

DuraLight Brilliance™ Technology



Screening images for signs of unsuspected disease is challenging in part because of limitations in our ability to see small and subtle objects. Display luminance, a critical factor in radiologists' visual acuity, evolved from 350 cd/m² to 600 cd/m² between 2002-2008, ultimately reaching 1000 cd/m² in the case of Barco displays for some modalities.

Barco's DuraLight Brilliance delivers the same luminance as x-ray films on a light box to visualize subtle and small structures. It increases the number of Just Noticeable Differences (JNDs) and the apparent contrast of the clinical images.

Key DuraLight Brilliance features

DuraLight Brilliance is capable of delivering a calibrated luminance of 1000 cd/m² throughout the entire useful life (5-7 years) of a diagnostic display. This is twice as bright as the 500 cd/m² typical of PACS displays. The DuraLight Brilliance technology powers these key features:

- **I-Luminate™** - temporarily doubles screen brightness (over 2000 cd/m²) with the touch of a button. This higher luminance is also calibrated to the DICOM standard.
- **Virtual Lightbox** - allows a reference film to be illuminated by the powerful backlight by placing directly on the screen. Accommodates standard mammography film sizes.
- **Uniform illumination** - center to corner, all areas are equally bright in combination with Barco's patented Per Pixel Uniformity™ (PPU) and the Barco Optical Glass™.
- **Choice of tints** - switchable between clear base and blue base.

The role of brightness in display contrast

One way to compare the contrast and brightness of calibrated medical displays is to count the JNDs. Based on the minimum and maximum luminance, a display can represent more or less of these steps, i.e., JNDs. This is the apparent contrast. In the adjacent chart, Barco's Coronis Uniti™ display is shown as it is driven with the DuraLight Brilliance. Also shown for comparison are a typical 5MP display and Coronis Uniti using I-Luminate®. Fig. 1 shows that DuraLight Brilliance raises the brightness and apparent contrast with powerful uniform illumination.

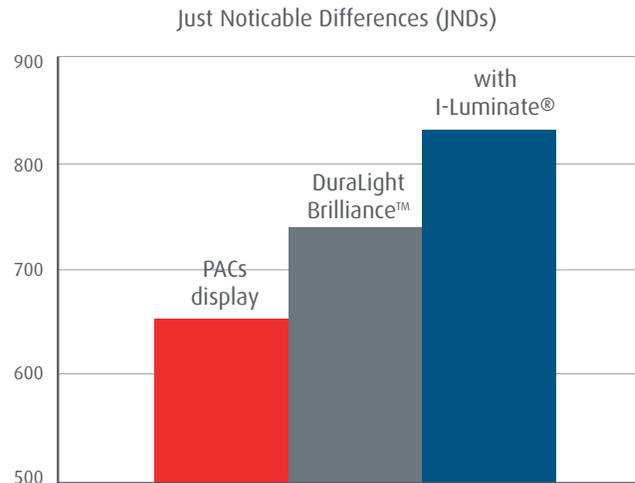


Fig. 1 More JNDs with higher brightness and apparent contrast

Advantages of higher ambient light

In early days, many reading rooms were brightly lit to enable ancillary tasks like reading charts and avoiding obstacles. However, because the first softcopy displays emitted much less luminance than film light boxes, the ratio of ambient to screen luminance was too high, resulting in much of the darker parts of the image on screen being obscured.

Ergonomic benefits

Although the logical solution is to significantly decrease the ambient light, total darkness is not recommended (Siegel et al., 2006), because the chemicals and muscles of the eye must work too hard to adjust, leading to eye fatigue. With DuraLight Brilliance, it is possible to use comfortable room lighting to minimize fatigue while preserving the contrast of medical images.

Enhanced detail

With DuraLight Brilliance, display luminance can be increased to make microcalcifications more conspicuous, while improving the appearance of both the fatty and dense breast tissue. Radiologists can work more quickly with higher luminance, performing fewer image manipulations to form their clinical interpretations of each image more rapidly. This also decreases fatigue to enhance comfort during image reading.

