AbstractID: 3045 Title: The use of megavoltage CT (MVCT) images for dose recomputation

Purpose:
Megavoltage CT (MVCT) images of patients are acquired daily on a helical tomotherapy unit (TomoTherapy, Inc., Madison, WI). These images are used in clinical practice for patient alignment; however, they can also be used to recalculate the treatment plans in the patient's anatomy. Prior to using this tool to evaluate clinical plans, a series of phantom based end-to-end tests were run to test the use of MVCT images for dose recomputations.

Method and Materials:
A CT to electron density phantom was used to calibrate the MVCT numbers in terms of electron density. The treatment plan parameters are used to recalculate the dose distribution in the MVCT image. The whole chain, from initial kVCT to final MVCT based dose recalculation was then applied to a rigid thorax phantom (CIRS Model 002LFC). The recalculation technique is based on the intended delivery and recalculation of the dose distribution in an MVCT image of a rigid phantom should result in a dose distribution identical to the planned dose distributions. This is tested and differences between the planned and recalculated dose volume histograms are reported. The prediction of dosimetric distortions caused by anatomical deformations is tested next. Several plans were delivered onto a deformed phantom anatomy. Recalculated point doses were compared with measurements.

Results:
In the four rigid phantom plans tested, the recalculated D_{95} for the target volumes agreed with the D_{95} from the planning kVCT to within 0.5 %. The measured change in point dose due to deformation of the phantom agreed with the recalculated change on average to within 0.5 %.

Conclusion:
The recalculation of tomotherapy plans on MVCT images is reliable and accurate. Changes in the patient dosimetry due to deformation can be determined using this technique.

Conflict of Interest:
Three of the co-authors are employees of TomoTherapy, Inc.