**Primary dose components of three 6 MV photon beams**

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**1. Introduction**

It is a common technique in radiotherapy treatment planning systems to simplify the calculations by splitting the radiation beam into two components: namely the primary and scattered components. The primary component is the radiation which arrives at the point of interest without having had any interactions. The scattered component is the radiation which arrives at the point of interest having undergone at least one interaction. The contributions of the two components are evaluated separately and then summed to give the dose at the point of interest. It is of vital importance to determine these components as accurately as possible, as any error will have an impact on the dose the patient receives. Usually the primary dose is obtained experimentally by extrapolating the ionization measured within the medium to zero field size. This approach offers the opportunity to obtain the primary component of dose without the need for an uncertain non-linear extrapolation. It is based on two papers by Nizin & Kase from 1988 and 1990 [1,2].

**2. Design and Method**

The total dose in a broad beam can be described as the sum of the primary and scattered dose components

(DT = Dp + Ds). A small diameter central axis absorber (denoted by superscript i) is placed between the source of radiation and the point of interest, resulting in additional attenuation of primary photons without appreciably changing the scattered component of the beam (DiT = DiP + Ds). For a specified depth d in a phantom, the ratio of primary components is independent of field size: Dp / DiP = constant = CD.

Thus: Dp (d) = [1 – 1/ CD(d)]-1 ∙ [DT (d,S) - DiT(d,S)]

CD can be measured by a series of ionization measurements with and without the attenuator in a narrow beam. The value of CD together with the total doses with and without the central axis attenuator in the beam enables one to calculate the primary dose component of the beam.

Measurements were done in Philips SL75-5, Siemens Mevatron KD2 and Varian 2300 Clinac 6 MV photon beams. Lead attenuators of 1 cm and 2 cm thickness were used.

**3. Results**

The values for the primary doses at dmax in a 10 cm x 10 cm field ranged from 0.925 Gy/100MU - 0.943 Gy/100MU with uncertainties ranging from 3.3% to 5.2% [3,4].

**4. Conclusion**

The obtained values of the primary dose component compare well with the values currently in use on the treatment planning systems as well as with Monte Carlo simulations. One can thus conclude that this method has the potential to provide an independent measurable verification of calculations of primary dose.

**5. References**

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