SIM02-16 ULTRA HIGH SPEED CAMERA

The Department of Mechanical Engineering has procured an Ultra High Speed Camera through the Fund for Improvement of S & T Infrastructure in Higher Educational Institutions scheme of Department of Science and Technology. This is the fastest camera in the world and the first one in our country. The system is currently housed in the High Speed Experimental Mechanics Laboratory (HSEML).

Unique features: Different important components and the entire assembly of ultrahigh speed of camera are shown in Figures 1 and 2, respectively. The camera can capture 16 monochrome images at rates as high as 200 million images per second, i.e. time difference between any two images can be as low as 5 nanoseconds. Exposure time as small as 5 nanoseconds allows capturing images of ultra fast dynamic events, without smearing, seemingly freezing the events in time (Note that in 5 nanoseconds light travels only 1.5 meters). The digital images have 12 bit depth and an active resolution of 1360 x 1024 pixels even at the highest framing rate.

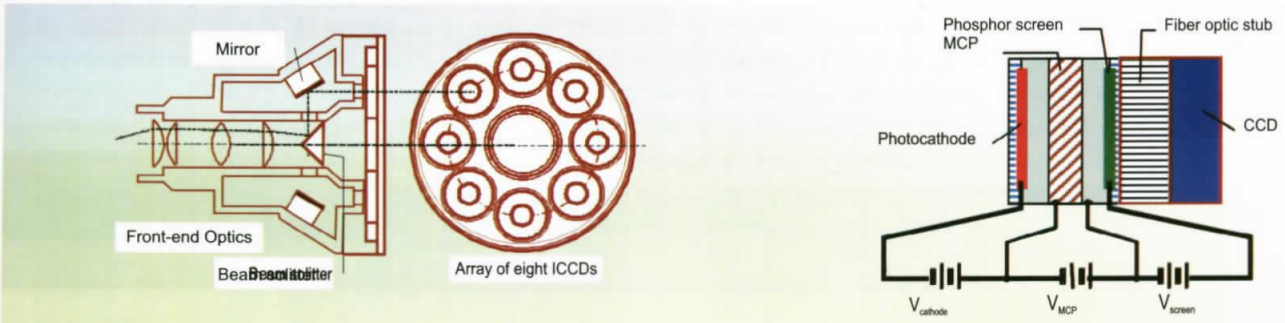

Figure 1: Configuration of various components of ultrahigh speed camera different aspect ratios

Principle of operation: The light collected by the front end lens is relayed to eight intensified CCD (ICCD) sensors by an eight-sided beam splitter. The photocathode in the ICCD converts the photons to electrons. These electrons get multiplied in number as they pass through the Micro Channel Plate (MCP). The electrons are converted back to photons by the Phosphor screen and captured by the Sony ICX285AL CCD. Additionally, the MCP also acts as an optical switch with a minimum gating time of 5 nanoseconds, allowing the recording of images with 5 nanoseconds exposure time. The ICCDs are exposed twice to capture 16 images.

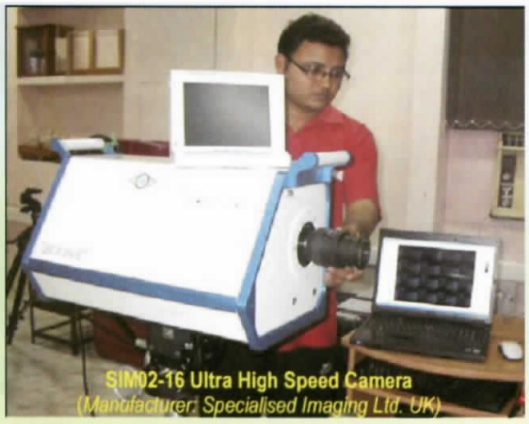

Figure 2: Entire assembly of SIM02-16 Camera. Schematic of a reactor

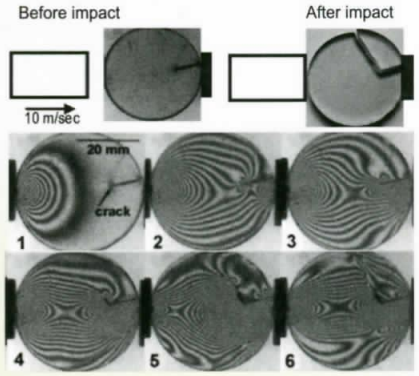

Figure 3: Results of the experiment performed recently at HSEML using SIM02-16. Total time window: 120 microseconds, Framing rate: 100,000/sec, Exposure time: 50 nanoseconds.

In Figure 3, the shear stress contours can be seen in a cracked disc subjected to impact. Crack is stationary in first three pictures, starts moving with a speed of ~ 300 m/sec in picture 4. The disc has broken into two pieces in picture 6.

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