

Purpose: For quality assurance x-ray phantoms are commonly used. To design or test the performance of the phantom, simulations studies using Monte Carlo simulations could be helpful. A problem in quality assurance occurred, due to different phantoms from different vendors which yield different results. A simulation was performed to verify the reason for those differences.

Material and methods: The EGSnrc package was used for the Monte Carlo simulations. The phantoms with their slightly different designs were modeled, used in the simulations and compared to the measurement results. All main features, except resolution test were reproduced in the mathematical phantom, the x-ray spectra was simulated using BEAMnrc.

Results: The Monte Carlo simulations yield excellent results and reproduced the differences seen in the measurements. The contrast differences correspond to the different design of the phantoms.

Conclusion: Monte Carlo simulations can predict the performance of x-ray phantoms used in quality assurance. They can be used to digitally design phantoms and predict their performance with a very good accuracy. Simulations can reduce costs and development time in the design of x-ray phantoms.