

AbstractID: 9273 Title: An enabling technology for creating sculpted brachytherapy dose patterns with the Xoft Axxent™ system

Purpose:

Study a potential means of partially attenuating X-rays from the Xoft Axxent™ system over controlled spatial areas, while minimizing changes to depth-dose characteristics. This would be the basis of an enabling technology to sculpt brachytherapy dose patterns to, for example, spare critical structures such as skin in breast brachytherapy treatments.

Method and Materials:

Measurements of output were made from the Xoft 50 kVp source attenuated by thin (0.001") dot-shaped layers of silver, with diameters of several mm. Measurements were made with azimuthal scans around the source at distances from 2 to 7 cm. The dots were attached to the source cooling catheter, approximately 2.6 mm from the source center. Attenuation calculations and Monte Carlo studies of the effect were performed using EGSnrc.

Results:

Partially attenuating dots of silver create shadows in measured dose that agree with attenuation calculations in proportion, and in the critical behavior of how the attenuation varies with distance. Monte Carlo studies were consistent with measured results. Materials other than silver (or elements nearby in atomic number) will harden the beam, and so the attenuation will lessen with distance. Silver has much less of a hardening effect, because the K absorption edge reduces the higher energy portion of the spectrum at a rate similar to the losses in the lower energy region.

Conclusion:

It is possible to create predictable, directed shadows in dose around the Xoft 50 kVp x-ray source using practical thicknesses of silver foils. The shadows have soft edges owing to penumbral effects when the dots are placed on the cooling catheter, within a few mm of the source. Such shadows could be used in future applications to spare healthy tissue during brachytherapy. In a simulated breast treatment plan, using a simple model of the attenuation, isodose lines were shifted by several mm.