AbstractID: 7251 Title: Metrics for Measuring Image Quality

Numerous imaging detectors are now available for radiographic imaging, and it is important to understand the relative performance of these devices. An ideal strategy for quantifying the performance of these devices would include a four step process: measurement of physical image quality, measurement of observed image quality, subjective (but quantitative) measurement of observer preference, and quantitative objective assessment of observer/system performance for a specific diagnostic task. The first step, measurement of physical image quality, includes a determination of inherent contrast of the system, an assessment of system artifacts, measurements of linearity, modulation transfer function (MTF), noise power function (NPS), and detective quantum efficiency (DQE). This course will teach the mathematical foundations for these various measures, as well as give appropriate practical methods for measuring them. The second step of the assessment process, observed image quality, is typically performed by a modified contrast-detail-dose experiment. General principles for this type of evaluation will be provided. The third step, subjective (but quantitative) observer performance, is often done with an observer preference study. Principles for such a study will be described. The last step, quantitative assessment of diagnostic accuracy, is typically done by ROC analysis, and is beyond the scope of this lecture. This course will also address some of the issues involved in assessing image quality when various image processing techniques are used.

The specific educational objectives for this course are:

1. To understand the four-step process for determining image quality in a given system
2. To understand the mathematical foundations of linear systems analysis (MTF, NPS, DQE)
3. To understand how to measure MTF, NPS, and DQE
4. To understand subtleties involved in the description of MTF, NPS, and DQE in digital systems containing aliasing
5. To understand general principles of contrast-detail-dose measurements
6. To understand general principles of observer preference studies
7. To understand how image processing affects the measurement of the above parameters