DOME® by NDSsi

Doing it *Right.*

Precision LUTs

PRECISE

High-precision lookup tables (LUTs) are one of the defining elements of a diagnostic display. When Dome introduced the first diagnostic LCD monitors, we incorporated special internal LUTs to allow the display system to be precisely calibrated to DICOM without depending on operating system software. Over the years, most other vendors have done the same, yet we continue to see claims indicating a real misunderstanding of the underlying technology.

High-precision LUTs are necessary to allow the system to specify particular colors or gray shades with greater accuracy than can be achieved with commercial display systems. Most diagnostic imaging software will display images with 256 or 1024 shades of gray. However, you want a larger number of shades to select from so that each targeted gray shade is correctly positioned on the DICOM curve. The number of shades needed depends on how precisely you need to specify the brightness of each gray shade. More precision is better, but at some point more precision doesn't make a perceivable difference.

In medical imaging, we use the DICOM Grayscale Display Function (GSDF) to define the target brightness for each gray shade. It is based on the minimal brightness difference a human can perceive, known as a Just Noticeable Difference (JND). At any given brightness, this is the smallest step a person can see in the ideal circumstances. If we can set the gray shades with less than a half a JND error, than any errors in the brightness steps will be invisible to the human eye.

The brightest displays used in medical imaging have less than 700 JND steps from black to white. If we designed a system with 1,400 available gray shades, we could select shades with less than half a JND error on average. For Dome displays, we doubled this to account for any non-linear behavior and designed our grayscale displays with more than 3,000 shades of gray. This yields an average error of about 0.2 JNDs, well below what can be perceived. So why are some vendors touting proprietary improvements moving them from 0.9 JND to 0.3 JND error, as if that was a great accomplishment? And others have systems with 14,000 shades of gray for 0.05 JND error, if the human eye can't see the difference? Don't let confusing marketing messages shape your understanding of true diagnostic value.