



Contribution ID: 147

Type: poster

Development and characterisation of a new miniaturised detector for in vivo dosimetry in HDR brachytherapy.

Thursday 22 September 2011 17:30 (1h 30m)

Due to the recent development of new conformal radiotherapy techniques, it's important to generate an improvement of dosimetric instruments especially in brachytherapy, in order to obtain a remarkable improvement of the measurement accuracy and precision of the absorbed dose both by healthy and pathologic tissues. The HDR brachytherapy requires the use of an interstitial implant or an intracavitary applicator where an Ir-192 source runs with its highest activity (10Ci) and gradient. The interest in in-vivo measurement of the dose delivered to the target or to the neighbouring healthy organs is getting higher, due to the strong complexity of the treatment. For this reason a real time miniaturized system for in-vivo dosimetry based on a Ce³⁺-doped SiO₂ optical fibre is now under study. A careful analysis was made in order to define one of the most important aspects of the measurement process: the detector sensibility connected to the source distance, to the dose rate and to the radiation incidence angle. The results of that investigation were very encouraging as they have proved a very good response linearity of the detector with the dose such as the independence of the response from energy and dose rate. Moreover it was tested that the response of the detector depends on the irradiation temperature with consequent determination of the correction factor. The results indicate that the use of this new system is very promising both for quality control measurements and in-vivo dosimetry, especially for gynaecological and prostatic treatments.

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Session Classification: Poster Section 2

Track Classification: Health Physics and Radiation Chemistry