

Timepix3 as X-ray detector for time resolved synchrotron experiments

Time resolved experiments are becoming more and more important in research carried out at synchrotrons. Timepix3 is a “data driven” ASIC that place a time stamp for every event. The resolution of the time stamp is 1.5625 ns. It enables accessing the nanosecond regime potentially revolutionizing time resolved experiments at synchrotron facilities. The Timepix3 ASIC flip chip bonded to a 300 μm thick Si detector.

We will report the results of the characterization of Timepix3 with synchrotron X-ray beam with particular reference to the timing characteristics.

In the DLS hybrid mode of operation, the electron beam circulating in the storage ring is made out of 686 contiguous bunches spaced 2 ns apart then a gap of 500 ns. In the middle of the gap it was placed an isolated bunch. Since the FWHM of the bunch is of the order of 50 ps when the data acquisition was triggered by the machine clock, the isolated bunch becomes an ideal tool to determine the actual time resolution of the detector. Histograms of the time of arrival of the photons were built leading to an estimation of the time resolution of the isolated bunch. When the beam was stopped down to 20 μm x 20 μm and impinged in the centre of the pixel it was obtained a time resolution of 10.21 ns for 20 keV photos, 20% signal threshold and 110 V bias voltage. A time resolution of 8.07 ns for 12 keV photons and 30% signal threshold is achieved when increasing the bias voltage to 350 V.

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