AbstractID: 7659 Title: Experimental confirmation of near parabolic shape of dose profile in cylindrical phantom for dual source CT

Purpose:
To measure the radial dose distribution in a cylindrical CT phantom for both a single and dual source CT and to characterize its shape in order to determine whether the near parabolic shape used to justify CTDI volume calculations with equal weighting of the center and peripheral CTDI values is applicable for a two tube device.

Method and Materials:
A cylindrical phantom, the same diameter (32 cm) as the standard CTDI phantom was made with acrylic plastic. When assembled, it consisted of a cylinder with a cut in the transverse plane. Landauer optically stimulated luminescence (OSL) dots and Kodak X-OMAT V films were sandwiched in the transversal slit. The assembled cylinder was scanned using a clinical protocol over a length that extended well beyond its endpoints at 120 kVp using a Siemens Dual Source Definition CT.

Results:
For a single tube, the radial dose distribution as measured using both the OSL detectors and film is close to parabolic. (The drop off in scatter close to the surface is not well accounted for by this simple curve.) Somewhat surprisingly, deviation from a parabolic shape near the surface when two tubes are used is only marginally different than for one tube. Under the conditions of the scan, equal weighting results in errors of only a few %, due mostly to the drop off at the surface. The 1/3*center+2/3*peripheral weighting used in standard calculations stems from a linear fit and results in errors of up to 11%.

Conclusion:
Measurements of the dose profile in a cylindrical phantom show that the shape is close to parabolic for both single and dual source machines except for drop off at the edges. A parabolic shape results in equal weighting coefficients for volumetric integral dose calculations using only center and peripheral CTDI measurements.