Impact of Intermediate Collimation on Line Scan X-Ray Images

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Various methods and techniques are used in the x-ray industry to improve the imaging quality of line scan x-ray detectors: increasing x-ray/source power, increasing the dynamic range of the imaging sensor, using longer integration time, etc. Other methods also include mechanical design alternatives such as optimized x-ray acceptance angles, sufficient shielding and radiation scatter guards, and collimation inside and outside the detector housing. This paper will focus on the more economical way of improving imaging quality of line scan x-ray detectors: collimation, specifically intermediate collimation that's outside the detector housing and some distance away from the source. Collimation is known among the NDT industry to be an effective tool for reducing scattered radiation. In theory, imaging quality can be improved with a great deal of contrast sensitivity elevation just by simply placing a high-Z material collimator plate strategically between the source and the detector. The theory has been put to test by collecting data with and without intermediate collimation under low (80kV) and high (up to 6MeV) energy conditions. This paper investigates the intermediate collimation both between the object and the detector, and between the source and the object. The effect of the improved imaging quality can be seen depending on the locations of the intermediate collimator plate.