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Design and fabrication of EXCALIBUR detector modules

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The EXCALIBUR detector is a small-pixel photon counting area detector developed by the Diamond Light Source and the Science and Technology Facility Council in the UK for coherent X-ray diffraction. EXCALIBUR is based on the 55 micron pixel size read-out ASIC developed by the MEDIPIX3 collaboration. This talk describes the geometry of EXCALIBUR modules consisting of 16 MEDIPIX3 ASICs bump-bonded to a large silicon sensor die. The design of the hybrid carrier board and flexi-rigid circuits interfacing the hybrid pixel detector to FPGA boards will be presented as well as the strategy for controlling the temperature of the module. A description of module fabrication and quality control procedures at every step of the fabrication process will be provided. X-ray images obtained with an EXCALIBUR detector module will be presented together with the acquisition set-up developed for the transfer of 3M-pixel images produced by the final 3-module detector assembly at a frame rate of 100 frames per second in continuous mode and 1000 frames per second in burst mode.

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