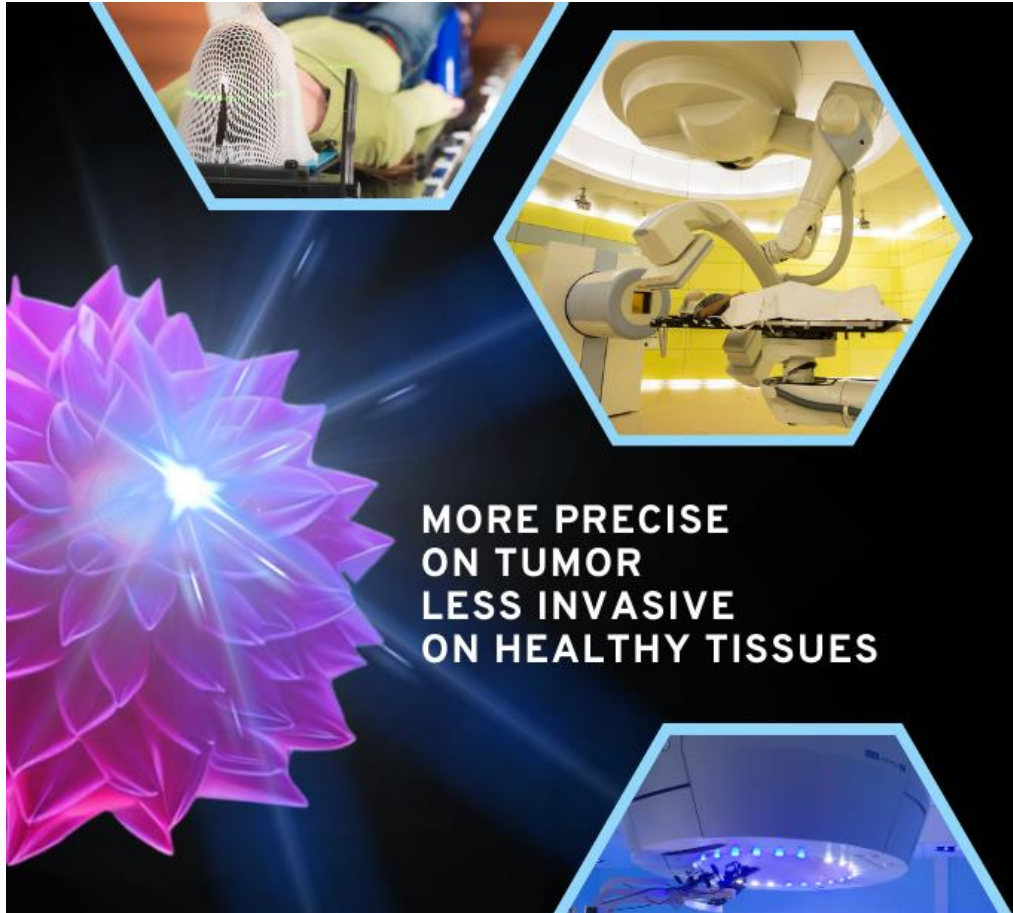


Clinical Aspects of Heavy Ion Therapy



Course Overview

Title: Clinical Aspects of Heavy Ion Therapy

Level: medical students specializing or considering specializing in oncology as well as clinicians of all levels in radiotherapy and particle therapy.

Knowledge Requirements: Introductory undergraduate medical knowledge.

Duration: 27 hours

Mode of Study: Online

Language: English

Course Objectives



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

Motivate oncologists to become part of the heavy ion therapy research community and who may then optimally exploit and access Europe's heavy ion therapy research infrastructures.

Educate a new generation of researchers and give them the required skills and tools to access and engage with Europe's heavy ion therapy research infrastructures.

Provide the medical community with updated knowledge of both heavy ion therapy and the ongoing activities of the four major heavy ion therapy facilities in Europe.

Provide students and early stage researchers with opportunities to network with leading researchers in the field.

How to Apply

Course is readily available online on YouTube. Interested students are free to access the course at a click of a button from the HITRIplus.eu webpage (Select Tab – Training and Events)

Content

- Radiobiology

- RBE Models
- Immunological Effects
- Hypoxia

- Head-and-Neck

- Skull Base,
- Central Nervous System
- Salivary Gland & Paranasal Sinuses
- Melanoma

- Sarcoma

- Osteo Sarcoma
- Chordoma and Chondrosarcoma
- Ewing and Rhabdomyosarcoma

- Organ Motion

- Abdomen

- Treatment Planning

- Re-irradiation

- Head and Neck
- Central Nervous System

- Gynae and Rare Indications

- Adenoid Cystic Carcinoma



- Paediatric

- Innovative Methods

- Linear Transfer Painting
- Spatial Fractionation
- Integration with Immune and Target Drugs

- Present and Future Clinical Trials

The session on **Treatment Planning** will include a hands-on ‘train the trainer’ part to give participants the ability to contribute as tutors to the [particle therapy masterclasses](#) that are periodically organized worldwide.

