Contribution ID: **43** Type: **contributed paper**

ALPIDE: the Monolithic Active Pixel Sensor for the ALICE ITS upgrade

The upgrade of the ALICE vertex detector, the Inner Tracking System (ITS), is scheduled to be installed during the next long shutdown period (2019-2020) of the CERN Large Hadron Collider (LHC). The current ITS will be replaced by seven concentric layers of Monolithic Active Pixel Sensors (MAPS) with total active surface of ~10 m^2, thus making ALICE the first LHC experiment implementing MAPS detector technology on a large scale.

The ALPIDE chip, based on TowerJazz 180 nm CMOS Imaging Process, is being developed for this purpose. A particular process feature, the deep p-well, is exploited so the full CMOS logic can be implemented over the active sensor area without impinging on the deposited charge collection. ALPIDE is implemented on silicon wafers with a high resistivity epitaxial layer. A single chip measures 15 mm by 30 mm and contains half a million pixels distributed in 512 rows and 1024 columns. In-pixel circuitry features amplification, shaping, discrimination and multi-event buffering. The readout is hit driven i.e. only addresses of hit pixels are sent to the periphery.

The upgrade of the ITS presents two different sets of requirements for sensors of the inner and of the outer layers due to the significantly different track density, radiation level and active detector surface. The ALPIDE chip fulfils the stringent requirements in both cases. The detection efficiency is higher than 99%, fake hit probability is orders of magnitude lower than the required 10^-5 and spatial resolution within required 5 um. This performance is maintained even after an irradiation up to several Mrad and few 10^13 1 Mev n_eq/cm^2, which is above what is expected during the detector lifetime. Readout rate of 100 kHz is provided and the power density of ALPIDE is less than 40 mW/cm^2.

This contribution will provide a summary of the ALPIDE features and main test results.

Primary author: SULJIC, Miljenko (Università degli studi di Trieste e INFN Trieste)

Presenter: SULJIC, Miljenko (Università degli studi di Trieste e INFN Trieste)