AbstractID: 2724 Title: Characteristics and Performance Evaluation of Digital Image Displays

The diagnostic radiology department is in the middle of a revolutionary change [1, 2]. Digital imaging sensors and displays are replacing the traditional sensor and display, namely, the film-screen combination. In many institutions the Totally Digital and Film less Radiology Department already exists. Here images are generated using digital detectors, and diagnosis is made using softcopy displays such as Cathode Ray Tube displays (CRT) and Liquid Crystal Displays (LCD).

CRTs are analog devices while LCDs are discrete and digital devices. This presentation describes the resulting image quality in terms of spatial resolution or Modulation Transfer Function (MTF) and in terms of spatial and temporal noise or Noise-Power-Spectrum (NPS) and Signal-to-Noise-Ratio (SNR).

Basic display image quality affects greatly the presentation of clinical images on the specific display. It is the display, which determines if the image quality captured by the image detector is transferred to the observer, i.e. the radiologist. So the display has a special importance amongst all components of the imaging chain.

There is a need to test the image quality of the digital displays, called Acceptance Testing, when the displays are acquired from the display companies. In fact, before the acquisition of the displays by the user, there is a need for the display manufacturer to test the image quality of the digital displays in order to get FDA approval (i.e. 410 k). Amongst other performance characteristics the FDA wants to see the MTF and the NPS of the respective displays at several luminance values.

There is a need for Image Quality Control in the Reading Room, because many things can go wrong in the Reading Room: (1) The luminance of the digital displays (CRTs as well as LCDs) can change, (2) the spatial resolution of CRTs can change as the luminance changes because the MTF is related to the luminance through the size of the scanning electron beam, (3) the display can be set-up incorrectly. These problems need to be evaluated in the Reading Room.

The AAPM Task Group 18 has prepared a thorough report on “Assessment of Display Performance for Medical Imaging Systems”.

•There are visual or qualitative or basic tests, where a human observer views the display and makes a decision on the presence or absence of a test object.

•There are quantitative or advanced tests, where an instrument like a photometer or a CCD camera is used to make a measurement and provide quantitative data.

Educational Objectives

1. Understand the operational characteristics of CRTs and LCDs
2. Understand the concept of display Image Quality Evaluation.
3. Understand the need for acceptance testing of display image quality.
4. Understand the need for Image Quality Evaluation in the Reading Room
5. Understand the idea of the AAPM TG18 Assessment of Display Performance for Medical Imaging Systems
6. Understand the idea of quantitative evaluation of display image quality using a hand-held CCD camera.