Purpose:
To assess the accuracy of generating an internal target volume (ITV) for lung tumors from a four-dimensional computed tomography (4DCT) dataset by automatically propagating a manually-contoured gross tumor volume (GTV) on one respiratory phase to the remaining nine phases on the basis of rigid body image registration.

Method and Materials:
For 23 non-small-cell lung cancer (NSCLC) patients a physician contoured the GTV on each of the ten phases that constituted a 4DCT dataset. The GTV contours were merged to form the manual ITV (mITV) (our definition does not include expansion for microscopic disease). The manually-contoured GTV at end expiration was propagated to the remaining phases with an in-house image registration tool based on rigid-body image registration to form the propagated ITV (pITV). The metric of success for the pITV was the matching index, or the intersection of mITV and pITV divided by the union of mITV and pITV. To estimate the uncertainty of physician contouring we defined the uncertainty index as the volume of the mITV contracted uniformly by 1 mm divided by the volume of mITV. The normalized matching index (NMI) is defined as the matching index divided by the uncertainty index.

Results:
The mITV volumes for all but 4 patients was less than 100 cc. The NMI for all patients is 1.01±0.08. For the 11 patients with tumor excursion greater than 0.5 cm, the NMI is 1.01±0.05.

Conclusion:
Generating an ITV on the basis of rigid image registration is a viable alternative to manually contouring the GTV on all phases of a 4DCT dataset.

Conflict of Interest (only if applicable):
SRA with Philips Medical Systems.