



LIETUVOS SVEIKATOS  
MOKSLŲ UNIVERSITETAS



LIETUVOS SVEIKATOS MOKSLŲ  
UNIVERSITETO LIGONINĖ  
KAUNO  
KLINIKOS



# Radiation Oncology at the Lithuanian University of Health Sciences: current situation and future trends

Prof. dr. Elona Juozaitytė

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# About Lithuanian University of Health Sciences



- The largest institution of higher education for biomedical sciences in Lithuania;
- Integration of studies, research and clinical practice.
- Consists of two main academies: Medical Academy and Veterinary Academy.
- Includes 7 faculties, 6 research institutes, two animal clinics and the Hospital of LUHS.
- Has more than 7,000 students enrolled.

# Hospital of Lithuanian University of Health Sciences Kauno Klinikos

Largest healthcare institution in Lithuania whose mission is:

- improve the health and quality of life of population
- develop ambitious and advanced health specialists
- create and implement innovations based on scientific research.

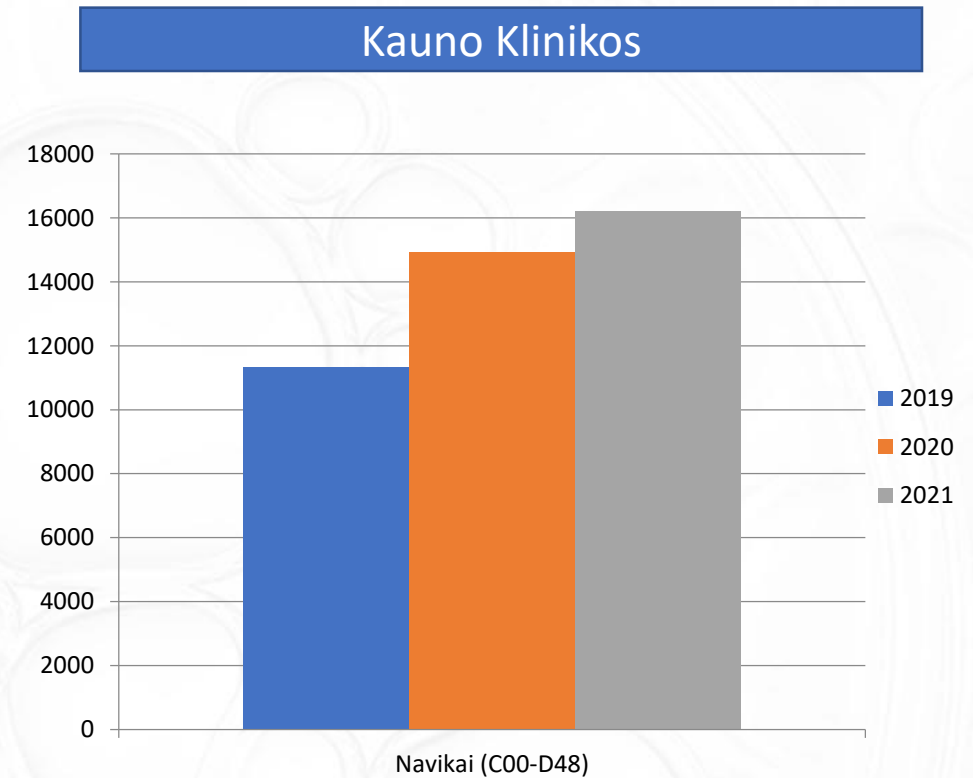
Brought many medical "first's" and "only's" to Lithuania

State-of-the-art technologies for medical imaging and radiotherapy.



# Cancer diagnostics and treatment

- Kauno Klinikos is a multidisciplinary oncology centre:
  - There is collaboration in cancer care among 27 different clinical departments;
  - Up to 16 000 cancer cases annually;
  - Cancer prevention and screening;
  - Infrastructure for diagnostics and treatment for all cancers;
  - Rare cancer diagnosis and treatment options;
  - Pediatric oncology;
  - Affiliated Hospital of Oncology;
  - Palliative care unit.



	2019	2020	2021
Cases where the main diagnosis is cancer (C00-D48)	11 325	14 929	16 221

