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EBT2 radiochromic films for absolute dose measurements in radiotherapy: prototype of an innovative system for their analysis

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One of the most important progress reached in radiotherapy in the last decade is intensity modulated radiation therapy (IMRT). This modern radiotherapy permits to achieve a conformed high dose distribution around the target volume, sparing at the same time the surrounding critical organs and healthy tissues. Since the radiation fields are very complex and the absorbed doses during IMRT treatments are very high, it's important to verify the effective dose distribution. Usually dose distribution verification is obtained by two dimensional detectors, such as diode or ion chamber arrays, or by film dosimetry. Film dosimetry is more time consuming if compared to detector arrays, but has the important advantage of gathering higher spatial resolution. The new GAFCHROMIC® EBT2 is the most modern film dosimeter. Previous GAFCHROMIC® film dosimeters, EBT, were modified to decrease their response dependence on energy and dose rate. GAFCHROMIC® EBT2 has a good dose and spatial resolution; therefore it's convenient to design a new analysis system more sensitive and precise than commercial scanners. The proposed system is composed by a planar uniform white light source and a CCD camera with an optical filter around 630nm. The system has been set up and optimized to achieve GAFCHROMIC® EBT2 analysis. A measure procedure was established to investigate EBT2 dose response over the adopted range of energies as well as to evaluate EBT2 sensitivity variation as a function of time after irradiation. Finally, absolute dosimetry of complex IMRT radiation fields was achieved with EBT2 films. Obtained results have been compared to treatment planning system calculations and the goodness of the proposed system has in such way confirmed.

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