AbstractID: 11431 Title: An investigation of the accuracy of head-and-neck IMRT dose distribution using three-dimensional dosimetry techniques and Monte Carlo simulation

Purpose: Complex dose delivery techniques like intensity-modulated radiation therapy (IMRT) require dose verification in three dimensions. This work investigates the accuracy of dose distribution of head-and-neck IMRT plans using three-dimensional measurement and Monte Carlo simulation.

Method and Materials: Eleven head-and-neck cases delivered by Varian 23EX were planned with Pinnacle 8.0. The plans were recalculated in the three-dimensional measurement phantom Delta4 with the structures of every patients and accurate plans parameters. The plans were also recalculated by Monte Carlo using leaf sequences and MUs for individual plans of every patients and Delta4 phantom. All plans of Delta4 phantom were delivered and measured using Delta4. The dose distribution of iso slice, dose profiles, gamma maps and dose-volume histograms were used to evaluate the agreement.

Results: The dose distribution of iso slice and dose profiles from Delta4 measurement were in excellent agreement with both the Monte Carlo simulation and the Pinnacle calculation at all points. Gamma maps comparison show that all three distributions mutually agreed to within a 3% (dose difference) and 3mm (distance-to-agreement) criteria. A 93.2% gamma pass ratio was obtained between the Delta4 measurement and Pinnacle distributions with 3mm/3% gamma criteria. A 96.8% gamma pass ratio was obtained between the Delta4 measurement and Monte Carlo simulation with 2mm/2% gamma criteria and 99.2% gamma pass ratio with 3mm/3% gamma criteria. The DVH plot have slightly differences between Pinnacle and Delta4 measurement as well as Pinnacle and Monte Carlo simulation, but have excellent agreement between Delta4 measurement and Monte Carlo simulation.

Conclusions: It was shown that Delta4 and Monte Carlo simulation can be used very efficiently to verify head-and-neck IMRT delivery and no data is missed. The primary advantage of Delta4 is the fact it can measure true 3D dosimetry while Monte Carlo can simulate in patients CT images but not in phantom.