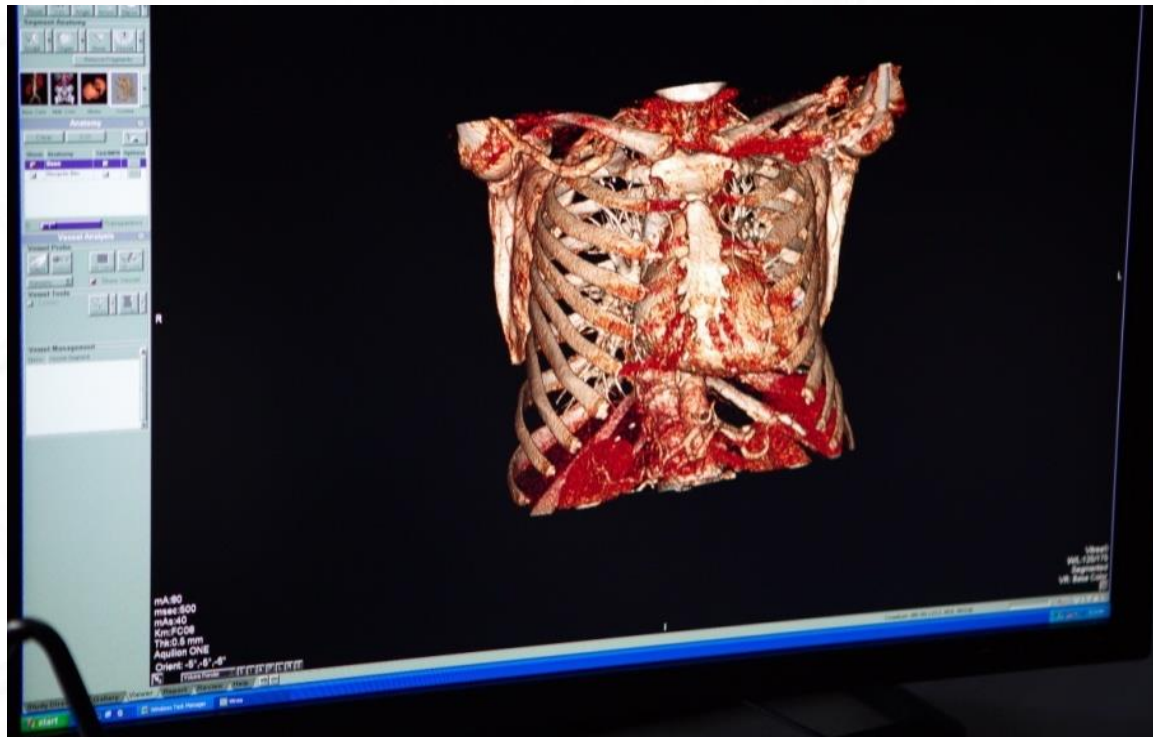
# Diagnostic facilities

Innovative diagnostic radiology centre with facilities for computed tomography, magnetic resonance imaging, ultrasound, mammography, radioisotope scanning, X-ray and others



# Diagnostic facilities

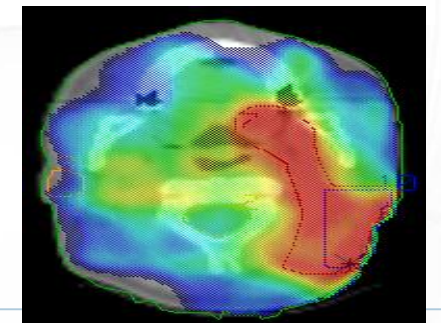
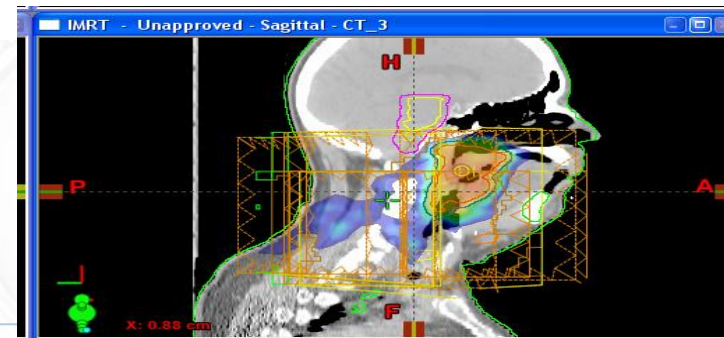
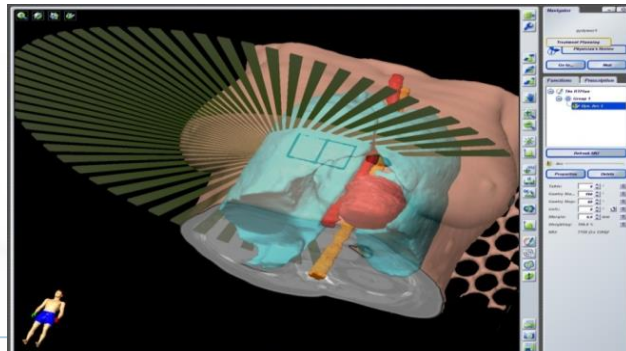
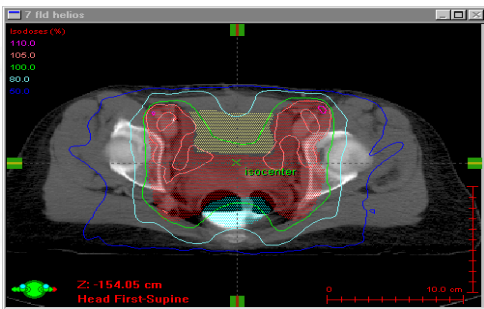
PET-CT scanner has brought new possibilities for detecting tumours before, during and after treatment, for cancer patients radiotherapy planning and follow-up of cancer patients.



# Radiotherapy infrastructure

Radiotherapy is part of multimodality cancer care system:

- Four modern linear accelerators;
- IMRT, IGRT and stereotactic intracranial and body radiotherapy;
- Extensive HDR and LDR brachytherapy programme.





