



Medical Radiation Physics

Department of Physics
Stockholm University





Medical Radiation Physics - MSF

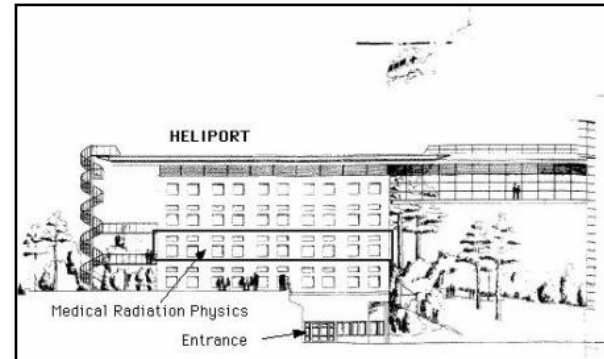


Stockholm
University

Naturvetenskapliga området

*Division of Medical Radiation
Physics*

Fysikum



*Research
Group*

Oncology-Pathology



**Karolinska
Institutet**



MSF - Education

Autumn Semester

Spring Semester

År 1

Matematik för naturvetenskaper I	Matematik för naturvetenskaper II
Klassisk fysik	

År 2

Matematik II - Analys del A	Matematik II - Analys del B	Matematik II – Linjär algebra	Kvantmekanik
Programmering, numeriska metoder och statistik för fysiker		Elektromagnetism & vågor	Experimentell fysik

År 3

Kvantfenomen och strålningsfysik	Joniserande strålningsväxelverkan med materia	Strålningsdosimetri	Anatomi, fysiologi, onkologi	Självständigt arbete (kandidat)
Strålkällor med medicinska tillämpningar	Strålningsdetektorer och mätmetoder (teori)	Strålningsdet. (lab)		

År 4

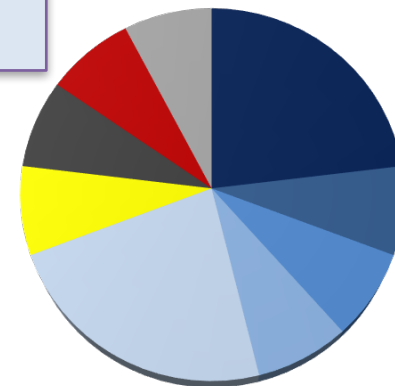
Bild- och systemanalys	Strålningsbiologi	Diagn. rad. fysik (VFU+ Lab)	Magnetresonanstomografi	Nukleärmedicinsk fysik	Projekt
Strålskyddslära med omgivningsradiologi	Diagnostisk radiologisk fysik (teori)				

År 5

Strålterapeutisk fysik och biologi	Klinisk strålterapifysik (VFU)	Självständigt arbete
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- MSc program in Medical Radiation Physics / Professional education
- 10 MSc students/year on average

Research



- EXRT - photons
- Radiosurgery
- Grid therapy
- Particle RT
- Radioprotection
- Dosimetry
- Radiobiology
- Imaging



MSF

Niels Bassler
Irena Gudowska
Albert Siegbahn
Iuliana Toma-Dasu

Postdocs

Marta Lazzeroni
Ana Ureba

PhD students

Oscar Ardenfors
Thomas Henry
Emely Lindblom
Gracinda Mondlane
Helena Sandström
Jakob Öden

MSc students

On average 10 students per year



MSF – Medical Radiation Physics

- **Medical Radiation Physics** is a vast and complex **translational research topic** that deals with **radiation physics** applied to medicine and biology for medical radiation **imaging** and **radiation therapy**

