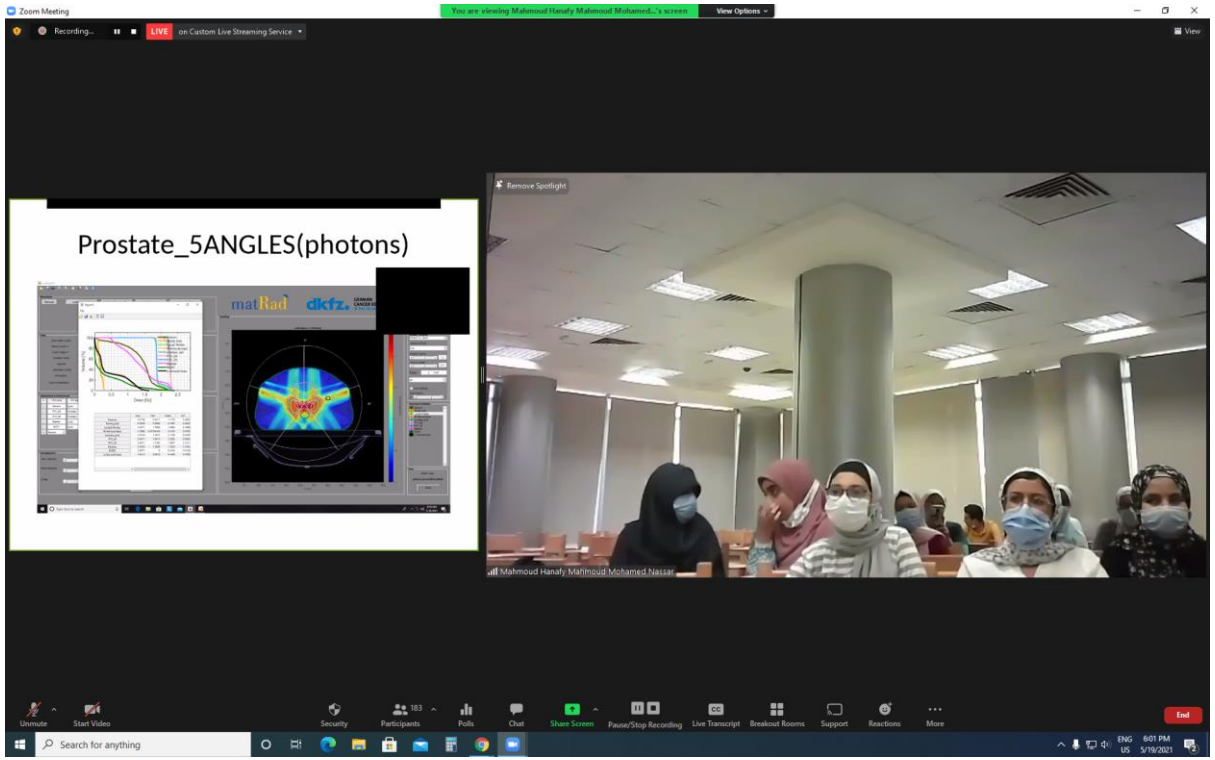
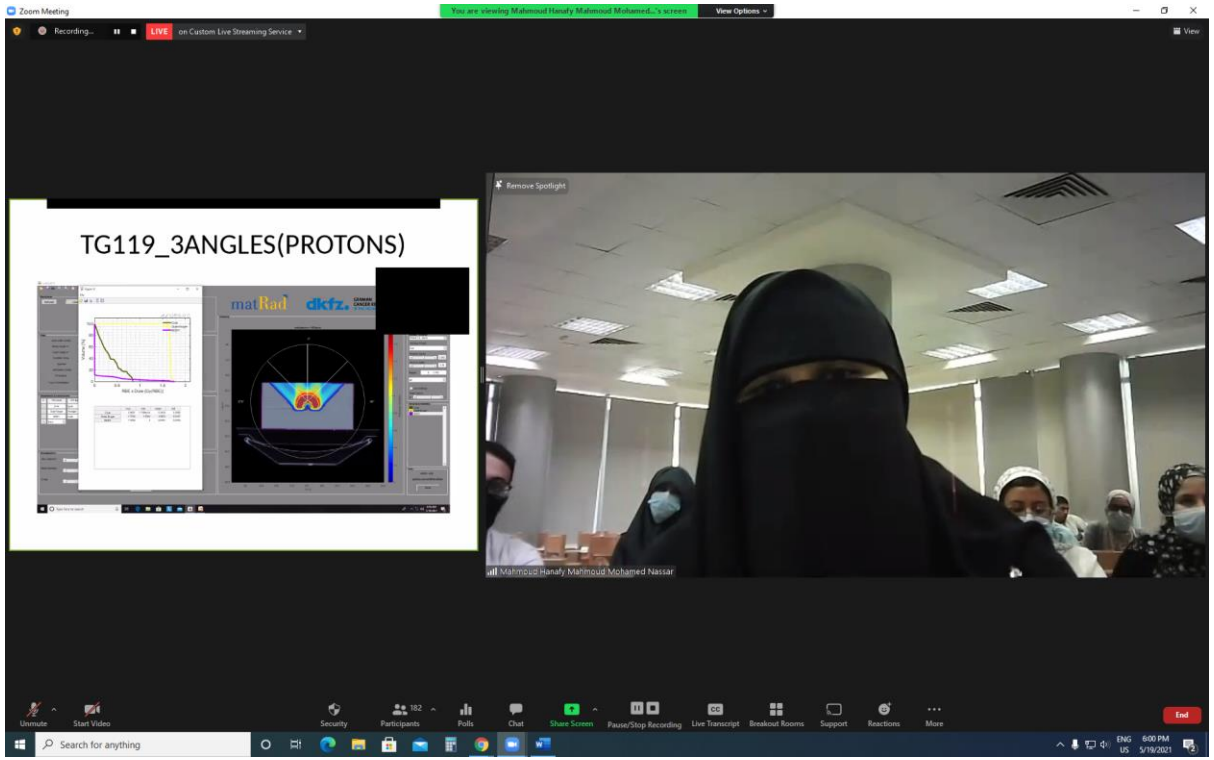
Diversity and sharing know-how





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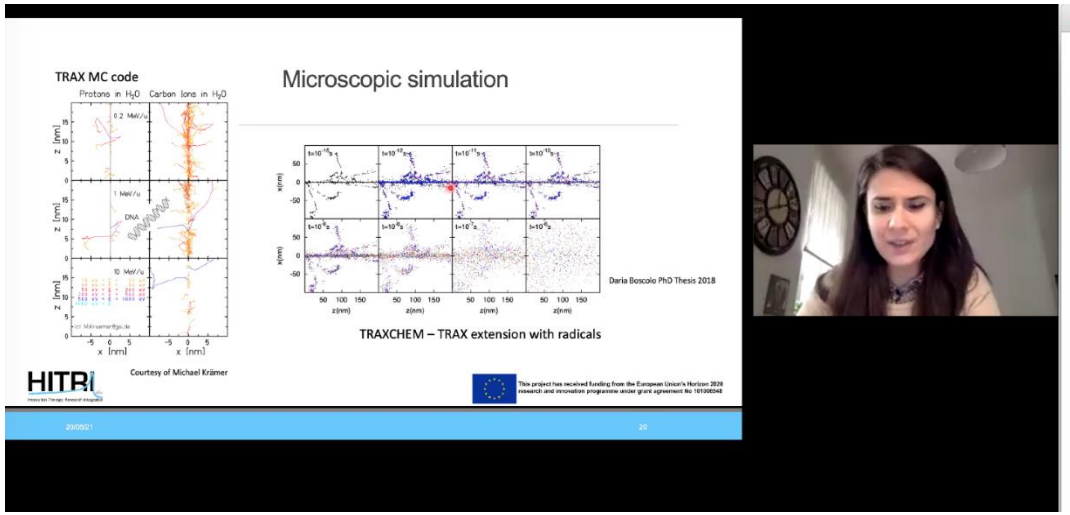
Gender equality and students presentations

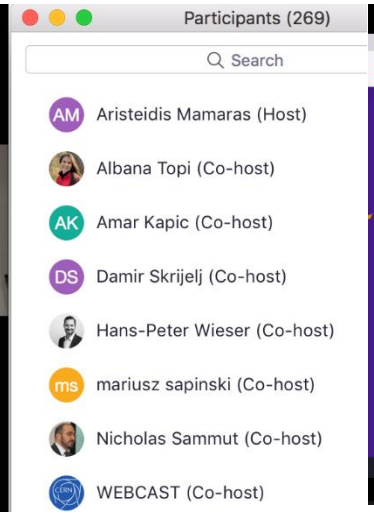
Timetable: https://indico.cern.ch/event/1024183/

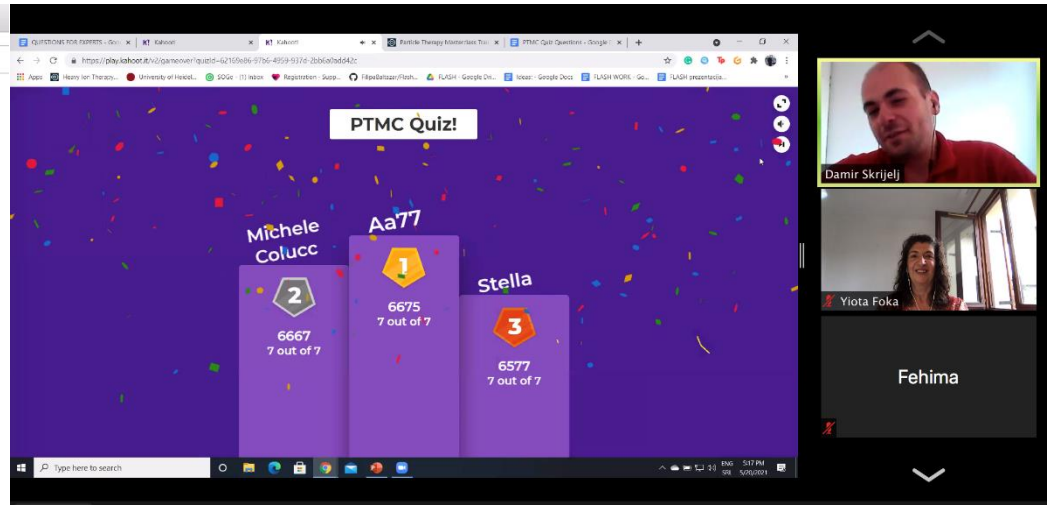
Statistics

Out of a total of 36 speakers, 18 female

Plus 23 students' presentations plus the students from uni Benha (Egypt)







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Heavy Ion Therapy Masterclass School

Themes of students sessions

- **Tuesday:**
  connected to GSI, the research institute where heavy-ion therapy was pioneered (C. Graeff)
  and CNAO, the running heavy-ion therapy centre (M. Pullia et al)
- **Wednesday:**
  dedicated to treatment planning
  expert from CNAO presented the real TP tools used in CNAO and explained real cases, discussed and contrasted to the matRad TP tool for training and research
- **Friday: focusing on future facilities and plans**

- **Thursday:**
  focus on International MasterClasses programme of IPPOG
  presentations of the coordinators Uta Billow and Ken Cecire
  complemented by presentation from Sarajevo MCs
  by Fehima on pedagogical value of MCs based on analysis of surveys and
  by Melika on the PTMC experiences

