

AbstractID: 8193 Title: Experimental Determination of Detector Volume Effect using a Gaussian Function on Output Factor Measurements in 5 mm Small Field

Purpose: We investigated the effect of detector volume for output factor measurement in the 5 mm collimator. Comparisons of measured and calculated output factors from a Gaussian fitting approaches the real doses to remove detector volume effect were performed.

Method and Materials: A 6 MV photon beam from a third-generation CyberKnife was used in this study. We have used a Gaussian function to correct for the spatial response of finite-sized detectors and to obtain the real beam profiles from measurement. The beam profiles were measured with a PTW 31006 pinpoint ionization chamber and a PTW 60008 diode. The calculated output factors were obtained from a Gaussian fitting for the beam profile with the same detector, which were compared to measured value with radiochromic film.

Results: The 5 mm collimator output factor measured with the ionization chamber was 0.615 ± 0.009 , the diode was 0.702 ± 0.015 and radiochromic film was 0.695 ± 0.022 . Ionization chamber show significant differences of more than 12.4% between measured and calculated output factor by Gaussian function for the 5 mm collimator. The main reason for an underestimation of the output factor is the increase of lateral electron disequilibrium with an increase of the ionization chamber measuring volume. The agreement between output factors measured and calculated value with the diode was within 1.5%. A diode was found to be suitable for output factor measurements of small beam because of its high spatial resolution. Also, we found good agreement between the measured output factor obtained with radiochromic EBT film and the calculation values of another detector.

Conclusion: The volume effect of the detector could lead to inaccurate in small field dosimetry. The results of this study indicated that the choice of a suitable detector is an important problem for dose measurement in high dose gradient region such as the 5 mm collimator.