# MODERN RADIATION THERAPY



2020m. TrueBeam  
Kauno klinikos

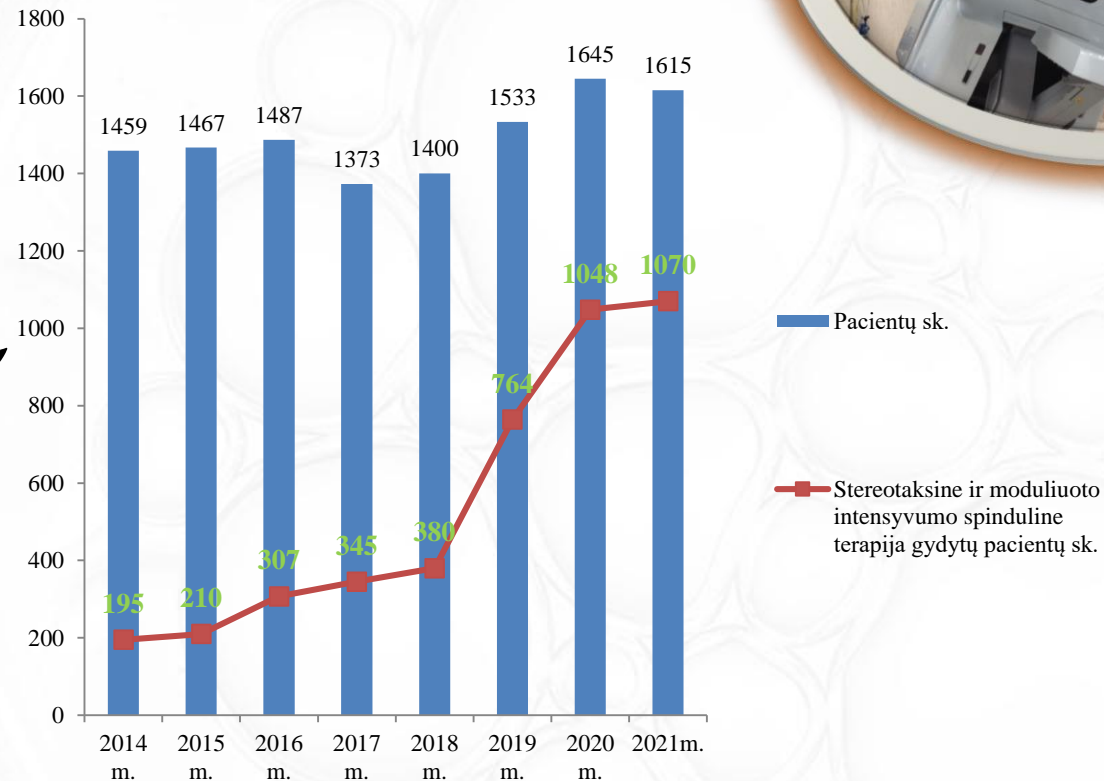


2020m. Gamma knife  
Kauno klinikos

- Modern linacs;
- Computerized planning systems;
- High quality tumour visualization methods – radiology and nuclear medicine.
- Kauno klinikos is the only center in Lithuania where Radiotherapy is applied to pediatric tumours.

# High precision radiotherapy

- Intensity modulation;
- Image guidance;
- Stereotactic approach:
  - radiosurgery,
  - Stereotactic intracranial radiotherapy,
  - stereotactic body radiotherapy,
  - Dose intensive treatment;
  - Short treatment time.

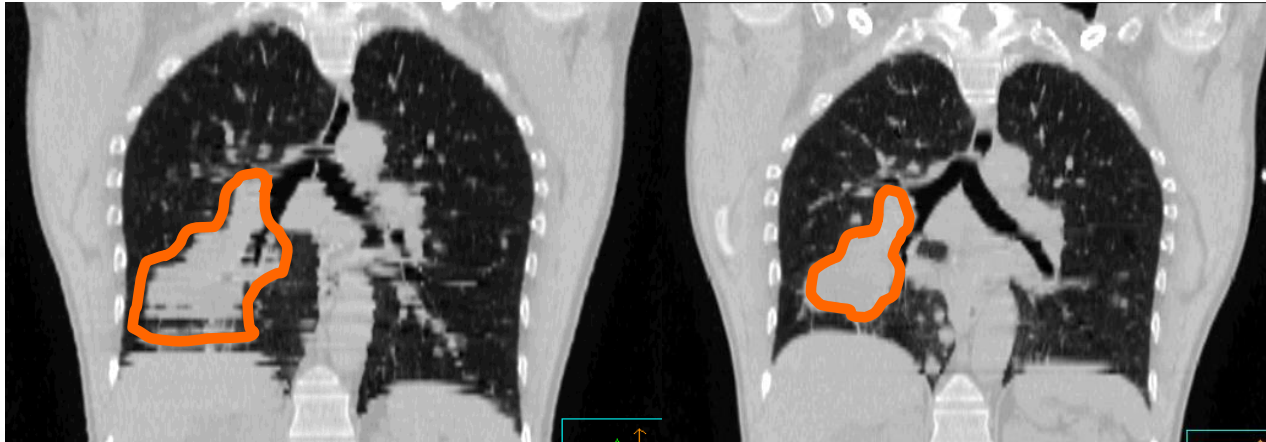


The number of patients receiving state-of-the-art radiotherapy technologies (IMRT, 4D, stereotactic radiosurgery) increased to 1,070 and accounted for 66.3% of all irradiated patients.

