

AbstractID: 5263 Title: Verifying Internal Target Volume using Cone-Beam CT for Stereotactic Body Radiotherapy Treatment

**Purpose:**

The internal target volume (ITV) could be determined using 4D CT simulation images and be verified in the treatment room using on-board cone-beam CT (CBCT) since the CBCT projection images are acquired over approximately 10 breathing cycles. This study used a 4D dynamic phantom to verify the accuracy of this technique and also to develop a procedure for using CBCT to clinically verify ITV in stereotactic body radiotherapy (SBRT) treatment.

**Method and Materials:**

A CIRS 4D dynamic phantom, with a target ball and precisely controlled motion, was imaged using a 4D CT scanner. A Varian RPM system was used for respiratory gating. Ten 3-D image sets were generated corresponding to 10 breathing phases. The ITV was determined based on the phase images. To assess concordance, on-board CBCT images of the target ball were compared with the 4D-CT defined ITV. SBRT patient with tumor targets located in the thorax and upper abdomen were similarly scanned using phase gating 4D CT. The ITVs were compared between simulation CT and CBCT scans to identify localization error.

**Results:**

The dynamic phantom motion was 20mm along the inferior-superior direction, 5mm along the anterior-posterior direction, and 2mm along the left-right direction with a cycle time of 4 seconds. The concordance of the CBCT and ITV matching was within 1 mm. For the lung SBRT patient, the target volume based on the CT images without respiratory gating was 0.7 cc. The ITV was 2 cc. The ITV matches well with the CBCT images. The localization errors between free-breathing CT and CBCT were 2 mm to the right, 1 mm to the anterior, and 2 mm to the superior.

**Conclusion:**

CBCT provides an accurate assessment of the ITV for targets affected by respiratory motion.