11th International "Hiroshima" Symposium on the Development and Application of Semiconductor Tracking Detectors (HSTD11) in conjunction with 2nd Workshop on SOI Pixel Detectors (SOIPIX2017) at OIST, Okinawa, Japan

Contribution ID: **81** Type: **ORAL**

# First bulk and surface results for the ATLAS ITk Strip stereo annulus sensors

*Tuesday 12 December 2017 16:50 (20 minutes)*

A novel microstrip sensor geometry, the "stereo annulus", has been developed for use in the end-cap of the ATLAS experiment's strip tracker upgrade at the High-Luminosity Large Hadron Collider (HL-LHC). The radiation-hard, single-sided, ac-coupled, n+-in-p microstrip sensors are designed by the ITk Strip Sensor Collaboration and produced by Hamamatsu Photonics.

The stereo annulus design has the potential to revolutionize the layout of end-cap microstrip trackers promising better tracking performance and more complete coverage than the contemporary configurations. These advantages are achieved by the union of equal length, radially oriented strips with a small stereo angle implemented directly into the sensor surface.

The first-ever results for the stereo annulus geometry have been collected across several sites world-wide and are presented here. A number of full-size, unirradiated sensors were evaluated for their mechanical, bulk, and surface properties. The new device, the ATLAS12EC, is compared against its conventionally shaped predecessors, the ATLAS07 and ATLAS12, for realistic evaluation of the sensor design.

The bulk character of the unirradiated sensors has been determined from IV curve, CV curve, and metrology studies. The leakage current and full depletion voltage characteristics have been obtained and compared with the strict specifications required by the next-generation tracker.

Interstrip capacitance and resistance in the four segments of strips, each with equal length constituents and a constant angular pitch, have also been ascertained and are compared to expectations. Long-term leakage current stability tests under various humidity conditions have been conducted to investigate more closely the surface and edge processing. These also allow the determination of any high electric field gradients in the synthesis of stereo radial strips with a tracking coverage enhancing slim edge-width.

The impact of the novel stereo annulus sensor geometry on the operation of the detector has been evaluated in these studies. The suitability of the optimized sensor shape for the ATLAS HL-LHC upgrade and future end-cap microstrip trackers will be discussed.

**Author:** THE ATLAS ITK STRIP SENSOR WORKING GROUP

**Co-authors:** HUNTER, Robert (Carleton University (CA)); KOFFAS, Thomas (Carleton University (CA)); KELLER, John Stakely (Carleton University (CA))

**Presenter:** HUNTER, Robert (Carleton University (CA))

**Session Classification:** Session8

**Track Classification:** Strip sensors