Purpose: To report on the design and operation of a fluoroscopic automatic gain control (AGC) system with arbitrary-shaped operator-selected region of interest (ROI) for a new high resolution detector consisting of an array of two EMCCD-based modules.

Methods: A solid-state x-ray imager consisting of dual EMCCD-based modules was built to provide high resolution (effective pixel size 26.4 um) and wide dynamic range (55dB) in fluoroscopy. A graphic user interface was employed based on LabVIEW to display the 2K x 1K 12-bit digital images. The image from the second sensor was digitally rotated and shifted so as to maintain image registration with the image from the first sensor. The AGC system consisting of a real-time feed-back loop and a universal asynchronous receiver/transmitter platform was implemented to enable control by comparing the current average digital values in the operator-selected ROI with a preset desired value resulting in a step by step change of the EMCCD built-in gains to achieve the desired image brightness. A standard aluminum step wedge was used to demonstrate the response speed and a head phantom was employed to provide a realistic complex structure, rich in contrast variations.

Results: The operator-selected ROI was able to be positioned anywhere in the full 1K x 2K field of view, even with parts in each module. The settling time for smoothly reaching stable brightness was in the range of 10 to 20 frames. A video sequence demonstrates a smooth brightness transition to the desired value when the head phantom is arbitrarily moved across the field of view of the detector.

Conclusions: We introduce a new real-time AGC design for a unique custom-built high resolution modular array detector. Stable levels of brightness within the ROI were demonstrated. Operators can set up an arbitrary shaped ROI in advance or during the procedure.

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