



Re-inventing the CT Imaging Chain

By Bob Beckett, CT Global Product Manager

Image quality is central to so many facets of our life. As consumers, we demand it, whether it is for HDTV, eyeglasses, video games, or a computer screen. Seeing things clearly with true representation is always preferred – intuitively, there is value in image quality.

This is no different in radiology. Image quality drives a radiologist's ability to see anatomy or pathology and quantify it with accuracy. Our customers tell us image quality is the single most important aspect of CT imaging, which is why GE Healthcare places so much emphasis in this area.

Parallel to image quality is the responsibility to lower dose. No one disputes that the efforts to lower dose is the proper action to take with ever-increasing healthcare demand for imaging in order to make a definitive diagnosis.

At GE Healthcare, we also believe that gaining insights into the way the body functions is central to understanding disease and personalizing treatment for the individual.

Together, these three central themes are the embodiment of the new Discovery™ CT750 HD and what we mean by See More, Know More, Less Dose.

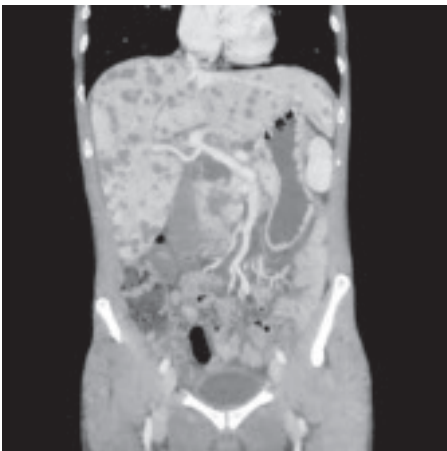
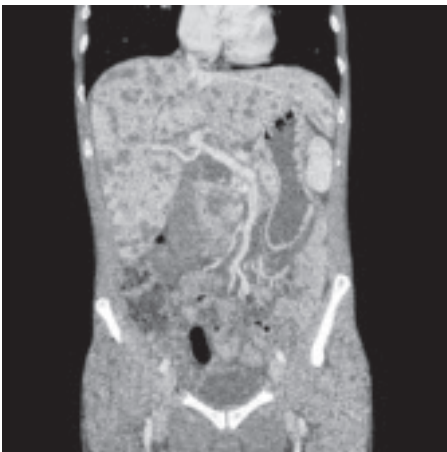
The overall image quality of a CT image is divided into four core components. Each component contributes to the visual appearance of the image and can greatly impact the quality of the diagnosis:

- Spatial resolution – the degree of blurring in an image;
- Low contrast detectability – the ability to differentiate between adjacent tissue densities;
- Noise – interference or the uniformity of CT number inaccuracies; and,
- Artifacts – distortion in the image that is unrelated to the subject being studied.





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Both images were generated from the same CT raw data. The top image is a typical reconstructed image using low dose technique at 87 mAs. The bottom image is reconstructed using the HD advanced reconstruction algorithm (ASIR). Notice the kidney stone clarity in the left kidney.

During the development of the Discovery™ CT750 HD, we utilized these four core components of image quality, observing differing tissue densities while reducing noise and artifact. This overhaul was going to take more than an extra X-ray tube or more detector rows. This required re-inventing virtually the entire imaging chain.

Each CT subsystem has an impact on the scanner's ability to generate the highest level of image quality with the lowest possible dose. Yet it isn't just about improving each aspect of the scanner, rather it is improving each in unison so all components work in harmony together.

We knew the future CT system would require a new scintillator, one that would enable higher sampling rates, particularly for dual energy, to contribute to higher image quality. The re-designed Data Acquisition System (DAS), which manages the amount the information in the reconstruction process, harvests more views to create an image. A new X-ray tube was also necessary, one that would switch between two energy levels. We also included dynamic focal spot control and higher mA focal spots for better image quality in larger-sized patients. And last, a new Adaptive Statistical Iterative Reconstruction (ASIR) algorithm to increase low contrast detectability up to 40%, in order to suppress artifact, contributes to dose reduction by up to 50%.

The result is high-definition, high-resolution CT imaging across all anatomic areas and clinical applications with significantly lower dose. In fact, the Discovery CT750 HD delivers 230 microns of resolution for scanning modes of up to two meters in scan range for true head-to-toe coverage. Historically, CT systems have achieved this level of resolution only for specific anatomic regions, and only with higher dose levels.

The clinical possibilities of the new Discovery CT750 HD are truly exciting, including the ability to:

- See small vessels from the proximal to distal extremes;
- Accurately quantify stenosis in coronary and vascular vessels;
- Minimize distortion and artifacts;
- Quantify, measure, and analyze suspicious pathologies and lesions, wherever located within the body;
- Segment and isolate pathology for treatment planning; and,
- Offer high quality diagnostic imaging using up to 50% less dose.

Higher image quality translates to greater levels of clinical precision and confidence. And lower dose is simply the responsible approach to the future of CT imaging.

Hardware and software has a life span. At some point in time, a new platform must take root to enable the user to leap into the next generation of technology. The Discovery CT750 HD is that new platform that will take our customers well into the future. ■