

# Abstract ID: 9660 Title: Pre-clinical evaluation of a 4D tracking DmMLC-based delivery to lung tumor

## Purpose

The aim of this study is to provide a pre-clinical evaluation of a four-dimensional tracking radiation therapy to lung tumor using a prototype tracking system. The evaluation was based on film dosimetric analysis, time delay measurements and treatment planning DVH analysis by using two types of dynamic phantoms.

## Materials

The key component of the 4DTRT system was a prototype of Track Beam. It consists of an image processing tool and a first-of-its-kind dual-layer micro MLC. DmMLC has two layers of orthogonal leaves which provide advantages in speed and conformity when forming beam aperture for tracking. The Track Beam was mounted to a Varian Linac and connected to a workstation which processes the online MV fluence and controls the leaf motion. A quasi-dynamic phantom was used for radiographic film irradiation with 4DTRT and also 3DCRT. The phantom has a Gafchromic film inserted and a gold marker in the insert. It can move in sinusoidal mode as well as real patient respiratory cycle. Another tissue-equivalent thorax dynamic phantom was used for DVH analysis of a phantom-based 3DCRT planning and a 4DTRT planning developed respectively.

## Results

The synchronization of marker motion and the DmMLC leaf motion was achieved within less than 0.05 seconds. The film analysis indicated that total 29.91% over the tolerance of 5% and 5.09% of over the tolerance of 5% when the 3DCRT and 4DTRT films compared to a static film. The DVH comparisons indicate 4DTRT reduces significant dose to the lung from 75% (80% volume) to 60% (50% volume). 4DTRT also reduces considerable amount of dose to the total lung from 33% (30% volume) to 22% (22%).

## Conclusion

The 4D tracking using MLC provides a feasible solution for delivering conformal dose to lung tumor and sparing surrounding tissue.

## Conflict of interest

The work was partially supported by Initia-RT medical device.