2020
8548

Heavy Ion Therapy Masterclass School

matRad Treatment Planning toolkit

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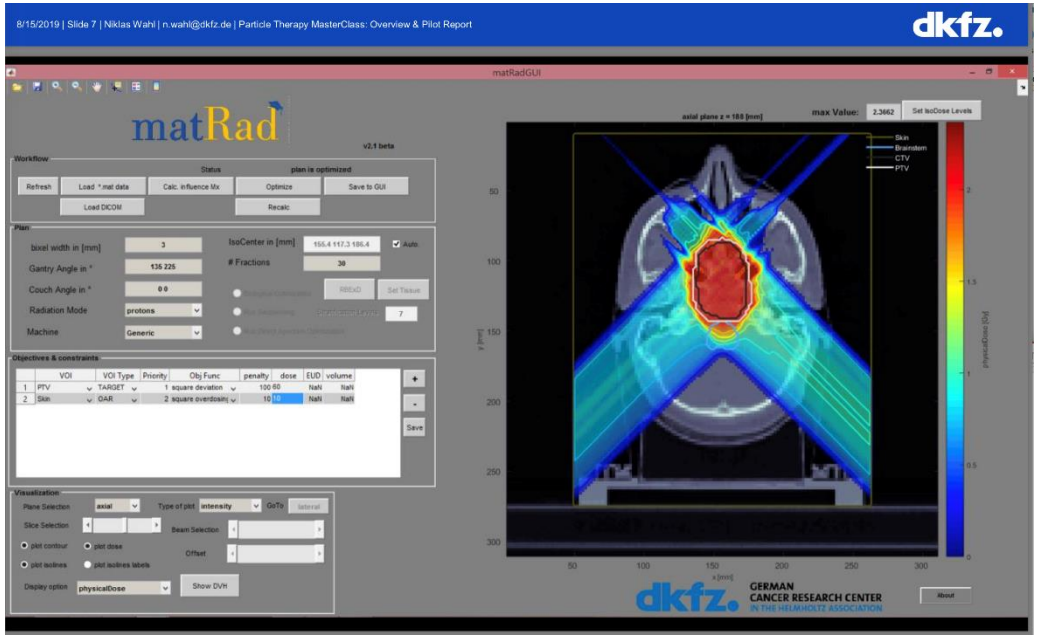
Hands-on: based on professional open source treatment planning toolkit matRad, developed by Heidelberg DKFZ www.matrad.org



14:00 → 15:30 **Cancer Radiotherapy Introduction**
Speaker: Joao Seco (DKFZ)

15:30 → 16:00 **MatRad General Introduction**
Speakers: Hans-Peter Wieser (LMU Munich) , Niklas Wahl (De

16:00 → 16:15 **Complete the evaluation form**
Evaluation Form

16:15 → 16:30

16:30 → 18:00 **MatRad Installation & Data**
Conveners: Hans-Peter Wieser (LMU Munich) , Niklas Wahl (

matRad - an open-source toolkit for dose calculation and optimization

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HIT Heavy Ion Therapy Research Integration

Heavy Ion Therapy Masterclass School

matRad Treatment Planning toolkit

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HIT Heavy Ion Therapy Research Integration

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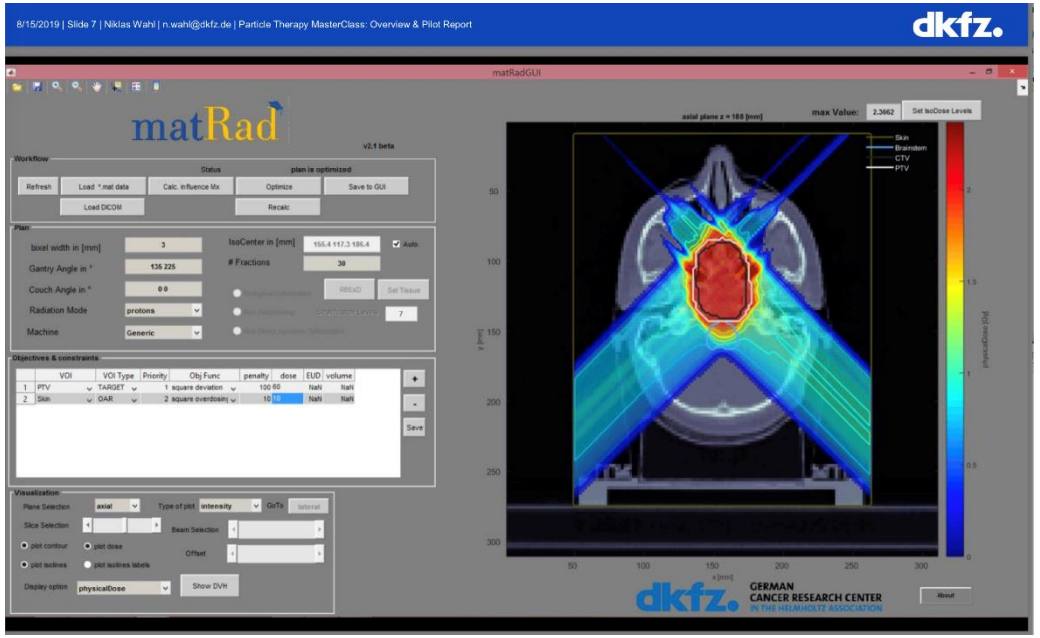

matRad - an open-source toolkit for dose calculation and optimization

180 participants delivered matRad hands-on results

Out of 238 certificate requests, 158 eligible having delivered hands-on and sufficient attendance

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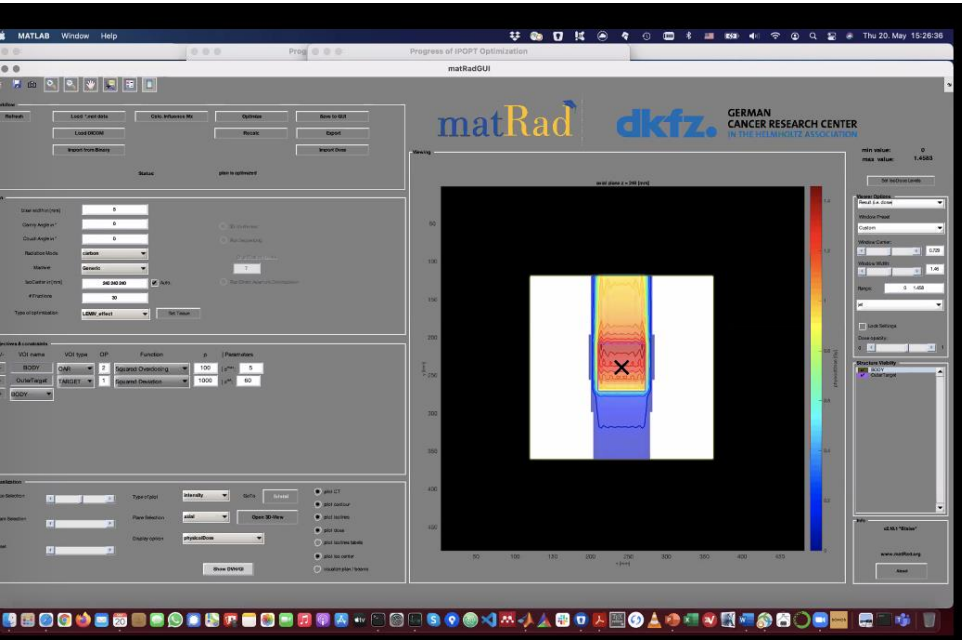
matRad Treatment Planning toolkit

….hats off to both of you….

Thanks to: Niklas Wahl and Hans-Peter Wieser



From Dr Sonali Bhatnagar to Everyone:
the doc file is very helpful

From Besa Sadiku to Everyone:
Me to like Dr. Sonali, I miss any step, and my results are not the same that you're explaining us,

From Adin Alić to Everyone:
Computations are now realy slow.

From Dr Sonali Bhatnagar to Everyone:
but hats off to you both for keeping patience with us.we are all working hard and trying to learn so the goal is achieved...
To work after your class,makes me miss on the social interactions sessions as earning matrad is important
learning

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matRad Treatment Planning toolkit

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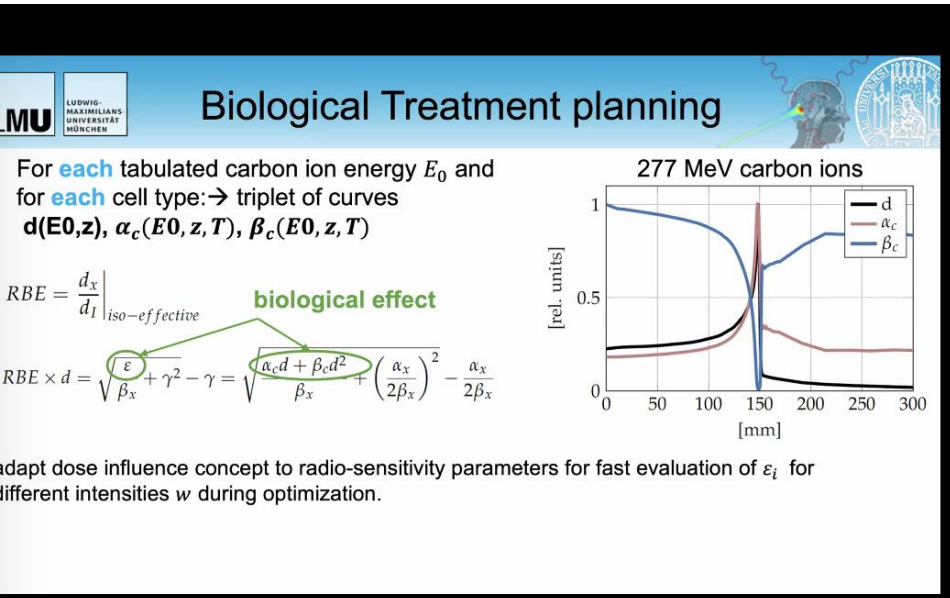

From Niklas Wahl to Everyone:
the blue area is bigger for carbon ions due to the fragmentation tail

Polls

Question: in Progress

Attendees are now viewing questions 147 of 229

1. Do you have MATLAB licenses?

Yes

No

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Heavy Ion Therapy Masterclass School

School Lectures

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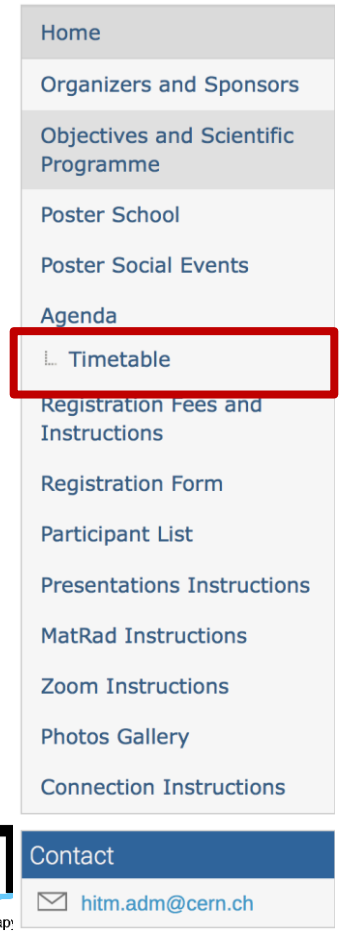

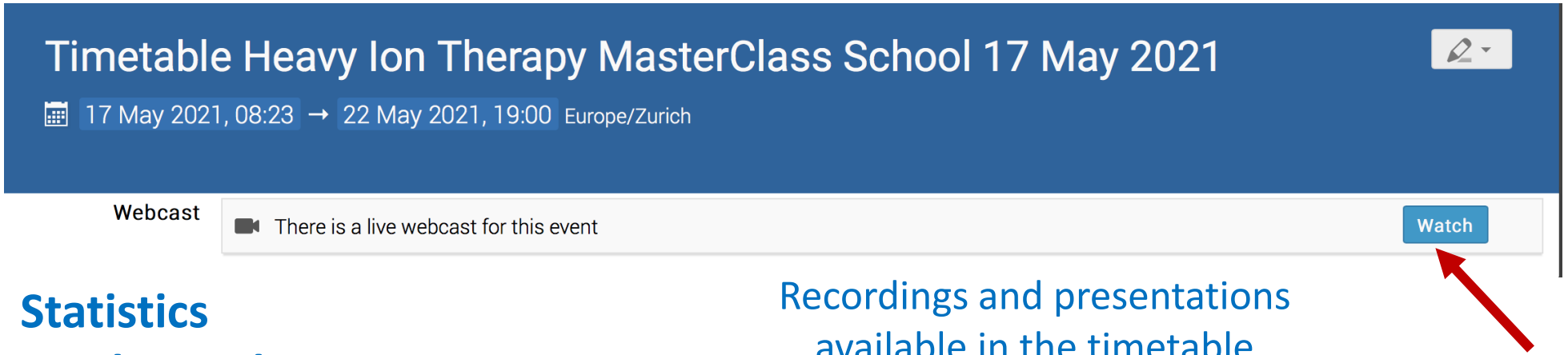

Statistics

Total: 35.5 h

- **Lectures: 18 h**
- **Hands-on 7.5 h**
- **Students sessions: 5 h**
- **Social Events: 5 h**

Recordings and presentations
available in the timetable
for the ones at different time zones
Immediately at lunch break and evening

Overall: much-too-much…
but still participation to social events !!