# 4D RADIATION THERAPY

- Motion control may decrease radiation toxicity;
- Breathing motion control is most often used for treatment of lung, liver, breast and esophageal malignancies.

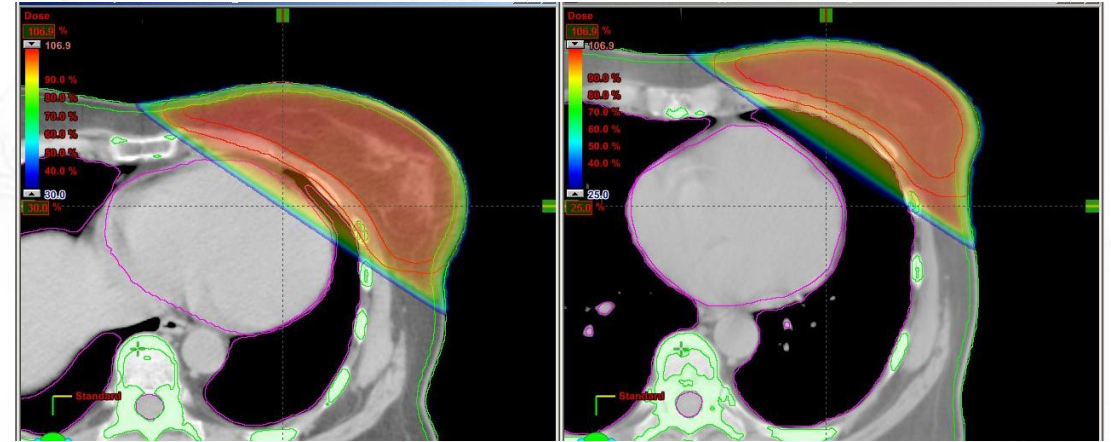
Lung cancer example:



■ Without gating

■ With gating

Breast cancer example:



■ Without DIBH

■ With DIBH

# Varian Halcyon, 2021



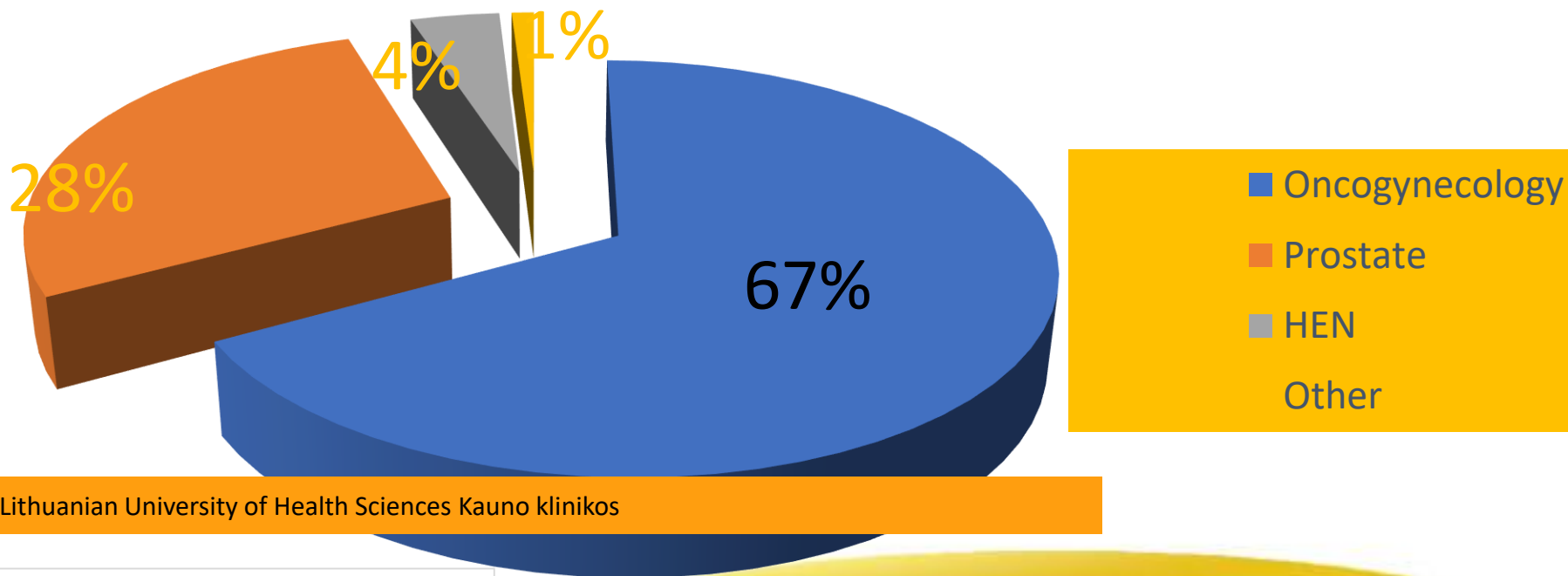
Halcyon was installed in the middle of 2021 and 490 patients already been treated with this linear accelerator

