

Feasibility of spirometer-guided single breath-hold kV-CBCTs on Halcyon in lung cancer patients

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Purpose

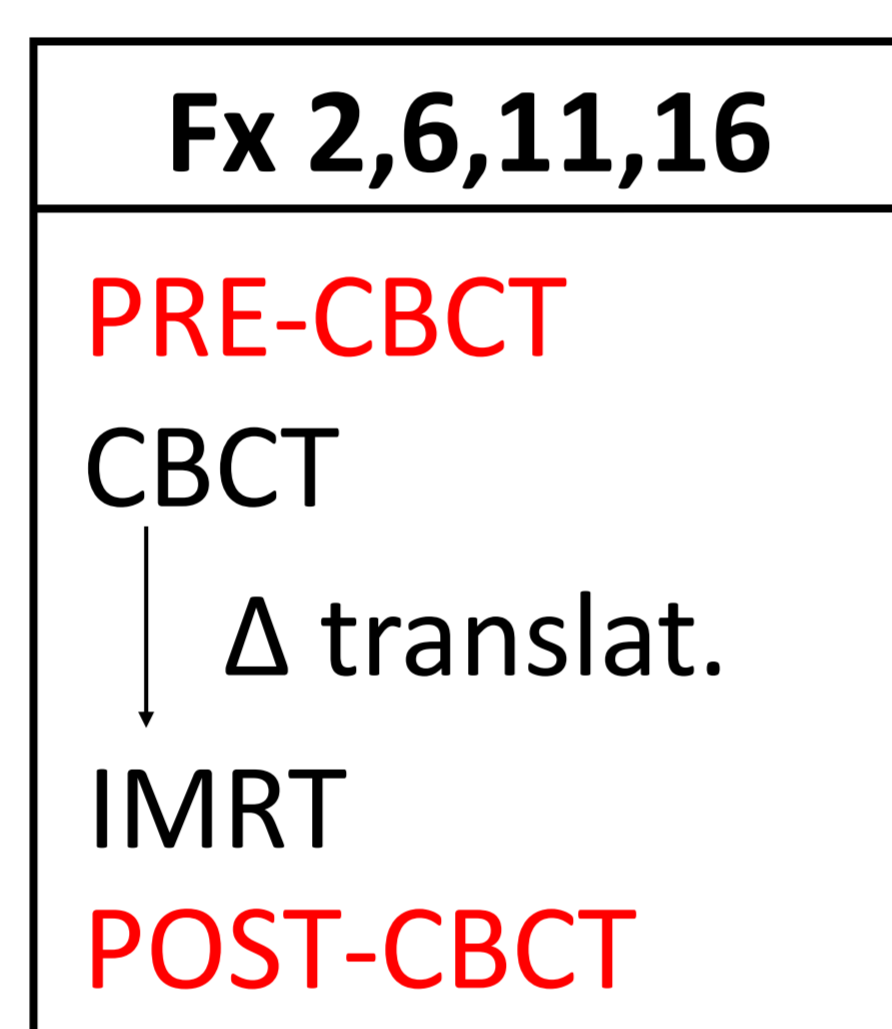
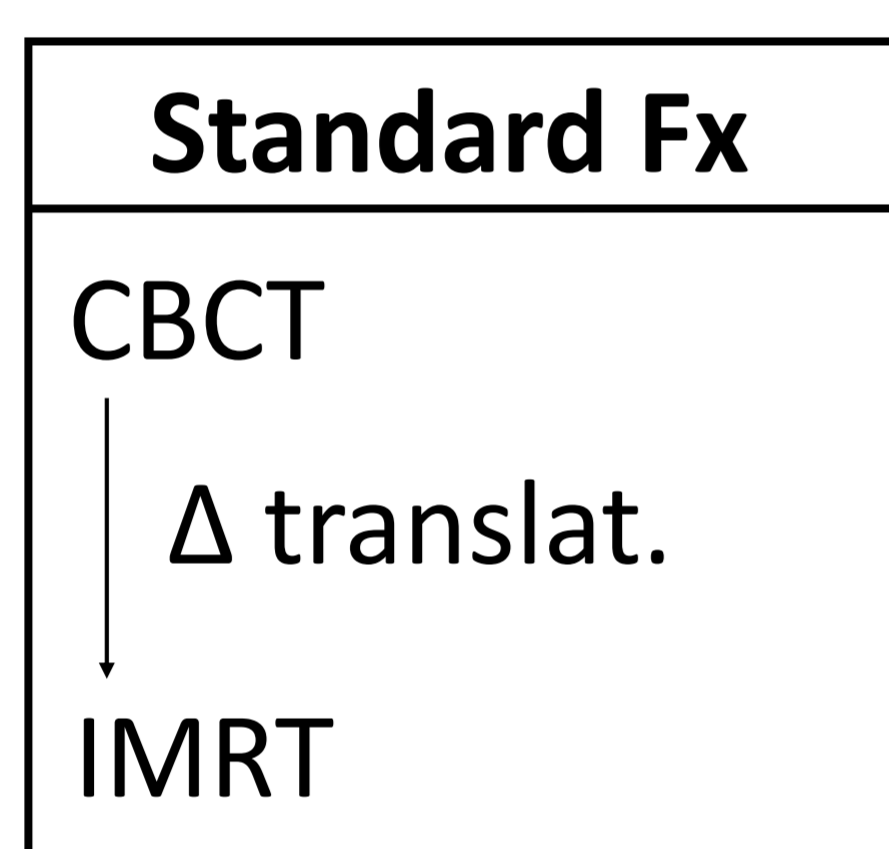
The ITV approach for lung cancer results in high volumes of healthy lung being exposed to high doses. Breath-hold techniques limit tumor motion, however a reproducible tumor position has to be guaranteed. In this study we determined the **inter-** and **intra-fraction tumor position reproducibility** with single breath-hold CBCTs on the Halcyon linac using the **SDX spirometer** (Dyn'R).

