AbstractID: 5057 Title: Quality assurance of individual segments of step-and-shoot IMRT

Purpose: Absolute point dose measurements as part of the quality assurance of step-and-shoot intensity modulated radiation therapy (IMRT) often reveales unexpected deviations. This study investigates the feasibility of IMRT-QA of individual segments to explain these deviations, and the efficacy of different evaluation methods.

Method and Materials: The dose in a small volume around the point of interest (POI) was calculated for the individual segments of an IMRT plan for which a software script was added to our treatment planning system (Pinnacle^3 7.6c, Philips). Furthermore, two input parameters for analysis of the measurements, i.e. the dose per monitor unit (D/MU) and the maximum dose gradient ($\delta D/\delta r$), were calculated for each segment. A software application was developed for automated data acquistion and analysis. The analysis was carried out either disregarding measurement data with a low confidence level ($\delta D/\delta r$ or D/MU outside a critical range), or using γ-evaluation.

Results: IMRT-QA was performed for 10 prostate and 5 head and neck patients. We found significantly higher deviations for segments at which the detector turned out to be located within the penumbra, which was consistent with $0.15 < D/MU < 0.55$ cGy/MU, or $\delta D/\delta r > 0.25$ cGy/mm. When these data were filtered out, the total dose deviation ranged from -2% to 3% (not filtered: -5% to 5%). However, only 78% of the fraction dose was verified on average due to filtering. When γ-evaluation was used, 93% of the fraction dose was within acceptance criteria (2.5% D_{segm}; 2.5mm) on average. Datapoints outside these acceptance criteria were predominantly related to measurements behind jaws or leafs ($D/MU < 0.15$).

Conclusion: IMRT-QA of individual segments revealed that penumbral ionometric uncertainty is the main cause of deviations in overall IMRT-QA. This method is feasible in daily clinical routine and provides more insight in deviations between measurements and calculations.