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Social Events Networking

The Platform

SpatialChat : 40-50 participants, 60 on Fri till 21:30

Link: https://spatial.chat/s/IonTherapyMasterclass

The Hosting team @ Social Events:

Amar Kapić

PhD student

EPFL/CERN

Aristeidis Mamaras

MSc student

AUTh/CERN

Damir Škrijelj

MSc student

UNSA/DKFZ

Rebecca Taylor

PhD student

ICL/CERN

Every evening 18:00-19:00 CET **8 speakers on various topics**

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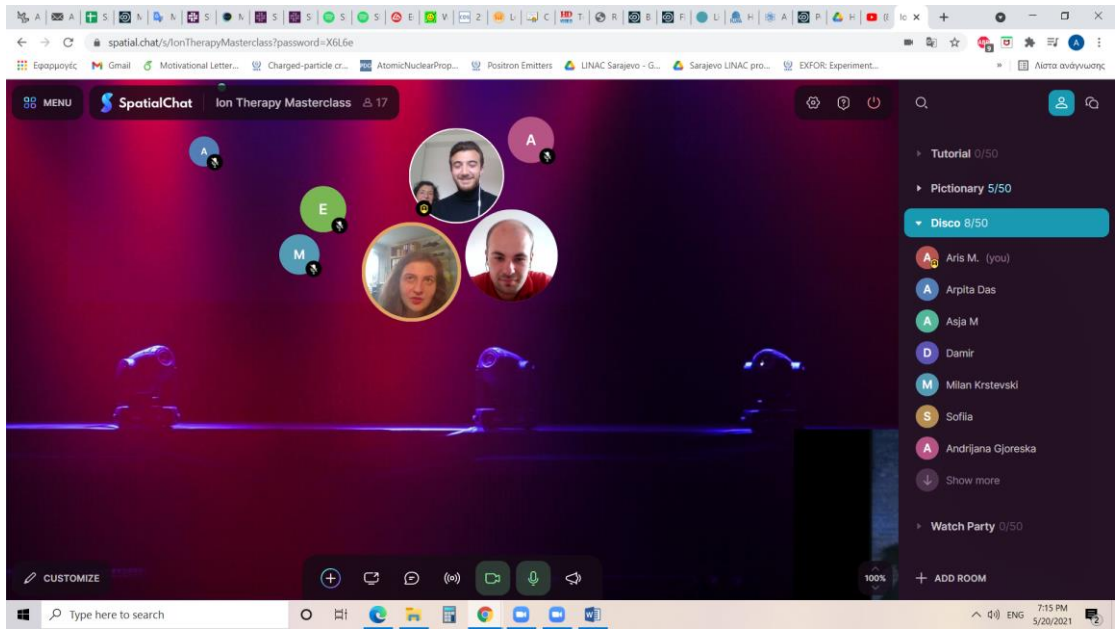
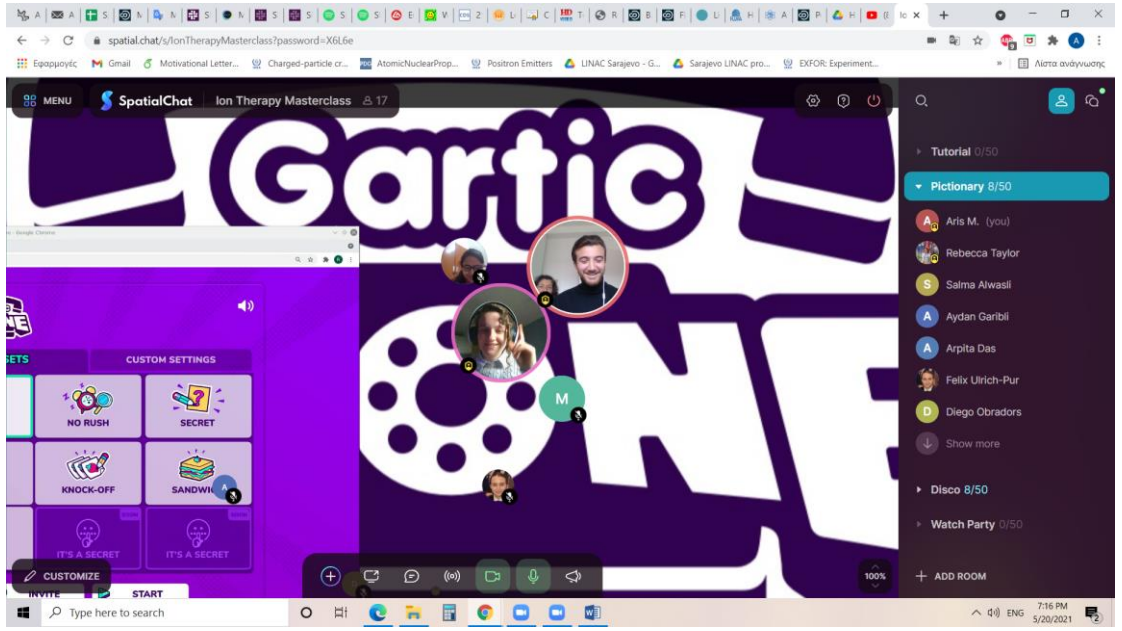
The disco and fun !





Requested to have SPATIAL available at coffee breaks !

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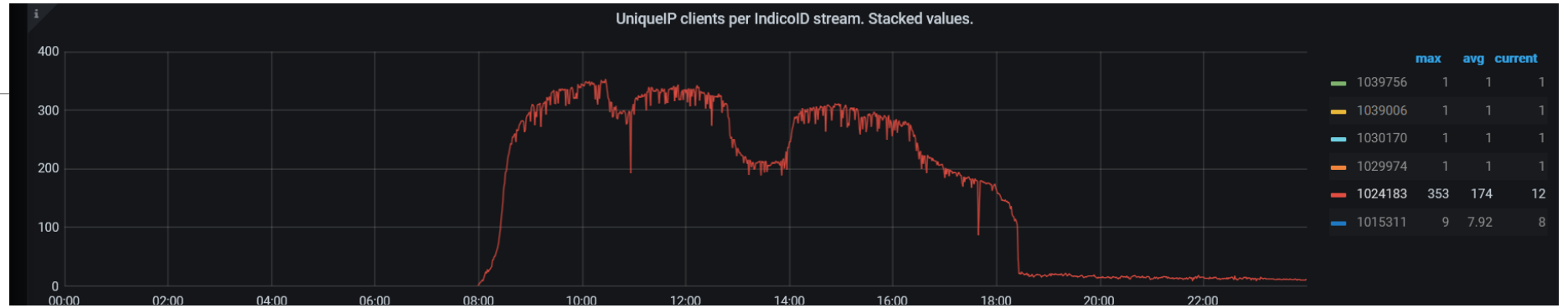
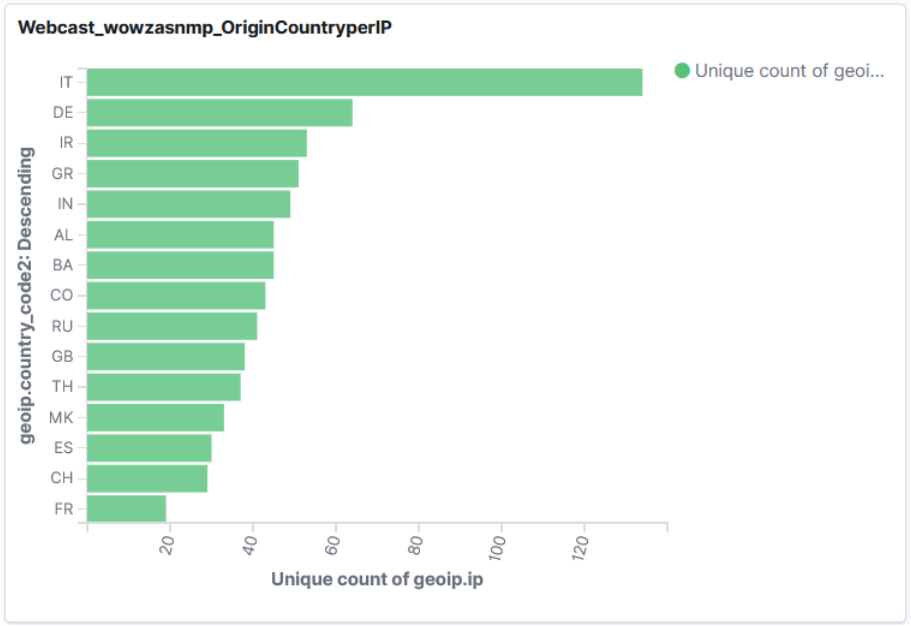
Participants via zoom and webacast

1st Day webcast: following via webcast in the afternoon too in addition to zoom connection

A single person
Could connect
Via different devices





Unique zoom IDs plus webcast by day
plus Egypt (80-100?) via one single zoom connection

- 17.5: 163 zoom + 353 webcast max +
- 18.5: 601 zoom + 51 webcast max +
- 19.5: 469 zoom + 78 webcast max +
- 20.5: 450 zoom + 32 webcast max +
- 21.5: 403 zoom + 21 webcast max +

