AbstractID: 3835 Title: Implementation of the Tungsten-Compensator based Intensity-Modulated Radiotherapy (IMRT)

Purpose:
One of the methods to deliver the intensity-modulated radiotherapy (IMRT) beams is by using physical compensators. The static nature of the compensator intensity modulation shortens the treatment time, simplify the dose optimization and reduces the leakage effect from MLC-IMRT. The purpose of this project is to study the feasibility of intensity modulation by a high density material, tungsten. The commissioning process, including the packing issue and dose modeling method, are described in details, which will be helpful for other institutions to implement this technique.

Method and Materials:
The consistency of filling tungsten and durability of the compensator were tested by the repetitive filling/handling. One symmetrical and one asymmetrical step function-type compensators were manufactured for dose modeling purpose. Mapcheck device and ion chamber were used to measure the dose attenuation at different field size, depth and off-axis distance. In-house make treatment planning system (TPS) was modified to incorporate the attenuation, scattering and beam hardening effects from the tungsten material. IMRT plans were made for 15 prostate, H&N and breast cancer patients. Intensity map and dose were acquired by the Mapcheck and compared to the TPS predictions.

Results:
The filling of the material is consistent with the maximum discrepancy 2.9% and 1.5%, respectively, for the intraoperator and interoperator filling tests. No compensator quality degeneration was found for two compensators after 30 fractions under normal and strenuous handling. Three dose calculation related parameters were fit using the data acquired on symmetrical and asymmetrical compensators. For 15 patients' plans, the measured intensity maps show that 97%±2% of points in the field have dose difference less than 5% from the TPS calculated.

Conclusion:
The tungsten compensator based IMRT was implemented by our group. The dose distribution discrepancy between the measured data and TPS calculation is small and meets the requirement of clinical needs.