

Medical Applications - news

Photo: CERN



Photo: CNAO treatment room



Knowledge Transfer
Accelerating Innovation

Manuela Cirilli
Medical Applications Adviser
CERN Knowledge Transfer Group

Strategy and framework applicable to knowledge transfer by CERN for the benefit of medical applications

approved by CERN Council in 2017

CERN/SPC/1091/RA
CERN/FC/6125/RA
CERN/3311/RA
Original: English
23 May 2017

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Action to be taken

Voting Procedure

For information	SCIENTIFIC POLICY COMMITTEE 304 th Meeting 12 & 13 June 2017	-
For information	FINANCE COMMITTEE 360 th Meeting 13 & 14 June 2017	-
For approval	RESTRICTED COUNCIL 185 th Session 16 March 2017	Simple majority of Member States represented and voting

**Strategy and framework applicable to knowledge transfer
by CERN for the benefit of medical applications**

The Council is invited to approve the strategy and framework set out in this document for medical applications-related activities, and to take note of the information contained in [Annexes I and II](#).

Updated strategy paper

Approved by CERN Council in June 2023

<https://cds.cern.ch/record/2864317?ln=en>

CERN/SPC/1091/Rev.
CERN/FC/6125/Rev.
CERN/3311/Rev.
Original: English
6 June 2023

ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
CERN EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Action to be taken

Voting Procedure

For information	SCIENTIFIC POLICY COMMITTEE 334 th Meeting 19-20 June 2023	-
For information	FINANCE COMMITTEE 386 th Meeting 20-21 June 2023	-
For decision	RESTRICTED COUNCIL 212 th Session 22-23 June 2023	Simple majority of Member States represented and voting

**Updated strategy and framework applicable to knowledge transfer
by CERN for the benefit of medical applications**

The Council is invited to take note of the information set out in this document and to approve the updated strategy and framework for medical-applications-related projects set out therein.

Reasons for the update

The CERN Medical Applications Advisory Committee (CMAAC) is replaced by dedicated review panels of external medical experts convened on an ad hoc basis.

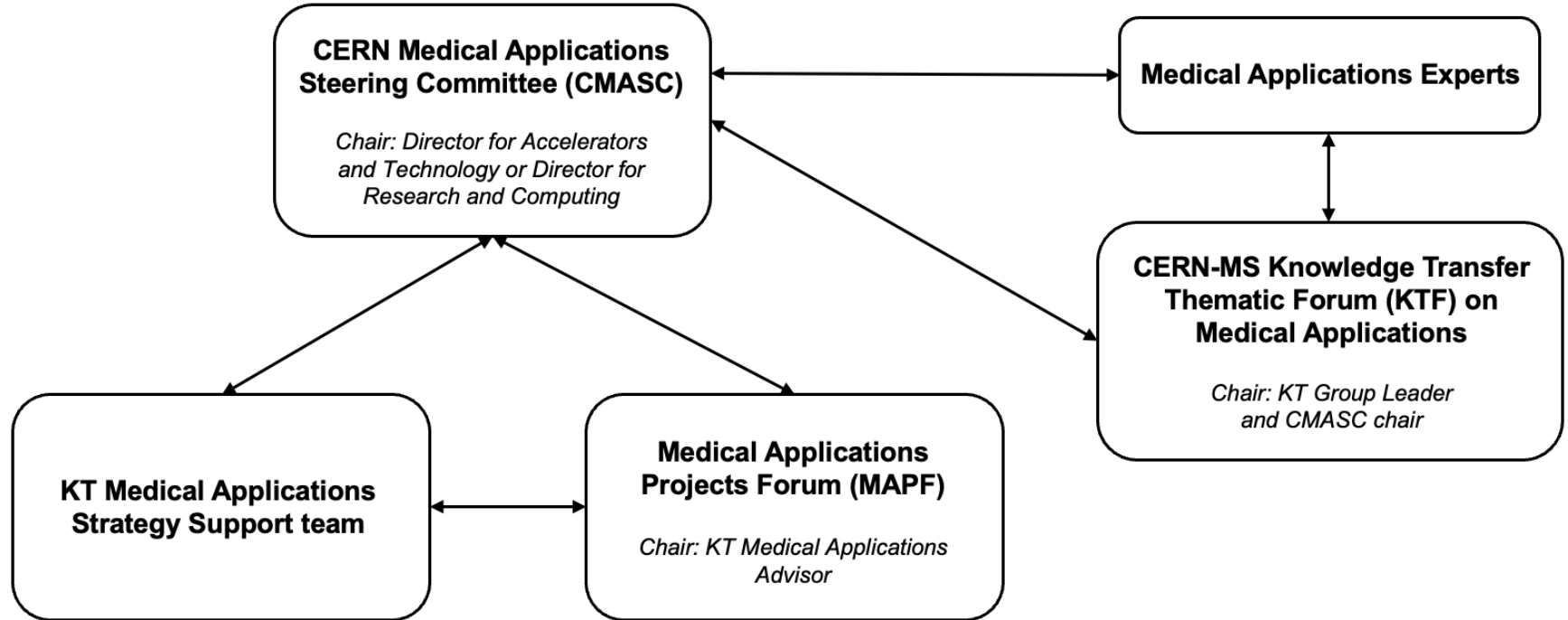
- The experience with the CMAAC has shown the need for more flexible and directed expert input. This change aims to provide meaningful and timely input on CERN's medical applications activities across a wide-ranging domain while considering the availability of heavily solicited medical experts.

