AbstractID: 8379 Title: Estimation of dosimetric uncertainties for a patient specific treatment plan in brachytherapy

Purpose: To develop a patient specific quality assurance procedure for interstitial brachytherapy by estimating the dosimetric uncertainties of a treatment plan. **Method and Materials:** Three different sources of errors in brachytherapy treatment planning are considered in this study: Errors due to the limited CT slice thickness, errors due to limited accuracy of the spatial reconstruction of catheters and the corresponding dwell positions, and errors due to inter-fraction motion of the catheters. The corresponding probability distributions of these errors are investigated and are used to estimate their impact on the dose distribution for a specific treatment plan. The quality assurance procedure consists of the quantitative comparison between the original dose distribution and the dose distribution calculated using the error probability distributions. **Results:** Dosimetric uncertainties of academic and clinical treatment plans indicate that the limited accuracy of the catheter reconstruction is most critical while the limited CT slice thickness mainly affects the dose distribution at locations near the tip or the connector end. The dosimetric uncertainties are depending on the magnitude of the errors and the relative weights of different sources of errors. As an example, the dosimetric impact of a 1 mm error in catheter reconstruction for a head and neck tumor is in the order of 5% for the PTV. **Conclusion:** In this work, a method for the estimation of dosimetric uncertainties for a brachytherapy treatment plan was developed. On a patient specific basis, different sources of errors and their particular dosimetric impact are analyzed. Consequently, by identifying and quantifying the sources of errors for an individual treatment plan, the method can be applied for highly efficient patient specific quality assurance procedures for interstitial brachytherapy.