MedAustron

Master Thesis

Optimization of microdosimetric detectors for Radiobiological studies

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Background: The radiation dose delivered to a tumor in radiotherapy is specified in terms of the amount of average energy deposited per unit mass by ionizing radiation. This macroscopic quantity works fine for radiations producing a fairly uniform pattern of energy deposition, such as high-energy x-rays and electrons, but fails to correlate well with the biological effects of radiations where the energy deposition is concentrated around the particle tracks, such as light-ion beams. The latter are becoming more common in radiotherapy and are the type of beams used at MedAustron. For these beams knowledge of the microscopic energy deposition patterns is needed to describe the physical influence of radiation on biological effects. The microdosimeters are the detectors capable of assessing the microscopic energy deposition. At MedAustron, diamond and silicon microdosimeters are being developed and tested for preclinical and clinical studies. Preclinical studies include the use of these detectors in water phantoms, in anthropomorphic phantoms, and during the irradiation of specific cell lines for radiobiological studies. These investigations are fundamental for the comprehension of the effects of the radiation to human tissue (healthy and cancer cells) and consequently to improve the radiation therapy.

Project: The project aims to study the implementation of diamond and silicon microdosimeters in radiobiological studies. The detector prototypes now available at MedAustron will be adapted to be used in anthropomorphic phantoms, water phantom, and biological phantoms. The study will concern the miniaturization of the detectors occupancy volumes, the optimization of the setup for the use in phantoms, and the study of coating and encapsulation which are water-resistant, radiation hard, and provide easy handling.

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