CT Simulation Phantom

Nuclear Associates Model 76-417

Introduction

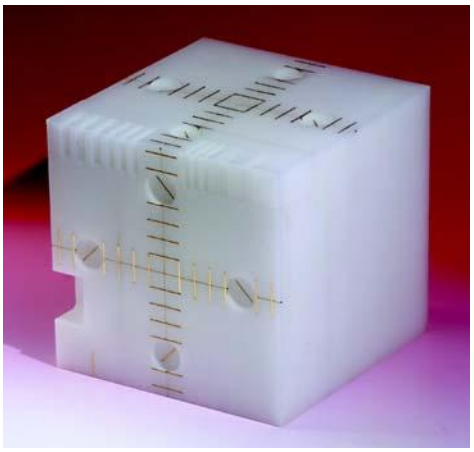
A CT simulator consists of a dedicated, fast CT scanner (often a spiral scanner), a virtual simulator (a set of computer software), and a laser marking device to mark the center of target volume. Therefore, methods of designing and implementing quality control procedures must include quality control on each segment of the process. Accuracy of table movements and lasers should also be checked to be within 1 millimeter accuracy.

Quality control of a virtual simulator is a very complex issue and difficult to verify, due to the nature of software quality. Since geometrical planning is the core of CT simulation, periodic quality control is essential for maintaining optimum image quality and patient care. Hence, the quality control of a virtual simulator consists of testing every segment of the software for possible flaws. A detailed description of such a process can be found in *"A Practical Guide to CT Simulation."*[1,2] The basic features which must be checked are reconstruction registration error (RRE), and geometrical accuracy in gantry, collimator and table simulations. The test should also include imaging parameters such as low contrast resolution and high contrast detectability of a DRR.

Applications

Digitally reconstructed radiographs produced from a commercial CT simulator have been evaluated using this phantom which consists of a 15 cm high-density polystyrene cubic block. Polystyrene was chosen due to the similarities in electron and physical densities between it and water, while it's dimensions were chosen as a compromise between the need to design a compact and portable phantom and the desire to represent a typical anatomical scan volume. In this instance, the anatomical volume most representative of the phantom can be considered as the head, the neck and the brain.

The phantom contains four test patterns engraved into three of its six faces. The four patterns are designed to measure low and high contrast resolution, modulation transfer function, ray line divergence accuracy, and spatial linearity of the digitally reconstructed radiograph.



The CT Simulation Phantom tests all quality control parameters that can affect patient treatment, including RRE, magnification, image quality, and more

Various 3D treatment planning systems can also generate DRR. Hence, the quality control of DRR generation needs to be addressed. This versatile phantom provides essential quality control tools for geometrical 3D treatment planning systems and imaging tools for CT-simulation as well, which are capable of generating DRR for portal design.

Specifications

Material Acrylic

Dimensions 5.906 x 5.906 in (15 x 15 cm)

Weight 9.24 lb (4.19 kg)

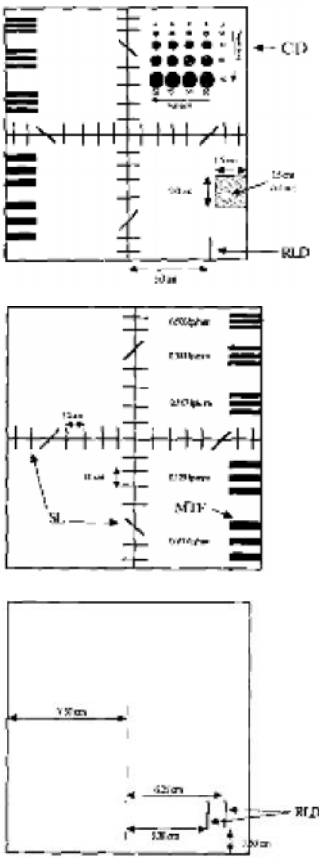
Available model(s)

76-417 CT Simulation Phantom

References

1. K.P., McGee, I.J. Das, "Commissioning Acceptance Testing and Quality Assurance of a CT Simulator," in *A Practical Guide to CT Simulation,"* L.R. Coia, T.E. Schultheiss, and G.E. Hanks, eds. (Madison, WI.: Advanced Medical Publishing, 1995), 39-50.
2. K.P., McGee, I.J. Das, C. Sims, "Evaluation of Digitally Reconstructed Radiographs (DRRs) Used for Clinical Radiotherapy: A Phantom Study," *Medical Physics*, 22 (1995),1815-1827. **Request Reprint No. 638B.**

- **For quality control of CT simulators and treatment planning systems capable of generating digitally reconstructed radiographs**
- **Designed for use with spiral CT scanners and may be used with conventional scanners**
- **Simplifies quality control for the radiology physicist and radiation oncology physicist**
- **Verifies the accuracy of the digitally reconstructed radiograph (DRR) reconstruction for 3D treatment planning systems**



Schematic representation of the phantom developed to evaluate DRRs: (a) Top face of the DRR phantom showing the contrast-detail, MTF, ray line divergence (RLD), and spatial linearity (SL) test patterns. (b) Side face of the phantom showing the MTF and SL test pattern. (c) shows the third face of the phantom containing the RLD pattern. The two lines represent the rods embedded at distances of 5.38 and 6.25 cm from the central axis of the phantom