Purpose: To provide an extended field-of-view (FOV) with higher resolution images, a new SSXII imager with a two-detector modular array was built. An acquisition, correction, and display system tiles two image modules in real-time with geometric and brightness matching at the boundary.

Methods: Two fiber-optic tapers (FOTs) were fitted together with minimum dead-space and embedded in liquid Sylgard 184 silicone elastomer which is allowed to cure and solidify; this 1x2 FOT array was fitted into an optical "head-box." The EMCCD sensors were fixed to the small-ends of the two FOTs while a single CsI x-ray phosphor plate was fastened onto the large-ends. The optical head-box was then combined with custom-built electronics boards that control the driving clocks and sample the output. The digitized frames were transmitted to a PC through a CameraLink port accommodating a rate of 30 fps for both modules simultaneously. Customized software enabled acquisition, correction (dealing with the rotational and translational misalignments between the sensors), and display of the x-ray images in real-time. Other functions including acquisition control, save options, temporal filters, flat-field correction, and mode selection for fluoroscopy, roadmapping, digital angiography (DA) and digital subtraction angiography (DSA), were also implemented.

Results: The processed high-resolution image was aligned properly along the boundary. The match up error was less than 1 pixel although there was a coupling loss of just under 7% due to chamfers at the edges of the FOTs; remachining the FOTs in future versions will reduce this loss. The two aligned images from each module exhibited balanced brightness between the sensors and flat-field correction to eliminate fixed patterns introduced by the FOTs.

Conclusions: The custom-built SSXII detector and its acquisition, correction, and display system provides higher spatial resolution and nearly seamless images for the array in real-time. Larger arrays are planned for future SSXII implementations.

Funding Support, Disclosures, and Conflict of Interest:

Support: NIH Grants R01-EB008425, R01-EB002873