**Development of the Timepix4 chip**

**Abstract**

The Timepix4 chip is the new hybrid pixel detector ASIC developed in the frame of the Medipix4 collaboration. This chip is designed for a wide range of applications such as particle identification and tracking in High-Energy Physics (HEP) experiments, time-resolved / energy-resolved photon detection and high frame rate (up to 90kFPS)  X-ray imaging.

The chip has 448 x 512 pixels intended to read out a sensor matrix with square pixels on a pitch of 55 μm.

The total area of the chip is $6.93cm^2$ of which 99.5% will be covered by the sensor .  In the peripheries the chip the Through-Silicon Via (TSV) IO pads have been implemented to make the chip 4-side buttable and therefore suitable for large-area detectors assemblies.

The chip can operate in particle tracking mode or in frame based mode. In particle tracking mode the chip works in a data driven readout mode where it sends out a 64-bit data packet containing pixel coordinate, time over threshold and time of arrival information immediately after the hit is processed by the pixel. The maximum hit rate in particle tracking mode is 360 Mhits/$cm^2$/s with a time tagging bin size of 195 ps. In frame based mode the pixel works as a photon counter with a maximum count rate of 500 Ghits/cm2/s.

In order to cope with such a high data rate the chip accommodates 16 channels of a 10.24 Gbps data transmission links.  Each link has a 64B/66B data encoder, a data serializer and a wireline driver.

In my presentation I will discuss the main features of the Timepix4 chip, the circuit design aspects, some experimental results and the future application opportunities.