

## MSc project in Medical Physics

### Exploring new concepts of dose reporting for organs at risk in external beam photon therapy of pelvic malignancies

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The Department of Radiation Oncology at the Medical University of Vienna offers a master project in medical physics starting from summer semester 2025.

#### **Project description:**

The treatment of locally advanced cervical cancer with radiotherapy consisting of external photon beam therapy (EBRT) followed by a high dose rate brachytherapy boost, has seen tremendous success after implementation of new technological and clinical concepts throughout the last decades. Improved clinical outcome and disease control nowadays allow to seek new ways to tailor dose distributions to minimize the risk of side effects related to organs at risk in the radiation fields. Available large datasets allow the exploration of dose-effect relationships for various endpoints related to radiation effects from EBRT, brachytherapy or the cumulative effect of both.

To drive the field forward, beyond current dose planning and reporting standards, this project aims at exploring new methods for reporting the EBRT dose to organs at risk. Treatment plans for patients treated with the EMBRACEII clinical trial protocol will be analysed. The current contouring protocol for OARs includes the delineation of organ boundaries for urinary bladder, rectum, sigmoid and bowel loops. This allows to calculate the dose exposure of the entire organ, average organ doses, or minimum dose to a certain fraction of the organ. This standard will be compared to a more advanced dose reporting workflow based on delineations of „hollow organs“, so the calculated dose to a subvolume can be interpreted as the exposure of the organ wall, which allows to gain insight on the dose-effect of hot spots in one or more highly exposed locations of healthy tissue. The project consists of the design and testing of a workflow for advanced dose reporting for organs at risk in external beam radiotherapy, and to evaluate the impact of clinical uncertainties, such as movement of organs between multiple treatment fractions, on the cumulative reported treatment dose. CT planning images, as well as daily cone-beam-CT images will be available, in addition to systematic reports of early clinical outcome after EBRT. State of the art clinical treatment planning software will be available for structure delineation on 3D images. Auxiliary Python scripts will be developed for efficient evaluation of dose plans on multiple image sets by the MSc candidate.

The results of this project could impact our future understanding of dose-response-relationships, leading to further improvement of organ sparing strategies for future patients.

#### **Qualifications:**

- Student of physics or biomedical engineering
- Research interest in medical physics
- Knowledge of Python
- Fluent in English (oral and written)
- Analytical skills and ability to work independently on a project basis
- Good communication skills relevant for working in an international and interdisciplinary research group

#### **Conditions:**

The working place will be the Department of Radiation Oncology at the Medical University of Vienna. Please submit applications by email to Prof. Dr. Dietmar Georg ([Dietmar.georg@meduniwien.ac.at](mailto:Dietmar.georg@meduniwien.ac.at)) or Assoc. Prof. Dr. Nicole Eder-Nesvacil ([nicole.eder-nesvacil@meduniwien.ac.at](mailto:nicole.eder-nesvacil@meduniwien.ac.at)).