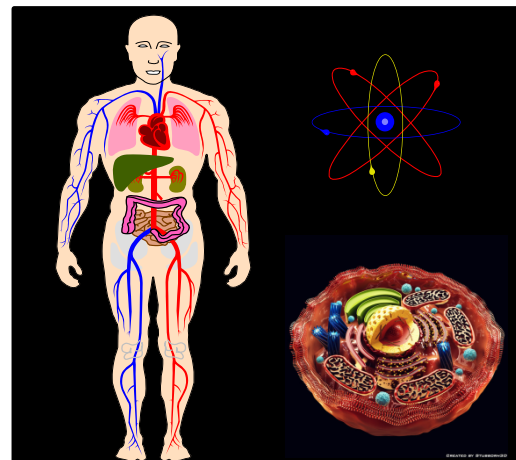
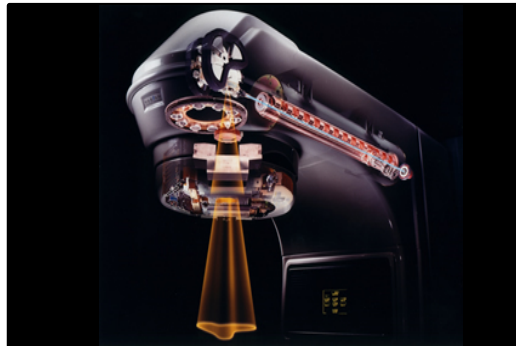
Radiation Sources