Learning Outcomes

This course consists of a number of advanced lectures that provide a good foundation of the field. It also consists of a few hands-on treatment planning exercises that may be done through freely available simulation software.

The skills and learning outcomes include:

- scientific knowledge of the underpinning theory, techniques and methods that should form the foundation of a specialist’s knowledge in heavy ion therapy that will allow the attainment of insight into real-world phenomena
- Specialised clinical knowledge with specific focus on heavy ion therapy research
- analytical, critical and evaluation skills of various clinical aspects of heavy ion therapy

Fees

This is a free online course

Career Prospects

Opportunities to work, study or conduct research in Heavy Ion Therapy facilities as part of their medical teams.

Suggested Reference Books

Carbon-Ion Radiotherapy: Principles, Practices and Treatment Planning, by H. Tsujii, T. Kamada, T. Shirai, K. Noda, H. Tsuji, K. Karasawa, Springer (2014), ISBN-13: 978-4-431-54456-2

Ion Beam Therapy; Fundamentals, Technology, Clinical Applications; by Ute Linz, Springer (2012), ISBN-13: 978-3-642-21413-4

Organisers and Sponsors

EU – European Union Horizon 2020 Research and Innovation Programme



HITRIplus – Heavy Ion Therapy Research Integration Plus
SEEIIST - South-East European International Institute for Sustainable Technologies
France Hadron – ARCADE Advanced Resource Center for HADrontherapy in Europe
CNAO – Centro Nazionale di Adroterapia Oncologica
CERN – The European Organisation for Nuclear Research
DKFZ – Deutsches Krebsforschungszentrum
EMMI – ExtreMe Matter Institute
ENLIGHT – European Network for Light Ion Hadron Therapy
FAIR – Facility for Antiproton and Ion Research in Europe
GSI - Helmholtzzentrum für Schwerionenforschung
HIT – Heidelberger Ionenstrahl-Therapiezentrum
IEO – Istituto Europeo di Oncologia
Klinikum Bremerhaven Reinekenheide GmbH
Mayo Clinic
MedAustron – EBG GmbH MedAustron
MIT - Marburger Ionenstrahl-Therapiezentrum
Aristotle University of Thessaloniki
University of Texas Southwestern Medical Centre
University of California San Francisco
University of Malta

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Maria Bonora	CNAO
Maria Rosaria Fiore	CNAO
Mack Roach	UCSF
Niklas Wahl	DKFZ
Razvan Galalae Klinikum	Bremerhaven
Roberto Orecchia	IEO
Rossana Ingargiola	CNAO
Silvia Molinelli	CNAO
Slavisa Tubin	MedAustron
Thomas Held	HIT
Walter Tinganelli	GSI

Technical Instructions – MatRad



Participants who wish to fully exploit matRad and take full advantage of the hands-on sessions are expected to have MATLAB licenses obtained via their academic institutions.

matRad is an open source software for radiation treatment planning of intensity-modulated photon, proton, and carbon ion therapy. matRad is developed for educational and research purposes. It is entirely written in [MATLAB](#).

Software Installation

Minimum requirements

There are no hard minimum requirements to do dose calculation and optimization with matRad. Treatment planning tutorials can be done with systems with 2GB RAM but then cases you are looking at are somewhat small (low spatial resolution, few beams, rather no particles). If you want to do treatment planning at realistic resolutions, we recommend 8GB RAM or more. More information can be found on <https://github.com/e0404/matRad/wiki/Minimum-System-Requirements>.

matRad Installation step by step

There are two ways to install matRad. The first (and suggested) one is to use the Matlab source code from within the MATLAB programming environment. It requires a local MATLAB installation. The second way is to use a standalone that installs a runtime that allows usage of matRad without a valid MATLAB license. However, the functionality is limited to the user interface and thus one would not be able to take part in coding exercises.

- 1st way (recommended): Source Code to use with valid MATLAB installation

You can also work with the current source code when you have matlab installed (even with Octave, but only without a GUI), which you can get from GitHub here:

<https://github.com/e0404/matRad/releases/tag/v2.10.1>

There, just download the provided *.zip or *.tar.gz file and extract it to a folder on your hard drive that can be accessed from Matlab.

For completeness and for the ones interested to go deeper, there's also a detailed documentation, targeted at people who work with the software (Matlab source code). It can be found in <https://github.com/e0404/matRad/wiki> explaining a lot about the workflow and the underlying principles.



