# AbstractID: 7108 Title: Comparison of Real-time Tracking & 4D Inverse Planning for Managing Patient Respiratory Motion

**Purpose:** Real-time tracking and 4D-planning at the mean target position have been two potential methodologies to manage respiratory target motion. In this study, we evaluated each method based on dose-volume criteria of organs in lung cancer radiotherapy.

**Method and Materials:** Four patients with respiratory target excursions 1.5cm to 3.0cm were included. Each patient had 4D-CT scans at 10 breathing phases. Deformable organ registration was applied to obtain subvolume displacement mapping for each phase of CT image. First, an idealized real-time tracking technique was evaluated assuming perfect estimation of target motion and beam tracking. Inverse planning was performed on each breathing phase CT image without using margins for target and normal structures. Treatment dose was accumulated from does of each breathing phase. Secondly, a 4D-inverse planning was performed on the mean 4D-CT image using the corresponding pdf of respiratory motion created from the 4D-CTs. Same beams and prescription dose (70Gy), as well as same objective and constraints, were applied in the planning optimization, and the cumulative dose was constructed accordingly. DVH and EUD in the GTV, lung, heart and cord were used for the evaluation.

**Results:** Cumulative doses in target are similar for both techniques. The beam intensity modulation in the 4D inverse planning is much higher than the one in the real-time tracking, but it can be delivered using beam compensator. Lung, heart and cord DVHs are similar with the corresponding EUDs, 4.6$\pm$2.2Gy, 8.3$\pm$4.6Gy and 11$\pm$4.35Gy for the tracking technique, and 5.3$\pm$2.3Gy, 8.8$\pm$5.1Gy and 11.9$\pm$5.0Gy for the 4D inverse planning.

**Conclusion:** Treatment technique with the 4D-inverse planning and online mean target position control is clinically practical. Compared to the idealized real-time tracking, 4D-inverse planning achieves slightly degraded, but similar. However, this degradation could be vanished when practical tracking error was considered.