AbstractID: 11333 Title: Verification of in-vivo dosimetry in TomoTherapy Treatments

Purpose:
The implementation of in-vivo dosimetry for a TomoTherapy® treatment system is described. The accuracy of the in-vivo dosimetry is verified with phantom study. The prospect of replacing the film measurement in pretreatment DQA with the in-vivo dosimetry is studied.

Method and Materials:
The exit detectors responses for each MLC leaf are measured with a series of solid water stack thicknesses and table heights during a calibration procedure. These measured responses forms a database that is used to reconstruct the incident fluence from the exit detector signal. The database could also be formed by scaling the gold standard database with necessary calibration procedure. The reconstructed incident fluence is then used as input to the dose calculator to get the reconstructed in-vivo dose.
Six different plans (tumor on or off center, under 1.0cm, 2.5cm and 5.0 cm field width respectively) are delivered on a phantom (Tomo® Cheese Phantom). The in-vivo dose is compared with planned dose and ion-chamber measurements.
DQA plans in patient archives from several clinical sites are retrospectively studied. The in-vivo dose is compared with the planned dose.

Results:
The reconstructed incident fluence agreed with the planned fluence within +/- 4%. In-vivo dose agreed with the planned and ion-chamber measured dose within +/- 1.5%. The accuracy is well within the normal 3% action level for DQA plan. The in-vivo dose can be computed within 3 minutes normally in retrospective study mode and it could be computed real-time during the delivery.

Conclusion:
TomoTherapy's in-vivo dosimetry implementation achieves good accuracy. It could be a tool used in a program that performs a filmless DQA that could saves hours of time.

Conflict of Interest (only if applicable):
Research sponsored by TomoTherapy Inc