AbstractID: 1749 Title: Extended-Source Brachytherapy Dose using FFT Convolution

Several brachytherapy treatment techniques employ radioactive liquid in an intracavitary balloon. Treatment planning systems typically do not calculate dose for such extended sources. If the balloon is assumed to be spherical, a modified point source can be used to model the dose. However, if the source distribution is homogeneous but non-spherical, no simple approach is available for accurately computing the dose. This paper analyzes the difficulties encountered in attempting to numerically model a distributed source by integration over a 3-D distribution of point sources. A proposed fast Fourier transform (FFT) convolution method completely eliminates the inaccuracies of point source modeling, and calculates the dose much more quickly. The dose kernel for this method is an accurately computed 3-D dose distribution due to one cubic voxel. The construction of the dose kernel and of the source volume distribution (fluence) is described. The accuracy and efficiency of the proposed method is shown for homogeneous sources in a water-density medium.