Development of X-ray 2D Detector for SACLA

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X-ray Free-Electron laser (XFEL) facilities are now enabling a new era of X-ray science owing to their high-peak intensity, pulse width down to a few femto-second, and full spatial coherence. In most of the XFEL experiments, samples are destroyed upon single pulse irradiation, and hence X-ray image data should be stored shot-by-shot. This experimental scheme gives also the opportunity to correlate the pulse characteristics, such as pulse intensity, pulse position, arrival time, etc., which are generally not stable with current XFEL generation technology.

These shot-by-shot data acquisition demands dedicated X-ray 2D detectors. Since the statistics of the data from the single shot cannot be improved by accumulating multiple shot data due to sample damage, data quality of each frame is the most important performance. Therefore one of the common requirements are (1) single photon detection, and (2) high peak signal. Furthermore, (3) x-ray radiation hardness more than 30 Mrad, and (4) frame rate matching the XFEL pulse period are mandatory. In order to meet these requirements, a multi-port charge-coupled device (MPCCD) detector has been developed. In this talk, MPCCD sensor and readout system is outlined.

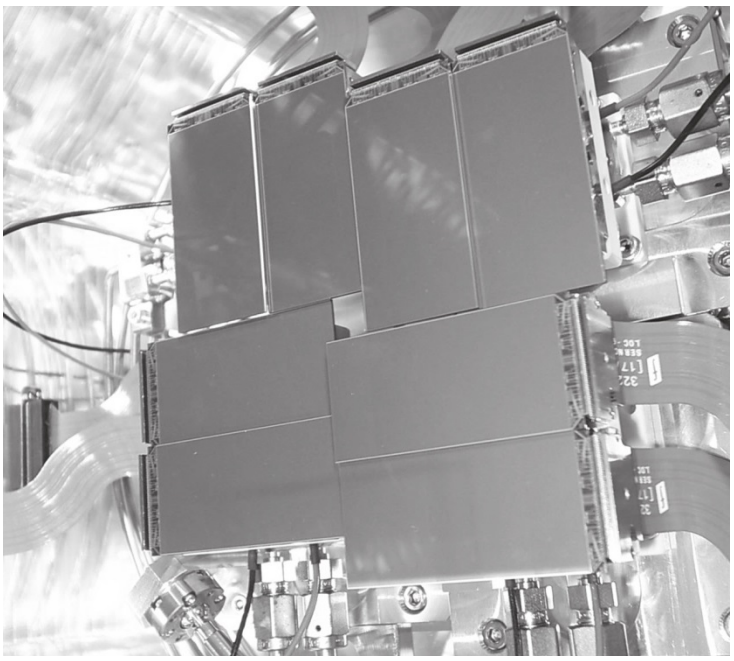

Fig. 1. Multi-port Charge-Coupled device (MPCCD) developed for SACLA. 8 sensors are arrayed to form imaging area of 100 mm x 100 mm. At the center, a rectangular hole with variable size is installed in order to avoid direct illumination of XFEL pulses.