# DOSIMETRIC COMPARISONS BETWEEN THE SCANNING BEAM DIGITIAL X-RAY (SBDX) SYSTEM AND A CONVENTIONAL FLAT-PANEL CARDIAC FLUOROSCOPIC IMAGING SYSTEM

## ABSTRACT

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The Scanning Beam Digital X-ray (SBDX) fluoroscopic system has great potential to become the next standard in cardiac fluoroscopic. This work consisted of a thorough dosimetric comparison between SBDX and a conventional flat-panel imaging system used for cardiac fluoroscopy. The investigation included NIST-traceable calibration of newly formulated radiochromic film designed for diagnostic x-ray beam qualities. Measurements and analysis of the x-ray fields of the SBDX and flat-panel systems were performed both free-in-air and at the surface of a phantom, and included measurements of free-in-air and on-phantom air kerma rates, x-ray field flatness and beam quality for both systems.

*In vivo* patient surface dosimetry was performed for fluoroscopically guided diagnostic and interventional cardiac procedures on the conventional flat-panel system. The film-measured air kerma was compared to the conventional system's regional dosimetry calculations. From this investigation it as shown that the conventional system's dosimetry values were approximately 23% lower than the film-measured air kerma. This difference was consistent with flat-field on-

phantom film measurements which showed that the conventional system did not apply appropriate backscatter factors to the reported air kerma.

From the *in vivo* investigation one patient case was selected and replicated on the conventional system and SBDX systems using an adult anthropomorphic phantom as a substitute for a patient. It was shown that when operated with x-ray tube parameters that produced equivalent image quality, SBDX delivered approximately two times less dose to the phantom entrance surface than the conventional system for the same procedure time. The x-ray fields of SBDX were larger and more diffuse than the conventional system leading to lower dose in the overlapping "hot spot" regions.

A second phantom study investigated the dose reduction potential of SBDX's unique *Equalization* feature. An adult anthropomorphic phantom was filled with high-sensitivity TLDs for this experiment. The TLD-filled phantom was exposed with the conventional system and SBDX both with and without *Equalization* to a single x-ray projection. The analysis showed that for equivalent phantom image quality, SBDX without *Equalization* produced average organ dose rates approximately one-quarter of the conventional system. With *Equalization* average organ dose rates were one-seventh of the conventional system.