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Implementation and yield studies of the ALICE ITS3 stitched sensor test structure: the MOST

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In the LHC long shutdown 3, the ALICE experiment upgrades the inner layers of its Inner Tracker System with three layers of wafer-scale stitched sensors bent around the beam pipe. Two stitched sensor evaluation structures, the MOⁿolithic Stitched Sensor (MOSS) and MOⁿolithic Stitched Sensor with Timing (MOST) allow the study of yield dependence on circuit density, power supply segmentation, stitching demonstration for power and data transmission, performance dependence on reverse bias, charge collection performance, parameter uniformity across the chip, and performance of wafer-scale data transmission.

The MOST measures 25.9 cm x 0.25 cm, has more than 900,000 pixels of 18x18 μm^2 and emphasizes the validation of pixel circuitry with maximum density, together with a high number of power domains separated by switches allowing to power down faulty circuits. It employs 1 Gb/s 26 cm long data transmission using asynchronous, data-driven readout. This readout preserves information on time of arrival and time over threshold. In the MOSS, by contrast, regions with different in-pixel densities are implemented to study yield dependence and are read synchronously.

MOST test results validated the concept of power domain switching and the data transmission over 26 cm stitched lines for the implementation of the full-size, full-functionality ITS3 prototype sensor, MOSAIX.

This contribution will summarize the performance of the stitched sensor test structures with emphasis on the MOST.

Primary experiment

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