Purpose: The authors started to use Symmetry 4D-CBCT as image guidance for lung SBRT in August 2011. Here the authors present the initial clinical experiences with this novel image guidance technique.

Methods: In total 118 4D-CBCT scans have been acquired for 17 lung patients among which 15 received SBRT and the other 2 received hypofractionated treatments. 4D-CBCT scans are acquired with Elekta XVI 4.5 using Symmetry, a procedure module in XVI that acquires 4D-CBCT, registers daily images to reference 3D-CT and generates shifts for patient setup.

Results: Typical thoracic 4D-CBCT scans with Symmetry take 3 minutes with a 200 degree gantry rotation. Symmetry automatically sorts images into 10 phases based on automatic detection of diaphragm position. Then Symmetry generates two independent intensity-based registrations, one according to a pre-defined large volume of interest including the tumor, surrounding tissues and bony structures, the other only according to an expanded target volume. The registrations are obtained by registering each phase image to the reference image and averaging across all phases in a time-weighted manner. Eventually Symmetry provides users the freedom to pick either one of the two registrations, a compromise, or a manual tuning. Compared to regular 3D-CBCT, 4D-CBCT enables physicians to visually place the moving target in the center of PTV, greatly reducing the probability of missing target due to respiratory motion, thus enables possible reduction in PTV margin. 4D-CBCT also provides the ability to repeatedly evaluate the quality of ITV. It is possible that ITV does not fully cover the tumor motion due to a low quality 4D-CT simulation for a patient with difficulties in regular breathing.

Conclusions: 4D-CBCT is a superior image guidance technique for lung SBRT treatments for its ability to visualize moving target. It provides physicians more confidence in tumor targeting and ability to repeatedly evaluate ITV quality during the treatment course.