Tutorial 1: Technological Advances in Proton Radiation Therapy.

This tutorial is designed to inform the audience about the latest developments in proton radiation therapy and current clinical indications. With the clinical realization of Pencil beam scanning, Proton Therapy entered into a second “renaissance of utilization” and a large portion of innovations are happening right now. We will elaborate on this. Furthermore the international proton therapy landscape and the future prospects of particle therapy and the clinical justification will be discussed. The remaining technological challenges and opportunities for scientists and engineers in the nuclear industry will be addressed as well.

Introductory topics will include:

• A review of proton therapy since the first patient treatments in 1954.
• Current technologies used in beam delivery systems with specific emphasis on Pencil Beam scanning.
• Modern techniques in proton treatment planning and the value of Monte Carlo Dose calculations.
• Radiobiological dose modelling in proton therapy.
• Clinical indications for proton therapy.

Practicum: A short live demo will show how a typical proton therapy plan is developed, calculated and delivered to the patient.

Tutorial 2: Current and future imaging techniques in Proton Therapy

This tutorial is designed to inform the audience about the latest developments in image guidance for proton radiation therapy. Proton therapy introduced image guidance to the field of radiation therapy and one of the earliest CT scans was done using protons at the Harvard Cyclotron Laboratory. After many years the clinical realization of proton radiography and proton tomography appears to be within reach. The current clinical uses of CT, cone beam CT and dual energy CT and proton imaging will be discussed.

Introductory topics will include:

• A review of proton therapy image guidance technologies.
• In-Vivo proton imaging to verify proton dose delivery.
• The theory and practical aspects of Proton imaging – proton radiography and proton tomography.
• The clinical benefits of proton imaging and workflow aspects – how can this actually be done in the clinic.
• Challenges in the implementation of proton imaging.

Practicum: A short video demo will show how proton image guidance is done in the clinic and how it is planned to achieve proton radiography in a clinic setting.