AbstractID: 9779 Title: CCD Digital Detectors

Optically coupled CCD (Charge Coupled Device) based DR systems use a scintillator, a mirror and a lens to capture and reduce an x-ray image onto a sensor for digitization. Such systems pre-date flat panel detectors by several years and have been maturing slowly but steadily. Today there are many installations in clinical use throughout the world. These systems can be divided into two groups, those using multiple cameras and lenses and those using only a single camera. There are many differences in operation required to produce an image from the two different systems but regardless the performance of either system is influenced by the performance of each individual component. Scintillator materials range from gadolinium oxysulfide with varying dopants to thallium doped cesium iodide. Optical coupling efficiency can be affected by the degree to which these scintillator materials can be considered lambertian emitters. Lens design is another critical element in performance, with the requirement for a very large aperture for light efficiency being balanced by the difficulty of working with very small depths of focus. The CCD sensor itself is a very reliable and very high efficiency device but consideration must be given to the influences of pixel size and fill factor on overall quantum efficiency. The medical physicist called on to perform acceptance and QC testing of these devices needs to be aware of the data processing and image processing steps performed by the vendor's software. Data processing operations are inherent to the device and do not vary with anatomy. Included are corrections for dark current, pixel non-uniformity and geometric distortion. Image processing operations are usually anatomy specific and include segmentation, tissue equalization and sharpening. By understanding the role of each step the physicist can better determine where any performance problems may arise. Novel features just now being developed include automated QC checks built into the system whereby a complete self diagnostic can be performed from the scintillator through the entire imaging chain to the acquisition computer without any involvement by hospital personnel. New switchable high resolution / high efficiency mode systems are also being launched. The presentation will discuss the geometry of the optically coupled CCD based system, the performance of its components and the performance metrics of the overall system. It will also cover details of self diagnostics and multi-mode systems.

Educational Objectives:

1. To become familiar with the geometry of CCD based systems
2. To understand the role of each key component in determining overall performance
3. To understand how to assess overall performance
4. To become familiar with new developments in automated QC procedures.