

AbstractID: 8488 Title: The Effect of Copper Beam Filtration on the Transmission of Scattered X-Rays Through a Typical Lead Barrier

Purpose: Standard use of copper beam filtration in modern cardiac catheterization and angiography systems can substantially change the x-ray beam quality and ultimately have an impact on scattered x-ray transmission through shielded barriers. A study was performed to investigate these effects.

Method and Materials: Scatter was measured using broad-beam geometry at 50 and 100 cm from the center of an 8"-thick Lucite phantom with an 1800 cc ionization chamber. A Siemens Axiom Artis system was employed using 60, 81, 102 and 125 kVp with filtrations of 0, 0.1, 0.2, 0.3, 0.6 and 0.9mm of copper. The ionization chamber was wrapped in 1/16"-thick lead to determine the transmission of scattered x-rays through a typical shielded barrier.

Results: Transmission at 125 kVp varied from 1.7×10^{-3} to 3.0×10^{-3} for beams with 0 to 0.9 mm of Cu, respectively. Similarly, transmission varied at 102 kVp from 1.2×10^{-3} to 2.2×10^{-3} and at 81 kVp from 7.1×10^{-4} to 9×10^{-4} . Transmission at 60 kVp was about 7×10^{-4} for beams with 0 to 0.3 mm of Cu. Transmissions without Cu filtration at 125 and 102 kVp were measured to be about half the theoretical value reported by Simpkin and Dixon, which could result from variations in lead thickness. At 60 and 81 kVp transmissions without Cu filtration are more than an order of magnitude higher than that reported at 70 kVp by Simpkin and Dixon.

Conclusion: Additional copper filtration can increase the barrier transmission up to a factor of two over unfiltered beams. However, it is unlikely that this amount of increase in transmission will significantly modify a shielding calculation. Further investigation is needed to determine the changes in typical workloads and scattered air kerma at different angles for these systems to understand the combined effect of these changes on barrier shielding calculations.