AbstractID: 8216 Title: The effect of number of projections on the accuracy of volumetric data reconstructed using digital tomosynthesis

Purpose: To investigate the effect of the number of projections used as source data on the volume of objects recreated by tomosynthesis when using the shift-and-add algorithm.

Method and Materials: A phantom was created in Matlab to represent a cube of water within which a cube, sphere and cylinder of bone were inserted. The phantom was imported into the Pinnacle treatment planning system and DRRs were produced at every degree from 340° to 20°. Different volumetric reconstructions were performed by using 2 to 41 of these DRRs. Slices were created every 2.5 mm and imported into Pinnacle to be contoured for the volume of each object to be determined.

Results: For the cube and cylinder, the volume calculated from the contours grew closer to the true volume as the number of projections used was increased, with the calculated volume agreeing with the true volume when nine projections were used to recreate the object. For the sphere, the volume oscillated about a value that is much larger than the real volume and never reached the true value.

Conclusion: Due to the nature of the shift-and-add algorithm, it is easier to determine the presence of an object on a slice if it has a uniform signal. Thus presence of the cylinder and cube on a slice was determined by ensuring no ghosting was present around the object. However, the sphere, which has an inherently varying signal on a two-dimensional projection, made it much harder to decide whether a slice contains the full object or if it is being partially smeared out, explaining the erroneous volumes from the contours. Therefore, while as few as seven projections are enough to identify the volume of certain objects, different reconstruction algorithms may be required to be used to the reconstruction of any arbitrary object.