Radiation Interaction

Detectors

Dosimetry

Radiation Biology



Dagnostic Radiology

Nuclear Medicine

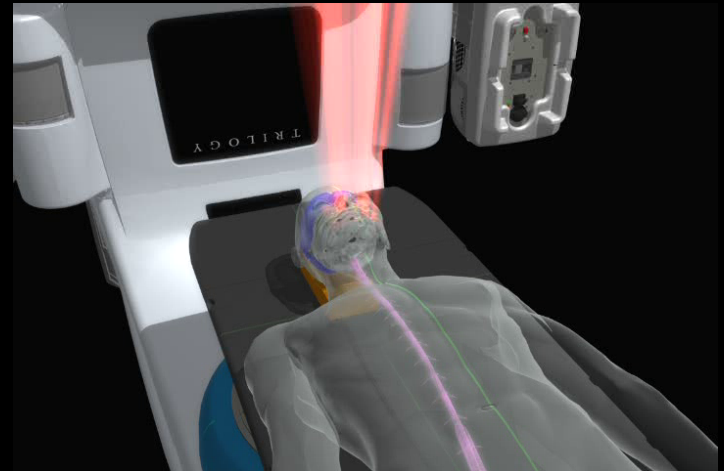
Radiation Therapy

Radiation Protection



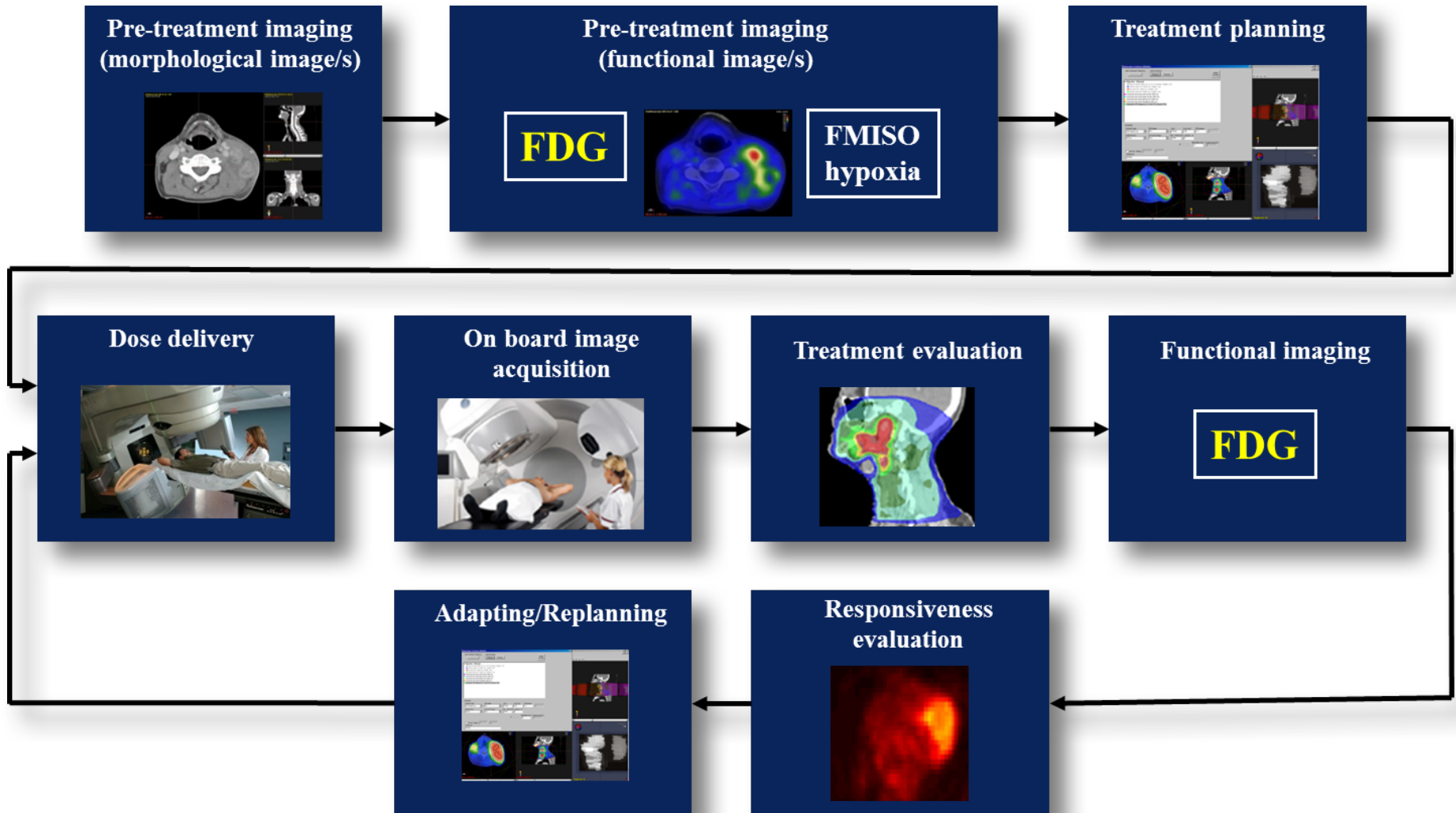
MSF - Radiotherapy

- **Radiotherapy** - the use of ionising radiation in the management of malign and benign diseases
- **Radiotherapy** is used alone or in combination with surgery and/or chemotherapy in about 50% of the cancer treatments
- **External beam radiotherapy**
 - dose is delivered from outside the patient
- **Brachytherapy**
 - dose delivered from radioactive sources placed inside the patient close to the target