# MR LINEAR ACCELERATOR-"Unity" 2022: an exciting new paradigm in cancer treatment

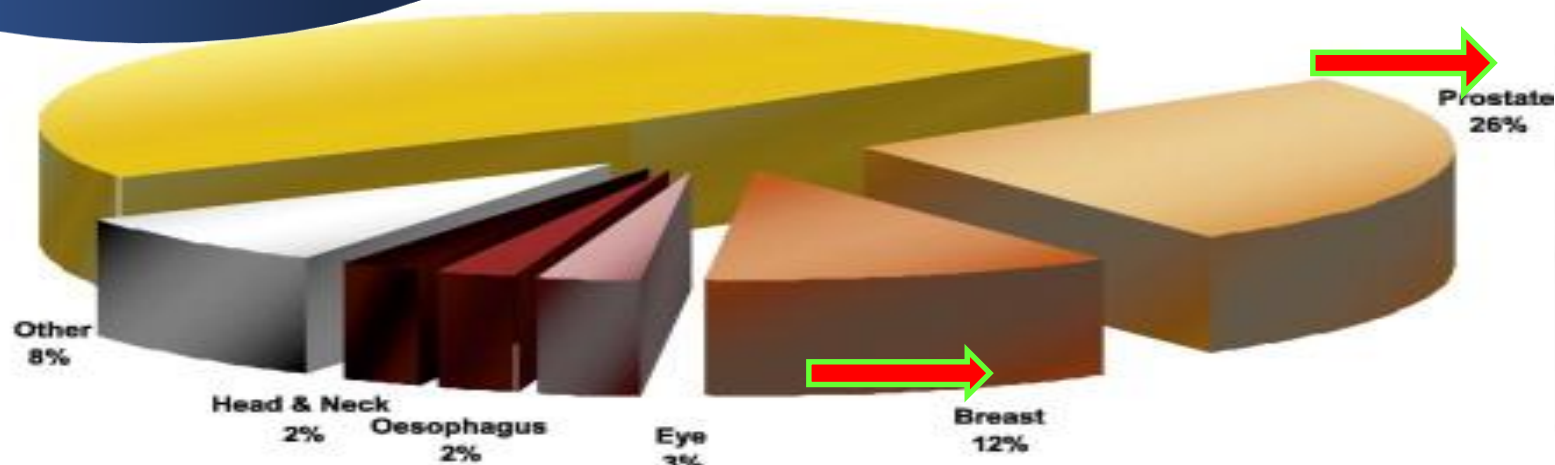
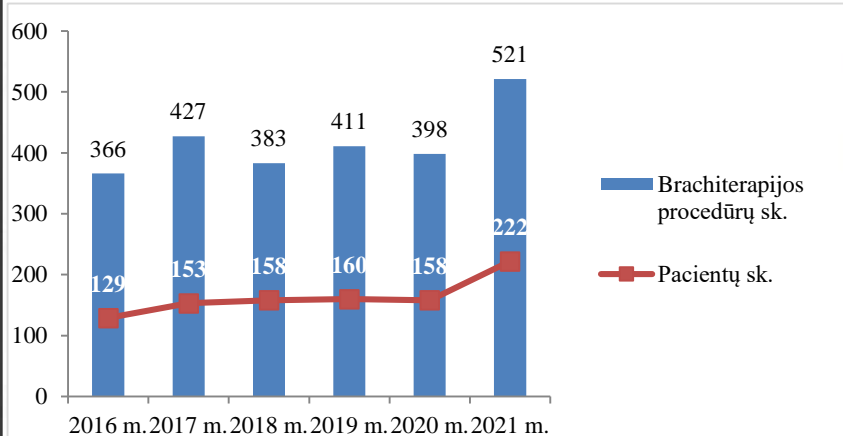


Radiotherapy guided by  
real- time MR imaging .

# Brachytherapy – main tumour sites, procedures & patients



Hospital of Lithuanian University of Health Sciences Kauno klinikos



# Radiotherapy staff

Staff	Number	Scientific degree
Radiation oncologists	19	5
Medical physicists	12	3
Radiation technologists	22	-



# INSPIRE

- €5M (Coordinated by Manchester)
- Integrating proton research across Europe
- 17 partners
- Networking, Transnational Access, Joint Research Activities
- 13 TNA providers
- 11 PBT centres; national hubs
- Varian and IBA

***“.....the aim of INSPIRE is to integrate national infrastructures in proton beam therapy (PBT) research and make them available to researchers from academia, hospitals and industry to ensure that excellent multi-disciplinary research is undertaken and best practice shared....”***

Grant Agreement Number 730983

[www.protonsinspire.eu](http://www.protonsinspire.eu)







# LSMU- INSPIRE activities



- **WP7 – Radiobiology.** We investigated molecular mechanisms of sensitivity and resistance to radiotherapy in breast cancer cell lines.
- Cell exposure to different chemical agents and the assessment of their possible radio-sensitising activities is our innovation task in this project.
- One of our team member had the opportunity to join the **Clinical Radiobiology group at GSI** and was contributing to the developments of the protocols for 3D cell culture phantoms. Additionally, she was involved in the *in vitro* FLASH experiments assessing the cell survival after irradiation with  $^{12}\text{C}$  ion beams at ultra-high dose rates.

