AbstractID: 3998 Title: New Approaches to Practical CT Dosimetry

Purpose: To outline the basics of conventional CT radiation dosimetry, to discuss difficulties that new cone-beam and wide-area detector geometries present to this conventional dosimetry approach, and to illustrate the practical application of recently proposed dosimetry techniques to both multirow and cone-beam CT configurations.

Method and Materials: Traditional CT radiation dosimetry is reviewed and its limitations in cases in which the radiation field is extended in the axial direction are discussed. Comparison is made between this approach, which is based on the use of the standard 100 mm pencil-type ion chamber, and a recently proposed technique employing a small "point detector" ion chamber (e.g. an RMI type TDC-100A with 0.1 ml volume)(RL Dixon, A new look at CT dose measurements: beyond CTDI, Med. Phys. 30, 1272-1280 (2003)). The specific corrections for using the small chamber are demonstrated in the case of full cone-beam CT performed with rotational angiography equipment (Siemens ARTIS BA neuro-angiographic room). A complete methodology for performing CT dose measurements with small chambers is presented.

Results: Good agreement between the point chamber and pencil chamber methods was demonstrated for conventional CT geometries. Direct measurement in cone-beam geometry is not possible with the pencil chamber, but can be performed with the point chamber. The estimated patient doses for conventional CTA were compared to those delivered by rotational angiographic equipment performing cone-beam acquisitions and found to be larger by a factor of between 8 and 25, depending on the specific protocol employed.

Conclusion: Modern CT equipment employs geometries that make conventional CT dosimetry inapplicable. The clinical physicist should be aware of this and of the necessity for developing new methods to characterize the radiation dose delivered to the patient.