AbstractID: 12597 Title: On the determination of the beam output of a kilovoltage cone-beam CT

Purpose:
To find suitable methods for the beam output determination resulting from a kilovoltage cone-beam CT (kV-CBCT) under reference conditions. The accurate determination of the beam output is essential in commissioning of a kilovoltage beam in a treatment planning system for the documentation of additional radiation exposure to radiotherapy patients resulting from kV-CBCT acquisitions.
Method and Materials:
Three different commercially available plastic materials are investigated as liquid water substitutes in the beam output determination for kV-CBCT scans. Both Monte Carlo and experimental methods were used in the study. The methods were tested in all kV-CBCT default clinical scan protocols available in Varian OBI 1.4 (Head, Low-dose Thorax, Pelvis, and Pelvis Spot Light). An Exradin Model A14 was used to measure dose in phantoms under specified reference conditions. The errors of dose calculations were investigated for different plastic phantoms with and without considering the medium dependence.
Results:
A method of obtaining the beam output was presented. In a commercial treatment planning system, the beam outputs for a specific kV-CBCT scan determined by measured values under reference conditions can be entered in the system as cGy/minute during the beam configuration. The results showed that the potential errors of determining the beam output of a kV-CBCT beam in Solid Water and PMMA phantoms may approach 8% and 20% respectively for use in a conventional treatment planning system. Whereas using the PLASTIC WATER® Low Energy Range (PW-LR) phantom results in errors within 2%.
Conclusion:
The determination of the beam output of a kV-CBCT scan is performed in a water phantom. The PW-LR phantom is shown to be a suitable liquid water substitute in the beam output determination resulting from a kV-CBCT acquisition. The method presented in this investigation facilitates the configuration of kV-CBCT beams for imaging dose calculations in a radiotherapy treatment planning system.