

# AbstractID: 5071 Title: Current Challenges in DICOM GSDF Calibration For Medical Displays

## **Purpose:**

Over the last few years liquid crystal displays have replaced the traditional light box in medical imaging. When display systems are used for primary diagnosis they need to comply with the DICOM GSDF standard.

Previous work already demonstrated that limited grayscale depth and viewing angle dependency of LCD results into lower calibration accuracy. As original contribution this paper investigates the impact of spatial noise and non-uniformities on calibration accuracy. Additionally we will also quantify the relative importance of each of those three shortcomings of medical LCDs.

## **Method and Materials:**

To study the effect of non-uniformity and spatial noise on DICOM GSDF compliance, we compare the observed transfer curve after calibration with the target DICOM GSDF curve and this for multiple locations across the display. The display used is a 5 Mega Pixel monochrome medical LCD display. We also analyze the typical GSDF compliance metrics  $dL/L$  and JNDs/step and compare these plots for the other effects of viewing angle dependency and grayscale depth.

## **Results:**

Current calibration practice is to characterize the native transfer curve of the display at only one position (often the centre). However there is significant variation in native transfer curve across the display surface and therefore calibration will only be accurate at the position where the characterization took place. On other display positions the average target luminance distortion compared to GSDF ranges from a few JNDs to over 20 JNDs. A technique of spatial noise-reduction can solve this problem. We also observe that spatial-noise is much more important than viewing angle and grayscale depth for typical usage.

## **Conclusion:**

This paper has demonstrated that non-uniformities and spatial noise can result into poor calibration accuracy. Also a possible solution to the problem has been described.

## **Conflict of Interest (only if applicable):**

Research sponsored by Barco Medical Imaging Systems.