- 2nd way: matRad Installation as standalone

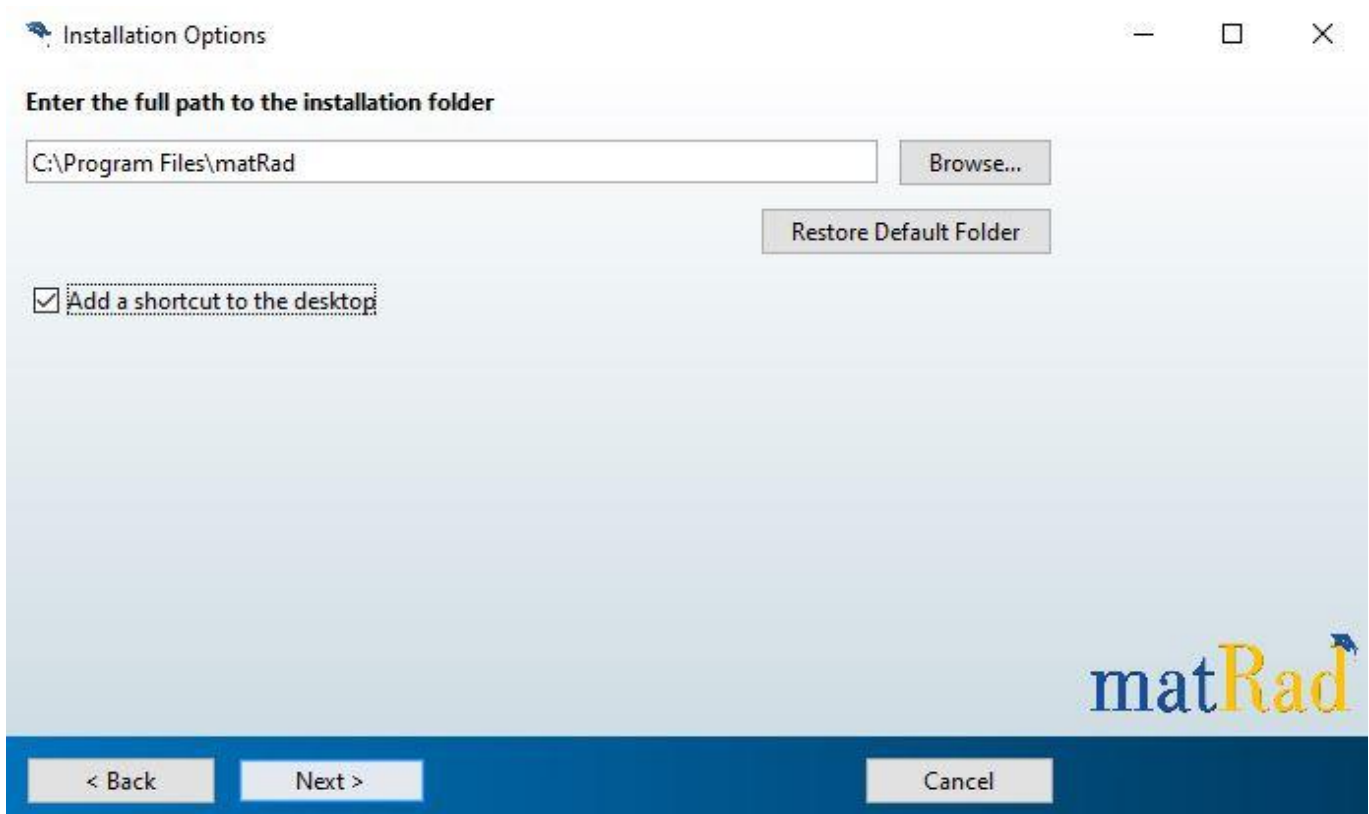
VIDEO: [MatRad Installation Video](#) (Installation_MatRad file)

1. To download matRad, download the installer for your system from <https://github.com/e0404/matRad/releases/tag/v2.10.1>

2. Run the respective installer for your system

- Windows: Run the downloaded executable installer
- Linux: Run the executable install script. Make sure that the *.install file has executable permissions.
- Mac: Here we provide a dmg containint the installer (Since the installer is not apple-certified, you might explicitly launch it from the terminal or by right-click).

After that, you should be guided through the installation process:



Note that the installers will want to download the "Matlab Runtime" from Mathworks in the process. The runtime is quite large (~2GB) and is required to run compiled deployed applications written in Matlab.

3. Run matRad:

- Windows: Just like with every other program, you should have a desktop icon.
- Linux & Mac: To start matRad, you can use the provided run_matRad.sh script from the terminal. It requires one argument which gives the path to the installed Matlab-Runtime. Refer to the readme_linux.txt and readme_mac.txt in your installation directory for more information.

Patient/Phantom files

The patient files should be included with the installer and will be installed into the desired location. For windows, for example, they can be found within the "application" folder of the chosen installation directory.

We also provide an extra link for the patient files: [Download here!](#)

