AbstractID: 4758 Title: High-Performance Dual-Energy Imaging with a Flat-Panel Detector: Answering the Challenge of Dual-kVp Flood-Field Correction

Purpose:
Flood-Field correction is a critical step in achieving high image quality in digital radiography (DR) and dual-energy (DE) imaging. The optimal Dark-Flood correction scheme suggests collection of Flood-Fields at the same technique as the Projection data. In practical applications calibration data are often collected at the start of the day, and Flood-Fields not collected for all techniques. The problem of proper Flood-Field correction is compounded in DE imaging where two projections at different energies need to be considered. The purpose of this study is to quantitatively examine the effects of various Flood-Field correction schemes on DE imaging performance.

Method and Materials:
In DE imaging two Projections are collected: a low-energy image (e.g., 60-90 kVp) and a high-energy image (e.g., 120-150 kVp). Five Flood-Field correction schemes were considered: optimal correction (Flood-Field at the same kVp as the Projection) and four sub-optimal cases (variations wherein the Flood-Field kVp is different from that of the Projection). Imaging performance was evaluated in terms of the uniformity, noise-power spectrum (NPS), and detective quantum efficiency (DQE) in Projection and DE image data. Phantom images were used to assess the contrast-to-noise ratio and perceived image quality of DE images processed under each correction scheme.

Results:
The results reveal a systematic degradation in the performance of the corrections as energy separation between the Projections and the Flood-Field increases. Sub-optimal correction schemes degraded imaging performance significantly: image uniformity degraded by a factor of 5-10; soft-tissue contrast degraded by ~13%; low-frequency NPS was significantly increased; and DQE was degraded by >10% at low- and mid-frequencies.

Conclusion:
The choice of Flood-Field correction scheme has significant impact on DE imaging performance. This study provides valuable guidance in the implementation of a high-performance calibration scheme for DE imaging. Deployment in a pre-clinical DE chest imaging system at our institution is underway.