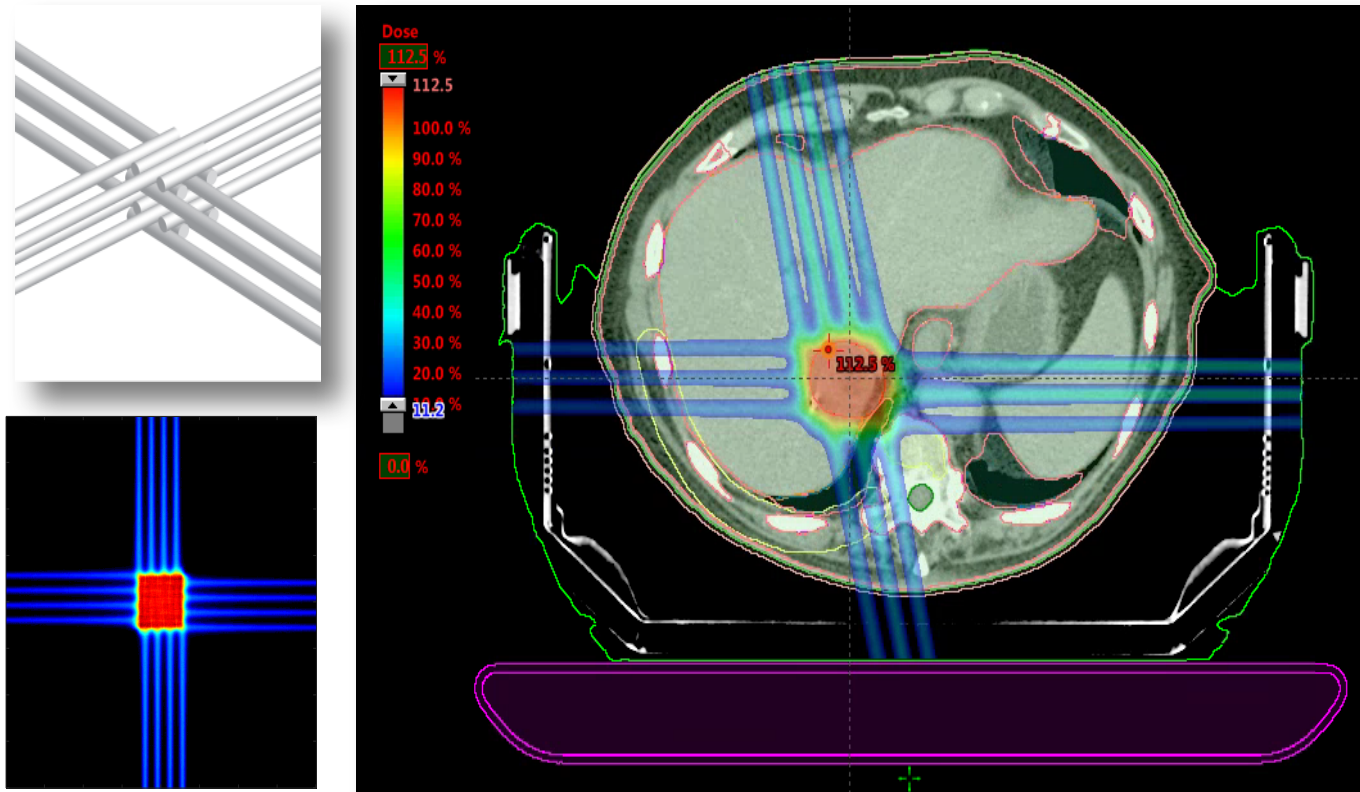


Customised RT based on functional imaging





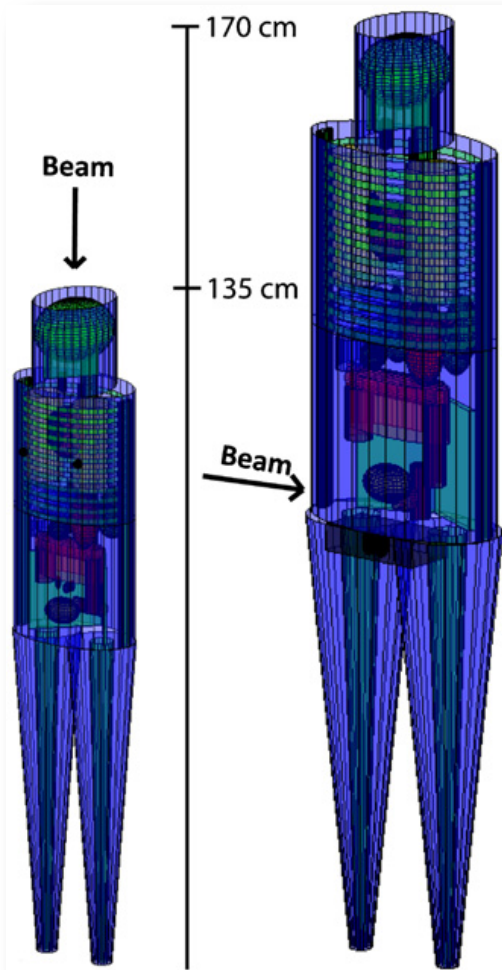
Microbeams and Grid Therapy



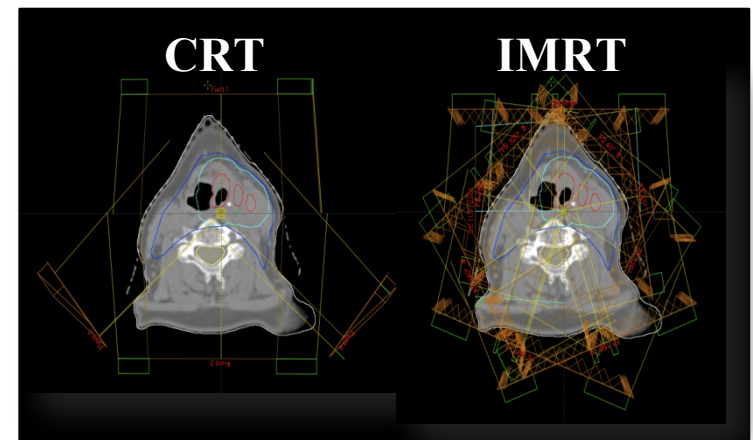
Innovative technique for high accuracy and precision RT



Radiation Protection



From anthropomorphic phantoms to patients



