

### Purpose

To investigate the strengths and weaknesses in motion effect of kV CBCT and MV CBCT for image guided radiation therapy with metal localization devices.

### Method and Materials

15 MU pelvis CBCT template for Siemens Artiste MVision and Pelvis template for Varian IX on-board Exact Arms kV were used to acquire CBCT images in this study. Images from both CBCT modalities were compared in CNRs, image landmark coordinates, and image volume distortion on three different planes of view. The images were taken on a breathing-simulated thoracic phantom in which several typical metal localization devices were implanted, including clips and wires for breast patients, gold seeds for prostate patients, and BBs as skin marks. To magnify the artifacts, a 4cm diameter metal ball was also implanted in the thoracic phantom to mimic the metal artifacts. The thoracic phantom was placed on a home-made moving phantom performing a sinusoidal motion in the patient superior-inferior direction. The amplitude of the sinusoidal waves was 1cm, and the period varies from 2sec, 4sec to 8sec.

### Results

For MV CBCT, the CNR at 4sec breathing cycle with 1cm breathing amplitude was 5.0, 3.4 and 4.6 for clips, gold seeds and BBs, respectively while it was 1.5, 2.0 and 1.6 for kV CBCT. On the images, kV CBCT showed symmetric streaking artifacts both in the transverse and longitudinal directions relative to the motion direction. kV CBCT images predicted 89% of the expected volume, while MV CBCT images predicted 95% of the expected volume.

### Conclusion

MV CBCT images showed better volume prediction, less streaking effects and better CNRs of a moving metal target, i.e. clips, BBs, gold seeds and metal balls than kV CBCT images. MV CBCT was more advantageous compared to kV CBCT with less motion artifacts for metal localization devices.