

AbstractID: 3162 Title: Effects of lung inhomogeneity for an intensity modulated field

Purpose: To study the effects of inhomogeneity for intensity modulated fields using slab phantoms.

Method and Materials: Tissue equivalent solid slab phantoms (20x20 cm² and varying thickness) were used to create inhomogeneous medium. A 4-cm thick lung equivalent material was used to simulate lung inhomogeneity. Radiographic films were placed at 1-cm upstream and at 2-cm downstream positions relative to the lung material along the beam axis. Note that the electronic equilibrium in the beam direction was achieved at these locations. Ten 5-mm wide bar patterns placed at every 1-cm were generated using the sliding window technique for intensity modulated fields. We used a 6MV photon beam of a Varian 2100CD with 52-leaf MLC. A concept of modulation transfer function (MTF) was applied for the analyses.

Results: The bar pattern of the beam intensity was smoothed at the depth of 5-cm in the phantom, becoming a dose profile similar to sine waves on the plane transverse to the beam axis. There was a clear difference of dose profiles between the homogeneous case and the 4-cm lung case. The latter exhibits a smaller attenuation of the amplitude of the sinusoidal waves. MTF measurements showed that there were five peaks between 0 and 0.2 mm⁻¹ for the homogeneous case; but, there were only three for the lung case. The MTF values of the sine waves were 0.783 and 0.914 for the homogeneous and the lung cases, respectively.

Conclusion: Using a sinusoidally modulated field, we have found that the effects of 4-cm thick lung are to increase the amplitude of the sine waves and to smooth the narrow fields. The application of MTF concept helps us with deeper understanding of the heterogeneity effects for intensity modulated fields