

# AbstractID: 7279 Title: Multiplexing radiography for ultra-fast computed tomography: a feasibility study

## **Purpose:**

Current CT scanners collect the projection images by a step-and-shoot process using a single x-ray source. The inefficient serial data collection scheme severely limits the data collection speed. Multiplexing technique, which has been widely adopted in communication devices, holds the promise to significantly increase the data throughput. It however, has not been applied to x-ray radiography, mainly due to limitations of the current x-ray source technology.

## **Method and Materials:**

We demonstrated the feasibility of multiplexing radiography technique based on the frequency division multiplexing (FDM) principle and the multi-pixel x-ray technology. The carbon nanotube based field emission multi-pixel x-ray source can generate spatially and temporally modulated x-ray radiation. During the multiplexing imaging process, all the x-ray pixels were turned on simultaneously with each beam modulated at a different frequency. The superimposed x-ray signals were captured by an x-ray detector and then demultiplexed to recover the original nine projection images from different view angles.

## **Results:**

In general a factor of  $N/2$  ( $N$ = total number of images) increase in the speed can be achieved using the multiplexing scheme. This becomes significant when  $N$  is large, for example for clinical CT scanners which use  $\sim 1000$  views per gantry rotation. On the other hand, if the total imaging time and x-ray dose are kept the same as used in the *sequential* process, then the x-ray power, i.e. the tube current, can be reduced by a factor of  $N/2$  by multiplexing because the exposure time per image is now longer.

## **Conclusion:**

In summary, we show the feasibility of multiplexing radiography that enables simultaneous collection of multiple projection images. Overall the experiment has sufficiently demonstrated the efficiency of multiplexing for data collection compared to the current *serial* approach. It has the potential to significantly increase the imaging speed for CT scanning without compromising the imaging quality.