

AbstractID: 12995 Title: Comparative study of dose calculations using the BrainLAB pencil beam and Monte Carlo dose algorithms

Purpose: To compare and assess accuracy of the doses calculated using the BrainLAB pencil beam (PB) and Monte Carlo (MC) algorithms for lung, prostate, brain, head and neck and paraspinal tumors.

Methods and Material: Dose was calculated using PB convolution and MC algorithms in the IPLAN treatment planning system from BrainLAB for 5 lungs, 3 brains, 5 prostates, 2 head and neck and 2 paraspinal tumors. Dose was calculated using a combination of three-dimensional conformal and IMRT plans. The leaf sequences from IMRT plans or beam shapes from conformal plan and monitor units (MUs) calculated by the PB were used to calculate dose with MC.

Results: The DVH's calculated by PB and MC in the brain, prostate, paraspinal and head and neck are in good agreement within 5%. However, the DVH's of the lung patients have large discrepancies and while PB shows good coverage, MC shows lack of dose coverage. For maintaining similar dose coverage, higher MUs up to 30% are needed for MC compared to that predicted by PB calculations. Despite large discrepancies in DVH coverage of the PTV between PB and MC, the point dose at isocenter for lung calculated by both algorithms were within 5%. Further, the dose measured at isocenter using ionization chamber agrees well with pencil beam within 5% for several selected plans.

Conclusions: The calculated dose by MC and PB agrees within 5% for prostate, brain, head and neck and paraspinal tumors. However, considerable discrepancies up to 30% are observed in dose-volume coverage between MC and PB in lung tumors. Point dose measurements at isocenter are not representative of the discrepancies in dose coverage between PB and MC and verification with two- and three-dimensional dose measurements are required.