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A scintillating fiber dosimeter for radiotherapy

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Radiotherapy, together with chemiotherapy and surgery, is one of the main methods applied in the fight against cancer; in order to increase the chances of a successful radiotherapy treatment the dose delivery to the tumour areas and the surrounding normal tissues has to be computed with high accuracy. Standard dosimeters are accurate but too small (ionization chambers and diodes) or non real time (radiographic films). At present there is no device that can perform real time and bidimensional measurements of a dose distribution. This article will describe the development of a real-time dosimeter based on scintillating fibers for photon and electron beams (each one of few mm 3); the fibers are made of polystyrene, that is water equivalent and thus tissue equivalent, allowing a direct dose calculation. The small scintillators are inserted in a PMMA phantom; the light produced is collected by white fibers and readout by a multichannel photomultiplier tube. Several prototypes (single and multi channel) have been assembled; they have passed successfully the tests of reliability, linearity response and comparison with standard dosimeters. The paper will describe the prototypes and the readout electronics, together with the results of the measurements with electron and photon beams with energy up to 20 MeV (Varian Clinac 1800), and the status of the 2D dosimeter development.

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