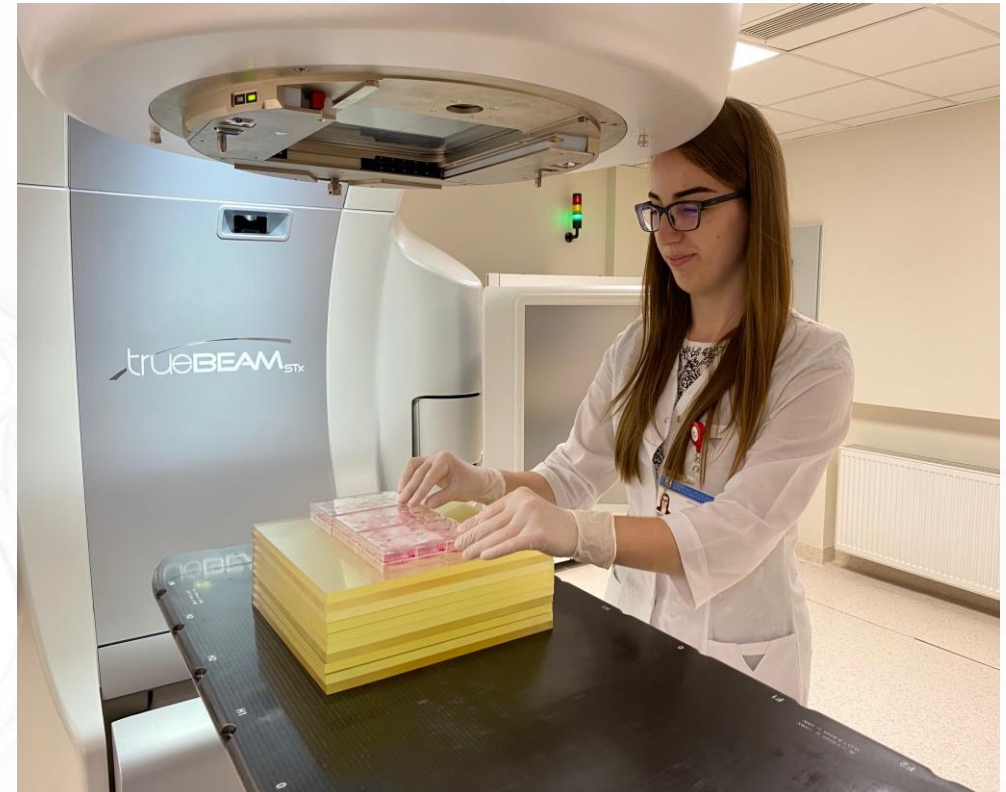
*Funded from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No: 730983*

- <https://protonsinspire.eu/knowledge-hub>



# Educational activities and projects

- In November and December several employees of the our Oncology Institute participated in the training course related to proton beam therapy „The Christie Proton Therapy E-School at The Christie School of Oncology“ .
- In December we attended in the 1st FLASH Radiotherapy and Particle Therapy Conference where we also had the opportunity to present the abstract and e-poster from the part of our research activities in INSPIRE project.



