

AbstractID: 9873 Title: Dose Descriptors and Dose Assessment for Cone Beam CT Scanners

Computed tomography(CT) dosimetry should be adapted to the developments in CT in order to keep pace with new technology. Recently, a cone beam CT scanner that challenges the existing Computed Tomography dose Index (CTDI) dosemetry paradigm was introduced. The appropriateness of existing CT dose metrics for cone beam CTs will be assessed and alternative approaches for CT dose assessment will be suggested.

Dose measurements with a small Faraday metal ionization chamber, and 100 mm and 300 mm long pencil ionization chambers can be performed freely-in-air to characterize the cone beam. According to the most common dose metric in CT, measurements can also be performed in 150 mm and 350 mm long CT body and phantom with 100 mm and 300 mm long ionization chambers. Effects that cannot be measured with ionization chambers can be explored with Carlo calculations of the dose distribution in 150 mm, 350 mm and 700 mm long CT head and CT body phantoms. To overcome inconsistencies in the definition of CTDI, doses are also expressed as $CT_Dose100 = CT_Dose100 / 100 \times CTDI\ 100$. CTDI300 is chosen as the standard of reference against which results were assessed.

Measurements for e-in-air are good-to-excellent correspondence between CTDI300 air and $CT_Dose100_{air}$; CTDI100 air substantially underestimates CTDI300 air. Measurements in phantoms and Monte Carlo calculations reveal good correspondence between CTDI300w, $CT_Dose100_w$ and CTDI600w; CTDI100w substantially underestimates CTDI300w. Measurements at different positions within CT dose phantom with an ionization chamber that has a smaller than the cone beam a fundamental difference compared to reading of pencil chambers that are longer than the cone beam.

$CT_Dose100_{air}$ and $CT_Dose100_w$ are pragmatic metrics for characterizing the dose of the cone beam CT scanner; the quantities scanned are measured with the widely available 100 mm pencil ionization chambers and 150 mm long CT dose phantoms. CTDI300air and CTDI300w in a 350 mm long CT dose phantom are reasonable approximations for characterizing the dose of the cone beam CT scanner. Simple geometrical considerations, supported by Monte Carlo calculations, explain the fundamental differences of different CT dose metrics when measurements are performed at different positions within CT dose phantoms.