AbstractID: 9054 Title: Quality Assurance Procedures for Helical Tomotherapy

Purpose:
To develop simple, accurate, and preferably filmless Quality Assurance (QA) procedures for Helical Tomotherapy, by using the signals from the systems' built-in MegaVolt CT-detector (MVCT).

Methods and Materials:
We developed three new QA procedures, all using data files imported from the Tomotherapy machines, containing 85 control signals and signals from all 640 MVCT channels, at a sample rate of 30Hz. An important role in this QA program is taken by the StepWedge, a step-like aluminium block positioned over the couch end in the gantry.
1) StepWedge procedure: to check laser alignment, couch movement and velocity, beam energy and field width. This 5min procedure is performed with a static beam, while couch and StepWedge move 20cm into the gantry.
2) Completion procedure: to check the correctness of a completion made by Tomotherapy software after an interruption. This procedure is based on the StepWedge procedure, interrupted by the user and completed by Tomotherapy software, of which the correctness is tested.
3) MLC-Gantry-Synchrony procedure: to check synchronization of MLC and gantry rotation. During this procedure the couch is static while the gantry rotates 40×20s, opening the middle two leaves at gantry angles 0°, 120° and 240°.

Results:
From the StepWedge procedure the position of the transversal and sagittal lasers can be checked with an accuracy of ~0.5mm, the field width with an accuracy of ~0.5mm, beam energy consistency with an accuracy of ~1%, and couch movement and velocity with an accuracy of ~0.1mm resp. ~0.5%. The accuracy of the Completion procedure, in terms of a possible additional couch shift, is ~0.1mm. MLC synchronization with gantry rotation can be checked with an accuracy of ~0.1°.

Conclusion:
The StepWedge combined with MVCT offer a fast, accurate and filmless QA program, allowing monitoring of almost all relevant parameters of Helical Tomotherapy.