

AbstractID: 13638 Title: Investigation of TomoTherapy Patient Specific Delivery Quality Assurance (DQA) Using a Cylindrical Diodes Array Detector System

Purpose: Diode array detector systems are attractive tools for patient specific QA. However, traditional 2D diode arrays have angular dependence which results in inevitable discrepancies between measured and planned dose. A recently introduced 3D diode array device, ArcCHECK (Sun Nuclear, FL) attempts to overcome this problem by arranging diodes on a cylindrical surface to provide measurement consistency regardless of gantry angles. The purpose of this study is to evaluate the performance of this 3D array for TomoTherapy DQA. Factors that can potentially affect measurement and plan agreement were also investigated. **Method and Material:** ArcCHECK, which consists of 1386 diodes embedded in a cylinder was commissioned. Fourteen TomoTherapy plans were selected representing a variety of tumor sites, including prostate, head and neck, liver, spine and lung. Dose per fraction for these plans ranged from 1.8 Gy to 5 Gy. To generate the planned dose, a dose map on the diode plane was extracted from DQA plan dose cloud. Differences between measured and planned doses were analyzed using distance to agreement (DTA) analysis and evaluation criteria of 10 percent threshold, 3 percent dose deviation and 3 mm DTA. Selected plans were also calculated and delivered to a 2D diode array, Mapcheck I (Sun Nuclear, FL) with MapPHAN. **Results:** Doses measured with ArcCHECK agreed well with plans, with an average agreement of $97.3\% \pm 1.8\%$ across all tumor sites. Plans utilizing predominately anterior beamlets had slightly better agreement ($98\% \pm 1.1\%$) compared to those with predominately posterior beamlets ($96\% \pm 2.0\%$). ArcCHECK performed well for delivery dose $>3\text{Gy}$ too ($98.2\% \pm 0.6\%$). 2D diode arrays had an average agreement of $90\% \pm 2.6\%$. Among all the investigated factors, treatment time appeared to be negatively correlated with agreement ($P < 0.05$). **Conclusion:** ArcCHECK provided significantly improved agreement between measured and calculated dose compared to the 2D MapPHAN system.