

## AbstractID: 5008 Title: Air-kerma Length Calibration of CT Ionization Chambers

**Purpose:** To develop a slit-based calibration method, for the quantity air-kerma length, for CT ionization chambers which combines the radiation response and response length properties of the chamber.

**Method and Materials:** CT ionization chamber response profiles are measured for 3 models, and the response length is calculated. Air-kerma length calibration coefficients require a correction for radiation that is scattered from and transmitted through the aperture. The Monte Carlo transport code MCNP5 is used to generate this correction factor,  $C_{st}$ . A variable-width aperture is used to test a previously published, linear-regression based correction factor,  $C_{reg}$ .

**Results:** The response lengths of several CT ionization chambers are calculated based on the chamber's response profile. The response lengths vary between 9.9cm and 12.1cm, which results in errors of -20% to +1%. The  $C_{st}$  correction factor yields an air-kerma length calibration coefficient that varies by 0.1% for aperture widths ranging from 5mm to 90mm.  $C_{reg}$  yields air-kerma length calibration coefficients that vary by 1% over the same range of slit width.

**Conclusion:** The proper way to calibrate a CT ionization chamber is via air-kerma length calibration, which combines the radiation response and response length in the calibration coefficient. Currently CT ionization chambers are calibrated with a large x-ray field that exposes the entire collecting volume, which only characterizes the radiation response of the chamber. The response length is then assumed to be 10cm, which is not always true and can cause errors of up to 20% compared to using an air-kerma length calibration coefficient.