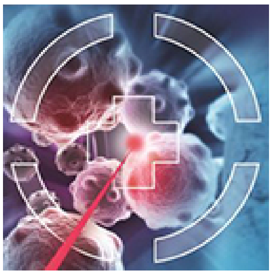

Contribution ID: **49**

Type: **not specified**

Luminescence imaging of proton beams in water: Is this method sufficient for use in clinical quality assurance?

Thursday, 5 September 2019 12:00 (20 minutes)

Proton therapy is increasingly used in modern radiation therapy. In the quality assurance of Proton therapy facilities, a recurring dosimetric task is the verification of the stability of the proton ranges in water for all energies provided by the system. The conventional measurement method using an ionization chamber with an adjustable water column (e.g. PTW Peakfinder) is very time-consuming, depending on the required spatial resolution and number of energies to be measured. The use of multi-layer ionization chambers (e.g. IBA Giraffe) is faster but limited in depth resolution.
Recently, luminescence light emitted from water irradiated with proton beams has been depicted and was subject of different studies x1,2x. It turned out that this luminescence light is strong enough to be detected by sensitive cameras at the dose levels typical for proton therapy. The local intensity of the luminescence light appears to depend on the dose.
In this work, we aim to prove the suitability of this method as a quality assurance tool in particle therapy, using the example of range measurements for proton beams within the therapeutical energy range.
For this purpose, a comparative measurement between standard measurement using multi-layer ionization chambers and an optical measurement using a high sensitive CMOS Camera was carried out in an experiment at the Westdeutsches Protonentherapiezentrum Essen (WPE). This work shall examine if the optical system is usable in a proton treatment room or if it gets disturbed by scattered radiation. The possibility to measure the proton ranges in water over the entire clinical energy range shall be determined. Furthermore, it shall be observed if the spatial resolution is sufficient to measure the smallest possible range difference of the therapy system

Indico rendering error

`Could not include image: [429] Error fetching image`

Indico rendering error

`Could not include image: [429] Error fetching image`

It has been proven that it is possible to measure the luminescence signal for a Bragg peak in pure water without any detector perturbation although the signal intensity is very weak. For the observation of the peak position, our measurements reach a high conformity with the peak position measured by a multi-layer ionization chamber. A statement about the relationship between dose and luminescence signal is challenging and will be subject of further investigations.

(1) Radioluminescence in biomedicine: physics, applications, and models
Y Helo et al 2014 Phys. Med. Biol.59 7107

(2)Luminescence imaging of water during proton-beam irradiation for range estimation.
Seiichi Yamamoto, Toshiyuki Toshito, Satoshi Okumura, Masataka Komori
Med Phys. 2015 Nov; 42(11): 6498–6506. doi: 10.1118/1.4932630

Primary authors: Mr BURG, Jan Michael (THM University of Applied Sciences, Giessen, Germany, University Medical Center Marburg Philipps-University, Marburg, Germany); Dr WULLF, Jörg (Westdeutsches Protonentherapiezentrum Essen (WPE) GmbH); Mr HORST, Felix (THM Gießen, GSI Darmstadt); Prof. ZINK, Klemens (THM Gießen, UKGM Marburg, FIAS Frankfurt)

Presenter: Mr BURG, Jan Michael (THM University of Applied Sciences, Giessen, Germany, University Medical Center Marburg Philipps-University, Marburg, Germany)