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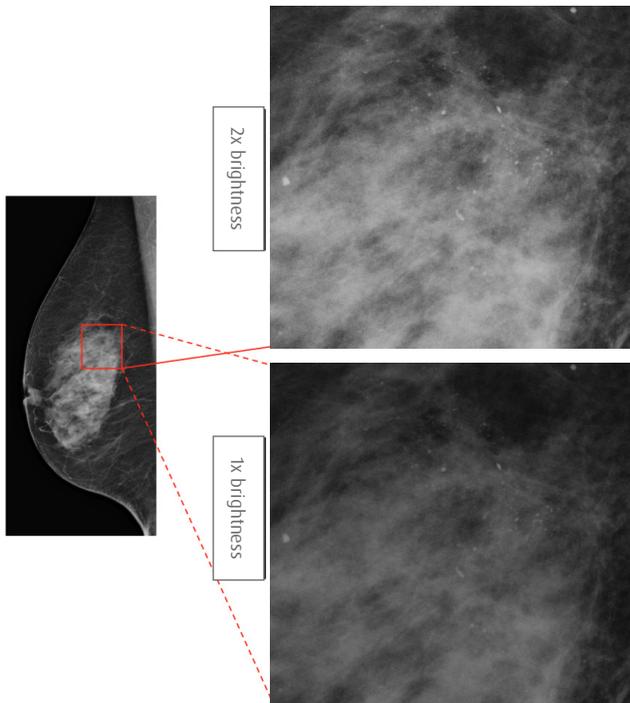


Fig. 2 2X brightness increases conspicuity of mammography targets

Fig. 2 illustrates that microcalcifications, projected onto a very small portion of our retina, are easier to see when they are brighter. Photons from the microcalcifications need to overcome a small inherent noise which is constant within our retina. So, when we double the brightness, the signal is doubled yet the noise remains the same. This higher signal-to-noise ratio is what makes these small objects easier to see with more luminance.

More vivid colors

DuraLight Brilliance produces brighter colors than other displays because of its extremely high luminance. Observe in Fig. 3 how the color arc at left shows a display with a luminance limited to 500 cd/m². The color arc at right shows brighter red values because of much higher luminance. This is a result of the display emitting more photons per second, producing a more vivid and saturated image despite being the same color.

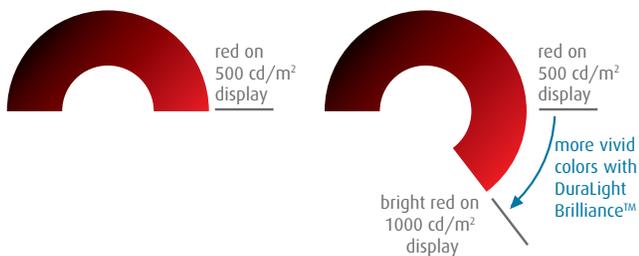


Fig. 3 Before (left) and after (right) DuraLight Brilliance

Clinical implication: improved detection

The clinical benefits of additional luminance are superior detection, less time manipulating the image, and faster decisions, all of which are enabled by the higher luminance and contrast of the DuraLight Brilliance.

Contrast and luminance are both strongly correlated with conspicuity of mammographic targets. Several studies corroborate the positive impact of higher luminance on diagnostic accuracy. Using FDA-trained inspectors to score phantoms, it was found that the mass and speck scores were significantly higher both with higher luminance and with greater contrast (Pisano et al., 2001). Detection probability of objects indeed increased when the visual adaptation luminance value matched the ambient illumination in the room (Chawla & Samei, 2007).

A study sponsored by the National Cancer Institute conducted at University of Pittsburgh studied the effect of luminance on chest x-ray diagnosis. The detection of pneumothorax, interstitial disease, and rib fracture showed statistically significant differences ($P < .05$) due to luminance (Herron et al., 2000).

Conclusion

DuraLight Brilliance enhances conspicuity of medical image details with a powerful, uniform luminance so radiologists can make an accurate interpretation more quickly with less eye strain. Without decreasing any other parameters, DuraLight Brilliance increases apparent contrast, spatial resolution and display lifetime. With higher luminance, increased ambient light is possible, which reduces radiologist fatigue for a more comfortable reading experience.

References

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