DESCRIPTION FOR THE GENERAL PUBLIC

(*State the objective of the project, describe the research to be carried out, and present reasons for choosing the research topic - max. 1 standard type-written page)*

ON-LINE MONITORING OF DOSE DISTRIBUTION IN PROTON THERAPY USING HEAVY SCINTILLATING FIBERS

The aim of the project is development of a method for on-line monitoring of a cancer treatment called proton therapy. In this kind of treatment a tumor is irradiated with a proton beam with parameters adjusted such, that protons deposit maximum of their energy in the tumor region, leading to destruction of tumor cells. For this purpose a treatment plan is prepared individually for each patient, usually based on CT (computer tomography) or PET (positron emission tomography) images. However, human body undergoes changes, which may lead to misplacement of the applied dose compared to the original plan. Therefore methods for on-line monitoring in proton therapy are sought for. In our project we want to test a possible option of design of a setup for proton therapy monitoring. Its operation consists in detection of gamma radiation, which is produced in a patient's body irradiated with a proton beam. By reconstructing the source of this radiation we can conclude about the location and shape of deposited dose. We will detect prompt-gamma radiation using long but thin pieces (called fibers) of a scintillating material, i.e. the one which shines light when being traversed by a particle or a gamma ray. This light can be registered with special sensors called multi-pixel photon counters. The setup we propose has two modes of operation: a Compton camera and a coded-mask, which allow to map the dose shape in three or two dimensions, respectively. The two options share a vast part of hardware, therefore we want to develop them in parallel. First we will conduct a series of virtual experiments (computer simulations) to find the best possible design option, then we will make sure in the laboratory tests that the simulation results correspond to reality. Once the design is fixed, we will build and test the setup, first in a laboratory, and then in a therapeutic center with phantoms simulating human body.

Cancer is the second most common cause of death in Europe, therefore new treatment methods and ways to improve the applied ones are sought. A working method of on-line monitoring in proton therapy would allow to prepare better treatment plans for patients, leading to better and safer treatment.