AbstractID: 8311 Title: The application of an aSi-based EPID to guide intensity modulated radiation therapy (IMRT) of head-and-neck cancer

Purpose: In head-and-neck IMRT treatment, doses to targets and critical organs are affected by many factors including patient positioning, weight loss and tumor shrinkage. To ensure therapeutic effectiveness, re-planning with a new CT is often conducted. However, it remains unclear how to re-plan in time before intolerable dose deviation occurs. We propose to use EPID to quantitatively monitor treatment delivery and guide re-planning decision.

Method and Materials: In the method, baseline exit intensity maps are obtained with EPID during the first treatment. Exit intensity maps during the following treatments are compared against the baseline. When deviation from the baseline is beyond a threshold, re-planning may be considered. To test the method, a phantom study and a patient study are conducted. In the phantom study, a cylindrical phantom with a 2.5cm bolus is scanned with CT, and an IMRT plan is generated in an Eclipse workstation. The baseline intensity maps are first obtained with EPID. Then, two new sets of intensity maps are respectively acquired after a shift of the phantom by 2cm to simulate mis-positionig and bolus removal to simulate tumor shrinkage. Deviations are quantified with gamma analysis. In the patient study, exit intensity maps are acquired for nine consecutive head-and-neck IMRT treatments. The first set is used as baseline and compared against the rest eight sets.

Results: In the phantom study, the shift and bolus removal introduce considerable deviations, indicated by low pass rates of 50%. In the patient study, pass rates of certain fields after seven fractions are dropped to 70%, which is well below 95% pass rate of portal dosimetry at DUMC. This suggests a verification of patient positioning and targets with consideration of re-planning.

Conclusion: This work presents a real-time, efficient and quantitative tool to monitor head-and-neck IMRT delivery. Future work involves automation of this method.