Conclusion

Our study shows good inter and intra fraction tumor position reproducibility for spirometer guided breath-holds. The dosimetric impact is under investigation.

Methods

- 8 locally advanced NSCLC patients received a spirometer coaching session
 - 3 patients excluded: inability to maintain breath-hold (2x), arm position prohibiting spirometer (1x)
- 5 patients had one additional CT scan in deep-inspiration breath-hold (DIBH)
- During 4 fractions 2 CBCTs were acquired in breath-hold (before and after treatment):



- 6 DoF vertebrae PRE-CBCT to DIBH CT followed by 3 DoF tumor registration → difference is the **inter** fraction variability
- 6 DoF vertebrae PRE-CBCT to POST-CBCT followed by 3 DoF tumor registration → difference is the **intra** fraction variability

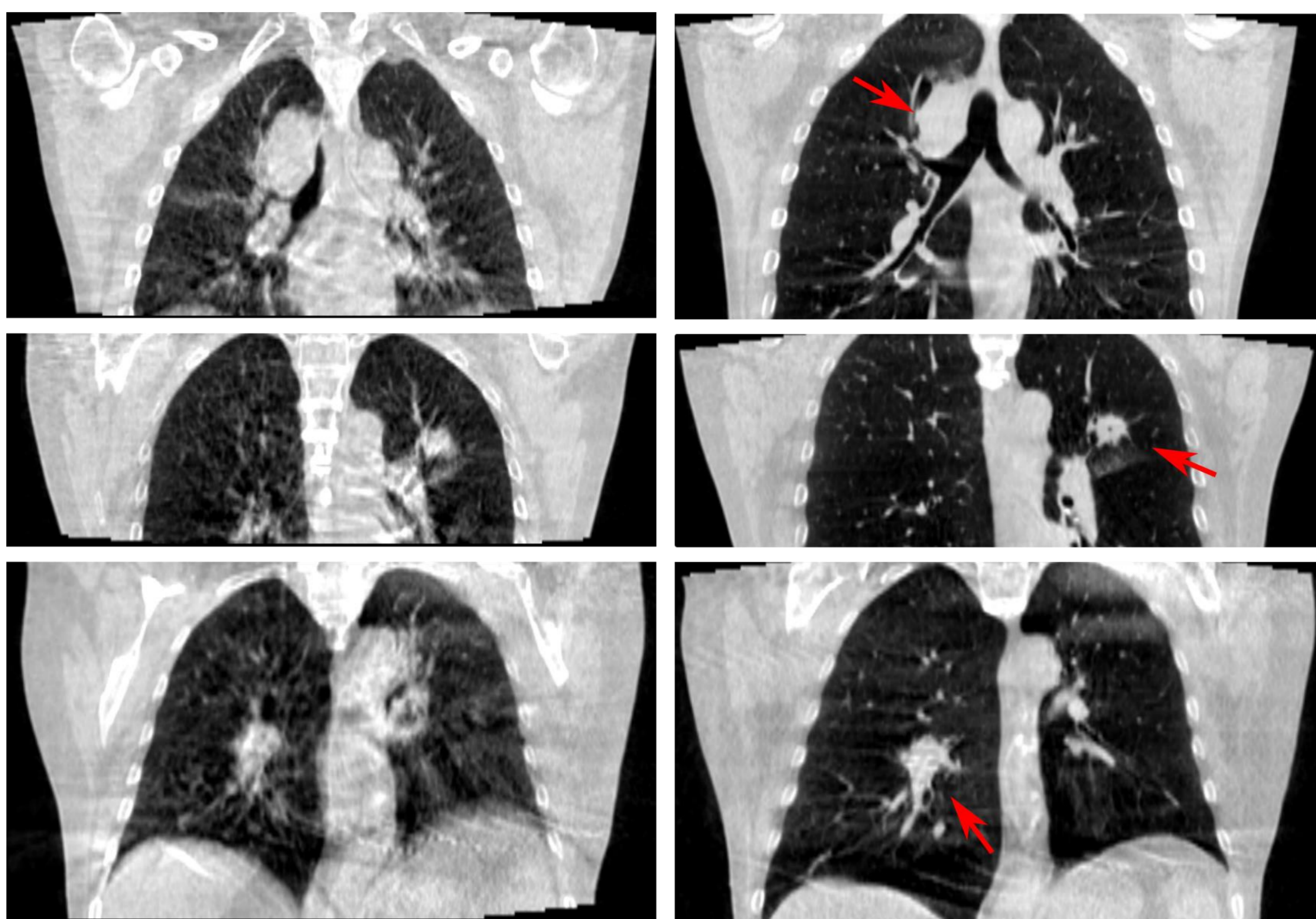
- kV-CBCT protocol: 17 sec. acquisition

Results

- Lung volume increased median 2700 cc (range 1160 cc – 2861 cc) above baseline breathing.

Free breathing

DIBH



- All CBCTs for all patients were performed in a single breath-hold even under concomitant chemotherapy.
- Tumor delineation is much improved over free breathing acquisitions.

| INTRA | ML (mm) | AP (mm) | CC (mm) |
|---------------------|---------|---------|---------|
| Systematic Σ | 0.7 | 0.7 | 0.9 |
| Random σ | 0.7 | 1.1 | 1.4 |

| INTER | ML (mm) | AP (mm) | CC (mm) |
|---------------------|---------|---------|---------|
| Systematic Σ | 0.6 | 0.9 | 1.4 |
| Random σ | 0.9 | 2.0 | 2.9 |