TOTAL= 730 zoomIDs + 182 webcast (+ 353 for Mon) + Egypt = 1265 + Egypt

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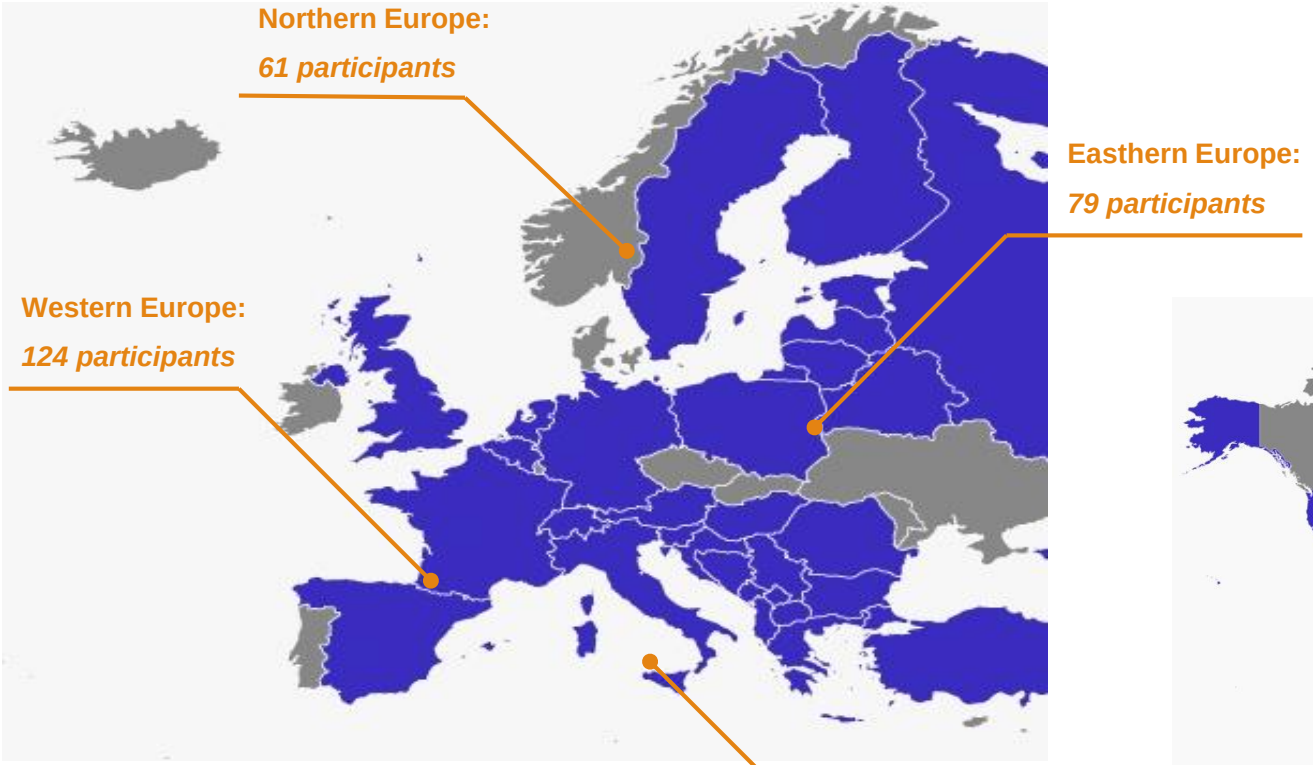
Heavy Ion Therapy Masterclass School

Expanding in Europe and beyond

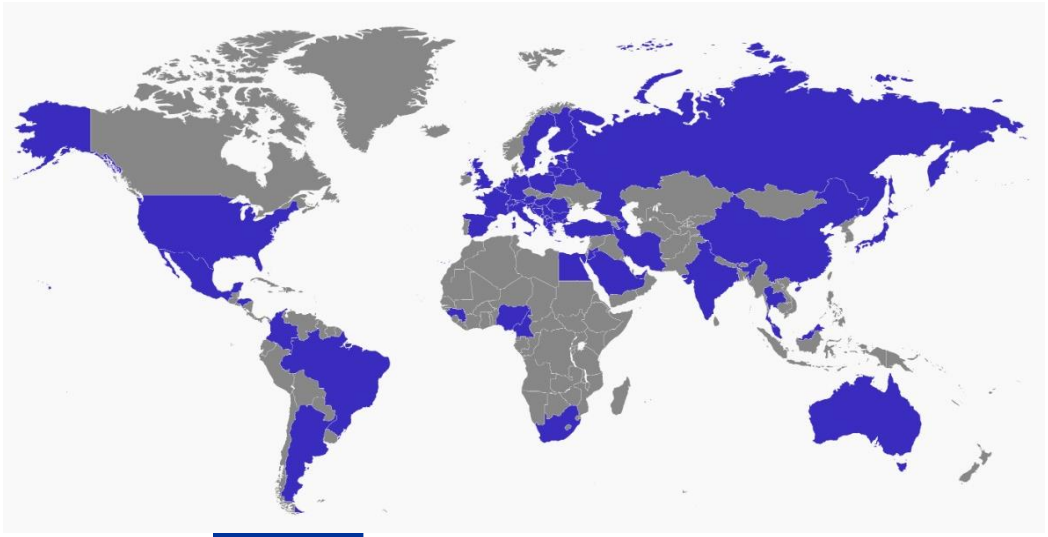


<u>European countries:</u>

- 495 partipants

<u>Non-European countries:</u>

- 470 participants



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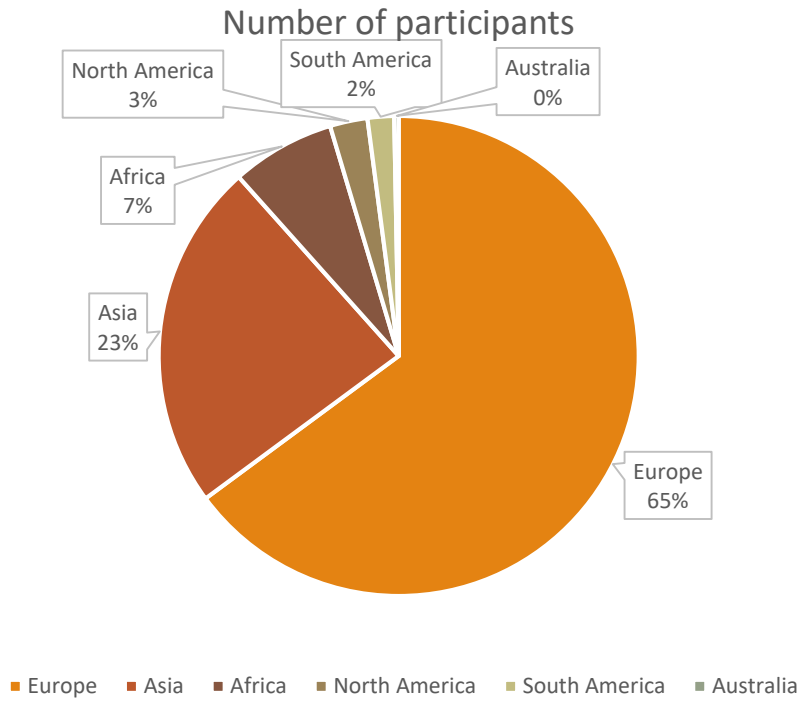
Heavy Ion Therapy Masterclass School

Expanding in Europe and beyond



	Europe	Asia	Africa	North America	South America	Australia
Number of participants	436	158	47	17	12	2

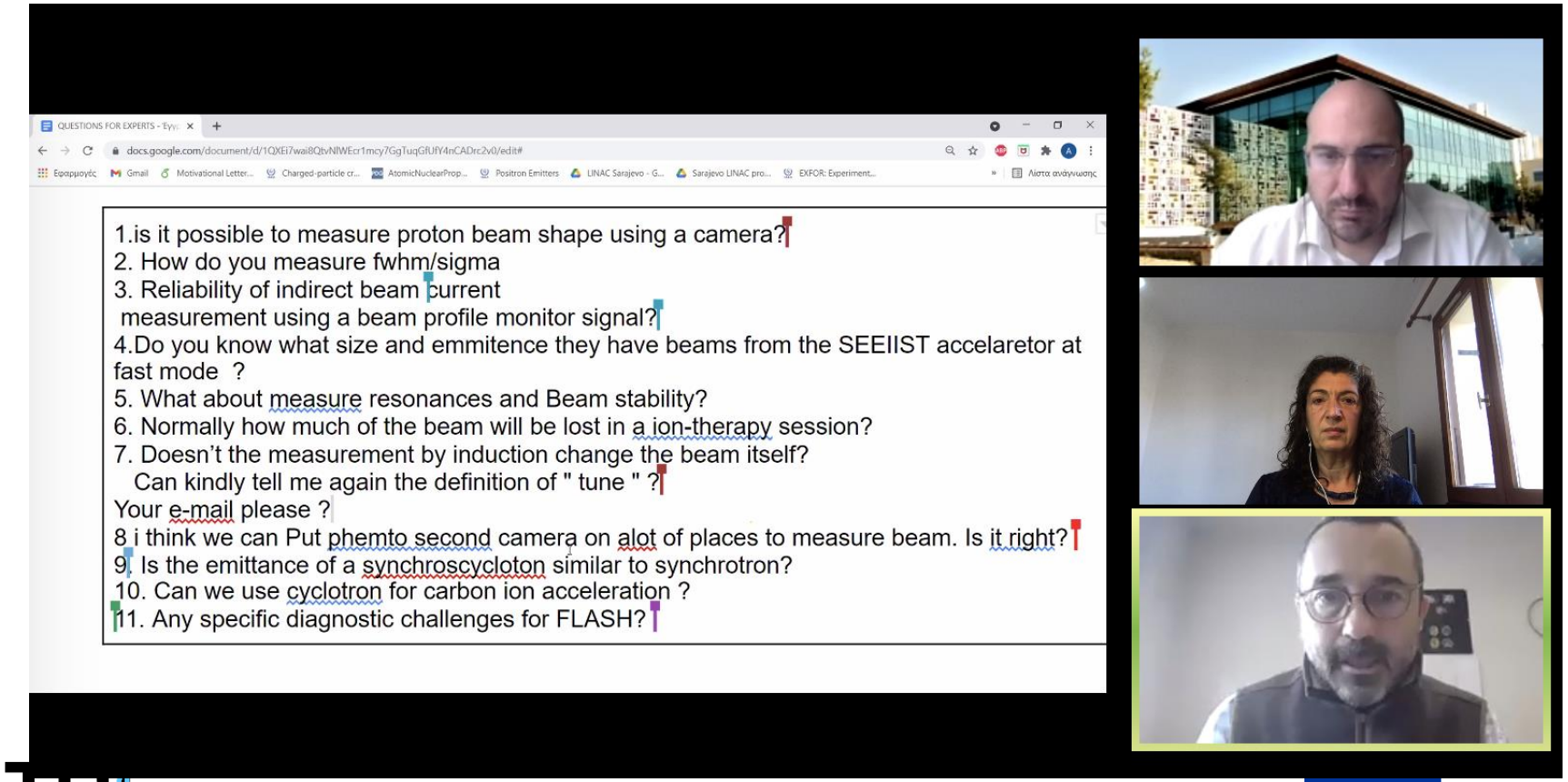
India, Egypt, Australia
Cameroon, Thailand, Iran, USA, Jordan, Nigeria, Ghana
Azerbajan, Singapore, South Africa, Malaysia,
Colombia, Mexico

