AbstractID: 12833 Title: Design and Development of a new micro beam treatment planning system

Purpose: To develop the Treatment Planning System for a new microbeam treatment system.

Method and Materials: The microbeam treatment system was composed of an x-band linac with a robot arm, the real-time tracking system using x-ray fluoroscopy, and the treatment planning system. The system realizes 4π irradiation using many microbeams of which the diameter is about 1mm. We developed the software for the optimization of beam directions/beam intensities and dose calculation. We used the pseudo Beam's Eye Beam (pBEV) method in the beam direction optimization and the steepest decent method and the objective function in the beam intensity optimization. We employed the superposition/convolution algorithm and the density scaling method (developed by Siddon) in the dose calculation. The dose kernel was calculated by using the EGS5 Monte Carlo simulation code. The calculated result was compared with the Monte Carlo-calculated PDD curve in water. Finally, the microbeam irradiation for a small tumor in lung was simulated using the treatment planning system.

Results: One hundred beams were selected using the pBEV scores from 408 beams. The beam intensities of each beam were determined by the steepest decent method. The dose distribution for a small lung tumor was calculated using the beam direction/intensity. The dose was concentrated on the PTV and the OARs were spared effectively. The dose difference between the calculated PDD curve with our system and the Monte-Carlo calculated curve in water was within 1%. The calculation time of 1 port was about 15sec.

Conclusion: We developed the treatment planning system for a new microbeam treatment system. The dose distribution for a small lung tumor was simulated using the software.