

AbstractID: 5519 Title: A new method of beam let weight and dose reconstruction for IMRT: Fine mesh study

A new method was developed for the reconstruction of beamlet weight and dose in a patient in intensity modulated radiation therapy (IMRT). The method is based on linear relationship between beamlets and dose scoring voxels in EPID, expressed in terms of beam let weights and kernels. Thus, the reconstruction does not involve iteration or assumption of dose image in EPID as a primary fluence. The kernels quantify dose deposition in each voxel in EPID from each beamlet and are determined by Monte Carlo particle transport calculations. The method was demonstrated computationally on a coronal plane in a phantom. Kernels on this plane and EPID were first calculated for each beamlet. Two IMRT dose distributions of pyramid and inverse pyramid shapes were constructed in phantom and EPID by weighting kernels of each beam let differently. An accident or error was designed by changing the weight of a certain beamlet, modeling MLC uncertainty or output instability. Using the dose difference in EPID due to the accident, the relationship was inversely solved for the changed amount in beamlet weight. For the demonstration, 30×12 ($6 \times 6 \text{ cm}^2$) source matrix was used involving the construction of 1296×360 kernel matrix in EPID and less than 10 seconds of calculation time and 10 MB of memory were used. The dose change due to the accident in phantom was calculated weighting the predetermined dose kernels in phantom by the reconstructed weight difference. Comparing the reconstructed weight change with the imposed change, the result showed a negligible error due to rounding-off of data. This validation has shown that the method is practically suitable for the verification of IMRT and useful for application in adaptive radiation therapy. A follow-up study will be performed, that includes detailed modeling of a therapeutic beam and EPID and experiments.