

# Multi-Energy CT Phantom

In collaboration with The University of Texas MD Anderson Cancer Center, Gammex has developed a phantom to ensure the performance and consistency of your Multi-Energy scans.

- Features 19 inserts representing different dimensions and concentrations of iodine, calcium, blood, adipose and other materials of particular interest to Multi-Energy CT (MECT)
- Enables comprehensive tests of Multi-Energy CT performance

Multi-Energy CT scanners have enabled improved clinical differentiations, such as distinguishing blood from calcification and calcification from iodinated contrast.<sup>1,2</sup> They can also create virtual mono-energetic images for clinical evaluation. However, the ability to achieve these benefits can greatly depend not only on one's equipment, but also on the protocols used.

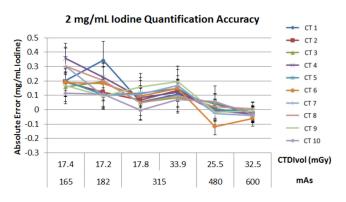
The Multi-Energy CT Phantom will enable robust evaluation of scanner performance.

- Test material discrimination using solid rods representing iodine, calcium, blood, adipose, and more
- Ensure the efficacy of clinical protocols for multienergy analysis
- Verify the quantitative accuracy of multi-energy scans
- Compare the consistency and stability across different scanners
- · Check for artifacts in an extended field-of-view
- Test in both head (20 cm) and body (40cm x 30 cm) configurations
- Enables automated analysis with patent-pending rod marker technology



### Ensure the accuracy you need

Scanner accuracy can vary based upon scanner hardware, the dual energy post-processing, and the mAs used. Without an appropriate phantom, neither scanner accuracy nor variability are well known. Use of the calibrated high-Z inserts enables such quantification. Additionally, protocols that appropriately balance patient dose with system performance can be identified.



2mg/mL iodine rod quantification accuracy by mAs for 10 fast-kVp switching Multi-Energy CT scanners. Accuracy averaged over a 1 year period.

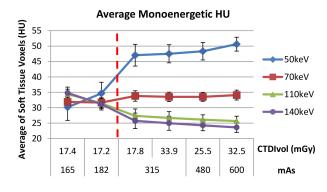


## **Automated Analysis**

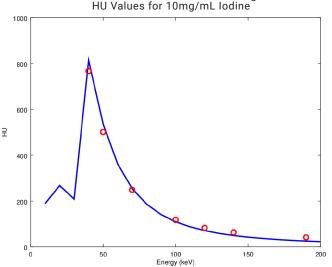
The Multi-Energy CT Phantom supports automated analysis using patent-pending rod marker technology. Each insert is tagged with a pattern, making it uniquely identifiable in a CT scan. Upcoming software will leverage these identifiers to evaluate results quickly and with minimal user interaction.

#### Enhance confidence in your virtual mono-energetic images

Monochromatic HU numbers have been shown to vary between scanners.<sup>3</sup> Moreover, the performance of multi-energy algorithms can be compromised by insufficient mAs. By utilizing Gammex Tissue-Mimicking Material that replicates expected HU dependencies from 40-200 keV, the Multi-Energy CT Phantom lets you quantify these effects and define effective operating parameters.



Average soft tissue monoenergetic HU for 50, 70, 110, and 140 keV reconstructions versus mAs, averaged over a 1 year period. Protocols left of the red dashed line were insufficient to provide reliable HU values.



#### Calculated vs Measured Mono-Energitic HU Values for 10mg/mL lodine

HU values of iodinated rod for mono-energetic reconstructions. Calculated values based on material compositions and NIST values (blue curve) vs HU values from mono-energetic reconstructions (red circles).



The ACR Quality Control Manual recommends checking for artifacts in a larger phantom on a weekly or monthly basis. The 40 cm extended field size of the Multi-Energy CT phantom enables this artifact check to be performed concurrently with other evaluations, efficiently fitting into your workflow.

## **Specifications**

In-plane Dimensions:	40.0 cm (15.7 in) x 30.0 cm (11.8 in)
Depth:	16.5 cm (6.3 in), up to 26.5 cm (10.2 in) with extension plates
Diameter of Removable Head Section:	20.0 cm (7.87 in)
Material:	HE CT Solid Water®
Interchangeable Inserts:	18 solid inserts plus 1 true water container, each tagged with a CT- visible rod identification code
4 lodine Inserts with Variable Concentrations:	4 inserts with concentrations of 2.0, 5.0, 10.0, and 15.0 mg/mL
3 lodine Inserts with Variable Diameters:	5.0 mg/mL concentration at diameters of 2.0, 5.0, and 10.0 mm
3 Calcium Inserts:	Calcium concentrations of 50, 100, and 300 mg/mL
3 Blood [iron] Inserts:	Blood-mimicking material at relative electron densities of 1.03, 1.07, and 1.10
2 Blood [iron] with lodine Inserts:	Blood-mimicking material plus iodine at 2.0 and 4.0 mg/mL
3 Tissue-Mimicking Inserts:	High-Equivalency Brain, High- Equivalency Adipose, High- Equivalency CT Solid Water
Weight:	15.5 kg (34.1 lbs)
Case:	Wheeled case is included
Stand:	Stand is included

DATA PROVIDED BY UT MD ANDERSON

<sup>1</sup> Nute JL, Jacobsen MC, Chandler A, Cody DD, Schellinghout D, Dual-Energy Computed Tomography for the Characterization of Intracranial Hemorrhage and Calcification: A Systematic Approach in a Phantom System. Invest Radiol. 2016; Jul 1

<sup>2</sup> Knoss N, Hoffman B, Krauss B, et al. Dual energy computed tomography of lung nodules: Differentiation of iodine and calcium in artificial pulmonary nodules in vitro. Eur J Radiology. 2011; 80(3): E516-519

 $^{\rm 3}$  Mileto A, Barina A, Marin D, Stinnett S, Choudhury K, Wilson J, Nelson R Virtual monochromatic images from dual-energy multidetector CT: Variance in CT numbers from the same lesion between single-source projection-based and dual-source image-based implementations Radiology 2016 (in press)