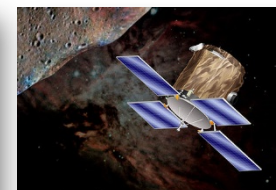
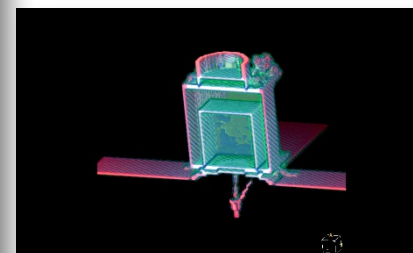
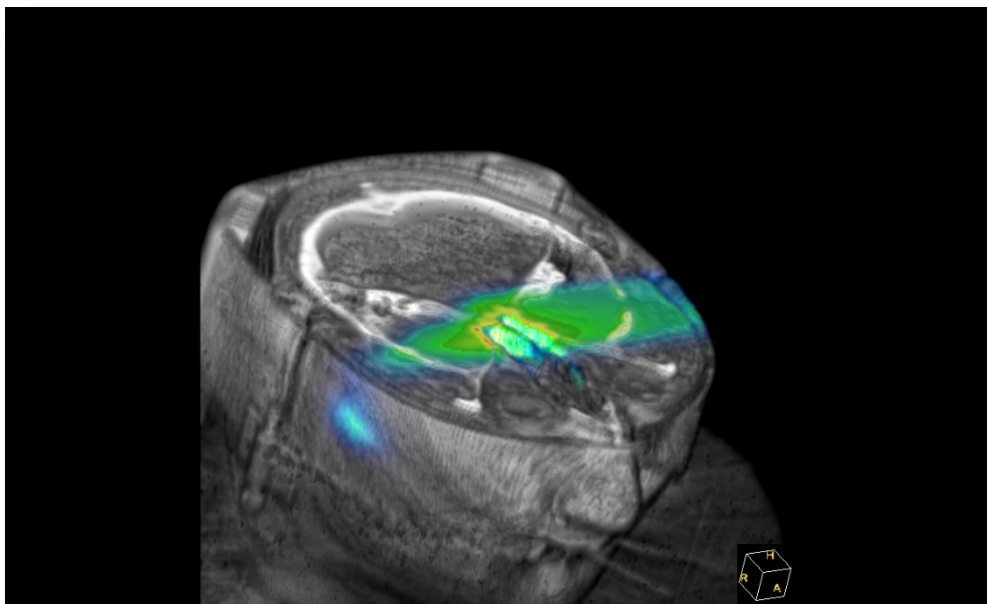
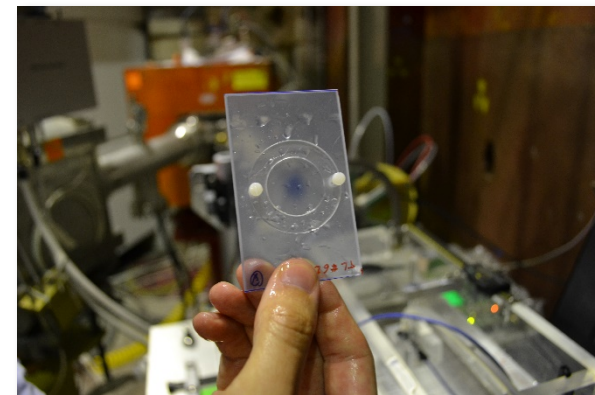
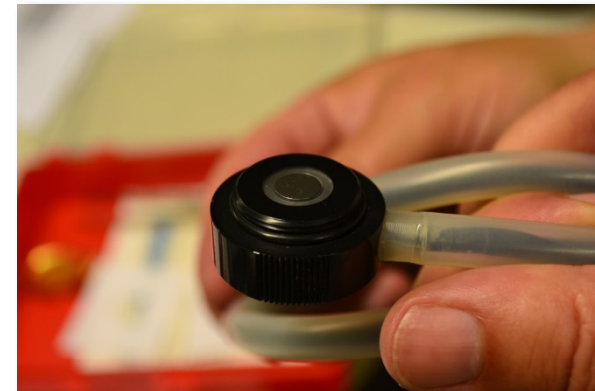
Secondary doses to healthy tissues from
radiotherapy and modern imaging techniques
=> Risk of secondary cancer