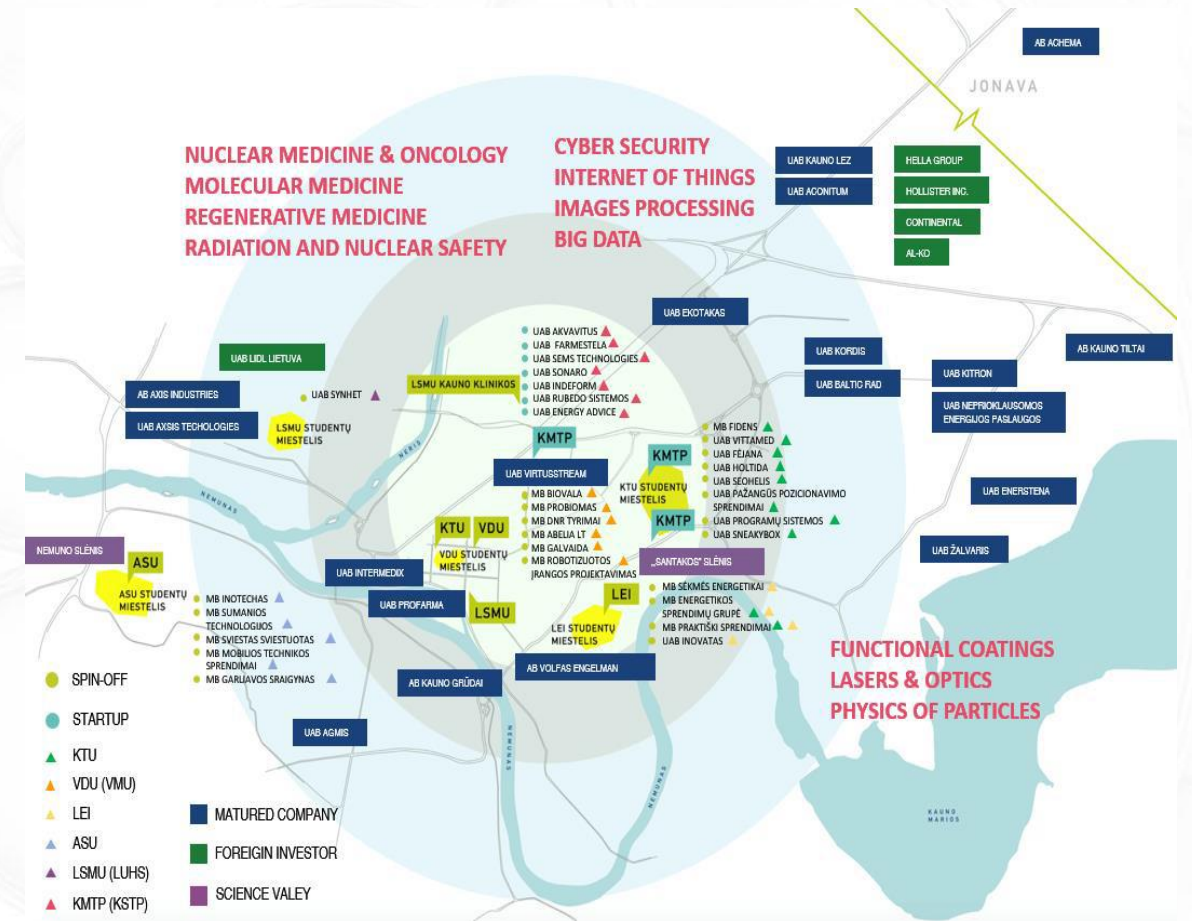
# Collaboration with CERN

During the last years training of medical physicists and radiation oncologists was organized in collaboration with CERN.

Development of nuclear medicine is closely related to the deployment of cyclotron at LUHS University Hospital.

Oncology institute: CERN- activities related 6 projects in Radiobiology.

We have implemented five radiobiology research projects related to CERN activities. We are currently continuing this research with another CERN related project. These projects funded by the Lithuanian Science Council.



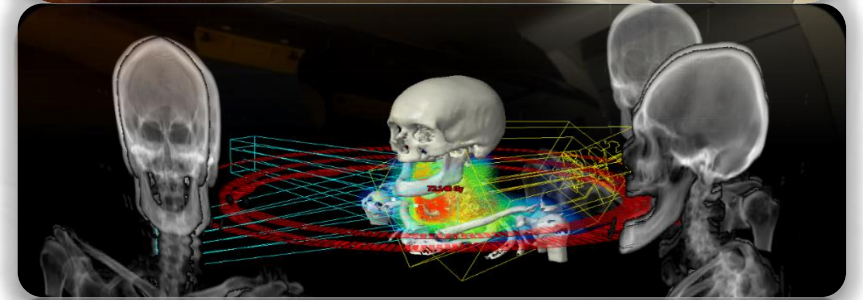
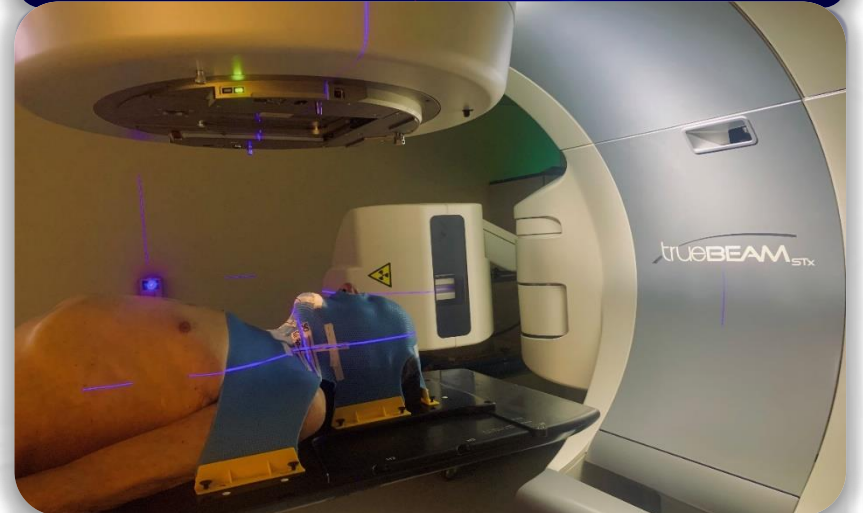
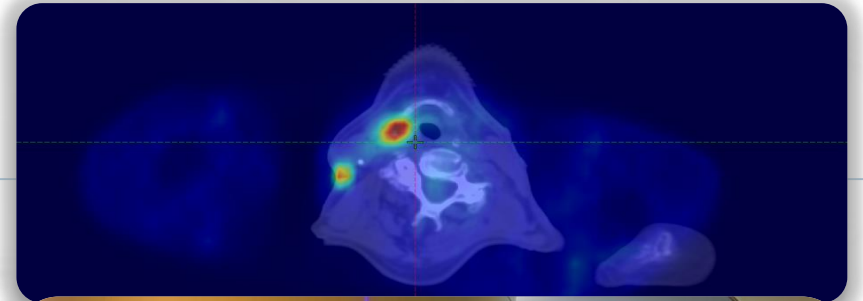
# Research areas in radiotherapy and radiobiology:

