Abstract ID: 16981 Title: Stereotactic body radiation therapy (SBRT) using respiratory-gated volumetric modulated arc therapy (VMAT) with flattening filter free (FFF)

Purpose: To evaluate treatment-plan quality and machine-delivery fidelity of SBRT using newly available respiratory-gated VMAT with FFF beams.

Methods:Varian TrueBeam and Eclipse TPS systems were used for this study. Fifteen lung patients previously treated with SBRT using ungated 6MV WFF VMAT were selected. For each case, two gated SBRT VMAT plans with high dose rate FFF beams (1400 MU/min for 6 MV and 2400 MU/min for 10 MV) were created using the same constraints and isocenter as the original treatment plan. Each FFF plan was then delivered four times under different clinic-relevant respiratory conditions: without gating, and with gating (25%-70% phase cycle) for three different respiration periods (3, 4.5 and 6 seconds). Three independent methods, using a ScandiDos Delta4 device, a 27x27 ion chamber array (PTW-Seven29), and an adapted dose reconstruction technique based on delivery log-files, were employed to evaluate dose delivered by TrueBeam. A variety of dosimetric metrics such as homogeneity, conformity and gamma indices were used to assess the plans and deliveries.

Results:Compared with the WFF plans, average target homogeneity of FFF plans was slightly improved by 5.5% while the average target conformity remained the same. No significant difference was observed in dose to the PTV and OARs (lungs, trachea, spinal cord, heart, esophagus, and chest wall). The mean of total MUs of 6 MV FFF plans was higher than that of WFF plans (3523 vs. 3161), however, with no statistical significance ($p=0.53$). Delta4 and Seven29 measurements and dose reconstruction demonstrated that the VMAT FFF plans for SBRT were faithfully realized under any of the four clinic-relevant delivery conditions, with high gamma-index passing rates (99.2%-100%) and measured/reconstructed dosimetric endpoints and distributions essentially identical with original plans.

Conclusions: Respiratory-gated VMAT with high dose-rate FFF beams provides a reliable means for SBRT treatment of moving targets with high dosimetric fidelity.