

New results from fast timing iLGAD sensors on Timepix4

With the High-Luminosity Large Hadron Collider (HL-LHC) the number of events per bunch crossing increases. To cope with these high rates in the pixel trackers, per-pixel time measurements are required, which implies the need for fast sensors. The Inverted Low-Gain Avalanche Detector (iLGAD) is one of the options that is being investigated. This presentation will show the results of an inverse Low-Gain Avalanche Detector (iLGAD) with a pitch of $55\text{ }\mu\text{m}$, a thickness of $250\text{ }\mu\text{m}$ and a large-area (2 cm^2), bump bonded to a Timepix4 ASIC. Timepix4 has 195 ps time binning on each pixel and therefore an ideal ASIC to test the sensor. The sensor is characterised with laser and radio-active source measurement in the lab and during beam test at the CERN SPS North Area H8 beamline, where the timepix4 telescope was used. The telescope consists of four $100\text{ }\mu\text{m}$ thick sensors for temporal resolution and four $300\text{ }\mu\text{m}$ thick sensors for spatial resolution. Downstream of the telescope there are two MCPs used as time reference, giving a temporal resolution of 12 ps . The iLGAD is placed in the centre of the telescope as DUT, where the telescope has a pointing resolution of $2.3 \pm 0.1\text{ }\mu\text{m}$.

The iLGAD shows an almost uniform gain of around 4 and an efficiency of $99.6 \pm 0.1\%$. Without any corrections the obtained time resolution is about 750 ps . After timewalk and clock corrections the time resolution becomes 358 ps . To understand the details of the time resolution also grazing angle measurements are done, which allow to measure the time-resolution as function of depth of the charge deposition in the sensor. This provides more insight for the perpendicular time resolution.

Workshop topics

Detector systems

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