

ESTRO MOBILITY GRANT (TTG) REPORT

**Title of the report: 4DCBCT reconstruction for moving targets for scanned
proton therapy**

HOST INSTITUTE:
Willis-Knighton Cancer Center - Shreveport, Louisiana

DATE OF VISIT:
17th – 31st March 2018

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Aim

The main goal of this visit was to form a closer collaboration to jointly work on the introduction and implementation of 4DCBCT imaging for the treatment of moving targets at scanned proton facilities. CBCT is currently only introduced in a limited number of proton therapy facilities for daily setup monitoring. For moving targets, 4DCBCT imaging would be beneficial, as scanned proton therapy is especially sensitive to breathing motion. Daily motion monitoring via 4DCBCT allows for a safe and conformal treatment at scanned proton facilities despite motion uncertainties.

The Groningen Proton Therapy Center (GPTC) is equipped with CBCT and started treating patients with proton therapy in the beginning of 2018. The first patient with a moving target (e.g. lung, liver, esophageal tumors) is expected to be treated in fall 2018. At the Willis-Knighton Cancer Center (WKCC) lung cancer patients are already treated with scanned proton therapy and CBCT images are acquired using comparable settings to what will be used at GPTC.

GPTC and WKCC have started collaborating November 2017 and have exchanged a first lung patient data set prior to my visit abroad. During the visit the aim was to get to know the proton therapy center in Shreveport and to learn about their established workflow for treating patients with scanned proton therapy. Furthermore CBCT projection data was retrieved and shared. GPTC is now working with these data sets towards a 4DCBCT reconstruction implementation for proton therapy centers.

Scientific details of the visit

From the first patient consult and multidisciplinary meetings to the patient QA and proton therapy treatment: every step in the workflow was observed. It was interesting to discuss relevant topics regarding the treatment of moving tumours with proton therapy. Regarding the main goal of the visit: data for ten non-small-cell lung cancer patients was shared. This included a minimum of ten fractions of CBCT projection data and one or two 4DCTs, depending on whether a re-planning was performed during treatment. Already during the visit, the first reconstructions in 4D could be done and the first steps were taken in optimizing the reconstruction quality. Preliminary results were shared and discussed and further work will be performed at the GPTC.

Results

First results included a 3D reconstructions of the CBCT data. When the quality in 3D was of sufficient quality, a 4D-reconstruction was made. Results so far show a promising reconstruction quality in 4D, and the next steps will include optimizing reconstruction parameters to improve the quality as much as possible.

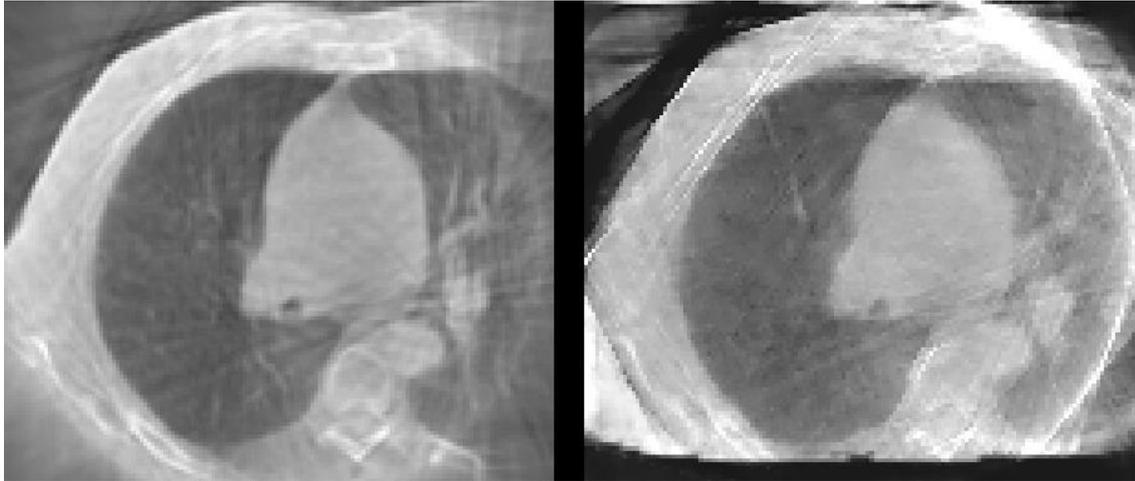


Figure 1: preliminary result of a CBCT 3D (left) and a 4D-phase (right) reconstruction image quality.

I would like to thank the people working at the WKCC for welcoming me in their center and showing me all aspect proton therapy treatment. I also want to thank the ESTRO for giving me the opportunity to visit another center in order to improve and further develop my research.



Willis-Knighton Proton Therapy Center