AbstractID: 9093 Title: Modeling of beam profiles based on three Gaussian functions in lung stereotactic body radiotherapy for acceptance test of radiotherapy planning system

Purpose: The purpose of this study was to estimate beam profiles in lung stereotactic body radiotherapy for acceptance test of radiotherapy planning system (RTP) system. The beam profiles measured by an ionization chamber were approximated by using three Gaussian functions, and compared with profile data calculated by two RTP systems.

Method & materials: X-ray linear accelerator with 4,6,10MV (Varian 21EX) was used to deliver symmetric beam profile for a field size of $5\times5cm^2$. A lung phantom consisted of a lung equivalent material (thickness : 170 mm) sandwiched by two Solid Waters, whose thickness were 30 mm and 50 mm for anterior and posterior sides, respectively. Measured beam profiles were approximated by manually determining three amplitudes and standard deviations of three Gaussian functions corresponding to three point spread functions of an x-ray focus, x-ray or electron scatter, and a detector ,and by integrating the composed function. Finally, we evaluated our method by comparing the approximated beam profiles with those calculated by two algorithms in two RTP systems, i.e., Convolution/superposition (CS) (Philips Pinnacle) and analytical anisotropic algorithm (AAA) (Varian Eclipse).

Results: Difference between the measured and approximated beam profiles were 4% at 20-80% doses, and 1.5% difference at the other doses. The fringe values (distance between the 50 and 90% levels) of beam profiles approximated by Gaussian functions and calculated by CS and AAA algorithms were 4.7, 6.1, 6.4 mm for 4MV x-ray, 5.7, 6.9, 7.1 mm for 6MV x-ray, and 6.8, 7.7, 8.2 mm for 10MV x-ray, respectively.

Conclusion: It was suggested the beam profile model based on the three Gaussian functions may be useful for acceptance test of a RTP system.