# AbstractID: 3101 Title: An analytic algorithm for dose calculation in an inhomogeneous medium

**Purpose:** To develop an analytic algorithm for calculating dose distributions in a heterogeneous medium using density scaling of the scatter dose in a convolution model.

**Method and Materials:** First, the dose in homogeneous medium was separated as primary and scatter dose. Second, primary and scaling doses were scaled. While scaling of the primary dose is straightforward, in this work we propose that scaling factor for scatter dose be expressed as the ratio of the kernel convolution within inhomogeneous medium to the one in homogeneous medium. With this scaled scatter dose, the total dose in the inhomogeneous medium was calculated in a challenging 3-D geometry of a 50 keV point source with a spherical inhomogeneity containing lung or bone tissues. The analytic calculations were compared with the Monte Carlo results using the PENELOPE code.

**Results:** Compared to Monte Carlo results, both the magnitude and the slope of the dose in the lung material were precisely calculated within lung inhomogeneity, while for within bone inhomogeneity, the magnitude and tendency were correct but the slope had less reduction along the primary photon direction. The dose distributions in the areas surrounding the inhomogeneities were predicted within 5%. Compared to the existing superposition/convolution algorithm such as Collapsed Cone Convolution, this algorithm has a much simpler form and fewer requirements for the point kernels.

**Conclusions:** The dose distribution in inhomogeneous media can be calculated with acceptable accuracy by using this extended scaling algorithm. The simple formulation and fewer requirements for the detailed point kernel will allow this algorithm for practical clinical application.