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

Heavy Ion Therapy Masterclass School

Questions and Discussions



N. of Questions:

- 343 on questions doc
- zoom chat

- more than 100 questions during social events

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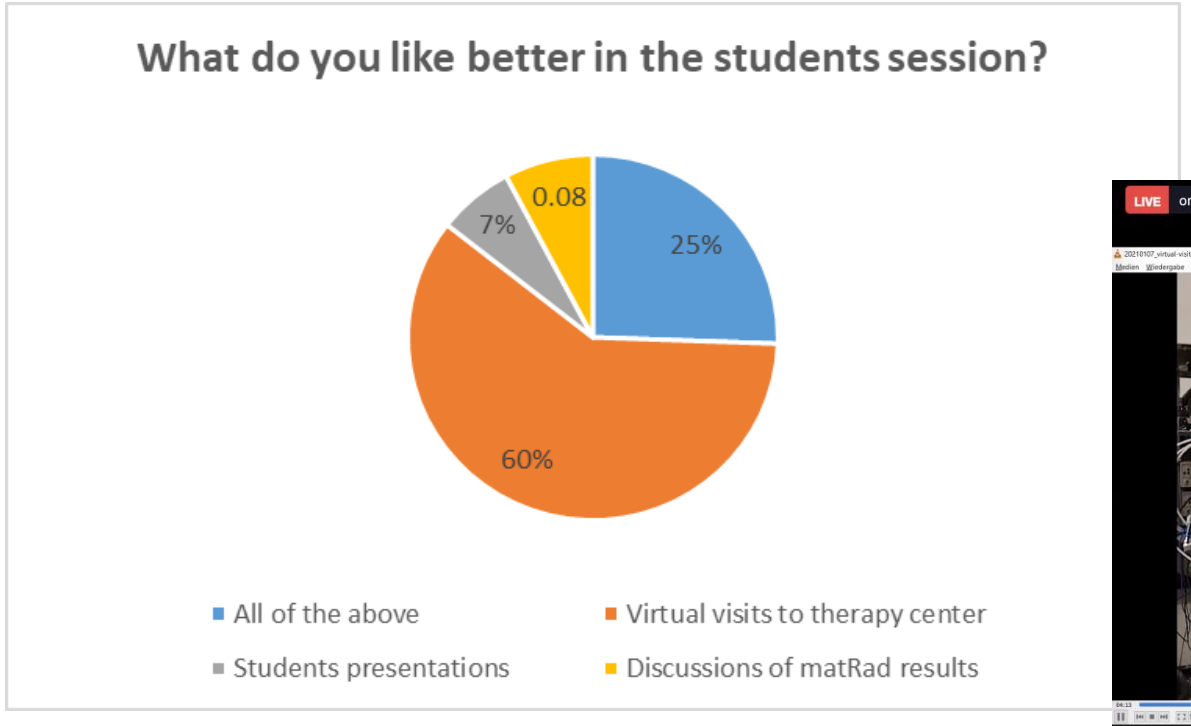
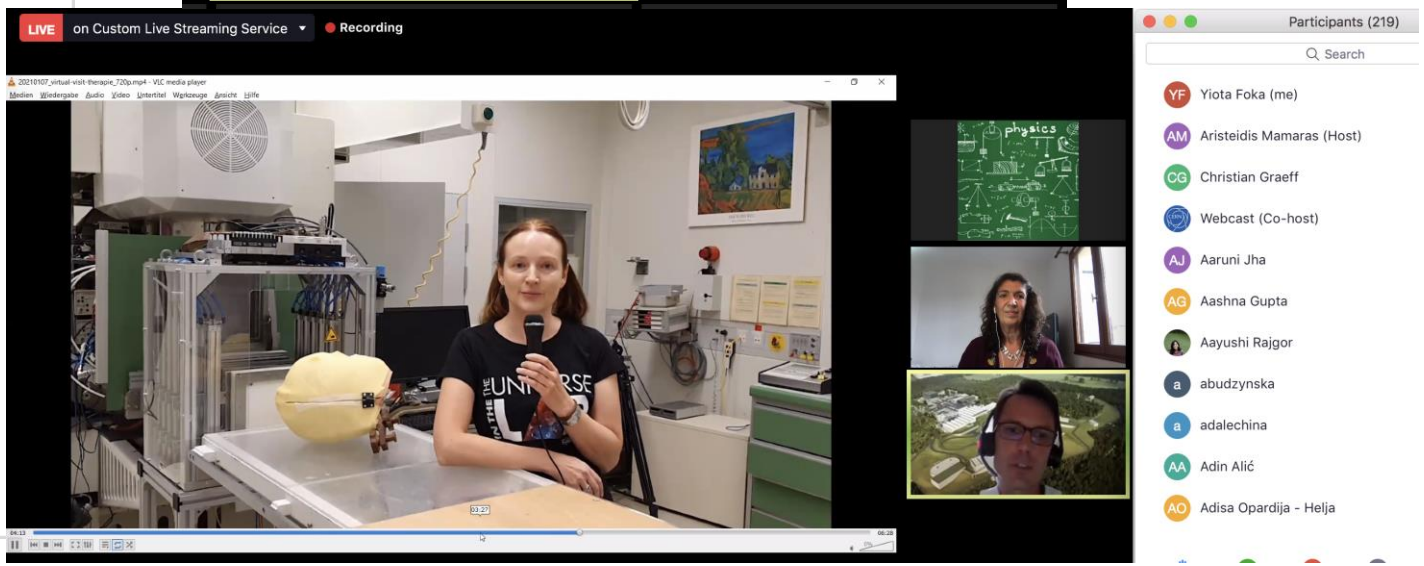
Zoom Polls

90 answers





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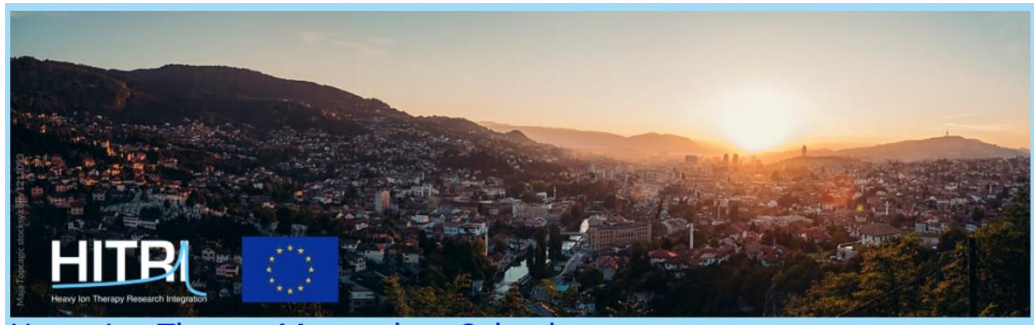
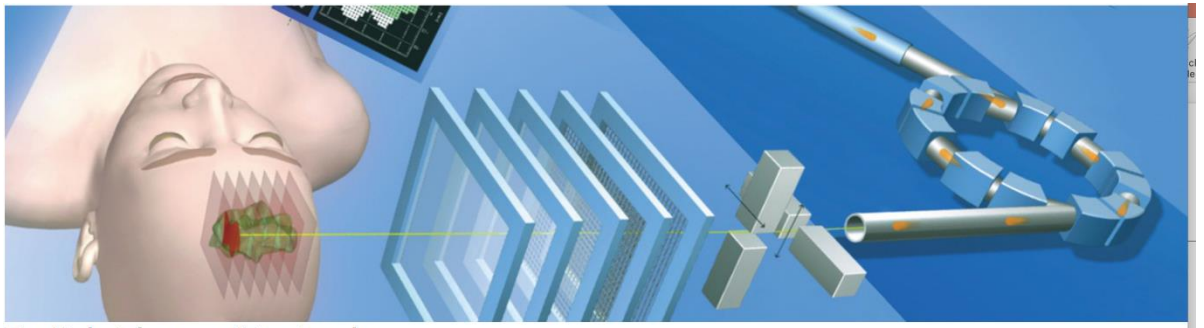


Heavy Ion Therapy Masterclass School

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



Particle Therapy Masterclass

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

Full week course

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

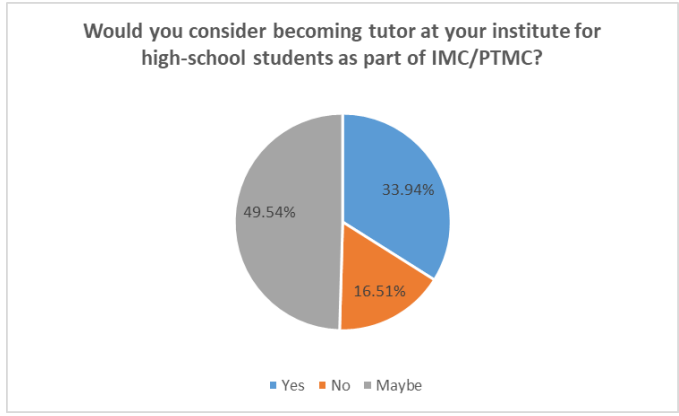
First of a series of schools and actions within HITRIplus to support the ones that *show strong promise and interest in becoming part of the heavy ion research community and who may then exploit and access Europe's heavy ion therapy research infrastructures.*

Details on internships and 2 future schools focusing on medical physics and clinical aspects by the WorkPackage coordinator Prof Nicholas Sammut

One day activity

The Particle Therapy MasterClass, is **aimed at high-school students (16-18),** to motivate them to choose related university studies.

Future Tutors



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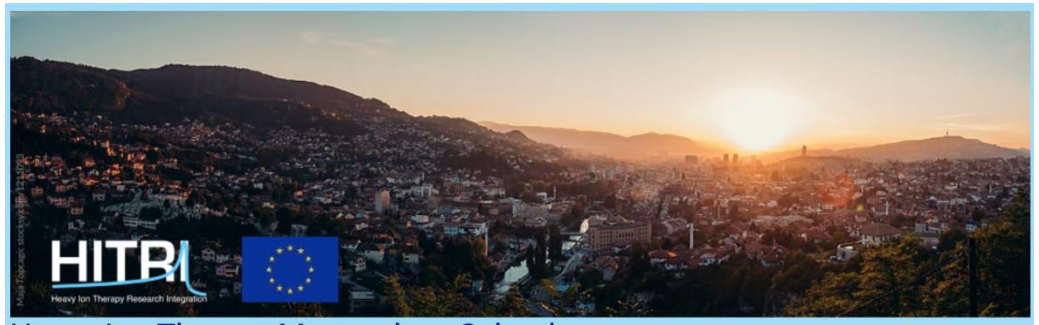

Heavy Ion Therapy Masterclass School

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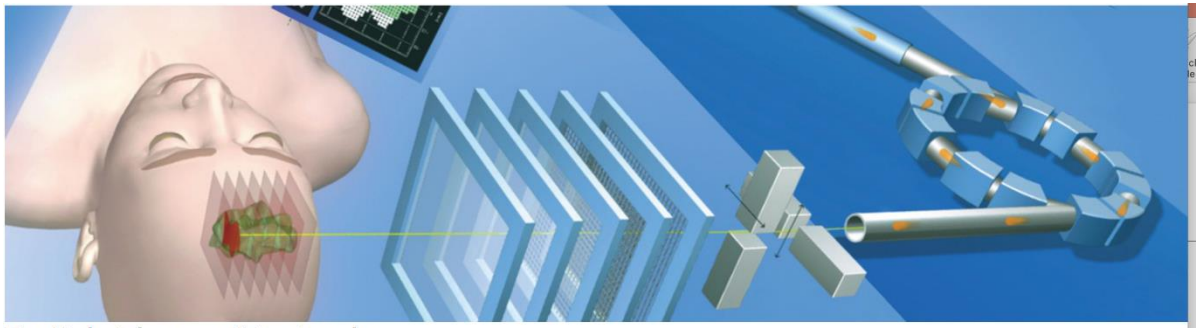


Particle Therapy Masterclass

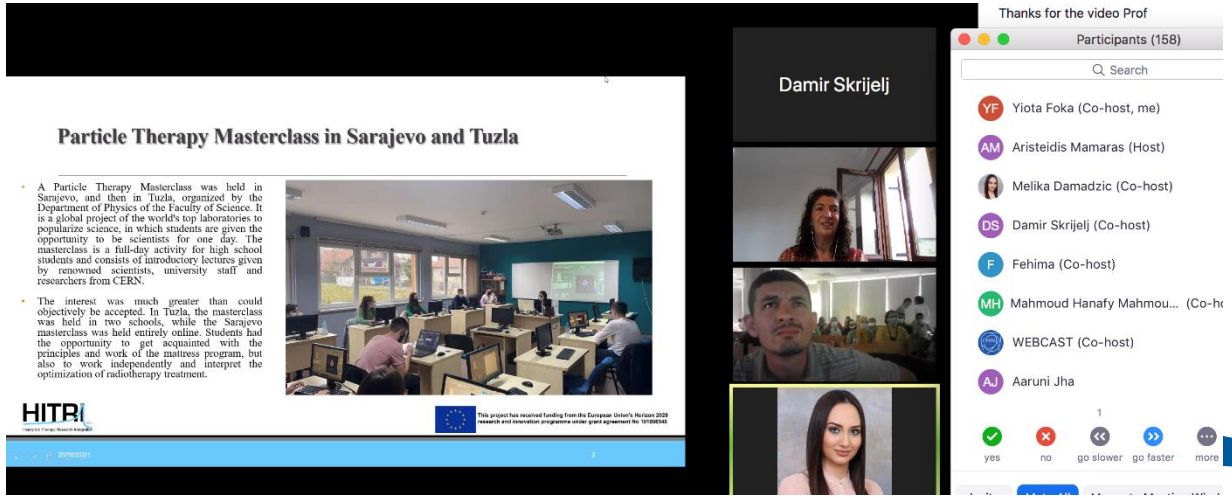
https://indico.cern.ch/event/840212/

Full week course

The HITRIplus HITM school will continue **supporting a growing community**

One day activity

The Particle Therapy MasterClass, is **aimed at high-school students (16-18),** to motivate them to choose related university studies.



