Eleventh International Workshop on Semiconductor Pixel Detectors for Particles and Imaging

ID de Contribution: **21** Type: **12mOral**

Exploring ALICE ITS3 MOST: Early Results on Power Segmentation and Asynchronous Readout for Timing in a Monolithic Stitched Sensor

jeudi 21 novembre 2024 16:57 (17 minutes)

The adoption of monolithic active pixel sensors (MAPS) in CMOS technologies for high-energy physics experiments was a breakthrough. These pixel detectors can achieve a material budget as low as 0.1% of the radiation length per layer, as they integrate the readout electronics within the sensor itself.

After the successful installation of the ITS2 detector, covering 10 m² with MAPS, a further upgrade (ITS3) is being developed to replace the three inner vertex layers with wafer-scale stitched sensors bent around the beam pipe. For this investigation, two stitched sensors were developed: the MOnolithic Stitched Sensor (MOSS) and the MOnolithic Stitched sensor with Timing (MOST), each 25.9 cm long and 1.4 cm and 0.25 cm wide, respectively. The MOST contains more than 900,000 pixels with a size of 18 µm x 18 µm. Which are divided into groups and units to minimize output signal collisions in the case of charge-sharing pixels on the four CML outputs of the chip.

In the MOST, one global analog and one global digital power domain for the matrix are implemented, and small fractions of the circuit can be connected to these using conservatively designed switches. This allows a finer granularity for powering and simplifies communication with the chip. This scheme will be used in the final chip for the ITS3.

The MOSS is equipped with a synchronous readout, whereas the MOST has an asynchronous readout in which hit data is transmitted immediately upon the detection of the hit to the endcap of the chip, up to about 26 cm away. Both chips have been tested and found to be functional.

One of the aims of the MOST is to evaluate whether and to what extent the timing information of these asynchronous signals is conserved during this long-distance on-chip transmission without being corrupted by on-chip activity and other factors. If successful, this would open the way to timing architectures that avoid distributing a timing reference over the full pixel matrix.

In this contribution, detailed measurement results of the MOST will be presented, covering basic functionality tests, including characterization of the threshold and noise of the pixel front end, as well as powering tests, validation of the powering scheme, and tests related to the transmission of timing signals.

Auteur principal: SELINA, Mariia (Nikhef, Utrecht University)

Orateur: SELINA, Mariia (Nikhef, Utrecht University)

Classification de Session: Monolithic sensors

Classification de thématique: Monolithic sensors