

Intensity modulated radiotherapy requires precise knowledge of the patient position and orientation relative to the delivery device. In tomotherapy the delivery device produces an intensity modulated fan-beam controlled by a multileaf collimator. The software generated collimator leaf patterns are based on a two dimensional array called the delivery sinogram. The optimization software determines the delivery sinogram from the oncologist's prescription and the diagnostic CT images assuming the patient's position remains fixed from one fraction to the next. Due to unavoidable errors in patient setup, this is generally not the case. A registration algorithm previously developed is capable of computing residual patient offsets. With this knowledge the transformation described here can be used to correct the delivery sinogram obviating patient repositioning which could introduce further error. In the future, when interactive registration is available, real time patient motion corrections may also be achievable.

To correct for z-offsets and rotation offsets about the isocenter, the initial gantry and couch positions respectively, can be adjusted. Corrections for x- and y-offsets are more complicated in that they depend nonlinearly on both the gantry and the fan-beam angles. The fan-beam dependence is removed by transforming the sinogram into parallel ray geometry where the offset corrections are a linear function of gantry angle. Finally, the delivery sinogram is inverse transformed back into the fan-beam geometry appropriate for patient treatment.

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