Future Tutors

Sustainability

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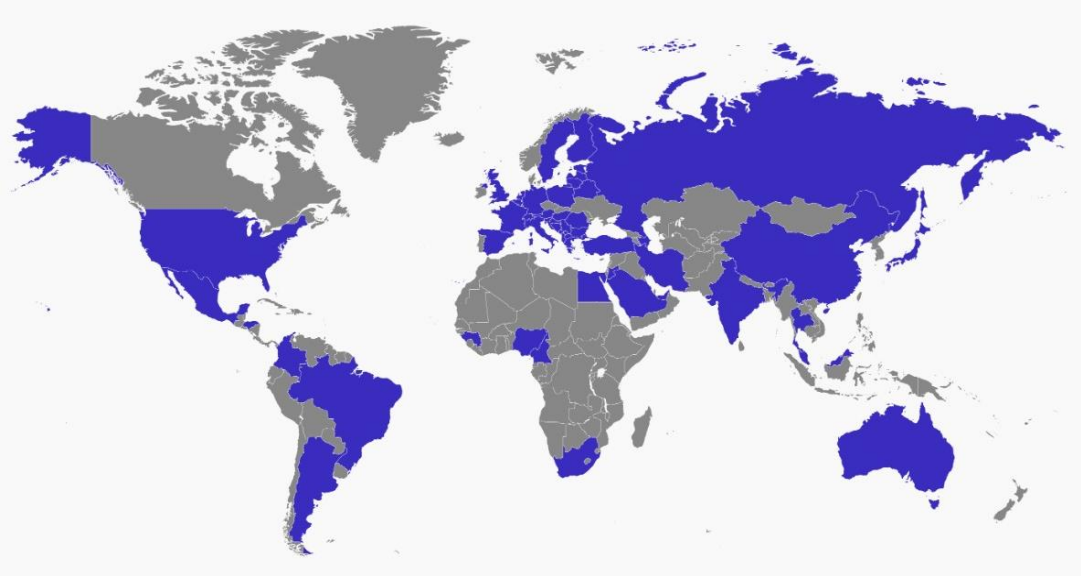
World-wide reach motivating next generation of scientists

HITRIplus full week heavy-ion therapy masterclass school

Heavy Ion Therapy Masterclass School



International MasterClasses one day activity

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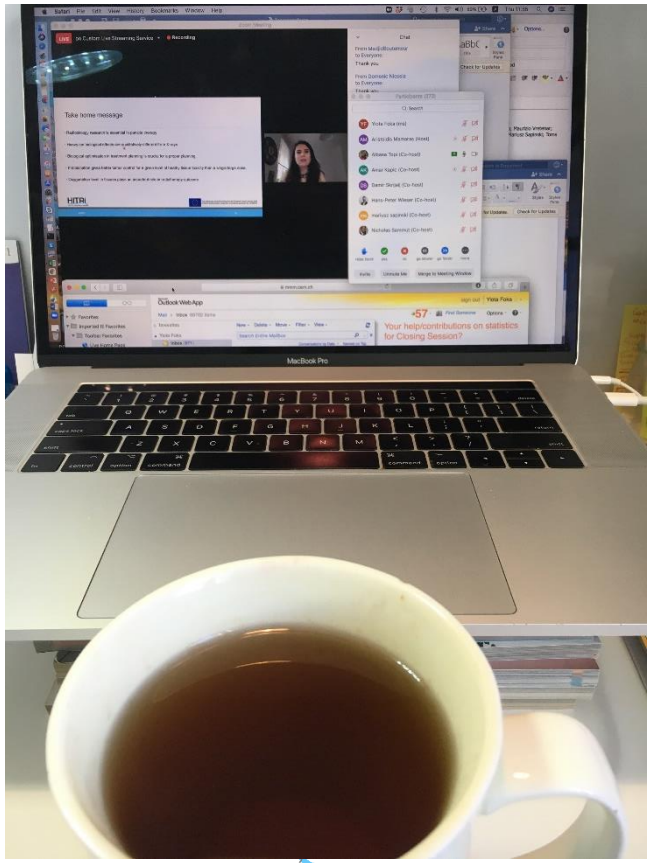
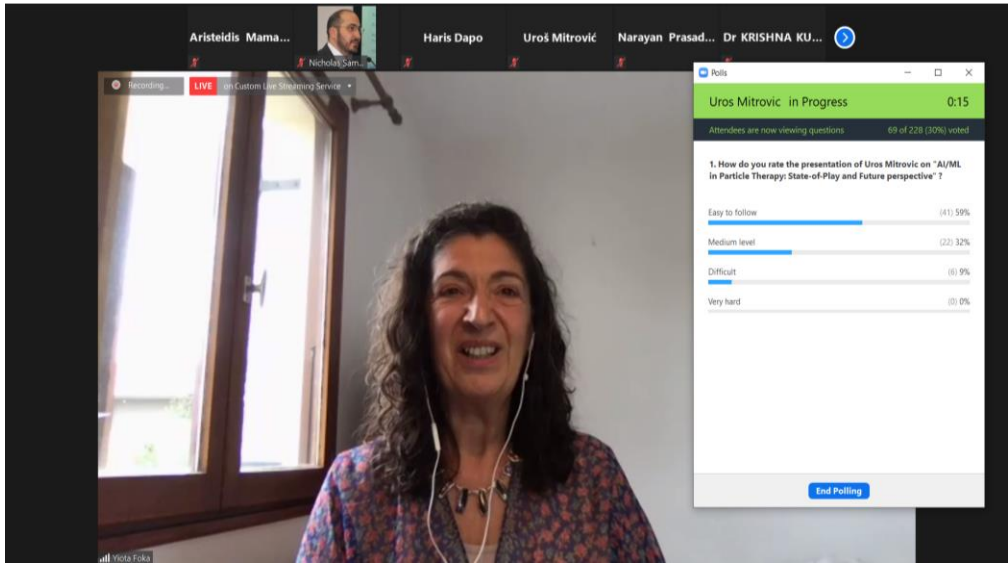
Heavy Ion Therapy Masterclass School

On the stage !



Statistics

- N. of litres of coffee
- N. of Kg of chocolate
- N. of emails answered
- N. of hours of sleep deficit…



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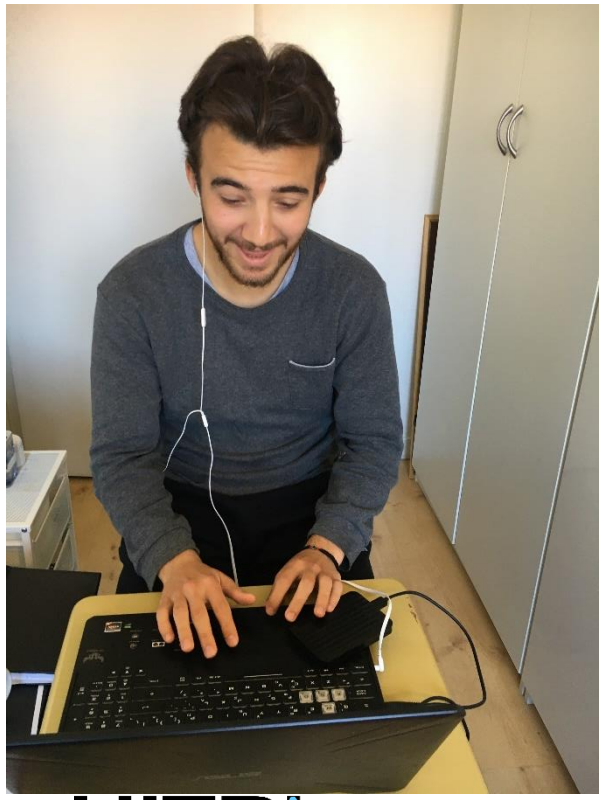
Behind the scenes !



Big Thanks!

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Heavy Ion Therapy Masterclass School

Thanks to all lecturers, speakers, moderators…

Speakers and Lecturers:	Institutes:
1. Amer Ajanović	ICL
2. Elena Benedetto	SEEIIST
3. Uta Bilow	TU Dresden
4. Giovanni Bisoffi	INFN
5. Manuella Cirili	CERN
6. Haris Dapo	ANKARA Univ./TARLA
7. Mirza Dautbasic	UNSA
8. Manjit Dosanjh	ENLIGHT/SEEIIST/CERN
9. Ana Đorđević	CERN
10. Angelica Facoetti	CNAO
11. Yiota Foka	GSI/EMMI
12. Piero Fossati	MedAustron
13. Nadia Gambino	MedAustron
14. Christian Graeff	GSI
15. Milkos Jaksic	IRB
16. Silvia Meneghello	CNAO
17. Uros Mitrović	Cosylab JSC
18. Silvia Molinelli	CNAO
19. Monica Necchi	CNAO
20. Ester Orlandi	CNAO
21. Matej Polzelnik	Cosylab JSC
22. Marco Pullia	CNAO
23. Ash Ravikumar	CERN
24. Mimoza Ristova	UKIM
25. Mariusz Sapinksi	SEEIIST
26. Joao Seco	DKFZ
27. Rebecca Taylor	ICL
28. Markus Stock	MedAustron
29. Dasa Stupica	Cosylab JSC
30. Albana Topi	GSI
31. Slavisa Tubin	MedAustron
32. Viviana Vitolo	CNAO
33. Vasilis Vlachoudis	CERN
34. Maurizio Vretenar	CERN
35. Niklas Wahl	DKFZ
36. Hans Peter Wieser	LMU

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Heavy Ion Therapy Masterclass School

