

DETECTORS

New Detectors in SPring-8

The notable new detectors at SPring-8, added in 1999/2000, are follows.

Fast CCD Camera

A fast CCD detector was introduced at the high flux beamline (BL40XU). The detector utilizes a fast camera, consisting of three interline CCD cameras arranged on the three sides of a prism to receive the same image, just as in the case of 3-CCD color video camera. Each camera operates in an exposure-readout cycle. By shifting this cycle, it is possible to achieve a frame rate three times higher than is possible with a single CCD. Using a full frame size of 640 (horizontal) \times 480 (vertical) pixels, the frame rate is 290 per second. This rate can be further increased by reducing the number of vertical pixels. The image is then read and digitized into 10 bits. A large frame memory can store the images continuously up to more than 20 sec.

To demonstrate the high frame acquisition rate, a drop of milk falling into milk was recorded (by courtesy of Hamamatsu Photonics, K.K.). It is possible to see how milk is splashed in small drops (Fig. 1).

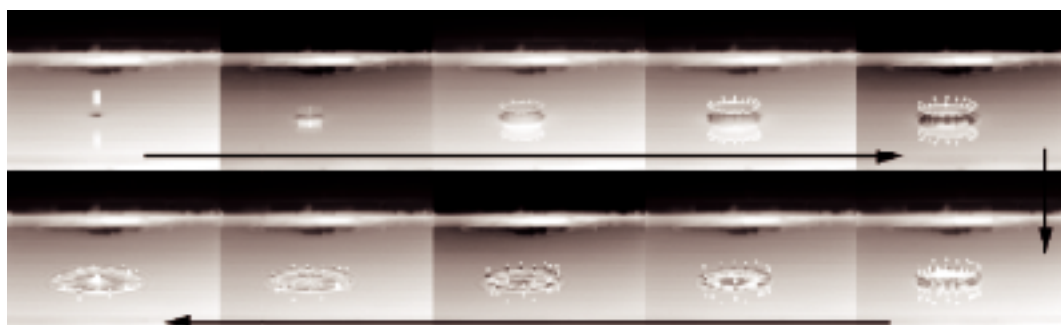
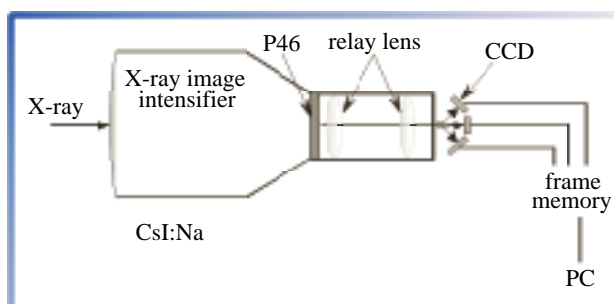


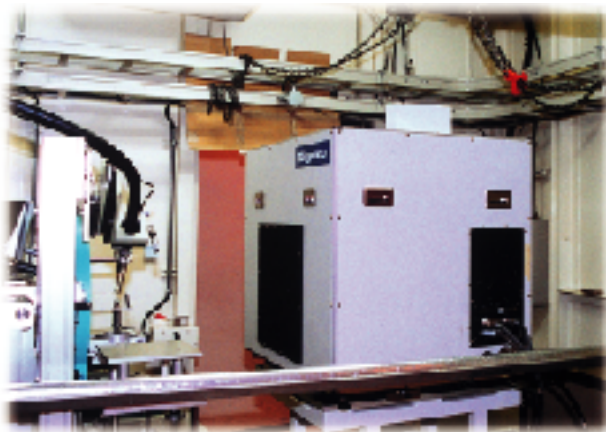
Fig. 1. The small drops created by the splash of the milk droplet are easily discernible by this high frame rate.

The detector is used with a Be-windowed X-ray image intensifier which uses a short-decay phosphor (P46) in the output window. The persistence is negligible, even in experiments with a time resolution greater than 1 msec. The 15 cm diameter of the X-ray image intensifier provides a spatial resolution of 0.22 mm. The detector system is currently used in X-ray diffraction experiments on skeletal muscle at a time resolution of 530 μ sec. Frame timing signal is used to synchronize the detector with the other equipments.



High-speed Imaging Plate Detector

At the protein crystallography station of RIKEN beamline I (BL45XU), a high-speed imaging plate detector (RAXIS V) was developed and installed in collaboration between RIKEN and RIGAKU Co. This detector was designed to reduce the readout time, in order to match to the short-exposure. The detector, containing three-IPs, performs the exposure, reading and erasing of the three-IPs at the same time, to allow quick repetition of the continuous readout. The stored image is read from the IP using a new double-beam helical-scanner, capable of reading out a 400 mm × 400 mm, 100 μm pixel image in less than 50 seconds. The turn-around time is, therefore, shortened to only 65 sec, in comparison to the ~4 min necessary for the previous model (RAXIS IV++). The large detection area and wide dynamic range of an image plate is especially advantageous over CCD-based detectors when collecting high resolution crystallographic data and accurate measurements of diffraction intensities. The detector will be also utilized in other protein crystallography beamlines in the future.



Detector Development Projects

A one-dimensional microstrip germanium detector [1] with 128 strips is now in trial operation at BL08W. A new readout electronics using VLSI technology is employed. The detector is being developed in a collaboration between the detector group of JASRI and the users of the beamline. The final goal of this development project is a detector with 512 strips, which will be a powerful tool to measure Compton scattering with high efficiency.

References

[1] SPring-8 Research Frontiers 1998/1999, p. 98.

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