# AbstractID: 10930 Title: A medium-dependent correction-based algorithm for calculating imaging dose resulting from kV x-rays


**Purpose:**

Kilovoltage (kV) x-rays are increasingly used in image-guided radiation therapy. Repeated imaging procedures add additional dose to patients. It has been shown that the dose to bone is 3-4 times higher than dose to soft tissue for kV x-rays. Currently there is no model-based dose calculation algorithm that can accurately calculate the dose from kV x-rays. In order to account for the image-guidance dose to patients in treatment planning it is necessary to develop an accurate algorithm for dose calculations that can be implemented in a commercial treatment planning system for patient dose calculations in the diagnostic energy range.

**Method and Materials:**

The new algorithm, referred to as the Medium-Dependent Correction (MDC), takes into account both the medium physical densities and medium atomic numbers of the absorbing media. The MDC algorithm employs an empirically parameterized correction method which is applicable for arbitrary phantom geometry. The empirical parameters are optimized for a specific kV beam. The dose calculation accuracy of the MDC algorithm was benchmarked against that of Monte Carlo calculations for dose distributions resulting from head and neck and pelvic kV-CBCT.

**Results:**

The dose distributions resulting from calculation using the MDC algorithm were compared to density-corrected calculations using the Monte Carlo results as the gold standard. Density-corrected calculations were shown to underestimate the dose to bone by 100-300% and overestimate the dose to soft-tissue by 10-30%. The MDC algorithm calculated the dose to bone to within 10-30% and soft tissue to within 5-20%.

**Conclusion:**

The MDC calculation algorithm overcomes the shortcomings of existing model-based density correction methods used in kV x-rays. The algorithm offers similar accuracy to the Monte Carlo method with a fraction of the calculation time and could be implemented in a commercial treatment planning system to include imaging dose in patient treatment planning.