ST 2: Radiation Therapy I

Time: Tuesday 10:00–10:45 Location: PC 203

ST 2.1 Tue 10:00 PC 203

Concept for the implementation of Ru-106 eye plaque characteristics in treatment planning — •Michelle Stroth[1], Henning Manke[1], Dirk Flühs[2], and Johannes Albrecht[1] — [1]TU Dortmund University, Dortmund, Germany — [2]Department of Radiotherapy, Essen University Hospital, Germany

Brachytherapy with Ruthenium-106 eye plaques is an effective method for successfully treating ocular tumours.
To minimize side effects due to irradiation of radiosensitive structures, such as the fovea and optic nerve head, a standardized treatment planning software is needed which considers every relevant therapy parameter. This includes the geometry of the treated eye, the plaque size and position, as well as the inhomogeneous surface dose rate distribution of an individual plaque.
Implementing a patient-specific eye model within Geant4-based Monte Carlo simulations allows for the generation of dose-volume histograms and, thus, for comparing different therapeutic approaches with various plaque types and positions. The general software concept for the investigation and implementation of the characteristics of Ru-106 eye plaques in treatment planning is presented.

ST 2.2 Tue 10:15 PC 203

Simulation of inhomogeneous surface dose rate distributions of Ru-106 eye plaques — •Johannes Wintz[1], Michelle Stroth[1], Johannes Albrecht[1], and Dirk Flühs[2] — [1]TU Dortmund University, Dortmund, Germany — [2]Department of Radio- therapy, Essen University Hospital, Essen

Brachytherapy with Ruthenium-106 plaques is a successful method for treating ocular tumours.

However, the surface dose distribution of the Ru-106 eye plaques is not homogeneous. There are so-called hot and cold spots where the dose can deviate from the dose at the centre of the plaque. To achieve the goal of complying with the tumour control rate, it is essential to consider these inhomogeneities in treatment planning.

The surface dose distribution is characterized by the manufacturer for each eye plaque using 33 defined measuring points. To simulate these dose profiles accurately, the measured dose values must be extrapolated and expanded, forming a mapping of the entire applicator surface. This approach allows the visualization of the surface as a two-dimensional array. The inhomogeneities of the dose profile are then simulated using Geant4-based Monte Carlo simulations. The processes, from the mapping of the dose distributions to the results of the simulation, are presented.

ST 2.3 Tue 10:30 PC 203

Total Reaction Cross Section Measurements for Proposed Technique in Proton Therapy Range-Verification — •Laila Weisel, Devin Hymers, Markus Schiffer, and Dennis Mücher — Institut für Kernphysik, Universität zu Köln, Köln, Germany

The use of proton beams in cancer treatment offers significant advantages compared to photon therapy due to their depth-dose distribution which is characterized by a small entrance dose and a sharp maximum at the Bragg peak. To ensure the prescribed dose is properly delivered, precise knowledge of beam range in the patient is required. A proposed technique for in vivo range verification by Kasanda et al. [1] uses an implanted hadron tumor marker (HTM) which emits characteristic γ-rays when activated by the treatment beam, with intensities which are maximized for energies near the Bragg peak. Previous investigations, which used an HTM consisting of two materials, have demonstrated a sub-milimeter precision in range verification. The ratio of the γ-ray yield from two reactions of interest ^{89}Y(p,n)^{89}Zr and ^{92}Mo(p,n)^{92}Tc has been measured for different initial proton beam energies. In previous experiments the γ-ray ratios were related to a beam energy at the marker position by using calculated reaction cross sections. In order to obtain a more precise calibration of the correspondence between γ-ray ratios and energy, an experimental setup is currently being finalized at the Cologne 10 MV tandem accelerator, to measure the total cross sections in small energy steps. The status of these measurements and preliminary results will be presented.
[1] E Kasanda *et al* 2023 *Phys. Med. Biol.* 68 185005