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The Properties of Beam Intensity Scanner(BInS) in IMRT with Phantom for Three Dimensional Dose Verification

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Objectives: Patient dose verification is clinically the most important parts in the treatment delivery of radiation therapy. The three dimensional(3D) reconstruction of dose distribution delivered to target volume helps to verify patient dose and determine the physical characteristics of beams used in intensity modulated radiation therapy(IMRT). We present Beam Intensity Scanner(BInS) system for the pre treatment dosimetric verification of two dimensional photon intensity. The BInS is a radiation detector with a custom made software for relative dose conversion of fluorescence signals from scintillator.

Methods: This scintillator is fabricated by phosphor Gadolinium Oxysulphide and is used to produce fluorescence from the irradiation of 6MV photons on a Varian Clinac 21EX. The digitized fluoroscopic signals obtained by digital video camera will be processed by our custom made software to reproduce 3D relative dose distribution. For the intensity modulated beam(IMB), the BInS calculates absorbed dose in absolute beam fluence, which are used for the patient dose distribution.

Results: Using BInS, we performed various measurements related to IMRT and found the followings: (1) The 3D dose profiles of the IMBs measured by the BInS demonstrate good agreement with radiographic film, pin type ionization chamber and Monte Carlo simulation. (2) The delivered beam intensity is altered by the mechanical and dosimetric properties of the collimating of dynamic and/or static MLC system. This is mostly due to leaf transmission, leaf penumbra, scattered photons from the round edges of leaves, and geometry of leaf. (3) The delivered dose depends on the operational detail of how to make multileaf opening.

Conclusions: These phenomena result in a fluence distribution that can be substantially different from the initial and calculative intensity modulation and therefore, should be taken into account by the treatment planning for accurate dose calculations delivered to the target volume in IMRT.

Key words: IMRT, BInS, dose verification, dosimetry, scintillator