Changes in CERN's organizational structure (SY, KT within IPT)

The update of CERN's personnel data processing policy

In 2019, the Medical Applications budget selection committee was introduced to scrutinise internal proposals to utilise CERN's seed funding for medical applications-related activities.

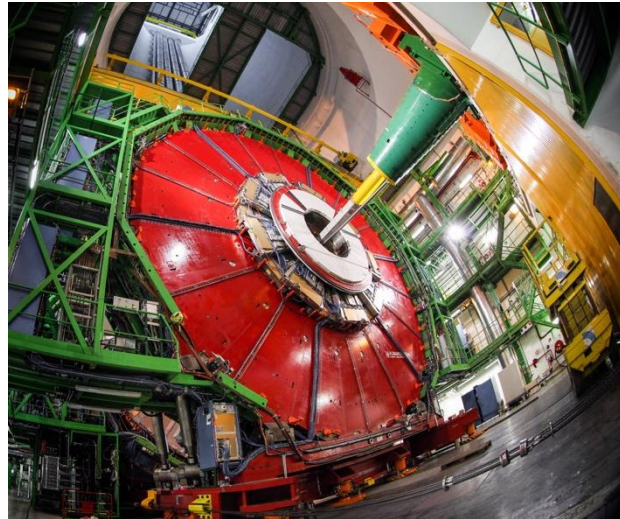
New Organization



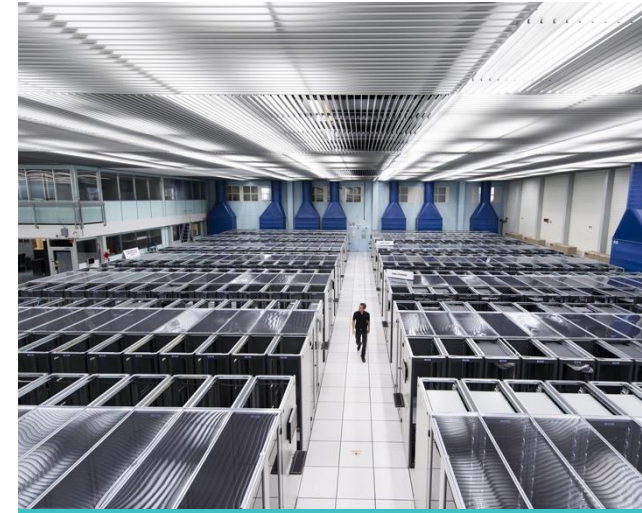
Annex I summarises the main ongoing medical applications projects



ACCELERATORS



DETECTORS



COMPUTING

This has been fully updated

CAFEIN

A modular federated learning platform to support medical analysis, diagnosis and forecast

MARCHESE

Machine learning based human recognition and health monitoring system

See talk from Mario Di Castro later today

CAIMIRA

a risk assessment tool developed to model the concentration of viruses in enclosed spaces, in order to inform space-management decisions.

