Two Years of Clinical Experience with DAVID – A Translucent Multi-Wire Detector for On-Line Verification of Patient Treatments

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INTRODUCTION
A complete IMRT QA program based on a combination of the 2D-ARRAY (Type 10024, PTW-Freiburg, Germany) and the DAVID system (PTW-Freiburg) has been developed and implemented in our clinic by Poppe et al [1, 2, 3]. During the daily fraction, the DAVID system is used for in-vivo verification of the delivery. In this work, we are going to present this IMRT QA program and our latest clinical experiences with the DAVID system.

MATERIALS AND METHODS
The DAVID system is a device for the permanent in-vivo verification of IMRT photon beam profiles by a radiation detector positioned at the radiation entrance side of the patient [1]. The system consists of a flat, multi-wire transmission-type ionization chamber, placed in the accessory holder of the linac. Each of detection wires of the chamber is positioned exactly in the projection line of a MLC leaf pair, the signal of each wire is proportional to the line integral of the ionization density along this wire and thereby to the opening width of this leaf pair.

RESULTS
The reference measurement for each IMRT plan is acquired with the DAVID system in parallel to the dosimetric plan verification (Fig. 1). During daily treatment the corresponding signals in all channels are re-measured with the system and compared to the reference values. A warning is set if there is a deviation beyond a user defined threshold.

The DAVID system has been used in the last 24 months in our clinic to verify all IMRT deliveries. Overall more than 50,000 segments have been verified with the system.

During this time some minor deviations such as MLC decalibrations and monitor chamber drifts have been detected.

Lost MLC Segments
For one patient an initial IMRT plan had been calculated with Oncentra Master Plan (OMP), verified by the methods described above and prepared for the first irradiation of the patient. Meanwhile it appeared that a small correction to some of the sub-fields would improve the dose distribution. These minor modifications were performed on a separate treatment planning system (Helax) in which the manual correction of single leaves within an IMRT plan sequence is possible. Both planning systems are compatible to each other and use the same calculation algorithms, therefore a DICOM export from OMP to Helax was performed and the plan correction was made manually. The modified plan was re-imported into the R&V system after the modification. However, the MLC information of a few segments was lost during this process, resulting in rectangular fields. In a subsequent visual inspection this error was not detected by the staff. As a second security step and to document the intended changes in the dose distribution no new DAVID reference values were collected before the initial irradiation of the modified plan. Accordingly, during the first irradiation of the modified plan, the DAVID system was able to detect the erroneous segments.

DISCUSSION AND CONCLUSIONS
The DAVID system closes a gap by securing the daily monitoring of the IMRT plan delivery for each segment. The results collected during the day can be analyzed at regular intervals and errors can be identified and corrected before the next fraction if necessary. With the combination of the 2D-ARRAY and the DAVID system it is possible to identify deviations in the machine parameters and their impacts on the quality of the patient treatment.

REFERENCES