

## AbstractID: 1622 Title: An Innovative Phantom for Quantitative / Qualitative Investigation

Development, characterization, and quality assurance of advanced x-ray imaging technologies require phantoms that are quantitative and well suited to such modalities. This paper reports on the design, construction, and use of an innovative phantom developed for advanced imaging technologies (e.g., multi-detector CT and the numerous applications of flat-panel detectors in dual-energy imaging, tomosynthesis, and cone-beam CT) in diagnostic and image-guided procedures. The design addresses shortcomings of existing phantoms by incorporating criteria satisfied by no other single phantom: 1.) Inserts are fully 3D – spherically symmetric rather than cylindrical; 2.) Modules are quantitative, presenting objects of known size and contrast for quality assurance and image quality investigation; 3.) Features are incorporated in ideal and semi-realistic (anthropomorphic) contexts; and 4.) The phantom allows devices to be inserted and manipulated in an accessible module (right lung). The phantom consists of five primary modules: 1.) Head, featuring contrast-detail spheres approximate to brain lesions; 2.) Left Lung, featuring contrast-detail spheres approximate to lung nodules; 3.) Right Lung, an accessible hull in which devices may be placed and manipulated; 4.) Liver, featuring contrast-detail spheres approximate to metastases; and 5.) Lower Abdomen, featuring simulated kidneys, colon, rectum, bladder, and prostate. The phantom represents a two-fold evolution in design philosophy – from 2D (cylindrically symmetric) to fully 3D, and from exclusively qualitative or quantitative to a design accommodating quantitative study within an anatomical context. It has proven an ideal tool in investigations throughout our institution, including low-dose CT, dual-energy radiography, and cone-beam CT for image-guided radiation therapy and surgery.