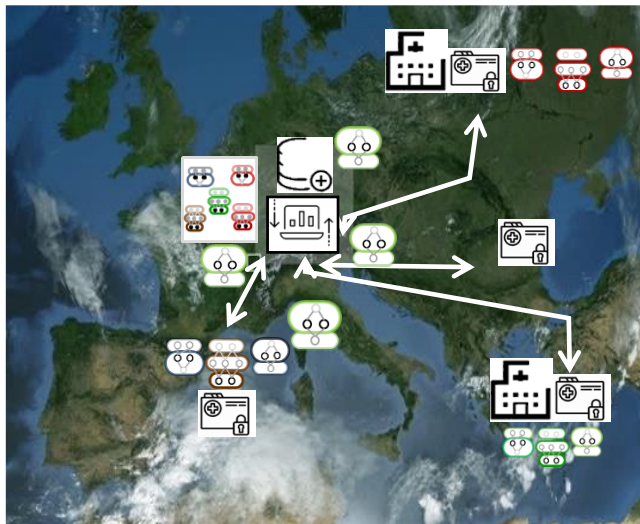
BioDynaMo

An agent-based simulation environment for multidisciplinary use

```
mirror_mod.use_z = False
if _operation == "MIRROR_Z":
    mirror_mod.use_x = False
    mirror_mod.use_y = False
    mirror_mod.use_z = True
...
... at the end -add back the deselected mirror modifier object
mirror_ob.select= 1
modifier_ob.select=1
bpy.context.scene.objects.active = modifier_ob
print("Selected" + str(modifier_ob)) # modifier ob is the active ob
#mirror_ob.select = 0
... = bpy.context.selected_objects[0]
```

CAFEIN

Federated Learning Platform developed and hosted at CERN for Medical Data algorithms training



share knowledge without exchanging data

Robustness of global models v. local models

Privacy and confidentiality of data

Decentralized Federated Learning for Healthcare Networks: A Case Study on Tumor Segmentation, B. Camajori Tedeschini, S. Savazzi, R. Stoklasa, L. Barbieri, I. Stathopoulos, M. Nicoli, L. Serio, January 2022, in IEEE Access

See talk from Luigi Serio at KT Forum MA 2022

Trustworthy Prediction of Stroke Outcome on a Federated Learning Infrastructure

<https://trustroke.eu>

Coordinator: Vall d'Hebron Institute of Research

Project Duration: 1 May 2023 – 30 April 2027

Stroke is the leading cause of severe disability worldwide

1.12 million strokes per year in EU

0.46 million deaths per year in EU

9.53 million stroke survivors

Stroke Organizations & Clinical Needs and Testing

Federated Learning Network Development



AI Algorithms Development

Sustainability, Legal & Ethical Regulations

Stroke Associations Coalition

Patient Communication & Monitoring



Data FAIRification & Trustworthiness

User Experience Design



AI-tool based on the integration of clinical and patient reported data

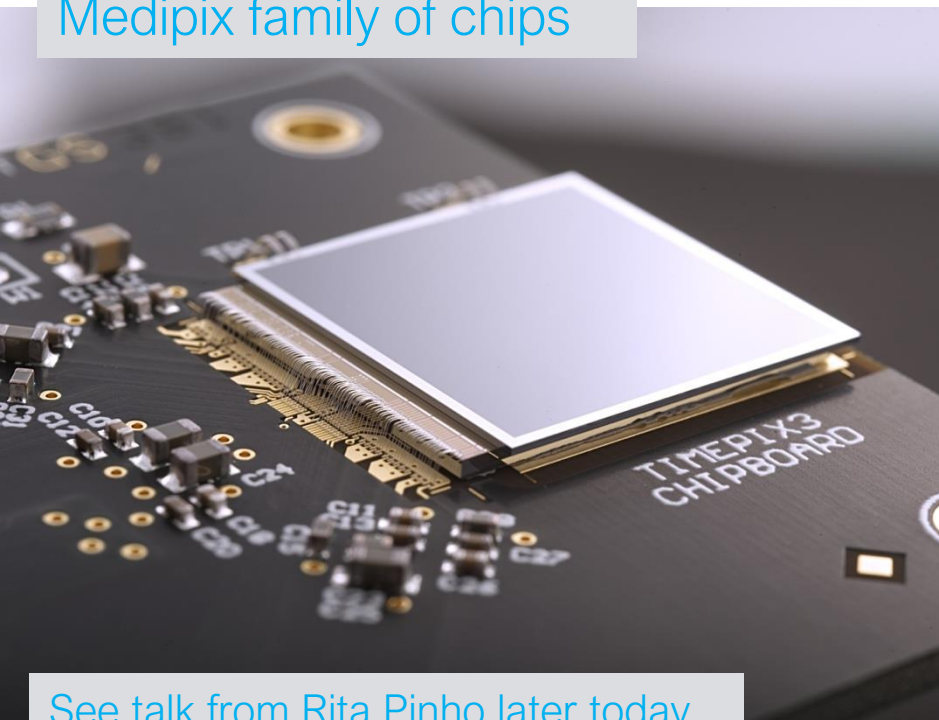
Trustworthy assessment of **disease progression** and **risk of recurrence**

