Introduction: Evaluation the tumor volume for liver cancer radiotherapy is usually performed by computed tomography scan. However, respiratory motion would cause variations of the position, volume and shape of the tumor on the CT image and result in deviation of target volume. This study will evaluate the influences of different CT scan and image reconstruction models towards target volume for liver cancer radiotherapy.

Methods: This study employed a home-made movable platform and liver tumor phantoms to simulate respiratory motion of human body. The movable platform was set up with different amplitudes and periods to explore various CT scan and reconstruction models of 4D CT-MIP, 4D CT-AIP, helical CT and slow CT. The differences among actual tumor volume and the target volumes produced by various CT scan and image reconstruction models were analyzed with a reconstructed 3D image of liver tumor after the scanning.

Results: The image reconstruction showed that the 4D CT-MIP provided clear tumor area and detected the tumor boundaries specifically. The area of tumor target was accurately delineated when determining the gross tumor volume in treatment planning system. The differences 4D CT-AIP and 4D CT-MIP for R-L, A-P and S-I directions were less than 0.5cm. When compared with 4D CT-MIP and slow CT were 2.8 cm and 1.6 cm, respectively. The reconstruction images of bigger tumors had greater deviations than the smaller ones. No matter what the volume was, the reconstructed images from 4D CT-MIP were the closest to the actual target volume.

Conclusion: 4D CT-MIP could completely define the motion ranges of the tumor during respiration and allow the tumor to receive complete radiation doses and promote the effectiveness of liver cancer radiotherapy.