Improving patient dosimetry under non-reference conditions for proton beams

Fördernummer: 2017-020

Antragsstellende

Prof. Dr. B. Poppe (Universitätsklinik für Medizinische Strahlenphysik), Prof. Dr. S. Brandenburg (University Medical Center Groningen, Niederlande), Prof. Dr. A.C. Knopf (University Medical Center Groningen, Niederlande) und Dr. H.K. Looe (Universitätsklinik für Medizinische Strahlenphysik)

Zusammenfassung

Radiation therapy is an important pillar in cancer care. Although most treatments are performed with high energy X-ray beams, clinical benefits of high energy particles, such as protons, have been demonstrated acknowledging the associated reduced probability of radiation induced toxicity. The joint PhD project proposed here addresses an unsolved issue, namely a high uncertainty associated with dosimetry of complex proton beams, i.e. the energy absorbed by tissues resulting in the biological reaction. Advancement in this field is of high priority since a precise and reproducible dosimetry is a key for a safe clinical use. In Groningen, at the UMCG, a proton therapy facility has been established in 2017. Additionally, at the KVI-CART a proton accelerator is operated for preclinical research. The project will serve as a bridge to facilitate the clinical transfer of expertise in dosimetry from Oldenburg to the clinical use in Groningen.

The objective is to develop novel dosimetry techniques for measurements in modulated and irregular proton beams. An essential part is to probe the validity and practicability of strategies incorporating physical, clinical and mathematical models developed in Oldenburg, readily established for high energy X-ray beams, in proton beams. The project is staged in three work packages (WP), each to be carried out in Oldenburg and Groningen. The first WP involves comprehensive measurements and detector modelling to establish and evaluate 1D reference detectors for point measurements at arbitrary positions within a proton beam. In the second WP, an extension from 1D to 2D using radiochromic (self-developing) films and a novel semi-empirical method is planned. A time resolved 3D dose measurement technique based on optical imaging will be validated in WP3 using the 1D and 2D reference detectors established in WP1 and WP2. Outcomes may guide developments of national and international standards in particle therapy and will complement several other follow up proposals.