Almost **10'000 enrolled patients** data will be used to train algorithms over **CERN federated learning platform**

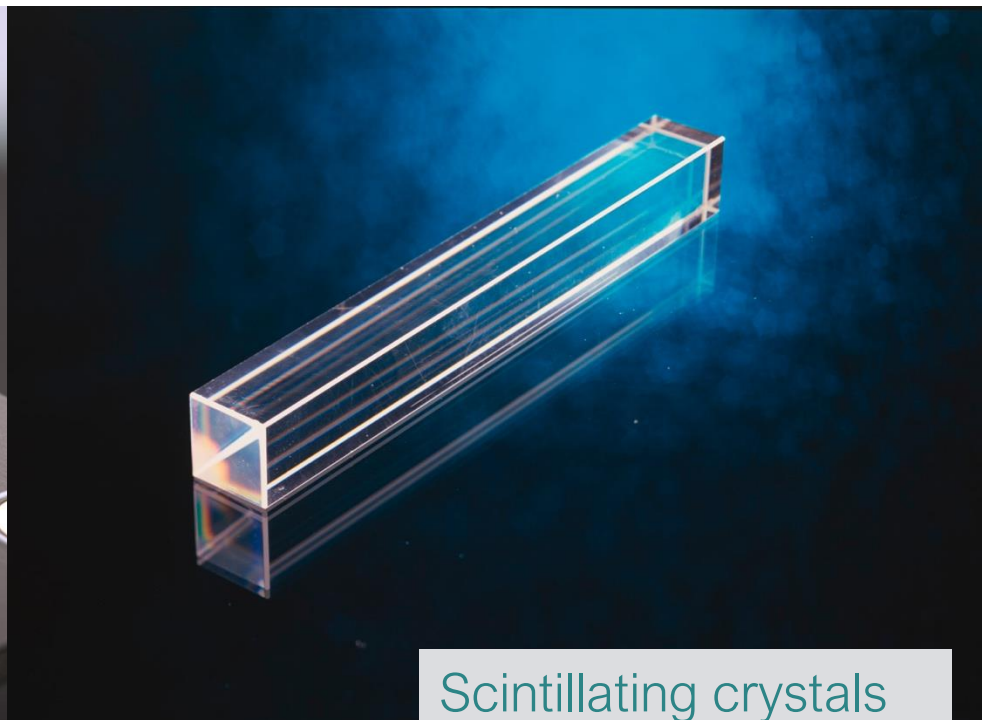
Funded by the European Commission under grant agreement No.101080564.



Medipix family of chips



See talk from Rita Pinho later today



Scintillating crystals

Radioisotopes








Non-conventional isotopes collected by mass separation for new medical applications



Innovative Nuclear Magnetic Resonance (NMR) techniques using unstable isotopes. Aimed at extremely high sensitivity and portability.



-  Provide access to new radionuclides and new purity grades for the medical research
-  Create a common entry port and web interface to the starting research community
-  Enhance clarity and regulatory procedures to enhance research with radiopharmaceuticals
-  Improve the delivered radionuclide data and regulation, along with biomedical research capacity
-  Ensure sustainability of PRISMAP on the long term

