AbstractID: 3397 Title: Optimal Configuration of a Dedicated SBRT Treatment Unit for Radiation Therapy of the Lung

Purpose:
In the interest of optimizing lung stereotactic body radiation therapy (SBRT), the operating characteristics of a new dedicated unit with high-resolution MMLC, tunable energy range, and removable flattening filter were assessed. The system provides cone-beam CT capabilities for image-guided placement of the treatment isocentre. Measurements, Monte Carlo (MC) simulations, and treatment planning trials were initiated to allow rational selection of the optimal operating characteristics of this device in the management of lung cancer.

Method and Materials:
In this study, two theoretical models were created: one using the convolution/superposition (C/S) algorithm and the other using the MC simulation (BEAMnrc05) of the treatment head. The models were validated through comparison with measurements made using water tank (CC08-0.08cm3 volume, Wellhofer ion chamber) for a range of operating points of the accelerator (energy and presence of flattening filter). In addition, normoxic PAG gel measurements with MR-based readout were performed in order to assess the 3D dose performance.

Results:
The MC and C/S models reproduced the measured dose distribution in water with an accuracy of 2% or 1mm. Modification of the beam energy decreased the dose rate from 675MU/min (6MV) to 56MU/min (~3MV). Removal of the flattening filter increased dose rate by a factor of 1.5-2 and a ~5% reduction in the 80%-20% measured penumbra in water. On-going planning studies will provide assessment of these changes on realistic clinical scenarios in the context of lung SBRT.

Conclusions:
A flexible treatment-imaging platform has been installed in our facility for SBRT. Selection of optimal operating point for this device for lung SBRT is being pursued. The removal of the flattening filter showed some merits for the recovery of dose rate and the decrease in penumbral width. Further studies are needed to identify the best machine configuration for lung SBRT.

Conflict of interest:
supported by Elekta