

The effect of Magnetic field on dose distribution of HDR Co-60 and Ir-192 sources

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ABSTRACT:

Purpose: MR-linac machines are being developed for image-guided radiation therapy, but the magnetic field of such machines could affect dose distributions. The purpose of this work was to evaluate the effect of MR magnetic field on HDR Co-60, Ir-192 sources dose distribution when are used in the MR-linac bunker at the presence of 1.5 T magnetic field.

Material/Methods: HDR brachytherapy sources Co-60 and Ir-192 were simulated in the Geant4 Monte Carlo code in the presence of a homogenous magnetic field of 1.5 T which is used in the MR- linac machine. The correct physical dimensions of the seeds were acquired from the Carleton University website and other dosimetric parameters also calculated by Monte Carlo code. The magnetic field was applied both perpendicularly and parallel to the longitudinal axis of the seeds. A 15 x15x 15 cm grid comprising small voxels of uniform 1 mm resolution in each direction was used for dose scoring in a water phantom. Calculated isodose distributions were compared. All the isodose lines were normalized to the delivered dose to a 1 cm away from the transverse axis.

Results: The results have shown that in the presence of a magnetic field when the magnetic field is applied transversely and perpendicularly, the dose profile distribution in the water phantom unaffected in all planes for both sources.

Conclusion: The presence of a homogenous 1.5T magnetic field for both HDR sources do not affect on the profile dose distribution at both transverse and perpendicular plane. These results show that, one could use the HDR machine in the same room of MR-linac machine and use concurrent MR imaging for accurate treatment.