

AbstractID: 7627 Title: Fast dose calculation with superposition algorithm using a scaling method

**Purpose:** To speed up the scatter dose calculation procedure in a superposition algorithm by using a scaling method where the superposition of scatter contributions can be carried out through instead of all sites in the medium but randomly selected scatter sites.

**Method and Materials:** The scatter dose in a heterogeneous medium was obtained by Monte Carlo simulated scatter dose in water multiplied by the ratio of the scatter dose in the heterogeneous medium to the scatter dose in water calculated with superposition algorithm. Because this ratio is the scaling of the dose calculation in the medium by the same calculation in water the superposition could be carried out through in stead of all scatter sites but randomly selected, sufficiently enough numbers of scatter sites representing the structure of the medium. The 3-D dose distributions for heterogeneous structures in a spherical water phantom such as spherical lung or bone materials were calculated for a point photon source of energies of 30 keV, 100 keV and 400 keV.

**Results:** For the phantom considered here, the reduction of about  $10^6$  scatter sites to  $10^4$  random scatter sites speeds up the dose calculation by a factor of 100 while keeping the fluctuation caused by the random selection within 5%.

**Conclusion:** Dose calculation with a superposition algorithm can be significantly speeded up by this scaling method with randomly selected scatter sites.