Purpose: For the effect of breathing motion, it is difficult to confirm the tumor accurately in lung cancer in the intensity-modulated radiotherapy (IMRT). This study is to confirm the internal target volume (ITV) and compare the volumetric and dosiology differences between 3D-CT and 4D-CT, using 4D-CT technology.

Methods: Eight patients with primarily lung cancer were enrolled and both 3D and 4D-CT were taken. For each patient, 3D-CT was taken as reference image and clinical target volume (CTV) was defined on it. Extended CTV with setup margin was defined as PTV-3D; for each respiratory phase, CTV were drawn separately and mixed together as ITV, which was extended as PTV-4D. Design different IMRT plans on PTV-3D and 4D separately for each patient with same prescription doses, field degrees and optimization target functions. The differences of target volumes, dose distributions on targets and organs as risk (OAR) were compared.

Results: The volume is $(150.67 \pm 86.67)\text{cm}^3$ for PTV-3D and $(130.17 \pm 79.89)\text{cm}^3$ for PTV-4D, which is $13.61\% (8.51\% \sim 23.53\%)$ smaller. There is no significant difference of target conformal index (CI) and homogeneity index (HI). About the dose on OARs (including lung, heart and spinal-cord), 4D plans have lower dose to the 3D plans: $V_5$, $V_{10}$, $V_{20}$ and $V_{30}$ for total-lung is cut separately from $41.25\%$, $29.75\%$, $21.25\%$, $13.00\%$ to $38.13\%$, $27.00\%$, $17.25\%$, $9.13\%$; mean lung dose (MLD) is cut from $1103.63\text{cGy}$ to $911.21\text{cGy}$; mean heart dose is cut from $450.43\text{cGy}$ to $372.20\text{cGy}$; maximum dose for spinal-cord is cut from $3162.83\text{cGy}$ to $2967.63\text{cGy}$.

Conclusions: 4D-CT technology can be used to bridge the gap of missing or extending the target volume on 3D radiotherapy. It will bring better accuracy and lower dose on OARs as well.