Status of Radiation Therapy Equipment

156 **7687**

Countries

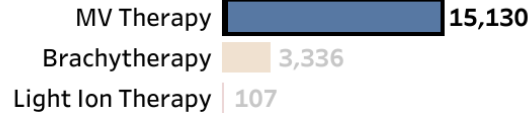
RT Centres

15130

MV Therapy

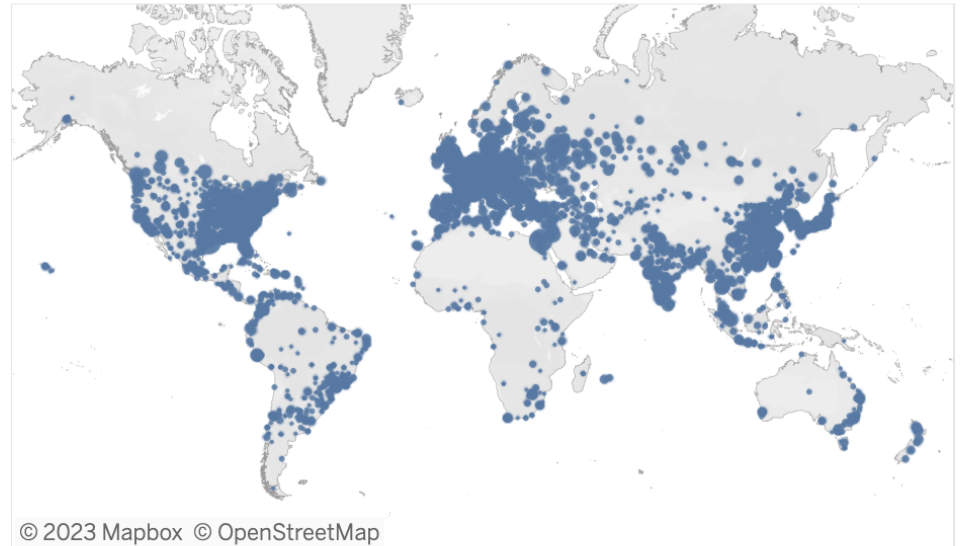
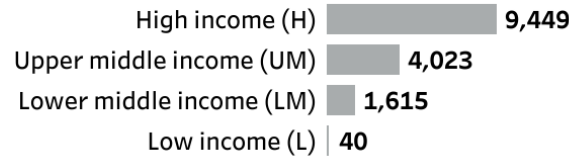
Equipment type

(Updated on : 09/03/2023 13:55:27)



Equipment per income groups

(Updated on : 09/03/2023 13:55:27)



IAEA

DIRAC

Directory of
RAdiotherapy Centres

STELLA - Smart Technology Extending Lives with Linear Accelerators

Just one example of a [widespread lack of access to cancer radiotherapy in LMICs](#):

A breast cancer patient in Zimbabwe requiring radiotherapy, being redirected to radical mastectomy after the machine broke down and fixing was going to take months. <https://www.bbc.com/news/world-africa-53322740>

STELLA unites a group of radiation oncologists, physicists, and biomedical experts with a goal to shift the paradigm in cancer care in LMICs, by [making radiotherapy more available](#).

ITAR (Innovative Technologies towards building Affordable and equitable global Radiotherapy capacity), supported by the STFC, surveyed needs and identified solutions:

- develop a new, technologically disruptive, more affordable and easier to maintain [LINAC-based radiation therapy system](#)

- use [Artificial Intelligence](#) to improve the patient outcomes and for machine management

- [capacity building](#) in LMICs to create a robust radiotherapy offer

What's next? CERN and the International Cancer Expert Corps (ICEC) are setting up a follow-up project to develop a more detailed overall design, preparing for industrial deployment in a subsequent phase

Status of Radiation Therapy Equipment

20 **104**

Countries RT Centres

107

Light Ion Therapy

Equipment type

(Updated on : 09/03/2023 13:55:27)