Radiation Interaction in Media

Development of fast and precise calculation tools for innovative treatment planning.

Development of radiation detector models for ion radiation, for better dosimetry.

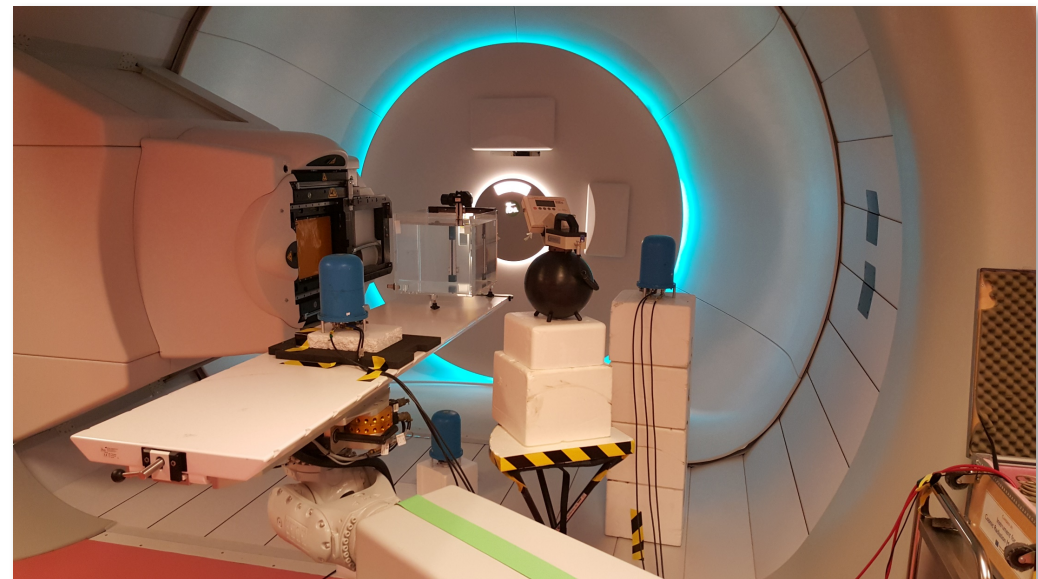


(works also for satellites)



