AbstractID: 6770 Title: The 3D dose measurement for low energy X-Ray beams using Polymer Gel scanned with optical CT and high-field (3 Tesla) MRI

Purpose:

Feasibility tests for measuring 3D dose distribution of 17.5 KeV low-energy photon fields from a miniature x-ray generating system using a BANG-2 Polymer Gel.

Method and Materials:

BANG-2 polymer gel (MGS Research Inc.), a tissue-equivalent gel infused with monomers that polymerize locally in proportion to the absorbed radiation dose, can trap the polymer particles that scatter visible light and result in the appearance of a white cloud in the gel. The relationship between the spatial distribution of optical density in the gel and the dose distribution was determined in optical CT images from an OCTOPUS scanner with slice thickness of 3 mm. In addition, the proton NMR relaxation rates, R_1, R_2, are increased in the vicinity of the polymer particles and the local R1 or R2 relaxation rates were measured from MRI images from GE 3.0 Tesla whole-body magnet scanner with slice thickness of 2 mm. The goal of this study is to verify the 3D dose distribution for low energy of only 17.5 KeV (Mono-energy, Kα) radiation field around a needle of the miniature x-ray generator (Advanced X-Ray Technology, Inc.). The miniature x-ray generator comprises a conventional x-ray tube with an Ag anode and a 6 mm diameter needle device with an interchangeable Mo target.

Results:

Through low energy x-ray exposure, GEL shows clear relationship between OD to doses. Thus, the dose distributions can be reconstructed from Optical CT images. More experiments would be performed to confirm the reproducibility and accuracy for such a 3D dosimetry system.

Conclusion:

Bang-2 Polymer GEL can be used to verify 3D-dose distribution in the low energy photon field with the advantages of tissue equivalent, true 3D representation, and less energy dependent.