MV Therapy 15,130

Brachytherapy 3,336

Light Ion Therapy 107

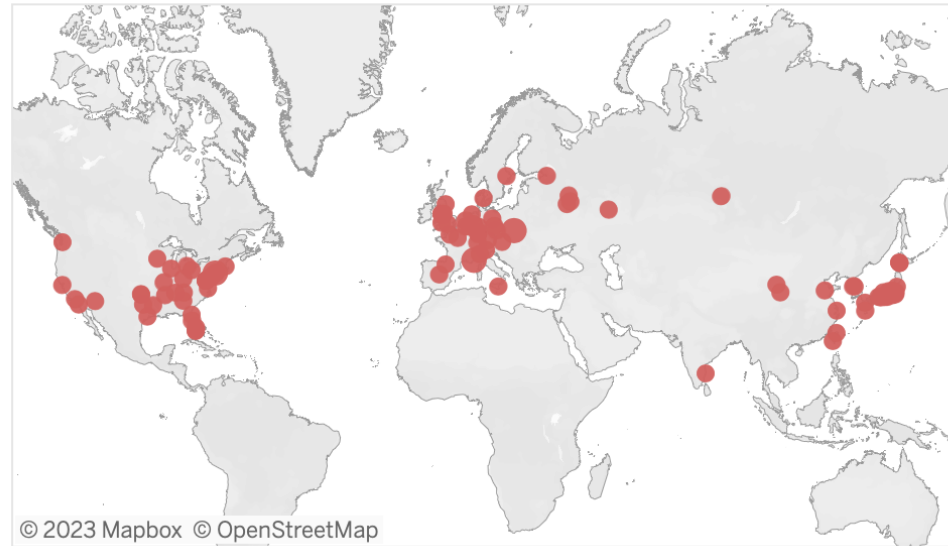
Equipment per income groups

(Updated on : 09/03/2023 13:55:27)

High income (H) 96

Upper middle income (UM) 10

Lower middle income (LM) 1



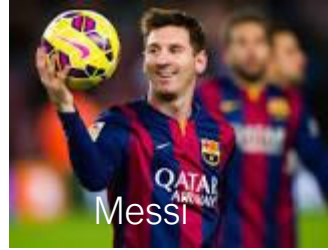
IAEA

DIRAC

Directory of
RAdiotherapy Centres



200



Messi



Higuain



Multi heavy ions
(protons + carbon ions)



Mandžukić

Proton multi-room



Karius

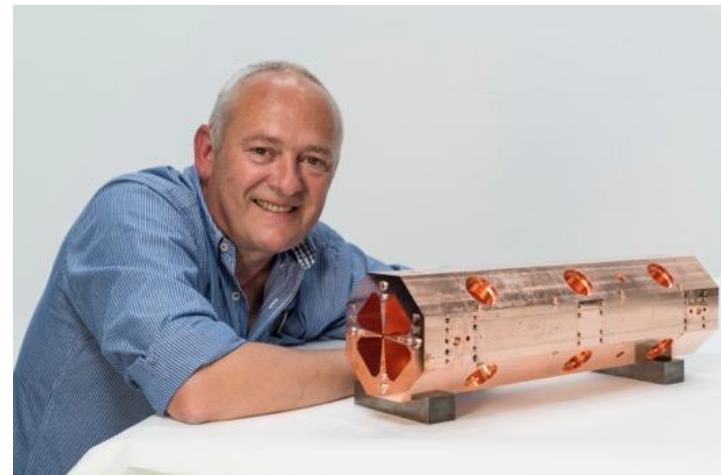
Proton single-room

Courtesy
(I'll never thank him enough!)
Marco Durante (GSI)
JENAS 2019

<https://indico.ijclab.in2p3.fr/event/5418/timetable/#20191016.detailed>

Protons: the LINAC way

<p>1990 RFQ2 200 MHz 0.5 MeV /m Weight :1200kg/m Ext. diametre : ~45 cm</p>	<p>2007 LINAC4 RFQ 352 MHz 1MeV/m Weight : 400kg/m Ext. diametre : 29 cm</p>	<p>2014 HF RFQ 750MHz 2.5MeV/m Weight : 100 kg/m Ext. diametre : 13 cm</p>
		



Licensed to AVO (Advanced
Oncotherapy) - ADAM

NIMMS – Next Ion Medical Machine Study

An R&D programme based at CERN for critical technologies related to ion therapy

Focus on the development of key technologies (a toolbox) corresponding to CERN core competences.

Various collaborations formalised:

SEEIST, STFC, Riga Technical University, University of Sarajevo, CNPEM

EuroSIG* collaboration CERN-CNAO-INFN-MedAustron: first project addendum signed, for the realization of a bending magnet demonstrator for a superconducting ion gantry

*former SGRUM

21 or 23 May, 2024
Marburg

Registration

Take Part of HITRI*plus*' Unique Expertise

Keep up to date on how you can benefit from the HITRI*plus* project by registering your interest for the Technology Matching Event. The event will match your potential with the technology that's right for your company's profile.

By registering your interest below, you'll be updated once more information is available.

