

**Purpose:** While Tomotherapy offers volumetric Imaging for image-guided radiation-therapy, it suffers from the drawbacks of slow image-reconstruction, and lack of planar imaging capability. Megavoltage (MV) topograms and kilo-voltage digitally reconstructed topograms (kV-DRTs), have the potential for reducing daily-localization times and patient-dose. Both kV-DRTs and MV-topograms were generated using our in-house Topographic Registration (TopoReg) Software. Primary goals of these tests were to validate the geometric integrity of the topograms in all 3- dimensions.

**Methods:** TopoReg software uses high-resolution CT-datasets for reconstructing the kV-DRTs while the MV-topograms are created from the Tomotherapy exit detector data. TopoReg software includes several tools for image enhancement and registration. Geometric verification of the reconstructed topograms was done in three steps; planar, volumetric, and anthropomorphic. The first phantom includes four 17x17x0.5 cm<sup>3</sup> water-equivalent plastic (WEP) plates fixed on top of a 40x40x1 cm<sup>3</sup> WEP for planar verification. There were two sets of holes on each WEP plate, separated by 12.5 cm. The second phantom was a Styrofoam cube (30x30x30 cm<sup>3</sup>) with embedded WEP plates; two plates on the diagonal axis and one plate on each side. Head and neck, thorax, and pelvis phantoms were also imaged and compared. The phantoms were imaged using Brilliance Large bore CT scanner and kV-DRTs were generated. MV-topograms were generated from the exit detector data.

**Results:** Geometric verification was conducted by comparing fiducial positions on the topograms. MV-topograms are overlaid on kV-DRTs for registration. Both translations and rotations were allowed during image registration. Geometric accuracy was within  $\pm 1$  mm in all 3-dimensions and the image quality of the topograms was adequate for bony anatomy-based registrations.

**Conclusion:** TopoReg software is valid and the geometric accuracy of the MV-topograms and kV-DRTs was acceptable for clinical implementation.

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