Contribution ID: **51** Type: **Oral Presentations**

ALICE ITS3: how to integrate a large dimension MAPS sensor in a bent configuration detector

Wednesday, 6 September 2023 12:20 (20 minutes)

The ALICE collaboration foresees the replacement of the three innermost layers of the present inner tracking system (ITS2), during the LHC long shutdown 3, with a completely new system, called ITS3. The expected performance will improve the pointing resolution of the tracking, particularly at low transverse momentum, hence significantly extending the heavy flavour physics program of the experiment.

The full detector consists of two half-barrels, each containing three sensors, of the size up to ~26 cm x ~10 cm, bent in a half-cylindrical shape, spaced by 6 mm in a concentrical configuration, covering a pseudo rapidity acceptance up to ±2.5 (layer 0). The development of a wafer size MAPS sensor is based on 65 nm technology, using the stitching technique to allow for a sensor size exceeding the technologies reticle size. A sensor thickness of less than 50 um and the usage of extremely light support structures based on carbon foam and air cooling allow reducing the material budget per layer to the order of 0.05% X/X_0 in the detector active area. Replacement of the beam pipe allows placing the first detector layer only 1.8 cm far from the interaction point.

The contribution will describe the global detector integration concept, focusing on: the sensor bending procedure at different thicknesses to the target radii, the electrical interconnection techniques via wire-bonding and the choice of the best carbon foam, in terms of material density and thermal dissipation properties, as light mechanical supporting structures. Details on the electrical characteristics and mechanical integration of the flexible circuits designed to provide power and communication with sensors will be discussed, as well as findings from the study of the cooling by air at the expected dissipated power. Moreover, results on the effects of the bending on already available 180 nm sensors (ALPIDE), both in laboratory and in particle beams, and on new 65 nm prototype sensor structure, will be exposed. Finally, the outcome of the assembly of the first working large-scale sensor detector prototype, called super-ALPIDE, will be reported.

Primary author: COLELLA, Domenico (INFN and University of Bari)

Presenter: COLELLA, Domenico (INFN and University of Bari)

Session Classification: D1