AbstractID: 4604 Title: Improvements of a Commercial Treatment Planning System on the MLC Field

Purpose: A recently released Pinnacle treatment planning system software, v7.4f includes some new physics features such as modeling of the rounded multi-leaf collimator (MLC) leaf ends and the tongue-and-groove structure between leaves. In this study, the above physics modeling improvements were verified by comparing the peripheral dose profiles for the small MLC fields calculated by the new Pinnacle v7.4f and the old Pinnacle v6.2b with those obtained from measurements experimentally.
Method and Materials: Three test MLC fields with different jaw sizes were prepared, and specific dose profiles (along cross-line, in-line and diagonal axis) at different depths were measured using a Varian 21EX linear accelerator with 120-leaf Millennium MLC, big scanning water tank and photon diode. Estimated dose profiles for the test fields were calculated using Pinnacle v6.2b and v7.4f.
Results: By comparing the measured and calculated results, both v6.2b and v7.4f performed well in calculating the cross-line (along the gap between the longitudinal lengths of two leaves) and diagonal axis dose profiles at different depths. However, v7.4f gave calculated doses closer to the measured field for in-line (gap between junctions of two rounded leaf ends) axis dose profiles at different depths. For the shape of profile along the in-line axis, v7.4f calculated a flat "platform" dose profile of about 34.3% (inter-bank leakage) at depth d_{max} beyond the MLC field edge using a clinical dose grid size of $0.4 \times 0.4 \times 0.4$ cm^3, compared to the "zigzag" dose profile varying between 35.4% and 42.1% measured using water tank and diode. However, both versions calculated the percentage depth dose for the test fields well compared to the measurements.
Conclusion: The physics improvements of the rounded leaf end, tongue-and-groove structure, inter-leaf and inter-bank leakage corrections as new features of v7.4f were verified.