AbstractID: 1248 Title: A Preliminary study of the Monte Carlo based inverse treatment planning for the clinical implementation

Even though the inverse technique with objective function and optimization model is regarded as the ultimate solution for the intensity modulated radiation therapy (IMRT) planning, calculations based on conventional convolution/superposition dose model can cause serious errors. In this study, Monte Carlo (MC) based inverse treatment planning system was developed. BEAMnrc and DOSXYZnrc codes were used for the MC simulation and Siemens Primus machine was modeled. Because of the characteristic of Siemens multi-leaf collimator (MLC), original MLC component of BEAMnrc code was modified. Phase space data was obtained below the MLC. Initial treatment plan was implemented using PC based Coreplan radiation therapy planning system (RTPS). The number and direction of beams and field shape were determined in this stage. Input files generated from Coreplan were transferred to linux system for the simulation. Objective function was made using the dose and dose volume constraints and the optimization model was based on the fast simulated annealing method. Calculated intensity map was verified using film dosimetry. They agreed within 3% error in homogeneous phantom. Developed system was applied to the planning of prostate case. Five coplanar beams were used and the maximum number of beamlets per beam was about 80. Each beamlet size was $1x1cm^2$ while the voxel size was set to $4x4x4mm^3$. Comparing with the planning result of Pinnacle RTPS, there was more than 10% improvement in dose calculation accuracy however it took more than 10 hours for the overall procedures.