Proton therapy physics – a postgraduate course

13-17 May 2019, Department of Medical Radiation Physics, Lund University

Course overview

The course covers the path of the proton from production and delivery until it deposits its energy in the patient. The pathway goes through interaction mechanisms, dosimetry, tissue characterization, dose planning, and radiation biology, to conclude with clinical examples and future visions. During the course, the participants will be given time for discussion and reflection in groups.

Target group

The course is primarily aimed at PhD students in the medical radiation physics research field. The course is also suitable for Medical Physicists in the national MPE training program (Swedish ST-sjukhusfysikerutbildning). However, all interested in proton therapy physics are welcome to participate – subject to availability.

Learning outcomes

By the end of this course participants should be able to:

- Understand the key processes of proton interaction with matter.
- Describe proton beam production and delivery techniques.
- Discuss how the composition of tissues can be estimated with different types of imaging modalities.
- Explain how the absorbed dose can be determined for the medium and how the reference dosimetry should be performed.
- Describe various RBE models and optimisation strategies and discuss the radiobiological foundations for proton therapy.
- Understand the uncertainties in proton planning and how to address them.

- Summarise the latest developments within proton therapy physics.
- Reflect on the current 'open questions' in proton therapy physics and discuss potential research projects to address these issues.

Course content
Proton physics, beam production and delivery, dosimetry, imaging and CT calibration, dual energy CT, treatment planning, *in-vivo* range verification, geometrical uncertainties, RBE optimisation, LET optimisation, Proton-MC validation, image guidance and adaptation, photon and proton plan comparisons, and patient selection approaches.

Teaching methods
Lectures, interactive treatment planning session, Kahoot learning game, and reflection exercises.

Course directors and teachers
Sofie Ceberg (Course director), PhD, Assoc. Senior Univ. Lecturer, Department of Medical Radiation Physics, Lund University
Marco Schwarz (Course director), Head of proton medical physics (Proton therapy Department) and of medical physics section (TIFPA-INFN), Trento.
Joakim Medin, Assoc Prof., Department of Hematology, Oncology and Radiation Physics, Skåne University Hospital, Lund
Ingrid Kristensen, PhD, Department of Hematology, Oncology and Radiation Physics, Skåne University Hospital, Lund
Jakob Ödén, PhD-student, Medical Radiation Physics, Stockholm University
Erik Traneus, PhD, Senior Physicist at Raysearch Laboratories

Assessment methods and criteria
- To pass the week of lectures (2 hp credits), the participant is required to attend all lectures and submit a written report (2 A4 pages), where she/he reflects on the significance of the course for her/his postgraduate education.
- To pass the individual assignment (additional 5.5 hp credits), the participant is required to submit an in-depth report (about 15 A4 pages) to be presented either at a final joint seminar in Lund, or at the course participant's local institution.
- The participant must also complete the course evaluation form.

Registration
The course will be given at Lund University in Lund and is free of charge for registered PhD students in Sweden. A registration fee of 3000 SEK will be charged for other participants. A detailed schedule will be distributed closer to the start of the course.
Registration is made to sofie.ceberg@med.lu.se no later than 30 April.

LUND UNIVERSITY