MSF – Proton Therapy

- MSF group is currently working on several projects in proton therapy at Skandionkliniken (Uppsala) and IFJ-PAN (Kraków):
 - Proton treatment planning comparison to photon therapy
 - Proton treatment evaluation and optimisation
 - Radiation protection aspects related to the risk of secondary cancer following proton therapy
 - Grid therapy





- Ion therapy has been for many years one of the most pursued areas of research at MSF



Collaboration with CERN

- **ENLIGHT**
(The European Network for LIGHT ion Hadron Therapy)
- Recent initiative => **Office for Medical Applications** => **OpenMED**





MSF - Industry and Innovation



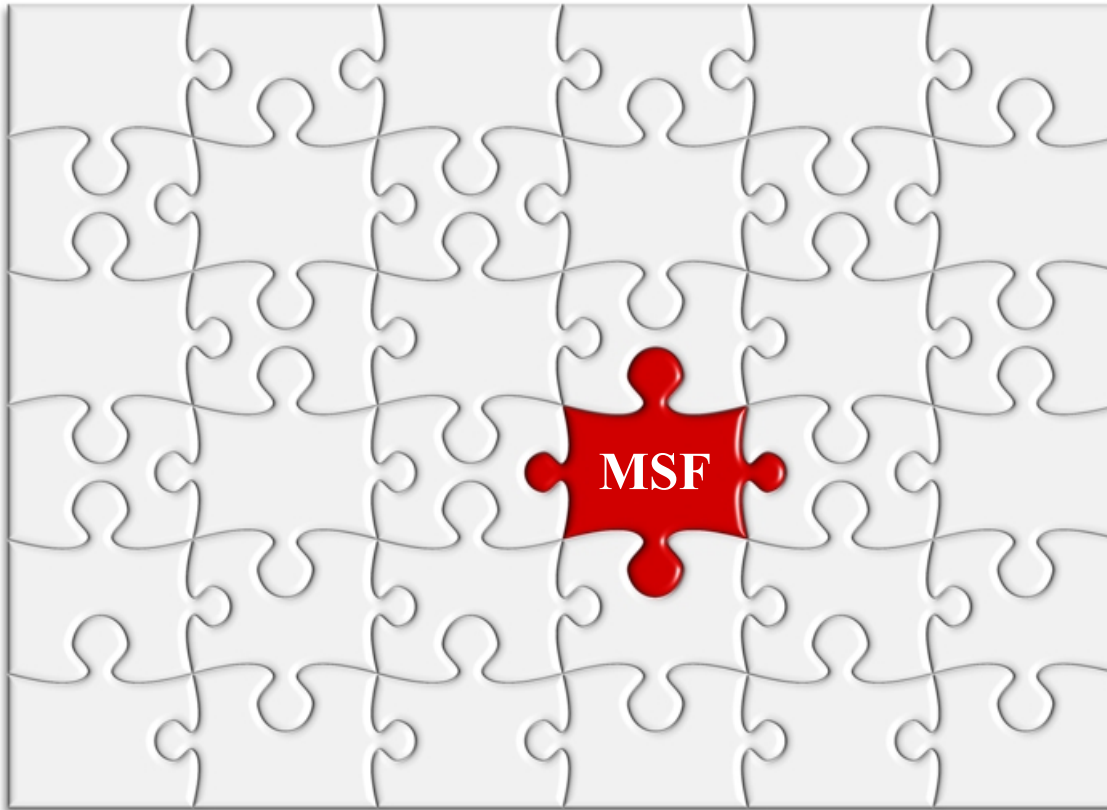
- Treatment planning based on tumour hypoxia
- Adaptive RT based on advanced imaging techniques
- Evaluation and selection of treatment plans using functional and radiobiological information
 - 2 research versions of RayStation
 - 1 full version of RayStation



- Variability in target and OARs delineation for SRS
- Robust treatment planning for SRS
 - 1 Leksell GammaPlan



- Grid therapy



Thank you!