AbstractID: 13656 Title: The use of 4D dose calculations to evaluate whether the ITV can be created using a reduced set of 4DCT phases.

Purpose: To investigate whether it is possible to create the ITV using a reduced set of 4DCT phases
Methods: Target contours were drawn on the exhale phase of a 4DCT image set for 10 lung cancer patients. Each target volume was mapped to all 10 phases of the 4DCT using deformable registration. An ITV was created as the union of the target volumes for the N phases closest to exhale, where N≤10 (10 indicates the full envelope of motion). VMAT plans were created for each ITV using the exhale phase CT (3D dose calculation). Doses were calculated on each of the 10 phases, and the cumulative dose calculated by deformable mapping of the doses to the exhale phase (4D dose calculation). For each plan, the dose received by 95% of the target (D95) on the exhale phase from the 4D dose calculation was compared with that calculated for N=10. The 4D and 3D dose calculations were also compared.
Results: Average tumor motion was 0.7cm (range 0.5 – 1.5cm), 0.9cm (0.5 – 1.5cm) and 0.8cm (0.5 – 1.0cm) in the AP, SI and RL directions, respectively. For all patients, reducing N from 10 to 8 reduced D95 by less than 5%, but the average reduction in ITV volume was only 5±3% (range: 1-10%). For N=7, there was up to a 13% reduction in D95. One patient was an exception: For this patient reducing N from 10 to 6 reduced D95 by just 4%, and reduced the ITV volume by 18% (10 c.c.)
Conclusions: For the majority of patients, it is not possible to reduce the size of the ITV appreciably without reducing coverage. There may be a subset of patients for whom the ITV could be further reduced, but they cannot be identified without 4D dose calculations.