

Purpose:

A simplified helical-tomotherapy independent planning system (SHIPS) has been developed for independent verification of the TomoTherapy Hi-ART (TomoTherapy Inc. Madison, WI) treatment scheme and to provide an alternative method to produce helical tomotherapy plans. The SHIPS program is designed to be simple, so the program can run on a desktop PC, and straightforward, so the delivery scheme is intuitive. Presented here are relationships/equations SHIPS uses to produce delivery parameters and treatment sinogram.

Methods and Materials:

SHIPS requires the user to input the patient geometry and contours as geometric shapes, e.g. cylinders and ellipsoids. Simplifying the geometry makes the structures in the treatment sinogram more perceptible and speeds the contouring process. The user specifies pitch, field size, and prescribed dose. SHIPS calculates the couch travel length, the number of rotations, couch travel speed, MU, and time of treatment. The required rotation period can be calculated using the prescription, depth to a point of interest, and measured beam data (depth dose output factors, and profile data). The treatment sinogram is created using geometry information, treatment parameters, beam data, and the prescription. SHIPS treatment parameters are compared against values produced from the Hi-ART system, forty plans are observed.

Results:

The average deviation of the SHIPS calculated couch travel distance, time of treatment, couch speed, and number of monitor units to the Hi-ART's values are, respectively, 0.08%, 0.05%, 0.37%, and 0.74%. Simulated imbedded targets(e.g. prostate) and external/convex(e.g. breast) are presented examples of SHIPS treatment plans. The SHIPS treatment plan calculation is less than 30 seconds.

Conclusion:

SHIPS bypasses the Hi-ART's optimizer, producing independently derived plans. Running SHIPS in parallel with the Hi-ART's treatment planner provides quality assurance of the entire treatment planning process. Additionally SHIPS can challenge how much inverse planning the Hi-ART system requires and can be used for basic forward planning.