Thanks to all supporting institutes

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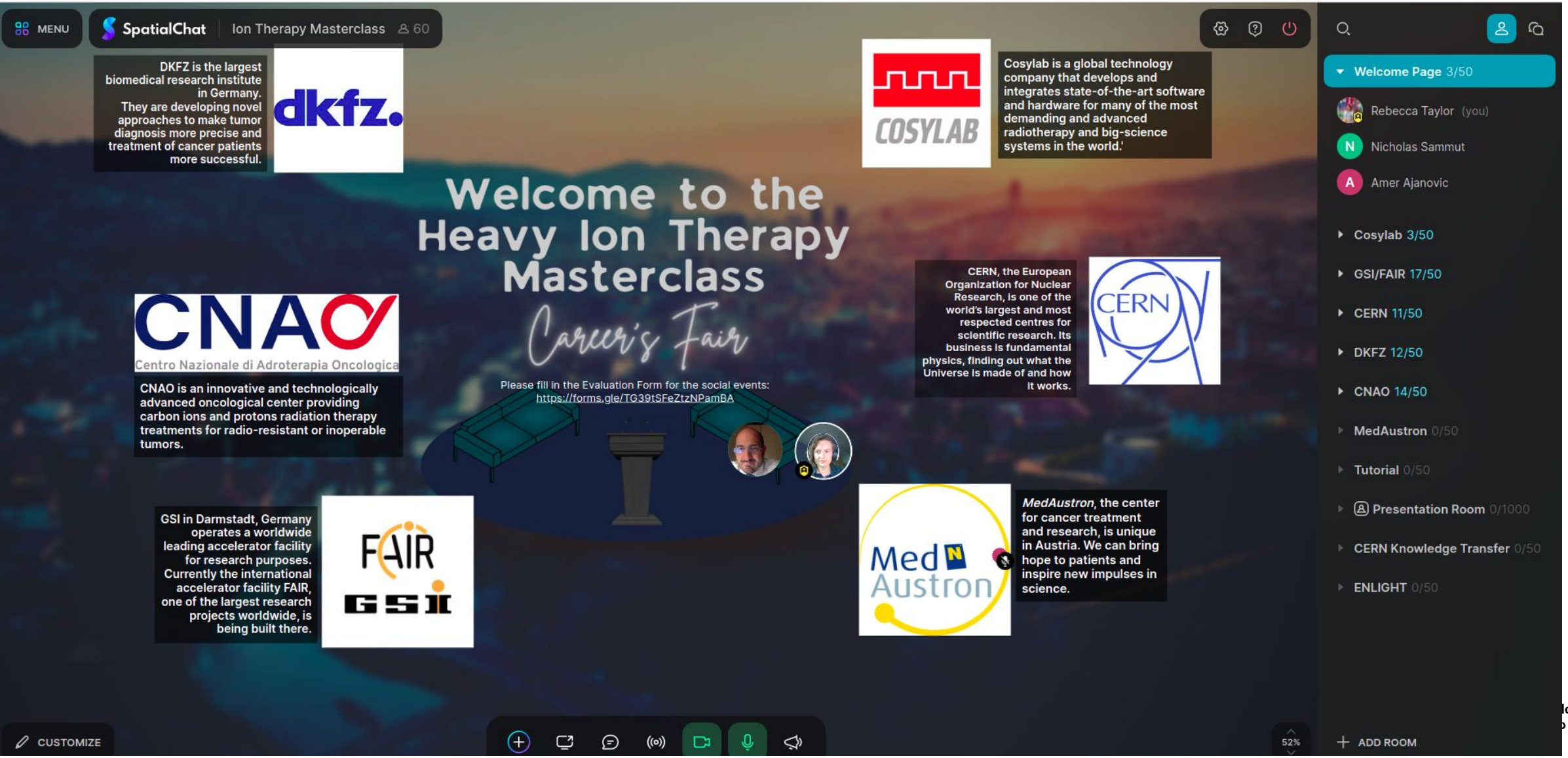
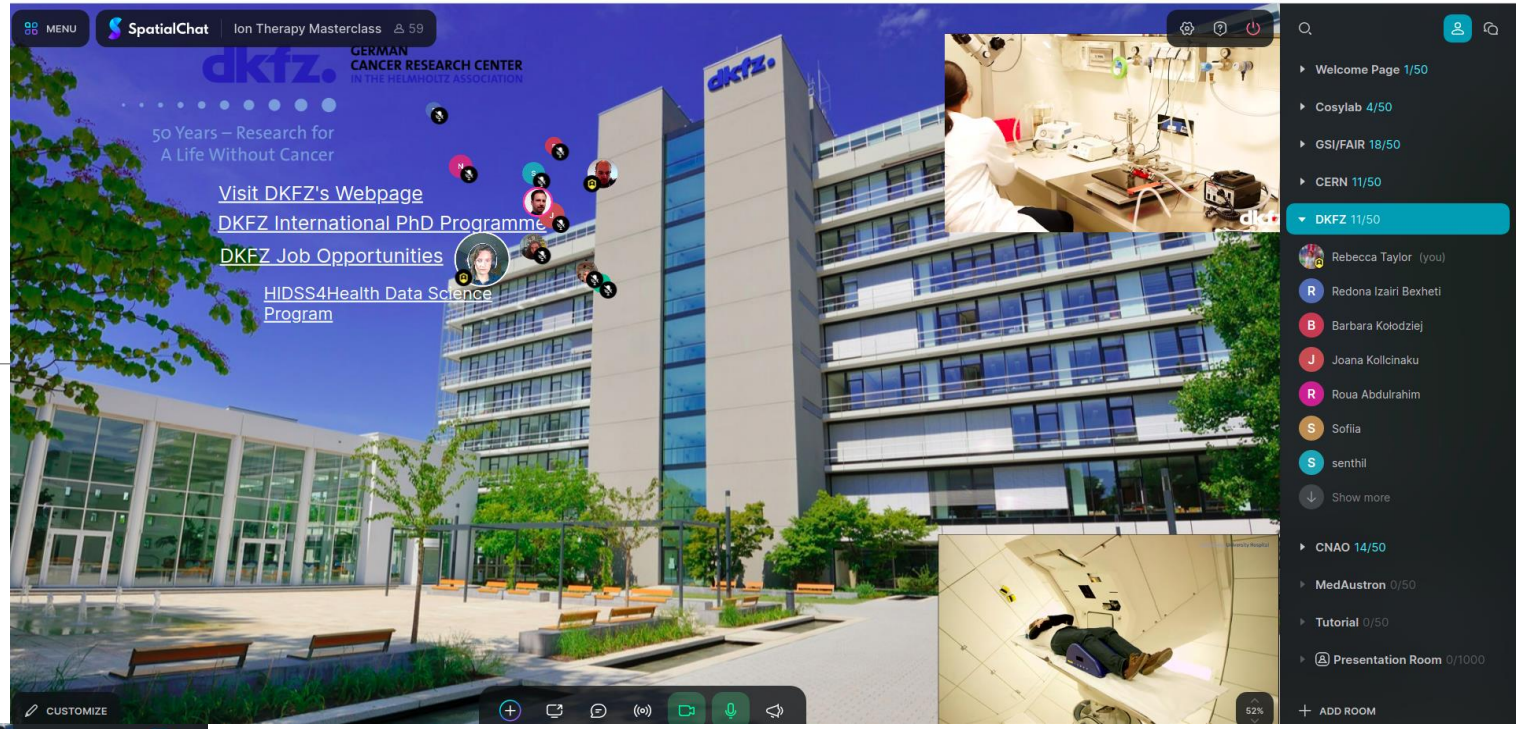
Thanks for your attention and comments !

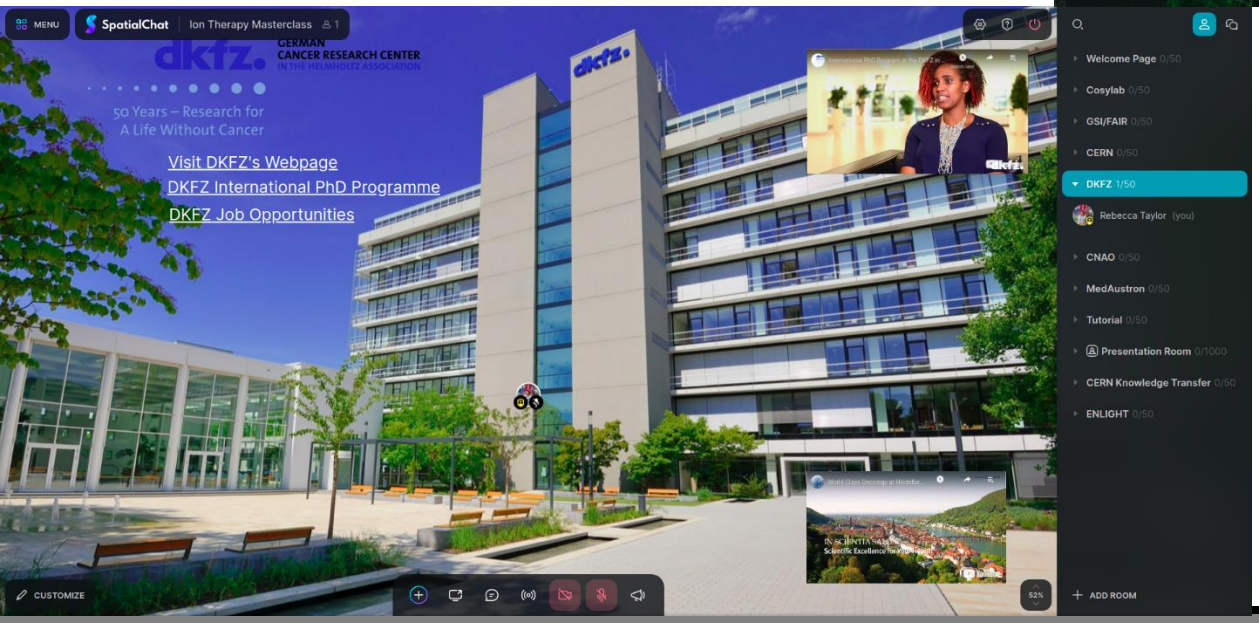


orizon 2020
101008548

Social Events: Career's Fair

DKFZ





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Social Events: Career's Fair

COSYLAB

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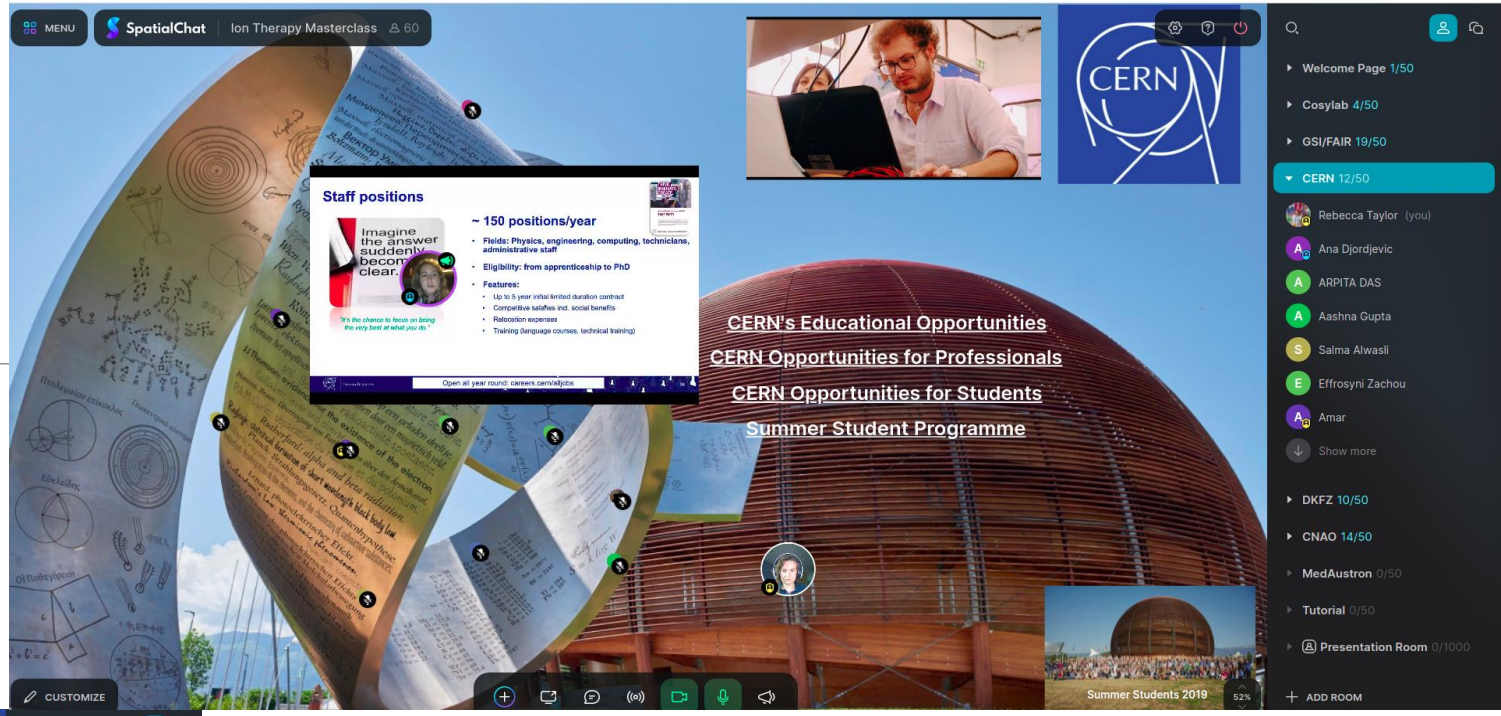
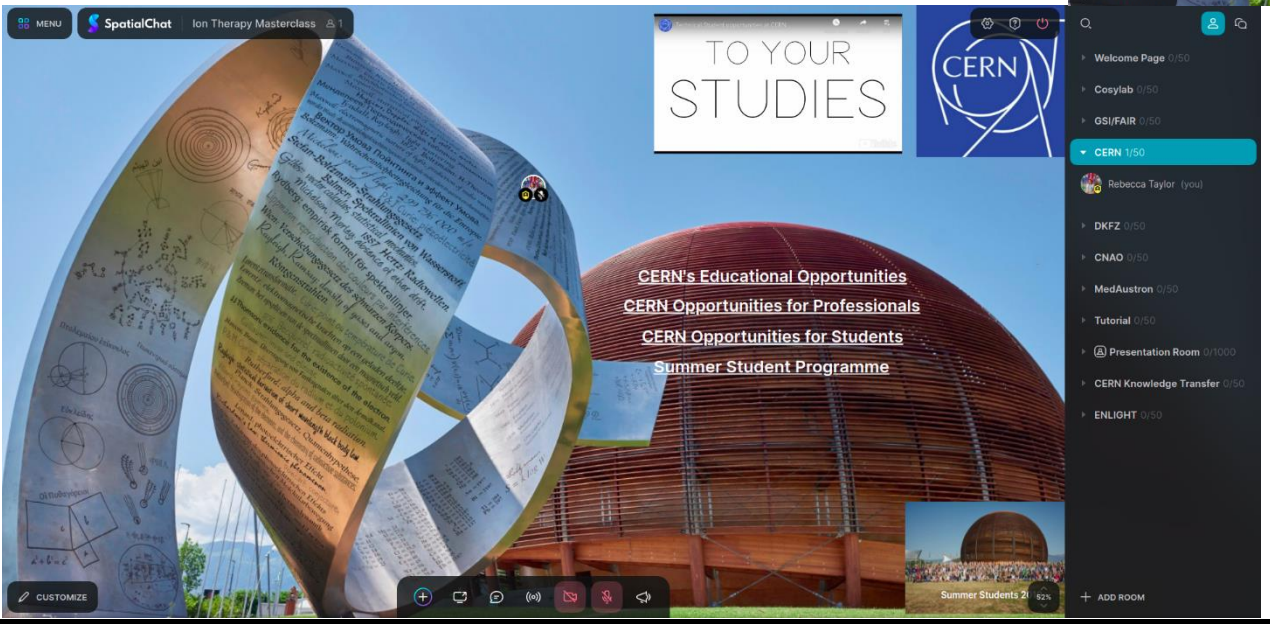
Social Events: Career's Fair

