MikroDose LLC

Company Overview

MikroDose LLC is developing innovative silicon 3D-microsensors that are capable of measuring key radiation quality parameters in proton therapy used to treat various cancers. These additional measurements of proton beam radiation quality will allow for enhanced radiotherapy regimen design that will vastly improve patient treatment outcomes.

Problem

Proton radiotherapy is a type of cancer radiation treatment that achieves very high dose conformity around the target region. This allows for better protection of at-risk organs by decreasing radiation side effects, and also allows for higher dose escalation. The number of patients treated with proton radiotherapy is greater than 10,000 per year, and has grown by 20% annually since 2009. The number of proton therapy treatment rooms has also grown at an annual rate of 13%. According to the Proton Therapy World Market report, the global proton therapy devices market will grow by 10% annually to reach $2.5B in 2030 across 1,000 proton therapy treatment rooms.

Protons have a higher biological effectiveness than conventional radiotherapy sources. Biophysical models are currently implemented in radiotherapy treatment planning systems (TPS) with the aim to calculate and optimize the biological dose distributions of proton treatments. However, there is no commercial dosimetric equipment available that can accurately measure the biological impact of proton beams, which means that the calculations performed by the TPS cannot be verified. This means that biologically optimized proton plans may not be correctly delivered, which could decrease their therapeutic benefit or even cause harm to the patient.

Solution

MikroDose is developing silicon 3D-microsensors that are capable of detecting energies deposited by protons at the micron level. These microdosimeters are efficient, portable, and provide a fast response. While current dosimeter arrays only measure dose, MikroDose is developing a solution that will be able to measure all the physical quantities required to calculate the biological effectiveness of protons, allowing for the verification of the same quantities calculated by TPS. This will ensure the quality of the treatment and help to improve the therapeutic benefit of this treatment modality.

Team Information

Alejandro Carabe-Fernandez, Ph.D. is an Assistant Professor in the Department of Radiation Oncology at UPenn. He is an expert in clinical physics and radiation biophysics, including biophysical modeling of biological effects after proton radiotherapy.

Consuelo Guardiola Salmeron, Ph.D. is a physicist and expert in microfabrication of new silicon radiation detectors for radio and hadrontherapy.

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