- Prognostic and predictive molecular markers of solid tumors;
- Radiobiology research;
- Radiotherapy optimisation using  $^{18}\text{F}$ -FDG-PET/CT images;
- Molecular mechanisms of sensitivity and resistance to radiotherapy in breast cancer or other cell lines;
- Association between common genetic variations with individual patient variability in normal tissue late radiation toxicities;
- Linac-based fractionated stereotactic radiotherapy vs. intensity modulated radiotherapy;
- New brachytherapy techniques.

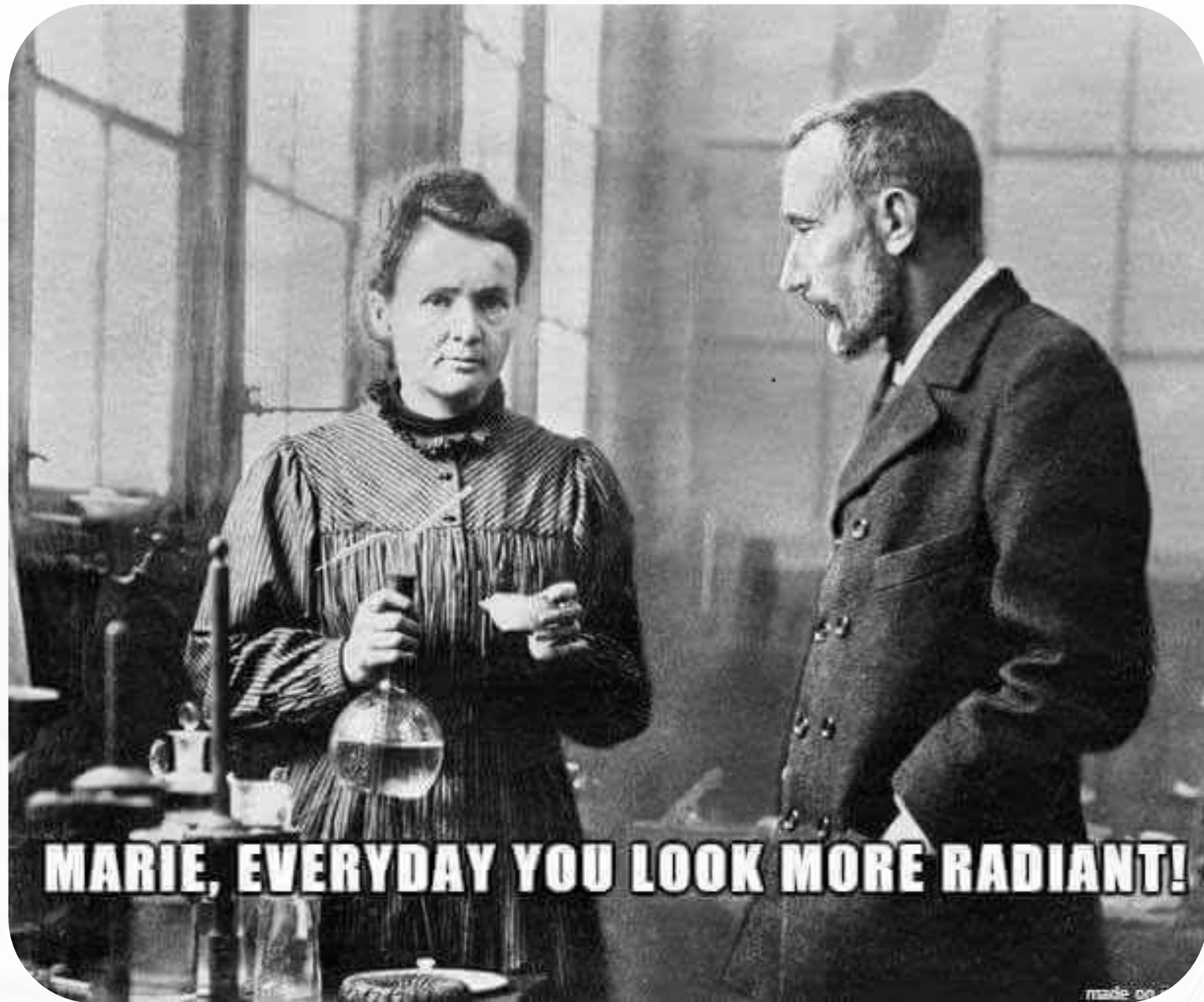
# Conclusion

Lithuanian University of Health Sciences and hospital Kauno klinikos is one of the best platforms for research and radiotherapy development, since it has:

- Well equipped diagnostic and treatment facilities
- Large flow of patients suffering from cancer
- Experience in implementation of R&D activities
- Open and ready for cooperation with researchers and business sector.



THANK YOU FOR  
YOUR ATTENTION!



**MARIE, EVERYDAY YOU LOOK MORE RADIANT!**