Contact:

cecilia.voena@roma1.infn.it

Sandra.Muhr@cern.ch

HITRIplus partners

HITRI
Heavy Ion Therapy Research Integration
WWW.HITRIPLUS.EU

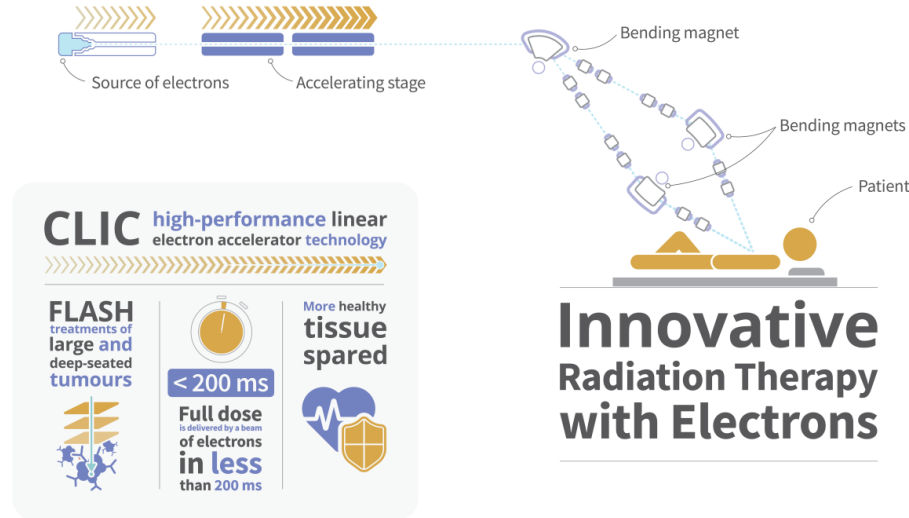
**HEAVY ION THERAPY
RESEARCH INTEGRATION PLUS
A NEXT GENERATION TOOL
AGAINST CANCER**

HITRI
Heavy Ion Therapy Research Integration
WWW.HITRIPLUS.EU

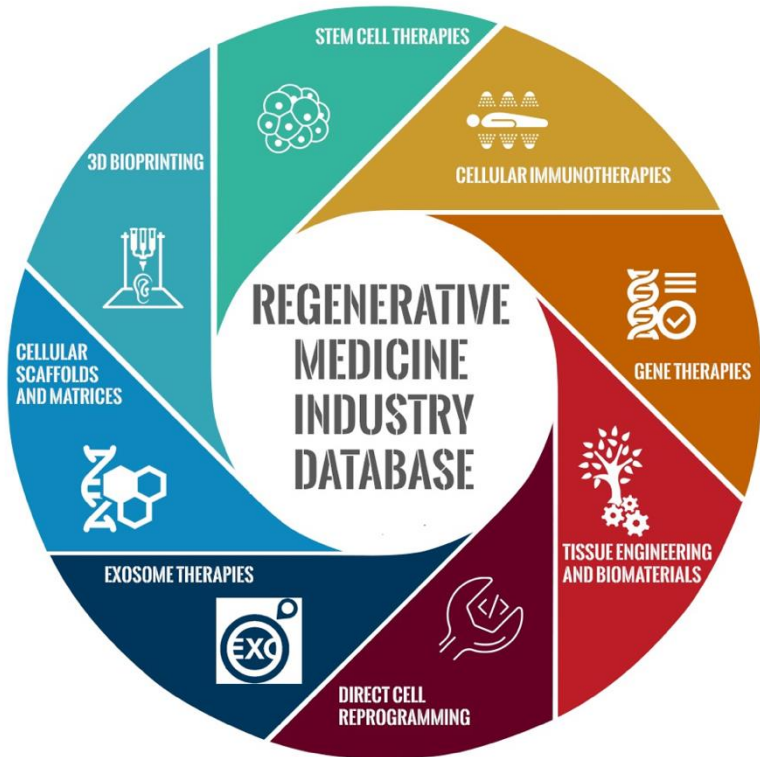
<https://indico.cern.ch/event/1266832/>

Very High Energy Electrons

CERN, the Centre Hospitalier Universitaire Vaudois (CHUV) and THERYQ (ALCEN group) have signed an agreement in November 2022 for the development of a revolutionary FLASH radiotherapy device that will use very high-energy electrons (VHEE) to treat cancers that are resistant to conventional treatments, with greatly reduced side effects.



Regenerative medicine



Exploring whether CERN tech and know-how can fuel innovation in regenerative medicine technologies:


KNOWLEDGE TRANSFER SEMINAR

The Promise of Regenerative Medicine and AI

- **Peter Egelberg**
(CEO and founder of Phase Holographic Imaging)

27 March 16:30
40/S2-A01 - Salle Anderson

<https://indico.cern.ch/e/regenmed>
for more information

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