CERN





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Social Events: Career's Fair

GSI

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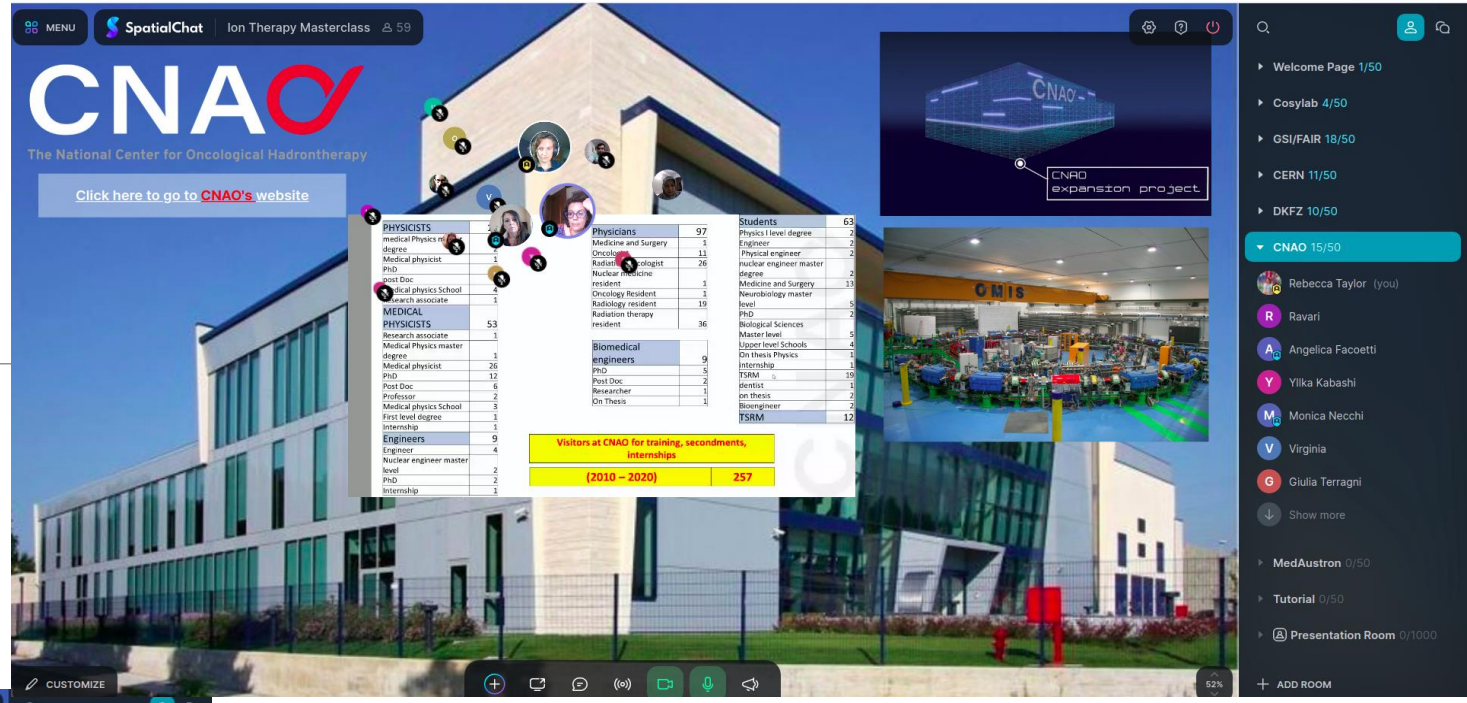
Social Events: Career's Fair

CNAO



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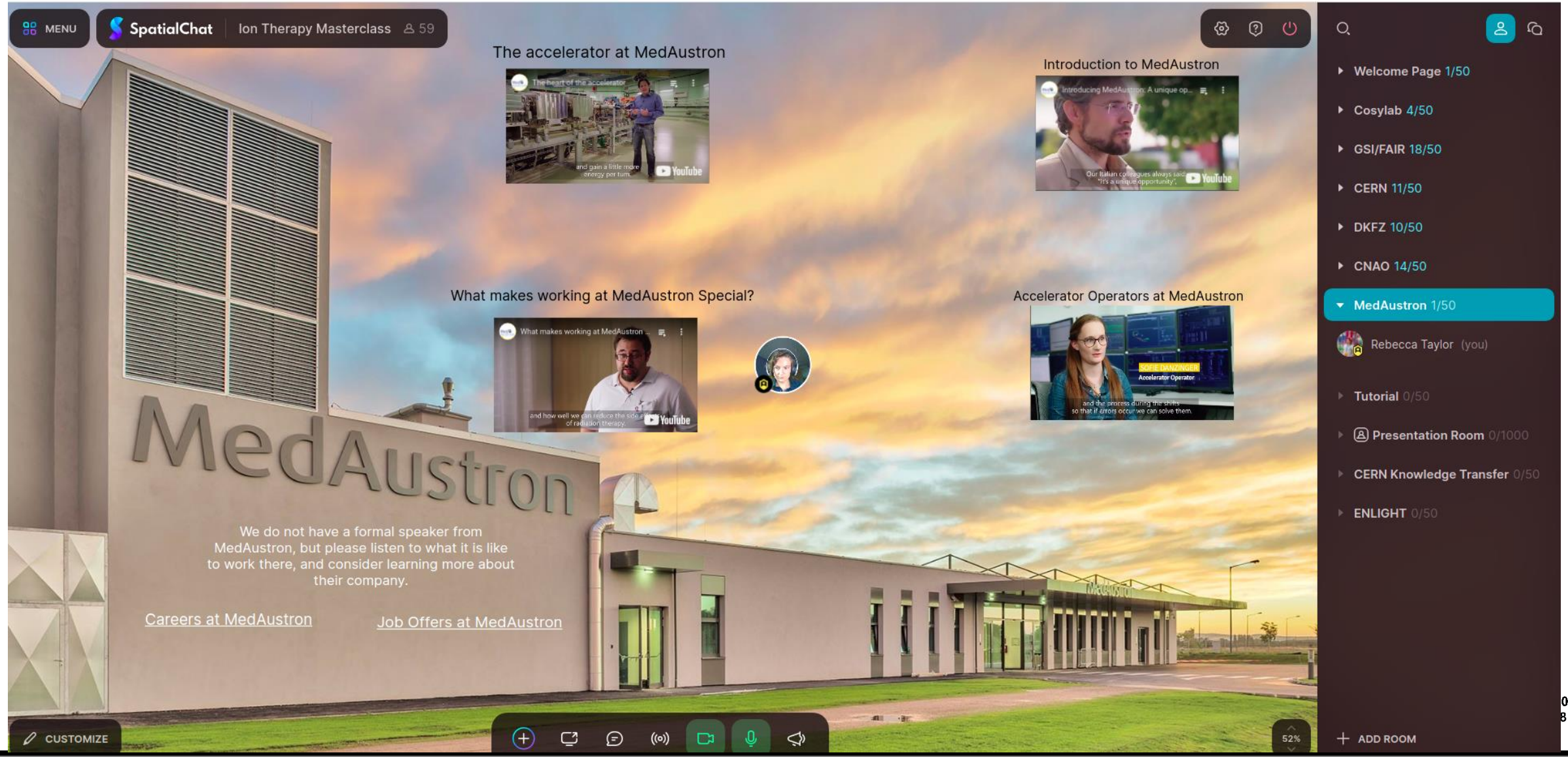
Social Events: Career's Fair MedAustron



Comments of Participants

Being online was a great advantage to get not only the students from all around the world to participate but also bring the experts

Opportunities to meet experts

We have no opportunity learn and have no experience in country

Interaction with foreign researchers, which is not a common experience

Variety of personalities and institutes

Sharing the knowledges between different centers

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Heavy Ion Therapy Masterclass School

Comments of Participants

Interactivity
Availability of presentations and recordings immediately

Question time/sessions
Questions shared document to experts
Excellent explanations
- speakers take time to answer all of the questions and that they answer any kind of question whether it is very simple or complicated

Patience answering questions
Availability for clarifications

MOTIVATING: The explanations were so interesting made me wanna learn more.

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Heavy Ion Therapy Masterclass School

Comments of Participants

Plethora, variety of excellent Top level, well known Speakers/experts in different related fields and the way that explain the topic, from basic concepts to in depth details with enthusiasm, keep the interest of the audience

Well structured/planned, very well-prepared sessions, high-quality program covering relevant interesting topics giving valuable information

Overview of possible future studies fields and directions

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Comments of Participants

Multidisciplinary, interdisciplinary approach, comprehensive school
Holistic approach of the topic of heavy ion therapy
Very informative

Combining physics concepts with biology and medicine topics
Balance between physics and biology aspects of the subject
Connecting accelerator physics, medical physics and biology

Starting from general and basic level, introducing concepts not cutting short
- very useful for the ones that come from other fields
- different aspects approached and discussed (in depth)
- detail descriptions and basics done very well

Covers most topics needed to get a grasp on what is really happening in particle therapy (starting from ion sources, accelerators, interaction with matter, radiobiology etc.)
Clear and concise, good insight in advanced cancer therapy technology
Deep technical insight
Approaching/analyzing particle therapy from different points of view

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Comments of Participants

I will be able to use this tool for improve my Masters thesis results.

I recognized at least 2 niches in which my team could contribute to solving current research problems/questions - microbeams and high dose rates.

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